

**ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT
INTENTIONAL RADIATOR CERTIFICATION TO
FCC PART 15 SUBPART C REQUIREMENT**

OF

Bluetooth WL-BT

MODEL No.: WL-BT

FCC ID: 2AAJ9BLUETOOTH

Trademark: GROWATT

REPORT NO: ES130110059E

ISSUE DATE: March 25, 2013

Prepared for

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VERIFICATION OF COMPLIANCE

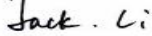
| | |
|----------------------|--|
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| Product Description: | Bluetooth WL-BT |
| Model Number: | WL-BT |
| Trade Mark: | GROWATT |
| Serial Number: | N/A |
| File Number: | ES130110059E |
| Date of Test: | November 08, 2012 to March 18, 2013 |


We hereby certify that:

The above equipment was tested by SHENZHEN EMTEK CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2009) and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247.

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

Date of Test : November 08, 2012 to March 18, 2013

Prepared by : 
Jack.Li/Editor

Reviewer : 
June Xie/Supervisor


Approve & Authorized Signer : 
Lisa Wang/Manager

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1. GENERAL INFORMATION

1.1 Product Description

Bluetooth WL-BT is a short range, lower power Device. It is designed by way of utilizing the GFSK, 1/4 Π -DQPSK modulation achieves the system operating.

A major technical descriptions of EUT is described as following:

- A). Operation Frequency: 2402-2480MHz
- B). Modulation: GFSK, 1/4 Π -DQPSK
- C). Number of Channel: 79
- D). Channel space: 1MHz
- E). RF Output Power: 16.64dBm(max)
- F). BIT Rate of Transmission: 1Mbps, 2Mbps
- G). Antenna Type: external (PIFA)antenna
- H). Antenna GAIN: 2.5dBi
- I). Power Supply: DC 9V from RS232 port

1.2 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: 2AAJ9BLUETOOTH filing to comply with Section 15.247 of the FCC Part 15 Subpart C Rules.

1.3 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4 (2009) and FCC Public Notice DA 00-705. Radiated testing was performed at an antenna to EUT distance 3 meters.

1.4 Special Accessories

Not available for this EUT intended for grant.

1.5 Equipment Modifications

Not available for this EUT intended for grant.

1.6 Test Facility

Site Description

- EMC Lab. : Accredited by CNAS, 2010.10.29
The certificate is valid until 2013.10.28
The Laboratory has been assessed and proved to be in compliance with CNAS/CL01:2006(identical to ISO/IEC17025: 2005)
The Certificate Registration Number is L2291
- Accredited by TUV Rheinland Shenzhen 2010.5.25
The Laboratory has been assessed according to the requirements ISO/IEC 17025
- Accredited by FCC, October 28, 2010
The Certificate Registration Number is 709623.
- Accredited by Industry Canada, March 5, 2010
The Certificate Registration Number is 4480A-2.
- Name of Firm : SHENZHEN EMTEK CO., LTD
- Site Location : Bldg 69, Majialong Industry Zone,
Nanshan District, Shenzhen, Guangdong, China

2. System Test Configuration

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4-2009 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and average detector mode.

2.3.2 Radiated Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4-2009.

2.4 Limitation

(1) Channel Separation test

FCC Part 15, Subpart C Section 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 Bandwidth of the hopping channel, whichever is greater.

| Frequency Range (MHz) | Limit(kHz) |
|-----------------------|------------|
| 902-928 | >25kHz |
| 2400-2483.5 | >25kHz |
| 5725-5850 | >25kHz |

(2)

| | | 20dB Bandwidth | | | |
|-------------------|------------------------------------|-----------------------|-----------|-----------|-----------|
| Frequency | Limit(kHz) | | | | |
| Range(MHz) | Quantity of Hopping Channel | 50 | 25 | 15 | 75 |
| 902-928 | | <250 | >250 | NA | NA |
| 2400-2483.5 | | NA | NA | >1000 | <1000 |

(3) Quantity of Hopping Channel

FCC Part 15, Subpart C Section 15.247

| | | Limit(Quantity of Hopping Channel) | | | |
|--------------------|-------------------|---|------------------|------------------|--|
| Frequency | 20dB | 20dB | 20dB | 20dB | |
| Range (MHz) | bandwidth | bandwidth | bandwidth | bandwidth | |
| | <250kHz | >250kHz | <1MHz | >1MHz | |
| 902-928 | 50 | 25 | NA | NA | |
| 2400-2483.5 | NA | NA | 75 | 15 | |
| 5725-5850 | NA | NA | 75 | NA | |

(4) Time of Occupancy(Dwell Time)

FCC Part 15, Subpart C Section 15.247

| | | LIMIT(rms) | | |
|------------------------|------------------------------|------------------------------|----------------------------|--|
| Frequency Range | 20dB bandwidth | 20dB bandwidth | 20dB bandwidth | |
| (MHz) | <250kHz(50Channel) | >250kHz(25Channel) | <1MHz(75Channel) | |
| 902-928 | 400(20S) | 400(10S) | NA | |
| 2400-2483.5 | NA | NA | 400(30S) | |
| 5725-5850 | NA | NA | 400(30S) | |

Note: The “()”is all channel’s average time of occupancy.

(5) Maximum Peak Output Power

FCC Part 15, Subpart C Section 15.247

| | | LIMIT(W) | | | |
|--------------------|--------------------|-----------------|--------------|--------------|-----------|
| Frequency | Quantity of | 50 | 25 | 15 | 75 |
| Range (MHz) | Hopping | | | | |
| | Channel | | | | |
| 902-928 | | 1(30dBm) | 0.125(21dBm) | NA | NA |
| 2400-2483.5 | | NA | NA | 0.125(21dBm) | 1(30dBm) |
| 5725-5850 | | NA | NA | NA | 1(30dBm) |

(6) Band edge

FCC Part15, Subpart C Section 15.247, In any 100kHz 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 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, attenuation below the general limits specified in section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a).

| Operating Frequency Range(MHz) | Spurious emission frequency | Limit Peak power ration to emission(dBc) | Emission level(dBuV/m) |
|--------------------------------|-----------------------------|--|------------------------|
| 902-928 | <902 | >20 | NA |
| | >928 | >20 | NA |
| | 960-1240 | NA | 54 |
| 2400-2483.5 | <2400 | >20 | NA |
| | >2483.5-2500 | NA | 54 |
| | <5350-5460 | NA | 54 |
| 5725-5850 | <5725 | >20 | NA |
| | >5850 | >20 | NA |

(7) Conducted Emission

| Frequency(MHz) | Quasi-peak | Average |
|----------------|------------|---------|
| 0.15-0.5 | 66-56 | 56-46 |
| 0.5-5.0 | 56 | 46 |
| 5.0-30.0 | 60 | 50 |

Note:

1. The lower limit shall apply at the transition frequencies
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

(8) Radiated Emission

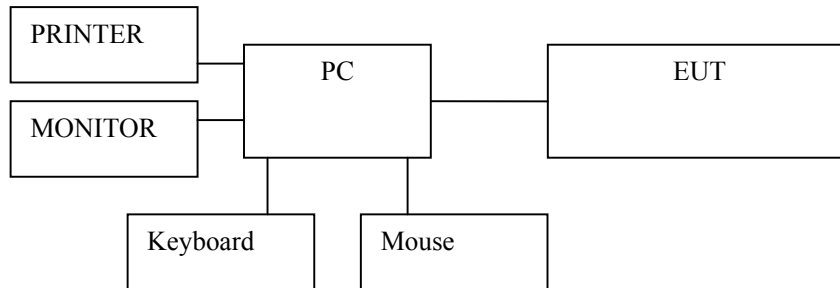
FCC Part 15, Subpart C Section 15.209 limit of radiated emission for frequency below 1000GHz. The emissions from an intentional radiator shall not exceed the field strength level specified in the following table:

| Frequency (MHz) | Field strength $\mu\text{V/m}$ | Distance(m) | Field strength at 3m $\text{dB}\mu\text{V/m}$ |
|--------------------|-----------------------------------|-------------|--|
| 0.009~0.490 | 2400/F(KHz) | 300 | See the remark |
| 0.490~1.705 | 2400/F(KHz) | 30 | |
| 1.705~30.0 | 30 | 30 | |
| 30-88 | 100 | 3 | 40 |
| 88-216 | 150 | 3 | 43.5 |
| 216-960 | 200 | 3 | 46 |
| Above 960 | 500 | 3 | 54 |

Remark: 1. Emission level in $\text{dB}\mu\text{V/m} = 20 \log(\mu\text{V/m})$
 2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
 3. Distance extrapolation factor $= 40 \log(\text{Specific distance} / \text{test distance}) (\text{dB})$;
 Limit line = Specific limits($\text{dB}\mu\text{V}$) + distance extrapolation factor.

2.5 Configuration of Tested System

Fig. 2-1 Configuration of Tested System



2.6 Equipment Used in Tested System

| Equipment | Mfr/Brand | Model/Type No. | FCC ID / IC | Series No. | Note |
|-----------------|-----------|------------------|----------------|--------------------|------|
| Bluetooth WL-BT | Growatt | WL-BT | 2AAJ9BLUETOOTH | N/A | EUT |
| PC | Lenovo | ThinkCentre 8701 | N/A | 8701A53L 3BC108 | |
| LCD Monitor | SONY | SDM-S53/B T8UC7 | N/A | P-1746581 1-F | |
| Printer | HP | C89520 | N/A | CN25S18 2N6 | |

2.7 Description of test modes

The EUT has been tested under TX operating condition.

This EUT is a FHSS system, were conducted to determine the final configuration from all possible combinations. We use software control the EUT, Let EUT hopping on and transmit with highest power, All the modes have been tested and the worst result was reported with modulation GFSK, 1/4 Π -DQPSK; 79 Channels are provided by EUT. The 3 channels of lower, medium and higher were chosen for test.

| Channel | Frequency(MHz) |
|---------|----------------|
| 1 | 2402 |
| 40 | 2441 |
| 79 | 2480 |

3. Summary of Test Results

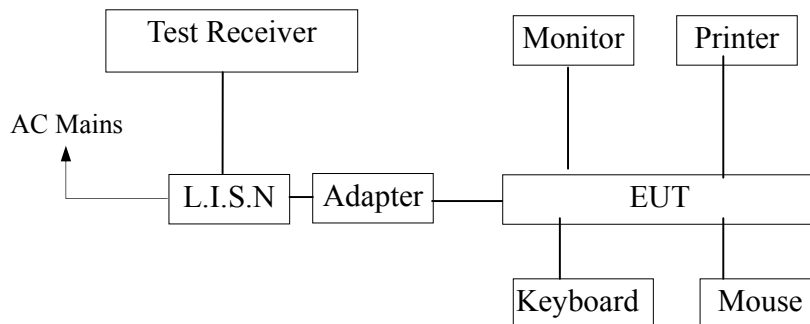
| FCC Rule | Description Of Test | Result |
|------------------|--|-----------|
| 15.247(a)(1) | Channel Separation test | Compliant |
| 15.247(a)(1) | 20dB Bandwidth | Compliant |
| 15.247(a)(1) | Quantity of Hopping Channel | Compliant |
| 15.247(a)(1) | Time of Occupancy (Dwell Time) | Compliant |
| 15.247(b)(1) | Max Peak output Power test | Compliant |
| 15.247(d) | Band edge test | Compliant |
| 15.207 | AC Power Conducted Emission | Compliant |
| 15.247(d) | Radiated Emission | Compliant |
| 15.247(d) | Antenna port conducted spurious emission | Compliant |
| 15.203&15.247(b) | Antenna Application | Compliant |

4. Conducted Emissions Test

4.1 Measurement Procedure:

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

4.2 Test SET-UP (Block Diagram of Configuration)



4.3 Measurement Equipment Used:

| Conducted Emission Test Site # 4 | | | | | |
|----------------------------------|-----------------|--------------|---------------|------------|------------|
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
| Test Receiver | Rohde & Schwarz | ESCS30 | 828985/018 | 05/29/2012 | 05/28/2013 |
| L.I.S.N | Rohde & Schwarz | ESH2-Z5 | 834549/005 | 05/29/2012 | 05/28/2013 |
| 50ΩCoaxial Switch | Anritsu | MP59B | M20531 | 05/29/2012 | 05/28/2013 |

4.4 Conducted Emission Limit

(7) Conducted Emission

Frequency(MHz)

0.15-0.5

0.5-5.0

5.0-30.0

Quasi-peak

66-56

56

60

Average

56-46

46

50

Note:

1. The lower limit shall apply at the transition frequencies
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.5 Measurement Result:

Date of Test: January 15, 2013 Temperature: 22°C
 Frequency Detector: 0.15~30MHz Humidity: 50%
 Test Result: PASS Test Mode: TX Mode

| Test Line | Frequency MHz | Emission Level QP dB(μV) | Emission Level AV dB(μV) | Limits QP dB(μV) | Limits AV dB(μV) | Margin QP dB(μV) | Margin AV dB(μV) |
|-----------|---------------|--------------------------|--------------------------|------------------|------------------|------------------|------------------|
| Line | 0.15 | 56.95 | 45.43 | 66.00 | 56.00 | -9.05 | -10.57 |
| | 0.21 | 43.20 | 43.68 | 63.21 | 53.21 | -20.01 | -9.53 |
| | 0.46 | 24.99 | 20.88 | 56.69 | 46.69 | -31.70 | -25.81 |
| | 3.71 | 32.17 | 14.34 | 56.00 | 46.00 | -23.83 | -31.66 |
| | 11.15 | 36.16 | 29.18 | 60.00 | 50.00 | -23.84 | -20.82 |
| | 25.98 | 51.75 | 44.66 | 60.00 | 50.00 | -8.25 | -5.34 |
| Neutral | 0.16 | 56.47 | 46.38 | 65.73 | 55.73 | -9.26 | -9.35 |
| | 0.21 | 46.70 | 43.46 | 63.21 | 53.21 | -16.51 | -9.75 |
| | 0.29 | 34.03 | 29.03 | 60.67 | 50.67 | -26.64 | -21.64 |
| | 7.44 | 31.32 | 24.93 | 60.00 | 50.00 | -28.68 | -25.07 |
| | 11.53 | 31.66 | 25.56 | 60.00 | 50.00 | -28.34 | -24.44 |
| | 26.10 | 52.41 | 43.89 | 60.00 | 50.00 | -7.59 | -6.11 |

5. Radiated Emission Test

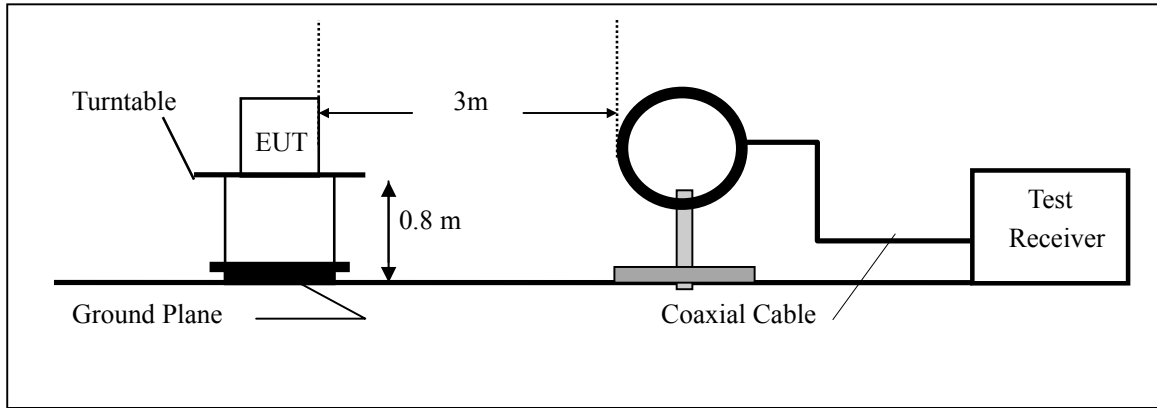
5.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
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 measured was complete.

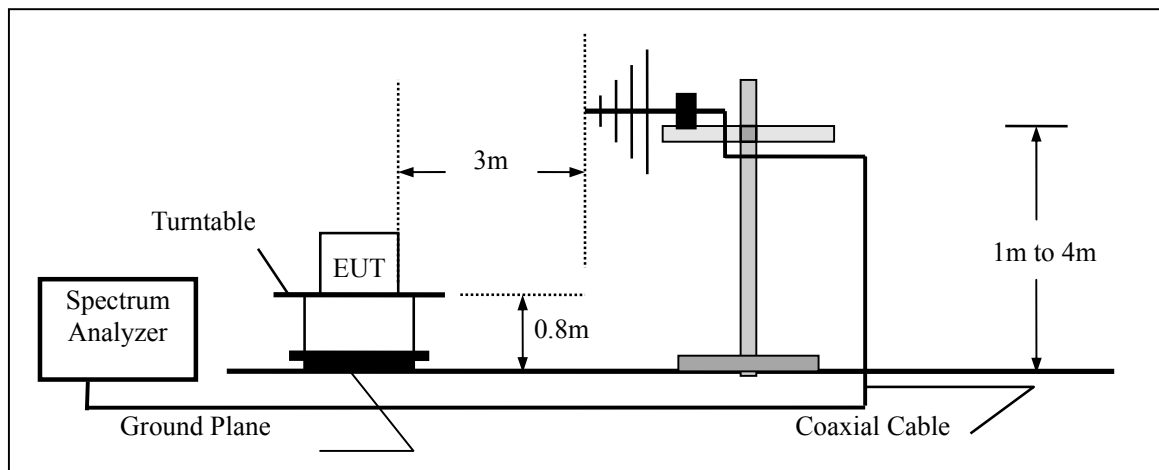
When spectrum scanned from 30 MHz to 1GHz setting resolution bandwidth 100 kHz and video bandwidth 300kHz. And spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 3MHz.

5.2 Test SET-UP (Block Diagram of Configuration)

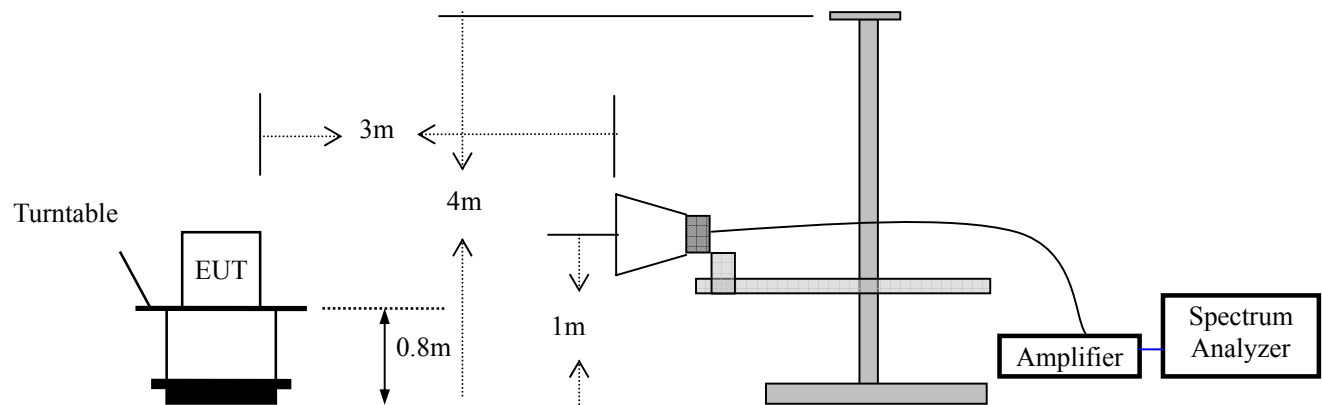
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



5.3 Measurement Equipment Used:

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
|-------------------|-----------------|--------------|---------------|------------|------------|
| Spectrum Analyzer | Rohde & Schwarz | FSP7 | 839511/010 | 05/29/2012 | 05/28/2013 |
| Spectrum Analyzer | HP | E4407B | 839840481 | 05/29/2012 | 05/28/2013 |
| EMI Test Receiver | Rohde & Schwarz | ESCS30 | 828985/018 | 05/29/2012 | 05/28/2013 |
| Pre-Amplifier | HP | 8447D | 2944A07999 | 05/29/2012 | 05/28/2013 |
| Bilog Antenna | Schwarzbeck | VULB9163 | 142 | 05/29/2012 | 05/28/2013 |
| Loop Antenna | ARA | PLA-1030/B | 1029 | 05/29/2012 | 05/28/2013 |
| Horn Antenna | Schwarzbeck | BBHA 9170 | BBHA9170399 | 05/29/2012 | 05/28/2013 |
| Horn Antenna | Schwarzbeck | BBHA 9120 | D143 | 05/29/2012 | 05/28/2013 |

5.4 Measurement Result

All modulation have been tested, the worst result GFSK modulation are recorded in the following:

Operation Mode: Bluetooth Mode Test Date : January 15, 2013
Frequency Range: 9KHz~30MHz Temperature : 28℃
Test Result: PASS Humidity : 65 %
Measured Distance: 3m Test By: WOLF

| Freq. (MHz) | Ant.Pol. H/V | Emission Level (dBuV/m) | Limit 3m (dBuV/m) | Over (dB) |
|----------------|-----------------|----------------------------|----------------------|--------------|
| -- | -- | -- | -- | -- |

Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.

Frequency Below 1000MHz Test result

Operation Mode: CH1:2402MHz Test Date : January 15, 2013
Frequency Range: 30~1000MHz Temperature : 28 °C
Test Result: PASS Humidity : 65 %
Measured Distance: 3m Test By: KL

| Freq. (MHz) | Ant.Pol. H/V | Emission Level (dBuV/m) | Limit 3m (dBuV/m) | Margin (dB) | Note |
|----------------|-----------------|----------------------------|----------------------|----------------|------|
| 36.22 | V | 37.15 | 40.00 | -2.85 | QP |
| 59.54 | V | 33.61 | 40.00 | -6.39 | QP |
| 117.05 | V | 41.17 | 43.50 | -2.33 | QP |
| 126.38 | V | 39.57 | 43.50 | -3.93 | QP |
| 140.37 | V | 37.29 | 43.50 | -6.21 | QP |
| 252.29 | V | 38.21 | 46.00 | -7.79 | QP |
| 199.44 | H | 34.97 | 43.50 | -8.53 | QP |
| 235.19 | H | 34.43 | 46.00 | -11.57 | QP |
| 252.29 | H | 42.80 | 46.00 | -3.20 | QP |
| 303.59 | H | 33.02 | 46.00 | -12.98 | QP |
| 404.63 | H | 33.26 | 46.00 | -12.74 | QP |
| 505.67 | H | 34.21 | 46.00 | -11.79 | QP |

- Note:**
- (1) All Readings are Peak Value.
 - (2) Emission Level= Reading Level+Probe Factor +Cable Loss.
 - (3) The average measurement was not performed when the peak measured data under the limit of average detection.
 - (4) EUT stood on the table position is the worst case result in the report.

Operation Mode: CH40:2441MHz Test Date : January 15, 2013
Frequency Range: 30~1000MHz Temperature : 28 °C
Test Result: PASS Humidity : 65 %
Measured Distance: 3m Test By: KL

| Freq. (MHz) | Ant.Pol. H/V | Emission Level (dBUV/m) | Limit 3m (dBUV/m) | Margin (dB) | Note |
|----------------|-----------------|----------------------------|----------------------|----------------|------|
| 59.54 | V | 37.00 | 40.00 | -3.00 | QP |
| 117.05 | V | 39.94 | 43.50 | -3.56 | QP |
| 252.29 | V | 41.73 | 46.00 | -4.27 | QP |
| 401.52 | V | 39.28 | 46.00 | -6.72 | QP |
| 699.98 | V | 36.10 | 46.00 | -9.90 | QP |
| 810.35 | V | 37.78 | 46.00 | -8.22 | QP |
| 235.19 | H | 37.75 | 46.00 | -8.25 | QP |
| 252.29 | H | 43.24 | 46.00 | -2.76 | QP |
| 269.39 | H | 35.34 | 46.00 | -10.66 | QP |
| 359.55 | H | 33.41 | 46.00 | -12.59 | QP |
| 468.37 | H | 33.75 | 46.00 | -12.25 | QP |
| 550.75 | H | 35.76 | 46.00 | -10.24 | QP |

- Note:**
- (1) All Readings are Peak Value.
 - (2) Emission Level= Reading Level+Probe Factor +Cable Loss.
 - (3) The average measurement was not performed when the peak measured data under the limit of average detection.
 - (4) EUT stood on the table position is the worst case result in the report.

Operation Mode: CH79:2480MHz Test Date : January 15, 2013
Frequency Range: 30~1000MHz Temperature : 28 °C
Test Result: PASS Humidity : 65 %
Measured Distance: 3m Test By: KL

| Freq. (MHz) | Ant.Pol. H/V | Emission Level (dBuV/m) | Limit 3m (dBuV/m) | Margin (dB) | Note |
|----------------|-----------------|----------------------------|----------------------|----------------|------|
| 51.76 | V | 34.42 | 40.00 | -5.58 | QP |
| 110.83 | V | 38.06 | 43.50 | -5.44 | QP |
| 118.61 | V | 39.90 | 43.50 | -3.60 | QP |
| 182.34 | V | 35.70 | 43.50 | -7.80 | QP |
| 199.44 | V | 35.40 | 43.50 | -8.10 | QP |
| 252.29 | V | 41.86 | 46.00 | -4.14 | QP |
| 191.67 | H | 35.27 | 43.50 | -8.23 | QP |
| 252.29 | H | 42.87 | 46.00 | -3.13 | QP |
| 359.55 | H | 37.94 | 46.00 | -8.06 | QP |
| 420.18 | H | 38.27 | 46.00 | -7.73 | QP |
| 471.47 | H | 36.51 | 46.00 | -9.49 | QP |
| 550.75 | H | 38.61 | 46.00 | -7.39 | QP |

Note: (1) All Readings are Peak Value.
(2) Emission Level= Reading Level+Probe Factor +Cable Loss.
(3) The average measurement was not performed when the peak measured data under the limit of average detection.
(4) EUT stood on the table position is the worst case result in the report.

Frequency above 1000MHz test result

Operation Mode: CH1: 2402MHz Test Date : January 15, 2013
Frequency Range: 1-25GHz Temperature : 28 °C
Test Result: PASS Humidity : 65 %
Measured Distance: 3m Test By: Andy

| Freq. (MHz) | Ant.Pol. H/V | Emission Level(dBuV/m) | | Limit 3m(dBuV/m) | | Margin(dB) | |
|----------------|-----------------|------------------------|-------|------------------|----|------------|--------|
| | | PK | AV | PK | AV | PK | AV |
| 4804 | V | 58.21 | 35.91 | 74 | 54 | -15.79 | -18.09 |
| 7206 | V | 59.96 | 35.82 | 74 | 54 | -14.04 | -18.18 |
| 9608 | V | 61.08 | 34.98 | 74 | 54 | -12.92 | -19.02 |
| -- | -- | -- | -- | -- | -- | -- | -- |
| 4804 | H | 57.54 | 36.22 | 74 | 54 | -16.46 | -17.78 |
| 7206 | H | 58.86 | 37.31 | 74 | 54 | -15.14 | -16.69 |
| 9608 | H | 59.38 | 38.28 | 74 | 54 | -14.62 | -15.72 |

No others harmonics emissions are higher than 20dB below the limits of 47 CFR Part 15.247.

- Note:** (1) All Readings are Peak Value and AV.
(2) Emission Level= Reading Level+Probe Factor +Cable Loss.
(3) Data of measurement within this frequency range shown “ -- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

Operation Mode: CH40: 2441MHz Test Date : January 15, 2013
Frequency Range: 1-25GHz Temperature : 28 °C
Test Result: PASS Humidity : 65 %
Measured Distance: 3m Test By: Andy

| Freq. (MHz) | Ant.Pol. H/V | Emission Level(dBuV/m) | | Limit 3m(dBuV/m) | | Margin(dB) | |
|----------------|-----------------|------------------------|-------|------------------|----|------------|--------|
| | | PK | AV | PK | AV | PK | AV |
| 4882 | V | 59.20 | 39.26 | 74 | 54 | -14.80 | -14.74 |
| 7323 | V | 58.72 | 39.62 | 74 | 54 | -15.28 | -14.38 |
| 9764 | V | 59.81 | 38.54 | 74 | 54 | -14.19 | -15.46 |
| -- | -- | -- | -- | -- | -- | -- | -- |
| 4882 | H | 61.97 | 40.52 | 74 | 54 | -12.03 | -13.48 |
| 7323 | H | 61.20 | 39.71 | 74 | 54 | -12.80 | -14.29 |
| 9764 | H | 62.10 | 41.14 | 74 | 54 | -11.90 | -12.86 |

No others harmonics emissions are higher than 20dB below the limits of 47 CFR Part 15.247.

- Note:** (1) All Readings are Peak Value and AV.
(2) Emission Level= Reading Level+Probe Factor +Cable Loss.
(3) Data of measurement within this frequency range shown “ -- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

Operation Mode: CH79: 2480MHz Test Date : January 15, 2013
Frequency Range: 1-25GHz Temperature : 28 °C
Test Result: PASS Humidity : 65 %
Measured Distance: 3m Test By: Andy

| Freq. (MHz) | Ant.Pol. H/V | Emission Level(dBuV/m) | | Limit 3m(dBuV/m) | | Margin(dB) | |
|----------------|-----------------|------------------------|-------|------------------|----|------------|--------|
| | | PK | AV | PK | AV | PK | AV |
| 4960 | V | 61.38 | 40.54 | 74 | 54 | -12.62 | -13.46 |
| 7440 | V | 61.31 | 40.10 | 74 | 54 | -12.69 | -13.90 |
| 9920 | V | 61.03 | 39.96 | 74 | 54 | -12.97 | -14.04 |
| -- | -- | -- | -- | -- | -- | -- | -- |
| 4960 | H | 61.54 | 40.74 | 74 | 54 | -12.46 | -13.26 |
| 7440 | H | 61.24 | 39.97 | 74 | 54 | -12.76 | -14.03 |
| 9920 | H | 60.93 | 39.48 | 74 | 54 | -13.07 | -14.52 |

No others harmonics emissions are higher than 20dB below the limits of 47 CFR Part 15.247.

- Note:**
- (1) All Readings are Peak Value and AV.
 - (2) Emission Level= Reading Level+Probe Factor +Cable Loss.
 - (3) Data of measurement within this frequency range shown “ -- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

6. Channel Separation test

6.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

6.2 Test SET-UP (Block Diagram of Configuration)



6.3 Measurement Equipment Used:

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
|-------------------|---------|--------------|---------------|------------|------------|
| Spectrum Analyzer | Agilent | E4407B | 88156318 | 05/29/2012 | 05/28/2013 |

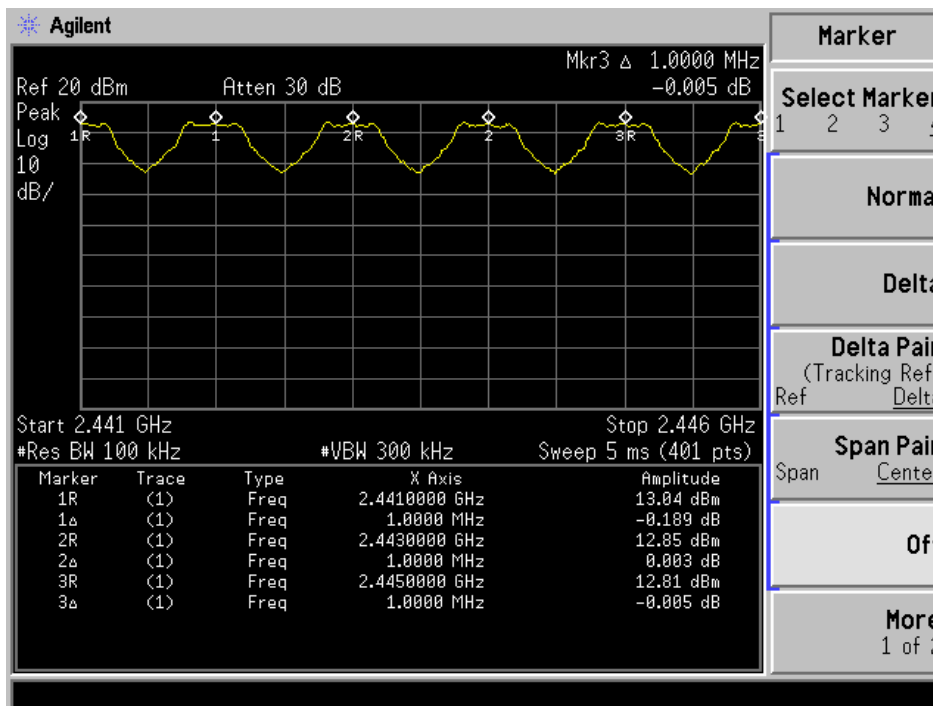
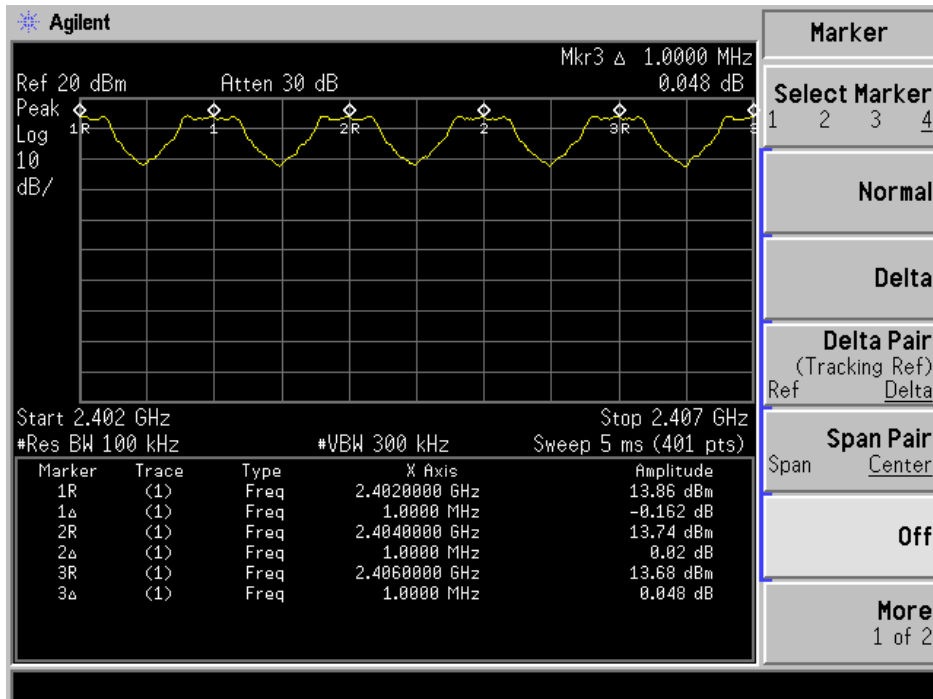
6.4 Measurement Results:

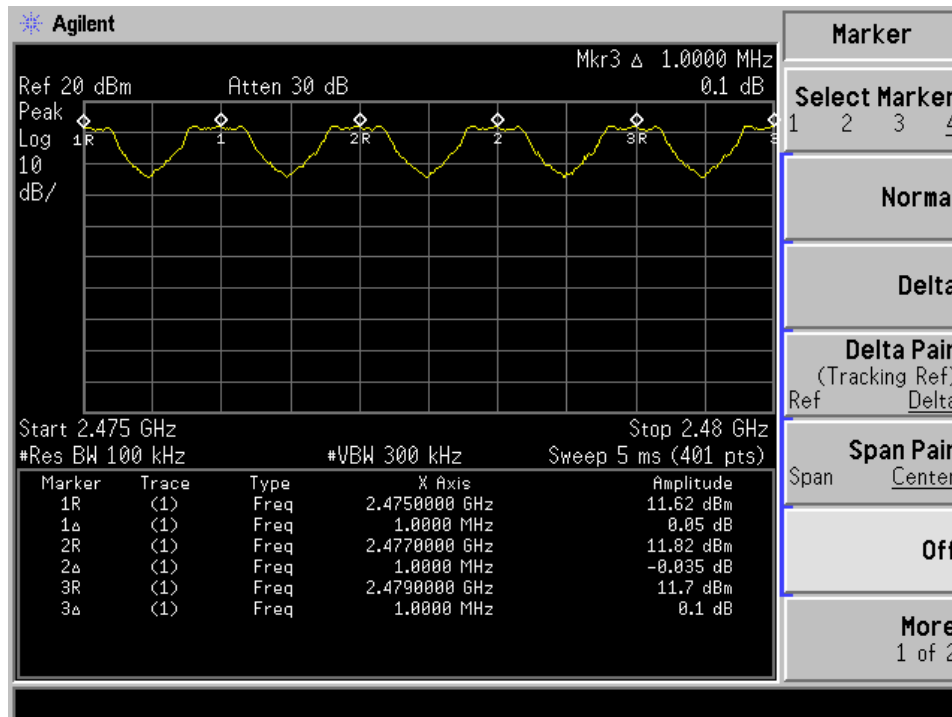
The following table is the setting of spectrum analyzer.

| | |
|-------------------|----------|
| EMI Test Receiver | Setting |
| Attenuation | Auto |
| RB | 100kHz |
| VB | 300kHz |
| Detector | Peak |
| Trace | Max hold |

| | | | |
|--------------------|------|---------------|---------------|
| Spectrum Detector: | PK | Test Date : | March 8, 2013 |
| Test By: | Andy | Temperature : | 28 °C |
| Test Result: | PASS | Humidity : | 65 % |
| Modulation: | GFSK | | |

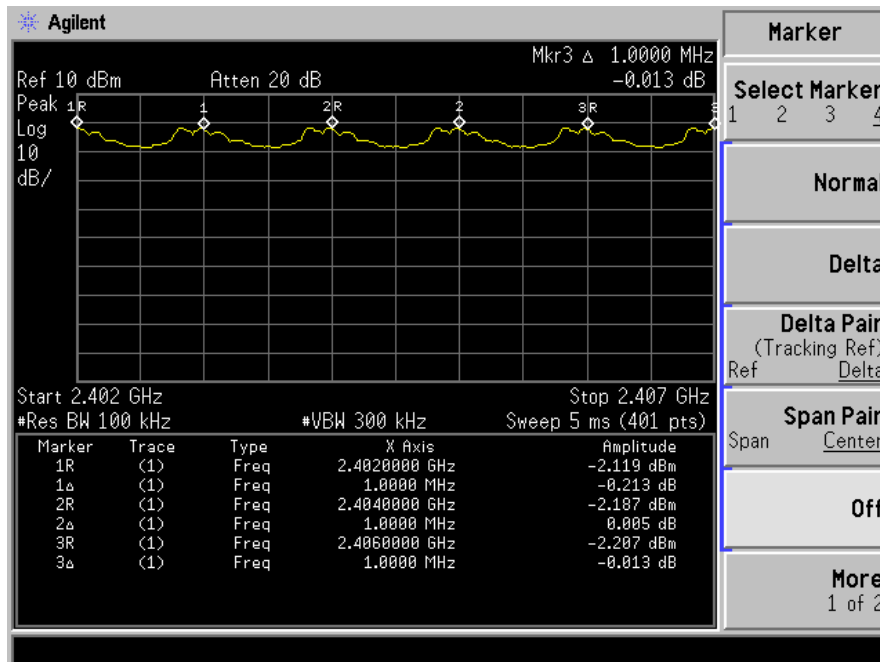
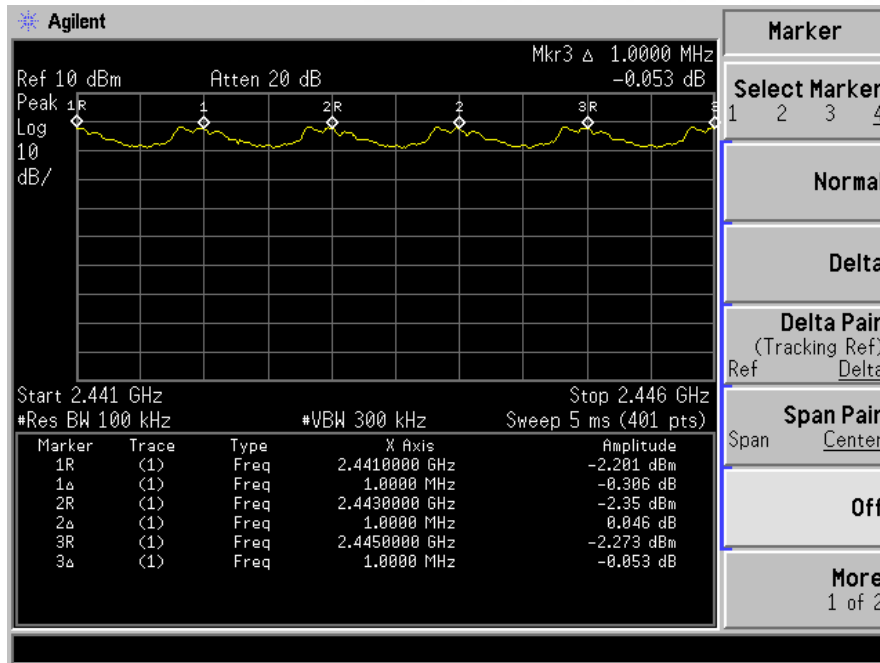
| Channel number | Channel frequency (MHz) | Separation Read Value (kHz) | Separation Limit 20dB Down BW(kHz) |
|----------------|-------------------------|-----------------------------|------------------------------------|
| 1 | 2402 | 1000.00 | >881.561 |
| 40 | 2441 | 1000.00 | >886.298 |
| 79 | 2480 | 1000.00 | >887.722 |

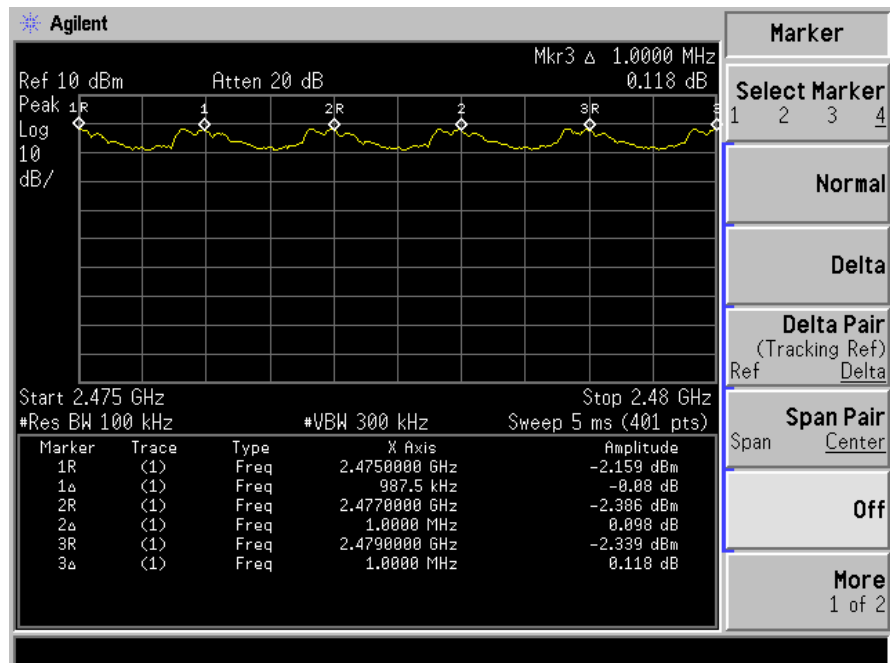




Spectrum Detector: PK Test Date : March 8, 2013
Test By: Andy Temperature : 28 °C
Test Result: PASS Humidity : 65 %
Modulation: 1/4 Π-DQPSK

| Channel number | Channel frequency (MHz) | Separation Read Value (kHz) | Separation Limit 2/3*20dB Down BW(kHz) |
|----------------|-------------------------|-----------------------------|--|
| 1 | 2402 | 1000.00 | >800.00 |
| 40 | 2441 | 1000.00 | >811.33 |
| 79 | 2480 | 1000.00 | >809.33 |



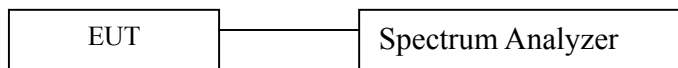


7. 20dB Bandwidth test

7.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

7.2 Test SET-UP (Block Diagram of Configuration)



7.3 Measurement Equipment Used:

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
|-------------------|---------|--------------|---------------|------------|------------|
| Spectrum Analyzer | Agilent | E4407B | 88156318 | 05/29/2012 | 05/28/2013 |

7.4 Measurement Results:

The following table is the setting of spectrum analyzer.

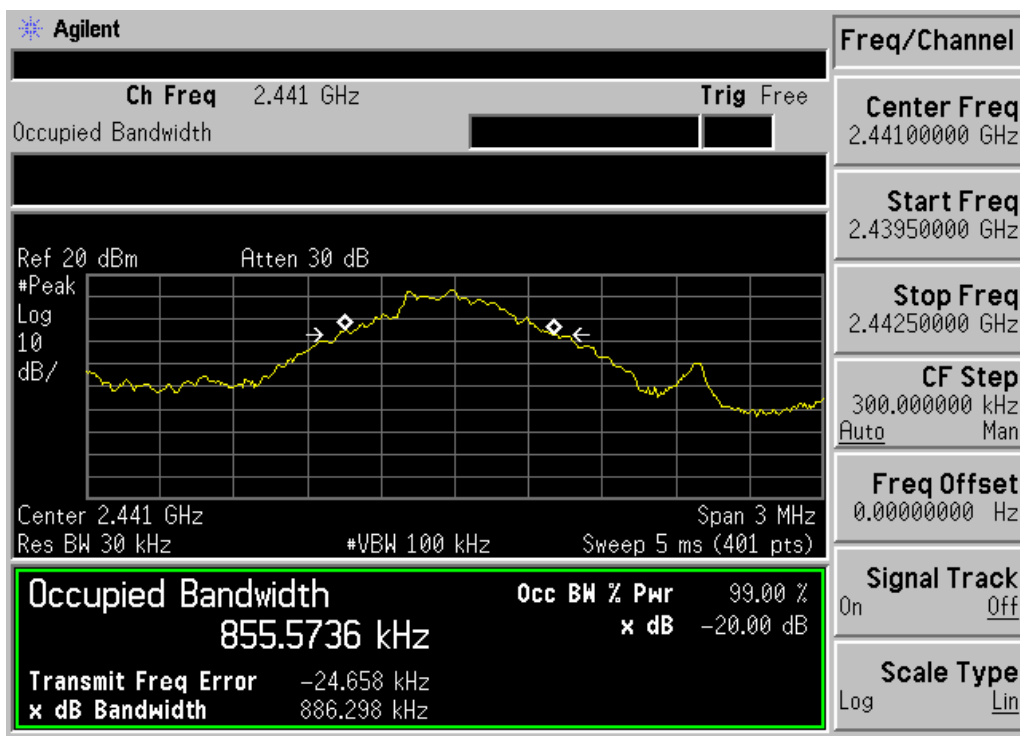
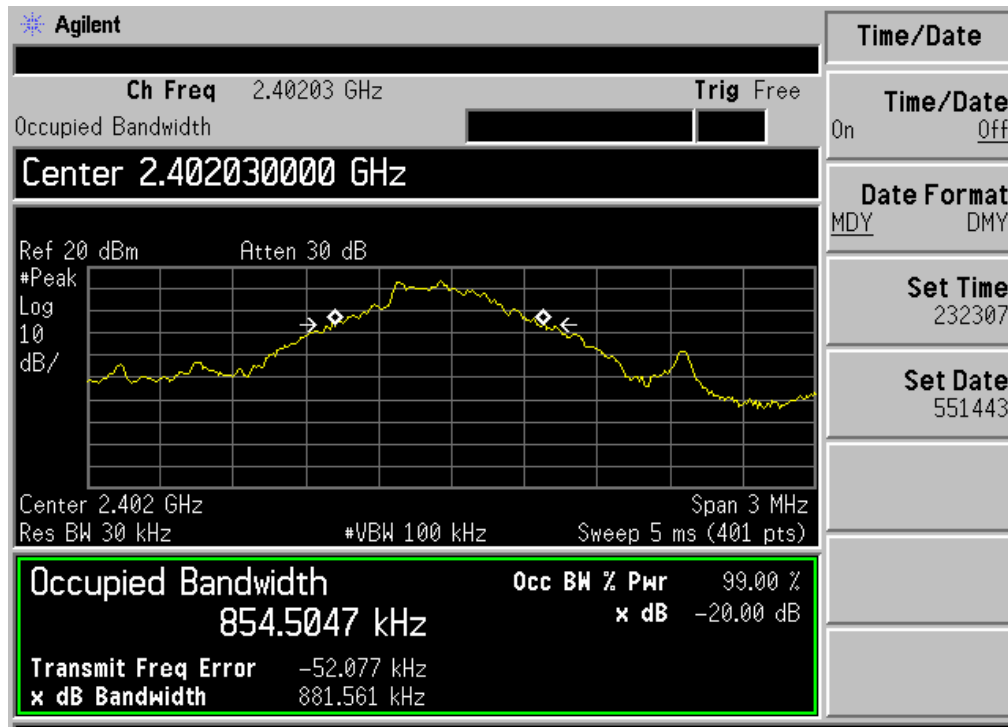
| | |
|-------------------|----------|
| EMI Test Receiver | Setting |
| Attenuation | Auto |
| Span | 3MHz |
| RB | 30kHz |
| VB | 100kHz |
| Detector | Peak |
| Trace | Max hold |

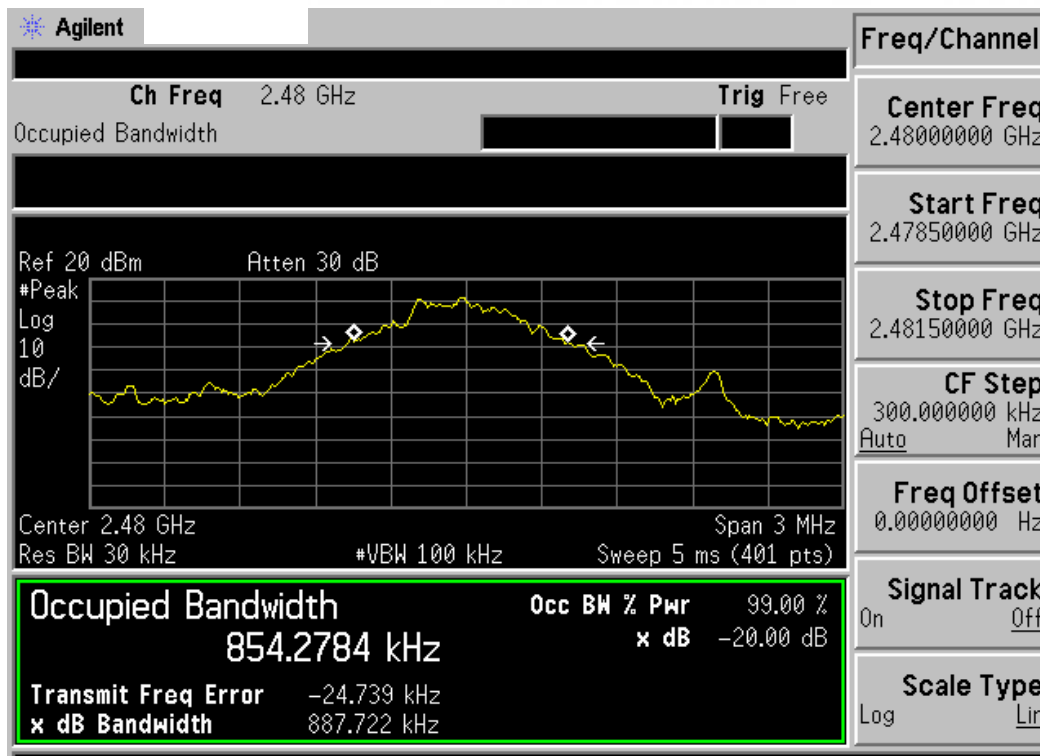
7.4.1. 20dB Bandwidth test data Chart:

Refer to attached data chart.

| | | | |
|--------------------|------|--------------|---------------|
| Spectrum Detector: | PK | Test Date: | March 8, 2013 |
| Test By: | Andy | Temperature: | 28 °C |
| Test Result: | PASS | Humidity: | 65 % |
| Modulation: | GFSK | | |

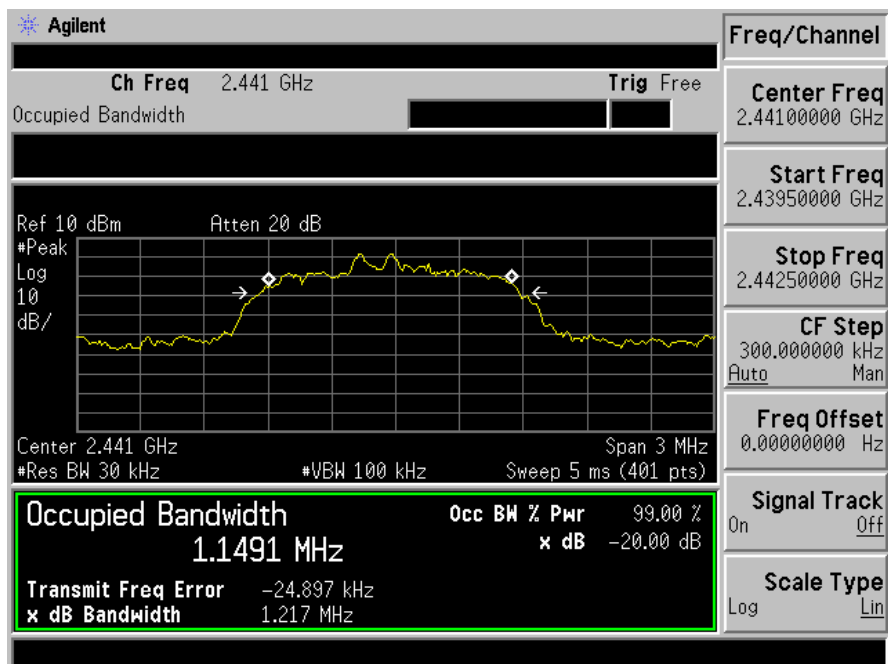
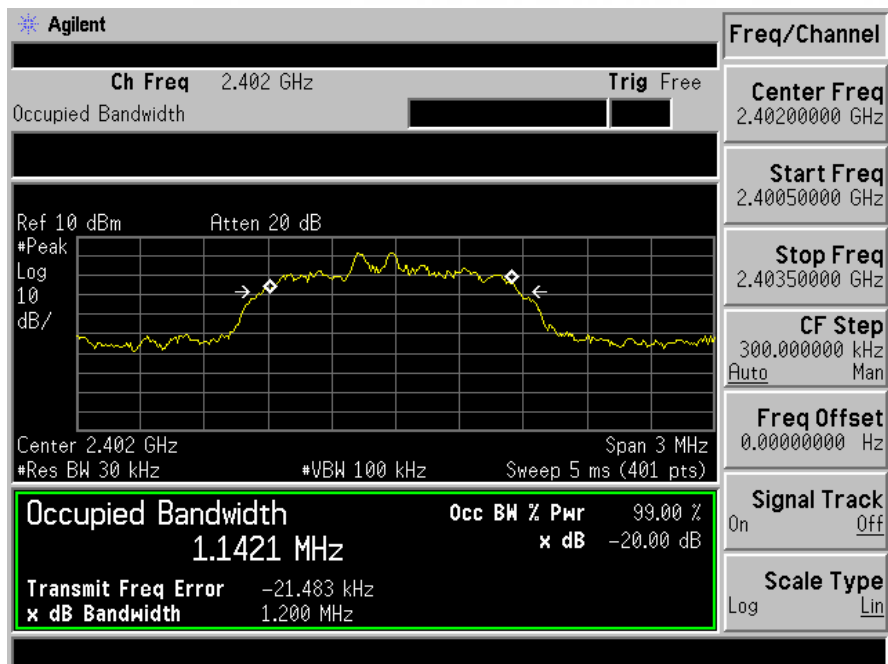
| Channel number | Channel frequency (MHz) | 20dB Down BW(kHz) |
|----------------|-------------------------|-------------------|
| 1 | 2402 | 881.561 |
| 40 | 2441 | 886.298 |
| 79 | 2480 | 887.722 |

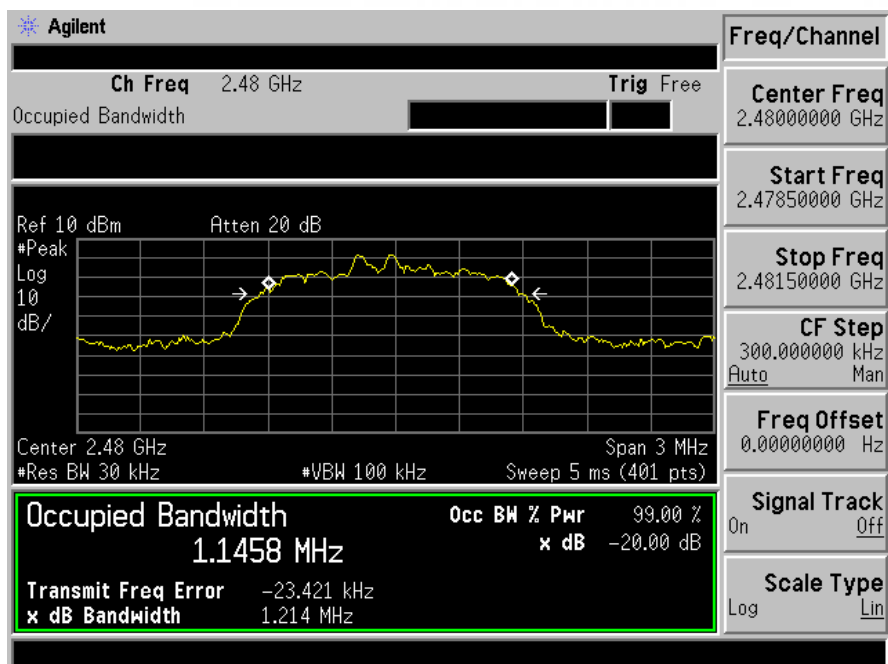




| | | | |
|--------------------|-------------|--------------|---------------|
| Spectrum Detector: | PK | Test Date: | March 8, 2013 |
| Test By: | Andy | Temperature: | 28 °C |
| Test Result: | PASS | Humidity: | 65 % |
| Modulation: | 1/4 Π-DQPSK | | |

| Channel number | Channel frequency (MHz) | 20dB Down BW(kHz) |
|----------------|-------------------------|-------------------|
| 1 | 2402 | 1200 |
| 40 | 2441 | 1217 |
| 79 | 2480 | 1214 |



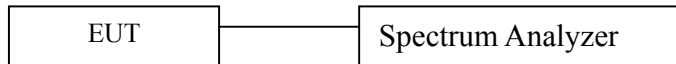


8. Quantity of Hopping Channel Test

8.1 Measurement Procedure

The EUT was operating in hopping mode or could be controlled its channel. Printed out the test result from the spectrum by hard copy function.

8.2 Test SET-UP (Block Diagram of Configuration)



8.3 Measurement Equipment Used:

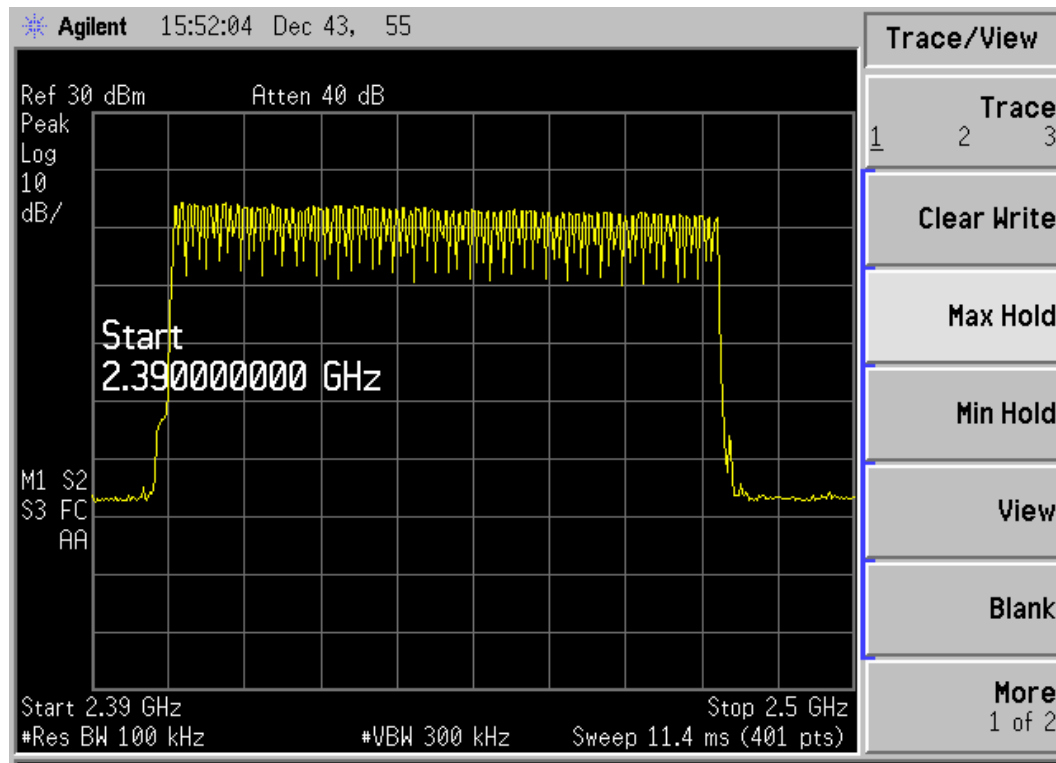
| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
|-------------------|---------|--------------|---------------|------------|------------|
| Spectrum Analyzer | Agilent | E4407B | 88156318 | 05/29/2012 | 05/28/2013 |

8.4 Measurement Results:

All modulation have been tested, the result GFSK modulation are recorded in the following:

| | | | |
|--------------------|------|---------------|---------------|
| Spectrum Detector: | PK | Test Date : | March 8, 2013 |
| Test By: | Andy | Temperature : | 28 °C |
| Test Result: | PASS | Humidity : | 65 % |

| Hopping Channel Frequency Range | Quantity of Hopping Channel | Quantity of Hopping Channel limit |
|---------------------------------|-----------------------------|-----------------------------------|
| 2402-2480 | 79 | ≥ 15 |

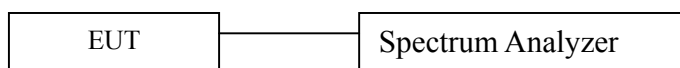


9. Time of Occupancy (Dwell Time) test

9.1 Measurement Procedure

- Check the calibration of the measuring instrument(SA) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect its antenna terminal to measurement 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.
- Adjust the center frequency of SA on any frequency be measured and set SA to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
- Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
- Repeat above procedures until all different time-slot modes have been completed.

9.2 Test SET-UP (Block Diagram of Configuration)



9.3 Measurement Equipment Used:

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
|-------------------|---------------|--------------|---------------|------------|------------|
| EMI Test Receiver | Rohde&Schwarz | ESU | 1302.6005.26 | 05/29/2012 | 05/28/2013 |

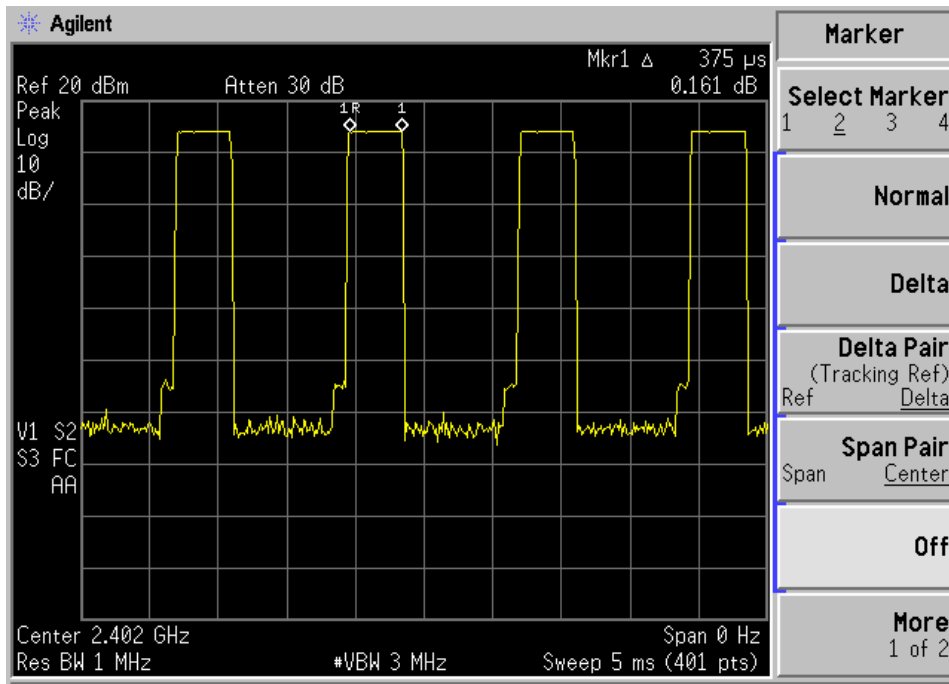
9.4 Measurement Results:

All modulations with Low, Middle and Highest channels have been tested, the worst test data GFSK modulation channel 2402 was recorded in this report.

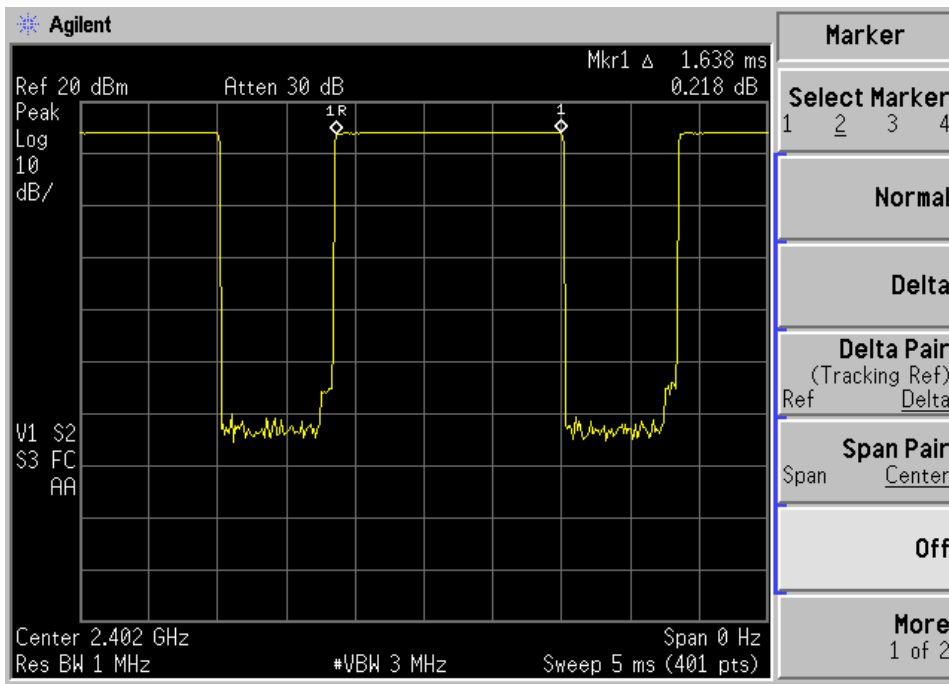
Spectrum Detector: PK Test Date : March 8, 2013
Test By: Andy Temperature : 28 °C
Test Result: PASS Humidity : 65 %

| Mode | Number of transmission in a 31.6(79 Hopping*0.4) | Length of transmissions time(msec) | Result (msec) | Limit (msec) |
|------|---|------------------------------------|---------------|--------------|
| DH1 | $1600/(2*79) \times 31.6 = 320$ | 0.375 | 120.00 | 400 |
| DH3 | $1600/(4*79) \times 31.6 = 160$ | 1.638 | 262.08 | 400 |
| DH5 | $1600/(6*79) \times 31.6 = 106.67$ | 2.900 | 309.34 | 400 |

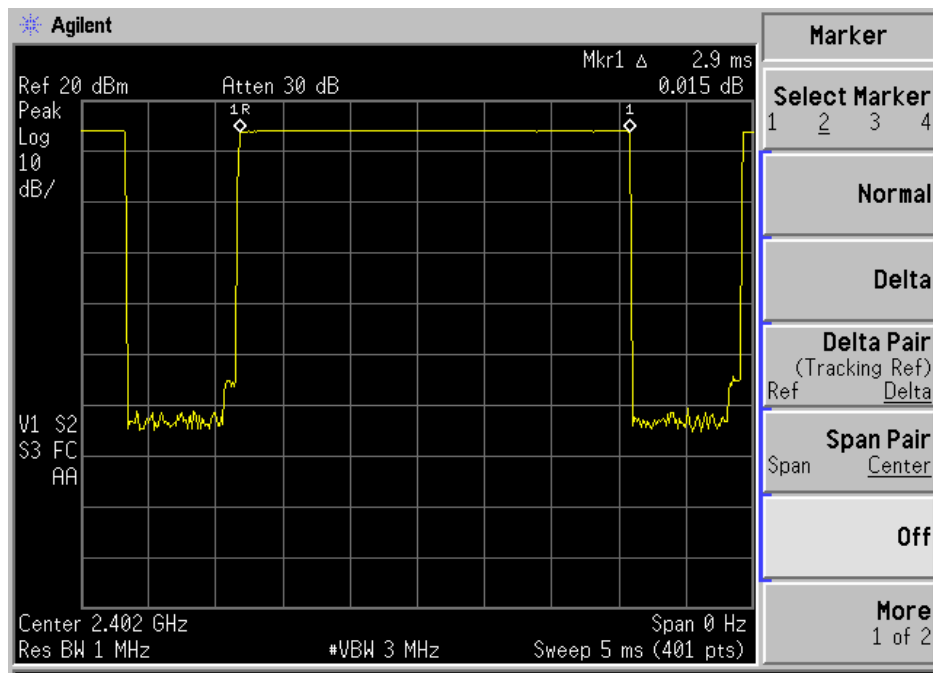
DH1



DH3



DH5

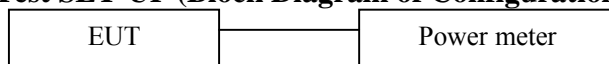


10. MAXIMUM PEAK OUTPUT POWER TEST

10.1 Measurement Procedure

- Check the calibration of the measuring instrument(Power meter) using either an internal calibrator or a known signal from an external generator.
- Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
- The center frequency of the spectrum analyzer is set to the fundamental frequency and using proper RBW and VBW setting.
- Measure the captured power within the band and recording the plot.
- Repeat above procedures until all frequencies required were complete.

10.2 Test SET-UP (Block Diagram of Configuration)



10.3 Measurement Equipment Used:

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
|----------------|---------|--------------|---------------|------------|------------|
| Power meter | Boonton | 4232A | 29001 | 05/29/2012 | 05/28/2013 |
| Power sensor | Boonton | 51011-EMC | 31184 | 05/29/2012 | 05/28/2013 |

10.4 Measurement Results:

Spectrum Detector: PK Test Date : March 8, 2013
 Test By: Andy Temperature : 28 °C
 Test Result: PASS Humidity : 65 %
 Modulation: GFSK

| Channel number | Channel Frequency (MHz) | Peak Power output(dBm) | Peak Power Limit(mW) | Pass/Fail |
|----------------|-------------------------|------------------------|----------------------|-----------|
| 1 | 2402.00 | 16.64 | 125 | PASS |
| 40 | 2441.00 | 15.91 | 125 | PASS |
| 79 | 2480.00 | 15.13 | 125 | PASS |

Spectrum Detector: PK Test Date : March 8, 2013
 Test By: Andy Temperature : 28 °C
 Test Result: PASS Humidity : 65 %
 Modulation: 1/4Π-DQPSK

| Channel number | Channel Frequency (MHz) | Peak Power output(dBm) | Peak Power Limit(mW) | Pass/Fail |
|----------------|-------------------------|------------------------|----------------------|-----------|
| 1 | 2402.00 | 15.02 | 125 | PASS |
| 40 | 2441.00 | 15.11 | 125 | PASS |
| 79 | 2480.00 | 14.92 | 125 | PASS |

11. Band Edge test

11.1 Measurement Procedure

1. The EUT was Operating in hopping mode or could be controlled its channel. Printed out test result from the spectrum by hard copy function.
2. The EUT was placed on a turn table which is 0.8m above ground plane.
3. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
4. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. Repeat above procedures until all frequency measured were complete.

11.2 Test SET-UP (Block Diagram of Configuration)

As 5.2 Test set up (B) and (C)

11.3 Measurement Equipment Used:

Same as 5.3 Radiated Emission Measurement.

11.4 Measurement Results:

We take GFSK and 1/4Π-DQPSK and hopping mode to test, the result are recorded in the following:

| | | | |
|--------------------|-------|---------------|---------------|
| Spectrum Detector: | PK/AV | Test Date : | March 8, 2013 |
| Test By: | Andy | Temperature : | 28 °C |
| Test channel: | CH 01 | Humidity : | 65 % |
| Modulation: | GFSK | | |

| Frequency (MHz) | Polarity | Level (dBuV/m) | | Limited (dBuV/m) | |
|--------------------|----------|-------------------|-------|---------------------|----|
| | | PK | AV | PK | AV |
| 2380.80 | H | 50.40 | 45.17 | 74 | 54 |
| 2381.48 | V | 48.42 | 42.39 | 74 | 54 |

| | | | |
|--------------------|-------|---------------|---------------|
| Spectrum Detector: | PK/AV | Test Date : | March 8, 2013 |
| Test By: | Andy | Temperature : | 28 °C |
| Test channel: | CH 79 | Humidity : | 65 % |
| Modulation: | GFSK | | |

| Frequency (MHz) | Polarity | Level (dBuV/m) | | Limited (dBuV/m) | |
|--------------------|----------|-------------------|-------|---------------------|----|
| | | PK | AV | PK | AV |
| 2486.28 | H | 50.31 | 44.60 | 74 | 54 |
| 2483.89 | V | 49.79 | 43.22 | 74 | 54 |

Spectrum Detector: PK/AV Test Date : March 8, 2013
Test By: Andy Temperature : 28 °C
Test channel: CH 01 Humidity : 65 %
Modulation: 1/4Π-DQPSK

| Frequency (MHz) | Polarity | Level (dBuV/m) | | Limited (dBuV/m) | |
|--------------------|----------|-------------------|-------|---------------------|----|
| | | PK | AV | PK | AV |
| 2390.0 | H | 51.41 | 45.39 | 74 | 54 |
| 2390.0 | V | 48.33 | 41.96 | 74 | 54 |

Spectrum Detector: PK/AV Test Date : March 8, 2013
Test By: Andy Temperature : 28 °C
Test channel: CH 79 Humidity : 65 %
Modulation: 1/4Π-DQPSK

| Frequency (MHz) | Polarity | Level (dBuV/m) | | Limited (dBuV/m) | |
|--------------------|----------|-------------------|-------|---------------------|----|
| | | PK | AV | PK | AV |
| 2486.35 | H | 50.67 | 44.81 | 74 | 54 |
| 2486.39 | V | 48.73 | 42.57 | 74 | 54 |

Spectrum Detector: PK/AV Test Date : March 8, 2013
Test By: Andy Temperature : 28 °C
Mode: Hopping mode Humidity : 65 %

| Frequency (MHz) | Polarity | Level (dBuV/m) | | Limited (dBuV/m) | |
|--------------------|----------|-------------------|-------|---------------------|----|
| | | PK | AV | PK | AV |
| 2390.80 | H | 51.16 | 44.89 | 74 | 54 |
| 2390.00 | V | 49.43 | 42.35 | 74 | 54 |
| 2483.5 | H | 51.06 | 46.19 | 74 | 54 |
| 2483.5 | V | 50.38 | 44.35 | 74 | 54 |

12. Antenna Port conducted spurious emission

12.1 Test Equipment

| EQUIPMENT TYPE | MFR | MODEL NUMBER | SERIAL NUMBER | LAST CAL. | CAL DUE. |
|-------------------|---------|--------------|---------------|------------|------------|
| Spectrum Analyzer | Agilent | E4407B | 88156318 | 05/29/2012 | 05/28/2013 |

12.2 Measuring Instruments and setting

All the modulation modes were tested and the data of the GFSK mode are recorded in the following pages and the others modulation methods do not exceed the limits.

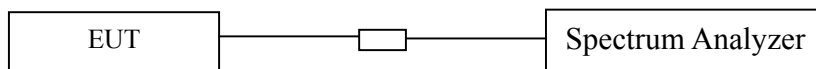
The following table is the setting of spectrum analyzer.

| | |
|-------------------|----------|
| EMI Test Receiver | Setting |
| Attenuation | Auto |
| RBW | 100kHz |
| VBW | 300kHz |
| Detector | Peak |
| Trace | Max hold |

12.3 Test Procedures

The conducted spurious emissions were measured conducted using a spectrum analyzer at low, mid, and hi channels, the limit was determined by attenuation 20dB of the RF peak power output.

12.4 Block Diagram of Test setup

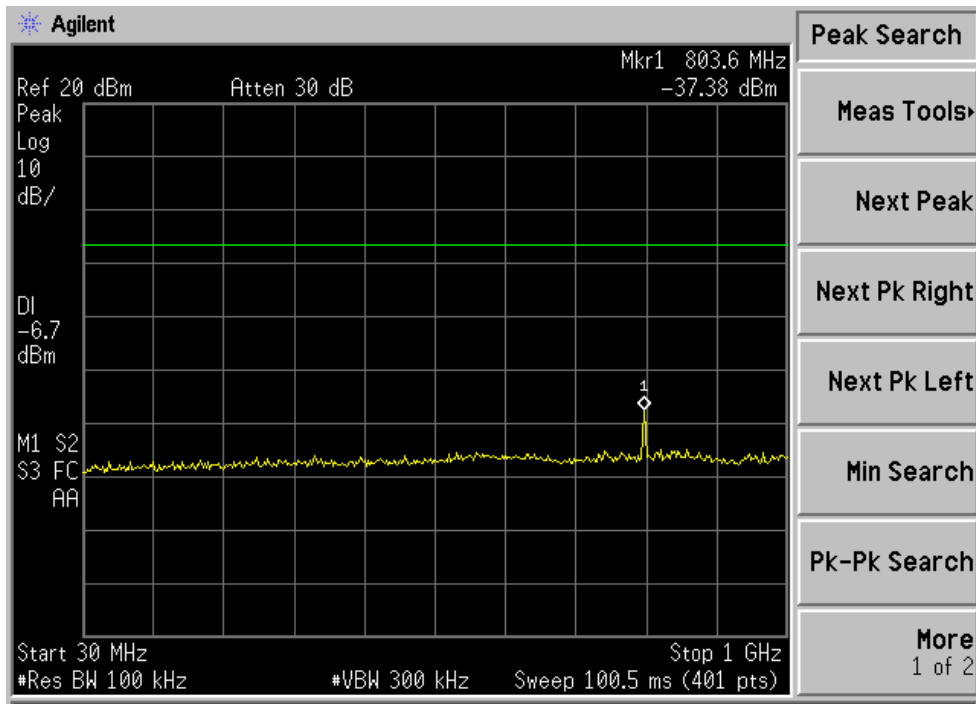
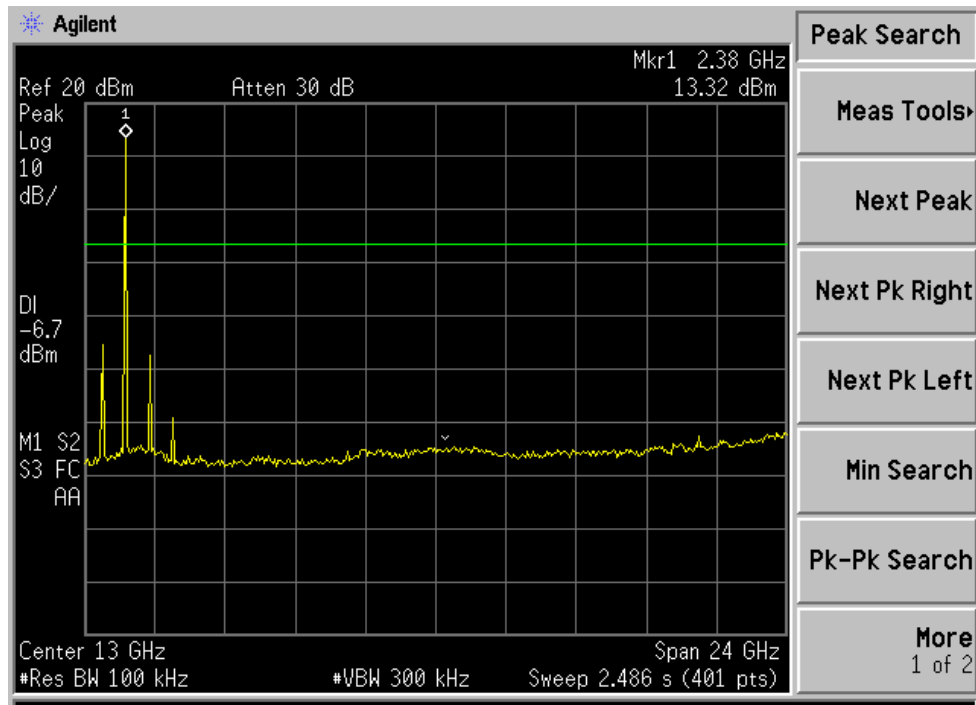


12.5 Test Result

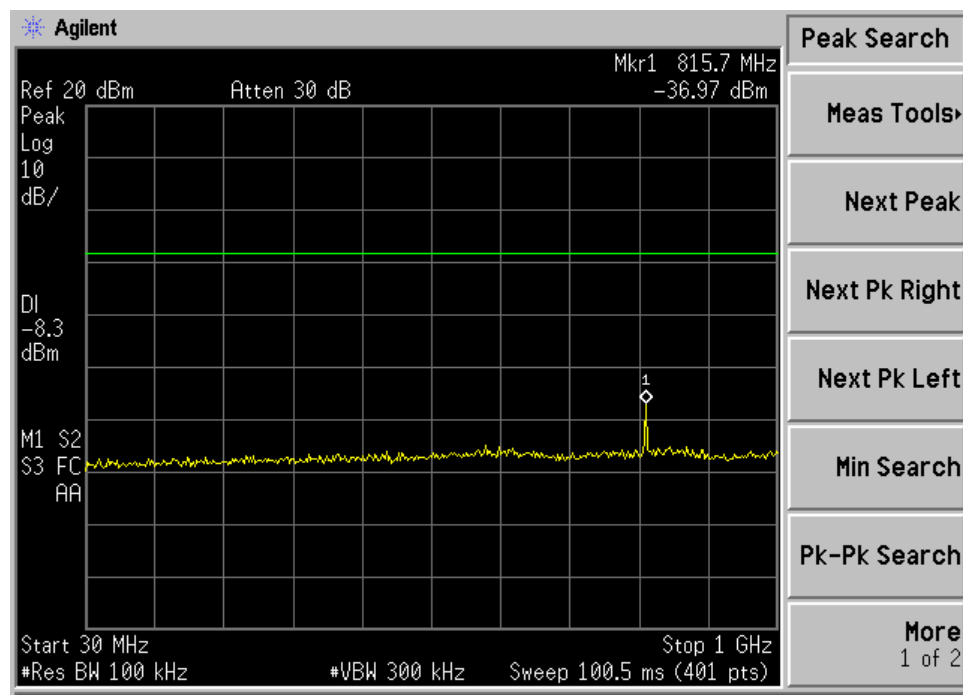
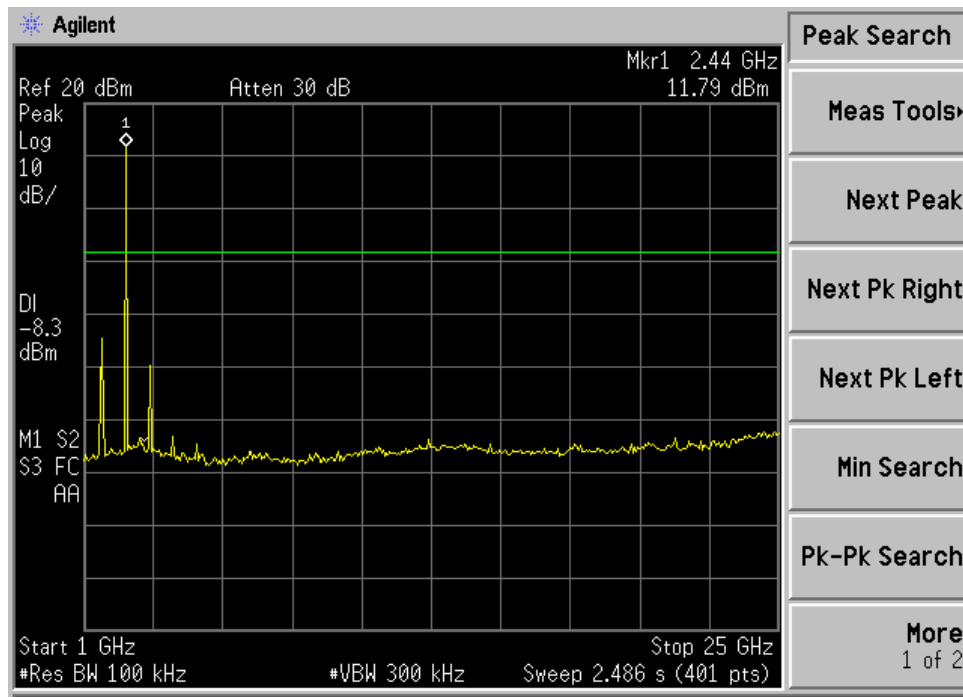
PASS.

All modulation have been tested, the worst result GFSK modulation are recorded in the following:

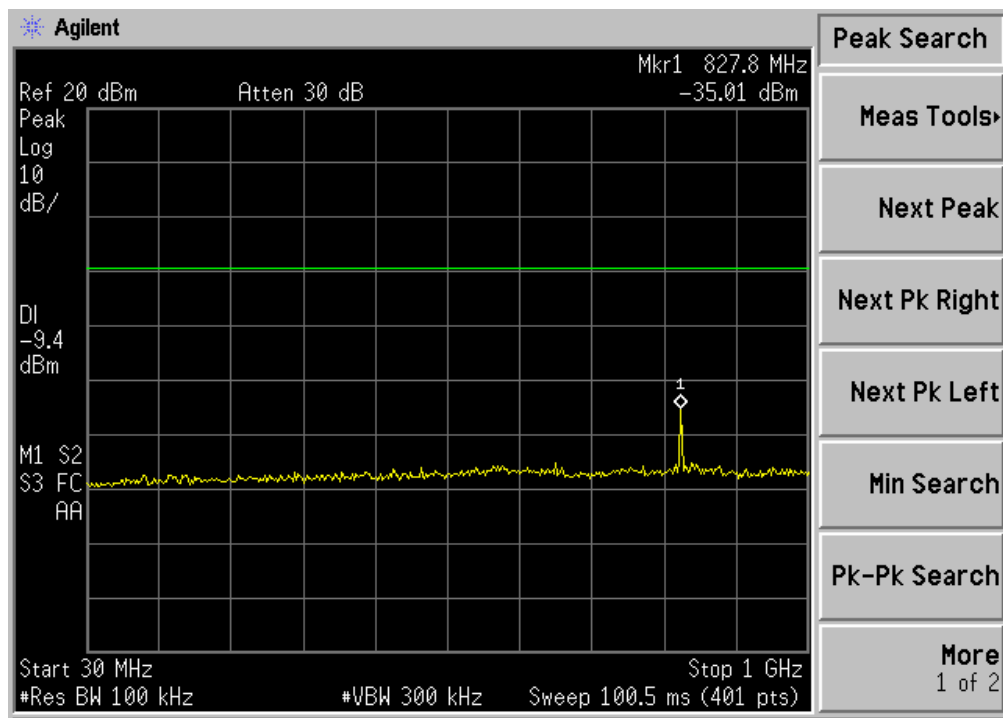
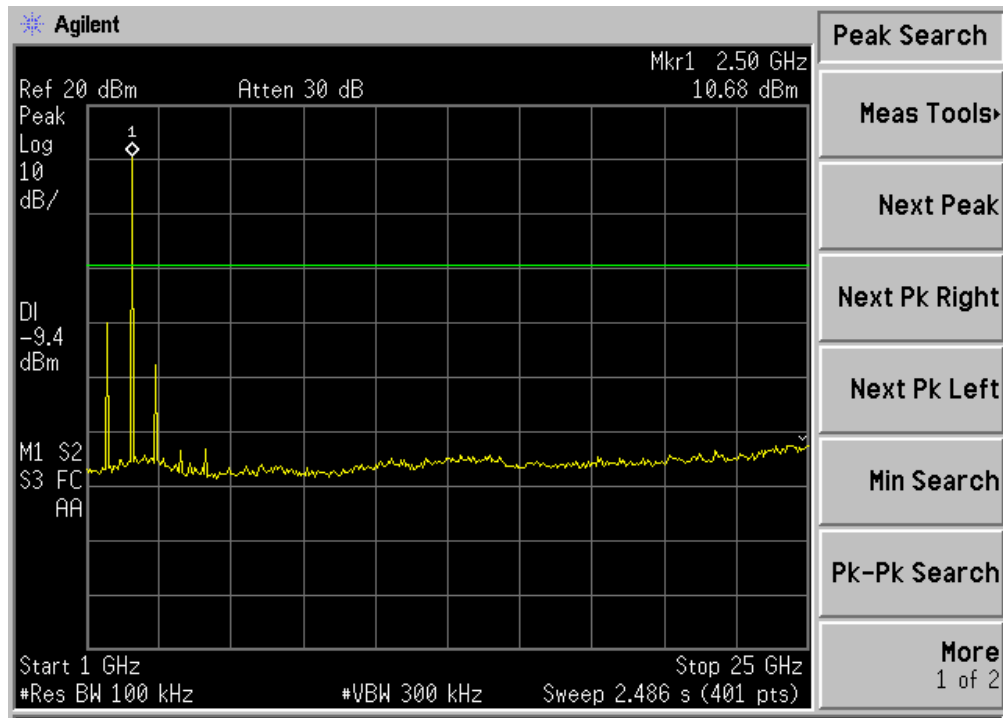
GFSK TX 2402MHz



TX 2441MHz



TX 2480MHz



13. Antenna Application

13.1 Antenna requirement

The EUT'S antenna is met the requirement of FCC part 15C section 15.203 and 15.247

FCC part 15C section 15.247 requirements:

Systems operating in the 2402-2480MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

13.2 Result

The EUT's antenna is PIFA antenna, the antenna's gain is 2.5dBi and meets the requirement.