# RADIO TEST REPORT

## No. 1718488STO-002, Ed. 1

## RF Performance

### EQUIPMENT UNDER TEST

| | |
|---|---|
| Equipment: | Thermostat |
| Type/Model: | ViCare Radiator Thermostat Valve |
| Manufacturer: | Viessmann Werke GmbH & Co. |
| Tested by request of: | Danfoss A/S |

### 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 (2016): Subpart C: Intentional radiators. Section 15.247

47 CFR Part 15 (2016): Subpart B: Unintentional radiators

RSS-GEN Issue 4 (2014): General requirements of compliance of radio apparatus (2014)

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

For details, see clause 2 – 4.

Date of issue: 2018-03-19

Tested by: Per Larsson — Per Larsson

Approved by: Matti Virkki — Matti Virkki

**Revision History**

| Edition | Date | Description | Changes |
|---|---|---|---|
| 1 | 2018-03-19 | First release | |
| | | | |
| | | | |

**CONTENTS**

# 1 CLIENT INFORMATION

The EUT has been tested by request of

| | |
|---|---|
| Company | Danfoss A/S |
| | Nordborgvej 81 |
| | DK-6430 Nordborg |
| | DENMARK |
| Name of contact | Hans Schou Christensen |
| | Phone +45 74882114 |

# 2 EQUIPMENT UNDER TEST (EUT)

## 2.1 Identification of the EUT

| | |
|---|---|
| Equipment: | Thermostat |
| Type/Model: | ViCare Radiator Thermostat Valve |
| Brand name: | Viessmann Werke GmbH & Co. |
| Serial number: | No visible |
| Manufacturer: | Viessmann Werke GmbH & Co . |
| Transmitter frequency range: | 2405 – 2480 MHz |
| Receiver frequency range: | 2405 – 2480 MHz |
| Frequency agile or hopping: | ☐ Yes ☒ No |
| Antenna: | ☒ Internal antenna ☐ External antenna |
| Antenna connector: | ☒ None, internal antenna ☐ Yes, type xxx |
| Antenna gain: | 0 dBi |
| Rating RF output power: | 11 dBm |
| Type of modulation: | DSSS (Zigbee) |
| Temperature range: | ☐ Category I (General): -20°C to +55°C<br>☐ Category II (Portable equipment): -10°C to +55°C<br>☐ Category III (Equipment for normal indoor use): +5°C to +35°C<br>☒ Other: 0°C to +40°C |
| Transmitter stand by mode supported: | ☐ Yes ☒ No |

## 2.2 Additional information about the EUT

The EUT consists of the following units:

| Unit | Type | Serial number |
|---|---|---|
| Thermostat | ViCare Radiator Thermostat Valve | No visible |
| | | |

## 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 | HP Elite Book 850 | HP | HP5CG54451CL |
| USB to serial programming cable | Not known | Not known | Not known |
| USB Zigbee dongle | Not known | Not known | Not known |

## 2.4 Test signals and operation modes

Continuous signal

# 3 TEST SPECIFICATIONS

## 3.1 Standards

Requirements:

47 CFR Part 15 (2016): Subpart C: Intentional radiators. Section 15.247

47 CFR Part 15 (2016): Subpart B: Unintentional radiators

RSS-GEN Issue 4 (2014): General requirements of compliance of radio apparatus (2014).

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,
P.O. Box 1103
SE-164 22 Kista

Intertek Semko AB is a FCC listed test site with site registration number 90913
Intertek Semko AB is a FCC accredited conformity assessment body with designation number SE0002
Intertek Semko AB is an Industry Canada listed test facility with IC assigned code 2042G

Measurement chambers

| Measurement Chamber | Type of chamber | IC Site filing # |
|---|---|---|
| 5 m CHAMBER | Semi-anechoic 5 m | 2042G-3 |

## 4 TEST SUMMARY

The results in this report apply only to sample tested:

| Requirement | Description | Result |
|---|---|---|
| **FCC §15.203**<br>**RSS-GEN 8.3** | **Antenna requirement** | **PASS** |
| | The EUT has integrated non detachable antenna which can't be removed without breaking the EUT. | |
| **FCC §15.207, 15.107**<br>**RSS-GEN 8.8 table 3** | **Conducted continuous emission in the frequency range 150 kHz to 30 MHz, AC Power input port** | **NA** |
| | Battery operated equipment. | |
| **FCC §15.247 (b)(4)**<br>**RSS-247 5.4(4), 5.4(5)** | **Antenna gain** | **PASS** |
| | Antenna gain is less than 6 dBi. | |
| **FCC §15.247 (d), 15.209(a)**<br>**RSS-GEN 8.9**<br>**RSS-247 5.5** | **Radiated emission of electromagnetic fields in the frequency range 30 – 1000 MHz** | **PASS** |
| | The EUT complies with the limits.<br>The margin to the limit was more than 20 dB<br>See clause 6.4 – 6.5. | |
| **FCC §15.247(d), 15.209(a)**<br>**RSS-GEN 8.9**<br>**RSS-247 5.5** | **Radiated emission of electromagnetic fields in the frequency range above 1 GHz** | **PASS** |
| | The EUT complies with the limits.<br>The margin to the limit was at least 1.3 dB at 4811.0 MHz.<br>See clause 6.6 – 6.7.<br>The measured result is below the upper limit, but by a margin less than half of the uncertainty interval. It is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance is more probable than non-compliance. | |
| **FCC §15.247(a)(2)**<br>**RSS-GEN 6.6**<br>**RSS-247 5.2(1)** | **Occupied bandwidth** | **PASS** |
| | The EUT complies with the limits.<br>The margin to the limit was more than 1 MHz<br>See clause 8.4. | |
| **FCC §15.247(b)**<br>**RSS-247 5.4(4)** | **Conducted output power** | **PASS** |
| | The EUT complies with the limits.<br>The margin to the limit was more than 10 dB.<br>See clause 8.4. | |
| **FCC §15.247(e)**<br>**RSS-247 5.2(2)** | **Peak power spectral density** | **PASS** |
| | The EUT complies with the limits.<br>The margin to the limit was at least 9.9 dB at 2445 MHz. See clause 10.4. | |
| **FCC §15.247(e)**<br>**RSS-247 5.5** | **Radiated band edge** | **PASS** |
| | The EUT complies with the limits.<br>The margin to the limit was at least 1.4 dB at 2484 MHz.<br>See clause 5.4. | |
| **FCC §15.247(e)**<br>**RSS-247 5.5** | **Band edge** | **PASS** |
| | The EUT complies with the limits.<br>The margin to the limit was at least 18.8 dB at 2402 MHz.<br>See clause 7.4. | |

## 5 RADIATED BAND EDGE

| | | | |
|---|---|---|---|
| **Date of test:** | 2017-12-05 | **Test location:** | 5mSAC |
| **EUT Serial:** | V60 | **Ambient temp:** | 21 °C |
| **Tested by:** | PLA | **Relative humidity:** | 35 % |
| **Test result:** | Pass | **Margin:** | 1.4 dB |

### 5.1 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.

The EUT was placed on an insulating support 1.5 m above the turntable which is part of the reference ground plane.
Overview sweeps were performed with the measurement receiver in max-hold mode and the peak and average detector was activated.

EUT was evaluated in three orthogonal orientations.

### 5.2 Test conditions

| | | | |
|---|---|---|---|
| **Test set-up:** | **1 GHz – 26.5 GHz** | | |
| Test receiver set-up: | | | |
| Preview test: | Peak, | RBW 1 MHz | VBW 3 MHz |
| Final test: | Peak, | RBW 1 MHz | VBW 3 MHz |
| | Average | Peak value + 20 x LOG (Duty cycle) / RBW 1 | |
| MHz. VBW 3 MHz | | | |
| Measuring distance: | 3 m | | |
| Measuring angle: | 0 – 359° | | |
| Antenna | | | |
| Height above ground plane: | 1 – 4 m | | |
| Polarisation: | Vertical and Horizontal | | |
| Type: | Horn | | |
| Antenna tilt: | Activated | | |

### 5.3 Requirement

Outside the restricted bands:
Reference: CFR 47 §15.247(d), RSS-247 5.5,

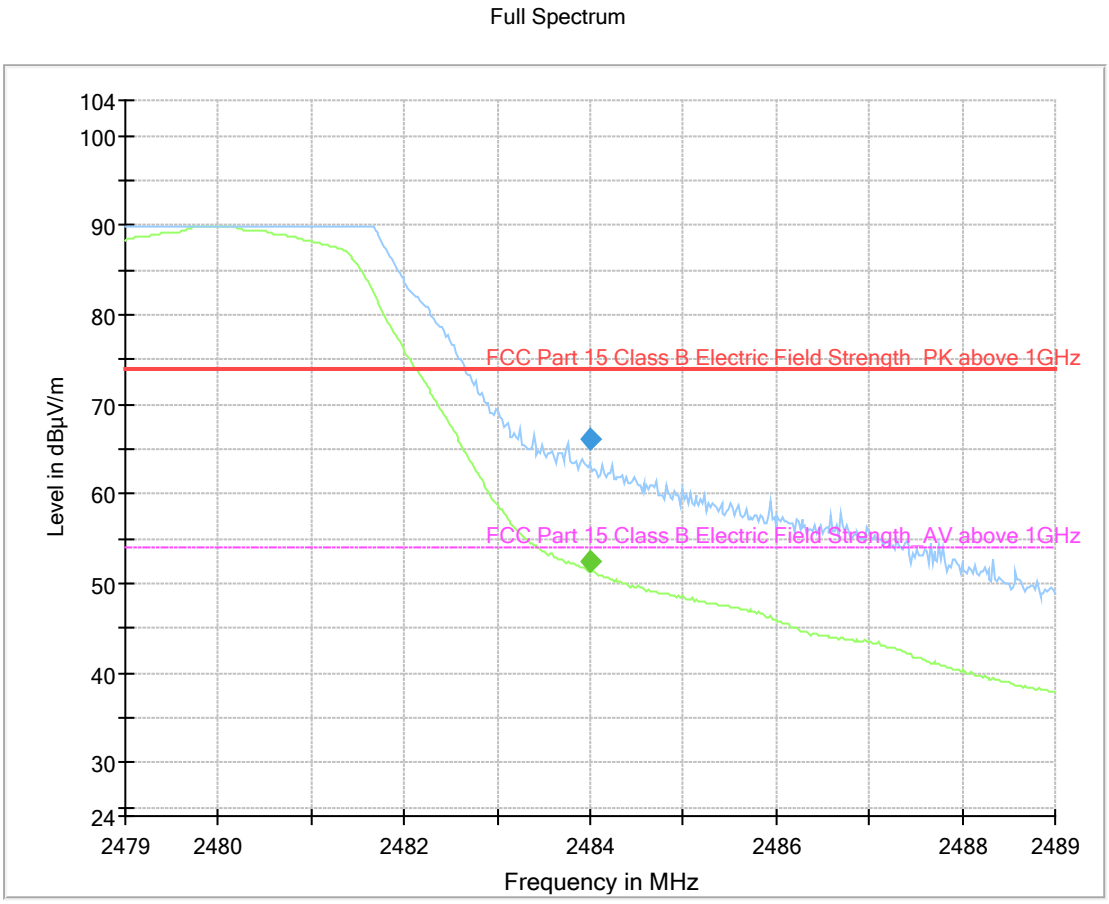
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either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

Within restricted bands:
Reference: CFR 47 §15.209, 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 |

## 5.4 Test results




**Upper band edge sweep**

**Field strength of band edge, high channel**

| Frequency [MHz] | Level [dBµV/m] | Limit [dBµV/m] | Detector | EUT Orientation | Polarization H/V | Margin [dB] |
|---|---|---|---|---|---|---|
| 2484.0 | 52.6 | 54.0 | Average | Vertical | H | 1.4* |
| 2484.0 | 66.1 | 73.9 | Peak | Vertical | H | 7.8 |
| | | | | | | |

* The measured result is below the upper limit, but by a margin less than half of the uncertainty interval. It is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance is more probable than non-compliance.

## 6 RADIATED RF EMISSION IN THE FREQUENCY-RANGE 30 MHZ TO 26.5 GHZ

| | | | |
|---|---|---|---|
| **Date of test:** | 2017-12-05 | **Test location:** | 5mSAC |
| **EUT Serial:** | V60 | **Ambient temp:** | 21 °C |
| **Tested by:** | PLA | **Relative humidity:** | 35 % |
| **Test result:** | Pass | **Margin:** | 1.3 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.
The EUT was placed on an insulating support 0.8 and 1.5 m above the turntable which is part of the reference ground plane.
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.
Pre scan was made in three orthogonal EUT orientations.
Results from vertical orientation are presented below, which was found to give worst spurious emissions.

### 6.2 Test conditions

**Test set-up:** **30 MHz to 1000 MHz**

| | | | |
|---|---|---|---|
| Test receiver set-up: | | | |
| Preview test: | Peak, | RBW 120 kHz | VBW 1 MHz |
| Final test: | Quasi-Peak, | RBW 120 kHz | VBW 1 MHz |
| EUT height above ground plane: | 0.8 m | | |
| Measuring distance: | 3 m | | |
| Measuring angle: | 0 – 359° | | |
| Antenna | | | |
| Height above ground plane: | 1 – 4 m | | |
| Polarisation: | Vertical and Horizontal | | |
| Type: | Bilog | | |

**Test set-up:** **1 GHz – 26.5 GHz**

| | | | |
|---|---|---|---|
| Test receiver set-up: | | | |
| Preview test: | Peak, | RBW 1 MHz | VBW 3 MHz |
| | Average, | RBW 1 MHz | VBW 3 MHz |
| Final test: | Peak, | RBW 1 MHz | VBW 3 MHz |
| | Average | Peak value + 20 x LOG (Duty cycle) / RBW 1 | |
| MHz VBW 3 MHz | | | |
| EUT height above ground plane: | 1.5 m | | |
| Measuring distance: | 3 m | | |
| Measuring angle: | 0 – 359° | | |
| Antenna | | | |
| Height above ground plane: | 1 – 4 m | | |
| Polarisation: | Vertical and Horizontal | | |
| Type: | Horn | | |
| Antenna tilt: | Activated | | |

### 6.3 Requirements

Within restricted bands and receive mode:

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

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

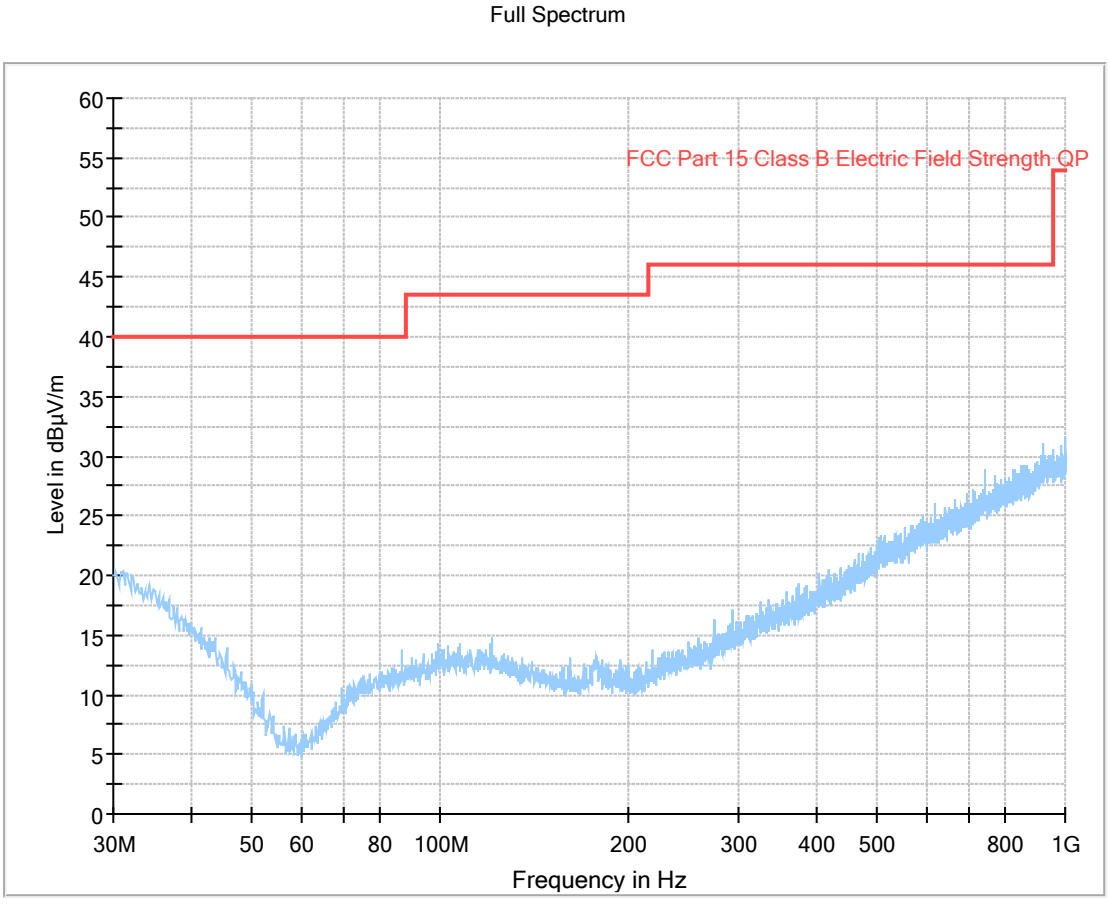
| Frequency range [MHz] | Field strength at 3 m (dBµV/m) | Field strength at 10 m (dBµV/m) | Detector (dBµV/m) |
|---|---|---|---|
| 30 – 88 | 40.0 | 29.5 | Quasi Peak |
| 88 – 216 | 43.5 | 33.0 | Quasi Peak |
| 216 – 960 | 46.0 | 35.5 | Quasi Peak |
| 960 – 1000 | 54.0 | 43.5 | Quasi Peak |
| Above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

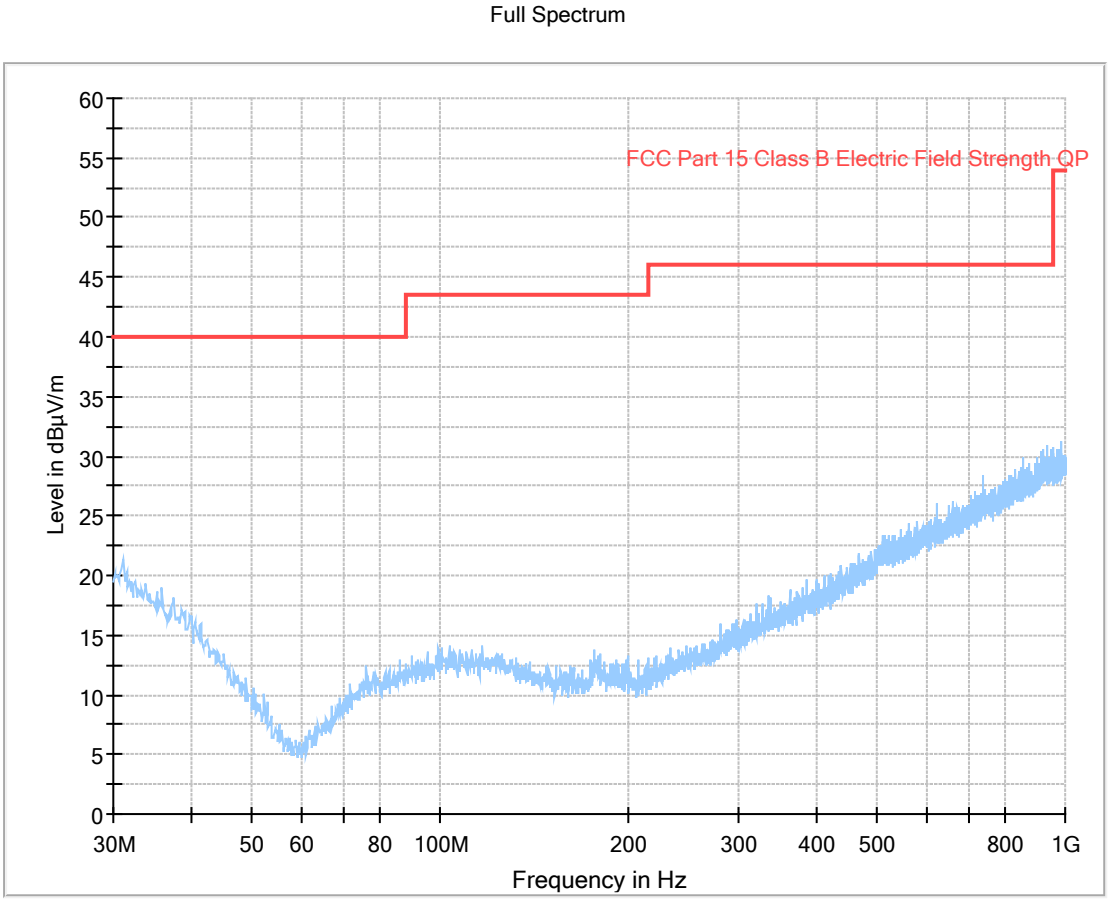
Outside the restricted bands:
Reference: CFR 47 §15.247(d), RSS-247 5.5,

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

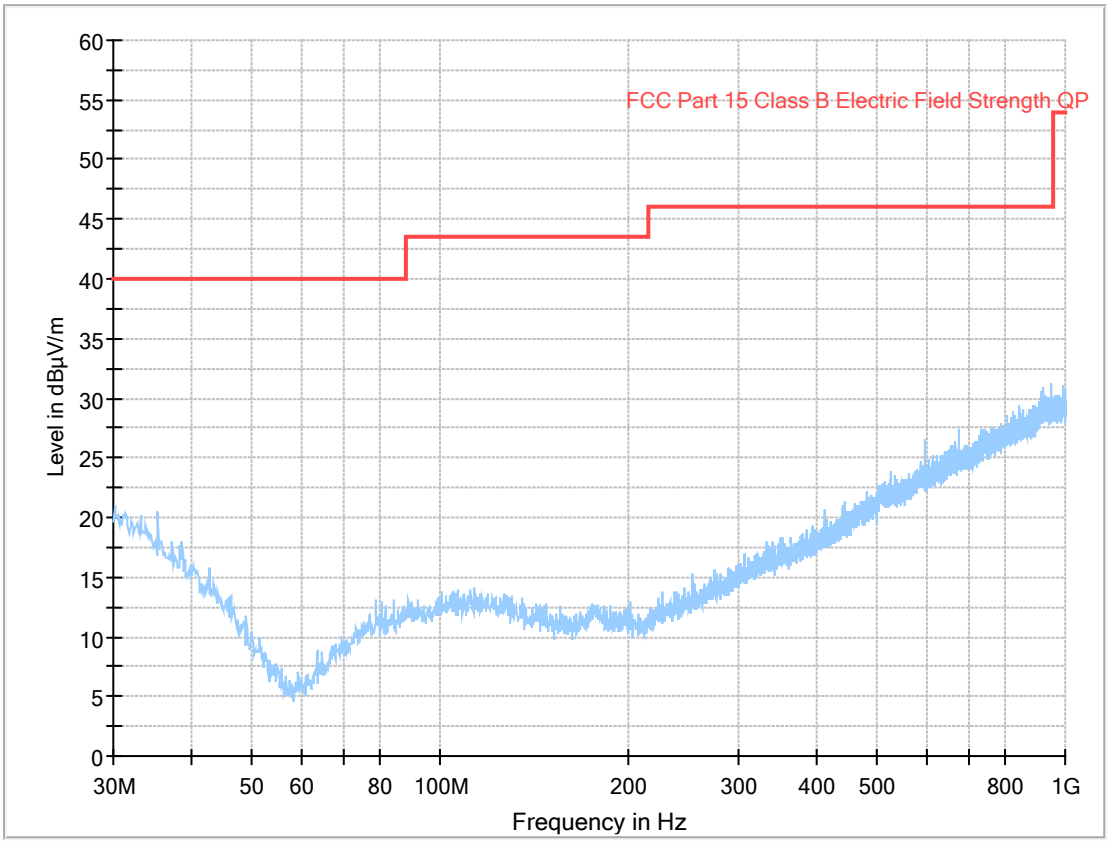



**Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. TX low channel**




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

Full Spectrum



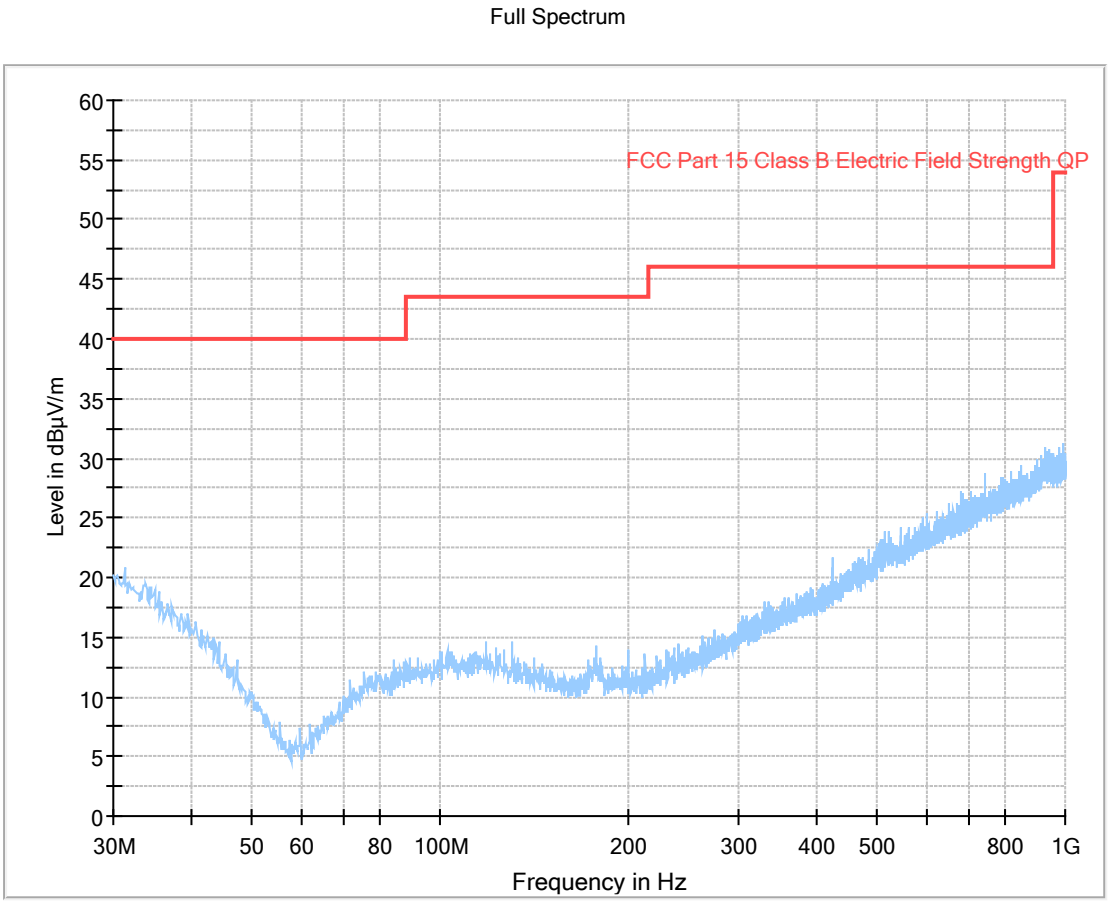

**Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. TX mid channel**

**Measurement results, Quasi Peak**

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

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



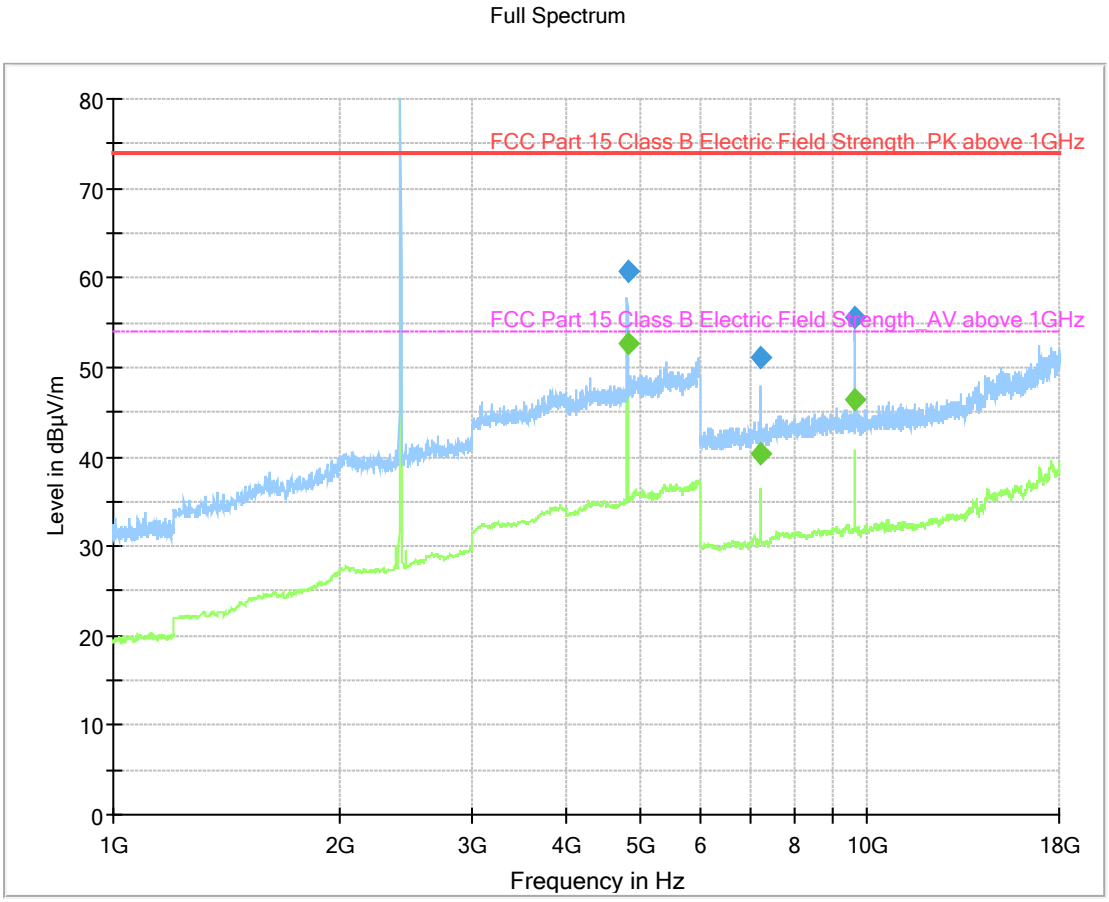

**Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. RX mid channel.**

### Measurement results, Quasi Peak

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

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

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




**Diagram, Peak overview sweep, 1– 18 GHz at 3 m distance. TX low channel.**

**Measurement results, Peak, TX low channel**

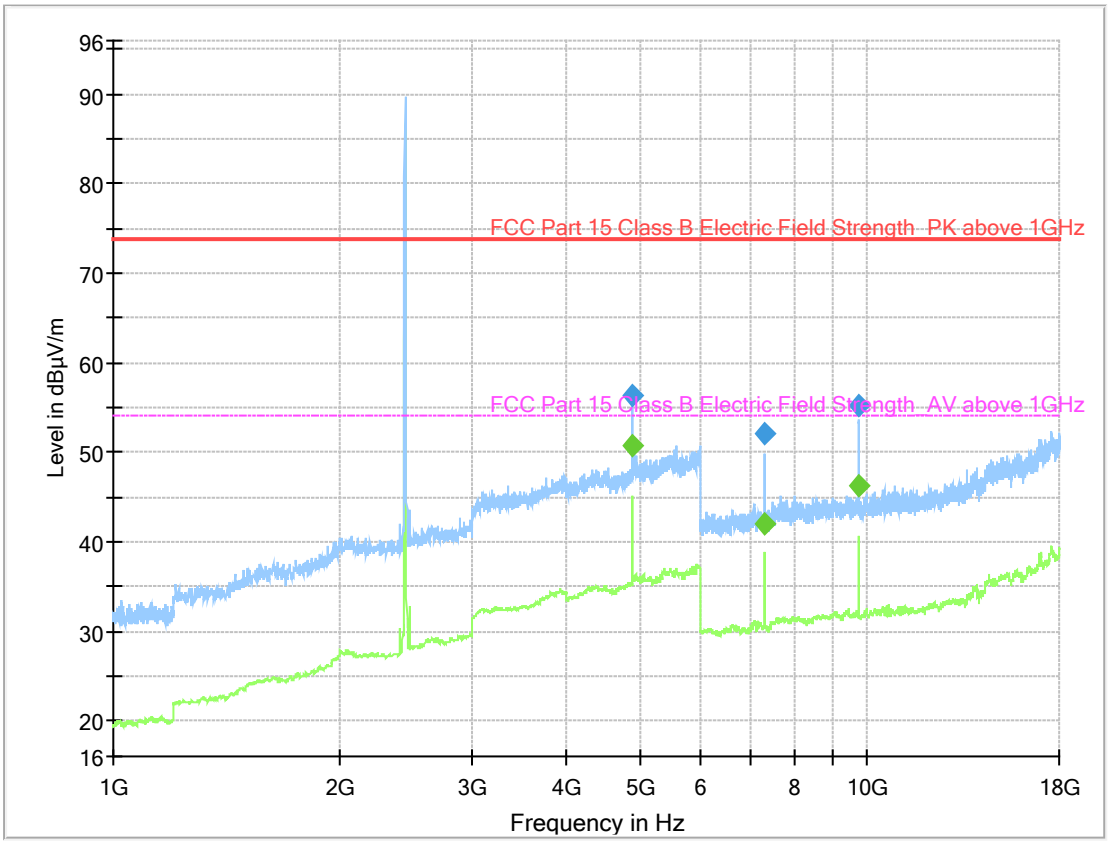
| Frequency [MHz] | Level [dBµV/m] | Limit [dBµV/m] | Polarization H/V | Margin [dB] |
|---|---|---|---|---|
| 4811.0 | 60.7 | 73.9 | V | 13.2 |
| 7216.6 | 51.0 | 73.9 | V | 22.9 |
| 9618.0 | 55.7 | 73.9 | V | 18.2 |
| | | | | |

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

| Frequency [MHz] | Level [dBµV/m] | Limit [dBµV/m] | Polarization H/V | Margin [dB] |
|---|---|---|---|---|
| 4811.0 | 52.7 | 54.0 | V | 1.3* |
| 7216.6 | 40.3 | 54.0 | V | 13.7 |
| 9618.0 | 46.5 | 54.0 | V | 7.6 |
| | | | | |

Note*:The measured result is below the upper limit, but by a margin less than half of the uncertainty interval. It is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance is more probable than non-compliance.

Full Spectrum




**Diagram, Peak overview sweep, 1– 18 GHz at 3 m distance. TX mid channel.**

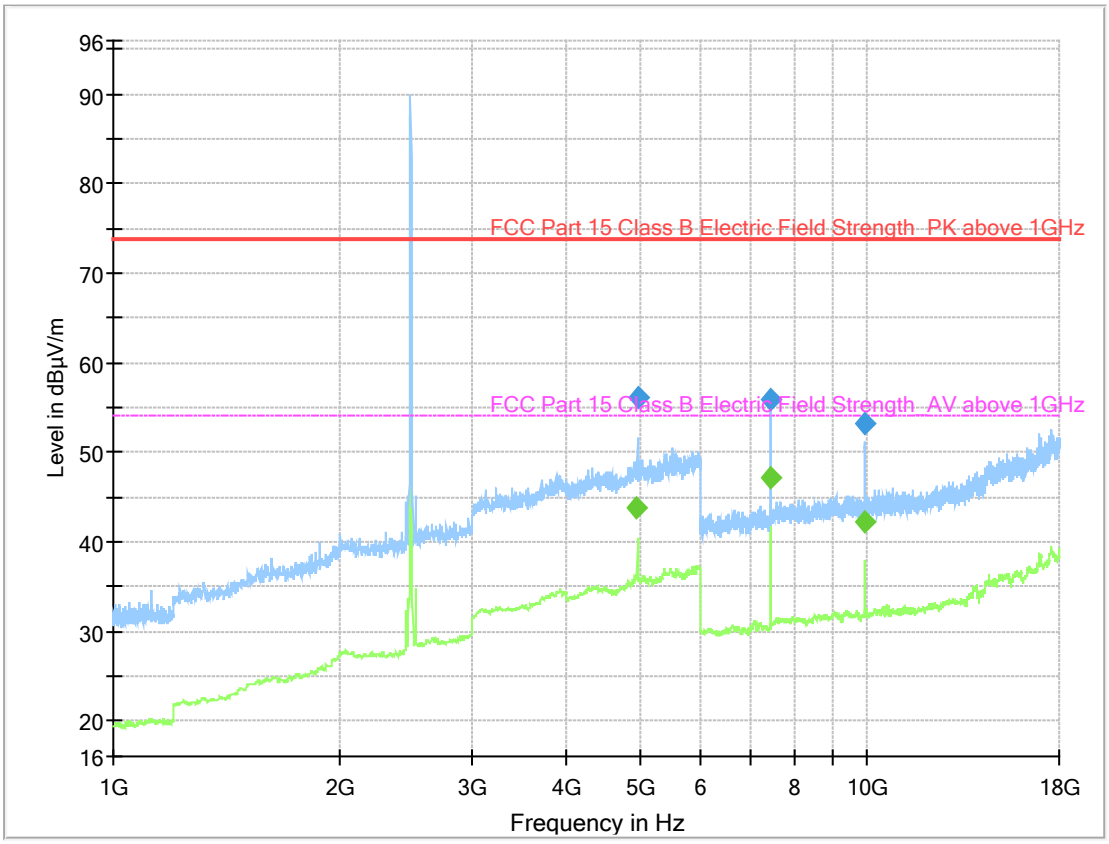
**Measurement results, Peak, TX middle channel**

| Frequency [MHz] | Level [dBµV/m] | Limit [dBµV/m] | Polarization H/V | Margin [dB] |
|---|---|---|---|---|
| 4881.2 | 56.3 | 73.9 | V | 17.6 |
| 7321.6 | 52.1 | 73.9 | V | 21.8 |
| 9757.7 | 55.2 | 73.9 | V | 18.8 |
| | | | | |

**Measurement results, Average, TX mid channel**

| Frequency [MHz] | Level [dBµV/m] | Limit [dBµV/m] | Polarization H/V | Margin [dB] |
|---|---|---|---|---|
| 4879.0 | 50.8 | 54.0 | V | 3.2 |
| 7321.6 | 41.9 | 54.0 | V | 12.1 |
| | | | | |

Full Spectrum




**Diagram, Peak overview sweep, 1– 18 GHz at 3 m distance. TX high channel.**

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

| Frequency [MHz] | Level [dBµV/m] | Limit [dBµV/m] | Polarization H/V | Margin [dB] |
|---|---|---|---|---|
| 4961.1 | 56.0 | 73.9 | V | 17.9 |
| 7441.7 | 55.8 | 73.9 | V | 18.1 |
| 9917.8 | 53.2 | 73.9 | V | 20.7 |
| | | | | |

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

| Frequency [MHz] | Level [dBµV/m] | Limit [dBµV/m] | Polarization H/V | Margin [dB] |
|---|---|---|---|---|
| 4958.9 | 43.7 | 54.0 | V | 10.3 |
| 7438.5 | 47.2 | 54.0 | V | 6.8 |
| 9917.8 | 42.1 | 54.0 | V | 11.9 |
| | | | | |

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

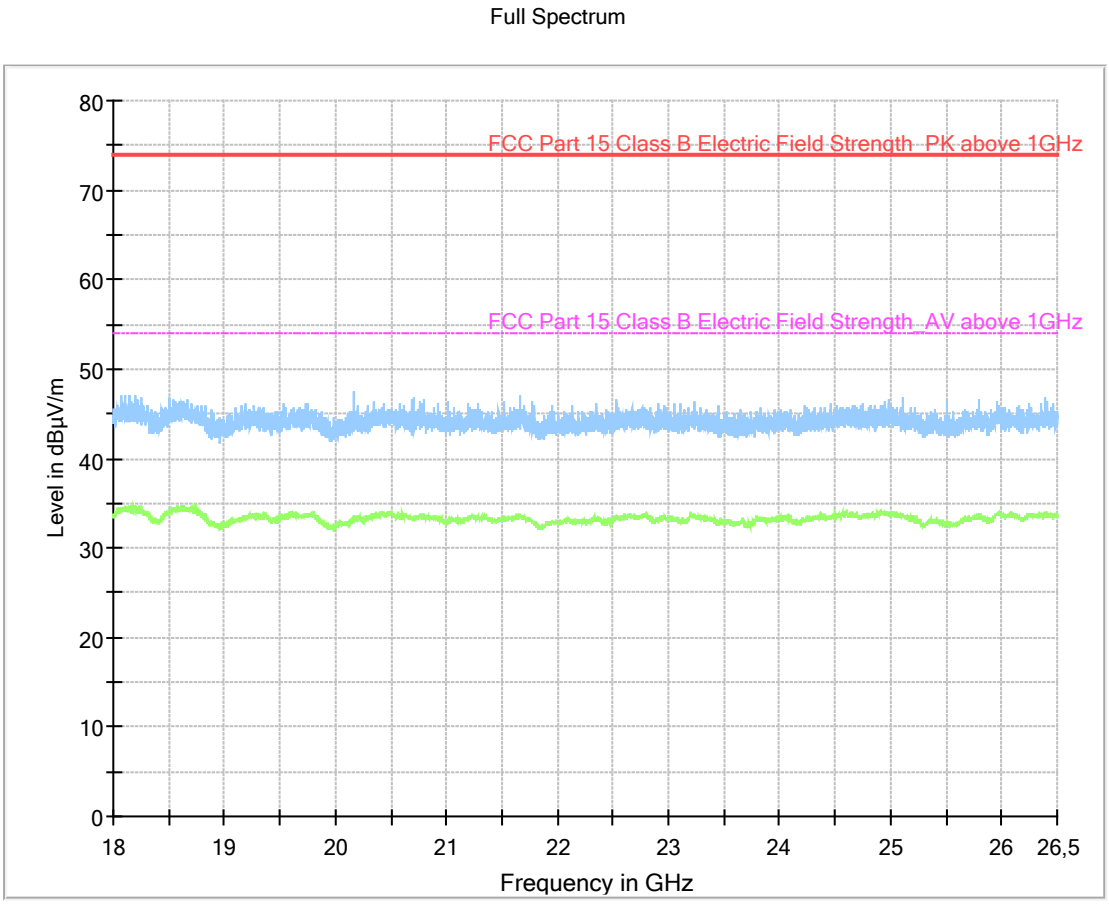



**Diagram. Peak overview sweep. 18– 26.5 GHz at 3 m distance. TX low channel.**

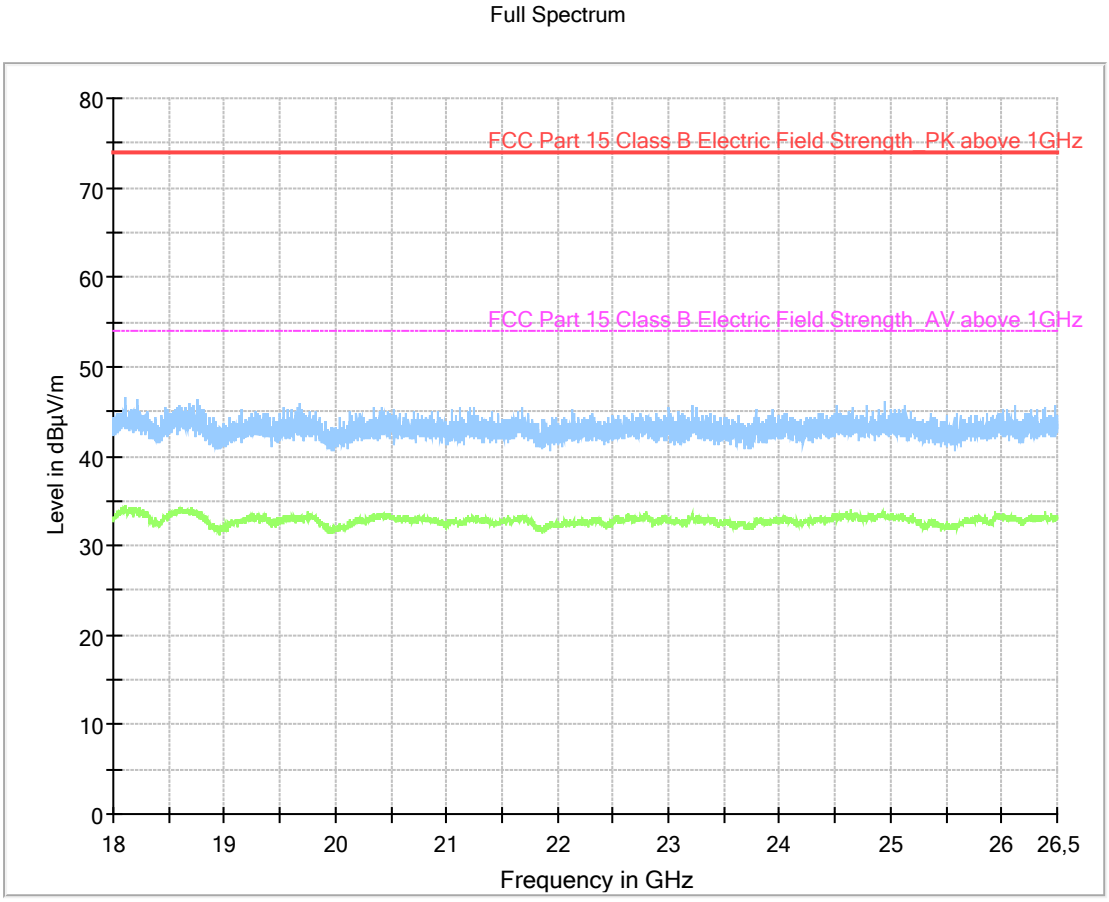



**Diagram. Peak overview sweep. 18– 26.5 GHz at 3 m distance. TX mid channel.**

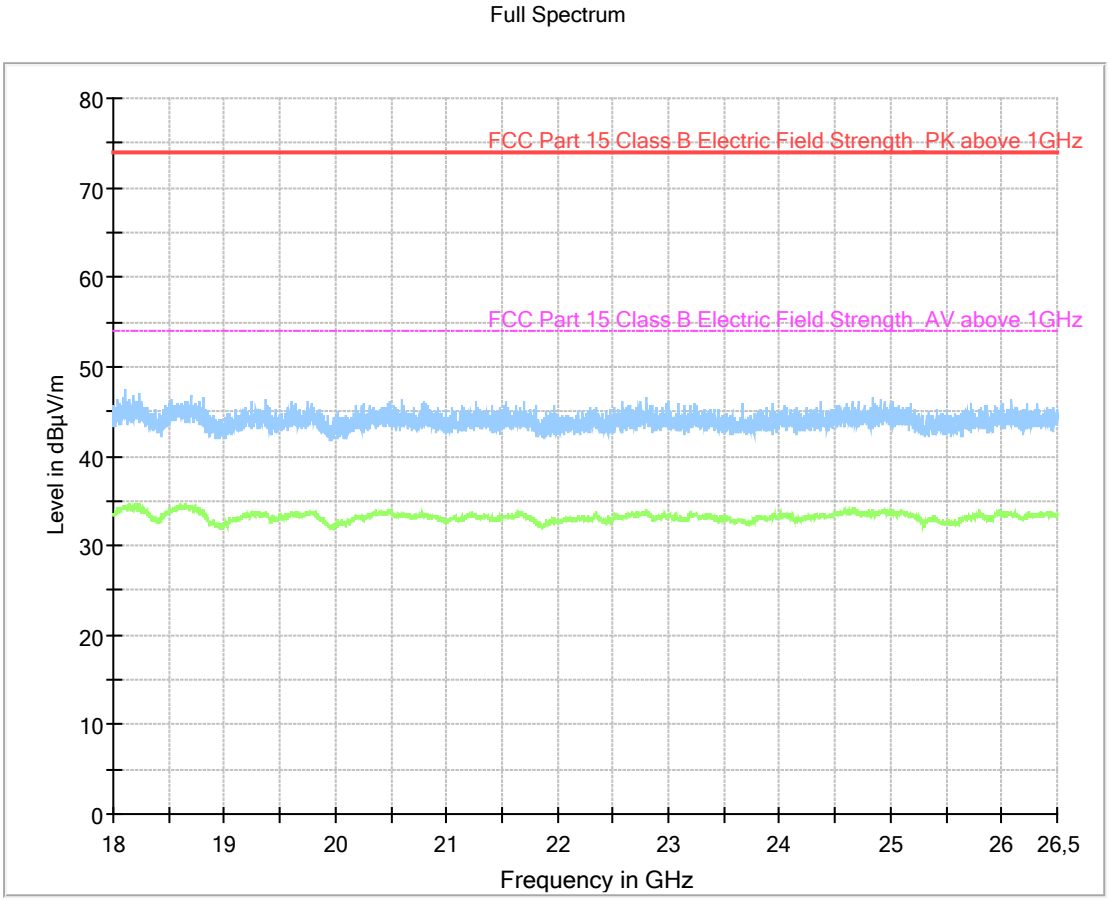



**Diagram. Peak overview sweep. 18– 26.5 GHz at 3 m distance. TX high channel.**

## 6.7 Test results 1 GHz – 18 GHz. RX

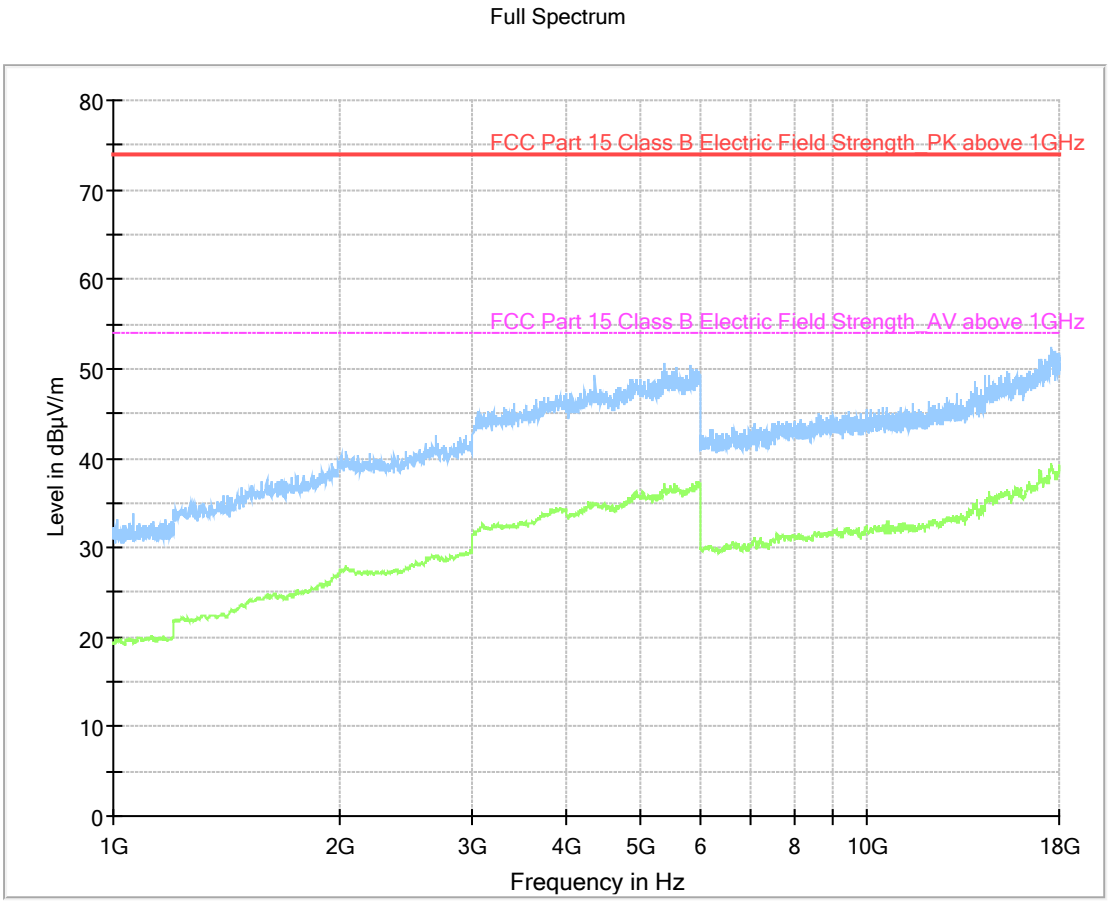



**Diagram. Peak overview sweep. 1– 18 GHz at 3 m distance. RX mid channel.**

No emissions are found above noise floor.

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

# 7 CONDUCTED BAND EDGE MEASUREMENT

| | | | |
|---|---|---|---|
| **Date of test:** | 2018-01-15 | **Test location:** | Wireless center |
| **EUT Serial:** | V56 | **Ambient temp:** | 21 °C |
| **Tested by:** | PLA | **Relative humidity:** | 35 % |
| **Test result:** | Pass | **Margin:** | >10 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

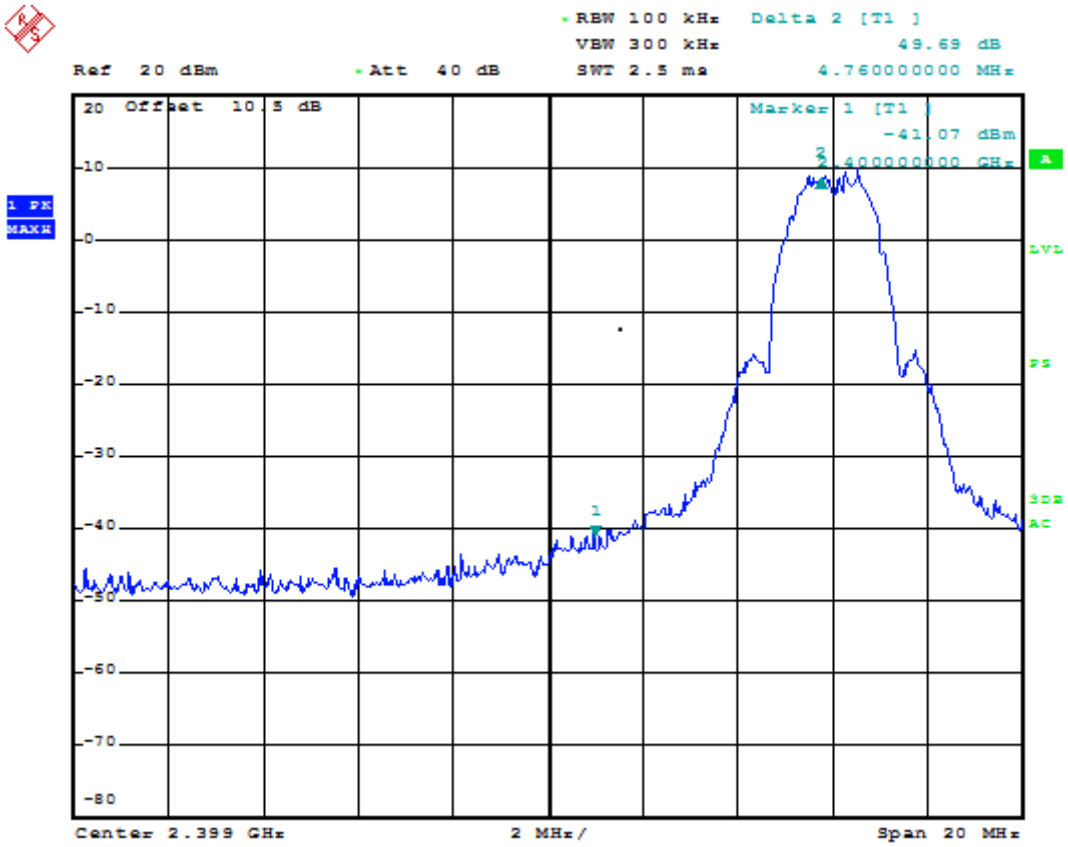
Detector: Peak,
RBW: 100 kHz
VBW: 300 kHz
Span: 20 MHz

## 7.3 Requirement

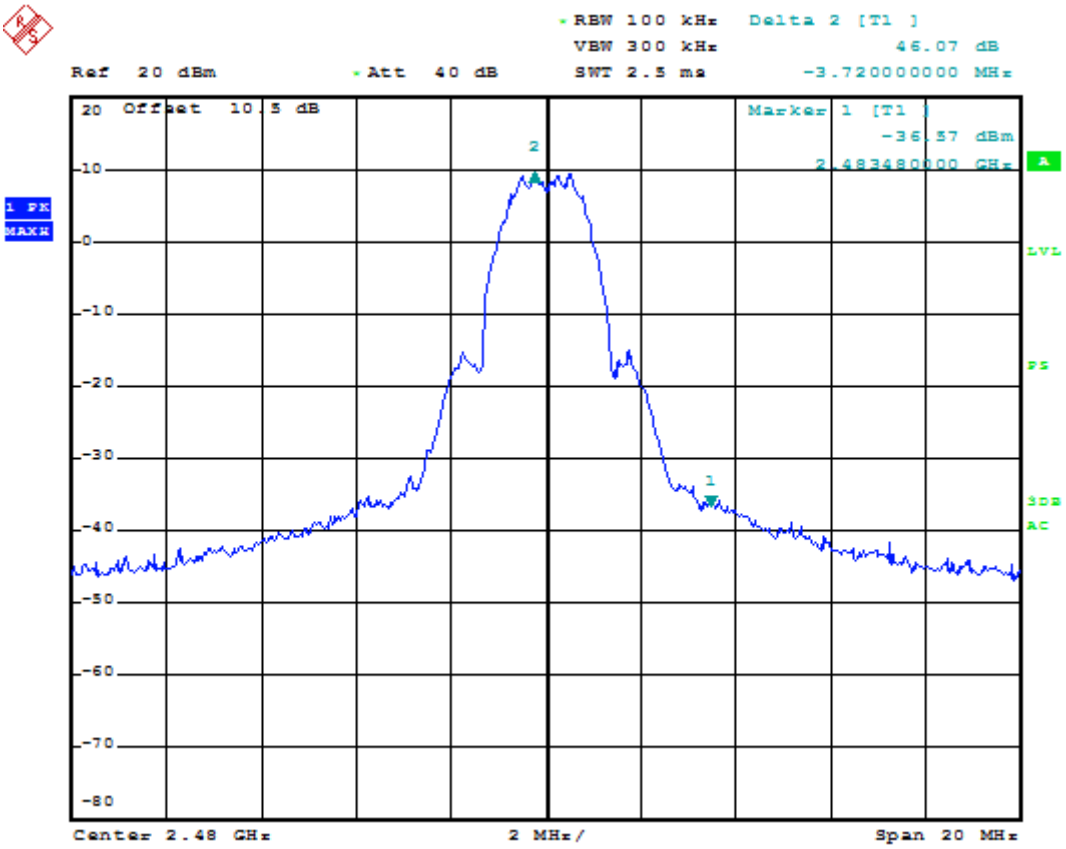
Reference: CFR 47 §15.247(d), RSS-247 5.5,

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 30 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, low channel channel**




**Screenshot: Upper band edge sweep, high channel**

**Test results**

| Band edge | Delta [dBc] | Limit [dBc] | Margin [dB] |
|---|---|---|---|
| Lower | 46,7 | 30.0 | 16,7 |
| Upper | 46,1 | 30.0 | 16,1 |

## 8 MAXIMUM CONDUCTED OUTPUT POWER

| | | | |
|---|---|---|---|
| **Date of test:** | 2018-01-15 | **Test location:** | Wireless center |
| **EUT Serial:** | V56 | **Ambient temp:** | 21 °C |
| **Tested by:** | PLA | **Relative humidity:** | 35 % |
| **Test result:** | Pass | **Margin:** | >10 dB |

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

The test method is in accordance with ANSI C63.10-2013 section 11.9.2.

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

**Test result**

| Channel [MHz] | Output power [dBm] |
|---|---|
| 2405 | 11.2 |
| 2445 | 11 |
| 2480 | 10.8 |

# 9 OCCUPIED 6 DB BANDWIDTH

| | | | |
|---|---|---|---|
| **Date of test:** | 2018-01-15 | **Test location:** | Wireless center |
| **EUT Serial:** | V56 | **Ambient temp:** | 21 °C |
| **Tested by:** | PLA | **Relative humidity:** | 35 % |
| **Test result:** | Pass | **Margin:** | >1 MHz |

## 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

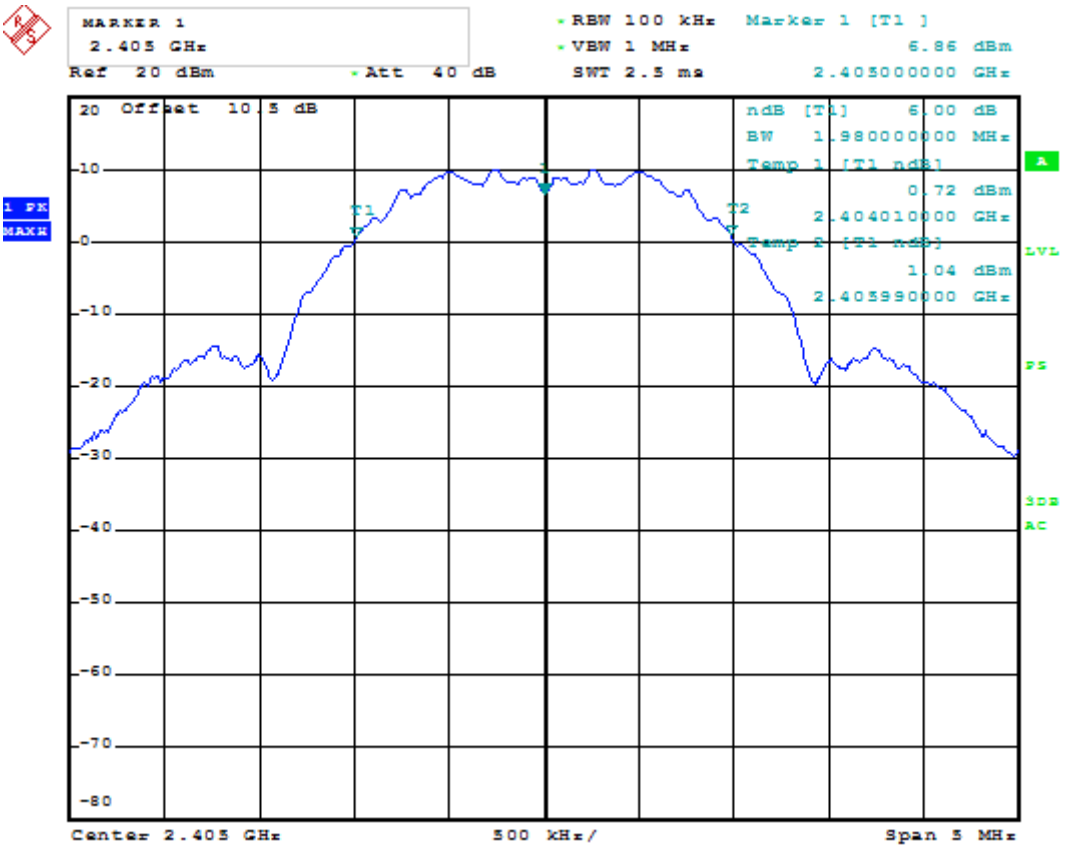
Detector: Peak.
RBW: 100 kHz
VBW: 3 x RBW
Span: >1.5 x OBW

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

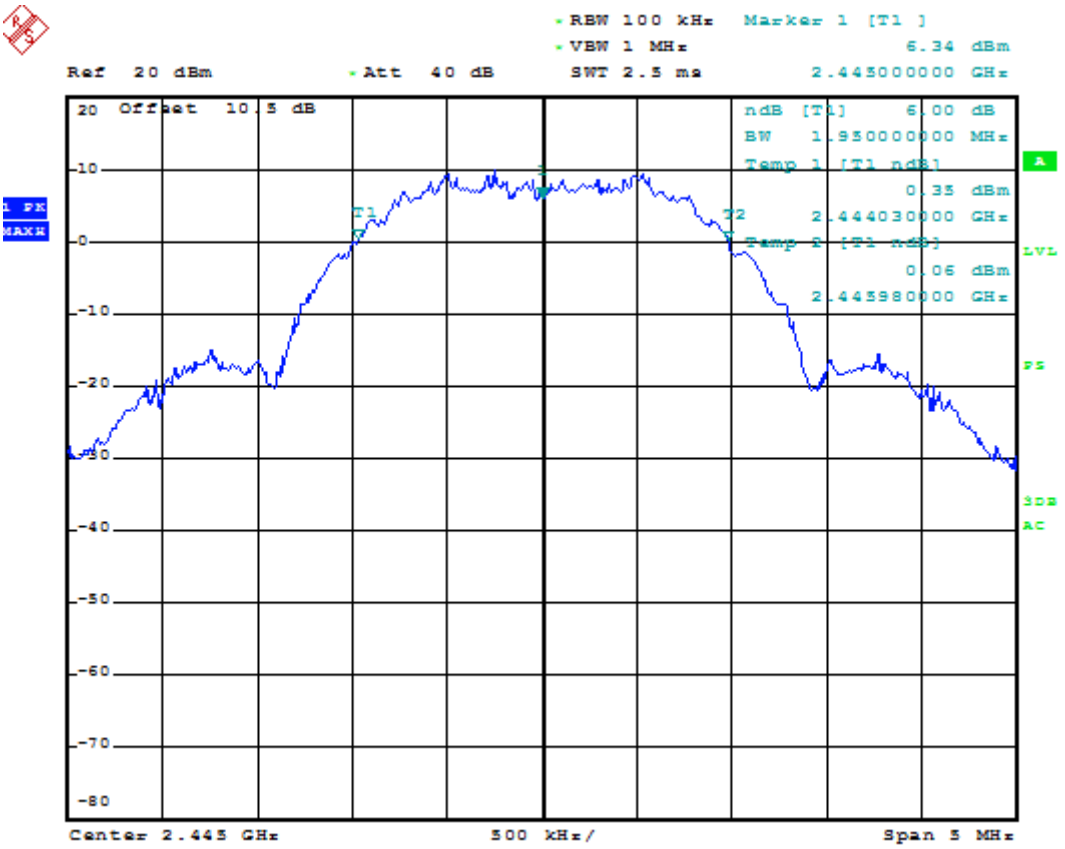
## 9.3 Requirements

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

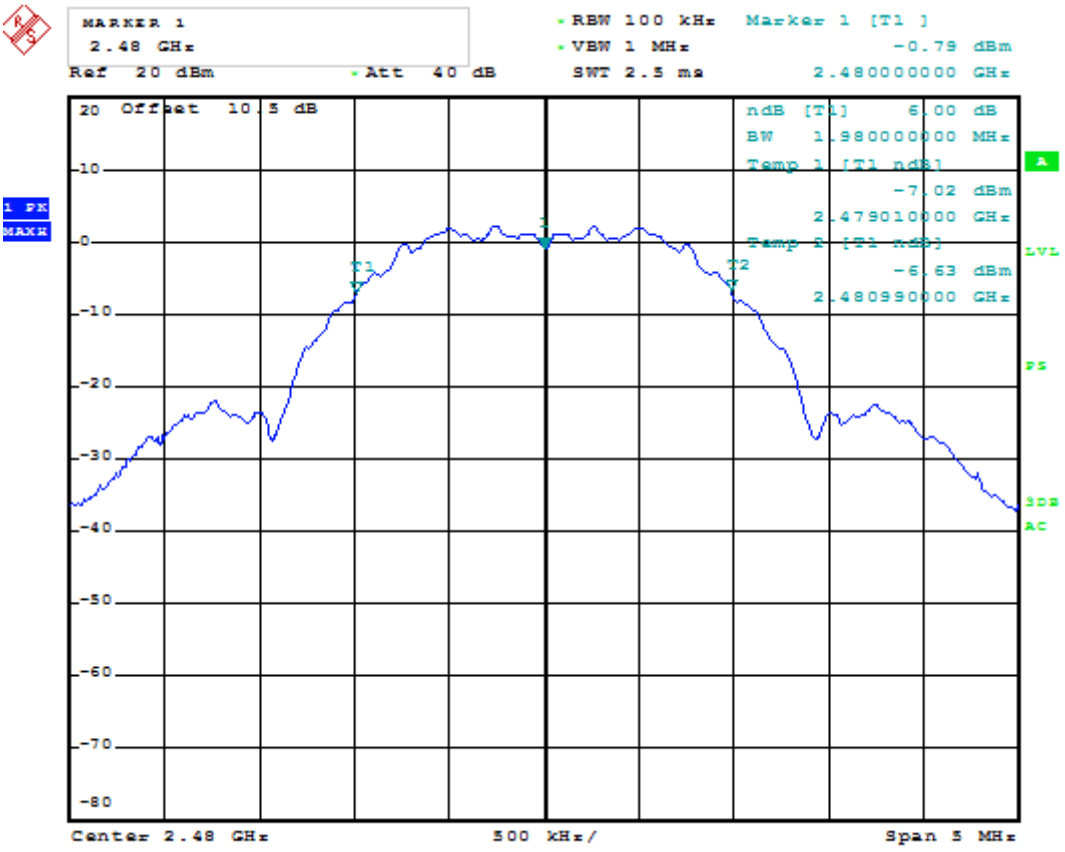
## 9.4 Test results




**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 [MHz] |
|---|---|
| 2405 | 1.98 |
| 2445 | 1.95 |
| 2480 | 1.98 |

## 10 99 % BANDWIDTH

| | | | |
|---|---|---|---|
| **Date of test:** | 2018-01-15 | **Test location:** | Wireless center |
| **EUT Serial:** | V56 | **Ambient temp:** | 21 °C |
| **Tested by:** | PLA | **Relative humidity:** | 35 % |
| **Test result:** | Pass | **Margin:** | N/A |

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

The test method is in accordance with RSS-GEN section 6.6.

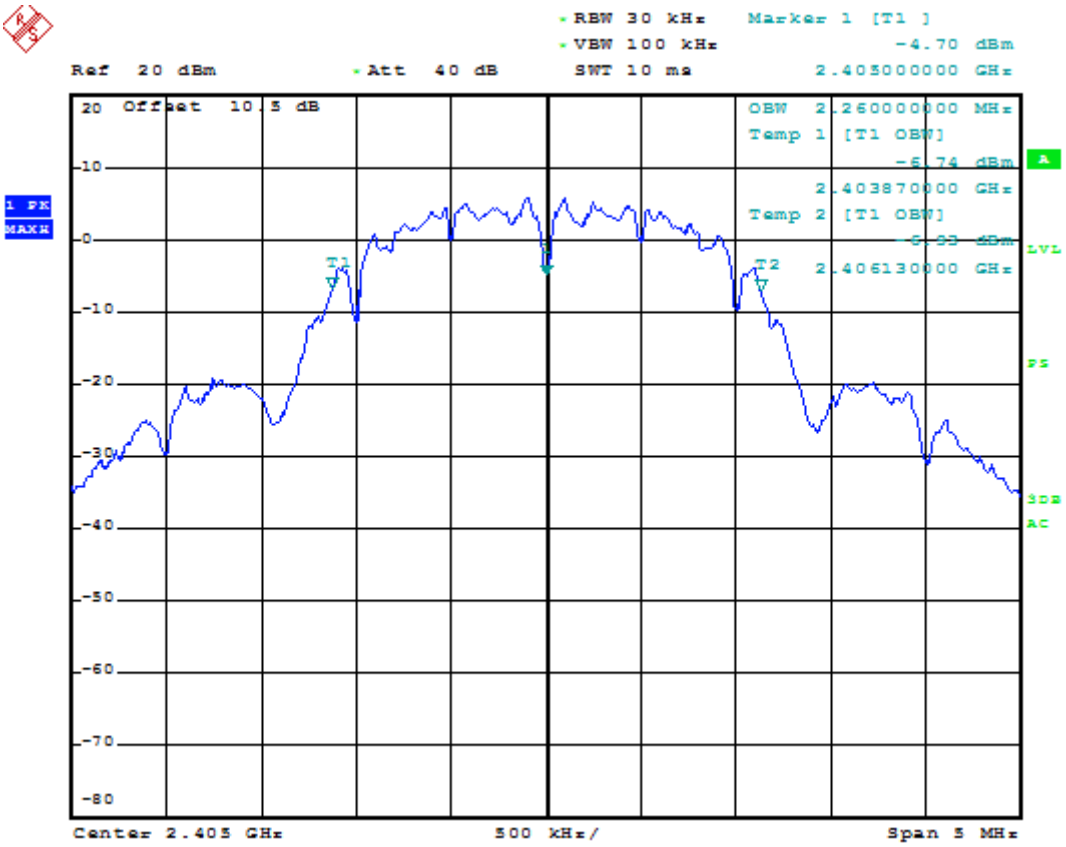
The EUT was connected to spectrum analyser via rf-cable and attenuator. Spectrum analyser with occupied bandwidth measurement function is used to determine the occupied bandwidth.

### 10.2 Test conditions

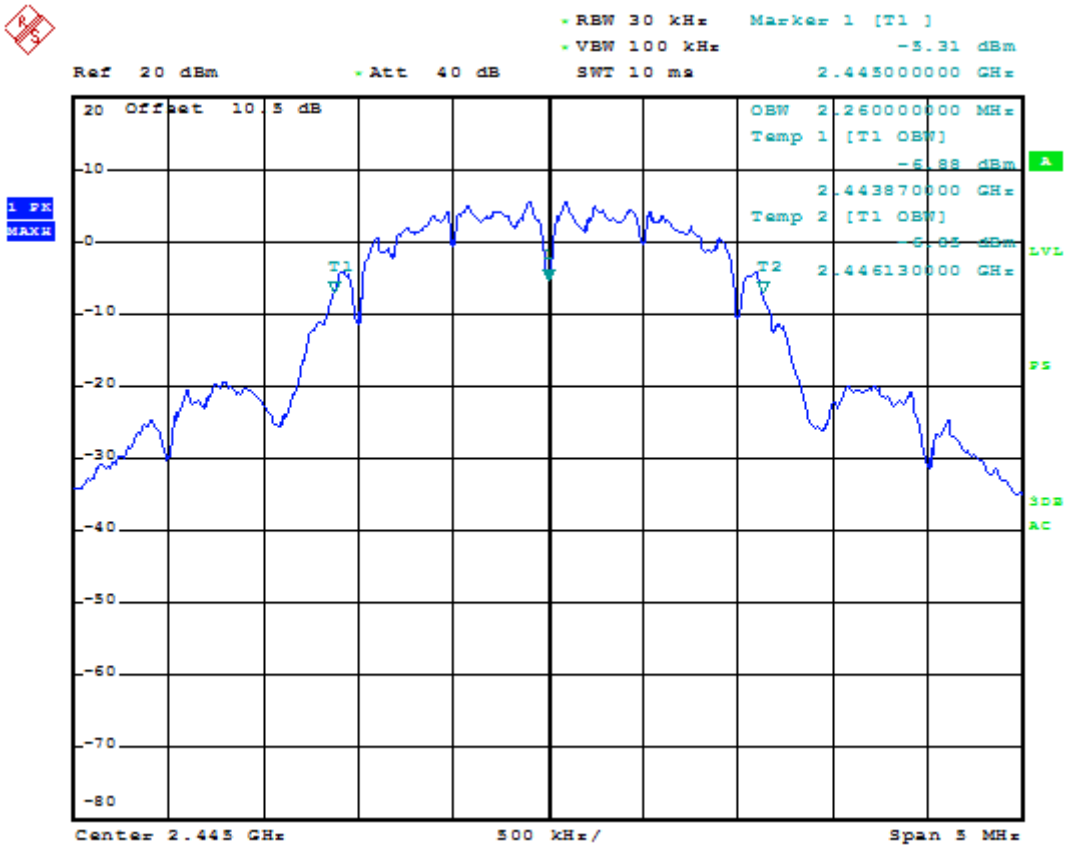
Detector: Peak.
RBW: 1 – 5 % of OBW
VBW: 3 x RBW

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

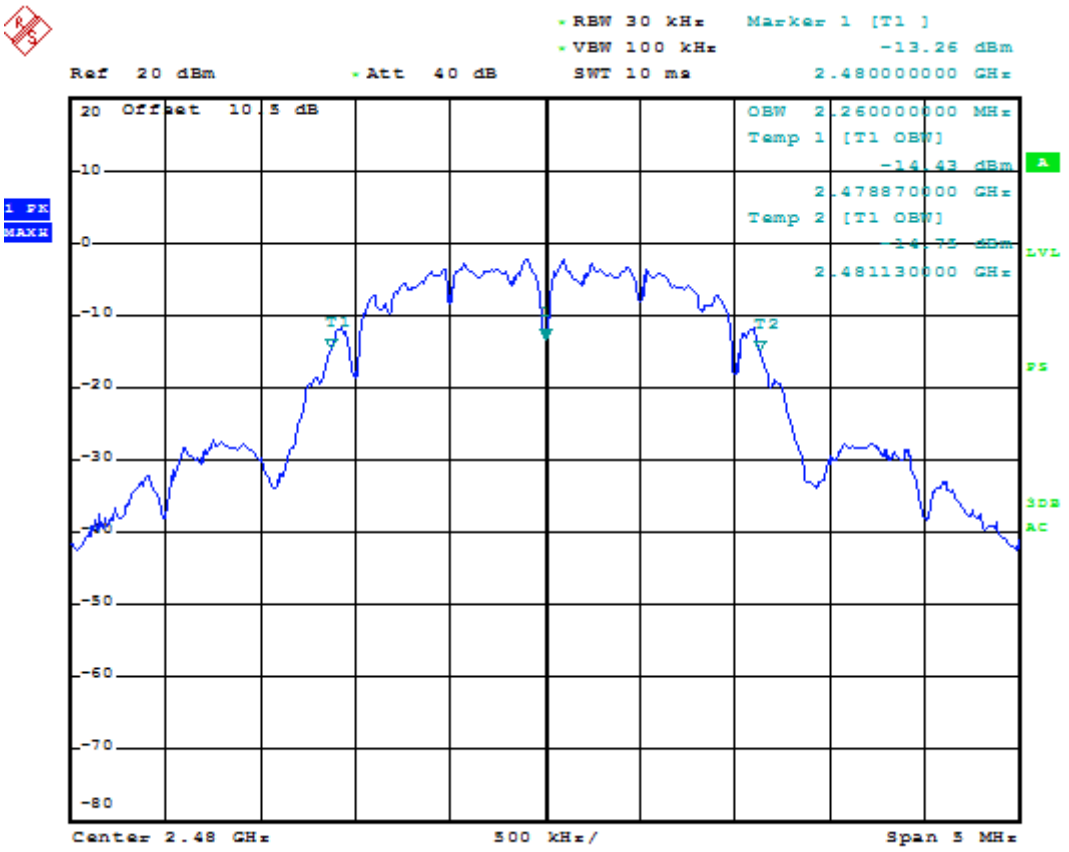
### 10.3 Test results




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




**Screenshot: 99 % bandwidth Measurement. middle channel**




**Screenshot: 99 % bandwidth Measurement. high channel**

**Test result**

| Channel [MHz] | 99 % BW [MHz] |
|---|---|
| 2405 | 2.26 |
| 2445 | 2.26 |
| 2480 | 2.26 |

## 11 PEAK POWER SPECTRAL DENSITY

| | | | |
|---|---|---|---|
| **Date of test:** | 2018-01-15 | **Test location:** | Wireless center |
| **EUT Serial:** | V56 | **Ambient temp:** | 21 °C |
| **Tested by:** | PLA | **Relative humidity:** | 35 % |
| **Test result:** | Pass | **Margin:** | 9.9 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

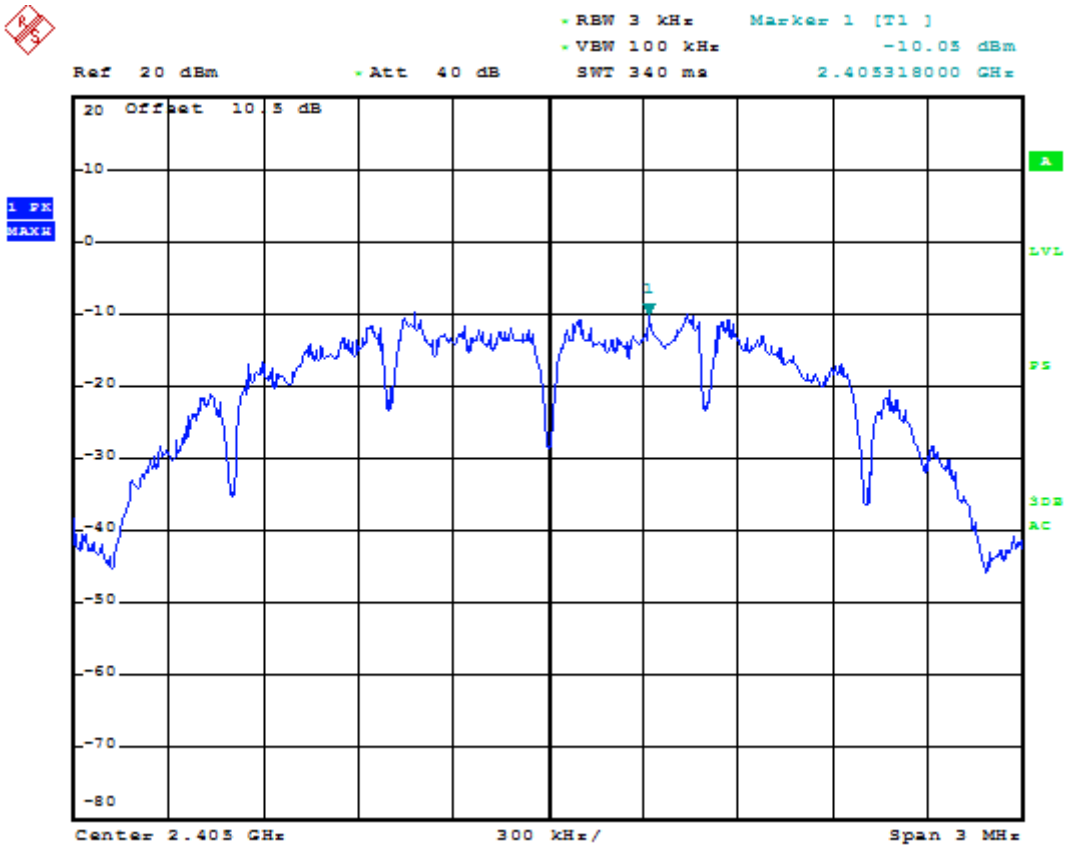
Detector: Peak.
RBW: 3 kHz
VBW: >3 x RBW
Span: 1.5 x 6 dB bandwidth

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

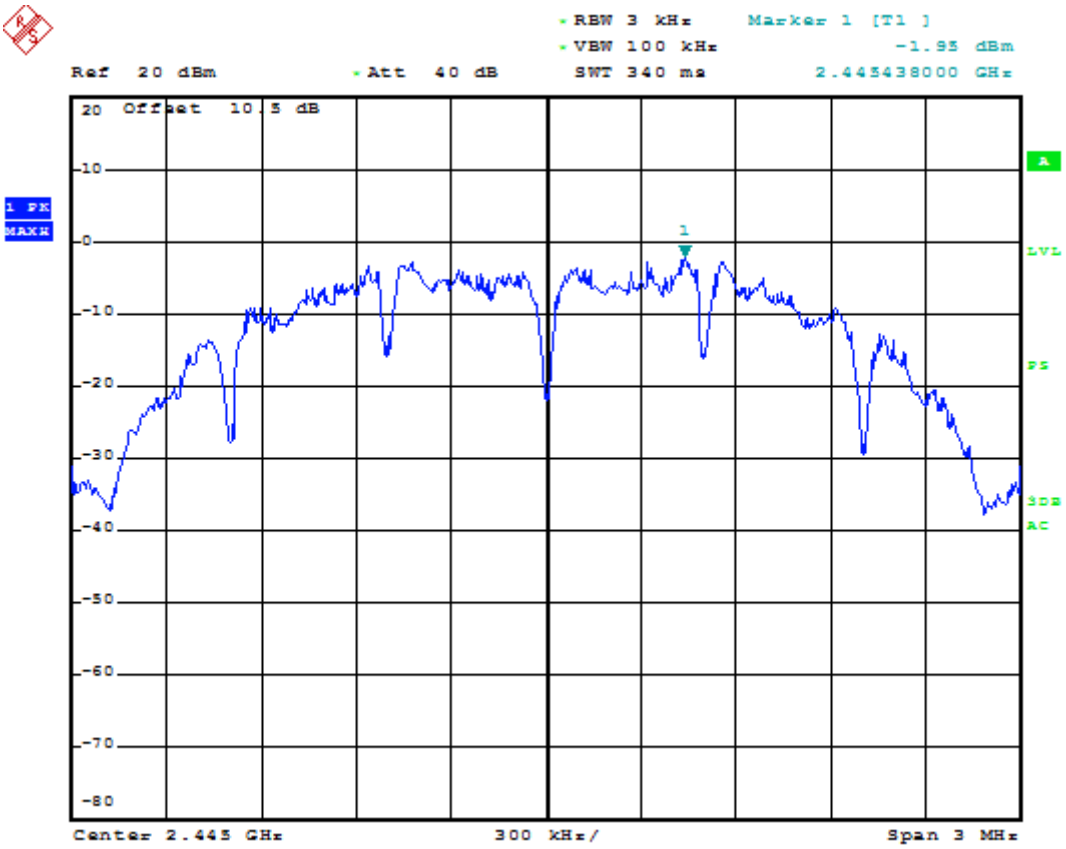
### 11.3 Requirements

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.

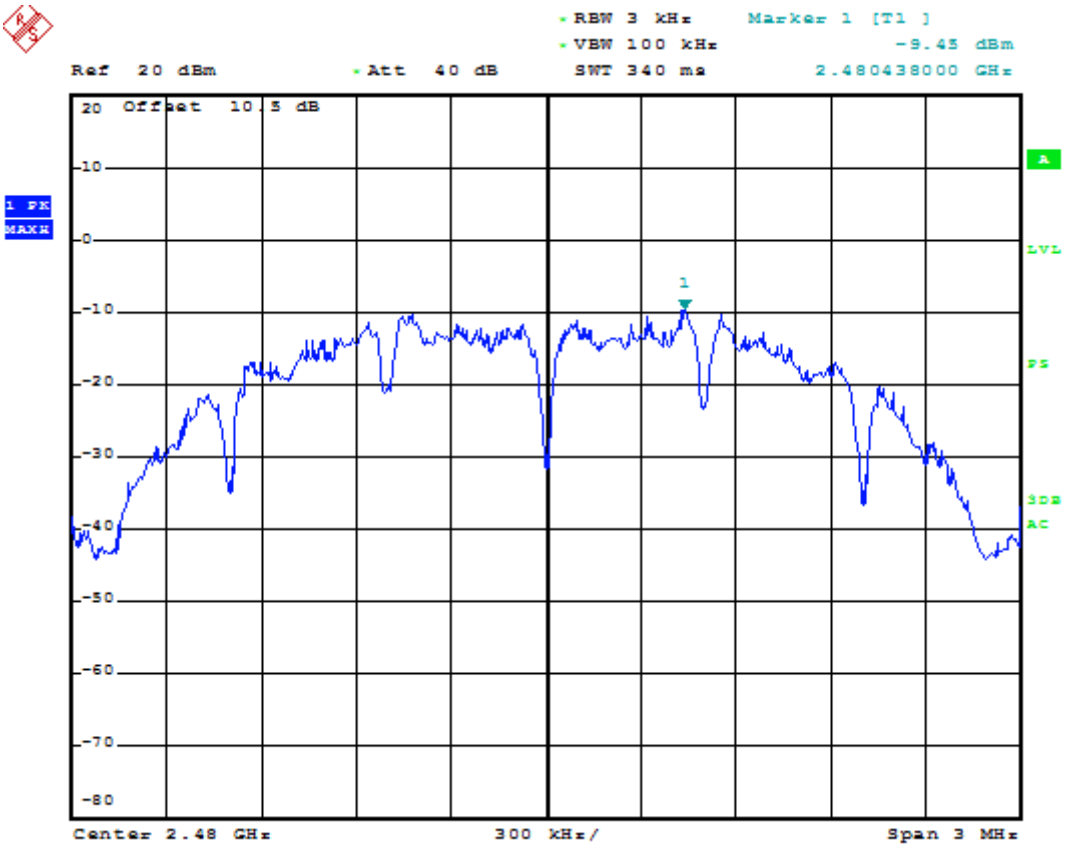
## 11.4 Test results




**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/3kHz] |
|---|---|
| 2405 | -10.0 |
| 2445 | -1.9 |
| 2480 | -9.4 |

## 12 TEST EQUIPMENT

Conducted measurements

| Equipment type | Manufacturer | Model | Inv. No. | Last Cal. date | Cal. interval |
|---|---|---|---|---|---|
| Receiver | Rohde & Schwarz | ESCI | 12798 | July-2017 | 1 year |
| Attenuator 10 dB | Narda | J1 | 9444 | June-2017 | 1 year |
| Coaxial cable | Huber + Suhner | Sucoflex 100 | 39094 | Mars-2017 | 1 year |
| Signal analyzer | Rohde & Schwarz | FSV | 32594 | July-2017 | 1 year |

5m SAC

| Equipment type | Manufacturer | Model | Inv. No. | Last Cal. date | Cal. interval |
|---|---|---|---|---|---|
| Measurement software | Rohde & Schwarz | EMC32 - 9 | -- | -- | -- |
| Receiver | Rohde & Schwarz | ESU40 | 13178 | July-2017 | 1 year |
| Receiver | Rohde & Schwarz | ESIB26 | 32286 | July-2017 | 1 year |
| Horn antenna with preamplifier | Bonn | 31247 | | Jan-2017 | 3 years |
| Antenna | Rohde & Schwarz | HL562 | 32310 | Mars-2017 | 3 years |
| Coaxial cable | Rosenberger | FP1-2/X1 | 39053 | April-2017 | 1 year |
| Coaxial cable | Rohde & Schwarz | 40 GHz | 39127 | July-2017 | 1 year |
| Preamplifier | Rohde & Schwarz | TS-PRE1 | 32306 | July-2017 | 1 year |
| Horn antenna | Bonn | BLMA | 31247 | Jan-2017 | 3 years |
| Coaxial cable | Huber+Suhner | Sucoflex | 39141 | Nov-2017 | 1 year |
| Coaxial cable | Huber+Suhner | Sucoflex | 39142 | Nov-2017 | 1 year |
| Horn antenna | Rohde & Schwarz | HF907 | 32296 | July-2017 | 3 years |
| Preamplifier | Rohde & Schwarz | TS-Pre1 | 32297 | July-2017 | 3 years |
| | | | | | |

## 13 MEASUREMENT UNCERTAINTY

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

Measurement uncertainty for radiated disturbance

| | |
|---|---|
| Uncertainty for the frequency range 30 to 1000 MHz at 3 m | ± 5.1 dB |
| Uncertainty for the frequency range 1.0 to 18 GHz at 3 m | ± 4.7 dB |
| Uncertainty for the frequency range 18 to 26 GHz at 3 m | ± 4.8 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 and test set up photos are in separate documents. EUT photo is in 1718488STOAnnex1-003. Ed 1 and test set up photos are in 1718488STOAnnex2-004. Ed 1.