

Simulation of SARAS Low-band Antenna

Nivedita Mahesh
ASU

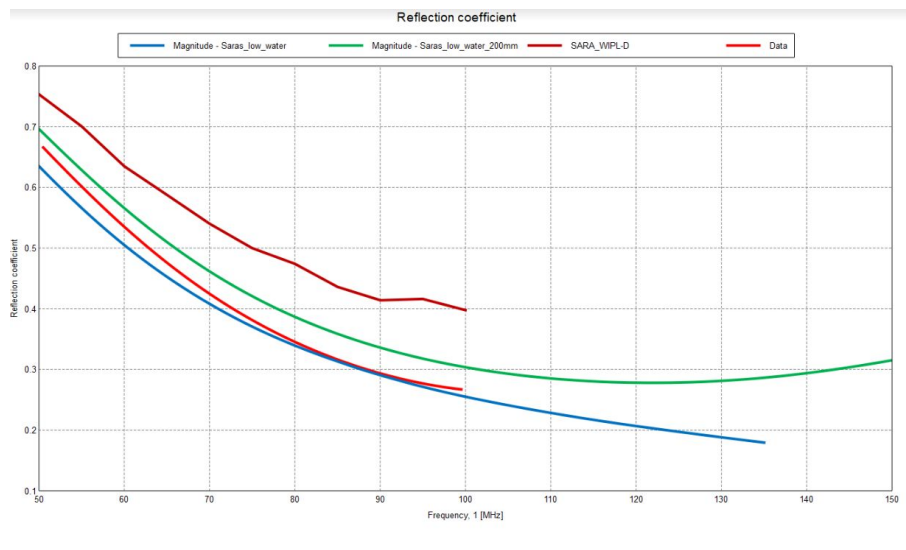
The document summarizes the simulation of the SARAS lowband discone monopole antenna. The S11 of the antenna obtained from FEKO is compared with the values obtained from WIPL-D and Measurements provided by Ravi Subhrahmanyan. The Antenna's beam chromaticity is analysed using Beam derivative plots and puncture points gain as done with the EDGES antenna.

Antenna configuration

- 1.) The discone has a base radius of 830mm and height of $830/\sqrt{2}$ mm
- 2.) The ground plane has a radius of 830 mm
- 3.) The antenna is 200mm above the water
- 4.) The properties of the water are: permittivity = 80 & conductivity = 0.06S/m
- 5.) The cone terminates at about 3mm above the ground plane and the connector pin is also 3mm in radius.

S11 results

The SARAS group simulated the antenna using WIPL-D and obtained S11 values that were 10% off from their actual measurement.

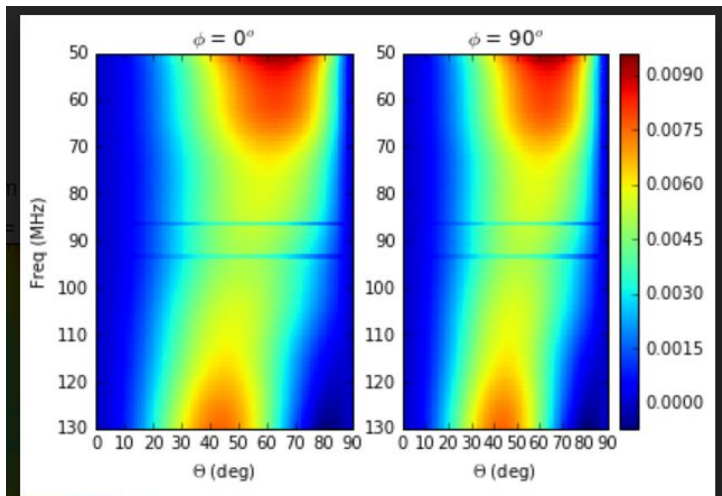


- FEKO is definitely more accurate in terms of simulating the antenna than WIPL-D
 - As seen with the better agreement with the actual measurement
- The actual measurement lies between the simulations of placing the antenna directly on water and 200mm above

- Caveats: 1.) exact connector pin wasn't taken into account, 2.) did not include shaft below.
- The S11 agreement to actual measurement gives us confidence in FEKO simulations in general. And answers one of the concerns that was raised in the workshop - "the strength of a simulation software can be judged with its S11 results"

Beam patterns and Chromaticity

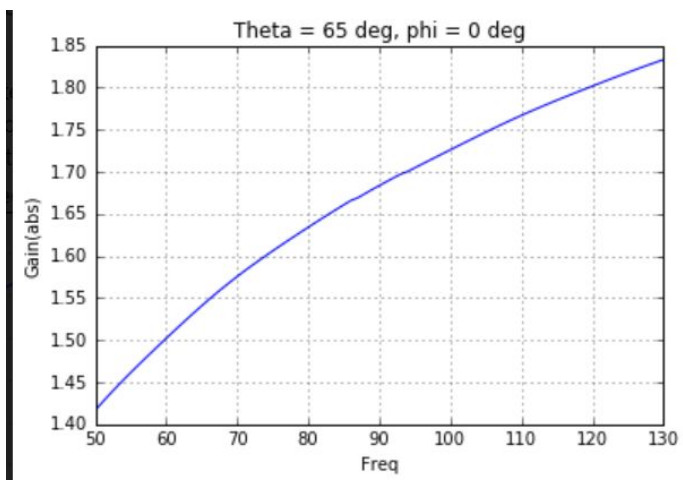
The beam chromaticity of the antenna was analyzed with the Beam Derivative plot below:



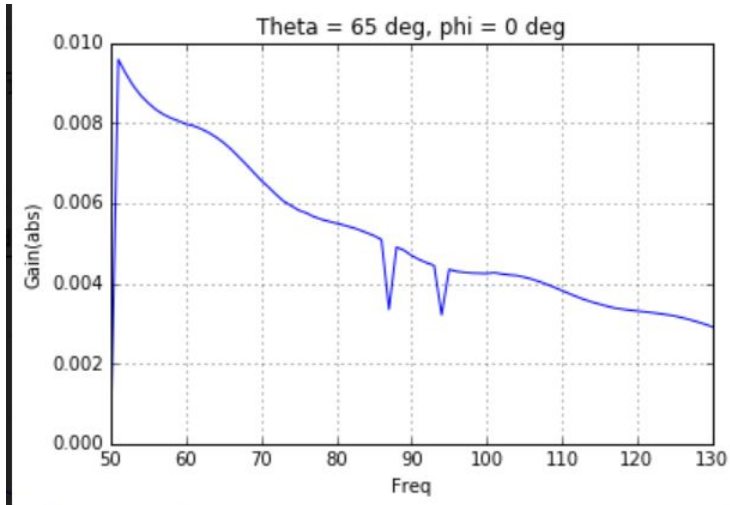
* Please note - The color scale! The beam is definitely less chromatic.

Also the peak of the beam is around 65 deg in theta.

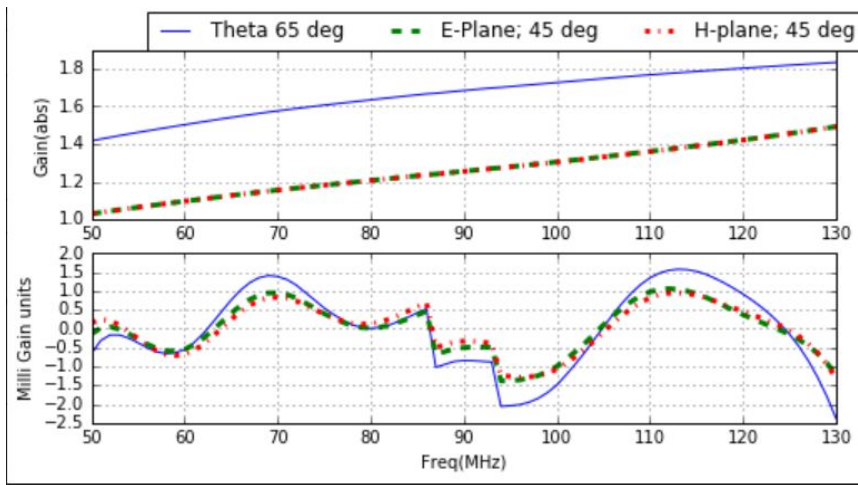
There is a step in the derivative plot. This is due to a glitch in the beam plot itself. As shown below:



For better visualization, below is the derivative plot of the above gain plot.

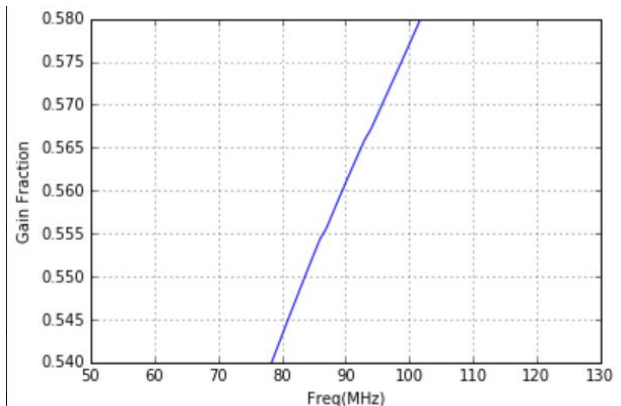
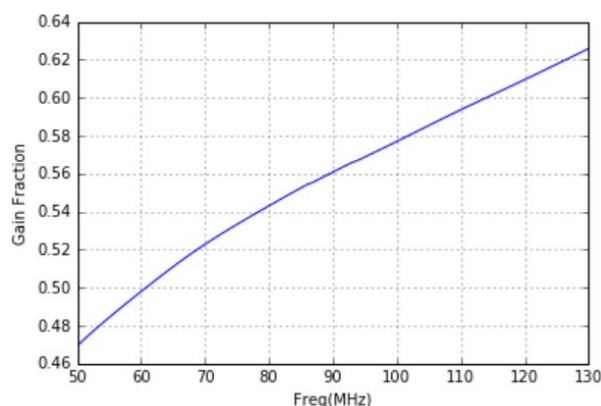


Chromaticity was also analysed with the Gain at puncture points plot:



- The max to max gain variation is within 2 milli gain units.
- For reference, the edges blade over PEC predicts max to max variation of 8 milli gain units.

The disadvantage of SARAS is that the gain fraction above the horizon is low than that of the EDGES low-band. Below is the gain fraction plot:



- There is definitely some glitches around 86 MHz and 93 MHz.
- This could be another confirmation of our glitch idea and it not being an artifact due to the antenna.