
Ofcom's new EMF licence condition

What you need to know as an amateur radio user
– Draft version

Ofcom's new EMF licence condition – here's what you need to know as an amateur radio user

Anyone holding an amateur radio licence needs to be aware of new rules designed to make sure radio equipment operates within internationally recognised limits for exposure to electromagnetic fields (EMF). This guide provides an overview of what you need to do.

There's more detailed information and guidance on the [Ofcom website](#).

What's this all about?

All radio equipment produces EMF, and there are internationally recognised limits for public exposure are set out in [guidelines](#) published by the International Commission for Non-Ionising Radiation Protection (ICNIRP). In this document we refer to these limits as the EMF limits.

Ofcom is now proposing to add a new EMF condition to spectrum licences which allow transmit powers above 10 Watts EIRP (which is equivalent to 6.1 Watts ERP). This means licensees will need to comply with the EMF limits and keep records demonstrating how they comply. The new EMF condition would be included in all amateur licences, including foundation licences. (We explain how to calculate your EIRP on page 9 of this guidance).

This guide provides an overview of the key points relating to the new EMF condition, with specific attention to the sorts of issues users of amateur radio are likely to encounter. For full details, you should read our detailed [Guidance on EMF Compliance and Enforcement](#). Licensees **must** take our detailed Guidance on EMF Compliance and Enforcement into account when assessing their compliance with the EMF limits.

What does this mean for me?

Once your licence has been varied to add the EMF condition, you will need to make sure that you use your equipment in a way which does not expose the general public to EMF above the EMF limits.

When we say "general public", we mean anyone who isn't:

- the licensee, owner, operator or installer of the radio equipment, or
- a worker who is already protected from EMF exposure under pre-existing health and safety legislation.

The general public can therefore include family, friends, lodgers, visitors, neighbours, as well as other members of the general public of all ages. None of these individuals should be exposed to EMF above the EMF limits.

An exception is when the individual is another amateur radio licensee; amateur licensees are not required to comply with the EMF limits when they are visiting each other or working together, and no other member of the general public is present.

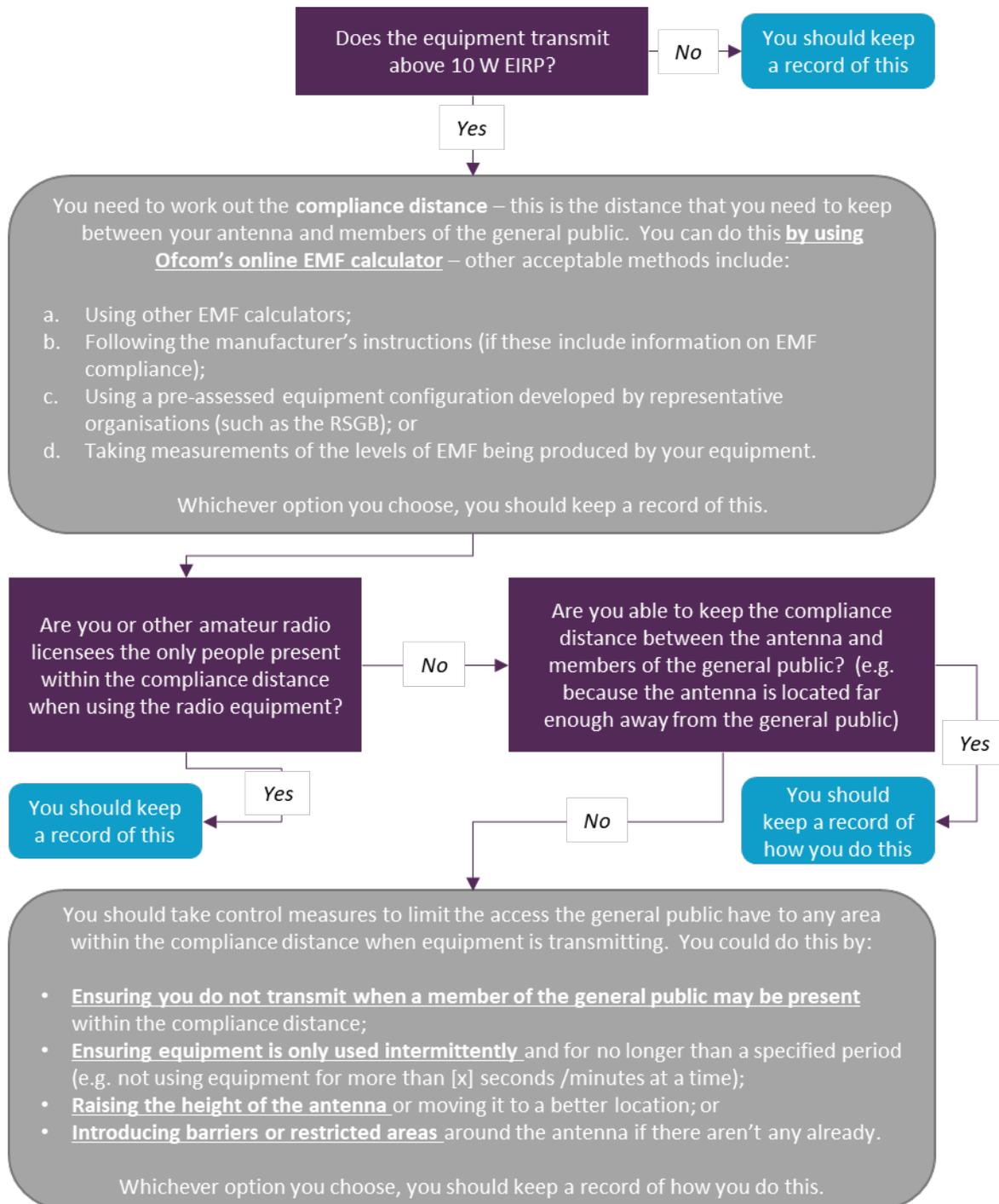
Further information on what we mean by the general public and the areas in which they may be present is set out in our detailed [Guidance on EMF Compliance and Enforcement](#).

What do I need to do in order to comply?

If you have not already done so, you will need to carry out an assessment to check that you use your radio equipment in a way which means it complies with the EMF limits, or to confirm that it is exempt.

You can use the flowchart below to help you work out how you can comply with the new licence condition. We provide a full text description of how to comply after the flowchart.

EMF compliance flowchart



Equipment transmitting below 10 W EIRP automatically complies

One simple way you can comply is by making sure your equipment does not transmit above 10 W EIRP, though you will need to record how you know this is the case.

Amateur licences use PEP rather than EIRP. To calculate the radiated power in EIRP, you need to know the gain of the antenna you are using (at the frequency you are transmitting at). We explain how to do this on page 9 of this guide. For example, if your radio equipment's output power is 3

Watts (PEP) and the gain of the antenna you are using is 5.19 dBi or less, your set up should not be capable of transmitting above 10 Watts EIRP.

If your equipment transmits above 10 W EIRP, you need to work out your compliance distance

If your radio equipment does transmit above 10 W EIRP, you'll need to work out your equipment's **compliance distance**. This is the distance you need to maintain between members of the general public and your antenna, to ensure they are not exposed to EMF exceeding the EMF limits. In general, higher transmitting powers will result in larger compliance distances.

One of the easiest ways to do this is to use [Ofcom's EMF calculator](#). We provide further information on how to use the Ofcom calculator, and some typical separation distances produced by the calculator, on page 9 of this guidance.

Other acceptable methods include:

- a) Using other EMF calculators that you are confident produce results that are sufficiently accurate (e.g. the calculator developed by the [Radio Society of Great Britain](#) (RSGB)).
- b) Following instructions from the manufacturer on EMF compliance when installing and operating your equipment. Some instructions may be available online and include information on EMF compliance distances.
- c) Show that your equipment uses a pre-assessed equipment configuration that has been developed and shared by representative organisations (e.g. the RSGB).
- d) Taking measurements (or having them made by a professional) of the EMF levels produced by your equipment – these may be helpful where there is some uncertainty in the calculations or for more complex radio installations.

We have included a few worked examples of compliance distance calculations for some typical amateur radio equipment configurations at the end of this guidance.

Further information on the different types of EMF assessments and how to work out compliance distances is set out in our detailed [Guidance on EMF Compliance and Enforcement](#).

What if I have multiple pieces of equipment on the same site?

All your radio equipment can contribute to the overall EMF levels. You will therefore need to ensure all your equipment that transmits above 10 W EIRP complies with the EMF limits.

If you operate more than one piece of equipment on the same site that transmits above 10 W EIRP, you may need to assess the overall EMF exposure levels from all of this equipment. For example, if you have two antennas on your roof that are located close together and transmit in the same direction, you will probably need to assess the combined effect of these (if you transmit from both simultaneously).

However, you do **not** need to do this if:

- The target coverage area of each piece of equipment is different (and is unlikely to overlap), for example highly directional antennas such as yagi antennas or satellite dishes. You can

assess this type of equipment on an individual basis using one of the approaches outlined above.

- You do not use different pieces of equipment at the same time. For example, if you only transmit intermittently on one radio at a time, you can assess each radio on an individual basis.

Further information on assessing compliance on sites where you have multiple pieces of equipment is set out in our detailed [Guidance on EMF Compliance and Enforcement](#) in the section "Sites that are not shared with another user".

You need to make sure the compliance distance can be maintained between the general public and your antenna

Once you've worked out the compliance distance for your equipment, you'll then need to make sure that the distance between your antenna and any area where a member of the general public may be present when your radio equipment is transmitting is **greater** than the compliance distance.

In most cases, the compliance distance is likely to be relatively small and it may already not be possible for members of the general public to get within the compliance distance (for instance, if the compliance distance works out to be 2 metres and the antenna is on top of a 4 metre high roof where the general public don't have access). But in some cases, it might be necessary to put measures in place to make sure the general public can't get too close (e.g. by raising the height of your antenna, moving it to a better location, putting up clear warning signs or introducing a barrier). Ultimately, if you see a member of the general public who is too close to your antenna, you should stop transmitting until they are beyond the compliance distance.

What records do I need to keep to show that I am complying with the EMF limits?

You will need to keep records showing how you have complied with the EMF limits and you will need to show these to Ofcom if asked to do so.

Examples of an acceptable record include:

- keeping a record of how you make sure your radio equipment never transmits above 10 W EIRP, e.g. because you set up your equipment in a way which means it does not or cannot transmit above 10 W EIRP, or by declaring that you never transmit above 10 W EIRP;
- keeping the manufacturer's EMF compliance instructions, or EMF compliance information from the installer of the equipment, to hand, and show how you are following these;
- documenting any calculations you've made (e.g. by printing the output from [Ofcom's EMF calculator](#));
- keeping the results of any EMF measurements that have been carried out by you (or another party);
- keeping a record of any pre-assessed equipment configuration (developed by a representative organisation, e.g. the RSGB) you have used; and/or

- keeping a record of any control measures you have put in place to ensure the general public cannot get within the compliance distance.

Further information on the type of records that can be used to demonstrate compliance are set out in our detailed [Guidance on EMF Compliance and Enforcement](#).

In what areas do I need to ensure I do not breach the EMF limits?

You need to make sure you comply in any area where a member of the general public (including family, friends, lodgers, visitors and neighbours) is present when you are transmitting.

One way in which you can comply with the EMF limits is by making sure members of the general public will not be present in any area within the compliance distance when you are transmitting.

However, if you can't be sure whether a member of general public will be present when you will be transmitting (for example, in a neighbour's garden or a public pathway next to your property), then you will need to assume they will be present and ensure you comply with the EMF limits.

This is the case even if members of the general public are not normally present in an area within the compliance distance. If, for example, a neighbour generally only goes in their garden once a month or the general public infrequently use a public pathway, that does **not** mean you can expose them to EMF above the EMF limits on the occasions that they are present in those areas.

You can presume the general public will not be present in:

- areas where you or a third party have installed appropriate warning signs, barriers and/or locks designed to prevent members of the general public from accessing areas within the compliance distance;
- areas which may be public property but which in practice have become and remain inaccessible, for example, due to overgrown vegetation.

I only use my equipment at home – do I really need to comply?

Yes, you need to ensure all family, friends, lodgers, visitors and neighbours are not exposed to EMF above the ICNIRP general public limits.

However, there are various ways in which you can comply. For example, you could simply not transmit - or not transmit above 10 Watts EIRP - when any family, friends, lodgers, visitors or neighbours are present in any area where you may exceed the EMF limits.

There are also various control measures you could use such as:

- Ensuring your equipment is only used intermittently and for no longer than a specified time period;
- Installing appropriate warnings (e.g. simple explanations of risks / do not hold button for more than [x] seconds/minutes), signs (e.g. where not to sit/stand), barriers and/or locks.

Other ways in which you can comply are set out above, and you should always keep a record of the basis on which you have ensured you comply with the EMF limits.

Are there any exemptions for compliance (e.g. in an emergency)?

You don't need to comply during an emergency while you are using your equipment for emergency communications. You will however need to comply if your equipment is being used in any other non-emergency situations. Training exercises, for example, are not emergencies. In any event, training will often involve workers (including volunteers) who are not covered by the licence condition. You should be able to explain the types of situations when you rely on the emergency exemption and why you think it applies in those situations.

I am a volunteer for RAYNET-UK. Do I still need to comply?

The EMF condition applies to amateur licensees that are volunteers in the same way it applies to other licensees. This means amateur licensees are not required to protect themselves or each other from EMF exposure.

If you have temporarily set-up your equipment near an emergency situation in order to assist first responders (for example, by acting as a relay facility in a car park) but where you are not actively and directly involved in the emergency response, you will still need to comply with the EMF limits. It should still be possible for you to set up your equipment to comply with the EMF limits, even if you don't know in advance what environment you will be operating in.

What if I my radio equipment is mobile and I use it in different places?

If you have radio equipment that you use in different places (e.g. at temporary locations like festivals, or in a car, caravan, boat or backpack) you must make sure the compliance distance is maintained wherever you set it up.

If your equipment is mobile, this doesn't mean you need to repeat your compliance assessment every time it moves from one location to another, but you should always make sure that members of the public do not come closer than the compliance distance to the equipment when it is transmitting.

I often change the setup of my equipment – do I need to keep a new EMF record every time?

You need to reassess compliance when you make any change or addition to your set-up which is likely to increase the EMF exposure levels from your equipment (e.g. if you increase the transmitter power, change or adjust the antenna, or begin operating on a new frequency band not previously used).

One way to reduce the number of assessments you need to make may be to assess a 'worst-case' equipment configuration e.g. the maximum power that you are likely to use in the future.

What do I need to do if my equipment transmits at a frequency lower than 10 MHz?

For the time being, you do not need to do anything for equipment that transmits at frequencies below 10 MHz. We are working on further guidance (which we anticipate publishing later in 2021) and considering whether to extend our EMF calculator to cover these frequencies. We have said that licensees will not need to have records in place demonstrating compliance for such equipment for a year after licences are varies. However, if requested by Ofcom, licensees will need to demonstrate how they comply within 20 calendar days of being asked. However, until we have provided further guidance, we do not expect to start asking licensees to demonstrate how they comply.

What will Ofcom do to assess compliance?

Ofcom's Spectrum Engineering Officers carry out spot checks to ensure that radio equipment is being operated in accordance with all the terms and conditions of licences.

The checks could come at any time, so it's important for you to make sure you can provide information which demonstrates you're complying with the rules.

If Ofcom finds the EMF from your equipment is above the EMF limits or if you cannot provide appropriate records demonstrating compliance to Ofcom, we may take enforcement action.

Further information on potential enforcement action and our approach to enforcement is set out in our detailed [Guidance on EMF Compliance and Enforcement](#).

The Ofcom EMF calculator

Downloading and using the calculator

The Ofcom EMF calculator can be downloaded [from Ofcom's website](#). It uses a Microsoft Excel format (.xlsx), but can also be used on most other freely available spreadsheet programs and apps. It should work on personal computers, tablets and mobile phones.

About the calculator

[The Ofcom EMF calculator](#) has been designed to allow users to simply and easily assess compliance, without the need for technical knowledge. It uses simplified assumptions and will produce conservative results. In most cases, the calculator is expected to overestimate the separation distances needed to ensure compliance. Separation distances that are smaller than the distances produced by the calculator do not necessarily indicate the EMF limits will be exceeded.

The separation distances produced by the calculator are the distances that should be maintained if the equipment is transmitting continuously. Where the equipment is not transmitting continuously and the user knows that the equipment will not transmit for more than a given percentage of the time, the user can calculate the average power of the equipment using the method set out in the calculator's 'Instructions for use'. This will result in smaller separation distances.

Users that wish to make a less conservative assessment of compliance distances may need to carry out a more detailed analysis, e.g. by using a more advanced assessment tool, doing measurements, or by seeking help from a competent person with detailed EMF knowledge. Calculating separation distances does not in itself demonstrate compliance; spectrum users then need to ensure no member of the general public is present within that distance when they are transmitting.

The Ofcom calculator takes just two input parameters:

- Radiated power in Watts (EIRP)
- Frequency in MHz

In the radio amateur licence, power is for the most part specified as peak envelope power (PEP). To calculate the radiated power in EIRP, you need to know the gain of the antenna you are using (at the frequency you are transmitting at).

You can use the following formulas to calculate the EIRP:

In linear units: $\text{EIRP (Watts)} = \text{PEP (Watts)} \times \text{Gain (isotropic)}$

In decibels: $\text{EIRP (dBW)} = \text{PEP (dBW)} + \text{Gain (dBi)}$

It is important to note that the gain must be the gain relative to an isotropic antenna (i.e. relative to a theoretical antenna that radiates equally in all directions) and will normally be available from the manufacturer (in the documentation supplied with the antenna or on its website).

Most manufactures will specify antenna gain in dBi or in dB (in both cases this should be the gain relative to an isotropic antenna). Sometimes, however, gain may be specified in dBd (gain relative to a half-wavelength dipole).

To convert from dBd to dBi, the following formula can be used:

$$\text{Gain (dBi)} = \text{Gain (dBd)} + 2.15$$

And to convert gain in decibels (dBi) to a gain as a linear ratio, use the following formula:

$$\text{Gain (linear ratio)} = 10^{(\text{Gain (dBi)}/10)}$$

Example separation distances

Table 1 has been created using the [Ofcom EMF calculator](#). It provides illustrative separation distances for a range of radiated powers (in EIRP) and frequencies, and based on the equipment transmitting continuously.

Table 1: Example separation distances, metres (generated by the Ofcom EMF calculator)

Frequency	Radiated Power (EIRP)				
	10 Watts	50 Watts	100 Watts	400 Watts	1,000 Watts
10 MHz	4.8	4.8	4.8	6.4	10.1
14 MHz	3.8	3.8	3.8	6.4	10.1
28 MHz	1.8	2.3	3.2	6.4	10.1
50 MHz	1.1	2.3	3.2	6.4	10.1
144 MHz	1.1	2.3	3.2	6.4	10.1
432 MHz	1.0	2.2	3.1	6.2	9.8
1,240 MHz	0.6	1.3	1.9	3.7	5.8
2,400 MHz	0.5	1.1	1.5	2.9	4.6
10,000 MHz	0.5	1.1	1.5	2.9	4.6
24,000 MHz	0.5	1.1	1.5	2.9	4.6

Worked examples for typical amateur radio use cases

Example 1

Transmitter output power:	25 Watts PEP
Antenna gain:	5 dBi
Frequency of operation:	142 MHz

As the power in this example is specified as PEP you will need to use the antenna gain to convert from PEP to EIRP.

First, calculate the gain as a linear ratio.

$$\text{Gain as linear ratio: } 10^{(5/10)} = 3.2$$

Next multiply this by the PEP to give the EIRP in Watts.

$$\text{EIRP in Watts } 3.2 \times 25 = 80$$

Put **80** in the transmitter power input field and **142** in the operating frequency field, which gives a separation distance of **2.85** metres.

In this example, you would need to ensure no members of the general public can get closer than 2.85 metres to the nearest part of the antenna while you are transmitting.

Example 2

Radiated power:	400 Watts EIRP
Frequency of operation:	50 MHz

As the power in this example is already in Watts EIRP there is no need to convert from PEP.

Put **400** in the transmitter power input field and **50** in the operating frequency field, which gives a separation distance of **6.38** metres.

In this example, you would need to ensure no members of the general public can get closer than 6.38 metres to the nearest part of the antenna while you are transmitting.