

# RADIO TEST REPORT

No. 1713337STO-002, Ed. 2

## RF Performance

### EQUIPMENT UNDER TEST

Equipment: Bluetooth Low Energy radio module  
Type/Model: BLEM  
Manufacturer: Husqvarna AB  
Tested by request of: Husqvarna AB

### SUMMARY

Referring to the emission limits, and the operating mode during the tests specified in this report, the equipment complies with the requirements according to the following standards:

47 CFR Part 15 (2018): Subpart C: Intentional radiators. Section 15.247

47 CFR Part 15 (2018): Subpart B: Unintentional radiators

RSS-GEN Issue 5 (2018): General requirements for compliance of radio apparatus (2018)

RSS-247 Issue 2 (2017): Digital Transmission Systems (DTSSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

For details, see clause 2 – 4.

Date of issue: 2019-10-27

Tested by:

  
Robert Hietala

Approved by:

  
Matti Virkki

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## Revision History

| Edition | Date       | Description    | Changes                                                                        |
|---------|------------|----------------|--------------------------------------------------------------------------------|
| 1       | 2018-04-24 | First release  | --                                                                             |
| 2       | 2019-10-27 | Second release | Updated type/model from Volter to BLEM and RSS-GEN issue 4 to RSS-GEN Issue 5. |

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## 1 CLIENT INFORMATION

The EUT has been tested by request of

Company Husqvarna AB  
Jons väg 19  
433 75 Jonsered  
Sweden

Name of contact Tero Borg  
Phone +46 31 94 91 65

## 2 EQUIPMENT UNDER TEST (EUT)

### 2.1 Identification of the EUT

Equipment: Bluetooth Low Energy radio module  
Type/Model: BLEM  
Brand name: Husqvarna  
Serial number: INTERTEK01 and INTERTEK02  
Manufacturer: Husqvarna AB  
Transmitter frequency range: 2400 – 2483,5 MHz  
Receiver frequency range: 2400 – 2483,5 MHz  
Frequency agile or hopping: ☐ Yes ☒ No  
Antenna: ☒ Internal antenna ☐ External antenna  
Antenna connector: ☒ None, internal antenna ☐ Yes  
Antenna gain: 0 dBi  
Rating RF output power: 2.4 dBm (measured conducted)  
Type of modulation: GFSK  
Temperature range: -30°C to +85°C  
Transmitter standby mode supported: ☒ Yes ☐ No

## 2.2 Additional information about the EUT

The EUT consists of the following units:

| Unit   | Type         | Serial number | Comment                             |
|--------|--------------|---------------|-------------------------------------|
| Unit 1 | Radio module | INTERTEK01    | Integrated antenna                  |
| Unit 2 | Radio module | INTERTEK02    | Fitted with temporary SMA connector |

During the tests the EUT supported following software:

| Software                                | Version   | Comment                 |
|-----------------------------------------|-----------|-------------------------|
| Nordic Semiconductor ASA – nRFgo Studio | 1.21.2.10 | Used to program the EUT |

## 2.3 Peripheral equipment

Peripheral equipment is equipment needed for correct operation of the EUT, but not included as part of the testing and evaluation of the EUT.

| Equipment       | Type / Model | Manufacturer | Serial no. |
|-----------------|--------------|--------------|------------|
| Laptop computer | T440s        | Lenovo       | --         |
| USB hub         | UH-400       | i-rocks      | 010833     |

## 2.4 Test signals and operation modes

During all tests the EUT was transmitting a continuous stream of pseudorandom data (PRBS9) with a payload of 37 bytes, with a duty cycle of approximately 66 %.

## 2.5 Modifications made to improve EMC-characteristics

No modifications have been made during the tests.

### 3 TEST SPECIFICATIONS

#### 3.1 Standards

Requirements:

47 CFR Part 15 (2017): Subpart C: Intentional radiators. Section 15.247

47 CFR Part 15 (2017): Subpart B: Unintentional radiators

RSS-GEN Issue 5 (2018): General requirements for compliance of radio apparatus (2018).

RSS-247 Issue 2 (2017): Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

Test methods:

ANSI C63.10-2013: American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

#### 3.2 Additions, deviations and exclusions from standards and accreditation

No additions, deviations or exclusions have been made from standards and accreditation.

#### 3.3 Test site

Measurements were performed at:

Intertek Semko AB  
Torshamnsgatan 43  
Box 1103  
SE-164 22 Kista

Intertek Semko AB is an FCC listed test site with site registration number 90913.

Intertek Semko AB is an FCC accredited conformity assessment body with designation number SE0002.

Intertek Semko AB is an Industry Canada listed test facility with IC assigned code 2042G.

Intertek Semko AB is an ISED recognized wireless testing laboratory with CAB identifier SE0003.

Measurement chambers

| Measurement Chamber | Type of chamber       | IC Site filing # |
|---------------------|-----------------------|------------------|
| BJÖRKHALLEN         | Semi-anechoic<br>3 m  | 2042G-1          |
| Radiohallen         | Fully-anechoic<br>3 m | 2042G-4          |

#### 4 TEST SUMMARY

The results in this report apply only to sample tested:

| Requirement                                                 | Description                                                                                                              | Result      |
|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-------------|
| FCC §15.203<br>RSS-GEN 8.3                                  | <b>Antenna requirement</b>                                                                                               | <b>PASS</b> |
|                                                             | The EUT has integrated non detachable antenna which can't be removed without breaking the EUT.                           |             |
| FCC §15.207,<br>15.107<br>RSS-GEN 8.8 table 3               | <b>Conducted continuous emission in the frequency range 150 kHz to 30 MHz, AC Power input port</b>                       | <b>PASS</b> |
|                                                             | The margin to the limit was at least 10 dB.                                                                              |             |
| FCC §15.247 (b)(4)<br>RSS-247 5.4(4),<br>5.4(5)             | <b>Field strength of fundamental and antenna gain</b>                                                                    | <b>PASS</b> |
|                                                             | The EUT complies with the limits.<br><br>Antenna gain is less than 6 dBi.                                                |             |
| FCC §15.247 (d),<br>15.209(a)<br>RSS-GEN 8.9<br>RSS-247 5.5 | <b>Radiated emission of electromagnetic fields in the frequency range 30 – 1000 MHz</b>                                  | <b>PASS</b> |
|                                                             | The EUT complies with the limits.<br>The margin to the limit was at least 6.6 dB at 31.864 MHz.<br>See clause 6.4 – 6.5. |             |
| FCC §15.247(d),<br>15.209(a)<br>RSS-GEN 8.9<br>RSS-247 5.5  | <b>Radiated emission of electromagnetic fields in the frequency range above 1 GHz</b>                                    | <b>PASS</b> |
|                                                             | The EUT complies with the limits.<br>The margin to the limit was at least 5.1 dB at 4878.0 MHz.<br>See clause 6.6 – 6.7. |             |
| FCC §15.247(a)(2)<br>RSS-GEN 6.7<br>RSS-247 5.2(1)          | <b>Occupied bandwidth</b>                                                                                                | <b>PASS</b> |
|                                                             | The EUT complies with the limits.<br>The margin to the limit is at least 242.6 kHz<br>See clause 9.4.                    |             |
| FCC §15.247(b)<br>RSS-247 5.4(4)                            | <b>Conducted output power</b>                                                                                            | <b>PASS</b> |
|                                                             | The EUT complies with the limits.<br>The margin to the limit was at least 10 dB.<br>See clause 8.4.                      |             |
| FCC §15.247(e)<br>RSS-247 5.2(2)                            | <b>Peak power spectral density</b>                                                                                       | <b>PASS</b> |
|                                                             | The EUT complies with the limits.<br>The margin to the limit was at least 10 dB.<br>See clause 11.4.                     |             |
| FCC §15.247(e)<br>RSS-247 5.5                               | <b>Band edge</b>                                                                                                         | <b>PASS</b> |
|                                                             | The EUT complies with the limits.<br>The margin to the limit was at least 10 dB.<br>See clause 7.4.                      |             |

## 5 CONDUCTED CONTINUOUS DISTURBANCES IN THE FREQUENCY-RANGE 0.15 TO 30 MHZ

|                      |                |                           |         |
|----------------------|----------------|---------------------------|---------|
| <b>Date of test:</b> | 2018-04-23     | <b>Test location:</b>     | BUR 1   |
| <b>EUT Serial:</b>   | INTERTEK01     | <b>Ambient temp:</b>      | 23 °C   |
| <b>Tested by:</b>    | Robert Hietala | <b>Relative humidity:</b> | 23 %    |
| <b>Test result:</b>  | Pass           | <b>Margin:</b>            | > 10 dB |

### 5.1 Test set-up and test procedure

The test method is in accordance with ANSI C63.10-2013 section 6.2.

The EUT was connected to the power via Artificial Mains Networks AMN.

The EUT was placed on an insulating support 0.8 m above the floor, 0.4 m from the vertical reference ground plane (RGP) and 0.8 m from the AMN/ISN.

During the test the EUT was in TX mode on high channel.

### 5.2 Requirement

#### Limits for conducted emission from AC mains

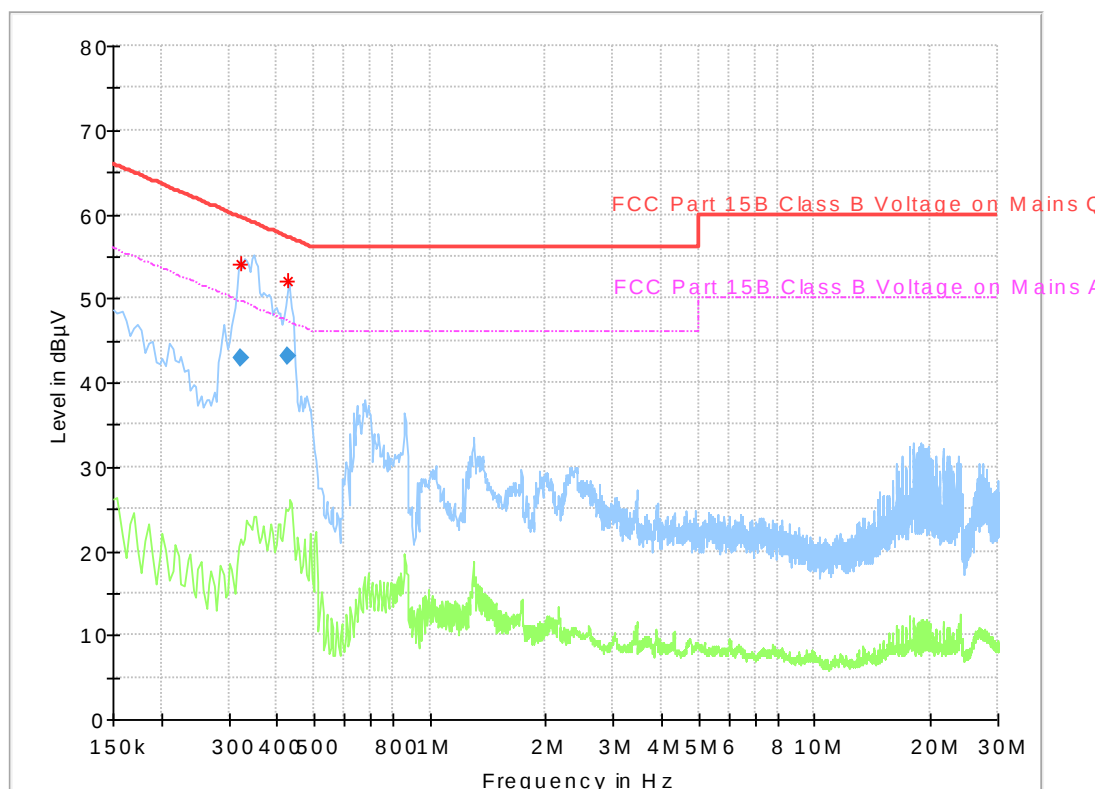
The EUT shall meet the limits for the standards.

Reference: 47 CFR §15.207

RSS-GEN, section 8.8 table 4

| Frequency range<br>[MHz] | Limits [dBμV] |         |
|--------------------------|---------------|---------|
|                          | Quasi-Peak    | Average |
| 0.15 – 0.50              | 66 – 56       | 56 – 46 |
| 0.50 – 5.00              | 56            | 46      |
| 5.00 – 30.0              | 60            | 50      |

### 5.3 Test results



Diagram, Peak and Average overview sweep

#### Measurement results, Quasi-peak

| Frequency [MHz] | Level [dBµV] | Limit [dBµV] | Line L/N | Margin [dB] |
|-----------------|--------------|--------------|----------|-------------|
| 0,321           | 43,0         | 59,7         | N        | 16,7        |
| 0,429           | 43,1         | 57,3         | N        | 14,1        |

Result [dBµV] = Analyser reading [dBµV] + cable loss [dB] + LISN insertion loss [dB]

All other measured disturbances have a margin of more than 20 dB to the limits.

## 6 RADIATED RF EMISSION IN THE FREQUENCY-RANGE 30 MHz TO 26.5 GHz

|                      |                |                           |                          |
|----------------------|----------------|---------------------------|--------------------------|
| <b>Date of test:</b> | 2018-04-19     | <b>Test location:</b>     | Björkhallen, Radiohallen |
| <b>EUT Serial:</b>   | INTERTEK01     | <b>Ambient temp:</b>      | 21 °C                    |
| <b>Tested by:</b>    | Robert Hietala | <b>Relative humidity:</b> | 13 %                     |
| <b>Test result:</b>  | Pass           | <b>Margin:</b>            | 5.1 dB                   |

### 6.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10-2013.  
The EUT was set up in order to emit maximum disturbances.

30 – 1000 MHz: The EUT was placed on an insulating support 0.8 m above the turntable which is part of the reference ground plane.

1 – 26.5 GHz: The EUT was placed 1.5 m above the floor on a positioner which allows the EUT to rotate freely around its X and Y axis.

Overview sweeps were performed with the measurement receiver in max-hold mode and the peak detector activated in the frequency-range 30 – 1000 MHz. Above 1 GHz additionally the average detector was activated.

### 6.2 Test conditions

#### Test set-up:

Test receiver set-up:

Preview test:

Final test:

EUT height above ground plane:

Measuring distance:

Measuring angle:

Antenna

Height above ground plane:

Polarisation:

Type:

#### 30 MHz to 1000 MHz

Peak, RBW 120 kHz VBW 1 MHz

Quasi-Peak, RBW 120 kHz VBW 1 MHz

0.8 m

3 m

0 – 359°

1 – 4 m

Vertical and Horizontal

Bilog

#### Test set-up:

Test receiver set-up:

Preview test:

Final test:

EUT height above ground plane:

Measuring distance:

Measuring angle:

Antenna

Height above ground plane:

Polarisation:

Type:

Antenna tilt:

#### 1 GHz – 26.5 GHz

Peak, RBW 1 MHz VBW 3 MHz

Average, RBW 1 MHz VBW 3 MHz

Peak, RBW 1 MHz VBW 3 MHz

Average RBW 1 MHz VBW 3 MHz

1.5 m

3 m

0 – 359°

1 – 4 m

Vertical and Horizontal

Horn

The EUT is rotated around its axis as described in ANSI C63.10 (2013) clause 6.6.5.

### 6.3 Requirements

Within restricted bands and receive mode:

Reference: CFR 47 §15.209, §15.109, RSS-Gen section 8.9

Field strength of emissions must comply with limits shown in table below

| Frequency range [MHz] | Field strength at 3 m (dBμV/m) | Field strength at 10 m (dBμV/m) | Detector (dBμV/m) |
|-----------------------|--------------------------------|---------------------------------|-------------------|
| 30 – 88               | 40.0                           | 29.5                            | Quasi Peak        |
| 88 – 216              | 43.5                           | 33.0                            | Quasi Peak        |
| 216 – 960             | 46.0                           | 35.5                            | Quasi Peak        |
| 960 – 1000            | 54.0                           | 43.5                            | Quasi Peak        |
| Above 1000            | 54.0 / 74.0                    | 43.5 / 63.5                     | Average / Peak    |

The values for 10 m measuring distance are calculated by subtracting 10.5 dB from the 3 m limit. (i.e. an extrapolation factor of 20 dB/decade according to CFR 47 §15.31(f)(1))

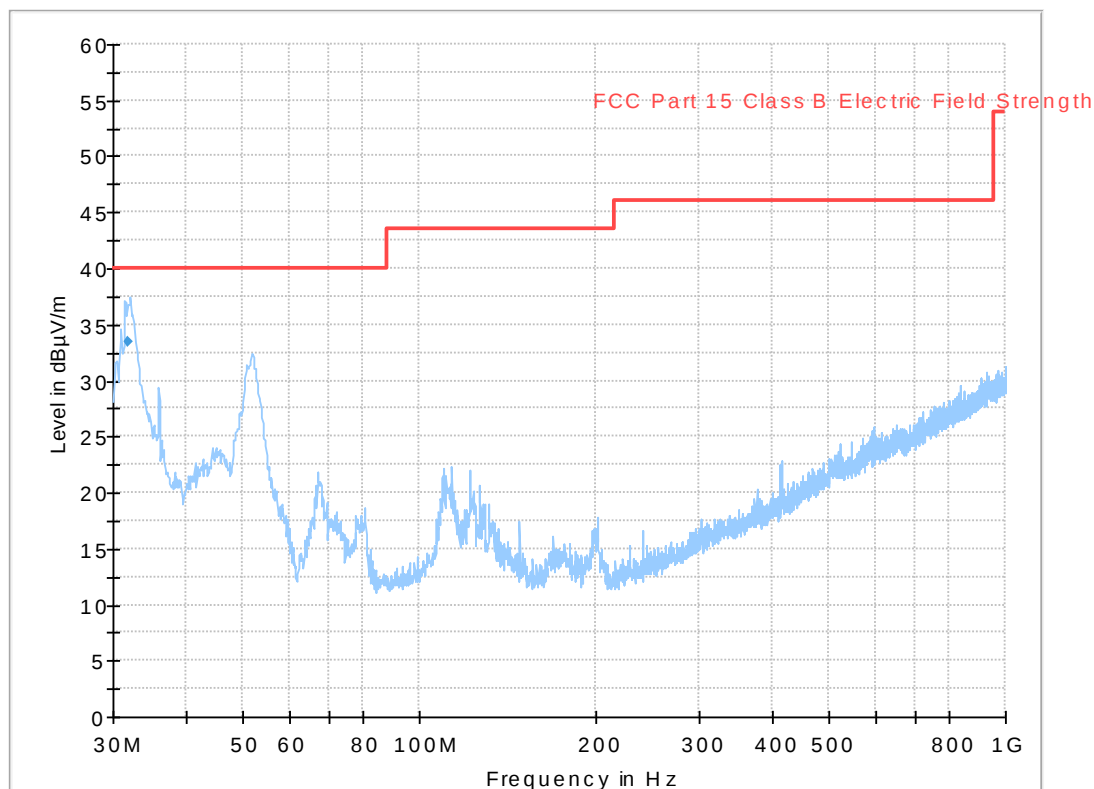
Outside the restricted bands:

Reference: CFR 47 §15.247(d), RSS-247 5.5,

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

### 6.4 Test results 30 MHz – 1000 MHz, TX

Full Spectrum



Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. TX high channel.

## Measurement results, Quasi Peak

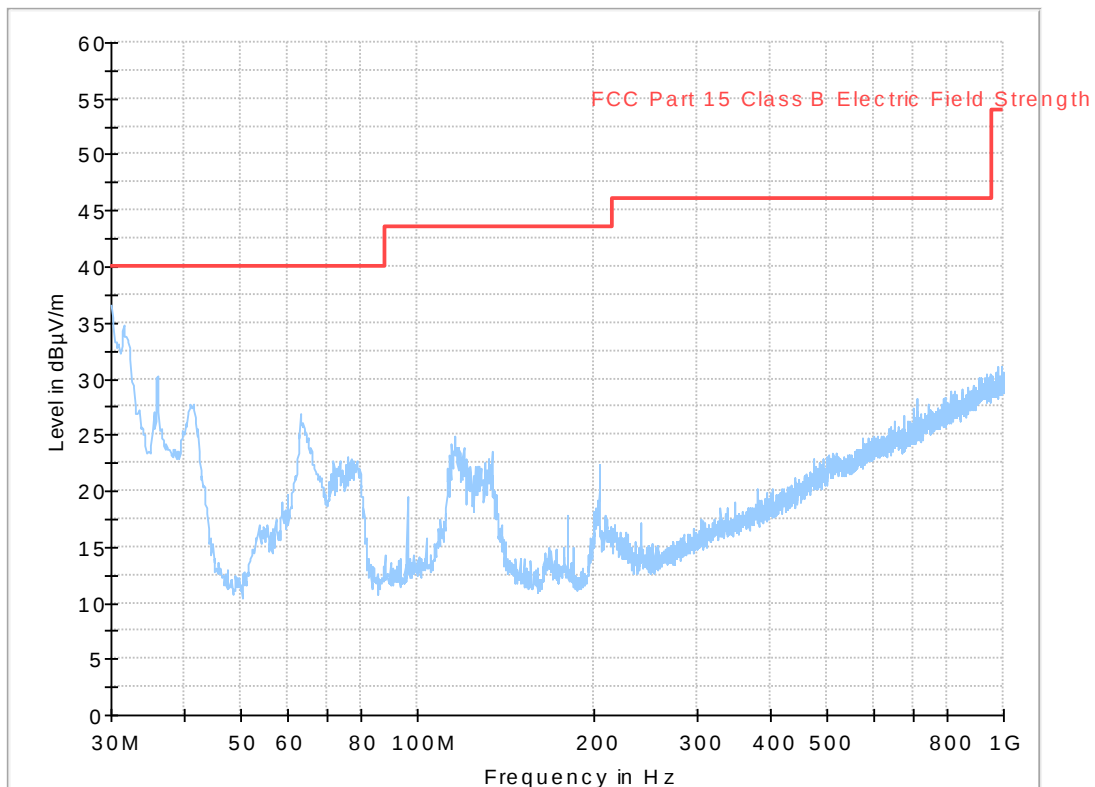
| Frequency [MHz] | Level [dBμV/m] | Limit [dBμV/m] | Polarization H/V | Margin [dB] |
|-----------------|----------------|----------------|------------------|-------------|
| 31.864          | 33.4           | 40.0           | V                | 6.6         |

All other measured disturbances have a margin of more than 20 dB to the limits.

Result [dBμV/m] = Analyser reading [dBμV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

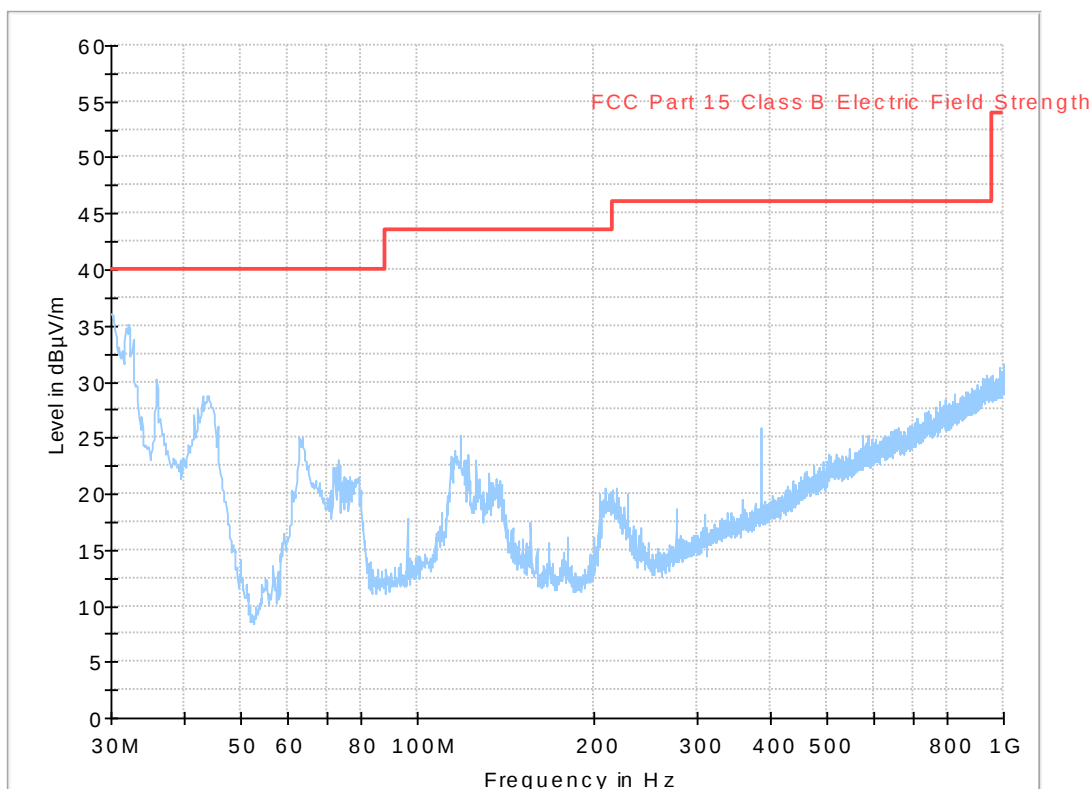
## 6.5 Test results 30 MHz – 1000 MHz, RX

Full Spectrum



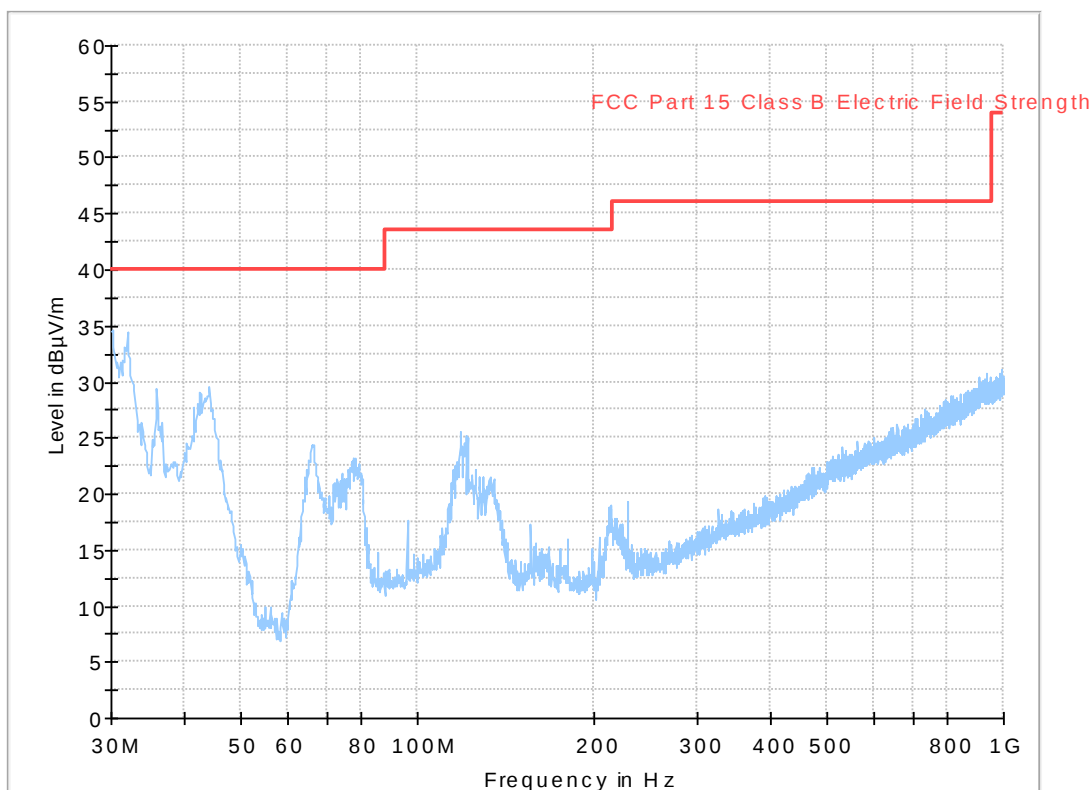
Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. RX low channel.

Full Spectrum



Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. RX middle channel.

Full Spectrum

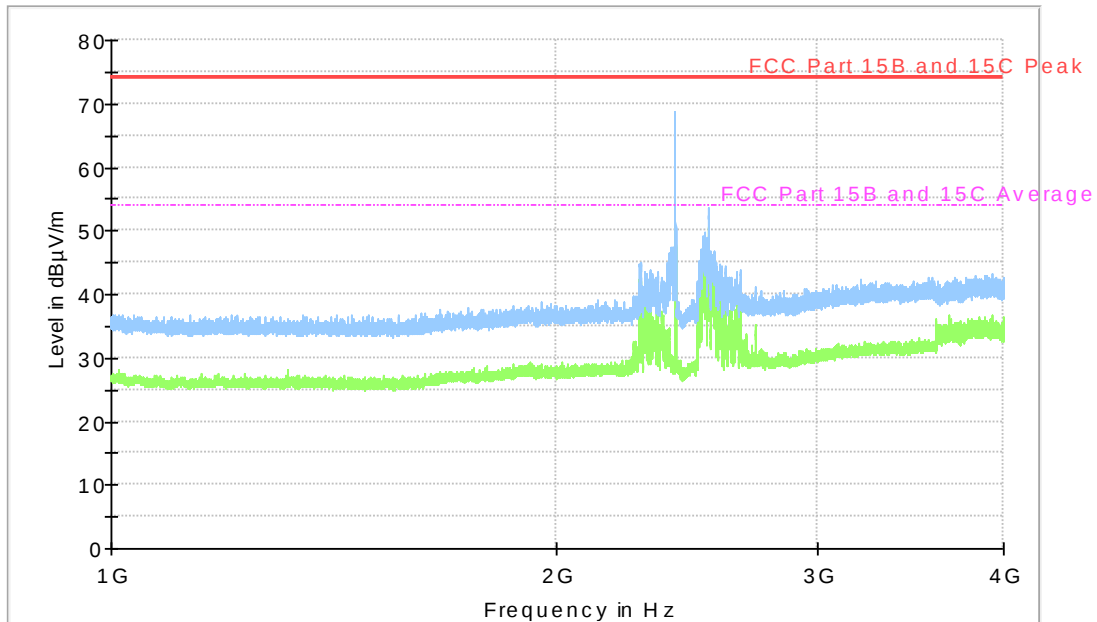


Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. RX high channel.

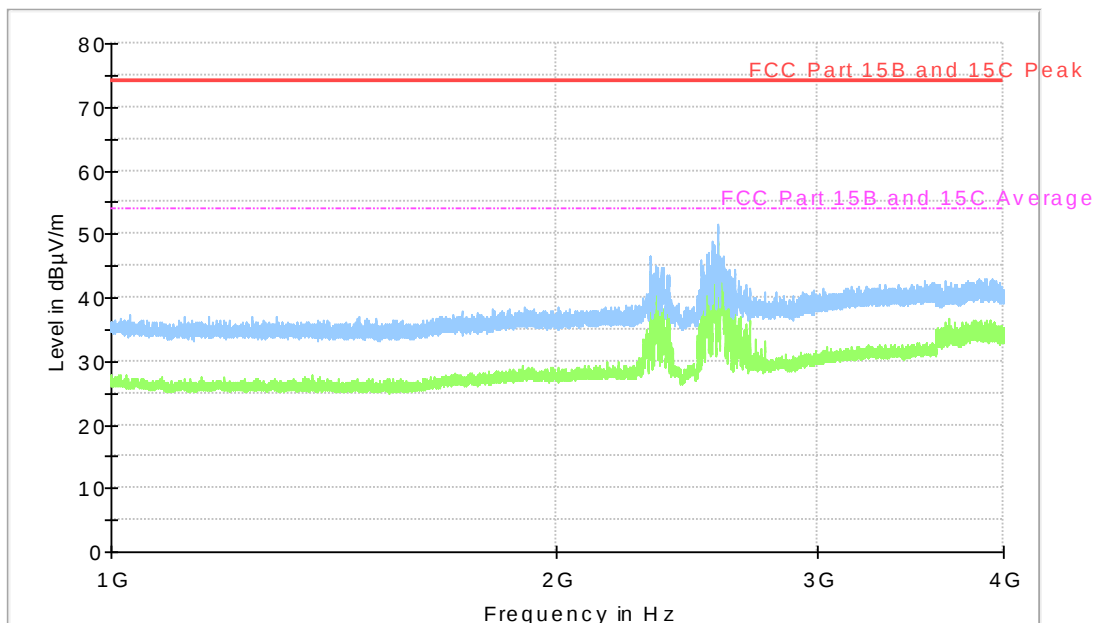
## Measurement results, Quasi Peak

No emissions are found above noise floor or closer than 20 dB from limit.

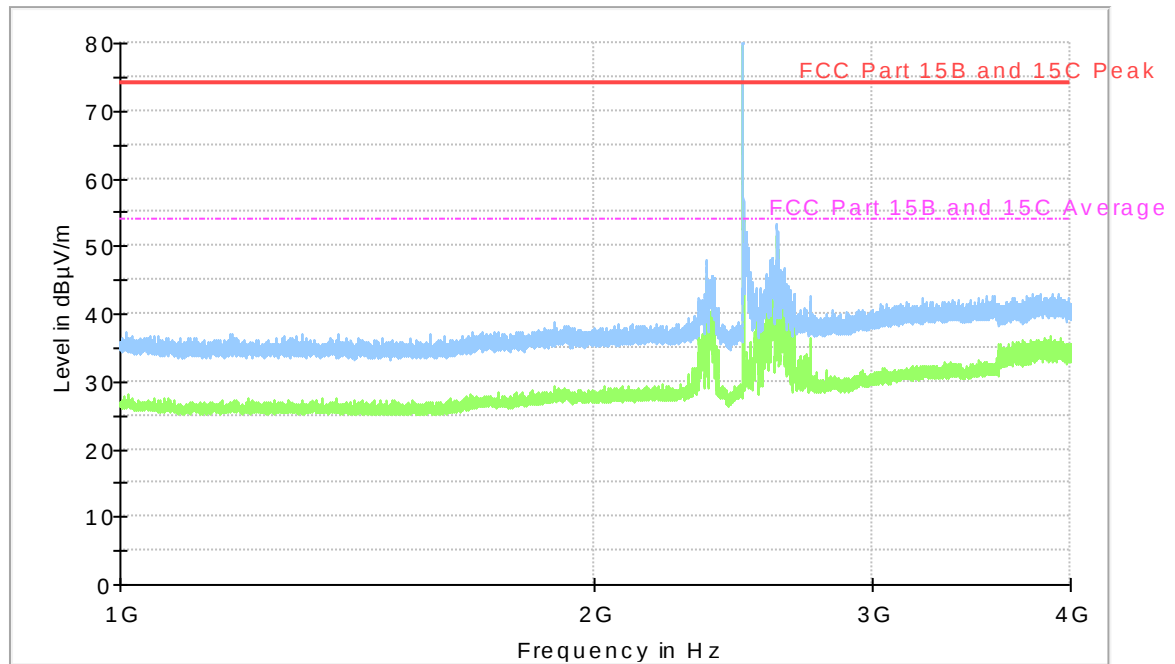
### 6.6 Test results 1 GHz – 26.5 GHz, TX



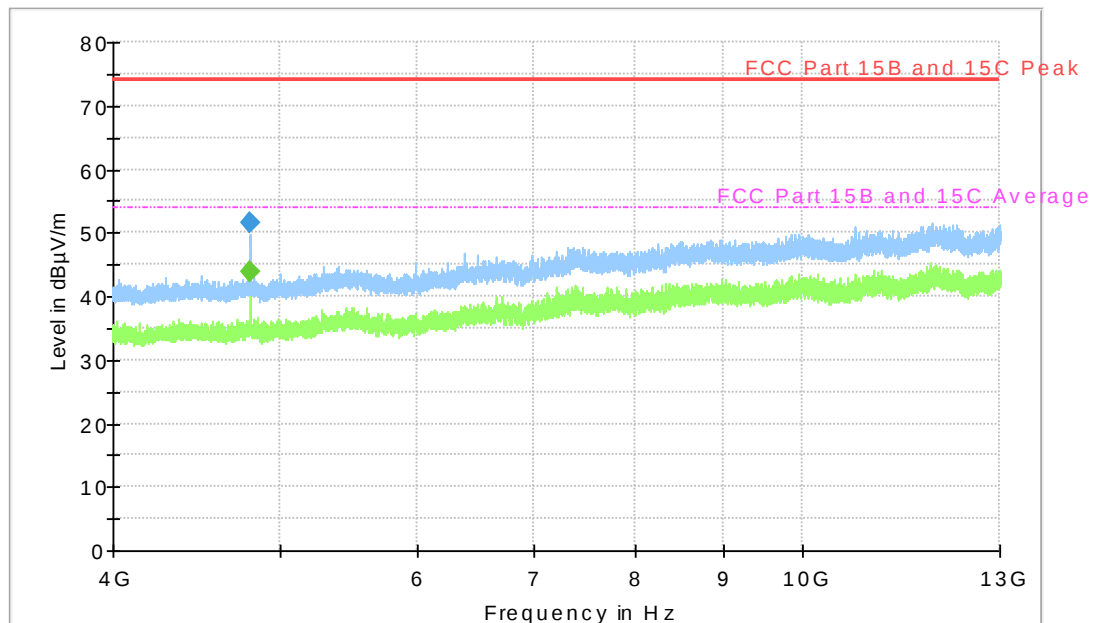
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX low channel. Carrier is attenuated by band rejection filter K&L 6N45-2450/T 100-0/0.



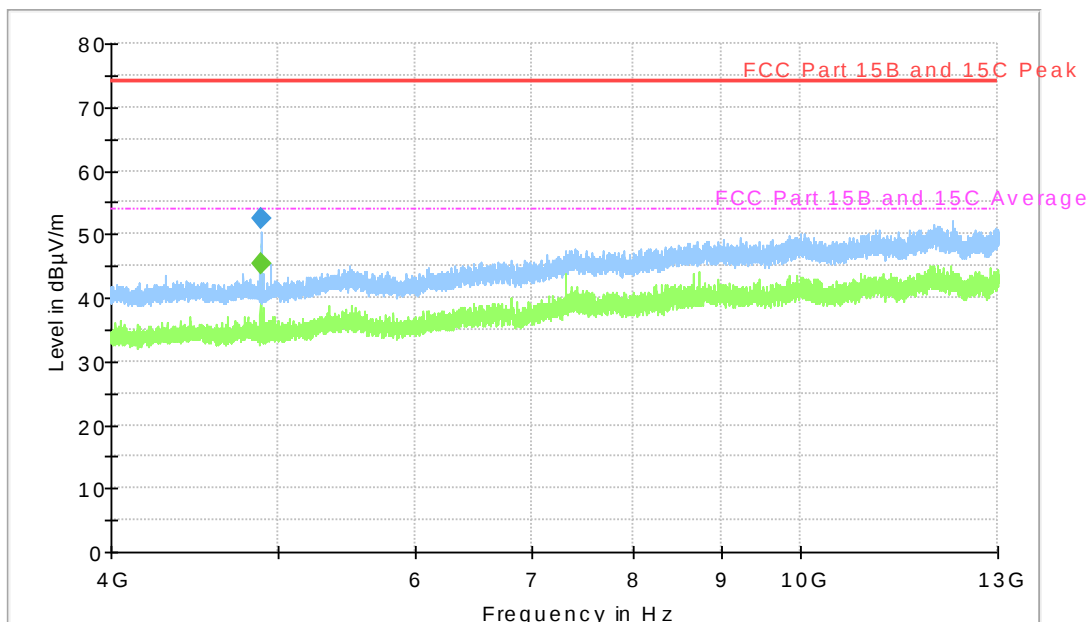
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX mid channel. Carrier is attenuated by band rejection filter K&L 6N45-2450/T 100-0/0.



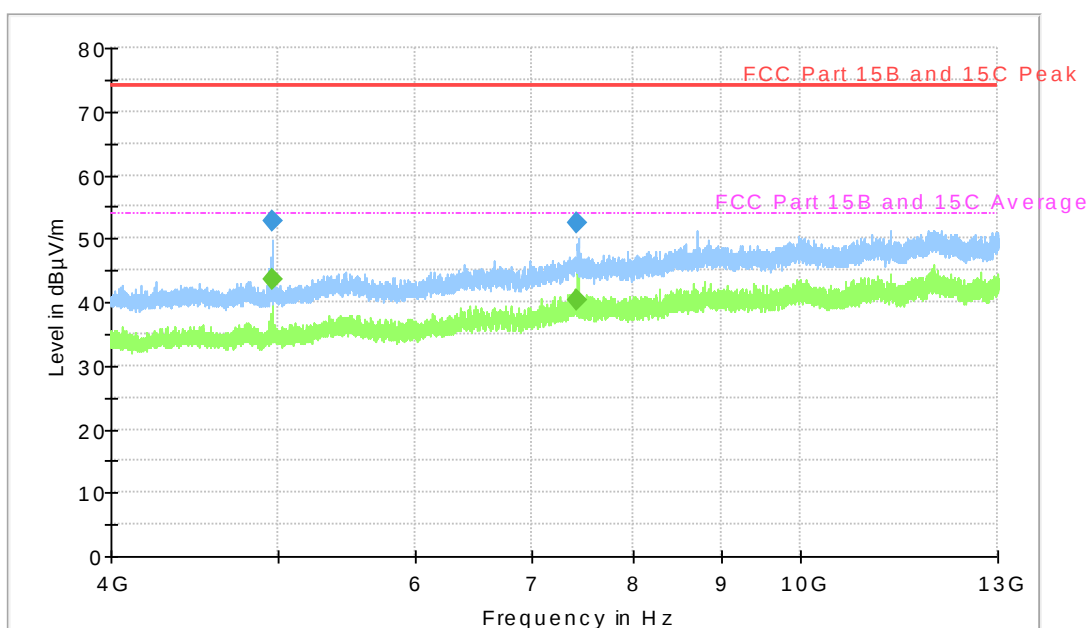
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX high channel. Carrier is attenuated by band rejection filter K&L 6N45-2450/T 100-0/0.



Diagram, Peak overview sweep, 4– 13 GHz at 3 m distance. TX low channel. Emissions below 4000 MHz are attenuated by high-pass filter K&L 4410-X4500/18000-0.

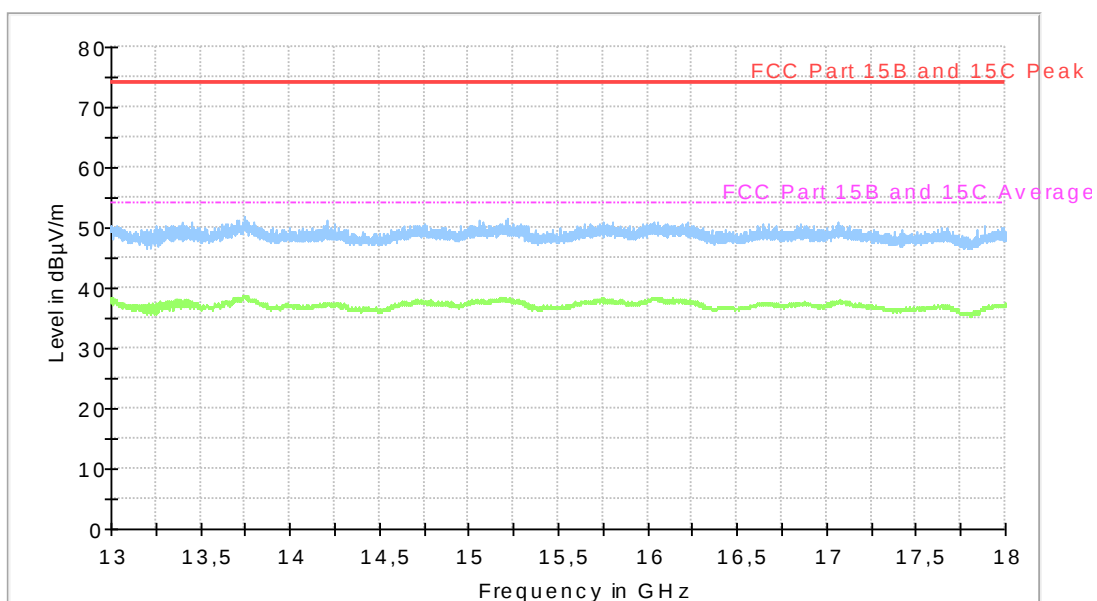


Diagram, Peak overview sweep, 4– 13 GHz at 3 m distance. TX mid channel. Emissions below 4000 MHz are attenuated by high-pass filter K&L 4410-X4500/18000-0.



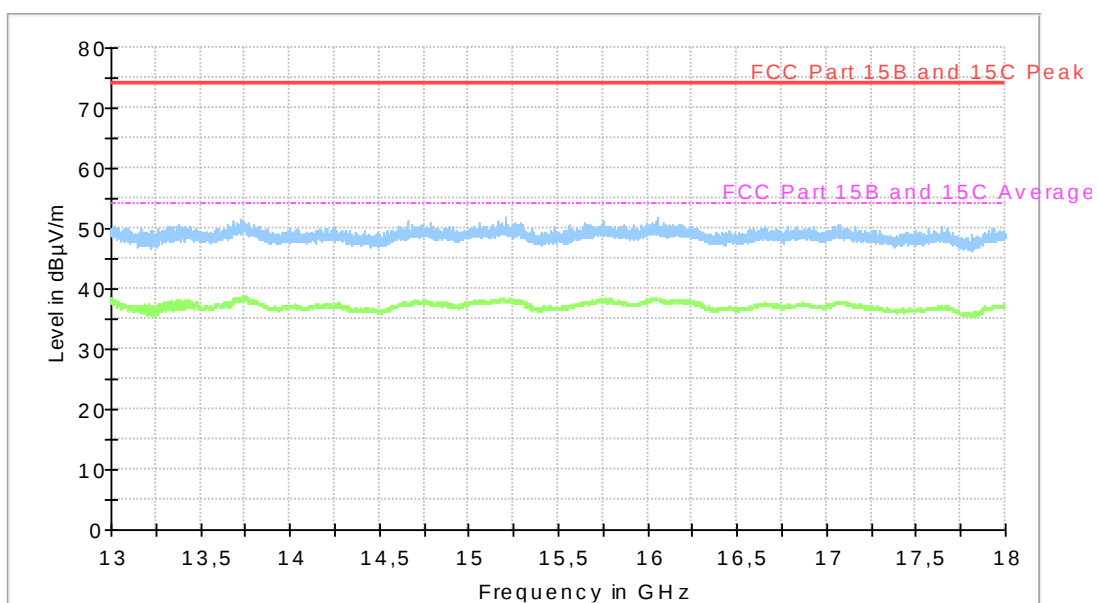
Diagram, Peak overview sweep, 4– 13 GHz at 3 m distance. TX high channel. Emissions below 4000 MHz are attenuated by high-pass filter K&L 4410-X4500/18000-0.

Full Spectrum



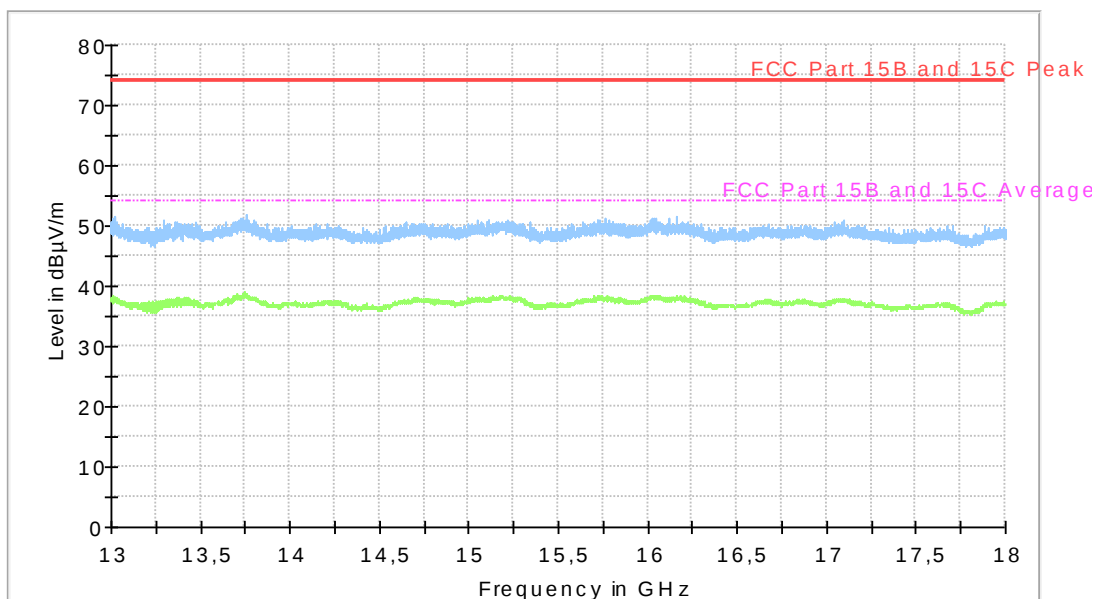
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX low channel

Full Spectrum



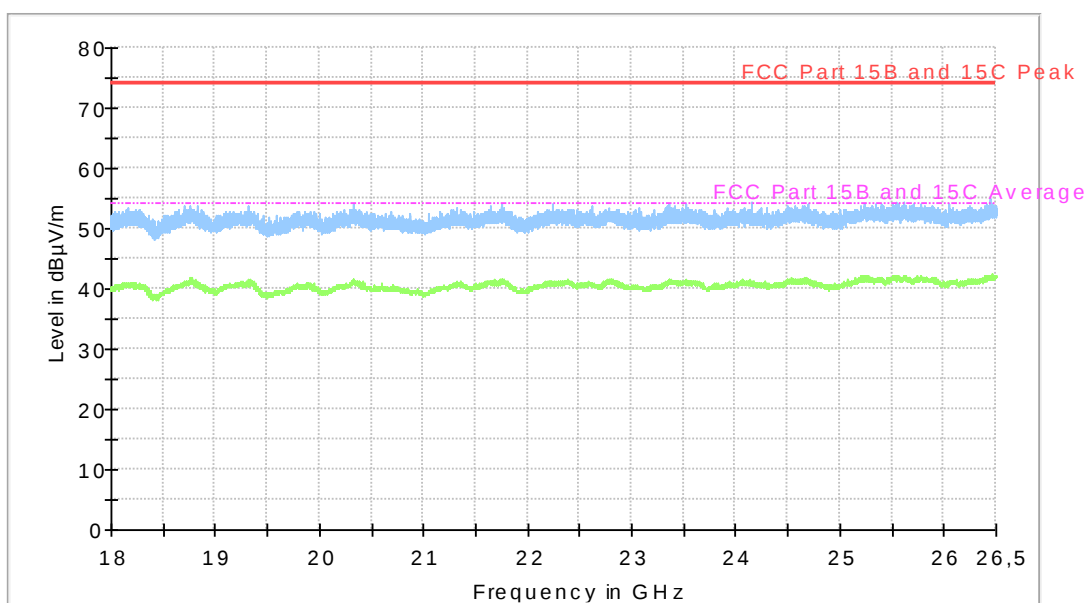
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX middle channel

Full Spectrum



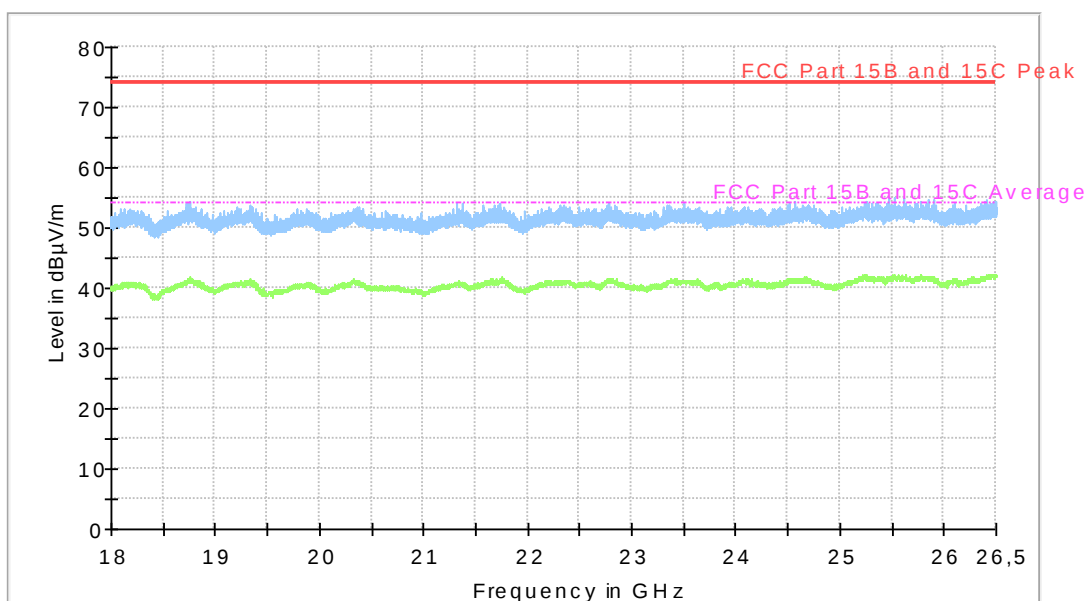
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX high channel

Full Spectrum



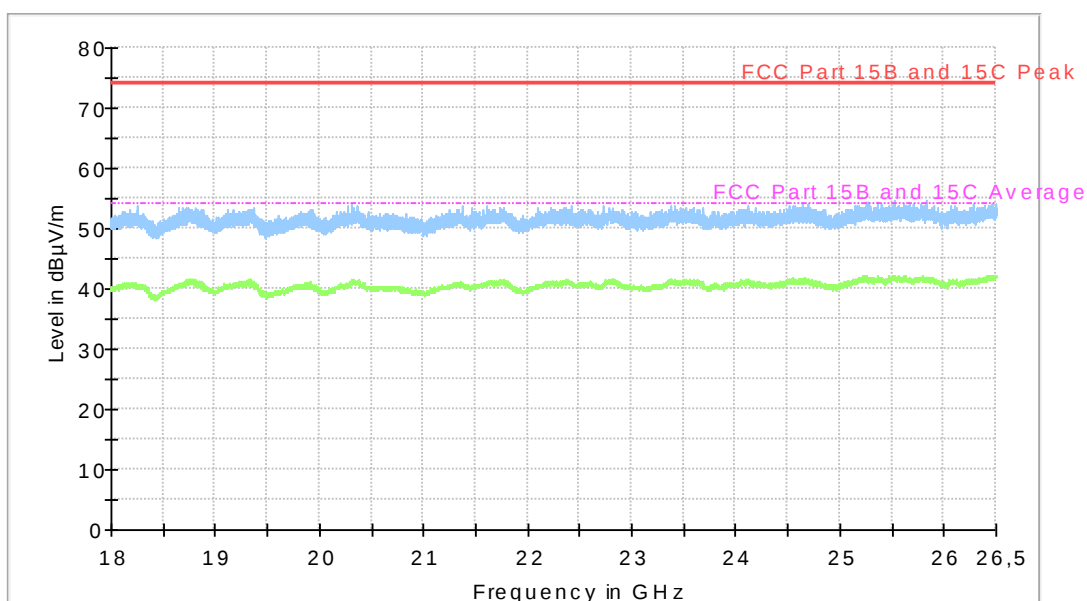
Diagram, Peak overview sweep, 18 – 26.5 GHz at 3 m distance. TX low channel

Full Spectrum



Diagram, Peak overview sweep, 18 – 26.5 GHz at 3 m distance. TX middle channel

Full Spectrum



Diagram, Peak overview sweep, 18 – 26.5 GHz at 3 m distance. TX high channel

Measurement results, Peak, TX low channel

| Frequency [MHz] | Level [dBµV/m] | Limit [dBµV/m] | Elevation [Degree] | Polarization H/V | Margin [dB] |
|-----------------|----------------|----------------|--------------------|------------------|-------------|
| 4804.3          | 51.6           | 47.0           | 80.0               | V                | 22.4        |

**Measurement results, Average, TX low channel**

| Frequency [MHz] | Level [dBμV/m] | Limit [dBμV/m] | Elevation [Degree] | Polarization H/V | Margin [dB] |
|-----------------|----------------|----------------|--------------------|------------------|-------------|
| 4803.7          | 44.0           | 54.0           | 90.0               | H                | 10.0        |

**Measurement results, Peak, TX middle channel**

| Frequency [MHz] | Level [dBμV/m] | Limit [dBμV/m] | Elevation [Degree] | Polarization H/V | Margin [dB] |
|-----------------|----------------|----------------|--------------------|------------------|-------------|
| 4879.8          | 52.4           | 74.0           | 82.0               | V                | 21.6        |

**Measurement results, Average, TX middle channel**

| Frequency [MHz] | Level [dBμV/m] | Limit [dBμV/m] | Elevation [Degree] | Polarization H/V | Margin [dB] |
|-----------------|----------------|----------------|--------------------|------------------|-------------|
| 4880.2          | 45.3           | 54.0           | 90.0               | V                | 8.7         |

**Measurement results, Peak, TX high channel**

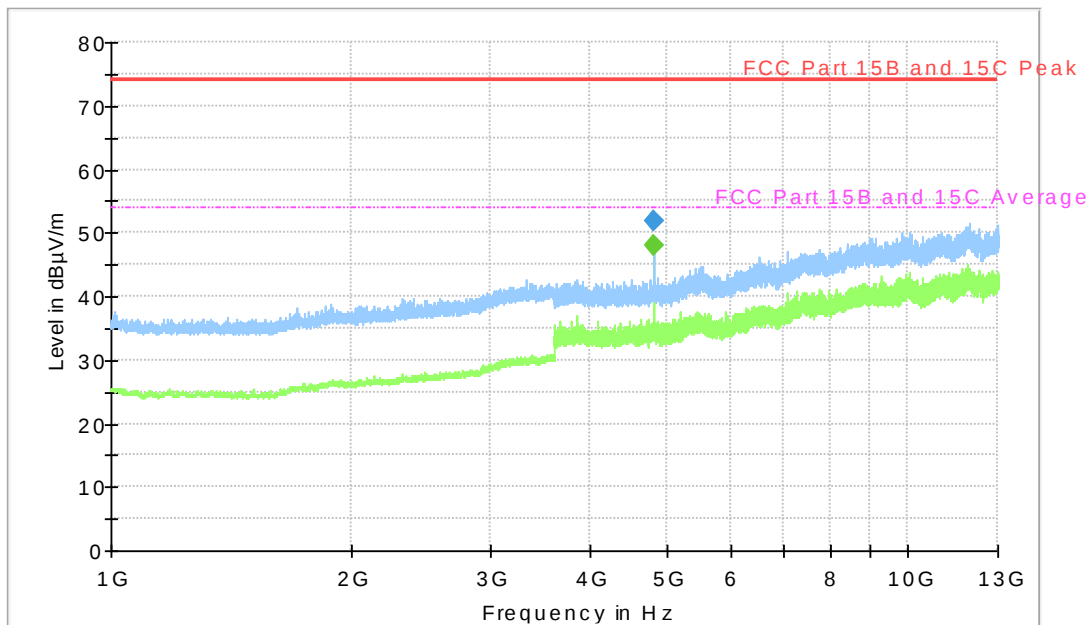
| Frequency [MHz] | Level [dBμV/m] | Limit [dBμV/m] | Elevation [Degree] | Polarization H/V | Margin [dB] |
|-----------------|----------------|----------------|--------------------|------------------|-------------|
| 2484.0          | 61.6           | 74.0           | 120.0              | V                | 12.4        |
| 4959.9          | 52.8           | 74.0           | 93.0               | V                | 21.2        |
| 7439.4          | 52.6           | 74.0           | 115.0              | V                | 21.4        |

**Measurement results, Average, TX high channel**

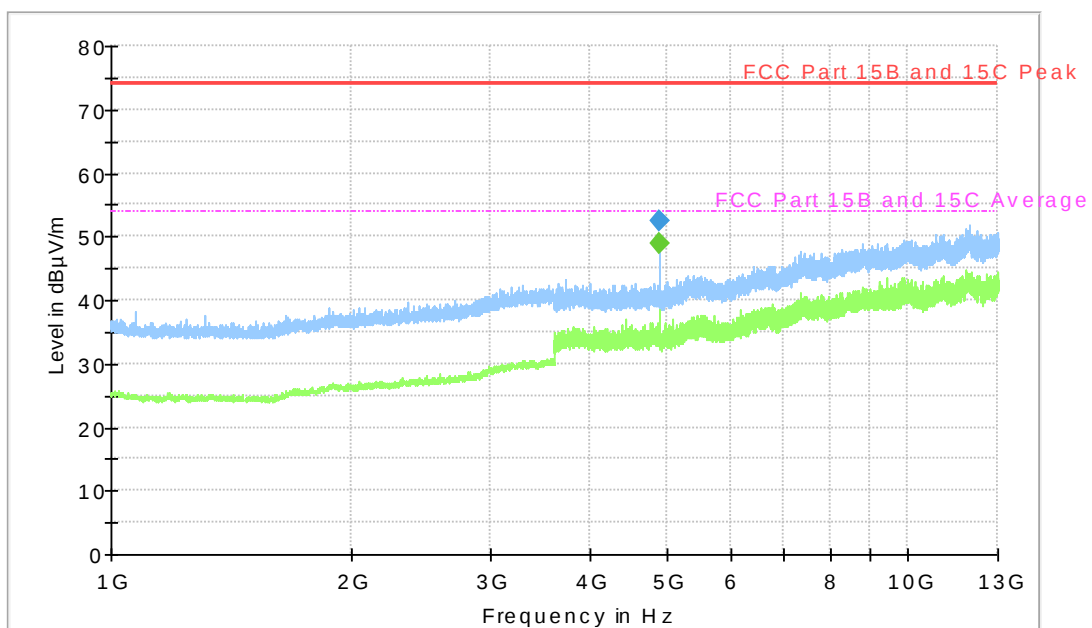
| Frequency [MHz] | Level [dBμV/m] | Limit [dBμV/m] | Elevation [Degree] | Polarization H/V | Margin [dB] |
|-----------------|----------------|----------------|--------------------|------------------|-------------|
| 2484.0          | 46.0           | 54.0           | 120.0              | V                | 8.0         |
| 4960.0          | 43.6           | 54.0           | 90.0               | V                | 10.4        |
| 7439.2          | 40.4           | 54.0           | 120.0              | V                | 13.6        |

Result [dBμV/m] = Analyser reading [dBμV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

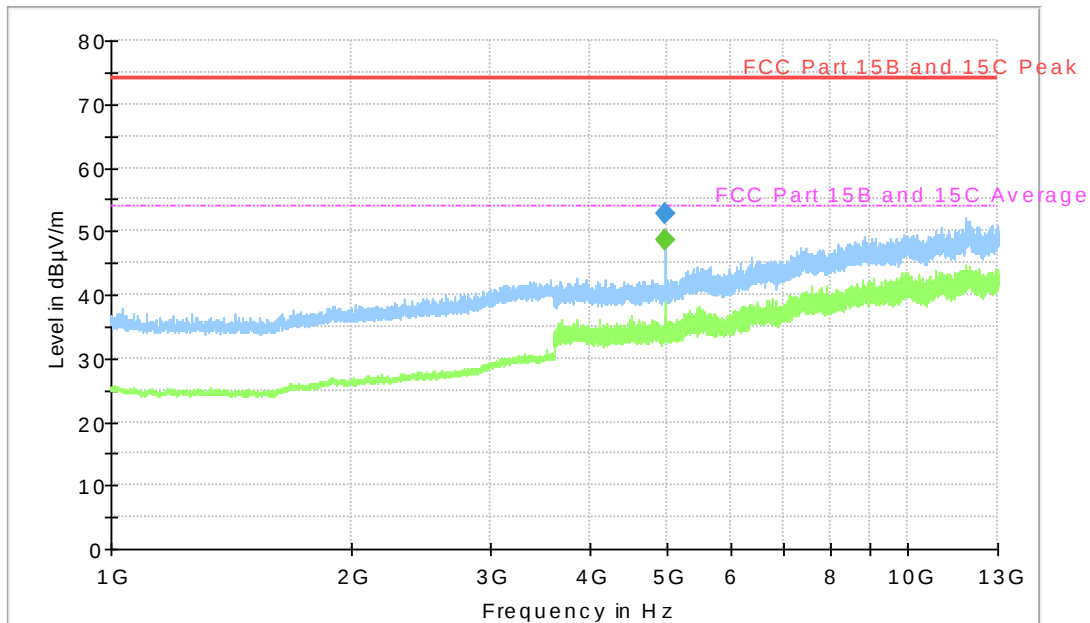
## 6.7 Test results 1 GHz – 13 GHz, RX



Diagram, Peak overview sweep, 1– 13 GHz at 3 m distance. RX low channel



Diagram, Peak overview sweep, 1– 13 GHz at 3 m distance. RX middle channel



Diagram, Peak overview sweep, 1– 13 GHz at 3 m distance. RX high channel

Measurement results, Peak, RX low channel

| Frequency [MHz] | Level [dBμV/m] | Limit [dBμV/m] | Elevation [Degree] | Polarization H/V | Margin [dB] |
|-----------------|----------------|----------------|--------------------|------------------|-------------|
| 4801.9          | 51.9           | 74.0           | 85.0               | V                | 22.1        |

Measurement results, Average, RX low channel

| Frequency [MHz] | Level [dBμV/m] | Limit [dBμV/m] | Elevation [Degree] | Polarization H/V | Margin [dB] |
|-----------------|----------------|----------------|--------------------|------------------|-------------|
| 4802.0          | 47.9           | 54.0           | 90.0               | V                | 6.1         |

Measurement results, Peak, RX middle channel

| Frequency [MHz] | Level [dBμV/m] | Limit [dBμV/m] | Elevation [Degree] | Polarization H/V | Margin [dB] |
|-----------------|----------------|----------------|--------------------|------------------|-------------|
| 4877.9          | 52.3           | 74.0           | 97.0               | V                | 21.7        |

Measurement results, Average, RX middle channel

| Frequency [MHz] | Level [dBμV/m] | Limit [dBμV/m] | Elevation [Degree] | Polarization H/V | Margin [dB] |
|-----------------|----------------|----------------|--------------------|------------------|-------------|
| 4878.0          | 48.9           | 54.0           | 90.0               | V                | 5.1         |

Measurement results, Peak, RX high channel

| Frequency [MHz] | Level [dBμV/m] | Limit [dBμV/m] | Elevation [Degree] | Polarization H/V | Margin [dB] |
|-----------------|----------------|----------------|--------------------|------------------|-------------|
| 4957.9          | 52.8           | 74.0           | 98.0               | V                | 21.2        |

**Measurement results, Average, RX high channel**

| Frequency<br>[MHz] | Level<br>[dBμV/m] | Limit<br>[dBμV/m] | Elevation<br>[Degree] | Polarization<br>H/V | Margin<br>[dB] |
|--------------------|-------------------|-------------------|-----------------------|---------------------|----------------|
| 4958.0             | 48.5              | 54.0              | 90.0                  | V                   | 5.5            |

Result [dBμV/m] = Analyser reading [dBμV] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

## 7 CONDUCTED BAND EDGE MEASUREMENT

|                      |                |                           |                 |
|----------------------|----------------|---------------------------|-----------------|
| <b>Date of test:</b> | 2018-03-26     | <b>Test location:</b>     | Wireless Center |
| <b>EUT Serial:</b>   | INTERTEK02     | <b>Ambient temp:</b>      | 22 °C           |
| <b>Tested by:</b>    | Robert Hietala | <b>Relative humidity:</b> | 19 %            |
| <b>Test result:</b>  | Pass           | <b>Margin:</b>            | 8.0 dB          |

### 7.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10-2013 section 6.10.4.

The EUT was connected to spectrum analyser via rf-cable and attenuator.

The EUT was set up in order to emit maximum disturbances.

### 7.2 Test conditions

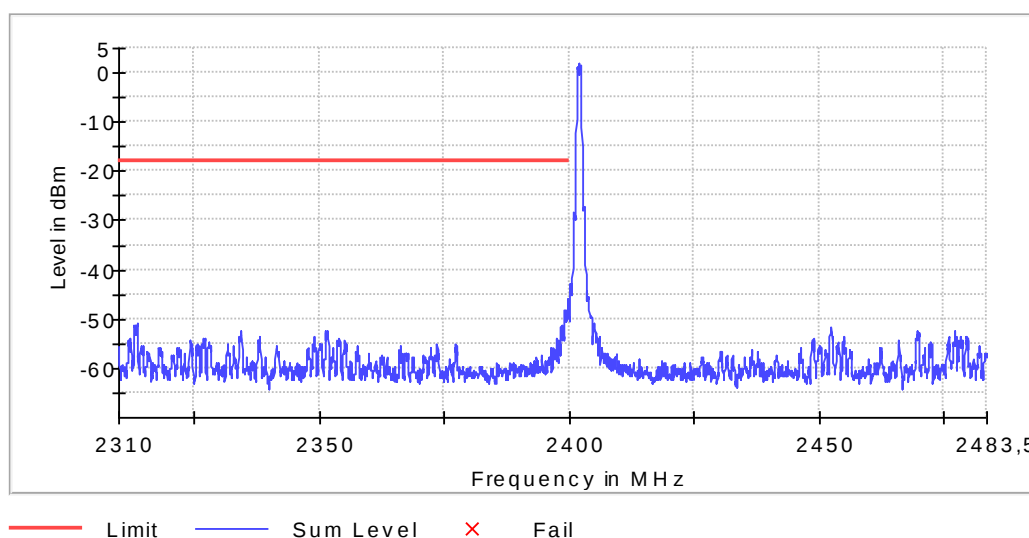
Detector: Peak,  
 RBW: 100 kHz  
 VBW: 300 kHz  
 Span: 90 MHz

### 7.3 Requirement

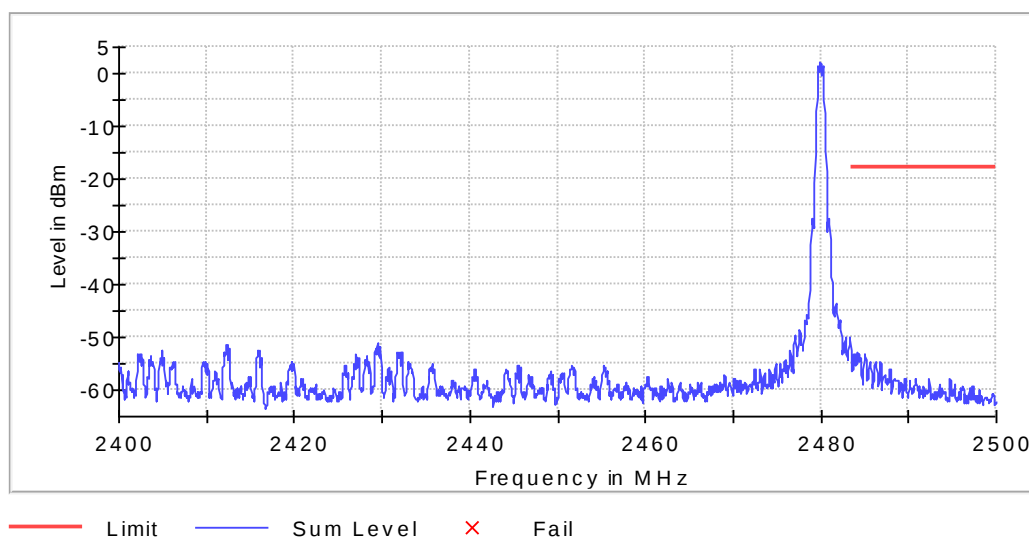
Reference: CFR 47 §15.247(d), RSS-247 5.5,

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

### 7.4 Test results



Screenshot: Lower band edge sweep, single channel



Screenshot: Upper band edge sweep, single channel

#### Test results

| Band edge | Delta [dBc] | Limit [dBc] | Margin [dB] |
|-----------|-------------|-------------|-------------|
| Lower     | 48.0        | 20.0        | 28.0        |
| Upper     | 55.2        | 20.0        | 35.2        |

## 8 PEAK CONDUCTED OUTPUT POWER

|                      |                |                           |                 |
|----------------------|----------------|---------------------------|-----------------|
| <b>Date of test:</b> | 2018-03-26     | <b>Test location:</b>     | Wireless Center |
| <b>EUT Serial:</b>   | INTERTEK02     | <b>Ambient temp:</b>      | 22 °C           |
| <b>Tested by:</b>    | Robert Hietala | <b>Relative humidity:</b> | 19 %            |
| <b>Test result:</b>  | Pass           | <b>Margin:</b>            | > 10 dB         |

### 8.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10-2013 section 11.9.1.1.

The EUT was connected to spectrum analyser via rf-cable and attenuator.

### 8.2 Test conditions

Detector: Peak,  
 RBW: >OBW  
 VBW: 3 x RBW  
 Span: >3 x OBW

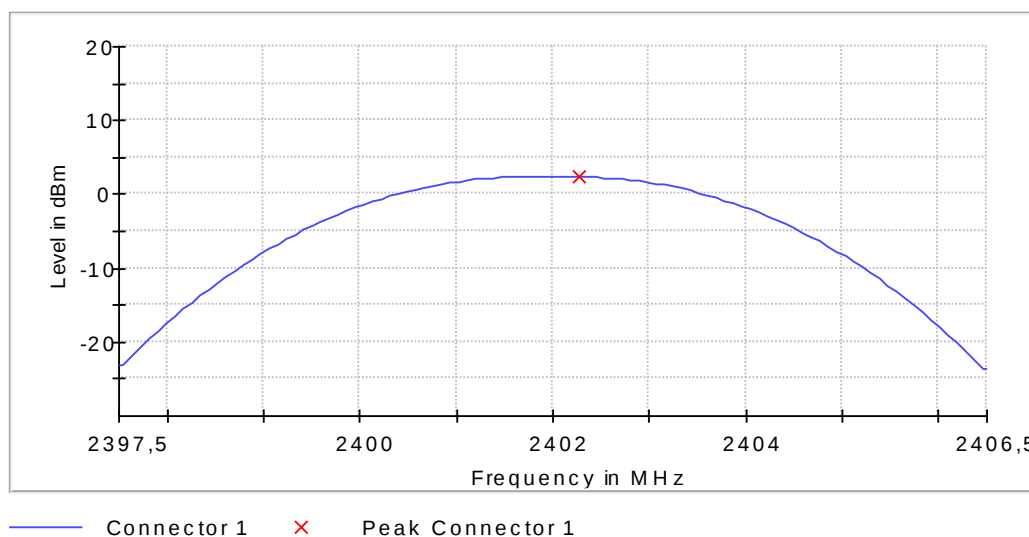
The EUT was set up in order to emit maximum disturbances.

### 8.3 Requirements

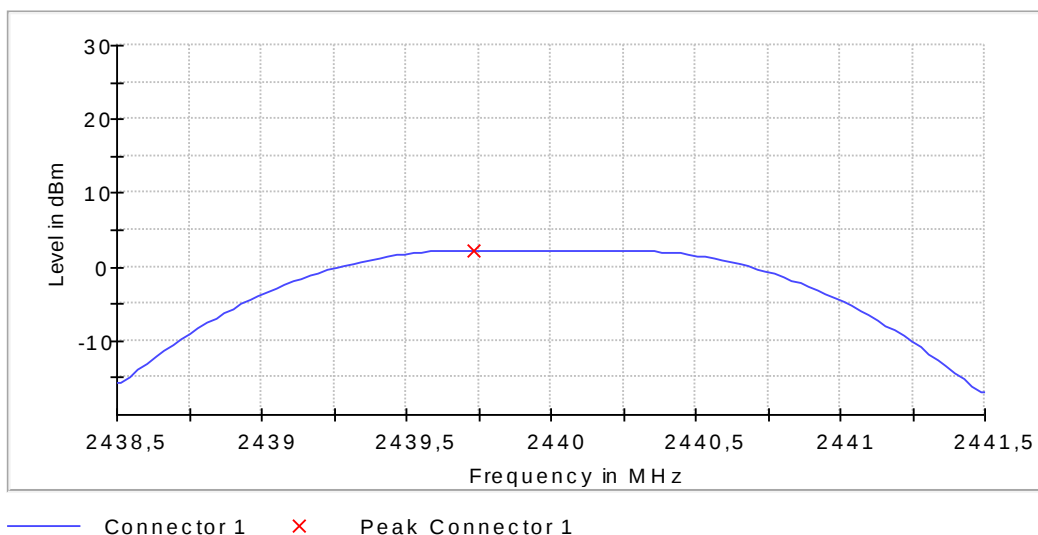
Reference: CFR 47§15.247(b)(3), RSS-247 5.4

For DTSS employing digital modulation techniques operating in the bands 902 – 128 MHz, 2400 – 2483.5 MHz and 5725 – 5850 MHz, the maximum peak conducted output power shall not exceed 1W.

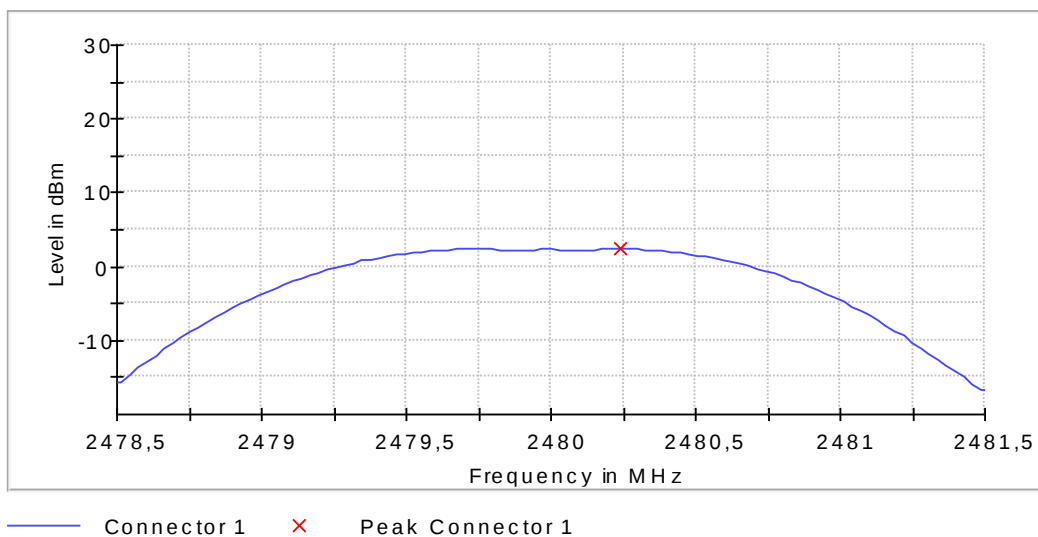
### 8.4 Test results



**Screenshot: Output power, low channel**



Screenshot: Output power, middle channel



Screenshot: Output power, high channel

Test result

| Channel [MHz] | Output power [dBm] |
|---------------|--------------------|
| 2402          | 2.4                |
| 2445          | 2.3                |
| 2480          | 2.4                |

## 9 OCCUPIED 6 DB BANDWIDTH

|                      |                |                           |                 |
|----------------------|----------------|---------------------------|-----------------|
| <b>Date of test:</b> | 2018-03-26     | <b>Test location:</b>     | Wireless Center |
| <b>EUT Serial:</b>   | INTERTEK02     | <b>Ambient temp:</b>      | 22 °C           |
| <b>Tested by:</b>    | Robert Hietala | <b>Relative humidity:</b> | 19 %            |
| <b>Test result:</b>  | Pass           | <b>Margin:</b>            | 242.6 kHz       |

### 9.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10-2013 section 11.8.1.

The EUT was connected to spectrum analyser via rf-cable and attenuator.

### 9.2 Test conditions

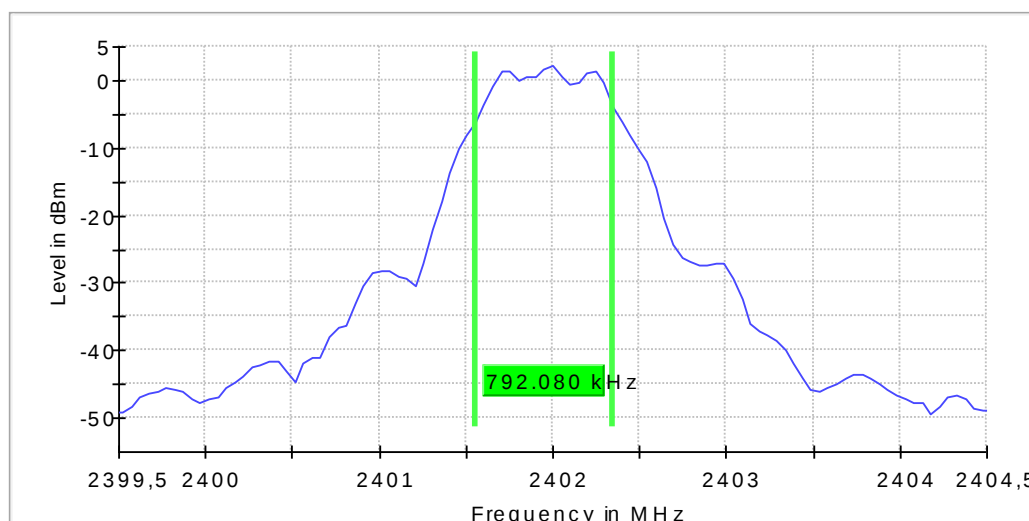
Detector: Peak,  
 RBW: 100 kHz  
 VBW: 3 x RBW  
 Span: >1,5 x OBW

The EUT was set up in order to emit maximum disturbances.

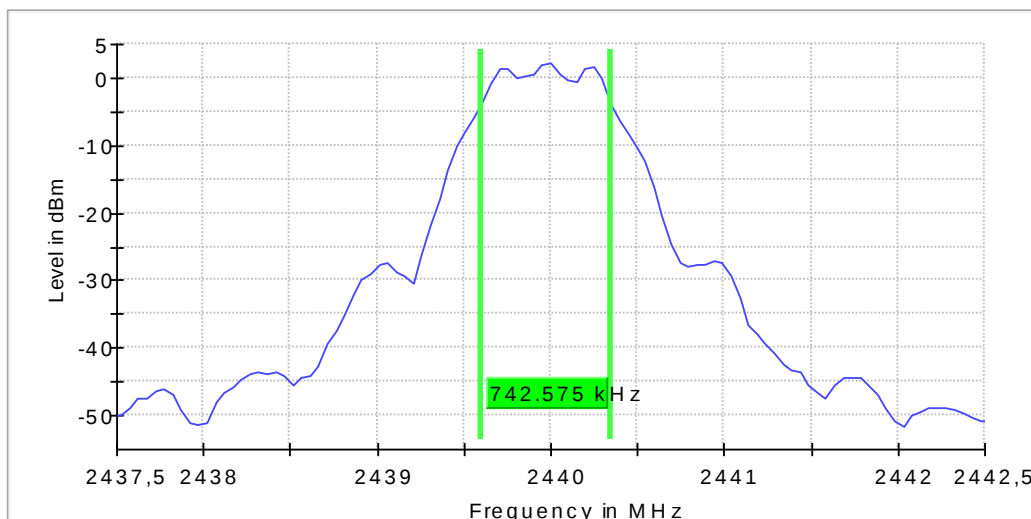
### 9.3 Requirements

Reference: CFR 47§15.247(a)(2), RSS-247 5.2(1)  
 The minimum 6 dB bandwidth shall be 500 kHz.

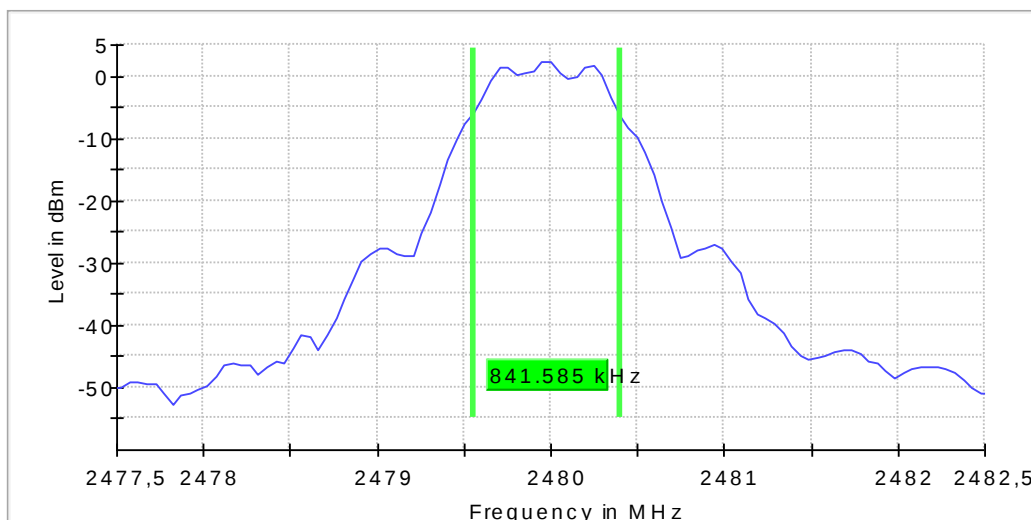
### 9.4 Test results



Screenshot: Occupied 6 dB bandwidth Measurement, low channel



Screenshot: Occupied 6 dB bandwidth Measurement, middle channel



Screenshot: Occupied 6 dB bandwidth Measurement, high channel

Test result

| Channel [MHz] | 6 dB BW [kHz] |
|---------------|---------------|
| 2402          | 792.1         |
| 2440          | 742.6         |
| 2480          | 841.6         |

## 10 99 % BANDWIDTH

|                      |                |                           |                 |
|----------------------|----------------|---------------------------|-----------------|
| <b>Date of test:</b> | 2018-04-09     | <b>Test location:</b>     | Wireless Center |
| <b>EUT Serial:</b>   | INTERTEK 02    | <b>Ambient temp:</b>      | 22 °C           |
| <b>Tested by:</b>    | Robert Hietala | <b>Relative humidity:</b> | 29 %            |
| <b>Test result:</b>  | Pass           | <b>Margin:</b>            | N/A             |

### 10.1 Test set-up and test procedure.

The test method is in accordance with RSS-GEN section 6.7.

The EUT was connected to spectrum analyser via rf-cable and attenuator. Spectrum analyser with occupied bandwidth measurement function is used to determine the occupied bandwidth.

### 10.2 Test conditions

Detector: Peak,  
 RBW: 1 – 5 % of OBW  
 VBW: 3 x RBW

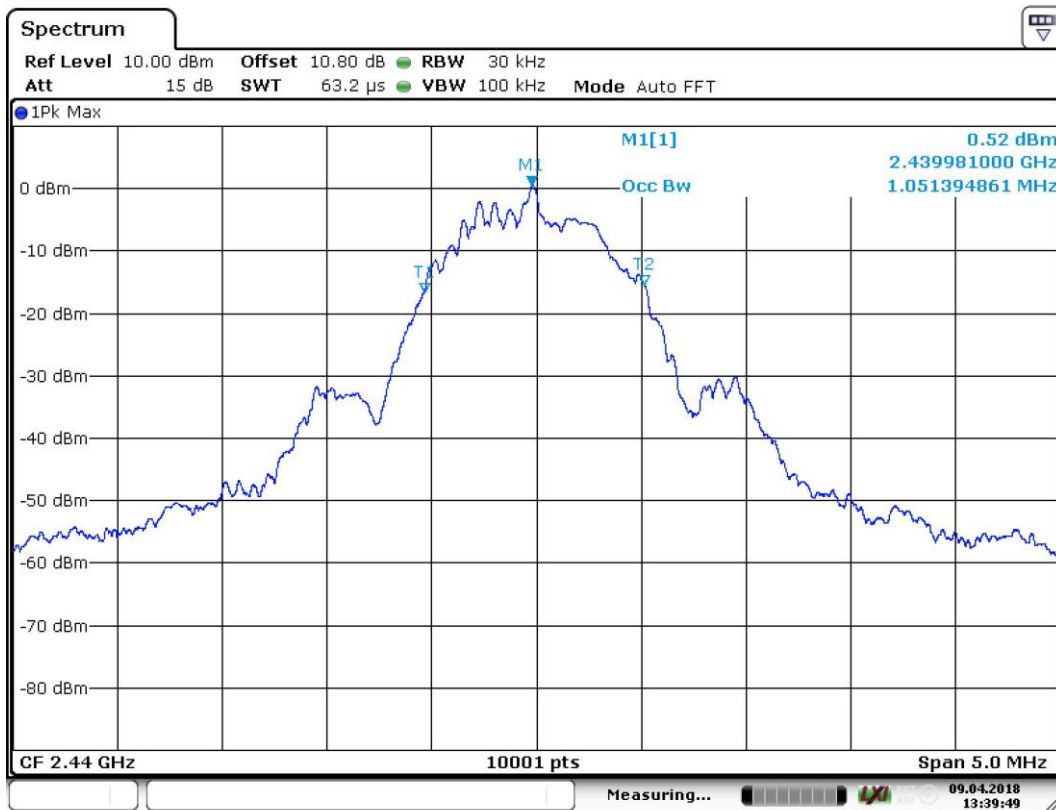
The EUT was set up in order to emit maximum disturbances.

### 10.3 Test results



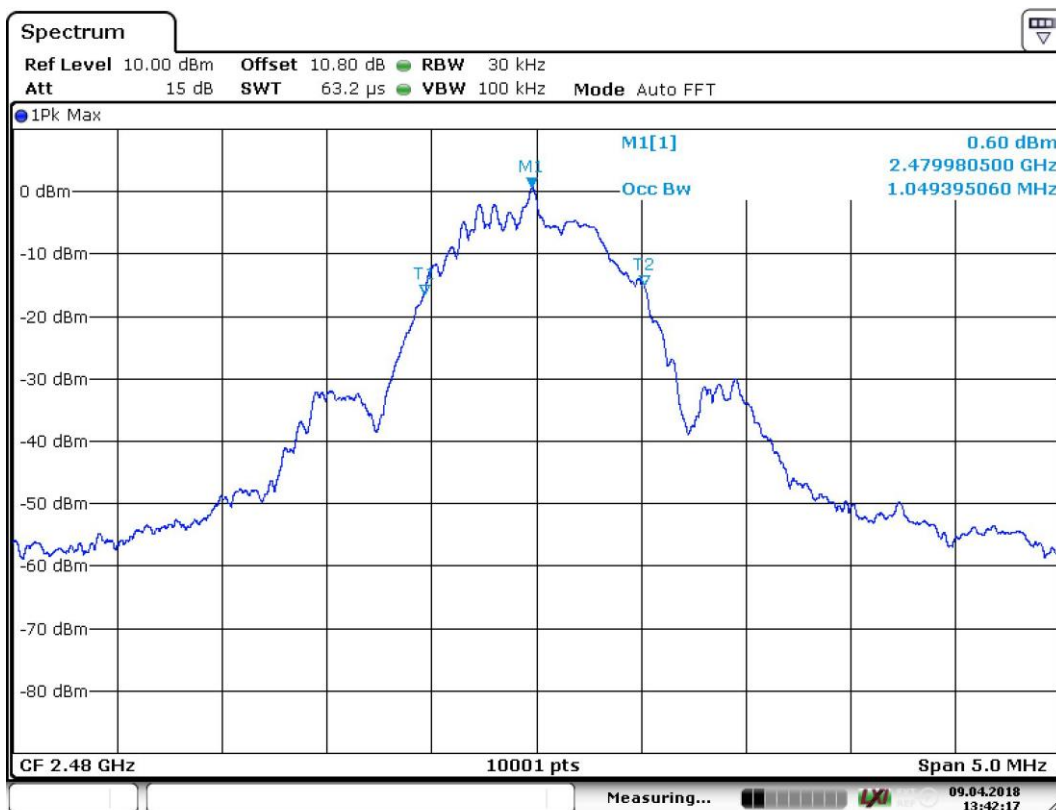
Date: 9.APR.2018 13:37:52

**Screenshot: 99 % bandwidth Measurement, low channel**



Date: 9.APR.2018 13:39:50

Screenshot: 99 % bandwidth Measurement, middle channel



Date: 9.APR.2018 13:42:18

Screenshot: 99 % bandwidth Measurement, high channel

**Test result**

| Channel<br>[MHz] | 99 % BW<br>[MHz] |
|------------------|------------------|
| 2402             | 1.05             |
| 2440             | 1.05             |
| 2480             | 1.05             |

## 11 PEAK POWER SPECTRAL DENSITY

|                      |                |                           |                 |
|----------------------|----------------|---------------------------|-----------------|
| <b>Date of test:</b> | 2018-03-26     | <b>Test location:</b>     | Wireless Center |
| <b>EUT number:</b>   | INTERTEK02     | <b>Ambient temp:</b>      | 22 °C           |
| <b>Tested by:</b>    | Robert Hietala | <b>Relative humidity:</b> | 19 %            |
| <b>Test result:</b>  | Pass           | <b>Margin:</b>            | > 10 dB         |

### 11.1 Test set-up and test procedure.

The test method is in accordance with ANSI C63.10-2013 section 11.10.2.

The EUT was connected to spectrum analyser via rf-cable and attenuator.

### 11.2 Test conditions

Detector: Peak,  
RBW: 10 kHz  
VBW: >3 x RBW  
Span: 3.75 MHz

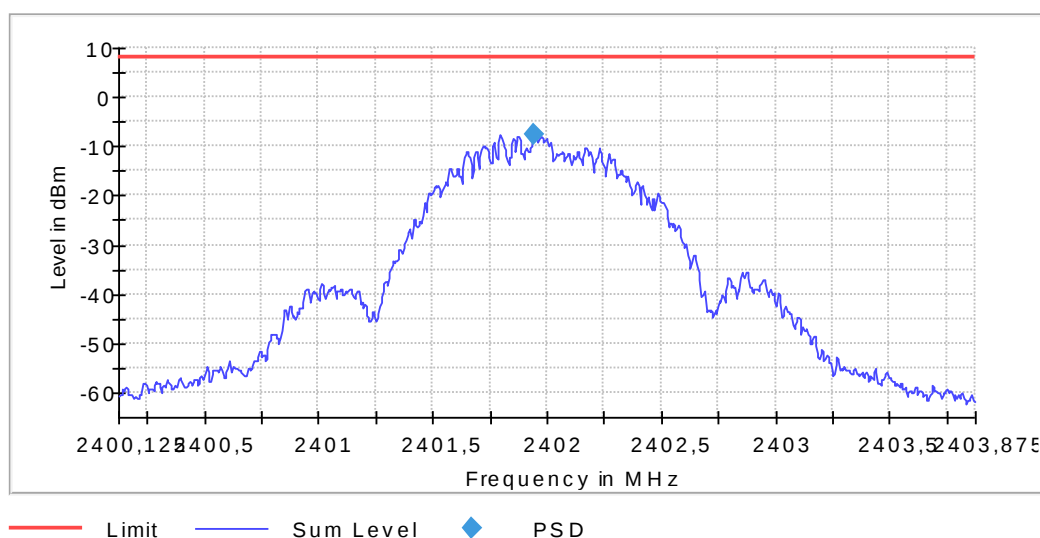
The EUT was set up in order to emit maximum disturbances.

### 11.3 Requirements

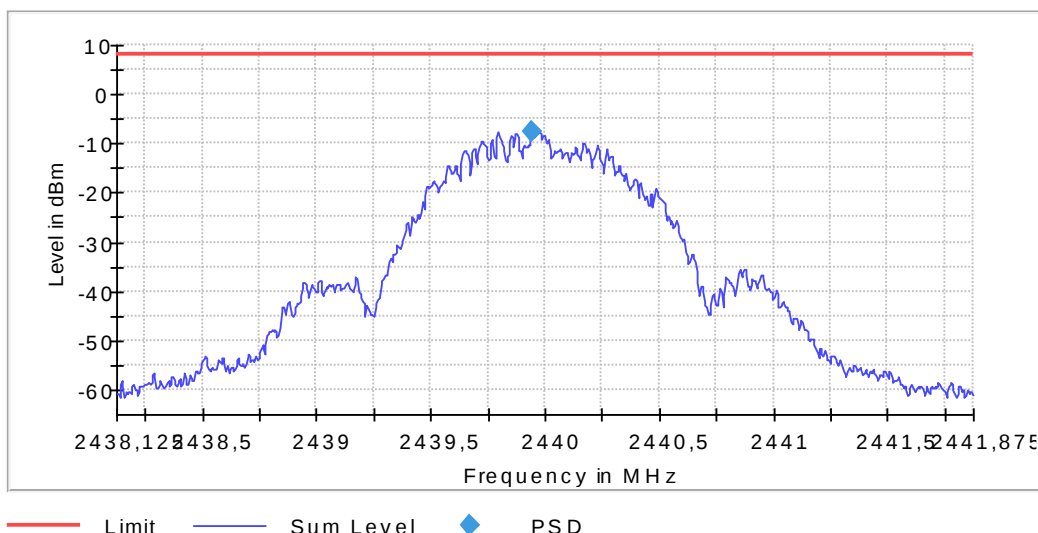
Reference: CFR 47§15.247(3), RSS-247 5.2(2)

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

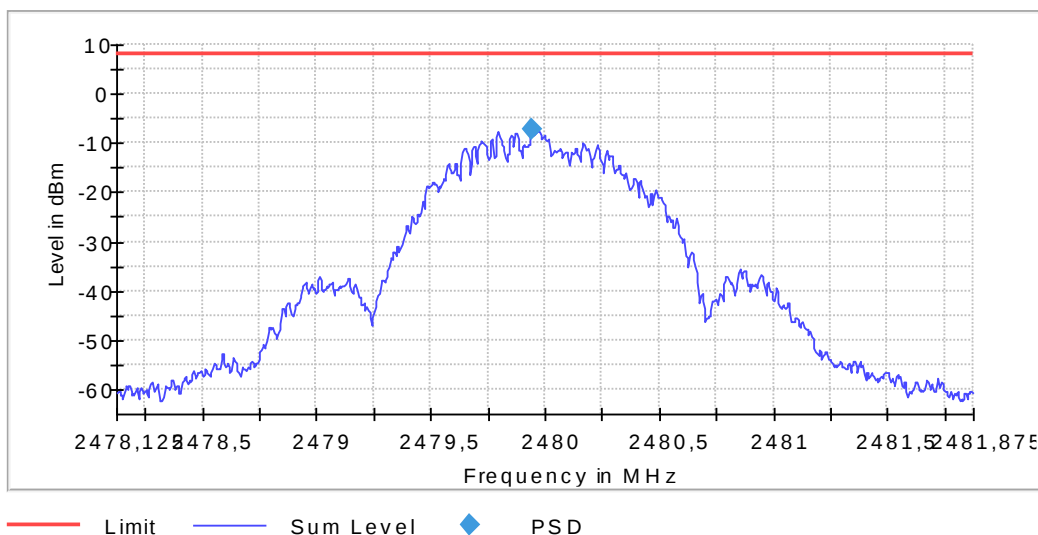
### 11.4 Test results



Screenshot: Peak power spectral density, low channel



Screenshot: Peak power spectral density, middle channel



Screenshot: Peak power spectral density, high channel

#### Test result

| Channel [MHz] | PSD [dBm/10kHz] |
|---------------|-----------------|
| 2402          | -7.5            |
| 2440          | -7.5            |
| 2480          | -7.4            |

## 12 TEST EQUIPMENT

### Conducted emission test site BUR 1

| Equipment type       | Manufacturer    | Model            | Inv. No. | Last Cal. date | Cal. interval |
|----------------------|-----------------|------------------|----------|----------------|---------------|
| Measurement software | Rohde & Schwarz | EMC32 - V9.26.01 | --       | --             | --            |
| Receiver             | Rohde & Schwarz | ESCI3            | 12741    | 07-2017        | 1 year        |
| AMN / LISN           | Rohde & Schwarz | ESH3-Z5          | 5875     | 07-2017        | 1 year        |

### Björkhallen

| Equipment type       | Manufacturer    | Model            | Inv. No. | Last Cal. date | Cal. interval |
|----------------------|-----------------|------------------|----------|----------------|---------------|
| Measurement software | Rohde & Schwarz | EMC32 - V9.12.10 | --       | --             | --            |
| Receiver             | Rohde & Schwarz | ESIB 26          | 32288    | 07-2017        | 1 year        |
| BiLog antenna        | Rohde & Schwarz | HL562            | 30711    | 01-2018        | 3 years       |

### Radiohallen

| Equipment type              | Manufacturer      | Model                                                 | Inv. No. | Last Cal. date | Cal. interval |
|-----------------------------|-------------------|-------------------------------------------------------|----------|----------------|---------------|
| Measurement software        | Rohde & Schwarz   | EMC32 - V10.35.1                                      | --       | --             | --            |
| Receiver                    | Rohde & Schwarz   | ESU 40                                                | 13178    | 01-2018        | 1 year        |
| Horn antenna                | EMCO              | 3115                                                  | 4628     | 11-2015        | 3 years       |
| Pre amplifier               | Sangus            | AFS6-00101400-23-10P -6-S   AFS44-12002400-32-10P -44 | 12335    | 07-2017        | 1 year        |
| Horn antenna                | EMCO              | 3160-08                                               | 30099    | 10-2016        | 3 years       |
| Horn antenna                | EMCO              | 3160-09                                               | 30101    | 10-2016        | 3 years       |
| Signal analyzer:            | Rohde & Schwarz   | FSV 30                                                | 32594    | 07-2017        | 1 year        |
| Signal generator:           | Rohde & Schwarz   | SMB100A                                               | 32592    | 07-2017        | 1 year        |
| 2,4 GHz band reject filter: | K&L MICROWAVE INC | 6N45-2450/T100-0/0                                    | 12389    | 03-2018        | 1 year        |
| 4 GHz high pass filter      | K&L MICROWAVE INC | 4410-X4500/18000-0/0                                  | 5133     | 08-2017        | 1 year        |
| Temperature chamber:        | Vötsch            | VC4018                                                | 12282    | 10-2017        | 1 year        |
| 20 dB Attenuator:           | Huber+Suhner      | 5920_N-50-010/199_NE                                  | 32697    | 04-2018        | 1 year        |
| Power splitter              | ET Industries     | D-0518-2                                              | 33756    | --             | --            |

### 13 MEASUREMENT UNCERTAINTY

Continuous conducted disturbances with AMN in the frequency range 9 kHz to 30 MHz  $\pm 3.7$  dB

Measurement uncertainty for radiated disturbance

|                                                            |              |
|------------------------------------------------------------|--------------|
| Uncertainty for the frequency range 30 to 1000 MHz at 3 m  | $\pm 5.1$ dB |
| Uncertainty for the frequency range 30 to 1000 MHz at 10 m | $\pm 5.0$ dB |
| Uncertainty for the frequency range 1.0 to 18 GHz at 3 m   | $\pm 4.7$ dB |
| Uncertainty for the frequency range 18 to 26 GHz at 3 m    | $\pm 4.8$ dB |
| Uncertainty for the frequency range 26 to 40 GHz at 3 m    | $\pm 5.7$ dB |

Measurement uncertainty is calculated in accordance with CISPR 16-4-2:2011.

The measurement uncertainty is given with a confidence of 95 %.

### 14 TEST SET UP AND EUT PHOTOS

EUT photos are in separate document 1713337STO-002 Annex 1.

Test set up photos are in separate document 1713337STO-002 Annex 2.