



**FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-247 ISSUE 1**

CERTIFICATION TEST REPORT

FOR

August Doorbell Cam

MODEL NUMBER: AB-R2

FCC ID: 2AB6UABR2

IC: 12163A-ABR2

REPORT NUMBER: 4788013564-1

ISSUE DATE: June 20, 2017

Prepared for

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Prepared by

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Revision History

| Rev. | Issue Date | Revisions | Revised By |
|------|------------|---------------|------------|
| -- | 06/20/2017 | Initial Issue | |

| Summary of Test Results | | | |
|-------------------------|---|--|--------------|
| Clause | Test Items | FCC/IC Rules | Test Results |
| 1 | 6db DTS Bandwidth And 99% Bandwidth | FCC 15.247 (a) (2) IC RSS-247 Clause 5.2 (1) | Complied |
| 2 | Peak Conducted Power | FCC 15.247 (b) (3) IC RSS-247 Clause 5.4 (4) | Complied |
| 3 | Power Spectral Density | FCC 15.247 (3) IC RSS-247 Clause 5.2 (2) | Complied |
| 4 | Conducted Band edge And Spurious emission | FCC 15.247 (d) IC RSS-247 Clause 5.4 | Complied |
| 5 | Radiated Band edges and Spurious emission | FCC 15.247 (d) FCC 15.209 FCC 15.205 IC RSS-247 Clause 5.5 IC RSS-GEN Clause 8.9 IC RSS-GEN Clause 8.10 | Complied |
| 6 | Conducted Emission Test For AC Power Port | FCC 15.207 RSS-GEN Clause 8.8 | Complied |
| 7 | Antenna Requirement | FCC 15.203 RSS-GEN Clause 8.3 | Complied |

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1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name: August Home Inc
Address: 657 Bryant Street, San Francisco, 94107, USA

Manufacturer Information

Company Name: August Home Inc
Address: 657 Bryant Street, San Francisco, 94107, USA

EUT Name: August Doorbell Cam

Model: AB-R2

Sample Status: Normal

Sample ID: 1000221

Brand: August

Sample Received: May 27, 2017

Date of Tested: May 27, 2017 ~ June 14, 2017

| APPLICABLE STANDARDS | |
|---------------------------------|--------------|
| STANDARD | TEST RESULTS |
| CFR 47 Part 15 Subpart C | PASS |
| INDUSTRY CANADA RSS-247 Issue 1 | PASS |
| INDUSTRY CANADA RSS-GEN Issue 4 | PASS |

Tested By :



Leo Liu
Engineer

Check By:



Shawn Wen
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Approved By:



Stephen Guo
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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, RSS-GEN Issue 4, and RSS-247 Issue 1.

3. FACILITIES AND ACCREDITATION

| | |
|---------------------------|---|
| Test Location | Dongguan Dongdian Testing Service Co., Ltd |
| Address | No. 17, Zongbu Road 2, Songshan Lake Sci&Tech, Dongguan City, Guangdong Province, 523808, China |
| Accreditation Certificate | <p>Dongguan Dongdian Testing Service Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing. Valid time is until January 31, 2018.</p> <p>Dongguan Dongdian Testing Service Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 270092, Renewal date March 11, 2015, valid time is until March 11, 2018.</p> <p>The 3m Alternate Test Site of Dongguan Dongdian Testing Service Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No.10288A on April 23, 2015, valid time is until April 23, 2018.</p> |

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| PARAMETER | UNCERTAINTY |
|---|-----------------------------------|
| Bandwidth | 1.1% |
| Peak Output Power(Conducted)(Spectrum analyzer) | 0.86dB(10 MHz \leq f < 3.6GHz); |
| | 1.38dB(3.6GHz \leq f < 8GHz) |
| Peak Output Power(Conducted)(Power Sensor) | 0.74dB |
| Dwell Time | 0.6% |
| Conducted spurious emissions | 0.86dB(10 MHz \leq f < 3.6GHz); |
| | 1.40dB(3.6GHz \leq f < 8GHz) |
| | 1.66dB(8GHz \leq f < 22GHz) |
| Uncertainty for radio frequency (RBW<20KHz) | 3 \times 10 ⁻⁸ |
| Temperature | 0.4℃ |
| Humidity | 2% |
| Uncertainty for Radiation Emission test (30MHz-1GHz) | 4.70 dB (Antenna Polarize: V) |
| | 4.84 dB (Antenna Polarize: H) |
| Uncertainty for Radiation Emission test (1GHz-18GHz) | 4.10dB(1-6GHz) |
| | 4.40dB (6GHz-18Gz) |
| Uncertainty for Power line conduction emission test | 3.32dB (150KHz-30MHz) |
| Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2. | |

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

| | | | |
|---------------------|---------------------|---------------------|-----------|
| Equipment | August Doorbell Cam | | |
| Model Name | AB-R2 | | |
| Product Description | Operation Frequency | 2402 MHz ~ 2480 MHz | |
| | Modulation Type | | Data Rate |
| | GFSK | | 1Mbps |
| Input: | DC 5V | | |
| Bluetooth Version | BT 4.2 | | |
| Adapter | N/A | | |

5.2. MAXIMUM OUTPUT POWER

| Frequency Range (MHz) | Number of Transmit Chains (NTX) | Bluetooth Mode | Frequency (MHz) | Channel Number | Max Output Power (dBm) |
|-----------------------|---------------------------------|----------------|-----------------|----------------|------------------------|
| 2400-2483.5 | 1 | BLE | 2402-2480 | 0-39[40] | 7.220 |

5.3. CHANNEL LIST

| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|
| 0 | 2402 | 11 | 2424 | 22 | 2442 | 33 | 2466 |
| 1 | 2404 | 12 | 2426 | 23 | 2446 | 34 | 2468 |
| 2 | 2406 | 13 | 2428 | 24 | 2448 | 35 | 2470 |
| 3 | 2408 | 14 | 2430 | 25 | 2450 | 36 | 2472 |
| 4 | 2410 | 15 | 2432 | 26 | 2452 | 37 | 2474 |
| 5 | 2412 | 16 | 2434 | 27 | 2454 | 38 | 2476 |
| 6 | 2414 | 17 | 2436 | 28 | 2456 | 39 | 2478 |
| 7 | 2416 | 18 | 2438 | 29 | 2458 | 40 | 2480 |
| 8 | 2418 | 19 | 2440 | 30 | 2460 | | |
| 9 | 2420 | 20 | 2442 | 31 | 2462 | | |
| 10 | 2422 | 21 | 2444 | 32 | 2464 | | |

5.4. TEST CHANNEL CONFIGURATION

| Test Mode | Test Channel | Frequency |
|-----------|---------------------|---------------------------|
| GFSK | CH 00, CH 19, CH 40 | 2402MHz, 2440MHz, 2480MHz |

5.5. THE WORSE CASE POWER SETTING PARAMETER

| The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band | | | | |
|--|-------------------------|--------------|-------|-------|
| Test Software Version | | N/A | | |
| Modulation Type | Transmit Antenna Number | Test Channel | | |
| | | CH 00 | CH 19 | CH 40 |
| GFSK | 1 | N/A | N/A | N/A |

5.6. DESCRIPTION OF AVAILABLE ANTENNAS

| Ant. | Frequency (MHz) | Antenna Type | Antenna Gain (dBi) |
|------|-----------------|--------------|--------------------|
| 1 | 2402-2480 | PCB Antenna | 1.48 |

5.7. WORST-CASE CONFIGURATIONS

| Bluetooth Mode | Modulation Technology | Modulation Type | Data Rate (Mbps) |
|----------------|-----------------------|-----------------|------------------|
| BLE | DTS | GFSK | 1Mbit/s |

5.8. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

| Item | Equipment | Brand Name | Model Name | P/N |
|------|-----------|------------|----------------|---------------|
| 1 | Laptop | Lenovo | ThinkPad T460s | SL10K24796 JS |

I/O CABLES

| Cable No | Port | Connector Type | Cable Type | Cable Length(m) | Remarks |
|----------|-----------|----------------|------------|-----------------|---------|
| 1 | USB out 1 | USB | Unshielded | 0.5 | N/A |

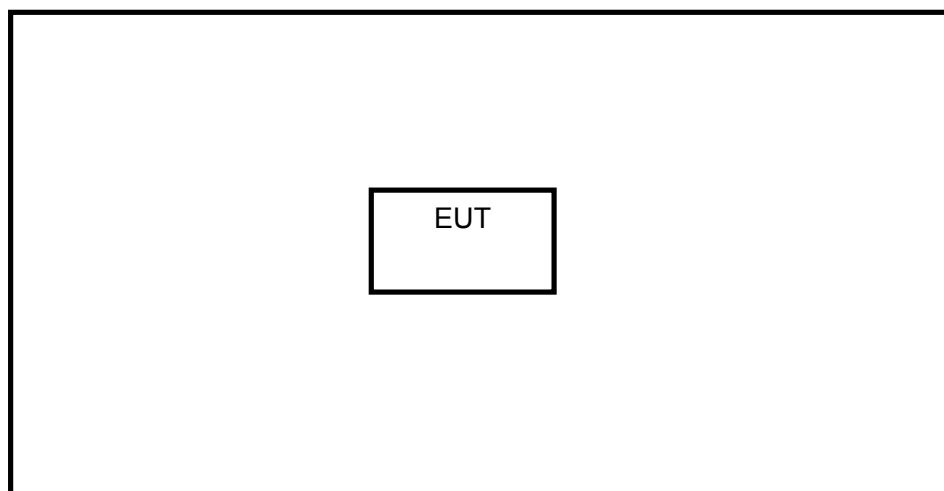
ACCESSORY

| Item | Accessory | Brand Name | Model Name | Description |
|------|-----------|------------|------------|-------------|
| 1 | N/A | N/A | N/A | N/A |

TEST SETUP

The EUT can work in an engineer mode with a software through a Laptop.

SETUP DIAGRAM FOR TEST



5.9. MEASURING INSTRUMENT AND SOFTWARE USED

| Instrument (Conducted for RF Port) | | | | | | |
|--|----------------------------|---------------|--------------|--------------|--------------|--------------|
| Used | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Due. Date |
| <input checked="" type="checkbox"/> | Spectrum Analyzer | Agilent | E4447A | MY50180031 | Jul.06, 2016 | Jul.06, 2017 |
| <input checked="" type="checkbox"/> | Spectrum analyzer | R&S | FSU26 | 1166.1660.26 | Oct.16, 2016 | Oct.16, 2017 |
| <input checked="" type="checkbox"/> | Power Sensor | Agilent | U2021XA | MY55150010 | Apr.04, 2017 | Apr.04, 2018 |
| <input checked="" type="checkbox"/> | Power Sensor | Agilent | U2021XA | MY55150011 | Apr.18, 2017 | Apr.18, 2018 |
| <input checked="" type="checkbox"/> | Attenuator | Mini-Circuits | BW-S10W2 | 101109 | Aug.18, 2016 | Aug.18, 2017 |
| <input checked="" type="checkbox"/> | RF Cable | Micable | C10-01-01-1 | 100309 | Aug.18, 2016 | Aug.18, 2017 |
| <input checked="" type="checkbox"/> | Test Software | JS Tonscend | JS1120-2 | Ver.2.5 | N/A | N/A |
| <input checked="" type="checkbox"/> | USB Data acquisition | Agilent | U2531A | TW55043503 | N/A | N/A |
| <input checked="" type="checkbox"/> | Auto control Unit | JS Tonscend | JS0806-2 | 158060010 | N/A | N/A |
| Instrument (Radiated Tests) | | | | | | |
| Used | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Expired date |
| <input checked="" type="checkbox"/> | EMI Test Receiver | R&S | ESU8 | 100316 | Oct.16, 2016 | Oct.16, 2017 |
| <input checked="" type="checkbox"/> | Spectrum analyzer | R&S | FSU26 | 1166.1660.26 | Oct.16, 2016 | Oct.16, 2017 |
| <input checked="" type="checkbox"/> | Trilog Broadband Antenna | Schwarzbeck | VULB9163 | 9163-462 | Oct.16, 2016 | Oct.16, 2017 |
| <input checked="" type="checkbox"/> | Active Loop antenna | Schwarzbeck | FMZB-1519 | 1519-038 | Oct.27, 2016 | Oct.27, 2017 |
| <input checked="" type="checkbox"/> | Double Ridged Horn Antenna | R&S | HF907 | 100276 | Oct.12, 2016 | Oct.12, 2017 |
| <input checked="" type="checkbox"/> | Pre-amplifier | A.H. | PAM-0118 | 360 | Oct.16, 2016 | Oct.16, 2017 |
| <input checked="" type="checkbox"/> | RF Cable | HUBSER | CP-X2 | W11.03 | Oct.16, 2016 | Oct.16, 2017 |
| <input checked="" type="checkbox"/> | RF Cable | HUBSER | CP-X1 | W12.02 | Oct.16, 2016 | Oct.16, 2017 |
| <input checked="" type="checkbox"/> | MI Cable | HUBSER | C10-01-01-1M | 1091629 | Oct.16, 2016 | Oct.16, 2017 |
| <input checked="" type="checkbox"/> | Test software | Audix | E3 | V 6.11111b | N/A | N/A |
| Instrument (Line Conducted Emission (AC Main)) | | | | | | |
| Used | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Expired date |
| <input checked="" type="checkbox"/> | Test Receiver | R&S | ESU8 | 100316 | Oct.16, 2016 | Oct.16, 2017 |
| <input checked="" type="checkbox"/> | LISN 1 | R&S | ENV216 | 101109 | Oct.16, 2016 | Oct.16, 2017 |

| | | | | | | |
|-------------------------------------|---------------|--------|----------|------------|--------------|--------------|
| <input checked="" type="checkbox"/> | LISN 2 | R&S | ESH2-Z5 | 100309 | Oct.16, 2016 | Oct.16, 2017 |
| <input checked="" type="checkbox"/> | Pulse Limiter | R&S | ESH3-Z2 | 101242 | Oct.16, 2016 | Oct.16, 2017 |
| <input checked="" type="checkbox"/> | CE Cable 1 | HUBSER | ESU8/RF2 | W10.01 | Oct.16, 2016 | Oct.16, 2017 |
| <input checked="" type="checkbox"/> | Test software | Audix | E3 | V 6.11111b | N/A | N/A |

6. MEASUREMENT METHODS

| No. | Test Item | KDB Name | Section |
|-----|---|-----------------------|---------|
| 1 | 6 dB Bandwidth | KDB 558074 D01 v03r05 | 8.2 |
| 2 | Peak Output Power | KDB 558074 D01 v03r05 | 9.1.1 |
| 3 | Power Spectral Density | KDB 558074 D01 v03r05 | 10.2 |
| 4 | Out-of-band emissions in non-restricted bands | KDB 558074 D01 v03r05 | 11.0 |
| 5 | Out-of-band emissions in restricted bands | KDB 558074 D01 v03r05 | 12.1 |
| 6 | Band-edge | KDB 558074 D01 v03r05 | 13.3.2 |
| 7 | Conducted Emission Test For AC Power Port | ANSI C63.4-2014 | 7.3 |

7. ANTENNA PORT TEST RESULTS

7.1. 6 dB DTS BANDWIDTH AND 99% BANDWIDTH

LIMITS

| FCC Part15 (15.247) , Subpart C IC RSS-247 ISSUE 1 | | | |
|---|---------------|------------------------------|-----------------------|
| Section | Test Item | Limit | Frequency Range (MHz) |
| FCC 15.247(a)(2) IC RSS-247 5.2 (1) | Bandwidth | $\geq 500\text{KHz}$ | 2400-2483.5 |
| RSS-Gen Clause 6.6 | 99% Bandwidth | For reporting purposes only. | 2400-2483.5 |

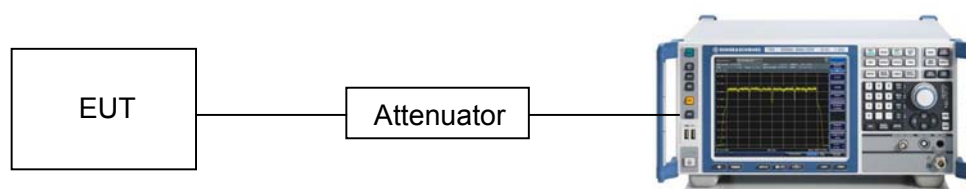
TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

| | |
|------------------|--|
| Center Frequency | The centre frequency of the channel under test |
| Detector | Peak |
| RBW | 100K |
| VBW | $\geq 3 \times \text{RBW}$ |
| Trace | Max hold |
| Sweep | Auto couple |

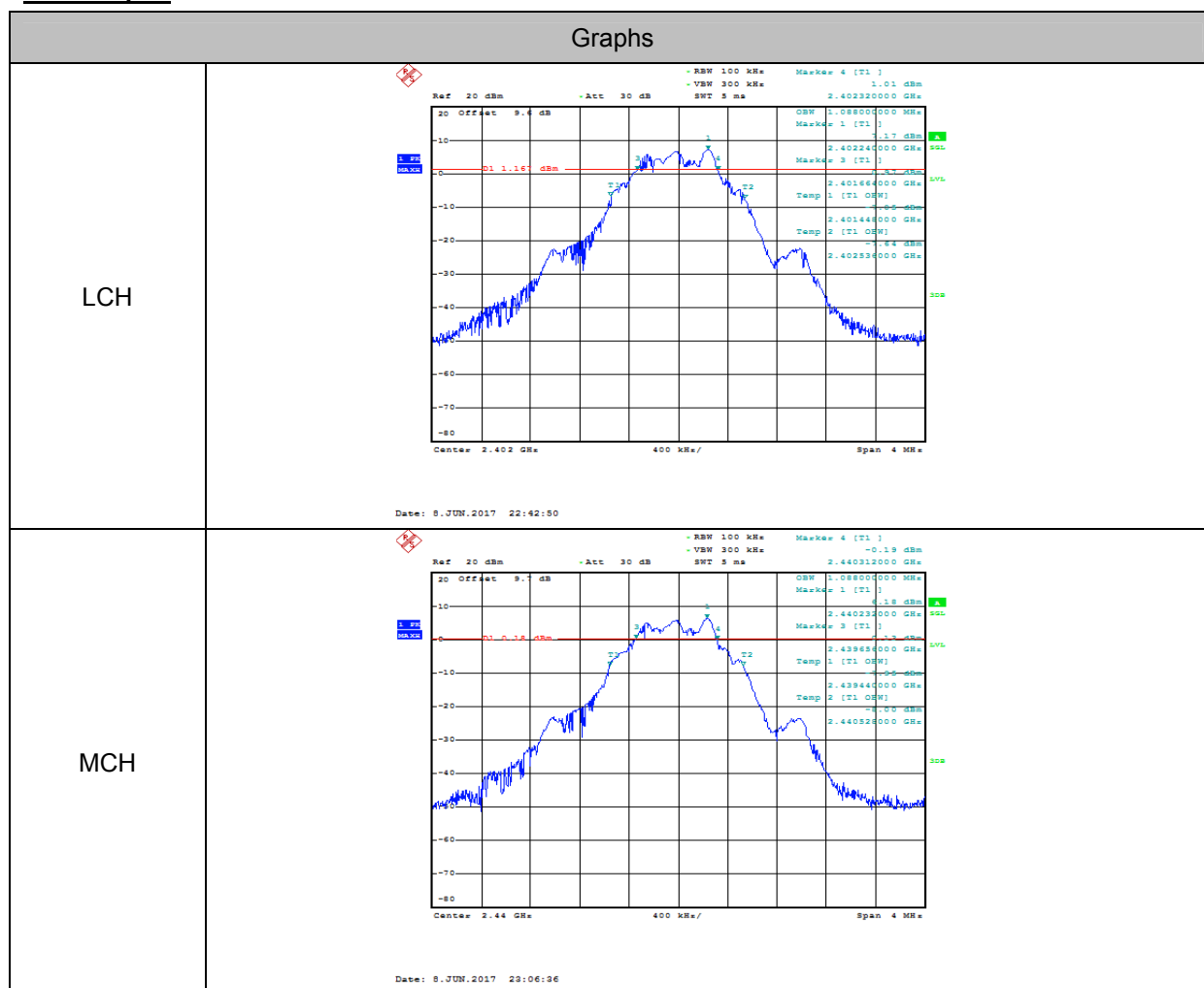
Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

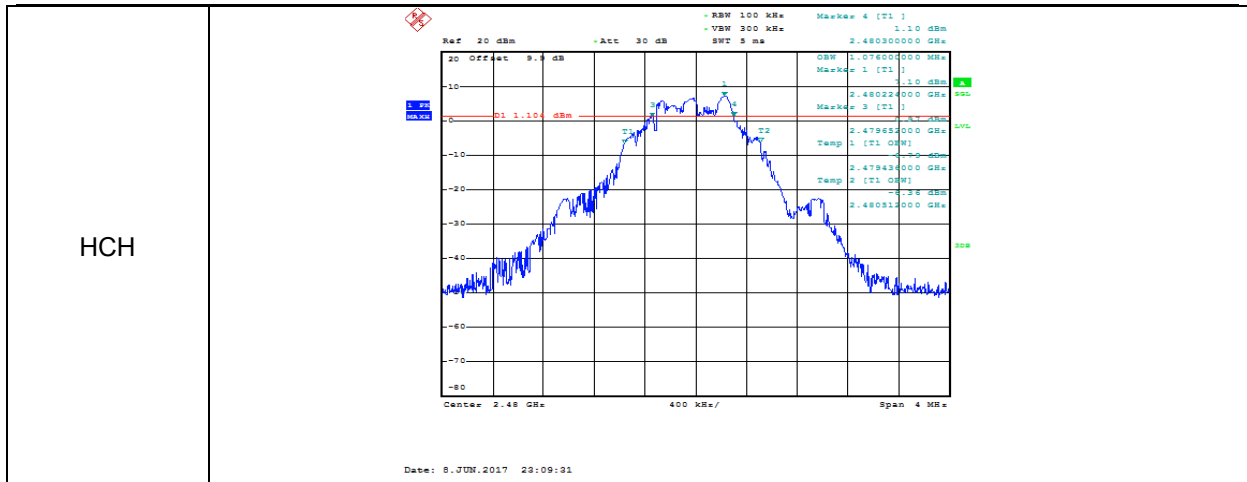
TEST SETUP



Temperature: 28°C
Relative Humidity: 60%
Test Voltage: DC5V

| Channel | Frequency (MHz) | 6dB bandwidth (kHz) | Limit (kHz) | 99% OBW[MHz] | Result |
|---------|-----------------|---------------------|-------------|--------------|--------|
| Low | 2402 | 0.656 | 500 | 1.088 | Pass |
| Middle | 2440 | 0.656 | 500 | 1.088 | Pass |
| High | 2480 | 0.648 | 500 | 1.076 | Pass |





7.2. PEAK CONDUCTED OUTPUT POWER

LIMITS

| FCC Part15 (15.247) , Subpart C IC RSS-247 ISSUE 1 | | | |
|---|-------------------|-----------------|-----------------------|
| Section | Test Item | Limit | Frequency Range (MHz) |
| FCC 15.247(b)(3) IC RSS-247 5.4 (4) | Peak Output Power | 1 watt or 30dBm | 2400-2483.5 |

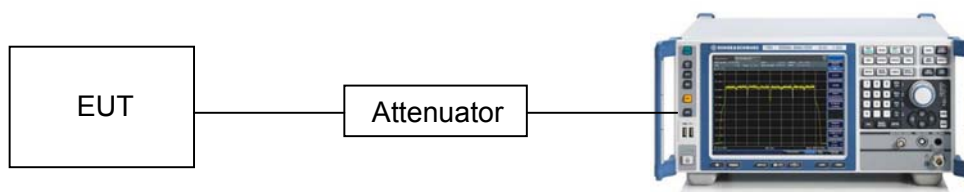
TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

| | |
|------------------|--|
| Center Frequency | The centre frequency of the channel under test |
| Detector | Peak |
| RBW | \geq DTS bandwidth(e.g. 1 MHz for BLE) |
| VBW | $\geq 3 \times$ RBW |
| Span | $3 \times$ RBW |
| Trace | Max hold |
| Sweep time | Auto couple. |

Allow trace to fully stabilize and use peak marker function to determine the peak amplitude level.

TEST SETUP



TEST CONDITIONS

Temperature: 28°C
Relative Humidity: 60%
Test Voltage: DC5V

RESULTS

| Test Channel | Frequency | Maximum Conducted Output Power(PK) | LIMIT |
|--------------|-----------|------------------------------------|-------|
| | (MHz) | (dBm) | dBm |
| CH00 | 2402 | 7.200 | 30 |
| CH19 | 2440 | 6.210 | 30 |
| CH39 | 2480 | 7.220 | 30 |

7.3. POWER SPECTRAL DENSITY

LIMITS

| FCC Part15 (15.247) , Subpart C IC RSS-247 ISSUE 1 | | | |
|---|---------------------------|----------------------------|--------------------------|
| Section | Test Item | Limit | Frequency Range (MHz) |
| FCC §15.247 (e) IC RSS-247 5.2 (2) | Power Spectral Density | 8 dBm in any 3 kHz band | 2400-2483.5 |

TEST PROCEDURE

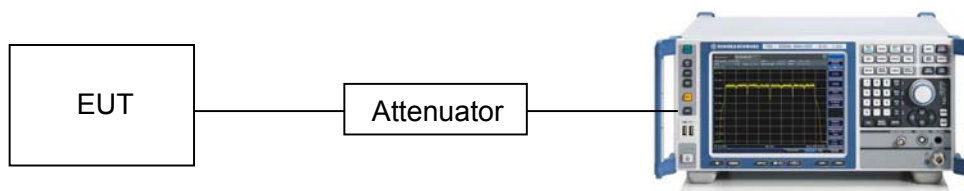
Connect the UUT to the spectrum analyser and use the following settings:

| | |
|------------------|--|
| Center Frequency | The centre frequency of the channel under test |
| Detector | Peak |
| RBW | $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ |
| VBW | $\geq 3 \times \text{RBW}$ |
| Span | 1.5 x DTS bandwidth |
| Trace | Max hold |
| Sweep time | Auto couple. |

Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST SETUP

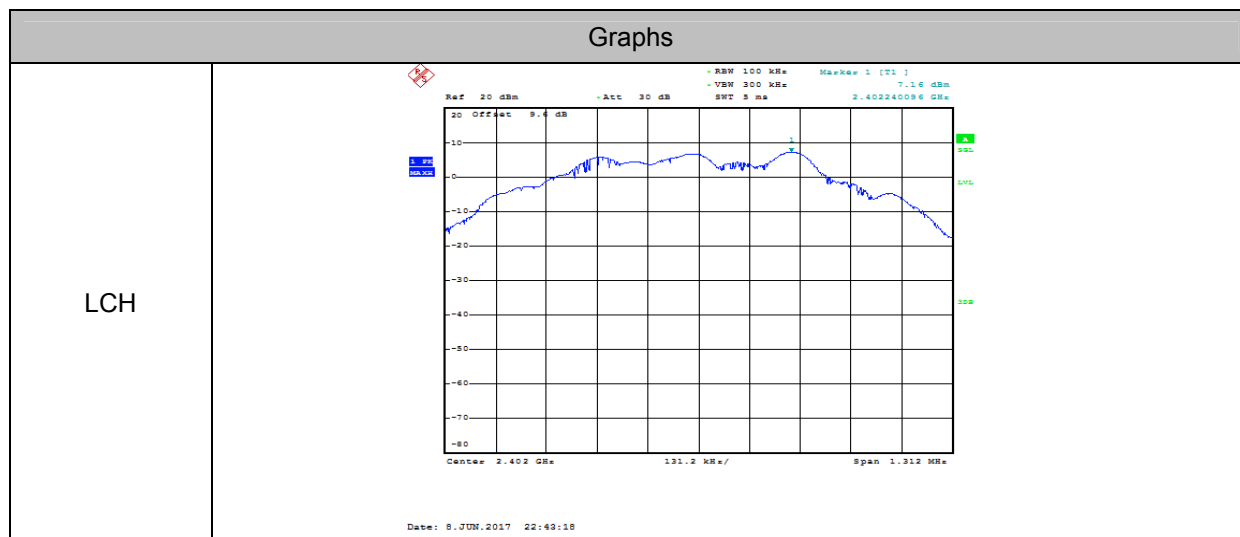


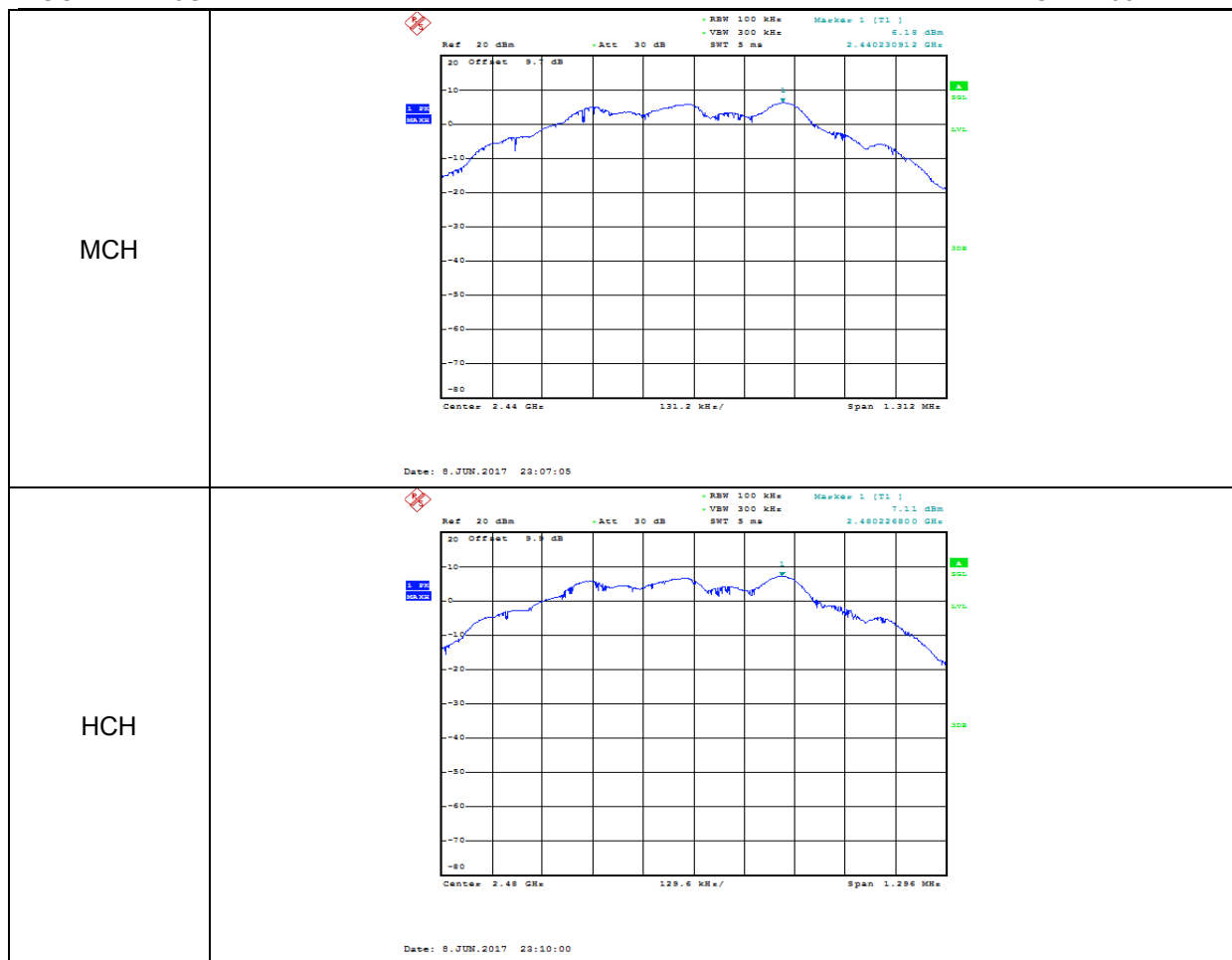
TEST CONDITIONS

Temperature: 28°C
Relative Humidity: 60%
Test Voltage: DC5V

RESULTS

| Frequency | Power Spectral Density (dBm) | Limit (dBm) | Result |
|-----------|------------------------------|-------------|--------|
| 2402 MHz | 7.160 | 8 | PASS |
| 2440 MHz | 6.180 | 8 | PASS |
| 2480 MHz | 7.110 | 8 | PASS |





7.4. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS

LIMITS

| FCC Part15 (15.247) , Subpart C IC RSS-247 ISSUE 1 | | |
|---|---|---|
| Section | Test Item | Limit |
| FCC §15.247 (d) IC RSS-247 5.5 | Conducted Bandedge and Spurious Emissions | at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power |

TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

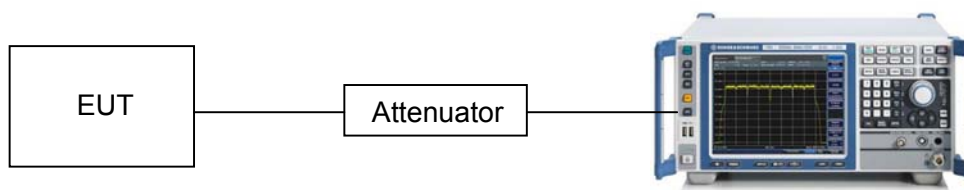
| | |
|------------------|--|
| Center Frequency | The centre frequency of the channel under test |
| Detector | Peak |
| RBW | 100K |
| VBW | $\geq 3 \times \text{RBW}$ |
| Span | 1.5 x DTS bandwidth |
| Trace | Max hold |
| Sweep time | Auto couple. |

Use the peak marker function to determine the maximum PSD level.

| | |
|--------------------|---|
| Span | Set the center frequency and span to encompass frequency range to be measured |
| Detector | Peak |
| RBW | 100K |
| VBW | $\geq 3 \times \text{RBW}$ |
| measurement points | $\geq \text{span}/\text{RBW}$ |
| Trace | Max hold |
| Sweep time | Auto couple. |

Use the peak marker function to determine the maximum amplitude level.

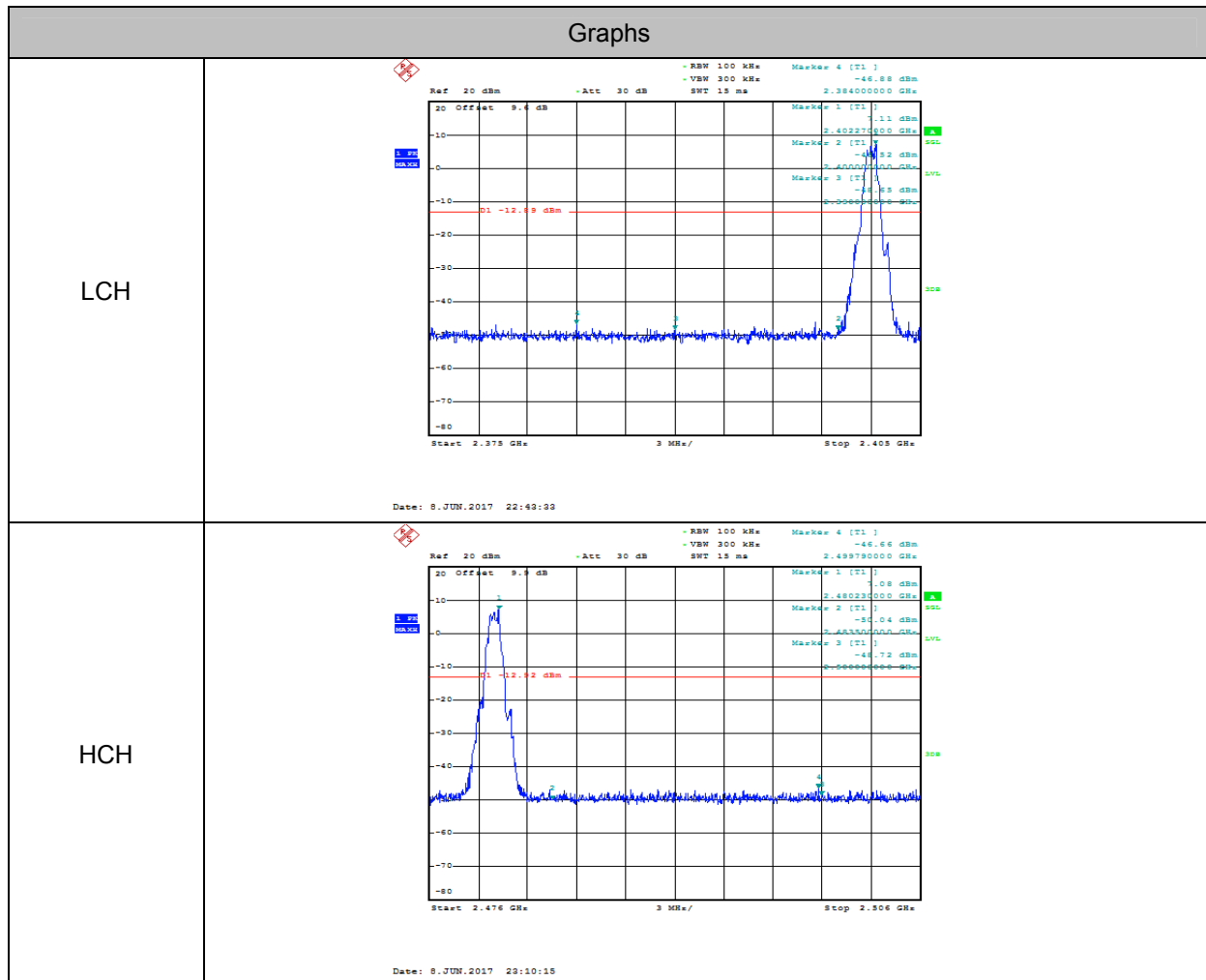
TEST SETUP



TEST CONDITIONS

Temperature: 28°C
Relative Humidity: 60%
Test Voltage: DC5V

RESULTS



8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

Please refer to FCC §15.205 and §15.209

Please refer to IC RSS-GEN Clause 8.9 and Clause 8.10

Radiation Disturbance Test Limit for FCC (Class B)(9KHz-1GHz)

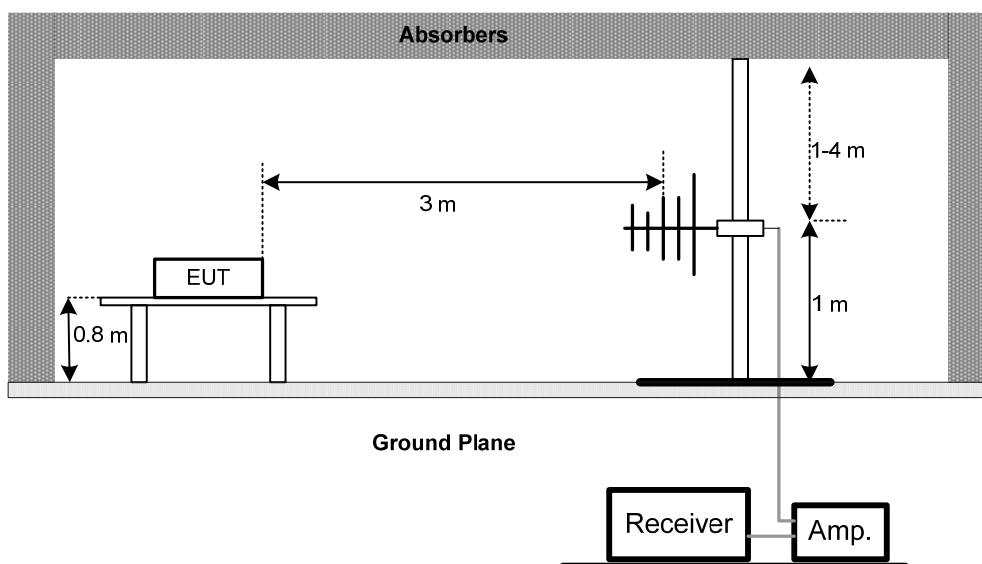
| Frequency (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|-----------------|-----------------------------------|-------------------------------|
| 0.009~0.490 | 2400/F(KHz) | 300 |
| 0.490~1.705 | 24000/F(KHz) | 30 |
| 1.705~30.0 | 30 | 30 |
| 30~88 | 100 | 3 |
| 88~216 | 150 | 3 |
| 216~960 | 200 | 3 |
| 960~1000 | 500 | 3 |

Radiation Disturbance Test Limit for FCC (Above 1G)

| Frequency (MHz) | dB(uV/m) (at 3 meters) | |
|-----------------|------------------------|---------|
| | Peak | Average |
| Above 1000 | 74 | 54 |

TEST SETUP AND PROCEDURE

Below 1G

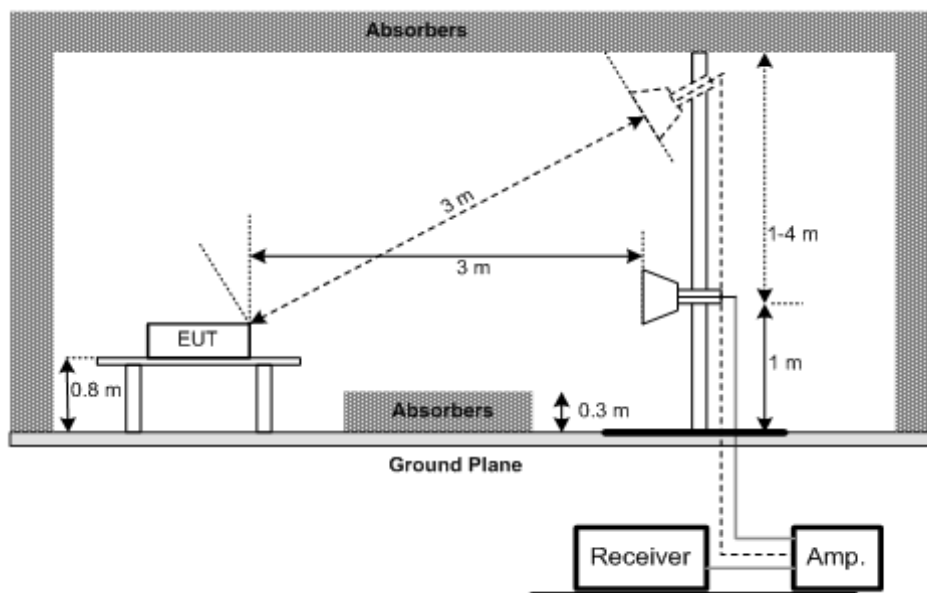


The setting of the spectrum analyser

| | |
|----------|----------|
| RBW | 120KHz |
| VBW | 300KHz |
| Sweep | Auto |
| Detector | Peak/QP |
| Trace | Max hold |

1. The testing follows the guidelines in ANSI C63.10-2013.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 0.8 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration)

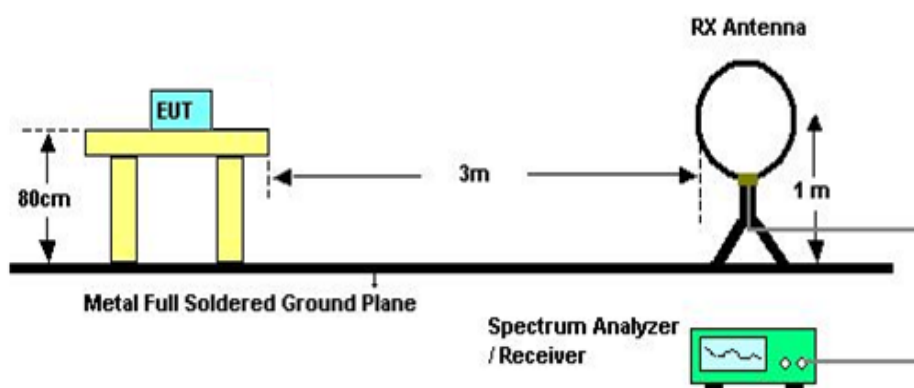
ABOVE 1G



The setting of the spectrum analyser

| | |
|----------|------------------------|
| RBW | 1M MHz |
| VBW | 3MHz |
| Sweep | Auto |
| Detector | Peak and CISPR Average |
| Trace | Max hold |

1. The testing follows the guidelines in ANSI C63.10-2013.
2. The EUT was arranged to its worst case and then tune the antenna tower (1.5 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 1.5 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement above 1GHz, the emission measurement will be measured by the peak detector and the AV detector.



The setting of the spectrum analyser

| | |
|----------|--|
| RBW | 200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz) |
| VBW | 200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz) |
| Sweep | Auto |
| Detector | Peak/QP/ Average |
| Trace | Max hold |

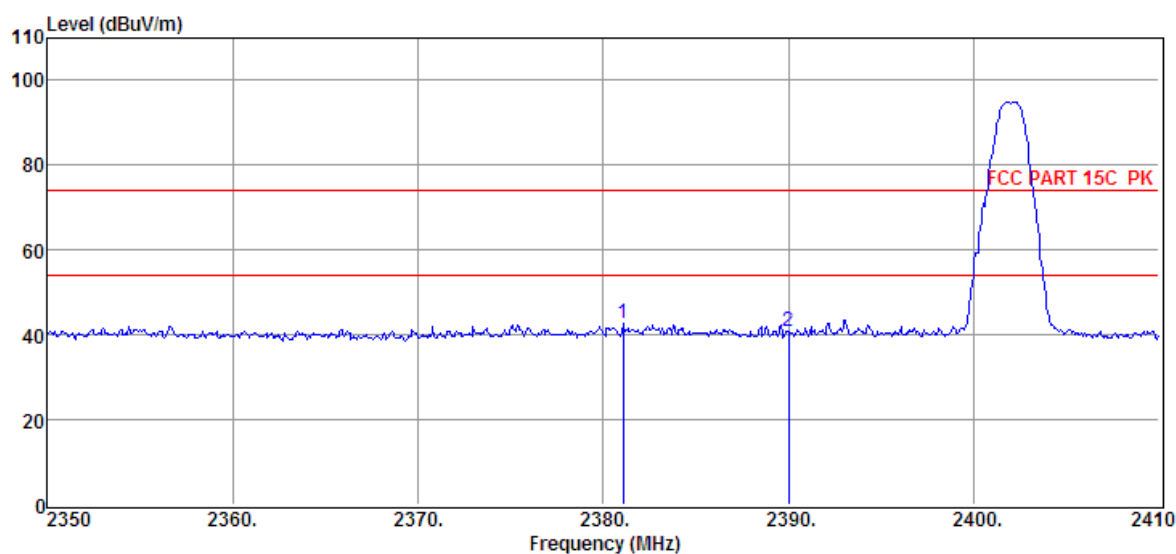
1. The testing follows the guidelines in ANSI C63.10-2013
2. The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 0.8 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. For the actual test configuration, please refer to the related item in this test report (Photographs of the Test Configuration)

TEST CONDITIONS

Temperature: 22.2°C
Relative Humidity: 61%
Test Voltage: DC5V

8.2. RESTRICTED BANDEDGE

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

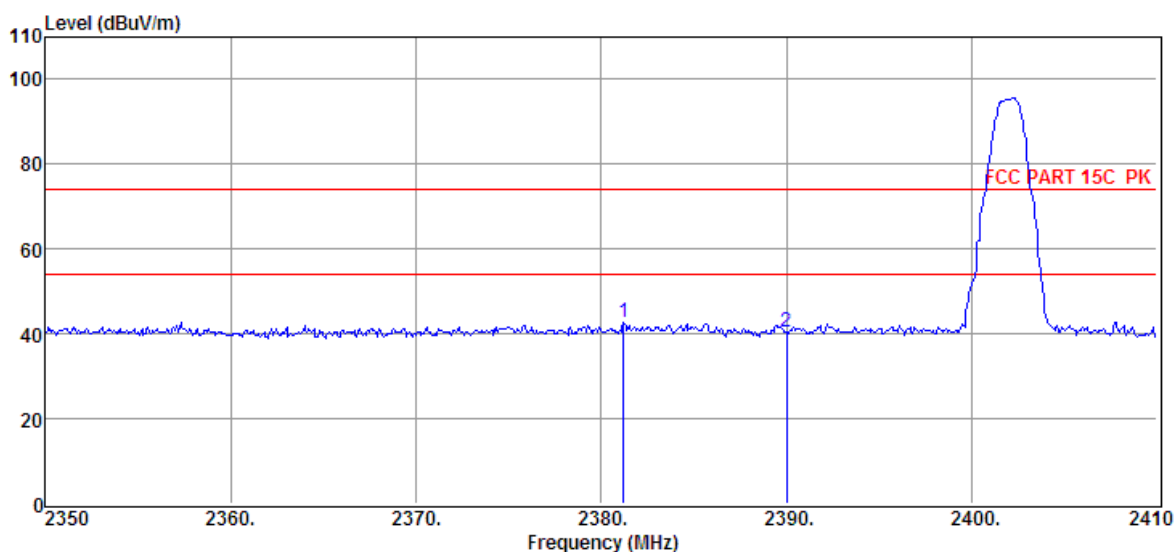


| Item (Mark) | Freq. (MHz) | Read Level (dBμV) | Antenna Factor (dB/m) | PRM Factor dB | Cable Loss dB | Result Level (dBμV/m) | Limit Line (dBμV/m) | Over Limit (dB) | Detector | Polarization |
|----------------|----------------|-------------------------|-----------------------------|---------------------|---------------------|-----------------------------|---------------------------|-----------------------|----------|--------------|
| 1 | 2381.08 | 36.33 | 29.74 | 29.41 | 6.01 | 42.67 | 74.00 | -31.33 | Peak | HORIZONTAL |
| 2 | 2390.02 | 34.48 | 29.78 | 29.42 | 6.03 | 40.87 | 74.00 | -33.13 | Peak | HORIZONTAL |

Note:

1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.
4. EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

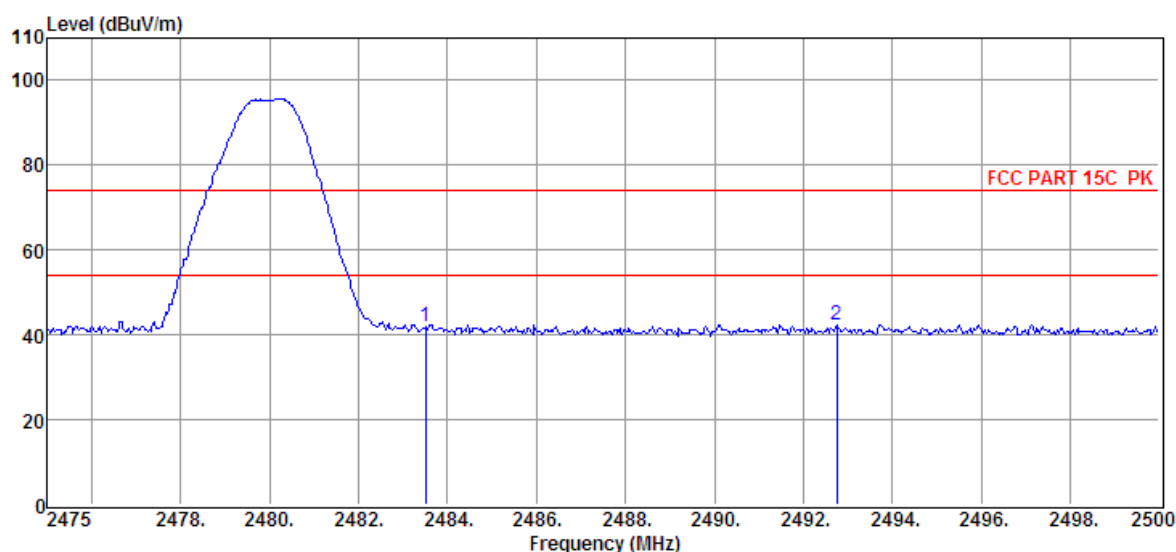


| Item (Mark) | Freq. (MHz) | Read Level (dBUV) | Antenna Factor (dB/m) | PRM Factor dB | Cable Loss dB | Result Level (dBUV/m) | Limit Line (dBUV/m) | Over Limit (dB) | Detector | Polarization |
|----------------|----------------|-------------------------|-----------------------------|---------------------|---------------------|-----------------------------|---------------------------|-----------------------|----------|--------------|
| 1 | 2381.20 | 36.29 | 29.74 | 29.41 | 6.01 | 42.63 | 74.00 | -31.37 | Peak | VERTICAL |
| 2 | 2390.02 | 33.90 | 29.78 | 29.42 | 6.03 | 40.29 | 74.00 | -33.71 | Peak | VERTICAL |

Note:

1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.
4. EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

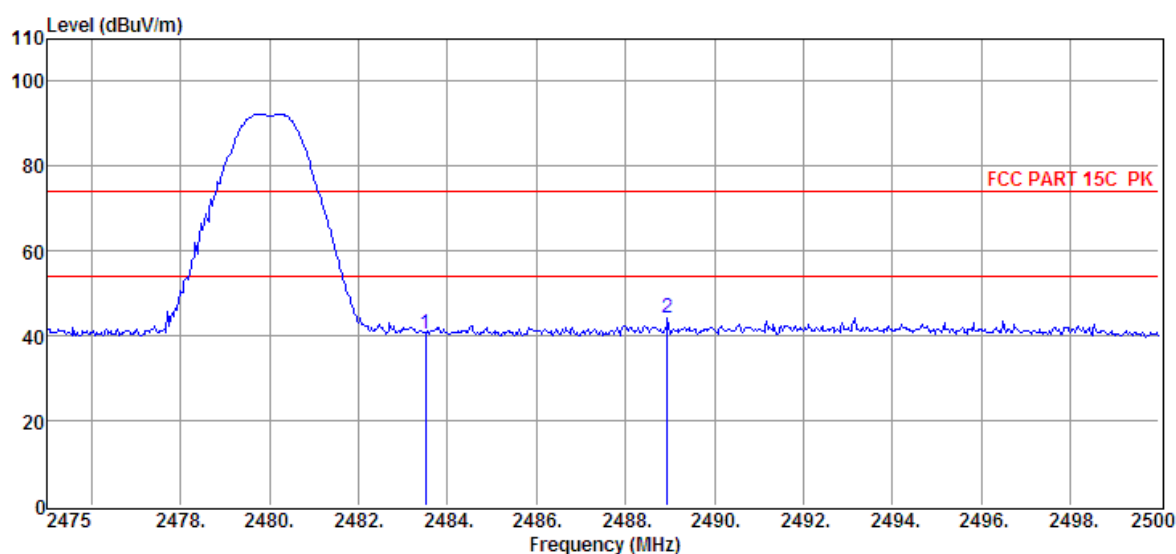


| Item (Mark) | Freq. (MHz) | Read Level (dBμV) | Antenna Factor (dB/m) | PRM Factor dB | Cable Loss dB | Result Level (dBμV/m) | Limit Line (dBμV/m) | Over Limit (dB) | Detector | Polarization |
|----------------|----------------|-------------------------|-----------------------------|---------------------|---------------------|-----------------------------|---------------------------|-----------------------|----------|--------------|
| 1 | 2483.50 | 35.24 | 30.14 | 29.71 | 6.13 | 41.80 | 74.00 | -32.20 | Peak | HORIZONTAL |
| 2 | 2492.75 | 35.88 | 30.17 | 29.73 | 6.17 | 42.49 | 74.00 | -31.51 | Peak | HORIZONTAL |

Note:

1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.
4. EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



| Item (Mark) | Freq. (MHz) | Read Level (dBμV) | Antenna Factor (dB/m) | PRM Factor dB | Cable Loss dB | Result Level (dBμV/m) | Limit Line (dBμV/m) | Over Limit (dB) | Detector | Polarization |
|----------------|----------------|-------------------------|-----------------------------|---------------------|---------------------|-----------------------------|---------------------------|-----------------------|----------|--------------|
| 1 | 2483.50 | 34.01 | 30.14 | 29.71 | 6.13 | 40.57 | 74.00 | -33.43 | Peak | VERTICAL |
| 2 | 2488.95 | 37.83 | 30.16 | 29.71 | 6.13 | 44.41 | 74.00 | -29.59 | Peak | VERTICAL |

Note:

1. Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.
4. EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

8.3. SPURIOUS EMISSIONS (1~25GHz)

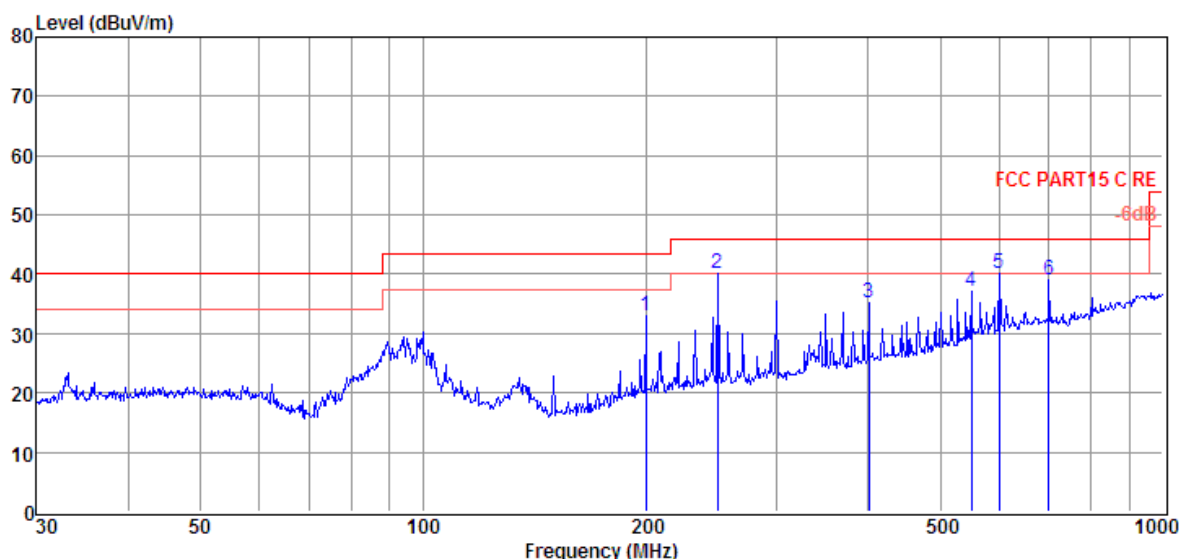
HARMONICS AND SPURIOUS EMISSIONS

| Freq (MHz) | Read level (dBμV) | Antenna Factor (dB/m) | PRM Factor (dB) | Cable Loss (dB) | Result Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Detector type | Polarization |
|--|-------------------|-----------------------|-----------------|-----------------|-----------------------|----------------|-------------|---------------|--------------|
| GFSK Tx mode 2402MHz | | | | | | | | | |
| 4791.00 | 35.99 | 33.74 | 29.31 | 8.46 | 48.88 | 74.00 | -25.12 | Peak | VERTICAL |
| 6270.00 | 33.89 | 35.44 | 29.44 | 9.82 | 49.71 | 74.00 | -24.29 | Peak | VERTICAL |
| 7171.00 | 35.26 | 36.34 | 30.48 | 10.57 | 51.69 | 74.00 | -22.31 | Peak | VERTICAL |
| 8004.00 | 34.86 | 36.69 | 31.13 | 11.13 | 51.55 | 74.00 | -22.45 | Peak | VERTICAL |
| 9075.00 | 34.00 | 37.33 | 32.35 | 11.89 | 50.87 | 74.00 | -23.13 | Peak | VERTICAL |
| 13240.00 | 34.72 | 39.04 | 35.50 | 14.73 | 52.99 | 74.00 | -21.01 | Peak | VERTICAL |
| 4111.00 | 35.61 | 33.49 | 29.06 | 7.71 | 47.75 | 74.00 | -26.25 | Peak | HORIZONTAL |
| 4791.00 | 35.83 | 33.74 | 29.31 | 8.46 | 48.72 | 74.00 | -25.28 | Peak | HORIZONTAL |
| 6474.00 | 34.89 | 35.76 | 29.78 | 9.93 | 50.80 | 74.00 | -23.20 | Peak | HORIZONTAL |
| 7851.00 | 35.06 | 36.67 | 31.07 | 11.05 | 51.71 | 74.00 | -22.29 | Peak | HORIZONTAL |
| 8990.00 | 34.11 | 37.46 | 32.32 | 11.81 | 51.06 | 74.00 | -22.94 | Peak | HORIZONTAL |
| 12696.00 | 34.64 | 38.50 | 35.48 | 14.65 | 52.31 | 74.00 | -21.69 | Peak | HORIZONTAL |
| GFSK Tx mode 2441MHz | | | | | | | | | |
| 4791.00 | 34.28 | 33.74 | 29.31 | 8.46 | 47.17 | 74.00 | -26.83 | Peak | VERTICAL |
| 5879.00 | 34.86 | 34.93 | 29.20 | 9.56 | 50.15 | 74.00 | -23.85 | Peak | VERTICAL |
| 7936.00 | 34.97 | 36.69 | 31.11 | 11.10 | 51.65 | 74.00 | -22.35 | Peak | VERTICAL |
| 8990.00 | 33.99 | 37.46 | 32.32 | 11.81 | 50.94 | 74.00 | -23.06 | Peak | VERTICAL |
| 9891.00 | 34.30 | 36.79 | 32.88 | 12.42 | 50.63 | 74.00 | -23.37 | Peak | VERTICAL |
| 12050.00 | 33.95 | 37.67 | 34.82 | 14.26 | 51.06 | 74.00 | -22.94 | Peak | VERTICAL |
| 4179.00 | 35.75 | 33.55 | 29.07 | 7.81 | 48.04 | 74.00 | -25.96 | Peak | HORIZONTAL |
| 4825.00 | 35.21 | 33.73 | 29.32 | 8.50 | 48.12 | 74.00 | -25.88 | Peak | HORIZONTAL |
| 7681.00 | 34.73 | 36.64 | 30.96 | 10.95 | 51.36 | 74.00 | -22.64 | Peak | HORIZONTAL |
| 8990.00 | 34.84 | 37.46 | 32.32 | 11.81 | 51.79 | 74.00 | -22.21 | Peak | HORIZONTAL |
| 10979.00 | 34.14 | 37.74 | 33.92 | 13.45 | 51.41 | 74.00 | -22.59 | Peak | HORIZONTAL |
| 12866.00 | 34.23 | 38.67 | 35.64 | 14.66 | 51.92 | 74.00 | -22.08 | Peak | HORIZONTAL |
| GFSK Tx mode 2480MHz | | | | | | | | | |
| 5131.00 | 33.90 | 33.97 | 29.34 | 8.80 | 47.33 | 74.00 | -26.67 | Peak | VERTICAL |
| 5505.00 | 33.76 | 34.70 | 29.26 | 9.18 | 48.38 | 74.00 | -25.62 | Peak | VERTICAL |
| 7341.00 | 35.64 | 36.48 | 30.59 | 10.72 | 52.25 | 74.00 | -21.75 | Peak | VERTICAL |
| 9041.00 | 33.83 | 37.41 | 32.34 | 11.87 | 50.77 | 74.00 | -23.23 | Peak | VERTICAL |
| 10979.00 | 33.43 | 37.74 | 33.92 | 13.45 | 50.70 | 74.00 | -23.30 | Peak | VERTICAL |
| 12866.00 | 34.64 | 38.67 | 35.64 | 14.66 | 52.33 | 74.00 | -21.67 | Peak | VERTICAL |
| 4961.00 | 37.05 | 33.71 | 29.35 | 8.63 | 50.04 | 74.00 | -23.96 | Peak | HORIZONTAL |
| 6916.00 | 34.76 | 36.13 | 30.33 | 10.37 | 50.93 | 74.00 | -23.07 | Peak | HORIZONTAL |
| 7766.00 | 34.69 | 36.65 | 31.02 | 11.01 | 51.33 | 74.00 | -22.67 | Peak | HORIZONTAL |
| 8905.00 | 34.49 | 37.09 | 32.24 | 11.77 | 51.11 | 74.00 | -22.89 | Peak | HORIZONTAL |
| 12050.00 | 33.84 | 37.67 | 34.82 | 14.26 | 50.95 | 74.00 | -23.05 | Peak | HORIZONTAL |
| 13444.00 | 34.53 | 39.24 | 35.28 | 14.78 | 53.27 | 74.00 | -20.73 | Peak | HORIZONTAL |
| Result: Pass | | | | | | | | | |
| Note1: Result Level = Read Level + Antenna Factor + Cable loss - PRM Factor. | | | | | | | | | |
| Note2: EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report. | | | | | | | | | |
| Note3: If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit. | | | | | | | | | |

8.4. SPURIOUS EMISSIONS BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)

| | | | |
|--------------|----------|--------------------|------------|
| Temperature: | 24.5°C | Relative Humidity: | 55% |
| Pressure: | 1012 hPa | Test Voltage: | CDC5V |
| Test Mode: | Tx Mode | Polarization: | HORIZONTAL |
| Remark: | N/A | | |

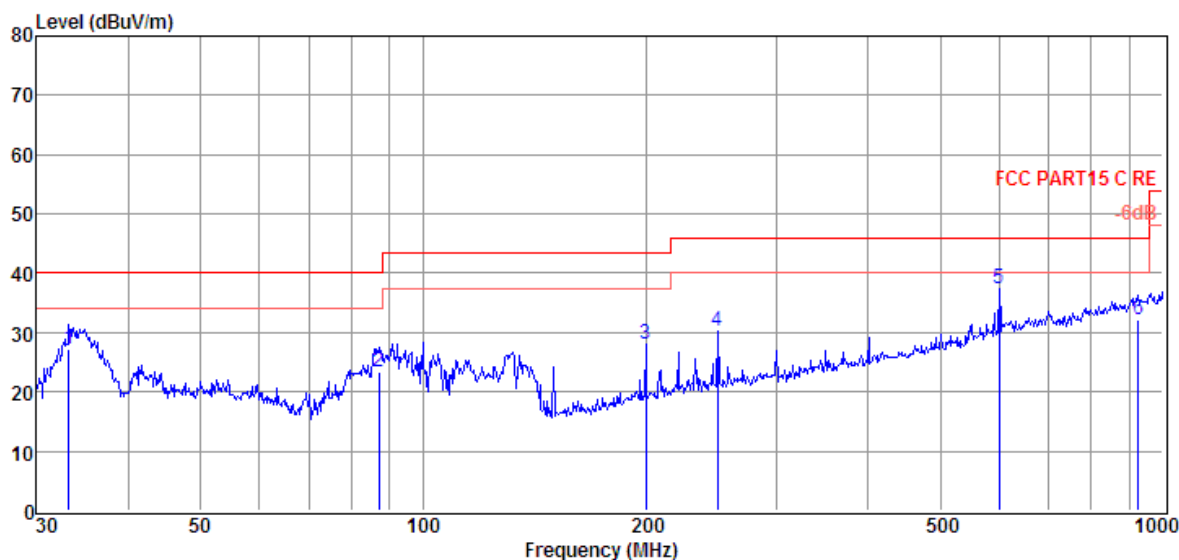


| Item (Mark) | Freq. (MHz) | Read Level (dBμV) | Antenna Factor (dB/m) | Cable Loss dB | Result Level (dBμV/m) | Limit Line (dBμV/m) | Over Limit (dB) | Detector | Polarization |
|----------------|----------------|-------------------------|-----------------------------|---------------------|-----------------------------|---------------------------|-----------------------|----------|--------------|
| 1 | 199.99 | 17.72 | 10.30 | 4.90 | 32.92 | 43.50 | -10.58 | QP | HORIZONTAL |
| 2 | 250.30 | 22.61 | 12.30 | 5.14 | 40.05 | 46.00 | -5.95 | QP | HORIZONTAL |
| 3 | 400.43 | 13.65 | 15.71 | 5.80 | 35.16 | 46.00 | -10.84 | QP | HORIZONTAL |
| 4 | 550.95 | 12.31 | 18.35 | 6.34 | 37.00 | 46.00 | -9.00 | QP | HORIZONTAL |
| 5 | 601.43 | 14.33 | 19.27 | 6.51 | 40.11 | 46.00 | -5.89 | QP | HORIZONTAL |
| 6 | 701.76 | 12.28 | 19.86 | 6.84 | 38.98 | 46.00 | -7.02 | QP | HORIZONTAL |

Note:

1. Result Level = Read Level + Antenna Factor + Cable loss.
2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.
3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.
4. EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

| | | | |
|--------------|----------|--------------------|----------|
| Temperature: | 24.5°C | Relative Humidity: | 55% |
| Pressure: | 1012 hPa | Test Voltage: | DC5V |
| Test Mode: | Tx Mode | Polarization: | VERTICAL |
| Remark: | N/A | | |



| Item (Mark) | Freq. (MHz) | Read Level (dBμV) | Antenna Factor (dB/m) | Cable Loss dB | Result Level (dBμV/m) | Limit Line (dBμV/m) | Over Limit (dB) | Detector | Polarization |
|----------------|----------------|-------------------------|-----------------------------|---------------------|-----------------------------|---------------------------|-----------------------|----------|--------------|
| 1 | 33.21 | 12.03 | 11.52 | 3.71 | 27.26 | 40.00 | -12.74 | QP | VERTICAL |
| 2 | 87.11 | 9.52 | 9.73 | 4.20 | 23.45 | 40.00 | -16.55 | QP | VERTICAL |
| 3 | 199.99 | 12.96 | 10.30 | 4.90 | 28.16 | 43.50 | -15.34 | QP | VERTICAL |
| 4 | 250.30 | 12.87 | 12.30 | 5.14 | 30.31 | 46.00 | -15.69 | QP | VERTICAL |
| 5 | 601.43 | 11.53 | 19.27 | 6.51 | 37.31 | 46.00 | -8.69 | QP | VERTICAL |
| 6 | 925.76 | 1.99 | 22.70 | 7.49 | 32.18 | 46.00 | -13.82 | QP | VERTICAL |

Note:

1. Result Level = Read Level + Antenna Factor + Cable loss.
2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.
3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.
4. EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

8.5. SPURIOUS EMISSIONS BELOW 30M

The emissions don't show in following result tables are more than 20dB below the limits.
The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

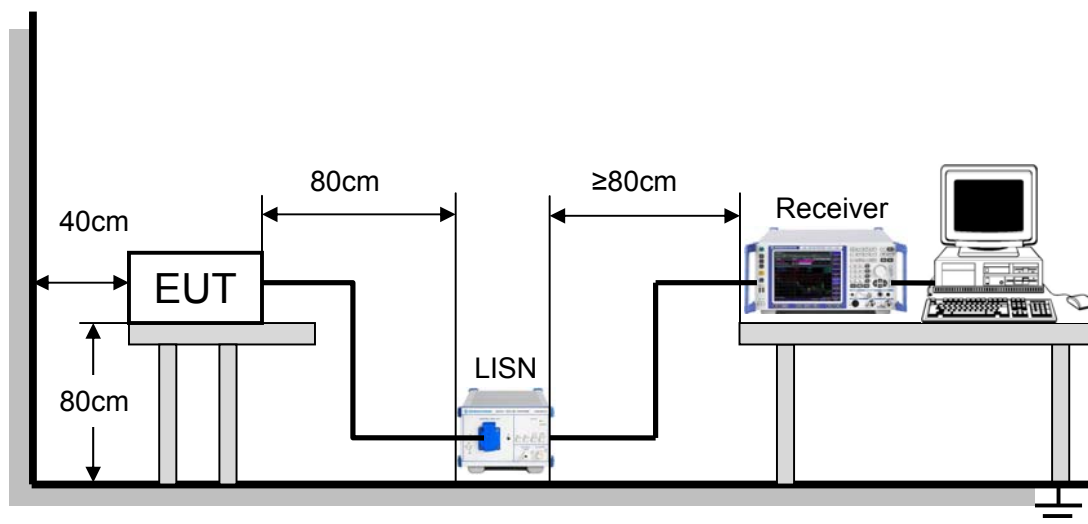
9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

Please refer to FCC §15.207 (a) and RSS-Gen Clause 8.8

| FREQUENCY (MHz) | Class A (dBuV) | | Class B (dBuV) | |
|-----------------|----------------|---------|----------------|-----------|
| | Quasi-peak | Average | Quasi-peak | Average |
| 0.15 -0.5 | 79.00 | 66.00 | 66 - 56 * | 56 - 46 * |
| 0.50 -5.0 | 73.00 | 60.00 | 56.00 | 46.00 |
| 5.0 -30.0 | 73.00 | 60.00 | 60.00 | 50.00 |

TEST SETUP AND PROCEDURE



The EUT is put on a table of non-conducting material that is 80cm high. The vertical conducting wall of shielding is located 40cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.). A EMI Measurement Receiver (R&S Test Receiver ESR3) is used to test the emissions from both sides of AC line. According to the requirements in Section 7 and 13 of ANSI C63.4-2003. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and average detector mode. The bandwidth of EMI test receiver is set at 9kHz.

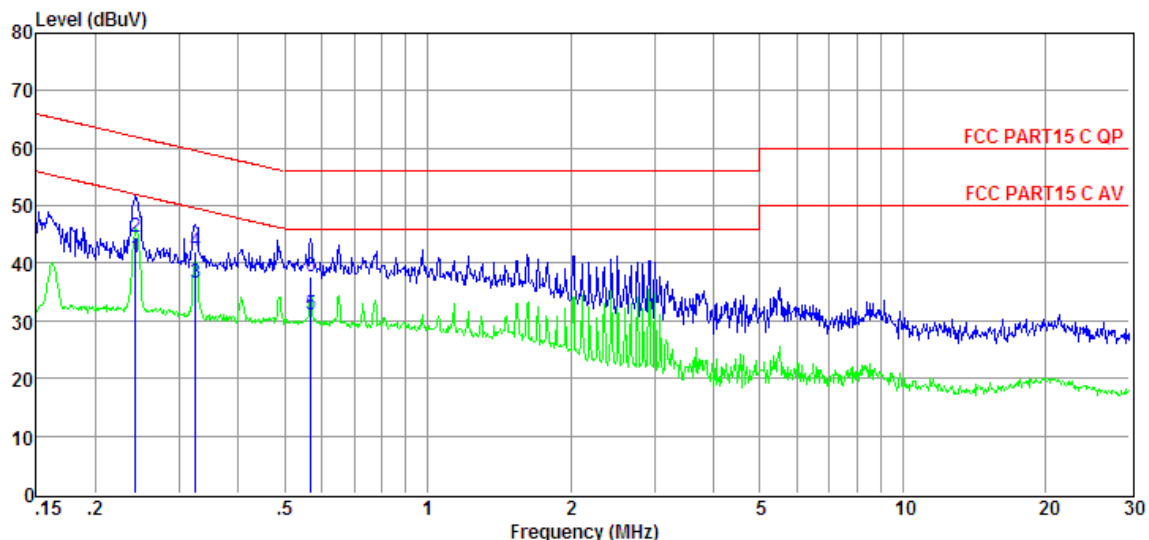
The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application.

TEST CONDITIONS

Temperature: 23.8°C
Relative Humidity: 58%
Test Voltage: DC5V

TEST RESULTS

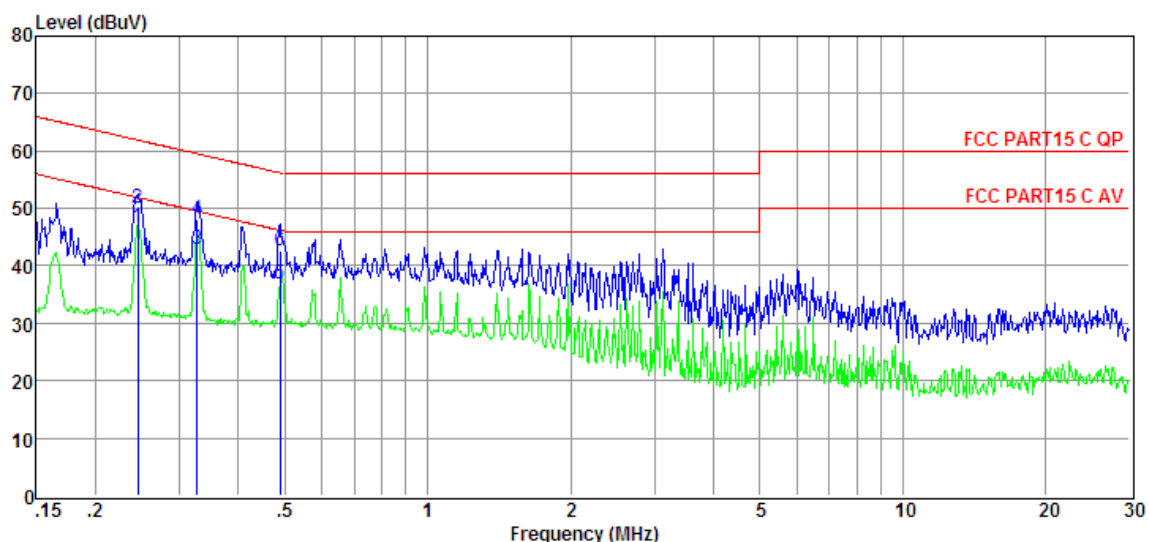
| | | | |
|--------------|----------|--------------------|-------------|
| Temperature: | 24.5°C | Relative Humidity: | 55% |
| Pressure: | 1012 hPa | Test Voltage: | AC120V,60Hz |
| Test Mode: | Tx Mode | Phase : | L1 |
| Remark: | N/A | | |



| Item (Mark) | Freq. (MHz) | Read Level (dBμV) | LISN Factor (dB) | Cable Loss (dB) | Pulse Limiter Factor (dB) | Result Level (dBμV) | Limit Line (dBμV) | Over Limit (dB) | Detector | Phase |
|----------------|----------------|-------------------------|------------------------|-----------------------|------------------------------------|---------------------------|-------------------------|-----------------------|----------|-------|
| 1 | 0.24 | 21.43 | 9.61 | 0.02 | 9.86 | 40.92 | 52.00 | -11.08 | Average | LINE |
| 2 | 0.24 | 25.05 | 9.61 | 0.02 | 9.86 | 44.54 | 62.00 | -17.46 | QP | LINE |
| 3 | 0.33 | 17.16 | 9.61 | 0.02 | 9.86 | 36.65 | 49.57 | -12.92 | Average | LINE |
| 4 | 0.33 | 22.44 | 9.61 | 0.02 | 9.86 | 41.93 | 59.57 | -17.64 | QP | LINE |
| 5 | 0.57 | 11.52 | 9.61 | 0.03 | 9.86 | 31.02 | 46.00 | -14.98 | Average | LINE |
| 6 | 0.57 | 18.29 | 9.61 | 0.03 | 9.86 | 37.79 | 56.00 | -18.21 | QP | LINE |

Note: 1. Result Level = Read Level + LISN Factor + Pulse Limiter Factor + Cable loss.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz).
4. Step size: 80Hz (0.009MHz-0.15MHz), 4 kHz (0.15MHz-30MHz), Scan time: auto.

| | | | |
|--------------|----------|--------------------|-------------|
| Temperature: | 24.5°C | Relative Humidity: | 55% |
| Pressure: | 1012 hPa | Test Voltage: | AC120V,60Hz |
| Test Mode: | Tx Mode | Phase : | N |
| Remark: | N/A | | |



| Item | Freq. | Read Level | LISN Factor | Cable Loss | Pulse Limiter Factor | Result Level | Limit Line | Over Limit | Detector | Phase |
|--------|-------|------------|-------------|------------|----------------------|--------------|------------|------------|----------|---------|
| (Mark) | (MHz) | (dBμV) | (dB) | (dB) | (dB) | (dBμV) | (dBμV) | (dB) | | |
| 1 | 0.25 | 27.17 | 9.61 | 0.02 | 9.86 | 46.66 | 51.91 | -5.25 | Average | NEUTRAL |
| 2 | 0.25 | 30.46 | 9.61 | 0.02 | 9.86 | 49.95 | 61.91 | -11.96 | QP | NEUTRAL |
| 3 | 0.33 | 23.46 | 9.61 | 0.02 | 9.86 | 42.95 | 49.53 | -6.58 | Average | NEUTRAL |
| 4 | 0.33 | 28.57 | 9.61 | 0.02 | 9.86 | 48.06 | 59.53 | -11.47 | QP | NEUTRAL |
| 5 | 0.49 | 17.28 | 9.61 | 0.02 | 9.86 | 36.77 | 46.19 | -9.42 | Average | NEUTRAL |
| 6 | 0.49 | 23.13 | 9.61 | 0.02 | 9.86 | 42.62 | 56.19 | -13.57 | QP | NEUTRAL |

Note: 1. Result Level = Read Level + LISN Factor + Pulse Limiter Factor + Cable loss.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz).
4. Step size: 80Hz (0.009MHz-0.15MHz), 4 kHz (0.15MHz-30MHz), Scan time: auto.

10. ANTENNA REQUIREMENTS

Applicable requirements

Please refer to FCC §15.203

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. 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 FCC rule.

Antenna Connector

Antenna Connector is on the PCB within enclosure and not accessible to user.

Antenna Gain

The antenna gain of EUT is less than 6 dBi.

END OF REPORT