

Test Report

Antenna Efficiency and Antenna Gain for KYOCERA AVX WLAN



Test Laboratory:

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Note:

The following test results relate only to the devices specified in this document. This report shall not be reproduced in parts without the written approval of the test laboratory.

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1 PROJEKT AND RESULT SUMMARY

DUT	KYOCERA AVX WLAN Part No. Part No. 1001932PT- AA10L0075	DUT Code	DE1015186AUX04
Test Lab	7layers GmbH Borsigstr. 11 40880 Ratingen Germany	Set up	free space
		Test start	08.04.2024
Customer	u-blox AG Zürcherstrasse 68 8800 Thalwil Switzerland	Report date	27.05.2024
		Report by	Dieter Sütthoff
		Approved by	Robert Machulec
	DUT in free space		

1.1 Set up Fotos

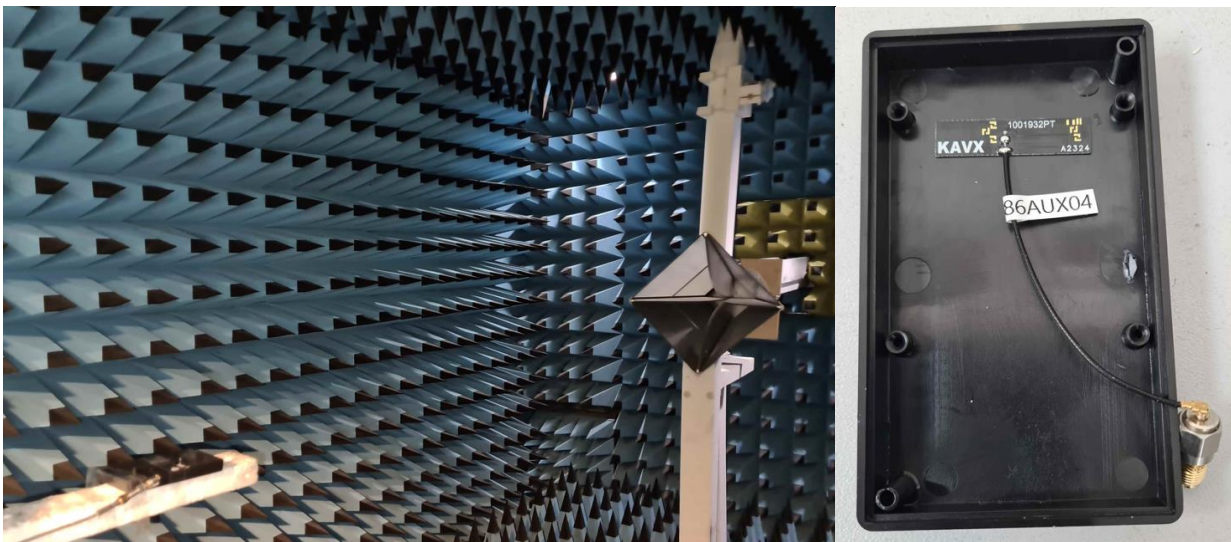


Fig. 1: Foto Set up. (DUT glued on a plastic housing part)

1.2 Antenna test results table

Frequency (MHz)	Efficiency (dB)	Peak EIRP (dBm)	Directivity (dBi)	Gain (dBi)
2400	-4.1	2.2	6.3	2.2
2440	-4.3	2.1	6.4	2.1
2480	-4.2	1.5	5.7	1.5
5180	-1.1	3.9	4.9	3.9
5200	-1.1	3.4	4.5	3.4
5250	-0.8	3.9	4.8	3.9
5320	-0.9	4.5	5.5	4.5
5500	-1.1	4.5	5.6	4.5
5600	-1.4	4.5	5.9	4.5
5700	-1.4	4.3	5.7	4.3
5825	-0.9	4.9	5.8	4.9

Fig. 2: Test results table over frequency (MHz)

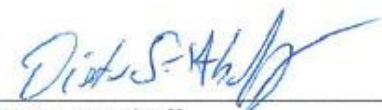
2 Signatures

Responsible for
Accreditation Scope:



Robert Machulec

Responsible
for Test Report:



Dieter Sütthoff

3 BRIEF DESCRIPTION OF SETTINGS AND TEST METHOD Passive antenna Efficiency test inside OTA chamber

3.1 GENERAL

The measurement procedures are based on a 3D test of radiated performance considering both polarizations.

An antenna fully anechoic chamber was used. The DUT RF-power was feed by RF-cable form a network analyzer with CW signal with 0 dBm power. The DUT was rotated in two axes (theta/phi) in 3D room directions and tested taking into account the horizontal and vertical polarization by using a grid step size angle of Theta 15 ° and Phi 15°. A OTA Software by ETS-Lindgren: EMQuest EMQ-100was used for the measurements. The software is a windows application that provides all necessary control of instrumentation and positioners. All used cabling, connectors, and equipment that is not a part of the test system was calibrated out by means of a full two port calibration procedure of the vector network analyzer.

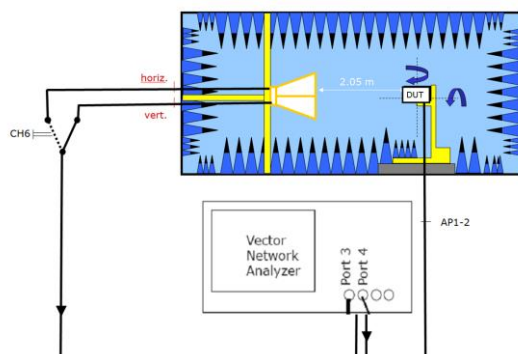


Fig. 1: Set up for antenna efficiency test

Orientation of EUT

For orientation of the EUT in the result pictures below the following photos illustrate the used orientation

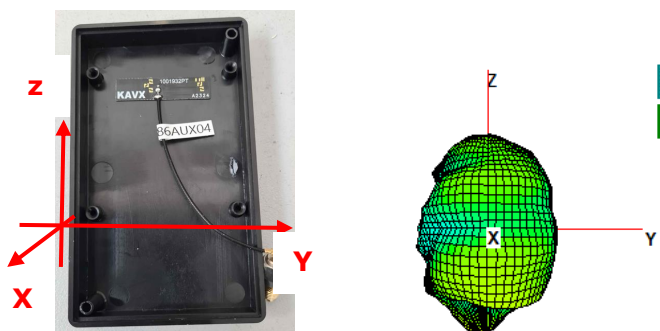


Fig. 3: Photo orientation of DUT.

3.2 EQUIPMENT LIST

VNA:	E5071B by Agilent	SN: MY42200813
Calibration kit	85035E by Agilent, open: 85033-60012, load: 85033-60010, short: 85033-60014,	SN: 006776 SN: 006464 SN: 006070
Antenna:	Dual polarized horn ETS3164-03 by ETS	SN 00052619

3.3 KEY SPECIFICATIONS AND UNCERTAINTIES

Frequency range: 400 MHz – 6 GHz
Measurement distance: 2.05 m

4 Definitions:

3GPP	3 rd Generation Partnership Project
CTIA	Cellular Telecommunications & Internet Association
OTA	Over The Air
DUT	Device under test
FS	Free space

5 REFERENCES AND STANDARDS USED

- [1] CTIA: "CTIA-01.20-Test-Methodology-SISO-Anechoic-Chamber", Revision 4.0.0, 02/2022
- [2] 3GPP TS 34.114: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; User Equipment (UE) / Mobile Station (MS) Over The Air (OTA) antenna performance; Conformance testing", (Release 11), Version V11.3.0, January 2013.
- [3] 7layers document: "7layers Germany OTA Measurement Uncertainties", Version Jun 2023.

Key Specification and Uncertainties

Frequency range: 400 MHz – 6 GHz Measurement distance: 2.05 m

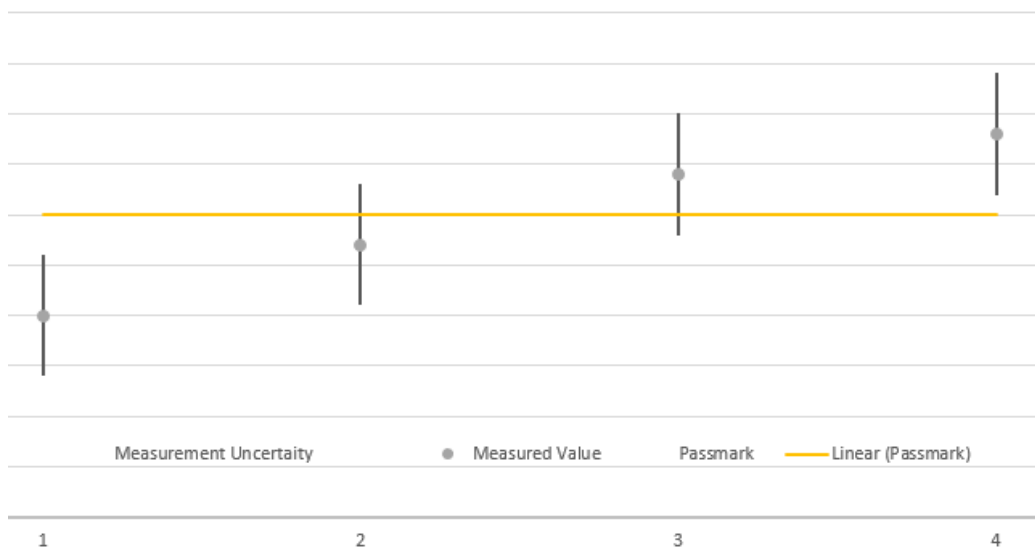
Measurement uncertainties

Test Configuration	OTA 7Layers Germany uncertainty [dB]	CTIA requirement [dB]
Free Space TRP	±1.7	± 2.0 dB

Tab. 1: Measurement uncertainties are valid for full 3D measurement results.

Standard specific table with the measurement uncertainties of the used parameters

The measurement uncertainties for all parameters are calculated with an expansion factor (coverage factor) $k = 1.96$. This means, that the true value is in the corresponding interval with a probability of 95 %.



The verdicts in this test report are given according the above diagram:

Case	Measured Value	Uncertainty Range	Verdict
1	below pass mark	below pass mark	Passed
2	below pass mark	within pass mark	Passed
3	above pass mark	within pass mark	Failed
4	above pass mark	above pass mark	Failed

That means, the laboratory applies, as decision rule (see ISO/IEC 17025:2017), the so called shared risk principle.

6 DETAILED RADIATED TEST RESULTS

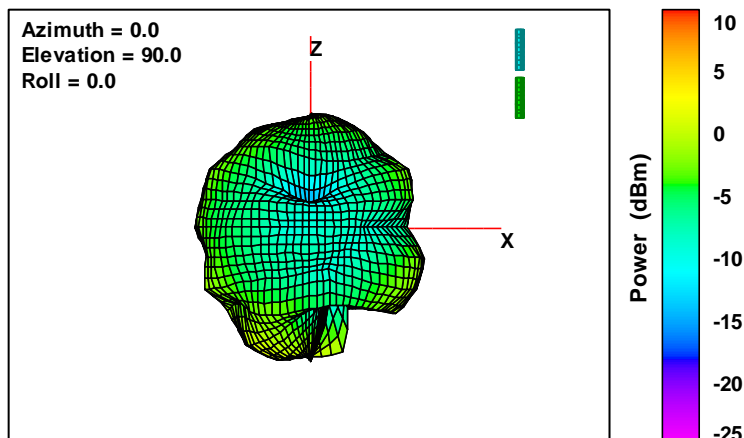
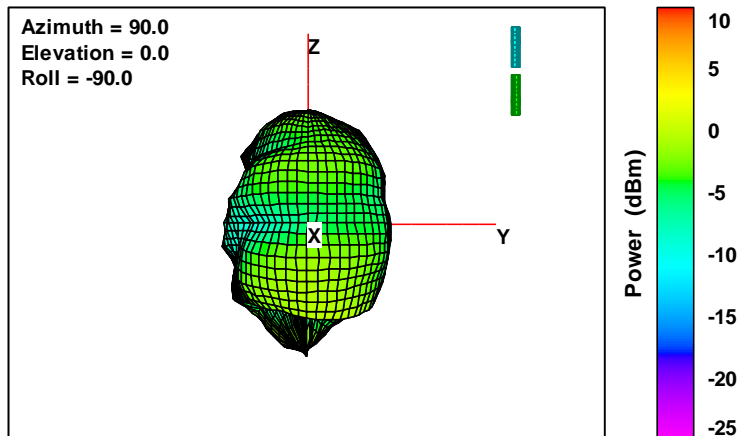
6.1 Test results, antenna pattern at 2400 - 2480 MHz

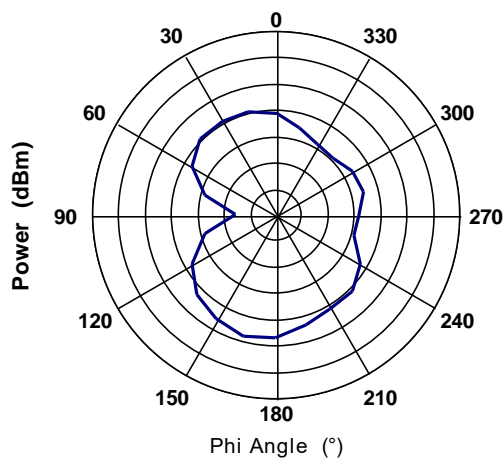
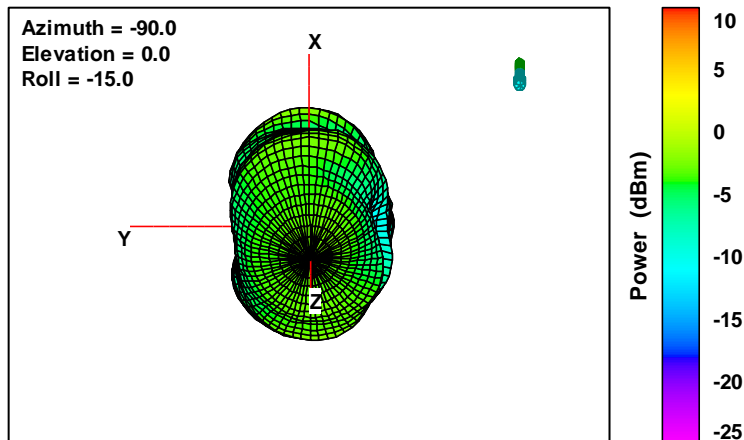
Temperature: 25.1°

Humidity: 42.0

Teast start: 15/04/2024

Frequency (MHz)	Efficiency (dB)	Peak EIRP (dBm)	Directivity (dBi)	Gain (dBi)
2400	-4.1	2.2	6.3	2.2
2440	-4.3	2.1	6.4	2.1
2480	-4.2	1.5	5.7	1.5





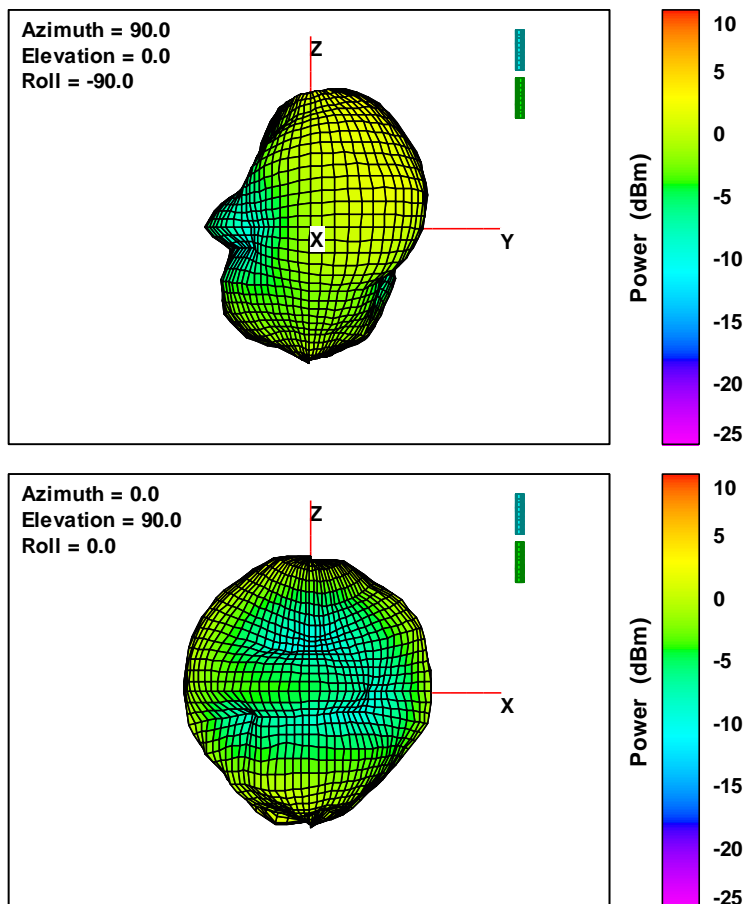
Theta = 90°

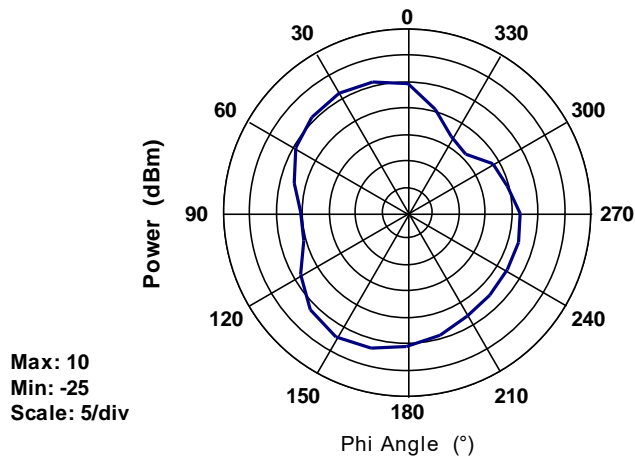
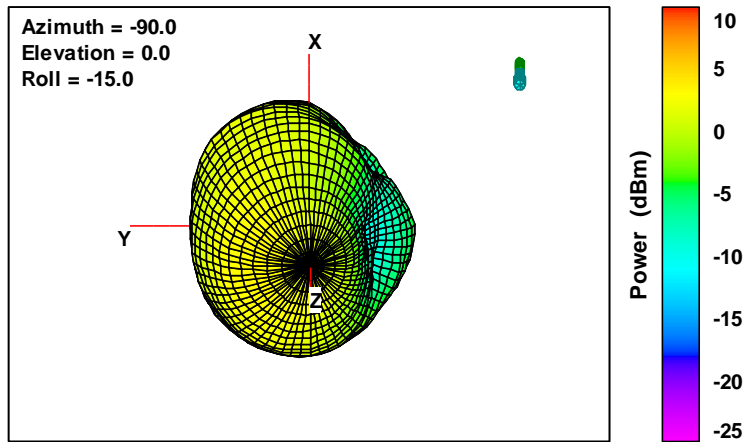
Fig. 4: Test results Pattern at 2440 MHz

6.2 Test results, antenna pattern at 5180 - 5825 MHz

Temperature: 25.1°
 Humidity: 42.0
 Teast start: 15/04/2024

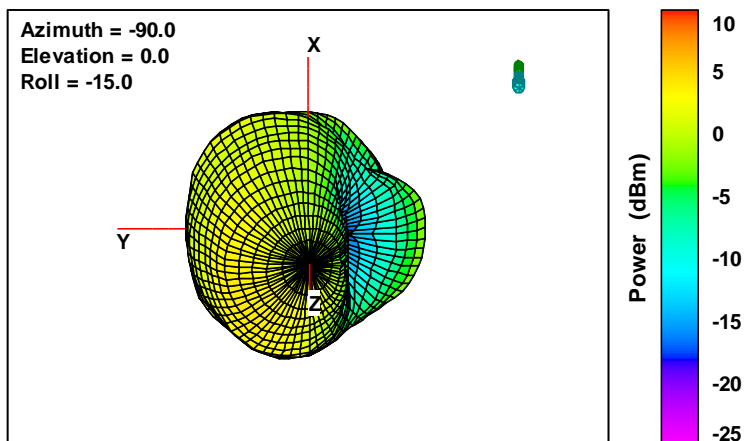
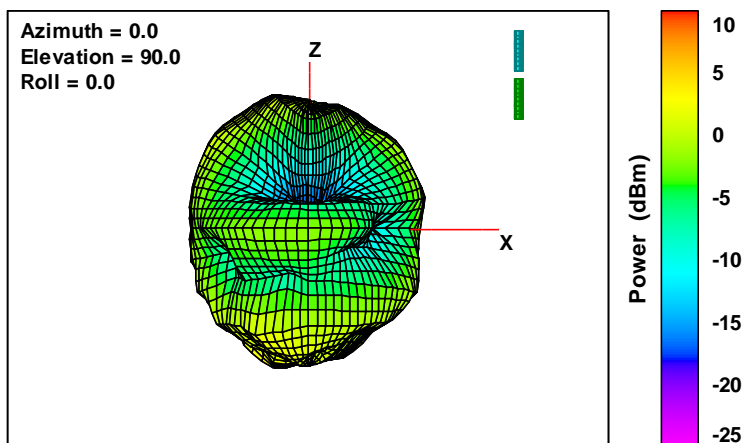
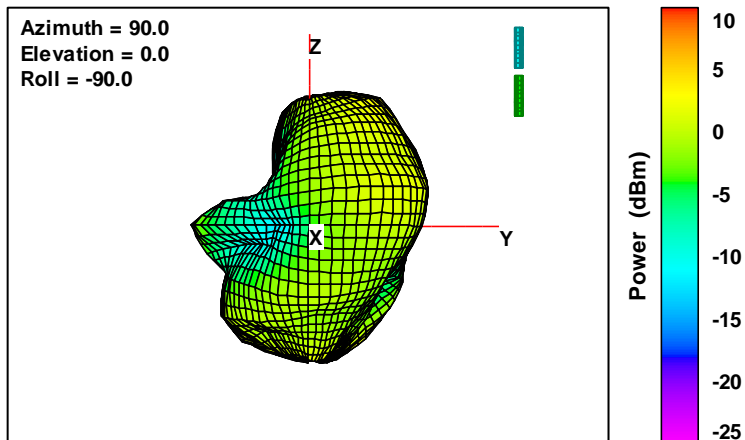
Frequency (MHz)	Efficiency (dB)	Peak EIRP (dBm)	Directivity (dBi)	Gain (dBi)
5180	-1.1	3.9	4.9	3.9
5200	-1.1	3.4	4.5	3.4
5250	-0.8	3.9	4.8	3.9
5320	-0.9	4.5	5.5	4.5
5500	-1.1	4.5	5.6	4.5
5600	-1.4	4.5	5.9	4.5
5700	-1.4	4.3	5.7	4.3
5825	-0.9	4.9	5.8	4.9

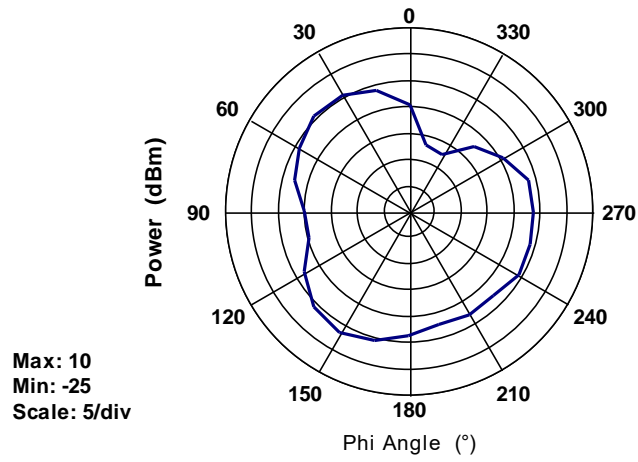




Theta = 90°

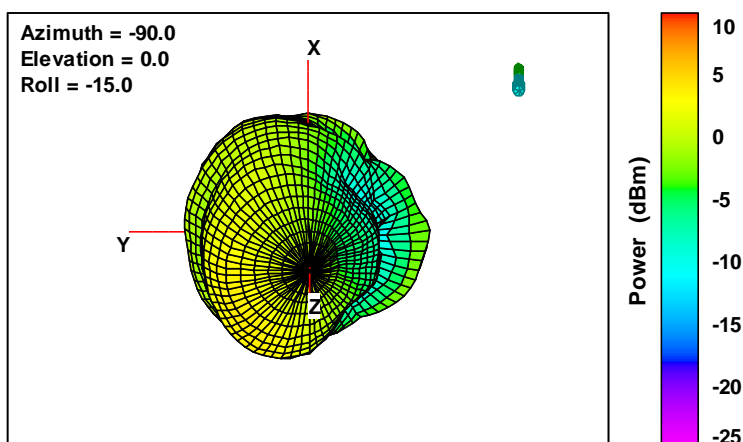
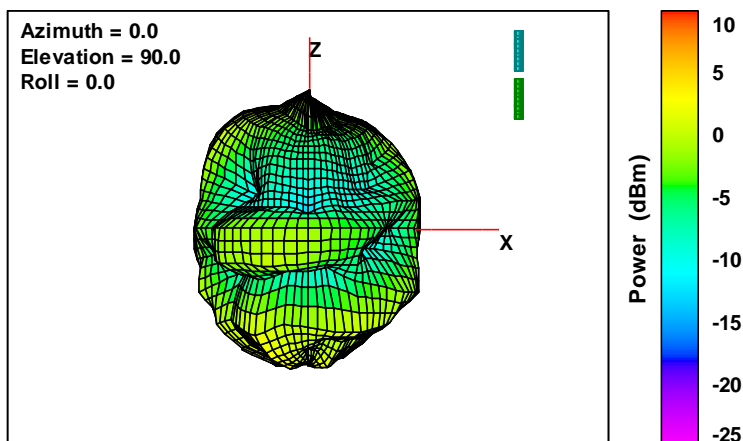
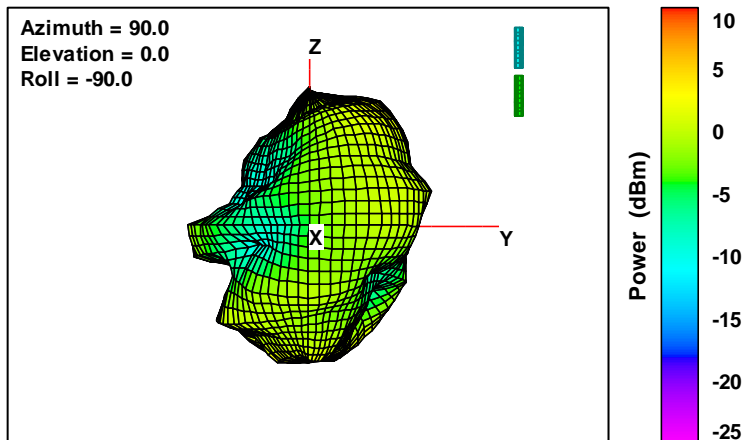
Fig. 5: Test results Pattern at 5200 MHz

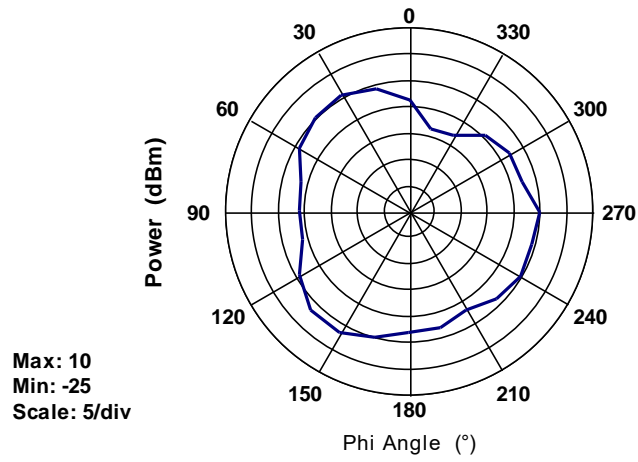




Theta = 90°

Fig. 6: Test results Pattern at 5500 MHz





Theta = 90°

Fig. 7: Test results Pattern at 5700 MHz