Antenna Pattern Measurement Test Report for I-1 by Impossible Camera GmbH

Report Reference: MDE_IMPOSSIBLE_1501_BT_2_RP
Date: 08.04.2016

Test Laboratory:
7layers GmbH
Borsigstrasse 11
40880 Ratingen
Germany

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

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.**

Responsible for Accreditation Scope: Dieter Sütthoff

Responsible for Test Report: Robert Machulec

2 References and Standards Used

[1] CTIA: "Test Plan for Wireless Device Over the Air Performance", Revision Number 3.5.2, 09/2015.

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

[3] 7 layers document: "Test Procedure for Over the Air Performance Estimation Applied by the OTA Test Lab at 7 layers Ratingen", Version January 2009.

3 Project and Result Summary

DUT	I-1	DUT SN	-
Test lab	7layers GmbH Borsigstr. 11 40880 Ratingen Germany	Set up	free space
		Test start	07.03.2016
Customer	Impossible Camera GmbH Potsdamer Strasse 87 10785 Berlin	Report date	08.04.2016
		Report by	Robert Machulec
		Approved by	Dieter Sütthoff

Bluetooth LE			
RMS Detector	**Low / Ch.0**	**Mid / Ch. 19**	**High / Ch. 39**
Antenna Port Input Power (Conducted Sample)	**-1.95**	**-2.31**	**-2.89**
Tot. Rad. Pwr. (dBm)	-6.1	-5.7	-5.5
Peak EIRP (dBm)	**-1.2**	**-0.9**	**-0.3**
Directivity (dBi)	4.8	4.8	5.2
Efficiency (dB)	-4.1	-3.4	-2.6
Efficiency (%)	38.8	46.0	55.4
Gain (dBi)	**0.7**	**1.4**	**2.6**

Tab. 1: Test result summary Bluetooth

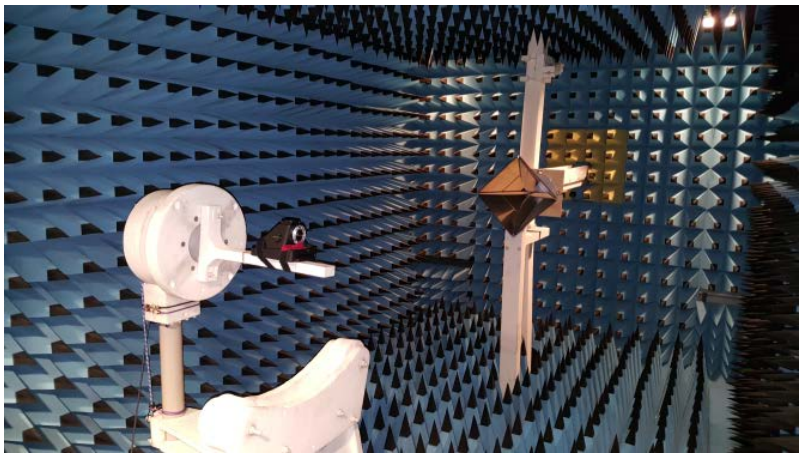


Fig. 1: Photo of DUT.

4 Brief Description of Settings and Test Method

4.1 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 transmitting periodical RF energy.
- Rotate the OUT in all room directions with a 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).

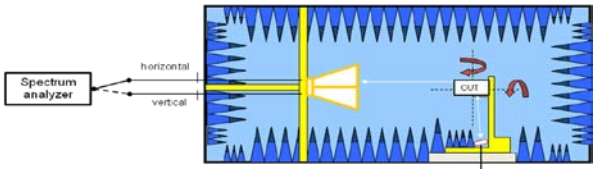


Fig. 1: Block diagram for TRP measurement

4.2 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

4.3 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

5 Detailed Radiated Test Results and Pattern

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:

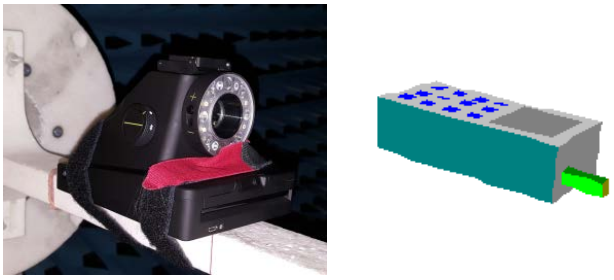


Fig. 2: Photo orientation of DUT compared to a phone.

5.1 TRP Bluetooth 2402 MHz

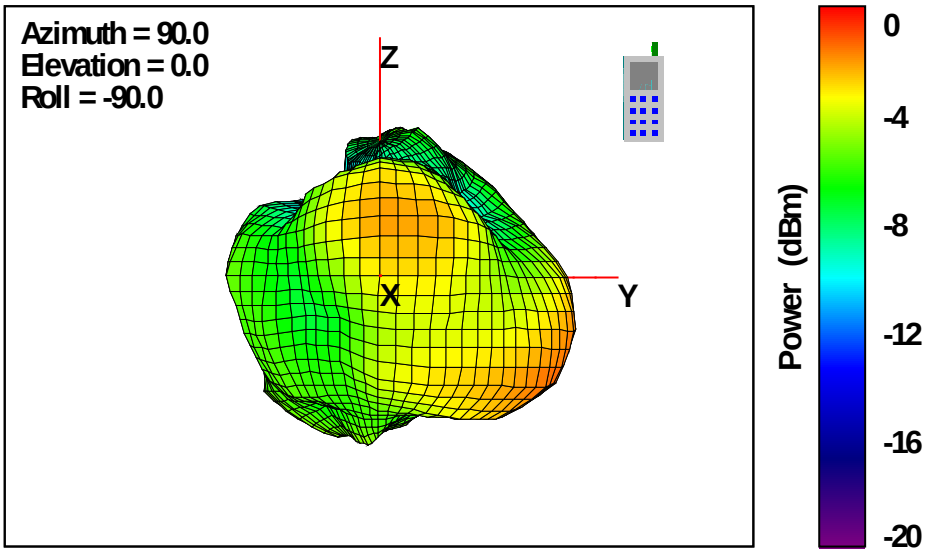
BT TRP low

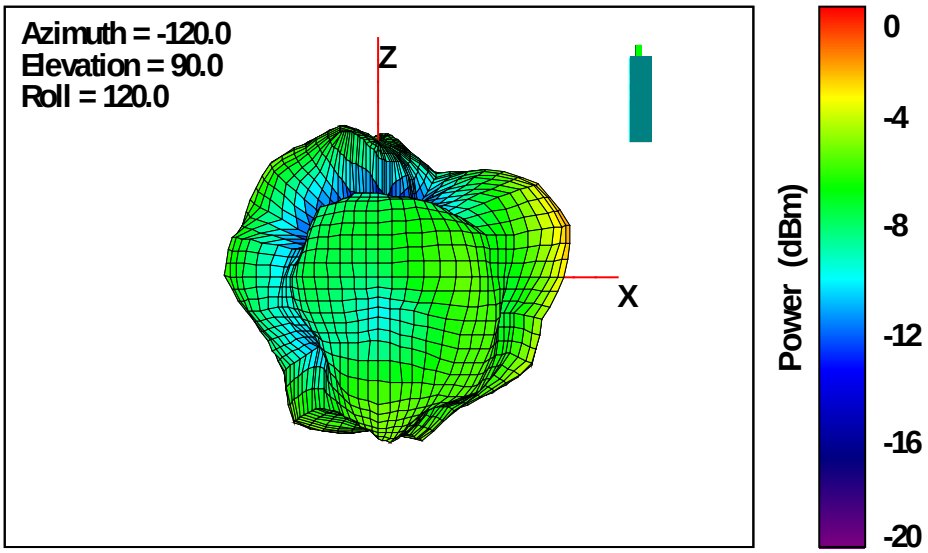
Test Information: <2.4Ghz TRP>
Phone: <I-1 IMPOSSIBLE>
Project Name: <MDE_IMPOSSIBLE_1501>
Technology: <Bluetooth low energy>
Setup: <Free Space>

CH:0
Length:27
PKT:2

without C13

Temperature: 22.1
Humidity: 36
Test start: 04/08/2016

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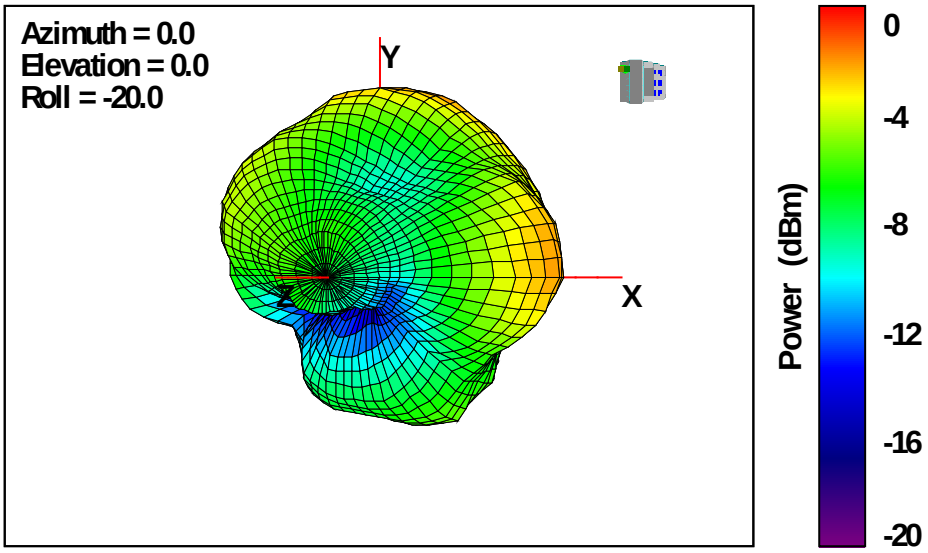
-8
-12
-16
-20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-12
-16
-20

5.2 TRP Bluetooth 2440 MHz

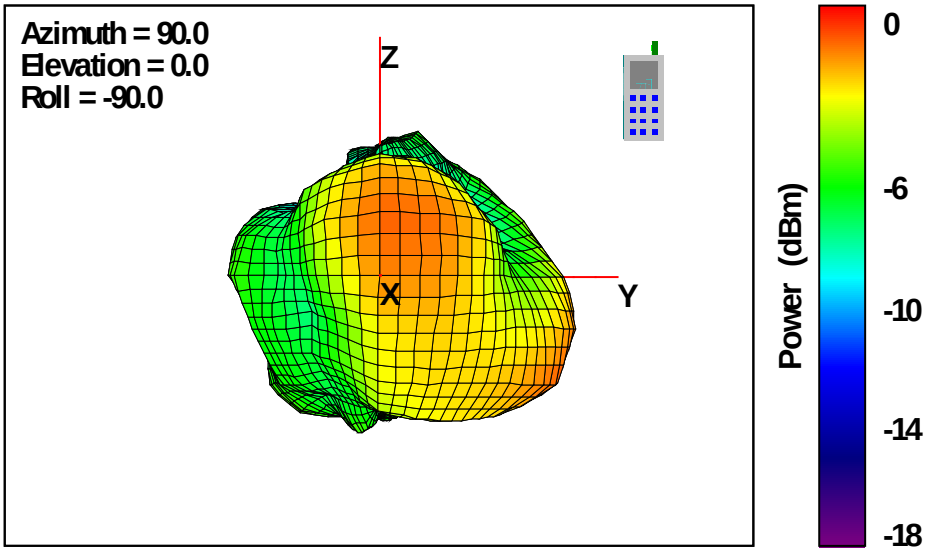
BT TRP mid

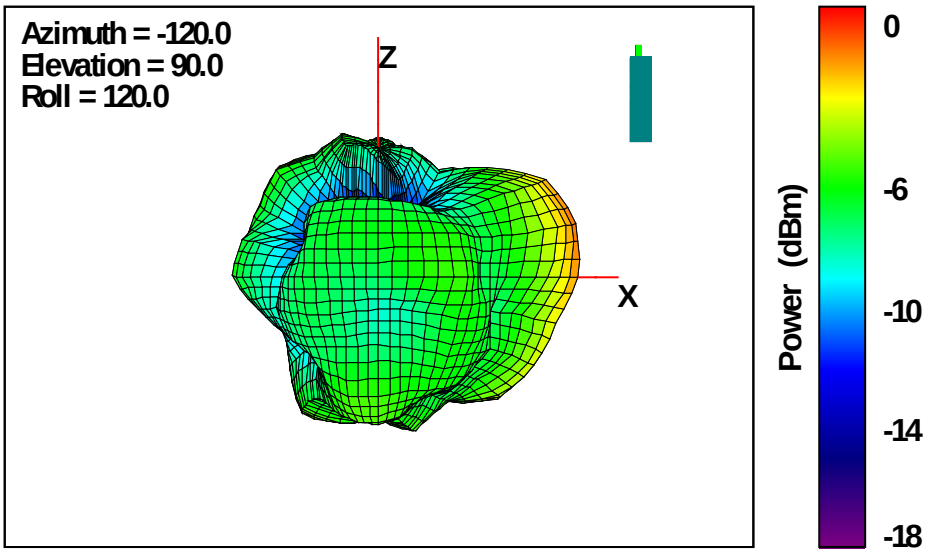
Test Information: <2.4Ghz TRP>
Phone: <I-1 IMPOSSIBLE>
Project Name: <MDE_IMPOSSIBLE_1501>
Technology: <Bluetooth low energy>
Setup: <Free Space>

CH:0
Length:27
PKT:2

without C13

Temperature: 22.7
Humidity: 38
Test start: 04/08/2016

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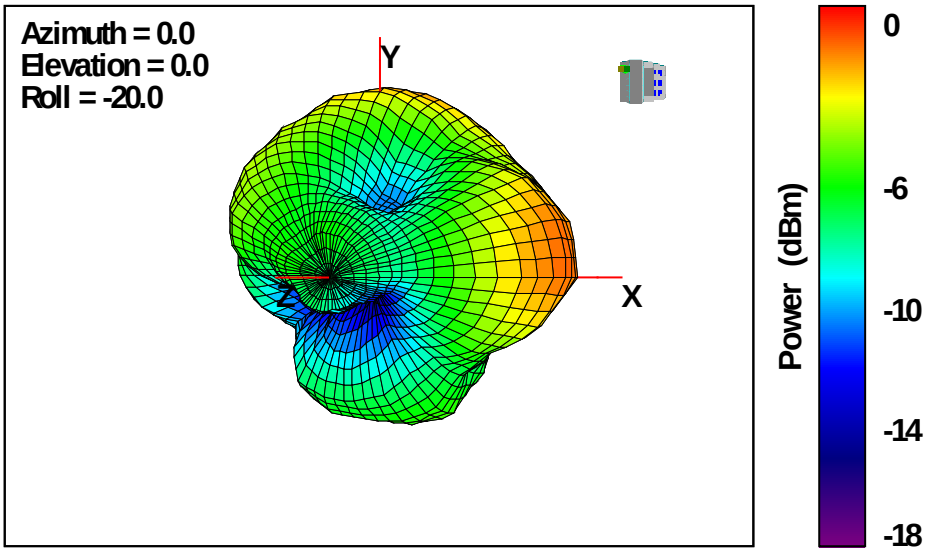
-10
-14
-18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Z
X
Power (dBm)
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-10
-14
-18

5.3 TRP Bluetooth 2480 MHz

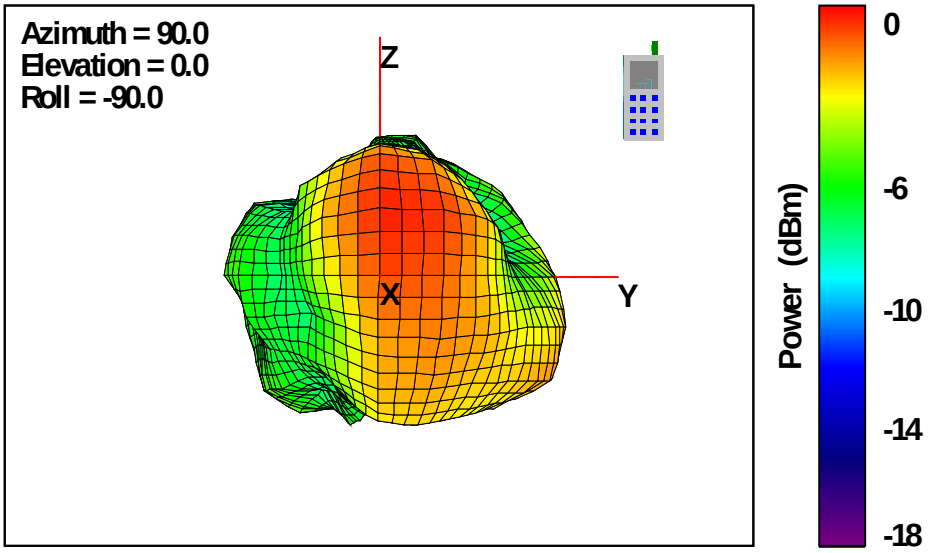
BT TRP high

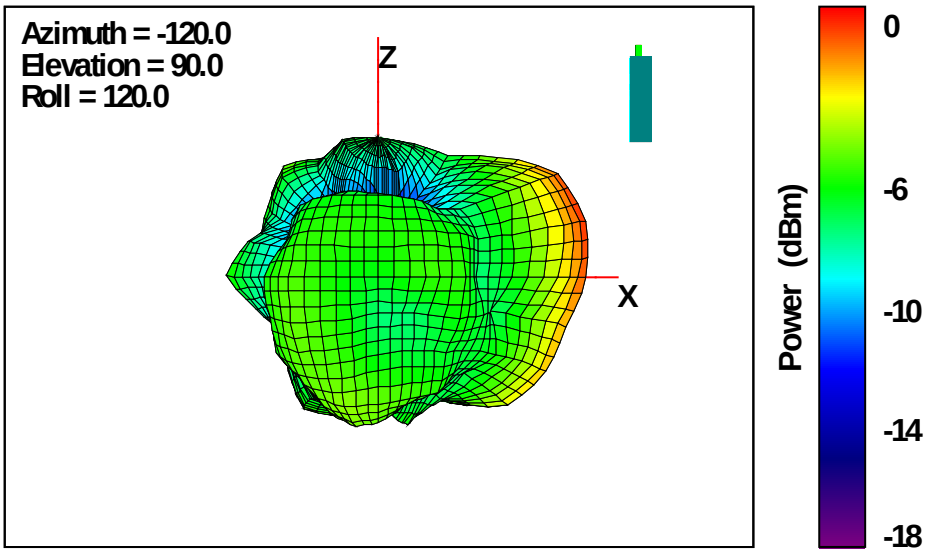
Test Information: <2.4Ghz TRP>
Phone: <I-1 IMPOSSIBLE>
Project Name: <MDE_IMPOSSIBLE_1501>
Technology: <Bluetooth low energy>
Setup: <Free Space>

CH:0
Length:27
PKT:2

without C13

Temperature: 22.7
Humidity: 38
Test start: 04/08/2016

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Roll = 120.0
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Power (dBm)
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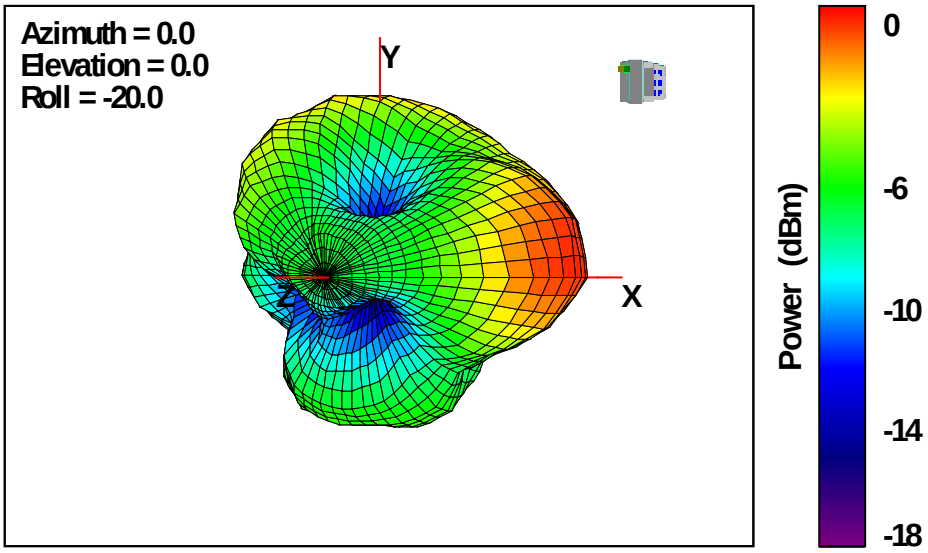
-10
-14
-18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X
Power (dBm)
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-6
-10
-14
-18