



# INTERIM EMF COMPLIANCE GUIDANCE FOR RADIO AMATEUR MICROWAVE APERTURE ANTENNAS

## Introduction

Following the EMF presentation<sup>1</sup> by Ian (GM3SEK) and Peter (G4DSE) at the 2021 BATC Convention in October, BATC and the UKuG have now formed a small team<sup>2</sup> joining with Peter and Ian to coordinate the development and communication of EMF compliance guidance to BATC and UKuG members. The aim is to help prepare the RSGB “Pre-Assessed Equipment Configuration #3” report (PAEC-3) to satisfy Ofcom that it provides a valid route to claiming compliance for microwave stations using dishes.

From experience with the PAEC-2 report for VHF-UHF beam antennas<sup>3</sup>, the PAEC-3 report will need to be an extensive and detailed technical document that will take some time to complete. Because people have the need NOW to perform their EMF assessments, this interim note is intended to cover many common situations for microwave users.

This note relates to establishing the Exclusion Zone (see PAEC-2 §2.1 for guidance on the EMF exclusion zone concept) **on the ground** around a few common configurations and showing compliance for many (very) low power configurations that are above the 10W EIRP Ofcom exemption.

This note does not include guidance on the width of the Exclusion Zone for clearance of buildings. This will be addressed in PAEC-3, but if the projected aperture clears any potentially occupied levels by a few aperture diameters, then it is unlikely that there will be a problem.

Although this note is mainly about parabolic dish antennas with a feedhorn, the term “aperture antennas” can also include horns. (NB: this definition does not include antennas with ‘wire’ elements such as Yagis – see PAEC-2.)

In advance of the publication of the full PAEC 3 report, the BATC and UKuG Team will publish any clarifications on the [BATC Forum](#). Please post any questions about this guidance there.

### RED TAPE

*This report presents “work in progress” on a complex subject that is still under development. Details are subject to change so this and other referenced material may be updated or replaced.*

*The RSGB, BATC, UK Microwave Group and its volunteers take all reasonable care in the production of advice, but can accept no responsibility for errors, inaccuracies or omissions contained within that advice, or for misuse of that advice.*

*In no event will RSGB, BATC, UK Microwave Group or their volunteers be liable for any loss or damage including, without limitation, indirect or consequential loss or damage, or any loss or damages whatsoever arising from use, or loss of use, of compliance advice given. By using any advice from this document, you agree to the above conditions.*

---

<sup>1</sup> [BATC Online](#)

<sup>2</sup> Noel (G8GTZ), David (M0GHZ), Dave (G8GKQ)

<sup>3</sup> [RSGB PAEC-2 VHF-UHF Beams V1p0 2021-09-22.pdf](#)

## What progress has been made?

To many people, the task may at first seem quite simple. Surely, you just need to know the power density and compare it with the relevant limit, and you will then know if you are compliant? However, when you examine international standards for assessing EMF compliance, you will see that they often extend to hundreds of pages. The difficulty is in the small print and care is needed when making decisions on what can be simplified and what might be significant in some or many situations. Ofcom was notified a while ago that there were no relevant international compliance assessment standards for the amateur licensee; and, even if there were, they would probably be too expensive for the average amateur (IEC standards can cost upwards of €200).

Therefore, we have had to start afresh to develop an assessment model for aperture antennas, to consider the influence of ground and to analyse the resulting data to present information that is relevant to radio amateurs.

Unlike coverage modelling or antenna design, the aim for EMF compliance assessment is not necessarily to give the most accurate determination of the power density in a location, rather it is to give a conservative estimate that is **likely to be higher than** the true value. The Ofcom calculator may do this, but may be so conservative that applying it in many cases would make common amateur microwave operations impractical. The team therefore has had to consider factors that may be utilised to establish compliance with less restrictive constraints and for a wide range of implementations commonly deployed by amateurs.

Work has continued apace since the 2021 BATC convention<sup>4</sup> and to date (21 Nov 2021) we have:

- a) Established a relatively simple algorithm to give a reasonably conservative power density at all locations around an aperture antenna (presented at BATC convention);
- b) Established how to include ground reflections (new since BATC convention);
- c) Established how to include sloping ground and upward-tilted dishes (new since BATC convention);
- d) Established an interim approach to assess offset-fed dishes as well as prime focus dishes (new since BATC convention);
- e) Developed a new way to demonstrate compliance with ICNIRP Basic Restrictions when the RF power level is very low (new since BATC convention).

While development of the methodology continues, and key aspects will eventually be recorded in the RSGB PAEC-3, the BATC/UKuG team feel sufficient progress has been made to share some interim compliance information.

## Compliance based on modelling

The following graphics show the computed exclusion zone for people at ground level near the dish. These relate to the ICNIRP 2020 general public guidelines. The legends show the average power (W) at the feed. The contours for a given power outline the computed exclusion zone for people standing on the ground X(m) along the direction of the main beam (projected onto the ground) and Y(m) to the side of the main beam.

The precise computed shape is challenging to reproduce. Also, especially for the X direction, the boundary is very sharp as an exposed person's head starts to enter the main beam. Therefore, in practice, it will be easier to implement a simpler shape that fully contains the computed boundary.

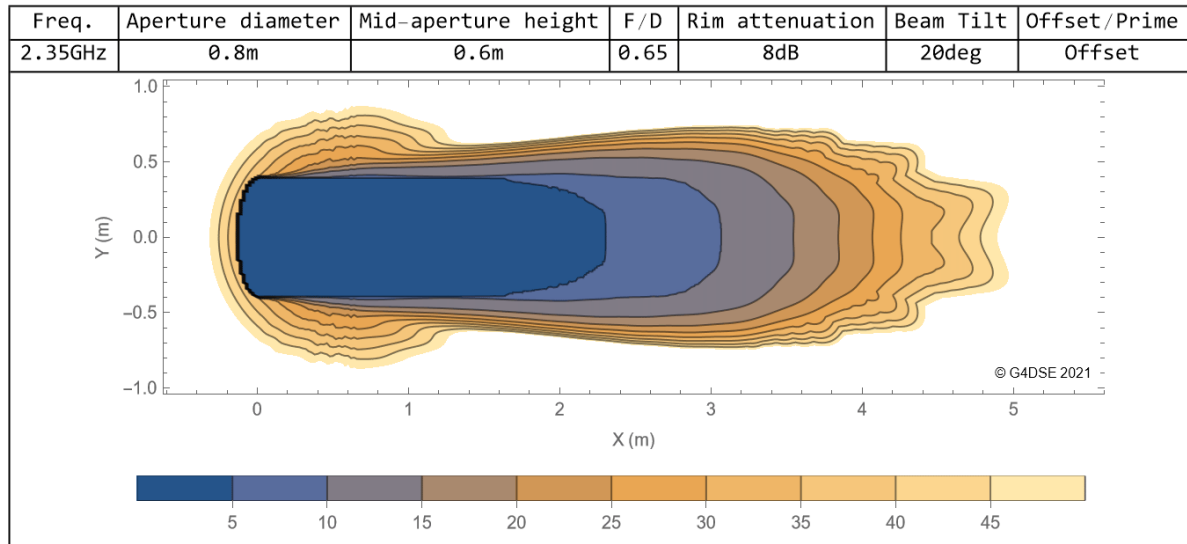
---

<sup>4</sup> [https://wiki.batc.org.uk/images/b/bd/Microwave\\_EMF\\_talk\\_to\\_UKuG-BATC\\_16-10-2021.pdf](https://wiki.batc.org.uk/images/b/bd/Microwave_EMF_talk_to_UKuG-BATC_16-10-2021.pdf)

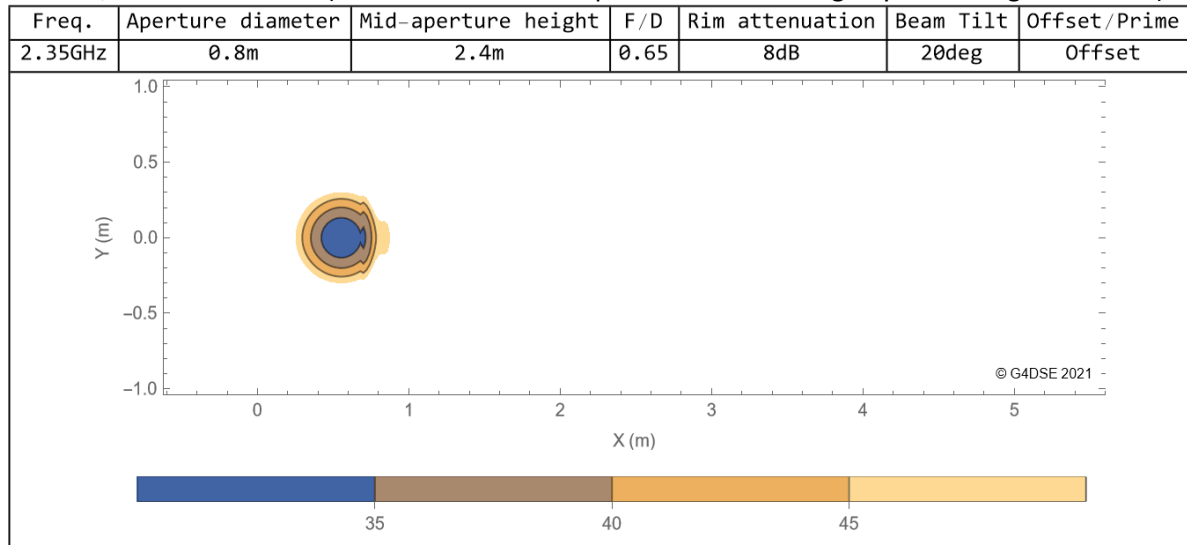
For example, for the ground level 0.8m satellite dish, extend the computed area to a rectangular Exclusion zone: for 10W, 1m wide and 3.5m long; for 50W 2m wide and 5.5m long. Provided you have also taken the requisite steps to ensure that there is no one in that area when you transmit, then you can record your compliance with the EMF licence condition.

### Satellite – 0.8m dish

“Ground level” 0.8m diameter

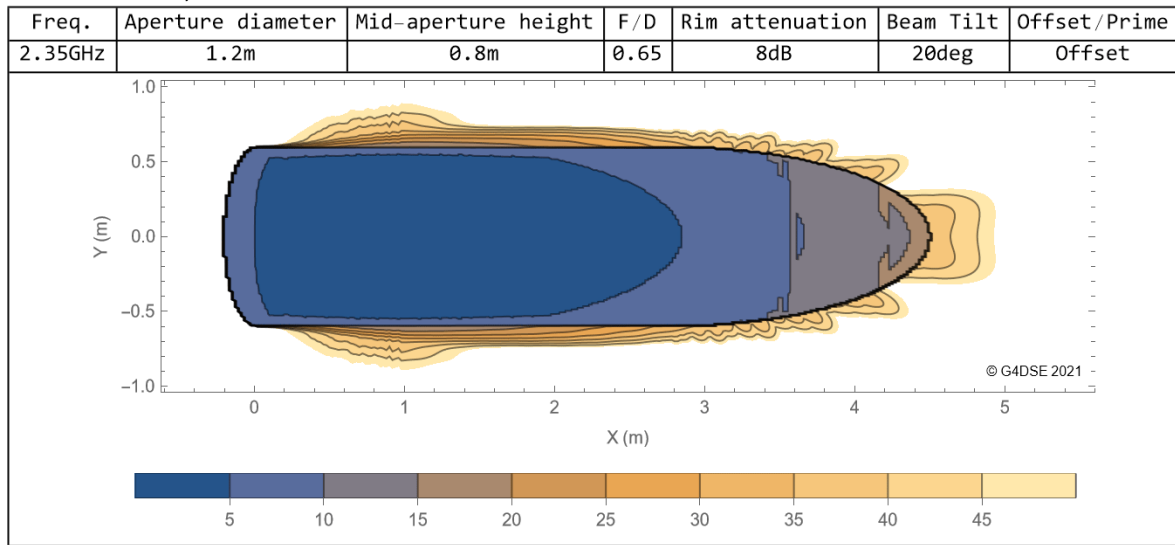


2m AGL, 0.8m diameter – (<30 watts means compliant when standing anywhere at ground level)

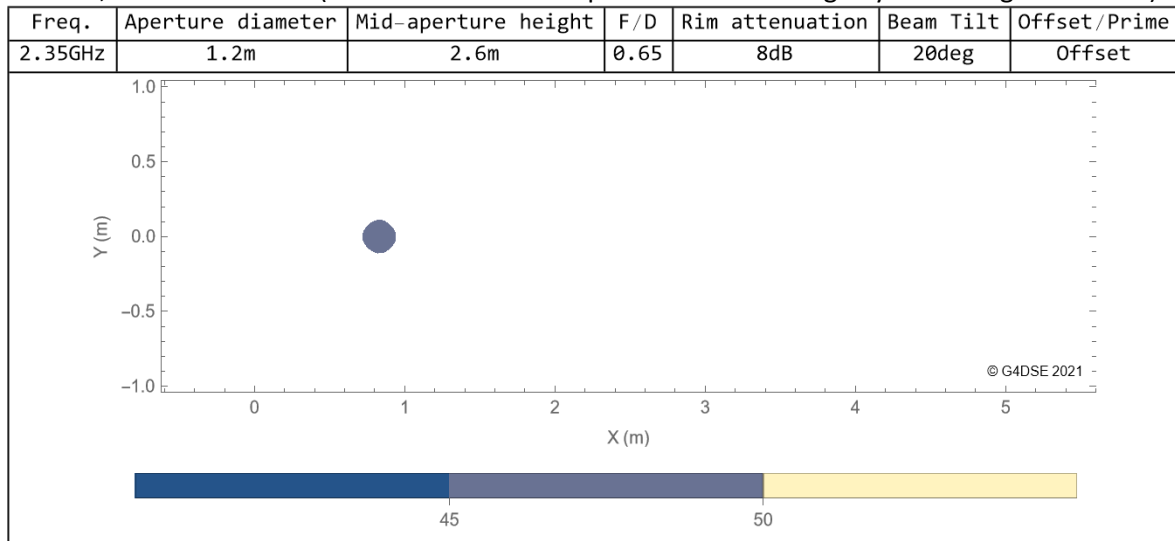


## Satellite – 1.2m dish

“Ground level”, 1.2m diameter

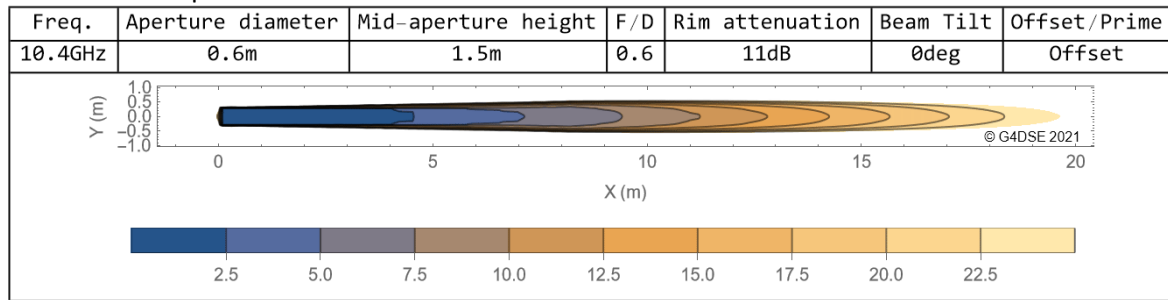


2m AGL, 1.2m diameter – (<40 watts means compliant when standing anywhere at ground level)



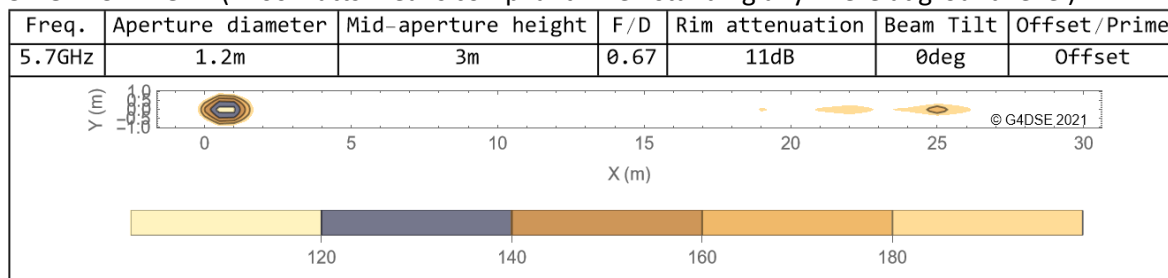
## Tripod – 10 GHz

### 10GHz 1.5m Tripod



## Low pole – 5.7 GHz

### 5.7GHz 3m AGL – (<100 watts means compliant when standing anywhere at ground level)



## Compliance based on low available power

This is a different approach that should be particularly convenient on the higher microwave bands where RF power levels are very low.

Ofcom already allows a low-power exclusion from further assessment if the 6-minute average EIRP is less than 10W (and also the maximum EIRP is under 100W). This concession is very useful for low-power VHF/UHF hand-held radios with small, low-gain antennas – but not for typical amateur microwave dishes because the high forward gain means that 10W EIRP is easily exceeded even with very low RF powers (sometimes only a few tens of milliwatts). But if the available RF power is small enough, there will be insufficient RF energy to exceed the ICNIRP Basic Restrictions<sup>5</sup>.

The ICNIRP Basic Restrictions are the legal basis for our EMF licence condition<sup>6</sup> and are based on the rate of energy absorption by human tissue. Starting from this basic concept, it can be proved that below certain levels of RF power there will be insufficient power absorbed to breach the ICNIRP Basic Restrictions, meaning that compliance is demonstrated. The detailed reasoning will be clarified in PAEC-3 so only the conclusions are given here.

<sup>5</sup> <https://www.icnirp.org/cms/upload/publications/ICNIRPrfgdl2020.pdf>

<sup>6</sup> [https://www.ofcom.org.uk/data/assets/pdf\\_file/0027/62991/amateur-terms.pdf](https://www.ofcom.org.uk/data/assets/pdf_file/0027/62991/amateur-terms.pdf)

The dish feed, the volume within the dish, and the volume projected forward to include the feed is always considered to be part of the EMF Exclusion Zone, where no one should be present when transmitting. The following table applies everywhere else – notably in the main beam from the dish. Compliance with ICNIRP Basic Restrictions (and hence with the licence condition) is assured if the total power available is less than the values given.

*EMF compliance based on low available power*

Frequency (MHz)	Aperture Diameter (m)	Maximum power (W) for unconditional compliance	
		Antenna heights above 2.2m	Antenna heights below 2.2m
1296	2 to 5	3.68	1.0
2350	1.2 to 5	3.68	1.0
3400	0.8	3.52	1.0
3400	1 to 4	3.68	1.0
5750	0.5	1.37	1.0
5750	0.6	1.98	1.0
5750	0.8	3.52	1.0
5750	1 to 2.5	3.68	1.0
10250	0.3	0.45	0.45
10250	0.5	1.25	1.0
10250	0.6	1.80	1.0
10250	0.8	3.20	1.0
10250	1	3.68	1.0
10250	1.2	3.68	1.0
24125	0.1	0.04	0.04
24125	0.2	0.17	0.17
24125	0.3	0.39	0.39
24125	0.5	1.07	1.0
24125	0.6	1.55	1.0
47100	0.1	0.038	0.038
47100	0.2	0.15	0.15
47100	0.3	0.34	0.34
78000	0.05	0.009	0.009
78000	0.1	0.035	0.035
122275	0.05	0.008	0.008
122275	0.1	0.032	0.032
136000	0.05	0.008	0.008
136000	0.1	0.032	0.032
246000	0.05	0.007	0.007

**Notes:**

- Power should be averaged over any 6-minute period, and also depends on the transmission mode (see the RSGB EMF calculator for guidance<sup>7</sup>).
- In addition to the above power limits, **no person must be allowed to access the EMF Exclusion Zone while transmitting. This zone comprises the dish feed, the volume within the dish, and the volume projected forward to include the feed.**

<sup>7</sup> <https://rsgb.org/main/technical/emc/emf-exposure/>