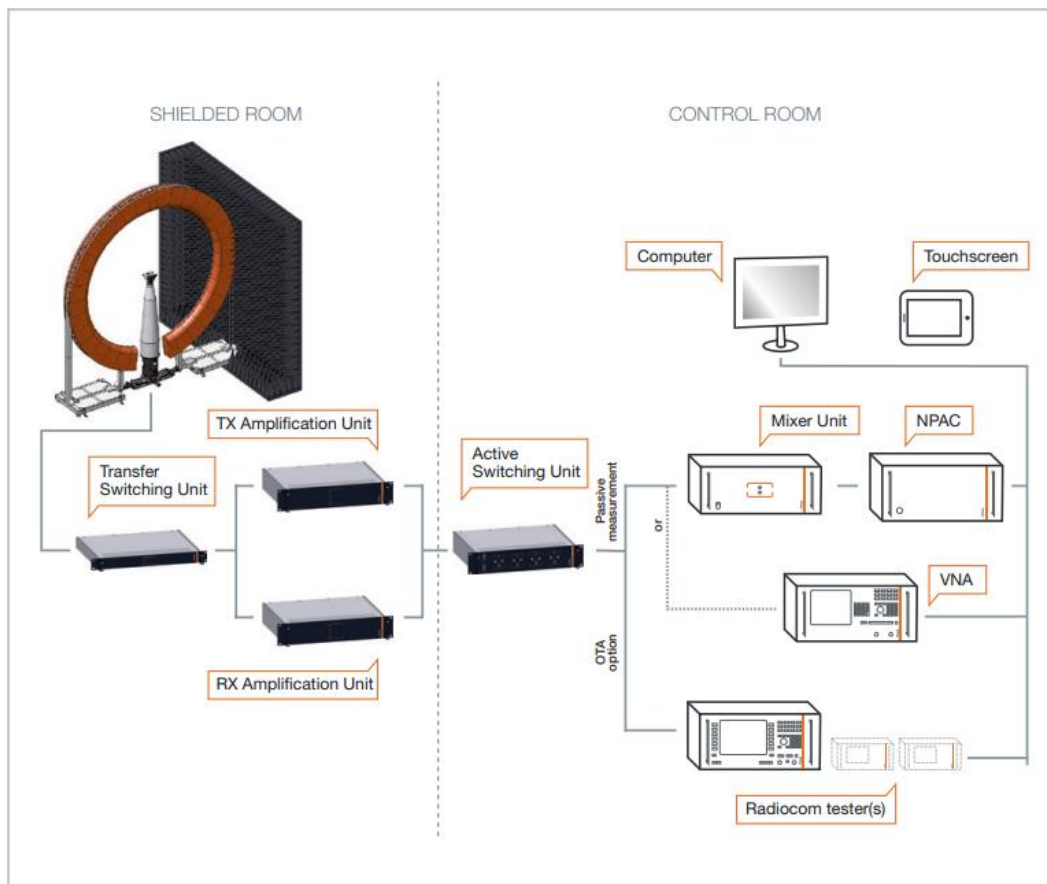


Antenna Test Report

For Tarana Part Number: 31-0156-200

1. Antenna Test Lab Information

- Lab Name: MVG, Inc.
- Address: 450 Franklin Gateway, Suite 100, Marietta, GA, 30067.
- [Certification](#): MVG is ISO 9001 and 17025 certified, and A2LA accredited, and offers NIST traceable antenna measurements. MVG is also a CTIA Authorized Test Laboratory (CATL) for Over the Air (OTA) active measurements.
- Test system: SG 64-S spherical near-field measurement system
- Frequency measurement range: SG64 frequency range of operation is from 400MHz to 6.0 GHz. The frequency range from 6.0 to 18.0 GHz is covered via an indoor far-field chamber.
- EUT measurement method: Gain-transfer or Substitution Method.
- For more detailed information about the test system, please refer to this [link](#).
- Equipment List / System Overview:

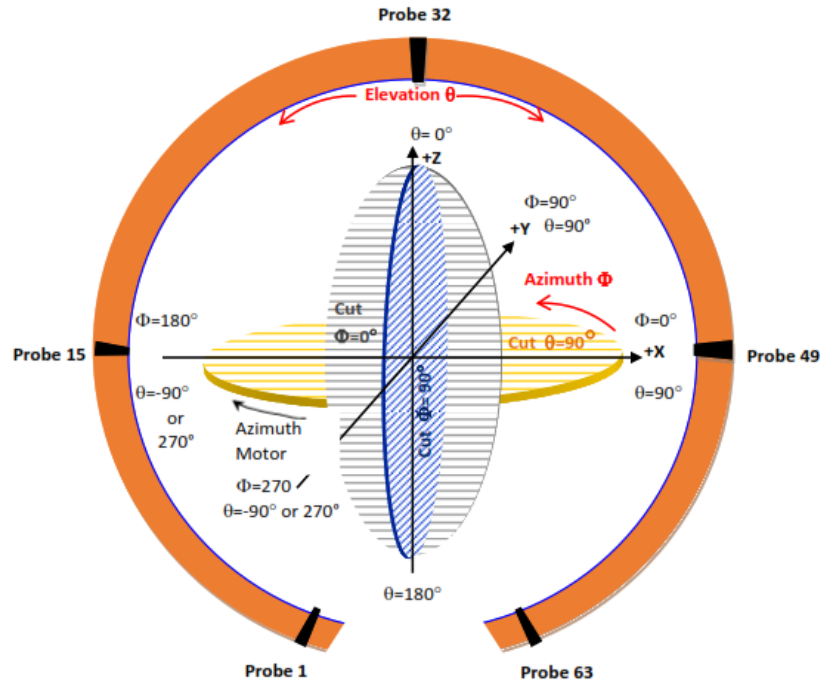


2. Measurement Setup:



3. Measurement setting – MVG SG64 Coordinate System

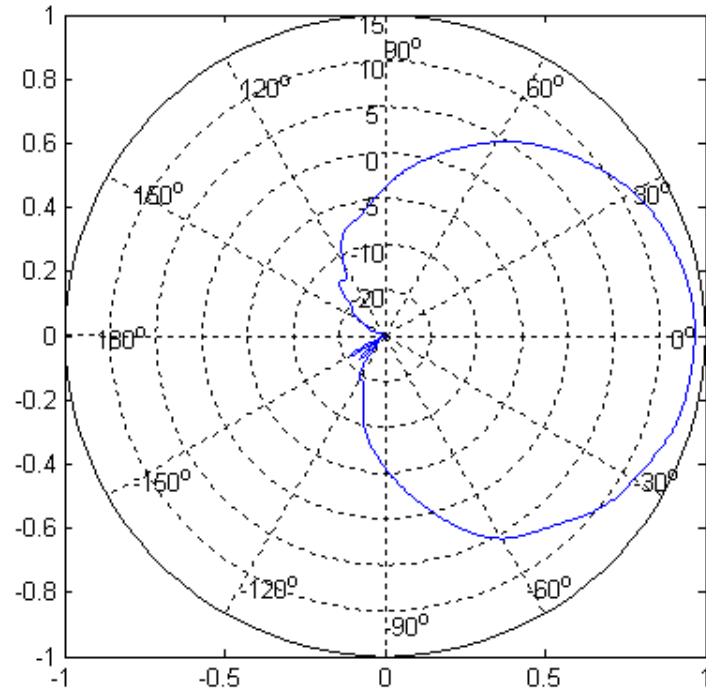
MVG SG64 Coordinate System



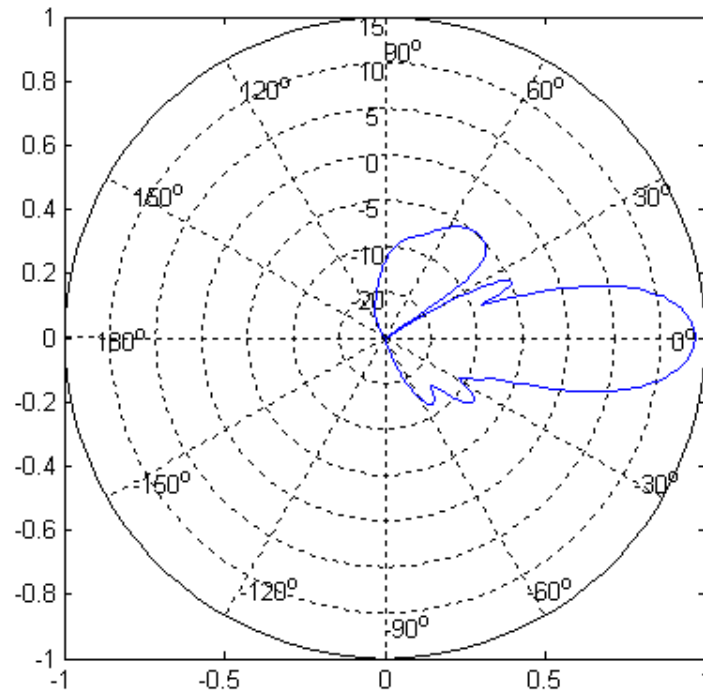
4. 2D Patterns

4.1. Antenna 0H Azimuth and Elevation Patterns at 5.2GHz

RN Hybrid, 0H Azimuth Antenna Pattern at 5.2GHz, $G_{MAX} = 13.7\text{dB}$

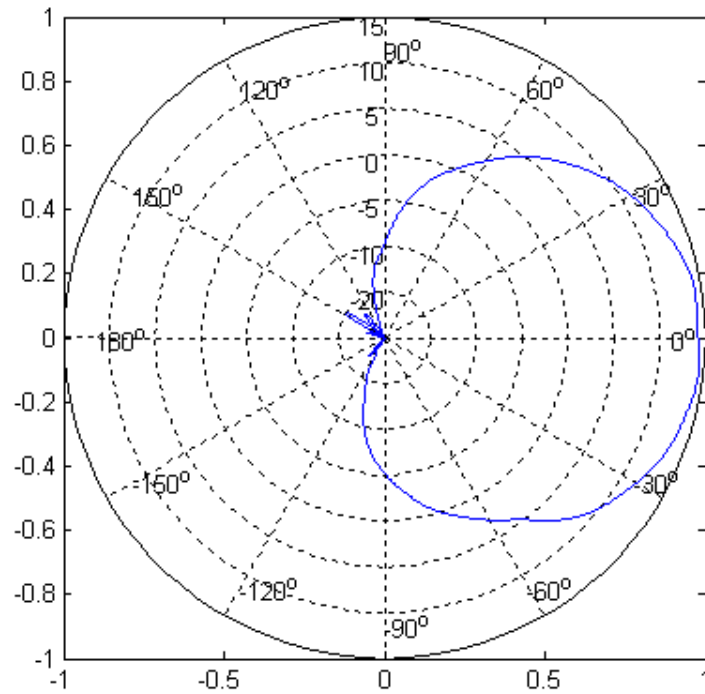


RN Hybrid, 0H Elevation Antenna Pattern at 5.2GHz, $G_{MAX} = 13.7\text{dB}$

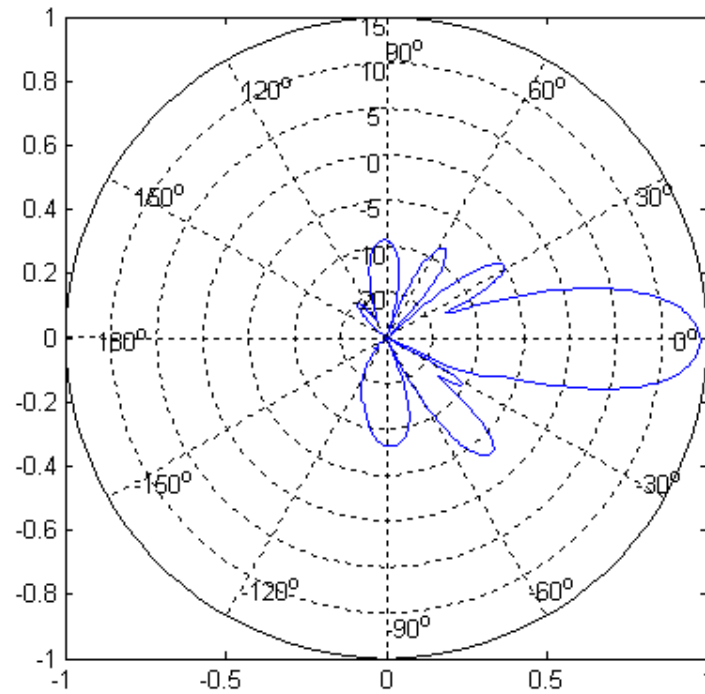


4.2. Antenna 0H Azimuth and Elevation Patterns at 5.8GHz

RN Hybrid, 0H Azimuth Antenna Pattern at 5.8GHz, $G_{MAX} = 14.4\text{dB}$

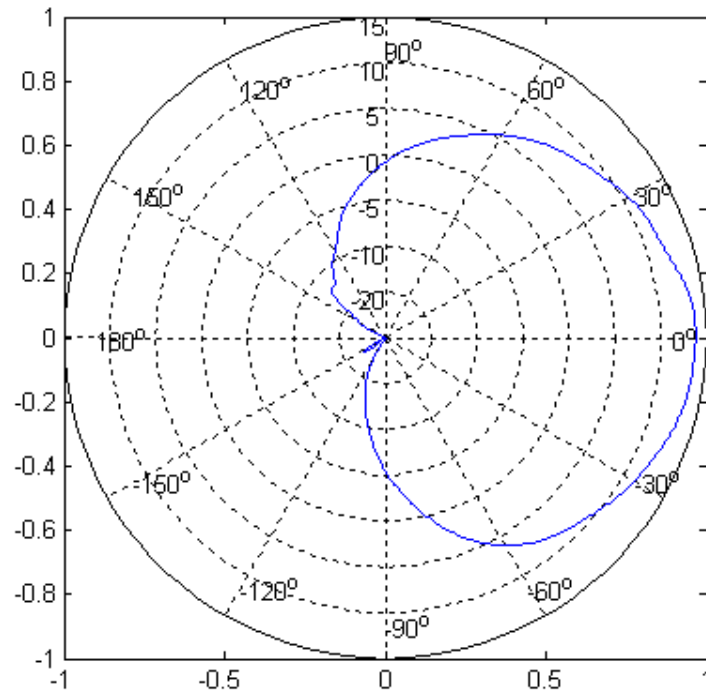


RN Hybrid, 0H Elevation Antenna Pattern at 5.8GHz, $G_{MAX} = 14.1\text{dB}$

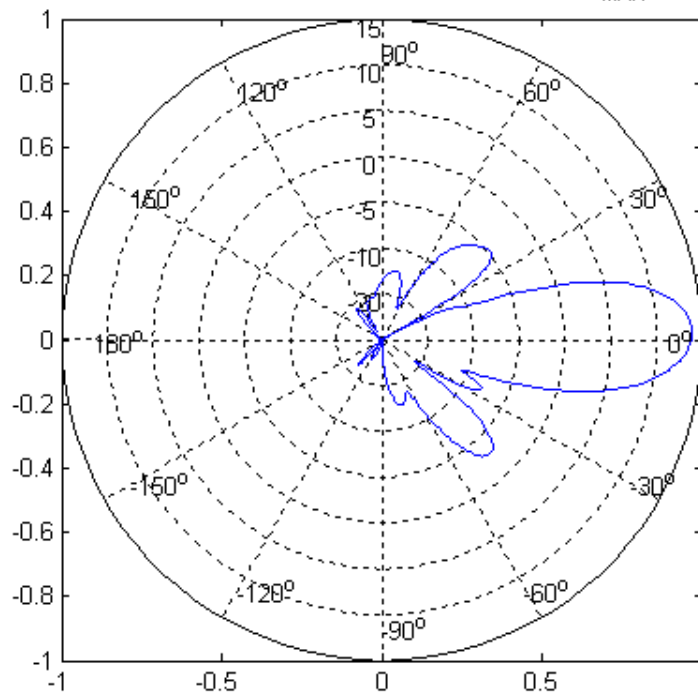


4.3. Antenna 1V Azimuth and Elevation Patterns at 5.2GHz

RN Hybrid, 1V Azimuth Antenna Pattern at 5.2GHz, $G_{MAX} = 13.6\text{dB}$

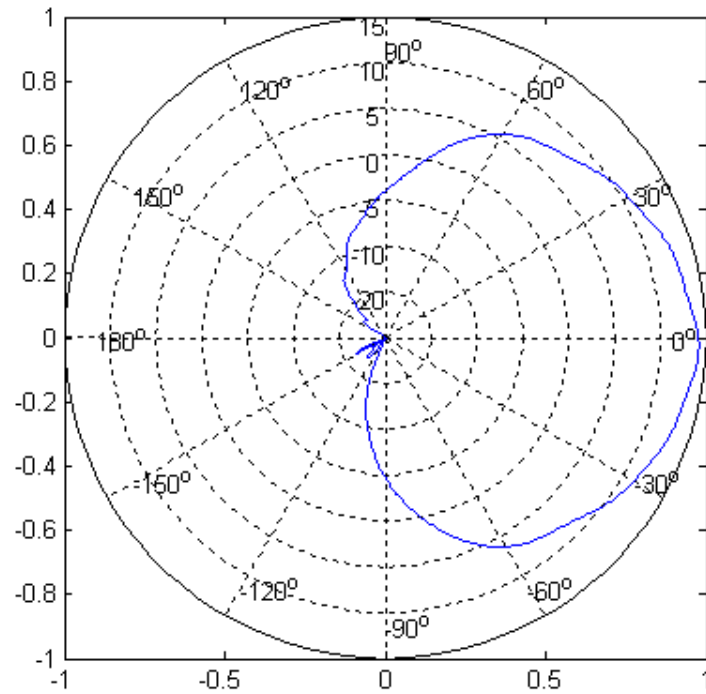


RN Hybrid, 1V Elevation Antenna Pattern at 5.2GHz, $G_{MAX} = 13.7\text{dB}$

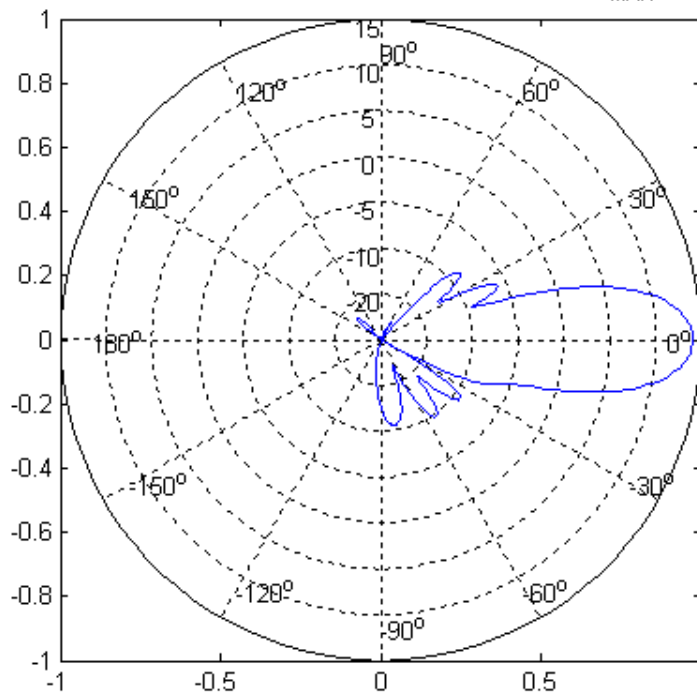


4.4. Antenna 1V Azimuth and Elevation Patterns at 5.8GHz

RN Hybrid, 1V Azimuth Antenna Pattern at 5.8GHz, $G_{MAX} = 14.1\text{dB}$

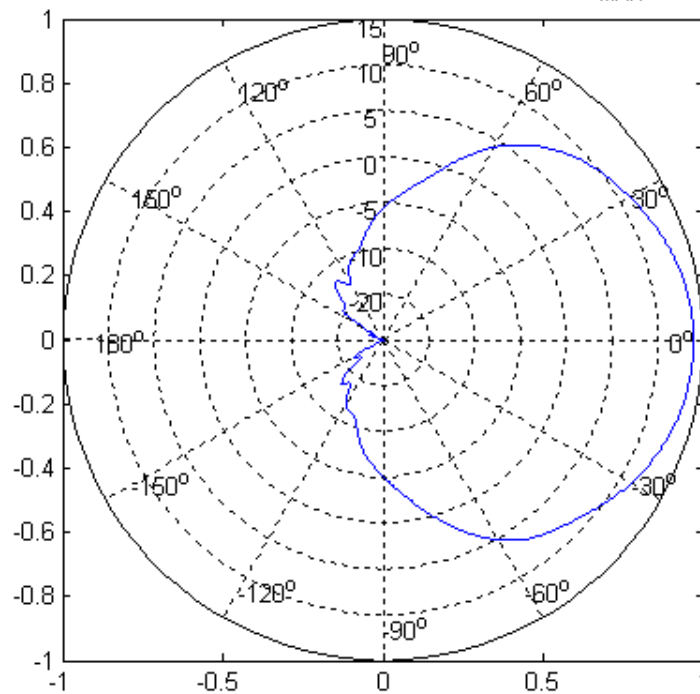


RN Hybrid, 1V Elevation Antenna Pattern at 5.8GHz, $G_{MAX} = 14\text{dB}$

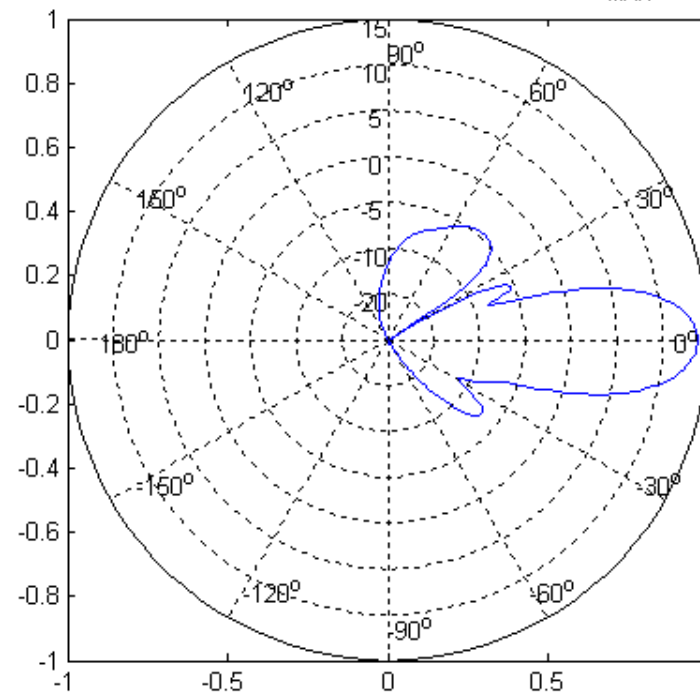


4.5. Antenna 2H Azimuth and Elevation Patterns at 5.2GHz

RN Hybrid, 2H Azimuth Antenna Pattern at 5.2GHz, $G_{MAX} = 13.7\text{dB}$

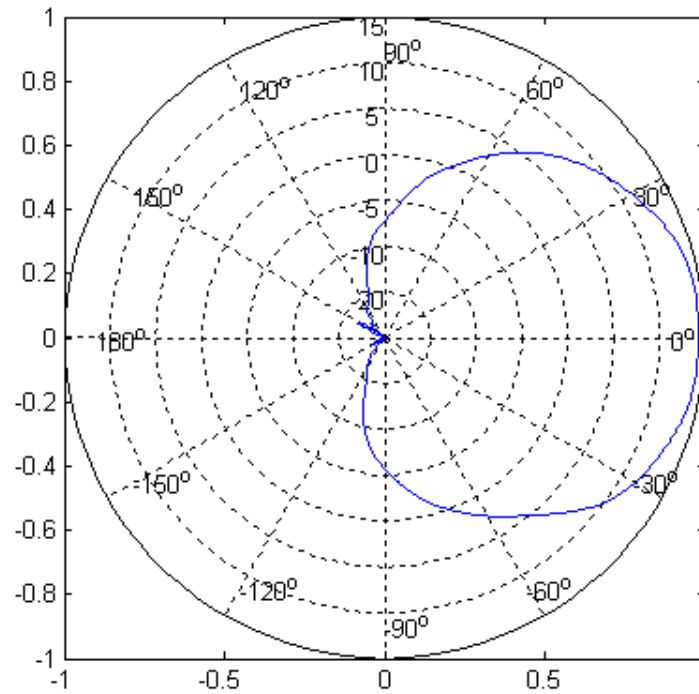


RN Hybrid, 2H Elevation Antenna Pattern at 5.2GHz, $G_{MAX} = 13.7\text{dB}$

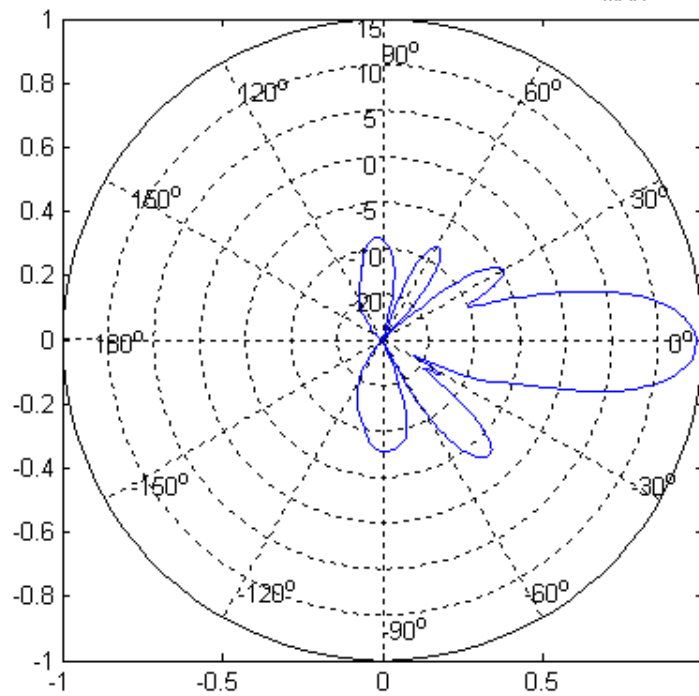


4.6. Antenna 2H Azimuth and Elevation Patterns at 5.8GHz

RN Hybrid, 2H Azimuth Antenna Pattern at 5.8GHz, $G_{MAX} = 14.2\text{dB}$

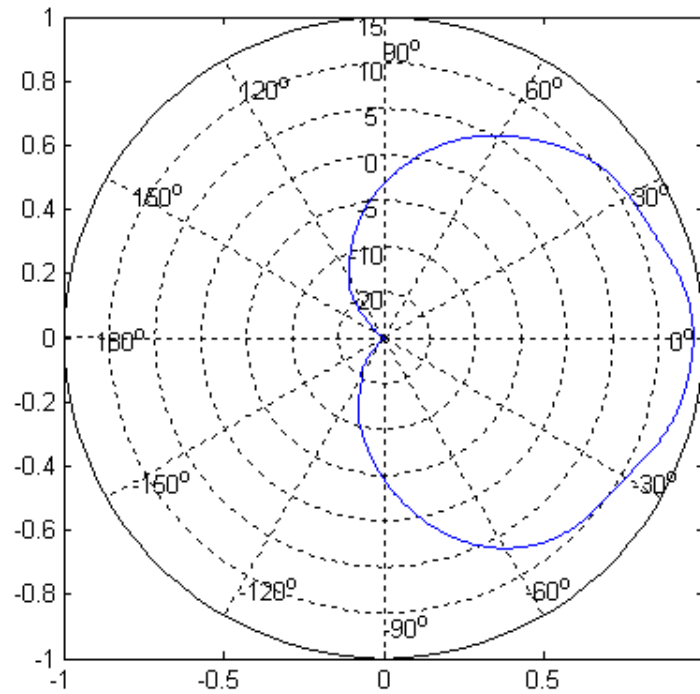


RN Hybrid, 2H Elevation Antenna Pattern at 5.8GHz, $G_{MAX} = 14.2\text{dB}$

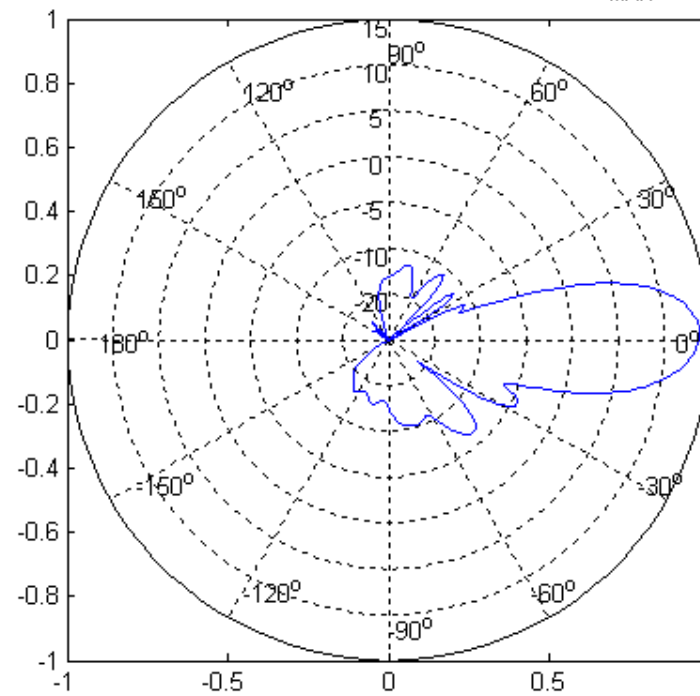


4.7. Antenna 3V Azimuth and Elevation Patterns at 5.2GHz

RN Hybrid, 3V Azimuth Antenna Pattern at 5.2GHz, $G_{MAX} = 13.7\text{dB}$

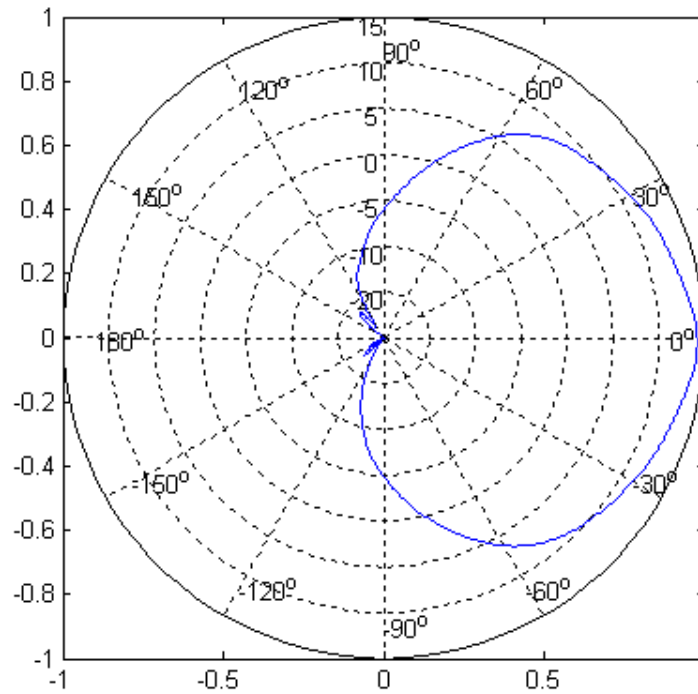


RN Hybrid, 3V Elevation Antenna Pattern at 5.2GHz, $G_{MAX} = 13.7\text{dB}$

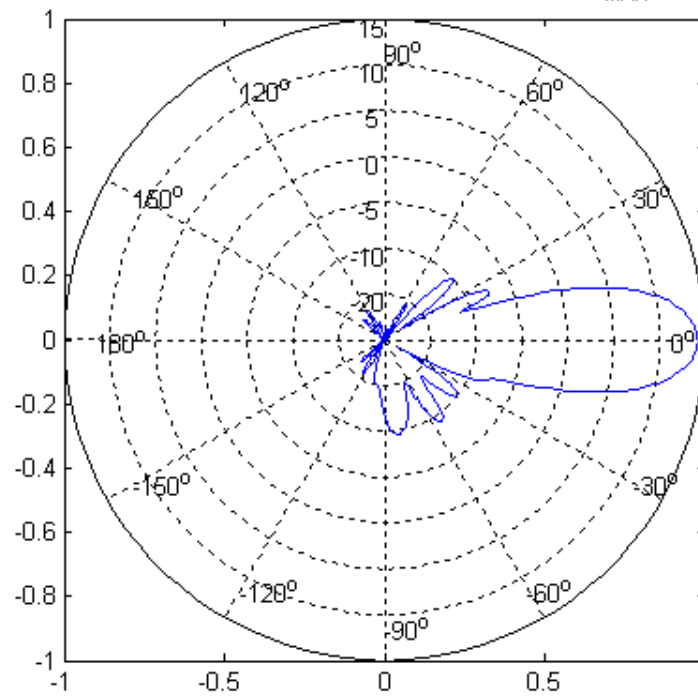


4.8. Antenna 3V Azimuth and Elevation Patterns at 5.8GHz

RN Hybrid, 3V Azimuth Antenna Pattern at 5.8GHz, $G_{MAX} = 14.1\text{dB}$

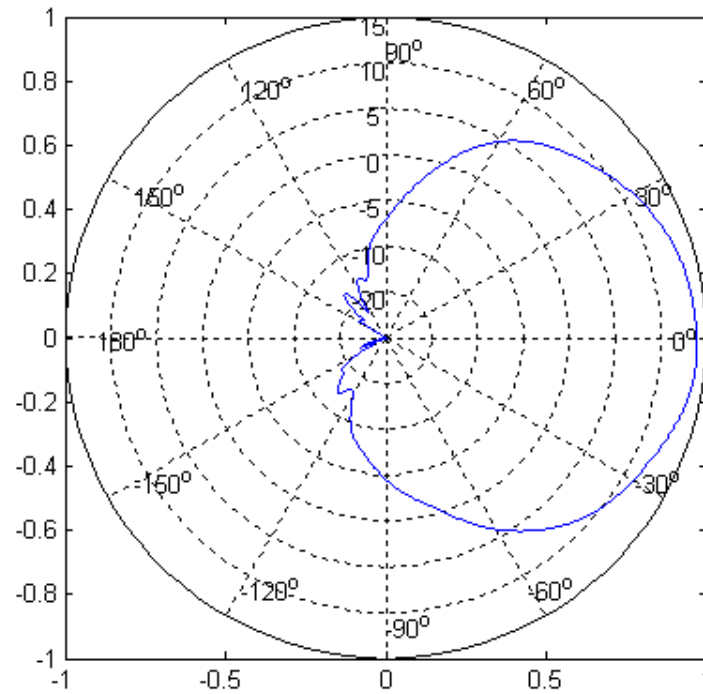


RN Hybrid, 3V Elevation Antenna Pattern at 5.8GHz, $G_{MAX} = 14.1\text{dB}$

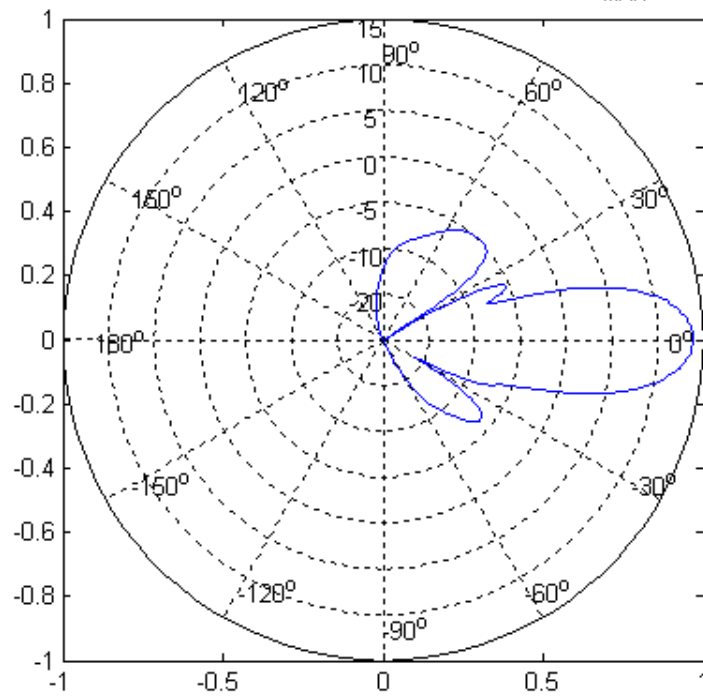


4.9. Antenna 4H Azimuth and Elevation Patterns at 5.2GHz

RN Hybrid, 4H Azimuth Antenna Pattern at 5.2GHz, $G_{MAX} = 13.8\text{dB}$

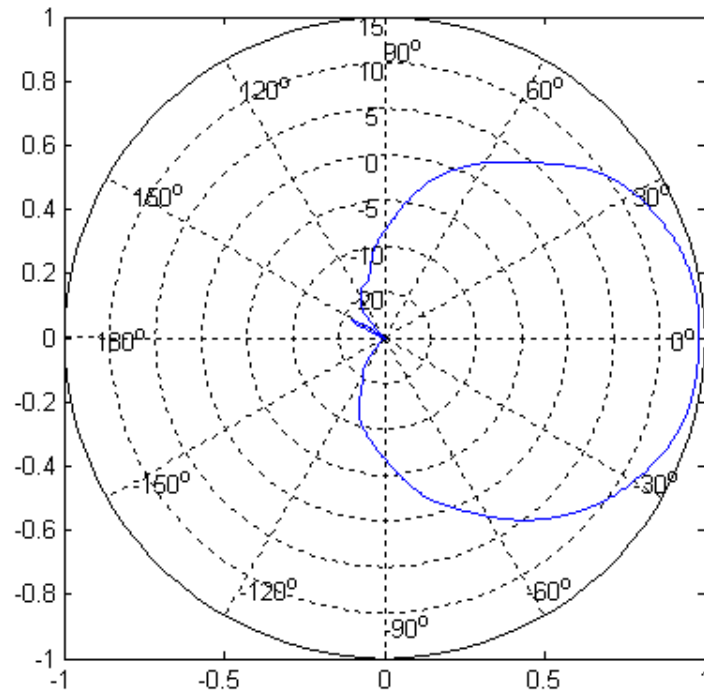


RN Hybrid, 4H Elevation Antenna Pattern at 5.2GHz, $G_{MAX} = 13.8\text{dB}$

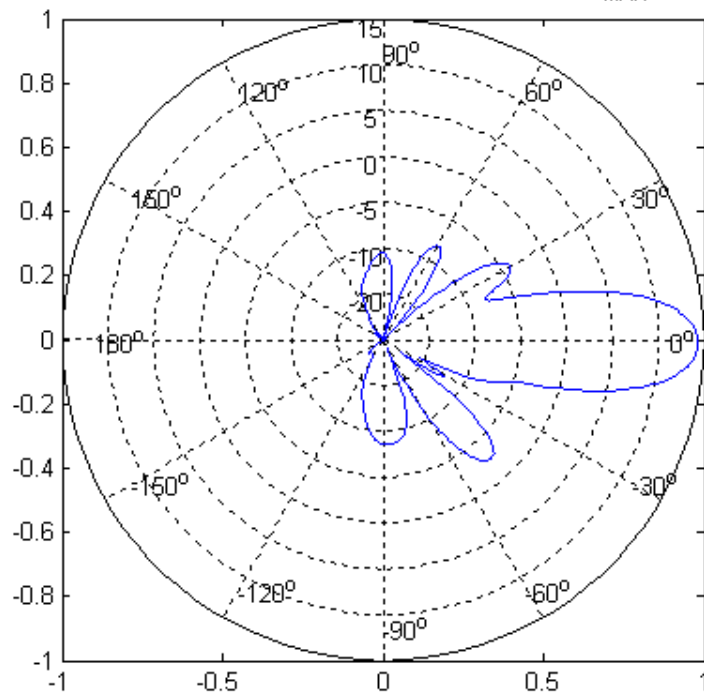


4.10. Antenna 4H Azimuth and Elevation Patterns at 5.8GHz

RN Hybrid, 4H Azimuth Antenna Pattern at 5.8GHz, $G_{MAX} = 14.3\text{dB}$

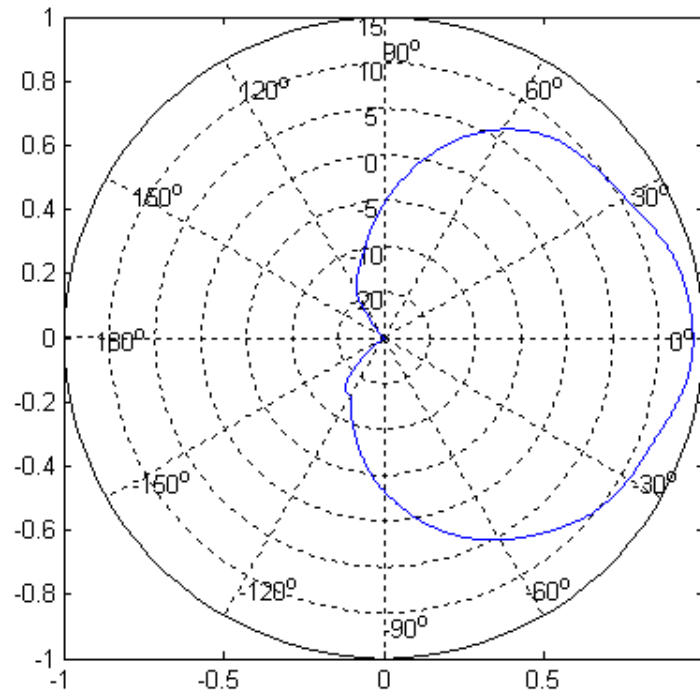


RN Hybrid, 4H Elevation Antenna Pattern at 5.8GHz, $G_{MAX} = 14.3\text{dB}$

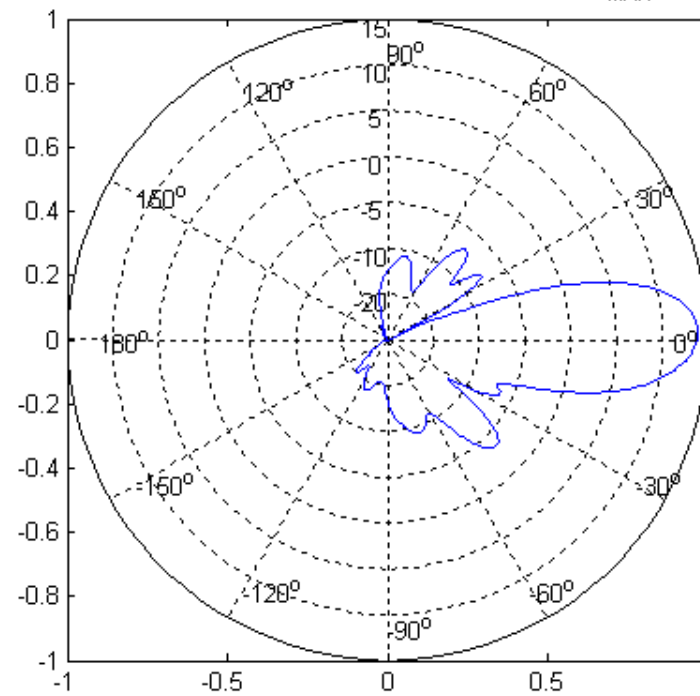


4.11. Antenna 5V Azimuth and Elevation Patterns at 5.2GHz

RN Hybrid, 5V Azimuth Antenna Pattern at 5.2GHz, $G_{MAX} = 13.6\text{dB}$

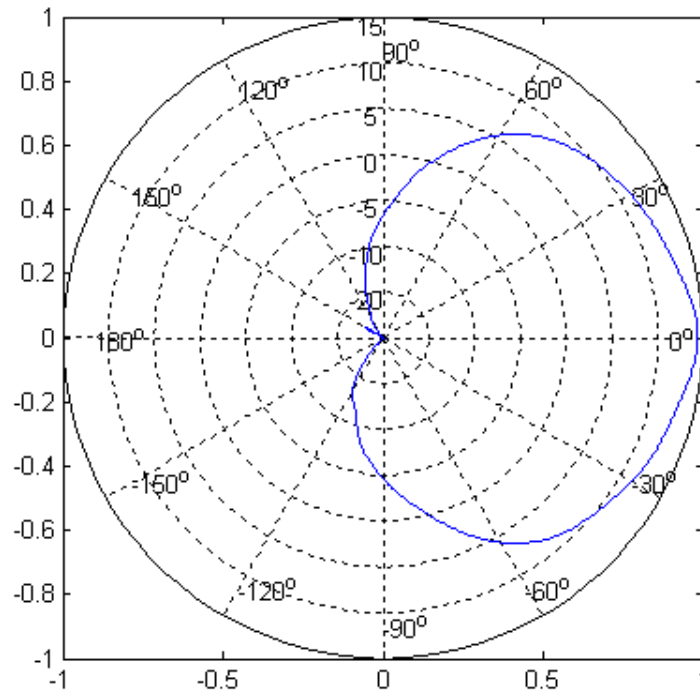


RN Hybrid, 5V Elevation Antenna Pattern at 5.2GHz, $G_{MAX} = 13.7\text{dB}$

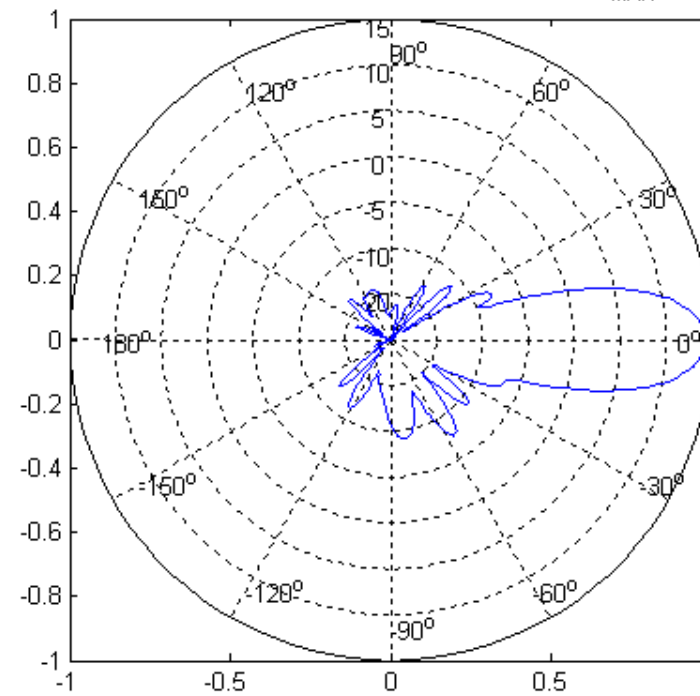


4.12. Antenna 5V Azimuth and Elevation Patterns at 5.8GHz

RN Hybrid, 5V Azimuth Antenna Pattern at 5.8GHz, $G_{MAX} = 14.3\text{dB}$

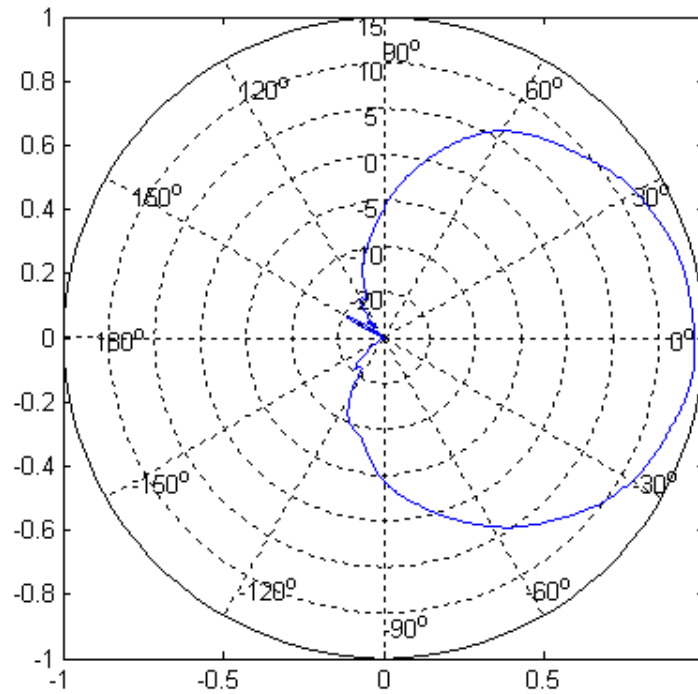


RN Hybrid, 5V Elevation Antenna Pattern at 5.8GHz, $G_{MAX} = 14.3\text{dB}$

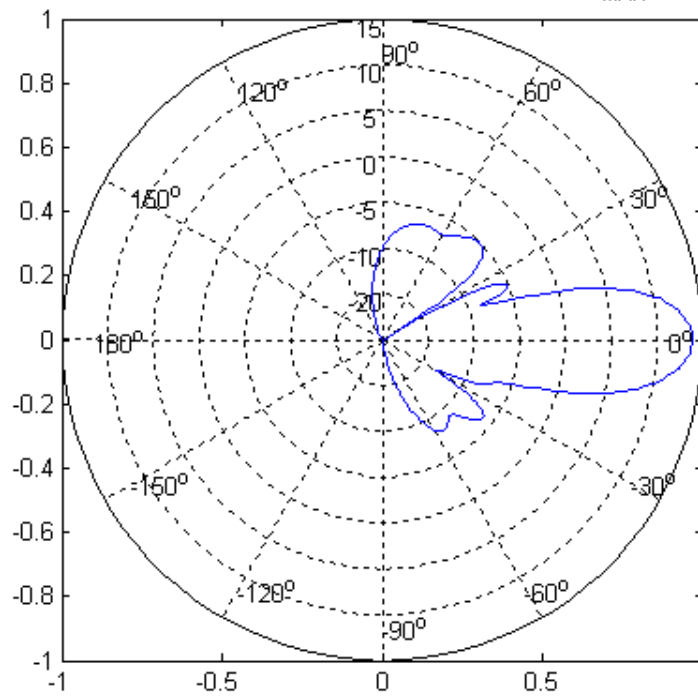


4.13. Antenna 6H Azimuth and Elevation Patterns at 5.2GHz

RN Hybrid, 6H Azimuth Antenna Pattern at 5.2GHz, $G_{MAX} = 13.9\text{dB}$

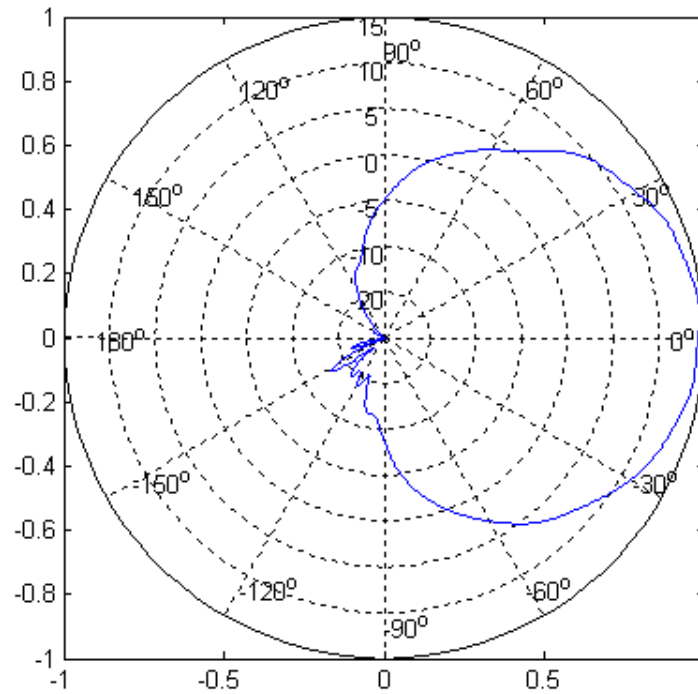


RN Hybrid, 6H Elevation Antenna Pattern at 5.2GHz, $G_{MAX} = 13.8\text{dB}$

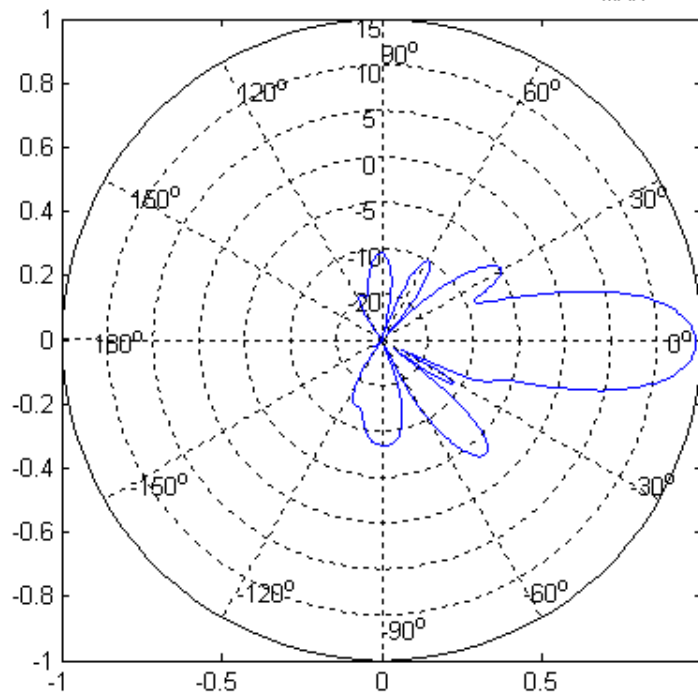


4.14. Antenna 6H Azimuth and Elevation Patterns at 5.8GHz

RN Hybrid, 6H Azimuth Antenna Pattern at 5.8GHz, $G_{MAX} = 14.5\text{dB}$

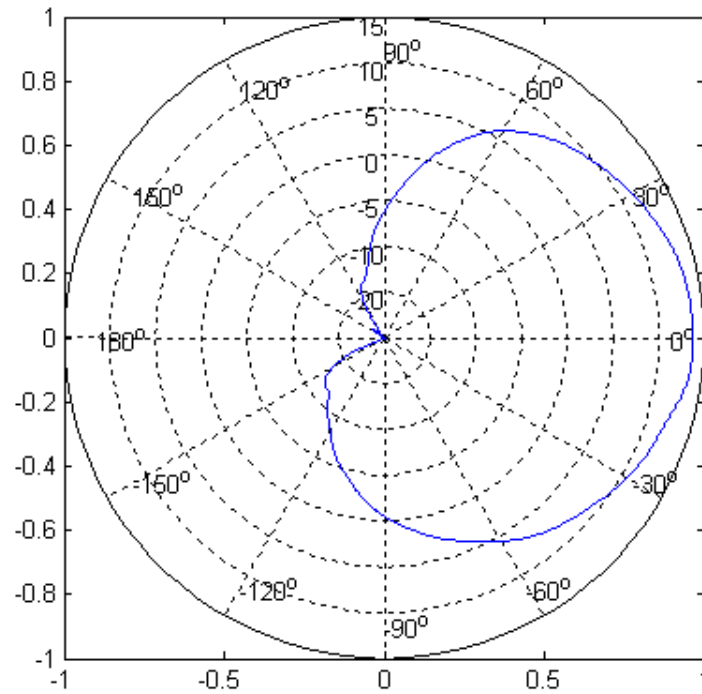


RN Hybrid, 6H Elevation Antenna Pattern at 5.8GHz, $G_{MAX} = 14.2\text{dB}$

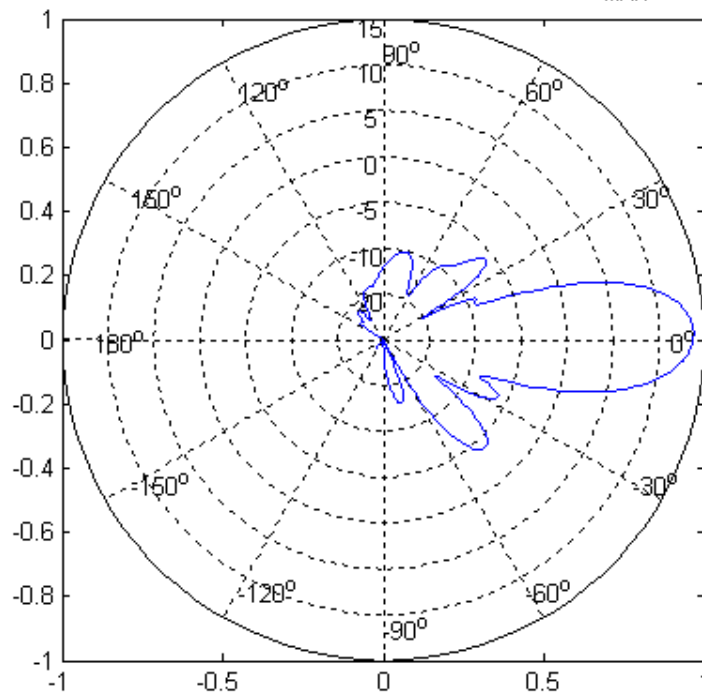


4.15. Antenna 7V Azimuth and Elevation Patterns at 5.2GHz

RN Hybrid, 7V Azimuth Antenna Pattern at 5.2GHz, $G_{MAX} = 13.5\text{dB}$

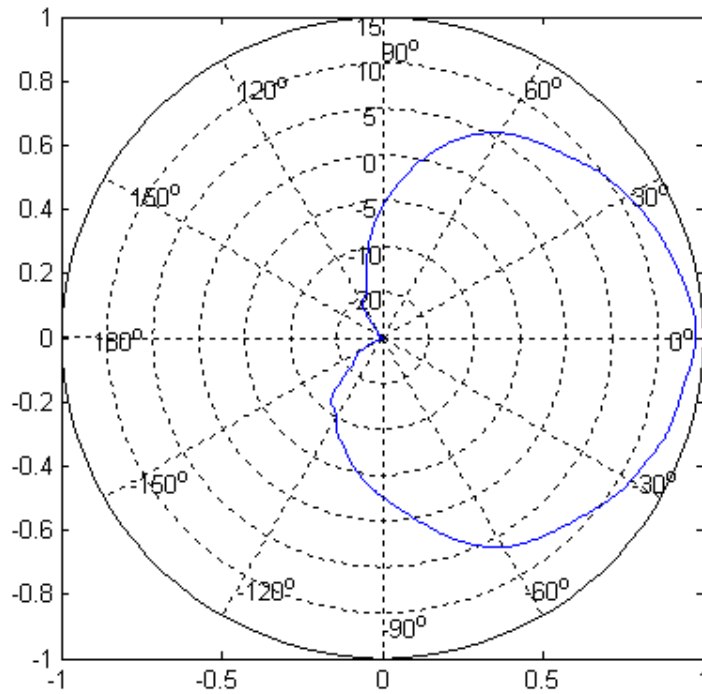


RN Hybrid, 7V Elevation Antenna Pattern at 5.2GHz, $G_{MAX} = 13.6\text{dB}$

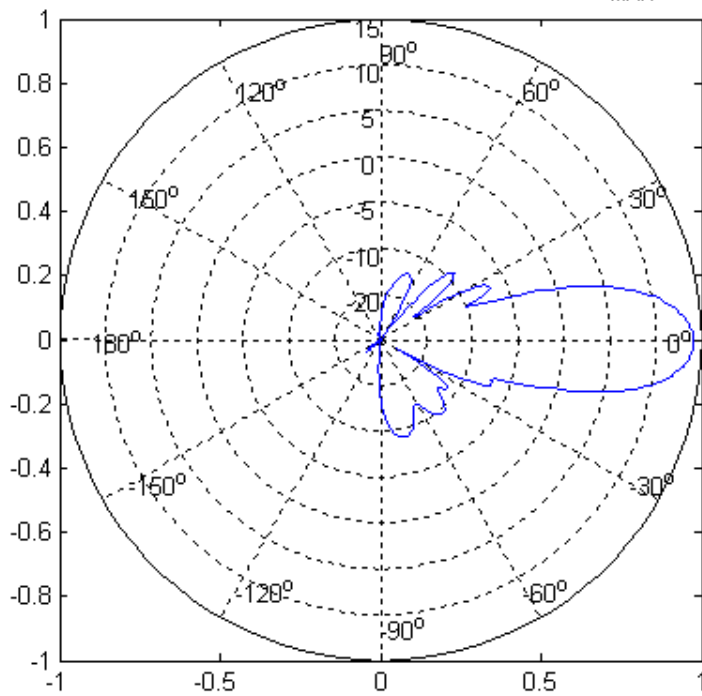


4.16. Antenna 7V Azimuth and Elevation Patterns at 5.8GHz

RN Hybrid, 7V Azimuth Antenna Pattern at 5.8GHz, $G_{MAX} = 14\text{dB}$



RN Hybrid, 7V Elevation Antenna Pattern at 5.8GHz, $G_{MAX} = 14\text{dB}$



5. Summary

5.1. Antenna Gain Summary

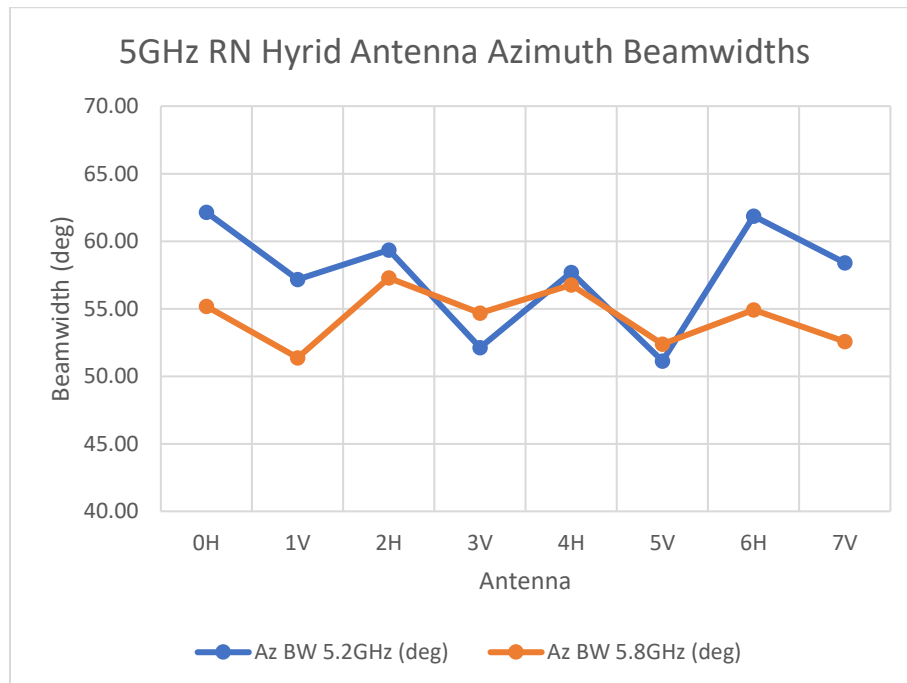
5GHz RN hybrid antenna with Rosenberger connectors measured in test fixture on 7/1/2022

PCB 31-0156-301 Rev 1

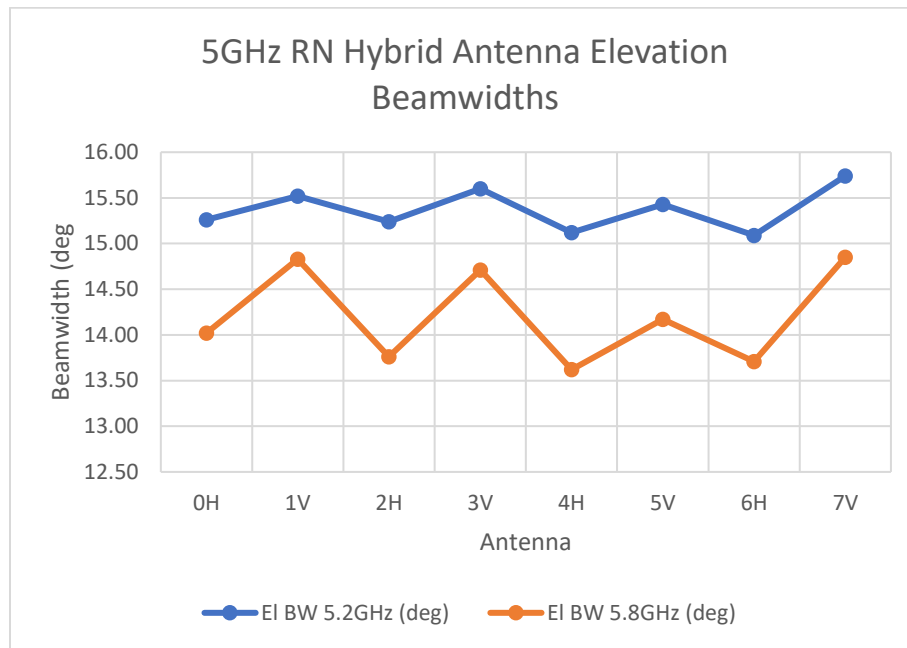
5GHz RN Antenna Pattern Measurements Results Summary:

	Az Gain, 5.2GHz (dBi)	Az Gain, 5.8GHz (dBi)	El Gain, 5.2GHz (dBi)	El Gain, 5.8GHz (dBi)	Az BW 5.2GHz (deg)	Az BW 5.8GHz (deg)	El BW 5.2GHz (deg)	El BW 5.8GHz (deg)	Backlobe (dBi)	Upper sidelobe (dBi)	+/-90 deg lobes (dBi)
0H	13.67	14.39	13.64	14.10	62.14	55.17	15.26	14.02	-14	-5	-11
1V	13.63	14.09	13.71	14.00	57.17	51.37	15.52	14.83	-12	-5	-15
2H	13.73	14.22	13.71	14.18	59.36	57.28	15.24	13.76	-14	-5	-11
3V	13.65	14.09	13.71	14.06	52.12	54.68	15.60	14.71	-15	-8	-12
4H	13.83	14.30	13.76	14.29	57.68	56.77	15.12	13.62	-15	-4	-11
5V	13.62	14.29	13.72	14.27	51.13	52.38	15.43	14.17	-16	-6	-12
6H	13.86	14.52	13.75	14.23	61.85	54.92	15.09	13.71	-16	-5	-11
7V	13.55	14.04	13.60	14.03	58.41	52.58	15.74	14.85	-12	-6	-13
H ave values	13.77	14.36	13.72	14.20	60.26	56.04	15.18	13.78			
V ave values	13.61	14.13	13.69	14.09	54.71	52.75	15.57	14.64			

5.2. Antenna Azimuth Beamwidths



5.3. Antenna Elevation Beamwidths



5.4. Antenna Backlobe, Upper Sidelobe and +/- 90deg Lobes

