

**TEST REPORT CONCERNING THE COMPLIANCE OF A
Low Power Communication Device Transmitter (DXX)
OPERATING IN THE FREQUENCYRANGE 2402 – 2480 MHz,
BRAND Tacx, MODEL T2240
WITH 47 CFR PART 15 (10-1-14 Edition) and
RSS-Gen (Issue 4, November 2014) and
RSS-210 (Issue 8, December 2010)**

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R&TTE and, EMC Notified Body : 1856

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MEASUREMENT/TECHNICAL REPORT

Brand: Tacx
Model: T2240

FCC ID: 2AAMI-T2240
IC: 11353A-T2240

| | |
|-----------------------|--|
| This report concerns: | Original grant,certification / Limited Single Modular Approval Verification Class 2 change |
| Equipment type: | Low Power Communication Device Transmitter (DXX) |
| Report prepared by: | Name : Richard van der Meer Company name : TÜV Rheinland Nederland B.V. Address : Eiberkamp 10 Postal code/city : 9351VT Leek Mailing address : P.O. Box 37 Postal code/city : 9350AA Leek Country : The Netherlands Telephone number : + 31 594 505 005 Telefax number : + 31 594 504 804 E-mail : products@nl.tuv.com |

The data taken for this test and report herein was done in accordance with 47 CFR Part 15 (10-1-14 Edition), RSS-Gen (Issue 4, November 2014) and RSS-210 (Issue 8, December 2010) and the measurement procedures of ANSI C63.10-2013. TÜV Rheinland Nederland B.V. at Leek, The Netherlands, certifies that the data is accurate and contains a true representation of the emission profile of the Equipment Under Test (EUT) on the date of the test as noted in the test report. I have reviewed the test report and find it to be an accurate description of the test(s) performed and the EUT so tested.

Date: April 28, 2016

Signature:



Pieter de Beer
Technical Manager
TÜV Rheinland Nederland B.V.

Description of test item

EUT : Low Power Communication Device Transmitter (DXX)
Manufacturer : Tacx b.v.
Brand : Tacx
Model(s) : T2240
Serial Number : 951500057 (conducted tests) and
951500042 (radiated tests)
Voltage input rating : 40 Vac
Voltage output rating : --
Current input rating : --
Antenna : Internal, integrated on the PCB
Antenna Gain : + 2.0 dBi
Operating frequency : 2402 MHz-2480 MHz.
Modulation : GFSK
Remarks : n.a.


Applicant information


Applicant's representative : Martin Smits
Company : Tacx b.v.
Address : Rijksstraatweg 52
Postal code : 2241BW,
City : Wassenaar
Country : Netherlands
Telephone number : +31705119259
Telefax number : +31705116411

Test(s) performed

Location : Leek
Test(s) started : April 04, 2016
Test(s) completed : April 18, 2016
Purpose of test(s) : Equipment Authorization (Original grant/certification)

Test specification(s) : 47 CFR Part 15, Subpart C, Section 15.249 (10-1-14 Edition) and
RSS-GEN (ISSUE 4, NOVEMBER 2014) AND
RSS-210 (ISSUE 8, DECEMBER 2010).

Test engineer(s) : R. van der Meer 

Report written by : R. van der Meer 

Report date : April 28, 2016

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The test results relate only to the item(s) tested.**

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1 General information.

1.1 Product description.

The brand Tacx, Model T2240, hereafter referred to as EUT, is a Low Power Communication Device Transmitter (DXX), Bluetooth Low Energy used in an Interactive Smart Trainer with Electric Motor Brake for bicycles to transmit performance data to PC, Tablet or smartphone. The EUT is factory configured for the 2402-2480 MHz band. The EUT also contains a Digital Transmission System (DTS) operating in the frequencyband 2403-2480 MHz, based on ANT technology, although the two transmitters never transmit at the same time. The DTS transmitter is covered in a separate report.

1.1.1 Introduction.

The content of this report and measurement results have not been changed other than the way of presenting the data.

1.2 Related submittal(s) and/or Grant(s).

1.2.1 General.

This test report supports the original grant/certification in equipment authorization files under:
 FCC ID: 2AAMI-T2240 and IC: 11353A-T2240.

1.3 Tested system details.

Details and an overview of the system and all of its components, as it has been tested, may be found below.

| | | |
|-----------------------|---|--|
| EUT | : | Low Power Communication Device Transmitter (DXX) |
| Manufacturer | : | Tacx b.v. |
| Brand | : | Tacx |
| Model(s) | : | T2240 |
| Serial Number | : | 951500057 (conducted tests) and 951500042 (radiated tests) |
| Voltage input rating | : | 40 Vac |
| Voltage output rating | : | -- |
| Current input rating | : | -- |
| Antenna | : | Internal, integrated on the PCB |
| Antenna Gain | : | + 2.0 dBi |
| Operating frequency | : | 2402 MHz-2480 MHz. |
| Modulation | : | GFSK |
| Spreading technique | : | Digital modulation |
| Remarks | : | n.a. |

| | | |
|------------------------------|---|--|
| Auxiliary equipment 1 (AUX1) | : | Notebook computer |
| Brand | : | Hewlett-Packard |
| Model | : | Compaq 6710b |
| Serial number | : | CNU8150MD3 |
| Remark | : | used for programming the EUT, property applicant |

| | | |
|------------------------------|---|--|
| Auxiliary equipment 2 (AUX2) | : | Programming interface |
| Brand | : | Segger |
| Model | : | J-Link Base version 9.3 |
| Serial number | : | 59307055 |
| Remarks | : | used for programming the EUT, property applicant |

1.3.1 Description of input and output ports.

No input and output connections ports on the EUT during testing, but for programming the following connections were used.

| Number | Terminal | From | To | Remarks |
|--------|----------|-------|--------|---------|
| 1 | Mains | Mains | (AUX1) | -- |
| 2 | Usb | AUX1 | AUX2 | -- |
| 3 | datacom | AUX2 | EUT | -- |
| 4 | Power | AUX3 | EUT | -- |

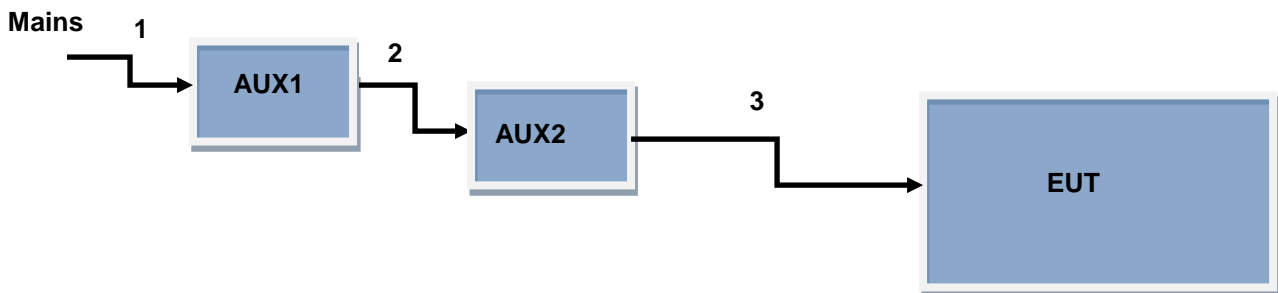


Figure 1. Basic set-up for programming

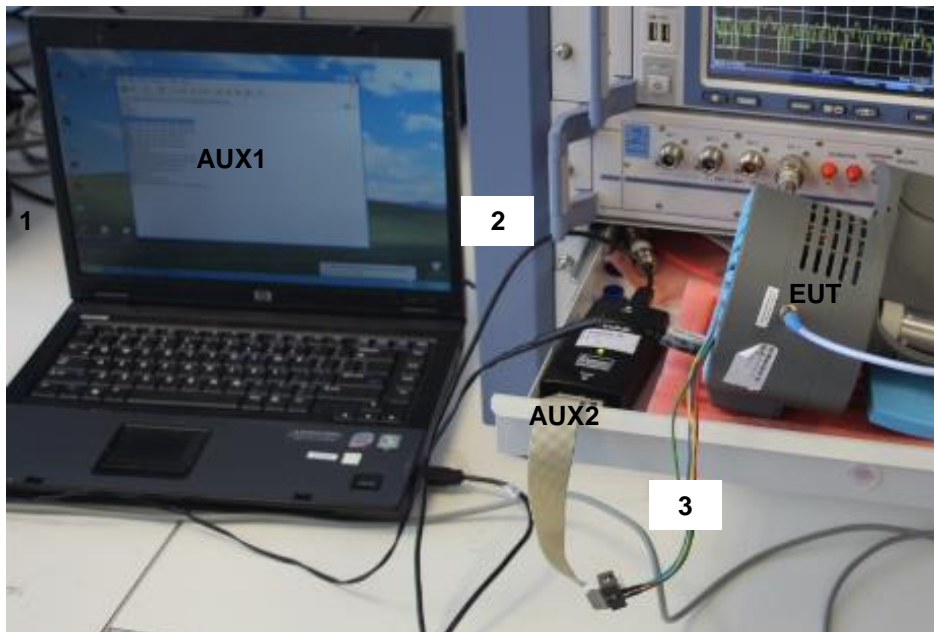


Photo 1: basic setup for frequency programming

The testsoftware (as installed on AUX1) is used to program the operating frequency of the EUT. AUX2 were used only to program the operating frequency and once set the auxiliary items were removed from the test-setup and the EUT operates on it's own.

1.4 Test results summary

The EUT was tested in accordance with the specifications given in the table below.

| Test Standard | | Description | Page | Pass / Fail |
|----------------------------------|---------------------------------------|-----------------------------------|---------|----------------|
| 47 CFR Part 15 (10-1-14 Edition) | RSS-Gen /RSS-210 | | | |
| 15.207(a) | RSS-Gen(8.8) | AC Power Line Conducted Emissions | 16 - 19 | Not Applicable |
| 15.205 and 15.209 | RSS-Gen(8.9, 8.10) and RSS-210 (A2.5) | Radiated Emissions | 11 - 15 | Pass |
| 15.249(d) | RSS-210 (section A2.9) | Band Edge Emissions | 20 - 22 | Pass |
| 15.215(c) | RSS-Gen(6.6) | Occupied Bandwidth | 23 - 28 | Pass |

Table : testspecifications

Testmethods: ANSI C63.10-2013 and RSS-Gen Issue 4, November 2014

1.5 Test methodology.

The test methodology used is based on the requirements of 47 CFR Part 15 (10-1-14 Edition), sections 15.31, 15.205, 15.207, 15.209 and 15.249, RSS-GEN (ISSUE 4, NOVEMBER 2014) RSS-210 (ISSUE 8, DECEMBER 2010).

The test methods, which have been used, are based on ANSI C63.10-2013.

The receivers are switching automatically to the right bandwidth in accordance with CISPR 16. This is implemented in the receiver. The antenna factors are programmed in the test receiver. The receiver automatically calculates the appropriate correction factor for the utilized antenna and also the appropriate antenna factor for the cable loss. The total correction is automatically added to the measured value.

1.6 Test facility.

The Federal Communications Commission and Industry Canada has reviewed the technical characteristics of the test facilities at TÜV Rheinland Nederland B.V. , located in Leek, 9351VT Eiberkamp 10, The Netherlands, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948.

The description of the test facilities has been filed at the Office of the Federal Communications Commission under registration number 90828. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The description of the test facilities has been filed to Industry Canada under registration number 2932G-2. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

1.7 Test conditions.

Normal test conditions:

Temperature (*) : +15°C to +35°C
Relative humidity(*) : 20 % to 75 %
Supply voltage : 40 Vac through a 230Vac Power Supply Adapter (AUX1)

When it was impracticable to carry out the tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests are stated separately.

2 System test configuration.

2.1 Justification.

As load, a system with a driving control and motor was applied to drive the wheel. The performance could be monitored on a smartphone.

The justification and manipulation of cables and equipment in order to simulate a worst-case behavior of the test setup has been carried out as prescribed in ANSI C63.10-2013.

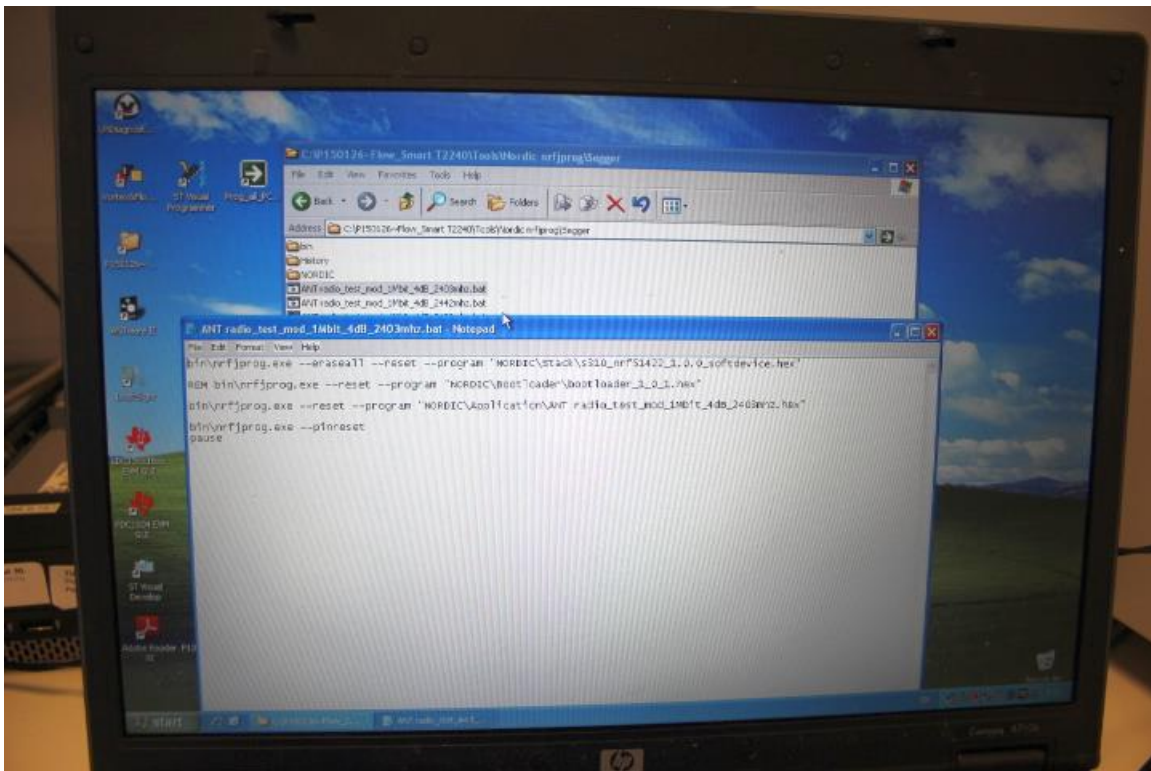
2.2 EUT mode of operation.

The EUT has been tested in continues transmit mode with a modulated carrier. The intentional radiator tests have been performed with a complete functioning EUT.

A continuous transmit mode could be initiated by using test software as supplied by the applicant. The test software was used to define various different operational modes of the EUT for the purpose of compliance testing. The version of the test software, as supplied by the applicant and used during all tests is:

Test software : nRFTools 51422 v1.0.0

Batch files programmed by the applicant are used to make the required settings.
This software was running on a laptop computer (AUX1).



Photograph of the software (and settings) as used on AUX1

2.3 Special accessories.

No special accessories are used and/or needed to achieve compliance.

2.4 Equipment modifications.

No modifications have been made to the equipment in order to achieve compliance.

2.5 Product Labeling

The product labeling information is available in the technical documentation package.

2.6 Block diagram of the EUT.

The block diagram is available in the technical documentation package.

2.7 Schematics of the EUT.

The schematics are available in the technical documentation package.

2.8 Part list of the EUT.

The part list is available in the technical documentation package.

3 Radiated emission data.

RESULT: PASS

Date of testing: 2016-04-05

Frequency range: 30MHz - 25GHz

Requirements:

FCC 15.205, FCC 15.209, FCC 15.249 and IC RSS-Gen(8.9, 8.10) and RSS-210(A2.5)

Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a), must comply with the radiated emission limits specified in FCC 15.209(a).

Radiated emissions which fall outside the operation frequency band and outside restricted bands shall either meet the limit specified in FCC 15.209(a)/ RSS-Gen (8.8) or be attenuated at least 20dB below the power level in the 100kHz bandwidth within the band that contains the highest level of the desired power (the less severe limit applies).

Test procedure:

ANSI C63.10-2013.

The EUT is considered as **floor-standing equipment** not typically installed with its base in direct electrical contact with, or connected to, a metal floor or grid. The EUT was placed on the floor with insulation material in-between of 4mm thickness to prevent electric contact.

Before final measurements of radiated emissions were performed, the EUT was scanned to determine its emission spectrum profile. The physical arrangement of the test system, the associated cabling were varied in order to ensure that maximum emission amplitudes were attained.

The spectrum was examined from 30MHz to the 10th harmonic of the highest fundamental transmitter frequency (25GHz). Final radiated emission measurements were made at 3m distance.

At each frequency where a spurious emission was found, the EUT was rotated 360° and the antenna was raised and lowered from 1 to 4m in order to determine the emission's maximum level. Measurements were taken using both horizontal and vertical antenna polarizations.

The highest emission amplitudes relative to the appropriate limit were recorded in this report. Field strength values of radiated emissions at frequencies not listed in the tables are more than 20 dB below the applicable limit. The levels are expressed in dBm which are derived from $\text{dBm} = E(\text{dB}\mu\text{V}/\text{m}) - 95.2\text{dB}$. Where Peak (Pk) values were at least 6 dB under the Average (Av) limits, Av value was not tested. Where Average values were tested, Average values were measured using a 10Hz Video Bandwidth.

3.1 Radiated field strength measurements (30 MHz – 1 GHz, E-field)

3.1.1 Radiated field strength measurements (30 MHz- 1 GHz, E-field)

| Frequency [MHz] | Antenna Orientation | Level QP [dB μ V/m] | Limit QP [dB μ V/m] | Result Pass/Fail |
|----------------------|---------------------|-------------------------|-------------------------|------------------|
| 111.48 ^{*R} | Vertical | 24.8 | 43.5 | Pass |
| 208.48 | Vertical | 24.0 | 43.5 | Pass |
| 258.92 ^{*R} | Vertical | 28.1 | 46.0 | Pass |
| 522.76 | Vertical | 35.5 | 46.0 | Pass |
| 858.38 (noise) | Vertical | 41.7 | 46.0 | Pass |
| 947.62 (noise) | Vertical | 43.2 | 46.0 | Pass |

Table 1 Radiated emissions of the EUT in the frequency range 30 MHz – 1 GHz.

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.209, 15.249 and RSS-210 Section A2.9 and RSS-Gen section 8.9 with the EUT operating in continues transmit mode are depicted in Table 1.

Notes:

1. Field strength values of radiated emissions at frequencies not listed in the table above are more than 20 dB below the applicable limit. The 6 highest values are noted
2. Measurement uncertainty is ± 5.0 dB
3. The reported field strength values are the worst case values at the indicated frequency. The EUT was varied in 2 positions (horizontal and vertical) because of it's physical limitations, the antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
4. Preliminary measurements indicated that the radiated emissions from EUT were not affected by the EUT's operating mode or frequency.
5. A Quasi-peak detector was used with a resolution bandwidth of 120 kHz.

Used test equipment and ancillaries:

| | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--|
| A00314 | A00447 | A00450 | A00257 | A00235 | A00258 | A00444 | A00466 | |
| | | | | | | | | |

3.2 Radiated field strength measurements (1 - 25 GHz, E-field)

3.2.1 Radiated field strength measurements (1 - 25 GHz, E-field), EUT's TX Frequency 2402 MHz

| Frequency [MHz] | Antenna Orientation | Detector | Resolution Bandwidth (kHz) | Level [dBm] | Limit [dBm] | Result |
|--------------------------------|---------------------|----------|----------------------------|-------------|--------------------------|--------|
| 2402 (fundamental) | Horizontal | Peak | 1000 | -4.7 | -1.2 Av +18.9 Pk | Pass |
| 1258.3 ^{*R} | Vertical | Peak | 1000 | -36.2 | -41.2 (Av) -21.2 (Pk) | Pass |
| 1440.8 ^{*R} | Vertical | Peak | 1000 | <-55.0 | -41.2 (Av) -21.2 (Pk) | Pass |
| 4806 ^{*H^R} | Vertical | Peak | 1000 | -47.5 | 41.2 (Av) -21.2 (Pk) | Pass |
| 7210 ^{*HR} | Vertical | Peak | 1000 | <-50.0 | -41.2 (Av) -21.2 (Pk) | Pass |
| 7408 ^{*R} | Vertical | Peak | 1000 | <-50.0 | -41.2 (Av) -21.2 (Pk) | Pass |

Table 2

3.2.2 Radiated field strength measurements (1 - 25 GHz, E-field), EUT's TX Frequency 2440 MHz

| Frequency [MHz] | Antenna Orientation | Detector | Resolution Bandwidth (kHz) | Level [dBm] | Limit [dBm] | Result |
|--------------------------------|---------------------|----------|----------------------------|-------------|----------------------|--------|
| 2440 (fundamental) | Horizontal | Peak | 1000 | -5.1 | -1.2 Av +18.9 Pk | Pass |
| 1086 ^{*R} | Horizontal | Peak | 1000 | -51.0 | -41.2 Av -21.2 Pk | Pass |
| 1441.8 ^{*R} | Vertical | Peak | 1000 | -50.0 | -41.2 Av -21.2 Pk | Pass |
| 1554 ^{*R} | Vertical | Peak | 1000 | -53.3 | -41.2 Av -21.2 Pk | Pass |
| 4884 ^{*H^R} | Vertical | Peak | 1000 | -47.9 | -21.2 Pk | Pass |
| 7326 ^{*HR} | Vertical | Peak | 1000 | <-55.0 | -41.2 Av -21.2 Pk | Pass |

Table 3

3.2.3 Radiated field strength measurements (1 - 25 GHz, E-field), EUT's TX Frequency 2480 MHz

| Frequency [MHz] | Antenna Orientation | Detector | Resolution Bandwidth (kHz) | Level [dBm] | Limit [dBm] | Result |
|--------------------------------|---------------------|----------|----------------------------|-------------|--------------------------|--------|
| 2480 (fundamental) | Horizontal | Peak | 1000 | -5.8 | -1.2 Av +18.9 Pk | Pass |
| 1234 ^{*R} | Vertical | Peak | 1000 | -37.4 | -41.2 (Av) -21.2 (Pk) | Pass |
| 4924 ^{*H^R} | Vertical | Peak | 1000 | -48.0 | -41.2 (Av) -21.2 (Pk) | Pass |
| 7452 ^{*H^R} | Vertical | Peak | 1000 | -55.0 | -41.2 (Av) -21.2 (Pk) | Pass |
| 9920.2 ^{*H} | Vertical | Peak | 1000 | -50.0 | -41.2 (Av) -21.2 (Pk) | Pass |

Table 4

3.2.4 Radiated field strength measurements (1 - 25 GHz, E-field), EUT normal operation

| Frequency [MHz] | Antenna Orientation | Detector | Resolution Bandwidth (kHz) | Level [dBm] | Limit [dBm] | Result |
|--------------------------------|---------------------|----------|----------------------------|-------------|----------------------|--------|
| 1431 | Horizontal | Peak | 1000 | -47.7 | -41.2 Av -21.2 Pk | Pass |
| 4810 ^{*R} | Horizontal | Peak | 1000 | -46.0 | -21.2 | Pass |
| 4810 ^{*R} | Horizontal | Average | 1000 | <-50 | -41.2 | Pass |
| 4884 ^{*R} | Horizontal | Peak | 1000 | -46.2 | -21.2 | Pass |
| 4884 ^{*R} | Horizontal | Average | 1000 | <-50 | -41.2 | Pass |
| 4921 ^{*H^R} | Vertical | Peak | 1000 | -45.7 | -41.2 Av -21.2 Pk | Pass |
| 4921 ^{*H^R} | Vertical | Average | 1000 | <-50 | -41.2 | Pass |
| 4960 ^{*H^R} | Vertical | Peak | 1000 | -45.9 | -41.2 Av -21.2 Pk | Pass |
| 4960 ^{*H^R} | Vertical | Average | 1000 | <-50 | -41.2 | Pass |
| 7212 ^{*H} | Vertical | Peak | 1000 | -49.1 | -41.2 Av -21.2 Pk | Pass |
| 7360 ^{*H^R} | Vertical | Peak | 1000 | -54.0 | -41.2 Av -21.2 Pk | Pass |

Table 5

The results of the radiated emission tests, carried out in accordance with 47 CFR Part 15 section 15.209 and 15.249 and RSS-210 section A2.9 and RSS-Gen section 8.9 with the EUT operating in continues transmit mode are depicted in Tables 2 through 5.

Notes:

1. Field strength values of radiated emissions at frequencies not listed in the table above are more than 20 dB below the applicable limit.
2. Measurement uncertainty is ± 5.0 dB
3. The reported field strength values are the worst case values at the indicated frequency. The EUT was varied in 2 positions, the antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
4. The EUT was tested on the lowest frequency (2402 MHz), a middle frequency (2440 MHz) and the highest frequency (2480 MHz) in the 2402 – 2480 MHz band wherein it operates and the normal operation with both transmitters (ANT and BLE) active, although they never transmit simultaneously.
5. Peak values were within Average limits, therefor not retested with Average detector,
6. *^H indicates a harmonic frequency, *^R indicates a frequency in the restricted band and *^{H+R} indicates a harmonic frequency in a restricted band.

Used test equipment and ancillaries:

| | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| A00450 | A00235 | A00337 | A00258 | A00444 | A00009 | A00012 | A00255 | A00247 |
| A00151 | A00131 | A00065 | | | | | | |

4 AC Powerline Conducted Emission Data.

4.1 AC Power Line Conducted Emission data of the EUT

RESULT: Pass

Date of testing: 2016-04-18

Requirements: for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

| Frequency of Emission (MHz) | Conducted Limit (dB μ V) Quasi-Peak | Conducted Limit (dB μ V) Average |
|-----------------------------|---|--------------------------------------|
| 0.15 – 0.5 | 66 to 56* | 56 to 46* |
| 0.5 – 5 | 56 | 46 |
| 5 - 30 | 46 | 50 |

*Decreases with the logarithm of the frequency.

Test procedure:

ANSI C63.10-2013.

Each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a 50 μ H / 50 Ω LISN. The frequency range from 150kHz to 30MHz was searched. The six highest EUT emissions relative to the limit were noted. The EUT is considered a floor-standing device. The EUT is placed on a non-conductive plate of 5mm thick above the ground plane, so to isolate it from the ground plane because the EUT normally does not make electrical contact with a ground plane. The EUT was positioned at least 80cm from the LISN. The power cable was routed over the non-conductive plate to the LISN.

4.1.1 AC Power Line Conducted Emissions

| Frequency (MHz) | Measurement results (dB μ V) L1 | | Measurement results (dB μ V) L2/Neutral | | Limits (dB μ V) | | Verdict (Pass/Fail) |
|-----------------|-------------------------------------|------|---|------|---------------------|------|---------------------|
| | QP | AV | QP | AV | QP | AV | |
| 0.15000 | 50.0 | 25.0 | 54.0 | 24.3 | 66.0 | 56.0 | Pass |
| 0.16172 | 52.6 | 24.7 | 52.4 | 23.8 | 65.5 | 55.5 | Pass |
| 0.16953 | 51.6 | 23.0 | 50.9 | 23.0 | 65.0 | 55.0 | Pass |
| 0.19297 | 48.4 | 22.9 | 48.8 | 22.5 | 64.0 | 54.0 | Pass |
| 0.22031 | 44.9 | 19.7 | 44.8 | 19.6 | 62.8 | 52.8 | Pass |
| 0.22813 | 43.9 | 20.5 | 43.9 | 20.4 | 62.4 | 52.4 | Pass |
| 0.25156 | 41.0 | 19.7 | 41.5 | 19.5 | 61.8 | 51.8 | Pass |
| 0.26719 | 39.2 | 15.9 | 39.2 | 15.9 | 61.1 | 51.1 | Pass |
| 0.27500 | 38.0 | 15.5 | 37.1 | 15.0 | 60.8 | 50.8 | Pass |
| 0.29844 | 35.3 | 15.5 | 35.2 | 15.4 | 60.2 | 50.2 | Pass |

Table 6 AC Power Line Conducted Emissions results

The results of the conducted emission tests, carried out in accordance with 47 CFR Part 15 section 15.207(a) and RS-Gen section 8.8, at the 120 Volts/ 60 Hz AC mains connection terminals of the AUX1 that connects to the EUT, are depicted in the table above.

Notes:

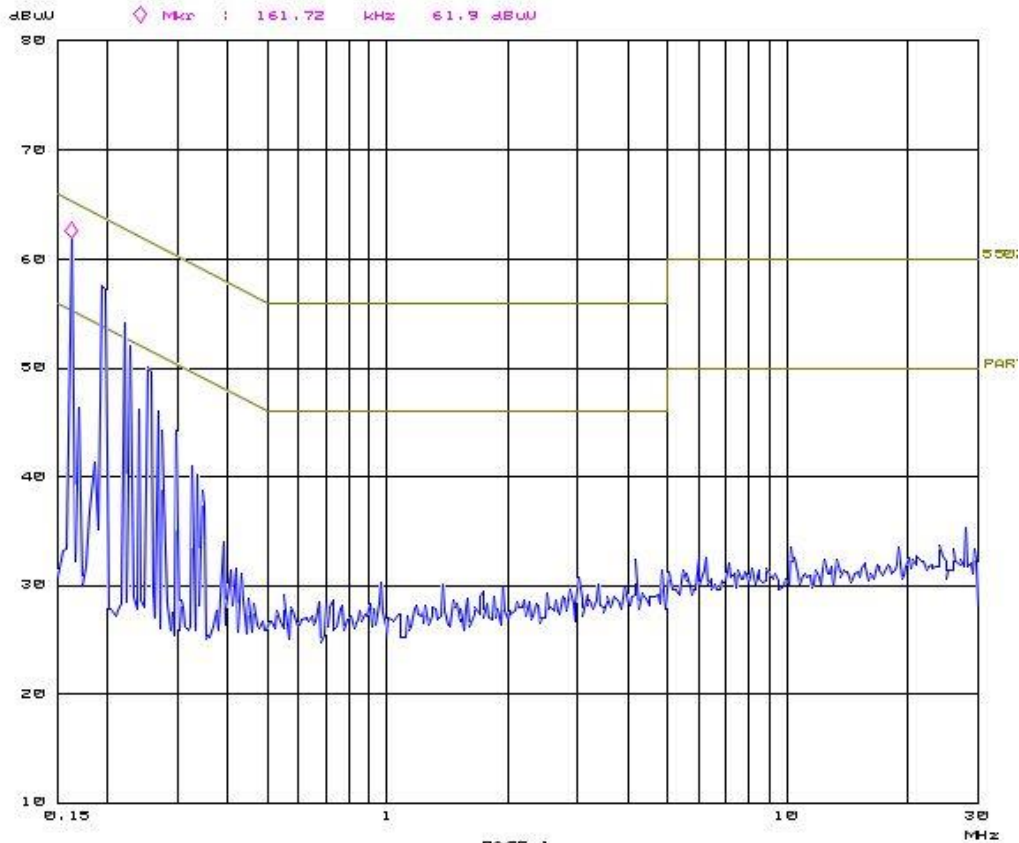
1. The resolution bandwidth used was 9 kHz.
2. From pre-test the worst case configuration proved to be the normal operation mode wherein both DTS transmitter and Bluetooth were operational but not transmitting simultaneously. Worst case values noted.
3. Measurement uncertainty is +/- 3.5 dB.
4. Plots are provided on the next pages.

4.1.2 Plots of the AC Power Line Conducted Emissions

18. Apr 16 09:36

```

Overview Scan Settings (1 Range)
-----
:----- Frequencies -----:----- Receiver Settings -----:
Start      Stop      Step      IF BW  Detector  M-Time  Atten  Preamp
150k       30M       3.9k      9k     PK        0.10ms  20dB  OFF
  
```

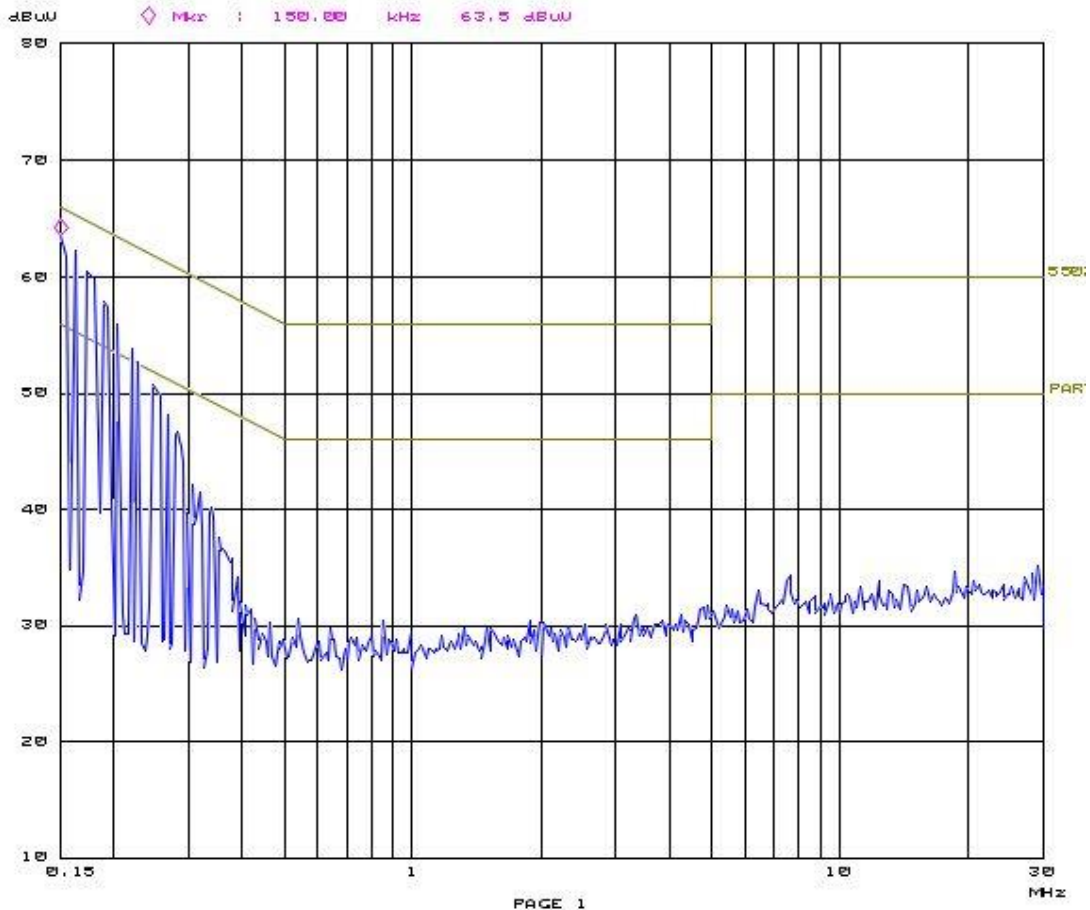


Plot of the AC Power Line Conducted Emissions on L1

18. Apr 16 09:45

Overview Scan Settings (1 Range)

| Frequencies | | | Receiver Settings | | | | |
|-------------|------|------|-------------------|----------|--------|---------|--------|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp |
| 150k | 30M | 3.9k | 9k | PK | 0.10ms | 20dB LN | OFF |



Plot of the AC Power Line Conducted Emissions on L2

5 Emissions at the band edges

RESULT: Pass

Date of testing: 2016-04-14

The tables below show compliance with the 47 CFR Part 15 section 15.249(d) and RSS-210 section A2.9, this section requires the emissions outside the 2400 and 2483.5 MHz frequency band to be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in section 15.209 and RSS-Gen section 7.2.5, whichever is the lower attenuation.

Table 7 below shows the levels at the band edges in respect to the general radiated emission limits.

| EUT Frequency [MHz] | Band Edge Frequency [MHz] | Antenna Orientation | Level Pk [dBm] | Limit Pk /Av [dBm] | Result Pass/Fail | Plot number |
|---------------------|---------------------------|---------------------|----------------|--------------------|------------------|-------------|
| 2402 | 2393.89 | Horizontal | -47.4 | -21.2 / -41.2 | Pass | 1a |
| 2480 | 2514.39 | Horizontal | -45.7 | -21.2 / -41.2 | Pass | 1b |

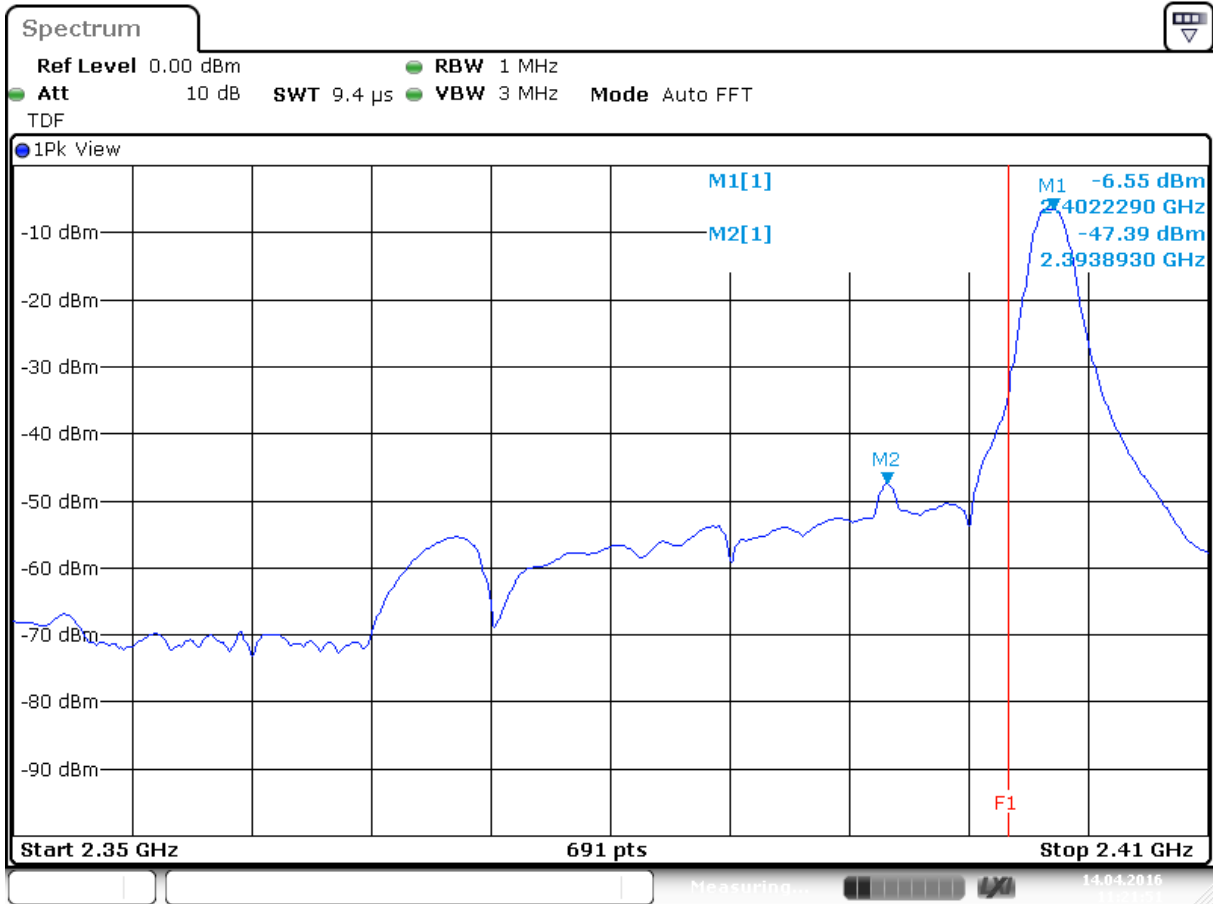
Table 7 level of the band edge emissions, Peak values

Notes:

1. Measurement uncertainty is ± 5.0 dB
2. The reported field strength values are the worst case values at the indicated frequency. The antenna was varied in horizontal and vertical orientations and also in height (between 1m and 4m).
3. The EUT was tested in on the lowest frequency (2402 MHz) and the highest frequency (2480 MHz) in the 2402 – 2480 MHz band wherein it operates.
4. Peak (Pk) values were already within Average (Av) limits, Av therefor not tested.
5. See plots on pages 21-22.

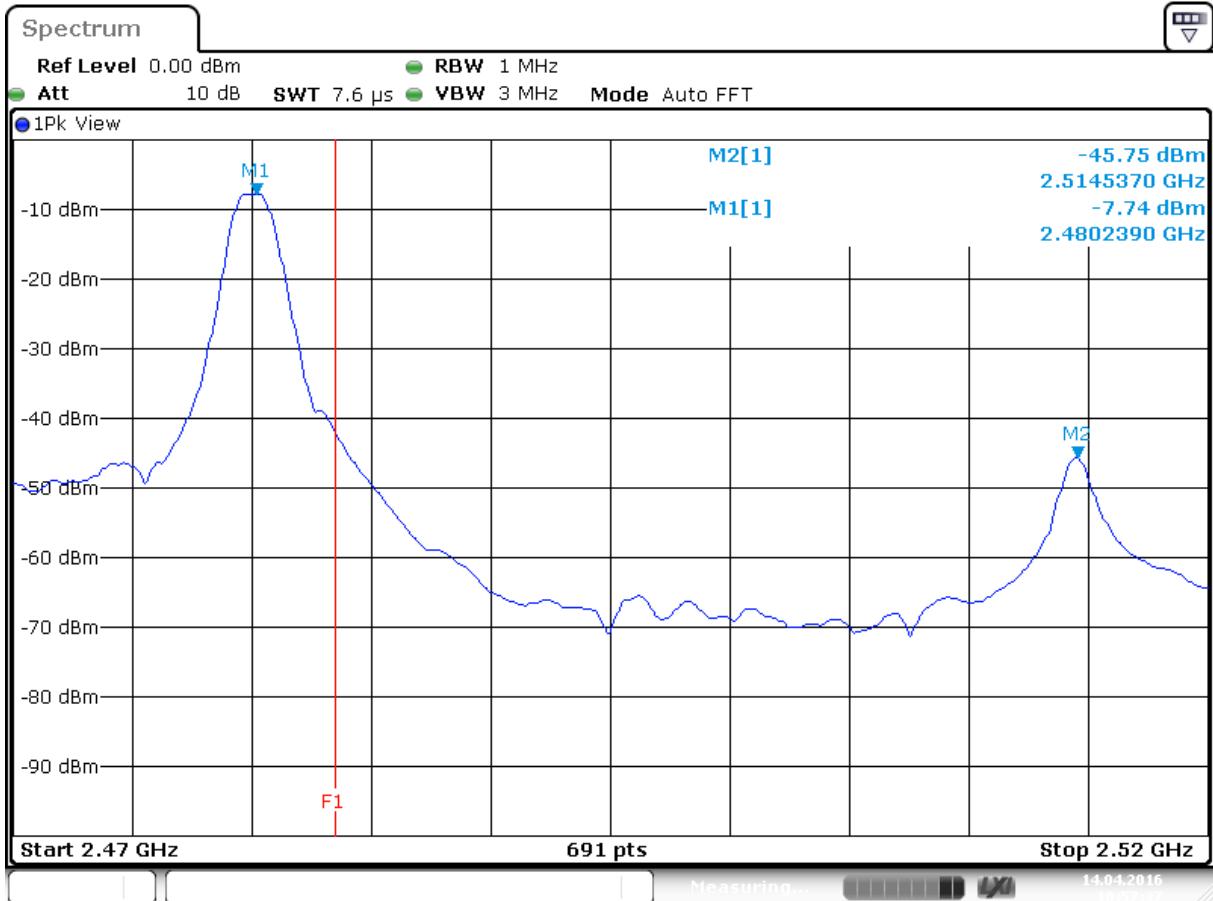
Used test equipment and ancillaries:

| | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| A00450 | A00235 | A00337 | A00258 | A00444 | A00009 | A00012 | A00255 | A00247 |
| | | | | | | | | |



Date: 14 APR 2016 11:21:52

Plot 1a Band Edge (Low), Peak value, Spectral Diagram, 2402 MHz
 F1 shows the band edge frequency of 2400 MHz.



Date: 14 APR 2016 10:57:37

Plot 2a Band Edge (High), Peak value, Spectral Diagram, 2480 MHz.

F1 shows the band edge frequency of 2483.5 MHz

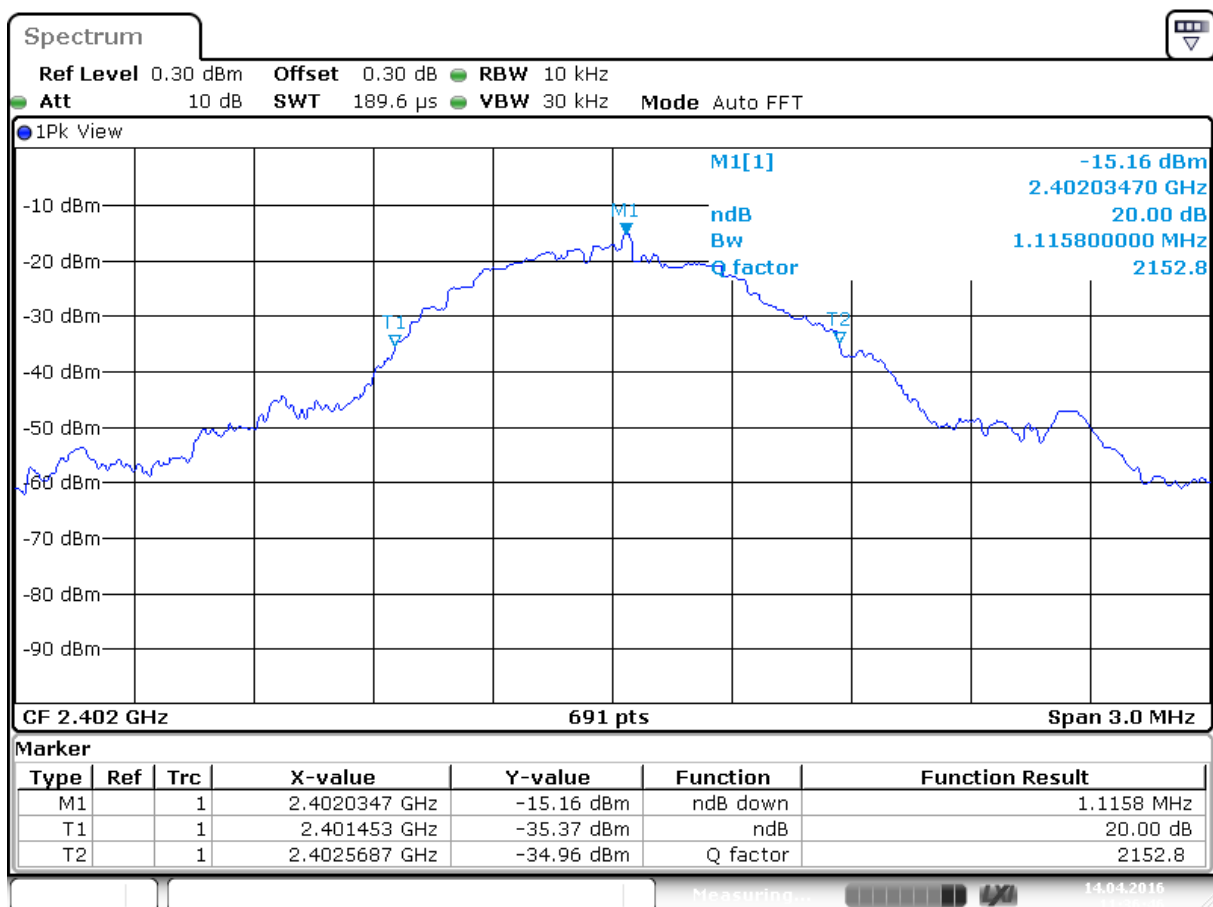
6 Bandwidth of the emission

RESULT: PASS

Date of testing: 2016-04-14

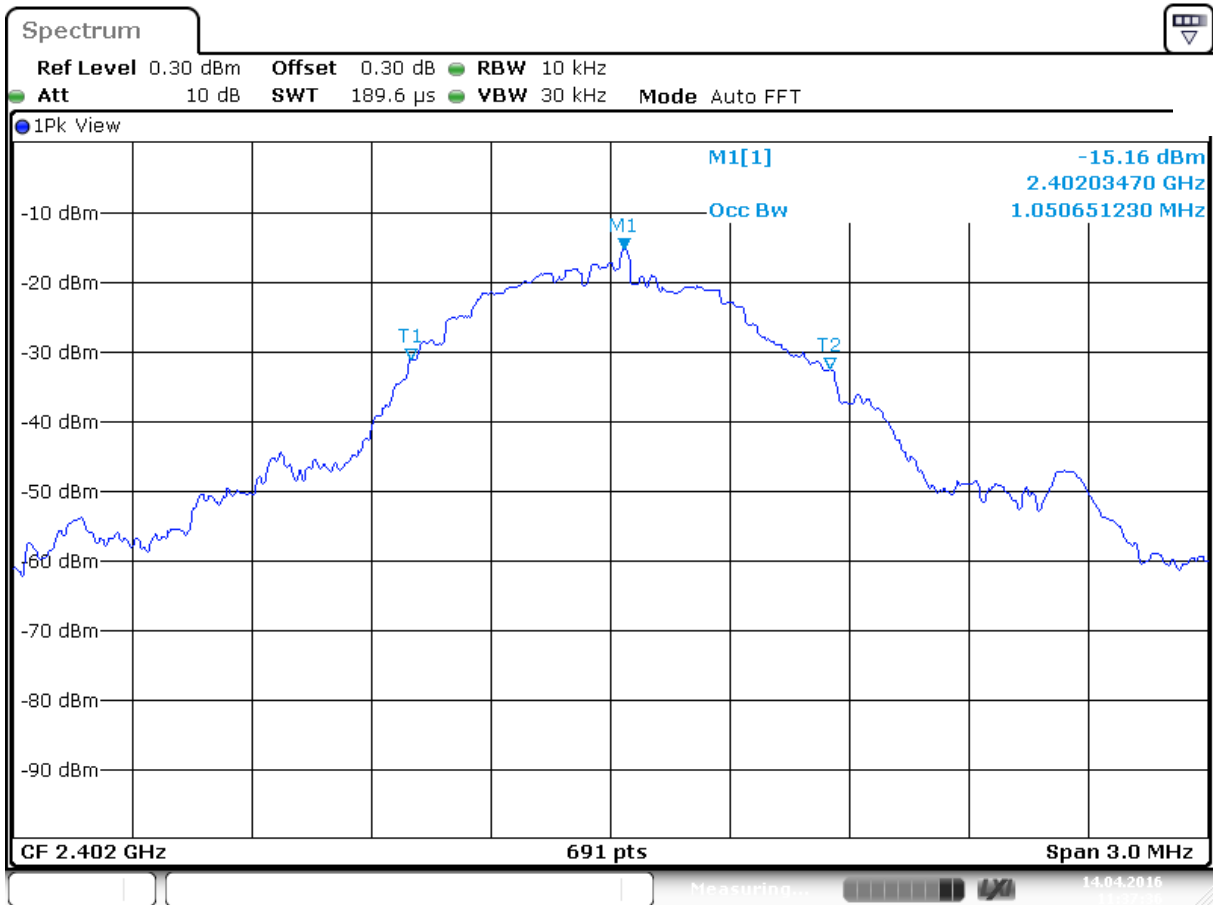
This was tested with a spectrum analyzer connected by a RF cable to the EUT antenna connector. Power level therefor differs from the radiated power levels.

The plots below show compliance with the 47 CFR Part 15 section 15.215(c), this section requires the 20 dB emission bandwidth is within the frequencyband designated in section 15.249.



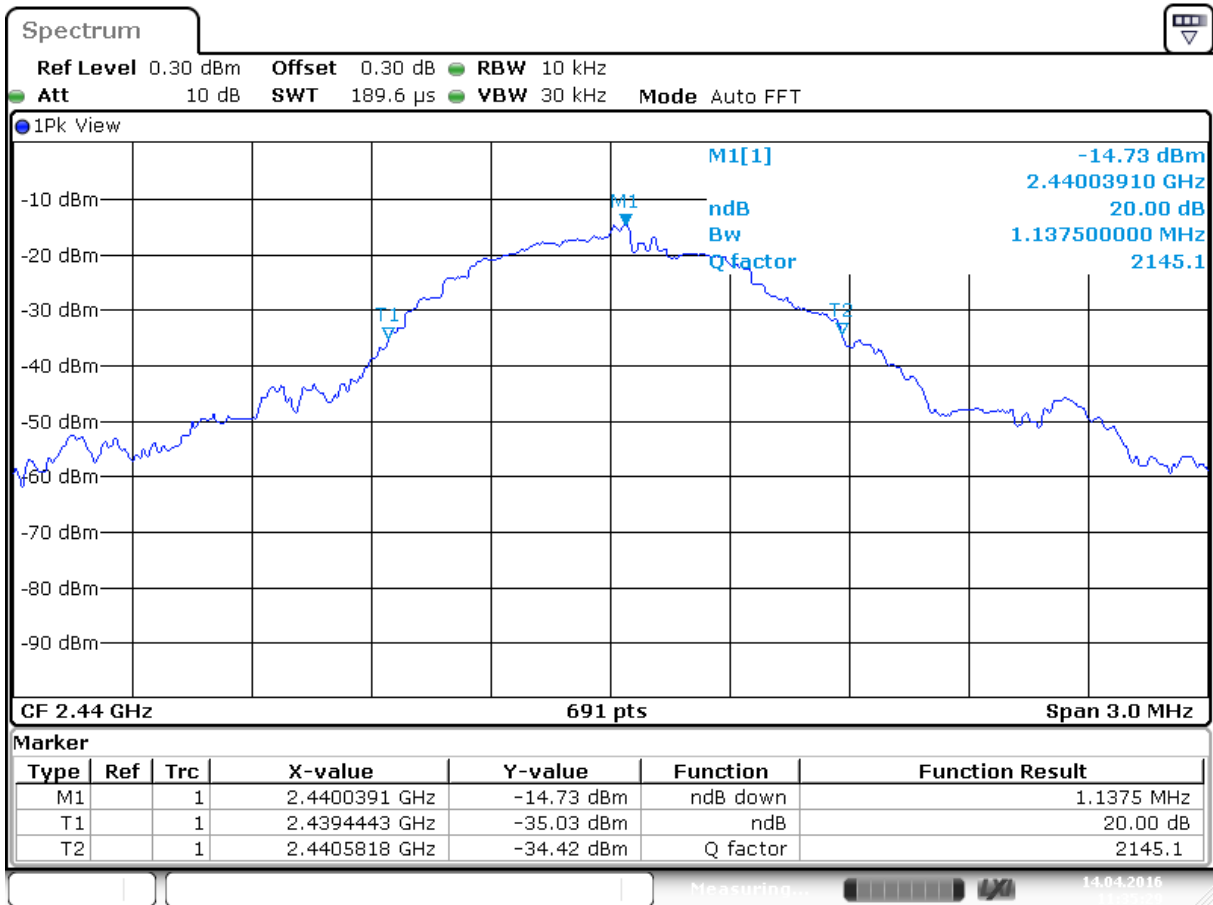
Date: 14 APR 2016 11:36:46

Plot lowest channel - 2402 MHz, Occupied bandwidth is 1115.80 kHz as measured on a spectrum analyzer.



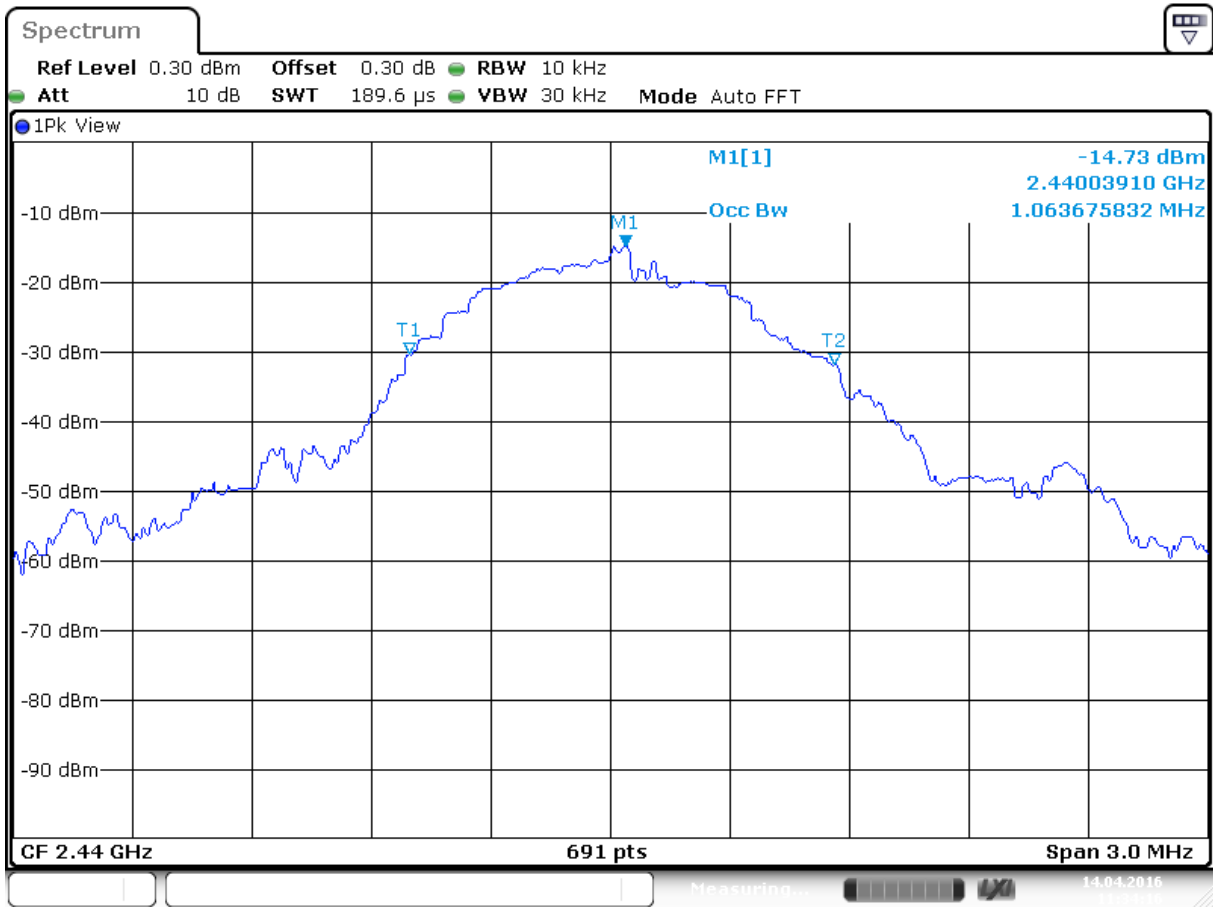
Date: 14 APR 2016 11:37:37

Plot lowest channel - 2402 MHz, 99% bandwidth is 1050.65 kHz as measured on a spectrum analyzer.



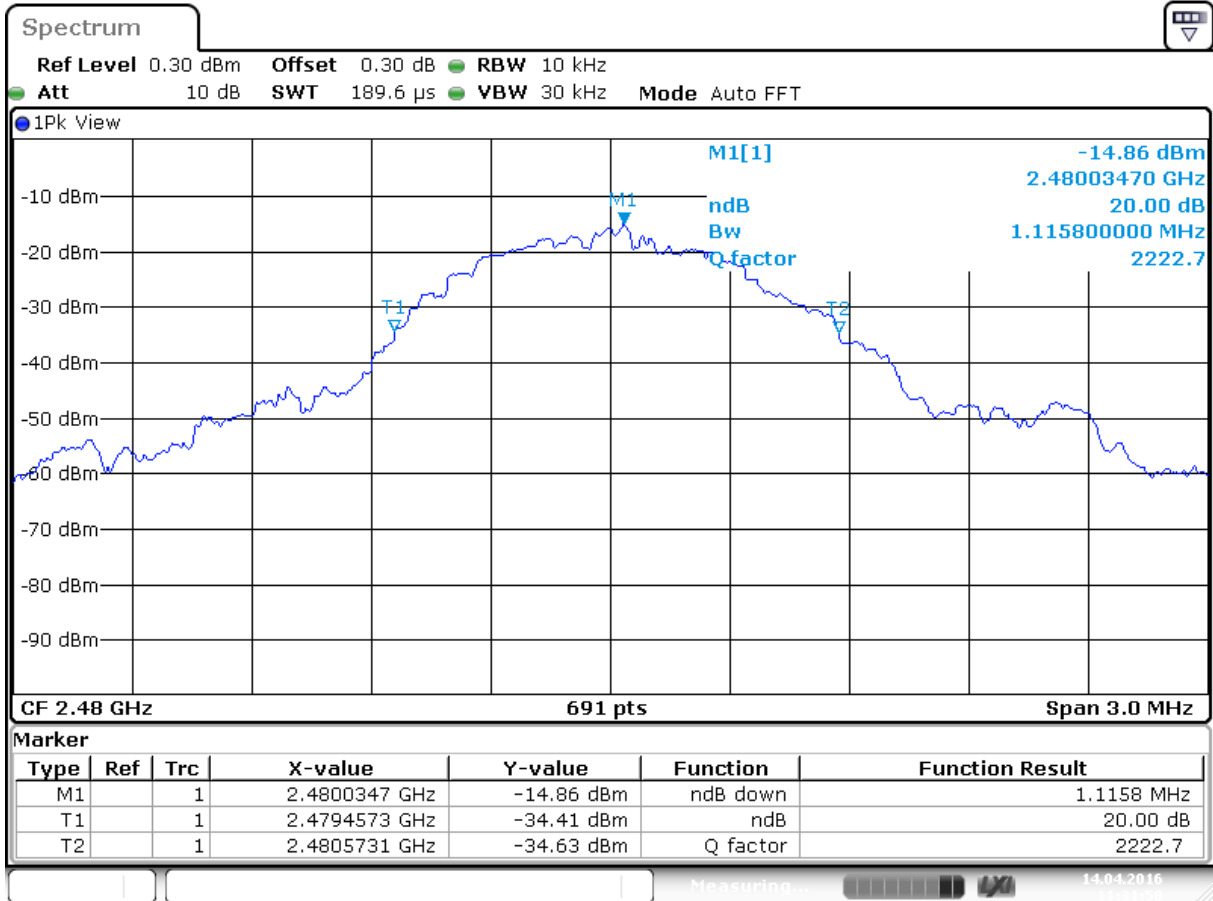
Date: 14 APR 2016 11:35:29

Plot middle channel - 2440 MHz, Occupied bandwidth is 1137.50 kHz as measured on a spectrum analyzer.



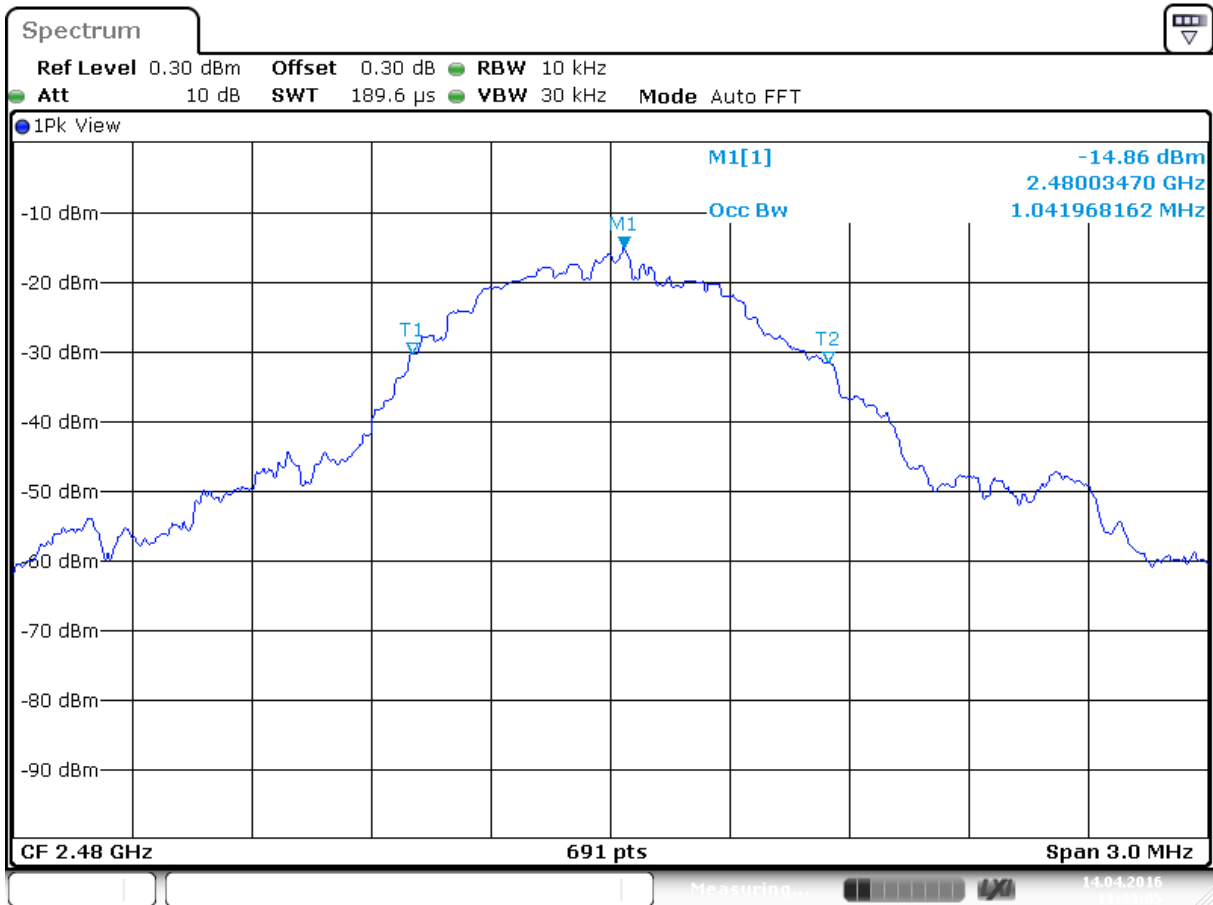
Date: 14 APR 2016 11:34:16

Plot middle channel - 2440 MHz, 99% bandwidth is 1063.68 kHz as measured on a spectrum analyzer



Date: 14 APR 2016 11:31:50

Plot highest channel - 2480 MHz, Occupied bandwidth is 1115.8 kHz as measured on a spectrum analyzer.



Date: 14 APR 2016 11:33:05

Plot highest channel - 2480 MHz, 99% bandwidth is 1041.96 kHz as measured on a spectrum analyzer

7 List of utilized test equipment.

| Kind of Equipment | Manufacturer | Model Name | Inventory number | Calibration date (mm/yyyy) | Calibration due date (mm/yyyy) |
|---|-----------------|----------------------------------|------------------|----------------------------|--------------------------------|
| For Antenna Port Conducted Emissions | | | | | |
| Temperature-Humiditymeter | Extech | SD500 | A00446 | 04-13/2016 | 04-13/2017 |
| Spectrum Analyzer | Rohde & Schwarz | FSV | A01744 | 07/2015 | 07/2016 |
| RF Cable | H+S | Secuflex | A00347 | 04-15/2015 | 04-15/2016 |
| For Radiated Emissions | | | | | |
| Measurement Receiver | Rohde & Schwarz | ESCI | A00314 | 03/2016 | 03/2017 |
| RF Cable S-AR | Gigalink | APG0500 | A00447 | 01/2016 | 01/2017 |
| Controller | Maturo | SCU/088/8090811 | A00450 | N/A | N/A |
| Controller | EMCS | DOC202 | A00257 | N/A | N/A |
| Test facility | Comtest | FCC listed: 90828 IC: 2932G-2 | A00235 | 04/2014 | 04/2017 |
| Spectrum Analyzer | Rohde & Schwarz | FSV | A00337 | 05/2015 | 05/2016 |
| Antenna mast | EMCS | AP-4702C | A00258 | N/A | N/A |
| Temperature-Humiditymeter | Extech | SD500 | A00444 | 04-13/2016 | 04-13/2017 |
| Guidehorn 1-18 GHz | EMCO | 3115 | A00009 | 04-14/2015 | 04-14/2016 |
| Guidehorn 18-40 GHz | EMCO | RA42-K-F-4B-C | A00012 | 04-14/2015 | 04-14/2016 |
| Biconilog Testantenna | Teseq | CBL 6111D | A00466 | 06/2015 | 06/2016 |
| 2.4 GHz bandreject filter | BSC | XN-1783 | A00065 | N/A | N/A |
| Bandpass filter 4-10 GHz | Reactel | 7AS-7G-6G-511 | A00131 | N/A | N/A |
| Bandpass filter 10-26 GHz | Reactel | 9HS-10G/26.5G-S11 | A00151 | N/A | N/A |
| Preamplifier 0.5 - 18 GHz | Miteq | AMF-5D-005180-28-13p | A00247 | N/A | N/A |
| Filterbox | EMCS | RFS06S | A00255 | 02/2016 | 02/2017 |

| Kind of Equipment | Manufacturer | Model Name | Inventory number | Calibration date (mm/yyyy) | Calibration due date (mm/yyyy) |
|---|-----------------|------------|------------------|----------------------------|--------------------------------|
| For AC Powerline Conducted Emissions | | | | | |
| Pulse limiter | R&S | ESH3-Z2 | A00051 | 01/2016 | 01/2017 |
| Variac | RFT | LSS020 | A00171 | NA | NA |
| LISN | EMCO | 3625/2 | A00022 | 01/2016 | 01/2018 |
| Measurement Receiver | Rohde & Schwarz | ESCS30 | A00726 | 09/2015 | 09/2016 |
| Shielded room for Conducted emissions | -- | -- | A00437 | NA | NA |
| Temperature-Humiditymeter | Extech | SD500 | A00444/ | 04-14/2016 | 04-14/2017 |

Conformance of the used measurement and test equipment with the requirements of ISO/IEC 17025:2005 has been confirmed before testing.
 NA= Not Applicable

<< End of report >>