



# RF TEST REPORT

**Applicant** HMD Global Oy  
**FCC ID** 2AJOTTA-1223  
**Product** mobile phone  
**Brand** Nokia  
**Model** TA-1223  
**Report No.** R2001A0040-R7  
**Issue Date** March 13, 2020

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15C (2019)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Performed by: Peng Tao

Approved by: Kai Xu

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## TA Technology (Shanghai) Co., Ltd.

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## Summary of measurement results

| Number  | Test Case                     | Clause in FCC rules               | Verdict |
|---|-------------------------------|-----------------------------------|---------|
| 1   | 20 dB bandwidth               | 2.1049                            | PASS    |
| 2   | Frequency Stability Tolerance | 15.225(e)                         | PASS    |
| 3   | Radiated Emissions            | 15.225 (a) (b) (c) (d) and 15.209 | PASS    |
| 4   | Conducted Emissions           | 15.207                            | PASS    |
| Date of Testing: January 16, 2020 ~ February 28, 2020   |                               |                                   |         |
| Note: All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. |                               |                                   |         |



## 1. Test Laboratory

### 1.1. Notes of the test report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above. This report must not be used by the client to claim product certification, approval, or endorsement by any government agencies.

### 1.2. Test facility

#### **FCC (Designation number: CN1179, Test Firm Registration Number: 446626)**

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

#### **A2LA (Certificate Number: 3857.01)**

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

### 1.3. Testing Location

Company: TA Technology (Shanghai) Co., Ltd.  
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City: Shanghai  
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## 2. General Description of Equipment under Test

### 2.1. Applicant and Manufacturer Information

|                             |  |
|-----------------------------|--|
| <b>Applicant</b>            | HMD Global Oy                              |
| <b>Applicant address</b>    | Bertel Jungin aukio 9,02600 ESPOO. FINLAND |
| <b>Manufacturer</b>         | HMD Global Oy                              |
| <b>Manufacturer address</b> | Bertel Jungin aukio 9,02600 ESPOO. FINLAND |

### 2.2. General information

| EUT Description              |   |           |       |       |
|------------------------------|---|-----------|-------|-------|
| Model:                       | TA-1223   |           |       |       |
| SN:                          | IMEI 1:355795100012570<br>IMEI 2:355795100015342                                    |           |       |       |
| Hardware Version:            | LLDM528   |           |       |       |
| Software Version:            | LLDB7749  |           |       |       |
| Power Supply:                | Battery   |           |       |       |
| Antenna Type:                | Internal Antenna  |           |       |       |
| Antenna Connector            | A permanently attached antenna (meet with the standard FCC Part 15.203 requirement) |           |       |       |
| Test Mode:                   | NFC-A   | NFC-B     | NFC-F | NFC-V |
| Modulation Type:             | ASK   | ASK, BPSK | ASK   | ASK   |
| Operating Frequency Range(s) | 13.56MHz  |           |       |       |
| Operating temperature range: | -10 ° C to 55° C  |           |       |       |
| Operating voltage range:     | 3.6 V to 4.4 V  |           |       |       |
| State DC voltage:            | 3.8 V   |           |       |       |
| EUT Accessory                |   |           |       |       |
| Adapter 1                    | Manufacturer: SHENZHEN TIANYIN ELECTRONICS CO.,LTD.<br>Model: CH-21E                |           |       |       |
| Adapter 2                    | Manufacturer: Jiangsu Chenyang Electron Co., Ltd.<br>Model: AD-10WE                 |           |       |       |
| Adapter 3                    | Manufacturer: SHENZHEN TIANYIN ELECTRONICS CO.,LTD.<br>Model: CH-21U                |           |       |       |
| Adapter 4                    | Manufacturer: SHENZHEN TIANYIN ELECTRONICS CO.,LTD.<br>Model: CH-21N                |           |       |       |
| Adapter 5                    | Manufacturer: SHENZHEN TIANYIN ELECTRONICS CO.,LTD.<br>Model: CH-21X                |           |       |       |



|   |   |
|---|---|
| Adapter 6   | Manufacturer: SHENZHEN TIANYIN ELECTRONICS CO.,LTD.<br>Model: CH-21A          |
| Adapter 7   | Manufacturer: DONGGUAN AOHAI POWER TECHNOLOGY CO.,LTD.<br>Model: AD-10WR      |
| Adapter 8   | Manufacturer: SHENZHEN TIANYIN ELECTRONICS CO.,LTD.<br>Model: CH-21B          |
| Battery 1   | Manufacturer: Jiade Energy Technology (Zhuhai) Co., Ltd.<br>Model: LC-620U    |
| Battery 2   | Manufacturer: Veken<br>Model: LC-620U   |
| Earphone 1  | Manufacturer: Huizhou New Leader Industry Co., Ltd.<br>Model: NLD-EM300M-03SF |
| Earphone 2  | Manufacturer: Xiaolin Electronics<br>Model: XL-5178                           |
| USB Cable 1   | Manufacturer: Xiamen Li Qi Electronics Co., Ltd.<br>Model: LQ03500090         |
| USB Cable 2   | Manufacturer: Saibao (Jiangxi) Industrial Co. , Ltd.<br>Model: SLQ-A125A      |
| <p>Note: The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.<br/>2. There is more than one Adapter, Battery, Earphone and USB Cable, each one should be applied throughout the compliance test respectively, and however, only the worst case (Adapter 1, Battery 1) will be recorded in this report.</p> |   |



### 3. Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

**Test standards:**

**FCC CFR47 Part 15C (2019)**

**ANSI C63.10 (2013)**

**Reference standard:**

**FCC CFR47 Part 2 (2019)**



## 4. Test Configuration

### Test Mode

The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.



## 5. Test Case Results

### 5.1. 20dB Bandwidth

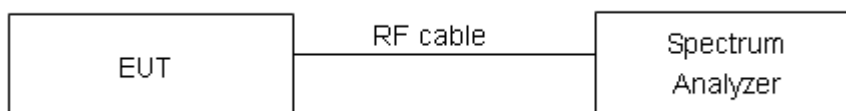
#### Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C  | 45%~50%           | 101.5kPa |

#### Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable. RBW is set to 10 kHz; VBW is set to 3 times the RBW on spectrum analyzer.

#### Test Setup



#### Limits

No specific occupied bandwidth requirements in part 2.1049.

#### Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 2$ ,  $U = 936$  Hz.

**Test Results:****NFC-A**

| Carrier frequency<br>(MHz) | 99% Bandwidth<br>(kHz) | 20dB Bandwidth<br>(kHz) | Conclusion |
|----------------------------|------------------------|-------------------------|------------|
| 13.56MHz                   | 21.218                 | 25.00                   | PASS       |

**NFC-B**

| Carrier frequency<br>(MHz) | 99% Bandwidth<br>(kHz) | 20dB Bandwidth<br>(kHz) | Conclusion |
|----------------------------|------------------------|-------------------------|------------|
| 13.56MHz                   | 21.284                 | 25.04                   | PASS       |

**NFC-V**

| Carrier frequency<br>(MHz) | 99% Bandwidth<br>(kHz) | 20dB Bandwidth<br>(kHz) | Conclusion |
|----------------------------|------------------------|-------------------------|------------|
| 13.56MHz                   | 21.244                 | 24.99                   | PASS       |

**NFC-F**

| Carrier frequency<br>(MHz) | 99% Bandwidth<br>(kHz) | 20dB Bandwidth<br>(kHz) | Conclusion |
|----------------------------|------------------------|-------------------------|------------|
| 13.56MHz                   | 21.220                 | 25.00                   | PASS       |

## 5.2. Frequency Stability

### Ambient condition

| Temperature | Relative humidity |
|-------------|-------------------|
| 21°C ~25°C  | 40%~60%           |

### Method of Measurement

#### 1. Frequency Stability (Temperature Variation)

The temperature inside the climate chamber is varied from -10°C to +55°C in 10°C step size,

(1) With all power removed, the temperature was decreased to 0°C and permitted to stabilize for three hours.

(2) Measure the carrier frequency with the test equipment in a “call mode”. These measurements should be made within 1 minute of powering up the mobile station, to prevent significant self warming.

(3) Repeat the above measurements at 10°C increments from -10°C to +55°C. Allow at least 1.5 hours at each temperature, un-powered, before making measurements.

#### 2. Frequency Stability (Voltage Variation)

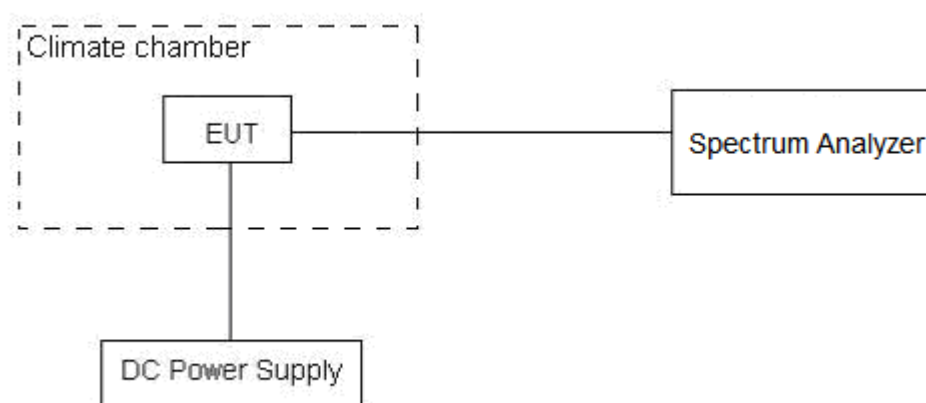
The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery-operating end point which shall be specified by the manufacturer.

This transceiver is specified to operate with an input voltage of between 3.6 V and 4.4 V, with a nominal voltage of 3.8V.

### Test setup





## Limits

Rule Part 15.225 (e) The frequency tolerance of the carrier signal shall be maintained within  $\pm 0.01\%$  of the operating frequency over a temperature variation of  $-20$  degrees to  $+ 50$  degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

## Measurement Uncertainty

The assessed measurement uncertainty to ensure 99.75% confidence level for the normal distribution is with the coverage factor  $k = 3$ ,  $U = 0.01\text{ppm}$ .



## Test Result

## NFC-A

| Test status | Frequency |           |           |           | Tolerance (MHz) |          |          |          |
|-------------|-----------|-----------|-----------|-----------|-----------------|----------|----------|----------|
|             | 13.56MHz  |           |           |           |                 |          |          |          |
|             | 1min      | 2min      | 5min      | 10min     | 1min            | 2min     | 5min     | 10min    |
| -10°C/3.8V  | 13.559348 | 13.559335 | 13.559343 | 13.559333 | 0.000652        | 0.000665 | 0.000657 | 0.000667 |
| 0°C/3.8V    | 13.559346 | 13.559334 | 13.559341 | 13.559330 | 0.000654        | 0.000666 | 0.000659 | 0.000670 |
| 10°C/3.8V   | 13.559345 | 13.559326 | 13.559332 | 13.559321 | 0.000655        | 0.000674 | 0.000668 | 0.000679 |
| 20°C/3.8V   | 13.559339 | 13.559318 | 13.559327 | 13.559315 | 0.000661        | 0.000682 | 0.000673 | 0.000685 |
| 30°C/3.8V   | 13.559339 | 13.559318 | 13.559327 | 13.559310 | 0.000661        | 0.000682 | 0.000673 | 0.000690 |
| 40°C/3.8V   | 13.559336 | 13.559309 | 13.559326 | 13.559301 | 0.000664        | 0.000691 | 0.000674 | 0.000699 |
| 50°C/3.8V   | 13.559329 | 13.559302 | 13.559322 | 13.559292 | 0.000671        | 0.000698 | 0.000678 | 0.000708 |

| Test status | Tolerance (%) |          |          |          | Limit (%) | Conclusion |
|-------------|---------------|----------|----------|----------|-----------|------------|
|             | 1min          | 2min     | 5min     | 10min    |           |            |
| -10°C/3.8V  | 0.004806      | 0.004907 | 0.004843 | 0.004923 | 0.01      | PASS       |
| 0°C/3.8V    | 0.004820      | 0.004910 | 0.004860 | 0.004942 | 0.01      | PASS       |
| 10°C/3.8V   | 0.004828      | 0.004968 | 0.004927 | 0.005011 | 0.01      | PASS       |
| 20°C/3.8V   | 0.004875      | 0.005028 | 0.004960 | 0.005053 | 0.01      | PASS       |
| 30°C/3.8V   | 0.004876      | 0.005031 | 0.004963 | 0.005089 | 0.01      | PASS       |
| 40°C/3.8V   | 0.004894      | 0.005092 | 0.004974 | 0.005152 | 0.01      | PASS       |
| 50°C/3.8V   | 0.004952      | 0.005147 | 0.004999 | 0.005222 | 0.01      | PASS       |



## NFC-B

| Test status | Frequency |           |           |           | Tolerance (MHz) |          |          |          |
|-------------|-----------|-----------|-----------|-----------|-----------------|----------|----------|----------|
|             | 13.56MHz  |           |           |           |                 |          |          |          |
|             | 1min      | 2min      | 5min      | 10min     | 1min            | 2min     | 5min     | 10min    |
| -10°C/3.8V  | 13.559348 | 13.559335 | 13.559343 | 13.559333 | 0.000652        | 0.000665 | 0.000657 | 0.000667 |
| 0°C/3.8V    | 13.559346 | 13.559334 | 13.559341 | 13.559330 | 0.000654        | 0.000666 | 0.000659 | 0.000670 |
| 10°C/3.8V   | 13.559345 | 13.559326 | 13.559332 | 13.559321 | 0.000655        | 0.000674 | 0.000668 | 0.000679 |
| 20°C/3.8V   | 13.559339 | 13.559318 | 13.559327 | 13.559315 | 0.000661        | 0.000682 | 0.000673 | 0.000685 |
| 30°C/3.8V   | 13.559339 | 13.559318 | 13.559327 | 13.559310 | 0.000661        | 0.000682 | 0.000673 | 0.000690 |
| 40°C/3.8V   | 13.559336 | 13.559309 | 13.559326 | 13.559301 | 0.000664        | 0.000691 | 0.000674 | 0.000699 |
| 50°C/3.8V   | 13.559329 | 13.559302 | 13.559322 | 13.559292 | 0.000671        | 0.000698 | 0.000678 | 0.000708 |

| Test status | Tolerance (%) |          |          |          | Limit (%) | Conclusion |
|-------------|---------------|----------|----------|----------|-----------|------------|
|             | 1min          | 2min     | 5min     | 10min    |           |            |
| -10°C/3.8V  | 0.004806      | 0.004907 | 0.004843 | 0.004923 | 0.01      | PASS       |
| 0°C/3.8V    | 0.004820      | 0.004910 | 0.004860 | 0.004942 | 0.01      | PASS       |
| 10°C/3.8V   | 0.004828      | 0.004968 | 0.004927 | 0.005011 | 0.01      | PASS       |
| 20°C/3.8V   | 0.004875      | 0.005028 | 0.004960 | 0.005053 | 0.01      | PASS       |
| 30°C/3.8V   | 0.004876      | 0.005031 | 0.004963 | 0.005089 | 0.01      | PASS       |
| 40°C/3.8V   | 0.004894      | 0.005092 | 0.004974 | 0.005152 | 0.01      | PASS       |
| 50°C/3.8V   | 0.004952      | 0.005147 | 0.004999 | 0.005222 | 0.01      | PASS       |



## NFC-F

| Test status | Frequency |           |           |           | Tolerance (MHz) |          |          |          |
|-------------|-----------|-----------|-----------|-----------|-----------------|----------|----------|----------|
|             | 13.56MHz  |           |           |           |                 |          |          |          |
|             | 1min      | 2min      | 5min      | 10min     | 1min            | 2min     | 5min     | 10min    |
| -10°C/3.8V  | 13.559348 | 13.559335 | 13.559343 | 13.559333 | 0.000652        | 0.000665 | 0.000657 | 0.000667 |
| 0°C/3.8V    | 13.559346 | 13.559334 | 13.559341 | 13.559330 | 0.000654        | 0.000666 | 0.000659 | 0.000670 |
| 10°C/3.8V   | 13.559345 | 13.559326 | 13.559332 | 13.559321 | 0.000655        | 0.000674 | 0.000668 | 0.000679 |
| 20°C/3.8V   | 13.559339 | 13.559318 | 13.559327 | 13.559315 | 0.000661        | 0.000682 | 0.000673 | 0.000685 |
| 30°C/3.8V   | 13.559339 | 13.559318 | 13.559327 | 13.559310 | 0.000661        | 0.000682 | 0.000673 | 0.000690 |
| 40°C/3.8V   | 13.559336 | 13.559309 | 13.559326 | 13.559301 | 0.000664        | 0.000691 | 0.000674 | 0.000699 |
| 50°C/3.8V   | 13.559329 | 13.559302 | 13.559322 | 13.559292 | 0.000671        | 0.000698 | 0.000678 | 0.000708 |

| Test status | Tolerance (%) |          |          |          | Limit (%) | Conclusion |
|-------------|---------------|----------|----------|----------|-----------|------------|
|             | 1min          | 2min     | 5min     | 10min    |           |            |
| -10°C/3.8V  | 0.004806      | 0.004907 | 0.004843 | 0.004923 | 0.01      | PASS       |
| 0°C/3.8V    | 0.004820      | 0.004910 | 0.004860 | 0.004942 | 0.01      | PASS       |
| 10°C/3.8V   | 0.004828      | 0.004968 | 0.004927 | 0.005011 | 0.01      | PASS       |
| 20°C/3.8V   | 0.004875      | 0.005028 | 0.004960 | 0.005053 | 0.01      | PASS       |
| 30°C/3.8V   | 0.004876      | 0.005031 | 0.004963 | 0.005089 | 0.01      | PASS       |
| 40°C/3.8V   | 0.004894      | 0.005092 | 0.004974 | 0.005152 | 0.01      | PASS       |
| 50°C/3.8V   | 0.004952      | 0.005147 | 0.004999 | 0.005222 | 0.01      | PASS       |



## NFC-V

| Test status | Frequency |           |           |           | Tolerance (MHz) |          |          |          |
|-------------|-----------|-----------|-----------|-----------|-----------------|----------|----------|----------|
|             | 13.56MHz  |           |           |           |                 |          |          |          |
|             | 1min      | 2min      | 5min      | 10min     | 1min            | 2min     | 5min     | 10min    |
| -10°C/3.8V  | 13.559348 | 13.559335 | 13.559343 | 13.559333 | 0.000652        | 0.000665 | 0.000657 | 0.000667 |
| 0°C/3.8V    | 13.559346 | 13.559334 | 13.559341 | 13.559330 | 0.000654        | 0.000666 | 0.000659 | 0.000670 |
| 10°C/3.8V   | 13.559345 | 13.559326 | 13.559332 | 13.559321 | 0.000655        | 0.000674 | 0.000668 | 0.000679 |
| 20°C/3.8V   | 13.559339 | 13.559318 | 13.559327 | 13.559315 | 0.000661        | 0.000682 | 0.000673 | 0.000685 |
| 30°C/3.8V   | 13.559339 | 13.559318 | 13.559327 | 13.559310 | 0.000661        | 0.000682 | 0.000673 | 0.000690 |
| 40°C/3.8V   | 13.559336 | 13.559309 | 13.559326 | 13.559301 | 0.000664        | 0.000691 | 0.000674 | 0.000699 |
| 50°C/3.8V   | 13.559329 | 13.559302 | 13.559322 | 13.559292 | 0.000671        | 0.000698 | 0.000678 | 0.000708 |

| Test status | Tolerance (%) |          |          |          | Limit (%) | Conclusion |
|-------------|---------------|----------|----------|----------|-----------|------------|
|             | 1min          | 2min     | 5min     | 10min    |           |            |
| -10°C/3.8V  | 0.004806      | 0.004907 | 0.004843 | 0.004923 | 0.01      | PASS       |
| 0°C/3.8V    | 0.004820      | 0.004910 | 0.004860 | 0.004942 | 0.01      | PASS       |
| 10°C/3.8V   | 0.004828      | 0.004968 | 0.004927 | 0.005011 | 0.01      | PASS       |
| 20°C/3.8V   | 0.004875      | 0.005028 | 0.004960 | 0.005053 | 0.01      | PASS       |
| 30°C/3.8V   | 0.004876      | 0.005031 | 0.004963 | 0.005089 | 0.01      | PASS       |
| 40°C/3.8V   | 0.004894      | 0.005092 | 0.004974 | 0.005152 | 0.01      | PASS       |
| 50°C/3.8V   | 0.004952      | 0.005147 | 0.004999 | 0.005222 | 0.01      | PASS       |



### 5.3. Radiates Emission

#### Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C  | 45%~50%           | 102.5kPa |

#### Method of Measurement

The test set-up was made in accordance to the general provisions of ANSI C63.10-2013. The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna. The radiated emissions measurements were made in a typical installation configuration. Sweep the whole frequency band through the range from 9 kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

During the test, below 30MHz, the center of the loop shall be 1 meters; above 30MHz, the height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna. The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing.

Set the spectrum analyzer in the following:

#### Out-of-band

Below 30MHz

RBW=9KHz, VBW=30KHz, detector=peak;

Above 30MHz,

RBW=100KHz, VBW=300KHz, Detector=peak

#### In-band

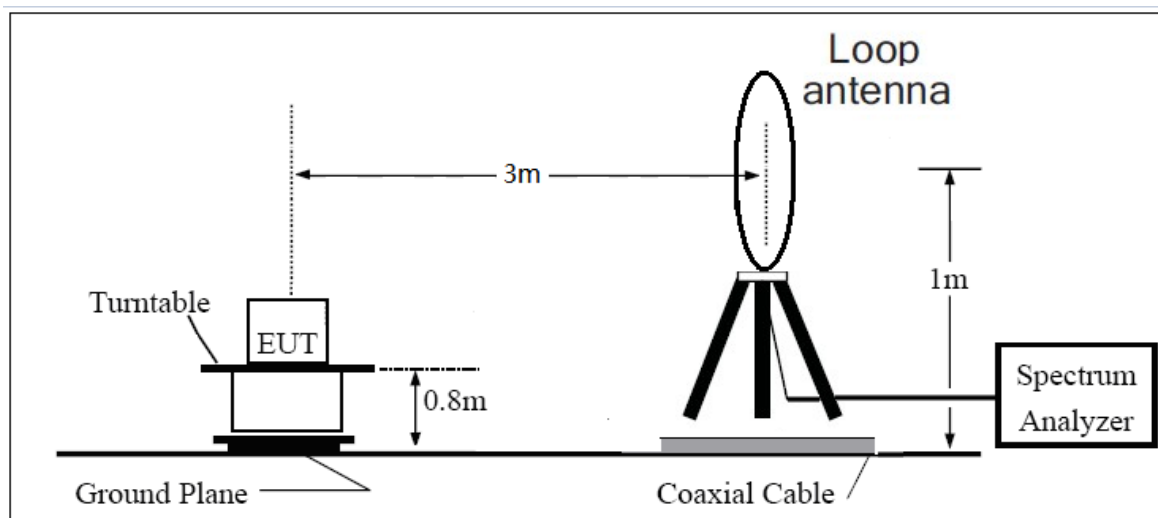
RBW=9KHz, VBW=30KHz, detector=peak;

The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the loop antenna is vertical, the other antennas are vertical and horizontal.

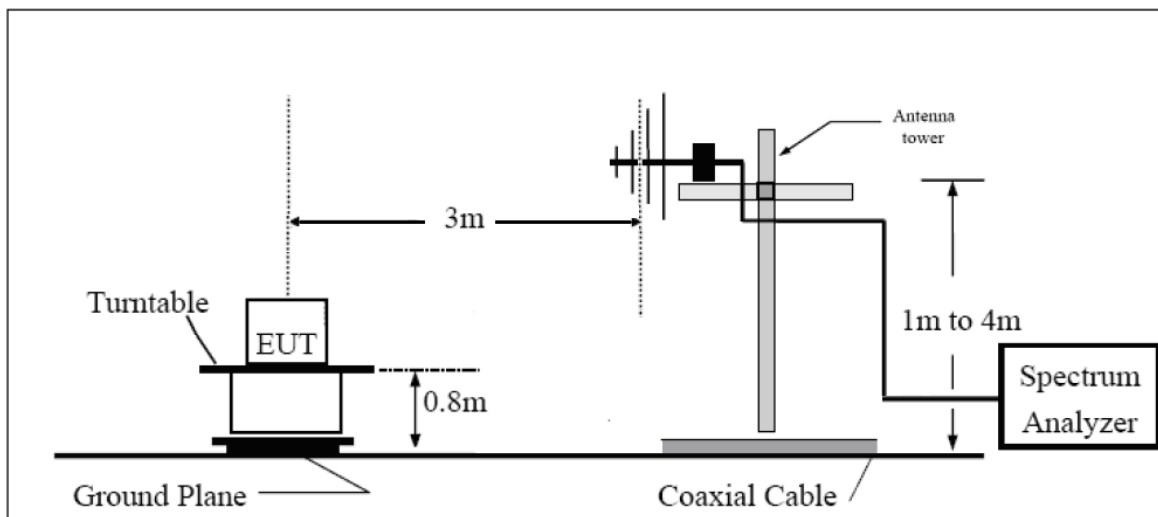
The test is in transmitting mode NFC-A ,NFC-B, NFC-F and NFC-V , choose worst mode NFC-A in report.

# Test setup

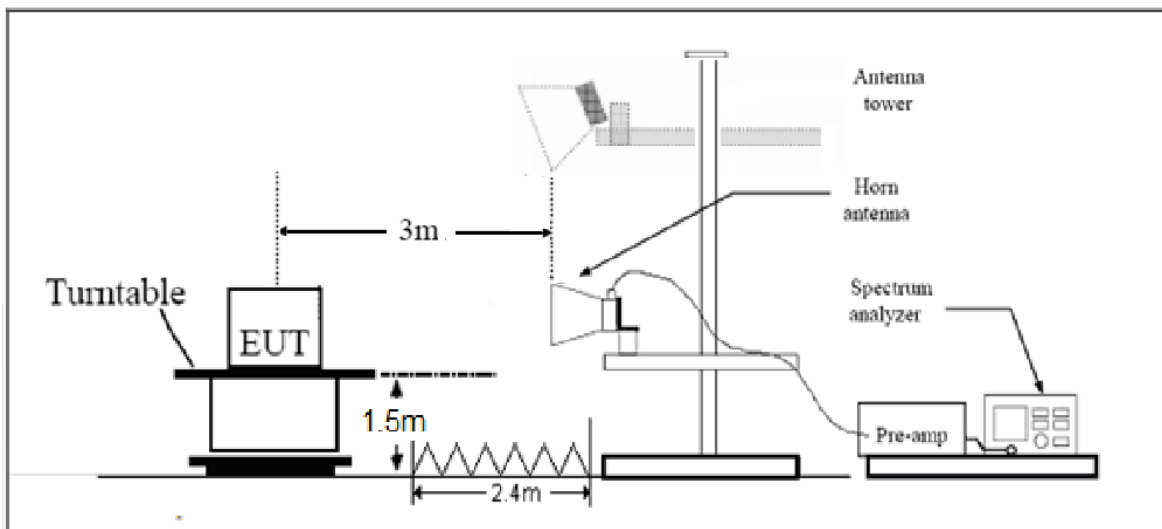
9kHz~~~ 30MHz



30MHz~~~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

## Limits

Clause 15.225(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.

Clause 15.225(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.

Clause 15.225(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.

Clause 15.225(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.

§15.209 (a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency of emission (MHz) | Field strength(uV/m) | Field strength(dBuV/m)    |
|-----------------------------|----------------------|---------------------------|
| 0.009–0.490                 | 2400/F(kHz)          | 128.519dBuV/m -93.8dBuV/m |
| 0.490–1.705                 | 24000/F(kHz)         | 73.8dBuV/m -62.969dBuV/m  |
| 1.705–30.0                  | 30                   | 69.5 dBuV/m               |
| 30-88                       | 100                  | 40 dBuV/m                 |
| 88-216                      | 150                  | 43.5 dBuV/m               |
| 216-960                     | 200                  | 46 dBuV/m                 |
| Above960                    | 500                  | 54 dBuV/m                 |

When using other measurement distance, according to the standard C63.10, If that point is closer to the EUT than  $\lambda/2\pi$  and the limit distance is greater than  $\lambda/2\pi$ , the data was extrapolated to the specified measurement distance of 30m using extrapolation factor as specified in §6.4.4.2. Extrapolation Factor =  $40\log(d \text{ near filed}/ d \text{ measure}) + 20\log(d \text{ limit} / d \text{ near filed})$

\*\*Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

§15.209 (d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

## Measurement Uncertainty

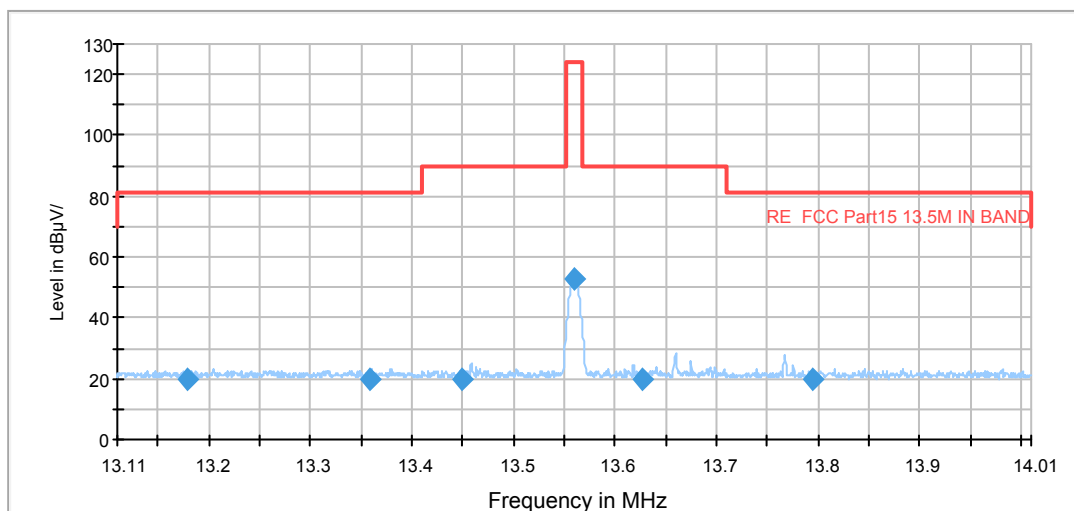
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 1.96$ .

| Frequency    | Uncertainty |
|--------------|-------------|
| 9KHz-30MHz   | 3.55 dB     |
| 30MHz-200MHz | 4.02 dB     |
| 200MHz-1GHz  | 3.28 dB     |
| Above 1GHz   | 3.70 dB     |

## Test result

NFC-A was selected as the worst condition. The test data of the worst-case condition was recorded in this report.

## In-band

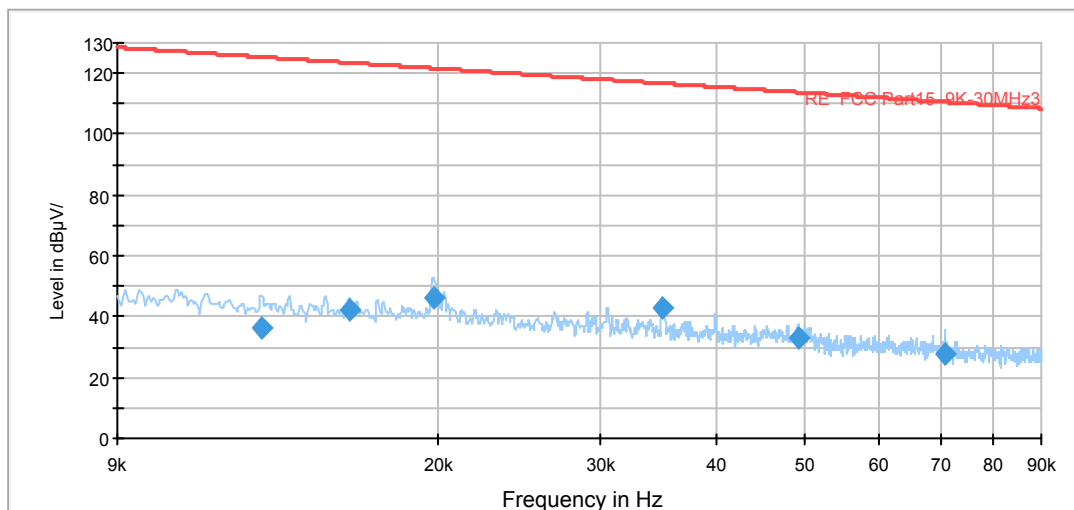


Radiates Emission from 13.11MHz to 14.01MHz

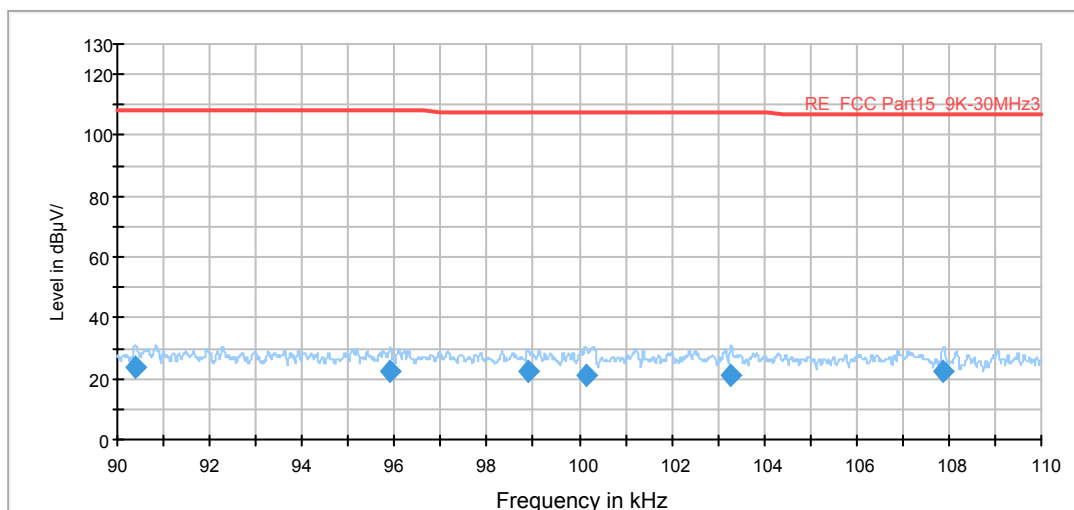
Note: This graph displays the maximum values of horizontal and vertical by software

## Out-of-band

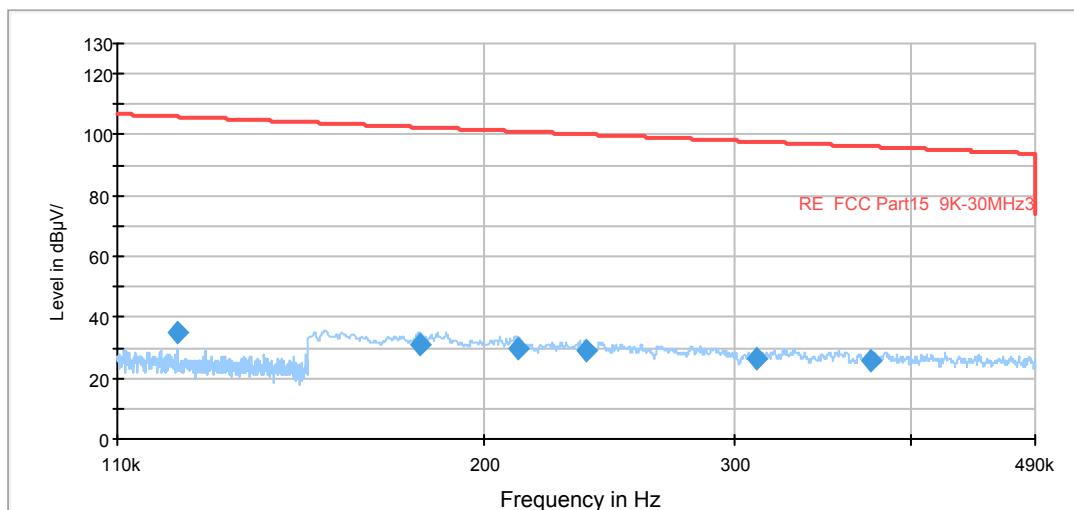
The following graphs display the maximum values of horizontal and vertical by software.  
For above 1GHz, Blue trace uses the peak detection, Green trace uses the average detection.



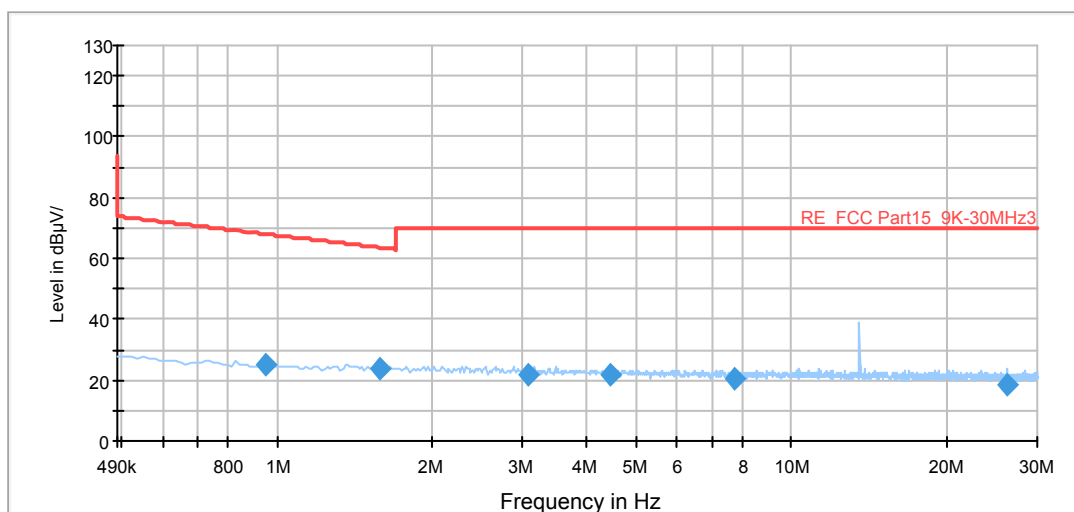
Radiates Emission from 9kHz to 90kHz



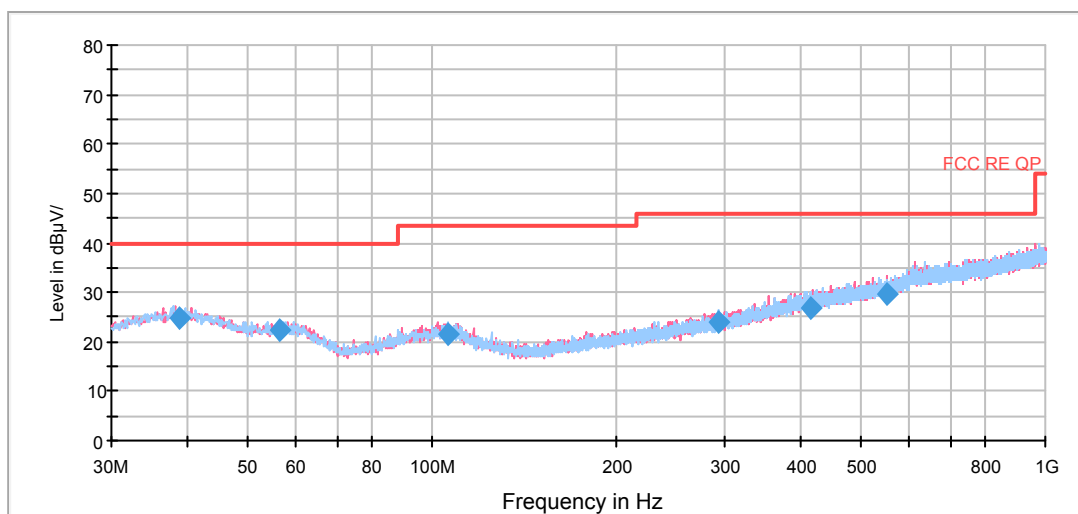
Radiates Emission from 90kHz to 110kHz



Radiates Emission from 110kHz to 490kHz



Radiates Emission from 490kHz to 30MHz



Radiates Emission from 30MHz to 1GHz

Note: This graph displays the maximum values of horizontal and vertical by software

| Frequency (MHz) | Quasi-Peak (dBuV/m) | Height (cm) | Polarization | Azimuth (deg) | Correct Factor (dB) | Margin (dB) | Limit (dBuV/m) |
|-----------------|---------------------|-------------|--------------|---------------|---------------------|-------------|----------------|
| 38.683750       | 24.7                | 175.0       | H            | 39.0          | 16.8                | 15.3        | 40.0           |
| 56.513750       | 22.3                | 100.0       | H            | 194.0         | 13.9                | 17.7        | 40.0           |
| 106.182500      | 21.4                | 114.0       | H            | 46.0          | 13.5                | 22.1        | 43.5           |
| 294.318750      | 24.1                | 175.0       | H            | 296.0         | 15.2                | 21.9        | 46.0           |
| 413.758750      | 26.9                | 125.0       | H            | 332.0         | 19.8                | 19.1        | 46.0           |
| 553.151250      | 29.8                | 100.0       | H            | 45.0          | 22.2                | 16.2        | 46.0           |

## 5.4. Conducted Emission

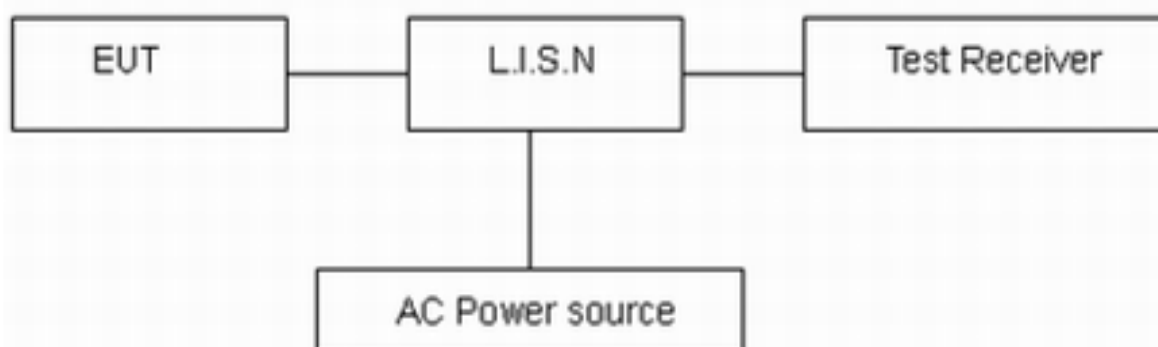
### Ambient condition

| Temperature | Relative humidity | Pressure |
|-------------|-------------------|----------|
| 23°C ~25°C  | 45%~50%           | 101.5kPa |

### Methods of Measurement

The EUT is placed on a non-metallic table of 80cm height above the horizontal metal reference ground plane. During the test, the EUT was operating in its typical mode. The test method is according to ANSI C63.10-2013. Connect the AC power line of the EUT to the L.I.S.N. Use EMI receiver to detect the average and Quasi-peak value. RBW is set to 9 kHz, VBW is set to 30kHz. The measurement result should include both L line and N line.  
The test is in transmitting mode.

### Test Setup



Note: AC Power source is used to change the voltage 110V/60Hz.

### Limits

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

| Frequency<br>(MHz) | Conducted Limits(dB $\mu$ V) |           |
|--------------------|------------------------------|-----------|
|                    | Quasi-peak                   | Average   |
| 0.15 - 0.5         | 66 to 56 *                   | 56 to 46* |
| 0.5 - 5            | 56                           | 46        |





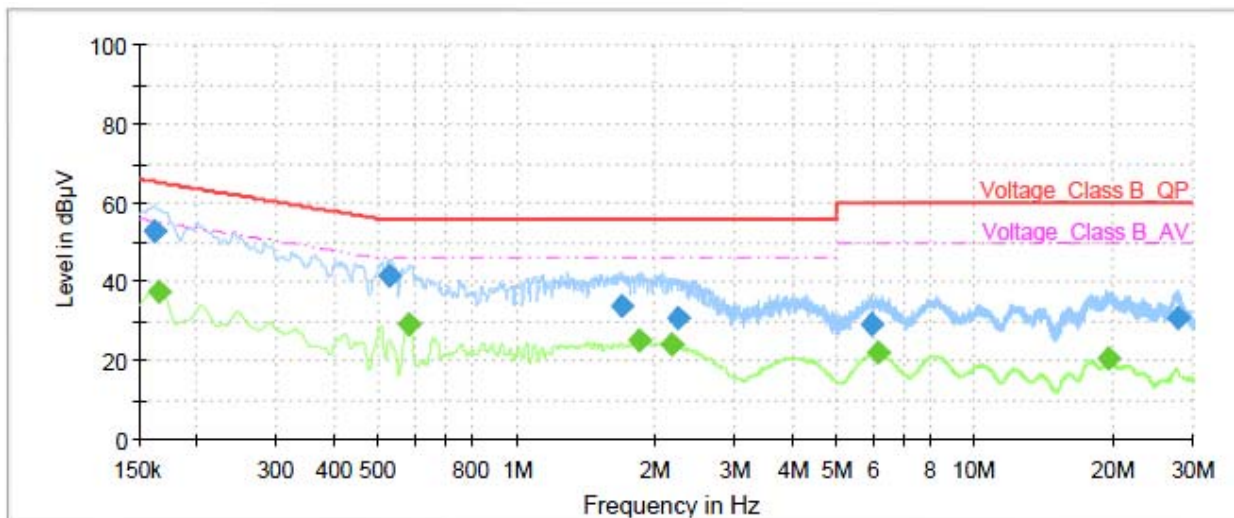
|   |    |    |
|---|----|----|
| 5 - 30  | 60 | 50 |
| *: Decreases with the logarithm of the frequency. |    |    |

### Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor  $k = 1.96$ ,  $U = 2.69$  dB.

### Test Results:

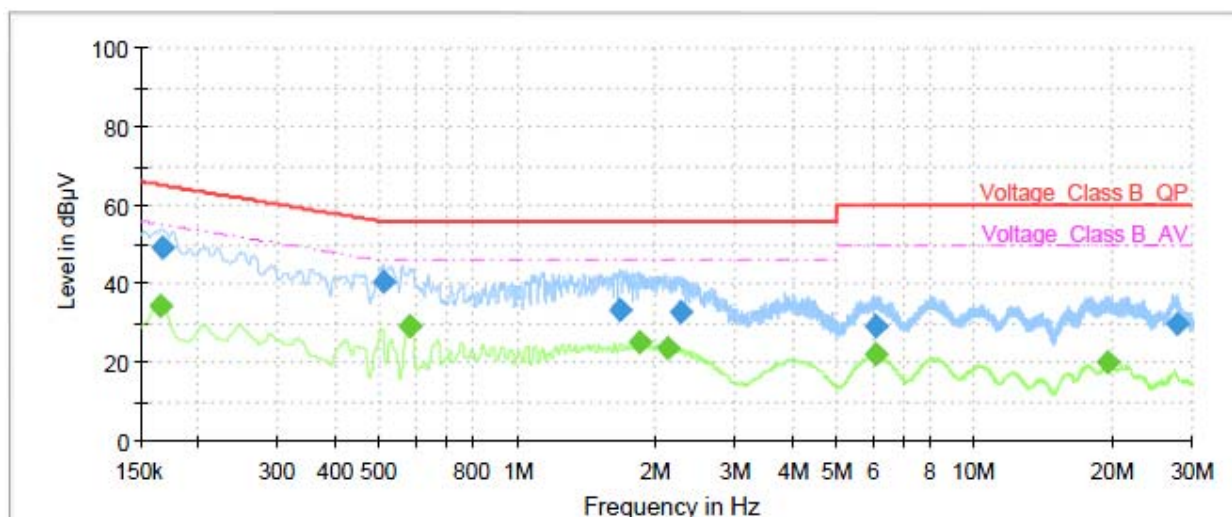
Following plots, Blue trace uses the peak detection and Green trace uses the average detection.



| Frequency (MHz) | QuasiPeak (dBμV) | Average (dBμV) | Limit (dBμV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Filter | Corr. (dB) |
|-----------------|------------------|----------------|--------------|-------------|-----------------|-----------------|------|--------|------------|
| 0.16            | 53.05            | ---            | 65.40        | 12.35       | 1000.0          | 9.000           | L1   | ON     | 19         |
| 0.17            | ---              | 37.44          | 55.17        | 17.73       | 1000.0          | 9.000           | L1   | ON     | 19         |
| 0.53            | 41.46            | ---            | 56.00        | 14.54       | 1000.0          | 9.000           | L1   | ON     | 19         |
| 0.58            | ---              | 29.14          | 46.00        | 16.86       | 1000.0          | 9.000           | L1   | ON     | 19         |
| 1.69            | 34.06            | ---            | 56.00        | 21.94       | 1000.0          | 9.000           | L1   | ON     | 19         |
| 1.85            | ---              | 25.30          | 46.00        | 20.70       | 1000.0          | 9.000           | L1   | ON     | 19         |
| 2.17            | ---              | 24.10          | 46.00        | 21.90       | 1000.0          | 9.000           | L1   | ON     | 19         |
| 2.26            | 30.96            | ---            | 56.00        | 25.04       | 1000.0          | 9.000           | L1   | ON     | 19         |
| 5.94            | 29.18            | ---            | 60.00        | 30.82       | 1000.0          | 9.000           | L1   | ON     | 19         |
| 6.13            | ---              | 22.27          | 50.00        | 27.73       | 1000.0          | 9.000           | L1   | ON     | 19         |
| 19.66           | ---              | 20.54          | 50.00        | 29.46       | 1000.0          | 9.000           | L1   | ON     | 20         |
| 27.78           | 31.02            | ---            | 60.00        | 28.98       | 1000.0          | 9.000           | L1   | ON     | 20         |

**Remark: Correct factor=cable loss + LISN factor**

L line Conducted Emission from 150 KHz to 30 MHz



| Frequency (MHz) | QuasiPeak (dBμV) | Average (dBμV) | Limit (dBμV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Filter | Corr. (dB) |
|-----------------|------------------|----------------|--------------|-------------|-----------------|-----------------|------|--------|------------|
| 0.17            | ---              | 34.14          | 55.17        | 21.03       | 1000.0          | 9.000           | N    | ON     | 19         |
| 0.17            | 49.48            | ---            | 65.06        | 15.58       | 1000.0          | 9.000           | N    | ON     | 19         |
| 0.51            | 40.49            | ---            | 56.00        | 15.51       | 1000.0          | 9.000           | N    | ON     | 19         |
| 0.58            | ---              | 29.01          | 46.00        | 16.99       | 1000.0          | 9.000           | N    | ON     | 19         |
| 1.67            | 33.32            | ---            | 56.00        | 22.68       | 1000.0          | 9.000           | N    | ON     | 19         |
| 1.84            | ---              | 25.16          | 46.00        | 20.84       | 1000.0          | 9.000           | N    | ON     | 19         |
| 2.12            | ---              | 23.83          | 46.00        | 22.17       | 1000.0          | 9.000           | N    | ON     | 19         |
| 2.29            | 32.67            | ---            | 56.00        | 23.33       | 1000.0          | 9.000           | N    | ON     | 19         |
| 6.06            | 29.14            | ---            | 60.00        | 30.86       | 1000.0          | 9.000           | N    | ON     | 19         |
| 6.10            | ---              | 22.24          | 50.00        | 27.76       | 1000.0          | 9.000           | N    | ON     | 19         |
| 19.63           | ---              | 20.20          | 50.00        | 29.80       | 1000.0          | 9.000           | N    | ON     | 19         |
| 27.71           | 29.80            | ---            | 60.00        | 30.20       | 1000.0          | 9.000           | N    | ON     | 20         |

Remark: Correct factor=cable loss + LISN factor

N line Conducted Emission from 150 KHz to 30 MHz



## 6. Main Test Instruments

| Name                     | Manufacturer | Type      | Serial Number      | Calibration Date | Expiration Time |
|--------------------------|--------------|-----------|--------------------|------------------|-----------------|
| Spectrum Analyzer        | R&S          | FSV30     | 100815             | 2019-12-16       | 2020-12-15      |
| EMI Test Receiver        | R&S          | ESCI      | 100948             | 2019-05-19       | 2020-05-18      |
| Loop Antenna             | SCHWARZBECK  | FMZB1519  | 1519-047           | 2017-09-26       | 2020-09-25      |
| TRILOG Broadband Antenna | Schwarzbeck  | VULB 9163 | 9163-201           | 2017-11-18       | 2020-11-17      |
| EMI Test Receiver        | R&S          | ESR       | 101667             | 2019-05-19       | 2020-05-18      |
| LISN                     | R&S          | ENV216    | 101171             | 2019-12-16       | 2020-12-15      |
| Spectrum Analyzer        | Agilent      | N9020A    | MY52330084         | 2019-05-19       | 2020-05-18      |
| TEMPERATURE CHAMBER      | WEISS        | VT4002    | 582261194500<br>10 | 2019-12-16       | 2020-12-15      |
| RF Cable                 | Agilent      | SMA 15cm  | 0001               | 2019-12-13       | 2020-03-12      |
| Software                 | R&S          | EMC32     | 9.26.0             | /                | /               |

\*\*\*\*\*END OF REPORT \*\*\*\*\*