## EMF-2 RSGB EMF Guidance on EMF compliance checking

In May 2021, Ofcom issued new Amateur Radio Licence conditions which now require an assessment of **EMF compliance** for all station **equipment configurations** that you are currently using. Implementation has been rolled out over a period of 18 months, moving downward in frequency, so all bands down to 1.8MHz will be covered from November 2022 onwards.

EMF assessments introduce many new concepts that can only be briefly outlined here. For full details, downloadable apps, calculators and practical advice, follow the RSGB EMF web pages at www.rsgb.org/emf

**What is EMF compliance?**

Our radio transmitting stations communicate by generating electromagnetic fields (**EMF** for short) that propagate to other stations, often over considerable distances. This 'far field' becomes weaker with increasing distance, but very close to the antenna there are potential hazards due to interactions of strong EM fields with the human body. Ofcom now requires us to comply with the recommendations of **ICNIRP**, the International Commission on Non-Ionizing Radiation Protection, and requires us to demonstrate compliance by making an EMF assessment for each **equipment configuration** that we currently use. You need to have these results available in case of any inspection.

**What is an "equipment configuration"?**

An **equipment configuration** is a list of the main factors that affect the EMFs around your station. These include:

- Frequency (typically, the middle of the amateur band in use)
- Mode of transmission and transmit/receive times (to calculate the RF power averaged over any rolling 6-minute period)
- RF power delivered to the antenna (PEP output of transmitter, minus losses in feedlines, ATU etc)
- Type and properties (gain, directivity etc) of the antenna which radiates the EM field
- How and where the antenna is installed, relative to nearby dwellings and other places where the general public may have access.

A change in any of the above will create a new equipment configuration and may well require a new assessment. However, if you can demonstrate compliance at the highest averaged RF power level that you currently use, that equipment configuration will also be compliant at lower power levels.

You do not need to update the EMF assessment or the equipment configuration if, for example, you replace your 100W transceiver with a different make and/or model. For these purposes, "100W is 100W" regardless of how that RF power is generated. However, you would need to review the assessment if you make a significant improvement to the feedline, because that increases the power delivered to the antenna.

**What is an EMF assessment?**

An EMF assessment is the combination of two steps:

1. A calculation or measurement of EM field strengths to define an **EMF Exclusion Zone** where no member of the general public should remain while you are transmitting.
   This is combined with:
2. A practical way to ensure that no member of the general public can enter the Exclusion Zone while you are transmitting.

Most real-life situations are very straightforward. For example:

- "My antenna is on the chimney, inaccessible without a ladder."
- "Height of mast or tower makes the Exclusion Zone completely inaccessible."
- "My vertical antenna is ground-mounted, but the Exclusion Zone is entirely in my back garden and under my control. I can easily verify that no-one is present while I am transmitting."
- "I have determined the extent of the Exclusion Zone around my vehicle [step 1 above]. I can thus make informed decisions on whether or not to transmit in any given circumstance."

**RSGB's minimum separation guideline is 2.4m**

For effective communication and to minimise interference, RSGB always recommends that antennas are installed as clear of obstructions as possible. To help meet the new requirements for EMF compliance – which begins by avoiding the risks of anyone touching the antenna while you are transmitting – RSGB now recommends that you should **aim for a minimum separation of 2.4m (8 feet) between any person and any part of the antenna**.

For example, if all parts of the antenna are more than 2.4m above ground, there is very little risk of anyone touching the antenna by accident. This minimum separation will also be a good start in ensuring compliance with the radiated EM fields. This obviously cannot guarantee compliance in every case, but a wide range of detailed assessments have shown 2.4m to be a useful guideline for time-averaged transmitter powers up to 100W.

**Low-power compliance**

The 2.4m separation guideline obviously cannot apply to hand-held or body-worn radios. For these and other low power situations, Ofcom allows compliance to be demonstrated a different way, by showing that the time-averaged EIRP is less than 10W (and the peak power is also less than 100W). If so, no further assessment is required – but you do have to calculate the EIRP and record that fact.

This same compliance route can often be used for low power operation on any band with simple low-gain antennas – but even at low power, operation on the VHF/UHF or microwave bands using high-gain beam antennas will very often exceed the 10W EIRP level, so more detailed assessment will be needed. This is where EMF calculators come in.

**EMF Calculators**

Ofcom and RSGB have both produced online EMF calculators to help you complete your assessments. The RSGB EMF calculator has been developed to offer extra help in numbers of areas:

- Help with entering the basic data that are pertinent to your equipment configuration
- A quick route to claim the low power exemption for typical VHF/UHF hand-held radios and some other kinds of low power operation
- Help with navigating the ICNIRP guidelines, which vary considerably across the amateur bands from 1.8MHz to the high microwaves
- Formatted, downloadable copies of the completed calculations

If the low power exemption does not apply, the RSGB calculator will then help you to choose the most appropriate method to check compliance:

- A simplified calculator that uses the same procedure as the Ofcom calculator but checking against ICNIRP 98 and/or ICNIRP 2020 levels (you can choose one or the other for a given configuration)
- Guidance and links to more advanced methods, eg for higher-power stations, users of beam antennas, and stations in heavily built-up areas

The "results" of any EMF compliance calculator are expressed as the size of the **EMF Exclusion Zone (EZ)** as noted earlier. Unfortunately, the use of any simplified EMF calculator (including either the Ofcom calculator or the compatible RSGB calculator) comes at a cost. For some equipment configurations, these calculators can over-estimate the size of the Exclusion Zone, giving a pessimistic impression about the possibilities for compliance.

If an overestimate of the size of the Exclusion Zone does not cause you any practical difficulty, then that's fine – save the results and you're done. But many UK amateurs operate in heavily built-up areas where an overestimate of even a few metres could cause practical difficulties… and that is why RSGB volunteers are developing advanced methods that can give more accurate results when needed.

**Pre-Assessed Equipment Configurations (PAECs)**

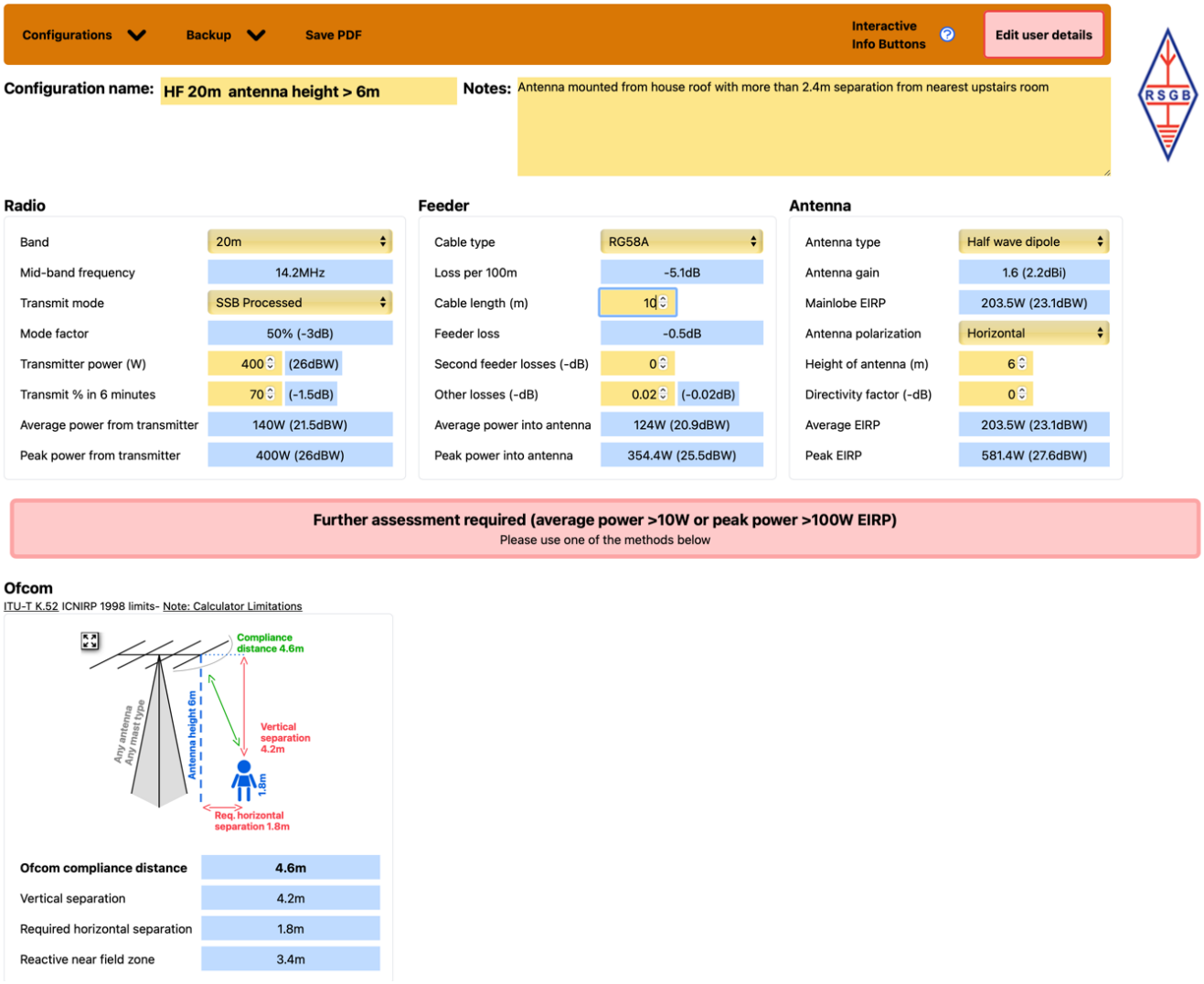
Advanced methods include the use of **Pre-Assessed Equipment Configurations (PAECs)**, which are station configurations that have been assessed in great detail to identify the Exclusion Zone(s), using methods that are acceptable to Ofcom. When embodied in a calculator these methods are the simplest way to get an accurate prediction of your own local EZ.

PAECs are continually under development and the latest version of the RSGB EMF calculator will signpost you to the options that are currently available. Download the latest version from the RSGB EMF web pages at www.rsgb.org/emf and then follow the instructions.

**Practical EMF Measurements**

If anyone's compliance check needs validation, then Ofcom will take measurements of actual field strengths. RSGB and Ofcom have been developing agreed methods for these measurements, which require specialised techniques and calibrated test equipment. RSGB has purchased the same professional instruments as Ofcom, so that any measurements can be directly comparable. RSGB's test equipment will also be used to help develop future advice to amateurs.

## RSGB EMF calculator




Input page of the RSGB EMF calculator including results (lower left) that duplicate the Ofcom calculator.

**Always use the latest version for the RSGB EMF calculator, from www.rsgb.org/emf**

Upgraded versions are likely to appear as more PAECs are produced, these may be different from the example shown here.

(Ofcom will accept calculations that have already been made using earlier versions of the Ofcom or RSGB calculators.)