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FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No.....: TRE1203003201

FCC ID.....: FTOSTTBTM2BC3

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Date of issue.....: Mar 30, 2012

Testing Laboratory Name: Shenzhen Huatongwei International Inspection Co., Ltd

Address: Keji Nan No.12 Road, Hi-tech Park, Shenzhen, China

Applicant's name.....: Stalmart Technology Limited

Address: Rm116-1107E, Building F, Xihaimingzhu, No.1, Taoyuan Road, Nanshan, Shenzhen, Guangdong, China

Test specification:

Standard: FCC Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz Direct Sequence System

TRF Originator.....: Shenzhen Huatongwei International Inspection CO., Ltd

Master TRF.....: Dated 2006-06

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Test item description: 2.4GHz WIRELESS MODULE

Trade Mark: /

Model/Type reference.....: STTBTM2BC3

Listed Models: /

Opeation Frequency.....: From 2400MHz to 2483.5MHz

Result.....: Positive

TEST REPORT

| | | |
|--------------------------|----------------------|---------------|
| Test Report No. : | TRE1203003201 | Mar 30, 2012 |
| | | Date of issue |

Equipment under Test : 2.4GHz WIRELESS MODULE

Model /Type : STTBTMC2BC3

Listed Models : /

Applicant : **Stalmart Technology Limited**

Address : Rm116-1107E, Building F, Xihaimingzhu, No.1, Taoyuan Road, Nanshan, Shenzhen, Guangdong, China

Manufacturer : **Stalmart Technology Limited**

Address : Rm116-1107E, Building F, Xihaimingzhu, No.1, Taoyuan Road, Nanshan, Shenzhen, Guangdong, China

| | |
|--|-----------------|
| Test Result according to the standards on page 4: | Positive |
|--|-----------------|

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.

ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices

2. SUMMARY

2.1. General Remarks

| | | |
|--------------------------------|---|--------------|
| Date of receipt of test sample | : | Mar 12, 2012 |
| | | |
| | | |
| Testing commenced on | : | Mar 12, 2012 |
| | | |
| | | |
| Testing concluded on | : | Mar 30, 2012 |

2.2. Equipment Under Test

Power supply system utilised

| | | | |
|----------------------|---|---|-----------------------------------|
| Power supply voltage | : | <input type="radio"/> 120V / 60 Hz | <input type="radio"/> 115V / 60Hz |
| | | <input type="radio"/> 12 V DC | <input type="radio"/> 24 V DC |
| | | <input checked="" type="radio"/> Other (specified in blank below) | |

DC 3.3V

2.3. Short description of the Equipment under Test (EUT)

2.4GHz (2.4GHz WIRELESS MODULE (STTBTM C2BC3))

For more details, refer to the user's manual of the EUT.

Serial number: Prototype

2.4. EUT operation mode

The EUT has been tested under typical operating condition. It is BDR (Basic Data Rate) mode. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. There are 79 channels of EUT, and the test carried out at the lowest channel, middle channel and highest channel.

| | |
|------------------|-----------------------------------|
| Frequency Range: | 2400-2483.5MHz |
| Channel number: | 79 channels |
| Modulation type: | Frequency Hopping Spread Spectrum |
| Antenna: | PCB Antenna |

| Test Channel | Test Frequency |
|----------------|----------------|
| Low Channel | 2402 MHz |
| Middle Channel | 2441 MHz |
| High Channel | 2480 MHz |

2.5. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- - supplied by the manufacturer
- - supplied by the lab

| | | | |
|-----------------------|-------------|----------------|---|
| <input type="radio"/> | Power Cable | Length (m) : | / |
| | | Shield : | / |
| | | Detachable : | / |
| <input type="radio"/> | Multimeter | Manufacturer : | / |
| | | Model No. : | / |

2.6. Configuration of Tested System

Fig. 2-1 Configuration of Tested System

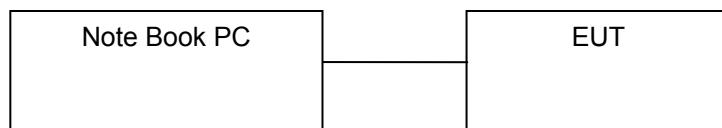


Table 2-1 Equipment Used in Tested System

| No. | Product | Manufacturer | Model No. | Serial No. | FCC ID |
|-----|-------------|--------------|-----------|--------------------------|--------|
| 1 | Notebook PC | DELL | D610 | CN-0D4571-48643-51S-0236 | ----- |

2.7. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: FTOSTTBMC2BC3** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.8. Modifications

No modifications were implemented to meet testing criteria.

2.9. NOTE

1. The EUT is a an Bluetooth Standard type device,The functions of the EUT listed as below:

| | Test Standards | Reference Report |
|-------------|---------------------------------------|------------------|
| Radio | FCC Part 15 Subpart C (Section15.247) | TRE1203003201 |
| RF Exposure | FCC Per 47 CFR 2.1091(b) | TRE1203003202 |

2. The frequency bands used in this EUT are listed as follows:

| Frequency Band(MHz) | 2400-2483.5 | 5150-5350 | 5470-5725 | 5725-5850 |
|---------------------|-------------|-----------|-----------|-----------|
| Bluetooth | √ | — | — | — |

3. The EUT provides one completed transmitter and receiver.

| Modulation Mode | TX Function |
|-----------------|-------------|
| Bluetooth | 1TX |

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen Huatongwei International Inspection Co., Ltd
Keji Nan No.12 Road, Hi-tech Park, Shenzhen, China
Phone: 86-755-26715686 Fax: 86-755-26748089

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 (2009) and CISPR Publication 22.

3.2. Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories, Date of Registration: Mar 30, 2009. Valid time is until Feb 28, 2015.

A2LA-Lab Cert. No. 2243.01

Shenzhen Huatongwei International Inspection Co., Ltd, EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing. Valid time is until Sept 30, 2013.

FCC-Registration No.: 662850

Shenzhen Huatongwei International Inspection Co., Ltd, EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 662850, Renewal date Jun 01, 2009.

IC-Registration No.: 5377

The 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377 on Jan 25, 2011. Valid time is until Jan 24, 2014

ACA

Shenzhen Huatongwei International Inspection Co., Ltd, EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

NEMKO-Aut. No.: ELA125

Shenzhen Huatongwei International Inspection Co., Ltd has been assessed the quality assurance system, the testing facilities, qualifications and testing practices of the relevant parts of the organization. The quality assurance system of the Laboratory has been validated against ISO/IEC 17025:2005 or equivalent. The laboratory also fulfils the conditions described in Nemko Document NLA-10, the Authorization is valid through July 07, 2013.

VCCI

The 3m Semi-anechoic chamber (12.2m×7.95m×6.7m) and Shielded Room (8m×4m×3m) of Shenzhen Huatongwei International Inspection Co., Ltd has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2484. Date of Registration: December 20, 2006. Valid time is until December 20, 2012.

Main Ports Conducted Interference Measurement of Shenzhen Huatongwei International Inspection Co., Ltd has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: C-2726. Date of Registration: December 20, 2006. Valid time is until December 19, 2012.

DNV

Shenzhen Huatongwei International Inspection Co Ltd has been found to comply with the requirements of DNV towards subcontractor of EMC and safety testing services in conjunction with the EMC and Low voltage Directives and in the voluntary field. The acceptance is based on a formal quality Audit and follow-ups according to relevant parts of ISO/IEC Guide 17025(2005), in accordance with the requirements of the DNV Laboratory Quality Manual towards subcontractors. Valid time is until Aug 24, 2013.

3.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 950-1050mbar

3.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Huatongwei International Inspection Co., Ltd quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for Shenzhen Huatongwei laboratory is reported:

| Test Items | Measurement Uncertainty | Notes |
|--|-------------------------|-------|
| Frequency stability | 150 Hz | (1) |
| Transmitter power conducted | 0.57 dB | (1) |
| Transmitter power Radiated | 2.20 dB | (1) |
| Conducted spurious emission 9KHz-12.75 GHz | 1.60 dB | (1) |
| Conducted Emission 9KHz-30MHz | 3.39 dB | (1) |
| Radiated Emission 30~1000MHz | 4.24 dB | (1) |
| Radiated Emissio 1~18GHz | 5.16 dB | (1) |
| Radiated Emissio 18-40GHz | 5.54 dB | (1) |
| Occupied Bandwidth | ----- | (1) |
| Emission Mask | ----- | (1) |
| Modulation Characteristic | ----- | (1) |
| Transmitter Frequency Behavior | ----- | (1) |

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

3.5. Test Description

| FCC PART 15 Subpart C | | |
|---------------------------------|-----------------------------|------|
| FCC Part 15.207 | AC Power Conducted Emission | N/A |
| FCC Part 15.247(a) | 20dB Bandwidth | PASS |
| FCC Part 15.247(d) | Spurious Emission | PASS |
| FCC Part 15.247(b) | Maximum Peak Output Power | PASS |
| FCC Part 15.109/ 15.205/ 15.209 | Radiated Emissions | PASS |
| FCC Part 15.247(d) | Band Edge | PASS |
| FCC Part 15.247(a)(1) | Frequency Separation | PASS |
| FCC Part 15.247(a)(1)(iii) | Number of hopping frequency | PASS |
| FCC Part 15.247(a)(1)(iii) | Time of Occupancy | PASS |
| FCC Part 15.203/15.247 (b) | Antenna Requirement | PASS |

Remark: The measurement uncertainty is not included in the test result.

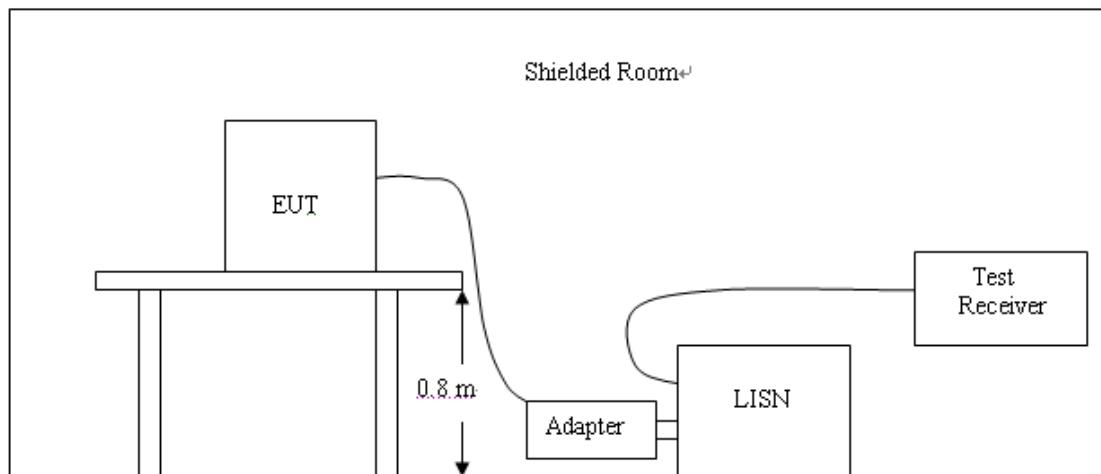
3.6. Equipments Used during the Test

| Test equipments | | | | | |
|-----------------|-------------------------|------------------------------|--------------------|--------------|------------|
| Item | Test Equipment | Manufacturer | Model No. | Serial No. | Last Cal. |
| 1 | ULTRA-BROADBAND ANTENNA | ROHDE & SCHWARZ | HL562 | 100015 | 2011/10/23 |
| 2 | EMI TEST RECEIVER | ROHDE & SCHWARZ | ESI 26 | 100009 | 2011/10/23 |
| 3 | Spectrum Analyzer | AGILENT | E4407B | MY44210775 | 2011/10/23 |
| 4 | RF TEST PANEL | ROHDE & SCHWARZ | TS / RSP | 335015/ 0017 | 2011/10/23 |
| 5 | TURNTABLE | ETS | 2088 | 2149 | 2011/10/23 |
| 6 | ANTENNA MAST | ETS | 2075 | 2346 | 2011/10/23 |
| 7 | EMI TEST SOFTWARE | ROHDE & SCHWARZ | ESK1 | N/A | 2011/10/23 |
| 8 | HORN ANTENNA | ROHDE & SCHWARZ | HF906 | 100039 | 2011/10/23 |
| 9 | Broad-Band Horn Antenna | SCHWARZBECK | BBHA9170 | 470 | 2011/10/23 |
| 10 | Amplifier | Sonoma | 310N | E009-13 | 2011/10/23 |
| 11 | JS amplifier | ROHDE & SCHWARZ | JS4-00101800-28-5A | F201504 | 2011/10/23 |
| 12 | High pass filter | Compliance Direction systems | BSU-6 | 34202 | 2011/10/23 |
| 13 | EMI Test Receiver | ROHDE & SCHWARZ | ESCI | 100106 | 2011/10/23 |
| 14 | Artificial Mains | ROHDE & SCHWARZ | ESH2-Z5 | 100028 | 2011/10/23 |
| 15 | Pulse Limiter | ROHDE & SCHWARZ | ESHSZ2 | 100044 | 2011/10/23 |
| 16 | EMI Test Software | ROHDE & SCHWARZ | ESK1 | N/A | 2011/10/23 |
| 17 | Loop Antenna | ROHDE & SCHWARZ | HFH2-Z2 | 100020 | 2011/10/23 |
| 18 | EMI Test Receiver | ROHDE & SCHWARZ | ESCS30 | 100038 | 2011/10/23 |

4. TEST CONDITIONS AND RESULTS

4.1. AC Power Conducted Emission (Not applicable)

TEST CONFIGURATION



TEST PROCEDURE

- 1 The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2009.
- 2 Support equipment, if needed, was placed as per ANSI C63.10-2009
- 3 All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2009
- 4 The EUT received DC5V power from the adapter, the adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
- 5 All support equipments received AC power from a second LISN, if any.
- 6 The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7 Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
- 8 During the above scans, the emissions were maximized by cable manipulation.

AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following :

| Frequency (MHz) | Maximum RF Line Voltage (dB _P V) | | | |
|--------------------|---|------|---------|--------|
| | CLASS A | | CLASS B | |
| | Q.P. | Ave. | Q.P. | Ave. |
| 0.15 - 0.50 | 79 | 66 | 66-56* | 56-46* |
| 0.50 - 5.00 | 73 | 60 | 56 | 46 |
| 5.00 - 30.0 | 73 | 60 | 60 | 50 |

* Decreasing linearly with the logarithm of the frequency

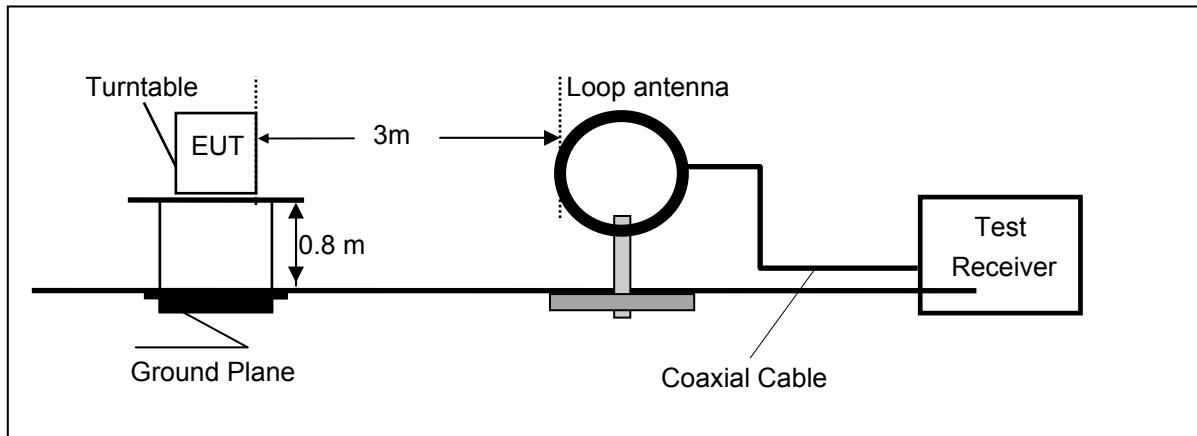
TEST RESULTS

Not applicable to this device (because the equipment power by DC)

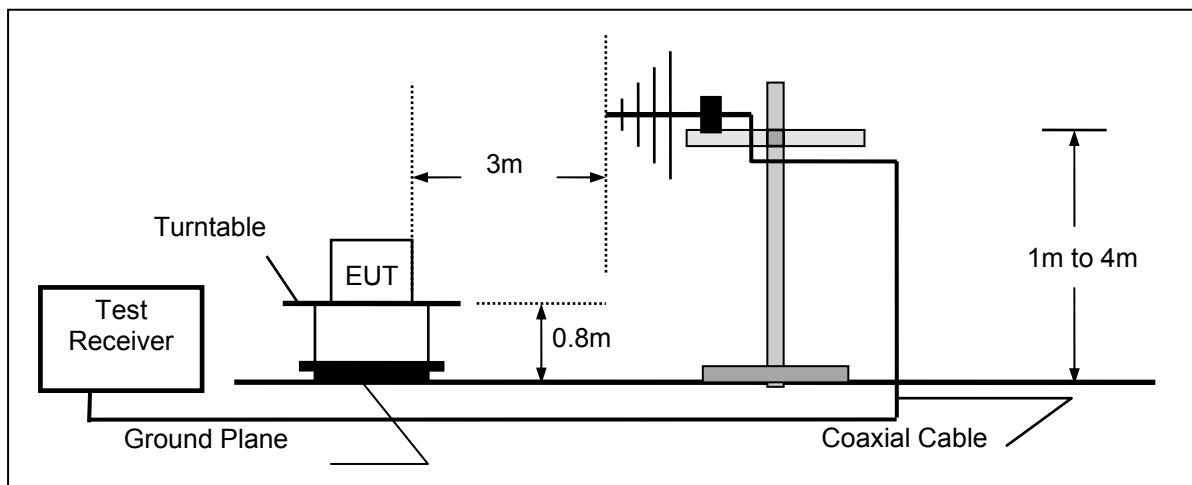
4.2. Radiated Emission

TEST CONFIGURATION

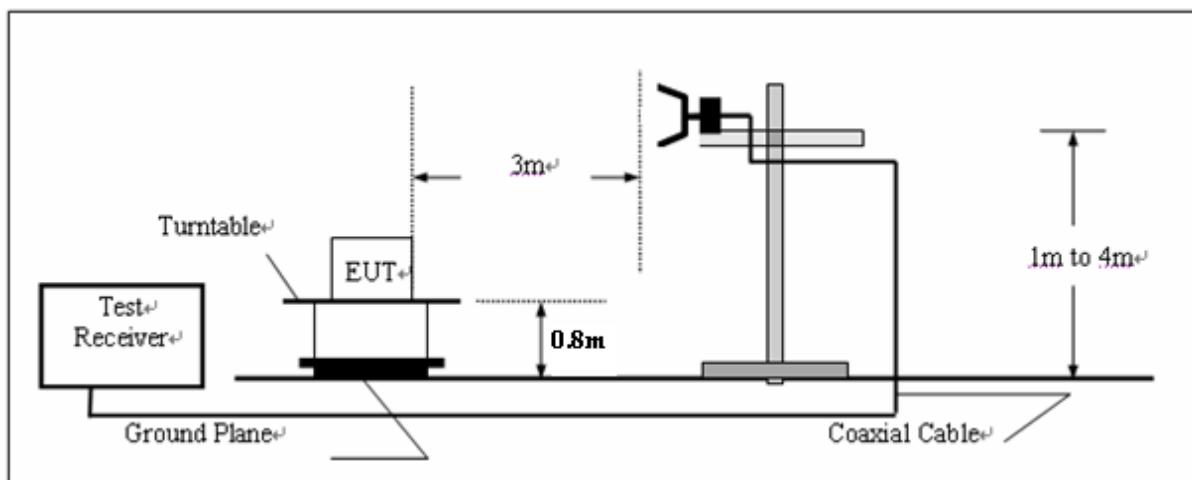
Radiated Emission Test Set-Up
Frequency range 9KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



TEST PROCEDURE

- 1 The EUT was placed on a turn table which is 0.8m above ground plane.

- 2 Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0°C to 360°C to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. the fundamental frequency is 2400-2483.5MHz, So the radiation emissions frequency range were tested from 9KHz to 25GHz.

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) | Transd (dB) |
|-----------------|-------------------|-------------------|---------|---------|---------|-------------|
| 300.00 | 40 | 58.1 | 12.2 | 1.6 | 31.90 | -18.1 |

$$Transd = AF + CL - AG$$

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.

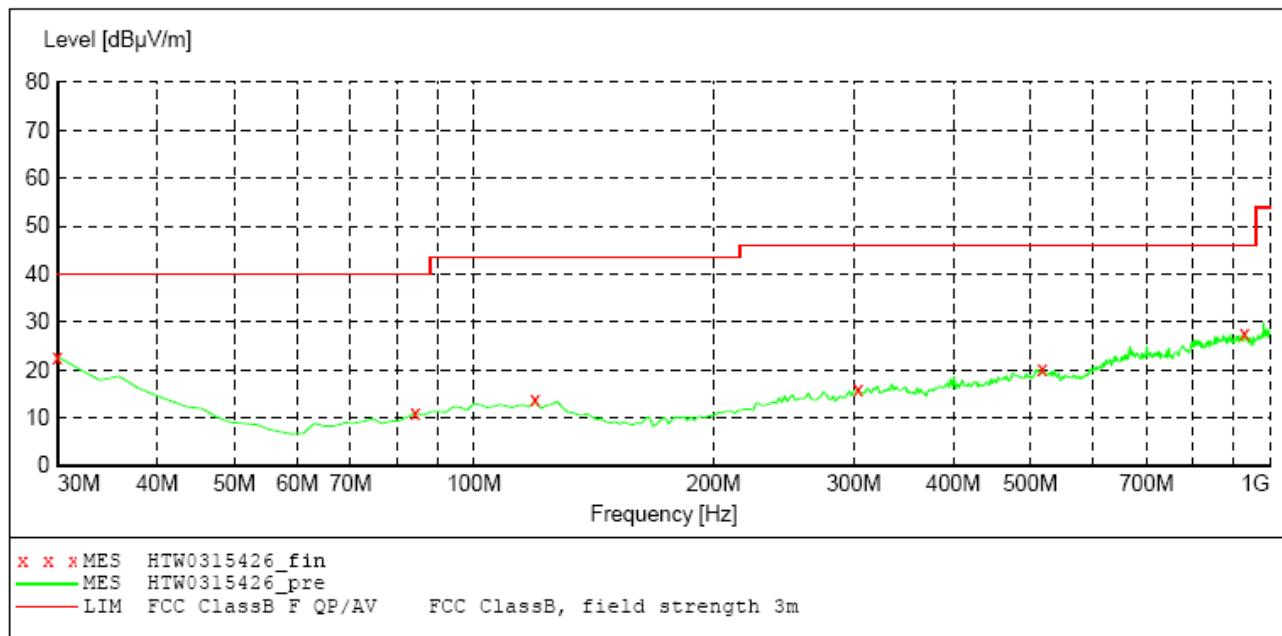
| Frequency (MHz) | Distance (Meters) | Radiated (dB μ V/m) | Radiated (μ V/m) |
|-----------------|-------------------|-------------------------|-----------------------|
| 30-88 | 3 | 40.0 | 100 |
| 88-216 | 3 | 43.5 | 150 |
| 216-960 | 3 | 46.0 | 200 |
| Above 960 | 3 | 54.0 | 500 |

TEST RESULTS**For 9KHz to 30MHz**

| Frequency (MHz) | Corrected Reading (dB μ V/m)@3m | FCC Limit (dB μ V/m) @3m | Margin (dB) | Detector | Result |
|-----------------|-------------------------------------|------------------------------|-------------|----------|--------|
| 0.53 | 48.52 | 73.11 | 24.59 | QP | Pass |
| 1.22 | 42.45 | 65.87 | 23.42 | QP | Pass |
| 16.00 | 40.52 | 69.54 | 29.02 | QP | Pass |
| 21.20 | 42.58 | 69.54 | 26.96 | QP | Pass |

For 30MHz to 1000MHz**SCAN TABLE: "test Field (30M-1G) QP"**

Short Description: Field Strength (30M-1G)
 Start Stop Step Detector Meas. IF Transducer
 Frequency Frequency Width Time Bandw.
 30.0 MHz 1.0 GHz 60.0 kHz QuasiPeak 1.0 s 120 kHz HL562

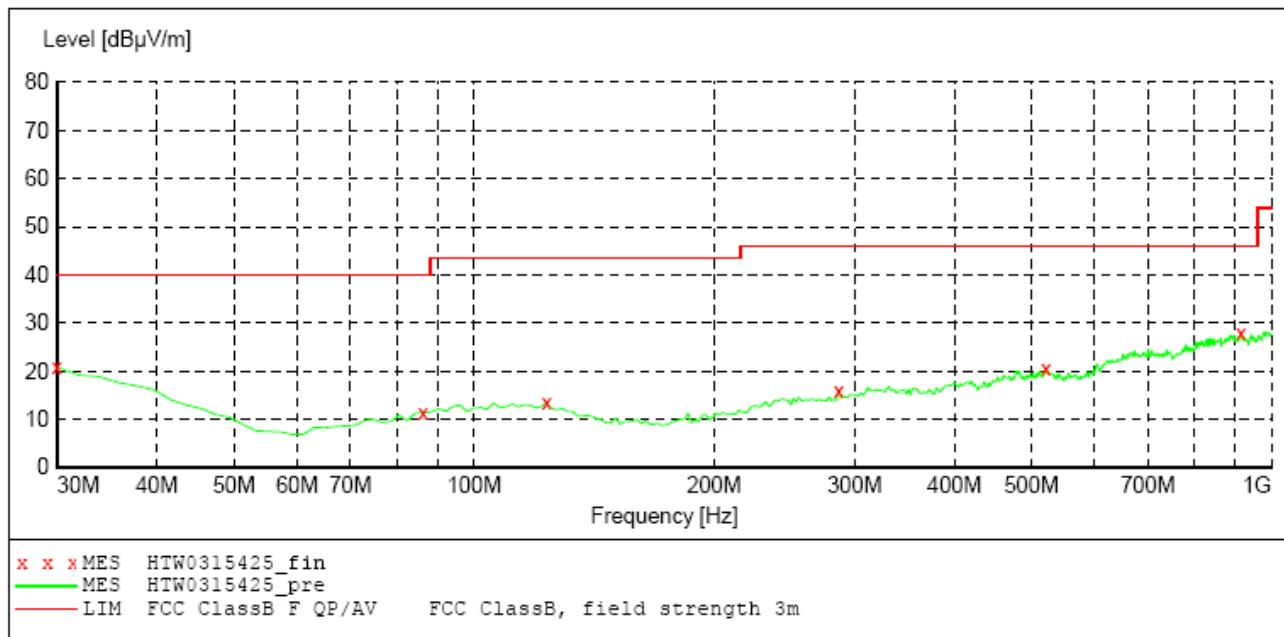
**MEASUREMENT RESULT: "HTW0315426_fin"**

3/15/2012 9:05AM

| Frequency MHz | Level dB μ V/m | Transd dB | Limit dB μ V/m | Margin dB | Det. | Height cm | Azimuth deg | Polarization |
|---------------|--------------------|-----------|--------------------|-----------|------|-----------|-------------|--------------|
| 30.000000 | 22.80 | -11.3 | 40.0 | 17.2 | QP | 100.0 | 331.00 | VERTICAL |
| 84.428858 | 11.10 | -21.2 | 40.0 | 28.9 | QP | 100.0 | 75.00 | VERTICAL |
| 119.418838 | 13.70 | -19.3 | 43.5 | 29.8 | QP | 100.0 | 306.00 | VERTICAL |
| 304.088176 | 16.00 | -16.7 | 46.0 | 30.0 | QP | 100.0 | 212.00 | VERTICAL |
| 517.915832 | 20.20 | -13.0 | 46.0 | 25.8 | QP | 100.0 | 95.00 | VERTICAL |
| 930.020040 | 27.50 | -7.1 | 46.0 | 18.5 | QP | 100.0 | 210.00 | VERTICAL |

SCAN TABLE: "test Field (30M-1G) QP"

Short Description: Field Strength (30M-1G)
 Start Stop Step Detector Meas. IF Transducer
 Frequency Frequency Width Time Bandw.
 30.0 MHz 1.0 GHz 60.0 kHz QuasiPeak 1.0 s 120 kHz HL562



MEASUREMENT RESULT: "HTW0315425_fin"

3/15/2012 9:03AM

| Frequency MHz | Level dB μ V/m | Transd dB | Limit dB μ V/m | Margin dB | Det. | Height cm | Azimuth deg | Polarization |
|------------------|-----------------------|--------------|-----------------------|--------------|------|--------------|----------------|--------------|
| 30.000000 | 20.80 | -11.3 | 40.0 | 19.2 | QP | 300.0 | 269.00 | HORIZONTAL |
| 86.372745 | 11.40 | -20.8 | 40.0 | 28.6 | QP | 300.0 | 71.00 | HORIZONTAL |
| 123.306613 | 13.40 | -19.5 | 43.5 | 30.1 | QP | 100.0 | 175.00 | HORIZONTAL |
| 286.593186 | 15.80 | -17.8 | 46.0 | 30.2 | QP | 100.0 | 355.00 | HORIZONTAL |
| 521.803607 | 20.70 | -13.0 | 46.0 | 25.3 | QP | 300.0 | 343.00 | HORIZONTAL |
| 916.412826 | 27.90 | -7.2 | 46.0 | 18.1 | QP | 300.0 | 215.00 | HORIZONTAL |

Above 1G

The frequency spectrum above 1 GHz for Transmitter was investigated. All emission not reported are much lower than the prescribed limits. Set the RBW=1MHz,VBW=3MHz for Peak Detector while the RBW=1MHz,VBW=10Hz for Average Detector,Readings are both peak and average values. The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

Low channel

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | | | |
|---|-----------------|------------------------|----|----------------|-------------|--------------------|----------------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No. | Frequency (MHz) | Emssion Level (dBuV/m) | | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1 | *2402.00 | 92.15 | PK | | | 1.00 | 178 | 95.55 | 28.3 | 4.90 | 36.6 | -3.40 |
| 1 | *2402.00 | 85.21 | AV | | | 1.00 | 178 | 88.61 | 28.3 | 4.90 | 36.6 | -3.40 |
| 2 | 4804.00 | 48.24 | PK | 74.00 | 25.76 | 1.00 | 152 | 45.04 | 32.7 | 7.00 | 36.5 | 3.20 |
| 2 | 4804.00 | -- | AV | 54.00 | -- | 1.00 | 152 | -- | 32.7 | 7.00 | 36.5 | 3.20 |
| 3 | 7206.00 | 49.15 | PK | 74.00 | 24.85 | 1.00 | 98 | 39.75 | 35.8 | 8.90 | 35.3 | 9.40 |
| 3 | 7206.00 | -- | AV | 54.00 | -- | 1.00 | 98 | -- | 35.8 | 8.90 | 35.3 | 9.40 |
| 4 | 10243.21 | 50.55 | PK | 74.00 | 23.45 | 1.00 | 322 | 33.95 | 38.0 | 11.30 | 32.7 | 16.6 |
| 4 | 10243.21 | -- | AV | 54.00 | -- | 1.00 | 322 | -- | 38.0 | 11.30 | 32.7 | 16.6 |

| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M | | | | | | | | | | | | |
|---|-----------------|------------------------|----|----------------|-------------|--------------------|----------------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No. | Frequency (MHz) | Emssion Level (dBuV/m) | | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1 | *2402.00 | 92.52 | PK | | | 1.00 | 145 | 95.9 | 28.3 | 4.90 | 36.6 | -3.40 |
| 1 | *2402.00 | 86.47 | AV | | | 1.00 | 145 | 89.8 | 28.3 | 4.90 | 36.6 | -3.40 |
| 2 | 4804.00 | 47.58 | PK | 74.00 | 26.42 | 1.00 | 256 | 44.3 | 32.7 | 7.00 | 36.5 | 3.20 |
| 2 | 4804.00 | -- | AV | 54.00 | -- | 1.00 | 256 | -- | 32.7 | 7.00 | 36.5 | 3.20 |
| 3 | 7206.00 | 49.55 | PK | 74.00 | 24.45 | 1.00 | 327 | 40.1 | 35.8 | 8.90 | 35.3 | 9.40 |
| 3 | 7206.00 | -- | AV | 54.00 | -- | 1.00 | 327 | -- | 35.8 | 8.90 | 35.3 | 9.40 |
| 4 | 10423.45 | 50.14 | PK | 74.00 | 23.86 | 1.00 | 85 | 33.5 | 38.0 | 11.30 | 32.7 | 16.6 |
| 4 | 10423.45 | -- | AV | 54.00 | -- | 1.00 | 85 | -- | 38.0 | 11.30 | 32.7 | 16.6 |

Middle channel

| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | | | |
|---|-----------------|------------------------|----|----------------|-------------|--------------------|----------------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No. | Frequency (MHz) | Emssion Level (dBuV/m) | | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1 | *2441.00 | 90.25 | PK | | | 1.00 | 322 | 93.45 | 28.3 | 5.10 | 36.6 | -3.20 |
| 1 | *2441.00 | 83.25 | AV | | | 1.00 | 322 | 86.45 | 28.3 | 5.10 | 36.6 | -3.20 |
| 2 | 4882.00 | 47.58 | PK | 74.00 | 26.42 | 1.00 | 141 | 44.18 | 32.3 | 7.60 | 36.5 | 3.40 |
| 2 | 4882.00 | -- | AV | 54.00 | -- | 1.00 | 141 | -- | 32.3 | 7.60 | 36.5 | 3.40 |
| 3 | 7323.00 | 50.52 | PK | 74.00 | 23.48 | 1.00 | 258 | 41.12 | 36.1 | 8.60 | 35.3 | 9.40 |
| 3 | 7323.00 | -- | AV | 54.00 | -- | 1.00 | 258 | -- | 36.1 | 8.60 | 35.3 | 9.40 |
| 4 | 10536.45 | 51.58 | PK | 74.00 | 22.42 | 1.00 | 36 | 34.98 | 38.0 | 11.30 | 32.7 | 16.6 |
| 4 | 10536.45 | -- | AV | 54.00 | -- | 1.00 | 36 | -- | 38.0 | 11.30 | 32.7 | 16.6 |

| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M | | | | | | | | | | | | |
|---|-----------------|------------------------|----|----------------|-------------|--------------------|----------------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No. | Frequency (MHz) | Emssion Level (dBuV/m) | | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1 | *2441.00 | 91.12 | PK | | | 1.00 | 179 | 94.32 | 28.3 | 5.10 | 36.6 | -3.20 |
| 1 | *2441.00 | 83.41 | AV | | | 1.00 | 179 | 86.61 | 28.3 | 5.10 | 36.6 | -3.20 |
| 2 | 4882.00 | 48.52 | PK | 74.00 | 25.48 | 1.00 | 146 | 45.12 | 32.3 | 7.60 | 36.5 | 3.40 |
| 2 | 4882.00 | -- | AV | 54.00 | -- | 1.00 | 146 | -- | 32.3 | 7.60 | 36.5 | 3.40 |
| 3 | 7323.00 | 50.54 | PK | 74.00 | 23.46 | 1.00 | 210 | 41.14 | 36.1 | 8.60 | 35.3 | 9.40 |
| 3 | 7323.00 | -- | AV | 54.00 | -- | 1.00 | 210 | -- | 36.1 | 8.60 | 35.3 | 9.40 |
| 4 | 10632.54 | 52.45 | PK | 74.00 | 21.55 | 1.00 | 265 | 35.85 | 38.0 | 11.30 | 32.7 | 16.6 |
| 4 | 10632.54 | -- | AV | 54.00 | -- | 1.00 | 265 | -- | 38.0 | 11.30 | 32.7 | 16.6 |

High channel

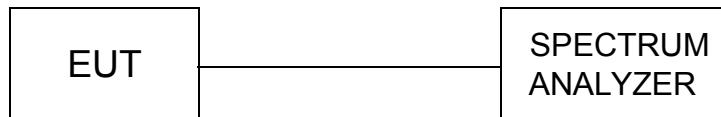
| ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M | | | | | | | | | | | | |
|---|-----------------|------------------------|----|----------------|-------------|--------------------|----------------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No. | Frequency (MHz) | Emssion Level (dBuV/m) | | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1 | *2480.00 | 88.33 | PK | | | 1.00 | 320 | 91.63 | 28.2 | 5.10 | 36.6 | -3.30 |
| 1 | *2480.00 | 80.10 | AV | | | 1.00 | 320 | 83.40 | 28.2 | 5.10 | 36.6 | -3.30 |
| 2 | 4960.00 | 48.52 | PK | 74.00 | 25.48 | 1.00 | 141 | 44.72 | 33.0 | 7.00 | 36.2 | 3.80 |
| 2 | 4960.00 | -- | AV | 54.00 | -- | 1.00 | 141 | -- | 33.0 | 7.00 | 36.2 | 3.80 |
| 3 | 7340.00 | 50.21 | PK | 74.00 | 23.79 | 1.00 | 256 | 40.81 | 36.2 | 8.50 | 35.3 | 9.40 |
| 3 | 7340.00 | -- | AV | 54.00 | -- | 1.00 | 256 | -- | 36.2 | 8.50 | 35.3 | 9.40 |
| 4 | 10535.10 | 52.41 | PK | 74.00 | 21.59 | 1.00 | 87 | 35.81 | 38.0 | 11.30 | 32.7 | 16.6 |
| 4 | 10535.10 | -- | AV | 54.00 | -- | 1.00 | 87 | -- | 38.0 | 11.30 | 32.7 | 16.6 |

| ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M | | | | | | | | | | | | |
|---|-----------------|------------------------|----|----------------|-------------|--------------------|----------------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No. | Frequency (MHz) | Emssion Level (dBuV/m) | | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1 | *2480.00 | 89.14 | PK | | | 1.00 | 48 | 92.4 | 28.2 | 5.10 | 36.6 | -3.30 |
| 1 | *2480.00 | 81.87 | AV | | | 1.00 | 48 | 85.1 | 28.2 | 5.10 | 36.6 | -3.30 |
| 2 | 4960.00 | 49.52 | PK | 74.00 | 24.48 | 1.00 | 252 | 45.7 | 36.2 | 8.50 | 35.3 | 3.80 |
| 2 | 4960.00 | -- | AV | 54.00 | -- | 1.00 | 252 | -- | 36.2 | 8.50 | 35.3 | 3.80 |
| 3 | 7340.00 | 50.22 | PK | 74.00 | 23.78 | 1.00 | 32 | 40.8 | 37.4 | 10.10 | 34.8 | 9.40 |
| 3 | 7340.00 | -- | AV | 54.00 | -- | 1.00 | 32 | -- | 37.4 | 10.10 | 34.8 | 9.40 |
| 4 | 10361.45 | 52.81 | PK | 74.00 | 21.19 | 1.00 | 144 | 36.2 | 38.0 | 11.30 | 32.7 | 16.6 |
| 4 | 10361.45 | -- | AV | 54.00 | -- | 1.00 | 144 | -- | 38.0 | 11.30 | 32.7 | 16.6 |

| Suprious emission in restricted band | | | | | | | | | | | | |
|--------------------------------------|-----------------|------------------------|----|----------------|-------------|--------------------|----------------------|------------------|-----------------------|-------------------|--------------------|--------------------------|
| No. | Frequency (MHz) | Emssion Level (dBuV/m) | | Limit (dBuV/m) | Margin (dB) | Antenna Height (m) | Table Angle (Degree) | Raw Value (dBuV) | Antenna Factor (dB/m) | Cable Factor (dB) | Pre-amplifier (dB) | Correction Factor (dB/m) |
| 1 | 2390.00 | 52.44 | PK | 74.00 | 21.56 | 1.00 H | 154 | 55.84 | 28.3 | 4.90 | 36.6 | -3.40 |
| 1 | 2390.00 | -- | AV | 54.00 | -- | 1.00 H | 154 | -- | 28.3 | 4.90 | 36.6 | -3.40 |
| 2 | 2390.00 | 52.78 | PK | 74.00 | 21.22 | 1.00 V | 355 | 56.18 | 28.3 | 4.90 | 36.6 | -3.40 |
| 2 | 2390.00 | -- | AV | 54.00 | -- | 1.00 V | 355 | -- | 28.3 | 4.90 | 36.6 | -3.40 |
| 3 | 2483.5 | 57.85 | PK | 74.00 | 16.15 | 1.00 H | 102 | 61.15 | 28.2 | 5.10 | 36.6 | -3.30 |
| 3 | 2483.5 | 47.61 | AV | 54.00 | 6.39 | 1.00 H | 102 | 50.91 | 28.2 | 5.10 | 36.6 | -3.30 |
| 4 | 2483.5 | 58.25 | PK | 74.00 | 15.75 | 1.00 V | 90 | 61.55 | 28.2 | 5.10 | 36.6 | -3.30 |
| 4 | 2483.5 | 49.21 | AV | 54.00 | 4.79 | 1.00 V | 90 | 52.51 | 28.2 | 5.10 | 36.6 | -3.30 |

4.3. Maximum Peak Output Power

TEST CONFIGURATION



TEST PROCEDURE

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum.

LIMIT

The Maximum Peak Output Power Measurement limit is 30dBm.

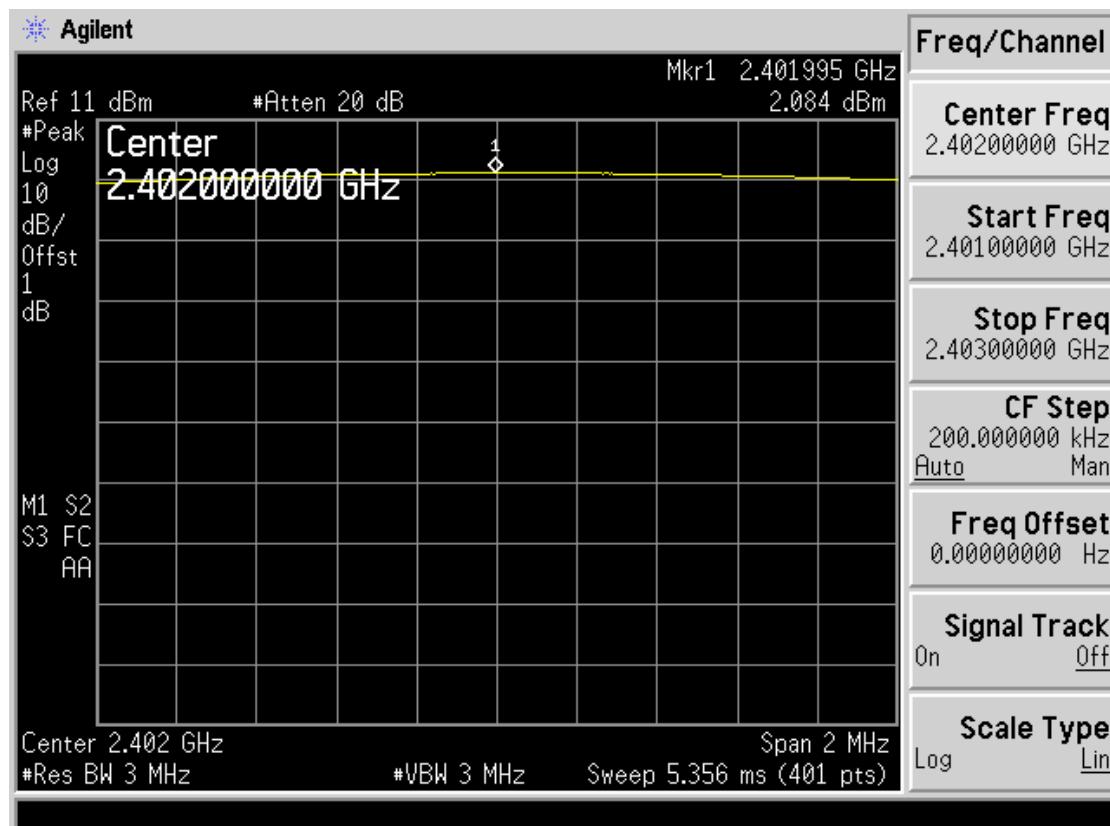
TEST RESULTS

BDR Mode:

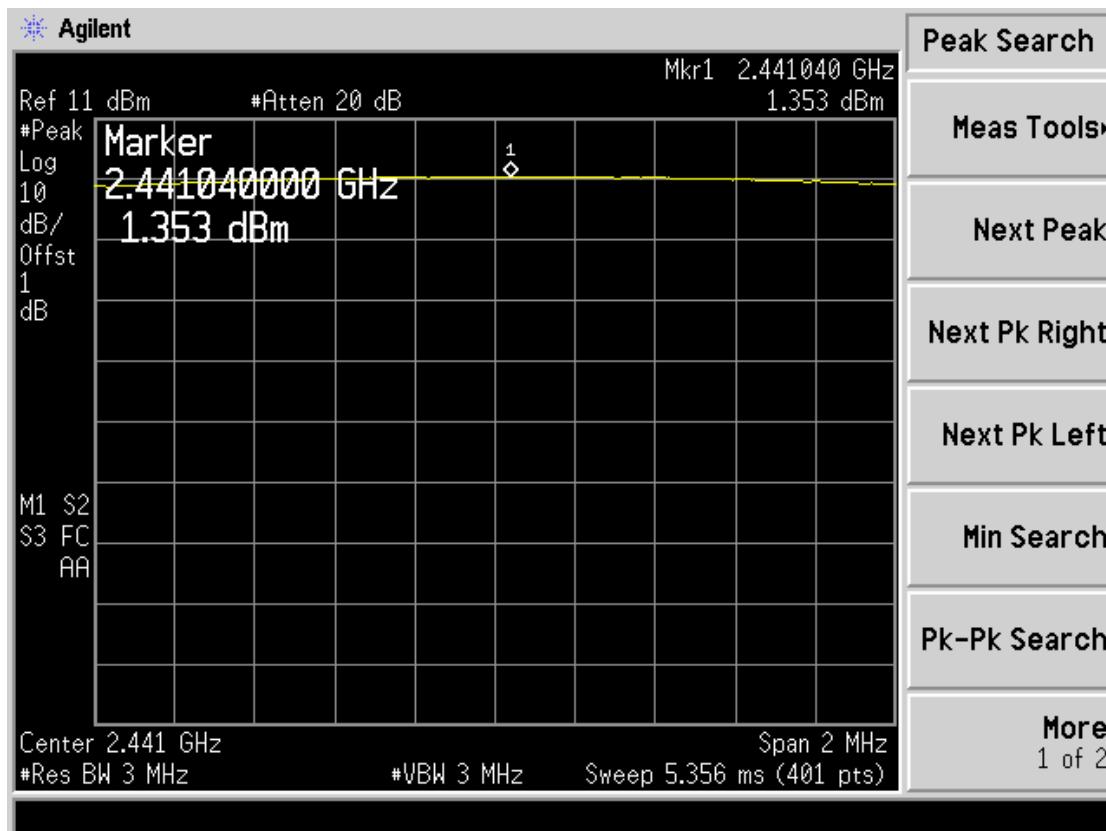
| Channel Frequency (MHz) | Peak Power Output (dBm) | Peak Power Limit (dBm) | Pass / Fail |
|-------------------------|-------------------------|------------------------|-------------|
| 2402 | 2.402 | 30 | PASS |
| 2441 | 1.353 | 30 | PASS |
| 2480 | 0.567 | 30 | PASS |

Note: The test results including the cable loss.

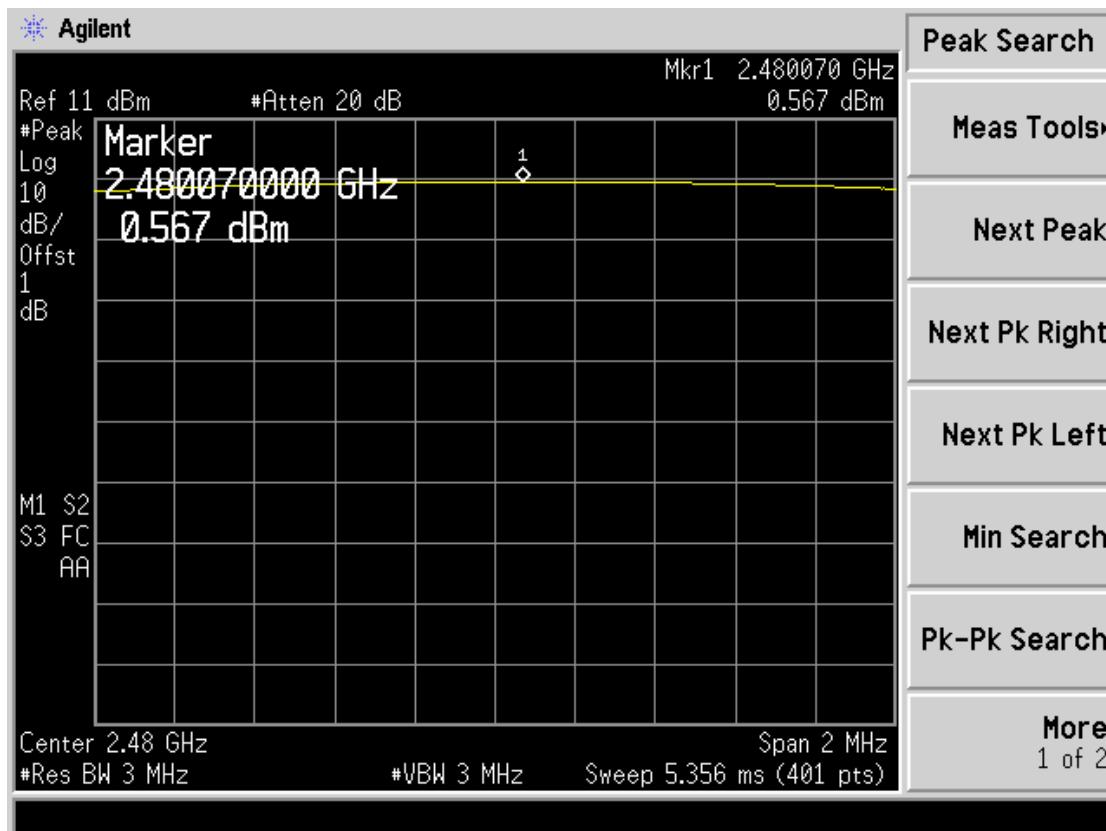
Low channel



Middle channel

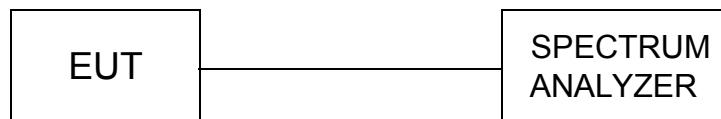


High channel



4.4. 20dB Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30 KHz RBW and 100KHz VBW.

The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

LIMIT

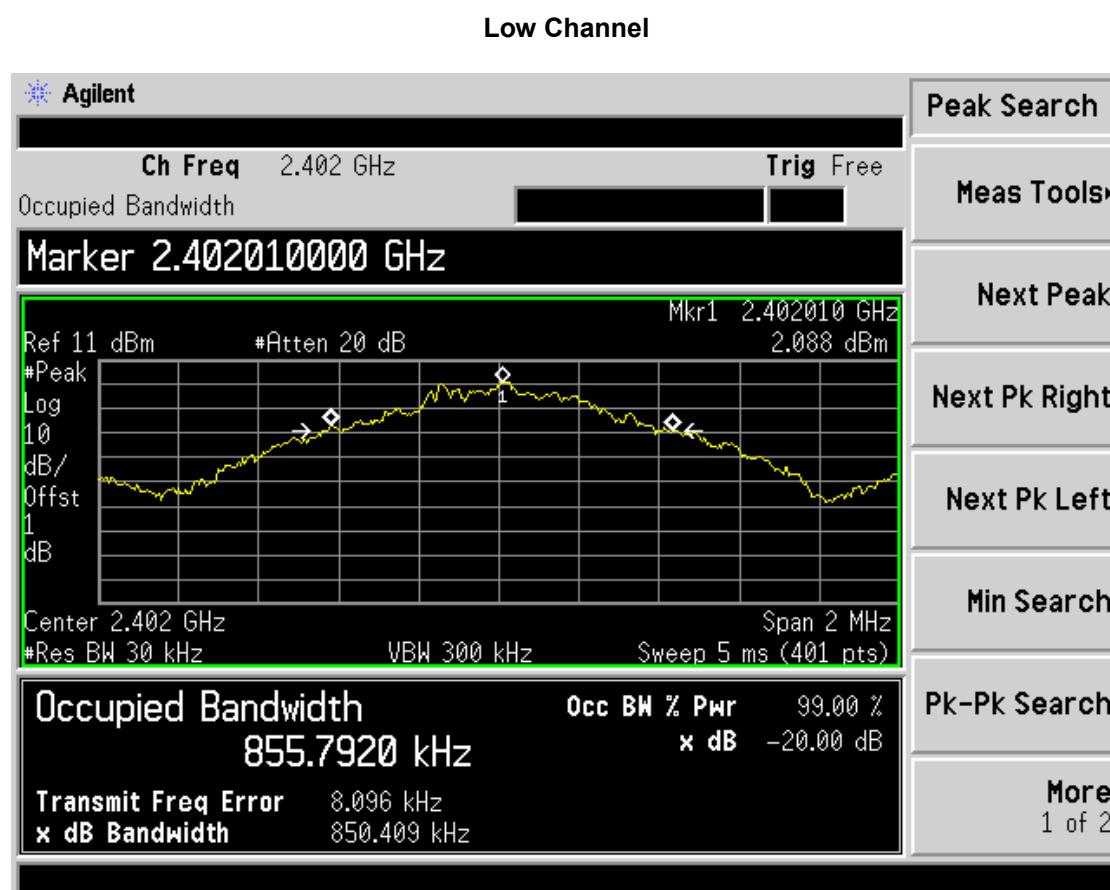
For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwidth.

TEST RESULTS

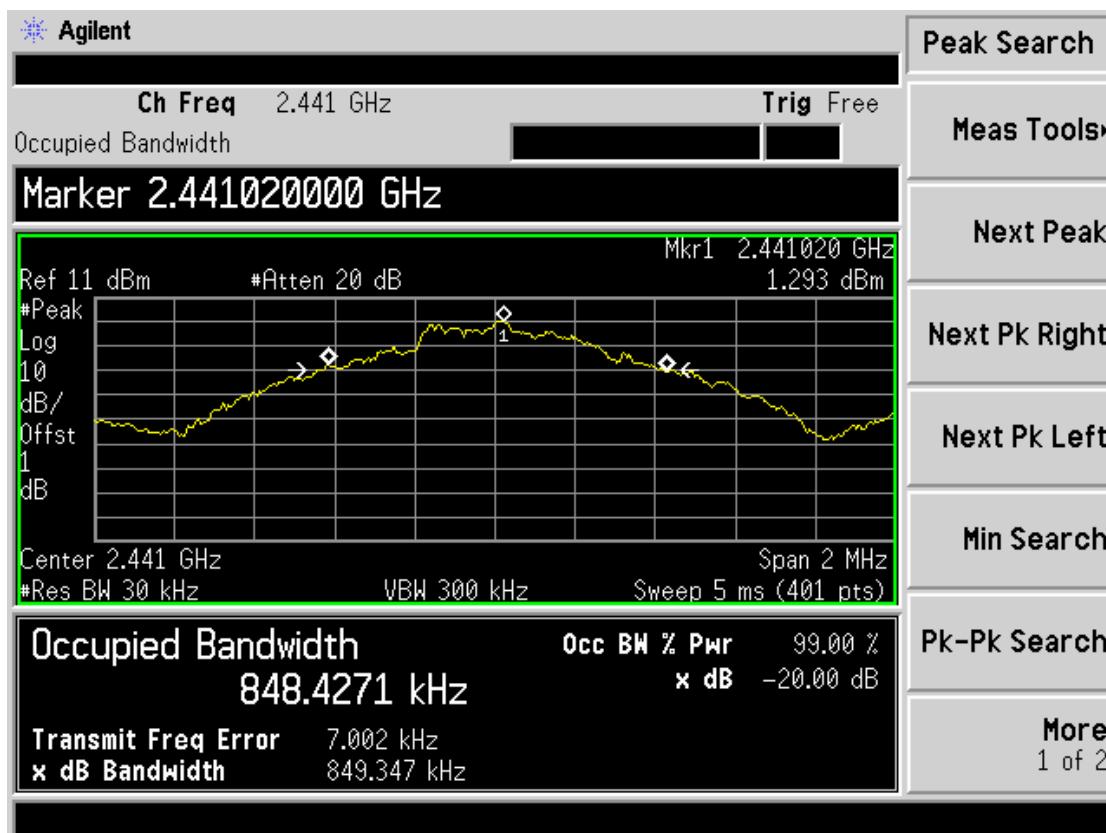
BDR Mode:

| CHANNEL FREQUENCY (MHz) | 20dB BANDWIDTH (MHz) | LIMIT (MHz) | PASS/FAIL |
|-------------------------|----------------------|-------------|-----------|
| 2402 | 0.850 | / | PASS |
| 2441 | 0.849 | / | PASS |
| 2480 | 0.867 | / | PASS |

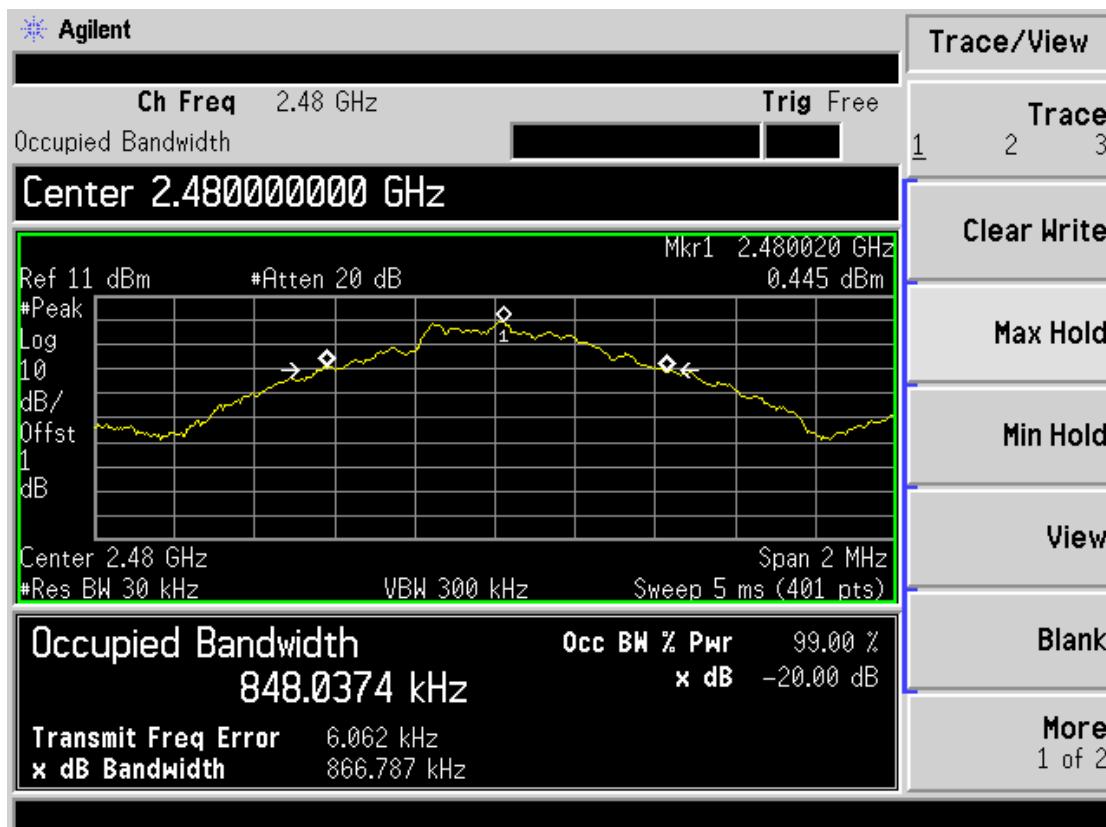
Photos of 20dB Bandwidth Measurement(BDR Mode)



Middle Channel



High Channel



4.5. Band Edge

Applicable Standard

In any 100 kHz 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 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions 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) (see §15.205(c)).

TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz.
4. 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.
5. Repeat above procedures until all measured frequencies were complete.

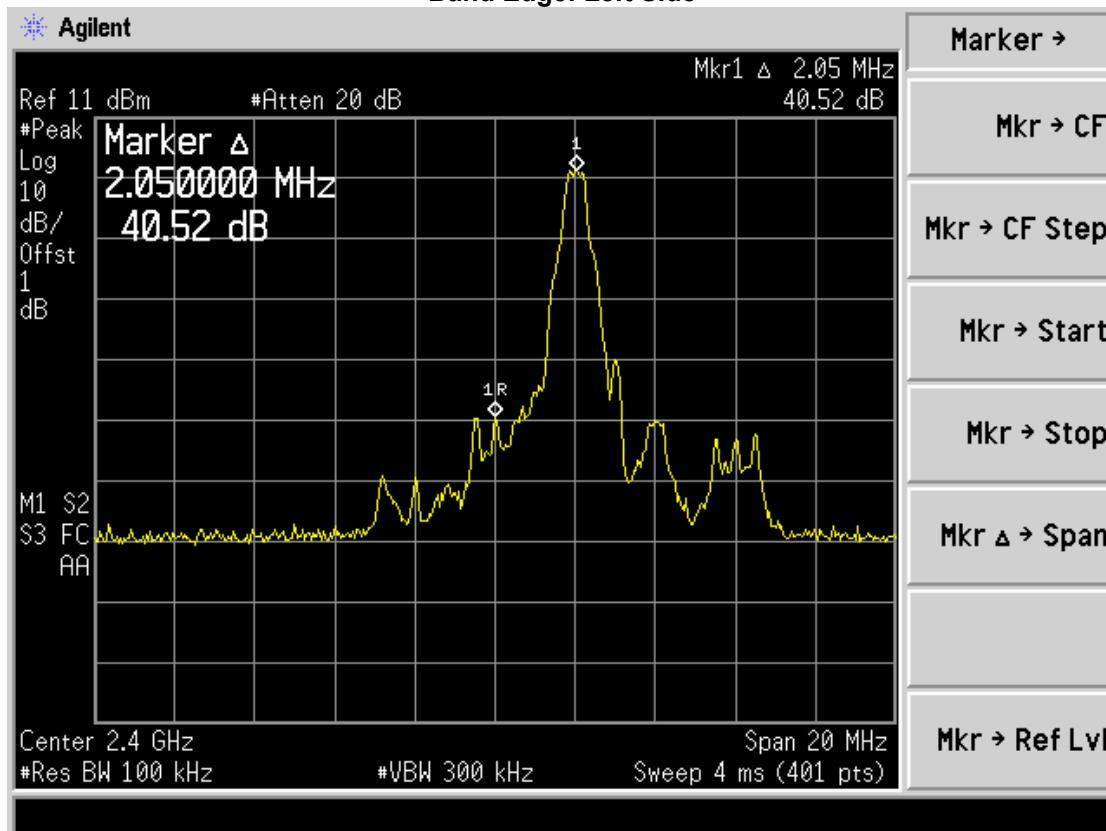
TEST RESULTS

Suprious emission in restricted band please see page 16

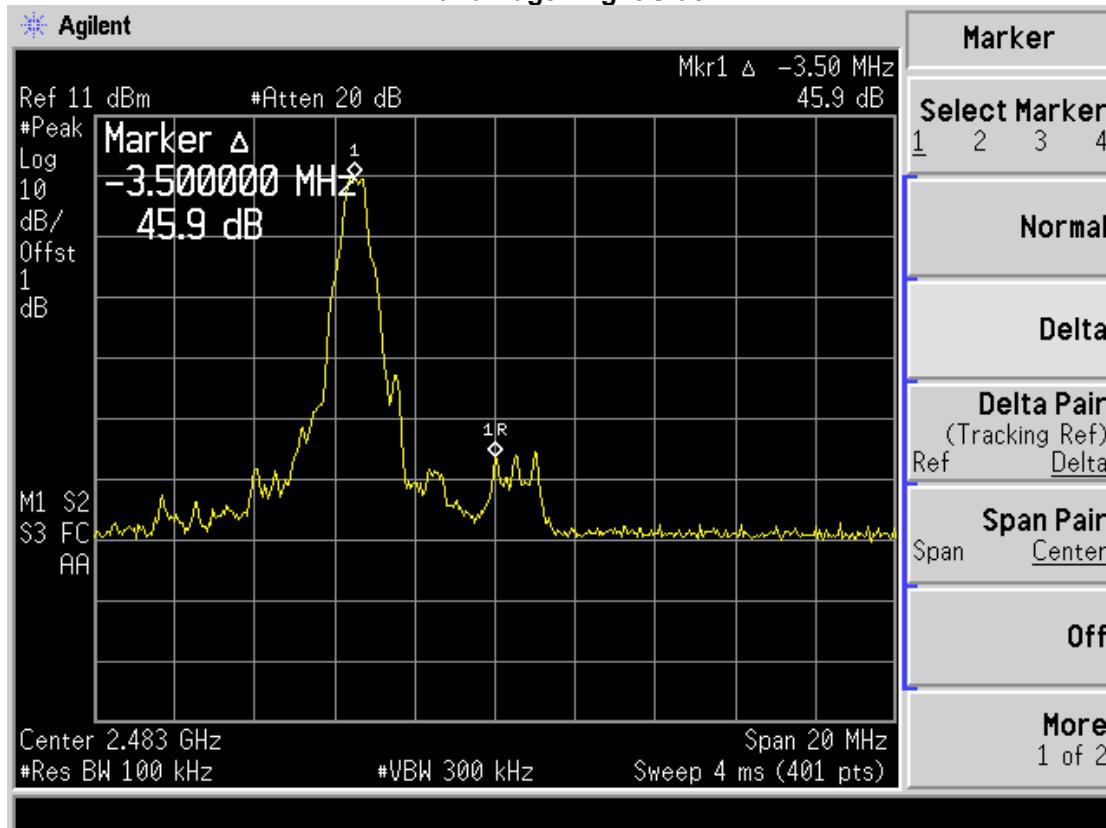
Plots of Conducted Band Edge Measurement (BDR Mode)

| Frequency | Delta peak to band emission | Limit(dBc) |
|-----------|-----------------------------|------------|
| 2400MHz | 40.52 | 20 |
| 2483.5MHz | 45.90 | 20 |

Band Edge: Left Side

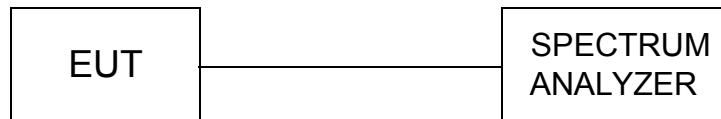


Band Edge: Right Side



4.6. Frequency Separation

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30 KHz RBW and 100KHz VBW.

LIMIT

According to 15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the $2/3 \times 20$ dB bandwidth of the hopping channel, whichever is greater.

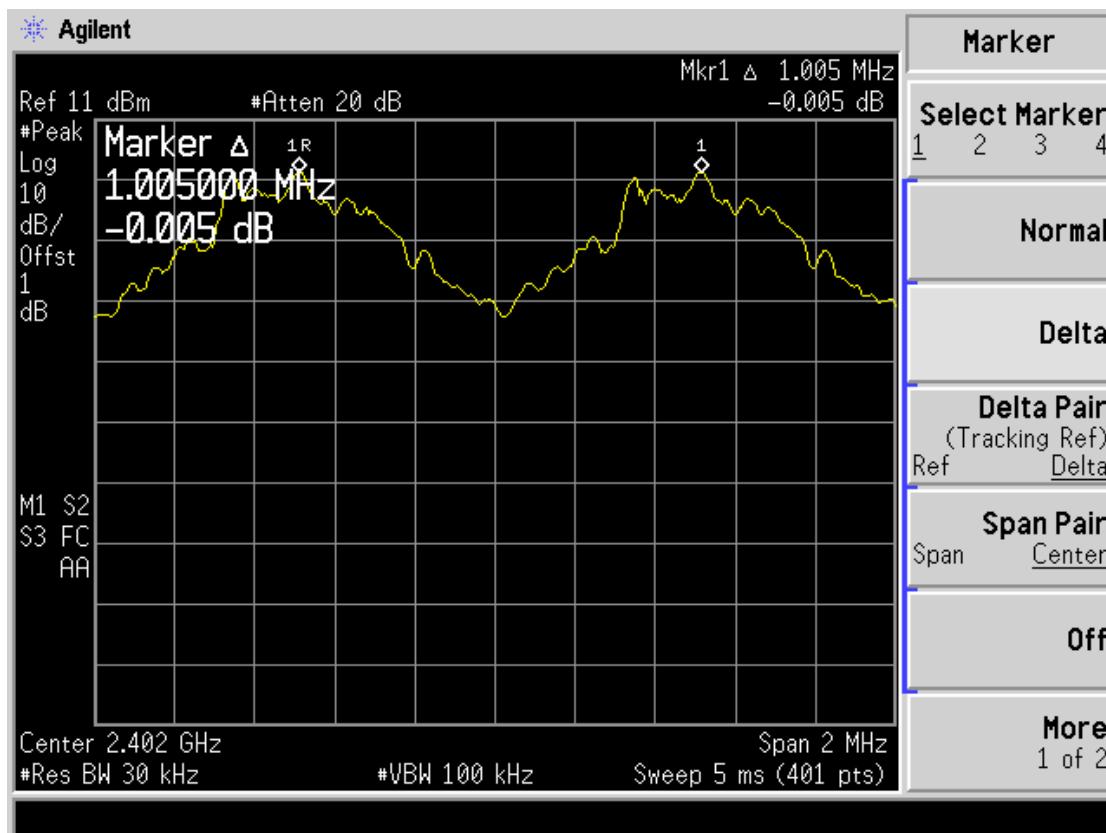
TEST RESULTS

BDR Mode:

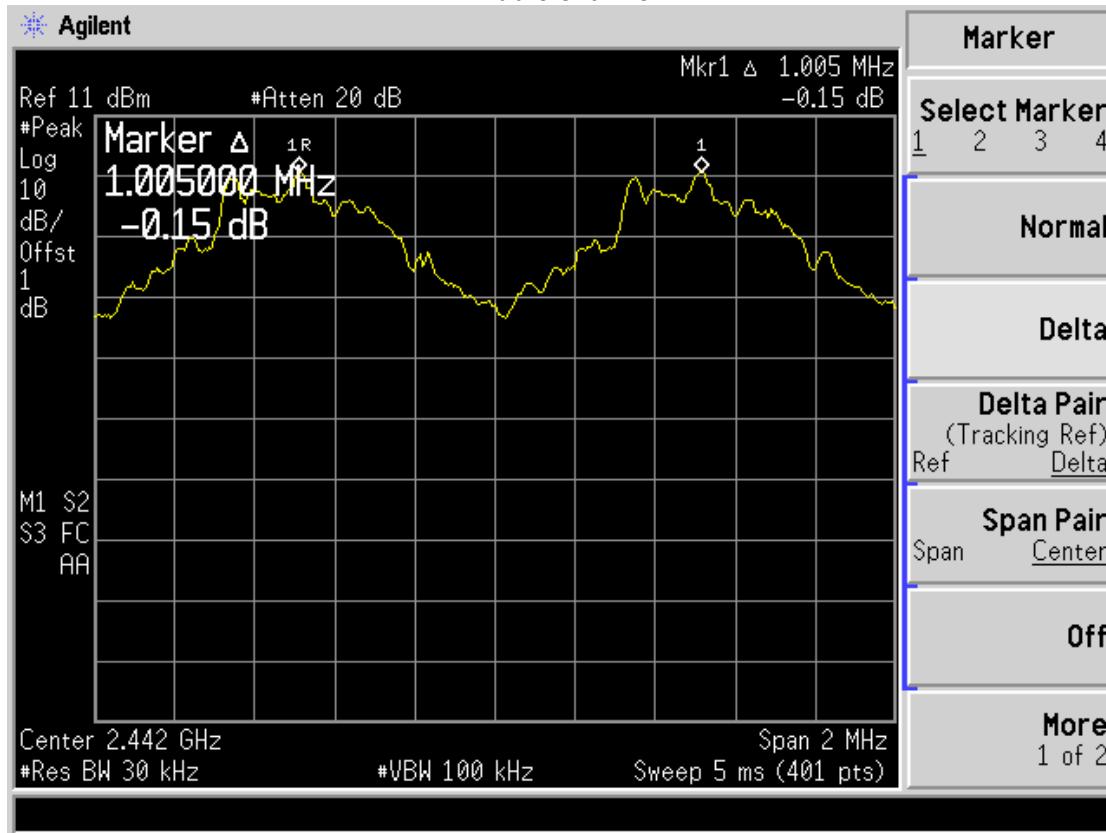
| Channel | Channel Frequency (MHz) | Channel Separation (MHz) | Limit (MHz) | Result |
|-------------------|-------------------------|--------------------------|---|--------|
| Low Channel | 2402 | 1.005 | 25KHz or $2/3 \times 20$ dB bandwidth(0.567MHz) | Pass |
| Adjacency Channel | 2403 | | | |
| Mid Channel | 2441 | 1.005 | 25KHz or $2/3 \times 20$ dB bandwidth(0.566MHz) | Pass |
| Adjacency Channel | 2442 | | | |
| High Channel | 2480 | 1.005 | 25KHz or $2/3 \times 20$ dB bandwidth(0.578MHz) | Pass |
| Adjacency Channel | 2479 | | | |

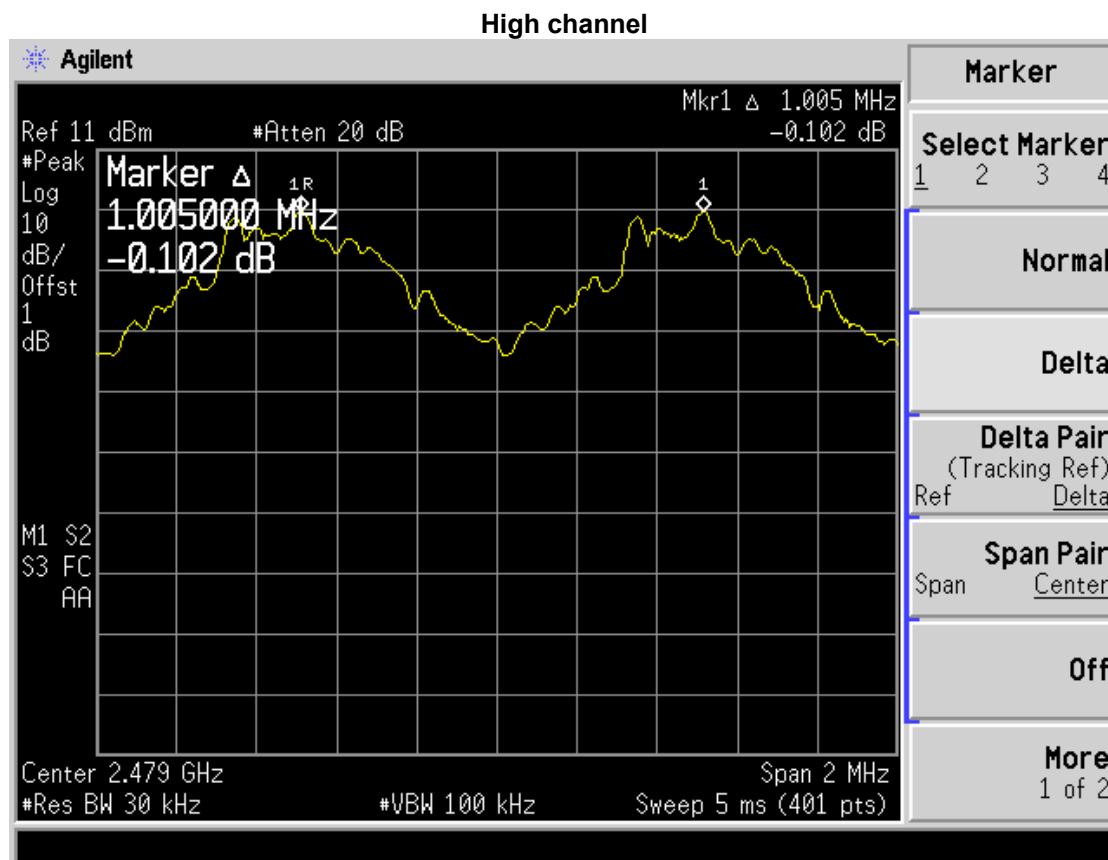
Photos of Frequency separation Measurement

Low channel



Middle channel





4.7. Number of hopping frequency

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. Set spectrum analyzer start 2400MHz to 2483.5MHz with 30 KHz RBW and 100KHz VBW.

LIMIT

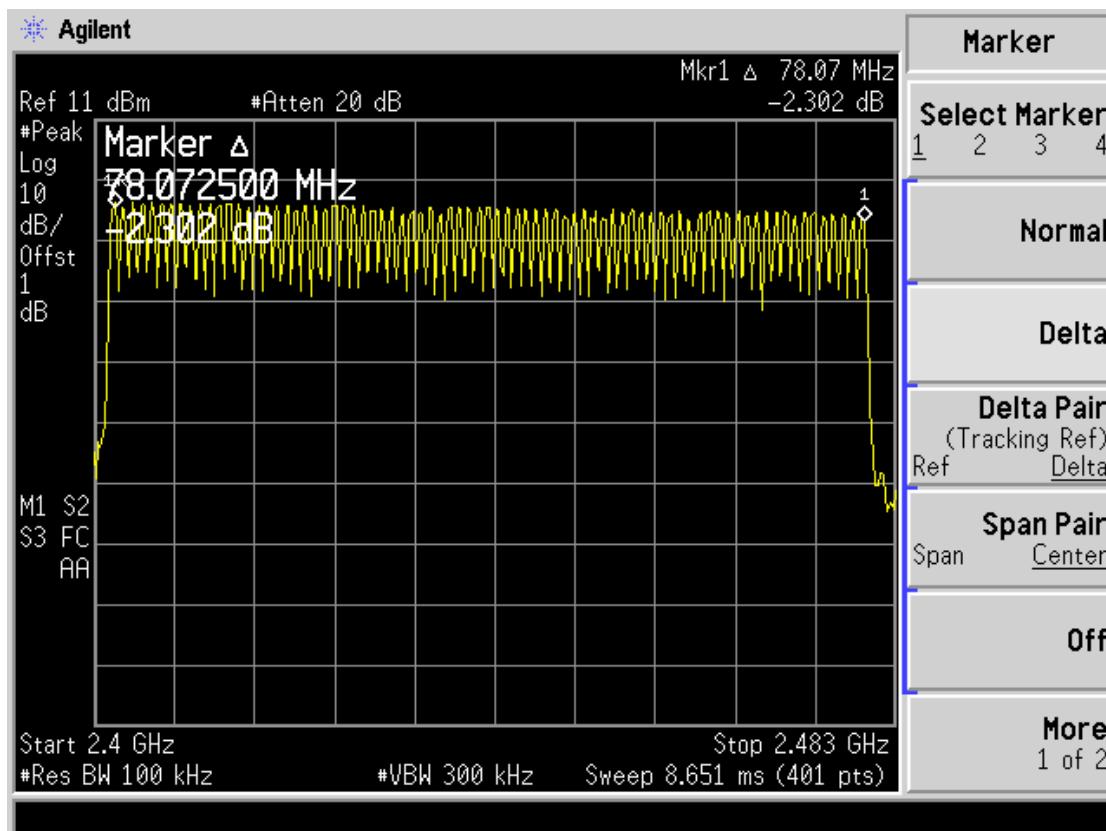
Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

TEST RESULTS

BDR Mode:

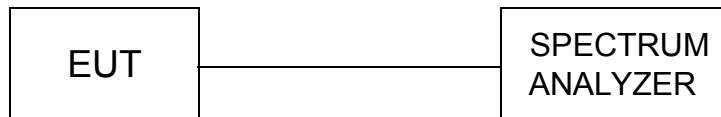
| Hopping Channel Frequency Range (MHz) | Number of Hopping Channel | Limit |
|---------------------------------------|---------------------------|-------|
| 2400-2483.5 | 79 | ≥15 |

Photos of Number of hopping channel Measurement(BDR Mode)



4.8. Time Of Occupancy(Dwell Time)

TEST CONFIGURATION



TEST PROCEDURE

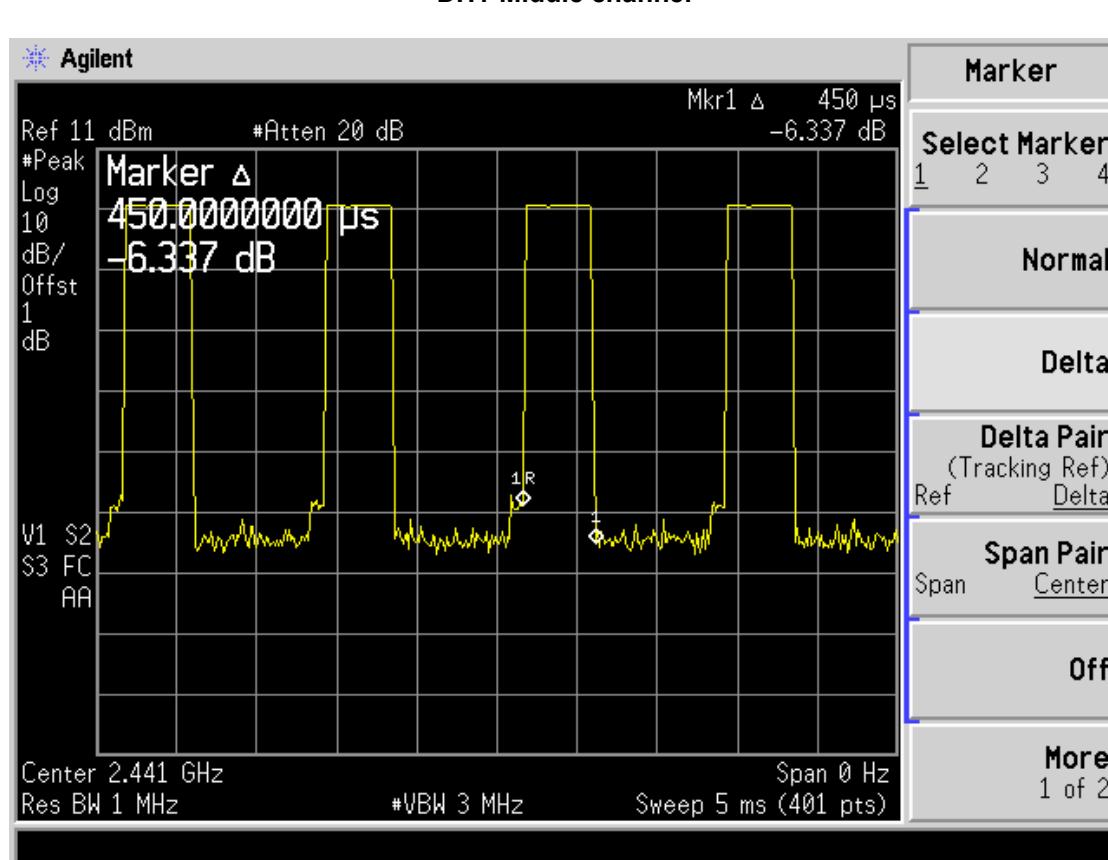
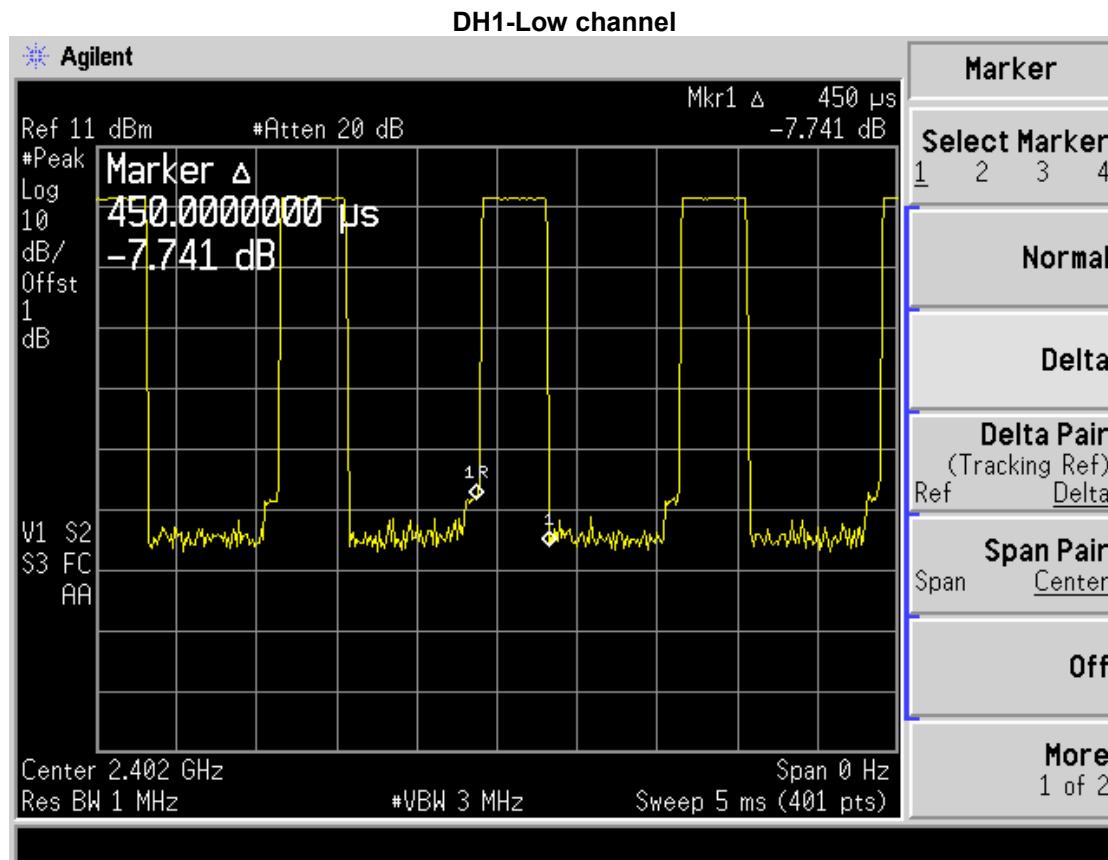
The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with 1MHz RBW and 3MHz VBW,Span 0Hz.

LIMIT

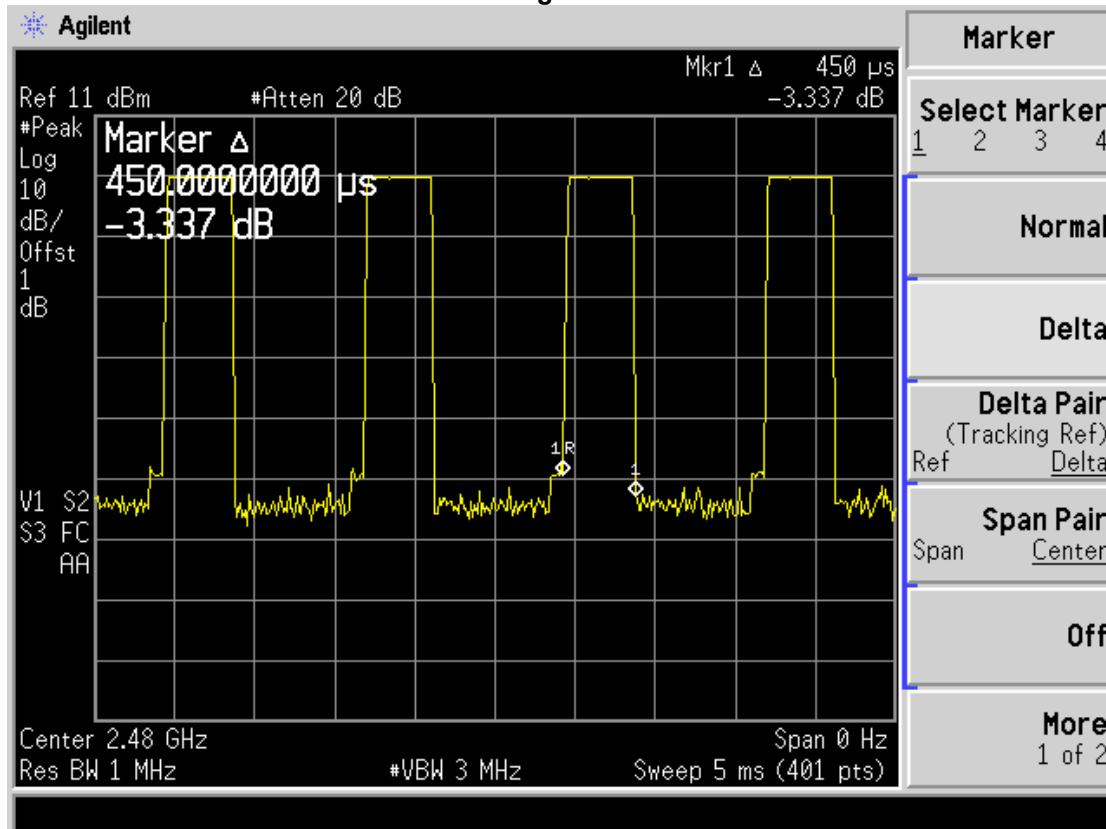
The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

TEST RESULTS

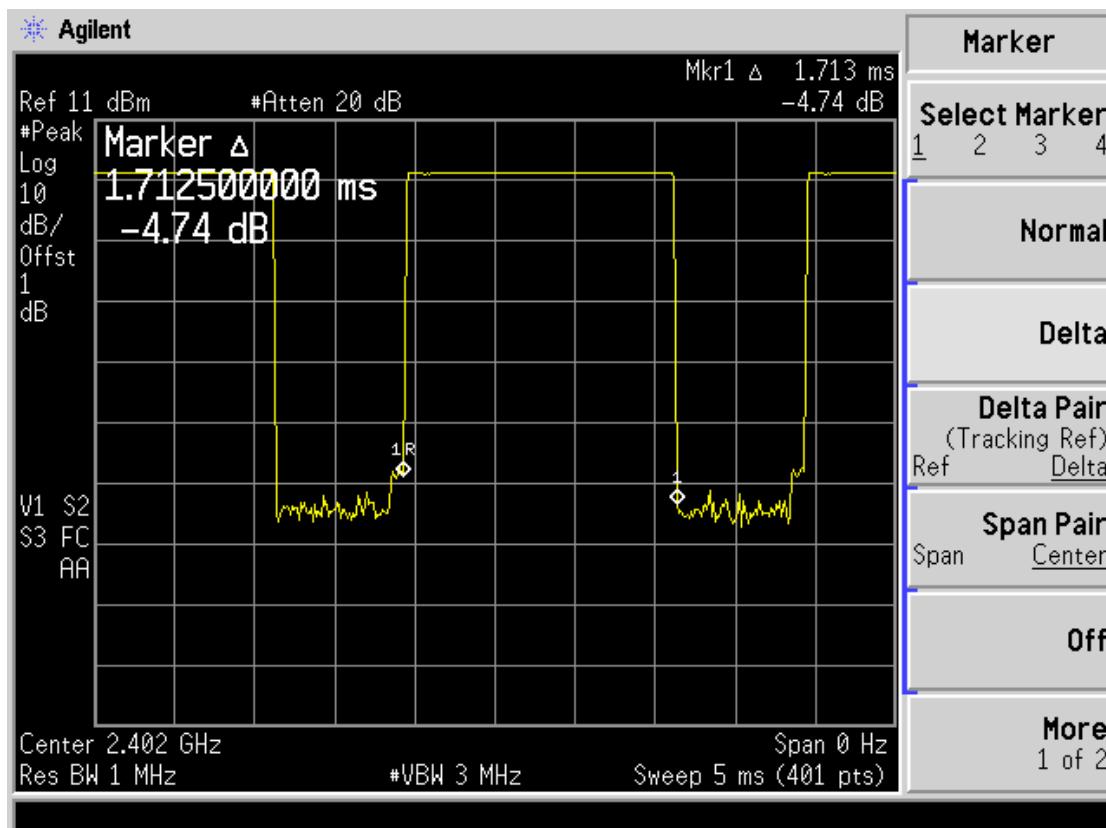
| Mode | Channel | Pulse Width (ms) | Dwell Time (S) | Limit (S) | Result |
|------|--|------------------|----------------|-----------|--------|
| DH 1 | Low | 0.450 | 0.144 | 0.4 | Pass |
| | Middle | 0.450 | 0.144 | 0.4 | Pass |
| | High | 0.450 | 0.144 | 0.4 | Pass |
| | Note: Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second | | | | |
| DH 3 | Low | 1.7125 | 0.274 | 0.4 | Pass |
| | Middle | 1.7375 | 0.278 | 0.4 | Pass |
| | High | 1.7125 | 0.274 | 0.4 | Pass |
| | Note: Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second | | | | |
| DH 5 | Low | 3.000 | 0.3200 | 0.4 | Pass |
| | Middle | 2.980 | 0.3179 | 0.4 | Pass |
| | High | 2.980 | 0.3179 | 0.4 | Pass |
| | Note: Dwell time=Pulse Time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second | | | | |

Photos of Dwell time Measurement:

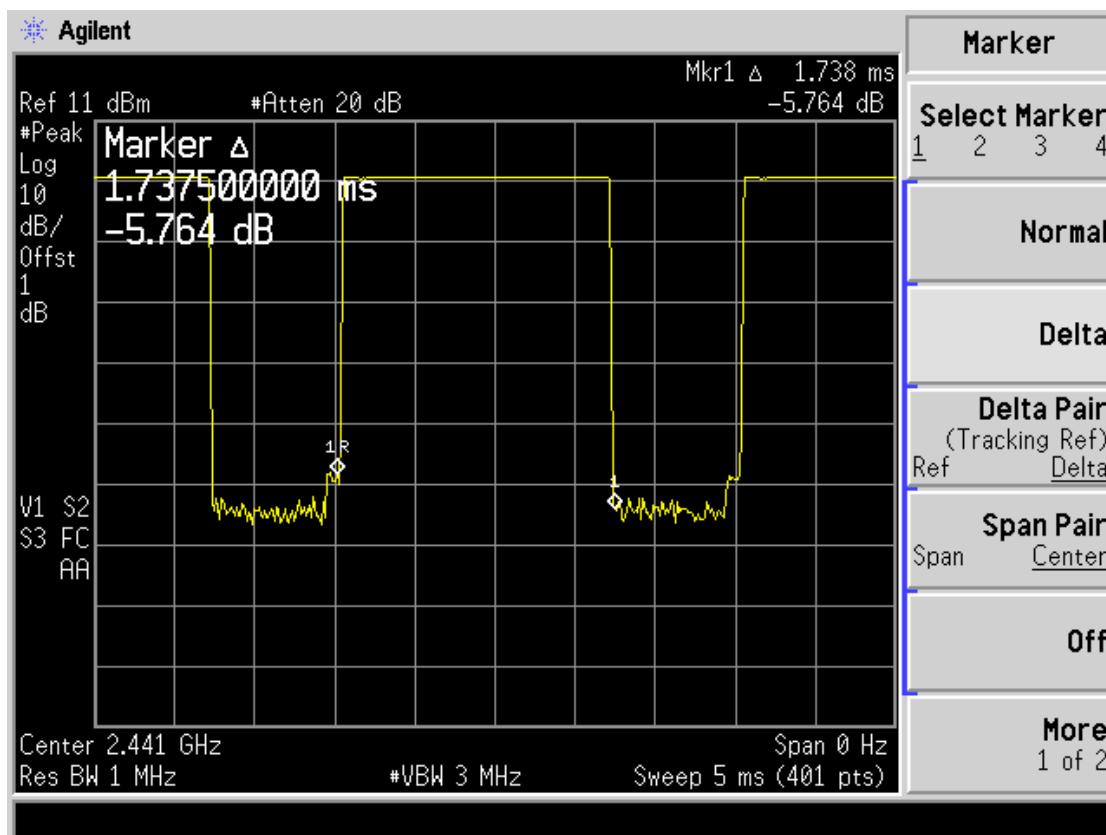
DH1-High channel



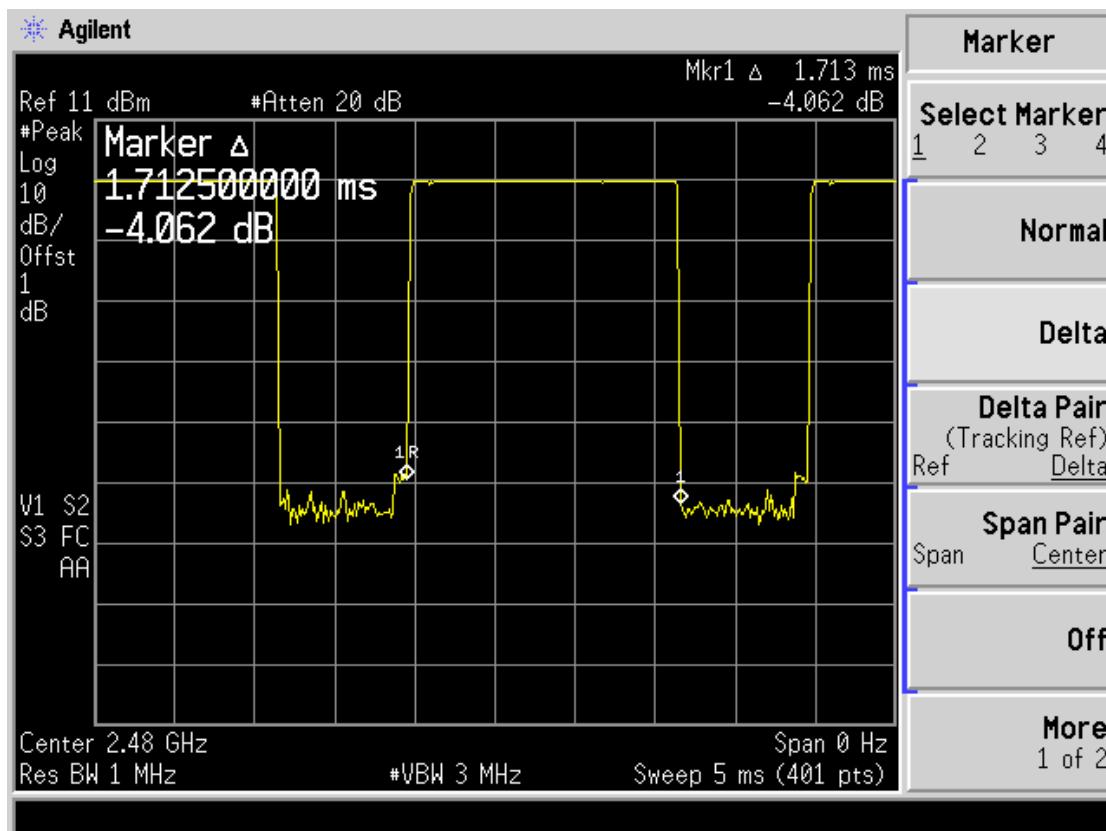
DH3-Low channel



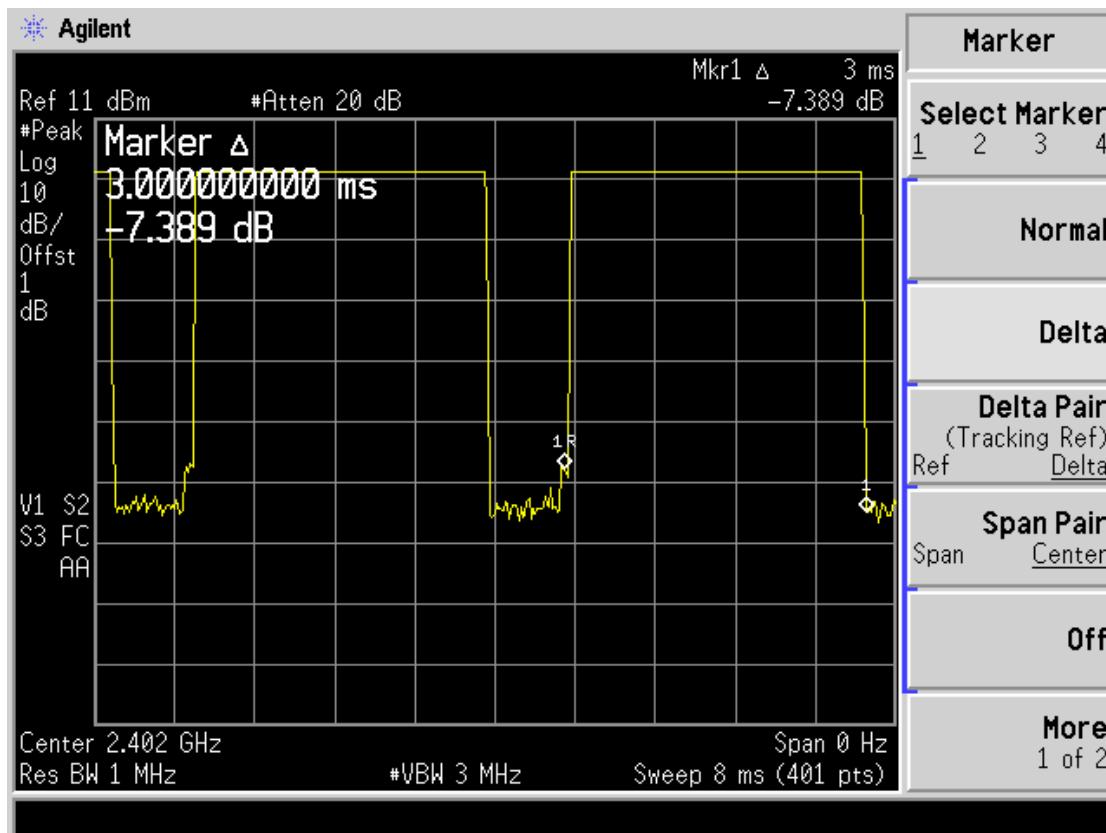
DH3-Middle channel



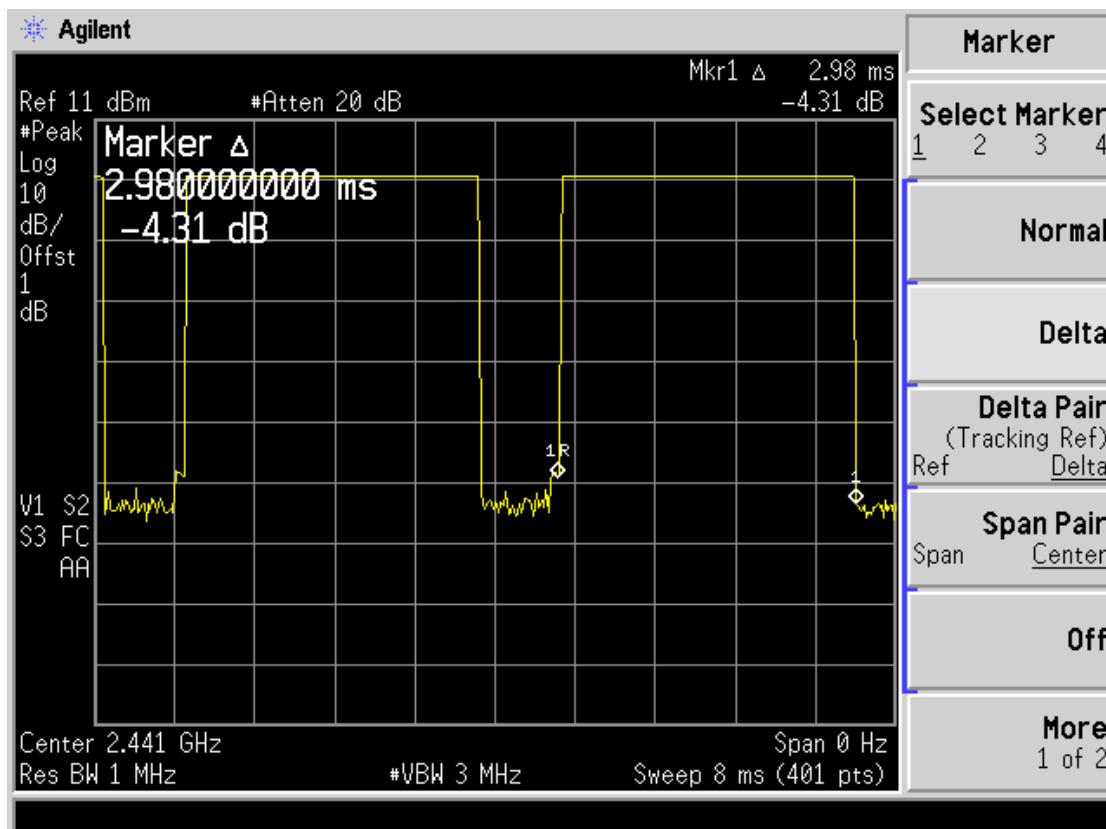
DH3-High channel



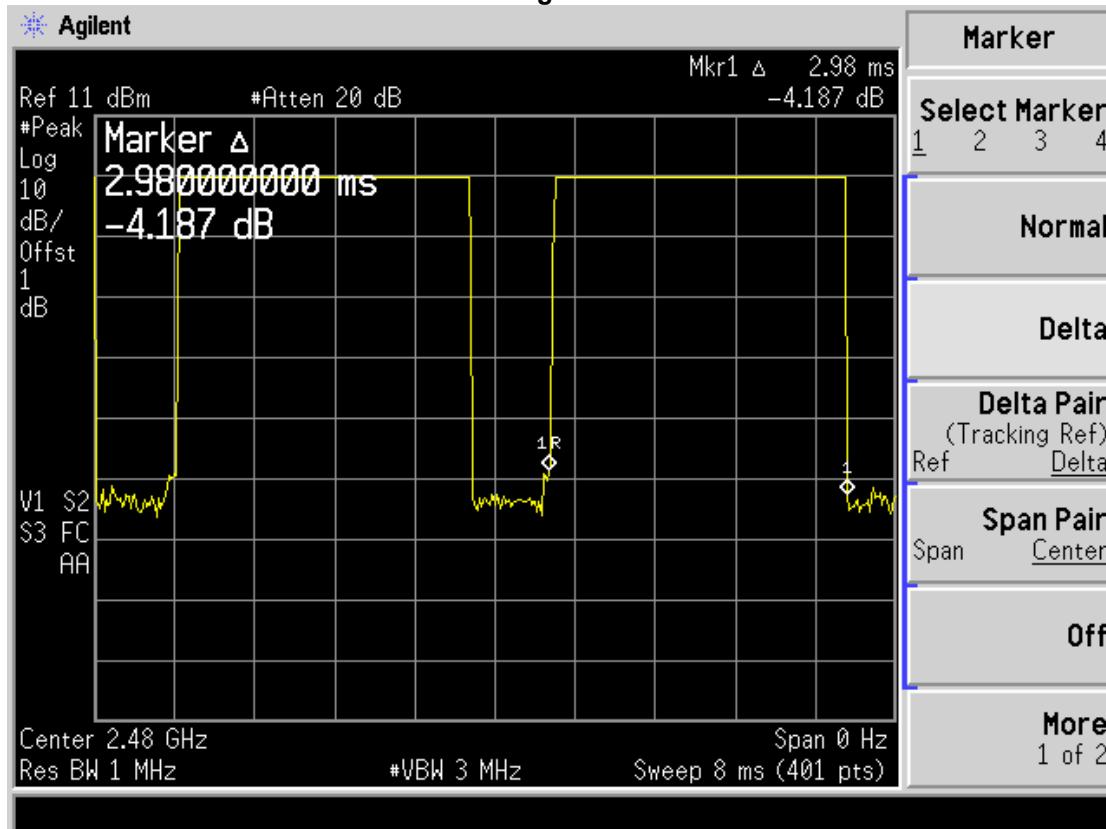
DH5-Low channel



DH5-Middle channel



DH5-High channel



4.9. Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 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.

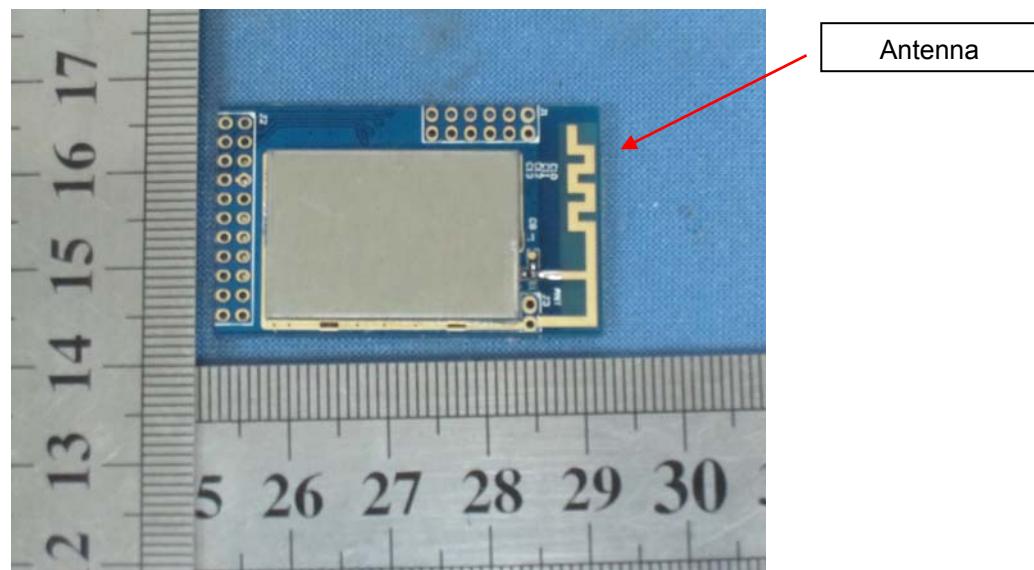
And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Refer to statement below for compliance.

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

The antenna used in this product is a PCB Antenna . please see the photos as following:



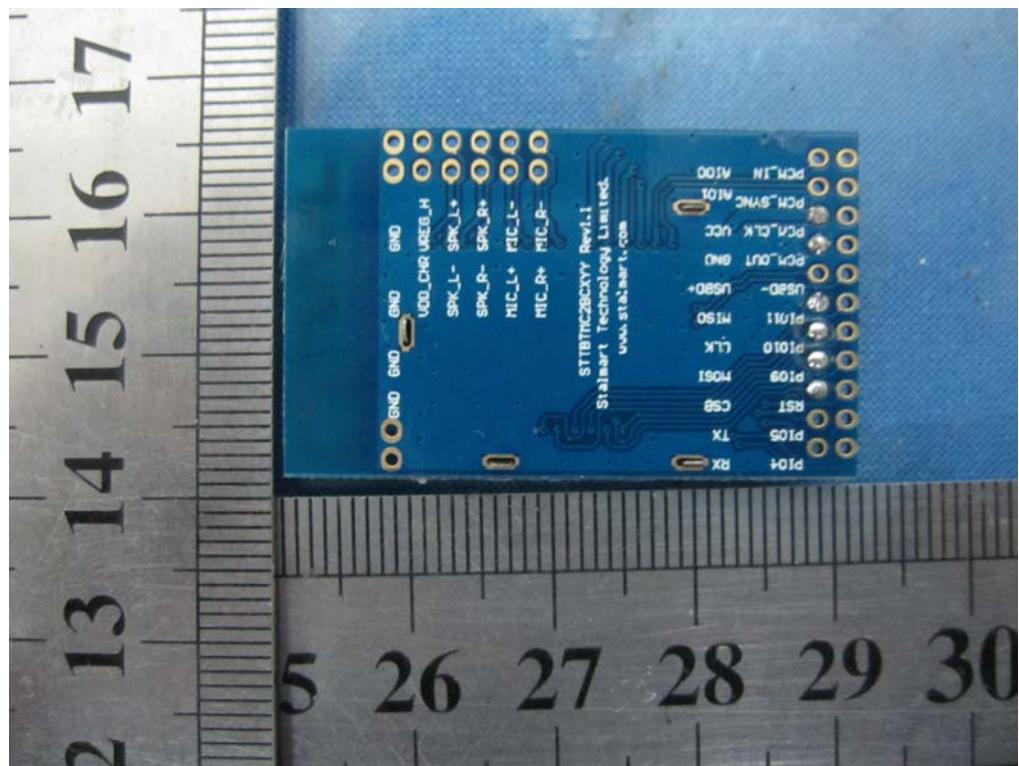
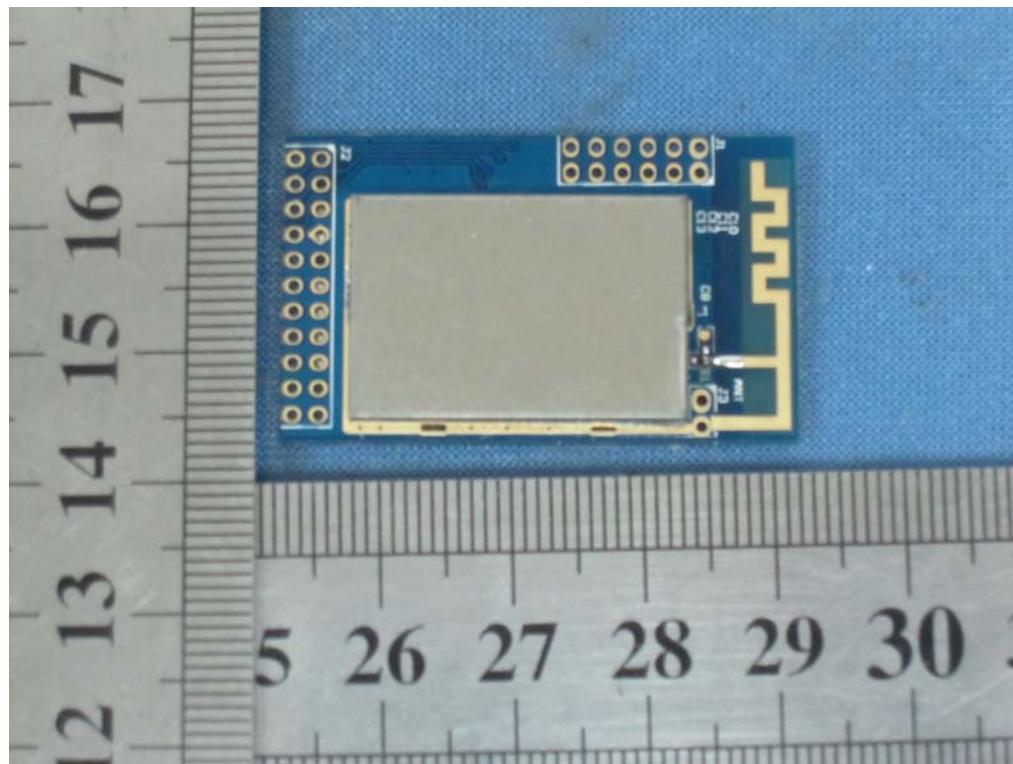
5. Test Setup Photos of the EUT

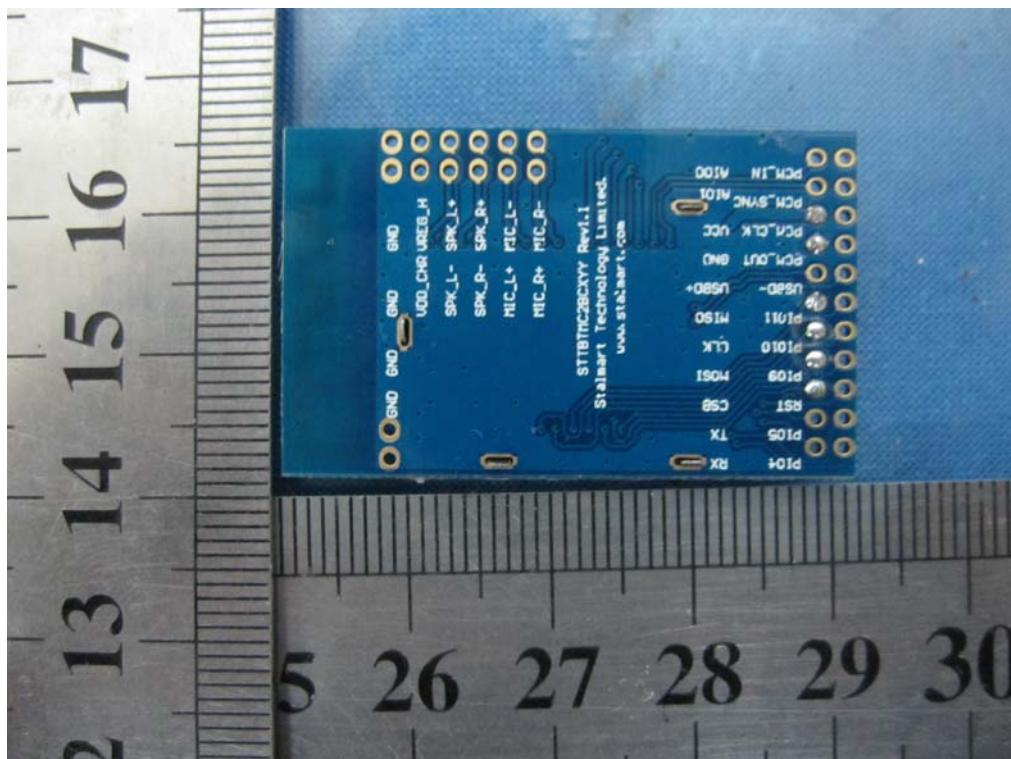




6. External and Internal Photos of the EUT

External Photos



Internal Photos

.....End of Report.....