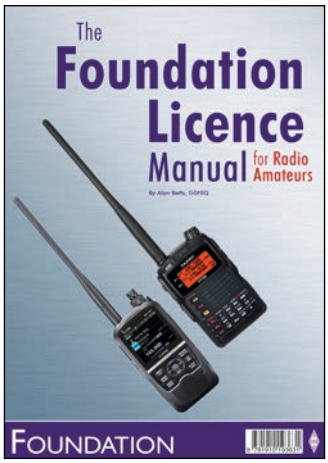
EMF updates to RSGB training books

This leaflet details the changes to RSGB Training books that have been made to cover the introduction of EMF into syllabus v1.5.

Foundation Manual



Page 15

Col 1 Immediately above heading 'Polarisation' insert a new section

ERPand EIRP

The Effective Radiated Power of an antenna recognises the focussing gain and is the product of the power fed to the antenna and its gain.

ERP = power fed to the antenna × antenna gain

ERP expresses antenna gain with respect to a dipole. It is a useful measurement reference in the laboratory as it is easy to set up. Looking at Fig 6.8 shows that a dipole radiates to the side and not off the ends.

An isotropic antenna is a theoretical antenna that radiates equally in all directions. It is not possible to make one, but it is very good for mathematical calculations and can also be used as a reference against which to express antenna gain. Antenna modelling software typically uses the isotropic reference.

EIRP, Effective Isotropic Radiated Power is simply ERP but using the isotropic reference.

For our purposes it is sufficient to remember that 10W EIRP is the same as 6.1W ERP.

Unfortunately, most manufacturers quote antenna gain in a scientific way, using units called decibels (dB). This can be converted to actual gain by using Table 6.1. Just for information, you should check whether the gain is quoted with reference to a dipole (shown as dBd) or isotropic (dBi). dBi = dBd+2.15.

Page 22

Add new heading and text below existing text of 1G1.

1G2 Identify and understand relevant information in Schedule 3 to the licence.

- **Purpose of basic EMF restrictions;**
- **Equipment to which the EMF restrictions apply;**
- **Transmit power level at which the EMF restrictions apply;**
- **Persons to which the restrictions apply;**
- **Need to keep a written record of assessments carried out**.

7(1) The licensee shall ensure that:

c) the establishment, installation, modification or use of the Radio Equipment is carried out in accordance with the provisions set out in Schedule 3 of this Licence in relation to electromagnetic field (EMF) exposure.

Schedule 3 is new and common to all Amateur and non-amateur licences, so some parts are more applicable to amateur radio than others.

The core purpose of the schedule is to avoid the general public being exposed to stronger radio frequency fields than is recommended. The published limits have a wide margin of safety so one can be sure there are no risks.

These rules apply to any transmitter producing more than 10W EIRP. The meaning of this is covered in chapter 6 on feeders and antennas. This does not affect handheld transceivers but does include transmitter powers permitted by the Foundation licence.

In the licence the term 'general public' includes family members and visitors but not licensed amateurs who are assumed to be aware of the risks and how to avoid them.

You must carry out an assessment and record the results. If you only have a handheld radio that cannot produce as much as 10W EIRP then that is all your record needs to say.

The aim is to determine the 'compliance distance', that it the closest point one can be to the antenna and be below the limit. Low power transmitters with an antenna on the house roof may not be a problem. If so, all you need to do is save the details of how you came to that conclusion.

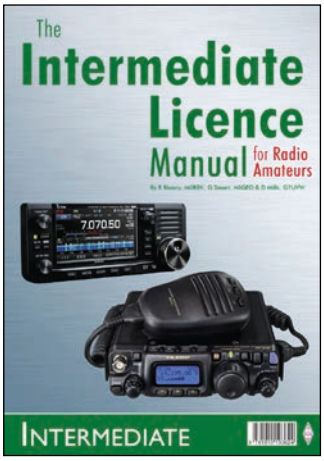
If you are unsure then you can use an Excel spreadsheet which is on the RSGB EMC Committee web site. That will perform most of the necessary calculations if a more detailed assessment is required. Remember to print a copy of the results. You may want to ask an experienced amateur or a local amateur radio club to help with this exercise.

Page 35

Col 1 bottom para (Guidance on safe levels of RF) - Replace para with:

The UK Health Security Agency recommend the guidance of the International Commission on Non-Ionising Radiation Protection, ICNIRP. The spreadsheet mentioned in the licensing chapter is based on those limits. Handheld radios should not exceed the 10W EIRP (6.1W ERP) limit and are unlikely to heat body tissue to any extent but it is still sensible to keep the antenna away from the eyes.

Intermediate Licence Manual



Page 3

Insert new sub-section after 1G1 and its text.

1G2 EMF restrictions and compliance
At Foundation you covered the purpose of the EMF requirements which was to limit human exposure to RF signals to the recommended levels. These apply if your transmitted power level exceeds either 10W EIRP (see chapter 12) averaged over any 6-minute period or 100W EIRP peak, an instantaneous value even for a very short time. You may like to re-read the Foundation material on EMF, electromagnetic fields.

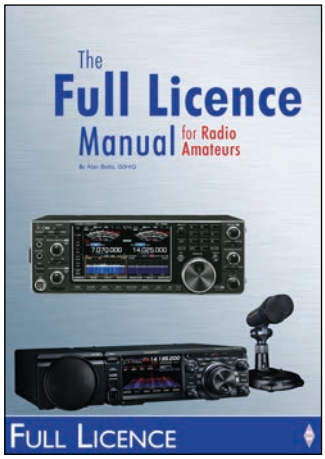
You will know that on FM means you are radiating full power all the time you are actually transmitting. SSB only produces RF when you speak, and the power level varies. Other modes, such as CW, also have an average value depending on the proportion of the time the key is down sending a dot or dash. Spending more time receiving than transmitting will also keep the average down.

The body can absorb RF energy and warm up as a result. By averaging the power over 6 minutes the overall warming effect can be estimated and kept well below the level that the body's own temperature regulation system can comfortably handle.

It is also possible that a peak level of RF will cause a momentary sensation which may be distracting. To avoid that there is a limit on the peak level at 100W EIRP.

No doubt you performed an assessment when you set up your Foundation station. Even a dipole has some gain off the sides so 10W to a dipole can produce just over 16W EIRP. You are now licensed for 50W so you must re-assess your compliance distances and exclusion zones. They will have increased. Any future change should also be reassessed. If you conclude there is no change then all you need to do is record the change and the conclusion and keep that, in writing, with the earlier assessment so it is always fully up to date.

Full Licence Manual



Page 8

Column 2 immediately above the heading CEPT; insert:

Electromagnetic Fields

ICNIRP

Clause, 7(1)(c) refers to Schedule 3 of the licence and requires amateurs to check that the RF fields do not exceed the compliance levels recommended by the ICNIRP, International Commission on Non-Ionising Radiation Protection. You are responsible for making these checks and keeping a permanent record.

Location

Any location where the RF field strength might be too high must be assessed. This will obviously include your premises, where your shack and antennas are located, front and back gardens, neighbours' premises and gardens and all areas accessible by the general public. In this context the general public includes non-amateur family and guests. Licensed amateurs are assumed to have the required knowledge to look after themselves.

If the affected area, the exclusion zone as it is called, includes part of a neighbour's garden then you can operate provided you know nobody is inside the zone. Alternatively, you can reduce power such that the zone does not extend outside your property. You may then simply need to show how you can control or monitor access inside the exclusion zone by non-amateur members of your family.

If the exclusion zone extends into areas where the general public may or

can be expected to be present, then other control measures will be needed. However you should bear in mind the rules and social norms about setting up a CCTV system covering more than your garden.

If you operate mobile then you must consider proximity of pedestrians and the occupants of other vehicles if you are temporarily stationary. You also need to consider non-amateur passengers in your own vehicle. A metal bodied vehicle may provide sufficient screening, but can you be sure of that and demonstrate it if challenged.

Assessment procedure

Ofcom have produced a spreadsheet which will calculate the dimensions of the exclusion zone – the compliance distance as it is termed. The RSGB use that with a 'front page' which simplifies the procedure for inputting your station details. You should print off the results and keep them available for inspection. The spreadsheet is fairly conservative and you can use other more sophisticated models if that is helpful. It is then up to you to satisfy Ofcom that your calculations are valid. The affected area may extend only to part of your own garden. All you need to do then, having recorded that fact, is to know when family members are inside that area and limit your transmissions.

RSGB/Ofcom spreadsheet

The spreadsheet in **Fig 1.1** shows 100W FM on 2m fed to a six element Yagi. Mounted at 7m still requires over a 5m horizontal exclusion zone at ground level after allowing for a head height of 1.8m. That distance may well extend outside your property and require further control measures to achieve compliance.

The parameters required by the spreadsheet are:
Transmit mode. The model has agreed factors for the average power of the different modes including processed and non-processed ssb and a variety of data modes.

Transmit % in 6 minutes. The percentage of any 6-minute period on transmit. If your overs are always less than four minutes with a gap of at least two then you can set this to 67%. You may be asked to substantiate your choice.

Feeder loss. The model has several typical feeder types built in for selection and requires the feeder length. Other losses can be RF switches, connectors and short tails to a patch panel. Antenna type allows a selection by name or generic type with the option for an own design which may well be appropriate for HF antennas in a restricted space. You will then need a sensible estimate from modelling software. The directivity factor is relevant to elevated antennas where people will be out of the main beam. The manufacturer's polar diagram will be needed.

The outputs from the model are the Reactive Near field zone, the Ofcom Compliance Distance and the Horizontal Separation needed.

Close to the antenna there are electrostatic (voltage) and electromagnetic (current) effects which may have a greater effect on the body that the 'normal' RF electromagnetic wave which will not have fully formed. That distance, given as $\lambda/2\pi$, is automatically part of the exclusion zone even if the normal inverse square law calculation gives a smaller zone. If the EIRP is below 10W averaged over 6 minutes or 100W peak then exclusion zones do not apply.

The Compliance Distance is the

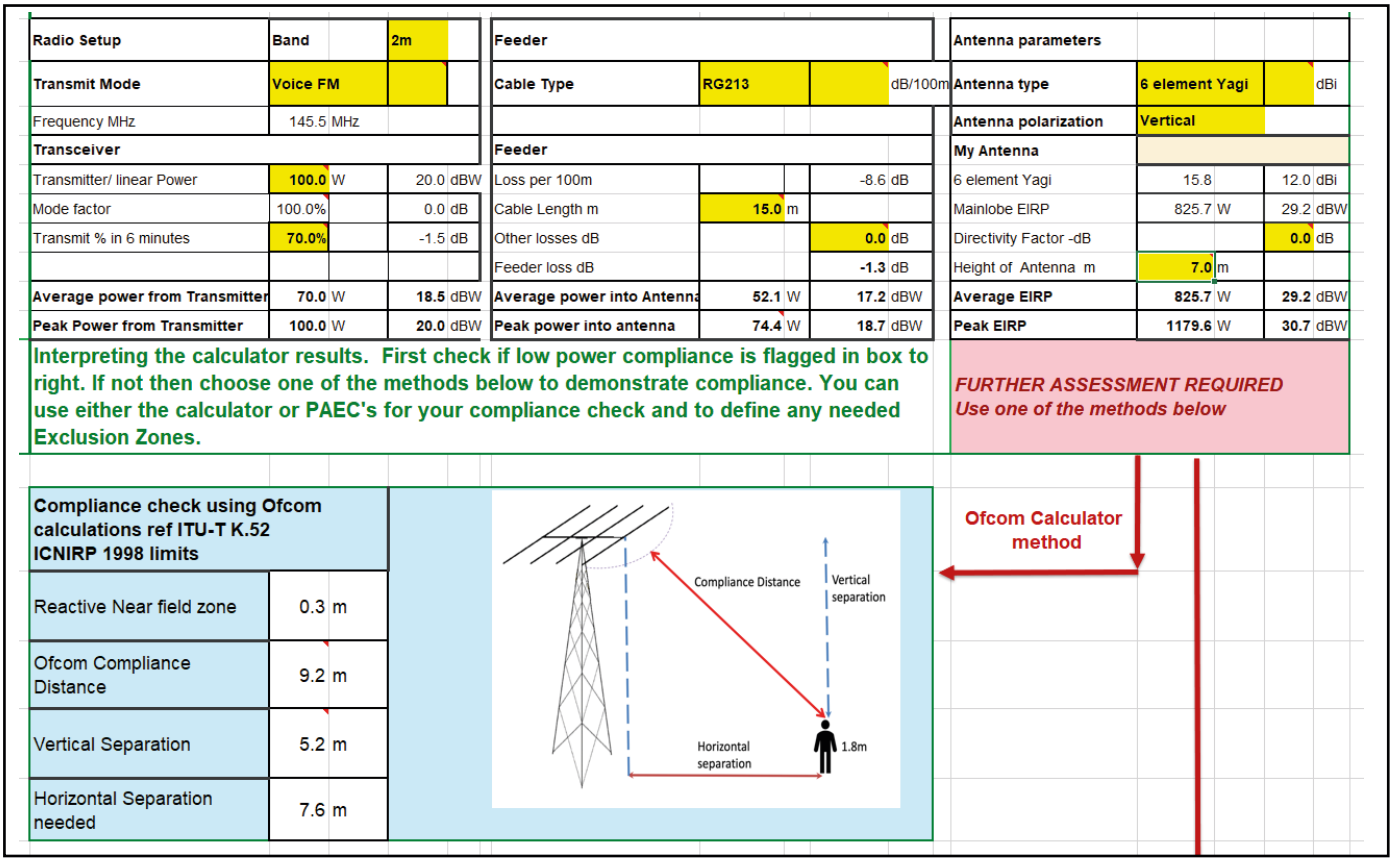


Fig 1.1 The RSGB EMF spreadsheet for a 100W FM 2m transmitter.

slant distance from the nearest point of the antenna and the Horizontal Separation allows for the height of the antenna. This is illustrated in Fig 1.1.

Alternatively, you can rely on pre-calculated scenarios or advice by the equipment manufacturers if your installation meets their assumptions. Measurements close to antennas and quite possibly in the near-field are problematic at best. Proper measurement techniques and calibrated equipment in line with professional practice are likely to be necessary if you want Ofcom to accept the results.

The need for such checks extends to operating outside. This may be when mobile or portable for personal enjoyment, a club field day or contest or an exhibition open to the public. Under those circumstances you should know the safe distances and simply not transmit if you can see other people are too close. At a field day or Special Event station the exclusion zone needs to be properly fenced off and watched to see there is no unauthorised access. It is advisable to consider the wording of warning signs, a sign 'Danger RF radiation' is likely to give the wrong impression!

There is an exception if you are passing messages in an emergency and are necessarily located at the site of the emergency. The exception does not extend to exercises conducted as preparation for emergencies or if you are a short distance away from the site of the emergency itself.

Guidance documents are available on the Ofcom and RSGB EMC Committee web sites.

Page 16

Col 1 Exposure to RF energy.

Retain the first two paras and delete the rest of the text under this heading. From 'The World Health Organisation' to 'as this proposal develops' in col 3. Replace with:

The exposure limits are now prescribed in the licence (see chapter 1) and refer to the ICNIRP guidance. The limits depend on the RF frequency and the period of time of exposure. Guidance is given in Ofcom documents 'Guidance on EMF Compliance and Enforcement', 'Ofcom's EMF licence condition – What you need to know as an Amateur radio user' and the RSGB Technical Note No. 1 'What You Need to Know about Electromagnetic Fields'. These are well worth reading but do go beyond the requirements of the syllabus.

Page 78

Col 1 Para 5 (In a normal) line 8. Delete the text starting 'The power flux density and the rest of the paragraph. Delete the following para 'Another way'. (Keep the last para 'The ground...')

Immediately above the heading Polarisation insert a new heading and text:

Power Flux Density

The 'power flux density (PFD) is a measure of the amount of radio energy falling on an area of 1 square metre. At twice the distance from the transmitter in free space the PFD will be quartered, so your signal strength meter will show a drop of about 6dB or 1 S-point. The PFD is related to the strength of the electric and magnetic components of the EM field.

The electric field is measured in Volts/metre and normally denoted by the letter E. The magnetic field is measured in Amps/m and designated H. The Power Flux density is given by their product:

PFD = E × H in W/m2

It will be noticed this mirrors the normal power calculation, P = V x I.

Not for the exam, but it is also the case that E/H gives a quantity known as the impedance of free space which is $120\pi\ \Omega$ or about 377Ω. You may have also realised that the that field strength, V/m, drops linearly with distance. This topic is considered in more detail in the EMC chapter.