



Inter**Lab**<sup>®</sup>

FCC Measurement/Technical Report on

WLAN transceiver  
WiBear11n-DF1

FCC ID PV7-WIBEAR11N-DF1  
IC: 7738A-WB11NDF1

**Report Reference:** MDE\_LESSW\_1401\_FCCb

**Test Laboratory:**

7Layers AG  
Borsigstrasse 11  
40880 Ratingen  
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.

7 layers AG  
Borsigstrasse 11  
40880 Ratingen, Germany  
Phone: +49 (0) 2102 749 0  
Fax: +49 (0) 2102 749 350  
www.7Layers.com

Aufsichtsratsvorsitzender •  
Chairman of the Supervisory Board:  
Peter Mertel  
Vorstand • Board:  
Dr. H.-J. Meckelburg  
Dr. H. Ansorge

Registergericht • registered in:  
Düsseldorf, HRB 44096  
USt-IdNr • VAT No.:  
DE 203159652  
TAX No. 147/5869/0385

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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 (10-1-13 Edition) 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

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 D01 General U-NII Test Procedures v01r03, 2013-4-08"

Instead of applying ANSI C63.4–1992 which is referenced in the FCC Public Note, the newer ANSI C63.4–2009 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

#### UNII equipment

Measurement	FCC reference	IC reference
Conducted emissions on AC Mains	§ 15.207	RSS-Gen Issue 3: 7.2.4
Occupied bandwidth	§ 15.403 (i) (26 dB) / § 15.407 (e) (6 dB)	RSS-210 Issue 8: A9.2, 9.4 (99%)
Maximum conducted output power	§ 15.407 (a) (1),(2),(3),(4)	RSS-210 Issue 8: A9.2, 9.4
Maximum power spectral density	§ 15.407 (a) (1),(2),(3),(5)	RSS-210 Issue 8: A9.2, 9.4
Transmitter undesirable emissions; General Field Strength Limits, Restricted Bands	15.407 (b) § 15.209 (a)	RSS-Gen Issue 3: 6; RSS-210 Issue 8: A9.2, 9.4
Frequency stability	§ 15.407 (g)	RSS-Gen Issue 3: 7.2.6, 4.7
Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS)	§ 15.407 (h)	RSS-210 Issue 8: A9.2, 9.4
Antenna requirement	§ 15.203 / 15.204	RSS-Gen Issue 3: 7.1.2
Receiver spurious emissions	–	RSS-210 Issue 8: 2.3; RSS Gen Issue 3: 6 *)

\*) Receivers which are part of Transceivers are exempted with respect to Notice 2012-DRS0126.



### 0.3 Measurement Summary / Signatures

#### FCC Part 15, Subpart C § 15.207

Conducted emissions (AC power line)

The measurement was performed according to ANSI C63.4

OP-Mode	Setup	Port	Final Result	
-	-	AC Port (power line)	N/A <sup>1)</sup>	

#### 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	
-	-	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

OP-Mode	Setup	Port	Final Result	
-	-	Temp.ant.connector	FCC	IC
			N/P	

#### 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

OP-Mode	Setup	Port	Final Result	
-	-	Temp.ant.connector	FCC	IC
			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	
-	-	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 C63.4

OP-Mode	Setup	Port	Final Result	
			FCC	IC
n-Mode, CH 44, 20 MHz	Setup_02	Enclosure	passed	passed
n-Mode, CH 56, 20 MHz	Setup_02	Enclosure	passed	passed
n-Mode, CH 116, 20 MHz	Setup_02	Enclosure	passed	passed
n-Mode, CH 159, 40 MHz	Setup_02	Enclosure	passed	passed

#### FCC Part 15, Subpart E § 15.407 (h)

Dynamic Frequency selection

The measurement was performed according to FCC § 15.31

OP-Mode	Setup	Port	Final Result	
-	-	-	FCC	IC
			N/P	N/P



- N/A Not applicable:  
1) the EUT is powered by DC, transmitter is automatically switched off when connected to USB  
2) the EUT operates only in bands where DFS is not required.
- N/P Not performed

Only the test case "Undesirable Emissions, General Field Strength Limits; Restricted Bands and Radiated Emission Limits" (incl. additional band edge measurements) in the frequency range from 30 MHz – 26.5 have been performed in the stated operating modes.

The EUT, in the same hardware and software configuration, was already completely tested.

For details please refer to the 7 Layers test report MDE\_LESSW\_1302\_FFCb.

The purpose of this test report is to show the compliance of the EUT for the performed test cases with a new external antenna (see ANC1 for details).

Responsible for  
Accreditation Scope: \_\_\_\_\_

Responsible  
for Test Report: \_\_\_\_\_



## **1 Administrative Data**

### **1.1 Testing Laboratory**

Company Name: 7Layers AG  
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 .

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: 2014-08-22

### **1.2 Project Data**

Responsible for testing and report: Dipl.-Ing. Daniel Gall  
Date of Test(s): 2014-08-27 to 2014-08-28  
Date of Report: 2014-10-06

### **1.3 Applicant Data**

Company Name: Lesswire AG  
Address: Rudower Chaussee 30  
12489 Berlin  
Germany  
Dr. Daniel Dietterle  
Contact Person:

### **1.4 Manufacturer Data**

Company Name: PRETTL Electronics AG  
Address: Robert-Bosch-Straße 10,  
01454 Radeberg, Germany  
Kerstin Sauer  
Contact Person:

## 2 Test object Data

### 2.1 General EUT Description

<b>Equipment under Test:</b>	IEEE 802.11a/b/g/n WLAN transceiver
<b>Type Designation:</b>	WiBear11n – DF1
<b>Kind of Device:</b>	Transceiver module
<b>(optional)</b>	
<b>Voltage Type:</b>	DC
<b>Voltage Level:</b>	1.8 V and 3.3 V
<b>Tested Modulation Type:</b>	DBPSK; OFDM:64-QAM

#### General product description:

The EUT is industrial universal module, targeted for integration into different Original Equipment Manufacturer products. The module is designed for both - simultaneous and independent operation of the following:

IEEE 802.11a/b/g/n payload data rates for Wireless Local Area Network (WLAN), Bluetooth 3.0+High Speed (HS) and Bluetooth 2.1+EDR. It provides a complete end-to-end solution for low power applications. It includes an integrated MAC/Baseband processor and RF front-end components, and can connect to a host processor via SDIO interface.

#### 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 and Bluetooth. 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 object of this test report is the WLAN transceiver, consequently switched on the IEEE 802.11 a/b/g/n modes, working in 2.4 GHz and 5 GHz bands. In IEEE 802.11n mode, it was tested with 20 MHz and 40 MHz channel bandwidth.

#### The EUT provides the following ports:

##### Ports

Enclosure  
DC port  
Data Port  
Antenna 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: LS000a01)	WLAN transceiver	WiBear11n - DF1	AN00J93172 C433 8004 5499	mounted on evaluation board #20 Ver. C4	14.44.35.p200 -
Remark: EUT A is equipped with joint antenna connector. It was connected to ANC1 (max. gain in the 5 GHz Band: 4.6 dBi)					

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	Antenna	LINX ANT-DB1-RAF-RP5	-	-	-

## 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
-	-	-	-	-	-

## 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_01	EUT A + ANC1	setup for radiated measurements
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## 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:

UNII-Subband 1 5150 - 5250 MHz			UNII-Subband 2A 5250 - 5350 MHz			UNII-Subband 2C 5470 - 5725 MHz			UNII-Subband 3 5725 - 5850 MHz		
Bottom	Middle	Top	Bottom	Middle	Top	Bottom	Middle	Top	Bottom	Middle	Top
36	44	-	-	56	64	100	116	140	149	-	165
5180	5220	-	-	5280	5320	5500	5580	5700	5745	-	5825

40 MHz Test Channels:

UNII-Subband 1 5150 - 5250 MHz			UNII-Subband 2A 5250 - 5350 MHz			UNII-Subband 2C 5470 - 5725 MHz			UNII-Subband 3 5725 - 5850 MHz		
Bottom	Middle	Top	Bottom	Middle	Top	Bottom	Middle	Top	Bottom	Middle	Top
-	-	-	-	-	-	-	-	-	-	-	159
-	-	-	-	-	-	-	-	-	-	-	5795

### 2.6.2 Datarates

SISO:

WLAN n-Mode; 20 MHz; 72.2 Mbit/s
WLAN n-Mode; 40 MHz; 150 Mbit/s

## 2.7 Special software used for testing

Marvell Labtool SW is used to set the EUT at different operating modes.

## 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 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 C 63.4

#### 3.1.1 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  $\mu$ 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  $180^\circ$
- Turntable step size:  $45^\circ$
- 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):  $45^\circ$
- 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  $\pm 22.5^\circ$  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 is also slowly varied by  $\pm 25$  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:  $-22.5^\circ$  to  $+22.5^\circ$  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.

### **3.1.2 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-210, A9.2 (1), Emissions outside the band 5150-5250 MHz, indoor operation only:  
Limit: -27 dBm/MHz EIRP outside of the band 5150-5250 MHz.

RSS-210, A9.2 (2), Emissions outside the band 5250-5350 MHz:  
Limit: -27 dBm/MHz EIRP outside of the band 5250-5350 MHz.

RSS-210, A9.2 (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-210, A9.2 (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)	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	(48.9 – 23.0) + 19.1 dB	60.0 – 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:       $\text{Limit (dBµV/m)} = 20 \log (\text{Limit (µV/m)}/1\mu\text{V/m})$   
     $\text{Limit (dBµV/m)} = \text{EIRP [dBm]} - 20 \log (d [\text{m}]) + 104.8$   
    where d is the measurement distance

### 3.1.3 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-RB – Band Edge Limit basing on “Undesirable Emission Limit”

Temperature: 24–29 °C

Air Pressure: 1000–1009 hPa

Humidity: 33–49 %

#### 3.1.3.1 Radiated spurious and undesired emissions

WLAN n-Mode; 20 MHz; 72.2 Mbit/s				Applied duty cycle correction (AV) [dB]: 0.0				
Ch. No.	Ch. Center Freq. [MHz]	Spurious Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type
44	5220	5250.5	51.9	PEAK	1000	68.0	16.1	UE
56	5280	5250.0	53.0	PEAK	1000	68.0	15.0	UE
116	5580	7440.0	43.5	PEAK	1000	74.0	30.5	RB
116	5580	7440.0	39.1	AV	1000	54.0	14.9	RB
116	5580	11160.0	45.6	PEAK	1000	74.0	28.4	RB
116	5580	11160.0	34.2	AV	1000	54.0	19.8	RB
116	5580	22320.5	43.7	PEAK	1000	74.0	30.3	RB
116	5580	22320.5	35.6	AV	1000	54.0	18.5	RB

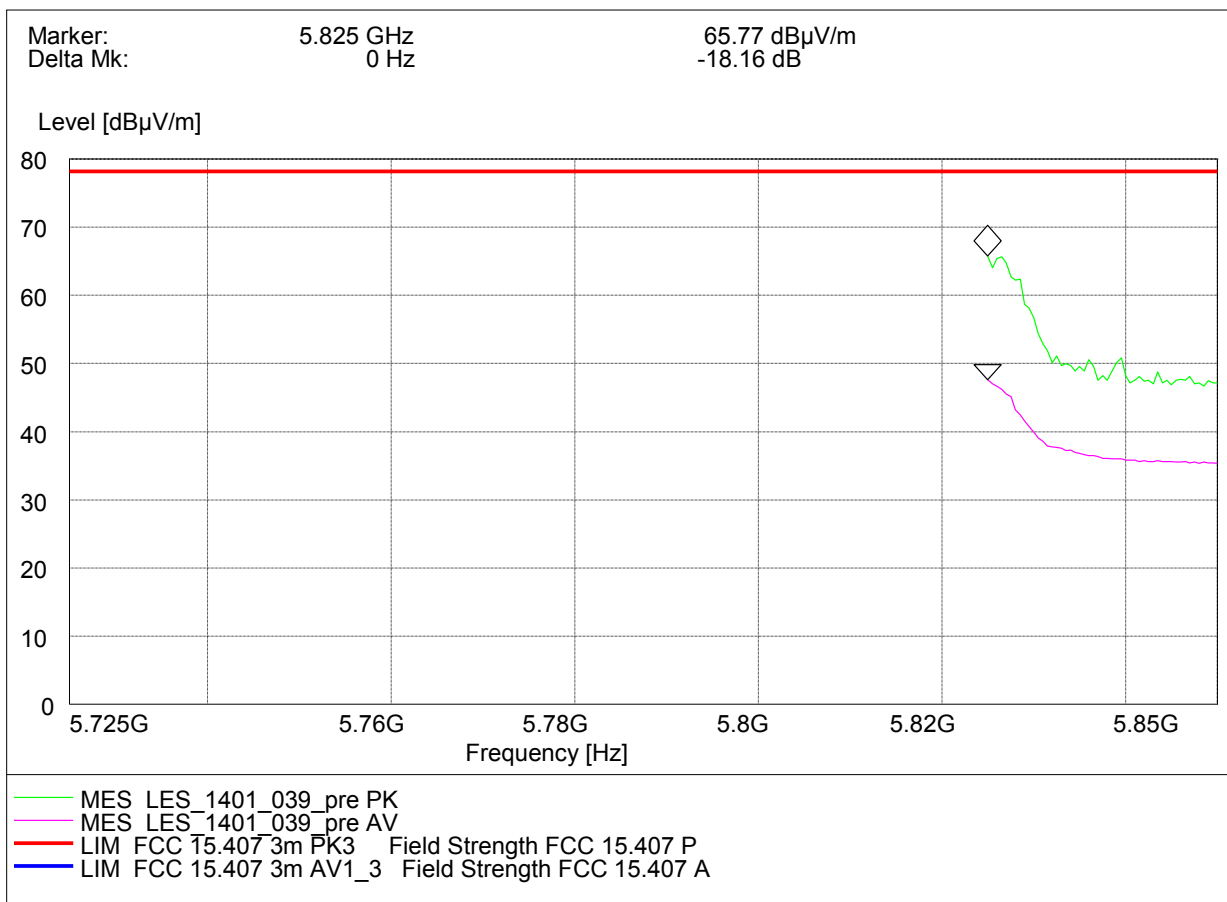
Note: No (further) spurious emissions in the range 20 dB below the limit found.

#### 3.1.3.2 Band Edge

WLAN n-Mode; 20 MHz; 72.2 Mbit/s					Applied duty cycle correction (AV) [dB]: 0.0					
UNII-Sub-band	Ch. No.	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type	FCC /IC?
1	36	5180	5150.0	54.1	PEAK	1000	74.0	19.9	BE-RB	FCC&IC
	36	5180	5150.0	36.7	AV	1000	54.0	17.3	BE-RB	FCC&IC
2A										
	64	5320	5350.0	48.4	PEAK	1000	74.0	25.6	BE-RB	FCC&IC
	64	5320	5350.0	35.4	AV	1000	54.0	18.6	BE-RB	FCC&IC
2C										
	140	5700	5725.0	53.7	PEAK	1000	68.0	14.3	BE-UE	FCC&IC
3	149	5745	5725.0	63.9	PEAK	1000	78.0	14.1	BE-UE	FCC&IC
	161	5805	5825.0	65.8	PEAK	1000	78.0	12.2	BE-UE	IC
	165	5825	5850.0	55.9	PEAK	1000	78.0	22.1	BE-UE	FCC

WLAN n-Mode; 40 MHz; 150 Mbit/s					Applied duty cycle correction (AV) [dB]: 0.0					
UNII-Sub-band	Ch. No.	Ch. Center Freq. [MHz]	Band Edge Freq. [MHz]	Spurious Level [dBμV/m]	Detector	RBW [kHz]	Limit [dBμV/m]	Margin [dB]	Limit Type	FCC /IC?
3	159	5795	5850.0	69.1	PEAK	1000	78.0	8.9	BE-UE	FCC&IC

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



WLAN n-Mode, 20 MHz, 72.2 Mbit/s, CH 161, 5805 MHz



## 4 Test Equipment

### List of Used Test Equipment

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

#### Test Equipment Anechoic Chamber

<b>Lab ID:</b>	<b>Lab 2</b>		
<b>Manufacturer:</b>	Frankonia		
<b>Description:</b>	Anechoic Chamber for radiated testing		
<b>Type:</b>	10.58x6.38x6.00 m <sup>3</sup>		
	<i>Calibration Details</i>	<i>Last Execution</i>	<i>Next Exec.</i>
	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 <sup>3</sup>	none	Frankonia
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	FCC listing 96716 3m Part15/18		2014/01/09 2017/01/08
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 Conducted emissions

<b>Lab ID:</b>	<b>Lab 1</b>
<b>Manufacturer:</b>	Rohde & Schwarz GmbH & Co.KG
<b>Description:</b>	EMI Conducted Auxiliary Equipment

#### Single Devices for Auxiliary Equipment for Conducted emissions

Single Device Name	Type	Serial Number	Manufacturer
AC Power Source	Chroma 6404	64040001304	Chroma ATE INC.
Cable "LISN to ESI"	RG214	W18.03+W48.03	Huber&Suhner
Impedance Stabilization Network	ISN T800	36159	Teseq GmbH
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2014/02/06 2016/02/28
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN ENY41	100002	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2013/03/01 2015/03/31
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN ST08	36292	Teseq GmbH
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2014/01/10 2016/01/31

### Single Devices for Auxiliary Equipment for Conducted emissions (continued)

<i>Single Device Name</i>	<i>Type</i>	<i>Serial Number</i>	<i>Manufacturer</i>		
Impedance Stabilization Network, Coupling Decoupling Network	ISN/CDN T8-Cat6	32187	Teseq GmbH		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	Standard Calibration			2014/01/08	2016/01/31
One-Line V-Network	ESH 3-Z6	100489	Rohde & Schwarz GmbH & Co. KG		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	standard calibration			2014/06/18	2017/11/30
One-Line V-Network	ESH 3-Z6	100570	Rohde & Schwarz GmbH & Co. KG		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	Standard Calibration			2013/11/25	2016/11/24
Two-Line V-Network	ESH 3-Z5	828304/029	Rohde & Schwarz GmbH & Co. KG		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	Standart Calibration			2013/03/01	2015/02/28
Two-Line V-Network	ESH 3-Z5	829996/002	Rohde & Schwarz GmbH & Co. KG		
	<i>Calibration Details</i>			<i>Last Execution</i>	<i>Next Exec.</i>
	Standard Calibration			2013/03/01	2015/02/28

## Test Equipment Auxiliary Equipment for Radiated emissions

**Lab ID:** Lab 2  
**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		
Biconical Broadband Antenna	SBA 9119	9119-005	Schwarzbeck		
Biconical dipole	VUBA 9117 <i>Calibration Details</i>	9117-108	Schwarzbeck	<i>Last Execution</i>	<i>Next Exec.</i>
	Standard Calibration			2012/01/18	2015/01/17
Broadband Amplifier 18MHz-26GHz	JS4-18002600-32-5P	849785	Miteq		
Broadband Amplifier 1GHz-4GHz	AFS4-01000400-1Q-10P-4	-	Miteq		
Broadband Amplifier 30MHz-18GHz	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"	UFB311A+UFB293C	W18.02-2+W38.02- 2	Rosenberger Micro-Coax		
Double-ridged horn	HF 906	357357/001	Rohde & Schwarz GmbH & Co. KG	<i>Last Execution</i>	<i>Next Exec.</i>
	<i>Calibration Details</i>				
	Standard Calibration			2012/05/18	2015/05/17
Double-ridged horn	HF 906	357357/002	Rohde & Schwarz GmbH & Co. KG	<i>Last Execution</i>	<i>Next Exec.</i>
	<i>Calibration Details</i>				
	Standard Calibration			2012/06/26	2015/06/25
High Pass Filter	4HC1600/12750-1.5-KK	9942011	Trilithic		
High Pass Filter	5HC2700/12750-1.5-KK	9942012	Trilithic		
High Pass Filter	5HC3500/12750-1.2-KK	200035008	Trilithic		
High Pass Filter	WHKX 7.0/18G-8SS	09	Wainwright		
Horn Antenna Schwarzbeck 15-26 GHz BBHA 9170	BBHA 9170				
Log.-per. Antenna	HL 562 Ultralog	100609	Rohde & Schwarz GmbH & Co. KG	<i>Last Execution</i>	<i>Next Exec.</i>
	<i>Calibration Details</i>				
	Standard Calibration			2012/12/18	2015/12/17
Log.-per. Antenna	HL 562 Ultralog	830547/003	Rohde & Schwarz GmbH & Co. KG		
Loop Antenna	HFH2-Z2	829324/006	Rohde & Schwarz GmbH & Co. KG	<i>Last Execution</i>	<i>Next Exec.</i>
	<i>Calibration Details</i>				
	Standard calibration			2011/10/27	2014/10/26
Pyramidal Horn Antenna 26,5 GHz	3160-09	00083069	EMCO Elektronik GmbH		
Pyramidal Horn Antenna 40 GHz	3160-10	00086675	EMCO Elektronik GmbH		

### Single Devices for Auxiliary Equipment for Radiated emissions (continued)

Single Device Name	Type	Serial Number	Manufacturer
Tilt device Maturo (Rohacell)	Antrieb TD1.5-10kg	TD1.5-10kg/024/3790709	Maturo GmbH

### Test Equipment Auxiliary Test Equipment

<b>Lab ID:</b>	<b>Lab 2, Lab 3</b>
<b>Manufacturer:</b>	see single devices
<b>Description:</b>	Single Devices for various Test Equipment
<b>Type:</b>	various
<b>Serial Number:</b>	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 Divider1506A / 93459 N (Aux)		LM390	Weinschel Associates
Broadband Power DividerWA1515 SMA		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 Transformatorenwerke 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
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Standard			2012/06/13   2015/06/12
Spectrum Analyser	FSU26	200418	Rohde & Schwarz GmbH & Co.KG
<i>Calibration Details</i>			<i>Last Execution</i> <i>Next Exec.</i>
Standard calibration			2013/07/29   2014/07/28
Vector Signal Generator	SMIQ 03B	832492/061	Rohde & Schwarz GmbH & Co.KG

## Test Equipment Digital Signalling Devices

### Lab ID:

Lab 1, Lab 2, Lab 3

### 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	
	Calibration Details		Last Execution	Next Exec.
	Standard calibration		2011/11/24	2014/11/23
CMW500	CMW500	107500	Rohde & Schwarz GmbH & Co.KG	
	Calibration Details		Last Execution	Next Exec.
	Standard calibration		2014/01/27	2016/01/26
Digital Radio Communication Tester	CMD 55	831050/020	Rohde & Schwarz GmbH & Co. KG	
	Calibration Details		Last Execution	Next Exec.
	Standard calibration		2011/11/28	2014/11/27
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	
	Calibration Details		Last Execution	Next Exec.
	Standard calibration		2011/12/07	2014/12/06
	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 1, Lab 2  
**Description:** Equipment for emission measurements  
**Serial Number:** see single devices

### Single Devices for Emission measurement devices

Single Device Name	Type	Serial Number	Manufacturer
Personal Computer	Dell	30304832059	Dell
Power Meter	NRVD	828110/016	Rohde & Schwarz GmbH & Co.KG
Calibration Details			Last Execution Next Exec.
Standard calibration			2014/05/13 2015/05/12
Sensor Head A	NRV-Z1	827753/005	Rohde & Schwarz GmbH & Co.KG
Calibration Details			Last Execution Next Exec.
Standard calibration			2014/05/13 2015/05/12
Signal Generator	SMR 20	846834/008	Rohde & Schwarz GmbH & Co. KG
Spectrum Analyzer	ESIB 26	830482/004	Rohde & Schwarz GmbH & Co. KG
Calibration Details			Last Execution Next Exec.
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 12

**Lab ID:** Lab 4, Lab 5  
**Description:** Ex-Tech 520  
**Serial Number:** 05157876

### Single Devices for Multimeter 12

Single Device Name	Type	Serial Number	Manufacturer
Digital Multimeter 12 (Multimeter)	EX520	05157876	Extech Instruments Corp.
Calibration Details			Last Execution Next Exec.
Customized calibration			2013/12/04 2015/12/03

## Test Equipment Radio Lab Test Equipment

**Lab ID:** Lab 3  
**Description:** Radio Lab Test Equipment

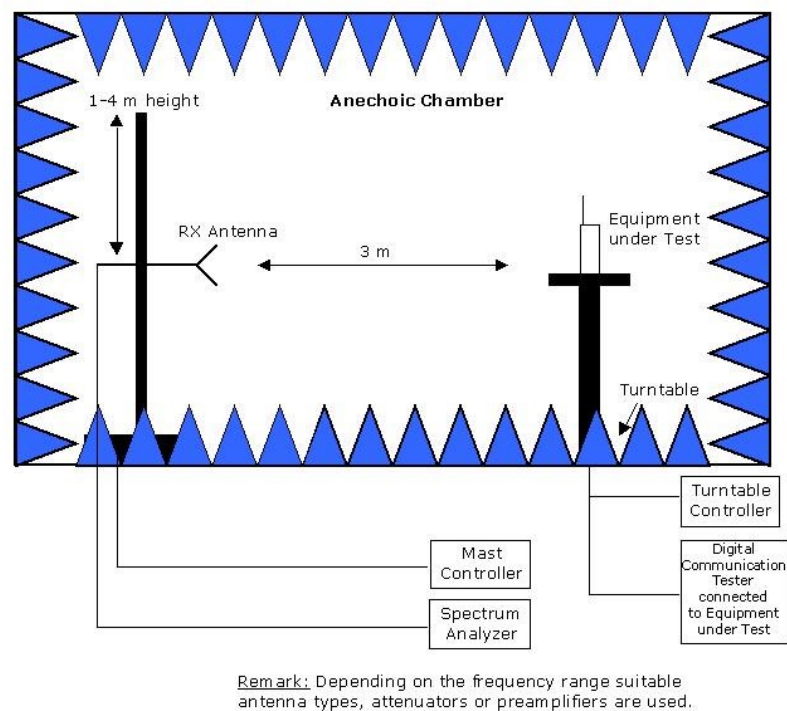
### Single Devices for Radio Lab Test Equipment

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
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2014/05/13   2015/05/12
RF Step Attenuator RSP	RSP	833695/001	Rohde & Schwarz GmbH & Co.KG
Rubidium Frequency Standard	Datum, Model: MFS	5489/001	Datum-Beverly
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2013/06/24   2014/07/02
	Standard calibration		2014/07/03   2015/07/02
Sensor Head A	NRV-Z1	827753/005	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2014/05/13   2015/05/12
Signal Generator SME	SME03	827460/016	Rohde & Schwarz GmbH & Co.KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2011/11/25   2014/11/24
Signal Generator SMP	SMP02	836402/008	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard calibration		2013/05/06   2016/05/05
Spectrum Analyser	FSIQ26	840061/005	Rohde & Schwarz GmbH & Co. KG
	<i>Calibration Details</i>		<i>Last Execution</i> <i>Next Exec.</i>
	Standard Calibration		2013/02/12   2015/02/11

## 5 Photo Report

Please refer to external report.

## 6 Setup Drawings



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