

CST Simulation Results Using the New Top Cap Design

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Full-model CST simulations were run using the August 11 revision of the new top cap design as specified by Alan Rogers. Figure 1a show a picture of the model used. Some features of interest are: a $\frac{1}{4}$ metal base plate was used, the bottom of the simulation space was ground, and there was a full shield in place. The S11 curves were extracted from these simulations using CST and shown in Fig 4. The tuning of the capacitors not associated with the top cap were varied in 9 different runs. This report focuses on three of these runs.

Run1 – New top cap design, old CST tuning parameters.

Run2 – New top cap design, new tuning parameters as suggested by Alan.

Run9 – New top cap design, old tuning parameters except the tuning capacitance between the tubes is increased by 10%

The graphs included are:

- 1) The tilt angle of the beam with frequency (Fig 3).
- 2) S11 patterns of the new top cap with tuning variations (Fig 4).
- 3) RMS error vs. LST of the old design vs the new designs for various powers of a log frequency polynomial fit (Fig. 5).
- 4) Residuals vs frequency of the old design vs the new designs for various powers of a log frequency polynomial fit (Fig 6).

The beam pattern and the residuals are very sensitive to the tuning parameters as can be seen in the graphs. I have not isolated the parameter with the highest impact as of this report.

Conclusion: The tilt angle is greatly reduced from previous designs, except that Run2 shows an anomaly at 195 MHz. Something went wrong with the simulation as the beam pattern degrades in a manner never seen before in simulations (see Figs 2a-c).

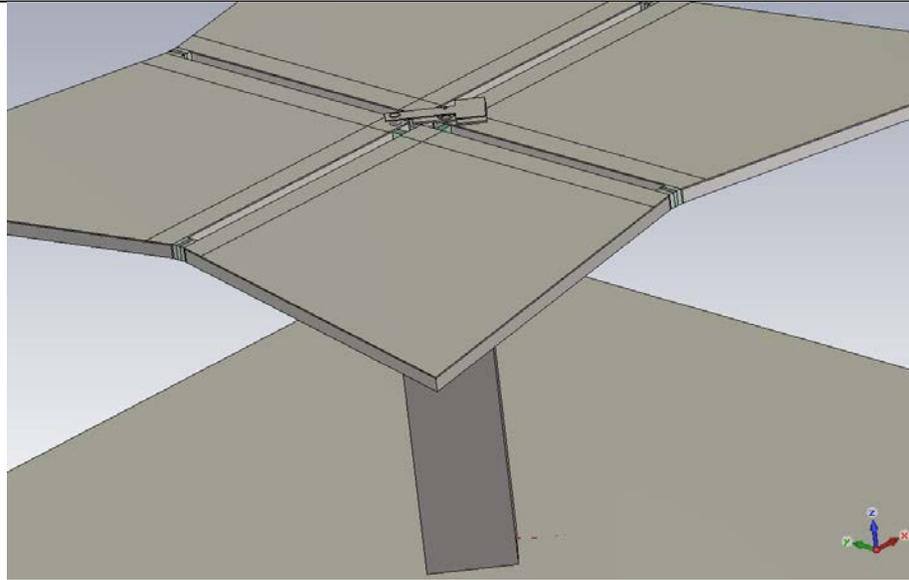


Figure 1a. Edges antenna used for simulations. There is no LNA box and the full shield is in place.

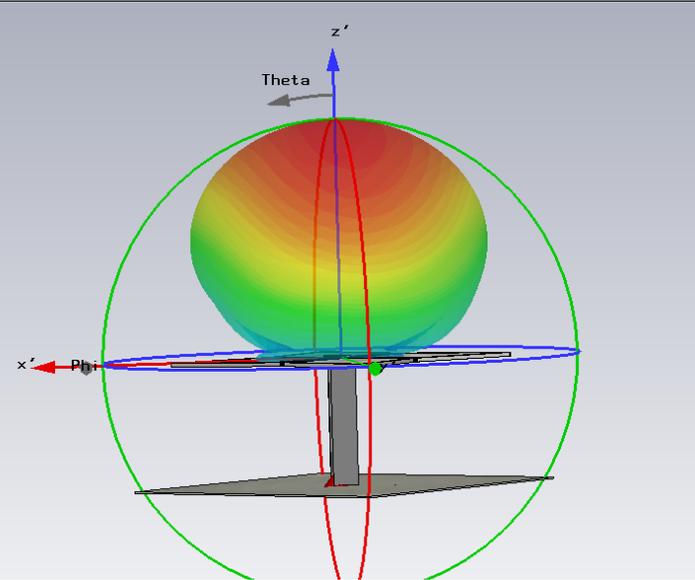


Figure 1b. Typical beam pattern at 190 MHz, Run #1.

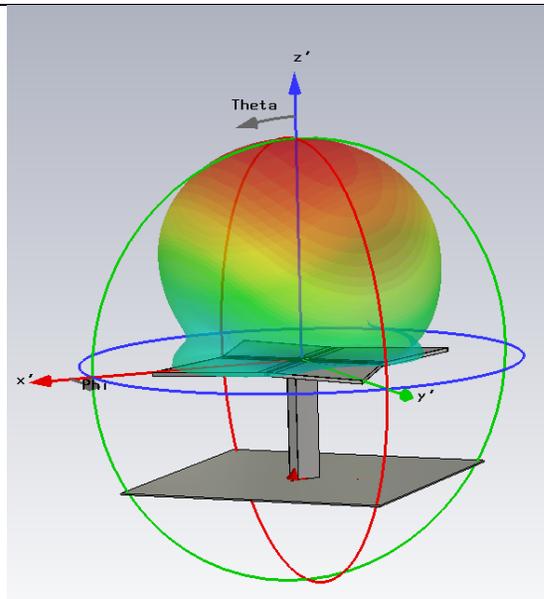


Figure 2a. Run 2. 3D beam pattern at 190 MHz. Excessive side lobes forming.

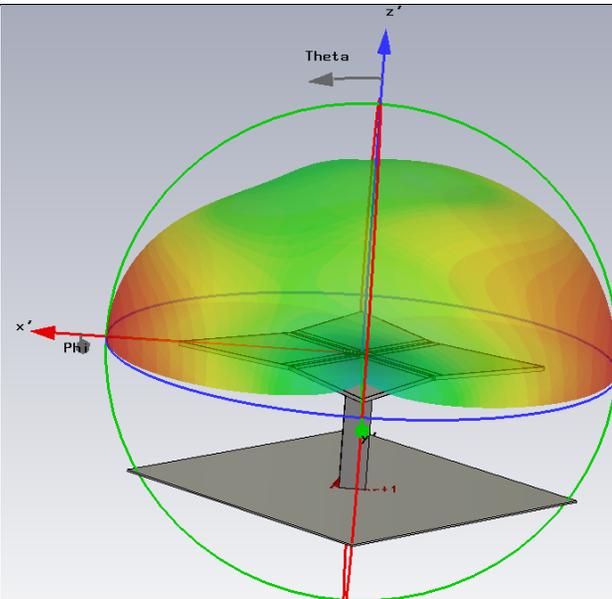


Figure 2b. Run 2. 3D beam pattern at 195 MHz

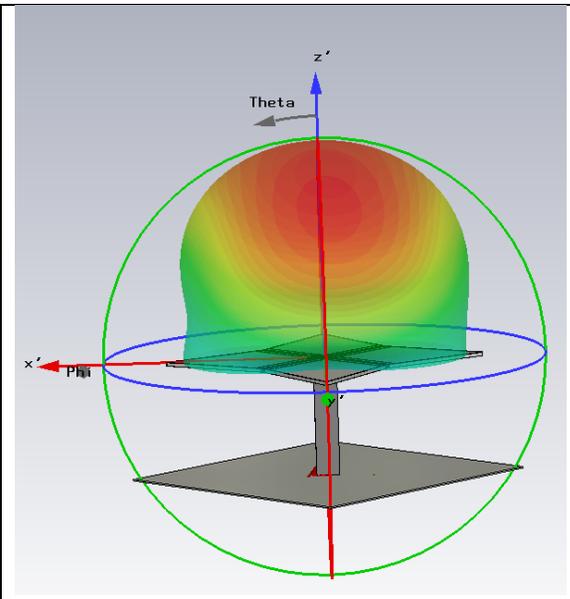


Figure 2c. Run 2. 3D beam pattern at 200 MHz

Tilt Angle Theta Using the New Top Cap using three tuning scenarios

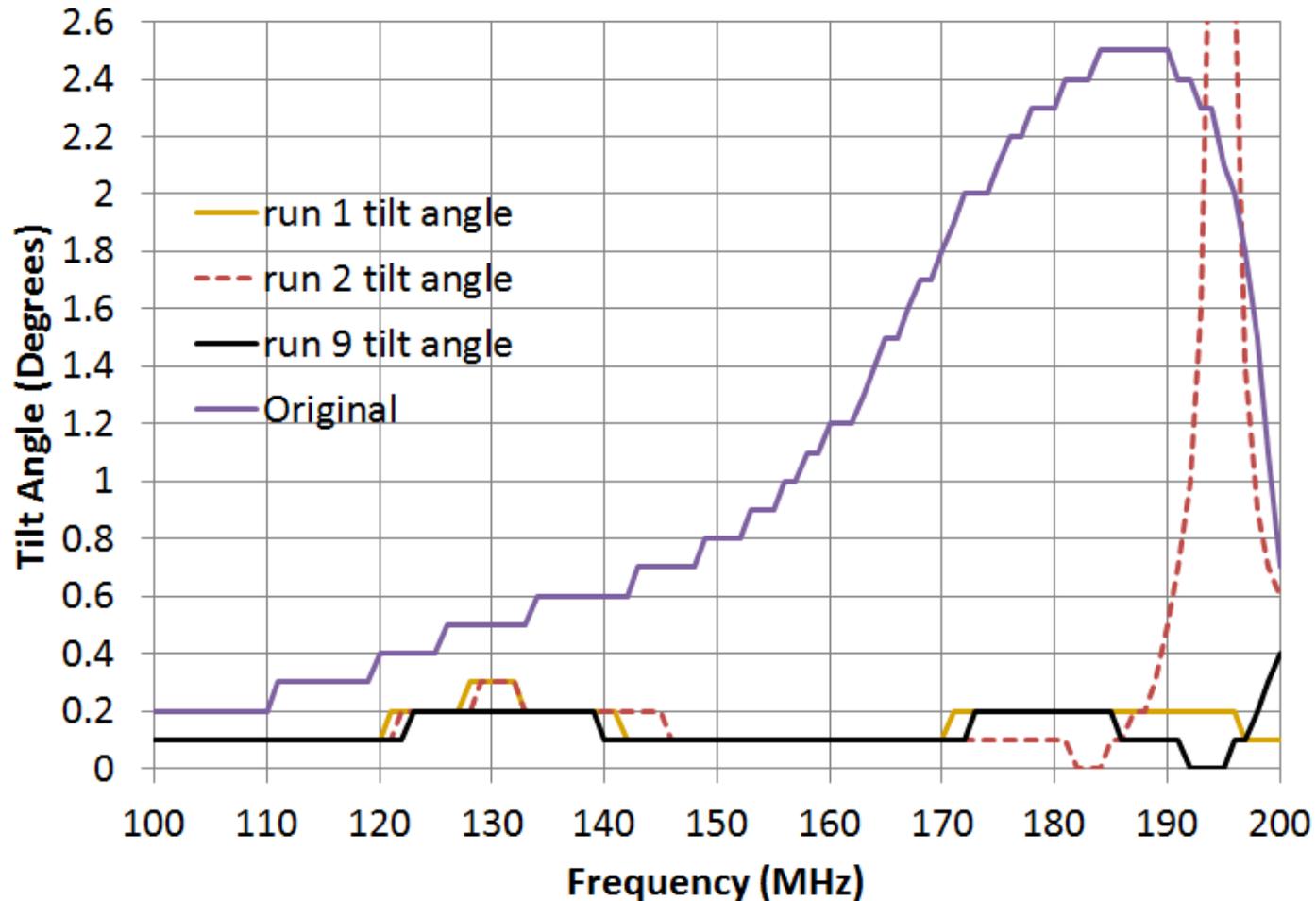


Figure 3. Tilt angle using the new top cap and three tuning parameter variations. Run 1 – old tuning parameters, Run 2 – Suggested tuning parameters, Run 3 – old tuning parameters with the tuning cap between the tubes in the balun increased by 10%. The beam pattern for Run 2 at 190 MHz is not to be trusted as the S11 response went to zero at that point.

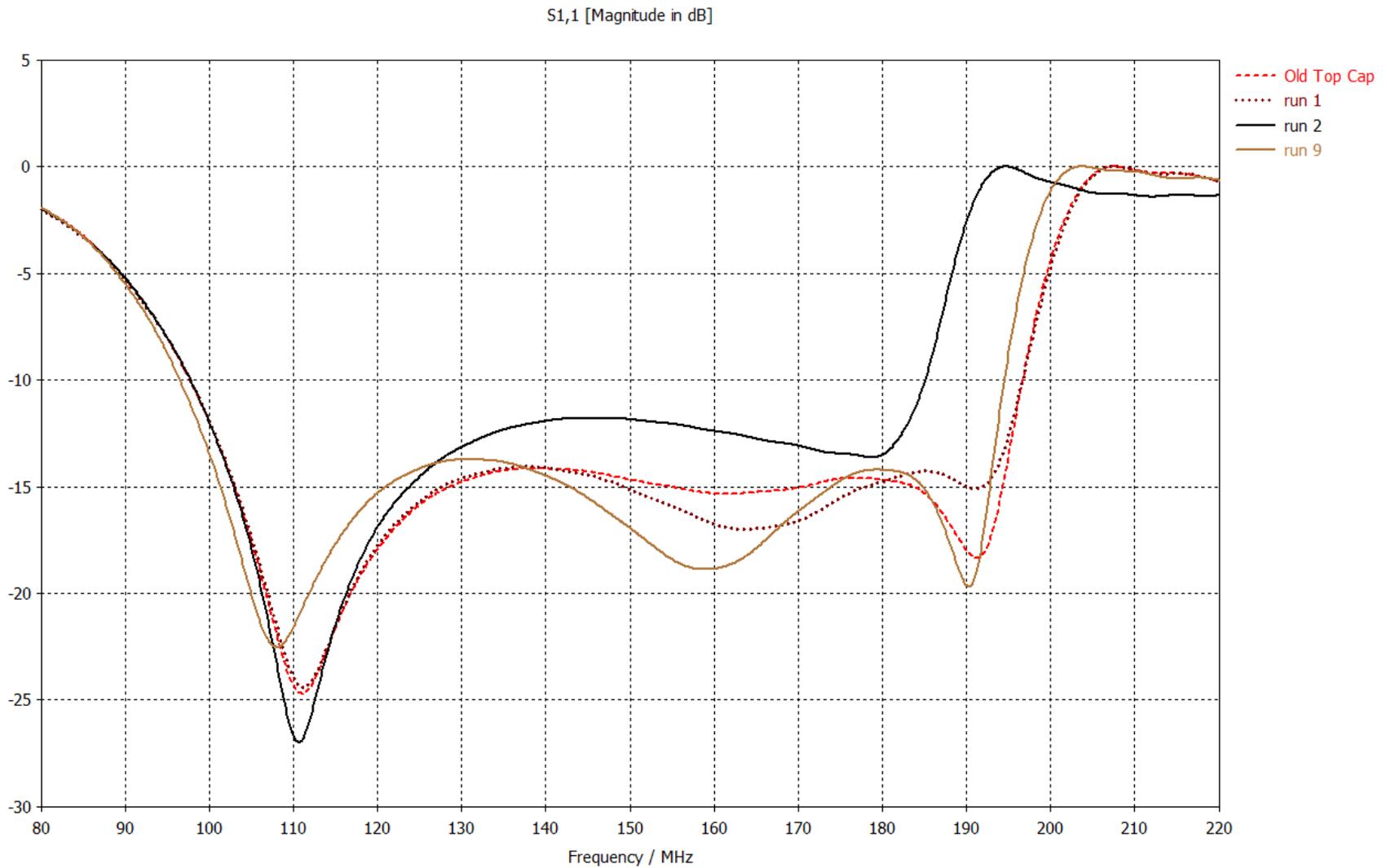


Figure 4. All curves use the new top cap except the “Old Top Cap”. Run 1 – old tuning parameters, Run 2 – Suggested tuning parameters, Run 3 – old tuning parameters with the tuning cap between the tubes in the balun increased by 10%.

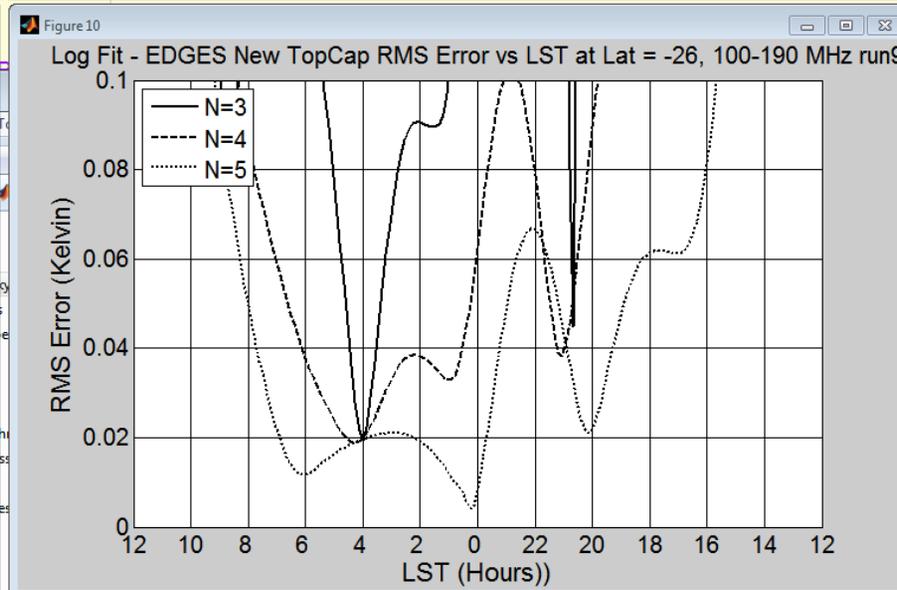
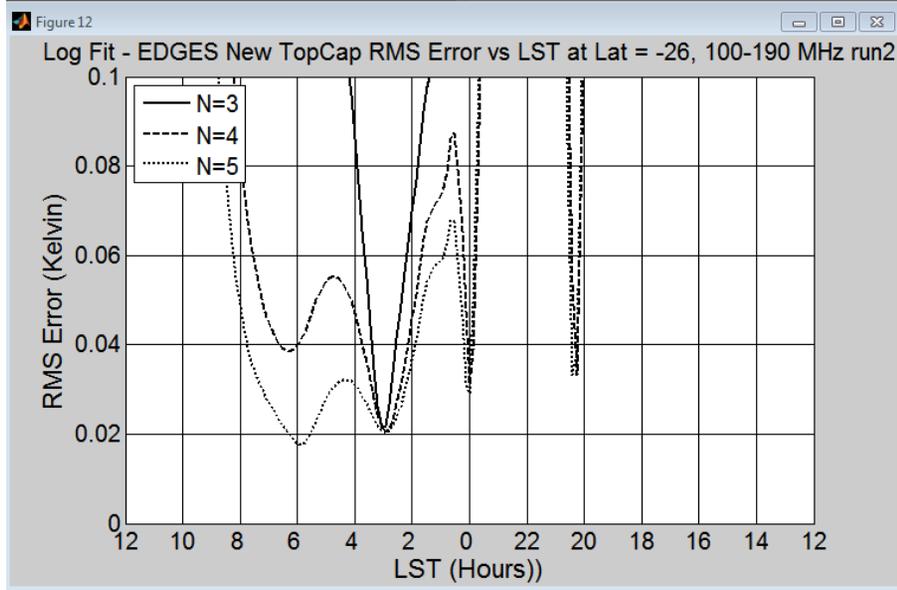
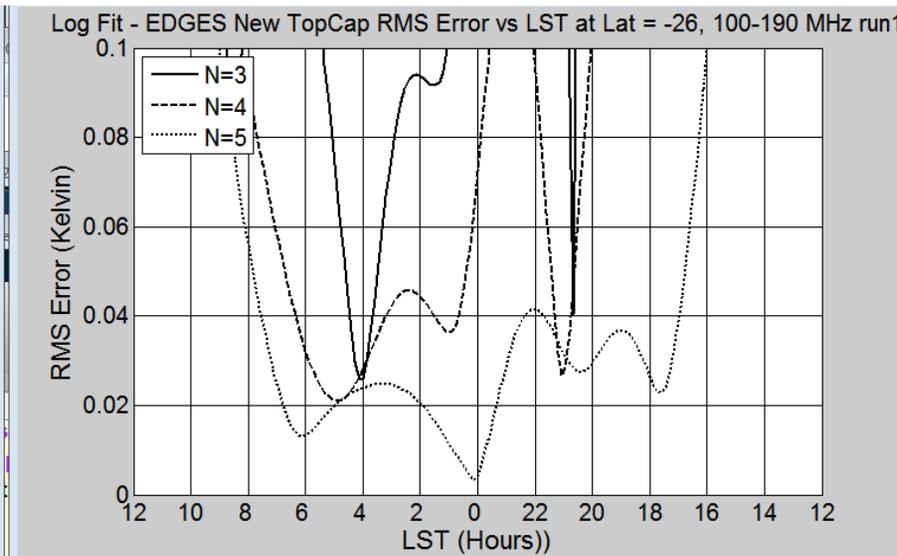
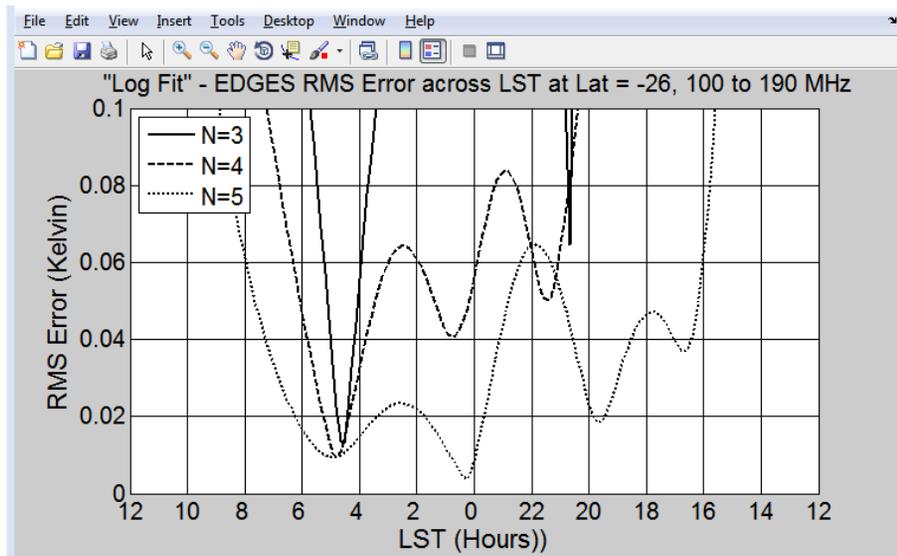


Figure 5. RMS Error using the new top cap and three tuning parameter variations. Upper left: Original. Upper right: Run 1 – old tuning parameters. Lower Left: Run 2 – Suggested tuning parameters. Lower Right: Run 3 – old tuning parameters with the tuning cap between the tubes in the balun increased by 10%.

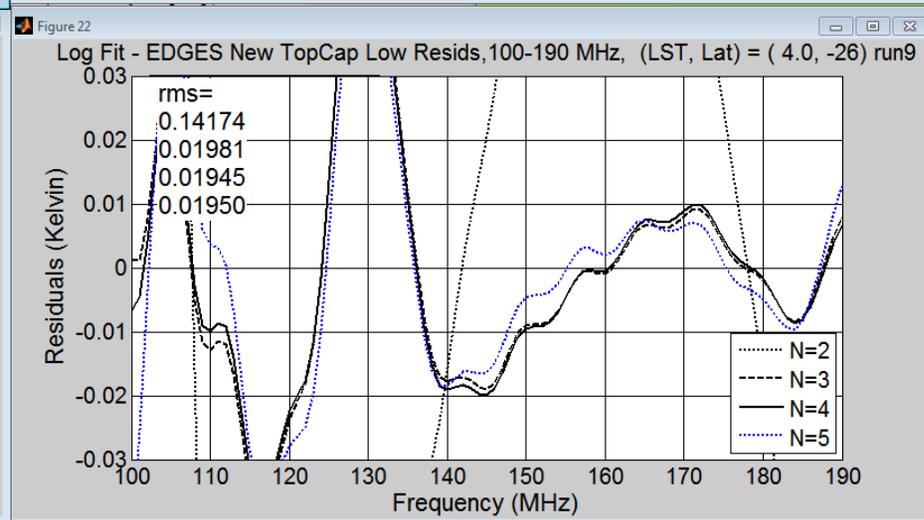
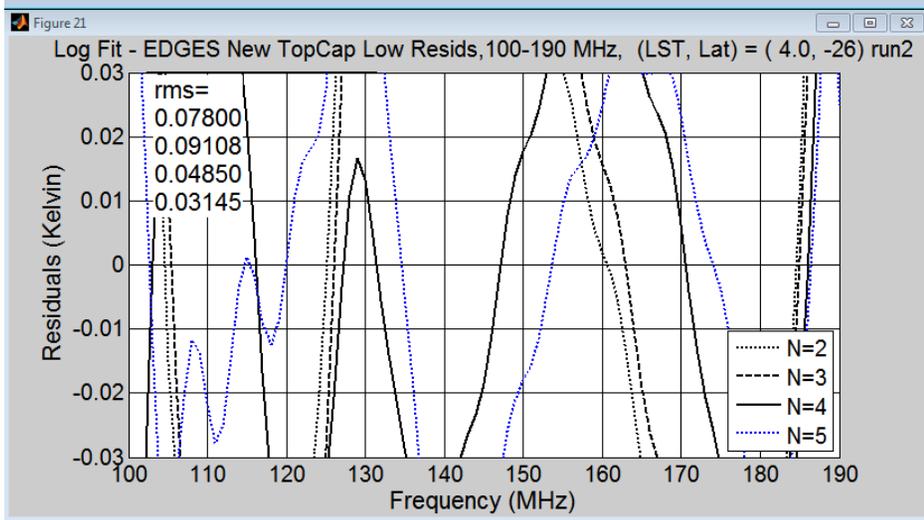
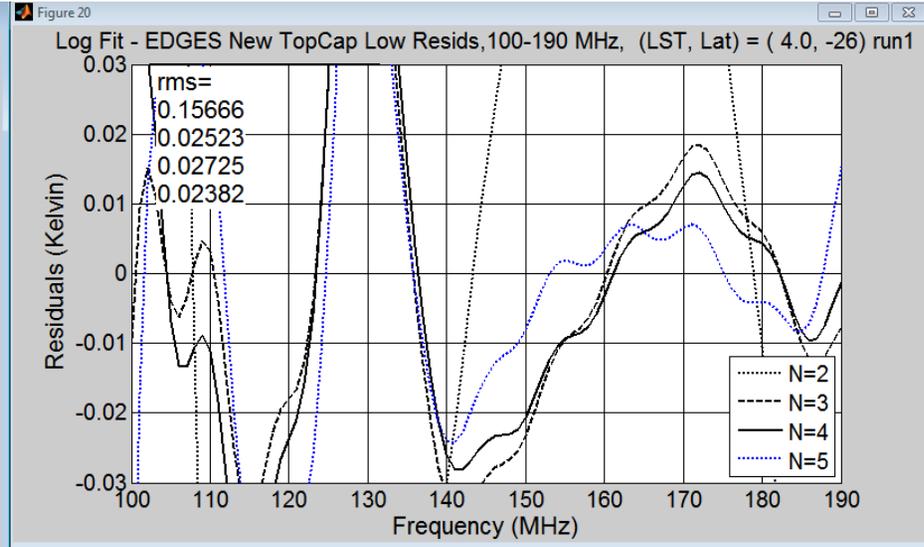
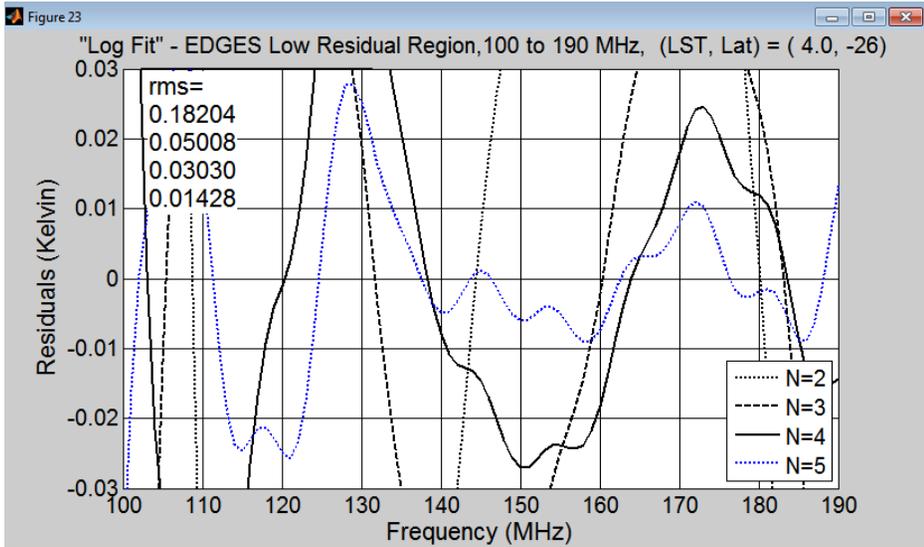


Figure 6. Residuals at the low LST location of Latitude = -26 using the new top cap and three tuning parameter variations. Upper left: Original. Upper right: Run 1 – old tuning parameters. Lower Left: Run 2 – Suggested tuning parameters. Lower Right: Run 3 – old tuning parameters with the tuning cap between the tubes in the balun increased by 10%.