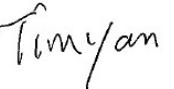


Test report No: 4393390.54

## TEST REPORT

### Radio Spectrum Matters (RF)

|                                 |                                                                                                    |
|---------------------------------|----------------------------------------------------------------------------------------------------|
| Identification of item tested   | Filter Reading Matte Box System                                                                    |
| Trademark                       | Light Widow LLC                                                                                    |
| Model and /or type reference    | FRS-Light V1                                                                                       |
| FCC ID                          | 2A8WP-FRSLV1                                                                                       |
| Contains FCC ID                 | YCP-STM32WB5M001                                                                                   |
| Features                        | Charging input: 5 Vdc<br>Li-ion Battery: 3.7 Vdc                                                   |
| Applicant's name / address      | Light Widow LLC<br>31 Chaparral Circle, Glenwood Springs, Colorado, 81601, USA                     |
| Test method requested, standard | FCC CFR Title 47 Part15 Subpart C Section 15.225;                                                  |
| Verdict Summary                 | COMPLIANCE                                                                                         |
| Tested by (name & signature)    | <br>Jazz Liang |
| Approved by (name & signature)  | <br>Tim Yan    |
| Date of issue                   | 2022-09-27                                                                                         |
| Report template No              | TRF_EMC 2017-06-others                                                                             |

## INDEX

|                                                                       | page |
|-----------------------------------------------------------------------|------|
| General conditions .....                                              | 3    |
| Uncertainty .....                                                     | 3    |
| Environmental conditions .....                                        | 3    |
| Possible test case verdicts .....                                     | 3    |
| Definition of symbols used in this test report .....                  | 4    |
| Abbreviations .....                                                   | 4    |
| Document History .....                                                | 4    |
| Remarks and Comments .....                                            | 4    |
| 1 General Information .....                                           | 5    |
| 1.1 General Description of the Item(s) .....                          | 5    |
| 1.2 Test data .....                                                   | 8    |
| 1.3 The environment(s) in which the EUT is intended to be used .....  | 8    |
| 2 Description of Test Setup .....                                     | 9    |
| 2.1 Operating mode(s) used for tests .....                            | 9    |
| 2.2 Support / Auxiliary equipment / unit / software for the EUT ..... | 9    |
| 2.3 Test Configuration / Block diagram used for tests .....           | 9    |
| 2.4 Measurement procedure .....                                       | 9    |
| 3 Verdict summary section .....                                       | 10   |
| 3.1 Standards .....                                                   | 10   |
| 3.2 Deviation(s) from the Standard(s) / Test Specification(s) .....   | 10   |
| 3.3 Overview of results .....                                         | 10   |
| 4 Transmitter Test Results .....                                      | 11   |
| 4.1 AC Power Line Conducted Emission .....                            | 11   |
| 4.2 Radidated Emissions .....                                         | 14   |
| 4.3 20dB Bandwidth .....                                              | 21   |
| 4.4 Emission Mask .....                                               | 23   |
| 4.5 Frequency tolerance .....                                         | 28   |
| 5 Identification of the Equipment Under Test .....                    | 30   |
| Annex 1 – Measurement Uncertainty .....                               | 31   |
| Annex 2 - Used Equipment .....                                        | 32   |
| Annex 3 - Test Photos .....                                           | 33   |

## GENERAL CONDITIONS

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or Competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA.
5. This report will not be used for social proof function in China market.

## UNCERTAINTY

For all measurements where guidance for the calculation of the instrumentation uncertainty of a measurement is specified in EN 55016-4-2 (CISPR 16-4-2), EN/IEC 61000-4 series or a product standard, the measurement instrumentation uncertainty has been calculated and applied in accordance with these standards.

Uncertainties have been calculated according to the DEKRA internal document. The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of  $k=2$ , providing a level of confidence of approximately 95%.

## ENVIRONMENTAL CONDITIONS

The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:

|                       |                  |
|-----------------------|------------------|
| Ambient temperature   | 15 °C – 35 °C    |
| Relative Humidity air | 30% - 60%        |
| Atmospheric pressure  | 86 kPa – 106 kPa |

If explicitly required in the basic standard or applied product / product family standard the climatic values are recorded and documented separately in this test report.

## POSSIBLE TEST CASE VERDICTS

|                                         |                 |
|-----------------------------------------|-----------------|
| Test case does not apply to test object | N/A             |
| Test object does meet requirement       | P (Pass) / PASS |
| Test object does not meet requirement   | F (Fail) / FAIL |
| Not tested                              | N/T             |

## DEFINITION OF SYMBOLS USED IN THIS TEST REPORT

|                                                                                                                                        |                                     |           |                                    |
|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-----------|------------------------------------|
| <input checked="" type="checkbox"/> Indicates that the listed condition, standard or equipment is applicable for this report/test/EUT. |                                     |           |                                    |
| <input type="checkbox"/> Indicates that the listed condition, standard or equipment is not applicable for this report/test/EUT.        |                                     |           |                                    |
| Decimal separator used in this report                                                                                                  | <input checked="" type="checkbox"/> | Comma (,) | <input type="checkbox"/> Point (.) |

## ABBREVIATIONS

For the purposes of the present document, the following abbreviations apply:

|       |   |                             |
|-------|---|-----------------------------|
| EUT   | : | Equipment Under Test        |
| QP    | : | Quasi-Peak                  |
| CAV   | : | CISPR Average               |
| AV    | : | Average                     |
| CDN   | : | Coupling Decoupling Network |
| SAC   | : | Semi-Anechoic Chamber       |
| OATS  | : | Open Area Test Site         |
| BW    | : | Bandwidth                   |
| AM    | : | Amplitude Modulation        |
| PM    | : | Pulse Modulation            |
| HCP   | : | Horizontal Coupling Plane   |
| VCP   | : | Vertical Coupling Plane     |
| $U_N$ | : | Nominal voltage             |
| $T_x$ | : | Transmitter                 |
| $R_x$ | : | Receiver                    |
| N/A   | : | Not Applicable              |
| N/M   | : | Not Measured                |

## DOCUMENT HISTORY

| Report nr. | Date       | Description    |
|------------|------------|----------------|
| 4393390.54 | 2022-09-27 | First release. |
|            |            |                |

## REMARKS AND COMMENTS

The equipment under test (EUT) does meet the essential requirements of the stated standard(s)/test(s).

## 1 GENERAL INFORMATION

### 1.1 General Description of the Item(s)

|                               |                                                  |
|-------------------------------|--------------------------------------------------|
| Description of the item ..... | Filter Reading Matte Box System                  |
| Trademark.....                | Light Widow LLC                                  |
| Model / Type number.....      | FRS-Light V1                                     |
| FCC ID .....                  | 2A8WP-FRSLV1                                     |
| Hardware .....                | FRSLEB010C                                       |
| Software.....                 | N/A                                              |
| Firmware .....                | 3.2.5                                            |
| Contains FCC ID.....          | YCP-STM32WB5M001                                 |
| Ratings.....                  | Charging input: 5 Vdc<br>Li-ion Battery: 3.7 Vdc |
| Manufacturer.....             | Same as applicant                                |
| Factory .....                 | Same as applicant                                |

| Rated power supply ..... | Voltage and Frequency                                   | Reference poles          |                          |                          |                          |                          |
|--------------------------|---------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                          |                                                         | L1                       | L2                       | L3                       | N                        | PE                       |
|                          | <input type="checkbox"/> AC:                            | <input type="checkbox"/> |
|                          | <input checked="" type="checkbox"/> DC: 5V              |                          |                          |                          |                          |                          |
|                          | <input checked="" type="checkbox"/> Battery: 3.7V       |                          |                          |                          |                          |                          |
| Mounting position.....   | <input type="checkbox"/> Table top equipment            |                          |                          |                          |                          |                          |
|                          | <input type="checkbox"/> Wall/Ceiling mounted equipment |                          |                          |                          |                          |                          |
|                          | <input type="checkbox"/> Floor standing equipment       |                          |                          |                          |                          |                          |
|                          | <input checked="" type="checkbox"/> Hand-held equipment |                          |                          |                          |                          |                          |
|                          | <input type="checkbox"/> Other:                         |                          |                          |                          |                          |                          |

Declared by manufacturer, the NFC module is the transceiver which need be provocative.

the characteristics of NFC module:

|                             |             |          |
|-----------------------------|-------------|----------|
| Operating Frequency         | 13.56 MHz   |          |
| Operating Temperature Range | -40 – 85 °C |          |
| Modulation                  | ASK         |          |
| Antenna Assembly            | Type        | Integral |
|                             | Gain        | 2 dBi    |

The characteristic of wireless chip(BLE mode)

|                                   |                     |
|-----------------------------------|---------------------|
| Contains FCC ID.....              | YCP-STM32WB5M001    |
| Operating frequency range(s)..... | 2402 MHz – 2480 MHz |
| Type of Modulation .....          | GFSK                |
| Maximum e.i.r.p .....             | 5.9 dBm             |
| Antenna type.....                 | Integral Antenna    |
| Operating Temperature Range.....  | -40 – 85 °C         |
| BT version.....                   | N/A                 |
| Antenna gain.....                 | 2.0 dBi             |
| Adaptivity/ Non-adaptivity .....  | Adaptivity          |

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|---------|-----------------|
| 0       | 2402            | 14      | 2430            | 28      | 2458            |
| 1       | 2404            | 15      | 2432            | 29      | 2460            |
| 2       | 2406            | 16      | 2434            | 30      | 2462            |
| 3       | 2408            | 17      | 2436            | 31      | 2464            |
| 4       | 2410            | 18      | 2438            | 32      | 2466            |
| 5       | 2412            | 19      | 2440            | 33      | 2468            |
| 6       | 2414            | 20      | 2442            | 34      | 2470            |
| 7       | 2416            | 21      | 2444            | 35      | 2472            |
| 8       | 2418            | 22      | 2446            | 36      | 2474            |
| 9       | 2420            | 23      | 2448            | 37      | 2476            |
| 10      | 2422            | 24      | 2450            | 38      | 2478            |
| 11      | 2424            | 25      | 2452            | 39      | 2480            |
| 12      | 2426            | 26      | 2454            | -       | -               |
| 13      | 2428            | 27      | 2456            | -       | -               |

Intended use of the Equipment Under Test (EUT)

The apparatus as supplied for the test is Filter Reading Matte Box System, which intended for residential use, the product contains electronic control circuitry but without earth connection.

After technical evaluation, model FRS-Light V1 was chosen for full testing.

Copy of marking plate:

No provide.

## 1.2 Test data

|                                  |                                                                                                                                                                                 |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Location                    | DEKRA Testing and Certification (Shanghai) Ltd. Guangzhou Branch<br>Block 5, No.3, Qiyun Road, Huangpu District, Guangzhou, Guangdong, China<br>FCC Designation Number: CN1324; |
| Date of receipt of test item     | 2022-08-24                                                                                                                                                                      |
| Date (s) of performance of tests | 2022-08-24 to 2022-09-20                                                                                                                                                        |
| Test sample                      | Normal sample: FRS-Light V1 (S/N:C1)                                                                                                                                            |

## 1.3 The environment(s) in which the EUT is intended to be used

The equipment under test (EUT) is intended to be used in the following environment(s):

|                                     |                                              |
|-------------------------------------|----------------------------------------------|
| <input checked="" type="checkbox"/> | Residential (domestic) environment.          |
| <input checked="" type="checkbox"/> | Commercial and light-industrial environment. |
| <input type="checkbox"/>            | Industrial environment.                      |

## 2 DESCRIPTION OF TEST SETUP

### 2.1 Operating mode(s) used for tests

During the tests the following operating mode(s) has(have) been used.

| Operating mode | Operating mode description | Used for methos          |                                     |
|----------------|----------------------------|--------------------------|-------------------------------------|
|                |                            | Conducted                | Radiated                            |
| 1              | NFC transmitting mode      | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2              |                            | <input type="checkbox"/> | <input type="checkbox"/>            |
| 3              |                            | <input type="checkbox"/> | <input type="checkbox"/>            |
| 4              |                            |                          |                                     |

Supplemental information: ---

### 2.2 Support / Auxiliary equipment / unit / software for the EUT

The EUT has been tested with the following auxiliary equipment / unit / software:

| Auxiliary equipment / unit / software | Type / Version | Manufacturer | Supplied by |
|---------------------------------------|----------------|--------------|-------------|
| Mobile phone                          | Galaxy A02s    | SAMSUNG      | Client      |
| Adaptor                               | -              | -            | DEKRA       |
|                                       |                |              |             |
|                                       |                |              |             |

Supplemental information: ---

### 2.3 Test Configuration / Block diagram used for tests

Refer to Annex 3.

### 2.4 Measurement procedure

The EUT was controlled by Mobile phone which provided by manufacturer which connected to Mobile phone through the Bluetooth. After connected, run the Apps "LW Cert" supplied by manufacturer to control the EUT work in required test NFC transmitting mode.

### 3 VERDICT SUMMARY SECTION

This chapter presents an overview of standards and results. Refer to the next chapters for details of measured test results and applied test levels.

#### 3.1 Standards

| Standard                                             | Year | Description                                                                                    |
|------------------------------------------------------|------|------------------------------------------------------------------------------------------------|
| FCC CFR Title 47 Part 15<br>Subpart C Section 15.225 | 2022 | Operation within the band 13.110-14.010 MHz.                                                   |
| ANSI C63.10                                          | 2013 | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |

#### 3.2 Deviation(s) from the Standard(s) / Test Specification(s)

The following deviation(s) was / were made from the published requirements of the listed standards: N/A.

#### 3.3 Overview of results

| FCC measurement                       |                        |         |        |
|---------------------------------------|------------------------|---------|--------|
| Requirement – Test case               | Basic standard(s)      | Verdict | Remark |
| AC Power Line Conducted Emission      | FCC 15.207             | PASS    | ---    |
| Radiated Emissions (30MHz-1GHz)       | FCC 15.225(d) & 15.209 | PASS    | ---    |
| Radiated Emissions (9kHz-30MHz)       | FCC 15.225(d) & 15.209 | PASS    | ---    |
| 20dB Bandwidth                        | FCC 15.215             | PASS    | ---    |
| Emission Mask                         | FCC 15.225(a)&(b)&(c)  | PASS    | ---    |
| Frequency tolerance                   | FCC 15.225(e)          | PASS    | ---    |
| Antenna Requirement                   | FCC 15.203             | PASS    | ---    |
| <u>Supplementary information:</u> --- |                        |         |        |

The measurement result is considered in conformance with the requirement if it is within the prescribed limit. It is not necessary to calculate the uncertainty associated with the measurement result.

## 4 TRANSMITTER TEST RESULTS

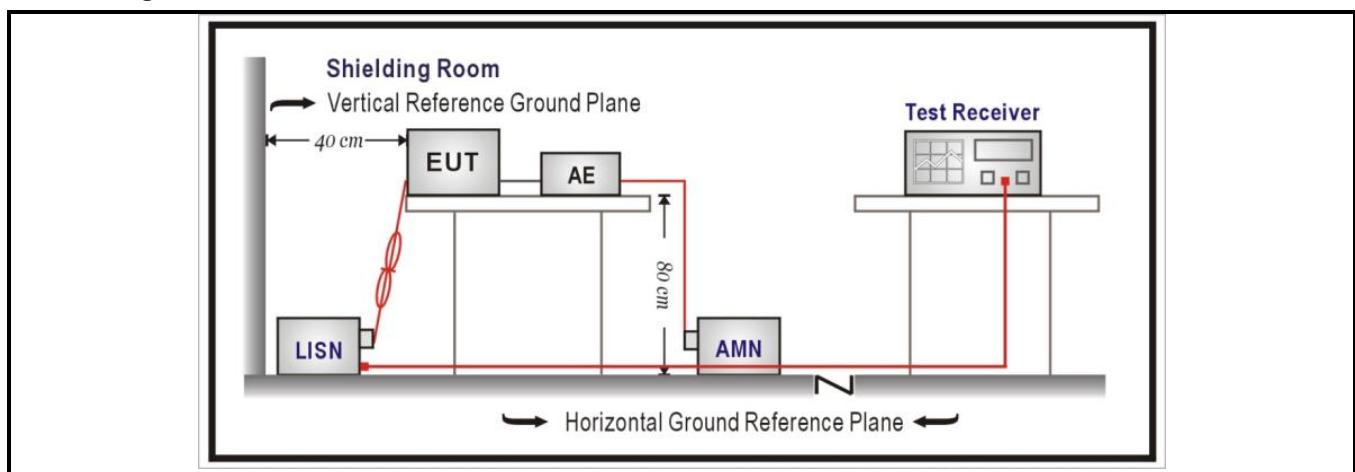
|                                             |                      |
|---------------------------------------------|----------------------|
| <b>4.1 AC Power Line Conducted Emission</b> | <b>VERDICT: PASS</b> |
|---------------------------------------------|----------------------|

### Limits

| FCC Part 15 Subpart C Paragraph 15.207 |                                   |                                   |       |             |
|----------------------------------------|-----------------------------------|-----------------------------------|-------|-------------|
| Frequency range [MHz]                  | Limit: QP [dB(µV) <sup>1)</sup> ] | Limit: AV [dB(µV) <sup>1)</sup> ] | IF BW | Detector(s) |
| 0,15 - 0,50                            | 66 - 56 <sup>2)</sup>             | 56 - 46 <sup>2)</sup>             | 9 KHz | QP, AV      |
| 0,50 - 5,0                             | 56                                | 46                                | 9 KHz | QP, AV      |
| 5,0 - 30                               | 60                                | 50                                | 9 KHz | QP, AV      |

<sup>1)</sup> At the transition frequency, the lower limit applies.  
<sup>2)</sup> The limit decreases linearly with the logarithm of the frequency.

### Test Configuration



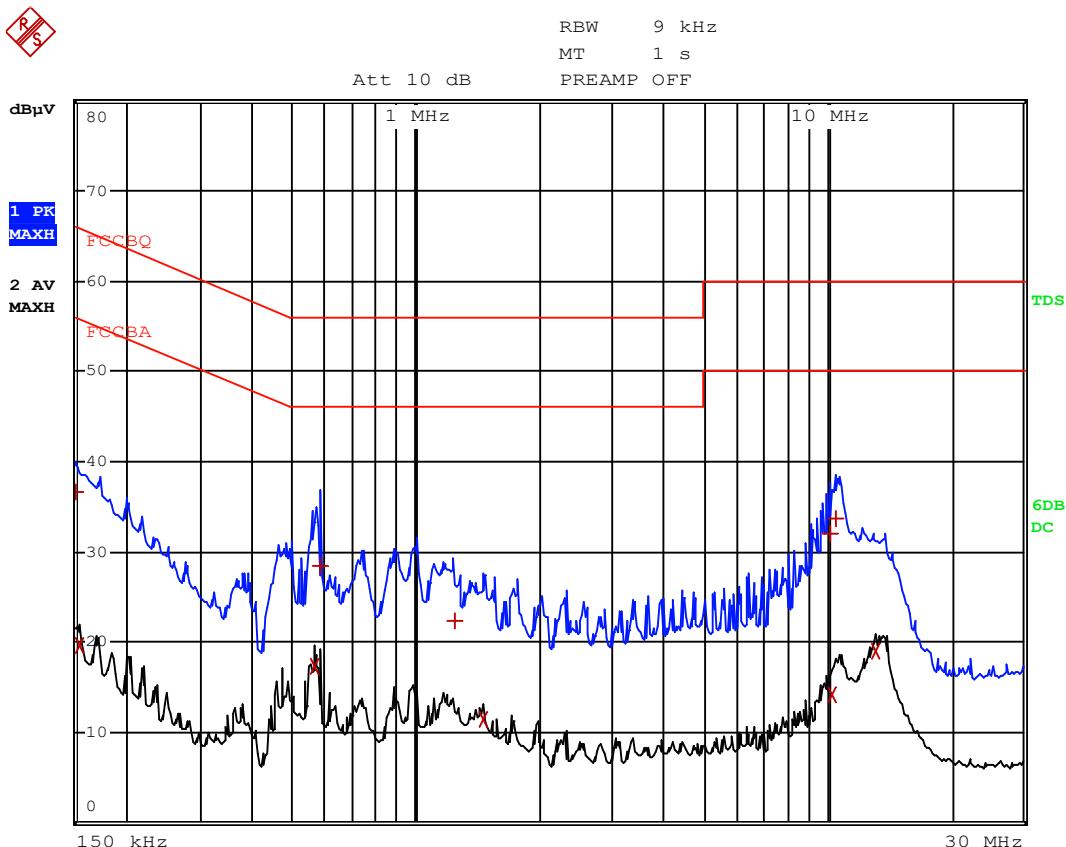
### Performed measurements

| Port under test                                          | Terminal                            |                                     |                                     |                          |                                                         |              |                          |    |  |  |  |  |  |  |  |
|----------------------------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|--------------------------|---------------------------------------------------------|--------------|--------------------------|----|--|--|--|--|--|--|--|
| <input checked="" type="checkbox"/> AC mains input power | <input checked="" type="checkbox"/> | N                                   | <input checked="" type="checkbox"/> | L1                       | <input type="checkbox"/>                                | L2           | <input type="checkbox"/> | L3 |  |  |  |  |  |  |  |
| <input type="checkbox"/> DC input power                  | <input type="checkbox"/>            | Positive (+)                        |                                     |                          | <input type="checkbox"/>                                | Negative (-) |                          |    |  |  |  |  |  |  |  |
| Test method applied                                      |                                     | <input checked="" type="checkbox"/> | Artificial mains network            |                          |                                                         |              |                          |    |  |  |  |  |  |  |  |
|                                                          |                                     | <input type="checkbox"/>            | Voltage probe                       |                          |                                                         |              |                          |    |  |  |  |  |  |  |  |
| Test setup                                               |                                     | <input checked="" type="checkbox"/> | Table top                           | <input type="checkbox"/> | Artificial hand applied                                 |              |                          |    |  |  |  |  |  |  |  |
|                                                          |                                     | <input type="checkbox"/>            | Floor standing                      | <input type="checkbox"/> | Other:<br>Refer to the Annex 2 for test setup photo(s). |              |                          |    |  |  |  |  |  |  |  |
| Operating mode(s) used                                   | Mode 1                              |                                     |                                     |                          |                                                         |              |                          |    |  |  |  |  |  |  |  |
| Envirment condition (temperature; humidiry)              | 23,0 °C; 45,0 %                     |                                     |                                     |                          |                                                         |              |                          |    |  |  |  |  |  |  |  |
| Remark                                                   | ---                                 |                                     |                                     |                          |                                                         |              |                          |    |  |  |  |  |  |  |  |

|                             |                           |
|-----------------------------|---------------------------|
| Operation Mode (worst case) | Mode 1(test with adaptor) |
| Test voltage                | 120 Vac, 60 Hz            |

## Results

### Live



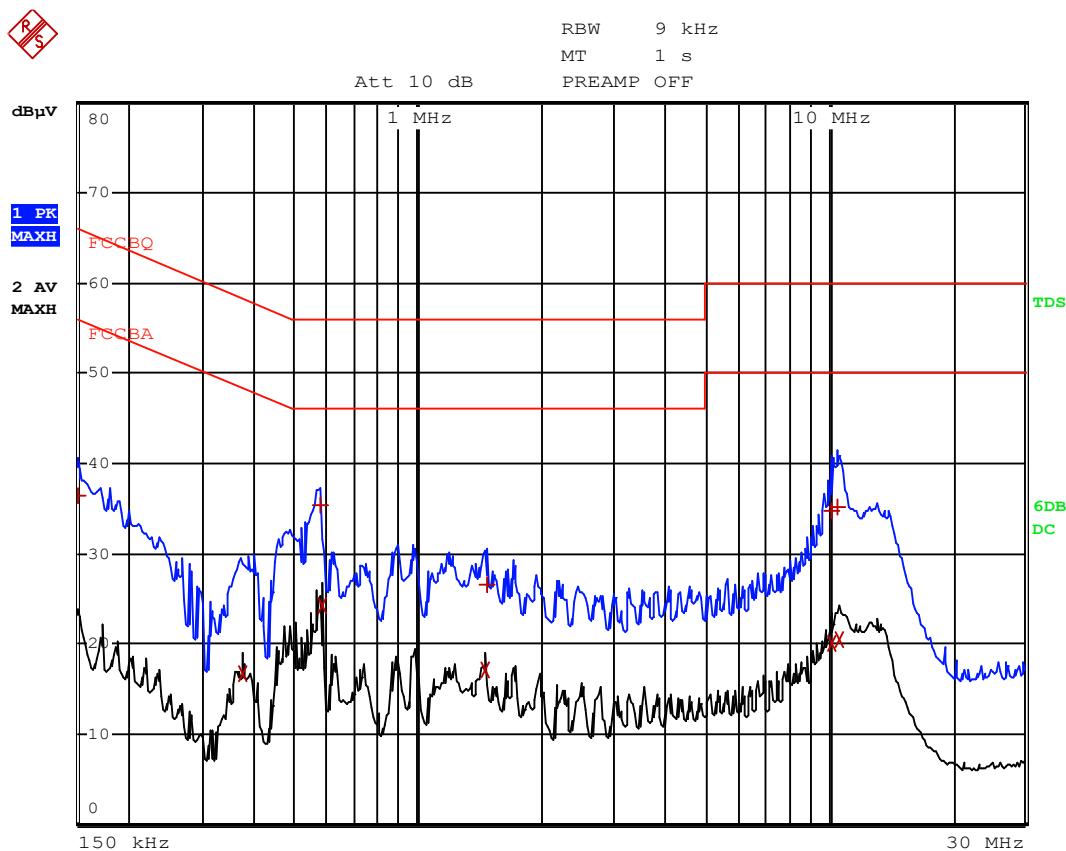
| EDIT PEAK LIST (Final Measurement Results) |            |            |        |          |
|--------------------------------------------|------------|------------|--------|----------|
| Trace1:                                    | FCCBQ      |            |        |          |
| Trace2:                                    | FCCBA      |            |        |          |
| Trace3:                                    | ---        |            |        |          |
| TRACE                                      | FREQUENCY  | LEVEL dBµV | DELTA  | LIMIT dB |
| 1 Quasi Peak                               | 10.494 MHz | 33.74      | -26.25 |          |
| 1 Quasi Peak                               | 582 kHz    | 28.43      | -27.56 |          |
| 1 Quasi Peak                               | 10.222 MHz | 32.12      | -27.87 |          |
| 2 Average                                  | 566 kHz    | 17.25      | -28.75 |          |
| 1 Quasi Peak                               | 150 kHz    | 36.54      | -29.45 |          |
| 2 Average                                  | 13.178 MHz | 18.91      | -31.09 |          |
| 1 Quasi Peak                               | 1.25 MHz   | 22.41      | -33.58 |          |
| 2 Average                                  | 1.462 MHz  | 11.44      | -34.55 |          |
| 2 Average                                  | 10.298 MHz | 14.07      | -35.92 |          |
| 2 Average                                  | 154 kHz    | 19.66      | -36.11 |          |

### Remarks:

- 1) Level (final measurement) = received value + transducer (Lisn+cable)
- 2) Delta = Level – Limit

No other significant emissions were measured at the frequency range of interest employing both the QP and AV detectors.

**Neutral**



| EDIT PEAK LIST (Final Measurement Results) |            |                  |        |          |
|--------------------------------------------|------------|------------------|--------|----------|
| Trace1:                                    | FCCBQ      |                  |        |          |
| Trace2:                                    | FCCBA      |                  |        |          |
| Trace3:                                    | ---        |                  |        |          |
| TRACE                                      | FREQUENCY  | LEVEL dB $\mu$ V | DELTA  | LIMIT dB |
| 1 Quasi Peak                               | 578 kHz    | 35.31            | -20.68 |          |
| 2 Average                                  | 582 kHz    | 24.32            | -21.68 |          |
| 1 Quasi Peak                               | 10.55 MHz  | 35.15            | -24.85 |          |
| 1 Quasi Peak                               | 10.222 MHz | 34.68            | -25.31 |          |
| 2 Average                                  | 1.462 MHz  | 17.19            | -28.80 |          |
| 2 Average                                  | 10.662 MHz | 20.52            | -29.47 |          |
| 1 Quasi Peak                               | 150 kHz    | 36.51            | -29.49 |          |
| 1 Quasi Peak                               | 1.47 MHz   | 26.47            | -29.52 |          |
| 2 Average                                  | 10.222 MHz | 20.10            | -29.89 |          |
| 2 Average                                  | 374 kHz    | 16.76            | -31.64 |          |

**Remarks:**

- 1) Level (final measurement) = received value + transducer (Lisn+cable)
- 2) Delta = Level – Limit

No other significant emissions were measured at the frequency range of interest employing both the QP and AV detectors.

## 4.2 Radidated Emissions

VERDICT: PASS

Emissions Limit 15.225(d) & 15.209 (a)

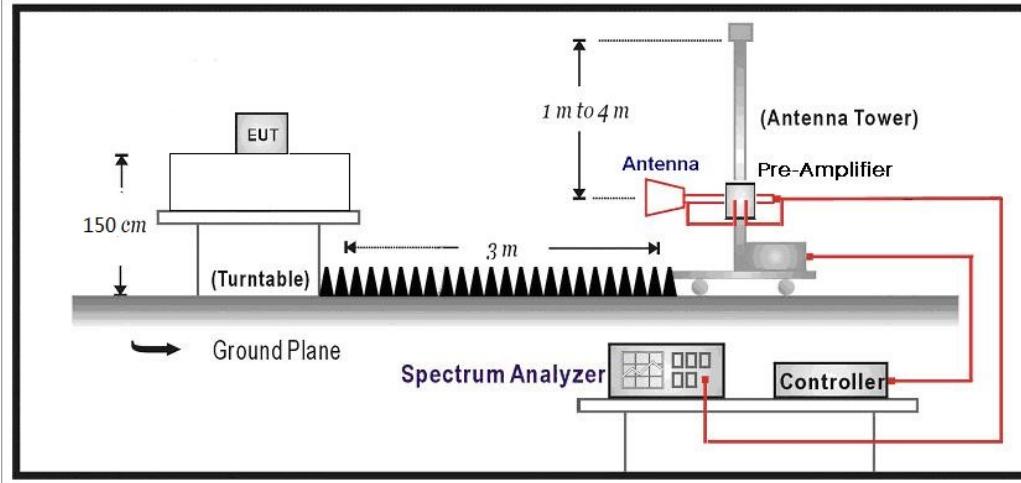
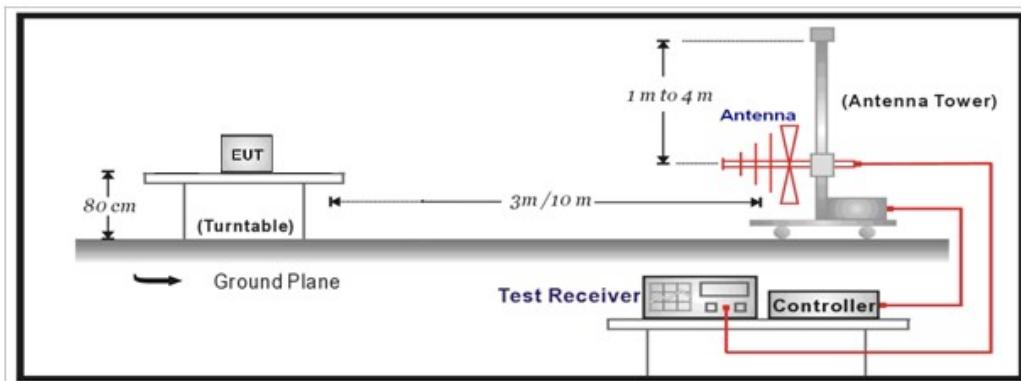
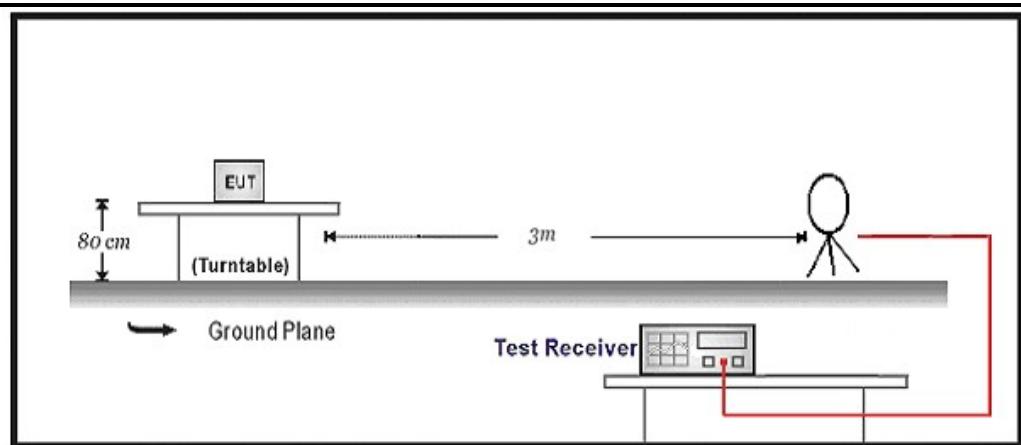
| Frequency<br>(MHz) | Field strength<br>( $\mu$ V/m) | Field strength<br>(dB $\mu$ V/m) | Measurement distance<br>(m) |
|--------------------|--------------------------------|----------------------------------|-----------------------------|
| 0.009 - 0.49       | 2400/F(kHz)                    | -                                | 300 (Note 1)                |
| 0.49 - 1.705       | 24000/F(kHz)                   | -                                | 30 (Note 1)                 |
| 1.705 - 30         | 30                             | -                                | 30 (Note 1)                 |
| 30 - 88            | 100                            | 40                               | 3 (Note 2)                  |
| 88 - 216           | 150                            | 43.5                             | 3 (Note 2)                  |
| 216 - 960          | 200                            | 46                               | 3 (Note 2)                  |
| Above 960          | 500                            | 54                               | 3 (Note 2)                  |

Note 1: At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

Note 2: At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment.

Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

## Test Configuration

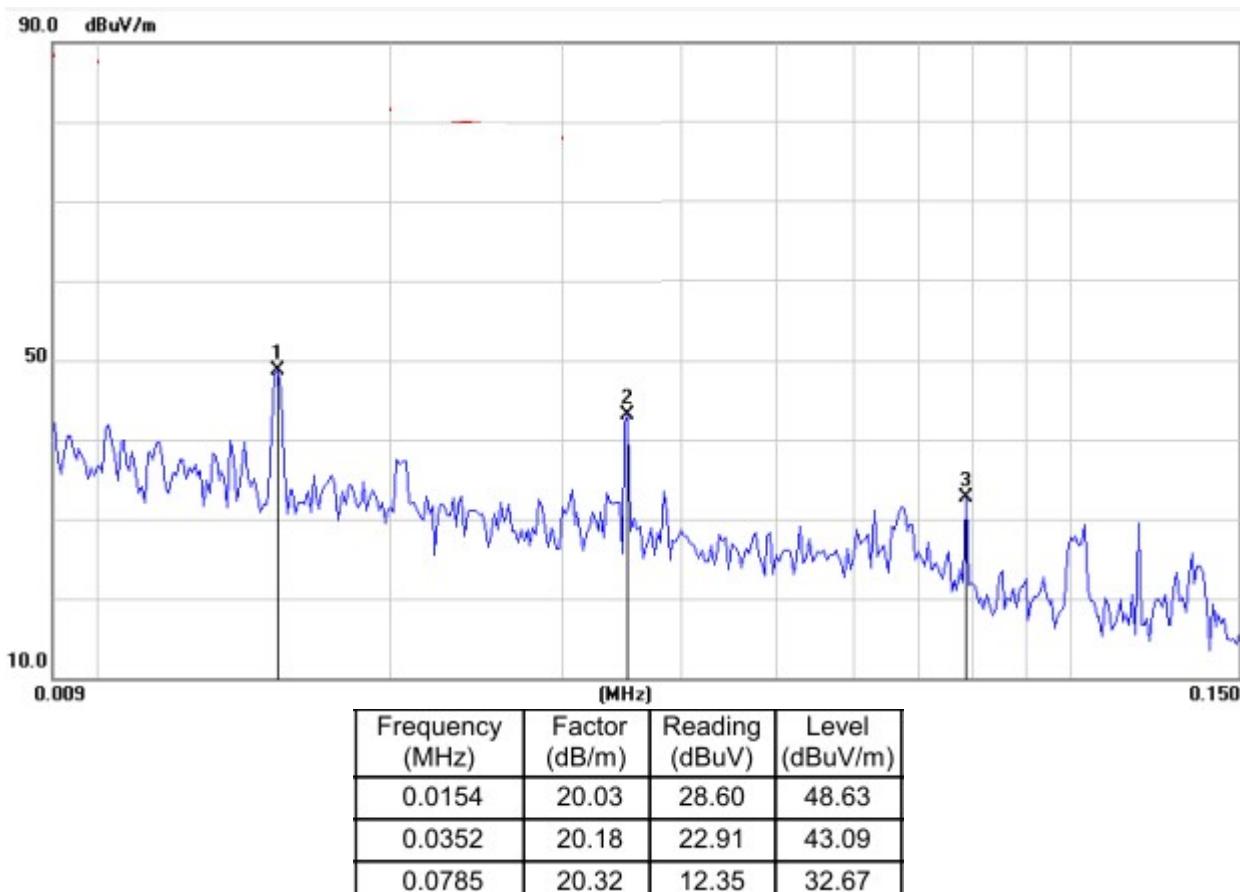


## Performed measurements

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Port under test        | Enclosure port                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Test method applied    | <input type="checkbox"/> Conducted measurement                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                        | <input checked="" type="checkbox"/> Radiated measurement @3m                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Test setup             | Refer to the Annex 3 for test setup photo(s).                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Operating mode(s) used | Mode 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Remark                 | <p>1)The test frequency range 1GHz~26GHz, both of the worst case are at least 20dB below the limits, therefore no data appear in the report.</p> <p>2)The EUT are tested in three orientations. The record is the worst orientation which refer to the Annex 3 for test setup photo(s).</p> <p>3)The antenna of NFC incorporates 3 matched antennas. Only ONE antenna can be activated at any given time. The desired antenna is selected using an RF switch in between the antenna and matching circuit.</p> |

## Results of 9 – 150 kHz

|                             |                                                                                                                                                                                                                                                                                                 |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation Mode (worst case) | Mode 1<br>The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.<br><br>Pre-test NFC antenna 1,2,3, the worst case is antenna 2, which test data was recorded. |
| Test voltage                | 3.7 Vdc                                                                                                                                                                                                                                                                                         |

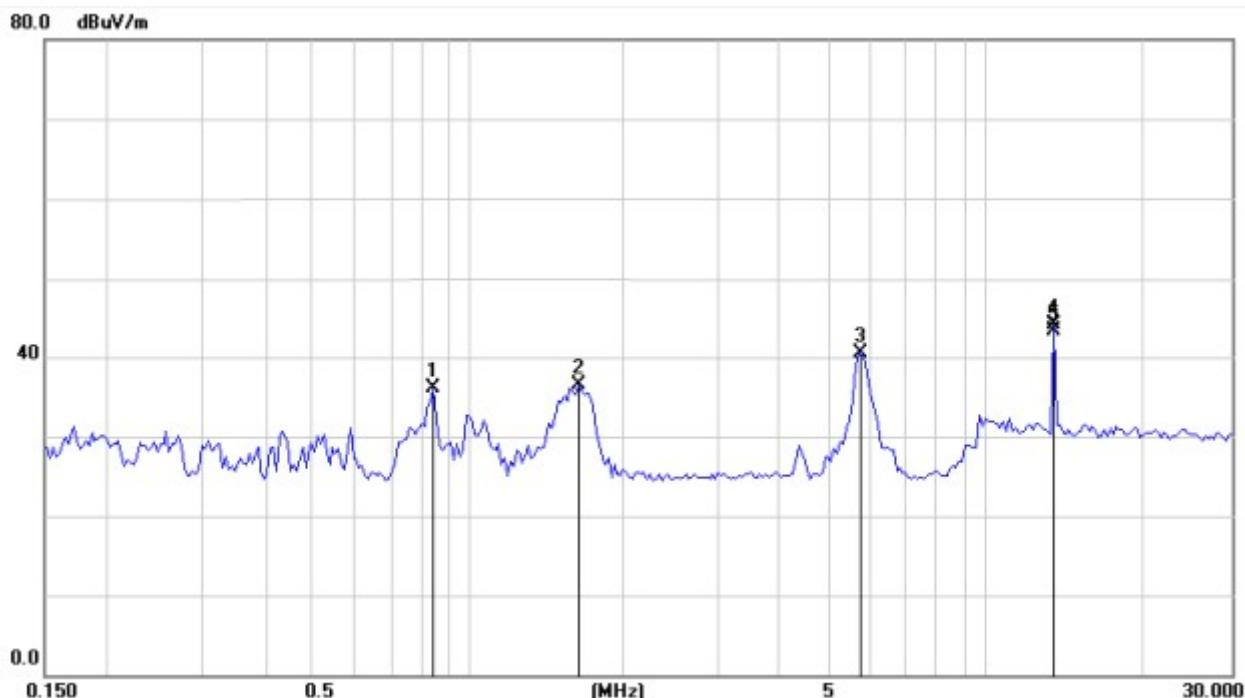


Remarks: Value = received value + Correction Factor (Antenna factor + Cable loss - Preamp gain)

All the test data below the background of emissions in the frequency band, and the peak field strength of any emission is not exceeding the maximum permitted average limits specified above. So, no limit was shown.

## Results of 0.15 – 30 MHz

|                             |                                                                                                                                                                                                                                                                                                 |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation Mode (worst case) | Mode 1<br>The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.<br><br>Pre-test NFC antenna 1,2,3, the worst case is antenna 2, which test data was recorded. |
| Test voltage                | 3.7 Vdc                                                                                                                                                                                                                                                                                         |



| Frequency (MHz) | Factor (dB/m) | Reading (dBuV) | Level (dBuV/m) |
|-----------------|---------------|----------------|----------------|
| 0.8505          | 20.60         | 15.52          | 36.12          |
| 1.6275          | 20.80         | 15.62          | 36.42          |
| 5.7285          | 21.03         | 19.57          | 40.60          |
| 13.5508         | 21.39         | 22.76          | 44.15          |
| 13.5509         | 21.39         | 21.91          | 43.30          |

Remarks: Value = received value + Correction Factor (Antenna factor + Cable loss - Preamp gain)

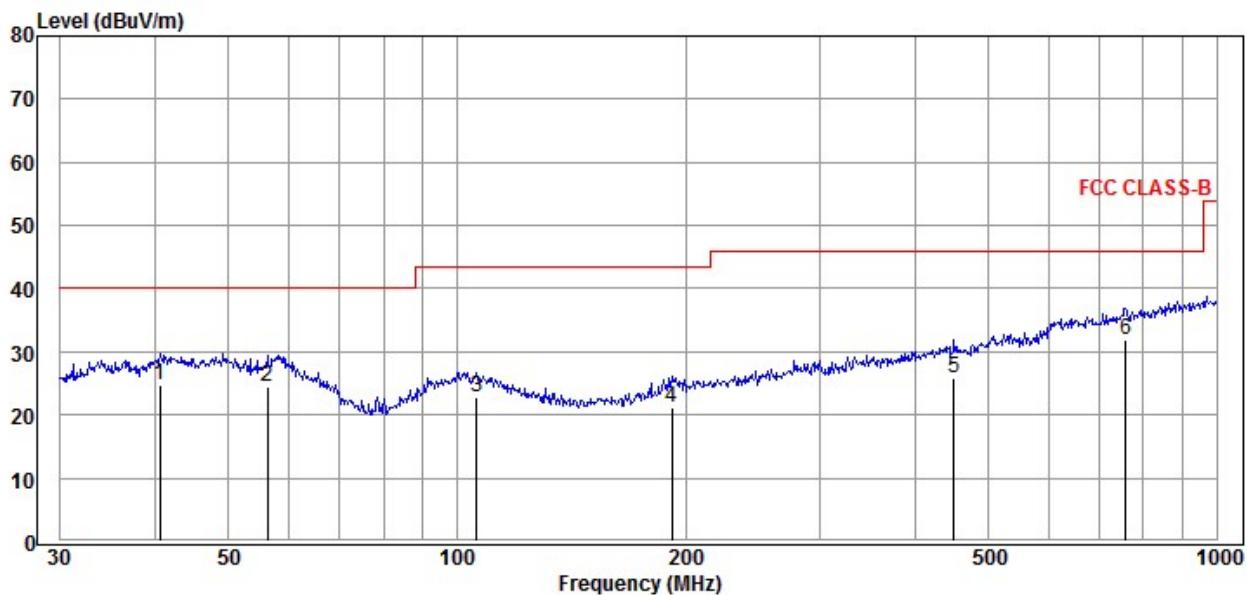
All the test data below the background of emissions in the frequency band, and the peak field strength of any emission is not exceeding the maximum permitted average limits specified above. So, no limit was shown.

## Results of 30 – 1000 MHz

|                |                                                                                                  |
|----------------|--------------------------------------------------------------------------------------------------|
| Operation Mode | Mode 1<br>Pre-test NFC antenna 1,2,3, the worst case is antenna 2, which test data was recorded. |
| Test voltage   | 3.7 Vdc                                                                                          |

### Results

#### Horizontal



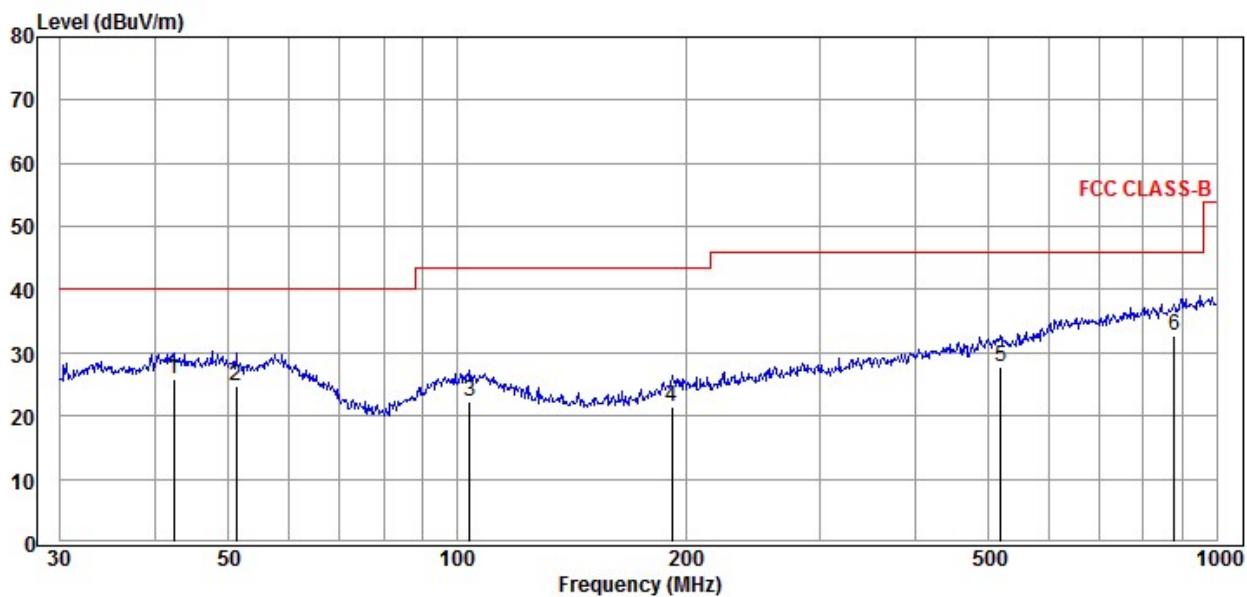
| Freq (MHz) | Reading (dBuV) | C.F (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin=limit-result (dB) |
|------------|----------------|----------|-----------------|----------------|--------------------------|
| 40.56      | 9.70           | 15.10    | 24.80           | 40.00          | 15.20                    |
| 56.20      | 9.47           | 15.05    | 24.52           | 40.00          | 15.48                    |
| 106.01     | 10.12          | 12.60    | 22.72           | 43.50          | 20.78                    |
| 191.75     | 9.18           | 11.90    | 21.08           | 43.50          | 22.42                    |
| 451.14     | 8.82           | 17.10    | 25.92           | 46.00          | 20.08                    |
| 758.04     | 10.43          | 21.35    | 31.78           | 46.00          | 14.22                    |

#### Remarks:

- 1) C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain
- 2) Result = Reading + C.F (Correction Factor)

No other significant emissions were measured at the frequency range of interest employing the QP detectors.

**Vertical**



| Freq (MHz) | Reading (dBuV) | C.F (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin=limit-result (dB) |
|------------|----------------|----------|-----------------|----------------|--------------------------|
| 42.30      | 10.31          | 15.54    | 25.85           | 40.00          | 14.15                    |
| 51.12      | 10.12          | 14.76    | 24.88           | 40.00          | 15.12                    |
| 103.81     | 9.72           | 12.63    | 22.35           | 43.50          | 21.15                    |
| 191.75     | 9.51           | 11.90    | 21.41           | 43.50          | 22.09                    |
| 519.07     | 9.41           | 18.30    | 27.71           | 46.00          | 18.29                    |
| 878.32     | 10.36          | 22.35    | 32.71           | 46.00          | 13.29                    |

**Remarks:**

- 1) C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain
- 2) Result = Reading + C.F (Correction Factor)

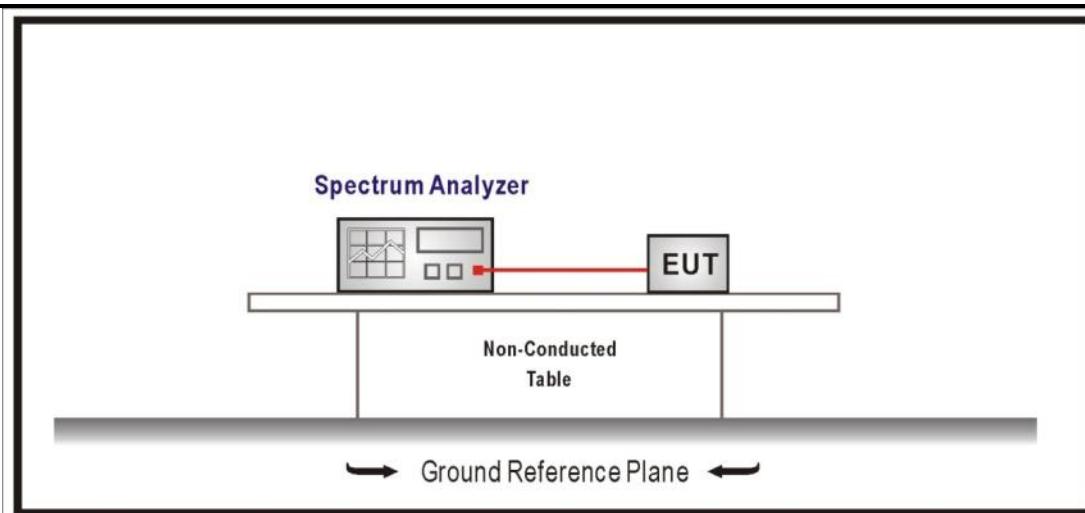
No other significant emissions were measured at the frequency range of interest employing the QP detectors.

### 4.3 20dB Bandwidth

**VERDICT: PASS**

|                                     |                                        |
|-------------------------------------|----------------------------------------|
| <b>Standard</b>                     | FCC Part 15 Subpart C Paragraph 15.215 |
| Limits:<br>13,553 MHz to 13,567 MHz |                                        |

#### Test Configuration



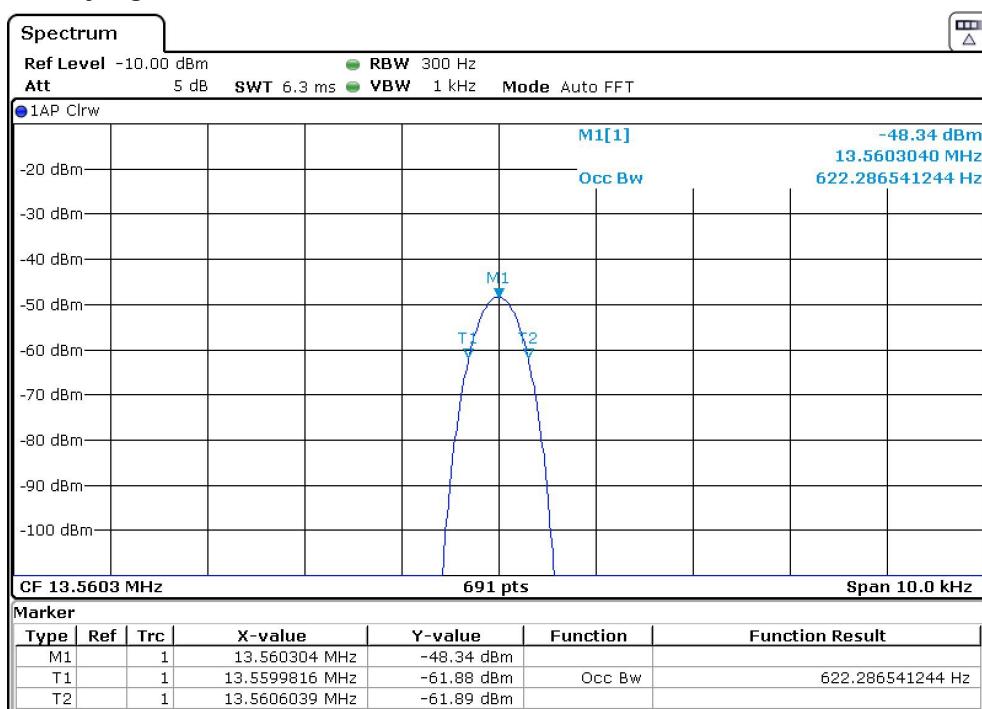
#### Performed measurements

|                        |                                               |                       |
|------------------------|-----------------------------------------------|-----------------------|
| Port under test        | Antenna port                                  |                       |
| Test method applied    | <input type="checkbox"/>                      | Conducted measurement |
|                        | <input checked="" type="checkbox"/>           | Radiated measurement  |
| Test setup             | Refer to the Annex 3 for test setup photo(s). |                       |
| Operating mode(s) used | Mode 1                                        |                       |
| Remark                 | ---                                           |                       |

**Results:**

| Measurement Conditions        |                               | Operating frequency | Nominal Operating Frequency | OCW   | Limit                |
|-------------------------------|-------------------------------|---------------------|-----------------------------|-------|----------------------|
| T <sub>normal</sub><br>(24°C) | V <sub>norm</sub> :<br>3.7Vdc | 13.56 MHz           | 13.56 MHz                   | 622Hz | 13,553 to 13,567 MHz |

**Occupancy bandwidth judgment**



Visible from the graph: OBW= 622 Hz

## 4.4 Emission Mask

VERDICT: PASS

| Standard | FCC Part 15 Subpart C Paragraph 15.225(a)&(b)&(c)                                                                                                      |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| (a)      | The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.                           |
| (b)      | Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.      |
| (c)      | Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.       |
| (d)      | The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209. |

### Below 30MHz

The test was performed at a 3m test site.

The factor calculated by the following equation:

If both the single point and the limit distance are equal to or closer to the EUT than  $\lambda/2\pi$ , then extrapolation to the limit distance shall be calculated using Equation (4):

$$FS_{\text{limit}} = FS_{\text{max}} - 40 \log\left(\frac{d_{\text{limit}}}{d_{\text{measure}}}\right) \quad (4)$$

where

$FS_{\text{limit}}$  is the calculation of field strength at the limit distance, expressed in dB $\mu$ V/m  
 $FS_{\text{max}}$  is the measured field strength, expressed in dB $\mu$ V/m  
 $d_{\text{near field}}$  is the  $\lambda/2\pi$  distance  
 $d_{\text{measure}}$  is the distance of the measurement point from the EUT  
 $d_{\text{limit}}$  is the reference distance or the distance of the  $\lambda/2\pi$  point

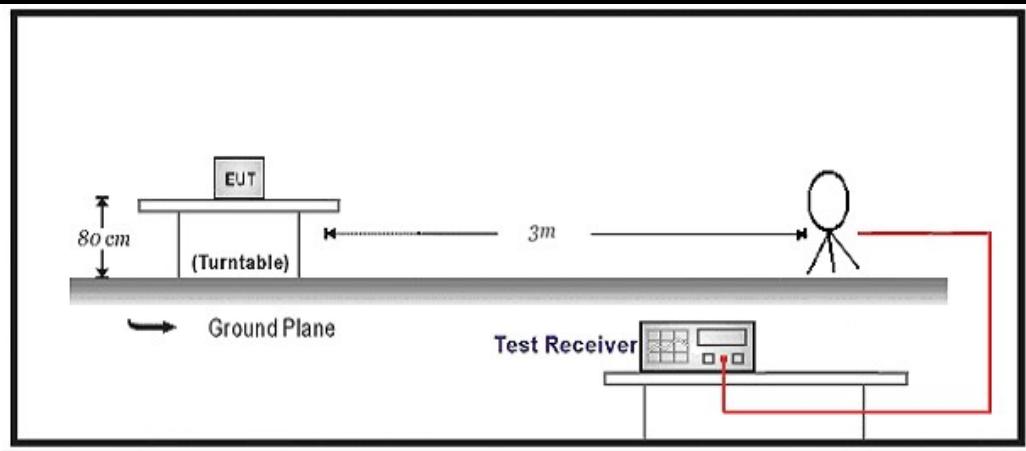
**Table 5—Relationship of frequency and wavelength (informative)**

| Frequency (MHz) | $\lambda$ (m) | $0.625\lambda$ (m) | $\lambda/2\pi$ |
|-----------------|---------------|--------------------|----------------|
| 0.009           | 33333.3       | 20833.3            | 5305.2         |
| 0.1             | 3000.0        | 1875.0             | 477.5          |
| 0.3             | 1000.0        | 625.0              | 159.2          |
| 1               | 300.0         | 187.5              | 47.7           |
| 4.76            | 63.0          | 39.4               | 10.0           |
| 16              | 18.8          | 11.7               | 3.0            |
| 30              | 10.0          | 6.3                | 1.6            |

The limit at 3m test distance is below:

The factor of field strength of any emissions within the band 13.553-13.567 MHz shall be 40 dB at 3 meters.

## Test Configuration



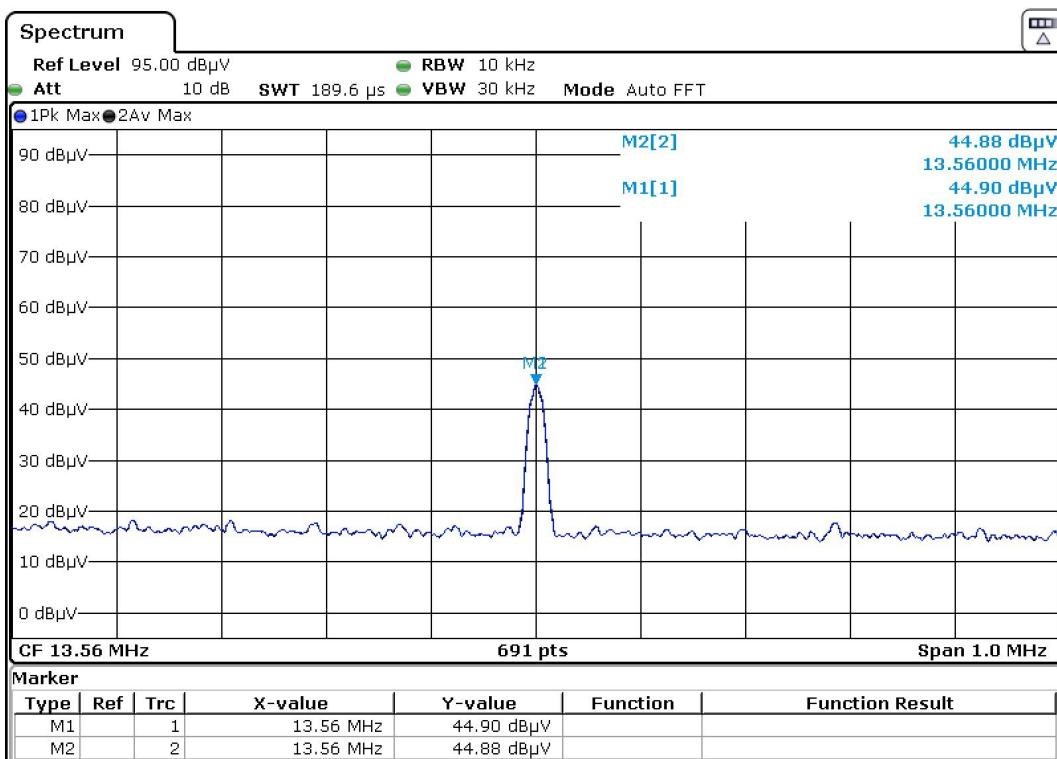
## Performed measurements

|                        |                                               |                       |
|------------------------|-----------------------------------------------|-----------------------|
| Port under test        | Antenna port                                  |                       |
| Test method applied    | <input type="checkbox"/>                      | Conducted measurement |
|                        | <input checked="" type="checkbox"/>           | Radiated measurement  |
| Test setup             | Refer to the Annex 3 for test setup photo(s). |                       |
| Operating mode(s) used | Mode 1                                        |                       |
| Remark                 | ---                                           |                       |

## Results

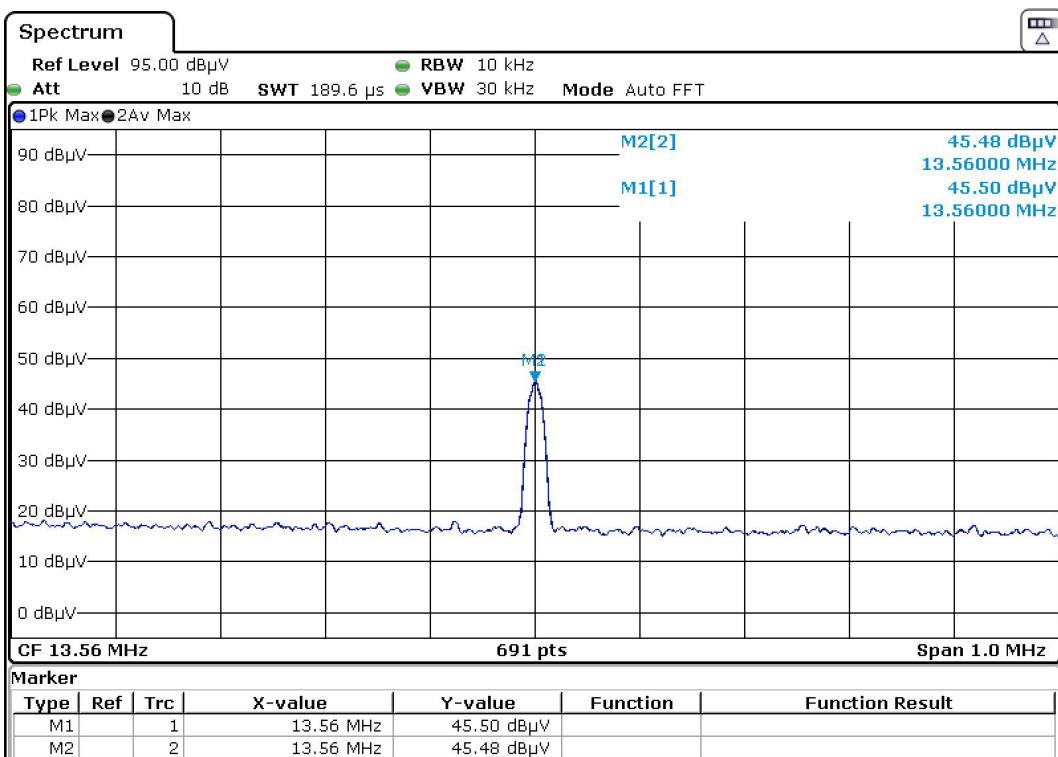
|                             |                                                                                                                                                                                                   |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation Mode (worst case) | Mode 1<br>The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report. |
| Test voltage                | 3.7 Vdc                                                                                                                                                                                           |

### For antenna 1



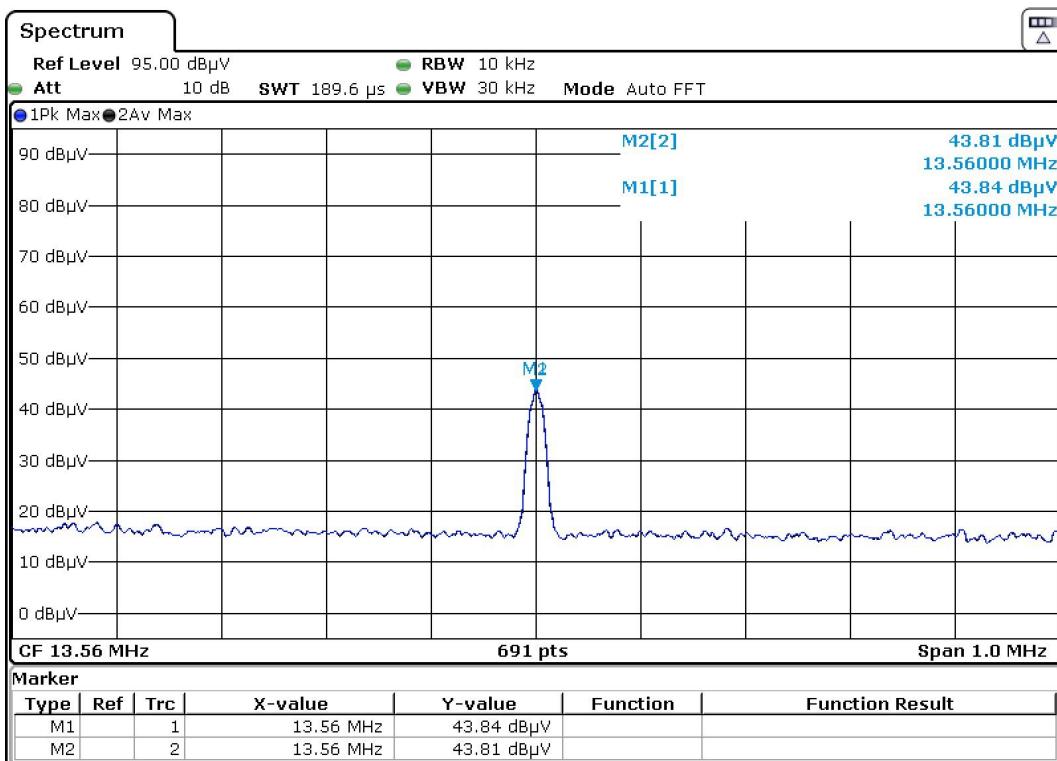
| Frequency (MHz) | Results @3m (dBuV/m) | Limit@3m (dBuV/m) | Bands                                   |
|-----------------|----------------------|-------------------|-----------------------------------------|
| 13.56           | 44.90                | 123.99            | 13.553-13.567 MHz                       |
|                 |                      | 90.47             | 13.410-13.553 MHz and 13.567-13.710 MHz |
|                 |                      | 80.50             | 13.110-13.410 MHz and 13.710-14.010 MHz |

**For antenna 2**



| Frequency (MHz) | Results @3m (dB $\mu$ V/m) | Limit@3m (dB $\mu$ V/m) | Bands                                   |
|-----------------|----------------------------|-------------------------|-----------------------------------------|
| 13.56           | 45.50                      | 123.99                  | 13.553-13.567 MHz                       |
|                 |                            | 90.47                   | 13.410-13.553 MHz and 13.567-13.710 MHz |
|                 |                            | 80.50                   | 13.110-13.410 MHz and 13.710-14.010 MHz |

For antenna 3



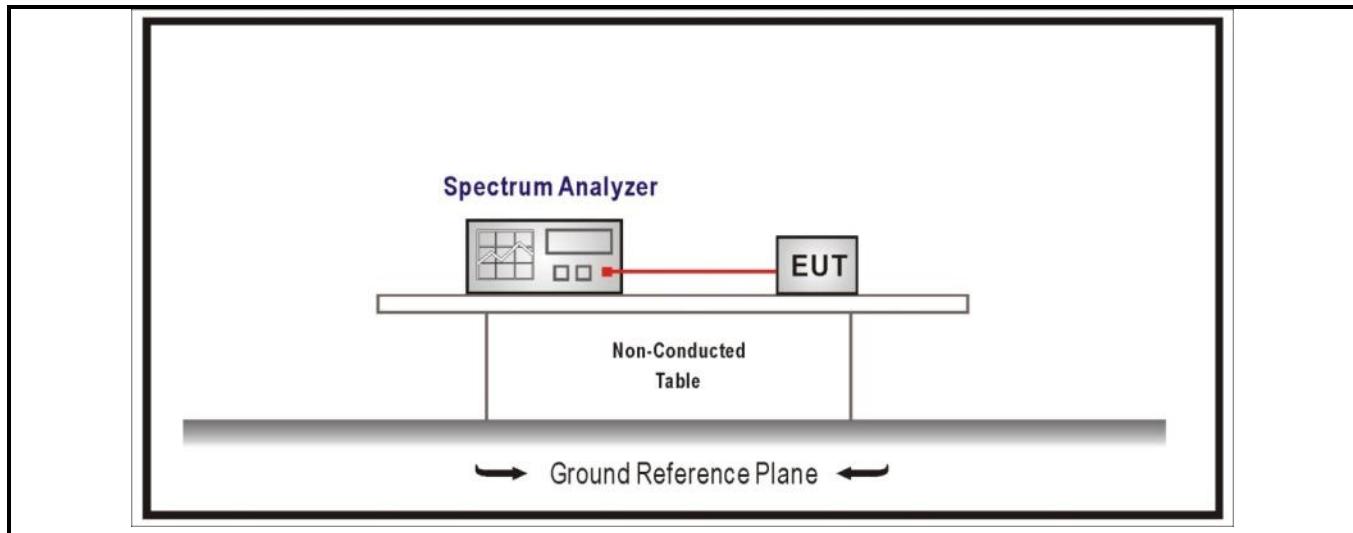
| Frequency (MHz) | Results @3m (dB $\mu$ V/m) | Limit@3m (dB $\mu$ V/m) | Bands                                   |
|-----------------|----------------------------|-------------------------|-----------------------------------------|
| 13.56           | 43.84                      | 123.99                  | 13.553-13.567 MHz                       |
|                 |                            | 90.47                   | 13.410-13.553 MHz and 13.567-13.710 MHz |
|                 |                            | 80.50                   | 13.110-13.410 MHz and 13.710-14.010 MHz |

#### 4.5 Frequency tolerance

**VERDICT: PASS**

|                                                 |                                           |
|-------------------------------------------------|-------------------------------------------|
| <b>Standard</b>                                 | FCC Part 15 Subpart C Paragraph 15.225(e) |
| <b>Limit: <math>\pm 0.01\%</math>(1.356kHz)</b> |                                           |

#### Test Configuration



#### Performed measurements

|                        |                                               |                       |
|------------------------|-----------------------------------------------|-----------------------|
| Port under test        | Antenna port                                  |                       |
| Test method applied    | <input type="checkbox"/>                      | Conducted measurement |
|                        | <input checked="" type="checkbox"/>           | Radiated measurement  |
| Test setup             | Refer to the Annex 3 for test setup photo(s). |                       |
| Operating mode(s) used | Mode 1                                        |                       |
| Remark                 | ---                                           |                       |

## Results

At startup:

| Measurement Conditions   |                           | Limit: $\pm 0.01\%$ (1.356kHz) |                 | Result |
|--------------------------|---------------------------|--------------------------------|-----------------|--------|
| Voltage (V DC)           | Temperature (°C)          | Frequency Measured (MHz)       | Deviation (kHz) |        |
| $V_{\text{norm}} : 3.7$  | -20                       | 13.561344                      | -0.0145         | PASS   |
|                          | -10                       | 13.561341                      | -0.0147         | PASS   |
|                          | 0                         | 13.561493                      | -0.0035         | PASS   |
|                          | +10                       | 13.561425                      | -0.0086         | PASS   |
|                          | $T_{\text{normal}} : +20$ | 13.561541                      | -               | -      |
|                          | +30                       | 13.561439                      | -0.0075         | PASS   |
|                          | +40                       | 13.561400                      | -0.0104         | PASS   |
|                          | +50                       | 13.561451                      | -0.0066         | PASS   |
| $V_{\text{max}} : 4.255$ | $T_{\text{normal}} : +20$ | 13.561343                      | -0.0146         | PASS   |
| $V_{\text{min}} : 3.145$ |                           | 13.561355                      | -0.0137         | PASS   |

At 10 minutes later:

| Measurement Conditions   |                           | Limit: $\pm 0.01\%$ (1.356kHz) |                 | Result |
|--------------------------|---------------------------|--------------------------------|-----------------|--------|
| Voltage (V DC)           | Temperature (°C)          | Frequency Measured (MHz)       | Deviation (kHz) |        |
| $V_{\text{norm}} : 3.7$  | -20                       | 13.561277                      | -0.0192         | PASS   |
|                          | -10                       | 13.561141                      | -0.0292         | PASS   |
|                          | 0                         | 13.561258                      | -0.0206         | PASS   |
|                          | +10                       | 13.561123                      | -0.0305         | PASS   |
|                          | $T_{\text{normal}} : +20$ | 13.561537                      | -               | -      |
|                          | +30                       | 13.561340                      | -0.0145         | PASS   |
|                          | +40                       | 13.561567                      | 0.0022          | PASS   |
|                          | +50                       | 13.561532                      | -0.0004         | PASS   |
| $V_{\text{max}} : 4.255$ | $T_{\text{normal}} : +20$ | 13.561333                      | -0.0150         | PASS   |
| $V_{\text{min}} : 3.145$ |                           | 13.561032                      | -0.0372         | PASS   |

## 5 IDENTIFICATION OF THE EQUIPMENT UNDER TEST

The photographs show the tested device.

Refer to documents External photo and Internal photo.

## ANNEX 1 – MEASUREMENT UNCERTAINTY

| Test Item                         | Uncertainty |
|-----------------------------------|-------------|
| Occupied Channel Bandwidth        | ±0,7%       |
| RF Output power, conducted        | ±0,6dB      |
| Power Spectral Density, Conducted | ±0,6dB      |
| Unwanted Emissions, Conducted     | ±0.7dB      |
| Spurious (30-1000MHz)             | ±4,4dB      |
| Spurious (1-12,75GHz)             | ±4,4dB      |

## ANNEX 2 - USED EQUIPMENT

Continuous disturbances conducted (150 kHz to 30 MHz)

| Item | Instrumentation | Manufacturer    | Model No. | Serial No. | DEKRA No. | Cal. Due date |
|------|-----------------|-----------------|-----------|------------|-----------|---------------|
| 1    | EMI Receiver    | R&S             | ESCI      | 101206     | G/L858    | 2023/07/21    |
| 2    | LISN            | R&S             | ENV216    | 101336     | G/L859    | 2023/07/21    |
| 3    | Shielding Room  | Changzhou Feite | /         | /          | G/L861    | 2023/06/17    |

Emissions in non-restricted frequency bands/ Emissions in restricted frequency bands

| Item | Instrumentation                                           | Manufacturer | Model No. | Serial No. | DEKRA No. | Cal. Due date |
|------|-----------------------------------------------------------|--------------|-----------|------------|-----------|---------------|
| 1    | EMI receiver                                              | R&S          | ESCI      | 101205     | G/L857    | 2023/07/21    |
| 2    | Antenna<br>(30MHz-3GHz)                                   | SCHWARZBECK  | VULB9163  | 506        | G/L864    | 2022/10/26    |
| 3    | Chamber                                                   | ETS          | /         | /          | G/L856    | 2024/06/10    |
| 4    | Antenna<br>(1GHz-18GHz)                                   | R&S          | HF907     | 102306     | G/L1236   | 2023/02/23    |
| 5    | Horn antenna<br>preamplifier                              | Schwarzbeek  | SCU-18    | 102234     | G/L1236-1 | 2023/02/21    |
| 6    | Spectrum analyzer                                         | R&S          | FSV       | SN101012   | G/L1235   | 2023/01/17    |
| 7    | HF antenna<br>(18 – 26.5 GHz)                             | ETS          | 3160-09   | 00164643   | G/L1237   | 2023/01/16    |
| 8    | High frequency<br>antenna preamplifier<br>(18 – 26.5 GHz) | Schwarzbeck  | SCU-26    | 1879064    | G/L1237-1 | 2023/01/10    |
| 9    | Broadband horn<br>antenna<br>(15 – 40 GHz)                | Schwarzbeck  | BBHA9170  | 00908      | GZ1901    | 2023/05/06    |
| 10   | High frequency<br>antenna preamplifier<br>(18 – 26.5 GHz) | Schwarzbeck  | SCU-26    | 1879064    | G/L1237-1 | 2023/01/10    |
| 11   | Annular magnetic field<br>antenna                         | TESEQ        | HLA6121   | 540045     | GZ1905    | 2023/05/12    |

Duty cycle/Band Edge/Fundamental emission output power/DTS Bandwidth/Power Spectral Density

| Item | Instrumentation   | Manufacturer | Model   | Serial no. | DEKRA No. | Cal Due date |
|------|-------------------|--------------|---------|------------|-----------|--------------|
| 1    | Spectrum analyzer | R&S          | FSV     | SN101012   | G/L1235   | 2023/01/17   |
| 2    | Chamber           | ETS          | /       | /          | G/L856    | 2024/06/10   |
| 3    | OSP               | R&S          | OSP 150 | 101907     | GZ1894    | 2023/04/27   |

## **ANNEX 3 - TEST PHOTOS**

Refer to document Test setup.

--- END ---