

# FCC Measurement/Technical Report on

## Wireless HD-Video-Transceiver

### Q1025

FCC ID: 2ABQT-Q1025  
IC: 23072-Q1025

**Test Report Reference:** MDE\_TQSYS\_2003\_FCC\_01\_rev01

**Test Laboratory:**

7layers GmbH  
Borsigstrasse 11  
40880 Ratingen  
Germany



Deutsche  
Akkreditierungsstelle  
D-PL-12140-01-01  
D-PL-12140-01-02  
D-PL-12140-01-03

**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.

**7layers GmbH**

Borsigstraße 11  
40880 Ratingen, Germany  
T +49 (0) 2102 749 0  
F +49 (0) 2102 749 350

Geschäftsführer/  
Managing Directors:  
Frank Spiller  
Bernhard Retka  
Alexandre Norré-Oudard

Registergericht/registered:  
Düsseldorf HRB 75554  
USt-Id.-Nr./VAT-No. DE203159652  
Steuer-Nr./TAX-No. 147/5869/0385

a Bureau Veritas  
Group Company

[www.7layers.com](http://www.7layers.com)

## Table of Contents

|          |                                                            |           |
|----------|------------------------------------------------------------|-----------|
| <b>1</b> | <b>Applied Standards and Test Summary</b>                  | <b>3</b>  |
| 1.1      | Applied Standards                                          | 3         |
| 1.2      | FCC-IC Correlation Table                                   | 4         |
| 1.3      | Measurement Summary                                        | 5         |
| <b>2</b> | <b>Revision History / Signatures</b>                       | <b>10</b> |
| <b>3</b> | <b>Administrative Data</b>                                 | <b>11</b> |
| 3.1      | Testing Laboratory                                         | 11        |
| 3.2      | Project Data                                               | 11        |
| 3.3      | Applicant Data                                             | 11        |
| 3.4      | Manufacturer Data                                          | 12        |
| <b>4</b> | <b>Test object Data</b>                                    | <b>13</b> |
| 4.1      | General EUT Description                                    | 13        |
| 4.2      | EUT Main components                                        | 14        |
| 4.3      | Ancillary Equipment                                        | 15        |
| 4.4      | Auxiliary Equipment                                        | 15        |
| 4.5      | EUT Setups                                                 | 16        |
| 4.6      | Operating Modes / Test Channels                            | 16        |
| 4.7      | Product labelling                                          | 17        |
| <b>5</b> | <b>Test Results</b>                                        | <b>18</b> |
| 5.1      | AC Conducted Emissions                                     | 18        |
| 5.2      | 26 dB Bandwidth                                            | 21        |
| 5.3      | 6 dB Bandwidth                                             | 24        |
| 5.4      | 99 % Bandwidth                                             | 27        |
| 5.5      | Maximum Conducted Output Power                             | 30        |
| 5.6      | Peak Power Spectral Density                                | 35        |
| 5.7      | Undesirable Emissions; General Field Strength Limits       | 39        |
| 5.8      | Band Edge                                                  | 51        |
| <b>6</b> | <b>Test Equipment</b>                                      | <b>67</b> |
| <b>7</b> | <b>Antenna Factors, Cable Loss and Sample Calculations</b> | <b>75</b> |
| 7.1      | LISN R&S ESH3-Z5 (150 kHz – 30 MHz)                        | 75        |
| 7.2      | Antenna R&S HFH2-Z2 (9 kHz – 30 MHz)                       | 76        |
| 7.3      | Antenna R&S HL562 (30 MHz – 1 GHz)                         | 77        |
| 7.4      | Antenna R&S HF907 (1 GHz – 18 GHz)                         | 78        |
| 7.5      | Antenna EMCO 3160-09 (18 GHz – 26.5 GHz)                   | 79        |
| 7.6      | Antenna EMCO 3160-10 (26.5 GHz – 40 GHz)                   | 80        |
| <b>8</b> | <b>Measurement Uncertainties</b>                           | <b>81</b> |
| <b>9</b> | <b>Photo Report</b>                                        | <b>82</b> |

## 1 APPLIED STANDARDS AND TEST SUMMARY

### 1.1 APPLIED STANDARDS

#### **Type of Authorization**

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

#### **Applicable FCC Rules**

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 (10-1-19 Edition) and 15 (10-1-19 Edition). The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 15, Subpart C – Intentional Radiators

§ 15.201 Equipment authorization requirement

§ 15.207 Conducted limits

§ 15.209 Radiated emission limits; general requirements

Part 15, Subpart E – Unlicensed National Information Infrastructure Devices

§ 15.403 Definitions

§ 15.407 General technical requirements

#### **Note:**

The tests were selected and performed with reference to the FCC Public Notice “Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, 789033 D02 General U-NII Test Procedures New Rules v02r01, 2017-12-14”.

ANSI C63.10-2013 is applied.

Some tests were performed according to older versions of the rules. However the tests inside of this document also comply with the current version.

## 1.2 FCC-IC CORRELATION TABLE

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

#### UNII equipment

| Measurement                                                                              | FCC reference                                 | IC reference                                                                                            |
|------------------------------------------------------------------------------------------|-----------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Conducted emissions on AC Mains                                                          | § 15.207                                      | RSS-Gen Issue 5: 8.8                                                                                    |
| Occupied bandwidth                                                                       | § 15.403 (i) (26 dB) /<br>§ 15.407 (e) (6 dB) | RSS-247 Issue 2: 6.2.1.1,<br>6.2.2.1, 6.2.3.1 (99%)<br>RSS-247 Issue 2: 6.2.4.1 (6<br>dB)               |
| Maximum conducted output power                                                           | § 15.407 (a)<br>(1),(2),(3),(4)               | RSS-247 Issue 2: 6.2.1.1,<br>6.2.2.1, 6.2.3.1, 6.2.4.1                                                  |
| Maximum power spectral density                                                           | § 15.407 (a)<br>(1),(2),(3),(5)               | RSS-247 Issue 2: 6.2.1.1,<br>6.2.2.1, 6.2.3.1, 6.2.4.1                                                  |
| Transmitter undesirable emissions;<br>General Field Strength Limits,<br>Restricted Bands | § 15.407 (b)<br>§ 15.209 (a)                  | RSS-Gen Issue 5:<br>6.13/8.9/8.10;<br>RSS-247 Issue 2: 3.3/6.2<br>6.2.1.2, 6.2.2.2, 6.2.3.2,<br>6.2.4.2 |
| Frequency stability                                                                      | § 15.407 (g)                                  | RSS-Gen Issue 5: 6.11/8.11                                                                              |
| Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS)                       | § 15.407 (h)                                  | RSS-247 Issue 2: 6.2.2.1,<br>6.2.3.1, 6.3                                                               |
| Antenna requirement                                                                      | § 15.203 / 15.204                             | RSS-Gen Issue 5: 8.3                                                                                    |
| Receiver spurious emissions                                                              | –                                             | –                                                                                                       |

### 1.3 MEASUREMENT SUMMARY

#### 47 CFR CHAPTER I FCC PART 15 Subpart E §15.407

#### FCC §15.207

AC Conducted Emissions

The measurement was performed according to ANSI C63.10

#### Final Result

| OP-Mode                      | Setup     | Date       | FCC    | IC     |
|------------------------------|-----------|------------|--------|--------|
| Operating mode<br>worst case | S01_G05RX | 2015-07-27 | Passed | Passed |

#### 47 CFR CHAPTER I FCC PART 15 Subpart E §15.407

#### FCC §15.31, §15.403 (i)

26 dB Bandwidth

The measurement was performed according to ANSI C63.10

#### Final Result

| OP-Mode                                        | Setup      | Date       | FCC       | IC  |
|------------------------------------------------|------------|------------|-----------|-----|
| Radio Technology, Operating Frequency, Subband |            |            |           |     |
| Video 20 MHz, high, U-NII-1                    | S01_W03RX  | 2014-02-01 | Performed | N/A |
| Video 20 MHz, high, U-NII-2A                   | S01_W03RX  | 2014-02-01 | Performed | N/A |
| Video 20 MHz, high, U-NII-2C                   | S01_W03RX  | 2014-02-01 | Performed | N/A |
| Video 20 MHz, high, U-NII-3                    | S01_W03RX  | 2014-01-21 | Performed | N/A |
| Video 20 MHz, low, U-NII-1                     | S01_W03RX  | 2014-02-01 | Performed | N/A |
| Video 20 MHz, low, U-NII-2A                    | S01_W03RX  | 2014-02-03 | Performed | N/A |
| Video 20 MHz, low, U-NII-2C                    | S01_W03RX  | 2014-02-01 | Performed | N/A |
| Video 20 MHz, low, U-NII-3                     | S01_W03RX  | 2014-02-01 | Performed | N/A |
| Video 20 MHz, mid, U-NII-1                     | S01_W03RX  | 2014-02-01 | Performed | N/A |
| Video 20 MHz, mid, U-NII-2A                    | S01_W03RX  | 2014-02-03 | Performed | N/A |
| Video 20 MHz, mid, U-NII-2C                    | S01_W03RX  | 2014-02-03 | Performed | N/A |
| Video 20 MHz, mid, U-NII-3                     | S01_W03RX  | 2014-02-01 | Performed | N/A |
| Video 40 MHz, high, U-NII-1                    | S01_W03RX  | 2014-02-01 | Performed | N/A |
| Video 40 MHz, high, U-NII-2A                   | S01_W03RX  | 2014-02-01 | Performed | N/A |
| Video 40 MHz, high, U-NII-2A                   | S01_AA02RX | 2021-03-17 | Performed | N/A |
| Video 40 MHz, high, U-NII-2C                   | S01_W03RX  | 2014-02-01 | Performed | N/A |
| Video 40 MHz, high, U-NII-3                    | S01_W03RX  | 2014-01-21 | Performed | N/A |
| Video 40 MHz, low, U-NII-1                     | S01_W03RX  | 2014-02-01 | Performed | N/A |
| Video 40 MHz, low, U-NII-2A                    | S01_W03RX  | 2014-02-03 | Performed | N/A |
| Video 40 MHz, low, U-NII-2C                    | S01_W03RX  | 2014-02-01 | Performed | N/A |
| Video 40 MHz, low, U-NII-3                     | S01_W03RX  | 2014-02-01 | Performed | N/A |
| Video 40 MHz, mid, U-NII-2C                    | S01_W03RX  | 2014-02-03 | Performed | N/A |

**47 CFR CHAPTER I FCC PART 15**  
**Subpart E §15.407**

**FCC §15.31, §15.407 (e)**

6 dB Bandwidth

The measurement was performed according to ANSI C63.10

**Final Result**

| <b>OP-Mode</b><br>Radio Technology, Operating Frequency,<br>Subband | <b>Setup</b> | <b>Date</b> | <b>FCC</b> | <b>IC</b> |
|---------------------------------------------------------------------|--------------|-------------|------------|-----------|
| Video 20 MHz, high, U-NII-3                                         | S01_E04RX    | 2014-05-27  | Passed     | Passed    |
| Video 20 MHz, low, U-NII-3                                          | S01_E04RX    | 2014-05-27  | Passed     | Passed    |
| Video 20 MHz, mid, U-NII-3                                          | S01_E04RX    | 2014-05-27  | Passed     | Passed    |
| Video 40 MHz, high, U-NII-3                                         | S01_E04RX    | 2014-06-05  | Passed     | Passed    |
| Video 40 MHz, low, U-NII-3                                          | S01_E04RX    | 2014-06-05  | Passed     | Passed    |
| Video 40 MHz, low, U-NII-3                                          | S01_AA02RX   | 2021-03-17  | Passed     | Passed    |

**47 CFR CHAPTER I FCC PART 15**  
**Subpart E §15.407**

**FCC §15.31, IC RSS 247 Ch. 6.2.x**

99 % Bandwidth

The measurement was performed according to ANSI C63.10

**Final Result**

| <b>OP-Mode</b><br>Radio Technology, Operating Frequency,<br>Subband | <b>Setup</b> | <b>Date</b> | <b>FCC</b> | <b>IC</b> |
|---------------------------------------------------------------------|--------------|-------------|------------|-----------|
| Video 20 MHz, high, U-NII-1                                         | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 20 MHz, high, U-NII-2A                                        | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 20 MHz, high, U-NII-2C                                        | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 20 MHz, high, U-NII-3                                         | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 20 MHz, low, U-NII-1                                          | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 20 MHz, low, U-NII-2A                                         | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 20 MHz, low, U-NII-2C                                         | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 20 MHz, low, U-NII-3                                          | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 20 MHz, mid, U-NII-1                                          | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 20 MHz, mid, U-NII-2A                                         | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 20 MHz, mid, U-NII-2C                                         | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 20 MHz, mid, U-NII-3                                          | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 40 MHz, high, U-NII-1                                         | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 40 MHz, high, U-NII-2A                                        | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 40 MHz, high, U-NII-2C                                        | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 40 MHz, high, U-NII-3                                         | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 40 MHz, low, U-NII-1                                          | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 40 MHz, low, U-NII-2A                                         | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 40 MHz, low, U-NII-2C                                         | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 40 MHz, low, U-NII-3                                          | S01_AA01RX   | 2021-02-01  | Performed  | Performed |
| Video 40 MHz, mid, U-NII-2C                                         | S01_AA01RX   | 2021-02-01  | Performed  | Performed |

**47 CFR CHAPTER I FCC PART 15**  
**Subpart E §15.407**

**FCC §15.31, §15.407 (a)(1)**

Maximum Conducted Output Power

The measurement was performed according to ANSI C63.10

**Final Result**

| <b>OP-Mode</b><br>Radio Technology, Operating Frequency,<br>Subband | <b>Setup</b> | <b>Date</b> | <b>FCC</b> | <b>IC</b> |
|---------------------------------------------------------------------|--------------|-------------|------------|-----------|
| Video 20 MHz, high, U-NII-1                                         | S01_W03RX    | 2014-01-02  | Passed     | Passed    |
| Video 20 MHz, high, U-NII-2A                                        | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 20 MHz, high, U-NII-2C                                        | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 20 MHz, high, U-NII-3                                         | S01_W03RX    | 2014-01-21  | Passed     | Passed    |
| Video 20 MHz, low, U-NII-1                                          | S01_W03RX    | 2014-01-02  | Passed     | Passed    |
| Video 20 MHz, low, U-NII-2A                                         | S01_W03RX    | 2014-01-02  | Passed     | Passed    |
| Video 20 MHz, low, U-NII-2C                                         | S01_W03RX    | 2014-01-02  | Passed     | Passed    |
| Video 20 MHz, low, U-NII-3                                          | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 20 MHz, mid, U-NII-1                                          | S01_W03RX    | 2014-01-02  | Passed     | Passed    |
| Video 20 MHz, mid, U-NII-2A                                         | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 20 MHz, mid, U-NII-2C                                         | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 20 MHz, mid, U-NII-3                                          | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 40 MHz, high, U-NII-1                                         | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 40 MHz, high, U-NII-2A                                        | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 40 MHz, high, U-NII-2C                                        | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 40 MHz, high, U-NII-3                                         | S01_W03RX    | 2014-01-21  | Passed     | Passed    |
| Video 40 MHz, low, U-NII-1                                          | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 40 MHz, low, U-NII-2A                                         | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 40 MHz, low, U-NII-2A                                         | S01_AA02RX   | 2021-03-17  | Passed     | Passed    |
| Video 40 MHz, low, U-NII-2C                                         | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 40 MHz, low, U-NII-3                                          | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 40 MHz, mid, U-NII-2C                                         | S01_W03RX    | 2014-01-03  | Passed     | Passed    |

**47 CFR CHAPTER I FCC PART 15**  
**Subpart E §15.407**

**FCC §15.31, §15.407 (a) (1),(5)**

Peak Power Spectral Density

The measurement was performed according to ANSI C63.10

**Final Result**

| <b>OP-Mode</b><br>Radio Technology, Operating Frequency,<br>Subband | <b>Setup</b> | <b>Date</b> | <b>FCC</b> | <b>IC</b> |
|---------------------------------------------------------------------|--------------|-------------|------------|-----------|
| Video 20 MHz, high, U-NII-1                                         | S01_W03RX    | 2014-01-02  | Passed     | Passed    |
| Video 20 MHz, high, U-NII-2A                                        | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 20 MHz, high, U-NII-2C                                        | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 20 MHz, high, U-NII-3                                         | S01_W03RX    | 2014-01-21  | Passed     | Passed    |
| Video 20 MHz, low, U-NII-1                                          | S01_W03RX    | 2014-01-02  | Passed     | Passed    |
| Video 20 MHz, low, U-NII-2A                                         | S01_W03RX    | 2014-01-02  | Passed     | Passed    |
| Video 20 MHz, low, U-NII-2C                                         | S01_W03RX    | 2014-01-02  | Passed     | Passed    |
| Video 20 MHz, low, U-NII-3                                          | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 20 MHz, mid, U-NII-1                                          | S01_W03RX    | 2014-01-02  | Passed     | Passed    |
| Video 20 MHz, mid, U-NII-2A                                         | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 20 MHz, mid, U-NII-2C                                         | S01_W03RX    | 2014-01-03  | Passed     | Passed    |

**47 CFR CHAPTER I FCC PART 15**  
**Subpart E §15.407**

**FCC §15.31, §15.407 (a) (1),(5)**

Peak Power Spectral Density

The measurement was performed according to ANSI C63.10

**Final Result**

| <b>OP-Mode</b><br>Radio Technology, Operating Frequency,<br>Subband | <b>Setup</b> | <b>Date</b> | <b>FCC</b> | <b>IC</b> |
|---------------------------------------------------------------------|--------------|-------------|------------|-----------|
| Video 20 MHz, mid, U-NII-3                                          | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 40 MHz, high, U-NII-1                                         | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 40 MHz, high, U-NII-2A                                        | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 40 MHz, high, U-NII-2A                                        | S01_AA02RX   | 2021-03-17  | Passed     | Passed    |
| Video 40 MHz, high, U-NII-2C                                        | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 40 MHz, high, U-NII-3                                         | S01_W03RX    | 2014-01-21  | Passed     | Passed    |
| Video 40 MHz, low, U-NII-1                                          | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 40 MHz, low, U-NII-2A                                         | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 40 MHz, low, U-NII-2C                                         | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 40 MHz, low, U-NII-3                                          | S01_W03RX    | 2014-01-03  | Passed     | Passed    |
| Video 40 MHz, mid, U-NII-2C                                         | S01_W03RX    | 2014-01-03  | Passed     | Passed    |

**47 CFR CHAPTER I FCC PART 15**  
**Subpart E §15.407**

**FCC §15.407 (b), (1),(2),(3),(4); FCC**  
**§15.205, §15.209, §15.407 (b) (5),(6)**

Undesirable Emissions; General Field Strength Limits

The measurement was performed according to ANSI C63.10

**Final Result**

| <b>OP-Mode</b><br>Radio Technology, Operating Frequency,<br>Measurement range, Subband | <b>Setup</b> | <b>Date</b> | <b>FCC</b> | <b>IC</b> |
|----------------------------------------------------------------------------------------|--------------|-------------|------------|-----------|
| Video 20 MHz, high, 1GHz - 26GHz, U-NII-1                                              | S01_A01RX    | 2012-10-30  | Passed     | Passed    |
| Video 20 MHz, high, 1GHz - 26GHz, U-NII-2A                                             | S01_W03RX    | 2014-03-14  | Passed     | Passed    |
| Video 20 MHz, high, 1GHz - 26GHz, U-NII-2C                                             | S01_W03RX    | 2012-10-30  | Passed     | Passed    |
| Video 20 MHz, high, 1GHz - 26GHz, U-NII-3                                              | S01_G05RX    | 2015-11-13  | Passed     | Passed    |
| Video 20 MHz, high, 26GHz - 40GHz, U-NII-2A                                            | S01_W03RX    | 2013-08-29  | Passed     | Passed    |
| Video 20 MHz, high, 26GHz - 40GHz, U-NII-2C                                            | S01_W03RX    | 2013-08-29  | Passed     | Passed    |
| Video 20 MHz, high, 30MHz - 1GHz, U-NII-2A                                             | S01_W03RX    | 2013-08-08  | Passed     | Passed    |
| Video 20 MHz, high, 30MHz - 1GHz, U-NII-2C                                             | S01_W03RX    | 2013-08-08  | Passed     | Passed    |
| Video 20 MHz, high, 30MHz - 1GHz, U-NII-3                                              | S01_G05RX    | 2015-07-27  | Passed     | Passed    |
| Video 20 MHz, low, 1GHz - 26GHz, U-NII-1                                               | S01_A01RX    | 2012-10-30  | Passed     | Passed    |
| Video 20 MHz, low, 1GHz - 26GHz, U-NII-2A                                              | S01_A01RX    | 2012-10-30  | Passed     | Passed    |
| Video 20 MHz, low, 1GHz - 26GHz, U-NII-2C                                              | S01_A01RX    | 2012-10-30  | Passed     | Passed    |
| Video 20 MHz, low, 1GHz - 26GHz, U-NII-3                                               | S01_G05RX    | 2015-11-13  | Passed     | Passed    |
| Video 20 MHz, low, 26GHz - 40GHz, U-NII-1                                              | S01_W03RX    | 2013-08-29  | Passed     | Passed    |
| Video 20 MHz, low, 26GHz - 40GHz, U-NII-2A                                             | S01_W03RX    | 2013-08-29  | Passed     | Passed    |
| Video 20 MHz, low, 30MHz - 1GHz, U-NII-1                                               | S01_W03RX    | 2013-08-07  | Passed     | Passed    |
| Video 20 MHz, low, 30MHz - 1GHz, U-NII-2A                                              | S01_W03RX    | 2013-08-07  | Passed     | Passed    |
| Video 20 MHz, low, 30MHz - 1GHz, U-NII-2C                                              | S01_W03RX    | 2013-08-08  | Passed     | Passed    |
| Video 20 MHz, low, 30MHz - 1GHz, U-NII-3                                               | S01_G05RX    | 2015-07-27  | Passed     | Passed    |
| Video 20 MHz, low, 9kHz - 30MHz, U-NII-2A                                              | S01_W03RX    | 2013-08-09  | Passed     | Passed    |
| Video 20 MHz, mid, 1GHz - 26GHz, U-NII-1                                               | S01_W03RX    | 2014-03-14  | Passed     | Passed    |
| Video 20 MHz, mid, 1GHz - 26GHz, U-NII-2A                                              | S01_W03RX    | 2014-03-14  | Passed     | Passed    |

**47 CFR CHAPTER I FCC PART 15**  
**Subpart E §15.407**

**FCC §15.407 (b), (1),(2),(3),(4); FCC**  
**§15.205, §15.209, §15.407 (b) (5),(6)**

Undesirable Emissions; General Field Strength Limits

The measurement was performed according to ANSI C63.10

**Final Result**

| <b>OP-Mode</b>                                                    | <b>Setup</b> | <b>Date</b> | <b>FCC</b> | <b>IC</b> |
|-------------------------------------------------------------------|--------------|-------------|------------|-----------|
| Radio Technology, Operating Frequency, Measurement range, Subband |              |             |            |           |
| Video 20 MHz, mid, 1GHz - 26GHz, U-NII-2C                         | S01_G05RX    | 2014-03-14  | Passed     | Passed    |
| Video 20 MHz, mid, 1GHz - 26GHz, U-NII-3                          | S01_G05RX    | 2015-11-13  | Passed     | Passed    |
| Video 20 MHz, mid, 26GHz - 40GHz, U-NII-2C                        | S01_W03RX    | 2013-08-29  | Passed     | Passed    |
| Video 20 MHz, mid, 30MHz - 1GHz, U-NII-2C                         | S01_G05RX    | 2013-08-08  | Passed     | Passed    |
| Video 20 MHz, mid, 30MHz - 1GHz, U-NII-3                          | S01_G05RX    | 2015-07-27  | Passed     | Passed    |
| Video 20 MHz, mid, 9kHz - 30MHz, U-NII-3                          | S01_W03RX    | 2013-08-09  | Passed     | Passed    |

**47 CFR CHAPTER I FCC PART 15**  
**Subpart E §15.407**

**FCC §15.407 (b), (1),(2),(3),(4)**

Band Edge

The measurement was performed according to ANSI C63.10

**Final Result**

| <b>OP-Mode</b>                                 | <b>Setup</b> | <b>Date</b> | <b>FCC</b> | <b>IC</b> |
|------------------------------------------------|--------------|-------------|------------|-----------|
| Radio Technology, Operating Frequency, Subband |              |             |            |           |
| Video 20 MHz, high, U-NII-1                    | S01_AB01RX   | 2021-02-08  | Passed     | Passed    |
| Video 20 MHz, high, U-NII-2A                   | S01_AB01RX   | 2021-02-17  | Passed     | Passed    |
| Video 20 MHz, high, U-NII-2C                   | S01_AB01RX   | 2021-02-22  | Passed     | Passed    |
| Video 20 MHz, high, U-NII-3                    | S01_AB01RX   | 2021-02-22  | Passed     | Passed    |
| Video 20 MHz, low, U-NII-1                     | S01_AB01RX   | 2021-02-17  | Passed     | Passed    |
| Video 20 MHz, low, U-NII-2C                    | S01_AB01RX   | 2021-02-17  | Passed     | Passed    |
| Video 20 MHz, low, U-NII-3                     | S01_AB01RX   | 2021-02-22  | Passed     | Passed    |
| Video 40 MHz, high, U-NII-1                    | S01_AB01RX   | 2021-02-22  | Passed     | Passed    |
| Video 40 MHz, high, U-NII-2A                   | S01_AB01RX   | 2021-02-22  | Passed     | Passed    |
| Video 40 MHz, high, U-NII-2C                   | S01_AB01RX   | 2021-02-22  | Passed     | Passed    |
| Video 40 MHz, high, U-NII-3                    | S01_AB01RX   | 2021-02-22  | Passed     | Passed    |
| Video 40 MHz, low, U-NII-1                     | S01_AB01RX   | 2021-02-22  | Passed     | Passed    |
| Video 40 MHz, low, U-NII-2C                    | S01_AB01RX   | 2021-02-22  | Passed     | Passed    |
| Video 40 MHz, low, U-NII-3                     | S01_AB01RX   | 2021-02-22  | Passed     | Passed    |

N/A: Not applicable

N/P: Not performed

## 2 REVISION HISTORY / SIGNATURES

| Report version control |              |                                                                            |                  |
|------------------------|--------------|----------------------------------------------------------------------------|------------------|
| Version                | Release date | Change Description                                                         | Version validity |
| initial                | 2021-03-17   | --                                                                         | valid            |
| rev01                  | 2021-04-16   | Added additional comment to test case undesirable emissions and this page. | valid            |

COMMENT: For results of the applicable DFS tests see report MDE\_TQSYS\_2001\_FCC\_01.  
The applicant will limit the output power setting of the final product to maximum 11 dBm. The tests performed at higher power setting were not repeated, since in comparison they are worst case.



(responsible for accreditation scope)  
Dipl.-Ing. Andreas Petz



(responsible for testing and report)  
Dipl.-Ing. Daniel Gall



7 layers GmbH, Borsigstr. 11  
40880 Ratingen, Germany  
Phone +49 (0)2102 749 0

### 3 ADMINISTRATIVE DATA

#### 3.1 TESTING LABORATORY

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

The test facility is accredited by the following accreditation organisation:

Laboratory accreditation no: DAKKS D-PL-12140-01-01 | -02 | -03  
FCC Designation Number: DE0015  
FCC Test Firm Registration: 929146  
ISED CAB Identifier: DE0007; ISED#: 3699A

Responsible for accreditation scope: Dipl.-Ing. Andreas Petz  
Report Template Version: 2021-01-13

#### 3.2 PROJECT DATA

Responsible for testing and report: Dipl.-Ing. Daniel Gall  
Employees who performed the tests: documented internally at 7Layers  
Date of Report: 2021-04-16  
Testing Period: 2012-10-30 to 2021-03-17

#### 3.3 APPLICANT DATA

Company Name: TQ-Systems Durach GmbH  
Address: Johann-Georg-Halske-Strasse 1  
87471 Durach  
Germany  
Contact Person: Mr. Bernd Wein

### 3.4 MANUFACTURER DATA

Company Name: please see Applicant Data

Address:

Contact Person:

## 4 TEST OBJECT DATA

### 4.1 GENERAL EUT DESCRIPTION

|                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Kind of Device product description       | Wireless HD-Video-Transceiver                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Product name                             | Wireless HD-Video-Transceiver                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Type                                     | Q1025                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Declared EUT data by the supplier</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Voltage Type                             | DC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Voltage Level                            | 12 V at Auxiliary Baseboard, 5 V at EUT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Tested Modulation Type                   | OFDM, 16-QAM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| General product description              | The Transceiver is operating in the 5 GHz band using Orthogonal Frequency Division Multiplexing (OFDM).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Specific product description             | <p>The EUT is a module which enables video transmission in the 5 GHz bands as part of a video system. It is using bi-directional communication with a proprietary modulation scheme and supports 20 MHz and 40 MHz bandwidth channels.</p> <p>The transceiver is operating in the 5 GHz band in the ranges 5.15 – 5.25 GHz, 5.25 – 5.35 GHz, 5.470 – 5.725 GHz and 5.725 – 5.850 GHz.</p> <p>The EUT is part of a video transfer system which uses a “logical transmitter” and a “logical receiver”. Both devices are RF transceivers.</p> <p>The object of this test report is the “logical video receiver”, it was tested at 20 and 40 MHz nominal bandwidth. In receive direction for the video signal, 4 RX receive chains are operating in MIMO mode while the transmitter operates with 1 TX transmit chain in order to send control commands.</p> <p>For the tests a synthetic signal (OFDM) is provided as test mode, 1 transmit chain is always active.</p> |
| Ports of the device                      | <p>Enclosure</p> <p>Data / DC port (system connector to ANC1)</p> <p>5 GHz Antennas (5x UFL connector)</p> <p>DC power (at ANC1)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Antennas                                 | All antennas are integral antennas with a gain of 2 dBi.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Special software used for testing        | <p>A tool which is called “AppCom” is used to set the EUT into the desired test modes.</p> <p>From the software, PRBS script files provided by the applicant, are used to control directly the EUT via a RS-232 port.</p> <p>A software tool “Debug View” is used to check the correct execution of the commands (at the software layer).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## 4.2 EUT MAIN COMPONENTS

| Sample Name      | Sample Code               | Description |
|------------------|---------------------------|-------------|
| EUT a01 RX       | V5010a01                  |             |
| Sample Parameter | Value                     |             |
| Serial No.       | Q1025-M-D2/ SRI/ CO222218 |             |
| HW Version       | M-D2                      |             |
| SW Version       | 1.1                       |             |
| Comment          |                           |             |

| Sample Name      | Sample Code                              | Description      |
|------------------|------------------------------------------|------------------|
| EUT aa01 RX      | DE1059004aa01                            | Conducted Sample |
| Sample Parameter | Value                                    |                  |
| Serial No.       | SRI2034028677                            |                  |
| HW Version       | 270275.0200 - SRI Q1025-X100-LN REV.0200 |                  |
| SW Version       | 4.2.28.141                               |                  |
| Comment          |                                          |                  |

| Sample Name      | Sample Code                              | Description      |
|------------------|------------------------------------------|------------------|
| EUT aa02 RX      | DE1059004aa02                            | Conducted Sample |
| Sample Parameter | Value                                    |                  |
| Serial No.       | SRI2034028677                            |                  |
| HW Version       | 270275.0200 - SRI Q1025-X100-LN REV.0200 |                  |
| SW Version       | 4.3.28.141                               |                  |
| Comment          |                                          |                  |

| Sample Name      | Sample Code                              | Description     |
|------------------|------------------------------------------|-----------------|
| EUT ab01 RX      | DE1059004ab01                            | Radiated Sample |
| Sample Parameter | Value                                    |                 |
| Serial No.       | SRI2034028669                            |                 |
| HW Version       | 270275.0200 - SRI Q1025-X100-LN REV.0200 |                 |
| SW Version       | 4.2.28.141                               |                 |
| Comment          |                                          |                 |

| Sample Name      | Sample Code               | Description |
|------------------|---------------------------|-------------|
| EUT e04 RX       | V5010e04                  |             |
| Sample Parameter | Value                     |             |
| Serial No.       | Q1025-M-5/ SRI132228 1769 |             |
| HW Version       | M-6                       |             |
| SW Version       | 1.1                       |             |
| Comment          |                           |             |

| Sample Name      | Sample Code   | Description |
|------------------|---------------|-------------|
| EUT g05 RX       | V5010g05      |             |
| Sample Parameter | Value         |             |
| Serial No.       | SRI1419217936 |             |
| HW Version       | Q1025-X100-2  |             |
| SW Version       | 3.x.28.1      |             |
| Comment          |               |             |

| Sample Name      | Sample Code               | Description |
|------------------|---------------------------|-------------|
| EUT w03 RX       | V5010w03                  |             |
| Sample Parameter | Value                     |             |
| Serial No.       | Q1025-M-6/ SRI132228 1886 |             |
| HW Version       | M-6                       |             |
| SW Version       | 1.1                       |             |
| Comment          |                           |             |

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

#### 4.3 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.

| Device | Details<br>(Manufacturer, Type Model, OUT Code) | Description |
|--------|-------------------------------------------------|-------------|
| -      | -                                               | -           |

#### 4.4 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.

| Device   | Details<br>(Manufacturer, Type Model, HW, SW, S/N)                | Description     |
|----------|-------------------------------------------------------------------|-----------------|
| AUX_A_RX | TQ-Systems, RX BaseBoard SDI (Q1034-M-6),<br>-, -, -              | Baseboard       |
| AUX_C_RX | TQ-Systems, RX BaseBoard SDI (Q1034-M-6) ,<br>-, -, SRI1322281809 | Baseboard       |
| AUX_D_RX | TQ-Systems, RX BaseBoard SDI (Q1034-M-6) ,<br>-, -, -             | Baseboard       |
| AUX_E_RX | TQ-Systems, RX_MOD_HDMI_V2 (Q1042-M-2),<br>-, -, SRI1423229930    | Baseboard       |
| AUX_F_RX | AMIMON, Q1036-M-1, Rev 1.0, -, -, -                               | Controllerboard |
| AUX_G_RX | Fujitsu, HP-OL093E03P, -, -, F3-<br>080701850701                  | AC/DC Adapter   |
| AUX_H_RX | FRIWO Gerätebau GmbH, FW8001M/12, -, -, -                         | AC/DC Adapter   |
| AUX_I_RX | AMIMON, AMN043PCB, Rev 1.0, -, -, -                               | Debug Board     |
| AUX_J_RX | TQ-Systems, Q1042-M-4, -, -, ,<br>SRI2034028818                   | Baseboard       |

| Device   | Details<br>(Manufacturer, Type Model, HW, SW, S/N) | Description |
|----------|----------------------------------------------------|-------------|
| AUX_K_RX | TQ-Systems, Q1042-M-4, -, -, SRI2039029458         | Baseboard   |

#### 4.5 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 |
|------------|-------------------------------------------|---------------------------|
| S01_G05RX  | EUT g05 RX, AUX_F_RX, AUX_G_RX, AUX_E_RX, | Standalone test setup     |
| S01_AB01RX | EUT ab01 RX, AUX_H_RX, AUX_I_RX, AUX_J_RX | Standalone test setup     |
| S01_E04RX  | EUT e04 RX, AUX_F_RX, AUX_D_RX,           | Standalone test setup     |
| S01_AA01RX | EUT aa01 RX, AUX_H_RX, AUX_I_RX, AUX_K_RX | Standalone test setup     |
| S01_AA02RX | EUT aa02 RX, AUX_H_RX, AUX_I_RX, AUX_K_RX | Standalone test setup     |
| S01_W03RX  | EUT w03 RX, AUX_C_RX, AUX_F_RX,           | Standalone test setup     |
| S01_A01RX  | EUT a01 RX, AUX_A_RX, AUX_F_RX,           | Standalone test setup     |

#### 4.6 OPERATING MODES / TEST CHANNELS

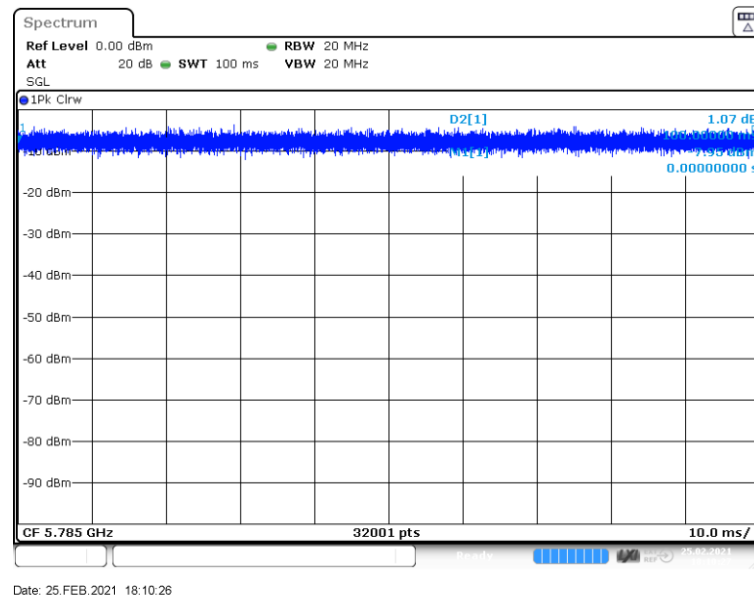
This chapter describes the operating modes of the EUTs used for testing.

| U-NII-Subband 1<br>5150 - 5250 MHz |            |      | U-NII-Subband 2A<br>5250 - 5350 MHz |            |      | U-NII-Subband 2C<br>5470 - 5725 MHz |      |      | U-NII-Subband 3<br>5725 - 5850 MHz |      |      | Nom.<br>BW  |
|------------------------------------|------------|------|-------------------------------------|------------|------|-------------------------------------|------|------|------------------------------------|------|------|-------------|
| low                                | mid        | high | low                                 | mid        | high | low                                 | mid  | high | low                                | mid  | high | 20<br>MHz   |
| 36                                 | 40/44*     | 48   | 52                                  | 56/60*     | 64   | 100                                 | 116  | 140  | 149                                | 157  | 165  | Ch.-<br>No. |
| 5180                               | 5200/5220* | 5240 | 5260                                | 5280/5300* | 5320 | 5500                                | 5580 | 5700 | 5745                               | 5785 | 5825 | MHz         |

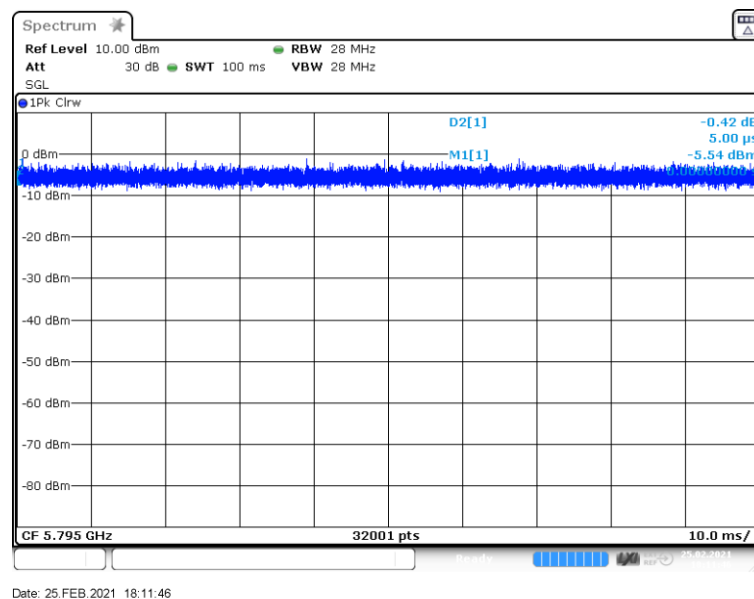
| low  | mid | high | low  | mid | high | low  | mid  | high | low  | mid | high | 40<br>MHz   |
|------|-----|------|------|-----|------|------|------|------|------|-----|------|-------------|
| 38   | -   | 46   | 54   | -   | 62   | 102  | 110  | 138  | 151  | -   | 159  | Ch.-<br>No. |
| 5190 | -   | 5230 | 5270 | -   | 5310 | 5510 | 5550 | 5690 | 5755 | -   | 5795 | MHz         |

\*) Used channel for 99 % bandwidth: 5200 MHz + 5300 MHz. For all other test cases: 5220 MHz / 5280 MHz.

## Duty Cycle Plots



20 MHz BW, 100 % DC



40 MHz BW, 100 % DC

## 4.7 PRODUCT LABELLING

### 4.7.1 FCC ID LABEL

Please refer to the documentation of the applicant.

### 4.7.2 LOCATION OF THE LABEL ON THE EUT

Please refer to the documentation of the applicant.

## 5 TEST RESULTS

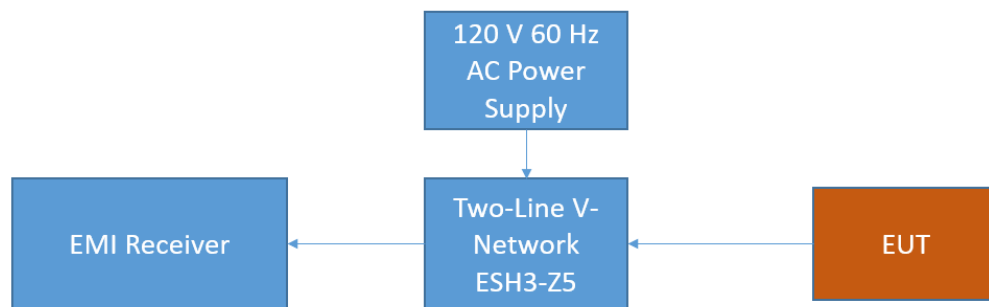
### 5.1 AC CONDUCTED EMISSIONS

Standard **FCC Part 15 Subpart E**

**The test was performed according to:**  
ANSI C63.10

#### 5.1.1 TEST DESCRIPTION

The test set-up was made in accordance to the general provisions of ANSI C 63.10. The Equipment Under Test (EUT) was setup in a shielded room to perform the conducted emissions measurements in a typical installation configuration. The EUT was powered from 50 $\mu$ H || 50 Ohm Line Impedance Stabilization Network (LISN). The LISN's unused connections were terminated with 50 Ohm loads.



FCC Conducted Emissions on AC

The measurement procedure consists of two steps. It is implemented into the EMI test software EMC-32 from R&S.

#### Step 1: Preliminary scan

Intention of this step is, to determine the conducted EMI-profile of the EUT.

EMI receiver settings:

- Detector: Peak – Maxhold & Average
- Frequency range: 150 kHz – 30 MHz
- Frequency steps: 2.5 kHz
- IF-Bandwidth: 9 kHz
- Measuring time / Frequency step: 100 ms (FFT-based)
- Measurement on phase + neutral lines of the power cords

On basis of this preliminary scan the highest amplitudes and the corresponding frequencies relative to the limit are identified. Emissions above the limit and emissions which are in the 10 dB range below the limit are considered.

#### Step 2: Final measurement

Intention of this step is, to determine the highest emissions with the settings defined in the test specification for the frequencies identified in step 1.

EMI receiver settings:

- Detector: Quasi-Peak & (CISPR) Average

- IF Bandwidth: 9 kHz
- Measuring time: 1 s / frequency

At each frequency determined in step 1, four measurements are performed in the following combinations:

- 1) Neutral lead - reference ground (PE grounded)
- 2) Phase lead - reference ground (PE grounded)
- 3) Neutral lead - reference ground (PE floating)
- 4) Phase lead - reference ground (PE floating)

The highest value is reported.

### 5.1.2 TEST REQUIREMENTS / LIMITS

FCC Part 15, Subpart C, §15.207

| Frequency (MHz) | QP Limits (dBμV) | AV Limits (dBμV) |
|-----------------|------------------|------------------|
| 0.15 – 0.5      | 66 - 56          | 56 - 46          |
| 0.5 - 5         | 56               | 46               |
| 5 - 30          | 60               | 50               |

### 5.1.3 TEST PROTOCOL

Temperature: 27 °C  
Air Pressure: 996 hPa  
Humidity: 41 %

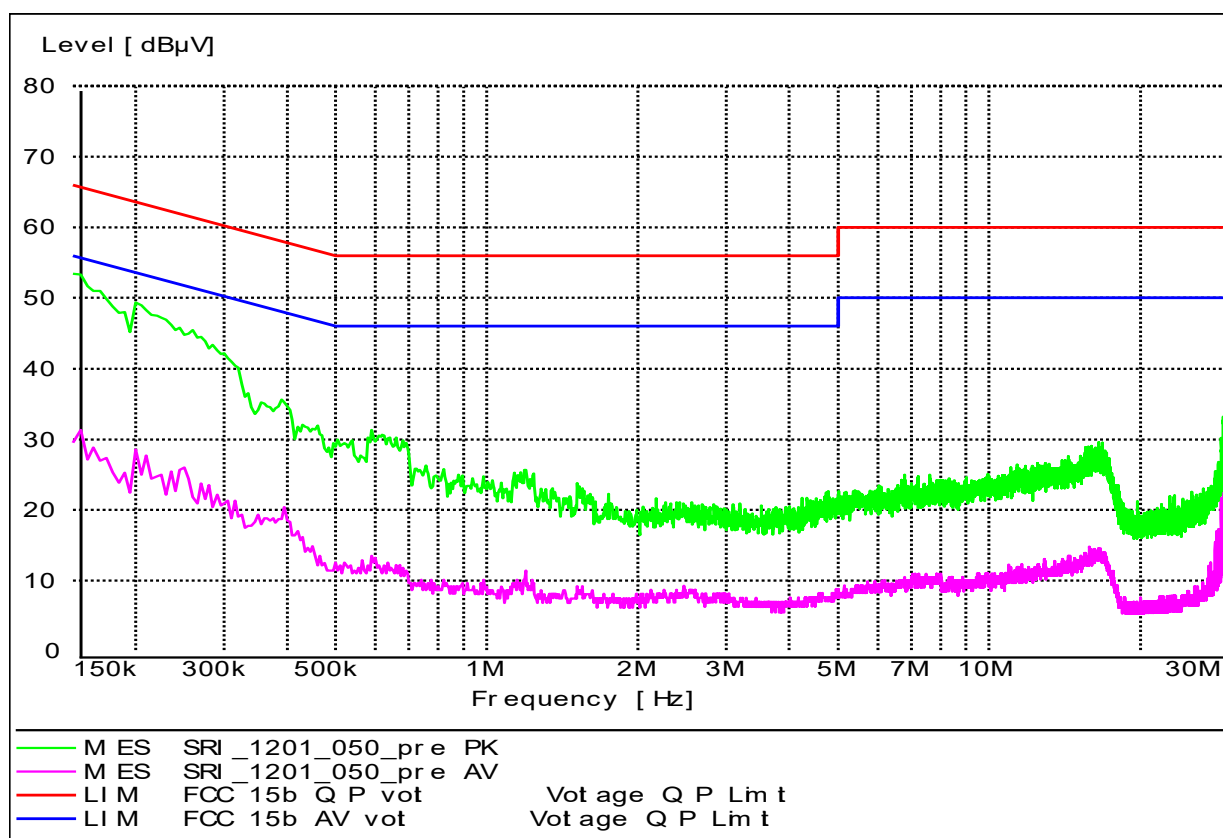
| Power line | PE | Frequency [MHz] | Measured value QP [dBμV] | Measured value AV [dBμV] | Limit [dBμV] | Margin [dB] |
|------------|----|-----------------|--------------------------|--------------------------|--------------|-------------|
| -          | -  | -               | -                        | -                        | -            | >10         |

Remark: No final measurement was performed because no frequencies (peaks) were found within the offset for acceptance analysis during the preliminary scan.  
Please see next sub-clause for the measurement plot. The chosen operating mode is selected as representative mode to generate "worst-case" conditions, i.e. high power consumption.  
The EUT is operated at 12 V DC while supplied by AUX\_G\_RX which is connected to AC Mains at 120 V / 60 Hz.

#### 5.1.4 MEASUREMENT PLOT

Operating mode = worst case  
(S01\_G05RX)

#### AC MAINS CONDUCTED



nominal output power set to: 11 dBm

#### 5.1.5 TEST EQUIPMENT USED

- Conducted Emissions

## 5.2 26 DB BANDWIDTH

Standard **FCC Part 15 Subpart E**

**The test was performed according to:**  
ANSI C63.10

### 5.2.1 TEST DESCRIPTION

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

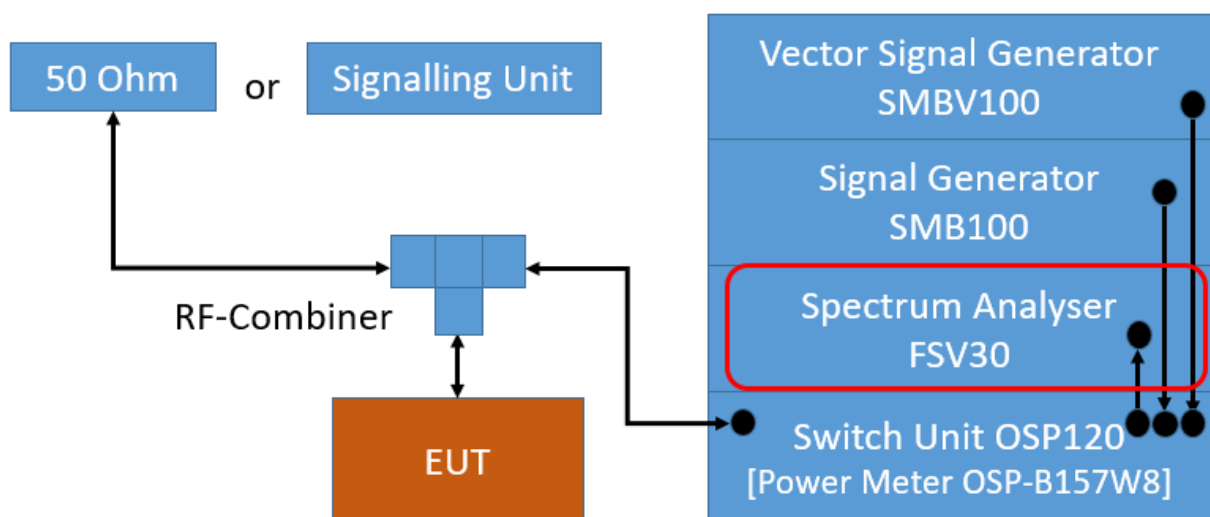
The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.

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

The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

Analyzer settings:

- Resolution Bandwidth (RBW): initially approx. 1 % of nominal emission bandwidth
- Video Bandwidth (VBW): > RBW
- Span: 40 / 80 / 160 / 320 MHz (for 20 / 40 / 80 / 160 MHz nominal bandwidth)
- Trace: Maxhold
- Sweeps: Until the trace is stable
- Sweeptime: Auto
- Detector: Peak



TS8997; Occupied Channel Bandwidth 6 dB / 26 dB / 99 %

Note: Deviant from the above picture, the EUT was directly connected to the spectrum analyser for the tests in this report.

## 5.2.2 TEST REQUIREMENTS / LIMITS

FCC Part 15, Subpart E, §15.403 (i)

There exist no applicable limits for the U-NII subbands 1, 2A and 2C. The test was performed to determine the limits for the "Maximum Conducted Output Power" test case. Therefore no result was applied.

## 5.2.3 TEST PROTOCOL

Ambient temperature: 22–25 °C  
Air Pressure: 997–1026 hPa  
Humidity: 34–47 %

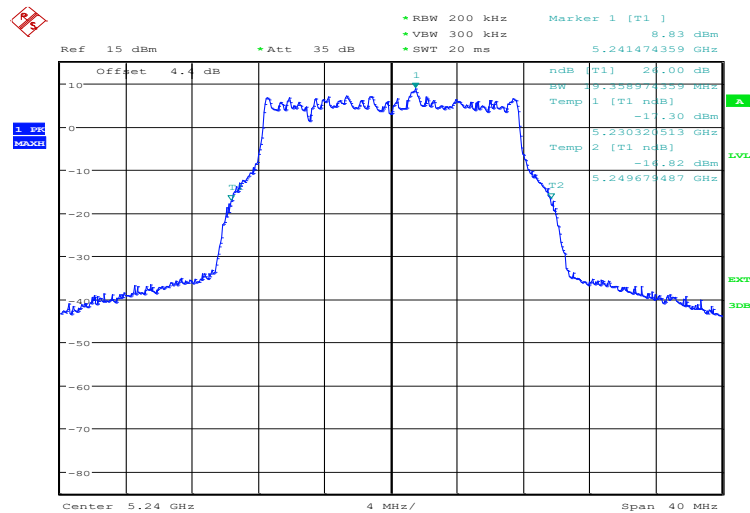
| Radio Technology | Operating Frequency | Subband  | 26 dB Bandwidth [MHz] |
|------------------|---------------------|----------|-----------------------|
| WLAN n 20 MHz    | low                 | U-NII-1  | 19.6                  |
| WLAN n 20 MHz    | mid                 | U-NII-1  | 19.4                  |
| WLAN n 20 MHz    | high                | U-NII-1  | 19.4                  |
| WLAN n 20 MHz    | low                 | U-NII-2A | 19.4                  |
| WLAN n 20 MHz    | mid                 | U-NII-2A | 19.4                  |
| WLAN n 20 MHz    | high                | U-NII-2A | 19.6                  |
| WLAN n 20 MHz    | low                 | U-NII-2C | 19.6                  |
| WLAN n 20 MHz    | mid                 | U-NII-2C | 19.5                  |
| WLAN n 20 MHz    | high                | U-NII-2C | 19.6                  |
| WLAN n 20 MHz    | low                 | U-NII-3  | 19.6                  |
| WLAN n 20 MHz    | mid                 | U-NII-3  | 19.4                  |
| WLAN n 20 MHz    | high                | U-NII-3  | 19.6                  |
| WLAN n 40 MHz    | low                 | U-NII-1  | 37.9                  |
| WLAN n 40 MHz    | high                | U-NII-1  | 38.1                  |
| WLAN n 40 MHz    | low                 | U-NII-2A | 38.2                  |
| WLAN n 40 MHz    | high                | U-NII-2A | 37.8                  |
| WLAN n 40 MHz    | high                | U-NII-2A | 38.2                  |
| WLAN n 40 MHz    | low                 | U-NII-2C | 38.1                  |
| WLAN n 40 MHz    | mid                 | U-NII-2C | 38.2                  |
| WLAN n 40 MHz    | high                | U-NII-2C | 38.2                  |
| WLAN n 40 MHz    | low                 | U-NII-3  | 38.3                  |
| WLAN n 40 MHz    | high                | U-NII-3  | 38.3                  |

1) Spot check with current sample.

Remark: Nominal output power set to: 17 dBm  
Please see next sub-clause for the measurement plot.

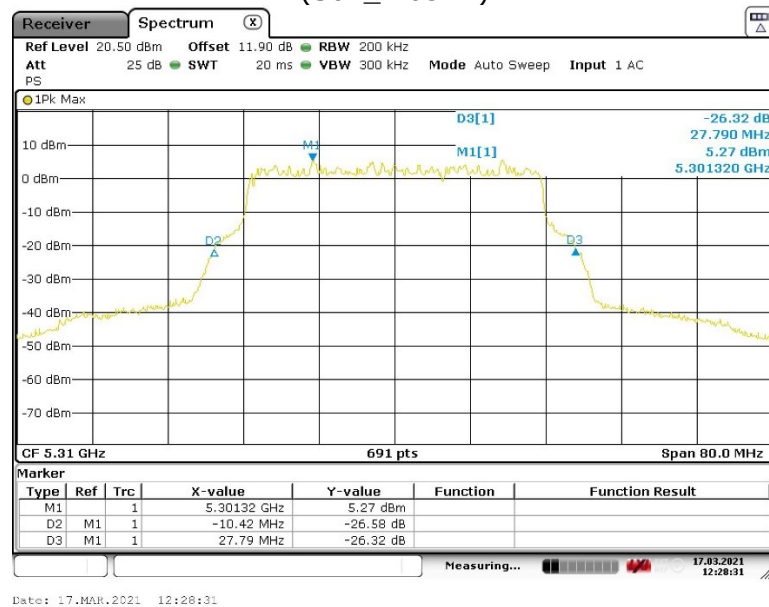
#### 5.2.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Radio Technology = WLAN n 20 MHz, Operating Frequency = high, Subband = U-NII-1 (S01\_W03RX)



Date: 2.JAN.2014 10:21:57

Radio Technology = WLAN n 40 MHz, Operating Frequency = high, Subband = U-NII-2A (S01\_W03RX)



Date: 17.MAR.2021 12:28:31

Spot check with current sample with the same settings as original measurement

#### 5.2.5 TEST EQUIPMENT USED

- WLAN RF Test Solution
- R&S TS8997 (spot check measurement using ESR)

### 5.3 6 DB BANDWIDTH

Standard **FCC Part 15 Subpart E**

**The test was performed according to:**  
ANSI C63.10

#### 5.3.1 TEST DESCRIPTION

The Equipment Under Test (EUT) was setup in a shielded room to perform the occupied bandwidth measurements.

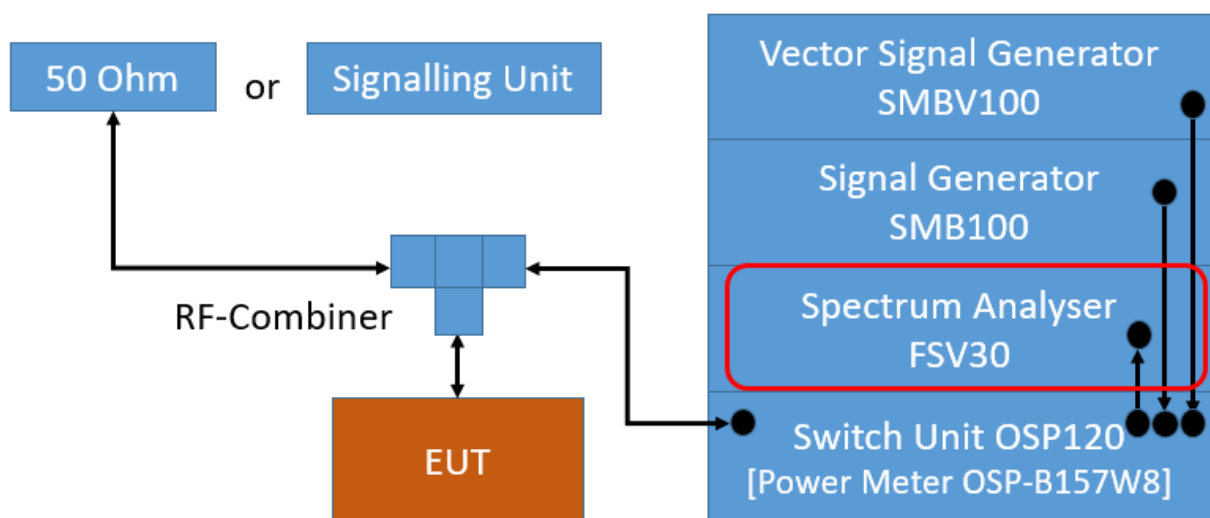
The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.

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

The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

Analyzer settings:

- Resolution Bandwidth (RBW): 100 kHz
- Video Bandwidth (VBW): 300 kHz
- Span: 40 / 80 / 160 / 320 MHz (for 20 / 40 / 80 / 160 MHz nominal bandwidth))
- Trace: Maxhold
- Sweeps: Until the trace is stable
- Sweeptime: Auto
- Detector: Peak



TS8997; Occupied Channel Bandwidth 6 dB / 26 dB / 99 %

Note: Deviant from the above picture, the EUT was directly connected to the spectrum analyser for the tests in this report.

### 5.3.2 TEST REQUIREMENTS / LIMITS

FCC Part 15, Subpart E, §15.407 (e)

Within the 5.725-5.850 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

### 5.3.3 TEST PROTOCOL

Ambient temperature: 22–25 °C  
Air Pressure: 997–1026 hPa  
Humidity: 34–47 %

| Radio Technology | Operating Frequency | 6 dB Bandwidth [MHz] | Limit [MHz] | Margin [MHz] |    |
|------------------|---------------------|----------------------|-------------|--------------|----|
| WLAN n 20 MHz    | low                 | 15.46                | 0.5         | 14.96        |    |
| WLAN n 20 MHz    | mid                 | 15.50                | 0.5         | 15.00        |    |
| WLAN n 20 MHz    | high                | 15.50                | 0.5         | 15.00        |    |
| WLAN n 40 MHz    | low                 | 31.05                | 0.5         | 30.55        |    |
| WLAN n 40 MHz    | low                 | 31.05                | 0.5         | 31.1         | 1) |
| WLAN n 40 MHz    | high                | 31.05                | 0.5         | 30.55        |    |

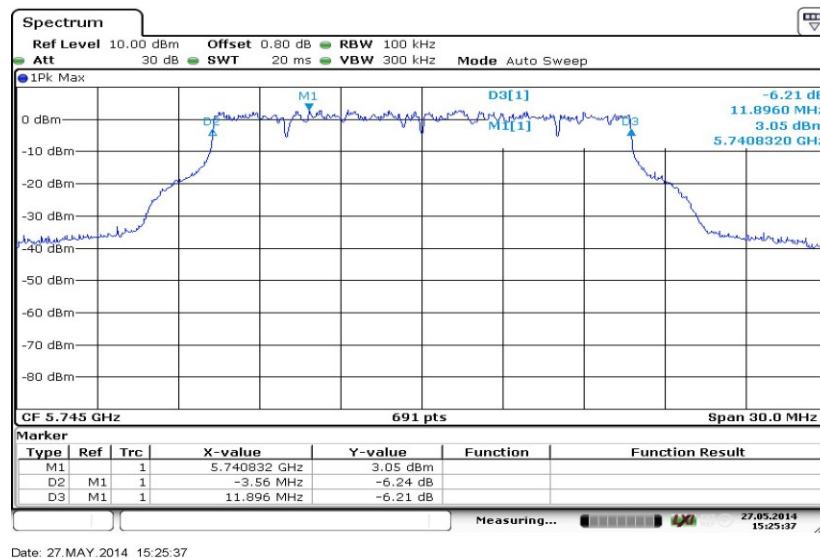
1) Spot check with current sample.

Remark: Nominal output power set to: 17 dBm.

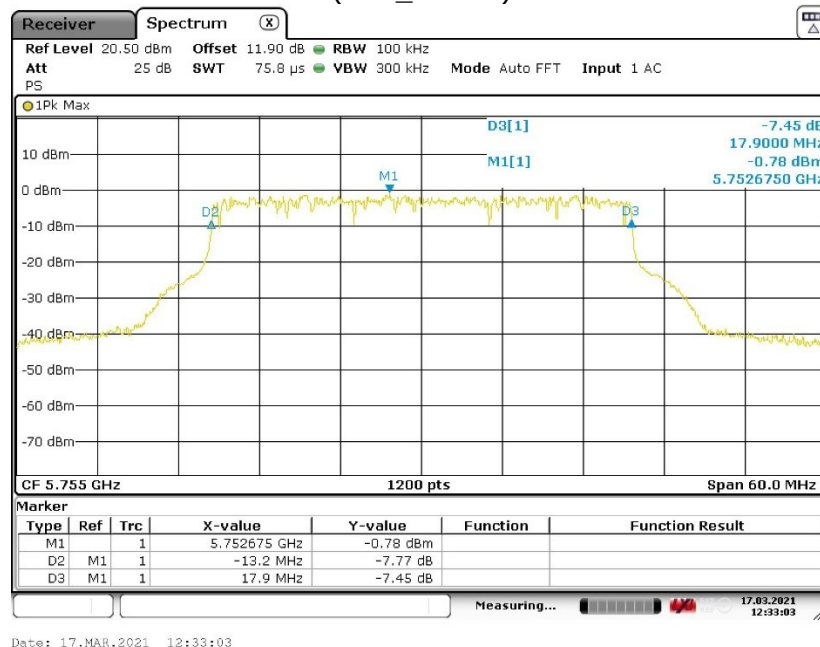
Please see next sub-clause for the measurement plot.

### 5.3.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Radio Technology = WLAN n 20 MHz, Operating Frequency = low, Subband = U-NII-3 (S01\_E04RX)



Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Subband = U-NII-3 (S01\_E04RX)



Spot check with current sample with the same settings as original measurement

### 5.3.5 TEST EQUIPMENT USED

- WLAN RF Test Solution
- R&S TS8997 (spot check measurement using ESR)

## 5.4 99 % BANDWIDTH

Standard **FCC Part 15 Subpart E**

**The test was performed according to:**  
ANSI C63.10

### 5.4.1 TEST DESCRIPTION

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

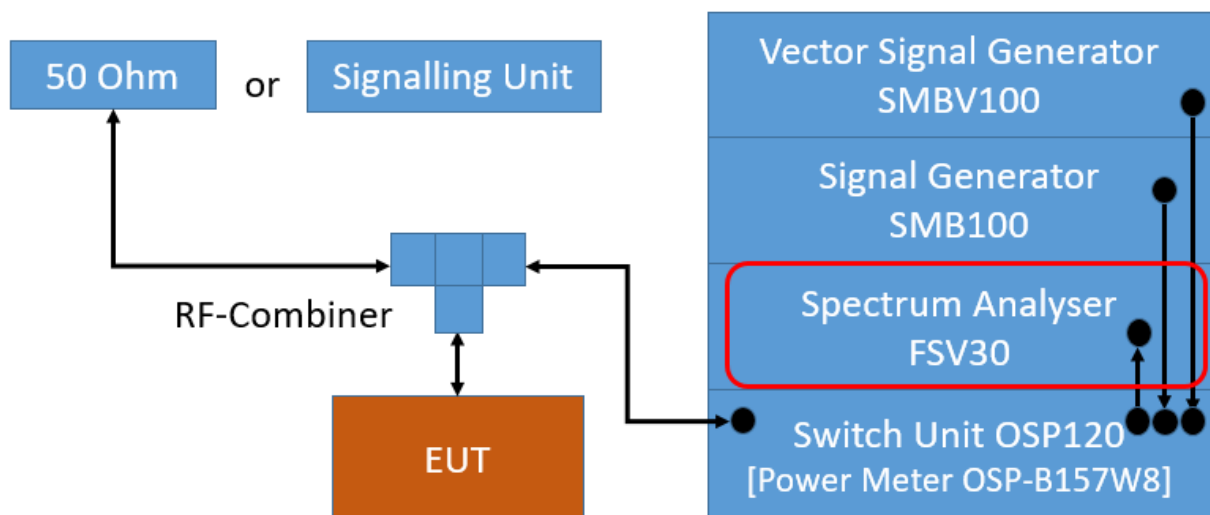
The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical.

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

The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

Analyzer settings:

- Resolution Bandwidth (RBW): approx.  $\geq 1$  % of the span, but not below
- Video Bandwidth (VBW):  $\geq 3$  times the RBW
- Span: 40 / 80 / 160 / 320 MHz (for 20 / 40 / 80 / 160 MHz nominal bandwidth)
- Trace: Maxhold
- Sweeps: Until the trace is stable
- Sweep time: Auto
- Detector: Peak



TS8997; Occupied Channel Bandwidth 6 dB / 26 dB / 99 %

## 5.4.2 TEST REQUIREMENTS / LIMITS

No applicable limit.

## 5.4.3 TEST PROTOCOL

Ambient temperature: 25 °C  
Air Pressure: 997 hPa  
Humidity: 32 %

| Radio Technology | Operating Frequency | Subband  | 99% Bandwidth [MHz] |
|------------------|---------------------|----------|---------------------|
| WLAN n 20 MHz    | low                 | U-NII-1  | 15.6                |
| WLAN n 20 MHz    | mid                 | U-NII-1  | 15.5                |
| WLAN n 20 MHz    | high                | U-NII-1  | 15.5                |
| WLAN n 20 MHz    | low                 | U-NII-2A | 15.5                |
| WLAN n 20 MHz    | mid                 | U-NII-2A | 15.6                |
| WLAN n 20 MHz    | high                | U-NII-2A | 15.5                |
| WLAN n 20 MHz    | low                 | U-NII-2C | 15.5                |
| WLAN n 20 MHz    | mid                 | U-NII-2C | 15.6                |
| WLAN n 20 MHz    | high                | U-NII-2C | 15.5                |
| WLAN n 20 MHz    | low                 | U-NII-3  | 15.5                |
| WLAN n 20 MHz    | mid                 | U-NII-3  | 15.5                |
| WLAN n 20 MHz    | high                | U-NII-3  | 15.6                |
| WLAN n 40 MHz    | low                 | U-NII-1  | 31.3                |
| WLAN n 40 MHz    | high                | U-NII-1  | 31.3                |
| WLAN n 40 MHz    | low                 | U-NII-2A | 31.3                |
| WLAN n 40 MHz    | high                | U-NII-2A | 31.3                |
| WLAN n 40 MHz    | low                 | U-NII-2C | 31.3                |
| WLAN n 40 MHz    | mid                 | U-NII-2C | 31.3                |
| WLAN n 40 MHz    | high                | U-NII-2C | 31.3                |
| WLAN n 40 MHz    | low                 | U-NII-3  | 31.3                |
| WLAN n 40 MHz    | high                | U-NII-3  | 31.0                |

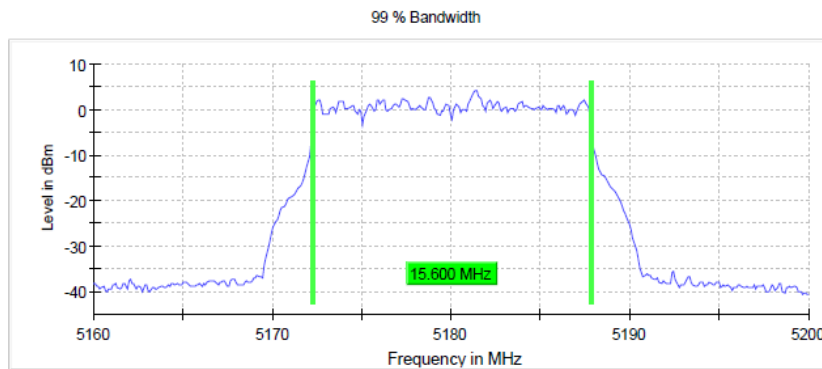
Remark: Nominal output power set to: 15 dBm.  
Please see next sub-clause for the measurement plot.

#### 5.4.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Radio Technology = WLAN n 20 MHz, Operating Frequency = low, Subband = U-NII-1 (S01\_AA01RX)

##### 99 % Bandwidth

| DUT Frequency (MHz) | Bandwidth (MHz) | Limit Min (MHz) | Limit Max (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Result |
|---------------------|-----------------|-----------------|-----------------|----------------------|-----------------------|--------|
| 5180.000000         | 15.600000       | ---             | ---             | 5172.250000          | 5187.850000           | PASS   |

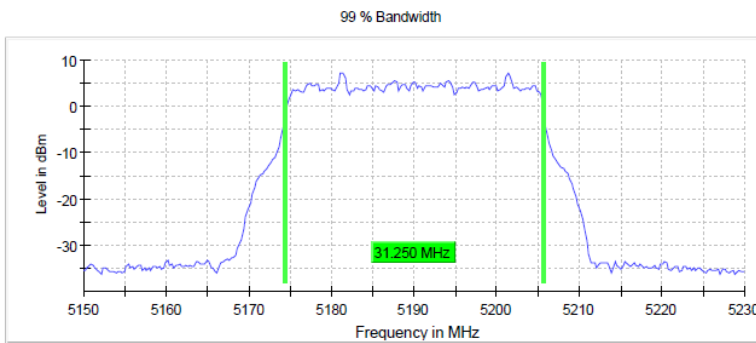


| Setting               | Instrument Value |
|-----------------------|------------------|
| Start Frequency       | 5.16000 GHz      |
| Stop Frequency        | 5.20000 GHz      |
| Span                  | 40.000 MHz       |
| RBW                   | 200.000 kHz      |
| VBW                   | 1.000 MHz        |
| SweepPoints           | 400              |
| Sweptime              | 28.477 $\mu$ s   |
| Reference Level       | 0.000 dBm        |
| Attenuation           | 20.000 dB        |
| Detector              | MaxPeak          |
| SweepCount            | 200              |
| Filter                | 3 dB             |
| Trace Mode            | Max Hold         |
| SweepType             | FFT              |
| Preamp                | off              |
| Stablemode            | Trace            |
| Stablevalue           | 0.30 dB          |
| Run                   | 22 / max. 150    |
| Stable                | 5 / 5            |
| Max Stable Difference | 0.15 dB          |

Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Subband = U-NII-1 (S01\_AA01RX)

##### 99 % Bandwidth

| DUT Frequency (MHz) | Bandwidth (MHz) | Limit Min (MHz) | Limit Max (MHz) | Band Edge Left (MHz) | Band Edge Right (MHz) | Result |
|---------------------|-----------------|-----------------|-----------------|----------------------|-----------------------|--------|
| 5190.000000         | 31.250000       | ---             | ---             | 5174.375000          | 5205.625000           | PASS   |



| Setting               | Instrument Value |
|-----------------------|------------------|
| Start Frequency       | 5.15000 GHz      |
| Stop Frequency        | 5.23000 GHz      |
| Span                  | 80.000 MHz       |
| RBW                   | 500.000 kHz      |
| VBW                   | 2.000 MHz        |
| SweepPoints           | 320              |
| Sweptime              | 18.906 $\mu$ s   |
| Reference Level       | 0.000 dBm        |
| Attenuation           | 20.000 dB        |
| Detector              | MaxPeak          |
| SweepCount            | 200              |
| Filter                | 3 dB             |
| Trace Mode            | Max Hold         |
| SweepType             | FFT              |
| Preamp                | off              |
| Stablemode            | Trace            |
| Stablevalue           | 0.30 dB          |
| Run                   | 25 / max. 150    |
| Stable                | 5 / 5            |
| Max Stable Difference | 0.00 dB          |

#### 5.4.5 TEST EQUIPMENT USED

- R&S TS8997 (using FSV)

## 5.5 MAXIMUM CONDUCTED OUTPUT POWER

Standard **FCC Part 15 Subpart E**

**The test was performed according to:**  
ANSI C63.10

### 5.5.1 TEST DESCRIPTION

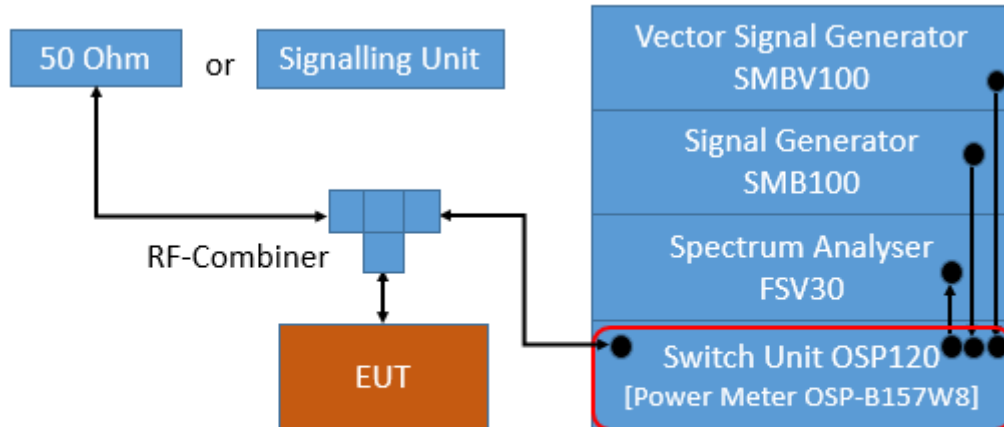
The Equipment Under Test (EUT) was set up to perform the output power measurements. The results recorded were measured with the modulation which produces the worst-case (highest) output power

The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

The OSP-B157W is a gated RF average power meter with a signal bandwidth > 300 MHz.

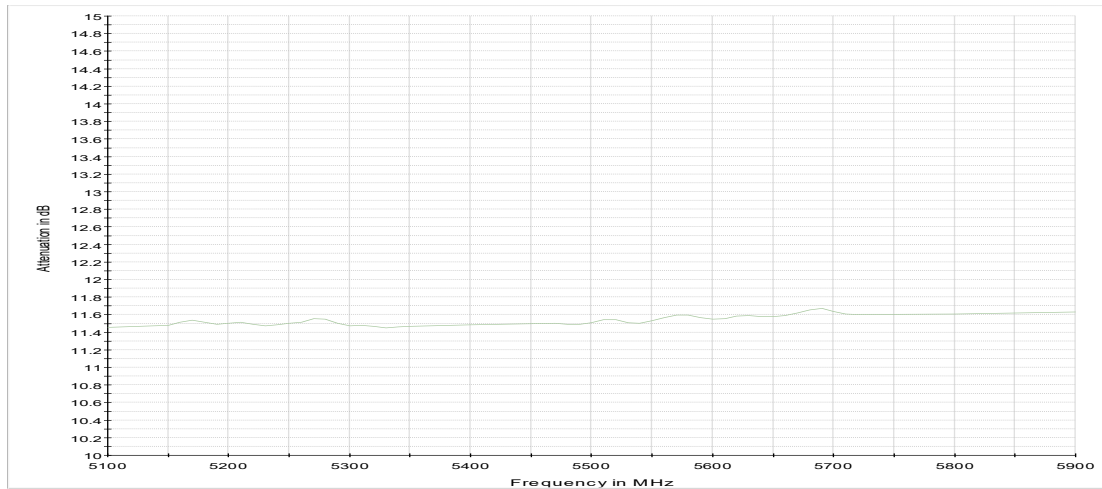
Note:

The measurement was performed according FCC Public Note "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, 789033 D02", method **PM-G**.



TS8997; Maximum Conducted Output Power

Note: Deviant from the above picture, the EUT was directly connected to the spectrum analyser for the tests in this report. The channel power function was used to determine the output power. See example plots for the respective Analyser settings.



Attenuation of measurement path

## 5.5.2 TEST REQUIREMENTS / LIMITS

### A) FCC

For systems using digital modulation techniques in the 5.15 – 5.25 GHz bands:

§15.407 (a) (1)

Limit: 50 mW (17 dBm) or  $4 \text{ dBm} + 10 \log (26 \text{ dB bandwidth/MHz})$  whatever is the lesser.

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

§15.407 (a) (1) (i): Outdoor access point:

Limit: 1 W (30 dBm) provided the maximum antenna gain does not exceed 6 dBi.

The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

§15.407 (a) (1) (ii): Indoor access point:

Limit: 1 W (30 dBm) provided the maximum antenna gain does not exceed 6 dBi.

§15.407 (a) (1) (iv): Mobile and portable client devices:

Limit: 250 mW (24 dBm) provided the maximum antenna gain does not exceed 6 dBi.

For systems using digital modulation techniques in the 5.25 – 5.35 GHz and 5.47 – 5.725 GHz bands:

§15.407 (a) (2)

Limit: 250 mW (24 dBm) or  $11 \text{ dBm} + 10 \log (26 \text{ dB bandwidth/MHz})$  whatever is the lesser.

For systems using digital modulation techniques in the 5.725 – 5.850 GHz bands:

§15.407 (a) (3)

Limit: 1 W (30 dBm) or  $17 \text{ dBm} + 10 \log (26 \text{ dB bandwidth/MHz})$  whatever is the lesser.

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

§15.407 (a) (3):

Limit: 1 W (30 dBm).

§15.407 (a) (4):

The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.

## **B) IC**

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

RSS-247, 6.2.1 (1), Band 5150-5250 MHz, indoor operation only:

Limit (e.i.r.p.): 200 mW (23 dBm) or  $10 + 10 \log_{10} B$  [dBm], whichever power is less.

B is the 99% emission bandwidth in MHz.

RSS-247, 6.2.2 (1), Band 5250-5350 MHz:

Limits:

Maximum conducted Power: 250 mW (24 dBm) or  $11 + 10 \log_{10} B$  [dBm], whichever power is less.

e.i.r.p.: 1.0 W (30 dBm) or  $17 + 10 \log_{10} B$  [dBm], whichever power is less.

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

RSS-247, 6.2.3 (1), Bands 5470-5600 MHz and 5650-5725 MHz:

Limits:

Maximum conducted Power: 250 mW (24 dBm) or  $11 + 10 \log_{10} B$  [dBm], whichever power is less.

e.i.r.p.: 1.0 W (30 dBm) or  $17 + 10 \log_{10} B$  [dBm], whichever power is less.

RSS-247, 6.2.4 (1), Band 5725-5825 MHz:

Limits:

Maximum conducted Power: 1W (30 dBm) or  $17 + 10 \log_{10} B$  [dBm], whichever power is less.

e.i.r.p.: 4.0 W (36 dBm) or  $23 + 10 \log_{10} B$  [dBm], whichever power is less.

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

### 5.5.3 TEST PROTOCOL

Temperature: 20–25 °C  
 Air Pressure: 994–1031 hPa  
 Humidity: 35–48 %  
 Video Transmission 20 MHz BW

| U-NII-Subband | Ch. No. | Freq. [MHz] | Cond. Power [dBm] | EIRP [dBm] | FCC Cond. Limit [dBm] | Margin [dB] | IC Cond. Limit [dBm] | Margin [dB] | IC EIRP Limit [dBm] | Margin [dB] |    |
|---------------|---------|-------------|-------------------|------------|-----------------------|-------------|----------------------|-------------|---------------------|-------------|----|
| 1             | 36      | 5180        | 13.7              | 15.7       | 30.0                  | 16.3        | N/A                  |             | 21.9                | 6.2         | 1) |
|               | 44      | 5220        | 14.0              | 16.0       | 30.0                  | 16.0        | N/A                  |             | 21.9                | 5.9         | 1) |
|               | 48      | 5240        | 13.7              | 15.7       | 30.0                  | 16.3        | N/A                  |             | 21.9                | 6.2         | 1) |
| 2A            | 52      | 5260        | 13.9              | 15.9       | 23.9                  | 10.0        | 22.9                 | 9.0         | 28.9                | 13.0        | 1) |
|               | 56      | 5280        | 13.7              | 15.7       | 23.9                  | 10.2        | 22.9                 | 9.2         | 28.9                | 13.2        | 1) |
|               | 64      | 5320        | 14.0              | 16.0       | 23.9                  | 9.9         | 22.9                 | 8.9         | 28.9                | 12.9        | 1) |
| 2C            | 100     | 5500        | 13.9              | 15.9       | 23.9                  | 10.0        | 22.9                 | 9.0         | 28.9                | 13.0        |    |
|               | 116     | 5580        | 13.6              | 15.6       | 23.9                  | 10.3        | 22.9                 | 9.3         | 28.9                | 13.3        |    |
|               | 140     | 5700        | 13.2              | 15.2       | 23.9                  | 10.7        | 22.9                 | 9.7         | 28.9                | 13.7        |    |
| 3             | 149     | 5745        | 12.7              | 14.7       | 30.0                  | 17.3        | 30.0                 | 17.3        | 36.0                | 21.3        |    |
|               | 157     | 5785        | 12.7              | 14.7       | 30.0                  | 17.3        | 30.0                 | 17.3        | 36.0                | 21.3        |    |
|               | 165     | 5825        | 12.2              | 14.2       | 30.0                  | 17.8        | 30.0                 | 17.8        | 36.0                | 21.8        |    |

Video Transmission 40 MHz BW

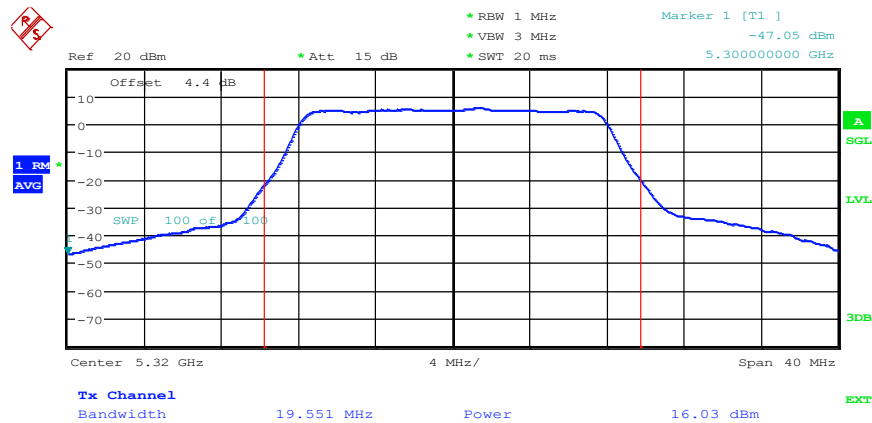
| U-NII-Subband | Ch. No. | Freq. [MHz] | Cond. Power [dBm] | EIRP [dBm] | FCC Cond. Limit [dBm] | Margin [dB] | IC Cond. Limit [dBm] | Margin [dB] | IC EIRP Limit [dBm] | Margin [dB] |      |
|---------------|---------|-------------|-------------------|------------|-----------------------|-------------|----------------------|-------------|---------------------|-------------|------|
| 1             | 38      | 5190        | 15.7              | 17.7       | 30.0                  | 14.3        | N/A                  |             | 23.0                | 5.3         | 1)   |
|               | 46      | 5230        | 15.5              | 17.5       | 30.0                  | 14.5        | N/A                  |             | 23.0                | 5.5         | 1)   |
| 2A            | 54      | 5270        | 15.8              | 17.8       | 24.0                  | 8.2         | 24.0                 | 8.2         | 30.0                | 12.2        | 1)   |
|               | 54      | 5270        | 15.9              | 17.9       | 24.0                  | 8.1         | 24.0                 | 8.1         | 30.0                | 12.1        | 1)2) |
|               | 62      | 5310        | 15.5              | 17.5       | 24.0                  | 8.5         | 24.0                 | 8.5         | 30.0                | 12.5        | 1)   |
| 2C            | 102     | 5510        | 15.7              | 17.7       | 24.0                  | 8.3         | 24.0                 | 8.3         | 30.0                | 12.3        |      |
|               | 110     | 5550        | 14.9              | 16.9       | 24.0                  | 9.1         | 24.0                 | 9.1         | 30.0                | 13.1        |      |
|               | 134     | 5670        | 14.8              | 16.8       | 24.0                  | 9.2         | 24.0                 | 9.2         | 30.0                | 13.2        |      |
| 3             | 151     | 5755        | 14.3              | 16.3       | 30.0                  | 15.7        | 30.0                 | 15.7        | 36.0                | 19.7        |      |
|               | 159     | 5795        | 14.2              | 16.2       | 30.0                  | 15.8        | 30.0                 | 15.8        | 36.0                | 19.8        |      |

- 1) No additional limit applies to the elevation.
- 2) Spot check with current sample on worst case power.

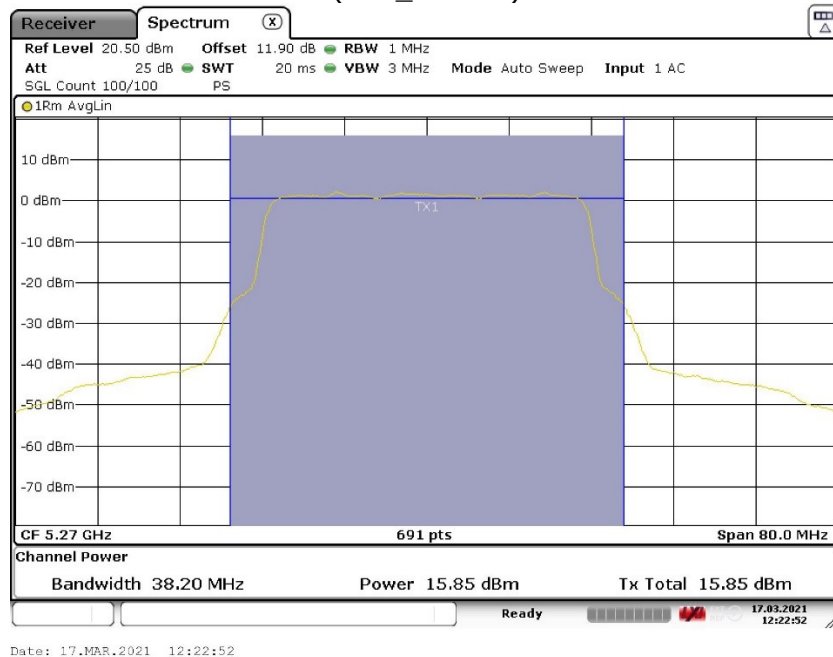
Remark: Nominal output power set to: 17 dBm.  
 Please see next sub-clause for the measurement plot.

#### 5.5.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Radio Technology = WLAN n 20 MHz, Operating Frequency = high, Subband = U-NII-2A (S01\_W03RX)



Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Subband = U-NII-2A (S01\_W03RX)



Spot check with current sample on worst case power. Result without antenna gain

#### 5.5.5 TEST EQUIPMENT USED

- WLAN RF Test Solution
- R&S TS8997 (using ESR)

## 5.6 PEAK POWER SPECTRAL DENSITY

Standard **FCC Part 15 Subpart E**

**The test was performed according to:**  
ANSI C63.10

### 5.6.1 TEST DESCRIPTION

The Equipment Under Test (EUT) was set up in a shielded room to perform the Maximum Power Spectral Density measurements.  
The results recorded were measured with the modulation which produces the worst-case (highest) output power.

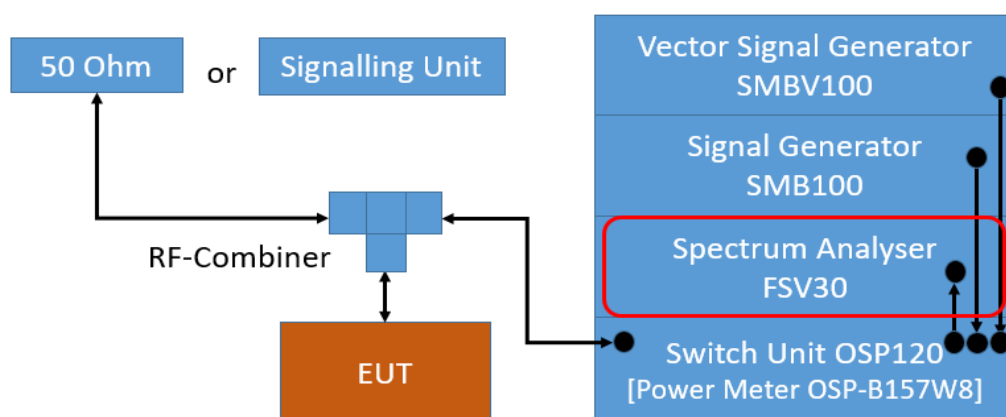
The EUT was connected to the test system as described in the block diagram below. The complete attenuation of the measurement path is known and considered.

Analyzer settings:

- Resolution Bandwidth (RBW): 1 MHz (for subband 3: 500 kHz)
- Video Bandwidth (VBW): 3 MHz (for subband 3: 2 MHz)
- Trace: Average, RMS power averaging mode
- Sweeps: 100
- Sweep time: 5 ms
- Detector: RMS
- Trigger: gated mode

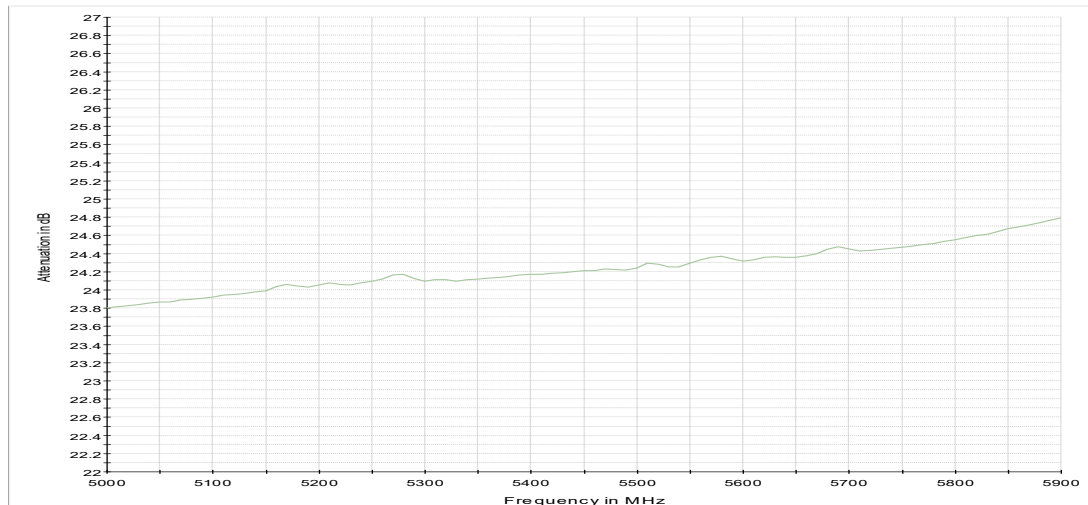
Note:

The analyser settings are according FCC Public Note "Guidelines for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices - Part 15, Subpart E, 789033 D02", method **SA-3**.



TS8997; Maximum Power Spectral Density

Note: For the measurements the EUT was directly connected to the spectrum analyser.



Attenuation of the measurement path

## 5.6.2 TEST REQUIREMENTS / LIMITS

### A) FCC

FCC Part 15, Subpart E, §15.407 (a) (1)

For systems using digital modulation techniques in the 5.15 – 5.25 GHz bands:

(i) and (ii), outdoor and indoor access points: Limit: 17 dBm/MHz.

(iv), mobile and portable client devices: Limit: 11 dBm/MHz.

FCC Part 15, Subpart E, §15.407 (a) (2)

For systems using digital modulation techniques in the 5.25 – 5.35 GHz and 5.47 – 5.725 GHz bands:

Limit: 11 dBm/MHz.

FCC Part 15, Subpart E, §15.407 (a) (3)

For systems using digital modulation techniques in the 5.725 – 5.850 GHz bands:

Limit: 30 dBm/500 kHz.

Note: The limit will be also fulfilled when measuring at any bandwidth greater than 500 kHz.

This applies to signals where the maximum conducted output power was measured at a bandwidth exceeding 500 kHz and which fulfil that limit of 30 dBm.

### B) IC

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

RSS-247, 6.2.1 (1), Band 5150-5250 MHz, indoor operation only:

Limit (e.i.r.p.): 10 dBm/MHz.

RSS-247, 6.2.2 (1), Band 5250-5350 MHz:

Limit: 11 dBm/MHz.

RSS-247, 6.2.3 (1), Bands 5470-5600 MHz and 5650-5725 MHz:

Limit: 11 dBm/MHz.

RSS-247, 6.2.4 (1), Band 5725-5850 MHz:

Limit: 30 dBm/500 kHz.

### 5.6.3 TEST PROTOCOL

Temperature: 20–25 °C  
 Air Pressure: 994–1031 hPa  
 Humidity: 35–48 %  
 Video Transmission 20 MHz BW

| U-NII-Subband | Ch. No. | Freq. [MHz] | MPSD [dBm/MHz] | FCC Limit [dBm/MHz] | Margin [dB] | IC Limit [dBm/MHz] | Margin [dB] | IC EIRP MPSD |
|---------------|---------|-------------|----------------|---------------------|-------------|--------------------|-------------|--------------|
| 1             | 36      | 5180        | 4.3            | 17.0                | 12.7        | 10.0               | 3.7         | 6.3          |
|               | 44      | 5220        | 3.8            | 17.0                | 13.2        | 10.0               | 4.2         | 5.8          |
|               | 48      | 5240        | 3.6            | 17.0                | 13.4        | 10.0               | 4.4         | 5.6          |
| 2A            | 52      | 5260        | 3.7            | 11.0                | 7.3         | 11.0               | 7.3         | unit:        |
|               | 56      | 5280        | 3.4            | 11.0                | 7.6         | 11.0               | 7.6         | dBm/         |
|               | 64      | 5320        | 4.8            | 11.0                | 6.2         | 11.0               | 6.2         | MHz          |
| 2C            | 100     | 5500        | 4.1            | 11.0                | 6.9         | 11.0               | 6.9         |              |
|               | 116     | 5580        | 3.0            | 11.0                | 8.0         | 11.0               | 8.0         |              |
|               | 140     | 5700        | 2.9            | 11.0                | 8.1         | 11.0               | 8.1         |              |
| 3             | 149     | 5745        | 2.4            | 30.0                | 27.6        | 30.0               | 27.6        |              |
|               | 157     | 5785        | 2.3            | 30.0                | 27.7        | 30.0               | 27.7        |              |
|               | 165     | 5825        | 1.9            | 30.0                | 28.1        | 30.0               | 28.1        |              |

Video Transmission 40 MHz BW

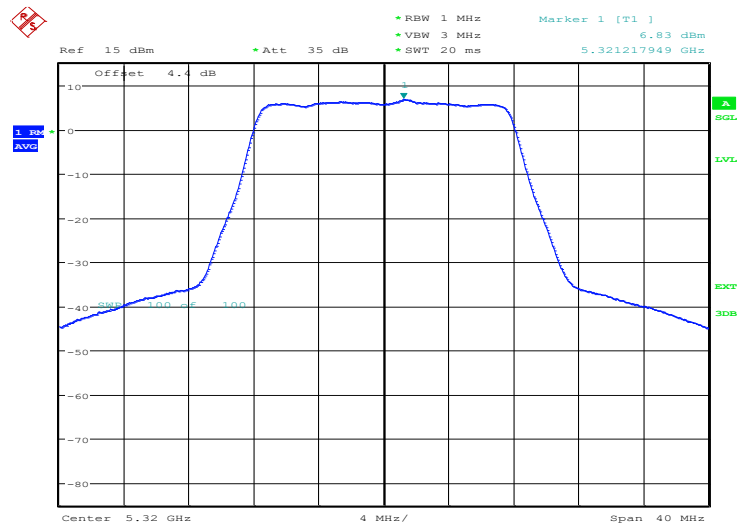
| U-NII-Subband | Ch. No. | Freq. [MHz] | MPSD [dBm/MHz] | FCC Limit [dBm/MHz] | Margin [dB] | IC Limit [dBm/MHz] | Margin [dB] | IC EIRP MPSD |    |
|---------------|---------|-------------|----------------|---------------------|-------------|--------------------|-------------|--------------|----|
| 1             | 38      | 5190        | 2.5            | 17.0                | 14.5        | 10.0               | 5.5         | 4.5          |    |
|               | 46      | 5230        | 2.3            | 17.0                | 14.7        | 10.0               | 5.7         | 4.3          |    |
| 2A            | 54      | 5270        | 2.6            | 11.0                | 8.4         | 11.0               | 8.4         | unit:        |    |
|               | 62      | 5310        | 2.7            | 11.0                | 8.3         | 11.0               | 8.3         | dBm/         |    |
|               | 62      | 5310        | 2.3            | 11.0                | 8.7         | 11.0               | 8.7         | MHz          | 1) |
| 2C            | 102     | 5510        | 2.2            | 11.0                | 8.8         | 11.0               | 8.8         |              |    |
|               | 110     | 5550        | 1.5            | 11.0                | 9.5         | 11.0               | 9.5         |              |    |
|               | 134     | 5670        | 1.6            | 11.0                | 9.4         | 11.0               | 9.4         |              |    |
| 3             | 151     | 5755        | 1.1            | 30.0                | 28.9        | 30.0               | 28.9        |              |    |
|               | 159     | 5795        | 0.7            | 30.0                | 29.3        | 30.0               | 29.3        |              |    |

1) Spot check with current sample.

Remark: Nominal output power set to: 17 dBm.  
 Please see next sub-clause for the measurement plot.

#### 5.6.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Radio Technology = WLAN n 20 MHz, Operating Frequency = high, Subband = U-NII-2A (S01\_W03RX)



Date: 2.JAN.2014 13:52:03

Radio Technology = WLAN n 40 MHz, Operating Frequency = high, Subband = U-NII-2A (S01\_W03RX)



#### 5.6.5 TEST EQUIPMENT USED

- WLAN RF Test Solution

## 5.7 UNDESIRABLE EMISSIONS; GENERAL FIELD STRENGTH LIMITS

Standard **FCC Part 15 Subpart E**

**The test was performed according to:**  
ANSI C63.10

### 5.7.1 TEST DESCRIPTION

The test set-up was made in accordance to the general provisions of ANSI C63.10 in a typical installation configuration. The measurements were performed according the following sub-chapters of ANSI C63.10:

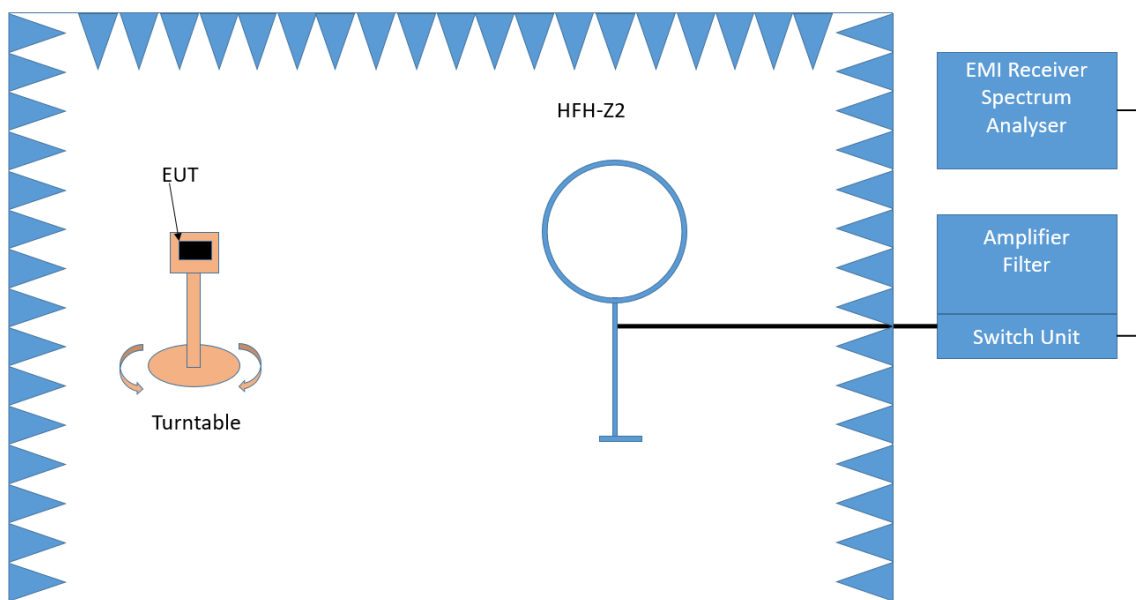
- < 30 MHz: Chapter 6.4
- 30 MHz – 1 GHz: Chapter 6.5
- > 1 GHz: Chapter 6.6 (procedure according 6.6.5 used)

The measurement procedure is implemented into the EMI test software EMC32 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 also performed at 3 axes. A pre-check is performed while the EUT is powered.

#### **Below 1 GHz:**

The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The influence of the EUT support table that is used between 30–1000 MHz was evaluated.

#### **1. Measurement up to 30 MHz**



Test Setup; Spurious Emission Radiated (SAC), 9 kHz – 30 MHz

The Loop antenna HFH2-Z2 is used.

**Step 1: pre measurement**

- Anechoic chamber
- Antenna distance: 3 m
- Detector: Peak-Maxhold
- Frequency range: 0.009 - 0.15 MHz and 0.15 - 30 MHz
- Frequency steps: 0.05 kHz and 2.25 kHz
- IF-Bandwidth: 0.2 kHz and 9 kHz
- Measuring time / Frequency step: 100 ms (FFT-based)

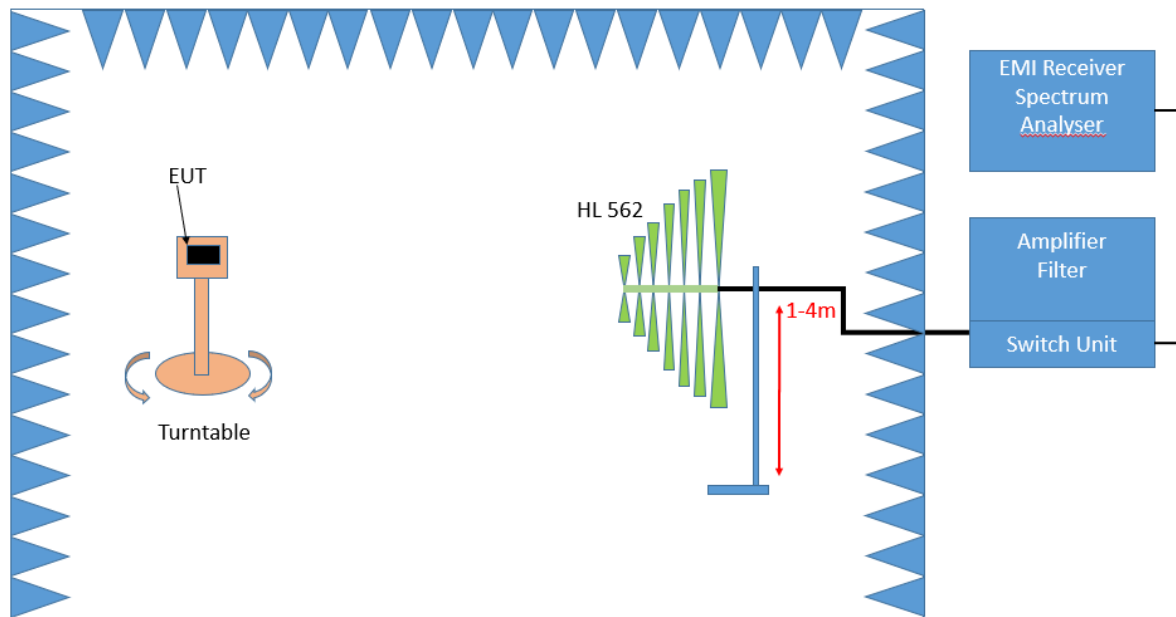
Intention of this step is, to determine the radiated EMI-profile of the EUT. Afterwards the relevant emissions for the final measurement are identified.

**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 site
- 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: 1 s

**2. Measurement above 30 MHz and up to 1 GHz**



Test Setup; Spurious Emission Radiated (SAC), 30 MHz- 1GHz

**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 / Quasipeak (FFT-based)
- Frequency range: 30 - 1000 MHz
- Frequency steps: 30 kHz
- IF-Bandwidth: 120 kHz
- Measuring time / Frequency step: 100 ms
- Turntable angle range: -180° to 90°

- Turntable step size: 90°
- Height variation range: 1 – 4 m
- Height variation step size: 1.5 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: Adjustment 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  $\pm 45^\circ$  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  $\pm 100$  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: 360 °
- Height variation range: 1 – 4 m
- Antenna Polarisation: max. value determined in step 1

### **Step 3: Final measurement with QP detector**

With the settings determined in step 2, the final measurement will be performed:

EMI receiver settings for step 3:

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

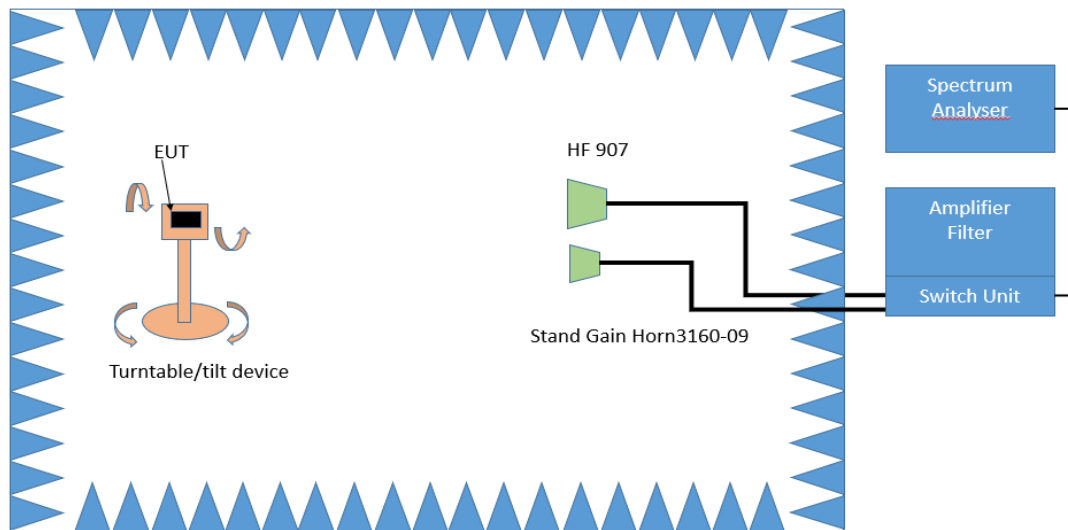
After the measurement a plot will be generated which contains a diagram with the results of the preliminary scan and a chart with the frequencies and values of the results of the final measurement.

### Above 1 GHz:

The Equipment Under Test (EUT) was set up on a non-conductive support (tilt device) at 1.5 m height in the fully-anechoic chamber.

All steps were performed with one height (1.5 m) of the receiving antenna only.

### 3. Measurement 1 GHz up to 26.5 GHz



Test Setup; Spurious Emission Radiated (FAC), 1 GHz-26.5 GHz

Note: For measurements before 2020 antenna HF 906 was used instead of HF 907.

#### Step 1:

The Equipment Under Test (EUT) was set up on a non-conductive support (tilt device) at 1.5 m height in the fully-anechoic chamber.

All steps were performed with one height (1.5 m) of the receiving antenna only.

The EUT is turned during the preliminary measurement across the elevation axis, with a step size of 90 °.

The turn table step size (azimuth angle) for the preliminary measurement is 45 °.

#### Step 2:

Due to the fact, that in this frequency range the test is performed in a fully anechoic room, the height scan of the receiving antenna in step 2 is omitted. Instead of this, a maximum search with a step size  $\pm 45^\circ$  for the elevation axis is performed.

The turn table azimuth will slowly vary by  $\pm 22.5^\circ$ .

The elevation angle will slowly vary by  $\pm 45^\circ$

EMI receiver settings (for all steps):

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

#### Step 3:

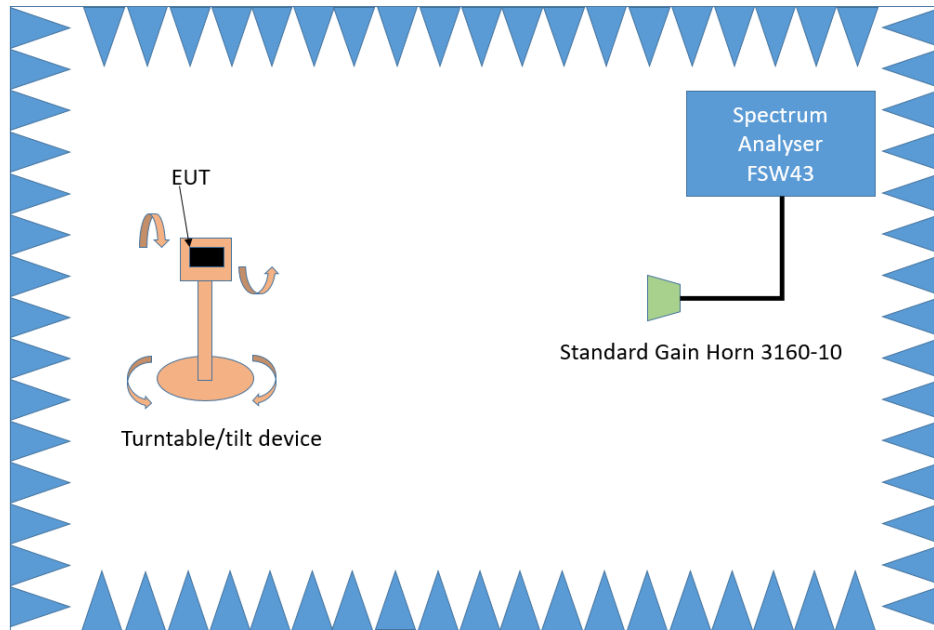
Spectrum analyser settings for step 3:

- Detector: Peak / Average
- Measured frequencies: in step 1 determined frequencies
- IF – Bandwidth: 1 MHz
- Measuring time: 1 s

#### 4. Measurement above 26.5 GHz up to 40 GHz

The following modifications, compared to the frequency range 1 GHz – 26.5 GHz, apply to the measurement procedure for the frequency range above 26.5 GHz:

- Measurement distance: 1m



Test Setup; Spurious Emission Radiated (FAC), 26.5 – 40 GHz

#### 5.7.2 TEST REQUIREMENTS / LIMITS

##### A) FCC

FCC Part 15 Subpart E, §15.407 (b)(1)

For transmitters operating in the 5150–5250 MHz band:

Limit: –27 dBm/MHz EIRP outside of the band 5150–5350 MHz.

FCC Part 15 Subpart E, §15.407 (b)(2)

For transmitters operating in the 5250–5350 MHz band:

Limit: –27 dBm/MHz EIRP outside of the band 5150–5350 MHz.

FCC Part 15 Subpart E, §15.407 (b)(3)

For transmitters operating in the 5470–5725 MHz band:

Limit: –27 dBm/MHz EIRP outside of the band 5470–5725 MHz.

FCC Part 15 Subpart E, §15.407 (b)(4)

For transmitters operating in the 5725–5850 MHz band:

Limit: –27 dBm/MHz at 75 MHz or more above or below the band edge  
 increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge  
 increasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edge  
 increasing linearly to 27 dBm/MHz at the band edge.

## B) IC

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

RSS-247, 6.2.1.2, Emissions outside the band 5150-5250 MHz, indoor operation only:  
Limit: -27 dBm/MHz EIRP outside of the band 5150-5250 MHz.

RSS-247, 6.2.2.2, Emissions outside the band 5250-5350 MHz:  
Limit: -27 dBm/MHz EIRP outside of the band 5250-5350 MHz.

RSS-247, 6.2.3.2, Emissions outside the bands 5470-5600 MHz and 5650-5725 MHz:  
Limit: -27 dBm/MHz EIRP outside of the band 5470-5725 MHz.  
However, devices with bandwidth overlapping the band edge of 5725 MHz can meet the emission limit of -27 dBm/MHz e.i.r.p. at 5850 MHz instead of 5725 MHz.  
Note: No operation is permitted for the frequency range 5600-5650 MHz.

RSS-247, 6.2.4.2, Emissions outside the band 5725-5850 MHz:

- 27 dBm/MHz at frequencies from the band edges decreasing linearly to 15.6 dBm/MHz at 5 MHz above or below the band edges;
- 15.6 dBm/MHz at 5 MHz above or below the band edges decreasing linearly to 10 dBm/MHz at 25 MHz above or below the band edges;
- 10 dBm/MHz at 25 MHz above or below the band edges decreasing linearly to -27 dBm/MHz at 75 MHz above or below the band edges; and
- 27 dBm/MHz at frequencies more than 75 MHz above or below the band edges.

## C) FCC & IC

FCC Part 15 Subpart E, §15.405  
The provisions of §§ 15.203 and 15.205 are included.

§15.407 (b)(6)  
Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in § 15.209.

§15.407 (b)(7)  
The provisions of §15.205 apply to intentional radiators operating under this section

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

| Frequency in MHz | Limit (µV/m)     | Measurement distance (m) | Limits (dBµV/m)    |
|------------------|------------------|--------------------------|--------------------|
| 0.009 – 0.49     | 2400/F(kHz)@300m | 3                        | (48.5 – 13.8)@300m |
| 0.49 – 1.705     | 24000/F(kHz)@30m | 3                        | (33.8 – 23.0)@30m  |
| 1.705 – 30       | 30@30m           | 3                        | 29.5@30m           |

The measured values are corrected with an inverse linear distance extrapolation factor (40 dB/decade) according FCC 15.31 (2).

| Frequency in MHz | Limit (µV/m) | Measurement distance (m) | Limits (dBµV/m) |
|------------------|--------------|--------------------------|-----------------|
| 30 – 88          | 100@3m       | 3                        | 40.0@3m         |
| 88 – 216         | 150@3m       | 3                        | 43.5@3m         |
| 216 – 960        | 200@3m       | 3                        | 46.0@3m         |
| 960 – 26000      | 500@3m       | 3                        | 54.0@3m         |
| 26000 – 40000    | 500@3m       | 1                        | 54.0@3m         |

The measured values above 26 GHz are corrected with an inverse linear distance extrapolation factor (20 dB/decade).

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

Used conversion factor:

- $\text{Limit (dB}\mu\text{V/m)} = 20 \log (\text{Limit } (\mu\text{V/m})/1\mu\text{V/m})$
- $\text{Limit (dB}\mu\text{V/m)} = \text{EIRP [dBm]} - 20 \log (d [\text{m}]) + 104.8$

Limit types (in result tables on next page):

RB – Emissions falls into a "Restricted Band" according FCC §§15.205 and 15.209 \*)

UE – "Undesirable Emission Limit" according FCC §15.407

BE-RB – Band Edge Limit basing on "Restricted Band Limits"

BE-UE – Band Edge Limit basing on "Undesirable Emission Limit"

\*) Below 1 GHz the limits of §15.209 are applied for all frequencies.

### 5.7.3 TEST PROTOCOL

Ambient temperature: 21–28 °C  
 Air Pressure: 994–1038 hPa  
 Humidity: 32–49 %  
 Video Transmission 20 MHz BW  
 Applied duty cycle correction (AV): 0 dB

| Ch. No. | Ch. Center Freq. [MHz] | Spurious Freq. [MHz] | Spurious Level [dBμV/m] | Detector | RBW [kHz] | Limit [dBμV/m] | Margin [dB] | Limit Type |
|---------|------------------------|----------------------|-------------------------|----------|-----------|----------------|-------------|------------|
| 36      | 5180                   | 46.0                 | 28.7                    | QP       | 120       | 40.0           | 11.3        | RB         |
| 36      | 5180                   | 113.0                | 36.9                    | QP       | 100       | 43.5           | 6.6         | RB         |
| 36      | 5180                   | 240.0                | 36.1                    | QP       | 100       | 46.0           | 9.9         | RB         |
| 36      | 5180                   | 360.0                | 33.6                    | QP       | 100       | 46.0           | 12.4        | RB         |
| 36      | 5180                   | 400.0                | 44.9                    | QP       | 100       | 46.0           | 1.1         | RB         |
| 36      | 5180                   | 431.9                | 42.9                    | QP       | 100       | 46.0           | 3.1         | RB         |
| 36      | 5180                   | 575.9                | 29.1                    | QP       | 100       | 46.0           | 16.9        | RB         |
| 36      | 5180                   | 719.9                | 26.2                    | QP       | 100       | 46.0           | 19.8        | RB         |
| 36      | 5180                   | 863.8                | 36.6                    | QP       | 100       | 46.0           | 9.4         | RB         |
| 36      | 5180                   | 21000.0              | 55.0                    | PEAK     | 1000      | 74.0           | 19.0        | RB         |
| 36      | 5180                   | 21000.0              | 51.2                    | AV       | 1000      | 54.0           | 2.8         | RB         |
| 52      | 5260                   | 46.8                 | 29.5                    | QP       | 100       | 40.0           | 10.5        | RB         |
| 52      | 5260                   | 148.3                | 30.1                    | QP       | 100       | 43.5           | 13.4        | RB         |
| 52      | 5260                   | 160.0                | 35.9                    | QP       | 100       | 43.5           | 7.6         | RB         |
| 52      | 5260                   | 240.0                | 39.2                    | QP       | 100       | 46.0           | 6.8         | RB         |
| 52      | 5260                   | 300.0                | 33.9                    | QP       | 100       | 46.0           | 12.1        | RB         |
| 52      | 5260                   | 360.0                | 38.0                    | QP       | 100       | 46.0           | 8.0         | RB         |
| 52      | 5260                   | 400.0                | 41.0                    | QP       | 100       | 46.0           | 5.0         | RB         |
| 52      | 5260                   | 21040.5              | 57.4                    | PEAK     | 1000      | 74.0           | 16.6        | RB         |
| 52      | 5260                   | 21040.5              | 53.9                    | AV       | 1000      | 54.0           | 0.1         | RB         |
| 64      | 5320                   | 46.9                 | 29.9                    | QP       | 100       | 40.0           | 10.1        | RB         |
| 64      | 5320                   | 128.6                | 29.7                    | QP       | 100       | 43.5           | 13.8        | RB         |
| 64      | 5320                   | 148.4                | 33.8                    | QP       | 100       | 43.5           | 9.7         | RB         |
| 64      | 5320                   | 160.0                | 35.4                    | QP       | 100       | 43.5           | 8.1         | RB         |
| 64      | 5320                   | 240.0                | 38.8                    | QP       | 100       | 46.0           | 7.2         | RB         |
| 64      | 5320                   | 300.0                | 36.2                    | QP       | 100       | 46.0           | 9.8         | RB         |
| 64      | 5320                   | 360.0                | 39.8                    | QP       | 100       | 46.0           | 6.2         | RB         |
| 64      | 5320                   | 400.0                | 40.4                    | QP       | 100       | 46.0           | 5.6         | RB         |
| 64      | 5320                   | 21280.5              | 57.7                    | PEAK     | 1000      | 74.0           | 16.3        | RB         |
| 64      | 5320                   | 21280.5              | 52.9                    | AV       | 1000      | 54.0           | 1.1         | RB         |
| 100     | 5500                   | 45.9                 | 30.1                    | QP       | 100       | 40.0           | 9.9         | RB         |
| 100     | 5500                   | 80.0                 | 25.8                    | QP       | 100       | 40.0           | 14.2        | RB         |
| 100     | 5500                   | 147.5                | 32.1                    | QP       | 100       | 43.5           | 11.4        | RB         |
| 100     | 5500                   | 160.0                | 35.1                    | QP       | 100       | 43.5           | 8.4         | RB         |
| 100     | 5500                   | 240.0                | 38.0                    | QP       | 100       | 46.0           | 8.0         | RB         |
| 100     | 5500                   | 280.0                | 28.2                    | QP       | 100       | 46.0           | 17.8        | RB         |
| 100     | 5500                   | 360.0                | 34.0                    | QP       | 100       | 46.0           | 12.0        | RB         |
| 100     | 5500                   | 400.0                | 38.9                    | QP       | 100       | 46.0           | 7.1         | RB         |
| 100     | 5500                   | 800.0                | 31.1                    | QP       | 100       | 46.0           | 14.9        | RB         |
| 100     | 5500                   | 22001.0              | 57.9                    | PEAK     | 1000      | 68.2           | 10.3        | UE         |
| 116     | 5580                   | 31.6                 | 31.7                    | PEAK     | 100       | 40.0           | 8.3         | RB         |
| 116     | 5580                   | 160.0                | 33.4                    | PEAK     | 100       | 43.5           | 10.1        | RB         |
| 116     | 5580                   | 320.0                | 35.5                    | PEAK     | 100       | 46.0           | 10.5        | RB         |
| 116     | 5580                   | 22320.5              | 57.7                    | PEAK     | 1000      | 74.0           | 16.3        | RB         |
| 116     | 5580                   | 22320.5              | 53.0                    | AV       | 1000      | 54.0           | 1.0         | RB         |
| 140     | 5700                   | 131.6                | 33.6                    | QP       | 100       | 43.5           | 9.9         | RB         |
| 140     | 5700                   | 160.0                | 36.1                    | QP       | 100       | 43.5           | 7.4         | RB         |
| 140     | 5700                   | 240.0                | 38.2                    | QP       | 100       | 46.0           | 7.8         | RB         |
| 140     | 5700                   | 280.0                | 32.0                    | QP       | 100       | 46.0           | 14.0        | RB         |
| 140     | 5700                   | 400.0                | 39.8                    | QP       | 100       | 46.0           | 6.2         | RB         |
| 140     | 5700                   | 22801.0              | 55.7                    | PEAK     | 1000      | 74.0           | 18.3        | RB         |
| 140     | 5700                   | 22801.0              | 48.4                    | AV       | 1000      | 54.0           | 5.6         | RB         |
| 149     | 5745                   | 31.7                 | 28.3                    | QP       | 100       | 40.0           | 11.7        | RB         |
| 149     | 5745                   | 55.0                 | 24.0                    | QP       | 100       | 40.0           | 16.0        | RB         |

|     |      |         |      |      |      |      |      |    |
|-----|------|---------|------|------|------|------|------|----|
| 149 | 5745 | 116.7   | 27.8 | QP   | 100  | 43.5 | 15.7 | RB |
| 149 | 5745 | 160.0   | 28.5 | QP   | 100  | 43.5 | 15.0 | RB |
| 149 | 5745 | 17432.0 | 61.5 | PEAK | 1000 | 68.2 | 6.7  | UE |
| 157 | 5785 | 31.2    | 30.1 | QP   | 100  | 40.0 | 9.9  | RB |
| 157 | 5785 | 53.3    | 25.2 | QP   | 100  | 40.0 | 14.8 | RB |
| 157 | 5785 | 123.4   | 29.9 | QP   | 100  | 43.5 | 13.6 | RB |
| 157 | 5785 | 160.0   | 28.1 | QP   | 100  | 43.5 | 15.4 | RB |
| 157 | 5785 | 22000.5 | 59.3 | PEAK | 1000 | 68.2 | 8.9  | UE |
| 165 | 5825 | 31.7    | 29.8 | QP   | 100  | 40.0 | 10.2 | RB |
| 165 | 5825 | 55.4    | 25.8 | QP   | 100  | 40.0 | 14.2 | RB |
| 165 | 5825 | 125.7   | 28.3 | QP   | 100  | 43.5 | 15.2 | RB |
| 165 | 5825 | 160.0   | 28.6 | QP   | 100  | 43.5 | 14.9 | RB |
| 165 | 5825 | 17108.8 | 62.5 | PEAK | 1000 | 68.2 | 5.7  | UE |

Remark: Setup S01\_A01RX, nominal output power set to: 15 dBm.

Setup S01\_W03RX, nominal output power set to: 14 dBm.

Setup S01\_G05RX, nominal output power set to: 11 dBm

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

Spurious emissions in the range 20 dB below the limit need not to be reported.

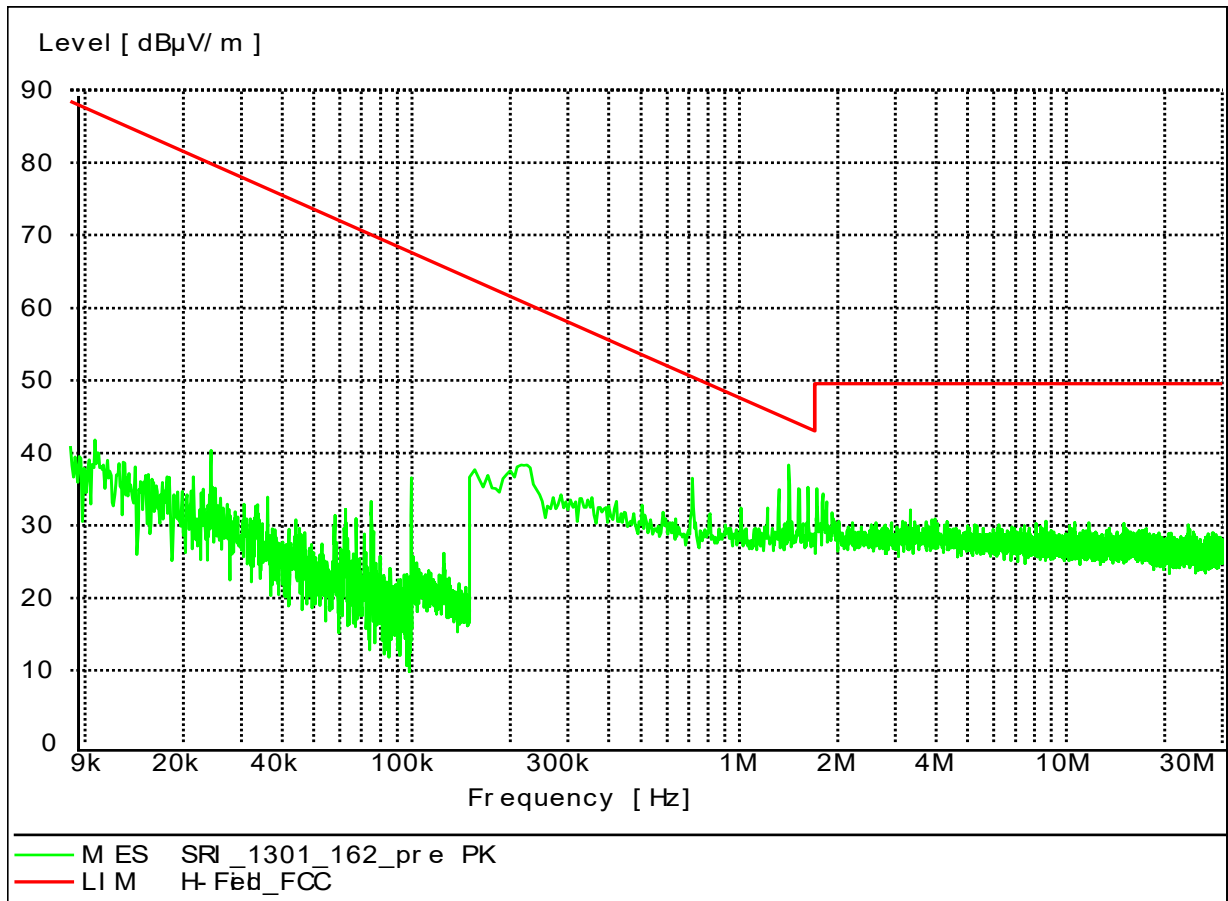
The measurement was performed from 9 kHz to 30 MHz for Setup S01\_W03RX on CH52 and 157, from 30 MHz to 1 GHz for Setup S01\_W03RX on CH36, 52, 64, 100 and 140, for Setup S01\_G05RX on CH116, 149, 157 and 165, from 26 to 40 GHz for Setup S01\_W03RX on CH36, 52, 64, 116, and 140 only because at pre-measurements no significant spurious emissions have been found.

Please see next sub-clause for the measurement plot.

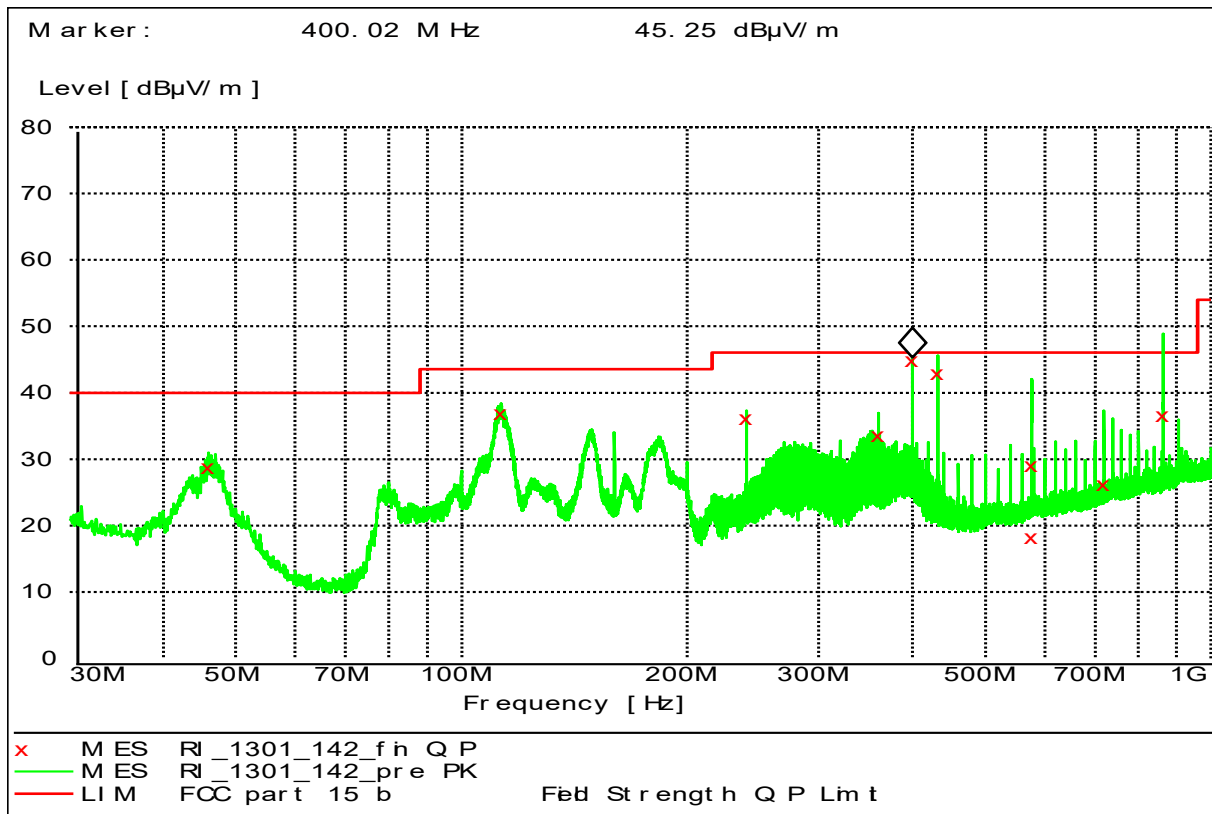
The applicant will limit the output power setting of the final product to maximum 11 dBm. Since all tests runs using higher output power than 11 dBm are worst case, they were not repeated with the lower output power.

#### 5.7.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

Radio Technology = WLAN n 20 MHz, Operating Frequency = low, Measurement range = 9kHz - 30MHz, Subband = U-NII-2A (S01\_W03RX)



Radio Technology = WLAN n 20 MHz, Operating Frequency = low, Measurement range = 30MHz - 1GHz, Subband = U-NII-1 (S01\_W03RX)

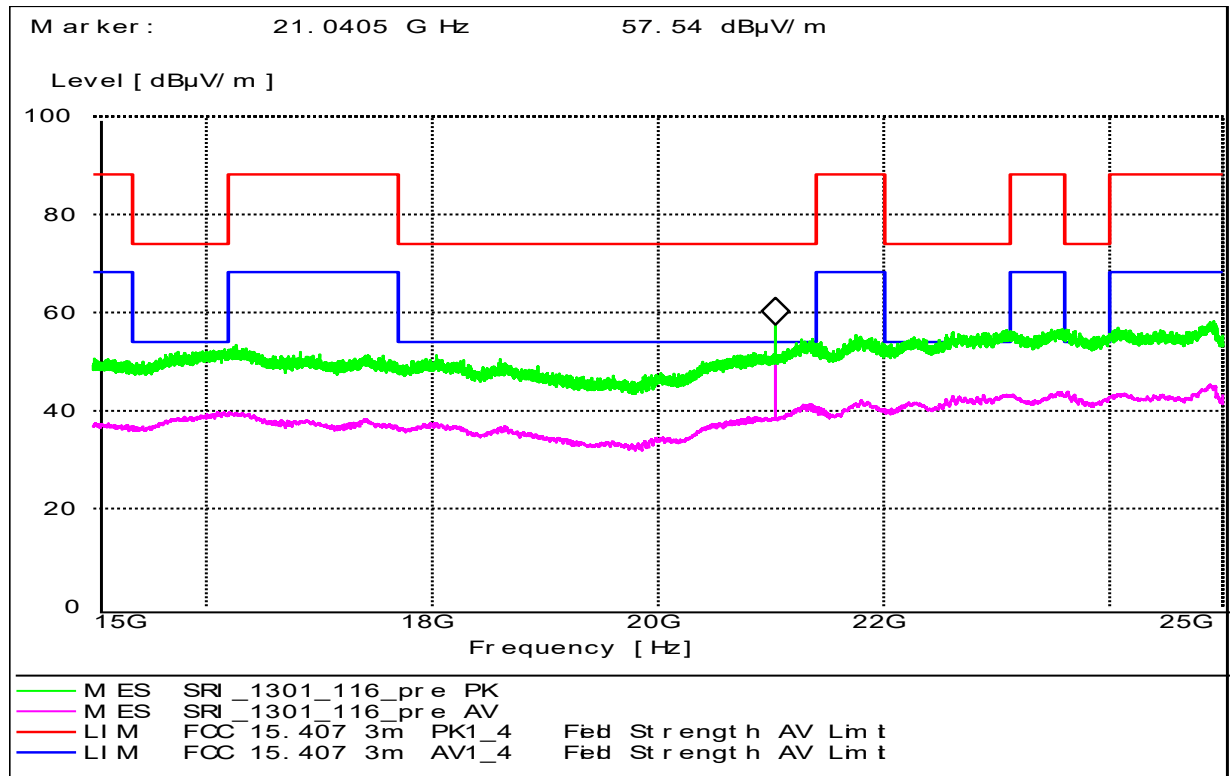


### MEASUREMENT RESULT: "RI\_1301\_142\_fin QP"

07.08.2013 12:59

| Frequency<br>MHz | Level<br>dBµV/m | Transd<br>dB | Limit<br>dBµV/m | Margin<br>dB | Height<br>cm | Azimuth<br>deg | Polarisation |
|------------------|-----------------|--------------|-----------------|--------------|--------------|----------------|--------------|
| 45.960000        | 28.70           | 11.4         | 40.0            | 11.3         | 100.0        | 22.00          | VERTICAL     |
| 112.860000       | 36.90           | 11.4         | 43.5            | 6.6          | 100.0        | 67.00          | VERTICAL     |
| 240.000000       | 36.10           | 10.8         | 46.0            | 9.9          | 100.0        | 292.00         | HORIZONTAL   |
| 360.000000       | 33.60           | 14.6         | 46.0            | 12.4         | 100.0        | 132.00         | HORIZONTAL   |
| 400.020000       | 44.90           | 15.6         | 46.0            | 1.1          | 101.0        | 68.00          | HORIZONTAL   |
| 431.880000       | 42.90           | 16.4         | 46.0            | 3.1          | 102.0        | 68.00          | HORIZONTAL   |
| 575.880000       | 29.10           | 19.5         | 46.0            | 16.9         | 100.0        | 188.00         | VERTICAL     |
| 576.120000       | 18.20           | 19.5         | 46.0            | 27.8         | 300.0        | 22.00          | VERTICAL     |
| 719.940000       | 26.20           | 21.7         | 46.0            | 19.8         | 125.0        | 247.00         | HORIZONTAL   |
| 863.760000       | 36.60           | 23.4         | 46.0            | 9.4          | 100.0        | 10.00          | HORIZONTAL   |

Radio Technology = WLAN n 20 MHz, Operating Frequency = low, Measurement range = 1GHz  
- 26GHz, Subband = U-NII-2A  
(S01\_A01RX)



## 5.7.5 TEST EQUIPMENT USED

- Radiated Emissions

## 5.8 BAND EDGE

Standard **FCC Part 15 Subpart E**

**The test was performed according to:**  
ANSI C63.10

### 5.8.1 TEST DESCRIPTION

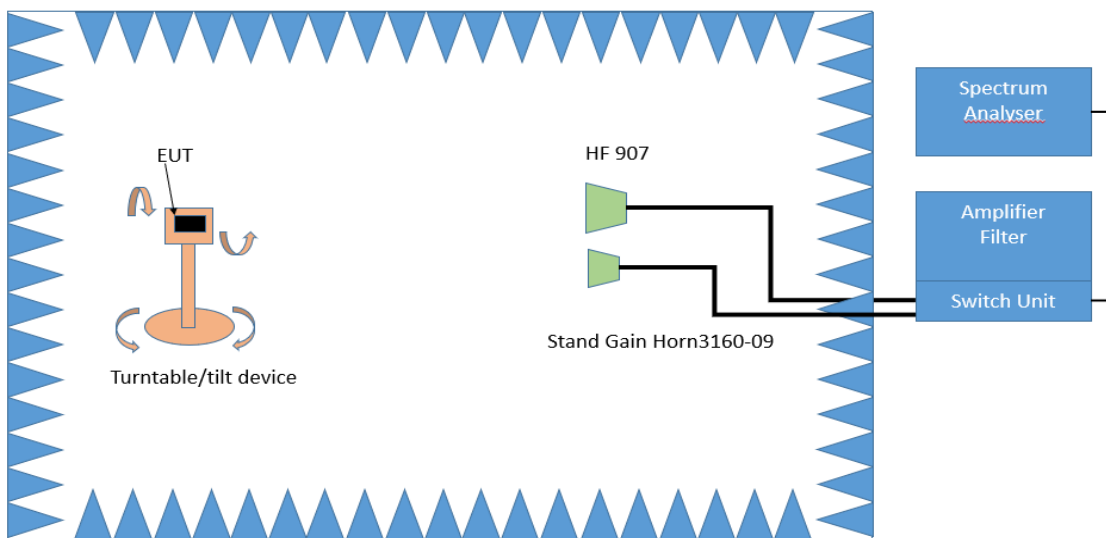
The test set-up was made in accordance to the general provisions of ANSI C63.10 in a typical installation configuration. The measurements were performed according the following sub-chapter of ANSI C63.10:

- Chapter 6.10.5

The Equipment Under Test (EUT) was set up on a non-conductive support (tilt device) at 1.5 m height in the fully-anechoic chamber.

All steps were performed with one height (1.5 m) of the receiving antenna only (procedure according ANSI C63.10, chapter 6.6.5).

### 3. Measurement above 1 GHz



Test Setup; Spurious Emission Radiated (FAC), 1 GHz-26.5 GHz

#### Step 1:

The EUT is turned during the preliminary measurement across the elevation axis, with a step size of 90 °.

The turn table step size (azimuth angle) for the preliminary measurement is 45 °.

Spectrum analyser settings:

- Detector: Peak, Average
- RBW = 1 MHz
- VBW = 3 MHz

#### Step 2:

The turn table azimuth will slowly vary by  $\pm 22.5^\circ$ .

The elevation angle will slowly vary by  $\pm 45^\circ$

Spectrum analyser settings:

- Detector: Peak

### Step 3:

Spectrum analyser settings for step 3:

- Detector: Peak / CISPR Average
- Measured frequencies: in step 1 determined frequencies
- RBW = 1 MHz
- VBW = 3 MHz
- Measuring time: 1 s

## 5.8.2 TEST REQUIREMENTS / LIMITS

For band edges connected to a restricted band, the limits are specified in Section 15.209(a)

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

| Frequency in MHz | Limit (µV/m)     | Measurement distance (m) | Limits (dBµV/m)    |
|------------------|------------------|--------------------------|--------------------|
| 0.009 – 0.49     | 2400/F(kHz)@300m | 3                        | (48.5 – 13.8)@300m |
| 0.49 – 1.705     | 24000/F(kHz)@30m | 3                        | (33.8 – 23.0)@30m  |
| 1.705 – 30       | 30@30m           | 3                        | 29.5@30m           |

The measured values are corrected with an inverse linear distance extrapolation factor (40 dB/decade) according FCC 15.31 (2).

| Frequency in MHz | Limit (µV/m) | Measurement distance (m) | Limits (dBµV/m) |
|------------------|--------------|--------------------------|-----------------|
| 30 – 88          | 100@3m       | 3                        | 40.0@3m         |
| 88 – 216         | 150@3m       | 3                        | 43.5@3m         |
| 216 – 960        | 200@3m       | 3                        | 46.0@3m         |
| 960 – 26000      | 500@3m       | 3                        | 54.0@3m         |
| 26000 – 40000    | 500@3m       | 1                        | 54.0@3m         |

The measured values above 26 GHz are corrected with an inverse linear distance extrapolation factor (20 dB/decade).

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

Used conversion factor: Limit (dBµV/m) = 20 log (Limit (µV/m)/1µV/m)

### 5.8.3 TEST PROTOCOL

Ambient temperature: 24 °C  
 Air Pressure: 1010 hPa  
 Humidity: 33 %  
 Video Transmission 20 MHz BW  
 Applied duty cycle correction (AV): 0 dB

| U-NII-Subband | Ch. No. | Ch. Center Freq. [MHz] | Band Edge Freq. [MHz] | Spurious Level [dBμV/m] | Detector | RBW [kHz] | Limit [dBμV/m] | Margin [dB] | Limit Type | FCC/IC? |
|---------------|---------|------------------------|-----------------------|-------------------------|----------|-----------|----------------|-------------|------------|---------|
| 1             | 36      | 5180                   | 5150.0                | 55.2                    | PEAK     | 1000      | 74.0           | 18.8        | BE-RB      | FCC&IC  |
|               | 36      | 5180                   | 5150.0                | 42.9                    | AV       | 1000      | 54.0           | 11.1        | BE-RB      | FCC&IC  |
| 2A            | 64      | 5320                   | 5350.0                | 55.4                    | PEAK     | 1000      | 74.0           | 18.6        | BE-RB      | FCC&IC  |
|               | 64      | 5320                   | 5350.0                | 43.3                    | AV       | 1000      | 54.0           | 10.7        | BE-RB      | FCC&IC  |
| 2C            | 100     | 5500                   | 5460.0                | 55.7                    | PEAK     | 1000      | 74.0           | 18.3        | BE-RB      | FCC&IC  |
|               | 100     | 5500                   | 5460.0                | 43.1                    | AV       | 1000      | 54.0           | 10.9        | BE-RB      | FCC&IC  |
|               | 100     | 5500                   | 5470.0                | 56.2                    | PEAK     | 1000      | 68.2           | 12.0        | BE-UE      | FCC&IC  |
|               | 140     | 5700                   | 5725.0                | 55.7                    | PEAK     | 1000      | 68.2           | 12.5        | BE-UE      | FCC&IC  |
| 3             | 149     | 5745                   | 5725.0                | 63.2                    | PEAK     | 1000      | 102.0          | 38.8        | BE-UE      | FCC&IC  |
|               | 165     | 5825                   | 5850.0                | 58.6                    | PEAK     | 1000      | 102.0          | 43.4        | BE-UE      | FCC&IC  |

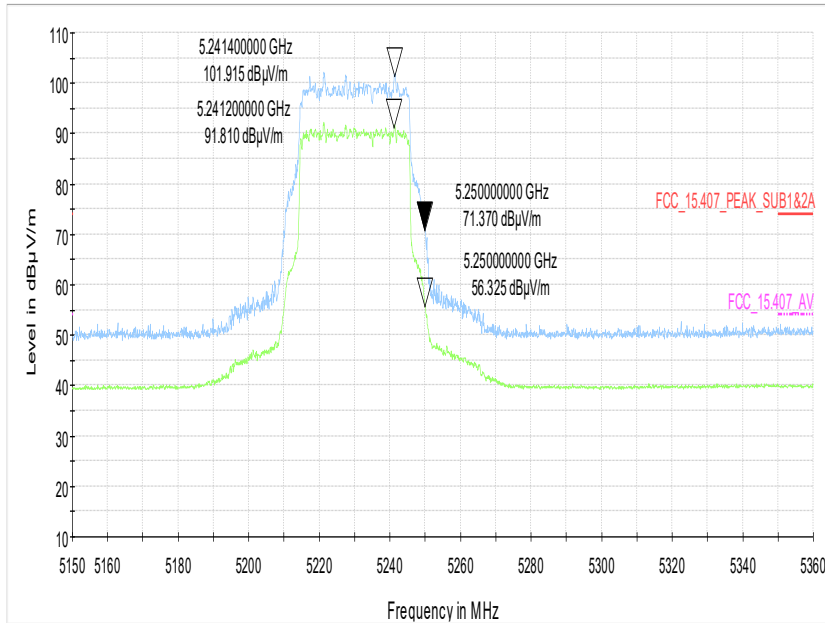
Video Transmission 40 MHz BW  
 Applied duty cycle correction (AV): 0 dB

| U-NII-Subband | Ch. No. | Ch. Center Freq. [MHz] | Band Edge Freq. [MHz] | Spurious Level [dBμV/m] | Detector | RBW [kHz] | Limit [dBμV/m] | Margin [dB] | Limit Type | FCC/IC? |
|---------------|---------|------------------------|-----------------------|-------------------------|----------|-----------|----------------|-------------|------------|---------|
| 1             | 38      | 5190                   | 5150.0                | 58.1                    | PEAK     | 1000      | 74.0           | 15.9        | BE-RB      | FCC&IC  |
|               | 38      | 5190                   | 5150.0                | 44.7                    | AV       | 1000      | 54.0           | 9.3         | BE-RB      | FCC&IC  |
| 2A            | 62      | 5310                   | 5350.0                | 59.3                    | PEAK     | 1000      | 74.0           | 14.7        | BE-RB      | FCC&IC  |
|               | 62      | 5310                   | 5350.0                | 48.2                    | AV       | 1000      | 54.0           | 5.8         | BE-RB      | FCC&IC  |
| 2C            | 102     | 5510                   | 5460.0                | 57.2                    | PEAK     | 1000      | 74.0           | 16.8        | BE-RB      | FCC&IC  |
|               | 102     | 5510                   | 5460.0                | 43.8                    | AV       | 1000      | 54.0           | 10.2        | BE-RB      | FCC&IC  |
|               | 102     | 5510                   | 5470.0                | 61.3                    | PEAK     | 1000      | 68.2           | 6.9         | BE-UE      | FCC&IC  |
|               | 134     | 5670                   | 5725.0                | 56.6                    | PEAK     | 1000      | 68.2           | 11.6        | BE-UE      | FCC&IC  |
| 3             | 151     | 5755                   | 5725.0                | 70.3                    | PEAK     | 1000      | 102.0          | 31.7        | BE-UE      | FCC&IC  |
|               | 159     | 5795                   | 5850.0                | 56.6                    | PEAK     | 1000      | 102.0          | 45.4        | BE-UE      | FCC&IC  |

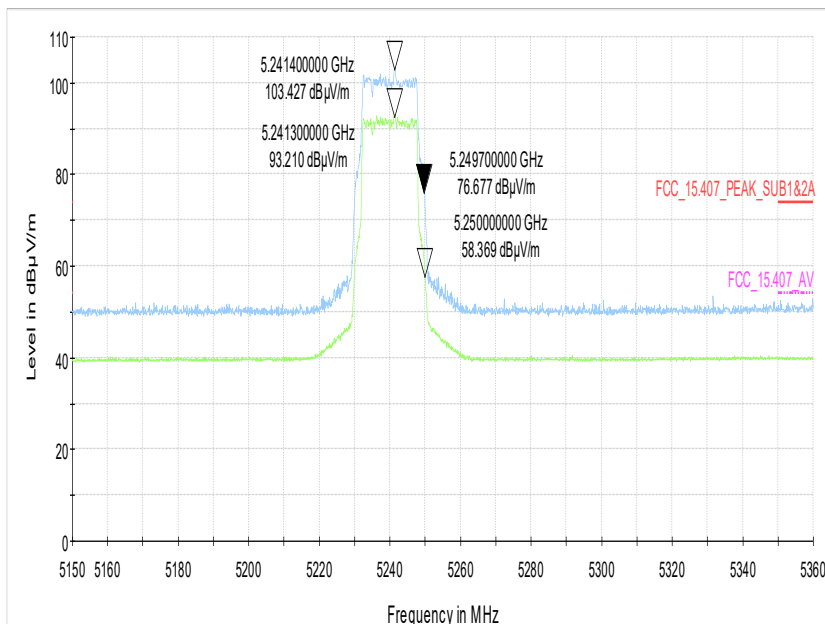
Remark: Nominal output power set to: 15 dBm.  
 Please see next sub-clause for the measurement plot.

#### 5.8.4 MEASUREMENT PLOT (EXAMPLE PLOT, SHOWING WORST CASE, IF APPLICABLE)

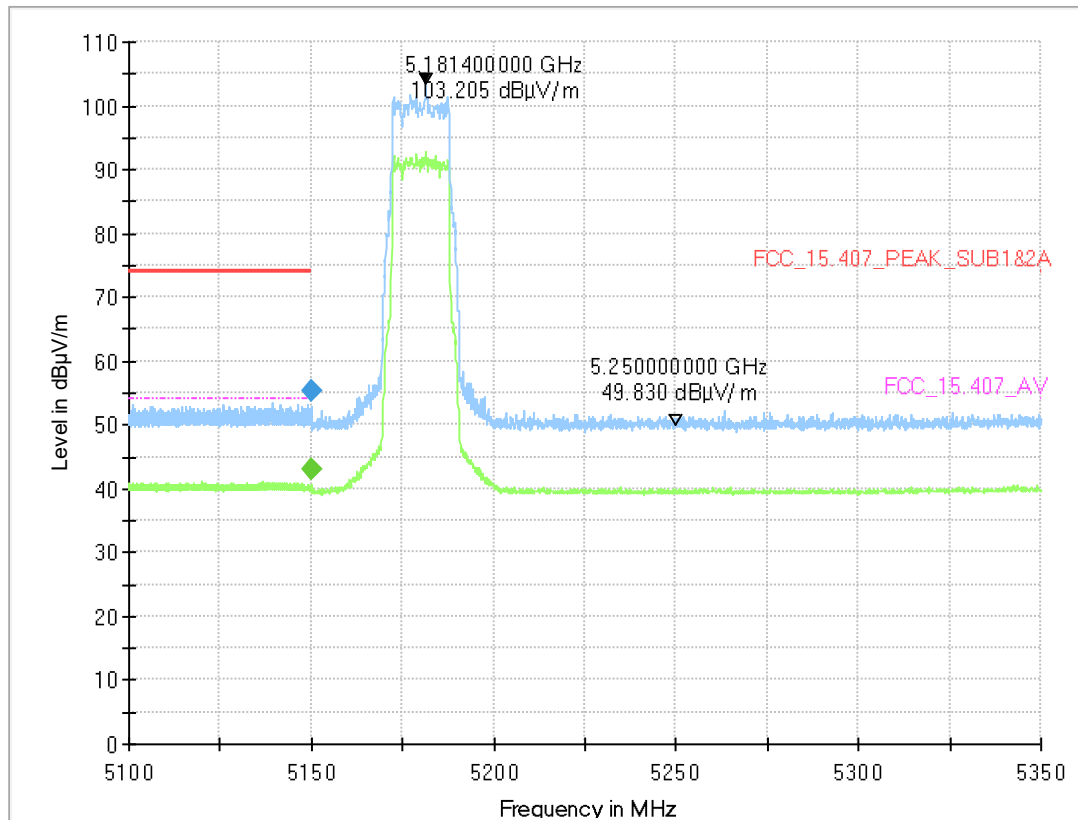
Radio Technology = WLAN n 40 MHz, Operating Frequency = high, Subband = U-NII-1 (S01\_AB01RX)



Radio Technology = WLAN n 20 MHz, Operating Frequency = high, Subband = U-NII-1 (S01\_AB01RX)



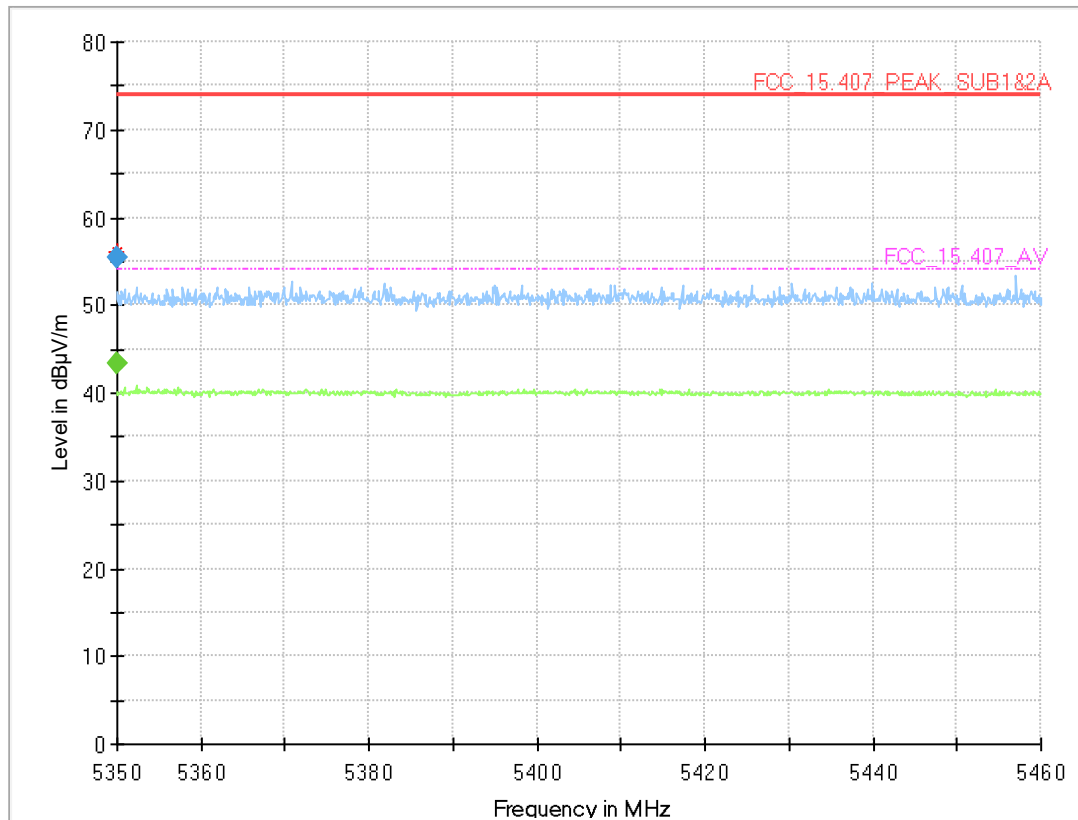
Radio Technology = WLAN n 20 MHz, Operating Frequency = low, Subband = U-NII-1 (S01\_AB01RX)



## Final Result

| Frequency (MHz) | MaxPeak (dBμV/m) | CAverage (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Elevation (deg) | Corr. (dB/) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|-------------|
| 5149.888        | 55.2             | ---               | 74.00          | 18.75       | 1000.0          | 1000.000        | 150.0       | V   | -174.0        | 105.0           | 13.2        |
| 5149.988        | ---              | 42.9              | 54.00          | 11.11       | 1000.0          | 1000.000        | 150.0       | H   | -169.0        | -4.0            | 13.2        |

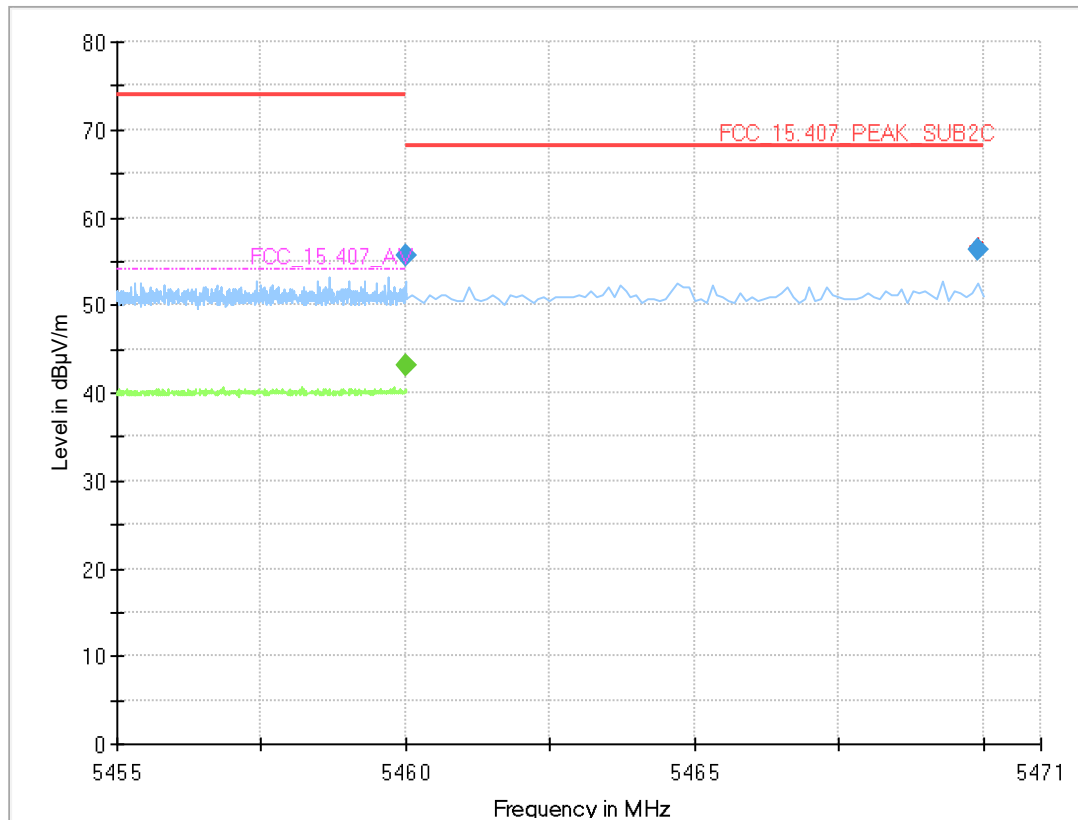
Radio Technology = WLAN n 20 MHz, Operating Frequency = high, Subband = U-NII-2A (S01\_AB01RX)



## Final Result

| Frequency (MHz) | MaxPeak (dBµV/m) | CAverage (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Elevation (deg) | Corr. (dB/) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|-------------|
| 5350.000        | 55.4             | ---               | 74.00          | 18.61       | 1000.0          | 1000.000        | 150.0       | H   | -95.0         | 87.0            | 13.9        |
| 5350.000        | ---              | 43.3              | 54.00          | 10.69       | 1000.0          | 1000.000        | 150.0       | V   | -145.0        | 75.0            | 13.9        |

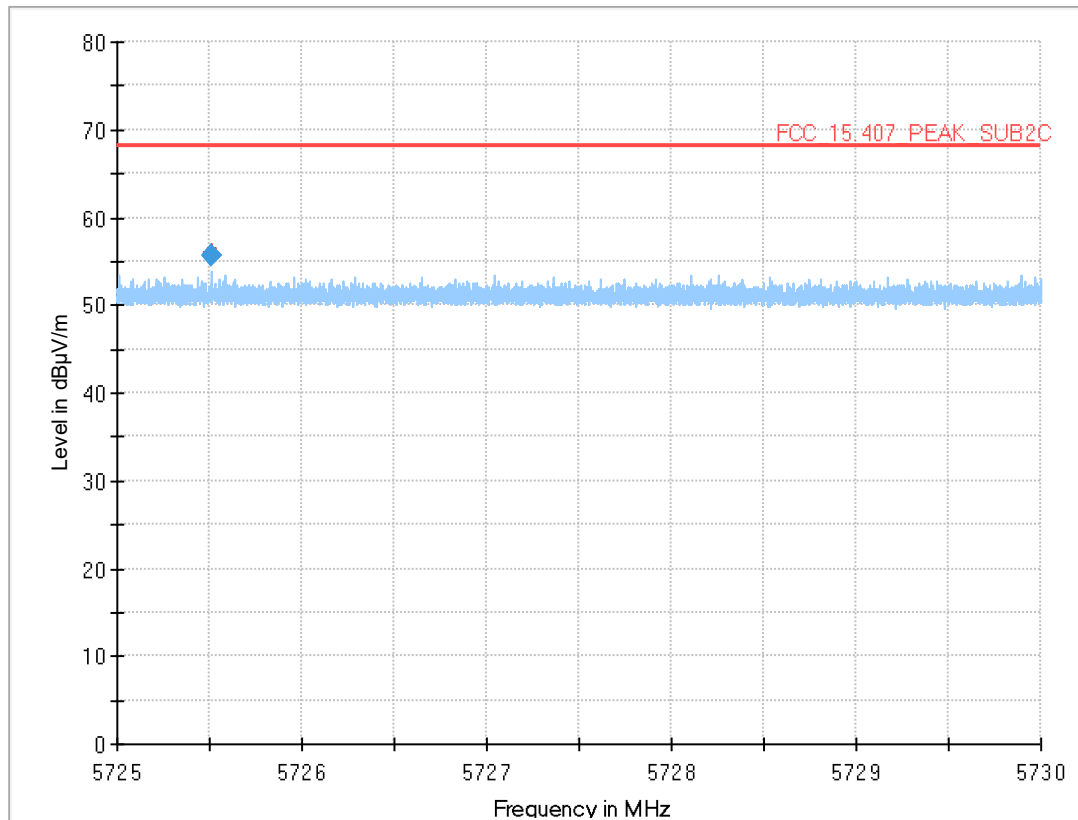
Radio Technology = WLAN n 20 MHz, Operating Frequency = low, Subband = U-NII-2C (S01\_AB01RX)



## Final Result

| Frequency (MHz) | MaxPeak (dBµV/m) | CAverage (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Elevation (deg) | Corr. (dB/) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|-------------|
| 5459.990        | ---              | 43.1              | 54.00          | 10.85       | 1000.0          | 1000.000        | 150.0       | H   | -90.0         | -12.0           | 14.1        |
| 5459.990        | 55.7             | ---               | 74.00          | 18.25       | 1000.0          | 1000.000        | 150.0       | H   | -79.0         | 4.0             | 14.1        |
| 5469.900        | 56.2             | ---               | 68.20          | 11.97       | 1000.0          | 1000.000        | 150.0       | V   | -6.0          | 104.0           | 14.0        |

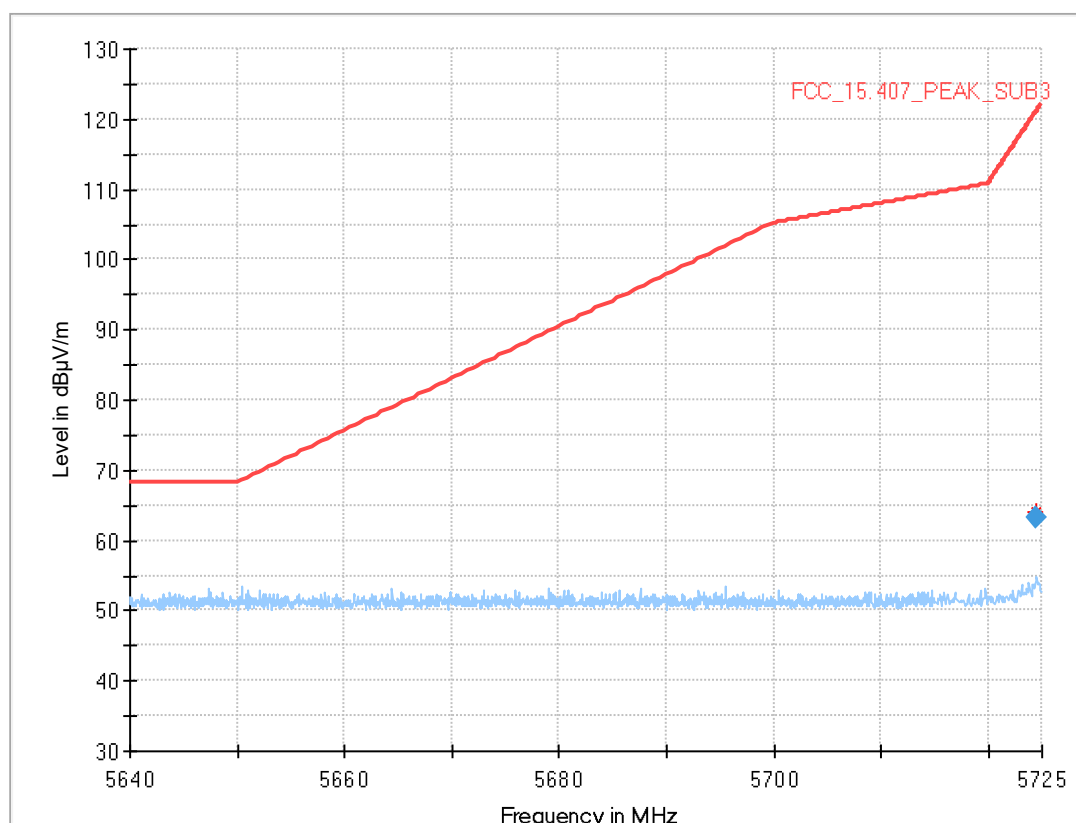
Radio Technology = WLAN n 20 MHz, Operating Frequency = high, Subband = U-NII-2C (S01\_AB01RX)



## Final Result

| Frequency (MHz) | MaxPeak (dBμV/m) | CAverage (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Elevation (deg) | Corr (dB) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|-----------|
| 5725.513        | 55.7             | ---               | 68.20          | 12.51       | 1000.0          | 1000.000        | 150.0       | H   | -131.0        | 15.0            | 14.1      |

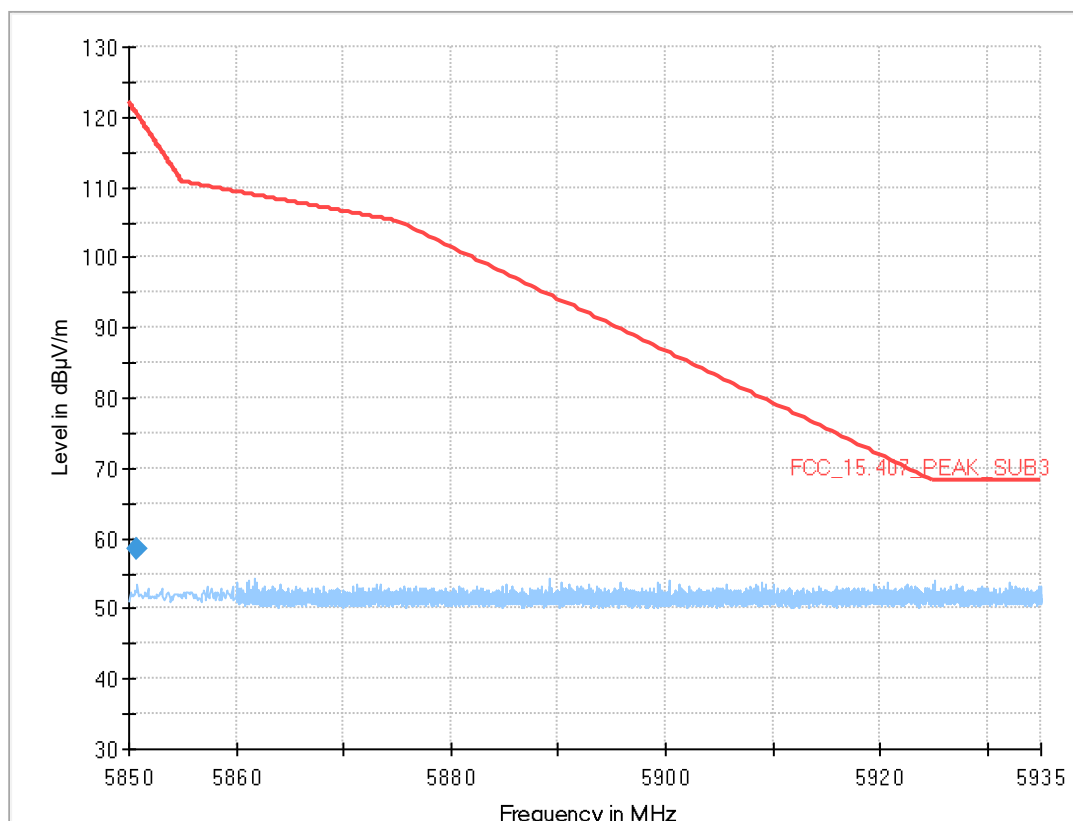
Radio Technology = WLAN n 20 MHz, Operating Frequency = low, Subband = U-NII-3 (S01\_AB01RX)



## Final Result

| Frequency (MHz) | MaxPeak (dBμV/m) | CAverage (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Elevation (deg) | Corr. (dB/) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|-------------|
| 5724.500        | 63.2             | ---               | 121.0          | 57.84       | 1000.0          | 1000.000        | 150.0       | H   | -174.0        | 4.0             | 14.1        |

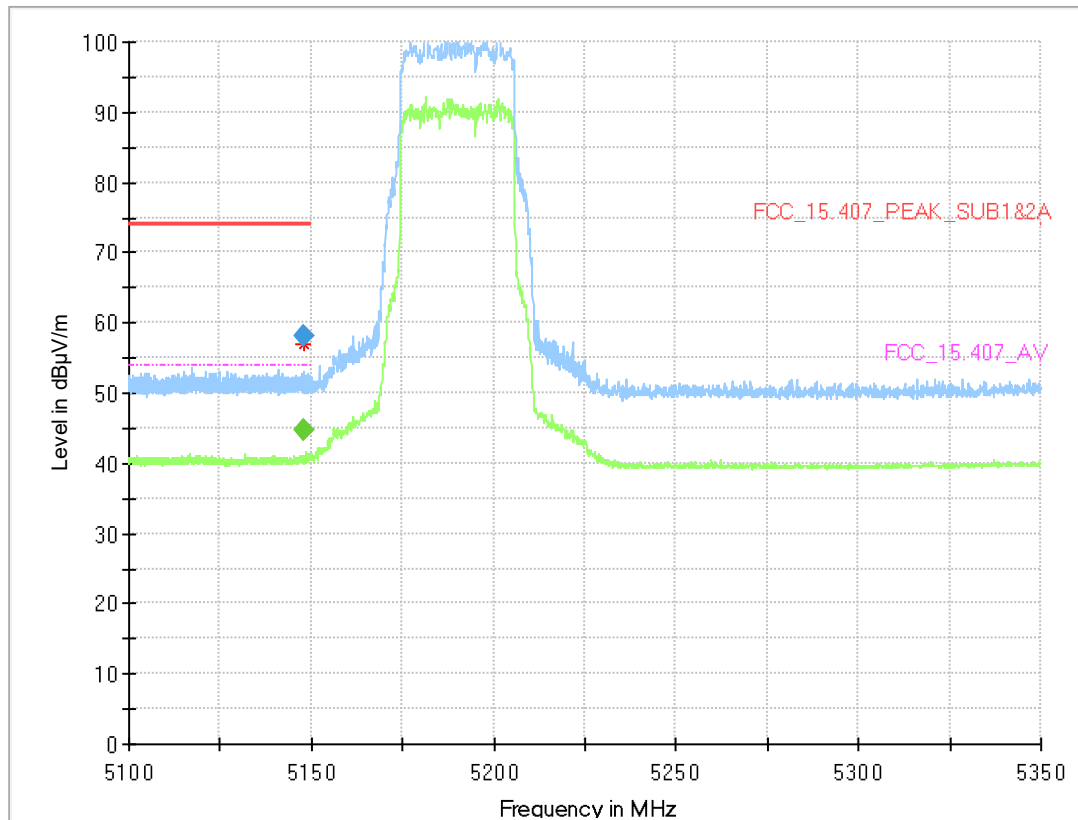
Radio Technology = WLAN n 20 MHz, Operating Frequency = high, Subband = U-NII-3 (S01\_AB01RX)



## Final Result

| Frequency (MHz) | MaxPeak (dBμV/m) | CAverage (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Elevation (deg) | Corr. (dB/ |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|------------|
| 5850.800        | 58.6             | ---               | 120.3          | 61.76       | 1000.0          | 1000.000        | 150.0       | H   | -191.0        | 8.0             | 14.7       |

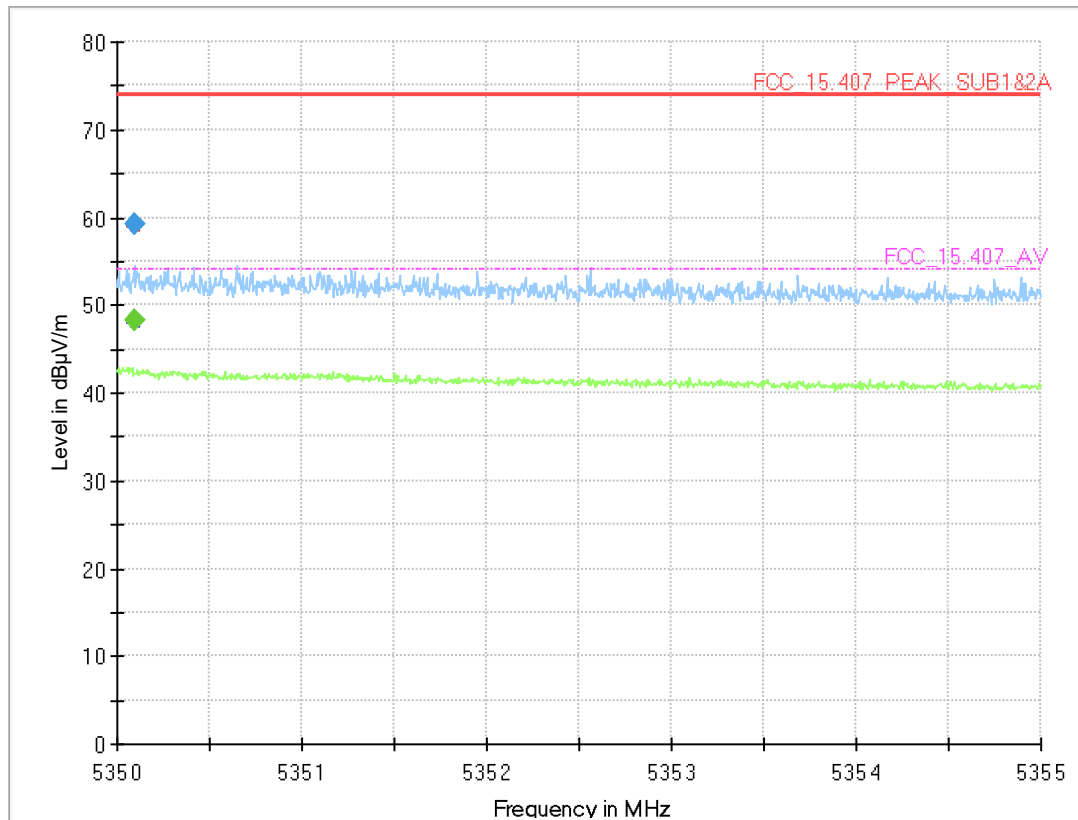
Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Subband = U-NII-1 (S01\_AB01RX)



## Final Result

| Frequency (MHz) | MaxPeak (dBμV/m) | CAverage (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Elevation (deg) | Corr. (dB/) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|-------------|
| 5148.075        | ---              | 44.7              | 54.00          | 9.30        | 1000.0          | 1000.000        | 150.0       | H   | -191.0        | 3.0             | 13.2        |
| 5148.075        | 58.1             | ---               | 74.00          | 15.92       | 1000.0          | 1000.000        | 150.0       | H   | -169.0        | 6.0             | 13.2        |

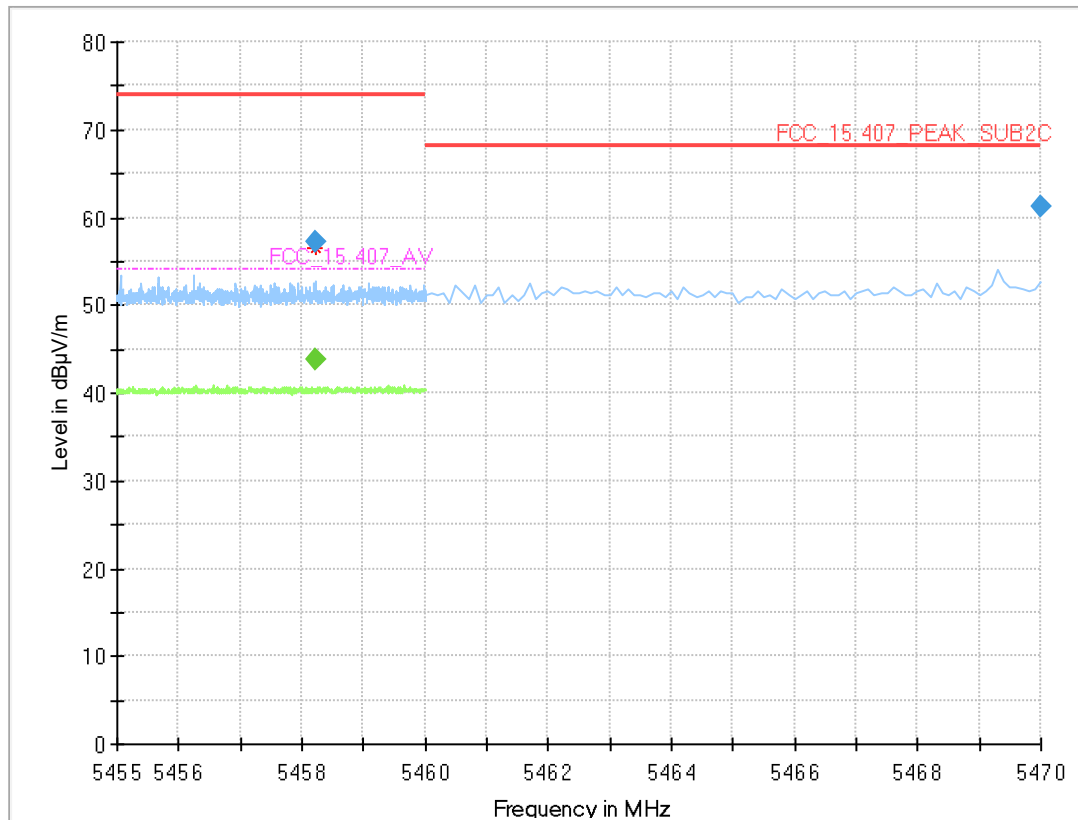
Radio Technology = WLAN n 40 MHz, Operating Frequency = high, Subband = U-NII-2A (S01\_AB01RX)



## Final Result

| Frequency (MHz) | MaxPeak (dBµV/m) | CAverage (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Elevation (deg) | Corr. (dB/) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|-------------|
| 5350.095        | ---              | 48.2              | 54.00          | 5.80        | 1000.0          | 1000.000        | 150.0       | H   | -188.0        | 4.0             | 13.9        |
| 5350.095        | 59.3             | ---               | 74.00          | 14.68       | 1000.0          | 1000.000        | 150.0       | V   | 35.0          | 98.0            | 13.9        |

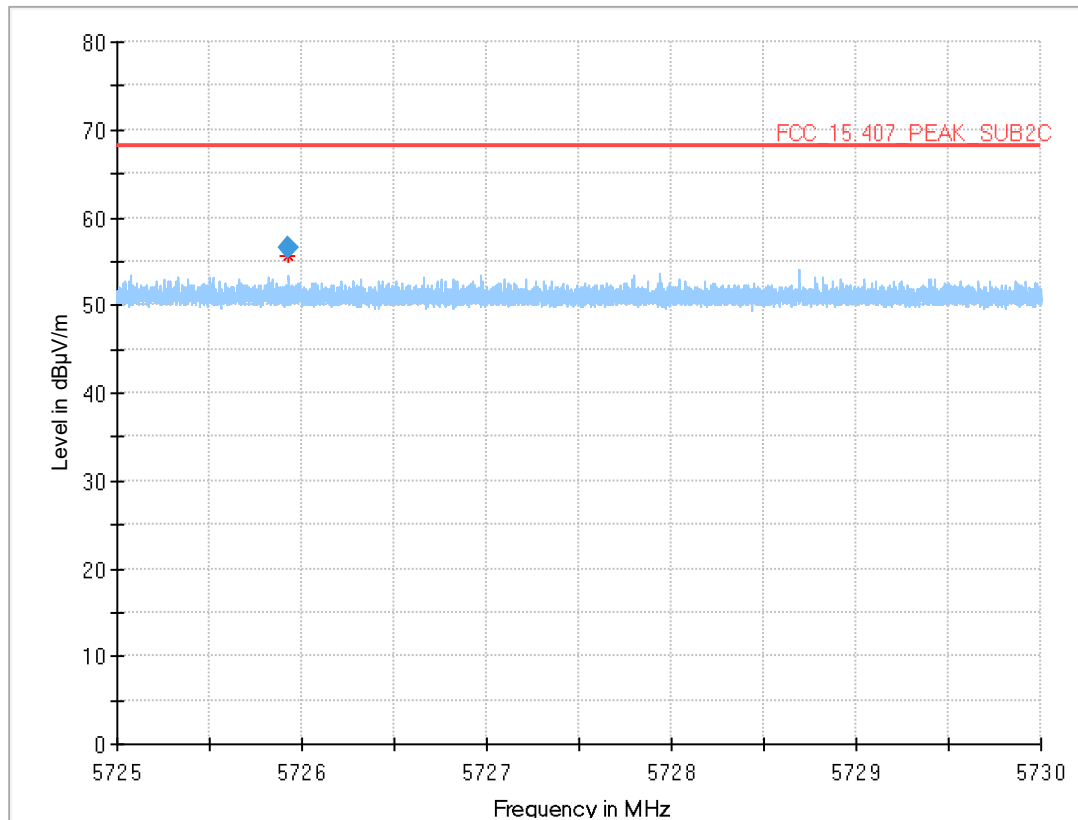
Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Subband = U-NII-2C (S01\_AB01RX)



## Final Result

| Frequency (MHz) | MaxPeak (dBμV/m) | CAverage (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Elevation (deg) | Corr. (dB/) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|-------------|
| 5458.220        | ---              | 43.8              | 54.00          | 10.19       | 1000.0          | 1000.000        | 150.0       | H   | -183.0        | 3.0             | 14.0        |
| 5458.220        | 57.2             | ---               | 74.00          | 16.82       | 1000.0          | 1000.000        | 150.0       | H   | -188.0        | 6.0             | 14.0        |
| 5470.000        | 61.3             | ---               | 68.20          | 6.91        | 1000.0          | 1000.000        | 150.0       | H   | -184.0        | 3.0             | 14.0        |

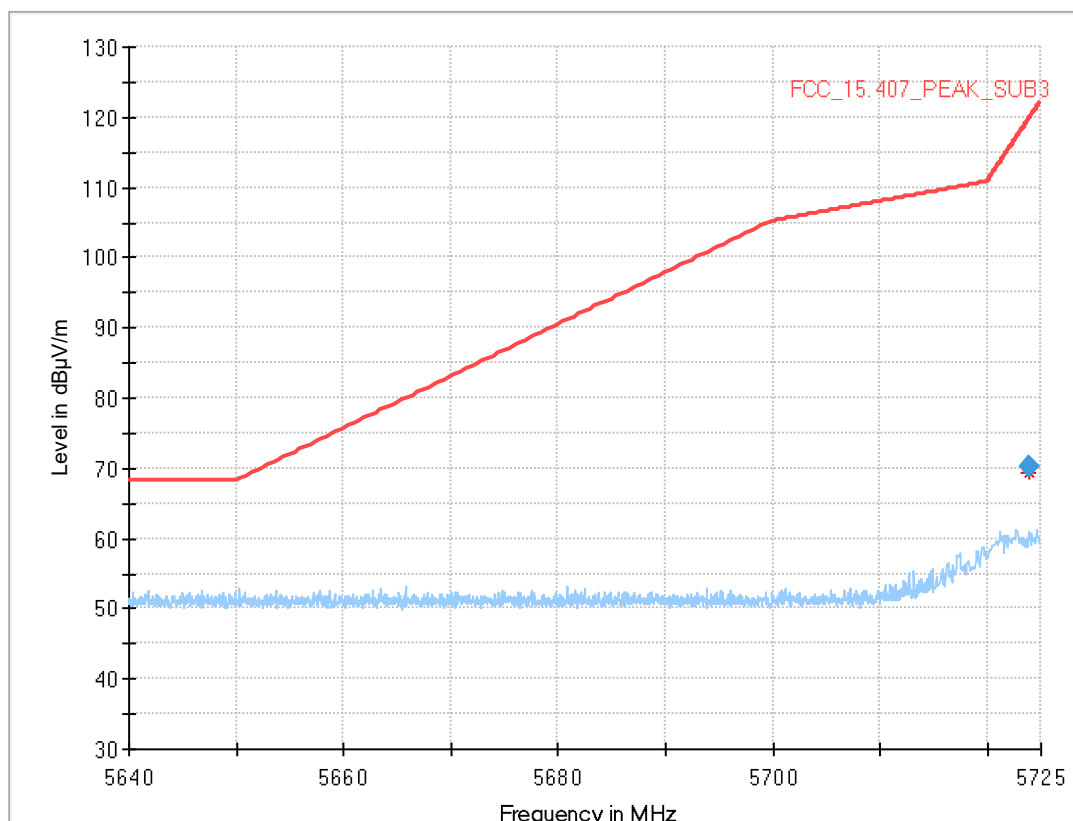
Radio Technology = WLAN n 40 MHz, Operating Frequency = high, Subband = U-NII-2C (S01\_AB01RX)



## Final Result

| Frequency (MHz) | MaxPeak (dBμV/m) | CAverage (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Elevation (deg) | Corr. (dB/) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|-------------|
| 5725.931        | 56.6             | ---               | 68.20          | 11.58       | 1000.0          | 1000.000        | 150.0       | V   | 6.0           | 105.0           | 14.1        |

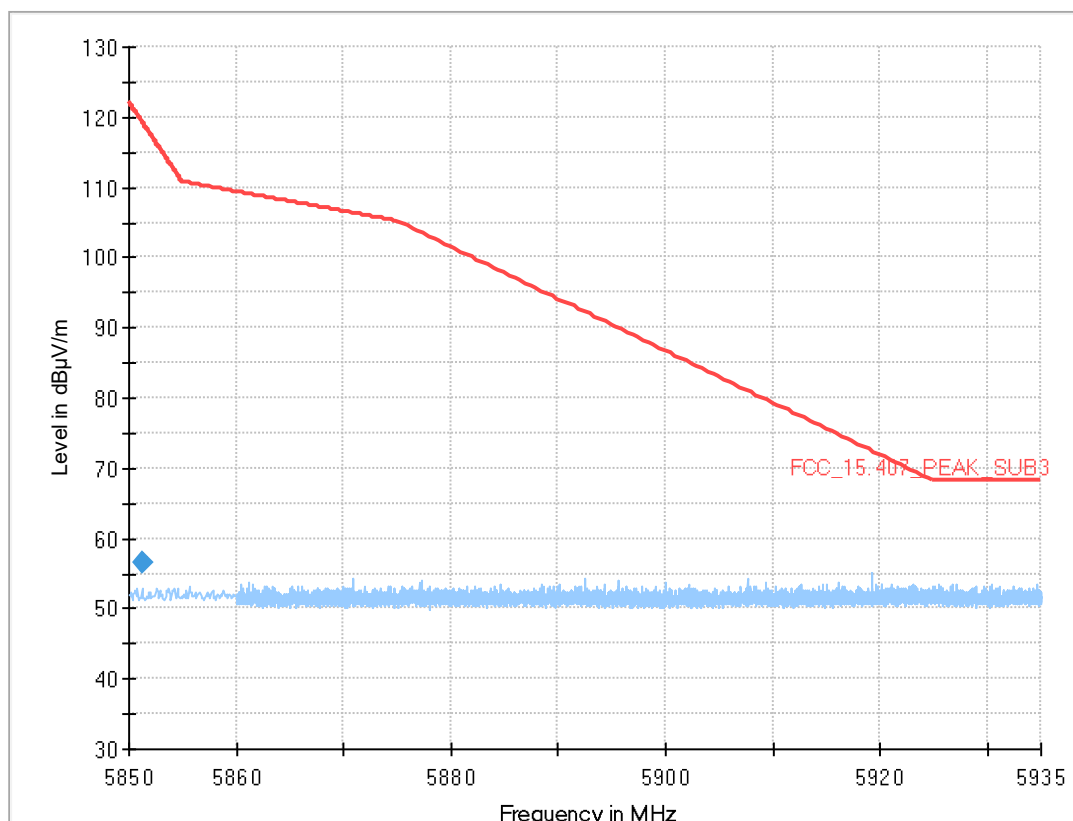
Radio Technology = WLAN n 40 MHz, Operating Frequency = low, Subband = U-NII-3 (S01\_AB01RX)



## Final Result

| Frequency (MHz) | MaxPeak (dBμV/m) | CAverage (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Elevation (deg) | Corr. (dB/) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|-------------|
| 5723.900        | 70.3             | ---               | 119.6          | 49.40       | 1000.0          | 1000.000        | 150.0       | H   | -190.0        | 6.0             | 14.1        |

Radio Technology = WLAN n 40 MHz, Operating Frequency = high, Subband = U-NII-3 (S01\_AB01RX)



## Final Result

| Frequency (MHz) | MaxPeak (dBμV/m) | CAverage (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Elevation (deg) | Correction (dB) |
|-----------------|------------------|-------------------|----------------|-------------|-----------------|-----------------|-------------|-----|---------------|-----------------|-----------------|
| 5851.200        | 56.6             | ---               | 119.4          | 62.82       | 1000.0          | 1000.000        | 150.0       | H   | -79.0         | -15.0           | 14.7            |

## 5.8.5 TEST EQUIPMENT USED

- Radiated Emissions

## 6 TEST EQUIPMENT

### Test Equipment of tests performed in 2021

- 1 R&S TS8997  
2.4 and 5 GHz Bands Conducted Test Lab

| Ref.No. | Device Name          | Description                                        | Manufacturer                      | Serial Number | Last Calibration | Calibration Due |
|---------|----------------------|----------------------------------------------------|-----------------------------------|---------------|------------------|-----------------|
| 1.1     | MFS                  | Rubidium Frequency Standard                        | Datum-Beverly                     | 5489/001      | 2020-09          | 2021-09         |
| 1.2     | FSV30                | Signal Analyzer 10 Hz - 30 GHz                     | Rohde & Schwarz                   | 103005        | 2020-05          | 2022-05         |
| 1.3     | ESR 7                | EMI Receiver / Spectrum Analyzer                   | Rohde & Schwarz                   | 101424        | 2021-01          | 2023-01         |
| 1.4     | Opus10 THI (8152.00) | T/H Logger 15                                      | Lufft Mess- und Regeltechnik GmbH | 13985         | 2019-06          | 2021-06         |
| 1.5     | Opus10 THI (8152.00) | T/H Logger 14                                      | Lufft Mess- und Regeltechnik GmbH | 13993         | 2019-06          | 2021-06         |
| 1.6     | Opus10 THI (8152.00) | T/H Logger 03                                      | Lufft Mess- und Regeltechnik GmbH | 7482          | 2019-06          | 2021-06         |
| 1.7     | OSP120               | Contains Power Meter and Switching Unit OSP-B157W8 | Rohde & Schwarz                   | 101158        | 2018-05          | 2021-05         |

- 2 Radiated Emissions  
Lab to perform radiated emission tests

| Ref.No. | Device Name             | Description                            | Manufacturer                      | Serial Number      | Last Calibration | Calibration Due |
|---------|-------------------------|----------------------------------------|-----------------------------------|--------------------|------------------|-----------------|
| 2.1     | MFS                     | Rubidium Frequency Normal MFS          | Datum GmbH                        | 002                | 2020-11          | 2021-11         |
| 2.2     | Opus10 TPR (8253.00)    | T/P Logger 13                          | Lufft Mess- und Regeltechnik GmbH | 13936              | 2019-05          | 2021-05         |
| 2.3     | AMF-7D00101800-30-10P-R | Broadband Amplifier 100 MHz - 18 GHz   | Miteq                             |                    |                  |                 |
| 2.4     | ASP 1.2/1.8-10 kg       | Antenna Mast                           | Maturo GmbH                       | -                  |                  |                 |
| 2.5     | Anechoic Chamber 03     | FAR, 8.80m x 4.60m x 4.05m (l x w x h) | Albatross Projects                | P26971-647-001-PRB | 2018-06          | 2020-06         |
| 2.6     | Opus10 THI (8152.00)    | T/H Logger 10                          | Lufft Mess- und Regeltechnik GmbH | 12488              | 2019-06          | 2021-06         |
| 2.7     | JS4-18002600-32-5P      | Broadband Amplifier 18 GHz - 26 GHz    | Miteq                             | 849785             |                  |                 |
| 2.8     | FSW 43                  | Spectrum Analyzer                      | Rohde & Schwarz                   | 103779             | 2019-02          | 2021-08         |

| Ref.No. | Device Name            | Description                                     | Manufacturer                      | Serial Number          | Last Calibration | Calibration Due |
|---------|------------------------|-------------------------------------------------|-----------------------------------|------------------------|------------------|-----------------|
| 2.9     | 3160-09                | Standard Gain / Pyramidal Horn Antenna 26.5 GHz | EMCO Elektronik GmbH              | 00083069               |                  |                 |
| 2.10    | WHKX 7.0/18G-8SS       | High Pass Filter                                | Wainwright Instruments GmbH       | 09                     |                  |                 |
| 2.11    | 3160-09                | Standard Gain / Pyramidal Horn Antenna 26.5 GHz | EMCO Elektronik GmbH              | 9910-1184              |                  |                 |
| 2.12    | JS4-00102600-42-5A     | Broadband Amplifier 30 MHz - 26 GHz             | Miteq                             | 619368                 |                  |                 |
| 2.13    | TT 1.5 WI              | Turn Table                                      | Maturo GmbH                       | -                      |                  |                 |
| 2.14    | HL 562 ULTRALOG        | Biconical-log-per Antenna (30 MHz - 3 GHz)      | Rohde & Schwarz GmbH & Co. KG     | 100609                 | 2019-05          | 2022-05         |
| 2.15    | 3160-10                | Standard Gain / Pyramidal Horn Antenna 40 GHz   | EMCO Elektronik GmbH              | 00086675               |                  |                 |
| 2.16    | JUN-AIR Mod. 6-15      | Air Compressor                                  | JUN-AIR Deutschland GmbH          | 612582                 |                  |                 |
| 2.17    | Opus10 THI (8152.00)   | T/H Logger 12                                   | Lufft Mess- und Regeltechnik GmbH | 12482                  | 2019-06          | 2021-06         |
| 2.18    | JS4-00101800-35-5P     | Broadband Amplifier 30 MHz - 18 GHz             | Miteq                             | 896037                 |                  |                 |
| 2.19    | AS 620 P               | Antenna Mast (pneumatic polarisation)           | HD GmbH                           | 620/37                 |                  |                 |
| 2.20    | TD1.5-10kg             | EUT Tilt Device (Rohacell)                      | Maturo GmbH                       | TD1.5-10kg/024/3790709 |                  |                 |
| 2.21    | HF 907-2               | Double-ridged horn                              | Rohde & Schwarz                   | 102817                 | 2019-04          | 2022-04         |
| 2.22    | PAS 2.5 - 10 kg        | Antenna Mast                                    | Maturo GmbH                       | -                      |                  |                 |
| 2.23    | AFS42-00101800-25-S-42 | Broadband Amplifier 25 MHz - 18 GHz             | Miteq                             | 2035324                |                  |                 |
| 2.24    | HF 907                 | Double-ridged horn                              | Rohde & Schwarz                   | 102444                 | 2018-07          | 2021-07         |

The calibration interval is the time interval between "Last Calibration" and "Calibration Due".

## Test Equipment of tests performed before 2021

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

### Test Equipment Anechoic Chamber

**Lab ID:** Lab 3  
**Manufacturer:** Frankonia  
**Description:** Anechoic Chamber for radiated testing  
**Type:** 10.58x6.38x6.00 m<sup>3</sup>

| Calibration Details | Last Execution | Next Exec. |
|---------------------|----------------|------------|
| NSA (FCC, IC)       | 2011/01/10     | 2014/01/10 |
| 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><br>FCC listing 96716 3m Part15/18<br>IC listing 3699A-1 3m<br>FCC listing 96716 3m Part15/18 | none                   | Frankonia<br>2011/01/11 2014/01/10<br>2011/02/07 2014/02/06<br>2014/01/09 2017/01/08 |
| Controller Innco 2000 | CO 2000                                                                                                                         | CO2000/328/12470 406/L | Innco innovative constructions GmbH                                                  |
| Controller Maturo     | MCU                                                                                                                             | 961208                 | Maturo GmbH                                                                          |
| EMC camera            | CE-CAM/1                                                                                                                        | -                      | CE-SYS                                                                               |
| EMC camera Nr.2       | CCD-400E                                                                                                                        | 0005033                | Mitsubishi                                                                           |
| Filter ISDN           | B84312-C110-E1                                                                                                                  |                        | Siemens&Matsushita                                                                   |
| Filter Universal 1A   | BB4312-C30-H3                                                                                                                   | -                      | Siemens&Matsushita                                                                   |

## Test Equipment Auxiliary Equipment for Conducted emissions

**Lab ID:** Lab 1  
**Manufacturer:** Rohde & Schwarz GmbH & Co.KG  
**Description:** 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<br>Path Calibration | W18.03+W48.03 | Huber&Suhner                  | 2011/11/11 2012/11/10 |
| Impedance Stabilization Network                              | ISN T800                  | 36159         | Teseq GmbH                    |                       |
| Calibration Details                                          |                           |               | Last Execution                | Next Exec.            |
| Standard Calibration                                         |                           |               | 2014/02/06                    | 2016/02/28            |
| Impedance Stabilization Network, Coupling Decoupling Network | ISN/CDN ENY41             | 100002        | Rohde & Schwarz GmbH & Co. KG |                       |
| Standard calibration                                         |                           |               | 2011/01/20                    | 2013/01/31            |
| Standard calibration                                         |                           |               | 2013/03/01                    | 2015/03/31            |
| Impedance Stabilization Network, Coupling Decoupling Network | ISN/CDN ST08              | 36292         | Teseq GmbH                    |                       |
| Calibration Details                                          |                           |               | Last Execution                | Next Exec.            |
| Standard calibration                                         |                           |               | 2014/01/10                    | 2016/01/31            |
| Impedance Stabilization Network, Coupling Decoupling Network | ISN/CDN T8-Cat6           | 32187         | Teseq GmbH                    |                       |
| Calibration Details                                          |                           |               | Last Execution                | Next Exec.            |
| Standard Calibration                                         |                           |               | 2014/01/08                    | 2016/01/31            |
| One-Line V-Network                                           | ESH 3-Z6                  | 100489        | Rohde & Schwarz GmbH & Co. KG |                       |
| standard calibration                                         |                           |               | 2014/06/18                    | 2017/11/30            |
| Standard calibration                                         |                           |               | 2011/02/08                    | 2014/02/07            |
| One-Line V-Network                                           | ESH 3-Z6                  | 100570        | Rohde & Schwarz GmbH & Co. KG |                       |
| Calibration Details                                          |                           |               | Last Execution                | Next Exec.            |
| Standard Calibration                                         |                           |               | 2013/11/25                    | 2016/11/24            |
| Two-Line V-Network                                           | ESH 3-Z5                  | 828304/029    | Rohde & Schwarz GmbH & Co. KG |                       |
| Calibration Details                                          |                           |               | Last Execution                | Next Exec.            |
| Standard Calibration                                         |                           |               | 2013/03/01                    | 2015/03/31            |
| DAkks Calibration                                            |                           |               | 2015/03/30                    | 2017/03/31            |
| Two-Line V-Network                                           | ESH 3-Z5                  | 829996/002    | Rohde & Schwarz GmbH & Co. KG |                       |
| Standard Calibration                                         |                           |               | 2013/03/01                    | 2015/02/28            |
| DAkks Calibration                                            |                           |               | 2015/03/30                    | 2017/03/31            |
| DKD Calibration                                              |                           |               | 2011/01/20                    | 2013/01/19            |

# Test Equipment Auxiliary Equipment for Radiated emissions

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

## Single Devices for Auxiliary Equipment for Radiated emissions

| Single Device Name                                | Type                   | Serial Number      | Manufacturer                    |                |            |
|---------------------------------------------------|------------------------|--------------------|---------------------------------|----------------|------------|
| Antenna mast                                      | AM 4.0                 | AM4.0/180/11920513 | Maturo GmbH                     |                |            |
| Antenna mast                                      | AS 620 P               | 620/37             | HD GmbH                         |                |            |
| Biconical Broadband Antenna                       | SBA 9119               | 9119-005           | Schwarzbeck Mess-Elektronik OHG |                |            |
|                                                   | Calibration Details    |                    |                                 | Last Execution | Next Exec. |
|                                                   | Standard Calibration   |                    |                                 | 2009/06/04     | 2014/06/03 |
| Biconical dipole                                  | VUBA 9117              | 9117-108           | Schwarzbeck Mess-Elektronik OHG |                |            |
|                                                   | Standard Calibration   |                    |                                 | 2012/01/18     | 2015/01/17 |
| Broadband Amplifier 1 GHz - 4 GHz                 | AFS4-01000400-1Q-10P-4 | -                  | Miteq                           |                |            |
|                                                   | Path Calibration       |                    |                                 | 2012/05/24     | 2012/11/23 |
| Broadband Amplifier 18 GHz - 26 GHz               | JS4-18002600-32-5P     | 849785             | Miteq                           |                |            |
|                                                   | Path Calibration       |                    |                                 | 2012/05/24     | 2012/11/23 |
| Broadband Amplifier 30 MHz - 18 GHz               | JS4-00101800-35-5P     | 896037             | Miteq                           |                |            |
|                                                   | Path Calibration       |                    |                                 | 2012/05/24     | 2012/11/23 |
| Cable "ESI to EMI Antenna"                        | EcoFlex10              | W18.01-2+W38.01-2  | Kabel Kusch                     |                |            |
|                                                   | Path Calibration       |                    |                                 | 2012/05/24     | 2012/11/23 |
| Cable "ESI to Horn Antenna"                       | SucoFlex               | W18.02-2+W38.02-2  | HUBER+SUHNER                    |                |            |
| Cable "ESI to Horn Antenna"                       | UFB311A+UFB293C        | W18.02-2+W38.02-2  | Rosenberger Micro-Coax          |                |            |
|                                                   | Path Calibration       |                    |                                 | 2012/05/24     | 2012/11/23 |
|                                                   | Path Calibration       |                    |                                 | 2012/11/23     | 2013/05/22 |
|                                                   | Path Calibration       |                    |                                 | 2013/05/22     | 2013/11/23 |
| Double-ridged horn                                | HF 906                 | 357357/002         | Rohde & Schwarz GmbH & Co. KG   |                |            |
|                                                   | Standard Calibration   |                    |                                 | 2012/06/26     | 2015/06/25 |
|                                                   | Standard Calibration   |                    |                                 | 2015/06/23     | 2018/06/22 |
| Double-ridged horn                                | HF 907                 | 102444             | Rohde & Schwarz GmbH & Co. KG   |                |            |
|                                                   | Calibration Details    |                    |                                 | Last Execution | Next Exec. |
|                                                   | Standard Calibration   |                    |                                 | 2015/05/11     | 2018/05/10 |
| Double-ridged horn-duplicated 2015-07-15 10:47:55 | HF 906                 | 357357/001         | Rohde & Schwarz GmbH & Co. KG   |                |            |
| Dreheinheit                                       | DE 325                 |                    | HD GmbH                         |                |            |
| High Pass Filter                                  | 4HC1600/12750-1.5-KK   | 9942011            | Trilithic                       |                |            |
|                                                   | Path Calibration       |                    |                                 | 2012/05/24     | 2012/11/23 |
| High Pass Filter                                  | 5HC2700/12750-1.5-KK   | 9942012            | Trilithic                       |                |            |
|                                                   | Path Calibration       |                    |                                 | 2012/05/24     | 2012/11/23 |
| High Pass Filter                                  | 5HC3500/18000-1.2-KK   | 200035008          | Trilithic                       |                |            |
|                                                   | Path Calibration       |                    |                                 | 2012/05/24     | 2012/11/23 |

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

| <i>Single Device Name</i>                             | <i>Type</i>                          | <i>Serial Number</i>       | <i>Manufacturer</i>                |                                         |
|-------------------------------------------------------|--------------------------------------|----------------------------|------------------------------------|-----------------------------------------|
| High Pass Filter                                      | WHKX 7.0/18G-8SS<br>Path Calibration | 09                         | Wainwright                         | 2012/05/24 2012/11/23                   |
| Horn Antenna<br>Schwarzbeck 15-26.5<br>GHz BBHA 9170  | BBHA 9170                            | BBHA9170262                | Schwarzbeck Mess-Elektronik<br>OHG |                                         |
| Log.-per. Antenna                                     | HL 562 Ultralog                      | 100609                     | Rohde & Schwarz GmbH & Co.<br>KG   |                                         |
|                                                       | <i>Calibration Details</i>           |                            |                                    | <i>Last Execution</i> <i>Next Exec.</i> |
|                                                       | Standard Calibration                 |                            |                                    | 2012/12/18 2015/12/17                   |
| Log.-per. Antenna<br>(upgraded)                       | HL 562 Ultralog new biconicals       | 830547/003                 | Rohde & Schwarz GmbH & Co.<br>KG   |                                         |
|                                                       | Standard Calibration                 |                            |                                    | 2015/06/30 2018/06/29                   |
| Loop Antenna                                          | HFH2-Z2                              | 829324/006                 | Rohde & Schwarz GmbH & Co.<br>KG   |                                         |
|                                                       | DKD Calibration                      |                            |                                    | 2014/11/27 2017/11/27                   |
|                                                       | Standard calibration                 |                            |                                    | 2011/10/27 2014/10/26                   |
| Standard Gain /<br>Pyramidal Horn Antenna<br>26.5 GHz | 3160-09                              | 00083069                   | EMCO Elektronik GmbH               |                                         |
| Standard Gain /<br>Pyramidal Horn Antenna<br>40 GHz   | 3160-10                              | 00086675                   | EMCO Elektronik GmbH               |                                         |
| Tilt device Maturo<br>(Rohacell)                      | Antrieb TD1.5-10kg                   | TD1.5-<br>10kg/024/3790709 | Maturo GmbH                        |                                         |

### Test Equipment Emission measurement devices

**Lab ID:** Lab 1, Lab 3  
**Description:** Equipment for emission measurements  
**Serial Number:** see single devices

### Single Devices for Emission measurement devices

| Single Device Name               | Type                                                | Serial Number | Manufacturer                  |                |             |
|----------------------------------|-----------------------------------------------------|---------------|-------------------------------|----------------|-------------|
| EMI Receiver / Spectrum Analyser | ESR 7                                               | 101424        | Rohde & Schwarz               |                |             |
|                                  | Calibration Details                                 |               |                               | Last Execution | Next Exec.  |
|                                  | Initial Factory Calibration                         |               |                               | 2014/11/13     | 2016/11/12  |
| Personal Computer                | Dell                                                | 30304832059   | Dell                          |                |             |
| Power Meter                      | NRVD                                                | 828110/016    | Rohde & Schwarz GmbH & Co.KG  |                |             |
|                                  | Calibration Details                                 |               |                               | Last Execution | Next Exec.  |
|                                  | Standard calibration                                |               |                               | 2012/05/22     | 2013/05/21  |
|                                  | Standard calibration                                |               |                               | 2013/05/03     | 2014/05/02  |
|                                  | Standard calibration                                |               |                               | 2014/05/13     | 2015/05/10  |
|                                  | Standard calibration                                |               |                               | 2015/05/11     | 2016/05/10  |
| Power Sensor                     | NRV-Z1                                              | 836219/005    | Rohde & Schwarz GmbH & Co. KG |                |             |
| Powermeter                       | NRVS                                                | 836333/064    | Rohde & Schwarz GmbH & Co. KG |                |             |
| Sensor Head A                    | NRV-Z1                                              | 827753/005    | Rohde & Schwarz GmbH & Co.KG  |                |             |
|                                  | Calibration Details                                 |               |                               | Last Execution | Next Exec.  |
|                                  | Standard calibration                                |               |                               | 2012/05/21     | 2013/05/20  |
|                                  | Standard calibration                                |               |                               | 2013/04/30     | 2014/04/29  |
|                                  | Standard calibration                                |               |                               | 2014/05/13     | 2015/05/10  |
|                                  | Standard calibration                                |               |                               | 2015/05/11     | 2016/05/10  |
| Signal Generator                 | SMR 20                                              | 846834/008    | Rohde & Schwarz GmbH & Co. KG |                |             |
|                                  | standard calibration                                |               |                               | 2011/05/12     | 2014/05/11  |
|                                  | Standard Calibration                                |               |                               | 2014/06/24     | 2017/06/23  |
| Spectrum Analyser                | FSW 43                                              | 103779        | Rohde & Schwarz               |                |             |
|                                  | Calibration Details                                 |               |                               | Last Execution | Next Exec.  |
|                                  | Initial Factory Calibration                         |               |                               | 2014/11/17     | 2016/11/16  |
| Spectrum Analyzer                | ESIB 26                                             | 830482/004    | Rohde & Schwarz GmbH & Co. KG |                |             |
|                                  | Standard Calibration                                |               |                               | 2011/12/05     | 2013/12/31  |
|                                  | 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 WLAN RF Test Solution

**Lab ID:** Lab 6  
**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    | 2012/07/24                   | 2013/07/23 |
|                                 | Standard Calibration                               |               | 2013/08/26                   | 2014/08/25 |
|                                 | Standard calibration                               |               | 2014/08/29                   | 2015/08/28 |
| Power Sensor NRV Z1 A           | PROBE                                              | 832279/013    |                              |            |
|                                 | Standard Calibration                               |               | 2012/07/23                   | 2013/07/22 |
|                                 | Standard calibration                               |               | 2013/08/28                   | 2014/08/27 |
|                                 | Standard calibration                               |               | 2014/08/28                   | 2015/08/27 |
| Power Supply                    | NGSM 32/10                                         | 2725          | 2011/06/15                   | 2013/06/14 |
|                                 | Standard Calibration                               |               | 2013/06/20                   | 2015/06/19 |
|                                 | Standard calibration                               |               | 2015/06/22                   | 2016/06/21 |
| Rubidium Frequency Normal MFS   | Datum MFS                                          | 002           | Datum GmbH                   |            |
|                                 | Standard Calibration                               |               | 2012/08/20                   | 2013/08/19 |
|                                 | Standard calibration                               |               | 2013/08/27                   | 2014/08/26 |
|                                 | Standard calibration                               |               | 2014/08/29                   | 2015/08/28 |
| Signal Analyser FSIQ26          | 1119.6001.26                                       | 832695/007    | Rohde & Schwarz GmbH & Co.KG |            |
| Signal Generator                | SMP03                                              | 833680/003    | Rohde & Schwarz GmbH & Co.KG |            |
|                                 | Standard                                           |               | 2013/10/29                   | 2016/10/28 |
| Spectrum Analyser               | FSU26                                              | 100136        | Rohde & Schwarz GmbH & Co.KG |            |
|                                 | Standard calibration                               |               | 2012/06/20                   | 2012/12/20 |
|                                 | Standard calibration                               |               | 2012/12/21                   | 2014/01/05 |
|                                 | Standard Calibration                               |               | 2014/01/06                   | 2015/02/01 |
|                                 | Standard Calibration                               |               | 2015/02/02                   | 2016/02/01 |
|                                 | 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 |            |
|                                 | Standard calibration                               |               | 2012/05/15                   | 2013/06/19 |
|                                 | Standard calibration                               |               | 2013/06/20                   | 2014/06/30 |
|                                 | Standard calibration                               |               | 2014/07/01                   | 2015/06/30 |
|                                 | Standard calibration                               |               | 2015/06/22                   | 2016/06/21 |
|                                 | 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    |                              |            |
|                                 | Standard Calibration                               |               | 2010/06/23                   | 2013/06/22 |
|                                 | Standard calibration                               |               | 2013/06/21                   | 2016/06/20 |

## 7 ANTENNA FACTORS, CABLE LOSS AND SAMPLE CALCULATIONS

This chapter contains the antenna factors with their corresponding path loss of the used measurement path for all antennas as well as the insertion loss of the LISN.

### 7.1 LISN R&S ESH3-Z5 (150 KHZ – 30 MHZ)

| Frequency |  | Corr. | LISN<br>insertion<br>loss<br>ESH3-<br>Z5 | cable<br>loss<br>(incl. 10<br>dB<br>atten-<br>uator) |
|-----------|--|-------|------------------------------------------|------------------------------------------------------|
| MHz       |  | dB    | dB                                       | dB                                                   |
| 0.15      |  | 10.1  | 0.1                                      | 10.0                                                 |
| 5         |  | 10.3  | 0.1                                      | 10.2                                                 |
| 7         |  | 10.5  | 0.2                                      | 10.3                                                 |
| 10        |  | 10.5  | 0.2                                      | 10.3                                                 |
| 12        |  | 10.7  | 0.3                                      | 10.4                                                 |
| 14        |  | 10.7  | 0.3                                      | 10.4                                                 |
| 16        |  | 10.8  | 0.4                                      | 10.4                                                 |
| 18        |  | 10.9  | 0.4                                      | 10.5                                                 |
| 20        |  | 10.9  | 0.4                                      | 10.5                                                 |
| 22        |  | 11.1  | 0.5                                      | 10.6                                                 |
| 24        |  | 11.1  | 0.5                                      | 10.6                                                 |
| 26        |  | 11.2  | 0.5                                      | 10.7                                                 |
| 28        |  | 11.2  | 0.5                                      | 10.7                                                 |
| 30        |  | 11.3  | 0.5                                      | 10.8                                                 |

#### Sample calculation

$$U_{\text{LISN}} (\text{dB } \mu\text{V}) = U (\text{dB } \mu\text{V}) + \text{Corr. (dB)}$$

U = Receiver reading

LISN Insertion loss = Voltage Division Factor of LISN

Corr. = sum of single correction factors of used LISN, cables, switch units (if used)

Linear interpolation will be used for frequencies in between the values in the table.

## 7.2 ANTENNA R&S HFH2-Z2 (9 KHZ – 30 MHZ)

| Frequency<br>MHz | AF<br>HFH-Z2)<br>dB (1/m) | Corr.<br>dB | cable<br>loss 1<br>(inside<br>chamber)<br>dB | cable<br>loss 2<br>(outside<br>chamber)<br>dB | cable<br>loss 3<br>(switch<br>unit)<br>dB | cable<br>loss 4<br>(to<br>receiver)<br>dB | distance<br>corr.<br>(-40 dB/<br>decade)<br>dB | d <sub>Limit</sub><br>(meas.<br>distance<br>(limit)<br>m | d <sub>used</sub><br>(meas.<br>distance<br>(used)<br>m |
|------------------|---------------------------|-------------|----------------------------------------------|-----------------------------------------------|-------------------------------------------|-------------------------------------------|------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------|
| 0.009            | 20.50                     | -79.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -80                                            | 300                                                      | 3                                                      |
| 0.01             | 20.45                     | -79.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -80                                            | 300                                                      | 3                                                      |
| 0.015            | 20.37                     | -79.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -80                                            | 300                                                      | 3                                                      |
| 0.02             | 20.36                     | -79.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -80                                            | 300                                                      | 3                                                      |
| 0.025            | 20.38                     | -79.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -80                                            | 300                                                      | 3                                                      |
| 0.03             | 20.32                     | -79.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -80                                            | 300                                                      | 3                                                      |
| 0.05             | 20.35                     | -79.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -80                                            | 300                                                      | 3                                                      |
| 0.08             | 20.30                     | -79.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -80                                            | 300                                                      | 3                                                      |
| 0.1              | 20.20                     | -79.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -80                                            | 300                                                      | 3                                                      |
| 0.2              | 20.17                     | -79.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -80                                            | 300                                                      | 3                                                      |
| 0.3              | 20.14                     | -79.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -80                                            | 300                                                      | 3                                                      |
| 0.49             | 20.12                     | -79.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -80                                            | 300                                                      | 3                                                      |
| 0.490001         | 20.12                     | -39.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 0.5              | 20.11                     | -39.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 0.8              | 20.10                     | -39.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 1                | 20.09                     | -39.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 2                | 20.08                     | -39.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 3                | 20.06                     | -39.6       | 0.1                                          | 0.1                                           | 0.1                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 4                | 20.05                     | -39.5       | 0.2                                          | 0.1                                           | 0.1                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 5                | 20.05                     | -39.5       | 0.2                                          | 0.1                                           | 0.1                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 6                | 20.02                     | -39.5       | 0.2                                          | 0.1                                           | 0.1                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 8                | 19.95                     | -39.5       | 0.2                                          | 0.1                                           | 0.1                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 10               | 19.83                     | -39.4       | 0.2                                          | 0.1                                           | 0.2                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 12               | 19.71                     | -39.4       | 0.2                                          | 0.1                                           | 0.2                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 14               | 19.54                     | -39.4       | 0.2                                          | 0.1                                           | 0.2                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 16               | 19.53                     | -39.3       | 0.3                                          | 0.1                                           | 0.2                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 18               | 19.50                     | -39.3       | 0.3                                          | 0.1                                           | 0.2                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 20               | 19.57                     | -39.3       | 0.3                                          | 0.1                                           | 0.2                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 22               | 19.61                     | -39.3       | 0.3                                          | 0.1                                           | 0.2                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 24               | 19.61                     | -39.3       | 0.3                                          | 0.1                                           | 0.2                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 26               | 19.54                     | -39.3       | 0.3                                          | 0.1                                           | 0.2                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 28               | 19.46                     | -39.2       | 0.3                                          | 0.1                                           | 0.3                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |
| 30               | 19.73                     | -39.1       | 0.4                                          | 0.1                                           | 0.3                                       | 0.1                                       | -40                                            | 30                                                       | 3                                                      |

### Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

distance correction =  $-40 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$

Linear interpolation will be used for frequencies in between the values in the table.

Table shows an extract of values

### 7.3 ANTENNA R&S HL562 (30 MHz – 1 GHz)

( $d_{\text{Limit}} = 3 \text{ m}$ )

| Frequency | AF<br>R&S<br>HL562 | Corr. |
|-----------|--------------------|-------|
| MHz       | dB (1/m)           | dB    |
| 30        | 18.6               | 0.6   |
| 50        | 6.0                | 0.9   |
| 100       | 9.7                | 1.2   |
| 150       | 7.9                | 1.6   |
| 200       | 7.6                | 1.9   |
| 250       | 9.5                | 2.1   |
| 300       | 11.0               | 2.3   |
| 350       | 12.4               | 2.6   |
| 400       | 13.6               | 2.9   |
| 450       | 14.7               | 3.1   |
| 500       | 15.6               | 3.2   |
| 550       | 16.3               | 3.5   |
| 600       | 17.2               | 3.5   |
| 650       | 18.1               | 3.6   |
| 700       | 18.5               | 3.6   |
| 750       | 19.1               | 4.1   |
| 800       | 19.6               | 4.1   |
| 850       | 20.1               | 4.4   |
| 900       | 20.8               | 4.7   |
| 950       | 21.1               | 4.8   |
| 1000      | 21.6               | 4.9   |

| cable<br>loss 1<br>(inside<br>chamber) | cable<br>loss 2<br>(outside<br>chamber) | cable<br>loss 3<br>(switch<br>unit) | cable<br>loss 4<br>(to<br>receiver) | distance<br>corr.<br>(-20 dB/<br>decade) | $d_{\text{Limit}}$<br>(meas.<br>distance<br>(limit)) | $d_{\text{used}}$<br>(meas.<br>distance<br>(used)) |
|----------------------------------------|-----------------------------------------|-------------------------------------|-------------------------------------|------------------------------------------|------------------------------------------------------|----------------------------------------------------|
| dB                                     | dB                                      | dB                                  | dB                                  | dB                                       | m                                                    | m                                                  |
| 0.29                                   | 0.04                                    | 0.23                                | 0.02                                | 0.0                                      | 3                                                    | 3                                                  |
| 0.39                                   | 0.09                                    | 0.32                                | 0.08                                | 0.0                                      | 3                                                    | 3                                                  |
| 0.56                                   | 0.14                                    | 0.47                                | 0.08                                | 0.0                                      | 3                                                    | 3                                                  |
| 0.73                                   | 0.20                                    | 0.59                                | 0.12                                | 0.0                                      | 3                                                    | 3                                                  |
| 0.84                                   | 0.21                                    | 0.70                                | 0.11                                | 0.0                                      | 3                                                    | 3                                                  |
| 0.98                                   | 0.24                                    | 0.80                                | 0.13                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.04                                   | 0.26                                    | 0.89                                | 0.15                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.18                                   | 0.31                                    | 0.96                                | 0.13                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.28                                   | 0.35                                    | 1.03                                | 0.19                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.39                                   | 0.38                                    | 1.11                                | 0.22                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.44                                   | 0.39                                    | 1.20                                | 0.19                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.55                                   | 0.46                                    | 1.24                                | 0.23                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.59                                   | 0.43                                    | 1.29                                | 0.23                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.67                                   | 0.34                                    | 1.35                                | 0.22                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.67                                   | 0.42                                    | 1.41                                | 0.15                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.87                                   | 0.54                                    | 1.46                                | 0.25                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.90                                   | 0.46                                    | 1.51                                | 0.25                                | 0.0                                      | 3                                                    | 3                                                  |
| 1.99                                   | 0.60                                    | 1.56                                | 0.27                                | 0.0                                      | 3                                                    | 3                                                  |
| 2.14                                   | 0.60                                    | 1.63                                | 0.29                                | 0.0                                      | 3                                                    | 3                                                  |
| 2.22                                   | 0.60                                    | 1.66                                | 0.33                                | 0.0                                      | 3                                                    | 3                                                  |
| 2.23                                   | 0.61                                    | 1.71                                | 0.30                                | 0.0                                      | 3                                                    | 3                                                  |

( $d_{\text{Limit}} = 10 \text{ m}$ )

|      |      |      |
|------|------|------|
| 30   | 18.6 | -9.9 |
| 50   | 6.0  | -9.6 |
| 100  | 9.7  | -9.2 |
| 150  | 7.9  | -8.8 |
| 200  | 7.6  | -8.6 |
| 250  | 9.5  | -8.3 |
| 300  | 11.0 | -8.1 |
| 350  | 12.4 | -7.9 |
| 400  | 13.6 | -7.6 |
| 450  | 14.7 | -7.4 |
| 500  | 15.6 | -7.2 |
| 550  | 16.3 | -7.0 |
| 600  | 17.2 | -6.9 |
| 650  | 18.1 | -6.9 |
| 700  | 18.5 | -6.8 |
| 750  | 19.1 | -6.3 |
| 800  | 19.6 | -6.3 |
| 850  | 20.1 | -6.0 |
| 900  | 20.8 | -5.8 |
| 950  | 21.1 | -5.6 |
| 1000 | 21.6 | -5.6 |

|      |      |      |      |       |    |   |
|------|------|------|------|-------|----|---|
| 0.29 | 0.04 | 0.23 | 0.02 | -10.5 | 10 | 3 |
| 0.39 | 0.09 | 0.32 | 0.08 | -10.5 | 10 | 3 |
| 0.56 | 0.14 | 0.47 | 0.08 | -10.5 | 10 | 3 |
| 0.73 | 0.20 | 0.59 | 0.12 | -10.5 | 10 | 3 |
| 0.84 | 0.21 | 0.70 | 0.11 | -10.5 | 10 | 3 |
| 0.98 | 0.24 | 0.80 | 0.13 | -10.5 | 10 | 3 |
| 1.04 | 0.26 | 0.89 | 0.15 | -10.5 | 10 | 3 |
| 1.18 | 0.31 | 0.96 | 0.13 | -10.5 | 10 | 3 |
| 1.28 | 0.35 | 1.03 | 0.19 | -10.5 | 10 | 3 |
| 1.39 | 0.38 | 1.11 | 0.22 | -10.5 | 10 | 3 |
| 1.44 | 0.39 | 1.20 | 0.19 | -10.5 | 10 | 3 |
| 1.55 | 0.46 | 1.24 | 0.23 | -10.5 | 10 | 3 |
| 1.59 | 0.43 | 1.29 | 0.23 | -10.5 | 10 | 3 |
| 1.67 | 0.34 | 1.35 | 0.22 | -10.5 | 10 | 3 |
| 1.67 | 0.42 | 1.41 | 0.15 | -10.5 | 10 | 3 |
| 1.87 | 0.54 | 1.46 | 0.25 | -10.5 | 10 | 3 |
| 1.90 | 0.46 | 1.51 | 0.25 | -10.5 | 10 | 3 |
| 1.99 | 0.60 | 1.56 | 0.27 | -10.5 | 10 | 3 |
| 2.14 | 0.60 | 1.63 | 0.29 | -10.5 | 10 | 3 |
| 2.22 | 0.60 | 1.66 | 0.33 | -10.5 | 10 | 3 |
| 2.23 | 0.61 | 1.71 | 0.30 | -10.5 | 10 | 3 |

#### Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + \text{AF (dB 1/m)} + \text{Corr. (dB)}$   
 $U$  = Receiver reading  
 $\text{AF}$  = Antenna factor  
 $\text{Corr.}$  = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)  
distance correction =  $-20 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$   
Linear interpolation will be used for frequencies in between the values in the table.  
Tables show an extract of values.

## 7.4 ANTENNA R&S HF907 (1 GHZ – 18 GHZ)

| Frequency | AF<br>R&S<br>HF907 | Corr. |
|-----------|--------------------|-------|
| MHz       | dB (1/m)           | dB    |
| 1000      | 24.4               | -19.4 |
| 2000      | 28.5               | -17.4 |
| 3000      | 31.0               | -16.1 |
| 4000      | 33.1               | -14.7 |
| 5000      | 34.4               | -13.7 |
| 6000      | 34.7               | -12.7 |
| 7000      | 35.6               | -11.0 |

| cable<br>loss 1<br>(relay +<br>cable<br>inside<br>chamber) | cable<br>loss 2<br>(outside<br>chamber) | cable<br>loss 3<br>(switch<br>unit,<br>atten-<br>uator &<br>pre-amp) | cable<br>loss 4 (to<br>receiver) |  |  |
|------------------------------------------------------------|-----------------------------------------|----------------------------------------------------------------------|----------------------------------|--|--|
| dB                                                         | dB                                      | dB                                                                   | dB                               |  |  |
| 0.99                                                       | 0.31                                    | -21.51                                                               | 0.79                             |  |  |
| 1.44                                                       | 0.44                                    | -20.63                                                               | 1.38                             |  |  |
| 1.87                                                       | 0.53                                    | -19.85                                                               | 1.33                             |  |  |
| 2.41                                                       | 0.67                                    | -19.13                                                               | 1.31                             |  |  |
| 2.78                                                       | 0.86                                    | -18.71                                                               | 1.40                             |  |  |
| 2.74                                                       | 0.90                                    | -17.83                                                               | 1.47                             |  |  |
| 2.82                                                       | 0.86                                    | -16.19                                                               | 1.46                             |  |  |

| Frequency | AF<br>R&S<br>HF907 | Corr. |
|-----------|--------------------|-------|
| MHz       | dB (1/m)           | dB    |
| 3000      | 31.0               | -23.4 |
| 4000      | 33.1               | -23.3 |
| 5000      | 34.4               | -21.7 |
| 6000      | 34.7               | -21.2 |
| 7000      | 35.6               | -19.8 |

| cable<br>loss 1<br>(relay<br>inside<br>chamber) | cable<br>loss 2<br>(inside<br>chamber) | cable<br>loss 3<br>(outside<br>chamber) | cable<br>loss 4<br>(switch<br>unit,<br>atten-<br>uator &<br>pre-amp) | cable<br>loss 5 (to<br>receiver) | used<br>for<br>FCC<br>15.247 |
|-------------------------------------------------|----------------------------------------|-----------------------------------------|----------------------------------------------------------------------|----------------------------------|------------------------------|
| dB                                              | dB                                     | dB                                      | dB                                                                   | dB                               |                              |
| 0.47                                            | 1.87                                   | 0.53                                    | -27.58                                                               | 1.33                             |                              |
| 0.56                                            | 2.41                                   | 0.67                                    | -28.23                                                               | 1.31                             |                              |
| 0.61                                            | 2.78                                   | 0.86                                    | -27.35                                                               | 1.40                             |                              |
| 0.58                                            | 2.74                                   | 0.90                                    | -26.89                                                               | 1.47                             |                              |
| 0.66                                            | 2.82                                   | 0.86                                    | -25.58                                                               | 1.46                             |                              |

| Frequency | AF<br>R&S<br>HF907 | Corr. |
|-----------|--------------------|-------|
| MHz       | dB (1/m)           | dB    |
| 7000      | 35.6               | -57.3 |
| 8000      | 36.3               | -56.3 |
| 9000      | 37.1               | -55.3 |
| 10000     | 37.5               | -56.2 |
| 11000     | 37.5               | -55.3 |
| 12000     | 37.6               | -53.7 |
| 13000     | 38.2               | -53.5 |
| 14000     | 39.9               | -56.3 |
| 15000     | 40.9               | -54.1 |
| 16000     | 41.3               | -54.1 |
| 17000     | 42.8               | -54.4 |
| 18000     | 44.2               | -54.7 |

| cable<br>loss 1<br>(relay<br>inside<br>chamber) | cable<br>loss 2<br>(High<br>Pass) | cable<br>loss 3<br>(pre-<br>amp) | cable<br>loss 4<br>(inside<br>chamber) | cable<br>loss 5<br>(outside<br>chamber) | cable<br>loss 6<br>(to<br>receiver) |
|-------------------------------------------------|-----------------------------------|----------------------------------|----------------------------------------|-----------------------------------------|-------------------------------------|
| dB                                              | dB                                | dB                               | dB                                     | dB                                      | dB                                  |
| 0.56                                            | 1.28                              | -62.72                           | 2.66                                   | 0.94                                    | 1.46                                |
| 0.69                                            | 0.71                              | -61.49                           | 2.84                                   | 1.00                                    | 1.53                                |
| 0.68                                            | 0.65                              | -60.80                           | 3.06                                   | 1.09                                    | 1.60                                |
| 0.70                                            | 0.54                              | -61.91                           | 3.28                                   | 1.20                                    | 1.67                                |
| 0.80                                            | 0.61                              | -61.40                           | 3.43                                   | 1.27                                    | 1.70                                |
| 0.84                                            | 0.42                              | -59.70                           | 3.53                                   | 1.26                                    | 1.73                                |
| 0.83                                            | 0.44                              | -59.81                           | 3.75                                   | 1.32                                    | 1.83                                |
| 0.91                                            | 0.53                              | -63.03                           | 3.91                                   | 1.40                                    | 1.77                                |
| 0.98                                            | 0.54                              | -61.05                           | 4.02                                   | 1.44                                    | 1.83                                |
| 1.23                                            | 0.49                              | -61.51                           | 4.17                                   | 1.51                                    | 1.85                                |
| 1.36                                            | 0.76                              | -62.36                           | 4.34                                   | 1.53                                    | 2.00                                |
| 1.70                                            | 0.53                              | -62.88                           | 4.41                                   | 1.55                                    | 1.91                                |

### Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

Linear interpolation will be used for frequencies in between the values in the table.

Tables show an extract of values.

## 7.5 ANTENNA EMCO 3160-09 (18 GHZ – 26.5 GHZ)

| Frequency | AF<br>EMCO<br>3160-09 | Corr. | cable<br>loss 1<br>(inside<br>chamber) | cable<br>loss 2<br>(pre-<br>amp) | cable<br>loss 3<br>(inside<br>chamber) | cable<br>loss 4<br>(switch<br>unit) | cable<br>loss 5<br>(to<br>receiver) |
|-----------|-----------------------|-------|----------------------------------------|----------------------------------|----------------------------------------|-------------------------------------|-------------------------------------|
| MHz       | dB (1/m)              | dB    | dB                                     | dB                               | dB                                     | dB                                  | dB                                  |
| 18000     | 40.2                  | -23.5 | 0.72                                   | -35.85                           | 6.20                                   | 2.81                                | 2.65                                |
| 18500     | 40.2                  | -23.2 | 0.69                                   | -35.71                           | 6.46                                   | 2.76                                | 2.59                                |
| 19000     | 40.2                  | -22.0 | 0.76                                   | -35.44                           | 6.69                                   | 3.15                                | 2.79                                |
| 19500     | 40.3                  | -21.3 | 0.74                                   | -35.07                           | 7.04                                   | 3.11                                | 2.91                                |
| 20000     | 40.3                  | -20.3 | 0.72                                   | -34.49                           | 7.30                                   | 3.07                                | 3.05                                |
| 20500     | 40.3                  | -19.9 | 0.78                                   | -34.46                           | 7.48                                   | 3.12                                | 3.15                                |
| 21000     | 40.3                  | -19.1 | 0.87                                   | -34.07                           | 7.61                                   | 3.20                                | 3.33                                |
| 21500     | 40.3                  | -19.1 | 0.90                                   | -33.96                           | 7.47                                   | 3.28                                | 3.19                                |
| 22000     | 40.3                  | -18.7 | 0.89                                   | -33.57                           | 7.34                                   | 3.35                                | 3.28                                |
| 22500     | 40.4                  | -19.0 | 0.87                                   | -33.66                           | 7.06                                   | 3.75                                | 2.94                                |
| 23000     | 40.4                  | -19.5 | 0.88                                   | -33.75                           | 6.92                                   | 3.77                                | 2.70                                |
| 23500     | 40.4                  | -19.3 | 0.90                                   | -33.35                           | 6.99                                   | 3.52                                | 2.66                                |
| 24000     | 40.4                  | -19.8 | 0.88                                   | -33.99                           | 6.88                                   | 3.88                                | 2.58                                |
| 24500     | 40.4                  | -19.5 | 0.91                                   | -33.89                           | 7.01                                   | 3.93                                | 2.51                                |
| 25000     | 40.4                  | -19.3 | 0.88                                   | -33.00                           | 6.72                                   | 3.96                                | 2.14                                |
| 25500     | 40.5                  | -20.4 | 0.89                                   | -34.07                           | 6.90                                   | 3.66                                | 2.22                                |
| 26000     | 40.5                  | -21.3 | 0.86                                   | -35.11                           | 7.02                                   | 3.69                                | 2.28                                |
| 26500     | 40.5                  | -21.1 | 0.90                                   | -35.20                           | 7.15                                   | 3.91                                | 2.36                                |

### Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

Linear interpolation will be used for frequencies in between the values in the table.

Table shows an extract of values.

## 7.6 ANTENNA EMCO 3160-10 (26.5 GHZ – 40 GHZ)

| Frequency<br>GHz | AF<br>EMCO<br>3160-10<br>dB (1/m) | Corr.<br>dB | cable<br>loss 1<br>(inside<br>chamber)<br>dB | cable<br>loss 2<br>(outside<br>chamber)<br>dB | cable<br>loss 3<br>(switch<br>unit)<br>dB | cable<br>loss 4<br>(to<br>receiver)<br>dB | distance<br>corr.<br>(-20 dB/<br>decade)<br>dB | d <sub>Limit</sub><br>(meas.<br>distance<br>(limit)<br>m | d <sub>used</sub><br>(meas.<br>distance<br>(used)<br>m |
|------------------|-----------------------------------|-------------|----------------------------------------------|-----------------------------------------------|-------------------------------------------|-------------------------------------------|------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------|
| 26.5             | 43.4                              | -11.2       | 4.4                                          |                                               |                                           |                                           | -9.5                                           | 3                                                        | 1.0                                                    |
| 27.0             | 43.4                              | -11.2       | 4.4                                          |                                               |                                           |                                           | -9.5                                           | 3                                                        | 1.0                                                    |
| 28.0             | 43.4                              | -11.1       | 4.5                                          |                                               |                                           |                                           | -9.5                                           | 3                                                        | 1.0                                                    |
| 29.0             | 43.5                              | -11.0       | 4.6                                          |                                               |                                           |                                           | -9.5                                           | 3                                                        | 1.0                                                    |
| 30.0             | 43.5                              | -10.9       | 4.7                                          |                                               |                                           |                                           | -9.5                                           | 3                                                        | 1.0                                                    |
| 31.0             | 43.5                              | -10.8       | 4.7                                          |                                               |                                           |                                           | -9.5                                           | 3                                                        | 1.0                                                    |
| 32.0             | 43.5                              | -10.7       | 4.8                                          |                                               |                                           |                                           | -9.5                                           | 3                                                        | 1.0                                                    |
| 33.0             | 43.6                              | -10.7       | 4.9                                          |                                               |                                           |                                           | -9.5                                           | 3                                                        | 1.0                                                    |
| 34.0             | 43.6                              | -10.6       | 5.0                                          |                                               |                                           |                                           | -9.5                                           | 3                                                        | 1.0                                                    |
| 35.0             | 43.6                              | -10.5       | 5.1                                          |                                               |                                           |                                           | -9.5                                           | 3                                                        | 1.0                                                    |
| 36.0             | 43.6                              | -10.4       | 5.1                                          |                                               |                                           |                                           | -9.5                                           | 3                                                        | 1.0                                                    |
| 37.0             | 43.7                              | -10.3       | 5.2                                          |                                               |                                           |                                           | -9.5                                           | 3                                                        | 1.0                                                    |
| 38.0             | 43.7                              | -10.2       | 5.3                                          |                                               |                                           |                                           | -9.5                                           | 3                                                        | 1.0                                                    |
| 39.0             | 43.7                              | -10.2       | 5.4                                          |                                               |                                           |                                           | -9.5                                           | 3                                                        | 1.0                                                    |
| 40.0             | 43.8                              | -10.1       | 5.5                                          |                                               |                                           |                                           | -9.5                                           | 3                                                        | 1.0                                                    |

### Sample calculation

$E \text{ (dB } \mu\text{V/m)} = U \text{ (dB } \mu\text{V)} + AF \text{ (dB 1/m)} + Corr. \text{ (dB)}$

U = Receiver reading

AF = Antenna factor

Corr. = sum of single correction factors of used cables, switch unit, distance correction, amplifier (if applicable)

Linear interpolation will be used for frequencies in between the values in the table.

distance correction =  $-20 * \text{LOG} (d_{\text{Limit}} / d_{\text{used}})$

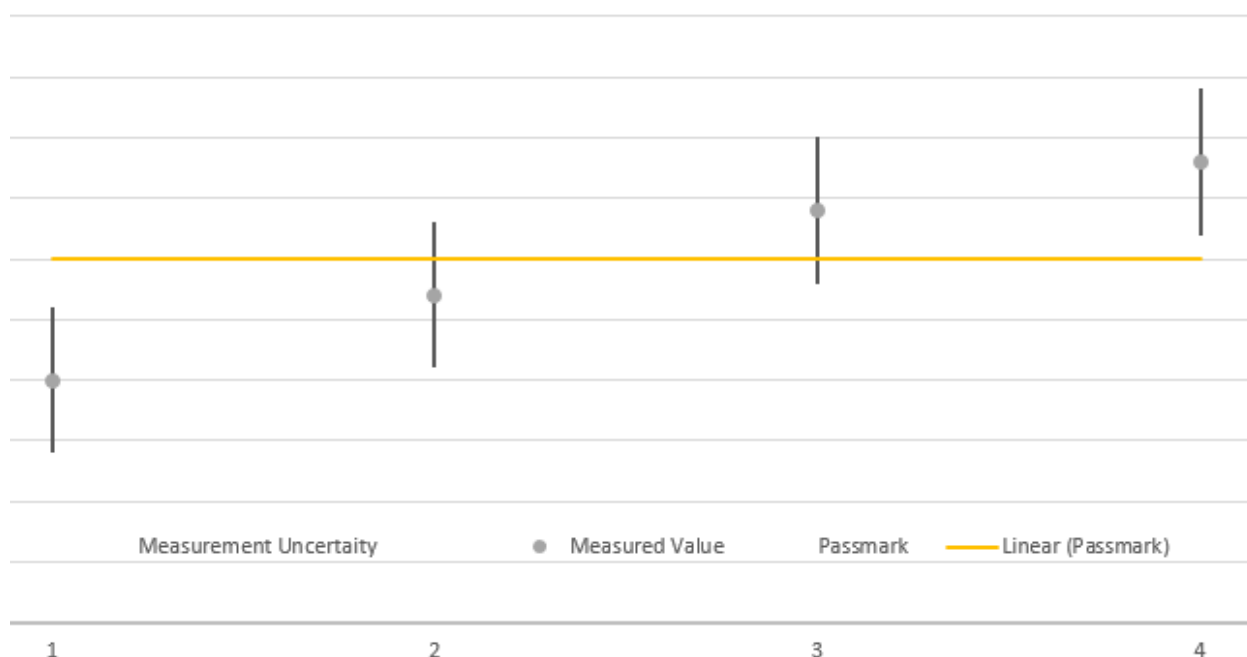
Linear interpolation will be used for frequencies in between the values in the table.

Table shows an extract of values.

## 8 MEASUREMENT UNCERTAINTIES

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

The measurement uncertainties for all parameters are calculated with an expansion factor (coverage factor)  $k = 1.96$ . This means, that the true value is in the corresponding interval with a probability of 95 %.



The verdicts in this test report are given according the above diagram:

| Case | Measured Value  | Uncertainty Range | Verdict |
|------|-----------------|-------------------|---------|
| 1    | below pass mark | below pass mark   | Passed  |
| 2    | below pass mark | within pass mark  | Passed  |
| 3    | above pass mark | within pass mark  | Failed  |
| 4    | above pass mark | above pass mark   | Failed  |

That means, the laboratory applies, as decision rule (see ISO/IEC 17025:2017), the so called shared risk principle.

## 9 PHOTO REPORT

Please see separate photo report.