

To: Stu Mackenzie – Bird Studies Canada

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Pages: 3

Subject: Yagi interaction when stacked

I did some more computed radiation patterns for our 9E166-* 9-element yagi at 166.38MHz to see the effects of stacking a second antenna pointed in the opposite direction (180°) with different vertical spacings.

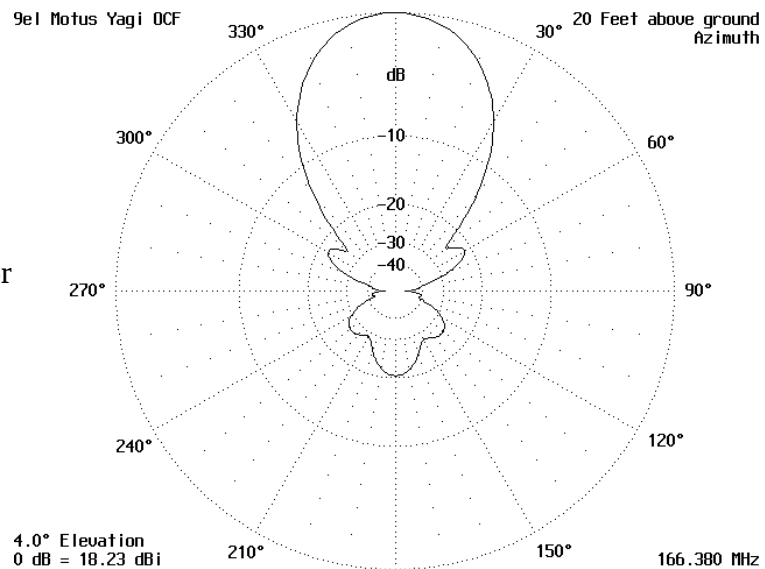
Below are the computed patterns.

1. - Single yagi at 20' above ground.

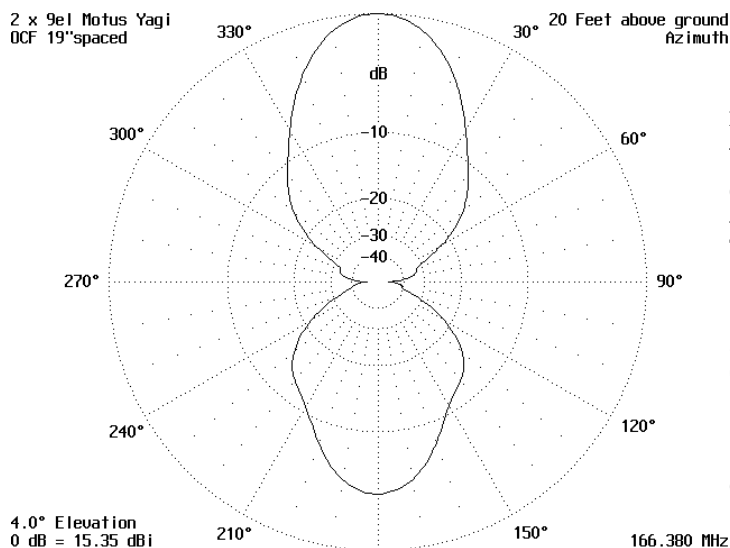
This is the reference pattern with no interaction.

The front-to-back is just over 20dB or 100 times weaker off the back of the yagi.

Detection distance off the back is about 10% of that off the front of the yagi.



2. - Two antennas with second yagi oriented 180° from the first antenna and spaced 19"(0.5m) above the other one up 20'. This shows the pattern change to the single yagi.

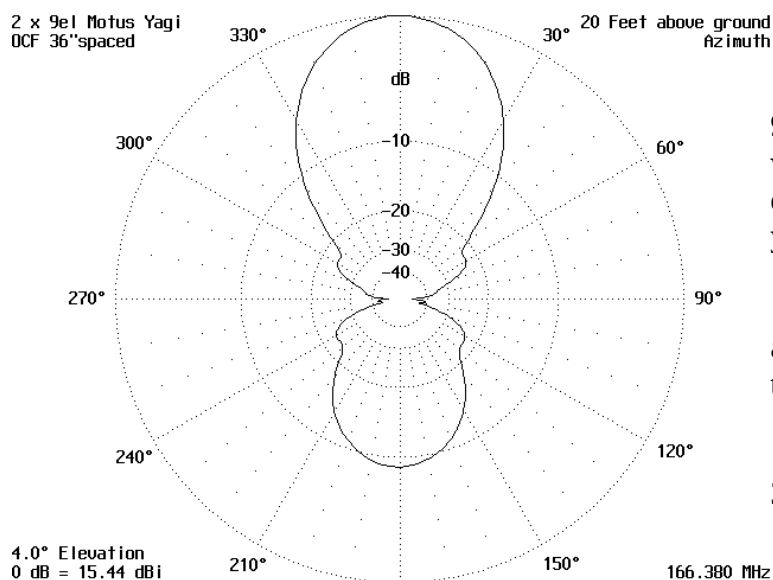


Besides the obvious loss of front-to-back ratio, the forward gain has dropped about 3dB which would cause a reduction of detection distance of almost 30% in the direction the yagi is pointed.

Signal detection off the back is now much greater by a factor of almost 16dB or approx. 63 times greater than just that of a single yagi.

Detection distance off the back is about 63% of that off the front of the yagi.

3. Two antennas with second yagi oriented 180° from the first antenna and spaced 36"(0.91m) above the other one up 20'.

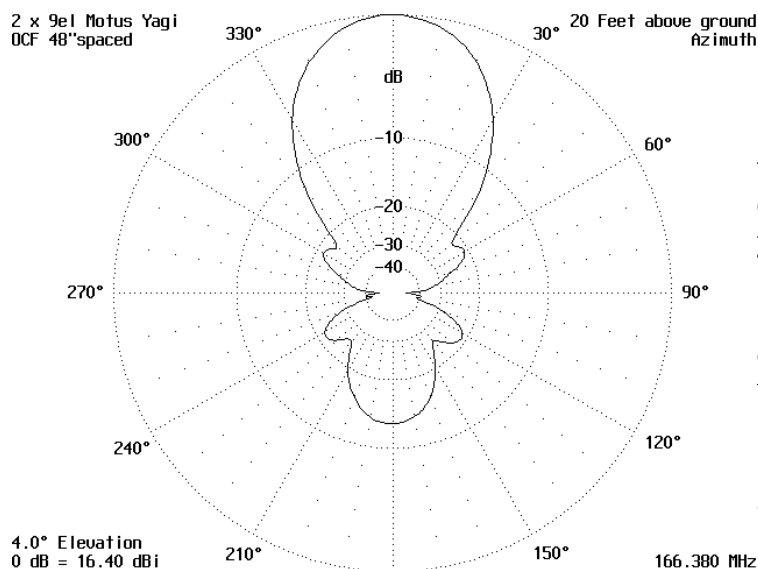


The front-to-back ratio is now close to 9dB, the gain has dropped about 2.8dB which would cause a reduction of detection distance of almost 28% in the direction the yagi is pointed.

Signal detection off the back is now almost 11dB or approx. 13 times greater than that of a single yagi.

Detection distance off the back is about 35% of that off the front.

4. Two antennas with second yagi oriented 180° from the first antenna and spaced 48"(1.22m) above the other one up 20'.

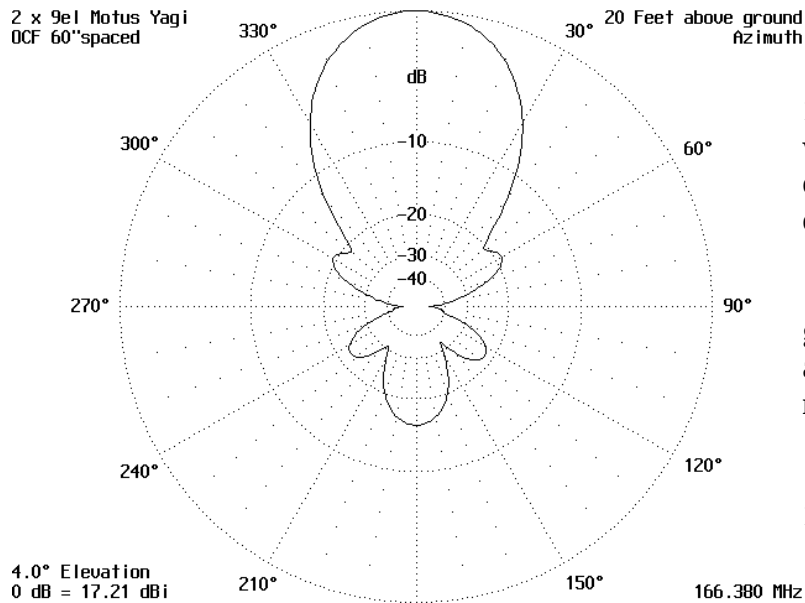


The front-to-back ratio is now close to 13dB, the gain has dropped about 1.8dB which would cause a reduction of detection distance of almost 19% in the direction the yagi is pointed.

Signal detection off the back is now almost 13dB or approx. 20 times greater than just that of a single yagi.

Detection distance off the back is about 22% of that off the front.

5. Two antennas with second yagi oriented 180° from the first antenna and spaced $60''$ (1.52m) above the other one up 20'.



The front-to-back ratio is now approx. 16dB, the gain has dropped about 1dB which would cause a reduction of detection distance of about 11% in the direction the yagi is pointed.

Signal detection off the back is now greater by a factor of about 3dB or approx. 2 times greater than just that referenced to a single yagi.

Detection distance off the back is about 14% of that off the front.

Recommendations: If only two yagis are to be used at a site, and they are to be oriented 180° apart, a minimum recommended spacing should be $60''$ (1.52m). There will be approx. 10% reduction of forward gain of both yagis, plus detection off the back of each yagi will be degraded by about 14%.

These are theoretical calculations and will vary somewhat in the field.

Feel free to share this information Bob Morton