

FCC Part 15 Subpart C Requirement  
and Industry Canada RSS-210  
Measurement and Test Report

For

**Sanwa Electronic Instrument Co., Ltd**

1-2-50, Yoshida Honmachi, Higashi-Osaka, Osaka 578-0982, Japan

**FCC ID: L73-90105**  
**IC: 7377A-90105**

April 28, 2013

|   |  |
|---|--|
| <b>This Report Concerns:</b><br><input checked="" type="checkbox"/> Original Report   | <b>Equipment Type:</b><br>2.4GHz Radio Control System                                |
| <b>Test Engineer:</b> Bossco He   |   |
| <b>Report Number:</b> SE13D-198FI   |  |
| <b>Test Date:</b> April 20 to 26, 2013  |  |
| <b>Reviewed By:</b>  Karbon Y. Chung (Senior Manager)  |  |
| <b>Prepared By:</b> S&E Technologies Laboratory Ltd<br>Room 407, Block A Shennan Garden, Hi-Tech Industrial Park,<br>Shenzhen 518057, P.R. China.<br>Tel: 86-755-26636573, 26630631<br>Fax: 86-755-26630557 |  |

**Note:** This test report is limited to the above client company and the product model only. It may not be duplicated without prior written consent of S&E Technologies Laboratory Ltd.

## Table of Contents

|   |          |
|---|----------|
| <b>1-TEST RESULT CERTIFICATION</b> .....                                      | <b>3</b> |
| <b>2- EUT DESCRIPTION</b> .....   | <b>4</b> |
| <b>3-TEST SYSTEM</b> .....  | <b>5</b> |
| 3.1 TEST MODE .....   | 5        |
| 3.2 TEST SETUP DIAGRAM .....  | 5        |
| 3.3 BLOCK DIAGRAM OF EUT SYSTEM .....   | 6        |
| 3.4 LIST OF CABLES .....  | 6        |
| <b>4- TEST EQUIPMENT AND CALIBRATION</b> .....                                | <b>7</b> |
| <b>5- LABORATORY ACCREDITATIONS AND MEASUREMENT UNCERTAINTY</b> .....         | <b>8</b> |
| 5.1 LABORATORY ACCREDITATION .....  | 8        |
| 5.2 MEASUREMENT UNCERTAINTY .....   | 8        |
| <b>6- TECHNICAL REQUIREMENTS AND RESULTS</b> .....                            | <b>9</b> |
| 6.1 CARRIER FREQUENCY SEPARATION MEASUREMENT .....                            | 9        |
| 6.2 NUMBER OF HOPPING FREQUENCIES MEASUREMENT .....                           | 11       |
| 6.3 TIME OF OCCUPY (DWELL TIME) MEASUREMENT .....                             | 14       |
| 6.4 PEAK OUTPUT POWER MEASUREMENT.....  | 17       |
| 6.5 BAND EDGE OF CONDUCTED EMISSION AND SPURIOUS RF CONDUCTED EMISSIONS ..... | 22       |
| 6.6 SPURIOUS RADIATED EMISSION MEASUREMENT .....                              | 30       |
| 6.7 CONDUCTED EMISSION MEASUREMENT .....                                      | 40       |
| 6.8 BAND EDGE AND RESTRICTED BAND OF RADIATED EMISSION MEASUREMENT.....       | 42       |
| 6.9 99% BANDWIDTH MEASUREMENT .....   | 48       |
| 6.10 RF EXPOSURE .....  | 52       |
| 6.11 ANTENNA REQUIREMENT .....  | 54       |

# 1-Test Result Certification

Applicant: Sanwa Electronic Instrument Co., Ltd  
 1-2-50, Yoshida Honmachi, Higashi-Osaka,  
 Osaka 578-0982, Japan

Equipment Under Test: 2.4GHz Radio Control System

Trade Name: SANWA

Model: 90105

Type of Modulation: FHSS

Number of Channels: 76 (FH3 mode)  
 51 (FH1 mode)

Channel Separation: 1MHz

Operation Frequency: 2403~2478MHz (FH3 mode)  
 2415~2465MHz (FH1 mode)

*Note: The above two operation modes can be converted into another by setup menu.*

*FH3 mode  
 data rate: 125kbps  
 packet rate: 6ms*

*FH1 mode  
 data rate: 15.625kbps  
 packet rate: 23.8ms*

Antenna Designation: Non-user replaceable (fixed)

Battery Voltage: DC7.2V [1.2V\*6 "AA" Ni-MH battery pack]

Date of Test: April 20 to 26, 2013

| Applicable Standards   |                         |
|--|-------------------------|
| Standard   | Test Result             |
| FCC 47 CFR Part 15 Subpart C: 2012, §15.247<br>Industry Canada: RSS-210 issue 8: 2010, Annex 8<br>Industry Canada: RSS-Gen issue 3: 2010 | No non-compliance noted |

**We hereby certify that:**

The above equipment was tested at ATC Lab Co., Ltd (Guangdong, China). 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: 2003 and Public Notice DA00-705. 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 15C: 2012, §15.247 and RSS-210 Issue 8, Annex 8.

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

## 2- EUT Description

|                      |   |
|----------------------|---|
| Product              | 2.4GHz Radio Control System                         |
| Trade Name           | SANWA   |
| Model Number         | 90105   |
| Model Difference     | N/A   |
| Type of Modulation:  | FHSS  |
| Number of Channels:  | 76 (FH3 mode)<br>51 (FH1 mode)                      |
| Channel Separation:  | 1MHz  |
| Power Supply         | 7.2V DC power from [1.2V*6 "AA" Ni-MH battery pack] |
| Operation Frequency: | 2403~2478MHz (FH3 mode)<br>2415~2465MHz (FH1 mode)  |
| Antenna Designation  | Non-user replaceable (fixed)                        |

*Remark: This submittal(s) of test report is intended for FCC ID: L73-90105, IC: 7377A-90105 filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules and RSS-210 Issue 8, Annex 8.*

## 3-Test System

### 3.1 Test Mode

The compliance test was performed under test modes:

Mode 1: Transmitting at 2403MHz without hopping at FH3 mode.

Mode 2: Transmitting at 2441MHz without hopping at FH3 mode.

Mode 3: Transmitting at 2478MHz without hopping at FH3 mode.

Mode 4: Transmitting with hopping at FH3 mode.

Mode 5: Transmitting at 2415MHz without hopping at FH1 mode.

Mode 6: Transmitting at 2441MHz without hopping at FH1 mode.

Mode 7: Transmitting at 2465MHz without hopping at FH1 mode.

Mode 8: Transmitting with hopping at FH1 mode.

The EUT is designed to be both of horizontally and vertically placed.

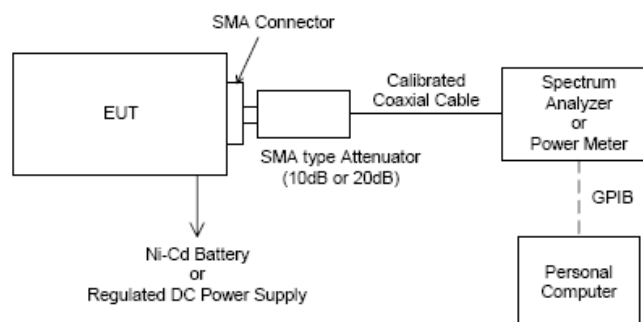
During radiated emission measurement, each condition was conducted.

As a result, the operation that produces the maximum emission under was reported.

- a) Carrier Frequency Separation Measurement ---Mode 4, Mode 8
- b) Number of Hopping Frequencies Measurement --- Mode 4, Mode 8
- c) Time of Occupancy Measurement --- Mode 4, Mode 8
- d) Peak Output Power Measurement --- Mode 1, Mode 2, Mode 3, Mode 5, Mode 6, Mode 7
- e) Band Edge of RF Conducted Measurement --- Mode 4, Mode 8
- f) Radiated Emission Measurement --- Mode 1, Mode 2, Mode 3, Mode 5, Mode 6, Mode 7
- g) Band Edge and Restricted Band of Radiated Emission Measurement--- Mode 1, Mode 3, Mode 4, Mode 5, Mode 7, Mode 8.
- h) 99% Bandwidth measurement --- Mode 1, Mode 2, Mode 3, Mode 5, Mode 6, Mode 7

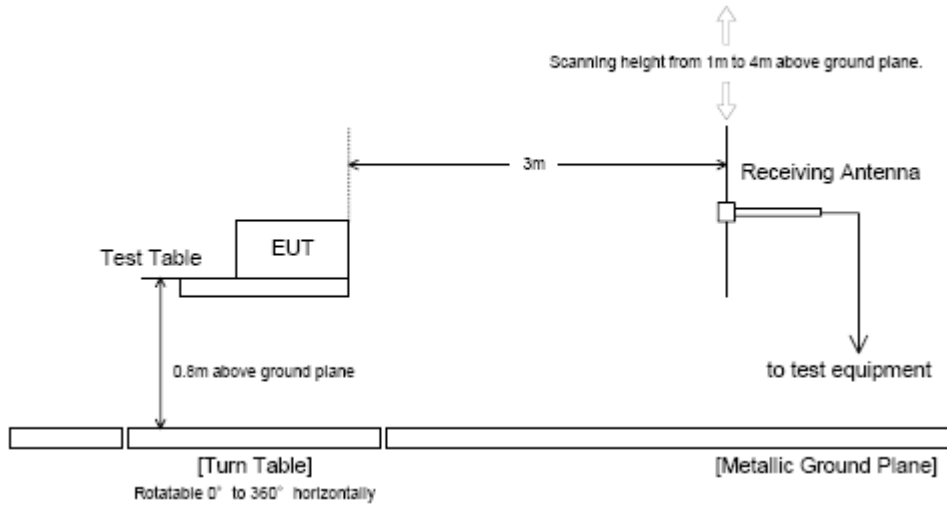
### 3.2 Test Setup Diagram

- . Carrier Frequency Separation
- . Number of Hopping Frequencies
- . Time of Occupancy (Dwell Time)
- . Peak Output Power
- . Band Edge of RF Conducted Emission
- . Band Edge and Restricted Band of Radiated Emission measurement
- . 99% Bandwidth

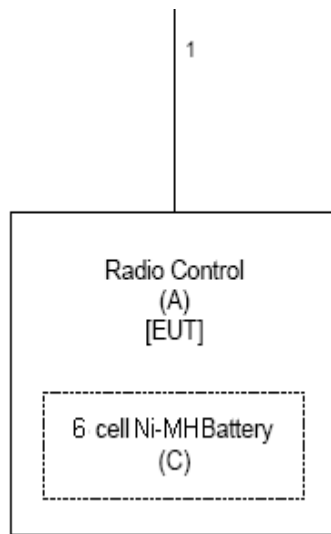


*Note: Regulated DC power supply is not used in this report.*

. Radiated Emission



3.3 Block Diagram of EUT System



3.4 List of Cables

| No | Cable Name | Shielded (Y/N) | Length (m) | Note | Remark |
|----|------------|----------------|------------|------|--------|
| 1  | Antenna    | Y              | 0.20       | /    | /      |

#### 4- Test Equipment and Calibration

| Equipment type                       | Manufacturer | Model    | Serial Number | Calibration Due |
|--------------------------------------|--------------|----------|---------------|-----------------|
| Biconilog Antenna                    | ETS          | 3142C    | 00042672      | 2013/09         |
| Receiver                             | SCHAFFNER    | SMR4503  | 11725         | 2013/07         |
| Spectrum Analyzer                    | R/S          | FSP30    | 100755        | 2013/11         |
| Double-Ridged-Waveguide Horn Antenna | ETS          | 3115     | 6587          | 2013/08         |
| Double-Ridged-Waveguide Horn Antenna | ETS          | 3160     | 00052486      | 2013/08         |
| Amplifier                            | Agilent      | 83017A   | MY39500438    | 2013/11         |
| Band-pass Filter                     | Micro-Tronic | BRM50702 | S/N-030       | 2013/11         |
| HF Loop Antenna                      | TESEQ        | HLA6120  | 26348         | 2013/10         |
| Chamber                              | ETS          | N/A      | N/A           | 2013/05         |

## 5- Laboratory Accreditations and Measurement Uncertainty

### 5.1 Laboratory Accreditation

FCC-Registration No.: 415467

ATC Lab Co., Ltd (Guangdong, China) 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. Listing date: December 01, 2011.

IC-Registration No.: 7949A

The 3m Alternate Test Site of ATC Lab Co., Ltd (Guangdong, China) has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 7949A on May 25th, 2011.

### 5.2 Measurement Uncertainty

of +/-  $3 \times 10^{-9}$  for Carrier Frequency Separation Measurement  
of +/-  $3 \times 10^{-9}$  for Number of Hopping Frequencies Measurement  
of +/-  $3 \times 10^{-9}$  for 20dB Bandwidth Measurement  
of +/-  $3 \times 10^{-9}$  for Time of Occupancy (Dwell time) Measurement  
of +/- 0.8 dB for Peak Output Power Measurement  
of +/- 0.8 dB for Band Edge RF Conducted Measurement  
of +/- 0.8 dB for Spurious RF Conducted Emission Measurement  
of +/- 0.8 dB for Power Density  
of +/- 4.8 dB for Radiated Emissions  
of +/- 2.3 dB for Conducted Emissions



## 6- Technical Requirements and Results

### 6.1 Carrier Frequency Separation Measurement

#### Applicable Standard:

According to §15.247(a)(1), frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

According to RSS 210 issue 8, A8.1(b), frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

#### Test Procedure:

1. Connect the EUT RF output port to spectrum analyzer via calibrated coaxial cable and suitable attenuator (if necessary).
2. Activates the EUT system and execute the software prepared for test, if necessary.
3. To find out the maximum emission condition, the transmitting data rate of EUT is set to maximum data rate.
4. The spectrums are scanned and allow the trace stabilized.
5. The separation between the peaks of the peaks of adjacent channel were measured by using delta-maker function of the spectrum analyzer

Spectrum analyzer setup conditions:

Frequency span : 2MHz  
 Resolution bandwidth : 100kHz  
 Video bandwidth : 300KHz  
 Sweep : Auto  
 Detector function : Peak  
 Trace mode : Max Hold

#### Test Result:

|                |                             |
|----------------|-----------------------------|
| Temperature:   | 25 °C                       |
| Humidity:      | 51%                         |
| EUT Operation: | Data Transmission (Hopping) |
| Test Date:     | April 21, 2013              |

| Test Mode   | Carrier Frequency Separation [ MHz ] | [ MHz ] Limit |
|---|--------------------------------------|---------------|
| FH3   | 1.008MHz                             | > 0.872       |
| FH1   | 1.000MHz                             | > 0.771       |
| <i>Note: Test plots shown in figures 1, 2 on page 10.</i> |                                      |               |

Figure 1: Channel separation at FH3 mode

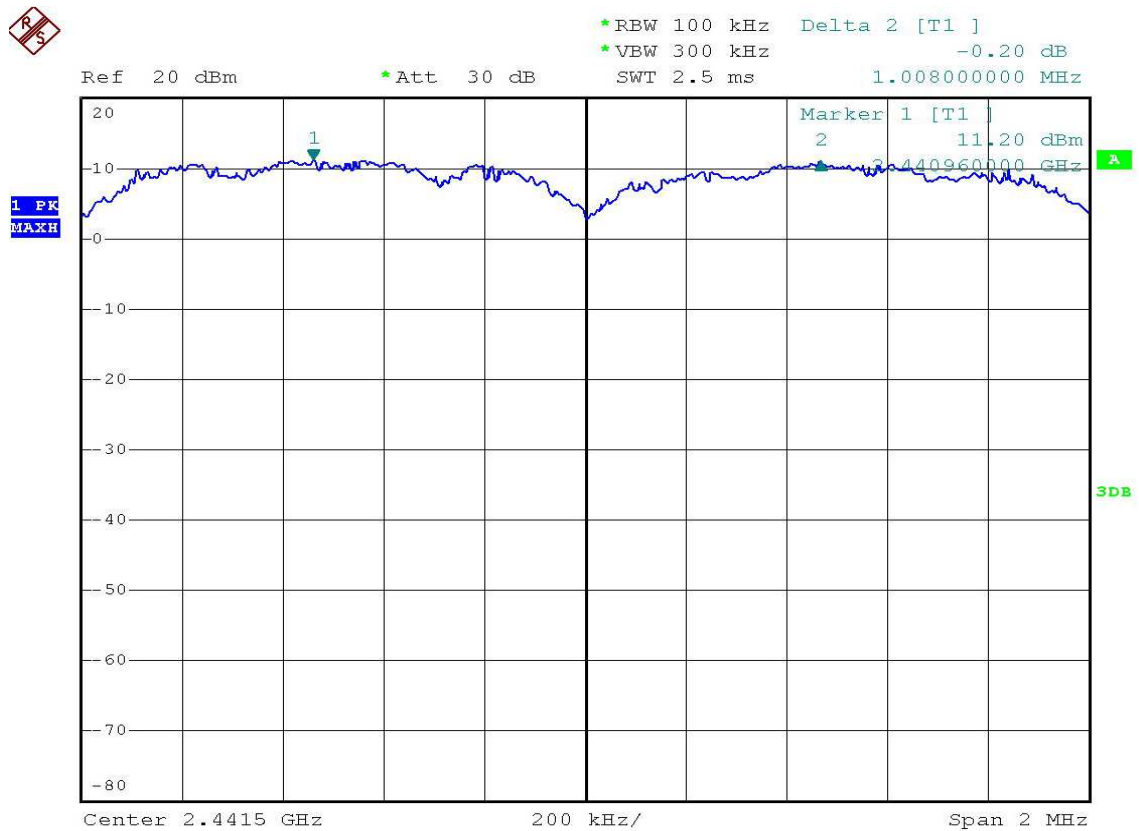
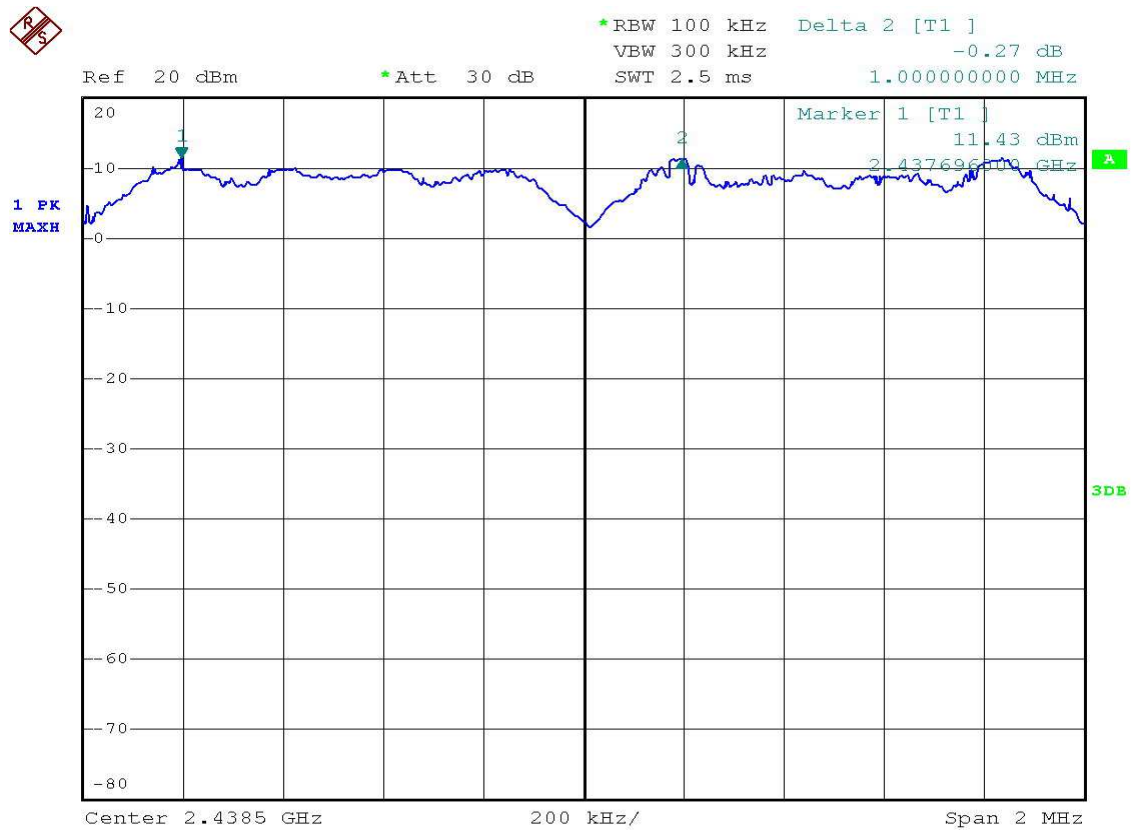


Figure 2: Channel separation at FH1 mode



## 6.2 Number of Hopping Frequencies Measurement

### Applicable Standard:

According to §15.247(a)(1)(iii), frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

According to RSS-210 issue 8, §A8.1(d), frequency hopping systems operating in the 2400-2483.5MHz band shall use at least 15 hopping channels. 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. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

### Test Procedure:

1. Connect the EUT RF output port to spectrum analyzer via calibrated coaxial cable and suitable attenuator (if necessary).
2. Activates the EUT system and executes the software prepared for test, if necessary.
3. To find out the maximum emission condition, the transmitting data rate of EUT is set to maximum data rate.
4. The spectrums are scanned and allow the trace to stabilize.
5. The number of hopping frequencies were counted on the spectrum analyzer and recorded.

Spectrum analyzer setup conditions:

Resolution bandwidth : 100KHz

Video bandwidth :  $\cong$  RBW

Sweep : Auto

Detector function : Peak

Trace mode : Max Hold

### Test Result:

|                |                             |
|----------------|-----------------------------|
| Temperature:   | 25 °C                       |
| Humidity:      | 51%                         |
| EUT Operation: | Data Transmission (Hopping) |
| Test Date:     | April 21, 2013              |

| Test Mode | Number of Hopping Frequencies | [ MHz ] Limit |
|-----------|-------------------------------|---------------|
| FH3       | 76                            | > 15          |
| FH1       | 51                            | > 15          |

*Note: Test plots shown in figures 3 to 6 on pages 12, 13.*

Figure 3: Number of hopping frequencies at FH3 mode

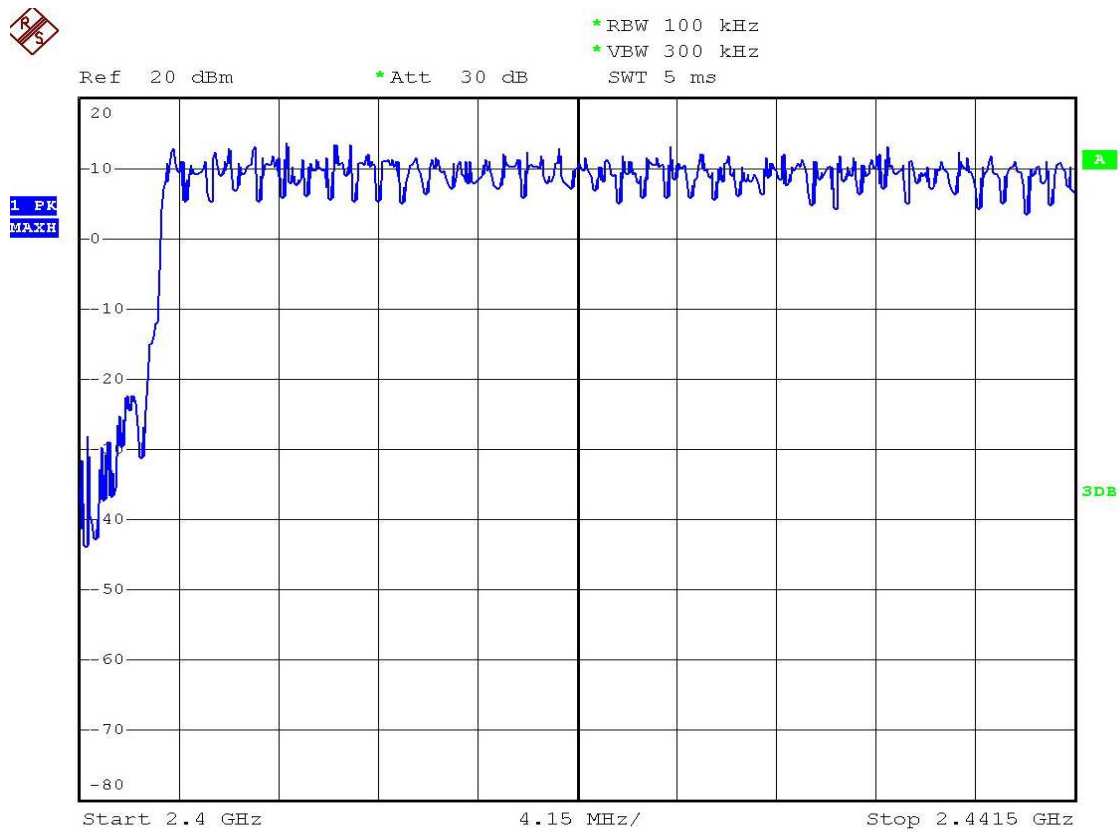


Figure 4: Number of hopping frequencies at FH3 mode

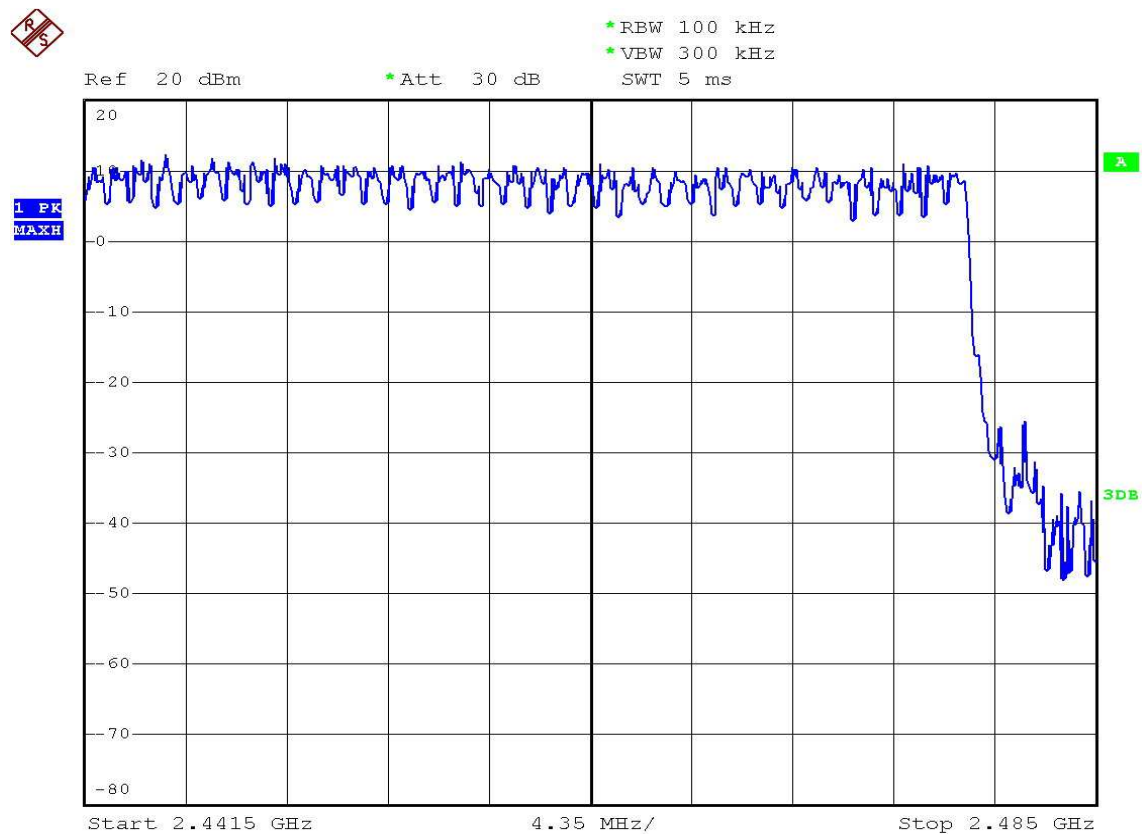


Figure 5: Number of hopping frequencies at FH1 mode

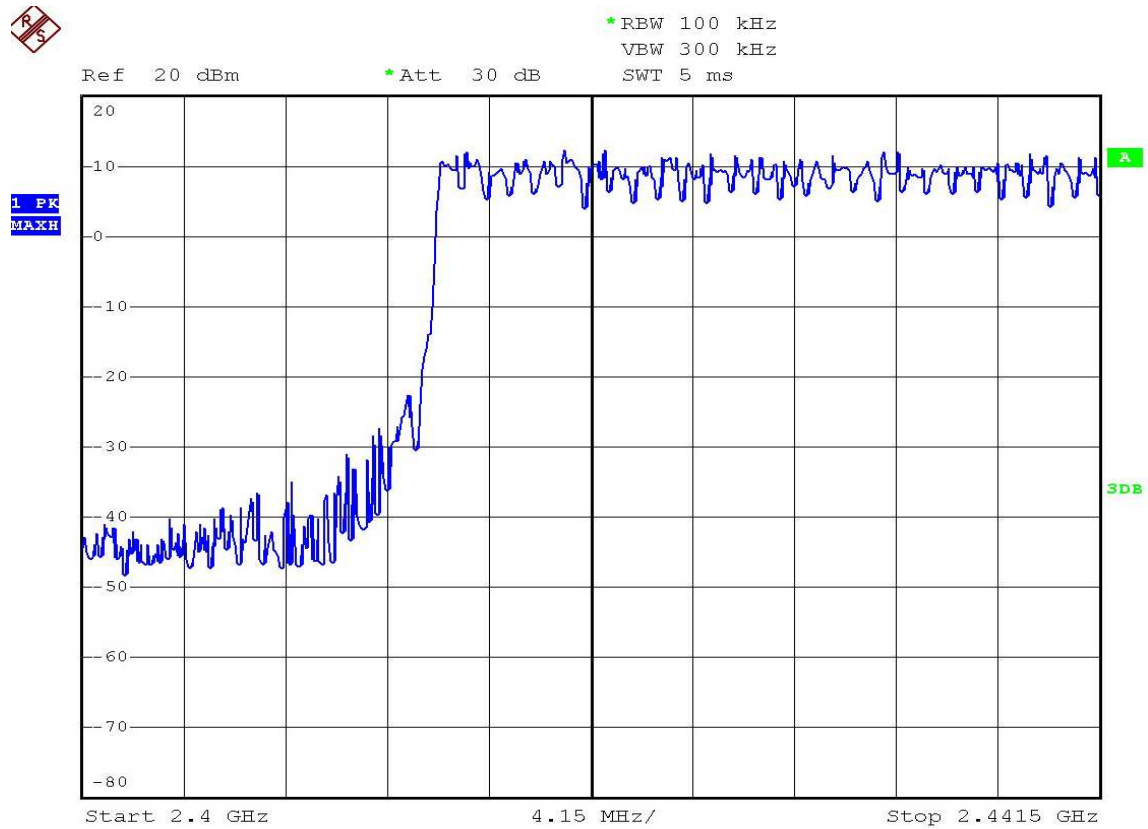
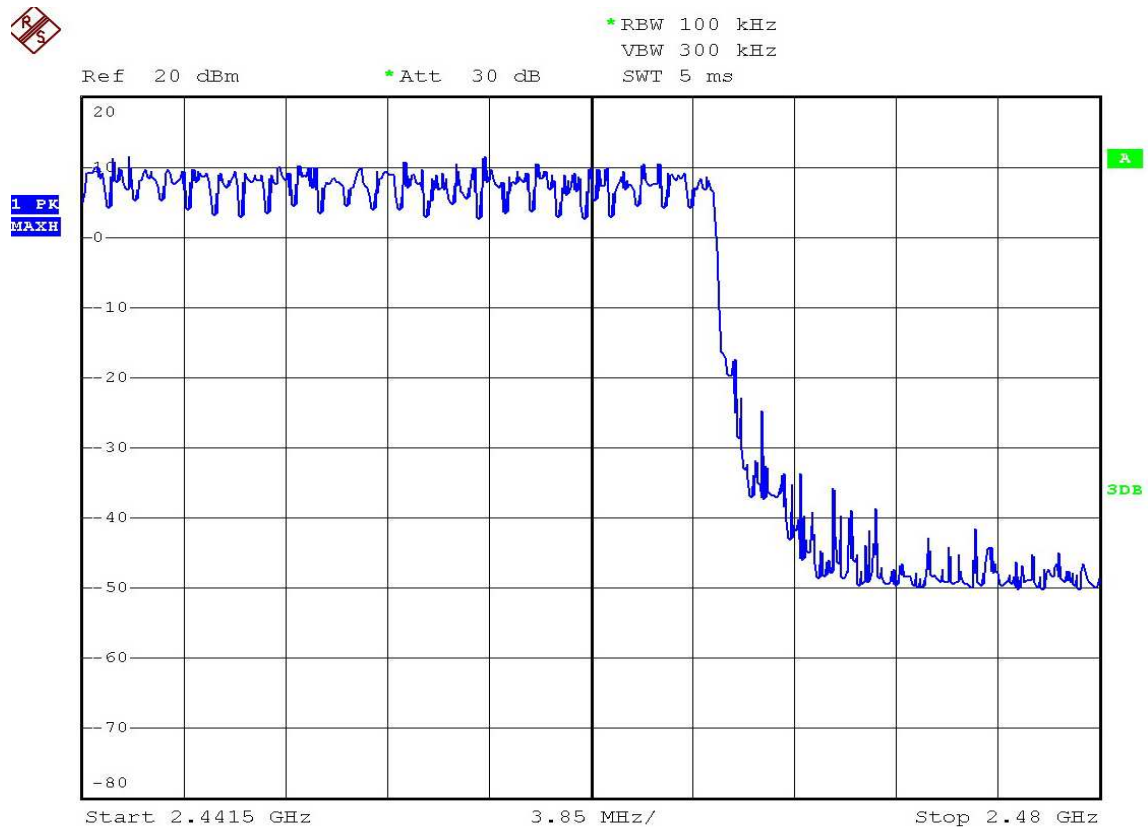


Figure 6: Number of hopping frequencies at FH1 mode



### 6.3 Time of Occupancy (Dwell Time) Measurement

**Applicable Standard:**

According to §15.247(a)(1)(iii), frequency hopping systems operating in the 2400MHz-2483.5 MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

According to RSS-210 issue 8, §A8.1 (d), frequency hopping systems operating in the 2400-2483.5MHz bands shall use at least 15 hopping channels. 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. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

**Test Procedure:**

1. Connect the EUT RF output port to spectrum analyzer via calibrated coaxial cable and suitable attenuator (if necessary).
2. Activates the EUT system and execute the software prepared for test, if necessary.
3. To find out the maximum emission condition, the transmitting data rate of EUT is set to maximum data rate.
4. The span of spectrum analyzer was set to zero (sweep time 30msec). The occupied time at center on a hopping frequency was observed and recorded as "Ton".
5. The spectrums are scanned by using the spectrum analyzer (\*1). And the numbers of occupied channel per Nsec (period of 0.4 seconds multiplied by the number of hopping channels employed) were counted by using the delta-marker function of spectrum analyzer and recorded as "N".
6. The dwell time was calculated by  $Ton \times N$ .

Spectrum analyzer setup conditions:

Frequency span : Zero span

Resolution bandwidth : 1MHz

Video bandwidth :  $\cong$  RBW

Sweep : As necessary to capture the entire dwell time per hopping channel.

Detector function : Peak

Trace mode : Max Hold

**Test Result:**

|                |                             |
|----------------|-----------------------------|
| Temperature:   | 25 °C                       |
| Humidity:      | 50%                         |
| EUT Operation: | Data Transmission (Hopping) |
| Test Date:     | April 22, 2013              |

| Test Mode | [ ms ]Dwell Time      | [ ms ] Limit |
|-----------|-----------------------|--------------|
| FH3       | 2.19ms x 67 = 146.73  | < 400        |
| FH1       | 10.40ms x 17 = 176.80 | < 400        |

*Note: Test plots shown in figures 7 to10 on pages 15, 16.*

Figure 7: Duration of one transmission at FH3 mode

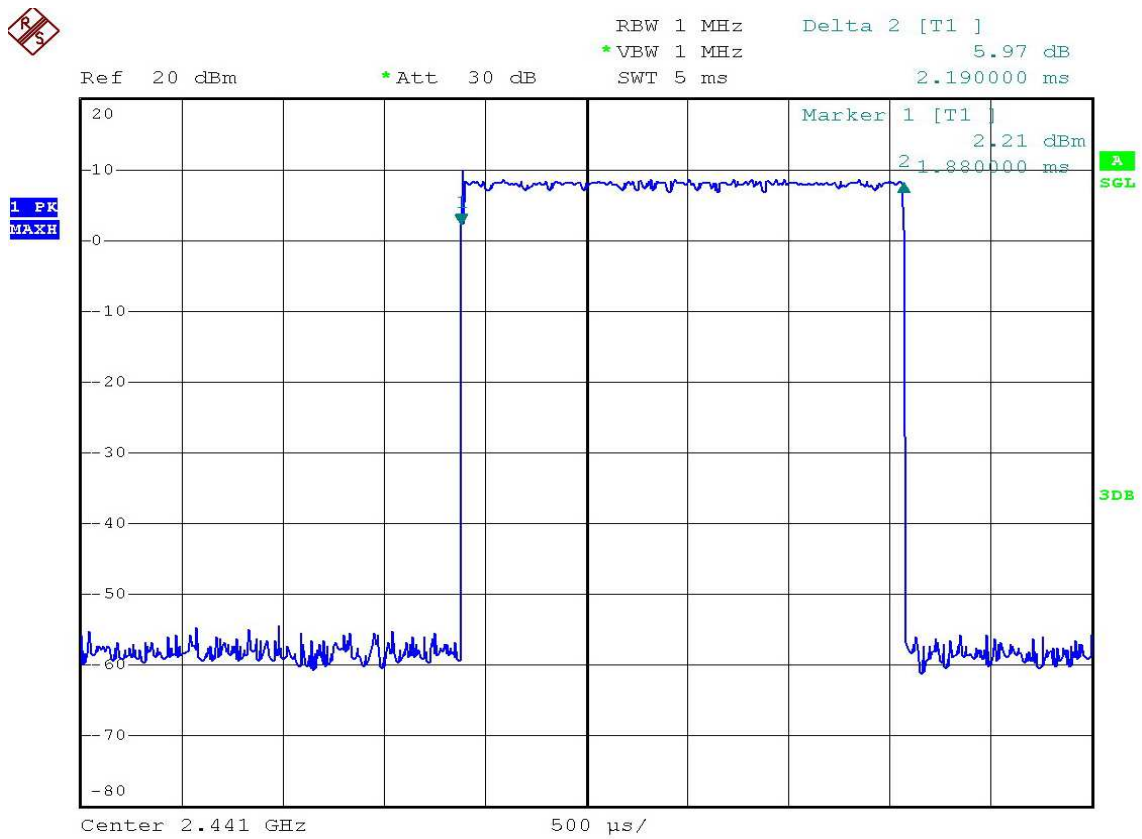


Figure 8: Number of transmission at 30.4 s at FH3 mode

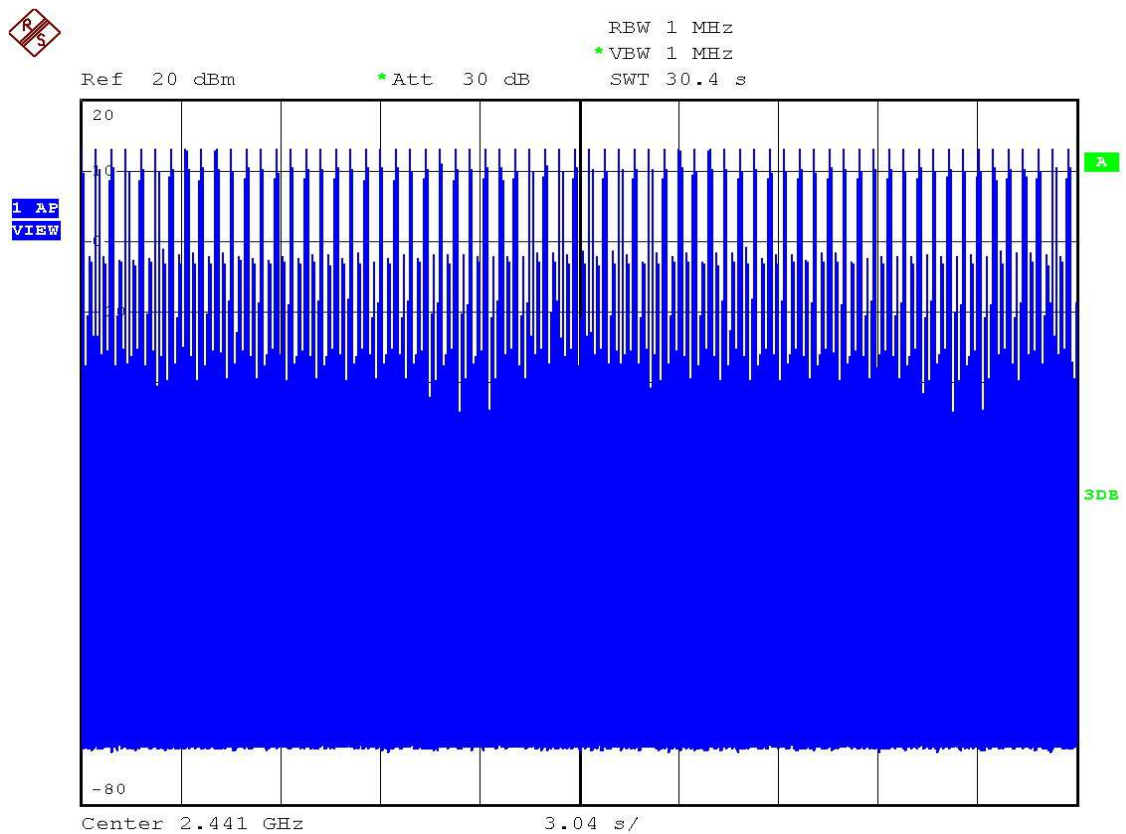


Figure 9: Duration of one transmission at FH1 mode

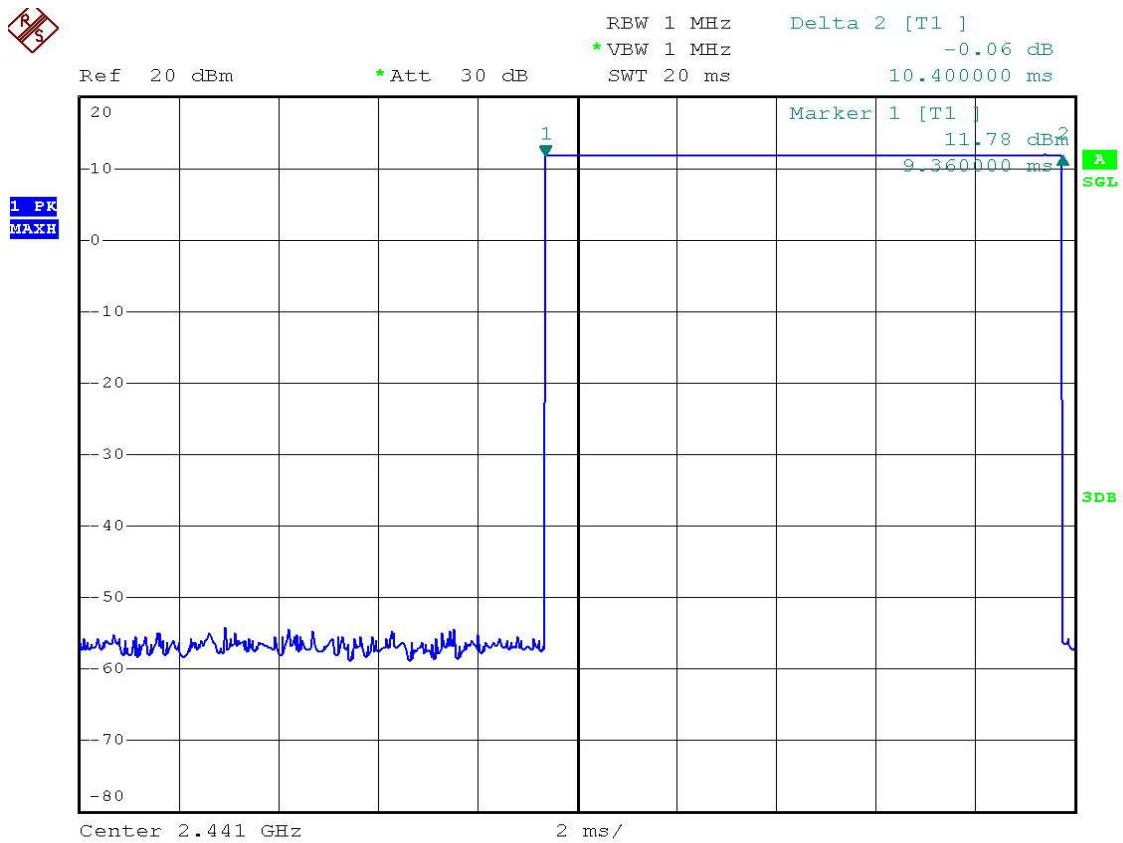
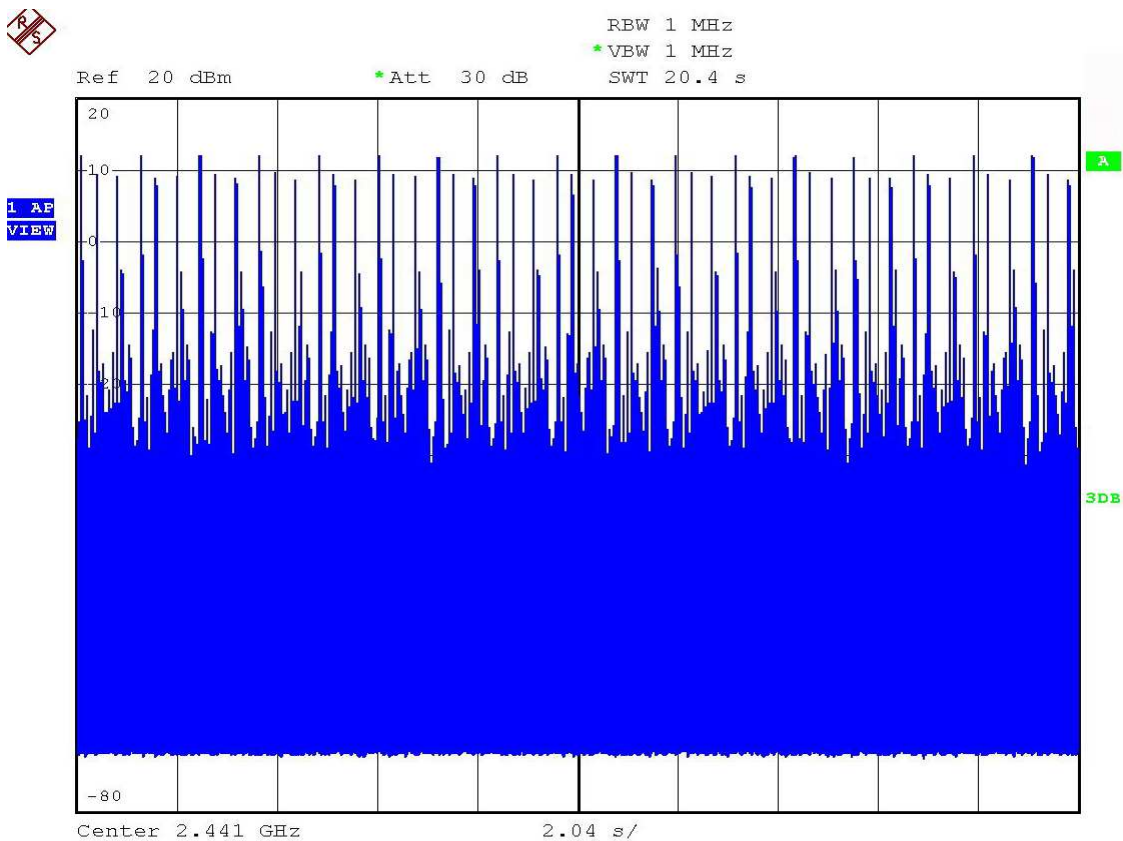


Figure 10: Number of transmission at 20.4 s with FH1 mode





## **6.4 Peak Output Power Measurement**

### **Applicable Standard:**

According to §15.247(b), for frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1Watt. For all other frequency hopping systems in the 2400-2483.5MHz band: 0.125 Watts.

According to RSS-210 issue 8, §A8.4 (2), for frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, the maximum conducted output power shall not exceed 1 W. For all other frequency hopping systems, the maximum peak conducted output power shall not exceed 0.125W.

### **Test Procedure:**

1. Connect the EUT RF output port to spectrum analyzer via calibrated coaxial cable and suitable attenuator (if necessary).
2. Activates the EUT system and executes the software prepared for test, if necessary.
3. To find out the worst case, the transmitting data rate of EUT is varied with the different modes of operation. The final test condition is recorded in this report.
4. The spectrums are scanned and allow the trace to stabilize.
5. The peak output power was determined by using the marker-data function of spectrum analyzer or peak type power meter.

Spectrum analyzer setup conditions:

Frequency span : Above 20dB bandwidth of the emission being measured

Resolution bandwidth : 3MHz

Video bandwidth : 10MHz

Sweep : Auto

Detector function : Peak

Trace mode : Max Hold

**Test Result:**

|                |                                     |
|----------------|-------------------------------------|
| Temperature:   | 25 °C                               |
| Humidity:      | 52%                                 |
| EUT Operation: | Data Transmission (without hopping) |
| Test Date:     | April 22, 2013                      |

| FH3 Mode  |        |         |         |         |        |
|-----------|--------|---------|---------|---------|--------|
| Frequency | Factor | Reading | Power   | Limit   | Margin |
| [ MHz ]   | [ dB ] | [ dBm ] | [ dBm ] | [ dBm ] | [ dB ] |
| 2403      | 1.00   | 12.52   | 13.52   | 30.00   | -16.48 |
| 2441      | 1.00   | 12.31   | 13.31   | 30.00   | -16.69 |
| 2478      | 1.00   | 10.94   | 11.94   | 30.00   | -18.06 |

*Note: Test plots shown in figures 11 to 13 on pages 19, 20.*

| FH1 Mode  |        |         |         |         |        |
|-----------|--------|---------|---------|---------|--------|
| Frequency | Factor | Reading | Power   | Limit   | Margin |
| [ MHz ]   | [ dB ] | [ dBm ] | [ dBm ] | [ dBm ] | [ dB ] |
| 2415      | 1.00   | 13.19   | 14.19   | 20.97   | -6.78  |
| 2441      | 1.00   | 12.19   | 13.19   | 20.97   | -7.78  |
| 2465      | 1.00   | 11.42   | 12.42   | 20.97   | -8.55  |

*Note: Test plots shown in figures 14 to 16 on pages 20, 21.*

Figure 11: Peak output power - Low channel at FH3 mode

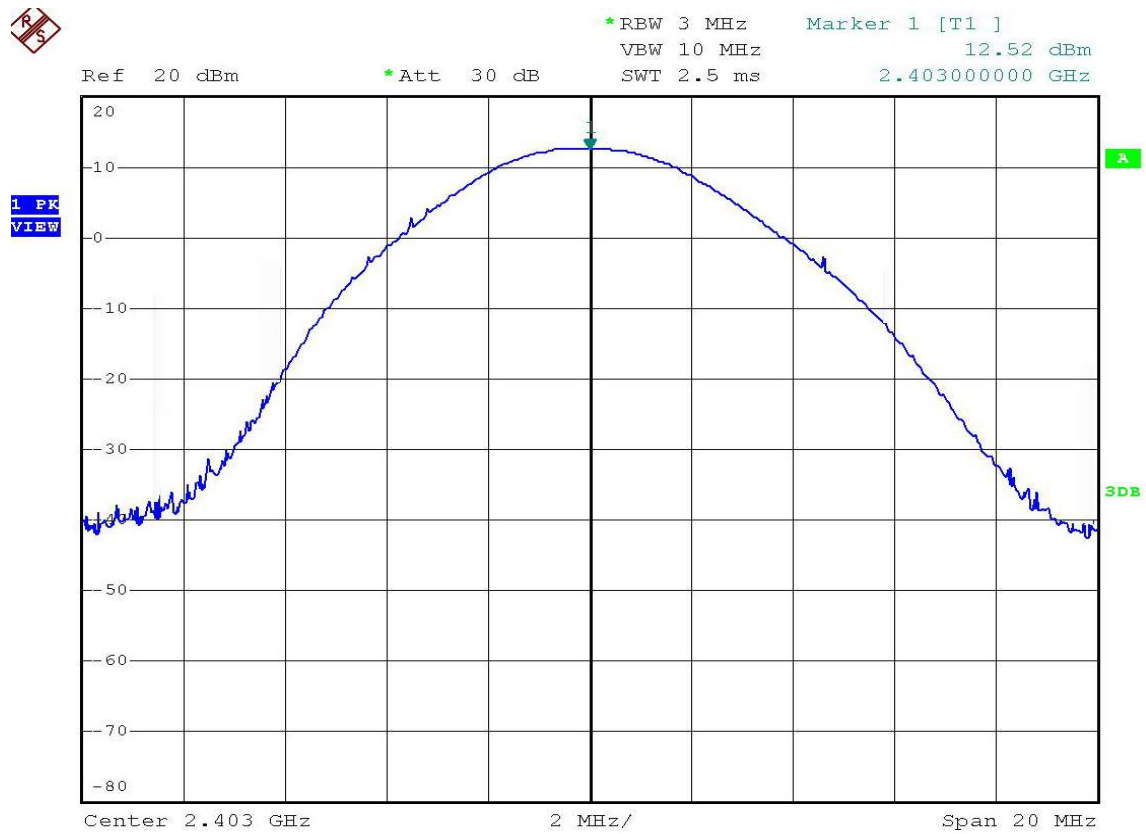


Figure 12: Peak output power - Middle channel at FH3 mode

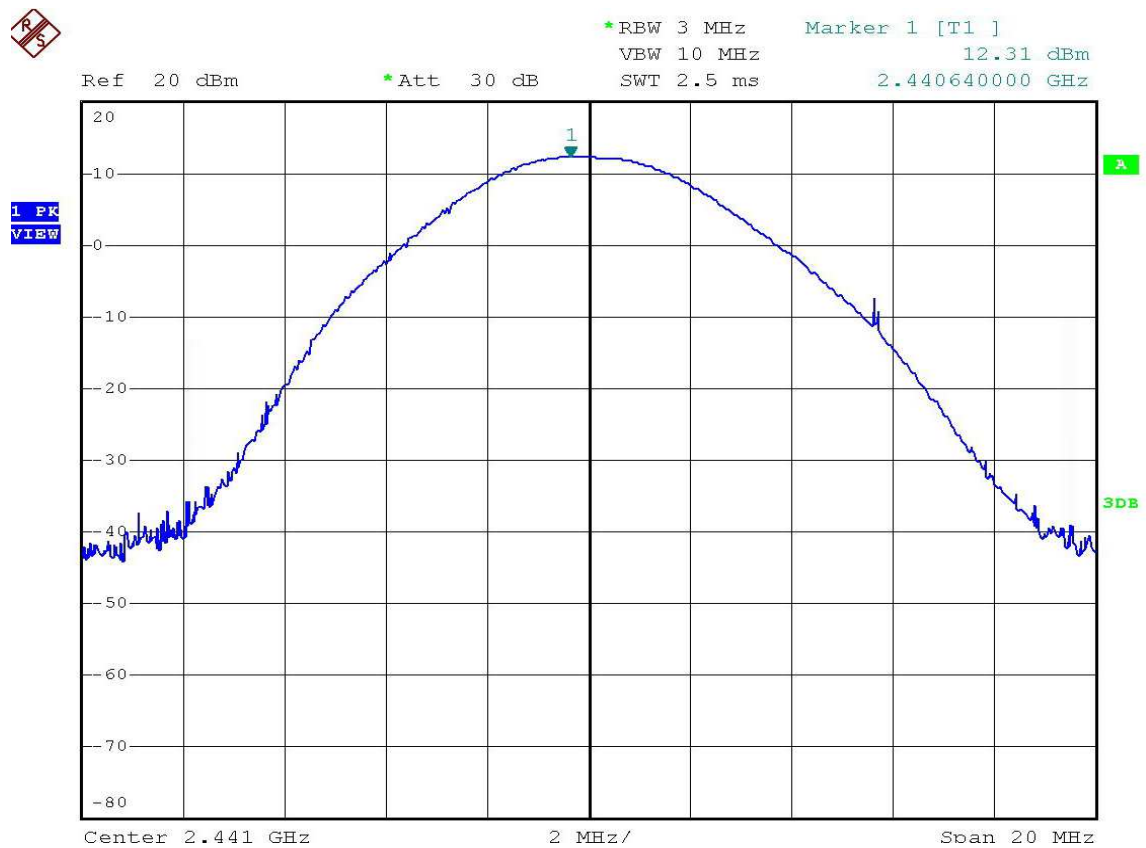


Figure 13: Peak output power - High channel at FH3 mode

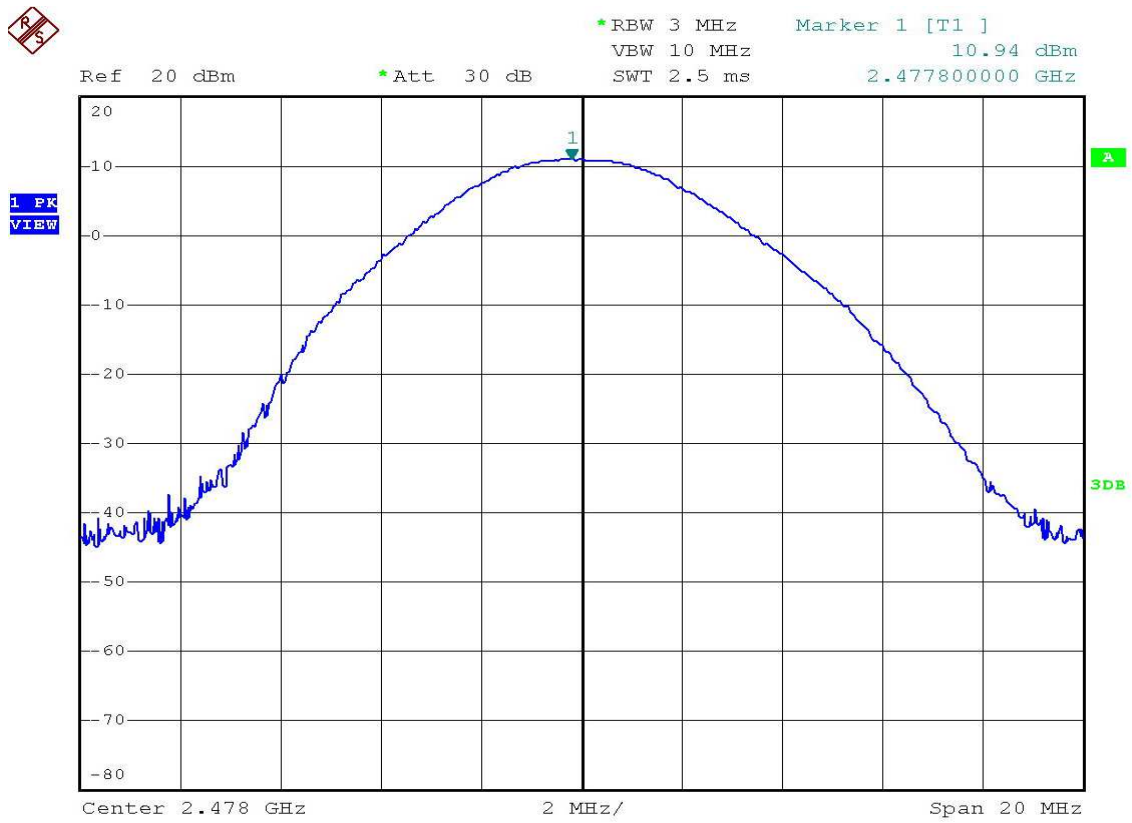
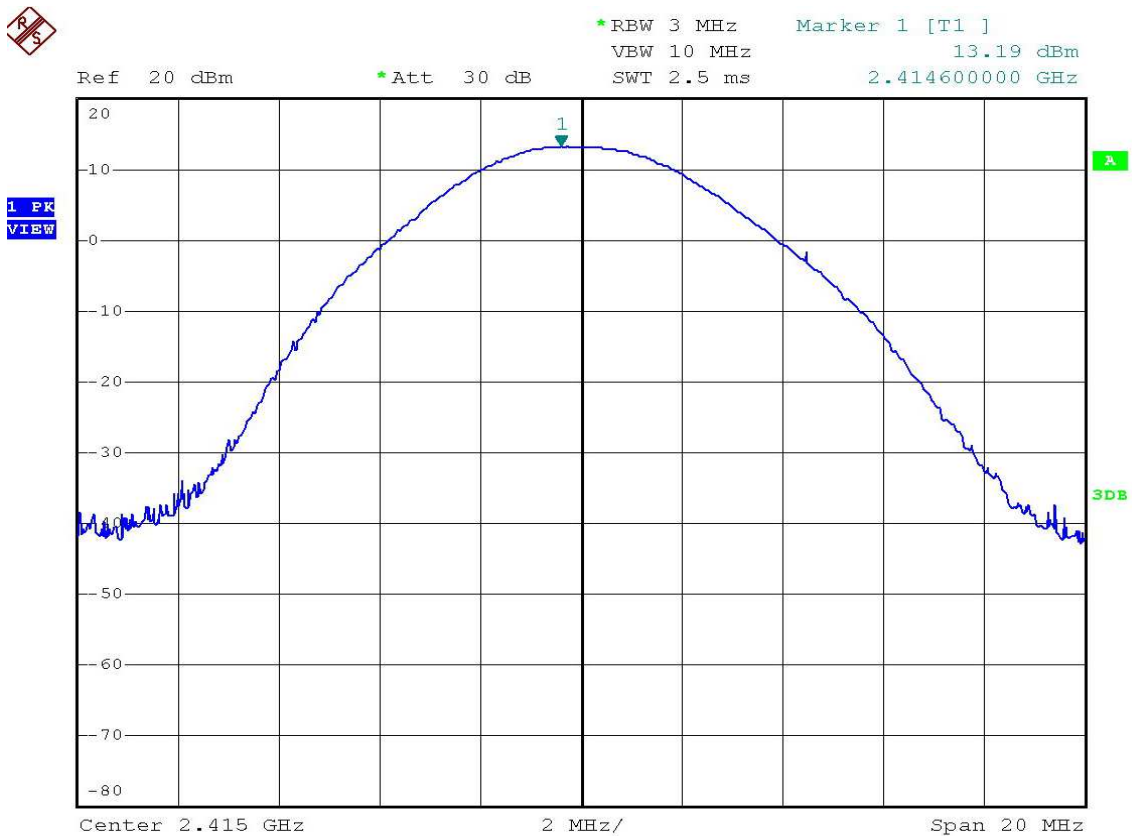


Figure 14: Peak output power - Low channel at FH1 mode





## 6.5 Band Edge of Conducted Emission and Spurious RF Conducted Emissions

### Applicable Standard:

According to §15.247(d), in any 100 KHz bandwidth outside the frequency bands 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, 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).

According to RSS-210 issue 8, §A8.5, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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 section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

### Test Procedure:

1. Connect the EUT RF output port to the spectrum analyzer via calibrated coaxial cable and suitable attenuator (if necessary).
2. Activates the EUT System and executes the software prepared for test, if necessary.
3. To find out the maximum emission condition, the transmitting data rate of EUT is set to maximum data rate.
4. The spectrum are scanned.
5. The emission at the band edge or the highest modulation product outside of band were measured by using the marker function of spectrum analyzer (\*1).
6. The peak of the in-band emission were measured by using the marker to peak function of spectrum analyzer.
7. Above measurement were repeated at other side band edge.

Spectrum analyzer setup conditions:

Frequency span : Wide enough to capture the peak level of emission on the band edge

Resolution bandwidth : 100kHz

Video bandwidth :  $\cong$  RBW

Sweep : Auto

Detector function : Peak

Trace Mode : Max Hold

### Test Results:

|                |  |
|----------------|--|
| Temperature:   | 25 °C  |
| Humidity:      | 52%  |
| EUT Operation: | Data Transmission (without hopping and normal operation) |
| Test Date:     | April 23, 2013   |

The unit does meet the requirement.

*Note: Test plots shown in figures 17 to 30 on pages 23 to 29*

Figure 17: Band edge - Low frequency side at FH3 mode without hopping

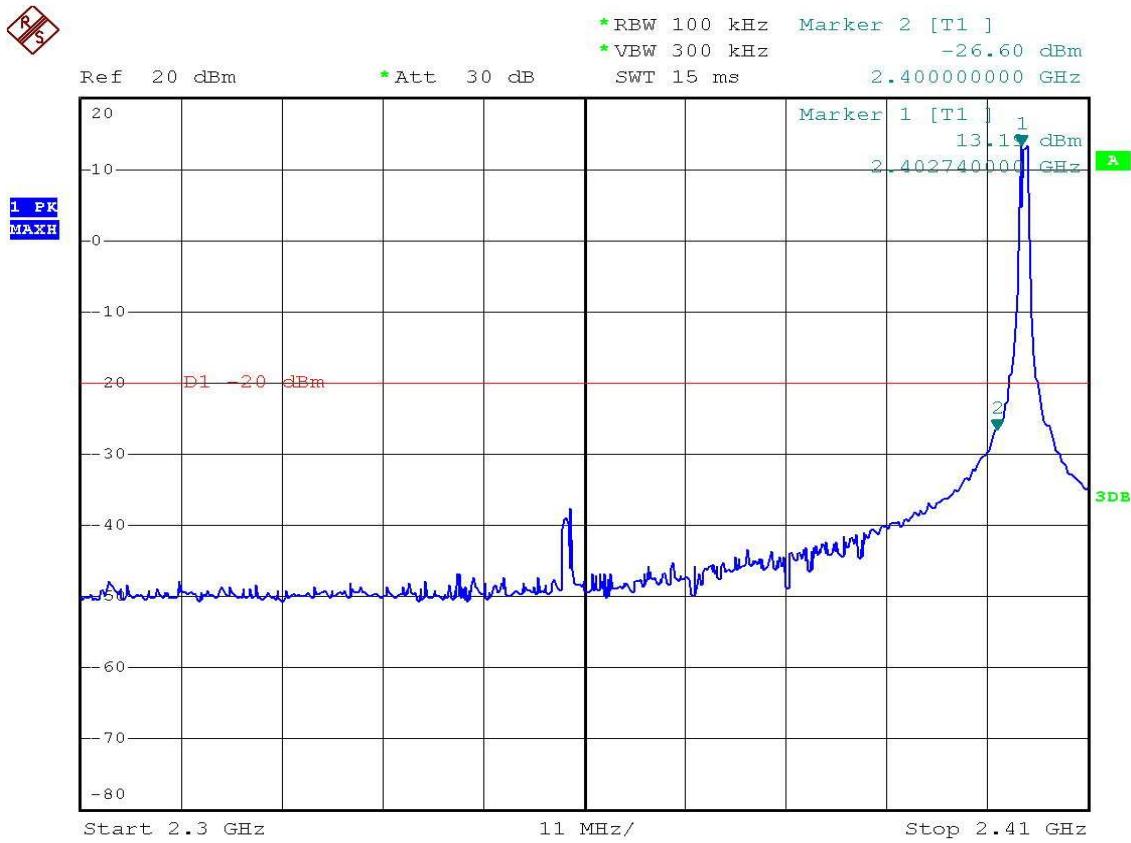


Figure 18: Band edge - High frequency side at FH3 mode without hopping









Figure 23: Band edge - Low frequency side at FH1 mode with normal operation

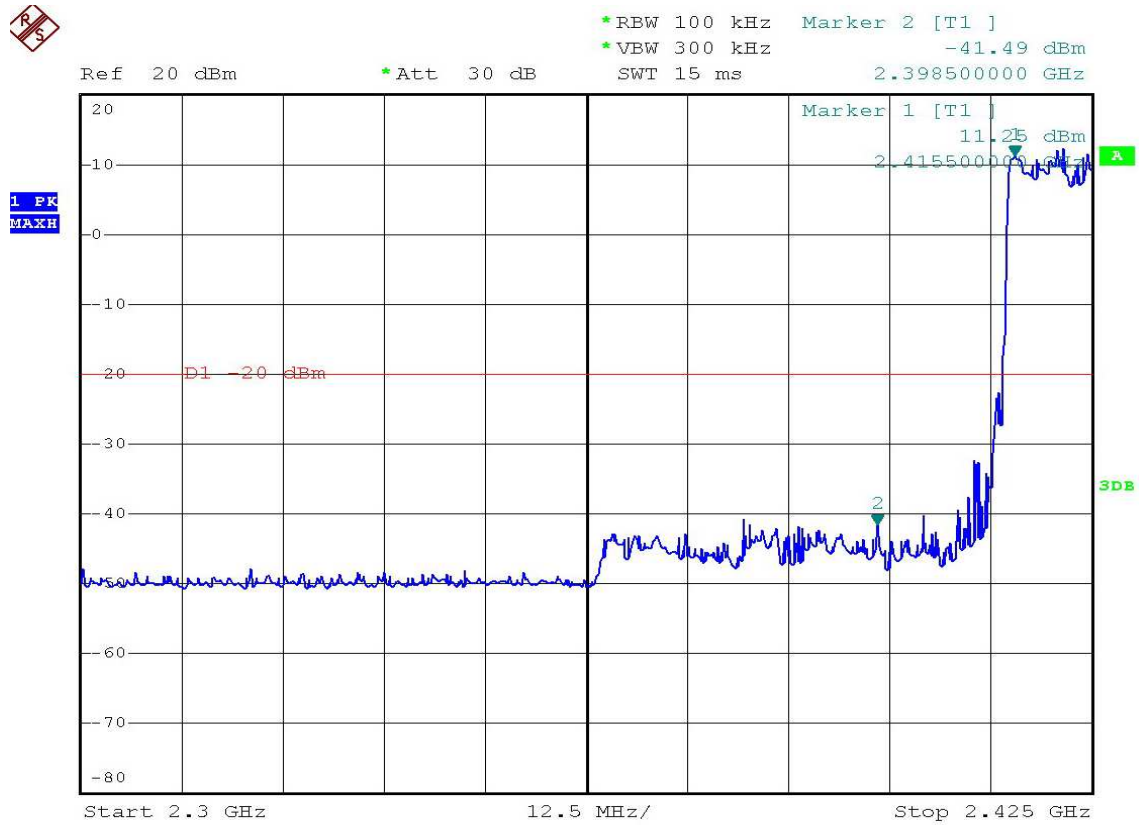


Figure 24: Band Edge - High frequency side at FH1 mode with normal operation

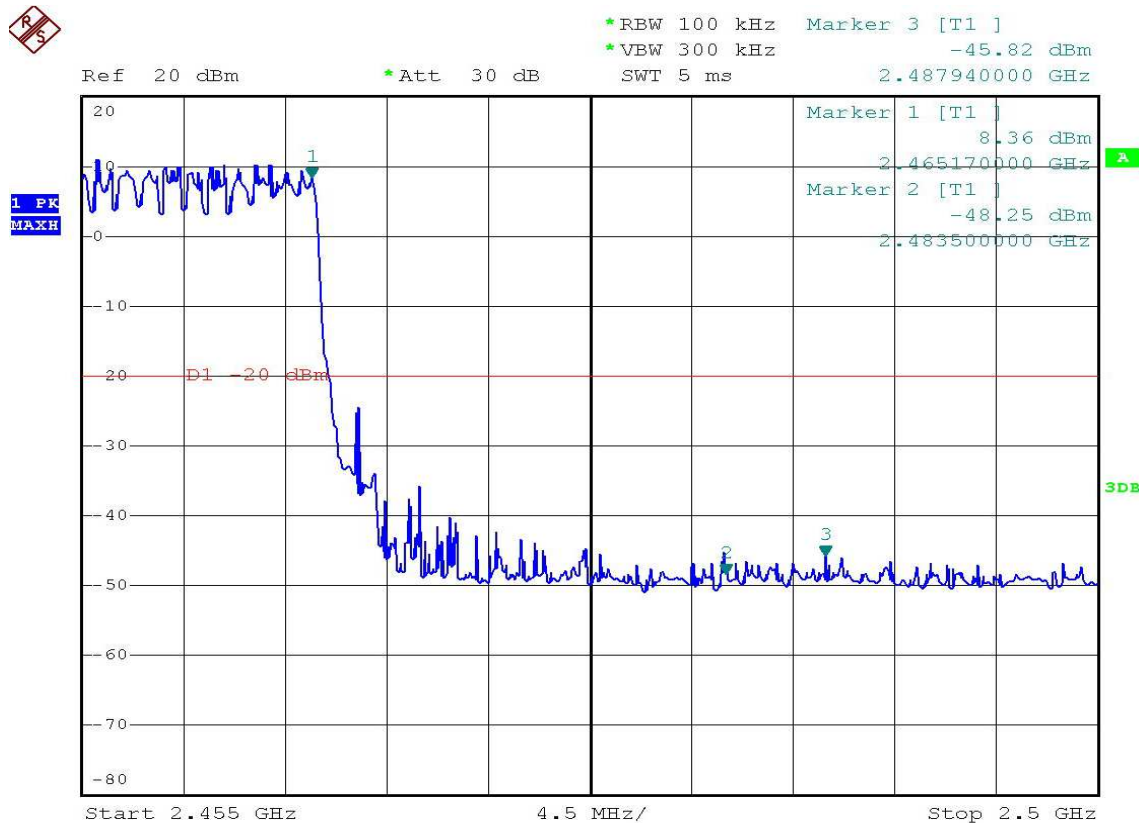


Figure 25 Conducted spurious emissions with FH3 mode at low channel

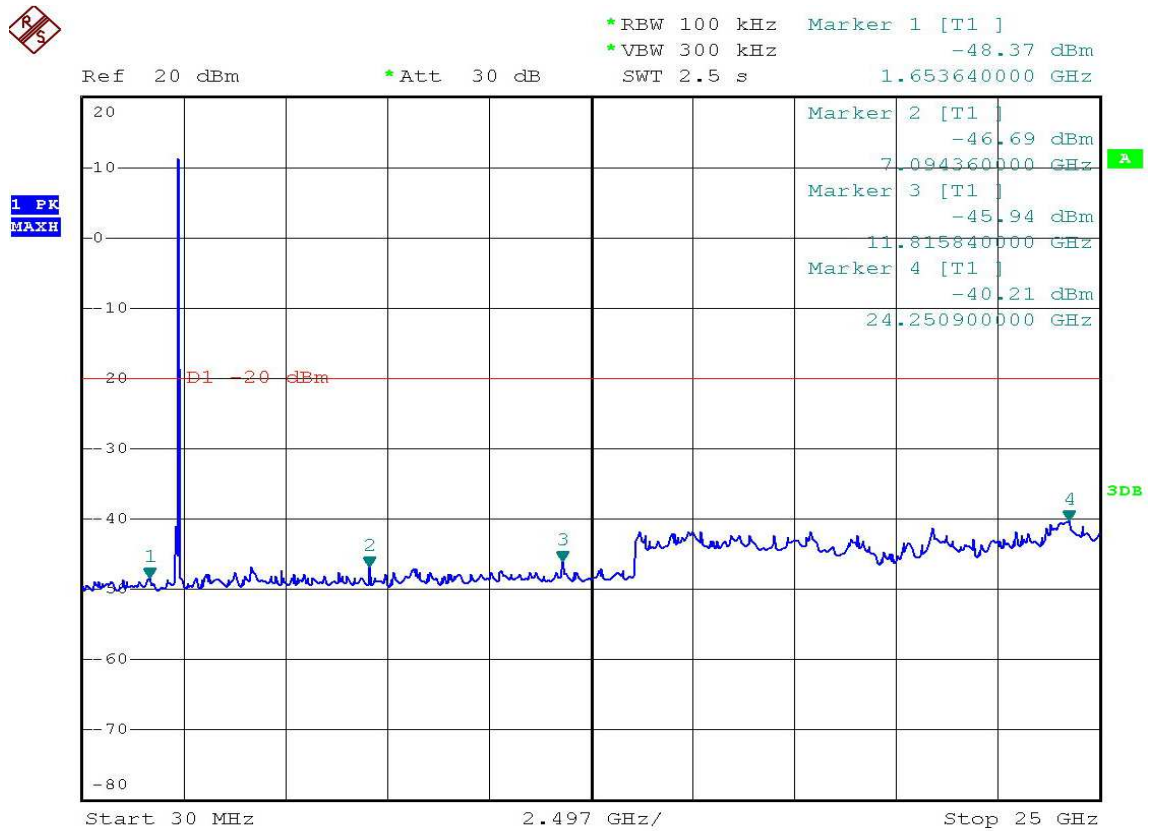


Figure 26 Conducted spurious emissions with FH3 mode at middle channel

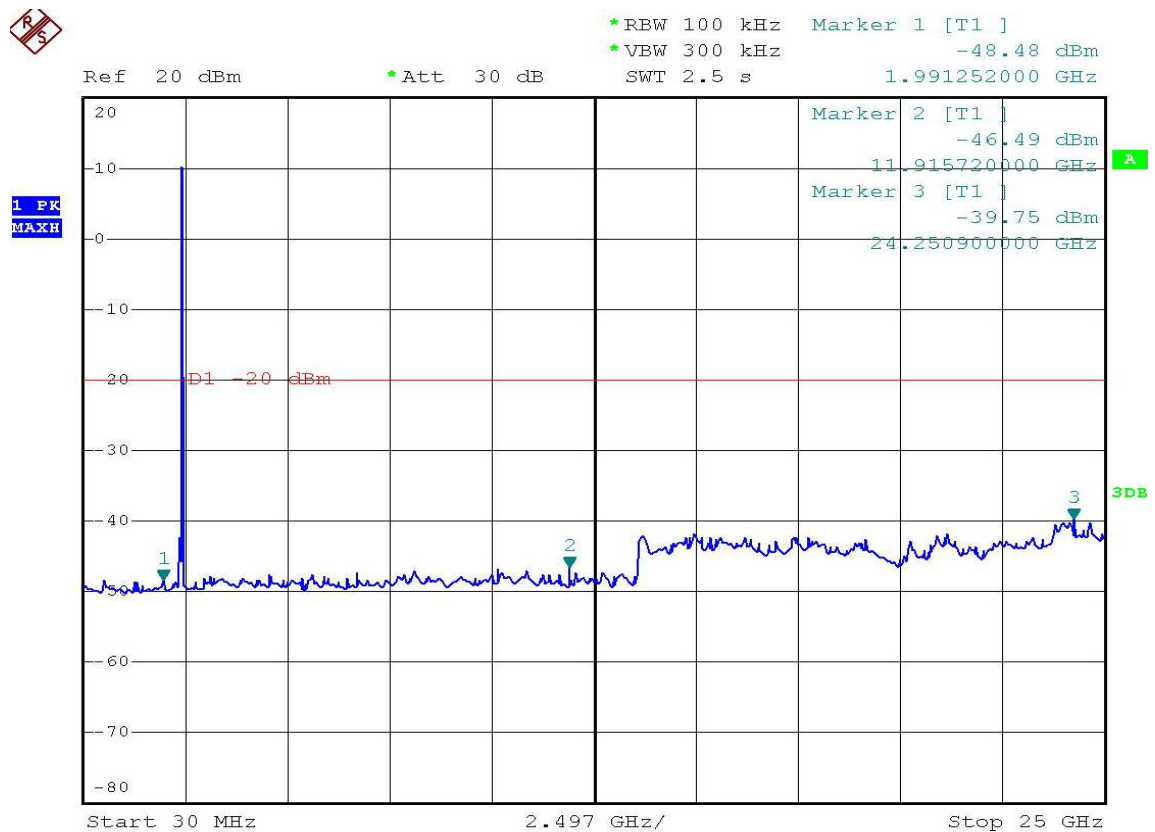


Figure 27 Conducted spurious emissions with FH3 mode at high channel

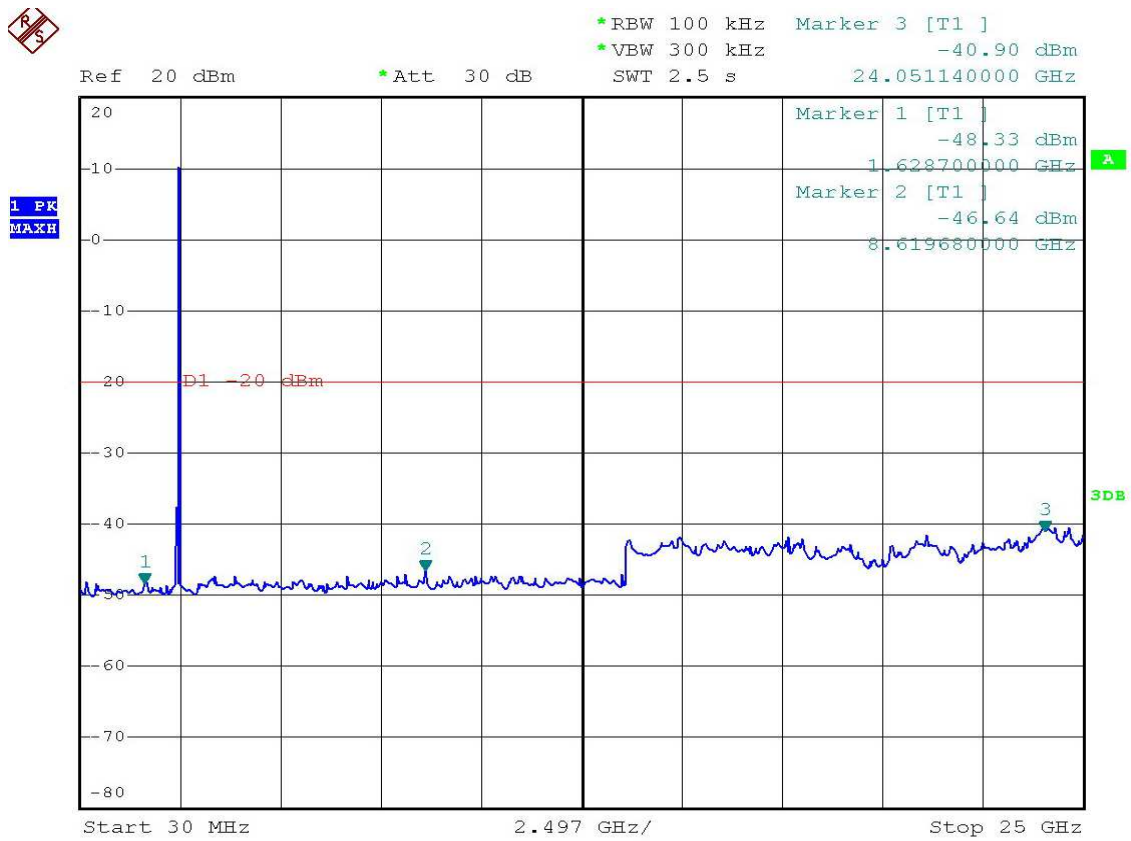
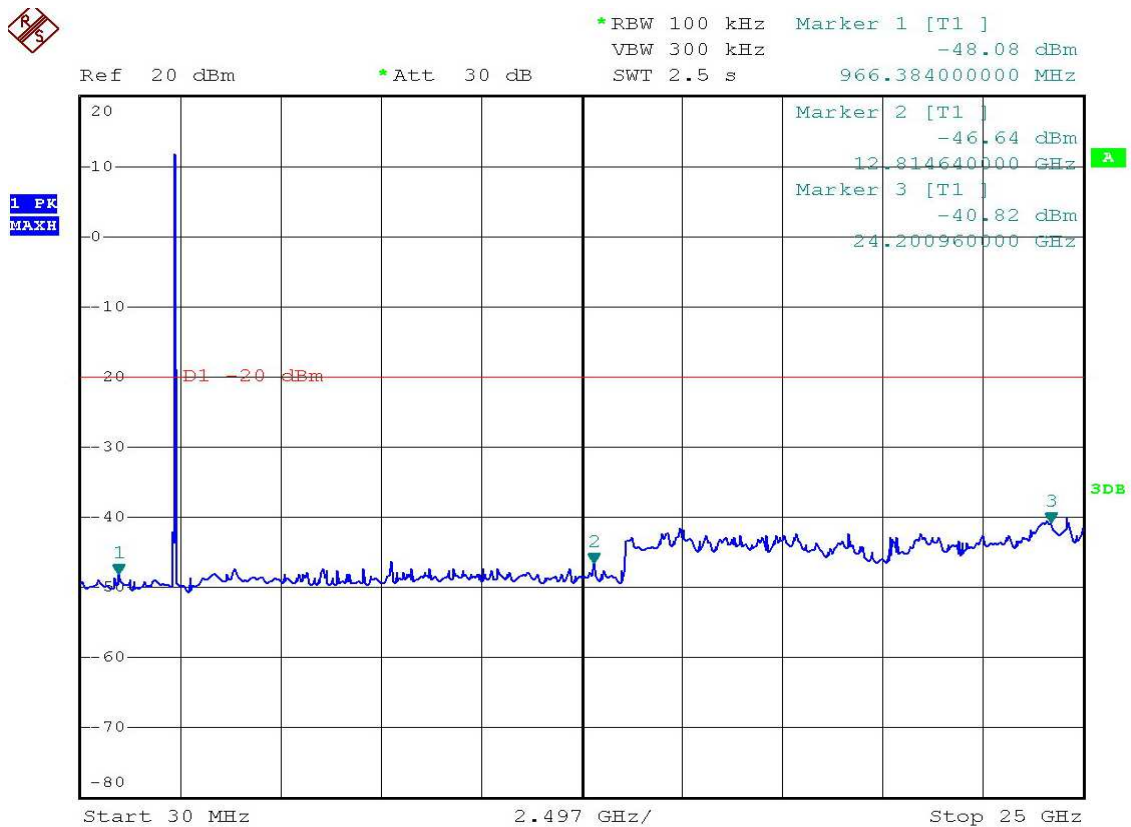


Figure 28 Conducted spurious emissions with FH1 mode at low channel





## 6.6 Spurious Radiated Emission Measurement

### Applicable Standard:

According to §15.247(c), all other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower. According to §15.31(o), the amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.

According to RSS-210 issue 8, §A8.5, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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 section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

### Test Procedure:

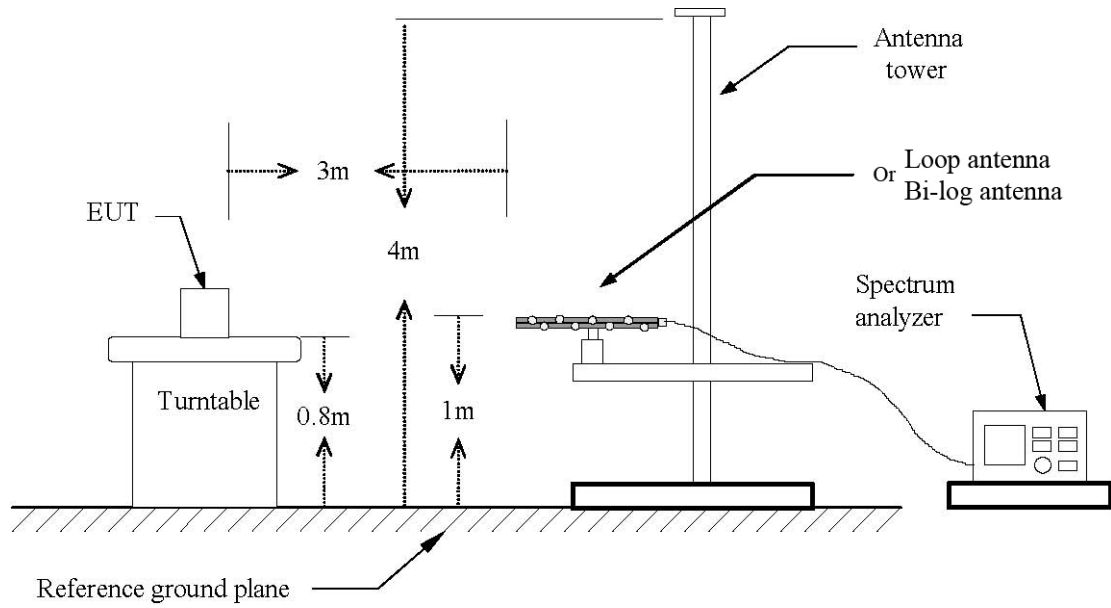
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until all frequency measured were complete.

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:

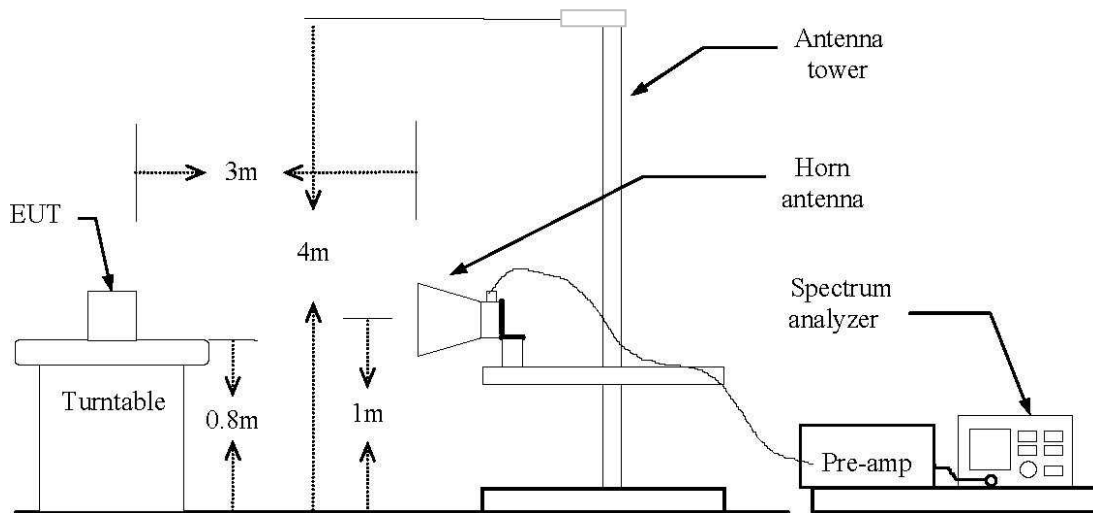
$$FS = RA + AF + CL - AG$$

|                           |  |
|---------------------------|--|
| Where FS = Field Strength | CL = Cable Attenuation Factor (Cable Loss) |
| RA = Reading Amplitude    | AG = Amplifier Gain                        |
| AF = Antenna Factor       |  |

Test Configuration between 9K and 1 GHz:



Test Configuration above 1 GHz:



Test Results:

|                |                                     |
|----------------|-------------------------------------|
| Temperature:   | 25°C                                |
| Humidity:      | 51%                                 |
| EUT Operation: | Data Transmission (without hopping) |
| Test Date:     | April 24, 2013                      |

**Spurious Emission In the Frequency Rang between 9kHz and 1GHz:**

At FH3 mode: Fc= 2403MHz transmitting operation

| Freq. (MHz) | Ant.Pol. (H/V) | Detector Mode (PK/QP) | Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS (dBuV/m) | Limit 3m (dBuV/m) | Margin (dB) |
|-------------|----------------|-----------------------|----------------|----------------------|--------------------|-------------------|-------------|
| 174.00      | H              | QP                    | 15.7           | 11.4                 | 27.1               | 43.5              | -16.4       |
| 253.98      | H              | QP                    | 18.5           | 12.9                 | 31.4               | 46.0              | -14.6       |
| 162.00      | V              | QP                    | 24.4           | 11.1                 | 35.5               | 43.5              | -8.0        |
| 384.00      | V              | QP                    | 19.7           | 15.6                 | 35.3               | 46.0              | -10.7       |
| -           | -              | -                     | -              | -                    | -                  | -                 | -           |

At FH3 mode: Fc= 2441MHz transmitting operation

| Freq. (MHz) | Ant.Pol. (H/V) | Detector Mode (PK/QP) | Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS (dBuV/m) | Limit 3m (dBuV/m) | Margin (dB) |
|-------------|----------------|-----------------------|----------------|----------------------|--------------------|-------------------|-------------|
| 172.60      | H              | QP                    | 14.9           | 11.4                 | 26.3               | 43.5              | -17.2       |
| 254.00      | H              | QP                    | 18.9           | 12.9                 | 31.8               | 46.0              | -14.2       |
| 121.98      | V              | QP                    | 23.9           | 7.0                  | 30.9               | 43.5              | -12.6       |
| 383.80      | V              | QP                    | 19.8           | 15.6                 | 35.4               | 46.0              | -10.6       |
| -           | -              | -                     | -              | -                    | -                  | -                 | -           |

At FH3 mode: Fc= 2478MHz transmitting operation

| Freq. (MHz) | Ant.Pol. (H/V) | Detector Mode (PK/QP) | Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS (dBuV/m) | Limit 3m (dBuV/m) | Margin (dB) |
|-------------|----------------|-----------------------|----------------|----------------------|--------------------|-------------------|-------------|
| 166.02      | H              | QP                    | 14.9           | 11.2                 | 26.1               | 43.5              | -17.4       |
| 254.00      | H              | QP                    | 19.2           | 12.9                 | 32.1               | 46.0              | -13.9       |
| 162.40      | V              | QP                    | 22.1           | 11.1                 | 33.2               | 43.5              | -10.3       |
| 380.60      | V              | QP                    | 21.1           | 15.6                 | 36.7               | 46.0              | -9.3        |
| -           | -              | -                     | -              | -                    | -                  | -                 | -           |

*Note: For spurious emission measurement, the compliance tests were performed both of horizontally and vertically placed in EUT(X position, Y position, Z position). As a result, the data of operation mode that produce the maximum emission were reported. The other emissions shown "-" are more than 20dB below the limits.*



At FH1 mode: Fc= 2415MHz transmitting operation

| Freq. (MHz) | Ant.Pol. (H/V) | Detector Mode (PK/QP) | Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS (dBuV/m) | Limit 3m (dBuV/m) | Margin (dB) |
|-------------|----------------|-----------------------|----------------|----------------------|--------------------|-------------------|-------------|
| 175.40      | H              | QP                    | 16.9           | 11.4                 | 28.3               | 43.5              | -15.2       |
| 253.40      | H              | QP                    | 19.7           | 12.9                 | 32.6               | 46.0              | -13.4       |
| 161.50      | V              | QP                    | 22.3           | 11.1                 | 33.4               | 43.5              | -10.1       |
| 382.90      | V              | QP                    | 18.9           | 15.6                 | 34.5               | 46.0              | -11.5       |
| -           | -              | -                     | -              | -                    | -                  | -                 | -           |

At FH1 mode: Fc= 2441MHz transmitting operation

| Freq. (MHz) | Ant.Pol. (H/V) | Detector Mode (PK/QP) | Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS (dBuV/m) | Limit 3m (dBuV/m) | Margin (dB) |
|-------------|----------------|-----------------------|----------------|----------------------|--------------------|-------------------|-------------|
| 174.20      | H              | QP                    | 16.0           | 11.4                 | 27.4               | 43.5              | -16.1       |
| 252.90      | H              | QP                    | 20.3           | 12.9                 | 33.2               | 46.0              | -12.8       |
| 163.40      | V              | QP                    | 23.7           | 11.1                 | 34.8               | 43.5              | -8.7        |
| 381.50      | V              | QP                    | 20.0           | 15.6                 | 35.6               | 46.0              | -10.4       |
| -           | -              | -                     | -              | -                    | -                  | -                 | -           |

At FH1 mode: Fc= 2465MHz transmitting operation

| Freq. (MHz) | Ant.Pol. (H/V) | Detector Mode (PK/QP) | Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS (dBuV/m) | Limit 3m (dBuV/m) | Margin (dB) |
|-------------|----------------|-----------------------|----------------|----------------------|--------------------|-------------------|-------------|
| 168.50      | H              | QP                    | 15.5           | 11.2                 | 26.7               | 43.5              | -16.8       |
| 254.70      | H              | QP                    | 20.0           | 12.9                 | 32.9               | 46.0              | -13.1       |
| 162.30      | V              | QP                    | 24.6           | 11.1                 | 35.7               | 43.5              | -7.8        |
| 382.60      | V              | QP                    | 20.5           | 15.6                 | 36.1               | 46.0              | -9.9        |
| -           | -              | -                     | -              | -                    | -                  | -                 | -           |

*Note: For spurious emission measurement, the compliance tests were performed both of horizontally and vertically placed in EUT(X position, Y position, Z position). As a result, the data of operation mode that produce the maximum emission were reported. The other emissions shown “-“ are more than 20dB below the limits.*

**Spurious Emission In the Frequency Rang above 1GHz:**

At FH3 mode: Fc= 2403MHz transmitting operation - Horizontal

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS     |             | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin |
|-------------|---------------------|-------------------|----------------------|---------------|-------------|---------------------|-------------------|--------|
|             |                     |                   |                      | Peak (dBuV/m) | AV (dBuV/m) |                     |                   |        |
| 4805.94     | 54.23               | 39.90             | 2.70                 | 56.93         | 42.60       | 74.00               | 54.00             | -11.40 |
| 7190.86     | 57.31               | 39.05             | 4.22                 | 61.53         | 43.27       | 74.00               | 54.00             | -10.73 |
| 9604.86     | 60.42               | 40.98             | 7.70                 | 68.12         | 48.68       | 74.00               | 54.00             | -5.32  |
| -           | -                   | -                 | -                    | -             | -           | -                   | -                 | -      |

At FH3 mode: Fc= 2403MHz transmitting operation - Vertical

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS     |             | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin |
|-------------|---------------------|-------------------|----------------------|---------------|-------------|---------------------|-------------------|--------|
|             |                     |                   |                      | Peak (dBuV/m) | AV (dBuV/m) |                     |                   |        |
| 4805.80     | 55.89               | 40.06             | 2.70                 | 58.59         | 42.76       | 74.00               | 54.00             | -11.24 |
| 7209.66     | 53.48               | 39.37             | 4.22                 | 57.70         | 43.59       | 74.00               | 54.00             | -10.41 |
| 9602.00     | 56.22               | 38.89             | 7.70                 | 63.92         | 46.59       | 74.00               | 54.00             | -7.41  |
| -           | -                   | -                 | -                    | -             | -           | -                   | -                 | -      |

*Note: 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.*

At FH3 mode: Fc= 2441MHz transmitting operation - Horizontal

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS     |             | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin |
|-------------|---------------------|-------------------|----------------------|---------------|-------------|---------------------|-------------------|--------|
|             |                     |                   |                      | Peak (dBuV/m) | AV (dBuV/m) |                     |                   |        |
| 4882.30     | 53.44               | 39.12             | 2.70                 | 56.14         | 41.82       | 74.00               | 54.00             | -12.18 |
| 7322.80     | 56.03               | 38.90             | 4.22                 | 60.25         | 43.12       | 74.00               | 54.00             | -10.88 |
| 9763.56     | 58.54               | 40.10             | 7.70                 | 66.24         | 47.80       | 74.00               | 54.00             | -6.20  |
| -           | -                   | -                 | -                    | -             | -           | -                   | -                 | -      |

At FH3 mode: Fc= 2441MHz transmitting operation - Vertical

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS     |             | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin |
|-------------|---------------------|-------------------|----------------------|---------------|-------------|---------------------|-------------------|--------|
|             |                     |                   |                      | Peak (dBuV/m) | AV (dBuV/m) |                     |                   |        |
| 4881.96     | 55.56               | 38.50             | 2.70                 | 58.26         | 41.20       | 74.00               | 54.00             | -12.80 |
| 7323.20     | 52.79               | 38.84             | 4.22                 | 57.01         | 43.06       | 74.00               | 54.00             | -10.94 |
| 9763.85     | 53.79               | 38.18             | 7.70                 | 61.49         | 45.88       | 74.00               | 54.00             | -8.12  |
| -           | -                   | -                 | -                    | -             | -           | -                   | -                 | -      |

Note: 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.

At FH3 mode: Fc= 2478MHz transmitting operation - Horizontal

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS     |             | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin |
|-------------|---------------------|-------------------|----------------------|---------------|-------------|---------------------|-------------------|--------|
|             |                     |                   |                      | Peak (dBuV/m) | AV (dBuV/m) |                     |                   |        |
| 4956.20     | 54.60               | 39.96             | 2.70                 | 57.30         | 42.66       | 74.00               | 54.00             | -11.34 |
| 7433.85     | 55.78               | 38.80             | 4.40                 | 60.18         | 43.20       | 74.00               | 54.00             | -10.80 |
| 9911.48     | 58.54               | 38.02             | 7.70                 | 66.24         | 45.72       | 74.00               | 54.00             | -8.28  |
| -           | -                   | -                 | -                    | -             | -           | -                   | -                 | -      |

At FH3 mode: Fc= 2478MHz transmitting operation - Vertical

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS     |             | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin |
|-------------|---------------------|-------------------|----------------------|---------------|-------------|---------------------|-------------------|--------|
|             |                     |                   |                      | Peak (dBuV/m) | AV (dBuV/m) |                     |                   |        |
| 4956.00     | 55.34               | 38.85             | 2.70                 | 58.04         | 41.55       | 74.00               | 54.00             | -12.45 |
| 7434.20     | 52.80               | 39.86             | 4.40                 | 57.20         | 44.26       | 74.00               | 54.00             | -9.74  |
| 9911.88     | 57.11               | 37.67             | 7.70                 | 64.81         | 45.37       | 74.00               | 54.00             | -8.63  |
| -           | -                   | -                 | -                    | -             | -           | -                   | -                 | -      |

Note: 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.

At FH1 mode: Fc= 2415MHz transmitting operation - Horizontal

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS     |             | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin |
|-------------|---------------------|-------------------|----------------------|---------------|-------------|---------------------|-------------------|--------|
|             |                     |                   |                      | Peak (dBuV/m) | AV (dBuV/m) |                     |                   |        |
| 4830.26     | 52.54               | 39.06             | 2.70                 | 55.24         | 41.76       | 74.00               | 54.00             | -12.24 |
| 7245.44     | 55.26               | 38.15             | 4.22                 | 59.48         | 42.37       | 74.00               | 54.00             | -11.63 |
| 9659.88     | 57.55               | 39.43             | 7.70                 | 65.25         | 47.13       | 74.00               | 54.00             | -6.87  |
| -           | -                   | -                 | -                    | -             | -           | -                   | -                 | -      |

At FH1 mode: Fc= 2415MHz transmitting operation - Vertical

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS     |             | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin |
|-------------|---------------------|-------------------|----------------------|---------------|-------------|---------------------|-------------------|--------|
|             |                     |                   |                      | Peak (dBuV/m) | AV (dBuV/m) |                     |                   |        |
| 4830.06     | 53.55               | 39.33             | 2.70                 | 56.25         | 42.03       | 74.00               | 54.00             | -11.97 |
| 7245.10     | 52.04               | 38.95             | 4.22                 | 56.26         | 43.17       | 74.00               | 54.00             | -10.83 |
| 9660.32     | 45.26               | 38.23             | 7.70                 | 52.96         | 45.93       | 74.00               | 54.00             | -8.07  |
| -           | -                   | -                 | -                    | -             | -           | -                   | -                 | -      |

Note: 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.

At FH1 mode: Fc= 2441MHz transmitting operation - Horizontal

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS     |             | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin |
|-------------|---------------------|-------------------|----------------------|---------------|-------------|---------------------|-------------------|--------|
|             |                     |                   |                      | Peak (dBuV/m) | AV (dBuV/m) |                     |                   |        |
| 4881.56     | 54.17               | 38.88             | 2.70                 | 56.87         | 41.58       | 74.00               | 54.00             | -12.42 |
| 7323.05     | 57.02               | 37.94             | 4.22                 | 61.24         | 42.16       | 74.00               | 54.00             | -11.84 |
| 9764.22     | 59.63               | 39.56             | 7.70                 | 67.33         | 47.26       | 74.00               | 54.00             | -6.74  |
| -           | -                   | -                 | -                    | -             | -           | -                   | -                 | -      |

At FH1 mode: Fc= 2441MHz transmitting operation - Vertical

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS     |             | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin |
|-------------|---------------------|-------------------|----------------------|---------------|-------------|---------------------|-------------------|--------|
|             |                     |                   |                      | Peak (dBuV/m) | AV (dBuV/m) |                     |                   |        |
| 4882.04     | 52.50               | 38.40             | 2.70                 | 55.20         | 41.10       | 74.00               | 54.00             | -12.90 |
| 7322.90     | 52.01               | 37.74             | 4.22                 | 56.23         | 41.96       | 74.00               | 54.00             | -12.04 |
| 9762.58     | 54.84               | 38.02             | 7.70                 | 62.54         | 45.72       | 74.00               | 54.00             | -8.28  |
| -           | -                   | -                 | -                    | -             | -           | -                   | -                 | -      |

Note: 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.

At FH1 mode: Fc= 2465MHz transmitting operation - Horizontal

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS     |             | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin |
|-------------|---------------------|-------------------|----------------------|---------------|-------------|---------------------|-------------------|--------|
|             |                     |                   |                      | Peak (dBuV/m) | AV (dBuV/m) |                     |                   |        |
| 4928.76     | 51.59               | 37.53             | 2.70                 | 54.29         | 40.23       | 74.00               | 54.00             | -13.77 |
| 7494.33     | 49.90               | 38.28             | 4.22                 | 54.12         | 42.50       | 74.00               | 54.00             | -11.50 |
| 9861.40     | 57.05               | 37.00             | 7.70                 | 64.75         | 44.70       | 74.00               | 54.00             | -9.30  |
| -           | -                   | -                 | -                    | -             | -           | -                   | -                 | -      |

At FH1 mode: Fc= 2465MHz transmitting operation - Vertical

| Freq. (MHz) | Peak Reading (dBuV) | AV Reading (dBuV) | Ant./CL/ Amp.CF (dB) | Actual FS     |             | Peak Limit (dBuV/m) | AV Limit (dBuV/m) | Margin |
|-------------|---------------------|-------------------|----------------------|---------------|-------------|---------------------|-------------------|--------|
|             |                     |                   |                      | Peak (dBuV/m) | AV (dBuV/m) |                     |                   |        |
| 4929.30     | 53.64               | 38.63             | 2.70                 | 56.34         | 41.33       | 74.00               | 54.00             | -12.67 |
| 7495.20     | 51.58               | 37.88             | 4.22                 | 55.80         | 42.10       | 74.00               | 54.00             | -11.90 |
| 9860.42     | 54.40               | 38.12             | 7.70                 | 62.10         | 45.82       | 74.00               | 54.00             | -8.18  |
| -           | -                   | -                 | -                    | -             | -           | -                   | -                 | -      |

Note: 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.

## 6.7 Conducted Emission Measurement

### Applicable Standard:

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

| Frequency of Emission (MHz) | Conducted Limit (dB $\mu$ V) |           |
|-----------------------------|------------------------------|-----------|
|                             | Quasi-peak                   | Average   |
| 0.15 ~ 0.5                  | 66 to 56*                    | 56 to 46* |
| 0.5 ~ 5                     | 56                           | 46        |
| 5 ~ 30                      | 60                           | 50        |

Note: \*Decreases with the logarithm of the frequency.

Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

According to RSS-GEN Section 7.2.2, the purpose of this test is to measure unwanted radio frequency currents induced in any AC conductor external to the equipment which could conduct interference to other equipment via the AC electrical network. Except when the requirements applicable to a given device state otherwise, for any licence-exempt radio communication device equipped to operate from the public utility AC power supply, either directly or indirectly, the radio frequency voltage that is conducted back onto the AC power lines in the frequency range of 0.15 MHz to 30 MHz shall not exceed the limits shown in Table 2. The tighter limit applies at the frequency range boundaries.

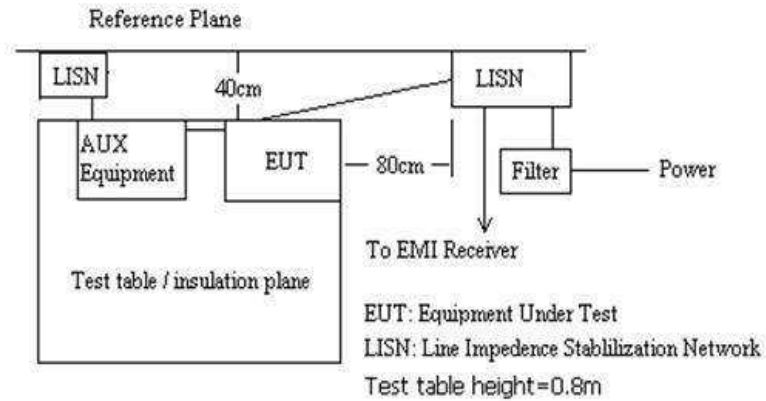
The conducted emissions shall be measured with a 50 ohm/50 microhenry line impedance stabilization network.

### Test Procedure:

1. The EUT was placed on a table which is at least 0.8 m high. Place the EUT so that it is 0.4 m from the wall of the shielding room, or place the EUT on a table which is 0.4 m high so that the bottom of the EUT is 0.4 m above the ground plane.
2. All the other conductive surface of the EUT shall be at least 0.8 m from the reference ground plane.
3. If the mains lead of the EUT is longer than necessary to be connected to the LISN the length of this lead in excess of 0.8 m shall be folded back and forth parallel to the lead so as to form a horizontal bundle with a length between 0.3 m and 0.4 m.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.



Test Configuration:



Test Result:

On the basis of field operation in the test site, while put the round connector of charger into the charging jack in the grip of EUT, the charger LED will illuminate red indicating that the charger is plugged in and charging. Meanwhile, the LCD display of EUT will be turned off and automatically stop ALL functions except for charging. Therefore, conducted emission test is not applicable to this device.

[Specification of charger equipped by the manufacturer - model no.: OE-156C, input voltage: 110V, output: 8.5V dc, 150mA]

## 6.8 Band Edge and Restricted Band of Radiated Emission Measurement

### Applicable Standard:

According to §15.247(d), 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).

According to RSS-210 issue 8, §A8.5, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

According to DA 00-705, in making radiated band-edge measurements, the following technique for determining band edge compliance.

Step 1: perform an in band field strength measurement of the fundamental emission using the RBW and detector function required by ANSI C63.4: 2003 and our Rules for the frequency being measured. For transmitters operating above 1 GHz, use a 1 MHz RBW, a 1 MHz VBW, and a peak detector (as required by Section 15.35). Repeat the measurement with an average detector (i.e., 1 MHz RBW with 10 Hz VBW).

Step 2: choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 1% of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement, it is only a relative measurement to determine the amount by which the emission drops at the band edge relative to the highest fundamental emission level.

Step 3: subtract the delta measured in step (2) from the field strengths measured in step (1). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band edge compliance as required by Section 15.205.

Step 4: the above "delta" measurement technique may be used for measuring emissions that are up to two "standard" bandwidths away from the band edge, where a "standard" bandwidth is the bandwidth specified by ANSI C63.4: 2003 for the frequency being measured.

### Test Procedure:

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the highest emissions in restricted band to ensure EUT compliance.

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       |  |

**Test Results:**

|                |                                 |
|----------------|---------------------------------|
| Temperature:   | 24°C                            |
| Humidity:      | 51%                             |
| EUT Operation: | FHSS modulation without hopping |
| Test Date:     | April 24, 2013                  |

Pre-scan the EUT in FH1 and FH3 mode and find out the worst case is FH3 mode without hopping in transmitting.

The unit does meet the requirements.

*Note: Test plots shown in Figures 31 to 38 on pages 42 to 45.*

Figure 31 Band edge of radiated emission – Low frequency side without hopping at FH3 mode  
Peak measurement in horizontal polarization

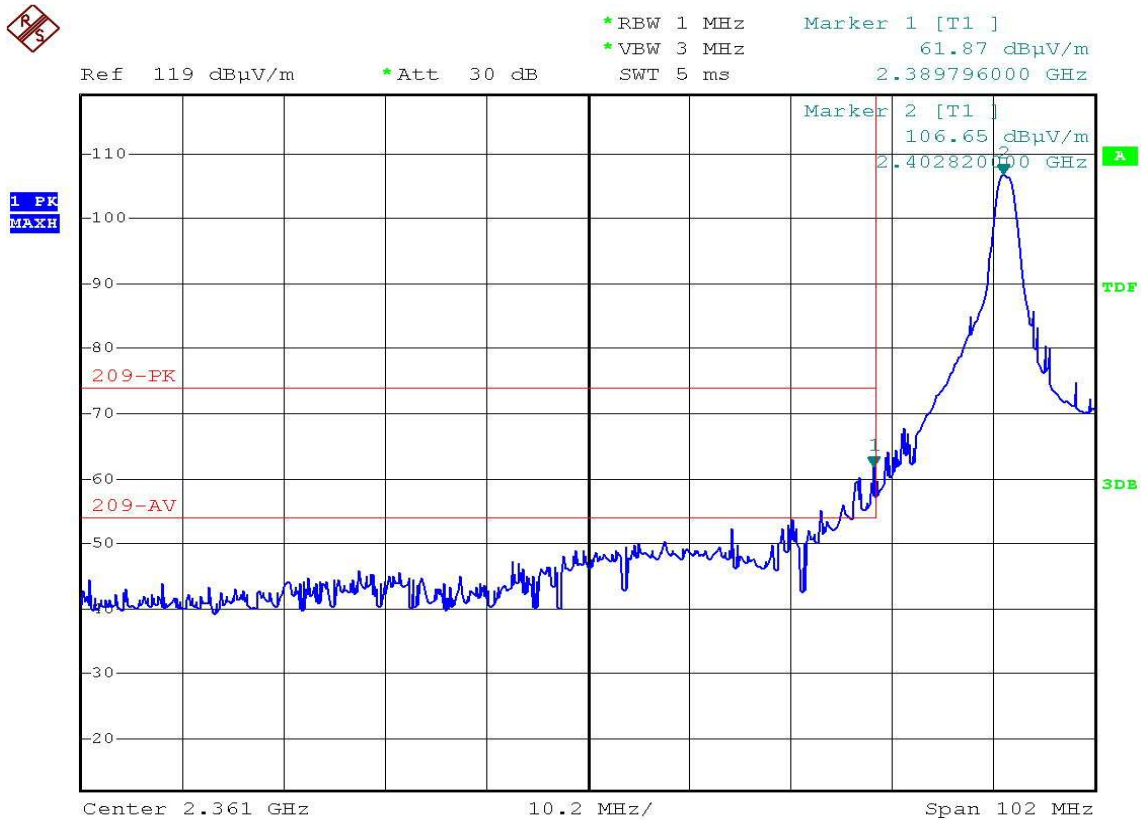


Figure 32 Band edge of radiated emission – Low frequency side without hopping at FH3 mode  
Average measurement in horizontal polarization

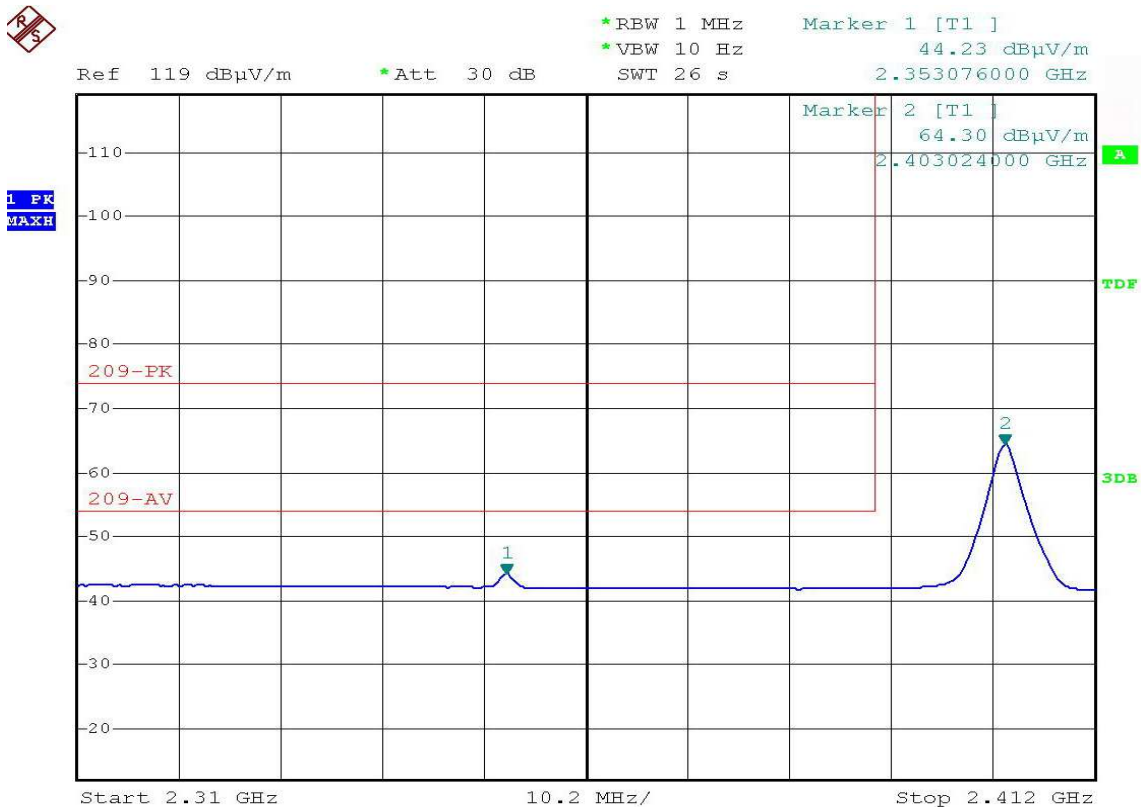


Figure 33 Band edge of radiated emission – Low frequency side without hopping at FH3 mode  
Peak measurement in vertical polarization

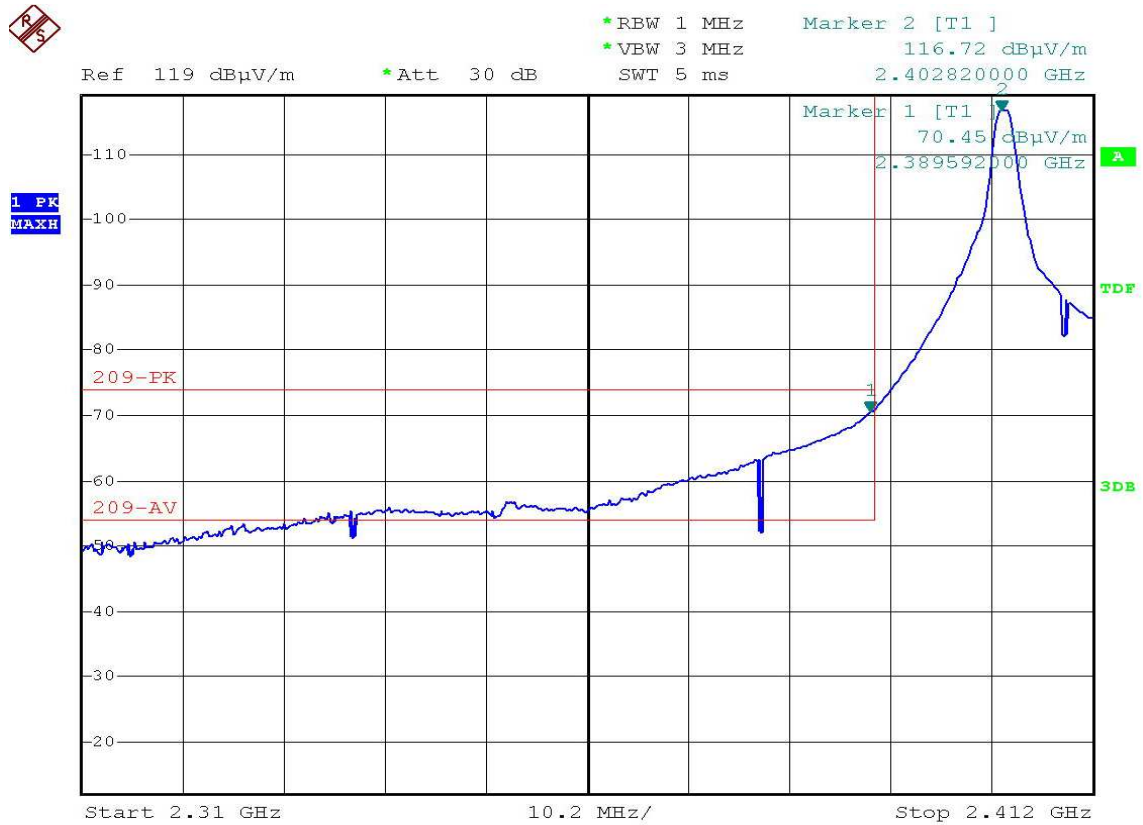


Figure 34 Band edge of radiated emission – Low frequency side without hopping at FH3 mode  
Average measurement in vertical polarization

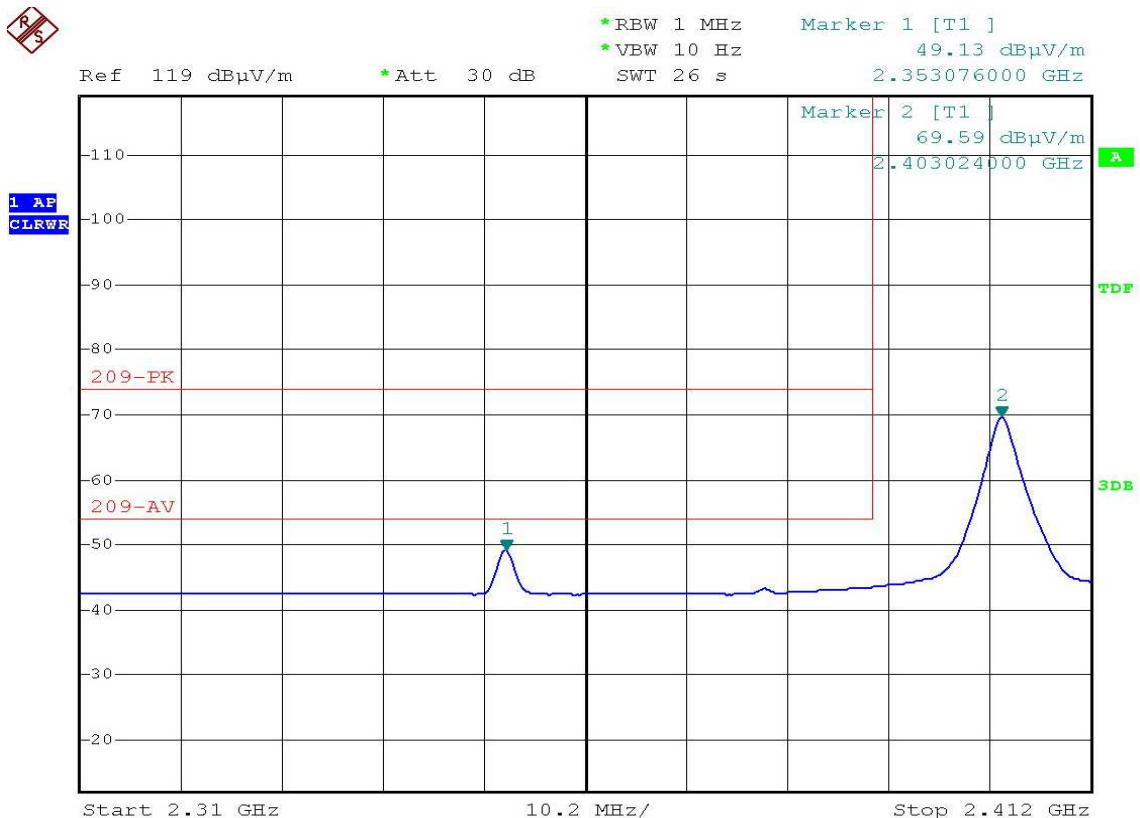


Figure 35 Band edge of radiated emission – High frequency side without hopping at FH3 mode  
Peak measurement in horizontal polarization

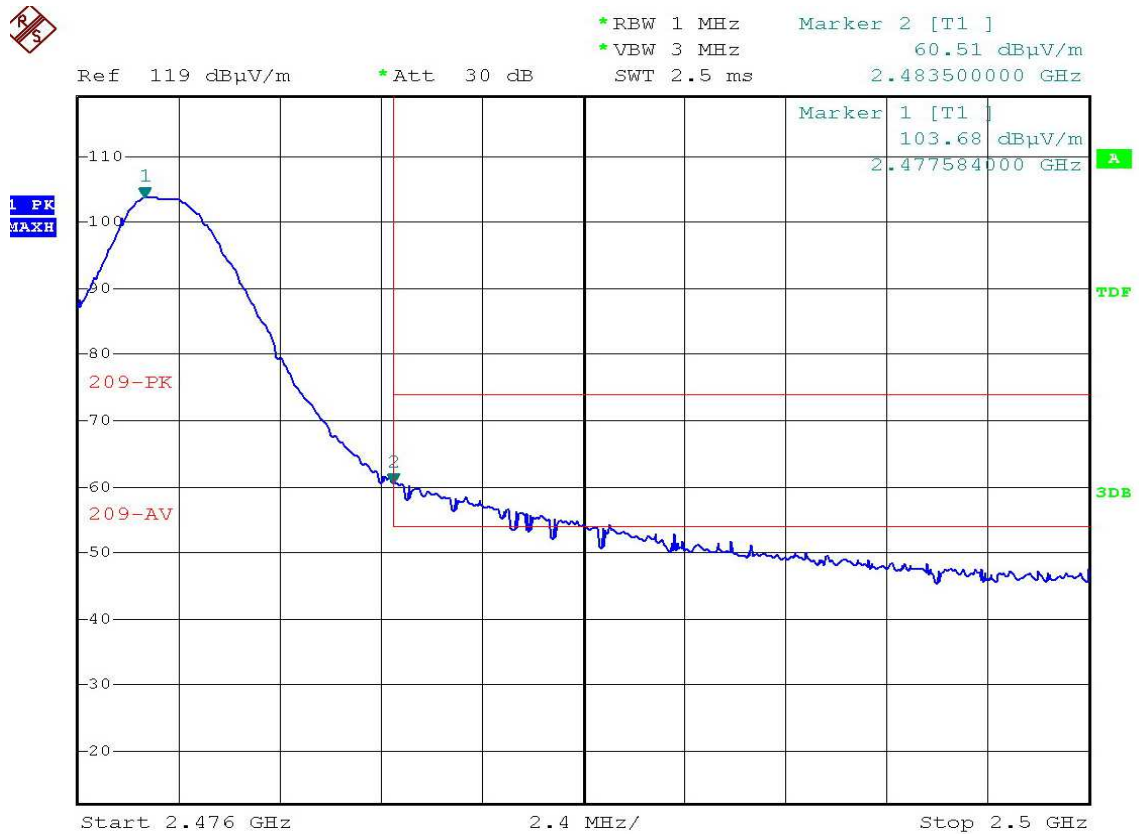


Figure 36 Band edge of radiated emission – High frequency side without hopping at FH3 mode  
Average measurement in horizontal polarization

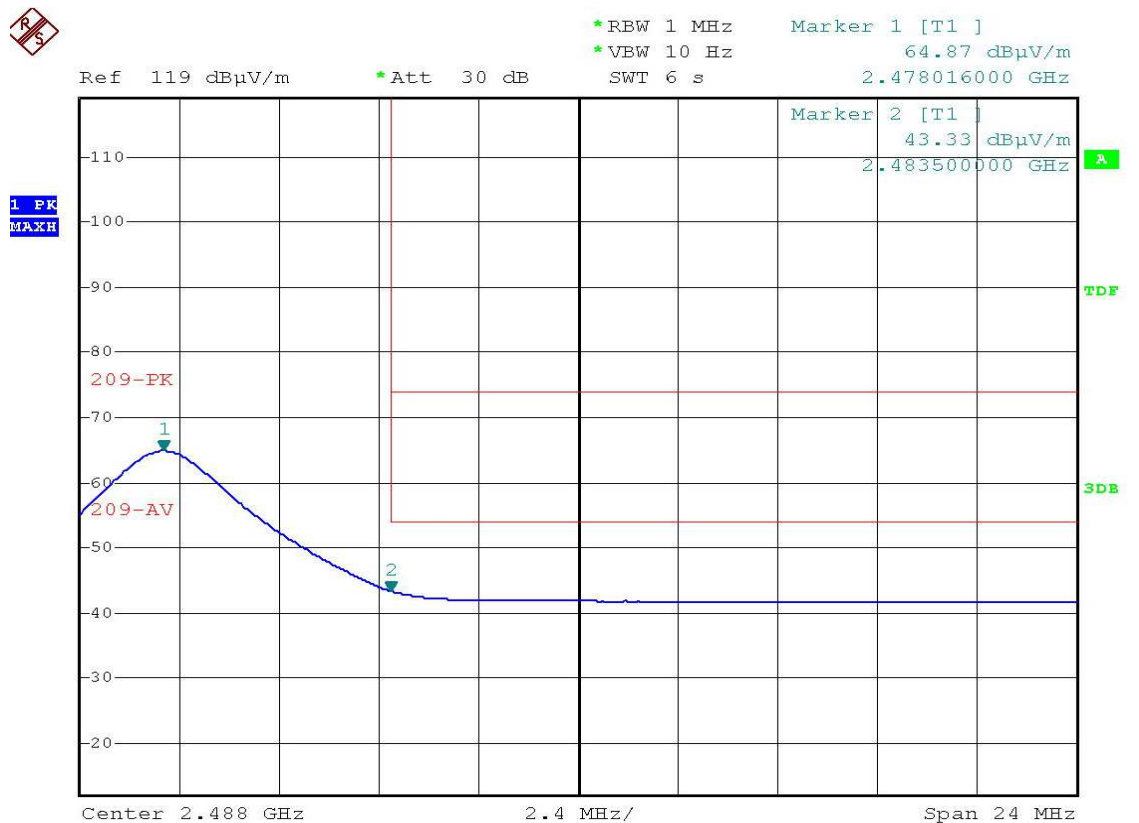


Figure 37 Band edge of radiated emission – High frequency side without hopping at FH3 mode  
Peak measurement in vertical polarization

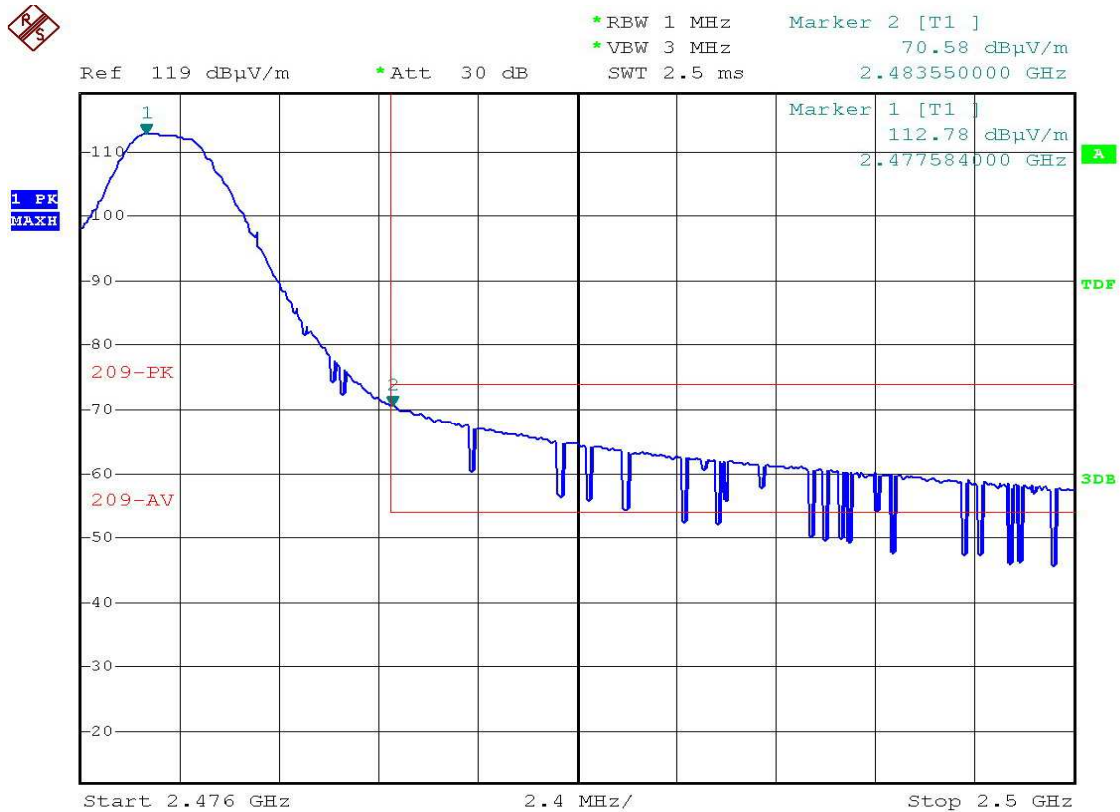
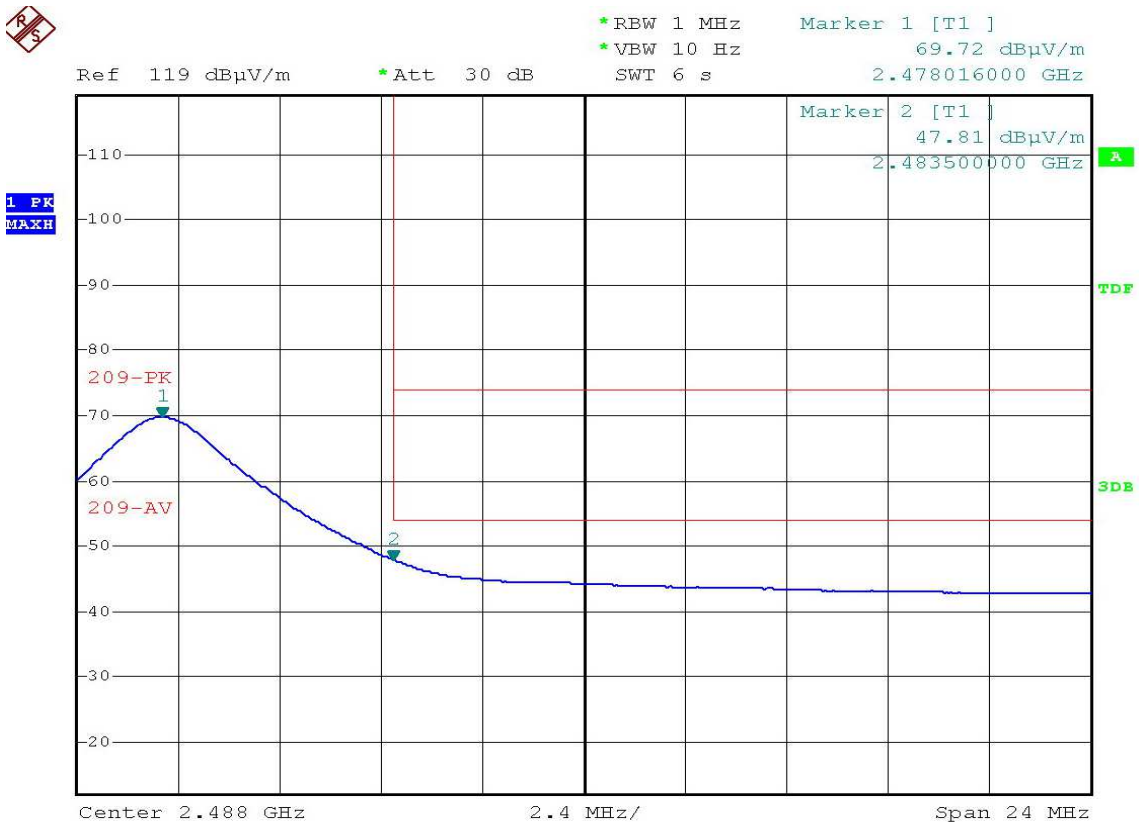


Figure 38 Band edge of radiated emission – High frequency side without hopping at FH3 mode  
Average measurement in vertical polarization



**6.9 99% Bandwidth Measurement**

**Applicable Standard:**

RSS-Gen §4.4.1, the transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

Spectrum analyzer set up conditions:

- Span = 5MHz
- Resolution Bandwidth = 100KHz
- Video Bandwidth = 300KHz
- Sweep = auto
- Detector function = peak
- Trace = max hold

**Test Results:**

|                |                                     |
|----------------|-------------------------------------|
| Temperature:   | 24°C                                |
| Humidity:      | 50%                                 |
| EUT Operation: | Data Transmission (without hopping) |
| Test Date:     | April 26, 2013                      |

| Operation Mode | Frequency | 99% Bandwidth |
|----------------|-----------|---------------|
|                | [ MHz ]   | (MHz)         |
| FH3            | 2403      | 1.148         |
|                | 2441      | 1.276         |
|                | 2478      | 1.308         |
| FH1            | 2415      | 1.132         |
|                | 2441      | 1.112         |
|                | 2465      | 1.156         |

*Note: Test plots shown in figures 39 to 44 on pages 47 to 49.*



Figure 39 99% Bandwidth measurement (fc=2403MHz) at FH3 mode

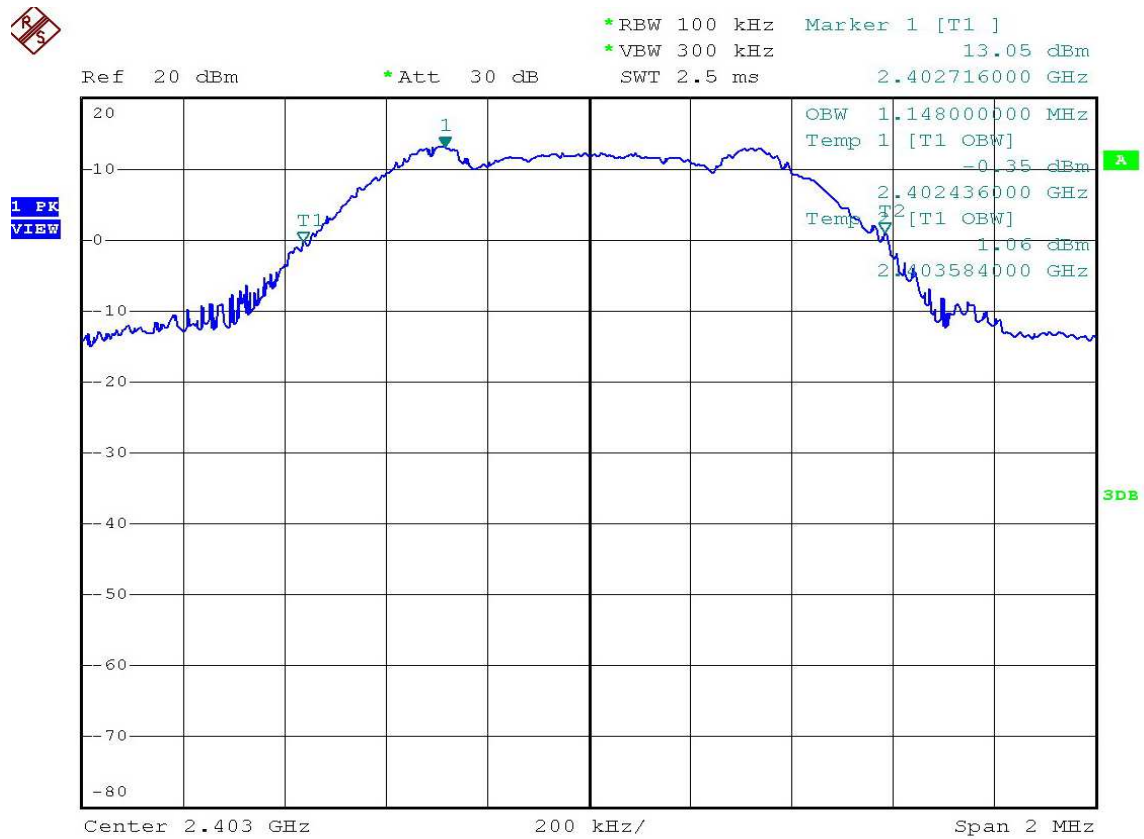


Figure 40 99% Bandwidth measurement (fc=2441MHz) at FH3 mode

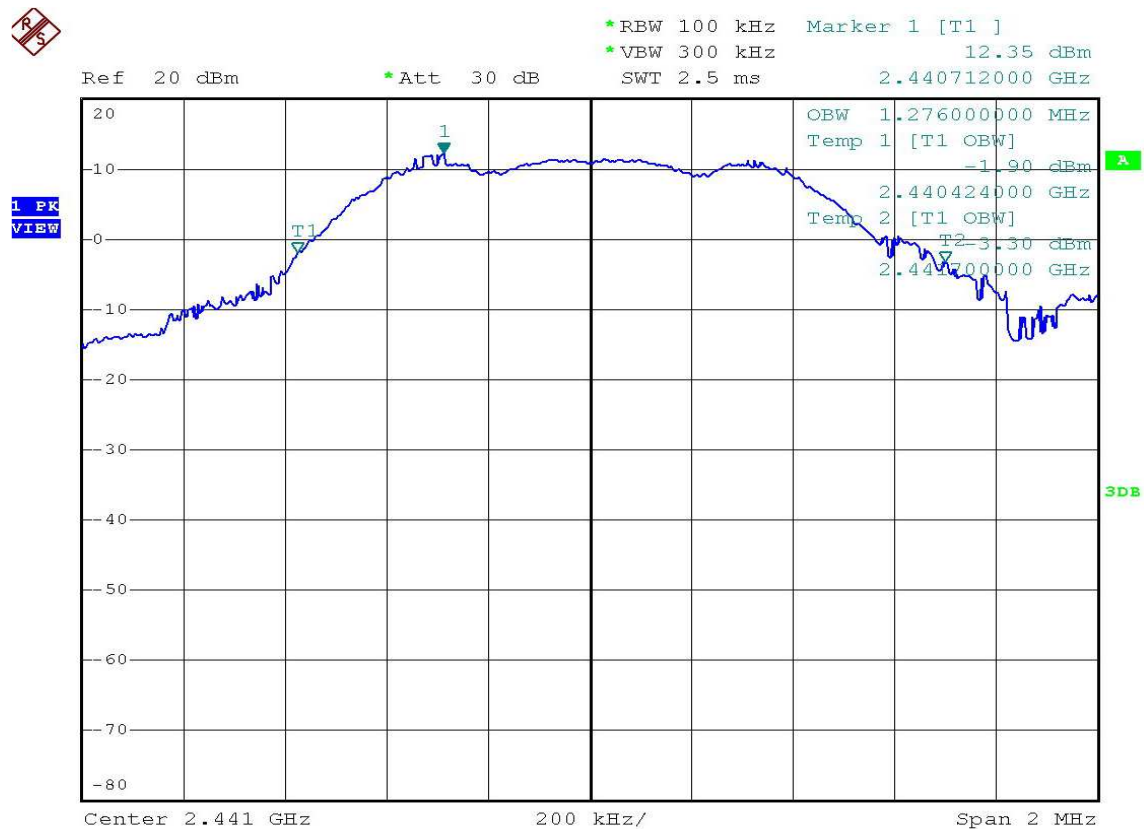


Figure 41 99% Bandwidth measurement (fc=2478MHz) at FH3 mode

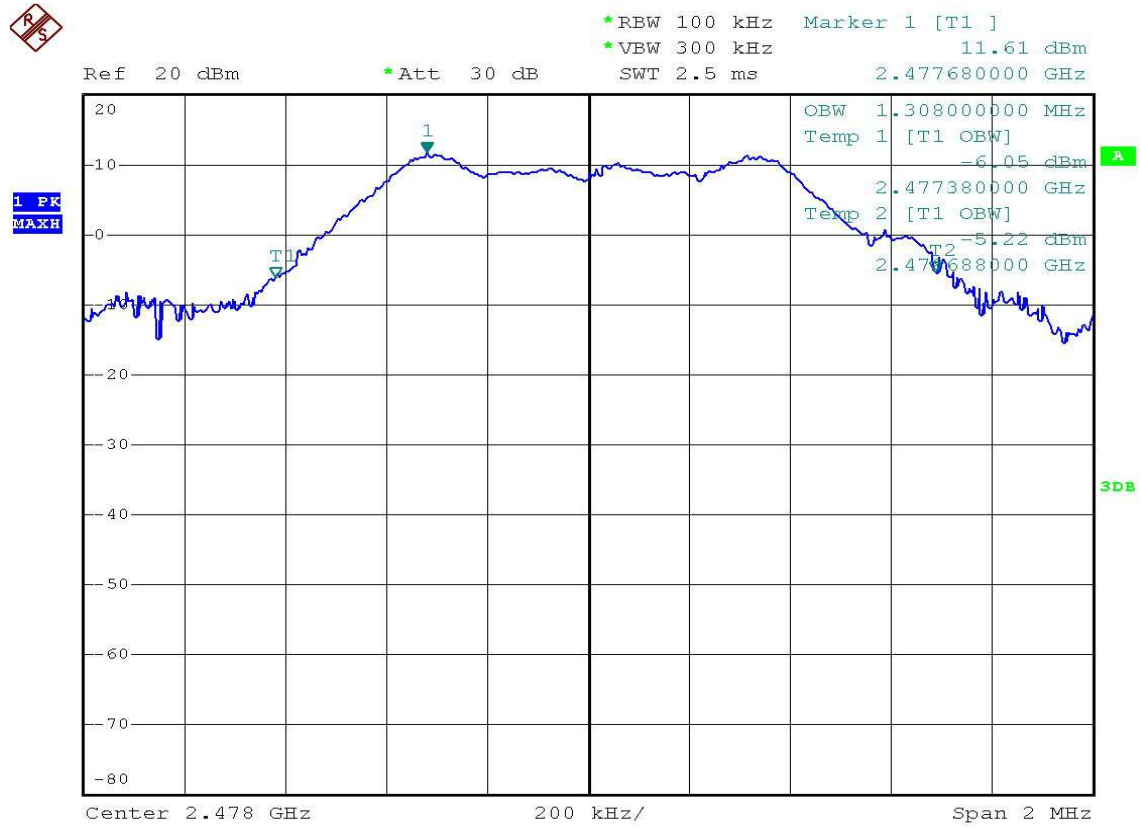
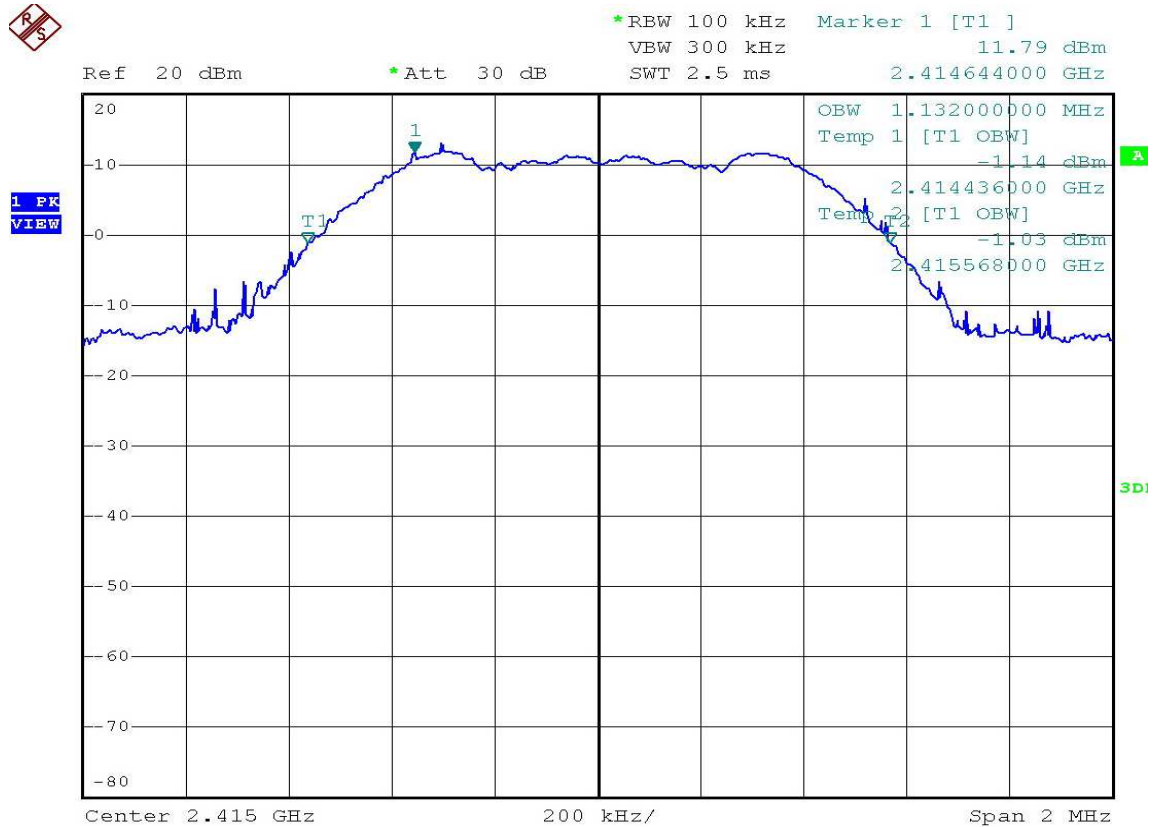


Figure 42 99% Bandwidth measurement (fc=2415MHz) at FH1 mode





**6.10 RF Exposure**

**Applicable Standard:**

According to FCC part 15.247(i) and 1.1307 (b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines.

And for KDB 447498 SAR D01 General RF Exposure Guidance v05 Appendix B

**SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and > 50 mm**

Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table.

| MHz  | 50  | 60  | 70  | 80  | 90  | 100 | 110 | 120 | 130 | 140  | 150  | 160  | 170  | 180  | 190  | mm |
|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|----|
| 100  | 474 | 481 | 487 | 494 | 501 | 507 | 514 | 521 | 527 | 534  | 541  | 547  | 554  | 561  | 567  | mW |
| 150  | 387 | 397 | 407 | 417 | 427 | 437 | 447 | 457 | 467 | 477  | 487  | 497  | 507  | 517  | 527  |    |
| 300  | 274 | 294 | 314 | 334 | 354 | 374 | 394 | 414 | 434 | 454  | 474  | 494  | 514  | 534  | 554  |    |
| 450  | 224 | 254 | 284 | 314 | 344 | 374 | 404 | 434 | 464 | 494  | 524  | 554  | 584  | 614  | 644  |    |
| 835  | 164 | 220 | 275 | 331 | 387 | 442 | 498 | 554 | 609 | 665  | 721  | 776  | 832  | 888  | 943  |    |
| 900  | 158 | 218 | 278 | 338 | 398 | 458 | 518 | 578 | 638 | 698  | 758  | 818  | 878  | 938  | 998  |    |
| 1500 | 122 | 222 | 322 | 422 | 522 | 622 | 722 | 822 | 922 | 1022 | 1122 | 1222 | 1322 | 1422 | 1522 |    |
| 1900 | 109 | 209 | 309 | 409 | 509 | 609 | 709 | 809 | 909 | 1009 | 1109 | 1209 | 1309 | 1409 | 1509 |    |
| 2450 | 96  | 196 | 296 | 396 | 496 | 596 | 696 | 796 | 896 | 996  | 1096 | 1196 | 1296 | 1396 | 1496 |    |
| 3600 | 79  | 179 | 279 | 379 | 479 | 579 | 679 | 779 | 879 | 979  | 1079 | 1179 | 1279 | 1379 | 1479 |    |
| 5200 | 66  | 166 | 266 | 366 | 466 | 566 | 666 | 766 | 866 | 966  | 1066 | 1166 | 1266 | 1366 | 1466 |    |
| 5400 | 65  | 165 | 265 | 365 | 465 | 565 | 665 | 765 | 865 | 965  | 1065 | 1165 | 1265 | 1365 | 1465 |    |
| 5800 | 62  | 162 | 262 | 362 | 462 | 562 | 662 | 762 | 862 | 962  | 1062 | 1162 | 1262 | 1362 | 1462 |    |

According to RSS-102 Section 2.5.1, SAR evaluation is required if the separation distance between the user and the radiating element of the device is less than or equal to 20cm, except when the device operates above 2.2 GHz and up to 3 GHz inclusively, and with output power [ i.e. the higher of the conducted or radiated (e.i.r.p.) source-based, time-averaged output power ] that is less than or equal to 20 mW for general public use and 100 mW for controlled use.

**Test Results:**

This is a portable device for general public use, which will be hand-held by users during normal operation with an antenna separation distance to the body of not less than 50 mm in worst case (between the antenna base and metal handle of EUT).

For FCC evaluation, the peak output power (26.24mW) is less than the corresponding SAR test exclusion power thresholds (96mW).

For IC evaluation, the maximum time-averaged conducted output power is 11.33dBm (13.58mW), and considering the antenna gain of 1.5dBi, the final evaluated time-averaged power is 12.83dBm (19.19mW), which is less than SAR test exclusion power thresholds (20mW) for general public use. *(please refer to the document of IC SAR Exemption Explanation)*

The unit does meet the requirements of SAR exemption.

## **6.11 Antenna Requirement**

### **Standard Applicable**

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device. And according to §15.246(1), 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 6 dBi.

According to RSS-GEN 7.1.4, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

### **Antenna Construction:**

The directional gain of antenna used for transmitting is 1.5 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

The unit does meet the requirement.