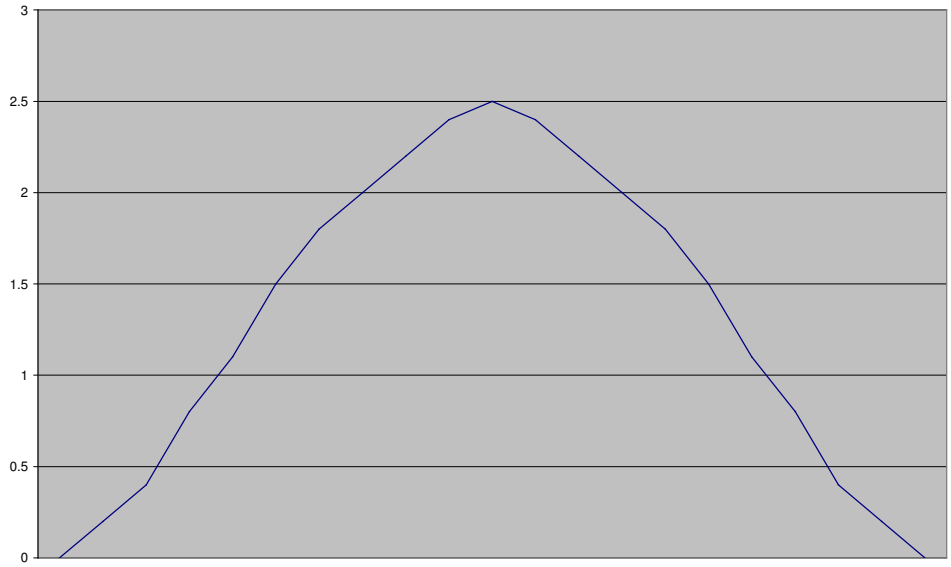
A suggestion for optimising the feedpoint of your dish; by Hans PA0EHG

On SHF and EHF bands the feedpoint needs to be very accurate positioned in the focus of the dish.
The most important parameter to be optimised is the distance from the reflector to the feed.
Of course the feed should be also in the middle of the dish but errors in this can be compensated by adjusting the beam heading to maximum signal.
This is not possible for the distance between the feed and the reflector and errors in this will lead to loss of gain.

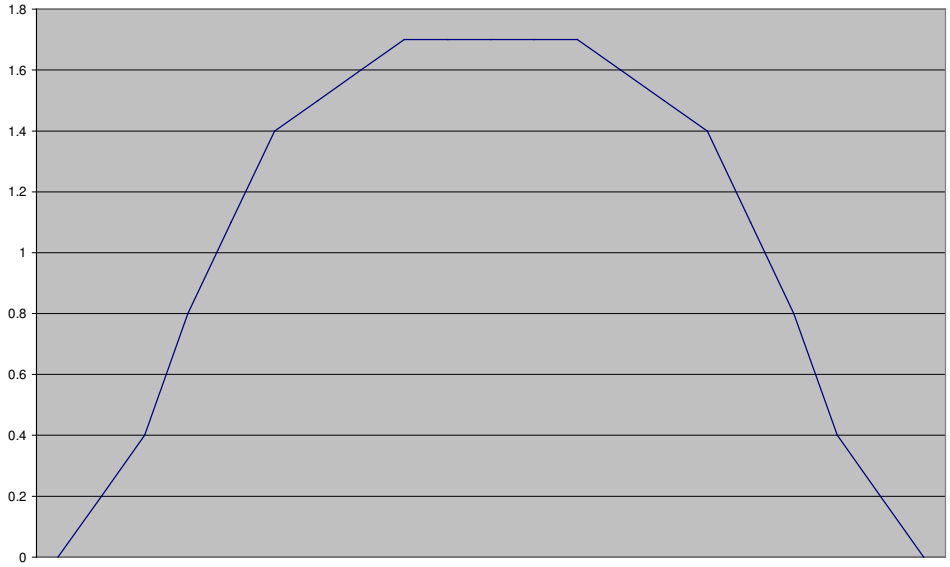
For SHF bands we are used to optimise the feed focal point by adjusting the feed for maximum solar noise.
On 24 GHz using a 3 meter dish this optimisation is a thankful process and from my own experience I adjusted the feed distance between the feed and reflector in several small steps from 2 millimetre ending at a change of almost 10 mm giving me a much sharper beam and about 2,5 dB more antenna gain.

If we set-up a graph for this optimisation it will look something like this:



For millimetre wave optimisation the feed optimisation will be even more critical but when using large dishes the beamwidth is already this small that the beam already covers part of the moon.
For dishes larger than 1.5 mtr (prime focus) the beamwidth on 47 GHz will be similar to the 3 mtr dish on 24 GHz.
If we have larger dishes we will see that changing the focal point will not change the received moon noise or solar noise. The angle of the sun is almost equal to the angle in which we can see the moon. So large dishes on millimetre band cannot be optimised for best solar noise.

I expect the adjustments will give a result like shown in the graph



It is clear that there is no real maximum and the graph shows a flat top.

Adjusting the feed focal point to the level of the flat top looks acceptable but in fact we do not use the total performance of the dish and we have a risk that we have the same performance as compared to a 1.5 meter dish.

For transmit however it's still rewarding if we have more antenna gain and only illuminate a part of the moon. When using a 2.4 mtr dish we can have about 4 dB more gain compared to the gain of a 2.4 mtr dish which is at the edge of the curve top.
To be able to adjust the feed focal point to the optimal point for maximum gain we can use a workaround which will be time consuming but in EME where each 0.1 dB counts it is well worth the effort.

How to optimise the feed focal point, first of all be sure you have a good reference plane to see the distance between the reflector and your feed. Preferably in steps of 1 millimetre we have to be able to adjust the feed distance from the reflector.

First of all we search for the point with optimal solar noise, probably you will notice that close to optimum the curve will flatten.
Then take good notice of the solar noise maximum and the focal distance. Now we will adjust the focal distance for the two points, in front and the back of the previous point to get a –1dB solar noise level. We do the same for the –3 dB solar noise level.
Now we find 4 point close to the first found max solar noise point and the only thing we now must do is to set the feed at the focal distance point exactly in the middle of the –1dB or the –3 dB point. This will get you the best gain performance of the dish.

In practical EME the better optimised dish will not give you a better receive performance but it will get you a better transmit performance with a stronger signal at your QSO partner and also less Doppler smear