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RADIO TEST REPORT

Report No: STS1711144W01

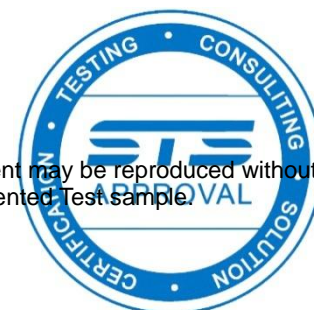
Issued for

BlueAnt Wireless

1-7 Weston St, Brunswick, Victoria 3056 Australia

| | |
|-----------------------|---|
| Product Name: | Bluetooth earphone |
| Brand Name: |  |
| Model Name: | PUMP AIR |
| Series Model: | N/A |
| FCC ID: | VHFBLUEANT-AIR |
| Test Standard: | FCC Part 15.247 |

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TEST RESULT CERTIFICATION

Applicant's name : BlueAnt Wireless
 Address : 1-7 Weston St, Brunswick, Victoria 3056 Australia
Manufacture's Name : BlueAnt Wireless
 Address : 1-7 Weston St, Brunswick, Victoria 3056 Australia

Product description

Product Name : Bluetooth earphone
 Brand Name : 


Model Name : PUMP AIR
 Series Model : N/A

Test Standards : FCC Part15.247
 Test procedure ANSI C63.10-2013

This device described above has been tested by STS, the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test :
 Date (s) of performance of tests : 14 Nov. 2017~23 Nov. 2017
 Date of Issue : 24 Nov. 2017
 Test Result : **Pass**

Testing Engineer : 

 (Sean she)

Technical Manager : 

 (Hakim.hou)

Authorized Signatory : 

 (Vita Li)





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Revision History

| Rev. | Issue Date | Report NO. | Effect Page | Contents |
|------|--------------|---------------|-------------|---------------|
| 00 | 24 Nov. 2017 | STS1711144W01 | ALL | Initial Issue |
| | | | | |





1. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:
KDB 558074 D01 DTS Meas Guidance v04

| FCC Part 15.247, Subpart C | | | |
|-------------------------------|---|----------|--------|
| Standard Section | Test Item | Judgment | Remark |
| 15.207 | Conducted Emission | PASS | -- |
| 15.247 (a)(2) | 6dB Bandwidth | PASS | -- |
| 15.247 (b)(3) | Output Power | PASS | -- |
| 15.247 (c) | Radiated Spurious Emission | PASS | -- |
| 15.247 (d) | Conducted Spurious & Band Edge Emission | PASS | -- |
| 15.247 (e) | Power Spectral Density | PASS | -- |
| 15.205 | Restricted Band Edge Emission | PASS | -- |
| Part 15.247(d)/part 15.209(a) | Band Edge Emission | PASS | -- |
| 15.203 | Antenna Requirement | PASS | -- |

NOTE:

- (1) "N/A" denotes test is not applicable in this Test Report
- (2) All tests are according to ANSI C63.10-2013



1.1 TEST FACTORY

Shenzhen STS Test Services Co., Ltd.

Add. : 1/F., Building B, Zhuoke Science Park, No.190, Chongqing Road,
Fuyong Street, Bao'an District, Shenzhen, Guangdong, China

CNAS Registration No.: L7649; FCC Registration No.: 625569

IC Registration No.: 12108A; A2LA Certificate No.: 4338.01;

1.2 MEASUREMENT UNCERTAINTY


The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately **95 %**.

| No. | Item | Uncertainty |
|-----|---|---------------------|
| 1 | Conducted Emission (9KHz-150KHz) | $\pm 2.88\text{dB}$ |
| 2 | Conducted Emission (150KHz-30MHz) | $\pm 2.67\text{dB}$ |
| 3 | RF power,conducted | $\pm 0.71\text{dB}$ |
| 4 | Spurious emissions,conducted | $\pm 0.63\text{dB}$ |
| 5 | All emissions,radiated (9KHz-30MHz) | $\pm 3.02\text{dB}$ |
| 6 | All emissions,radiated (30MHz-200MHz) | $\pm 3.80\text{dB}$ |
| 7 | All emissions,radiated (200MHz-1000MHz) | $\pm 3.97\text{dB}$ |
| 8 | All emissions,radiated(>1G) | $\pm 3.03\text{dB}$ |



2. GENERAL INFORMATION

2.1 GENERAL DESCRIPTION OF EUT

| | | |
|-------------------------|---|--------------------|
| Product Name | Bluetooth earphone | |
| Trade Name |  | |
| Model Name | PUMP AIR | |
| Series Model | N/A | |
| Model Difference | N/A | |
| Product Description | The EUT is a Bluetooth earphone | |
| | Operation Frequency: | 2402~2480 MHz |
| | Modulation Type: | GFSK |
| | Radio Technology | BLE |
| | Number Of Channel | 40 |
| | Antenna Designation: | Please see Note 3. |
| | Antenna Gain (dBi) | 0 dBi |
| Channel List | Please refer to the Note 2. | |
| Adapter | Output: DC 5V | |
| Battery | Rated Voltage: 3.7V Charge Limit: 4.35V Capacity: 500mAh | |
| Hardware version number | M101H REV2.1 | |
| Software version number | NRD90M DEV-KEYS | |
| Connecting I/O Port(s) | Please refer to the User's Manual | |

Note:

1. For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.




2.

| Channel List | | | | | | | |
|--------------|-----------------|---------|-----------------|---------|-----------------|---------|-----------------|
| Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) | Channel | Frequency (MHz) |
| 01 | 2402 | 11 | 2422 | 21 | 2442 | 31 | 2462 |
| 02 | 2404 | 12 | 2424 | 22 | 2444 | 32 | 2464 |
| 03 | 2406 | 13 | 2426 | 23 | 2446 | 33 | 2466 |
| 04 | 2408 | 14 | 2428 | 24 | 2448 | 34 | 2468 |
| 05 | 2410 | 15 | 2430 | 25 | 2450 | 35 | 2470 |
| 06 | 2412 | 16 | 2432 | 26 | 2452 | 36 | 2472 |
| 07 | 2414 | 17 | 2434 | 27 | 2454 | 37 | 2474 |
| 08 | 2416 | 18 | 2436 | 28 | 2456 | 38 | 2476 |
| 09 | 2418 | 19 | 2438 | 29 | 2458 | 39 | 2478 |
| 10 | 2420 | 20 | 2440 | 30 | 2460 | 40 | 2480 |

3.

Table for Filed Antenna

| Ant. | Brand | Model Name | Antenna Type | Connector | Gain (dBi) | NOTE |
|------|---|------------|-----------------|-----------|------------|---------|
| 1 |  | PUMP AIR | Ceramic Antenna | N/A | 0 | BLE ANT |



2.2 DESCRIPTION OF TEST MODES

For conducted test items and radiated spurious emissions
Each of these EUT operation mode(s) or test configuration mode(s) mentioned below was evaluated respectively..

| Worst Mode | Description | Data/Modulation |
|------------|------------------|-----------------|
| Mode 1 | TX CH1(2402MHz) | 1 MHz/GFSK |
| Mode 2 | TX CH20(2440MHz) | 1 MHz/GFSK |
| Mode 3 | TX CH40(2480MHz) | 1 MHz/GFSK |

Note:

- (1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported
- (2) We have be tested for all avaiable U.S. voltage and frequencies(For 120V,50/60Hz and 240V, 50/60Hz) for which the device is capable of operation, and the worst case of 120V,50/60Hz is shown in the report
- (3) The EUT was programmed to be in continuously transmitting with a modulated carrier at maximum power on bottom/middle/top channels as required using the supported data rates/modulation types and the transmit duty cycle is not less than 98%.
- (4) Controlled using a bespoke application on the laptop PC supplied by the customer. The application was used to enable a continuous transmission mode and to select the test channels, data rates and modulation schemes as required.

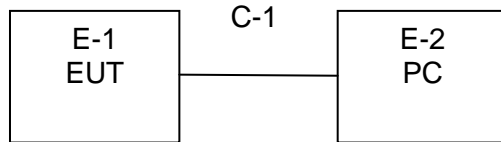
For AC Conducted Emission

| Test Case | |
|-----------------------|------------------------|
| AC Conducted Emission | Mode 4 : Keeping BT TX |

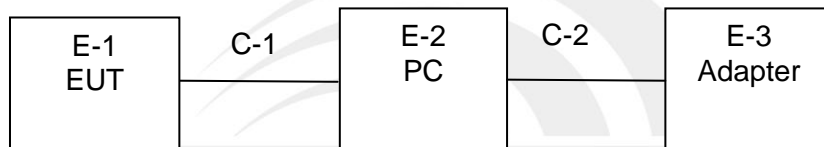


2.3 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Spurious Emission Test



Conducted Emission Test





2.4 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

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.

| Item | Equipment | Mfr/Brand | Model/Type No. | Serial No. | Note |
|------|-----------|-----------|----------------|------------|------|
| E-2 | PC | HP | N/A | N/A | N/A |
| E-3 | Adapter | HP | N/A | N/A | N/A |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

| Item | Shielded Type | Ferrite Core | Length | Note |
|------|---------------------------------|--------------|--------|------|
| C-1 | USB Cable shielded line | NO | 110cm | N/A |
| C-2 | Cable shielded line (Charging) | NO | 100cm | N/A |
| | | | | |

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
- (3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.



2.5 EQUIPMENTS LIST FOR ALL TEST ITEMS

Radiation Test equipment

| Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until |
|---|---------------|-------------|-------------|------------------|------------------|
| EMI Test Receiver | R&S | ESW | 101535 | 2017.06.01 | 2018.05.31 |
| Bilog Antenna | TESEQ | CBL6111D | 34678 | 2017.03.24 | 2018.03.23 |
| Horn Antenna | Schwarzbeck | BBHA 9120D | 9120D-1343 | 2017.03.06 | 2018.03.05 |
| SHF-EHF Horn Antenna (15G-40GHz) | BBHA 9170 | SCHWARZBECK | BBHA9170367 | 2017.05.02 | 2018.05.01 |
| Temperature & Humidity | HH660 | Mieo | N/A | 2017.10.15 | 2018.10.14 |
| Temperature & Humidity | HH660 | Mieo | N/A | 2017.10.15 | 2018.10.14 |
| Pre-mpifier (0.1M-3GHz) | EM | EM330 | 60538 | 2017.03.12 | 2018.03.11 |
| PreAmplifier (1G-26.5GHz) | Agilent | 8449B | 60538 | 2017.10.15 | 2018.10.14 |
| Pre-mpifier (18G-40G) | MINI-CIRCUITS | AP-040G | 1382501 | 2017.05.15 | 2018.05.14 |
| Operational Manual Passive Loop (9K--30MHz) | ETS | 6512 | 00165355 | 2017.03.06 | 2018.03.05 |
| Low frequency cable | EM | R01 | N/A | 2017.03.12 | 2018.03.11 |
| Low frequency cable | EM | R06 | N/A | 2017.03.12 | 2018.03.11 |
| High frequency cable | SCHWARZBECK | R04 | N/A | 2017.03.12 | 2018.03.11 |
| High frequency cable | SCHWARZBECK | R02 | N/A | 2017.03/12 | 2018.03.11 |
| Semi-anechoic chamber | Changling | 966 | N/A | 2017.10.15 | 2018.10.14 |
| trun table | EM | SC100_1 | 60531 | N/A | N/A |
| Antnna mast | EM | SC100 | N/A | N/A | N/A |
| Max-full Antenna Corp | MF | MFA-440H | N/A | N/A | N/A |

Conduction Test equipment

| Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until |
|------------------------|--------------|----------|------------|------------------|------------------|
| Test Receiver | R&S | ESCI | 101427 | 2017.10.15 | 2018.10.14 |
| LISN | R&S | ENV216 | 101242 | 2017.10.15 | 2018.10.14 |
| conduction Cable | EM | C01 | N/A | 2017.03.12 | 2018.03.11 |
| Temperature & Humidity | Mieo | HH660 | N/A | 2017.10.15 | 2018.10.14 |



RF Connected Test

| Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until |
|---------------------|--------------|----------|---------------|------------------|------------------|
| USB RF power sensor | DARE | RPR3006W | 15I00041SNO03 | 2017.10.15 | 2018.10.14 |
| Power Meter | R&S | NRP | 100510 | 2017.10.15 | 2018.10.14 |
| Spectrum Analyzer | Agilent | E4407B | MY50140340 | 2017.03.11 | 2018.03.10 |
| Signal Analyzer | Agilent | N9020A | MY49100060 | 2017.03.11 | 2018.03.10 |





3. EMC EMISSION TEST

3.1 CONDUCTED EMISSION MEASUREMENT

3.1.1 POWER LINE CONDUCTED EMISSION LIMITS

operating frequency band. In case the emission fall within the restricted band specified on Part 207(a) limit in the table below has to be followed.

| FREQUENCY (MHz) | Conducted Emission limit (dBUV) | |
|-----------------|---------------------------------|-----------|
| | Quasi-peak | Average |
| 0.15 -0.5 | 66 - 56 * | 56 - 46 * |
| 0.50 -5.0 | 56.00 | 46.00 |
| 5.0 -30.0 | 60.00 | 50.00 |

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

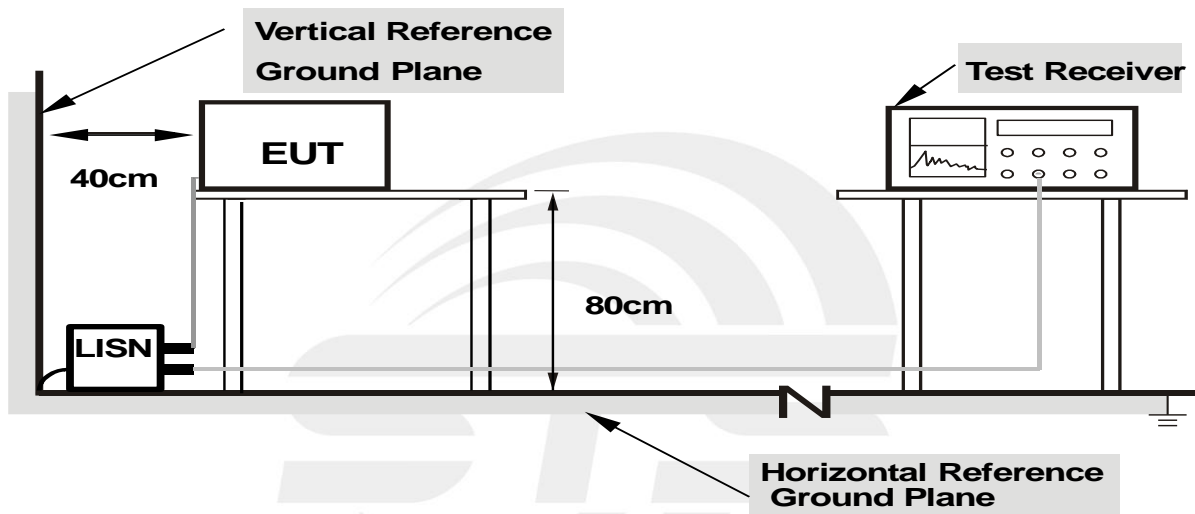
The following table is the setting of the receiver

| Receiver Parameters | Setting |
|---------------------|----------|
| Attenuation | 10 dB |
| Start Frequency | 0.15 MHz |
| Stop Frequency | 30 MHz |
| IF Bandwidth | 9 kHz |

3.2 TEST PROCEDURE

- a. The EUT was 0.8 meters from the horizontal ground plane and 0.4 meters from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

3.3 TEST SETUP



- Note: 1.Support units were connected to second LISN.**
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

3.4 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.



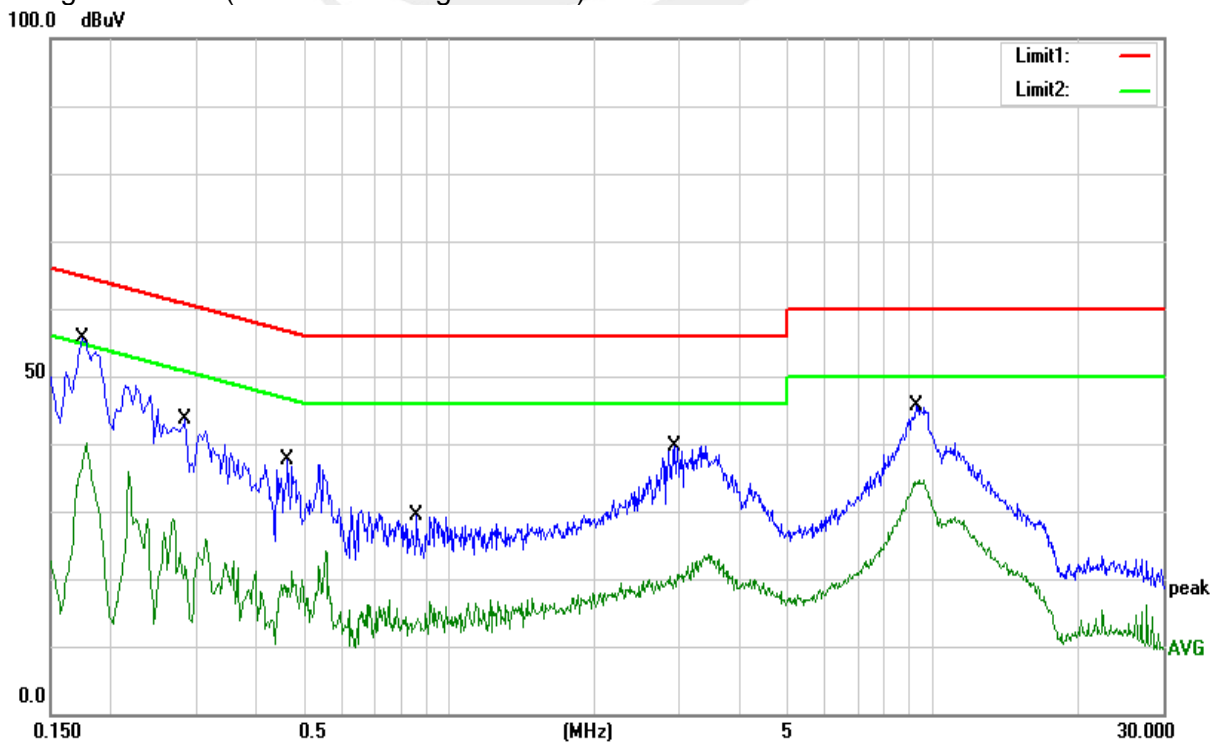
3.5 TEST RESULTS

| | | | |
|---------------|--------------|--------------------|--------|
| Temperature: | 26.5 °C | Relative Humidity: | 68% |
| Pressure: | 1010hPa | Phase: | L |
| Test Voltage: | AC 120V/60Hz | Test Mode: | Mode 4 |

| Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 0.1740 | 45.81 | 9.79 | 55.60 | 64.77 | -9.17 | QP |
| 0.1740 | 29.33 | 9.79 | 39.12 | 54.77 | -15.65 | AVG |
| 0.2860 | 33.42 | 10.17 | 43.59 | 60.64 | -17.05 | QP |
| 0.2860 | 13.52 | 10.17 | 23.69 | 50.64 | -26.95 | AVG |
| 0.4660 | 27.71 | 10.03 | 37.74 | 56.58 | -18.84 | QP |
| 0.4660 | 10.99 | 10.03 | 21.02 | 46.58 | -25.56 | AVG |
| 0.8580 | 19.57 | 9.82 | 29.39 | 56.00 | -26.61 | QP |
| 0.8580 | 2.45 | 9.82 | 12.27 | 46.00 | -33.73 | AVG |
| 2.9260 | 29.82 | 9.81 | 39.63 | 56.00 | -16.37 | QP |
| 2.9260 | 10.13 | 9.81 | 19.94 | 46.00 | -26.06 | AVG |
| 9.2700 | 35.38 | 10.13 | 45.51 | 60.00 | -14.49 | QP |
| 9.2700 | 24.04 | 10.13 | 34.17 | 50.00 | -15.83 | AVG |

Remark:

1. All readings are Quasi-Peak and Average values.
2. Margin = Result (Result = Reading + Factor) – Limit



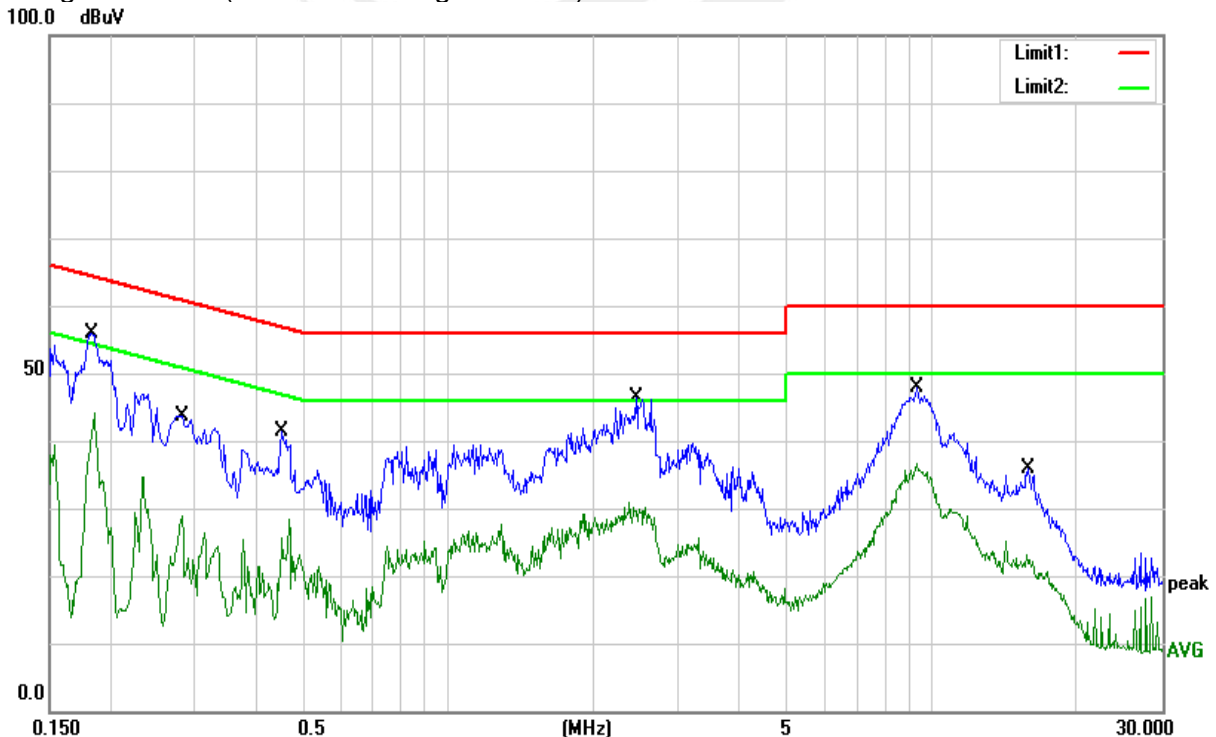


| | | | |
|---------------|--------------|--------------------|--------|
| Temperature: | 26.5 °C | Relative Humidity: | 68% |
| Pressure: | 1010hPa | Phase: | N |
| Test Voltage: | AC 120V/60Hz | Test Mode: | Mode 4 |

| Frequency (MHz) | Reading (dBuV) | Correct Factor(dB) | Result (dBuV) | Limit (dBuV) | Margin (dB) | Remark |
|-----------------|----------------|--------------------|---------------|--------------|-------------|--------|
| 0.1833 | 46.07 | 9.83 | 55.90 | 64.33 | -8.43 | QP |
| 0.1833 | 32.34 | 9.83 | 42.17 | 54.33 | -12.16 | AVG |
| 0.2820 | 33.52 | 10.20 | 43.72 | 60.76 | -17.04 | QP |
| 0.2820 | 9.69 | 10.20 | 19.89 | 50.76 | -30.87 | AVG |
| 0.4540 | 31.24 | 10.02 | 41.26 | 56.80 | -15.54 | QP |
| 0.4540 | 18.40 | 10.02 | 28.42 | 46.80 | -18.38 | AVG |
| 2.4540 | 36.39 | 9.89 | 46.28 | 56.00 | -9.72 | QP |
| 2.4540 | 20.03 | 9.89 | 29.92 | 46.00 | -16.08 | AVG |
| 9.3300 | 37.85 | 9.92 | 47.77 | 60.00 | -12.23 | QP |
| 9.3300 | 25.42 | 9.92 | 35.34 | 50.00 | -14.66 | AVG |
| 15.8780 | 25.79 | 10.14 | 35.93 | 60.00 | -24.07 | QP |
| 15.8780 | 12.04 | 10.14 | 22.18 | 50.00 | -27.82 | AVG |

Remark:

1. All readings are Quasi-Peak and Average values.
2. Margin = Result (Result = Reading + Factor) – Limit





4. RADIATED EMISSION MEASUREMENT

4.1 RADIATED EMISSION LIMITS

in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205(a)&209(a) limit in the table and according to ANSI C63.10-2013 below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (Frequency Range 9kHz-1000MHz)

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

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

| FREQUENCY (MHz) | (dBuV/m) (at 3M) | |
|-----------------|------------------|---------|
| | PEAK | AVERAGE |
| Above 1000 | 74 | 54 |

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

For Radiated Emission

| Spectrum Parameter | Setting |
|---------------------------------------|-------------------------------|
| Attenuation | Auto |
| Detector | Peak |
| Start Frequency | 1000 MHz(Peak/AV) |
| Stop Frequency | 10th carrier hamonic(Peak/AV) |
| RB / VB (emission in restricted band) | 1 MHz / 3 MHz |

For Band edge

| Spectrum Parameter | Setting |
|---------------------------------------|--|
| Detector | Peak |
| Start/Stop Frequency | Lower Band Edge: 2300 to 2403 MHz Upper Band Edge: 2479 to 2500 MHz |
| RB / VB (emission in restricted band) | 1 MHz / 3 MHz |



| Receiver Parameter | Setting |
|------------------------|--------------------------------------|
| Start ~ Stop Frequency | 9kHz~90kHz / RB 200Hz for PK & AV |
| Start ~ Stop Frequency | 90kHz~110kHz / RB 200Hz for QP |
| Start ~ Stop Frequency | 110kHz~490kHz / RB 200Hz for PK & AV |
| Start ~ Stop Frequency | 490kHz~30MHz / RB 9kHz for QP |
| Start ~ Stop Frequency | 30MHz~1000MHz / RB 120kHz for QP |

4.2 TEST PROCEDURE

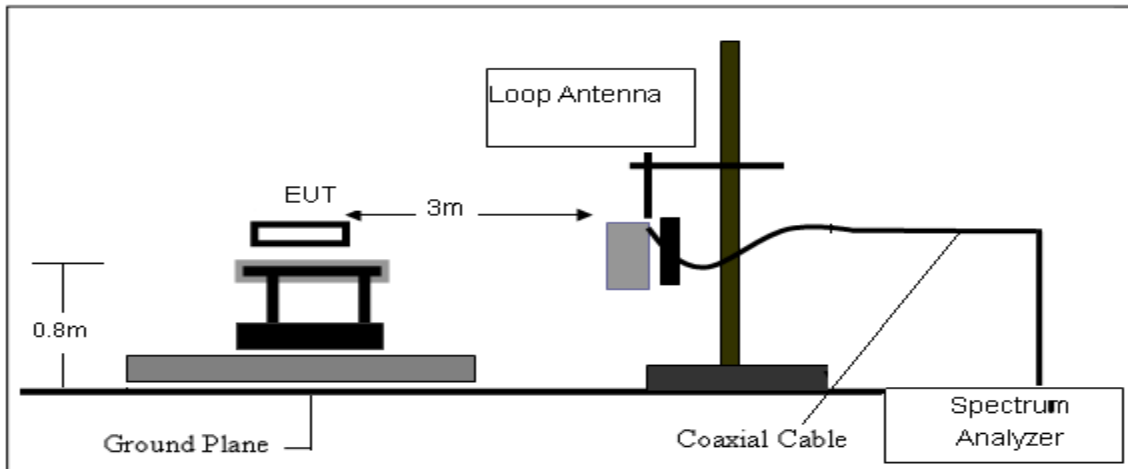
- a. The measuring distance of at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
- b. The EUT was placed on the top of a rotating table 0.8 meters(above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment shall be 0.8 m(above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. Horizontal and vertical polarizations of the antenna are set to make the measurement
- d. 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.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

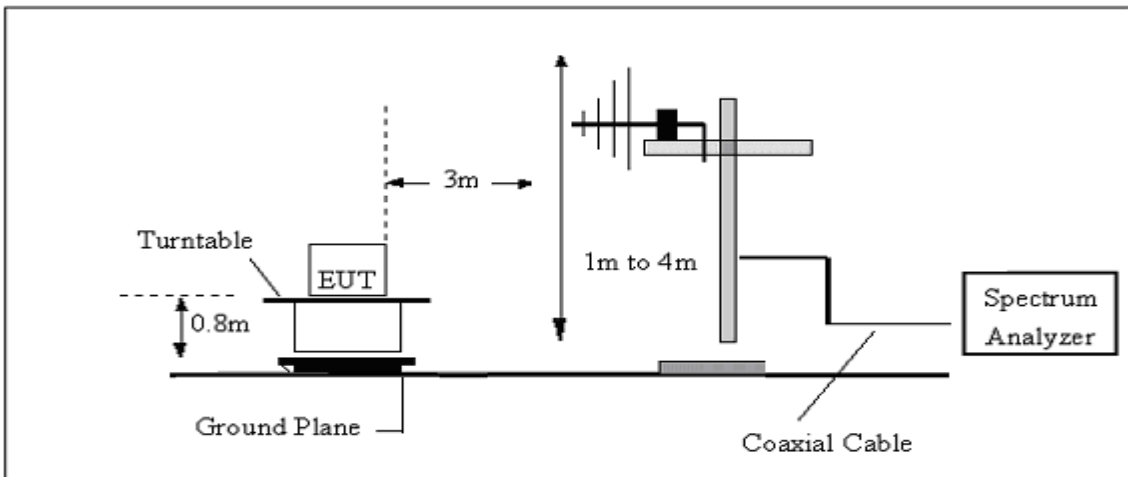
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

4.3 TEST SETUP

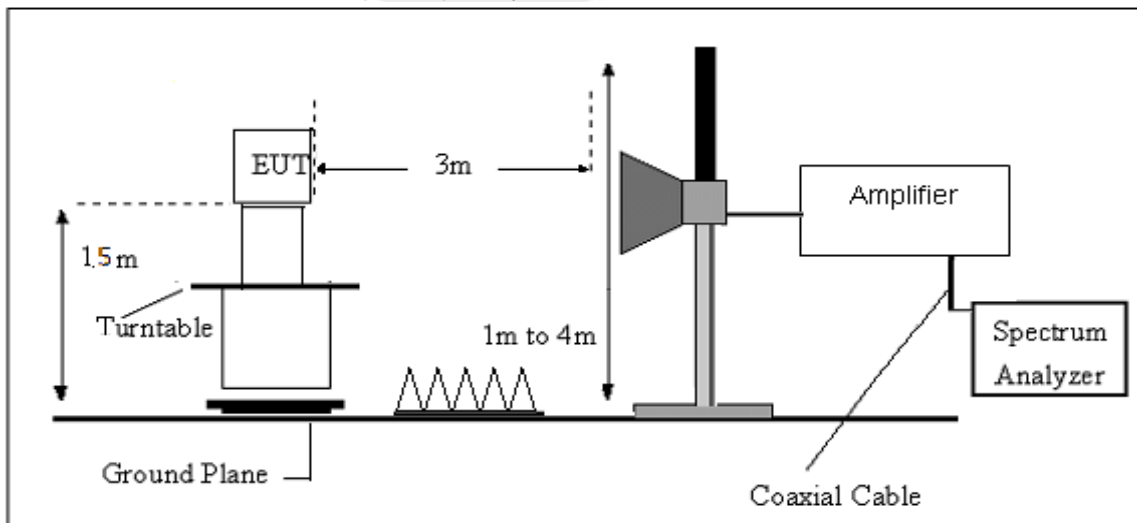
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



4.4 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



4.5 FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where

FS = Field Strength

CL = Cable Attenuation Factor (Cable Loss)

RA = Reading Amplitude

AG = Amplifier Gain

AF = Antenna Factor

For example

| Frequency (MHz) | FS (dB μ V/m) | RA (dB μ V/m) | AF (dB) | CL (dB) | AG (dB) | Factor (dB) |
|--------------------|----------------------|----------------------|------------|------------|------------|----------------|
| 300 | 40 | 58.1 | 12.2 | 1.6 | 31.9 | -18.1 |

$$\text{Factor} = \text{AF} + \text{CL} - \text{AG}$$





4.6 TEST RESULTS

(Between 9KHz – 30 MHz)

| | | | |
|--------------|----------|--------------------|----------------------|
| Temperature: | 24.4 °C | Relative Humidity: | 57% |
| Pressure: | 1010 hPa | Test Voltage: | DC 3.7V from battery |
| Test Mode: | TX Mode | Polarization: | -- |

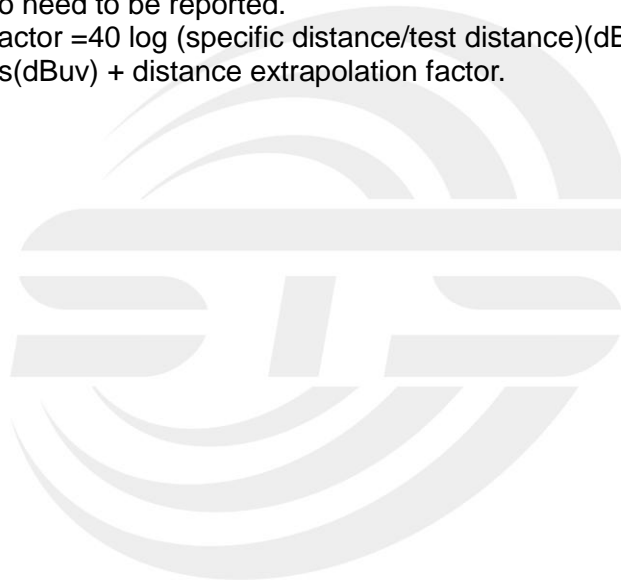
| Freq. (MHz) | Reading (dBuV/m) | Limit (dBuV/m) | Margin (dB) | State P/F |
|----------------|---------------------|-------------------|----------------|--------------|
| -- | -- | -- | -- | PASS |
| -- | -- | -- | -- | PASS |

Note:

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log(\text{specific distance}/\text{test distance})(\text{dB})$;

Limit line = specific limits(dBuv) + distance extrapolation factor.





(30MHz -1000MHz)

| | | | |
|---------------|----------------------|--------------------|-------------------------------------|
| Temperature: | 24.4 °C | Relative Humidity: | 57% |
| Pressure: | 1010hPa | Phase: | Horizontal |
| Test Voltage: | DC 3.7V from battery | Test Mode: | Mode1/2/3 (Mode 1-3M worst mode) |

| Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|--------------------|-------------------|-------------------------|--------------------|-------------------|----------------|--------|
| 56.0007 | 34.39 | -23.19 | 11.20 | 40.00 | -28.80 | QP |
| 67.9130 | 37.35 | -24.15 | 13.20 | 40.00 | -26.80 | QP |
| 124.5690 | 31.58 | -17.63 | 13.95 | 43.50 | -29.55 | QP |
| 150.0108 | 32.23 | -17.97 | 14.26 | 43.50 | -29.24 | QP |
| 408.9460 | 28.59 | -11.08 | 17.51 | 46.00 | -28.49 | QP |
| 689.5644 | 30.32 | -5.57 | 24.75 | 46.00 | -21.25 | QP |

Remark:

1. Margin = Result (Result =Reading + Factor)–Limit





| | | | |
|---------------|----------------------|--------------------|-------------------------------------|
| Temperature: | 24.4 °C | Relative Humidity: | 57% |
| Pressure: | 1010hPa | Phase: | Vertical |
| Test Voltage: | DC 3.7V from battery | Test Mode: | Mode1/2/3 (Mode 1-3M worst mode) |

| Frequency (MHz) | Reading (dBuV) | Correct Factor(dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Remark |
|--------------------|-------------------|-------------------------|--------------------|-------------------|----------------|--------|
| 69.1141 | 39.09 | -24.12 | 14.97 | 40.00 | -25.03 | QP |
| 104.5361 | 35.71 | -18.81 | 16.90 | 43.50 | -26.60 | QP |
| 125.0066 | 36.92 | -17.61 | 19.31 | 43.50 | -24.19 | QP |
| 150.0108 | 36.18 | -17.97 | 18.21 | 43.50 | -25.29 | QP |
| 501.1790 | 31.19 | -8.90 | 22.29 | 46.00 | -23.71 | QP |
| 916.0687 | 34.09 | -1.71 | 32.38 | 46.00 | -13.62 | QP |

Remark:

1. Margin = Result (Result =Reading + Factor)–Limit





(1GHz-25GHz)Restricted band and Spurious emission Requirements

GFSK Low Channel

| Frequency (MHz) | Reading (dBμV) | Amplifier (dB) | Loss (dB) | Antenna Factor (dB/m) | Corrected Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type | Comment |
|------------------------|-------------------|-------------------|--------------|-----------------------------|-----------------------------|-------------------------------|--------------------|----------------|------------------|------------|
| Low Channel (2402 MHz) | | | | | | | | | | |
| 3264.83 | 48.76 | 44.70 | 6.70 | 28.20 | -9.80 | 38.96 | 74.00 | -35.04 | PK | Vertical |
| 3264.83 | 39.27 | 44.70 | 6.70 | 28.20 | -9.80 | 29.47 | 54.00 | -24.53 | AV | Vertical |
| 3264.61 | 48.05 | 44.70 | 6.70 | 28.20 | -9.80 | 38.25 | 74.00 | -35.75 | PK | Horizontal |
| 3264.61 | 37.89 | 44.70 | 6.70 | 28.20 | -9.80 | 28.09 | 54.00 | -25.91 | AV | Horizontal |
| 4804.58 | 59.27 | 44.20 | 9.04 | 31.60 | -3.56 | 55.71 | 74.00 | -18.29 | PK | Vertical |
| 4804.58 | 38.96 | 44.20 | 9.04 | 31.60 | -3.56 | 35.40 | 54.00 | -18.60 | AV | Vertical |
| 4804.35 | 58.50 | 44.20 | 9.04 | 31.60 | -3.56 | 54.94 | 74.00 | -19.06 | PK | Horizontal |
| 4804.35 | 39.32 | 44.20 | 9.04 | 31.60 | -3.56 | 35.76 | 54.00 | -18.24 | AV | Horizontal |
| 5359.69 | 44.97 | 44.20 | 9.86 | 32.00 | -2.34 | 42.63 | 74.00 | -31.37 | PK | Vertical |
| 5359.69 | 37.41 | 44.20 | 9.86 | 32.00 | -2.34 | 35.07 | 54.00 | -18.93 | AV | Vertical |
| 5359.82 | 46.16 | 44.20 | 9.86 | 32.00 | -2.34 | 43.82 | 74.00 | -30.18 | PK | Horizontal |
| 5359.82 | 37.67 | 44.20 | 9.86 | 32.00 | -2.34 | 35.33 | 54.00 | -18.67 | AV | Horizontal |
| 7205.82 | 51.59 | 43.50 | 11.40 | 35.50 | 3.40 | 54.99 | 74.00 | -19.01 | PK | Vertical |
| 7205.82 | 32.57 | 43.50 | 11.40 | 35.50 | 3.40 | 35.97 | 54.00 | -18.03 | AV | Vertical |
| 7205.75 | 50.99 | 43.50 | 11.40 | 35.50 | 3.40 | 54.39 | 74.00 | -19.61 | PK | Horizontal |
| 7205.75 | 33.28 | 43.50 | 11.40 | 35.50 | 3.40 | 36.68 | 54.00 | -17.32 | AV | Horizontal |



GFSK Mid Channel

| Frequency (MHz) | Reading (dBμV) | Amplifier (dB) | Loss (dB) | Antenna Factor (dB/m) | Corrected Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type | Comment |
|------------------------|-------------------|-------------------|--------------|-----------------------------|-----------------------------|-------------------------------|--------------------|----------------|------------------|------------|
| Mid Channel (2440 MHz) | | | | | | | | | | |
| 3264.87 | 48.57 | 44.70 | 6.70 | 28.20 | -9.80 | 38.77 | 74.00 | -35.23 | PK | Vertical |
| 3264.87 | 39.78 | 44.70 | 6.70 | 28.20 | -9.80 | 29.98 | 54.00 | -24.02 | AV | Vertical |
| 3264.60 | 48.84 | 44.70 | 6.70 | 28.20 | -9.80 | 39.04 | 74.00 | -34.96 | PK | Horizontal |
| 3264.60 | 38.39 | 44.70 | 6.70 | 28.20 | -9.80 | 28.59 | 54.00 | -25.41 | AV | Horizontal |
| 4880.50 | 58.58 | 44.20 | 9.04 | 31.60 | -3.56 | 55.02 | 74.00 | -18.98 | PK | Vertical |
| 4880.50 | 39.56 | 44.20 | 9.04 | 31.60 | -3.56 | 36.00 | 54.00 | -18.00 | AV | Vertical |
| 4880.45 | 58.63 | 44.20 | 9.04 | 31.60 | -3.56 | 55.07 | 74.00 | -18.93 | PK | Horizontal |
| 4880.45 | 38.78 | 44.20 | 9.04 | 31.60 | -3.56 | 35.22 | 54.00 | -18.78 | AV | Horizontal |
| 5359.81 | 45.63 | 44.20 | 9.86 | 32.00 | -2.34 | 43.29 | 74.00 | -30.71 | PK | Vertical |
| 5359.81 | 38.01 | 44.20 | 9.86 | 32.00 | -2.34 | 35.67 | 54.00 | -18.33 | AV | Vertical |
| 5359.67 | 46.41 | 44.20 | 9.86 | 32.00 | -2.34 | 44.07 | 74.00 | -29.93 | PK | Horizontal |
| 5359.67 | 38.42 | 44.20 | 9.86 | 32.00 | -2.34 | 36.08 | 54.00 | -17.92 | AV | Horizontal |
| 7310.84 | 50.77 | 43.50 | 11.40 | 35.50 | 3.40 | 54.17 | 74.00 | -19.83 | PK | Vertical |
| 7310.84 | 32.77 | 43.50 | 11.40 | 35.50 | 3.40 | 36.17 | 54.00 | -17.83 | AV | Vertical |
| 7310.80 | 51.73 | 43.50 | 11.40 | 35.50 | 3.40 | 55.13 | 74.00 | -18.87 | PK | Horizontal |
| 7310.80 | 32.81 | 43.50 | 11.40 | 35.50 | 3.40 | 36.21 | 54.00 | -17.79 | AV | Horizontal |



GFSK High Channel

| Frequency (MHz) | Reading (dBμV) | Amplifier (dB) | Loss (dB) | Antenna | Corrected | Emission | | | | |
|-------------------------|-------------------|-------------------|--------------|------------------|----------------|-------------------|--------------------|----------------|------------------|------------|
| | | | | Factor (dB/m) | Factor (dB) | Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Detector Type | Comment |
| High Channel (2480 MHz) | | | | | | | | | | |
| 3264.60 | 48.64 | 44.70 | 6.70 | 28.20 | -9.80 | 38.84 | 74.00 | -35.16 | PK | Vertical |
| 3264.60 | 39.30 | 44.70 | 6.70 | 28.20 | -9.80 | 29.50 | 54.00 | -24.50 | AV | Vertical |
| 3264.63 | 49.24 | 44.70 | 6.70 | 28.20 | -9.80 | 39.44 | 74.00 | -34.56 | PK | Horizontal |
| 3264.63 | 38.05 | 44.70 | 6.70 | 28.20 | -9.80 | 28.25 | 54.00 | -25.75 | AV | Horizontal |
| 4960.29 | 58.82 | 44.20 | 9.04 | 31.60 | -3.56 | 55.26 | 74.00 | -18.74 | PK | Vertical |
| 4960.29 | 39.12 | 44.20 | 9.04 | 31.60 | -3.56 | 35.56 | 54.00 | -18.44 | AV | Vertical |
| 4960.43 | 59.31 | 44.20 | 9.04 | 31.60 | -3.56 | 55.75 | 74.00 | -18.25 | PK | Horizontal |
| 4960.43 | 38.77 | 44.20 | 9.04 | 31.60 | -3.56 | 35.21 | 54.00 | -18.79 | AV | Horizontal |
| 5359.74 | 45.01 | 44.20 | 9.86 | 32.00 | -2.34 | 42.67 | 74.00 | -31.33 | PK | Vertical |
| 5359.74 | 37.52 | 44.20 | 9.86 | 32.00 | -2.34 | 35.18 | 54.00 | -18.82 | AV | Vertical |
| 5359.75 | 45.40 | 44.20 | 9.86 | 32.00 | -2.34 | 43.06 | 74.00 | -30.94 | PK | Horizontal |
| 5359.75 | 38.35 | 44.20 | 9.86 | 32.00 | -2.34 | 36.01 | 54.00 | -17.99 | AV | Horizontal |
| 7439.70 | 50.63 | 43.50 | 11.40 | 35.50 | 3.40 | 54.03 | 74.00 | -19.97 | PK | Vertical |
| 7439.70 | 33.15 | 43.50 | 11.40 | 35.50 | 3.40 | 36.55 | 54.00 | -17.45 | AV | Vertical |
| 7439.81 | 51.52 | 43.50 | 11.40 | 35.50 | 3.40 | 54.92 | 74.00 | -19.08 | PK | Horizontal |
| 7439.81 | 32.86 | 43.50 | 11.40 | 35.50 | 3.40 | 36.26 | 54.00 | -17.74 | AV | Horizontal |

Note:

1) Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Emission Level = Reading + Factor

2) The frequency emission of peak points that did not show above the forms are at least 20dB below the limit, the frequency emission is mainly from the environment noise.



4.6 TEST RESULTS (Restricted Bands Requirements)

| Frequency (MHz) | Reading (dB μ V) | Amplifier (dB) | Loss (dB) | Antenna Factor (dB/m) | Corrected Factor (dB) | Emission Level (dB μ V/m) | Limits (dB μ V/m) | Margin (dB) | Detector Type | Comment |
|---|-------------------------|-------------------|--------------|-----------------------------|-----------------------------|-------------------------------------|--------------------------|----------------|------------------|------------|
| GFSK | | | | | | | | | | |
| 2390.00 | 67.27 | 43.80 | 4.91 | 25.90 | -12.99 | 54.28 | 74.00 | -19.72 | PK | Vertical |
| 2390.00 | 54.06 | 43.80 | 4.91 | 25.90 | -12.99 | 41.07 | 54.00 | -12.93 | AV | Vertical |
| 2390.00 | 68.50 | 43.80 | 4.91 | 25.90 | -12.99 | 55.51 | 74.00 | -18.49 | PK | Horizontal |
| 2390.00 | 53.43 | 43.80 | 4.91 | 25.90 | -12.99 | 40.44 | 54.00 | -13.56 | AV | Horizontal |
| 2483.50 | 69.33 | 43.80 | 5.12 | 25.90 | -12.78 | 56.55 | 74.00 | -17.45 | PK | Vertical |
| 2483.50 | 53.11 | 43.80 | 5.12 | 25.90 | -12.78 | 40.33 | 54.00 | -13.67 | AV | Vertical |
| 2483.50 | 70.00 | 43.80 | 5.12 | 25.90 | -12.78 | 57.22 | 74.00 | -16.78 | PK | Horizontal |
| 2483.50 | 52.53 | 43.80 | 5.12 | 25.90 | -12.78 | 39.75 | 54.00 | -14.25 | AV | Horizontal |
| <p>Low measurement frequencies is range from 2300 to 2403 MHz, high measurement frequencies is range from 2479 to 2500 MHz. Only show the worst point data of the emissions in the frequency 2300-2403 MHz and 2479-2500 MHz.</p> | | | | | | | | | | |

5. CONDUCTED SPURIOUS & BAND EDGE EMISSION

5.1 REQUIREMENT

According to FCC section 15.247(d), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

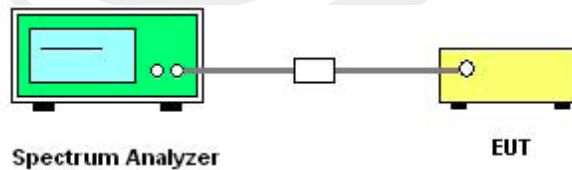
5.2 TEST PROCEDURE

| Spectrum Parameter | Setting |
|---------------------------------------|---------------------------------|
| Detector | Peak |
| Start/Stop Frequency | 30 MHz to 10th carrier harmonic |
| RB / VB (emission in restricted band) | 100 KHz/300 KHz |
| Trace-Mode: | Max hold |

For Band edge

| Spectrum Parameter | Setting |
|---------------------------------------|--|
| Detector | Peak |
| Start/Stop Frequency | Lower Band Edge: 2300 – 2403 MHz Upper Band Edge: 2479 – 2500 MHz |
| RB / VB (emission in restricted band) | 100 KHz/300 KHz |
| Trace-Mode: | Max hold |

5.3 TEST SETUP



The EUT which is powered by the Battery, is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50 Ohm; the path loss as the factor is calibrated to correct the reading. Make the measurement with the spectrum analyzer's resolution bandwidth(RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

5.4 EUT OPERATION CONDITIONS

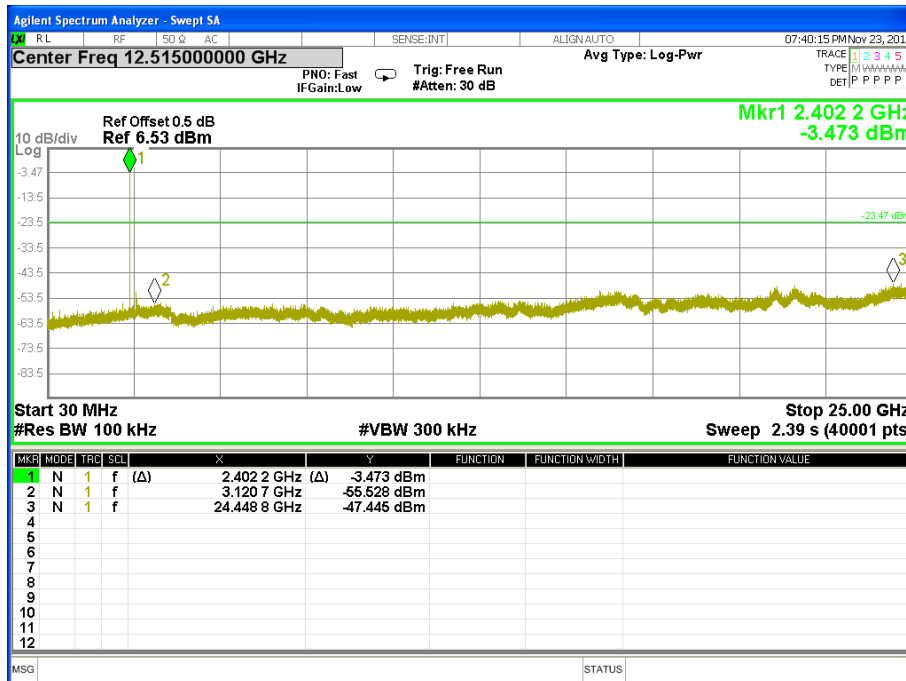
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



5.5 TEST RESULTS

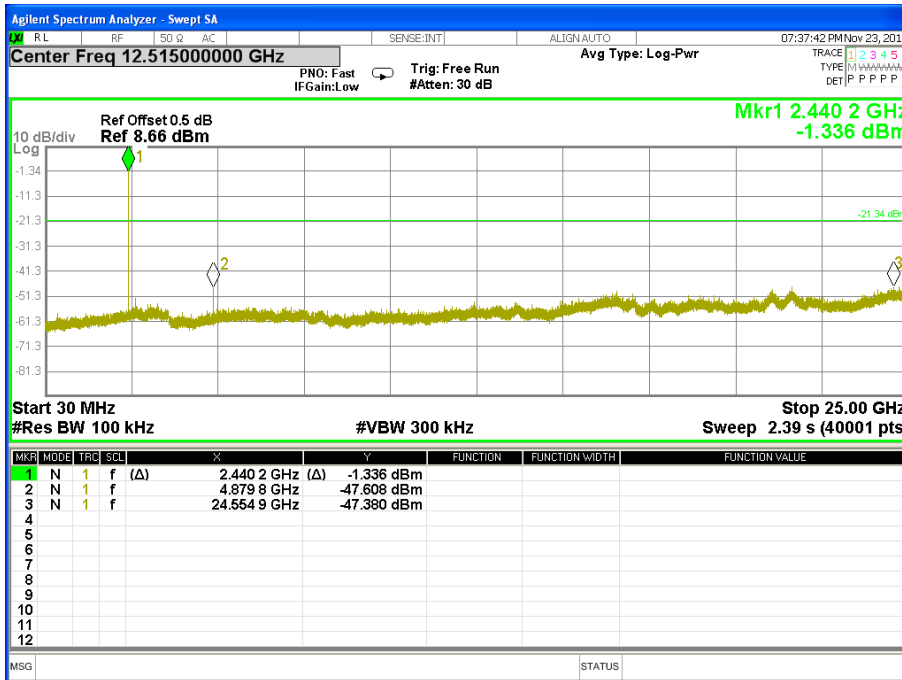
| | | | |
|--------------|---------------------------|--------------------|---------|
| Temperature: | 25 °C | Relative Humidity: | 50% |
| Pressure: | 1012 hPa | Test Voltage: | DC 3.7V |
| Test Mode: | TX Mode /CH01, CH20, CH40 | | |

01 CH

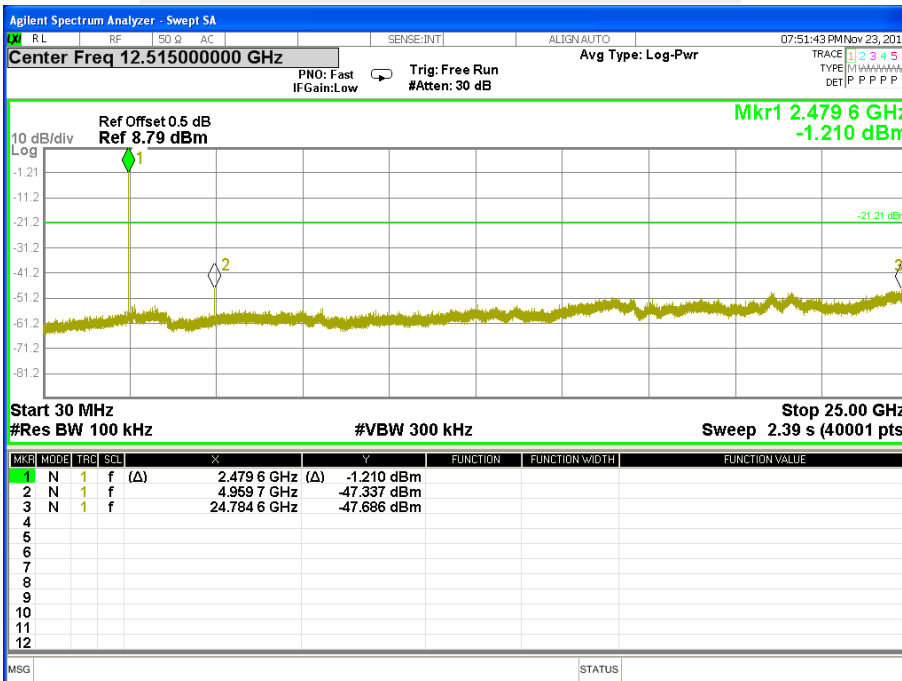




20 CH



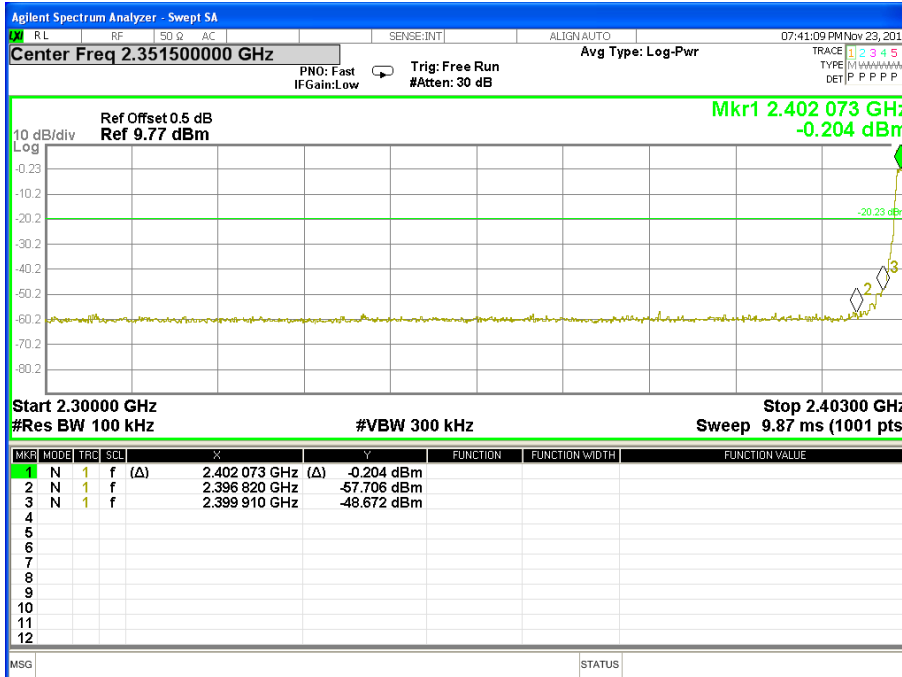
40 CH



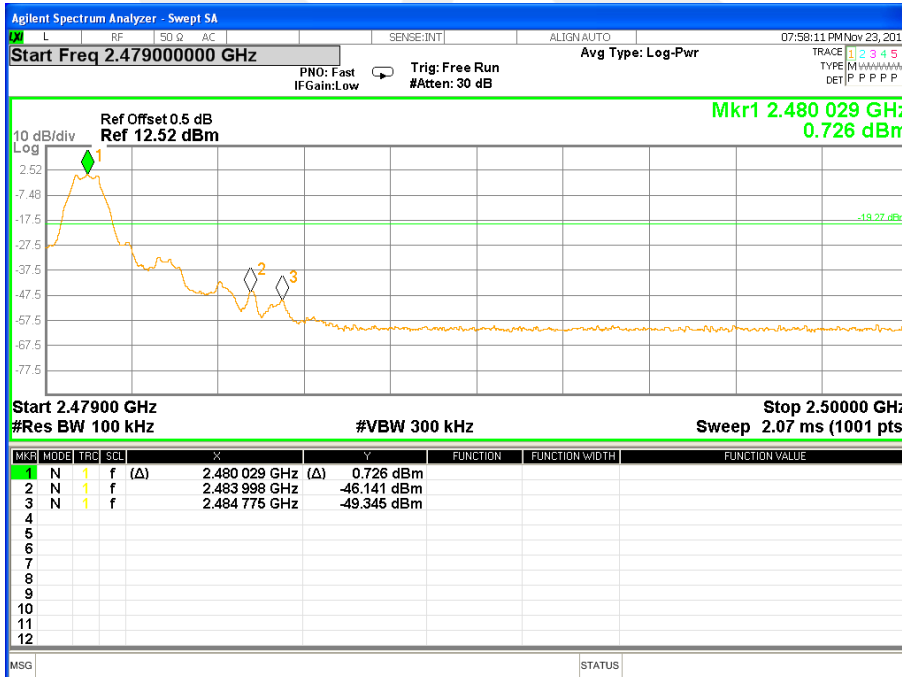
For Band edge



01 CH



40 CH





6. POWER SPECTRAL DENSITY TEST

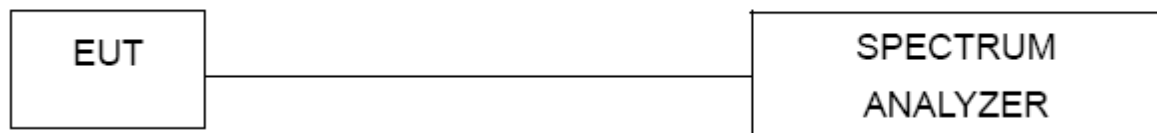
6.1 APPLIED PROCEDURES / LIMIT

| FCC Part 15.247, Subpart C | | | | |
|----------------------------|------------------------|------------------------------------|-----------------------|--------|
| Section | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.247(e) | Power Spectral Density | ≤ 8 dBm (RBW ≥ 3 KHz) | 2400-2483.5 | PASS |

6.2 TEST PROCEDURE

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW to: $100 \text{ kHz} \geq \text{RBW} \geq 3 \text{ kHz}$.
4. Set the VBW $\geq 3 \times \text{RBW}$.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

6.3 TEST SETUP



6.4 EUT OPERATION CONDITIONS

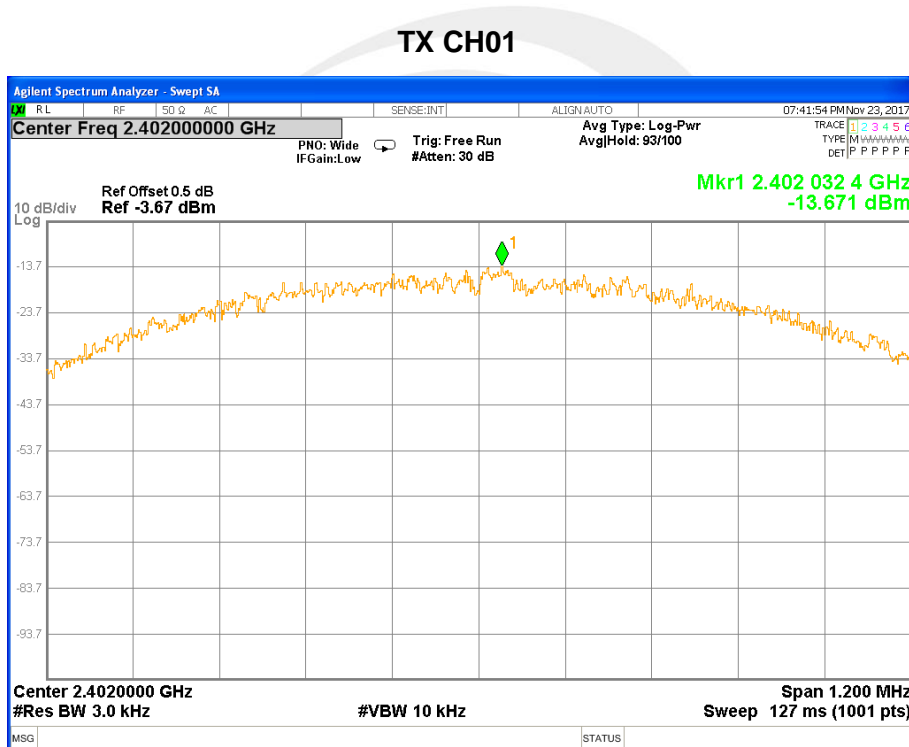
The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



6.5 TEST RESULTS

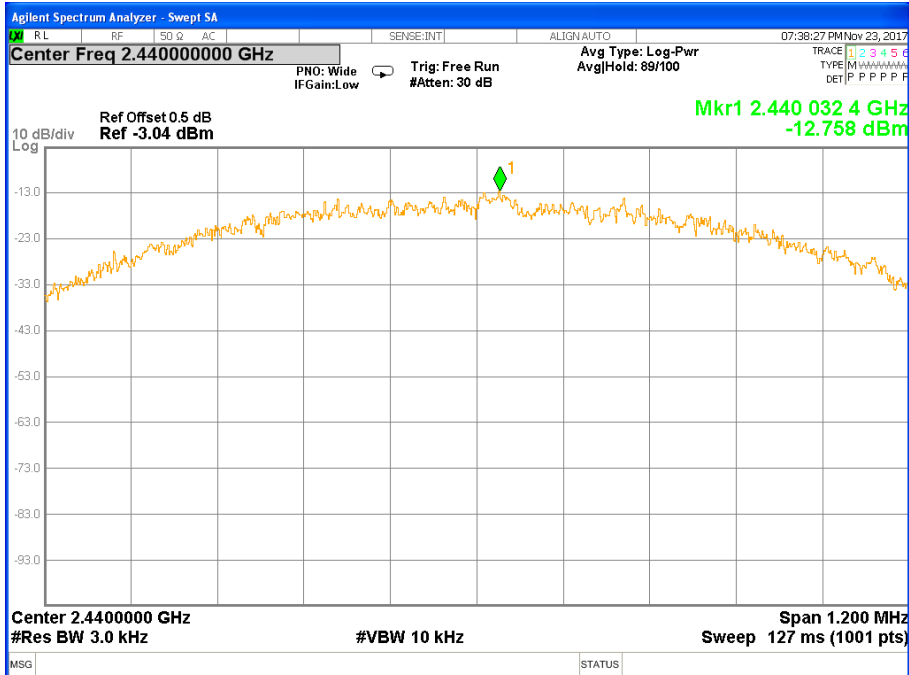
| | | | |
|--------------|---------------------------|--------------------|---------|
| Temperature: | 25 °C | Relative Humidity: | 60% |
| Pressure: | 1015 hPa | Test Voltage: | DC 3.7V |
| Test Mode: | TX Mode /CH01, CH20, CH40 | | |

| Frequency | Power Density (dBm/3kHz) | Limit (dBm/3KHz) | Result |
|-----------|--------------------------|------------------|--------|
| 2402 MHz | -13.671 | ≤8 | PASS |
| 2440 MHz | -12.758 | ≤8 | PASS |
| 2480 MHz | -11.711 | ≤8 | PASS |

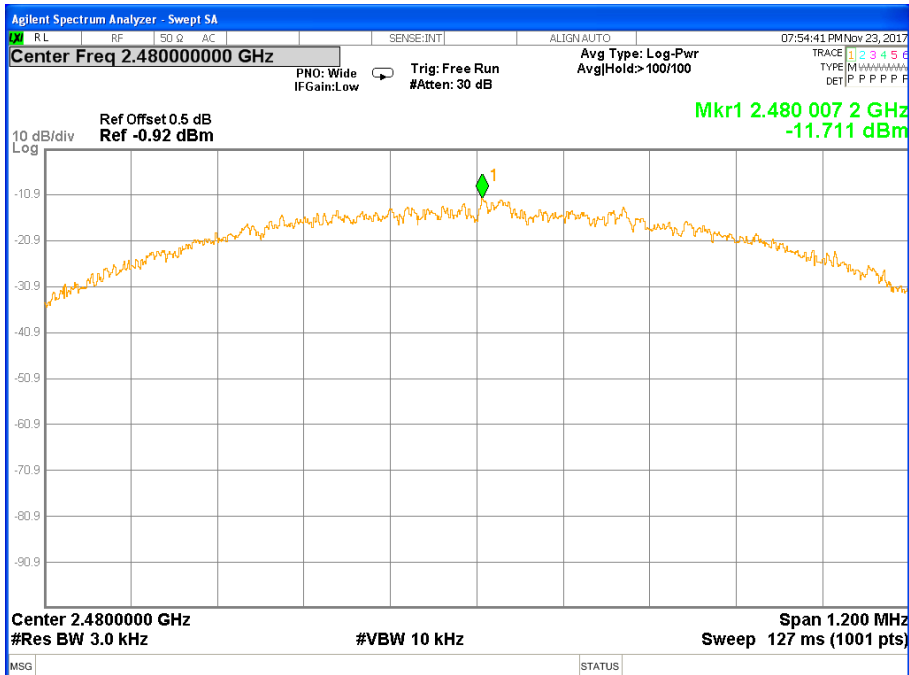




TX CH20



TX CH40





7. BANDWIDTH TEST

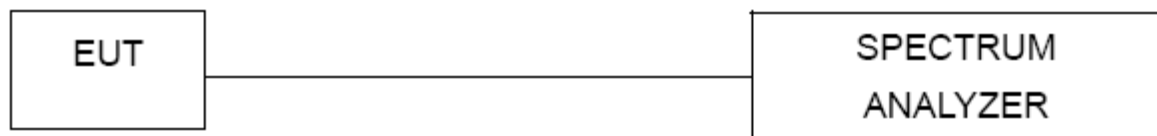
7.1 APPLIED PROCEDURES / LIMIT

| FCC Part 15.247, Subpart C | | | | |
|----------------------------|-----------|---|-----------------------|--------|
| Section | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.247(a)(2) | Bandwidth | $\geq 500\text{KHz}$ (6dB bandwidth) | 2400-2483.5 | PASS |

7.2 TEST PROCEDURE

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW \geq RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be \geq dB.

7.3 TEST SETUP



7.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.

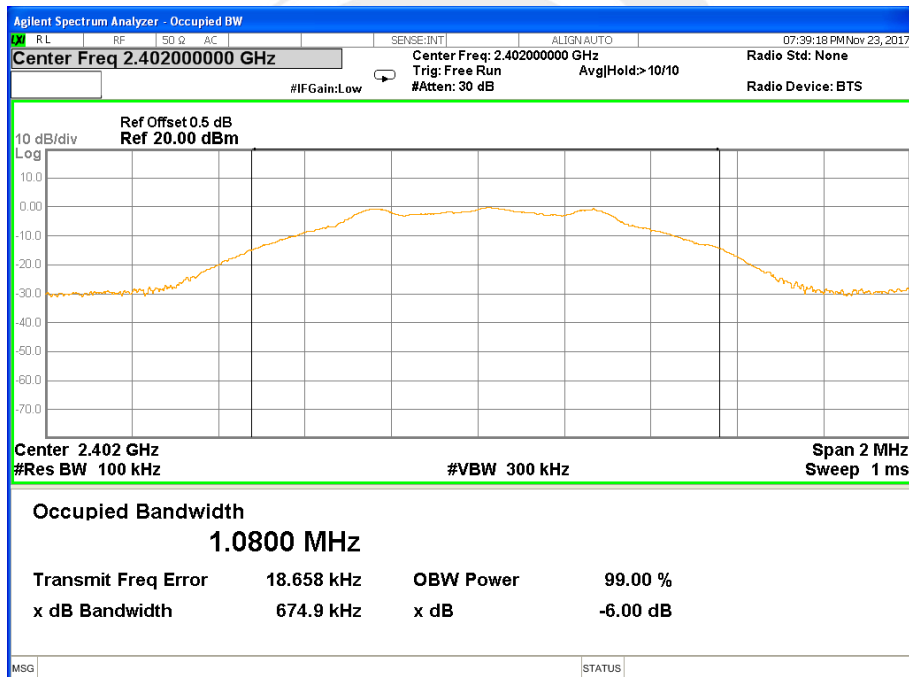


7.5 TEST RESULTS

| | | | |
|--------------|---------------------------|--------------------|---------|
| Temperature: | 25 °C | Relative Humidity: | 60% |
| Pressure: | 1012 hPa | Test Voltage: | DC 3.7V |
| Test Mode: | TX Mode /CH01, CH20, CH40 | | |

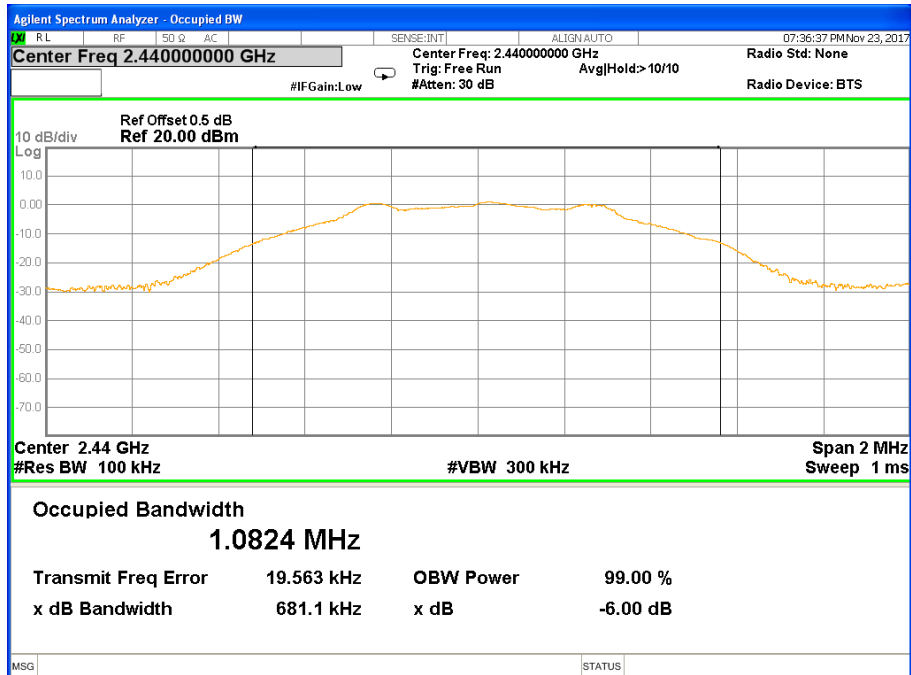
| Frequency | 6dB Bandwidth (MHz) | Channel Separation (MHz) | Result |
|-----------|---------------------|--------------------------|--------|
| 2402 MHz | 0.675 | >=500KHz | PASS |
| 2440 MHz | 0.681 | >=500KHz | PASS |
| 2480 MHz | 0.675 | >=500KHz | PASS |

TX CH 01

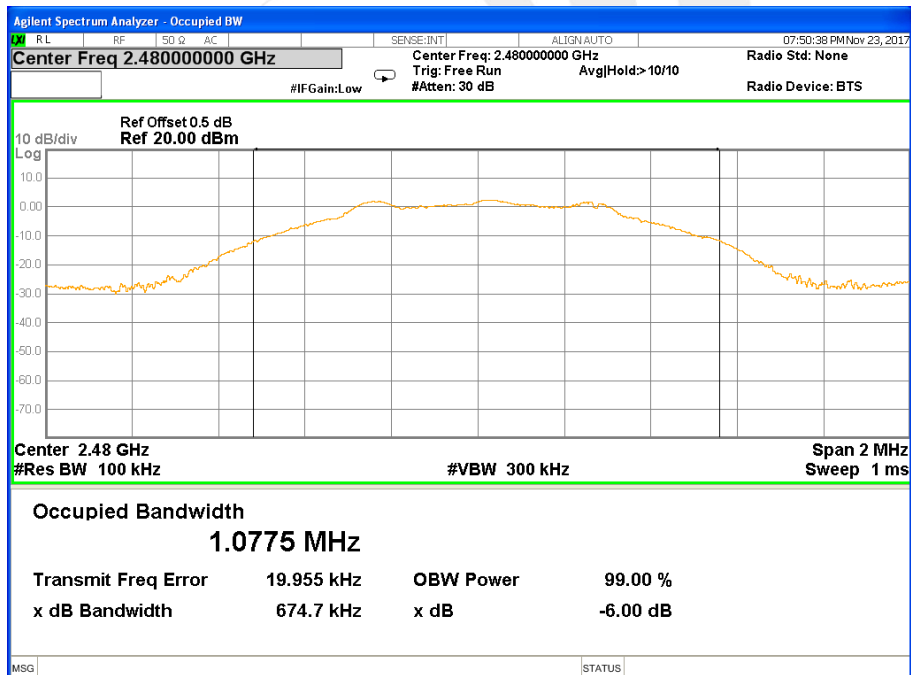




TX CH 20



TX CH 40





8. PEAK OUTPUT POWER TEST

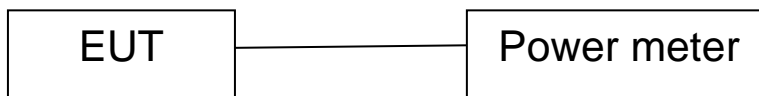
8.1 APPLIED PROCEDURES / LIMIT

| FCC Part 15.247, Subpart C | | | | |
|----------------------------|--------------|-----------------|-----------------------|--------|
| Section | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.247(b)(3) | Output Power | 1 watt or 30dBm | 2400-2483.5 | PASS |

8.2 TEST PROCEDURE

- a. The EUT was directly connected to the Power Meter

8.3 TEST SETUP



8.4 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



8.5 TEST RESULTS

| | | | |
|--------------|---------------------------|--------------------|---------|
| Temperature: | 25 °C | Relative Humidity: | 60% |
| Pressure: | 1012 hPa | Test Voltage: | DC 3.7V |
| Test Mode: | TX Mode /CH01, CH20, CH40 | | |

| TX Mode | | | | |
|--------------|-----------|------------------------|-----------|-------|
| Test Channel | Frequency | Conducted Output Power | | LIMIT |
| | (MHz) | Peak (dBm) | AVG (dBm) | dBm |
| CH01 | 2402 | 0.08 | -4.02 | 30 |
| CH20 | 2440 | 0.57 | -3.59 | 30 |
| CH40 | 2480 | 1.42 | -2.45 | 30 |



9. ANTENNA REQUIREMENT

9.1 STANDARD REQUIREMENT

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

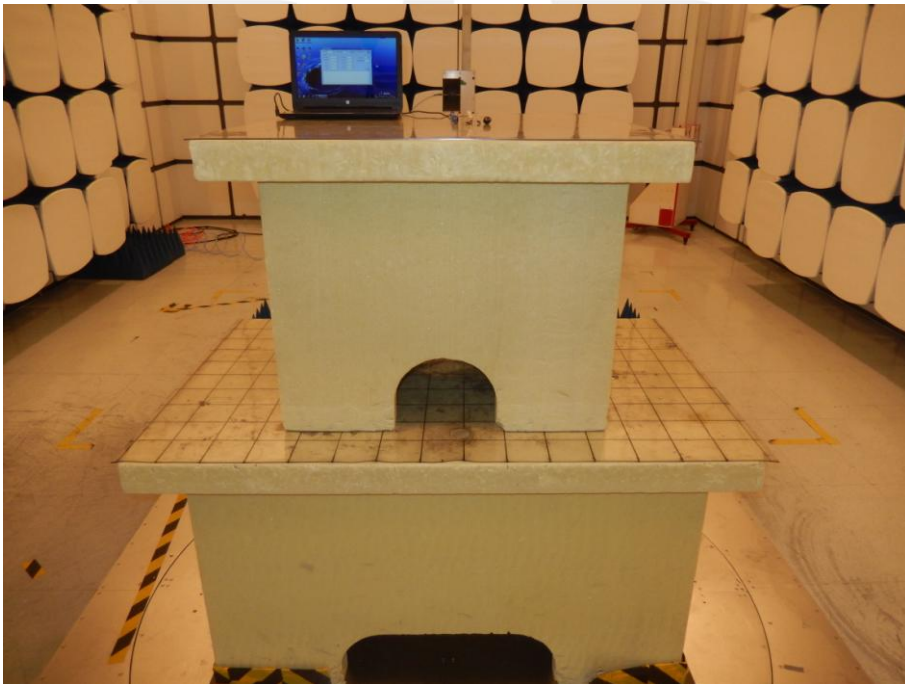
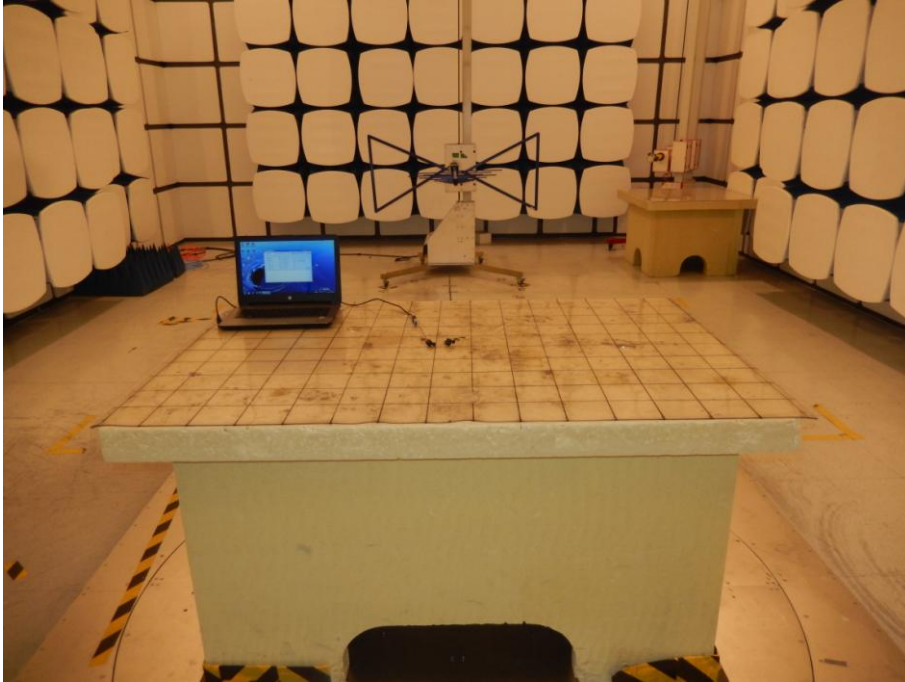
9.2 EUT ANTENNA

The EUT antenna is Ceramic Antenna. It comply with the standard requirement.



10. EUT TEST PHOTO

Radiated Measurement Photos





Conducted Measurement Photos



*****END OF THE REPORT*****

