Medidas del Diagrama de Radiación del prototipo de antena para VGOS Dyqsa en la Cámara Anecoica del CDT Yebes

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Informe Técnico CDT 2014-3

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1. Organization contact information

- ***Organización (Organization):***
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2. Chamber Measurement Specifications

Temperature	20 C ±1 C
Humidity	30% ±1%

All measurements where carried out under the IEEE Standards Test Procedures for Antennas.

Documentation of the chambers as measured RF, electrical and mechanical characteristics are available upon request.

3. AUT Specifications

The basic specifications of the antenna to be measured are presented below

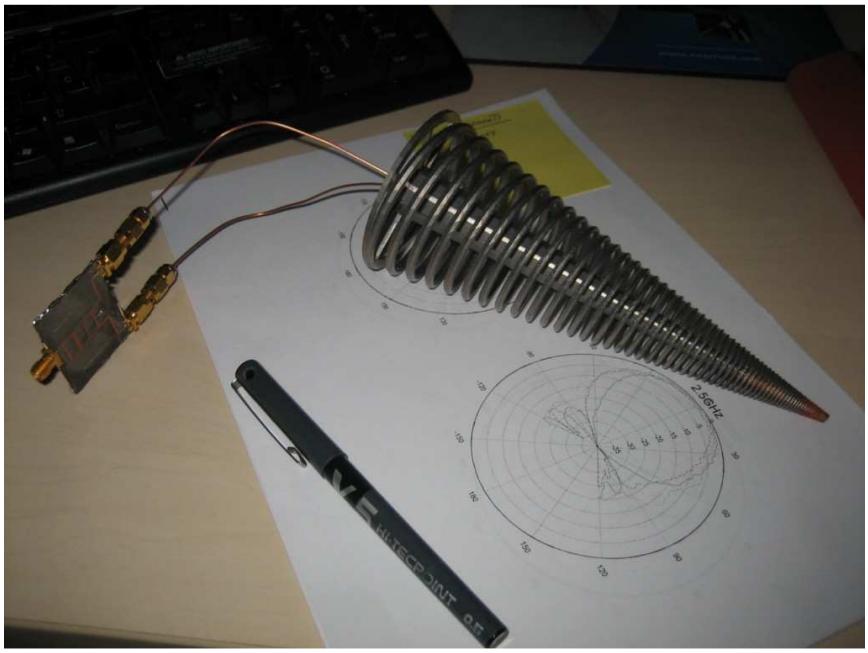

Figure 1: DYQSA AUT with output rat-race

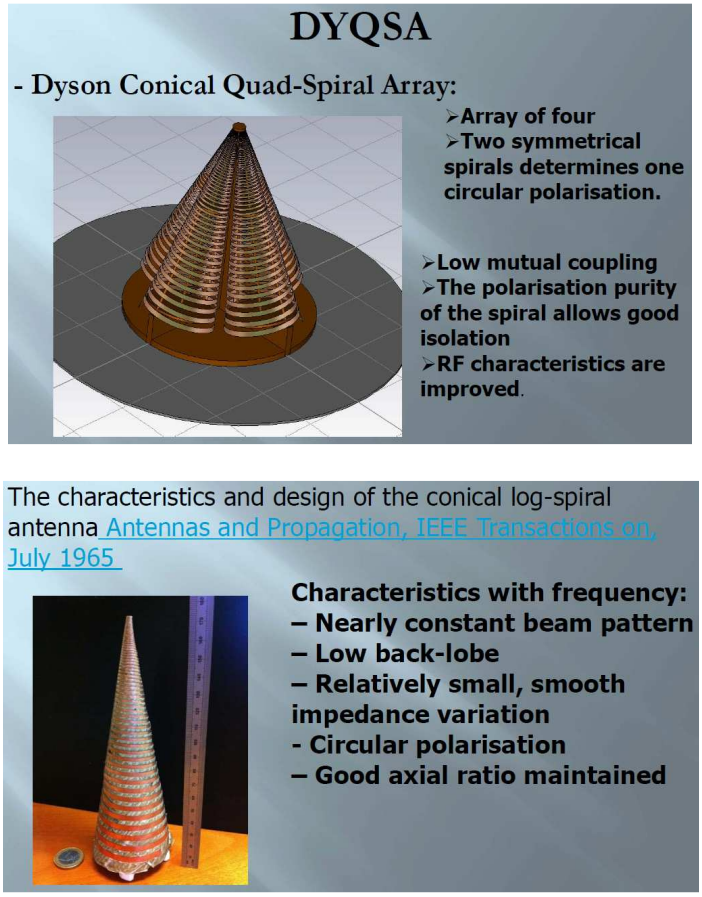

Figure 2: DYQSA characteristics

4. Measurement Requirements

The measurements will consist of radiation pattern cuts at 0, 45, 90 and 135 degrees in both co and cross polar. It will also include gain measurement using the direct method and a directivity calculation. The measurement frequencies are from 2 to 14GHz.

5. Antenna Measurement system configuration

The overall characteristics and specifications of the Centro de Desarrollos Tecnológicos Anechoic Chamber (CDTAC) can be reviewed in [1].

The following figures show the antenna in CDTAC undergoing alignment and prepared for measurement with the radome in place.

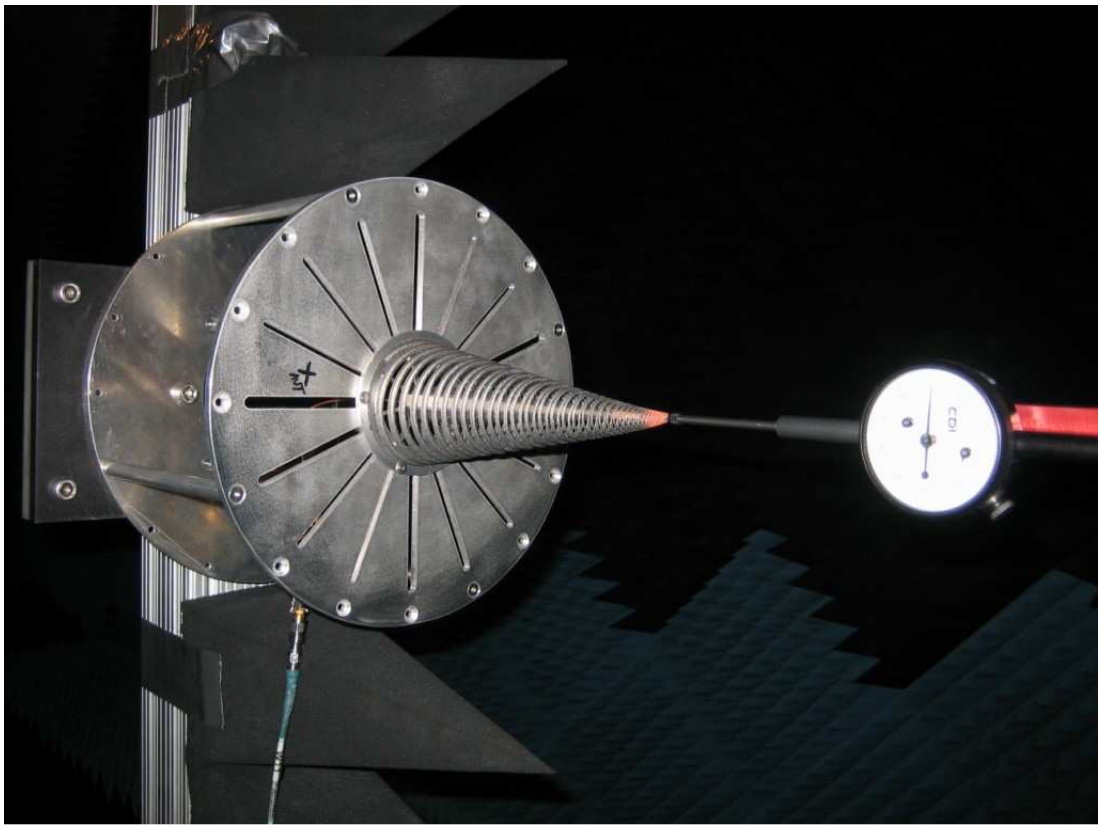

Figure 3: DYQSA mechanical alignment in CDTAC

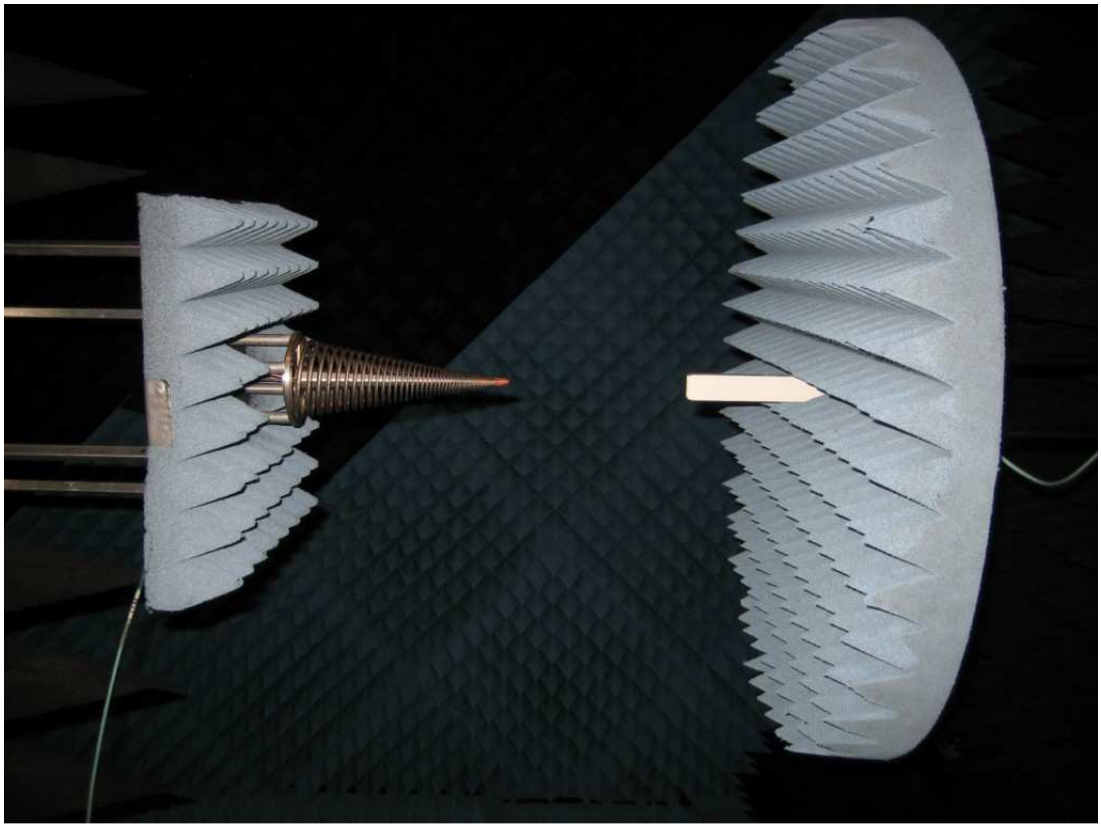

Figure 4: DYQSA ready for measurement (I)

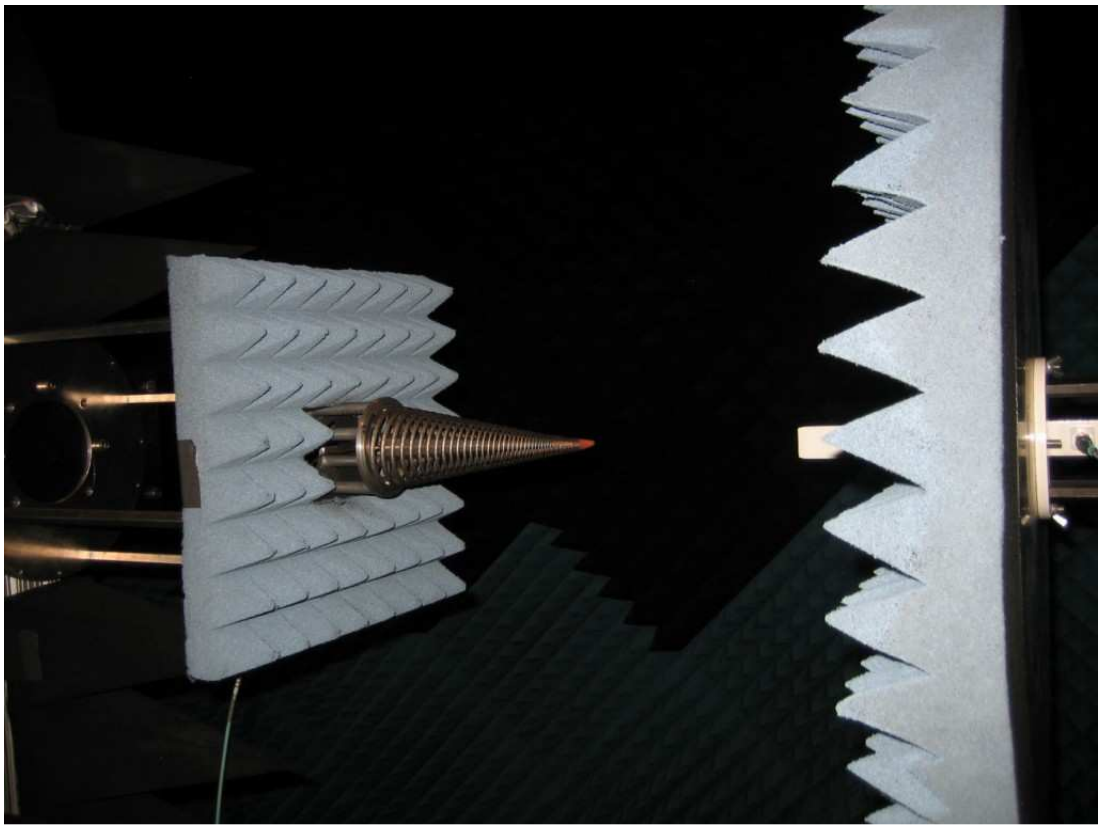

Figure 5: DYQSA ready for measurement (II)

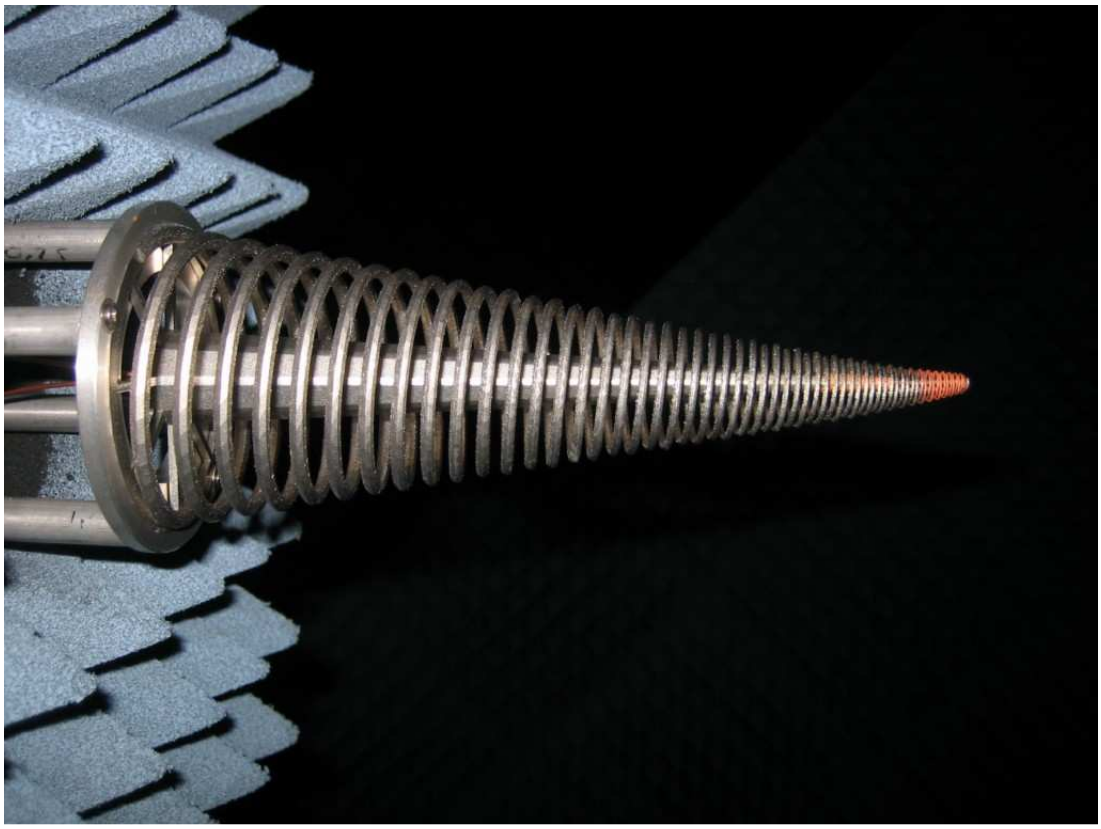

Figure 6: DYQSA ready for measurement (III)

5.1. AUT Alignment

The AUT was aligned mechanically using a touch probe which yields a positional accuracy of 25 microns.

The distance between AUT and probe is **3λ**.

	X [mm]	Y [mm]	Z [mm]
Scan Center	-0.020m	+0.005m	-0.025m

Table 2

5.2. Probe

- OEWP
- 2-14GHz band (WR430, WR284, WR112 and WR75)
- The polarisation definition is as follows;
    - Lin-0 indicates that the E-field vector of the probe lies in the scanner x-direction
    - Lin 90 indicates that the E-field vector of the probe lies in the scanner y-direction

6. Measurement results

The measurement allows for the evaluation of drift during the duration of the measurement.

6.1. DYQSA S11 (with rat-race)

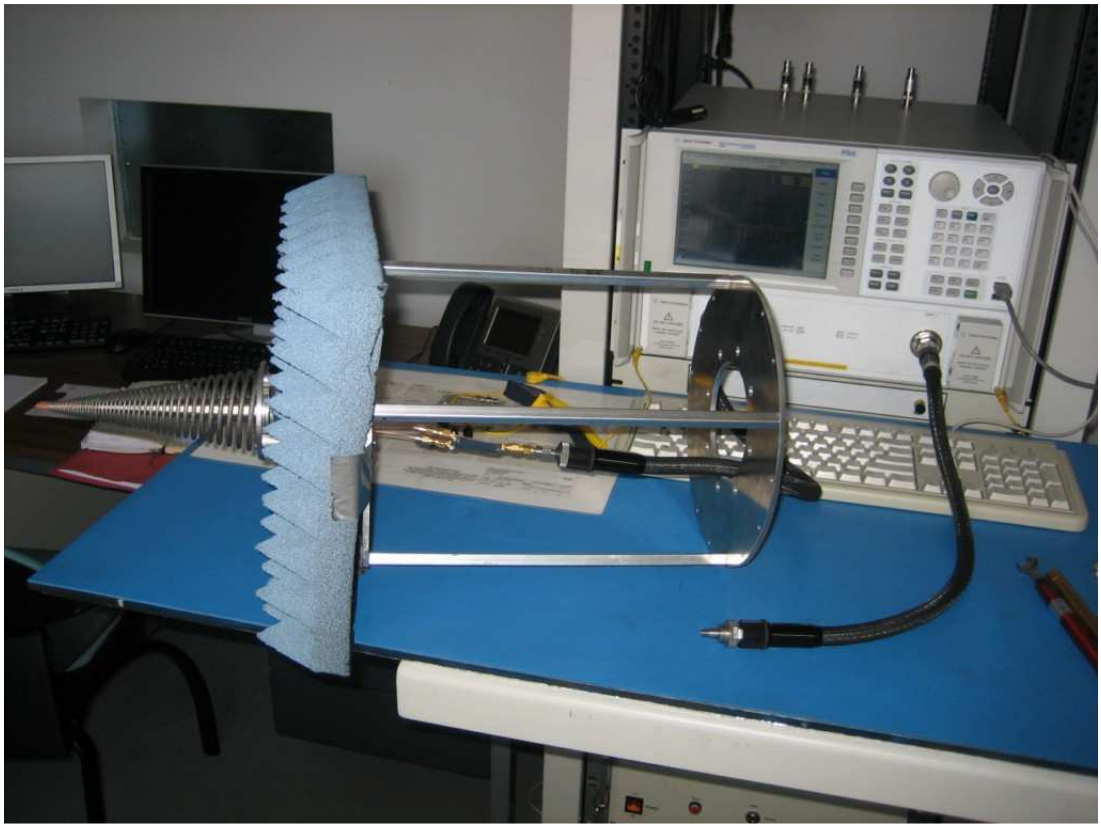

Figure 7: DYQSA S11 Measurements

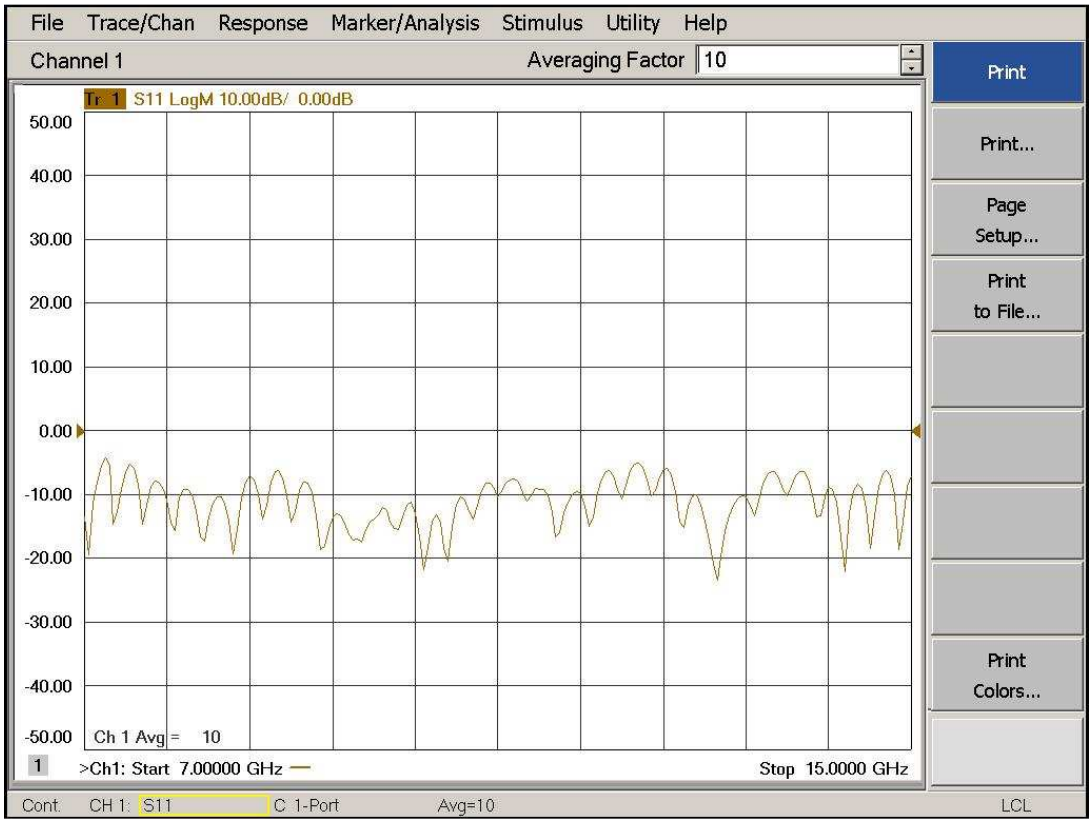

Figure 8: DYQSA + RatRace S11 (7-15GHz)

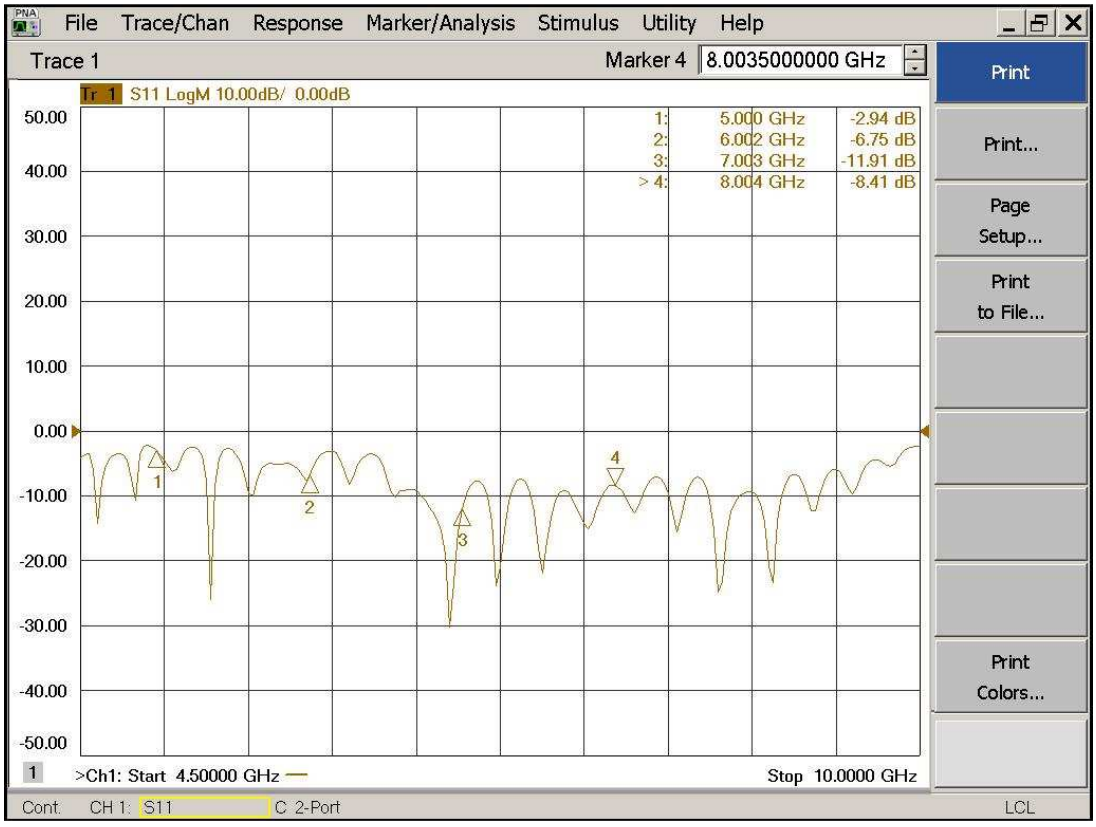

Figure 9: DYQSA + RatRace S11 (4.5-10GHz)

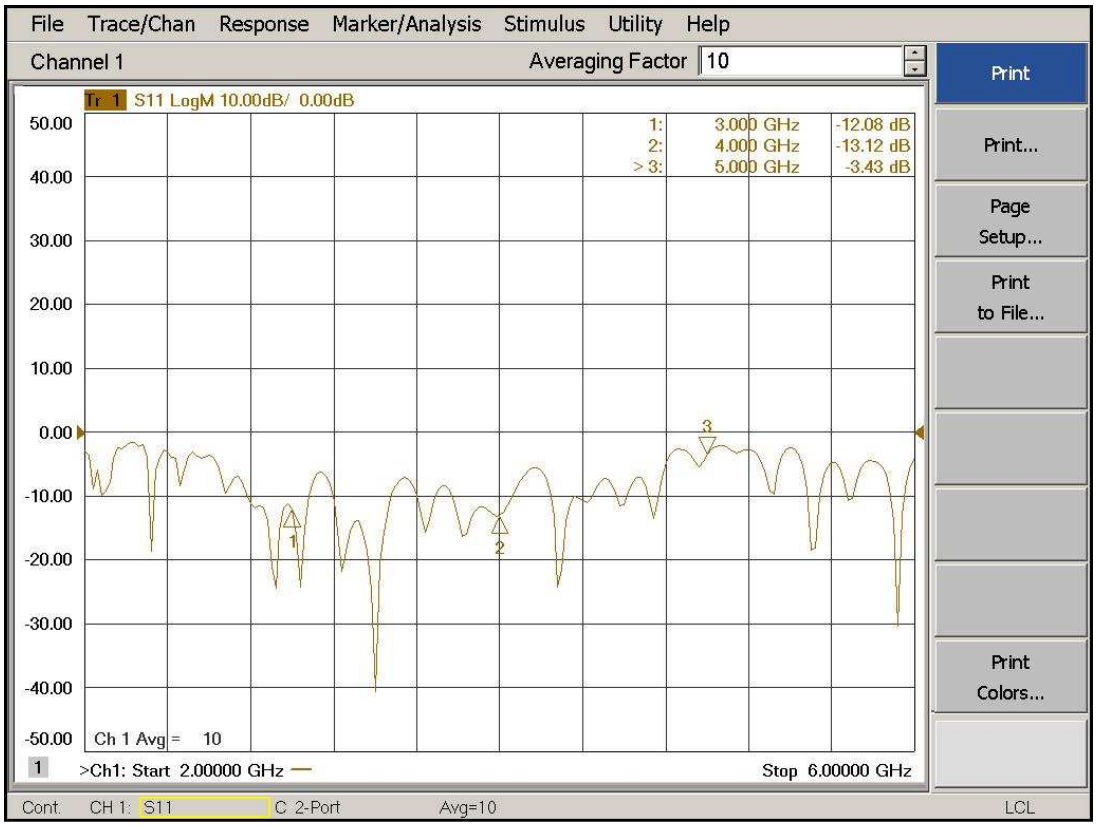

Figure 10: DYQSA + RatRace S11 (2-6GHz)

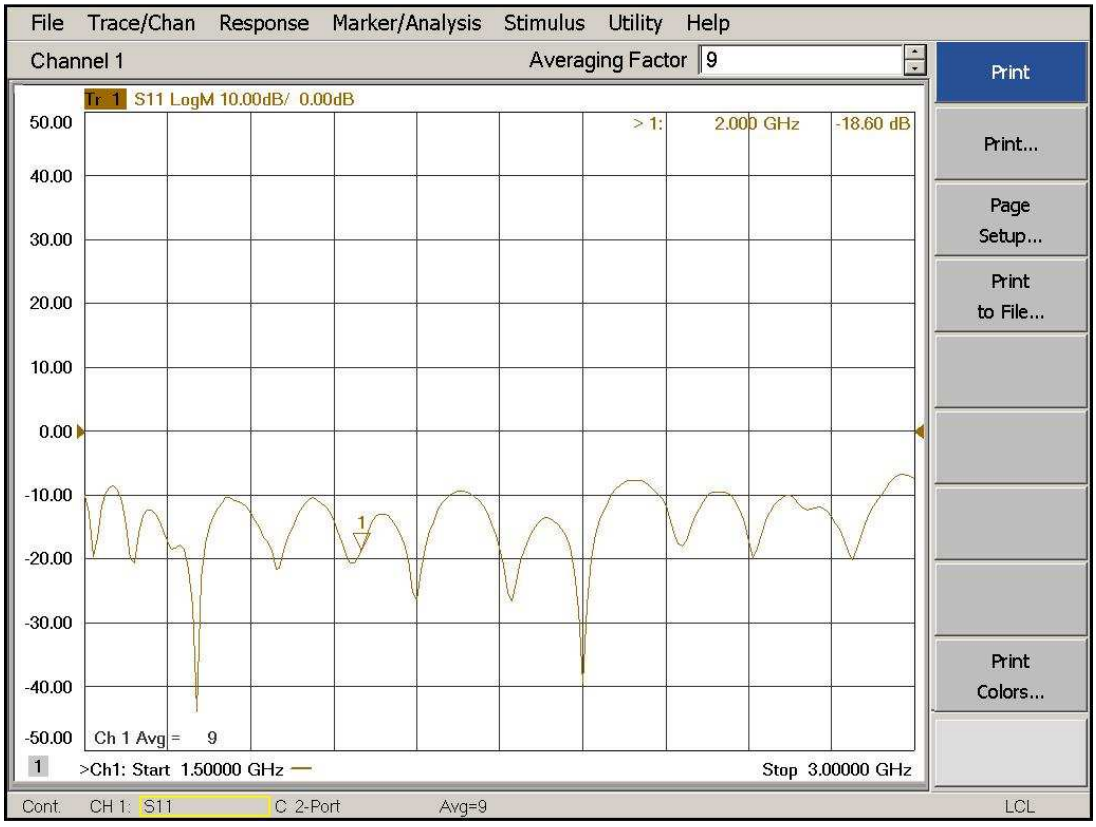

Figure 11: DYQSA + RatRace S11 (1.5-3GHz)

6.2. Radiation Pattern (2-14GHz)

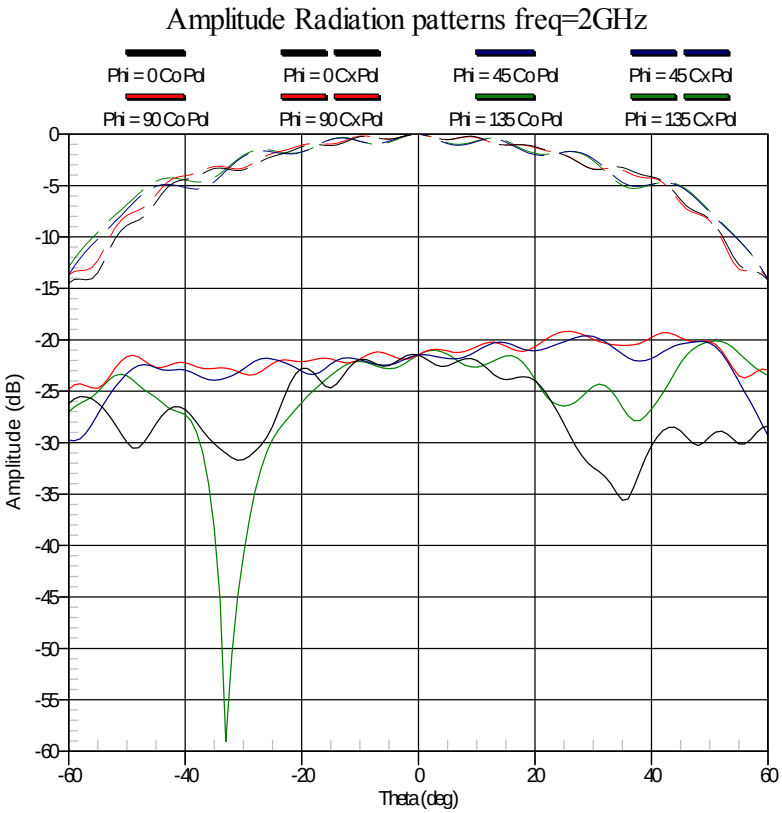

Figure 12: DYQSA 2Ghz radiation pattern

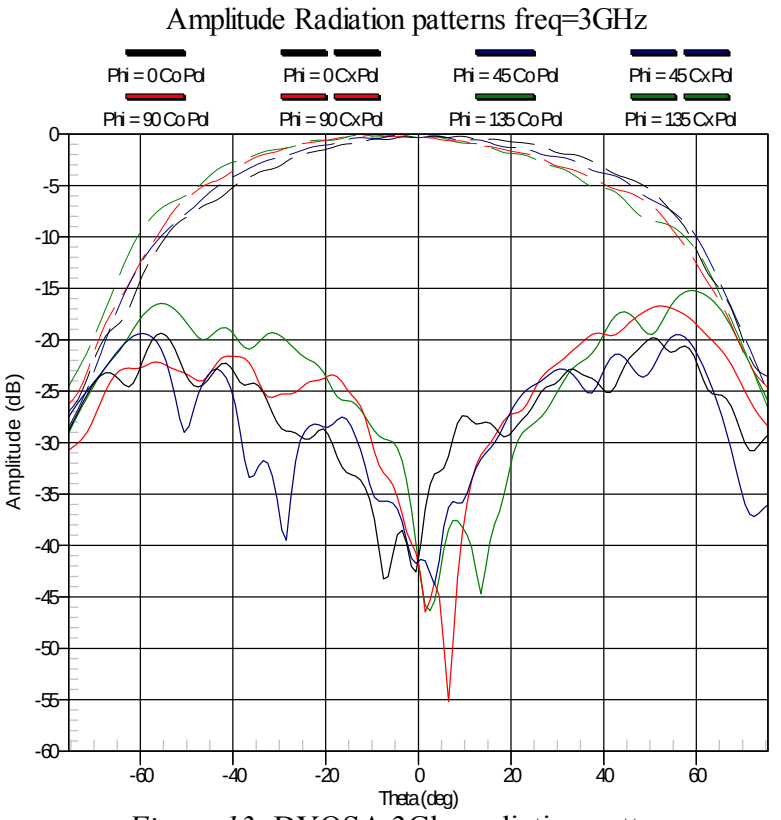

Figure 13: DYQSA 3Ghz radiation pattern

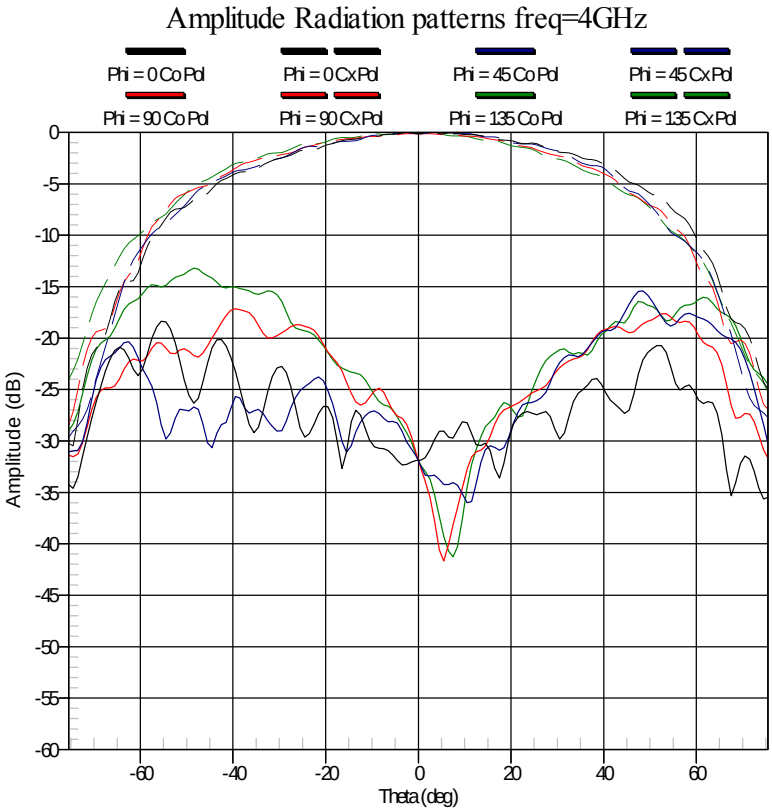

Figure 14: DYQSA 4Ghz radiation pattern

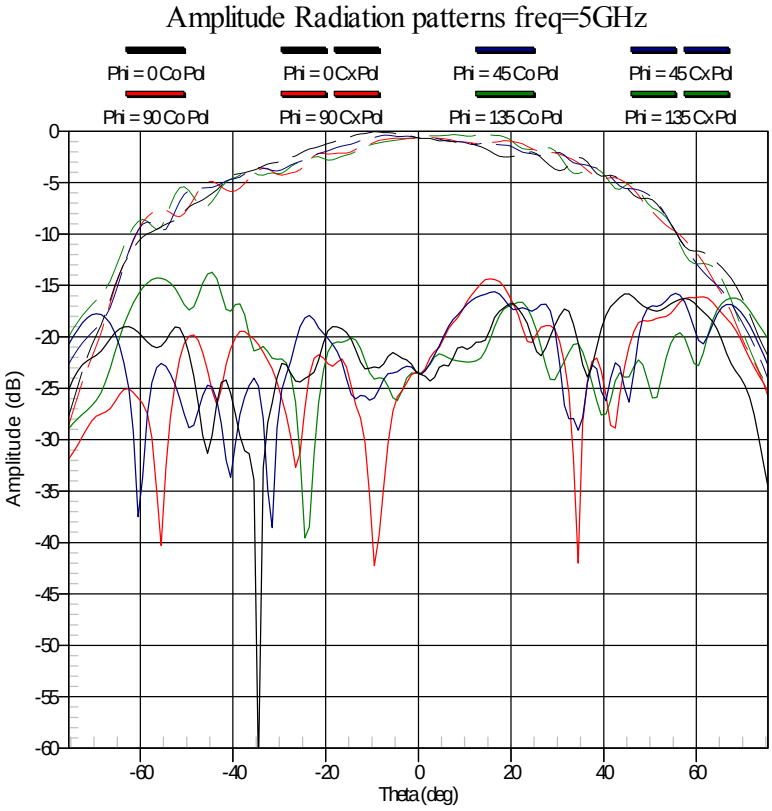

Figure 15: DYQSA 5Ghz radiation pattern

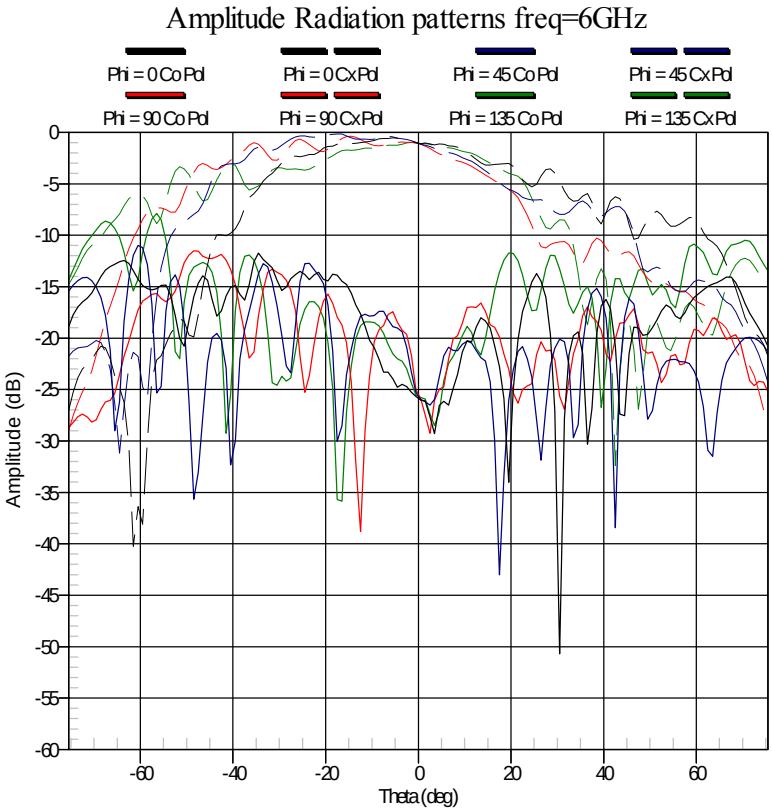

Figure 16: DYQSA 6Ghz radiation pattern

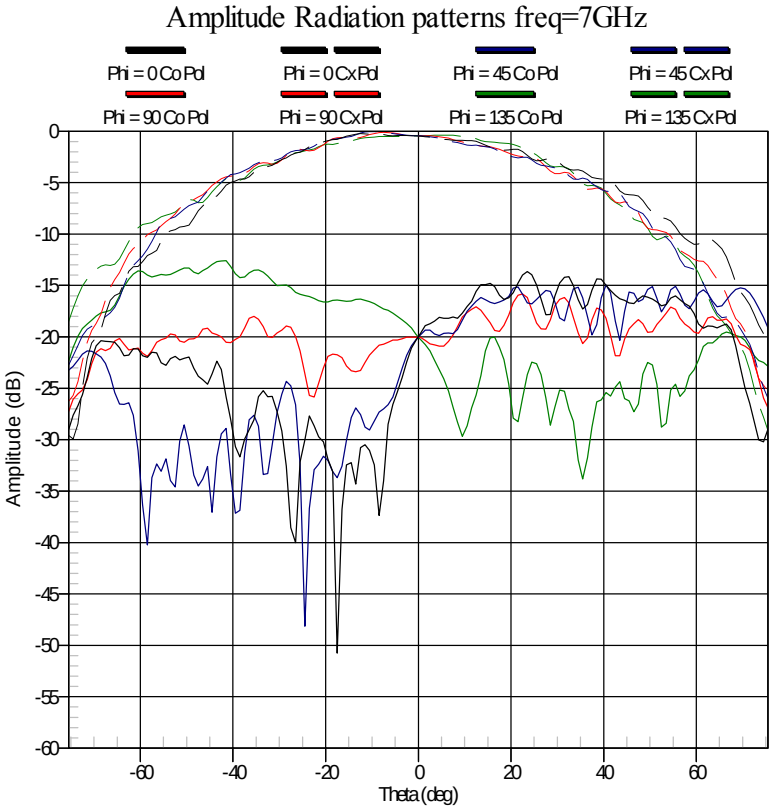

Figure 17: DYQSA 7Ghz radiation pattern

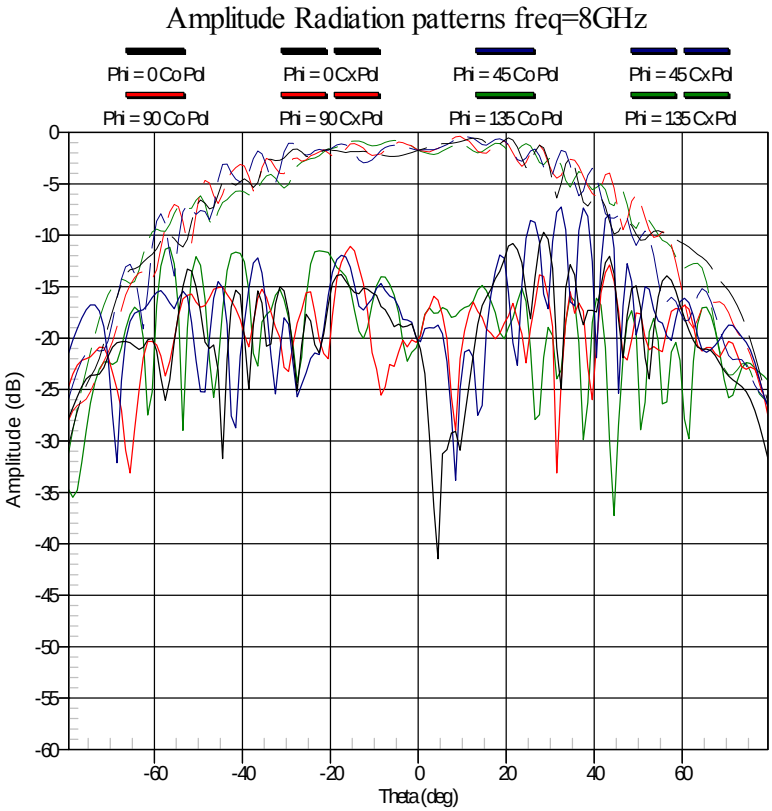

Figure 18: DYQSA 8Ghz radiation pattern

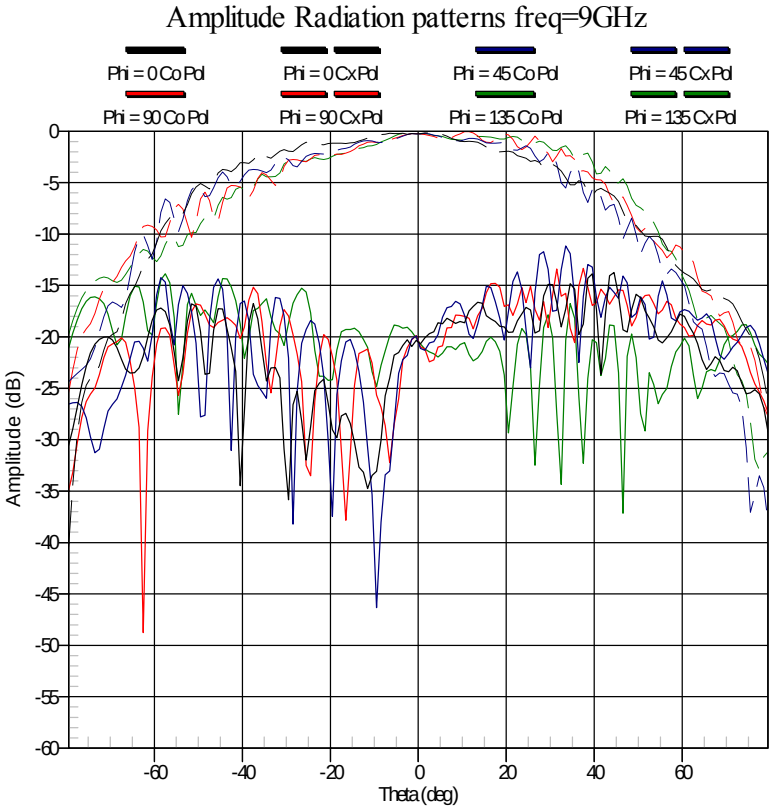

Figure 19: DYQSA 9Ghz radiation pattern

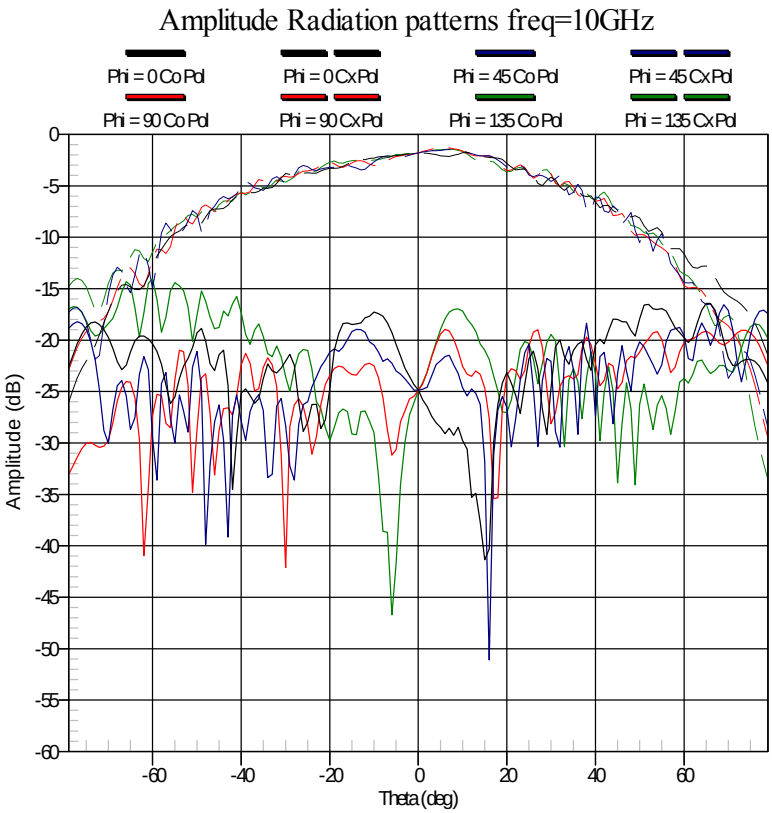

Figure 20: DYQSA 10Ghz radiation pattern

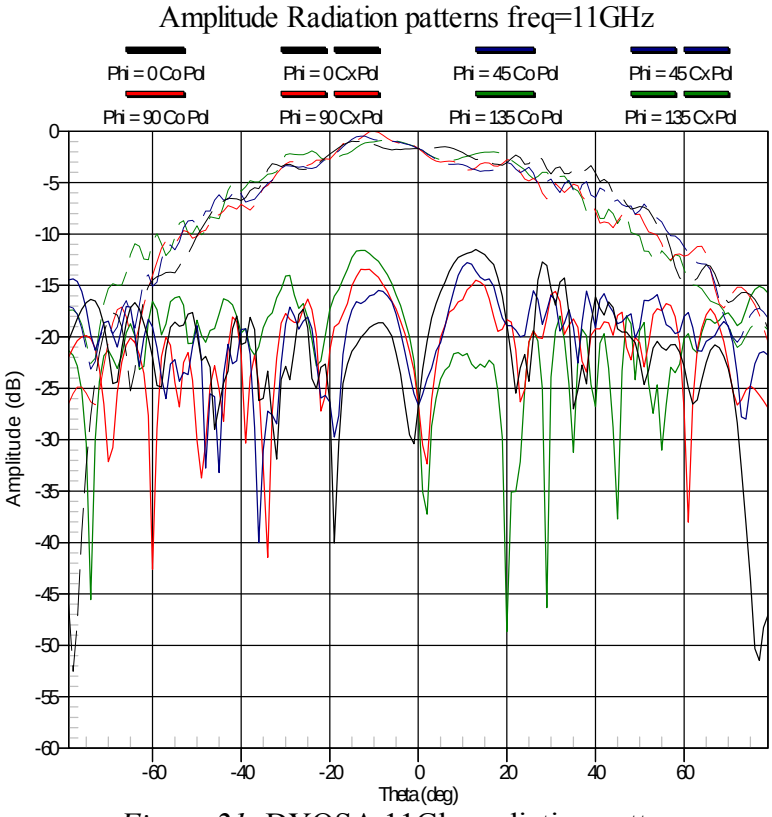

Figure 21: DYQSA 11Ghz radiation pattern

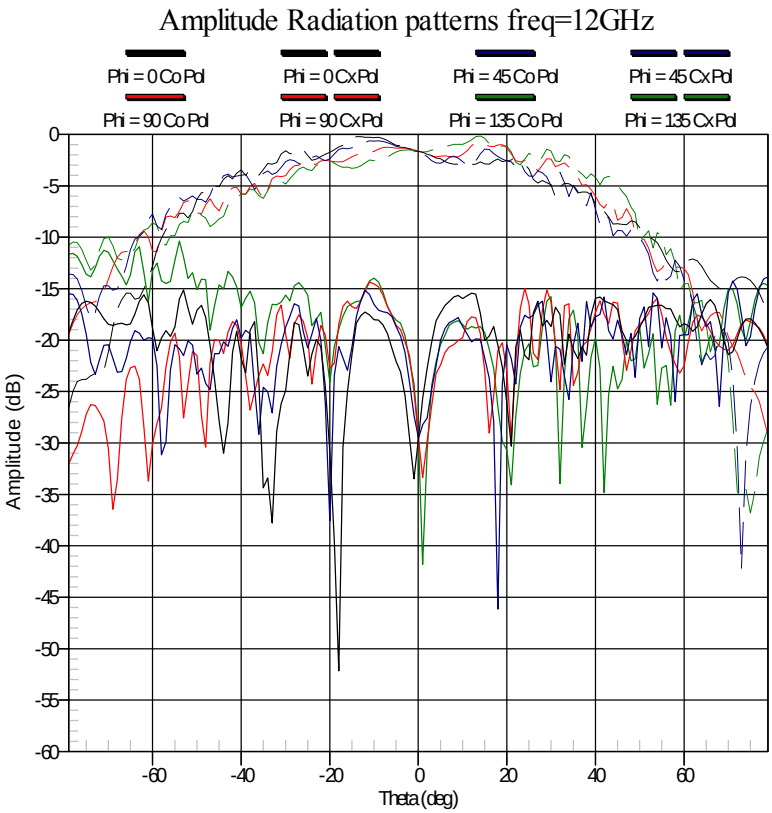

Figure 22: DYQSA 12Ghz radiation pattern

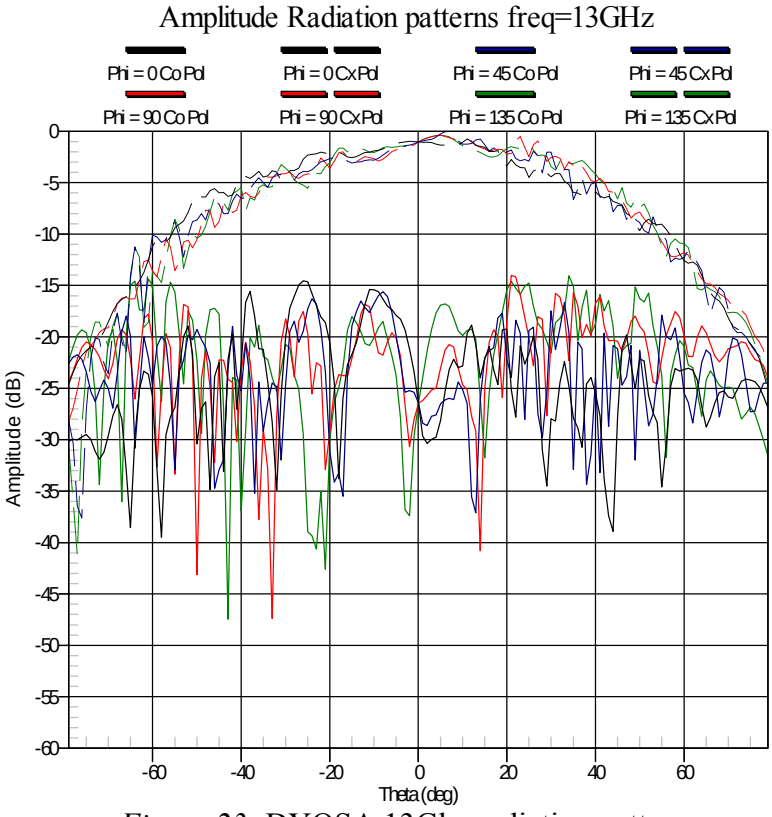

Figure 23: DYQSA 13Ghz radiation pattern

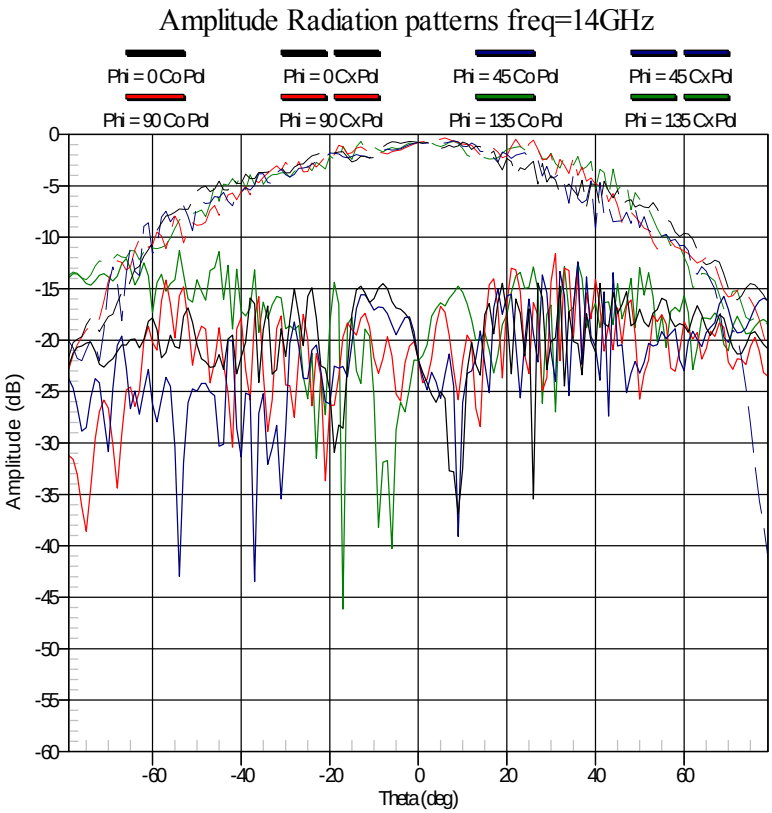

Figure 24: DYQSA 14Ghz radiation pattern

6.3. Directivity and Gain

Fr (GHz)	D (dB)	G (dB)	S11p (dB)	correction	probe	S11aut (dB)	correction	IEEE Gain (dB)
2,0	10,3	7,93	-10,5	0,41	WR430	-18,6	0,06	8,40
3,0	9,6	6,4	-9,1	0,57	WR284	-12,1	0,28	7,25
4,0	9,5	5,4	-10,6	0,40		-13,1	0,22	6,01
5,0	9,97	1,63	-9,74	0,49	WR159	-3	3,02	5,14
6,0	10,8	-1,7	-16,13	0,11		-7	0,97	-0,63
7,0	10,2	6	-11	0,36		-12	0,28	6,64
8,0	10,15	2,67	-10,17	0,44	WR112	-8,7	0,63	3,74
9,0	9,95	4,3	-10,9	0,37		-14,6	0,16	4,82
10,0	11,2	8,2	-13,7	0,19	WR75	-15,4	0,13	8,52
11,0	11,1	7,9	-13,2	0,21		-10,3	0,43	8,54
12,0	10,3	5,2	-10	0,46		-7,7	0,81	6,47
13,0	10,8	5,1	-18,9	0,06		-12,3	0,26	5,42
14,0	10,1	4,6	-8,7	0,63		-7,6	0,83	6,06

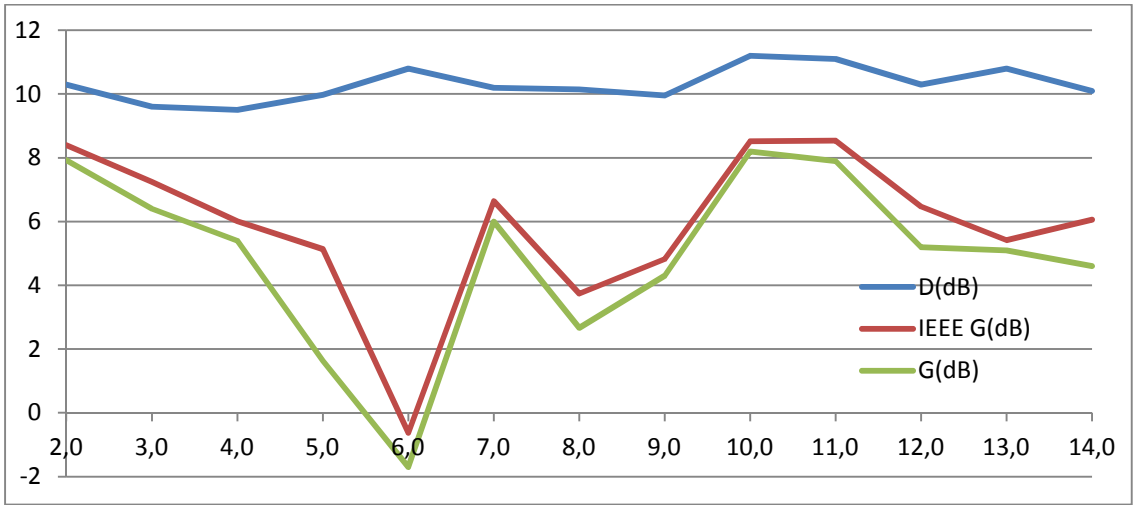

Figure 25: DYQSA G and D

6.4. Polarization: Axial Ratio

fr (GHz)	AR (dB)	Pol ratio(dB)
2	1,47	21,46
3	0,15	41,2
4	0,45	31,7
5	1,25	22,91
6	1,01	24,7
7	1,83	19,58
8	2	18,83
9	1,7	20,1
10	1,22	23,08
11	0,98	25
12	0,7	27,9
13	0,93	25,4
14	1,52	21,17

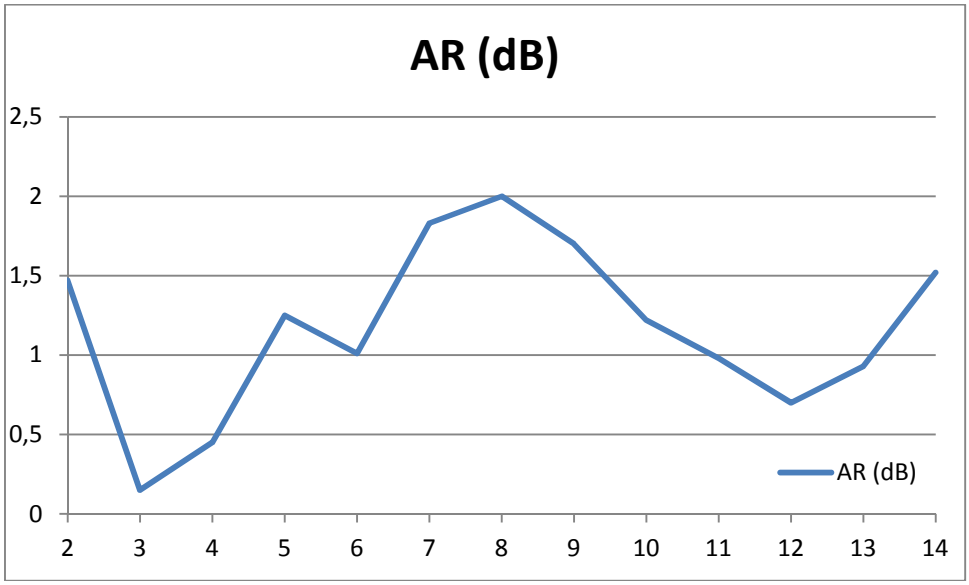

Figure 26: DYQSA Axial Ratio

6.5. Phase Center

fr (GHz)	Δz (m)	PC(mm)	AUT-probe d (m)
2	0,574	124,0	0,45
3	0,374	74,0	0,3
4	0,355	55,0	0,3
5	0,238	38,0	0,2
6	0,235	35,0	0,2
7	0,227	27,0	0,2
8	0,155	25,0	0,13
9	0,149	19,0	0,13
10	0,104	14,0	0,09
11	0,101	11,0	0,09
12	0,105	14,6	0,09
13	0,098	8,0	0,09
14	0,100	10,2	0,09

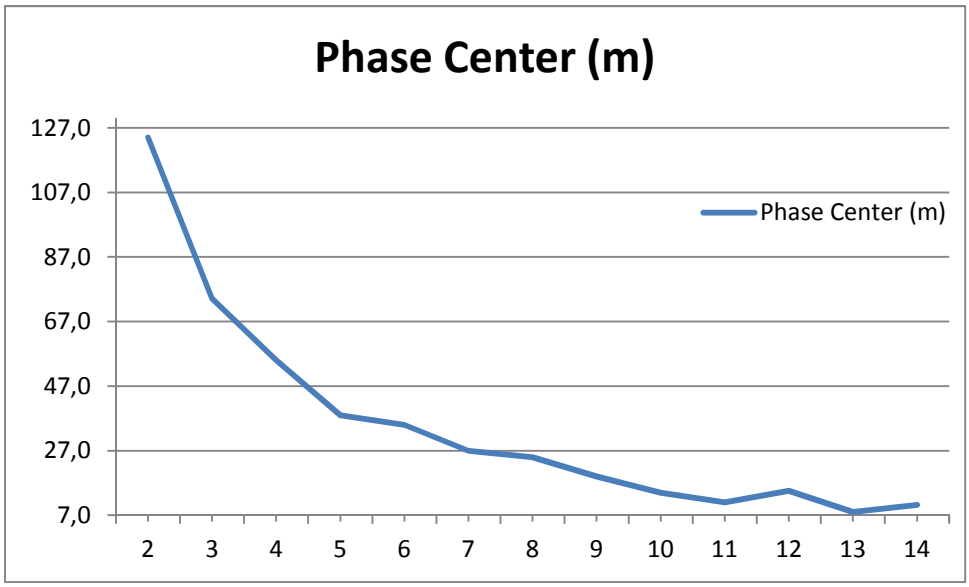

Figure 27: DYQSA Phase Center

7. Conclusions

8. References

[1] *"The CDT Ultra Wide-Band Anechoic Chamber", José Manuel Serna Puente, Félix Tercero, Tim Finn, 5th European Conference on Antennas and Propagation (EUCAP 2011)*
[2] *"Antenna measurement techniques", Gary E.Evans, Artech House IPF book, 1990.*
[3] *"Formula for gain of open-ended rectangular", B. Enkhbayar et al Electronic Letters,Vol 45, No. 24, Nov 2009*
[4] *"Gain and Power Measurement Parameters using Planar Near Field Techniques" A Newell et al, IEEE Trans. AAP, Vol 36, Issue 6, June 1988*
[5] *www.nearfield.com*
[6] *www.agilent.com*
[7] *www.omlinc.com*

9. Appendix

9.1. Data files

9.2. Measurement Interface Design

In order to attach the antenna to the AUT positioner, the following hardware has been designed and built.

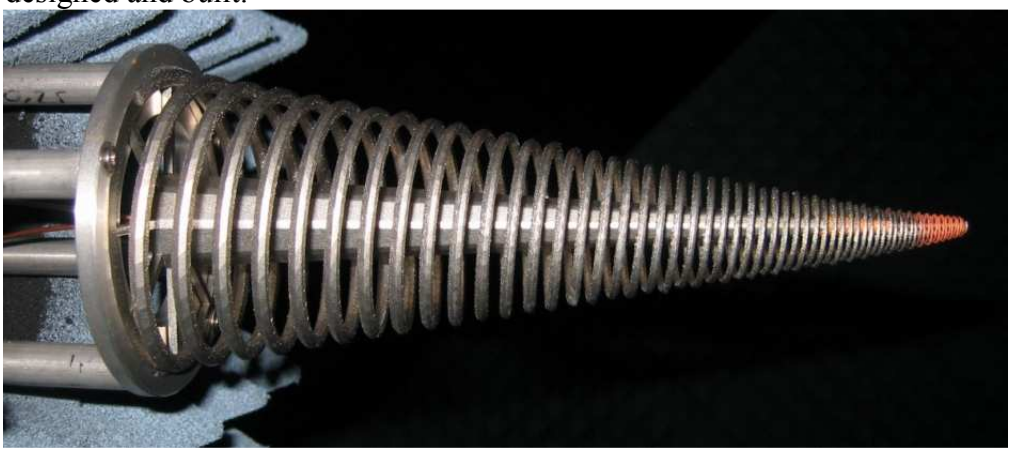

Figure 28: Structure designed for the installation in the AUT positioner

9.3. Frame reference of scanner and probe

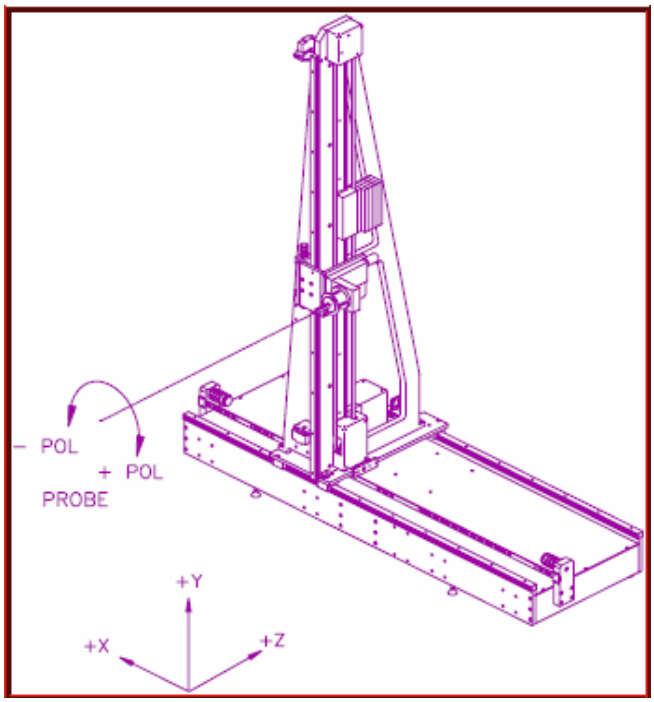

Figure 29: Coordinate systems of the scanner and AUT