



FCC Part 15C Test Report

FCC ID: 2AFBVCDW337632U01

| | |
|------------------|--|
| Product Name: | wifi module |
| Trademark: | N/A |
| Model Name : | CDW-337632U-01 |
| Prepared For : | QUBER Co., Ltd. |
| Address : | B-704 Samwhan Hipex, 230 Pangyoyeok-ro, Bundang-gu, Seongnam-si, South Korea |
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| Test Date: | Dec. 21 - Dec. 30, 2016 |
| Date of Report : | Dec. 30, 2016 |
| Report No.: | BCTC-FY161214092-2E |



CERTIFICATION


Applicant's name : **QUBER Co., Ltd.**
Address : B-704 Samwhan Hipex, 230 Pangyoyeok-ro, Bundang-gu,
Seongnam-si, South Korea
Manufacture's Name : **CHINA DRAGON TECHNOLOGY LIMITED**
Address : B4 Bidg.haosan No.1 Industry Park, Shajing street B shenzhen.
China


Product description

Product name : wifi module
Trademark : N/A
Model and/or type reference : CDW-337632U-01
Standards : FCC Part15.247
ANSI C63.10:2013

This device described above has been tested by BCTC, and 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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Testing Engineer : 
Eric Yang

Reviewer (Supervisor) : 
Simon Wang

Approved & Authorized Signer(Manager) : 


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. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

| FCC Part15 (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) | Peak Output Power | PASS | |
| 15.247 (c) | Radiated Spurious Emission | PASS | |
| 15.247 (d) | Power Spectral Density | PASS | |
| 15.205 | Band Edge Emission | PASS | |
| 15.203 | Antenna Requirement | PASS | |

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

**TEST FACILITY**

Shenzhen BCTC Technology Co., Ltd.

Add. : No.101,Yousong Road,Longhua New District, Shenzhen,China

FCC Registered No.: 187086

IC Registered No.: 12655A

MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expended 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 Test | $\pm 1.38\text{dB}$ |
| 2 | RF power,conducted | $\pm 0.16\text{dB}$ |
| 3 | Spurious emissions,conducted | $\pm 0.21\text{dB}$ |
| 4 | All emissions,radiated(<1G) | $\pm 4.68\text{dB}$ |
| 5 | All emissions,radiated(>1G) | $\pm 4.89\text{dB}$ |
| 6 | Temperature | $\pm 0.5^{\circ}\text{C}$ |
| 7 | Humidity | $\pm 2\%$ |



. GENERAL INFORMATION

GENERAL DESCRIPTION OF EUT

| | |
|---------------------|--|
| Equipment | wifi module |
| Trade Name | N/A |
| Model Name | CDW-337632U-01 |
| Serial Model | N/A |
| Model Difference | N/A |
| Product Description | The EUT is a wifi module |
| | Operation Frequency: BT BLE:2402~2480MHz |
| | Modulation Type: GFSK |
| | Bit Rate of Transmitter 2MHz |
| | Number Of Channel 40 CH |
| | Antenna Designation: Please see Note 3. |
| | Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual. |
| Channel List | Please refer to the Note 2. |
| Power Source | DC 3.3V |
| Adapter | N/A |
| hardware version | 132-337832U-00 |
| Software version | V1.0 |

Note:

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

2. Table for Filed Antenna

| Ant. | Brand | Model Name | Antenna Type | Gain (dBi) | NOTE |
|------|-------|------------|------------------|------------|------|
| 1 | N/A | N/A | External antenna | 2dBi | |

**DESCRIPTION OF TEST MODES**

| Pretest Mode | Description |
|--------------|------------------|
| Mode 1 | BT CH1/CH20/CH40 |
| Mode 2 | Link Mode |

| Conducted Emission | |
|--------------------|-------------|
| Final Test Mode | Description |
| Mode 2 | Link Mode |

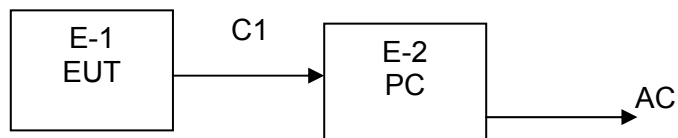
| For Radiated Emission | |
|-----------------------|------------------|
| Final Test Mode | Description |
| Mode 1 | BT CH1/CH20/CH40 |
| Mode 2 | Link Mode |

Note:

(1) The measurements are performed at all Bit Rate of Transmitter, the worst data was reported.

BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED Conducted/

Radiated Spurious Emission Test



**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. | Series No. | Note |
|------|-------------|-----------|----------------|------------|------------|
| E-1 | wifi module | N/A | CDW-337632U-01 | N/A | EUT |
| E-2 | PC | N/A | N/A | N/A | Peripheral |
| | | | | | |

| Item | Shielded Type | Ferrite Core | Length | Note |
|------|---------------|--------------|--------|-----------|
| C1 | NO | NO | 1.0m | USB cable |
| | | | | |

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.

**EQUIPMENTS LIST FOR ALL TEST ITEMS** For Conducted

Emission at the mains terminals Test

| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until | Calibration period |
|------|-------------------|--------------|----------|------------|------------------|------------------|--------------------|
| 1 | 843 Shielded Room | ChengYu | 843 Room | 843 | 2016.07.06 | 2017.07.05 | 1 year |
| 2 | EMI Receiver | R&S | ESCI | 101421 | 2016.06.07 | 2017.06.06 | 1 year |
| 3 | LISN | Schwarzbeck | NSLK8127 | 8127739 | 2016.07.06 | 2017.07.05 | 1 year |
| 4 | Attenuator | R&S | ESH3-Z2 | BCTC021E | 2016.06.07 | 2017.06.06 | 1 year |

Radiation test, Band-edge test and 20db bandwidth test equipment

| Item | Kind of Equipment | Manufacturer | Type No. | Serial No. | Last calibration | Calibrated until | Calibration period |
|------|--------------------|----------------|------------|--------------|------------------|------------------|--------------------|
| 1 | Spectrum Analyzer | Agilent | E4407B | MY45108040 | 2016.07.06 | 2017.07.05 | 1 year |
| 2 | Test Receiver | R&S | ESPI | 101318 | 2016.06.07 | 2017.06.06 | 1 year |
| 3 | Bilog Antenna | R&S | VULB 9168 | VULB9168-438 | 2016.07.06 | 2017.07.05 | 1 year |
| 4 | 50Ω Coaxial Switch | Anritsu | MP59B | 6200264416 | 2016.06.07 | 2017.06.06 | 1 year |
| 5 | Spectrum Analyzer | ADVANTEST | R3132 | 150900201 | 2016.06.07 | 2017.06.06 | 1 year |
| 6 | Horn Antenna | R&S | HF906 | 10027 | 2016.07.06 | 2017.07.05 | 1 year |
| 7 | Horn Ant | Schwarzbeck | BBHA 9170 | 9170-181 | 2016.07.06 | 2017.07.05 | 1 year |
| 8 | Amplifier | R&S | BBV9743 | 9743-019 | 2016.08.25 | 2017.08.24 | 1 year |
| 9 | Loop Antenna | ARA | PLA-1030/B | 1029 | 2016.06.08 | 2017.06.07 | 1 year |
| 10 | RF cables | R&S | R203 | R20X | 2016.07.06 | 2017.07.05 | 1 year |
| 11 | Antenna connector | Florida RFLabs | Lab-Fle | RF 01# | 2016.07.06 | 2017.07.05 | 1 year |



EMC EMISSION TEST

CONDUCTED EMISSION MEASUREMENT

POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)

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

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

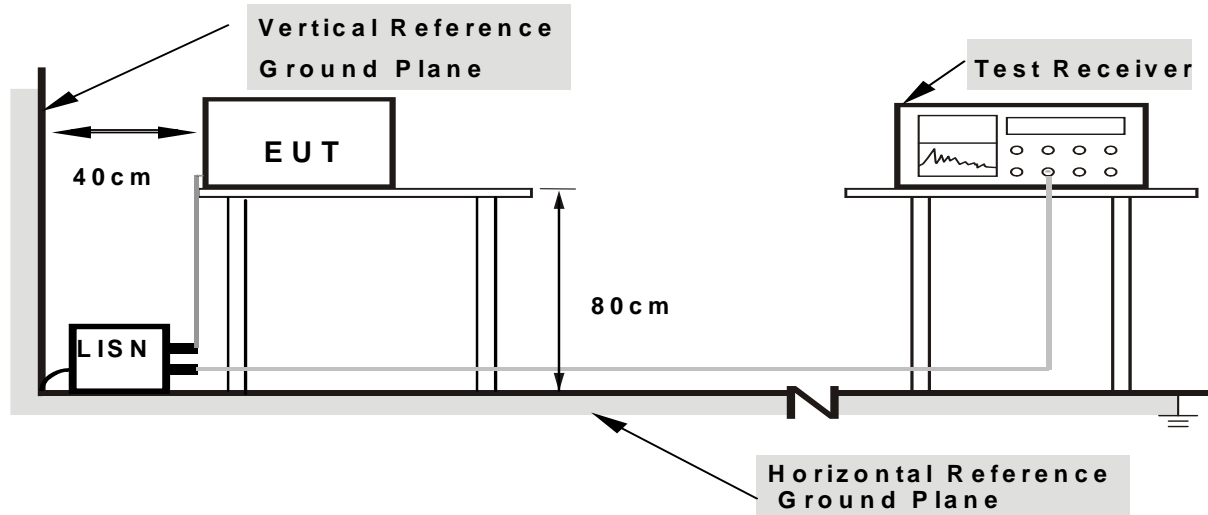
| Receiver Parameters | Setting |
|---------------------|----------|
| Attenuation | 10 dB |
| Start Frequency | 0.15 MHz |
| Stop Frequency | 30 MHz |
| IF Bandwidth | 9 kHz |

TEST PROCEDURE

- a. The EUT was placed 0.8 meters from the horizontal 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.

DEVIATION FROM TEST STANDARD No deviation

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 cm from other units and other metal planes

EUT OPERATING CONDITIONS

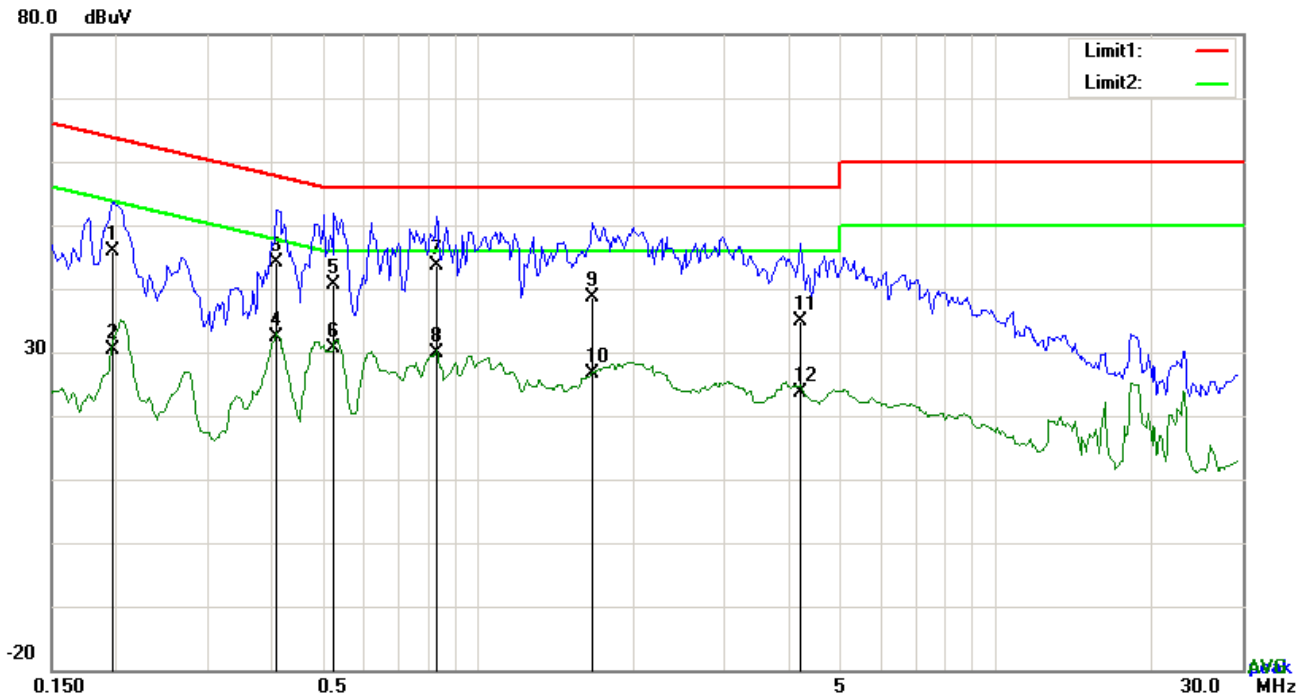
The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

We pretest AC 120V and AC 240V, the worst voltage was AC 120V and the data recording in the report.

TEST RESULTS



| | | | |
|----------------|--------------|---------------------|--------|
| Temperature : | 25 °C | Relative Humidity : | 54% |
| Pressure : | 1010hPa | Phase : | L |
| Test Voltage : | AC 120V/60Hz | Test Mode : | Mode 2 |



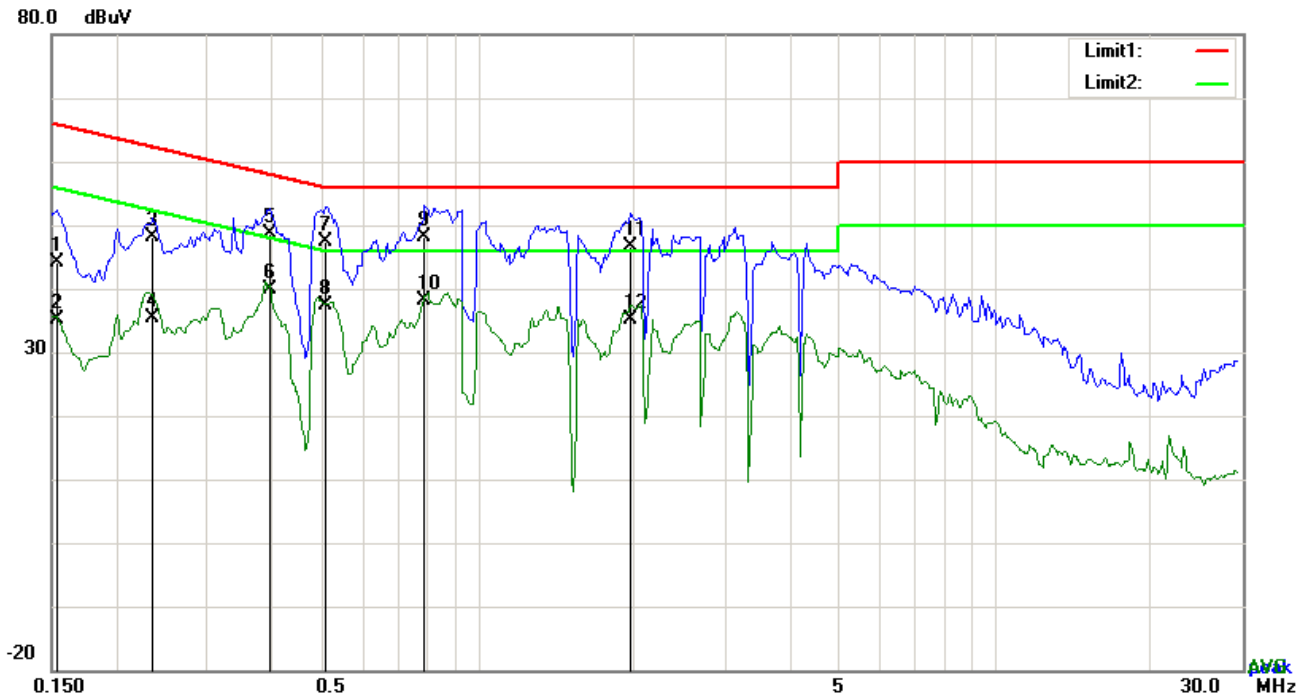
Test Data

Phase Neutral Plot at 120Vac, 60Hz

| No. | P/L | Frequency (MHz) | Reading (dBμV) | Detector | Corrected (dB) | Result (dBμV) | Limit (dBμV) | Margin (dB) |
|-----|-----|-----------------|----------------|----------|----------------|---------------|--------------|-------------|
| 1 | N | 0.1968 | 35.82 | QP | 10.02 | 45.84 | 63.74 | -17.90 |
| 2 | N | 0.1968 | 20.46 | AVG | 10.02 | 30.48 | 53.74 | -23.26 |
| 3 | N | 0.4074 | 34.04 | QP | 10.02 | 44.06 | 57.70 | -13.64 |
| 4 | N | 0.4074 | 22.43 | AVG | 10.02 | 32.45 | 47.70 | -15.25 |
| 5 | N | 0.5283 | 30.64 | QP | 10.02 | 40.66 | 56.00 | -15.34 |
| 6 | N | 0.5283 | 20.65 | AVG | 10.02 | 30.67 | 46.00 | -15.33 |
| 7 | N | 0.8325 | 33.72 | QP | 10.03 | 43.75 | 56.00 | -12.25 |
| 8 | N | 0.8325 | 19.84 | AVG | 10.03 | 29.87 | 46.00 | -16.13 |
| 9 | N | 1.6671 | 28.56 | QP | 10.04 | 38.60 | 56.00 | -17.40 |
| 10 | N | 1.6671 | 16.57 | AVG | 10.04 | 26.61 | 46.00 | -19.39 |
| 11 | N | 4.1973 | 24.77 | QP | 10.06 | 34.83 | 56.00 | -21.17 |
| 12 | N | 4.1973 | 13.49 | AVG | 10.06 | 23.55 | 46.00 | -22.45 |



| | | | |
|----------------|--------------|---------------------|--------|
| Temperature : | 25 °C | Relative Humidity : | 54% |
| Pressure : | 1010hPa | Phase : | N |
| Test Voltage : | AC 120V/60Hz | Test Mode : | Mode 2 |



Test Data

Phase Line Plot at 120Vac, 60Hz

| No. | P/L | Frequency (MHz) | Reading (dBμV) | Detector | Corrected (dB) | Result (dBμV) | Limit (dBμV) | Margin (dB) |
|-----|-----|-----------------|----------------|----------|----------------|---------------|--------------|-------------|
| 1 | L1 | 0.1539 | 34.22 | QP | 10.03 | 44.25 | 65.79 | -21.54 |
| 2 | L1 | 0.1539 | 25.04 | AVG | 10.03 | 35.07 | 55.79 | -20.72 |
| 3 | L1 | 0.2358 | 38.09 | QP | 10.03 | 48.12 | 62.24 | -14.12 |
| 4 | L1 | 0.2358 | 25.38 | AVG | 10.03 | 35.41 | 52.24 | -16.83 |
| 5 | L1 | 0.3957 | 38.68 | QP | 10.03 | 48.71 | 57.94 | -9.23 |
| 6 | L1 | 0.3957 | 29.86 | AVG | 10.03 | 39.89 | 47.94 | -8.05 |
| 7 | L1 | 0.5088 | 37.34 | QP | 10.03 | 47.37 | 56.00 | -8.63 |
| 8 | L1 | 0.5088 | 27.44 | AVG | 10.03 | 37.47 | 46.00 | -8.53 |
| 9 | L1 | 0.7896 | 38.00 | QP | 10.03 | 48.03 | 56.00 | -7.97 |
| 10 | L1 | 0.7896 | 28.22 | AVG | 10.03 | 38.25 | 46.00 | -7.75 |
| 11 | L1 | 1.9791 | 36.65 | QP | 10.04 | 46.69 | 56.00 | -9.31 |
| 12 | L1 | 1.9791 | 25.11 | AVG | 10.04 | 35.15 | 46.00 | -10.85 |

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

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

| Frequencies (MHz) | Field Strength (microvolt/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) | Class B (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).

| Spectrum Parameter | Setting |
|---------------------------------------|--|
| Attenuation | Auto |
| Start Frequency | 1000 MHz |
| Stop Frequency | 25GHz |
| RB / VB (emission in restricted band) | 1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average |

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



TEST PROCEDURE Below 1GHz test

procedure as below:

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Above 1GHz test procedure as below:

- g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 metre to 1.5 metre(Above 18GHz the distance is 1 meter and table is 1.5 metre).
- h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel

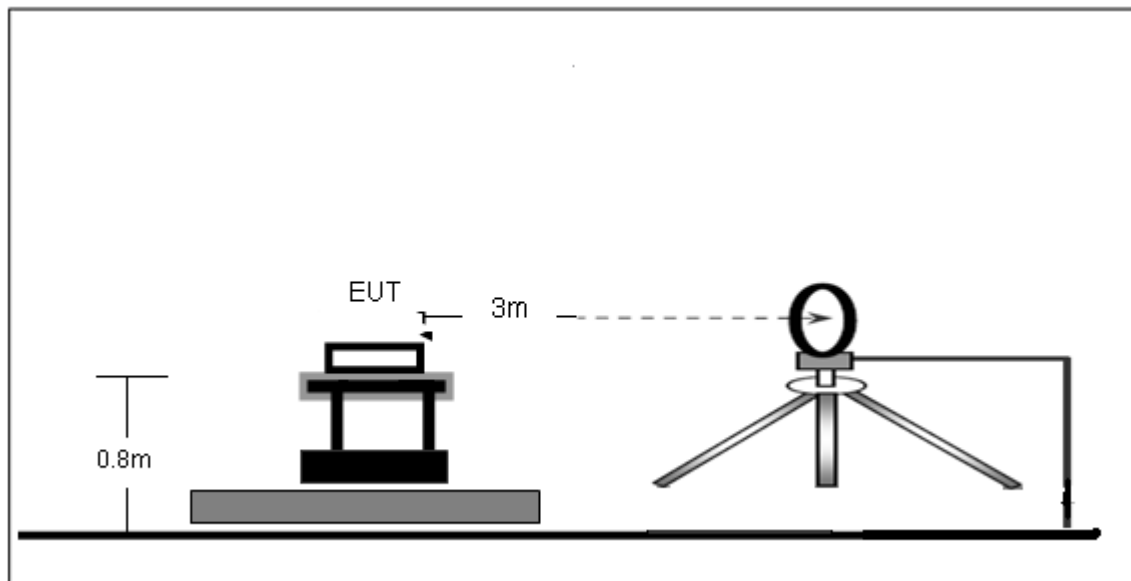
Note:

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

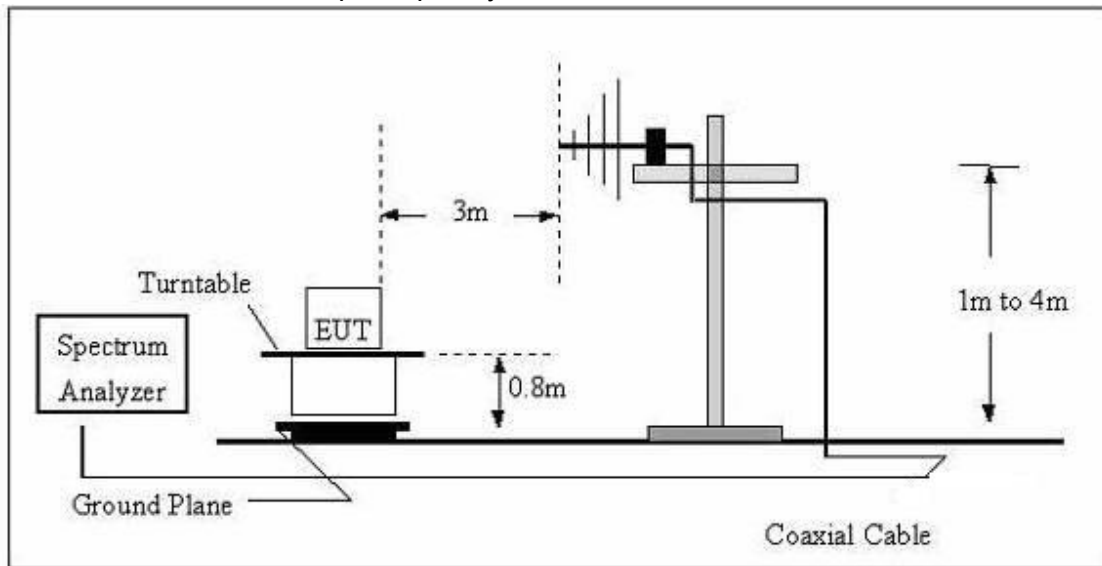
DEVIATION FROM TEST STANDARD No deviation

TEST SETUP

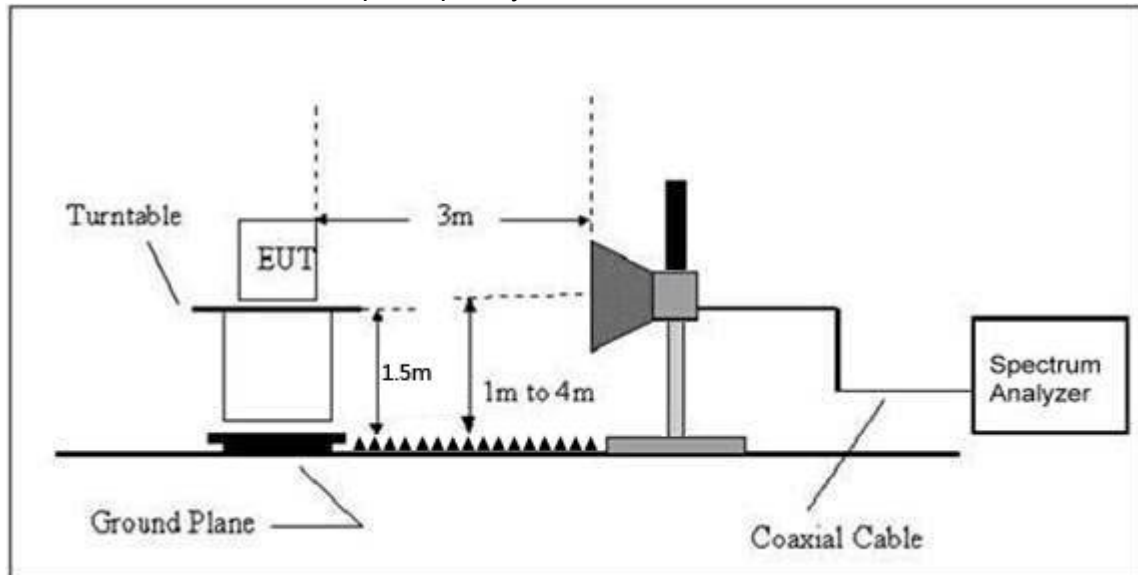
(A) Radiated Emission Test-Up Frequency Below 30MHz



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



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



EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

**TEST RESULTS (BETWEEN 9KHZ – 30 MHZ)**

| | | | |
|--------------|----------|--------------------|---------|
| Temperature: | 20℃ | Relative Humidity: | 48% |
| Pressure: | 1010 hPa | Test Voltage : | DC 3.3V |
| Test Mode : | Mode 1 | Polarization : | -- |

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

NOTE:

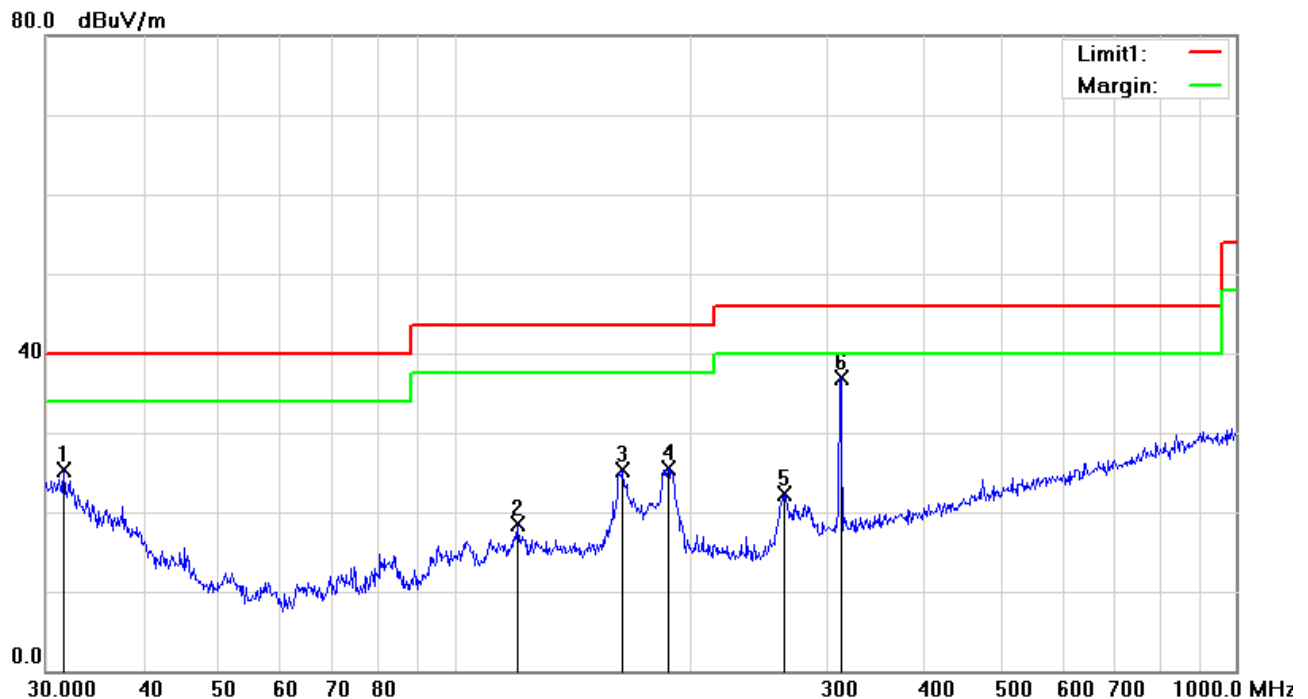
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

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

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

**TEST RESULTS (BETWEEN 30MHZ – 1GHZ)**

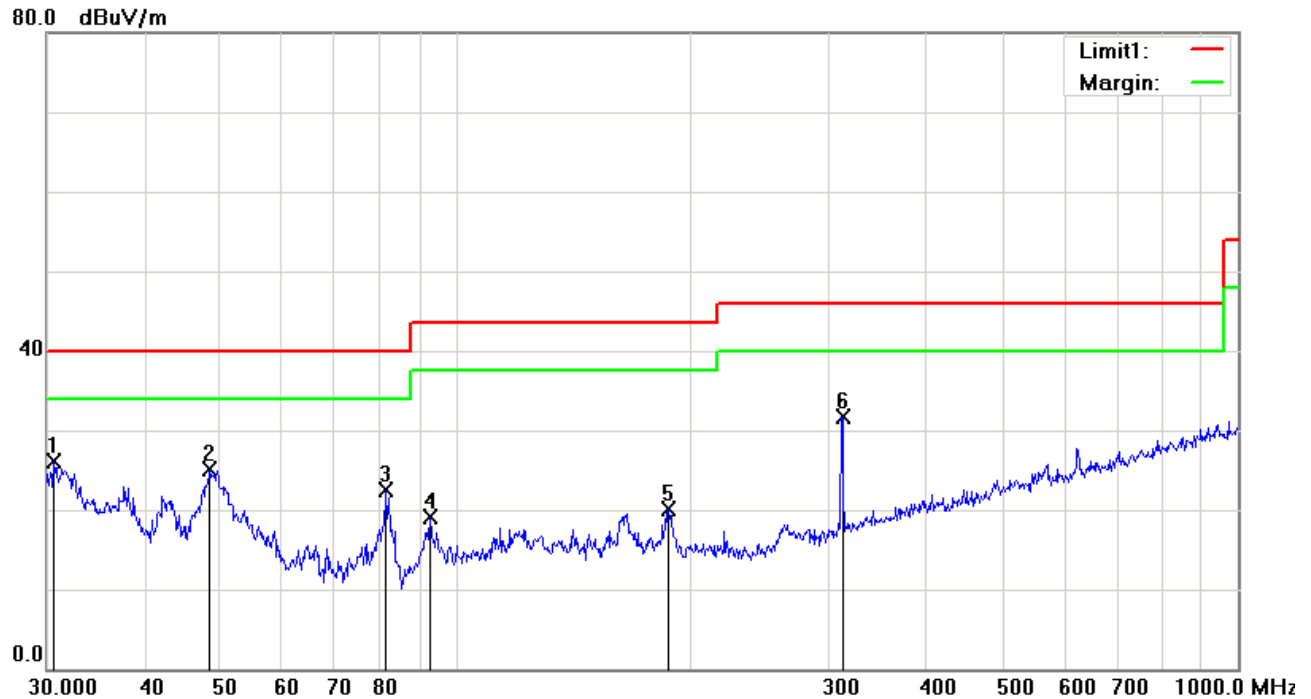
| | | | |
|----------------|----------|---------------------|------------|
| Temperature : | 26℃ | Relative Humidity : | 54% |
| Pressure : | 1010 hPa | Polarization : | Horizontal |
| Test Voltage : | DC 3.3V | | |
| Test Mode : | Mode 1 | | |

*Test Data***Vertical Polarity Plot @3m**

| No | P/L | Frequency (MHz) | Reading (dBμV) | Detector | Corrected (dB) | Result (dBμV) | Limit (dBμV) | Margin (dB) | Height | Degree |
|----|-----|-----------------|----------------|----------|----------------|---------------|--------------|-------------|--------|--------|
| 1 | H | 31.6202 | 26.79 | peak | -1.45 | 25.34 | 40.00 | -14.66 | 100 | 358 |
| 2 | H | 120.2766 | 25.77 | peak | -7.32 | 18.45 | 43.50 | -25.05 | 100 | 251 |
| 3 | H | 164.3302 | 33.86 | peak | -8.64 | 25.22 | 43.50 | -18.28 | 100 | 270 |
| 4 | H | 187.7530 | 34.96 | peak | -9.37 | 25.59 | 43.50 | -17.91 | 100 | 222 |
| 5 | H | 263.8190 | 30.77 | peak | -8.56 | 22.21 | 46.00 | -23.79 | 100 | 342 |
| 6 | H | 312.1794 | 43.49 | peak | -6.55 | 36.94 | 46.00 | -9.06 | 100 | 359 |



| | | | |
|----------------|----------|---------------------|----------|
| Temperature : | 26℃ | Relative Humidity : | 54% |
| Pressure : | 1010 hPa | Polarization : | Vertical |
| Test Voltage : | DC 3.3V | | |
| Test Mode : | Mode 1 | | |



Test Data

Horizontal Polarity Plot @3m

| No | P/L | Frequency (MHz) | Reading (dBμV) | Detector | Corrected (dB) | Result (dBμV) | Limit (dBμV) | Margin (dB) | Height | Degree |
|----|-----|-----------------|----------------|----------|----------------|---------------|--------------|-------------|--------|--------|
| 1 | V | 30.6379 | 26.86 | peak | -0.73 | 26.13 | 40.00 | -13.87 | 100 | 357 |
| 2 | V | 48.5016 | 37.54 | peak | -12.50 | 25.04 | 40.00 | -14.96 | 100 | 263 |
| 3 | V | 81.4970 | 36.26 | peak | -13.69 | 22.57 | 40.00 | -17.43 | 100 | 172 |
| 4 | V | 92.7872 | 31.72 | peak | -12.68 | 19.04 | 43.50 | -24.46 | 100 | 119 |
| 5 | V | 187.0958 | 29.59 | peak | -9.42 | 20.17 | 43.50 | -23.33 | 100 | 236 |
| 6 | V | 312.1794 | 38.24 | peak | -6.55 | 31.69 | 46.00 | -14.31 | 100 | 217 |

**TEST RESULTS (1GHZ~25GHZ)****Low Channel (2402 MHz)**

| Frequency (MHz) | S.A. Reading (dBμV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Cord. Amp. (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|---------------------|------------------|----------------|--------------------|-----------------|--------------------|---------------------|----------------|-------------|
| 3332.22 | 37.44 | AV | V | 33.63 | 6.74 | 31.68 | 46.13 | 54 | -7.87 |
| 3332.22 | 32.11 | AV | H | 33.63 | 6.74 | 31.68 | 40.8 | 54 | -13.2 |
| 4804.00 | 38.49 | AV | V | 33.83 | 6.86 | 31.72 | 47.46 | 54 | -6.54 |
| 4804.00 | 37.92 | AV | H | 33.83 | 6.86 | 31.72 | 46.89 | 54 | -7.11 |
| 7206.00 | 39.35 | AV | V | 34.32 | 6.95 | 31.84 | 48.78 | 54 | -5.22 |
| 7206.00 | 36.22 | AV | H | 34.32 | 6.95 | 31.84 | 45.65 | 54 | -8.35 |
| 3332.22 | 42.69 | AV | V | 33.63 | 6.74 | 31.68 | 51.38 | 74 | -22.62 |
| 3332.22 | 40.58 | AV | H | 33.63 | 6.74 | 31.68 | 49.27 | 74 | -24.73 |
| 4804.00 | 47.65 | PK | V | 33.83 | 6.86 | 31.72 | 56.62 | 74 | -17.38 |
| 4804.00 | 47.18 | PK | H | 33.83 | 6.86 | 31.72 | 56.15 | 74 | -17.85 |
| 7206.00 | 46.54 | PK | V | 34.32 | 6.95 | 31.84 | 55.97 | 74 | -18.03 |
| 7206.00 | 42.05 | PK | H | 34.32 | 6.95 | 31.84 | 51.48 | 74 | -22.52 |

Middle Channel (2440 MHz)

| Frequency (MHz) | S.A. Reading (dBμV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Cord. Amp. (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|---------------------|------------------|----------------|--------------------|-----------------|--------------------|---------------------|----------------|-------------|
| 3260.64 | 36.88 | AV | V | 33.62 | 6.72 | 31.64 | 45.58 | 54 | -8.42 |
| 3260.64 | 31.81 | AV | H | 33.62 | 6.72 | 31.64 | 40.51 | 54 | -13.49 |
| 4880.00 | 38.53 | AV | V | 33.86 | 6.82 | 31.82 | 47.39 | 54 | -6.61 |
| 4880.00 | 37.88 | AV | H | 33.86 | 6.82 | 31.82 | 46.74 | 54 | -7.26 |
| 7320.00 | 37.58 | AV | V | 34.54 | 6.98 | 31.88 | 52.22 | 54 | -6.88 |
| 7320.00 | 36.30 | AV | H | 34.54 | 6.98 | 31.88 | 50.94 | 54 | -8.06 |
| 3260.64 | 46.52 | AV | V | 33.62 | 6.72 | 31.64 | 55.22 | 74 | -18.78 |
| 3260.64 | 46.23 | AV | H | 33.62 | 6.72 | 31.64 | 54.93 | 74 | -19.07 |
| 4880.00 | 47.56 | AV | V | 33.86 | 6.82 | 31.82 | 56.42 | 74 | -17.58 |
| 4880.00 | 47.22 | AV | H | 33.86 | 6.82 | 31.82 | 56.08 | 74 | -17.92 |



| | | | | | | | | | |
|---------|-------|----|---|-------|------|-------|-------|----|--------|
| 7320.00 | 52.65 | PK | V | 34.54 | 6.98 | 31.88 | 62.29 | 74 | -11.71 |
| 7320.00 | 52.51 | PK | H | 34.54 | 6.98 | 31.88 | 62.15 | 74 | -11.85 |

High Channel (2480 MHz)

| Frequency (MHz) | S.A. Reading (dBμV) | Detector (PK/AV) | Polarity (H/V) | Ant. Factor (dB/m) | Cable Loss (dB) | Pre-Amp. Gain (dB) | Cord. Amp. (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|---------------------|------------------|----------------|--------------------|-----------------|--------------------|---------------------|----------------|-------------|
| 3155.25 | 35.48 | AV | V | 33.15 | 6.67 | 31.58 | 43.72 | 54 | -10.28 |
| 3155.25 | 34.25 | AV | H | 33.15 | 6.67 | 31.58 | 42.49 | 54 | -11.51 |
| 4960.00 | 38.47 | AV | V | 33.90 | 6.76 | 31.92 | 47.21 | 54 | -6.79 |
| 4960.00 | 37.93 | AV | H | 33.90 | 6.76 | 31.92 | 46.67 | 54 | -7.33 |
| 7440.00 | 35.64 | AV | V | 34.60 | 7.02 | 31.98 | 45.28 | 54 | -8.72 |
| 7440.00 | 34.58 | AV | H | 34.60 | 7.02 | 31.98 | 44.22 | 54 | -9.78 |
| 3155.25 | 45.12 | PK | V | 33.15 | 6.67 | 31.58 | 53.36 | 74 | -20.64 |
| 3155.25 | 45.05 | PK | H | 33.15 | 6.67 | 31.58 | 53.29 | 74 | -20.71 |
| 4960.00 | 47.48 | PK | V | 33.90 | 6.76 | 31.92 | 56.22 | 74 | -17.78 |
| 4960.00 | 47.14 | PK | H | 33.90 | 6.76 | 31.92 | 55.88 | 74 | -18.12 |
| 7440.00 | 43.24 | PK | V | 34.60 | 7.02 | 31.98 | 52.88 | 74 | -21.12 |
| 7440.00 | 44.15 | PK | H | 34.60 | 7.02 | 31.98 | 53.79 | 74 | -20.21 |

Note:

1, The testing has been conformed to $10 \times 2480 \text{ MHz} = 24,800 \text{ MHz}$

2, All other emissions more than 30 dB below the limit



3.3 RADIATED BAND EMISSION MEASUREMENT

3.3.1 TEST REQUIREMENT:

RSS-247 5.5

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

| FREQUENCY (MHz) | Class B (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).

| Spectrum Parameter | Setting |
|---------------------------------------|--|
| Attenuation | Auto |
| Start Frequency | 2300MHz |
| Stop Frequency | 2520 |
| RB / VB (emission in restricted band) | 1 MHz / 1 MHz for Peak, 1 MHz / 10Hz for Average |

3.3.2 TEST PROCEDURE

Above 1GHz test procedure as below:

- a. 1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel,the Highest channel

Note:

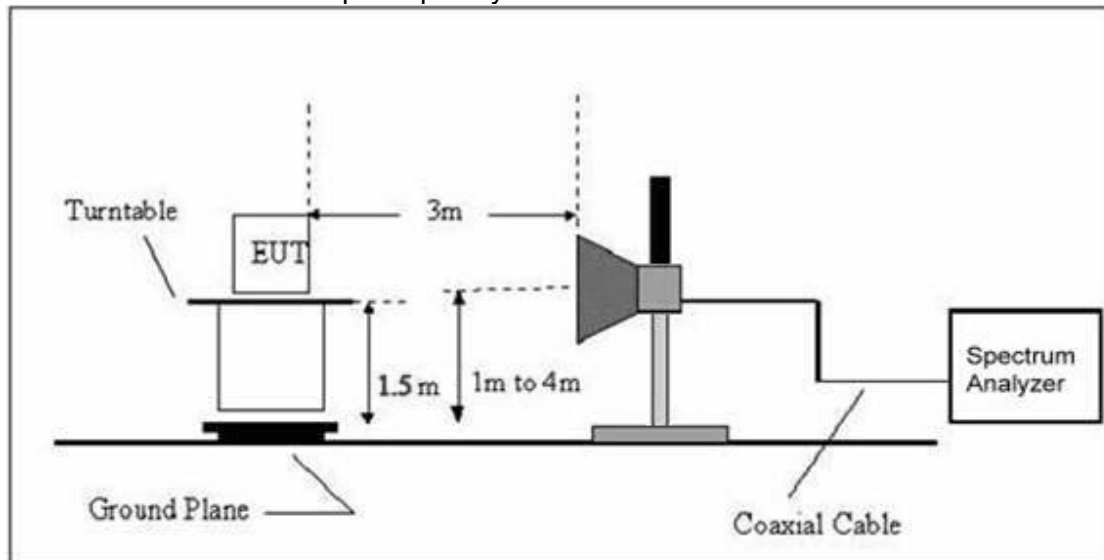
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported

3.3.3 DEVIATION FROM TEST STANDARD

No deviation

3.3.4 TEST SETUP

Radiated Emission Test-Up Frequency Above 1GHz



3.3.5 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.



3.3.6 TEST RESULT

BLE

| Polar (H/V) | Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|--------------------------|-----------|------------------|--------|-------------------|----------|--------|------------------|
| | (MHz) | (dBuV) | (dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| operation frequency:2402 | | | | | | | |
| V | 2390.00 | 37.58 | 13.83 | 51.41 | 74.00 | -22.59 | PK |
| V | 2390.00 | 26.11 | 13.83 | 39.94 | 54.00 | -14.06 | AV |
| V | 2400.00 | 37.79 | 13.85 | 51.64 | 74.00 | -22.36 | PK |
| V | 2400.00 | 25.69 | 13.85 | 39.54 | 54.00 | -14.46 | AV |
| H | 2390.00 | 37.88 | 13.83 | 51.71 | 74.00 | -22.29 | PK |
| H | 2390.00 | 26.13 | 13.83 | 39.96 | 54.00 | -14.04 | AV |
| H | 2400.00 | 37.74 | 13.85 | 51.59 | 74.00 | -22.41 | PK |
| H | 2400.00 | 26.08 | 13.85 | 39.93 | 54.00 | -14.07 | AV |

| Polar (H/V) | Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Detector Type |
|--------------------------|-----------|------------------|--------|-------------------|----------|--------|------------------|
| | (MHz) | (dBuV) | (dB) | (dBuV/m) | (dBuV/m) | (dB) | |
| operation frequency:2480 | | | | | | | |
| V | 2483.50 | 37.79 | 14.02 | 51.81 | 74.00 | -22.19 | PK |
| V | 2483.50 | 26.35 | 14.02 | 40.37 | 54.00 | -13.63 | AV |
| V | 2500.00 | 37.73 | 14.06 | 51.79 | 74.00 | -22.21 | PK |
| V | 2500.00 | 25.79 | 14.06 | 39.85 | 54.00 | -14.15 | AV |
| H | 2483.50 | 37.92 | 14.02 | 51.94 | 74.00 | -22.06 | PK |
| H | 2483.50 | 26.39 | 14.02 | 40.41 | 54.00 | -13.59 | AV |
| H | 2500.00 | 37.53 | 14.06 | 51.59 | 74.00 | -22.41 | PK |
| H | 2500.00 | 26.64 | 14.06 | 40.70 | 54.00 | -13.30 | AV |

Remark:

1. Emission Level = Meter Reading + Factor, Margin= Emission Level - Limit
2. If peak below the average limit, the average emission was no test.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.



. POWER SPECTRAL DENSITY TEST APPLIED

PROCEDURES / LIMIT

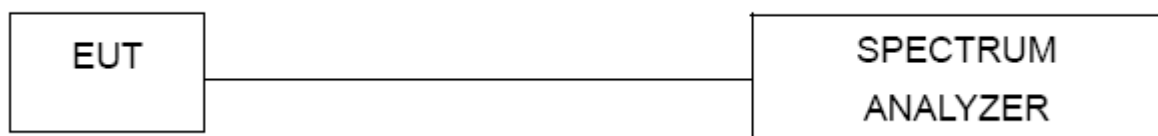
| FCC Part15 (15.247) , Subpart C | | | | |
|---------------------------------|------------------------|------------------------|-----------------------|--------|
| Section | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.247 | Power Spectral Density | 8 dBm (in any 3KHz) | 2400-2483.5 | PASS |

TEST PROCEDURE

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
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 within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

DEVIATION FROM STANDARD No deviation.

TEST SETUP



EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.1 Unless otherwise a special operating condition is specified in the follows during the testing.

**TEST RESULTS**

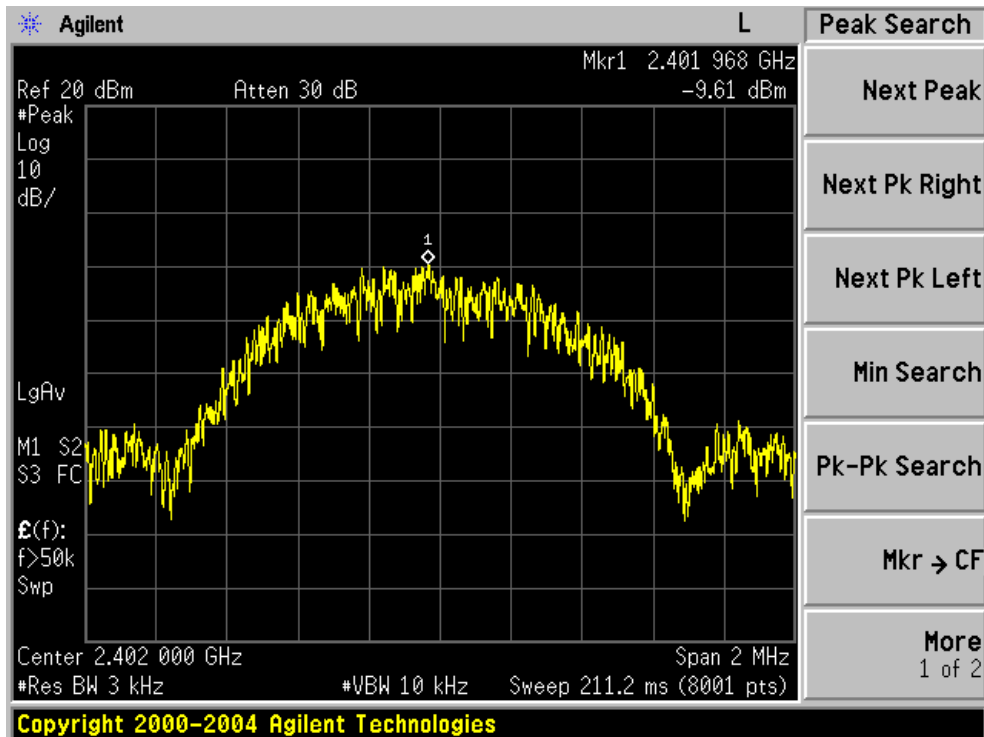
| | | | |
|---------------|----------|---------------------|---------|
| Temperature : | 25°C | Relative Humidity : | 60% |
| Pressure : | 1015 hPa | Test Voltage : | DC 3.3V |
| Test Mode : | BT | | |

| Frequency | Power Spectral Density(dBm) | Limit (dBm) | Result |
|-----------|-----------------------------|-------------|--------|
| 2402 MHz | -9.61 | 8 | PASS |
| 2440 MHz | -8.74 | 8 | PASS |
| 2480 MHz | -8.07 | 8 | PASS |



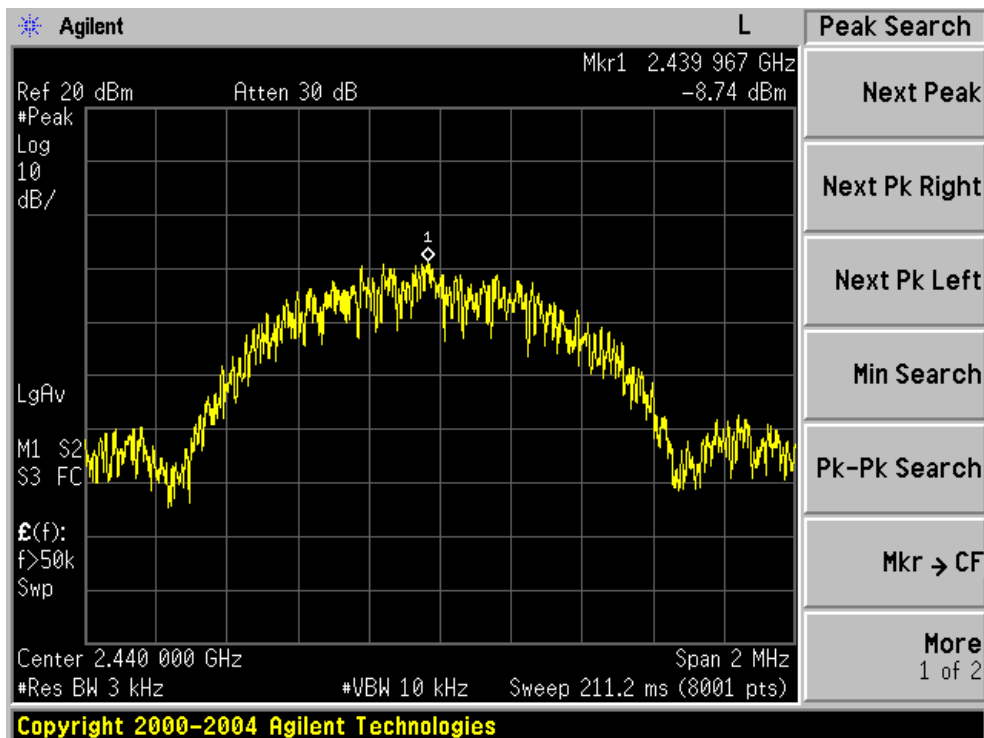
Power spectral density plot on channel 00

1Mbps



Power spectral density plot on channel 19

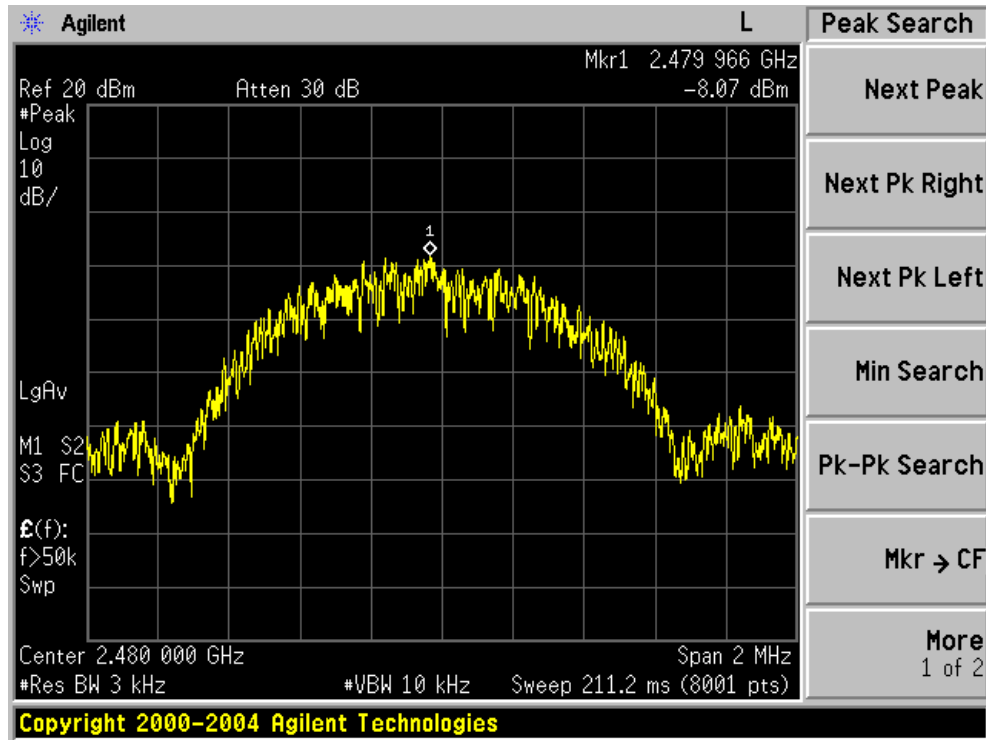
1Mbps





Power spectral density plot on channel 39

1Mbps





. BANDWIDTH TEST

APPLIED PROCEDURES / LIMIT

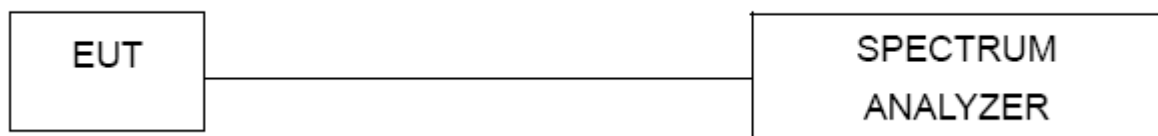
| FCC Part15 (15.247) , Subpart C | | | | |
|---------------------------------|-----------|---|-----------------------|--------|
| Section | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.247(a)(2) | Bandwidth | $\geq 500\text{KHz}$ (6dB bandwidth) | 2400-2483.5 | PASS |

TEST PROCEDURE

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) $\geq 3 \times \text{RBW}$.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. 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.

DEVIATION FROM STANDARD No deviation.

TEST SETUP



EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

**TEST RESULTS**

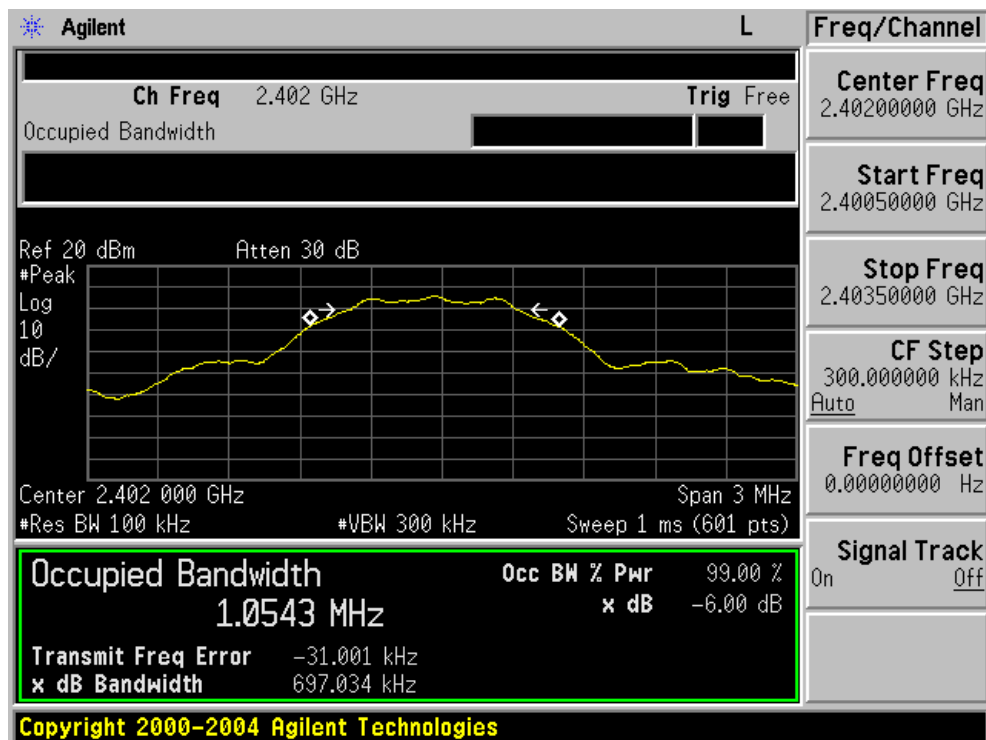
| | | | |
|---------------|----------|---------------------|---------|
| Temperature : | 25℃ | Relative Humidity : | 60% |
| Pressure : | 1012 hPa | Test Voltage : | DC 3.3V |
| Test Mode : | BT | | |

| Frequency (MHz) | 6dB bandwidth (kHz) | Limit (kHz) | Result |
|--------------------|------------------------|----------------|--------|
| 2402 | 697.034 | 500 | Pass |
| 2440 | 690.467 | 500 | Pass |
| 2480 | 696.241 | 500 | Pass |



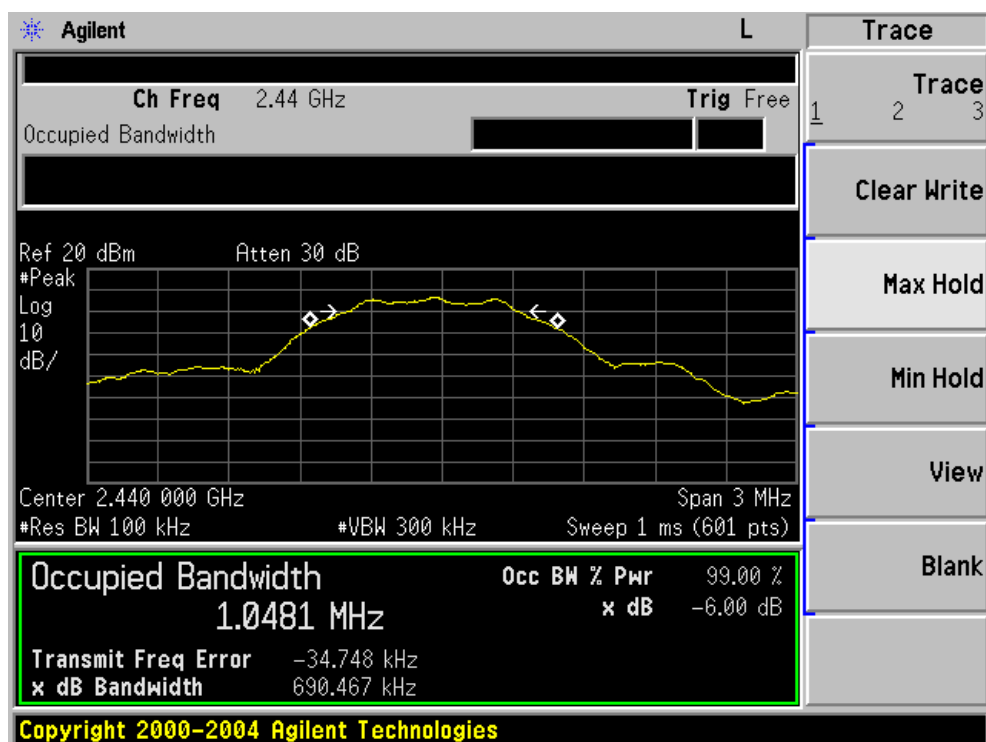
6dB Bandwidth plot on channel 00

1Mbps(GFSK)



6dB Bandwidth plot on channel 19

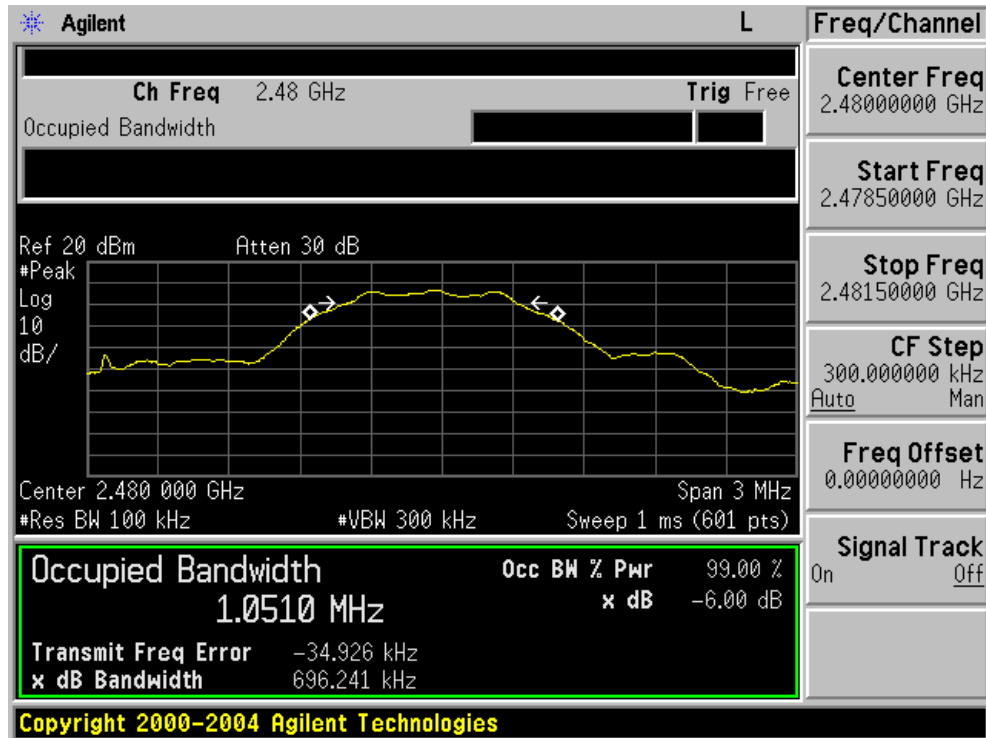
1Mbps(GFSK)





6dB Bandwidth plot on channel 39

1Mbps(GFSK)



**. PEAK OUTPUT POWER TEST APPLIED****PROCEDURES / LIMIT**

| FCC Part15 (15.247) , Subpart C | | | | |
|---------------------------------|-------------------|-----------------|-----------------------|--------|
| Section | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.247(b)(3) | Peak Output Power | 1 watt or 30dBm | 2400-2483.5 | PASS |

TEST PROCEDURE

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

DEVIATION FROM STANDARD No deviation.

TEST SETUP**EUT OPERATION CONDITIONS**

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

**TEST RESULTS**

| | | | |
|---------------|----------|---------------------|---------|
| Temperature : | 25℃ | Relative Humidity : | 60% |
| Pressure : | 1012 hPa | Test Voltage : | DC 3.3V |

| | Frequency | Maximum Conducted Output Power(PK) | LIMIT |
|--------|-----------|---------------------------------------|-------|
| | (MHz) | (dBm) | dBm |
| BT BLE | 2402 | 1.02 | 30 |
| | 2440 | 1.43 | 30 |
| | 2480 | 2.98 | 30 |



DUTY CYCLE APPLICABLE STANDARD

According to KDB 558074)6)b), issued Apr. 8, 2016

CONFORMANCE LIMIT

No limit requirement.

MEASURING INSTRUMENTS

The Measuring equipment is listed in the section 6.3 of this test report.

TEST SETUP

Please refer to Section 6.1 of this test report.

TEST PROCEDURE

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW \geq OBW if possible; otherwise, set RBW to the largest available value. Set VBW \geq RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are $> 50/T$ and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if $T \leq 16.7$ microseconds.)

The transmitter output is connected to the Spectrum Analyzer. We tested according to the zero-span measurement method, 6.0)b) in KDB 558074(issued 06/09/2015)

The largest available value of RBW is 8 MHz and VBW is 50 MHz. The zero-span method of measuring duty cycle shall not be used if $T \leq 6.25$ microseconds. ($50/6.25 = 8$)

The zero-span method was used because all measured T data are > 6.25 microseconds and both RBW and VBW are $> 50/T$.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator.

The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously.

The EUT was operating in controlled its channel.

Use the following spectrum analyzer settings:

Span = Zero Span

RBW = 8MHz(the largest available value)

VBW = 8MHz (\geq RBW)

Number of points in Sweep > 100

Detector function = peak

Trace = Clear write

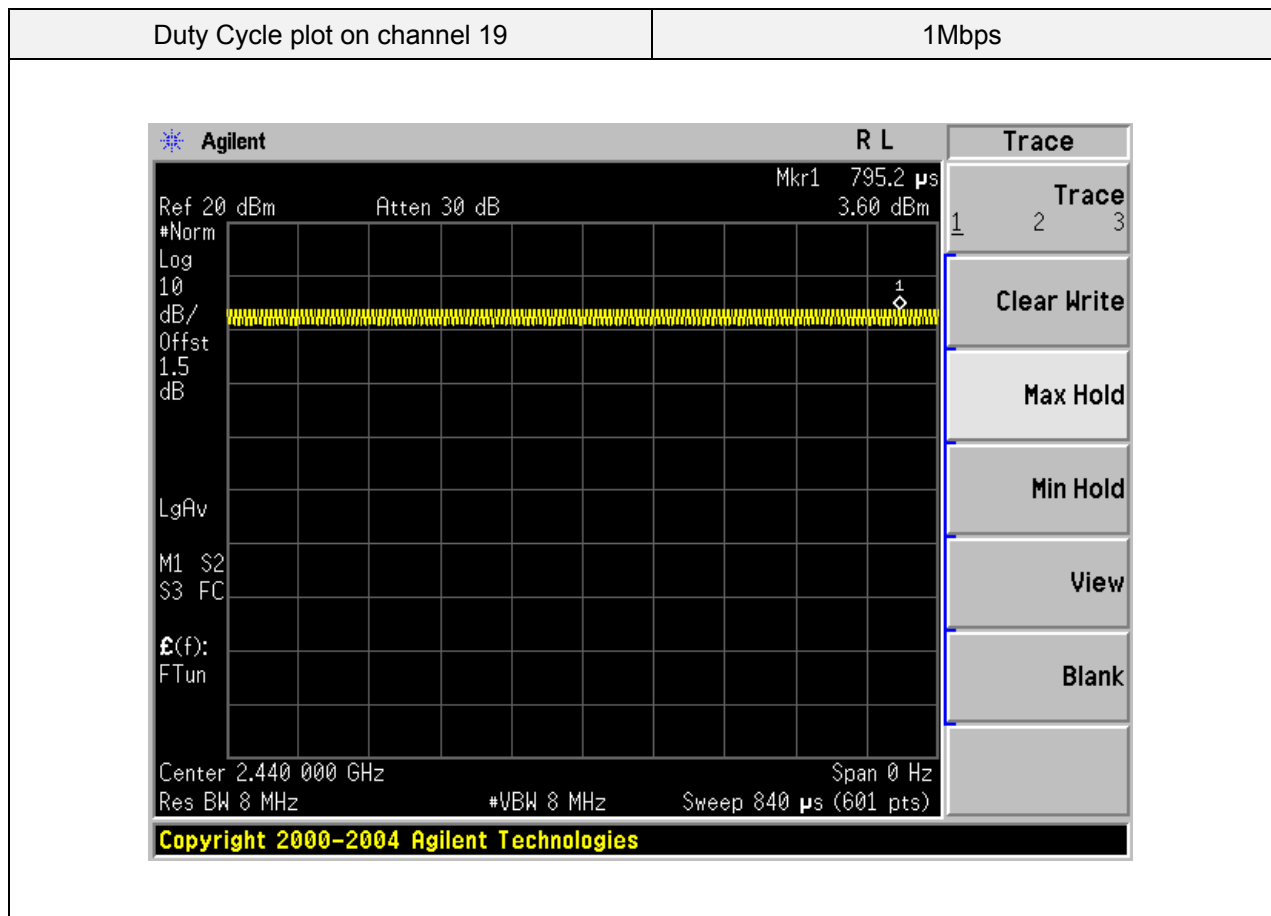
Measure T_{total} and T_{on}

Calculate Duty Cycle = T_{on} / T_{total} and Duty Cycle Factor = $10 * \log(1/Duty\ Cycle)$

**TEST RESULTS**

| | | | |
|--------------|--------|--------------------|------------|
| Temperature: | 20 °C | Relative Humidity: | 48% |
| Test Mode: | Mode 2 | Test By: | Eileen Liu |

| | | | | | |
|-----------------|-----------|-----------------|--------------------|------------|------------------------|
| Modulation Mode | Data rate | T _{on} | T _{total} | Duty Cycle | Duty Cycle Factor (dB) |
| GFSK | 1Mbps | - | - | 100% | 0 |





. 100 KHZ BANDWIDTH OF FREQUENCY BAND EDGE

7.1 APPLICABLE STANDARD

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

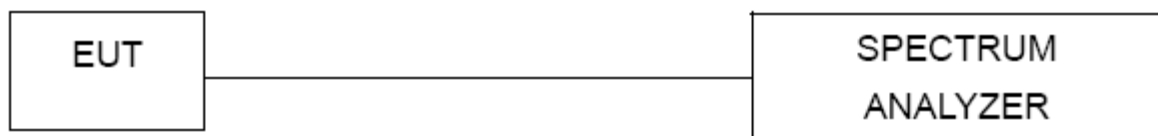
7.2 TEST PROCEDURE

- a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- c) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- d) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- e) Repeat above procedures until all measured frequencies were complete.

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP



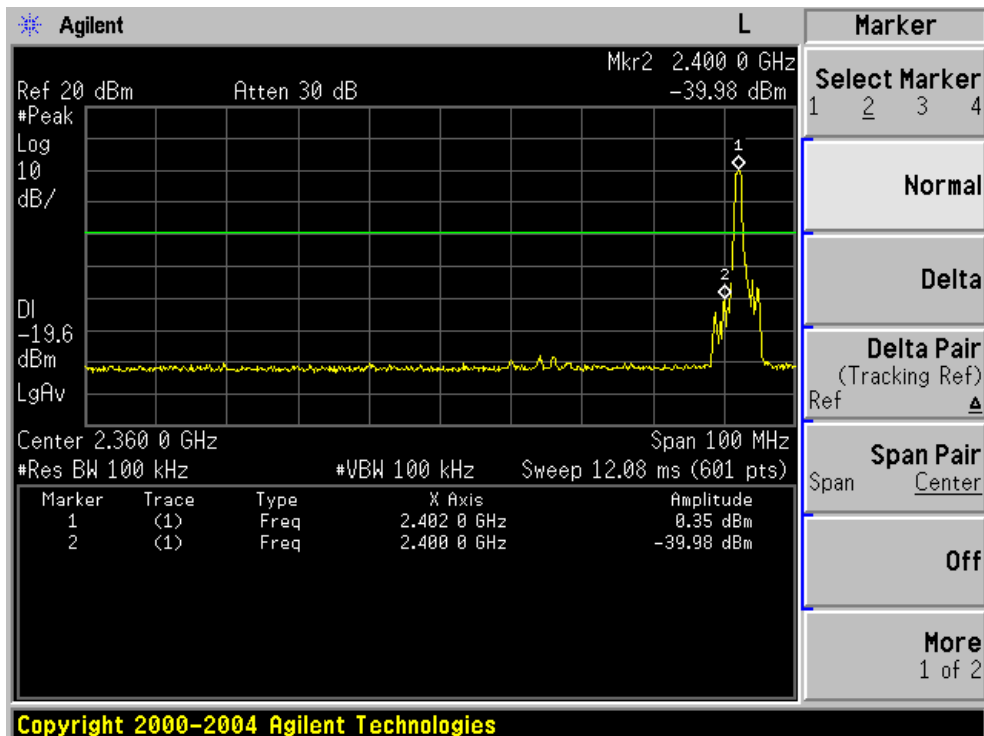
7.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

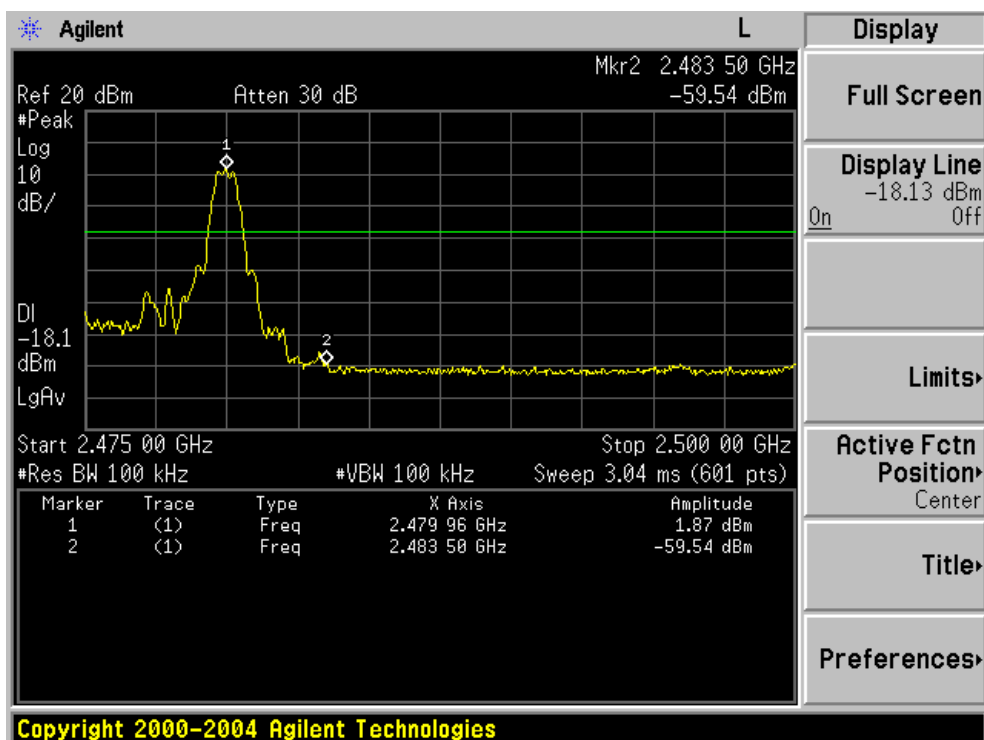
TEST RESULTS



GFSK mode: Band Edge-Low Channel



GFSK mode: Band Edge-High Channel





. ANTENNA REQUIREMENT

STANDARD REQUIREMENT

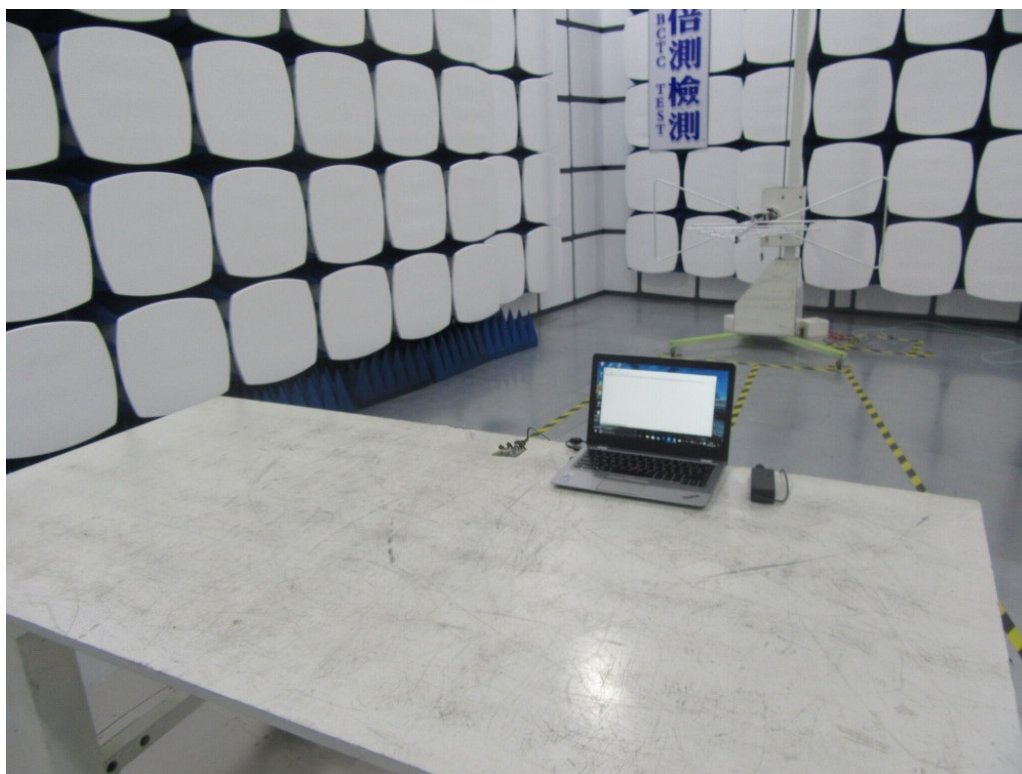
15.203 requirement: For intentional device, according to 15.203: an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

EUT ANTENNA

The EUT antenna is external antenna, It comply with the standard requirement.

. EUT TEST PHOTO

Radiated Measurement Photos



Radiated Measurement Photos

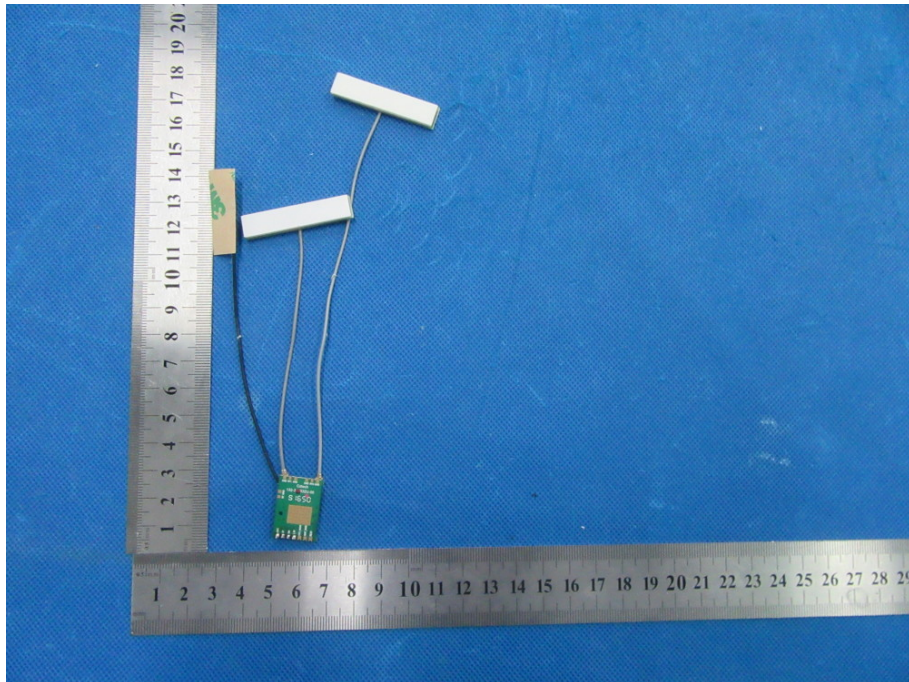
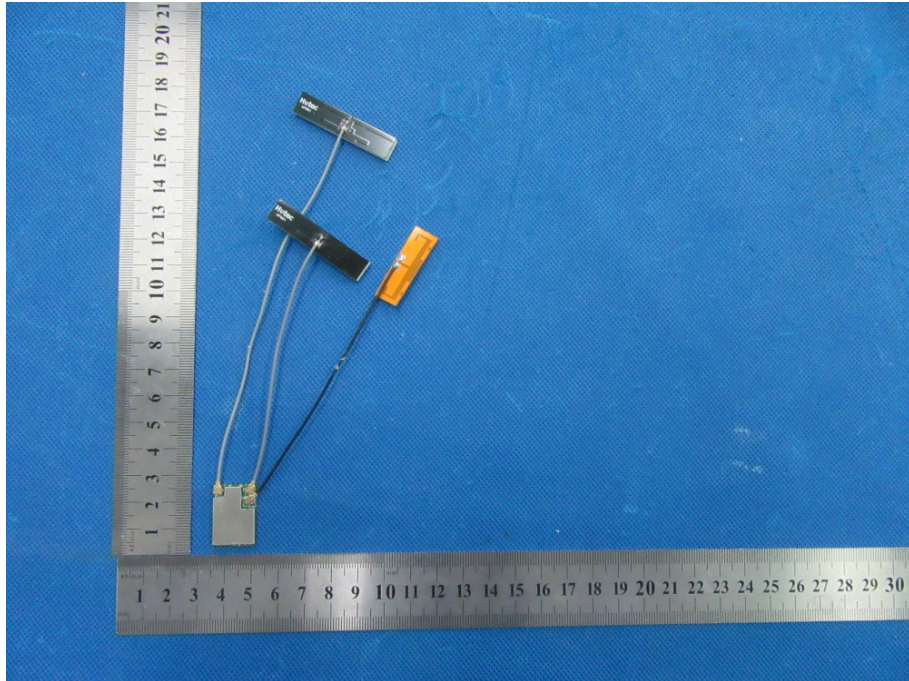




Conducted Emission



. EUT PHOTO



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