# FCC RF Test Report

| | | |
|---|---|---|
| APPLICANT | : | Fitbit, Inc. |
| EQUIPMENT | : | Wireless Fitness Headphone |
| BRAND NAME | : | Fitbit |
| MODEL NAME | : | FB205 |
| MARKETING NAME | : | FLYER |
| FCC ID | : | XRAFB205 |
| STANDARD | : | FCC Part 15 Subpart C §15.247 |
| CLASSIFICATION | : | (DSS) Spread Spectrum Transmitter |

**The product was received on Apr. 17, 2017 and testing was completed on Jul. 11, 2017. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.**

**The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.**

**Reviewed by: Joseph Lin / Supervisor**

**Approved by: Jones Tsai / Manager**

Testing Laboratory
1190

***SPORTON INTERNATIONAL INC.***
***No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.***

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# REVISION HISTORY

| REPORT NO. | VERSION | DESCRIPTION | ISSUED DATE |
|---|---|---|---|
| FR741718 | Rev. 01 | Initial issue of report | Jul. 19, 2017 |
| FR741718 | Rev. 02 | Updating FCC designation Number of test site | Aug. 04, 2017 |
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# SUMMARY OF TEST RESULT

| Report Section | FCC Rule | Description | Limit | Result | Remark |
|---|---|---|---|---|---|
| 3.1 | 15.247(a)(1) | Number of Channels | ≥ 15Chs | Pass | - |
| 3.2 | 15.247(a)(1) | Hopping Channel Separation | ≥ 2/3 of 20dB BW | Pass | - |
| 3.3 | 15.247(a)(1) | Dwell Time of Each Channel | ≤ 0.4sec in 31.6sec period | Pass | - |
| 3.4 | 15.247(a)(1) | 20dB Bandwidth | NA | Pass | - |
| 3.4 | - | 99% Bandwidth | - | Pass | - |
| 3.5 | 15.247(b)(1) | Peak Output Power | ≤ 125 mW | Pass | - |
| 3.6 | 15.247(d) | Conducted Band Edges | ≤ 20dBc | Pass | - |
| 3.7 | 15.247(d) | Conducted Spurious Emission | ≤ 20dBc | Pass | - |
| 3.8 | 15.247(d) | Radiated Band Edges and Radiated Spurious Emission | 15.209(a) & 15.247(d) | Pass | Under limit 2.85 dB at 7440.000 MHz |
| - | 15.207 | AC Conducted Emission | 15.207(a) | Not Required | - |
| 3.9 | 15.203 & 15.247(b) | Antenna Requirement | N/A | Pass | - |
| **Note:** Not required means after assessing, test items are not necessary to carry out. | | | | | |

# 1 General Description

## 1.1 Applicant

**Fitbit, Inc.**
405 Howard Street Suite 550, San Francisco, California, United States, 94105

## 1.2 Manufacturer

**Fitbit, Inc.**
405 Howard Street Suite 550, San Francisco, California, United States, 94105

## 1.3 Product Feature of Equipment Under Test

Bluetooth

| Product Specification subjective to this standard | |
|---|---|
| **Antenna Type** | Bluetooth: Stamping Antenna |

## 1.4 Modification of EUT

No modifications are made to the EUT during all test items.

## 1.5 Testing Location

Sporton Lab is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code : 1190) and the FCC designation No. TW0007 nder the FCC 2.948(e) by Mutual Recognition Agreement (MRA) in FCC Test.

| | |
|---|---|
| **Test Site** | SPORTON INTERNATIONAL INC. |
| **Test Site Location** | No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park,<br>Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C.<br>TEL: +886-3-327-3456<br>FAX: +886-3-328-4978 |
| **Test Site No.** | **Sporton Site No.** |
| | TH05-HY |

**Note:** The test site complies with ANSI C63.4 2014 requirement.

| | |
|---|---|
| **Test Site** | SPORTON INTERNATIONAL INC. |
| **Test Site Location** | No.58, Aly. 75, Ln. 564, Wenhua 3rd Rd. Guishan Dist,<br>Taoyuan City, Taiwan (R.O.C.)<br>TEL: +886-3-327-0868<br>FAX: +886-3-327-0855 |
| **Test Site No.** | **Sporton Site No.** |
| | 03CH11-HY |

**Note:** The test site complies with ANSI C63.4 2014 requirement.

## 1.6 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §15.247
- ANSI C63.10-2013

**Remark:**

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.

# 2 Test Configuration of Equipment Under Test

## 2.1 Carrier Frequency Channel

| Frequency Band | Channel | Freq. (MHz) | Channel | Freq. (MHz) | Channel | Freq. (MHz) |
|---|---|---|---|---|---|---|
| 2400-2483.5 MHz | 0 | 2402 | 27 | 2429 | 54 | 2456 |
| | 1 | 2403 | 28 | 2430 | 55 | 2457 |
| | 2 | 2404 | 29 | 2431 | 56 | 2458 |
| | 3 | 2405 | 30 | 2432 | 57 | 2459 |
| | 4 | 2406 | 31 | 2433 | 58 | 2460 |
| | 5 | 2407 | 32 | 2434 | 59 | 2461 |
| | 6 | 2408 | 33 | 2435 | 60 | 2462 |
| | 7 | 2409 | 34 | 2436 | 61 | 2463 |
| | 8 | 2410 | 35 | 2437 | 62 | 2464 |
| | 9 | 2411 | 36 | 2438 | 63 | 2465 |
| | 10 | 2412 | 37 | 2439 | 64 | 2466 |
| | 11 | 2413 | 38 | 2440 | 65 | 2467 |
| | 12 | 2414 | 39 | 2441 | 66 | 2468 |
| | 13 | 2415 | 40 | 2442 | 67 | 2469 |
| | 14 | 2416 | 41 | 2443 | 68 | 2470 |
| | 15 | 2417 | 42 | 2444 | 69 | 2471 |
| | 16 | 2418 | 43 | 2445 | 70 | 2472 |
| | 17 | 2419 | 44 | 2446 | 71 | 2473 |
| | 18 | 2420 | 45 | 2447 | 72 | 2474 |
| | 19 | 2421 | 46 | 2448 | 73 | 2475 |
| | 20 | 2422 | 47 | 2449 | 74 | 2476 |
| | 21 | 2423 | 48 | 2450 | 75 | 2477 |
| | 22 | 2424 | 49 | 2451 | 76 | 2478 |
| | 23 | 2425 | 50 | 2452 | 77 | 2479 |
| | 24 | 2426 | 51 | 2453 | 78 | 2480 |
| | 25 | 2427 | 52 | 2454 | - | - |
| | 26 | 2428 | 53 | 2455 | - | - |

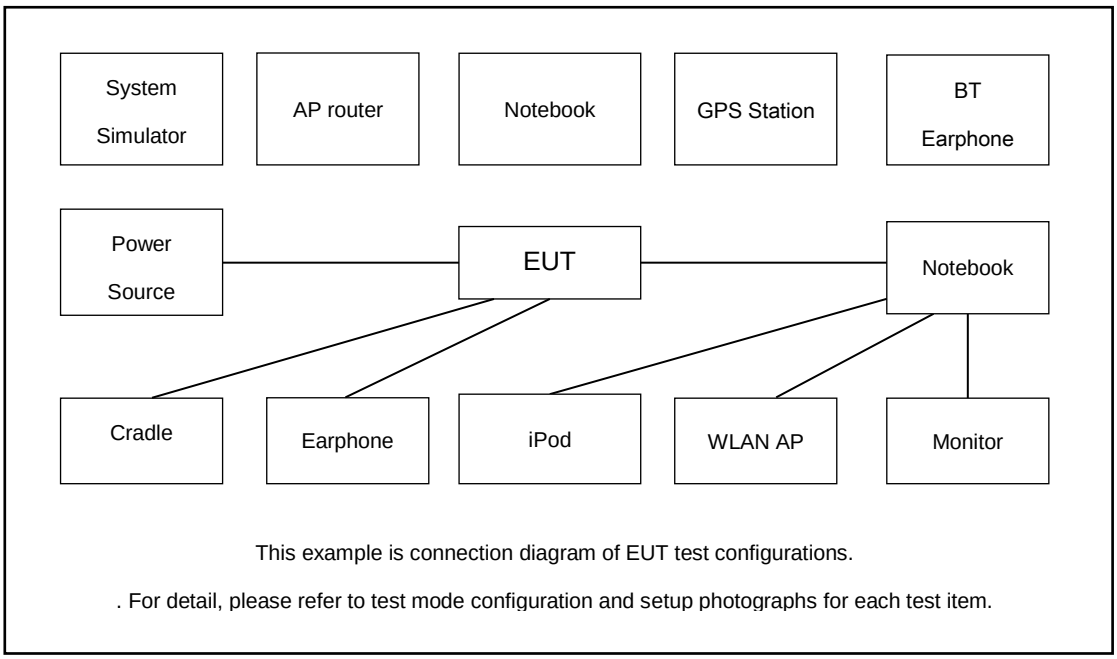
## 2.2 Test Mode

a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report, and the worst mode of radiated spurious emissions is Bluetooth 3Mbps mode, and recorded in this report.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

| Summary table of Test Cases | | | |
|---|---|---|---|
| **Test Item** | **Data Rate / Modulation** | | |
| | **Bluetooth BR 1Mbps GFSK** | **Bluetooth EDR 2Mbps $\pi$/4-DQPSK** | **Bluetooth EDR 3Mbps 8-DPSK** |
| **Conducted Test Cases** | Mode 1: CH00_2402 MHz<br>Mode 2: CH39_2441 MHz<br>Mode 3: CH78_2480 MHz | Mode 4: CH00_2402 MHz<br>Mode 5: CH39_2441 MHz<br>Mode 6: CH78_2480 MHz | Mode 7: CH00_2402 MHz<br>Mode 8: CH39_2441 MHz<br>Mode 9: CH78_2480 MHz |
| **Radiated Test Cases** | **Bluetooth EDR 3Mbps 8-DPSK** | | |
| | Mode 1: CH00_2402 MHz<br>Mode 2: CH39_2441 MHz<br>Mode 3: CH78_2480 MHz | | |
| **Remark:** For radiated test cases, the worst mode data rate 3Mbps was reported only, because this data rate has the highest RF output power at preliminary tests, and the conducted spurious emissions and conducted band edge measurement for each data rate are no worse than 3Mbps, and no other significantly frequencies found in conducted spurious emission. | | | |

## 2.3 Connection Diagram of Test System




## 2.4 EUT Operation Test Setup

The RF test items, programmed RF utility, “Blue Test3” installed in the notebook make the EUT provide functions like channel selection and power level for continuous transmitting and receiving signals.

## 2.5 Measurement Results Explanation Example

**For all conducted test items:**

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

*Offset = RF cable loss + attenuator factor.*

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

*Offset(dB) = RF cable loss(dB) + attenuator factor(dB).*

= 4.2 + 10 = 14.2 (dB)

# 3 Test Result

## 3.1 Number of Channel Measurement

### 3.1.1 Limits of Number of Hopping Frequency

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

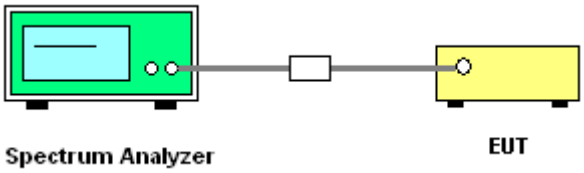
### 3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

### 3.1.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.3.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = the frequency band of operation; RBW = 300kHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. The number of hopping frequency used is defined as the number of total channel.
7. Record the measurement data derived from spectrum analyzer.

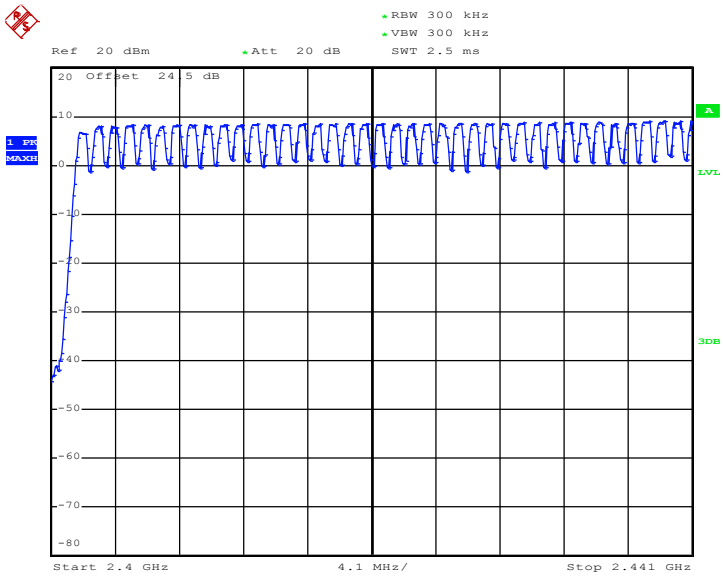
### 3.1.4 Test Setup



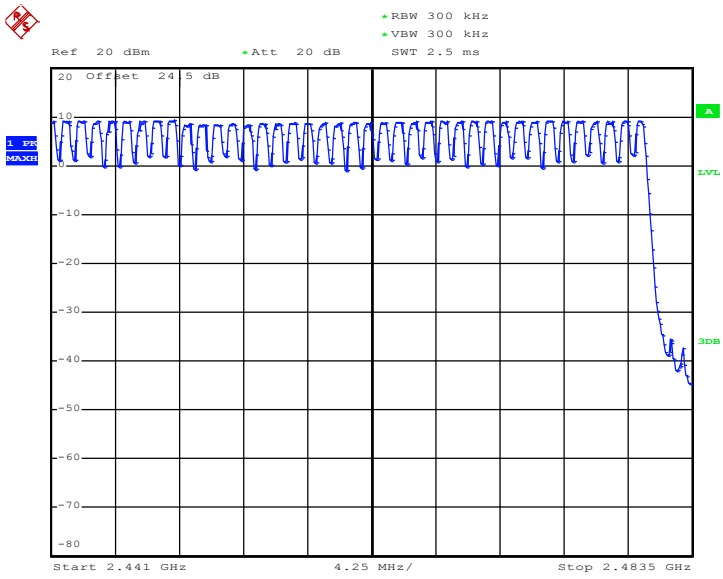
### 3.1.5 Test Result of Number of Hopping Frequency

Please refer to Appendix A.

**Number of Hopping Channel Plot on Channel 00 - 78**




Date: 10.JUL.2017 22:48:30

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## 3.2 Hopping Channel Separation Measurement

### 3.2.1 Limit of Hopping Channel Separation

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.

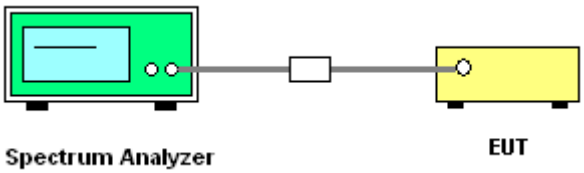
### 3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

### 3.2.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.2.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels;
   RBW = 300kHz; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

### 3.2.4 Test Setup

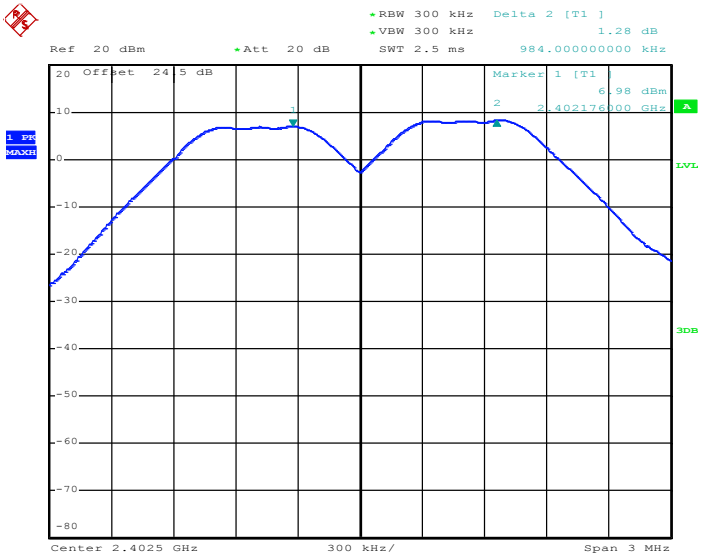



### 3.2.5 Test Result of Hopping Channel Separation

Please refer to Appendix A.

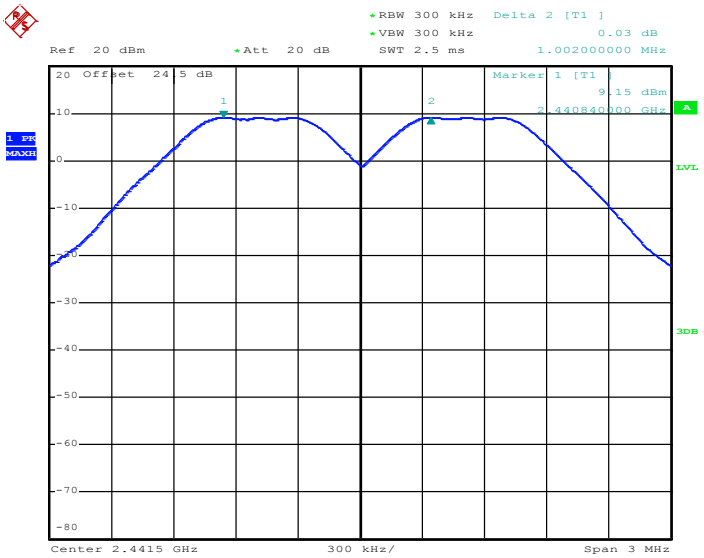
**<1Mbps>**

**Channel Separation Plot on Channel 00 - 01**



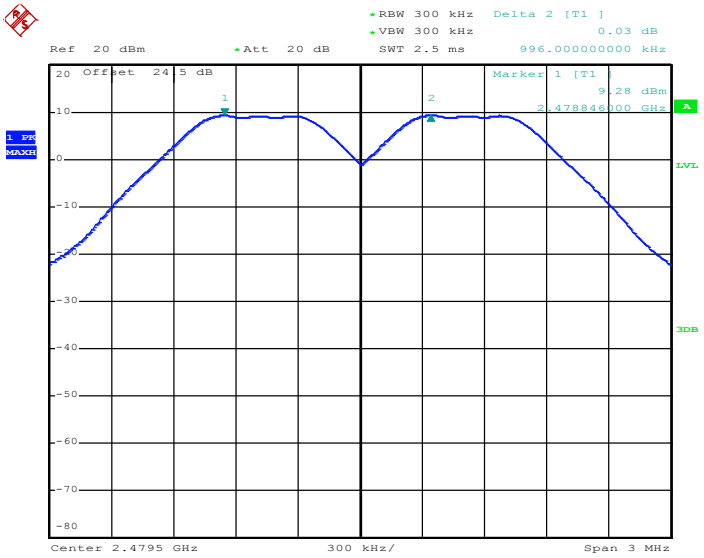

Date: 10.JUL.2017 22:18:57

**Channel Separation Plot on Channel 39 - 40**




Date: 10.JUL.2017 22:17:28

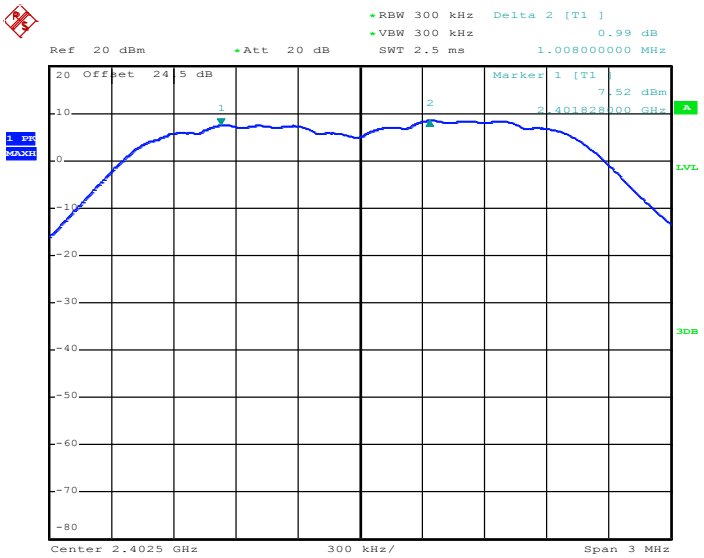
## Channel Separation Plot on Channel 77 - 78




Date: 10.JUL.2017 22:19:59

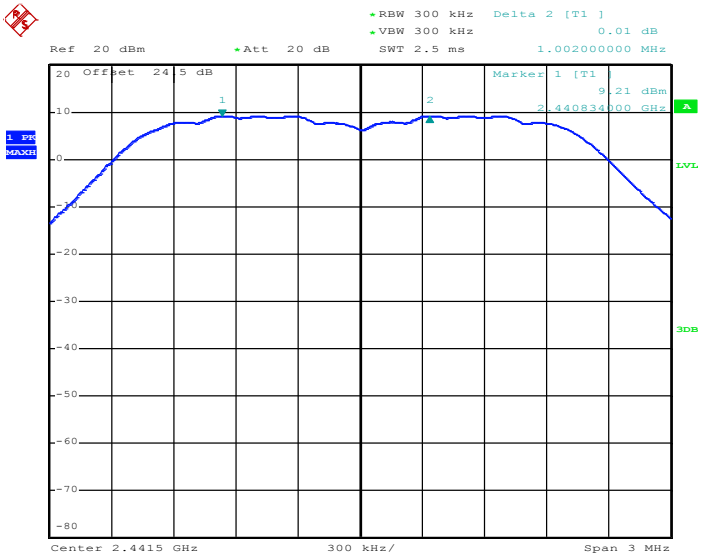
## <2Mbps>

## Channel Separation Plot on Channel 00 - 01



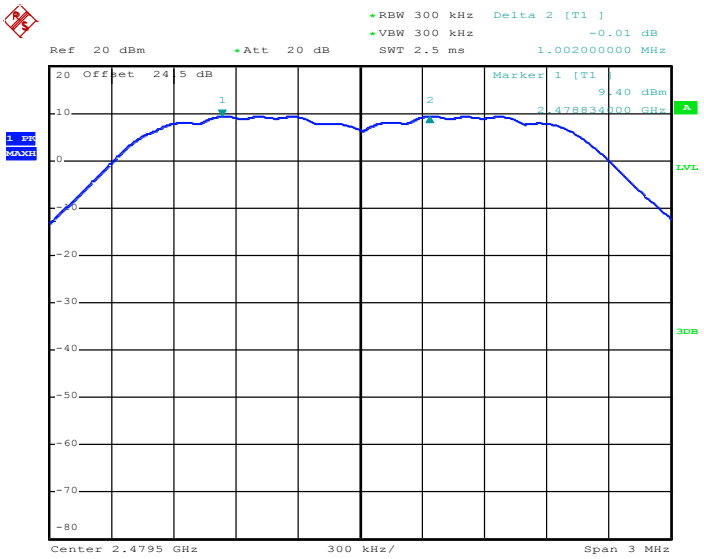

Date: 10.JUL.2017 23:25:51

## Channel Separation Plot on Channel 39 - 40




Date: 10.JUL.2017 23:01:47

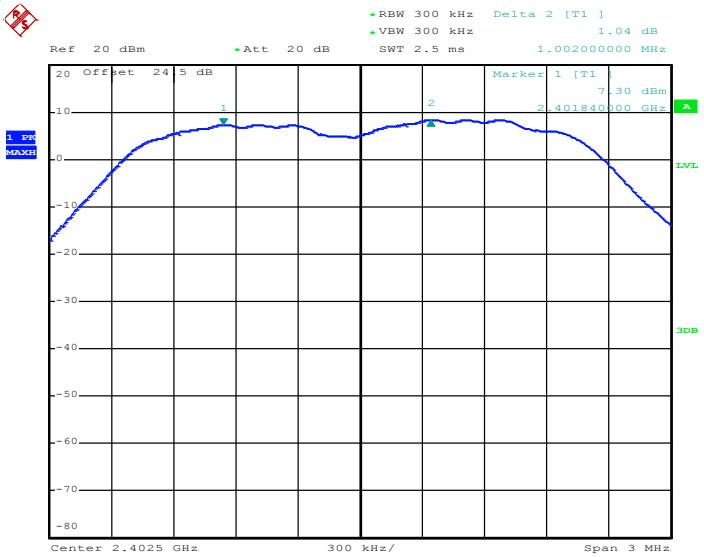
## Channel Separation Plot on Channel 77 - 78




Date: 10.JUL.2017 23:00:23

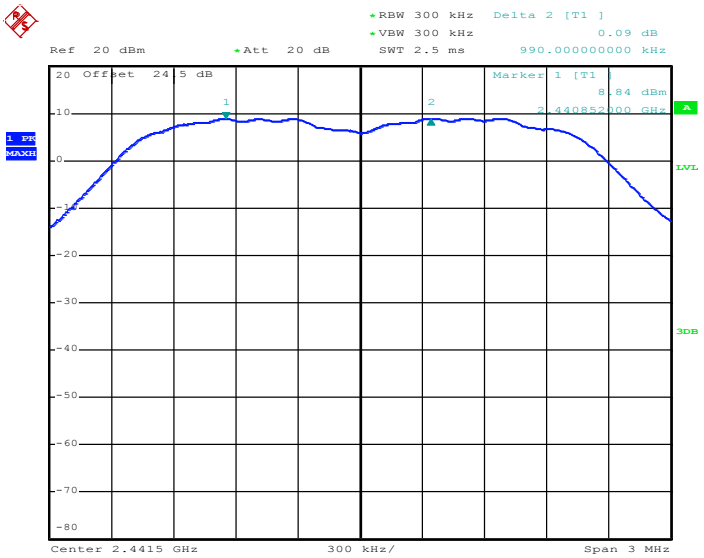
**<3Mbps>**

**Channel Separation Plot on Channel 00 - 01**



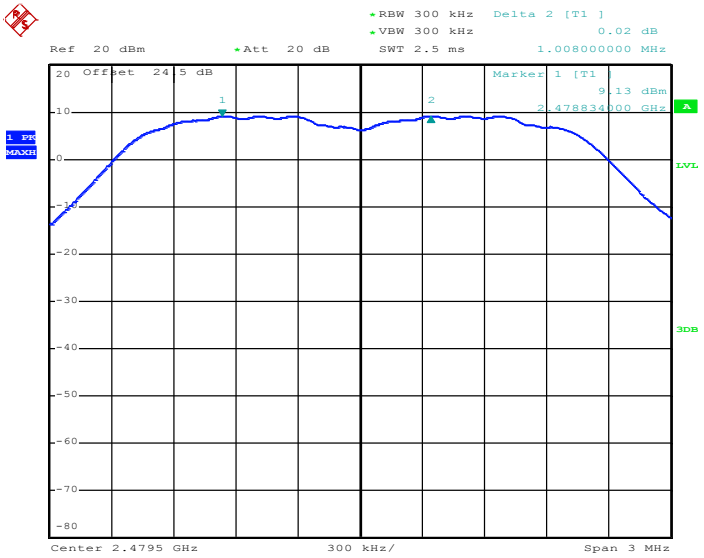

Date: 10.JUL.2017 23:40:13

**Channel Separation Plot on Channel 39 - 40**




Date: 10.JUL.2017 23:44:32

## Channel Separation Plot on Channel 77 - 78




Date: 10.JUL.2017 23:46:03

## 3.3 Dwell Time Measurement

### 3.3.1 Limit of Dwell Time

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.

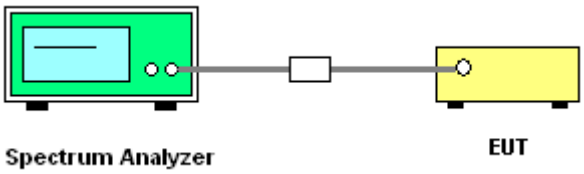
### 3.3.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

### 3.3.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.4.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW ≥ RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

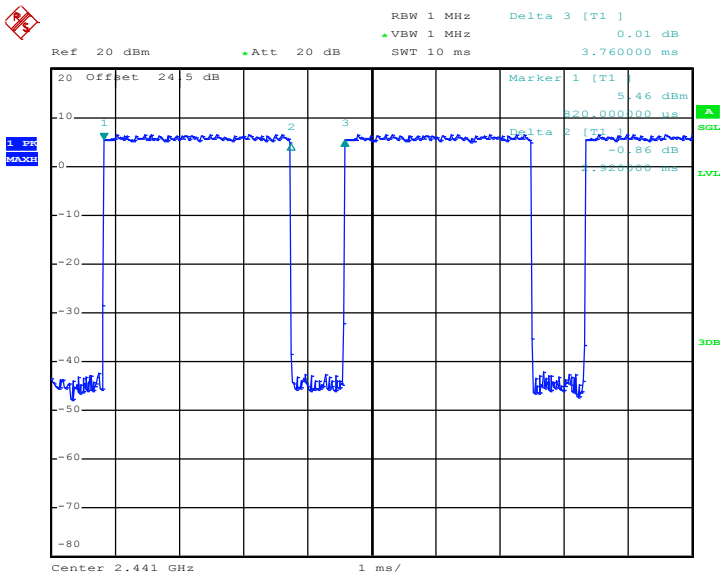
### 3.3.4 Test Setup




### 3.3.5 Test Result of Dwell Time

Please refer to Appendix A.

**Package Transfer Time Plot**




Date: 4.JUL.2017 19:00:33

**Remark:**

**1.** In normal mode, hopping rate is 1600 hops/s with 6 slots in 79 hopping channels. With channel hopping rate (1600 / 6 / 79) in Occupancy Time Limit (0.4 x 79) (s),Hops Over Occupancy Time comes to (1600 / 6 / 79) x (0.4 x 79) = 106.67 hops.

**2.** In AFH mode, hopping rate is 800 hops/s with 6 slots in 20 hopping channels. With channel hopping rate (800 / 6 / 20) in Occupancy Time Limit (0.4 x 20) (s), Hops Over Occupancy Time comes to (800 / 6 / 20) x (0.4 x 20) = 53.33 hops.

**3.** Dwell Time(s) = Hops Over Occupancy Time (hops) x Package Transfer Time

## 3.4 20dB and 99% Bandwidth Measurement

### 3.4.1 Limit of 20dB and 99% Bandwidth

Reporting only

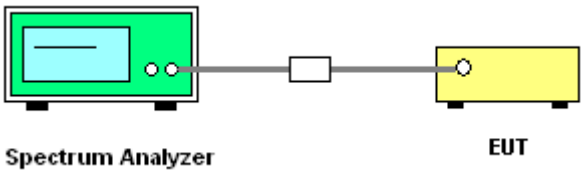
### 3.4.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

### 3.4.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 6.9.2 and 6.9.3.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.
   Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel;
   RBW ≥ 1% of the 20 dB bandwidth; VBW ≥ RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
5. Use the following spectrum analyzer settings for 99 % Bandwidth measurement.
   Span = approximately 1.5 to 5 times the 99% bandwidth, centered on a hopping channel;
   RBW ≥ 1% of the 99% bandwidth; VBW ≥ RBW; Sweep = auto; Detector function = peak;
   Trace = max hold.
6. Measure and record the results in the test report.

### 3.4.4 Test Setup

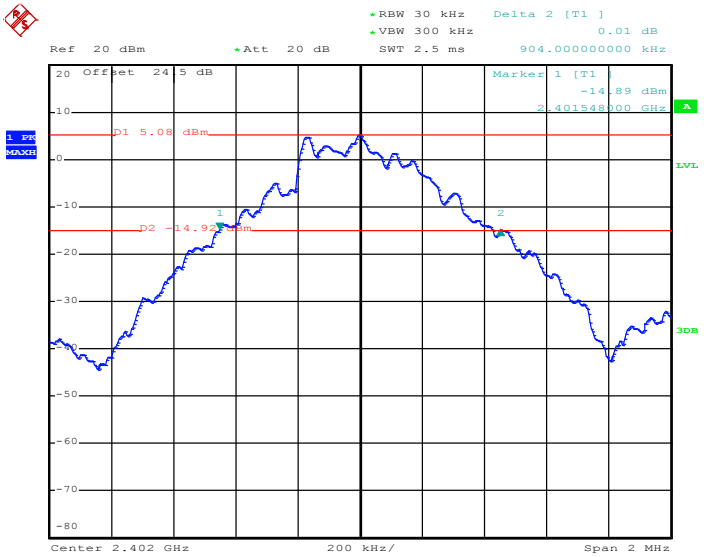



### 3.4.5 Test Result of 20dB Bandwidth

Please refer to Appendix A.

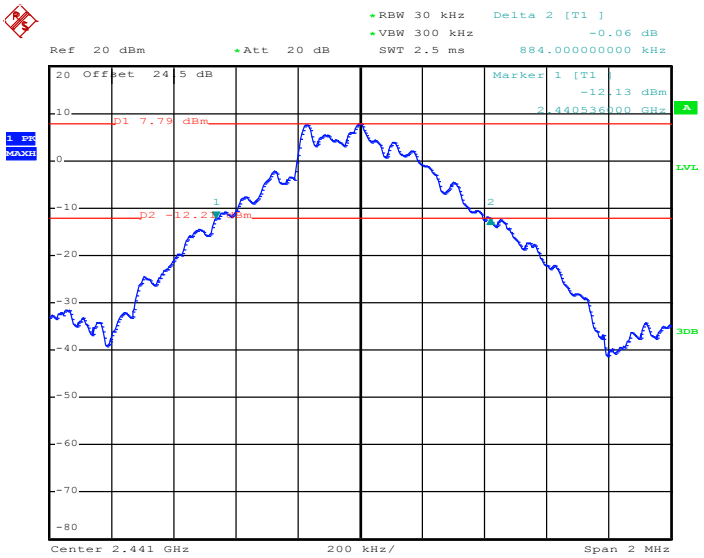
**<1Mbps>**

**20 dB Bandwidth Plot on Channel 00**



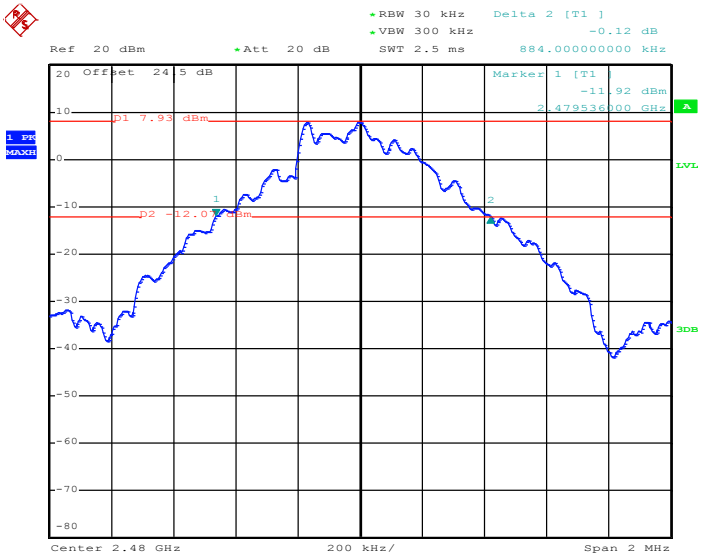

Date: 10.JUL.2017 22:39:49

**20 dB Bandwidth Plot on Channel 39**




Date: 10.JUL.2017 22:37:34

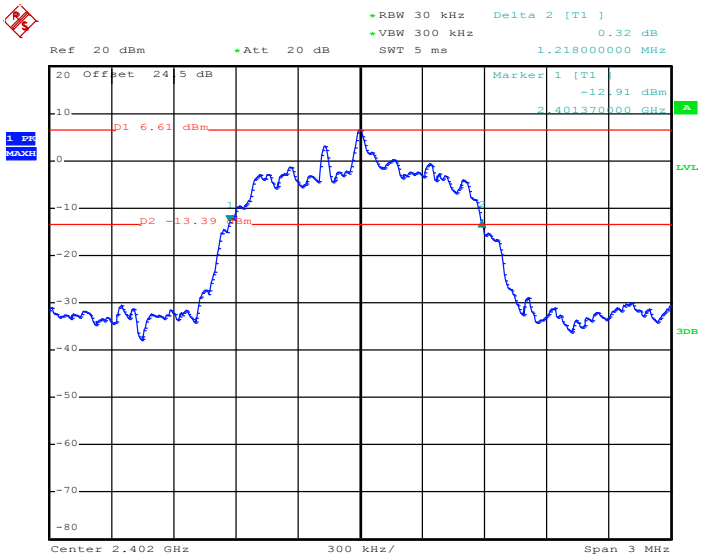
## 20 dB Bandwidth Plot on Channel 78




Date: 10.JUL.2017 22:35:15

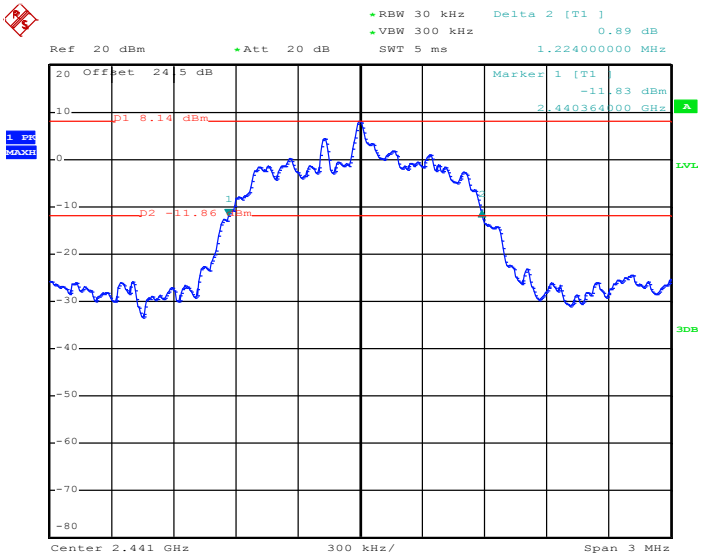
## <2Mbps>

## 20 dB Bandwidth Plot on Channel 00



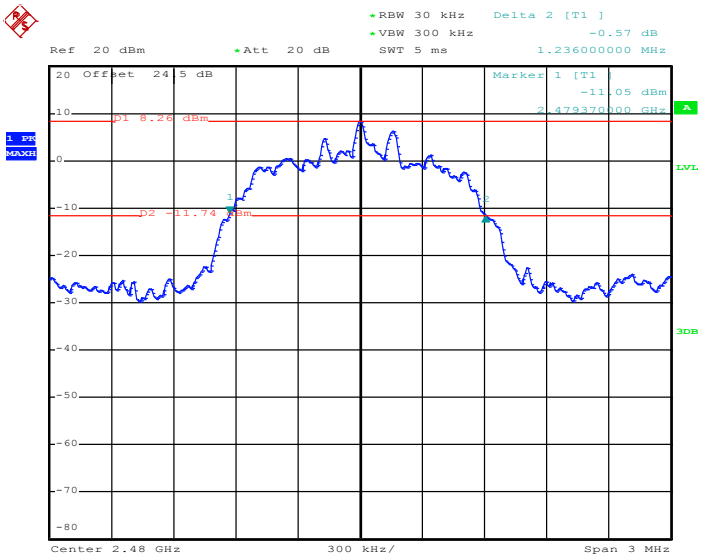

Date: 10.JUL.2017 23:28:18

## 20 dB Bandwidth Plot on Channel 39




Date: 10.JUL.2017 23:30:05

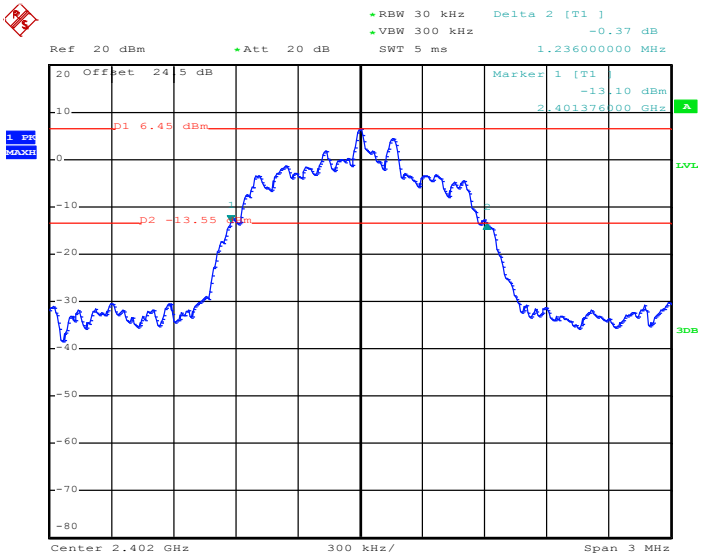
## 20 dB Bandwidth Plot on Channel 78




Date: 11.JUL.2017 00:05:37

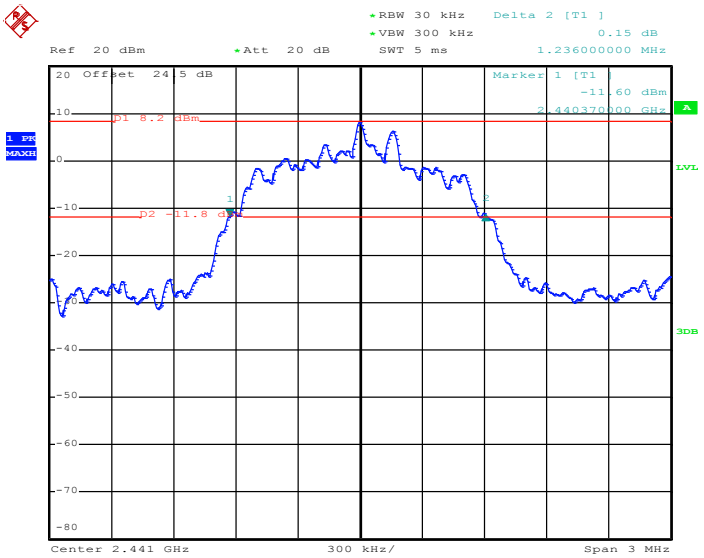
**<3Mbps>**

**20 dB Bandwidth Plot on Channel 00**



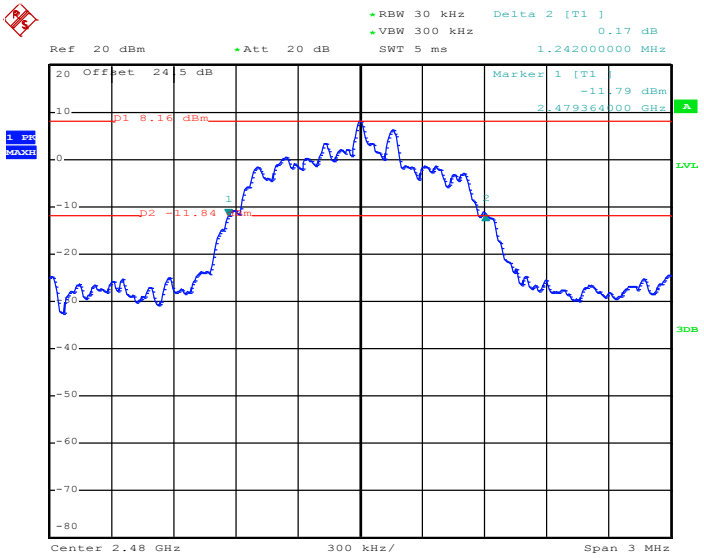

Date: 10.JUL.2017 23:52:51

**20 dB Bandwidth Plot on Channel 39**




Date: 10.JUL.2017 23:54:24

**20 dB Bandwidth Plot on Channel 78**



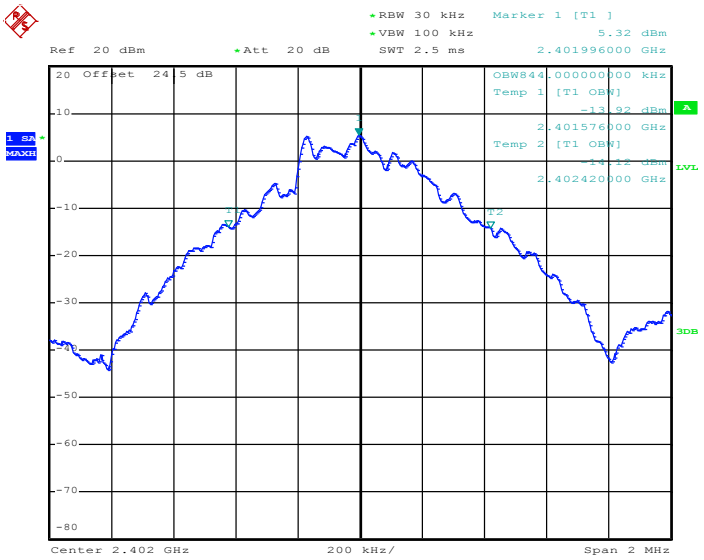

Date: 10.JUL.2017 23:55:56

## 3.4.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.

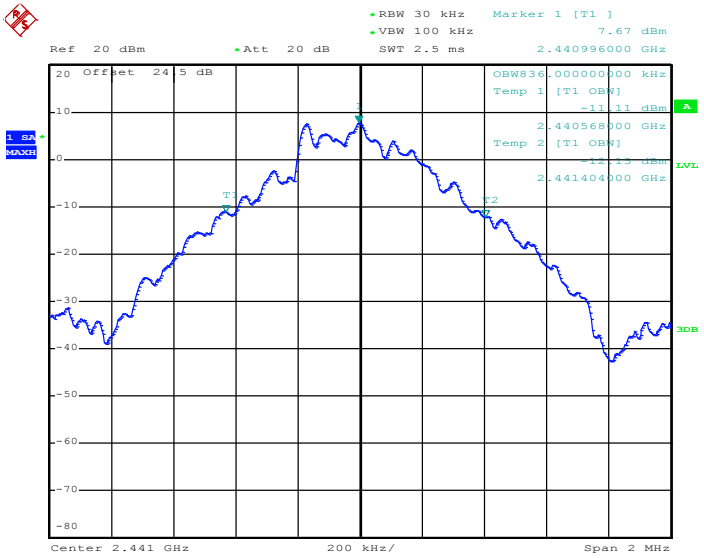
**<1Mbps>**

**99% Occupied Bandwidth Plot on Channel 00**



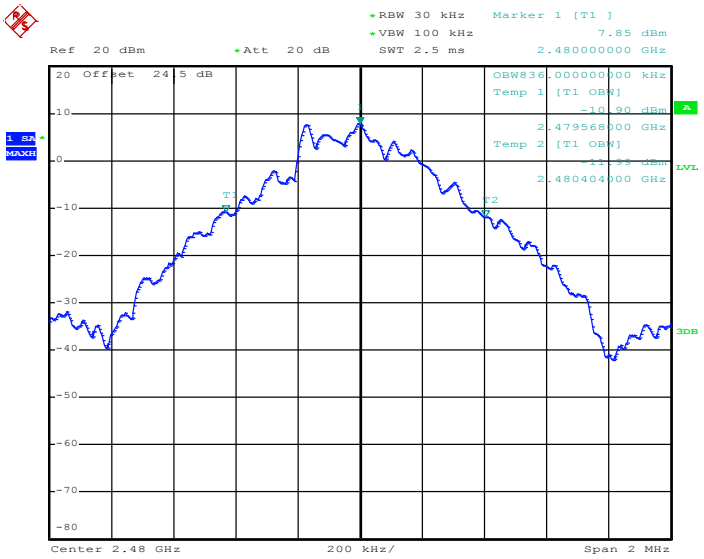

Date: 10.JUL.2017 22:09:25

## 99% Occupied Bandwidth Plot on Channel 39




Date: 10.JUL.2017 22:14:04

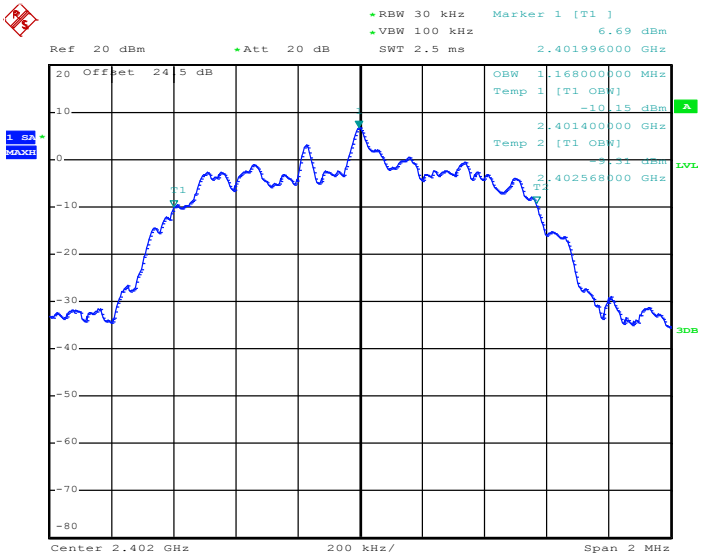
## 99% Occupied Bandwidth Plot on Channel 78




Date: 10.JUL.2017 22:21:01

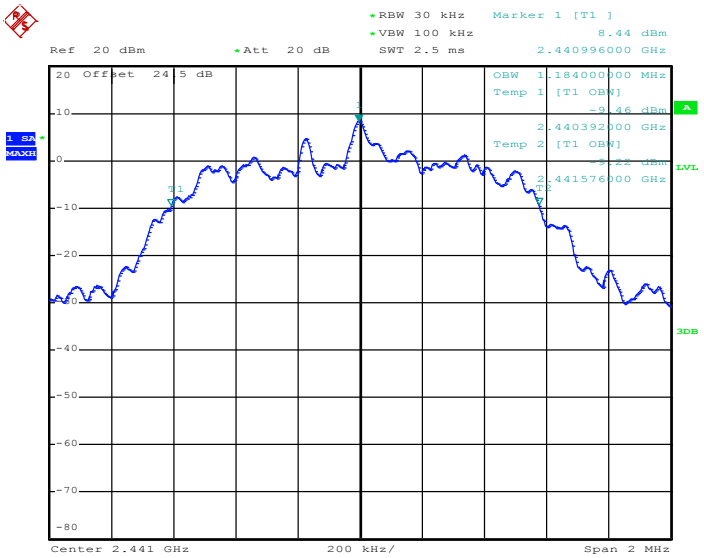
**<2Mbps>**

**99% Occupied Bandwidth Plot on Channel 00**



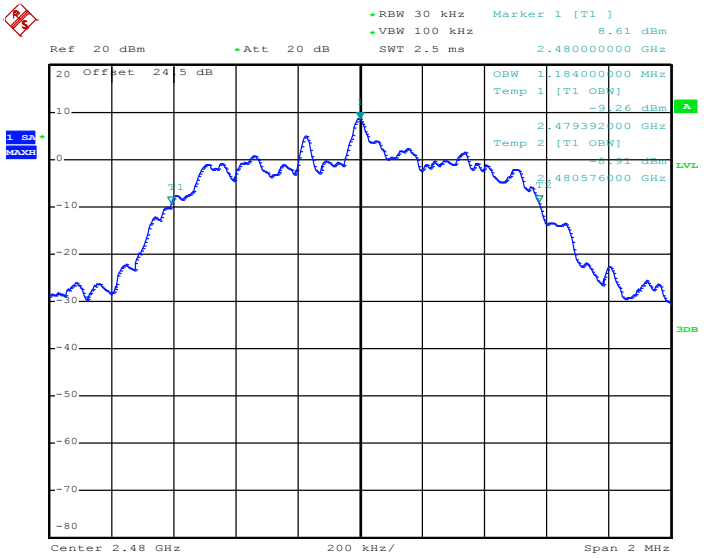

Date: 10.JUL.2017 23:19:28

**99% Occupied Bandwidth Plot on Channel 39**




Date: 10.JUL.2017 23:03:28

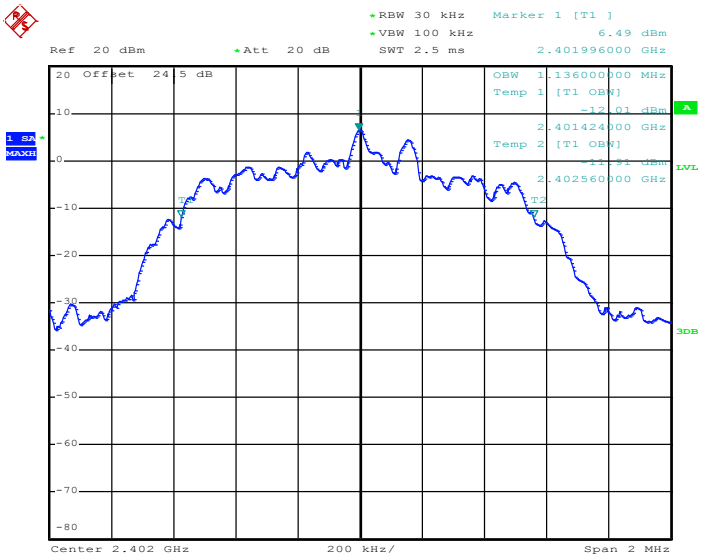
### 99% Occupied Bandwidth Plot on Channel 78




Date: 10.JUL.2017 22:56:03

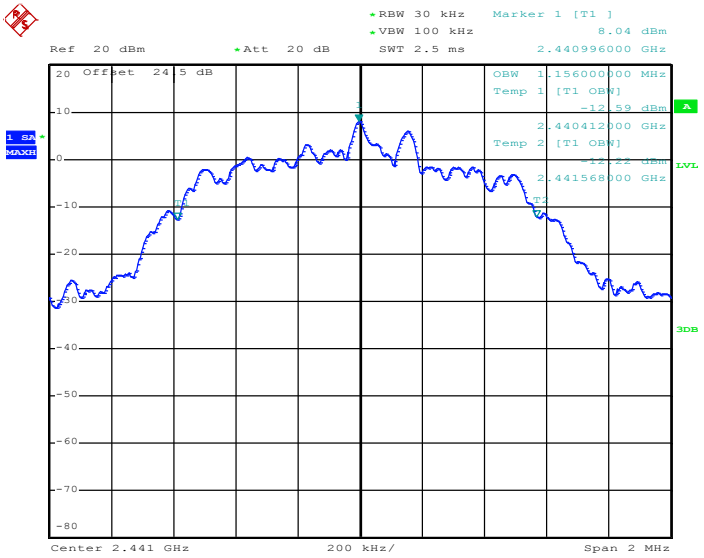
### <3Mbps>

### 99% Occupied Bandwidth Plot on Channel 00



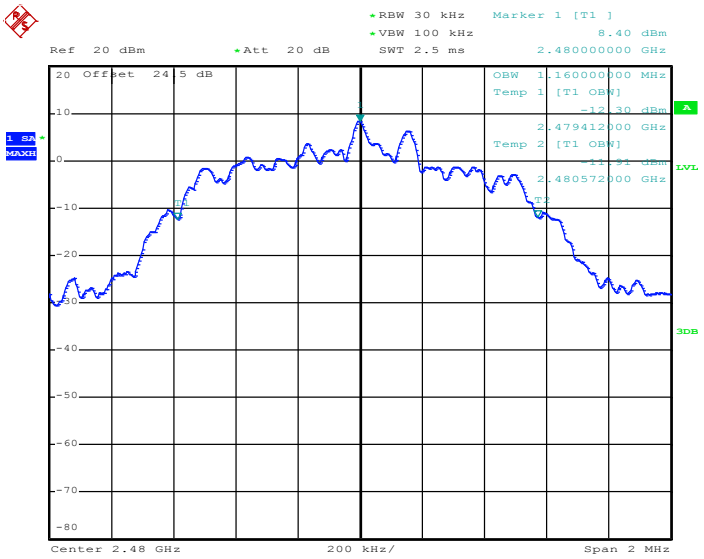

Date: 10.JUL.2017 23:37:32

**99% Occupied Bandwidth Plot on Channel 39**




Date: 10.JUL.2017 23:41:28

**99% Occupied Bandwidth Plot on Channel 78**




Date: 10.JUL.2017 23:47:20

**Note:** The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

## 3.5 Peak Output Power Measurement

### 3.5.1 Limit of Peak Output Power

Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts. The power limit for 1Mbps, 2Mbps, 3Mbps and AFH modes are 0.125 watts.

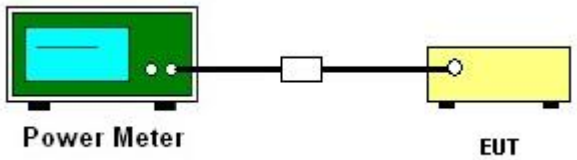
### 3.5.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

### 3.5.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.5.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

### 3.5.4 Test Setup




### 3.5.5 Test Result of Peak Output Power

Please refer to Appendix A.

## 3.6 Conducted Band Edges Measurement

### 3.6.1 Limit of Band Edges

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

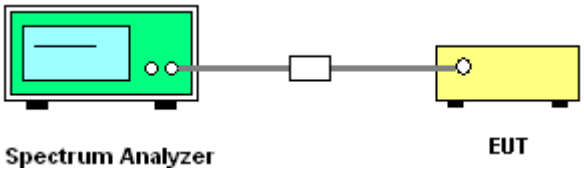
### 3.6.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

### 3.6.3 Test Procedures

1. The testing follows ANSI C63.10-2013 clause 7.8.6.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 100kHz, VBW = 300kHz. Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
4. Enable hopping function of the EUT and then repeat step 2. and 3.
5. Measure and record the results in the test report.

### 3.6.4 Test Setup

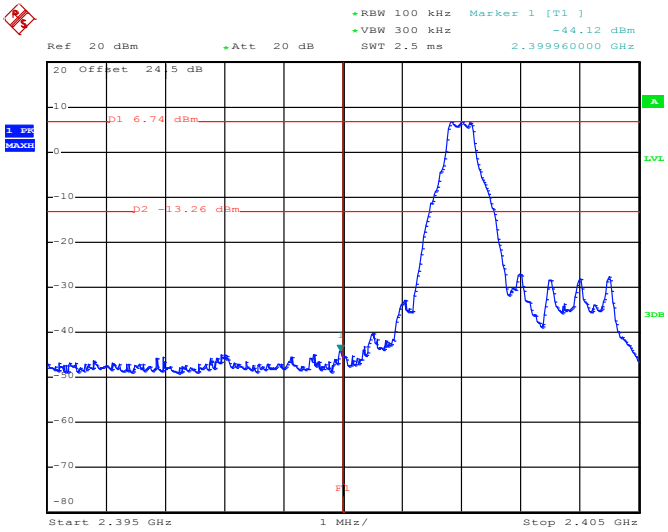



### 3.6.5 Test Result of Conducted Band Edges

Please refer to Appendix A.

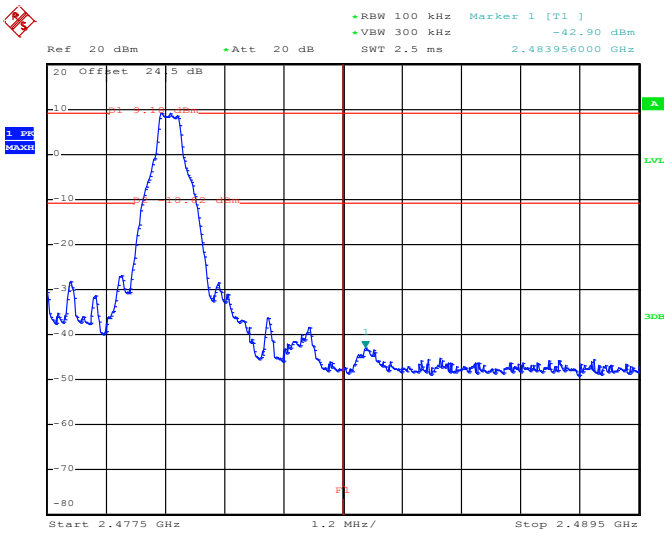
**<1Mbps>**

**Low Band Edge Plot on Channel 00**




Date: 10.JUL.2017 22:08:46

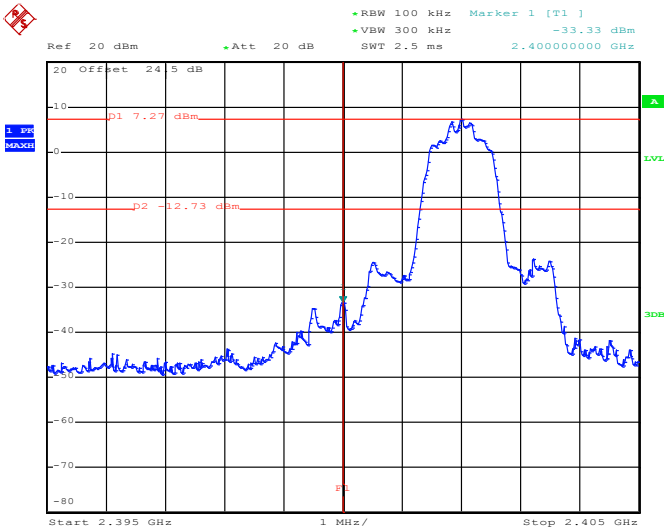
**High Band Edge Plot on Channel 78**




Date: 10.JUL.2017 22:20:26

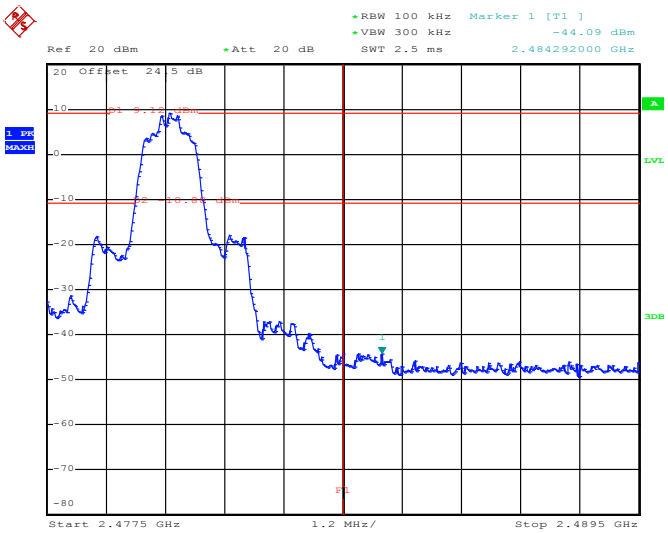
**<2Mbps>**

**Low Band Edge Plot on Channel 00**




Date: 10.JUL.2017 23:24:32

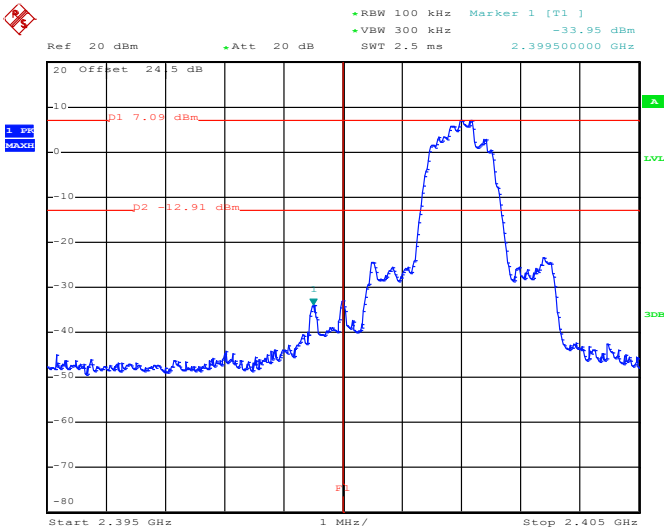
**High Band Edge Plot on Channel 78**




Date: 10.JUL.2017 22:54:18

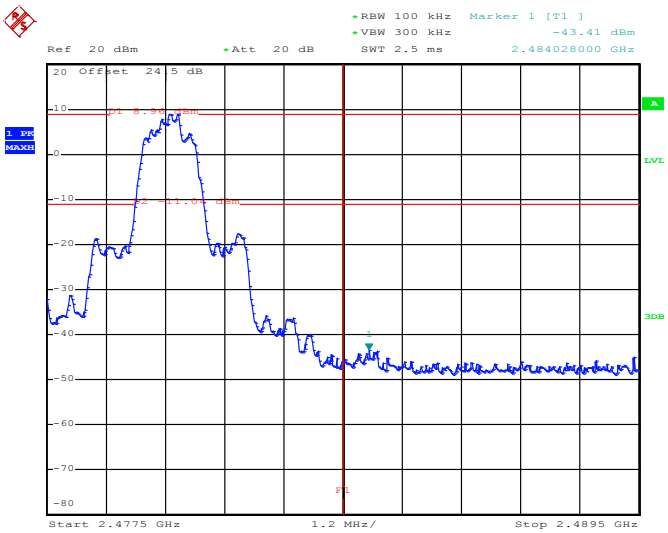
**<3Mbps>**

**Low Band Edge Plot on Channel 00**




Date: 10.JUL.2017 23:38:24

**High Band Edge Plot on Channel 78**



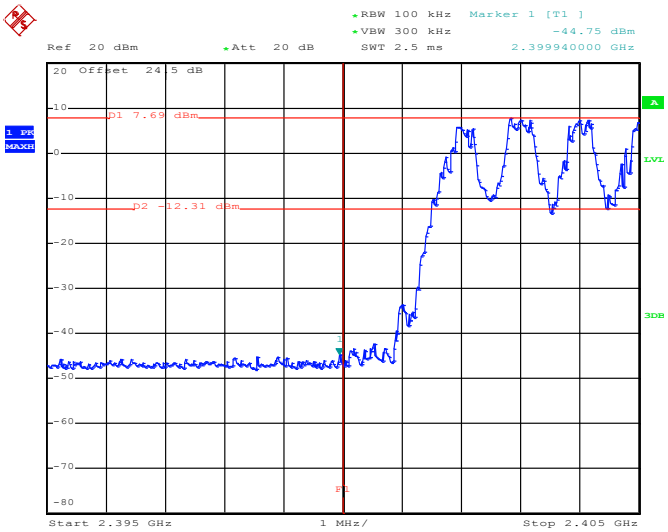

Date: 10.JUL.2017 23:46:42

### 3.6.6 Test Result of Conducted Hopping Mode Band Edges

Please refer to Appendix A.

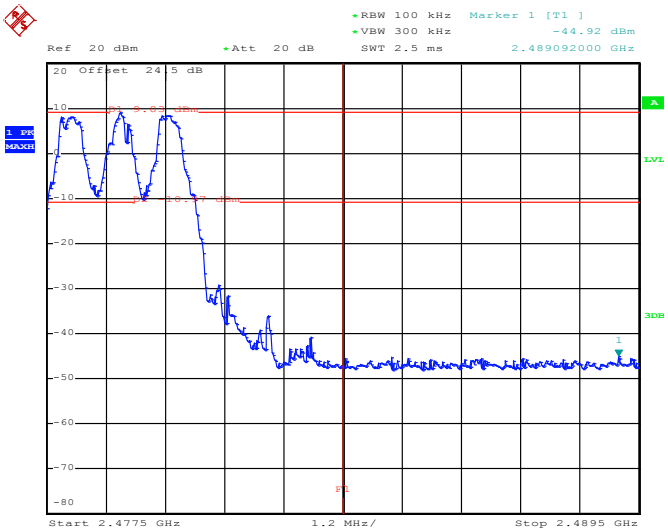
**<1Mbps>**

**Hopping Mode Low Band Edge Plot**




Date: 10.JUL.2017 22:43:25

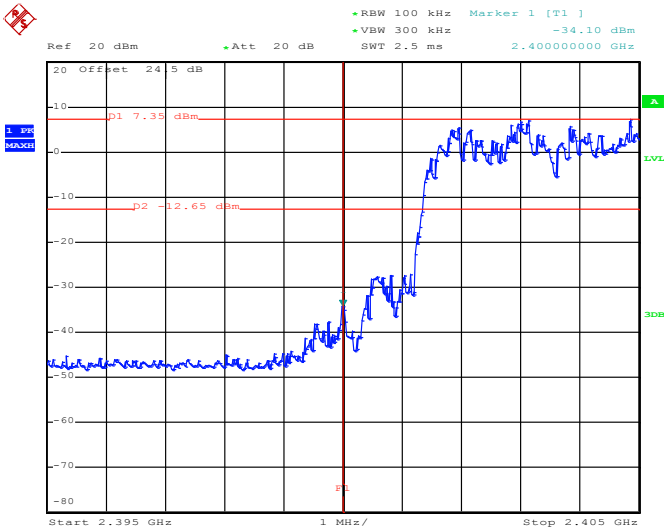
**Hopping Mode High Band Edge Plot**




Date: 10.JUL.2017 22:44:30

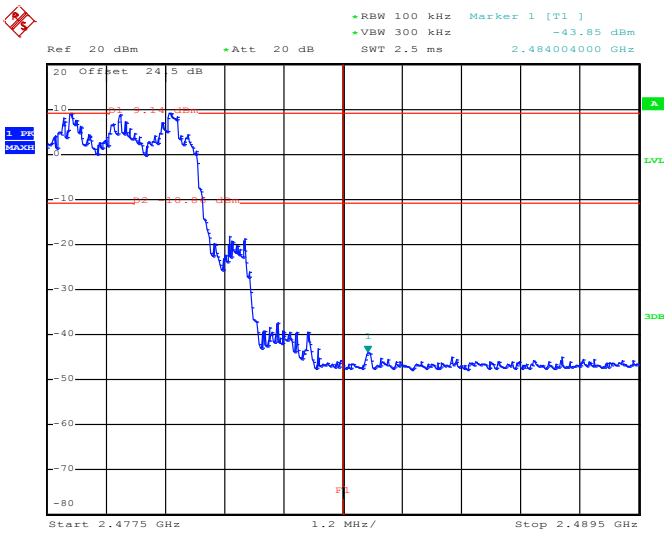
**<2Mbps>**

**Hopping Mode Low Band Edge Plot**




Date: 10.JUL.2017 22:52:05

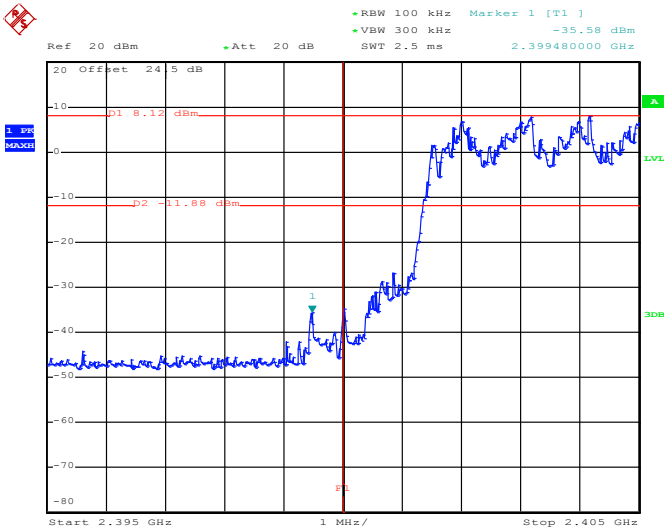
**Hopping Mode High Band Edge Plot**




Date: 10.JUL.2017 22:53:30

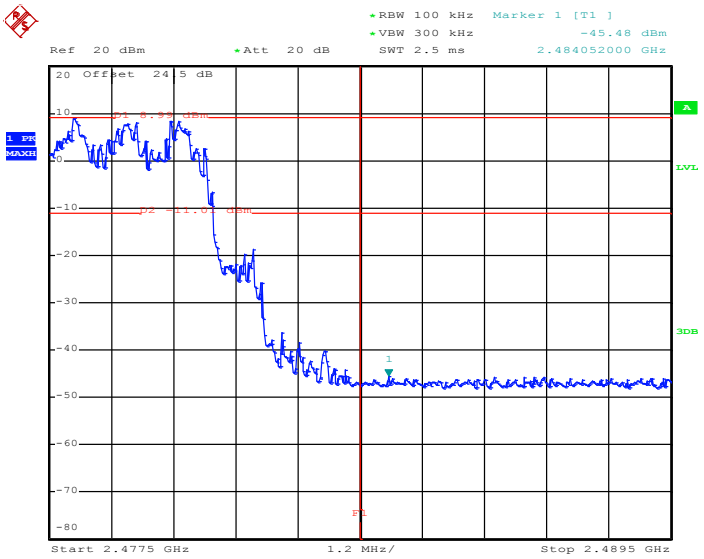
**<3Mbps>**

**Hopping Mode Low Band Edge Plot**




Date: 10.JUL.2017 23:50:43

**Hopping Mode High Band Edge Plot**




Date: 10.JUL.2017 23:49:15

## 3.7 Conducted Spurious Emission Measurement

### 3.7.1 Limit of Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

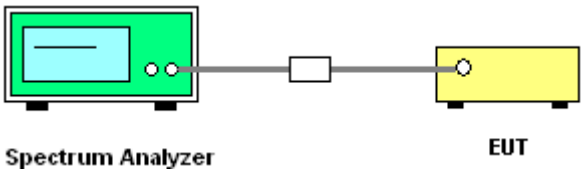
### 3.7.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

### 3.7.3 Test Procedure

1. The testing follows ANSI C63.10-2013 clause 7.8.8.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW.
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

### 3.7.4 Test Setup

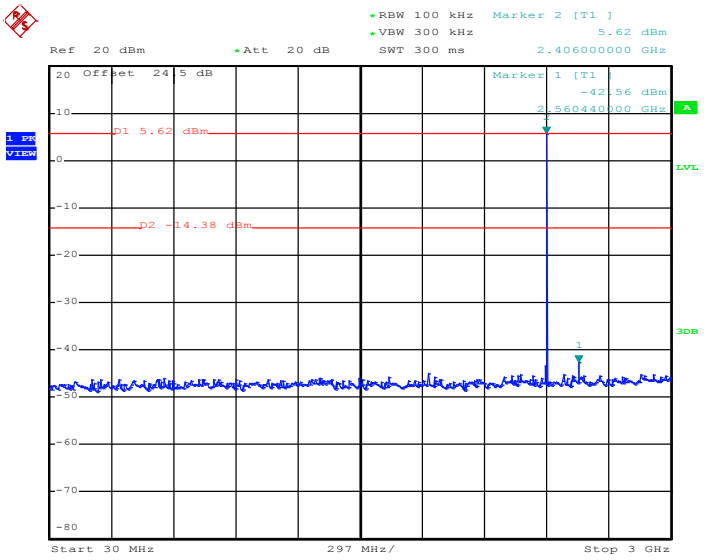


### 3.7.5 Test Result of Conducted Spurious Emission

Please refer to Appendix A.

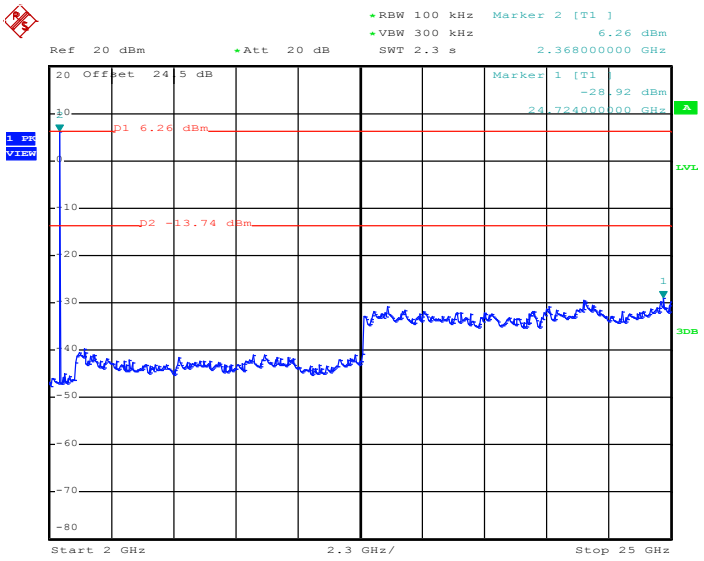
**<1Mbps>**

**CSE Plot on Ch 00 between 30MHz ~ 3 GHz**



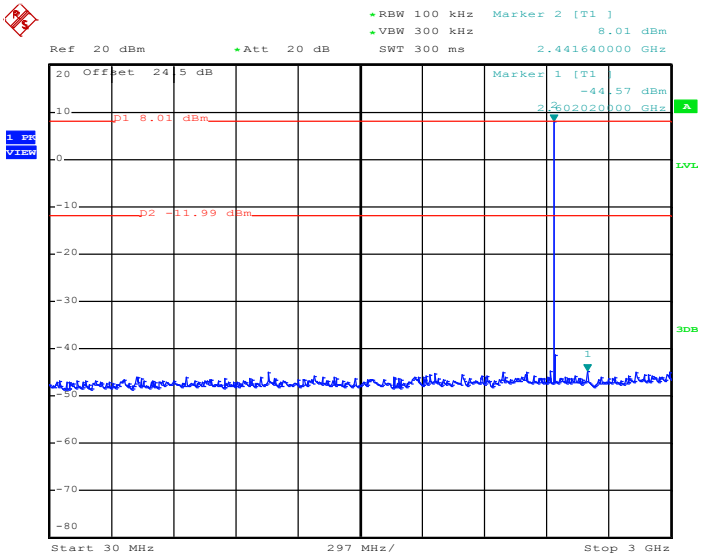

Date: 10.JUL.2017 22:11:32

**1Mbps CSE Plot on Ch 00 between 2 GHz ~ 25 GHz**



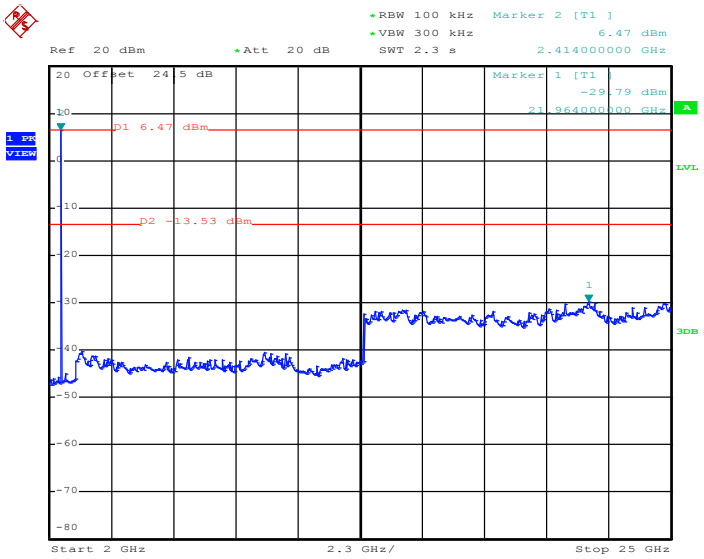

Date: 10.JUL.2017 22:11:53

## CSE Plot on Ch 39 between 30MHz ~ 3 GHz



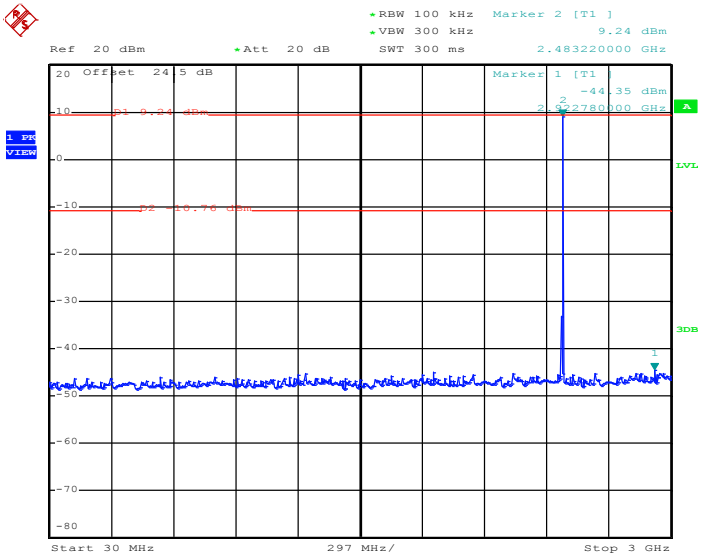

Date: 10.JUL.2017 22:14:35

## CSE Plot on Ch 39 between 2 GHz ~ 25 GHz



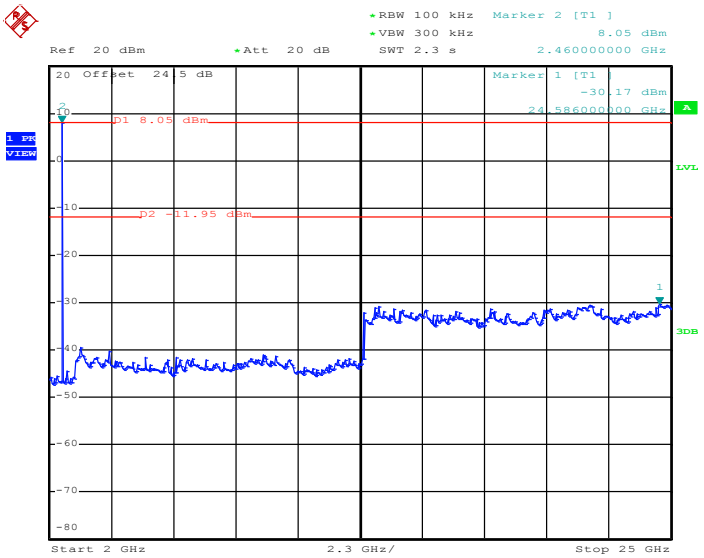

Date: 10.JUL.2017 22:15:57

## CSE Plot on Ch 78 between 30MHz ~ 3 GHz




Date: 10.JUL.2017 22:21:33

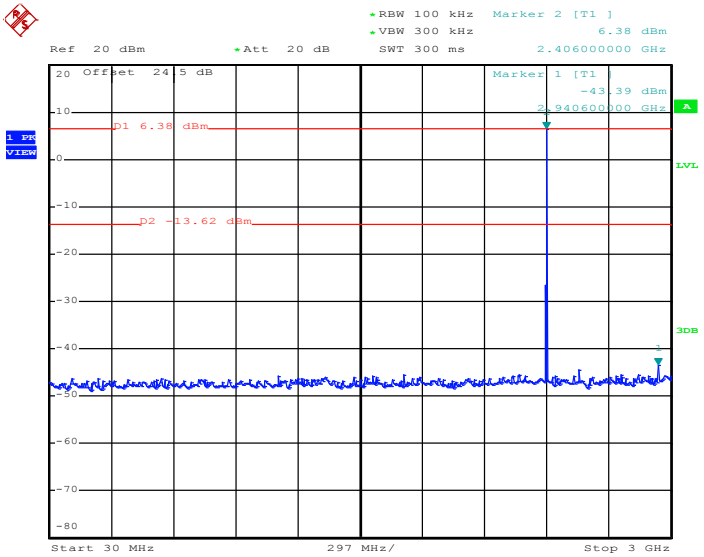
## CSE Plot on Ch 78 between 2 GHz ~ 25 GHz




Date: 10.JUL.2017 22:21:55

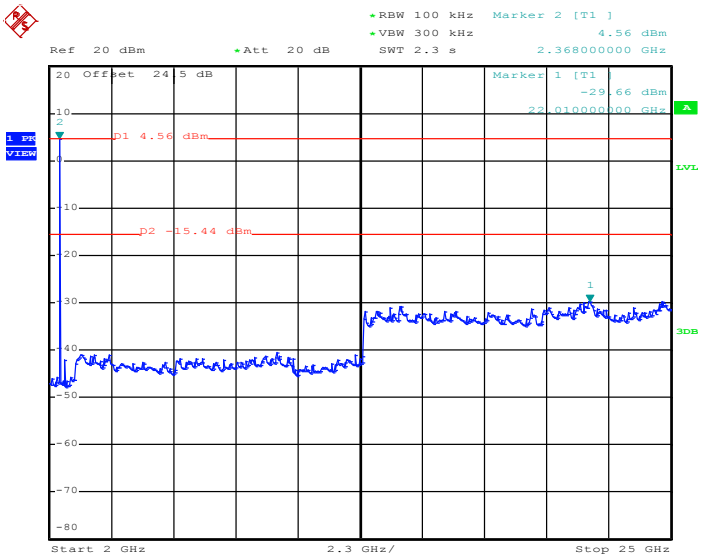
**<2Mbps>**

**CSE Plot on Ch 00 between 30MHz ~ 3 GHz**



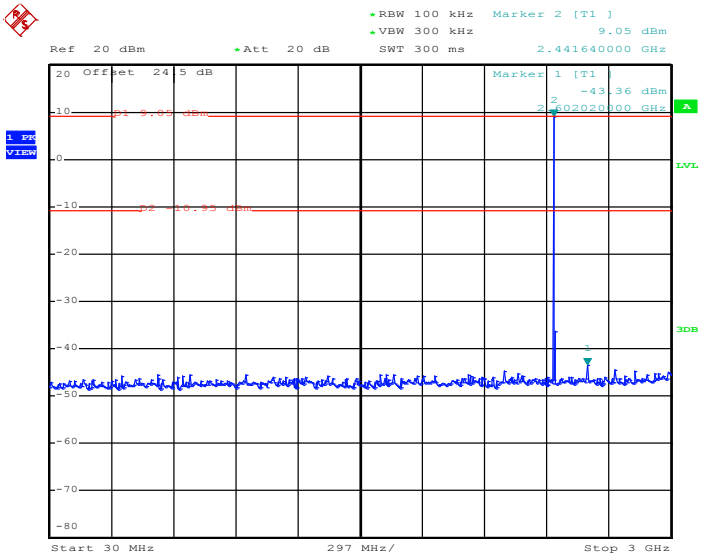

Date: 10.JUL.2017 23:23:28

**CSE Plot on Ch 00 between 2 GHz ~ 25 GHz**



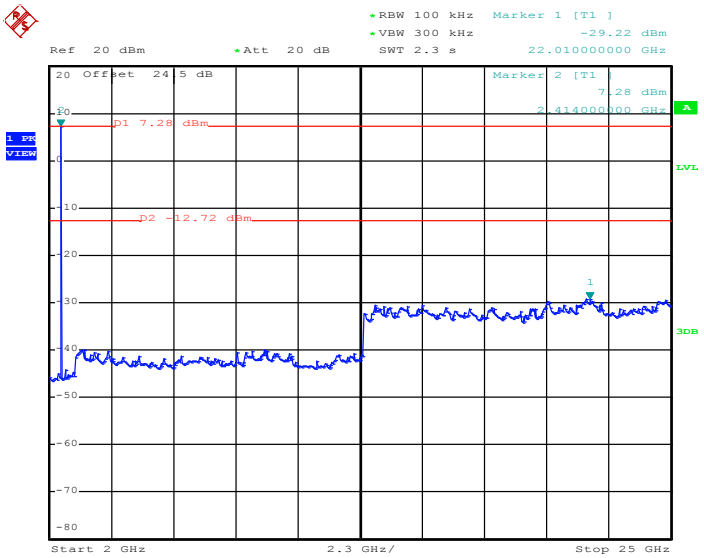

Date: 10.JUL.2017 23:23:50

## CSE Plot on Ch 39 between 30MHz ~ 3 GHz



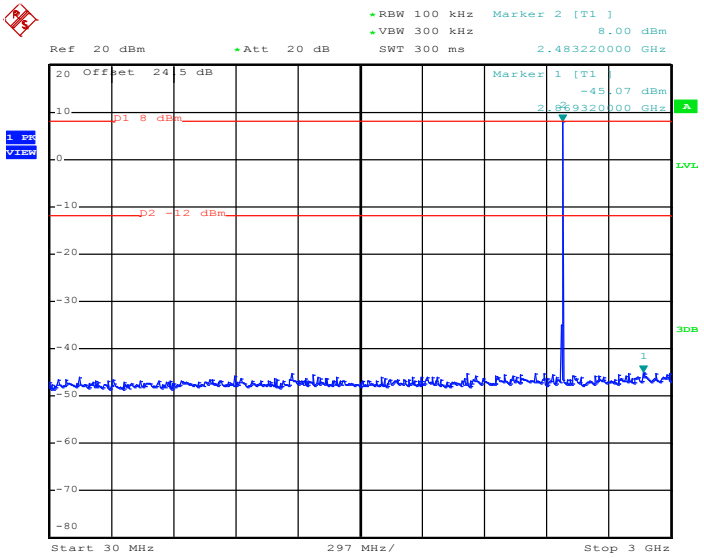

Date: 10.JUL.2017 23:08:54

## CSE Plot on Ch 39 between 2 GHz ~ 25 GHz



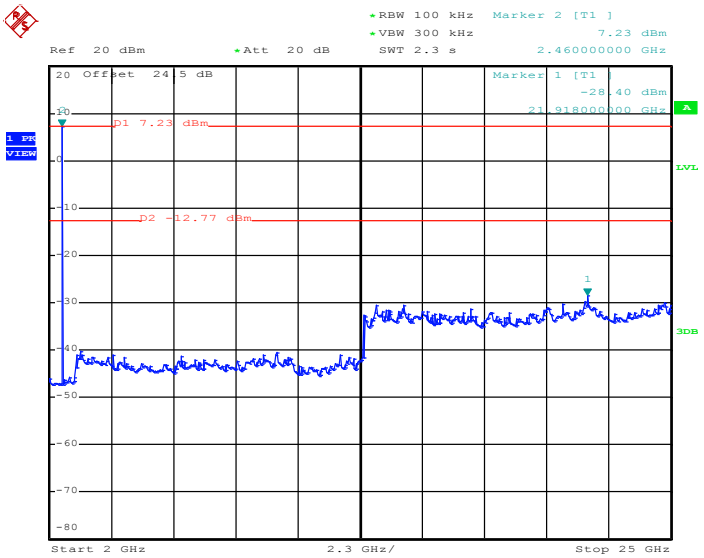

Date: 10.JUL.2017 23:17:49

## CSE Plot on Ch 78 between 30MHz ~ 3 GHz




Date: 10.JUL.2017 22:57:42

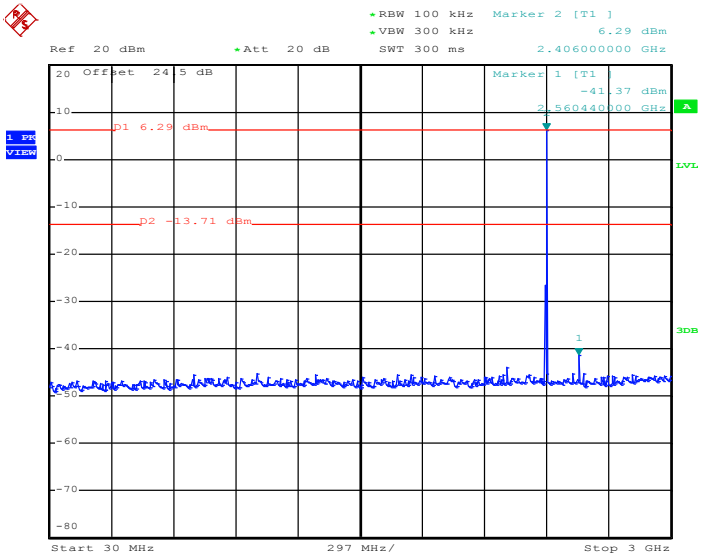
## CSE Plot on Ch 78 between 2 GHz ~ 25 GHz




Date: 10.JUL.2017 22:58:04

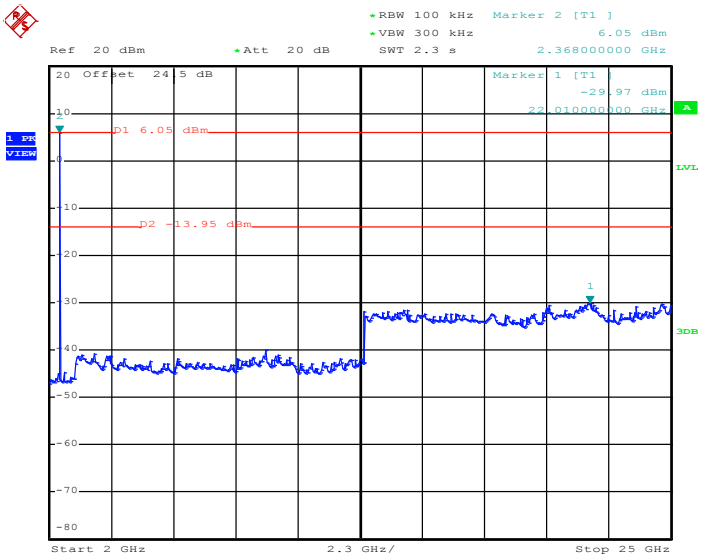
**<3Mbps>**

**CSE Plot on Ch 00 between 30MHz ~ 3 GHz**



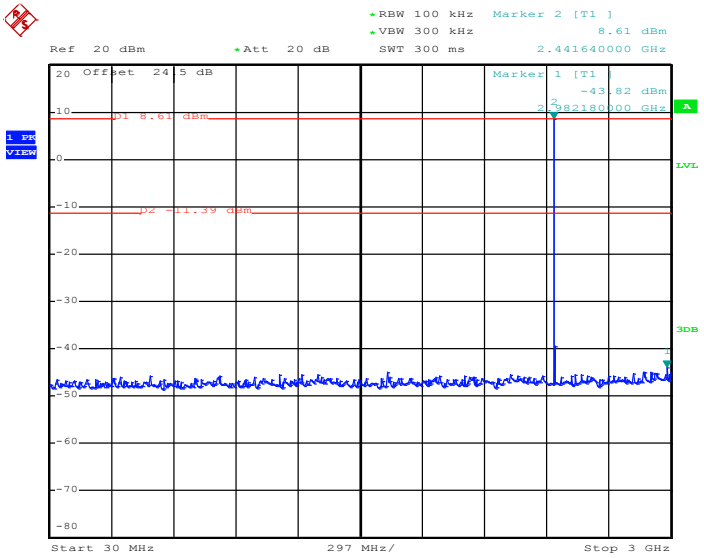

Date: 10.JUL.2017 23:36:25

**CSE Plot on Ch 00 between 2 GHz ~ 25 GHz**



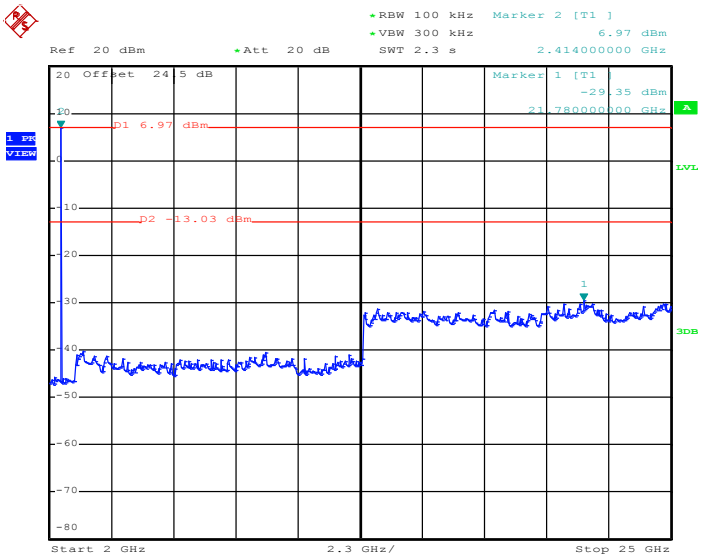

Date: 10.JUL.2017 23:36:47

## CSE Plot on Ch 39 between 30MHz ~ 3 GHz



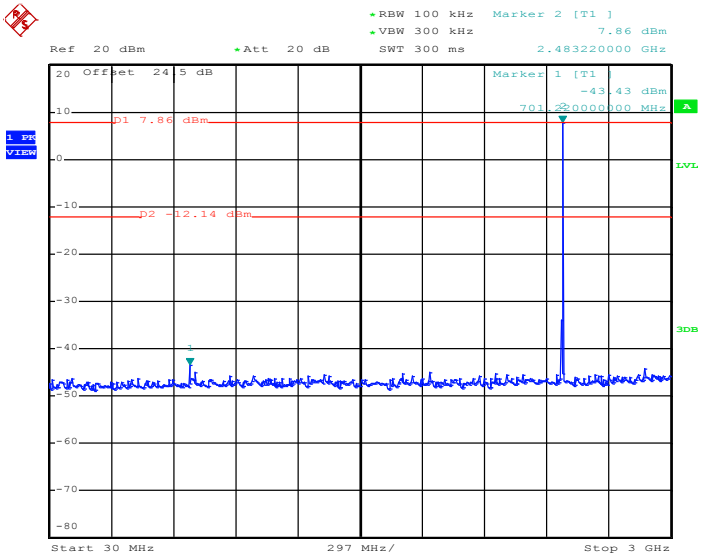

Date: 10.JUL.2017 23:42:56

## CSE Plot on Ch 39 between 2 GHz ~ 25 GHz



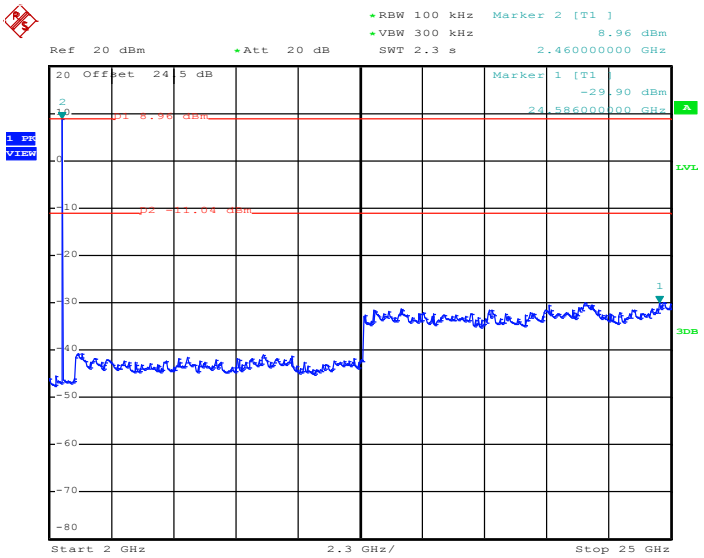

Date: 10.JUL.2017 23:43:18

## CSE Plot on Ch 78 between 30MHz ~ 3 GHz




Date: 10.JUL.2017 23:47:47

## CSE Plot on Ch 78 between 2 GHz ~ 25 GHz




Date: 10.JUL.2017 23:48:09

## 3.8 Radiated Band Edges and Spurious Emission Measurement

### 3.8.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

| Frequency (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |
| 30 – 88 | 100 | 3 |
| 88 – 216 | 150 | 3 |
| 216 - 960 | 200 | 3 |
| Above 960 | 500 | 3 |

### 3.8.2 Measuring Instruments

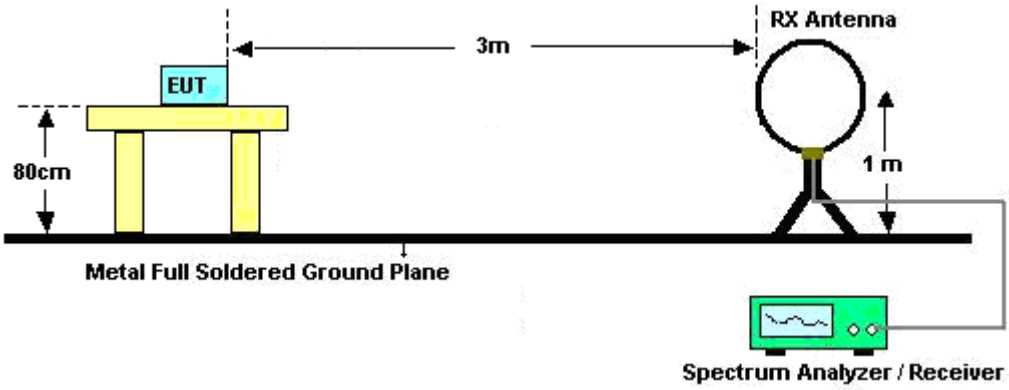
The measuring equipment is listed in the section 4 of this test report.

### 3.8.3 Test Procedures

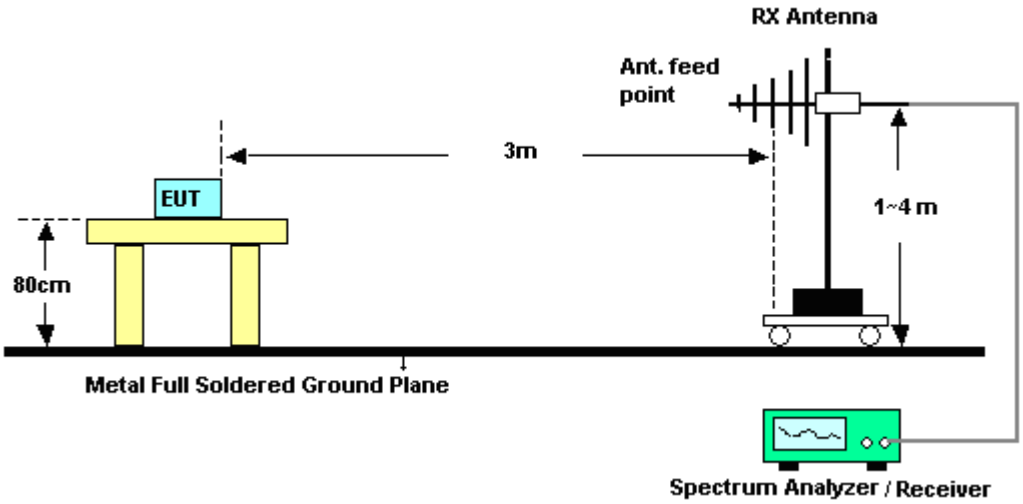
1. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
4. Set to the maximum power setting and enable the EUT transmit continuously.
5. Use the following spectrum analyzer settings:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz for f < 1 GHz, RBW=1MHz for f>1GHz ; VBW ≥ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
   (3) For average measurement:
   VBW = 10 Hz, when duty cycle is no less than 98 percent.
   VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

### 3.8.4 Test Setup

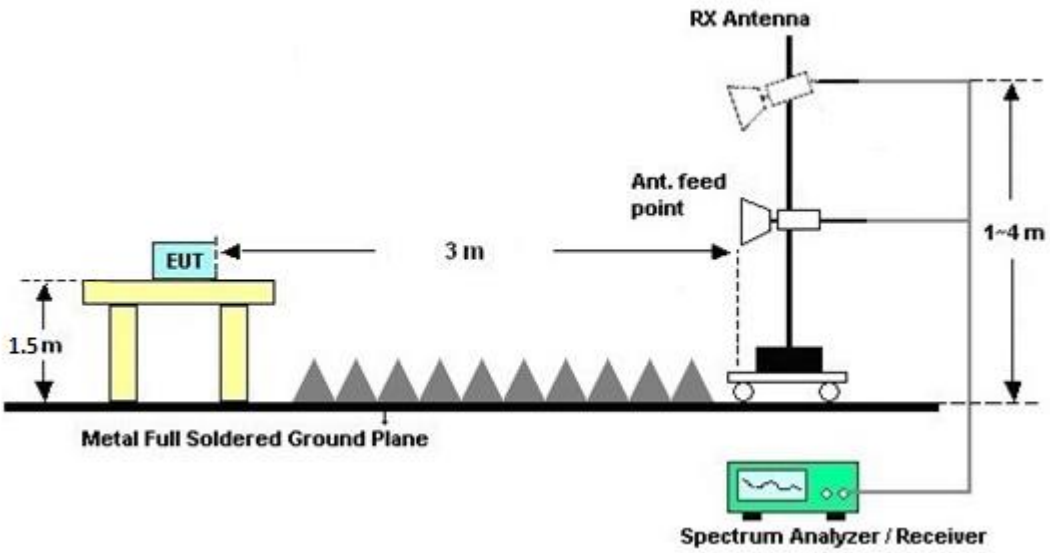
**For radiated emissions below 30MHz**




**For radiated emissions from 30MHz to 1GHz**



**For radiated emissions above 1GHz**




### 3.8.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

### 3.8.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix B and C.

### 3.8.7 Duty Cycle

Please refer to Appendix D.

### 3.8.8 Test Result of Radiated Spurious Emission (30MHz ~ 10$^{th}$ Harmonic)

Please refer to Appendix B and C.

## 3.9 Antenna Requirements

### 3.9.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the rule.

### 3.9.2 Antenna Anti-Replacement Construction

An embedded-in antenna design is used.

### 3.9.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

# 4 List of Measuring Equipment

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|---|---|---|---|---|---|---|---|---|
| Power Meter | Agilent | E4416A | GB41292344 | NA | Dec. 26, 2016 | Jun. 30, 2017 ~ Jul. 11, 2017 | Dec. 25, 2017 | Conducted (TH05-HY) |
| Power Sensor | Agilent | E9327A | US40441548 | 50MHz~18GHz | Dec. 26, 2016 | Jun. 30, 2017 ~ Jul. 11, 2017 | Dec. 25, 2017 | Conducted (TH05-HY) |
| Spectrum Analyzer | Rohde & Schwarz | FSP40 | 100055 | 9kHz-40GHz | Jul. 17, 2016 | Jun. 30, 2017 ~ Jul. 11, 2017 | Jul. 16, 2017 | Conducted (TH05-HY) |
| Amplifier | SONOMA | 310N | 187312 | 9kHz~1GHz | Nov. 10, 2016 | Jul. 07, 2017 ~ Jul. 08, 2017 | Nov. 09, 2017 | Radiation (03CH11-HY) |
| Bilog Antenna | TESEQ | CBL 6111D&N-6-06 | 35414&AT-N0602 | 30MHz~1GHz | Oct. 15, 2016 | Jul. 07, 2017 ~ Jul. 08, 2017 | Oct. 14, 2017 | Radiation (03CH11-HY) |
| Horn Antenna | SCHWARZBECK | BBHA 9120 D | 9120D-1326 | 1GHz ~ 18GHz | Oct. 07, 2016 | Jul. 07, 2017 ~ Jul. 08, 2017 | Oct. 06, 2017 | Radiation (03CH11-HY) |
| Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100488 | 9 kHz~30 MHz | Oct. 20, 2016 | Jul. 07, 2017 ~ Jul. 08, 2017 | Oct. 19, 2018 | Radiation (03CH11-HY) |
| Preamplifier | Keysight | 83017A | MY53270080 | 1GHz~26.5GHz | Nov. 10, 2016 | Jul. 07, 2017 ~ Jul. 08, 2017 | Nov. 09, 2017 | Radiation (03CH11-HY) |
| Spectrum Analyzer | Keysight | N9010A | MY54200486 | 10Hz ~ 44GHz | Oct. 12, 2016 | Jul. 07, 2017 ~ Jul. 08, 2017 | Oct. 11, 2017 | Radiation (03CH11-HY) |
| Antenna Mast | EMEC | AM-BS-4500-B | N/A | 1~4m | N/A | Jul. 07, 2017 ~ Jul. 08, 2017 | N/A | Radiation (03CH11-HY) |
| Turn Table | EMEC | TT 2000 | N/A | 0~360 Degree | N/A | Jul. 07, 2017 ~ Jul. 08, 2017 | N/A | Radiation (03CH11-HY) |
| Preamplifier | MITEQ | AMF-7D-00101800-30-10P | 1902247 | 1GHz~18GHz | Jun. 23, 2017 | Jul. 07, 2017 ~ Jul. 08, 2017 | Jun. 22, 2018 | Radiation (03CH11-HY) |
| Preamplifier | MITEQ | TTA 1840-35-HG | 1871923 | 18GHz ~ 40GHz | Jul. 16, 2016 | Jul. 07, 2017 ~ Jul. 08, 2017 | Jul. 15, 2017 | Radiation (03CH11-HY) |
| SHF-EHF Horn Antenna | SCHWARZBECK | BBHA 9170 | BBHA9170584 | 18GHz- 40GHz | Nov. 08, 2016 | Jul. 07, 2017 ~ Jul. 08, 2017 | Nov. 07, 2017 | Radiation (03CH11-HY) |
| EMI Test Receiver | Agilent | N9038A (MXE) | MY53290053 | 20Hz to 26.5GHz | Jan. 12, 2017 | Jul. 07, 2017 ~ Jul. 08, 2017 | Jan. 11, 2018 | Radiation (03CH11-HY) |

# 5 Uncertainty of Evaluation

**Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)**

| | |
|---|---|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 2.70 |

**Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)**

| | |
|---|---|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 5.2 |

**Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)**

| | |
|---|---|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 5.5 |

**Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)**

| | |
|---|---|
| Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y)) | 5.2 |

# Appendix A. Conducted Test Results

# Appendix A. Test Result of Conducted Test Items

| | | | | |
|---|---|---|---|---|
| Test Engineer: | Kai Liao | Temperature: | 21~25 | °C |
| Test Date: | 2017/6/30 ~ 7/10 | Relative Humidity: | 51~54 | % |

Report Number : FR741718

## Bluetooth

| | | | | |
|---|---|---|---|---|
| Test Engineer: | Kai Liao | Temperature: | 21~25 | °C |
| Test Date: | 2017/6/30 ~ 7/10 | Relative Humidity: | 51~54 | % |

### TEST RESULTS DATA
### 20dB and Hopping Channel Separation

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | 20db BW (MHz) | Hopping Channel Separation Measurement (MHz) | Hopping Channel Separation Measurement Limit (MHz) | Pass/Fail |
|---|---|---|---|---|---|---|---|---|
| DH | 1Mbps | 1 | 0 | 2402 | 0.90 | 0.98 | 0.6027 | Pass |
| DH | 1Mbps | 1 | 39 | 2441 | 0.88 | 1.00 | 0.5893 | Pass |
| DH | 1Mbps | 1 | 78 | 2480 | 0.88 | 1.00 | 0.5893 | Pass |
| 2DH | 2Mbps | 1 | 0 | 2402 | 1.22 | 1.01 | 0.8120 | Pass |
| 2DH | 2Mbps | 1 | 39 | 2441 | 1.22 | 1.00 | 0.8160 | Pass |
| 2DH | 2Mbps | 1 | 78 | 2480 | 1.24 | 1.00 | 0.8240 | Pass |
| 3DH | 3Mbps | 1 | 0 | 2402 | 1.24 | 1.00 | 0.8240 | Pass |
| 3DH | 3Mbps | 1 | 39 | 2441 | 1.24 | 0.99 | 0.8240 | Pass |
| 3DH | 3Mbps | 1 | 78 | 2480 | 1.24 | 1.01 | 0.8280 | Pass |

### TEST RESULTS DATA
### 99% Bandwidth

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | 99% Bandwidth (MHz) |
|---|---|---|---|---|---|
| DH | 1Mbps | 1 | 0 | 2402 | 0.84 |
| DH | 1Mbps | 1 | 39 | 2441 | 0.84 |
| DH | 1Mbps | 1 | 78 | 2480 | 0.84 |
| 2DH | 2Mbps | 1 | 0 | 2402 | 1.17 |
| 2DH | 2Mbps | 1 | 39 | 2441 | 1.18 |
| 2DH | 2Mbps | 1 | 78 | 2480 | 1.18 |
| 3DH | 3Mbps | 1 | 0 | 2402 | 1.14 |
| 3DH | 3Mbps | 1 | 39 | 2441 | 1.16 |
| 3DH | 3Mbps | 1 | 78 | 2480 | 1.16 |

### TEST RESULTS DATA
### Dwell Time

| Mod. | Hopping Channel Number Rate | Hops Over Occupancy Time(hops) | Package Transfer Time (msec) | Dwell Time (sec) | Limits (sec) | Pass/Fail |
|---|---|---|---|---|---|---|
| Nomal | 79 | 106.67 | 2.92 | 0.31 | 0.4 | Pass |
| AFH | 20 | 53.33 | 2.92 | 0.16 | 0.4 | Pass |

## ***TEST RESULTS DATA***
## ***Peak Power Table***

| DH | channel | | Peak Power (dBm) | Power Limit (dBm) | Test Result |
|---|---|---|---|---|---|
| DH1 | 0 | 1 | 7.23 | 20.97 | Pass |
| | 39 | 1 | 9.15 | 20.97 | Pass |
| | 78 | 1 | **9.47** | 20.97 | Pass |

| 2DH | channel | | Peak Power (dBm) | Power Limit (dBm) | Test Result |
|---|---|---|---|---|---|
| 2DH1 | 0 | 1 | 8.26 | 20.97 | Pass |
| | 39 | 1 | 9.49 | 20.97 | Pass |
| | 78 | 1 | **9.85** | 20.97 | Pass |

| 3DH | channel | | Peak Power (dBm) | Power Limit (dBm) | Test Result |
|---|---|---|---|---|---|
| 3DH1 | 0 | 1 | 8.39 | 20.97 | Pass |
| | 39 | 1 | 9.57 | 20.97 | Pass |
| | 78 | 1 | **9.95** | 20.97 | Pass |

## ***TEST RESULTS DATA***
## ***Avg Power Table***

| DH | channel | | Avg Power (dBm) |
|---|---|---|---|
| DH1 | 0 | 1 | 6.81 |
| | 39 | 1 | 8.91 |
| | 78 | 1 | **9.23** |

| 2DH | channel | | Avg Power (dBm) |
|---|---|---|---|
| 2DH5 | 0 | 1 | 6.60 |
| | 39 | 1 | 8.32 |
| | 78 | 1 | **8.67** |

| 3DH | channel | | Avg Power (dBm) |
|---|---|---|---|
| 3DH5 | 0 | 1 | 6.57 |
| | 39 | 1 | 8.31 |
| | 78 | 1 | **8.69** |

## ***TEST RESULTS DATA***
## ***Number of Hopping Frequency***

| Number of Hopping (Channel) | Adaptive Frequency Hopping (Channel) | Limits (Channel) | Pass/Fail |
|---|---|---|---|
| 79 | 20 | > 15 | Pass |

# Appendix B. Radiated Spurious Emission

| Test Engineer : | Jacky Hung | Temperature : | 21~24°C |
|---|---|---|---|
| | | Relative Humidity : | 51~55% |

**2.4GHz 2400~2483.5MHz**

**BT (Band Edge @ 3m)**

| BT | Note | Frequency | Level | Over | Limit | Read | Antenna | Cable | Preamp | Ant | Table | Peak | Pol. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| | | ( MHz ) | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| BT CH00 2402MHz | | 2376.05 | 42.64 | -31.36 | 74 | 43.14 | 26.81 | 6.29 | 33.6 | 102 | 233 | P | H |
| | | 2349.8 | 32.04 | -21.96 | 54 | 32.72 | 26.7 | 6.22 | 33.6 | 102 | 233 | A | H |
| | | 2402 | 94.76 | - | - | 95.12 | 26.87 | 6.36 | 33.59 | 102 | 233 | P | H |
| | | 2402 | 94.43 | - | - | 94.79 | 26.87 | 6.36 | 33.59 | 102 | 233 | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 2332.26 | 42.06 | -31.94 | 74 | 42.8 | 26.65 | 6.22 | 33.61 | 123 | 181 | P | V |
| | | 2375.94 | 32.44 | -21.56 | 54 | 32.94 | 26.81 | 6.29 | 33.6 | 123 | 181 | A | V |
| | | 2402 | 98.8 | - | - | 99.16 | 26.87 | 6.36 | 33.59 | 123 | 181 | P | V |
| | | 2402 | 98.54 | - | - | 98.9 | 26.87 | 6.36 | 33.59 | 123 | 181 | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| BT CH 39 2441MHz | | 2313.22 | 41.84 | -32.16 | 74 | 42.71 | 26.59 | 6.15 | 33.61 | 239 | 118 | P | H |
| | | 2388.96 | 32.44 | -21.56 | 54 | 32.81 | 26.87 | 6.36 | 33.6 | 239 | 118 | A | H |
| | | 2441 | 97.29 | - | - | 97.46 | 27.03 | 6.38 | 33.58 | 239 | 118 | P | H |
| | | 2441 | 97.01 | - | - | 97.18 | 27.03 | 6.38 | 33.58 | 239 | 118 | A | H |
| | | 2491.18 | 42.19 | -31.81 | 74 | 42.18 | 27.2 | 6.39 | 33.58 | 239 | 118 | P | H |
| | | 2492.93 | 33.53 | -20.47 | 54 | 33.51 | 27.2 | 6.39 | 33.57 | 239 | 118 | A | H |
| | | 2381.82 | 41.67 | -32.33 | 74 | 42.1 | 26.81 | 6.36 | 33.6 | 114 | 170 | P | V |
| | | 2310.98 | 34.19 | -19.81 | 54 | 35.06 | 26.59 | 6.15 | 33.61 | 114 | 170 | A | V |
| | | 2441 | 98.47 | - | - | 98.64 | 27.03 | 6.38 | 33.58 | 114 | 170 | P | V |
| | | 2441 | 98.19 | - | - | 98.36 | 27.03 | 6.38 | 33.58 | 114 | 170 | A | V |
| | | 2492.86 | 42.99 | -31.01 | 74 | 42.97 | 27.2 | 6.39 | 33.57 | 114 | 170 | P | V |
| | | 2492.93 | 34.19 | -19.81 | 54 | 34.17 | 27.2 | 6.39 | 33.57 | 114 | 170 | A | V |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BT CH 78 2480MHz | | 2480 | 97.12 | - | - | 97.18 | 27.14 | 6.38 | 33.58 | 108 | 110 | P | H |
| | | 2480 | 96.84 | - | - | 96.9 | 27.14 | 6.38 | 33.58 | 108 | 110 | A | H |
| | | 2484 | 46.31 | -27.69 | 74 | 46.37 | 27.14 | 6.38 | 33.58 | 108 | 110 | P | H |
| | | 2484.04 | 41.11 | -12.89 | 54 | 41.17 | 27.14 | 6.38 | 33.58 | 108 | 110 | A | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 2480 | 99.54 | - | - | 99.6 | 27.14 | 6.38 | 33.58 | 121 | 168 | P | V |
| | | 2480 | 99.12 | - | - | 99.18 | 27.14 | 6.38 | 33.58 | 121 | 168 | A | V |
| | | 2484.08 | 47.12 | -26.88 | 74 | 47.18 | 27.14 | 6.38 | 33.58 | 121 | 168 | P | V |
| | | 2484.04 | 42.04 | -11.96 | 54 | 42.1 | 27.14 | 6.38 | 33.58 | 121 | 168 | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| **Remark** | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |

## 2.4GHz 2400~2483.5MHz

## BT (Harmonic @ 3m)

| BT | Note | Frequency ( MHz ) | Level ( dBμV/m ) | Over Limit ( dB ) | Limit Line ( dBμV/m ) | Read Level ( dBμV ) | Antenna Factor ( dB/m ) | Cable Loss ( dB ) | Preamp Factor ( dB ) | Ant Pos ( cm ) | Table Pos ( deg ) | Peak Avg. (P/A) | Pol. (H/V) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BT CH 00 2402MHz | | 4804 | 45.24 | -28.76 | 74 | 66.63 | 31.6 | 9.6 | 63.02 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 4804 | 42.68 | -31.32 | 74 | 64.5 | 31.6 | 9.6 | 63.02 | 100 | 0 | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| BT CH 39 2441MHz | | 4882 | 45.79 | -28.21 | 74 | 66.96 | 31.71 | 9.56 | 62.87 | 100 | 0 | P | H |
| | | 7323 | 55.44 | -18.56 | 74 | 68.88 | 37.51 | 11.31 | 62.7 | 100 | 105 | P | H |
| | | 7323 | 51.08 | -2.92 | 54 | 64.52 | 37.51 | 11.31 | 62.7 | 100 | 105 | A | H |
| | | | | | | | | | | | | | H |
| | | 4882 | 45.29 | -28.71 | 74 | 66.89 | 31.71 | 9.56 | 62.87 | 100 | 0 | P | V |
| | | 7323 | 44.73 | -29.27 | 74 | 58.61 | 37.51 | 11.31 | 62.7 | 100 | 0 | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| BT CH 78 2480MHz | | 4960 | 47.53 | -26.47 | 74 | 68.4 | 31.84 | 9.53 | 62.68 | 100 | 0 | P | H |
| | | 7440 | 55.59 | -18.41 | 74 | 68.58 | 38.06 | 11.34 | 62.77 | 100 | 118 | P | H |
| | | 7440 | 51.15 | -2.85 | 54 | 64.14 | 38.06 | 11.34 | 62.77 | 100 | 118 | A | H |
| | | | | | | | | | | | | | H |
| | | 4960 | 46.51 | -27.49 | 74 | 67.82 | 31.84 | 9.53 | 62.68 | 100 | 0 | P | V |
| | | 7440 | 44.44 | -29.56 | 74 | 57.81 | 38.06 | 11.34 | 62.77 | 100 | 0 | A | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line. | | | | | | | | | | | | |

## Emission below 1GHz

## 2.4GHz BT (LF)

| BT | Note | Frequency | Level | Over | Limit | Read | Antenna | Cable | Preamp | Ant | Table | Peak | Pol. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| | | ( MHz ) | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | (dBμV) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| 2.4GHz BT LF | | 30.81 | 21.07 | -18.93 | 40 | 28.88 | 23.84 | 0.82 | 32.49 | - | - | P | H |
| | | 159.87 | 16.49 | -27.01 | 43.5 | 30.79 | 16.42 | 1.61 | 32.43 | - | - | P | H |
| | | 264.36 | 18.85 | -27.15 | 46 | 29.52 | 19.54 | 2.09 | 32.38 | - | - | P | H |
| | | 787.9 | 30.37 | -15.63 | 46 | 30.63 | 28.31 | 3.49 | 32.21 | - | - | P | H |
| | | 862.1 | 31.75 | -14.25 | 46 | 30.39 | 29.4 | 3.67 | 31.86 | - | - | P | H |
| | | 955.2 | 32.95 | -13.05 | 46 | 29.01 | 31.02 | 3.9 | 31.15 | 100 | 0 | P | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | | | | | | | | | | | | H |
| | | 30.81 | 27.41 | -12.59 | 40 | 35.22 | 23.84 | 0.82 | 32.49 | 100 | 0 | P | V |
| | | 63.48 | 26.6 | -13.4 | 40 | 46.25 | 11.81 | 1.02 | 32.49 | - | - | P | V |
| | | 148.53 | 20.99 | -22.51 | 43.5 | 34.62 | 17.12 | 1.61 | 32.44 | - | - | P | V |
| | | 562.5 | 27.32 | -18.68 | 46 | 30.43 | 26.2 | 3.03 | 32.43 | - | - | P | V |
| | | 729.1 | 31.19 | -14.81 | 46 | 32.46 | 27.59 | 3.4 | 32.39 | - | - | P | V |
| | | 909 | 32.71 | -13.29 | 46 | 31.01 | 29.33 | 3.79 | 31.58 | - | - | P | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| | | | | | | | | | | | | | V |
| Remark | 1. No other spurious found.<br>2. All results are PASS against limit line. | | | | | | | | | | | | |

## Note symbol

| | |
|---|---|
| * | **Fundamental Frequency** which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency. |
| ! | Test result is **over limit** line. |
| P/A | **P**eak or **A**verage |
| H/V | **H**orizontal or **V**ertical |

## A calculation example for radiated spurious emission is shown as below:

| WIFI | Note | Frequency | Level | Over | Limit | Read | Antenna | Cable | Preamp | Ant | Table | Peak | Pol. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ant. | | | | Limit | Line | Level | Factor | Loss | Factor | Pos | Pos | Avg. | |
| 1+2 | | ( MHz ) | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | (P/A) | (H/V) |
| 802.11b CH 01 2412MHz | | 2390 | 55.45 | -18.55 | 74 | 54.51 | 32.22 | 4.58 | 35.86 | 103 | 308 | P | H |
| | | 2390 | 43.54 | -10.46 | 54 | 42.6 | 32.22 | 4.58 | 35.86 | 103 | 308 | A | H |

1. Level(dBμV/m) =

Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

2. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

**For Peak Limit @ 2390MHz:**

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

**For Average Limit @ 2390MHz:**

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Cable Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Over Limit(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

= -10.46(dB)

**Both peak and average measured complies with the limit line, so test result is “PASS”.**

# Appendix C. Radiated Spurious Emission Plots

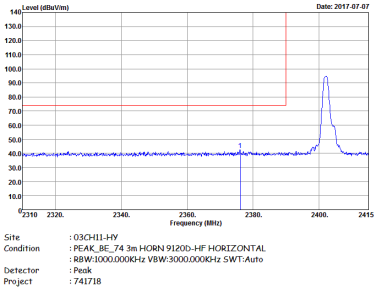
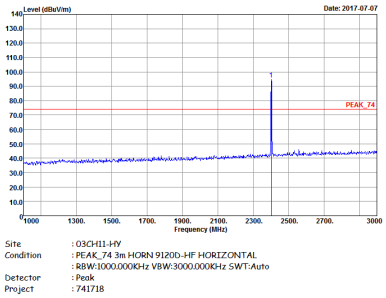
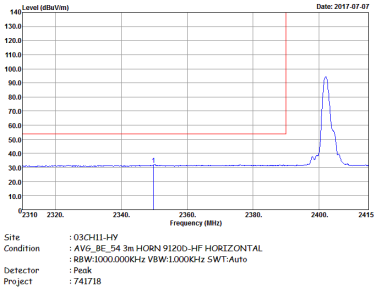
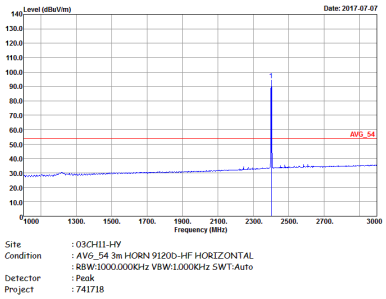
| | | | |
|---|---|---|---|
| **Test Engineer :** | Jacky Hung | **Temperature :** | 21~24°C |
| | | **Relative Humidity :** | 51~55% |

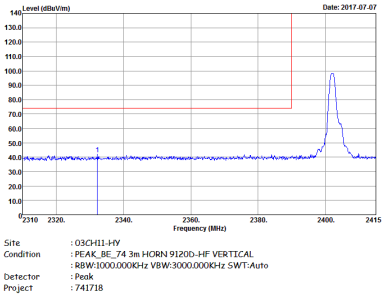
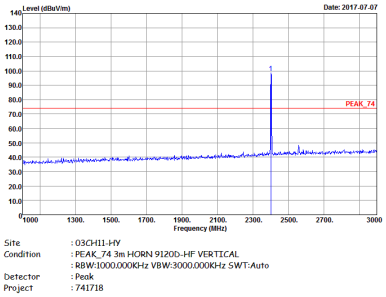
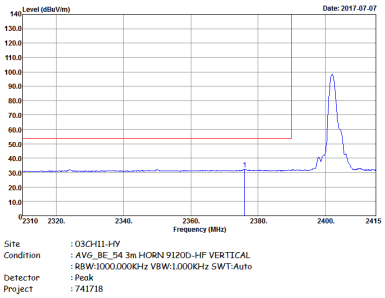
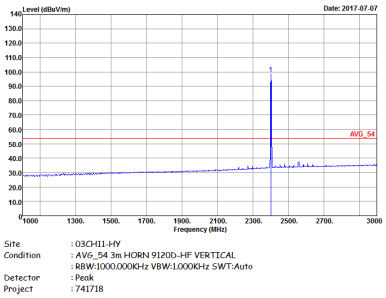
**Note symbol**

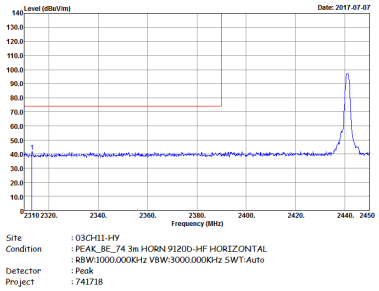
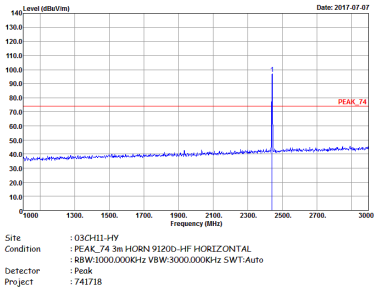
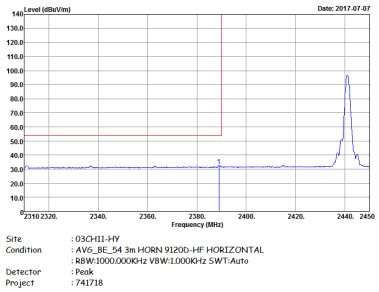
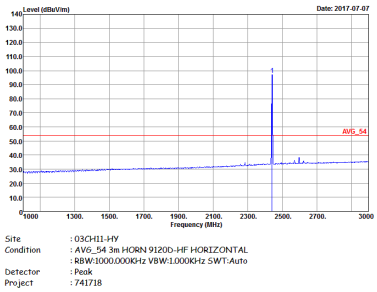
| | |
|---|---|
| -L | **Low channel location** |
| -R | **High channel location** |

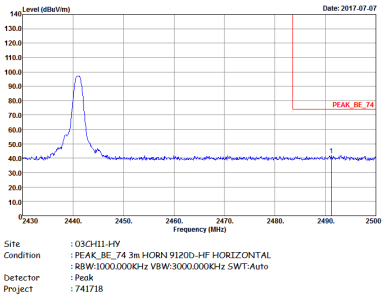
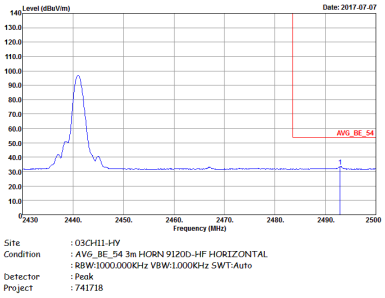
## 2.4GHz 2400~2483.5MHz

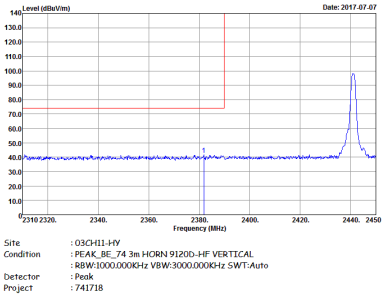
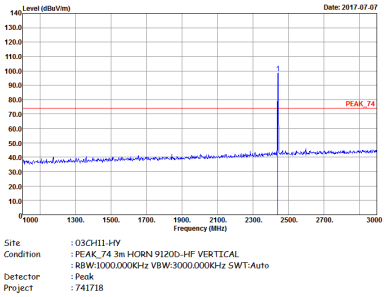
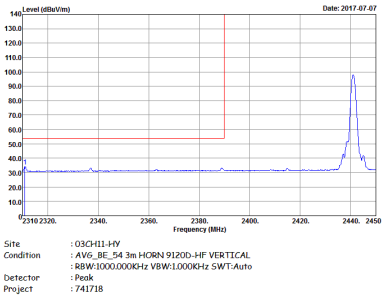
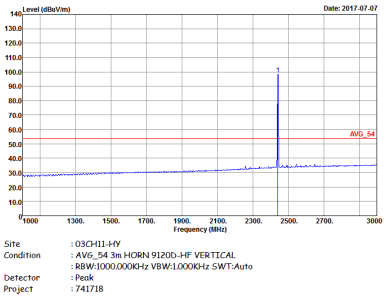
## BT (Band Edge @ 3m)

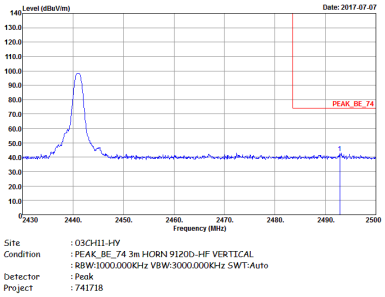
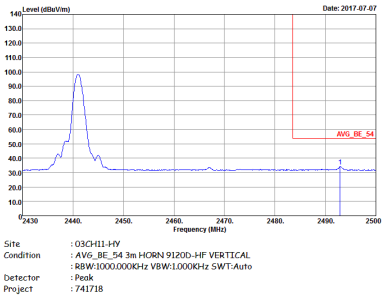
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | BT CH00 2402MHz | |
| 1 | Horizontal | Fundamental |
| Peak |  |  |
| Avg. |  |  |

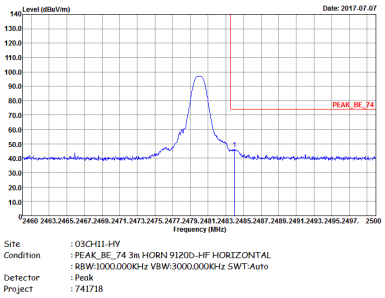
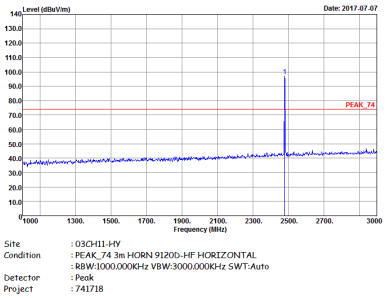
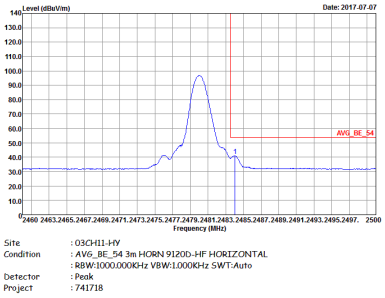
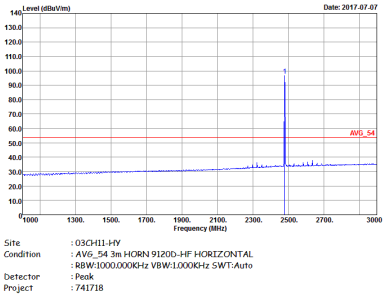
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | BT CH00 2402MHz | |
| 1 | Vertical | Fundamental |
| Peak |  |  |
| Avg |  |  |

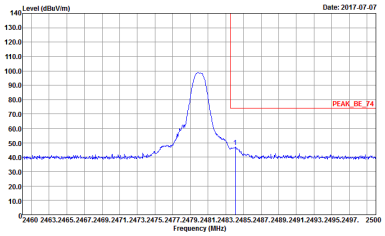
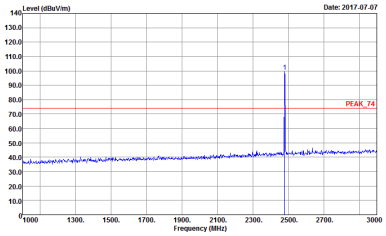
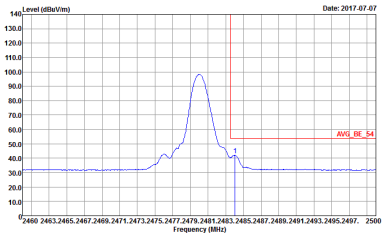
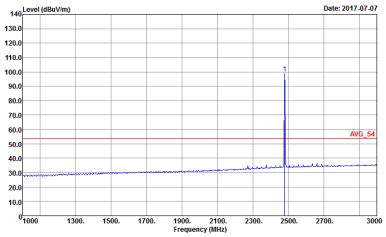
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | BT CH39 2441MHz - L | |
| 1 | Horizontal | Fundamental |
| Peak |  |  |
| Avg. |  |  |

| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | BT CH39 2441MHz - R | |
| 1 | Horizontal | Fundamental |
| Peak |  | Left blank |
| Avg. |  | Left blank |

| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | BT CH39 2441MHz - L | |
| 1 | Vertical | Fundamental |
| Peak |  |  |
| Avg. |  |  |

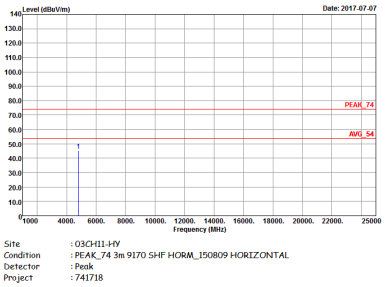
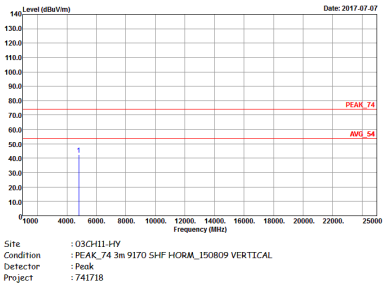
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | BT CH39 2441MHz - R | |
| 1 | Vertical | Fundamental |
| Peak |  | Left blank |
| Avg. |  | Left blank |

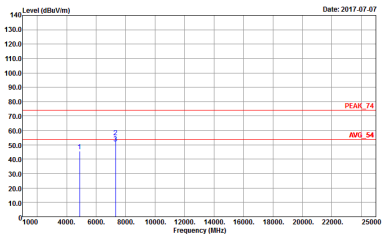
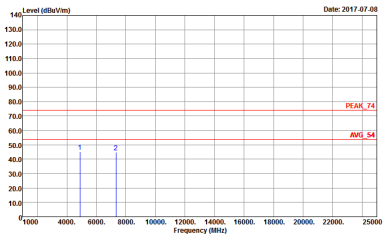
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | BT CH78 2480MHz | |
| 1 | Horizontal | Fundamental |
| Peak |  |  |
| Avg. |  |  |

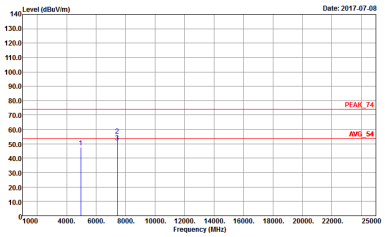
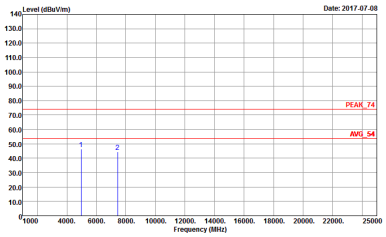
| BT | 2.4GHz 2400~2483.5MHz Band Edge @ 3m | |
|---|---|---|
| ANT | BT CH78 2480MHz | |
| 1 | Vertical | Fundamental |
| Peak |  <br>Site : 03CH11-HY<br>Condition : PEAK_BE_74 3m HORN 9120D-HF VERTICAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto<br>Detector : Peak<br>Project : 741718 |  <br>Site : 03CH11-HY<br>Condition : PEAK_74 3m HORN 9120D-HF VERTICAL<br>: RBW:1000.000KHz VBW:3000.000KHz SWT:Auto<br>Detector : Peak<br>Project : 741718 |
| Avg. |  <br>Site : 03CH11-HY<br>Condition : AVG_BE_54 3m HORN 9120D-HF VERTICAL<br>: RBW:1000.000KHz VBW:1.000KHz SWT:Auto<br>Detector : Peak<br>Project : 741718 |  <br>Site : 03CH11-HY<br>Condition : AVG_54 3m HORN 9120D-HF VERTICAL<br>: RBW:1000.000KHz VBW:1.000KHz SWT:Auto<br>Detector : Peak<br>Project : 741718 |

## 2.4GHz 2400~2483.5MHz

## BT (Harmonic @ 3m)

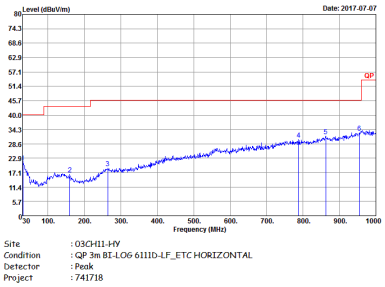
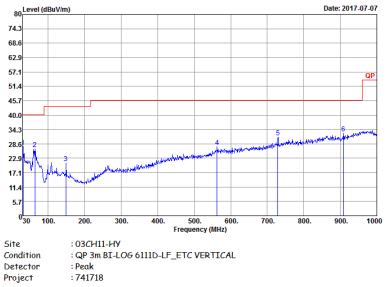
| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|---|---|---|
| ANT | BT CH00 2402MHz | |
| 1 | Horizontal | Vertical |
| Peak<br>Avg. |  <br> |  <br> |

| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|---|---|---|
| ANT | BT CH39 2440MHz | |
| 1 | Horizontal | Vertical |
| Peak<br>Avg. |  <br>Site : 03CH11-HY<br>Condition : PEAK_74 3m 9170 SHF HORM_150809 HORIZONTAL<br>Detector : Peak<br>Project : 741718 |  <br>Site : 03CH11-HY<br>Condition : PEAK_74 3m 9170 SHF HORM_150809 VERTICAL<br>Detector : Peak<br>Project : 741718 |

| BT | 2.4GHz 2400~2483.5MHz Harmonic @ 3m | |
|---|---|---|
| ANT | BT CH78 2480MHz | |
| 1 | Horizontal | Vertical |
| Peak |  <br>Site : 03CH11-HY<br>Condition : PEAK_74 3m 9170 SHF HORM_150809 HORIZONTAL<br>Detector : Peak<br>Project : 741718 |  <br>Site : 03CH11-HY<br>Condition : PEAK_74 3m 9170 SHF HORM_150809 VERTICAL<br>Detector : Peak<br>Project : 741718 |

## Emission below 1GHz

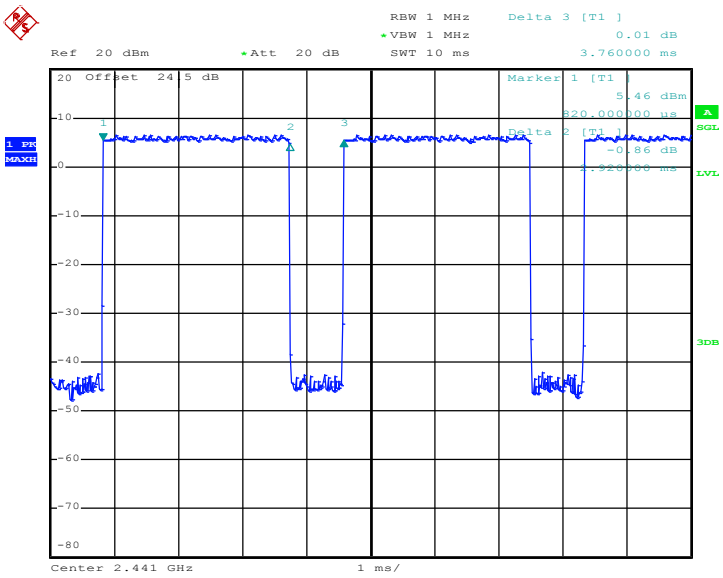
## 2.4GHz BT (LF)

| BT | 2.4GHz 2400~2483.5MHz | |
|---|---|---|
| ANT | BT LF | |
| 1 | Horizontal | Vertical |
| QP / Peak |  |  |

# Appendix D. Duty Cycle Plots

| Band | Duty Cycle(%) | T(us) | 1/T(kHz) | VBW Setting |
|---|---|---|---|---|
| Bluetooth | 77.66 | 2920.00 | 0.34 | 1kHz |

**Bluetooth**




Date: 4.JUL.2017 19:00:33