



# SPORTON International Inc.

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## FCC RADIO TEST REPORT

|                        |                                              |
|------------------------|----------------------------------------------|
| Applicant's company    | Broadcom Corporation                         |
| Applicant Address      | 190 Mathilda Place Sunnyvale CA 94086 U.S.A. |
| FCC ID                 | QDS-BRCM1075                                 |
| Manufacturer's company | Broadcom Corporation                         |
| Manufacturer Address   | 190 Mathilda Place Sunnyvale CA 94086 U.S.A. |

|                  |                                                                   |
|------------------|-------------------------------------------------------------------|
| Product Name     | Broadcom 802.11a/b/g/n/ac WLAN + Bluetooth 4.0 NGFF2230 Mini Card |
| Brand Name       | Broadcom                                                          |
| Model Name       | BCM943162ZP                                                       |
| Test Rule        | 47 CFR FCC Part 15 Subpart C § 15.247                             |
| Test Freq. Range | 2402 ~ 2480MHz                                                    |
| Received Date    | Dec. 25, 2013                                                     |
| Final Test Date  | Jan. 23, 2014                                                     |
| Submission Type  | Original Equipment                                                |

### Statement

**Test result included is only for the Bluetooth BR/EDR part of the product.**

The test result in this report refers exclusively to the presented test model / sample.

Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.

The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in **ANSI C63.4-2003** and **47 CFR FCC Part 15 Subpart C**.

The test equipment used to perform the test is calibrated and traceable to NML/ROC.



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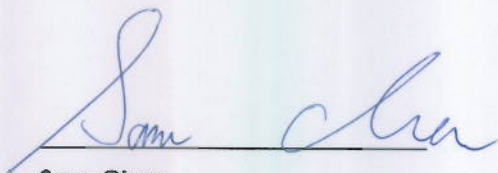
## History of This Test Report

| REPORT NO. | VERSION | DESCRIPTION                                        | ISSUED DATE   |
|------------|---------|----------------------------------------------------|---------------|
| FR3D2546AC | Rev. 01 | Initial issue of report                            | Jan. 31, 2014 |
| FR3D2546AC | Rev. 02 | 1. Adding Duty Cycle value<br>2. Adding peak power | Feb. 12, 2014 |
|            |         |                                                    |               |
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|            |         |                                                    |               |

## 1. CERTIFICATE OF COMPLIANCE

Product Name : Broadcom 802.11a/b/g/n/ac WLAN + Bluetooth 4.0 NGFF2230 Mini Card  
Brand Name : Broadcom  
Model No. : BCM943162ZP  
Applicant : Broadcom Corporation  
Test Rule Part(s) : 47 CFR FCC Part 15 Subpart C § 15.247

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Dec. 25, 2013 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.



Sam Chen

SPORTON INTERNATIONAL INC.

## 2. SUMMARY OF THE TEST RESULT

| Applied Standard: 47 CFR FCC Part 15 Subpart C |              |                                   |          |             |
|------------------------------------------------|--------------|-----------------------------------|----------|-------------|
| Part                                           | Rule Section | Description of Test               | Result   | Under Limit |
| 4.1                                            | 15.207       | AC Power Line Conducted Emissions | Complies | 14.30 dB    |
| 4.2                                            | 15.247(b)(1) | Maximum Conducted Output Power    | Complies | 19.88 dB    |
| 4.3                                            | 15.247(a)(1) | Hopping Channel Separation        | Complies | -           |
| 4.4                                            | 15.247(b)(1) | Number of Hopping Frequency       | Complies | -           |
| 4.5                                            | 15.247(a)(1) | Dwell Time                        | Complies | -           |
| 4.6                                            | 15.247(d)    | Radiated Emissions                | Complies | 3.47 dB     |
| 4.7                                            | 15.247(d)    | Band Edge Emissions               | Complies | 9.06 dB     |
| 4.8                                            | 15.203       | Antenna Requirements              | Complies | -           |

### 3. GENERAL INFORMATION

#### 3.1. Product Details

| Items                                                                                 | Description                                                                                                |
|---------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Power Type                                                                            | From host system                                                                                           |
| Modulation                                                                            | FHSS (GFSK / $\pi/4$ -DQPSK / 8DPSK)                                                                       |
| Data Rate (Mbps)                                                                      | GFSK: 1 ; $\pi/4$ -DQPSK: 2 ; 8DPSK: 3                                                                     |
| Frequency Range                                                                       | 2402 ~ 2480MHz                                                                                             |
| Channel Number                                                                        | 79                                                                                                         |
| Channel Band Width (99%)                                                              | BR (GFSK) 1 Mbps: 0.8960 MHz<br>EDR ( $\pi/4$ -DQPSK) 2 Mbps: 1.2120 MHz<br>EDR (8DPSK) 3 Mbps: 1.2320 MHz |
| Maximum Conducted Output Power                                                        | BR (GFSK) 1 Mbps: 10.12 dBm<br>EDR ( $\pi/4$ -DQPSK) 2 Mbps: 9.83 dBm<br>EDR (8DPSK) 3 Mbps: 9.42 dBm      |
| Carrier Frequencies                                                                   | Please refer to section 3.4                                                                                |
| Antenna                                                                               | Please refer to section 3.3                                                                                |
| Note 1: Bluetooth BR uses a combination of GFSK (1Mbps).                              |                                                                                                            |
| Note 2: Bluetooth EDR uses a combination of $\pi/4$ -DQPSK (2Mbps) and 8DPSK (3Mbps). |                                                                                                            |

#### 3.2. Accessories

N/A

### 3.3. Table for Filed Antenna

| Set | Ant. | Brand   | Model Name       | Antenna Type    | Connector     | Gain (dBi) |         |         |         |         |
|-----|------|---------|------------------|-----------------|---------------|------------|---------|---------|---------|---------|
|     |      |         |                  |                 |               | 2.4GHz     | 5GHz B1 | 5GHz B2 | 5GHz B3 | 5GHz B4 |
| 1   | 1    | Hitachi | HMT05/HFT17-DL07 | WLAN/BT antenna | Micro Coaxial | 3.9        | 3.9     | 5.6     | 5.8     | 5.8     |
|     | 2    | Hitachi | HMT05/HFT17-DL07 | WLAN/BT antenna | Micro Coaxial | 3.9        | 3.9     | 5.6     | 5.8     | 5.8     |

Note: The EUT has one set of antenna and each set has two antennas.

#### For 2.4GHz:

##### For IEEE 802.11b/g/n mode (1TX/1RX)

The EUT supports the antenna with TX/RX diversity function.

Both Chain 1 and Chain 2 can be used as transmitting/receiving antenna, but only one antenna can be used as transmitting/receiving antenna at the same time.

Chain 1 generated the worst case than Chain 2, so it tested and recorded in the report.

#### For 5GHz:

##### For IEEE 802.11a/n/ac mode (1TX/1RX)

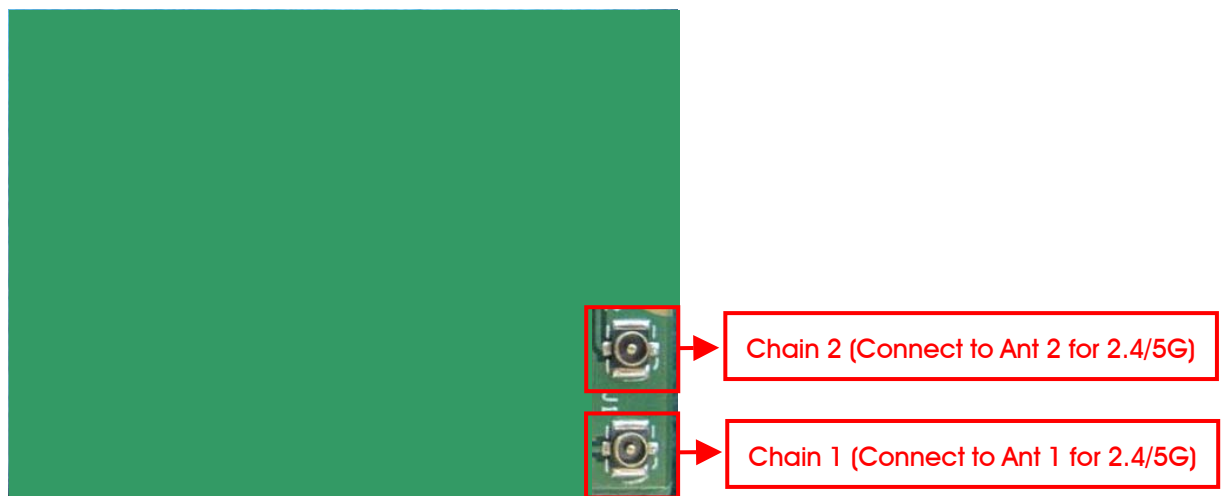
The EUT supports the antenna with TX/RX diversity function.

Both Chain 1 and Chain 2 can be used as transmitting/receiving antenna, but only one antenna can be used as transmitting/receiving antenna at the same time.

Chain 1 generated the worst case than Chain 2, so it tested and recorded in the report.

##### For Bluetooth mode (1TX/1RX)

Only Chain 1 can be used as transmitting/receiving antenna.



### 3.4. Table for Carrier Frequencies

| Frequency Band | Channel No. | Frequency | Channel No. | Frequency |
|----------------|-------------|-----------|-------------|-----------|
| 2400~2483.5MHz | 0           | 2402 MHz  | 40          | 2442 MHz  |
|                | 1           | 2403 MHz  | :           | :         |
|                | :           | :         | 77          | 2479 MHz  |
|                | 38          | 2440 MHz  | 78          | 2480 MHz  |
|                | 39          | 2441 MHz  | -           | -         |

### 3.5. Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

| Test Items                     | Mode                         | Data Rate | Channel               | Chain |
|--------------------------------|------------------------------|-----------|-----------------------|-------|
| AC Power Conducted Emissions   | Normal Link                  | -         | -                     | -     |
| Maximum Conducted Output Power | BR (GFSK)                    | 1 Mbps    | 0/39/78               | 1     |
|                                | EDR ( $\pi/4$ -DQPSK)        | 2 Mbps    | 0/39/78               | 1     |
|                                | EDR (8DPSK)                  | 3 Mbps    | 0/39/78               | 1     |
| Hopping Channel Separation     | BR (GFSK)                    | 1 Mbps    | 0~1<br>39~40<br>77~78 | 1     |
|                                | EDR ( $\pi/4$ -DQPSK)        | 2 Mbps    | 0~1<br>39~40<br>77~78 | 1     |
|                                | EDR (8DPSK)                  | 3 Mbps    | 0~1<br>39~40<br>77~78 | 1     |
| Number of Hopping Frequency    | BR (GFSK)                    | 1 Mbps    | 0~78                  | 1     |
| Dwell Time                     | BR (GFSK)<br>(DH1, DH3, DH5) | 1 Mbps    | 0/39/78               | 1     |
| Radiated Emissions Below 1GHz  | Normal Link                  | -         | -                     | -     |
| Radiated Emissions Above 1GHz  | BR (GFSK)                    | 1 Mbps    | 0/39/78               | 1     |
|                                | EDR (8DPSK)                  | 3 Mbps    | 0/39/78               | 1     |
| Band Edge Emissions            | BR (GFSK)                    | 1 Mbps    | 0/39/78               | 1     |
|                                | EDR (8DPSK)                  | 3 Mbps    | 0/39/78               | 1     |

The following test modes were performed for all tests:

**For Conducted Emission test:**

Mode 1. Normal Link -2.4GHz WLAN function + Bluetooth function

Mode 2. Normal Link -5GHz WLAN function + Bluetooth function

Mode 1 is the worst case, so it was selected to record in this test report.

**For Radiated Emission Below 1GHz test:**

Mode 1. Normal Link -2.4GHz WLAN function + Bluetooth function

Mode 2. Normal Link -5GHz WLAN function + Bluetooth function

Mode 1 is the worst case, so it was selected to record in this test report.

**For Radiated Emission Above 1GHz test:**

Mode 1. CTX-EUT

**For Co-location test:**

Mode 1. 2.4GHz WLAN function + Bluetooth function

Mode 2. 5GHz WLAN function + Bluetooth function

**For MPE and Co-location Test:**

The EUT could be applied 2.4GHz / 5GHz with WLAN function and Bluetooth function; therefore Maximum Permissible Exposure (please refer to Appendix C) and Co-location (please refer to Appendix B) tests are added for simultaneously transmit between 2.4GHz / 5GHz WLAN function and Bluetooth function.

### 3.6. Table for Testing Locations

| Test Site Location |                                                                            |          |              |             |              |
|--------------------|----------------------------------------------------------------------------|----------|--------------|-------------|--------------|
| Address:           | No.8, Lane 724, Bo-ai St., Jhubei City, Hsinchu County 302, Taiwan, R.O.C. |          |              |             |              |
| TEL:               | 886-3-656-9065                                                             |          |              |             |              |
| FAX:               | 886-3-656-9085                                                             |          |              |             |              |
| Test Site No.      | Site Category                                                              | Location | FCC Reg. No. | IC File No. | VCCI Reg. No |
| 03CH01-CB          | SAC                                                                        | Hsin Chu | 262045       | IC 4086D    | -            |
| CO01-CB            | Conduction                                                                 | Hsin Chu | 262045       | IC 4086D    | -            |
| TH01-CB            | OVEN Room                                                                  | Hsin Chu | -            | -           | -            |

Open Area Test Site (OATS); Semi Anechoic Chamber (SAC).

### 3.7. Table for Supporting Units

For Test Site No: CO01-CB and 03CH01-CB (Below 1GHz)

| Support Unit                                                               | Brand      | Model         | FCC ID       |
|----------------------------------------------------------------------------|------------|---------------|--------------|
| Wireless AP                                                                | Planex     | GW-AP54SGX    | N/A          |
| NB                                                                         | DELL       | E6220         | DoC          |
| NB                                                                         | DELL       | E6430         | DoC          |
| Mouse                                                                      | Logitech   | M-U0026       | DoC          |
| Earphone                                                                   | SHYARO CHI | MIC-04        | N/A          |
| Test fixture*2                                                             | Broadcom   | BCM9NGFF2EC_1 | N/A          |
| Broadcom 802.11a/b/g/n/ac WLAN + Bluetooth 4.0 NGFF2230 Mini Card (Device) | Broadcom   | BCM943162ZP   | QDS-BRCM1075 |

For Test Site No: 03CH01-CB (Above 1GHz)

| Support Unit | Brand    | Model         | FCC ID |
|--------------|----------|---------------|--------|
| NB           | DELL     | E6220         | DoC    |
| Test fixture | Broadcom | BCM9NGFF2EC_1 | N/A    |

For Test Site No: TH01-CB

| Support Unit | Brand    | Model         | FCC ID |
|--------------|----------|---------------|--------|
| NB           | DELL     | E6510         | N/A    |
| Test fixture | Broadcom | BCM9NGFF2EC_1 | N/A    |

### 3.8. Table for Parameters of Test Software Setting

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

#### Power Parameters of Bluetooth

For BR (GFSK) 1 Mbps:

| Test Software Version | Broadcom Blue Tool V1.7.2.5 |          |          |
|-----------------------|-----------------------------|----------|----------|
| Frequency             | 2402 MHz                    | 2441 MHz | 2480 MHz |
| Power Parameters      | 0                           | 0        | 0        |

For EDR ( $\pi/4$ -DQPSK) 2 Mbps:

| Test Software Version | Broadcom Blue Tool V1.7.2.5 |          |          |
|-----------------------|-----------------------------|----------|----------|
| Frequency             | 2402 MHz                    | 2441 MHz | 2480 MHz |
| Power Parameters      | 0                           | 0        | 0        |

For EDR (8DPSK) 3 Mbps:

| Test Software Version | Broadcom Blue Tool V1.7.2.5 |          |          |
|-----------------------|-----------------------------|----------|----------|
| Frequency             | 2402 MHz                    | 2441 MHz | 2480 MHz |
| Power Parameters      | 0                           | 0        | 0        |

### 3.9. EUT Operation during Test

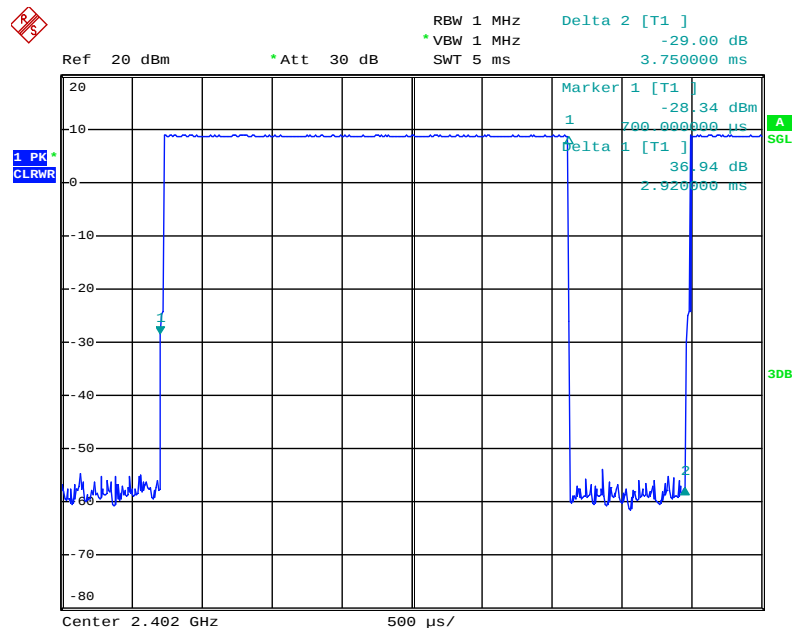
The EUT was programmed to be in continuously transmitting mode.

### 3.10. Test Signal Duty Cycle

| Band | Mode                  | TX-on (ms) | TX-on+TX-off (ms) | TX-on/(TX-on+TX-off)x100=Duty cycle (%) |
|------|-----------------------|------------|-------------------|-----------------------------------------|
| 2.4G | BR (GFSK)             | 2.92       | 3.75              | 77.87                                   |
|      | EDR ( $\pi/4$ -DQPSK) | 2.92       | 3.74              | 78.07                                   |
|      | EDR (8DPSK)           | 2.93       | 3.74              | 78.34                                   |

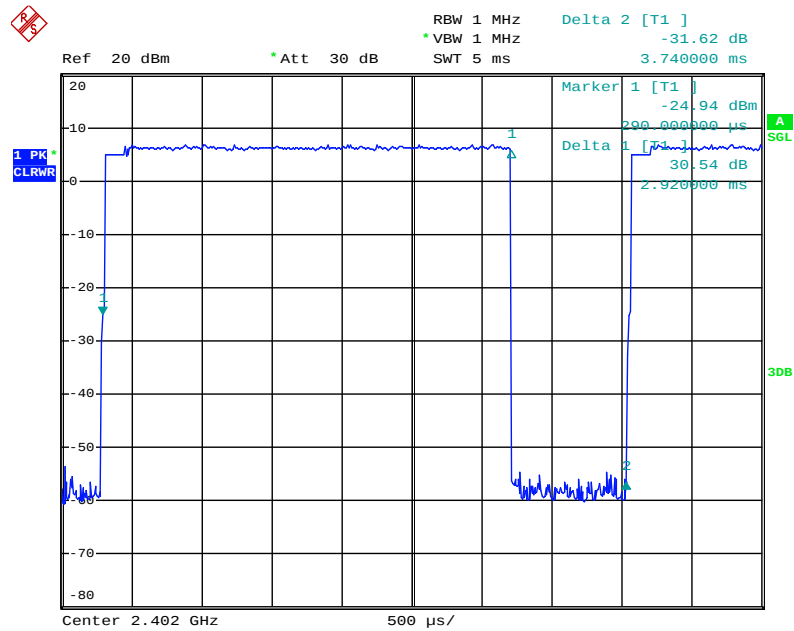
### 3.11. Plots of Duty Cycle

BR (GFSK)



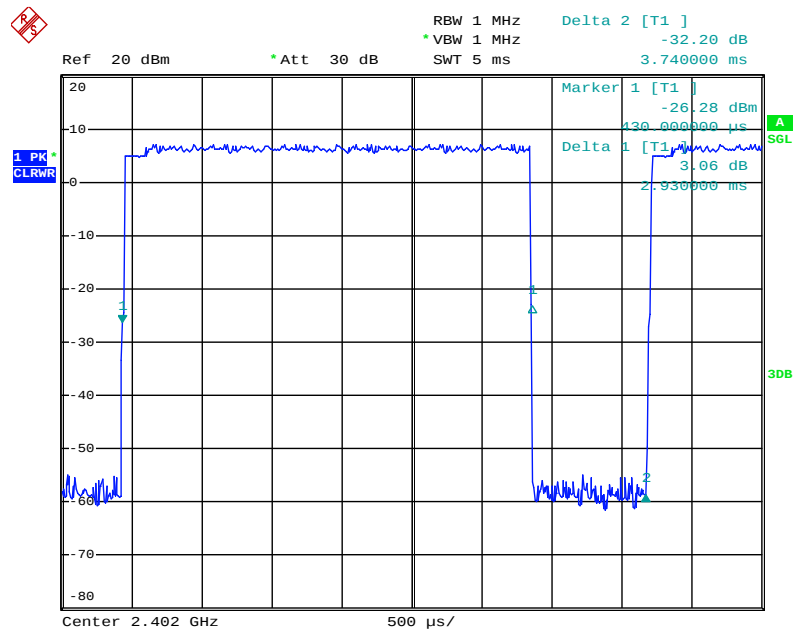
Date: 23.JAN.2014 02:36:51

### EDR ( $\pi/4$ -DQPSK)



Date: 23.JAN.2014 02:33:24

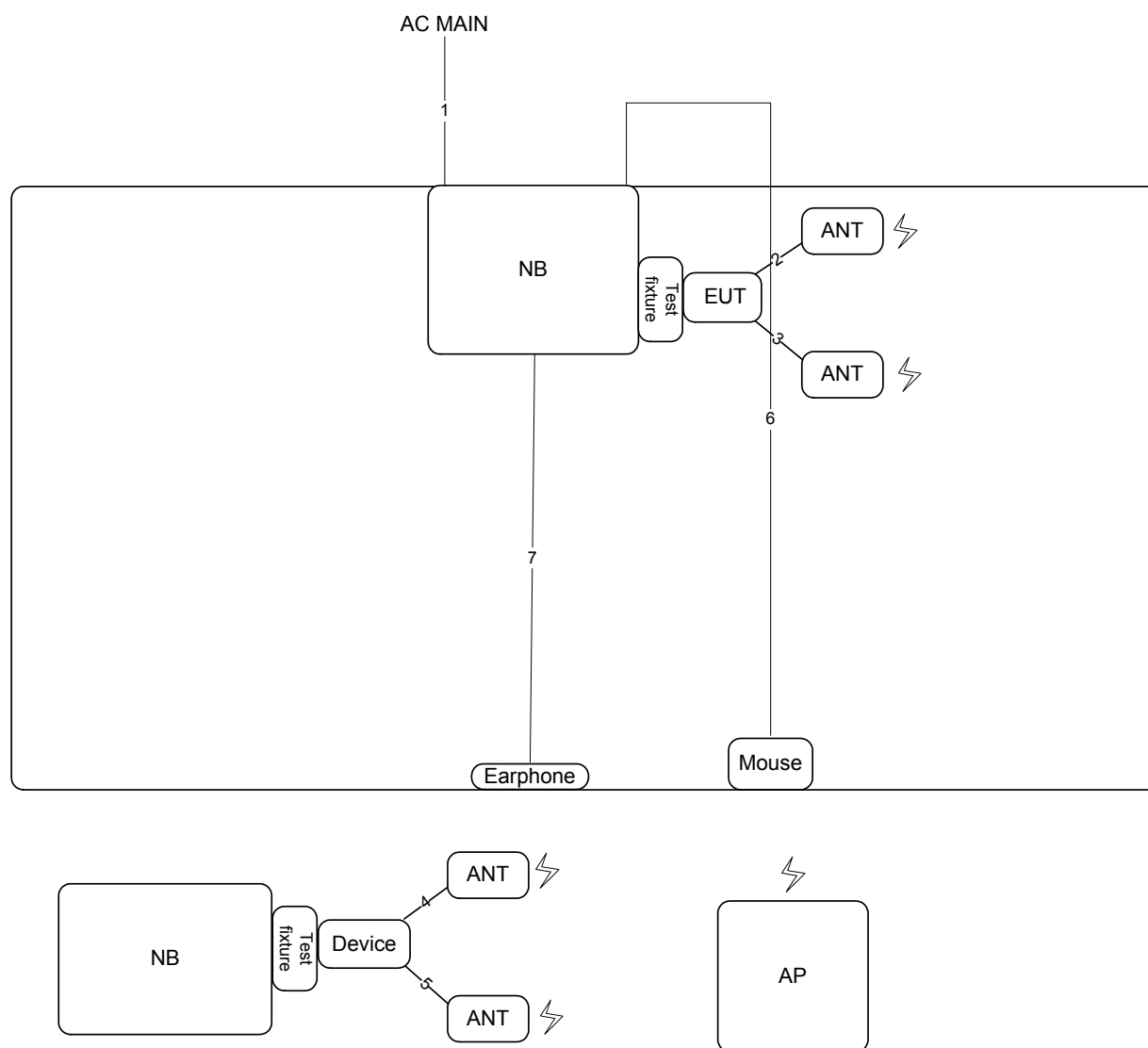
### EDR (8DPSK)



Date: 23.JAN.2014 02:37:49

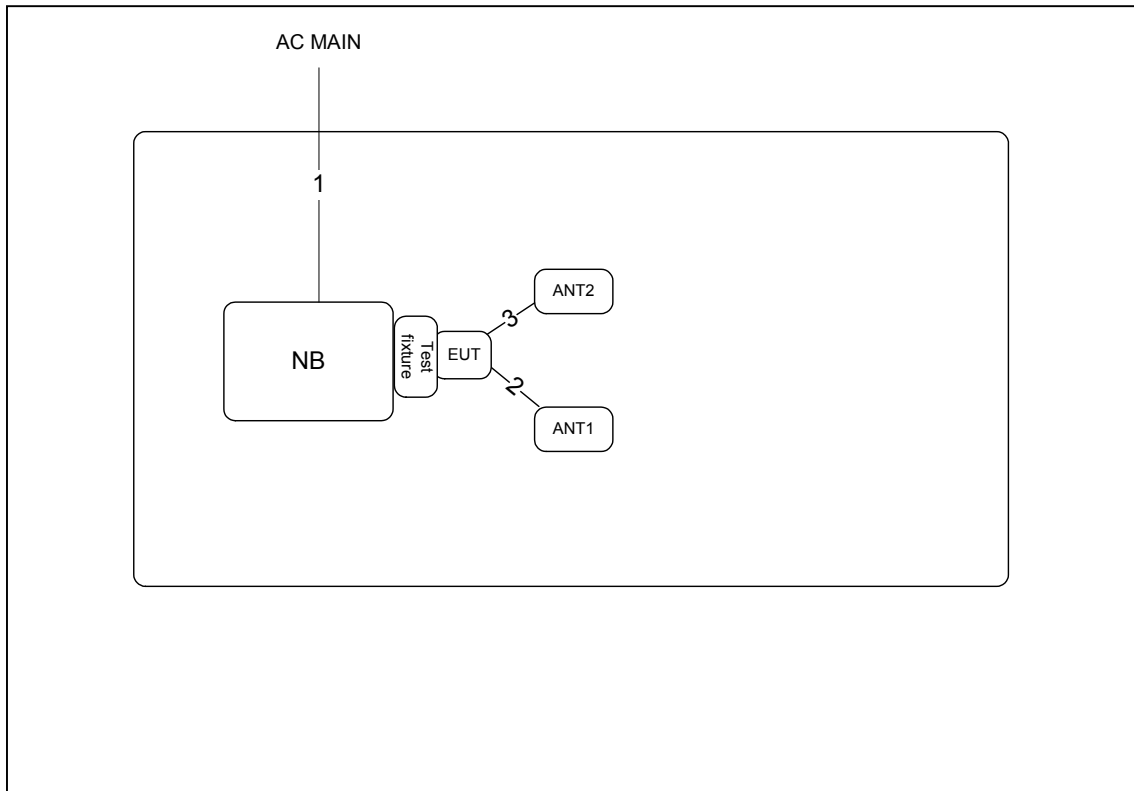
## 3.12. Test Configurations

### 3.12.1. AC Power Line Conduction and Radiation Emissions Below 1GHz Test Configuration



| Item | Connection  | Shielded | Length |
|------|-------------|----------|--------|
| 1    | Power cable | No       | 2.6m   |
| 2    | ANT cable   | Yes      | 0.2m   |
| 3    | ANT cable   | Yes      | 0.2m   |
| 4    | ANT cable   | Yes      | 0.2m   |
| 5    | ANT cable   | Yes      | 0.2m   |
| 6    | USB cable   | Yes      | 1.8m   |
| 7    | Audio cable | No       | 1.1m   |

### 3.12.2. Radiation Emissions Above 1GHz Test Configuration



| Item | Connection  | Shielded | Length |
|------|-------------|----------|--------|
| 1    | Power cable | No       | 2.6m   |
| 2    | ANT cable   | Yes      | 0.2m   |
| 3    | ANT cable   | Yes      | 0.2m   |

## 4. TEST RESULT

### 4.1. AC Power Line Conducted Emissions Measurement

#### 4.1.1. Limit

For a Low-power Radio-frequency Device which is designed to be connected to the 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 below limits table.

| Frequency (MHz) | QP Limit (dBuV) | AV Limit (dBuV) |
|-----------------|-----------------|-----------------|
| 0.15~0.5        | 66~56           | 56~46           |
| 0.5~5           | 56              | 46              |
| 5~30            | 60              | 50              |

#### 4.1.2. Measuring Instruments and Setting

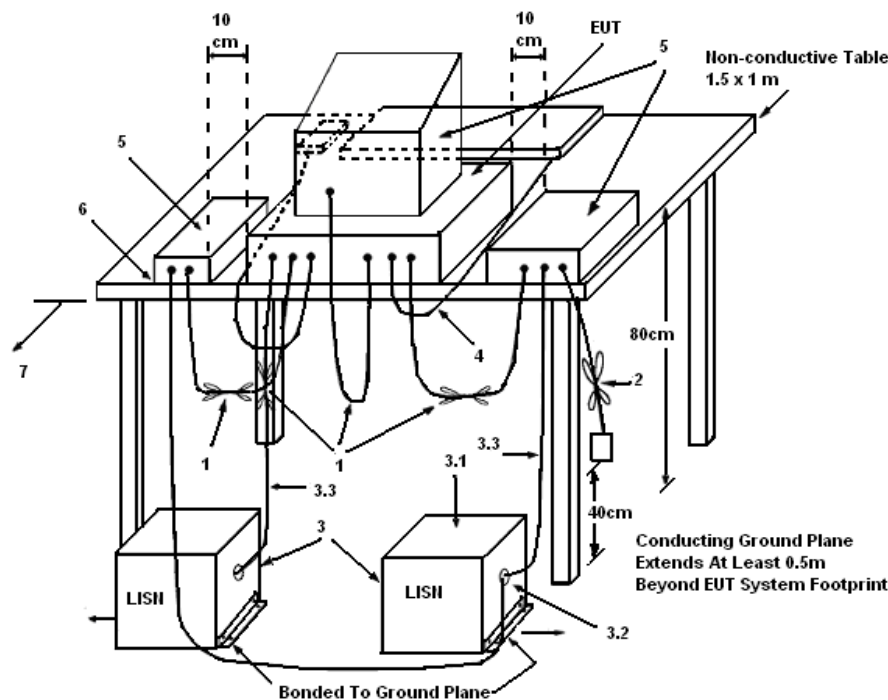
Please refer to section 5 of equipments list in this report. The following table is the setting of the receiver.

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

#### 4.1.3. Test Procedures

1. Configure the EUT according to ANSI C63.4. The EUT or host of EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connected to the other LISNs. The LISN should provide 50uH/50ohms coupling impedance.
4. The frequency range from 150 kHz to 30 MHz was searched.
5. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. The measurement has to be done between each power line and ground at the power terminal.

#### 4.1.4. Test Setup Layout



##### LEGEND:

- (1) Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- (2) I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- (3) EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50  $\Omega$ . LISN can be placed on top of, or immediately beneath, reference ground plane.
- (3.1) All other equipment powered from additional LISN(s).
- (3.2) Multiple outlet strip can be used for multiple power cords of non-EUT equipment.
- (3.3) LISN at least 80 cm from nearest part of EUT chassis.
- (4) Cables of hand-operated devices, such as keyboards, mice, etc., shall be placed as for normal use.
- (5) Non-EUT components of EUT system being tested.
- (6) Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.
- (7) Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground plane.

#### 4.1.5. Test Deviation

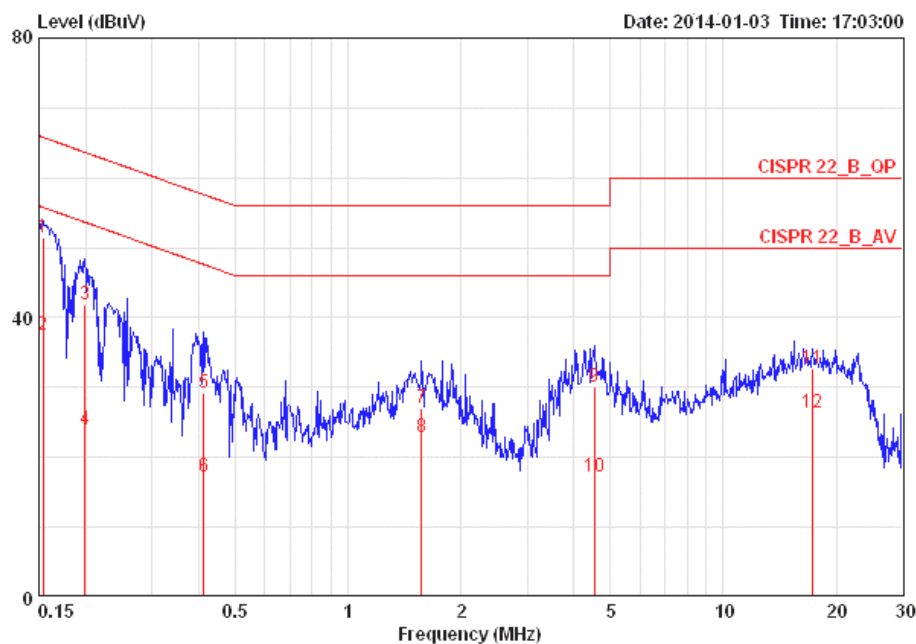
There is no deviation with the original standard.

#### 4.1.6. EUT Operation during Test

The EUT was placed on the test table and programmed in normal function.

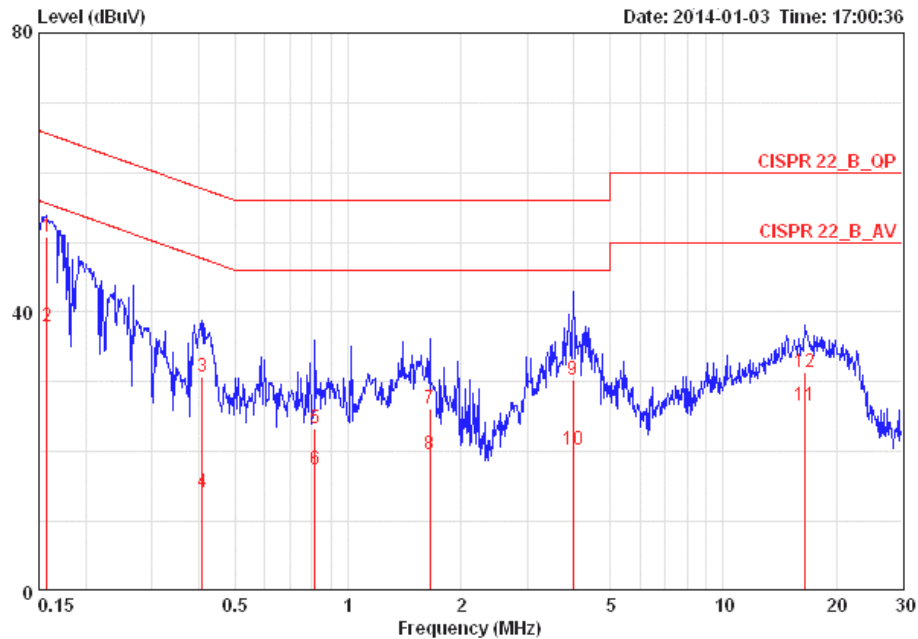
#### 4.1.7. Results of AC Power Line Conducted Emissions Measurement

|               |             |           |        |
|---------------|-------------|-----------|--------|
| Temperature   | 25°C        | Humidity  | 52%    |
| Test Engineer | Justin Chiu | Phase     | Line   |
| Configuration | Normal Link | Test Mode | Mode 1 |



|    | Freq    | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark  | Pol/Phase |
|----|---------|-------|------------|------------|------------|-------------|------------|---------|-----------|
|    | MHz     | dBuV  | dB         | dBuV       | dBuV       | dB          | dB         |         |           |
| 1  | 0.15403 | 51.48 | -14.30     | 65.78      | 51.17      | 0.15        | 0.16       | QP      | LINE      |
| 2  | 0.15403 | 37.53 | -18.25     | 55.78      | 37.22      | 0.15        | 0.16       | AVERAGE | LINE      |
| 3  | 0.19863 | 41.83 | -21.83     | 63.67      | 41.52      | 0.15        | 0.16       | QP      | LINE      |
| 4  | 0.19863 | 24.04 | -29.62     | 53.67      | 23.73      | 0.15        | 0.16       | AVERAGE | LINE      |
| 5  | 0.41266 | 29.25 | -28.34     | 57.59      | 28.92      | 0.15        | 0.18       | QP      | LINE      |
| 6  | 0.41266 | 17.23 | -30.36     | 47.59      | 16.90      | 0.15        | 0.18       | AVERAGE | LINE      |
| 7  | 1.568   | 27.12 | -28.88     | 56.00      | 26.71      | 0.18        | 0.23       | QP      | LINE      |
| 8  | 1.568   | 22.83 | -23.17     | 46.00      | 22.42      | 0.18        | 0.23       | AVERAGE | LINE      |
| 9  | 4.525   | 30.12 | -25.88     | 56.00      | 29.52      | 0.29        | 0.31       | QP      | LINE      |
| 10 | 4.525   | 17.19 | -28.81     | 46.00      | 16.59      | 0.29        | 0.31       | AVERAGE | LINE      |
| 11 | 17.291  | 32.62 | -27.38     | 60.00      | 31.60      | 0.54        | 0.48       | QP      | LINE      |
| 12 | 17.291  | 26.45 | -23.55     | 50.00      | 25.43      | 0.54        | 0.48       | AVERAGE | LINE      |

|               |             |           |         |
|---------------|-------------|-----------|---------|
| Temperature   | 25°C        | Humidity  | 52%     |
| Test Engineer | Justin Chiu | Phase     | Neutral |
| Configuration | Normal Link | Test Mode | Mode 1  |



|     | Freq    | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark  | Pol/Phase |
|-----|---------|-------|------------|------------|------------|-------------|------------|---------|-----------|
|     | MHz     | dBuV  | dB         | dBuV       | dBuV       | dB          | dB         |         |           |
| 1 @ | 0.15733 | 50.75 | -14.85     | 65.60      | 50.52      | 0.07        | 0.16       | QP      | NEUTRAL   |
| 2 @ | 0.15733 | 37.89 | -17.71     | 55.60      | 37.66      | 0.07        | 0.16       | AVERAGE | NEUTRAL   |
| 3   | 0.40831 | 30.65 | -27.03     | 57.68      | 30.40      | 0.07        | 0.18       | QP      | NEUTRAL   |
| 4   | 0.40831 | 14.26 | -33.42     | 47.68      | 14.01      | 0.07        | 0.18       | AVERAGE | NEUTRAL   |
| 5   | 0.81737 | 23.29 | -32.71     | 56.00      | 23.02      | 0.08        | 0.20       | QP      | NEUTRAL   |
| 6   | 0.81737 | 17.42 | -28.58     | 46.00      | 17.15      | 0.08        | 0.20       | AVERAGE | NEUTRAL   |
| 7   | 1.654   | 26.16 | -29.84     | 56.00      | 25.82      | 0.10        | 0.24       | QP      | NEUTRAL   |
| 8   | 1.654   | 19.56 | -26.44     | 46.00      | 19.22      | 0.10        | 0.24       | AVERAGE | NEUTRAL   |
| 9   | 3.985   | 30.40 | -25.60     | 56.00      | 29.97      | 0.13        | 0.30       | QP      | NEUTRAL   |
| 10  | 3.985   | 20.33 | -25.67     | 46.00      | 19.90      | 0.13        | 0.30       | AVERAGE | NEUTRAL   |
| 11  | 16.486  | 26.51 | -23.49     | 50.00      | 25.66      | 0.39        | 0.47       | AVERAGE | NEUTRAL   |
| 12  | 16.486  | 31.45 | -28.55     | 60.00      | 30.60      | 0.39        | 0.47       | QP      | NEUTRAL   |

Note: Level = Read Level + LISN Factor + Cable Loss.

## 4.2. Maximum Conducted Output Power Measurement

### 4.2.1. Limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, the limit for peak output power is 1Watt (30dBm). For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts (21dBm). The limited has to be reduced by the amount in dB that the gain of the antenna exceed 6dBi. In case of point-to-point operation, the limit has to be reduced by 1 dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

### 4.2.2. Measuring Instruments and Setting

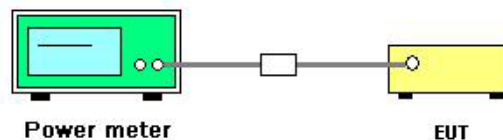
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

| Power Meter Parameter | Setting                                                    |
|-----------------------|------------------------------------------------------------|
| Bandwidth             | 50MHz bandwidth is greater than the EUT emission bandwidth |
| Detector              | Peak and Average                                           |

### 4.2.3. Test Procedures

This procedure provides an alternative for determining the RMS output power using a broadband RF average power meter with a thermocouple detector.

### 4.2.4. Test Setup Layout



### 4.2.5. Test Deviation

There is no deviation with the original standard.

### 4.2.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

#### 4.2.7. Test Result of Maximum Conducted Output Power

|               |               |                |                             |
|---------------|---------------|----------------|-----------------------------|
| Temperature   | 20°C          | Humidity       | 53%                         |
| Test Engineer | Wen Chao      | Configurations | GFSK, $\pi/4$ -DQPSK, 8DPSK |
| Test Date     | Jan. 23, 2014 |                |                             |

For BR (GFSK) 1 Mbps:

| Channel | Frequency | Conducted Average Power (dBm) | Conducted Peak Power (dBm) | Max. Limit (dBm) | Result   |
|---------|-----------|-------------------------------|----------------------------|------------------|----------|
| 0       | 2402 MHz  | 9.56                          | 9.96                       | 30.00            | Complies |
| 39      | 2441 MHz  | 9.81                          | 10.12                      | 30.00            | Complies |
| 78      | 2480 MHz  | 9.77                          | 9.81                       | 30.00            | Complies |

For EDR ( $\pi/4$ -DQPSK) 2 Mbps:

| Channel | Frequency | Conducted Average Power (dBm) | Conducted Peak Power (dBm) | Max. Limit (dBm) | Result   |
|---------|-----------|-------------------------------|----------------------------|------------------|----------|
| 0       | 2402 MHz  | 6.93                          | 9.62                       | 30.00            | Complies |
| 39      | 2441 MHz  | 7.24                          | 9.83                       | 30.00            | Complies |
| 78      | 2480 MHz  | 7.06                          | 9.26                       | 30.00            | Complies |

For EDR (8DPSK) 3 Mbps:

| Channel | Frequency | Conducted Average Power (dBm) | Conducted Peak Power (dBm) | Max. Limit (dBm) | Result   |
|---------|-----------|-------------------------------|----------------------------|------------------|----------|
| 0       | 2402 MHz  | 7.29                          | 9.37                       | 30.00            | Complies |
| 39      | 2441 MHz  | 7.48                          | 9.42                       | 30.00            | Complies |
| 78      | 2480 MHz  | 7.3                           | 9.15                       | 30.00            | Complies |

### 4.3. Hopping Channel Separation Measurement

#### 4.3.1. Limit

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.

#### 4.3.2. Measuring Instruments and Setting

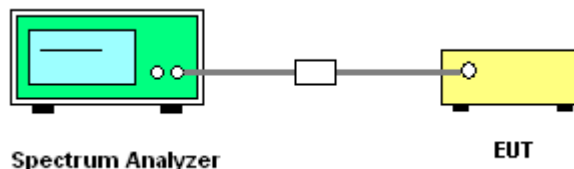
Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer.

| Spectrum Parameter | Setting                                                 |
|--------------------|---------------------------------------------------------|
| Attenuation        | Auto                                                    |
| Span Frequency     | > Measurement Bandwidth or Channel Separation           |
| RBW                | 30 kHz (20dB Bandwidth) / 100 kHz (Channel Separation)  |
| VBW                | 100 kHz (20dB Bandwidth) / 100 kHz (Channel Separation) |
| Detector           | Peak                                                    |
| Trace              | Max Hold                                                |
| Sweep Time         | Auto                                                    |

#### 4.3.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilized for 20 dB bandwidth measurement.
3. The resolution bandwidth of 100 kHz and the video bandwidth of 100 kHz were utilized for channel separation measurement.

#### 4.3.4. Test Setup Layout



#### 4.3.5. Test Deviation

There is no deviation with the original standard.

#### 4.3.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

#### 4.3.7. Test Result of Hopping Channel Separation

|               |          |                |                             |
|---------------|----------|----------------|-----------------------------|
| Temperature   | 20°C     | Humidity       | 53%                         |
| Test Engineer | Wen Chao | Configurations | GFSK, $\pi/4$ -DQPSK, 8DPSK |

For BR (GFSK) 1 Mbps:

| Frequency | 20dB Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) | Ch. Separation (MHz) | Two-Thirds of 20dB Bandwidth (MHz) | Result   |
|-----------|----------------------|------------------------------|----------------------|------------------------------------|----------|
| 2402 MHz  | 0.9280               | 0.8840                       | 1.00                 | 0.619                              | Complies |
| 2441 MHz  | 0.9920               | 0.8960                       | 1.00                 | 0.661                              | Complies |
| 2480 MHz  | 1.0080               | 0.8960                       | 1.00                 | 0.672                              | Complies |

Ch. Separation Limits: >20dB bandwidth or > Two-Thirds of 20dB bandwidth

For EDR ( $\pi/4$ -DQPSK) 2 Mbps:

| Frequency | 20dB Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) | Ch. Separation (MHz) | Two-Thirds of 20dB Bandwidth (MHz) | Result   |
|-----------|----------------------|------------------------------|----------------------|------------------------------------|----------|
| 2402 MHz  | 1.3320               | 1.2080                       | 1.00                 | 0.888                              | Complies |
| 2441 MHz  | 1.3480               | 1.2120                       | 1.00                 | 0.899                              | Complies |
| 2480 MHz  | 1.3440               | 1.2120                       | 1.00                 | 0.896                              | Complies |

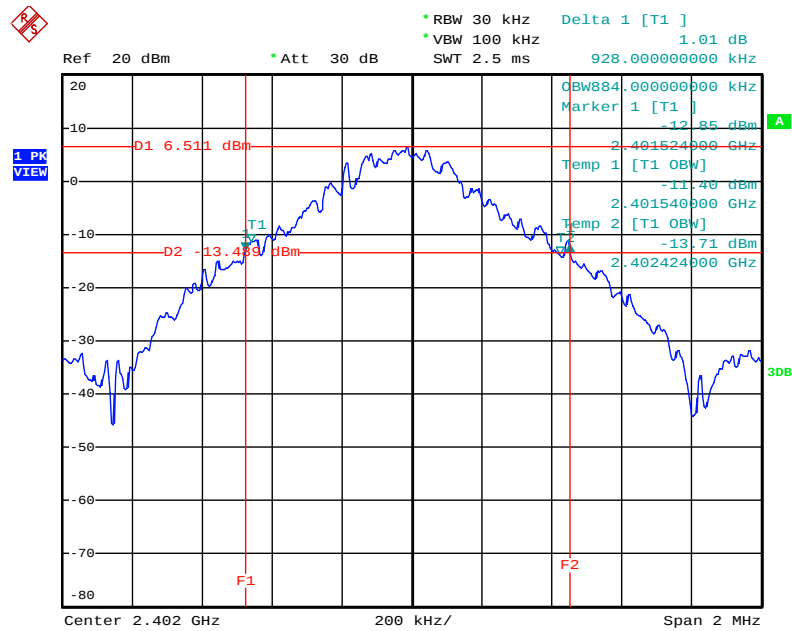
Ch. Separation Limits: >20dB bandwidth or > Two-Thirds of 20dB bandwidth

For EDR (8DPSK) 3 Mbps:

| Frequency | 20dB Bandwidth (MHz) | 99% Occupied Bandwidth (MHz) | Ch. Separation (MHz) | Two-Thirds of 20dB Bandwidth (MHz) | Result   |
|-----------|----------------------|------------------------------|----------------------|------------------------------------|----------|
| 2402 MHz  | 1.3480               | 1.2240                       | 1.00                 | 0.899                              | Complies |
| 2441 MHz  | 1.3320               | 1.2320                       | 1.00                 | 0.888                              | Complies |
| 2480 MHz  | 1.3320               | 1.2120                       | 1.00                 | 0.888                              | Complies |

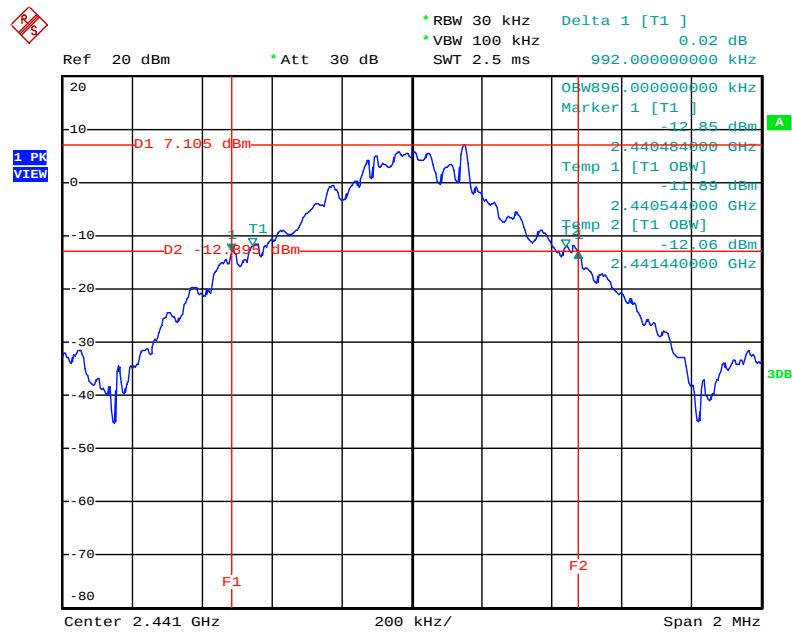
Ch. Separation Limits: >20dB bandwidth or > Two-Thirds of 20dB bandwidth

### 20 dB Bandwidth Plot on BR (GFSK) 1 Mbps / Channel 0 / 2402 MHz



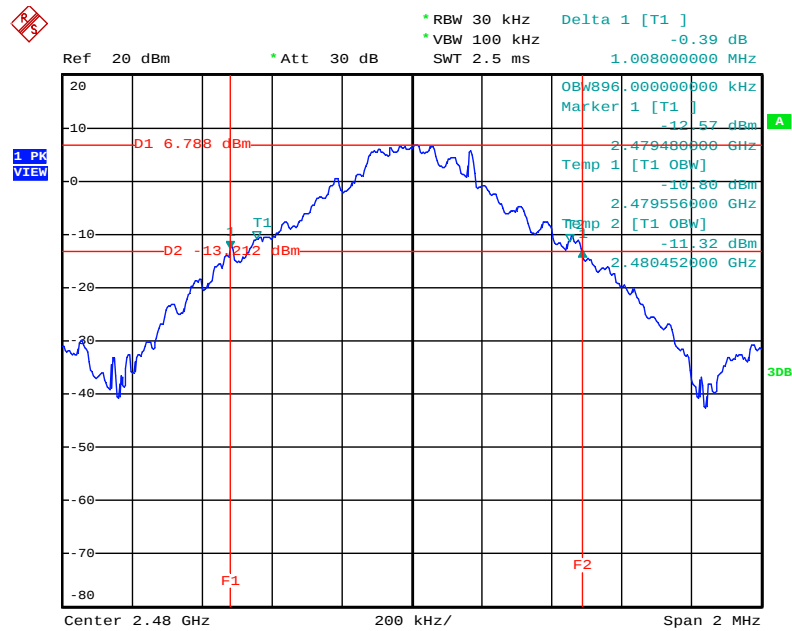
Date: 23.JAN.2014 02:47:23

### 20 dB Bandwidth Plot on BR (GFSK) 1 Mbps / Channel 39 / 2441 MHz



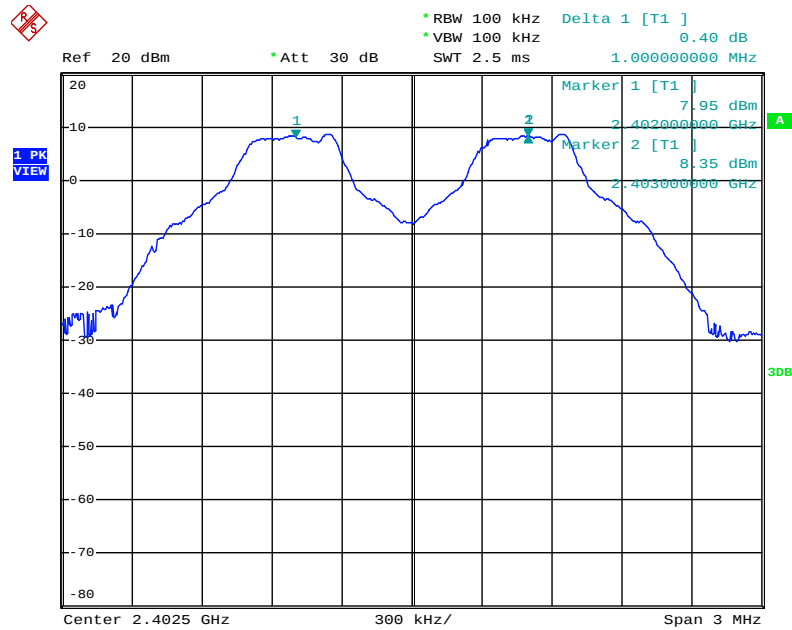
Date: 23.JAN.2014 02:46:54

### 20 dB Bandwidth Plot on BR (GFSK) 1 Mbps / Channel 78 / 2480 MHz



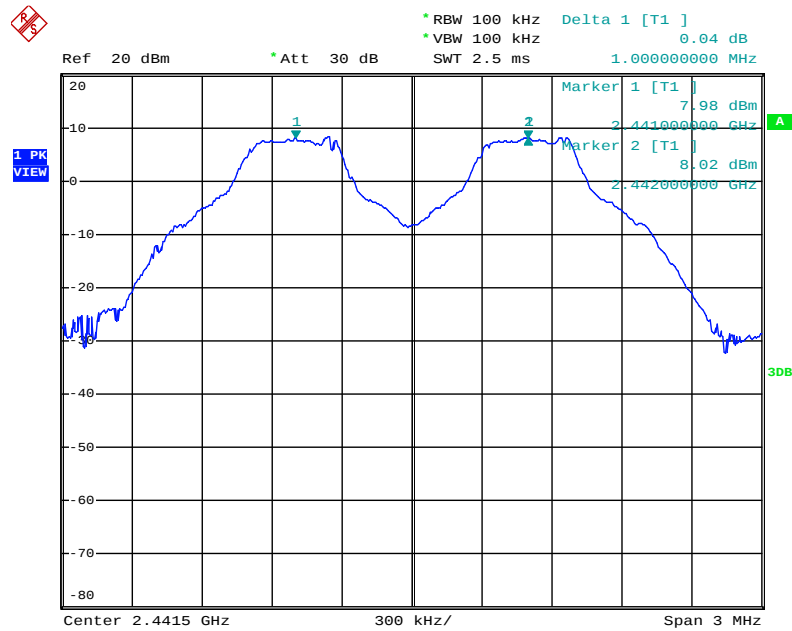
Date: 23.JAN.2014 02:46:09

### Channel Separation Plot on BR (GFSK) 1 Mbps / Channel 0~1 / 2402 MHz ~ 2403 MHz



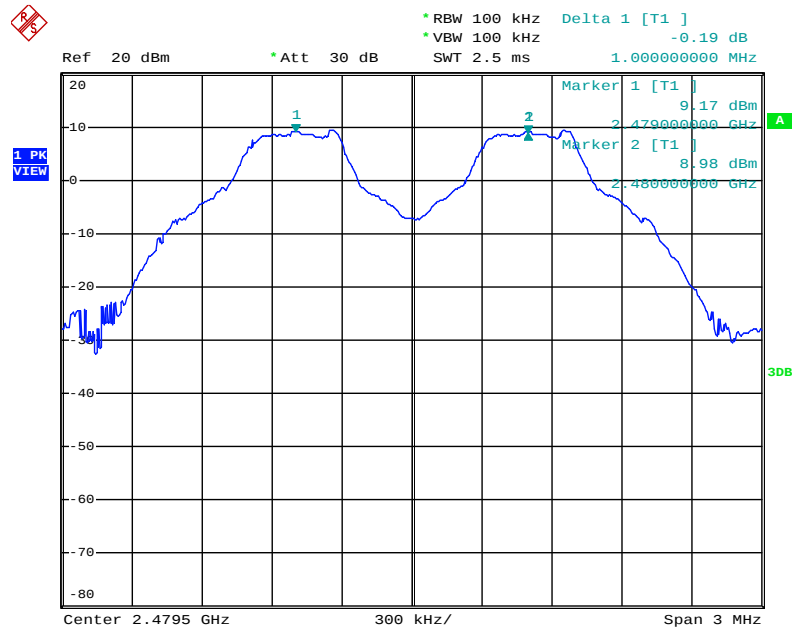
Date: 23.JAN.2014 02:49:29

### Channel Separation Plot on BR (GFSK) 1 Mbps / Channel 39~40 / 2441 MHz ~ 2442 MHz



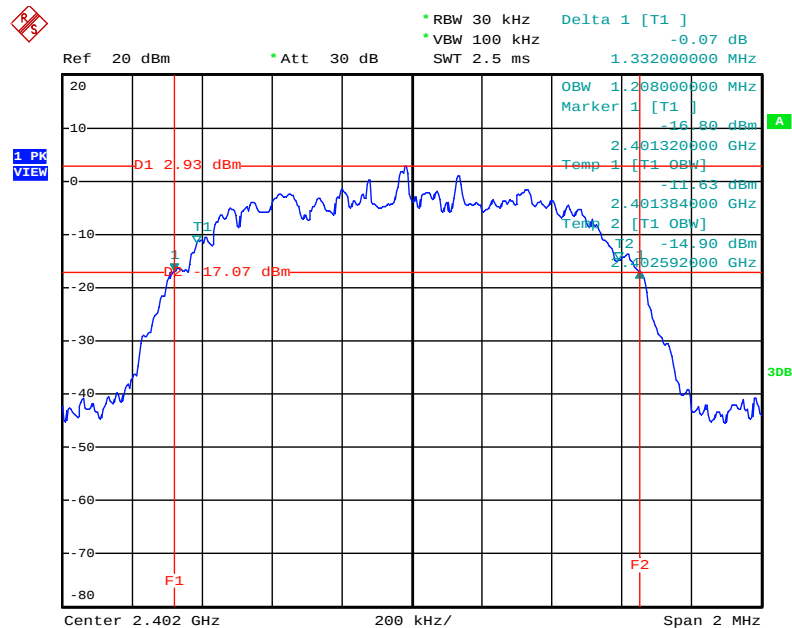
Date: 23.JAN.2014 02:50:52

### Channel Separation Plot on BR (GFSK) 1 Mbps / Channel 77~78 / 2479 MHz ~ 2480 MHz



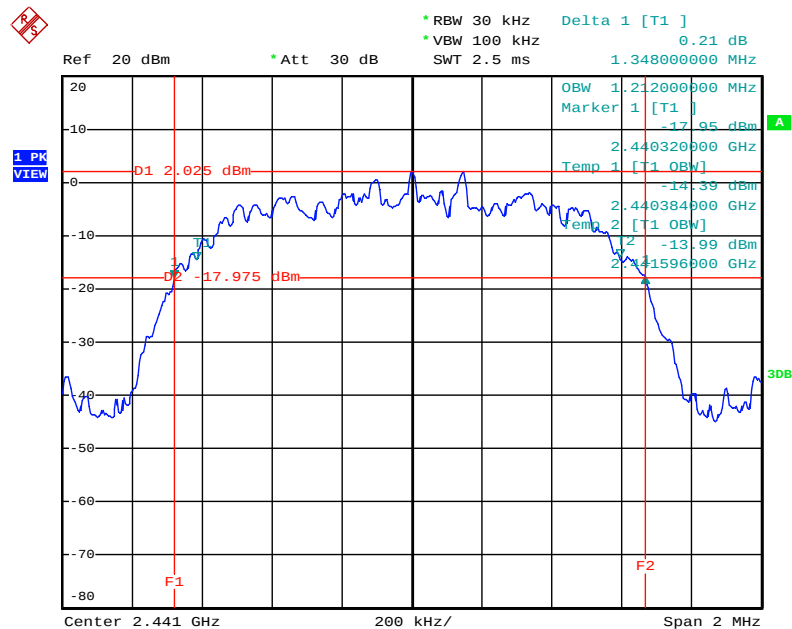
Date: 23.JAN.2014 02:51:32

### 20 dB Bandwidth Plot on EDR ( $\pi/4$ -DQPSK) 2 Mbps / Channel 0 / 2402 MHz



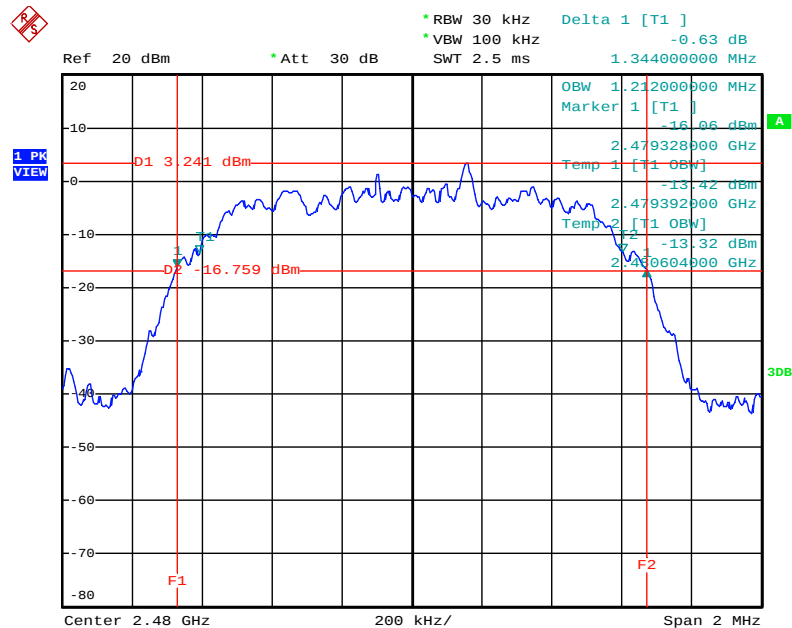
Date: 23.JAN.2014 02:44:25

### 20 dB Bandwidth Plot on EDR ( $\pi/4$ -DQPSK) 2 Mbps / Channel 39 / 2441 MHz



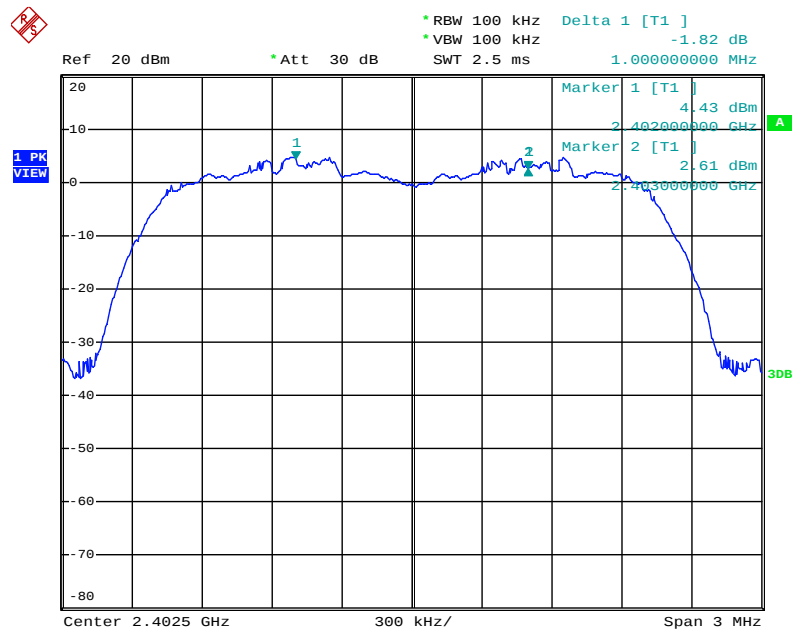
Date: 23.JAN.2014 02:45:02

### 20 dB Bandwidth Plot on EDR ( $\pi/4$ -DQPSK) 2 Mbps / Channel 78 / 2480 MHz



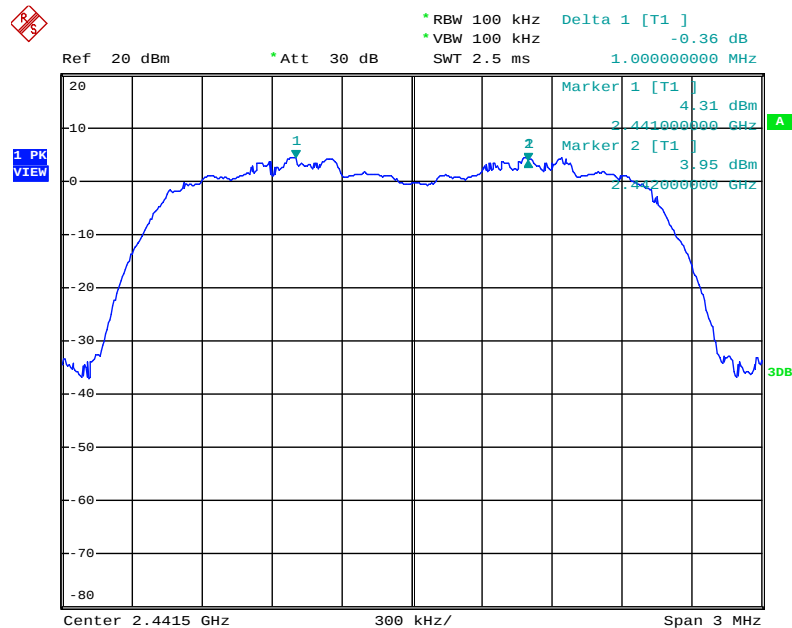
Date: 23.JAN.2014 02:45:34

### Channel Separation Plot on EDR ( $\pi/4$ -DQPSK) 2 Mbps / Channel 0~1 / 2402 MHz ~ 2403 MHz



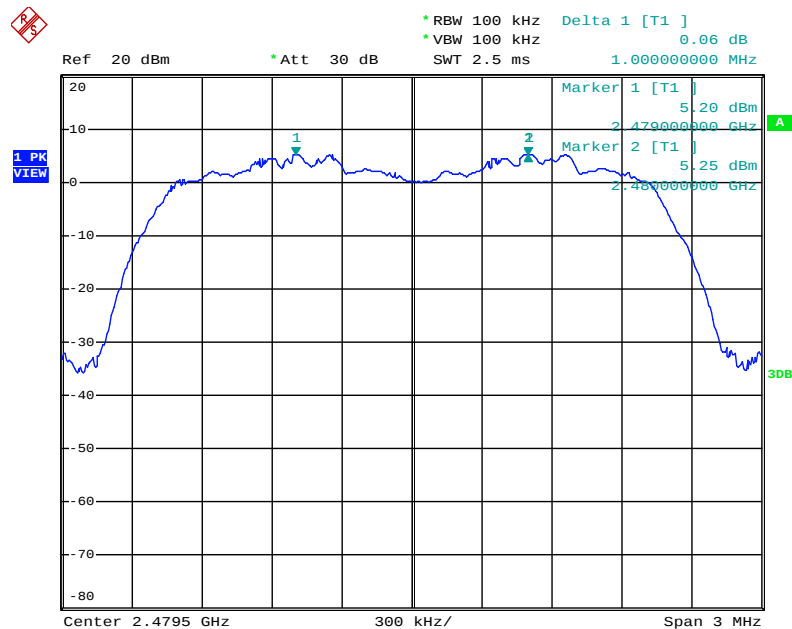
Date: 23.JAN.2014 02:54:02

### Channel Separation Plot on EDR ( $\pi/4$ -DQPSK) 2 Mbps / Channel 39~40 / 2441 MHz ~ 2442 MHz



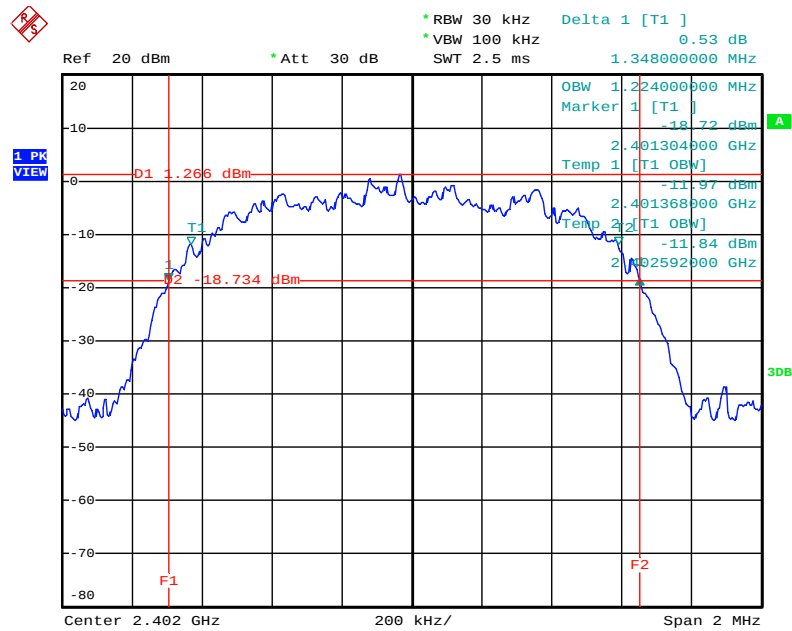
Date: 23.JAN.2014 02:53:20

### Channel Separation Plot on EDR ( $\pi/4$ -DQPSK) 2 Mbps / Channel 77~78 / 2479 MHz ~ 2480 MHz



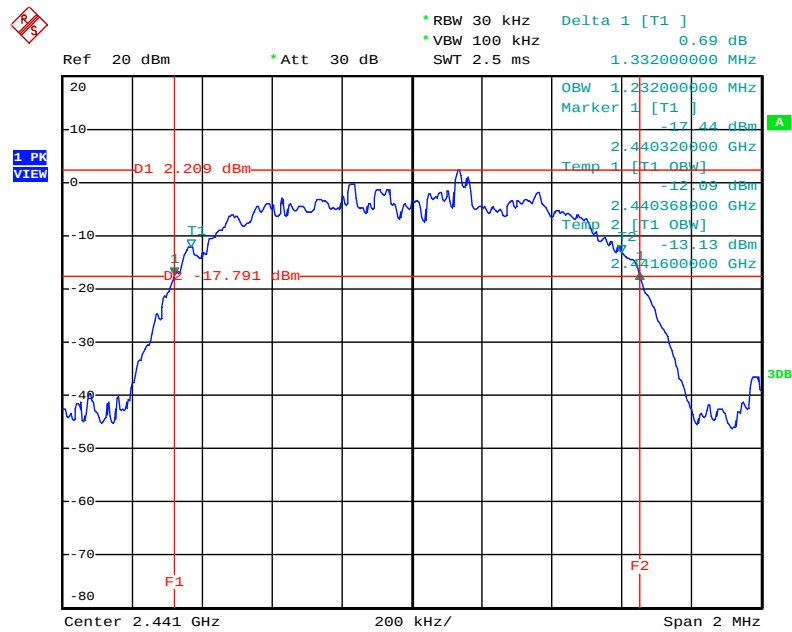
Date: 23.JAN.2014 02:52:38

### 20 dB Bandwidth Plot on EDR (8DPSK) 3 Mbps / Channel 0 / 2402 MHz



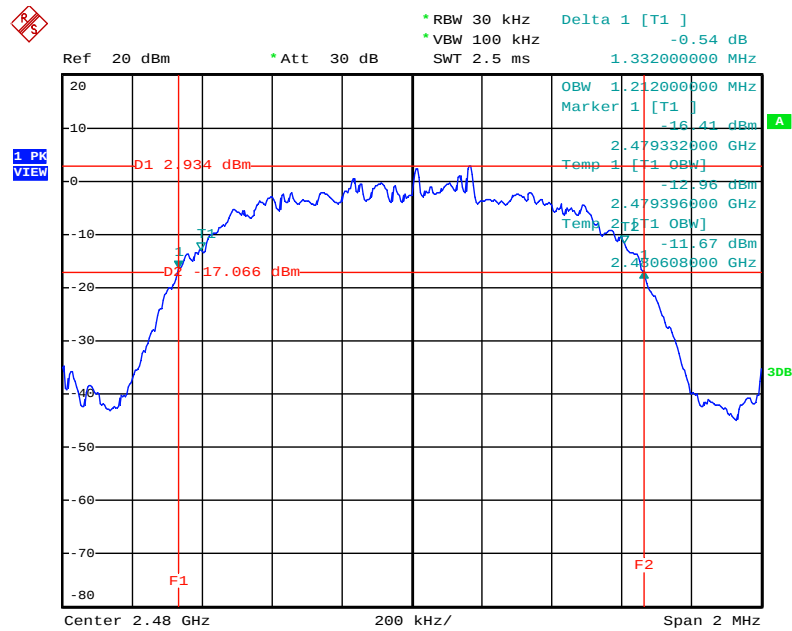
Date: 23.JAN.2014 02:43:01

### 20 dB Bandwidth Plot on EDR (8DPSK) 3 Mbps / Channel 39 / 2441 MHz



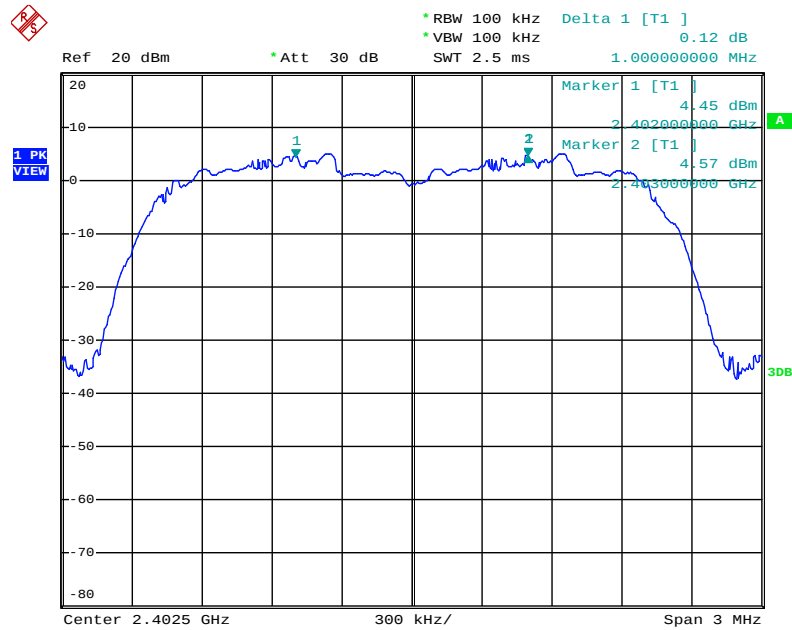
Date: 23.JAN.2014 02:42:33

### 20 dB Bandwidth Plot on EDR (8DPSK) 3 Mbps / Channel 78 / 2480 MHz



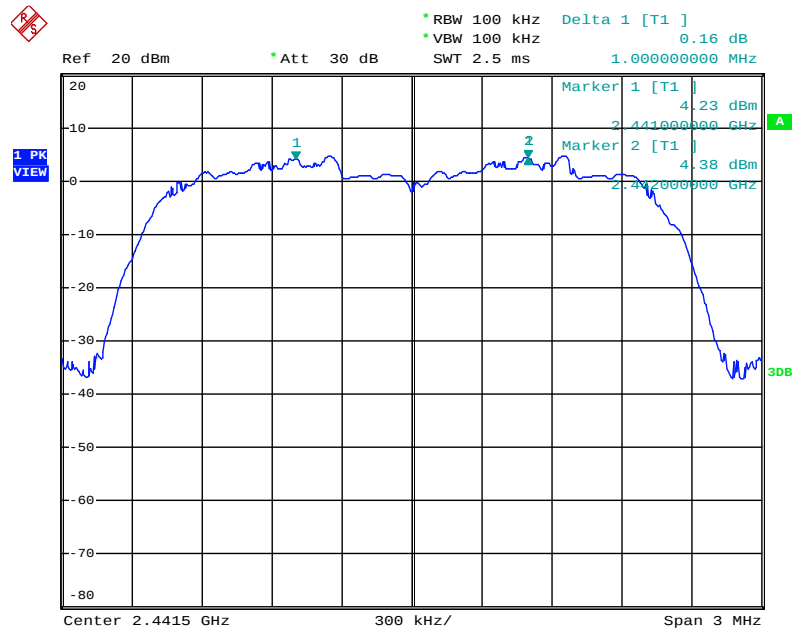
Date: 23.JAN.2014 02:41:49

### Channel Separation Plot on EDR (8DPSK) 3 Mbps / Channel 0~1 / 2402 MHz ~ 2403 MHz



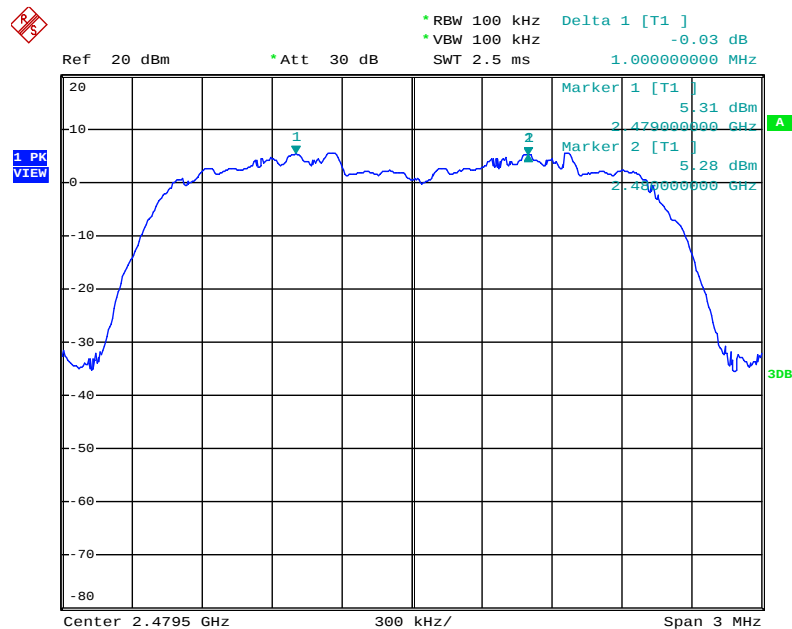
Date: 23.JAN.2014 02:55:07

### Channel Separation Plot on EDR (8DPSK) 3 Mbps / Channel 39~40 / 2441 MHz ~ 2442 MHz



Date: 23.JAN.2014 02:55:46

### Channel Separation Plot on EDR (8DPSK) 3 Mbps / Channel 77~78 / 2479 MHz ~ 2480 MHz



Date: 23.JAN.2014 02:56:27

#### 4.4. Number of Hopping Frequency Measurement

##### 4.4.1. Limit

At least 15 hopping frequencies, and should be equally spaced.

##### 4.4.2. Measuring Instruments and Setting

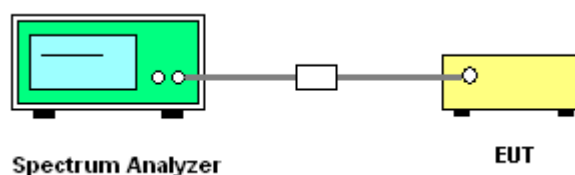
Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer.

| Spectrum Parameters | Setting                     |
|---------------------|-----------------------------|
| Attenuation         | Auto                        |
| Span Frequency      | > Operating Frequency Range |
| RBW                 | 1000 kHz                    |
| VBW                 | 1000 kHz                    |
| Detector            | Peak                        |
| Trace               | Max Hold                    |
| Sweep Time          | Auto                        |

##### 4.4.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. The resolution bandwidth of 1000 kHz and the video bandwidth of 1000 kHz were utilized.
3. Observe frequency hopping in 2400MHz~2483.5MHz, there are at least 75 non-overlapping channels.

##### 4.4.4. Test Setup Layout



##### 4.4.5. Test Deviation

There is no deviation with the original standard.

##### 4.4.6. EUT Operation during Test

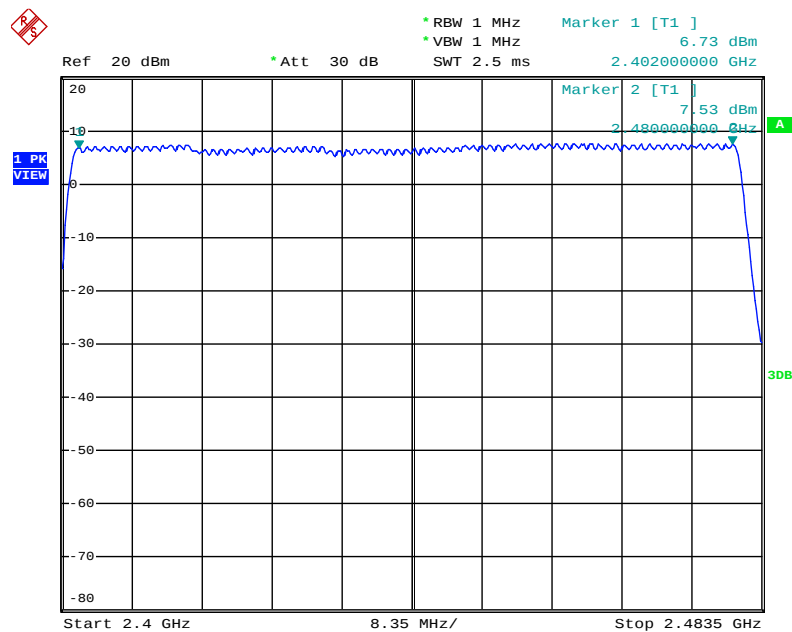
The EUT was programmed to be in continuously transmitting mode.

#### 4.4.7. Test Result of Number of Hopping Frequency

|               |          |                |             |
|---------------|----------|----------------|-------------|
| Temperature   | 20°C     | Humidity       | 53%         |
| Test Engineer | Wen Chao | Configurations | EDR (8DPSK) |

| Modulation Type | Channel No. | Frequency (MHz) | Hopping Ch. (Channels) | Min. Limit (Channels) | Test Result |
|-----------------|-------------|-----------------|------------------------|-----------------------|-------------|
| EDR (8DPSK)     | 0 ~ 78      | 2402 ~ 2480MHz  | 79                     | 15                    | Complies    |

#### Number of Hopping Channel Plot on EDR (8DPSK) / Channel 0~78 / 2402 MHz ~ 2480 MHz



Date: 23.JAN.2014 03:17:30

## 4.5. Dwell Time Measurement

### 4.5.1. Limit

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

### 4.5.2. Measuring Instruments and Setting

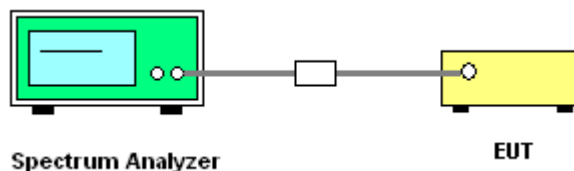
Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer.

| Spectrum Parameter | Setting        |
|--------------------|----------------|
| Attenuation        | Auto           |
| Span Frequency     | 0 MHz          |
| RBW                | 1000 kHz       |
| VBW                | 1000 kHz       |
| Detector           | Peak           |
| Trace              | Single Trigger |

### 4.5.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer
2. Set RBW of spectrum analyzer to 1000kHz and VBW to 1000kHz.
3. Use a video trigger with the trigger level set to enable triggering only on full pulses.
4. Sweep Time is more than once pulse time.
5. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
6. Measure the maximum time duration of one single pulse.
7. Set the EUT for DH1, DH3, DH5 packet transmitting.
8. Measure the maximum time duration of one single pulse.

### 4.5.4. Test Setup Layout



### 4.5.5. Test Deviation

There is no deviation with the original standard.

### 4.5.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

#### 4.5.7. Test Result of Dwell Time

|               |          |                |                           |
|---------------|----------|----------------|---------------------------|
| Temperature   | 20°C     | Humidity       | 53%                       |
| Test Engineer | Wen Chao | Configurations | BR (GFSK) / DH1, DH3, DH5 |

| Data Packet | Frequency (MHz) | Pulse Duration (ms) | Dwell Time (s) | Limits (s) | Test Result |
|-------------|-----------------|---------------------|----------------|------------|-------------|
| DH5         | 2402 MHz        | 2.9000              | 0.3093         | 0.4000     | Complies    |
| DH3         | 2402 MHz        | 1.6500              | 0.2640         | 0.4000     | Complies    |
| DH1         | 2402 MHz        | 0.3900              | 0.1248         | 0.4000     | Complies    |
| DH5         | 2441 MHz        | 2.9000              | 0.3093         | 0.4000     | Complies    |
| DH3         | 2441 MHz        | 1.6400              | 0.2624         | 0.4000     | Complies    |
| DH1         | 2441 MHz        | 0.3900              | 0.1248         | 0.4000     | Complies    |
| DH5         | 2480 MHz        | 2.9000              | 0.3093         | 0.4000     | Complies    |
| DH3         | 2480 MHz        | 1.6500              | 0.2640         | 0.4000     | Complies    |
| DH1         | 2480 MHz        | 0.3900              | 0.1248         | 0.4000     | Complies    |

**Note:** Pulse Duration \* Number of Pulses\*(Dwell time / measure time)

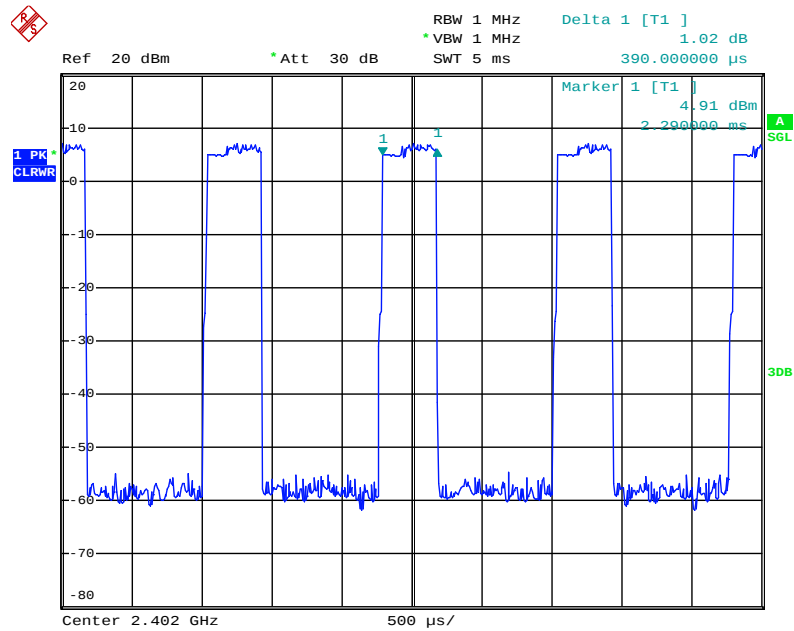
**Remark:**

Dwell Time= 79(channels) x 0.4(s) x average hopping channel x package transfer time (us)

79 channels come from the Hopping Channel number.

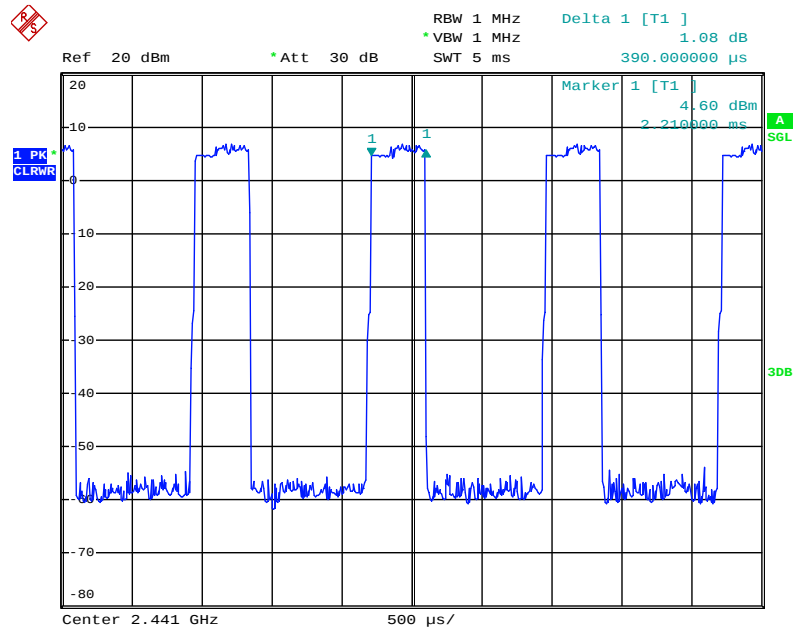
Average Hopping Channel = hops / sweep time

### Dwell Time Plot on BR (GFSK) / Channel 0 / DH1 / 2402 MHz



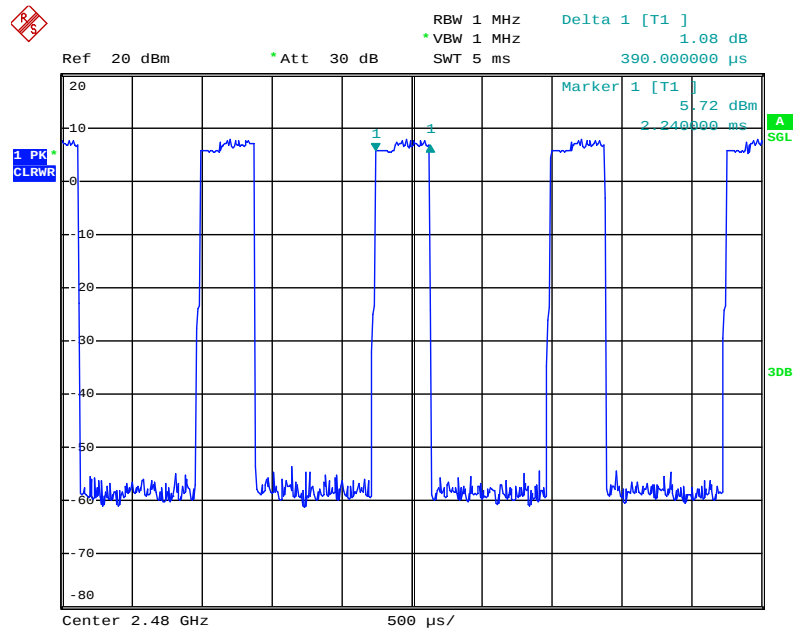
Date: 23.JAN.2014 03:04:14

### Dwell Time Plot on BR (GFSK) / Channel 39 / DH1 / 2441 MHz



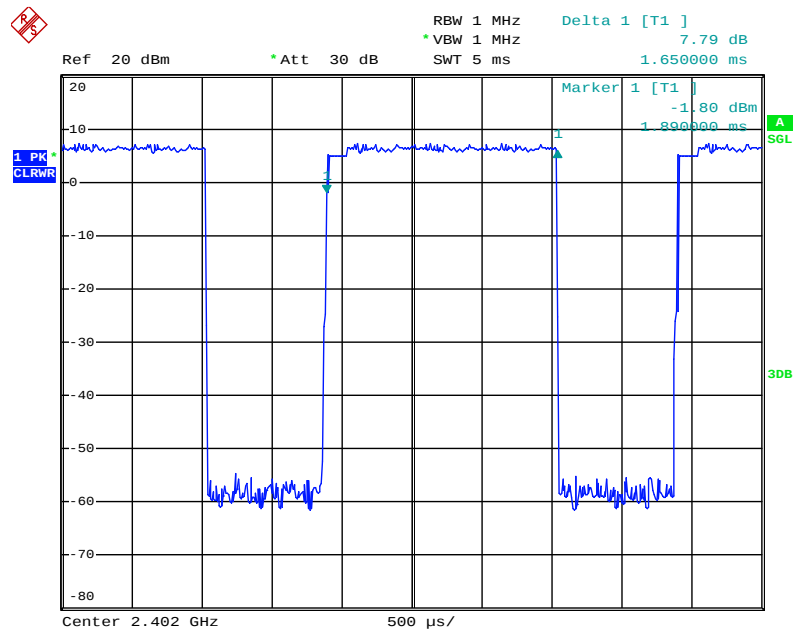
Date: 23.JAN.2014 03:03:37

### Dwell Time Plot on BR (GFSK) / Channel 78 / DH1 / 2480 MHz



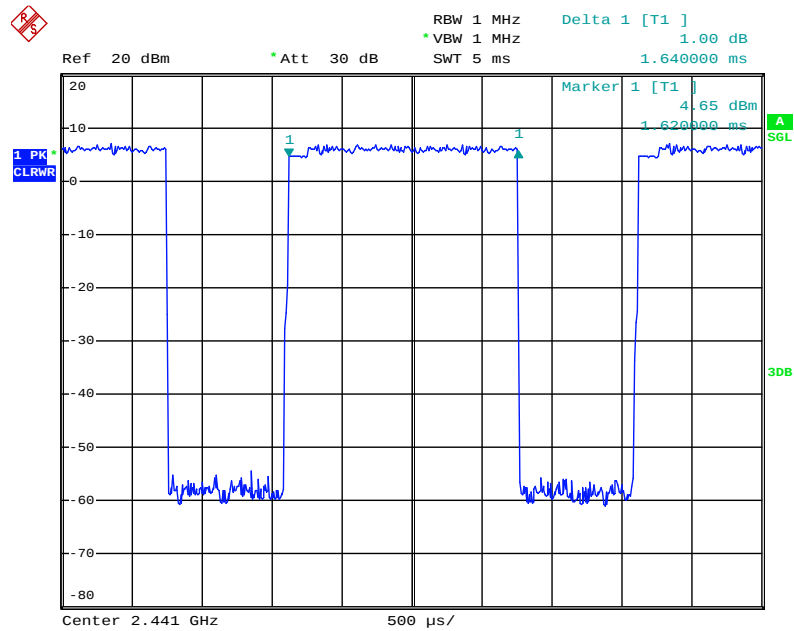
Date: 23.JAN.2014 03:03:01

### Dwell Time Plot on BR (GFSK) / Channel 0 / DH3 / 2402 MHz



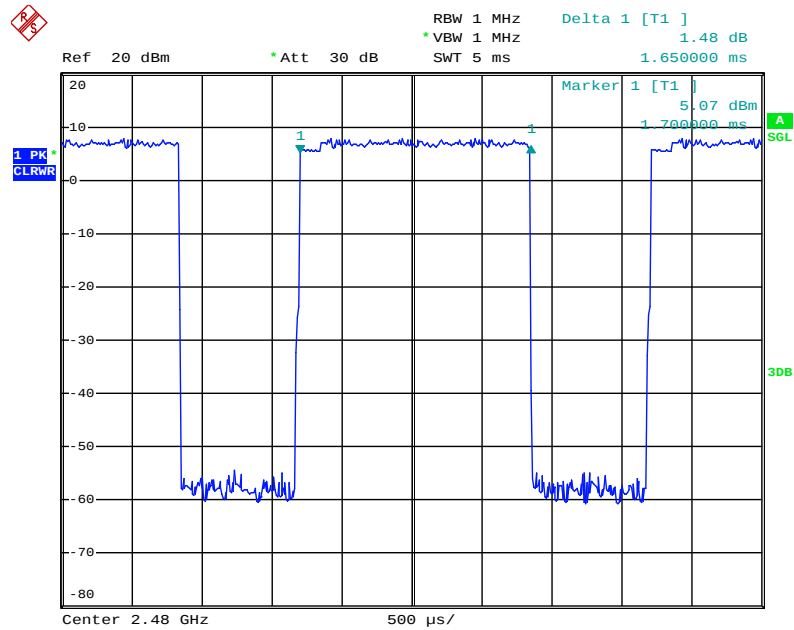
Date: 23.JAN.2014 03:00:51

### Dwell Time Plot on BR (GFSK) / Channel 39 / DH3 / 2441 MHz



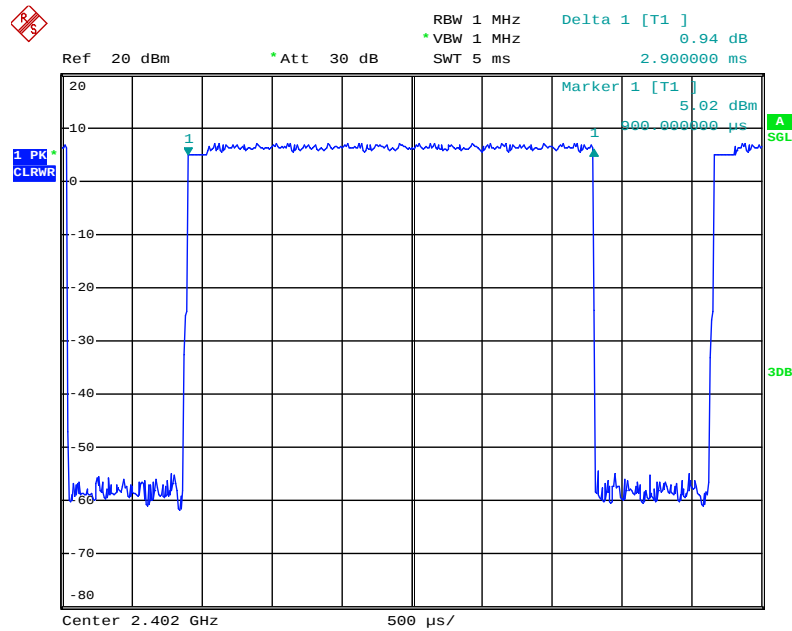
Date: 23.JAN.2014 03:01:43

### Dwell Time Plot on BR (GFSK) / Channel 78 / DH3 / 2480 MHz



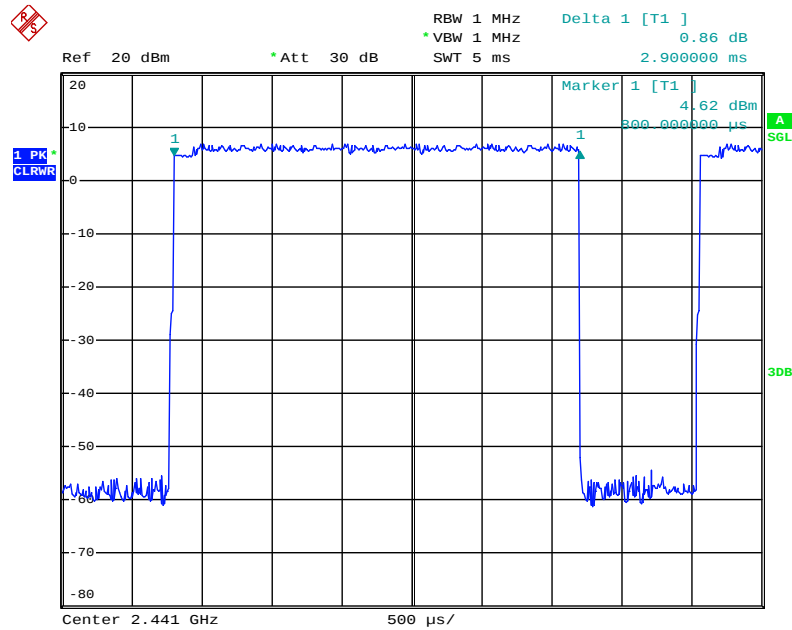
Date: 23.JAN.2014 03:02:19

### Dwell Time Plot on BR (GFSK) / Channel 0 / DH5 / 2402 MHz



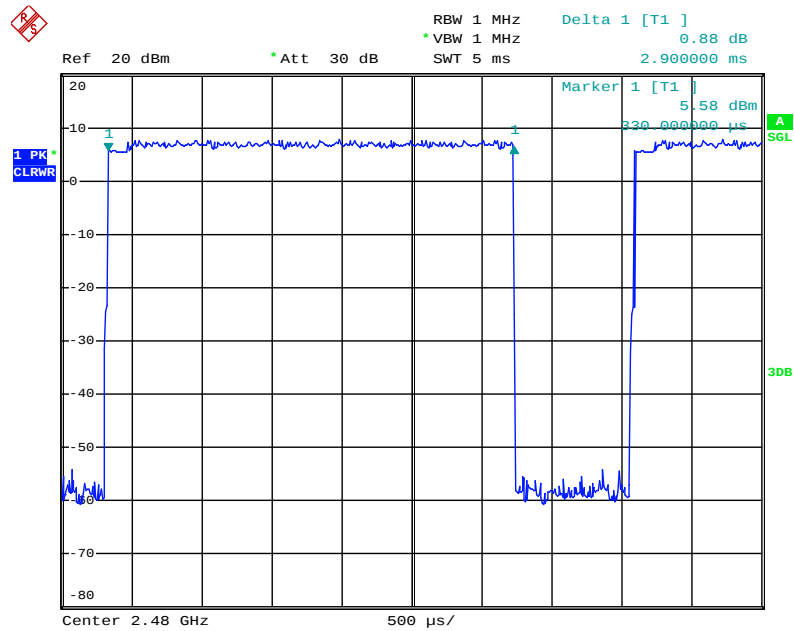
Date: 23.JAN.2014 03:00:05

### Dwell Time Plot on BR (GFSK) / Channel 39 / DH5 / 2441 MHz



Date: 23.JAN.2014 02:59:18

### Dwell Time Plot on BR (GFSK) / Channel 78 / DH5 / 2480 MHz



Date: 23.JAN.2014 02:58:29

## 4.6. Radiated Emissions Measurement

### 4.6.1. Limit

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

| Frequencies<br>(MHz) | Field Strength<br>(micorvolts/meter) | Measurement Distance<br>(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                                |

### 4.6.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

| Spectrum Parameter                          | Setting                                       |
|---------------------------------------------|-----------------------------------------------|
| Attenuation                                 | Auto                                          |
| Start Frequency                             | 1000 MHz                                      |
| Stop Frequency                              | 10th carrier harmonic                         |
| RBW / VBW (Emission in restricted band)     | 1MHz / 3MHz for Peak, 1MHz / 10Hz for Average |
| RBW / VBW (Emission in non-restricted band) | 100kHz / 300kHz for peak                      |

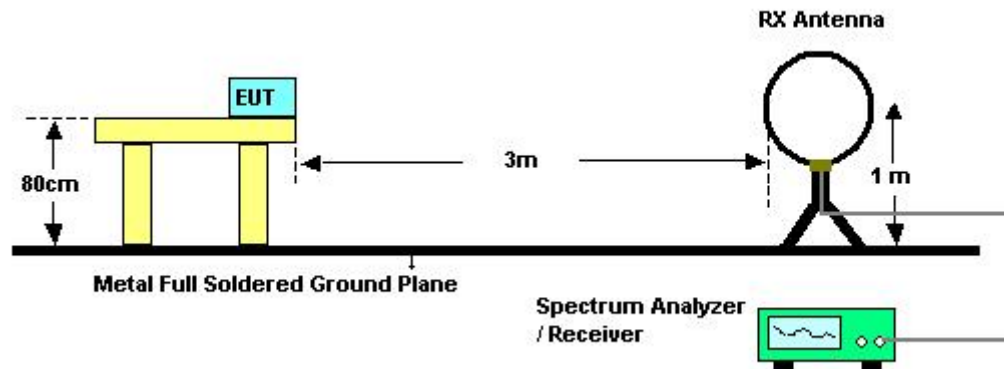
| Receiver Parameter     | Setting                           |
|------------------------|-----------------------------------|
| Attenuation            | Auto                              |
| Start ~ Stop Frequency | 9kHz~150kHz / RBW 200Hz for QP    |
| Start ~ Stop Frequency | 150kHz~30MHz / RBW 9kHz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

#### 4.6.3. Test Procedures

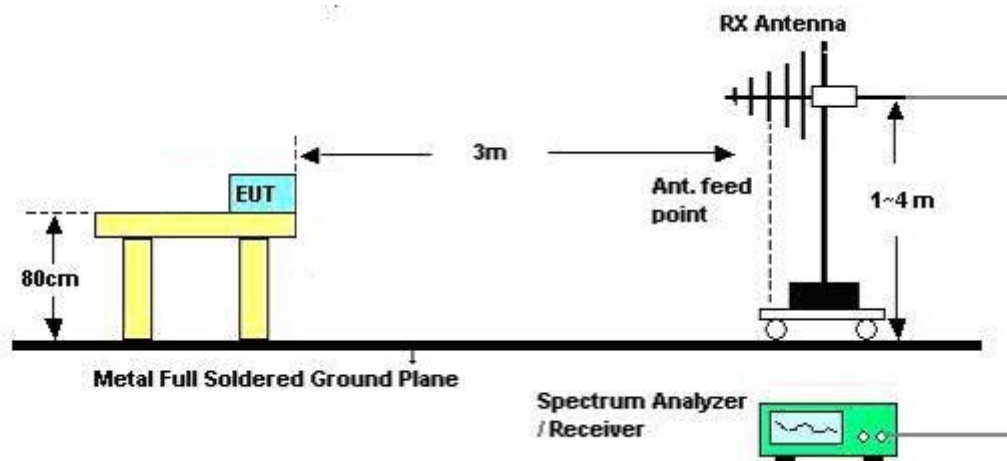
1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High – Low scan is not required in this case.

#### 4.6.4. Test Setup Layout

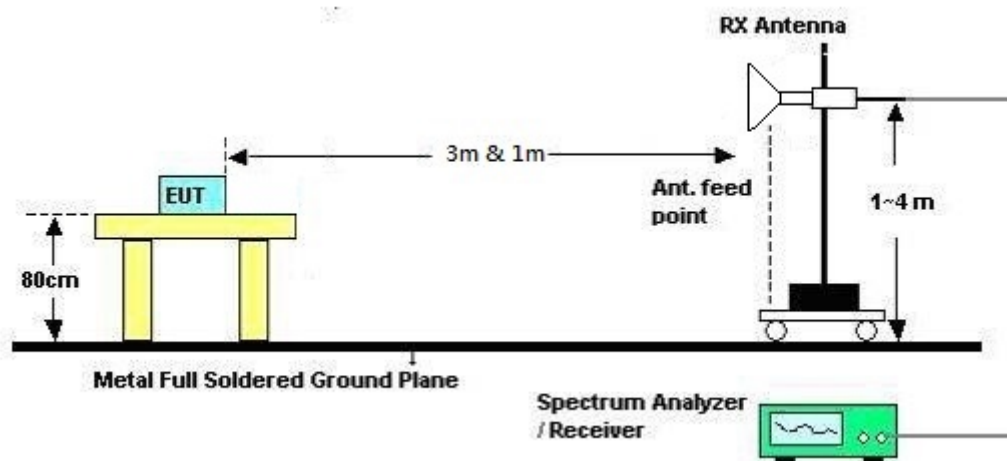
For Radiated Emissions: 9kHz ~30MHz



For Radiated Emissions: 30MHz~1GHz



For Radiated Emissions: Above 1GHz



#### **4.6.5. Test Deviation**

There is no deviation with the original standard.

#### **4.6.6. EUT Operation during Test**

The EUT was programmed to be in continuously transmitting mode.

#### 4.6.7. Results of Radiated Emissions (9kHz~30MHz)

|                |             |           |               |
|----------------|-------------|-----------|---------------|
| Temperature    | 20°C        | Humidity  | 55%           |
| Test Engineer  | David Tseng | Test Date | Jan. 08, 2014 |
| Configurations | Normal Link | Test Mode | Mode 1        |

| Freq.<br>(MHz) | Level<br>(dBuV) | Over Limit<br>(dB) | Limit Line<br>(dBuV) | Remark   |
|----------------|-----------------|--------------------|----------------------|----------|
| -              | -               | -                  | -                    | See Note |

Note:

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

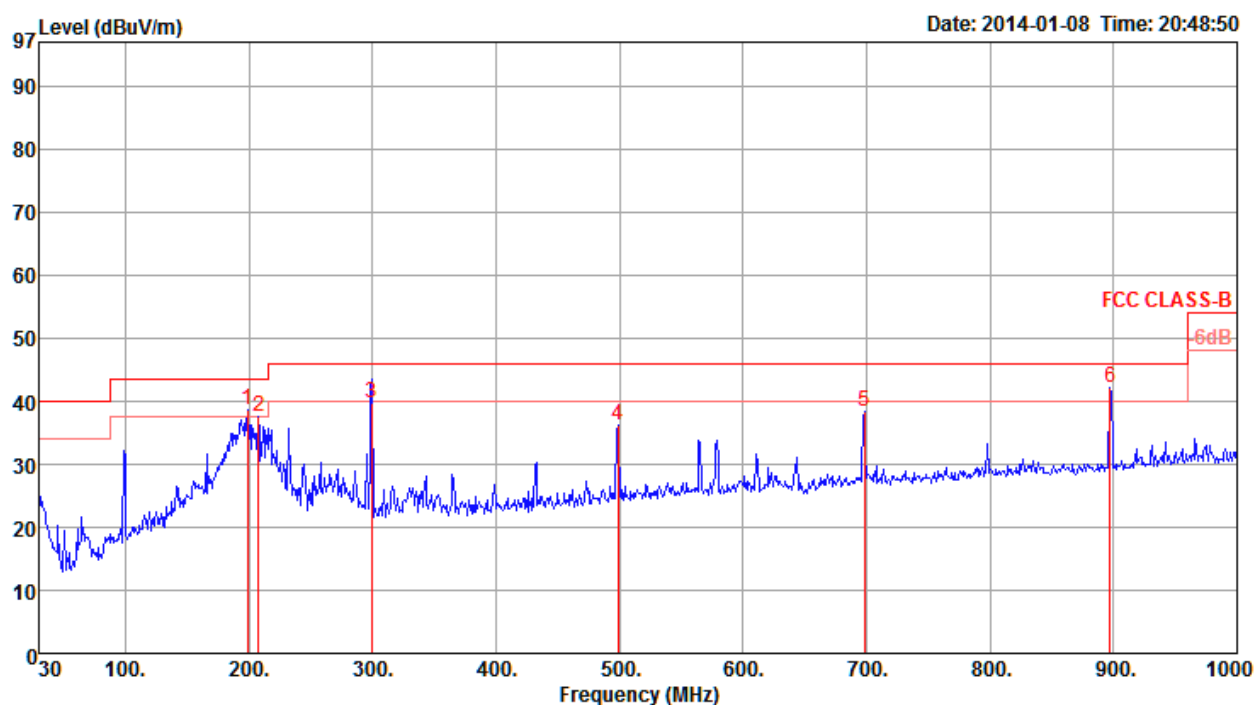
Distance extrapolation factor =  $40 \log (\text{specific distance} / \text{test distance})$  (dB);

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

#### 4.6.8. Results of Radiated Emissions (30MHz~1GHz)

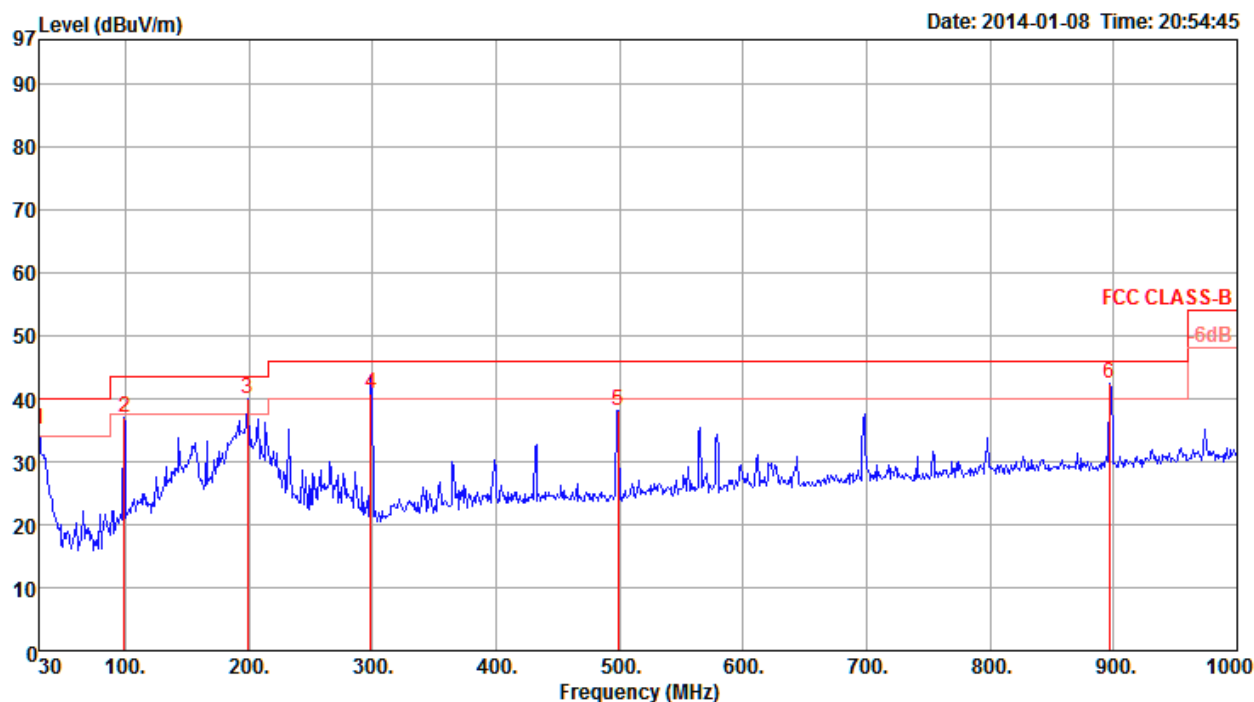
|               |             |                |             |
|---------------|-------------|----------------|-------------|
| Temperature   | 20°C        | Humidity       | 55%         |
| Test Engineer | David Tseng | Configurations | Normal Link |
| Test Mode     | Mode 1      |                |             |

##### Horizontal



|   | Freq   | Level  | Limit  | Over  | Read  | Cable | Preamp |        |        | T/Pos | A/Pos | Pol/Phase  |
|---|--------|--------|--------|-------|-------|-------|--------|--------|--------|-------|-------|------------|
|   | MHz    | dBuV/m | dBuV/m | dB    | dBuV  | dB    | dB     | dB/m   | Remark | deg   | cm    |            |
| 1 | 198.78 | 38.73  | 43.50  | -4.77 | 53.56 | 2.09  | 27.26  | -14.83 | Peak   | 0     | 400   | HORIZONTAL |
| 2 | 207.51 | 37.62  | 43.50  | -5.88 | 52.11 | 2.15  | 27.19  | -14.49 | Peak   | 0     | 400   | HORIZONTAL |
| 3 | 299.66 | 39.82  | 46.00  | -6.18 | 50.34 | 2.51  | 26.83  | -10.52 | QP     | 349   | 106   | HORIZONTAL |
| 4 | 498.51 | 36.29  | 46.00  | -9.71 | 43.07 | 3.38  | 27.93  | -6.78  | Peak   | 0     | 400   | HORIZONTAL |
| 5 | 698.33 | 38.35  | 46.00  | -7.65 | 41.32 | 4.15  | 27.10  | -2.97  | Peak   | 0     | 400   | HORIZONTAL |
| 6 | 897.18 | 42.27  | 46.00  | -3.73 | 43.04 | 4.58  | 26.83  | -0.77  | Peak   | 0     | 400   | HORIZONTAL |

# Vertical



|   | Freq   | Level  | Limit  | Over  | Read  | Cable | Preamp | Factor | Remark | T/Pos | A/Pos | Pol/Phase |
|---|--------|--------|--------|-------|-------|-------|--------|--------|--------|-------|-------|-----------|
|   | MHz    | dBuV/m | dBuV/m | dB    | dBuV  | dB    | dB     | dB/m   |        | deg   | cm    |           |
| 1 | 30.00  | 35.16  | 40.00  | -4.84 | 42.40 | 0.83  | 27.97  | -7.24  | Peak   | 0     | 100   | VERTICAL  |
| 2 | 98.87  | 36.98  | 43.50  | -6.52 | 52.12 | 1.49  | 27.82  | -15.14 | Peak   | 0     | 100   | VERTICAL  |
| 3 | 198.78 | 40.03  | 43.50  | -3.47 | 54.86 | 2.09  | 27.26  | -14.83 | Peak   | 0     | 100   | VERTICAL  |
| 4 | 298.69 | 40.78  | 46.00  | -5.22 | 51.30 | 2.51  | 26.83  | -10.52 | QP     | 166   | 100   | VERTICAL  |
| 5 | 498.51 | 38.14  | 46.00  | -7.86 | 44.92 | 3.38  | 27.93  | -6.78  | Peak   | 0     | 100   | VERTICAL  |
| 6 | 896.21 | 42.29  | 46.00  | -3.71 | 43.07 | 4.58  | 26.84  | -0.78  | Peak   | 0     | 100   | VERTICAL  |

## Note:

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

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

#### 4.6.9. Results for Radiated Emissions (1GHz~10<sup>th</sup> Harmonic)

|               |               |                |                       |
|---------------|---------------|----------------|-----------------------|
| Temperature   | 20°C          | Humidity       | 55%                   |
| Test Engineer | David Tseng   | Configurations | BR (GFSK) / Channel 0 |
| Test Date     | Jan. 06, 2014 |                |                       |

##### Horizontal

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamp Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase  |
|---|---------|--------|------------|------------|------------|------------|---------------|--------|---------|-------|-------|------------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB            | dB/m   |         | deg   | cm    |            |
| 1 | 4803.76 | 52.46  | 74.00      | -21.54     | 50.44      | 4.20       | 34.70         | 2.02   | Peak    | 311   | 103   | HORIZONTAL |
| 2 | 4804.04 | 48.39  | 54.00      | -5.61      | 46.37      | 4.20       | 34.70         | 2.02   | Average | 311   | 103   | HORIZONTAL |

##### Vertical

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamp Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase |
|---|---------|--------|------------|------------|------------|------------|---------------|--------|---------|-------|-------|-----------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB            | dB/m   |         | deg   | cm    |           |
| 1 | 4804.04 | 48.29  | 54.00      | -5.71      | 46.27      | 4.20       | 34.70         | 2.02   | Average | 286   | 143   | VERTICAL  |
| 2 | 4804.35 | 52.44  | 74.00      | -21.56     | 50.42      | 4.20       | 34.70         | 2.02   | Peak    | 286   | 143   | VERTICAL  |

|               |               |                |                        |
|---------------|---------------|----------------|------------------------|
| Temperature   | 20°C          | Humidity       | 55%                    |
| Test Engineer | David Tseng   | Configurations | BR (GFSK) / Channel 39 |
| Test Date     | Jan. 06, 2014 |                |                        |

### Horizontal

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamp Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase  |
|---|---------|--------|------------|------------|------------|------------|---------------|--------|---------|-------|-------|------------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB            | dB/m   |         | deg   | cm    |            |
| 1 | 4879.66 | 52.08  | 74.00      | -21.92     | 49.87      | 4.22       | 34.67         | 2.21   | Peak    | 309   | 103   | HORIZONTAL |
| 2 | 4880.06 | 48.02  | 54.00      | -5.98      | 45.81      | 4.22       | 34.67         | 2.21   | Average | 309   | 103   | HORIZONTAL |
| 3 | 7319.51 | 49.04  | 74.00      | -24.96     | 41.64      | 5.35       | 34.94         | 7.40   | Peak    | 247   | 100   | HORIZONTAL |
| 4 | 7319.83 | 37.07  | 54.00      | -16.93     | 29.67      | 5.35       | 34.94         | 7.40   | Average | 247   | 100   | HORIZONTAL |

### Vertical

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamp Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase |
|---|---------|--------|------------|------------|------------|------------|---------------|--------|---------|-------|-------|-----------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB            | dB/m   |         | deg   | cm    |           |
| 1 | 4879.70 | 51.96  | 74.00      | -22.04     | 49.75      | 4.22       | 34.67         | 2.21   | Peak    | 89    | 104   | VERTICAL  |
| 2 | 4880.07 | 48.14  | 54.00      | -5.86      | 45.93      | 4.22       | 34.67         | 2.21   | Average | 89    | 104   | VERTICAL  |
| 3 | 7319.51 | 47.95  | 74.00      | -26.05     | 40.55      | 5.35       | 34.94         | 7.40   | Peak    | 58    | 100   | VERTICAL  |
| 4 | 7320.45 | 36.68  | 54.00      | -17.32     | 29.28      | 5.35       | 34.94         | 7.40   | Average | 58    | 100   | VERTICAL  |

|               |               |                |                        |
|---------------|---------------|----------------|------------------------|
| Temperature   | 20°C          | Humidity       | 55%                    |
| Test Engineer | David Tseng   | Configurations | BR (GFSK) / Channel 78 |
| Test Date     | Jan. 06, 2014 |                |                        |

#### Horizontal

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamp Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase  |
|---|---------|--------|------------|------------|------------|------------|---------------|--------|---------|-------|-------|------------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB            | dB/m   |         | deg   | cm    |            |
| 1 | 4960.07 | 48.72  | 54.00      | -5.28      | 46.30      | 4.23       | 34.64         | 2.42   | Average | 310   | 100   | HORIZONTAL |
| 2 | 4960.38 | 52.47  | 74.00      | -21.53     | 50.05      | 4.23       | 34.64         | 2.42   | Peak    | 310   | 100   | HORIZONTAL |
| 3 | 7440.32 | 38.34  | 54.00      | -15.66     | 30.81      | 5.37       | 34.98         | 7.53   | Average | 246   | 151   | HORIZONTAL |
| 4 | 7440.77 | 49.43  | 74.00      | -24.57     | 41.90      | 5.37       | 34.98         | 7.53   | Peak    | 246   | 151   | HORIZONTAL |

#### Vertical

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamp Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase |
|---|---------|--------|------------|------------|------------|------------|---------------|--------|---------|-------|-------|-----------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB            | dB/m   |         | deg   | cm    |           |
| 1 | 4960.07 | 50.35  | 54.00      | -3.65      | 47.93      | 4.23       | 34.64         | 2.42   | Average | 93    | 113   | VERTICAL  |
| 2 | 4960.46 | 53.89  | 74.00      | -20.11     | 51.47      | 4.23       | 34.64         | 2.42   | Peak    | 93    | 113   | VERTICAL  |
| 3 | 7440.07 | 40.35  | 54.00      | -13.65     | 32.82      | 5.37       | 34.98         | 7.53   | Average | 331   | 110   | VERTICAL  |
| 4 | 7440.11 | 50.66  | 74.00      | -23.34     | 43.13      | 5.37       | 34.98         | 7.53   | Peak    | 331   | 110   | VERTICAL  |

#### Note:

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

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

|               |               |                |                         |
|---------------|---------------|----------------|-------------------------|
| Temperature   | 20°C          | Humidity       | 55%                     |
| Test Engineer | David Tseng   | Configurations | EDR (8DPSK) / Channel 0 |
| Test Date     | Jan. 06, 2014 |                |                         |

### Horizontal

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamplifier Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase  |
|---|---------|--------|------------|------------|------------|------------|---------------------|--------|---------|-------|-------|------------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB                  | dB/m   |         | deg   | cm    |            |
| 1 | 4803.98 | 41.15  | 54.00      | -12.85     | 39.13      | 4.20       | 34.70               | 2.02   | Average | 311   | 104   | HORIZONTAL |
| 2 | 4804.33 | 49.70  | 74.00      | -24.30     | 47.68      | 4.20       | 34.70               | 2.02   | Peak    | 311   | 104   | HORIZONTAL |

### Vertical

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamplifier Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase |
|---|---------|--------|------------|------------|------------|------------|---------------------|--------|---------|-------|-------|-----------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB                  | dB/m   |         | deg   | cm    |           |
| 1 | 4803.93 | 49.77  | 74.00      | -24.23     | 47.75      | 4.20       | 34.70               | 2.02   | Peak    | 77    | 118   | VERTICAL  |
| 2 | 4803.96 | 41.42  | 54.00      | -12.58     | 39.40      | 4.20       | 34.70               | 2.02   | Average | 77    | 118   | VERTICAL  |

|               |               |                |                          |
|---------------|---------------|----------------|--------------------------|
| Temperature   | 20°C          | Humidity       | 55%                      |
| Test Engineer | David Tseng   | Configurations | EDR (8DPSK) / Channel 39 |
| Test Date     | Jan. 06, 2014 |                |                          |

#### Horizontal

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamplifier Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase  |
|---|---------|--------|------------|------------|------------|------------|---------------------|--------|---------|-------|-------|------------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB                  | dB/m   |         | deg   | cm    |            |
| 1 | 4879.82 | 48.63  | 74.00      | -25.37     | 46.42      | 4.22       | 34.67               | 2.21   | Peak    | 309   | 103   | HORIZONTAL |
| 2 | 4880.03 | 40.00  | 54.00      | -14.00     | 37.79      | 4.22       | 34.67               | 2.21   | Average | 309   | 103   | HORIZONTAL |

#### Vertical

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamplifier Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase |
|---|---------|--------|------------|------------|------------|------------|---------------------|--------|---------|-------|-------|-----------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB                  | dB/m   |         | deg   | cm    |           |
| 1 | 4879.74 | 49.13  | 74.00      | -24.87     | 46.92      | 4.22       | 34.67               | 2.21   | Peak    | 90    | 102   | VERTICAL  |
| 2 | 4880.05 | 40.51  | 54.00      | -13.49     | 38.30      | 4.22       | 34.67               | 2.21   | Average | 90    | 102   | VERTICAL  |

|               |               |                |                          |
|---------------|---------------|----------------|--------------------------|
| Temperature   | 20°C          | Humidity       | 55%                      |
| Test Engineer | David Tseng   | Configurations | EDR (8DPSK) / Channel 78 |
| Test Date     | Jan. 06, 2014 |                |                          |

#### Horizontal

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamp Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase  |
|---|---------|--------|------------|------------|------------|------------|---------------|--------|---------|-------|-------|------------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB            | dB/m   |         | deg   | cm    |            |
| 1 | 4959.65 | 47.88  | 74.00      | -26.12     | 45.46      | 4.23       | 34.64         | 2.42   | Peak    | 311   | 100   | HORIZONTAL |
| 2 | 4960.09 | 39.58  | 54.00      | -14.42     | 37.16      | 4.23       | 34.64         | 2.42   | Average | 311   | 100   | HORIZONTAL |

#### Vertical

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamp Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase |
|---|---------|--------|------------|------------|------------|------------|---------------|--------|---------|-------|-------|-----------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB            | dB/m   |         | deg   | cm    |           |
| 1 | 4960.06 | 48.96  | 74.00      | -25.04     | 46.54      | 4.23       | 34.64         | 2.42   | Peak    | 94    | 114   | VERTICAL  |
| 2 | 4960.06 | 41.10  | 54.00      | -12.90     | 38.68      | 4.23       | 34.64         | 2.42   | Average | 94    | 114   | VERTICAL  |

#### Note:

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

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

## 4.7. Emissions Measurement

### 4.7.1. Limit

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

| Frequencies<br>(MHz) | Field Strength<br>(micorvolts/meter) | Measurement Distance<br>(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                                |

### 4.7.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

| Spectrum Parameter                          | Setting                                       |
|---------------------------------------------|-----------------------------------------------|
| Attenuation                                 | Auto                                          |
| Span Frequency                              | 100 MHz                                       |
| RBW / VBW (Emission in restricted band)     | 1MHz / 3MHz for Peak, 1MHz / 10Hz for Average |
| RBW / VBW (Emission in non-restricted band) | 100 kHz / 100 kHz for Peak                    |

### 4.7.3. Test Procedures

For Radiated band edges Measurement:

- The test procedure is the same as section 4.6.3, only the frequency range investigated is limited to 100MHz around band edges.

For Radiated Out of Band Emission Measurement:

- The radiated emission test is performed on each TX port of operating mode without summing or adding 10log (N) since the limit is relative emission limit.  
Only worst data of each operating mode is presented.

#### **4.7.4. Test Setup Layout**

For Radiated band edges Measurement:

This test setup layout is the same as that shown in section 4.6.4.

For Radiated Out of Band Emission Measurement:

This test setup layout is the same as that shown in section 4.6.4.

#### **4.7.5. Test Deviation**

There is no deviation with the original standard.

#### **4.7.6. EUT Operation during Test**

The EUT was programmed to be in continuously transmitting mode.

#### 4.7.7. Test Result of Band Edge and Fundamental Emissions

|               |               |                |                               |
|---------------|---------------|----------------|-------------------------------|
| Temperature   | 20°C          | Humidity       | 55%                           |
| Test Engineer | David Tseng   | Configurations | BR (GFSK) / Channel 0, 39, 78 |
| Test Date     | Jan. 06, 2014 |                |                               |

##### Channel 0

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamp Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase  |
|---|---------|--------|------------|------------|------------|------------|---------------|--------|---------|-------|-------|------------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB            | dB/m   |         | deg   | cm    |            |
| 1 | 2372.50 | 43.73  | 54.00      | -10.27     | 12.94      | 2.90       | 0.00          | 30.79  | Average | 14    | 126   | HORIZONTAL |
| 2 | 2386.40 | 56.04  | 74.00      | -17.96     | 25.26      | 2.91       | 0.00          | 30.78  | Peak    | 14    | 126   | HORIZONTAL |
| 3 | 2401.90 | 108.97 |            |            | 78.19      | 2.91       | 0.00          | 30.78  | Peak    | 14    | 126   | HORIZONTAL |
| 4 | 2402.00 | 108.56 |            |            | 77.78      | 2.91       | 0.00          | 30.78  | Average | 14    | 126   | HORIZONTAL |

Item 3, 4 are the fundamental frequency at 2402 MHz.

##### Channel 39

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamp Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase  |
|---|---------|--------|------------|------------|------------|------------|---------------|--------|---------|-------|-------|------------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB            | dB/m   |         | deg   | cm    |            |
| 1 | 2390.00 | 54.35  | 74.00      | -19.65     | 23.57      | 2.91       | 0.00          | 30.78  | Peak    | 16    | 100   | HORIZONTAL |
| 2 | 2390.00 | 43.90  | 54.00      | -10.10     | 13.12      | 2.91       | 0.00          | 30.78  | Average | 16    | 100   | HORIZONTAL |
| 3 | 2441.00 | 108.83 |            |            | 78.11      | 2.94       | 0.00          | 30.72  | Peak    | 16    | 100   | HORIZONTAL |
| 4 | 2441.00 | 108.35 |            |            | 77.63      | 2.94       | 0.00          | 30.72  | Average | 16    | 100   | HORIZONTAL |
| 5 | 2488.90 | 44.94  | 54.00      | -9.06      | 14.27      | 2.97       | 0.00          | 30.67  | Average | 16    | 100   | HORIZONTAL |
| 6 | 2492.70 | 55.96  | 74.00      | -18.04     | 25.29      | 2.97       | 0.00          | 30.67  | Peak    | 16    | 100   | HORIZONTAL |

Item 3, 4 are the fundamental frequency at 2441 MHz.

##### Channel 78

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamp Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase  |
|---|---------|--------|------------|------------|------------|------------|---------------|--------|---------|-------|-------|------------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB            | dB/m   |         | deg   | cm    |            |
| 1 | 2480.00 | 107.85 |            |            | 77.16      | 2.96       | 0.00          | 30.69  | Average | 13    | 121   | HORIZONTAL |
| 2 | 2480.20 | 108.29 |            |            | 77.60      | 2.96       | 0.00          | 30.69  | Peak    | 13    | 121   | HORIZONTAL |
| 3 | 2483.50 | 44.77  | 54.00      | -9.23      | 14.08      | 2.96       | 0.00          | 30.69  | Average | 13    | 121   | HORIZONTAL |
| 4 | 2484.80 | 56.96  | 74.00      | -17.04     | 26.27      | 2.96       | 0.00          | 30.69  | Peak    | 13    | 121   | HORIZONTAL |

Item 1, 2 are the fundamental frequency at 2480 MHz.

Note:

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

|               |               |                |                                 |
|---------------|---------------|----------------|---------------------------------|
| Temperature   | 20°C          | Humidity       | 55%                             |
| Test Engineer | David Tseng   | Configurations | EDR (8DPSK) / Channel 0, 39, 78 |
| Test Date     | Jan. 06, 2014 |                |                                 |

#### Channel 0

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamplifier Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase |
|---|---------|--------|------------|------------|------------|------------|---------------------|--------|---------|-------|-------|-----------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB                  | dB/m   |         | deg   | cm    |           |
| 1 | 2383.20 | 55.97  | 74.00      | -18.03     | 25.18      | 2.90       | 0.00                | 30.79  | Peak    | 148   | 105   | VERTICAL  |
| 2 | 2390.00 | 43.79  | 54.00      | -10.21     | 13.01      | 2.91       | 0.00                | 30.78  | Average | 148   | 105   | VERTICAL  |
| 3 | 2402.00 | 97.00  |            |            | 66.22      | 2.91       | 0.00                | 30.78  | Peak    | 148   | 105   | VERTICAL  |
| 4 | 2402.00 | 100.78 |            |            | 70.00      | 2.91       | 0.00                | 30.78  | Average | 148   | 105   | VERTICAL  |

Item 3, 4 are the fundamental frequency at 2402 MHz.

#### Channel 39

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamplifier Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase  |
|---|---------|--------|------------|------------|------------|------------|---------------------|--------|---------|-------|-------|------------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB                  | dB/m   |         | deg   | cm    |            |
| 1 | 2386.80 | 55.91  | 74.00      | -18.09     | 25.13      | 2.91       | 0.00                | 30.78  | Peak    | 18    | 125   | HORIZONTAL |
| 2 | 2390.00 | 43.32  | 54.00      | -10.68     | 12.54      | 2.91       | 0.00                | 30.78  | Average | 18    | 125   | HORIZONTAL |
| 3 | 2441.00 | 107.93 |            |            | 77.21      | 2.94       | 0.00                | 30.72  | Peak    | 18    | 125   | HORIZONTAL |
| 4 | 2441.00 | 104.04 |            |            | 73.32      | 2.94       | 0.00                | 30.72  | Average | 18    | 125   | HORIZONTAL |
| 5 | 2483.50 | 43.94  | 54.00      | -10.06     | 13.25      | 2.96       | 0.00                | 30.69  | Average | 18    | 125   | HORIZONTAL |
| 6 | 2487.50 | 55.16  | 74.00      | -18.84     | 24.49      | 2.97       | 0.00                | 30.67  | Peak    | 18    | 125   | HORIZONTAL |

Item 3, 4 are the fundamental frequency at 2441 MHz.

#### Channel 78

|   | Freq    | Level  | Limit Line | Over Limit | Read Level | Cable Loss | Preamplifier Factor | Factor | Remark  | T/Pos | A/Pos | Pol/Phase  |
|---|---------|--------|------------|------------|------------|------------|---------------------|--------|---------|-------|-------|------------|
|   | MHz     | dBuV/m | dBuV/m     | dB         | dBuV       | dB         | dB                  | dB/m   |         | deg   | cm    |            |
| 1 | 2480.00 | 106.13 |            |            | 75.44      | 2.96       | 0.00                | 30.69  | Peak    | 17    | 120   | HORIZONTAL |
| 2 | 2480.00 | 102.39 |            |            | 71.70      | 2.96       | 0.00                | 30.69  | Peak    | 17    | 120   | HORIZONTAL |
| 3 | 2483.50 | 44.38  | 54.00      | -9.62      | 13.69      | 2.96       | 0.00                | 30.69  | Average | 17    | 120   | HORIZONTAL |
| 4 | 2485.20 | 56.07  | 74.00      | -17.93     | 25.38      | 2.96       | 0.00                | 30.69  | Peak    | 17    | 120   | HORIZONTAL |

Item 1, 2 are the fundamental frequency at 2480 MHz.

Note:

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.



**Spectrum**

Ref Level 107.00 dBμV    RBW 100 kHz  
 Att 10 dB    SWT 265 ms    VBW 300 kHz    Mode Sweep

1Pk View

M1 100.98 dBμV 2.402070 GHz

D1 100.980 dBμV

D2 70.980 dBμV

Start 30.0 MHz    30001 pts    Stop 26.5 GHz    05.01.2014

Spectrum

Ref Level 107.00 dBμV

Att 10 dB

SWT 30.1 ms

RBW 100 kHz

VBW 300 kHz

Mode Sweep

1Pk View

M1

M1[1]

41.85 dBμV

328.7290 MHz

D1 100.980 dBμV

D2 70.980 dBμV

Start 30.0 MHz

30001 pts

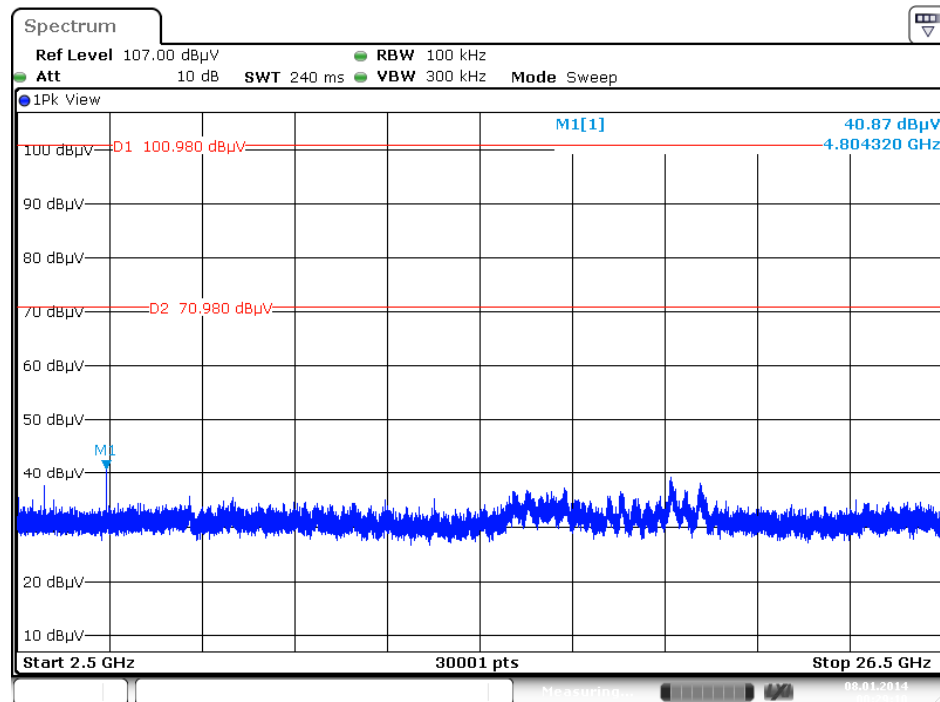
Stop 2.4 GHz

Measuring...

08.01.2014

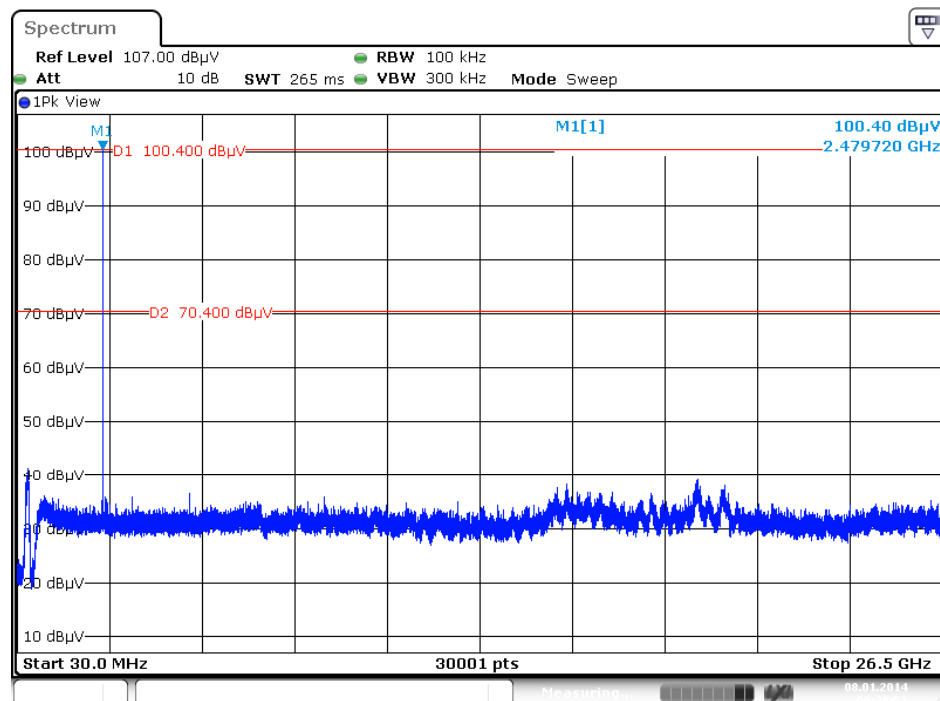
Page No. : 55 of 70  
Issued Date : Feb. 12, 2014

### Plot on Configuration For BR (GFSK) / Channel 0 / 2500MHz~26500MHz (down 30dBc)



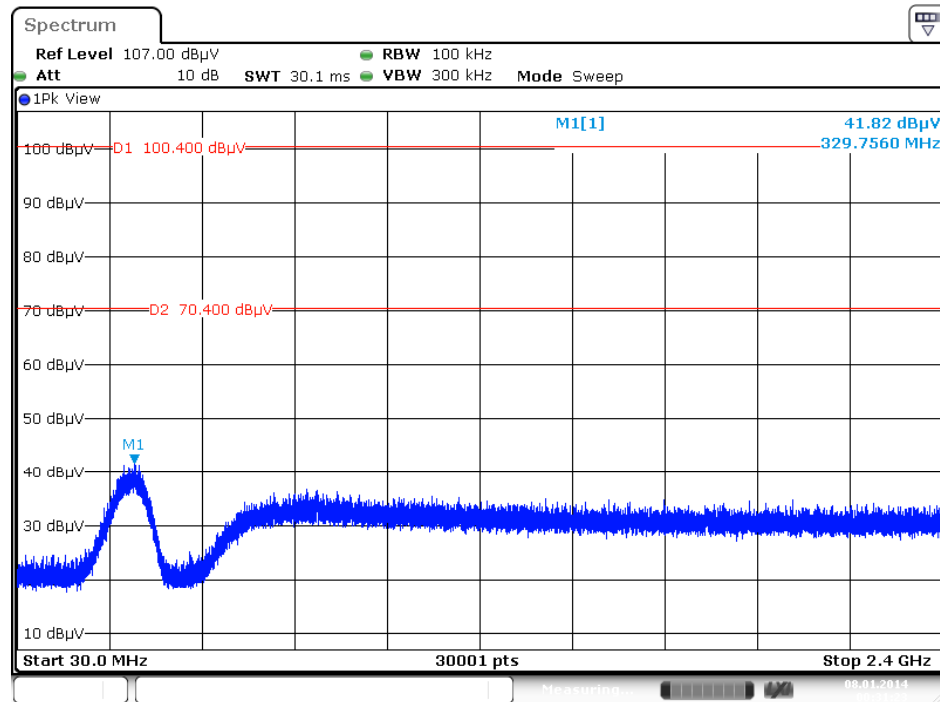
Date: 8.JAN.2014 00:29:10

### Plot on Configuration For BR (GFSK) / Channel 78 / Reference Level

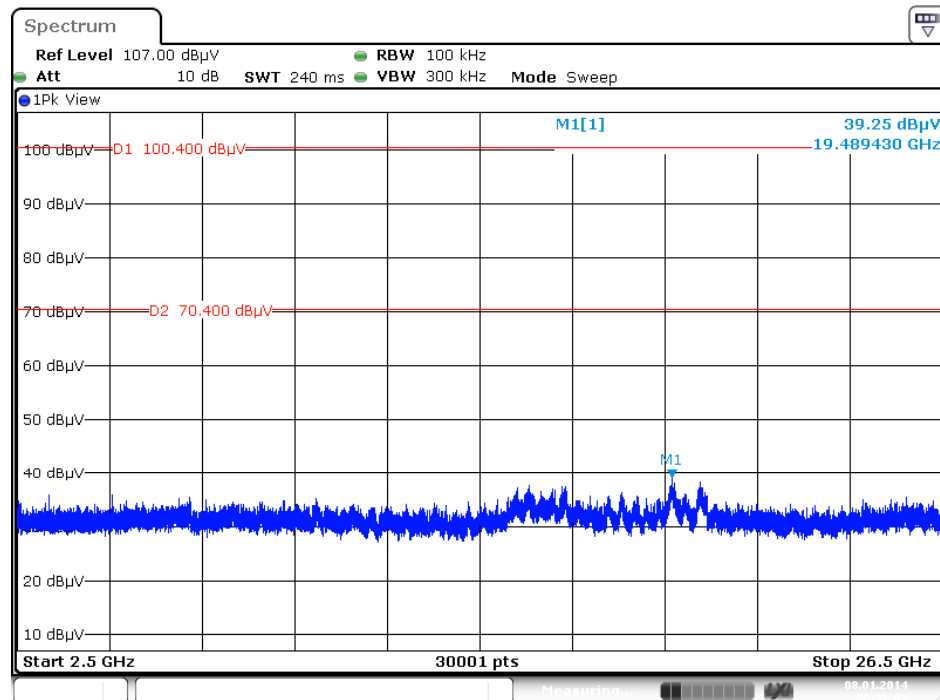


Date: 8.JAN.2014 00:30:51

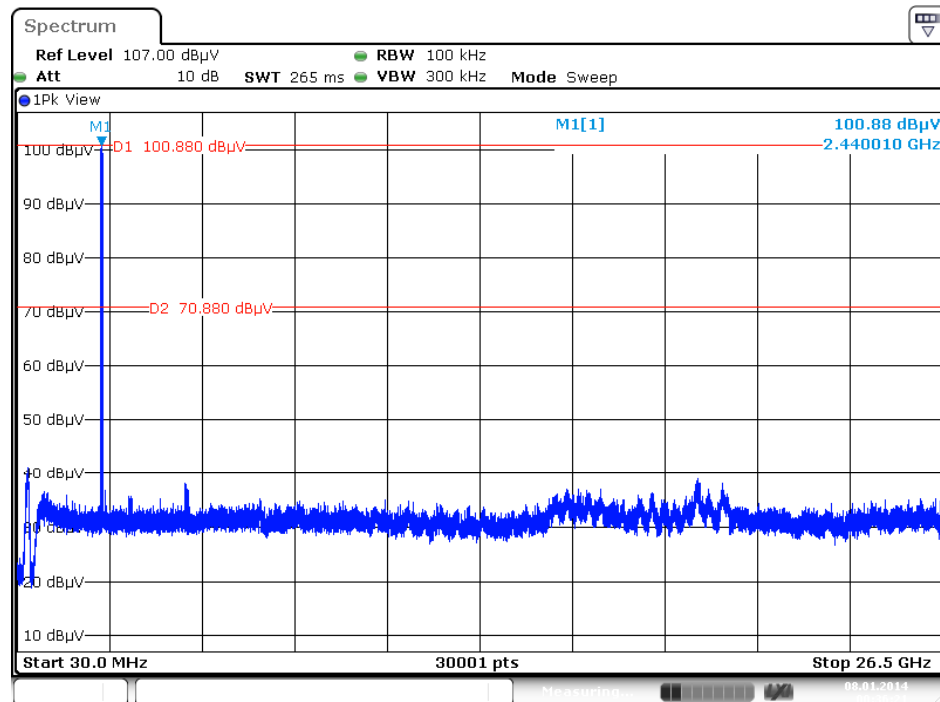
### Plot on Configuration For BR (GFSK) / Channel 78 / 30MHz~2400MHz (down 30dBc)



### Plot on Configuration For BR (GFSK) / Channel 78 / 2500MHz~26500MHz (down 30dBc)

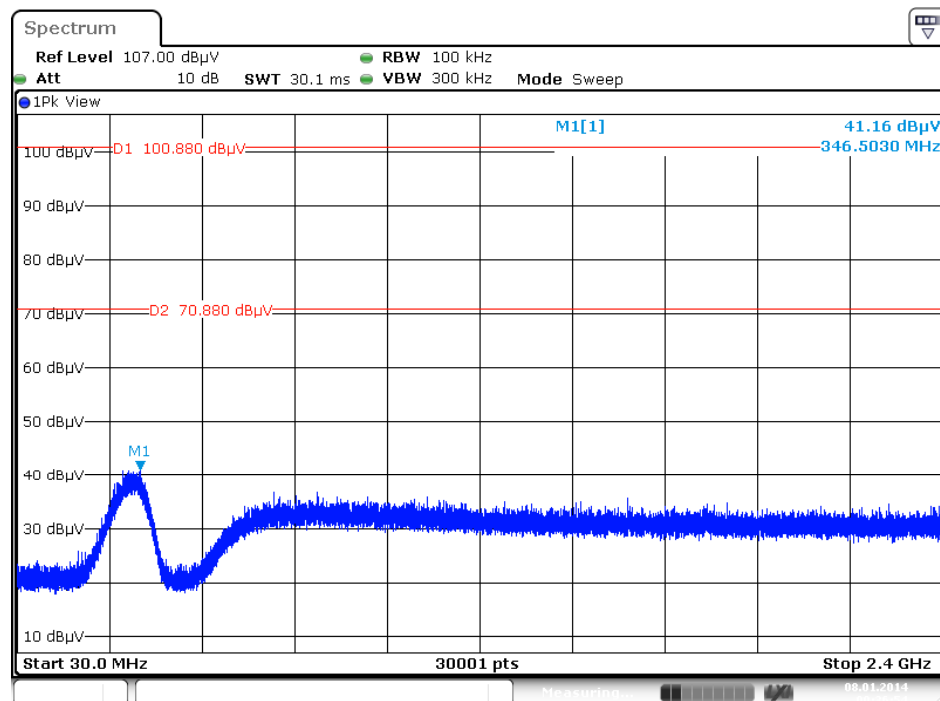


### Plot on Configuration For BR (GFSK) / Hopping / Reference Level



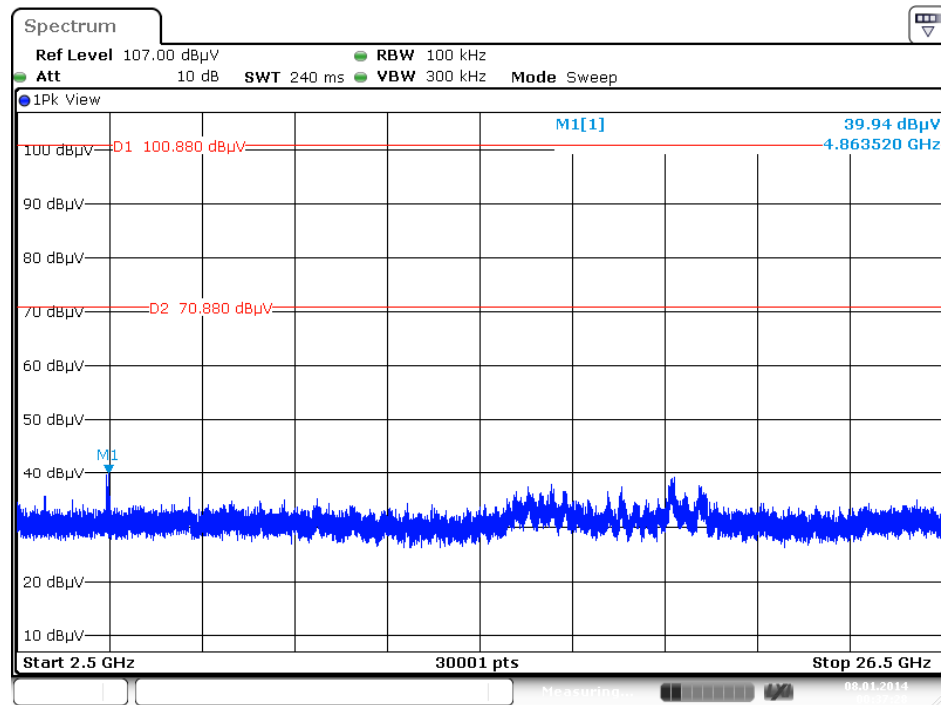
Date: 8. JAN. 2014 00:36:20

### Plot on Configuration For BR (GFSK) / Hopping / 30MHz~2400MHz (down 30dBc)



Date: 8. JAN. 2014 00:36:54

### Plot on Configuration For BR (GFSK) / Hopping / 2500MHz~26500MHz (down 30dBc)



Date: 8. JAN. 2014 00:37:27



**Spectrum**

Ref Level 107.00 dB $\mu$ V   RBW 100 kHz   Att 10 dB   SWT 265 ms   VBW 300 kHz   Mode Sweep

1Pk View

M1[1] 96.72 dB $\mu$ V 2.402070 GHz

D1 96.720 dB $\mu$ V

D2 66.720 dB $\mu$ V

Start 30.0 MHz   30001 pts   Stop 26.5 GHz

Measurement...

08.01.2014

**Spectrum**

Ref Level 107.00 dBμV    RBW 100 kHz  
 Att 10 dB    SWT 30.1 ms    VBW 300 kHz    Mode Sweep

● 1Pk View

M1[1] 42.17 dBμV 319.5650 MHz

D1 96.720 dBμV  
 D2 66.720 dBμV

M1

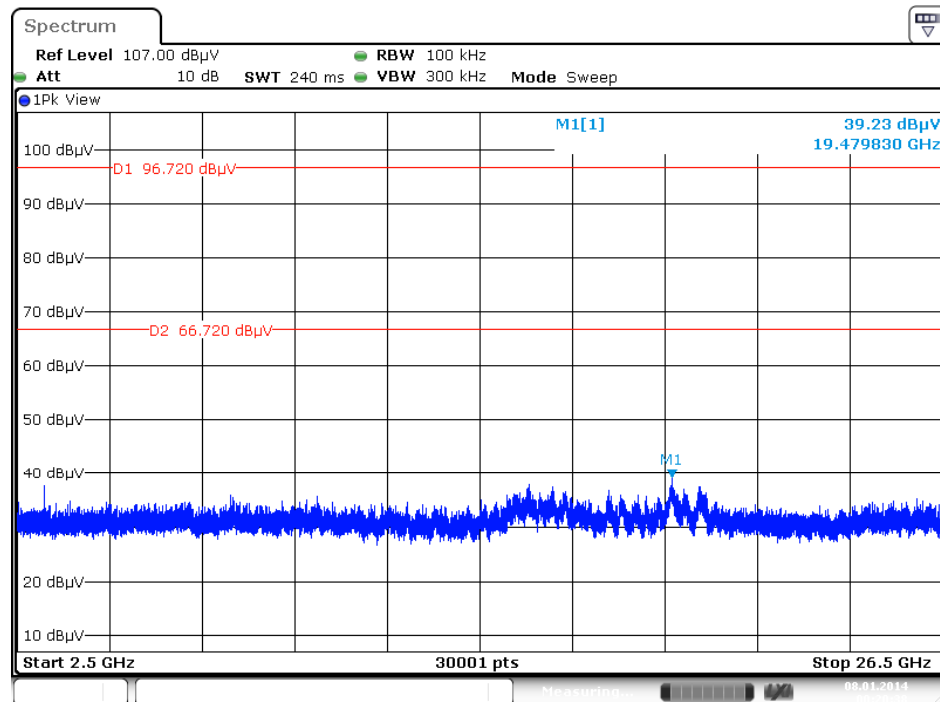
Start 30.0 MHz    30001 pts    Stop 2.4 GHz

Measuring...

09.01.2014

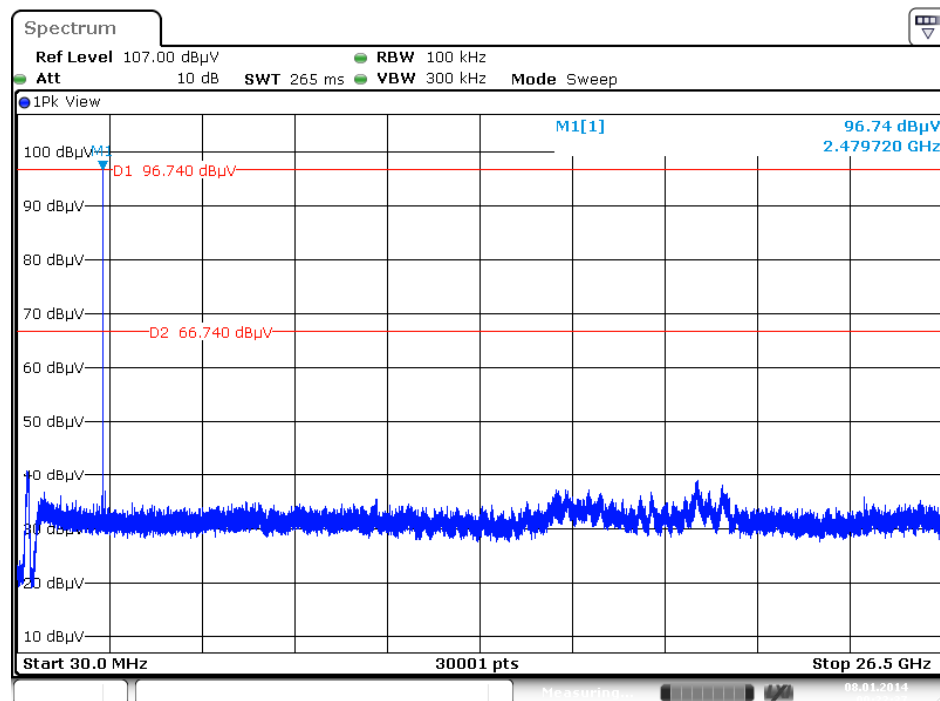
Issued Date : Feb. 12, 2014

### Plot on Configuration For EDR (8DPSK) / Channel 0 / 2500MHz~26500MHz (down 30dBc)



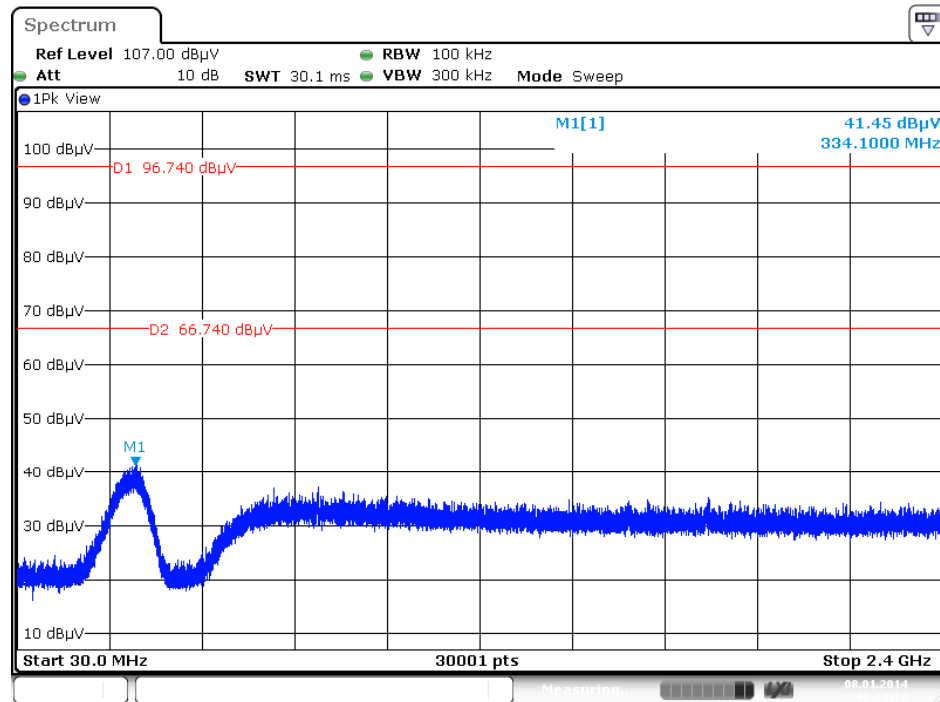
Date: 8. JAN. 2014 00:20:38

### Plot on Configuration For EDR (8DPSK) / Channel 78 / Reference Level

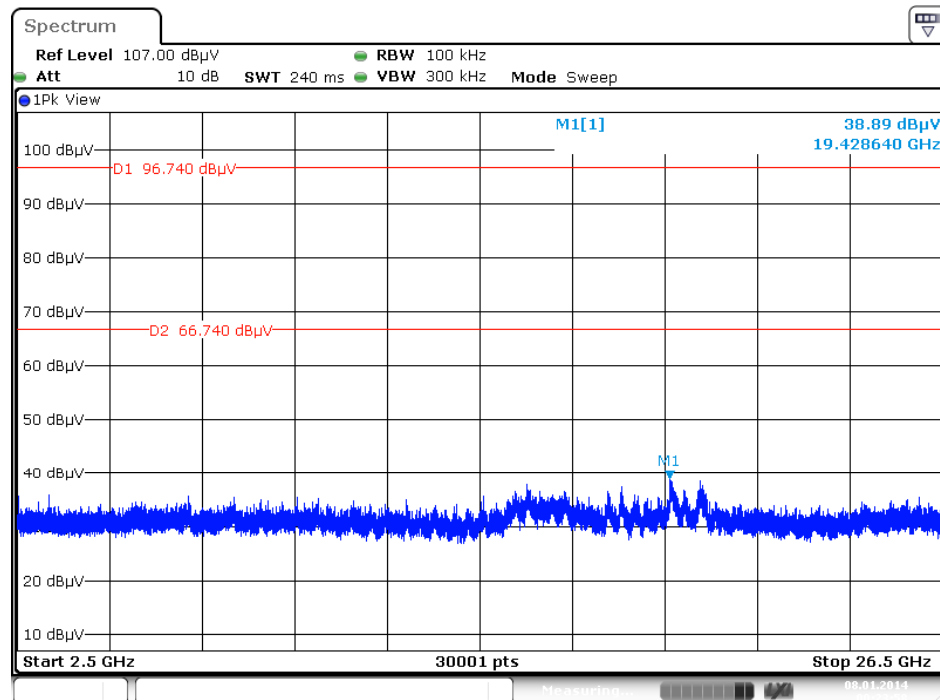


Date: 8. JAN. 2014 00:22:37

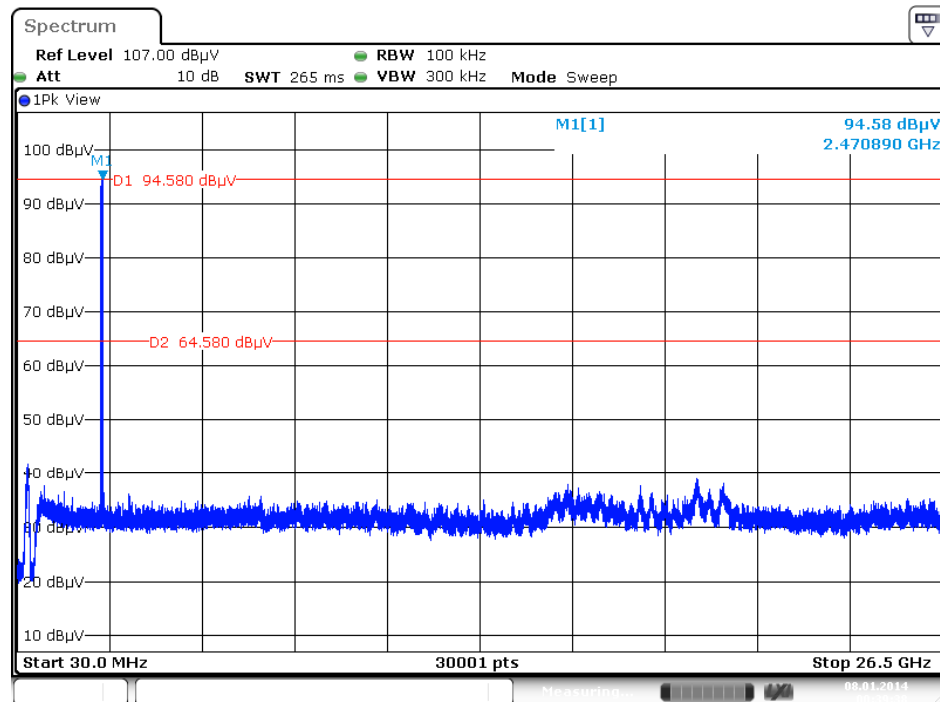
### Plot on Configuration For EDR (8DPSK) / Channel 78 / 30MHz~2400MHz (down 30dBc)



### Plot on Configuration For EDR (8DPSK) / Channel 78 / 2500MHz~26500MHz (down 30dBc)

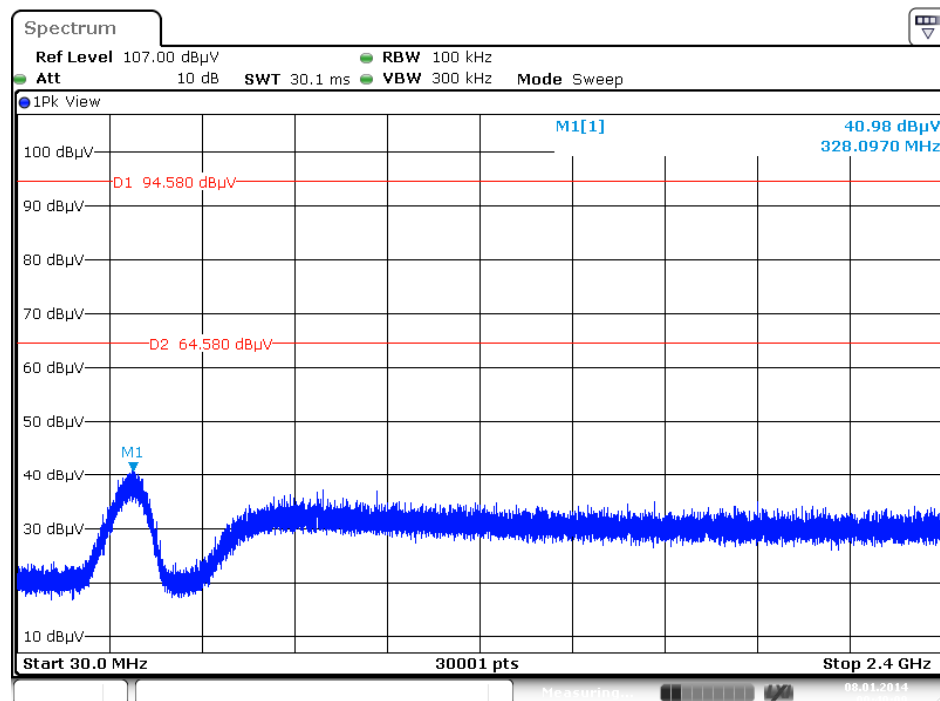


### Plot on Configuration For EDR (8DPSK) / Hopping / Reference Level



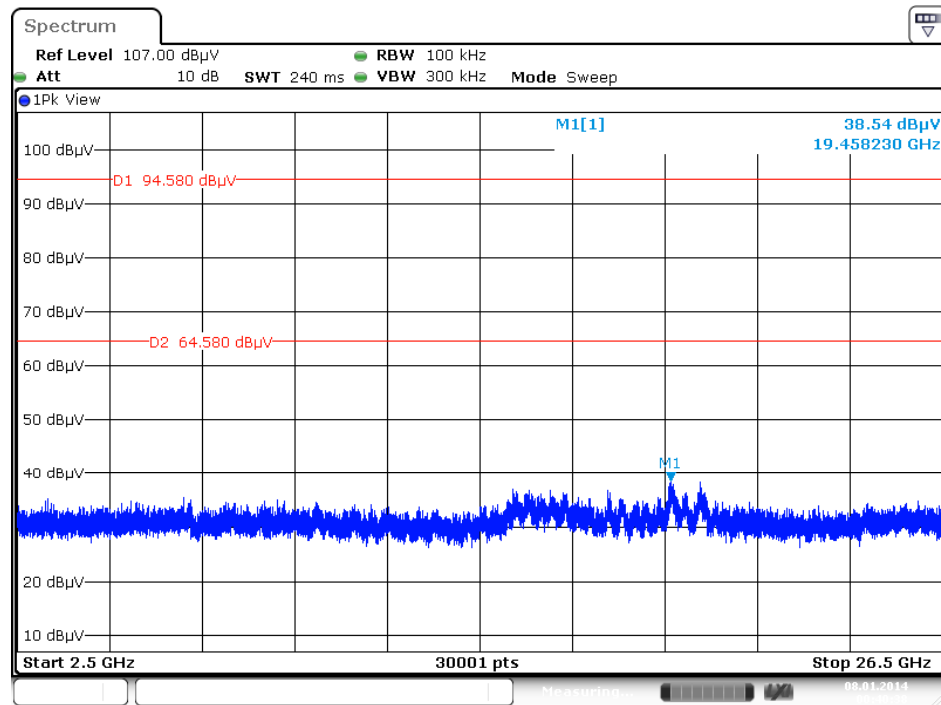
Date: 8. JAN. 2014 00:39:38

### Plot on Configuration For EDR (8DPSK) / Hopping / 30MHz~2400MHz (down 30dBc)



Date: 8. JAN. 2014 00:40:08

### Plot on Configuration For EDR (8DPSK) / Hopping / 2500MHz~26500MHz (down 30dBc)



Date: 8. JAN. 2014 00:40:38

## **4.8. Antenna Requirements**

### **4.8.1. Limit**

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. 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 provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited.

### **4.8.2. Antenna Connector Construction**

Please refer to section 3.3 in this test report, antenna connector complied with the requirements.

## 5. LIST OF MEASURING EQUIPMENTS

| Instrument               | Manufacturer | Model No.        | Serial No.     | Characteristics  | Calibration Date | Remark                |
|--------------------------|--------------|------------------|----------------|------------------|------------------|-----------------------|
| EMI Test Receiver        | R&S          | ESCS 30          | 100355         | 9kHz ~ 2.75 GHz  | Apr. 12, 2013    | Conduction (CO01-CB)  |
| LISN                     | F.C.C.       | FCC-LISN-50-16-2 | 04083          | 150kHz ~ 100 MHz | Nov. 23, 2013    | Conduction (CO01-CB)  |
| Artificial Mains Network | Schwarzbeck  | NSLK 8127        | 8127647        | 9kHz ~ 30MHz     | Nov. 23, 2013    | Conduction (CO01-CB)  |
| COND Cable               | Woken        | Cable            | 01             | 150kHz ~ 30 MHz  | Dec. 04, 2013    | Conduction (CO01-CB)  |
| Software                 | Audix        | E3               | 5.410e         | -                | -                | Conduction (CO01-CB)  |
| BILOG ANTENNA            | Schaffner    | CBL6112D         | 22021          | 20MHz ~ 2GHz     | Apr. 16, 2013    | Radiation (03CH01-CB) |
| Loop Antenna             | Teseq        | HLA 6120         | 24155          | 9kHz - 30 MHz    | Nov. 05, 2012*   | Radiation (03CH01-CB) |
| Horn Antenna             | EMCO         | 3115             | 00075790       | 750MHz~18GHz     | Nov. 01, 2013    | Radiation (03CH01-CB) |
| Horn Antenna             | SCHWARZBEAK  | BBHA 9170        | BBHA9170252    | 15GHz ~ 40GHz    | Dec. 17, 2013    | Radiation (03CH01-CB) |
| Pre-Amplifier            | Agilent      | 8447D            | 2944A10991     | 0.1MHz ~ 1.3GHz  | Nov. 12, 2013    | Radiation (03CH01-CB) |
| Pre-Amplifier            | Agilent      | 8449B            | 3008A02310     | 1GHz ~ 26.5GHz   | Dec. 16, 2013    | Radiation (03CH01-CB) |
| Pre-Amplifier            | WM           | TF-130N-R1       | 923365         | 26GHz ~ 40GHz    | Oct. 23, 2013    | Radiation (03CH01-CB) |
| Spectrum analyzer        | R&S          | FSP40            | 100019         | 9kHz~40GHz       | Dec. 02, 2013    | Radiation (03CH01-CB) |
| EMI Test Receiver        | Agilent      | N9038A           | MY52260123     | 9kHz ~ 8GHz      | Dec. 12, 2013    | Radiation (03CH01-CB) |
| Turn Table               | INN CO       | CO 2000          | N/A            | 0 ~ 360 degree   | N.C.R            | Radiation (03CH01-CB) |
| Antenna Mast             | INN CO       | CO2000           | N/A            | 1 m - 4 m        | N.C.R            | Radiation (03CH01-CB) |
| RF Cable-low             | Woken        | Low Cable-1      | N/A            | 30 MHz - 1 GHz   | Nov. 17, 2013    | Radiation (03CH01-CB) |
| RF Cable-high            | Woken        | High Cable-1     | N/A            | 1 GHz ~ 26.5 GHz | Nov. 17, 2013    | Radiation (03CH01-CB) |
| RF Cable-high            | Woken        | High Cable-2     | N/A            | 1 GHz ~ 26.5 GHz | Nov. 17, 2013    | Radiation (03CH01-CB) |
| RF Cable-high            | Woken        | High Cable-3     | N/A            | 1 GHz - 40 GHz   | Nov. 17, 2013    | Radiation (03CH01-CB) |
| RF Cable-high            | Woken        | High Cable-4     | N/A            | 1 GHz - 40 GHz   | Nov. 17, 2013    | Radiation (03CH01-CB) |
| Signal analyzer          | R&S          | FSV40            | 100979         | 9kHz~40GHz       | Nov. 29, 2013    | Conducted (TH01-CB)   |
| RF Power Divider         | Woken        | 2 Way            | 0120A02056002D | 2GHz ~ 18GHz     | Nov. 17, 2013    | Conducted (TH01-CB)   |
| RF Power Divider         | Woken        | 3 Way            | MDC2366        | 2GHz ~ 18GHz     | Nov. 17, 2013    | Conducted (TH01-CB)   |
| RF Power Divider         | Woken        | 4 Way            | 0120A04056002D | 2GHz ~ 18GHz     | Nov. 17, 2013    | Conducted (TH01-CB)   |
| RF Cable-high            | Woken        | High Cable-7     | -              | 1 GHz ~ 26.5 GHz | Nov. 17, 2013    | Conducted (TH01-CB)   |
| RF Cable-high            | Woken        | High Cable-8     | -              | 1 GHz ~ 26.5 GHz | Nov. 17, 2013    | Conducted (TH01-CB)   |
| RF Cable-high            | Woken        | High Cable-9     | -              | 1 GHz ~ 26.5 GHz | Nov. 17, 2013    | Conducted (TH01-CB)   |

| Instrument    | Manufacturer | Model No.     | Serial No. | Characteristics  | Calibration Date | Remark              |
|---------------|--------------|---------------|------------|------------------|------------------|---------------------|
| RF Cable-high | Woken        | High Cable-10 | -          | 1 GHz – 26.5 GHz | Nov. 17, 2013    | Conducted (TH01-CB) |
| RF Cable-high | Woken        | High Cable-11 | -          | 1 GHz – 26.5 GHz | Nov. 17, 2013    | Conducted (TH01-CB) |
| Power Sensor  | Anritsu      | MA2411B       | 0917223    | 300MHz~40GHz     | Sep. 18, 2013    | Conducted (TH01-CB) |
| Power Meter   | Anritsu      | ML2495A       | 1035008    | 300MHz~40GHz     | Sep. 18, 2013    | Conducted (TH01-CB) |

Note: Calibration Interval of instruments listed above is one year.

“\*” Calibration Interval of instruments listed above is two years.

N.C.R. means Non-Calibration required.

## 6. MEASUREMENT UNCERTAINTY

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

| Contribution                                                       | Uncertainty of $x_i$ |      |                               | $u(x_i)$ |
|--------------------------------------------------------------------|----------------------|------|-------------------------------|----------|
|                                                                    | Value                | Unit | Probability Distribution<br>k |          |
| Receiver reading                                                   | 0.026                | dB   | normal(k=2)                   | 0.013    |
| Cable loss                                                         | 0.002                | dB   | normal(k=2)                   | 0.001    |
| AMN/LISN specification                                             | 1.200                | dB   | normal(k=2)                   | 0.600    |
| Mismatch<br>Receiver VSWR 1 =<br>AMN/LISN VSWR 2 =                 | -0.080               | dB   | U-shaped                      | 0.060    |
| Combined standard uncertainty $U_c(y)$                             |                      |      |                               | 1.2      |
| Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$ |                      |      |                               | 2.4      |

### Uncertainty of Radiated Emission Measurement (30MHz ~ 1,000MHz)

| Contribution                                                       | Uncertainty of $x_i$ |      |                               | $u(x_i)$ |
|--------------------------------------------------------------------|----------------------|------|-------------------------------|----------|
|                                                                    | Value                | Unit | Probability Distribution<br>k |          |
| Receiver reading                                                   | $\pm 0.173$          | dB   | K=1                           | 0.086    |
| Cable loss                                                         | $\pm 0.174$          | dB   | K=2                           | 0.087    |
| Antenna gain                                                       | $\pm 0.169$          | dB   | K=2                           | 0.084    |
| Site imperfection                                                  | $\pm 0.433$          | dB   | Triangular                    | 0.214    |
| Pre-amplifier gain                                                 | $\pm 0.366$          | dB   | K=2                           | 0.183    |
| Transmitter antenna                                                | $\pm 1.200$          | dB   | Rectangular                   | 0.600    |
| Signal generator                                                   | $\pm 0.461$          | dB   | Rectangular                   | 0.231    |
| Mismatch                                                           | $\pm 0.080$          | dB   | U-shape                       | 0.040    |
| Spectrum analyzer                                                  | $\pm 0.500$          | dB   | Rectangular                   | 0.250    |
| Combined standard uncertainty $U_c(y)$                             |                      |      |                               | 1.778    |
| Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$ |                      |      |                               | 3.555    |

### Uncertainty of Radiated Emission Measurement (1GHz ~ 18GHz)

| Contribution                                                       | Uncertainty of $x_i$ |      |                            | $u(x_i)$ |
|--------------------------------------------------------------------|----------------------|------|----------------------------|----------|
|                                                                    | Value                | Unit | Probability Distribution k |          |
| Receiver reading                                                   | $\pm 0.191$          | dB   | K=1                        | 0.095    |
| Cable loss                                                         | $\pm 0.169$          | dB   | K=2                        | 0.084    |
| Antenna gain                                                       | $\pm 0.191$          | dB   | K=2                        | 0.096    |
| Site imperfection                                                  | $\pm 0.582$          | dB   | Triangular                 | 0.291    |
| Pre-amplifier gain                                                 | $\pm 0.304$          | dB   | K=2                        | 0.152    |
| Transmitter antenna                                                | $\pm 1.200$          | dB   | Rectangular                | 0.600    |
| Signal generator                                                   | $\pm 0.461$          | dB   | Rectangular                | 0.231    |
| Mismatch                                                           | $\pm 0.080$          | dB   | U-shape                    | 0.040    |
| Spectrum analyzer                                                  | $\pm 0.500$          | dB   | Rectangular                | 0.250    |
| Combined standard uncertainty $U_c(y)$                             |                      |      |                            | 1.839    |
| Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$ |                      |      |                            | 3.678    |

### Uncertainty of Radiated Emission Measurement (18GHz ~ 40GHz)

| Contribution                                                       | Uncertainty of $x_i$ |      |                            | $u(x_i)$ |
|--------------------------------------------------------------------|----------------------|------|----------------------------|----------|
|                                                                    | Value                | Unit | Probability Distribution k |          |
| Receiver reading                                                   | $\pm 0.186$          | dB   | K=1                        | 0.093    |
| Cable loss                                                         | $\pm 0.167$          | dB   | K=2                        | 0.083    |
| Antenna gain                                                       | $\pm 0.190$          | dB   | K=2                        | 0.095    |
| Site imperfection                                                  | $\pm 0.488$          | dB   | Triangular                 | 0.244    |
| Pre-amplifier gain                                                 | $\pm 0.269$          | dB   | K=2                        | 0.134    |
| Transmitter antenna                                                | $\pm 1.200$          | dB   | Rectangular                | 0.600    |
| Signal generator                                                   | $\pm 0.461$          | dB   | Rectangular                | 0.231    |
| Mismatch                                                           | $\pm 0.080$          | dB   | U-shape                    | 0.040    |
| Spectrum analyzer                                                  | $\pm 0.500$          | dB   | Rectangular                | 0.250    |
| Combined standard uncertainty $U_c(y)$                             |                      |      |                            | 1.771    |
| Measuring uncertainty for a level of confidence of 95% $U=2U_c(y)$ |                      |      |                            | 3.541    |

### Uncertainty of Conducted Emission Measurement

| Contribution                                                         | Uncertainty of $x_i$ |      |                            | $u(x_i)$ |
|----------------------------------------------------------------------|----------------------|------|----------------------------|----------|
|                                                                      | Value                | Unit | Probability Distribution k |          |
| Cable loss                                                           | $\pm 0.038$          | dB   | K=2                        | 0.019    |
| Attenuator                                                           | $\pm 0.047$          | dB   | K=2                        | 0.024    |
| Power Meter specification                                            | $\pm 0.300$          | dB   | Triangular                 | 0.150    |
| Power Sensor specification                                           | $\pm 0.300$          | dB   | Rectangular                | 0.150    |
| Signal generator                                                     | $\pm 0.461$          | dB   | Rectangular                | 0.231    |
| Mismatch                                                             | $\pm 0.080$          | dB   | U-shape                    | 0.040    |
| Spectrum analyzer                                                    | $\pm 0.500$          | dB   | Rectangular                | 0.250    |
| Combined standard uncertainty $U_c(y)$                               |                      |      |                            | 0.863    |
| Measuring uncertainty for a level of confidence of 95% $U = 2U_c(y)$ |                      |      |                            | 1.726    |