

# Reflection Coefficient Measurements of the EDGES High-Band BLADE Antenna Starting on 2015/09/19

Raul Monsalve

SESE, Arizona State University

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## Description

The reflection coefficient of the high-band BLADE EDGES antenna was measured between UTC 2015/09/19-19:15:24 and 2015/09/22-19:47:03 (~ 3 days). The environmental conditions were good and stable throughout this period. The highest humidity was ~ 60% close to the beginning of the measurement. The dew point temperature at the same time reached ~ 6°C, about 8°C below ambient temperature. The ambient temperature range throughout the measurement was ~ 14°C - 32°C. The temperature of the S11 switch, with the receiver stable at 25°C, ranged between 28°C and 31° except at the very beginning of the measurement since it takes about 30 minutes for stabilization. The median night time temperature of the S11 switch is 29°C.

The time resolution of the S11 measurements is 1 minute. In other words, within 1 minute the automated system measures the reflection standards (open, short, match) and the antenna. At this rate, 4330 calibrated antenna reflection traces were produced in the ~ 3 days. The first-level calibration references the antenna measurement to the 4-position switch (where the standards are connected), and the final calibration yields the antenna reflection referenced to the 50-Ω impedance at the input of the receiver.

One representative trace is produced from the average of night time data, specifically trace ranges 1000-1600, 2400-3000, and 3800-4330. There is a jump-like anomaly about 940 traces (15.7 hours) into the measurement, which doesn't have an obvious explanation. The antenna S11 takes about 5 minutes to recover and come back to normal. This jump is presented in figure 5. Obviously, this jump is not considered in the representative average S11. Apart from this jump, there are no other obvious anomalies in the data.

The results are presented in the following figures.

# Results

2015\_262\_19\_14

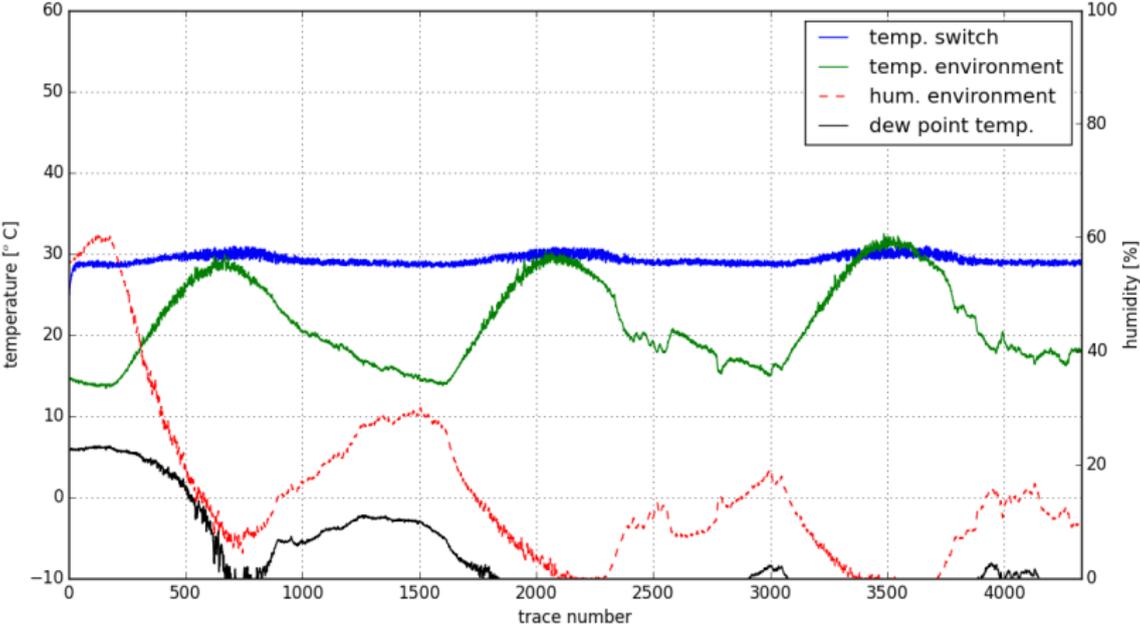
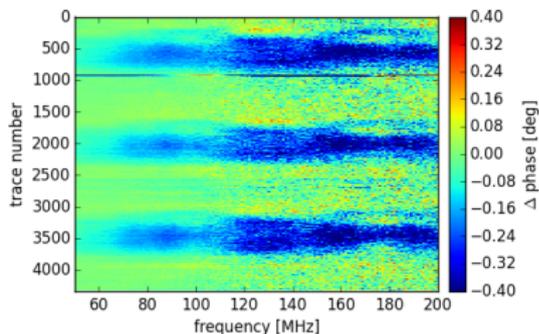
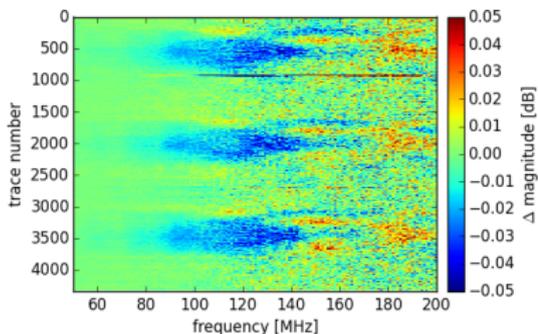
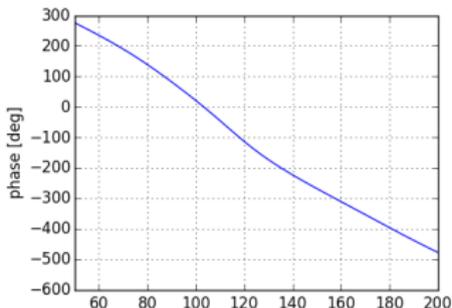
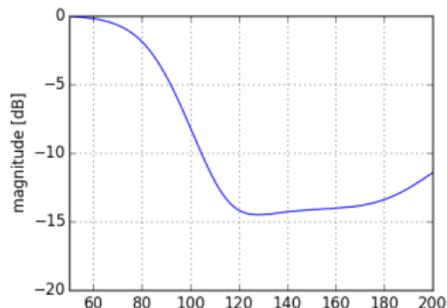


Figure : (1): Temperature of the 4-position switch, along with ambient temperature, humidity, and dew point temperature.

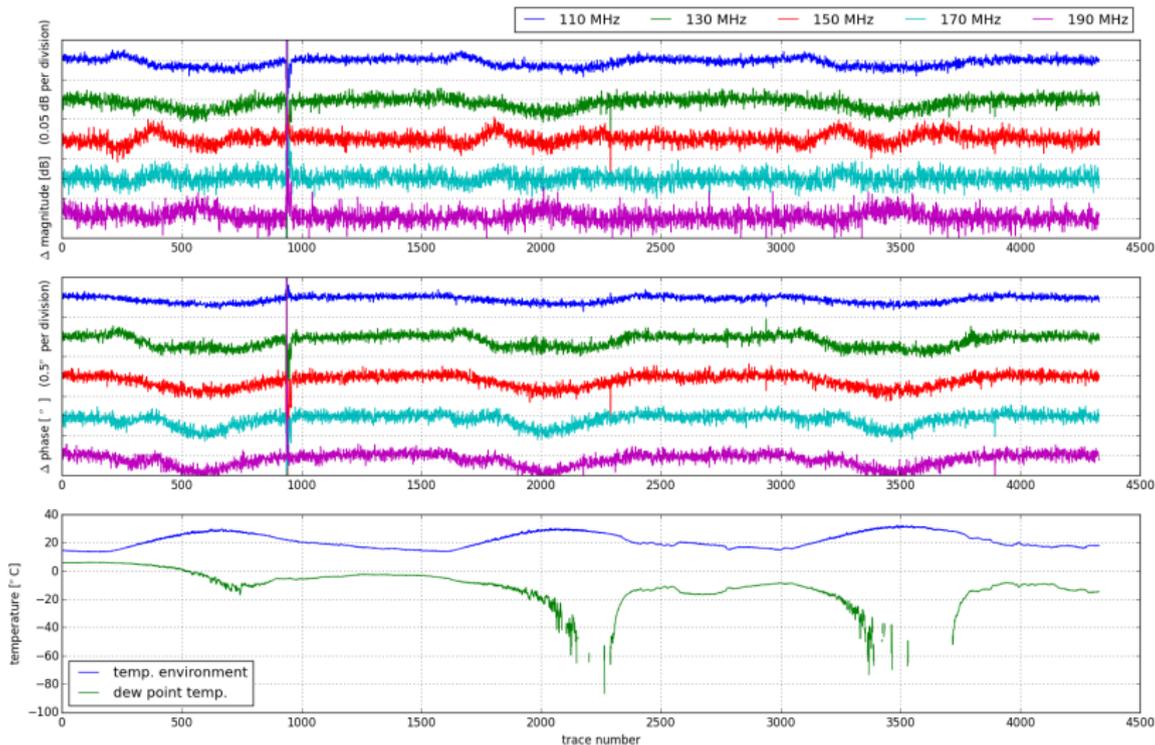
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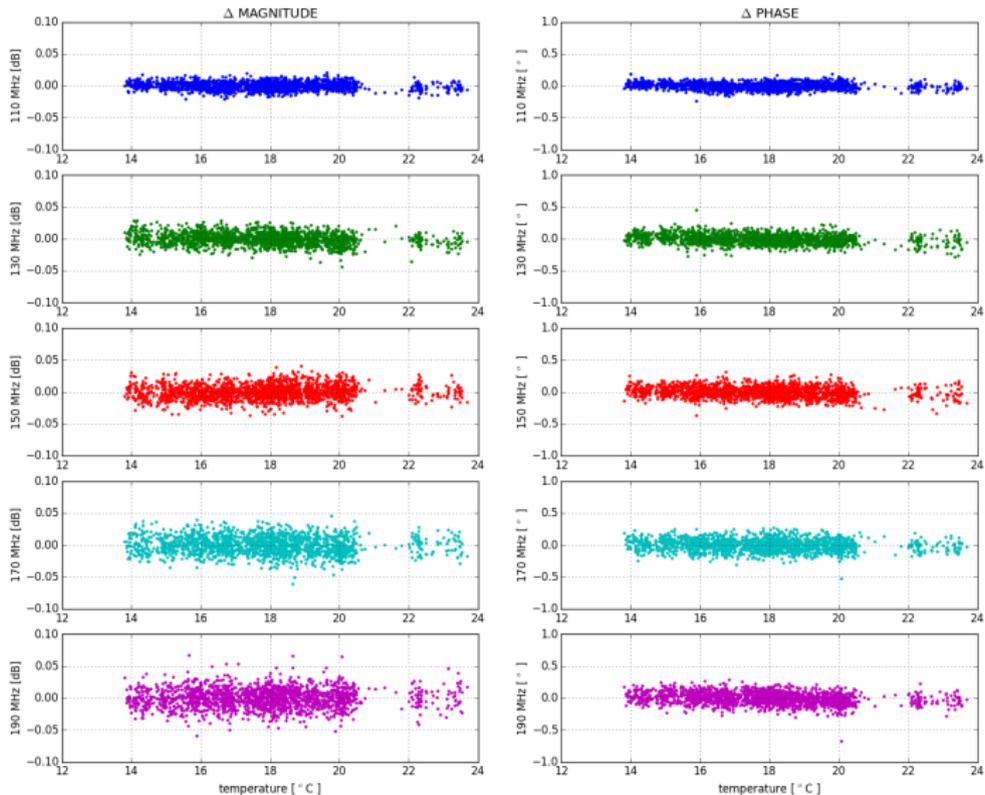
**Figure : (2):** (TOP) Average reflection coefficient from night time data (ranges 1000-1600, 2400-3000, and 3800-4330). (BOTTOM) Variations from the average. Magnitude variations relative to night time data are  $\pm 0.04$  dB. The phase changes by  $\sim 0.4^\circ$  during the day relative to the night.

# Results



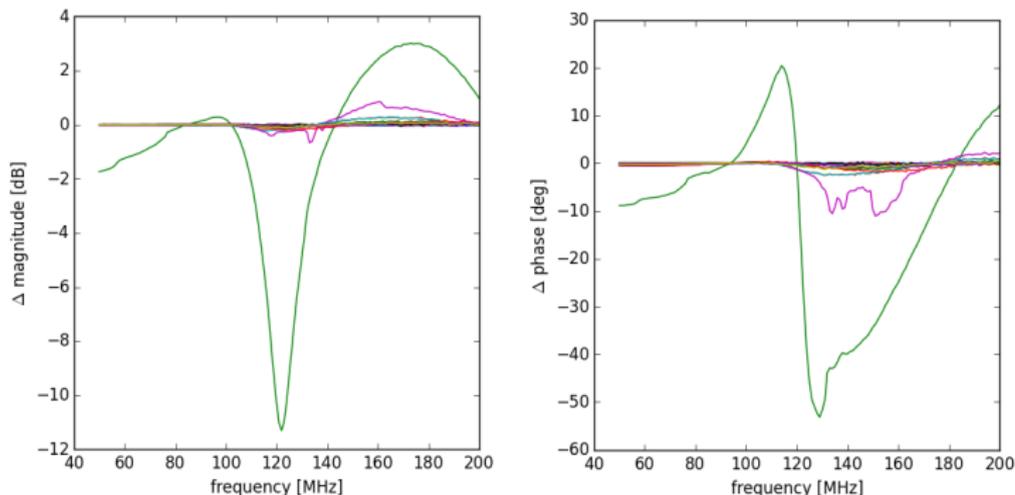
**Figure : (3):** Time evolution of 5 representative frequency channels (110, 130, 150, 170, and 190 MHz), and corresponding temperatures. There is a *jump* in the S11 by trace 940. It took about 5 minutes to come back to normal.

# Results



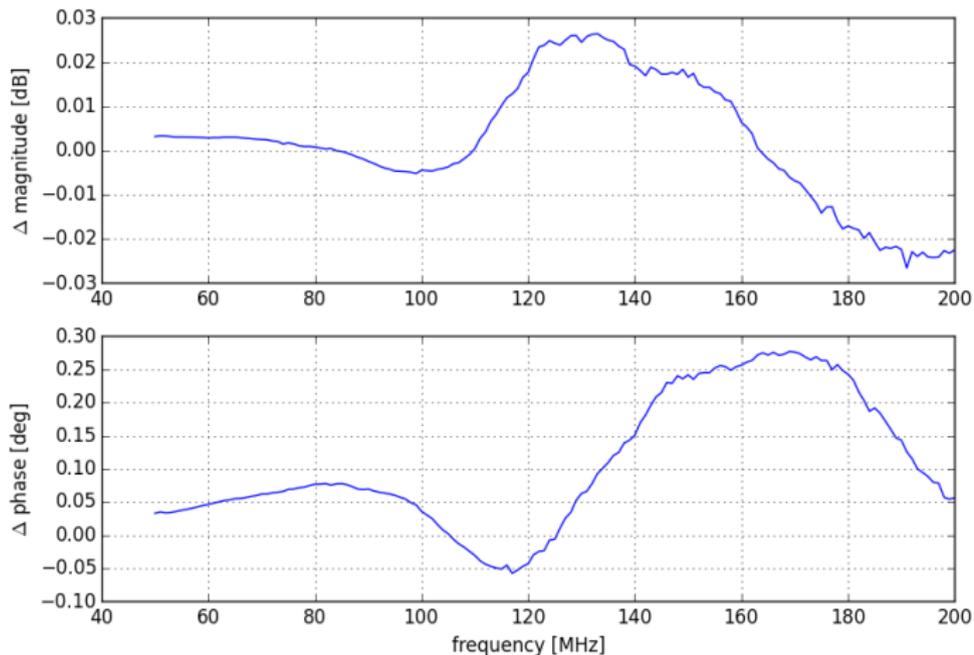
**Figure : (4):** Correlations between reflection and ambient temperature, for the night time data used to compute the representative average. There is no significant temperature dependence. The stability and day-to-day repeatability is excellent.

# Results



**Figure : (5):** Change of reflection coefficient, in magnitude and phase, relative to a normal measurement, during the *jump* of trace  $\sim 940$ . It took about 5 minutes for the measurement to go back to normal.

# Results



**Figure : (6):** Difference between representative S11 for day 262 (reported here) and 212 (reported at [http://loco.lab.asu.edu/memos/edges\\_reports/report\\_20150804.pdf](http://loco.lab.asu.edu/memos/edges_reports/report_20150804.pdf)).