

# Finite Ground Screen Effects Upon Below Horizon Response

## Supplemental Update - 9/9/2014

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The 5.5m x 5.5m (18'x18') sized ground screen case was run with rectangular extenders added to the ground screen as shown in figures 1-2. Two sized extensions were run: 1m x 5m and 2m x 5m. The 1m x 5m case is similar in size to the 24'x24' case if one cuts the corners are cut out of the 24'x24' ground plate.

Using the 1m x 5m extensions, the RMS error improves over the base case without extensions from 56 mK to 35 mK, but isn't quite as low as 26 mK which is obtained with the corners filled in (see Table 1).

Using the 2m x 2m extensions, the RMS improves further to 13 mK. This is better than the 24' x 24' size ground plate, but not quite as good as the 48' x 48' ground plate (8 mK).

The last case of a 13.5m x 13.5m (44.3' x 44.3') full grid with small 0.5m x 2m protrusions on the edges, Figure 5, hasn't been run yet, but is expected to be very similar to the 48'x48' sized grid.

Ground Size	RMS Error (mK) 100-200 MHz Poly3	RMS Error (mK) 100-190 MHz Poly3	RMS Error (mK) 100-190 MHz Poly4
4' x 4'	393	425	472
6' x 6'	261	231	119
8' x 8'	138	106	102
10' x 10'	138	131	98
12' x 12'	150	137	31
14' x 14'	114	61	63
16' x 16'	105	101	37
18' x 18'	59	56	57
24' x 24'	49	26	20
48' x 48'	31	8	3
5.5m x 5.5m (18'x18')	59	56	57
5.5m x 5.5m ext 1m x 5m	61	35	21
5.5m x 5.5m ext 2m x 5m	40	13	13

Table 1. RMS error values of the fit assuming the ground is at 300K.

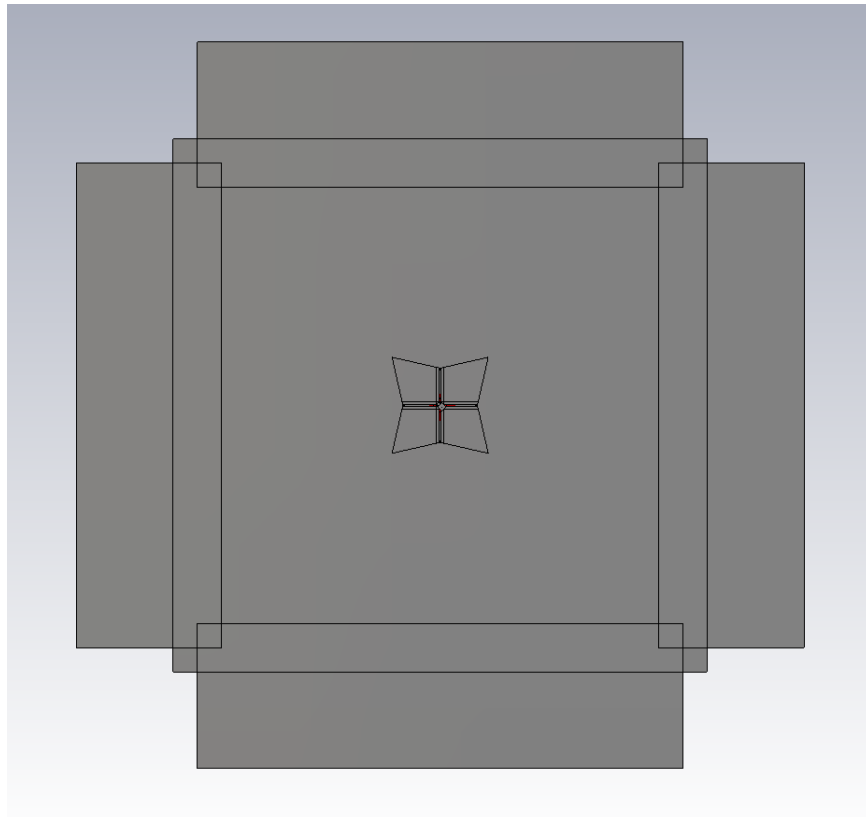


Figure 1. CST simulation using 1m x 5m extensions to the 5.5m x 5.5m central base.

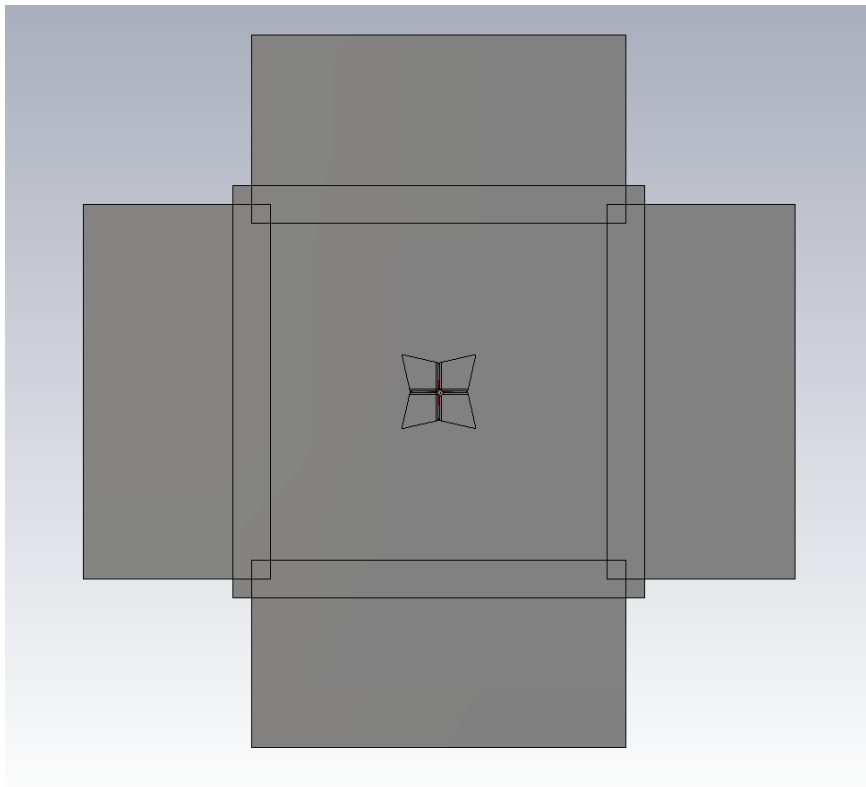


Figure 2. CST simulation using 2m x 5m extensions to the 5.5m x 5.5m central base.

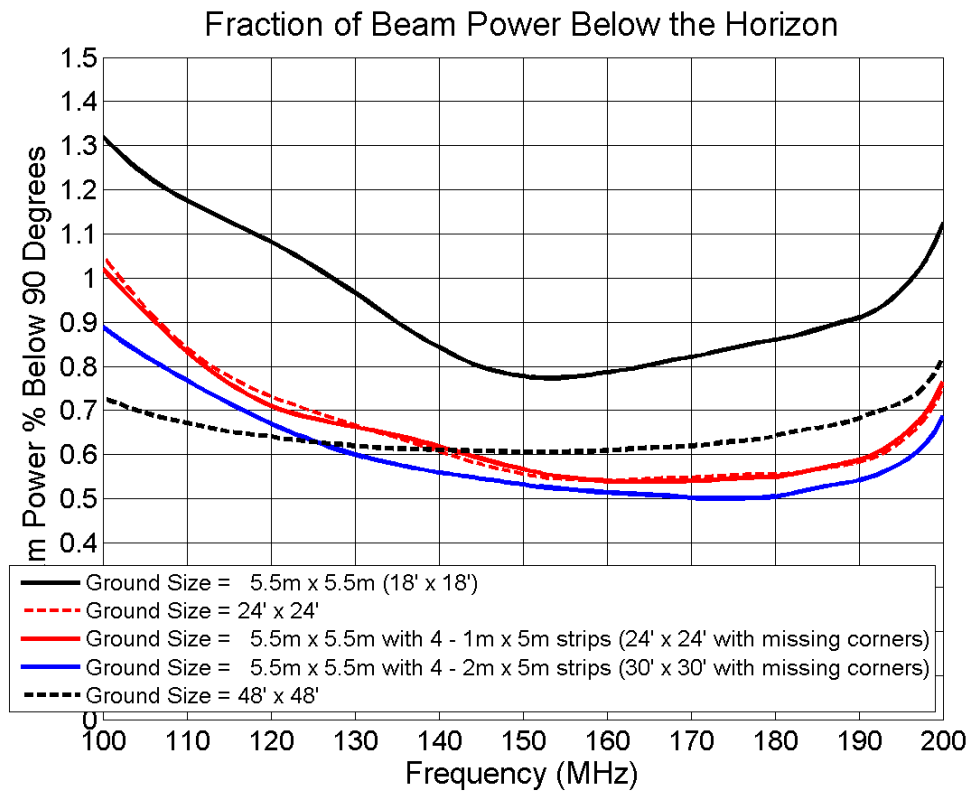


Figure 3. Percentage of the beam below the horizon ( $\theta > 90^\circ$ ) for various sizes of solid ground planes. This graph focuses on the 5m x 5m case with rectangular extensions added as shown in figures 1 and 2. The 48' x 48' case is less frequency dependent than the other cases.

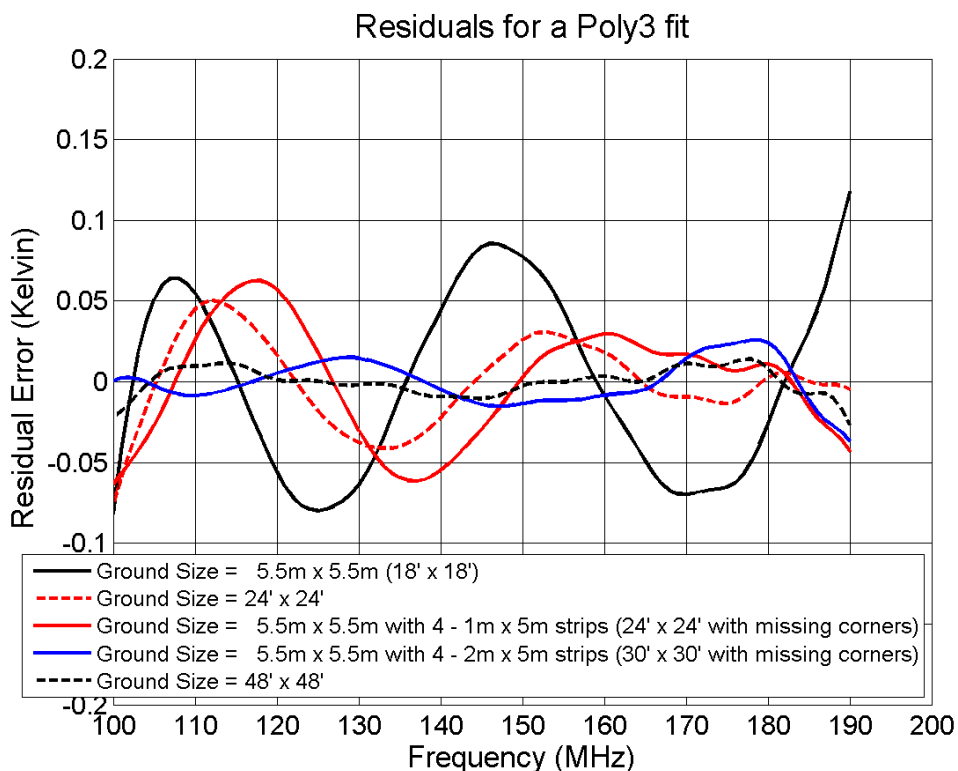


Figure 4. Residuals for a 3<sup>rd</sup> order polynomial fit to  $\log(\text{frequency})$ . The RMS errors are shown in Table 1 above.

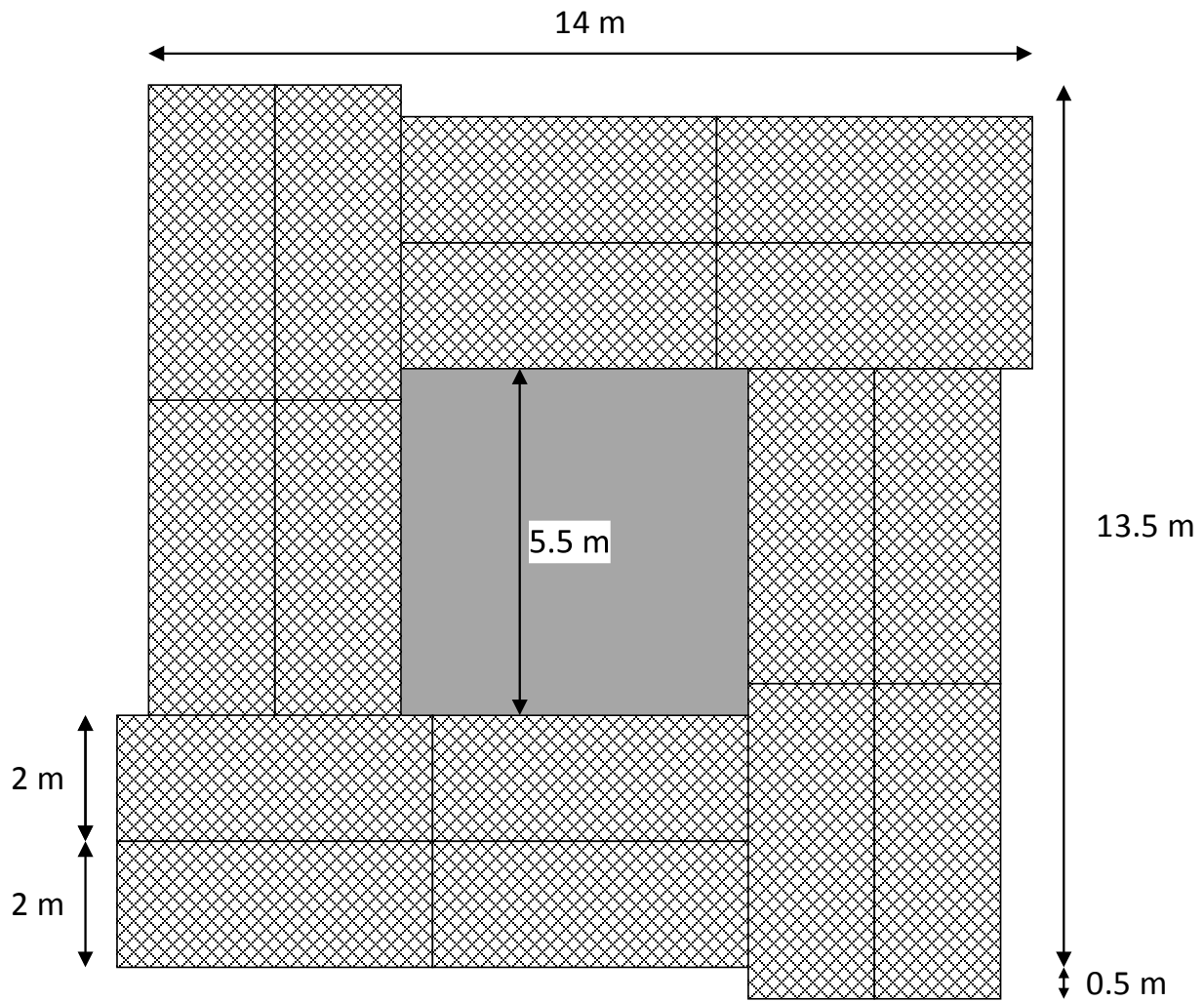


Figure 5. Irregular 13.5m x 13.5m ground plane formed with pieces of 2m x 5m mesh.