# Airline Measurements at the Input of the Low-Band 1 Receiver

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Here we show the calibrated reflection of the terminated Maury 8043S15 15-cm airline measured at the input of the Low-Band 1 receiver. The VNA used was the Agilent E5061A. We compare these measurements with equivalent measurements done at the input of the same VNA (described in report #100), as well as with theoretical models for the terminated airline.

Two measurements were done at the receiver input, in 2017-05 and 2017-07 respectively. Both were done with the receiver at $25°$C, and during the sessions of S11 switch characterization, after the receiver had been brought back from the field for recalibration.

As the following figures show, we find that the calibrated measurements at the receiver input, in particular of the airline+match, agree reasonably well (better than $0.2$ dB in magnitude and $\pm 4°$ in phase) with the models as long as we assume in the models a value for the radius of the inner conductor that is $\approx 0.34\%$ larger than the nominal value. Equivalently, we could have assumed a smaller value for the outer conductor radius. These changes for the radii are consistent with what was found for the measurements of the terminated airline done at the VNA input, shown in report #100, and also here for the case using the E5061A VNA. However, to agree better with the measurement of the airline+match at the VNA input, the model requires a value for the inner conductor radius that is $\approx 0.5\%$ larger than the nominal value.

For the airline+match, the phase differences between measurements and model cannot be reduced below $2°$ for all measurements simultaneously. If the model is refined to achieve the best possible agreement with one specific measurement, the agreement with the other measurements will be degraded. The differences in the calibrated measurements at the receiver input or VNA input, in particular of the airline+match, is not necessarily due to measurement inaccuracies or instabilities, but potentially due to limited repeatability in the airline assembly.

Finally, a more consistent difference is observed between the magnitude of the model and measurements of the airline+open and airline+short. The differences are $\lesssim 0.003$ and $\lesssim 0.005$ dB, respectively. This difference is not sensitive to realistic changes in airline parameters, and is present for the measurements at the VNA input and receiver input, both done with the E5061A.

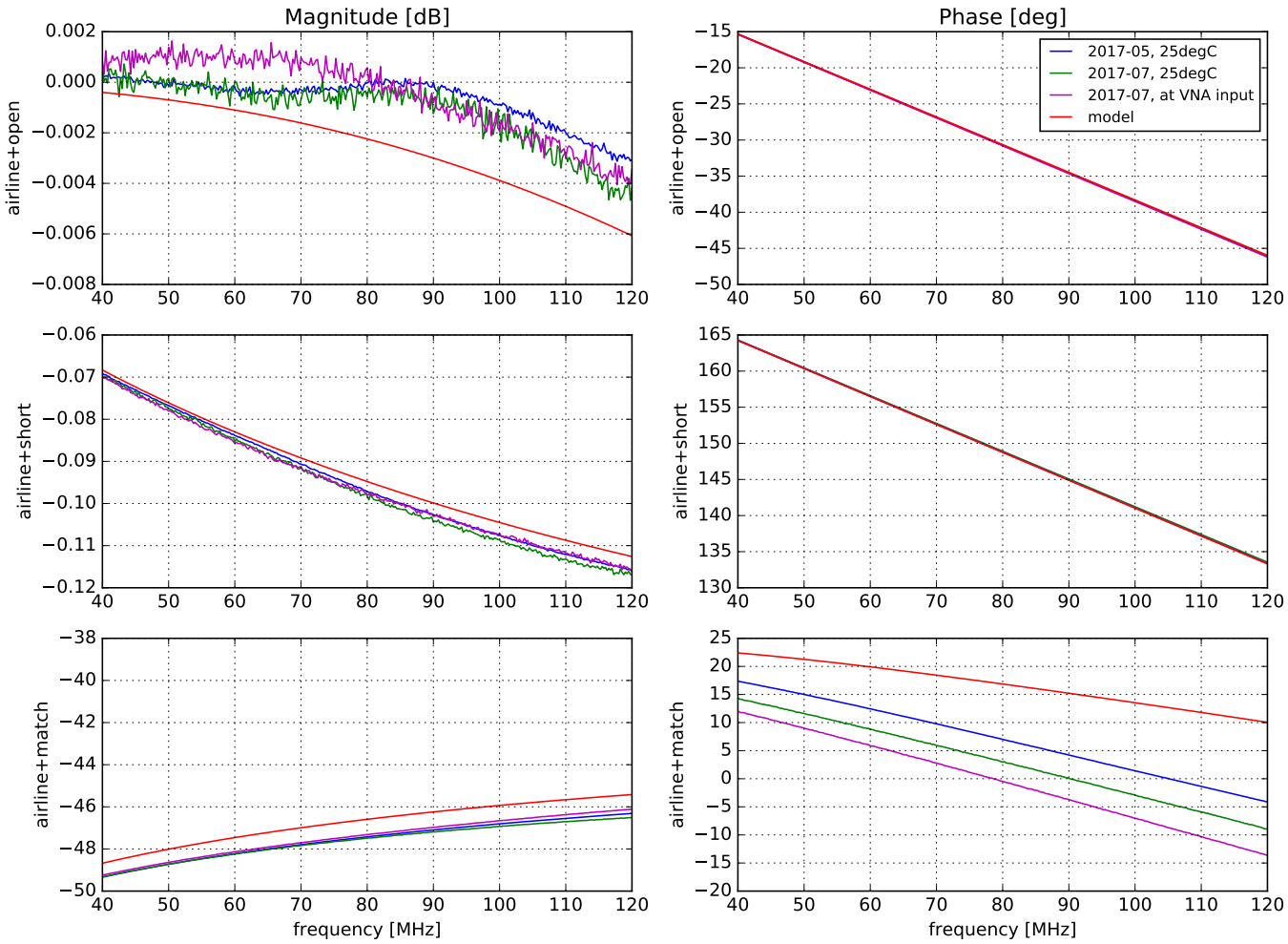


Figure 1: Calibrated measurements of the terminated airline at the input of the Low-Band 1 receiver, compared to measurements at the input of the E5061A VNA, and to nominal models of the terminated airline. The measurements through the receiver were calibrated using the 2017-05 and 2017-07 parameters of the switch, respectively.

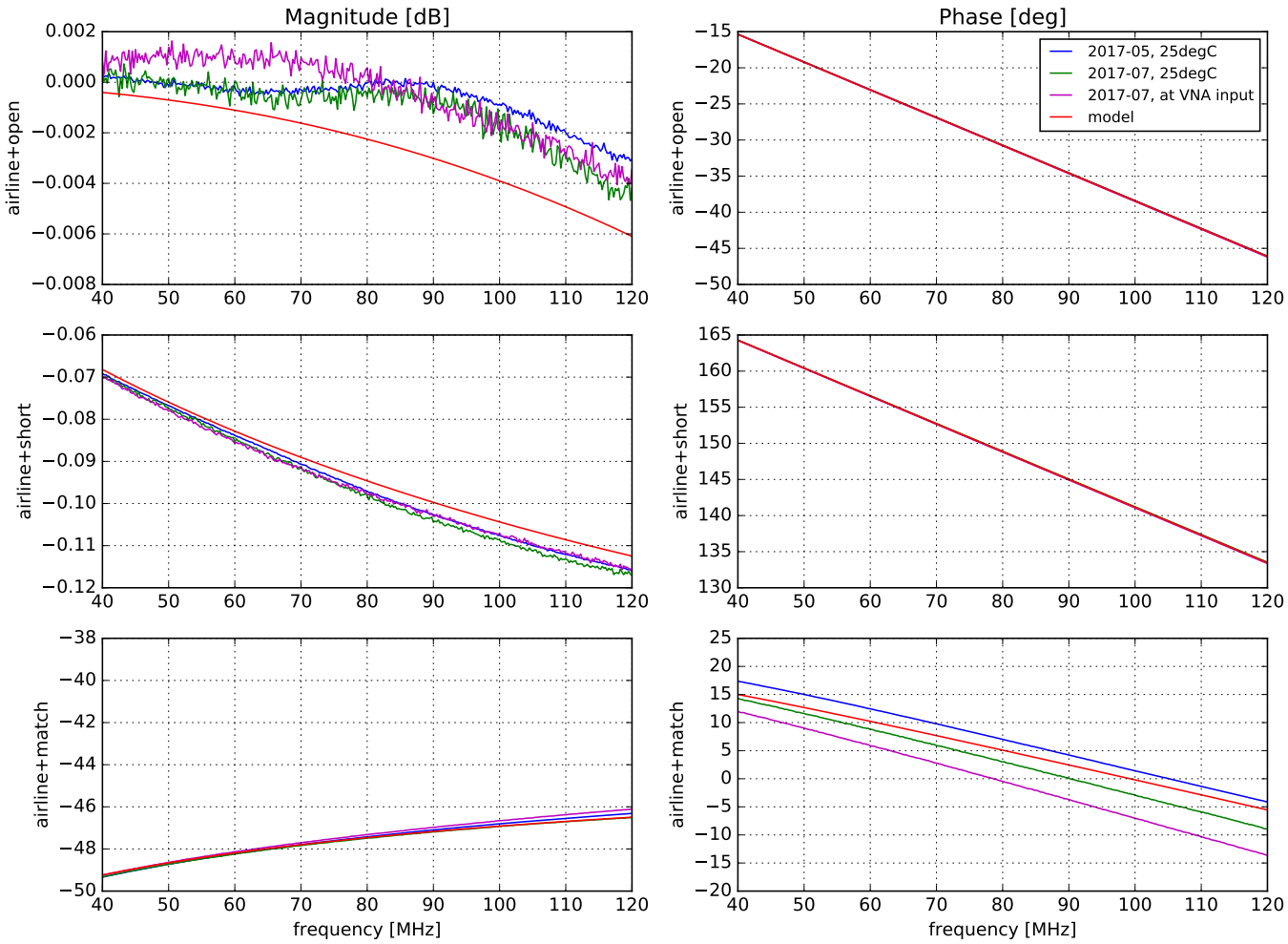


Figure 2: Here, the model of the terminated airline has been produced using a value for the inner conductor radius that is $0.34\%$ larger than the nominal. Notice how the agreement of the airline+match (last row) improves, especially for the measurements through the receiver, compared to the previous figure.

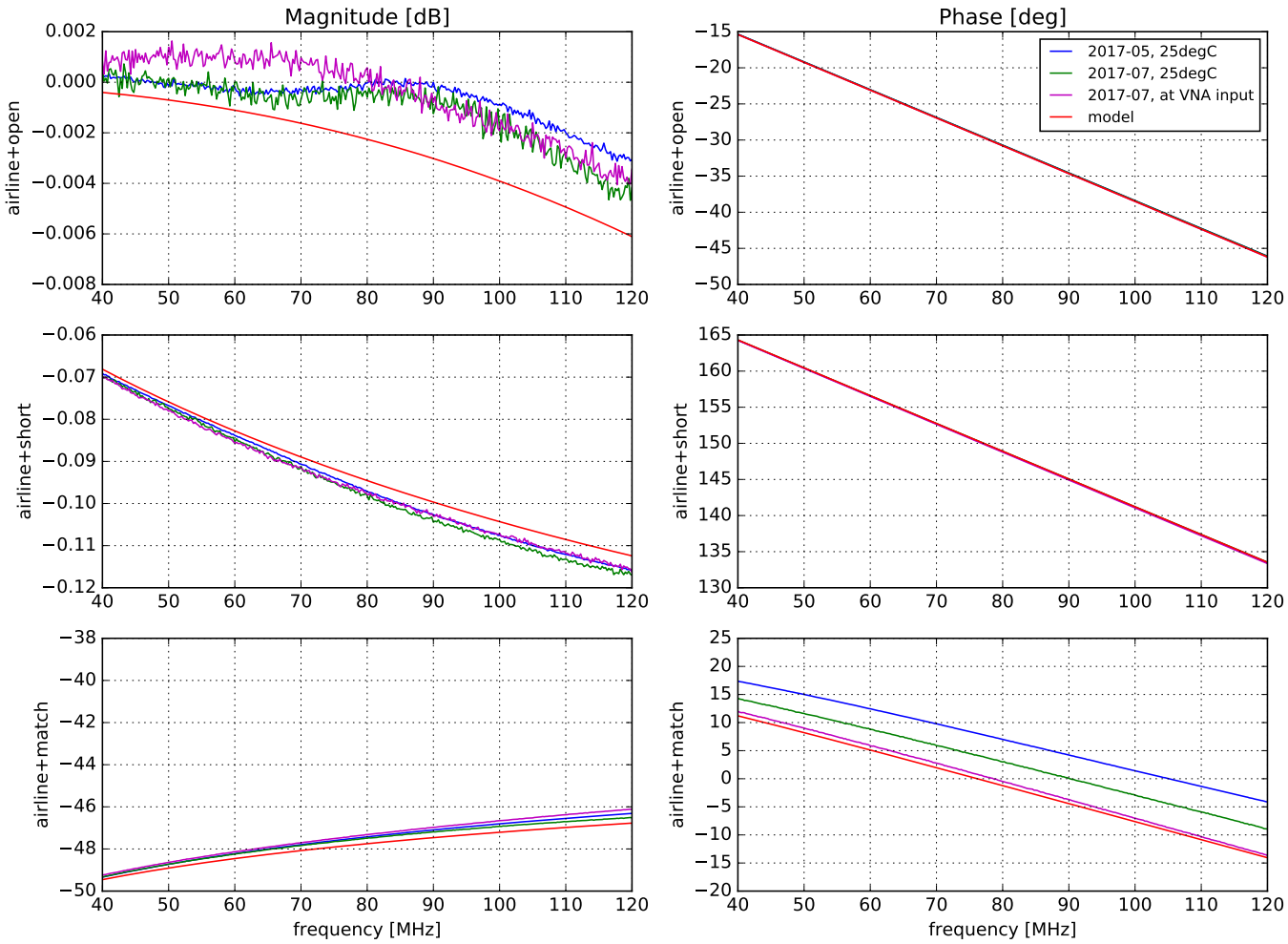


Figure 3: Here, the model of the terminated airline has been produced using a value for the inner conductor radius that is $0.5\%$ larger than the nominal. This value improves the agreement of the airline+match (last row), between the model (red) and the measurement at the VNA input (magenta).

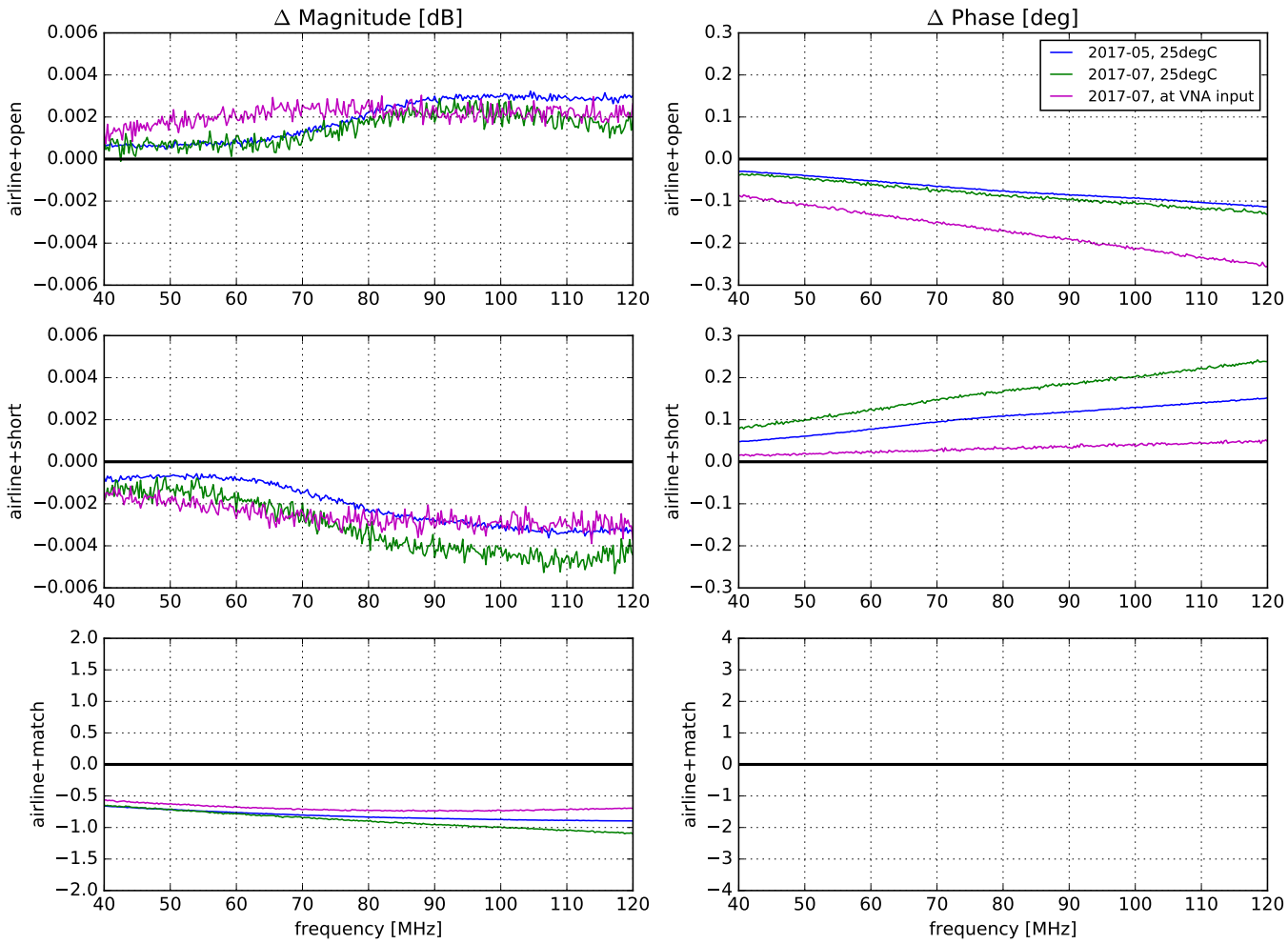


Figure 4: Differences between measurements and models of the terminated airline, for nominal airline parameters. In the case of the airline+match phase (lower right panel), the differences are larger than the vertical range of the panel.

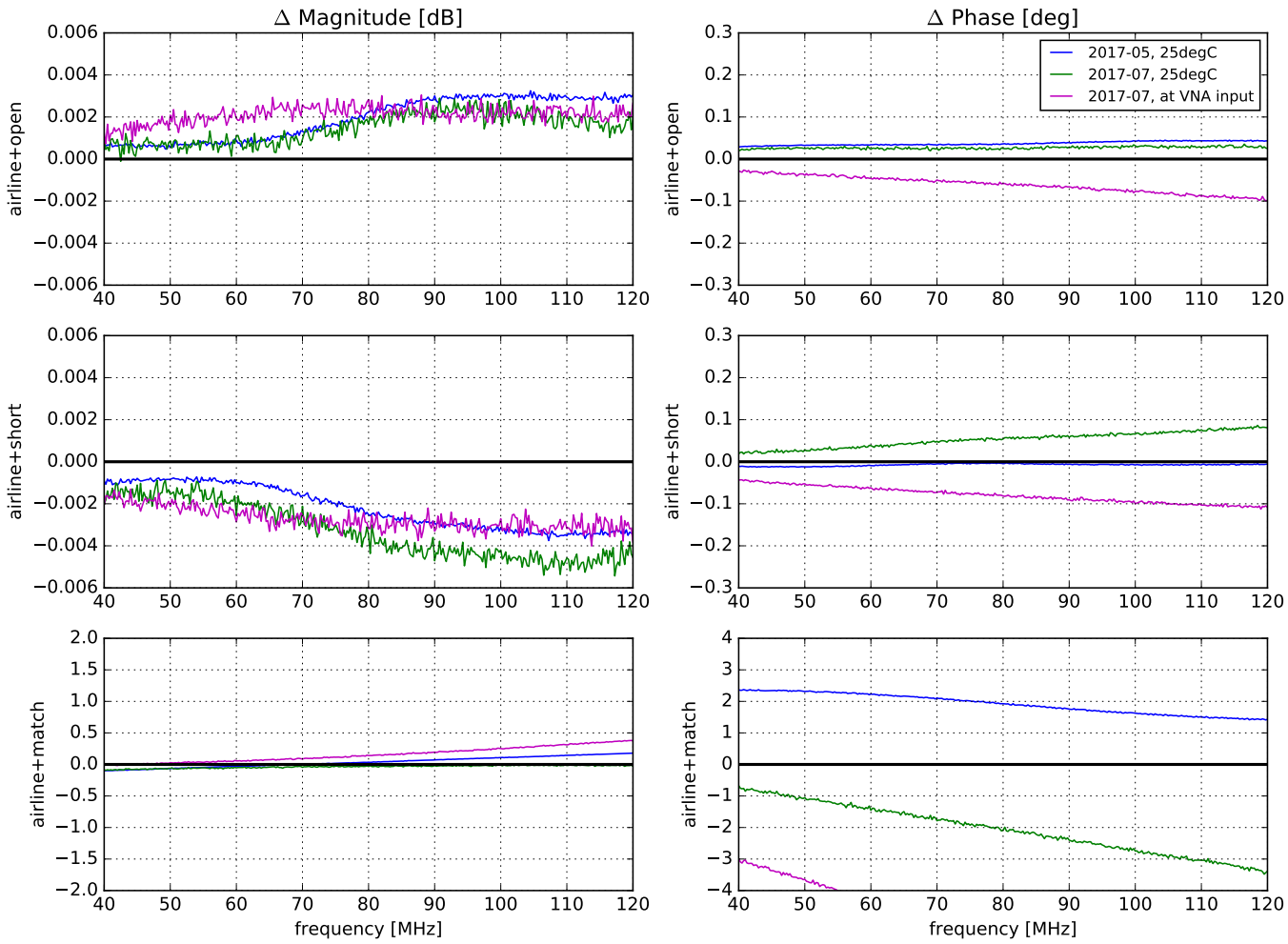


Figure 5: Differences between measurements and models of the terminated airline, after assuming an inner conductor radius that is $0.34\%$ larger than nominal.

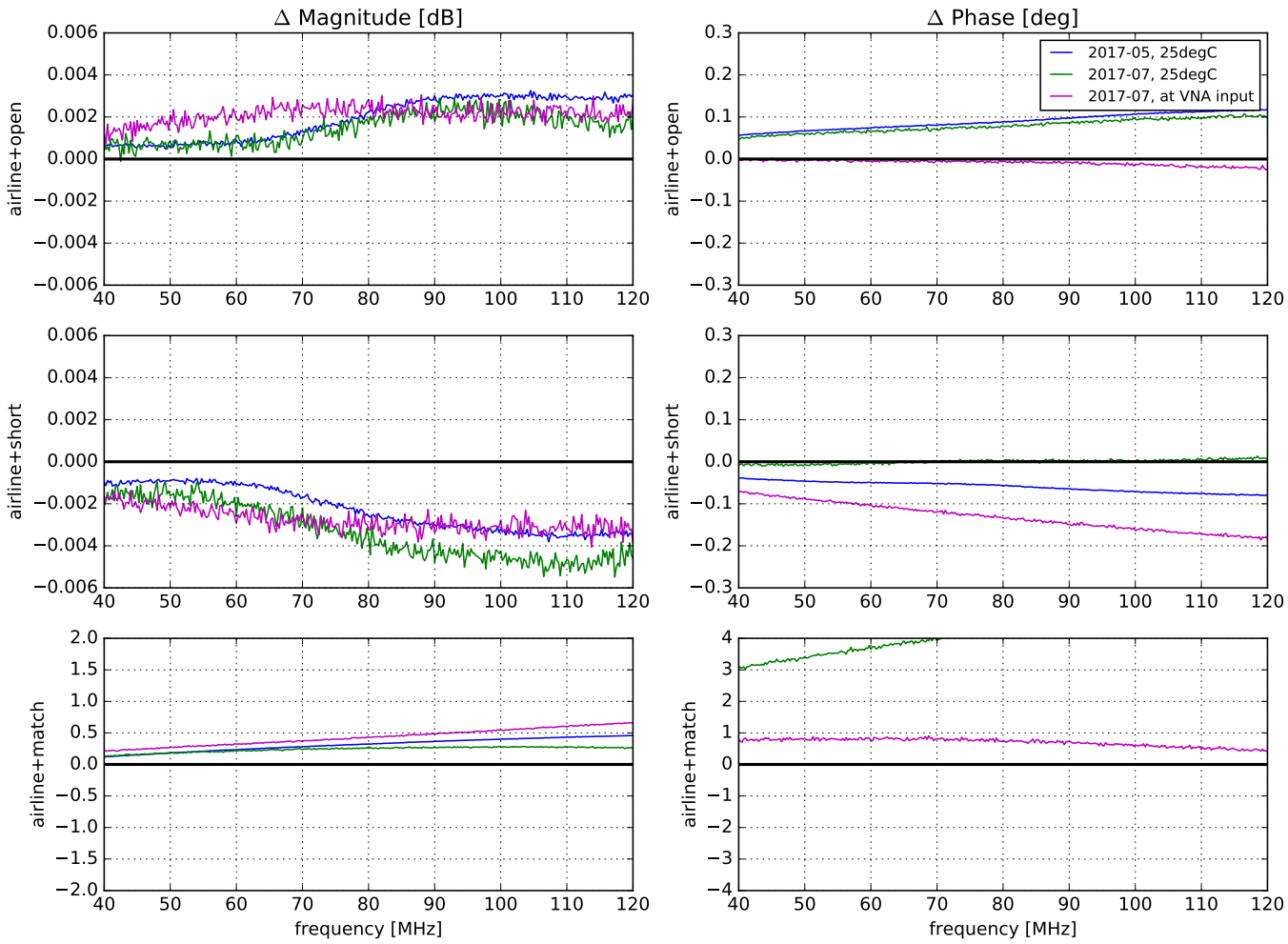


Figure 6: Differences between measurements and models of the terminated airline, after assuming an inner conductor radius that is $0.5\%$ larger than nominal.