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October 4, 2017

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## Prüfbericht / Test Report

Nr. / No. TR-33368-03325-03 (Edition 4)

Applicant: Häfele GmbH & Co. KG  
Type of equipment: Radio Interface  
Type designation: BLEBox  
Order No.:  
Test standards: FCC Code of Federal Regulations,  
CFR 47, Part 15,  
Sections 15.205, 15.207, 15.215 and 15.247  
KDB 558074 D01 v04  
  
Industry Canada Radio Standards Specifications  
RSS-GEN Issue 4, Section 8.8 and  
RSS-247 Issue 2, Section 5

### Note:

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BNetzA-CAB-16/21-15

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## 1 Description of the Equipment Under Test (EUT)

### General data of EUT

|                                 |                                            |
|---------------------------------|--------------------------------------------|
| Type designation <sup>1</sup> : | BLEBox                                     |
| Parts <sup>2</sup> :            |                                            |
| Serial number(s):               |                                            |
| Manufacturer:                   | Häfele GmbH & Co. KG                       |
| Type of equipment:              | Radio Interface                            |
| Version:                        |                                            |
| FCC ID:                         | 2AHJI- BLEBOX01                            |
| Industry Canada ID:             | 21197-BLEBOX01                             |
| Additional parts/accessories:   | As received, each.<br>HW 1111;<br>SW V20.1 |

<sup>1</sup> Type designation of the system if EUT consists of more than one part.

<sup>2</sup> Type designations of the parts of the system, if applicable.

| Technical data of EUT                 |                                                                                        |       |
|---------------------------------------|----------------------------------------------------------------------------------------|-------|
| Application frequency range:          | 2400.0 MHz - 2483.5 MHz                                                                |       |
| Frequency range:                      | 2401 MHz to 2480 MHz                                                                   |       |
| Operating frequency:                  | 2401 MHz; 2480 MHz; 2480 MHz                                                           |       |
| Type of modulation                    | GFSK                                                                                   |       |
| Pulse train:                          | ---                                                                                    |       |
| Pulse width:                          | ---                                                                                    |       |
| Number of RF-channels:                | 40                                                                                     |       |
| Channel spacing:                      | 2 MHz                                                                                  |       |
| Designation of emissions <sup>3</sup> | 1M67F1D                                                                                |       |
| Type of antenna:                      | Integrated antenna                                                                     |       |
| Size/length of antenna:               | 7 mm x 2 mm                                                                            |       |
| Connection of antenna:                | <input type="checkbox"/> detachable <input checked="" type="checkbox"/> not detachable |       |
| Type of power supply:                 | AC supply                                                                              |       |
| Specifications for power supply:      | nominal voltage:                                                                       | 110 V |
|                                       | nominal frequency:                                                                     | 60 Hz |

<sup>3</sup> Also known as "Class of Emission".

## 2 Administrative Data

### Application details

|                           |                                                                        |
|---------------------------|------------------------------------------------------------------------|
| Applicant (full address): | Häfele GmbH & Co. KG<br>Adolf-Häfele-Str. 1<br>72202 Nagold<br>Germany |
| Contact person:           | Mr. Christoph Stopper                                                  |
| Order number:             |                                                                        |
| Receipt of EUT:           | 2017-03-05; 2017-07-20                                                 |
| Date(s) of test:          | 2017-03-05 to 2017-07-21                                               |
| Note(s):                  |                                                                        |

### Report details

|                |                   |
|----------------|-------------------|
| Report number: | TR-33368-03325-03 |
| Edition:       | 4                 |
| Issue date:    | 2017-10-04        |

### 3 Identification of the Test Laboratory

#### Details of the Test Laboratory

|                                         |                                                              |
|-----------------------------------------|--------------------------------------------------------------|
| Company name:                           | TÜV SÜD Product Service GmbH                                 |
| Address:                                | Aeussere Fruehlingstrasse 45<br>D-94315 Straubing<br>Germany |
| Laboratory accreditation:               | DAkKS Registration No. D-PL-11321-11-01                      |
| Laboratory recognition:                 | Registration No. BNetzA-CAB-16/21-15                         |
| Industry Canada test site registration: | 3050A-2                                                      |
| Contact person:                         | Mr. Markus Biberger                                          |
|                                         | Phone: +49 9421 5522-0<br>Fax: +49 9421 5522-99              |

## 4 Summary

### Summary of test results

The tested sample complies with the requirements set forth in the

**Code of Federal Regulations CFR 47, Part 15, Sections 15.205, 15.207, 15.215 and 15.247  
KDB 558074 D01 v04**

of the Federal Communication Commission (FCC) and the

**Radio Standards Specifications  
RSS-GEN Issue 4, Section 8.8 and  
RSS-247 Issue 2, Section 5**

of Industry Canada (IC).

Die Prüfergebnisse beziehen sich ausschließlich auf das zur Prüfung vorgestellte Prüfmuster. Ohne schriftliche Genehmigung des Prüflabors darf der Prüfbericht auszugsweise nicht vervielfältigt werden. *The test results relate only to the individual item which has been tested. Without the written approval of the test laboratory this report may not be reproduced in extracts.*

| Datum / Date | Geprüft von / Tested by                                            | Freigabe durch / Checked by                           |
|--------------|--------------------------------------------------------------------|-------------------------------------------------------|
| 2017-10-04   | <i>Martin Steindl</i><br>Martin Steindl<br>Responsible for testing | <i>Markus Biberger</i><br>Markus Biberger<br>Reviewer |

### Prüfergebnis / Test Result

☒ Erfüllt / Passed

☐ Nicht erfüllt / Not passed

## 5 Operation Mode and Configuration of EUT

### Operation Mode(s)

Transmitting on lowest, middle and highest frequency channel with Bluetooth Low Energy and Proprietary Radio.  
Receiving

### Configuration(s) of EUT

The EUT was configured as external device of a LOOX LED Driver

### List of ports and cables

| Port | Description                  | Classification <sup>4</sup> | Cable type | Cable length |
|------|------------------------------|-----------------------------|------------|--------------|
| 1    | AC supply of LOOX LED Driver | ac power                    | Unshielded | 1 m          |
| 2    | DC supply of EUT             | dc power                    | Unshielded | 50 cm        |

### List of devices connected to EUT

| Item | Description   | Type Designation | Serial no. or ID | Manufacturer |
|------|---------------|------------------|------------------|--------------|
| 1    | AC/DC adapter | LOOX LED Driver  |                  | Häfele       |

### List of support devices

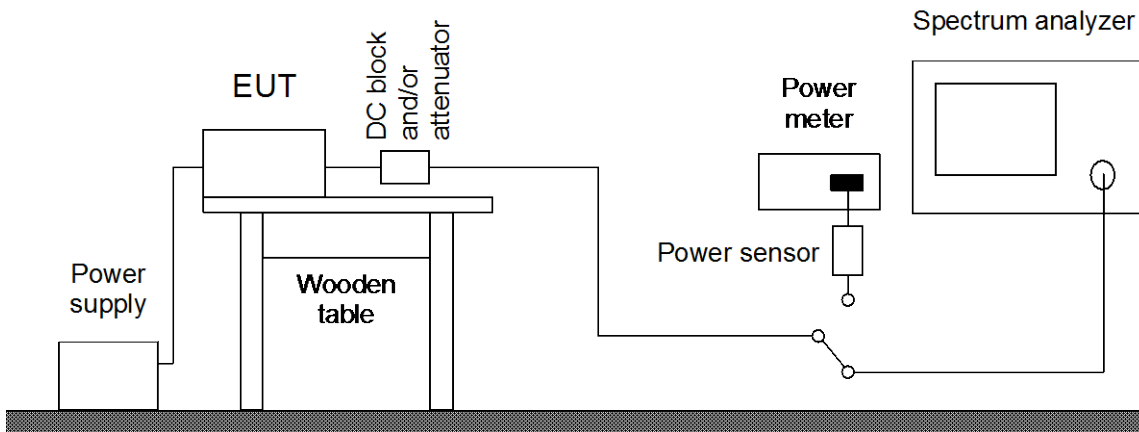
| Item | Description | Type Designation | Serial no. or ID | Manufacturer |
|------|-------------|------------------|------------------|--------------|
| 1    | Test board  |                  |                  | Nordic       |

<sup>4</sup> Ports shall be classified as ac power, dc power or signal/control port

6 Measurement Procedures

6.1 Conducted Output Power

| Measurement Procedure:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Rules and specifications:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | CFR 47 Part 2, section 2.1046(a)<br>CFR 47 Part 15, section 15.247(b)(2)<br>IC RSS-247, Issue 2, section 5.4(4) |
| Guide:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ANSI C63.10 / CFR 47 Part 2, section 2.1046<br>KDB558074 v04                                                    |
| <p>Conducted output power is measured at the RF output terminals (e.g. antenna connector if antenna is detachable) when the transmitter is adjusted in accordance with the tune-up procedure, if applicable. The RF output terminals are connected to a spectrum analyzer and/or a power meter with appropriate sensor. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as DC block and appropriate attenuators (50 Ohms). The electrical characteristics of the radio frequency load attached to the output terminals shall be stated, if applicable.</p> <p>If a spectrum analyzer is used for peak measurement the resolution bandwidth (RBW) is set to a value equal or greater than the digital transmission systems (DTS) bandwidth. The video bandwidth (VBW) shall be at least three times greater than the RBW. The settings used have to be indicated within the appropriate test record(s).</p> |                                                                                                                 |

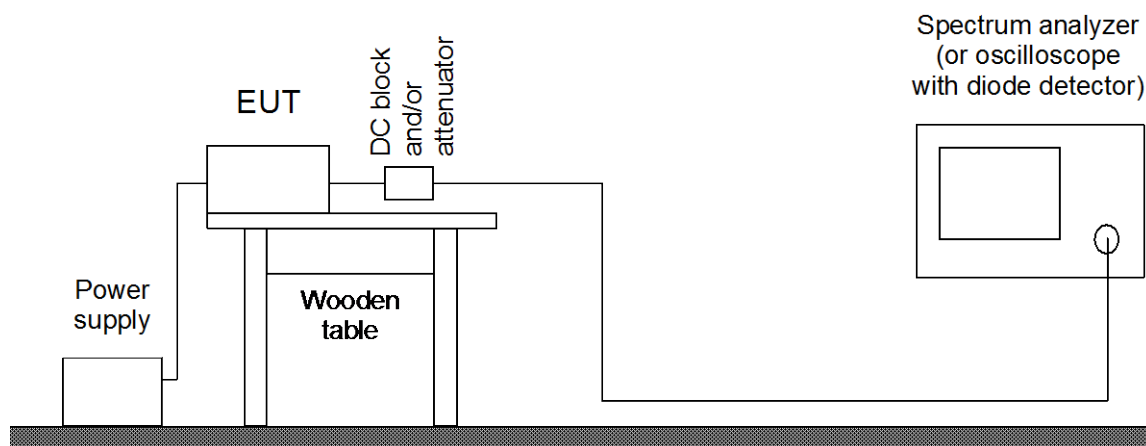


Test instruments used:

| Type                                                  | Designation        | Inv.-no. | Serial No. or ID         | Manufacturer    |
|-------------------------------------------------------|--------------------|----------|--------------------------|-----------------|
| <input type="checkbox"/> Spectrum analyzer            | FSP30              | 1666     | 100063                   | Rohde & Schwarz |
| <input checked="" type="checkbox"/> Spectrum analyzer | FSV40              | 2364     | 101448                   | Rohde & Schwarz |
| <input type="checkbox"/> Spectrum analyzer            | FSP30              | (R&S)    | 1093.4495.30             | Rohde & Schwarz |
| <input type="checkbox"/> EMI test receiver            | ESPI7              | 1711     | 836914/0002              | Rohde & Schwarz |
| <input type="checkbox"/> EMI test receiver            | ESMI               | 1569     | 839379/013<br>839587/006 | Rohde & Schwarz |
| <input type="checkbox"/> Power meter                  | NRVS               | 1264     | 836856/015               | Rohde & Schwarz |
| <input type="checkbox"/> Peak power sensor            | NRV-Z31            | 1701     | 8579604.03               | Rohde & Schwarz |
| <input type="checkbox"/> Power sensor                 | NRV-Z52            | 1499     | 837901/030               | Rohde & Schwarz |
| <input type="checkbox"/> Power sensor                 | NRV-Z4             | 1034     | 863828/015               | Rohde & Schwarz |
| <input type="checkbox"/> DC-block                     | 7006               | 1636     | A2798                    | Weinschel       |
| <input checked="" type="checkbox"/> Microwave cable   | ST-18/SMAm/SMAm/48 | 1949     | 696378                   | Huber+Suhner    |
| <input type="checkbox"/> Attenuator                   | 4776-10            | 1638     | 9412                     | Narda           |
| <input type="checkbox"/> Attenuator                   | 4776-20            | 1639     | 9503                     | Narda           |

## 6.2 Bandwidth Measurements

| Measurement Procedure:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rules and specifications:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | CFR 47 Part 2, section 2.202(a)<br>CFR 47 Part 15, section 15.215(c) and 15.247(a)(2)<br>IC RSS-Gen Issue 4, section 6.6<br>IC RSS-247 Issue 2, section 5.2(1)<br>ANSI C63.10, section 6.9.1 |
| Guide:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ANSI C63.10 / IC RSS-Gen Issue 4, section 6.6<br>KDB 55074 D01 v04                                                                                                                           |
| Measurement setup:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <input checked="" type="checkbox"/> Conducted: See below<br><input type="checkbox"/> Radiated: Radiated Emission in Fully or Semi Anechoic Room (6.6)                                        |
| <p>If antenna is detachable bandwidth measurements shall be performed at the antenna connector (conducted measurement) when the transmitter is adjusted in accordance with the tune-up procedure, if applicable. The RF output terminals are connected to a spectrum analyzer. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as dc block and appropriate attenuators (50 Ohms). The electrical characteristics of the radio frequency load attached to the output terminals shall be stated, if applicable.</p> <p>If radiated measurements are performed the same test setups and instruments are used as with radiated emission measurements for the appropriate frequency range.</p> <p>The analyzer settings are specified by the test description of the appropriate test record(s).</p> |                                                                                                                                                                                              |



Test instruments used:

| Type                                                  | Designation        | Inv.-no. | Serial No. or ID | Manufacturer    |
|-------------------------------------------------------|--------------------|----------|------------------|-----------------|
| <input type="checkbox"/> Spectrum analyzer            | FSP30              | 1666     | 100036           | Rohde & Schwarz |
| <input checked="" type="checkbox"/> Spectrum analyzer | FSV40              | 2364     | 101448           | Rohde & Schwarz |
| <input type="checkbox"/> EMI test receiver            | ESPI7              | 1711     | 836914/0002      | Rohde & Schwarz |
| <input type="checkbox"/> Diode detector negative      | 8473D              | 1581     | 01492            | Hewlett Packard |
| <input type="checkbox"/> Oscilloscope                 | 54602B             | 1535     | US35060304       | Hewlett Packard |
| <input type="checkbox"/> Digital oscilloscope         | Wave Surfer 452    | 1796     | LCRY0301J11938   | LeCroy          |
| <input type="checkbox"/> Test probe                   | TP 01              | 1628     | 001              | TÜV SÜD PS      |
| <input type="checkbox"/> DC-block                     | 7006               | 1636     | A2798            | Weinschel       |
| <input checked="" type="checkbox"/> Microwave cable   | ST-18/SMAm/SMAm/48 | 1949     | 696378           | Huber+Suhner    |
| <input type="checkbox"/> Attenuator                   | 4776-10            | 1638     | 9412             | Narda           |
| <input type="checkbox"/> Attenuator                   | 4776-20            | 1639     | 9503             | Narda           |

## 6.3 Power spectral density

| Measurement Procedure:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rules and specifications:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | CFR 47 Part 15, sections 15.215(b) and 15.247<br>KDB558074 v03r03<br>IC RSS-247 Issue 2, section 5.2(2)                                                                  |
| Guide:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ANSI C63.4, ANSI C63.10                                                                                                                                                  |
| Measurement setup:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <input checked="" type="checkbox"/> Conducted: Bandwidth Measurements (6.2)<br><input type="checkbox"/> Radiated: Radiated Emission in Fully or Semi Anechoic Room (6.6) |
| <p>If antenna is detachable bandwidth measurements shall be performed at the antenna connector (conducted measurement) when the transmitter is adjusted in accordance with the tune-up procedure, if applicable. The RF output terminals are connected to a spectrum analyzer. If required, a resistive matching network equal to the impedance specified or employed for the antenna is used as well as dc block and appropriate attenuators (50 Ohms). The electrical characteristics of the radio frequency load attached to the output terminals shall be stated, if applicable.</p> <p>If radiated measurements are performed the same test setups and instruments are used as with radiated emission measurements for the appropriate frequency range.</p> <p>The center frequency of the spectrum analyzer is set to the center frequency of the digital transmission systems (DTS) channel center frequency and the span shall be set to 1.5 times the DTS bandwidth. The resolution bandwidth (RBW) shall be set in the range 3 kHz to 100 kHz. The video bandwidth (VBW) shall be at least three times greater than the RBW. The detector is set to peak and the trace mode to max-hold. The maximum power spectral density is the maximum amplitude level of the fully stabilized trace. If the measured value exceeds the limit the RBW is reduced, but not less than 3 kHz and the test is repeated.</p> |                                                                                                                                                                          |

## 6.4 Conducted AC Powerline Emission

### Measurement Procedure:

Rules and specifications: CFR 47 Part 15, section 15.207  
 IC RSS-GEN Issue 4, section 8.8

Guide: ANSI C63.10 / CISPR 22

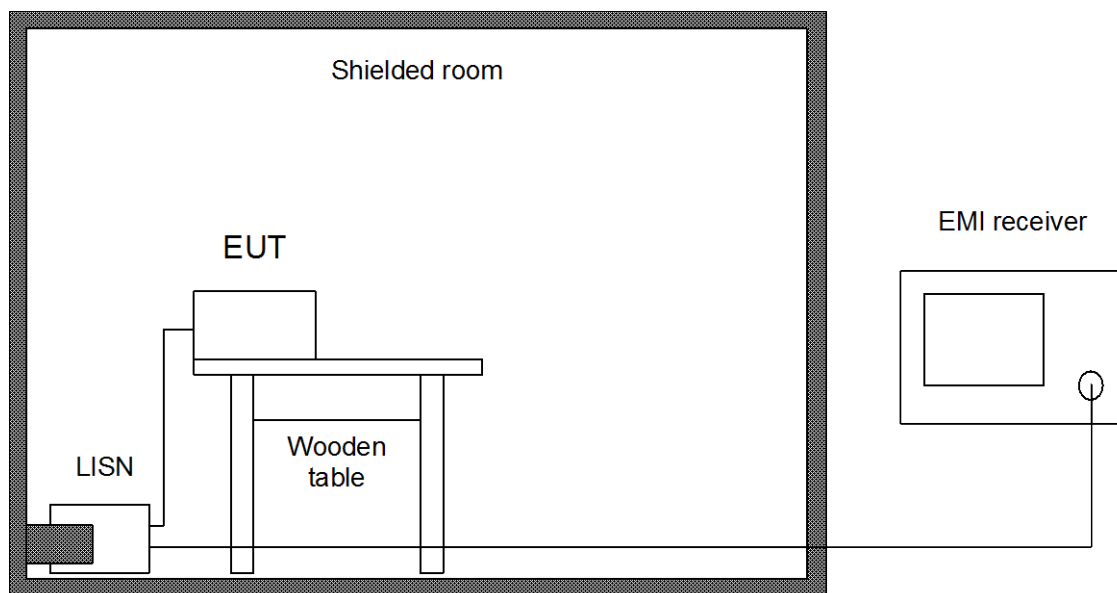
Conducted emission tests in the frequency range 150 kHz to 30 MHz are performed using Line Impedance Stabilization Networks (LISNs). To simplify testing with quasi-peak and average detector the following procedure is used:

First the whole spectrum of emission caused by the equipment under test (EUT) is recorded with detector set to peak using CISPR bandwidth of 10 kHz. After that all emission levels having less margin than 10 dB to or exceeding the average limit are retested with detector set to quasi-peak.

If average limit is kept with quasi-peak levels no additional scan with average detector is necessary. In cases of emission levels between quasi-peak and average limit an additional scan with detector set to average is performed.

According to ANSI C63.10, section 6.2.5, testing of intentional radiators with detachable antenna shall be performed using a suitable dummy load connected to the antenna output terminals. Otherwise, the tests shall be made with the antenna connected and, if adjustable, fully extended.

Testing with dummy load may be necessary to distinguish (unintentional) conducted emissions on the supply lines from (intentional) emissions radiated by the antenna and coupling directly to supply lines and/or LISN. Usage of dummy load has to be stated in the appropriate test record(s) and notes should be added to clarify the test setup.



Test instruments used:

| Type                                                     | Designation       | Inv.-no. | Serial No. or ID | Manufacturer              |
|----------------------------------------------------------|-------------------|----------|------------------|---------------------------|
| <input checked="" type="checkbox"/> Test receiver        | ESCI              | 2364     | 101448           | Rohde & Schwarz           |
| <input checked="" type="checkbox"/> V-network            | ESH 3-Z5          | 1059     | 894785/005       | Rohde & Schwarz           |
| <input type="checkbox"/> V-network                       | ESH 3-Z5          | 1218     | 830952/025       | Rohde & Schwarz           |
| <input type="checkbox"/> Artificial mains network        | ESH 2-Z5          | 1536     | 842966/004       | Rohde & Schwarz           |
| <input checked="" type="checkbox"/> Microwave cable      | FB293C1080005050  | 2157     | 72110-02         | Rosenberger<br>Micro-Coax |
| <input type="checkbox"/> Coax cable                      | RG214 N/N 5m      | 1188     | ---              | Senton                    |
| <input type="checkbox"/> Shielded room                   | No. 1             | 1451     | ---              | Albatross                 |
| <input type="checkbox"/> Shielded room                   | No. 4             | 1454     | 3FD 100 544      | Euroshield                |
| <input checked="" type="checkbox"/> Shielded room        | No. 9             | 21083    | ---              | Albatross                 |
| <input checked="" type="checkbox"/> Measurement Software | EMC32_K1 V9.26.01 | 2230     | 100281           | Rohde & Schwarz           |

## 6.5 Radiated Emission Measurement 9 kHz to 30 MHz

### Measurement Procedure:

Rules and specifications: CFR 47 Part 15, sections 15.209 and 15.247  
 IC RSS-GEN Issue 4, sections 6.4, 6.13 and 8.9  
 IC RSS-247 Issue 2, section 5.5

Guide: ANSI C63.10

Radiated emission in the frequency range 9 kHz to 30 MHz is measured using an active loop antenna. First the whole spectrum of emission caused by the equipment is recorded at a distance of 3 meters in a fully or semi anechoic room with the detector of the spectrum analyzer or EMI receiver set to peak. This configuration is also used for recording the spectrum of intentional radiators.

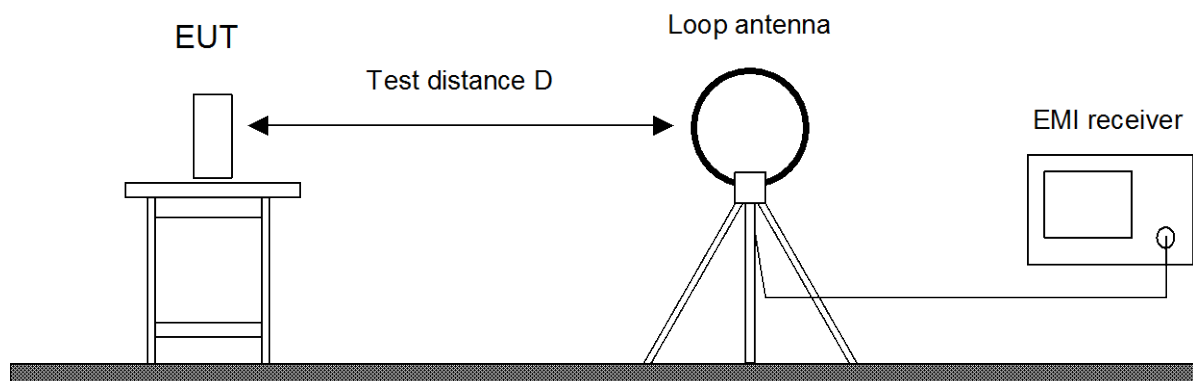
Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.

EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

If worst case emission of the EUT cannot be recorded with EUT in standard position and loop antenna in vertical polarization the EUT (or the radiating part of the EUT) is rotated by 90 degrees instead of changing the loop antenna to horizontal polarization. This procedure is selected to minimize the influence of the environment (e.g. effects caused by the floor especially with longer distances).

Final measurement is performed at a test distance D of 30 meters using an open field test site. In case the regulation requires testing at other distances, the result is extrapolated by either making measurements at an additional distance D of 10 meters to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). In cases of very low emissions measurements are performed at shorter distances and results are extrapolated to the required distance. The provisions of CFR 47 Part 15 sections 15.31(d) and (f)(2) apply. According to CFR 47 Part 15 section 15.209(d) final measurement is performed with detector function set to quasi-peak except for the frequency bands 9 to 90 kHz and 110 to 490 kHz where, for non-pulsed operation, average detector is employed.

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.



Test instruments used:

| Type                                                            | Designation       | Inv.-no. | Serial No. or ID | Manufacturer              |
|-----------------------------------------------------------------|-------------------|----------|------------------|---------------------------|
| <input type="checkbox"/> Spectrum analyzer                      | FSP30             | 1666     | 100036           | Rohde & Schwarz           |
| <input checked="" type="checkbox"/> EMI test receiver           | ESR7              | 22642    | 101713           | Rohde & Schwarz           |
| <input type="checkbox"/> Test receiver                          | ESHS 10           | 1028     | 860043/016       | Rohde & Schwarz           |
| <input type="checkbox"/> EMI test receiver                      | ESU8              | 2044     | 100232           | Rohde & Schwarz           |
| <input type="checkbox"/> Preamplifier Cabin no. 2               | CPA9231A          | 1716     | 3557             | Schaffner                 |
| <input checked="" type="checkbox"/> Loop antenna                | HFH2-Z2           | 1016     | 882964/1         | Rohde & Schwarz           |
| <input checked="" type="checkbox"/> Microwave cable Cabin no. 8 | EF393             | 2053     | ---              | Albatross Projects        |
| <input type="checkbox"/> Microwave cable Cabin no. 8            | FB293C1050005050  | 2054     | 63834-1          | Rosenberger<br>Micro-Coax |
| <input type="checkbox"/> Microwave cable Cabin no. 8            | FB293C1080005050  | 2055     | 63833-1          | Rosenberger<br>Micro-Coax |
| <input type="checkbox"/> Microwave cable Cabin no. 8            | LCF12-50          | 2057     | P1.3.9           | RFS                       |
| <input type="checkbox"/> Microwave cable Cabin no. 8            | LCF12-50          | 2057     | P1.4.12          | RFS                       |
| <input checked="" type="checkbox"/> Microwave cable Cabin no. 8 | LCF12-50          | 2057     | P1.6.19          | RFS                       |
| <input type="checkbox"/> Microwave cable Cabin no. 8            | FA210AF040005050G | 2127     | 72061-01         | Rosenberger<br>Micro-Coax |
| <input type="checkbox"/> Microwave cable Cabin no. 8            | FA210AF04000505G  | 2056     | 64567-01         | Rosenberger<br>Micro-Coax |
| <input checked="" type="checkbox"/> Microwave cable Cabin no. 8 | FA210AF04000505   | 2068     | 64610-1          | Rosenberger<br>Micro-Coax |
| <input type="checkbox"/> Fully anechoic room                    | No. 2             | 1452     | ---              | Albatross                 |
| <input type="checkbox"/> Semi anechoic room                     | No. 3             | 1453     | ---              | Siemens                   |
| <input checked="" type="checkbox"/> Semi anechoic room          | No. 8             | 2057     | ---              | Albatross                 |
| <input checked="" type="checkbox"/> Measurement Software        | EMC32_K8 V9.25.00 | 1852     | 100016           | Rohde & Schwarz           |

## 6.6 Radiated Emission in Fully or Semi Anechoic Room

### Measurement Procedure:

|                           |                                                                                                                                                   |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Rules and specifications: | CFR 47 Part 15, sections 15.209 and 15.247<br>KDB 558074 v04<br>IC RSS-GEN Issue 4, sections 6.5, 6.13 and 8.9<br>IC RSS-247 Issue 2, section 5.5 |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|

|        |             |
|--------|-------------|
| Guide: | ANSI C63.10 |
|--------|-------------|

Radiated emission in fully or semi anechoic room is measured in the frequency range from 30 MHz to the maximum frequency as specified in CFR 47 Part 15 section 15.33.

Measurements are made in both the horizontal and vertical planes of polarization using a spectrum analyzer with the detector function set to peak and resolution as well as video bandwidth set to 100 kHz (below 1 GHz) or 1 MHz (above 1 GHz).

Testing up to 1 GHz is performed with a linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna"). For testing above 1 GHz horn antennas are used.

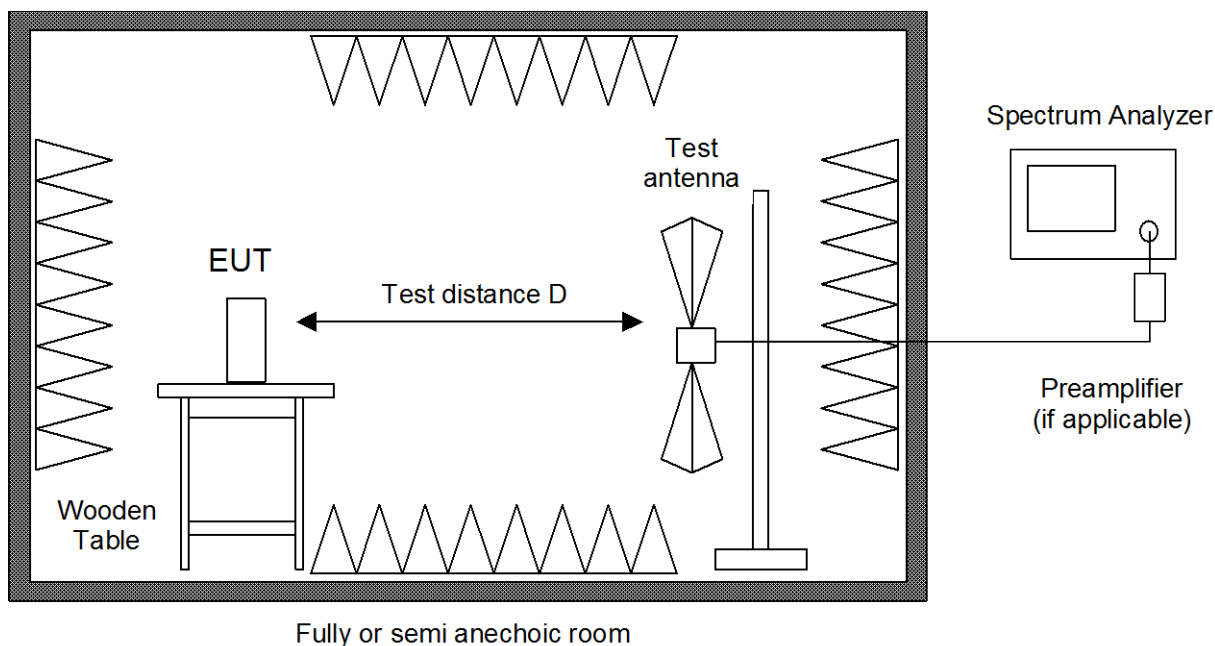
All tests below 8.2 GHz are performed at a test distance D of 3 meters. For higher frequencies the test distance may be reduced (e.g. to 1 meter) due to the sensitivity of the measuring instrument(s) and the test results are calculated according to CFR 47 Part 15 section 15.31(f)(1) using an extrapolation factor of 20 dB/decade. If required, preamplifiers are used for the whole frequency range. Special care is taken to avoid overload, using appropriate attenuators and filters, if necessary.

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

Hand-held or body-worn devices are rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relative to the limit and therefore shall be used for final testing.

During testing the EUT is rotated all around to find the maximum levels of emissions. Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

For final testing below 1 GHz a semi anechoic room complying with the NSA requirements of ANSI C63.4 respectively ANSI C63.10 for alternative test sites is used (see 6.7). If prescans are recorded in fully anechoic room they are indicated appropriately.



#### Test instruments used:

| Type                                                  |             | Designation          | Inv.-no. | Serial No. or ID | Manufacturer    |
|-------------------------------------------------------|-------------|----------------------|----------|------------------|-----------------|
| <input type="checkbox"/> Spectrum analyzer            |             | FSP30                | 1666     | 100036           | Rohde & Schwarz |
| <input type="checkbox"/> EMI test receiver            | Cabin no. 3 | ESPI7                | 2010     | 101018           | Rohde & Schwarz |
| <input type="checkbox"/> EMI test receiver            |             | ESU8                 | 2044     | 100232           | Rohde & Schwarz |
| <input checked="" type="checkbox"/> EMI test receiver |             | ESR7                 | 22642    | 101713           | Rohde & Schwarz |
| <input checked="" type="checkbox"/> Spectrum analyzer |             | FSV40                | 2364     | 101448           | Rohde & Schwarz |
| <input type="checkbox"/> Preamplifier                 | Cabin no. 2 | CPA9231A             | 1716     | 3557             | Schaffner       |
| <input type="checkbox"/> Preamplifier                 |             | R14601               | 1142     | 13120026         | Advantest       |
| <input type="checkbox"/> Preamplifier (1 - 8 GHz)     |             | AFS3-00100800-32-LN  | 1684     | 847743           | Miteq           |
| <input type="checkbox"/> Preamplifier (0.5 - 8 GHz)   |             | AMF-4D-005080-25-13P | 1685     | 860149           | Miteq           |

| Type                                                            | Designation       | Inv.-no. | Serial No. or ID | Manufacturer              |
|-----------------------------------------------------------------|-------------------|----------|------------------|---------------------------|
| <input type="checkbox"/> Preamplifier (8 - 18 GHz)              | ACO/180-3530      | 1484     | 32641            | CTT                       |
| <input type="checkbox"/> External Mixer                         | WM782A            | 1576     | 845881/005       | Tektronix                 |
| <input type="checkbox"/> Harmonic Mixer Accessories             | FS-Z30            | 1577     | 624413/003       | Rohde & Schwarz           |
| <input type="checkbox"/> Trilog antenna Cabin no. 2             | VULB 9163         | 1802     | 9163-214         | Schwarzbeck               |
| <input type="checkbox"/> Trilog antenna Cabin no. 3             | VULB 9163         | 1722     | 9163-188         | Schwarzbeck               |
| <input type="checkbox"/> Trilog antenna Cabin no. 8             | VULB 9163         | 2058     | 9163-408         | Schwarzbeck               |
| <input type="checkbox"/> Trilog antenna Cabin no. 2             | VULB 9162         | 2256     | 9162-048         | Schwarzbeck               |
| <input type="checkbox"/> Horn antenna                           | 3115              | 1516     | 9508-4553        | EMCO                      |
| <input checked="" type="checkbox"/> Horn antenna                | HF907             | 2073     | 100154           | Rohde & Schwarz           |
| <input type="checkbox"/> Horn antenna                           | 3160-03           | 1010     | 9112-1003        | EMCO                      |
| <input type="checkbox"/> Horn antenna                           | 3160-04           | 1011     | 9112-1001        | EMCO                      |
| <input type="checkbox"/> Horn antenna                           | 3160-05           | 1012     | 9112-1001        | EMCO                      |
| <input type="checkbox"/> Horn antenna                           | 3160-06           | 1013     | 9112-1001        | EMCO                      |
| <input checked="" type="checkbox"/> Horn antenna                | 3160-07           | 1014     | 9112-1008        | EMCO                      |
| <input checked="" type="checkbox"/> Horn antenna                | 3160-08           | 1015     | 9112-1002        | EMCO                      |
| <input checked="" type="checkbox"/> Horn antenna                | 3160-09           | 1265     | 9403-1025        | EMCO                      |
| <input type="checkbox"/> Horn antenna                           | 3160-10           | 1575     | 399185           | EMCO                      |
| <input type="checkbox"/> Microwave cable Cabin no. 2            | UFA210A-FG        | 1681     | 23516            | Rosenberger<br>Micro-Coax |
| <input type="checkbox"/> Microwave cable Cabin no. 2            | KKSF1040016       | 2020     | 289854/4         | Huber + Suhner            |
| <input type="checkbox"/> Microwave cable Cabin no. 2            | FA210AF020000000  | 2060     | 64566-2          | Rosenberger<br>Micro-Coax |
| <input type="checkbox"/> Microwave cable Cabin no. 8            | EF393             | 2053     | ---              | Albatross Projects        |
| <input type="checkbox"/> Microwave cable Cabin no. 8            | FB293C1050005050  | 2054     | 63834-1          | Rosenberger<br>Micro-Coax |
| <input checked="" type="checkbox"/> Microwave cable Cabin no. 8 | FB293C1080005050  | 2055     | 63833-1          | Rosenberger<br>Micro-Coax |
| <input type="checkbox"/> Microwave cable Cabin no. 8            | LCF12-50          | 2057     | P1.3.9           | RFS                       |
| <input checked="" type="checkbox"/> Microwave cable Cabin no. 8 | LCF12-50          | 2057     | P1.4.12          | RFS                       |
| <input type="checkbox"/> Microwave cable Cabin no. 8            | LCF12-50          | 2057     | P1.6.19          | RFS                       |
| <input type="checkbox"/> Microwave cable Cabin no. 8            | FA210AF040005050G | 2127     | 72061-01         | Rosenberger<br>Micro-Coax |
| <input checked="" type="checkbox"/> Microwave cable Cabin no. 8 | FA210AF04000505G  | 2056     | 64567-01         | Rosenberger<br>Micro-Coax |
| <input type="checkbox"/> Microwave cable Cabin no. 8            | FA210AF04000505   | 2068     | 64610-1          | Rosenberger<br>Micro-Coax |
| <input type="checkbox"/> Fully anechoic room                    | No. 2             | 1452     | ---              | Albatross                 |
| <input checked="" type="checkbox"/> Semi anechoic room          | No. 8             | 2057     | ---              | Albatross                 |
| <input type="checkbox"/> Measurement Software                   | EMC32_K2 V9.25.00 | 2033     | 100003           | Rohde & Schwarz           |
| <input checked="" type="checkbox"/> Measurement Software        | EMC32_K8 V9.25.00 | 1852     | 100016           | Rohde & Schwarz           |

## 6.7 Radiated Emission at Alternative Test Site

### Measurement Procedure:

|                           |                                                                                                                                                              |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rules and specifications: | CFR 47 Part 15, sections 15.209, 15.215(b) and 15.247<br>KDB 558074 v04<br>IC RSS-GEN Issue 4, sections 6.5, 6.13 and 8.9<br>IC RSS-247 Issue 2, section 5.5 |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|

|        |             |
|--------|-------------|
| Guide: | ANSI C63.10 |
|--------|-------------|

Radiated emission in the frequency range 30 MHz to 1 GHz is measured within a semi-anechoic room with groundplane complying with the NSA requirements of ANSI C63.4 respectively ANSI C63.10 for alternative test sites. A linear polarized logarithmic periodic antenna combined with a 4:1 broadband dipole ("Trilog broadband antenna") is used. The measurement bandwidth of the test receiver is set to 120 kHz with quasi-peak detector selected.

If the radiated emission limits are expressed in terms of the average value of the emission there also is a peak limit corresponding to 20 dB above the maximum permitted average limit. Additionally, if pulsed operation is employed, the average field strength is determined by averaging over one complete pulse train, including blanking intervals, as specified in CFR 47 Part 15 section 15.35(c). If the pulse train exceeds 0.1 second that 0.1 second interval during which the value of the emission is at its maximum is selected for calculation. The pulse train correction is added to the peak value of the emission to get the average value.

Hand-held or body-worn devices are tested in the position producing the highest emission relative to the limit as verified by prescans in fully anechoic room.

If no prescan in a fully anechoic room is used first a peak scan is performed in four positions to get the whole spectrum of emission caused by EUT with the measuring antenna raised and lowered from 1 to 4 m to find table position, antenna height and antenna polarization for the maximum emission levels.

Data reduction is applied to these results to select those levels having less margin than 10 dB to or exceeding the limit using subranges and limited number of maximums. Further maximization is following.

With detector of the test receiver set to quasi-peak final measurements are performed immediately after frequency zoom (for drifting disturbances) and maximum adjustment.

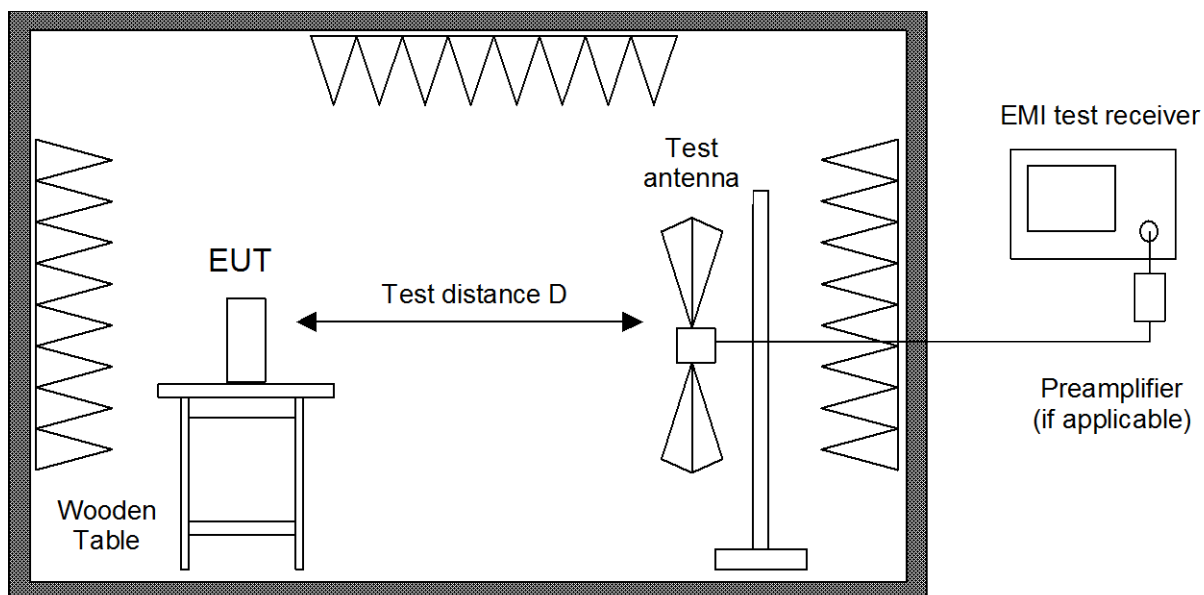
Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

In cases where prescans in a fully anechoic room are taken (e. g. if EUT is operating for a short time only or battery is discharged quickly) final measurements with quasi-peak detector are performed manually at frequencies indicated by prescan with EUT rotating all around and receiving antenna raising and lowering within 1 meter to 4 meters to find the maximum levels of emission.

Equipment and cables are placed and moved within the range of position likely to find their maximum emissions.

For measuring emissions of intentional radiators and receivers a test distance D of 3 meters is selected. Testing of unintentional radiators is performed at a distance of 10 meters. If limits specified for 3 meters shall be used for measurements performed at 10 meters distance the limits are calculated according to CFR 47 Part 15 section 15.31(d) and (f)(1) using an inverse linear-distance extrapolation factor of 20 dB/decade.

According to section 13 of KDB558074 the requirement for radiated emissions on the band edges was performed with a reduced bandwidth of 100 kHz instead of 1 MHz.



Alternate test site (semi anechoic room)

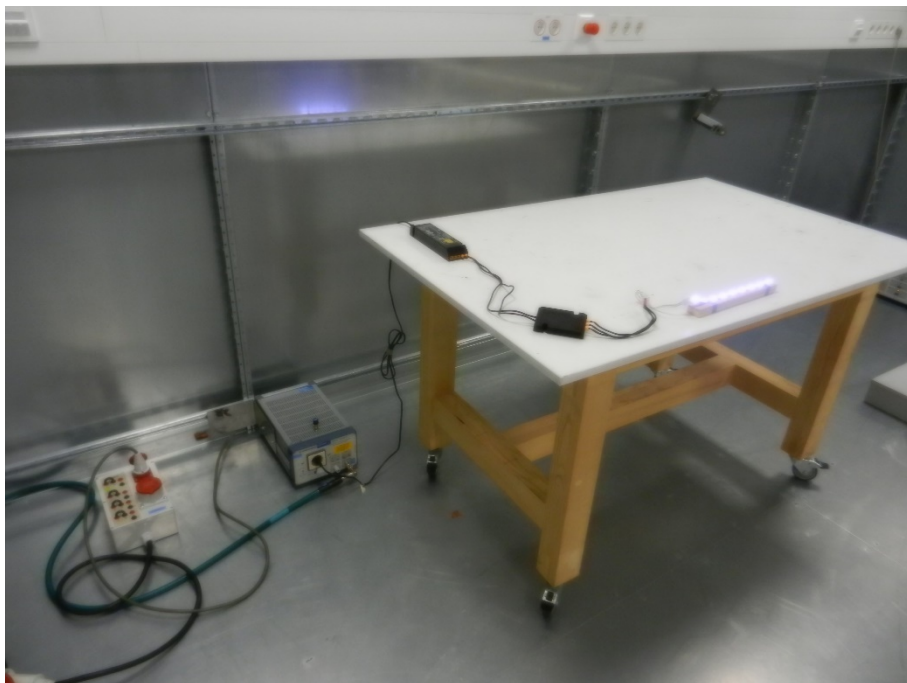
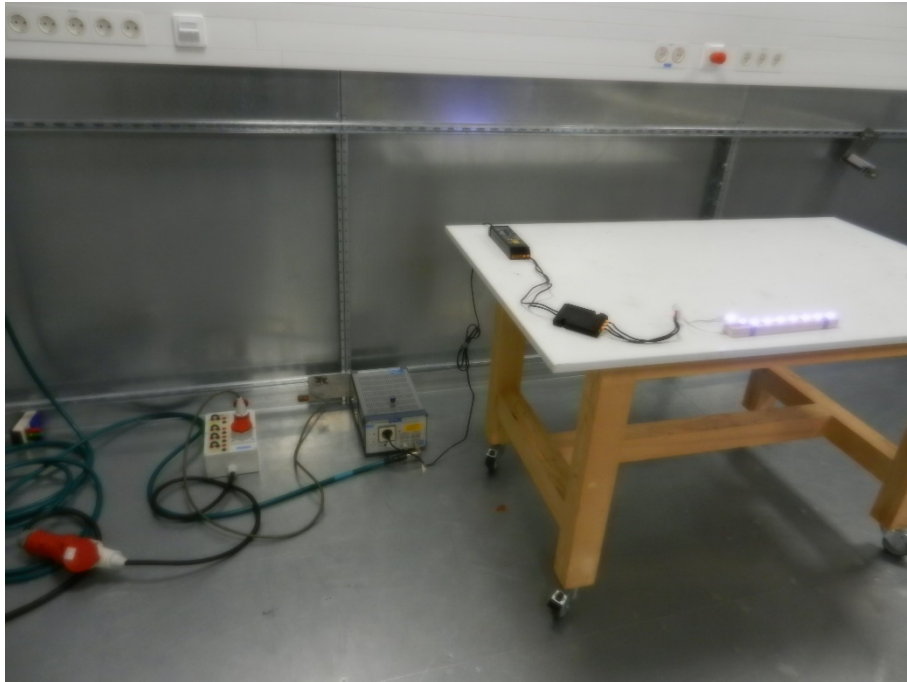
#### Test instruments used:

| Type                                                            | Designation       | Inv.-no. | Serial No. or ID | Manufacturer              |
|-----------------------------------------------------------------|-------------------|----------|------------------|---------------------------|
| <input type="checkbox"/> EMI test receiver                      | ESU8              | 2044     | 100232           | Rohde & Schwarz           |
| <input checked="" type="checkbox"/> EMI test receiver           | ESR7              | 22642    | 101713           | Rohde & Schwarz           |
| <input checked="" type="checkbox"/> Trilog antenna Cabin no. 8  | VULB 9163         | 2058     | 9163-408         | Schwarzbeck               |
| <input checked="" type="checkbox"/> Microwave cable Cabin no. 8 | EF393             | 2053     | ---              | Albatross Projects        |
| <input checked="" type="checkbox"/> Microwave cable Cabin no. 8 | LCF12-50          | 2057     | P1.6.19          | RFS                       |
| <input type="checkbox"/> Microwave cable Cabin no. 8            | LCF12-50          | 2057     | P1.3.9           | RFS                       |
| <input checked="" type="checkbox"/> Microwave cable Cabin no. 8 | FA210AF04000505   | 2068     | 64610-1          | Rosenberger<br>Micro-Coax |
| <input checked="" type="checkbox"/> Microwave cable Cabin no. 8 | FA210AF040005050G | 2127     | 72061-01         | Rosenberger<br>Micro-Coax |
| <input checked="" type="checkbox"/> Semi anechoic room          | No. 8             | 2057     | ---              | Albatross                 |
| <input checked="" type="checkbox"/> Measurement Software        | EMC32_K8 V9.25.00 | 1852     | 100016           | Rohde & Schwarz           |

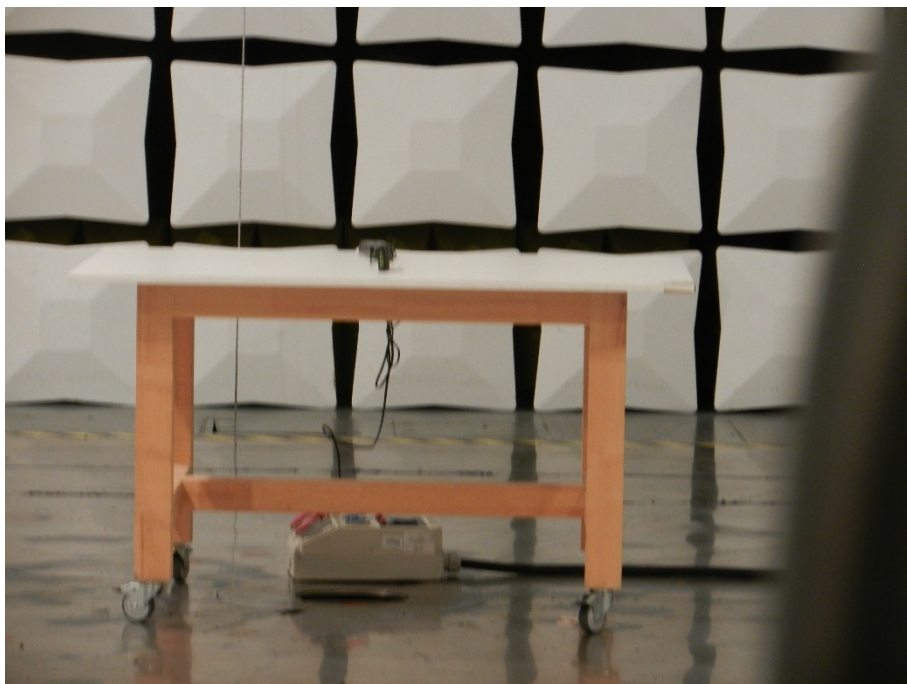
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## **7      Photographs Taken During Testing**

## Test setup for conducted AC powerline emission measurement



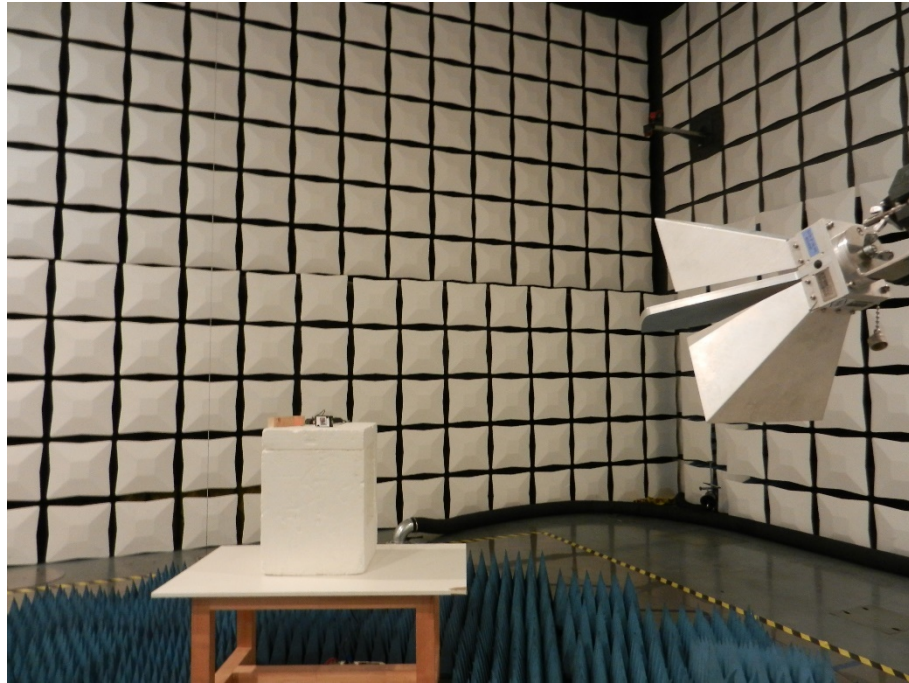
## Test setup for radiated emission measurement 9 kHz – 30 MHz



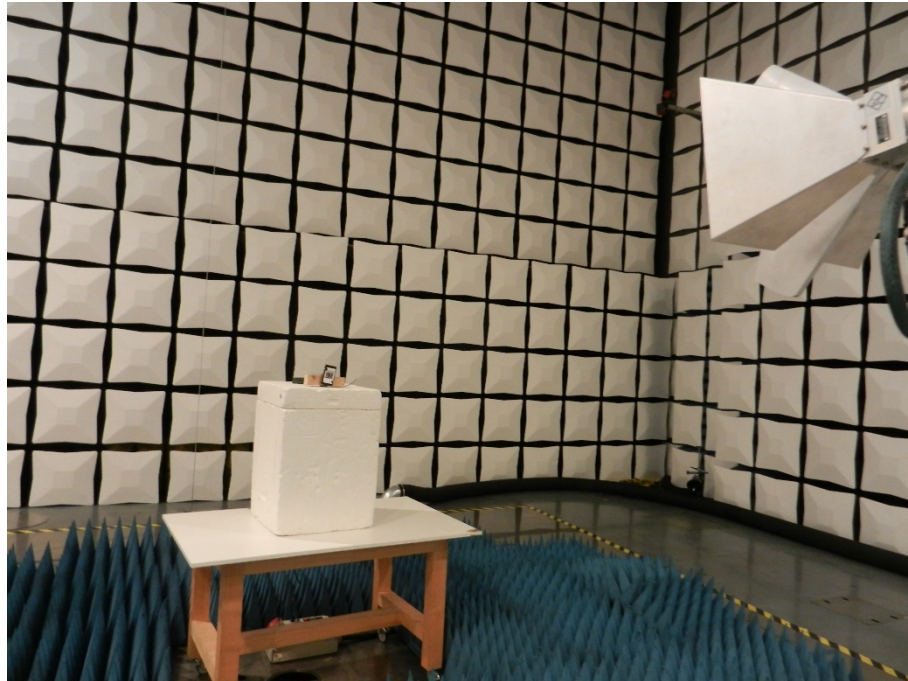
## Test setup for radiated emission measurement 9 kHz – 30 MHz - continued -



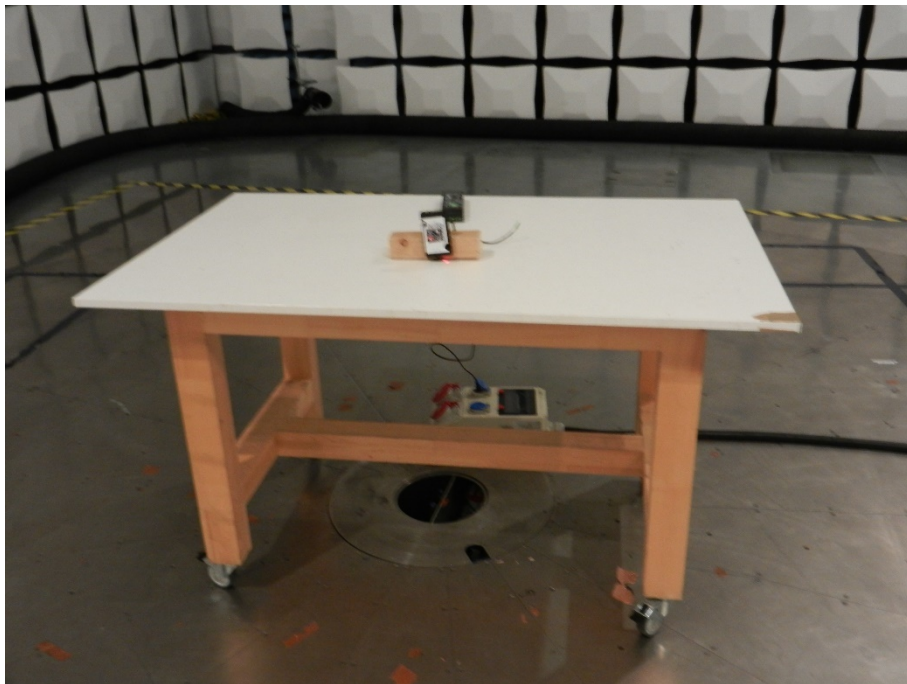
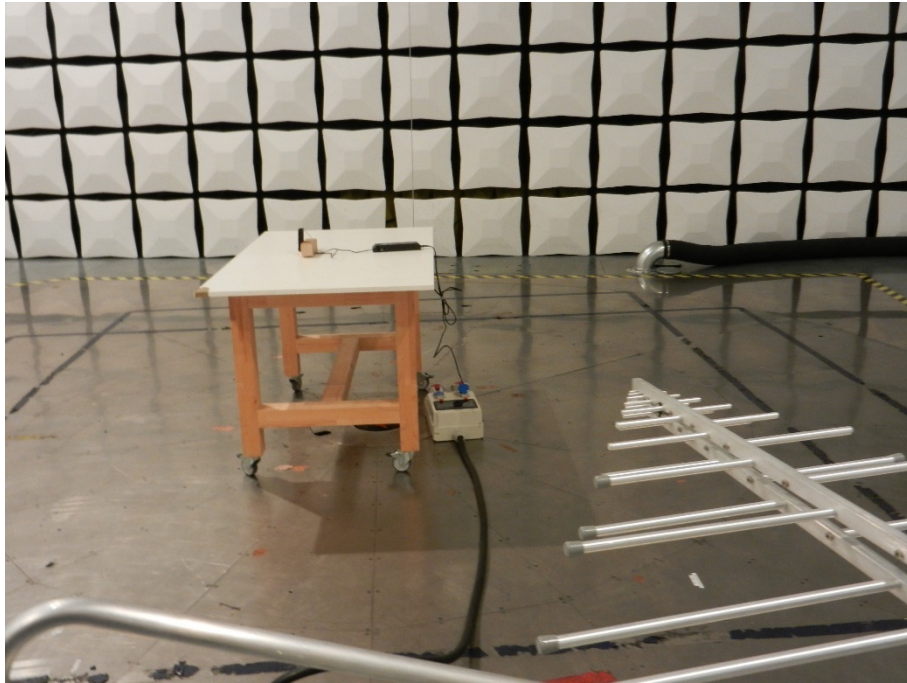
## Test setup for radiated emission measurement (fully anechoic room)



## Test setup for radiated emission measurement (fully anechoic room) - continued -



## Test setup for radiated emission measurement (alternate test site)



## 8 Test Results

| FCC CFR 47 Parts 2 and 15           |                                                      |      |                    |
|-------------------------------------|------------------------------------------------------|------|--------------------|
| Section(s)                          | Test                                                 | Page | Result             |
| 2.1046(a)                           | Conducted output power                               | ---  | Not applicable     |
| 2.202(a)                            | Occupied bandwidth                                   |      | Recorded           |
| 15.204                              | Antenna requirement                                  | ---  | Integrated Antenna |
| 15.215(c)                           | Bandwidth of the emission                            | ---  | Not applicable     |
| 2.201, 2.202                        | Class of emission                                    | 34   | Calculated         |
| 15.35(c)                            | Pulse train measurement for pulsed operation         | ---  | Not applicable     |
| 15.205(a)                           | Restricted bands of operation                        | 35   | Test passed        |
| 15.247(a)(2)                        | DTS (6 dB) Bandwidth                                 | 32   | Test passed        |
| 15.247(e)                           | Power spectral density                               | 36   | Test passed        |
| 15.247(b)(3)                        | Maximum peak output power                            | 37   | Test passed        |
| 15.207                              | Conducted AC powerline emission<br>150 kHz to 30 MHz | 38   | Test passed        |
| 15.247(d)                           | Unwanted conducted emissions<br>30 MHz to 25 GHz     | 41   | Test passed        |
| 15.205(b)<br>15.247(d)              | Unwanted radiated emission<br>9 kHz to 30 MHz        | 44   | Test passed        |
| 15.205(b)<br>15.215(b)<br>15.247(d) | Unwanted radiated emission<br>30 MHz to 25 GHz       | 45   | Test passed        |
| 15.247(i)<br>2.1093                 | RF exposure requirement                              | 52   | Test passed        |

#### IC RSS-Gen Issue 4

| Section(s)     | Test                                                 | Page | Result                                      |
|----------------|------------------------------------------------------|------|---------------------------------------------|
| 6.12           | Transmitter output power (conducted)                 | ---  | Not applicable                              |
| 6.6            | Occupied Bandwidth                                   |      | Recorded                                    |
| 9              | Designation of emissions                             | 34   | Calculated                                  |
| 6.10           | Pulsed operation                                     | ---  | Not applicable                              |
| 8.8            | Conducted AC powerline emission<br>150 kHz to 30 MHz | 38   | Test passed                                 |
| 8.10           | Restricted bands and unwanted emission frequencies   | ---  | Not applicable <sup>5</sup>                 |
| 6.4, 6.13, 8.9 | Unwanted emissions<br>9 kHz to 30 MHz                | ---  | Not applicable <sup>5</sup>                 |
| 6.5, 6.13, 8.9 | Unwanted emissions<br>30 MHz to 25 GHz               | ---  | Not applicable <sup>5</sup>                 |
| 3.2            | Exposure of Humans to RF Fields                      | 54   | Exempted from<br>SAR and RF eval-<br>uation |

#### IC RSS-247 Issue 2

| Section(s) | Test                                                                    | Page | Result      |
|------------|-------------------------------------------------------------------------|------|-------------|
| 5.2(1)     | Minimum 6 dB bandwidth                                                  | 32   | Test passed |
| 5.2(2)     | Power spectral density                                                  | 36   | Test passed |
| 5.4(4)     | Transmitter Output Power and<br>Equivalent Isotropically Radiated Power | 37   | Test passed |
| 5.5        | Unwanted conducted emissions<br>30 MHz to 25 GHz                        | 41   | Test passed |
| 5.5        | Unwanted radiated emission<br>9 kHz to 30 MHz                           | 44   | Test passed |
| 5.5        | Unwanted radiated emission<br>30 MHz to 25 GHz                          | 45   | Test passed |

<sup>5</sup> See IC RSS-247 Issue 2, section 5.5

## 8.1 DTS bandwidth

|                           |                                                                                                                                                                     |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rules and specifications: | CFR 47 Part 15, section 15.247(a)(2)<br>IC RSS-247 Issue 2, section 5.2(1)                                                                                          |
| Guide:                    | ANSI C63.10                                                                                                                                                         |
| Description:              | The minimum 6 dB bandwidth shall be at least 500 kHz<br><br>RBW = 100 kHz; VBW $\geq 3 \times$ RBW; Sweep = auto couple.<br>Detector = Peak; Trace mode = max hold. |
| Measurement procedure:    | Bandwidth Measurements (6.2)                                                                                                                                        |

|               |                                                 |
|---------------|-------------------------------------------------|
| Comment:      | See section 1 of ANNEX to test report for plots |
| Date of test: | 2017-07-20 and 2017-08-21                       |
| Test site:    | Radio laboratory                                |

| Mode | Frequency (MHz) | Channel Bandwidth (MHz) | Limit (kHz) | Result |
|------|-----------------|-------------------------|-------------|--------|
| BLE  | 2402            | 689.4                   | $\geq 500$  | Pass   |
| BLE  | 2440            | 709.3                   | $\geq 500$  | Pass   |
| BLE  | 2480            | 704.3                   | $\geq 500$  | Pass   |
| Prop | 2401            | 589.4                   | $\geq 500$  | Pass   |
| Prop | 2440            | 594.4                   | $\geq 500$  | Pass   |
| Prop | 2480            | 639.4                   | $\geq 500$  | Pass   |

|              |             |
|--------------|-------------|
| Test Result: | Test passed |
|--------------|-------------|

## 8.2 Occupied Bandwidth

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rules and specifications: | CFR 47 Part 2, section 2.202(a)<br>ANSI C63.10, section 6.9.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Guide:                    | ANSI C63.10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Description:              | <p>The occupied bandwidth according to CFR 47 Part 2, section 2.202(a), is measured as the 99% emission bandwidth, i.e. below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission.</p> <p>The occupied bandwidth according to ANSI C63.10, section 6.9.1; is measured as the frequency range defined by the points that are 20 dB down relative to the maximum level of the modulated carrier.</p> <p>The span range of the spectrum analyser display shall be between two times and five times of the occupied bandwidth. The resolution bandwidth of the spectrum analyzer should be approximately 1 % to 5 % of the occupied bandwidth, unless otherwise specified, depending on the applicable requirement. The video bandwidth shall be at least three times greater than the resolution bandwidth. The dynamic range of the spectrum analyzer at the selected resolution bandwidth shall be more than 10 dB below the target "dB down" (attenuation) requirement.</p> |
| Measurement procedure:    | Bandwidth Measurements (6.2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

|               |                                                 |
|---------------|-------------------------------------------------|
| Comment:      | See section 2 of ANNEX to test report for plots |
| Date of test: | 2017-07-20 and 2017-08-21                       |
| Test site:    | Radio laboratory                                |

| Mode | Frequency (MHz) | Occupied Bandwidth (MHz) | Minimum Frequency (GHz) | Maximum Frequency (GHz) |
|------|-----------------|--------------------------|-------------------------|-------------------------|
| BLE  | 2402            | 1.049204                 | 2.40148625              | 2.40253546              |
| BLE  | 2440            | 1.049204                 | 2.43948625              | 2.44053546              |
| BLE  | 2480            | 1.049204                 | 2.47948625              | 2.48053546              |
| Prop | 2401            | 1.683317                 | 2.40016084              | 2.40185516              |
| Prop | 2440            | 1.713287                 | 2.43915085              | 2.44086414              |
| Prop | 2480            | 1.673327                 | 2.47916583              | 2.48083916              |

### 8.3 Designation of Emissions

|                           |                                                                          |
|---------------------------|--------------------------------------------------------------------------|
| Rules and specifications: | CFR 47 Part 2, sections 2.201 and 2.202<br>IC RSS-Gen Issue 4, section 9 |
| Guide:                    | ANSI C63.10 / TRC-43                                                     |

|                     |                              |
|---------------------|------------------------------|
| Type of modulation: | Frequency Shift Keying (FSK) |
|---------------------|------------------------------|

|                              |                                                                                  |
|------------------------------|----------------------------------------------------------------------------------|
| $B_n$ = Necessary Bandwidth  | $B_n = 2DK + B$                                                                  |
| D = Peak deviation           | D = 700 kHz                                                                      |
| K = Overall numerical factor | K = 1                                                                            |
| B = Modulation rate          | B = 270 kHz                                                                      |
| Calculation:                 | $B_n = 2 \cdot (700 \text{ kHz}) \cdot 1 + (270 \text{ kHz}) = 1.67 \text{ MHz}$ |

|                           |                |
|---------------------------|----------------|
| Designation of Emissions: | <b>1M67F1D</b> |
|---------------------------|----------------|

## 8.4 Restricted Bands of Operation

|                           |                                                                                                                                                                                                                                                                                           |
|---------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rules and specifications: | CFR 47 Part 15, sections 15.205(a) and 15.247(d)                                                                                                                                                                                                                                          |
| Guide:                    | ANSI C63.10                                                                                                                                                                                                                                                                               |
| Limit:                    | Only spurious emissions are permitted in any of the frequency bands listed in CFR 47 Part 15, section 15.205(a).<br>In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits specified in CFR 47 Part 15, section 15.209(a). |
| Measurement procedure:    | Conducted Output Power (6.1)                                                                                                                                                                                                                                                              |

|               |                                                 |
|---------------|-------------------------------------------------|
| Comment:      | See section 3 of ANNEX to test report for plots |
| Date of test: | 2017-07-20 and 2017-08-21                       |
| Test site:    | Radio laboratory                                |

No fundamental emissions within restricted bands of operation

|              |             |
|--------------|-------------|
| Test Result: | Test passed |
|--------------|-------------|

## 8.5 Power Spectral Density

|                           |                                                                                                                                                                                                                        |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rules and specifications: | CFR 47 Part 15, section 15.247(e)<br>IC RSS-247 Issue 2, section 5.2(2)                                                                                                                                                |
| Guide:                    | ANSI C63.10                                                                                                                                                                                                            |
| Limit:                    | For digital 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 |
| Measurement procedure:    | Power spectral density (6.3)                                                                                                                                                                                           |

|               |                                                 |
|---------------|-------------------------------------------------|
| Comment:      | See section 4 of ANNEX to test report for plots |
| Date of test: | 2017-07-20; 2017-08-21                          |
| Test site:    | Radio laboratory                                |

| Mode | Frequency (MHz) | Power Spectral Density (dBm) | Limit (dBm) | Margin |
|------|-----------------|------------------------------|-------------|--------|
| BLE  | 2402            | -2.4                         | 8.0         | 10.4   |
| BLE  | 2440            | -2.8                         | 8.0         | 10.8   |
| BLE  | 2480            | -3.4                         | 8.0         | 11.4   |
| Prop | 2401            | -0.7                         | 8.0         | 8.7    |
| Prop | 2440            | -0.5                         | 8.0         | 8.5    |
| Prop | 2480            | -0.6                         | 8.0         | 8.6    |

|              |             |
|--------------|-------------|
| Test Result: | Test passed |
|--------------|-------------|

## 8.6 Maximum output power

|                           |                                                                                   |
|---------------------------|-----------------------------------------------------------------------------------|
| Rules and specifications: | CFR 47 Part 15, section 15.247(b)(2)<br>IC RSS-247 Issue 2, section 5.4(4)        |
| Guide:                    | ANSI C63.10                                                                       |
| Limit:                    | The maximum output power is 1 W (30 dBm) for systems employing digital modulation |
| Measurement procedure:    | Conducted Output Power (6.1)                                                      |

|               |                                                 |
|---------------|-------------------------------------------------|
| Comment:      | See section 5 of ANNEX to test report for plots |
| Date of test: | 2017-07-20; 2017-08-21                          |
| Test site:    | Radio laboratory                                |

| Mode | Frequency (MHz) | Conducted output power PEP (dBm) | Limit (dBm) | Margin |
|------|-----------------|----------------------------------|-------------|--------|
| BLE  | 2402            | -2.2                             | 30.0        | 32.2   |
| BLE  | 2440            | -2.8                             | 30.0        | 32.8   |
| BLE  | 2480            | -3.3                             | 30.0        | 33.3   |
| Prop | 2401            | -0.7                             | 30.0        | 30.7   |
| Prop | 2440            | -0.4                             | 30.0        | 30.4   |
| Prop | 2480            | -0.5                             | 30.0        | 30.5   |

|              |             |
|--------------|-------------|
| Test Result: | Test passed |
|--------------|-------------|

## 8.7 Conducted Powerline Emission Measurement 150 kHz to 30 MHz

|                           |                                                                   |                        |          |
|---------------------------|-------------------------------------------------------------------|------------------------|----------|
| Rules and specifications: | CFR 47 Part 15, section 15.207<br>IC RSS-GEN Issue 4, section 8.8 |                        |          |
| Guide:                    | ANSI C63.10 / CISPR 22                                            |                        |          |
| Limit:                    | Frequency of Emission (MHz)                                       | Conducted Limit (dBμV) |          |
|                           |                                                                   | Quasi-peak             | Average  |
|                           | 0.15 - 0.5                                                        | 66 to 56               | 56 to 46 |
|                           | 0.5 - 5                                                           | 56                     | 46       |
|                           | 5 - 30                                                            | 60                     | 50       |
| Measurement procedure:    | Conducted AC Powerline Emission (6.4)                             |                        |          |

|              |             |
|--------------|-------------|
| Test Result: | Test passed |
|--------------|-------------|

### Sample calculation of final values:

$$\text{Final Value (dB}\mu\text{V)} = \text{Reading Value (dB}\mu\text{V)} + \text{Correction Factor (dB)}$$

Comment: Tested with DC 12 V power supply  
 See section 6.1 of ANNEX to test report for plots  
 Date of test: 2017-07-21  
 Test site: Shielded room, cabin no. 9

Tested on: L1

| Frequency<br>MHz | QuasiPeak<br>dBμV | CAverage<br>dBμV | Limit<br>dBμV | Margin<br>dB | Meas. Time<br>ms | Bandwidth<br>kHz | Corr.<br>dB |
|------------------|-------------------|------------------|---------------|--------------|------------------|------------------|-------------|
| 0.474            |                   | 28.1             | 46.4          | 18.4         | 1000             | 9                | 0.0         |
| 0.474            | 32.2              |                  | 56.4          | 24.3         | 1000             | 9                | 0.0         |
| 3.966            |                   | 25.5             | 46.0          | 20.5         | 1000             | 9                | 0.3         |
| 3.966            | 32.8              |                  | 56.0          | 23.3         | 1000             | 9                | 0.3         |

Tested on: N

| Frequency<br>MHz | QuasiPeak<br>dBμV | CAverage<br>dBμV | Limit<br>dBμV | Margin<br>dB | Meas. Time<br>ms | Bandwidth<br>kHz | Corr.<br>dB |
|------------------|-------------------|------------------|---------------|--------------|------------------|------------------|-------------|
| 3.926            |                   | 25.8             | 46.0          | 20.2         | 1000             | 9                | 0.3         |
| 3.926            | 31.2              |                  | 56.0          | 24.8         | 1000             | 9                | 0.3         |
| 4.290            |                   | 23.8             | 46.0          | 22.1         | 1000             | 9                | 0.3         |
| 4.290            | 30.3              |                  | 56.0          | 25.7         | 1000             | 9                | 0.3         |

Test Result: Test passed

Comment: Tested with DC 24 V power supply  
See section 6.2 of ANNEX to test report for plots  
Date of test: 2017-07-21  
Test site: Shielded room, cabin no. 9

Tested on: L1

| Frequency<br>MHz | QuasiPeak<br>dB $\mu$ V | CAverage<br>dB $\mu$ V | Limit<br>dB $\mu$ V | Margin<br>dB | Meas. Time<br>ms | Bandwidth<br>kHz | Corr.<br>dB |
|------------------|-------------------------|------------------------|---------------------|--------------|------------------|------------------|-------------|
| 0.446            |                         | 25.0                   | 47.0                | 22.0         | 1000             | 9                | 0.0         |
| 0.446            | 40.0                    |                        | 57.0                | 17.0         | 1000             | 9                | 0.0         |
| 3.682            |                         | 16.3                   | 46.0                | 29.7         | 1000             | 9                | 0.3         |
| 3.682            | 36.4                    |                        | 56.0                | 19.6         | 1000             | 9                | 0.3         |
| 3.702            |                         | 15.7                   | 46.0                | 30.3         | 1000             | 9                | 0.3         |
| 3.702            | 35.5                    |                        | 56.0                | 20.5         | 1000             | 9                | 0.3         |
| 3.726            |                         | 16.3                   | 46.0                | 29.7         | 1000             | 9                | 0.3         |
| 3.726            | 36.0                    |                        | 56.0                | 20.0         | 1000             | 9                | 0.3         |
| 3.750            |                         | 16.5                   | 46.0                | 29.5         | 1000             | 9                | 0.3         |
| 3.750            | 36.0                    |                        | 56.0                | 20.0         | 1000             | 9                | 0.3         |

Tested on: N

| Frequency<br>MHz | QuasiPeak<br>dB $\mu$ V | CAverage<br>dB $\mu$ V | Limit<br>dB $\mu$ V | Margin<br>dB | Meas. Time<br>ms | Bandwidth<br>kHz | Corr.<br>dB |
|------------------|-------------------------|------------------------|---------------------|--------------|------------------|------------------|-------------|
| 0.446            |                         | 25.6                   | 47.0                | 21.3         | 1000             | 9                | 0.0         |
| 0.446            | 40.7                    |                        | 57.0                | 16.3         | 1000             | 9                | 0.0         |
| 3.706            |                         | 16.4                   | 46.0                | 29.6         | 1000             | 9                | 0.3         |
| 3.706            | 35.2                    |                        | 56.0                | 20.8         | 1000             | 9                | 0.3         |
| 3.750            |                         | 16.4                   | 46.0                | 29.6         | 1000             | 9                | 0.3         |
| 3.750            | 34.2                    |                        | 56.0                | 21.8         | 1000             | 9                | 0.3         |
| 4.034            |                         | 16.9                   | 46.0                | 29.1         | 1000             | 9                | 0.3         |
| 4.034            | 35.2                    |                        | 56.0                | 20.8         | 1000             | 9                | 0.3         |
| 4.054            |                         | 16.2                   | 46.0                | 29.8         | 1000             | 9                | 0.3         |
| 4.054            | 34.3                    |                        | 56.0                | 21.7         | 1000             | 9                | 0.3         |

Test Result: Test passed

## 8.8 Conducted Emission Measurement 30 MHz to 25 GHz

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rules and specifications: | CFR 47 Part 15, section 15.247(d)<br>IC RSS-247 Issue 2, section 5.5                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Guide:                    | ANSI C63.10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Limit:                    | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator 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. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation shall be 30 dB instead of 20 dB. |
| Measurement procedure:    | Conducted Output Power (6.1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

|               |                                                 |
|---------------|-------------------------------------------------|
| Comment:      | See section 7 of ANNEX to test report for plots |
| Date of test: | 2017-07-20; 2017-08-21                          |
| Test site:    | Radio laboratory                                |

See Plots and tables for details

|              |             |
|--------------|-------------|
| Test Result: | Test passed |
|--------------|-------------|

### Conducted Output Power; BLE, lowest channel:

| Frequency (MHz) | Conducted Power (dBm) | Conducted Power (dBc) | Limit (dBc) | Margin |
|-----------------|-----------------------|-----------------------|-------------|--------|
| 2402            | -2.6                  | ---                   | ---         | ---    |
| 4804            | -41.7                 | 39.1                  | $\geq 20.0$ | Pass   |
| 7206            | -46.0                 | 43.4                  | $\geq 20.0$ | Pass   |

### Conducted Output Power; BLE, middle channel:

| Frequency (MHz) | Conducted Power (dBm) | Conducted Power (dBc) | Limit (dBc) | Margin |
|-----------------|-----------------------|-----------------------|-------------|--------|
| 2440            | -2.7                  | ---                   | ---         | ---    |
| 4880            | -40.6                 | 37.9                  | $\geq 20.0$ | Pass   |
| 7320            | -49.0                 | 46.3                  | $\geq 20.0$ | Pass   |

### Conducted Output Power; BLE, highest channel:

| Frequency (MHz) | Conducted Power (dBm) | Conducted Power (dBc) | Limit (dBc) | Margin |
|-----------------|-----------------------|-----------------------|-------------|--------|
| 2480            | -3.4                  | ---                   | ---         | ---    |
| 4960            | -41.2                 | 37.8                  | $\geq 20.0$ | Pass   |
| 4770            | -49.4                 | 46.0                  | $\geq 20.0$ | Pass   |

### Conducted Output Power; Proprietary radio, lowest channel:

| Frequency (MHz) | Conducted Power (dBm) | Conducted Power (dBc) | Limit (dBc) | Margin |
|-----------------|-----------------------|-----------------------|-------------|--------|
| 2401            | -3.1                  | ---                   | ---         | ---    |
| 4802            | -47.6                 | 44.5                  | $\geq 20.0$ | Pass   |
| 7203            | -43.1                 | 40.0                  | $\geq 20.0$ | Pass   |

### Conducted Output Power; Proprietary radio, middle channel:

| Frequency (MHz) | Conducted Power (dBm) | Conducted Power (dBc) | Limit (dBc) | Margin |
|-----------------|-----------------------|-----------------------|-------------|--------|
| 2440            | -1.8                  | ---                   | ---         | ---    |
| 4880            | -46.6                 | 44.8                  | $\geq 20.0$ | Pass   |
| 7320            | -47.7                 | 45.9                  | $\geq 20.0$ | Pass   |

### Conducted Output Power; Proprietary radio, highest channel:

| Frequency (MHz) | Conducted Power (dBm) | Conducted Power (dBc) | Limit (dBc) | Margin |
|-----------------|-----------------------|-----------------------|-------------|--------|
| 2480            | -1.1                  | ---                   | ---         | ---    |
| 4960            | -37.6                 | 36.5                  | $\geq 20.0$ | Pass   |
| 7440            | -52.7                 | 51.6                  | $\geq 20.0$ | Pass   |

## 8.9 Radiated Emission Measurement 9 kHz to 30 MHz

|                                                                                                           |                                                                                                                            |                                    |                                             |                                 |
|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|------------------------------------|---------------------------------------------|---------------------------------|
| Rules and specifications:                                                                                 | CFR 47 Part 15, sections 15.215(b) and 15.249(d)<br>IC RSS-210 Issue 9, section B.10(b)<br>IC RSS-247 Issue 2, section 5.5 |                                    |                                             |                                 |
| Guide:                                                                                                    | ANSI C63.10                                                                                                                |                                    |                                             |                                 |
| Limit:                                                                                                    | Frequency of Emission (MHz)                                                                                                | Field Strength ( $\mu\text{V/m}$ ) | Field Strength ( $\text{dB}\mu\text{V/m}$ ) | Measurement Distance d (meters) |
|                                                                                                           | 0.009 - 0.490                                                                                                              | 2400/F(kHz)                        | 67.6 - 20 · log(F(kHz))                     | 300                             |
|                                                                                                           | 0.490 - 1.705                                                                                                              | 24000/F(kHz)                       | 87.6 - 20 · log(F(kHz))                     | 30                              |
|                                                                                                           | 1.705 - 30.000                                                                                                             | 30                                 | 29.5                                        | 30                              |
| Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission. |                                                                                                                            |                                    |                                             |                                 |
| Measurement procedure:                                                                                    | Radiated Emission Measurement 9 kHz to 30 MHz (6.5)                                                                        |                                    |                                             |                                 |

|               |                                                 |
|---------------|-------------------------------------------------|
| Comment:      | See section 8 of ANNEX to test report for plots |
| Date of test: | 2017-05-04                                      |
| Test site:    | Open field test site                            |

|              |             |
|--------------|-------------|
| Test Result: | Test passed |
|--------------|-------------|

No emissions above noise level detected.  
See plots for details.

### Sample calculation of final values:

$$\begin{aligned} \text{Extrapolation Factor (dB)} &= (\text{Log}(d) - \text{Log}(d_1)) \cdot \text{Extrapolation Factor (dB/decade)} \\ \text{Final Value (dB}\mu\text{V/m)} &= \text{Reading Value } d_1 \text{ (dB}\mu\text{V)} + \text{Correction Factor (dB/m)} \\ &\quad + \text{Extrapolation Factor (dB)} + \text{Pulse Train Correction (dB)} \end{aligned}$$

Note: Extrapolation factor (dB) and final value ( $\text{dB}\mu\text{V/m}$ ) are relating to distance d.

## 8.10 Radiated Emission Measurement 30 MHz to 25 GHz

|                                                                                                           |                                                                                                                      |                       |                         |
|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|-----------------------|-------------------------|
| Rules and specifications:                                                                                 | CFR 47 Part 15, sections 15.215(b) and 15.249<br>IC RSS-210 Issue 9, section B.10<br>IC RSS-247 Issue 2, section 5.5 |                       |                         |
| Guide:                                                                                                    | ANSI C63.10                                                                                                          |                       |                         |
| Limit:                                                                                                    | Frequency of Emission (MHz)                                                                                          | Field Strength (µV/m) | Field Strength (dBµV/m) |
|                                                                                                           | 30 - 88                                                                                                              | 100                   | 40.0                    |
|                                                                                                           | 88 - 216                                                                                                             | 150                   | 43.5                    |
|                                                                                                           | 216 - 960                                                                                                            | 200                   | 46.0                    |
|                                                                                                           | Above 960                                                                                                            | 500                   | 54.0                    |
| Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission. |                                                                                                                      |                       |                         |
| Measurement procedures:                                                                                   | Radiated Emission in Fully or Semi Anechoic Room (6.6)<br>Radiated Emission at Alternative Test Site (6.7)           |                       |                         |

|                |                                                 |          |  |
|----------------|-------------------------------------------------|----------|--|
| Comment:       | See section 9 of ANNEX to test report for plots |          |  |
| Date of test:  | 2017-05-04 and 2017-05-09                       |          |  |
| Test site:     | Semi-anechoic room, cabin no. 8                 |          |  |
| Test distance: | Frequencies ≤ 8.2 GHz:                          | 3 meters |  |
|                | Frequencies > 8.2 GHz:                          | 1 meter  |  |

|              |             |
|--------------|-------------|
| Test Result: | Test passed |
|--------------|-------------|

### Sample calculation of final values:

$$\text{Final Value (dBµV/m)} = \text{Reading Value (dBµV)} + \text{Correction Factor (dB/m)} + \text{Pulse Train Correction (dB)}$$

Operation mode: Bluetooth Low Energy on lowest channel

| Frequency<br>(MHz) | Antenna<br>Polarization | Detector   | Receiver<br>Reading<br>(dBμV) | Correction<br>Factor<br>(dB/m) | Pulse Train<br>Correction<br>(dB) | Final<br>Value<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>(dB) |
|--------------------|-------------------------|------------|-------------------------------|--------------------------------|-----------------------------------|----------------------------|-------------------|----------------|
| 33.355             | vertical                | Quasi-Peak | 7.0                           | 13.8                           |                                   | 20.8                       | 67.9              | 47.0           |
| 48.930             | vertical                | Quasi-Peak | 6.3                           | 15.8                           |                                   | 22.1                       | 67.9              | 45.8           |
| 124.760            | horizontal              | Quasi-Peak | 10.1                          | 11.4                           |                                   | 21.5                       | 43.5              | 22.0           |
| 2401.000           | horizontal              | Average    | 41.6                          | 33.3                           |                                   | 74.9                       |                   |                |
| 2401.000           | horizontal              | Peak       | 54.6                          | 33.3                           |                                   | 87.9                       |                   |                |
| 4802.000           | horizontal              | Average    | 12.9                          | 41.0                           |                                   | 53.9                       | 54.0              | 0.1            |
| 4802.000           | horizontal              | Peak       | 31.7                          | 41.0                           |                                   | 72.7                       | 74.0              | 1.3            |
| 4804.000           | vertical                | Peak       | 53.7                          | 2.2                            |                                   | 55.9                       | 74.0              | 18.1           |
| 7203.000           | horizontal              | Average    | 3.4                           | 44.7                           |                                   | 48.1                       | 67.9              | 19.8           |

Test Result: Test passed

Operation mode: Bluetooth Low Energy on middle channel

| Frequency<br>(MHz) | Antenna<br>Polarization | Detector   | Receiver<br>Reading<br>(dBμV) | Correction<br>Factor<br>(dB/m) | Pulse Train<br>Correction<br>(dB) | Final<br>Value<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>(dB) |
|--------------------|-------------------------|------------|-------------------------------|--------------------------------|-----------------------------------|----------------------------|-------------------|----------------|
| 33.355             | vertical                | Quasi-Peak | 7.0                           | 13.8                           |                                   | 20.8                       | 67.9              | 47.0           |
| 48.930             | vertical                | Quasi-Peak | 6.3                           | 15.8                           |                                   | 22.1                       | 67.9              | 45.8           |
| 124.760            | horizontal              | Quasi-Peak | 10.1                          | 11.4                           |                                   | 21.5                       | 43.5              | 22.0           |
| 2440.000           | horizontal              | Average    | 42.6                          | 33.3                           |                                   | 75.9                       |                   |                |
| 2440.000           | horizontal              | Peak       | 54.6                          | 33.3                           |                                   | 87.9                       |                   |                |
| 4880.000           | horizontal              | Average    | 12.9                          | 41.0                           |                                   | 53.9                       | 54.0              | 0.1            |
| 4880.000           | horizontal              | Peak       | 31.7                          | 41.0                           |                                   | 72.7                       | 74.0              | 1.3            |
| 7320.000           | horizontal              | Average    | 3.3                           | 44.7                           |                                   | 48.0                       | 54.0              | 6.0            |
| 7320.000           | horizontal              | Peak       | 18.8                          | 44.7                           |                                   | 63.5                       | 74.0              | 10.5           |

Test Result: Test passed

Operation mode: Bluetooth Low Energy on highest channel

| Frequency<br>(MHz) | Antenna<br>Polarization | Detector   | Receiver<br>Reading<br>(dBμV) | Correction<br>Factor<br>(dB/m) | Pulse Train<br>Correction<br>(dB) | Final<br>Value<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>(dB) |
|--------------------|-------------------------|------------|-------------------------------|--------------------------------|-----------------------------------|----------------------------|-------------------|----------------|
| 33.355             | vertical                | Quasi-Peak | 7.0                           | 13.8                           |                                   | 20.8                       | 68.5              | 47.7           |
| 48.930             | vertical                | Quasi-Peak | 6.3                           | 15.8                           |                                   | 22.1                       | 68.5              | 46.5           |
| 124.760            | horizontal              | Quasi-Peak | 10.1                          | 11.4                           |                                   | 21.5                       | 43.5              | 22.0           |
| 2480.000           | horizontal              | Average    | 42.6                          | 33.3                           |                                   | 75.9                       |                   |                |
| 2480.000           | horizontal              | Peak       | 87.7                          | 0.8                            |                                   | 88.5                       |                   |                |
| 4960.000           | horizontal              | Average    | 12.9                          | 41.0                           |                                   | 53.9                       | 54.0              | 0.1            |
| 4960.000           | horizontal              | Peak       | 31.7                          | 41.0                           |                                   | 72.7                       | 74.0              | 1.3            |
| 7440.000           | horizontal              | Average    | 3.3                           | 44.7                           |                                   | 48.0                       | 54.0              | 6.0            |
| 7440.000           | horizontal              | Peak       | 18.8                          | 44.7                           |                                   | 63.5                       | 74.0              | 10.5           |

Test Result: Test passed

Operation mode: Proprietary radio on lowest channel

| Frequency<br>(MHz) | Antenna<br>Polarization | Detector   | Receiver<br>Reading<br>(dBμV) | Correction<br>Factor<br>(dB/m) | Pulse Train<br>Correction<br>(dB) | Final<br>Value<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>(dB) |
|--------------------|-------------------------|------------|-------------------------------|--------------------------------|-----------------------------------|----------------------------|-------------------|----------------|
| 33.355             | vertical                | Quasi-Peak | 7.0                           | 13.8                           |                                   | 20.8                       | 67.9              | 47.0           |
| 48.930             | vertical                | Quasi-Peak | 6.3                           | 15.8                           |                                   | 22.1                       | 67.9              | 45.8           |
| 124.760            | horizontal              | Quasi-Peak | 10.1                          | 11.4                           |                                   | 21.5                       | 43.5              | 22.0           |
| 2401.000           | horizontal              | Average    | 42.6                          | 33.3                           |                                   | 75.9                       |                   |                |
| 2401.000           | horizontal              | Peak       | 54.6                          | 33.3                           |                                   | 87.9                       |                   |                |
| 4802.000           | horizontal              | Average    | 12.9                          | 41.0                           |                                   | 53.9                       | 54.0              | 0.1            |
| 4802.000           | horizontal              | Peak       | 31.7                          | 41.0                           |                                   | 72.7                       | 74.0              | 1.3            |
| 7203.000           | horizontal              | Average    | 3.3                           | 44.7                           |                                   | 48.0                       | 67.9              | 19.8           |
| 7203.000           | horizontal              | Peak       | 18.8                          | 44.7                           |                                   | 63.5                       | 74.0              | 10.5           |

Test Result: Test passed

Operation mode: Proprietary radio on middle channel

| Frequency<br>(MHz) | Antenna<br>Polarization | Detector   | Receiver<br>Reading<br>(dBμV) | Correction<br>Factor<br>(dB/m) | Pulse Train<br>Correction<br>(dB) | Final<br>Value<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>(dB) |
|--------------------|-------------------------|------------|-------------------------------|--------------------------------|-----------------------------------|----------------------------|-------------------|----------------|
| 33.355             | vertical                | Quasi-Peak | 7.0                           | 13.8                           |                                   | 20.8                       | 67.9              | 47.0           |
| 48.930             | vertical                | Quasi-Peak | 6.3                           | 15.8                           |                                   | 22.1                       | 67.9              | 45.8           |
| 124.760            | horizontal              | Quasi-Peak | 10.1                          | 11.4                           |                                   | 21.5                       | 43.5              | 22.0           |
| 2440.000           | horizontal              | Average    | 42.6                          | 33.3                           |                                   | 75.9                       |                   |                |
| 2440.000           | horizontal              | Peak       | 54.6                          | 33.3                           |                                   | 87.9                       |                   |                |
| 4880.000           | horizontal              | Average    | 12.9                          | 41.0                           |                                   | 53.9                       | 54.0              | 0.1            |
| 4880.000           | horizontal              | Peak       | 31.7                          | 41.0                           |                                   | 72.7                       | 74.0              | 1.3            |
| 7320.000           | horizontal              | Average    | 3.3                           | 44.7                           |                                   | 48.0                       | 54.0              | 6.0            |
| 7320.000           | horizontal              | Peak       | 18.8                          | 44.7                           |                                   | 63.5                       | 74.0              | 10.5           |

Test Result: Test passed

Operation mode: Proprietary radio on highest channel

| Frequency<br>(MHz) | Antenna<br>Polarization | Detector   | Receiver<br>Reading<br>(dBμV) | Correction<br>Factor<br>(dB/m) | Pulse Train<br>Correction<br>(dB) | Final<br>Value<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>(dB) |
|--------------------|-------------------------|------------|-------------------------------|--------------------------------|-----------------------------------|----------------------------|-------------------|----------------|
| 33.355             | vertical                | Quasi-Peak | 7.0                           | 13.8                           |                                   | 20.8                       | 69.6              | 48.8           |
| 48.930             | vertical                | Quasi-Peak | 6.3                           | 15.8                           |                                   | 22.1                       | 69.6              | 47.6           |
| 124.760            | horizontal              | Quasi-Peak | 10.1                          | 11.4                           |                                   | 21.5                       | 43.5              | 22.0           |
| 2480.000           | horizontal              | Average    | 42.6                          | 33.3                           |                                   | 75.9                       |                   |                |
| 2480.000           | horizontal              | Peak       | 88.8                          | 0.8                            |                                   | 89.6                       |                   |                |
| 4960.000           | horizontal              | Average    | 12.9                          | 41.0                           |                                   | 53.9                       | 54.0              | 0.1            |
| 4960.000           | horizontal              | Peak       | 31.7                          | 41.0                           |                                   | 72.7                       | 74.0              | 1.3            |
| 7440.000           | horizontal              | Average    | 3.3                           | 44.7                           |                                   | 48.0                       | 54.0              | 6.0            |

Test Result: Test passed

## 8.11 RF Exposure

|                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rules and specifications: | CFR 47 Part 15, sections 247(i)<br>CFR 47 Part 1, section 1.1307(b)(1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Guide:                    | KDB 447498 D01 v06, section 4.3.1 a)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Limit:                    | <p>Standalone SAR test exclusion considerations</p> <p>Unless specifically required by the <i>published RF exposure KDB procedures</i>, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding <i>SAR Test Exclusion Threshold</i> conditions(s), listed below is (are) satisfied:</p> <p>a) For 100 MHz to 6 GHz and test separation distances <math>\leq 50</math> mm, the 1-g and 10-g SAR Test Exclusion Thresholds are determined by the following: <math>(P_{max, (mW)} / d_{min, (mm)}) (\sqrt{f_{(GHz)}}) \leq 3.0</math> for 1-g SAR and <math>\leq 7.5</math> for 10-g extremity SAR.</p> <p><math>f_{(GHz)}</math> is the RF channel transmit frequency in GHz<br/> <math>P_{max, (mW)}</math> is the max. power of channel, including tune-up tolerance, rounded to the nearest mW before calculation<br/> <math>d_{min, (mm)}</math> is the min. test separation distance, rounded to the nearest mm before calculation. When the minimum test separation distance is <math>&lt; 5</math> mm, a distance of 5 mm is applied.</p> |

| Spectral power density    |                     |                                                              | Declared by applicant               | Measured                            |
|---------------------------|---------------------|--------------------------------------------------------------|-------------------------------------|-------------------------------------|
| Prediction <sup>6</sup> : | P                   | = Max. Power input of antenna                                |                                     |                                     |
| Where:                    | G                   | = Power gain of the antenna relativ to an isotropic radiator |                                     |                                     |
|                           | f                   | = Frequency of the channel                                   |                                     |                                     |
|                           | d                   | = Distance to the center of radiation of the antenna         |                                     |                                     |
| Maximum output power:     | P                   | = -0.4 dBm = 912 $\mu$ W                                     | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Antenna gain:             | G                   | = 1.3 dBi = 1.35                                             |                                     |                                     |
|                           | P <sub>max</sub>    | = 1 mW                                                       |                                     |                                     |
|                           | f                   | = 2.48 GHz                                                   |                                     |                                     |
| Prediction distance:      | R                   | = 5 mm                                                       |                                     |                                     |
|                           | STET                | = 0.3                                                        |                                     |                                     |
| Limit                     | STET <sub>lim</sub> | = 3.0                                                        |                                     |                                     |

<sup>6</sup> MPE Prediction of MPE according to equation from page 19 of OET Bulletin 65, Ed. 97-01



Test Result:

Test passed

## 8.12 Exposure of Humans to RF Fields

|                           |                                 |
|---------------------------|---------------------------------|
| Rules and specifications: | IC RSS-Gen Issue 4, section 3.2 |
| Guide:                    | IC RSS-102 Issue 5, section 2.5 |

| Exposure of Humans to RF Fields                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Applicable | Declared by applicant | Measured                            | Exemption                           |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------------------|-------------------------------------|-------------------------------------|
| The antenna is                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                       |                                     |                                     |
| <input type="checkbox"/> detachable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                       |                                     |                                     |
| <p>The conducted output power (CP in watts) is measured at the antenna connector:</p> <p style="text-align: center;"><math>CP = \dots\dots\dots \text{ W}</math></p> <p>The effective isotropic radiated power (EIRP in watts) is calculated using</p> <p><input type="checkbox"/> the numerical antenna gain: <math>G = \dots\dots\dots</math></p> <p style="text-align: center;"><math>EIRP = G \cdot CP \Rightarrow EIRP = \dots\dots\dots \text{ W}</math></p> <p><input type="checkbox"/> the field strength<sup>7</sup> in V/m: <math>FS = \dots\dots\dots \text{ V/m}</math></p> <p style="text-align: center;"><math>EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP = \dots\dots\dots \text{ W}</math></p> <p>with:</p> <p>Distance between the antennas in m: <math>D = \dots\dots\dots \text{ m}</math></p> |            |                       | <input type="checkbox"/>            |                                     |
| <input checked="" type="checkbox"/> not detachable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |                       |                                     |                                     |
| <p>A field strength measurement is used to determine the effective isotropic radiated power (EIRP in watts) given by<sup>7</sup>:</p> <p style="text-align: center;"><math>EIRP = \frac{(FS \cdot D)^2}{30} \Rightarrow EIRP = 273.6 \text{ } \mu\text{W}</math></p> <p>with:</p> <p>Field strength in V/m: <math>FS = 30.2 \text{ mV/m}</math></p> <p>Distance between the two antennas in m: <math>D = 3 \text{ m}</math></p>                                                                                                                                                                                                                                                                                                                                                                                          |            |                       | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Selection of output power                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                       |                                     |                                     |
| <p>The output power TP is the higher of the conducted or effective isotropic radiated power (e.i.r.p.):</p> <p style="text-align: center;"><math>TP = 273.6 \text{ } \mu\text{W}</math></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                       |                                     |                                     |

<sup>7</sup> The conversion formula is valid only for properly matched antennas. In other cases the transmitter output power may have to be measured by a terminated measurement when applying the exemption clauses. If an open area test site is used for field strength measurement, the effect due to the metal ground reflecting plane should be subtracted from the maximum field strength value in order to reference it to free space, before calculating TP.

| Exposure of Humans to RF Fields (continued)                         | Applicable | Declared by applicant               | Measured | Exemption |
|---------------------------------------------------------------------|------------|-------------------------------------|----------|-----------|
| Separation distance between the user and the transmitting device is |            |                                     |          |           |
| <input checked="" type="checkbox"/> less than or equal to 20 cm     |            | <input checked="" type="checkbox"/> |          |           |
| <input type="checkbox"/> greater than 20 cm                         |            |                                     |          |           |
| Transmitting device is                                              |            |                                     |          |           |
| <input type="checkbox"/> in the vicinity of the human head          |            | <input type="checkbox"/>            |          |           |
| <input type="checkbox"/> body-worn                                  |            |                                     |          |           |

## SAR evaluation

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in the table.

For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in the table are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in the table, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.

For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.

| Frequency<br>(MHz) | Exemption limits (mW) <sup>8</sup> at separation distance of |       |       |       |       |       |       |       |       |        |
|--------------------|--------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
|                    | ≤5 mm                                                        | 10 mm | 15 mm | 20 mm | 25 mm | 30 mm | 35 mm | 40 mm | 45 mm | ≥50 mm |
| ≤300 <sup>9</sup>  | 71                                                           | 101   | 132   | 162   | 193   | 223   | 254   | 284   | 315   | 345    |
| 450                | 52                                                           | 70    | 88    | 106   | 123   | 141   | 159   | 177   | 195   | 213    |
| 835                | 17                                                           | 30    | 42    | 55    | 67    | 80    | 92    | 105   | 117   | 130    |
| 1900               | 7                                                            | 10    | 18    | 34    | 60    | 99    | 153   | 225   | 316   | 431    |
| 2450               | 4                                                            | 7     | 15    | 30    | 52    | 83    | 123   | 173   | 235   | 309    |
| 3500               | 2                                                            | 6     | 16    | 32    | 55    | 86    | 124   | 170   | 225   | 290    |
| 5800               | 1                                                            | 6     | 15    | 27    | 41    | 56    | 71    | 85    | 97    | 106    |

Carrier frequency:  $f$  = **2440 MHz**

Distance:  $d$  = **5 mm**

Transmitter output power:  $TP$  = **273.6 μW**

Limit:  $TP_{limit}$  = **4 mW**

☐ SAR evaluation is documented in test report no. ....

<sup>8</sup> The exemption limit in the table are based on measurements and simulations on half-wave dipole antennas at separation distances of 5 mm to 25 mm from a flat phantom, providing a SAR value of approximately 0.4 W/kg for 1 g of tissue. For low frequencies (300 MHz to 835 MHz), the exemption limits are derived from a linear fit. For high frequencies (1900 MHz and above), the exemption limits are derived from a third order polynomial fit.

<sup>9</sup> Transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine SAR evaluation, shall demonstrate compliance to the instantaneous limits in IC RSS-102, issue 5, section 4.

| Exposure of Humans to RF Fields (continued)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Applicable | Declared by applicant | Measured | Exemption                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------------------|----------|--------------------------|
| <b>RF exposure evaluation</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                       |          |                          |
| <p>RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:</p> <p><input type="checkbox"/> below 20 MHz<sup>10</sup> and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance).</p> <p><input type="checkbox"/> between 3 kHz and 10 MHz exposure limits apply as following:</p> <p><input type="checkbox"/> In a uncontrolled environment the basic restriction for the instantaneous internal electric field strength is equal to or less than <math>2.7 \cdot 10^{-4} f \text{ V/m}_{\text{rms}}</math> at any part of the body where <math>f</math> is in Hz. The instantaneous RF field strength is equal or less than 83 V/m<sub>rms</sub> and equal or less than 90 A/m<sub>rms</sub>.</p> <p><input type="checkbox"/> In a controlled environment the basic restriction for the instantaneous internal electric field strength is equal to or less than <math>1.35 \cdot 10^{-4} f \text{ V/m}_{\text{rms}}</math> at any part of the body where <math>f</math> is in Hz. The instantaneous RF field strength is equal or less than 170 V/m<sub>rms</sub> and equal or less than 180 A/m<sub>rms</sub>.</p> <p><input type="checkbox"/> at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than <math>4,49/f^{0.5} \text{ W}</math> (adjusted for tune-up tolerance, where <math>f</math> is in MHz).</p> <p><input type="checkbox"/> at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance).</p> <p><input type="checkbox"/> at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than <math>1.31 \cdot 10^{-2} f^{0.6834} \text{ W}</math> (adjusted for tune-up tolerance), where <math>f</math> is in MHz.</p> <p><input type="checkbox"/> at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).</p> <p>In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.</p> |            |                       |          |                          |
| <p>Carrier frequency: <math>f</math> =</p> <p>Transmitter output power: <math>TP</math> =</p> <p>Limit: <math>TP_{\text{limit}}</math> =</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |                       |          | <input type="checkbox"/> |
| <input type="checkbox"/> RF exposure evaluation is documented in test report no. ....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                       |          |                          |

<sup>10</sup> Transmitters operating between 3 kHz and 10 MHz, meeting the exemption from routine RF Exposure evaluation, shall demonstrate compliance to the instantaneous limits in IC RSS-102, issue 5, section 4.

## 9 Referenced Regulations

All tests were performed with reference to the following regulations and standards:

|                                     |                |                                                                                                                                                                                                         |                                                 |
|-------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| <input checked="" type="checkbox"/> | CFR 47 Part 2  | Code of Federal Regulations Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC)                                         | October 1, 2016                                 |
| <input checked="" type="checkbox"/> | CFR 47 Part 15 | Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)                                                                                             | October 1, 2016                                 |
| <input type="checkbox"/>            | ANSI C63.4     | American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz                                     | June 13, 2014 (published on June 20, 2014)      |
| <input checked="" type="checkbox"/> | ANSI C63.10    | American national Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices                                                                                                          | June 27, 2013 (published on September 13, 2013) |
| <input checked="" type="checkbox"/> | RSS-Gen        | Radio Standards Specification RSS-Gen Issue 4 containing General Requirements for Compliance of Radio Apparatus, published by Industry Canada                                                           | November 2014                                   |
| <input type="checkbox"/>            | RSS-210        | Radio Standards Specification RSS-210 Issue 9 for Licence-Exempt Radio Apparatus: Category I Equipment, published by Industry Canada                                                                    | August 2016                                     |
| <input checked="" type="checkbox"/> | RSS-247        | Radio Standards Specification RSS-247 Issue 2 Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices                              | February 2017                                   |
| <input type="checkbox"/>            | RSS-310        | Radio Standards Specification RSS-310 Issue 3 for Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category II Equipment, published by Industry Canada                        | December 2010                                   |
| <input checked="" type="checkbox"/> | RSS-102        | Radio Standards Specification RSS-102 Issue 5: Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands), published by Industry Canada                             | March 2015                                      |
| <input type="checkbox"/>            | ICES-003       | Interference-Causing Equipment Standard ICES-003 Issue 6: Information Technology Equipment (Including Digital Apparatus) – Limits and methods of measurement, published by Industry Canada              | January 2016                                    |
| <input checked="" type="checkbox"/> | CISPR 22       | Third Edition of the International Special Committee on Radio Interference (CISPR), Pub. 22, "Information Technology Equipment – Radio Disturbance Characteristics – Limits and Methods of Measurement" | 1997                                            |

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|                                     |                        |                                                                                                                                                                       |               |
|-------------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <input type="checkbox"/>            | CAN/CSA<br>CISPR 22-10 | Information technology equipment -<br>Radio disturbance characteristics -<br>Limits and methods of measurement<br>(Adopted IEC CISPR 22:2008, sixth edition, 2008-09) | 2010          |
| <input type="checkbox"/>            | TRC-43                 | Designation of Emissions, Class of Station and Na-<br>ture of Service, published by Industry Canada                                                                   | November 2012 |
| <input checked="" type="checkbox"/> | KDB 558074             | Guidance for performing compliance measurements<br>on digital transmission systems (DTS) operating un-<br>der section 15.247 (KDB 447498 D01 v06)                     | April 2017    |

## 10 Test Equipment List with Calibration Data

| Type                       | Inv.-No. | Type Designation | Serial Number          | Manufacturer    | Calibration Organization | Last Calibration | Next Calibration |
|----------------------------|----------|------------------|------------------------|-----------------|--------------------------|------------------|------------------|
| EMI test receiver          | 1863     | ESCI3            | 100008                 | Rohde & Schwarz | Rohde & Schwarz          | 2016/10          | 2017/10          |
| EMI test receiver          |          | ESR7             | 101713                 | Rohde & Schwarz | Rohde & Schwarz          | 2016/11          | 2017/11          |
| Spectrum analyser          | 2364     | FSV40            | 101448                 | Rohde & Schwarz | Rohde & Schwarz          | 2016/11          | 2017/11          |
| V-network                  | 1059     | ESH3-Z5          | 894785/005             | Rohde & Schwarz | Rohde & Schwarz          | 2016/10          | 2019/10          |
| Double ridged horn antenna | 2073     | HF907            | 100154                 | Rohde & Schwarz | Rohde & Schwarz          | 2017/06          | 2019/06          |
| Horn antenna               | 1014     | 3160-07          | 9112-1008              | EMCO Elektronik |                          | see note 1       |                  |
| Horn antenna               | 1015     | 3160-08          | 9112-1002              | EMCO Elektronik |                          | see note 1       |                  |
| Horn antenna               | 1265     | 3160-09          | 9403-1025 (931941-010) | EMCO Elektronik |                          | see note 1       |                  |
| Loop antenna               | 1016     | HFH2-Z2          | 882964/0001            | Rohde & Schwarz | Rohde & Schwarz          | 2016/07          | 2018/07          |
| TRILOG Broadband Antenna   | 2058     | VULB 9163        | 9163-408               | Schwarzbeck     | Rohde & Schwarz          | 2016/07          | 2018/07          |

Note 1: No calibration required.

Note 2: Not calibrated separately but with the whole test system when recording calibration data.

Note 3: No calibration required. Devices are checked before use.

Note 4: No calibration required. Devices are checked by calibrated equipment during test.

## 11 Revision History

| Revision History |             |                    |                                                                                                                                                            |
|------------------|-------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Edition</i>   | <i>Date</i> | <i>Issued by</i>   | <i>Modifications</i>                                                                                                                                       |
| 1                | 2017-08-28  | M. Steindl<br>(lc) | First Edition                                                                                                                                              |
| 2                | 2017-09-11  | M. Steindl<br>(lc) | Correction of type designation;<br>Deleted address on wrong entry                                                                                          |
| 3                | 2017-09-20  | M. Steindl<br>(lc) | Updated reference to IC RSS-247, Issue 2.<br>Added references to protocols<br>Altered the distance for human exposure calculations to „smaller than 20 cm. |
| 4                | 2017-10-04  | M. Steindl<br>(lc) | Altered 8.11 RF Exposure to KDB 447498 D01 v06                                                                                                             |