

# RADIO TEST REPORT

No. 1613920STO-002, Ed. 2

## RF Performance

### EQUIPMENT UNDER TEST

Equipment: Battery monitoring system  
Type/Model: BattByte  
Manufacturer: Northstar Battery COLLC  
Tested by request of: SiteTel Sweden 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 (2015): Subpart C: Intentional radiators. Section 15.247

47 CFR Part 15 (2015): 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: 2018-01-25

Tested by:

  
Robert Hietala

Approved by:

  
Matti Virkki

**Revision History**

| <b>Edition</b> | <b>Date</b> | <b>Description</b> | <b>Changes</b>             |
|----------------|-------------|--------------------|----------------------------|
| 1              | 2016-09-12  | First release      |                            |
| 2              | 2018-01-25  | Second release     | Updated RSS-247 to issue 2 |
|                |             |                    |                            |

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## 1 CLIENT INFORMATION

The EUT has been tested by request of

Company SiteTel Sweden AB  
Box 7039  
192 07 Sollentuna  
Sweden

Name of contact Karin Ögren  
Phone +46 8 410 102 09

## 2 EQUIPMENT UNDER TEST (EUT)

### 2.1 Identification of the EUT

Equipment: Battery monitoring system  
Type/Model: BattByte  
Brand name: BattByte  
Serial number: XX1000000013 and XX1000000035  
Manufacturer: SiteTel Sweden AB  
Transmitter frequency range: 2402 – 2480 MHz  
Receiver frequency range: 2402 – 2480 MHz  
Frequency agile or hopping: ☒ Yes ☐ No  
Antenna: ☒ Internal antenna ☐ External antenna  
Antenna connector: ☒ None, internal antenna ☐ Yes  
Antenna gain: -1.8 dBi  
Rating RF output power: -0.3 dBm (measured conducted)  
Type of modulation: GFSK  
Temperature range: ☐ Category I (General): -20°C to +55°C  
☐ Category II (Portable equipment): -10°C to +55°C  
☐ Category III (Equipment for normal indoor use): +5°C to +35°C  
☒ Other: -40°C to +80°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 | UPS battery | XX1000000013  | With internal antenna        |
| Unit 2 | UPS battery | XX1000000035  | With temporary SMA connector |

During the tests the EUT supported following software:

| Software     | Version   | Comment                          |
|--------------|-----------|----------------------------------|
| nRFgo Studio | 1.21.2.10 | Used for Direct Test Mode access |

## 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 | B590         | Lenovo       | WB14001765 |

## 2.4 Test signals and operation modes

During the tests the EUT was in Bluetooth "Direct Test Mode" transmitting a PRBS9 signal with a payload of 37 bytes and a duty cycle of 70 %.

## 2.5 Modifications made during the tests.

No modifications have been made during the tests.

### 3 TEST SPECIFICATIONS

#### 3.1 Standards

Requirements:

47 CFR Part 15 (2015): Subpart C: Intentional radiators. Section 15.247

47 CFR Part 15 (2015): 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

RSS-247 Issue 2 (2017) is not within Intertek's scope of accreditation.

No other 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 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 # |
|---------------------|-------------------------------|------------------|
| STORA HALLEN        | Semi-anechoic<br>10 m and 3 m | 2042G-2          |

#### 4 TEST SUMMARY

The results in this report apply only to sample tested:

| Requirement                                                                   | Description                                                                                                                                             | Result      |
|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| <b>FCC §15.203<br/>RSS-GEN 8.3</b>                                            | <b>Antenna requirement</b><br>The EUT has integrated non detachable antenna which can't be remove without breaking the EUT.                             | <b>PASS</b> |
| <b>FCC §15.207<br/>RSS-GEN 8.8 table 3</b>                                    | <b>Conducted continuous emission in the frequency range 150 kHz to 30 MHz, AC Power input port</b>                                                      | <b>NA</b>   |
| <b>FCC §15.247 (b)(4)<br/>RSS-247 5.4(4),<br/>5.4(5)</b>                      | <b>Field strength of fundamental and antenna gain</b><br>The EUT complies with the limits.<br><br>Antenna gain is less than 6 dBi.                      | <b>PASS</b> |
| <b>FCC §15.247 (d),<br/>15.209(a), 15.109<br/>RSS-GEN 8.9<br/>RSS-247 5.5</b> | <b>Radiated emission of electromagnetic fields in the frequency range 30 – 1000 MHz</b><br>The EUT complies with the limits.<br><br>See clause 5.4.     | <b>PASS</b> |
| <b>FCC §15.247(d),<br/>15.209(a), 15.109<br/>RSS-GEN 8.9<br/>RSS-247 5.5</b>  | <b>Radiated emission of electromagnetic fields in the frequency range above 1 GHz</b><br>The EUT complies with the limits.<br><br>See clause 5.5 – 5.6. | <b>PASS</b> |
| <b>FCC §15.247(a)(1)<br/>RSS-GEN 6.6<br/>RSS-247 5.1</b>                      | <b>Occupied bandwidth</b><br>The EUT complies with the limits.<br><br>See clause 8.4 and 9.3.                                                           | <b>PASS</b> |
| <b>FCC §15.247(b)<br/>RSS-247 5.4</b>                                         | <b>Conducted output power</b><br>The EUT complies with the limits.<br><br>See clause 7.4.                                                               | <b>PASS</b> |
| <b>FCC §15.247(a)(1)<br/>RSS-247 5.1(2)</b>                                   | <b>Carrier frequency separation</b>                                                                                                                     | <b>NA</b>   |
| <b>FCC §15.247(a)(1)<br/>RSS-247 5.1</b>                                      | <b>Number of hopping frequencies</b>                                                                                                                    | <b>NA</b>   |
| <b>FCC §15.247(a)(1)<br/>RSS-247 5.1</b>                                      | <b>Time of occupancy</b>                                                                                                                                | <b>NA</b>   |
| <b>FCC §15.247(d)<br/>RSS-247 5.5</b>                                         | <b>Band edge</b><br>The EUT complies with the limits.<br><br>See clause 6.4.                                                                            | <b>PASS</b> |

NA = Not Applicable

**5 RADIATED RF EMISSION IN THE FREQUENCY-RANGE 30 MHZ TO 26 GHZ**

|                      |                |                           |                               |
|----------------------|----------------|---------------------------|-------------------------------|
| <b>Date of test:</b> | 2016-08-22     | <b>Test location:</b>     | Stora Hallen, Wireless Center |
| <b>EUT Serial:</b>   | XX1000000013   | <b>Ambient temp:</b>      | 21 °C                         |
| <b>Tested by:</b>    | Robert Hietala | <b>Relative humidity:</b> | 71 %                          |
| <b>Test result:</b>  | Pass           | <b>Margin:</b>            | 6.4 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 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.

**5.2 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

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

Final test:

Average, RBW 1 MHz. VBW 3 MHz

Final test:

Peak, RBW 1 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

### 5.3 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 (dB $\mu$ V/m) | Field strength at 10 m (dB $\mu$ V/m) | Detector (dB $\mu$ V/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))

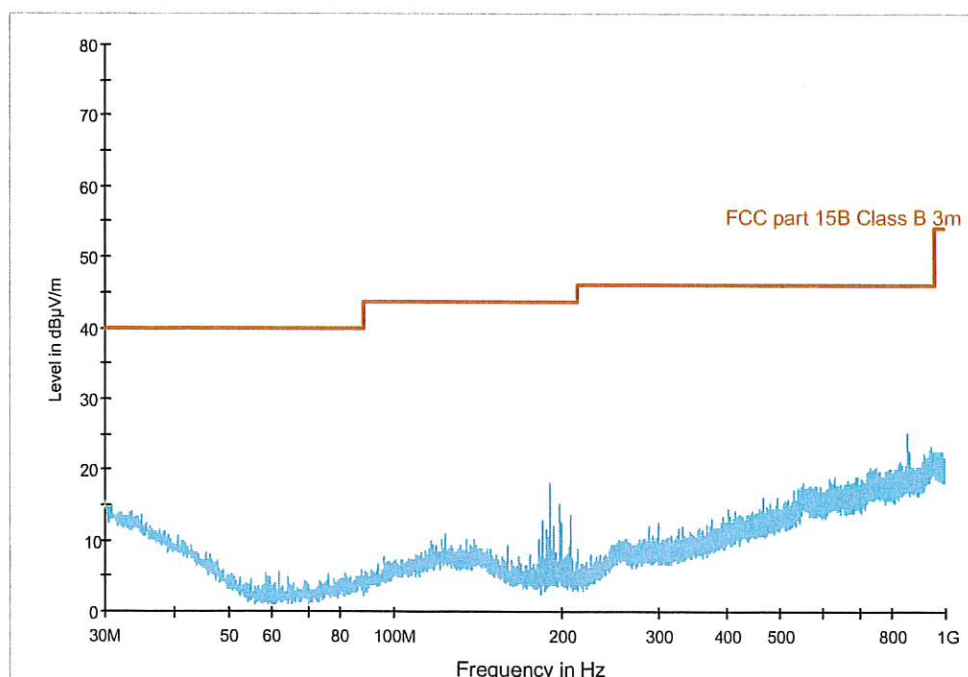
Outside the restricted bands:

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.

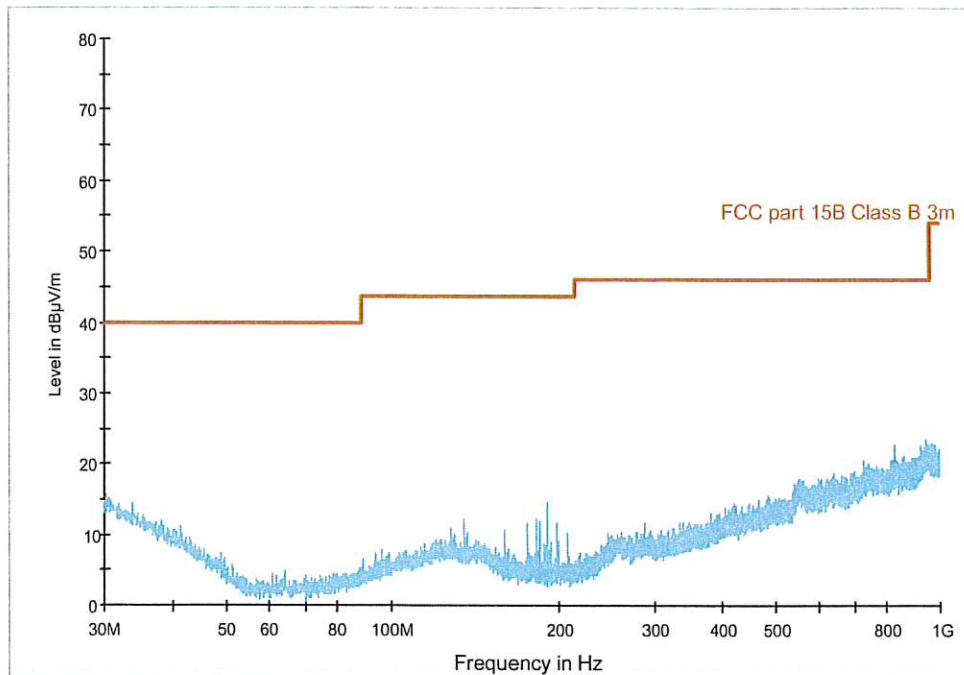
### 5.4 Test results 30 MHz – 1000 MHz, RX

Radio FCC 30 - 1000 MHz FCC class B 10m continuous TT rotation

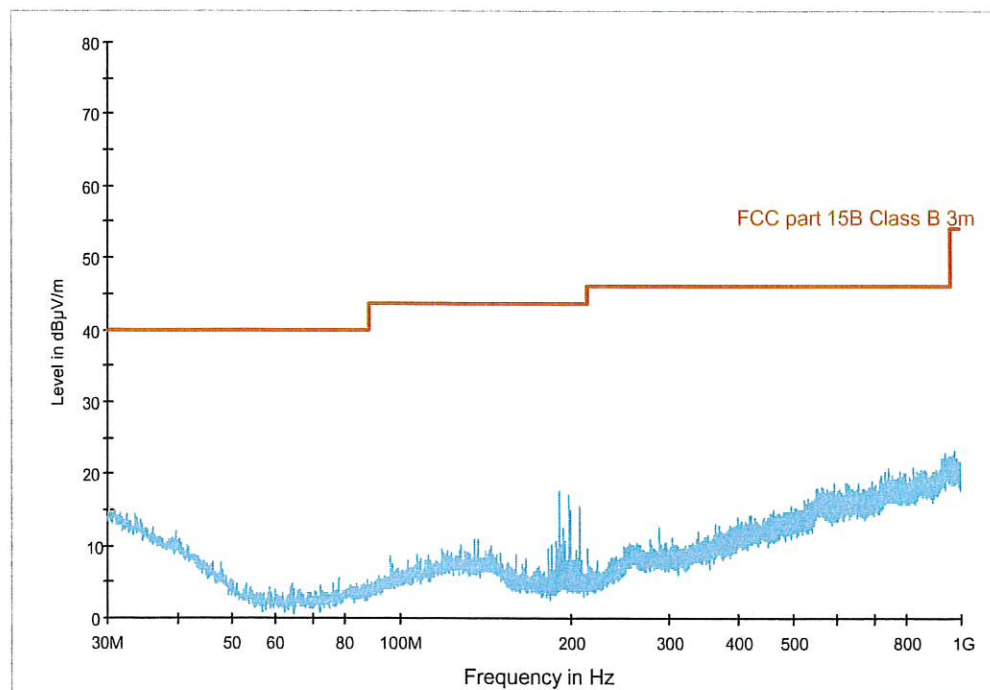


Diagram, Peak overview sweep, 30 – 1000 MHz at 3 m distance. RX low channel.

Radio FCC 30 - 1000 MHz FCC class B 10m continuous TT rotation

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

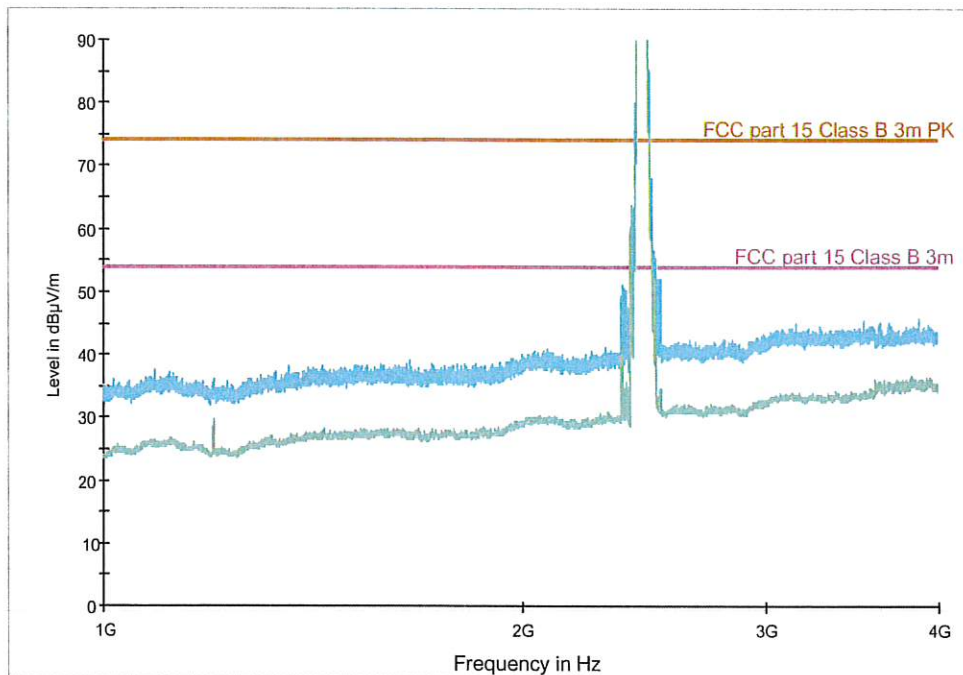
Radio FCC 30 - 1000 MHz FCC class B 10m continuous TT rotation

**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.

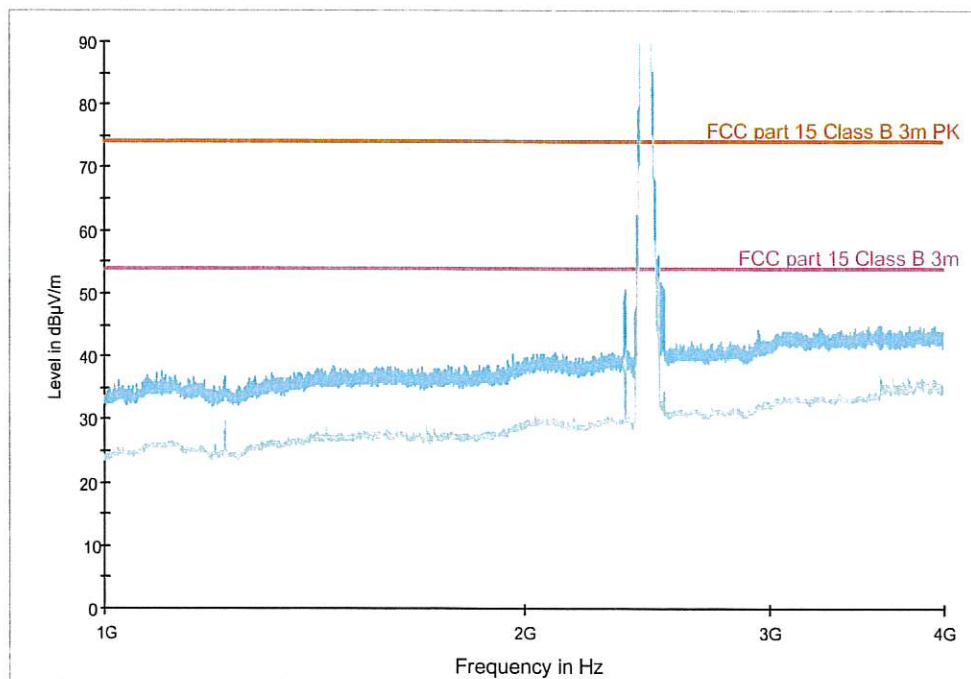
## 5.5 Test results 1 GHz – 26 GHz, TX

FCC 1 G - 4 G class B 3m ESU40 Continuous TT rotation



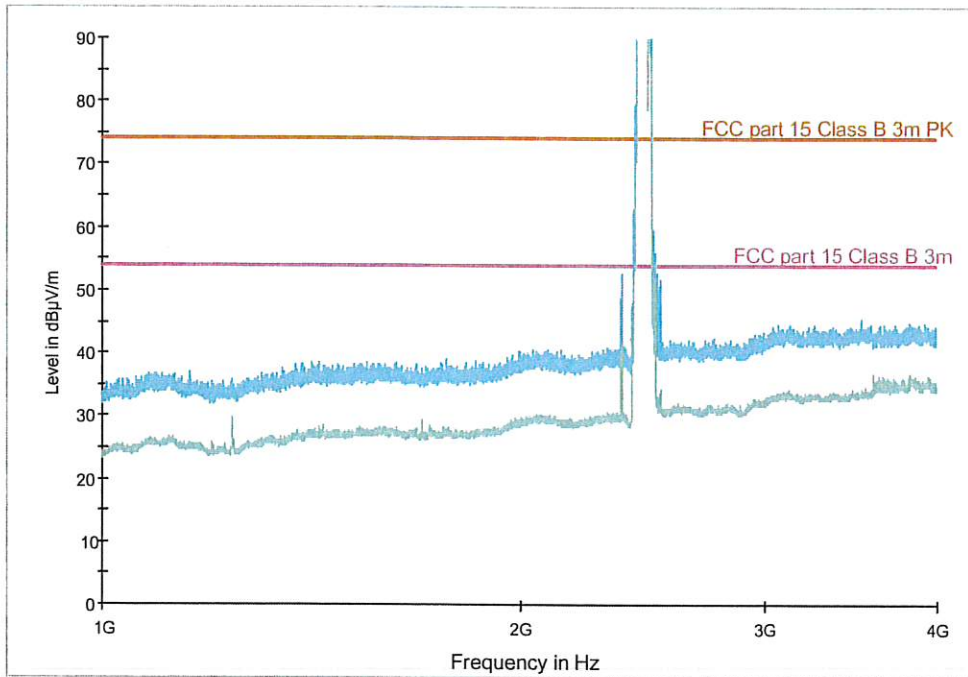
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX low channel. Carrier is attenuated by band rejection filter K&L 6N45-2450/T 100-0/0.

FCC 1 G - 4 G class B 3m ESU40 Continuous TT rotation



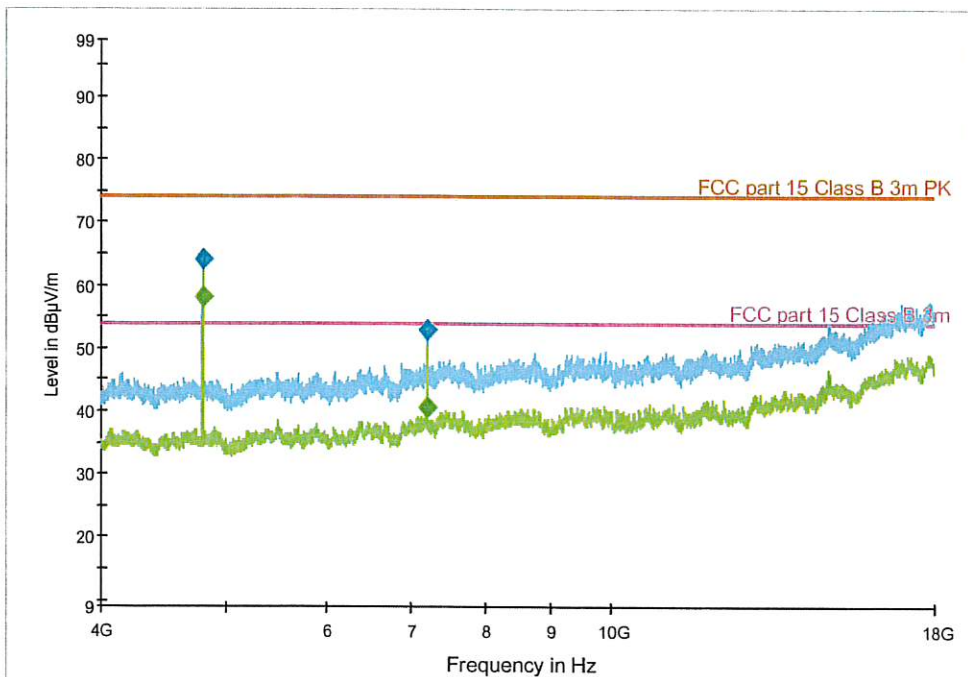
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX mid channel. Carrier is attenuated by band rejection filter K&L 6N45-2450/T 100-0/0.

FCC 1 G - 4 G class B 3m ESU40 Continuous TT rotation



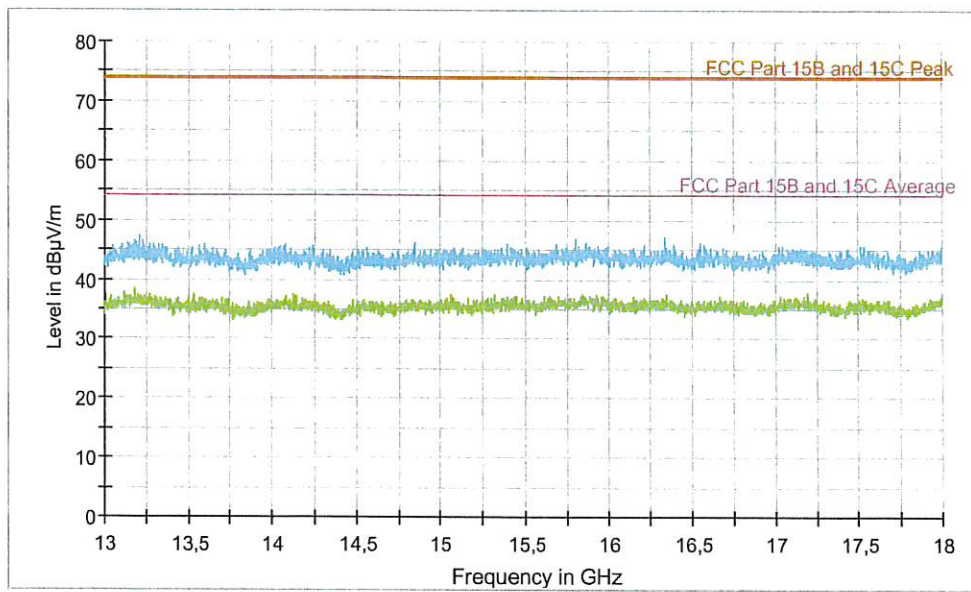
Diagram, Peak overview sweep, 1– 4 GHz at 3 m distance. TX high channel. Carrier is attenuated by band rejection filter K&L 6N45-2450/T 100-0/0.

FCC 4 G - 18 G class B 3m ESU40 Continuous TT rotation



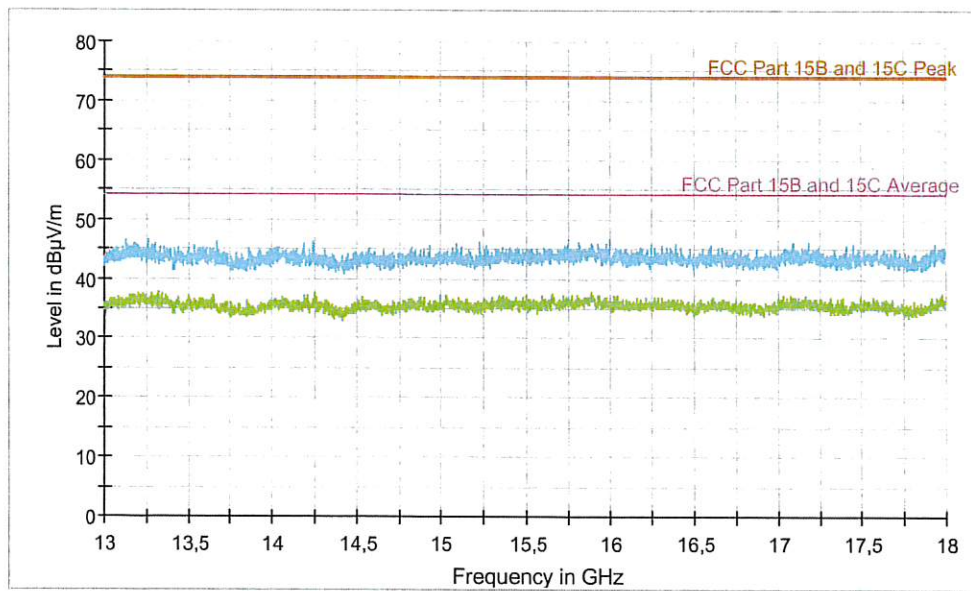
Diagram, Peak overview sweep, 4– 18 GHz at 3 m distance. TX low channel. Emissions below 4000 MHz are attenuated by high-pass filter K&L 4410-X4500/18000-0.

Full Spectrum



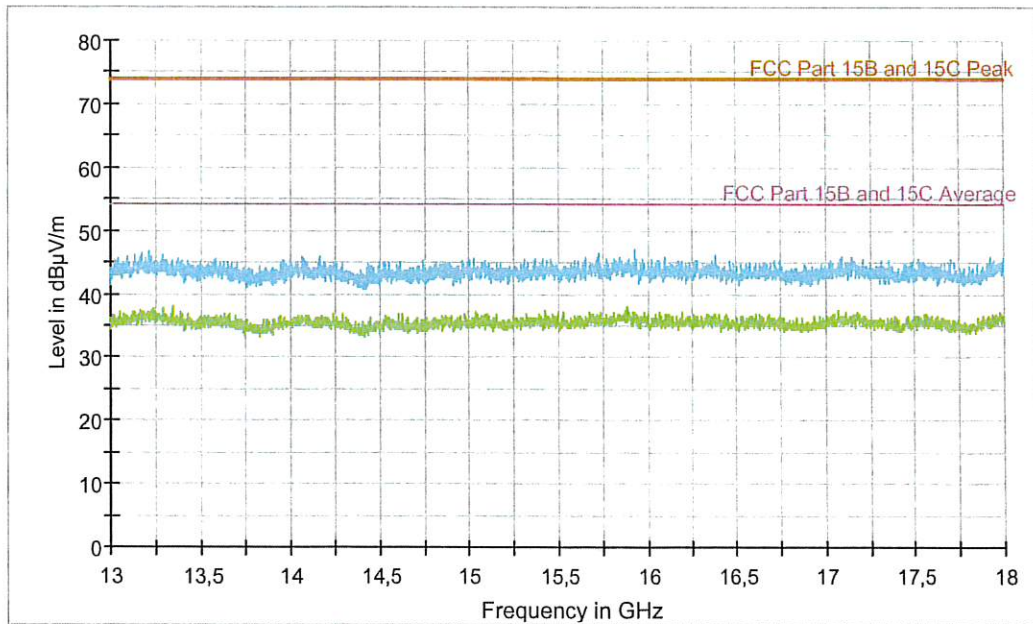
Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX low channel.

Full Spectrum

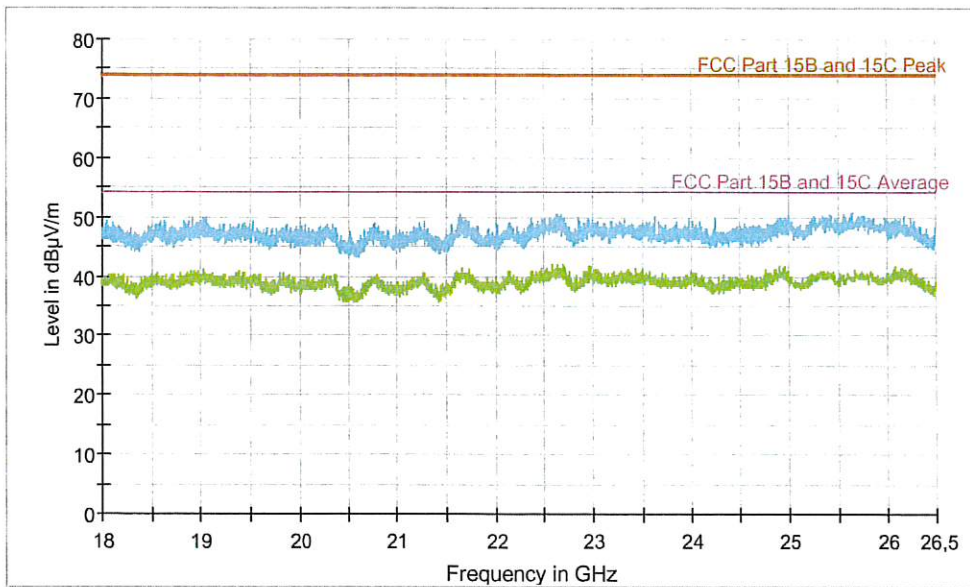


Diagram, Peak overview sweep, 13 – 18 GHz at 3 m distance. TX mid channel.

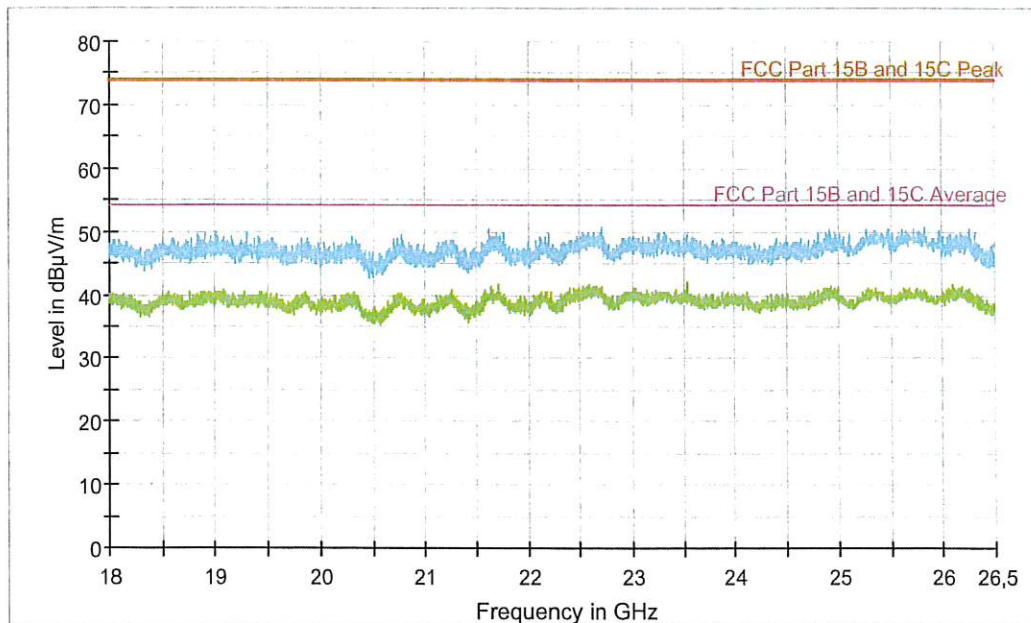
Full Spectrum

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

Full Spectrum

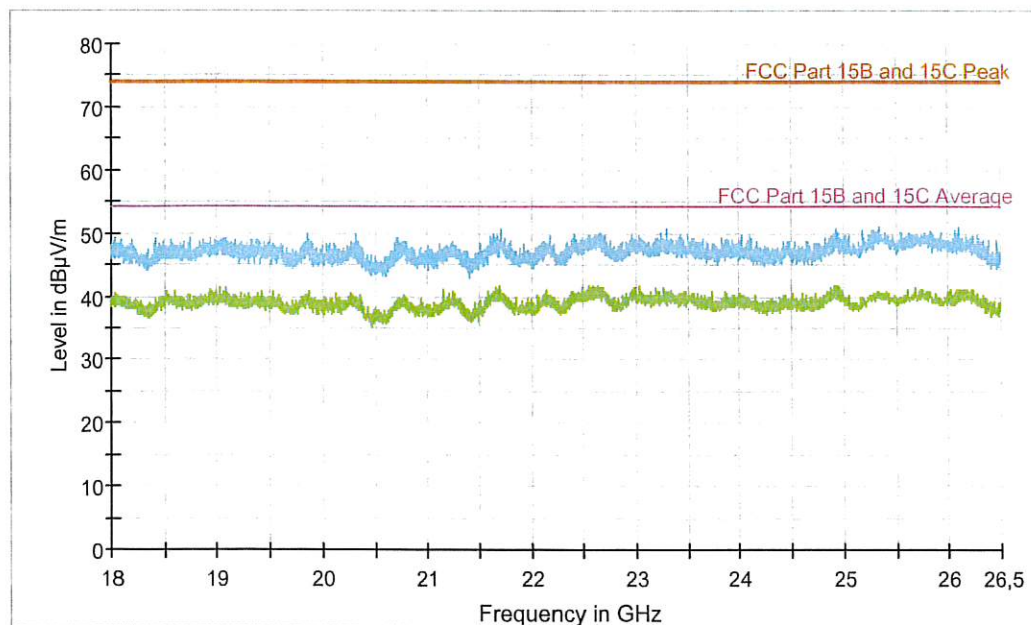
**Diagram, Peak overview sweep, 18 – 26.5 GHz at 3 m distance. TX low channel.**

Full Spectrum



Diagram, Peak overview sweep, 18 – 26.5 GHz at 3 m distance. TX mid 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 [dB $\mu$ V/m] | Limit [dB $\mu$ V/m] | EUT orientation | Polarization H/V | Margin [dB] |
|-----------------|----------------------|----------------------|-----------------|------------------|-------------|
| 4803.6          | 64.1                 | 74.0                 | --              | H                | 9.9         |
| 7205.1          | 53.0                 | 74.0                 | --              | H                | 21.0        |

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

| Frequency [MHz] | Corr. Factor* [dB] | Level [dB $\mu$ V/m] | Limit [dB $\mu$ V/m] | EUT orientation | Polarization H/V | Margin [dB] |
|-----------------|--------------------|----------------------|----------------------|-----------------|------------------|-------------|
| 4803.6          | -31.9              | 32.2                 | 54.0                 | --              | H                | 21.8        |
| 7205.1          | -31.9              | 21.1                 | 54.0                 | --              | H                | 32.9        |

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

| Frequency [MHz] | Level [dB $\mu$ V/m] | Limit [dB $\mu$ V/m] | EUT orientation | Polarization H/V | Margin [dB] |
|-----------------|----------------------|----------------------|-----------------|------------------|-------------|
| 4880.6          | 65.4                 | 74.0                 | --              | H                | 8.6         |

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

| Frequency [MHz] | Corr. Factor* [dB] | Level [dB $\mu$ V/m] | Limit [dB $\mu$ V/m] | EUT orientation | Polarization H/V | Margin [dB] |
|-----------------|--------------------|----------------------|----------------------|-----------------|------------------|-------------|
| 4880.6          | -31.9              | 33.5                 | 54.0                 | --              | H                | 20.5        |

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

| Frequency [MHz] | Level [dB $\mu$ V/m] | Limit [dB $\mu$ V/m] | EUT orientation | Polarization H/V | Margin [dB] |
|-----------------|----------------------|----------------------|-----------------|------------------|-------------|
| 4960.4          | 67.6                 | 74.0                 | --              | H                | 6.4         |

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

| Frequency [MHz] | Corr. Factor* [dB] | Level [dB $\mu$ V/m] | Limit [dB $\mu$ V/m] | EUT orientation | Polarization H/V | Margin [dB] |
|-----------------|--------------------|----------------------|----------------------|-----------------|------------------|-------------|
| 4960.4          | -31.9              | 35.7                 | 54.0                 | --              | H                | 18.3        |

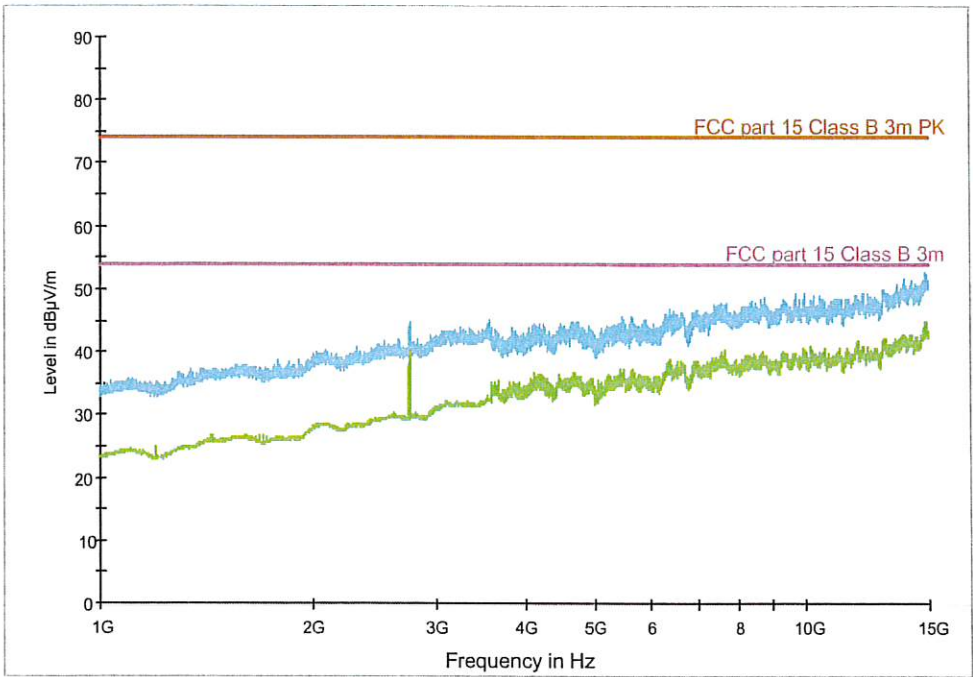
All other measured disturbances have a margin of more than 20 dB to the limits.

Result [dB $\mu$ V/m] = Analyser reading [dB $\mu$ V] + Antenna factor [1/m] - Amplifier gain [dB] + Cable loss [dB]

\*Correction factor from measured peak level, see section 11.

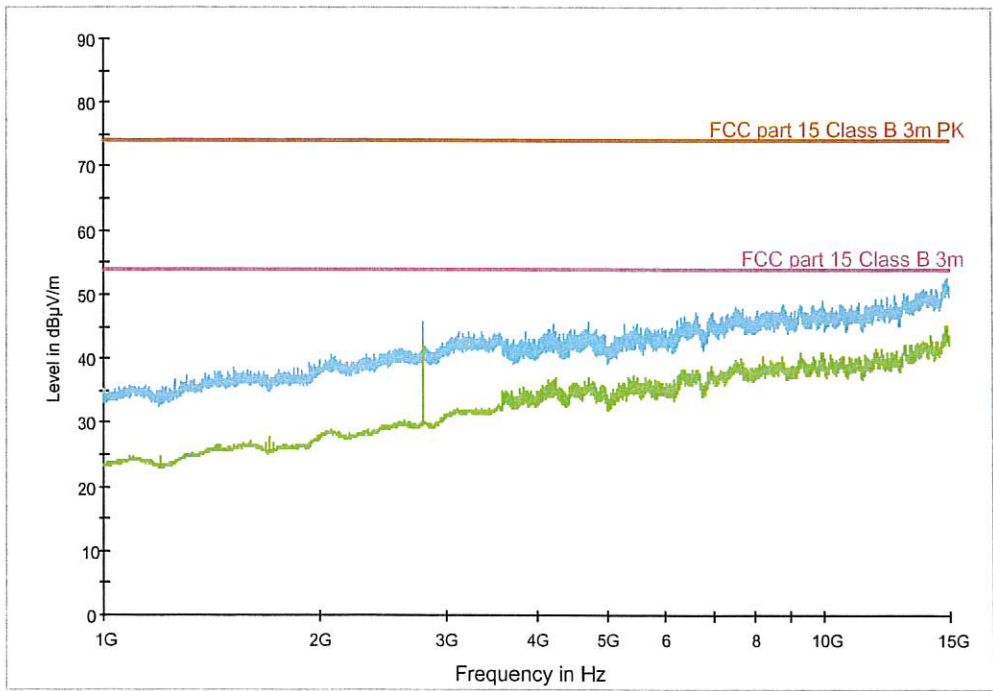
5.6 Test results 1 GHz – 15 GHz, RX

FCC 1 G - 15 G class B 3m ESU40 Continuous TT rotation



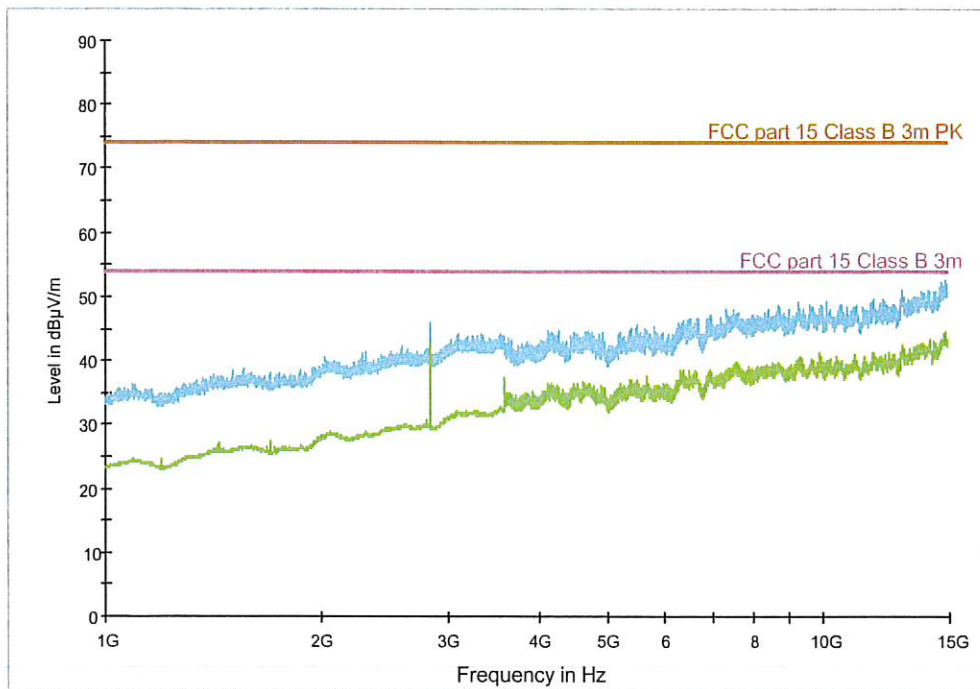
Diagram, Peak overview sweep, 1– 15 GHz at 3 m distance. RX low channel.

FCC 1 G - 15 G class B 3m ESU40 Continuous TT rotation



Diagram, Peak overview sweep, 1– 15 GHz at 3 m distance. RX mid channel.

## FCC 1 G - 15 G class B 3m ESU40 Continuous TT rotation



Diagram, Peak overview sweep, 1– 15 GHz at 3 m distance. RX high channel.

#### Measurement results, RX

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

## 6 CONDUCTED BAND EDGE MEASUREMENT

|                      |                |                           |                 |
|----------------------|----------------|---------------------------|-----------------|
| <b>Date of test:</b> | 2016-08-11     | <b>Test location:</b>     | Wireless Center |
| <b>EUT Serial:</b>   | XX1000000035   | <b>Ambient temp:</b>      | 21 °C           |
| <b>Tested by:</b>    | Robert Hietala | <b>Relative humidity:</b> | 37 %            |
| <b>Test result:</b>  | Pass           | <b>Margin:</b>            | > 10 dB         |

### 6.1 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. Measurements are made with EUT on single channel.

### 6.2 Test conditions

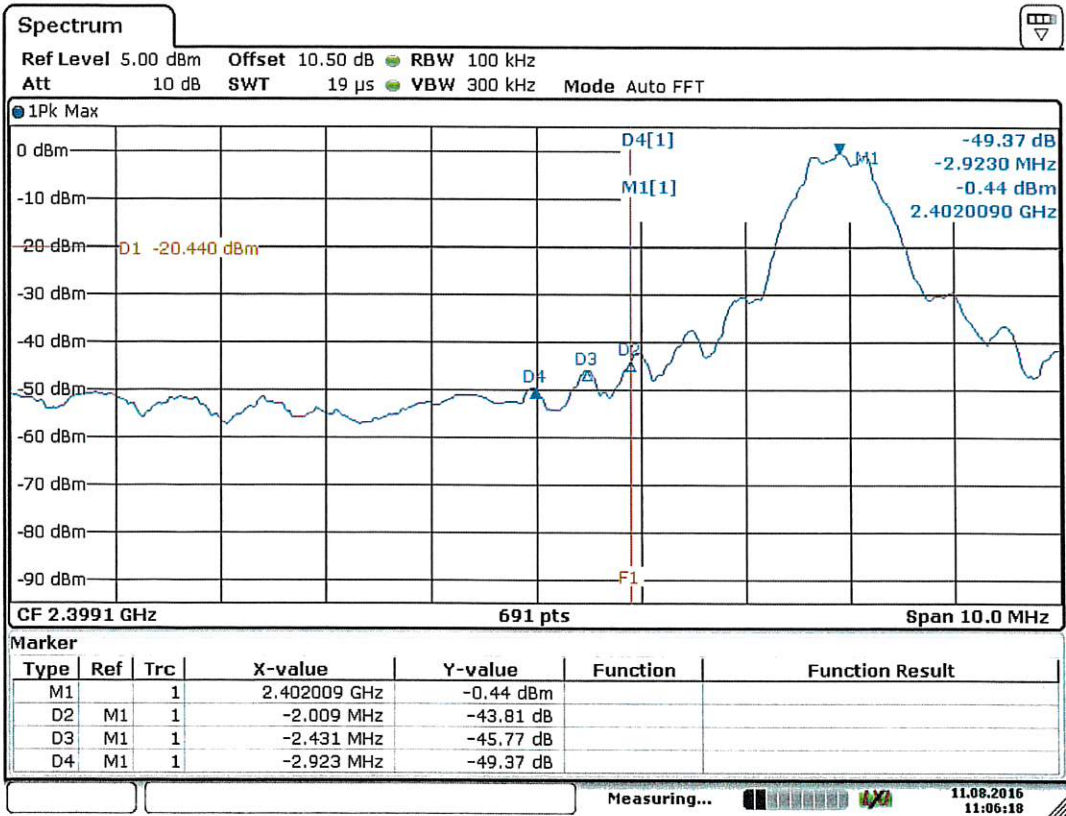
Detector: Peak  
RBW: 100 kHz  
VBW: 300 kHz  
Span: 10 MHz

### 6.3 Requirement

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

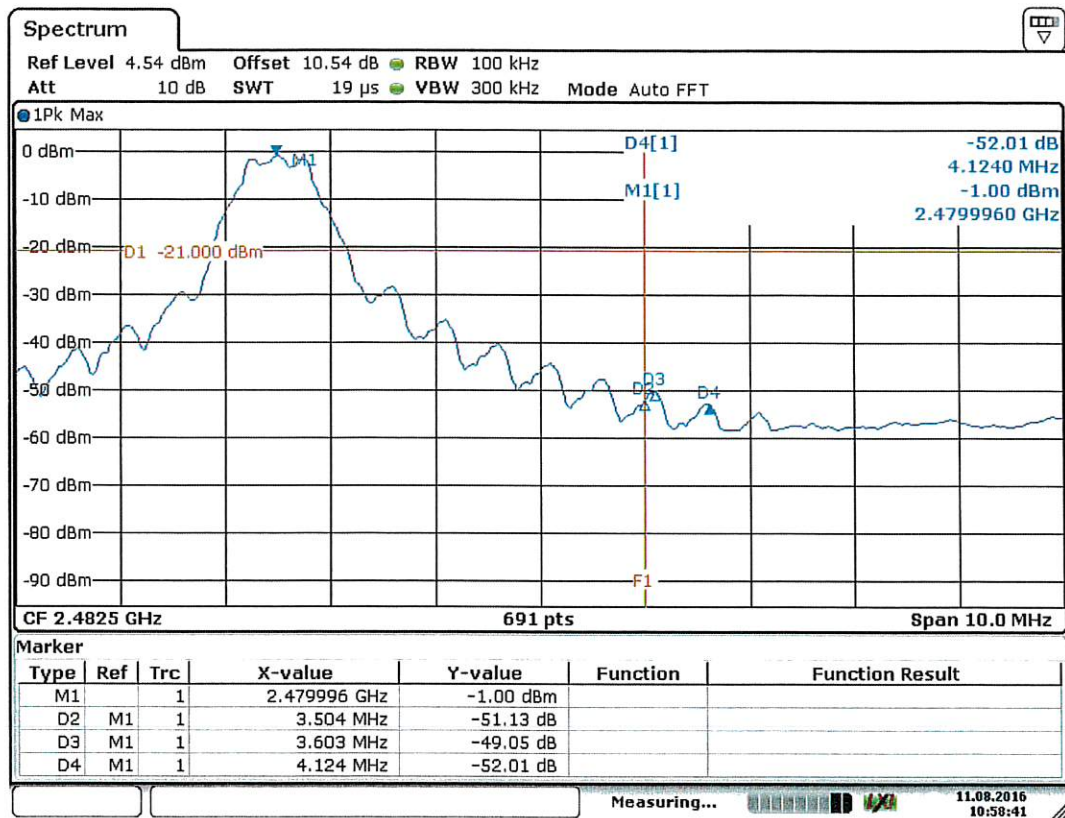
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either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

6.4 Test results



Date: 11 AUG 2016 11:06:19

Screenshot: Lower band edge sweep, single channel



Date: 11 AUG 2016 10:58:41

Screenshot: Upper band edge sweep, single channel

## Test results

| Band edge | EUT mode of operation | Delta [dBc] | Limit [dBc] | Margin [dB] |
|-----------|-----------------------|-------------|-------------|-------------|
| Lower     | Single channel        | 43.8        | 20.0        | 23.8        |
| Upper     | Single channel        | 49.1        | 20.0        | 29.1        |

## 7 PEAK CONDUCTED OUTPUT POWER

|                      |                |                           |                 |
|----------------------|----------------|---------------------------|-----------------|
| <b>Date of test:</b> | 2016-08-11     | <b>Test location:</b>     | Wireless Center |
| <b>EUT Serial:</b>   | XX1000000035   | <b>Ambient temp:</b>      | 21 °C           |
| <b>Tested by:</b>    | Robert Hietala | <b>Relative humidity:</b> | 37 %            |
| <b>Test result:</b>  | Pass           | <b>Margin:</b>            | > 10 dB         |

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

The test method is in accordance with ANSI C63.10-2013 section 11.9.1.

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

### 7.2 Test conditions

Detector: Peak  
RBW: 3 MHz  
VBW: 10 MHz  
Span: 10 MHz

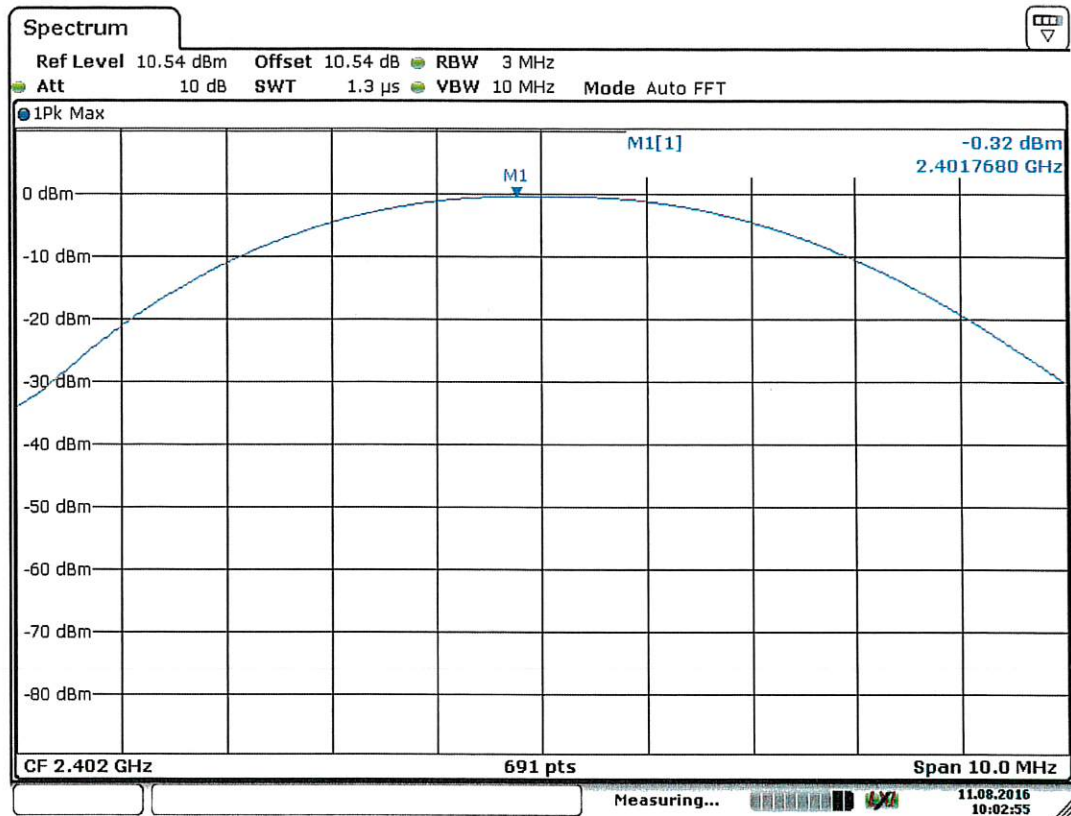
The EUT was set up in order to emit maximum disturbances.

### 7.3 Requirements

Reference: CFR 47 §15.247(b)(1), RSS-247 5.4

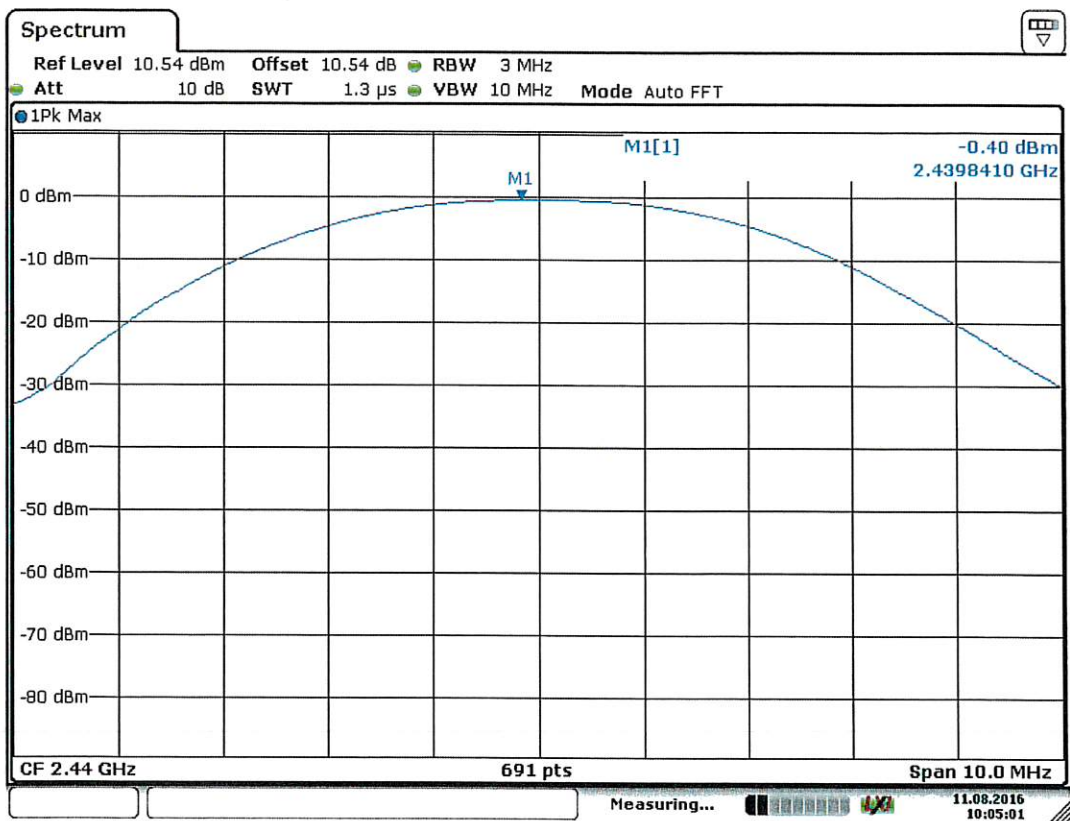
The maximum peak conducted output power of the intentional radiator shall not exceed 1 watt.

## 7.4 Test results



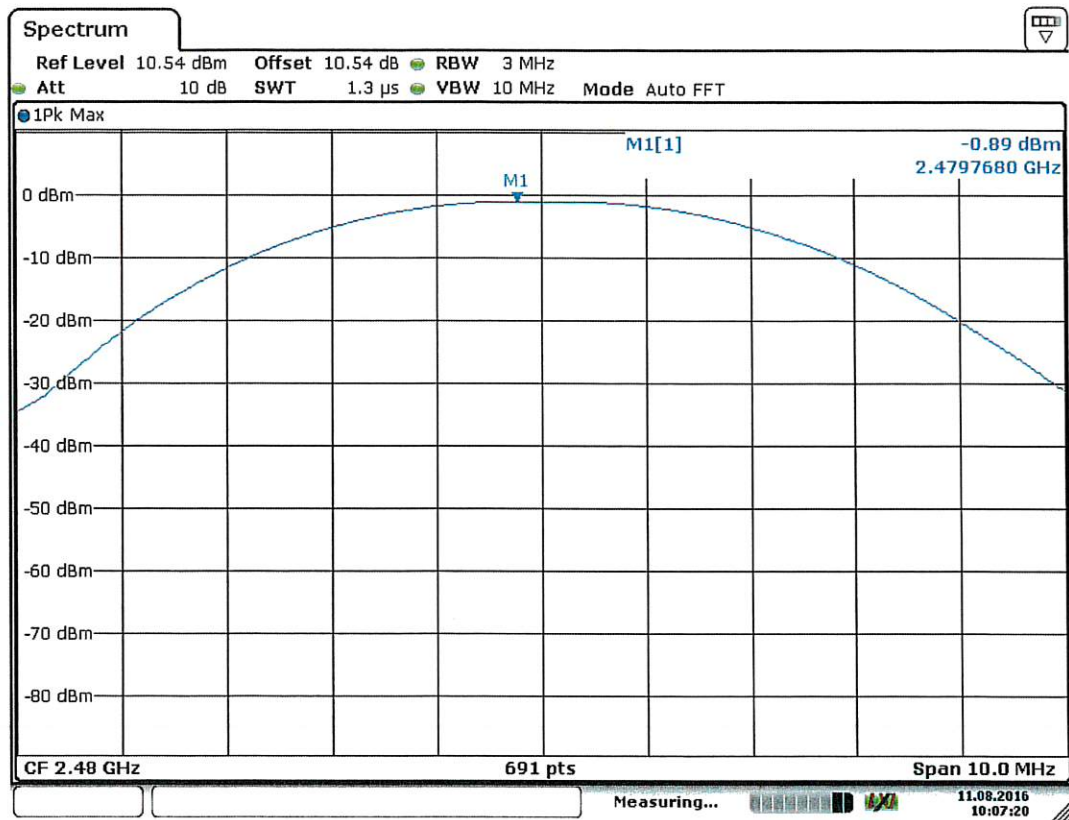
Date: 11 AUG 2016 10:02:55

Screenshot: Output power, low channel



Date: 11 AUG 2016 10:05:02

Screenshot: Output power, middle channel



Date: 11 AUG 2016 10:07:21

Screenshot: Output power, high channel

## Test result

| Channel [MHz] | Output power [dBm] |
|---------------|--------------------|
| 2402          | -0.3               |
| 2440          | -0.4               |
| 2480          | -0.9               |

**8 OCCUPIED 6 DB BANDWIDTH**

|                      |                |                           |                 |
|----------------------|----------------|---------------------------|-----------------|
| <b>Date of test:</b> | 2016-08-11     | <b>Test location:</b>     | Wireless Center |
| <b>EUT Serial:</b>   | XX1000000035   | <b>Ambient temp:</b>      | 21 °C           |
| <b>Tested by:</b>    | Robert Hietala | <b>Relative humidity:</b> | 37 %            |
| <b>Test result:</b>  | Pass           | <b>Margin:</b>            | 180.2 kHz       |

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

The test method is in accordance with ANSI C63.10-2013 section 11.8.1, option 2.

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

**8.2 Test conditions**

Detector: Peak  
RBW: 100 kHz  
VBW: 300 kHz  
Span: 5 MHz

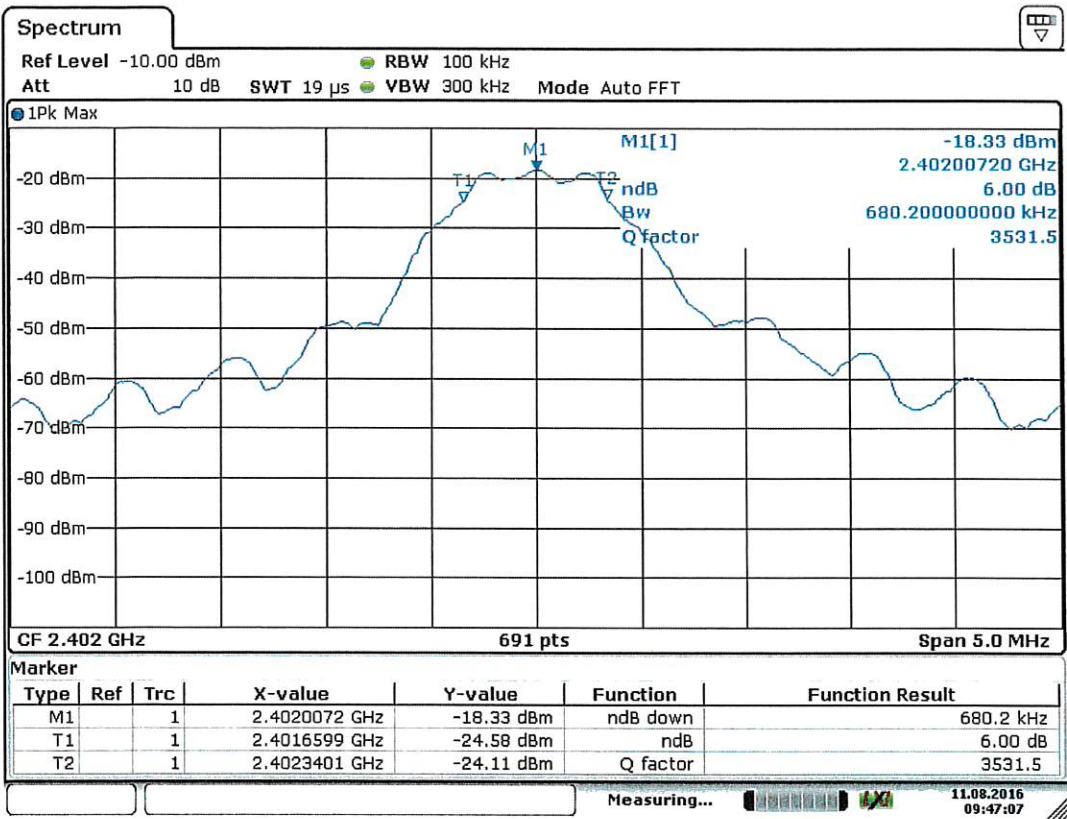
The EUT was set up in order to emit maximum disturbances.

**8.3 Requirements**

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

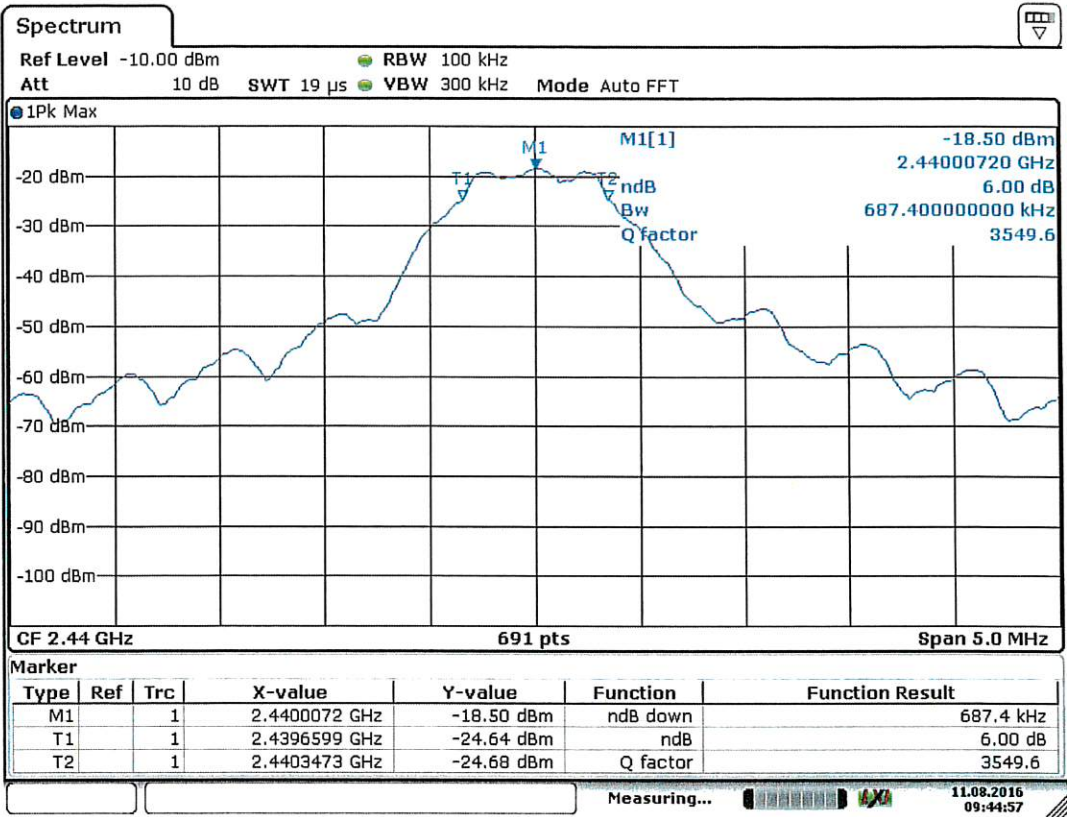
The minimum 6 dB bandwidth shall be 500 kHz.

8.4 Test results



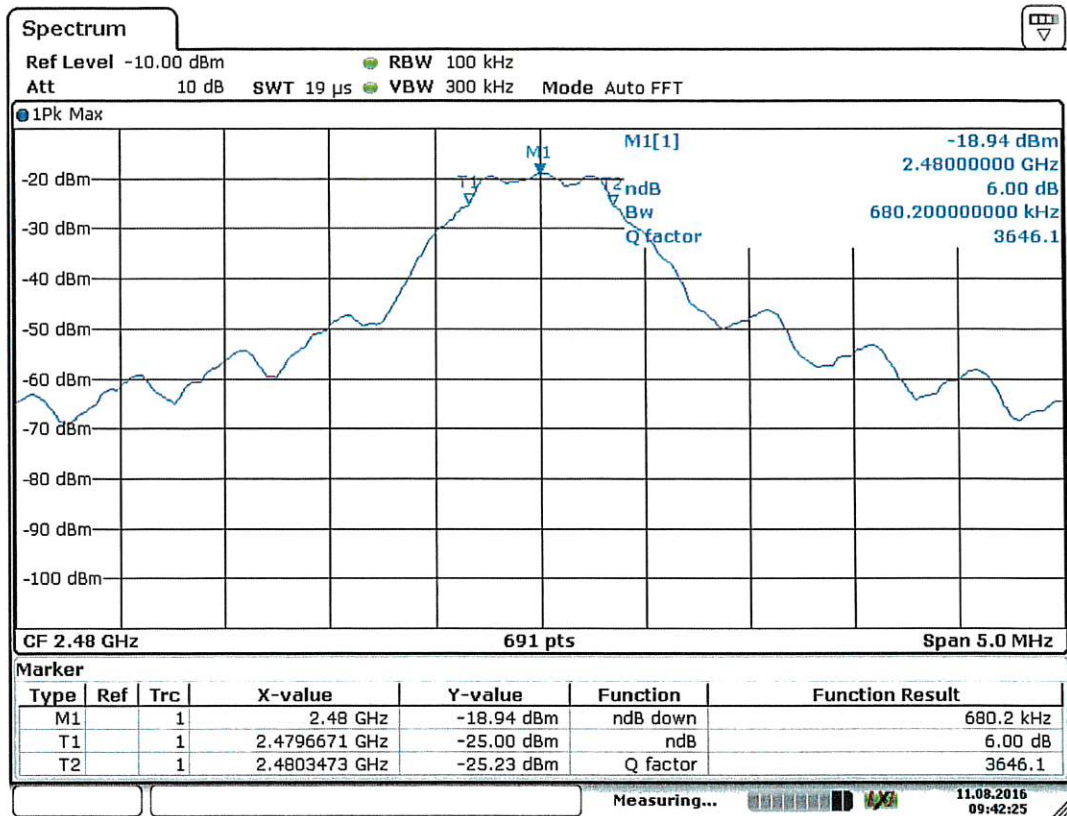
Date: 11 AUG 2016 09:47:06

Screenshot: Occupied bandwidth Measurement, low channel



Date:11 AUG 2016 09:44:57

Screenshot: Occupied bandwidth Measurement, middle channel



Date: 11 AUG 2016 09:42:25

**Screenshot: Occupied bandwidth Measurement, high channel****Test result**

| Channel<br>[MHz] | 6 dB BW<br>[kHz] |
|------------------|------------------|
| 2402             | 680.2            |
| 2440             | 687.4            |
| 2480             | 680.2            |

## 9 99 % BANDWIDTH

|               |                |                    |                 |
|---------------|----------------|--------------------|-----------------|
| Date of test: | 2016-08-11     | Test location:     | Wireless Center |
| EUT Serial:   | XX1000000035   | Ambient temp:      | 21 °C           |
| Tested by:    | Robert Hietala | Relative humidity: | 37 %            |
| Test result:  | Pass           | Margin:            | --              |

## 9.1 Test set-up and test procedure.

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

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

## 9.2 Test conditions

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

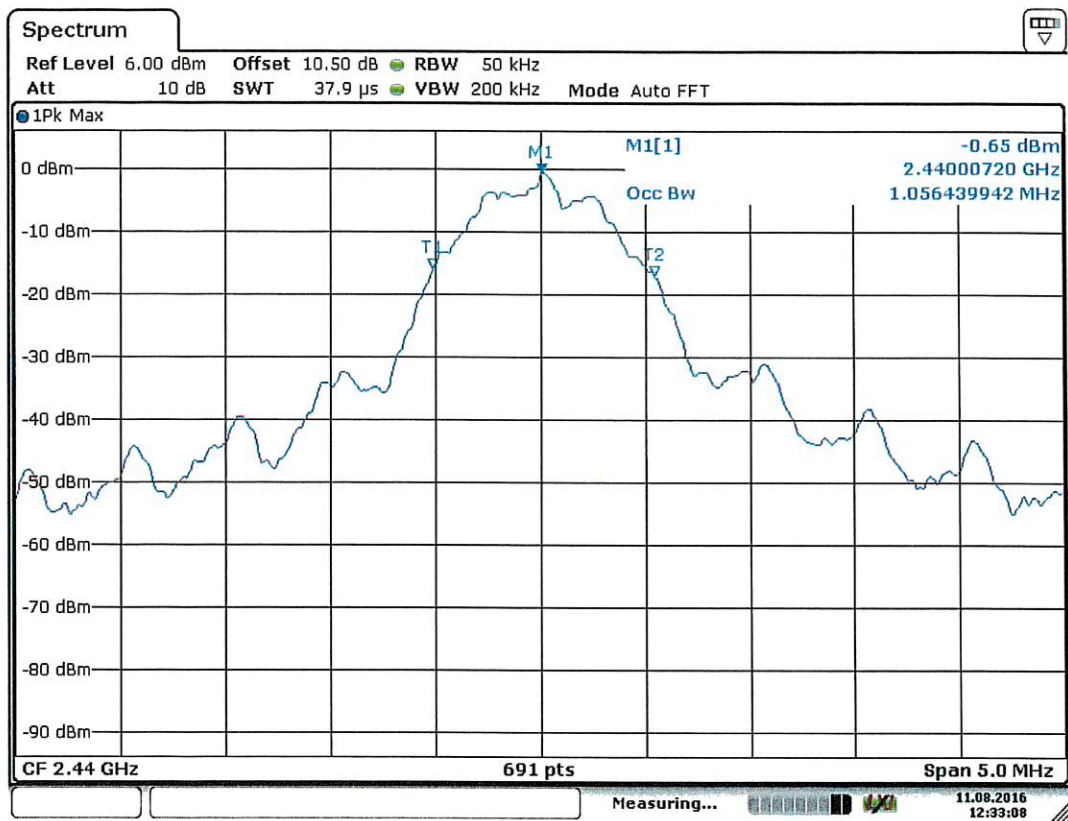
The EUT was set up in order to emit maximum disturbances.

## 9.3 Test results



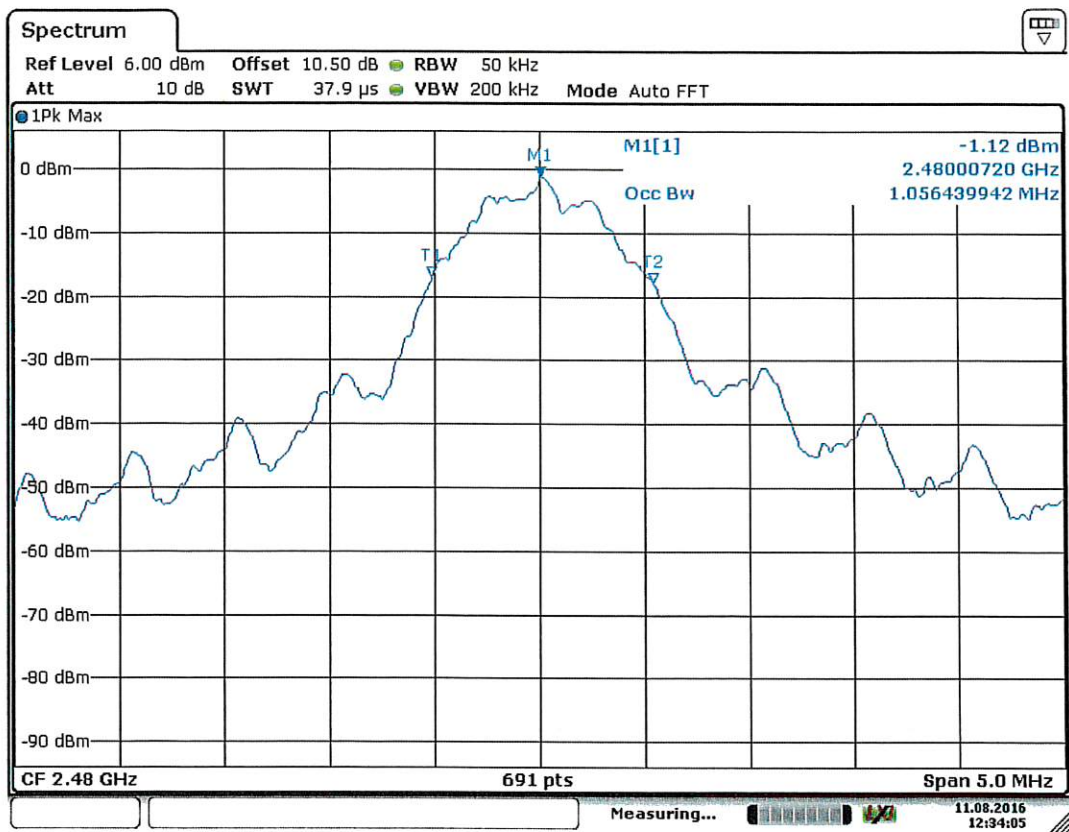
Date: 11.AUG 2016 12:32:03

Screenshot: Occupied bandwidth Measurement, low channel



Date: 11.AUG.2016 12:33:08

Screenshot: Occupied bandwidth Measurement, middle channel



Date: 11 AUG 2016 12:34:05

**Screenshot: Occupied bandwidth Measurement, high channel****Test result**

| Channel [MHz] | 99 % BW [MHz] |
|---------------|---------------|
| 2402          | 1.05          |
| 2440          | 1.06          |
| 2480          | 1.06          |

**10 PEAK POWER SPECTRAL DENSITY**

|                      |                |                           |                 |
|----------------------|----------------|---------------------------|-----------------|
| <b>Date of test:</b> | 2016-08-11     | <b>Test location:</b>     | Wireless Center |
| <b>EUT number:</b>   | XX1000000035   | <b>Ambient temp:</b>      | 21 °C           |
| <b>Tested by:</b>    | Robert Hietala | <b>Relative humidity:</b> | 37 %            |
| <b>Test result:</b>  | Pass           | <b>Margin:</b>            | > 10 dB         |

**10.1 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.

**10.2 Test conditions**

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

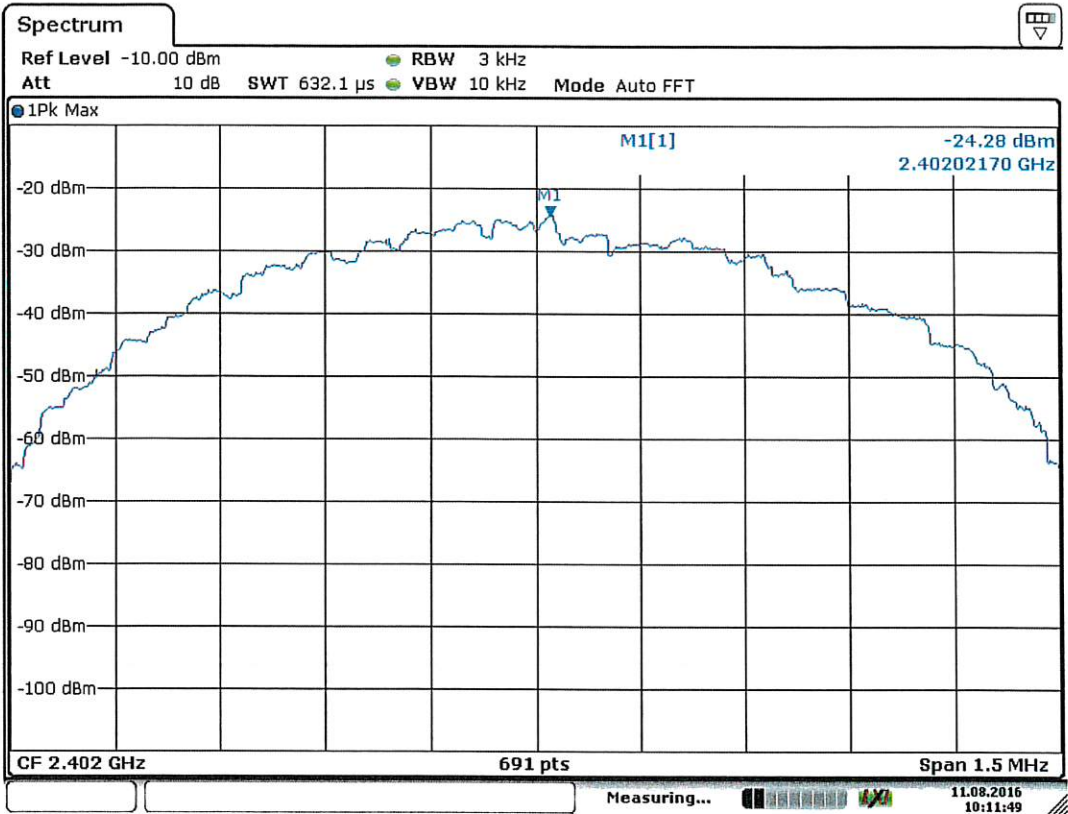
The EUT was set up in order to emit maximum disturbances.

**10.3 Requirements**

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

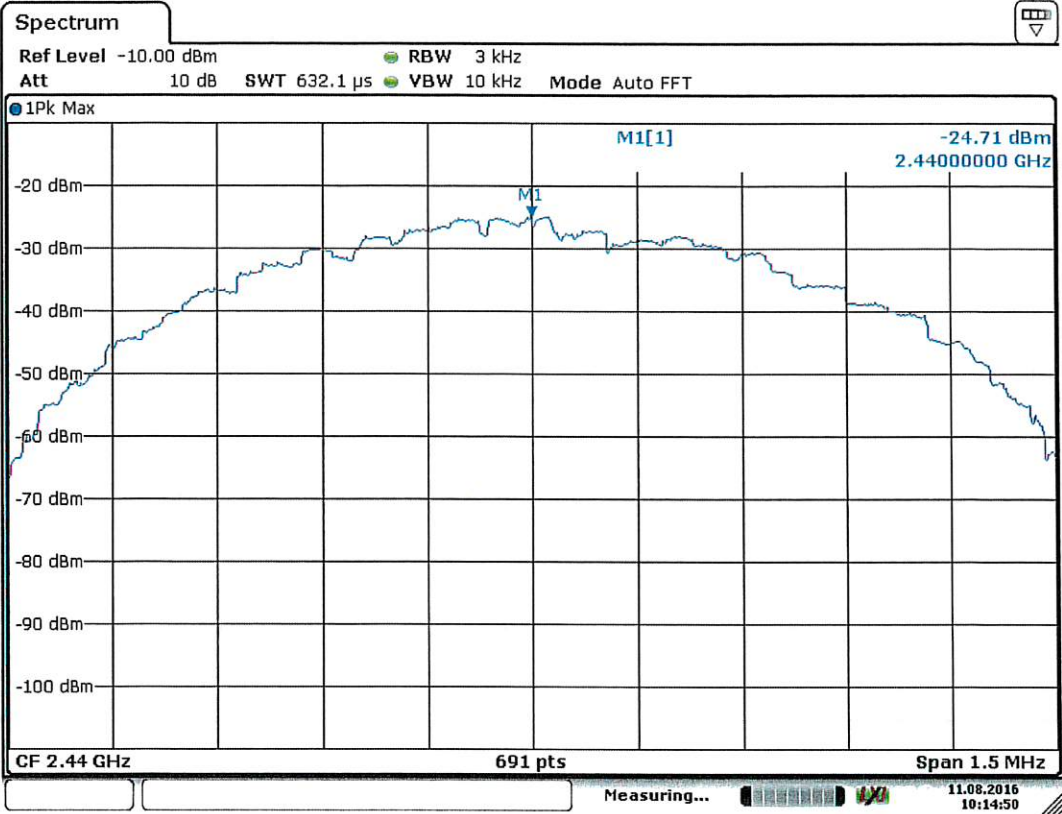
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

10.4 Test results



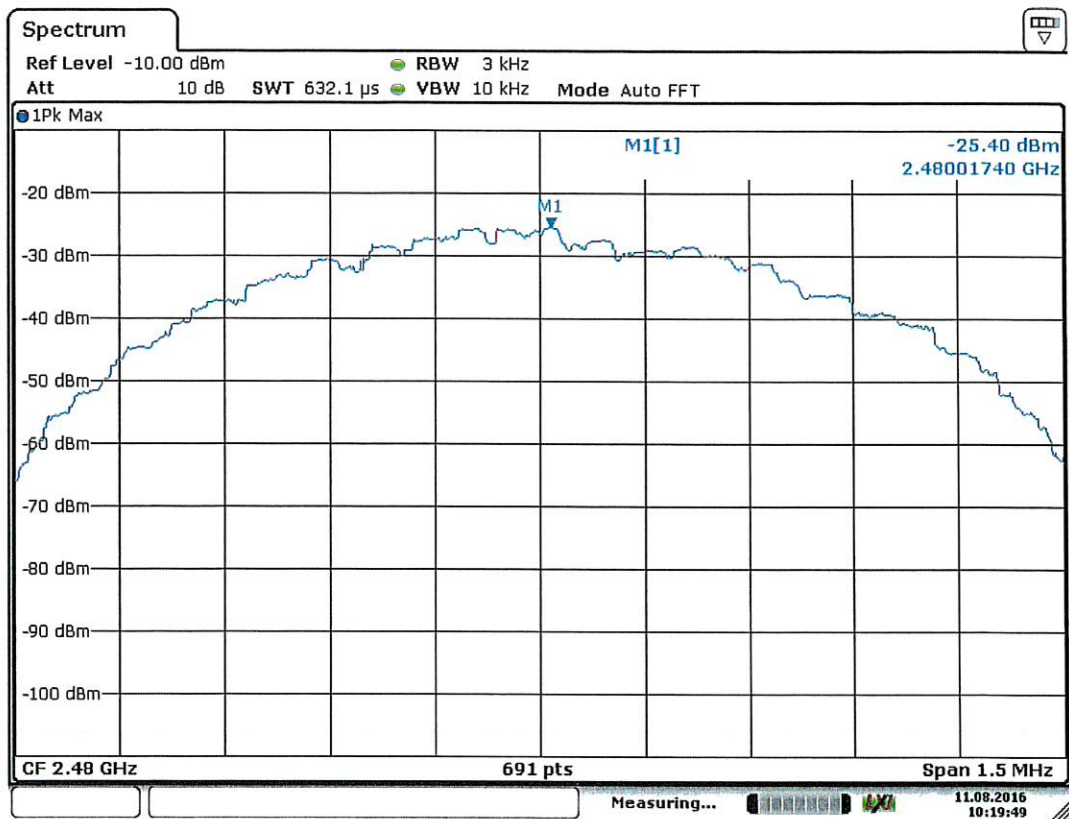
Date: 11 AUG 2016 10:11:50

Screenshot: Peak power spectral density, low channel



Date: 11 AUG 2016 10:14:50

Screenshot: Peak power spectral density, middle channel



Date: 11 AUG 2016 10:19:49

**Screenshot: Peak power spectral density, high channel****Test result**

| Channel [MHz] | PSD [dBm/3kHz] |
|---------------|----------------|
| 2402          | -24.3          |
| 2444          | -24.7          |
| 2480          | -25.4          |

**11 DUTY CYCLE DECLARATION**

|                      |                |                           |                 |
|----------------------|----------------|---------------------------|-----------------|
| <b>Date of test:</b> | 2016-09-06     | <b>Test location:</b>     | Wireless Center |
| <b>EUT Serial:</b>   | --             | <b>Ambient temp:</b>      | --              |
| <b>Tested by:</b>    | Robert Hietala | <b>Relative humidity:</b> | --              |
| <b>Test result:</b>  | --             | <b>Margin:</b>            | --              |

**11.1 Duty cycle declaration**

According to the client the information listed below is the worst case scenario of the duty cycle for normal mode of operation.

The packet length is 476  $\mu$ s; the chipset used is capable of sending six (6) packets per connection event.

Connection interval is 7.5 ms; the minimum number of frequencies hops is 15.

**11.2 Duty cycle correction factor**

Duty cycle correction factor is calculated using the equation:  $\delta$  (dB) = 20 log (duty cycle).

Given the information provided by the client the duty cycle correction factor is calculated as follows:

$$\delta \text{ (dB)} = 20 * \log \left( \frac{6 * 476 \mu s}{15 * 7.5 ms} \right)$$

$$\delta \text{ (dB)} = -31.9$$

The duty cycle correction factor is -31.9 dB.

**12 TEST EQUIPMENT**

Stora Hallen

| Equipment type              | Manufacturer      | Model                | Inv. No.    | Last Cal. date | Cal. interval |
|-----------------------------|-------------------|----------------------|-------------|----------------|---------------|
| Measurement software        | Rohde & Schwarz   | EMC32 -- 8.51.0      | --          | --             | --            |
| Receiver                    | Rohde & Schwarz   | ESU 8                | 12866       | 07-2016        | 1 year        |
| Receiver                    | Rohde & Schwarz   | ESU 40               | 13178       | 07-2016        | 1 year        |
| BiLog antenna               | Chase             | CBL6110A             | 971         | 07-2016        | 3 year        |
| Preamplifier                | HP                | --                   | 7992 / 7993 | 06-2016        | 1 year        |
| Horn antenna                | Rohde & Schwarz   | HF907                | 31246       | 06-2016        | 1 year        |
| 2,4 GHz band reject filter: | K&L MICROWAVE INC | 6N45-2450/T100-0/0   | 12389       | 03-2016        | 1 year        |
| 4 GHz high pass filter      | K&L MICROWAVE INC | 4410-X4500/18000-0/0 | 5133        | 07-2016        | 1 year        |

## Wireless Center and 3m FAC

| Equipment type              | Manufacturer      | Model                                               | Inv. No. | Last Cal. date | Cal. interval |
|-----------------------------|-------------------|-----------------------------------------------------|----------|----------------|---------------|
| Measurement software        | Rohde & Schwarz   | EMC32 – 9.21.0                                      | --       | --             | --            |
| Signal analyzer             | Rohde & Schwarz   | FSIQ 40                                             | 12793    | 07-2016        | 1 year        |
| Measurement cable           | Huber + Suhner    | Sucoflex 104 PE                                     | 39071    | 07-2016        | 1 year        |
| Measurement cable           | Huber + Suhner    | Sucoflex 104 PE                                     | 39084    | 07-2016        | 1 year        |
| Measurement cable           | Huber + Suhner    | Sucoflex 104                                        | 39033    | 07-2016        | 1 year        |
| Measurement cable           | Huber+ Suhner     | Sucoflex 104                                        | 39119    | 07-2016        | 1 year        |
| Measurement cable           | Huber+ Suhner     | Sucoflex 102                                        | 39138    | 07-2016        | 1 year        |
| Horn antenna                | EMCO              | 3115                                                | 4936     | 04-2014        | 3 years       |
| Pre amplifier               | Sangus            | 00101400-23-10P -6-S ;<br>AFS44-12002400-32-10P -44 | 12335    | 07-2016        | 1 year        |
| Horn antenna                | EMCO              | 3160-08                                             | 30099    | 10-2013        | 3 years       |
| Horn antenna                | EMCO              | 3160-09                                             | 30101    | 10-2013        | 3 years       |
| Signal analyzer:            | Rohde & Schwarz   | FSV 30                                              | 32594    | 07-2016        | 1 year        |
| Signal generator:           | Rohde & Schwarz   | SMB100A                                             | 32592    | 07-2016        | 1 year        |
| Signal analyzer             | Rohde & Schwarz   | FSIQ 40                                             | 12793    | 07-2016        | 1 year        |
| 2,4 GHz band reject filter: | K&L MICROWAVE INC | 6N45-2450/T100-0/0                                  | 12389    | 03-2016        | 1 year        |
| 4 GHz high pass filter      | K&L MICROWAVE INC | 4410-X4500/18000-0/0                                | 5133     | 08-2016        | 1 year        |
| Temperature chamber:        | Vötsch            | VC4018                                              | 12282    | month-year     | 1 year        |
| Multimeter                  | Fluke             | 179                                                 | 33105    | 10-2015        | 1 year        |

### 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 1613920STO-002 Annex 1.

Test set up photos are in separate document 1613920STO-002 Annex 2.