InterLab®

FCC Measurement/Technical Report on

WLAN transceiver
FC7100 HW09

FCC ID: RKXFC7100
IC: 5119A-FC7100

Report Reference: MDE_PARRO_1508_FCCd

Test Laboratory:
7layers GmbH
Borsigstrasse 11
40880 Ratingen
Germany

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

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0 Applied Standards and Test Summary

0.1 Applied Standards

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 (10-1-14 Edition) and 15 (10-1-14 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

Part 15, Subpart E – Unlicensed National Information Infrastructure Devices

§ 15.403 Definitions

§ 15.407 General technical requirements

Note:
The tests were selected and performed with reference to the FCC Public Notice "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, 789033 D02 General U-NII Test Procedures v01, 2014-06-06".

ANSI C63.10-2013 is applied.

FCC ET Docket No. 13-49, FIRST REPORT AND ORDER, April 1, 2014 ("new rules") is applied.

Summary Test Results:

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

0.2 FCC-IC Correlation Table

Correlation of measurement requirements for UNII / LE-LAN (e.g. WLAN 5 GHz) equipment from FCC and IC

UNII equipment

Measurement	FCC reference	IC reference
Conducted emissions on AC Mains	§ 15.207	RSS-Gen Issue 4: 8.8
Occupied bandwidth	§ 15.403 (i) (26 dB) / § 15.407 (e) (6 dB)	RSS-247 Issue 1: 6.2.1 (1), 6.2.2 (1), 6.2.3 (1) (99%) RSS-247 Issue 1: 6.2.4 (1) (6 dB)
Maximum conducted output power	§ 15.407 (a) (1),(2),(3),(4)	RSS-247 Issue 1: : 6.2.1 (1), 6.2.2 (1), 6.2.3 (1), 6.2.4 (1)
Maximum power spectral density	§ 15.407 (a) (1),(2),(3),(5)	RSS-247 Issue 1: : 6.2.1 (1), 6.2.2 (1), 6.2.3 (1), 6.2.4 (1)
Transmitter undesirable emissions; General Field Strength Limits, Restricted Bands	15.407 (b) § 15.209 (a)	RSS-Gen Issue 4: 6.13/8.9/8.10; RSS-247 Issue 1: : 6.2.1 (2), 6.2.2 (2), 6.2.3 (2), 6.2.4 (2)
Frequency stability	§ 15.407 (g)	RSS-Gen Issue 4: 6.11/8.11
Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS)	§ 15.407 (h)	RSS-247 Issue 1: 6.2.2 (1), 6.2.3 (1), 6.3
Antenna requirement	§ 15.203 / 15.204	RSS-Gen Issue 4: 8.3
Receiver spurious emissions	–	-

0.3 Measurement Summary / Signatures

FCC Part 15, Subpart C **§ 15.207**

Conducted emissions (AC power line)
The measurement was performed according to ANSI C63.10

OP-Mode	Setup	Port	Final Result
-	-	AC Port (power line)	N/P

FCC Part 15, Subpart E **§ 15.403 (i), 15.407 (e)**

26 / 6 dB Emission bandwidth / 99 % occupied bandwidth
The measurement was performed according to FCC § 15.31

OP-Mode	Setup	Port	Final Result
a-Mode, CH 36, 20 MHz	Setup_01	Temp.ant.connector	N/P
a-Mode, CH 44, 20 MHz	Setup_01	Temp.ant.connector	N/P
a-Mode, CH 48, 20 MHz	Setup_01	Temp.ant.connector	N/P
a-Mode, CH 149, 20 MHz	Setup_01	Temp.ant.connector	N/P
a-Mode, CH 157, 20 MHz	Setup_01	Temp.ant.connector	N/P
a-Mode, CH 165, 20 MHz	Setup_01	Temp.ant.connector	N/P
n-Mode, CH 36, 20 MHz	Setup_01	Temp.ant.connector	N/P
n-Mode, CH 44, 20 MHz	Setup_01	Temp.ant.connector	N/P
n-Mode, CH 48, 20 MHz	Setup_01	Temp.ant.connector	N/P
n-Mode, CH 149, 20 MHz	Setup_01	Temp.ant.connector	N/P
n-Mode, CH 157, 20 MHz	Setup_01	Temp.ant.connector	N/P
n-Mode, CH 165, 20 MHz	Setup_01	Temp.ant.connector	N/P
n-Mode, CH 38, 40 MHz	Setup_01	Temp.ant.connector	N/P
n-Mode, CH 46, 40 MHz	Setup_01	Temp.ant.connector	N/P
n-Mode, CH 151, 40 MHz	Setup_01	Temp.ant.connector	N/P
n-Mode, CH 159, 40 MHz	Setup_01	Temp.ant.connector	N/P

FCC Part 15, Subpart E **§ 15.407 (a)(1,2,3,4)**

Maximum Conducted Output Power
The measurement was performed according to FCC § 15.31

			Final Result	
OP-Mode	**Setup**	**Port**	**FCC**	**IC**
a-Mode, CH 36, 20 MHz	Setup_01	Temp.ant.connector	passed	passed
a-Mode, CH 44, 20 MHz	Setup_01	Temp.ant.connector	passed	passed
a-Mode, CH 48, 20 MHz	Setup_01	Temp.ant.connector	passed	passed
a-Mode, CH 149, 20 MHz	Setup_01	Temp.ant.connector	passed	passed
a-Mode, CH 157, 20 MHz	Setup_01	Temp.ant.connector	passed	passed
a-Mode, CH 165, 20 MHz	Setup_01	Temp.ant.connector	passed	passed
n-Mode, CH 36, 20 MHz	Setup_01	Temp.ant.connector	passed	passed
n-Mode, CH 44, 20 MHz	Setup_01	Temp.ant.connector	passed	passed
n-Mode, CH 48, 20 MHz	Setup_01	Temp.ant.connector	passed	passed
n-Mode, CH 149, 20 MHz	Setup_01	Temp.ant.connector	passed	passed
n-Mode, CH 157, 20 MHz	Setup_01	Temp.ant.connector	passed	passed
n-Mode, CH 165, 20 MHz	Setup_01	Temp.ant.connector	passed	passed
n-Mode, CH 38, 40 MHz	Setup_01	Temp.ant.connector	passed	passed
n-Mode, CH 46, 40 MHz	Setup_01	Temp.ant.connector	passed	passed
n-Mode, CH 151, 40 MHz	Setup_01	Temp.ant.connector	passed	passed
n-Mode, CH 159, 40 MHz	Setup_01	Temp.ant.connector	passed	passed

FCC Part 15, Subpart E	§ 15.407 (a)(1,2,3,5)			
Maximum Power Spectral Density				
The measurement was performed according to FCC § 15.31			Final Result	
OP-Mode	**Setup**	**Port**	**FCC**	**IC**
a-Mode, CH 36, 20 MHz	Setup_01	Temp.ant.connector	N/P	N/P
a-Mode, CH 44, 20 MHz	Setup_01	Temp.ant.connector	N/P	N/P
a-Mode, CH 48, 20 MHz	Setup_01	Temp.ant.connector	N/P	N/P
a-Mode, CH 149, 20 MHz	Setup_01	Temp.ant.connector	N/P	N/P
a-Mode, CH 157, 20 MHz	Setup_01	Temp.ant.connector	N/P	N/P
a-Mode, CH 165, 20 MHz	Setup_01	Temp.ant.connector	N/P	N/P
n-Mode, CH 36, 20 MHz	Setup_01	Temp.ant.connector	N/P	N/P
n-Mode, CH 44, 20 MHz	Setup_01	Temp.ant.connector	N/P	N/P
n-Mode, CH 48, 20 MHz	Setup_01	Temp.ant.connector	N/P	N/P
n-Mode, CH 149, 20 MHz	Setup_01	Temp.ant.connector	N/P	N/P
n-Mode, CH 157, 20 MHz	Setup_01	Temp.ant.connector	N/P	N/P
n-Mode, CH 165, 20 MHz	Setup_01	Temp.ant.connector	N/P	N/P
n-Mode, CH 38, 40 MHz	Setup_01	Temp.ant.connector	N/P	N/P
n-Mode, CH 46, 40 MHz	Setup_01	Temp.ant.connector	N/P	N/P
n-Mode, CH 151, 40 MHz	Setup_01	Temp.ant.connector	N/P	N/P
n-Mode, CH 159, 40 MHz	Setup_01	Temp.ant.connector	N/P	N/P

FCC Part 15, Subpart E	§ 15.407 (g)		
Frequency Stability			
The measurement was performed according to FCC § 15.31			
OP-Mode	**Setup**	**Port**	**Final Result**
-	Setup_01	Temp.ant.connector	N/P

FCC Part 15, Subpart C & E	§ 15.205, § 15.209 § 15.407 (b)(1,2,3,4,5,6)		
Undesirable Emissions, General Field Strength Limits;			
Restricted Bands and Radiated Emission Limits			
The measurement was performed according to ANSI C63.10			Final Result
OP-Mode	**Setup**	**Port**	**FCC**	**IC**
a-Mode, CH 36, 20 MHz	Setup_02	Enclosure	N/P	N/P
a-Mode, CH 44, 20 MHz	Setup_02	Enclosure	passed	passed
a-Mode, CH 48, 20 MHz	Setup_02	Enclosure	N/P	N/P
a-Mode, CH 149, 20 MHz	Setup_02	Enclosure	N/P	N/P
a-Mode, CH 157, 20 MHz	Setup_02	Enclosure	passed	passed
a-Mode, CH 165, 20 MHz	Setup_02	Enclosure	N/P	N/P
n-Mode, CH 36, 20 MHz	Setup_02	Enclosure	N/P	N/P
n-Mode, CH 44, 20 MHz	Setup_02	Enclosure	N/P	N/P
n-Mode, CH 48, 20 MHz	Setup_02	Enclosure	N/P	N/P
n-Mode, CH 149, 20 MHz	Setup_02	Enclosure	N/P	N/P
n-Mode, CH 157, 20 MHz	Setup_02	Enclosure	N/P	N/P
n-Mode, CH 165, 20 MHz	Setup_02	Enclosure	N/P	N/P
n-Mode, CH 38, 40 MHz	Setup_02	Enclosure	N/P	N/P
n-Mode, CH 46, 40 MHz	Setup_02	Enclosure	N/P	N/P
n-Mode, CH 151, 40 MHz	Setup_02	Enclosure	N/P	N/P
n-Mode, CH 159, 40 MHz	Setup_02	Enclosure	N/P	N/P

FCC Part 15, Subpart E	§ 15.407 (h)		
Dynamic Frequency selection			
The measurement was performed according to FCC § 15.31			**Final Result**
OP-Mode	**Setup**	**Port**	**FCC** **IC**
–	–	–	N/A [1)] N/A [1)]

N/A Not applicable:
1) the EUT operates only in bands where DFS is not required.
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_FCCd

Responsible for Accreditation Scope: MARCO KULLIK 2015.09.25 17:56:09 +02'00'

Responsible for Test Report: DANIEL GALL 2015.09.25 17:51:37 +02'00'

1 Administrative Data

1.1 Testing Laboratory

Company Name:	7layers 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:	2015-09-10

1.2 Project Data

Responsible for testing and report:	Dipl.-Ing. Daniel Gall
Employees who performed the tests:	documented internally at 7Layers
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 802.11 a/b/g/n WLAN transceiver
Type Designation:	FC7100
Kind of Device:	Module supporting these technologies:
(optional)	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 5 GHz band using Direct Sequence Spread Spectrum (DSSS) Modulation and Orthogonal Frequency Division Multiplexing (OFDM).

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 ranges 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 is 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 + 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

	UNII-Subband 1 5150 - 5250 MHz			UNII-Subband 3 5725 - 5850 MHz			Nom. BW
20 MHz Test Channels:	**Bottom**	**Middle**	**Top**	**Bottom**	**Middle**	**Top**	**20 MHz**
Channel:	36	44	48	149	157	165	**Ch.-No.**
Frequency [MHz]	5180	5220	5240	5745	5785	5825	**MHz**

40 MHz Test Channels:	**Bottom**	**Middle**	**Top**	**Bottom**	**Middle**	**Top**	**40 MHz**
Channel:	38	-	46	151	-	159	**Ch.-No.**
Frequency [MHz]	5190	-	5230	5755	-	5795	**MHz**

2.6.2 Datarates

WLAN a-Mode; 20 MHz; 6 Mbit/s
WLAN n-Mode; 20 MHz; 6,5 Mbit/s
WLAN n-Mode; 40 MHz; 150 Mbit/s

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 Maximum conducted output power

Standard FCC Part 15, Subpart E

The test was performed according to: FCC §15.31

3.1.1 Test Description

The Equipment Under Test (EUT) was set up in a shielded room to perform the output power measurements. The results recorded were measured with the modulation which produces the worst-case (highest) output power. The EUT was connected to spectrum analyser via a short coax cable with a known loss.

Analyser settings:
- Resolution Bandwidth (RBW): 1 MHz
- Video Bandwidth (VBW): 3 MHz
- Detector: RMS
- Trace: Average, RMS power averaging mode
- Sweeps: 100
- Sweeptime: coupled
- Trigger: gated mode

Note:
The analyser settings are according FCC Public Note "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, 789033 D02", method **SA-1**.

3.1.2 Test Requirements / Limits

A) FCC
For systems using digital modulation techniques in the 5.15 – 5.25 GHz bands:
§15.407 (a) (1)
Limit: 50 mW (17 dBm) or 4 dBm + 10 log (26 dB bandwidth/MHz) whatever is the lesser.
FCC ET Docket No. 13-49, FIRST REPORT AND ORDER, April 1, 2014 ("new rules"):
§15.407 (a) (1) (i): Outdoor access point:
Limit: 1 W (30 dBm) provided the maximum antenna gain does not exceed 6 dBi.
The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).
§15.407 (a) (1) (ii): Indoor access point:
Limit: 1 W (30 dBm) provided the maximum antenna gain does not exceed 6 dBi.
§15.407 (a) (1) (iv): Mobile and portable client devices:
Limit: 250 mW (24 dBm) provided the maximum antenna gain does not exceed 6 dBi.

For systems using digital modulation techniques in the 5.25 – 5.35 GHz and 5.47 – 5.725 GHz bands:
§15.407 (a) (2)
Limit: 250 mW (24 dBm) or 11 dBm + 10 log (26 dB bandwidth/MHz) whatever is the lesser.

For systems using digital modulation techniques in the 5.725 – 5.850 GHz bands:
§15.407 (a) (3)
Limit: 1 W (30 dBm) or 17 dBm + 10 log (26 dB bandwidth/MHz) whatever is the lesser.
FCC ET Docket No. 13-49, FIRST REPORT AND ORDER, April 1, 2014 ("new rules"):
§15.407 (a) (3):
Limit: 1 W (30 dBm).

§15.407 (a) (4):
The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

B) IC
Different frequency bands and limits apply, as compared to the FCC requirements.

RSS-247, 6.2 (1), Band 5150-5250 MHz, indoor operation only:
Limit (e.i.r.p.): 200 mW (23 dBm) or 10 + 10 log10 B [dBm], whichever power is less.
B is the 99% emission bandwidth in MHz.

RSS-247, 6.2 (2), Band 5250-5350 MHz:
Limits:
Maximum conducted Power: 250 mW (24 dBm) or 11 + 10 log10 B [dBm], whichever power is less.
e.i.r.p.: 1.0 W (30 dBm) or 17 + 10 log10 B [dBm], whichever power is less.

Note: For EUTs operating at a higher e.i.r.p. than 200 mW (23 dBm), compliance with the e.i.r.p. elevation mask is required.

RSS-247, 6.2 (3), Bands 5470-5600 MHz and 5650-5725 MHz:
Limits:
Maximum conducted Power: 250 mW (24 dBm) or 11 + 10 log10 B [dBm], whichever power is less.
e.i.r.p.: 1.0 W (30 dBm) or 17 + 10 log10 B [dBm], whichever power is less.

RSS-247, 6.2 (4), Band 5725-5825 MHz:
Limits:
Maximum conducted Power: 1W (30 dBm) or 17 + 10 log10 B [dBm], whichever power is less.
e.i.r.p.: 4.0 W (36 dBm) or 23 + 10 log10 B [dBm], whichever power is less.

All frequency bands: B is the 99% emission bandwidth in MHz.

3.1.3 Test Protocol

Ambient temperature: 23 °C

Air Pressure: 1010 hPa

Humidity: 40 %

WLAN a-Mode; 20 MHz; 6 Mbit/s					FCC		IC				
UNII-Sub-band	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	Cond. Limit [dBm]	Margin [dB]	Cond. Limit [dBm]	Margin [dB]	EIRP Limit [dBm]	Margin [dB]	
1	36	5180	15.0	17.5	30.0	15.0	N/A		23.0	5.5	1)
	44	5220	14.7	17.2	30.0	15.3	N/A		23.0	5.8	1)
	48	5240	14.7	17.2	30.0	15.3	N/A		23.0	5.8	1)
3	149	5745	13.7	16.2	30.0	16.4	30.0	16.4	36.0	19.9	
	157	5785	13.5	16.0	30.0	16.5	30.0	16.5	36.0	20.0	
	165	5825	13.6	16.1	30.0	16.4	30.0	16.4	36.0	19.9	

WLAN n-Mode; 20 MHz; 6,5 Mbit/s					FCC		IC				
UNII-Sub-band	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	Cond. Limit [dBm]	Margin [dB]	Cond. Limit [dBm]	Margin [dB]	EIRP Limit [dBm]	Margin [dB]	
1	36	5180	15.2	17.7	30.0	14.8	N/A		23.0	5.3	1)
	44	5220	14.5	17.0	30.0	15.5	N/A		23.0	6.0	1)
	48	5240	14.3	16.8	30.0	15.7	N/A		23.0	6.2	1)
3	149	5745	13.6	16.1	30.0	16.4	30.0	16.4	36.0	19.9	
	157	5785	13.6	16.1	30.0	16.5	30.0	16.5	36.0	20.0	
	165	5825	13.5	16.0	30.0	16.5	30.0	16.5	36.0	20.0	

WLAN n-Mode; 40 MHz; 150 Mbit/s					FCC		IC				
UNII-Sub-band	Ch. No.	Freq. [MHz]	Cond. Power [dBm]	EIRP [dBm]	Cond. Limit [dBm]	Margin [dB]	Cond. Limit [dBm]	Margin [dB]	EIRP Limit [dBm]	Margin [dB]	
1	38	5190	14.4	16.9	30.0	15.6	N/A		23.0	6.1	1)
	46	5230	13.8	16.3	30.0	16.3	N/A		23.0	6.8	1)
3	151	5755	12.9	15.4	30.0	17.1	30.0	17.1	36.0	20.6	
	159	5795	13.3	15.8	30.0	16.8	30.0	16.8	36.0	20.3	

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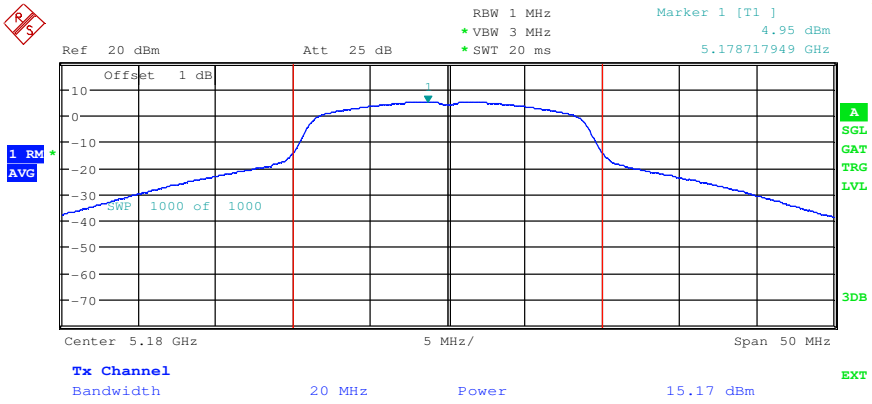
Maximum [dBm]:	20 MHz:	15.2	40 MHz:	14.4	(conducted)
Maximum [dBm]:	20 MHz:	17.7	40 MHz:	16.9	(EIRP)

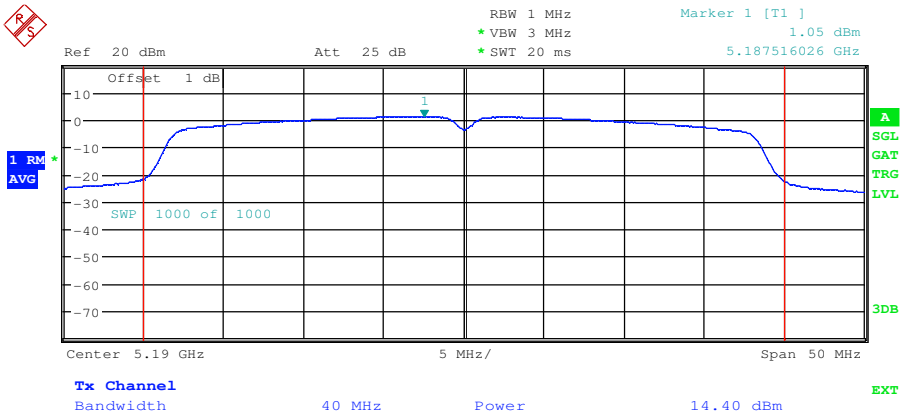
1) = no additional limit applies related to the elevation.

Note: The IC limit is chosen according the bandwidth measured in the initial report.

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



Date: 16.JUL.2015 11:00:50



Date: 16.JUL.2015 11:19:46

3.2 Undesirable Emissions / General Field Strength Limits; Restricted Band and Radiated Emission Limits, Band Edge

Standard FCC Part 15, Subpart C & E

The test was performed according to: ANSI C63.10

3.2.1 Test Description

The radiated emissions measurements were made in a typical installation configuration. The measurement procedure is implemented into the EMI test software ES-K1 from R&S.

1. Measurement up to 30 MHz
The Equipment Under Test (EUT) was set up on a non-conductive table in the anechoic chamber.
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 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: 200 Hz - 10 kHz
- Measuring time / Frequency step: 100 ms

2. Measurement above 30 MHz and up to 1 GHz
Step 1: Preliminary scan
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 µs
- 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 be slowly varied by ±22.5° 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 is also slowly varied 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: –22.5° to +22.5° around the determined value
- Height variation range: –0.25 m to +0.25 m 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
- 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.

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 15 GHz) and a horn antenna (15-26 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 15 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.

In the frequency range 26 – 40 GHz the measurement was performed conducted.

3.2.2 Test Requirements / Limits

A) FCC

FCC Part 15 Subpart E , §15.407 (b)(1)
For transmitters operating in the 5150–5250 MHz band:
Limit: –27 dBm/MHz EIRP outside of the band 5150–5350 MHz.

FCC Part 15 Subpart E , §15.407 (b)(2)
For transmitters operating in the 5250–5350 MHz band:
Limit: –27 dBm/MHz EIRP outside of the band 5150–5350 MHz.

FCC Part 15 Subpart E , §15.407 (b)(3)
For transmitters operating in the 5470–5725 MHz band:
Limit: –27 dBm/MHz EIRP outside of the band 5470–5725 MHz.

FCC Part 15 Subpart E , §15.407 (b)(4)
For transmitters operating in the 5725–5850 MHz band:
Limit: –27 dBm/MHz EIRP outside of the band 5715–5860 MHz and additionally
Limit: –17 dBm/MHz EIRP within the frequency ranges 5715–5725 and 5850–5860 MHz.

B) IC
Different frequency bands and limits apply, as compared to the FCC requirements.

RSS-247, A6.2 (1), Emissions outside the band 5150-5250 MHz, indoor operation only:
Limit: –27 dBm/MHz EIRP outside of the band 5150–5250 MHz.

RSS-247, A6.2 (2), Emissions outside the band 5250-5350 MHz:
Limit: –27 dBm/MHz EIRP outside of the band 5250–5350 MHz.

RSS-247, A6.2 (3), Emissions outside the bands 5470-5600 MHz and 5650-5725 MHz:
Limit: –27 dBm/MHz EIRP outside of the band 5470–5725 MHz.
Note: No operation is permitted for the frequency range 5600–5650 MHz.

RSS-247, A6.2 (4), Emissions outside the band 5725-5825 MHz:
Limit: –27 dBm/MHz EIRP outside of the band 5715–5835 MHz and additionally
Limit: –17 dBm/MHz EIRP within the frequency ranges 5715–5725 and 5825–5835 MHz.

C) FCC & IC

FCC Part 15 Subpart E , §15.405 and §15.407 (b)(6,7)
Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209. The provisions of §§ 15.203 and 15.205 are included.

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

Frequency in MHz	Limit (µV/m)	Specified distance (m)	Measurement distance (m)	Calculated Limit (dBµV/m @10m)	Limit (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: Limit (dBµV/m) = 20 log (Limit (µV/m)/1µV/m)
Limit (dBµV/m) = EIRP [dBm] – 20 log (d [m]) + 104.8
where d is the measurement distance

3.2.3 Test Protocol

Limit types:
RB – Emissions falls into a "Restricted Band" according FCC §§15.205 and 15.209 *)
UE – "Undesirable Emission Limit" according FCC §15.407
BE-RB – Band Edge Limit basing on "Restricted Band Limits"
BE-UE – Band Edge Limit basing on "Undesirable Emission Limit"
*) Below 1 GHz the limits of §15.209 are applied for all frequencies.

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

3.2.3.1 Radiated spurious and undesired emissions

WLAN a-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]	Detec-tor	RBW [kHz]	Limit [dBµV/m]	Margin [dB]	Limit Type
44	5220	428.0	35.2	QP	120	46.0	10.8	RB
44	5220	2004.9	51.2	PEAK	1000	68.0	16.8	UE
44	5220	5113.9	53.3	AV	1000	54.0	0.7	RB
44	5220	5147.6	62.4	PEAK	1000	74.0	11.6	RB
44	5220	15661.5	49.2	AV	1000	54.0	4.8	RB
157	5785	2004.8	51.6	PEAK	1000	68.0	16.4	UE
157	5785	3856.6	57.0	PEAK	1000	74.0	17.0	RB
157	5785	3856.6	53.6	AV	1000	54.0	0.4	RB
157	5785	4820.8	58.5	PEAK	1000	74.0	15.5	RB
157	5785	5705.9	63.9	PEAK	1000	68.0	4.1	UE
157	5785	5724.3	67.0	PEAK	1000	78.0	11.0	BE
157	5785	17110.2	62.7	PEAK	1000	68.0	5.3	UE

Note: No (further) spurious emissions in the range 20 dB below the limit found.

The tests have been performed in the frequency range 30–26500 MHz.

4 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

5 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 m³		
	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 m³ 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	AM4.0/180/11920513	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	
	Calibration Details		*Last Execution*	*Next Exec.*
	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	
	Calibration Details		*Last Execution*	*Next Exec.*
	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.	
	Calibration Details		*Last Execution*	*Next Exec.*
	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 Transformatorenwerke GmbH	
Notch Filter Ultra Stable (Aux)	WRCA800/960-6EEK	24	Wainwright	
Signal Analyzer	FSV30	103005	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		*Last Execution*	*Next Exec.*
	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 Analyser	ESR 7	101424	Rohde & Schwarz	
	Calibration Details		*Last Execution*	*Next Exec.*
	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	
	Calibration Details		*Last Execution*	*Next Exec.*
	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
	HW/SW Status		*Date of Start*	*Date of End*
	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.	
	Calibration Details		*Last Execution*	*Next Exec.*
	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 Divider SMA	WA1515	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 Datalogger 03 (Environ)	Opus10 THI (8152.00)	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 Datalogger 12 (Environ)	Opus10 THI (8152.00)	12482	Lufft Mess- und Regeltechnik GmbH	
	Customized calibration		2015/03/10	2017/03/09

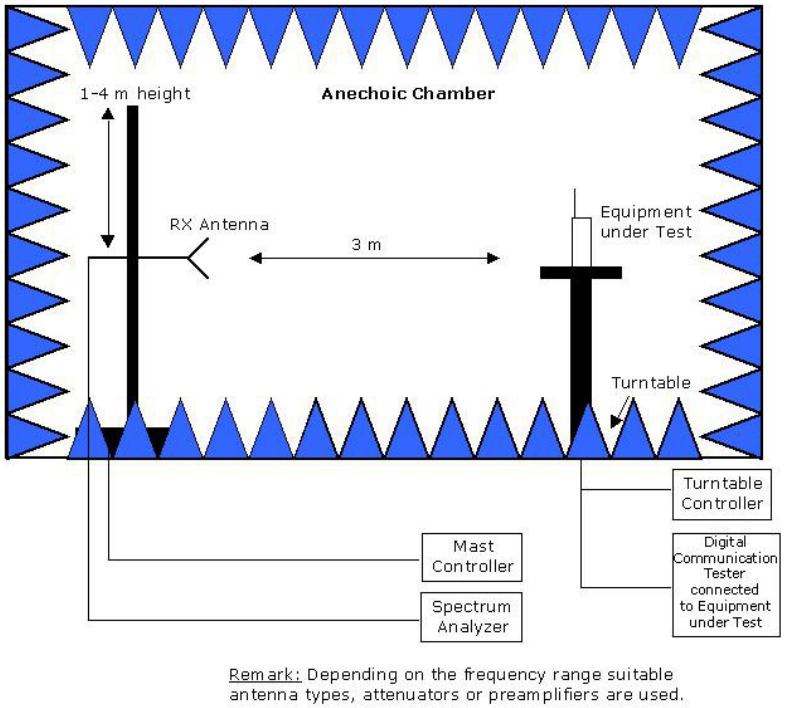
Test Equipment Temperature Chamber 05

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

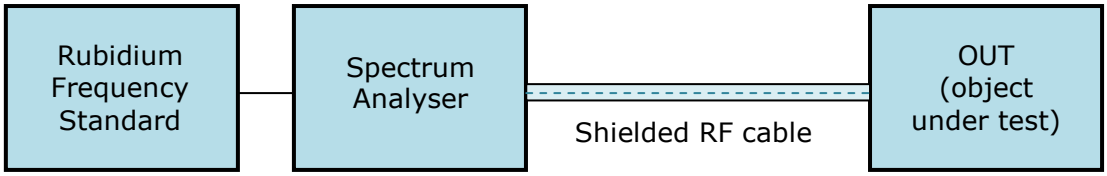
Single Devices for Temperature Chamber 05

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

6 Setup Drawings



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.

7 Photo Report

Please refer to external report.