

Thomas Steen Halkier  
NEOCORTEC A/S  
Nannasgade 28, 2. sal  
2200 Copenhagen NFCC Designation  
no.: DK0002  
ISED CAB no.:  
DK0001**FCC ID: 2AB76NC1000C1**

(12 appendices)

**Test object: NC1000C-9, Mesh Network Module****Summary**

See Appendix 1 for general information and Appendix 12 for photos.  
Emission measurements as specified below have been performed.

| Standard  | Compliant  | Appendix | Remarks |
|---|------------|----------|---------|
| <b>FCC 47 CFR Part 15 C</b><br>15.247 Operation within the band 902-928 MHz   | <b>Yes</b> |          | Note 1  |
| <b>IC RSS-247, Issue 2, February 2017/</b><br><b>IC RSS-Gen Issue 5 March 2019</b><br>DTSs, Operation within the band 902-928 MHz | <b>Yes</b> |          | Note 1  |
| Duty cycle measurements   | N/A        | 2        |         |
| 15.247 (a) (2) / RSS-247 5.2 (a), 6 dB bandwidth  | <b>Yes</b> | 3        |         |
| 15.247 (b) (3) / RSS-247 5.4 (d), Maximum peak conducted power  | <b>Yes</b> | 4        |         |
| 15.247 (d) / RSS-247 5.5/RSS-Gen 8.10, Restricted bands of operation and 20 dB below fundamental                                  | <b>Yes</b> | 5        |         |
| 15.247 (e) / RSS-247 5.2 (b), Power spectral density  | <b>Yes</b> | 6        |         |
| 15.247 (i) / RSS-102 2.5.1, RF Exposure   | <b>Yes</b> | 7        |         |
| 15.215 (c), 20 dB bandwidth   | <b>Yes</b> | 8        |         |
| 15.207 / RSS-Gen 8.8, AC power line conducted emissions   | <b>Yes</b> | 9        |         |
| 2.1049 / RSS-Gen 6.7, Occupied bandwidth  | <b>Yes</b> | 10       |         |
| 15.247 (d) / RSS-247 5.5/RSS-Gen 8.10, Band Edge  | <b>Yes</b> | 11       | Note 1  |

Note 1: Operating Band limited to 902.6 – 927.4 MHz.

**EKTOS Testing & Reliability Services A/S**

Performed by

David Busk  
Lab. Manager M. Sc. EE

Examined by

Søren Søltoft  
Senior EMC Engineer**EKTOS Testing & Reliability Services A/S**Postal address  
EKTOS TRS A/S  
A. C. Meyers Vænge 15  
2450 Copenhagen SV  
DenmarkPhone / E-mail  
+45 7070 1499  
info@ektos.net

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## Purpose of test

The tests were performed to verify that NC1000C-9 meets the electromagnetic compatibility requirements of FCC 47 CFR part 15 C and IC RSS-Gen/RSS-247.

The used semi-anechoic chamber is compliant with the requirements of section 2.948 of the FCC rules with the designation number DK0002, as a facility accepted for certification under parts 15 and 18. The site complies with RSS Gen and is accepted by Innovation, Science and Economic Development Canada for the performance of radiated measurements, ISED CAB identifier DK0001.

## Changes in revisions

### **6P02721-3 rev. 3 supersedes 6P02721-3 rev. 2 issued 2019-06-07**

Changes:

Conducted emission test was added.

Model name changed to “NC1000C-9” and description changed to “Mesh Network Module”.

Reasoning that the test object is tested as DTS.

### **6P02721-3 rev. 2 supersedes 6P02721-3 rev. 1 issued 2019-02-19**

Changes:

The following test was retested: *“Restricted bands of operation and 20 dBc below fundamental measurements according to FCC 47 CFR part 15.247 (d) / RSS-247 5.5/RSS-Gen 8.10”*

References to FCC, RSS and KDB’s updated to newest versions.

Calibration dates updated.

### **6P02721-3 rev. 1 supersedes 6P02721-3 issued 2016-12-06**

Changes: Test laboratory name and contact person changed, FCC ID updated.

## Test object

|                               |   |
|-------------------------------|---|
| Mesh Network Module:          | NC1000C-9   |
| Antenna connector             | U. Fl   |
| Antenna:                      | Pulse Electronics W5017   |
| Antenna gain:                 | 2 dBi   |
| Operating frequency band:     | Transmit: 902 to 928 MHz<br>Receive: 902 to 928 MHz                     |
| Supported frequency band:     | Transmit: 902.6 and 927.4 MHz<br>Receive: 902.6 and 927.4 MHz           |
| Frequencies used during test: | Transmit: 902.6, 915 and 927.4 MHz<br>Receive: 902.6, 915 and 927.4 MHz |
| Modulation:                   | 2-FSK   |
| Data rate:                    | 250 baud  |
| Power supply:                 | 3.6 Volt battery. External PSU during test                              |
| Battery type:                 | Li-SOCl <sub>2</sub>  |
| Software                      | TI Test software  |

## Radiated tests

The test object was powered the USB PC connection board (CC Debugger, TI Instruments), for controlling the test object.

Justification measurements were performed with rotation of the EUT through three orthogonal axes to determine which orientation the NC1000C-9 had the highest emission levels, see photos in Appendix 12.

During the radiated tests the PC was placed inside the semi-anechoic chamber on the floor, during the test.

## AC power line conducted emission

AC power line conducted emission test was performed with the NC1000C-9 powered by a representative power supply. As the NC1000C-9 can be powered from different power supplies, an AC/DC adapter was chosen together with the client as a representative setup. The test was done on the AC Power port of the AC/DC adapter.

## RF conducted tests and justifications measurements:

The test object was tested stand alone as a module. The module was powered by a separate external DC Power supply, 3.6 V DC, which was powered with 120 V AC/60 Hz, The PC Connection board was powered via USB from a PC laptop, which was also powered with 120 V AC/60 Hz.

Preliminary conducted RF tests were performed with the NC1000C-9 at mid channel (915 MHz). The measurements were then done at 2-FSK, 250 baud. See Appendix 4, if not otherwise stated.

## Measurement equipment

| Description                    | Model       | ID tag | Cal. due   |
|--------------------------------|-------------|--------|------------|
| Analyzer 20Hz-26.5GHz          | ESI         | 20763  | 2019-12-10 |
| Antenna, Broadband, 30MHz-3GHz | HL562       | 19830  | 2019-04-14 |
| Antenna Horn 1 – 18 GHz        | BBHA 9120 D | 20031  | 2022-04-15 |
| Antenna Log Per 0.3 - 1 GHz    | 3148        | 50083  | 2019-04-14 |
| Multimeter                     | 34401A      | 14880  | 2017-02-25 |
| Analyzer 20Hz-26.5GHz          | ESIB 26     | 18880  | 2020-15-19 |
| V-network Two Line             | ESH3-Z5     | 20682  | 2020-02-25 |

## Operational test mode

The test was performed with continuous transmission, if not otherwise stated, and with normal modulation.

A programmable test sample was used. With a laptop PC the test sample could be configured for different power levels. The EUT was tested placed on a development PCB interfacing to a Laptop PC via USB.

Test in conducted mode was done by attaching RF test cable via U.FL to SMA antenna adapter. The test was performed with continuous transmission with normal modulation and maximum output power, if other not stated.

The following were set in the PC s/w TI SmartRF Studio 7, if not otherwise stated:

Power: +10 dBm)  
Modulation: 2-FSK  
Baud: 250kBaud  
Deviation: 165kHz  
Xtal Frequency: 26 MHz

The designated Frequency Band is 902 – 928 MHz. The Frequency Range tested is 902.6 – 927.4 MHz. The device supports 251 channels (with 98.983765 kHz spacing) from 902.609741 – 927.3555682 MHz, from which 16 channels can be selected for actual use.

According to §15.247(a)(1)(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

Because the NC1000C-9 only uses 16 channels then it does not fulfill the requirements of a DSS (Frequency Hopping Spread Spectrum system) and is thus considered a DTS (Digital Transmission System).

## Ancillary and/or support equipment

|                          |                  |
|--------------------------|------------------|
| Laptop PC, Lenovo R500   | SP equipment     |
| TI SmartRF Studio 7      | Client software  |
| 915MHzFSK                | Client software  |
| NC1000 Development Board | Client equipment |

## 120 VAC 60 Hz equipment

| Description           | Supplier        | Model    | ID tag |
|-----------------------|-----------------|----------|--------|
| Oscillator 10Hz-1MHz  | B&O             | TG7      | 11199  |
| Multimeter            | Hewlett Packard | 34401A   | 14880  |
| Audio power amplifier | img Stage Line  | STA-3000 | 50027  |

**Uncertainties**

|   | Frequency<br>[MHz] | Polarization | Expanded<br>Uncertainty<br>[dB] (k=2) |
|---|--------------------|--------------|---------------------------------------|
| <b>Radiated Emission AEC 30 – 3000 MHz</b><br>(CISPR 16-4)<br>HL562 Antenna | 30 – 200           | Vertical     | <b>4.73</b>                           |
|   | 200 – 3000         | Vertical     | <b>4.97</b>                           |
|   | 30 – 200           | Horizontal   | <b>4.72</b>                           |
|   | 200 - 3000         | Horizontal   | <b>5.08</b>                           |
| Radiated Emission AEC 1 – 18 GHz<br>(CISPR 16-4)                            | 1000 – 18000       | Vertical     | <b>3.76</b>                           |
|   | 1000 – 18000       | Horizontal   | <b>3.77</b>                           |
| Conducted emission  | 0.01 - 30          |              | <b>3.44</b>                           |

Compliance evaluation is based on a shared risk principle with respect to the measurement uncertainty.

**Reservation**

The test results in this report apply only to the particular test object as declared in the report.

**Delivery of test object**

The test object was delivered: 2016-04-04

The test object for supplementary tests was delivered: 2019-05-14

**Test engineers**

Ruben Hansen, David Busk, Søren Søltoft

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Appendix 2

### Duty cycle measurements

Test not applicable, the EUT was set to continuous transmission (100% duty cycle) and with normal modulation.

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Appendix 3

**6 dB bandwidth measurements according to FCC 47 CFR part 15.247 (a) (2) / RSS-247 5.2 (1)**

|                    |                             |                        |
|--------------------|-----------------------------|------------------------|
| Date<br>2016-12-06 | Temperature<br>23 °C ± 3 °C | Humidity<br>21 % ± 5 % |
|--------------------|-----------------------------|------------------------|

**Test set-up and procedure**

The measurements were performed according to ANSI C63.10-2013 sec. 11.8.1 and the KDB 558074 D01 DTS Meas Guidance v05r02, April 2, 2019, clause 8.2.

Conducted measurements were performed with the ESI26 at the antenna connector and with continuous transmission and with 2-FSK modulation, see the results.

| Measurement equipment              | SP number |
|------------------------------------|-----------|
| Test site RF Room                  |           |
| Signal Analyser R&S ESI26          | 18880     |
| Lenovo R500 Laptop                 |           |
| EUT Power supply via Laptop USB    |           |
| Temperature and humidity meter CAN | 14395     |

**Results**

Final test, 6 dB measurements with modulation 2-FSK, 250kBaud, 165kHz Dev., can be found in the diagrams below:

|           |           |                        |
|-----------|-----------|------------------------|
| Diagram 1 | 902.6 MHz | 6 dBW = <b>583 kHz</b> |
| Diagram 2 | 915.0 MHz | 6 dBW = <b>589 kHz</b> |
| Diagram 3 | 927.4 MHz | 6 dBW = <b>580 kHz</b> |

**Limits**

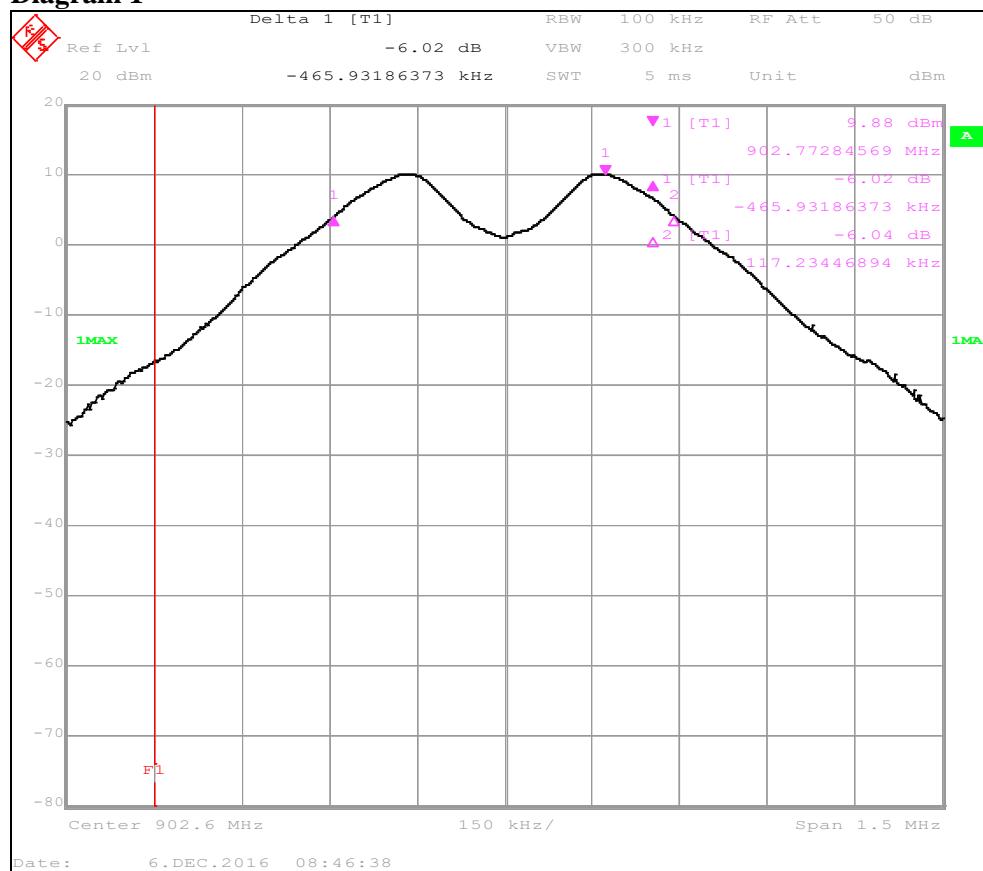
According to 47CFR 15.247(a)(2), the minimum 6 dB bandwidth shall be at least 500 kHz.

According to RSS-247 5.2 (a), the minimum 6 dB bandwidth shall be 500 kHz.

|           |            |
|-----------|------------|
| Complies? | <b>Yes</b> |
|-----------|------------|

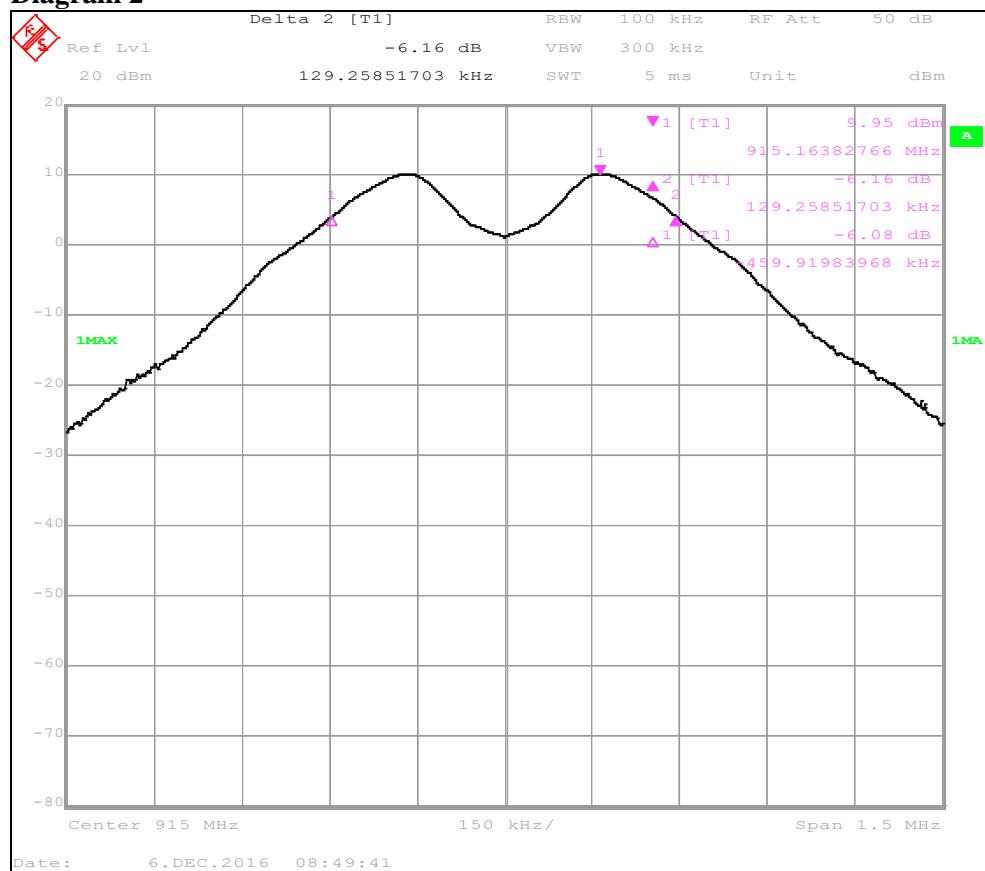
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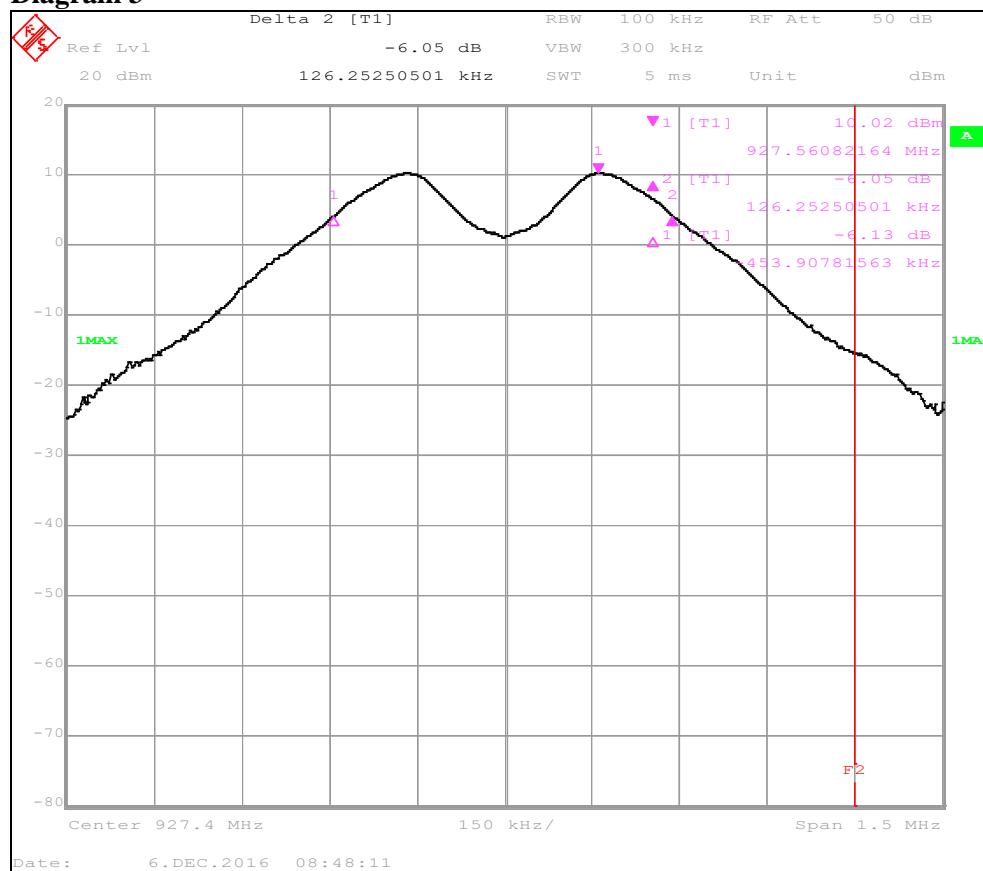
Appendix 3

**Diagram 1**


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Appendix 3

**Diagram 2**


**Diagram 3**


**Maximum peak conducted output power measurements according to  
FCC 47 CFR part 15.247 (b) (3) / RSS-247 5.4 (a)**

| Date       | Temperature  | Humidity   |
|------------|--------------|------------|
| 2016-08-29 | 24 °C ± 3 °C | 50 % ± 5 % |

**Test set-up and procedure**

Both peak and RMS measurements were performed. The RMS values were used for the RF exposure evaluation.

The measurements were performed according to ANSI C63.10-2013 and the KDB 558074 D01 DTS Meas Guidance v05r02, April 2, 2019. Peak measurements were measured according to clause 11.9.1.1 in ANSI C63.10-2013.

Conducted measurements were performed at the antenna connector of NC1000C-9 with continuous transmission and with 2-FSK modulation.

| Measurement equipment              | SP number |
|------------------------------------|-----------|
| Test site RF Room                  | -         |
| Signal Analyser R&S ESI26          | 18880     |
| Lenovo R500 Laptop                 | -         |
| Multimeter Agilent                 | 14880     |
| HP 6632A Power Supply              | 11386     |
| Temperature and humidity meter CAN | 14395     |

**Results**

Final test with peak detector on NC1000C-9, powered by the external power supply, maximum conducted peak output power, 2-FSK, 250 kbaud can be found in the diagrams below:

|           |           |          |
|-----------|-----------|----------|
| Diagram 1 | 902.6 MHz | 3.6 V DC |
| Diagram 2 | 915.0 MHz | 3.6 V DC |
| Diagram 3 | 927.4 MHz | 3.6 V DC |

Final test, 2-FSK, 250 kbaud, RBW= 1 MHz (greater than 6 dB BW)

|                       |                                     | Max peak output power<br>Peak (dBm) |         |           |
|-----------------------|-------------------------------------|-------------------------------------|---------|-----------|
|                       |                                     | 902.6 MHz                           | 915 MHz | 927.4 MHz |
| T <sub>nom</sub> 24°C | V <sub>max</sub> 3.6 V DC           | 10.42                               | 10.54   | 10.81     |
| T <sub>nom</sub> 24°C | V <sub>min</sub> 2.0 V DC<br>Note 1 | 10.24                               | 10.43   | 10.60     |

Final test with RMS detector on NC1000C-9, powered by the external power supply, maximum conducted peak output power, 2-FSK, 250 kbaud can be found in the diagrams below:

|           |           |          |
|-----------|-----------|----------|
| Diagram 4 | 902.6 MHz | 3.6 V DC |
| Diagram 5 | 915.0 MHz | 3.6 V DC |
| Diagram 6 | 927.4 MHz | 3.6 V DC |

Final test, 2-FSK, 250 kbaud, RBW= 1 MHz (greater than 6 dB BW)

|                       |                                     | Max peak output power<br>RMS (dBm) |         |           |
|-----------------------|-------------------------------------|------------------------------------|---------|-----------|
|                       |                                     | 902.6 MHz                          | 915 MHz | 927.4 MHz |
| T <sub>nom</sub> 24°C | V <sub>max</sub> 3.6 V DC           | 10.33                              | 10.51   | 10.73     |
| T <sub>nom</sub> 24°C | V <sub>min</sub> 2.0 V DC<br>Note 1 | 10.14                              | 10.36   | 10.56     |

Note 1: According 47CFR 15.31(e), for intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery-operated equipment, the equipment tests shall be performed using a new battery.  
 USB Supply voltage was disconnected, and power supply was added by external power supply. Manufacturer specification for supply range is 2.0 – 3.6 Volt

## Limits

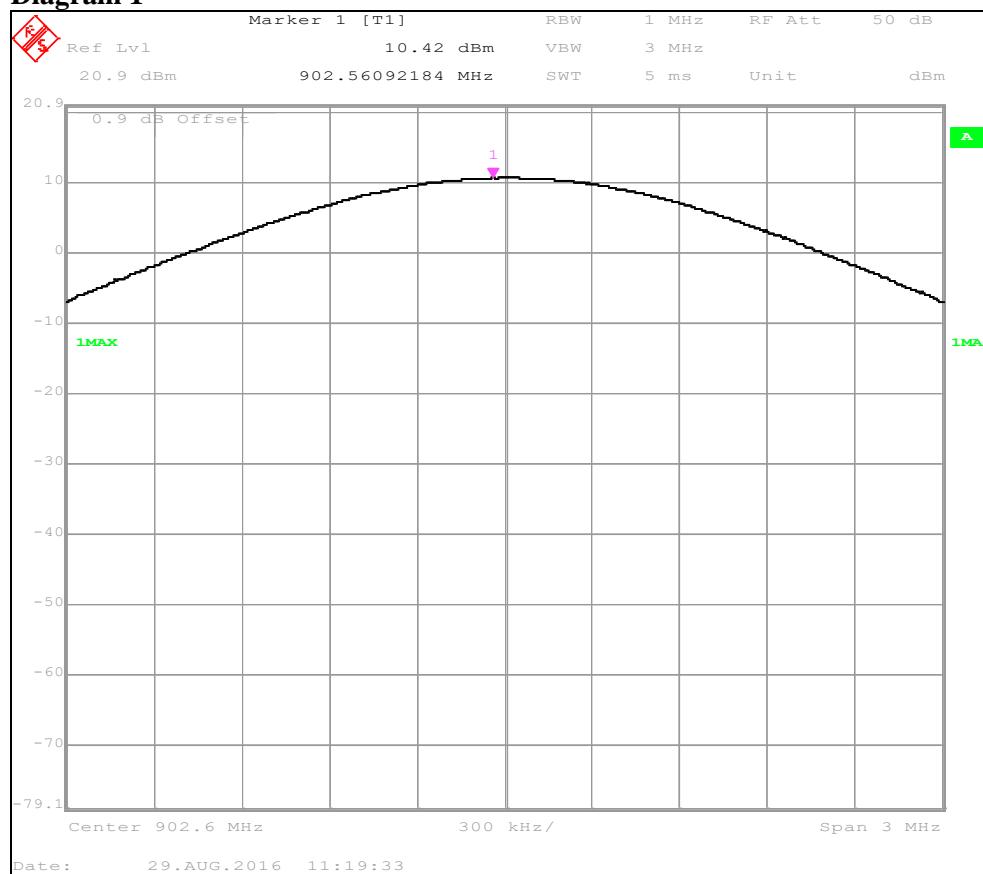
According to 47CFR 15.247(b)(3), for systems using digital modulation in the 902-928 MHz band: 1 Watt (30 dBm).

According to RSS-247 5.4 (d), For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.

|           |     |
|-----------|-----|
| Complies? | YES |
|-----------|-----|

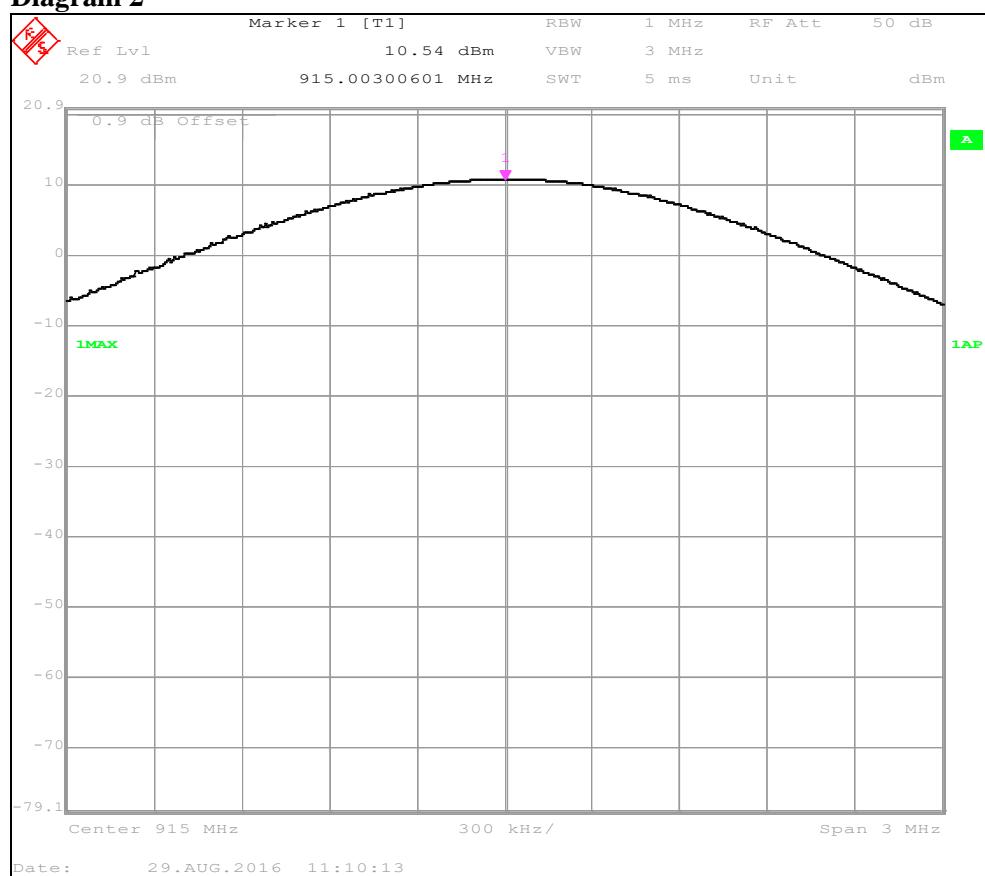
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Appendix 4

**Diagram 1**

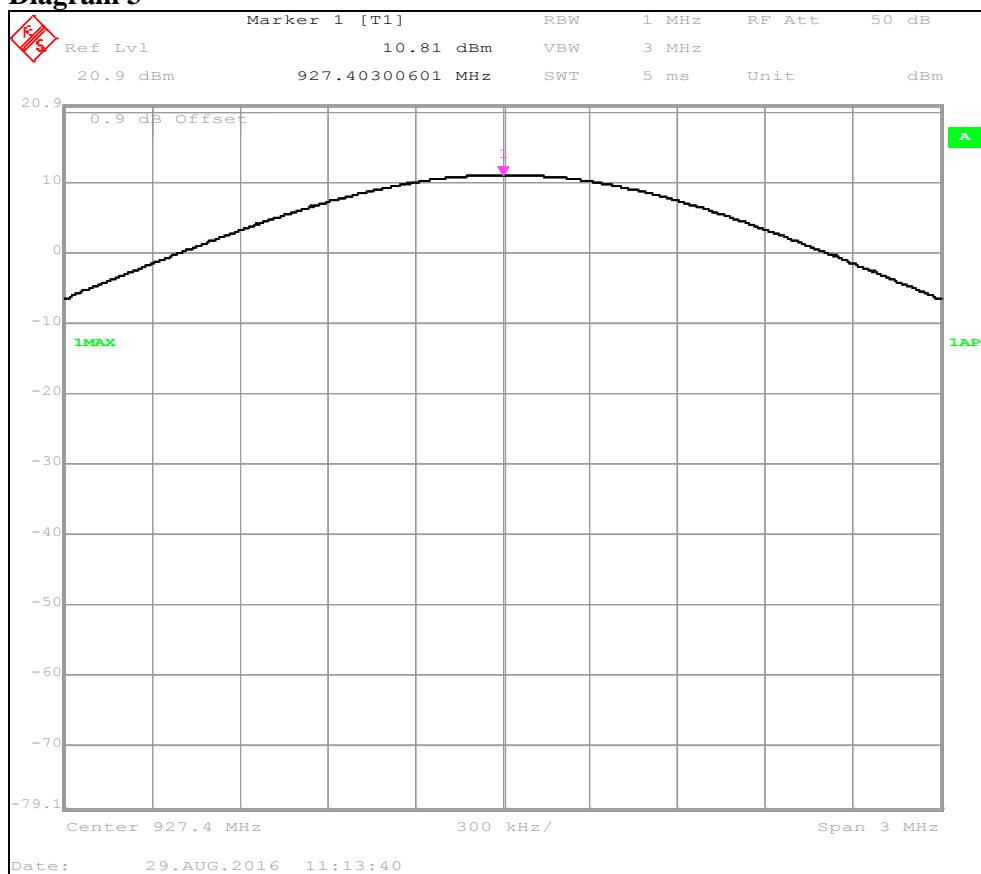
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Appendix 4

**Diagram 2**

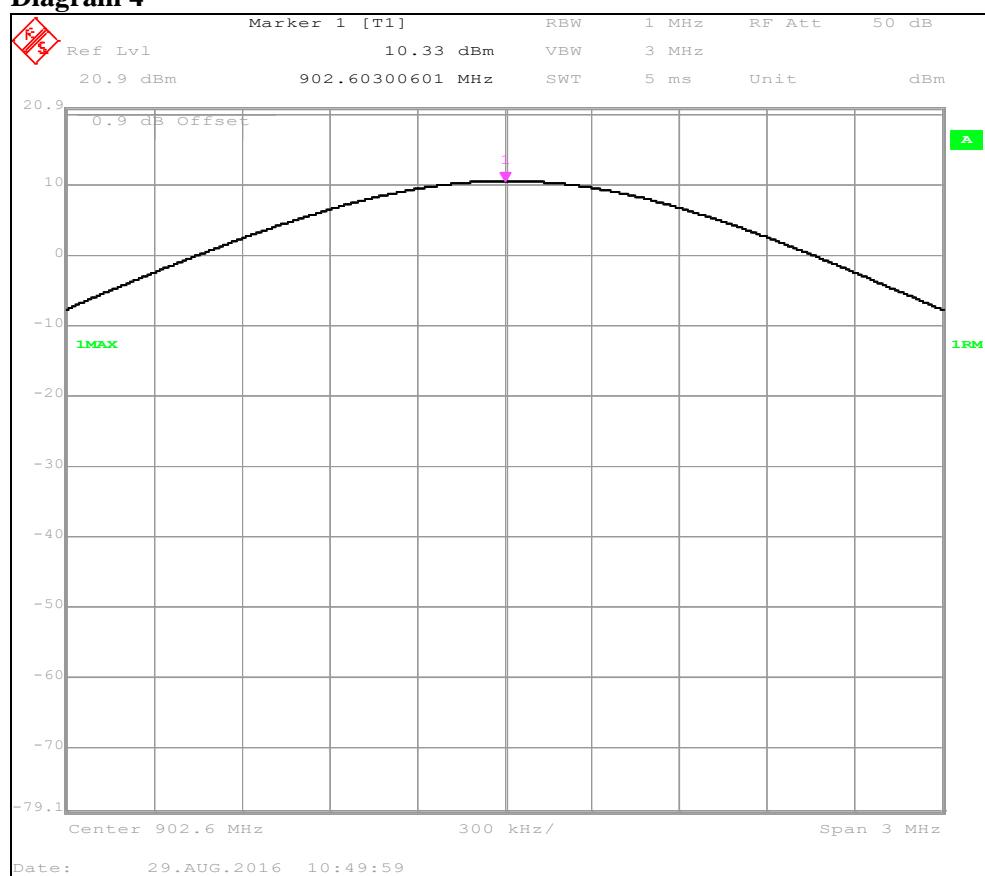
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Appendix 4

**Diagram 3**

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Appendix 4

**Diagram 4**

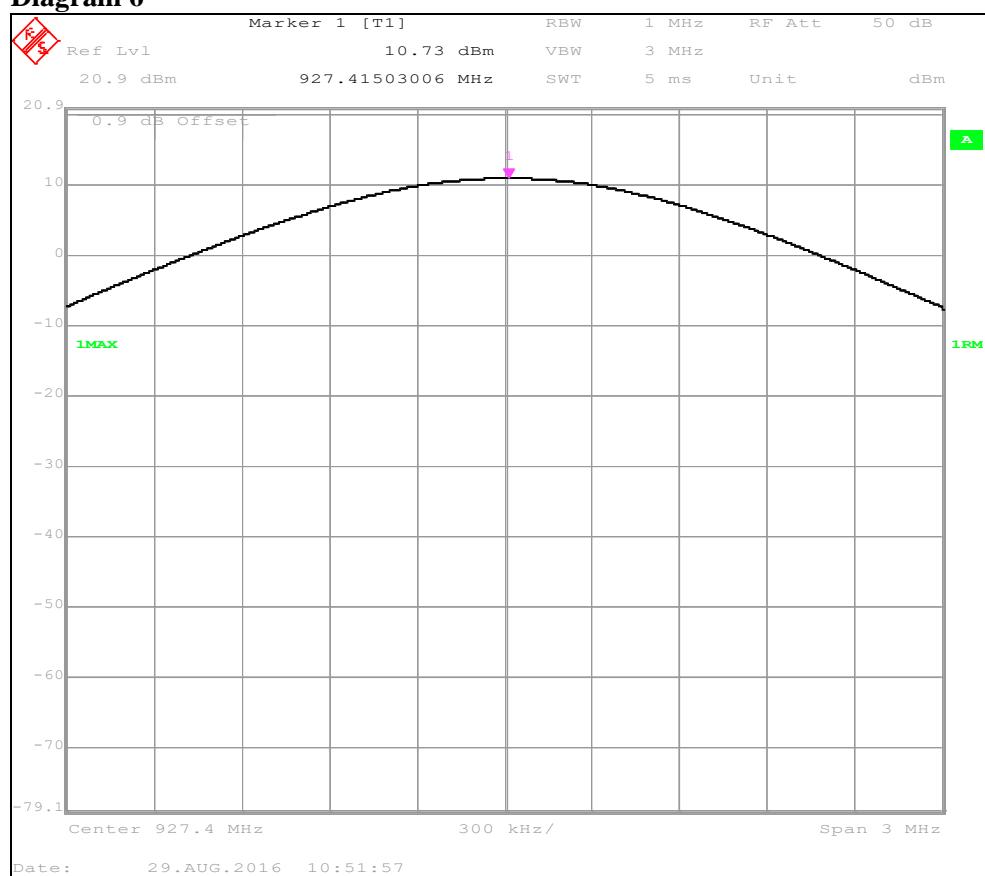
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Appendix 4

**Diagram 5**

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Appendix 4

**Diagram 6**

**Restricted bands of operation and 20 dBc below fundamental measurements according to FCC 47 CFR part 15.247 (d) / RSS-247 5.5/RSS-Gen 8.10**

| Date       | Temperature  | Humidity   |
|------------|--------------|------------|
| 2019-05-28 | 22 °C ± 3 °C | 45 % ± 5 % |

**Test set-up and procedure**

The measurements were performed according to ANSI C63.10-2013 and the KDB 558074 D01 DTS Meas Guidance v05r02, April 2, 2019.

Justification measurements were performed with rotation of the EUT through three orthogonal axes to determine which orientation the NC1000C-9 had the highest emission levels, see photos in Appendix 12.

The test was performed with the NC1000C-9 with continuous transmission and with modulation 2-FSK, 250 baud.

The test of radiated emission was performed in a semi anechoic chamber. The measurements were performed with both horizontal and vertical polarizations of the antenna. The antenna distance during the measurements was 3.0 m in the frequency range 30 MHz-10 GHz.

The EUT height above the reference ground plane was 0.8 m in the frequency range 30-1000 MHz and 1.5 m in the frequency range 1-10 GHz.

The measurement procedure is as follows:

1. A pre-measurement is performed with peak detector. The test object is measured in eight directions with the antenna in the frequency range 30-1000 MHz and in sixteen directions at frequencies above 1 GHz, with the antenna at three heights, 1.0 m, 1.5 m and 2.0 m.
2. If the emission is close or above the limit during the pre-measurement, the test object is scanned 360 degrees and the antenna height scanned from 1 to 4 m for maximum response. Then the emission is measured with the quasi-peak detector on frequencies below 1 GHz and with the average detector above 1 GHz.

The following RBW were used:

30 MHz-1 GHz: RBW=100 kHz

1-10 GHz: RBW=1 MHz

Test set-up photos during the tests can be found in Appendix 12.

**Test equipment.**

| Description                    | Supplier        | Model       | ID tag |
|--------------------------------|-----------------|-------------|--------|
| Analyzer 20Hz-26.5GHz          | Rohde & Schwarz | ESI         | 20763  |
| Antenna, Broadband, 30MHz-3GHz | Rohde & Schwarz | HL562       | 19830  |
| Antenna Horn 1 – 18 GHz        | Schwarzbeck     | BBHA 9120 D | 20031  |

**Results**

The pre-measurement emission spectra for the worst case configuration can be found in the diagrams below:

|            |   |
|------------|---|
| Diagram 1: | 915 MHz, EUT in pos “1”, vertical and horizontal polarization                 |
| Diagram 2: | 30-1000 MHz, 902.6 MHz, EUT in pos “1”, vertical and horizontal polarization  |
| Diagram 3  | 1 – 3 GHz, EUT on 902.6 MHz in pos “1”, vertical and horizontal polarization  |
| Diagram 4  | 3 - 10 GHz, EUT on 902.6 MHz in pos “1”, vertical and horizontal polarization |

Note: Worst-case plots are attached.

The highest detected levels during the final measurement in the frequency range 30 MHz-10 GHz are listed in the tables below.

**Restricted bands:**

902.6 MHz, EUT in pos “1”:

## 30 – 1000 MHz Quasi Peak

| Frequency (MHz) | QuasiPeak (dB $\mu$ V/m) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Margin (dB) | Limit (dBc) | Comment |
|-----------------|--------------------------|-----------------|-------------|--------------|---------------|-------------|-------------|---------|
| 37.155070       | 23.8                     | 100.000         | 100.1       | V            | 198.0         | 16.2        | 40.0        |         |
| 74.638537       | 21.9                     | 100.000         | 149.0       | V            | 47.0          | 18.1        | 40.0        |         |
| 163.437495      | 24.3                     | 100.000         | 100.0       | V            | 344.0         | 19.2        | 43.5        |         |
| 165.683146      | 13.7                     | 100.000         | 279.0       | V            | 91.0          | 29.8        | 43.5        |         |
| 328.869038      | 17.4                     | 100.000         | 157.8       | V            | 209.0         | 28.6        | 46.0        |         |

902.6 MHz, EUT in pos “1”:

## 1 – 10 GHz Peak

| Frequency (MHz) | MaxPeak (dB $\mu$ V/m) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Margin (dB) | Limit (dB $\mu$ V/m) | Comment |
|-----------------|------------------------|-----------------|-------------|--------------|---------------|-------------|----------------------|---------|
| 1396.785571     | 45.1                   | 1000.000        | 155.1       | H            | 124.0         | 28.9        | 74.0                 |         |
| 2389.881563     | 46.2                   | 1000.000        | 155.1       | V            | 303.0         | 27.8        | 74.0                 |         |
| 2708.218838     | 48.5                   | 1000.000        | 155.3       | V            | 194.0         | 25.5        | 74.0                 |         |
| 3611.012425     | 49.6                   | 1000.000        | 155.1       | V            | 175.0         | 24.4        | 74.0                 |         |
| 4513.826052     | 57.4                   | 1000.000        | 155.0       | V            | 150.0         | 16.6        | 74.0                 |         |
| 9027.652104     | 48.7                   | 1000.000        | 155.1       | V            | 169.0         | 25.3        | 74.0                 |         |

## 1 – 10 GHz Average

| Frequency (MHz) | Average (dB $\mu$ V/m) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Margin (dB) | Limit (dB $\mu$ V/m) | Comment |
|-----------------|------------------------|-----------------|-------------|--------------|---------------|-------------|----------------------|---------|
| 1396.785571     | 26.4                   | 1000.000        | 155.1       | H            | 124.0         | 27.6        | 54.0                 |         |
| 2389.881563     | 28.8                   | 1000.000        | 155.1       | V            | 303.0         | 25.2        | 54.0                 |         |
| 2708.218838     | 39.5                   | 1000.000        | 155.3       | V            | 194.0         | 14.5        | 54.0                 |         |
| 3611.012425     | 42.1                   | 1000.000        | 155.1       | V            | 175.0         | 11.9        | 54.0                 |         |
| 4513.826052     | 50.1                   | 1000.000        | 155.0       | V            | 150.0         | 3.9         | 54.0                 |         |
| 9027.652104     | 38.0                   | 1000.000        | 155.1       | V            | 169.0         | 16.0        | 54.0                 |         |

**20 dBc below fundamental measurements:**

902.6 MHz, EUT in pos “1”:

## 1 – 10 GHz Peak

| Frequency (MHz) | MaxPeak (dB $\mu$ V/m) | Bandwidth (kHz) | Height (cm) | Polarization | Azimuth (deg) | Margin (dB) | Limit (dBc) | Comment |
|-----------------|------------------------|-----------------|-------------|--------------|---------------|-------------|-------------|---------|
| 1804.711222     | 59.4                   | 100.000         | 154.8       | V            | 69.0          | 31.6        | 20          |         |
| 5416.639679     | 43.7                   | 100.000         | 154.8       | V            | 212.0         | 47.3        | 20          |         |
| 5996.602004     | 37.8                   | 100.000         | 155.1       | V            | 108.0         | 53.2        | 20          |         |

## Limits

According to 47CFR 15.247(d), 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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

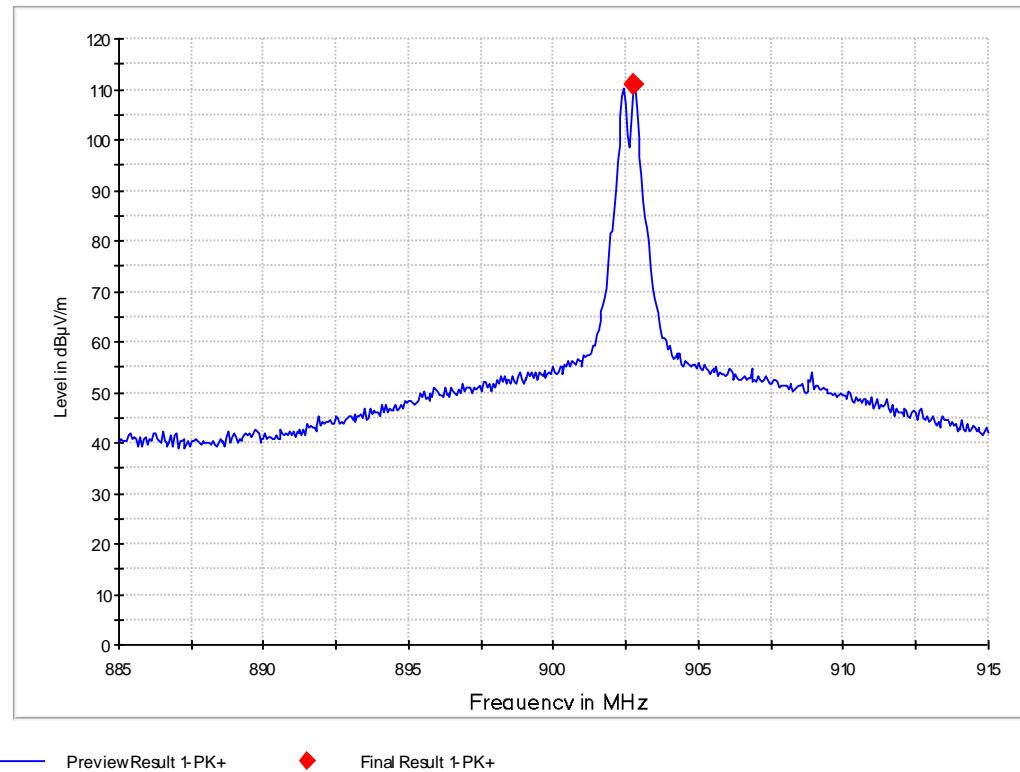
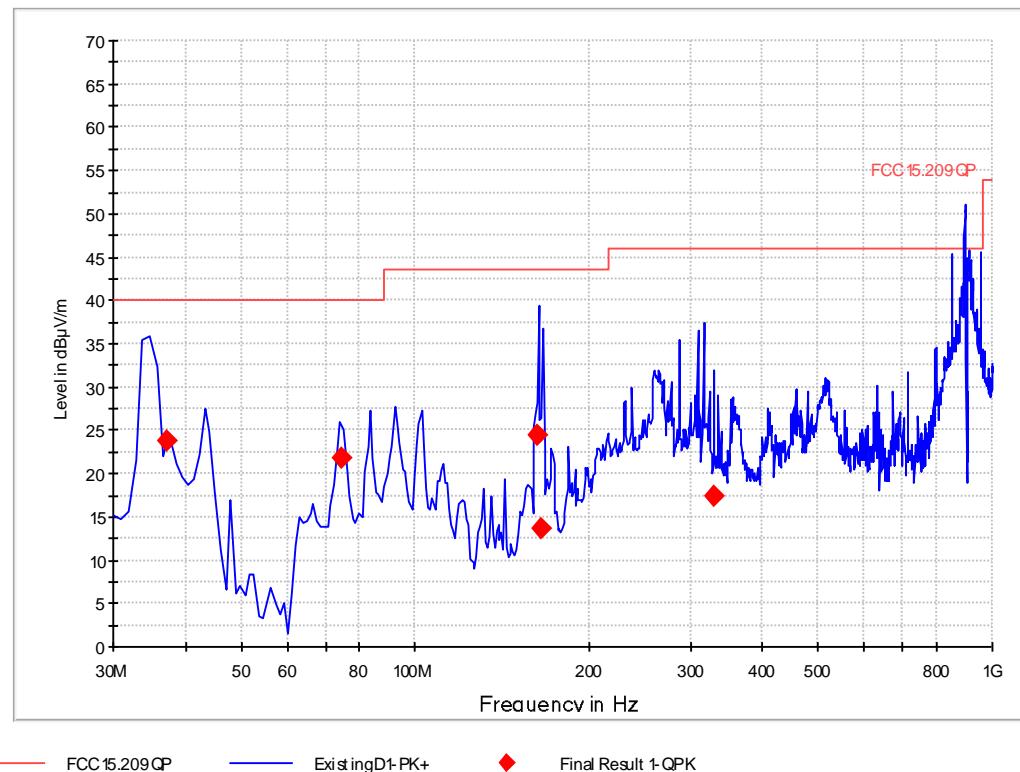
Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

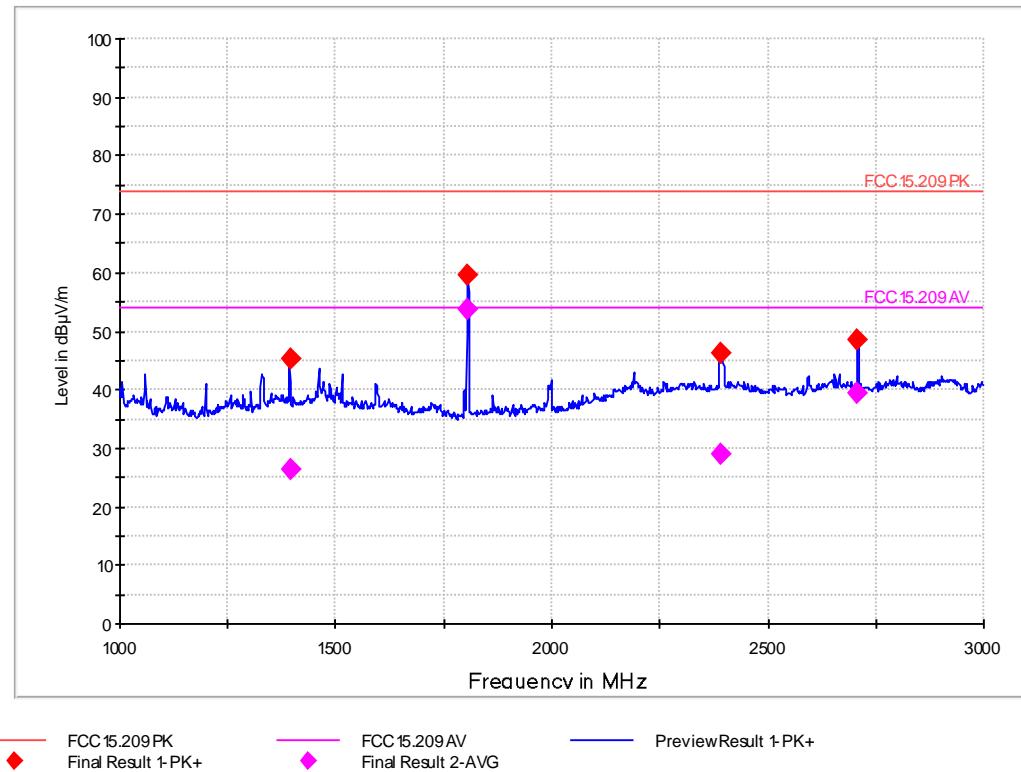
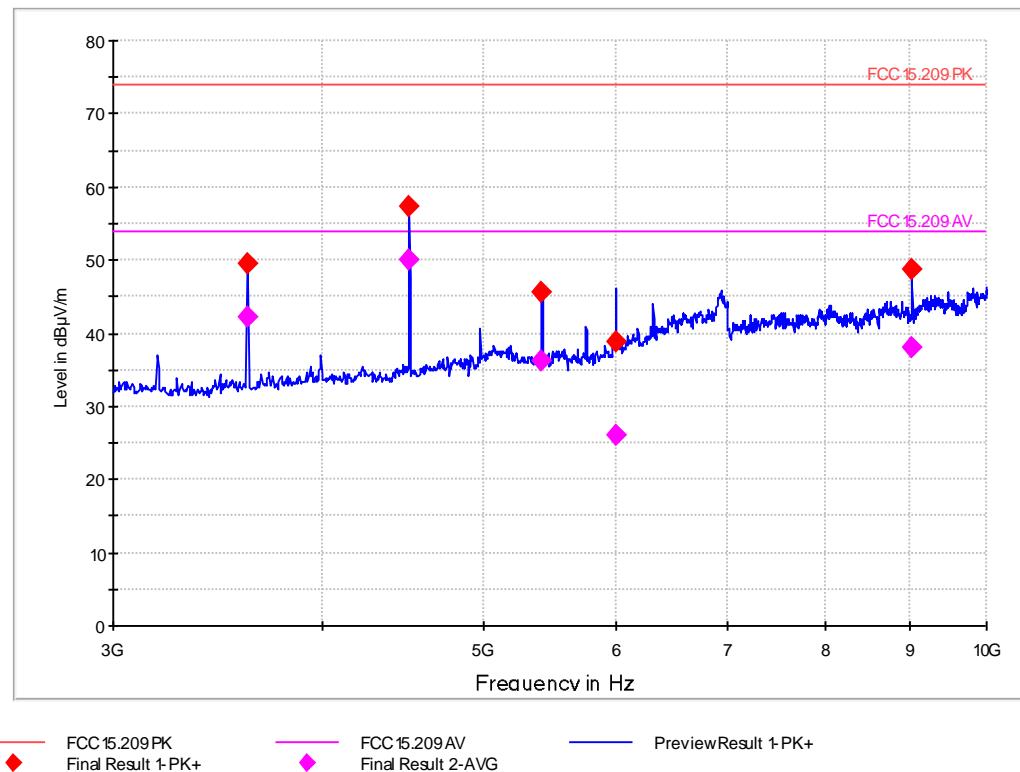
According to RSS-247 5.5, modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

According to RSS-Gen 8.10, Restricted bands, identified in Table 7, are designated primarily for safety-of-life services (distress calling and certain aeronautical bands), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following restrictions apply:

- (a) Fundamental components of modulation of license-exempt radio apparatus shall not fall within the restricted bands of Table 6 except for apparatus complying under RSS-287;
- (b) Unwanted emissions that fall into restricted bands of Table 7 shall comply with the limits specified in table 5 and table 6.
- (c) Unwanted emissions that do not fall within the restricted frequency bands of Table 7 shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

|           |     |
|-----------|-----|
| Complies? | Yes |
|-----------|-----|

**Diagram 1****Diagram 2**

**Diagram 3**

**Diagram 4**


**Power spectral density measurements according to FCC 47 CFR part 15.247 (e) / RSS-247 5.2 (b)**

|                    |                             |                        |
|--------------------|-----------------------------|------------------------|
| Date<br>2016-04-19 | Temperature<br>24 °C ± 3 °C | Humidity<br>25 % ± 5 % |
|--------------------|-----------------------------|------------------------|

**Test set-up and procedure**

The measurements were performed according to ANSI C63.10-2013 sec 11.10.2 and the KDB 558074 D01 DTS Meas Guidance v05r02, April 2, 2019.

Conducted measurements were performed with the NC1000C-9 at the antenna connector and with continuous transmission and with 2-FSK modulation.

| Measurement equipment              | SP number |
|------------------------------------|-----------|
| Test site RF Room                  |           |
| Signal Analyser R&S ESI26          | 18880     |
| Lenovo R500 Laptop                 |           |
| Multimeter Agilent                 | 14880     |
| HP 6632A Power Supply              | 11386     |
| Temperature and humidity meter CAN | 14395     |

**Results**

The final measurements with 2-FSK, 250 kBaud can be found in the diagrams below:  
RBW=3 kHz

|           |           |  |
|-----------|-----------|--|
| Diagram 1 | 902.6 MHz | Power spectral density = <b>7.28 dBm</b> |
| Diagram 2 | 915.0 MHz | Power spectral density = <b>7.43 dBm</b> |
| Diagram 3 | 927.4 MHz | Power spectral density = <b>6.45 dBm</b> |

**Limits**

According to 47CFR 15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

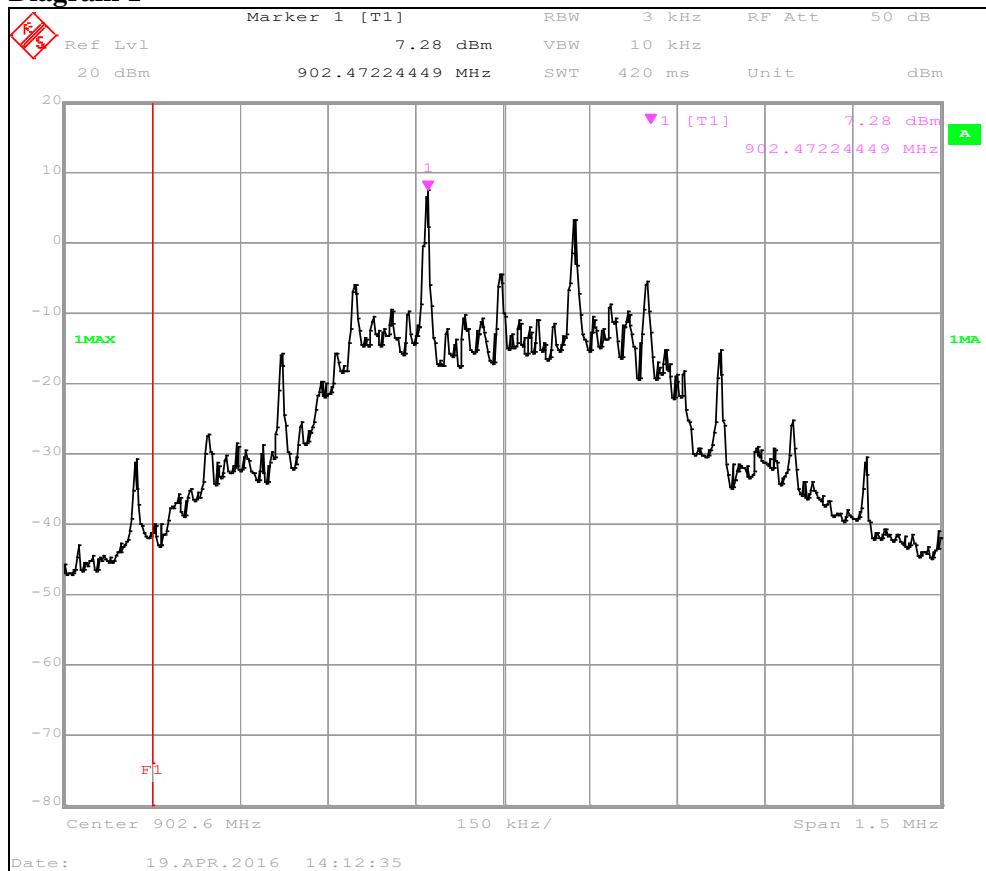
According to RSS-247 5.2 (b), The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of Section 5.4(d), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

|           |     |
|-----------|-----|
| Complies? | YES |
|-----------|-----|

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Appendix 6

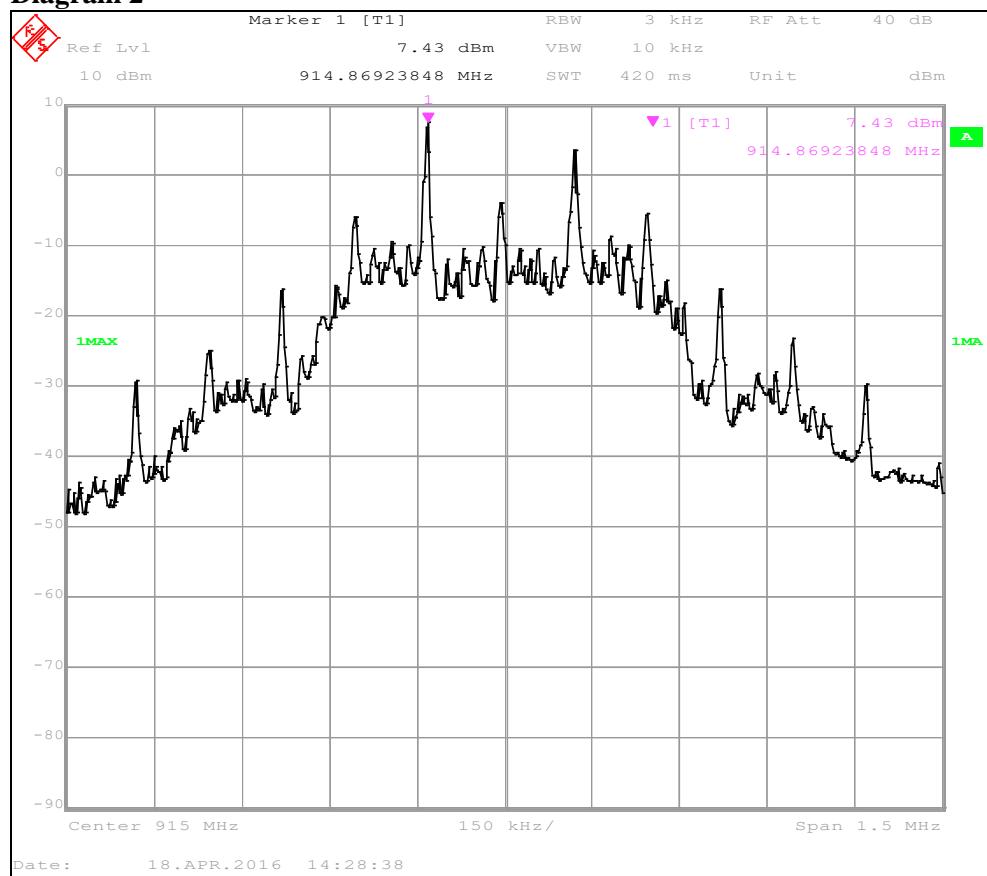
Diagram 1

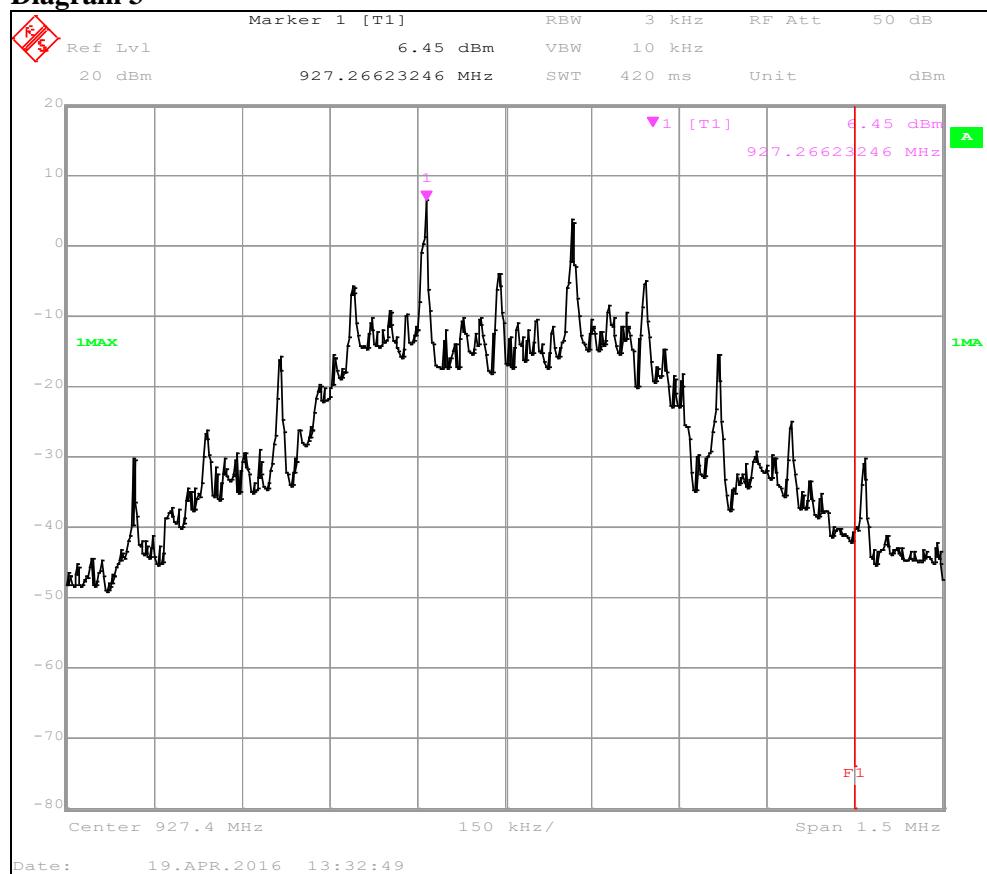


2AB76NC1000C1

Appendix 6

Diagram 2



**Diagram 3**

**RF exposure evaluation: 2.1093 Portable devices FCC 47 CFR part 15.247 (i) / KDB 447498 / RSS-102 2.5.1**

|                    |                             |                        |
|--------------------|-----------------------------|------------------------|
| Date<br>2016-04-20 | Temperature<br>24 °C ± 3 °C | Humidity<br>20 % ± 5 % |
|--------------------|-----------------------------|------------------------|

**Procedure**

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1093 this device has been defined as a portable device to be used within 20 centimeters of the body of the user.

**Results**

Standalone SAR exclusion:

Step 1:

The following formula was used to calculate the RF exposure SAR exclusion threshold,  $Thld = [Pout / r] \times [\sqrt{f}]$

where,

Thld= SAR exclusion threshold

Pout = Maximum output power measured with RMS detector, in mW

r = minimum test separation distance, in mm

f=frequency, in GHz

Tune-up tolerance= + 0.5 to -7.0 dB

| Frequency<br>f, (GHz) | Maximum<br>output power<br>Pout with<br>RMS det,<br>(mW) | Distance<br>r, (mm) | Exclusion<br>threshold<br>Thld | Limit<br>Threshold<br>1-g SAR | Limit<br>Threshold<br>10-g SAR |
|-----------------------|--|---------------------|--------------------------------|-------------------------------|--------------------------------|
| 0.928                 | 14.03<br>Note 1  | 5                   | 2.7                            | < 3                           | < 7.5                          |

Note 1: The maximum measured RMS level was 10.73 dBm (2-PSK, 250kbaud). According to RSS-102 cl. 2.5.1 the RMS value shall be adjusted for tune-up tolerance, thus 11.47 dBm (14.03 mW) was used as Maximum output power Pout in the table above.

## Limits

### FCC 2.1093 / KDB 447498 (v06) 4.3.1:

#### 4.3.1 Standalone SAR exclusion:

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances  $\leq 50$  mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \times [\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR and  $\leq 7.5$  for 10-g extremity SAR, where

- $f(\text{GHz})$  is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is  $\leq 50$  mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is  $< 5$  mm, a distance of 5 mm is applied to determine SAR test exclusion.

2) At 100 MHz to 6 GHz and for test separation distances  $> 50$  mm, the SAR test exclusion threshold is determined according to the following, and as illustrated in Appendix B.

- [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)  $\times (f(\text{MHz})/150)$ ] mW, at 100 MHz to 1500 MHz
- [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm)  $\times 10$ ] mW at  $> 1500$  MHz and  $\leq 6$  GHz

#### IC RSS-102 Issue 5 cl. 2.5.1 Exemption from Routine Evaluation Limits – 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 Table 1.

**Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance**

| Frequency (MHz) | Exemption Limits (mW)                 |                                 |                                 |                                 |                                 |
|-----------------|---------------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
|                 | At separation distance of $\leq 5$ mm | At separation distance of 10 mm | At separation distance of 15 mm | At separation distance of 20 mm | At separation distance of 25 mm |
| ≤300            | 71 mW                                 | 101 mW                          | 132 mW                          | 162 mW                          | 193 mW                          |
| 450             | 52 mW                                 | 70 mW                           | 88 mW                           | 106 mW                          | 123 mW                          |
| 835             | 17 mW                                 | 30 mW                           | 42 mW                           | 55 mW                           | 67 mW                           |
| 1900            | 7 mW                                  | 10 mW                           | 18 mW                           | 34 mW                           | 60 mW                           |
| 2450            | 4 mW                                  | 7 mW                            | 15 mW                           | 30 mW                           | 52 mW                           |
| 3500            | 2 mW                                  | 6 mW                            | 16 mW                           | 32 mW                           | 55 mW                           |
| 5800            | 1 mW                                  | 6 mW                            | 15 mW                           | 27 mW                           | 41 mW                           |

| Frequency<br>(MHz) | Exemption Limits (mW)                 |                                       |                                       |                                       |  |
|--------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|--|
|                    | At separation<br>distance of<br>30 mm | At separation<br>distance of<br>35 mm | At separation<br>distance of<br>40 mm | At separation<br>distance of<br>45 mm | At separation<br>distance of<br>≥50 mm |
| ≤300               | 223 mW                                | 254 mW                                | 284 mW                                | 315 mW                                | 193 mW                                 |
| 450                | 141 mW                                | 159 mW                                | 177 mW                                | 195 mW                                | 123 mW                                 |
| 835                | 80 mW                                 | 92 mW                                 | 105 mW                                | 117 mW                                | 67 mW                                  |
| 1900               | 99 mW                                 | 153 mW                                | 225 mW                                | 316 mW                                | 60 mW                                  |
| 2450               | 83 mW                                 | 123 mW                                | 173 mW                                | 235 mW                                | 52 mW                                  |
| 3500               | 86 mW                                 | 124 mW                                | 170 mW                                | 225 mW                                | 55 mW                                  |
| 5800               | 56 mW                                 | 71 mW                                 | 85 mW                                 | 27 mW                                 | 41 mW                                  |

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table 1, 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.

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.

|           |     |
|-----------|-----|
| Complies? | YES |
|-----------|-----|

**20 dB bandwidth measurements according to FCC 47 CFR part 15.215 (c)**

|                    |                             |                        |
|--------------------|-----------------------------|------------------------|
| Date<br>2016-08-30 | Temperature<br>24 °C ± 3 °C | Humidity<br>25 % ± 5 % |
|--------------------|-----------------------------|------------------------|

**Test set-up and procedure**

The measurements were performed according to ANSI C63.10-2013.

Conducted measurements were performed with the NC1000C-9 at the antenna connector and with continuous transmission and with modulation 2-FSK, 250 kBaud.

| Measurement equipment              | SP number |
|------------------------------------|-----------|
| Test site RF Room                  | -         |
| Signal Analyser R&S ESI26          | 18880     |
| Lenovo R500 Laptop                 | -         |
| Multimeter Agilent                 | 14880     |
| HP 6632A Power Supply              | 11386     |
| Temperature and humidity meter CAN | 14395     |

**Results**

The final measurements with modulation 2-FSK, 250 kBaud, can be found in the diagrams below:

|            |           |                           |
|------------|-----------|---------------------------|
| Diagram 1: | 902.6 MHz | 20 dB BW = <b>799 kHz</b> |
| Diagram 2: | 915 MHz   | 20 dB BW = <b>803 kHz</b> |
| Diagram 3: | 927.4 MHz | 20 dB BW = <b>799 kHz</b> |

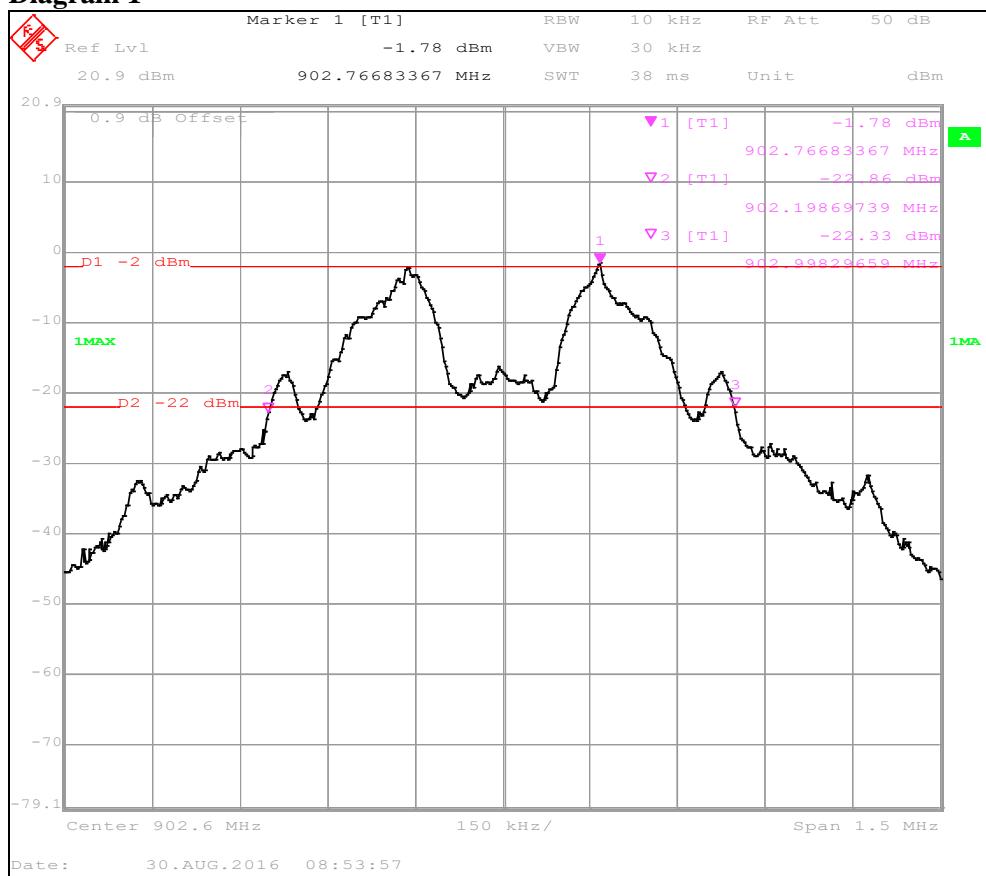
**Limits**

According to 47CFR 15.215(c), intentional radiators operating under the alternative provisions to the general emission limits, as contained in § 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

|           |     |
|-----------|-----|
| Complies? | YES |
|-----------|-----|

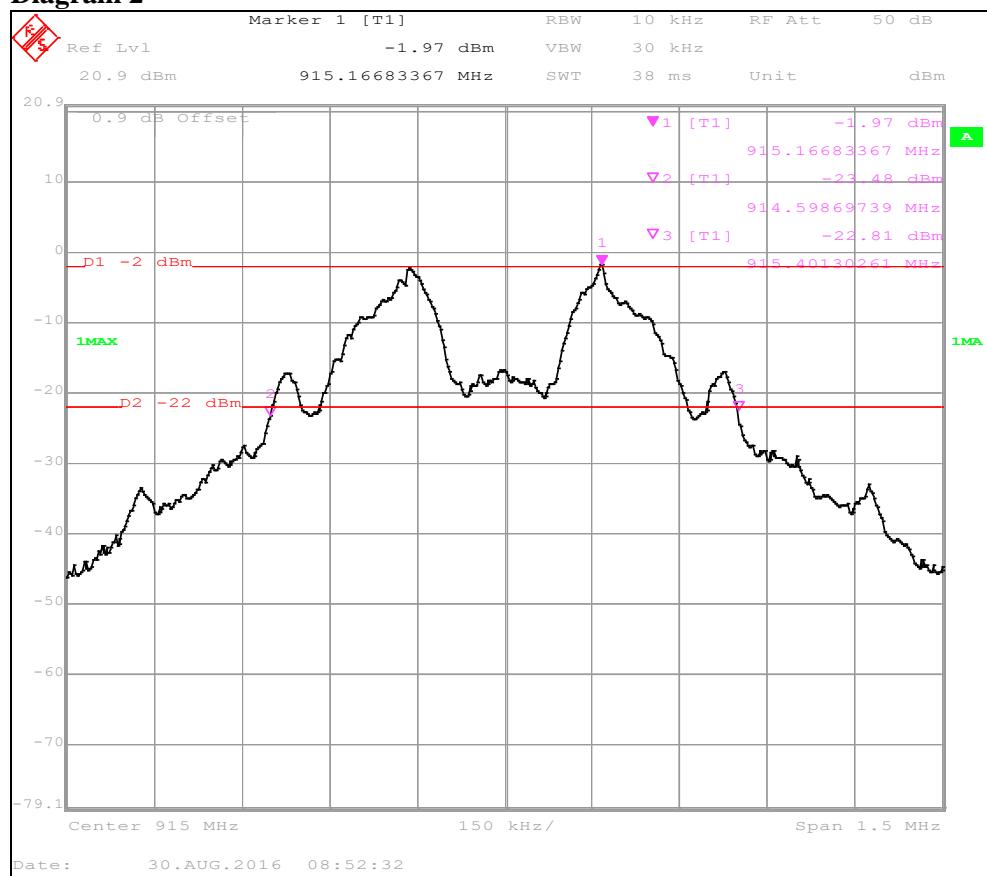
2AB76NC1000C1

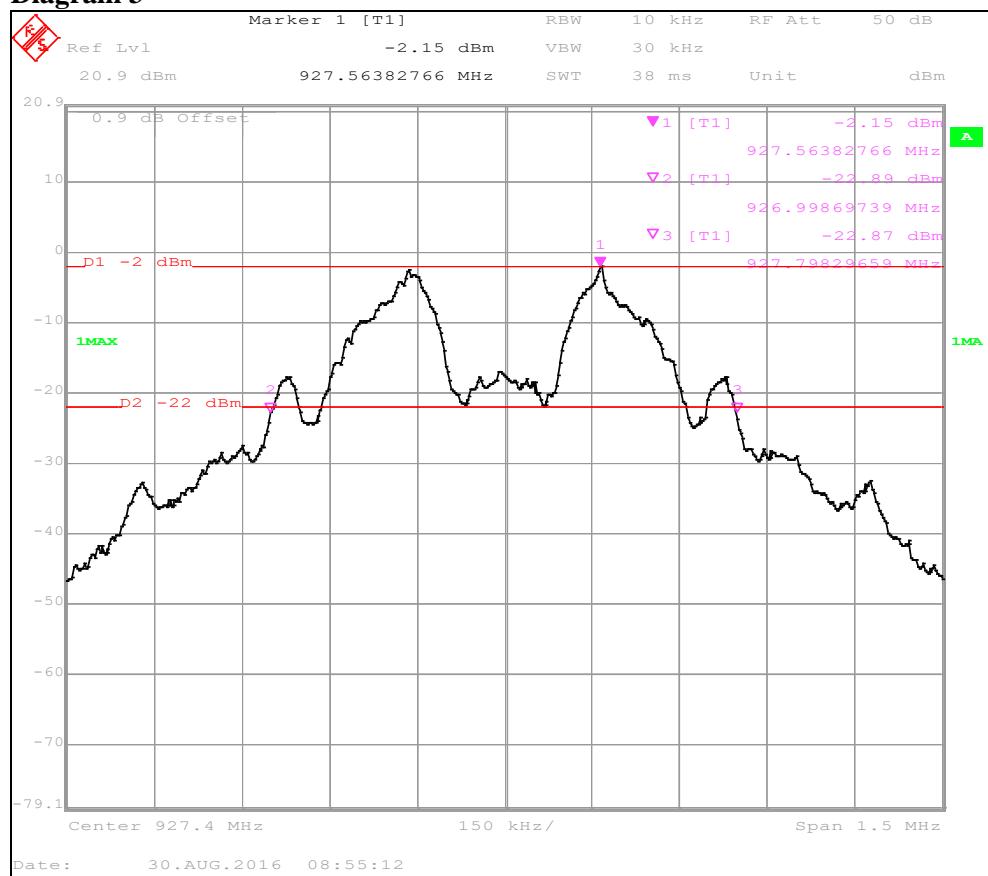
Appendix 9

**Diagram 1**


2AB76NC1000C1

Appendix 9

**Diagram 2**


**Diagram 3**


2AB76NC1000C1

Appendix 9

## AC power line conducted emission according to FCC 47 CFR part 15.207 / RSS-Gen 8.8

| Date       | Temperature  | Humidity   |
|------------|--------------|------------|
| 2019-12-12 | 19 °C ± 3 °C | 52 % ± 5 % |

### Test set-up and procedure

The measurements were performed according to ANSI C63.10-2013.

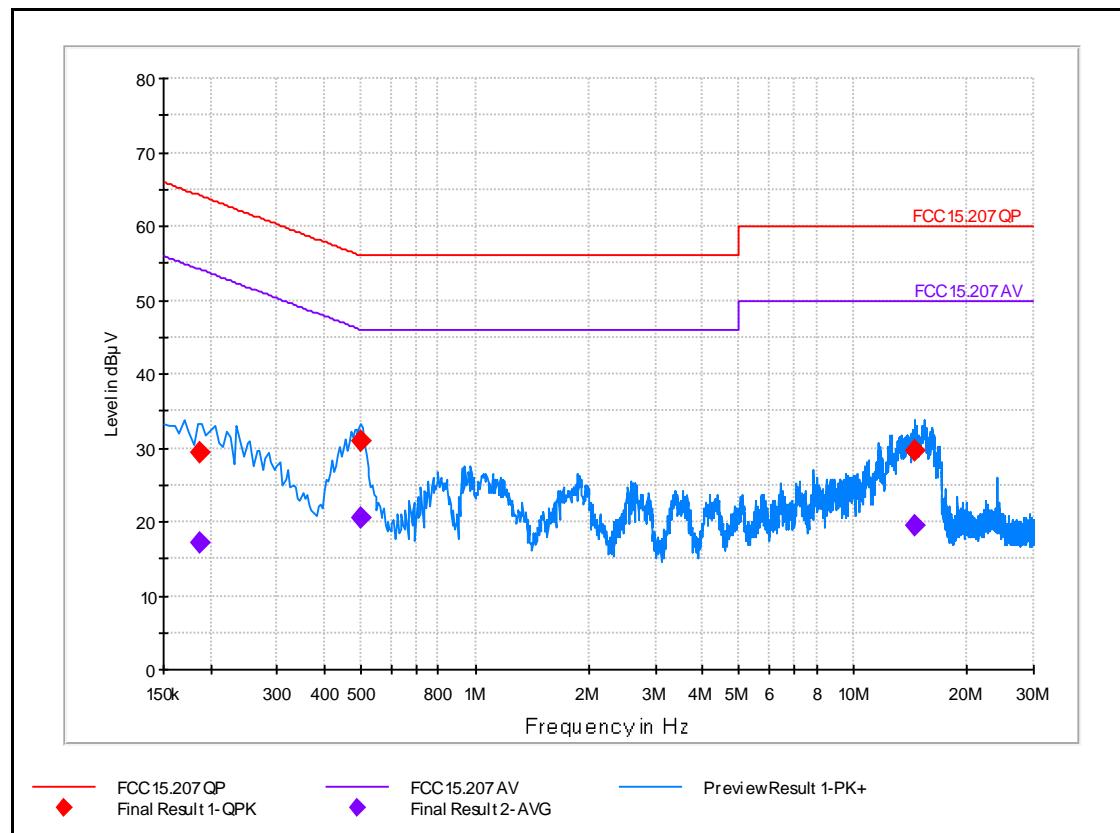
Conducted emission test was performed with the NC1000C-9 powered by a representative power supply. As the NC1000C-9 can be powered from different power supplies, an AC/DC adapter was chosen together with the client as a representative setup.

The test was done on the AC Power port of the AC/DC adapter. The AC/DC adapter had the following specifications: Manufacturer: HTC, Model: TC P900-EU, P/N: 79H00129-00M, S/N: 3DTA1431002451.

| Measurement equipment          | SP number |
|--------------------------------|-----------|
| Pulse Limiter 9KHz-30MHz       | 13513     |
| Receiver EMI Test 20Hz-26.5GHz | 18880     |
| V-network Two Line             | 20682     |

### Results

The final measurements for AC power line conducted emission can be found in the diagram and tables below:



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Appendix 9

| Frequency (MHz) | QuasiPeak (dB $\mu$ V) | Bandwidth (kHz) | Line | Margin (dB) | Limit (dB $\mu$ V) |
|-----------------|------------------------|-----------------|------|-------------|--------------------|
| 0.186700        | 29.3                   | 9.000           | N    | 34.90       | 64.20              |
| 0.501400        | 30.8                   | 9.000           | L1   | 25.20       | 56.00              |
| 14.584300       | 29.5                   | 9.000           | L1   | 30.50       | 60.00              |

| Frequency (MHz) | Average (dB $\mu$ V) | Bandwidth (kHz) | Line | Margin (dB) | Limit (dB $\mu$ V) |
|-----------------|----------------------|-----------------|------|-------------|--------------------|
| 0.186700        | 17.0                 | 9.000           | N    | 37.20       | 54.20              |
| 0.501400        | 20.5                 | 9.000           | L1   | 25.50       | 46.00              |
| 14.584300       | 19.6                 | 9.000           | L1   | 30.40       | 50.00              |

## Limits

According to 47CFR 15.207(a), Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency of emission (MHz) | Conducted limit (dB $\mu$ V) |           |
|-----------------------------|------------------------------|-----------|
|                             | Quasi-peak                   | Average   |
| 0.15-0.5                    | 66 to 56*                    | 56 to 46* |
| 0.5-5                       | 56                           | 46        |
| 5-30                        | 60                           | 50        |

|           |     |
|-----------|-----|
| Complies? | YES |
|-----------|-----|

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Appendix 10

**Occupied bandwidth measurements according to 47CFR 2.1049 / RSS-Gen 6.7**

| Date       | Temperature  | Humidity   |
|------------|--------------|------------|
| 2016-04-19 | 24 °C ± 3 °C | 24 % ± 5 % |

**Test set-up and procedure**

The measurements were performed according to ANSI C63.10-2013.

Conducted measurements were performed with the NC1000C-9 at the antenna connector and with continuous transmission and with modulation 2-FSK, 250 kBaud.

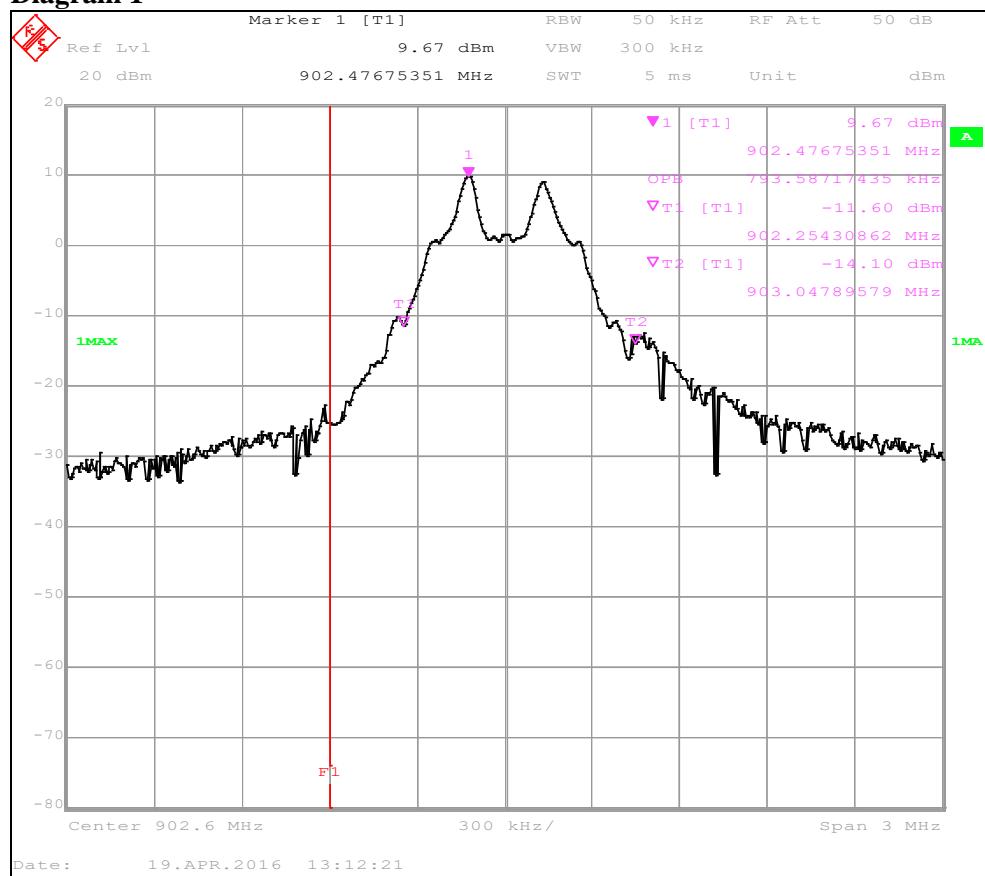
| Measurement equipment              | SP number |
|------------------------------------|-----------|
| Test site RF Room                  |           |
| Signal Analyser R&S ESI26          | 18880     |
| Lenovo R500 Laptop                 |           |
| Multimeter Agilent                 | 14880     |
| HP 6632A Power Supply              | 11386     |
| Temperature and humidity meter CAN | 14395     |

**Results**

The final measurements with modulation 2-FSK, 250kBaud can be found in the diagrams below:

|           |           |                            |
|-----------|-----------|----------------------------|
| Diagram 1 | 902.6 MHz | OBW = <b>793 kHz</b> (99%) |
| Diagram 2 | 915 MHz   | OBW = <b>763 kHz</b> (99%) |
| Diagram 3 | 927.4 MHz | OBW = <b>679 kHz</b> (99%) |

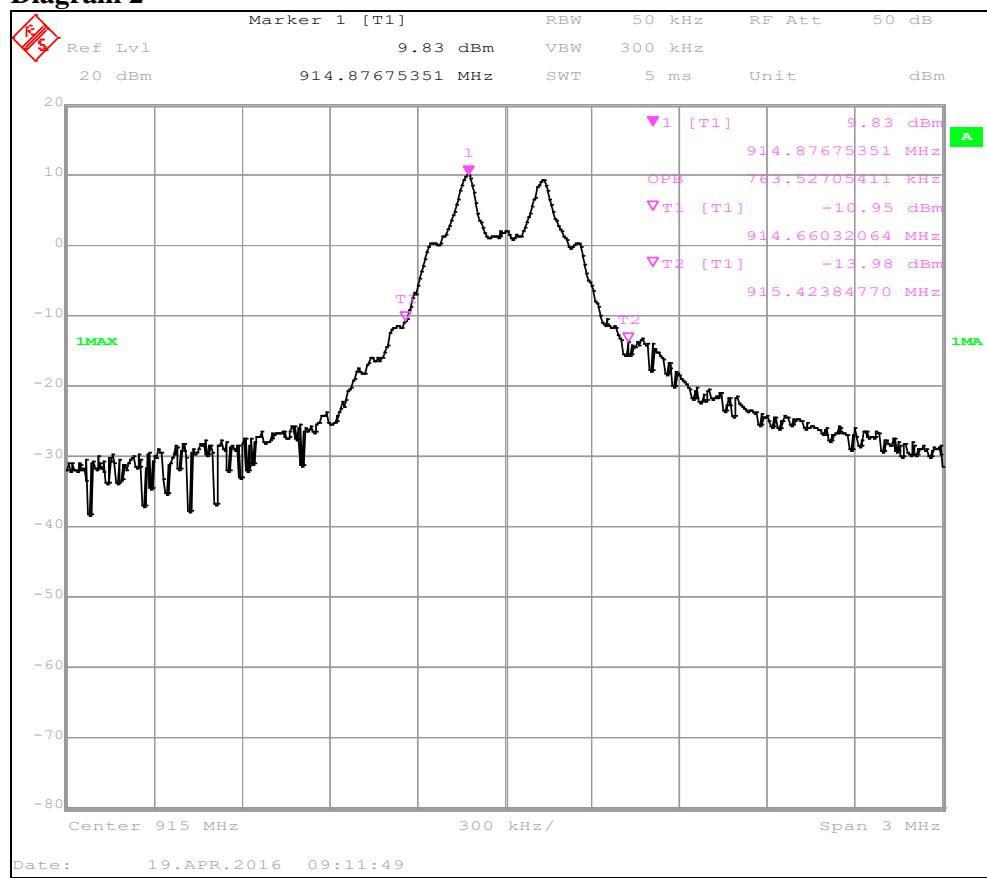
|           |     |
|-----------|-----|
| Complies? | YES |
|-----------|-----|

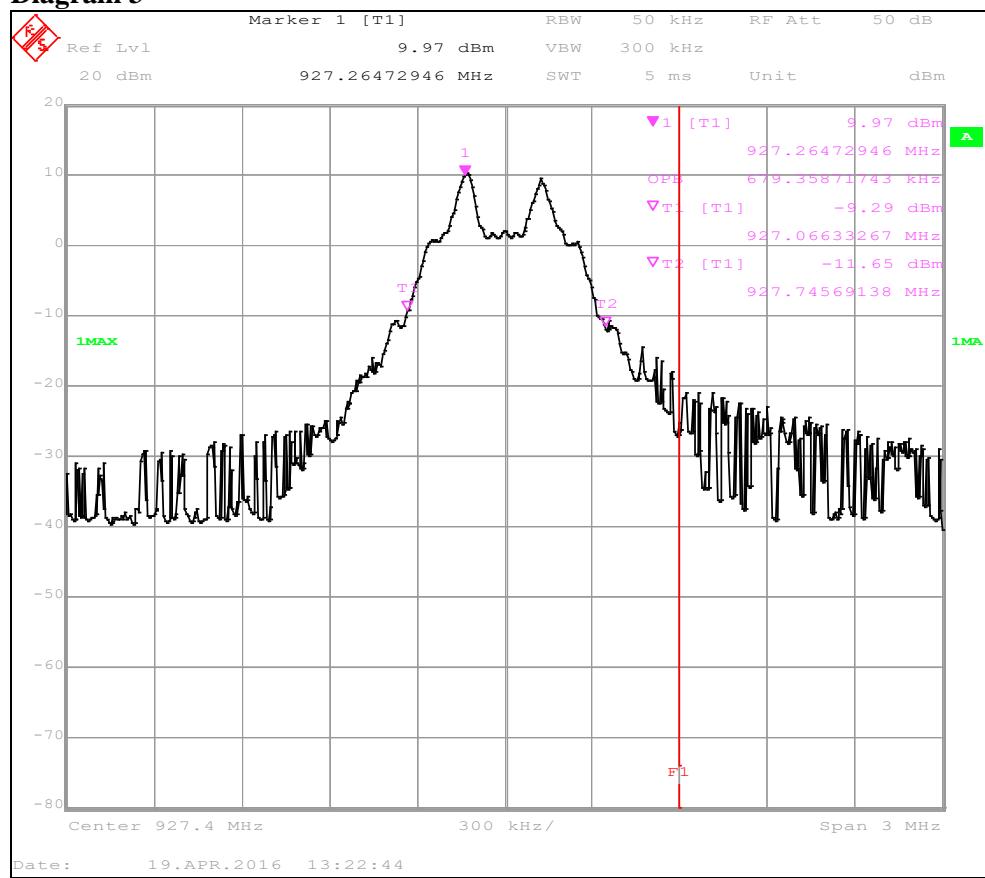
**Diagram 1**


2AB76NC1000C1

## Appendix 10

## Diagram 2



**Diagram 3**


**Band edge measurements according to FCC 47 CFR part 15.247 (d) / KDB 558074 / RSS-247 5.5 / RSS-Gen 8.10**

|                    |                             |                        |
|--------------------|-----------------------------|------------------------|
| Date<br>2016-08-30 | Temperature<br>23 °C ± 3 °C | Humidity<br>27 % ± 5 % |
|--------------------|-----------------------------|------------------------|

**Test set-up and procedure**

The measurements were performed according to ANSI C63.10-2013 and KDB 558074 D01 DTS Meas Guidance v05r02, April 2. 2019.

Average levels were measured according to ANSI C63.10 sec 11.13.3.3 with trace mode in Max hold and RMS Averaging Detector.

Radiated measurements at the restricted bands were performed in a semi anechoic chamber. The measurements were performed with both horizontal and vertical polarizations of the antenna. The antenna distance during the measurements was 3.0 m in the frequency range 30 MHz-10 GHz.

The EUT height above the reference ground plane was 0.8 m in the frequency range 30-1000 MHz and 1.5 m in the frequency range 1-10 GHz.

Conducted measurements were performed with the NC1000C-9 at the antenna connector and with continuous transmission and with modulation 2-FSK, 250 kBaud.

Test set-up photos during the tests can be found in Appendix 12.

| Measurement equipment              | SP number |
|------------------------------------|-----------|
| Test site RF Room                  |           |
| Signal Analyser R&S ESI26          | 18880     |
| Lenovo R500 Laptop                 |           |
| Multimeter Agilent                 | 14880     |
| HP 6632A Power Supply              | 11386     |
| Temperature and humidity meter CAN | 14395     |

**Results**

Operation band 902-928 MHz

|           |           |  |
|-----------|-----------|--|
| Diagram 1 | 902 MHz   | Band edge at 614 MHz (restricted band) |
| Diagram 2 | 902.6 MHz | Band edge at 902.6 MHz (20 dBc) *      |
| Diagram 3 | 927.4 MHz | Band edge at 927.4 MHz (20 dBc) *      |
| Diagram 4 | 928 MHz   | Band edge at 960 MHz (restricted band) |

Note 1: Operating Band limited to 902.6 – 927.4 MHz

## Final measurements:

902 MHz:

| Frequency (MHz) | QP level (dB $\mu$ V/m) | QP Limit (dB $\mu$ V/m) | dBc, peak det (limit=20dBc) | Polarization |
|-----------------|-------------------------|-------------------------|-----------------------------|--------------|
| 614.00 *)       | < 46                    | 46                      | N/A                         | Horizontal   |
| 902.6 **)       | N/A                     | N/A                     | 28.7                        | Vertical     |

\*) Restricted band

\*\*) 20 dBc

928 MHz:

| Frequency (MHz) | QP level (dB $\mu$ V/m) | QP Limit (dB $\mu$ V/m) | dBc, peak det (limit=20dBc) | Polarization |
|-----------------|-------------------------|-------------------------|-----------------------------|--------------|
| 927.4 **)       | N/A                     | N/A                     | 28.7                        | Vertical     |
| 960.00 *)       | <54                     | 54.0                    | N/A                         | Horizontal   |

\*) Restricted band

\*\*) 20 dBc

## Limits

Band edge at 614 MHz and 960 MHz (Restricted bands):

According to 47CFR 15.247(d), In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

According to RSS-Gen 8.10, Restricted bands, identified in Table 7, are designated primarily for safety-of-life services (distress calling and certain aeronautical bands), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following restrictions apply:

- (a) Fundamental components of modulation of licence-exempt radio apparatus shall not fall within the restricted bands of Table 7 except for apparatus complying under RSS-287;
- (b) Unwanted emissions that fall into restricted bands of Table 7 shall comply with the limits specified in table 5 and table 6.
- (c) Unwanted emissions that do not fall within the restricted frequency bands of Table 6 shall comply either with the limits specified in the applicable RSS or with those specified in table 5 and table 6.

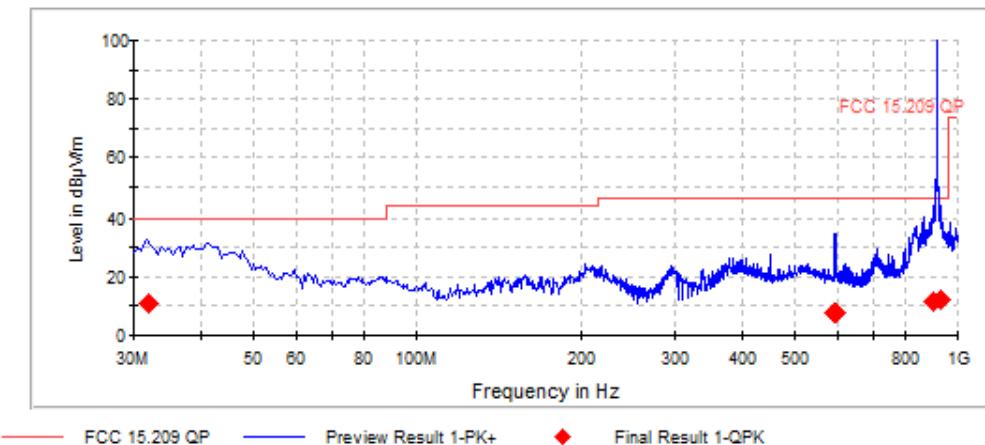
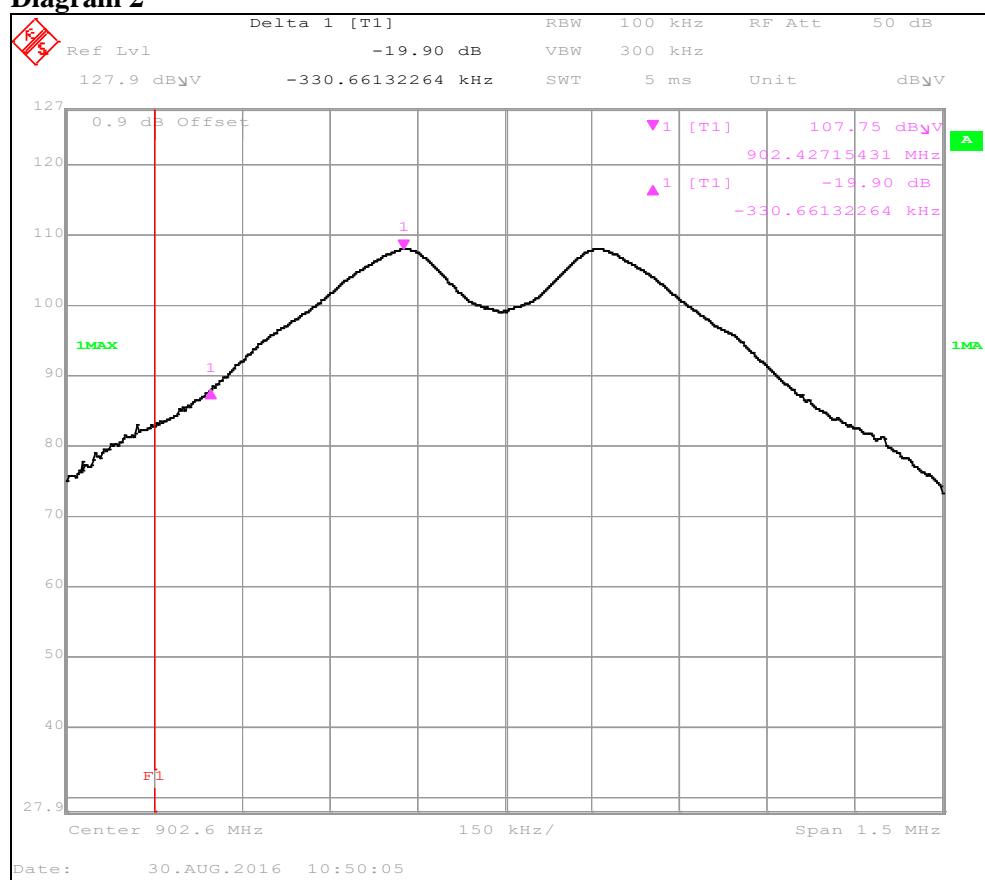
Band edge at 902 MHz and 928 MHz (Non restricted bands):

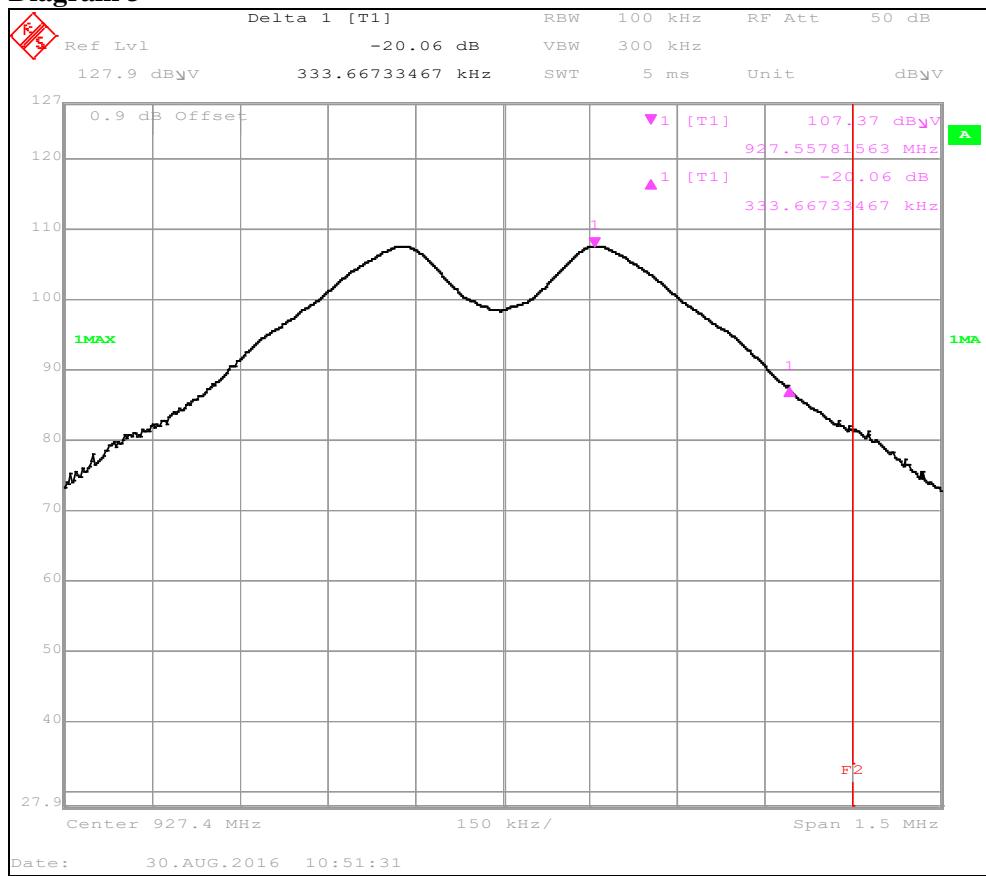
According to 47CFR 15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

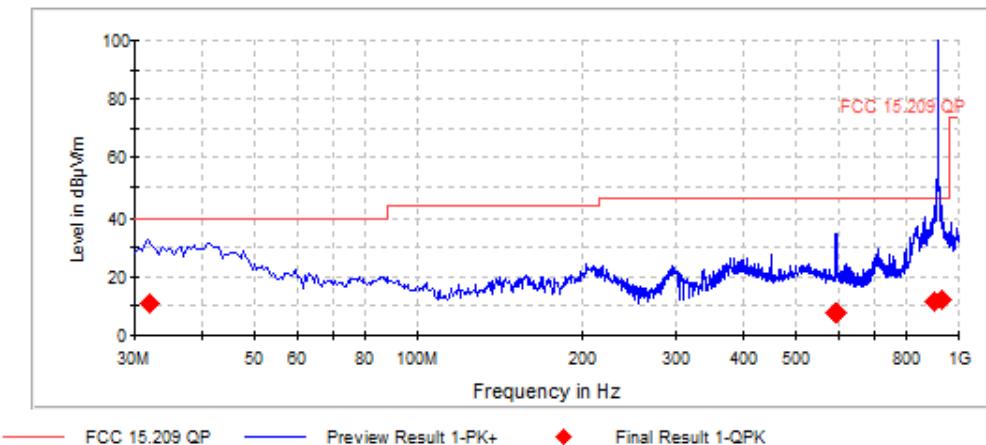
According to RSS-247 5.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the

100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

|           |     |
|-----------|-----|
| Complies? | Yes |
|-----------|-----|

**Diagram 1**

**Diagram 2**

**Figure 1 Frequencyline F1 @ 902 MHz**

**Diagram 3**

**Figure 2 Frequencyline F2 @ 928 MHz**

**Diagram 4**

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Appendix 12

**Photos**

The test set-up during all the conducted RF tests can be seen in the pictures below, powered by the external power supply.



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Appendix 12

The test set-up during the AC power line conducted emission test can be seen in the picture below, powered by the external power supply.



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Appendix 12

The test set-up during all the radiated tests can be seen in the pictures below.

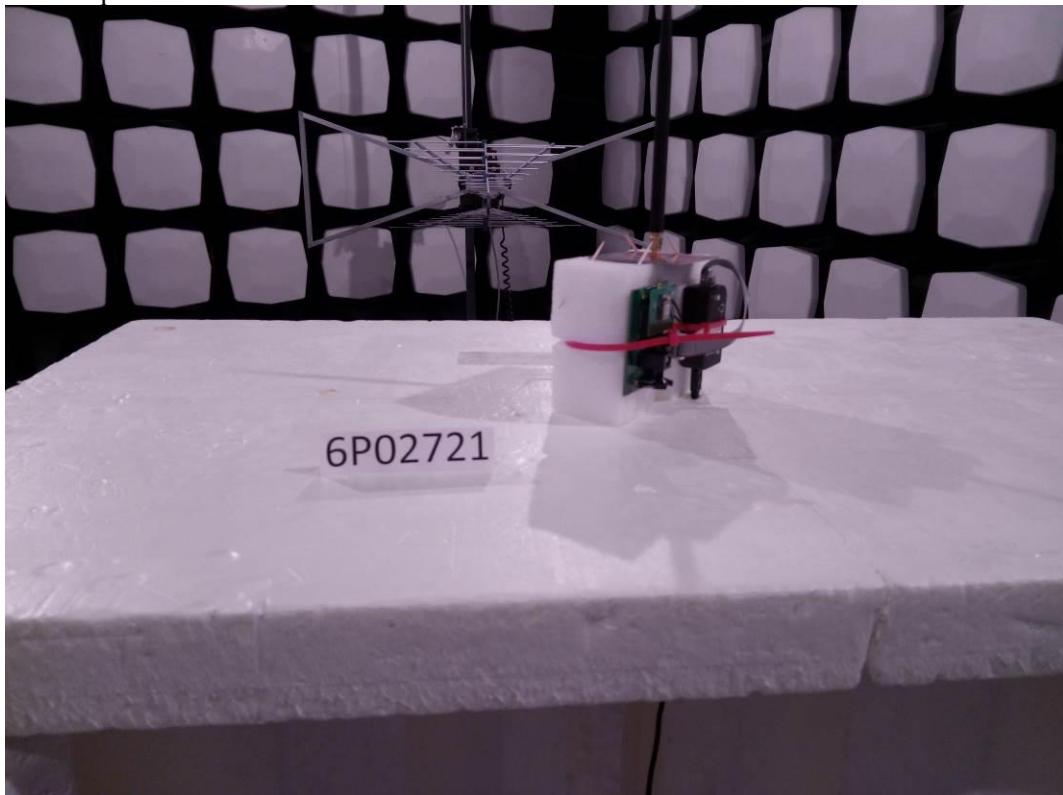
EUT set-up (measurements below 1 GHz):



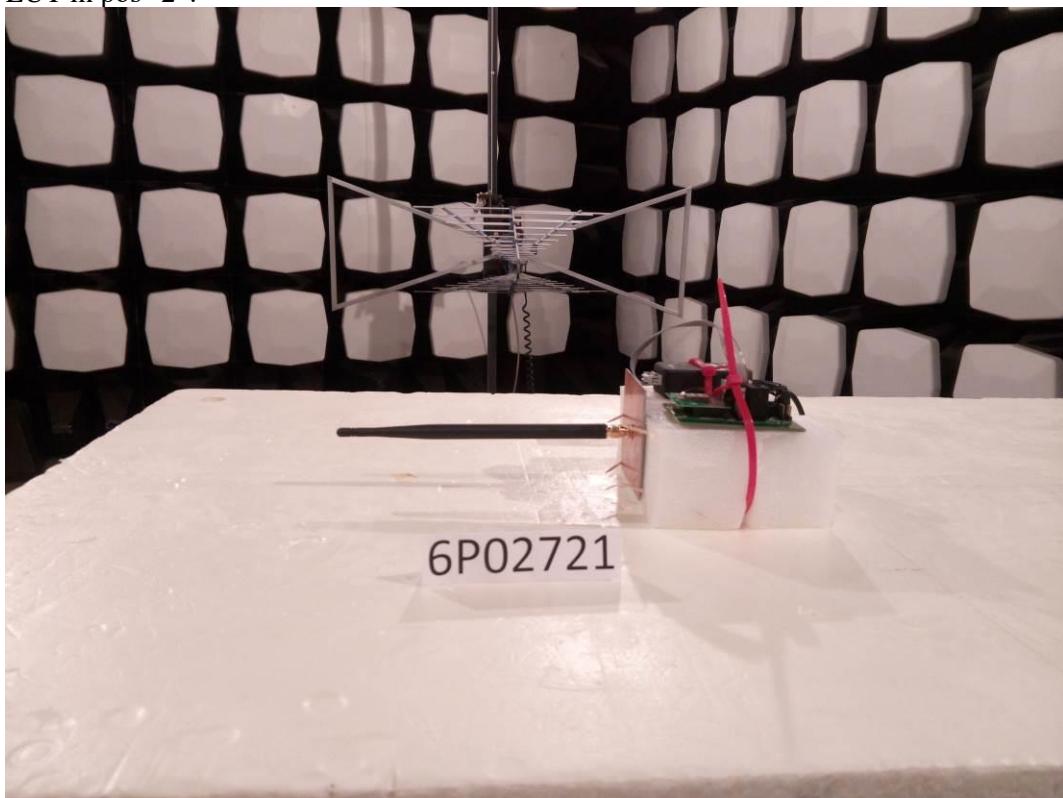
2AB76NC1000C1

Appendix 12

EUT in pos “1”:



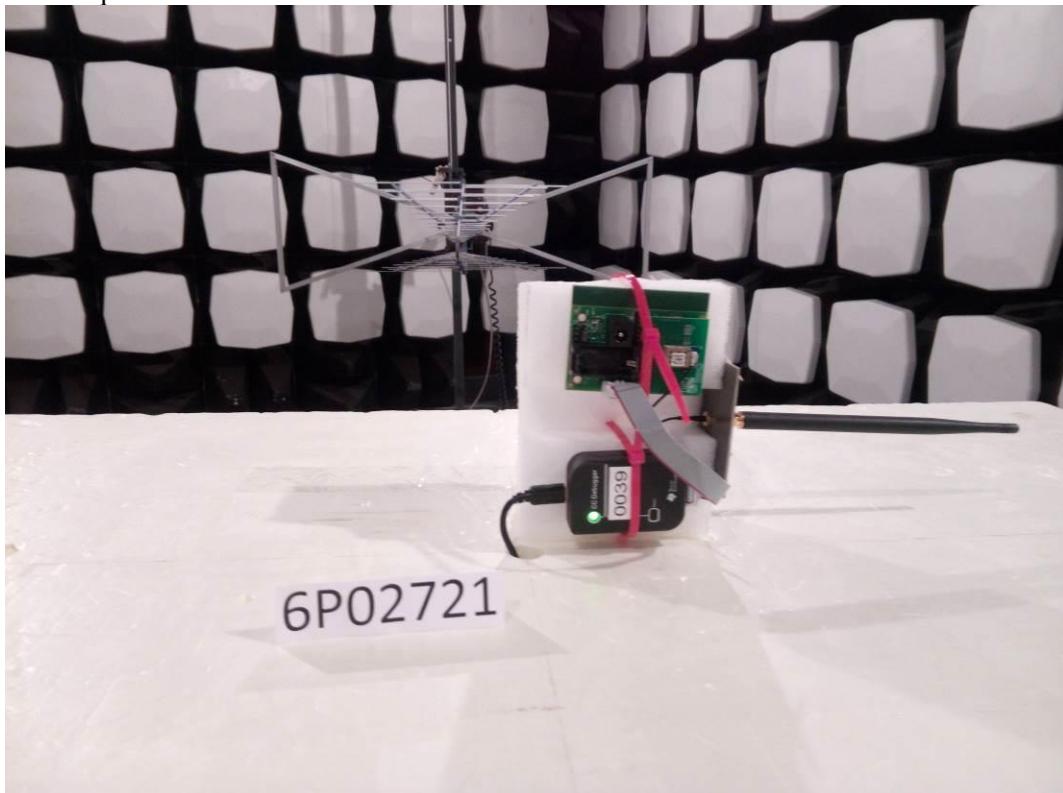
EUT in pos “2”:



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Appendix 12

EUT in pos "3":



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Appendix 12

30-1000 MHz:



1-10 GHz:

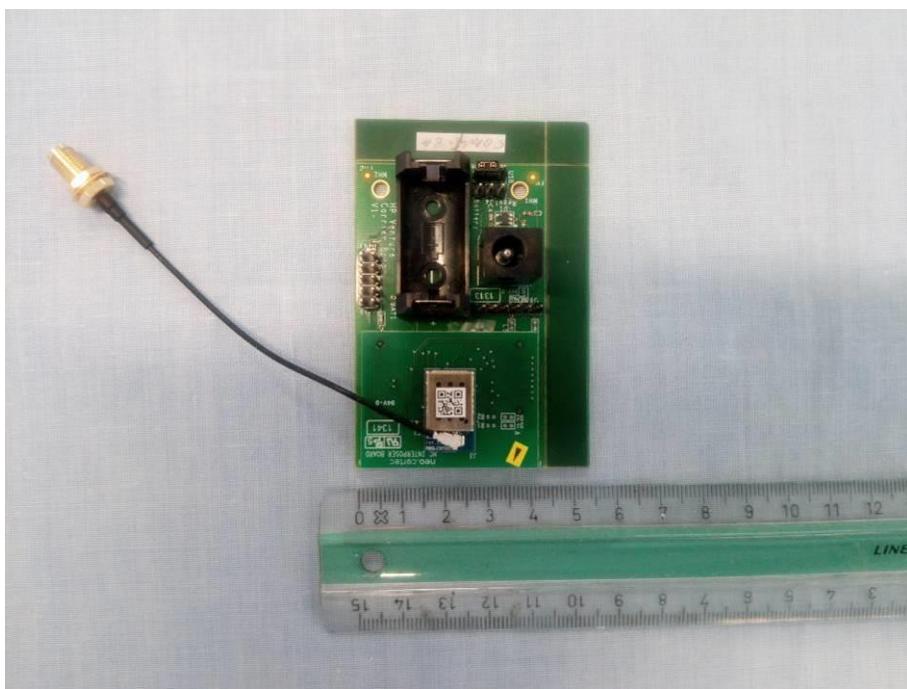
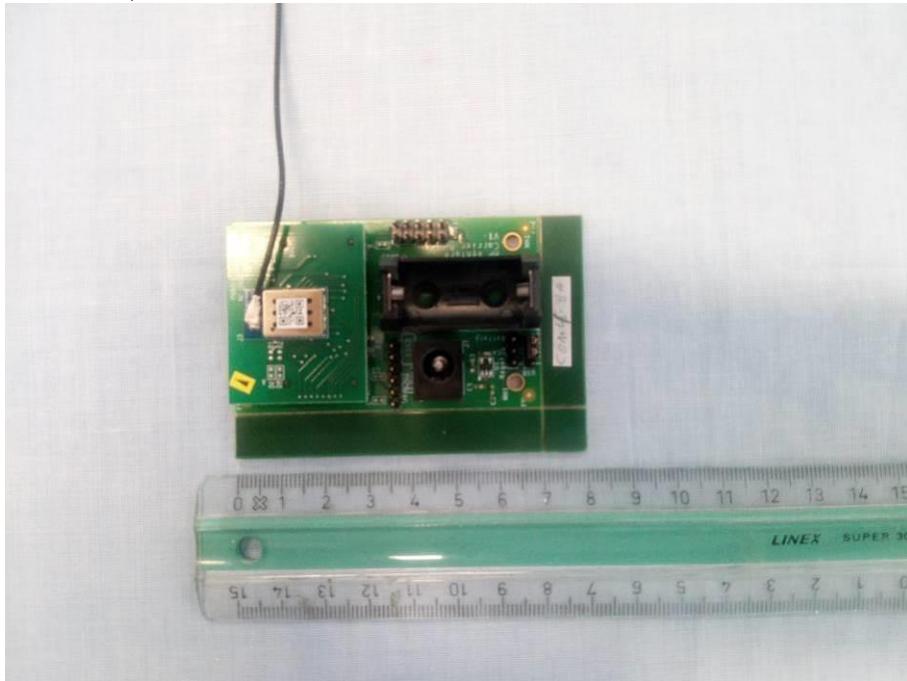


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Appendix 12

EUT, radiated sample

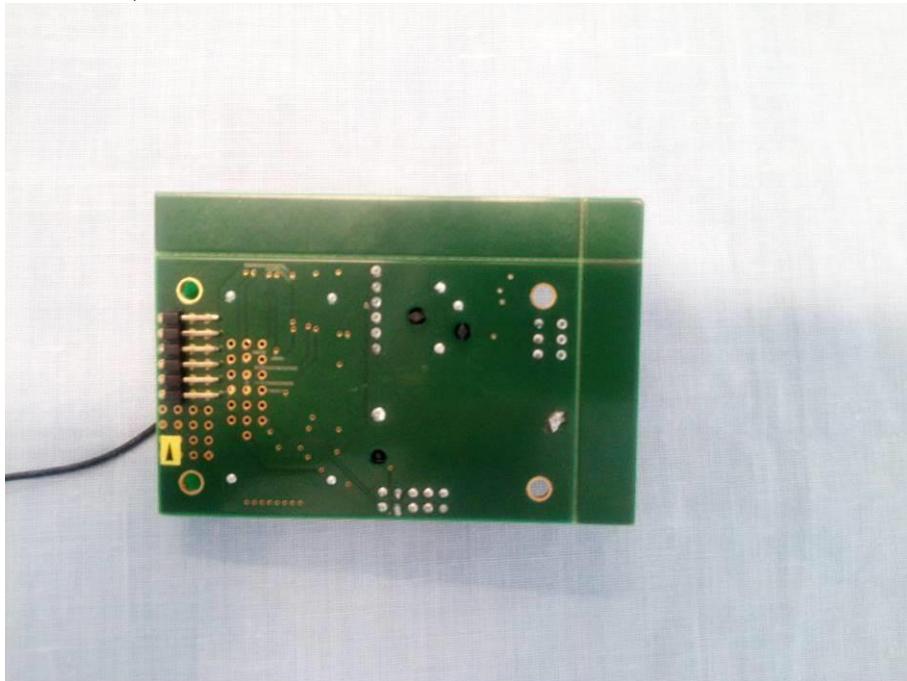
Over view, front



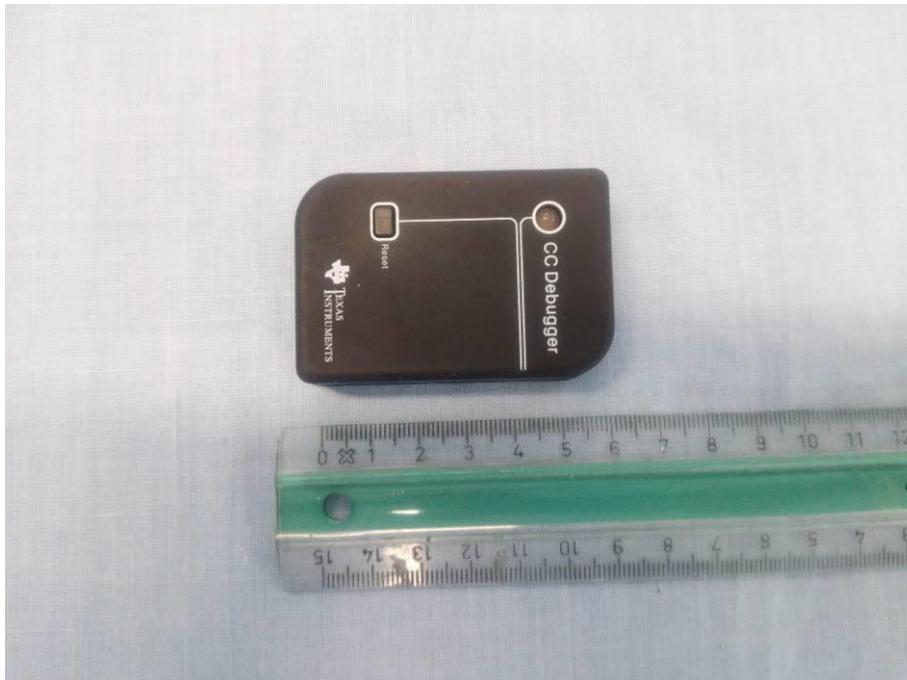
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Appendix 12

Over-view, rear



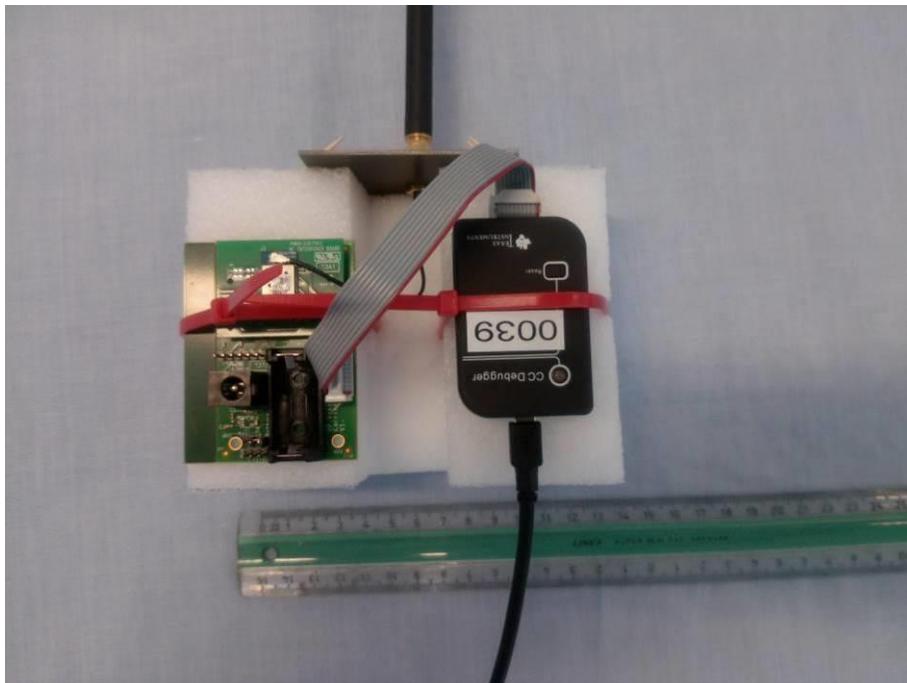
USB Interface module



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Appendix 12

Combination of units



Antenna

