



FCC 47 CFR PART 15 SUBPART C

for

GeoSafari Jr. Walkie Talkies

Model: EI-5130

Brand: N/A

Test Report Number:

C161109Z01-RP1

Issued for:

K-Mark Industrial LTD.

**Flat A, 7/F., Mai On Ind. Bldg., 17-21, Kung Yip St., Kwai Chung,
Hong Kong**

Issued by:

COMPLIANCE CERTIFICATION SERVICES (SHENZHEN) INC.

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Issued Date: November 15, 2016



TESTING CERT #2861.01

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Revision History

| Rev. | Issue Date | Revisions | Effect Page | Revised By |
|------|-------------------|---------------|-------------|-------------|
| 00 | November 15, 2016 | Initial Issue | ALL | Amzula Chen |
| | | | | |
| | | | | |



TABLE OF CONTENTS

1 TEST CERTIFICATION 4

2 EUT DESCRIPTION..... 5

3 TEST METHODOLOGY..... 6

 3.1. DESCRIPTION OF TEST MODES 6

4 TEST METHODOLOGY..... 7

 4.1. EUT EXERCISE..... 7

 4.2. FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS 7

5 INSTRUMENT CALIBRATION 8

6 SETUP OF EQUIPMENT UNDER TEST 8

 6.1. DESCRIPTION OF SUPPORT UNITS..... 8

 6.2. CONFIGURATION OF SYSTEM UNDER TEST 8

7 FACILITIES AND ACCREDITATIONS 9

 7.1. FACILITIES..... 9

 7.2. ACCREDITATIONS 9

 7.3. MEASUREMENT UNCERTAINTY..... 10

8 FCC PART 15.249 REQUIREMENTS 11

 8.1. 20DB BANDWIDTH 11

 8.2. BAND EDGES MEASUREMENT..... 14

 8.3. POWER LINE CONDUCTED EMISSIONS MEASUREMENT 21

 8.4. SPURIOUS EMISSIONS MEASUREMENT..... 24



1 TEST CERTIFICATION

| | |
|---------------------|--|
| Product | GeoSafari Jr. Walkie Talkies |
| Model | EI-5130 |
| Brand | N/A |
| Tested | November 9~November 15, 2016 |
| Applicant | K-Mark Industrial LTD. Flat A, 7/F., Mai On Ind. Bldg., 17-21, Kung Yip St., Kwai Chung, Hong Kong |
| Manufacturer | K-Mark Industrial LTD. Flat A, 7/F., Mai On Ind. Bldg., 17-21, Kung Yip St., Kwai Chung, Hong Kong |

| APPLICABLE STANDARDS | |
|------------------------------------|-------------------------|
| STANDARD | TEST RESULT |
| FCC 47 CFR Part 15 Subpart C | No non-compliance noted |
| DEVIATION FROM APPLICABLE STANDARD | |
| None | |

We hereby certify that:

The above equipment was tested by Compliance Certification Services (Shenzhen) Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.249.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:

Reviewed by:

Sunday Hu
Supervisor of EMC Dept.
Compliance Certification Service (Shenzhen)
Inc.

Ruby Zhang
Supervisor of Report Dept.
Compliance Certification Service (Shenzhen)
Inc.



2 EUT DESCRIPTION

| | |
|------------------------------|------------------------------------|
| Product | GeoSafari Jr. Walkie Talkies |
| Model Number | EI-5130 |
| Brand Name | N/A |
| Model Discrepancy | N/A |
| Identify Number | C161109Z01-RP1 |
| EUT Power Rating | DC1.5V *3 supplied by the battery |
| Frequency Range | 2407MHz~2477MHz |
| Transmit Power | 70.66uV/m (Max.) |
| Modulation Technique | GFSK |
| Number of Channels | 3 Channel |
| Antenna Specification | PVC antenna with 1.8dBi gain (Max) |
| Temperature Range | -20°C ~ 60°C |
| Hardware Version | P1603010_V11A.TSK |
| Software Version | EDI-43 V1.3 |

Note: 1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.

2. This submittal(s) (test report) is intended for **FCC ID: VEPGLEI-5130** filing to comply with Section 15.207, 15.209 and 15.249 of the FCC Part 15, Subpart C Rules.



3 TEST METHODOLOGY

3.1. DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

The following test mode(s) were scanned during the preliminary test below 1G:

| Test Item | Test mode | Worse mode |
|--------------------|---|-------------------------------------|
| Conducted Emission | Not applicable, since the EUT received DC power from Battery. | <input type="checkbox"/> |
| Radiated Emission | Mode 1: TX | <input checked="" type="checkbox"/> |

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz, one statement for spurious below 1GHz, that only worst case was recorded and whether it was low, mid or high.



4 TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and FCC CFR 47 15.207, 15.209 and 15.249.

4.1. EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209, 15.249 under the FCC Rules Part 15 Subpart C.

4.2. FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(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 - | 2483.5 - 2500 | 17.7 - 21.4 |
| 8.37625 - 8.38675 | 156.52525 | 2655 - 2900 | 22.01 - 23.12 |
| 8.41425 - 8.41475 | 156.7 - 156.9 | 3260 - 3267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 162.0125 - 167.17 | 3332 - 3339 | 31.2 - 31.8 |
| 12.51975 - 12.52025 | 167.72 - 173.2 | 3345.8 - 3358 | 36.43 - 36.5 |
| 12.57675 - 12.57725 | 240 - 285 | 3600 - 4400 | (²) |
| 13.36 - 13.41 | 322 - 335.4 | | |

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

² Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.



5 INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

6 SETUP OF EQUIPMENT UNDER TEST

6.1. DESCRIPTION OF SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

| No. | Equipment | Model No. | Serial No. | FCC ID | Brand | Data Cable | Power Cord |
|-----|-----------|-----------|------------|--------|-------|------------|------------|
| 1 | Battery*3 | N/A | N/A | DoC | N/A | N/A | N/A |

Note:

- 1) Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

6.2. CONFIGURATION OF SYSTEM UNDER TEST

See test photographs attached in Appendix II for the actual connections between EUT and support equipment.



7 FACILITIES AND ACCREDITATIONS

7.1. FACILITIES

All measurement facilities used to collect the measurement data are located at

No10-1, Mingkeda Logistics Park, No.18 Huanguan South Rd., Guan Lan Town, Baoan District, Shenzhen China

The sites are constructed in conformance with the requirements of ANSI C63.10, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

7.2. ACCREDITATIONS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

| | |
|--------------|-------------|
| USA | A2LA |
| China | CNAS |

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

| | |
|---------------|---|
| USA | FCC |
| Japan | VCCI (C-4815,R-4320,T-2317, G-10624) |
| Canada | INDUSTRY CANADA |

Copies of granted accreditation certificates are available for downloading from our web site, <http://www.ccssz.com>



7.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

| Parameter | Uncertainty |
|--|-------------|
| Radiated Emission, 30 to 200 MHz Test Site : 966(2) | +/-3.6880dB |
| Radiated Emission, 200 to 1000 MHz Test Site : 966(2) | +/-3.6695dB |
| Radiated Emission, 1 to 8 GHz | +/-5.1782dB |
| Radiated Emission, 8 to 18 GHz | +/-5.2173dB |
| Conducted Emissions | +/-3.6836dB |
| Band Width | 178kHz |
| Peak Output Power MU | +/-1.906dB |
| Band Edge MU | +/-0.182dB |
| Channel Separation MU | 416.178Hz |
| Duty Cycle MU | 0.054ms |
| Frequency Stability MU | 226Hz |

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

The measured result is above (below) the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance (non-compliance) is more probable than non-compliance) with the specification limit.



8 FCC PART 15.249 REQUIREMENTS

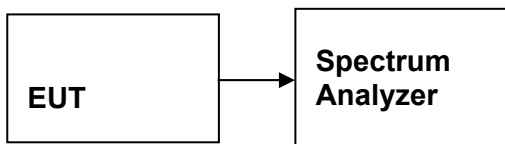
8.1. 20DB BANDWIDTH

None; for reporting purpose only.

MEASUREMENT EQUIPMENT USED

| Name of Equipment | Manufacturer | Model | Serial Number | Last Calibration | Due Calibration |
|-------------------|--------------|--------|---------------|------------------|-----------------|
| Spectrum Analyzer | Agilent | N9010A | MY55370330 | 02/21/2016 | 02/20/2017 |

Remark: Each piece of equipment is scheduled for calibration once a year.



TEST CONFIGURATION

TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT, then connect a low loss RF cable from antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=100 kHz, VBW=300 kHz, Span=6MHz, Sweep = auto.
4. Mark the peak frequency and 20dB (upper and lower) frequency.
5. Repeat until all the test channels are investigated.

TEST RESULTS

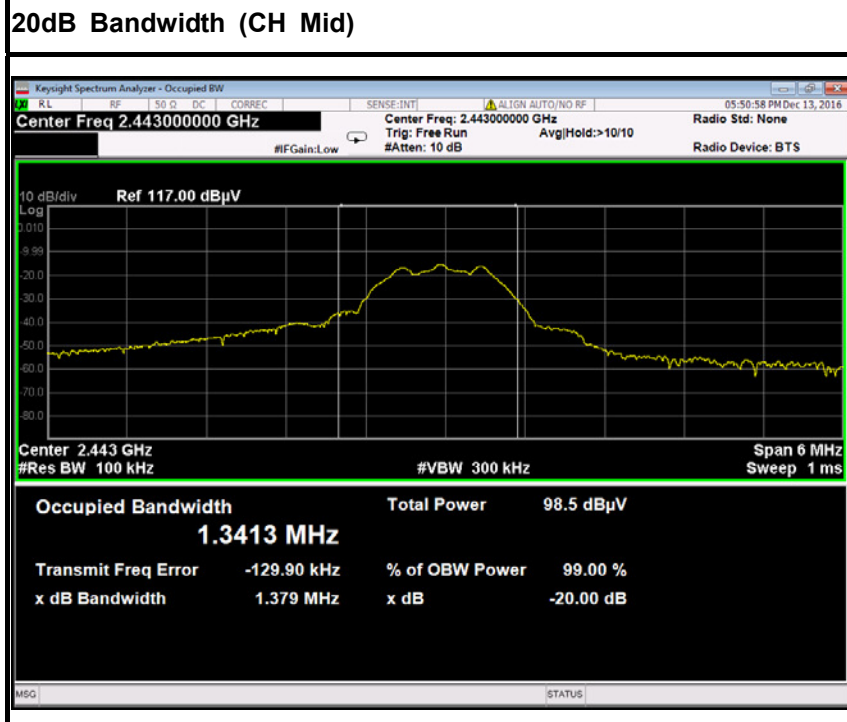
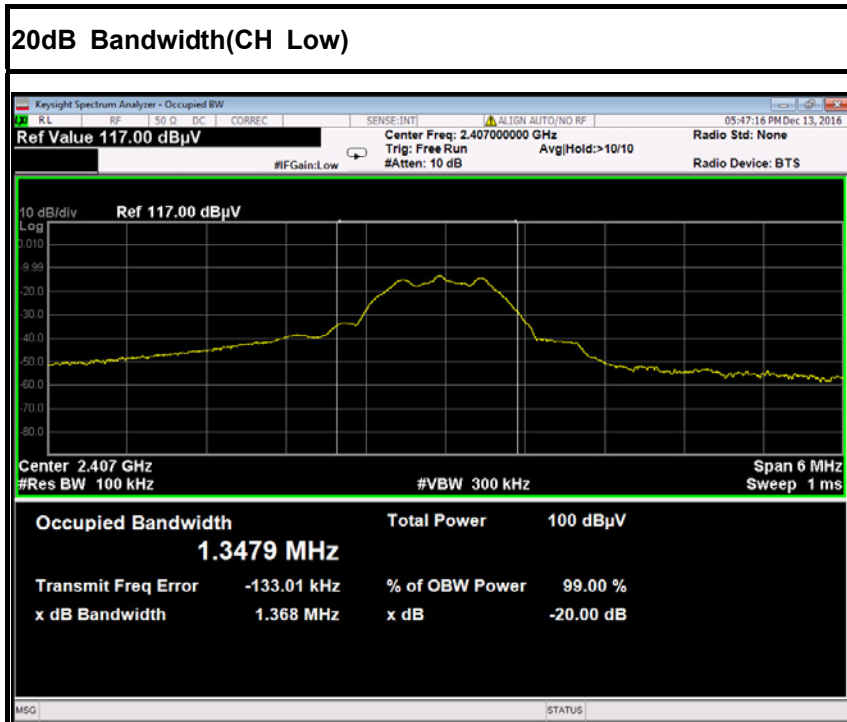
No non-compliance noted

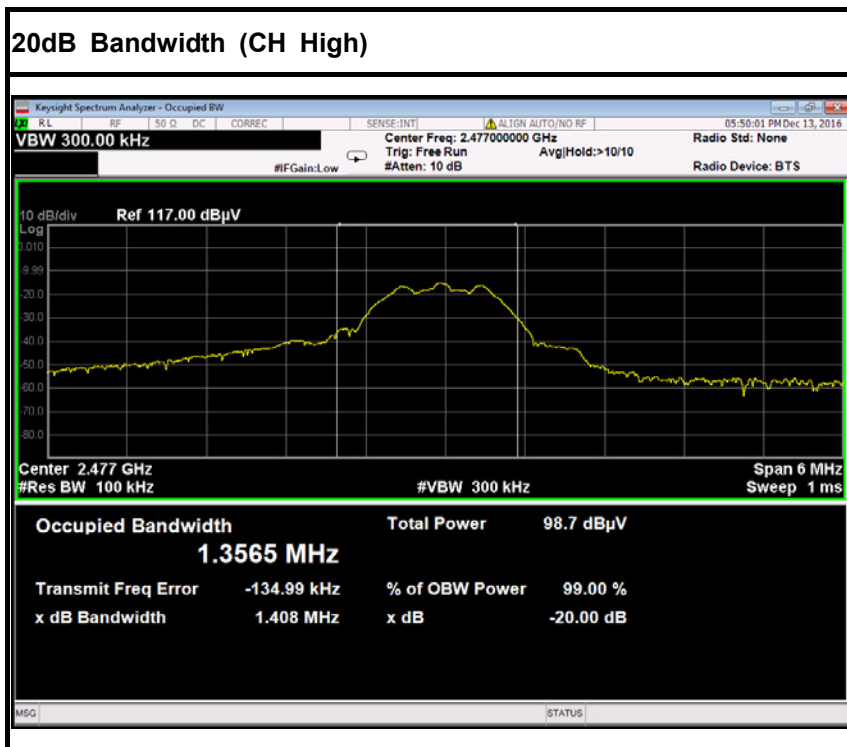
Test Data

| Channel | Frequency (MHz) | Bandwidth (kHz) | Limit (kHz) | Margin (kHz) |
|---------|-----------------|-----------------|-------------|--------------|
| Low | 2407 | 1368 | >500 | PASS |
| Mid | 2443 | 1379 | | PASS |
| High | 2477 | 1408 | | PASS |



Test plot







8.2. BAND EDGES MEASUREMENT

LIMIT

1. In the above emission table, the tighter limit applies at the band edges.

| Frequency (Hz) | Field Strength ($\mu\text{V}/\text{m}$ at 3-meter) | Field Strength ($\text{dB}\mu\text{V}/\text{m}$ at 3-meter) |
|----------------|--|---|
| 30-88 | 100 | 40 |
| 88-216 | 150 | 43.5 |
| 216-960 | 200 | 46 |
| Above 960 | 500 | 54 |

2. As shown in Section 15.35(b), for frequencies above 1000 MHz, the above field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.
3. As shown in Section 15.249(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

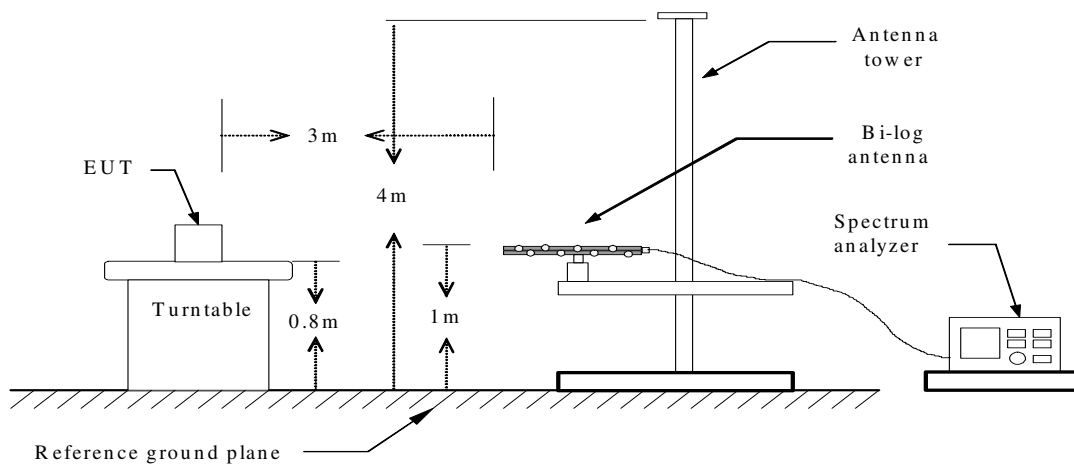


MEASUREMENT EQUIPMENT USED

| Radiated Emission Test Site 966 (2) | | | | | |
|-------------------------------------|----------------|--------------------|---------------|------------------|-----------------|
| Name of Equipment | Manufacturer | Model Number | Serial Number | Last Calibration | Due Calibration |
| PSA Series Spectrum Analyzer | Agilent | E4446A | US44300399 | 02/21/2016 | 02/20/2017 |
| EMI TEST RECEIVER | ROHDE&SCHWARZ | ESCI | 100783 | 02/21/2016 | 02/20/2017 |
| Amplifier | MITEQ | AM-1604-3000 | 1123808 | 03/18/2016 | 03/17/2017 |
| High Noise Amplifier | Agilent | 8449B | 3008A01838 | 02/21/2016 | 02/20/2017 |
| Board-Band Horn Antenna | Schwarzbeck | BBHA 9170 | 9170-497 | 02/28/2016 | 02/27/2017 |
| Bilog Antenna | SCHAFFNER | CBL6143 | 5082 | 02/21/2016 | 02/20/2017 |
| Horn Antenna | SCHWARZBECK | BBHA9120 | D286 | 02/28/2016 | 02/27/2017 |
| Loop Antenna | COM-POWER | AL-130 | 121044 | 09/25/2016 | 09/24/2017 |
| Turn Table | N/A | N/A | N/A | N.C.R | N.C.R |
| Controller | Sunol Sciences | SC104V | 022310-1 | N.C.R | N.C.R |
| Controller | CT | N/A | N/A | N.C.R | N.C.R |
| Temp. / Humidity Meter | Anymetre | JR913 | N/A | 02/21/2016 | 02/20/2017 |
| Antenna Tower | SUNOL | TLT2 | N/A | N.C.R | N.C.R |
| Test S/W | FARAD | LZ-RF / CCS-SZ-3A2 | | | |

Remark: Each piece of equipment is scheduled for calibration once a year.

TEST CONFIGURATION



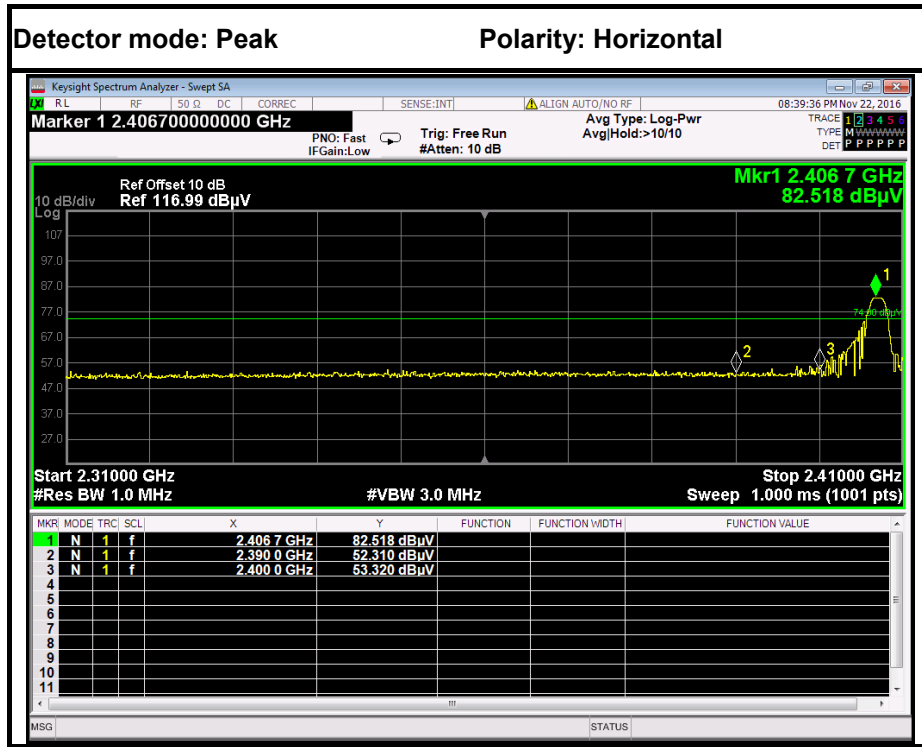


TEST PROCEDURE

1. The EUT is placed on a turntable, which is 1.5m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - (a) PEAK: RBW=1MHz / VBW=3MHz / Sweep=AUTO
 - (b) Average: RBW=1MHz / VBW=2.7kHz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

TEST RESULTS

Refer to attach spectrum analyzer data chart.



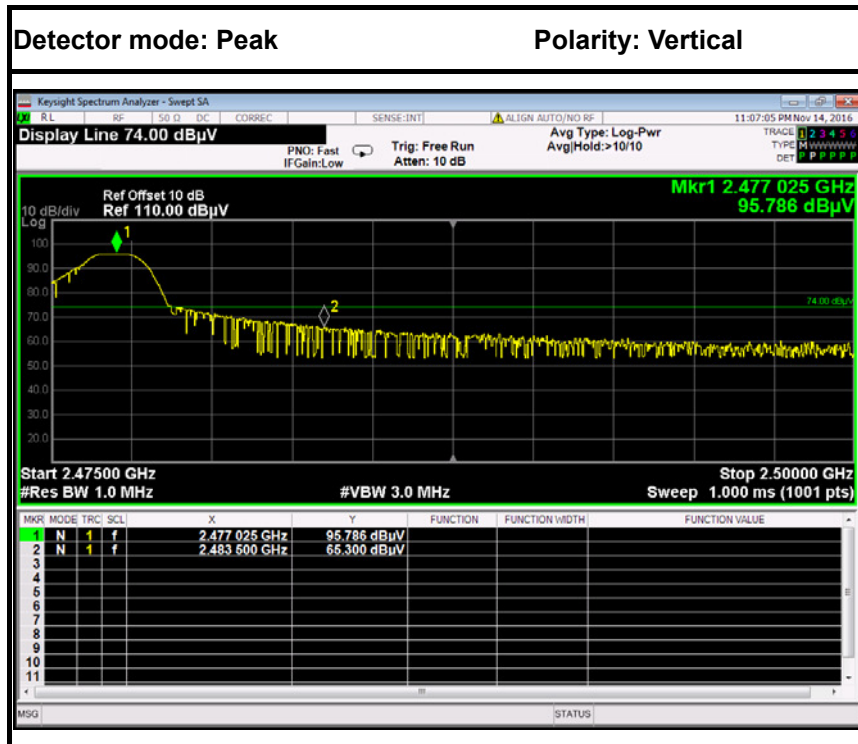
| No. | Frequency (MHz) | Reading (dBuV) | Corrected (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Antenna Pole |
|-----|-----------------|----------------|----------------|---------------|--------------|-------------|----------|--------------|
| 1 | 2390.0000 | 46.72 | -6.60 | 53.32 | 74.00 | -20.68 | Peak | Horizontal |
| 2 | 2390.0000 | 20.62 | -6.60 | 27.22 | 54.00 | -26.78 | Average | Horizontal |

Remark: $20\text{Log} \{1/[\text{on}/(\text{on}+\text{off})]\} = 20\text{Log} [1/(0.39/7.87)] = 26.1\text{dB}$;

AVG (Result) = Peak - $20\text{Log} \{1/[\text{on}/(\text{on} + \text{off})]\}$;

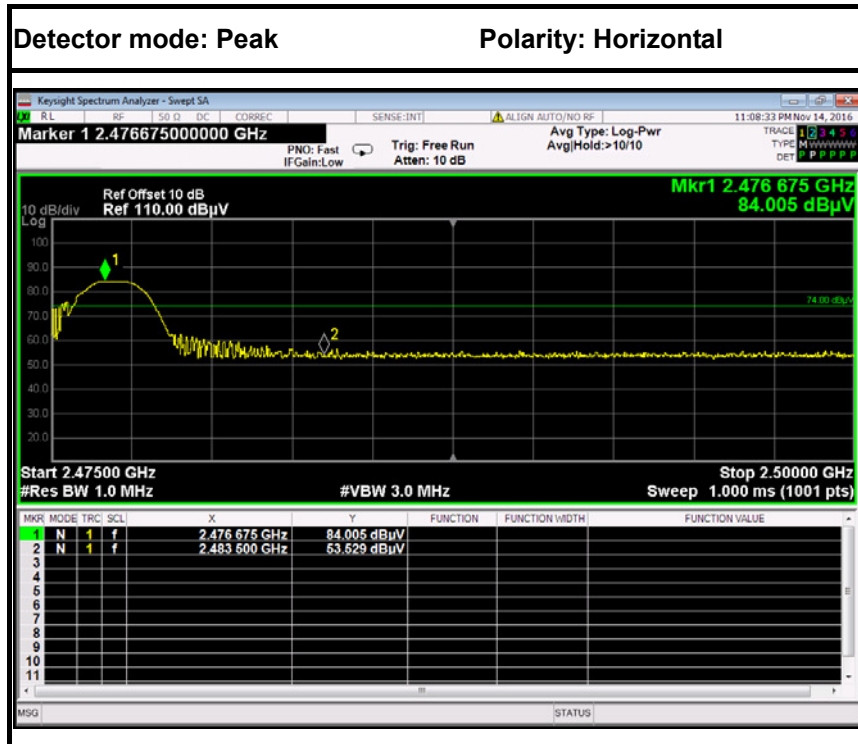


Band Edges (High)



| No. | Frequency (MHz) | Reading (dBuV) | Corrected (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Antenna Pole |
|-----|-----------------|----------------|----------------|---------------|--------------|-------------|----------|--------------|
| 1 | 2483.5000 | 59.06 | -6.24 | 65.30 | 74.00 | -8.70 | Peak | Vertical |
| 2 | 2483.5000 | 32.96 | -6.24 | 39.20 | 54.00 | -14.80 | Average | Vertical |

Remark: $20\text{Log} \{1/[\text{on}/(\text{on}+\text{off})]\} = 20\text{Log} [1/(0.39/7.87)] = 26.1\text{dB}$;
 AVG (Result) = Peak - $20\text{Log} \{1/[\text{on}/(\text{on} + \text{off})]\}$;



| No. | Frequency (MHz) | Reading (dBuV) | Corrected (dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Detector | Antenna Pole |
|-----|-----------------|----------------|----------------|---------------|--------------|-------------|----------|--------------|
| 1 | 2483.5000 | 47.29 | -6.24 | 53.53 | 74.00 | -20.47 | Peak | Horizontal |
| 2 | 2483.5000 | 21.19 | -6.24 | 27.43 | 54.00 | -26.57 | Average | Horizontal |

Remark: $20\text{Log} \{1/[\text{on}/(\text{on}+\text{off})]\} = 20\text{Log} [1/(0.39/7.87)] = 26.1\text{dB}$;
 $\text{AVG (Result)} = \text{Peak} - 20\text{Log} \{1/[\text{on}/(\text{on} + \text{off})]\}$;



8.3. POWER LINE CONDUCTED EMISSIONS MEASUREMENT

8.3.1. LIMITS OF CONDUCTED EMISSIONS MEASUREMENT

According to §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 μ 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 Range (MHz) | Limits (dB μ V) | |
|-----------------------|---------------------|-----------|
| | 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 |

NOTE:

- (1) The lower limit shall apply at the transition frequencies.
- (2) The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
- (3) All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

TEST INSTRUMENTS

| Conducted Emission Test Site | | | | | |
|------------------------------|---------------|--------------------|---------------|------------------|-----------------|
| Name of Equipment | Manufacturer | Model Number | Serial Number | Last Calibration | Due Calibration |
| EMI TEST RECEIVER | ROHDE&SCHWARZ | ESCI | 100783 | 02/21/2016 | 02/20/2017 |
| LISN(EUT) | ROHDE&SCHWARZ | ENV216 | 101543-WX | 02/21/2016 | 02/20/2017 |
| LISN | EMCO | 3825/2 | 8901-1459 | 02/21/2016 | 02/20/2017 |
| Temp. / Humidity Meter | VICTOR | HTC-1 | N/A | 02/21/2016 | 02/20/2017 |
| Test S/W | FARAD | EZ-EMC/ CCS-3A1-CE | | | |

- NOTE:**
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. N.C.R = No Calibration Request.

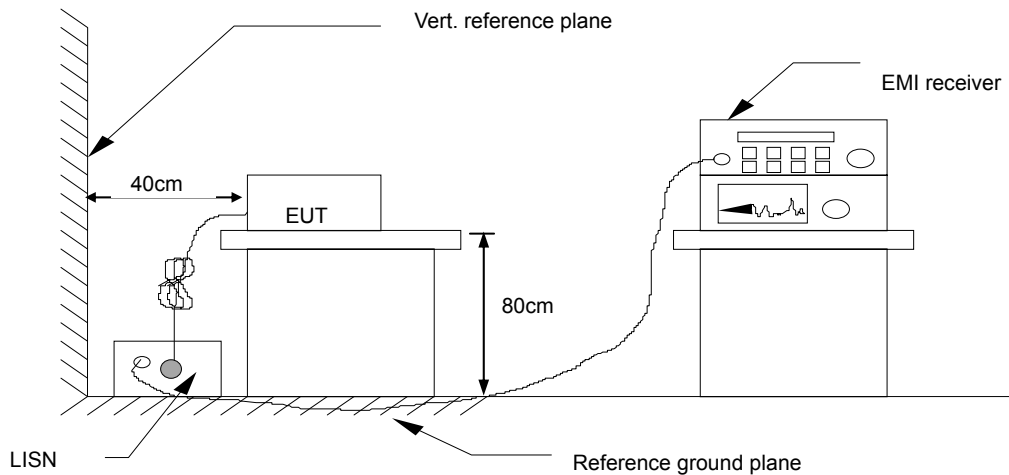


8.3.2. TEST PROCEDURES (please refer to measurement standard)

- The EUT and Support equipment, if needed, was placed on a non-conducted table, which is 0.8m above the ground plane and 0.4m away from the conducted wall.
- The test equipment EUT installed received AC main power, through a Line Impedance Stabilization Network (LISN), which supplied power source and was grounded to the ground plane. All support equipment power received from a second LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- The EUT test program was started. Emissions were measured on each current carrying line of the EUT using an EMI Test Receiver connected to the LISN powering the EUT.
- The frequency range from 150 kHz to 30 MHz was searched. The test data of the worst-case condition(s) was recorded. Emission levels under limit 20dB were not recorded.



8.3.3. TEST SETUP



For the actual test configuration, please refer to the related item - Photographs of the Test Configuration.

8.3.4. DATA SAMPLE

| Frequency (MHz) | QuasiPeak Reading (dBuV) | Average Reading (dBuV) | Correction Factor (dB) | QuasiPeak Result (dBuV) | Average Result (dBuV) | QuasiPeak Limit (dBuV) | Average Limit (dBuV) | QuasiPeak Margin (dB) | Average Margin (dB) | Remark (Pass/Fail) |
|-----------------|--------------------------|------------------------|------------------------|-------------------------|-----------------------|------------------------|----------------------|-----------------------|---------------------|--------------------|
| X.XXXX | 32.69 | 25.65 | 11.52 | 44.21 | 37.17 | 65.78 | 55.79 | -21.57 | -18.62 | Pass |

Factor = Insertion loss of LISN + Cable Loss
Result = Quasi-peak Reading/ Average Reading + Factor
Limit = Limit stated in standard
Margin = Result (dBuV) – Limit (dBuV)

8.3.5. TEST RESULTS

Not applicable, since the EUT received DC power from Battery.



8.4. SPURIOUS EMISSIONS MEASUREMENT

8.4.1. LIMITS OF RADIATED EMISSIONS MEASUREMENT

1. In the section 15.249(a):

Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

| Fundamental Frequency | Field Strength of Fundamental Field Strength (mV/m) | Field Strength of Harmonics (μ V/m) |
|-----------------------|---|--|
| 902-928 MHz | 50 | 500 |
| 2400 - 2483.5 MHz | 50 | 500 |
| 5725 - 5875 MHz | 50 | 500 |
| 24.0 - 24.25 GHz | 250 | 2500 |

2. 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 (MHz) | Field Strength (μ V/m) | Measurement Distance (m) |
|-----------------|-----------------------------|--------------------------|
| 30-88 | 100* | 3 |
| 88-216 | 150* | 3 |
| 216-960 | 200* | 3 |
| Above 960 | 500 | 3 |

Remark: 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., Sections 15.231 and 15.241.

3. In the above emission table, the tighter limit applies at the band edges.

| Frequency (Hz) | Field Strength (μ V/m at 3-meter) | Field Strength (dB μ V/m at 3-meter) |
|----------------|--|--|
| 30-88 | 100 | 40 |
| 88-216 | 150 | 43.5 |
| 216-960 | 200 | 46 |
| Above 960 | 500 | 54 |

**8.4.2. TEST INSTRUMENTS**

| Radiated Emission Test Site 966 (2) | | | | | |
|-------------------------------------|----------------|--------------------|---------------|------------------|-----------------|
| Name of Equipment | Manufacturer | Model Number | Serial Number | Last Calibration | Due Calibration |
| PSA Series Spectrum Analyzer | Agilent | E4446A | US44300399 | 02/21/2016 | 02/20/2017 |
| EMI TEST RECEIVER | ROHDE&SCHWARZ | ESCI | 100783 | 02/21/2016 | 02/20/2017 |
| Amplifier | MITEQ | AM-1604-3000 | 1123808 | 03/18/2016 | 03/17/2017 |
| High Noise Amplifier | Agilent | 8449B | 3008A01838 | 02/21/2016 | 02/20/2017 |
| Board-Band Horn Antenna | Schwarzbeck | BBHA 9170 | 9170-497 | 02/28/2016 | 02/27/2017 |
| Bilog Antenna | SCHAFFNER | CBL6143 | 5082 | 02/21/2016 | 02/20/2017 |
| Horn Antenna | SCHWARZBECK | BBHA9120 | D286 | 02/28/2016 | 02/27/2017 |
| Loop Antenna | COM-POWER | AL-130 | 121044 | 09/25/2016 | 09/24/2017 |
| Turn Table | N/A | N/A | N/A | N.C.R | N.C.R |
| Controller | Sunol Sciences | SC104V | 022310-1 | N.C.R | N.C.R |
| Controller | CT | N/A | N/A | N.C.R | N.C.R |
| Temp. / Humidity Meter | Anymetre | JR913 | N/A | 02/21/2016 | 02/20/2017 |
| Antenna Tower | SUNOL | TLT2 | N/A | N.C.R | N.C.R |
| Test S/W | FARAD | LZ-RF / CCS-SZ-3A2 | | | |

NOTE: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

2. N.C.R = No Calibration Required.

8.4.3. Measuring Instruments and Setting

The following table is the setting of spectrum analyzer and receiver.

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



| Receiver Parameter | Setting |
|------------------------|-----------------------------------|
| Attenuation | Auto |
| Start ~ Stop Frequency | 9kHz~150kHz / RB 200Hz for QP/AVG |
| Start ~ Stop Frequency | 150kHz~30MHz / RB 9kHz for QP/AVG |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 100kHz for QP |

8.4.4 TEST PROCEDURE (please refer to measurement standard)

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.

Pre measurement:

- 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 pre measurement 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 pre measurement 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.

Pre measurement:

--- 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 ($\pm 45^\circ$) 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.

Pre measurement:

- 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 ($\pm 45^\circ$) 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 pre measurement 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.

Pre measurement:

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

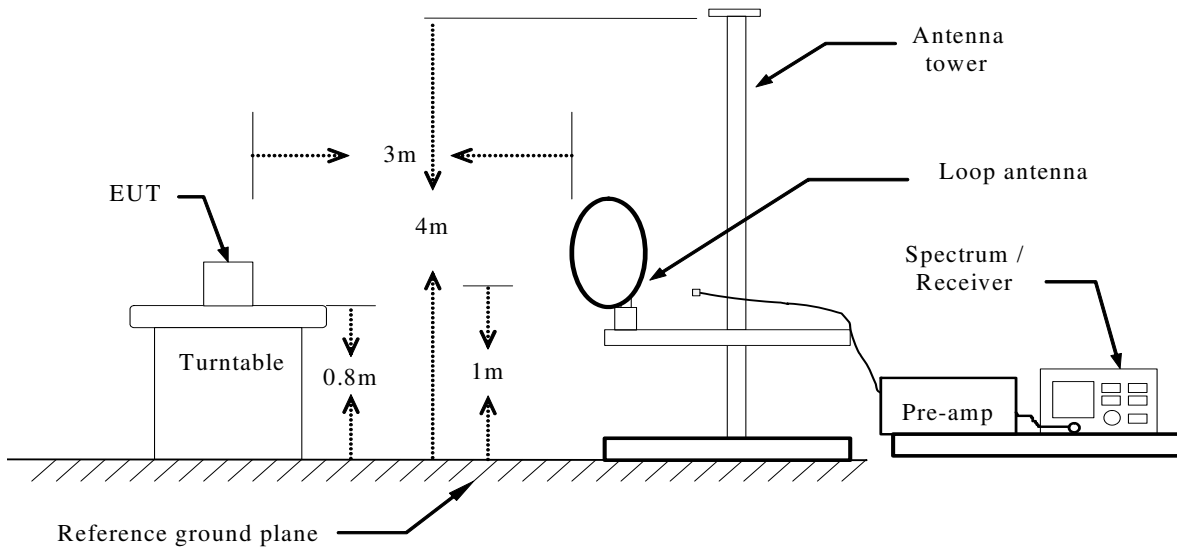
Final measurement:

--- 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.

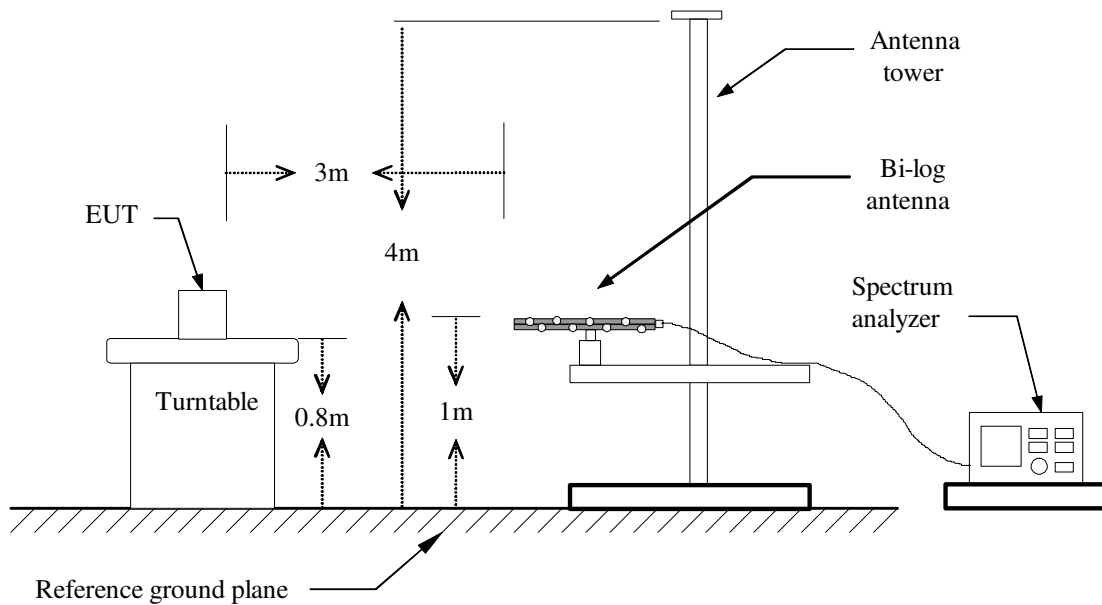


8.4.5 TEST SETUP

Below 30 MHz

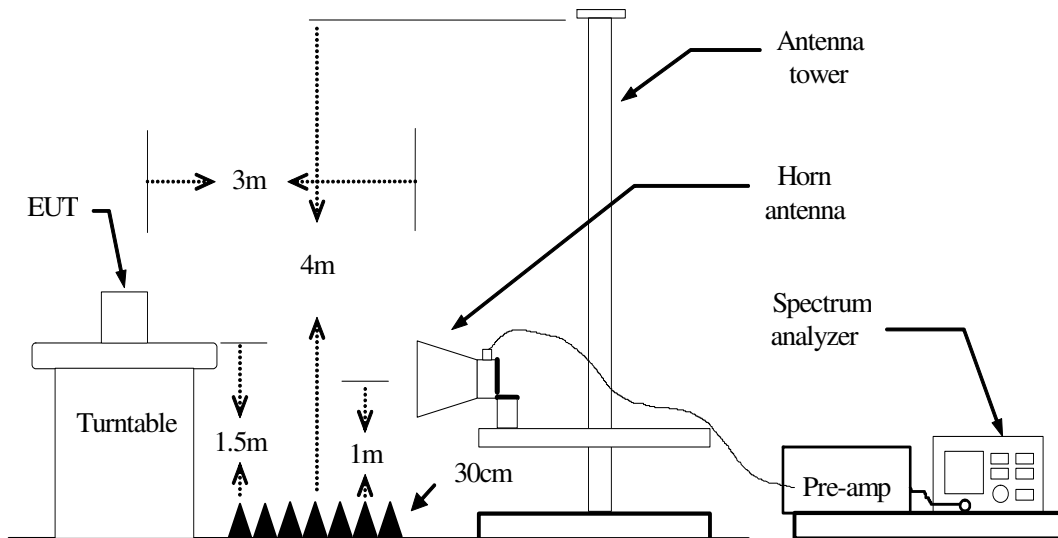


Below 1 GHz





Above 1 GHz



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

8.4.6 DATA SAMPLE

Below 1 GHz

| Frequency (MHz) | Ant.Pol. (H/V) | Reading (Remark) (dBuV) | Correction Factor (dB/m) | Result (Remark) (dBuV/m) | Limit (Peak) (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|-------------------------|--------------------------|--------------------------|-----------------------|-------------|--------|
| xxx | V | 12.12 | 10.21 | 22.33 | 40.00 | -17.67 | Peak |

Above 1 GHz

| Frequency (MHz) | Ant.Pol. (H/V) | Reading (Peak) (dBuV) | Reading (Average) (dBuV) | Correction Factor (dB/m) | Result (Peak) (dBuV/m) | Result (Average) (dBuV/m) | Limit (Peak) (dBuV/m) | Limit (Average) (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|-----------------------|--------------------------|--------------------------|------------------------|---------------------------|-----------------------|--------------------------|-------------|--------|
| xxx | V | 65.45 | 63.00 | -11.12 | 54.33 | 51.88 | 74.00 | 54.00 | -2.12 | AVG |

- Frequency (MHz) = Emission frequency in MHz
- Ant.Pol. (H/V) = Antenna polarization
- Reading (dBuV) = Uncorrected Analyzer / Receiver reading
- Correction Factor (dB/m) = Antenna factor + Cable loss – Amplifier gain
- Result (dBuV/m) = Reading (dBuV) + Correction Factor (dB/m)
- Limit (dBuV/m) = Limit stated in standard
- Margin (dB) = Remark Result (dBuV/m) – Limit (dBuV/m)
- Peak = Peak Reading
- QP = Quasi-peak Reading
- AVG = Average Reading

**8.4.7 TEST RESULTS****Below 1 GHz**Test Mode: TXTested by: Sam ZengAmbient temperature: 24°C Relative humidity: 52% RH Date: November 10, 2016

| Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Pole (V/H) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------------------|--------|
| 132.8200 | 33.77 | -20.89 | 12.88 | 43.50 | -30.62 | V | QP |
| 226.9100 | 36.40 | -21.39 | 15.01 | 46.00 | -30.99 | V | QP |
| 289.9600 | 38.81 | -20.47 | 18.34 | 46.00 | -27.66 | V | QP |
| 350.1000 | 39.97 | -17.66 | 22.31 | 46.00 | -23.69 | V | QP |
| 386.9600 | 33.45 | -16.44 | 17.01 | 46.00 | -28.99 | V | QP |
| 580.9600 | 32.87 | -13.10 | 19.77 | 46.00 | -26.23 | V | QP |
| | | | | | | | |
| 193.9300 | 44.43 | -22.81 | 21.62 | 43.50 | -21.88 | H | QP |
| 289.9600 | 48.87 | -20.47 | 28.40 | 46.00 | -17.60 | H | QP |
| 386.9600 | 36.74 | -16.44 | 20.30 | 46.00 | -25.70 | H | QP |
| 580.9600 | 35.58 | -13.10 | 22.48 | 46.00 | -23.52 | H | QP |
| 677.9600 | 34.99 | -12.37 | 22.62 | 46.00 | -23.38 | H | QP |
| 704.1500 | 35.23 | -11.92 | 23.31 | 46.00 | -22.69 | H | QP |

****Note:**

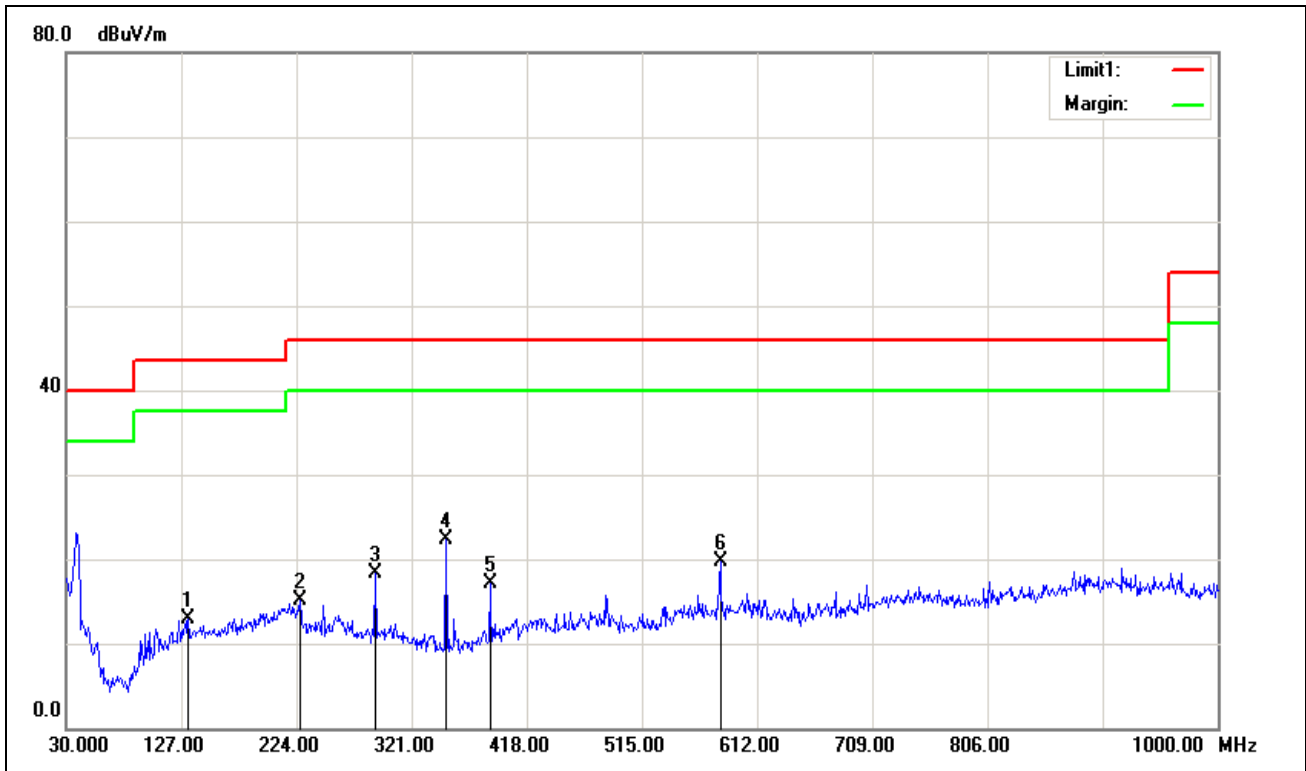
1. No emission found between lowest internal used/generated frequency to 30 MHz.
2. Only worst case recorded for radiated emissions below 1GHz.

REMARKS:

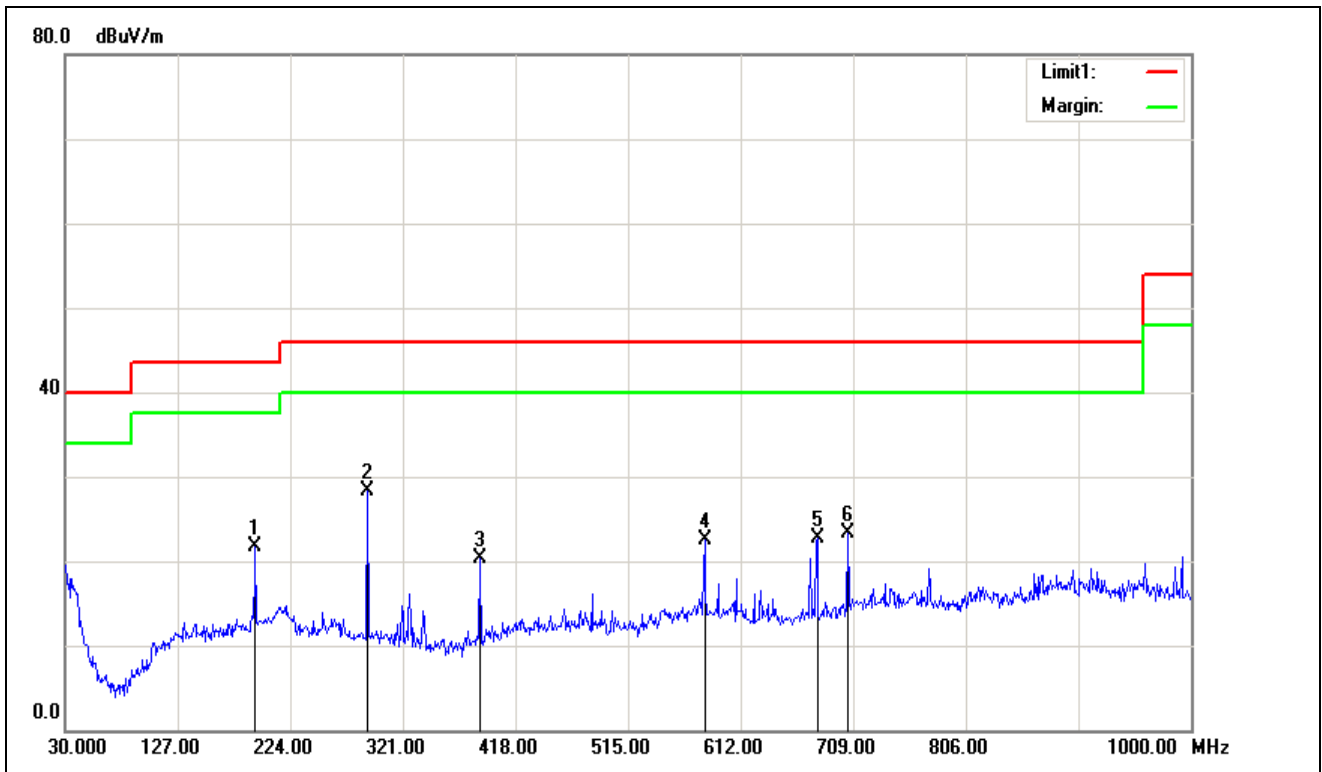
1. Radiated emissions measured in frequency range from 9kHz to 1GHz were made with an instrument using peak/quasi-peak detector mode.
2. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
3. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
4. Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m)



Vertical

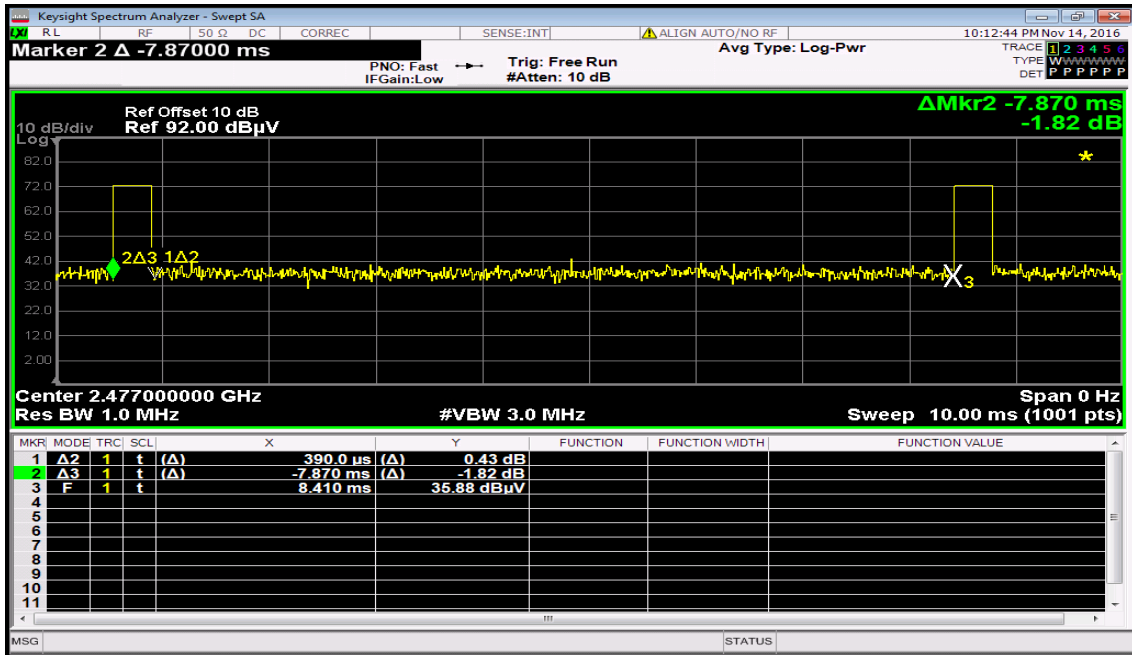


Horizontal





Above 1 GHz



Remark: $20\text{Log} \{1/[\text{on}/(\text{on}+\text{off})]\} = 20\text{Log} [1/(0.39/7.87)] = 26.1\text{dB}$;
 $\text{AVG} (\text{Result}) = \text{Peak} - 20\text{Log} \{1/[\text{on}/(\text{on} + \text{off})]\}$;

Fundamental

| Channel | Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Pole (V/H) | Remark |
|---------|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------------------|--------|
| CH Low | 2407.0000 | 99.53 | -2.77 | 96.76 | 114.00 | -17.24 | V | Peak |
| | 2407.0000 | 73.43 | -2.77 | 70.66 | 94.00 | -23.34 | V | AVG |
| | 2407.0000 | 86.74 | -2.77 | 83.97 | 114.00 | -30.03 | H | Peak |
| | 2407.0000 | 60.64 | -2.77 | 57.87 | 94.00 | -36.13 | H | AVG |

| Channel | Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Pole (V/H) | Remark |
|---------|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------------------|--------|
| CH Mid | 2443.0000 | 99.17 | -2.57 | 96.60 | 114.00 | -17.40 | V | Peak |
| | 2443.0000 | 73.07 | -2.57 | 70.50 | 94.00 | -23.50 | V | AVG |
| | 2443.0000 | 87.13 | -2.57 | 84.56 | 114.00 | -29.44 | H | Peak |
| | 2443.0000 | 61.03 | -2.57 | 58.46 | 94.00 | -35.54 | H | AVG |

| Channel | Frequency (MHz) | Reading (dBuV) | Correction Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Antenna Pole (V/H) | Remark |
|---------|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------------------|--------|
| CH High | 2477.0000 | 98.44 | -2.38 | 96.06 | 114.00 | -17.94 | V | Peak |
| | 2477.0000 | 72.34 | -2.38 | 69.96 | 94.00 | -24.04 | V | AVG |
| | 2477.0000 | 86.99 | -2.39 | 84.60 | 114.00 | -29.40 | H | Peak |
| | 2477.0000 | 60.89 | -2.39 | 58.50 | 94.00 | -35.50 | H | AVG |



Test Mode: GFSK (CH Low)

Tested by: Sam Zeng

Ambient temperature: 24°C Relative humidity: 52% RH Date: November 14, 2016

| Frequency (MHz) | Reading (dBμV) | Correction Factor (dB/m) | Result (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Antenna Pole (V/H) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------------------|--------|
| 1207.000 | 48.09 | -7.76 | 40.33 | 74.00 | -33.67 | V | peak |
| 1945.000 | 46.26 | -5.35 | 40.91 | 74.00 | -33.09 | V | peak |
| 2503.000 | 46.09 | -2.25 | 43.84 | 74.00 | -30.16 | V | peak |
| 3700.000 | 43.47 | 0.32 | 43.79 | 74.00 | -30.21 | V | peak |
| 4672.000 | 42.62 | 3.91 | 46.53 | 74.00 | -27.47 | V | peak |
| 5599.000 | 42.53 | 5.91 | 48.44 | 74.00 | -25.56 | V | peak |
| --- | | | | | | | |
| 1630.000 | 47.12 | -6.64 | 40.48 | 74.00 | -33.52 | H | peak |
| 2494.000 | 47.08 | -2.29 | 44.79 | 74.00 | -29.21 | H | peak |
| 3358.000 | 44.22 | -0.76 | 43.46 | 74.00 | -30.54 | H | peak |
| 4231.000 | 42.87 | 2.40 | 45.27 | 74.00 | -28.73 | H | peak |
| 4627.000 | 42.73 | 3.76 | 46.49 | 74.00 | -27.51 | H | peak |
| 5599.000 | 41.87 | 5.91 | 47.78 | 74.00 | -26.22 | H | peak |

REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).



Test Mode: GFSK (CH Mid)

Tested by: Sam Zeng

Ambient temperature: 24°C Relative humidity: 52% RH Date: November 14, 2016

| Frequency (MHz) | Reading (dBμV) | Correction Factor (dB/m) | Result (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Antenna Pole (V/H) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------------------|--------|
| 1207.000 | 48.42 | -7.76 | 40.66 | 74.00 | -33.34 | V | peak |
| 2242.000 | 45.75 | -3.67 | 42.08 | 74.00 | -31.92 | V | peak |
| 2521.000 | 45.06 | -2.22 | 42.84 | 74.00 | -31.16 | V | peak |
| 3070.000 | 43.21 | -1.24 | 41.97 | 74.00 | -32.03 | V | peak |
| 4204.000 | 41.16 | 2.31 | 43.47 | 74.00 | -30.53 | V | peak |
| 5455.000 | 41.04 | 5.79 | 46.83 | 74.00 | -27.17 | V | peak |
| 1198.000 | 46.95 | -7.80 | 39.15 | 74.00 | -34.85 | H | peak |
| 2107.000 | 44.71 | -4.41 | 40.30 | 74.00 | -33.70 | H | peak |
| 2521.000 | 44.44 | -2.22 | 42.22 | 74.00 | -31.78 | H | peak |
| 3691.000 | 41.76 | 0.29 | 42.05 | 74.00 | -31.95 | H | peak |
| 4915.000 | 40.93 | 4.70 | 45.63 | 74.00 | -28.37 | H | peak |
| 5626.000 | 40.66 | 5.92 | 46.58 | 74.00 | -27.42 | H | peak |

REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).



Test Mode: GFSK (CH High)

Tested by: Sam Zeng

Ambient temperature: 24°C Relative humidity: 52% RH Date: November 14, 2016

| Frequency (MHz) | Reading (dBμV) | Correction Factor (dB/m) | Result (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Antenna Pole (V/H) | Remark |
|-----------------|----------------|--------------------------|-----------------|----------------|-------------|--------------------|--------|
| 1765.000 | 48.15 | -6.35 | 41.80 | 74.00 | -32.20 | V | peak |
| 2530.000 | 46.57 | -2.21 | 44.36 | 74.00 | -29.64 | V | peak |
| 3349.000 | 44.47 | -0.77 | 43.70 | 74.00 | -30.30 | V | peak |
| 4627.000 | 42.36 | 3.76 | 46.12 | 74.00 | -27.88 | V | peak |
| 5140.000 | 41.77 | 5.23 | 47.00 | 74.00 | -27.00 | V | peak |
| 5653.000 | 41.74 | 5.93 | 47.67 | 74.00 | -26.33 | V | peak |
| | | | | | | | |
| 1315.000 | 47.35 | -7.37 | 39.98 | 74.00 | -34.02 | H | peak |
| 2242.000 | 46.90 | -3.67 | 43.23 | 74.00 | -30.77 | H | peak |
| 2494.000 | 46.87 | -2.29 | 44.58 | 74.00 | -29.42 | H | peak |
| 3781.000 | 43.14 | 0.67 | 43.81 | 74.00 | -30.19 | H | peak |
| 4699.000 | 42.68 | 4.00 | 46.68 | 74.00 | -27.32 | H | peak |
| 5338.000 | 41.59 | 5.58 | 47.17 | 74.00 | -26.83 | H | peak |

REMARKS:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit or as required by the applicant.
4. Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
6. Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).