

# Antenna $S_{11}$ Measurements at MRO, April/May 2015

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# Description

The antenna  $S_{11}$  was measured five times between April and May, during the current deployment of the high-band instrument. Specifically, it happened on days 109 (April 19), 119, 120, 123, and 124 (May 4).

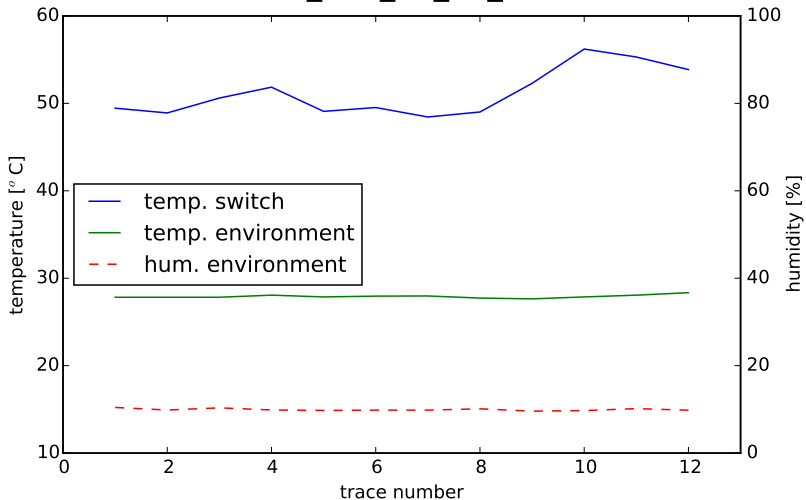
The two-step correction process was applied to the measurements: first-order correction up to the 4-way switch inside the receiver, and a final correction between the switch and the receiver input. This final correction uses calibration data taken in the lab, and the temperature of the switch as measured by the thermistor of the  $S_{11}$  circuitry.

Between 12 and 20 consecutive traces were measured in the five measurement instances, which took up to 20 minutes to perform. Within these periods, the antenna response remained stable and thus, the average responses are provided for calibration of EDGES data.

Rain occurred on days 121 and 122 (between measurements of days 120 and 123), and on day 123 (between measurements of days 123 and 124). This gives the opportunity to test the stability of the antenna with respect to rain events.

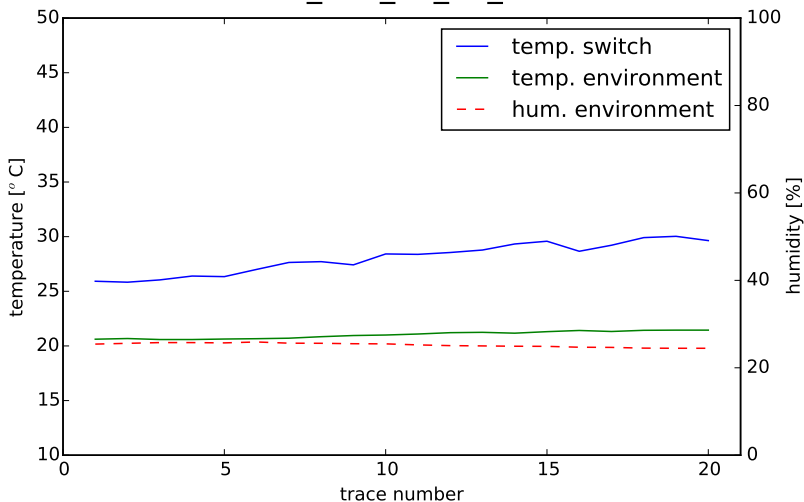
The following plots summarize the results.

2015\_109\_07\_39\_s11



**Figure: (1):** Temperature of switch, and temperature and humidity of the environment for measurement of day 109. Most likely, the switch temperature was high due to long preliminary test measurements. The 12 traces were taken within 12 minutes.

# 2015\_119\_13\_04\_s11



**Figure: (1):** Temperature of switch, and temperature and humidity of the environment for measurement of day 119. The 20 traces were taken within 13 minutes.

2015\_120\_14\_05\_s11

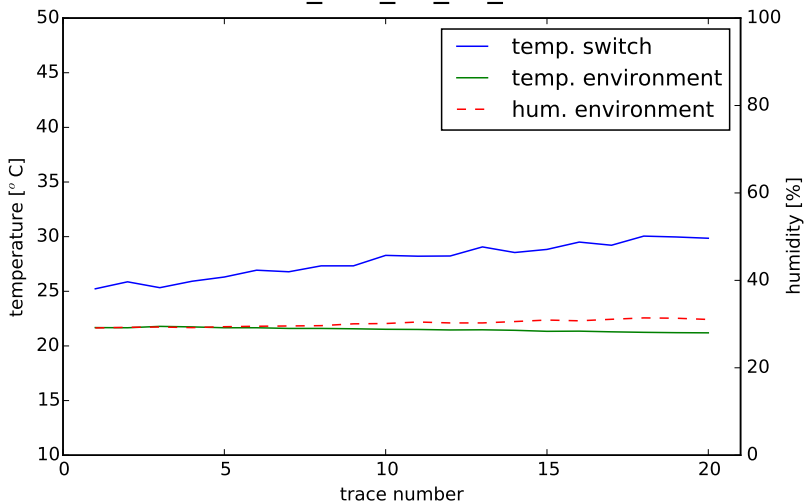
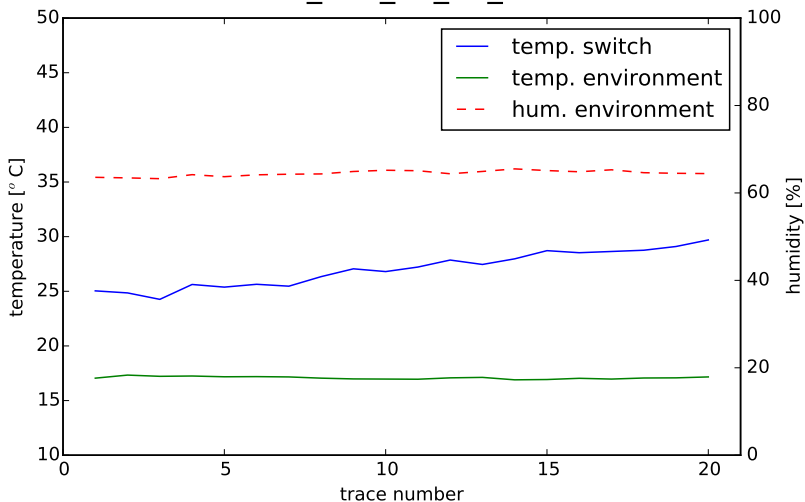


Figure: (1): Temperature of switch, and temperature and humidity of the environment for measurement of day 120. The 20 traces were taken within 13 minutes.

## 2015\_123\_14\_32\_s11



**Figure: (1):** Temperature of switch, and temperature and humidity of the environment for measurement of day 123. The 20 traces were taken within 13 minutes.

# 2015\_124\_13\_27\_s11

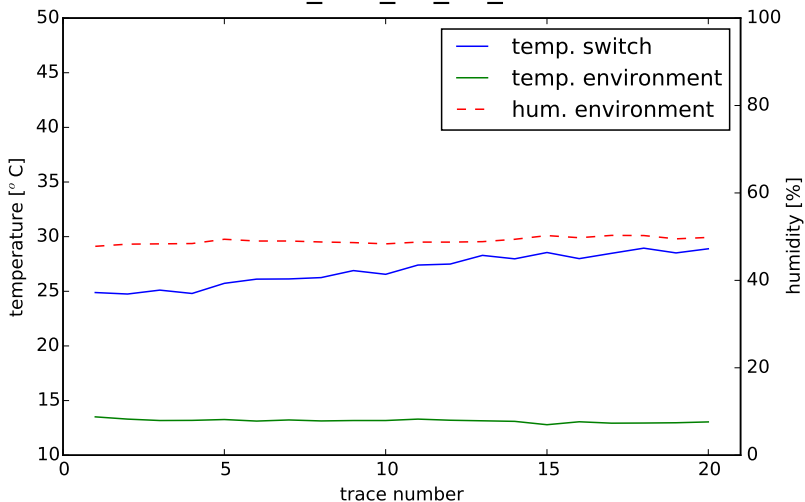
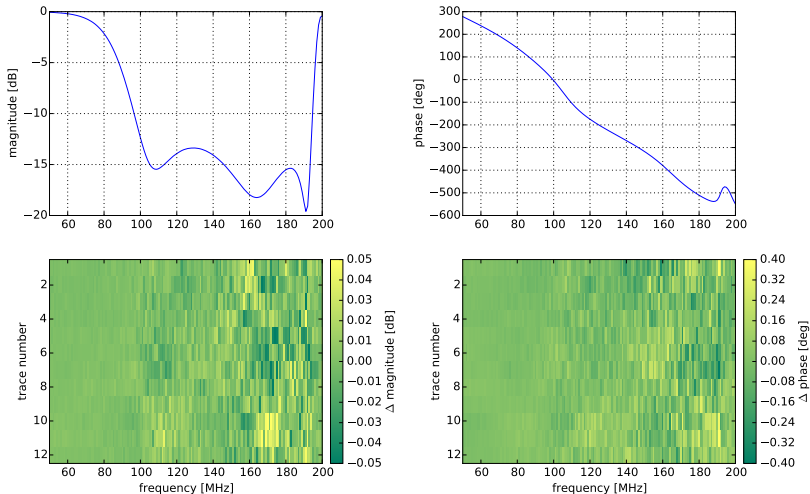
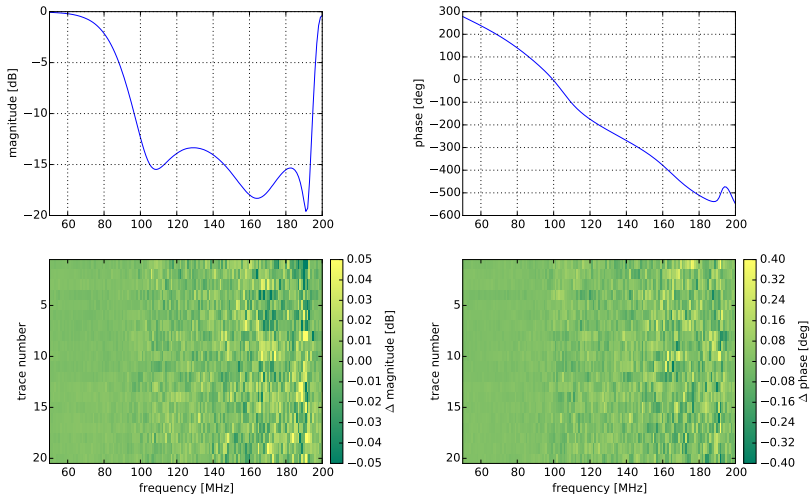


Figure: (1): Temperature of switch, and temperature and humidity of the environment for measurement of day 124. The 20 traces were taken within 13 minutes.

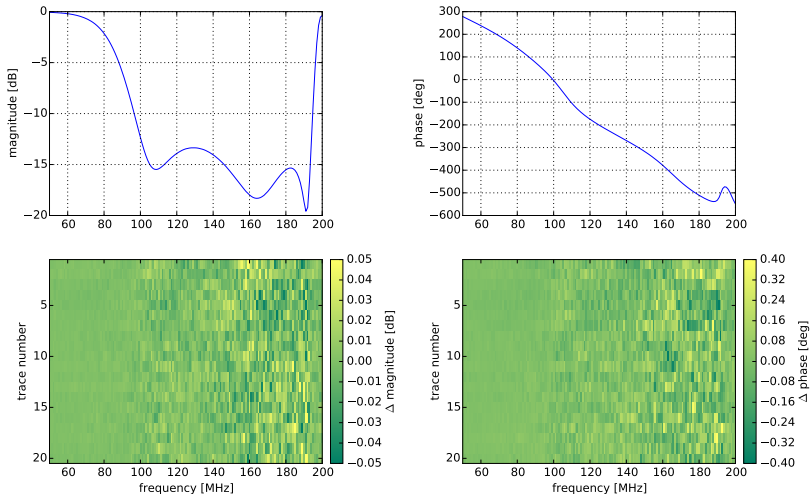


**Figure: (1):** *TOP:* Average corrected measurement for day 109. *BOTTOM:* Residuals after subtracting the average from the 12 traces.

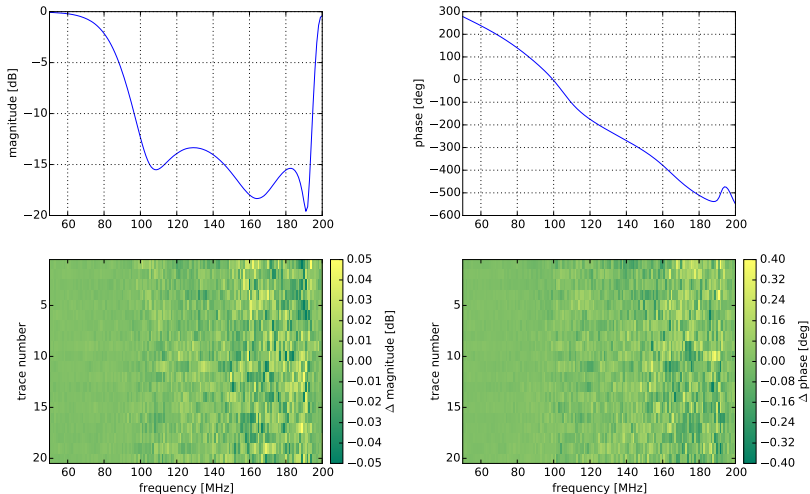




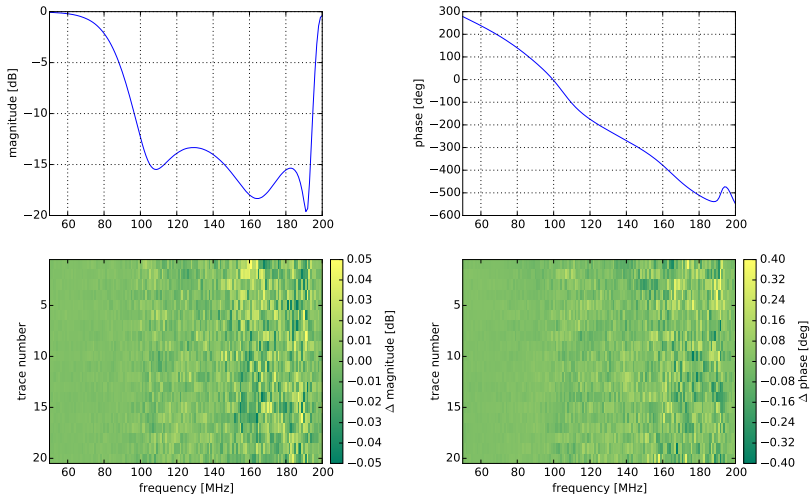
**Figure: (1):** *TOP:* Average corrected measurement for day 119. *BOTTOM:* Residuals after subtracting the average from the 20 traces.



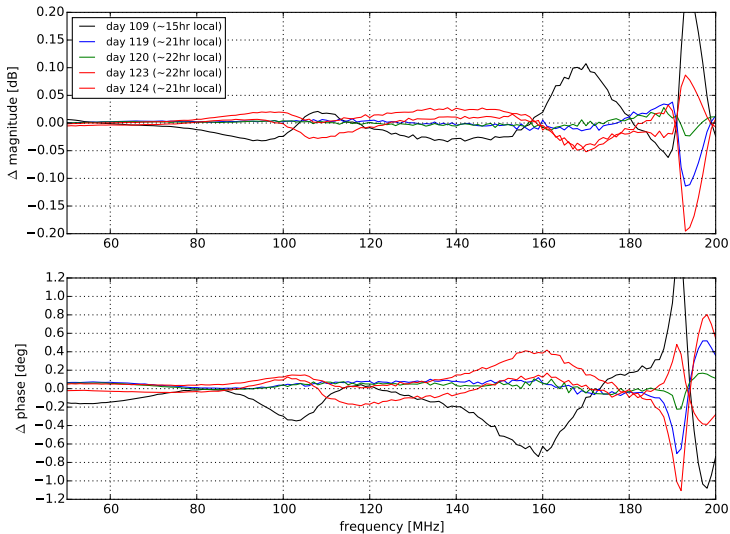
**Figure: (1):** *TOP:* Average corrected measurement for day 120. *BOTTOM:* Residuals after subtracting the average from the 20 traces.



**Figure: (1):** *TOP:* Average corrected measurement for day 123. *BOTTOM:* Residuals after subtracting the average from the 20 traces.



**Figure: (1):** *TOP:* Average corrected measurement for day 124. *BOTTOM:* Residuals after subtracting the average from the 20 traces.



**Figure: (1):** Five average traces (from the five days), after subtracting their average. Day 109 is the one that departs the most from the average. Days 119 and 120 are very similar, which is to be expected since there was no rain in those days. There is a change between 123 and 124, most likely due to the rain between those measurements.

# Conclusion

The antenna reflection coefficients presented here show significant changes throughout a period of 15 days, some of which can be attributed to rain events. In the EDGES data analysis, it is recommended to use the one that is the closest to the data set under study.