

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                             |                                                                                                                                                                            |                      |                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------------------------------|
| <b>Prüfbericht-Nr.:</b><br><i>Test Report No.:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>50144049 001</b>                                                                         | <b>Auftrags-Nr.:</b><br><i>Order No.:</i>                                                                                                                                  | <b>114076719</b>     | <b>Seite 1 von 45</b><br><i>Page 1 of 45</i> |
| <b>Kunden-Referenz-Nr.:</b><br><i>Client Reference No.:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>N/A</b>                                                                                  | <b>Auftragsdatum:</b><br><i>Order date:</i>                                                                                                                                | <b>13-April-2018</b> |                                              |
| <b>Auftraggeber:</b><br><i>Client:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Audeze LLC</b><br>3410 S Susan St., Santa Ana CA, USA, Zip Code: 92704                   |                                                                                                                                                                            |                      |                                              |
| <b>Prüfgegenstand:</b><br><i>Test item:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Immersive Cinematic 3D Audio Headphone</b>                                               |                                                                                                                                                                            |                      |                                              |
| <b>Bezeichnung / Typ-Nr.:</b><br><i>Identification / Type No.:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>MOBIUS</b>                                                                               |                                                                                                                                                                            |                      |                                              |
| <b>Auftrags-Inhalt:</b><br><i>Order content:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>FCC/IC Test report (BDR/EDR)</b>                                                         |                                                                                                                                                                            |                      |                                              |
| <b>Prüfgrundlage:</b><br><i>Test specification:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>FCC 47CFR Part 15: Subpart C Section 15.247(FHSS)</b><br><b>RSS-247 ISSUE 2 FEB 2017</b> |                                                                                                                                                                            |                      |                                              |
| <b>Wareneingangsdatum:</b><br><i>Date of receipt:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>22-April-2018</b>                                                                        |                                                                                                                                                                            |                      |                                              |
| <b>Prüfmuster-Nr.:</b><br><i>Test sample No.:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>A000728303-006 Rad</b><br><b>A000728303-005 Cond</b>                                     |                                                                                                                                                                            |                      |                                              |
| <b>Prüfzeitraum:</b><br><i>Testing period:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>3-May-2018 – 14-May-2018</b>                                                             |                                                                                                                                                                            |                      |                                              |
| <b>Ort der Prüfung:</b><br><i>Place of testing:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>EMC Laboratory Taipei</b>                                                                |                                                                                                                                                                            |                      |                                              |
| <b>Prüflaboratorium:</b><br><i>Testing laboratory:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>TUV Rheinland Taiwan Ltd.</b>                                                            |                                                                                                                                                                            |                      |                                              |
| <b>Prüfergebnis*:</b><br><i>Test result*:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Pass</b>                                                                                 |                                                                                                                                                                            |                      |                                              |
| <b>geprüft von / tested by:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                             | <b>kontrolliert von / reviewed by:</b>                                                                                                                                     |                      |                                              |
| <b>2018-05-18</b> <b>Mars Y.J. Lin / Project Engineer</b><br><i>Datum</i> <i>Name / Stellung</i> <i>Unterschrift</i><br><i>Date</i> <i>Name / Position</i> <i>Signature</i>                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                             | <b>2018-05-21</b> <b>Arvin Ho / Vice General Manager</b><br><i>Datum</i> <i>Name / Stellung</i> <i>Unterschrift</i><br><i>Date</i> <i>Name / Position</i> <i>Signature</i> |                      |                                              |
| <b>Sonstiges / Other:</b><br>They are two chips of this MOBIUS, the chip is same, only the item number is different. They just put different marking for paying loyalty. Please refer the APPENDIX for detailed information.                                                                                                                                                                                                                                                                                                                                      |                                                                                             |                                                                                                                                                                            |                      |                                              |
| <b>Zustand des Prüfgegenstandes bei Anlieferung:</b><br><i>Condition of the test item at delivery:</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                             | <b>Prüfmuster vollständig und unbeschädigt</b><br><i>Test item complete and undamaged</i>                                                                                  |                      |                                              |
| * Legende:    1 = sehr gut              2 = gut              3 = befriedigend              4 = ausreichend              5 = mangelhaft<br>P(ass) = entspricht o.g. Prüfgrundlage(n)    F(ail) = entspricht nicht o.g. Prüfgrundlage(n)    N/A = nicht anwendbar    N/T = nicht getestet<br>Legend:    1 = very good              2 = good              3 = satisfactory              4 = sufficient              5 = poor<br>P(ass) = passed a.m. test specification(s)    F(ail) = failed a.m. test specification(s)    N/A = not applicable    N/T = not tested |                                                                                             |                                                                                                                                                                            |                      |                                              |
| <b>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</b><br><i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>                                                                                                        |                                                                                             |                                                                                                                                                                            |                      |                                              |

## TEST SUMMARY

### 5.1.1 ANTENNA REQUIREMENT

RESULT: Passed

### 5.1.2 PEAK OUTPUT POWER

RESULT: Passed

### 5.1.3 20dB BANDWIDTH

RESULT: Passed

### 5.1.4 99% BANDWIDTH

RESULT: Passed

### 5.1.5 CONDUCTED SPURIOUS EMISSIONS AND FREQUENCY BAND EDGE MEASURED IN 100kHz BANDWIDTH

RESULT: Passed

### 5.1.6 SPURIOUS EMISSION

RESULT: Passed

### 5.1.7 FREQUENCY SEPARATION

RESULT: Passed

### 5.1.8 NUMBER OF HOPPING FREQUENCY

RESULT: Passed

### 5.1.9 TIME OF OCCUPANCY

RESULT: Passed

### 5.2.1 MAINS CONDUCTED EMISSIONS

RESULT: Passed

### 6.1.1 ELECTROMAGNETIC FIELDS

RESULT: Passed

## Contents

|            |                                                                                               |           |
|------------|-----------------------------------------------------------------------------------------------|-----------|
| <b>1.</b>  | <b>GENERAL REMARKS .....</b>                                                                  | <b>5</b>  |
| <b>1.1</b> | <b>COMPLEMENTARY MATERIALS.....</b>                                                           | <b>5</b>  |
| <b>2.</b>  | <b>TEST SITES .....</b>                                                                       | <b>6</b>  |
| <b>2.1</b> | <b>TEST LABORATORY .....</b>                                                                  | <b>6</b>  |
| <b>2.2</b> | <b>TEST FACILITY.....</b>                                                                     | <b>6</b>  |
| <b>2.3</b> | <b>LIST OF TEST AND MEASUREMENT INSTRUMENTS.....</b>                                          | <b>7</b>  |
| <b>2.4</b> | <b>TRACEABILITY .....</b>                                                                     | <b>8</b>  |
| <b>2.5</b> | <b>CALIBRATION .....</b>                                                                      | <b>8</b>  |
| <b>2.6</b> | <b>MEASUREMENT UNCERTAINTY .....</b>                                                          | <b>8</b>  |
| <b>3.</b>  | <b>GENERAL PRODUCT INFORMATION.....</b>                                                       | <b>9</b>  |
| <b>3.1</b> | <b>PRODUCT FUNCTION AND INTENDED USE .....</b>                                                | <b>9</b>  |
| <b>3.2</b> | <b>SYSTEM DETAILS AND RATINGS.....</b>                                                        | <b>9</b>  |
| <b>3.3</b> | <b>INDEPENDENT OPERATION MODES.....</b>                                                       | <b>10</b> |
| <b>3.4</b> | <b>NOISE GENERATING AND NOISE SUPPRESSING PARTS .....</b>                                     | <b>11</b> |
| <b>3.5</b> | <b>SUBMITTED DOCUMENTS.....</b>                                                               | <b>11</b> |
| <b>4.</b>  | <b>TEST SET-UP AND OPERATION MODES.....</b>                                                   | <b>12</b> |
| <b>4.1</b> | <b>PRINCIPLE OF CONFIGURATION SELECTION .....</b>                                             | <b>12</b> |
| <b>4.2</b> | <b>TEST OPERATION AND TEST SOFTWARE.....</b>                                                  | <b>12</b> |
| <b>4.3</b> | <b>SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT .....</b>                                      | <b>12</b> |
| <b>4.4</b> | <b>COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE.....</b>                                         | <b>13</b> |
| <b>4.5</b> | <b>TEST SETUP DIAGRAM .....</b>                                                               | <b>13</b> |
| <b>5.</b>  | <b>TEST RESULTS .....</b>                                                                     | <b>15</b> |
| <b>5.1</b> | <b>TRANSMITTER REQUIREMENT &amp; TEST SUITES.....</b>                                         | <b>15</b> |
| 5.1.1      | <i>Antenna Requirement .....</i>                                                              | <i>15</i> |
| 5.1.2      | <i>Peak Output Power .....</i>                                                                | <i>16</i> |
| 5.1.3      | <i>20dB Bandwidth .....</i>                                                                   | <i>17</i> |
| 5.1.4      | <i>99% Bandwidth .....</i>                                                                    | <i>21</i> |
| 5.1.5      | <i>Conducted spurious emissions and Frequency Band Edge measured in 100kHz Bandwidth.....</i> | <i>23</i> |
| 5.1.6      | <i>Spurious Emission .....</i>                                                                | <i>31</i> |
| 5.1.7      | <i>Frequency Separation.....</i>                                                              | <i>32</i> |
| 5.1.8      | <i>Number of hopping frequency.....</i>                                                       | <i>34</i> |
| 5.1.9      | <i>Time of Occupancy .....</i>                                                                | <i>37</i> |
| <b>5.2</b> | <b>MAINS EMISSIONS.....</b>                                                                   | <b>39</b> |
| 5.2.1      | <i>Mains Conducted Emissions.....</i>                                                         | <i>39</i> |

|            |                                                  |           |
|------------|--------------------------------------------------|-----------|
| <b>6.</b>  | <b>SAFETY HUMAN EXPOSURE .....</b>               | <b>40</b> |
| <b>6.1</b> | <b>RADIO FREQUENCY EXPOSURE COMPLIANCE .....</b> | <b>40</b> |
| 6.1.1      | <i>Electromagnetic Fields.....</i>               | <i>40</i> |
| <b>7.</b>  | <b>PHOTOGRAPHS OF THE TEST SET-UP.....</b>       | <b>41</b> |
| <b>8.</b>  | <b>LIST OF TABLES .....</b>                      | <b>45</b> |
| <b>9.</b>  | <b>LIST OF PHOTOGRAPHS.....</b>                  | <b>45</b> |

## 1. General Remarks

### 1.1 Complementary Materials

The following attachments are integral parts of this test report:

**Appendix P: Photo Documentation**

(File Name: 50144049APPENDIX P)

**Appendix D: Test Result of Radiated Emissions**

(File Name: 50144049APPENDIX D)

Test Specifications

The following standards were applied

**Table 1: Applied Standard and Test Levels**

| Radio                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| FCC CFR47 Part 15: Subpart C Section 15.247<br>FCC CFR47 Part 2: Subpart J Section 2.1091<br>RSS-247 Issue 2 Feb 2017<br>RSS-102 Issue 5<br>RSS-Gen, Issue 4, November 2014<br>ANSI C63.10:2013 |

## 2. Test Sites

### 2.1 Test Laboratory

TUV Rheinland Taiwan Ltd.  
Taichung Branch Office

No.9, Lane 36, Minsheng Rd., Sec. 3, Daya District,  
Taichung City 428  
Taiwan (R.O.C.)

### 2.2 Test Facility

TUV Rheinland Taiwan Ltd.  
Taipei Office

11F. No.758, Sec. 4, Bade Rd., Songshan Dist.  
Taipei City 105  
Taiwan (R.O.C.)

FCC RegistrationNo.: 340738  
IC Canada Registration No.: 9465A-1  
TAF Accredited NCC Test Lab. No.:0759  
TAF ISO17025 Certification effective periods: 2016-Jul-1st to 2019-Jun-30th



**Testing Laboratory**  
**0759**

## 2.3 List of Test and Measurement Instruments

**Table 2: List of Test and Measurement Equipment**

| Kind of Equipment             | Manu-facturer  | Type         | S/N         | Last Calibration | Next Calibration |
|-------------------------------|----------------|--------------|-------------|------------------|------------------|
| Test Software                 | Farad          | EZ_EMC       | Ver. TUV3A1 | N/A              | N/A              |
| EMI Test Receiver             | R&S            | ESR 7        | 101549      | 2017/11/10       | 2018/11/10       |
| Spectrum Analyzer             | R&S            | FSV 40       | 100921      | 2018/05/02       | 2019/05/01       |
| Spectrum Analyzer             | Agilent        | N9010A       | MY53470241  | 2018/05/23       | 2019/05/22       |
| Preamplifier (30MHz -1GHz)    | HP             | 8447F        | 2805A03335  | 2017/08/14       | 2018/08/14       |
| Preamplifier (18 GHz -40 GHz) | COM-POWER      | PAM-840      | 461257      | 2018/01/18       | 2019/01/18       |
| Pre-Amplifier (1GHz~18GHz)    | EM Electronics | EM01G18G     | 60558       | 2017/11/21       | 2018/11/21       |
| Bilog Antenna                 | TESEQ          | CBL6111D     | 29804       | 2017/08/18       | 2018/08/18       |
| Horn Antenna                  | ETS-Lindgren   | 3117         | 201918      | 2017/08/18       | 2018/08/18       |
| Horn Antenna (18GHz~40GHz)    | COM-POWER      | AH-840       | 101029      | 2017/11/28       | 2018/11/28       |
| Loop Antenna                  | Schwarzbeck    | FMZB 1513    | 1513-076    | 2017/06/14       | 2018/06/14       |
| EMI Test Receiver             | R&S            | ESR 7        | 101549      | 2017/11/10       | 2018/11/10       |
| Spectrum Analyzer             | R&S            | FSL3         | 101943      | 2015/09/07       | 2018/09/07       |
| Temp. & Humid. Chamber        | Giant Force    | GCT-099-40-S | MAF0103-007 | 2017/03/09       | 2019/03/09       |
| LISN (1 phase)                | R&S            | ENV216       | 101243      | 2017/06/18       | 2018/06/18       |
| LISN                          | R&S            | ENV216       | 101262      | 2017/06/22       | 2018/06/21       |

## 2.4 Traceability

All measurement equipment calibrations are traceable to NML(Taiwan)/NIST(USA) or where calibration is performed outside Taiwan, to equivalent nationally recognized standards organizations.

## 2.5 Calibration

Equipment requiring calibration is calibrated periodically in a suitably accredited Calibration Lab. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

## 2.6 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements.

**Table 3: Emission Measurement Uncertainty**

| Parameter                                            | Uncertainty   |
|------------------------------------------------------|---------------|
| Radio Frequency                                      | $\pm 0.1$ ppm |
| RF power, conducted                                  | $\pm 1.5$ dB  |
| Adjacent channel power                               | $\pm 3$ dB    |
| Radiated emission of transmitter, valid up to 26 GHz | $\pm 6$ dB    |
| Radiated emission of receiver, valid up to 26 GHz    | $\pm 6$ dB    |
| Temperature                                          | $\pm 2$ °C    |
| Humidity                                             | $\pm 10$ %    |

### 3. General Product Information

#### 3.1 Product Function and Intended Use

The EUT is a Bluetooth Headphone. It contains a Bluetooth 4.2 compatible module enabling the user to communicate data through a Wireless interface.  
For details refer to the User Guide, Data Sheet and Circuit Diagram.

#### 3.2 System Details and Ratings

**Table 4: Basic Information of EUT**

| Item                        | EUT information                        |
|-----------------------------|----------------------------------------|
| Kind of Equipment/Test Item | Immersive Cinematic 3D Audio Headphone |
| Type Identification         | MOBIUS                                 |
| Brand Name                  | Audeze                                 |
| FCC ID                      | 2APRZ-MOBIUS                           |
| Canada ID                   | 23865-MOBIUS                           |
| Canada HVIN                 | MOBIUS                                 |

**Table 5: Technical Specification of EUT**

| Technical Specification | Value                      |
|-------------------------|----------------------------|
| Operating Frequency     | 2402 MHz ~ 2480 MHz        |
| Channel Spacing         | 1 MHz                      |
| Channel number          | 79                         |
| Operation Voltage       | 5Vdc                       |
| Modulation              | GFSK, $\pi/4$ DQPSK, 8DPSK |
| Antenna gain            | 2.459dBi                   |

**Table 6: Frequency hopping information**

| Technical Specification  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hopping Range            | Hereby we declare that the maximum frequency of this device is: 2402-2480MHz. This is according the Bluetooth Core Specification V2.1+EDR for devices which will be operated in the USA. This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/04).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Hopping Sequence         | Example of a 79 hopping sequence in data mode:<br><br>33,04,21,44,23,42,53,46,55,48,40,59,72,29,76,31,08,73,07,75,09,45,60,39,58,13,47,11,77,52,35,50,65,54,67,56,69,62,71,64, 7,25,27,66,57,70,74,61,78,63,10,41,05,43,15,44,64,68,02,70,06,01,51,03,55,05,03,66,53,49,36,47,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Receiver input bandwidth | <p>The input bandwidth of the receiver is 1MHz. In every connection one Bluetooth device is the master and the other one is the slave. The master determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master.</p> <p>Additionally the type of connection is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also the slave of the connection will use these settings.</p> <p>Repeating of a packer has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case.</p> <p>That means a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.</p> |

### 3.3 Independent Operation Modes

The basic operation modes are:

- A. Transmitting
  - 1. Low channel
  - 2. Middle channel
  - 3. High channel
- B. Receiving
  - 1. Low channel
  - 2. Middle channel
  - 3. High channel

### **3.4 Noise Generating and Noise Suppressing Parts**

Refer to the Circuit Diagram.

### **3.5 Submitted Documents**

- Circuit Diagram
- Block Diagram
- Instruction Manual
- Rating Label
- Technical Description

## 4. Test Set-up and Operation Modes

### 4.1 Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its maximum power level. The test modes were adapted accordingly in reference to the instructions for use.

### 4.2 Test Operation and Test Software

Setup for testing: Test samples are provided with a USB interface which makes it possible to control them through a test software installed on a notebook computer.

This software, Bluetooth RF test tool ISRT-5145 provided by manufacturer was running on the laptop computer connected to the EUT. It was used to enable the operation modes listed in section 3.3 as appropriate.

The samples were used as follows:  
Conducted: **A000728303-005** Cond  
Radiation: **A000728303-006** Rad

Full test was applied on all test modes, but only worst case was shown.

### 4.3 Special Accessories and Auxiliary Equipment

The product has been tested together with the following additional accessories:

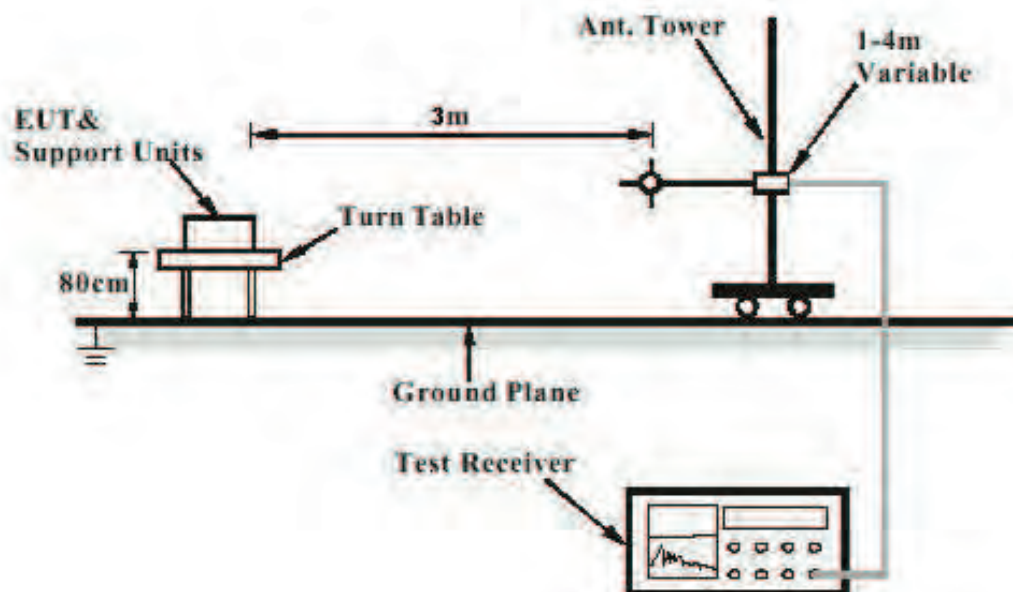
| Kind of Equipment | Manufacturer | Model Name | Serial No. |
|-------------------|--------------|------------|------------|
| Notebook(EMC-06)  | Lenovo       | TP00048A   | PB-0F8B2   |

## 4.4 Countermeasures to achieve EMC Compliance

The test sample which has been tested containing the noise suppression parts as in the Photo Appendix and the Test Setup Photos. No additional measures were employed to achieve compliance.

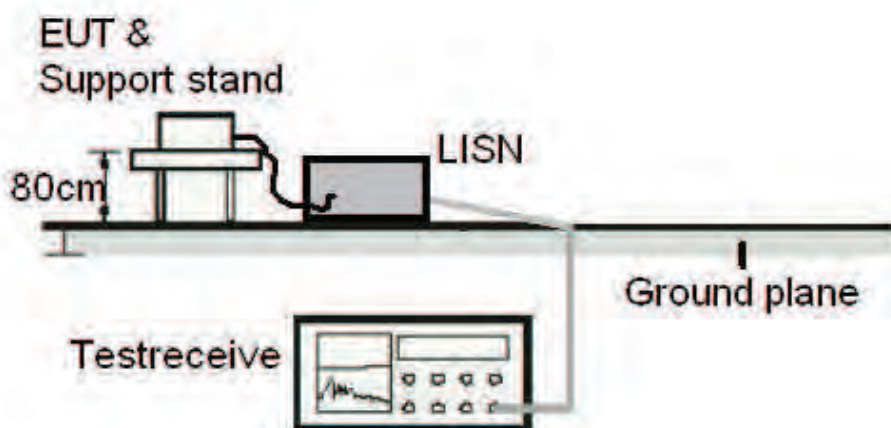
## 4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test

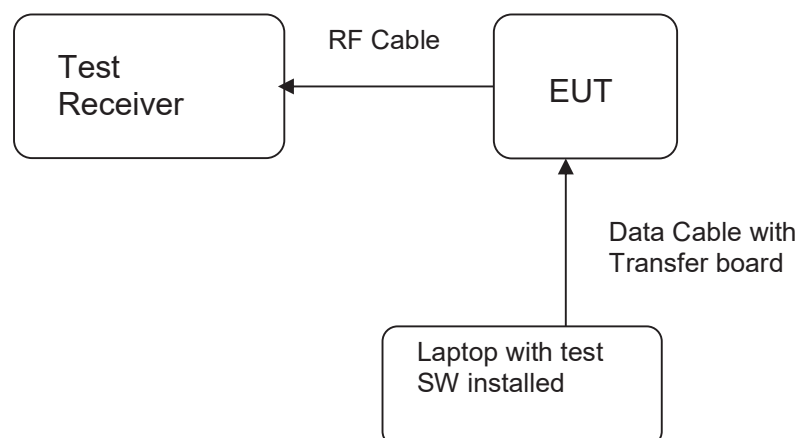


Note: Measurements above 1 GHz are done with a table height of 1.5m

## Diagram of Measurement Equipment Configuration for Mains Conduction Measurement



## Diagram of Measurement Equipment Configuration for Conducted Transmitter Measurement



## 5. Test Results

### 5.1 Transmitter Requirement & Test Suites

#### 5.1.1 Antenna Requirement

**RESULT:** **Passed**

|               |   |                                                                               |
|---------------|---|-------------------------------------------------------------------------------|
| Test standard | : | FCC Part 15.247(b)(4), Part 15.203 and RSS-Gen 8.3                            |
| Requirement   | : | use of approved antennas only with directional gains that do not exceed 6 dBi |

According to the manufacturer declaration, the EUT has an antenna with a directional gain of 2.459 dBi. The antenna is a printed PCB trace with no possibility of replacement with a non-approved antenna by the end-user. Therefore, the EUT is considered to comply with this provision.

Refer to EUT photo for details.

## 5.1.2 Peak Output Power

### RESULT:

**Passed**

Test standard : FCC Part 15.247(b)(1),  
RSS-247 5.4(2)

Basic standard : ANSI C63.10:2013

Kind of test site : Shielded room

### Test setup

Test Channel : Low/ Middle/ High

Operation Mode : A

Ambient temperature : 22-26 °C

Relative humidity : 50-65 %

Atmospheric pressure : 100-103 kPa

**Table 7: Test result of Peak Output Power, GFSK modulation**

| Channel        | Channel Frequency | Peak Output Power |         | Limit |
|----------------|-------------------|-------------------|---------|-------|
|                | (MHz)             | (dBm)             | (W)     | (W)   |
| Low Channel    | 2402              | 4.76              | 0.00299 | 0.125 |
| Middle Channel | 2441              | 4.58              | 0.00287 | 0.125 |
| High Channel   | 2480              | 4.44              | 0.00278 | 0.125 |

**Table 8: Test result of Peak Output Power, 8DPSK modulation**

| Channel        | Channel Frequency | Peak Output Power |         | Limit |
|----------------|-------------------|-------------------|---------|-------|
|                | (MHz)             | (dBm)             | (W)     | (W)   |
| Low Channel    | 2402              | 5.27              | 0.00337 | 0.125 |
| Middle Channel | 2441              | 5.14              | 0.00327 | 0.125 |
| High Channel   | 2480              | 5.03              | 0.00318 | 0.125 |

Pmax: **3.3651mW**

### 5.1.3 20dB Bandwidth

**RESULT:**
**Passed**

Test standard : FCC Part 15.247(a)(1),  
RSS-247 5.1(1)

Basic standard : ANSI C63.10:2013

**Test setup**

Test Channel : Low/ Middle/ High

Operation Mode : A

Ambient temperature : 22-26°C

Relative humidity : 50-65%

Atmospheric pressure : 100-103kPa

**Table 9: Test result of 20dB Bandwidth, GFSK modulation**

| Channel      | Channel Frequency (MHz) | 20dB Bandwidth (kHz) | Limit (MHz) | Result |
|--------------|-------------------------|----------------------|-------------|--------|
| Low Channel  | 2402                    | 937.8                | 1.5         | Pass   |
| Mid Channel  | 2441                    | 937.8                | 1.5         | Pass   |
| High Channel | 2480                    | 933.4                | 1.5         | Pass   |

Note: Limit is for Channel Separation of 1 MHz and a power limit of 125 mW.

**Table 10: Test result of 20dB Bandwidth, 8DPSK modulation**

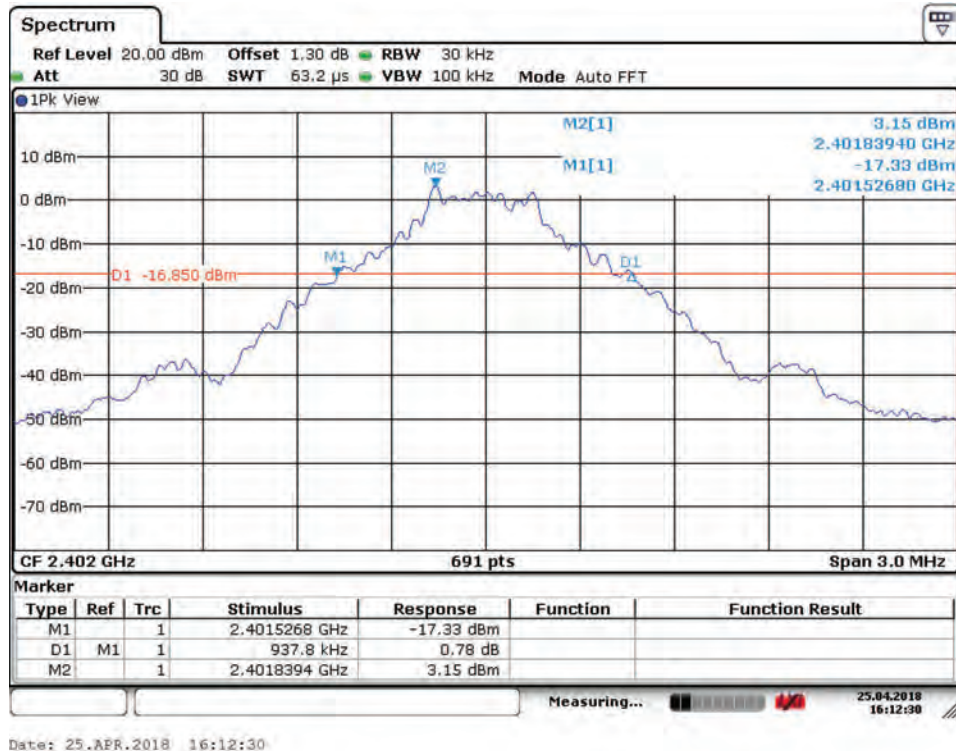
| Channel      | Channel Frequency (MHz) | 20dB Bandwidth (kHz) | Limit (MHz) | Result |
|--------------|-------------------------|----------------------|-------------|--------|
| Low Channel  | 2402                    | 1267.7               | 1.5         | Pass   |
| Mid Channel  | 2441                    | 1259                 | 1.5         | Pass   |
| High Channel | 2480                    | 1263.4               | 1.5         | Pass   |

Note: Limit is for Channel Separation of 1 MHz and a power limit of 125 mW.

If the carrier separation frequency of a Bluetooth Device is set at 1 MHz due to the firmware setting and the Bluetooth Standard, then for power <125 mW the limit for the 20 dB Bandwidth, becomes 1 MHz / 0.66666 = 1.5 MHz.

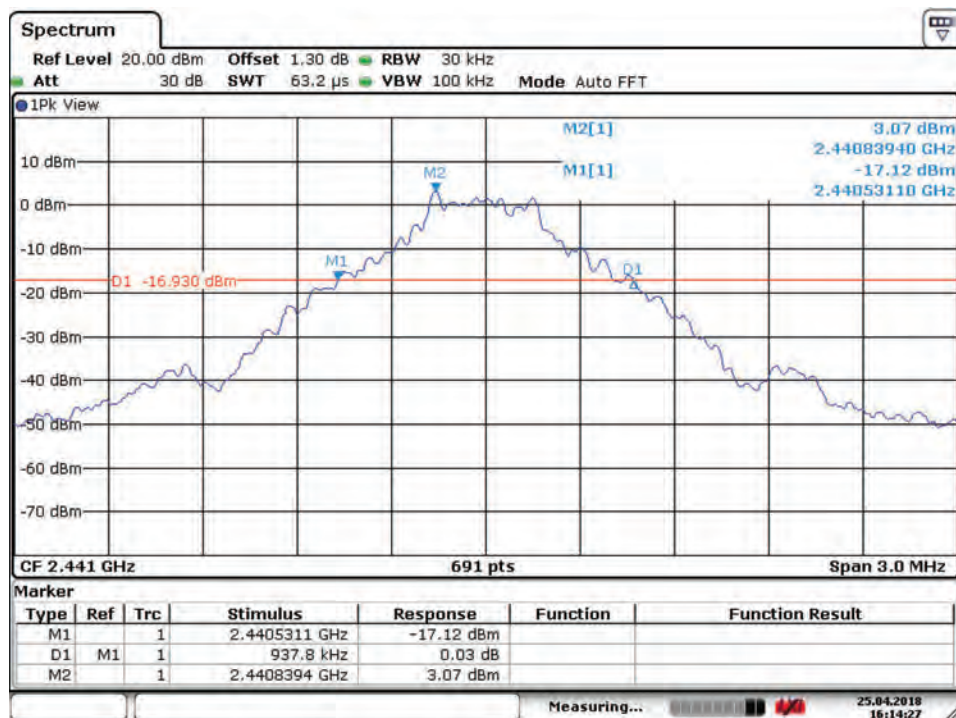
## Test Plot of 20dB Bandwidth, GFSK modulation

### Low Channel

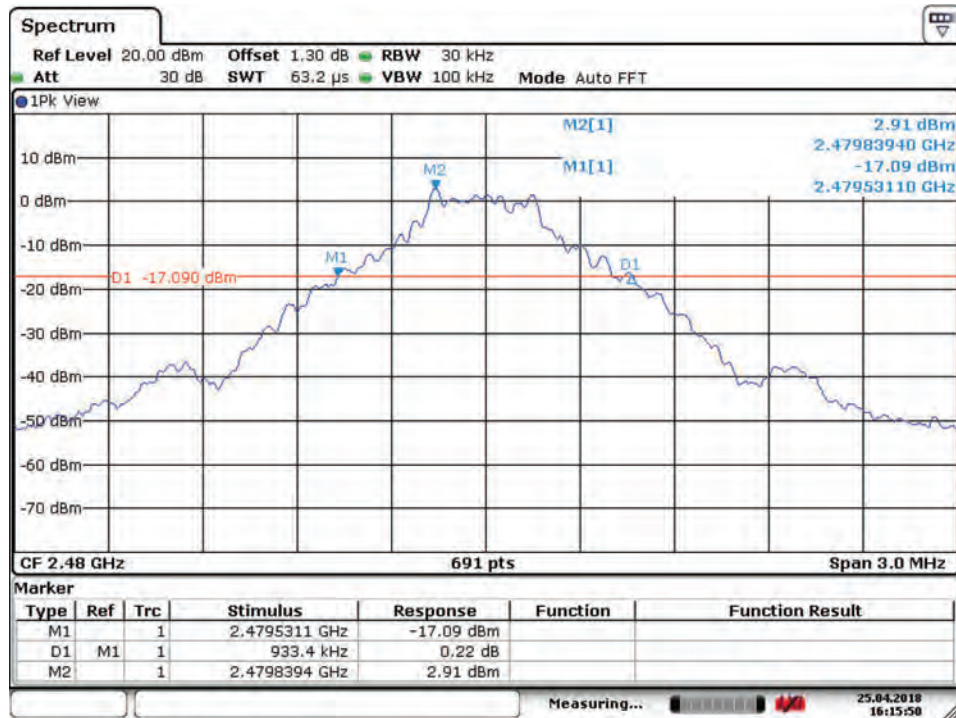


Date: 25.APR.2018 16:12:30

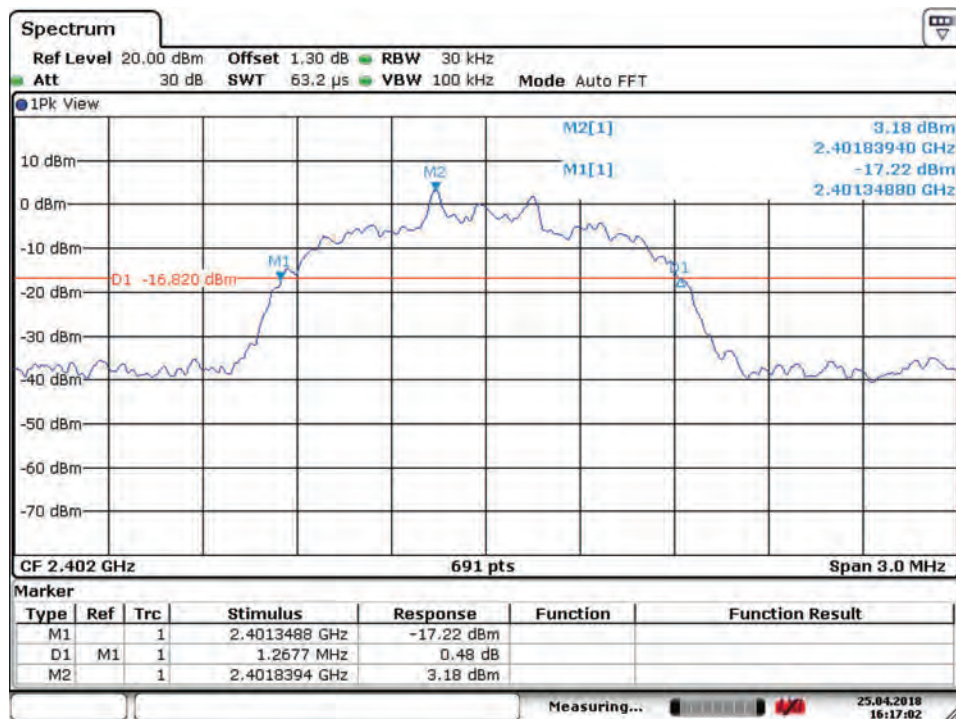
### Middle Channel



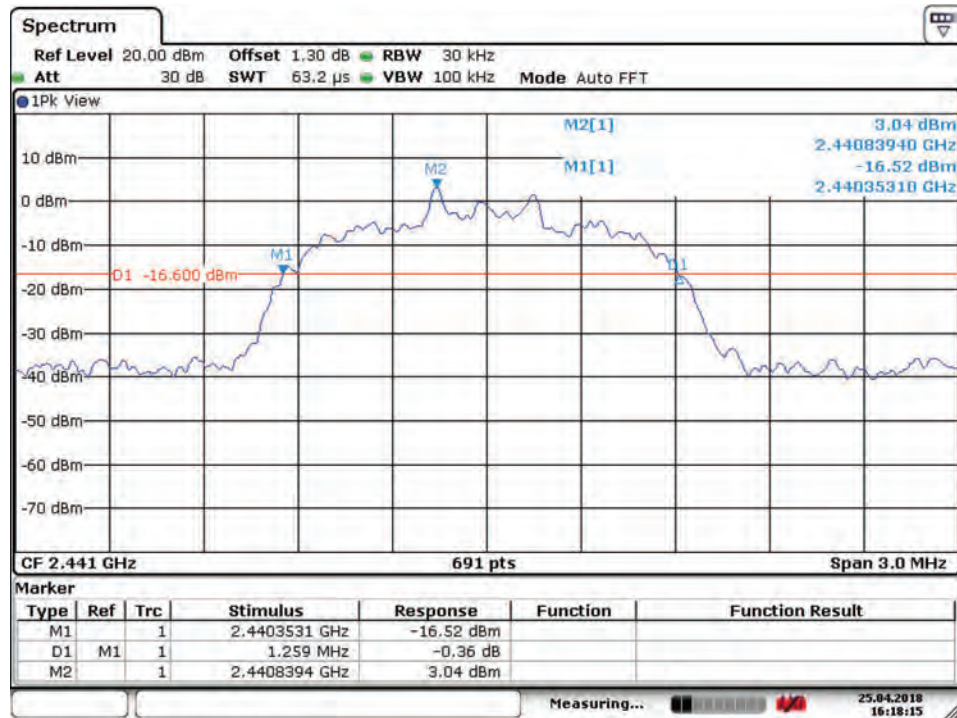
Date: 25.APR.2018 16:14:27

**High Channel**


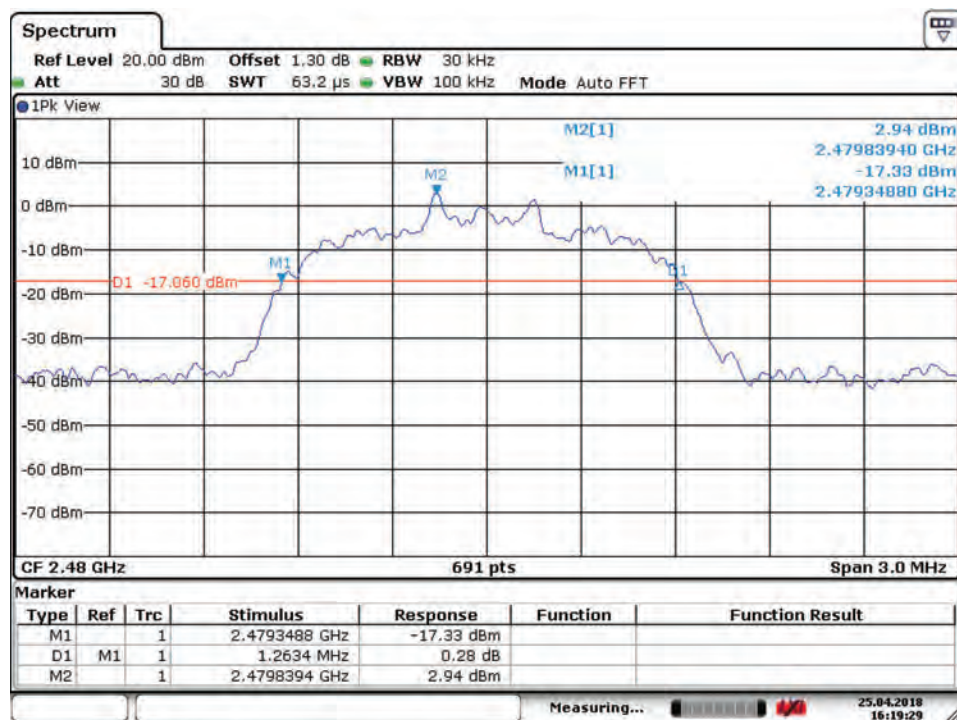
Date: 25.APR.2018 16:15:50

**Test Plot of 20dB Bandwidth, 8DPSK modulation**
**Low Channel**


Date: 25.APR.2018 16:17:02

**Middle Channel**


Date: 25.APR.2018 16:18:15

**High Channel**


Date: 25.APR.2018 16:19:29

### 5.1.4 99% Bandwidth

**RESULT:****Passed**

Test standard : RSS-Gen (Issue 4)  
Basic standard : RSS-Gen (Issue 4)  
Kind of test site : Shielded room

**Test setup**

Test Channel : Middle  
Operation Mode : A  
  
Ambient temperature : 22-26°C  
Relative humidity : 50-65%  
Atmospheric pressure : 100-103kPa

**Table 11: Test result of 99% Bandwidth, GFSK modulation**

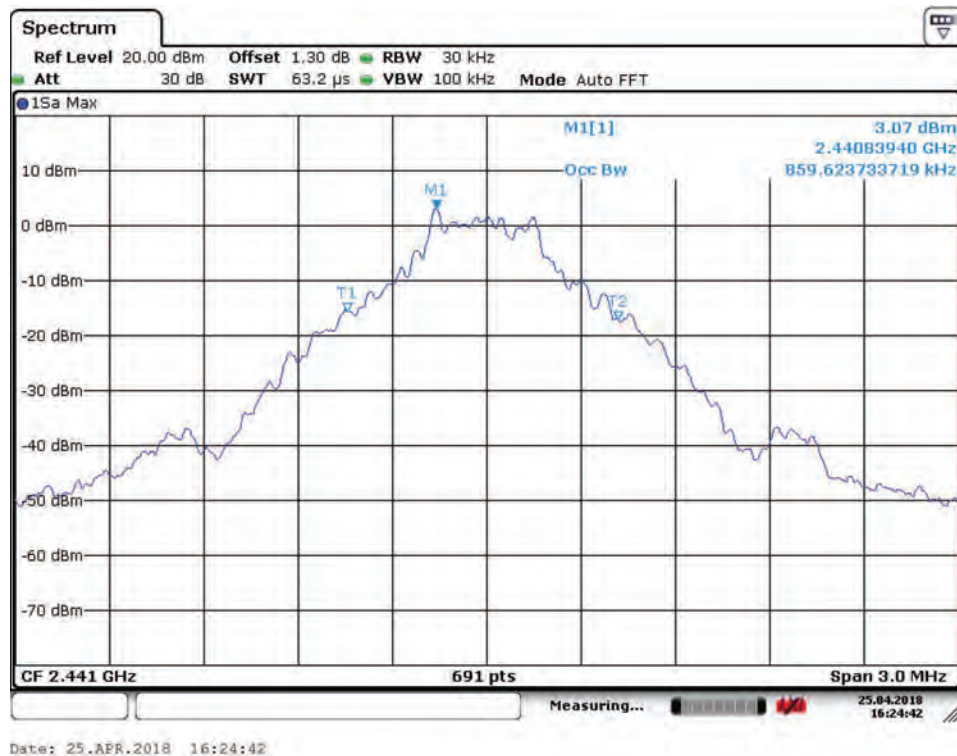
| Channel     | Channel Frequency (MHz) | 99% Bandwidth (kHz) |
|-------------|-------------------------|---------------------|
| Mid Channel | 2441                    | 859.62              |

**Table 12: Test result of 99% Bandwidth, PSK modulation**

| Channel     | Channel Frequency (MHz) | 99% Bandwidth (kHz) |
|-------------|-------------------------|---------------------|
| Mid Channel | 2441                    | 1172.2              |

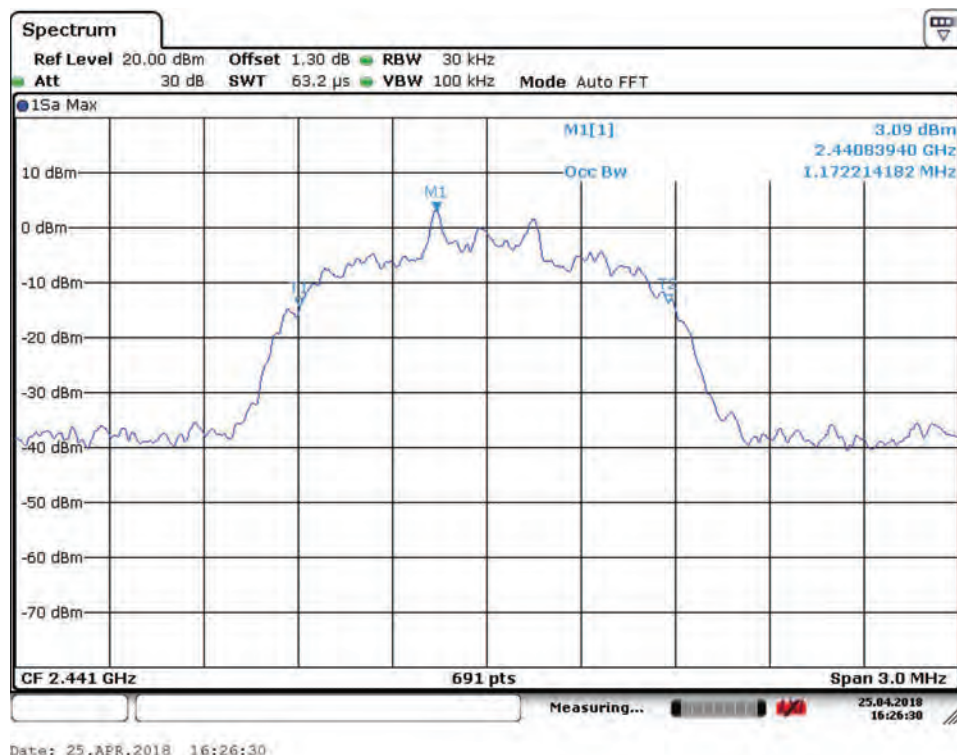
## Test Plot of 99% Bandwidth, GFSK modulation

### Middle Channel



## Test Plot of 99% Bandwidth, 8DPSK modulation

### Middle Channel



### 5.1.5 Conducted spurious emissions and Frequency Band Edge measured in 100kHz Bandwidth

**RESULT:****Passed**

|                   |   |                                                                                                                   |
|-------------------|---|-------------------------------------------------------------------------------------------------------------------|
| Test standard     | : | FCC part 15.247(d),<br>RSS-247 5.5                                                                                |
| Basic standard    | : | ANSI C63.10:2013                                                                                                  |
| Limit             | : | 20dB (below that in the 100kHz bandwidth within the<br>band that contains the highest level of the desired power) |
| Kind of test site | : | Shielded room                                                                                                     |

**Test setup**

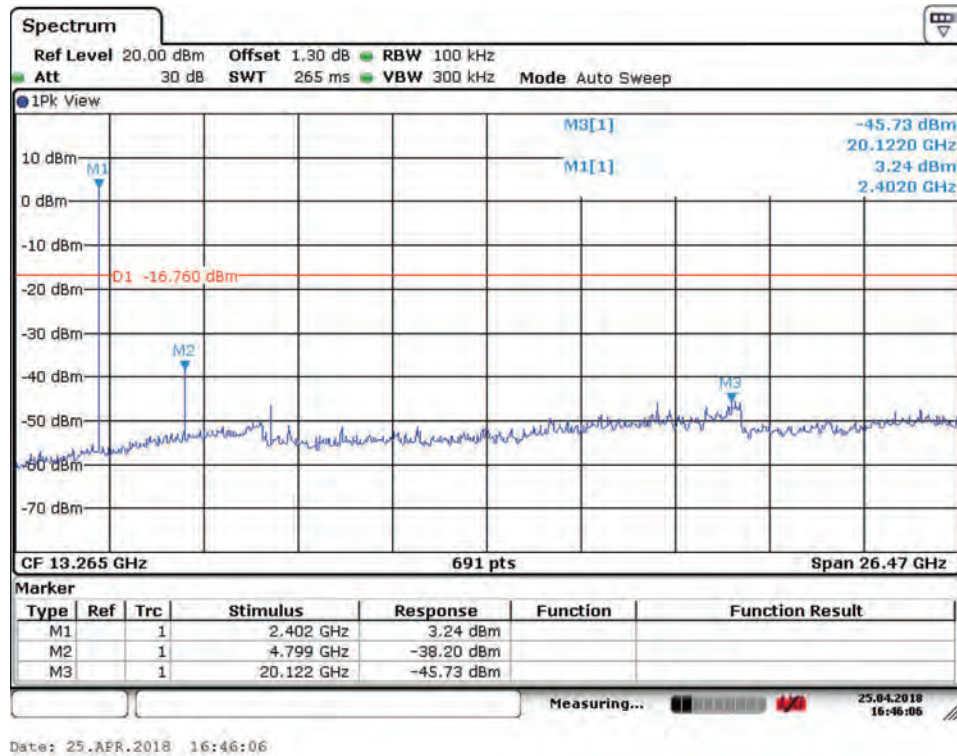
|                      |   |                                                                                                     |
|----------------------|---|-----------------------------------------------------------------------------------------------------|
| Test Channel         | : | Low/ Middle/ High for Conducted Spurious Emissions<br>Low/ High/ Hopping on for Frequency Band Edge |
| Operation Mode       | : | A                                                                                                   |
| Ambient temperature  | : | 22-26°C                                                                                             |
| Relative humidity    | : | 50-65%                                                                                              |
| Atmospheric pressure | : | 100-103 kPa                                                                                         |

All emissions are more than 20dB below fundamental, details refer to following test plot, and compliance is achieved as well.

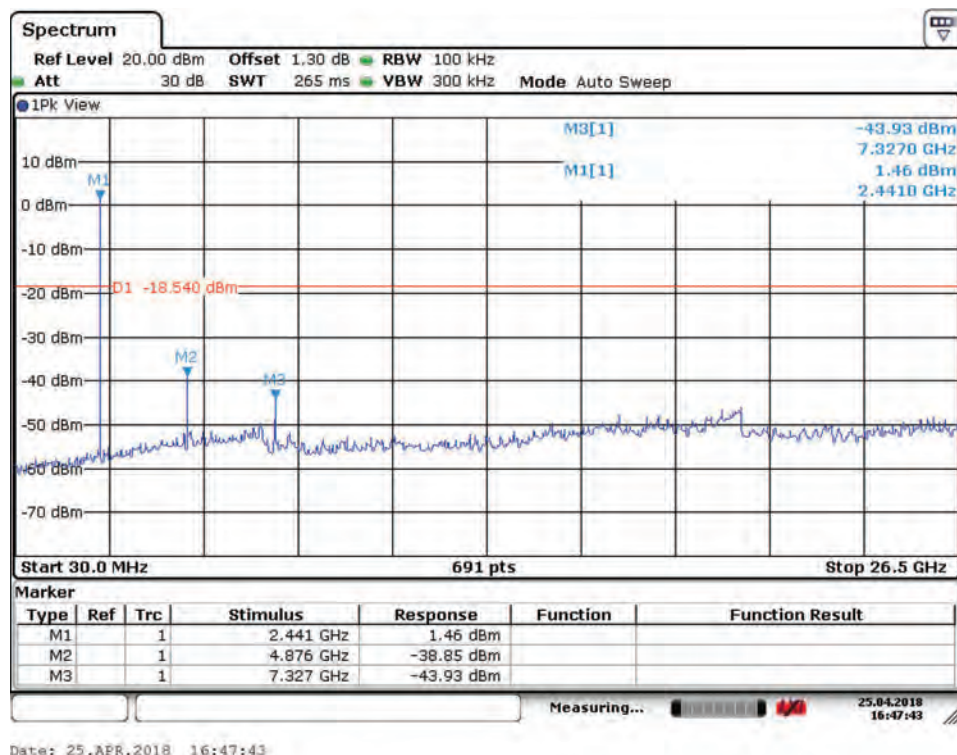
Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

## Test Plot of 100kHz Conducted Emissions, GFSK modulation

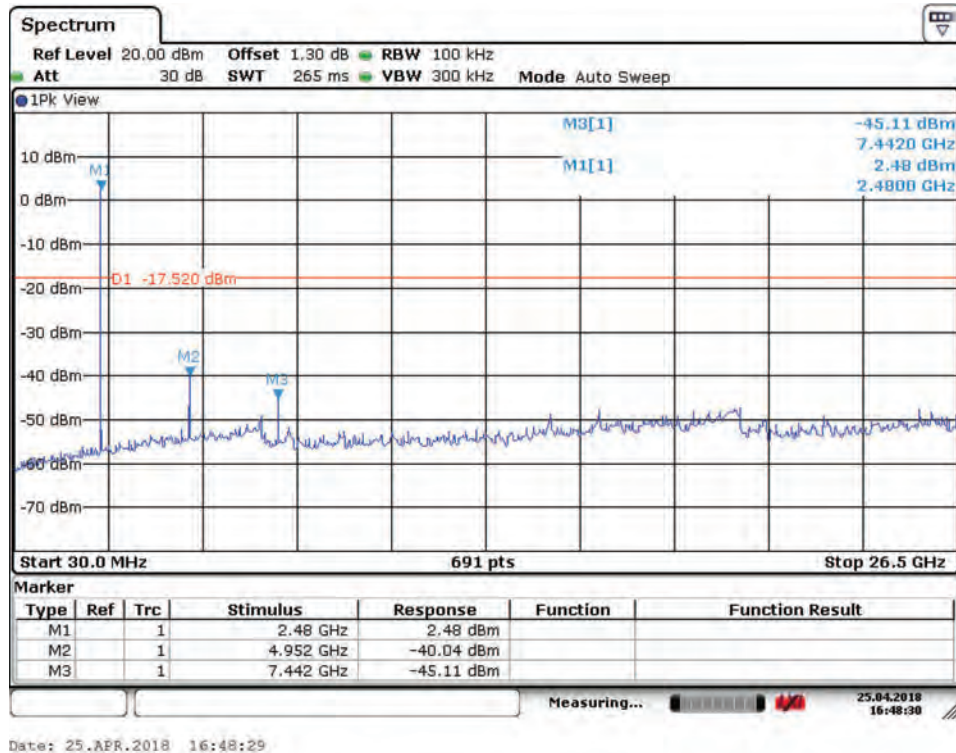
### Low Channel



### Middle Channel

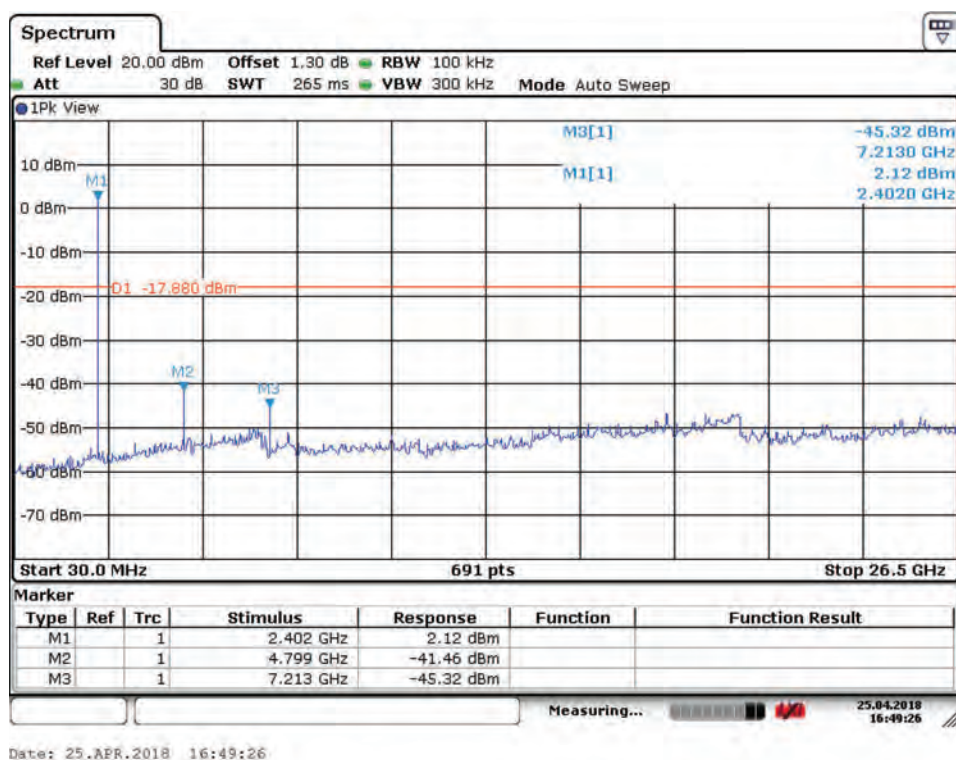


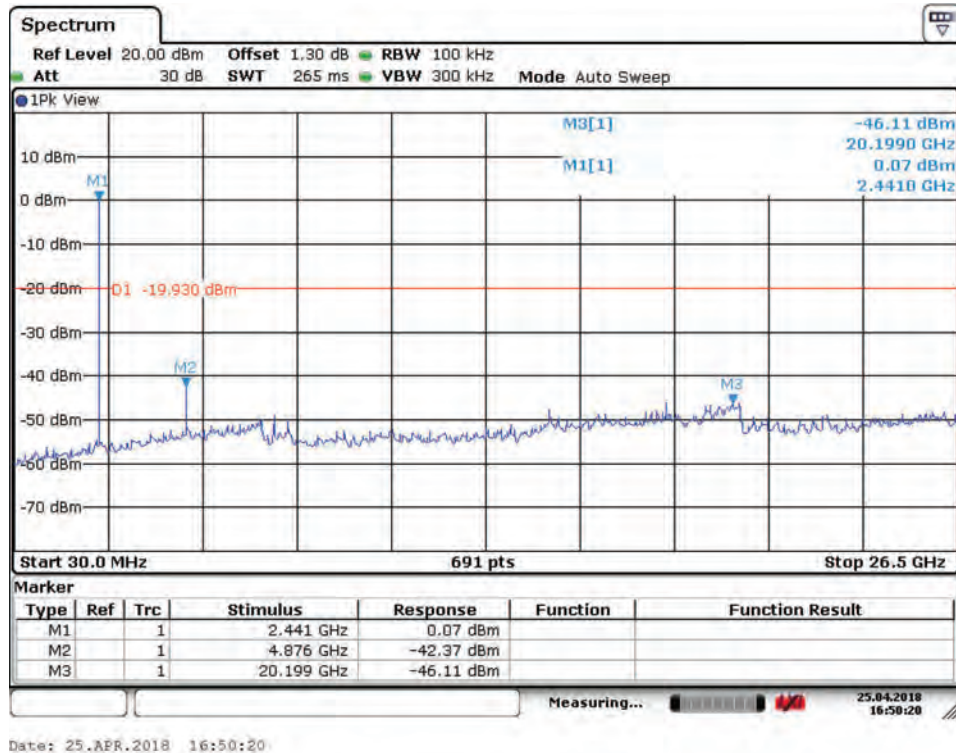
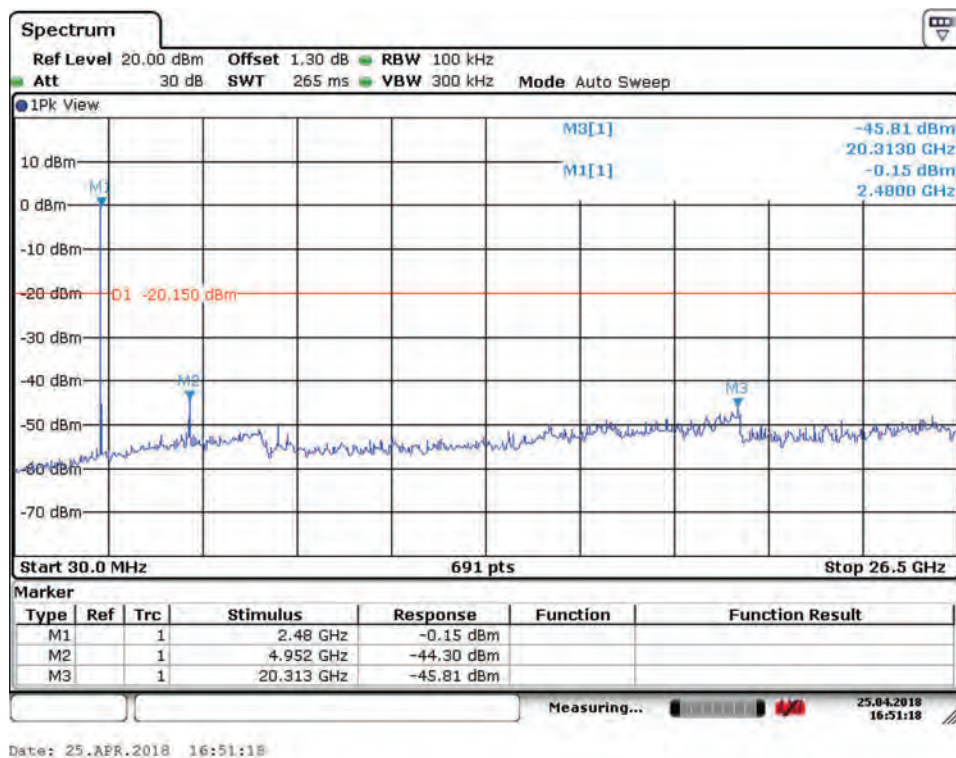
### High Channel



## Test Plot of 100kHz Conducted Emissions, 8DPSK modulation

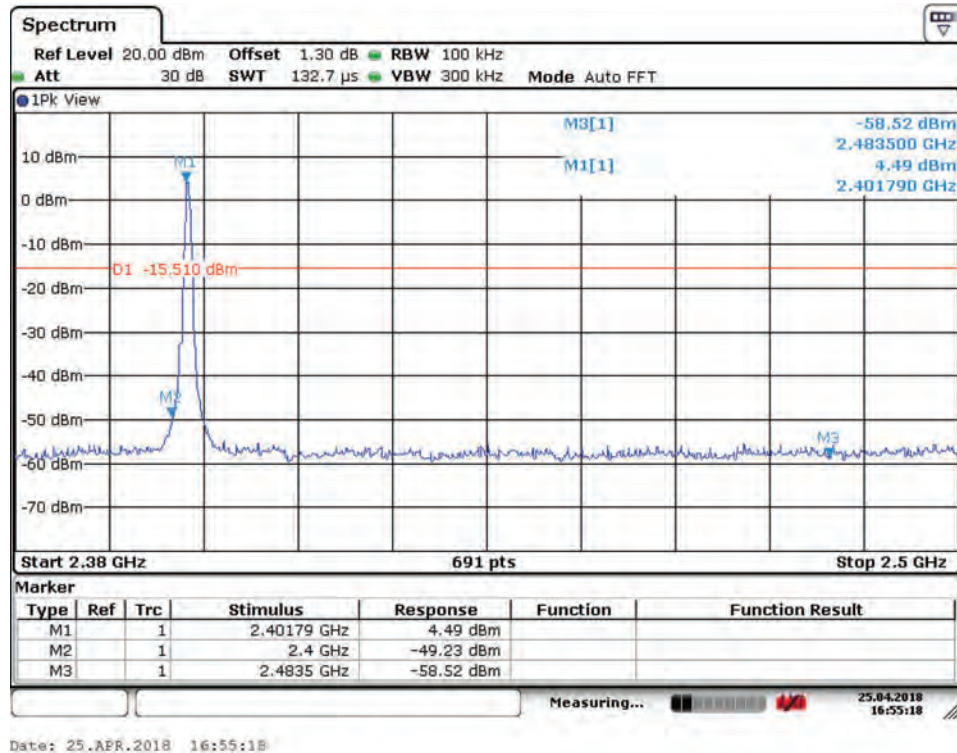
### Low Channel



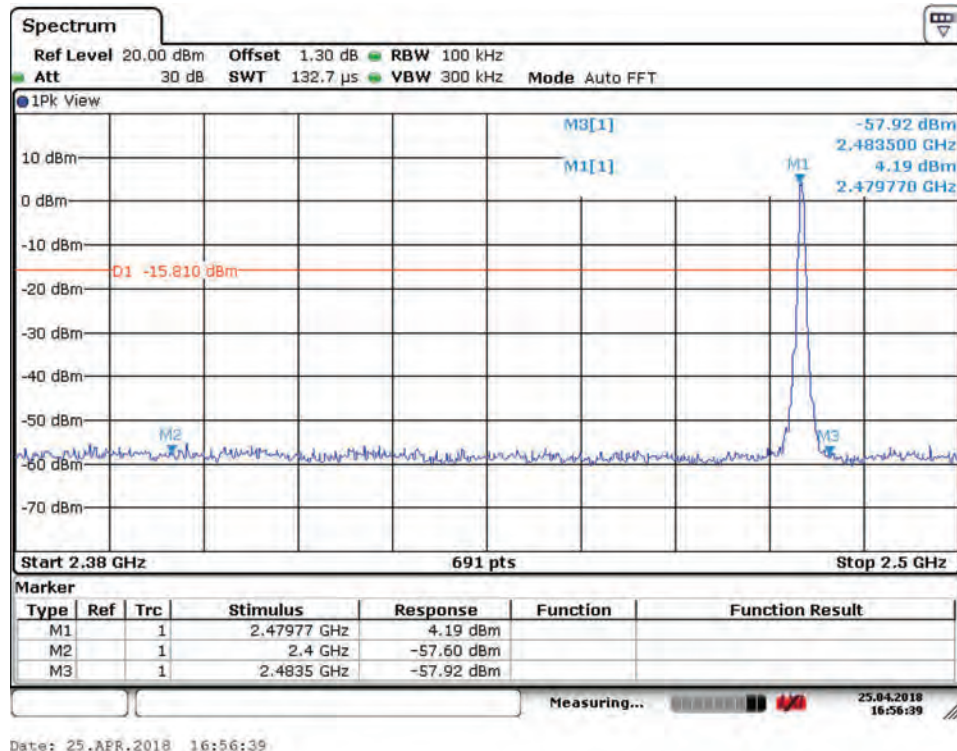
**Middle Channel**

**High Channel**


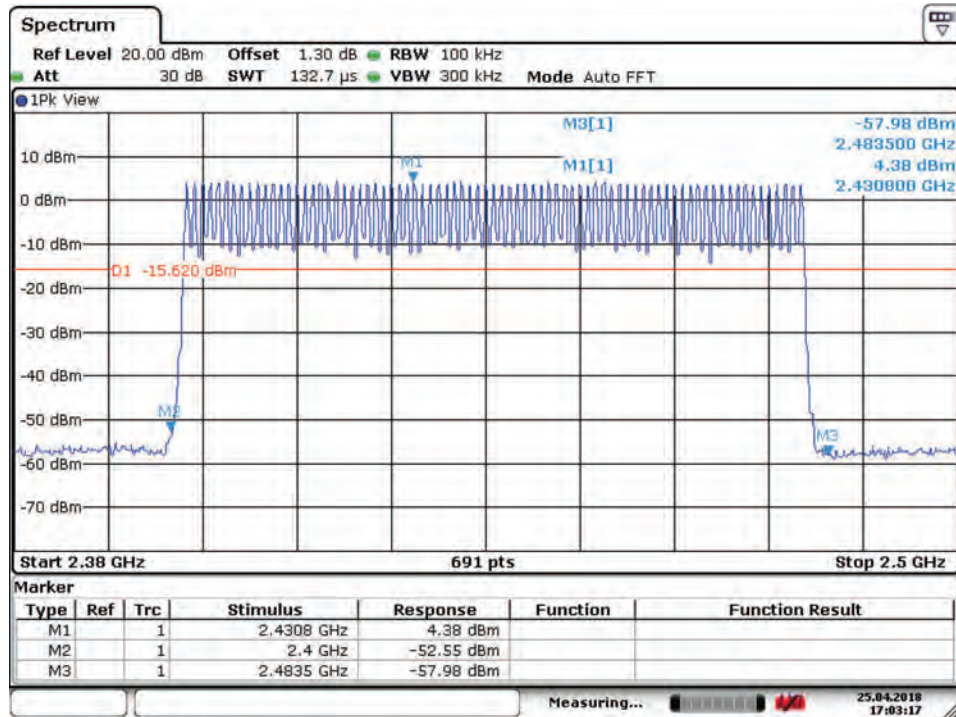
## Test Plot of 100kHz Bandwidth of Frequency Band Edge, GFSK modulation

### Low Channel



### High Channel

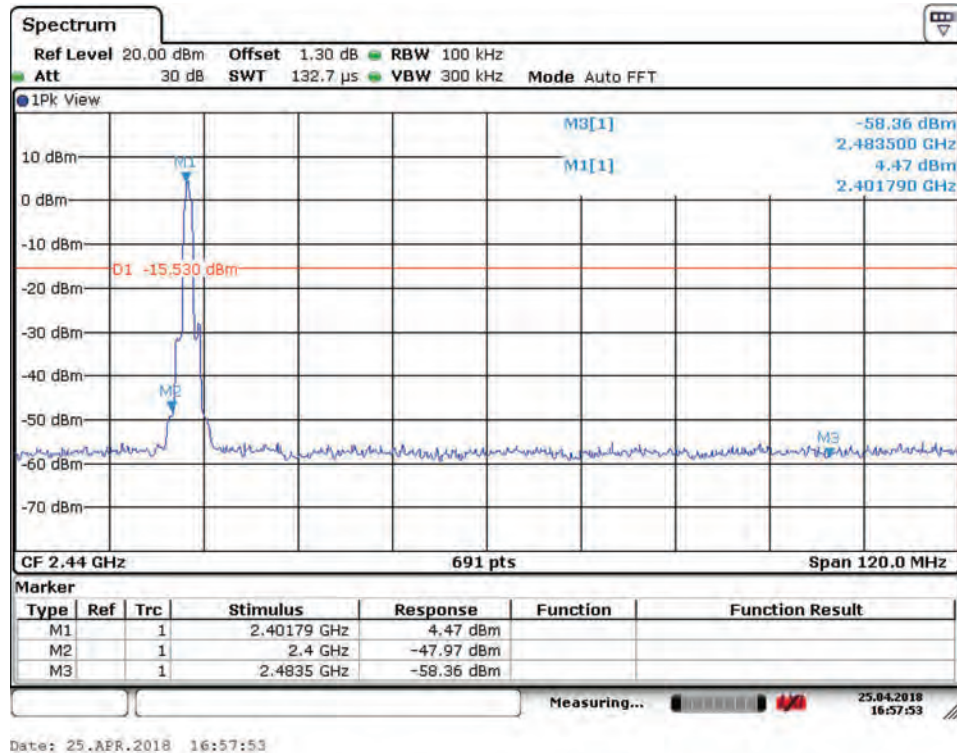


**Hopping ON**


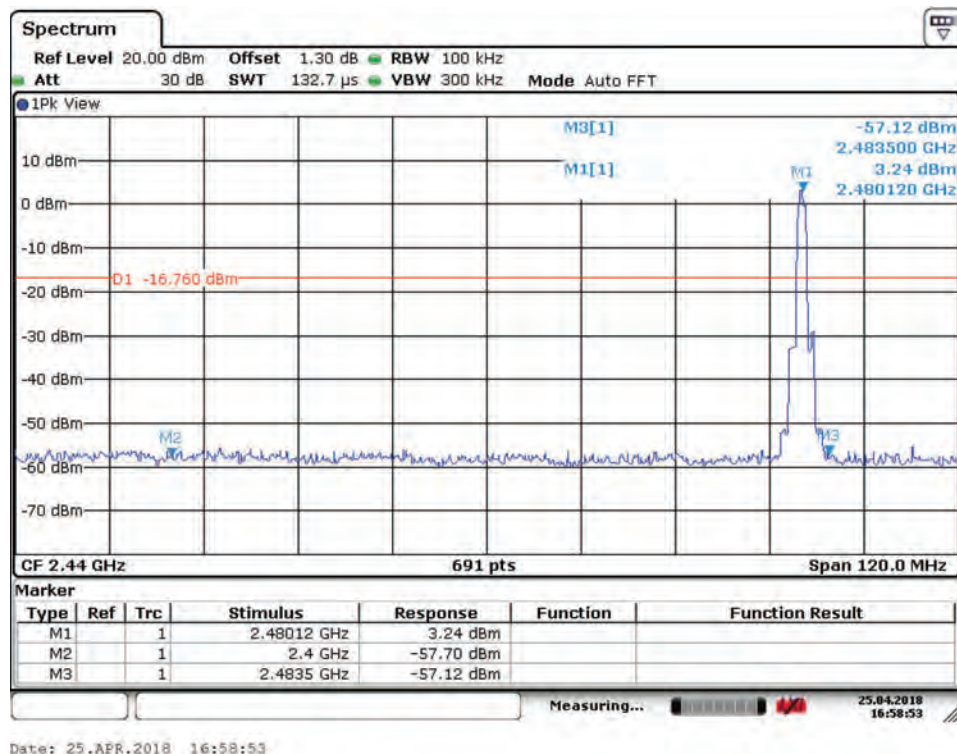
Date: 25.APR.2018 17:03:17

## Test Plot of 100kHz Bandwidth of Frequency Band Edge, 8DPSK modulation

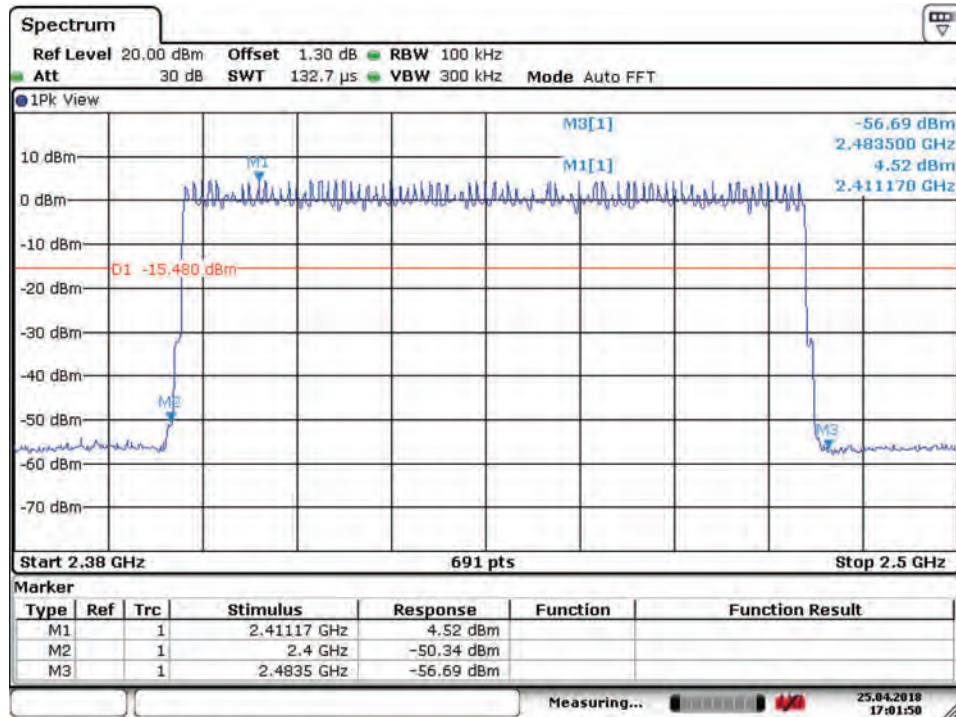
### Low Channel



### High Channel



### Hopping ON



Date: 25.APR.2018 17:01:49

## 5.1.6 Spurious Emission

### RESULT:

**Passed**

Test standard : FCC part 15.247(d), FCC 15.205, FCC 15.209, RSS-210 2.2, RSS-247 5.5 and RSS-Gen 8.9

Basic standard : ANSI C63.10  
Limits : Radiated emissions which fall in the restricted bands, as defined in FCC 15.205(a) and RSS-Gen i4, 8.9 (Table 6), must comply with the radiated emission limits specified in FCC 15.209(a) and RSS-Gen i4, 8.9 (Table 4 and 5).  
Emission radiated outside the specified frequency bands must comply with the radiated emission limits specified in FCC 15.209(a) and FCC 15.249(a), RSS-Gen i4, 8.9 (Table 4 and 5) and RSS-210 A2.9(a).

Kind of test site : 3m Semi-Anechoic Chamber

### Test setup

Test Channel : Low/ Middle/ High  
Operation Mode : A, B

Remark: Testing was carried out within frequency range 30MHz to the tenth harmonic. For details refer to Appendix D. The Radiated Emissions testing was performed in the X, Y and Z axis orientation. The worst-case Axis orientation is recorded in this test report. Due to the small size of the product and that there are no inductive components of significant size, 9kHz to 30MHz frequency range is not tested based on technical judgment.

### 5.1.7 Frequency Separation

**RESULT:**
**Passed**

Test standard : FCC part 15.247(a)(1)  
 RSS-247 5.1

Basic standard : ANSI C63.10:2013

Limit :  $\geq 25\text{kHz}$  or  $2/3$  of  $20\text{dB}$  bandwidth, whichever is greater

**Test setup**

Test Channel : Middle

Operation Mode : A

Ambient temperature :  $24^{\circ}\text{C}$

Relative humidity : 53%

**Table 13: Test result of Frequency Separation (GFSK)**

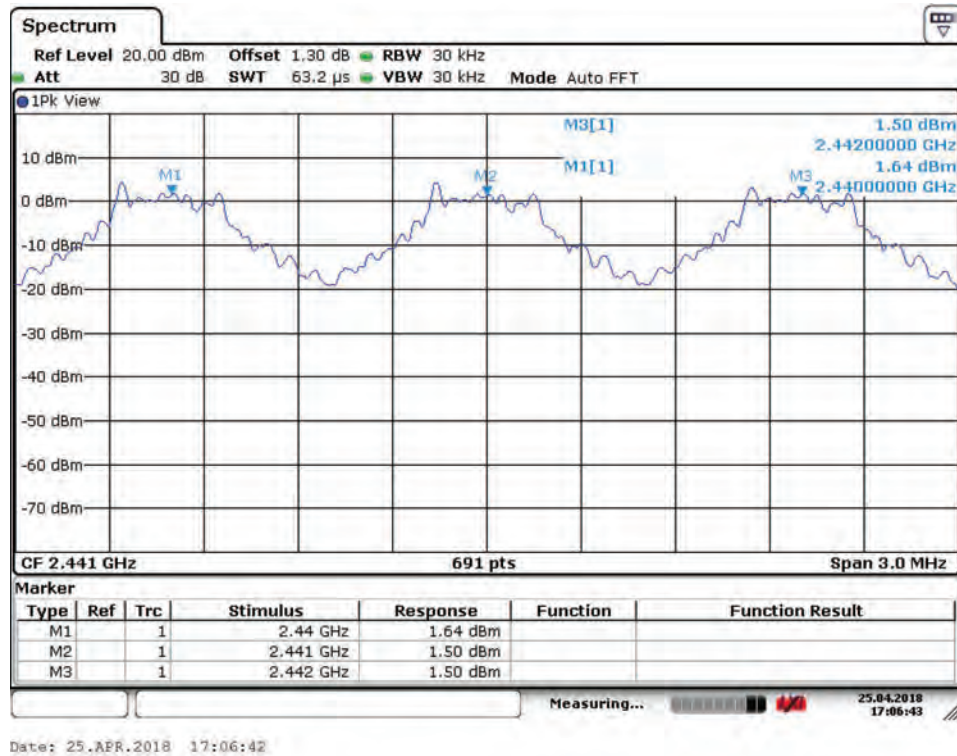
| Channel              | Channel Frequency (MHz) | Measured Channel Separation (MHz) | Limit (kHz)                                             | Result |
|----------------------|-------------------------|-----------------------------------|---------------------------------------------------------|--------|
| Record Channel       | 2441                    | 1                                 | $\geq 25\text{kHz}$ or $2/3$ of $20\text{dB}$ bandwidth | Pass   |
| Record Channel adj 1 | 2440                    |                                   |                                                         |        |
| Record Channel adj 2 | 2442                    |                                   |                                                         |        |

**Table 14: Test result of Frequency Separation (8DPSK)**

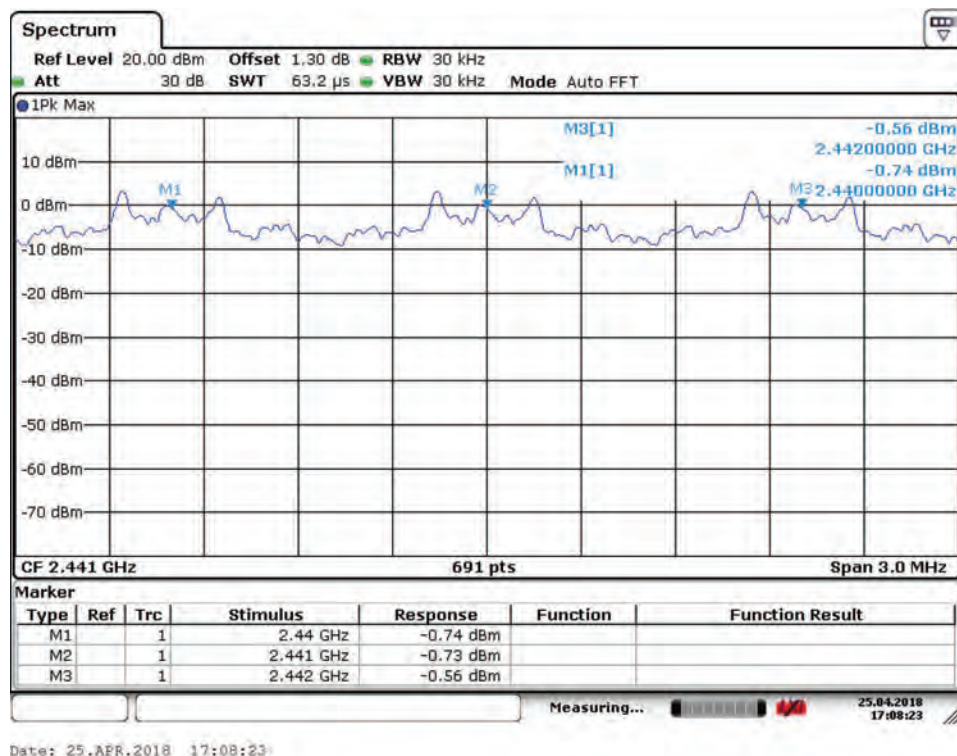
| Channel              | Channel Frequency (MHz) | Measured Channel Separation (MHz) | Limit (kHz)                                             | Result |
|----------------------|-------------------------|-----------------------------------|---------------------------------------------------------|--------|
| Record Channel       | 2441                    | 1                                 | $\geq 25\text{kHz}$ or $2/3$ of $20\text{dB}$ bandwidth | Pass   |
| Record Channel adj 1 | 2440                    |                                   |                                                         |        |
| Record Channel adj 2 | 2442                    |                                   |                                                         |        |

## Test Plot of Frequency Separation

### GFSK



### 8DPSK



**5.1.8 Number of hopping frequency****RESULT:****Passed**Test standard : FCC part 15.247(a)(1)(iii)  
RSS-247 5.1(5)

Basic standard : ANSI C63.10:2013

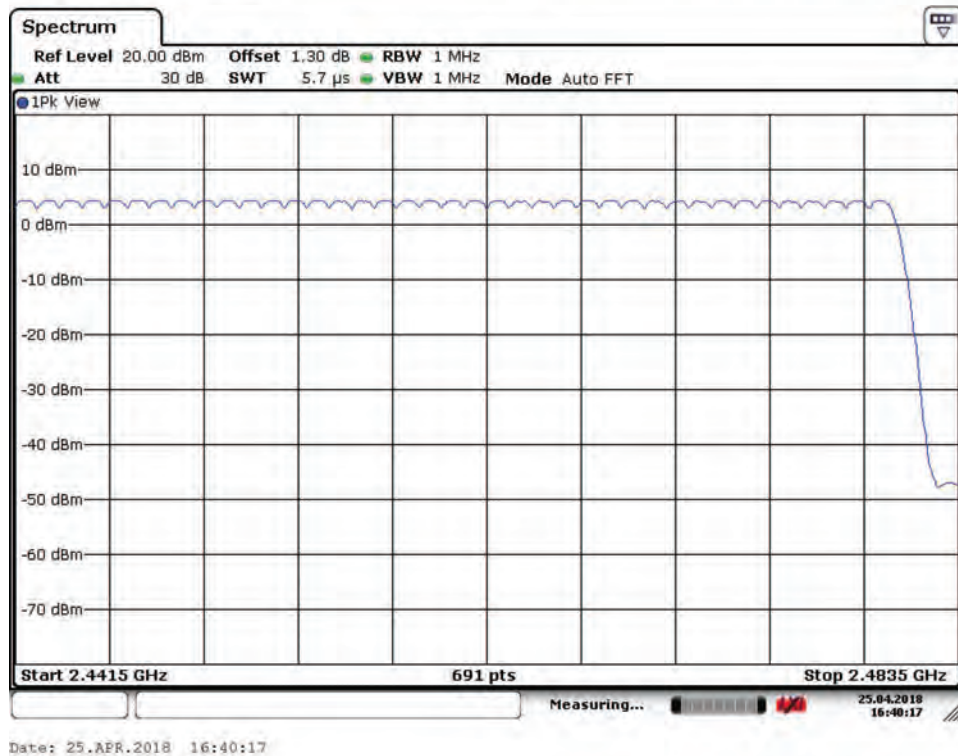
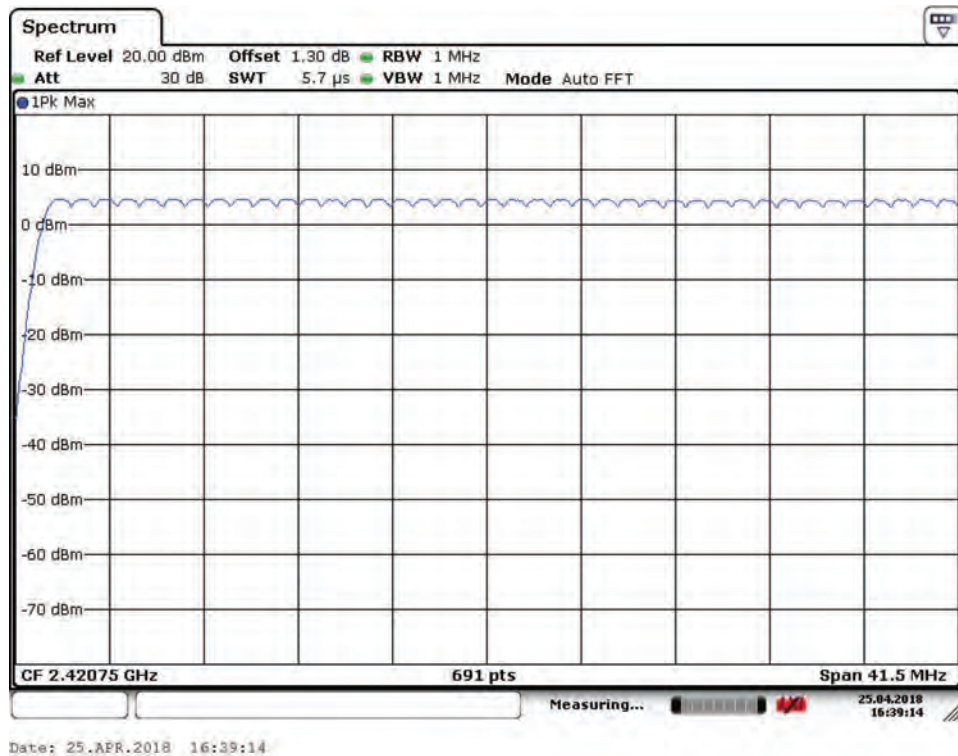
**Test setup**

Test Channel : Hopping On

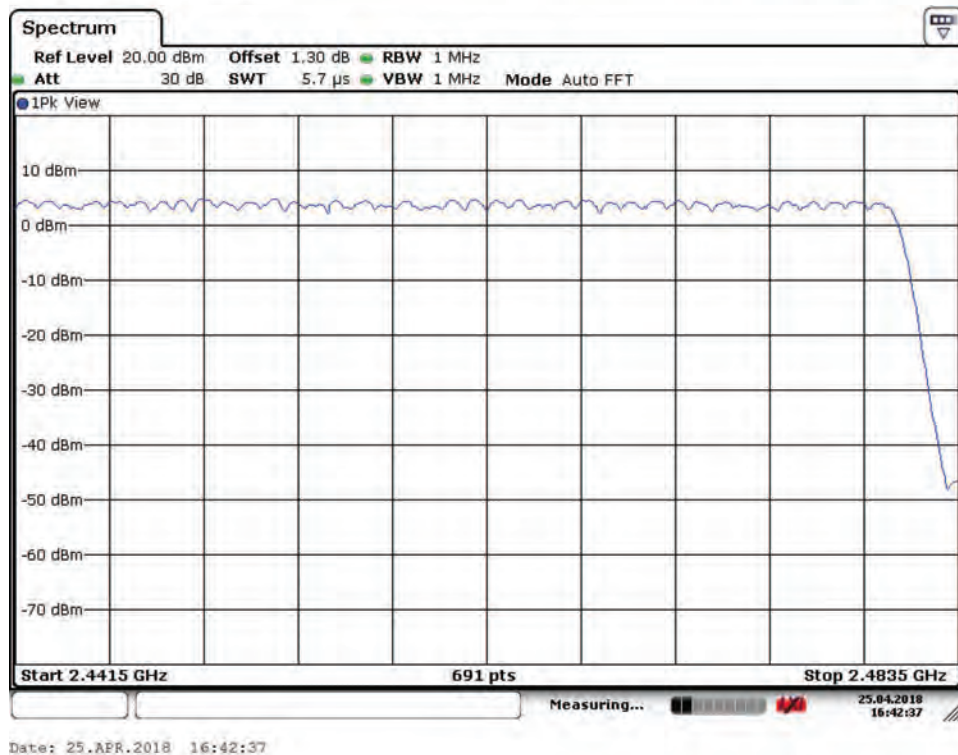
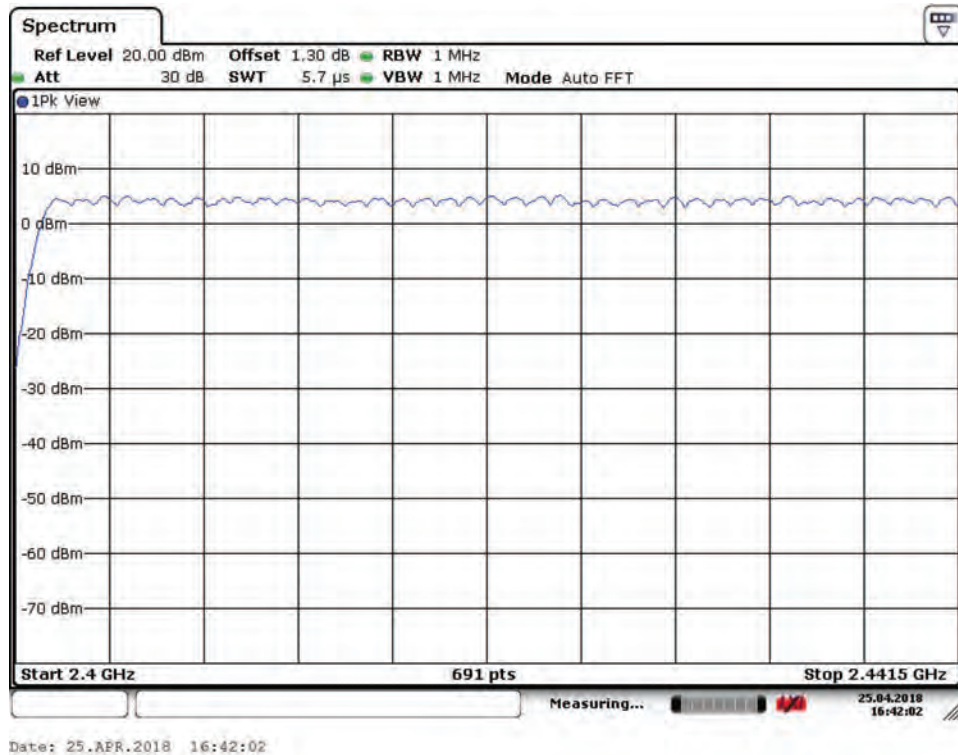
Ambient temperature : 22-26°C  
Relative humidity : 50-65%  
Atmospheric pressure : 100-103 kPa**Table 15: Test result of Number of hopping frequency**

| Frequency Range                  | Measured Quantity of Hopping Channel | Limit | Result |
|----------------------------------|--------------------------------------|-------|--------|
| <u>2400</u> to <u>2483.5</u> MHz | 79                                   | ≥15   | Pass   |

## Test Plot of Number of hopping frequencies GFSK



## 8DPSK



### 5.1.9 Time of Occupancy

**RESULT:**
**Passed**

Test standard : FCC part 15.247(a)(1)(iii)  
 RSS-247 5.1(5)

Basic standard : ANSI C63.10:2013

Limits : 0.4s

Kind of test site : Shield room

**Test setup**

Test Channel : Low

Operation Mode : A

Ambient temperature : 22-26°C

Relative humidity : 50-65%

Atmospheric pressure : 100-103 kPa

**Table 16: Test result of Time of Occupancy**

| Data Mode | Captured Burst (s) | Dwell time (s) | On+Off time (s) | Limit (s) | Result |
|-----------|--------------------|----------------|-----------------|-----------|--------|
| DH5       | 0.00294            | 0.3138         | 0.00377         | 0.4       | Pass   |
| 3DH5      | 0.00293            | 0.375          | 0.00375         | 0.4       | Pass   |

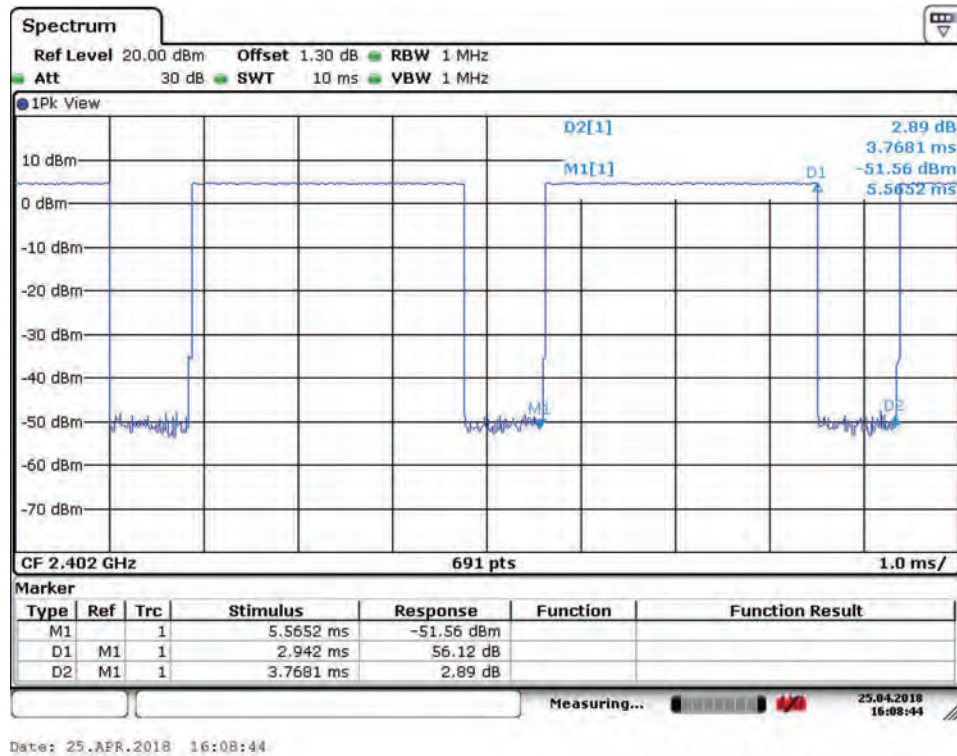
Note:

Dwell time = Pulse width x (Hopping rate / Number of channels) x Period

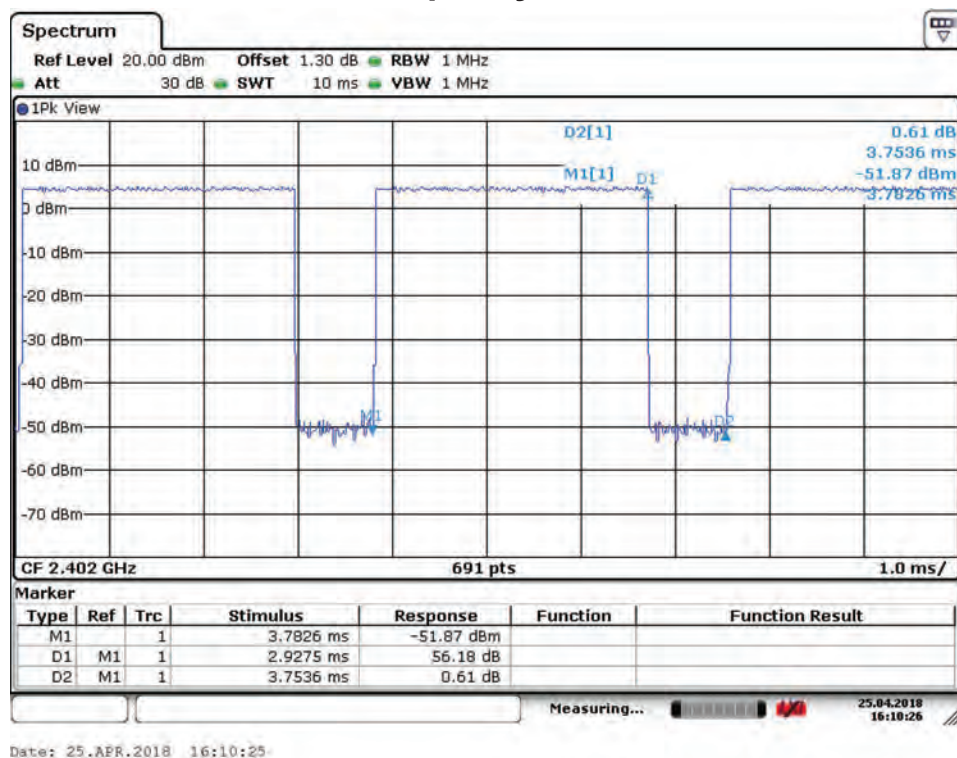
Period = 0.4 (seconds/ channel) x 79 (channel) = 31.6 seconds.

Hopping rate = 1 / (On+Off time) = 266 Hz

## Test Plot of Time of Occupancy, GFSK modulation



## Test Plot of Time of Occupancy, 8DPSK modulation



## 5.2 Mains Emissions

### 5.2.1 Mains Conducted Emissions

**RESULT:****Passed**

Test standard : FCC Part 15.207  
FCC Part 15.107  
RSS-Gen 8.8

Limits : Mains Conducted emissions as defined in  
above test standards must comply with the  
mains conducted emission limits specified

Kind of test site : Shielded Room

**Test setup**

Test Channel : Middle  
Operation mode : A

Remark: For details refer to Appendix D.

## 6. Safety Human exposure

### 6.1 Radio Frequency Exposure Compliance

#### 6.1.1 Electromagnetic Fields

**RESULT:****Passed**

Test standard : FCC KDB Publication 447498 D01  
RSS-102 issue 5, Table 1

FCC:

Since maximum peak output power of the transmitter is  $3.3651\text{mW} < 10\text{mW}$ , hence the EUT is excluded from SAR evaluation according to FCC KDB publication 447498: Mobile Portable RF Exposure

Canada:

Maximum conducted peak power: 3.3651mW

-----  
Antenna Gain: 2.459dbi -> 1.76157

Maximum EIRP available 5.927 mW

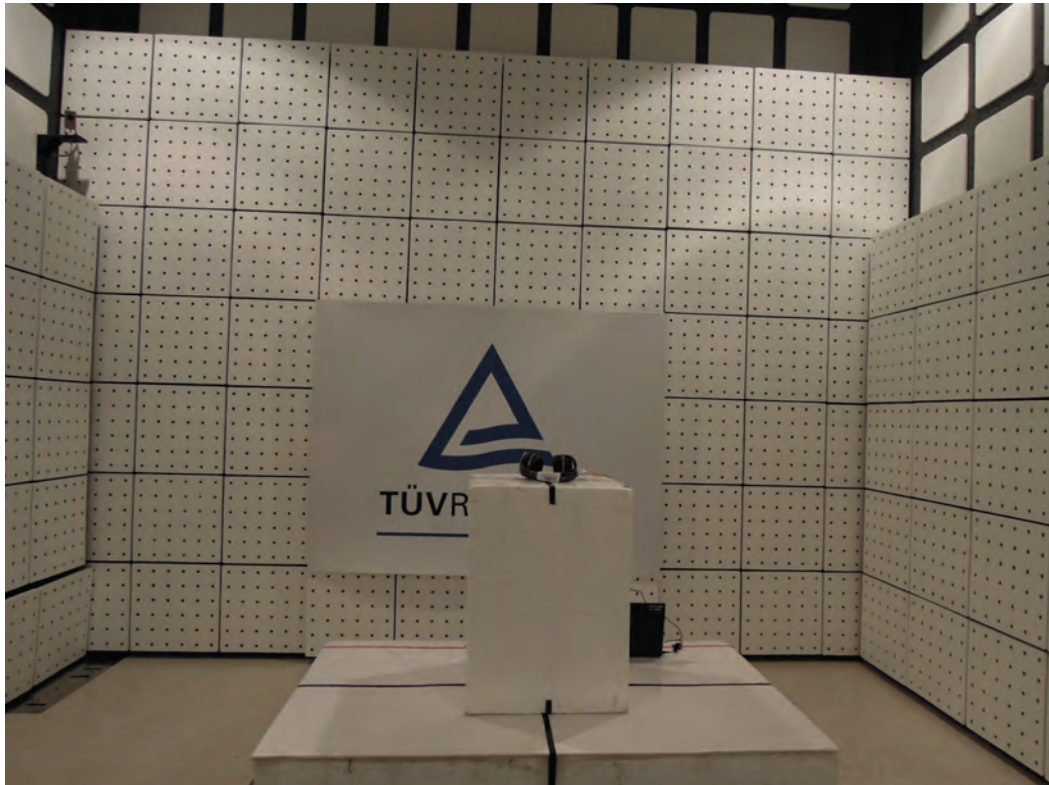
=====  
Maximum Power available: 5.927 mW  
(higher of EIRP or conducted)

Since maximum output power of the transmitter is  $5.927\text{mW} < 7\text{mW}$ , hence the EUT is excluded from SAR evaluation according to Table 1 in RSS-102

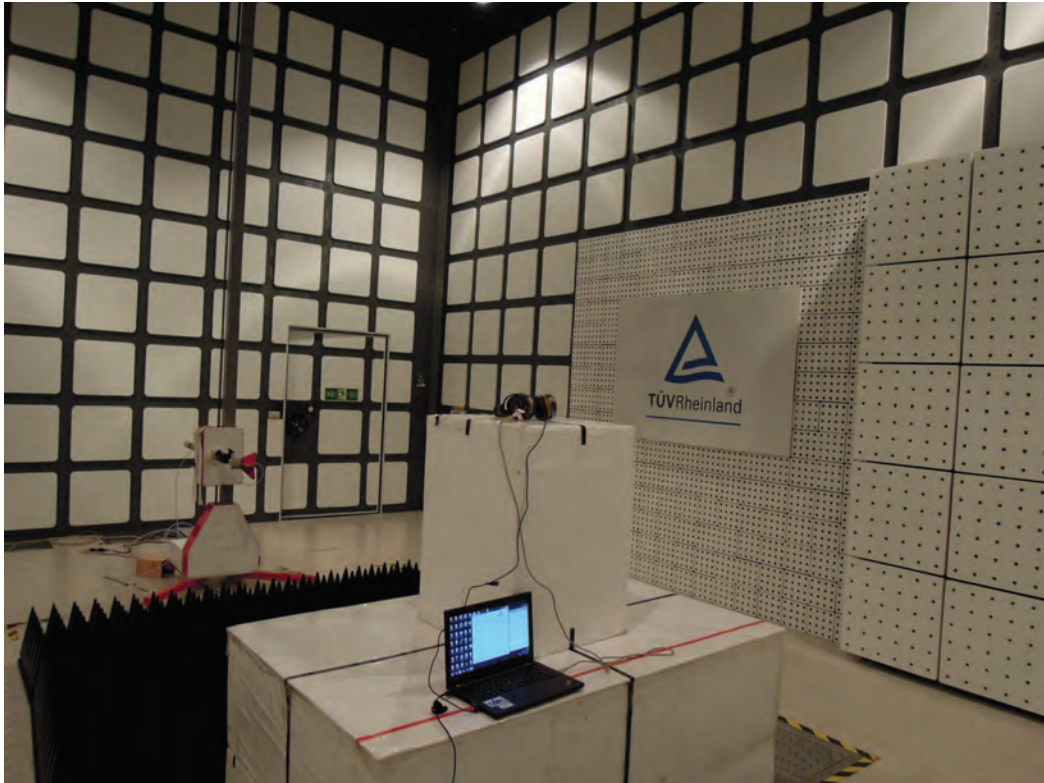
The enclosure outer surface has minimum 10mm distance to the RF antenna.  
So it's guaranteed that distance between the RF antenna and the human body is more than 10mm.

## 7. Photographs of the Test Set-Up

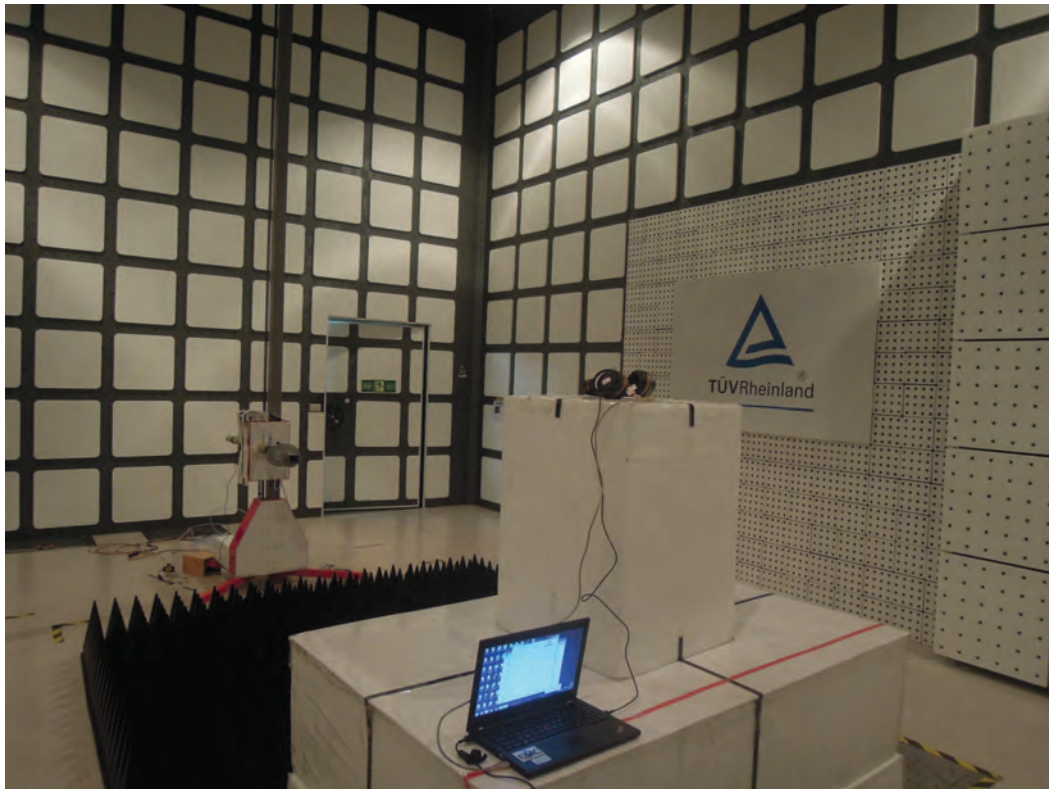
Photograph 1: Set-up for Spurious Emissions (Front View)



**Photograph 2: Set-up for Spurious Emissions (Back View 1)**



**Photograph 3: Set-up for Spurious Emissions (Back View 2)**



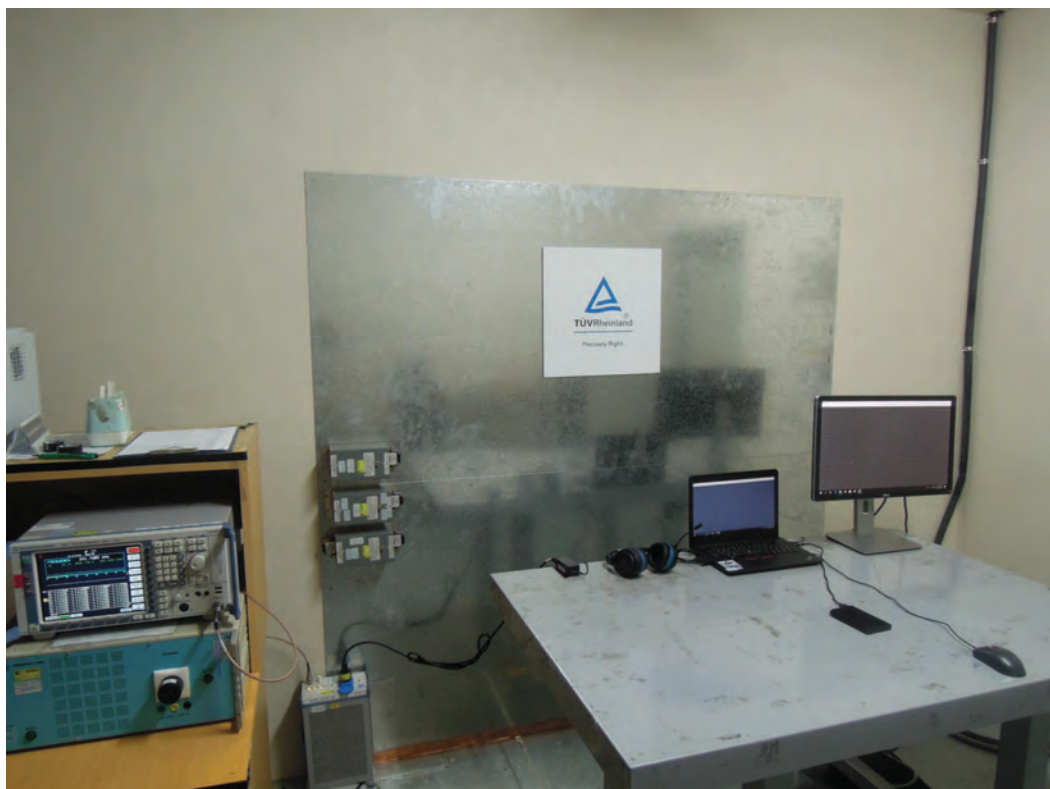
**Photograph 4: Set-up for Conducted testing**



**Photograph 5: Set-up for Mains Conducted testing (Back View)**



**Photograph 6: Set-up for Mains Conducted testing (Front)**



## 8. List of Tables

|                                                                  |    |
|------------------------------------------------------------------|----|
| Table 1: Applied Standard and Test Levels .....                  | 5  |
| Table 2: List of Test and Measurement Equipment .....            | 7  |
| Table 3: Emission Measurement Uncertainty.....                   | 8  |
| Table 4: Basic Information of EUT .....                          | 9  |
| Table 5: Technical Specification of EUT .....                    | 9  |
| Table 6: Frequency hopping information.....                      | 10 |
| Table 7: Test result of Peak Output Power, GFSK modulation.....  | 16 |
| Table 8: Test result of Peak Output Power, 8DPSK modulation..... | 16 |
| Table 9: Test result of 20dB Bandwidth, GFSK modulation.....     | 17 |
| Table 10: Test result of 20dB Bandwidth, 8DPSK modulation.....   | 17 |
| Table 11: Test result of 99% Bandwidth, GFSK modulation .....    | 21 |
| Table 12: Test result of 99% Bandwidth, PSK modulation.....      | 21 |
| Table 13: Test result of Frequency Separation (GFSK).....        | 32 |
| Table 14: Test result of Frequency Separation (8DPSK).....       | 32 |
| Table 15: Test result of Number of hopping frequency .....       | 34 |
| Table 16: Test result of Time of Occupancy.....                  | 37 |

## 9. List of Photographs

|                                                                   |    |
|-------------------------------------------------------------------|----|
| Photograph 1: Set-up for Spurious Emissions (Front View).....     | 41 |
| Photograph 2: Set-up for Spurious Emissions (Back View 1) .....   | 42 |
| Photograph 3: Set-up for Spurious Emissions (Back View 2) .....   | 43 |
| Photograph 4: Set-up for Conducted testing .....                  | 43 |
| Photograph 5: Set-up for Mains Conducted testing (Back View)..... | 44 |
| Photograph 6: Set-up for Mains Conducted testing (Front).....     | 44 |