

FCC ID: M82-AIM37AC
Report No.: T170919D06-A-RP2

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Rev.: 02

RADIO TEST REPORT

FCC 47 CFR PART 15 SUBPART C

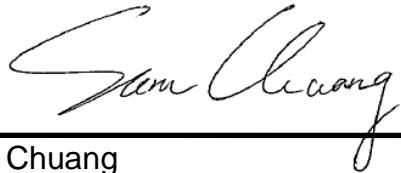
| | |
|----------------------|---|
| Test Standard | FCC Part 15.247 |
| Product name | Computer |
| Brand Name | ADVANTECH |
| Model Name | AIM-37ACxxxxxxxxxxxxxx; AIM37ACxxxxxxxxxxxxxx (where "x" may be any alphanumeric character, "-" or blank for marketing purpose and no impact safety related critical components and constructions) |
| Test Result | Pass |

The test Result was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were given in ANSI C63.10: 2013 and compliance standards.

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

The test Report of full or partial shall not copy. Without written approval of Compliance Certification Services Inc. (Wugu Laboratory)

Approved by:



Sam Chuang
Manager

Tested by:



Jerry Chuang
Engineer

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
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Revision History

| Rev. | Issue Date | Revisions | Revised By |
|------|------------------|---|------------|
| 00 | January 24, 2018 | Initial Issue | May Lin |
| 01 | May 14, 2018 | 1. Revised model discrepancy: P.4. 2. Revised radiation test photo: P.44 | May Lin |
| 02 | July 31, 2018 | 1. Re-test AC Conducted Emissions and modify test setup photo: P.15-16, P.46 | May Lin |

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1. GENERAL INFORMATION

1.1 EUT INFORMATION

| | | | | | | | | | | | |
|-------------------|--|---|------------------------|-----------|------------------|--------|--|--|--|--|--|
| Applicant | Advantech Co.Ltd. No.1, Alley 20, Lane 26, Rueiguang Road, Neihu District, Taipei 114, Taiwan, R.O.C. | | | | | | | | | | |
| Manufacturer | Advantech Co.Ltd. No.1, Alley 20, Lane 26, Rueiguang Road, Neihu District, Taipei 114, Taiwan, R.O.C. | | | | | | | | | | |
| Equipment | Computer | | | | | | | | | | |
| Model No. | AIM-37ACxxxxxxxxxxxxxx; AIM37ACxxxxxxxxxxxxxx (where "x" may be any alphanumeric character, “-” or blank for marketing purpose and no impact safety related critical components and constructions) | | | | | | | | | | |
| Model Discrepancy | Model Name | Model Discrepancy | | | | | | | | | |
| | - | - | Magnetic stripe reader | IC reader | Memory / Storage | Color | | | | | |
| | AIM-37AC | SKU1 | V | V | 4GB / 64GB | Orange | | | | | |
| | | SKU2 | V | V | | | | | | | |
| | | SKU3 | X | X | 2GB / 32GB | Grey | | | | | |
| | | SKU4 | | | 4GB / 64GB | | | | | | |
| | | SKU5 | | | | | | | | | |
| | AIM-37ACxxxxxxxxxxxxxx; AIM37ACxxxxxxxxxxxxxx (where "x" may be any alphanumeric character, “-” or blank for marketing purpose and no impact safety related critical components and constructions) | All the model number was just for marketing purpose only. | | | | | | | | | |
| Received Date | September 19, 2017 | | | | | | | | | | |
| Date of Test | January 15 ~ July 27, 2018 | | | | | | | | | | |
| Output Power (W) | BLE : 0.0047 | | | | | | | | | | |
| Power Supply | VDC from Power Adapter Brand: Asian Power Devices Inc. Model name: WA-15I05R Input: 100-240Vac, 50-60Hz, 0.5A Max Output: 5Vdc, 3A | | | | | | | | | | |

1.2 EUT CHANNEL INFORMATION

| | |
|-------------------|--------------------|
| Frequency Range | 2402MHz-2480MHz |
| Modulation Type | GFSK for BLE-1Mbps |
| Number of channel | 40 Channels |

Remark:

Refer as ANSI 63.10:2013 clause 5.6.1 Table 4 for test channels

| Number of frequencies to be tested | | |
|--|-----------------------|--|
| Frequency range in which device operates | Number of frequencies | Location in frequency range of operation |
| <input type="checkbox"/> 1 MHz or less | 1 | Middle |
| <input type="checkbox"/> 1 MHz to 10 MHz | 2 | 1 near top and 1 near bottom |
| <input checked="" type="checkbox"/> More than 10 MHz | 3 | 1 near top, 1 near middle, and 1 near bottom |

1.3 ANTENNA INFORMATION

| | |
|--------------|--|
| Antenna Type | <input checked="" type="checkbox"/> PIFA <input type="checkbox"/> PCB <input type="checkbox"/> Dipole <input type="checkbox"/> Coils |
| Antenna Gain | Gain: 1.13dBi |

1.4 MEASUREMENT UNCERTAINTY

| PARAMETER | UNCERTAINTY |
|---------------------------------------|-------------|
| AC Powerline Conducted Emission | +/- 2.96 |
| Emission bandwidth, 20dB bandwidth | +/- 1.4003 |
| RF output power, conducted | +/- 1.1372 |
| Power density, conducted | +/- 1.4003 |
| 3M Semi Anechoic Chamber / 30M~200M | +/- 4.0138 |
| 3M Semi Anechoic Chamber / 200M~1000M | +/- 3.9483 |
| 3M Semi Anechoic Chamber / 1G~8G | +/- 2.5975 |
| 3M Semi Anechoic Chamber / 8G~18G | +/- 2.6112 |
| 3M Semi Anechoic Chamber / 18G~26G | +/- 2.7389 |
| 3M Semi Anechoic Chamber / 26G~40G | +/- 2.9683 |
| 3M Semi Anechoic Chamber / 40G~60G | +/- 1.8509 |
| 3M Semi Anechoic Chamber / 60G~75G | +/- 1.9869 |
| 3M Semi Anechoic Chamber / 75G~110G | +/- 2.9651 |
| 3M Semi Anechoic Chamber / 110G~170G | +/- 2.7807 |
| 3M Semi Anechoic Chamber / 170G~220G | +/- 3.6437 |
| 3M Semi Anechoic Chamber / 220G~325G | +/- 4.2982 |

Remark:

1. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$
2. ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report.

1.5 FACILITIES AND TEST LOCATION

All measurement facilities used to collect the measurement data are located at
No.11, Wugong 6th Rd., Wugu Dist., New Taipei City 24891, Taiwan. (R.O.C.)

| Test site | Test Engineer | Remark |
|--------------------|---------------|--------|
| AC Conduction Room | Dally Hong | |
| Radiation | Jerry Chuang | |
| RF Conducted | Eric Lee | |

Remark: The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.6 INSTRUMENT CALIBRATION

| RF Conducted Test Site | | | | | |
|------------------------|--------------------|-----------------|------------|------------|------------|
| Equipment | Manufacturer | Model | S/N | Cal Date | Cal Due |
| Power Meter | Anritsu | ML2495A | 1033009 | 04/11/2017 | 04/10/2018 |
| Power Sensor | Anritsu | MA2411B | 917072 | 07/03/2017 | 07/02/2018 |
| Spectrum Analyzer | R&S | FSV 40 | 101073 | 10/02/2017 | 10/01/2018 |
| Directional Coupler | Agilent | 87301D | MY44350252 | 07/25/2017 | 07/24/2018 |
| SUCOFLEX Cable | HUBER SUHNER | SUCOFLEX 104PEA | 25157 | 07/31/2017 | 07/30/2018 |
| Divider | Solvang Technology | 2-18GHz 4Way | STI08-0015 | 07/26/2017 | 07/25/2018 |

| 3M 966 Chamber Test Site | | | | | |
|--------------------------|----------------|-----------------|------------|------------|------------|
| Equipment | Manufacturer | Model | S/N | Cal Date | Cal Due |
| Bilog Antenna | Sunol Sciences | JB3 | A030105 | 06/20/2017 | 06/19/2018 |
| Horn Antenna | EMCO | 3117 | 00055165 | 02/20/2017 | 02/19/2018 |
| Pre-Amplifier | EMEC | EM330 | 060609 | 06/07/2017 | 06/06/2018 |
| Spectrum Analyzer | Agilent | E4446A | US42510252 | 11/27/2017 | 11/26/2018 |
| Loop Ant | COM-POWER | AL-130 | 121051 | 03/02/2017 | 03/01/2018 |
| Antenna Tower | CCS | CC-A-1F | N/A | N.C.R | N.C.R |
| Controller | CCS | CC-C-1F | N/A | N.C.R | N.C.R |
| Turn Table | CCS | CC-T-1F | N/A | N.C.R | N.C.R |
| Pre-Amplifier | HP | 8449B | 3008A00965 | 06/27/2017 | 06/26/2018 |
| Filter | N/A | 2400-2500 | N/A | N/A | N/A |
| Filter | N/A | 0-6000 | N/A | N/A | N/A |
| Cable | HUBER SUHNER | SUCOFLEX 104PEA | 25157 | 07/31/2017 | 07/30/2018 |
| Cable | HUBER SUHNER | SUCOFLEX 104PEA | 20995 | 07/31/2017 | 07/30/2018 |

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| AC Conducted Emissions Test Site | | | | | |
|----------------------------------|--------------|-----------|----------|------------|------------|
| Equipment | Manufacturer | Model | S/N | Cal Date | Cal Due |
| LISN | R&S | ENV216 | 101054 | 02/06/2018 | 02/05/2019 |
| LISN | SCHWARZBECK | NSLK 8127 | 8127-541 | 02/09/2018 | 02/08/2019 |
| EMI Test Receiver | R&S | ESCI | 101203 | 11/02/2017 | 11/01/2018 |

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

1.7 SUPPORT AND EUT ACCESSORIES EQUIPMENT

| Support Equipment | | | | | |
|-------------------|-----------|---------|---------|------------|--------|
| No. | Equipment | Brand | Model | Series No. | FCC ID |
| 1. | NB(K) | Toshiba | voyager | ZD 154034s | N/A |

1.8 TEST METHODOLOGY AND APPLIED STANDARDS

The test methodology, setups and results comply with all requirements in accordance with ANSI C63.10:2013, FCC Part 2, FCC Part 15.247, KDB 558074 D01 v04.

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2. TEST SUMMARY

| FCC Standard Section | Report Section | Test Item | Result |
|----------------------|----------------|-----------------------------|--------|
| 15.203 | 1.3 | Antenna Requirement | Pass |
| 15.207(a) | 4.1 | AC Conducted Emission | Pass |
| 15.247(a)(2) | 4.2 | 6 dB Bandwidth | Pass |
| - | 4.2 | Occupied Bandwidth (99%) | Pass |
| 15.247(b) | 4.3 | Output Power Measurement | Pass |
| 15.247(e) | 4.4 | Power Spectral Density | Pass |
| 15.247(d) | 4.5 | Conducted Band Edge | Pass |
| 15.247(d) | 4.5 | Conducted Emission | Pass |
| 15.247(d) | 4.6 | Radiation Band Edge | Pass |
| 15.247(d) | 4.6 | Radiation Spurious Emission | Pass |

3. DESCRIPTION OF TEST MODES

3.1 THE WORST MODE OF OPERATING CONDITION

| | |
|--------------------------|---|
| Operation mode | BT4.0 Mode (1Mbps) |
| Test Channel Frequencies | 1.Lowest Channel : 2402MHz 2.Middle Channel : 2440MHz 3.Highest Channel : 2480MHz |

Remark:

1. *EUT pre-scanned data rate of output power for each mode, the worst data rate were recorded in this report.*

3.2 THE WORST MODE OF MEASUREMENT

| AC Power Line Conducted Emission | |
|----------------------------------|--|
| Test Condition | AC Power line conducted emission for line and neutral |
| Voltage/Hz | 120V/60Hz |
| Test Mode | Mode 1: EUT power by AC adapter via power cable. |
| Worst Mode | <input checked="" type="checkbox"/> Mode 1 <input type="checkbox"/> Mode 2 <input type="checkbox"/> Mode 3 <input type="checkbox"/> Mode 4 |

| Radiated Emission Measurement Above 1G | |
|--|---|
| Test Condition | Band edge, Emission for Unwanted and Fundamental |
| Voltage/Hz | 120V/60Hz |
| Test Mode | Mode 1: EUT power by AC adapter via power cable. |
| Worst Mode | <input checked="" type="checkbox"/> Mode 1 <input type="checkbox"/> Mode 2 <input type="checkbox"/> Mode 3 <input type="checkbox"/> Mode 4 |
| Worst Position | <input type="checkbox"/> Placed in fixed position. <input checked="" type="checkbox"/> Placed in fixed position at X-Plane (E2-Plane) <input type="checkbox"/> Placed in fixed position at Y-Plane (E1-Plane) <input type="checkbox"/> Placed in fixed position at Z-Plane (H-Plane) |
| Worst Polarity | <input checked="" type="checkbox"/> Horizontal <input type="checkbox"/> Vertical |

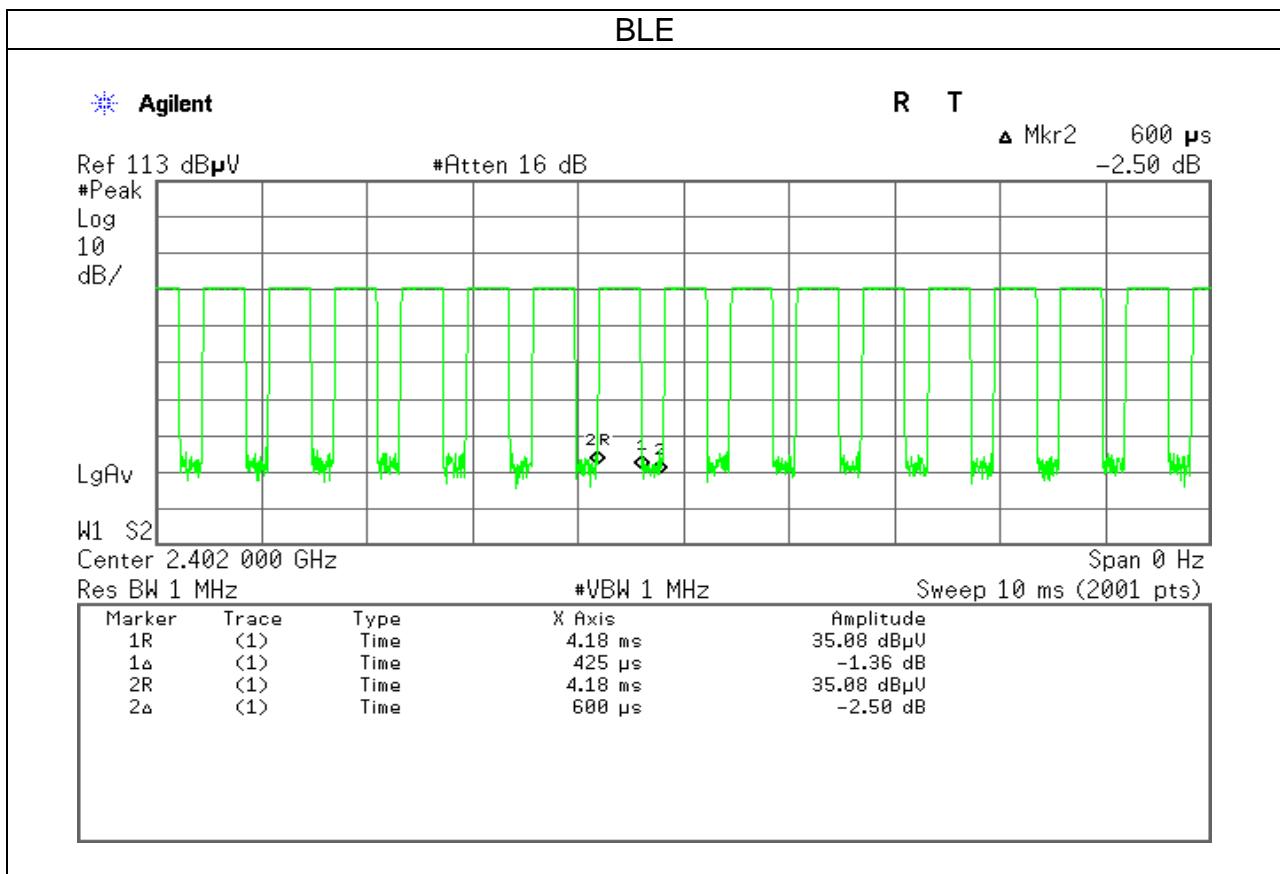
| Radiated Emission Measurement Below 1G | |
|--|--|
| Test Condition | Radiated Emission Below 1G |
| Voltage/Hz | 120V/60Hz |
| Test Mode | Mode 1: EUT power by AC adapter via power cable. |
| Worst Mode | <input checked="" type="checkbox"/> Mode 1 <input type="checkbox"/> Mode 2 <input type="checkbox"/> Mode 3 <input type="checkbox"/> Mode 4 |

Remark:

1. The worst mode was record in this test report.
2. EUT pre-scanned in three axis, X, Y, Z and two polarity, Horizontal and Vertical for radiated measurement. The worst case (X-Plane and Horizontal) were recorded in this report
3. For below 1G, AC power line conducted emission and radiation emission were performed the EUT transmit at the highest output power channel as worse case.

3.3 EUT DUTY CYCLE

| Duty Cycle | | | | |
|---------------|------------|-------------|----------------|-----------------|
| Configuration | TX ON (ms) | TX ALL (ms) | Duty Cycle (%) | Duty Factor(dB) |
| BLE | 0.4250 | 0.6000 | 70.83% | 1.50 |



4. TEST RESULT

4.1 AC POWER LINE CONDUCTED EMISSION

4.1.1 Test Limit

According to §15.207(a),

| 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 |

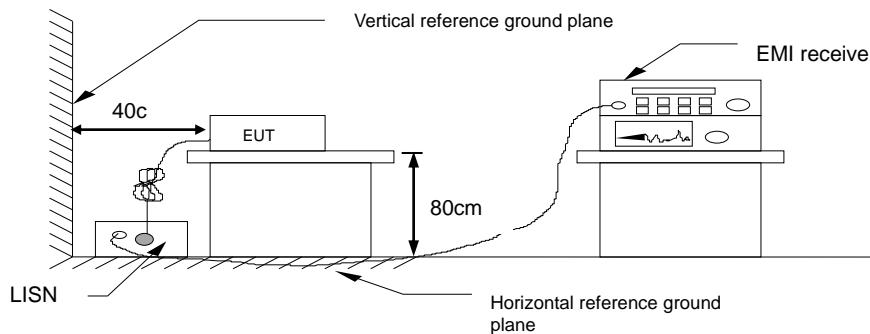
* Decreases with the logarithm of the frequency.

4.1.2 Test Procedure

Test method Refer as ANSI 63.10:2013 clause 6.2,

1. The EUT was placed on a non-conducted table, which is 0.8m above horizontal ground plane and 0.4m above vertical ground plane.
2. EUT connected to the line impedance stabilization network (LISN)
3. Receiver set RBW of 9kHz and Detector Peak, and note as quasi-peak and average.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. Recorded Line for Neutral and Line.

4.1.3 Test Setup

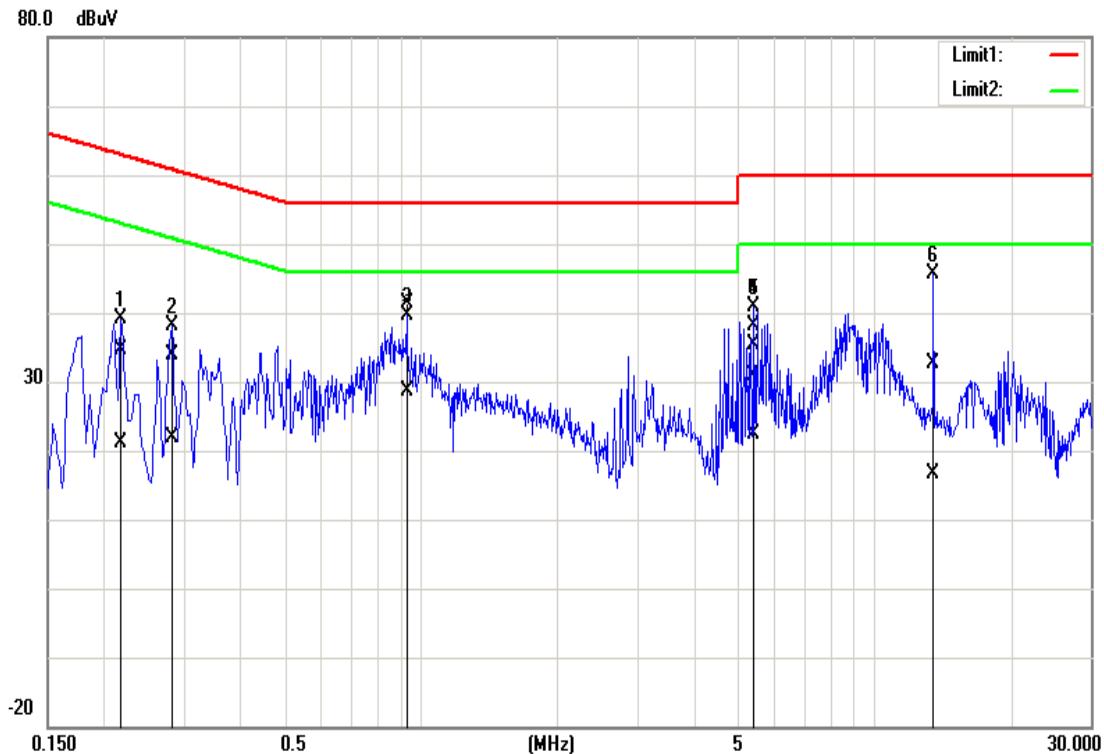


4.1.4 Test Result

Pass.

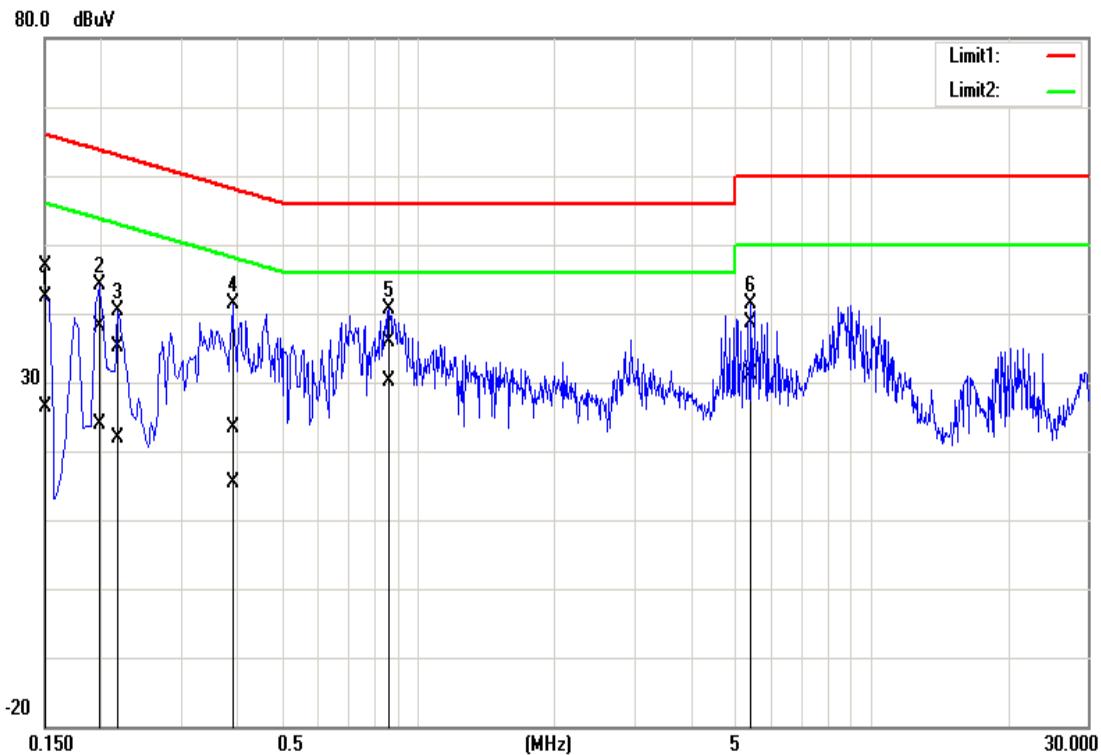
Test Data

| | | | |
|---------------|---------------|---------------|---------------|
| Test Mode: | Mode 1 | Temp/Hum | 24(°C)/ 50%RH |
| Test Voltage: | 120Vac / 60Hz | Test Date | 2018/07/27 |
| Phase: | Line | Test Engineer | Dally Hong |



| No. | 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 |
|-----|--------------------|--------------------------------|------------------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|----------------------------|-----------------------------|---------------------------|--------|
| 1 | 0.2180 | 34.46 | 21.09 | 0.11 | 34.57 | 21.20 | 62.89 | 52.89 | -28.32 | -31.69 | Pass |
| 2 | 0.2820 | 33.70 | 21.81 | 0.11 | 33.81 | 21.92 | 60.76 | 50.76 | -26.95 | -28.84 | Pass |
| 3 | 0.9300 | 41.36 | 28.51 | 0.13 | 41.49 | 28.64 | 56.00 | 46.00 | -14.51 | -17.36 | Pass |
| 4 | 5.4420 | 37.99 | 30.72 | 0.22 | 38.21 | 30.94 | 60.00 | 50.00 | -21.79 | -19.06 | Pass |
| 5 | 5.4460 | 35.16 | 22.12 | 0.22 | 35.38 | 22.34 | 60.00 | 50.00 | -24.62 | -27.66 | Pass |
| 6 | 13.5340 | 32.27 | 16.31 | 0.36 | 32.63 | 16.67 | 60.00 | 50.00 | -27.37 | -33.33 | Pass |

| | | | |
|---------------|---------------|---------------|---------------|
| Test Mode: | Mode 1 | Temp/Hum | 24(°C)/ 50%RH |
| Test Voltage: | 120Vac / 60Hz | Test Date | 2018/07/27 |
| Phase: | Neutral | Test Engineer | Dally Hong |



| No. | 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 |
|-----|--------------------|--------------------------------|------------------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|----------------------------|-----------------------------|---------------------------|--------|
| 1 | 0.1500 | 46.86 | 26.36 | 0.14 | 47.00 | 26.50 | 65.99 | 56.00 | -18.99 | -29.50 | Pass |
| 2 | 0.1980 | 38.05 | 23.67 | 0.13 | 38.18 | 23.80 | 63.69 | 53.69 | -25.51 | -29.89 | Pass |
| 3 | 0.2180 | 34.96 | 21.76 | 0.13 | 35.09 | 21.89 | 62.89 | 52.89 | -27.80 | -31.00 | Pass |
| 4 | 0.3899 | 23.13 | 15.22 | 0.13 | 23.26 | 15.35 | 58.06 | 48.07 | -34.80 | -32.72 | Pass |
| 5 | 0.8620 | 35.80 | 29.97 | 0.14 | 35.94 | 30.11 | 56.00 | 46.00 | -20.06 | -15.89 | Pass |
| 6 | 5.4420 | 38.29 | 30.87 | 0.22 | 38.51 | 31.09 | 60.00 | 50.00 | -21.49 | -18.91 | Pass |

4.2 6DB BANDWIDTH AND OCCUPIED BANDWIDTH (99%)

4.2.1 Test Limit

According to §15.247(a)(2).

6 dB Bandwidth :

| | |
|-------|--------------------------|
| Limit | Shall be at least 500kHz |
|-------|--------------------------|

Occupied Bandwidth(99%) : For reporting purposes only.

4.2.2 Test Procedure

Test method Refer as KDB 558074 D01 v04, section 8.1 and ANSI 63.10:2013 clause 6.9.2 & 6.9.3.

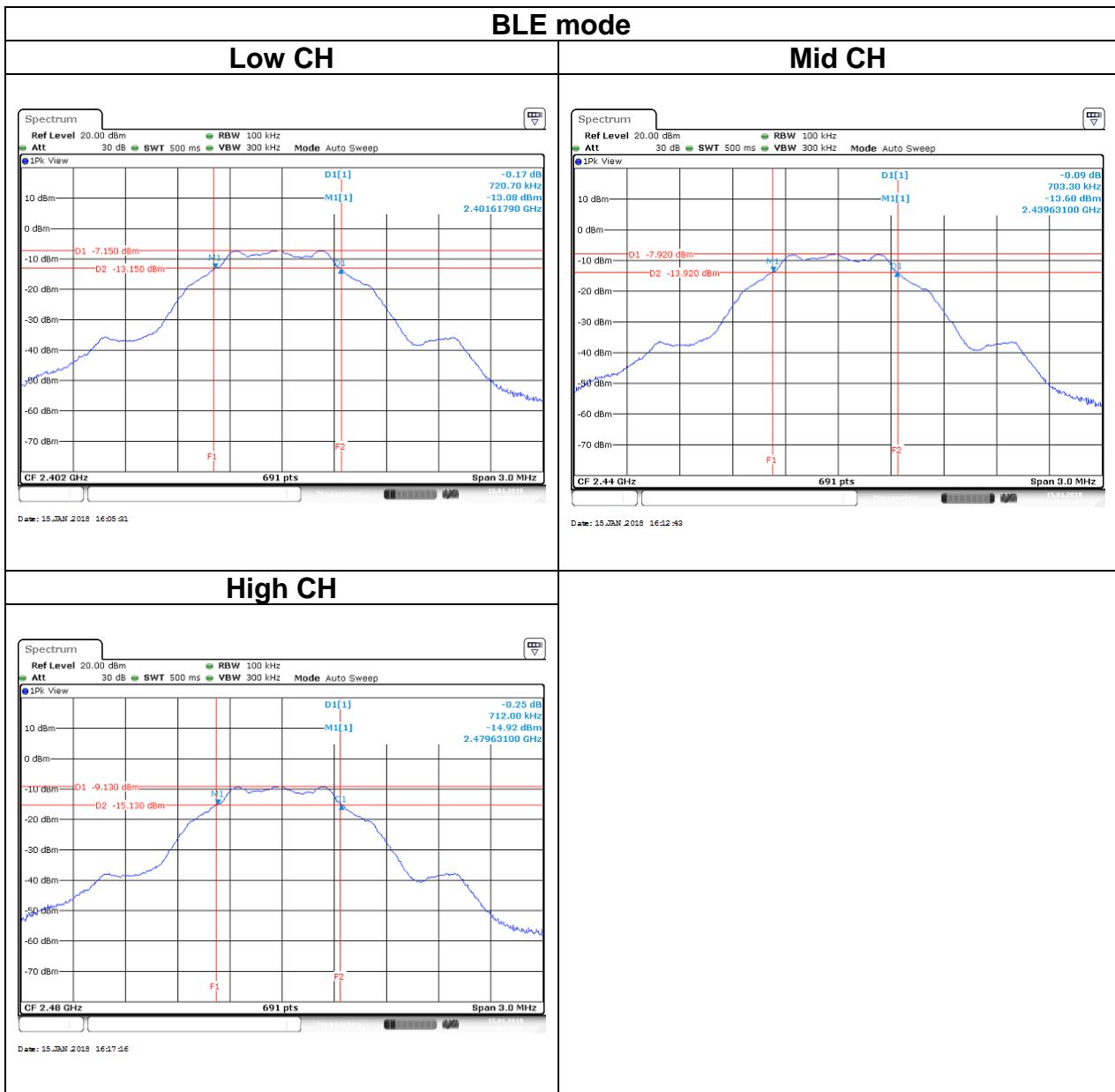
1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT
3. SA set RBW = 100kHz, VBW = 300kHz and Detector = Peak, to measurement 6 dB Bandwidth.
4. SA set RBW = 1% ~ 5% OBW, VBW = three times the RBW and Detector = Peak, to measurement 99% Bandwidth
5. Measure and record the result of 6 dB Bandwidth and 99% Bandwidth. in the test report.

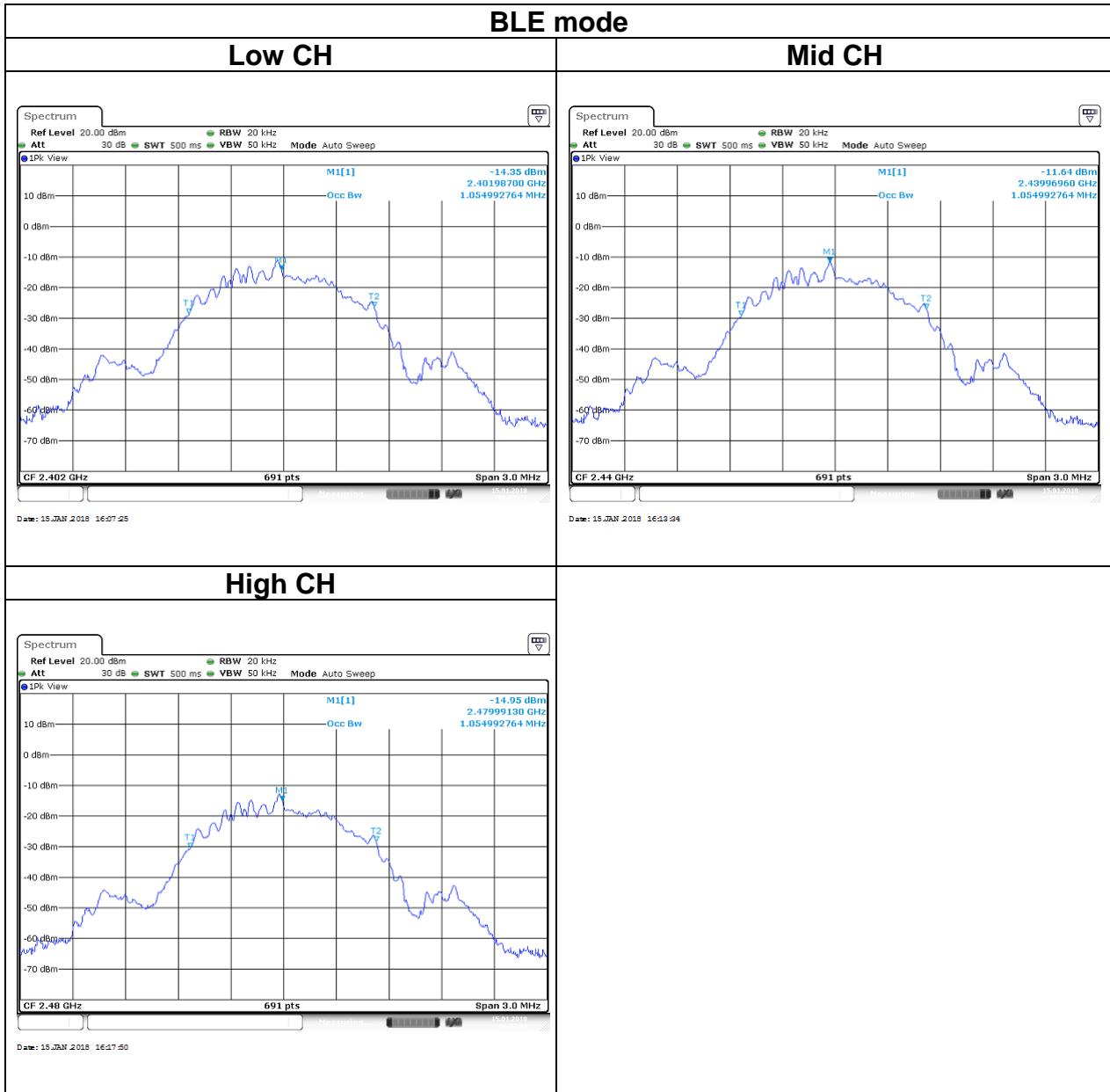
4.2.3 Test Setup



4.2.4 Test Result

| Test mode: BLE mode / 2402-2480 MHz | | | | |
|-------------------------------------|-----------------|----------------|--------------|-----------------|
| Channel | Frequency (MHz) | OBW(99%) (MHz) | 6dB BW (MHz) | 6dB limit (kHz) |
| Low | 2402 | 1.0549 | 0.7207 | >500 |
| Mid | 2440 | 1.0549 | 0.7033 | |
| High | 2480 | 1.0549 | 0.7120 | |

Test Data (6dB)

Test Data (99%OBW)

4.3 OUTPUT POWER MEASUREMENT

4.3.1 Test Limit

According to §15.247(b)

Peak output power :

For systems using digital modulation in the 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt(30 dBm), base on the use of antennas with directional gain not exceed 6 dBi. If transmitting antennas of directional gain greater than 6dBi are used the peak output power the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

| | |
|-------|---|
| Limit | <input checked="" type="checkbox"/> Antenna not exceed 6 dBi : 30dBm <input type="checkbox"/> Antenna with DG greater than 6 dBi [Limit = 30 – (DG – 6)] <input type="checkbox"/> Point-to-point operation |
|-------|---|

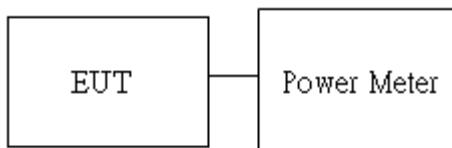
Average output power : For reporting purposes only.

4.3.2 Test Procedure

Test method Refer as KDB 558074 D01 v04, section 9.1.2.

1. The EUT RF output connected to the power meter by RF cable.
2. Setting maximum power transmit of EUT.
3. The path loss was compensated to the results for each measurement.
4. Measure and record the result of Peak output power and Average output power. in the test report.

4.3.3 Test Setup



4.3.4 Test Result

Peak output power :

| BLE Mode | | | | | |
|----------------------------|----|----------------|----------------------|--------------------|----------------|
| Config. | CH | Freq. (MHz) | PK Power (dBm) | PK Power (W) | Limit (dBm) |
| BLE Data rate: 1Mbps | 0 | 2402 | 6.74 | 0.0047 | 30 |
| | 19 | 2440 | 5.74 | 0.0037 | |
| | 39 | 2480 | 4.86 | 0.0031 | |

Average output power :

| BLE Mode | | | |
|----------------------------|----|----------------|-------------------|
| Config. | CH | Freq. (MHz) | AV Power (dBm) |
| BLE Data rate: 1Mbps | 0 | 2402 | 5.52 |
| | 19 | 2440 | 4.58 |
| | 39 | 2480 | 3.72 |

4.4 POWER SPECTRAL DENSITY

4.4.1 Test Limit

According to §15.247(e) .

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

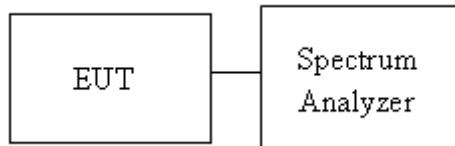
| | |
|-------|---|
| Limit | <input checked="" type="checkbox"/> Antenna not exceed 6 dBi : 8dBm <input type="checkbox"/> Antenna with DG greater than 6 dBi $[\text{Limit} = 8 - (\text{DG} - 6)]$ <input type="checkbox"/> Point-to-point operation : |
|-------|---|

4.4.2 Test Procedure

Test method Refer as KDB 558074 D01 v04, Section 10.2

1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT
3. SA set RBW = 3kHz, VBW = 30kHz, Span = 1.5 times DTS Bandwidth (6 dB BW), Detector = Peak, Sweep Time = Auto and Trace = Max hold.
4. The path loss and Duty Factor were compensated to the results for each measurement by SA.
5. Mark the maximum level.
6. Measure and record the result of power spectral density. in the test report.

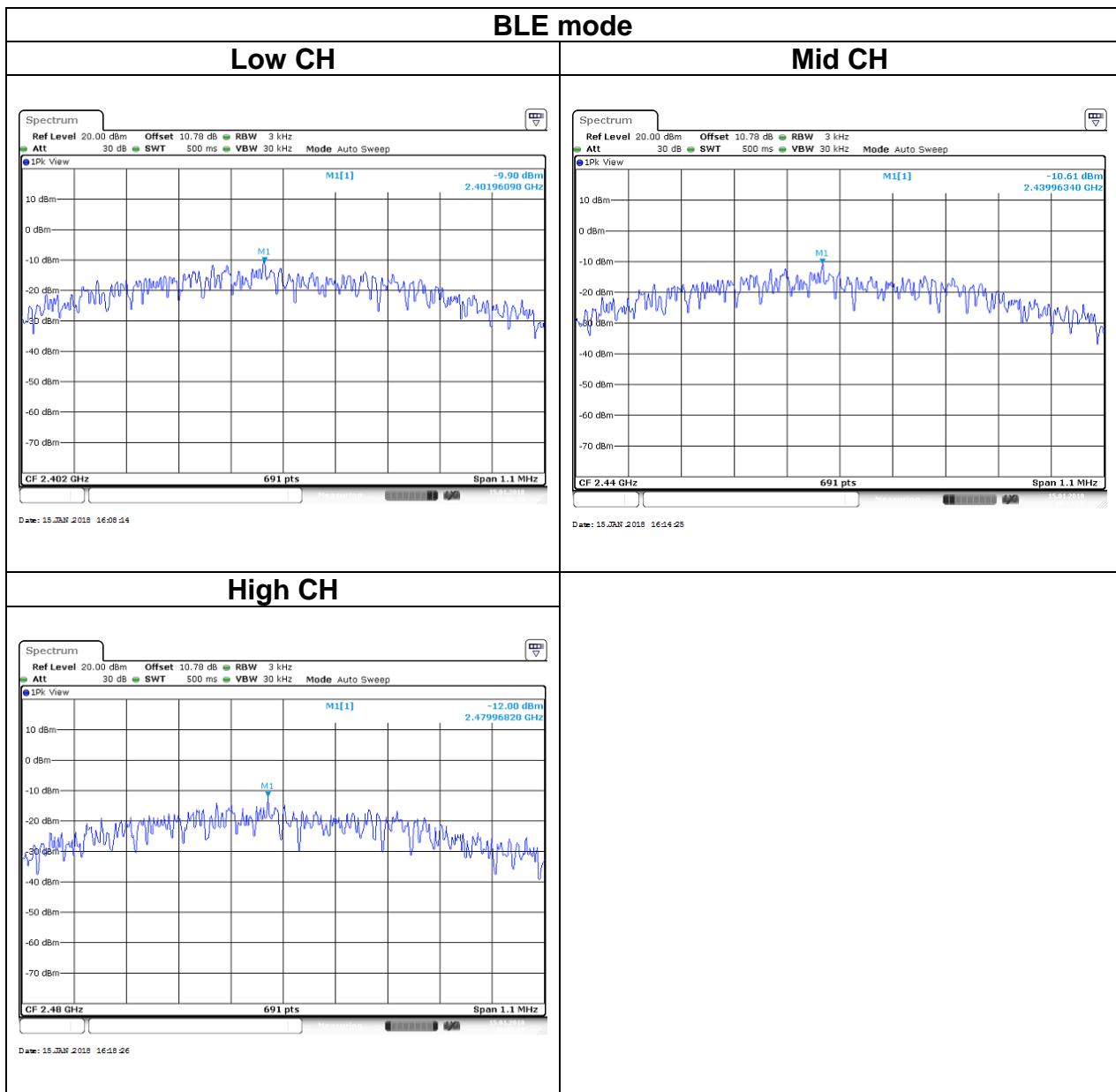
4.4.3 Test Setup



4.4.4 Test Result

| Test mode: BLE mode / 2402-2480 MHz | | | |
|-------------------------------------|-----------------|-----------|-----------------|
| Channel | Frequency (MHz) | PSD (dBm) | FCC limit (dBm) |
| Low | 2402 | -9.90 | 8 |
| Mid | 2440 | -10.61 | |
| High | 2480 | -12.00 | |

Test Data



4.5 CONDUCTED BAND EDGE AND SPURIOUS EMISSION

4.5.1 Test Limit

According to §15.247(d) .

In any 100 kHz bandwidth outside the authorized frequency band,

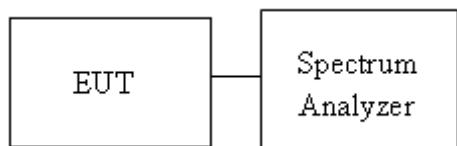
Non-restricted bands shall be attenuated at least 20 dB/30 dB relative to the maximum PSD level in 100 kHz by RF conducted or a radiated measurement which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

4.5.2 Test Procedure

Test method Refer as KDB 558074 D01 v04, Section 11.

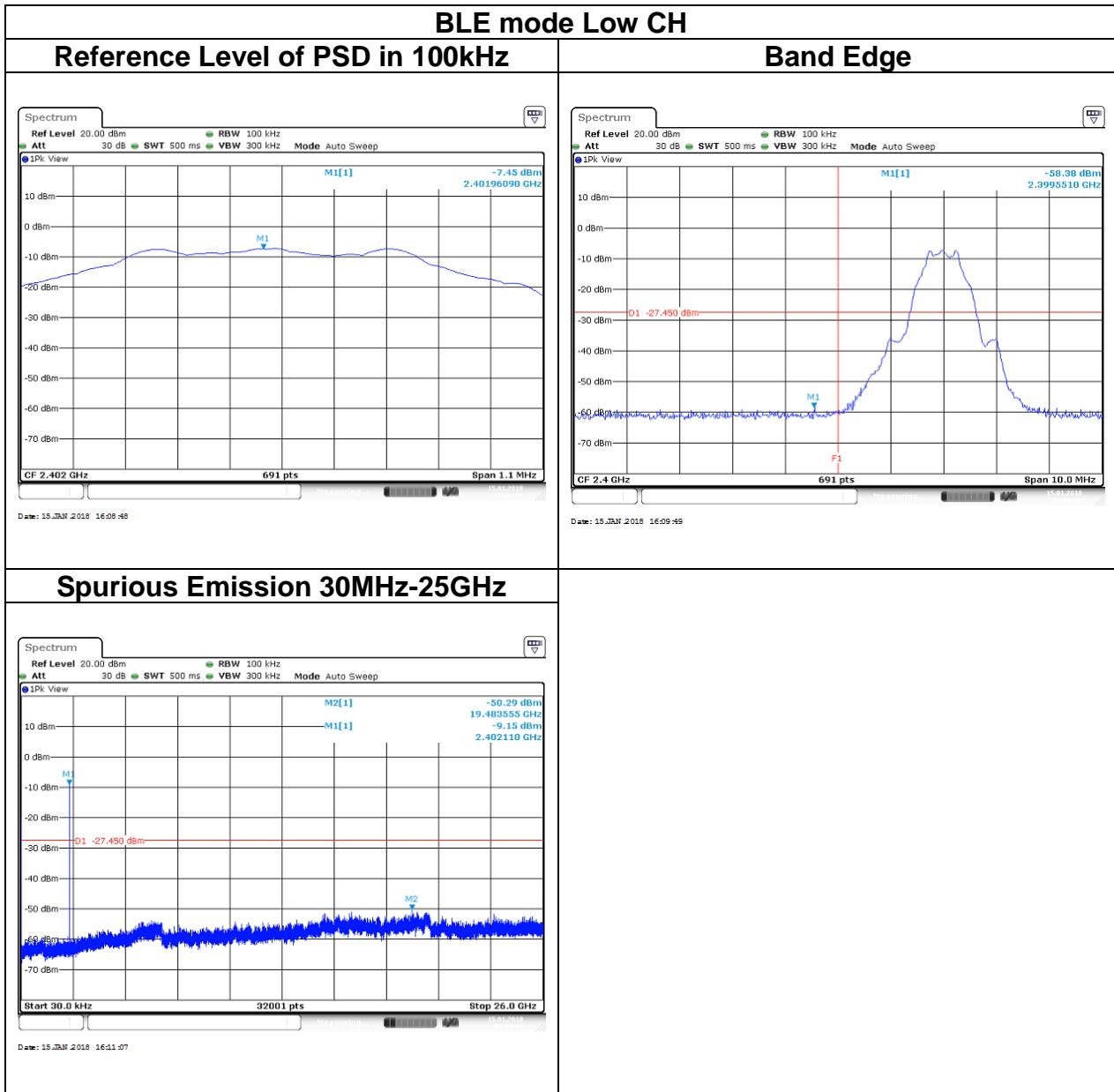
1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.
2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.
3. In any 100 kHz bandwidth outside the authorized frequency band, shall be attenuated at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when conducted power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

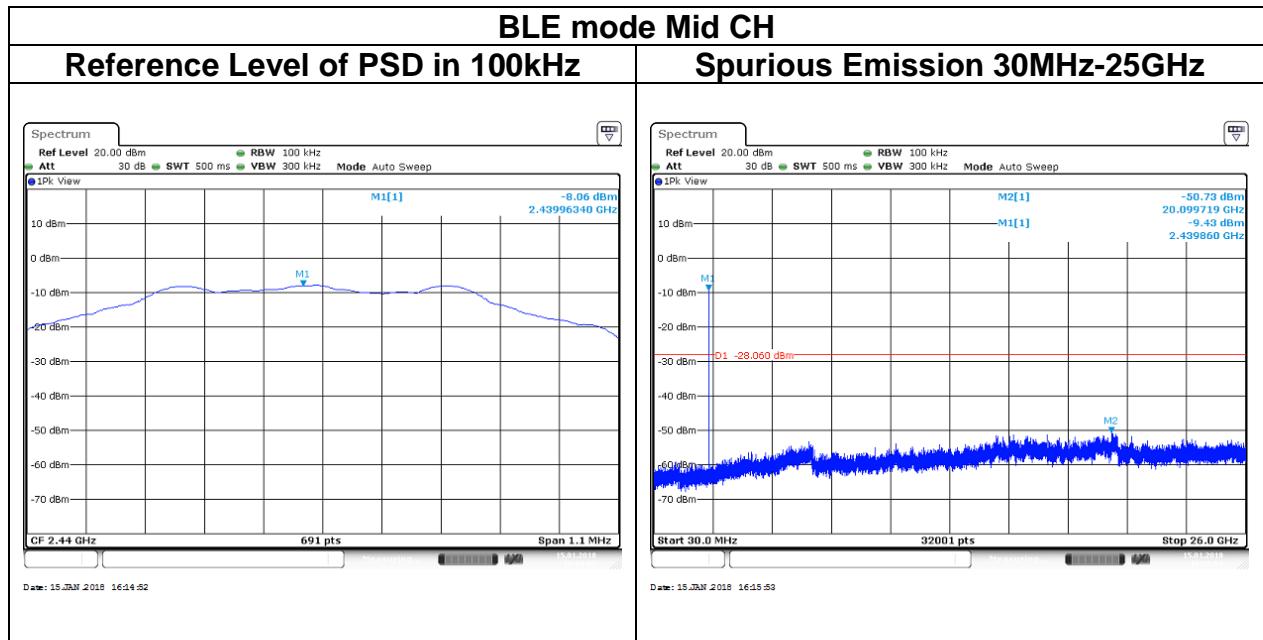
4.5.3 Test Setup

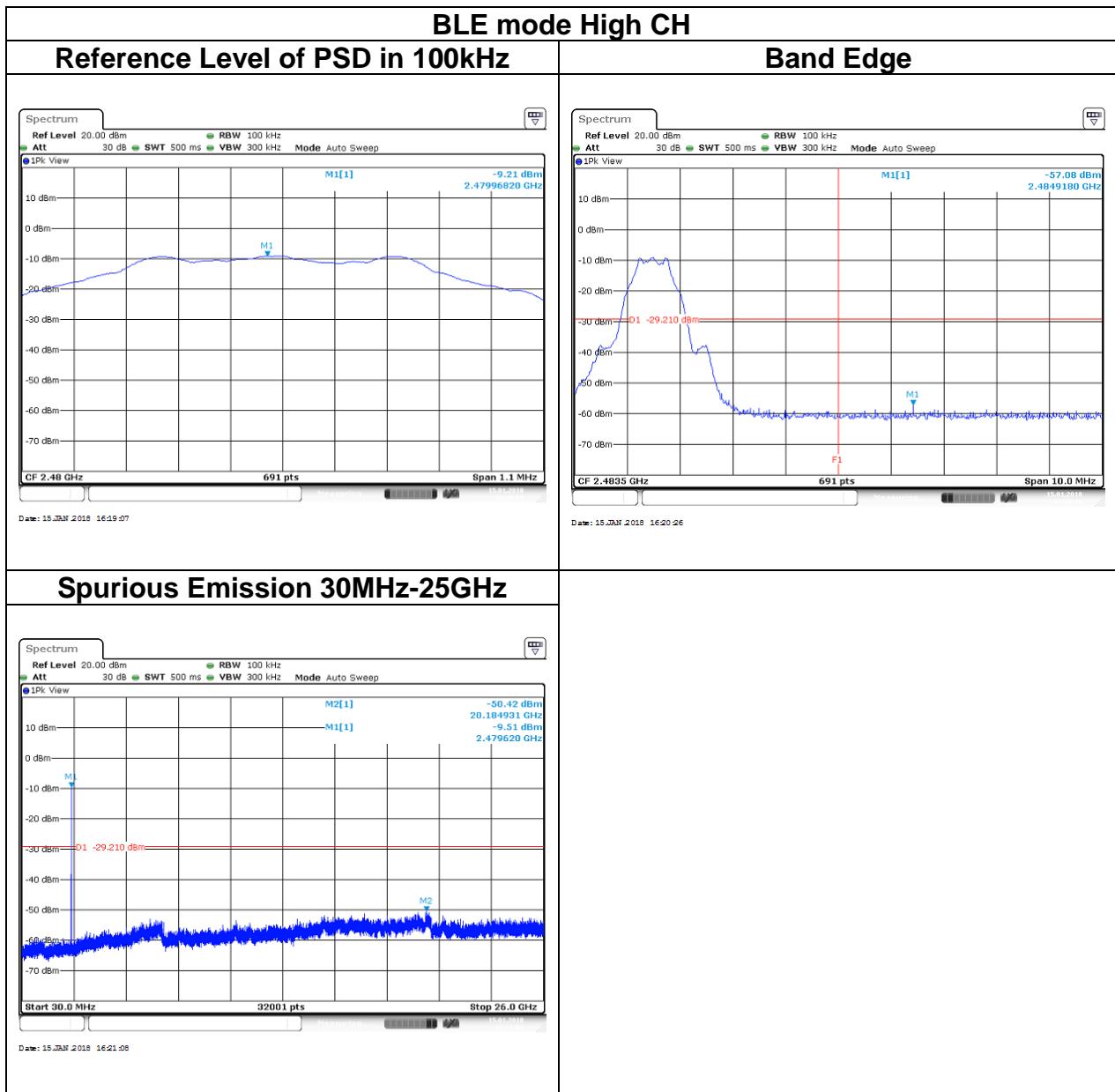


4.5.4 Test Result

Test Data







4.6 RADIATION BANDEDGE AND SPURIOUS EMISSION

4.6.1 Test Limit

FCC according to §15.247(d), §15.209 and §15.205,

In any 100 kHz bandwidth outside the authorized frequency band, all harmonic and spurious must be least 20 dB below the highest emission level with the authorized frequency band. Radiation emission which fall in the restricted bands must also follow the FCC section 15.209 as below limit in table.

Below 30 MHz

| Frequency | Field Strength (microvolts/m) | Magnetic H-Field (microamperes/m) | Measurement Distance (metres) |
|---------------|----------------------------------|---|-------------------------------------|
| 9-490 kHz | 2,400/F (F in kHz) | 2,400/F (F in kHz) | 300 |
| 490-1,705 kHz | 24,000/F (F in kHz) | 24,000/F (F in kHz) | 30 |
| 1.705-30 MHz | 30 | N/A | 30 |

Above 30 MHz

| Frequency (MHz) | Field Strength microvolts/m at 3 metres (watts, e.i.r.p.) | |
|--------------------|--|--------------|
| | Transmitters | Receivers |
| 30-88 | 100 (3 nW) | 100 (3 nW) |
| 88-216 | 150 (6.8 nW) | 150 (6.8 nW) |
| 216-960 | 200 (12 nW) | 200 (12 nW) |
| Above 960 | 500 (75 nW) | 500 (75 nW) |

Remark:

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

4.6.2 Test Procedure

Test method Refer as KDB 558074 D01 v04, Section 12.1.

1. The EUT is placed on a turntable, Above 1 GHz is 1.5m and below 1 GHz is 0.8m above ground plane. The EUT Configured un accordance with ANSI C63.10, and the EUT set in a continuous mode.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. And EUT is set 3m away from the receiving antenna, which is scanned from 1m to 4m above the ground plane to find out the highest emissions. Measurement are made polarized in both the vertical and the horizontal positions with antenna.
3. Span shall wide enough to full capture the emission measured. The SA from 9kHz to 26.5GHz set to the low, Mid and High channels with the EUT transmit.

Note: No emission found between lowest internal used/generated frequency to 30MHz(9KHz~30MHz)

Remark:

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30 m open are test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.

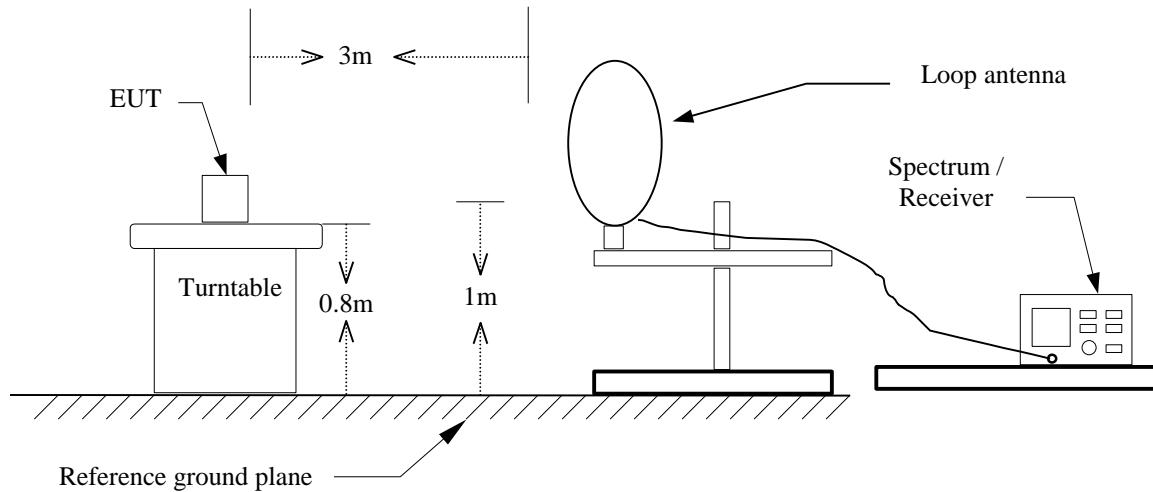
4. The SA setting following :

- (1) Below 1G : RBW = 100kHz, VBW \geq 3 RBW, Sweep = Auto, Detector = Peak, Trace = Max hold.
- (2) Above 1G :
 - (2.1) For Peak measurement : RBW = 1MHz, VBW \geq 3 RBW, Sweep = Auto, Detector = Peak, Trace = Max hold.
 - (2.2) For Average measurement : RBW = 1MHz, VBW
 - If Duty Cycle \geq 98%, VBW=10Hz.
 - If Duty Cycle < 98%, VBW=1/T.

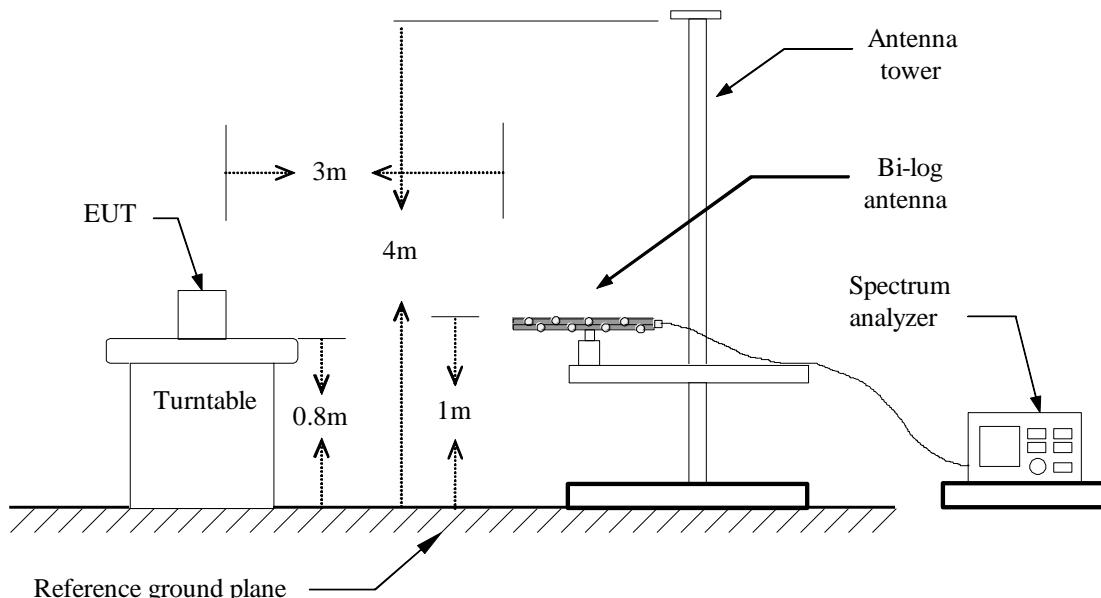
| Configuration | Duty Cycle (%) | T(ms) | 1/T (kHz) | VBW Setting |
|---------------|----------------|--------|-----------|-------------|
| BLE | 71% | 0.4250 | 2.353 | 2.4KHz |

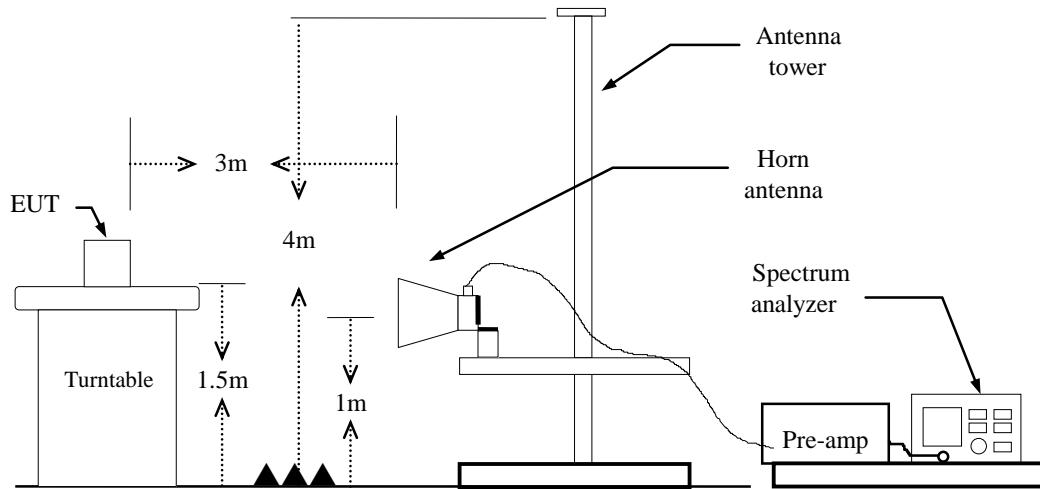
4.6.3 Test Setup

9kHz ~ 30MHz



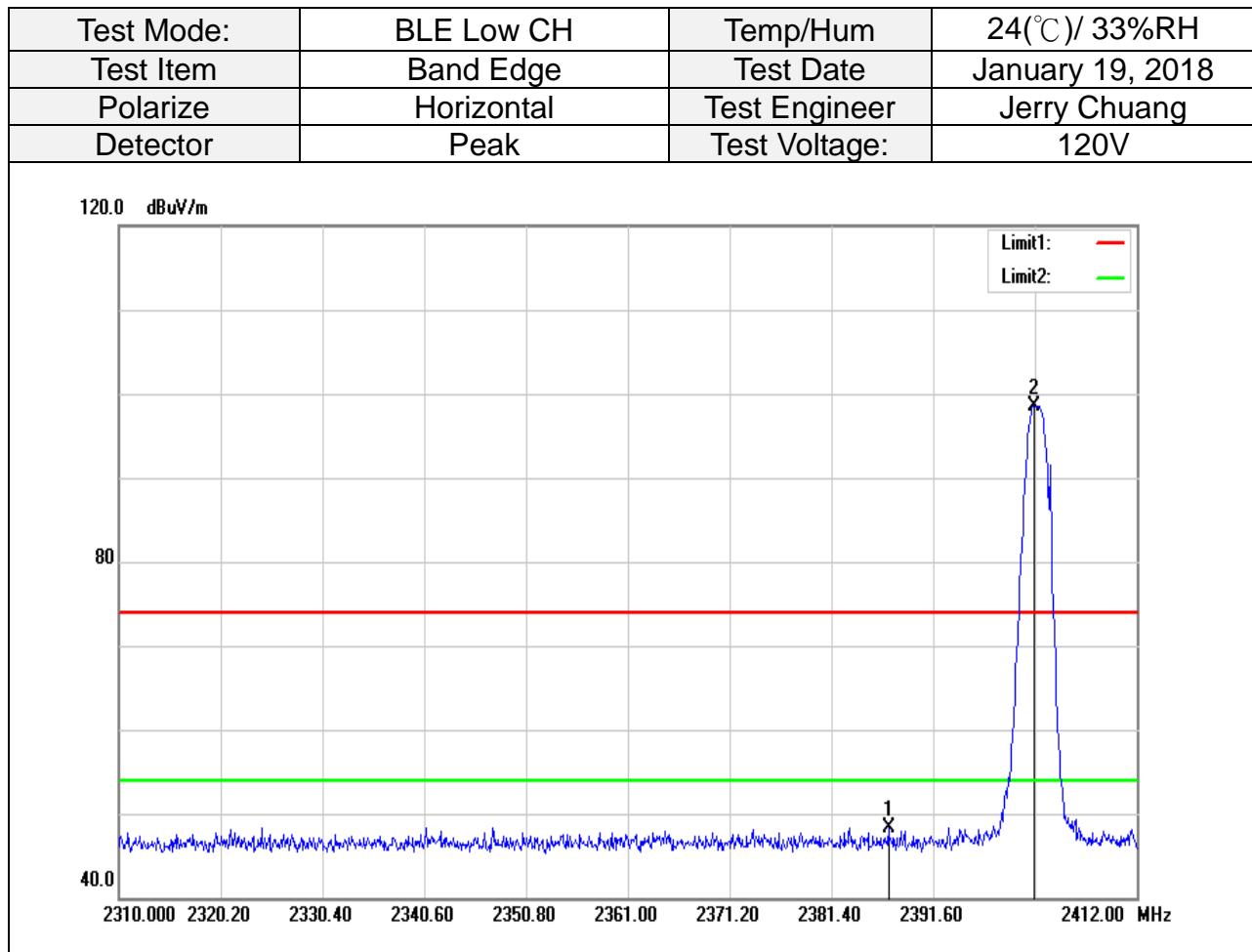
30MHz ~ 1GHz



Above 1 GHz

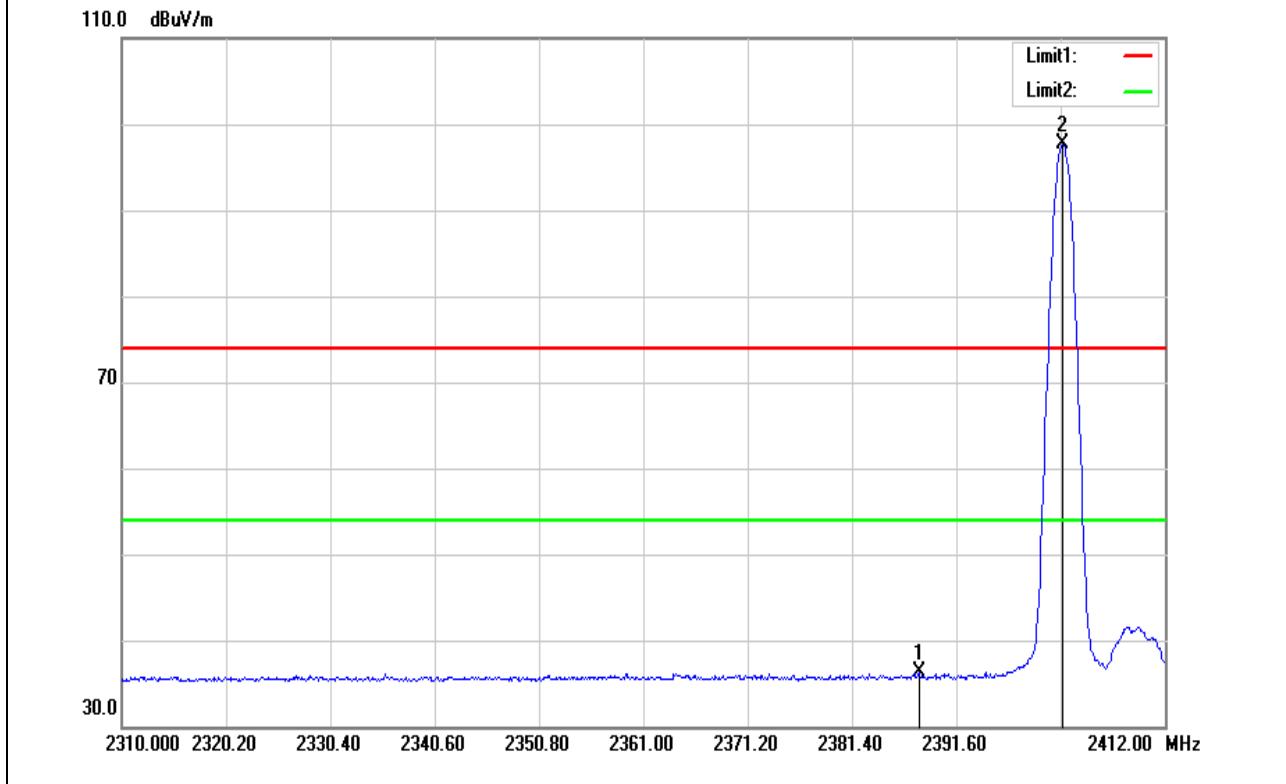
4.6.4 Test Result

Band Edge Test Data



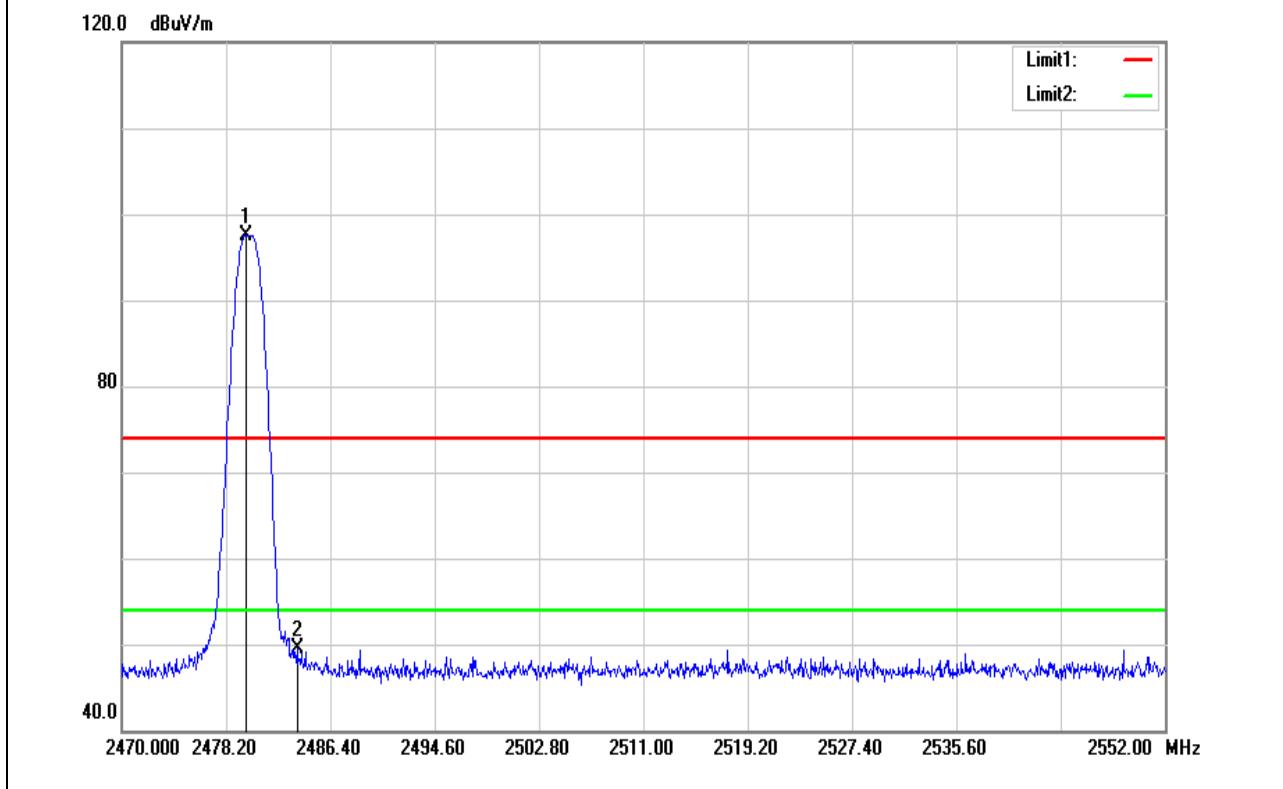
| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|-----------------|----------------|----------------------|-----------------|----------------|-------------|--------|
| 1 | 2387.112 | 51.34 | -2.99 | 48.35 | 74.00 | -25.65 | peak |
| 2 | 2401.749 | 101.45 | -2.95 | 98.50 | - | - | peak |

| | | | |
|------------|------------|---------------|------------------|
| Test Mode: | BLE Low CH | Temp/Hum | 24(°C)/ 33%RH |
| Test Item | Band Edge | Test Date | January 19, 2018 |
| Polarize | Horizontal | Test Engineer | Jerry Chuang |
| Detector | Average | Test Voltage: | 120V |



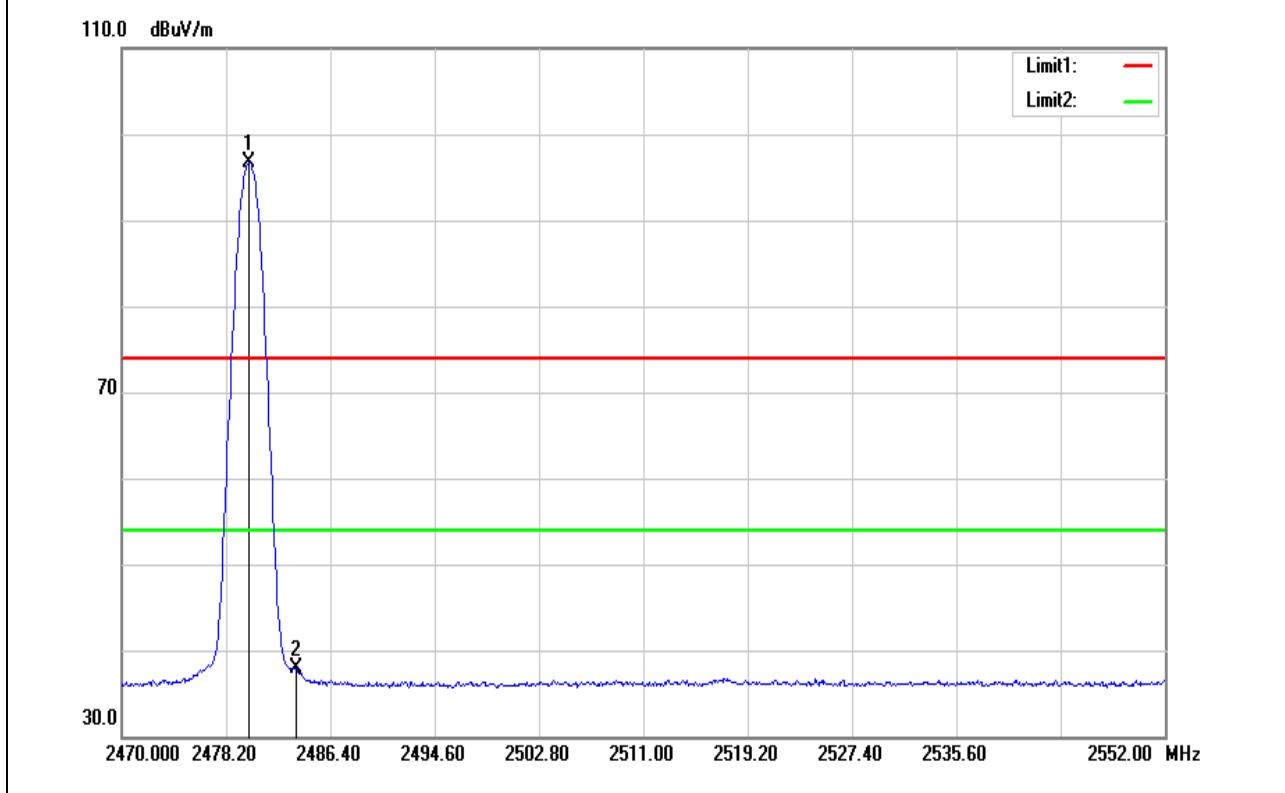
| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|--------------------|-------------------|-------------------------|--------------------|-------------------|----------------|--------|
| 1 | 2387.979 | 39.21 | -2.98 | 36.23 | 54.00 | -17.77 | AVG |
| 2 | 2402.055 | 100.57 | -2.95 | 97.62 | - | - | AVG |

| | | | |
|------------|-------------|---------------|------------------|
| Test Mode: | BLE High CH | Temp/Hum | 24(°C)/ 33%RH |
| Test Item | Band Edge | Test Date | January 19, 2018 |
| Polarize | Horizontal | Test Engineer | Jerry Chuang |
| Detector | Peak | Test Voltage: | 120V |



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|--------------------|-------------------|-------------------------|--------------------|-------------------|----------------|--------|
| 1 | 2479.758 | 100.21 | -2.70 | 97.51 | - | - | peak |
| 2 | 2483.776 | 52.19 | -2.69 | 49.50 | 74.00 | -24.50 | peak |

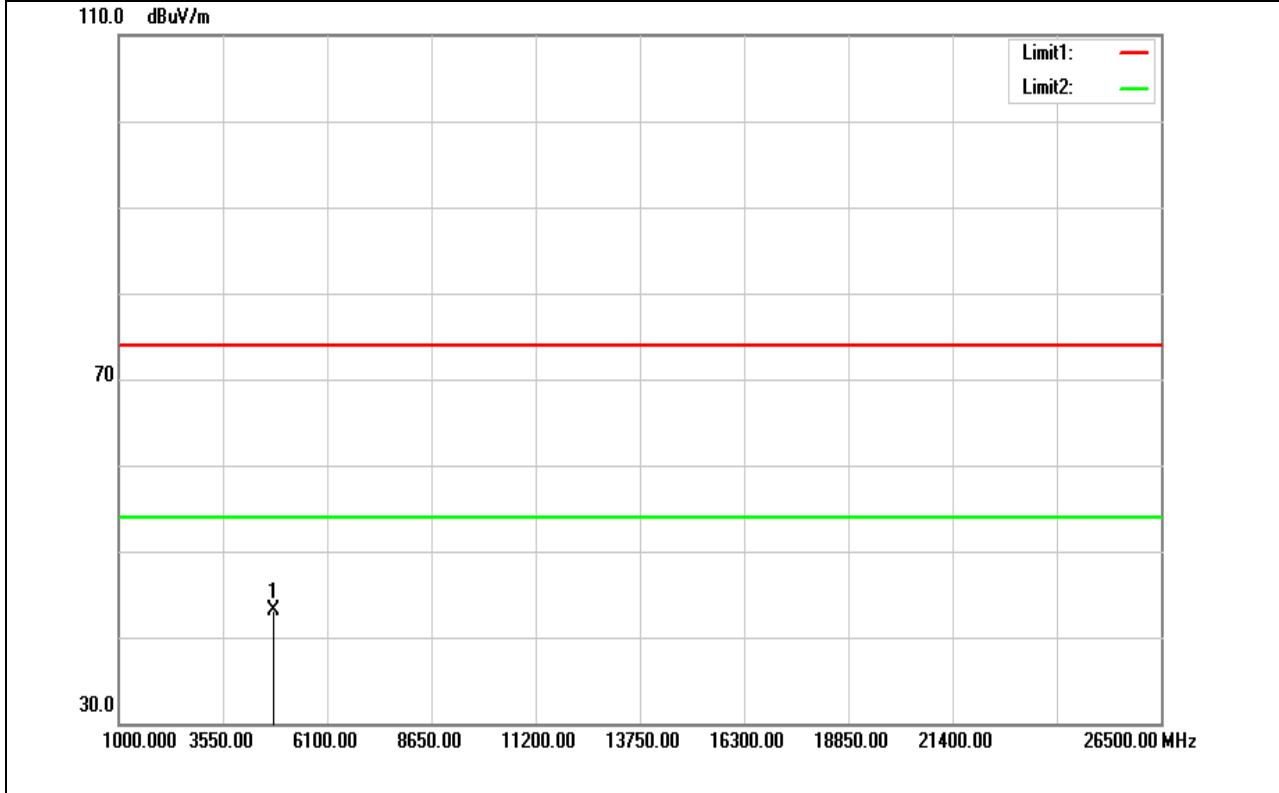
| | | | |
|------------|-------------|---------------|------------------|
| Test Mode: | BLE High CH | Temp/Hum | 24(°C)/ 33%RH |
| Test Item | Band Edge | Test Date | January 19, 2018 |
| Polarize | Horizontal | Test Engineer | Jerry Chuang |
| Detector | Average | Test Voltage: | 120V |



| No. | Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----|--------------------|-------------------|-------------------------|--------------------|-------------------|----------------|--------|
| 1 | 2480.045 | 99.35 | -2.70 | 96.65 | - | - | AVG |
| 2 | 2483.694 | 40.66 | -2.69 | 37.97 | 54.00 | -16.03 | AVG |

Above 1G Test Data

| | | | |
|------------|------------------|---------------|------------------|
| Test Mode: | BLE Low CH | Temp/Hum | 24(°C)/ 33%RH |
| Test Item | Harmonic | Test Date | January 22, 2018 |
| Polarize | Vertical | Test Engineer | Jerry Chuang |
| Detector | Peak and Average | Test Voltage: | 120V |

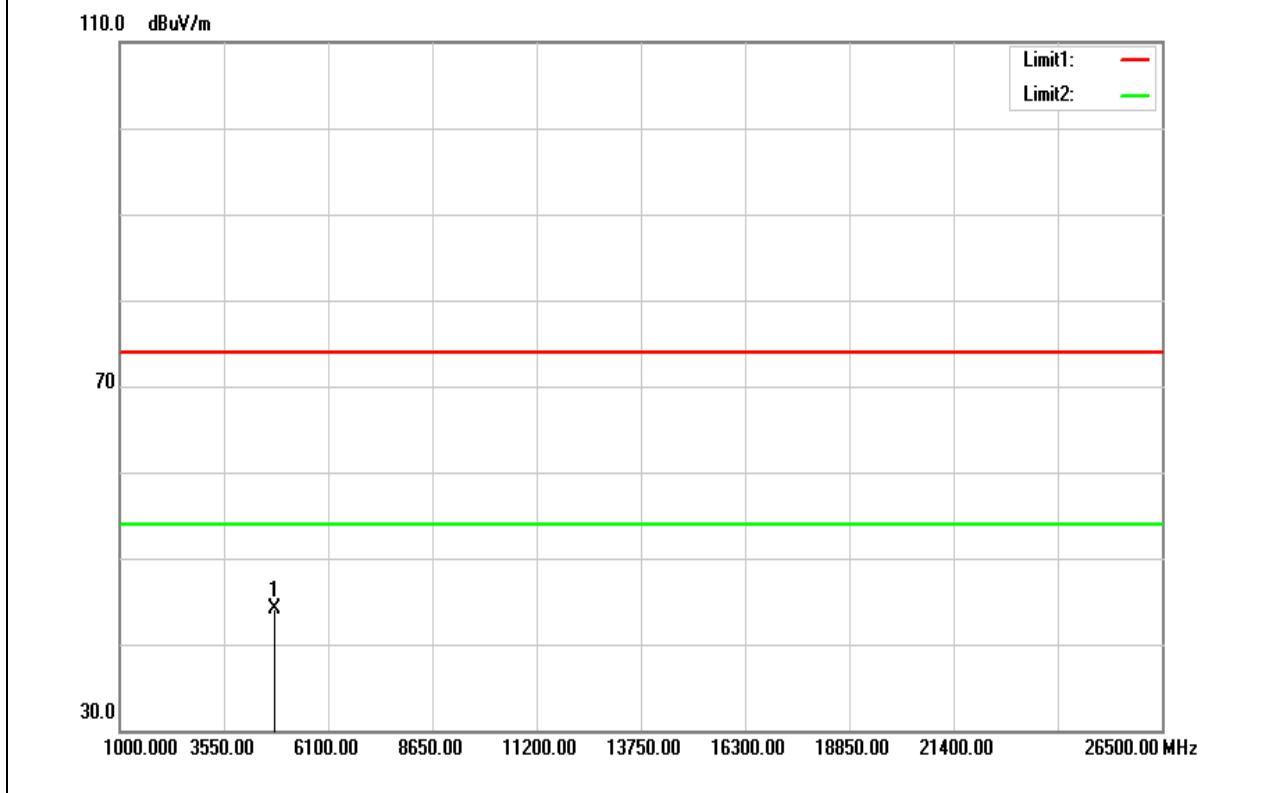


| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|-----------------------|-----------------|----------------|-------------|--------|
| 4804.000 | 38.84 | 4.34 | 43.18 | 74.00 | -30.82 | peak |
| N/A | | | | | | |
| | | | | | | |
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Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

| | | | |
|------------|------------------|---------------|------------------|
| Test Mode: | BLE Low CH | Temp/Hum | 24(°C)/ 33%RH |
| Test Item | Harmonic | Test Date | January 22, 2018 |
| Polarize | Horizontal | Test Engineer | Jerry Chuang |
| Detector | Peak and Average | Test Voltage: | 120V |

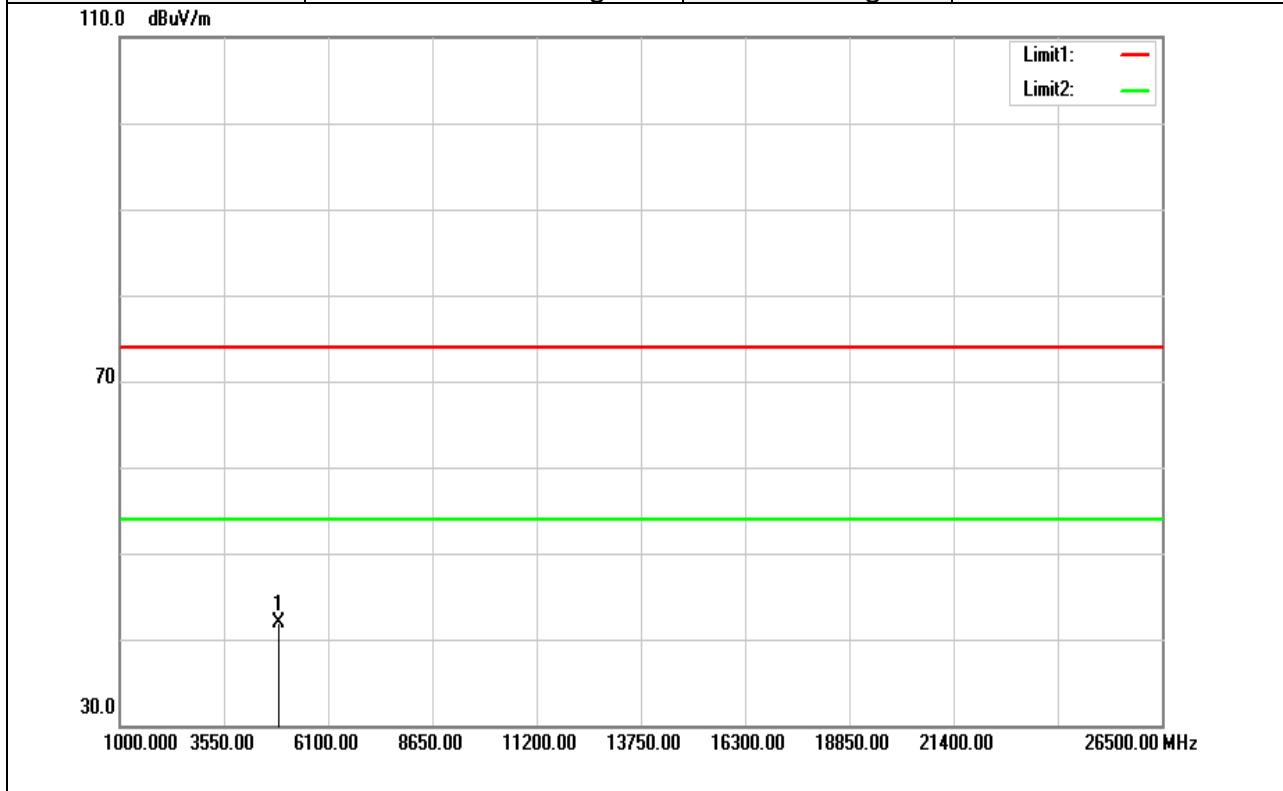


| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|-----------------------|-----------------|----------------|-------------|--------|
| 4804.000 | 39.70 | 4.34 | 44.04 | 74.00 | -29.96 | peak |
| N/A | | | | | | |
| | | | | | | |
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Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

| | | | |
|------------|------------------|---------------|------------------|
| Test Mode: | BLE Mid CH | Temp/Hum | 24(°C)/ 33%RH |
| Test Item | Harmonic | Test Date | January 22, 2018 |
| Polarize | Vertical | Test Engineer | Jerry Chuang |
| Detector | Peak and Average | Test Voltage: | 120V |

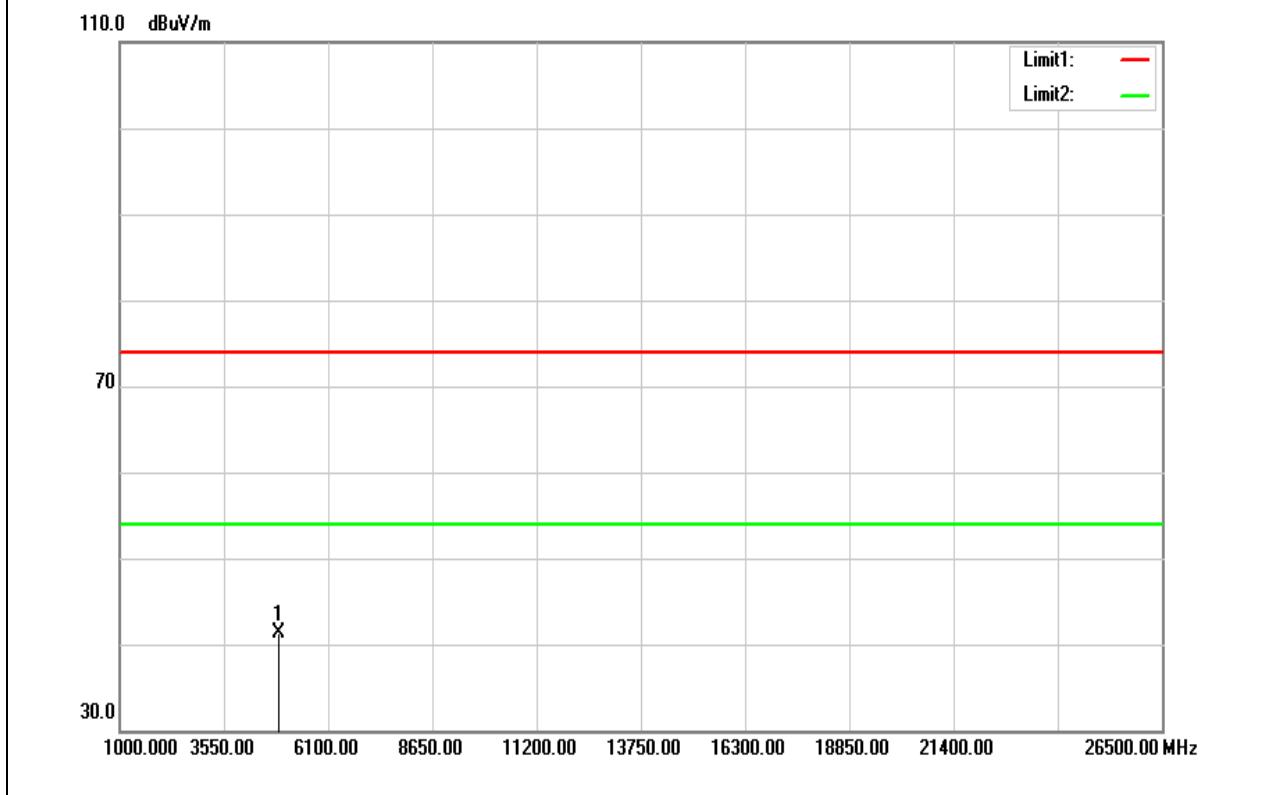


| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|-----------------------|-----------------|----------------|-------------|--------|
| 4880.000 | 37.34 | 4.48 | 41.82 | 74.00 | -32.18 | peak |
| N/A | | | | | | |
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Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

| | | | |
|------------|------------------|---------------|------------------|
| Test Mode: | BLE Mid CH | Temp/Hum | 24(°C)/ 33%RH |
| Test Item | Harmonic | Test Date | January 22, 2018 |
| Polarize | Horizontal | Test Engineer | Jerry Chuang |
| Detector | Peak and Average | Test Voltage: | 120V |

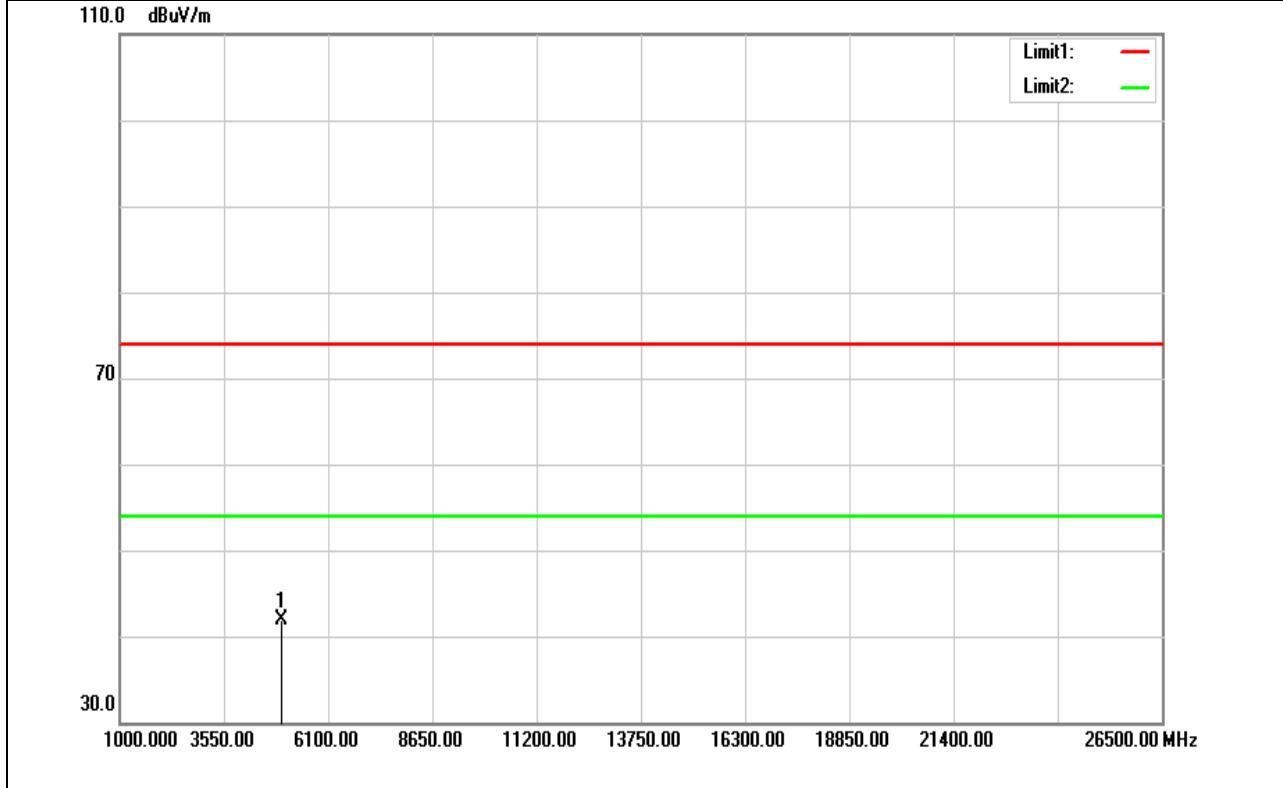


| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|-----------------------|-----------------|----------------|-------------|--------|
| 4880.000 | 36.92 | 4.48 | 41.40 | 74.00 | -32.60 | peak |
| N/A | | | | | | |
| | | | | | | |
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Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

| | | | |
|------------|------------------|---------------|------------------|
| Test Mode: | BLE High CH | Temp/Hum | 24(°C)/ 33%RH |
| Test Item | Harmonic | Test Date | January 22, 2018 |
| Polarize | Vertical | Test Engineer | Jerry Chuang |
| Detector | Peak and Average | Test Voltage: | 120V |

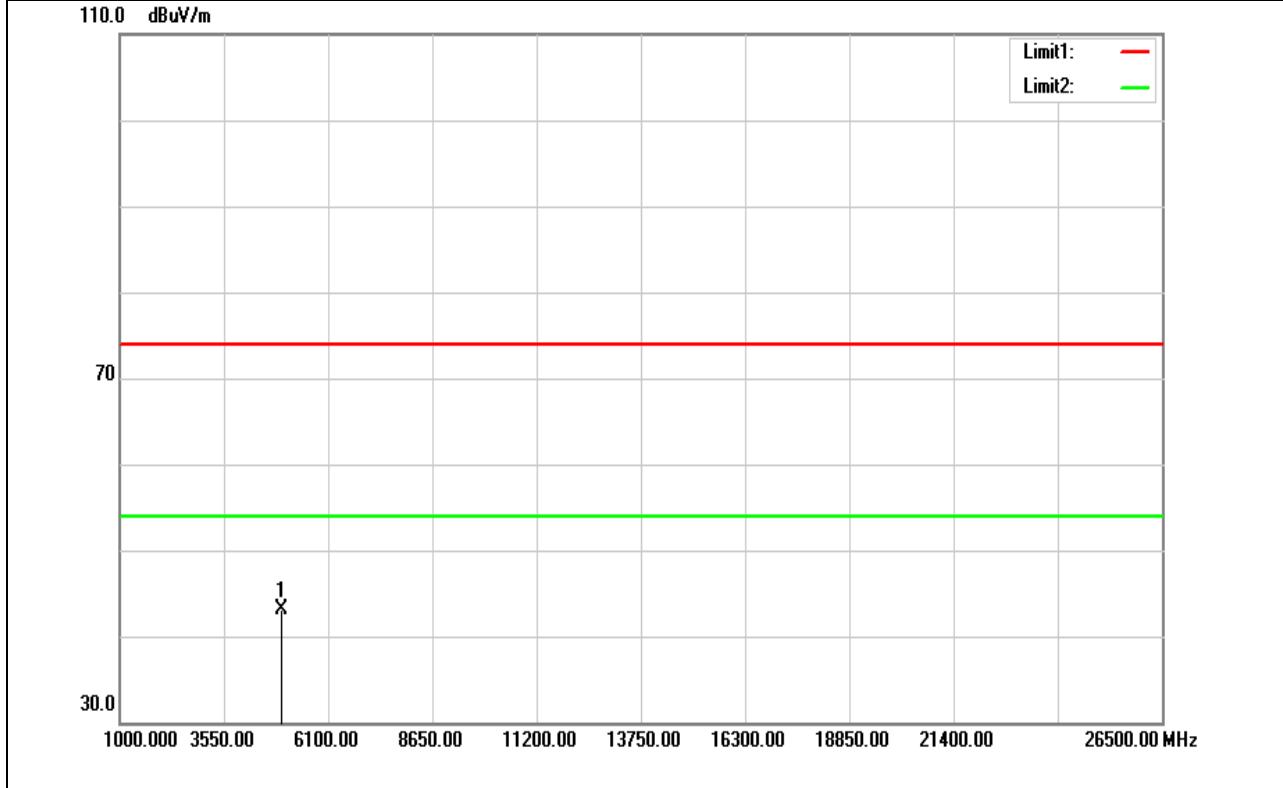


| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|-----------------------|-----------------|----------------|-------------|--------|
| 4960.000 | 37.38 | 4.61 | 41.99 | 74.00 | -32.01 | peak |
| N/A | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
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Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

| | | | |
|------------|------------------|---------------|------------------|
| Test Mode: | BLE High CH | Temp/Hum | 24(°C)/ 33%RH |
| Test Item | Harmonic | Test Date | January 22, 2018 |
| Polarize | Horizontal | Test Engineer | Jerry Chuang |
| Detector | Peak and Average | Test Voltage: | 120V |



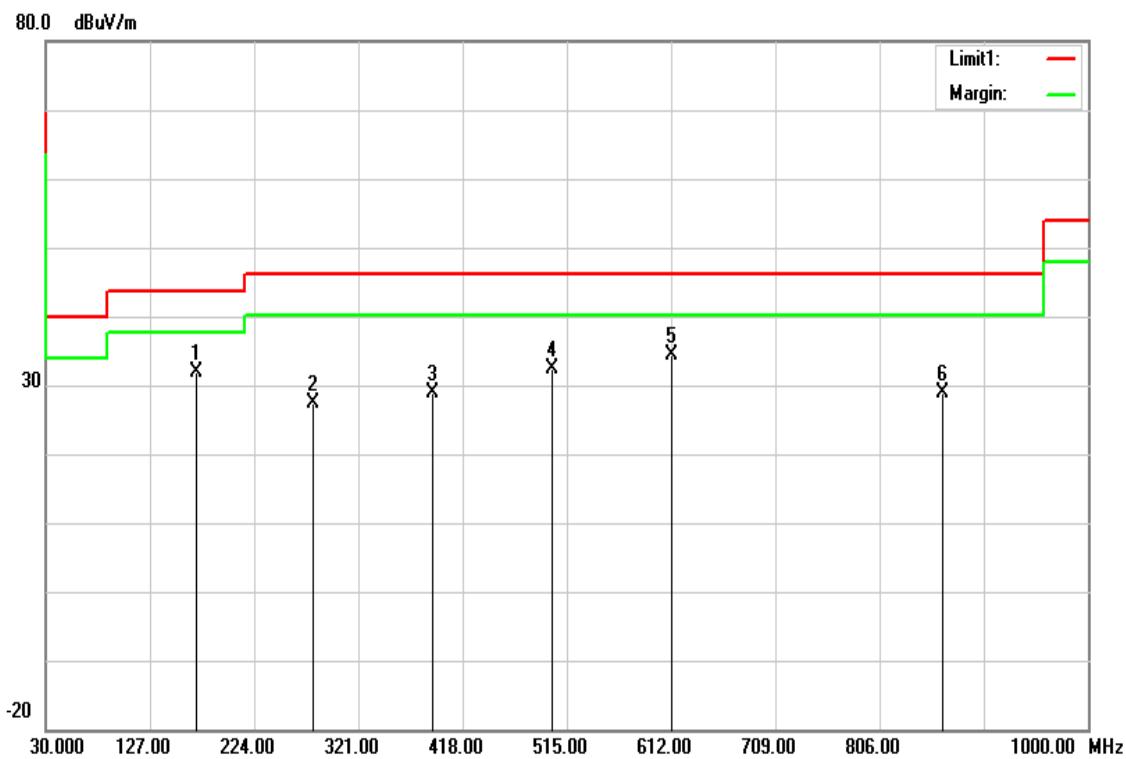
| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|-----------------------|-----------------|----------------|-------------|--------|
| 4960.000 | 38.43 | 4.61 | 43.04 | 74.00 | -30.96 | peak |
| N/A | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. For above 1GHz, the EUT peak value was under average limit, therefore the Average value compliance with the average limit

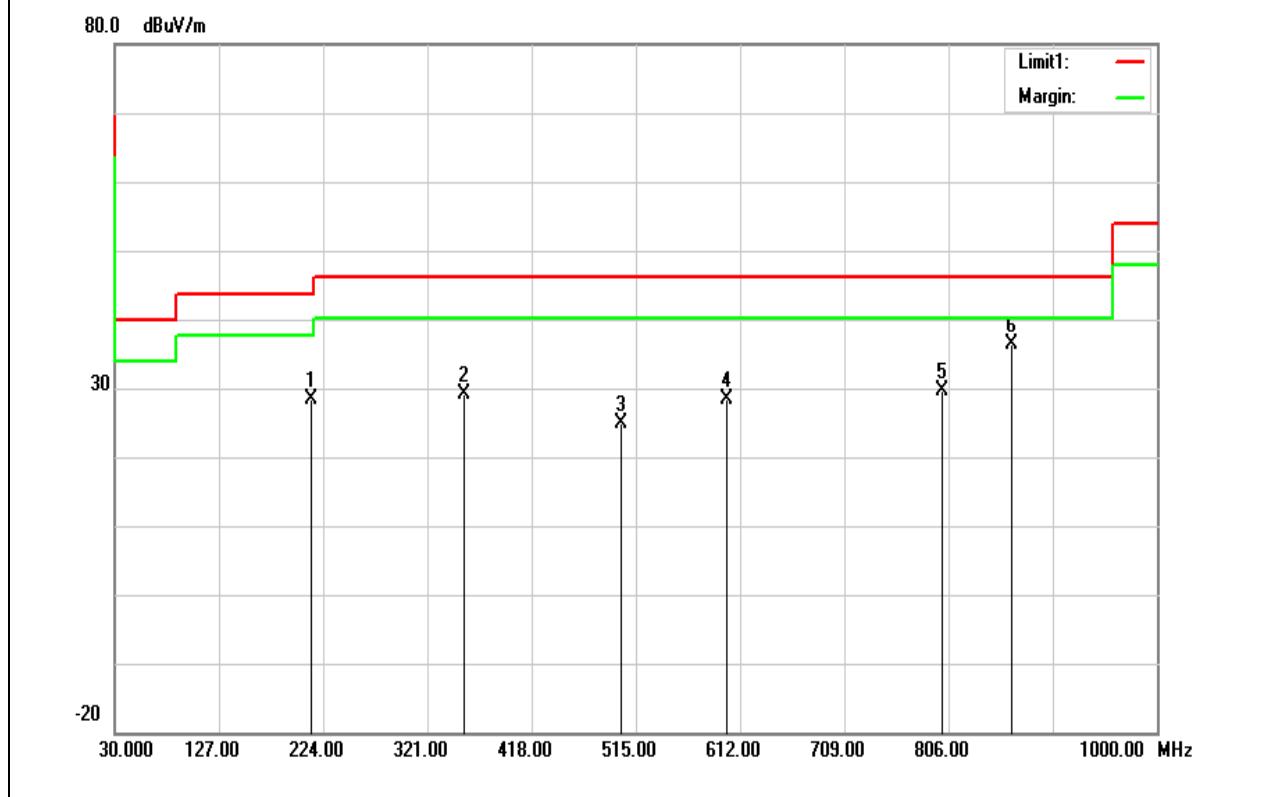
Below 1G Test Data

| | | | |
|------------|---------------------|---------------|------------------|
| Test Mode: | BT Mode | Temp/Hum | 24(°C)/ 33%RH |
| Test Item | 30MHz-1GHz | Test Date | January 19, 2018 |
| Polarize | Vertical | Test Engineer | Jerry Chuang |
| Detector | Peak and Quasi-peak | Test Voltage: | 120V |



| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|-----------------------|-----------------|----------------|-------------|--------|
| 169.6800 | 48.48 | -16.53 | 31.95 | 43.52 | -11.57 | peak |
| 278.8050 | 41.66 | -14.35 | 27.31 | 46.02 | -18.71 | peak |
| 390.3550 | 40.70 | -11.70 | 29.00 | 46.02 | -17.02 | peak |
| 501.9050 | 40.81 | -8.45 | 32.36 | 46.02 | -13.66 | peak |
| 613.4550 | 40.84 | -6.55 | 34.29 | 46.02 | -11.73 | peak |
| 864.2000 | 31.49 | -2.62 | 28.87 | 46.02 | -17.15 | peak |

| | | | |
|------------|---------------------|---------------|------------------|
| Test Mode: | BT Mode | Temp/Hum | 24(°C)/ 33%RH |
| Test Item | 30MHz-1GHz | Test Date | January 19, 2018 |
| Polarize | Horizontal | Test Engineer | Jerry Chuang |
| Detector | Peak and Quasi-peak | Test Voltage: | 120V |



| Frequency (MHz) | Reading (dBuV) | Correct Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|-----------------|----------------|-----------------------|-----------------|----------------|-------------|--------|
| 213.3300 | 44.97 | -16.66 | 28.31 | 43.52 | -15.21 | peak |
| 355.4350 | 42.01 | -12.81 | 29.20 | 46.02 | -16.82 | peak |
| 501.9050 | 33.35 | -8.45 | 24.90 | 46.02 | -21.12 | peak |
| 599.8750 | 35.20 | -6.93 | 28.27 | 46.02 | -17.75 | peak |
| 800.1800 | 33.08 | -3.38 | 29.70 | 46.02 | -16.32 | peak |
| 864.2000 | 38.97 | -2.62 | 36.35 | 46.02 | -9.67 | peak |