Bluetooth LE Antenna Pattern Measurement
Test Report for BPP2

Report Reference: MDE_VEGA_1701_BT_1

Date: 12.09.2019

Test Laboratory:

7layers GmbH

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DAkkS Deutsche Akkreditierungsstelle D-PL-12140-01-01

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.

Content:

1 Test Lab Declaration

All test results stated relate only to the device tested.

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- **in the resulting document it's status (being an excerpt) is clearly stated and**
- **in minimum chapter 3 is included completely.**

2 SIGNATURES

Responsible for Accreditation Scope:	Robert Machulec	Responsible for Test Report:	Dieter Sütthoff

3 Project and Result Summary

DUT	BPP2	OUT Code	Radiated Sample: DE1373000ab01 Conducted Sample: DE1373000ad01
Test lab	7layers GmbH Borsigstr. 11 40880 Ratingen Germany	Set up	free space
		Test start	11.06.2019
Customer	VEGA Grieshaber KG Am Hohenstein 113 77761 Schiltach	Report date	12.09.2019
		Report by	Dieter Sütthoff
		Approved by	Robert Machulec

Bluetooth LE			
RMS Detector Modulated	**2402 MHz**	**2440 MHz**	**2480 MHz**
Antenna Port Input Power (EUT Conducted Sample)	**-0.6**	**-0.8**	**-0.9**
Tot. Rad. Pwr. (dBm)	-7.9	-8.4	-8.5
Peak EIRP (dBm)	**-3.2**	**-3.1**	**-2.9**
Directivity (dBi)	4.8	5.3	5.6
Efficiency (dB)	-7.3	-7.6	-7.6
Efficiency (%)	18	17	17
Gain (dBi)	**-2.6**	**-2.3**	**-2.0**

Tab. 1: Test result summary Bluetooth

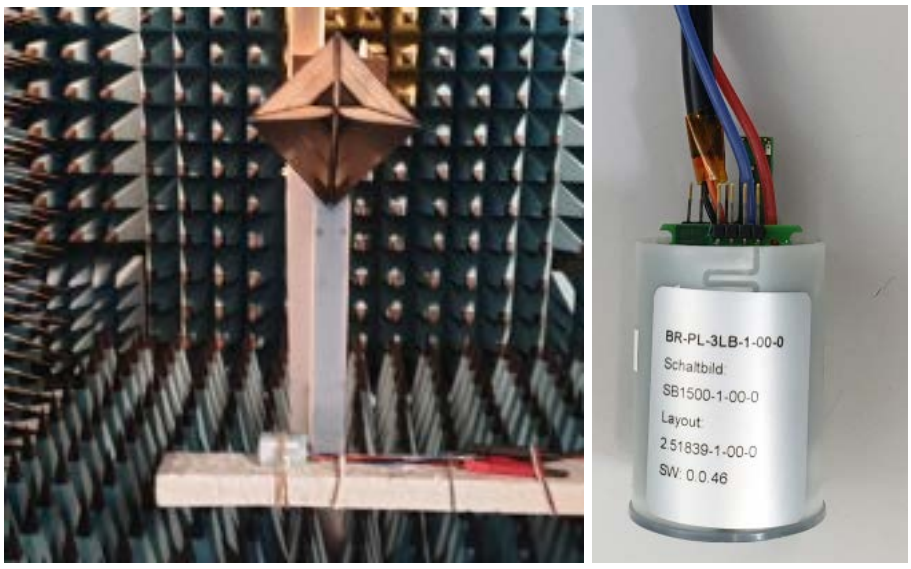


Fig. 1: Photo of DUT.

4 Brief Description of Settings and Test Method

4.1 References and Standards Used

[1] CTIA: “Test Plan for Wireless Device Over the Air Performance”, Revision Number 3.8.2, 04/2019.

[2] 3GPP TS 25.101: “User Equipment (UE) radio transmission and reception (FDD)”, (Release 11), Version V11.2.0, June 2012.

4.2 Test Procedure TRP

The method of measurement for radiated RF power and receiver performance are based on the principals of the test standard CTIA: “Test Plan for Mobile Station Over the Air Performance” [1].

In general, the following approach is applied for TRP measurements:

- For TRP measurement put OUT in a mode where it is transmitting periodical RF energy.
- Rotate the EUT in all room directions with an angle grid of 15°.
- Gather power data for both, vertical and horizontal polarization.
- Calculate total radiated power by integrating over the whole sphere as outlined in [1].

The test setup was placed at the turning device inside a fully anechoic chamber. The object under test (OUT) was set to transmit permanently signal on specific frequencies

The total radiated power (TRP) of the test setup was measured in all angle direction (3D) using a step width of <= 15° and using two measurement antenna polarizations (vertical and horizontal).

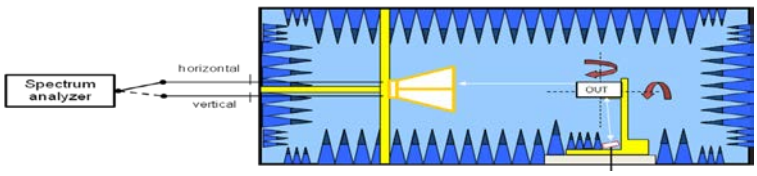


Fig. 1: Block diagram for TRP measurement

4.3 Definitions

3GPP	3rd Generation Partnership Project
BER	Bit error rate or bit error ratio
BS	Base station
CTIA	Cellular Telecommunications & Internet Association
DUT	Device under test
FS	Free space
TP	Talk position (phone is situated at SAM = human head phantom)
TRP	Total Radiated Power
EIRP	Effective Isotropic Radiated Power
TRS	Total Radiated Sensitivity (same as TIS in CTIA), loss of link level
EIRS	Effective Isotropic Radiated Sensitivity

5 Detailed Radiated Test Results and Pattern

5.1 Equipment List

For TRP measurements:

Antenna:	Dual polarized horn ETS3164-03 by ETS	SN 00052619
Receiver:	FSP3 spectrum analyzer by R&S for 2.4 GHz	SN 838164/004

Orientation of EUT compared to a standard device

For orientation of the EUT in the result pictures below the following photos illustrate the used orientation compared to a standard device:

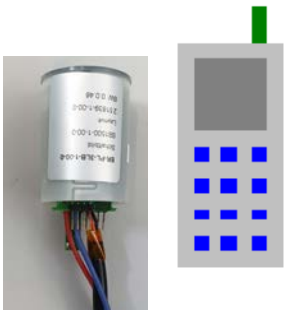
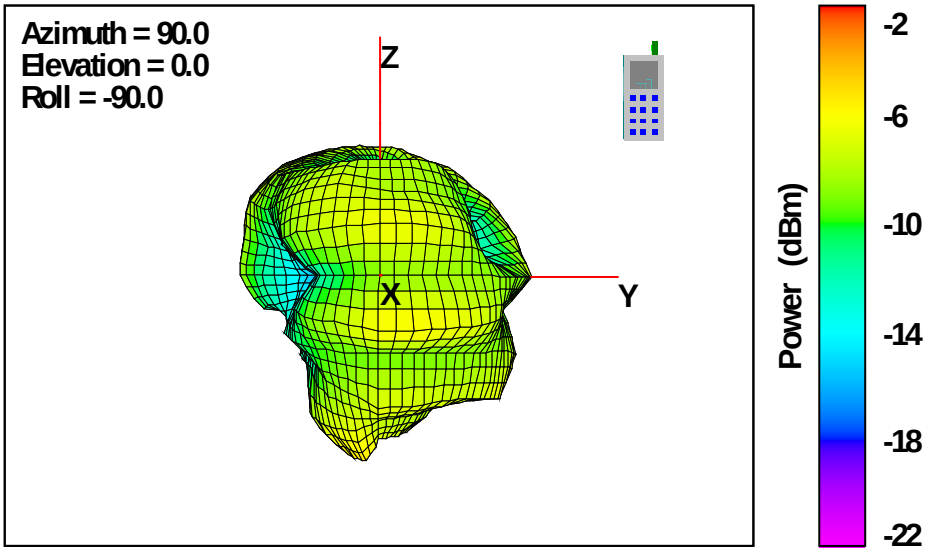
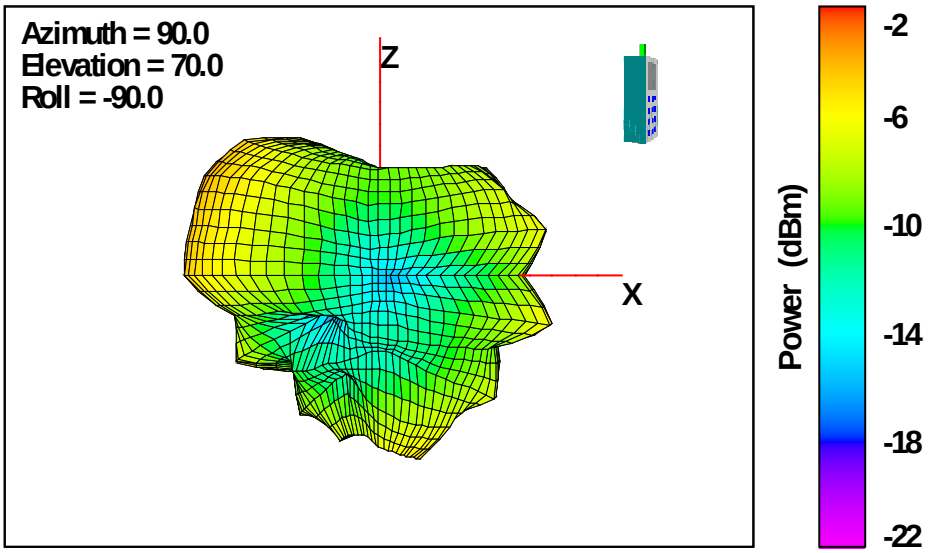
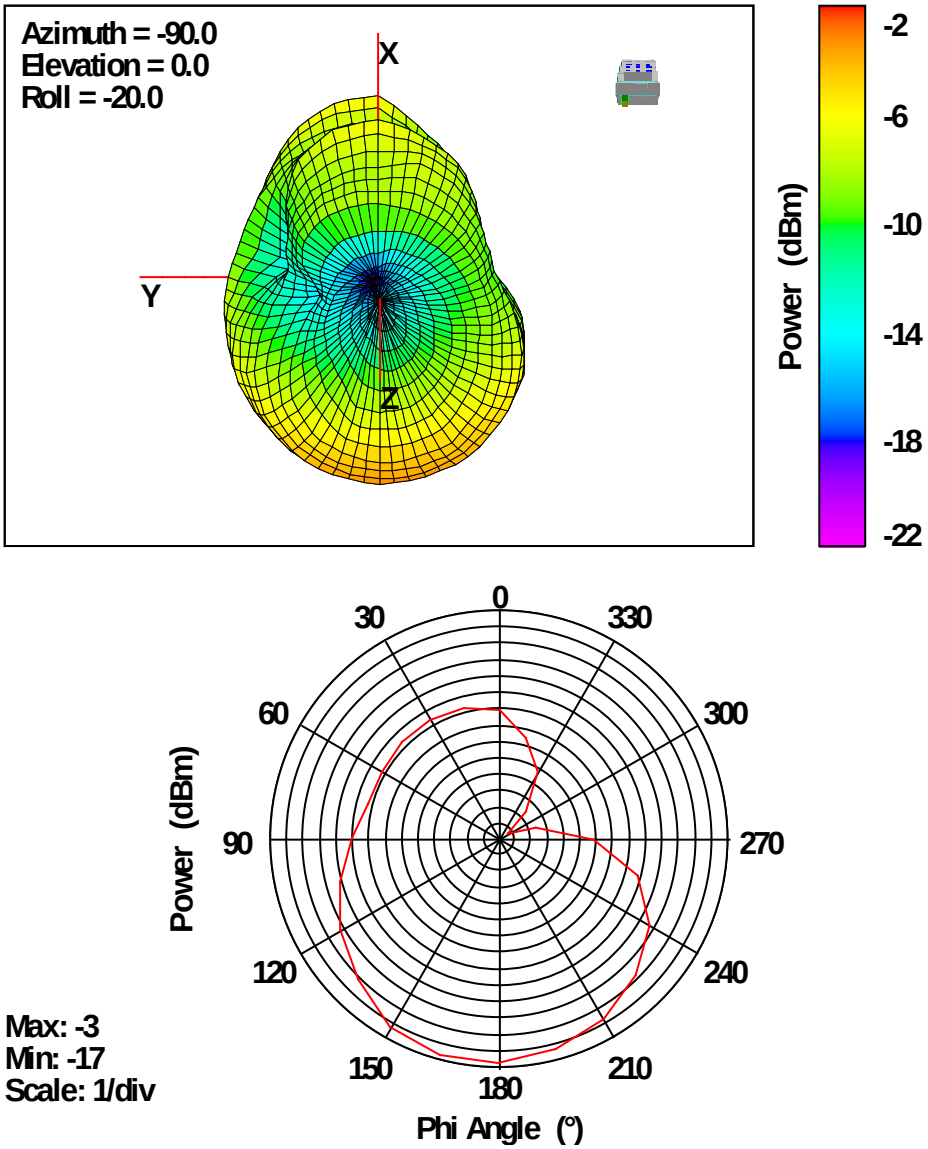


Fig. 2: Photo orientation of DUT compared to a phone.

5.2 Radiation Pattern TRP Bluetooth LE 2402 MHz



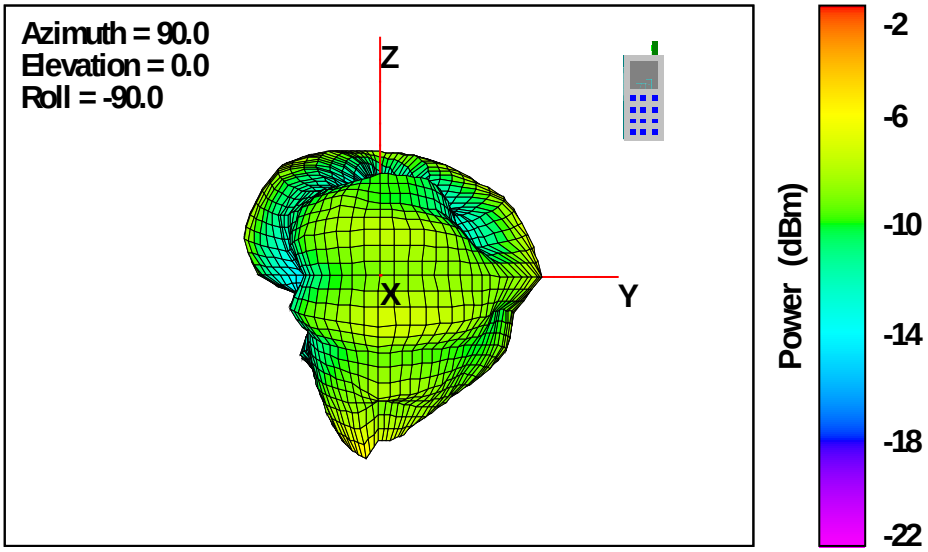


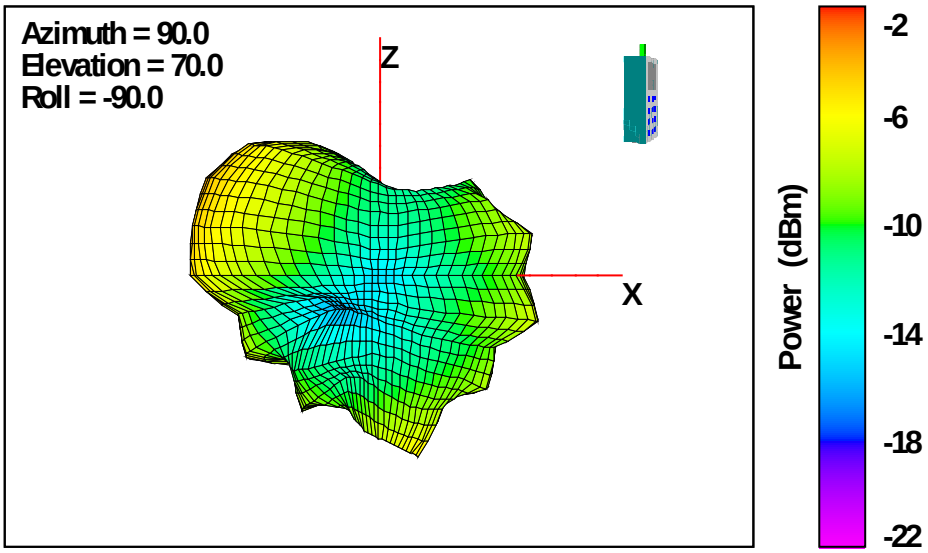


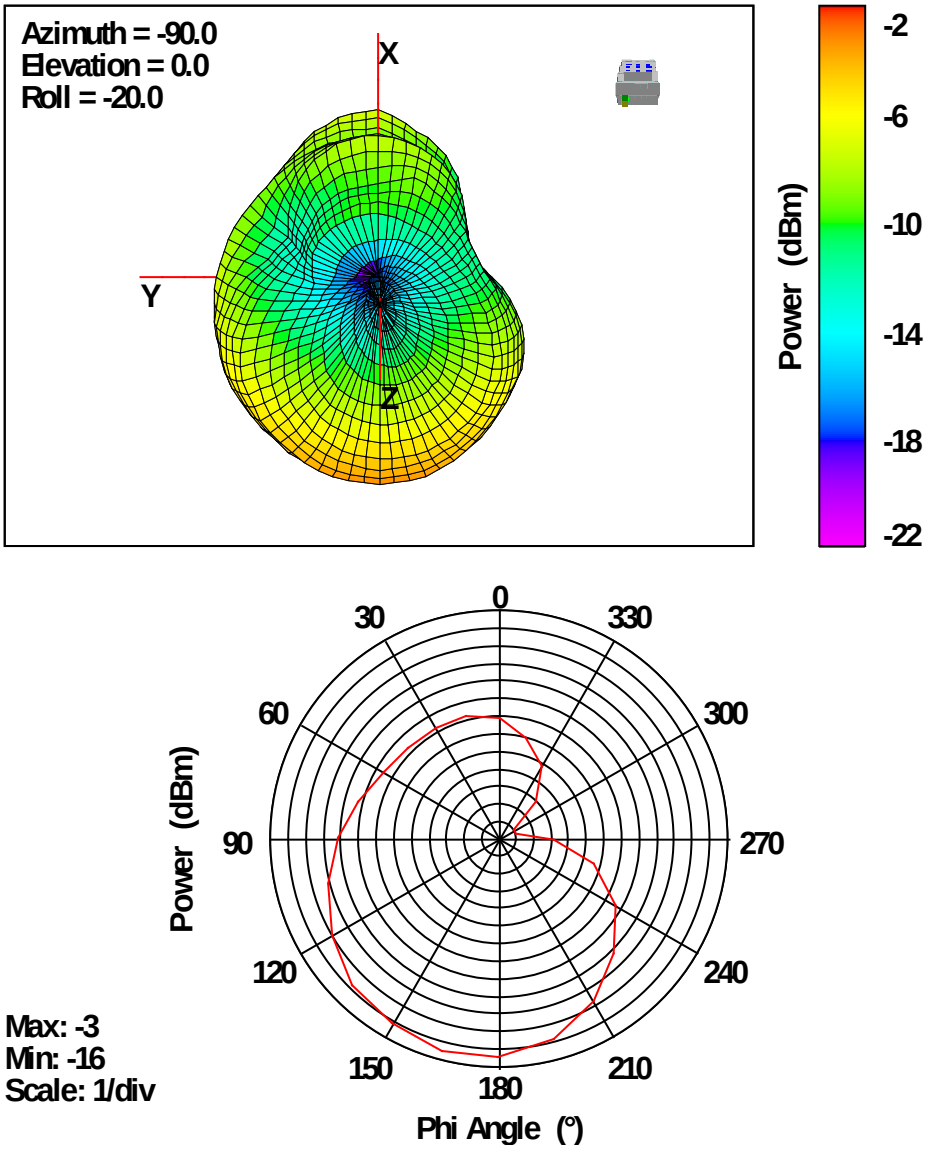
Theta = 90°

Fig. 3: 2402 MHz 3D Radiated pattern orientation of DUT compared to a phone.

5.3 Radiation Pattern TRP Bluetooth LE 2440 MHz



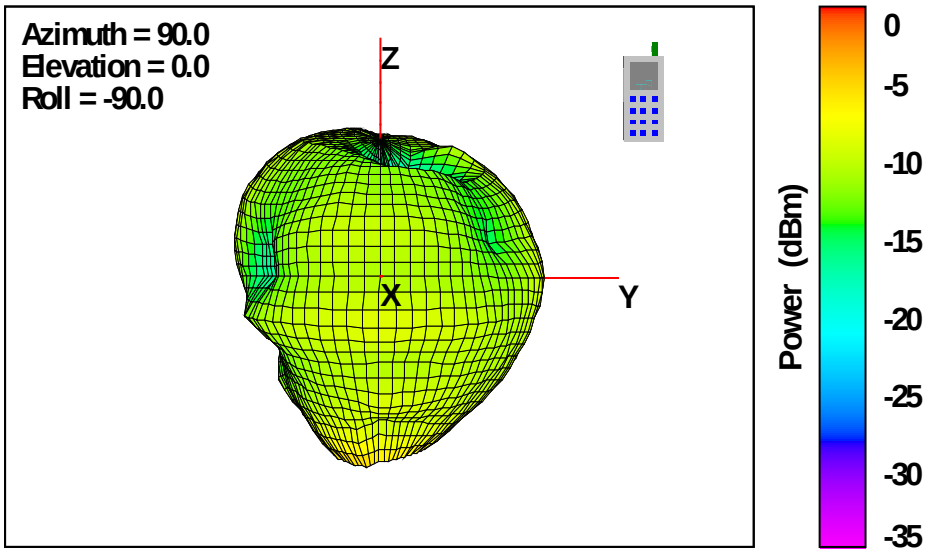


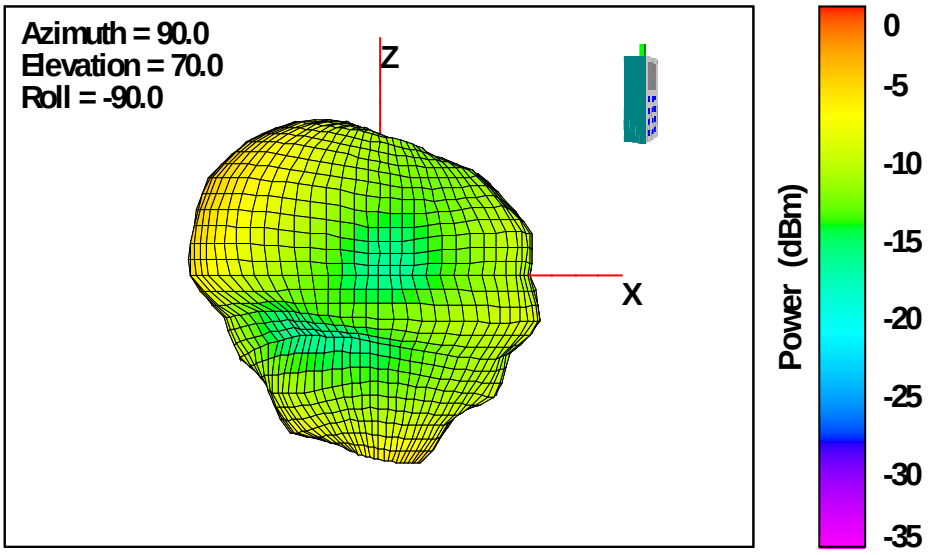


Theta = 90°

Fig. 4: 2440 MHz 3D Radiated pattern orientation of DUT compared to a phone.

5.4 Radiation Pattern TRP Bluetooth LE 2480 MHz





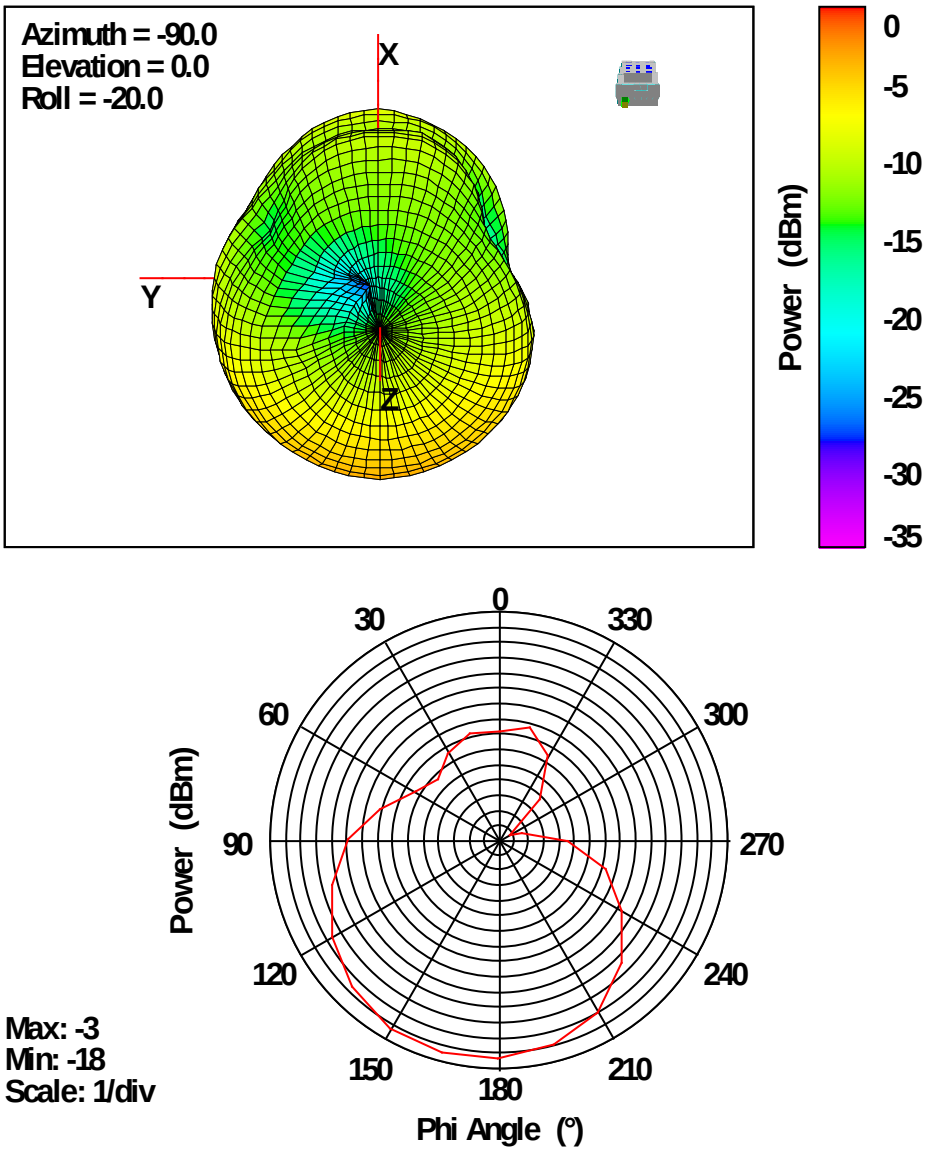


Fig. 5: 2480 MHz 3D Radiated pattern orientation of DUT compared to a phone.