

Reflection Coefficient Measurements of the EDGES High-Band BLADE Antenna Starting on 2015/07/31

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 2015/07/31-18:56:03 and 2015/08/03-08:15:18 (~ 2.5 days). During half of the first day (mostly night time) it was raining, as evident in the humidity plots that follow. During the second night period the humidity also became very high. There was no rain but the dew point temperature reached the ambient temperature, suggesting that the antenna could have been affected by moisture. During the final day the weather was good and stable.

The time resolution of the calibrated 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, 3661 calibrated antenna reflection traces were produced in the ~ 2.5 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. With the receiver kept at 25°C, the 4-position switch stayed at a temperature of $\sim 29 \pm 1$ °C throughout the measurement (after a 30-minute stabilization period).

In summary, during the last full day (after trace ~ 1900) the variations in reflection coefficient stay within ± 0.04 dB and $\pm 0.4^\circ$ in the ambient temperature range 9.9°C - 21.0°C, after sufficient noise averaging.

The results are presented in the following figures.

Results

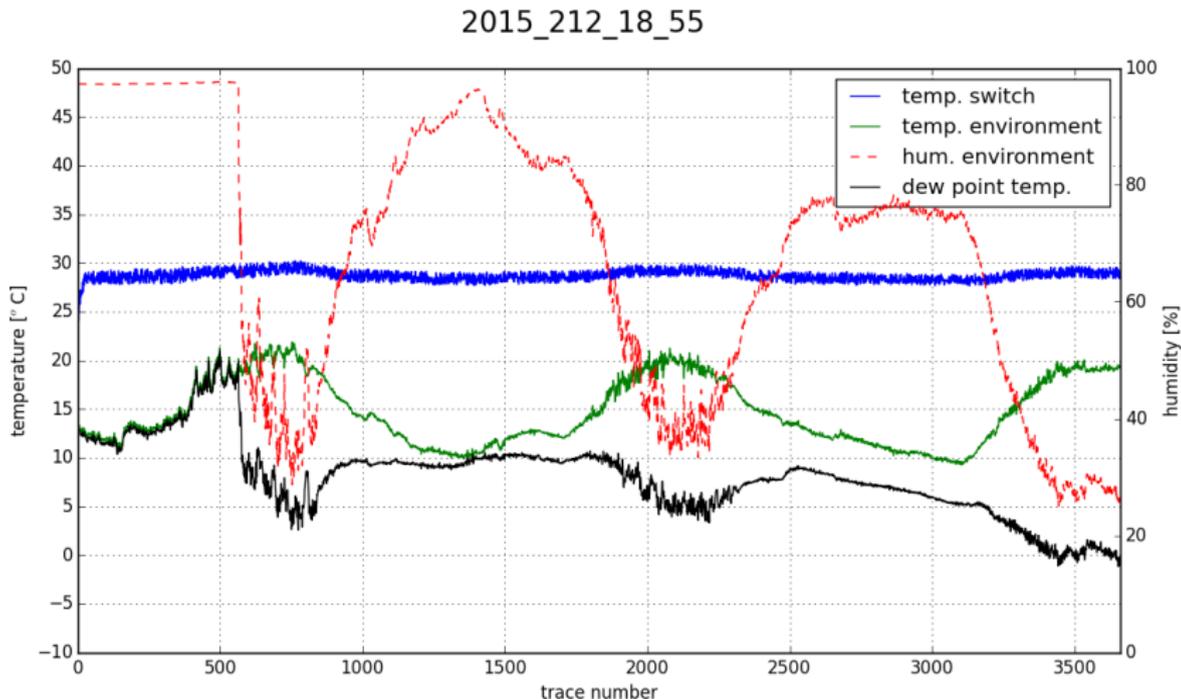


Figure: (1): Temperature of the 4-position switch, along with ambient temperature, humidity, and dew point temperature. Obviously, during the rain (before trace ~ 600) the dew point was equal to the ambient temperature. Also, since humidity was high during the second night (centered on trace ~ 1400), the dew point also reached ambient temperature. Starting with trace ~ 1900 , humidity was low and the dew point was at least $\sim 4^{\circ}\text{C}$ below ambient temperature.

Results

2015_212_18_55

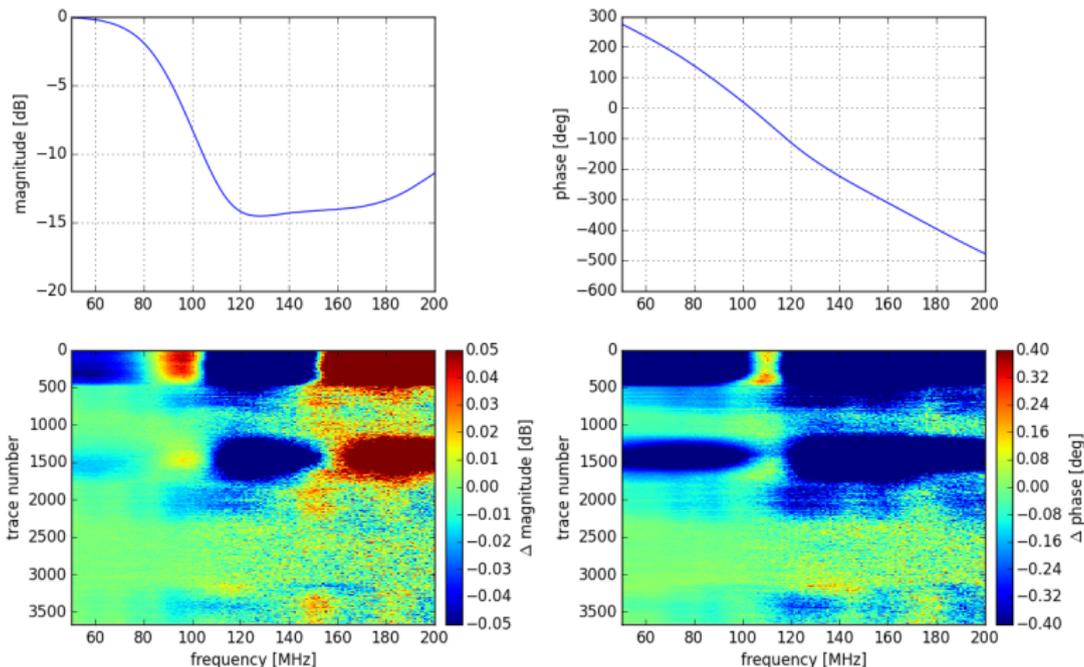


Figure: (2): (TOP) Average reflection coefficient between traces 2500 and 3100, i.e., night time of the last day when the weather conditions were optimal. (BOTTOM) variations from the average. The variations starting with trace 1900 stay within ± 0.04 dB and $\pm 0.4^\circ$ in the ambient temperature range $9.9^\circ\text{C} - 21.0^\circ\text{C}$, after sufficient noise averaging. The saturation before trace ~ 600 is due to rain, and the large change centered on trace ~ 1400 is due to high humidity and potential moisture on the antenna.

Results

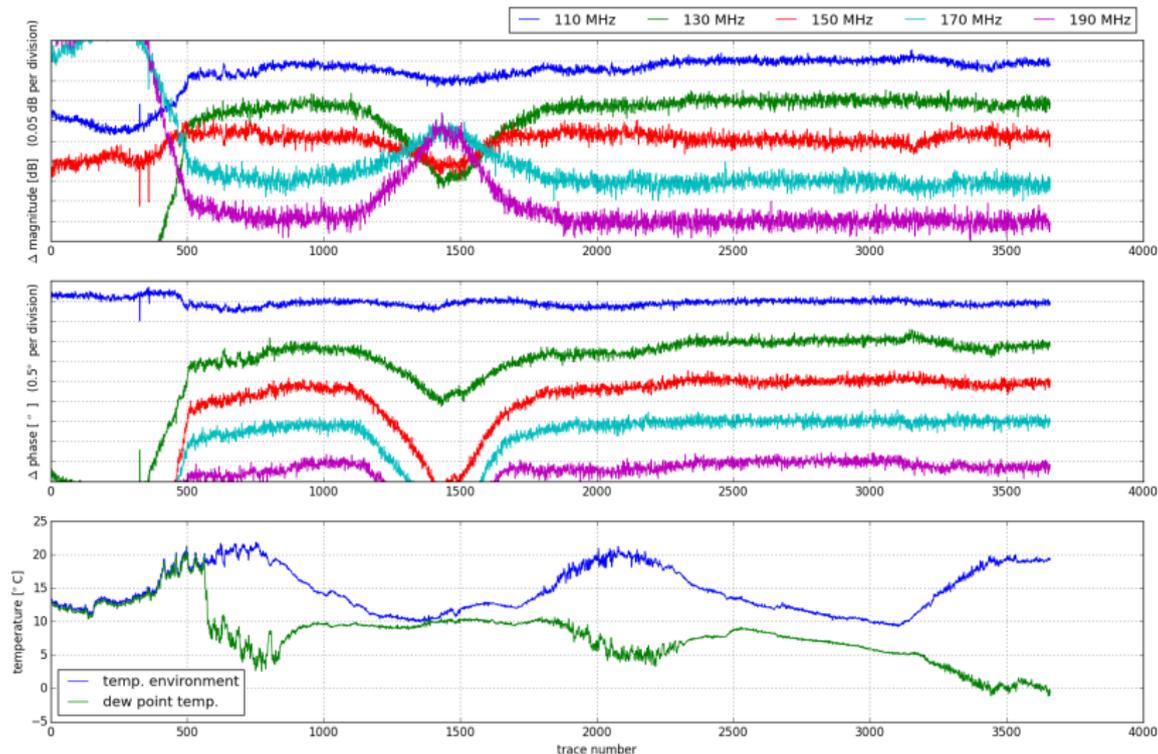


Figure: (3): Time evolution of 5 representative frequency channels (110, 130, 150, 170, and 190 MHz), and corresponding temperatures.

Results

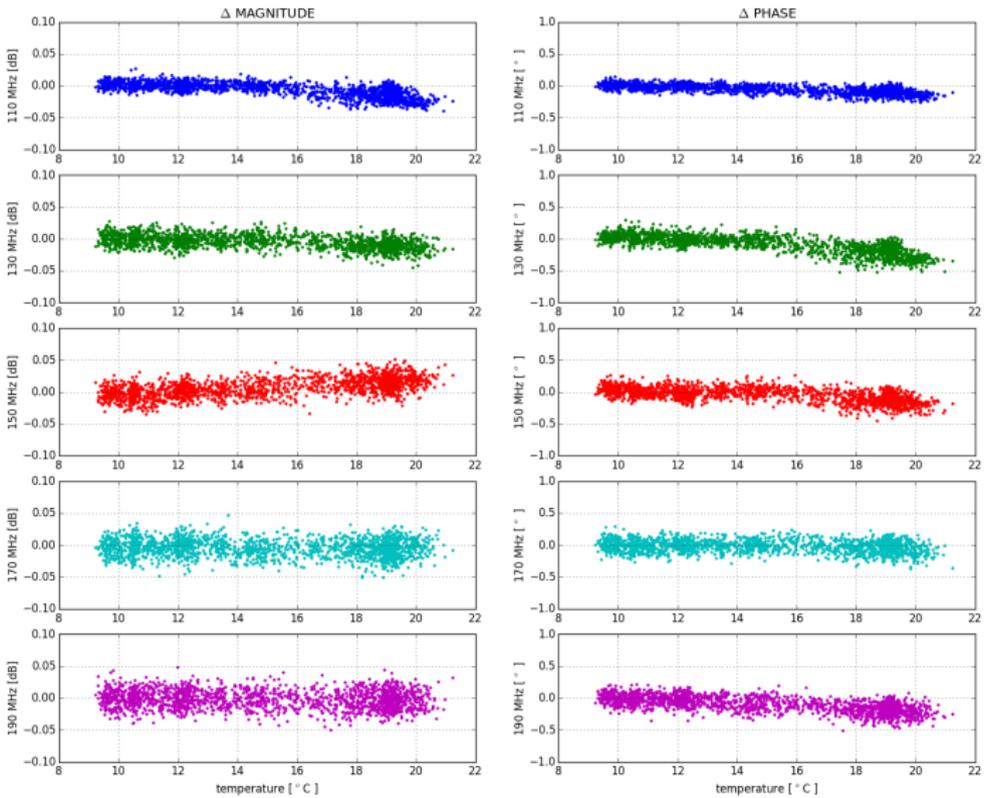


Figure: (4): Correlations between reflection and ambient temperature, for data starting with trace 1900.