**Shenzhen Global Test Service Co.,Ltd.**
No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

# FCC PART 15 SUBPART C TEST REPORT

## FCC PART 15 C (15.225)

| | |
|---|---|
| **Report Reference No. .....** : | **GTS20181224005-1-21** |
| **FCC ID. ..... :** | **2AU3C-B1** |
| Compiled by<br>( position+printed name+signature) . : | File administrators Tracy Hu |
| Supervised by<br>( position+printed name+signature) . : | Test Engineer Moon Tan |
| Approved by<br>( position+printed name+signature) . : | Manager Simon Hu |
| Date of issue ..... : | Nov.21,2019 |

| | |
|---|---|
| **Representative Laboratory Name.:** | **Shenzhen Global Test Service Co.,Ltd.** |
| Address ..... : | No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong,China |

| | |
|---|---|
| **Applicant's name**..... : | **RFinder.LLC** |
| Address ..... : | 455 sunrise highway West Islip New York 11795 USA. |

| | |
|---|---|
| **Test specification**.....**:** | |
| Standard..... : | **FCC Part 15 C (15.225)** |
| TRF Originator..... : | Shenzhen Global Test Service Co.,Ltd. |
| Master TRF ..... : | Dated 2014-12 |



| | |
|---|---|
| **Test item description .....:** | **RFinder B1** |
| Trade Mark..... : | N/A |
| Manufacturer ..... : | Shenzhen Tinfull Technology Co.,Ltd. |
| Model/Type reference ..... : | B1 |
| List Model ..... : | N/A |
| Modulation Type..... : | ASK |
| Operation Frequency ..... : | 13.56 MHz |
| Hardware Version ..... : | DT863-MB-V0.4 |
| Software Version..... : | N/A |
| Rating..... : | DC 7.6V by Battery<br>Recharged by DC 8.7V/1.8A Adapter |
| Result ..... : | **PASS** |

# TEST REPORT

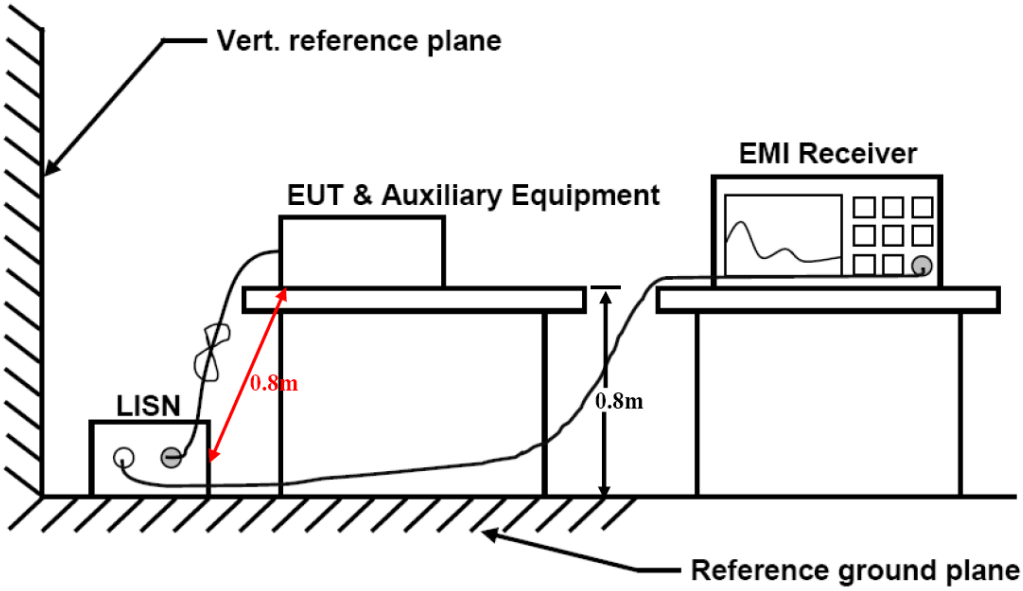
| **Test Report No. :** | **GTS20181224005-1-21** | Nov.21,2019<br>Date of issue |
|---|---|---|

| | | |
|---|---|---|
| Equipment under Test | : | RFinder B1 |
| Model /Type | : | B1 |
| List Model | : | N/A |
| **Applicant** | : | **RFinder.LLC** |
| Address | : | 455 sunrise highway West Islip New York 11795 USA. |
| **Manufacturer** | : | **Shenzhen Tinfull Technology Co.,Ltd.** |
| Address | : | Floor 6&8, C1 Plant, changfang Industrial Park, julong mountain No.3 road, dagongyeyuan, longtian street, Pingshan District, Shenzhen, China. |

| **Test Result**: | **PASS** |
|---|---|

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

# Contents



# 1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.225: RADIO FREQUENCY DEVICES.
ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices

# 2. SUMMARY

## 2.1. General Remarks

| | | |
|---|---|---|
| Date of receipt of test sample | : | Oct. 28, 2019 |
| | | |
| | | |
| Testing commenced on | : | Nov.01,2019 |
| | | |
| | | |
| Testing concluded on | : | Nov.21,2019 |

## 2.2. Product Description

| | |
|---|---|
| Product Name | RFinder B1 |
| Trade Mark | N/A |
| Model/Type reference | B1 |
| List Model | N/A |
| Model Declaration | N/A |
| Power supply: | DC 7.6V by Battery<br>Recharged by DC 8.7V/1.8A Adapter |
| 2G | |
| Support Band | GSM850/PCS1900/GPRS850/GPRS1900/EDGE850/EDGE1900 |
| Release Version | R99 |
| GPRS Class | Class 12 |
| EGPRS Class | Class 12 |
| GSM/EDGE/GPRS Power Class | GSM850:Power Class 4/ PCS1900:Power Class 1 |
| GPRS/EDGE Multislot Class | GPRS/EDGE: Multi-slot Class 12 |
| Type Of Modulation | GMSK for GSM/GPRS; GMSK/8PSK for EGPRS |
| Antenna Description | PIFA Antenna;<br>-5.0dBi (max.) For GSM 850;<br>-3.0dBi (max.) For DCS 1900; |
| 3G | |
| UMTS Operation Frequency Band | UMTS FDD Band II/V |
| WCDMA Release Version | R6 |
| HSDPA Release Version | Release 6 |
| HSUPA Release Version | Release 6 |
| Modulation Type | QPSK for UMTS |
| Antenna Description | PIFA Antenna;<br>-3.0dBi (max.) For WCDMA Band II;<br>-5.0dBi (max.) For WCDMA Band V |
| LTE | |
| LTE Operation Frequency Band | LTE Band 2, 4, 5, 7,12,17, 26, 38, 41 |
| LTE Release Version | R9 |
| Type Of Modulation | QPSK/16QAM |
| Antenna Description | PIFA Antenna;<br>-3.0dBi (max.) For Band 2;-3.0dBi (max.) For Band 4;<br>-5.0dBi (max.) For Band 5;-3.0dBi (max.) For Band 7; |

| | |
|---|---|
| | -5.0dBi (max.) For Band 12;-5.0dBi (max.) For Band 17;<br>-3.0dBi (max.) For Band 26;-3.0dBi (max.) For Band 38<br>-3.0dBi (max.) For Band 41 |
| Bluetooth | |
| Frequency Range | 2402MHz ~ 2480MHz |
| Channel Number | 79 channels for Bluetooth V4.0 (BDR/EDR)<br>40 channels for Bluetooth V4.0 (BT LE) |
| Channel Spacing | 1MHz for Bluetooth V4.0 (BDR/EDR)<br>2MHz for Bluetooth V4.0 (BT LE) |
| Modulation Type | GFSK, π/4-DQPSK, 8-DPSK for Bluetooth V4.0 (BDR/EDR)<br>GFSK for Bluetooth V4.0 (BT LE) |
| Bluetooth Version | V4.0 |
| Antenna Description | PIFA Antenna, -1.2dBi (Max.) |
| WIFI(2.4G Band) | |
| Frequency Range | 2412MHz ~ 2462MHz |
| Channel Spacing | 5MHz |
| Channel Number | 11 Channel for 20MHz bandwidth(2412~2462MHz)<br>7 channels for 40MHz bandwidth(2422~2452MHz) |
| Modulation Type | 802.11b: DSSS; 802.11g/n: OFDM |
| Antenna Description | PIFA Antenna, -1.2dBi (Max.) |
| WIFI(5.2G Band) | |
| Frequency Range | 5180MHz ~ 5240MHz |
| Channel Number | 4 channels for 20MHz bandwidth(5180-5240MHz)<br>2 channels for 40MHz bandwidth(5190~5230MHz) |
| Modulation Type | 802.11a/n/ac: OFDM |
| Antenna Description | PIFA Antenna, -1.4dBi (Max.) |
| WIFI (5.8G Band) | |
| Frequency Range | 5745MHz ~ 5825MHz |
| Channel Number | 5 channels for 20MHz bandwidth(5745-5825MHz)<br>2 channels for 40MHz bandwidth(5755~5795MHz) |
| Modulation Type | 802.11a/n/ac: OFDM |
| Antenna Description | PIFA Antenna, -1.4dBi (Max.) |
| PMR | |
| Frequency Range | VHF:136MHz to 174 MHz;UHF:400MHz to 470MHz |
| Channel Separation | Analog Voice 12.5KHz<br>Digital Voice 12.5KHz |
| Modulation Type | FM for Analog Voice<br>FSK for Digital Voice |
| Channel Bandwidth | 12.5 KHz |
| Rate Power | 4W/2W |
| Antenna Description | External Antenna, 1.8dBi (Max.) |
| RFID(13.56MHz) | |
| Frequency Range | 13.56MHz |
| Channel Number | 1 |
| Modulation Type | ASK |
| Antenna Description | PIFA Antenna, -1.20dBi (Max.) |

| | |
|---|---|
| GPS Receiver | Support and only RX |

## 2.3. Equipment Under Test

### Power supply system utilised

| | | | | | |
|---|---|---|---|---|---|
| Power supply voltage | : | ○ | 230V / 50 Hz | ○ | 120V / 60Hz |
| | | ○ | 12 V DC | ○ | 24 V DC |
| | | ● | Other (specified in blank below) | | |

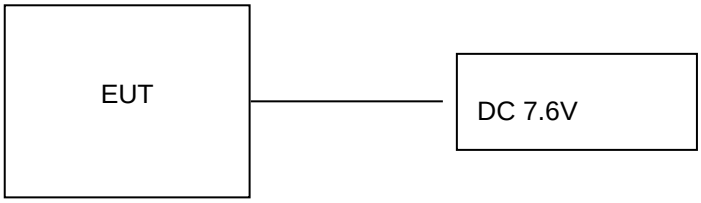
DC 7.6V form battery

## 2.4. Short description of the Equipment under Test (EUT)

This is a RFinder B1

For more details, refer to the user's manual of the EUT.

## 2.5. Block Diagram of Test Setup




## 2.6. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2AU3C-B1** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

## 2.7. Special Accessories

| Manufacturer | Description | Model | Serial Number | Certificate |
|---|---|---|---|---|
| ShenZhen Tinfull Technology Co.,Ltd | Adapter | STK018-08718T | -- | SDOC |

## 2.8. Modifications

No modifications were implemented to meet testing criteria.

# 3. TEST ENVIRONMENT

## 3.1. Address of the test laboratory

**Shenzhen Global Test Service Co.,Ltd.**
No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong,China,China.

## 3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS (No. CNAS L8169)
Shenzhen Global Test Service Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2019 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA (Certificate No. 4758.01)
Shenzhen Global Test Service Co., Ltd. has been assessed by the American Association for Laboratory Accreditation (A2LA). Certificate No. 4758.01.

## 3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

| | |
|---|---|
| Temperature: | 15-35 ° C |
| | |
| Humidity: | 30-60 % |
| | |
| Atmospheric pressure: | 950-1050mbar |

## 3.4. Summary of measurement results

| Applied Standard: FCC Part 15 Subpart C | | |
|---|---|---|
| **Test Items** | **FCC Rules** | **Result** |
| Line Conducted Emissions | §15.207(a) | PASS |
| Field Strength of Fundamental Emissions | §15.225(a)(b)(c) | PASS |
| Radiated Emissions | §15.225(d) & §15.209 | PASS |
| 20dB Bandwidth | § 15.215 | PASS |
| Frequency Stability | §15.225(e) | PASS |
| Antenna Requirement | §15.203 | PASS |

## 3.5. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Global Test Service Co.,Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen GTS laboratory is reported:

| Test | Range | Measurement Uncertainty | Notes |
|---|---|---|---|
| Radiated Emission | 30~1000MHz | 4.10 dB | (1) |
| Radiated Emission | 1~18GHz | 4.32 dB | (1) |
| Radiated Emission | 18-40GHz | 5.54 dB | (1) |
| Conducted Disturbance | 0.15~30MHz | 3.12 dB | (1) |

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

## 3.6. Equipments Used during the Test

| Test Equipment | Manufacturer | Model No. | Serial No. | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| LISN | R&S | ENV216 | 3560.6550.08 | 2019/09/20 | 2020/09/19 |
| LISN | R&S | ESH2-Z5 | 893606/008 | 2019/09/20 | 2020/09/19 |
| EMI Test Receiver | R&S | ESPI3 | 101841-cd | 2019/09/20 | 2020/09/19 |
| EMI Test Receiver | R&S | ESCI7 | 101102 | 2019/09/20 | 2020/09/19 |
| Spectrum Analyzer | Agilent | N9020A | MY48010425 | 2019/09/20 | 2020/09/19 |
| Spectrum Analyzer | R&S | FSV40 | 100019 | 2019/09/20 | 2020/09/19 |
| Vector Signal generator | Agilent | N5181A | MY49060502 | 2019/09/20 | 2020/09/19 |
| Signal generator | Agilent | E4421B | 3610AO1069 | 2019/09/20 | 2020/09/19 |
| Climate Chamber | ESPEC | EL-10KA | A20120523 | 2019/09/20 | 2020/09/19 |
| Controller | EM Electronics | Controller EM 1000 | N/A | N/A | N/A |
| Horn Antenna | Schwarzbeck | BBHA 9120D | 01622 | 2019/09/23 | 2020/09/22 |
| Active Loop Antenna | Beijing Da Ze Technology Co.,Ltd. | ZN30900C | 15006 | 2019/10/12 | 2020/10/11 |
| Bilog Antenna | Schwarzbeck | VULB9163 | 000976 | 2019/05/26 | 2020/05/25 |
| Broadband Horn Antenna | SCHWARZBECK | BBHA 9170 | 791 | 2019/09/20 | 2020/09/19 |
| Amplifier | Schwarzbeck | BBV 9743 | #202 | 2019/09/20 | 2020/09/19 |
| Amplifier | Schwarzbeck | BBV9179 | 9719-025 | 2019/09/20 | 2020/09/19 |
| Amplifier | EMCI | EMC051845B | 980355 | 2019/09/20 | 2020/09/19 |
| Temperature/Humidity Meter | Gangxing | CTH-608 | 02 | 2019/09/20 | 2020/09/19 |
| High-Pass Filter | K&L | 9SH10-2700/X12750-O/O | KL142031 | 2019/09/20 | 2020/09/19 |
| High-Pass Filter | K&L | 41H10-1375/U12750-O/O | KL142032 | 2019/09/20 | 2020/09/19 |
| RF Cable(below 1GHz) | HUBER+SUHNER | RG214 | RE01 | 2019/09/20 | 2020/09/19 |
| RF Cable(above 1GHz) | HUBER+SUHNER | RG214 | RE02 | 2019/09/20 | 2020/09/19 |
| Data acquisition card | Agilent | U2531A | TW53323507 | 2019/09/20 | 2020/09/19 |
| Power Sensor | Agilent | U2021XA | MY5365004 | 2019/09/20 | 2020/09/19 |
| Test Control Unit | Tonscend | JS0806-1 | 178060067 | 2019/06/20 | 2020/06/19 |
| Automated filter bank | Tonscend | JS0806-F | 19F8060177 | 2019/06/20 | 2020/06/19 |
| EMI Test Software | Tonscend | JS1120-1 | Ver 2.6.8.0518 | / | / |
| EMI Test Software | Tonscend | JS1120-3 | Ver 2.5.77.0418 | / | / |
| EMI Test Software | Tonscend | JS32-CE | Ver 2.5 | / | / |
| EMI Test Software | Tonscend | JS32-RE | Ver 2.5.1.8 | / | / |

Note: The Cal.Interval was one year.

# 4. Radiated Measurement

## 4.1. Standard Applicable

According to §15.209/ §15.205

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| \1\ 0.495-0.505 | 16.69475-16.69525 | 608-614 | 5.35-5.46 |
| 2.1735-2.1905 | 16.80425-16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 1435-1626.5 | 9.0-9.2 |
| 4.20725-4.20775 | 73-74.6 | 1645.5-1646.5 | 9.3-9.5 |
| 6.215-6.218 | 74.8-75.2 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 108-121.94 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 123-138 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 149.9-150.05 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 156.52475-156.52525 | 2483.5-2500 | 17.7-21.4 |
| 8.37625-8.38675 | 156.7-156.9 | 2690-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 162.0125-167.17 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293. | 167.72-173.2 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 240-285 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 322-335.4 | 3600-4400 | (\2\) |
| 13.36-13.41 | | | |

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

\2\ Above 38.6

According to §15.247 (d): 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

| Frequencies (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009~0.490 | 2400/F(KHz) | 300 |
| 0.490~1.705 | 24000/F(KHz) | 30 |
| 1.705~30.0 | 30 | 30 |
| 30~88 | 100 | 3 |
| 88~216 | 150 | 3 |
| 216~960 | 200 | 3 |
| Above 960 | 500 | 3 |

## 4.2. Measuring Instruments and Setting

Please refer to equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

| Spectrum Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Start Frequency | 1000 MHz |
| Stop Frequency | $10^{th}$ carrier harmonic |
| RB / VB (Emission in restricted band) | 1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average |
| RB / VB (Emission in non-restricted band) | 1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average |

| Receiver Parameter | Setting |
|---|---|
| Attenuation | Auto |
| Start ~ Stop Frequency | 9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG |
| Start ~ Stop Frequency | 150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB/VB 120kHz/1MHz for QP |

## 4.3. Test Procedures

**1) Sequence of testing 9 kHz to 30 MHz**

**Setup:**

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

**Premeasurement:**

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 0.8 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

**Final measurement:**

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

**2) Sequence of testing 30 MHz to 1 GHz**

**Setup:**

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

**Premeasurement:**

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

**Final measurement:**

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

**3) Sequence of testing 1 GHz to 18 GHz**

**Setup:**

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

**Premeasurement:**

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

**Final measurement:**

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

**4) Sequence of testing above 18 GHz**

**Setup:**

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

**Premeasurement:**

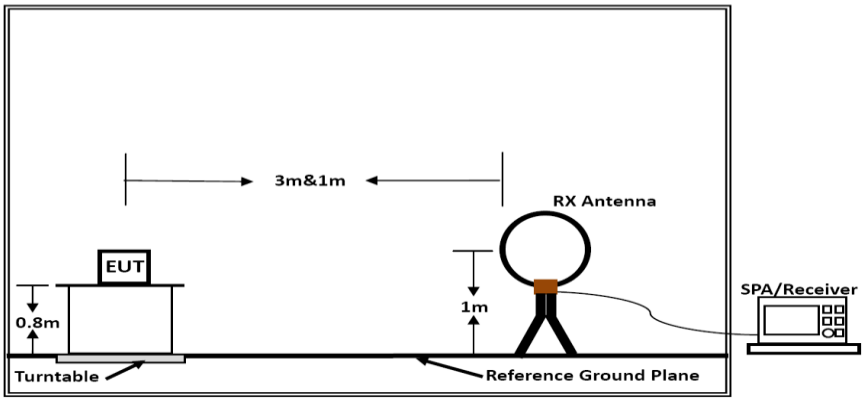
--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

**Final measurement:**

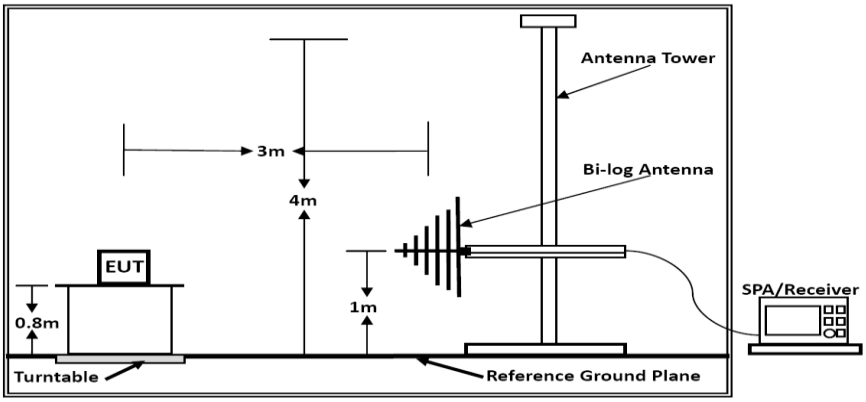
--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

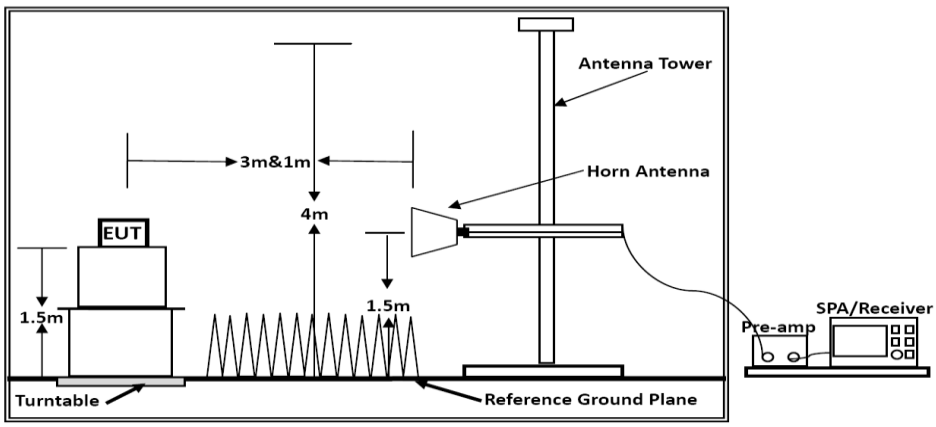
## 4.4. Test Setup Layout




Below 30MHz




Below 1GHz




Above 1GHz

Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m.

Distance extrapolation factor = 20 log (specific distanc [3m] / test distance [1m]) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

## 4.5. Test Results

PASS.

The test data please refer to following page:

***9 KHz~30MHz***

Note: Only recorded the worst test result.

| Freq. MHz | Reading dBuV | Factor dB | Measured dBuV/m | Limit dBuV/m | Margin dB | Remark |
|---|---|---|---|---|---|---|
| 0.52 | -- | -- | -- | 92.64 | -- | -- |
| 1.62 | -- | -- | -- | 63.58 | -- | -- |
| 2.64 | 23.31 | 20.76 | 44.07 | 69.5 | -25.43 | QP |
| 6.32 | 27.43 | 20.78 | 48.21 | 69.5 | -21.29 | QP |
| 13.56 | 34.17 | 20.64 | 54.81 | 124 | -57.69 | QP |
| 21.15 | 26.00 | 20.78 | 46.78 | 69.5 | -22.72 | QP |
| 20.77 | 27.54 | 20.40 | 47.94 | 69.5 | -21.56 | QP |
| 25.91 | 29.53 | 20.41 | 49.94 | 69.5 | -19.56 | QP |

*Note: Emission Level= Reading Level + Antenna Factor + Cable Loss

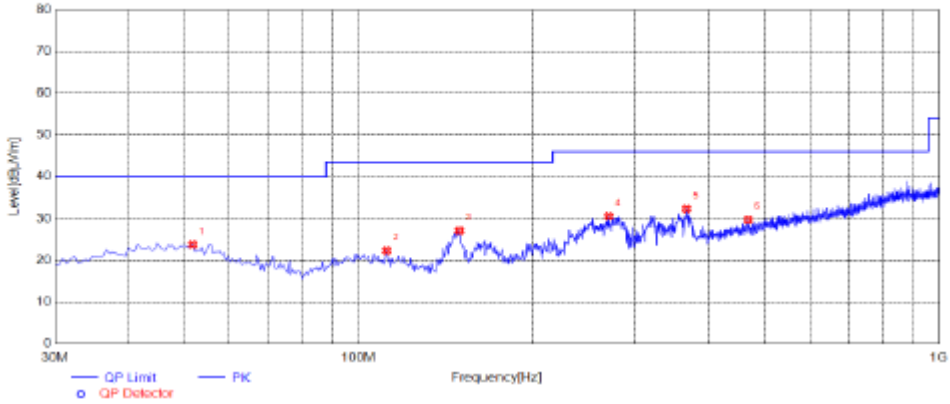
Margin = Emission Limit – Emission Values

"--" means noise floor.

***30MHz ~ 1GHz***

Horizontal

**Test Graph**



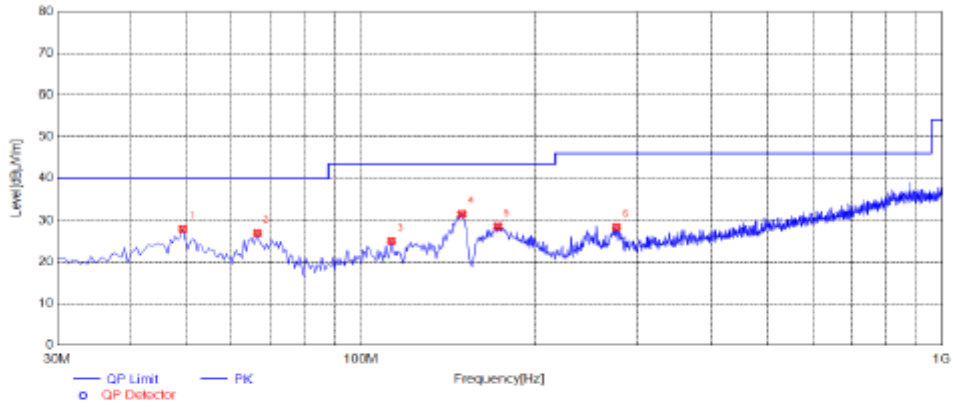

| Suspected List | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NO. | Frequency [MHz] | Reading [dBµV/m] | Factor [dB] | Result [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity | Remark |
| 1 | 51.8250 | 38.97 | -15.20 | 23.77 | 40.00 | 16.23 | 100 | 50 | PK | Horizonta | PASS |
| 2 | 111.9650 | 39.63 | -17.31 | 22.32 | 43.50 | 21.18 | 100 | 300 | PK | Horizonta | PASS |
| 3 | 149.3100 | 46.84 | -19.72 | 27.12 | 43.50 | 16.38 | 100 | 260 | PK | Horizonta | PASS |
| 4 | 270.0750 | 45.04 | -14.49 | 30.55 | 46.00 | 15.45 | 100 | 340 | PK | Horizonta | PASS |
| 5 | 367.5600 | 44.70 | -12.42 | 32.28 | 46.00 | 13.72 | 100 | 30 | PK | Horizonta | PASS |
| 6 | 469.4100 | 40.05 | -10.36 | 29.69 | 46.00 | 16.31 | 100 | 290 | PK | Horizonta | PASS |

Note:1. Result (dBµV/m) = Reading(dBµV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

Vertical

**Test Graph**



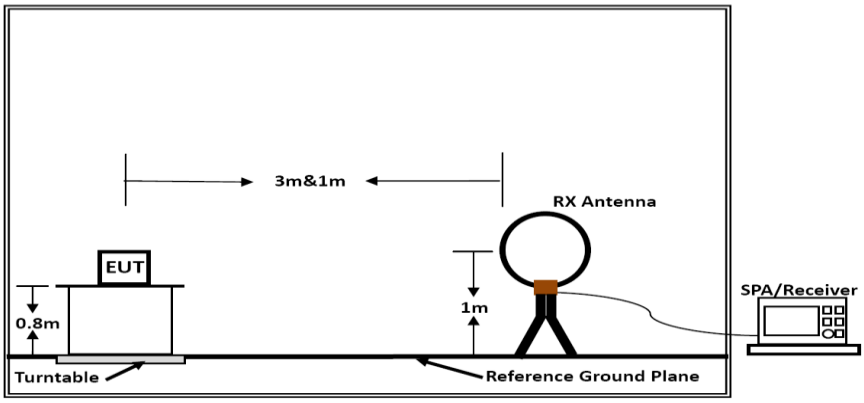

| Suspected List | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NO. | Frequency [MHz] | Reading [dBµV/m] | Factor [dB] | Result [dBµV/m] | Limit [dBµV/m] | Margin [dB] | Height [cm] | Angle [°] | Detector | Polarity | Remark |
| 1 | 49.4000 | 42.71 | -14.84 | 27.87 | 40.00 | 12.13 | 100 | 290 | PK | Vertical | PASS |
| 2 | 66.3750 | 45.38 | -18.44 | 26.94 | 40.00 | 13.06 | 100 | 350 | PK | Vertical | PASS |
| 3 | 112.9350 | 42.47 | -17.46 | 25.01 | 43.50 | 18.49 | 100 | 40 | PK | Vertical | PASS |
| 4 | 149.3100 | 51.24 | -19.72 | 31.52 | 43.50 | 11.98 | 100 | 300 | PK | Vertical | PASS |
| 5 | 172.1050 | 47.44 | -18.88 | 28.56 | 43.50 | 14.94 | 100 | 340 | PK | Vertical | PASS |
| 6 | 275.4100 | 42.85 | -14.49 | 28.36 | 46.00 | 17.64 | 100 | 260 | PK | Vertical | PASS |

Note:1. Result (dBµV/m) = Reading(dBµV/m) + Factor (dB) .

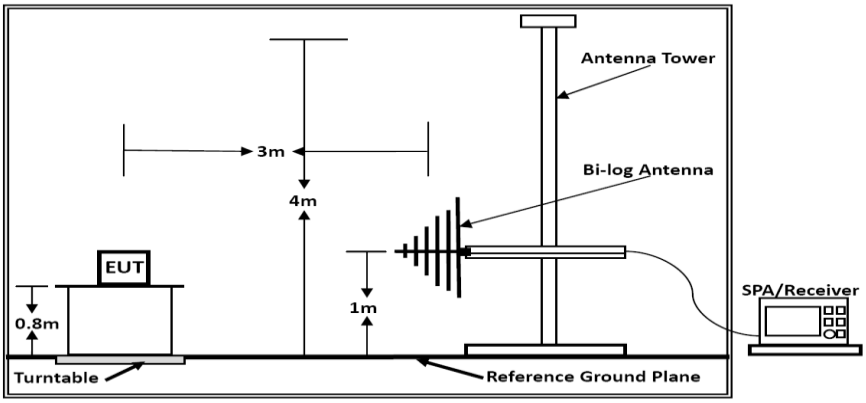
2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

# 5. Field Strength of Fundamental Emissions and Mask Measurement

## 5.1. Block Diagram of Test Setup




Below 30MHz




Below 1GHz

## 5.2. Field strength of fundamental emissions limit and Mask limit

The field strength of fundamental emissions shall not exceed 15848 microvolts/meter at 30 meters. The emissions limit in this paragraph is based on measurement instrumentation employing a QP detector.

| Frequencies (MHz) | Field Strength (microvolts/meter) | Field Strength (dBμV/m) at 10m | Field Strength (dBμV/m) at 3m |
|---|---|---|---|
| 13.553 ~ 13.567MHz | 15848 at 30m | 103.08 (QP) | 124 (QP) |

Mask Limit:

| Frequency (MHz) | Limit (dBuV/m) | Distance (m) |
|---|---|---|
| 1.705-13.110 | 69.5 | 3 |
| 13.110-13.410 | 80.5 | 3 |
| 13.410-13.553 | 90.5 | 3 |
| 13.553-13.567 | 124.0 | 3 |
| 13.567-13.710 | 90.5 | 3 |
| 13.710-14.010 | 80.5 | 3 |
| 14.010-30.000 | 69.5 | 3 |

## 5.3. Test Results

PASS.

The test data please refer to following page:

| | Freq.(MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV/m) | Limit (dBuV/m) | Pol. | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 13.56 | 54.35 | 20.64 | 74.99 | 124.0 | H | QP |
| 2 | 13.43 | 45.36 | 20.64 | 66 | 90.5 | H | QP |
| 3 | 13.37 | 39.58 | 20.64 | 60.22 | 80.5 | H | QP |
| 4 | 13.64 | 44.61 | 20.64 | 65.25 | 90.5 | H | QP |
| 5 | 13.85 | 38.69 | 20.64 | 59.33 | 80.5 | H | QP |

*Note: Factor= Antenna Factor + Cable Loss

Emission level (dBμV/m) = 20 log Emission level (μV/m).

Measured distance is 3m.

All emissions emit from non-NFC function of digital unintentional emissions. All NFC's spurious emissions are below 20dB of limits.

# 6. Bandwidth of the operating frequency

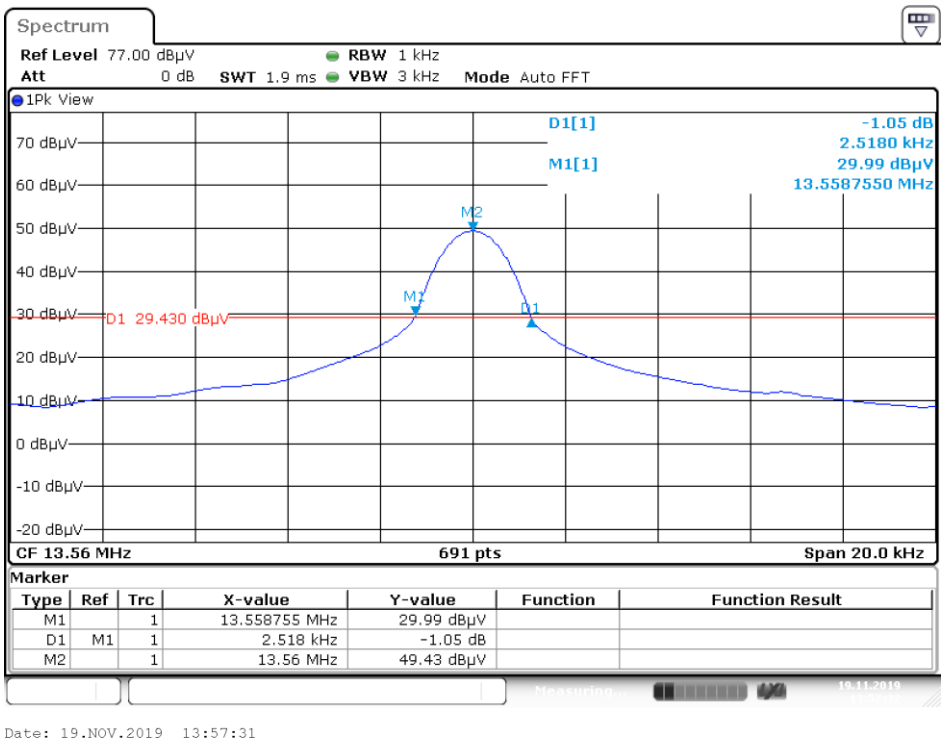
## 6.1. Standard Applicable

Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emissions in the specific band (13.553 ~ 13.567MHz).

## 6.2. Test Result

| Carrier Frequency (MHz) | 20dB Bandwidth (KHz) | $F_L$ (MHz) | $F_H$ (MHz) |
|---|---|---|---|
| 13.56 | 2.5 | 13.558755 | 13.561273 |

Please refer to the test plot:



# 7. Frequency Stability Measurement

## 7.1. Standard Applicable

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% (100ppm) 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 full charged battery.

## 7.2. Test Result

Voltage vs. Frequency Stability

| Voltage(V) | Measurement Frequency (MHz) | Deviation (KHz) | Deviation (ppm) | Limit (ppm) |
|---|---|---|---|---|
| DC 6.70V | 13.56044 | 0.44 | 32.45 | 100 |
| DC 7.60V | 13.56013 | 0.13 | 9.59 | 100 |
| DC 8.40V | 13.56031 | 0.31 | 22.86 | 100 |

Temperature vs. Frequency Stability

| Temperature (℃) | Measurement Frequency (MHz) | Deviation (KHz) | Deviation (ppm) | Limit (ppm) |
|---|---|---|---|---|
| -20 | 13.56007 | 0.07 | 5.16 | 100 |
| -10 | 13.56013 | 0.13 | 9.59 | 100 |
| 0 | 13.56021 | 0.21 | 15.49 | 100 |
| 10 | 13.56026 | 0.26 | 19.17 | 100 |
| 20 | 13.56044 | 0.44 | 32.45 | 100 |
| 30 | 13.56018 | 0.18 | 13.27 | 100 |
| 40 | 13.56039 | 0.39 | 28.76 | 100 |
| 50 | 13.56044 | 0.44 | 32.45 | 100 |

# 8. line conducted emissions

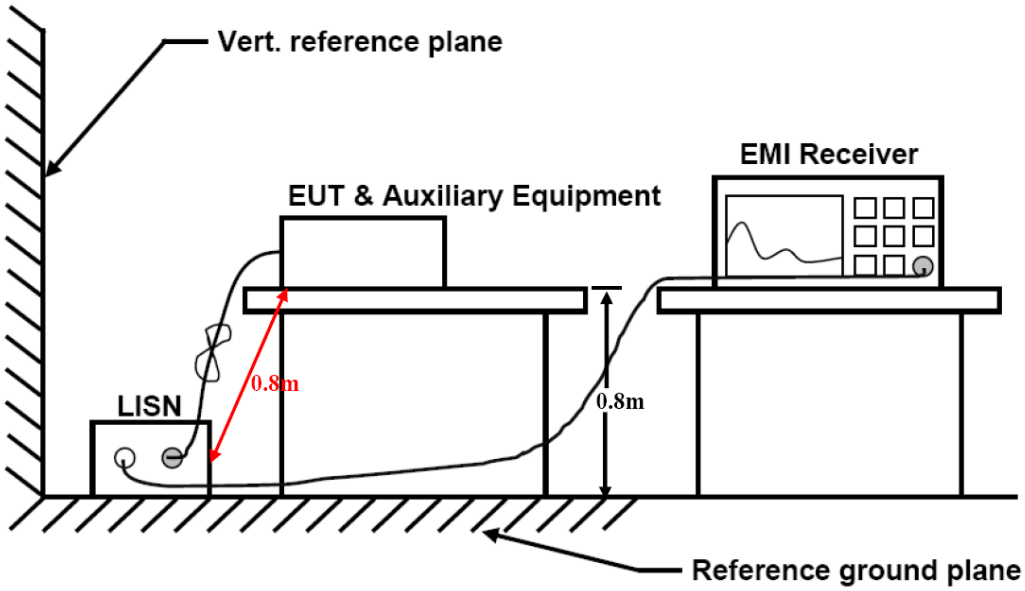
## 8.1. Standard Applicable

According to §15.207(a): For an intentional radiator which 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 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

| Frequency Range (MHz) | Limits (dBμV) | |
|---|---|---|
| | Quasi-peak | Average |
| 0.15 to 0.50 | 66 to 56 | 56 to 46 |
| 0.50 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

* Decreasing linearly with the logarithm of the frequency

## 8.2. Block Diagram of Test Setup




## 8.3. Test Results

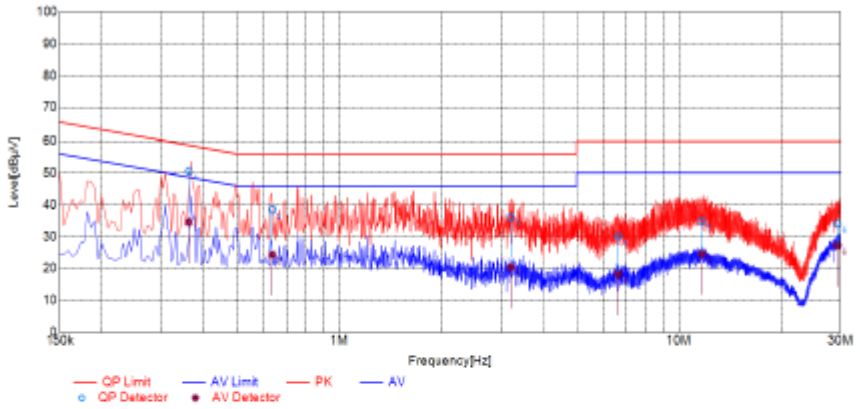
**PASS.**

The test data please refer to following page.

***AC Conducted Emission of charge from adapter mode @ AC 120V/60Hz (worst case)***

| Power supply: | AC 120V/60Hz | Polarization | L |
|---|---|---|---|

**Test Graph**



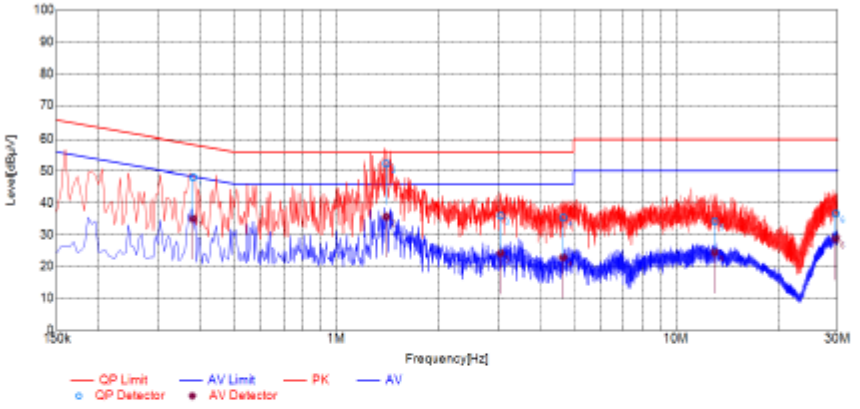

Final Data List

| NO. | Frequency [MHz] | QP Reading [dBµV] | AVG. Reading [dBµV] | Factor [dB] | QP Result [dBµV] | AVG. Result [dBµV] | QP Limit [dBµV] | AVG. Limit [dBµV] | QP Margin [dB] | AVG. Margin [dB] | Line | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.3605 | 40.49 | 24.47 | 10.13 | 50.62 | 34.60 | 58.72 | 48.72 | 8.10 | 14.12 | L1 | PASS |
| 2 | 0.6356 | 28.32 | 14.21 | 10.20 | 38.52 | 24.41 | 56.00 | 46.00 | 17.48 | 21.59 | L1 | PASS |
| 3 | 3.2032 | 25.89 | 10.03 | 10.35 | 36.24 | 20.38 | 56.00 | 46.00 | 19.76 | 25.62 | L1 | PASS |
| 4 | 6.6466 | 19.62 | 7.83 | 10.50 | 30.12 | 18.33 | 60.00 | 50.00 | 29.88 | 31.67 | L1 | PASS |
| 5 | 11.7008 | 24.13 | 13.94 | 10.79 | 34.92 | 24.73 | 60.00 | 50.00 | 25.08 | 25.27 | L1 | PASS |
| 6 | 29.3340 | 22.32 | 15.57 | 11.74 | 34.06 | 27.31 | 60.00 | 50.00 | 25.94 | 22.69 | L1 | PASS |

Note:1. Result (dBµV) = Reading (dBµV) + Factor (dB).
2. Factor (dB) = Cable loss (dB) + LISN Factor (dB).

| Power supply: | AC 120V/60Hz | Polarization | N |
|---|---|---|---|

**Test Graph**




Final Data List

| NO. | Frequency [MHz] | QP Reading [dBµV] | AVG. Reading [dBµV] | Factor [dB] | QP Result [dBµV] | AVG. Result [dBµV] | QP Limit [dBµV] | AVG. Limit [dBµV] | QP Margin [dB] | AVG. Margin [dB] | Line | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.3793 | 37.95 | 24.93 | 10.15 | 48.10 | 35.08 | 58.30 | 48.30 | 10.20 | 13.22 | N | PASS |
| 2 | 1.4023 | 42.04 | 25.47 | 10.23 | 52.27 | 35.70 | 56.00 | 46.00 | 3.73 | 10.30 | N | PASS |
| 3 | 3.0478 | 25.67 | 13.97 | 10.34 | 36.01 | 24.31 | 56.00 | 46.00 | 19.99 | 21.69 | N | PASS |
| 4 | 4.6595 | 25.06 | 12.55 | 10.35 | 35.41 | 22.90 | 56.00 | 46.00 | 20.59 | 23.10 | N | PASS |
| 5 | 13.0335 | 23.36 | 13.61 | 10.91 | 34.27 | 24.52 | 60.00 | 50.00 | 25.73 | 25.48 | N | PASS |
| 6 | 29.6310 | 24.96 | 17.12 | 11.72 | 36.68 | 28.84 | 60.00 | 50.00 | 23.32 | 21.16 | N | PASS |

Note:1. Result (dBµV) = Reading (dBµV) + Factor (dB).
2. Factor (dB) = Cable loss (dB) + LISN Factor (dB).

# 9. Antenna Requirements

## 9.1. Standard Applicable

According to antenna requirement of §15.203.

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

## 9.2. Antenna Connected Construction

9.2.1. Standard Applicable

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

9.2.2. Antenna Connector Construction

The gains of antenna used for transmitting is -1.2dBi, and the antenna is a Loop antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.

9.2.3. Results: Compliance.

# 10. Test Setup Photos of the EUT

Reference to the **TEST SETUP PHOTOS**

# 11. External and Internal Photos of the EUT

Reference to the **EXTERNAL AND INTERNAL PHOTOS**

**.....End of Report.....**