

InterLab®

FCC Measurement/Technical Report on

WLAN transceiver
FC7100 HW09

FCC ID: RKXFC7100
IC: 5119A-FC7100

Report Reference: MDE_PARRO_1508_FCCc

Test Laboratory:

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Germany



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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Table of Contents

0	Applied Standards and Test Summary	3
0.1	Technical Report Summary	3
0.2	FCC and IC Correlation Table	4
0.3	Measurement Summary	5
1	Administrative Data	8
1.1	Testing Laboratory	8
1.2	Project Data	8
1.3	Applicant Data	8
1.4	Manufacturer Data	8
2	Test object Data	9
2.1	General EUT Description	9
2.2	EUT Main components	10
2.3	Ancillary Equipment	10
2.4	Auxiliary Equipment	11
2.5	EUT Setups	11
2.6	Operating Modes	12
2.7	Special software used for testing	12
2.8	Product labelling	12
3	Test Results	13
3.1	Peak power output	13
3.2	Spurious radiated emissions	16
4	Test Equipment	21
5	Measurement Uncertainty	28
6	Photo Report	28
7	Setup Drawings	29

0 Applied Standards and Test Summary

0.1 Technical Report Summary

Type of Authorization

Certification for an Intentional Radiator (Digital Device / Spread Spectrum).

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 and 15 (10-1-13 Edition). The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 15, Subpart C – Intentional Radiators

§ 15.201 Equipment authorization requirement

§ 15.207 Conducted limits

§ 15.209 Radiated emission limits; general requirements

§ 15.247 Operation within the bands 902-928 MHz, 2400-2483.5 MHz

Note:

The tests were selected and performed with reference to the FCC Public Notice "Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247, 558074 D01 DTS Meas Guidance v03r03, 2015-06-09".

ANSI C63.10–2013 is applied.

Summary Test Results:

The EUT complied with all performed tests as listed in chapter 0.3 Measurement Summary.

0.2 FCC and IC Correlation Table

Correlation of measurement requirements for DTS (e.g. WLAN 2.4 GHz, BT LE) equipment from FCC and IC

DTS equipment

Measurement	FCC reference	IC reference
Conducted emissions on AC Mains	§ 15.207	RSS-Gen Issue 4: 8.8
Occupied bandwidth	§ 15.247 (a) (2)	RSS-247 Issue 1: 5.2 (1)
Peak conducted output power	§ 15.247 (b) (3), (4)	RSS-247 Issue 1: 5.4 (4)
Transmitter spurious RF conducted emissions	§ 15.247 (d)	RSS-Gen Issue 4: 6.13 / 8.9/8.10; RSS-247 Issue 1: 5.5
Transmitter spurious radiated emissions	§ 15.247 (d); § 15.209 (a)	RSS-Gen Issue 4: 6.13 / 8.9/8.10; RSS-247 Issue 1: 5.5
Band edge compliance	§ 15.247 (d)	RSS-247 Issue 1: 5.5
Power density	§ 15.247 (e)	RSS-247 Issue 1: 5.2 (2)
Antenna requirement	§ 15.203 / 15.204	RSS-Gen Issue 4: 8.3
Receiver spurious emissions	–	–

0.3 Measurement Summary

FCC Part 15, Subpart C

§ 15.207

Conducted emissions (AC power line)

The measurement was performed according to ANSI C63.10

2013

OP-Mode	Setup	Port	Final Result
-	-	AC port	N/P

FCC Part 15, Subpart C

§ 15.247 (a) (1)

Occupied bandwidth

The measurement was performed according to ANSI C63.10

2013

OP-Mode	Setup	Port	Final Result
op-mode 1b	Setup_01	Temp.ant.connector	N/P
op-mode 1g	Setup_01	Temp.ant.connector	N/P
op-mode 1n	Setup_01	Temp.ant.connector	N/P
op-mode 2b	Setup_01	Temp.ant.connector	N/P
op-mode 2g	Setup_01	Temp.ant.connector	N/P
op-mode 2n	Setup_01	Temp.ant.connector	N/P
op-mode 3b	Setup_01	Temp.ant.connector	N/P
op-mode 3g	Setup_01	Temp.ant.connector	N/P
op-mode 3n	Setup_01	Temp.ant.connector	N/P
op-mode 1n+	Setup_01	Temp.ant.connector	N/P
op-mode 2n+	Setup_01	Temp.ant.connector	N/P
op-mode 3n+	Setup_01	Temp.ant.connector	N/P

FCC Part 15, Subpart C

§ 15.247 (b) (1)

Peak power output

The measurement was performed according to ANSI C63.10

2013

OP-Mode	Setup	Port	Final Result
op-mode 1b	Setup_01	Temp.ant.connector	Passed
op-mode 1g	Setup_01	Temp.ant.connector	Passed
op-mode 1n	Setup_01	Temp.ant.connector	Passed
op-mode 2b	Setup_01	Temp.ant.connector	Passed
op-mode 2g	Setup_01	Temp.ant.connector	Passed
op-mode 2n	Setup_01	Temp.ant.connector	Passed
op-mode 3b	Setup_01	Temp.ant.connector	Passed
op-mode 3g	Setup_01	Temp.ant.connector	Passed
op-mode 3n	Setup_01	Temp.ant.connector	Passed
op-mode 1n+	Setup_01	Temp.ant.connector	Passed
op-mode 2n+	Setup_01	Temp.ant.connector	Passed
op-mode 3n+	Setup_01	Temp.ant.connector	Passed

FCC Part 15, Subpart C

§ 15.247 (d), § 15.35 (b), § 15.207

Spurious conducted emissions

The measurement was performed according to ANSI C63.10

2013

OP-Mode	Setup	Port	Final Result
op-mode 1b	Setup_01	Temp.ant.connector	N/P
op-mode 1g	Setup_01	Temp.ant.connector	N/P
op-mode 1n	Setup_01	Temp.ant.connector	N/P
op-mode 2b	Setup_01	Temp.ant.connector	N/P
op-mode 2g	Setup_01	Temp.ant.connector	N/P
op-mode 2n	Setup_01	Temp.ant.connector	N/P
op-mode 3b	Setup_01	Temp.ant.connector	N/P
op-mode 3g	Setup_01	Temp.ant.connector	N/P
op-mode 3n	Setup_01	Temp.ant.connector	N/P
op-mode 1n+	Setup_01	Temp.ant.connector	N/P
op-mode 2n+	Setup_01	Temp.ant.connector	N/P
op-mode 3n+	Setup_01	Temp.ant.connector	N/P

FCC Part 15, Subpart C

§ 15.247 (d), § 15.35 (b), § 15.209

Spurious radiated emissions

The measurement was performed according to ANSI C63.10

2013

OP-Mode	Setup	Port	Final Result
op-mode 1b	Setup_02	Enclosure	N/P
op-mode 2b	Setup_02	Enclosure	N/P
op-mode 3b	Setup_02	Enclosure	N/P
op-mode 1g	Setup_02	Enclosure	N/P
op-mode 2g	Setup_02	Enclosure	Passed
op-mode 3g	Setup_02	Enclosure	N/P
op-mode 1n	Setup_02	Enclosure	N/P
op-mode 2n	Setup_02	Enclosure	N/P
op-mode 3n	Setup_02	Enclosure	N/P

FCC Part 15, Subpart C

§ 15.247 (d)

Band edge compliance

The measurement was performed according to ANSI C63.10

2013

OP-Mode	Setup	Port	Final Result
op-mode 1b	Setup_01	Temp.ant.connector	N/P
op-mode 1g	Setup_01	Temp.ant.connector	N/P
op-mode 1n	Setup_01	Temp.ant.connector	N/P
op-mode 3b	Setup_01	Temp.ant.connector	N/P
op-mode 3g	Setup_01	Temp.ant.connector	N/P
op-mode 3n	Setup_01	Temp.ant.connector	N/P
op-mode 1n+	Setup_01	Temp.ant.connector	N/P
op-mode 3n+	Setup_01	Temp.ant.connector	N/P
op-mode 3b	Setup_02	Enclosure	N/P
op-mode 3g	Setup_02	Enclosure	N/P
op-mode 3n	Setup_02	Enclosure	N/P

FCC Part 15, Subpart C

§ 15.247 (e)

Power density

The measurement was performed according to ANSI C63.10

2013

OP-Mode	Setup	Port	Final Result
op-mode 1b	Setup_01	Temp.ant.connector	N/P
op-mode 1g	Setup_01	Temp.ant.connector	N/P
op-mode 1n	Setup_01	Temp.ant.connector	N/P
op-mode 2b	Setup_01	Temp.ant.connector	N/P
op-mode 2g	Setup_01	Temp.ant.connector	N/P
op-mode 2n	Setup_01	Temp.ant.connector	N/P
op-mode 3b	Setup_01	Temp.ant.connector	N/P
op-mode 3g	Setup_01	Temp.ant.connector	N/P
op-mode 3n	Setup_01	Temp.ant.connector	N/P
op-mode 1n+	Setup_01	Temp.ant.connector	N/P
op-mode 2n+	Setup_01	Temp.ant.connector	N/P
op-mode 3n+	Setup_01	Temp.ant.connector	N/P

N/A not applicable (the EUT is powered by DC)

N/P not performed

Not all tests, which are applicable to the EUT, have been performed. The tests have been selected by the applicant with the purpose to demonstrate that hardware-changes does not affect harmfully the performance.

The EUT was initially tested as documented in the test report referenced by MDE_PARRO_1426_FCCc

Responsible for
Accreditation Scope: _____

Responsible
for Test Report: _____

1 Administrative Data

1.1 Testing Laboratory

Company Name: 7 layers GmbH
Address Borsigstr. 11
40880 Ratingen
Germany

This facility has been fully described in a report submitted to the FCC and accepted under the registration number: 96716 .
This facility has been fully described in a report submitted to the IC and accepted under the registration number: Site# 3699A-1
The test facility is also accredited by the following accreditation organisation:
Laboratory accreditation no.: DAKkS D-PL-12140-01-01

Responsible for Accreditation Scope: Dipl.-Ing. Bernhard Retka
Dipl.-Ing. Robert Machulec
Dipl.-Ing. Thomas Hoell
Dipl.-Ing. Andreas Petz
Dipl.-Ing. Marco Kullik

Report Template Version: 2015-02-23

1.2 Project Data

Responsible for testing and report: Dipl.-Ing. Daniel Gall
Date of Test(s): 2015-07-21 to 2015-09-04
Date of Report: 2015-09-25

1.3 Applicant Data

Company Name: PARROT AUTOMOTIVE S.A.S
Address: 174, quai de Jemappes
75010 Paris
France
Contact Person: Mr. Lakhdar Bouchelouk

1.4 Manufacturer Data

Company Name: Please see applicant data
Address:
Contact Person:

2 Test object Data

2.1 General EUT Description

Equipment under Test:	IEEE 802.11a/b/g/n WLAN transceiver
Type Designation:	FC7100
Kind of Device: (optional)	Module supporting these technologies: 1) WLAN 2.4 GHz modes b/g/n, 20+40 MHz BW 2) WLAN 5 GHz modes a/n, 20+40 MHz BW 3) Bluetooth, normal and low energy mode 4) GPS receiver
Voltage Type:	DC
Voltage Level:	3.3 V
Tested Modulation Type:	DBPSK; OFDM:BPSK; OFDM:64-QAM

General product description:

The WLAN Transceiver is operating in the 2.4 GHz ISM band using Direct Sequence Spread Spectrum (DSSS) Modulation and Orthogonal Frequency Division Multiplexing (OFDM).

The BT Transceiver is operating in the 2.4 GHz ISM band using Frequency Hopping Spread Spectrum (FHSS) Modulation, in Low Energy Mode operating in the 2.4 GHz ISM band using Direct Sequence Spread Spectrum (DSSS) Modulation..

Specific product description for the EUT:

The EUT is a dual band WLAN (802.11 a/b/g/n, 2.4 and 5 GHz) and Bluetooth module with one joint antenna connector for WLAN 2.4 GHz and Bluetooth, but simultaneous transmission is not possible and is managed by the module. In IEEE 802.11n mode it supports 20 MHz and 40 MHz bandwidth channels (both with MCS7), providing 72.2 Mbit/s, and 150 Mbit/s transfer data rates respectively.

The WLAN (Wireless Local Area Network) transceiver is operating in the 5 GHz band in the range 5.15 – 5.25 GHz and 5.725 – 5.850 GHz.

Additionally, it contains a GPS receiver.

The object of this test report is the WLAN transceiver.

The EUT provides the following ports:

Ports

Enclosure

Data / DC port (system connector)

2.4 GHz Antenna (UFL connector)

5 GHz Antenna (UFL connector)

GPS Antenna (UFL connector)

The main components of the EUT are listed and described in Chapter 2.2

2.2 EUT Main components

Type, S/N, Short Descriptions etc. used in this Test Report

Short Description	Equipment under Test	Type Designation	Serial No.	HW Status	SW Status
EUT A (Code: DE1018011ab01)	WLAN transceiver	FC7100	PI214004AA10 0055D000059	09	2.4.44.92
Remark: EUT A is equipped with a permanent antenna connector and an external antenna with a maximum gain of 2.5 dBi in the 5 GHz band.					

NOTE: The short description used to simplify the identification of the EUT in this test report.

2.3 Ancillary Equipment

For the purposes of this test report, ancillary equipment is defined as equipment, which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

Short Description	Equipment under Test	Type Designation	Serial No.	HW Status	SW Status
ANC1	Supply and Communication Board	Parrot WB FC7100 EMC MEZZ	A8424/012	01	–

2.4 Auxiliary Equipment

For the purposes of this test report, auxiliary equipment is defined as equipment, which is used temporarily to enable operational and control features especially used for the tests of the EUT, which is not used during normal operation or equipment that is used during the tests in combination with the EUT but is not subject of this test report. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Auxiliary Equipment can influence the test results.

Short Description	Equipment under Test	Type Designation	Serial No.	HW Status	SW Status
AUX1	Antenna for 2.4 GHz band	Parrot PCB IFA antenna 2.4 GHz	–	–	–
AUX2	Antenna for 5 GHz band	Parrot PCB IFA antenna 5 GHz	–	–	–

2.5 EUT Setups

This chapter describes the combination of EUTs and equipment used for testing. The rationale for selecting the EUTs, ancillary and auxiliary equipment and interconnecting cables, is to test a representative configuration meeting the requirements of the referenced standards.

Setup	Combination of EUTs	Description and Rationale
Setup_01	EUT A + ANC1	setup for conducted measurements
Setup_02	EUT A + ANC1 and AUX1 to AUX2	setup for radiated measurements

2.6 Operating Modes

This chapter describes the operating modes of the EUTs used for testing.

2.6.1 Test Channels

20 MHz Test Channels:	Band:					
	900 MHz			2.4 GHz ISM		
	902 - 928 MHz			2400 - 2483.5 MHz		
	Bottom	Middle	Top	Bottom	Middle	Top
Channel:				1	6	11
Frequency [MHz]				2412	2437	2462

40 MHz Test Channels:	Bottom	Middle	Top	Bottom	Middle	Top
				3	6	11
				2422	2437	2462

2.6.2 Datarates

Data rate / frequency	2412	2437	2462
WLAN b-Mode; 20 MHz; 1 Mbit/s	1b	2b	3b
WLAN g-Mode; 20 MHz; 6 Mbit/s	1g	2g	3g
WLAN n-Mode; 20 MHz; 72.2 Mbit/s	1n	2n	3n
WLAN n-Mode; 40 MHz; 150 Mbit/s	1n+	2n+	3n+

2.7 Special software used for testing

A tool which is called "Pulsar Shell" (an adb tool) is used to set the EUT into the desired WLAN test modes. Different commands can be entered via the "calibrator tool". The LAN interface at AUX1 is used for this purpose.

2.8 Product labelling

2.8.1 FCC ID label

Please refer to the documentation of the applicant.

2.8.2 Location of the label on the EUT

Please refer to the documentation of the applicant.

3 Test Results

3.1 Peak power output

Standard FCC Part 15, Subpart C

The test was performed according to: ANSI C63.10

3.1.1 Test Description

The Equipment Under Test (EUT) was set up to perform the output power measurements. The results recorded were measured with the modulation which produces the worst-case (highest) output power. The reference level of the spectrum analyzer was set higher than the output power of the EUT. The EUT was connected to the spectrum analyzer via a short coax cable with a known loss.

Analyzer settings:

- Detector: Peak

3.1.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (b) (3)

For systems using digital modulation techniques in the 902-928 MHz and 2400-2483.5 MHz bands: 1 watt.

=> Maximum conducted peak output power: 30 dBm (excluding antenna gain, if antennas with directional gains that do not exceed 6 dBi are used).

Used conversion factor: $\text{Limit (dBm)} = 10 \log (\text{Limit (W)}/1\text{mW})$

3.1.3 Test Protocol

Temperature: 23 °C
Air Pressure: 1010 hPa
Humidity: 40 %

The antenna gain is excluded in the table.

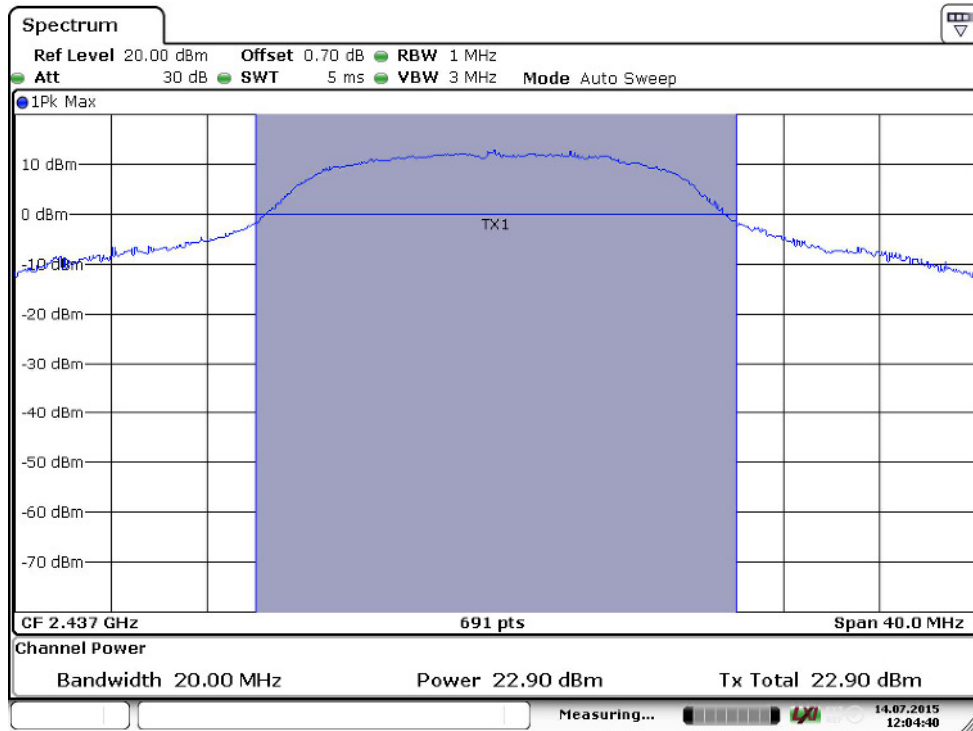
WLAN b-Mode; 20 MHz; 1 Mbit/s					
Band	Channel No.	Frequency [MHz]	Peak Power [dBm]	Limit [dBm]	Margin to Limit [dB]
2.4 GHz ISM	1	2412	17.7	30.0	12.3
	6	2437	17.5	30.0	12.5
	11	2462	17.6	30.0	12.4

WLAN g-Mode; 20 MHz; 6 Mbit/s					
Band	Channel No.	Frequency [MHz]	Peak Power [dBm]	Limit [dBm]	Margin to Limit [dB]
2.4 GHz ISM	1	2412	20.4	30.0	9.6
	6	2437	22.9	30.0	7.1
	11	2462	20.5	30.0	9.5

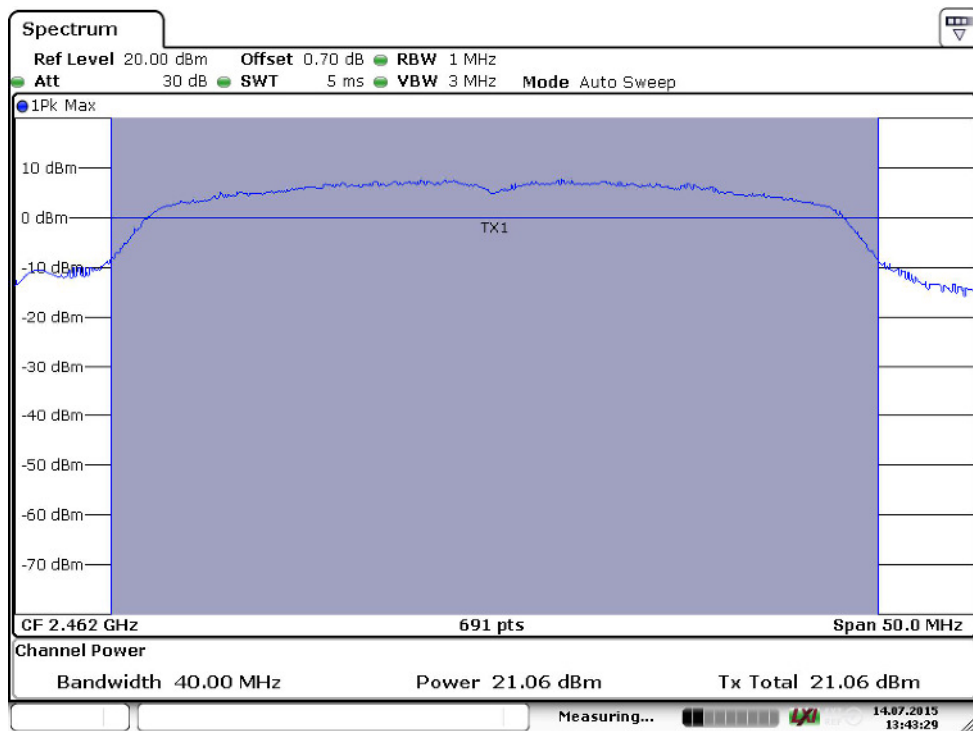
WLAN n-Mode; 20 MHz; 72.2 Mbit/s					
Band	Channel No.	Frequency [MHz]	Peak Power [dBm]	Limit [dBm]	Margin to Limit [dB]
2.4 GHz ISM	1	2412	20.9	30.0	9.1
	6	2437	22.5	30.0	7.6
	11	2462	21.0	30.0	9.0

WLAN n-Mode; 40 MHz; 150 Mbit/s					
Band	Channel No.	Frequency [MHz]	Peak Power [dBm]	Limit [dBm]	Margin to Limit [dB]
2.4 GHz ISM	3	2412	18.8	30.0	11.2
	6	2437	21.0	30.0	9.0
	11	2462	21.1	30.0	8.9

3.1.4 Measurement Plot (showing the highest value, "worst case")



Date: 14. JUL 2015 12:04:41



Date: 14. JUL 2015 13:43:30

3.2 Spurious radiated emissions

Standard FCC Part 15, Subpart C

The test was performed according to: ANSI C63.10

3.2.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C63.10 in a typical installation configuration. The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m² in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.

The measurement procedure is implemented into the EMI test software ES-K1 from R&S. Exploratory tests are performed at 3 orthogonal axes to determine the worst-case orientation of a body-worn or handheld EUT. The final test on all kind of EUTs is performed at 2 axes. A pre-check is performed while the EUT is powered from a DC power source.

1. Measurement up to 30 MHz

The Loop antenna HFH2-Z2 is used.

Step 1: pre measurement

- Anechoic chamber
- Antenna distance: 10 m
- Detector: Peak-Maxhold
- Frequency range: 0.009 - 0.15 MHz and 0.15 – 30 MHz
- Frequency steps: 0.1 kHz and 5 kHz
- IF-Bandwidth: 0.2 kHz and 10 kHz
- Measuring time / Frequency step: 100 ms

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: final measurement

For the relevant emissions determined in step 1, an additional measurement with the following settings will be performed. Intention of this step is to find the maximum emission level.

- Open area test side
- Antenna distance: according to the Standard
- Detector: Quasi-Peak
- Frequency range: 0.009 – 30 MHz
- Frequency steps: measurement at frequencies detected in step 1
- IF-Bandwidth: 0.2 - 10 kHz
- Measuring time / Frequency step: 100 ms

2. Measurement above 30 MHz and up to 1 GHz

Step 1: Preliminary scan

This is a preliminary test to identify the highest amplitudes relative to the limit.

Settings for step 1:

- Antenna distance: 3 m
- Detector: Peak-Maxhold
- Frequency range: 30 – 1000 MHz
- Frequency steps: 60 kHz
- IF-Bandwidth: 120 kHz
- Measuring time / Frequency step: 100 μ s
- Turntable angle range: -180° to 180°
- Turntable step size: 90°
- Height variation range: 1 – 3 m
- Height variation step size: 2 m
- Polarisation: Horizontal + Vertical

Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

Step 2: second measurement

For the relevant emissions determined in step 1, an additional measurement with the following settings will be performed. Intention of this step is, to find out the approximate turntable angle and antenna height for each frequency.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: -180° to 180°
- Turntable step size: 45°
- Height variation range: 1 – 4 m
- Height variation step size: 0.5 m
- Polarisation: horizontal + vertical

After this step, the EMI test system has determined the following values for each frequency (of step 1):

- Frequency
- Azimuth value (of turntable)
- Antenna height

The last two values have now the following accuracy:

- Azimuth value (of turntable): 45°
- Antenna height: 0.5 m

Step 3: final measurement

In this step the accuracy of the turntable azimuth and antenna height will be improved.

This is necessary to find out the maximum value of every frequency.

For each frequency, which was determined the turntable azimuth and antenna height will be adjusted. The turntable azimuth will slowly vary by $\pm 22.5^{\circ}$ around this value. During this action, the value of emission is continuously measured. The turntable azimuth at the highest emission will be recorded and adjusted. In this position, the antenna height will also slowly vary by ± 25 cm around the antenna height determined. During this action, the value of emission is also continuously measured. The antenna height of the highest emission will also be recorded and adjusted.

- Detector: Peak – Maxhold
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 100 ms
- Turntable angle range: $\pm 22.5^{\circ}$ around the determined value
- Height variation range: ± 25 cm around the determined value

Step 4: final measurement with QP detector

With the settings determined in step 3, the final measurement will be performed:

EMI receiver settings for step 4:

- Detector: Quasi-Peak (< 1 GHz)
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 120 kHz
- Measuring time: 1 s

After the measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

3. Measurement above 1 GHz

The following modifications apply to the measurement procedure for the frequency range above 1 GHz:

The Equipment Under Test (EUT) was set up on a non-conductive support at 1.4 m height in the fully-anechoic chamber. The measurement distance was reduced to 1 m. The results were extrapolated by the extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements, inverse linear-distance squared for the power reference level measurements). Due to the fact, that in this frequency range a double-ridged wave guided horn antenna (up to 18 GHz) and a horn antenna (18–25 GHz) are used, the steps 2-4 are omitted. Step 1 was performed with one height of the receiving antenna only.

EMI receiver settings:

- Detector: Peak, Average
- IF Bandwidth = 1 MHz

For the data rate in mode n the test is performed as worst-case-check in order to verify that emissions have a comparable level as found at modes b and g. Typically, the measurement is performed in the frequency range 1 to 8 GHz but it depends on the emissions found during the test for the modes b and g. Please refer to the results for the used frequency range.

3.2.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (d)

... In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

FCC Part 15, Subpart C, §15.209, Radiated Emission Limits

Frequency in MHz	Limit (μV/m)	Measurement distance (m)	Calculated Limits(dBμV/m @10m)	Limits(dBμV/m @10m)
0.009 – 0.49	2400/F(kHz)	300 → 10	(48.5 – 13.8) + 59.1 dB	107.6 – 72.9
0.49 – 1.705	24000/F(kHz)	30 → 10	(33.8 – 23.0) + 19.1 dB	52.9 – 42.1
1.705 – 30	30	30 → 10	29.5 + 19.1 dB	48.6

Frequency in MHz	Limit (μV/m)	Measurement distance (m)	Limit (dBμV/m)
30 – 88	100	3	40.0
88 – 216	150	3	43.5
216 – 960	200	3	46.0
above 960	500	3	54.0

§15.35(b) ..., there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit....

Used conversion factor: $\text{Limit (dB}\mu\text{V/m)} = 20 \log (\text{Limit } (\mu\text{V/m})/1\mu\text{V/m})$

3.2.3 Test Protocol

Temperature: 24–28 °C
Air Pressure: 1003–1012 hPa
Humidity: 38–50 %

WLAN g-Mode; 20 MHz; 6 Mbit/s				Applied duty cycle correction (AV) [dB]: 0.7				
Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin to Limit [dB]	Limit Type
6	2437	2335.8	54.9	PEAK	1000	74.0	19.1	RB
6	2437	2334.2	45.5	AV	1000	54.0	8.5	RB
6	2437	2386.8	46.6	AV	1000	54.0	7.4	RB
6	2437	2389.8	64.7	PEAK	1000	74.0	9.3	RB
6	2437	2484.2	59.4	PEAK	1000	74.0	14.6	RB
6	2437	2487.2	45.1	AV	1000	54.0	8.9	RB

Note: No (further) spurious emissions in the range 20 dB below the limit found.
The measurement was performed from 30 MHz up to 26 GHz.

4 Test Equipment

The calibration, hardware and software states are shown for the testing period.

Test Equipment Anechoic Chamber

Lab ID:	Lab 3		
Manufacturer:	Frankonia		
Description:	Anechoic Chamber for radiated testing		
Type:	10.58x6.38x6.00 m ³ NSA (FCC)	2014/01/09	2017/01/09

Single Devices for Anechoic Chamber

Single Device Name	Type	Serial Number	Manufacturer
Air compressor	none	-	Atlas Copco
Anechoic Chamber	10.58 x 6.38 x 6.00 m ³ FCC listing 96716 3m Part15/18	none	Frankonia 2014/01/09 2017/01/08
Controller Innco 2000	CO 2000	CO2000/328/12470 406/L	Innco innovative constructions GmbH
Controller Maturo	MCU	961208	Maturo GmbH
EMC camera	CE-CAM/1	-	CE-SYS
EMC camera Nr.2	CCD-400E	0005033	Mitsubishi
Filter ISDN	B84312-C110-E1		Siemens&Matsushita
Filter Universal 1A	BB4312-C30-H3	-	Siemens&Matsushita

Test Equipment Auxiliary Equipment for Radiated emissions

Lab ID:	Lab 3
Description:	Equipment for emission measurements
Serial Number:	see single devices

Single Devices for Auxiliary Equipment for Radiated emissions

Single Device Name	Type	Serial Number	Manufacturer
Antenna mast	AM 4.0	AM4.0/180/119205 13	Maturo GmbH
Antenna mast	AS 620 P	620/37	HD GmbH
Biconical Broadband Antenna	SBA 9119	9119-005	Schwarzbeck Mess-Elektronik OHG
Biconical dipole	VUBA 9117	9117-108	Schwarzbeck Mess-Elektronik OHG
Broadband Amplifier 1 GHz - 4 GHz	AFS4-01000400-1Q-10P-4	-	Miteq
Broadband Amplifier 18 GHz - 26 GHz	JS4-18002600-32-5P	849785	Miteq
Broadband Amplifier 30 MHz - 18 GHz	JS4-00101800-35-5P	896037	Miteq
Cable "ESI to EMI Antenna"	EcoFlex10	W18.01-2+W38.01- 2	Kabel Kusch
Cable "ESI to Horn Antenna"	SucoFlex	W18.02-2+W38.02- 2	HUBER+SUHNER
Cable "ESI to Horn Antenna"	UFB311A+UFB293C	W18.02-2+W38.02- 2	Rosenberger Micro-Coax

Single Devices for Auxiliary Equipment for Radiated emissions (continued)

Single Device Name	Type	Serial Number	Manufacturer
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz GmbH & Co. KG
	Standard Calibration		2015/06/23 2018/06/22
Double-ridged horn	HF 907	102444	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2015/05/11 2018/05/10
Double-ridged horn-duplicated 2015-07-15 10:47:55	HF 906	357357/001	Rohde & Schwarz GmbH & Co. KG
Dreheinheit	DE 325		HD GmbH
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic
High Pass Filter	5HC3500/18000-1.2-KK	200035008	Trilithic
High Pass Filter	WHKX 7.0/18G-8SS	09	Wainwright
Horn Antenna Schwarzbeck 15-26.5 GHz BBHA 9170	BBHA 9170	BBHA9170262	Schwarzbeck Mess-Elektronik OHG
Log.-per. Antenna	HL 562 Ultralog	100609	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2012/12/18 2015/12/17
Log.-per. Antenna (upgraded)	HL 562 Ultralog new biconicals	830547/003	Rohde & Schwarz GmbH & Co. KG
	Standard Calibration		2015/06/30 2018/06/29
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz GmbH & Co. KG
	DKD Calibration		2014/11/27 2017/11/27
Standard Gain / Pyramidal Horn Antenna 26.5 GHz	3160-09	00083069	EMCO Elektronik GmbH
Standard Gain / Pyramidal Horn Antenna 40 GHz	3160-10	00086675	EMCO Elektronik GmbH
Tilt device Maturo (Rohacell)	Antrieb TD1.5-10kg	TD1.5-10kg/024/3790709	Maturo GmbH

Test Equipment Auxiliary Test Equipment

Lab ID:	Lab 3, Lab 4
Manufacturer:	see single devices
Description:	Single Devices for various Test Equipment
Type:	various
Serial Number:	none

Single Devices for Auxiliary Test Equipment

Single Device Name	Type	Serial Number	Manufacturer		
AC Power Source	Chroma 6404	64040001304	Chroma ATE INC.		
Broadband Power Divider N (Aux)	1506A / 93459	LM390	Weinschel Associates		
Broadband Power Divider SMA	WA1515	A855	Weinschel Associates		
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	Fluke Europe B.V.		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	Customized calibration			2013/12/04	2015/12/03
Fibre optic link Satellite (Aux)	FO RS232 Link	181-018	Pontis		
Fibre optic link Transceiver (Aux)	FO RS232 Link	182-018	Pontis		
Isolating Transformer	LTS 604	1888	Thalheimer Transformatorwerke GmbH		
Notch Filter Ultra Stable (Aux)	WRCA800/960-6EEK	24	Wainwright		
Signal Analyzer	FSV30	103005	Rohde & Schwarz GmbH & Co. KG		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	Standard			2014/02/10	2016/02/09
Spectrum Analyser	FSP3	836722/011	Rohde & Schwarz GmbH & Co. KG		
	DKD calibration			2015/06/23	2018/06/22
Spectrum Analyser	FSU26	200418	Rohde & Schwarz GmbH & Co.KG		
	Standard calibration			2014/07/29	2015/07/28
Vector Signal Generator	SMIQ 03B	832492/061	Rohde & Schwarz GmbH & Co.KG		

Test Equipment Digital Signalling Devices

Lab ID:

Lab 3, Lab 4

Description:

Signalling equipment for various wireless technologies.

Single Devices for Digital Signalling Devices

Single Device Name	Type	Serial Number	Manufacturer	
Bluetooth Signalling Unit CBT CBT		100589	Rohde & Schwarz GmbH & Co. KG	
	Standart calibration		2015/01/21	2018/01/19
CMW500	CMW500	107500	Rohde & Schwarz GmbH & Co.KG	
	Standard calibration		2014/01/27	2016/01/26
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz GmbH & Co. KG	
	DKD calibration		2014/12/02	2017/12/01
Universal Radio Communication Tester	CMU 200	102366	Rohde & Schwarz GmbH & Co. KG	
	HW/SW Status		Date of Start	Date of End
	Hardware: B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B56V14, B68 3v04, PCMCIA, U65V04 Software: K21 4v21, K22 4v21, K23 4v21, K24 4v21, K42 4v21, K43 4v21, K53 4v21, K56 4v22, K57 4v22, K58 4v22, K59 4v22, K61 4v22, K62 4v22, K63 4v22, K64 4v22, K65 4v22, K66 4v22, K67 4v22, K68 4v22, K69 4v22 Firmware: µP1 8v50 02.05.06 ---		2007/07/16	
Universal Radio Communication Tester	CMU 200	837983/052	Rohde & Schwarz GmbH & Co. KG	
	DKD calibration		2014/12/03	2017/12/02
	HW/SW Status		Date of Start	Date of End
	HW options: B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2, B54V14, B56V14, B68 3v04, B95, PCMCIA, U65V02 SW options: K21 4v11, K22 4v11, K23 4v11, K24 4v11, K27 4v10, K28 4v10, K42 4v11, K43 4v11, K53 4v10, K65 4v10, K66 4v10, K68 4v10, Firmware: µP1 8v40 01.12.05 ---		2007/01/02	
	SW: K62, K69		2008/11/03	
Vector Signal Generator	SMU200A	100912	Rohde & Schwarz GmbH & Co. KG	

Test Equipment Emission measurement devices

Lab ID: Lab 3
Description: Equipment for emission measurements
Serial Number: see single devices

Single Devices for Emission measurement devices

Single Device Name	Type	Serial Number	Manufacturer		
EMI Receiver / Spectrum ESR 7 Analyser		101424	Rohde & Schwarz		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	Initial Factory Calibration			2014/11/13	2016/11/12
Personal Computer	Dell	30304832059	Dell		
Power Meter	NRVD	828110/016	Rohde & Schwarz GmbH & Co.KG		
	Standard calibration			2015/05/11	2016/05/10
Power Sensor	NRV-Z1	836219/005	Rohde & Schwarz GmbH & Co. KG		
Powermeter	NRVS	836333/064	Rohde & Schwarz GmbH & Co. KG		
Sensor Head A	NRV-Z1	827753/005	Rohde & Schwarz GmbH & Co.KG		
	Standard calibration			2015/05/11	2016/05/10
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG		
	Standard Calibration			2014/06/24	2017/06/23
Spectrum Analyser	FSW 43	103779	Rohde & Schwarz		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	Initial Factory Calibration			2014/11/17	2016/11/16
Spectrum Analyzer	ESIB 26	830482/004	Rohde & Schwarz GmbH & Co. KG		
	Standard Calibration			2014/01/07	2016/01/31
	<i>HW/SW Status</i>			<i>Date of Start</i>	<i>Date of End</i>
	Firmware-Update 4.34.4 from 3.45 during calibration			2009/12/03	

Test Equipment Multimeter 03

Lab ID: Lab 3, Lab 4
Description: Fluke 177
Serial Number: 86670383

Single Devices for Multimeter 03

Single Device Name	Type	Serial Number	Manufacturer		
Digital Multimeter 03 (Multimeter)	Fluke 177	86670383	Fluke Europe B.V.		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	Customized calibration			2013/12/04	2015/12/03

Test Equipment Radio Lab Test Equipment

Lab ID: Lab 4
Description: Radio Lab Test Equipment

Single Devices for Radio Lab Test Equipment

Single Device Name	Type	Serial Number	Manufacturer
Broadband Power DividerWA1515 SMA		A856	Weinschel Associates
Coax Attenuator 10dB SMA 2W	4T-10	F9401	Weinschel Associates
Coax Attenuator 10dB SMA 2W	56-10	W3702	Weinschel Associates
Coax Attenuator 10dB SMA 2W	56-10	W3711	Weinschel Associates
Coax Cable Huber&Suhner	Sucotest 2,0m		Huber&Suhner
Coax Cable Rosenberger Micro Coax FA210A0010003030 SMA/SMA 1,0m	FA210A0010003030	54491-2	Rosenberger Micro-Coax
Power Meter	NRVD	828110/016	Rohde & Schwarz GmbH & Co.KG
	Standard calibration		2015/05/11 2016/05/10
Power Sensor	NRV-Z1	836219/005	Rohde & Schwarz GmbH & Co. KG
Powermeter	NRVS	836333/064	Rohde & Schwarz GmbH & Co. KG
RF Step Attenuator RSP	RSP	833695/001	Rohde & Schwarz GmbH & Co.KG
Rubidium Frequency Standard	Datum, Model: MFS	5489/001	Datum-Beverly
	Standard Calibration		2015/06/25 2016/06/24
Sensor Head A	NRV-Z1	827753/005	Rohde & Schwarz GmbH & Co.KG
	Standard calibration		2015/05/11 2016/05/10
Signal Generator SME	SME03	827460/016	Rohde & Schwarz GmbH & Co.KG
	Standard calibration		2014/12/02 2017/12/01
Signal Generator SMP	SMP02	836402/008	Rohde & Schwarz GmbH & Co. KG
	Calibration Details		Last Execution Next Exec.
	Standard calibration		2013/05/06 2016/05/05
Spectrum Analyser	FSIQ26	840061/005	Rohde & Schwarz GmbH & Co. KG
	Calibration after reparation		2015/04/02 2017/04/01
Vector Signal Generator	SMIQ 03B	837747/020	Rohde & Schwarz GmbH & Co. KG

Test Equipment T/A Logger 13

Lab ID: Lab 3, Lab 4
Description: Lufft Opus10 TPR
Type: Opus10 TPR
Serial Number: 13936

Single Devices for T/A Logger 13

Single Device Name	Type	Serial Number	Manufacturer
ThermoAirpressure Datalogger 13 (Environ)	Opus10 TPR (8253.00)	13936	Lufft Mess- und Regeltechnik GmbH
	Customized calibration		2015/02/27 2017/02/26

Test Equipment T/H Logger 03

Lab ID: Lab 4
Description: Lufft Opus10
Serial Number: 7482

Single Devices for T/H Logger 03

Single Device Name	Type	Serial Number	Manufacturer
ThermoHygro DataloggerOpus10 THI (8152.00) 03 (Environ)		7482	Lufft Mess- und Regeltechnik GmbH
	Customized calibration		2015/02/27 2017/02/26

Test Equipment T/H Logger 12

Lab ID: Lab 3
Description: Lufft Opus10
Serial Number: 12482

Single Devices for T/H Logger 12

Single Device Name	Type	Serial Number	Manufacturer
ThermoHygro DataloggerOpus10 THI (8152.00) 12 (Environ)		12482	Lufft Mess- und Regeltechnik GmbH
	Customized calibration		2015/03/10 2017/03/09

Test Equipment Temperature Chamber 05

Lab ID: Lab 4
Manufacturer: see single devices
Description: Temperature Chamber VT4002
Type: Vötsch
Serial Number: see single devices

Single Devices for Temperature Chamber 05

Single Device Name	Type	Serial Number	Manufacturer
Temperature Chamber Vötsch 05	VT 4002	58566080550010	Vötsch
	Customized calibration		2014/03/11 2016/03/10

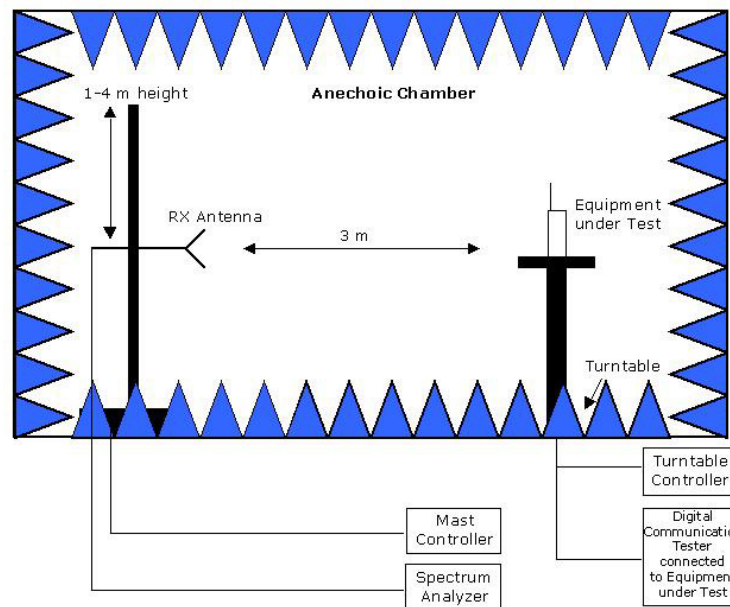
5 Measurement Uncertainty

Test Case	Parameter	Uncertainty
AC Power Line	Power	± 3.4 dB
Field Strength of spurious radiation	Power	± 5.5 dB
6 dB / 26 dB / 99% Bandwidth	Power Frequency	± 2.9 dB ± 11.2 kHz
Conducted Output Power	Power	± 2.2 dB
Band Edge Compliance	Power Frequency	± 2.2 dB ± 11.2 kHz
Frequency Stability	Frequency	± 25 Hz
Power Spectral Density	Power	± 2.2 dB

6 Photo Report

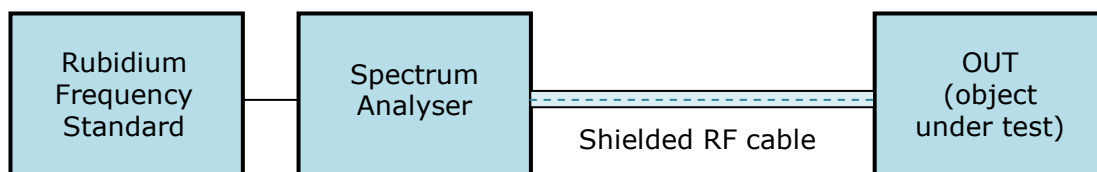
Please refer to external report.

7 Setup Drawings



Remark: Depending on the frequency range suitable antenna types, attenuators or preamplifiers are used.

Drawing 1: Setup in the Anechoic chamber. For measurements below 1 GHz the ground was replaced by a conducting groundplane.



Drawing 2: Setup for conducted radio tests.