

## FCC Test report for parts 15.207, 15.209, 15.247

Product name : Wireless Awinda dongle with external antenna  
Applicant : Xsens Technologies B.V.  
FCC ID : QILAW-DNG2-ANT

Test report No. : 201000148 01 Ver 1.00

## Laboratory information

### Accreditation

Telefication complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2017. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L021 and is granted on 30 November 1990 by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie).

Telefication is designated by the FCC as an Accredited Test Firm for compliance testing of equipment subject to Certification under Parts 15 & 18. The Designation number is: NL0001.

Telefication is a Wireless Device Testing laboratory recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements.

The Industry Canada company number for Telefication is: 4173A.

Telefication is a registered Conformity Assessment body (CAB) under the Japan-EC MRA (Agreement on Mutual Recognition between Japan and the European Community). The registration number is: 201.

### Documentation

The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 10 years at Telefication Netherlands.

### Testing Location

|                           |                                                                                   |
|---------------------------|-----------------------------------------------------------------------------------|
| <b>Test Site</b>          | Kiwa Telefication BV                                                              |
| <b>Test Site location</b> | Wilmersdorf 50<br>7327 AC Apeldoorn<br>The Netherlands<br><br>Tel. +31 88998 3393 |
| <b>Test Site FCC</b>      | NL0001                                                                            |
| <b>CABID</b>              | NL0001                                                                            |

## Revision History

| Version | Date       | Remarks         | By |
|---------|------------|-----------------|----|
| v0.50   | 30-08-2021 | First draft     | PS |
| v1.00   | 12-10-2021 | Initial release | PS |

## Table of Contents

|                                                                    |           |
|--------------------------------------------------------------------|-----------|
| <b>Revision History.....</b>                                       | <b>2</b>  |
| <b>Summary of Test results .....</b>                               | <b>5</b>  |
| <b>1 General Description .....</b>                                 | <b>6</b>  |
| 1.1 Applicant .....                                                | 6         |
| 1.2 Manufacturer .....                                             | 6         |
| 1.3 Tested Equipment Under Test (EUT) .....                        | 6         |
| 1.4 Product specifications of Equipment under test.....            | 7         |
| 1.5 Environmental conditions .....                                 | 7         |
| 1.6 Measurement standards .....                                    | 7         |
| 1.7 Applicable standards .....                                     | 7         |
| 1.8 Observation and remarks .....                                  | 7         |
| 1.9 Conclusions .....                                              | 8         |
| <b>2 Test configuration of the Equipment Under Test.....</b>       | <b>9</b>  |
| 2.1 Test mode .....                                                | 9         |
| 2.2 Test setups .....                                              | 9         |
| 2.3 Equipment used in the test configuration .....                 | 10        |
| 2.4 Sample calculations.....                                       | 10        |
| <b>3 Test results.....</b>                                         | <b>11</b> |
| 3.1 6dB bandwidth Measurement .....                                | 11        |
| 3.1.1 Limit .....                                                  | 11        |
| 3.1.2 Measurement instruments .....                                | 11        |
| 3.1.3 Test setup .....                                             | 11        |
| 3.1.4 Test procedure.....                                          | 11        |
| 3.1.5 Test Results of the 6 dB bandwidth Measurement .....         | 11        |
| 3.1.6 Plots of the 6 dB occupied bandwidth measurement .....       | 12        |
| 3.2 99% Occupied Bandwidth .....                                   | 14        |
| 3.2.1 Limit .....                                                  | 14        |
| 3.2.2 Measurement instruments .....                                | 14        |
| 3.2.3 Test setup .....                                             | 14        |
| 3.2.4 Test procedure.....                                          | 14        |
| 3.2.5 Test results of the 99% occupied bandwidth measurement ..... | 14        |
| 3.2.6 Plots of the 99% occupied bandwidth measurement.....         | 15        |
| 3.3 Output Power Measurement .....                                 | 17        |
| 3.3.1 Limit .....                                                  | 17        |
| 3.3.2 Measurement instruments .....                                | 17        |
| 3.3.3 Test setup .....                                             | 17        |
| 3.3.4 Test procedure.....                                          | 17        |

|          |                                                                             |           |
|----------|-----------------------------------------------------------------------------|-----------|
| 3.3.5    | Test results of Output Power Measurement .....                              | 17        |
| 3.4      | Power Spectral Density .....                                                | 18        |
| 3.4.1    | Limit .....                                                                 | 18        |
| 3.4.2    | Measurement instruments .....                                               | 18        |
| 3.4.3    | Test setup .....                                                            | 18        |
| 3.4.4    | Test procedure.....                                                         | 18        |
| 3.4.5    | Test results of Power Spectral Density Measurement.....                     | 18        |
| 3.5      | Band edge Measurement.....                                                  | 19        |
| 3.5.1    | Limit .....                                                                 | 19        |
| 3.5.2    | Measurement instruments .....                                               | 19        |
| 3.5.3    | Test setup .....                                                            | 19        |
| 3.5.4    | Test procedure.....                                                         | 19        |
| 3.5.5    | Measurement Uncertainty .....                                               | 19        |
| 3.5.6    | Results of the band edge measurements .....                                 | 19        |
| 3.5.7    | Plots of the Band edge Measurements.....                                    | 19        |
| 3.6      | Conducted emissions .....                                                   | 21        |
| 3.6.1    | Limit .....                                                                 | 21        |
| 3.6.2    | Measurement instruments .....                                               | 21        |
| 3.6.3    | Test setup .....                                                            | 21        |
| 3.6.4    | Test procedure.....                                                         | 21        |
| 3.6.5    | Test results and plots of the AC mains conducted measurement .....          | 21        |
| 3.6.6    | Measurement uncertainty .....                                               | 21        |
| 3.6.7    | Plots of the AC mains conducted spurious measurement.....                   | 22        |
| 3.7      | Spurious emissions (incl. spurious emissions in the restricted bands) ..... | 23        |
| 3.7.1    | Limit .....                                                                 | 23        |
| 3.7.2    | Measurement instruments .....                                               | 23        |
| 3.7.3    | Test setup .....                                                            | 23        |
| 3.7.4    | Test procedure.....                                                         | 23        |
| 3.7.5    | Test results of the spurious emission measurements .....                    | 23        |
| 3.7.6    | Measurement uncertainty .....                                               | 23        |
| <b>4</b> | <b>Sample calculations.....</b>                                             | <b>30</b> |

## Summary of Test results

| FCC        | Description                                | Section in report | Verdict |
|------------|--------------------------------------------|-------------------|---------|
| 15.247 (d) | Conducted spurious emissions               | 3.7               | Pass    |
| 15.205 (a) | Spurious emissions in the restricted bands | 3.7               | Pass    |
| 15.247 (a) | 6 dB bandwidth                             | 3.1               | Pass    |
| --         | 99% bandwidth                              | 3.2               | Pass    |
| 15.247 (b) | RF output power                            | 3.3               | Pass    |
| 15.247 (e) | Power spectral density                     | 3.4               | Pass    |
| 15.247 (d) | Band edge emissions                        | 3.5               | Pass    |
| 15.207 (c) | Conducted spurious emissions on AC mains   | 3.6               | Pass    |

## 1 General Description

### 1.1 Applicant

**Client name:** Xsens Technologies B.V.  
**Address:** Pantheon 6a  
**Zip code:** 7521 PR, Enschede, The Netherlands  
**Telephone:** +31(0)889736700  
**E-mail:** robert.gielians@xsens.com  
**Contact name:** Mr. R.P.G. Gielians

### 1.2 Manufacturer

**Manufacturer name:** Xsens Technologies B.V.  
**Address:** Pantheon 6a  
**Zip code:** 7521 PR, Enschede, The Netherlands  
**Telephone:** +31(0)889736700  
**E-mail:** robert.gielians@xsens.com  
**Contact name:** Mr. R.P.G. Gielians

### 1.3 Tested Equipment Under Test (EUT)

**Product name:** Wireless Awinda dongle with external antenna  
**Brand name:** Xsens MVN Awinda  
**FCC ID:** QILAW-DNG2-ANT  
**Product type:** 2.4 GHz wireless data transmission equipment  
**Model(s):** AW-DNG2-ANT  
**Batch and/or serial No.** 0121xxxx  
**Software version:** --  
**Hardware version:** AA200811  
**Date of receipt** 26-02-2021  
**Tests started:** 21-04-2021  
**Testing ended:** 28-04-2021

#### 1.4 Product specifications of Equipment under test

|                            |                 |
|----------------------------|-----------------|
| <b>Tx Frequency band:</b>  | 2405 – 2475 MHz |
| <b>Rx frequency band:</b>  | 2405 – 2475 MHz |
| <b>Antenna type:</b>       | External        |
| <b>Antenna gain:</b>       | 3.2 dBi (peak)  |
| <b>Type of modulation:</b> | DSSS            |
| <b>Emission designator</b> | 1M29G1D         |

Disclaimer: The antenna gain and operating frequency bands are declared by the applicant

#### 1.5 Environmental conditions

|                            |            |            |
|----------------------------|------------|------------|
| <b>Test date</b>           | 21-04-2021 | 28-04-2021 |
| <b>Ambient temperature</b> | 22.5°C     | 20.5°C     |
| <b>Humidity</b>            | 29.8% RH   | 25.8% RH   |

#### 1.6 Measurement standards

- ANSI C63.4:2014
- ANSI C63.10:2013

#### 1.7 Applicable standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.207
- FCC Part 15 Subpart C §15.209
- FCC Part 15 Subpart C §15.247

#### 1.8 Observation and remarks

The lowest radio signal generated in the device is 32.32 MHz



## 1.9 Conclusions

The sample of the product showed **NO NON-COMPLIANCES** to the specifications stated in paragraph 1.7 of this report.

The results of the test as stated in this report, are exclusively applicable to the product items as identified in this report. Telefication accepts no responsibility for any properties of product items in this test report, which are not supported by the tests as specified in paragraph 1.7 "*Applicable standards*".

All conducted tests are performed by:

Name : ing P.A. Suringa

Review of test methods and report by:

Name : Paul van Wanrooij, BASc

The above conclusions have been verified by the following signatory:

Date : 15-10-2021

Name : ing. R. Van Barneveld

Function : Test Engineer

Signature :

A handwritten signature in blue ink, consisting of a stylized 'R' followed by a horizontal line and a diagonal stroke.

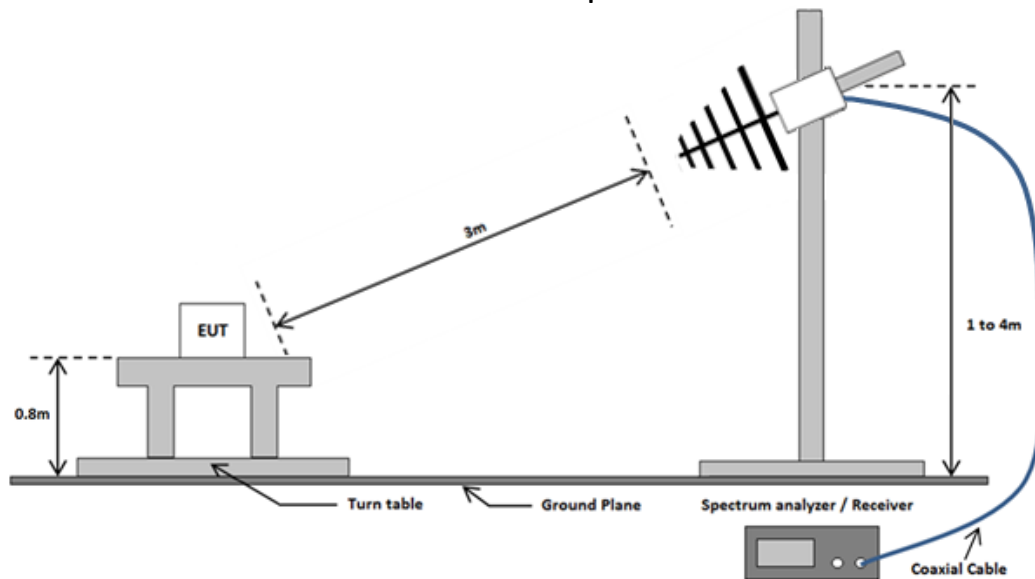
## 2 Test configuration of the Equipment Under Test

### 2.1 Test mode

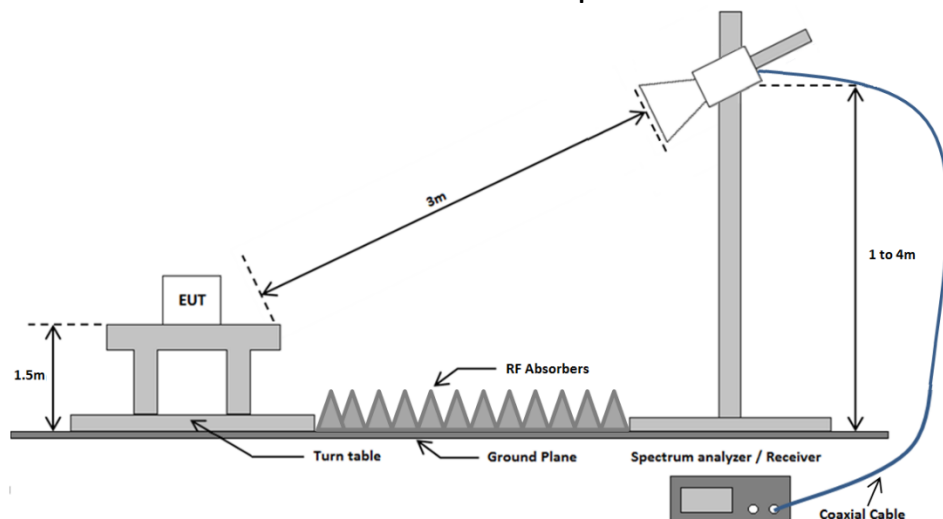
The applicant provided test mode software to configure the sample in Tx/Rx mode on different channel frequencies.

### 2.2 Test setups

**Radiated emissions test setup 30 MHz - 1 GHz**

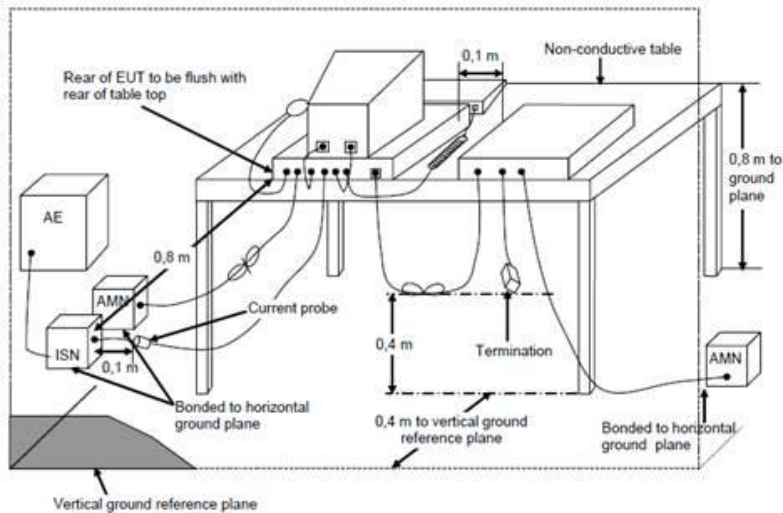


**Radiated emissions test setup above 1 GHz**



## Conducted emissions test setup

### Emissions test at AC mains



## 2.3 Equipment used in the test configuration

| Description               | Manufacturer    | Model                      | ID       | Used at Par. |
|---------------------------|-----------------|----------------------------|----------|--------------|
| EMI Receiver              | Rohde & Schwarz | ESCI                       | TE11128  | 3.6          |
| EMI Receiver              | Rohde & Schwarz | ESR7                       | TE01220  | 3.7          |
| Spectrum Analyzer         | Rohde & Schwarz | FSV40                      | TE01269  | All          |
| 3.0 GHz HPF               | Wainwright      | WHK3.0/18G-10EF            | TE01140  | 3.7          |
| Biconilog antenna         | Chase           | CBL6112A                   | TE00967  | 3.7          |
| Horn antenna              | EMCO            | 3115                       | TE00531  | 3.7          |
| Preamplifier<br>1-18 GHz  | µComp Nordic    | MCNA-40-0010800-<br>25-10P | TE11175  | 3.7          |
| Horn antenna              | FLANN-MICROWAVE | 20240-25                   | TE 00818 | 3.7          |
| Preamplifier<br>18-26 GHz | Miteq           | JS4-18004000-33-<br>8P     | TE 11131 | 3.7          |
| AC source                 | Croma           | 61601                      | TE02001  | 3.6          |
| Two-Line V-<br>Network    | Rohde & Schwarz | ENV216                     | TE11176  | 3.6          |

## 2.4 Sample calculations

All formulas for data conversions and conversion factors are reported in chapter 4 of this test report.

### 3 Test results

#### 3.1 6dB bandwidth Measurement

##### 3.1.1 Limit

The minimum 6 dB Bandwidth shall be at least 500 kHz.

##### 3.1.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

##### 3.1.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

##### 3.1.4 Test procedure

Tests according to ANSI C63.10

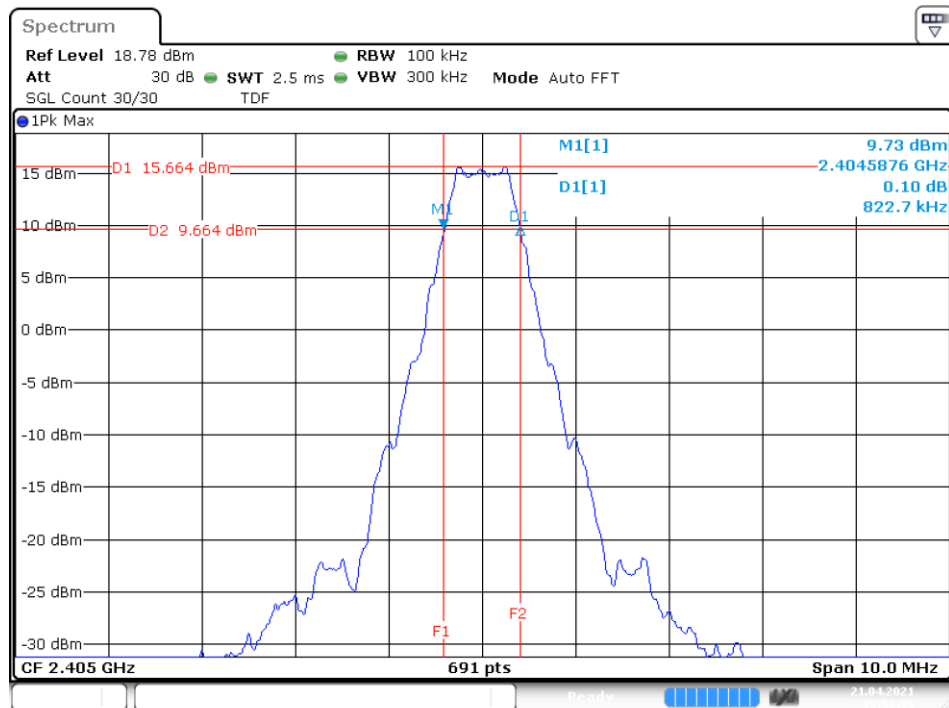
IRN 017 - Occupied bandwidth (Hz) Method 4 – DTS Bandwidth

##### 3.1.5 Test Results of the 6 dB bandwidth Measurement

| Technology Std.     | Channel        | Frequency (MHz) | Data rate | 6dB bandwidth (kHz) |
|---------------------|----------------|-----------------|-----------|---------------------|
| 2.4 GHz proprietary | 11             | 2405            | 1 Mbps    | 822.7               |
|                     | 18             | 2440            | 1 Mbps    | 777.9               |
|                     | 25             | 2475            | 1 Mbps    | 747.5               |
| Uncertainty         | $\pm 36.2$ kHz |                 |           |                     |

### 3.1.6 Plots of the 6 dB occupied bandwidth measurement

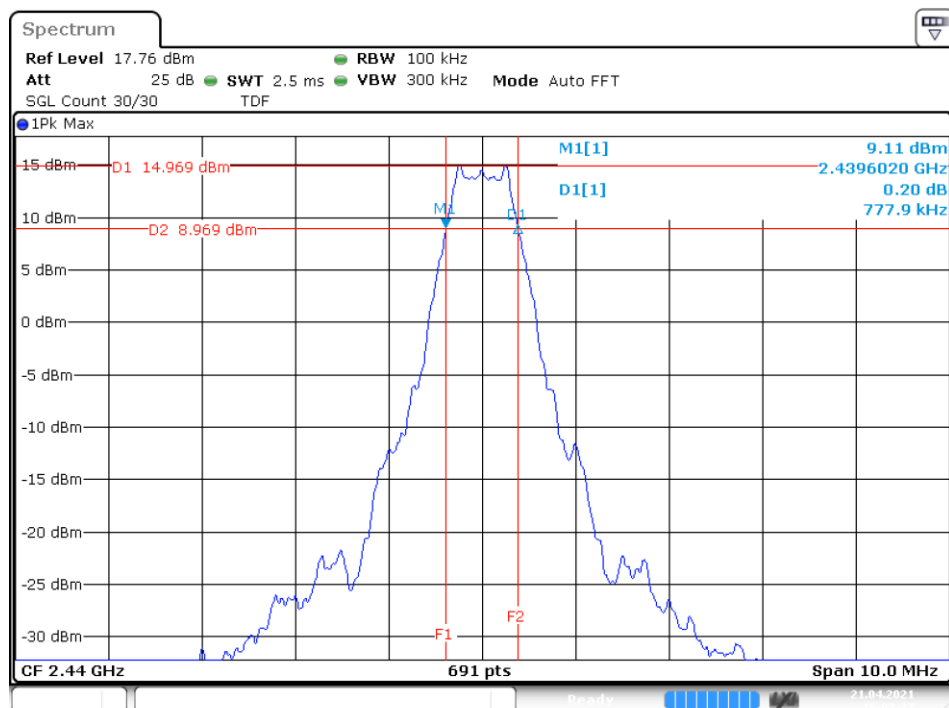
Channel 11



Bt, channel: 3 : 6dB BW measurement

Date: 21.APR.2021 15:53:56

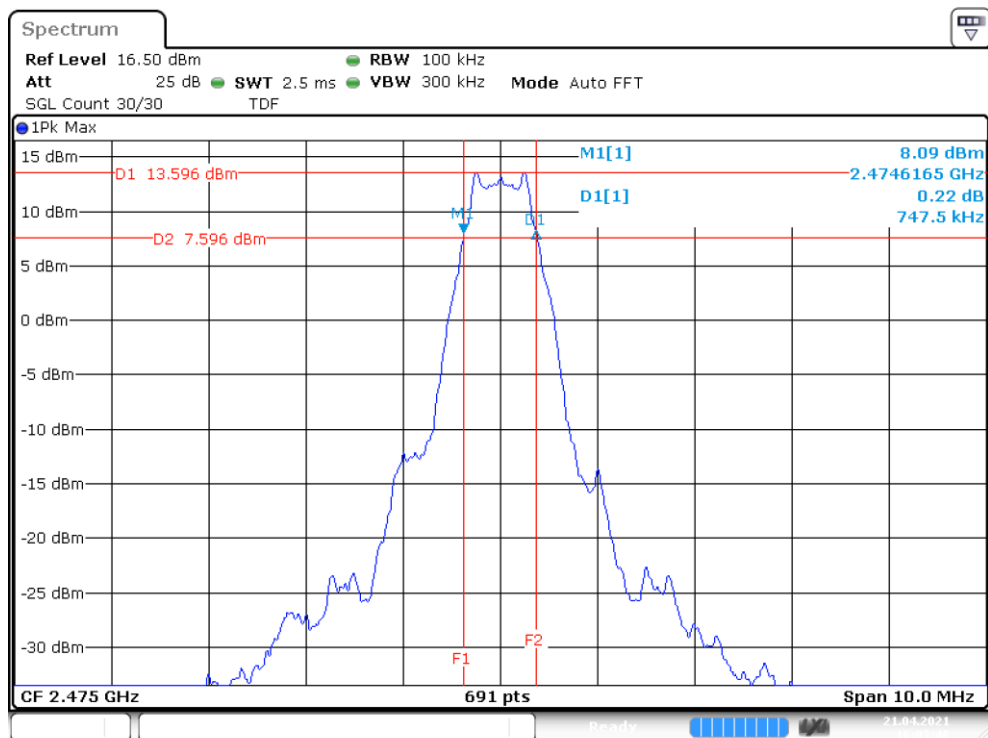
Channel 18



Bt, channel: 38 : 6 dB BW Measurement

Date: 21.APR.2021 16:02:27

### Channel 25



Bt, channel: 73 : 6 dB BW Measurement

Date: 21.APR.2021 16:03:48

## 3.2 99% Occupied Bandwidth

### 3.2.1 Limit

According to RSS-Gen 6.7

### 3.2.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

### 3.2.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

### 3.2.4 Test procedure

IRN 017 - Occupied bandwidth (Hz) Method 1 – XX % power bandwidth.

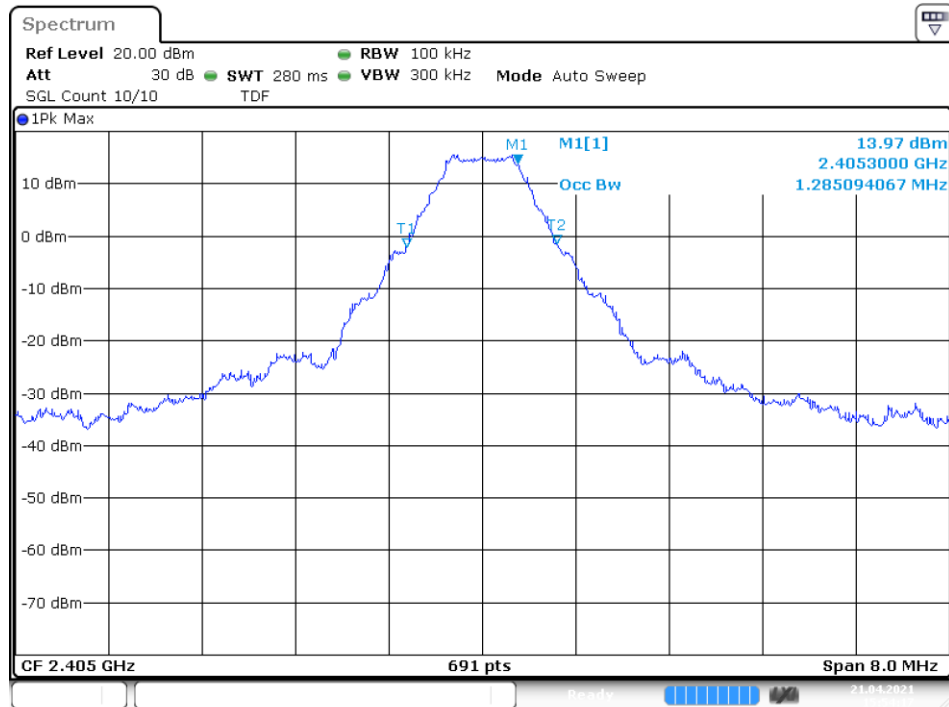
1. Set the centre frequency to the nominal EUT channel centre frequency
2. Set span = 1.5 times to 0.5 times the Occupied Bandwidth
3. Set VBW  $\geq$  3x RBW
4. Video averaging is not permitted. Where practical, detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

### 3.2.5 Test results of the 99% occupied bandwidth measurement

| Technology Std.     | Channel      | Frequency (MHz) | Data rate | 99% bandwidth (kHz) |
|---------------------|--------------|-----------------|-----------|---------------------|
| 2.4 GHz proprietary | 11           | 2405            | 1 Mbps    | 1285.1              |
|                     | 18           | 2440            | 1 Mbps    | 1169.3              |
|                     | 25           | 2475            | 1 Mbps    | 1123.0              |
| Uncertainty         | $\pm 12$ kHz |                 |           |                     |

### 3.2.6 Plots of the 99% occupied bandwidth measurement

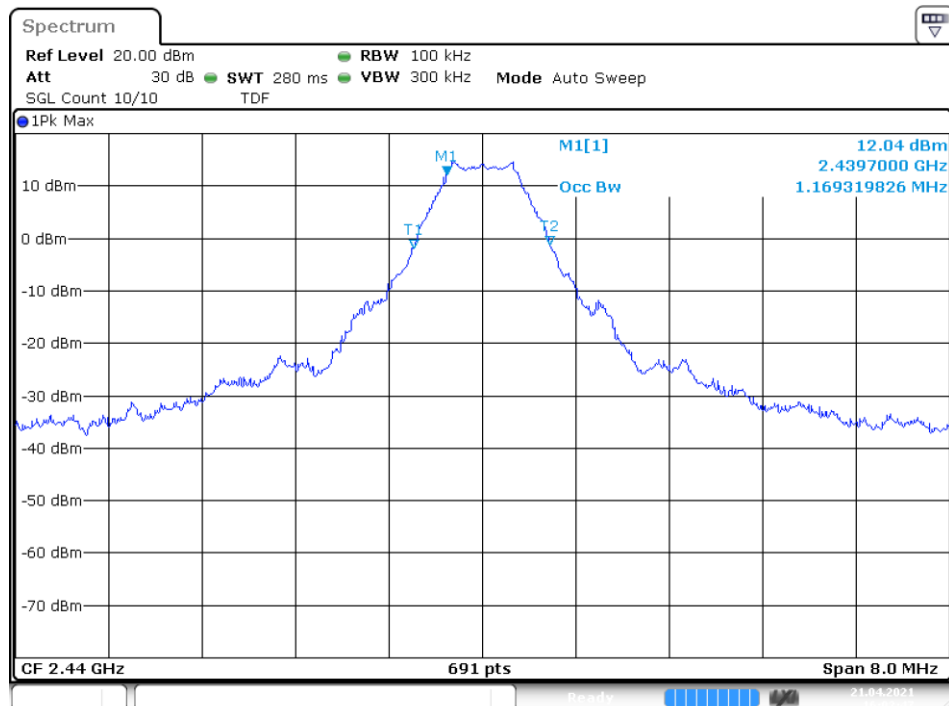
Channel 11



Bt Channel: 3 : Measure Occupied Bandwidth

Date: 21.APR.2021 15:54:17

Channel 18

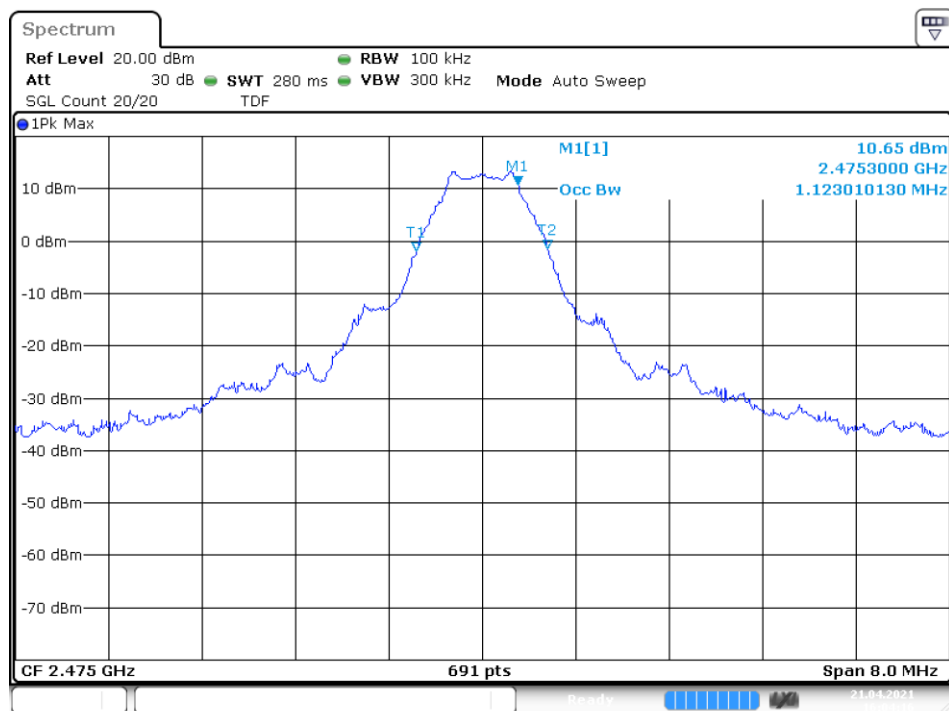


Bt Channel: 38 : Measure Occupied Bandwidth

Date: 21.APR.2021 16:02:48



## Channel 25



Bt Channel: 73 : Measure Occupied Bandwidth

Date: 21.APR.2021 16:04:17

### 3.3 Output Power Measurement

#### 3.3.1 Limit

For systems using digital modulation in the 2400-2483.5 MHz, the limit for the peak output power is 30 dBm. If transmitting antenna of directional gain greater than 6 dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point to point operation, the limit has to be reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

#### 3.3.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

#### 3.3.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

#### 3.3.4 Test procedure

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05.  
IRN 014 - RF power (W) - Method 1 – AVGSA (DTS) according to ANSI C63.10.

#### 3.3.5 Test results of Output Power Measurement

| Technology Std.     | Channel  | Peak method     |           | Peak output power (dBm) |
|---------------------|----------|-----------------|-----------|-------------------------|
|                     |          | Frequency (MHz) | Data rate |                         |
| 2.4 GHz proprietary | 11       | 2405            | 1 Mbps    | 18.5                    |
|                     | 18       | 2440            | 1 Mbps    | 17.6                    |
|                     | 25       | 2475            | 1 Mbps    | 16.0                    |
| Uncertainty         | ±0.71 dB |                 |           |                         |

### 3.4 Power Spectral Density

#### 3.4.1 Limit

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band at any time interval of continuous transmission.

#### 3.4.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

#### 3.4.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

#### 3.4.4 Test procedure

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05.

IRN 030 - Spectral power density (W per n.Hz) - Method 5 – Peak method PKPSD (PSD in 3 kHz band)

#### 3.4.5 Test results of Power Spectral Density Measurement

| Peak Power spectral density |         |                 |           |                 |
|-----------------------------|---------|-----------------|-----------|-----------------|
| Technology Std.             | Channel | Frequency (MHz) | Data rate | PSD (dBm/3 kHz) |
| 2.4 GHz proprietary         | 11      | 2405            | 1 Mbps    | 5.2             |
|                             | 18      | 2440            | 1 Mbps    | 5.0             |
|                             | 75      | 2475            | 1 Mbps    | 2.9             |
| Uncertainty                 | ±2 dB   |                 |           |                 |

### 3.5 Band edge Measurement

#### 3.5.1 Limit

**Band edge:**

At the edge of the authorized band the RF power shall be at least 20 dB down.

#### 3.5.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

#### 3.5.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

#### 3.5.4 Test procedure

The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05, sections 11.3 and 12.1.  
IRN 026 - Radiated electrical disturbance (V per m) Method 6 – Radiated electrical disturbance at the Authorized band edge.

#### 3.5.5 Measurement Uncertainty

± 5.7 dB.

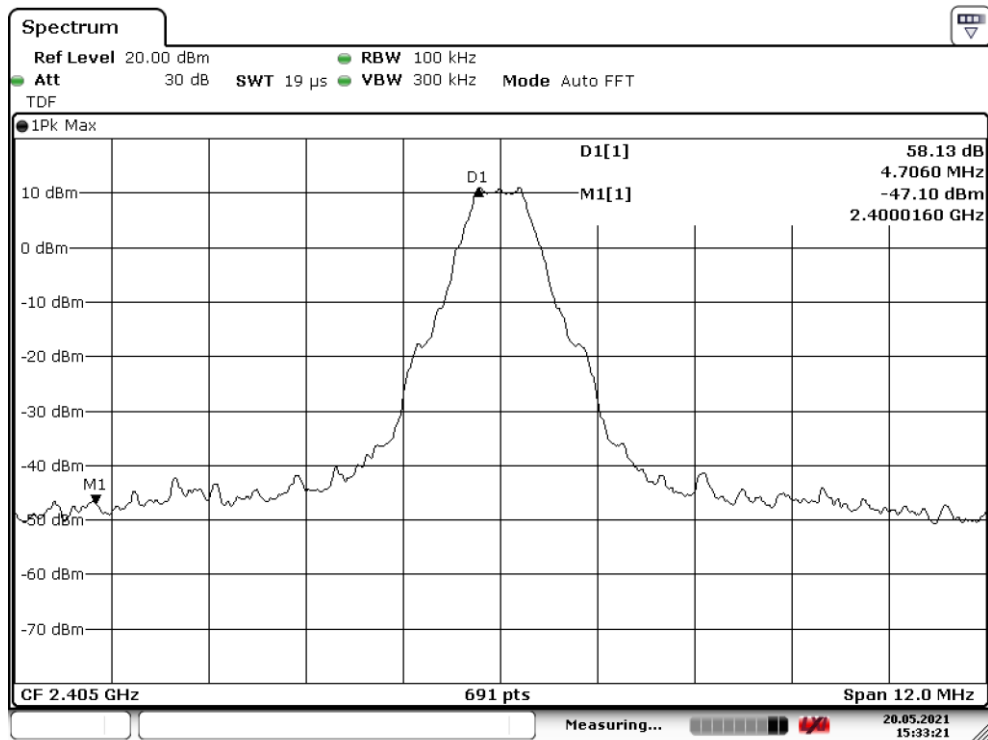
#### 3.5.6 Results of the band edge measurements

| Technology Std.     | Channel | Frequency (MHz) | Band edge frequency (MHz) | Attenuation at band edge (dB) |
|---------------------|---------|-----------------|---------------------------|-------------------------------|
| 2.4 GHz proprietary | 11      | 2405            | 2400                      | 58.13                         |
|                     | --      | --              | --                        | --                            |
|                     | 75      | 2475            | 2483.5                    | 61.52                         |
| Uncertainty         |         |                 |                           |                               |

#### 3.5.7 Plots of the Band edge Measurements

See next page

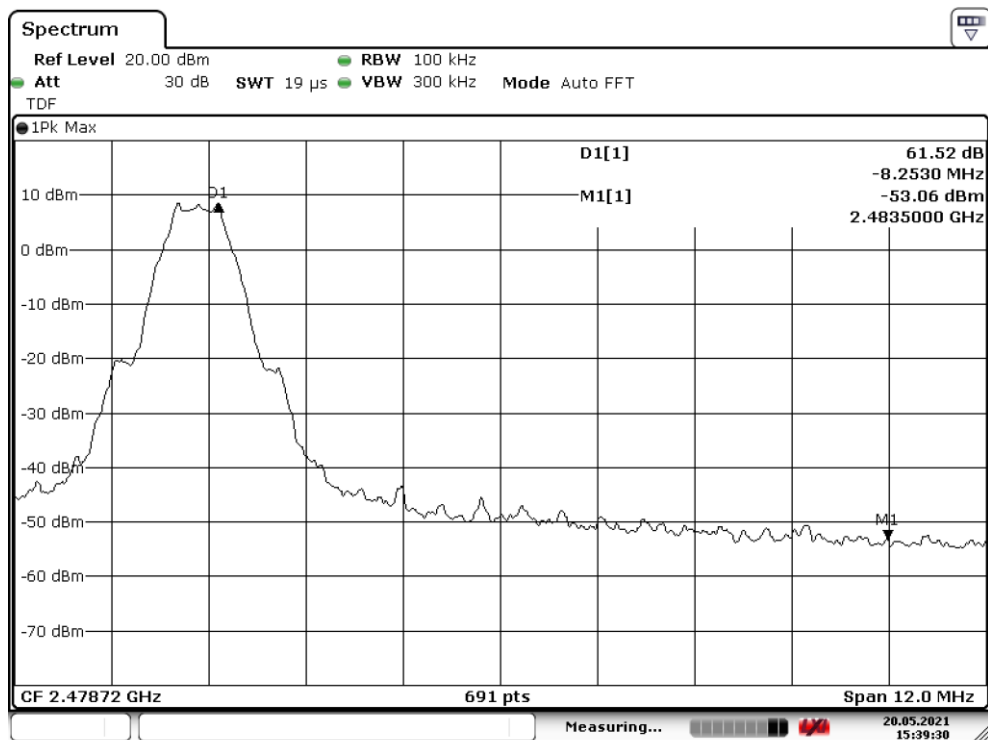
### Lower band edge (Channel 11)



Bt, channel: 73 : Measure RX Spurious Emission 1 - 12.5 GHz

Date: 20.MAY.2021 15:33:21

### Upper band edge (Channel 25)



Bt, channel: 73 : Measure RX Spurious Emission 1 - 12.5 GHz

Date: 20.MAY.2021 15:39:30

### 3.6 Conducted emissions

#### 3.6.1 Limit

According to 15.207 (c)

Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

| Frequency of emission (MHz) | Conducted limit (dB $\mu$ V) |           |
|-----------------------------|------------------------------|-----------|
|                             | Quasi-peak                   | Average   |
| 0.15–0.5 .....              | 66 to 56* .....              | 56 to 46* |
| 0.5–5 .....                 | 56 .....                     | 46        |
| 5–30 .....                  | 60 .....                     | 50        |

\*Decreases with the logarithm of the frequency.

#### 3.6.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

#### 3.6.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

#### 3.6.4 Test procedure

According to ANSI C63.4: 2014, section 13.3  
IRN 029 – Method 1

#### 3.6.5 Test results and plots of the AC mains conducted measurement

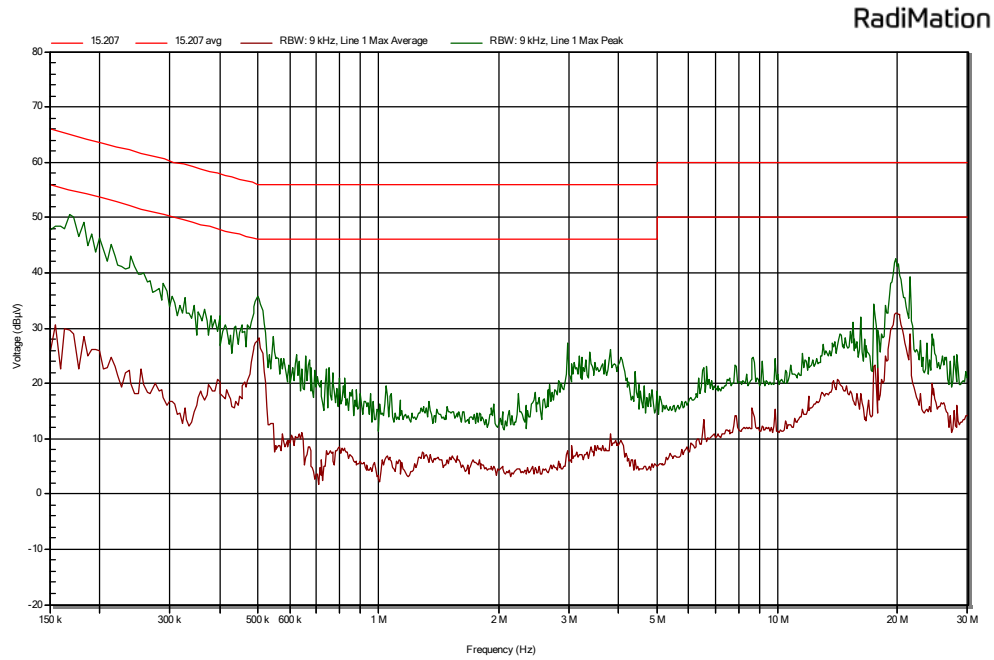
See next page.

#### 3.6.6 Measurement uncertainty

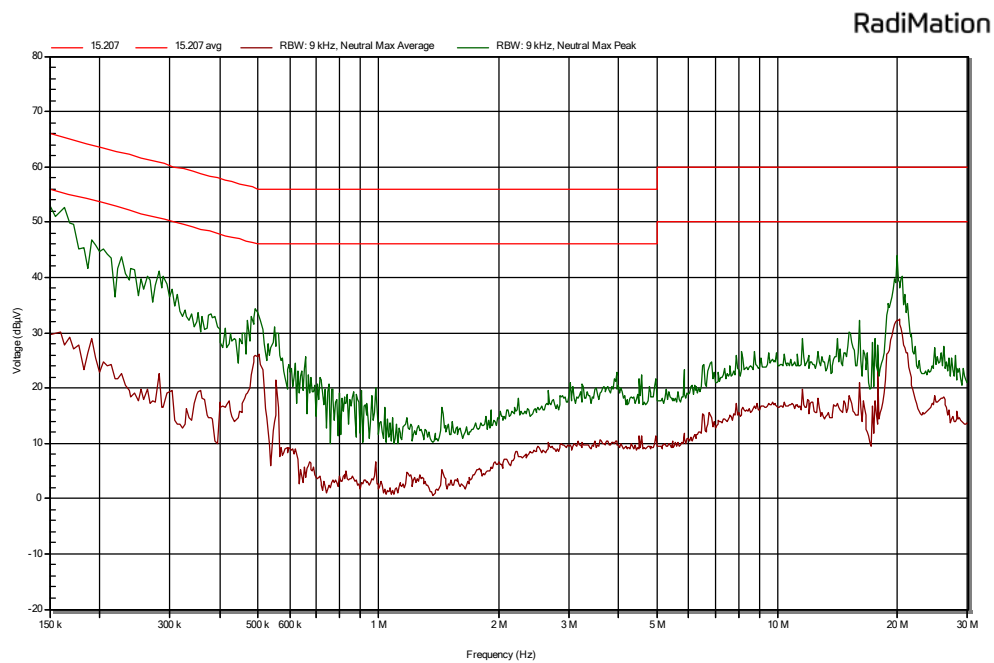
+/- 3.6 dB

### 3.6.7 Plots of the AC mains conducted spurious measurement

#### 110 Vac phase



#### 110 Vac neutral



### **3.7 Spurious emissions (incl. spurious emissions in the restricted bands)**

#### **3.7.1 Limit**

§ 15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the RF power shall be at least 20 dB attenuation below that in the 100 kHz bandwidth within the band that contains the highest level of desired power, based on either a conducted or radiated measurement.

§15.205(c)

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

#### **3.7.2 Measurement instruments**

The measurement instruments are listed in chapter 2.3 of this report.

#### **3.7.3 Test setup**

The test setup is as shown in chapter 2.2 of this report.

#### **3.7.4 Test procedure**

According to ANSI C63.10: 2013; sections 5.6, 6.6

IRN 016\_12.2 Spurious emission (W); method 1, 2, 11

IRN 026 - Radiated electrical disturbance (V per m)

#### **3.7.5 Test results of the spurious emission measurements**

See next pages.

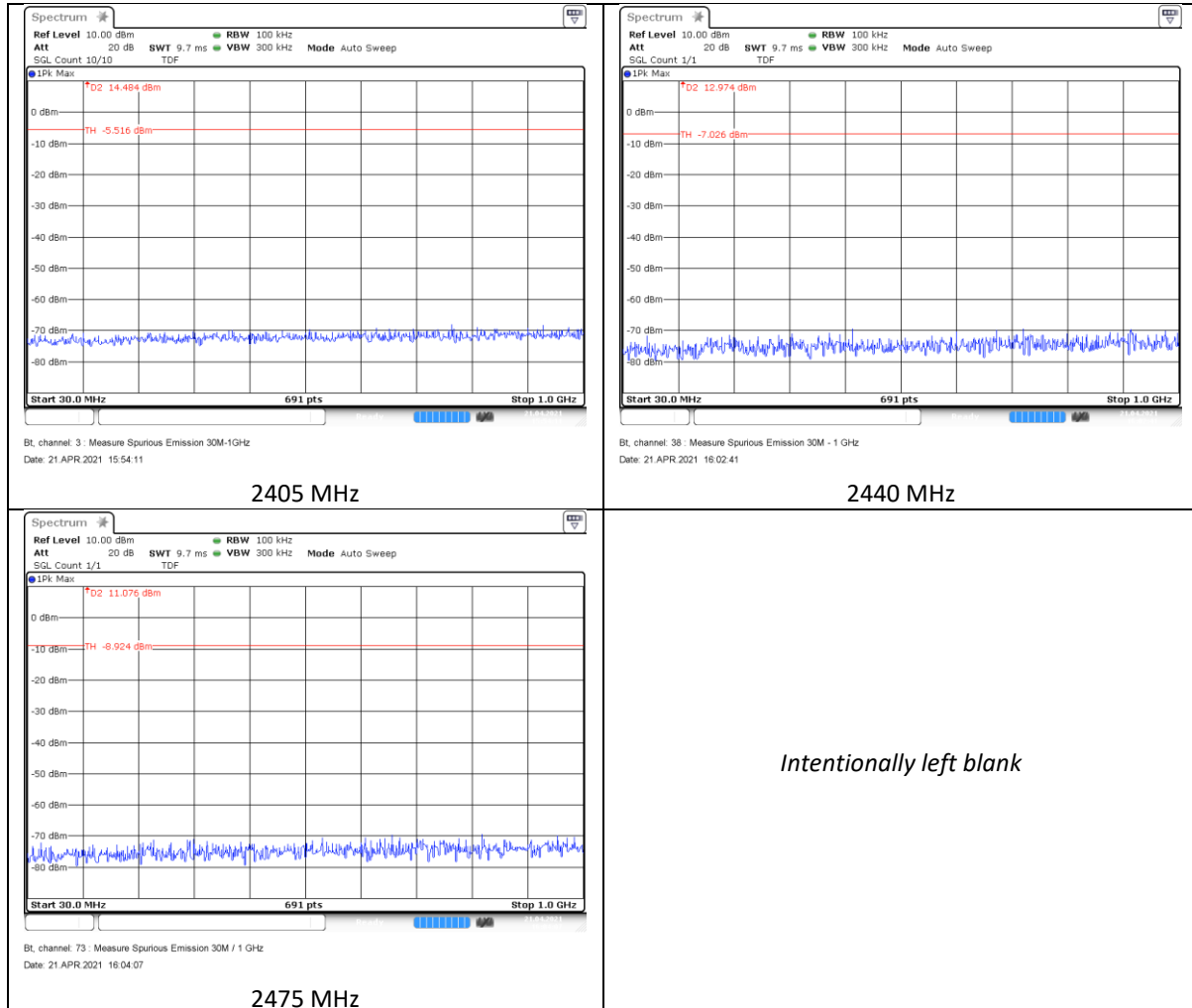
#### **3.7.6 Measurement uncertainty**

|               | Radiated | Conducted |
|---------------|----------|-----------|
| 0.03 - 1 GHz  | 3.76 dB  | 1.37 dB   |
| 1 - 18 GHz    | 5.27 dB  | 2.53 dB   |
| 18 - 26.5 GHz | 4.70 dB  | 2.53 dB   |

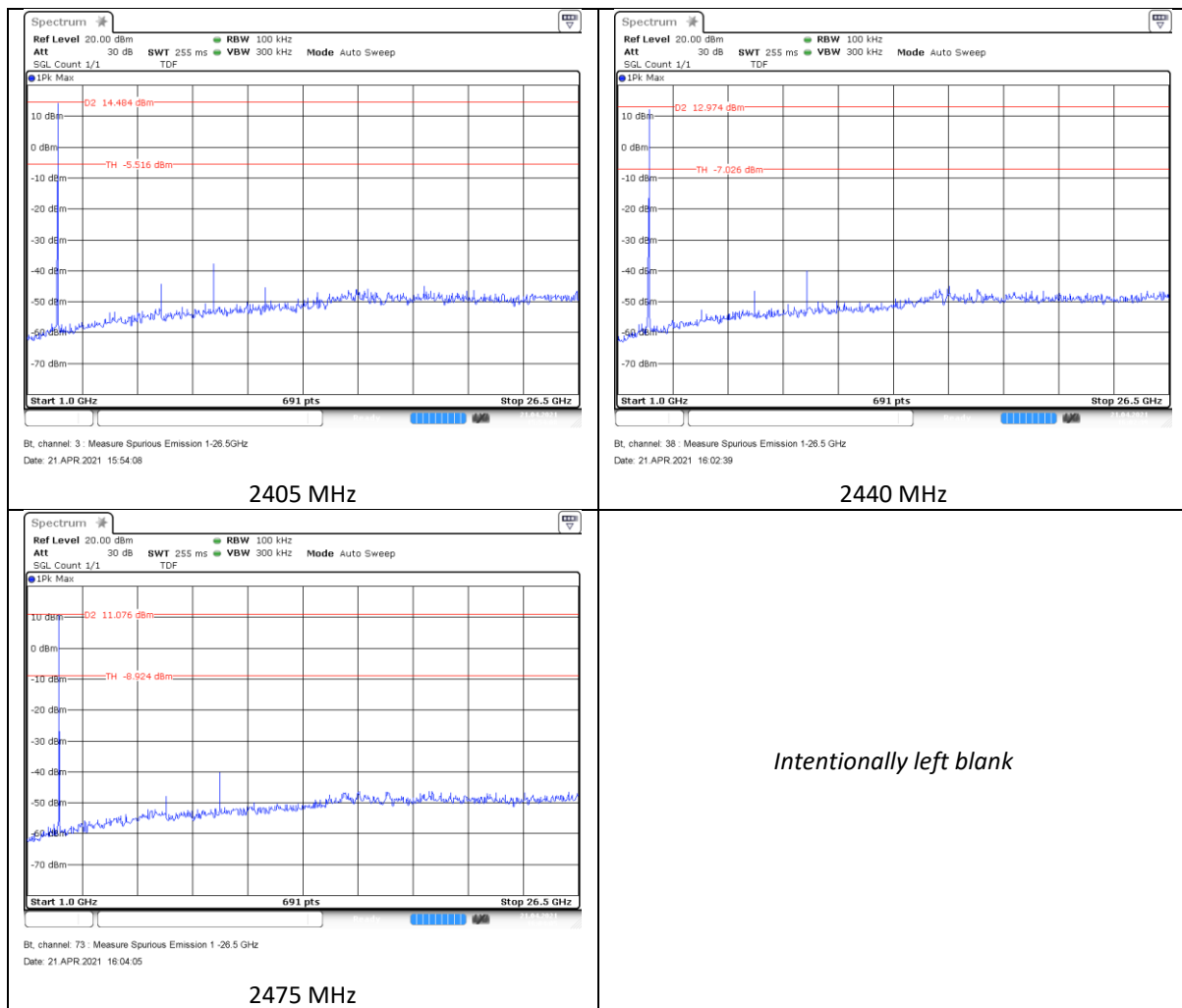


## Conducted measurements

0.03 – 1 GHz



## 1 – 26.5 GHz



### Calculation of electrical field strength

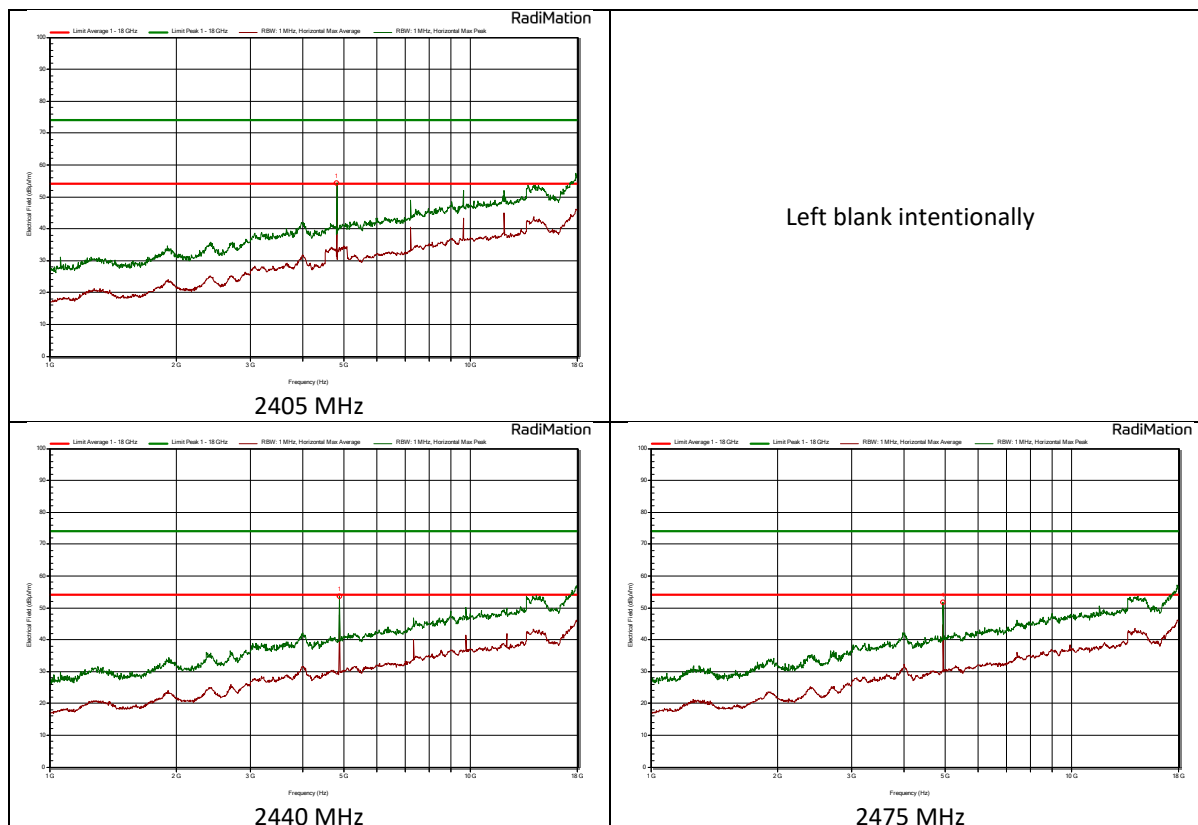
| Frequency (MHz) | Reading from plot (dBm) | Peak antenna gain (dBi) | EIRP (dBm) | Ground reflection factor (dB) | Fieldstrength E (dBμV/m) (Note) |
|-----------------|-------------------------|-------------------------|------------|-------------------------------|---------------------------------|
| 7320            | -46                     | 3.2                     | -42.8      | 0                             | 52.6                            |
| 7425            | -48                     | 3.2                     | -44.8      | 0                             | 50.5                            |

Note: calculated field strength with the formula:  $E = \text{EIRP} - 20 \log d + 104.8$

## radiated measurements in the restricted bands (cabinet radiation)

1 – 18 GHz

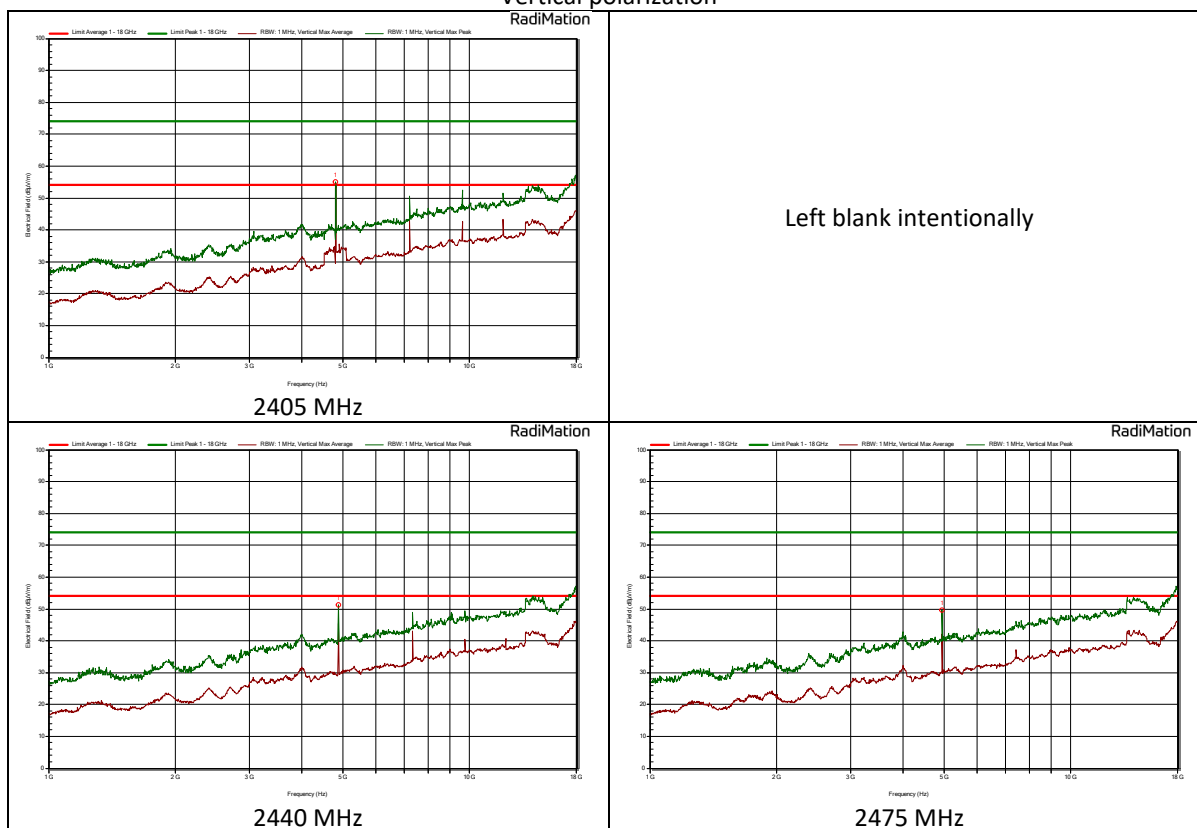
Horizontal polarization



### Final measurements 2405 MHz

| Peak Number | Frequency | Peak        | Peak Limit | Average     | Average Limit | Status | Angle       | Height |
|-------------|-----------|-------------|------------|-------------|---------------|--------|-------------|--------|
| 1           | 4,81 GHz  | 54,4 dBμV/m | 74 dBμV/m  | 53,1 dBμV/m | 54 dBμV/m     | Pass   | 342 degrees | 1 m    |

### Vertical polarization

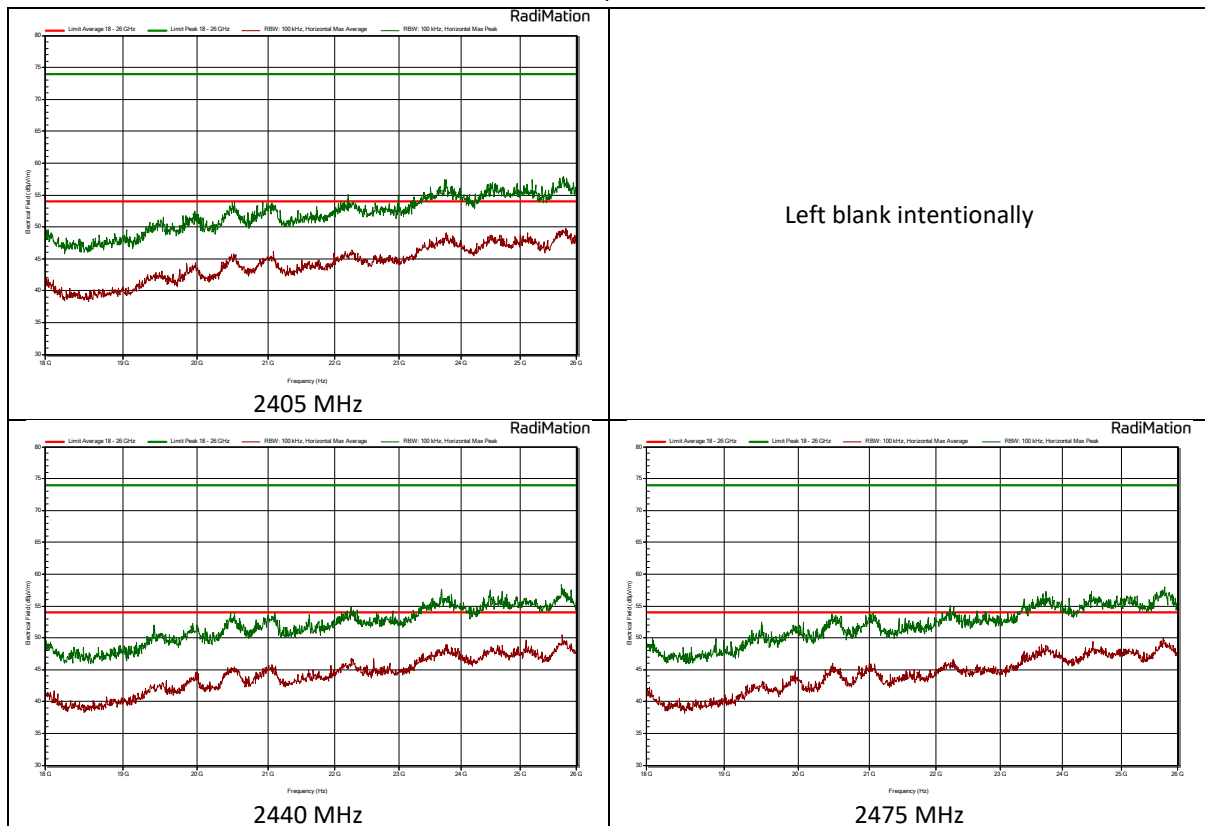


### Final measurements 2405 MHz

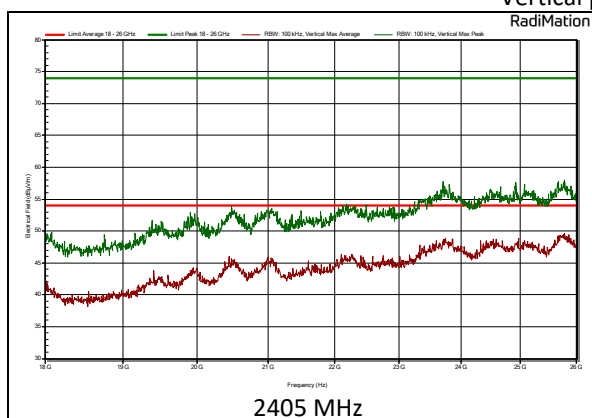
| Peak Number | Frequency | Peak      | Peak Limit | Average     | Average Limit | Angle       | Height |
|-------------|-----------|-----------|------------|-------------|---------------|-------------|--------|
| 1           | 4,81 GHz  | 55 dBµV/m | 74 dBµV/m  | 53,1 dBµV/m | 54 dBµV/m     | 346 degrees | 4 m    |

18- 26 GHz

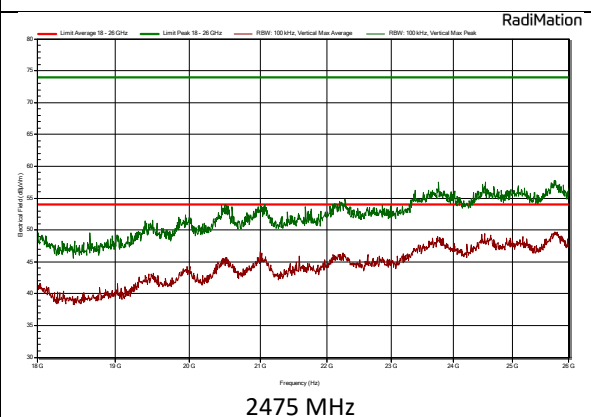
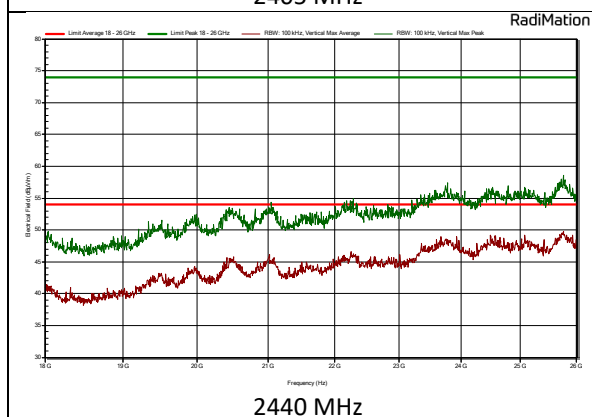
Horizontal polarization



# Vertical polarization



Left blank intentionally



## 4 Sample calculations

All formulas for data conversions and conversion factors are reported in this chapter.

Conducted emission Measurement:

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

Where:

U = Measuring receiver voltage

LISN insertion loss = Voltage division factor of LISN

Corr. = sum of single correction factors of used LISN, cables and pulse limiter.

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

| Frequency (Mhz) | Voltage division LISN (db)                         | Insertion Loss<br>Pulse limiter (dB)             | Cable loss (dB) | Corr. (dB) |
|-----------------|----------------------------------------------------|--------------------------------------------------|-----------------|------------|
|                 | TE 00208 SN: 892785/004<br>Rohde & Schwarz ESH3-Z5 | TE 00756 SN: 5SM03153<br>Rohde & Schwarz ESH3-Z2 | TE 11134        |            |
| 0,15            | 0,09                                               | 9,87                                             | 0,02            | 9,98       |
| 0,2             | 0,1                                                | 9,87                                             | 0,03            | 10         |
| 0,3             | 0,1                                                | 9,87                                             | 0,03            | 10         |
| 0,5             | 0,1                                                | 9,87                                             | 0,08            | 10,05      |
| 0,7             | 0,12                                               | 9,87                                             | 0,25            | 10,24      |
| 0,8             | 0,12                                               | 9,87                                             | 0,25            | 10,24      |
| 1               | 0,13                                               | 9,87                                             | 0,11            | 10,11      |
| 2               | 0,16                                               | 9,87                                             | 0,15            | 10,18      |
| 3               | 0,19                                               | 9,87                                             | 0,21            | 10,27      |
| 5               | 0,26                                               | 9,88                                             | 0,21            | 10,35      |
| 7               | 0,36                                               | 9,89                                             | 0,25            | 10,5       |
| 8               | 0,39                                               | 9,89                                             | 0,25            | 10,53      |
| 10              | 0,46                                               | 9,91                                             | 0,29            | 10,66      |
| 15              | 0,77                                               | 9,93                                             | 0,34            | 11,04      |
| 20              | 0,95                                               | 9,96                                             | 0,37            | 11,28      |
| 25              | 1,12                                               | 9,99                                             | 0,43            | 11,54      |
| 30              | 1,1                                                | 10,04                                            | 0,45            | 11,59      |

# Field Strength Measurement:

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

Where:

E = Electric field strength

U = Measuring receiver voltage

AF = Antenna factor

CL = Cable loss

Corr. = sum of single correction factors of used cable and amplifier (if applicable).

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

Tables shows an extract of the values.

| Frequency (Mhz) | AF (dB/m)                              | Cable loss (dB) | Corr. (dB) |
|-----------------|----------------------------------------|-----------------|------------|
|                 | TE 00967<br>Chase CBL6112A<br>SN: 2308 | Id: SAR cable   |            |
| 30              | 18,6                                   | 0,68            | 19,28      |
| 100             | 10,7                                   | 1,15            | 11,85      |
| 150             | 10,6                                   | 1,41            | 12,01      |
| 200             | 9,3                                    | 1,63            | 10,93      |
| 250             | 12,6                                   | 1,93            | 14,53      |
| 300             | 13,3                                   | 2,12            | 15,42      |
| 350             | 14,6                                   | 2,2             | 16,8       |
| 400             | 15,5                                   | 2,29            | 17,79      |
| 450             | 16,9                                   | 2,53            | 19,43      |
| 500             | 17,5                                   | 2,67            | 20,17      |
| 550             | 18,4                                   | 2,9             | 21,3       |
| 600             | 18,8                                   | 3,02            | 21,82      |
| 650             | 19,2                                   | 3,09            | 22,29      |
| 700             | 19                                     | 3,22            | 22,22      |
| 750             | 19,8                                   | 3,56            | 23,36      |
| 800             | 19,7                                   | 3,69            | 23,39      |
| 900             | 20,4                                   | 3,81            | 24,21      |
| 950             | 20,8                                   | 3,91            | 24,71      |
| 1000            | 21,2                                   | 4,3             | 25,5       |



| Frequency (Mhz) | AF (dB/m)                              | Gain (dB)                                  | Cable loss (dB) | Corr. (dB) |
|-----------------|----------------------------------------|--------------------------------------------|-----------------|------------|
|                 | TE 00531<br>Emco 3115<br>SN: 9412-4377 | TE 11132<br>Miteq<br>JS4-18004000-30-8P-A1 | TE 01315        |            |
| 1000            | 23,6                                   | 40,4                                       | 2,0             | 66         |
| 1500            | 25,1                                   | 40,5                                       | 2,4             | 68         |
| 2000            | 27,1                                   | 40,5                                       | 2,7             | 70,3       |
| 2500            | 28,6                                   | 40,7                                       | 3,2             | 72,5       |
| 3000            | 30,5                                   | 40,7                                       | 3,2             | 74,4       |
| 3500            | 31,2                                   | 40,7                                       | 3,4             | 75,3       |
| 4000            | 32,7                                   | 40,9                                       | 4,9             | 78,5       |
| 4500            | 32,4                                   | 40,9                                       | 4,4             | 77,7       |
| 5000            | 33,2                                   | 40,7                                       | 4,6             | 78,5       |
| 5500            | 34,0                                   | 40,5                                       | 4,5             | 79         |
| 6000            | 34,6                                   | 40,0                                       | 5,2             | 79,8       |
| 6500            | 34,3                                   | 39,4                                       | 5,9             | 79,6       |
| 7000            | 35,2                                   | 38,6                                       | 5,7             | 79,5       |
| 7500            | 36,4                                   | 39,2                                       | 5,9             | 81,5       |
| 8000            | 37,0                                   | 38,9                                       | 6,3             | 82,2       |
| 8500            | 37,5                                   | 38,4                                       | 6,4             | 82,3       |
| 9000            | 38,1                                   | 37,4                                       | 6,5             | 82         |
| 9500            | 37,8                                   | 37,0                                       | 7,1             | 81,9       |
| 10000           | 38,2                                   | 36,5                                       | 7,3             | 82         |
| 10500           | 38,1                                   | 36,7                                       | 7,6             | 82,4       |
| 11000           | 38,3                                   | 36,9                                       | 8,3             | 83,5       |
| 11500           | 38,5                                   | 37,6                                       | 8,1             | 84,2       |
| 12000           | 39,1                                   | 38,3                                       | 8,4             | 85,8       |
| 12500           | 38,7                                   | 38,5                                       | 8,3             | 85,5       |
| 13000           | 39,2                                   | 38,9                                       | 9,2             | 87,3       |
| 13500           | 40,5                                   | 40,2                                       | 8,3             | 89         |
| 14000           | 41,1                                   | 40,0                                       | 8,2             | 89,3       |
| 14500           | 41,4                                   | 40,1                                       | 8,2             | 89,7       |
| 15000           | 40,2                                   | 41,4                                       | 8,3             | 89,9       |
| 15500           | 37,9                                   | 41,4                                       | 8,6             | 87,9       |
| 16000           | 37,5                                   | 42,8                                       | 9,2             | 89,5       |
| 16500           | 38,6                                   | 42,3                                       | 8,8             | 89,7       |
| 17000           | 41,1                                   | 43,1                                       | 9,4             | 93,6       |
| 17500           | 42,7                                   | 43,2                                       | 9,4             | 95,3       |
| 18000           | 44,0                                   | 44,2                                       | 9,8             | 98         |

| Frequency (Mhz) | AF (dB/m)                              | Gain (dB)                                  | Cable loss (dB) | Corr. (dB) |
|-----------------|----------------------------------------|--------------------------------------------|-----------------|------------|
|                 | TE 00531<br>Emco 3115<br>SN: 9412-4377 | TE 11132<br>Miteq<br>JS4-18004000-30-8P-A1 | TE 01315        |            |
| 18000           | 31,3                                   | 26,2                                       | 9,8             | 67,3       |
| 19000           | 31,5                                   | 26,1                                       | 9,6             | 67,2       |
| 20000           | 31,7                                   | 25,9                                       | 11              | 68,6       |
| 21000           | 31,9                                   | 24,3                                       | 10,7            | 66,9       |
| 22000           | 32,1                                   | 18,3                                       | 10,5            | 60,9       |
| 23000           | 32,2                                   | 18,9                                       | 10,8            | 61,9       |
| 24000           | 32,3                                   | 23,6                                       | 11,4            | 67,3       |
| 25000           | 32,4                                   | 24,5                                       | 11,6            | 68,5       |
| 26000           | 32,5                                   | 25,3                                       | 11,7            | 69,5       |