CURIE: ANTENNA CHARACTERIZATION

Antenna Prototypes and Characterization performed by members of the Group of Solar Astrophysics Research Group at Observatorio Astronómico Nacional – Universidad Nacional de Colombia, and at the Anechoic Chamber at the Universidad de Los Andes.

1. *Helix Antenna Prototype for Ground Station*: Helix Antenna mounted around a 3D Printed Structure Tube in PLA (Polylactic Acid) with a Small Aluminum Solid Reflector Dish. In addition, a Balun is connected to the Helix Antenna wire in order to enhance the input impedance matching. At the desired frequency of 2.4GHz, there is no resonance (input reflection coefficient lower value of -1.9dB at 3.247 GHz; figure 1.1), hence, gain is very low (~4dBi). However, antenna has a high Front-to Back Ratio (17.5dBi), so all of the received power is collected from the frontal main lobe. Data plotted is shown in figures 1.2 and 1.3.

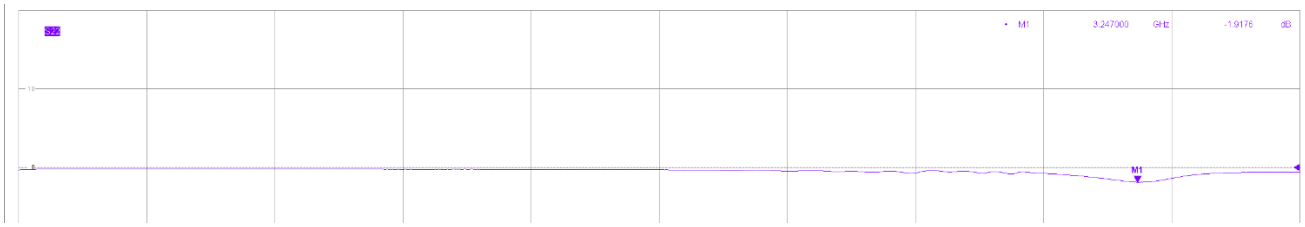

Figure 1.1. Helix Antenna: Measured Input Reflection Coefficient (S11 Parameter) between 1.5GHz and 3.5GHz.

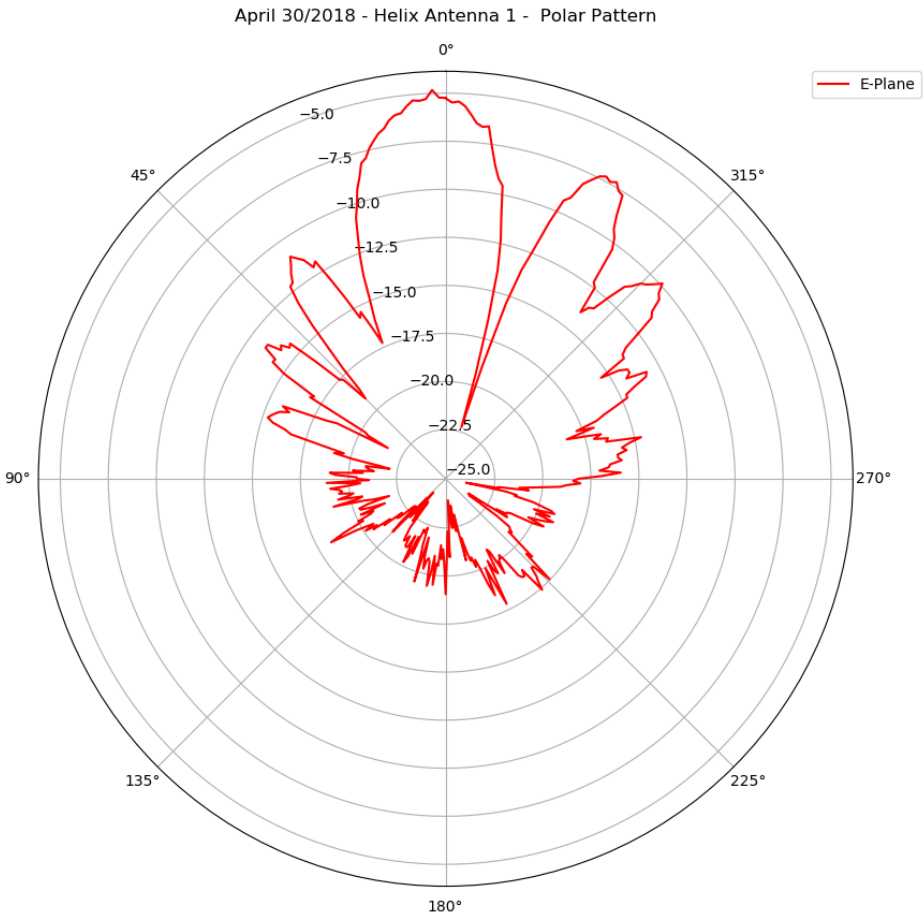

Figure 1.2. Helix Antenna: Measured E-Plane, Polar Plot.

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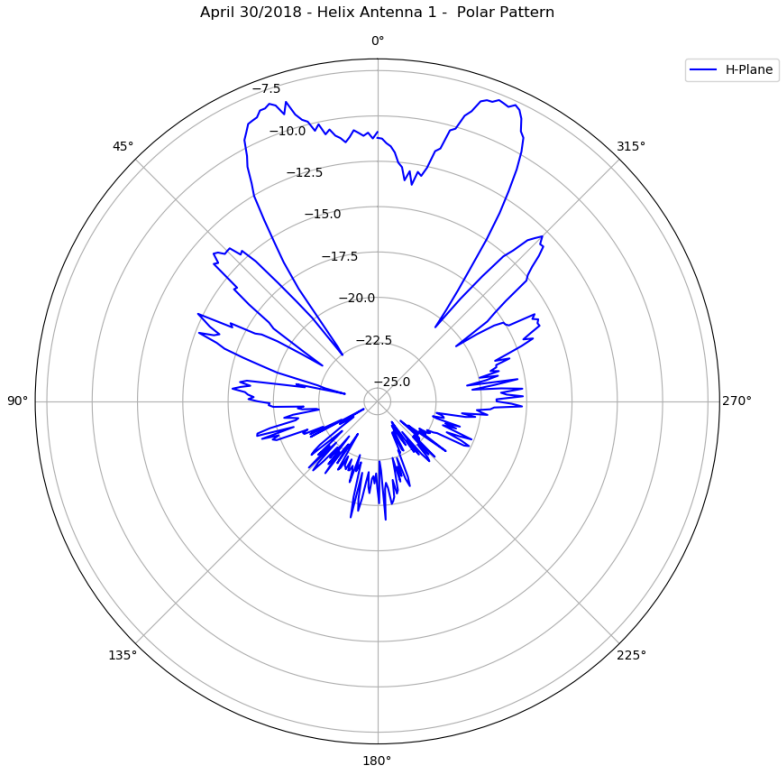

Figure 1.3. Helix Antenna: Measured H-Plane, Polar Plot.

2. *Helix Antenna Prototype for Ground Station, without Balun*: Same Helix Antenna structure as in previous section, but the Balun for impedance matching is removed. Removing the Balun shows a higher gain (9.63 dBi) and a more stable behavior, with a nearly similar pattern for both E and H planes, besides a high Front-to-Back ratio of 20.6. Near the desired frequency of 2.4GHz, input reflection coefficient is acceptable, with a value of -29.25 dB at 2.37 GHz (figure 2.1), besides some additional harmonics, specially at higher frequencies. Data plotted is shown in figures 2.2 and 2.3.

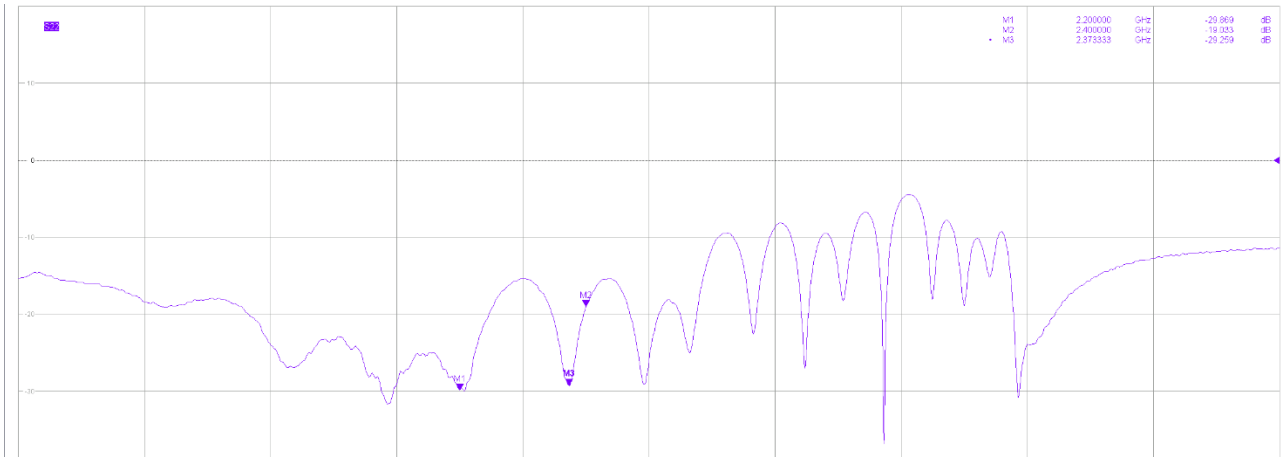

Figure 2.1. Helix Antenna without Balun: Measured Input Reflection Coefficient (S11 Parameter) between 1.5GHz and 3.5GHz.

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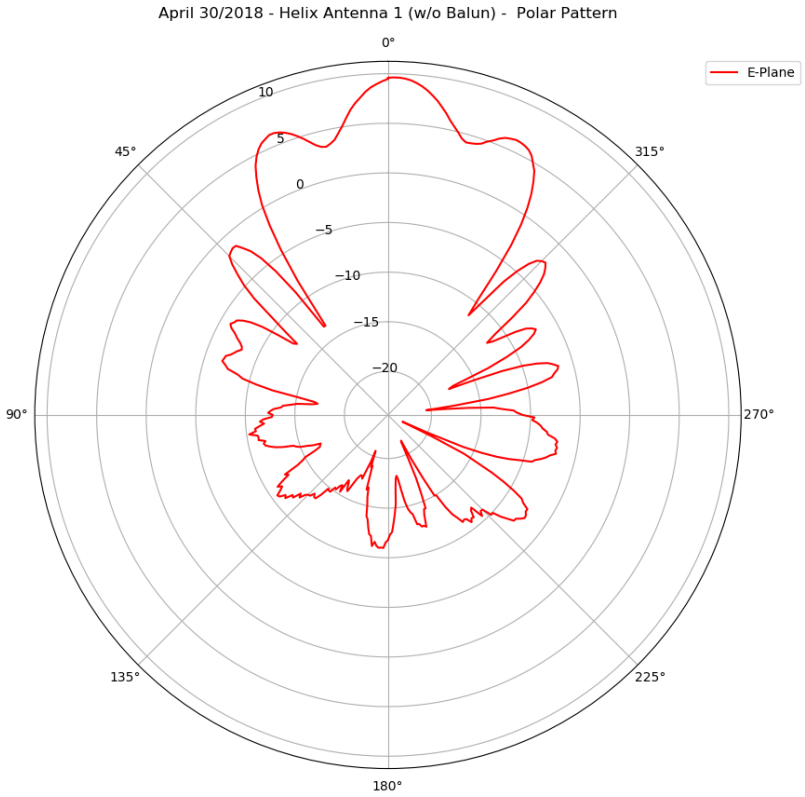

Figure 2.2. Helix Antenna without Balun: Measured E-Plane, Polar Plot.

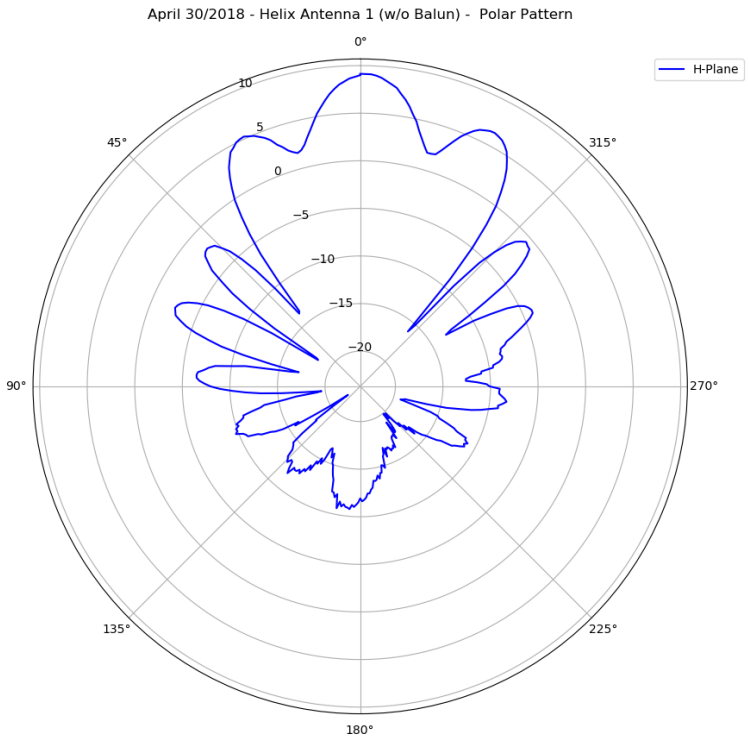

Figure 2.3. Helix Antenna without Balun: Measured H-Plane, Polar Plot.

3. *S-Band Patch Antenna Prototype for CubeSat Structure:* S-Band rectangular patch antenna, for operation at 2.4GHz, mounted on Right-side of CubeSat structure, fabricated with photolithograpy process. 2 Aluminum sheets were attached to the CubeSat simulating deployed Solar Panels. Antenna Resonance (Input Reflection Coefficient, S11 parameter) of -9.16 dB at 2.43GHz (Figure 3.1), with maximum gain of 2.63 dBi and high Front-to-Back ratio of 22.8dBi, similar to parameters obtained in Simulations on Design Stage (Previous Report). Data plotted is shown in figures 3.2 and 3.3.

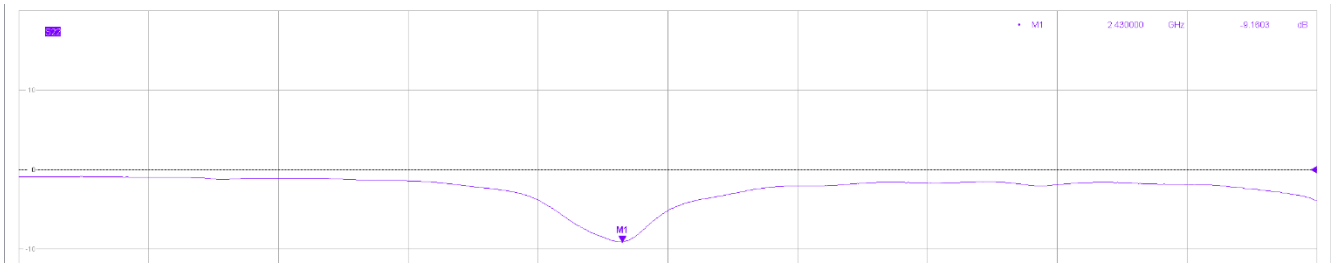

Figure 3.1. S-Band Patch Antenna on CubeSat structure with simulated solar panels: Measured Input Reflection Coefficient (S11 Parameter) between 1.5GHz and 3.5GHz.

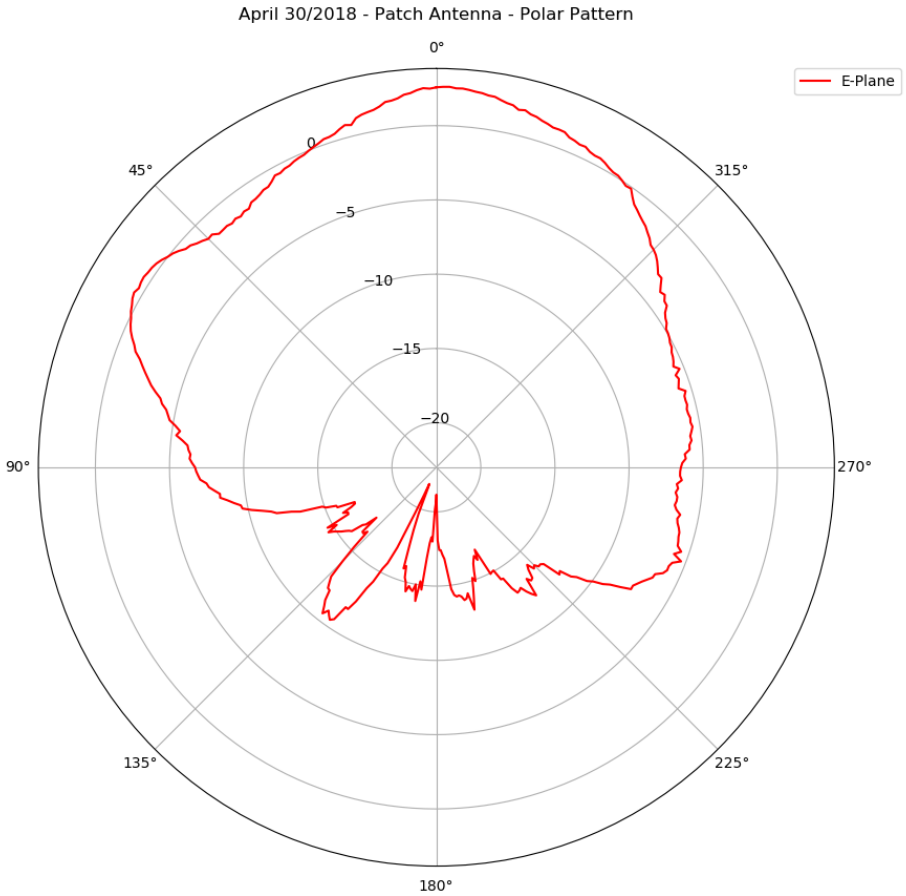

Figure 3.2. S-Band Patch Antenna on CubeSat structure with simulated solar panels: Measured E-Plane, Polar Plot.

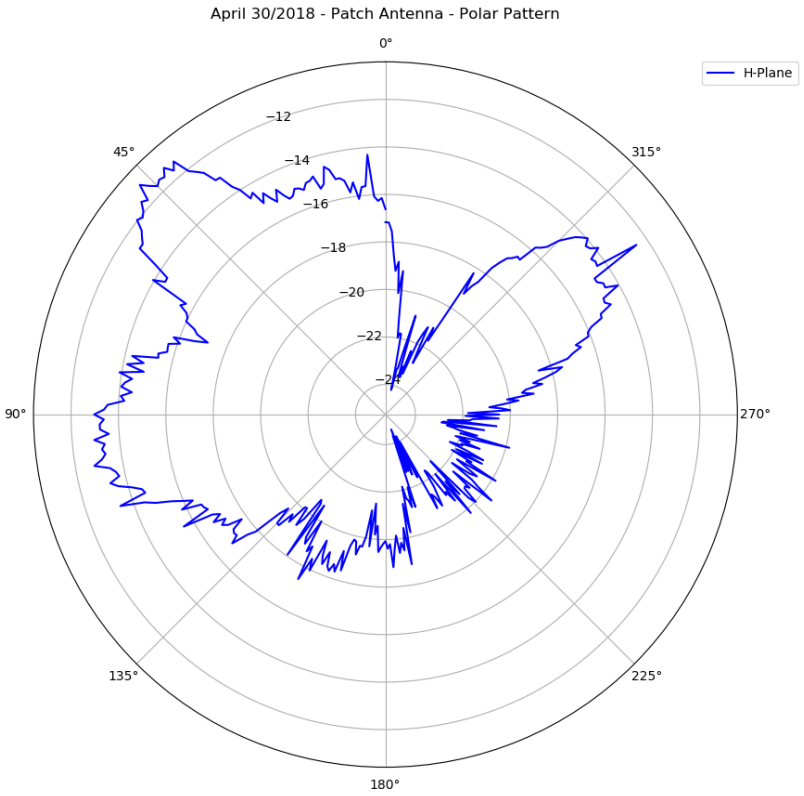

Figure 3.3. S-Band Patch Antenna on CubeSat structure with simulated solar panels: Measured H-Plane, Polar Plot.

4. ***Helix Antenna Prototype 2 for Ground Station***: Helix Antenna mounted around a 3D Printed Structure Tube in PLA (Polylactic Acid) with a Small Aluminum Meshgrid Reflector Dish. At the desired frequency of 2.4GHz, there is no resonance (lower points at 1.6 and 2.84 GHz). However, measured gain value is high (8.16 dBi). Data plotted is shown in figures 4.2 and 4.3.

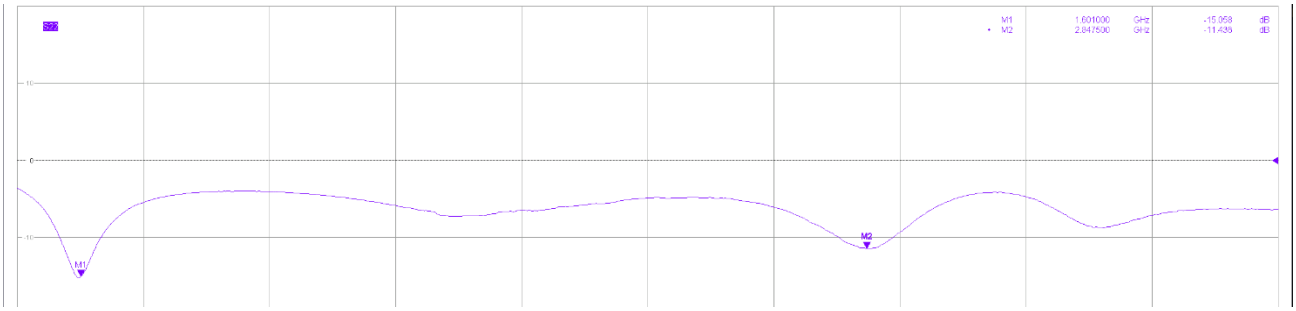

Figure 4.1. Helix Antenna prototype #2: Measured Input Reflection Coefficient (S11 Parameter) between 1.5GHz and 3.5GHz.

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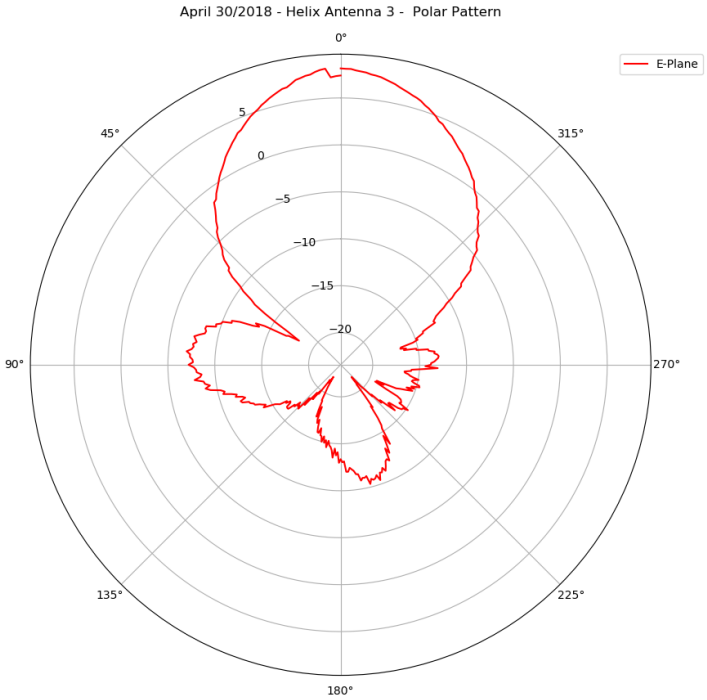

Figure 4.2. Helix Antenna prototype #2: Measured E-Plane, Polar Plot.

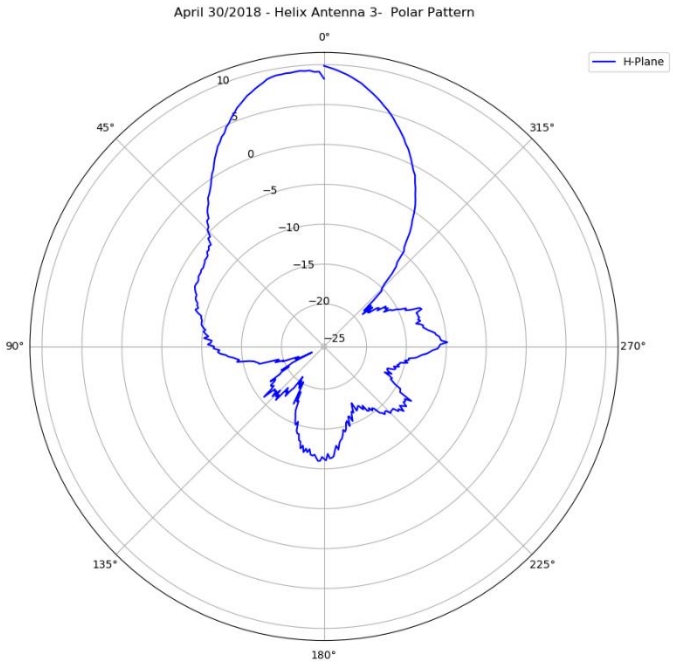

Figure 4.3. Helix Antenna prototype #2: Measured H-Plane, Polar Plot.

Pending: Analysis of Helix Antennas comparing with Design Simulation.
Characterization with at least one of the 2.5m wire antennas to verify the level of interference on the patch behavior.