

InterLab®

FCC Measurement/Technical Report on

WLAN transceiver  
NG 2.5 HMI

FCC ID YBN-NG25HMI  
IC: 9595A-NG25HMI

**Report Reference:** MDE\_BOSCH\_1407\_FCCb

**Test Laboratory:**

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**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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## 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 v03r02, 2014-06-05".

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.**

## 0.2 FCC and IC Correlation Table

### Correlation of measurement requirements for DTS devices (e.g. WLAN 2.4/5 GHz) equipment

The following tables show the correlation of measurement requirements for DTS (e.g. WLAN) equipment and Information Technology Equipment (ITE) from FCC and IC standards.

#### 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-210 Issue 8: A8.2 (a)                                  |
| Peak power output               | § 15.247 (b) (3), (4)         | RSS-210 Issue 8: A8.4 (4)                                  |
| Spurious RF conducted emissions | § 15.247 (d)                  | RSS-Gen Issue 4: 6.13 / 8.9/8.10;<br>RSS-210 Issue 8: A8.5 |
| Spurious radiated emissions     | § 15.247 (d);<br>§ 15.209 (a) | RSS-Gen Issue 4: 6.13 / 8.9/8.10;<br>RSS-210 Issue 8: A8.5 |
| Band edge compliance            | § 15.247 (d)                  | RSS-210 Issue 8: A8.5                                      |
| Power density                   | § 15.247 (e)                  | RSS-210 Issue 8: A8.2 (b)                                  |
| Antenna requirement             | § 15.203 / 15.204             | RSS-Gen Issue 4: 8.3                                       |
| Receiver spurious emissions     | –                             | RSS-210 Issue 8: 2.3<br>RSS Gen Issue 4: 5 / 7 *)          |

Receivers are exempted from certification besides if operating in stand-alone mode in the frequency range 30–960 MHz or if these are scanner receivers.

#### Information Technology Equipment (ITE)

| Measurement                     | FCC reference | IC reference          |
|---------------------------------|---------------|-----------------------|
| Conducted emissions on AC Mains | § 15.107      | ICES-003 Issue 5: 6.1 |
| Spurious Radiated Emissions     | § 15.109      | ICES-003 Issue 5: 6.2 |

### 0.3 Measurement Summary

#### 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 |
|---------|-------|------|--------------|
| -       | -     | -    | N/A          |

#### FCC Part 15, Subpart C

#### § 15.247 (a) (1)

Occupied bandwidth

The measurement was performed according to FCC § 15.31

| 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       |

#### FCC Part 15, Subpart C

#### § 15.247 (b) (1)

Peak power output

The measurement was performed according to FCC § 15.31

| 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       |

#### FCC Part 15, Subpart C

#### § 15.247 (d), § 15.35 (b), § 15.207

Spurious conducted emissions

The measurement was performed according to ANSI C63.4

| 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       |

### **FCC Part 15, Subpart C**

### **§ 15.247 (d), § 15.35 (b), § 15.209**

Spurious radiated emissions

The measurement was performed according to ANSI C63.4

| <b>OP-Mode</b> | <b>Setup</b> | <b>Port</b>        | <b>Final Result</b> |
|----------------|--------------|--------------------|---------------------|
| op-mode 1b     | Setup_02     | Temp.ant.connector | passed              |
| op-mode 1g     | Setup_02     | Temp.ant.connector | passed              |
| op-mode 2b     | Setup_02     | Temp.ant.connector | passed              |
| op-mode 2g     | Setup_02     | Temp.ant.connector | passed              |
| op-mode 3b     | Setup_02     | Temp.ant.connector | passed              |
| op-mode 3g     | Setup_02     | Temp.ant.connector | passed              |

### **FCC Part 15, Subpart C**

### **§ 15.247 (d)**

Band edge compliance

The measurement was performed according to FCC § 15.31 / ANSI C63.4

| <b>OP-Mode</b> | <b>Setup</b> | <b>Port</b>        | <b>Final Result</b> |
|----------------|--------------|--------------------|---------------------|
| 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 1b     | Setup_02     | Temp.ant.connector | passed              |
| op-mode 1g     | Setup_02     | Temp.ant.connector | passed              |
| op-mode 1n     | Setup_02     | Temp.ant.connector | passed              |
| op-mode 2b     | Setup_02     | Temp.ant.connector | passed              |
| op-mode 2g     | Setup_02     | Temp.ant.connector | passed              |
| op-mode 2n     | Setup_02     | Temp.ant.connector | passed              |
| op-mode 3b     | Setup_02     | Temp.ant.connector | passed              |
| op-mode 3g     | Setup_02     | Temp.ant.connector | passed              |
| op-mode 3n     | Setup_02     | Temp.ant.connector | passed              |

# FCC Part 15, Subpart C

# § 15.247 (e)

Power density

The measurement was performed according to FCC § 15.31

| 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       |

N/A: OUT is powered by DC



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Responsible for  
Accreditation Scope:



Responsible  
for Test Report:



## 1 Administrative Data

### 1.1 Testing Laboratory

Company Name: 7 Layers 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. Carsten Steinröder  
Employees who performed the tests: documented internally at 7Layers

Date of Test(s): 2014-11-28 to 2014-12-01  
Date of Report: 2014-12-16

### 1.3 Applicant Data

Company Name: Robert Bosch Car Multimedia GmbH

Address: Robert-Bosch-Strasse 200  
31139 Hildesheim  
Germany

Contact Person: Mr. Torsten Sahm

### 1.4 Manufacturer Data

Company Name: Please see applicant data

Address:

Contact Person:



## 2 Test object Data

### 2.1 General EUT Description

|   |   |
|---|---|
| <b>Equipment under Test:</b>                | IEEE 802.11/b/g/n WLAN transceiver (2.4 GHz)                                    |
| <b>Type Designation:</b>                    | NG 2.5 HMI  |
| <b>Kind of Device:</b><br><b>(optional)</b> | Module supporting these technologies:<br>1) WLAN 2.4 GHz modes b/g/n, 20 MHz BW |
| <b>Voltage Type:</b>                        | DC  |
| <b>Voltage Level:</b>                       | 12 V  |
| <b>Tested Modulation Type:</b>              | DBPSK; OFDM:BPSK; GFSK  |

#### 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).

#### Specific product description for the EUT:

The EUT is a dual band WLAN (802.11 b/g/n, 2.4 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 bandwidth channels, providing 72.2 Mbit/s transfer data rate respectively.

The object of this test report is the WLAN transceiver, it was tested at 20 MHz channel bandwidth resp. at 1 MHz bandwidth.

## The EUT provides the following ports:

### Ports

Enclosure  
2 x USB port  
Cable Harness with DC connector  
MOST  
LVDS

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<br>(Code: DE1050002aa01)                                     | WLAN transceiver     | NG 2.5 HMI       | 6114293A1000016X | DSB5.1    | 14.6A002  |
| Remark: EUT A is equipped with a temporary antenna connector.      |                      |                  |                  |           |           |
| EUT B<br>(Code: DE1050002ac01)                                     | WLAN transceiver     | NG 2.5 HMI       | 6114293A1000051X | DSB5.1    | 14.6A002  |
| Remark: EUT B is equipped with internal antenna (gain = +2.5 dBi). |                      |                  |                  |           |           |

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 |
|-------------------|----------------------|------------------|------------|-----------|-----------|
| -                 | -                    | -                | -          | -         | -         |

## 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              | D-Link USB - Ethernet Adapter | DUB-E100         | -          | -         | -         |
| AUX2              | D-Link USB - Ethernet Adapter | DUB-E100         | -          | -         | -         |
| AUX3              | USB 2.0 Adapter               | -                | -          | -         | -         |
| AUX4              | Patch-Cable Cat.6 (1m)        | -                | -          | -         | -         |

## 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 + AUX1 + AUX2 + AUX3 + AUX4 | setup for conducted radio measurements |
| Setup_02 | EUT B + AUX1 + AUX2 + AUX3 + AUX4 | setup for radiated measurements        |

## 2.6 Operating Modes

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

| Data rate / frequency              | 2402 | 2412 | 2437 | 2440 | 2462 | 2480 |
|------------------------------------|------|------|------|------|------|------|
| b-mode, 1 Mbit/s                   | –    | 1b   | 2b   | –    | 3b   | –    |
| g-mode, 6 Mbit/s                   | –    | 1g   | 2g   | –    | 3g   | –    |
| n-Mode, 72.2 Mbit/s (MCS7), 20 MHz | –    | 1n   | 2n   | –    | 3n   | –    |

## 2.7 Special software used for testing

The OUT was connected to a Laptop via Serial/USB connection to set the test modes. The OUT could be set into Bluetooth Test Modes by using a terminal program.

The specific test modes could be set and controlled by the signalling unit "CBT" by Rohde&Schwarz over the air. The OUT was disconnected from the Laptop during testing.

## 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 Occupied bandwidth

**Standard** FCC Part 15, Subpart C

**The test was performed according to:** FCC §15.31

#### 3.1.1 Test Description

The Equipment Under Test (EUT) was set up to perform the occupied bandwidth measurements.

The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.

The results recorded were measured with the modulation which produce the worst-case (widest) occupied bandwidth.

The EUT was connected to spectrum analyzer via a short coax cable with a known loss. Analyzer settings:

- Resolution Bandwidth (RBW): 100 / 500 kHz (6 dB bandwidth / 99% bandwidth)
- Video Bandwidth (VBW): 300 kHz / 2 MHz (6 dB bandwidth / 99% bandwidth)
- Span: 30 MHz (for 20 nominal bandwidth)
- Detector: Peak / Sample (6 dB bandwidth / 99% bandwidth)

#### 3.1.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (a) (2)

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Used conversion factor: Output power (dBm) = 10 log (Output power (W) / 1mW)

### 3.1.3 Test Protocol

Temperature: 23 °C  
Air Pressure: 1010 hPa  
Humidity: 45 %

#### 3.1.3.1 6 dB bandwidth

| WLAN b-Mode; 20 MHz; 1 Mbit/s |             |                 |                      |             |                       |
|-------------------------------|-------------|-----------------|----------------------|-------------|-----------------------|
| Band                          | Channel No. | Frequency [MHz] | 6 dB Bandwidth [MHz] | Limit [MHz] | Margin to Limit [MHz] |
| 2.4 GHz ISM                   | 1           | 2412            | 10.164               | 0.5         | 9.7                   |
|                               | 6           | 2437            | 10.164               | 0.5         | 9.7                   |
|                               | 11          | 2462            | 10.164               | 0.5         | 9.7                   |

| WLAN g-Mode; 20 MHz; 6 Mbit/s |             |                 |                      |             |                       |
|-------------------------------|-------------|-----------------|----------------------|-------------|-----------------------|
| Band                          | Channel No. | Frequency [MHz] | 6 dB Bandwidth [MHz] | Limit [MHz] | Margin to Limit [MHz] |
| 2.4 GHz ISM                   | 1           | 2412            | 16.116               | 0.5         | 15.6                  |
|                               | 6           | 2437            | 16.116               | 0.5         | 15.6                  |
|                               | 11          | 2462            | 16.356               | 0.5         | 15.9                  |

| WLAN n-Mode; 20 MHz; 72.2 Mbit/s |             |                 |                      |             |                       |
|----------------------------------|-------------|-----------------|----------------------|-------------|-----------------------|
| Band                             | Channel No. | Frequency [MHz] | 6 dB Bandwidth [MHz] | Limit [MHz] | Margin to Limit [MHz] |
| 2.4 GHz ISM                      | 1           | 2412            | 17.316               | 0.5         | 16.8                  |
|                                  | 6           | 2437            | 17.136               | 0.5         | 16.6                  |
|                                  | 11          | 2462            | 17.436               | 0.5         | 16.9                  |

### 3.1.3.2 99% bandwidth

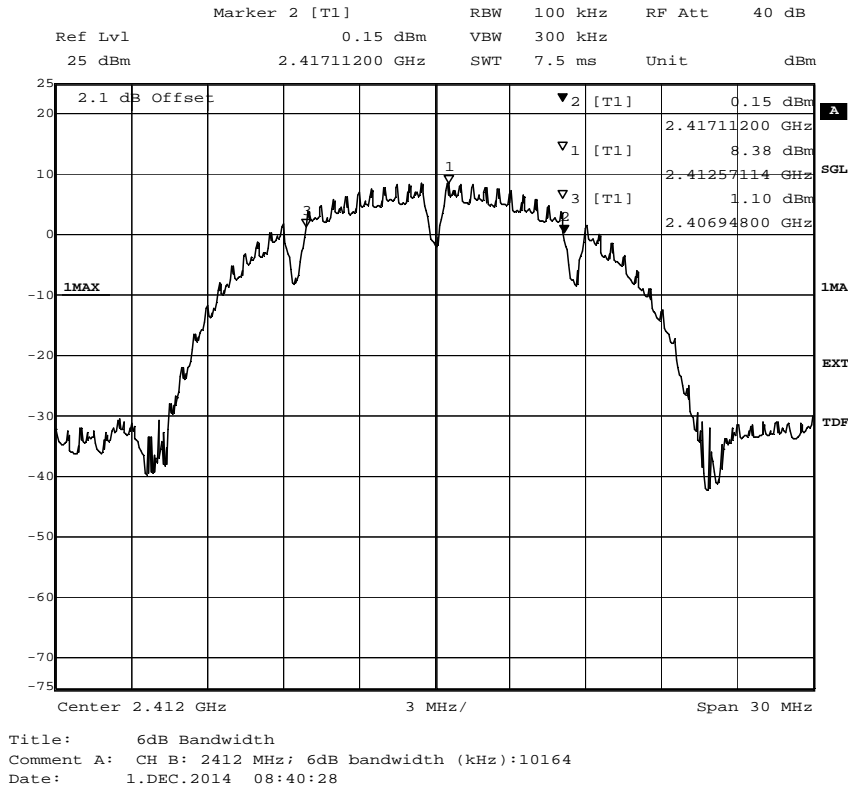
| WLAN b-Mode; 20 MHz; 1 Mbit/s |             |                 |                      |             |                      |
|-------------------------------|-------------|-----------------|----------------------|-------------|----------------------|
| Band                          | Channel No. | Frequency [MHz] | 99 % Bandwidth [MHz] | Limit [MHz] | Margin to Limit [dB] |
| 2.4 GHz ISM                   | 1           | 2412            | 15.412               | 0.5         | 14.9                 |
|                               | 6           | 2437            | 15.557               | 0.5         | 15.1                 |
|                               | 11          | 2462            | 15.557               | 0.5         | 15.1                 |

| WLAN g-Mode; 20 MHz; 6 Mbit/s |             |                 |                      |             |                      |
|-------------------------------|-------------|-----------------|----------------------|-------------|----------------------|
| Band                          | Channel No. | Frequency [MHz] | 99 % Bandwidth [MHz] | Limit [MHz] | Margin to Limit [dB] |
| 2.4 GHz ISM                   | 1           | 2412            | 17.438               | 0.5         | 16.9                 |
|                               | 6           | 2437            | 17.511               | 0.5         | 17.0                 |
|                               | 11          | 2462            | 17.583               | 0.5         | 17.0                 |

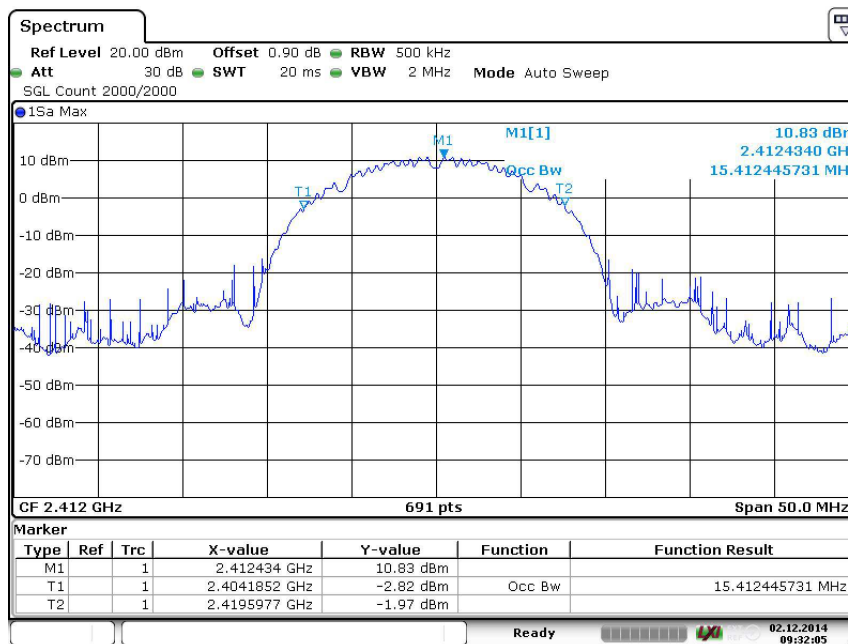
| WLAN n-Mode; 20 MHz; 72.2 Mbit/s |             |                 |                      |             |                      |
|----------------------------------|-------------|-----------------|----------------------|-------------|----------------------|
| Band                             | Channel No. | Frequency [MHz] | 99 % Bandwidth [MHz] | Limit [MHz] | Margin to Limit [dB] |
| 2.4 GHz ISM                      | 1           | 2412            | 17.800               | 0.5         | 17.3                 |
|                                  | 6           | 2437            | 17.873               | 0.5         | 17.4                 |
|                                  | 11          | 2462            | 17.873               | 0.5         | 17.4                 |

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

#### a) 6 dB Bandwidth



#### b) 99% Bandwidth



Date: 2 DEC.2014 09:32:05



## 3.2 Peak power output

**Standard** FCC Part 15, Subpart C

**The test was performed according to:** FCC §15.31

### 3.2.1 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

### 3.2.2 Test Requirements / Limits

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

For systems using digital modulation techniques in the 902-928 MHz, 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:  $\text{Limit (dBm)} = 10 \log (\text{Limit (W)}/1\text{mW})$

### 3.2.3 Test Protocol

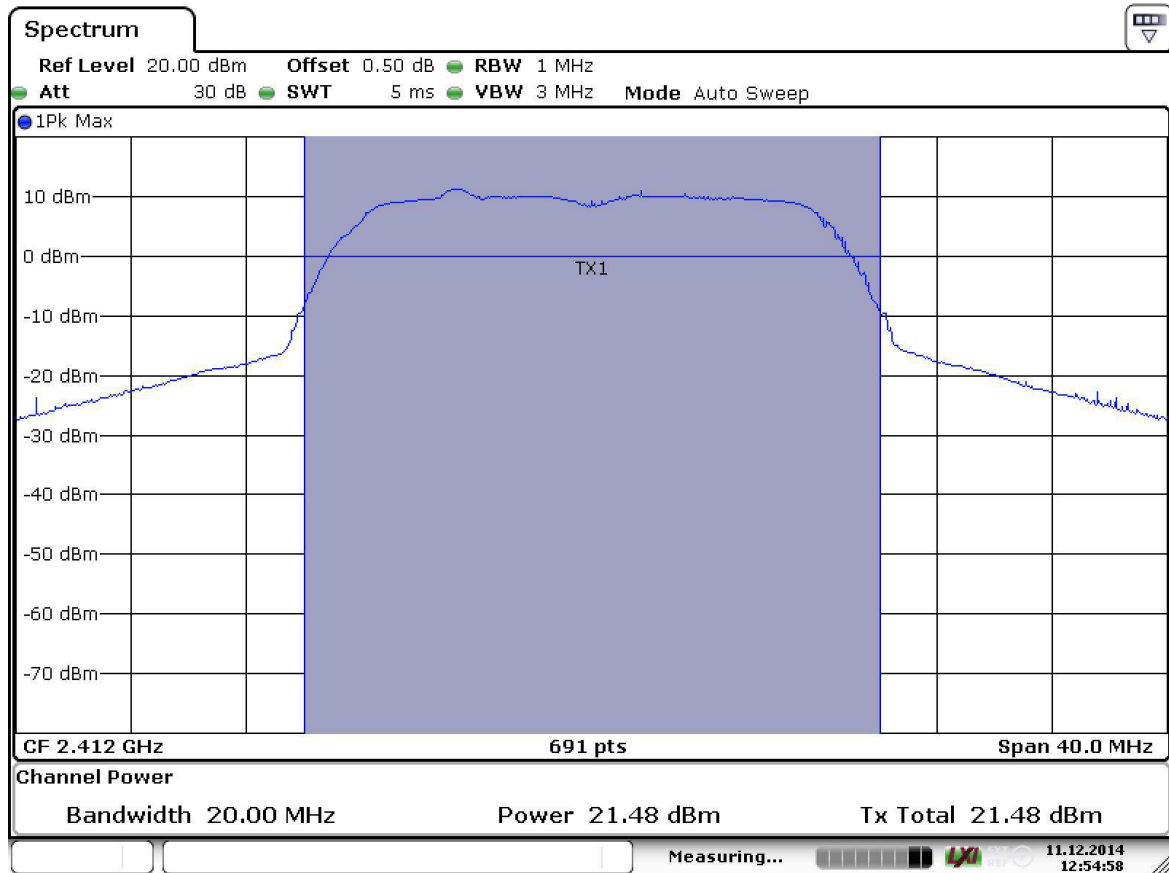
Temperature: 23 °C  
Air Pressure: 1010 hPa  
Humidity: 45 %

| WLAN b-Mode; 20 MHz; 1 Mbit/s |             |                 |                  |             |                      |               |
|-------------------------------|-------------|-----------------|------------------|-------------|----------------------|---------------|
| Band                          | Channel No. | Frequency [MHz] | Peak Power [dBm] | Limit [dBm] | Margin to Limit [dB] | E.I.R.P [dBm] |
| 2.4 GHz ISM                   | 1           | 2412            | 18.6             | 30.0        | 11.4                 | 21.1          |
|                               | 6           | 2437            | 18.6             | 30.0        | 11.4                 | 21.1          |
|                               | 11          | 2462            | 18.7             | 30.0        | 11.3                 | 21.2          |

| WLAN g-Mode; 20 MHz; 6 Mbit/s |             |                 |                  |             |                      |               |
|-------------------------------|-------------|-----------------|------------------|-------------|----------------------|---------------|
| Band                          | Channel No. | Frequency [MHz] | Peak Power [dBm] | Limit [dBm] | Margin to Limit [dB] | E.I.R.P [dBm] |
| 2.4 GHz ISM                   | 1           | 2412            | 21.5             | 30.0        | 8.5                  | 24.0          |
|                               | 6           | 2437            | 21.5             | 30.0        | 8.5                  | 24.0          |
|                               | 11          | 2462            | 21.4             | 30.0        | 8.6                  | 23.9          |

| WLAN n-Mode; 20 MHz; 72.2 Mbit/s |             |                 |                  |             |                      |               |
|----------------------------------|-------------|-----------------|------------------|-------------|----------------------|---------------|
| Band                             | Channel No. | Frequency [MHz] | Peak Power [dBm] | Limit [dBm] | Margin to Limit [dB] | E.I.R.P [dBm] |
| 2.4 GHz ISM                      | 1           | 2412            | 20.6             | 30.0        | 9.4                  | 23.1          |
|                                  | 6           | 2437            | 20.6             | 30.0        | 9.4                  | 23.1          |
|                                  | 11          | 2462            | 20.8             | 30.0        | 9.2                  | 23.3          |

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



Date: 11.DEC.2014 12:54:58

### 3.3 Spurious RF conducted emissions

**Standard** FCC Part 15, Subpart C

**The test was performed according to:** FCC §15.31

#### 3.3.1 Test Description

The Equipment Under Test (EUT) was set up to perform the spurious emissions measurements.

The EUT was connected to spectrum analyzer via a short coax cable with a known loss.

Analyzer settings:

- |                               |                |
|-------------------------------|----------------|
| - Detector:                   | Peak-Maxhold   |
| - Frequency range:            | 30 – 40000 MHz |
| - Resolution Bandwidth (RBW): | 100 kHz        |
| - Video Bandwidth (VBW):      | 300 kHz        |
| - Sweep Time:                 | 330 s          |

The reference value for the measurement of the spurious RF conducted emissions is determined during the test "band edge compliance" (cf. chapter 3.5). This value is used to calculate the 20 dBc limit.

#### 3.3.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (c)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

### 3.3.3 Test Protocol

Temperature: 23 °C  
Air Pressure: 1010 hPa  
Humidity: 45 %

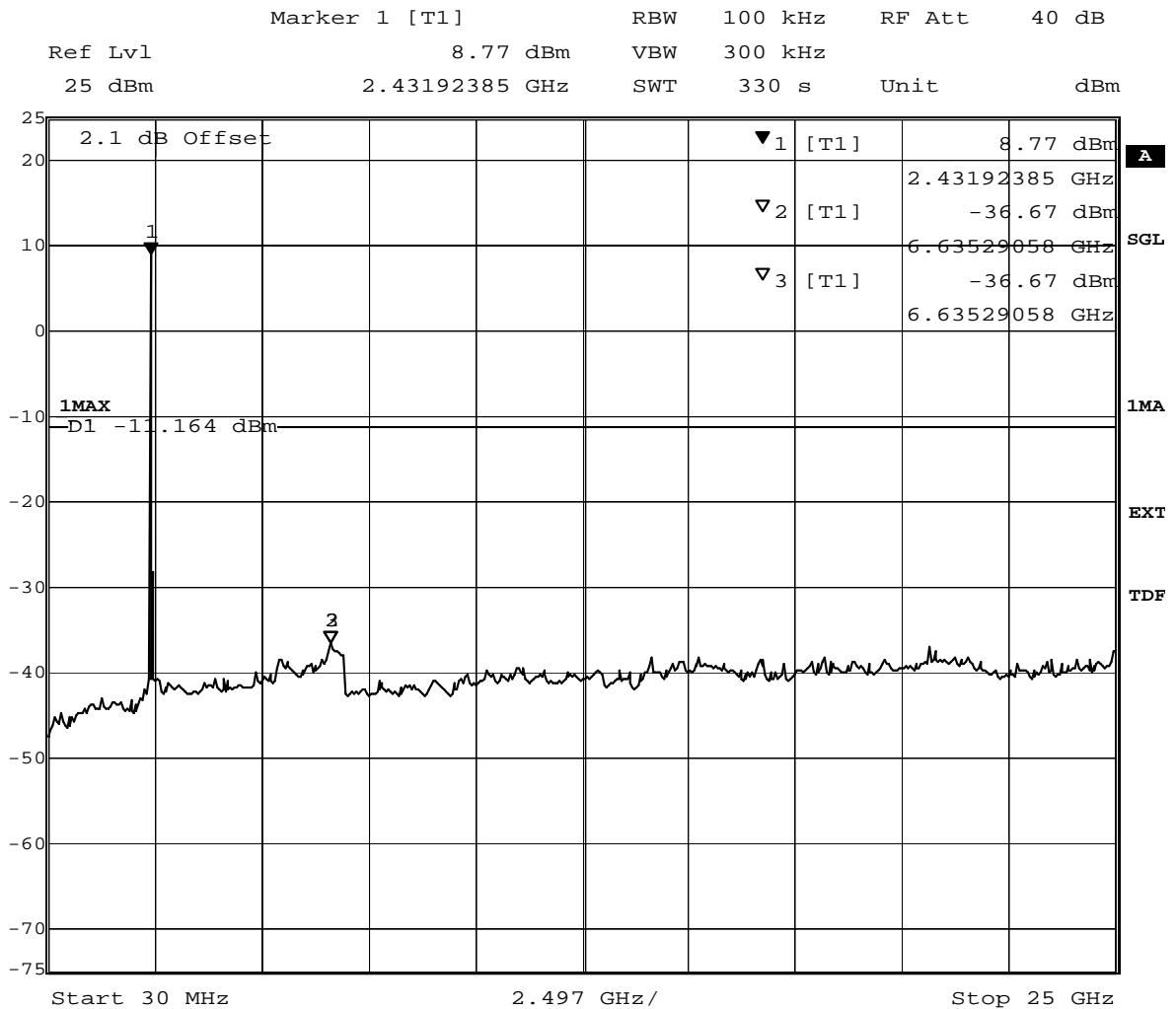
| WLAN b-Mode; 20 MHz;<br>1 Mbit/s |                            |                      |                      |          |           |                  |             |                      |
|----------------------------------|----------------------------|----------------------|----------------------|----------|-----------|------------------|-------------|----------------------|
| Channel No                       | Channel Center Freq. [MHz] | Spurious Freq. [MHz] | Spurious Level [dBm] | Detector | RBW [kHz] | Ref. Level [dBm] | Limit [dBm] | Margin to Limit [dB] |
| 1                                | 2412                       |                      |                      | PEAK     | 100       | 8.2              | -11.8       | - - -                |
| 6                                | 2437                       |                      |                      | PEAK     | 100       | 8.5              | -11.5       | - - -                |
| 11                               | 2462                       |                      |                      | PEAK     | 100       | 8.8              | -11.2       | - - -                |

| WLAN g-Mode; 20 MHz;<br>6 Mbit/s |                            |                      |                      |          |           |                  |             |                      |
|----------------------------------|----------------------------|----------------------|----------------------|----------|-----------|------------------|-------------|----------------------|
| Channel No                       | Channel Center Freq. [MHz] | Spurious Freq. [MHz] | Spurious Level [dBm] | Detector | RBW [kHz] | Ref. Level [dBm] | Limit [dBm] | Margin to Limit [dB] |
| 1                                | 2412                       |                      |                      | PEAK     | 100       | 5.5              | -14.6       | - - -                |
| 6                                | 2437                       |                      |                      | PEAK     | 100       | 5.1              | -14.9       | - - -                |
| 11                               | 2462                       |                      |                      | PEAK     | 100       | 5.2              | -14.8       | - - -                |

| WLAN n-Mode; 20 MHz;<br>72.2 Mbit/s |                            |                      |                      |          |           |                  |             |                      |
|-------------------------------------|----------------------------|----------------------|----------------------|----------|-----------|------------------|-------------|----------------------|
| Channel No                          | Channel Center Freq. [MHz] | Spurious Freq. [MHz] | Spurious Level [dBm] | Detector | RBW [kHz] | Ref. Level [dBm] | Limit [dBm] | Margin to Limit [dB] |
| 1                                   | 2412                       |                      |                      | PEAK     | 100       | 4.6              | -15.4       | - - -                |
| 6                                   | 2437                       |                      |                      | PEAK     | 100       | 4.3              | -15.7       | - - -                |
| 11                                  | 2462                       |                      |                      | PEAK     | 100       | 4.5              | -15.5       | - - -                |

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

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



Title: spurious emissions  
 Comment A: CH T: 2462 MHz  
 Date: 1.DEC.2014 09:42:02

### 3.4 Spurious radiated emissions

**Standard** FCC Part 15, Subpart C

**The test was performed according to:** ANSI C63.4

#### 3.4.1 Test Description

The test set-up was made in accordance to the general provisions of ANSI C63.4 in a typical installation configuration. The Equipment Under Test (EUT) was set up on a non-conductive table 1.0 x 2.0 m<sup>2</sup> 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  $\mu$ s
- Turntable angle range:  $-180^{\circ}$  to  $180^{\circ}$
- Turntable step size:  $90^{\circ}$
- 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:  $-180^{\circ}$  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 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  $\pm 25$  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:  $\pm 22.5^{\circ}$  around the determined value
- Height variation range:  $\pm 25$  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.

**3.4.2 Test Requirements / Limits**

FCC Part 15, Subpart C, §15.247 (e)

For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

...

The same method of determining the conducted output power shall be used to determine the power spectral density.

### 3.4.3 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 | (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:  $\text{Limit (dBµV/m)} = 20 \log (\text{Limit (µV/m)}/1\mu\text{V/m})$

### 3.4.4 Test Protocol

Temperature: 24–26 °C  
 Air Pressure: 1007–1023 hPa  
 Humidity: 41–50 %

| WLAN b-Mode; 20 MHz; 1 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 to Limit [dB] | Limit Type |
| 1                             | 2412                   | 255.4                | 38.7                    | PEAK   | 120       | 46.0           | 7.3                  | RB         |
| 1                             | 2412                   | 257.2                | 40.1                    | PEAK   | 120       | 46.0           | 5.9                  | RB         |
| 1                             | 2412                   | 257.9                | 36.5                    | PEAK   | 120       | 46.0           | 9.5                  | RB         |
| 1                             | 2412                   | 259.2                | 39.4                    | PEAK   | 120       | 46.0           | 6.6                  | RB         |
| 1                             | 2412                   | 259.4                | 40.5                    | PEAK   | 120       | 46.0           | 5.5                  | RB         |
| 1                             | 2412                   | 260.0                | 44.9                    | PEAK   | 120       | 46.0           | 1.1                  | RB         |
| 1                             | 2412                   | 262.6                | 36.2                    | PEAK   | 120       | 46.0           | 9.8                  | RB         |
| 1                             | 2412                   | 263.3                | 38.3                    | PEAK   | 120       | 46.0           | 7.7                  | RB         |
| 1                             | 2412                   | 264.8                | 32.9                    | PEAK   | 120       | 46.0           | 13.1                 | RB         |
| 1                             | 2412                   | 266.1                | 39.7                    | PEAK   | 120       | 46.0           | 6.3                  | RB         |
| 6                             | 2437                   | 254.6                | 42.7                    | PEAK   | 120       | 46.0           | 3.3                  | RB         |
| 6                             | 2437                   | 255.4                | 42.1                    | PEAK   | 120       | 46.0           | 3.9                  | RB         |
| 6                             | 2437                   | 257.2                | 43.3                    | PEAK   | 120       | 46.0           | 2.7                  | RB         |
| 6                             | 2437                   | 257.9                | 39.3                    | PEAK   | 120       | 46.0           | 6.7                  | RB         |
| 6                             | 2437                   | 259.2                | 41.3                    | PEAK   | 120       | 46.0           | 4.7                  | RB         |
| 6                             | 2437                   | 259.4                | 43.0                    | PEAK   | 120       | 46.0           | 3.0                  | RB         |
| 6                             | 2437                   | 260.0                | 44.1                    | PEAK   | 120       | 46.0           | 1.9                  | RB         |
| 6                             | 2437                   | 405.1                | 38.1                    | PEAK   | 120       | 46.0           | 7.9                  | RB         |
| 6                             | 2437                   | 407.9                | 34.6                    | PEAK   | 120       | 46.0           | 11.4                 | RB         |
| 6                             | 2437                   | 408.9                | 40.4                    | PEAK   | 120       | 46.0           | 5.6                  | RB         |
| 11                            | 2462                   | 257.2                | 40.3                    | PEAK   | 120       | 46.0           | 5.7                  | RB         |
| 11                            | 2462                   | 257.9                | 40.4                    | PEAK   | 120       | 46.0           | 5.6                  | RB         |
| 11                            | 2462                   | 259.2                | 39.7                    | PEAK   | 120       | 46.0           | 6.3                  | RB         |
| 11                            | 2462                   | 259.4                | 41.2                    | PEAK   | 120       | 46.0           | 4.8                  | RB         |
| 11                            | 2462                   | 260.0                | 43.3                    | PEAK   | 120       | 46.0           | 2.7                  | RB         |
| 11                            | 2462                   | 262.6                | 36.1                    | PEAK   | 120       | 46.0           | 9.9                  | RB         |
| 11                            | 2462                   | 266.1                | 42.0                    | PEAK   | 120       | 46.0           | 4.0                  | RB         |
| 11                            | 2462                   | 408.9                | 40.0                    | PEAK   | 120       | 46.0           | 6.0                  | RB         |

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

| WLAN g-Mode; 20 MHz; 6 Mbit/s |                        |                      |                         | Applied duty cycle correction (AV) [dB]: |           |                |                      | 0.1        |
|-------------------------------|------------------------|----------------------|-------------------------|--|-----------|----------------|----------------------|------------|
| 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 |
| 1                             | 2412                   | -                    | -                       | PEAK                                     | 1000      | 74.0           | ---                  | RB         |
| 1                             | 2412                   | -                    | -                       | AV                                       | 1000      | 54.0           | ---                  | RB         |
| 6                             | 2437                   | -                    | -                       | PEAK                                     | 1000      | 74.0           | ---                  | RB         |
| 6                             | 2437                   | -                    | -                       | AV                                       | 1000      | 64.0           | ---                  | RB         |
| 11                            | 2462                   | -                    | -                       | PEAK                                     | 1000      | 74.0           | ---                  | RB         |
| 11                            | 2462                   | -                    | -                       | AV                                       | 1000      | 54.0           | ---                  | RB         |

Note: No (further) spurious emissions in the range 20 dB below the limit found.  
The measurement was performed from 1 GHz up to 8 GHz because at pre-measurements no significant spurious emissions have been found outside this frequency range.

### 3.5 Band edge compliance

**Standard** FCC Part 15, Subpart C

**The test was performed according to:** ANSI C63.4-2009, FCC §15.31

#### 3.5.1 Test Description

The procedure to show compliance with the band edge requirement is divided into two measurements:

1. Show compliance of the lower and higher band edge by a conducted measurement. For the conducted measurement, the Equipment Under Test (EUT) is placed in a shielded room.

For the lower band edge the EUT is set to transmit as follows:

For a WLAN transmitter working in the 2.4 GHz band on lowest channel:

CH1 = 2412 MHz / CH3 = 2422 MHz for a channel bandwidth of 20 MHz.

The lower band edge is 2400 MHz for 2.4 GHz band transmitter.

For the higher band edge the EUT is set to transmit as follows:

For a WLAN transmitter working in the 2.4 GHz band on highest channel:

CH11 = 2462 MHz or CH13 = 2472 MHz / CH11 = 2462 MHz for a channel bandwidth of 20 MHz.

The higher band edge is 2483.5 MHz for a 2.4 GHz band transmitter.

Analyzer settings for conducted measurement:

- Detector: Peak
- RBW / VBW = 100 / 300 kHz

2. Showing compliance of the higher band edge falls in to restricted bands by a radiated measurement.

The radiated emissions measurements are performed in a typical installation configuration inside the fully anechoic chamber using a horn antenna at 1 m distance.

EMI receiver settings for radiated measurement:

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

#### 3.5.2 Test Requirements / Limits

FCC Part 15.247 (d)

"In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. ...

If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. 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))."

For the conducted measurement the RF power at the band edge shall be "at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power..."

For the radiated measurement of the higher band edge connected to a restricted band the limit is "specified in Section 15.209(a)".

### 3.5.3 Test Protocol

#### 3.5.3.1 Conducted measurement, lower and higher band edge

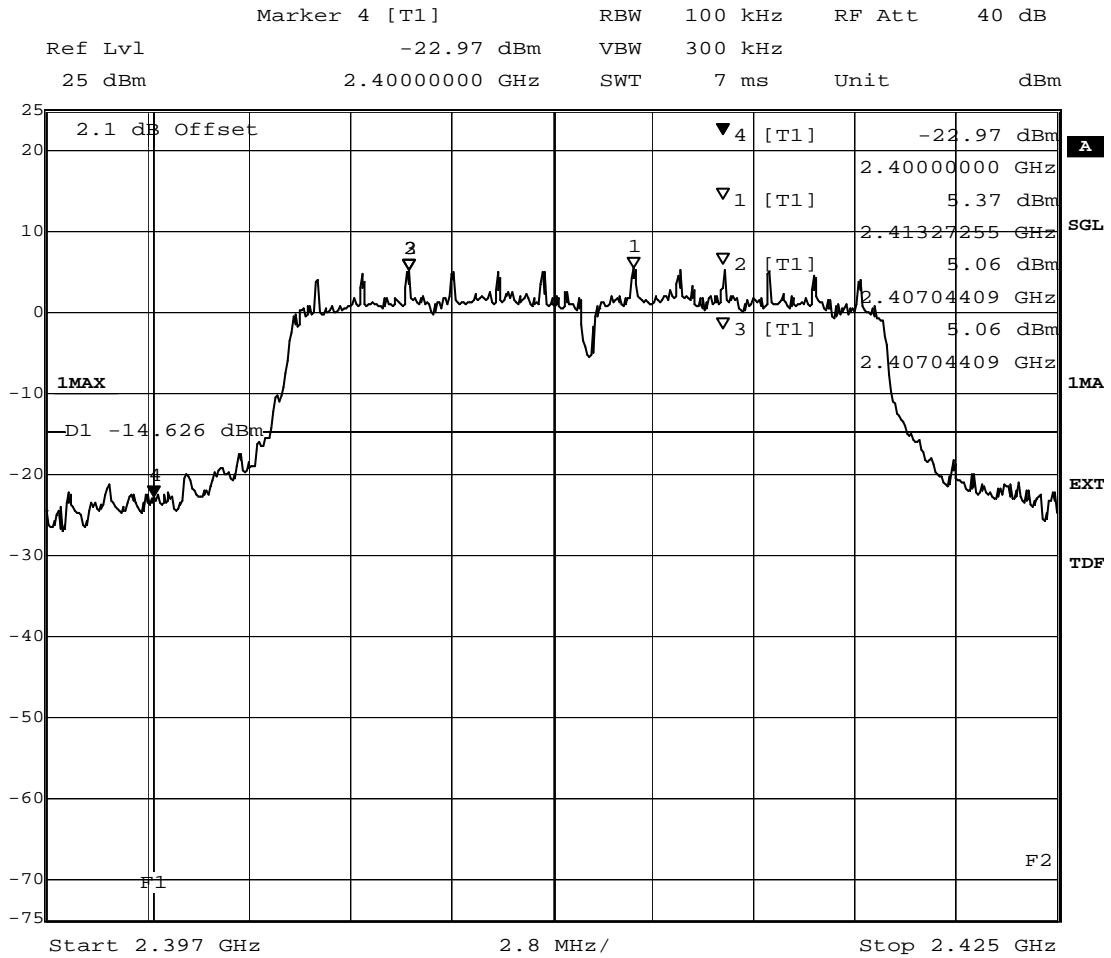
Temperature: 23 °C  
Air Pressure: 1009 hPa  
Humidity: 38 %

| WLAN b-Mode; 20 MHz; 1 Mbit/s |                                |                       |                      |          |           |                  |                |                      |
|-------------------------------|--------------------------------|-----------------------|----------------------|----------|-----------|------------------|----------------|----------------------|
| Channel No.                   | Channel Center Frequency [MHz] | Band Edge Freq. [MHz] | Spurious Level [dBm] | Detector | RBW [kHz] | Ref. Level [dBm] | Limit [dBμV/m] | Margin to Limit [dB] |
| 1                             | 2412                           | 2400.0                | -31.4                | PEAK     | 100       | 8.5              | -11.5          | 19.9                 |
| 11                            | 2462                           | 2483.5                | -37.9                | PEAK     | 100       | 8.8              | -11.2          | 26.7                 |

| WLAN g-Mode; 20 MHz; 6 Mbit/s |                                |                       |                      |          |           |                  |             |                      |
|-------------------------------|--------------------------------|-----------------------|----------------------|----------|-----------|------------------|-------------|----------------------|
| Channel No.                   | Channel Center Frequency [MHz] | Band Edge Freq. [MHz] | Spurious Level [dBm] | Detector | RBW [kHz] | Ref. Level [dBm] | Limit [dBm] | Margin to Limit [dB] |
| 1                             | 2412                           | 2400.0                | -23.0                | PEAK     | 100       | 5.4              | -14.6       | 8.3                  |
| 11                            | 2462                           | 2483.5                | -33.2                | PEAK     | 100       | 5.4              | -14.6       | 18.6                 |

| WLAN n-Mode; 20 MHz; 72.2 Mbit/s |                                |                       |                      |          |           |                  |             |                      |
|----------------------------------|--------------------------------|-----------------------|----------------------|----------|-----------|------------------|-------------|----------------------|
| Channel No.                      | Channel Center Frequency [MHz] | Band Edge Freq. [MHz] | Spurious Level [dBm] | Detector | RBW [kHz] | Ref. Level [dBm] | Limit [dBm] | Margin to Limit [dB] |
| 1                                | 2412                           | 2400.0                | -28.9                | PEAK     | 100       | 4.6              | -15.4       | 13.5                 |
| 11                               | 2462                           | 2483.5                | -35.8                | PEAK     | 100       | 4.5              | -15.5       | 20.3                 |

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



Title: Band Edge Compliance  
Comment A: CH B: 2412 MHz  
Date: 1.DEC.2014 10:04:13

### 3.5.3.3 Radiated measurement, higher band edge

Temperature: 24 – 26 °C  
 Air Pressure: 1000 – 1007 hPa  
 Humidity: 37 – 47 %

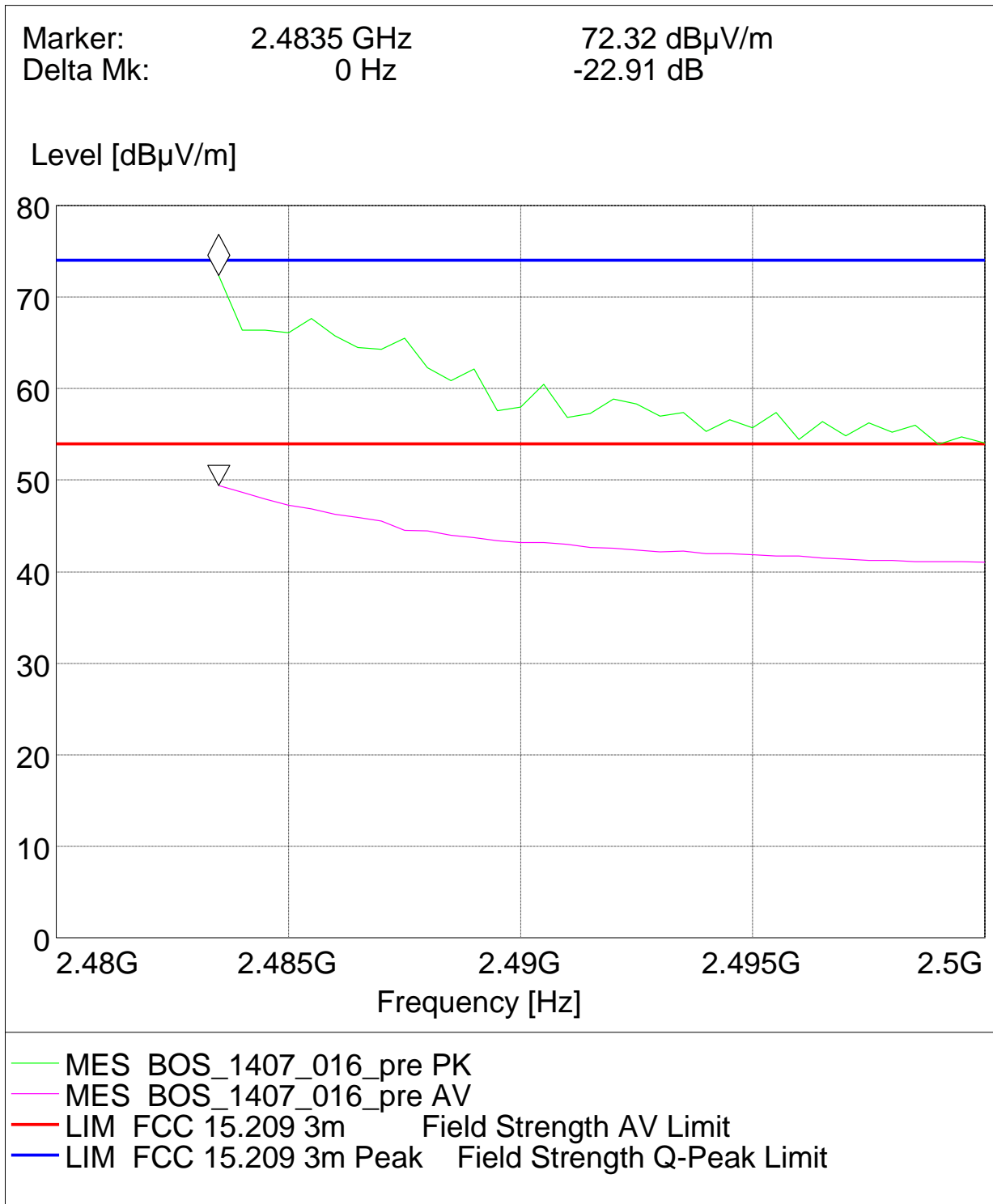
| WLAN b-mode; 20 MHz; 1 Mbit/s |                        |                       |                         | Applied duty cycle correction (AV) [dB]: 0.0 |           |                |                      |            |
|-------------------------------|------------------------|-----------------------|-------------------------|--|-----------|----------------|----------------------|------------|
| Ch. No.                       | Ch. Center Freq. [MHz] | Band Edge Freq. [MHz] | Spurious Level [dBμV/m] | Detector                                     | RBW [kHz] | Limit [dBμV/m] | Margin to Limit [dB] | Limit Type |
| 11                            | 2462                   | 2483.5                | 72.3                    | PEAK   | 1000      | 74.0           | 1.7                  | BE         |
| 11                            | 2462                   | 2483.5                | 49.4                    | AV   | 1000      | 54.0           | 4.6                  | BE         |

| WLAN g-Mode; 20 MHz; 6 Mbit/s |                        |                       |                         | Applied duty cycle correction (AV) [dB]: 0.1 |           |                |                      |            |
|-------------------------------|------------------------|-----------------------|-------------------------|--|-----------|----------------|----------------------|------------|
| Ch. No.                       | Ch. Center Freq. [MHz] | Band Edge Freq. [MHz] | Spurious Level [dBμV/m] | Detector                                     | RBW [kHz] | Limit [dBμV/m] | Margin to Limit [dB] | Limit Type |
| 11                            | 2462                   | 2483.5                | 71.5                    | PEAK   | 1000      | 74.0           | 2.5                  | BE         |
| 11                            | 2462                   | 2483.5                | 50.1                    | AV   | 1000      | 54.0           | 3.9                  | BE         |

| WLAN n-Mode; 20 MHz; 72.2 Mbit/s |                        |                       |                         | Applied duty cycle correction (AV) [dB]: 2.4 |           |                |                      |            |
|----------------------------------|------------------------|-----------------------|-------------------------|--|-----------|----------------|----------------------|------------|
| Ch. No.                          | Ch. Center Freq. [MHz] | Band Edge Freq. [MHz] | Spurious Level [dBμV/m] | Detector                                     | RBW [kHz] | Limit [dBμV/m] | Margin to Limit [dB] | Limit Type |
| 11                               | 2462                   | 2483.5                | 67.1                    | PEAK   | 1000      | 74.0           | 7.0                  | BE         |
| 11                               | 2462                   | 2483.5                | 48.2                    | AV   | 1000      | 54.0           | 5.8                  | BE         |



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



### 3.6 Power density

**Standard** FCC Part 15, Subpart C

**The test was performed according to:** FCC §15.31

#### 3.6.1 Test Description

The EUT was connected to spectrum analyzer via a short coax cable with a known loss.

Analyzer settings:

- Detector: Peak-Maxhold
- Resolution Bandwidth (RBW): 3 kHz
- Video Bandwidth (VBW):  $\geq 3 \times \text{RBW}$
- Sweep Time: Coupled

#### 3.6.2 Test Requirements / Limits

FCC Part 15, Subpart C, §15.247 (e)

For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

...

The same method of determining the conducted output power shall be used to determine the power spectral density.

### 3.6.3 Test Protocol

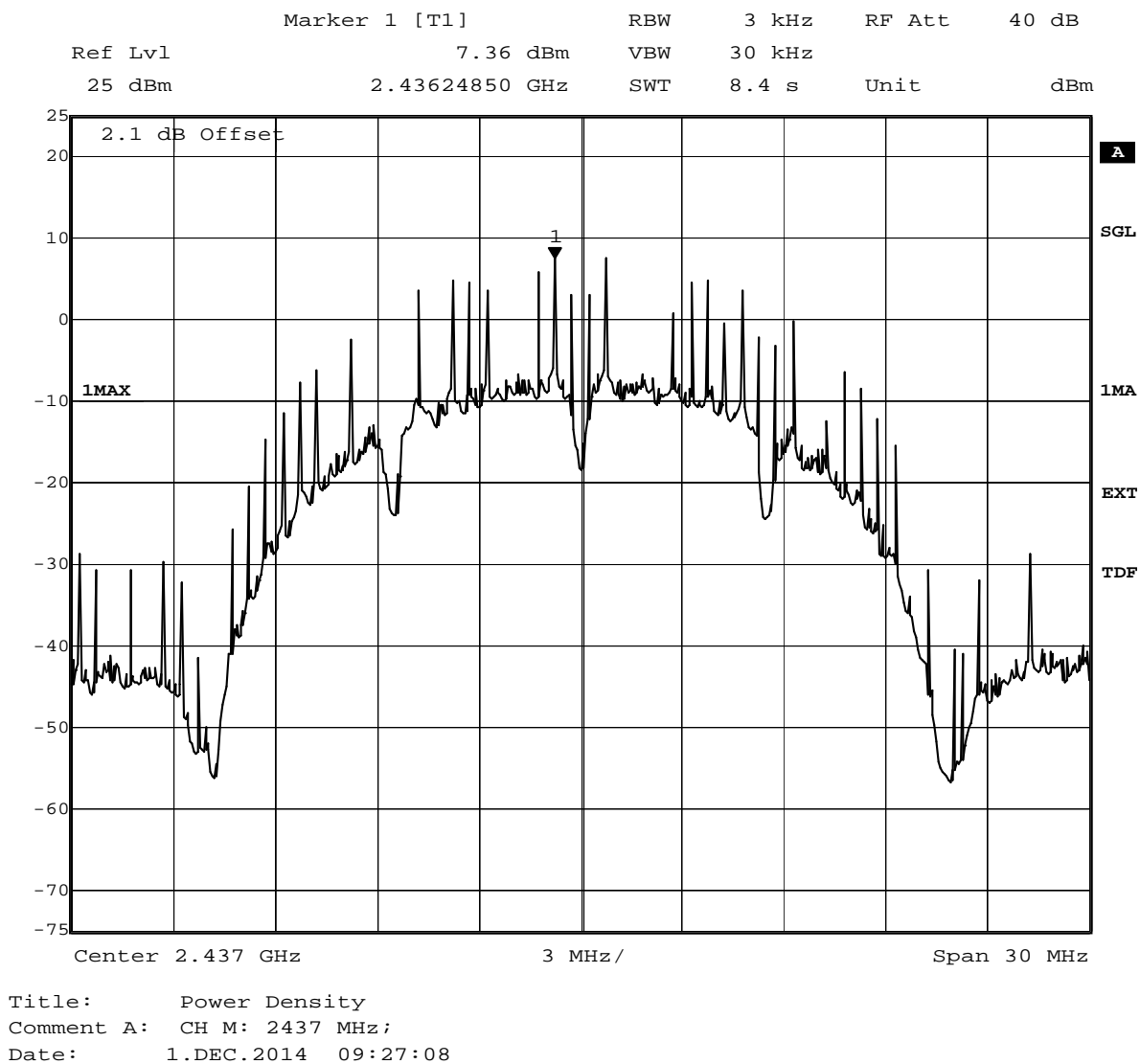
Temperature: 23 °C  
 Air Pressure: 1010 hPa  
 Humidity: 45 %

| WLAN b-Mode; 20 MHz; 1 Mbit/s |             |                 |                          |                  |                      |
|-------------------------------|-------------|-----------------|--------------------------|------------------|----------------------|
| Band                          | Channel No. | Frequency [MHz] | Power Density [dBm/3kHz] | Limit [dBm/3kHz] | Margin to Limit [dB] |
| 2.4 GHz ISM                   | 1           | 2412            | 7.0                      | 8.0              | 1.0                  |
|                               | 6           | 2437            | 7.4                      | 8.0              | 0.6                  |
|                               | 11          | 2462            | 6.7                      | 8.0              | 1.3                  |

| WLAN g-Mode; 20 MHz; 6 Mbit/s |             |                 |                          |                  |                      |
|-------------------------------|-------------|-----------------|--------------------------|------------------|----------------------|
| Band                          | Channel No. | Frequency [MHz] | Power Density [dBm/3kHz] | Limit [dBm/3kHz] | Margin to Limit [dB] |
| 2.4 GHz ISM                   | 1           | 2412            | -9.1                     | 8.0              | 17.1                 |
|                               | 6           | 2437            | -8.9                     | 8.0              | 16.9                 |
|                               | 11          | 2462            | -9.6                     | 8.0              | 17.6                 |

| WLAN n-Mode; 20 MHz; 72.2 Mbit/s |             |                 |                          |                  |                      |
|----------------------------------|-------------|-----------------|--------------------------|------------------|----------------------|
| Band                             | Channel No. | Frequency [MHz] | Power Density [dBm/3kHz] | Limit [dBm/3kHz] | Margin to Limit [dB] |
| 2.4 GHz ISM                      | 1           | 2412            | -10.8                    | 8.0              | 18.8                 |
|                                  | 6           | 2437            | -11.2                    | 8.0              | 19.2                 |
|                                  | 11          | 2462            | -10.8                    | 8.0              | 18.8                 |

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



## 4 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)

| Single Device Name   | Type                       | Serial Number | Manufacturer                  |                   |
|--|----------------------------|---------------|-------------------------------|-------------------|
| 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<br>13 | Maturo GmbH                      |                   |
| Biconical Broadband Antenna                        | SBA 9119                                | 9119-005               | Schwarzbeck                      |                   |
| Biconical dipole                                   | VUBA 9117<br><i>Calibration Details</i> | 9117-108               | Schwarzbeck                      | <i>Next Exec.</i> |
|  | Standard Calibration                    |                        | 2012/01/18                       | 2015/01/17        |
| Broadband Amplifier<br>18MHz-26GHz                 | JS4-18002600-32-5P                      | 849785                 | Miteq                            |                   |
| Broadband Amplifier<br>1GHz-4GHz                   | AFS4-01000400-1Q-10P-4                  | -                      | Miteq                            |                   |
| Broadband Amplifier<br>30MHz-18GHz                 | JS4-00101800-35-5P                      | 896037                 | Miteq                            |                   |
| Cable "ESI to EMI Antenna"                         | EcoFlex10                               | W18.01-2+W38.01-<br>2  | Kabel Kusch                      |                   |
| Cable "ESI to Horn Antenna"                        | UFB311A+UFB293C                         | W18.02-2+W38.02-<br>2  | Rosenberger Micro-Coax           |                   |
| Double-ridged horn                                 | HF 906                                  | 357357/001             | Rohde & Schwarz GmbH & Co.<br>KG | <i>Next Exec.</i> |
|  | <i>Calibration Details</i>              |                        | <i>Last Execution</i>            |                   |
|  | Standard Calibration                    |                        | 2012/05/18                       | 2015/05/17        |
| Double-ridged horn                                 | HF 906                                  | 357357/002             | Rohde & Schwarz GmbH & Co.<br>KG | <i>Next Exec.</i> |
|  | <i>Calibration Details</i>              |                        | <i>Last Execution</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<br>Schwarzbeck 15-26 GHz<br>BBHA 9170 | BBHA 9170                               |                        |                                  |                   |
| Log.-per. Antenna                                  | HL 562 Ultralog                         | 100609                 | Rohde & Schwarz GmbH & Co.<br>KG | <i>Next Exec.</i> |
|  | <i>Calibration Details</i>              |                        | <i>Last Execution</i>            |                   |
|  | Standard Calibration                    |                        | 2012/12/18                       | 2015/12/17        |
| Log.-per. Antenna                                  | HL 562 Ultralog                         | 830547/003             | Rohde & Schwarz GmbH & Co.<br>KG |                   |
| Loop Antenna                                       | HFH2-Z2                                 | 829324/006             | Rohde & Schwarz GmbH & Co.<br>KG | <i>Next Exec.</i> |
|  | <i>Calibration Details</i>              |                        | <i>Last Execution</i>            |                   |
|  | Standard calibration                    |                        | 2011/10/27                       | 2014/10/26        |
| Pyramidal Horn Antenna<br>26,5 GHz                 | 3160-09                                 | 00083069               | EMCO Elektronik GmbH             |                   |
| Pyramidal Horn Antenna<br>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                         |                  |               | 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 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<br>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<br>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<br>Communication Tester | CMU 200  | 102366        | Rohde & Schwarz GmbH & Co. KG |
|   | HW/SW Status   |               | Date of Start Date of End     |
|   | Hardware:<br>B11, B21V14, B21-2, B41, B52V14, B52-2,<br>B53-2, B56V14, B68 3v04, PCMCIA, U65V04<br>Software:<br>K21 4v21, K22 4v21, K23 4v21, K24 4v21, K42 4v21,<br>K43 4v21, K53 4v21, K56 4v22, K57 4v22, K58 4v22,<br>K59 4v22, K61 4v22, K62 4v22, K63 4v22, K64 4v22,<br>K65 4v22, K66 4v22, K67 4v22, K68 4v22, K69 4v22<br>Firmware:<br>µP1 8v50 02.05.06<br>--- |               | 2007/07/16                    |
| Universal Radio<br>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:<br>B11, B21V14, B21-2, B41, B52V14, B52-2, B53-2,<br>B54V14, B56V14, B68 3v04, B95, PCMCIA, U65V02<br>SW options:<br>K21 4v11, K22 4v11, K23 4v11, K24 4v11, K27 4v10,<br>K28 4v10, K42 4v11, K43 4v11, K53 4v10, K65 4v10,<br>K66 4v10, K68 4v10,<br>Firmware:<br>µP1 8v40 01.12.05<br>---  |               | 2007/01/02                    |
|   | SW:<br>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 |
| Calibration Details                                 |         |               | Last Execution Next Exec.     |
| Standard Calibration                                |         |               | 2014/06/24 2017/06/23         |
| 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<br>SMA                                     |                            | A856          | Weinschel Associates                    |
| Coax Attenuator 10dB<br>SMA 2W   | 4T-10                      | F9401         | Weinschel Associates                    |
| Coax Attenuator 10dB<br>SMA 2W   | 56-10                      | W3702         | Weinschel Associates                    |
| Coax Attenuator 10dB<br>SMA 2W   | 56-10                      | W3711         | Weinschel Associates                    |
| Coax Cable<br>Huber&Suhner   | Sucotest 2,0m              |               | Huber&Suhner                            |
| Coax Cable Rosenberger<br>Micro Coax<br>FA210A0010003030<br>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<br>Standard   | Datum, Model: MFS          | 5489/001      | Datum-Beverly                           |
|  | <i>Calibration Details</i> |               | <i>Last Execution</i> <i>Next Exec.</i> |
|  | 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                   |

### Test Equipment Regulatory Bluetooth RF Test Solution

**Lab ID:** Lab 4  
**Description:** Regulatory Bluetooth RF Tests  
**Type:** Bluetooth RF  
**Serial Number:** 001

#### Single Devices for Regulatory Bluetooth RF Test Solution

| Single Device Name              | Type                       | Serial Number | Manufacturer                 |                   |  |
|---------------------------------|----------------------------|---------------|------------------------------|-------------------|--|
| ADU 200 Relay Box 7             | Relay Box                  | A04380        | Ontrak Control Systems Inc.  |                   |  |
| Bluetooth Signalling Unit CBT   | CBT                        | 100302        | Rohde & Schwarz GmbH & Co.KG |                   |  |
|                                 | <i>Calibration Details</i> |               | <i>Last Execution</i>        | <i>Next Exec.</i> |  |
|                                 | Standard calibration       |               | 2014/08/29                   | 2015/08/28        |  |
| Power Meter NRVD                | NRVD                       | 832025/059    |                              |                   |  |
|                                 | <i>Calibration Details</i> |               | <i>Last Execution</i>        | <i>Next Exec.</i> |  |
|                                 | Standard calibration       |               | 2014/08/29                   | 2015/08/28        |  |
| Power Sensor NRV Z1 A           | PROBE                      | 832279/013    |                              |                   |  |
|                                 | <i>Calibration Details</i> |               | <i>Last Execution</i>        | <i>Next Exec.</i> |  |
|                                 | Standard calibration       |               | 2014/08/28                   | 2015/08/27        |  |
| Power Supply                    | NGSM 32/10                 | 2725          |                              |                   |  |
|                                 | <i>Calibration Details</i> |               | <i>Last Execution</i>        | <i>Next Exec.</i> |  |
|                                 | Standard calibration       |               | 2013/06/20                   | 2015/06/19        |  |
| Rubidium Frequency Normal MFS   | Datum MFS                  | 002           | Datum GmbH                   |                   |  |
| Signal Analyser FSIQ26          | 1119.6001.26               | 832695/007    | Rohde & Schwarz GmbH & Co.KG |                   |  |
| Vector Signal Generator SMIQ03B | SMIQ03B                    | 832870/017    |                              |                   |  |
|                                 | <i>Calibration Details</i> |               | <i>Last Execution</i>        | <i>Next Exec.</i> |  |
|                                 | Standard calibration       |               | 2013/06/21                   | 2016/06/20        |  |

### Test Equipment Shielded Room 02

**Lab ID:** Lab 1  
**Manufacturer:** Frankonia  
**Description:** Shielded Room for conducted testing  
**Type:** 12 qm  
**Serial Number:** none

### Test Equipment Shielded Room 07

**Lab ID:** Lab 4, Lab 5  
**Description:** Shielded Room 4m x 6m

### Test Equipment T/A Logger 13

**Lab ID:** Lab 1, Lab 2, Lab 3  
**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 |
| Calibration Details                       |                      |               | Last Execution Next Exec.         |
| Customized calibration                    |                      |               | 2013/02/07 2015/02/06             |

### Test Equipment T/H Logger 02

**Lab ID:** Lab 1  
**Description:** Lufft Opus10  
**Serial Number:** 7489

#### Single Devices for T/H Logger 02

| Single Device Name                                      | Type                 | Serial Number | Manufacturer                      |
|---|----------------------|---------------|-----------------------------------|
| ThermoHygro DataloggerOpus10 THI (8152.00) 02 (Environ) | Opus10 THI (8152.00) | 7489          | Lufft Mess- und Regeltechnik GmbH |
| Calibration Details                                     |                      |               | Last Execution Next Exec.         |
| Customized calibration                                  |                      |               | 2013/02/07 2015/02/06             |

### Test Equipment T/H Logger 03

**Lab ID:** Lab 3  
**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) | Opus10 THI (8152.00) | 7482          | Lufft Mess- und Regeltechnik GmbH |
| Calibration Details                                     |                      |               | Last Execution Next Exec.         |
| Customized calibration                                  |                      |               | 2013/02/07 2015/02/06             |

### Test Equipment T/H Logger 12

**Lab ID:** Lab 2  
**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) | Opus10 THI (8152.00) | 12482         | Lufft Mess- und Regeltechnik GmbH |
| Calibration Details                                     |                      |               | Last Execution Next Exec.         |
| Customized calibration                                  |                      |               | 2013/01/07 2015/01/06             |

### Test Equipment T/H Logger 15

**Lab ID:** Lab 4, Lab 5  
**Description:** Lufft Opus10  
**Serial Number:** 13985

#### Single Devices for T/H Logger 15

| Single Device Name                                      | Type | Serial Number          | Manufacturer                      |
|---|------|------------------------|-----------------------------------|
| ThermoHygro DataloggerOpus10 THI (8152.00) 15 (Environ) |      | 13985                  | Lufft Mess- und Regeltechnik GmbH |
|   |      | Calibration Details    | Last Execution Next Exec.         |
|   |      | Customized calibration | 2013/01/07 2015/01/06             |

### Test Equipment Temperature Chamber 01

**Lab ID:** Lab 4, Lab 5  
**Manufacturer:** see single devices  
**Description:** Temperature Chamber KWP 120/70  
**Type:** Weiss  
**Serial Number:** see single devices

#### Single Devices for Temperature Chamber 01

| Single Device Name           | Type       | Serial Number          | Manufacturer              |
|------------------------------|------------|------------------------|---------------------------|
| Temperature Chamber Weiss 01 | KWP 120/70 | 59226012190010         | Weiss Umwelttechnik GmbH  |
|                              |            | Calibration Details    | Last Execution Next Exec. |
|                              |            | Customized calibration | 2014/03/12 2016/03/11     |

### Test Equipment Temperature Chamber 05

**Lab ID:** Lab 3  
**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                    |
|                               |         | Calibration Details    | Last Execution Next Exec. |
|                               |         | Customized calibration | 2014/03/11 2016/03/10     |

## Test Equipment WLAN RF Test Solution

**Lab ID:** Lab 5  
**Manufacturer:** 7 layers AG  
**Description:** Regulatory WLAN RF Tests  
**Type:** WLAN RF  
**Serial Number:** 001

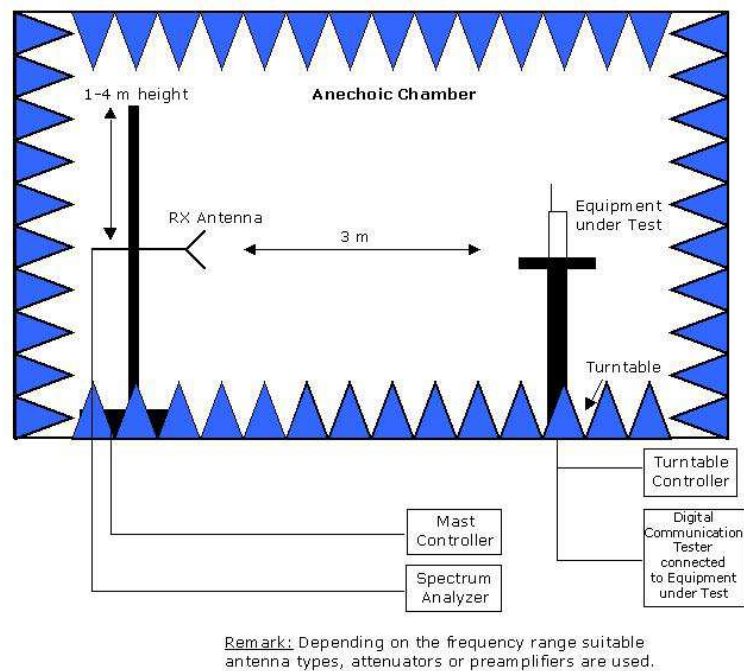
## Single Devices for WLAN RF Test Solution

| Single Device Name              | Type   | Serial Number | Manufacturer                 |                       |                    |
|---------------------------------|--|---------------|------------------------------|-----------------------|--------------------|
| Arbitrary Waveform Generator    | TGA12101   | 284482        |                              |                       |                    |
| Power Meter NRVD                | NRVD   | 832025/059    |                              | <i>Last Execution</i> | <i>Next Exec.</i>  |
|                                 | <i>Calibration Details</i>                         |               |                              |                       |                    |
|                                 | Standard calibration                               |               |                              | 2014/08/29            | 2015/08/28         |
| Power Sensor NRV Z1 A           | PROBE  | 832279/013    |                              |                       |                    |
|                                 | <i>Calibration Details</i>                         |               |                              | <i>Last Execution</i> | <i>Next Exec.</i>  |
|                                 | Standard calibration                               |               |                              | 2014/08/28            | 2015/08/27         |
| Power Supply                    | NGSM 32/10   | 2725          |                              | <i>Last Execution</i> | <i>Next Exec.</i>  |
|                                 | <i>Calibration Details</i>                         |               |                              |                       |                    |
|                                 | Standard calibration                               |               |                              | 2013/06/20            | 2015/06/19         |
| Rubidium Frequency Normal MFS   | Datum MFS  | 002           | Datum GmbH                   |                       |                    |
| Signal Analyser FSIQ26          | 1119.6001.26                                       | 832695/007    | Rohde & Schwarz GmbH & Co.KG |                       |                    |
| Spectrum Analyser               | FSU26  | 100136        | Rohde & Schwarz GmbH & Co.KG |                       |                    |
|                                 | <i>Calibration Details</i>                         |               |                              | <i>Last Execution</i> | <i>Next Exec.</i>  |
|                                 | Standard Calibration                               |               |                              | 2014/01/06            | 2015/01/05         |
|                                 | <i>HW/SW Status</i>                                |               |                              | <i>Date of Start</i>  | <i>Date of End</i> |
|                                 | FSU FW Update to v4.61 SP3, K5 v4.60 and K73 v4.61 |               |                              | 2011/12/05            |                    |
| Spectrum Analyser               | FSU3   | 200046        | Rohde & Schwarz GmbH & Co.KG |                       |                    |
|                                 | <i>Calibration Details</i>                         |               |                              | <i>Last Execution</i> | <i>Next Exec.</i>  |
|                                 | Standard calibration                               |               |                              | 2014/07/01            | 2015/06/30         |
|                                 | <i>HW/SW Status</i>                                |               |                              | <i>Date of Start</i>  | <i>Date of End</i> |
|                                 | Firmware Version 4.51 SP1                          |               |                              | 2011/12/07            |                    |
|                                 | Option FS-K72 4.50 SP1                             |               |                              |                       |                    |
|                                 | Option FS-K73 4.50 SP1                             |               |                              |                       |                    |
| TOCT Switching Unit             | Switching Unit                                     | 040107        | 7 layers, Inc.               |                       |                    |
| Vector Signal Generator SMIQ03B | SMIQ03B  | 832870/017    |                              |                       |                    |
|                                 | <i>Calibration Details</i>                         |               |                              | <i>Last Execution</i> | <i>Next Exec.</i>  |
|                                 | Standard calibration                               |               |                              | 2013/06/21            | 2016/06/20         |

## 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.