

# TEST REPORT

For

**Bluetooth Unit**

In conformity with

**FCC CFR 47 Part15 / RSS-210, RSS-Gen**

**Model: BU-30**

**FCC ID/ IC Certification No.: AZDK30298 / 498C-K30298**

**Test Item: Bluetooth Unit**

**Report No: RY0802Z04R1**

**Issue Date: 4 February 2008**

**Prepared for**

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**RF Technologies Ltd. is managed to ISO17025 and has the necessary knowledge and test facilities for testing according to the referenced standards.**

## Table of contents

|          |                                                                      |           |
|----------|----------------------------------------------------------------------|-----------|
| <b>1</b> | <b>General information.....</b>                                      | <b>3</b>  |
| 1.1      | Product description .....                                            | 3         |
| 1.2      | Test(s) performed/ Summary of test result .....                      | 3         |
| 1.3      | Test facility .....                                                  | 4         |
| 1.4      | Measurement uncertainty.....                                         | 4         |
| 1.5      | Summary of test results.....                                         | 5         |
| 1.5.1    | Table of test summary.....                                           | 5         |
| 1.6      | Setup of equipment under test (EUT) .....                            | 6         |
| 1.6.1    | Test configuration of EUT .....                                      | 6         |
| 1.6.2    | Operating condition: .....                                           | 6         |
| 1.6.3    | Setup diagram of tested system:.....                                 | 7         |
| 1.7      | Equipment modifications.....                                         | 7         |
| 1.8      | Deviation from the standard .....                                    | 7         |
| <b>2</b> | <b>Test procedure and test data .....</b>                            | <b>8</b>  |
| 2.1      | Occupied Bandwidth (20 dB / 99%).....                                | 8         |
| 2.1.1    | Operating Mode: Basic rate .....                                     | 9         |
| 2.1.2    | Operating Mode: EDR 2M rate.....                                     | 12        |
| 2.2      | Hopping Carrier Frequency Separation .....                           | 15        |
| 2.2.1    | Operating Mode: Basic rate .....                                     | 16        |
| 2.2.2    | Operating Mode: EDR 2M rate.....                                     | 16        |
| 2.3      | Number of Hopping Channel.....                                       | 17        |
| 2.3.1    | Operating Mode: Basic rate .....                                     | 18        |
| 2.3.2    | Operating Mode: EDR 2M rate.....                                     | 18        |
| 2.4      | Average Time of Occupancy .....                                      | 19        |
| 2.4.1    | Operating Mode: Basic rate .....                                     | 20        |
| 2.4.2    | Operating Mode: EDR 2M rate.....                                     | 21        |
| 2.5      | Peak Output Power .....                                              | 23        |
| 2.5.1    | Operating Mode: Basic rate .....                                     | 24        |
| 2.5.2    | Operating Mode: EDR 2M rate.....                                     | 25        |
| 2.6      | Peak Power Spectral Density .....                                    | 27        |
| 2.6.1    | Operating Mode: Basic rate .....                                     | 28        |
| 2.6.2    | Operating Mode: EDR 2M rate.....                                     | 29        |
| 2.7      | Conducted Spurious Emissions (Antenna Port).....                     | 31        |
| 2.7.1    | Operating Mode: Basic rate .....                                     | 32        |
| 2.7.2    | Operating Mode: EDR 2M rate.....                                     | 35        |
| 2.8      | Transmitter Radiated spurious emissions .....                        | 38        |
| 2.8.1    | Below 30 MHz.....                                                    | 40        |
| 2.8.2    | Between 30 – 1000 MHz .....                                          | 41        |
| 2.8.3    | Above 1000 MHz.....                                                  | 45        |
| 2.9      | Transmitter AC power line conducted emissions .....                  | 55        |
| 2.9.1    | Operating Mode: Basic rate (Worst case configuration).....           | 56        |
| 2.9.2    | Operating Mode: EDR 2M rate (Worst case configuration) .....         | 58        |
| 2.10     | Receiver Radiated spurious emissions .....                           | 60        |
| 2.10.1   | Between 30 – 1000 MHz .....                                          | 60        |
| 2.10.2   | Above 1000 MHz.....                                                  | 62        |
| 2.11     | Receiver AC power line conducted emissions.....                      | 63        |
| 2.12     | Maximum Permissible Exposure (Exposure of Humans to RF Fields) ..... | 66        |
| <b>3</b> | <b>Test setup photographs .....</b>                                  | <b>67</b> |
| 3.1      | Definition of the EUT axis.....                                      | 67        |
| 3.2      | Antenna Port Measurements .....                                      | 68        |
| 3.3      | Radiated spurious emissions.....                                     | 69        |
| 3.4      | AC power line conducted emissions.....                               | 72        |
| <b>4</b> | <b>List of utilized test equipment/ calibration .....</b>            | <b>73</b> |

## 1 General information

### 1.1 Product description

Test item : Bluetooth Unit  
Manufacturer : FUJITSU ELECTRONICS INC.  
Address : 9-5, Nishigotanda 8-chome, Shinagawa-ku, Tokyo 224-0046, Japan  
Model : BU-30  
FCC ID : AZDK30298  
IC Certification No : 498C-K30298  
Serial numbers : None  
Fundamental Operated Frequency : Tx/Rx Freq. (2402 - 2480 MHz)  
Oscillator frequencies : 16 MHz  
Type of Modulation : GFSK: Basic Rate,  $\pi/4$ DQPSK: EDR 2M rate  
RF Output Power : 2.94dBm (measured at the antenna terminal)  
Antenna Gain : -0.72 dBi (Nominal Maximum Value)  
Receipt date of EUT : 17 January 2008  
Nominal power source voltages : DC 5.0V (from USB port)

### 1.2 Test(s) performed/ Summary of test result

Test specification(s) : FCC CFR 47. Part 15 (October 1, 2007) / RSS-210 Issue 7, RSS-Gen Issue 2  
Test method(s) : ANSI C63.4: 2003  
Test(s) started : 17 January 2008  
Test(s) completed : 1 February 2008  
Purpose of test(s) : Grant for Certification of FCC / IC

Summary of test result : Complied

Note: The above judgment is only based on the measurement data and it does not include the measurement uncertainty. Accordingly, the statement below is applied to the test result.

The EUT complies with the limit required in the standard in case that the margin is not less than the measurement uncertainty in the Laboratory.

Compliance of the EUT is more probable than non-compliance is case that the margin is less than the measurement uncertainty in the Laboratory.

Test engineer

: K. Ohnishi  
K. Ohnishi

Reviewer

: T. Ikegami  
T. Ikegami

## 1.3 Test facility

The Federal Communications Commission has reviewed the technical characteristics of the test facilities at RF Technologies Ltd., located in 472, Nippa-cho, Kohoku-ku, Yokohama, 223-0057, Japan, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948, per October 1, 2007. The description of the test facilities has been filed under registration number 879401 at the Office of the Federal Communications Commission. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The list of all public test facilities is available on the Internet at <http://www.fcc.gov>.

Registered by Voluntary Control Council for Interference by Information Technology Equipment (VCCI)

Each registered facility number is as follows;

Test site (Semi-Anechoic chamber 3m) R-2393

Test site (Shielded room) C-2617

Registered by Industry Canada (IC): The registered facility number is as follows;

Test site No. 1 (Semi-Anechoic chamber 3m): 6974A

## 1.4 Measurement uncertainty

The treatment of uncertainty is based on the general matters on the definition of uncertainty in “Guide to the expression of uncertainty in measurement (GUM)” published by ISO. The Lab’s uncertainty is determined by referring UKAS Publication LAB34: 2002 “The Expression of Uncertainty in EMC Testing” and CISPR16-4-2: 2003 “Uncertainty in EMC Measurements”.

The uncertainty of the measurement result in the level of confidence of approximately 95% ( $k=2$ ) is as follows;

Conducted emission:  $\pm 3.5$  dB (10 kHz – 150 kHz),  $\pm 3.6$  dB (150 kHz – 30 MHz)

Radiated emission (9 kHz - 30MHz):  $\pm 3.2$  dB

Radiated emission (30MHz - 1000MHz):  $\pm 4.6$  dB

Radiated emission (above 1000MHz):  $\pm 4.6$  dB

## 1.5 Summary of test results

### 1.5.1 Table of test summary

| Requirement of;                                                       | Section in FCC15       | Section in RSS210/ RSS-Gen | Result   | Section in this report |
|-----------------------------------------------------------------------|------------------------|----------------------------|----------|------------------------|
| 1.5.1 Occupied Bandwidth (20 dB)                                      | 15.247(a)(1)           | A8.1(1)                    | Complied | 2.1                    |
| 1.5.2 Hopping Carrier Frequency Separation                            | 15.247(a)(1)           | A8.1(2)                    | Complied | 2.2                    |
| 1.5.3 Number of Hopping Channel                                       | 15.247(a)(1)(iii)      | A8.1(4)                    | Complied | 2.3                    |
| 1.5.4 Average Time of Occupancy                                       | 15.247(a)(1)(iii)      | A8.1(4)                    | Complied | 2.4                    |
| 1.5.5 Peak Output Power                                               | 15.247(a)(1)/(b)(1)    | A8.4(2)                    | Complied | 2.5                    |
| 1.5.6 Peak Power Spectral Density                                     | 15.247(f)              | A8.3(2)                    | Complied | 2.6                    |
| 1.5.7 Conducted Spurious Emissions                                    | 15.247(d)              | A8.5                       | Complied | 2.7                    |
| 1.5.8 Transmitter Radiated Spurious Emissions                         | 15.205(b)/15.209       | A8.5                       | Complied | 2.8                    |
| 1.5.9 Transmitter AC Power Line Conducted Emissions                   | 15.207                 | RSS-Gen 7.2.2              | Complied | 2.9                    |
| 1.5.10 Receiver Radiated Spurious Emissions                           | 15.109                 | RSS-Gen 6                  | Complied | 2.10                   |
| 1.5.11 Receiver AC Power Line Conducted Emissions                     | 15.107                 | RSS-Gen 7.2.2              | Complied | 2.11                   |
| 1.5.12 Maximum Permissible Exposure (Exposure of Humans to RF Fields) | 15.247(i)/1.1307(b)(1) | RSS-Gen 5.5/ RSS-102       | Complied | 2.12                   |

## 1.6 Setup of equipment under test (EUT)

### 1.6.1 Test configuration of EUT

#### Equipment(s) under test:

|   | Item           | Manufacturer             | Model No. | Serial No. |
|---|----------------|--------------------------|-----------|------------|
| A | Bluetooth Unit | FUJITSU ELECTRONICS INC. | BU-30     | None       |

#### Support Equipment(s):

|   | Item              | Manufacturer        | Model No.     | Serial No.   |
|---|-------------------|---------------------|---------------|--------------|
| B | Personal Computer | TOSHIBA CORPORATION | PSJ60N-01J00C | 86147293H    |
| C | AC Adaptor        | TOSHIBA CORPORATION | PA3282U-2ACA  | G71C0002SC10 |

#### Connected cable(s):

| No. | Item           | Identification<br>(Manu.e.t.c) | Shielded<br>YES / NO | Ferrite<br>Core<br>YES / NO | Connector Type<br>Shielded<br>YES / NO | Length<br>(m) |
|-----|----------------|--------------------------------|----------------------|-----------------------------|----------------------------------------|---------------|
| 1   | USB cable      | -                              | Yes                  | No                          | Yes                                    | 3.0           |
| 2   | DC power cable | TOSHIBA                        | Yes                  | No                          | Yes                                    | 1.7           |
| 3   | AC power cable | TOSHIBA                        | No                   | No                          | No                                     | 2.0           |

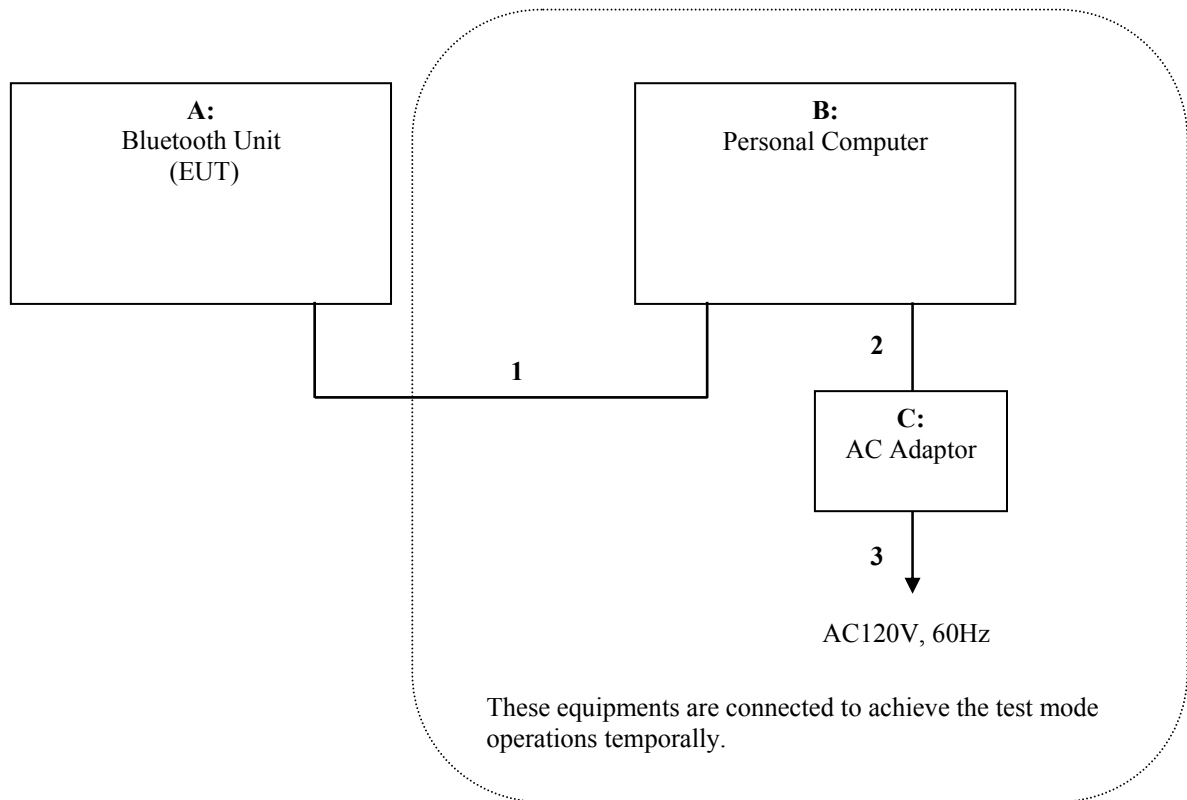
### 1.6.2 Operating condition:

#### Operating mode:

The EUT was tested under the following test mode prepared by the applicant,;

- (1-1) Basic Rate, continuous transmission with DH5 PACKET at hopping off (2402MHz)
- (1-2) Basic Rate, continuous transmission with DH5 PACKET at hopping off (2441MHz)
- (1-3) Basic Rate, continuous transmission with DH5 PACKET at hopping off (2480MHz)
- (1-4) Basic Rate, continuous transmission with DH5 PACKET at hopping on
- (2-1) EDR 2M Rate, continuous transmission with DH5 PACKET at hopping off (2402MHz)
- (2-2) EDR 2M Rate, continuous transmission with DH5 PACKET at hopping off (2441MHz)
- (2-3) EDR 2M Rate, continuous transmission with DH5 PACKET at hopping off (2480MHz)
- (2-4) EDR 2M Rate, continuous transmission with DH5 PACKET at hopping on
- (3-1) Continuous receiving

### 1.6.3 Setup diagram of tested system:



### 1.7 Equipment modifications

No modifications have been made to the equipment in order to achieve compliance with the applicable standards described in clause 1.2.

### 1.8 Deviation from the standard

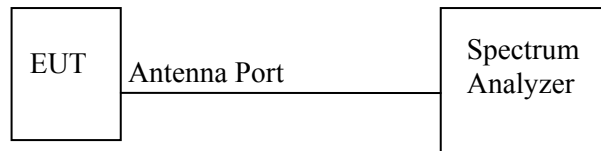
No deviations from the standards described in clause 1.2.

## 2 Test procedure and test data

### 2.1 Occupied Bandwidth (20 dB / 99%)

#### Test setup

Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



#### Test procedure

Measurement procedures were implemented according to the method of ANSI C63.4: 2003 clauses 13.1.7. The EUT antenna port connected to the spectrum analyzer. The RBW is set to 1% to 3% of the measured 20dB bandwidth. The VBW is set to 3 times of the RBW. The sweep time is coupled appropriate.

#### Limitation

There are no limitations. The measurement value is used to calculation of the limitation of the channel separation and the emission designator.

#### Test equipment used (refer to List of utilized test equipment)

|      |  |  |  |  |  |
|------|--|--|--|--|--|
| SA06 |  |  |  |  |  |
|------|--|--|--|--|--|

#### Test results – Reporting purpose.

Operating mode: Basic rate

| Transmission Channel | Transmission Frequency | Bandwidth [KHz] |       |
|----------------------|------------------------|-----------------|-------|
|                      |                        | 20dB            | 99%   |
| Low (0ch)            | 2402                   | 1136.0          | 956.0 |
| Middle (39ch)        | 2441                   | 1132.0          | 948.0 |
| High (78ch)          | 2480                   | 1120.0          | 940.0 |

Operating mode: EDR 2M rate

| Transmission Channel | Transmission Frequency | Bandwidth [KHz] |        |
|----------------------|------------------------|-----------------|--------|
|                      |                        | 20dB            | 99%    |
| Low (0ch)            | 2402                   | 1370.0          | 1220.0 |
| Middle (39ch)        | 2441                   | 1380.0          | 1200.0 |
| High (78ch)          | 2480                   | 1380.0          | 1200.0 |

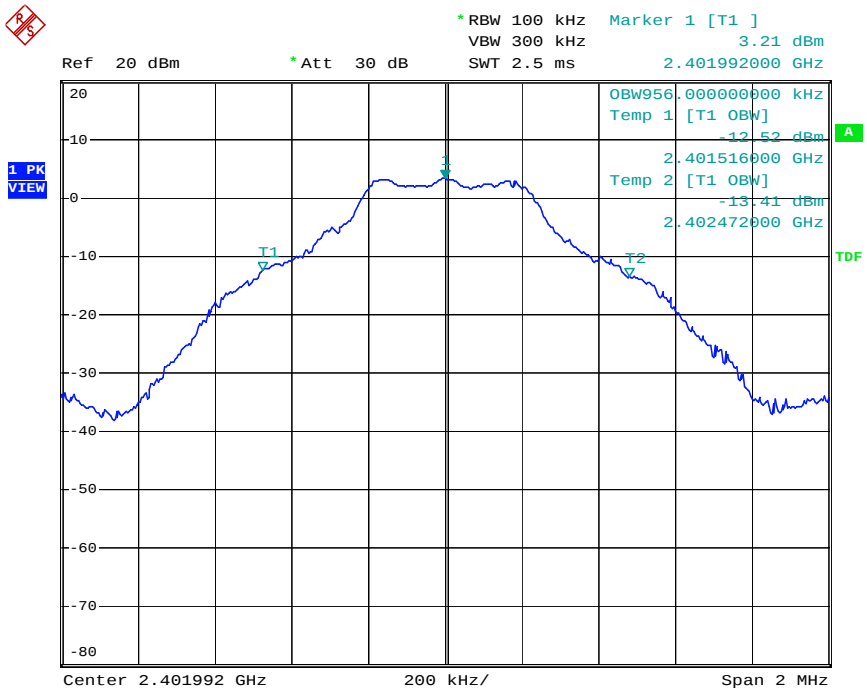
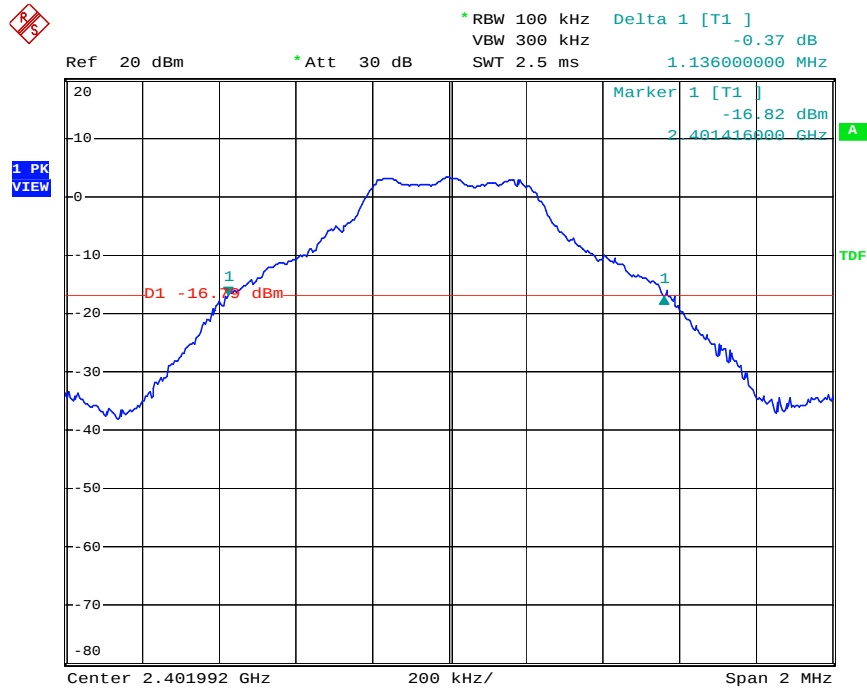
## Test Data

Tested Date: January 25, 2008

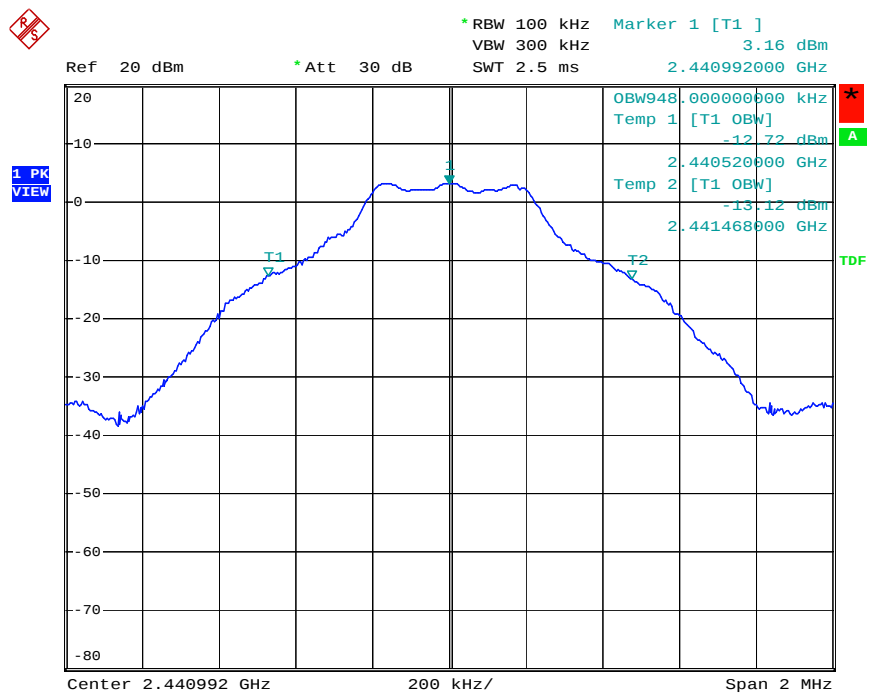
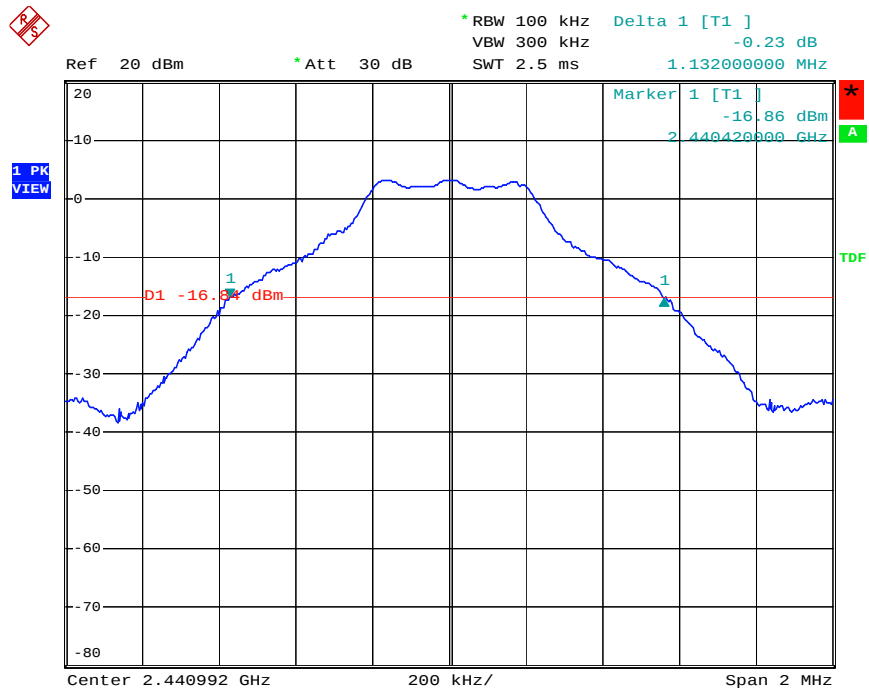
Temperature: 23 °C  
Humidity: 35 %  
Atmos. Press: 1012 hPa

### 2.1.1 Operating Mode: Basic rate

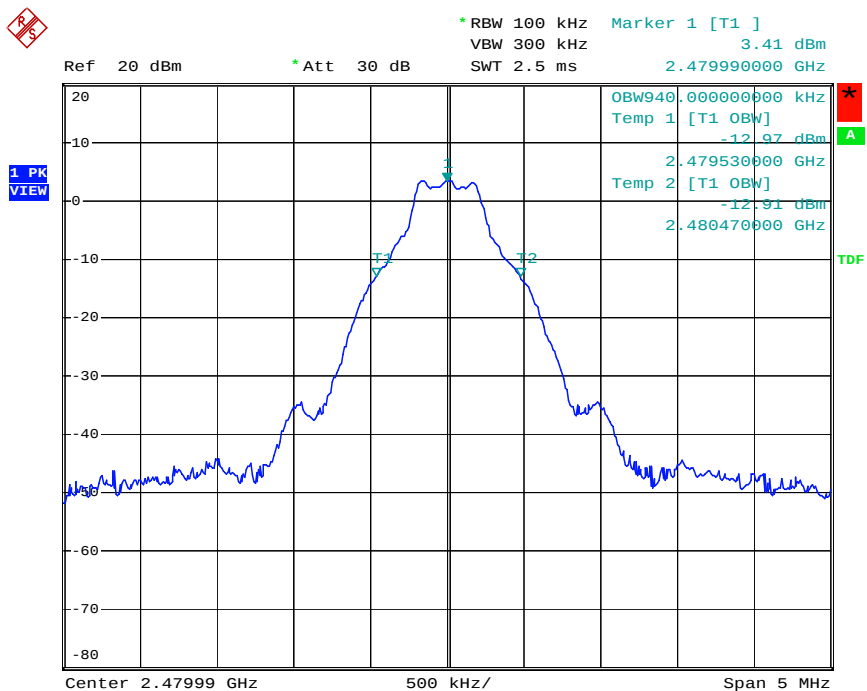
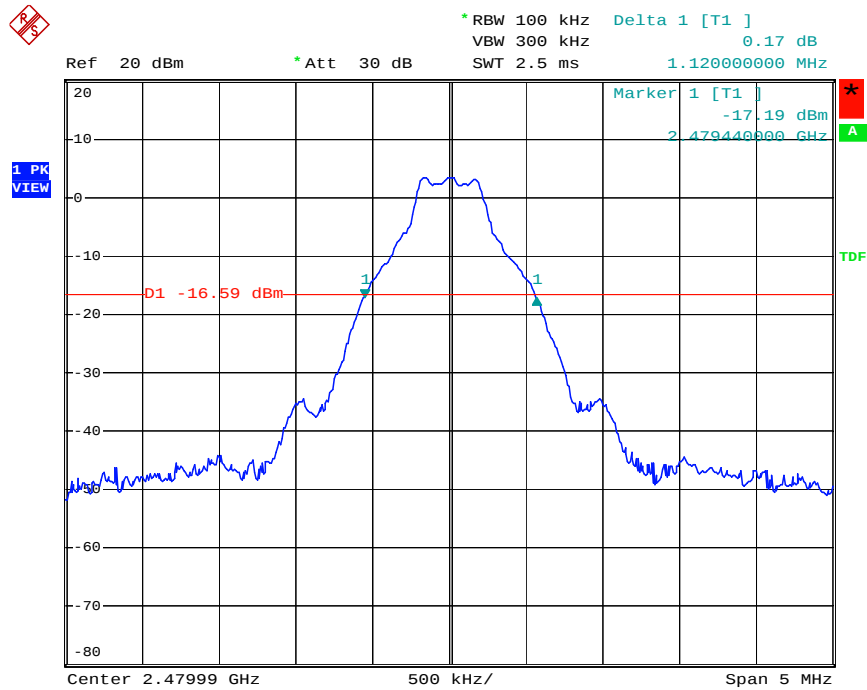
#### Low (0ch) 2402MHz



## Middle (39ch) 2441MHz

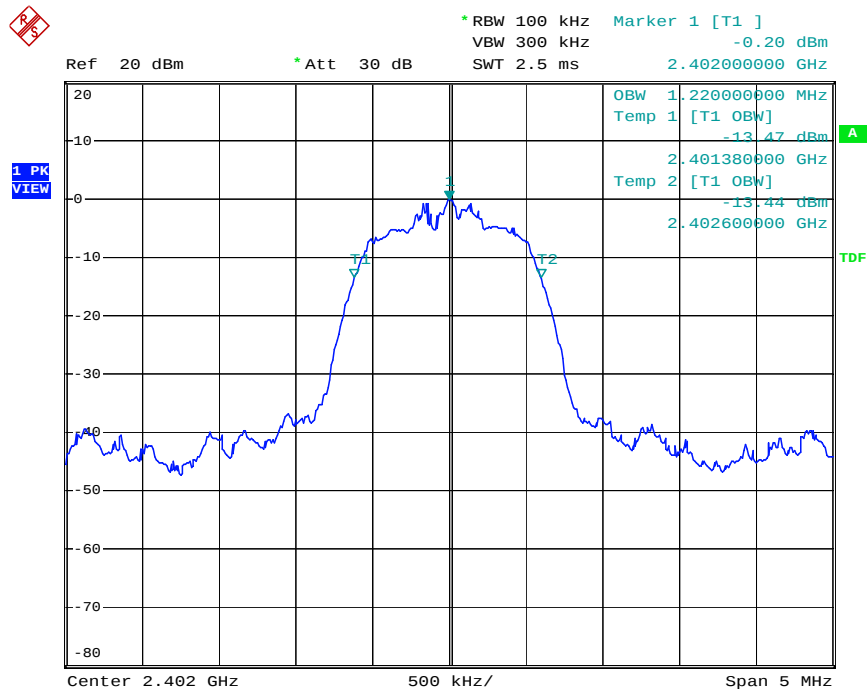
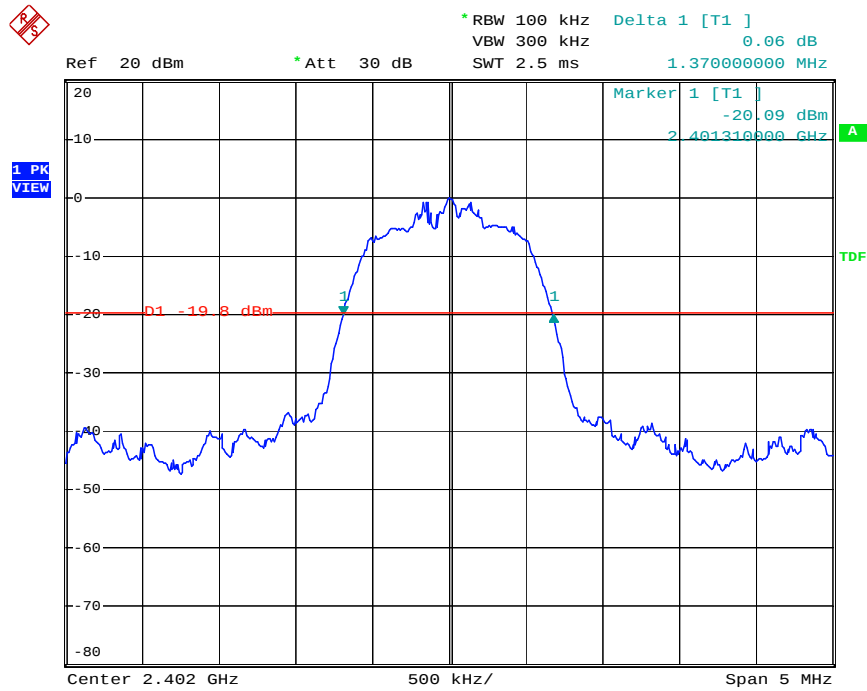


## High (78ch) 2480MHz

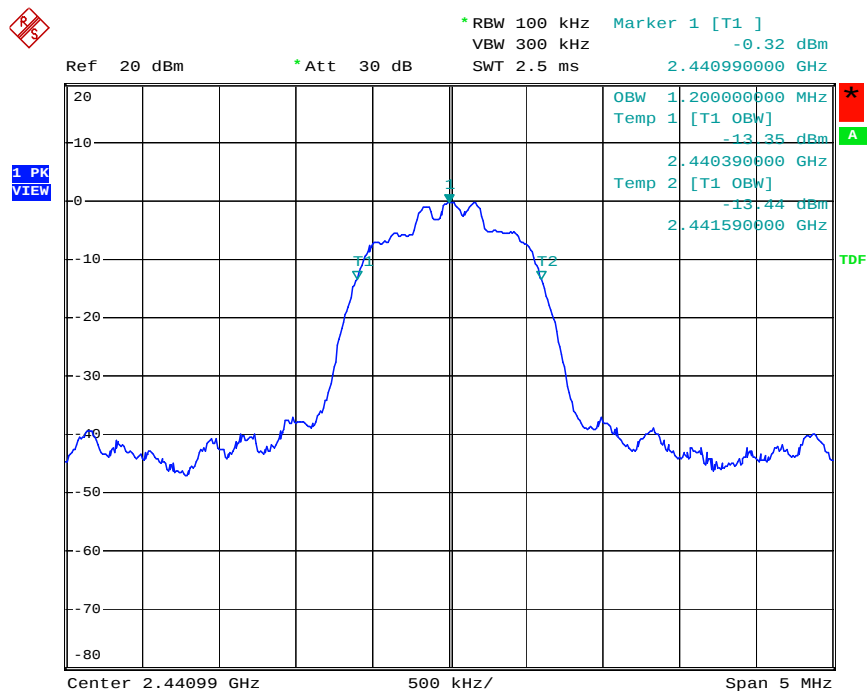
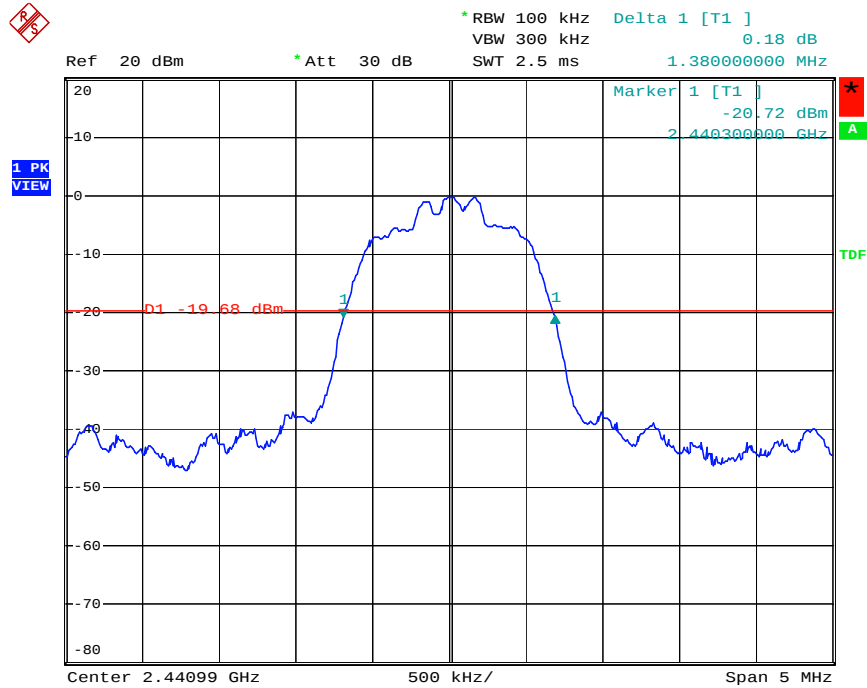


## 2.1.2 Operating Mode: EDR 2M rate

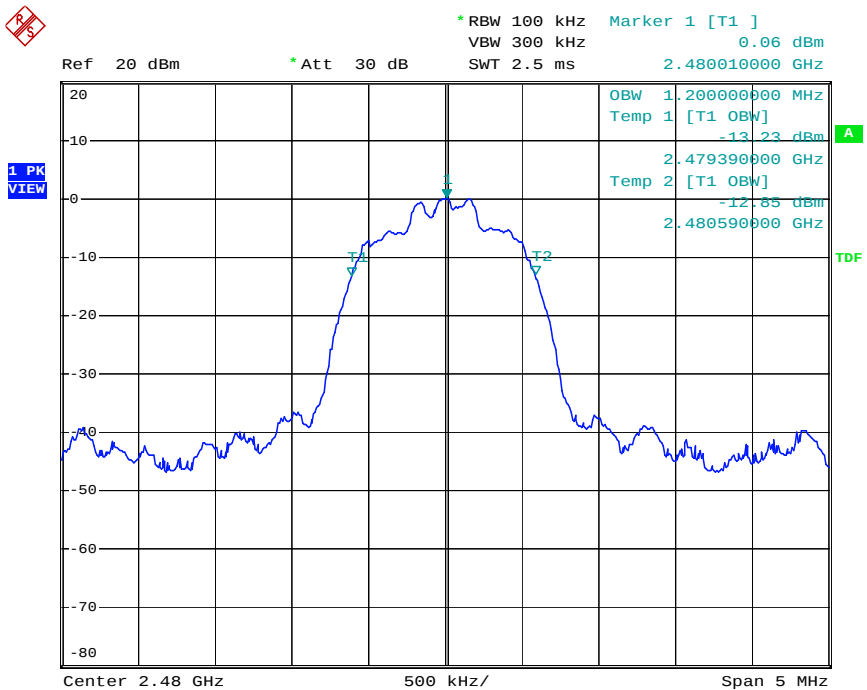
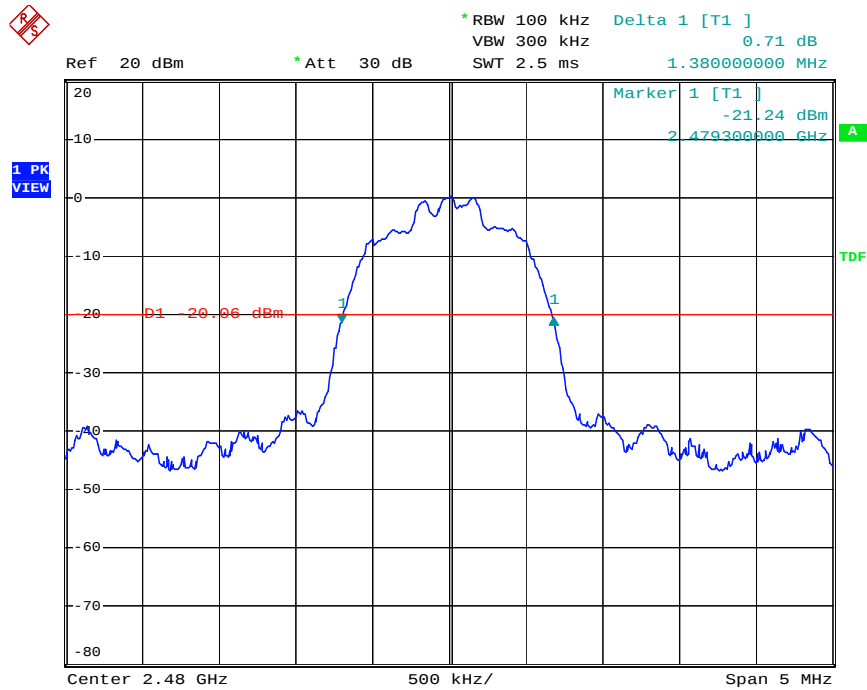
### Low (0ch) 2402MHz



## Middle (39ch) 2441MHz



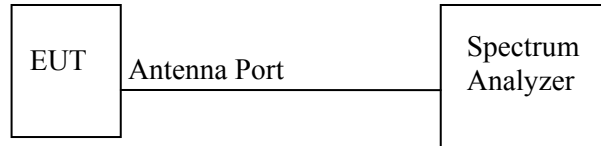
## High (78ch) 2480MHz



## 2.2 Hopping Carrier Frequency Separation

### Test setup

Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



### Test procedure

The EUT antenna port connected to the spectrum analyzer. The RBW is set to 300 kHz. The VBW is set to appropriate in order to read carrier frequency separation. The sweep time is coupled appropriate.

### Limitation

15.247(a)(1) 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, provided the systems operate with an output power no greater than 125 mW.

Therefore limitation value is greater than 757.3 kHz for basic rate and 920 kHz for EDR 2M rate.

### Test equipment used (refer to List of utilized test equipment)

|      |  |  |  |  |  |
|------|--|--|--|--|--|
| SA06 |  |  |  |  |  |
|------|--|--|--|--|--|

### Test results – comply with the limitation.

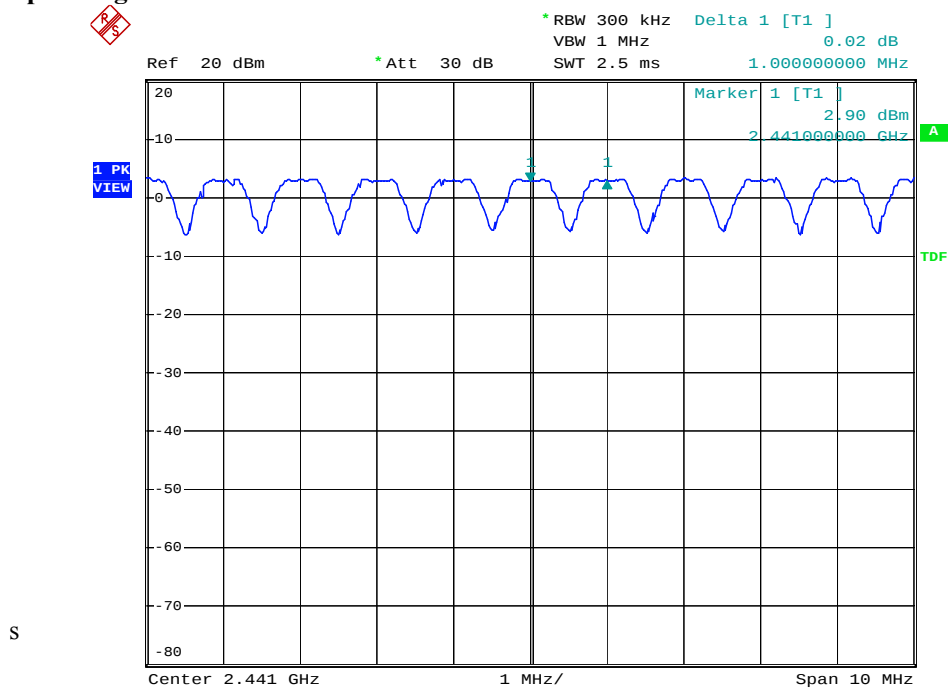
| Measured Channel | Measured Frequency (MHz) | Frequency Separation (MHz) |             |
|------------------|--------------------------|----------------------------|-------------|
|                  |                          | Basic rate                 | EDR 2M rate |
| Middle (39ch)    | 2441                     | 1.0                        | 1.0         |

## Test Data

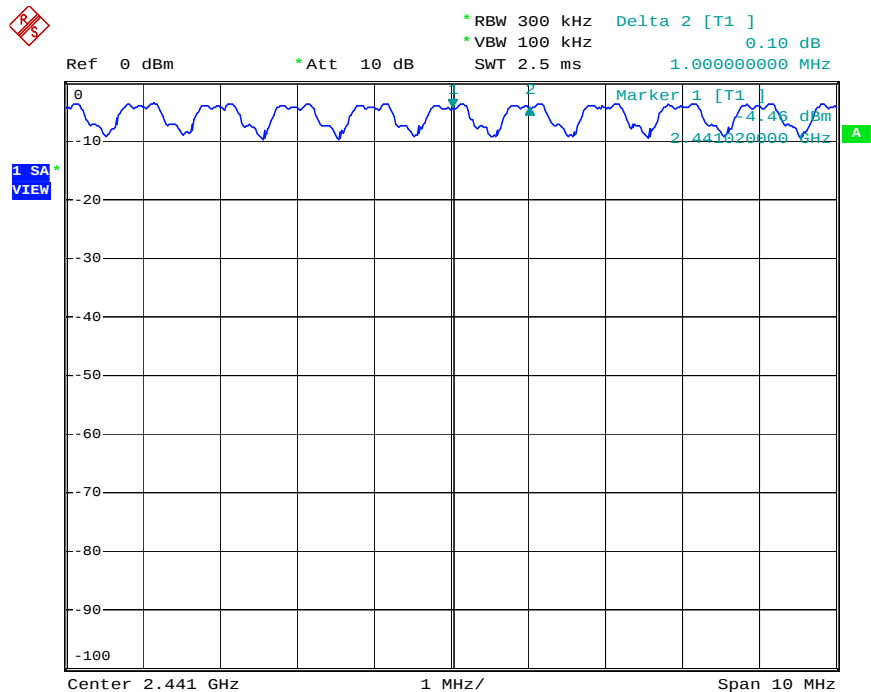
Tested Date: January 25, 2008

Temperature: 23 °C  
Humidity: 35 %  
Atmos. Press: 1012 hPa

### 2.2.1 Operating Mode: Basic rate



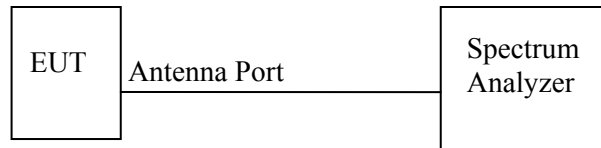
### 2.2.2 Operating Mode: EDR 2M rate



## 2.3 Number of Hopping Channel

### Test setup

Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



### Test procedure

The EUT antenna port connected to the spectrum analyzer. The RBW is set to 300 kHz. The VBW is set to appropriate in order to read carrier frequency. The sweep time is coupled appropriate. The span is set to cover the authorized band. The analyzer is set to MAX HOLD. The EUT is hopping operation.

### Limitation

15.247(a) (1) (iii) (iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

### Test equipment used (refer to List of utilized test equipment)

|      |  |  |  |  |  |
|------|--|--|--|--|--|
| SA06 |  |  |  |  |  |
|------|--|--|--|--|--|

### Test results – Comply with the limitation

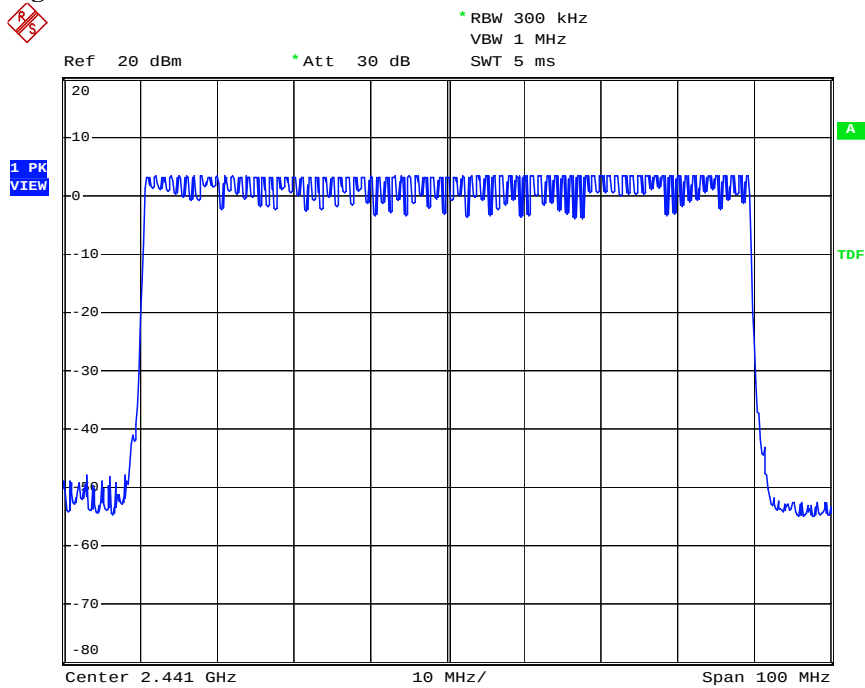
| Operation Mode |             |
|----------------|-------------|
| Basic rate     | EDR 2M rate |
| 79             | 79          |

## Test Data

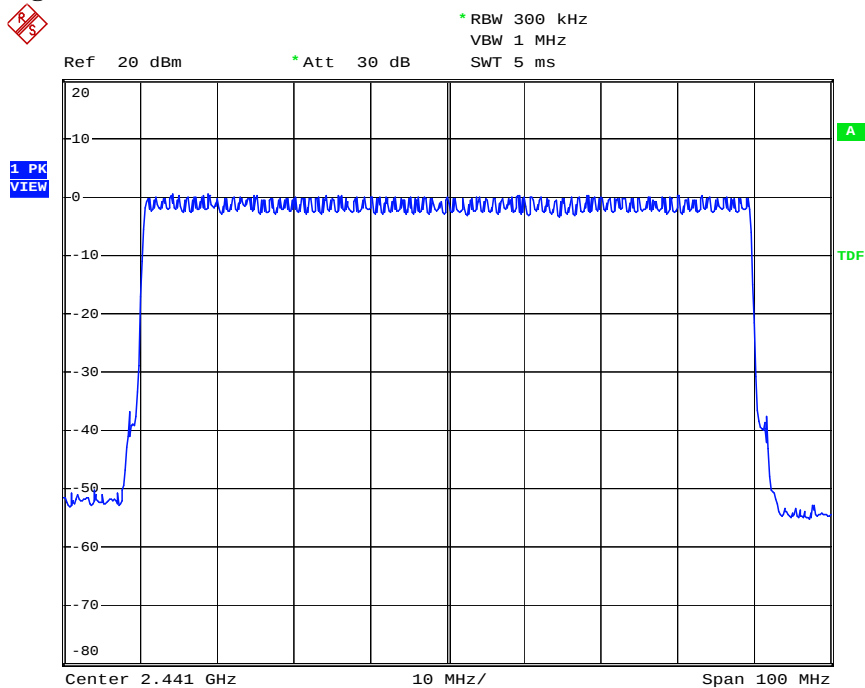
Tested Date: January 25, 2008

Temperature: 23 °C  
Humidity: 35 %  
Atmos. Press: 1012 hPa

### 2.3.1 Operating Mode: Basic rate



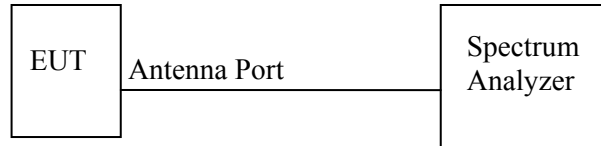
### 2.3.2 Operating Mode: EDR 2M rate



## 2.4 Average Time of Occupancy

### Test setup

Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



### Test procedure

The EUT antenna port connected to the spectrum analyzer. The RBW is set to 300 kHz. The VBW is set to appropriate in order to read the plus duration. The sweep time is coupled appropriate. The span is set to 0 MHz and single sweep with video triggered. The EUT is hopping operation.

The average time of occupancy within the 31.6 seconds (79 channels \* 0.4) is calculated as follows in accordance with Bluetooth formula;

In case of DH1: (average time of occupancy) = (pulse width) \* (1600 / 2) / 79 \* 31.6

In case of DH3: (average time of occupancy) = (pulse width) \* (1600 / 4) / 79 \* 31.6

In case of DH5: (average time of occupancy) = (pulse width) \* (1600 / 6) / 79 \* 31.6

### Limitation

15.247(a)(1)(iii) The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### Test equipment used (refer to List of utilized test equipment)

|      |  |  |  |  |  |
|------|--|--|--|--|--|
| SA06 |  |  |  |  |  |
|------|--|--|--|--|--|

### Test results – comply with the limitation.

| Operation Mode | Transmission Packet Type | Pulse width (msec) | Time of occupancy (msec) |
|----------------|--------------------------|--------------------|--------------------------|
| Basic rate     | DH1                      | 0.408              | 130.56                   |
|                | DH3                      | 1.668              | 266.88                   |
|                | DH5                      | 2.944              | 314.02                   |
| EDR 2M rate    | DH1                      | 0.424              | 134.82                   |
|                | DH3                      | 1.694              | 271.04                   |
|                | DH5                      | 2.954              | 313.09                   |

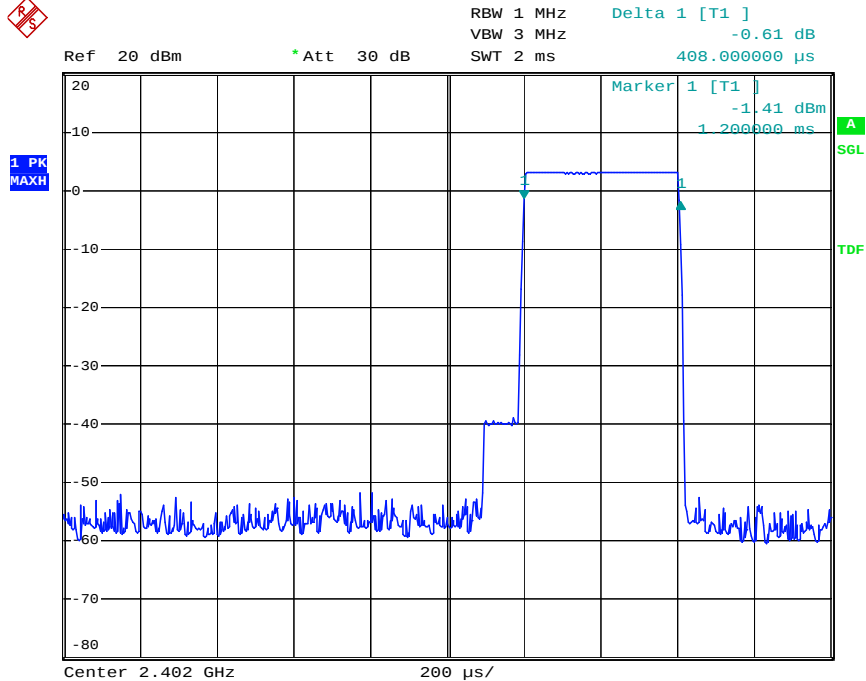
## Test Data

Tested Date: January 25, 2008

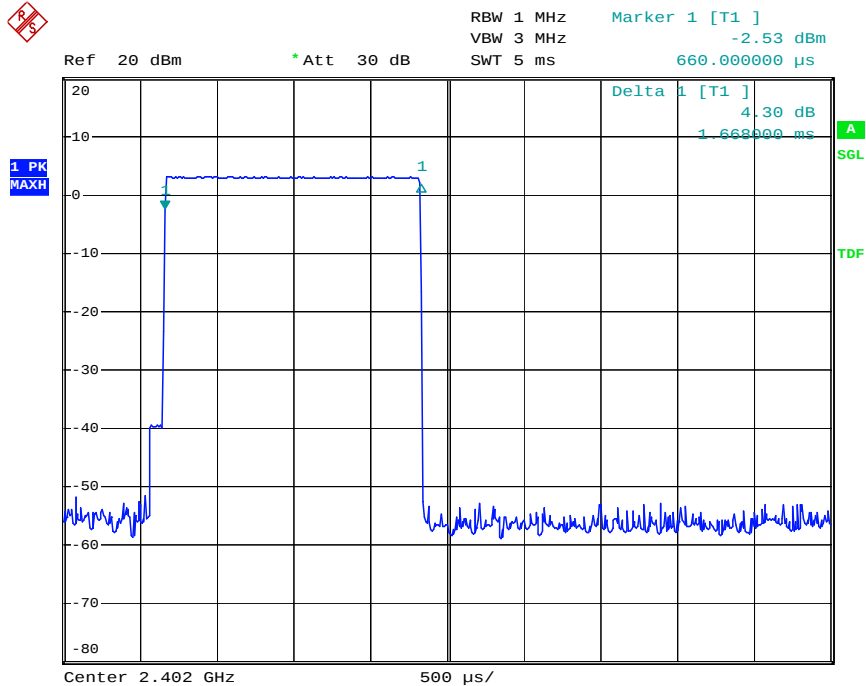
Temperature: 23 °C  
Humidity: 35 %  
Atmos. Press: 1012 hPa

### 2.4.1 Operating Mode: Basic rate

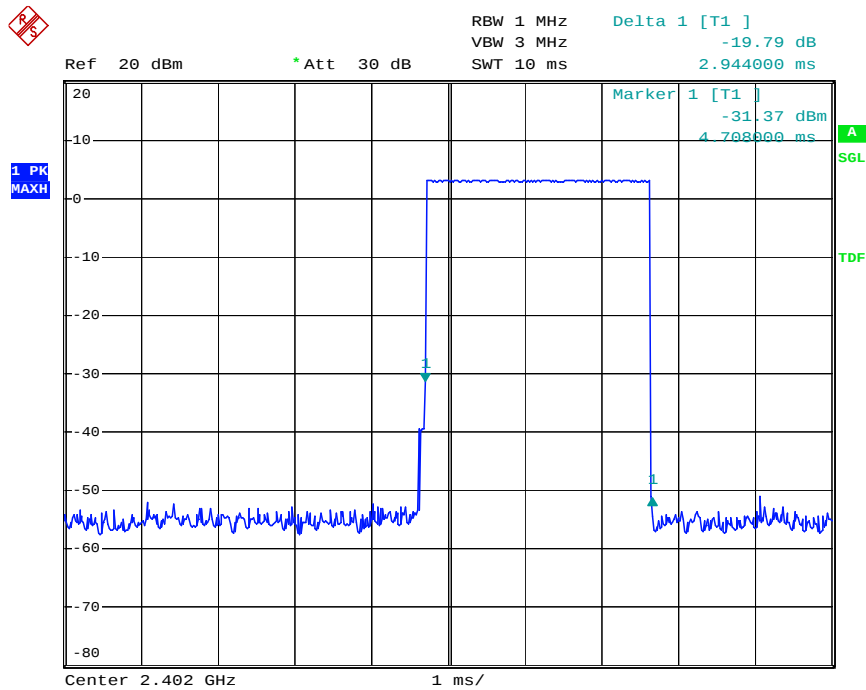
#### DH1 Packet



#### DH3 Packet

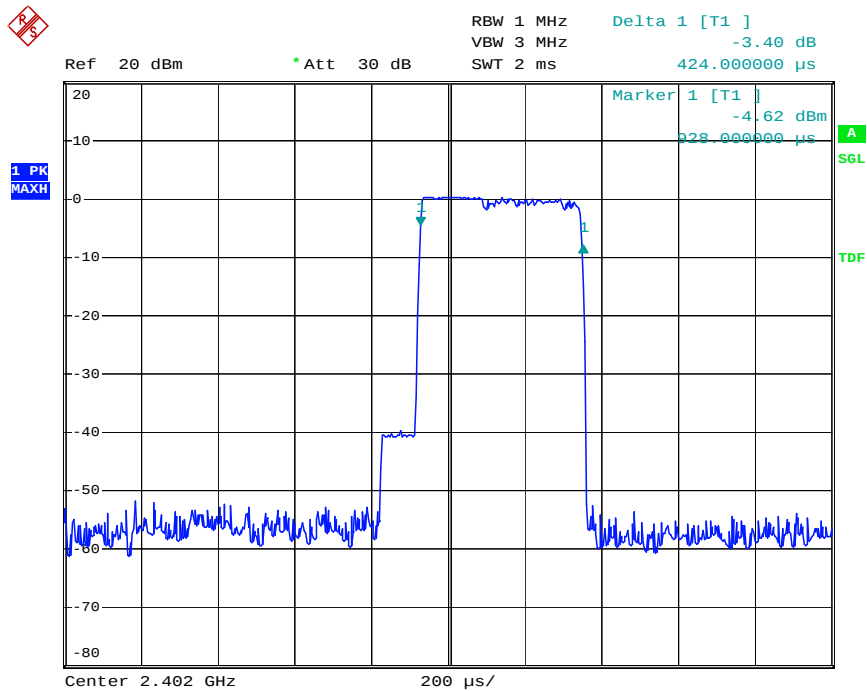


## DH5 Packet

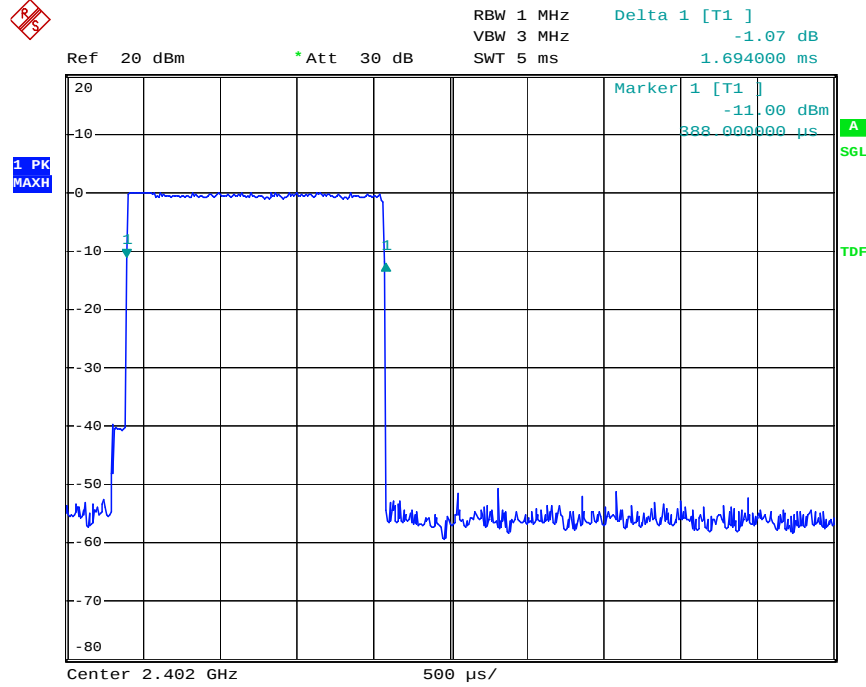


## 2.4.2 Operating Mode: EDR 2M rate

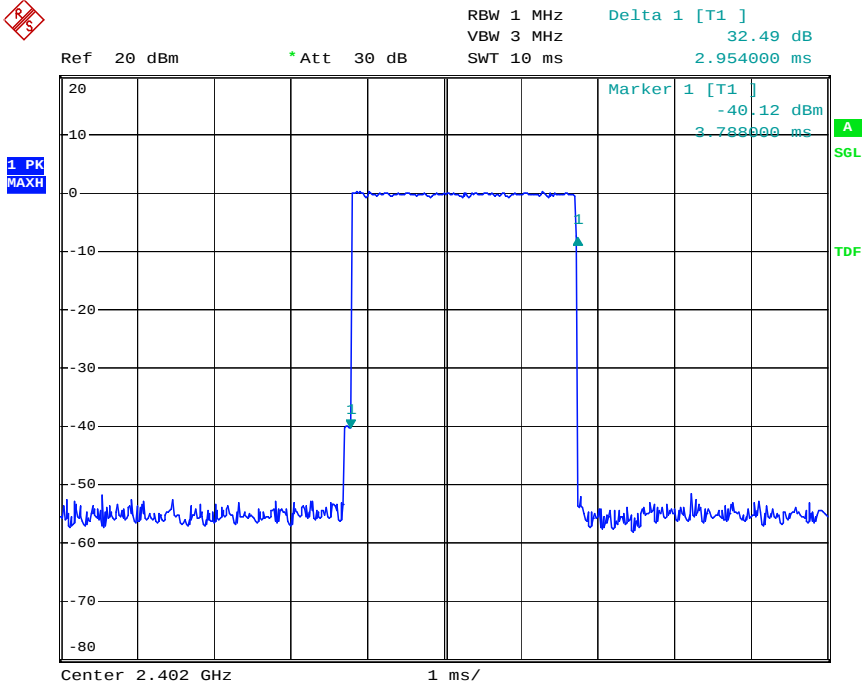
### DH1 Packet



## DH3 Packet



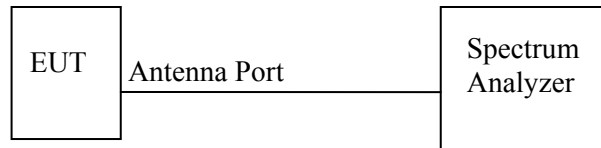
## DH5 Packet



## 2.5 Peak Output Power

### Test setup

Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



### Test procedure

The EUT antenna port connected to the spectrum analyzer. The RBW is set to the greater than 20dB bandwidth. The VBW is set to three times of RBW. The sweep time is coupled appropriate. The span is set to cover the carrier output spectrum. The analyzer is set to MAX HOLD. The EUT is set measured transmission channel under hopping off mode.

The correction factor is set to the spectrum analyzer in order to correct of the connected cable loss.

### Limitation

15.247(a) (1) 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, provided the systems operate with an output power no greater than 125 mW(21dBm).

### Test equipment used (refer to List of utilized test equipment)

|      |  |  |  |  |  |
|------|--|--|--|--|--|
| SA06 |  |  |  |  |  |
|------|--|--|--|--|--|

### Test results – comply with the limitation.

| Operation Mode | Transmission Channel<br>(Frequency: MHz) | Output power<br>(dBm) | Output power<br>(mW) |
|----------------|------------------------------------------|-----------------------|----------------------|
| Basic rate     | Low (2402)                               | 2.92                  | 1.958                |
|                | Middle (2441)                            | 2.81                  | 1.909                |
|                | High (2480)                              | 2.94                  | 1.967                |
| EDR 2M rate    | Low (2402)                               | 2.79                  | 1.901                |
|                | Middle (2441)                            | 2.73                  | 1.874                |
|                | High (2480)                              | 2.94                  | 1.967                |

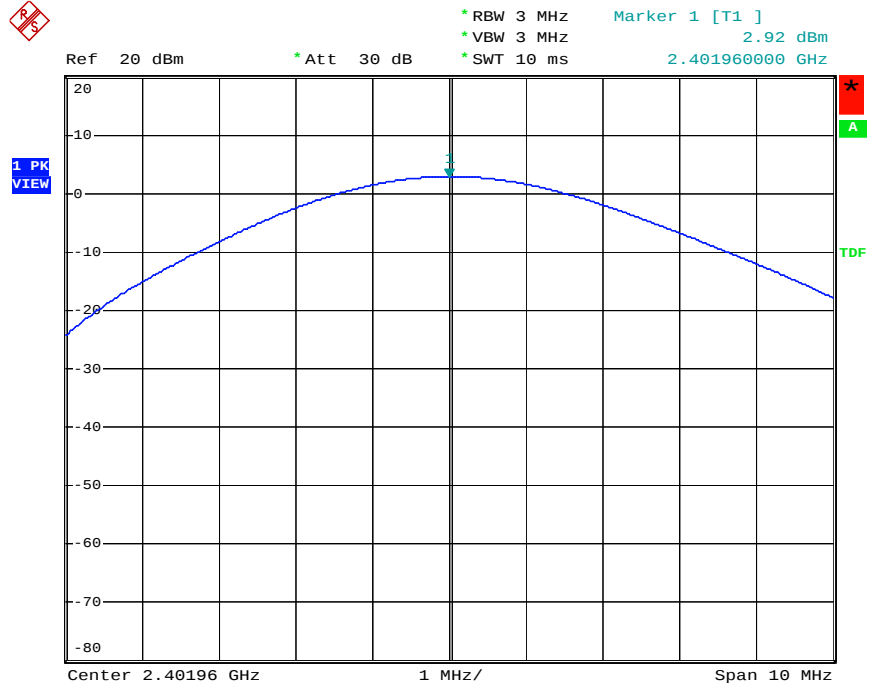
## Test Data

Tested Date: January 25, 2008

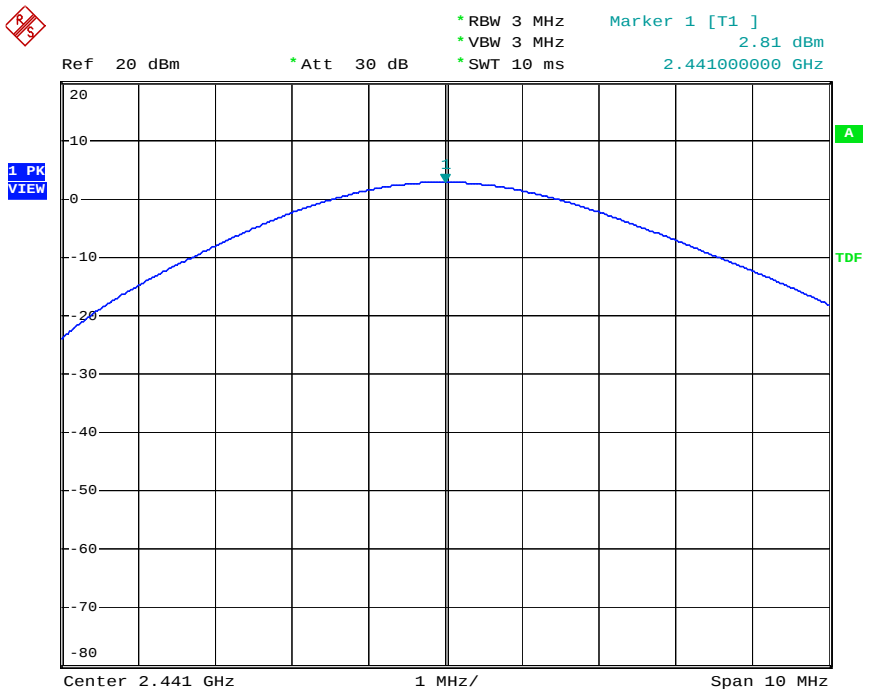
Temperature: 23 °C  
Humidity: 35 %  
Atmos. Press: 1012 hPa

### 2.5.1 Operating Mode: Basic rate

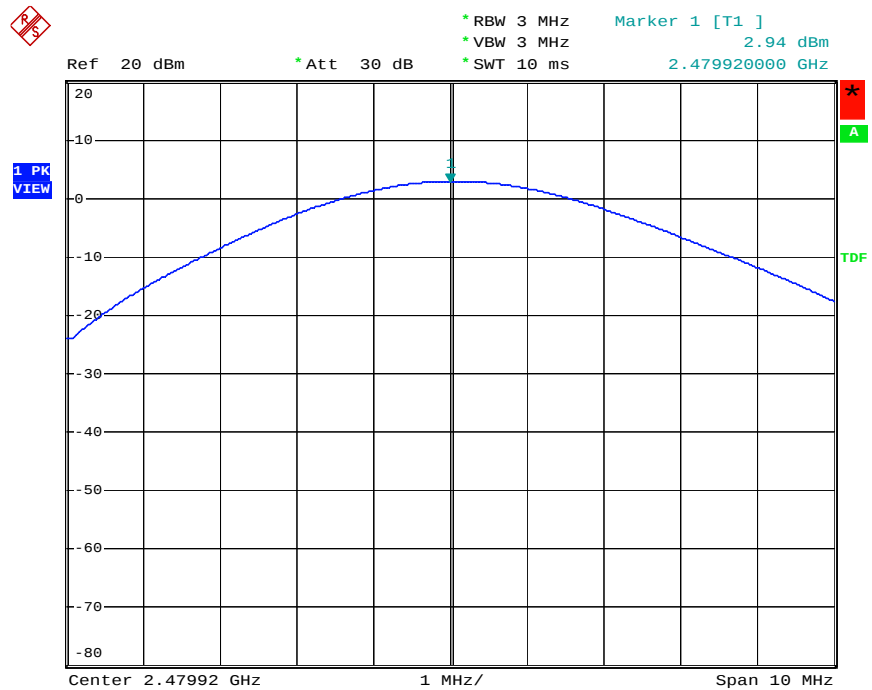
Low (0ch) 2402MHz



Middle (39ch) 2441MHz

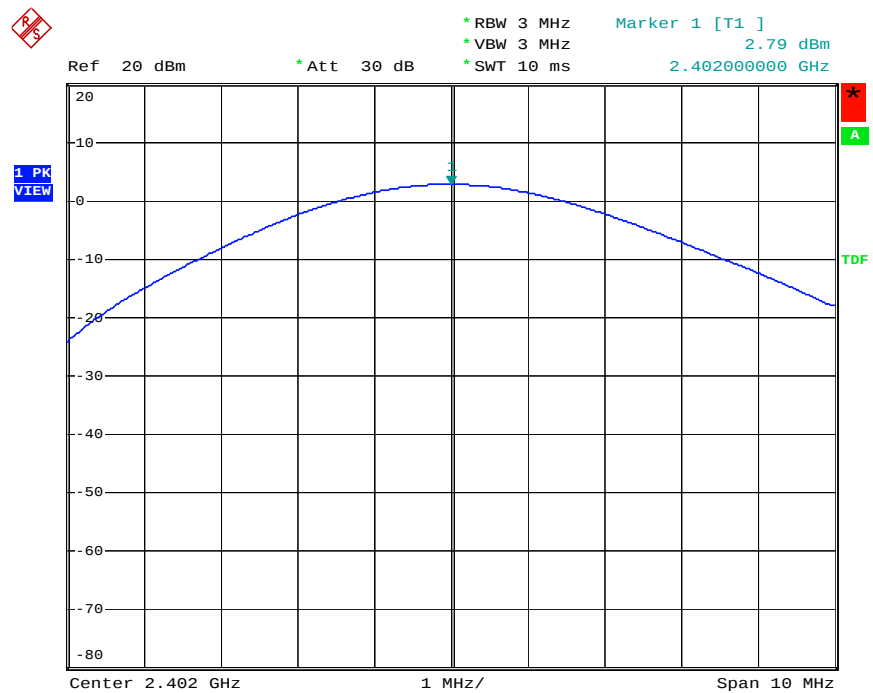


## High (78ch) 2480MHz

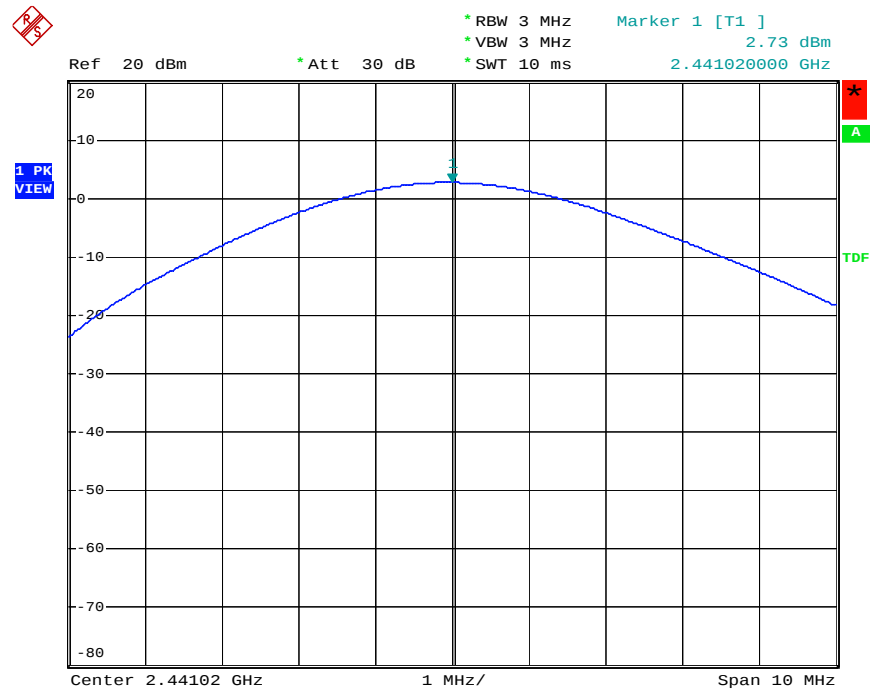


## 2.5.2 Operating Mode: EDR 2M rate

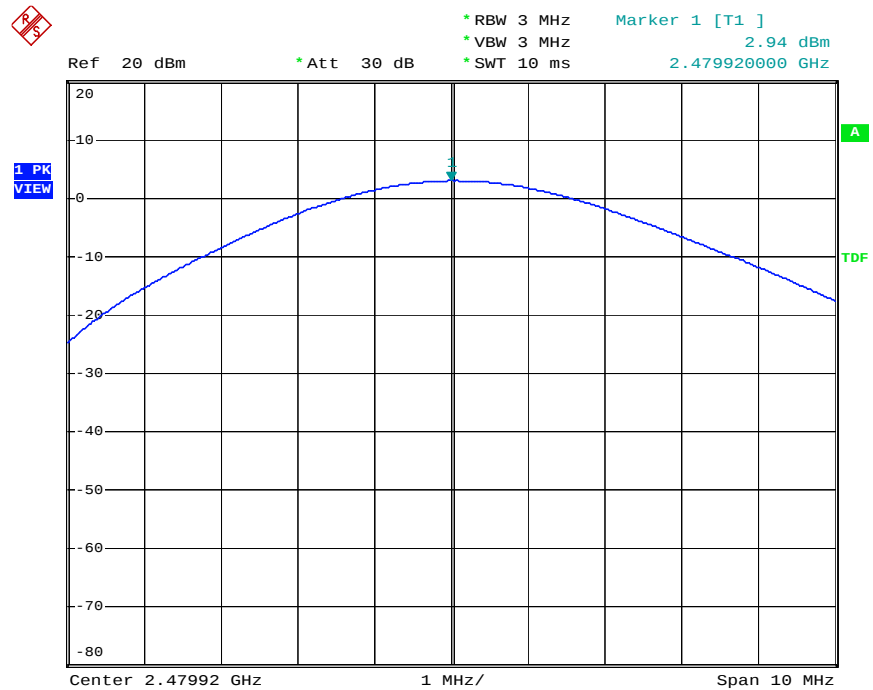
### Low (0ch) 2402MHz



## Middle (39ch) 2441MHz



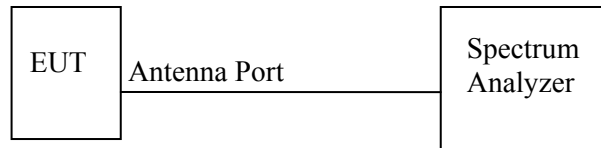
## High (78ch) 2480MHz



## 2.6 Peak Power Spectral Density

### Test setup

Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



### Test procedure

The EUT antenna port connected to the spectrum analyzer. The RBW is set to 3 kHz. The VBW is set to 10 kHz. The sweep time is set to 100 seconds. The span is set to cover the carrier output spectrum.

The EUT is set measured transmission channel under hopping off mode.

The correction factor is set to the spectrum analyzer in order to correct of the connected cable loss.

### Limitation

15.247(f) the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section. The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### Test equipment used (refer to List of utilized test equipment)

|      |  |  |  |  |  |
|------|--|--|--|--|--|
| SA06 |  |  |  |  |  |
|------|--|--|--|--|--|

### Test results – comply with the limitation.

| Operation Mode | Transmission Channel<br>(Frequency: MHz) | PPSD<br>(dBm) |
|----------------|------------------------------------------|---------------|
| Basic rate     | Low (2402)                               | -9.09         |
|                | Middle (2441)                            | -9.12         |
|                | High (2480)                              | -7.76         |
| EDR 2M rate    | Low (2402)                               | -10.74        |
|                | Middle (2441)                            | -11.45        |
|                | High (2480)                              | -11.79        |

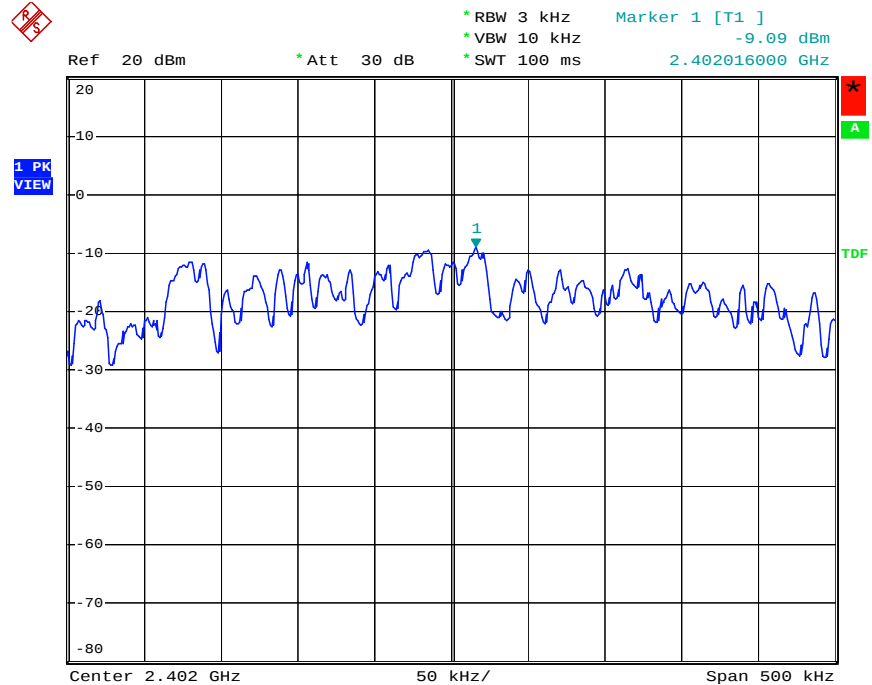
## Test Data

Tested Date: January 25, 2008

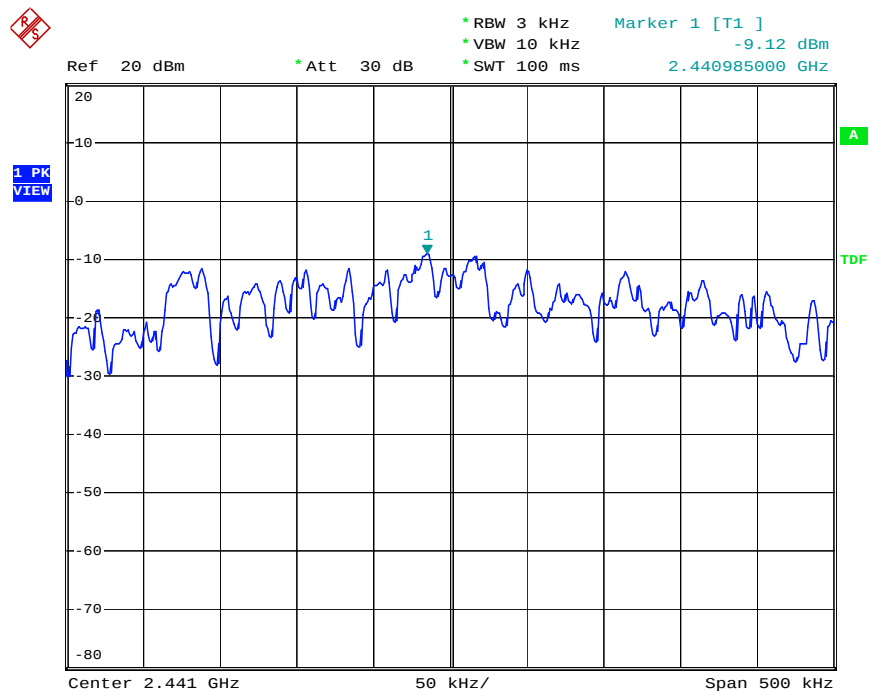
Temperature: 23 °C  
Humidity: 35 %  
Atmos. Press: 1012 hPa

### 2.6.1 Operating Mode: Basic rate

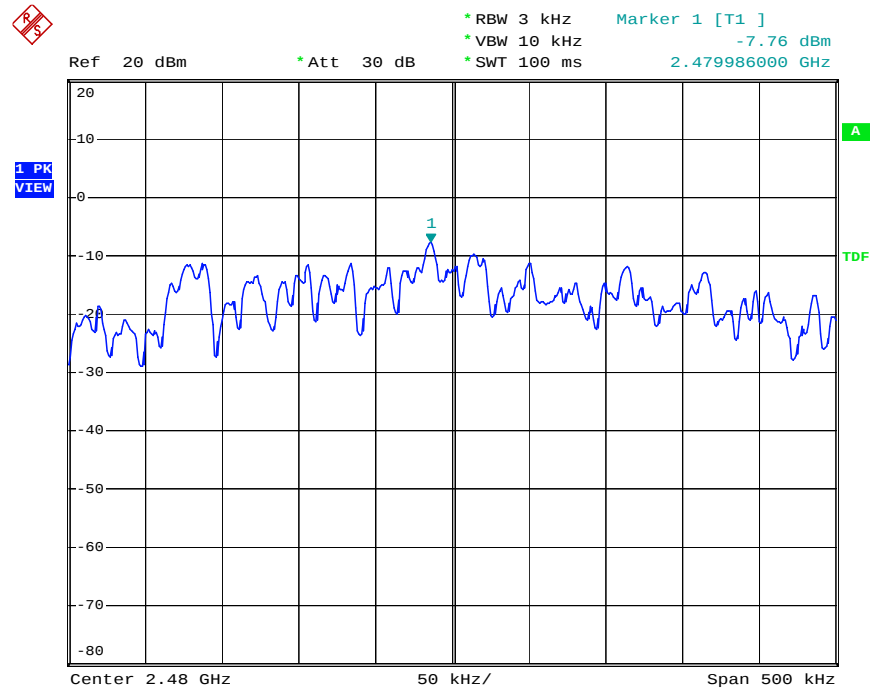
Low (0ch) 2402MHz



Middle (39ch) 2441MHz

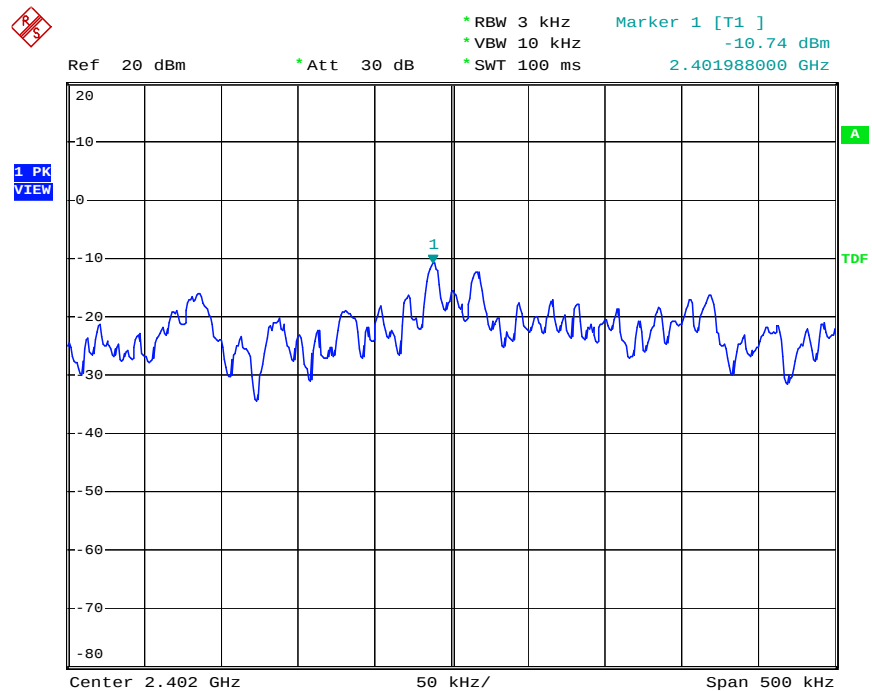


## High (78ch) 2480MHz

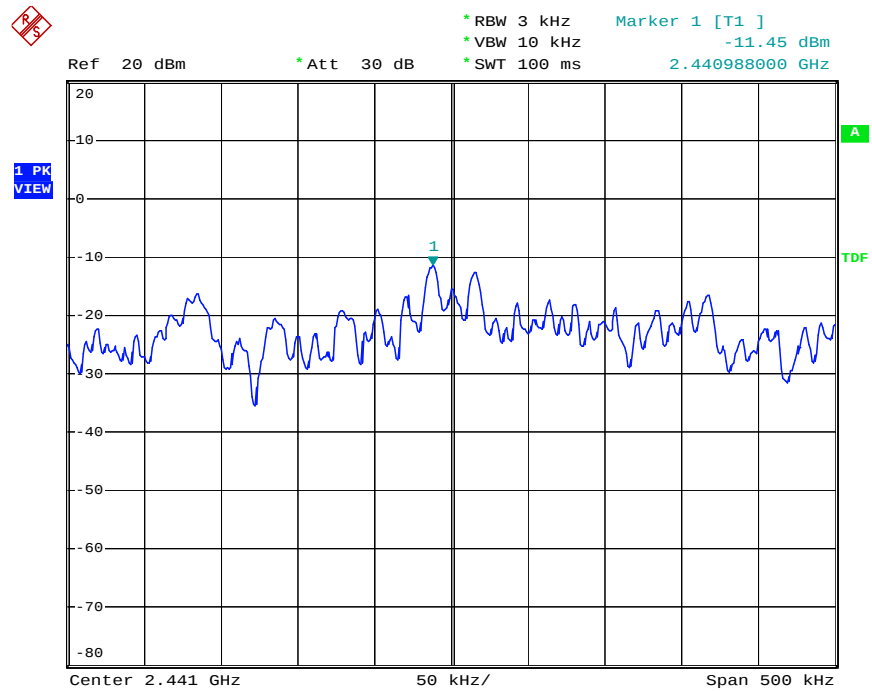


## 2.6.2 Operating Mode: EDR 2M rate

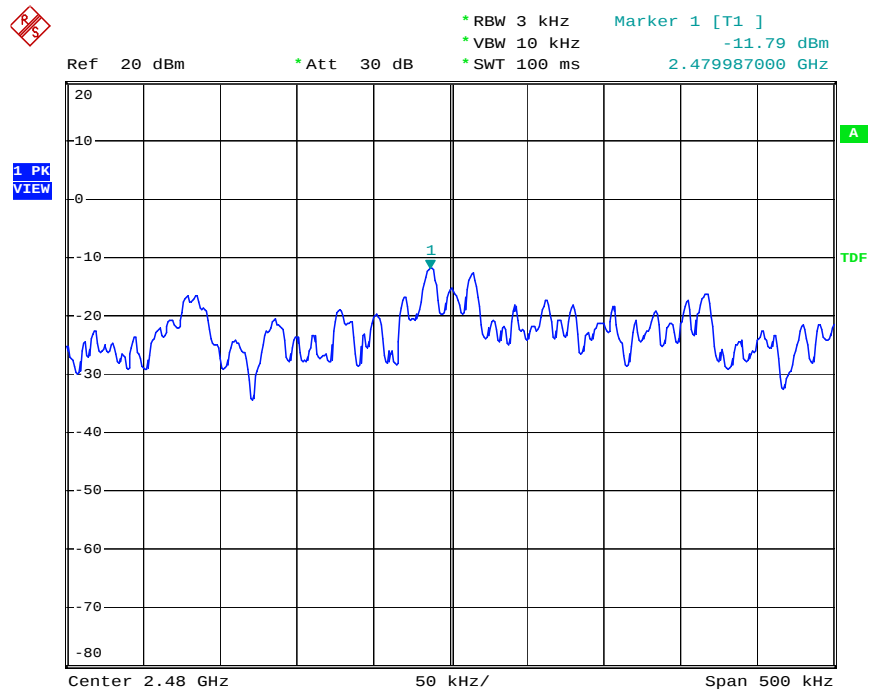
### Low (0ch) 2402MHz



## Middle (39ch) 2441MHz



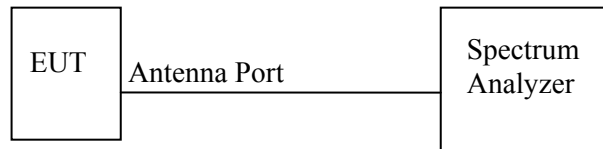
## High (78ch) 2480MHz



## 2.7 Conducted Spurious Emissions (Antenna Port)

### Test setup

Test setup is the following drawing. The antenna port of EUT was connected to the spectrum analyzer.



### Test procedure

The EUT antenna port connected to the spectrum analyzer. The RBW is set to 100 kHz. The VBW is set to 300 kHz. The sweep time is set to the coupled. The spectrum is checked from 30 MHz to 26 GHz.

The EUT is set measured transmission channel under hopping off mode.

### Limitation

15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

### Test equipment used (refer to List of utilized test equipment)

|      |  |  |  |  |  |
|------|--|--|--|--|--|
| SA06 |  |  |  |  |  |
|------|--|--|--|--|--|

### Test results – comply with the limitation.

There were no conducted spurious emissions with levels of more than 20 dB below the applicable limit.

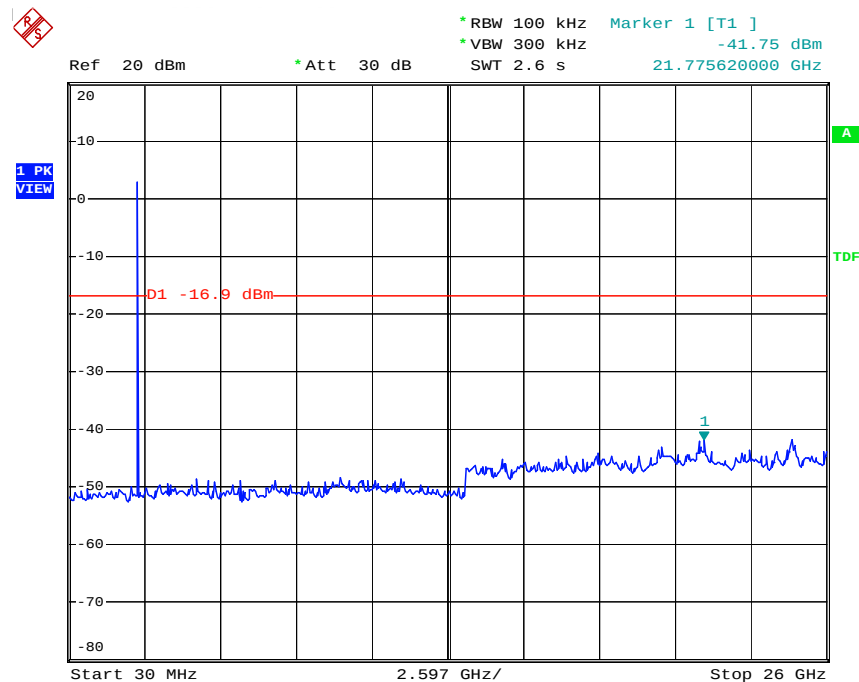
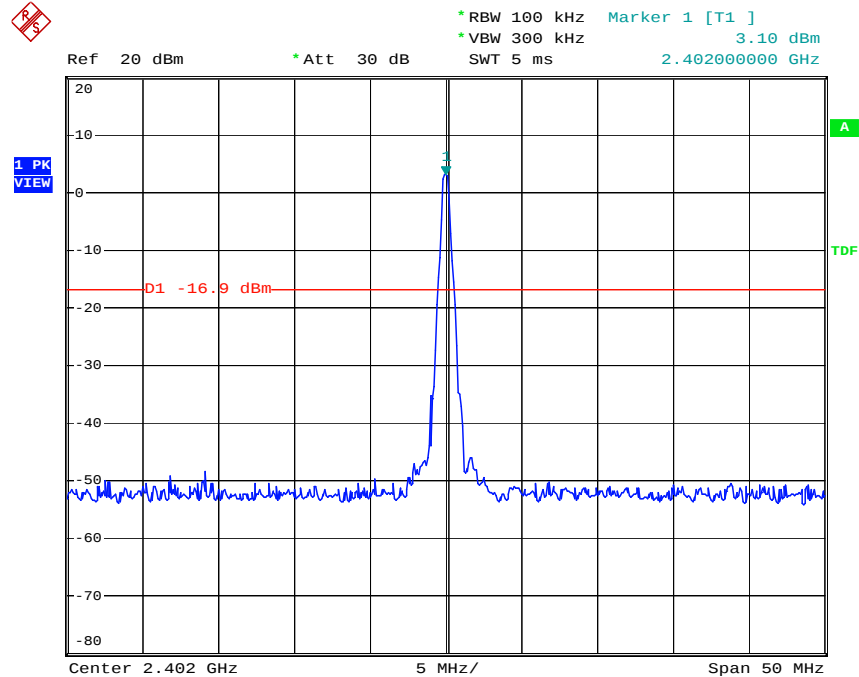
## Test Data

Tested Date: January 25, 2008

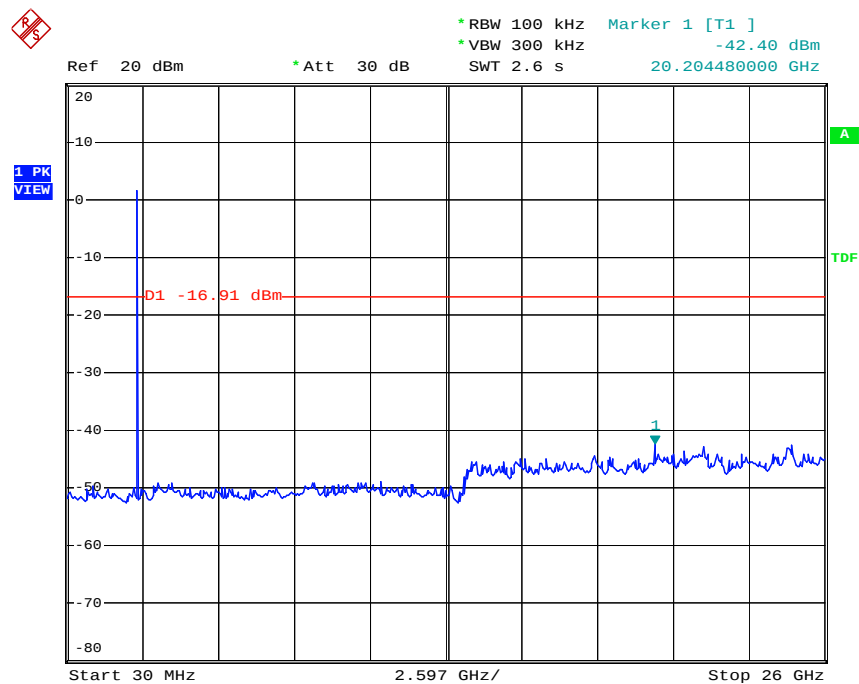
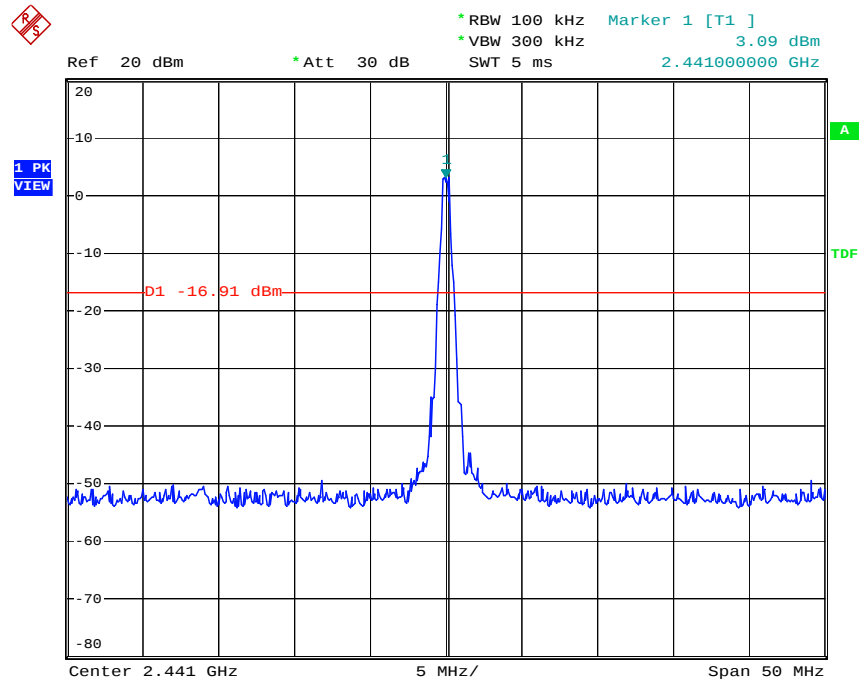
Temperature: 23 °C  
Humidity: 35 %  
Atmos. Press: 1012 hPa

### 2.7.1 Operating Mode: Basic rate

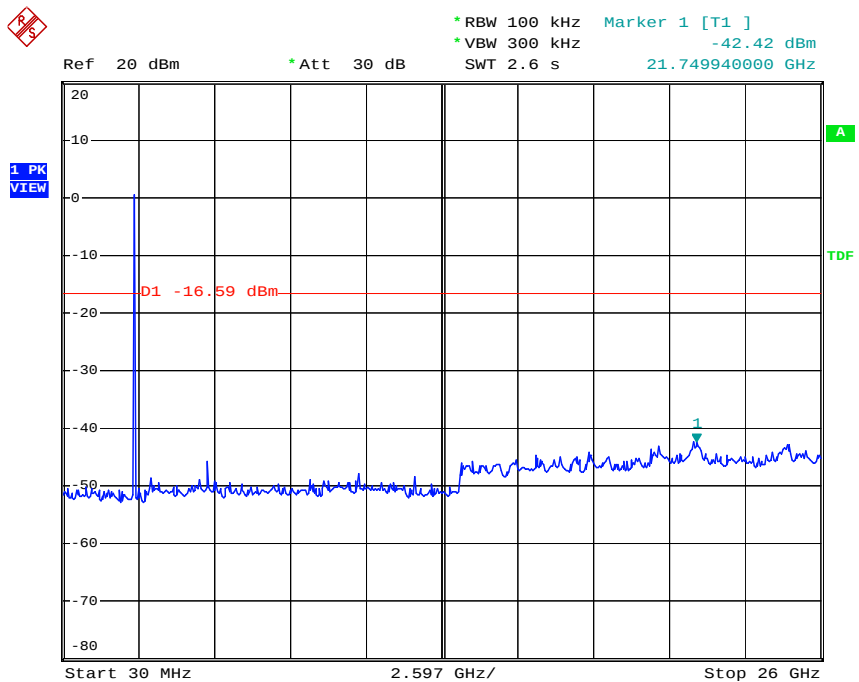
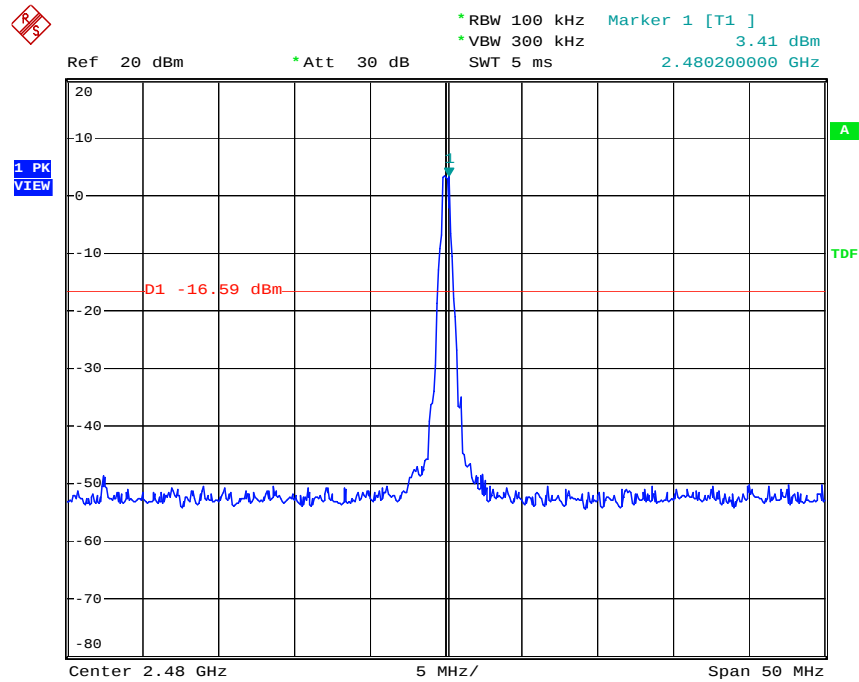
#### Low (0ch) 2402MHz



## Middle (39ch) 2441MHz

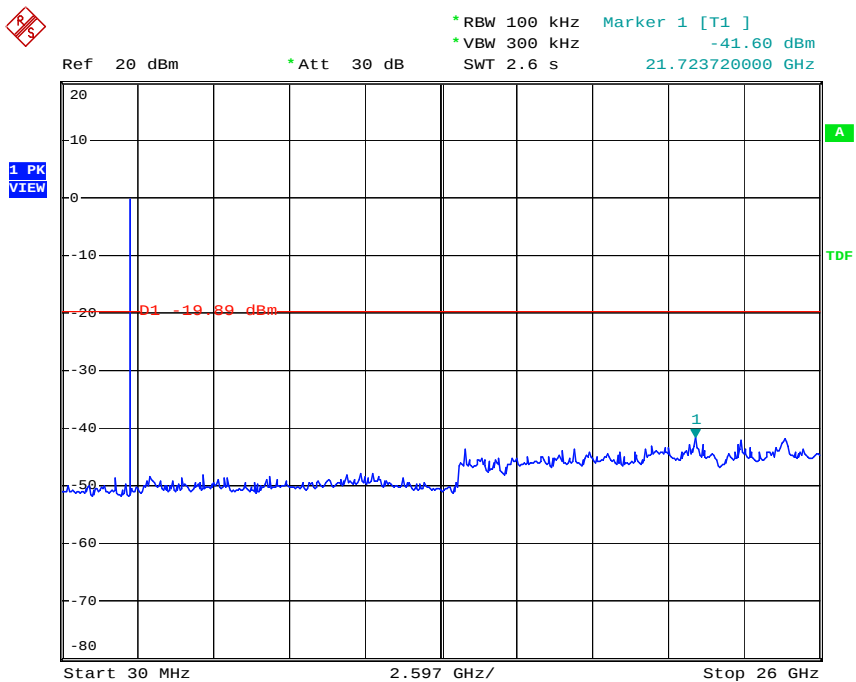
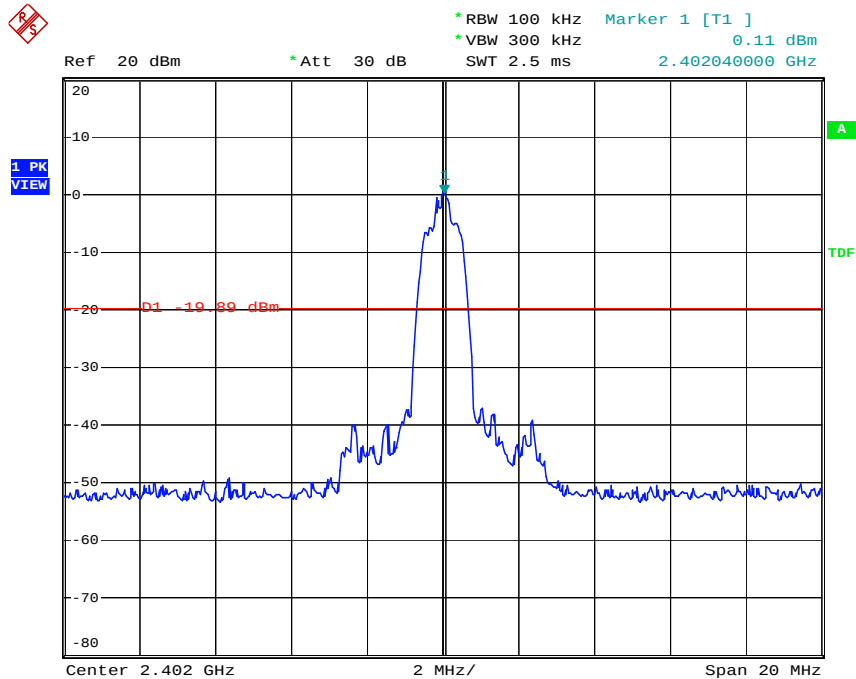


## High (78ch) 2480MHz

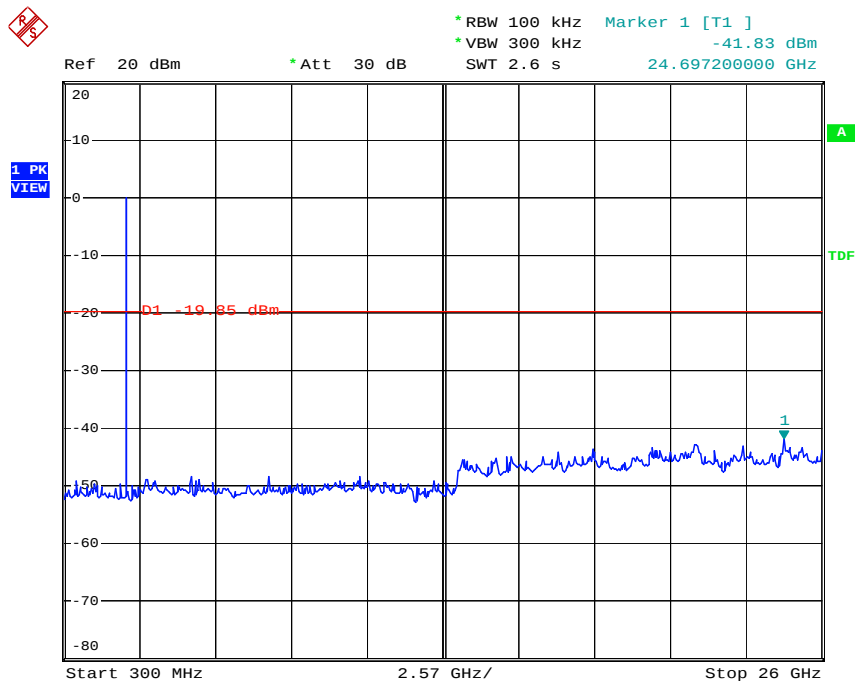
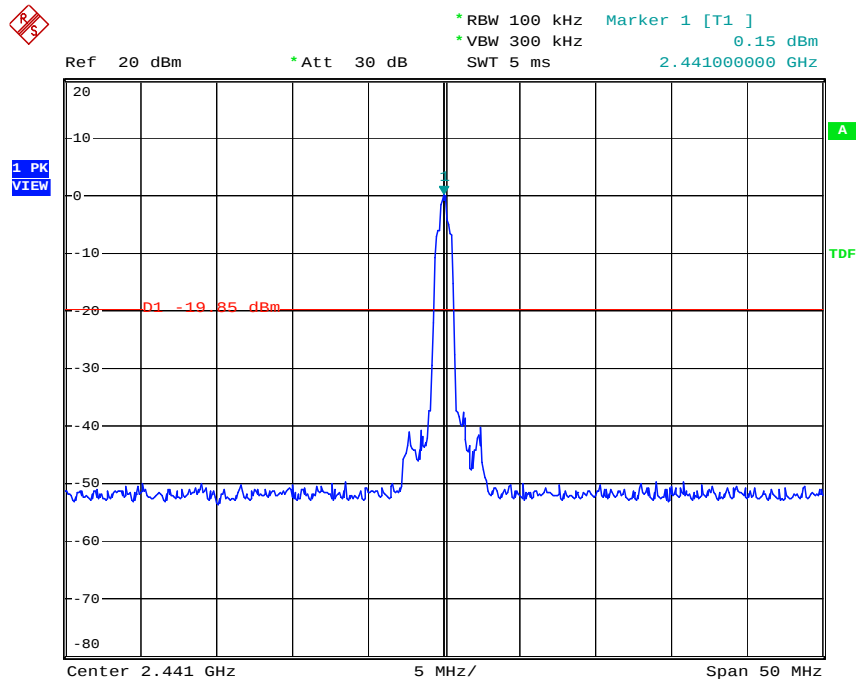


## 2.7.2 Operating Mode: EDR 2M rate

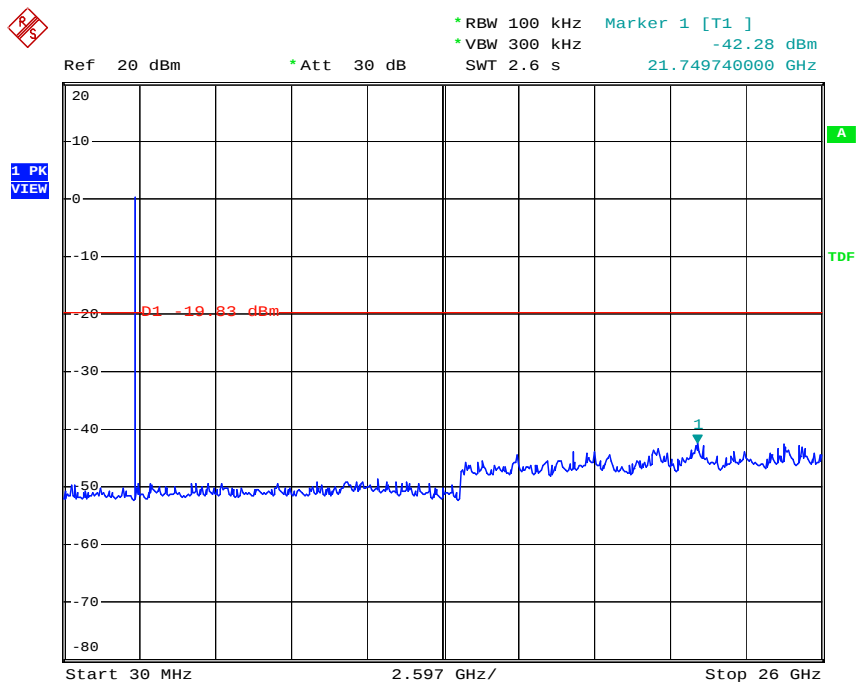
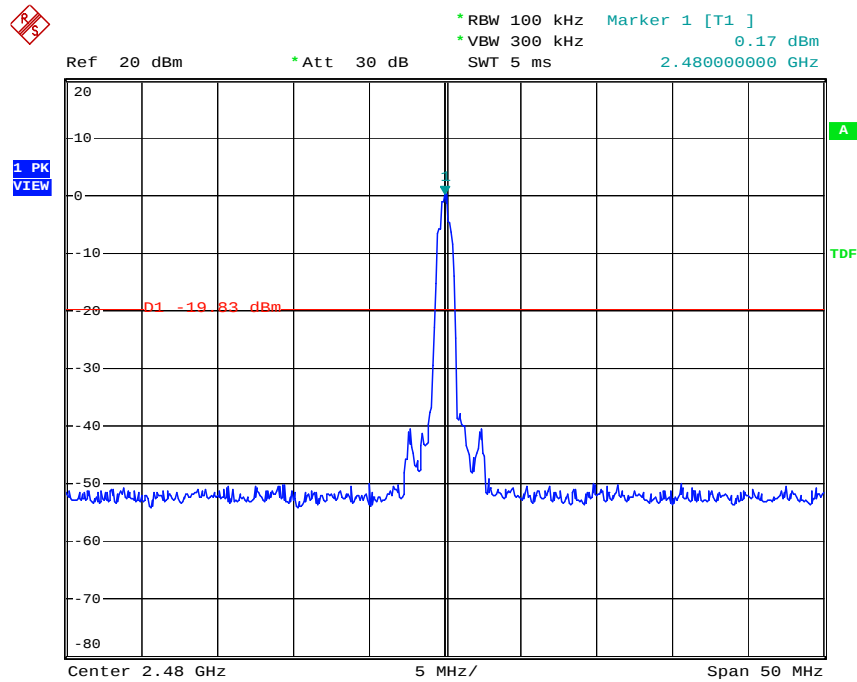
### Low (0ch) 2402MHz



## Middle (39ch) 2441MHz



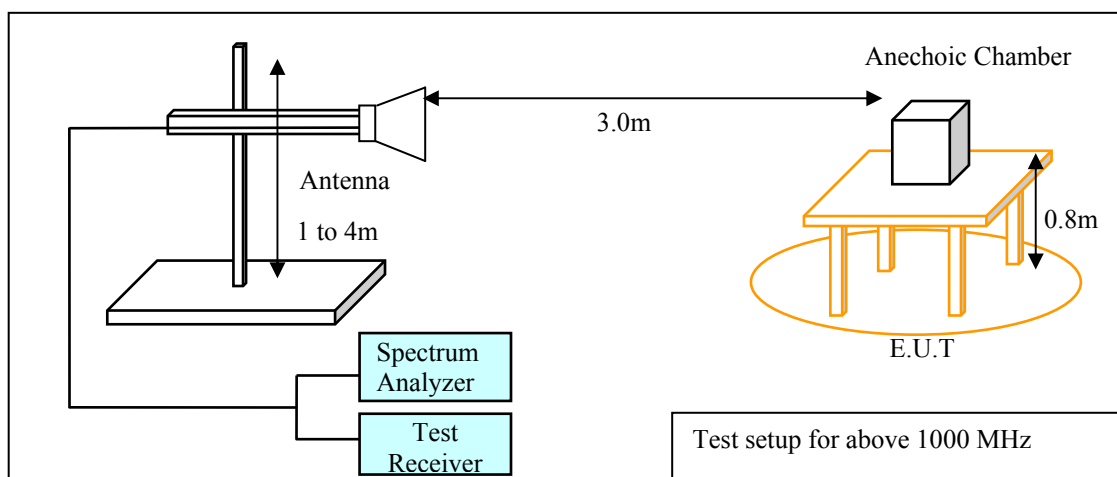
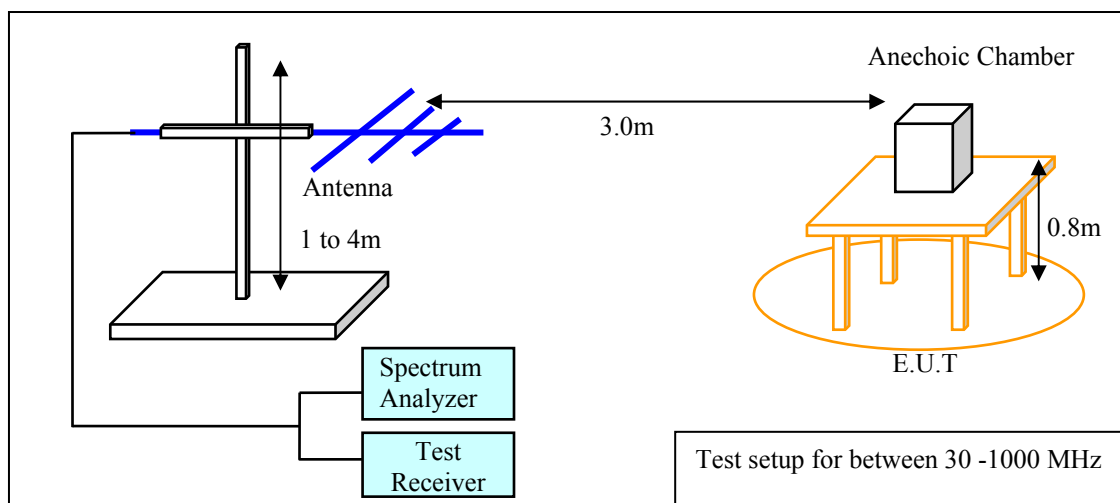
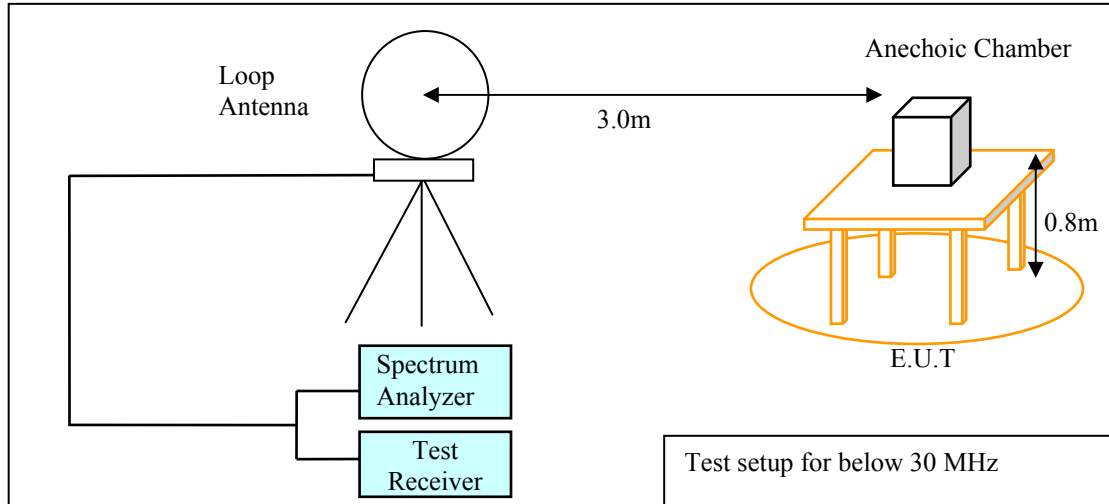
## High (78ch) 2480MHz



## 2.8 Transmitter Radiated spurious emissions

### Test setup

Test setup was implemented according to the method of ANSI C63.4: 2003 clause 6 “General requirements for EUT equipment arrangements and operation”, clause 8.2 and Annex H.3 “Radiated emission measurements setup”.



## Test procedure

Measurement procedures were implemented according to the method of ANSI C63.4: 2003 clauses 8.2.

The EUT is placed on a non-conducted table which is 0.8m height from a ground plane and the measurement antenna to EUT distance is 3 meters. The turn table is rotated for 360 degrees to determine the maximum emission level.

In the frequency range of 9 kHz to 30 MHz, a calibrated loop antenna was positioned with its plane vertical at the distance 3m from the EUT with an extrapolation of corrected distance factor and rotated about its vertical axis for maximum response at each azimuth about the EUT. For certain applications, the loop antenna also needs to be positioned horizontally. The center of the loop shall be 1 m above the ground.

In the frequency above 30 MHz, the antenna height scanned between 1m and 4m, and the antenna rotated to repeat the measurements for both the horizontal and vertical antenna polarizations.

EUT is placed at three different orientations (X, Y and Z axis) in order to find the worst orientation.

The spectrum analyzer and receiver is set to the followings;

|                        |                                                                                                   |
|------------------------|---------------------------------------------------------------------------------------------------|
| Below 30 MHz:          | RBW=10 kHz, VBW= 30 kHz<br>Final measurement is carried out with a receiver RBW of 9 kHz (QP)     |
| Between 30 - 1000 MHz: | RBW=100 kHz, VBW= 300 kHz<br>Final measurement is carried out with a receiver RBW of 120 kHz (QP) |
| Above 1000 MHz:        | Peak measurement- RBW=1 MHz, VBW= 1 MHz<br>Average measurement – RBW=1 MHz, VBW=10 Hz             |

## Applicable rule and limitation

### §15.205 restricted bands of operation

Except as shown in paragraph 15.205 (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz                 | MHz                   | MHz             | GHz           |
|---------------------|-----------------------|-----------------|---------------|
| 0.090 - 0.110       | 16.42 - 16.423        | 399.9 - 410     | 4.5 - 5.15    |
| 0.490 - 0.510       | 16.69475 - 16.69525   | 608 - 614       | 5.35 - 5.46   |
| 2.1735 - 2.1905     | 16.80425 - 16.80475   | 960 - 1240      | 7.25 - 7.75   |
| 4.125 - 4.128       | 25.5 - 25.67          | 1300 - 1427     | 8.025 - 8.5   |
| 4.17725 - 4.17775   | 37.5 - 38.25          | 1435 - 1626.5   | 9.0 - 9.2     |
| 4.20725 - 4.20775   | 73 - 74.6             | 1645.5 - 1646.5 | 9.3 - 9.5     |
| 6.215 - 6.218       | 74.8 - 75.2           | 1660 - 1710     | 10.6 - 12.7   |
| 6.26775 - 6.26825   | 108 - 121.94          | 1718.8 - 1722.2 | 13.25 - 13.4  |
| 6.31175 - 6.31225   | 123 - 138             | 2200 - 2300     | 14.47 - 14.5  |
| 8.291 - 8.294       | 149.9 - 150.05        | 2310 - 2390     | 15.35 - 16.2  |
| 8.362 - 8.366       | 156.52475 - 156.52525 | 2483.5 - 2500   | 17.7 - 21.4   |
| 8.37625 - 8.38675   | 156.7 - 156.9         | 2690 - 2900     | 22.01 - 23.12 |
| 8.41425 - 8.41475   | 162.0125 - 167.17     | 3260 - 3267     | 23.6 - 24.0   |
| 12.29 - 12.293      | 167.72 - 173.2        | 3332 - 3339     | 31.2 - 31.8   |
| 12.51975 - 12.52025 | 240 - 285             | 3345.8 - 3358   | 36.43 - 36.5  |
| 12.57675 - 12.57725 | 322 - 335.4           | 3600 - 4400     | (1)           |

15.205(b) except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

15.209( a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

| Frequency<br>(MHz) | Field Strength<br>(uV/m) | Measurement Distance<br>(m) |
|--------------------|--------------------------|-----------------------------|
| 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                           |

In the emission table above, the tighter limit applies at the band edges.

The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz.

Radiated emission limits in the above bands are based on measurements employing an average detector.

**Test results** - Complied with requirement.

## Test Data

### 2.8.1 Below 30 MHz

**Test equipment used (refer to List of utilized test equipment)**

|      |      |      |      |  |
|------|------|------|------|--|
| LP01 | CL11 | SA06 | TR04 |  |
|------|------|------|------|--|

Tested Date: January 31, 2008

Temperature: 18 °C  
Humidity: 32 %  
Atmos. Press: 1014 hPa

| Operation Mode                       | Result                                                                                   |
|--------------------------------------|------------------------------------------------------------------------------------------|
| Basic rate Worst case configuration  | There is no spurious emissions with levels of more than 20 dB below the applicable limit |
| EDR 2M rate Worst case configuration | There is no spurious emissions with levels of more than 20 dB below the applicable limit |

**2.8.2 Between 30 – 1000 MHz****Test equipment used (refer to List of utilized test equipment)**

|      |      |      |      |      |
|------|------|------|------|------|
| BA03 | CL11 | PR03 | SA06 | TR04 |
|------|------|------|------|------|

Tested Date: January 31, 2008

Temperature: 18 °C

Humidity: 32 %

Atmos. Press: 1014 hPa

**2.8.2.1 Operating Mode: Basic rate Worst case configuration**

| No.      | Frequency [MHz] | Reading [dBuV] | Factor [dB/m] | Loss [dB]  | Gain [dB]   | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Antenna Polarization |
|----------|-----------------|----------------|---------------|------------|-------------|-----------------|----------------|-------------|----------------------|
| 1        | 39.144          | 39.2           | 13.7          | 4.2        | 29.8        | 27.3            | 40.0           | 12.7        | Vert.                |
| 2        | 258.537         | 44.8           | 12.8          | 6.7        | 29.8        | 34.5            | 46.0           | 11.5        | Hori.                |
| <b>3</b> | <b>258.537</b>  | <b>47.5</b>    | <b>12.8</b>   | <b>6.7</b> | <b>29.8</b> | <b>37.2</b>     | <b>46.0</b>    | <b>8.8</b>  | <b>Vert.</b>         |
| 4        | 389.675         | 39.9           | 15.6          | 7.7        | 30.0        | 33.2            | 46.0           | 12.8        | Hori.                |
| 5        | 452.016         | 36.2           | 17.2          | 7.9        | 30.0        | 31.3            | 46.0           | 14.7        | Hori.                |
| 6        | 452.368         | 40.6           | 17.2          | 7.9        | 30.0        | 35.7            | 46.0           | 10.3        | Vert.                |

**Calculation method**

The Correction Factors and RESULT are calculated as followings.

$$\text{Correction Factor [dB]} = \text{FACTOR [dB/m]} + \text{LOSS [dB]} - \text{GAIN [dB]}$$

$$\text{RESULT [dBuV/m]} = \text{READING [dBuV]} + \text{Correction Factor [dB]}$$

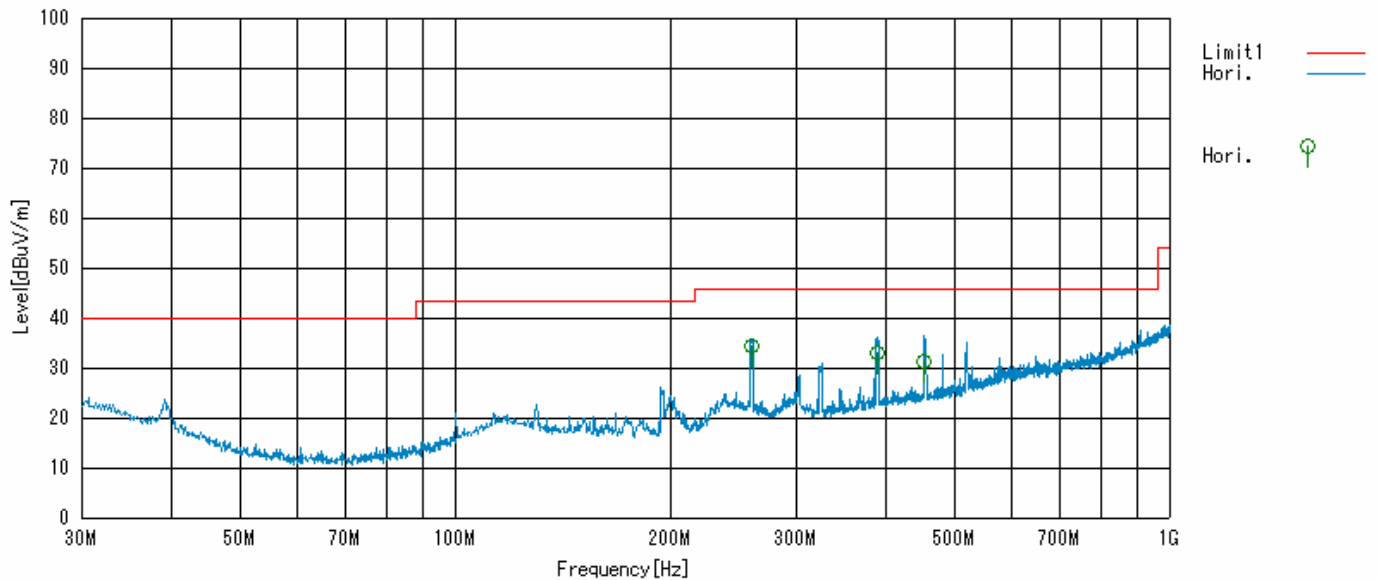
Sample calculation at 258.537 MHz vertical result as follow:

$$\text{Result [dBuV/m]} = \text{Reading} + \text{C.F} = 47.5 + 12.8 + 6.7 - 29.8 = 37.2$$

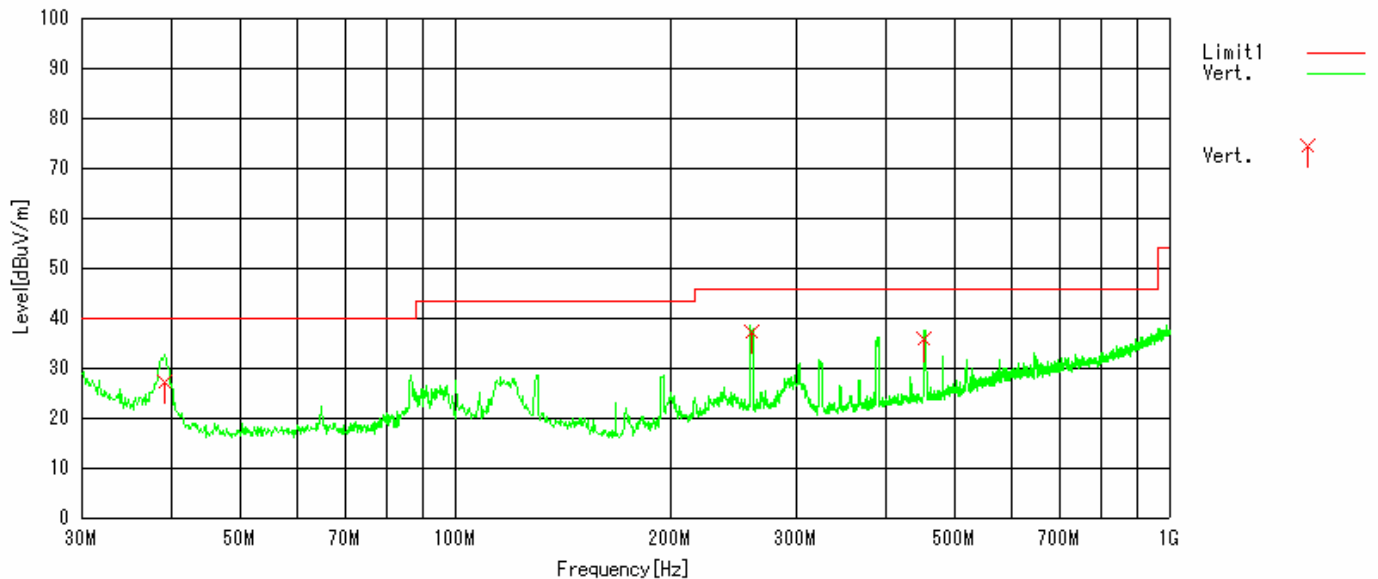
$$\text{Margin} = \text{Limit} - \text{Result} = 46.0 - 37.2 = 8.8 \text{ [dBuV/m]}$$

## Graphical express of test result (30MHz-1000MHz)

Antenna polarization: Horizontal



Antenna polarization: Vertical



## 2.8.2.2 Operating Mode: EDR 2M rate Worst case configuration

| No.      | Frequency [MHz] | Reading [dBuV] | Factor [dB/m] | Loss [dB]  | Gain [dB]   | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Antenna Polarization |
|----------|-----------------|----------------|---------------|------------|-------------|-----------------|----------------|-------------|----------------------|
| 1        | 39.015          | 38.5           | 13.8          | 4.2        | 29.8        | 26.7            | 40.0           | 13.3        | Vert.                |
| 2        | 258.925         | 41.6           | 12.8          | 6.7        | 29.8        | 31.3            | 46.0           | 14.7        | Hori.                |
| 3        | 259.368         | 44.8           | 12.8          | 6.7        | 29.8        | 34.5            | 46.0           | 11.5        | Vert.                |
| <b>4</b> | <b>387.662</b>  | <b>41.4</b>    | <b>15.5</b>   | <b>7.7</b> | <b>30.0</b> | <b>34.6</b>     | <b>46.0</b>    | <b>11.4</b> | <b>Vert.</b>         |
| 5        | 389.196         | 40.0           | 15.6          | 7.7        | 30.0        | 33.3            | 46.0           | 12.7        | Hori.                |
| 6        | 451.633         | 38.0           | 17.2          | 7.9        | 30.0        | 33.1            | 46.0           | 12.9        | Hori.                |

### Calculation method

The Correction Factors and RESULT are calculated as followings.

$$\text{Correction Factor [dB]} = \text{FACTOR [dB/m]} + \text{LOSS [dB]} - \text{GAIN [dB]}$$

$$\text{RESULT [dBuV/m]} = \text{READING [dBuV]} + \text{Correction Factor [dB]}$$

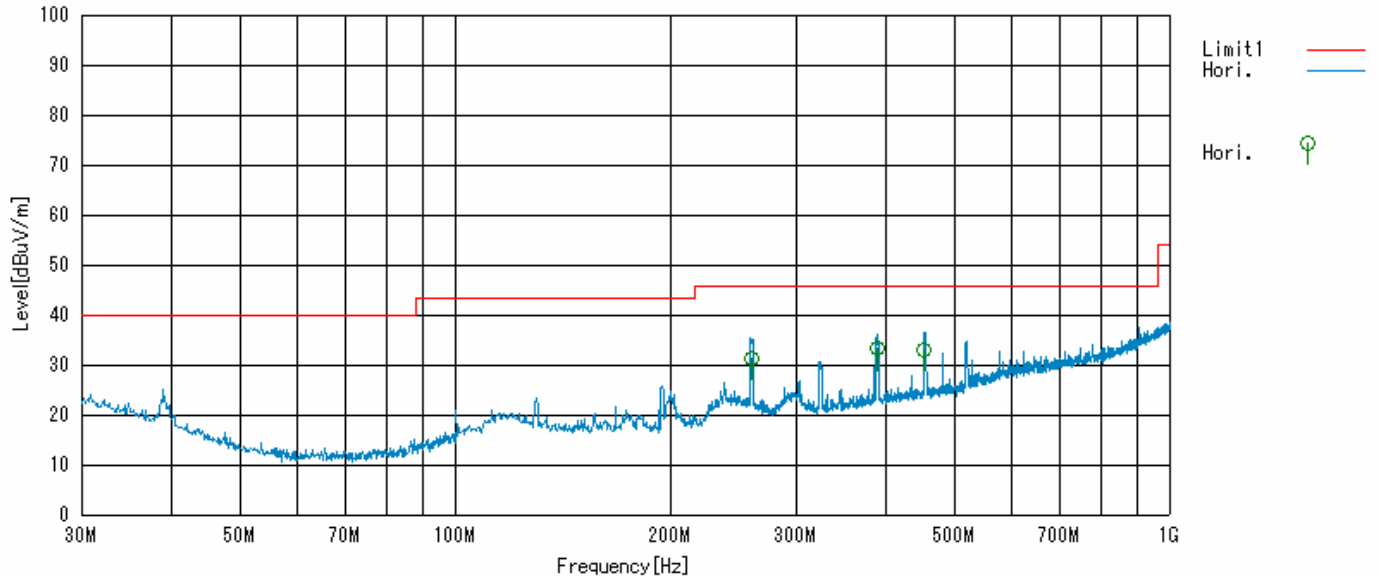
Sample calculation at 258.537 MHz vertical result as follow:

$$\text{Result [dBuV/m]} = \text{Reading} + \text{C.F} = 41.4 + 15.5 + 7.7 - 30.0 = 34.6$$

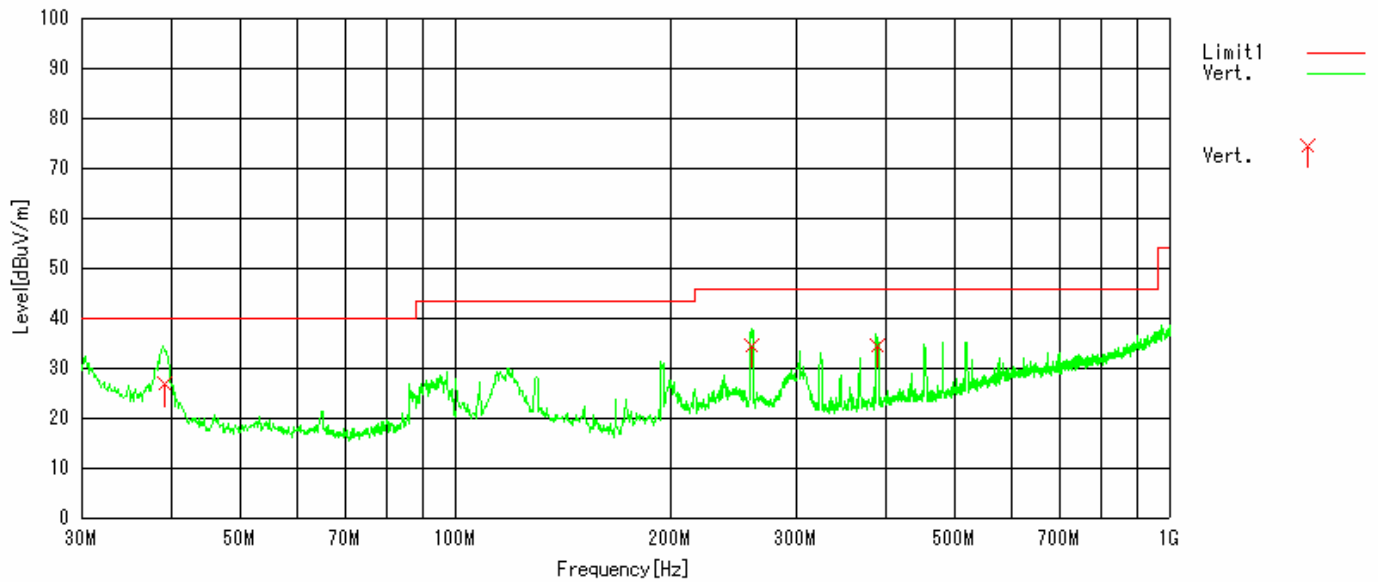
$$\text{Margin} = \text{Limit} - \text{Result} = 46.0 - 34.6 = 11.4 \text{ [dBuV/m]}$$

## Graphical express of test result (30MHz-1000MHz)

Antenna polarization: Horizontal



Antenna polarization: Vertical



## 2.8.3 Above 1000 MHz

Test equipment used (refer to List of utilized test equipment)

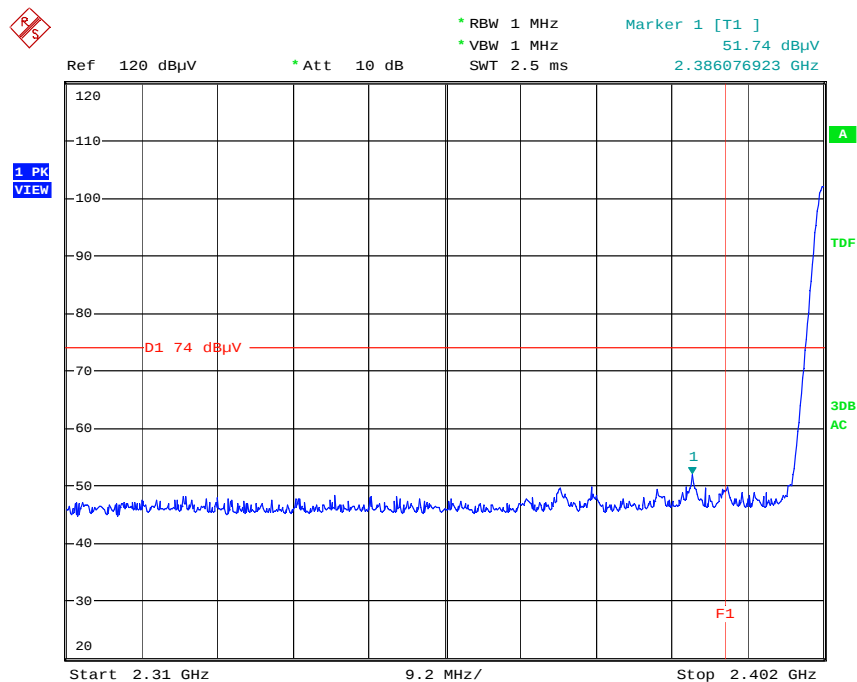
|      |      |      |      |      |      |
|------|------|------|------|------|------|
| PR04 | SH01 | SA06 | CL21 | CL22 | DH02 |
|------|------|------|------|------|------|

Tested Date: January 14, 2008

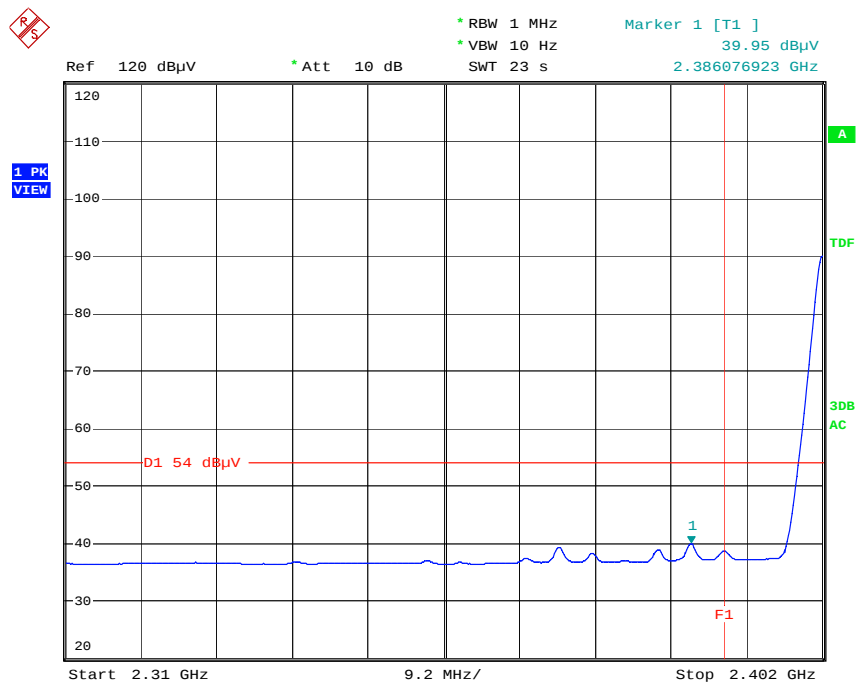
Temperature: 22 °C  
Humidity: 32 %  
Atmos. Press: 1004 hPa

### 2.8.3.1 Operating Mode: Basic rate

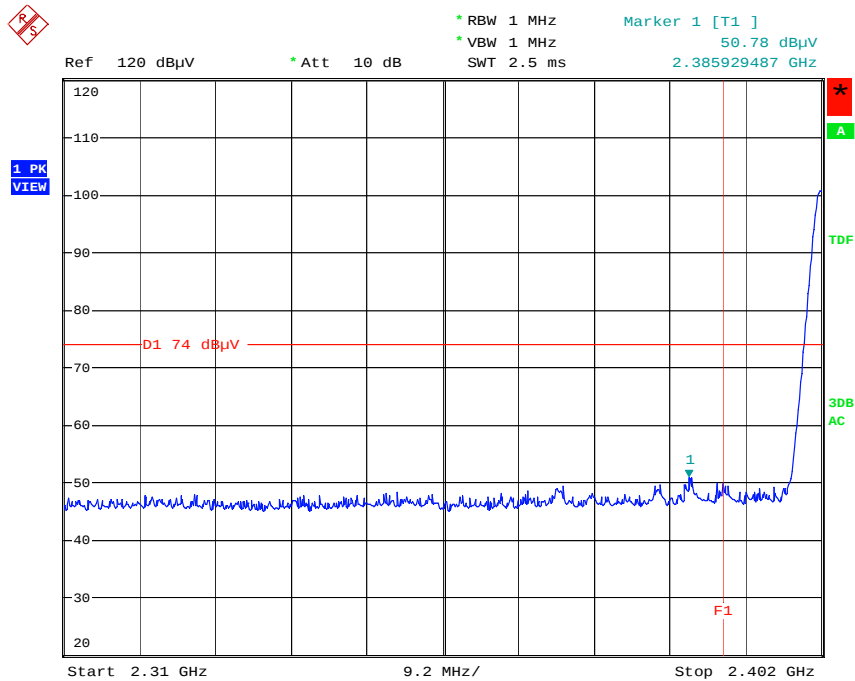
Restricted Band Edge (Low channel, Horizontal, Peak)



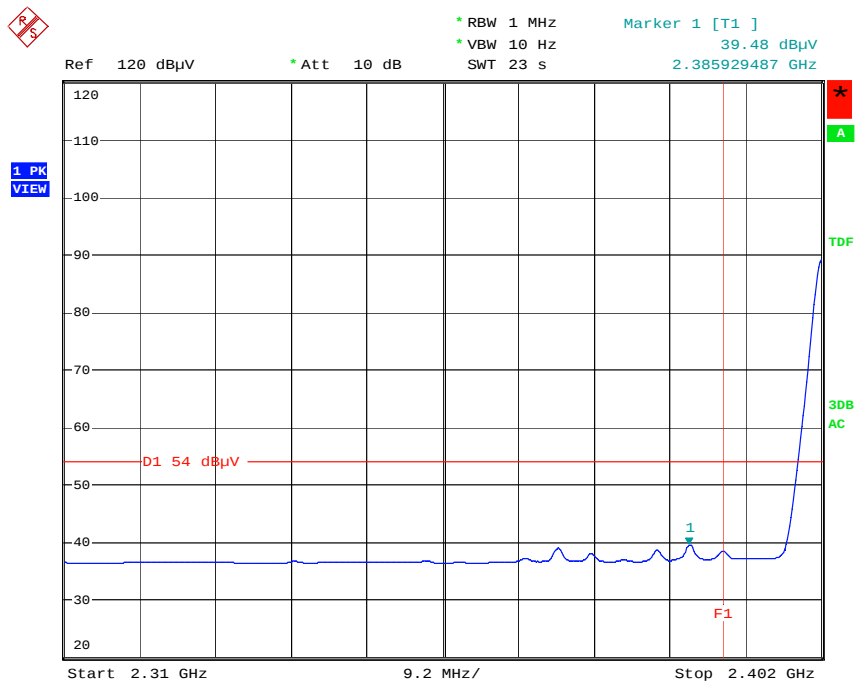
Restricted Band Edge (Low channel, Horizontal, Average)



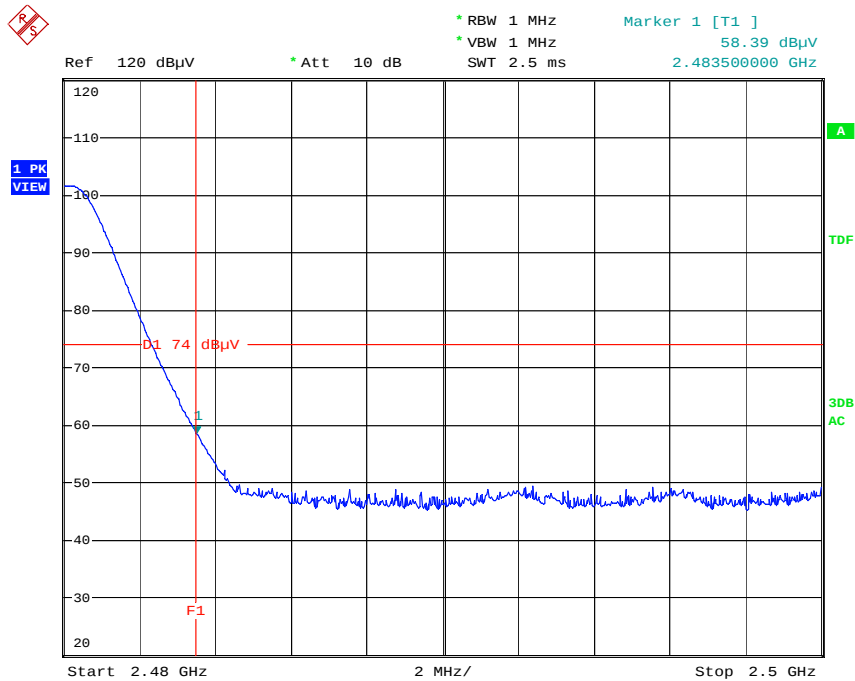
## Restricted Band Edge (Low channel, Vertical, Peak)



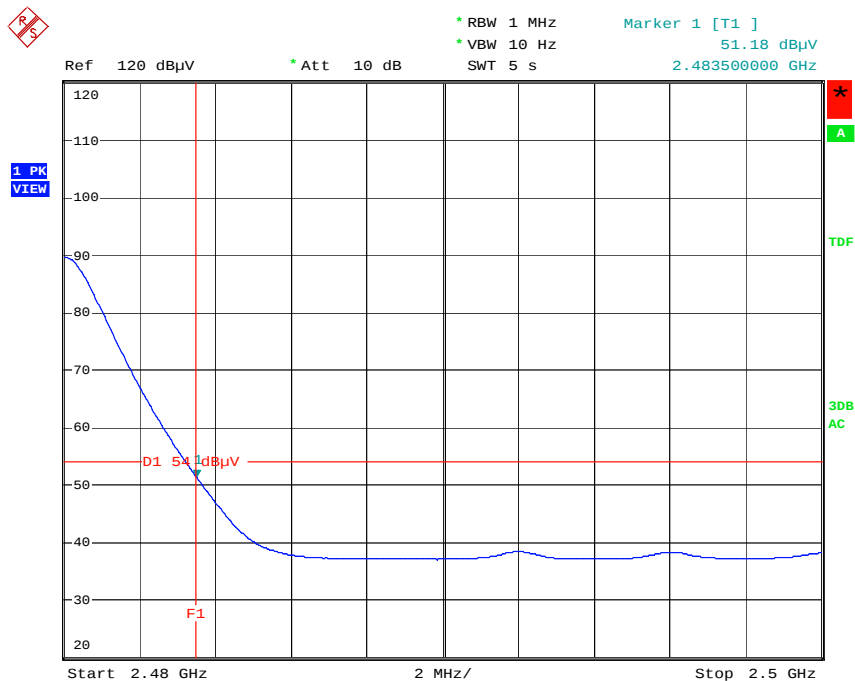
## Restricted Band Edge (Low channel, Vertical, Average)



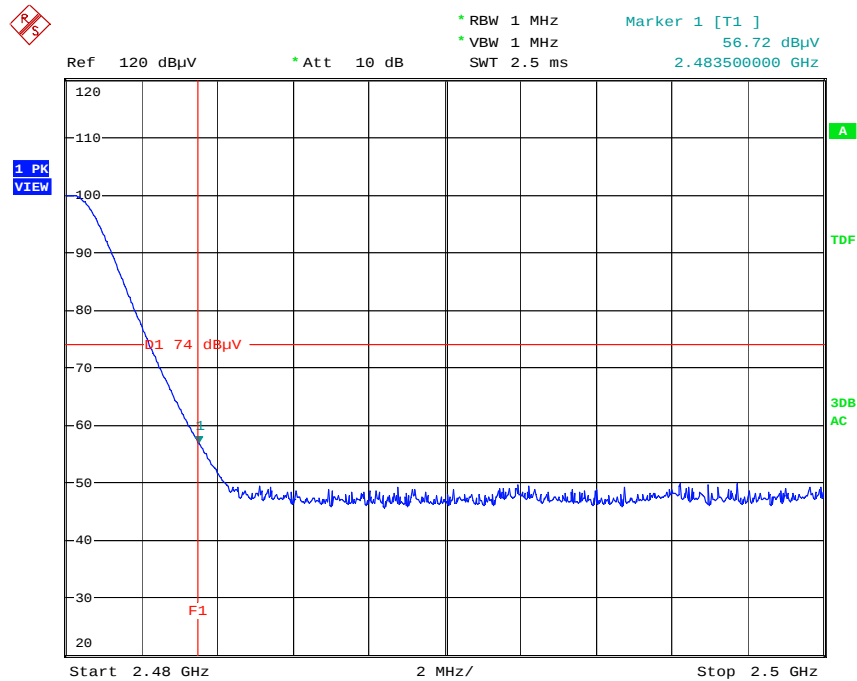
## Restricted Band Edge (High channel, Horizontal, Peak)



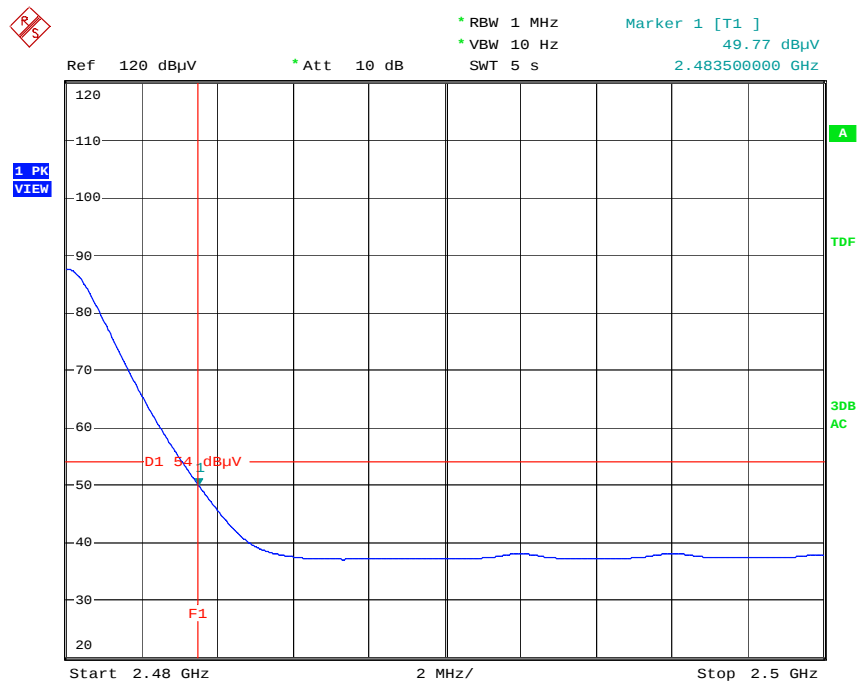
## Restricted Band Edge (High channel, Horizontal, Average)



## Restricted Band Edge (High channel, Vertical, Peak)



## Restricted Band Edge (High channel, Vertical, Average)



## Harmonics and Spurious Emission above 1000 MHz

Operating mode: Continuous Communication  
EUT position: Z-plane (Maximum position)  
Measurement distance: 3 m

There are no spurious emissions other than listed below;

| TX<br>CH<br>(MHz) | Freq.<br>(MHz) | Cable<br>Loss<br>(dB) | Antenna<br>Factor<br>(dB) | AMP<br>Gain<br>(dB) | Result (dBuV/m) |             |             |       | Limit<br>(dBuV) |      | Margin<br>(dB) |      |
|-------------------|----------------|-----------------------|---------------------------|---------------------|-----------------|-------------|-------------|-------|-----------------|------|----------------|------|
|                   |                |                       |                           |                     | Ave.            |             | Peak        |       | Ave.            | Peak | Ave.           | Peak |
|                   |                |                       |                           |                     | Hori.           | Vert.       | Hori.       | Vert. |                 |      |                |      |
| 0ch               | 1601           | 1.9                   | 25.8                      | 30.1                | <b>51.1</b>     | 48.2        | <b>55.2</b> | 52.7  | 54.0            | 74.0 | 2.9            | 18.8 |
| 2401              | 4804           | 3.7                   | 29.2                      | 31.0                | <b>53.3</b>     | 52.2        | <b>63.3</b> | 59.5  | 54.0            | 74.0 | 0.7            | 10.7 |
| 39ch              | 1627           | 1.9                   | 25.8                      | 30.1                | <b>50.7</b>     | 48.7        | <b>54.3</b> | 53.5  | -               | 79.9 | -              | 25.6 |
| 2441              | 4882           | 3.7                   | 29.2                      | 31.0                | 50.4            | <b>53.4</b> | <b>63.4</b> | 60.5  | 54.0            | 74.0 | 0.6            | 10.6 |
| 78ch              | 1653           | 2.0                   | 25.8                      | 30.1                | <b>48.3</b>     | 46.3        | <b>52.7</b> | 51.8  | -               | 79.0 | -              | 26.3 |
| 2480              | 4960           | 3.7                   | 29.2                      | 31.2                | 49.1            | <b>52.2</b> | <b>64.0</b> | 59.6  | 54.0            | 74.0 | 1.8            | 10.0 |

Note1: This frequency is in the restriction band therefore it is applied the 15.209 Radiated emission limits, general requirements.

Note2: This frequency is not in the restriction band therefore this spurious emission shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power (15.247 (d)).

The radiated carrier level of each frequency is follows (RBW = 100 kHz);

- < 99.5 dBuV/m at 2402 MHz
- < 99.9 dBuV/m at 2441 MHz
- < 99.0 dBuV/m at 2480 MHz

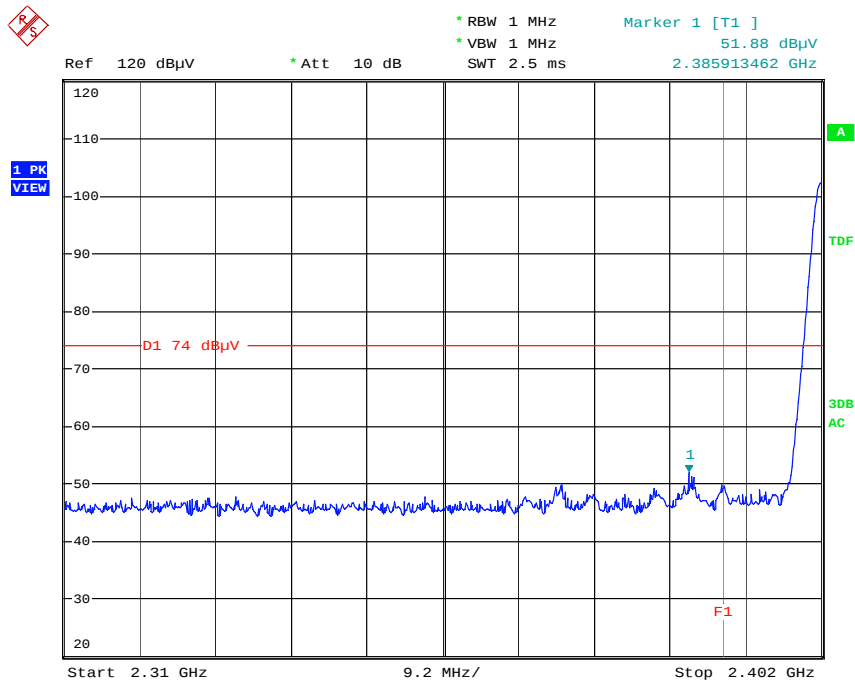
## Calculation method

The RESULT is calculated as followings.

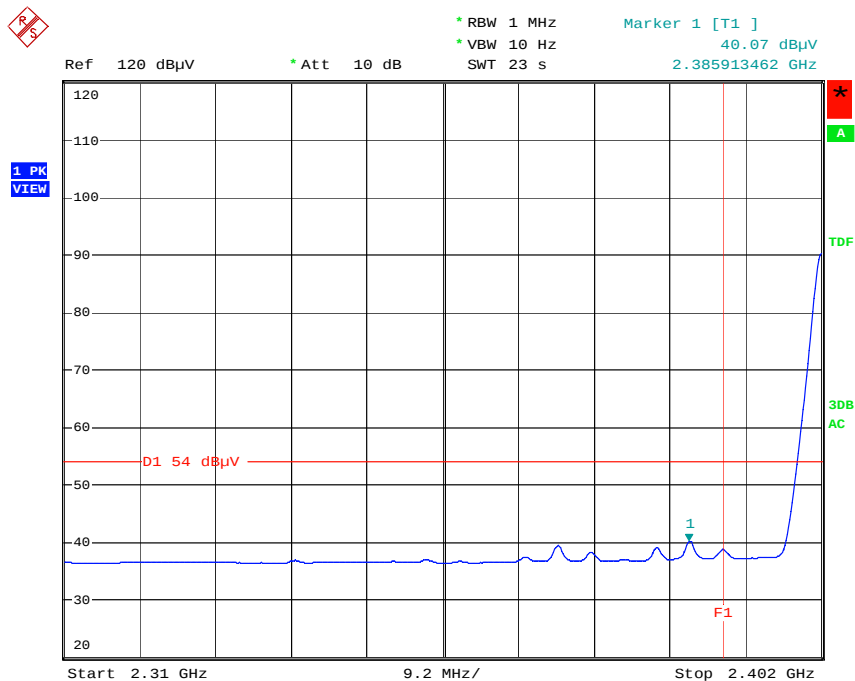
$$\text{RESULT [dBuV/m]} = \text{READING [dBuV]} + \text{Antenna Factor [dB/m]} + \text{Cable Loss [dB]} - \text{AMP Gain [dB]}$$

## 2.8.3.2 Operating Mode: EDR 2M rate

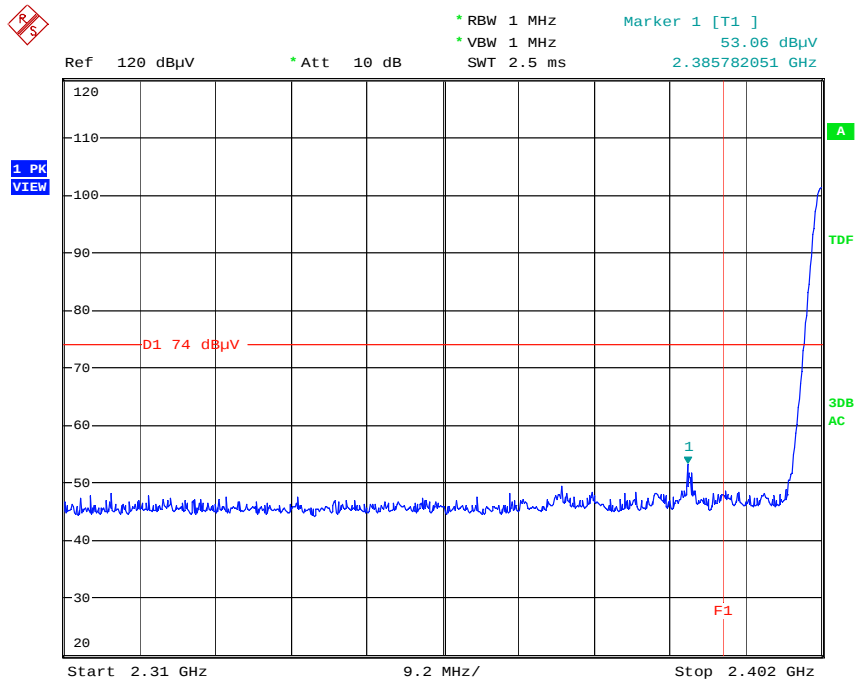
### Restricted Band Edge (Low channel, Horizontal, Peak)



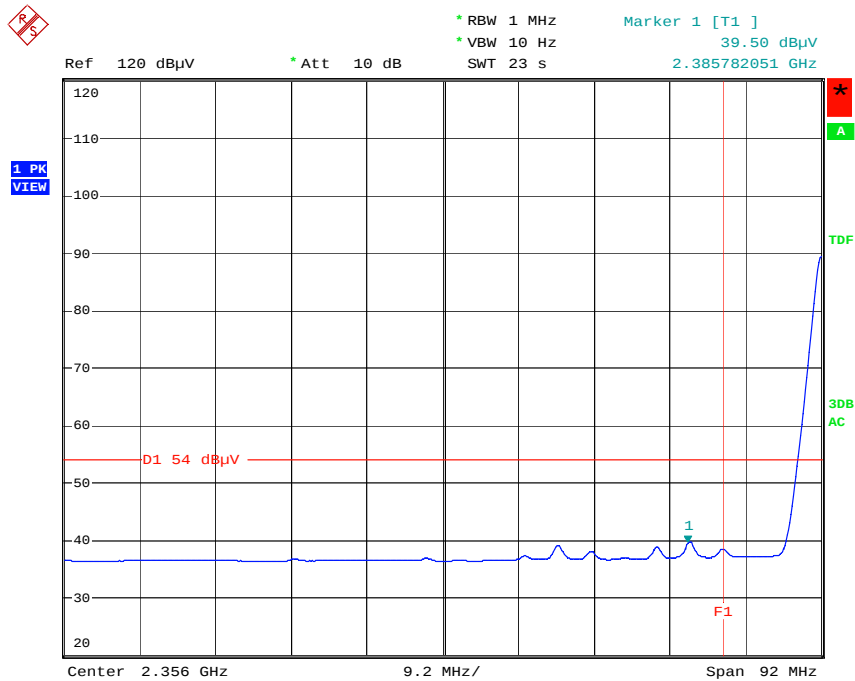
### Restricted Band Edge (Low channel, Horizontal, Average)



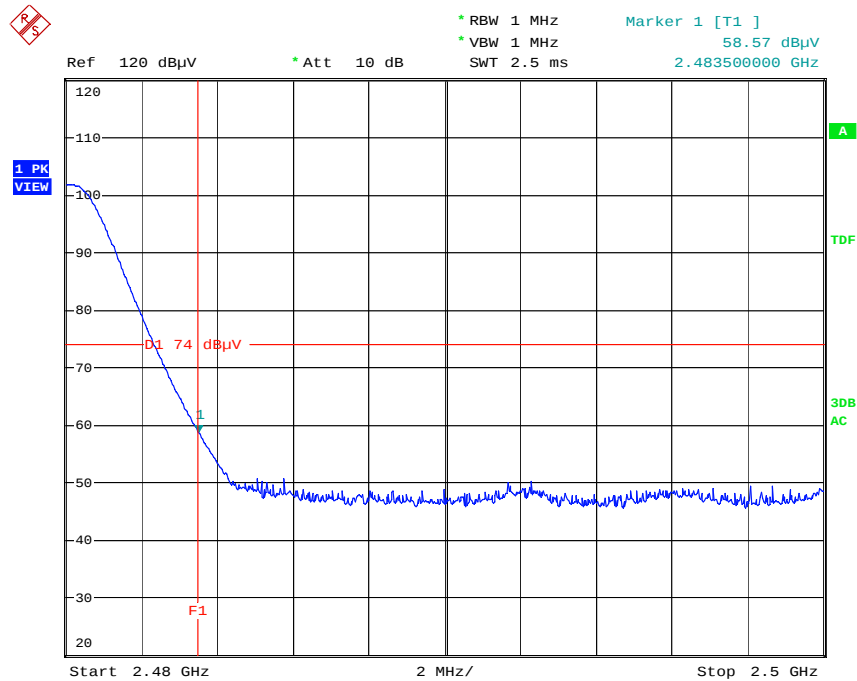
## Restricted Band Edge (Low channel, Vertical, Peak)



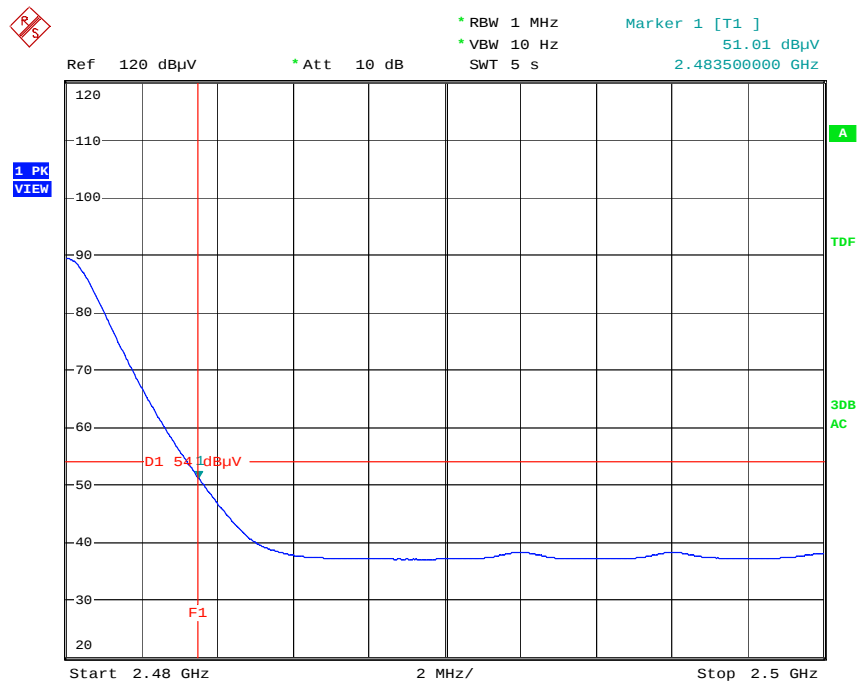
## Restricted Band Edge (Low channel, Vertical, Average)



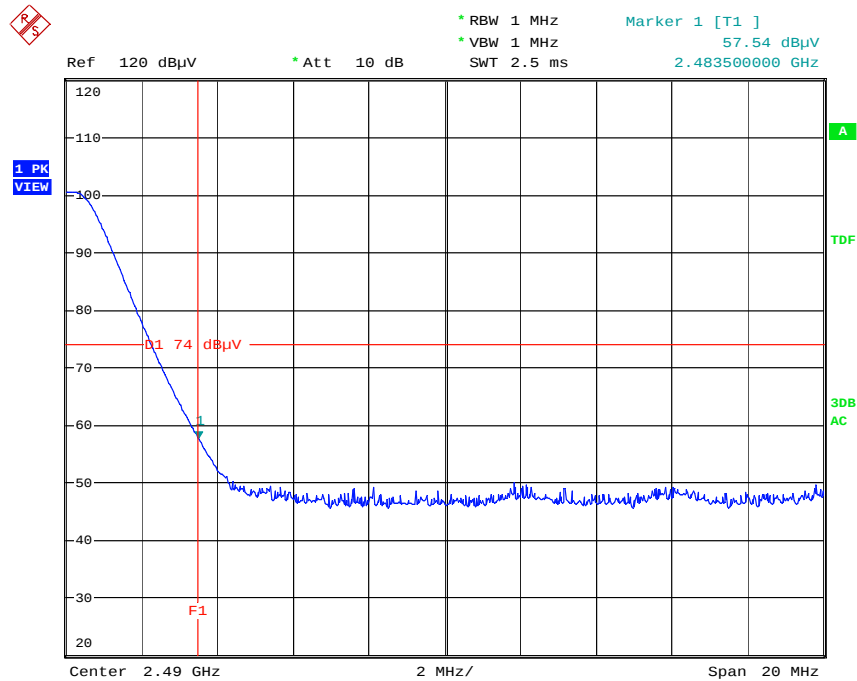
## Restricted Band Edge (High channel, Horizontal, Peak)



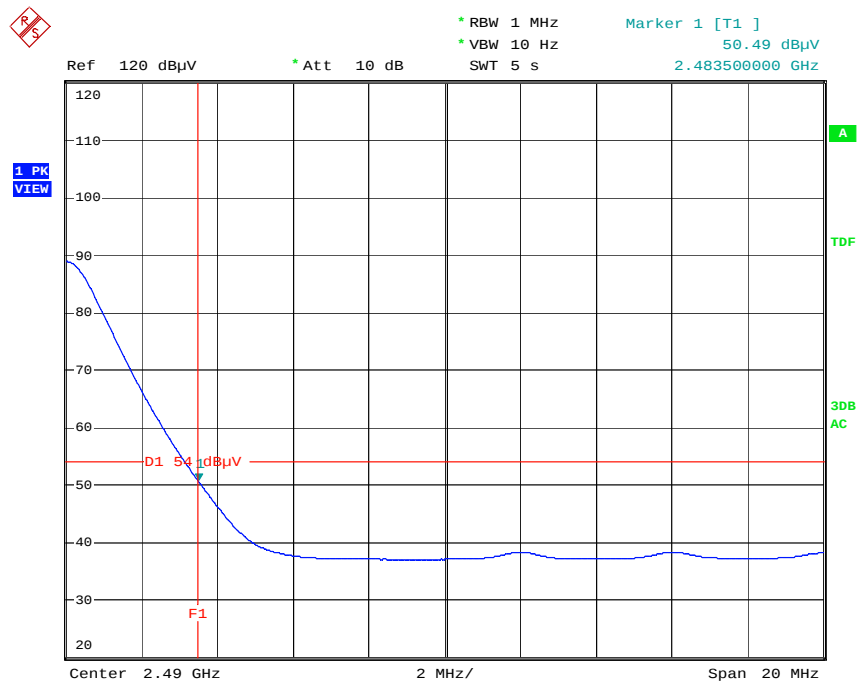
## Restricted Band Edge (High channel, Horizontal, Average)



## Restricted Band Edge (High channel, Vertical, Peak)



## Restricted Band Edge (High channel, Vertical, Average)



**Harmonics and Spurious Emission above 1000 MHz**

Operating mode: Continuous Communication  
EUT position: Z-plane (Maximum position)  
Measurement distance: 3 m

There are no spurious emissions other than listed below;

| TX<br>CH<br>(MHz) | Freq.<br>(MHz) | Cable<br>Loss<br>(dB) | Antenna<br>Factor<br>(dB) | AMP<br>Gain<br>(dB) | Result (dBuV/m) |             |             |       | Limit<br>(dBuV) |      | Margin<br>(dB) |      |
|-------------------|----------------|-----------------------|---------------------------|---------------------|-----------------|-------------|-------------|-------|-----------------|------|----------------|------|
|                   |                |                       |                           |                     | Ave.            |             | Peak        |       | Ave.            | Peak | Ave.           | Peak |
|                   |                |                       |                           |                     | Hori.           | Vert.       | Hori.       | Vert. |                 |      |                |      |
| 0ch               | 1601           | 1.9                   | 25.8                      | 30.1                | <b>51.0</b>     | 48.2        | <b>54.2</b> | 52.7  | 54.0            | 74.0 | 3.0            | 19.8 |
| 2401              | 4804           | 3.7                   | 29.2                      | 31.0                | 42.3            | <b>44.7</b> | <b>58.3</b> | 56.4  | 54.0            | 74.0 | 9.3            | 15.7 |
| 39ch              | 1627           | 1.9                   | 25.8                      | 30.1                | <b>50.8</b>     | 48.2        | <b>54.2</b> | 52.7  | -               | 77.2 | -              | 23.0 |
| 2441              | 4882           | 3.7                   | 29.2                      | 31.0                | 39.8            | <b>44.8</b> | <b>57.9</b> | 56.5  | 54.0            | 74.0 | 9.2            | 16.1 |
| 78ch              | 1653           | 2.0                   | 25.8                      | 30.1                | <b>48.2</b>     | 46.1        | <b>52.8</b> | 51.2  | -               | 75.9 | -              | 23.1 |
| 2480              | 4960           | 3.7                   | 29.2                      | 31.2                | <b>40.6</b>     | -           | <b>57.7</b> | -     | 54.0            | 74.0 | 13.4           | 16.3 |

Note1: This frequency is in the restriction band therefore it is applied the 15.209 Radiated emission limits, general requirements.

Note2: This frequency is not in the restriction band therefore this spurious emission shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power (15.247 (d)).

The radiated carrier level of each frequency is follows (RBW = 100 kHz);

- < 96.6 dBuV/m at 2402 MHz
- < 97.2 dBuV/m at 2441 MHz
- < 95.9 dBuV/m at 2480 MHz

**Calculation method**

The RESULT is calculated as followings.

$$\text{RESULT [dBuV/m]} = \text{READING [dBuV]} + \text{Antenna Factor [dB/m]} + \text{Cable Loss [dB]} - \text{AMP Gain [dB]}$$

## 2.9 Transmitter AC power line conducted emissions

### Test setup

Test setup was implemented according to the method of ANSI C63.4: 2003 clause 6 “General requirements for EUT equipment arrangements and operation” and Annex H.1 “AC power line conducted emission measurements setup”.

### Test procedure

Measurement procedures were implemented according to the method of ANSI C63.4: 2003 clauses 7, clause 13.1.3 and Annex H.2 “AC power line conducted emission measurements”.

Exploratory measurements were used the spectrum analyzer to identify the frequency of the emission that has the highest amplitude relative to the limit by operating the EUT in a range of typical modes of operation, cable positions, and with a typical system equipment configuration and arrangement.

Final ac power line conducted emission measurements were performed based on the exploratory tests.

The EUT cable configuration and arrangement and mode of operation that produced the emission with the highest amplitude relative to the limit are selected for the final measurement.

When the measurement value is greater than average limitation the average detection measurements were performed.

### Applicable rule and limitation

§15.207 (a) AC power line conducted limits

| Frequency of Emission (MHz) | Conducted Limit (dBuV) |            |
|-----------------------------|------------------------|------------|
|                             | Quasi-peak             | Average    |
| 0.15-0.5                    | 66 to 56 *             | 56 to 46 * |
| 0.5-5                       | 56                     | 46         |
| 5-30                        | 60                     | 50         |

\* Decreases with the logarithm of the frequency.

The lower limit applies at the band edges.

### Test equipment used (refer to List of utilized test equipment)

|      |      |      |      |
|------|------|------|------|
| TR04 | PL01 | LN05 | CL11 |
|------|------|------|------|

**Test results** - Complied with requirement.

## Test Data

Tested Date: February 1, 2007

Temperature: 22 °C  
Humidity: 32 %  
Atmos. Press: 1015 hPa

### 2.9.1 Operating Mode: Basic rate (Worst case configuration)

| No.      | Frequency<br>[MHz] | Reading      |              | C.F.<br>[dB] | Result       |              | Limit        |              | Margin       |              | PHASE    |
|----------|--------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|----------|
|          |                    | QP<br>[dBuV] | AV<br>[dBuV] |              | QP<br>[dBuV] | AV<br>[dBuV] | QP<br>[dBuV] | AV<br>[dBuV] | QP<br>[dBuV] | AV<br>[dBuV] |          |
| 1        | 0.196              | 28.9         | 19.3         | 0.2          | 29.1         | 19.5         | 63.8         | 53.8         | 34.7         | 34.3         | N        |
| 2        | 0.196              | 27.9         | 19.4         | 0.2          | 28.1         | 19.6         | 63.8         | 53.8         | 35.7         | 34.2         | L        |
| <b>3</b> | <b>1.377</b>       | <b>28.9</b>  | <b>28.3</b>  | <b>0.2</b>   | <b>29.1</b>  | <b>28.5</b>  | <b>56.0</b>  | <b>46.0</b>  | <b>26.9</b>  | <b>17.5</b>  | <b>L</b> |
| 4        | 4.910              | 28.6         | 24.2         | 0.5          | 29.1         | 24.7         | 56.0         | 46.0         | 26.9         | 21.3         | N        |
| 5        | 4.922              | 26.6         | 24.1         | 0.5          | 27.1         | 24.6         | 56.0         | 46.0         | 28.9         | 21.4         | L        |
| 6        | 20.000             | 19.9         | 10.1         | 1.0          | 20.9         | 11.1         | 60.0         | 50.0         | 39.1         | 38.9         | N        |

The power line conducted emission voltage is calculated by adding the LISN factor and Cable loss attenuation from the measured reading. The calculation is as follows:

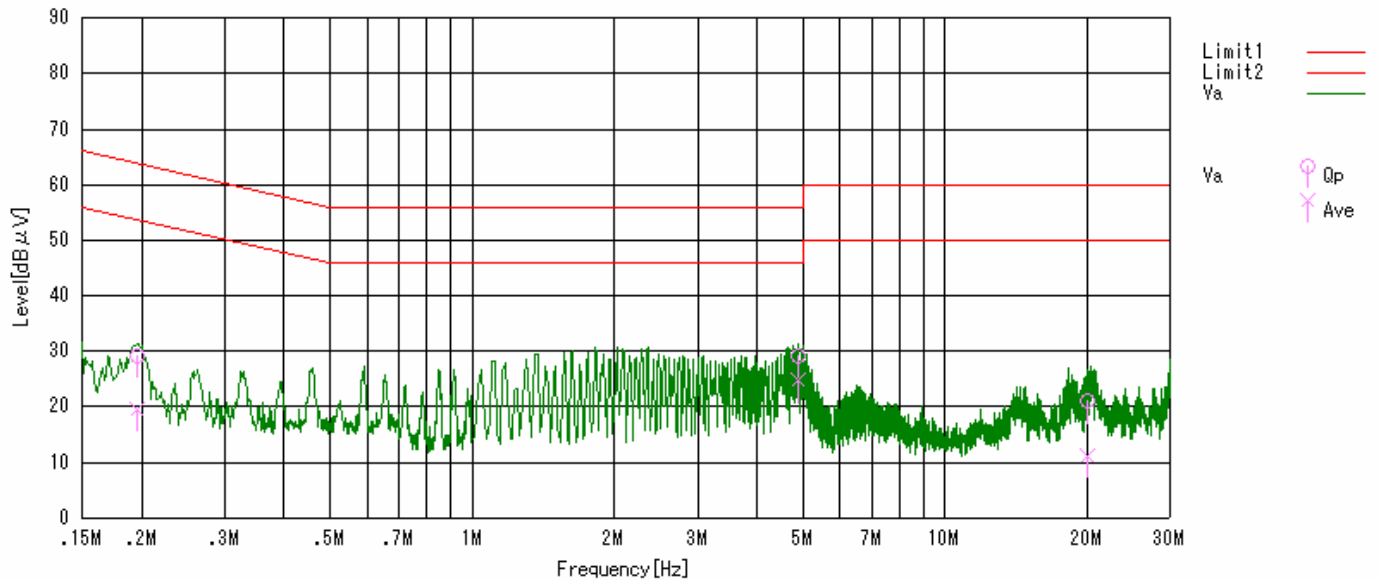
Result = Reading + C. F  
where C.F = LISN Factor + Cable Loss [dB]

Sample calculation at 1.377 MHz Ave. result as follow:

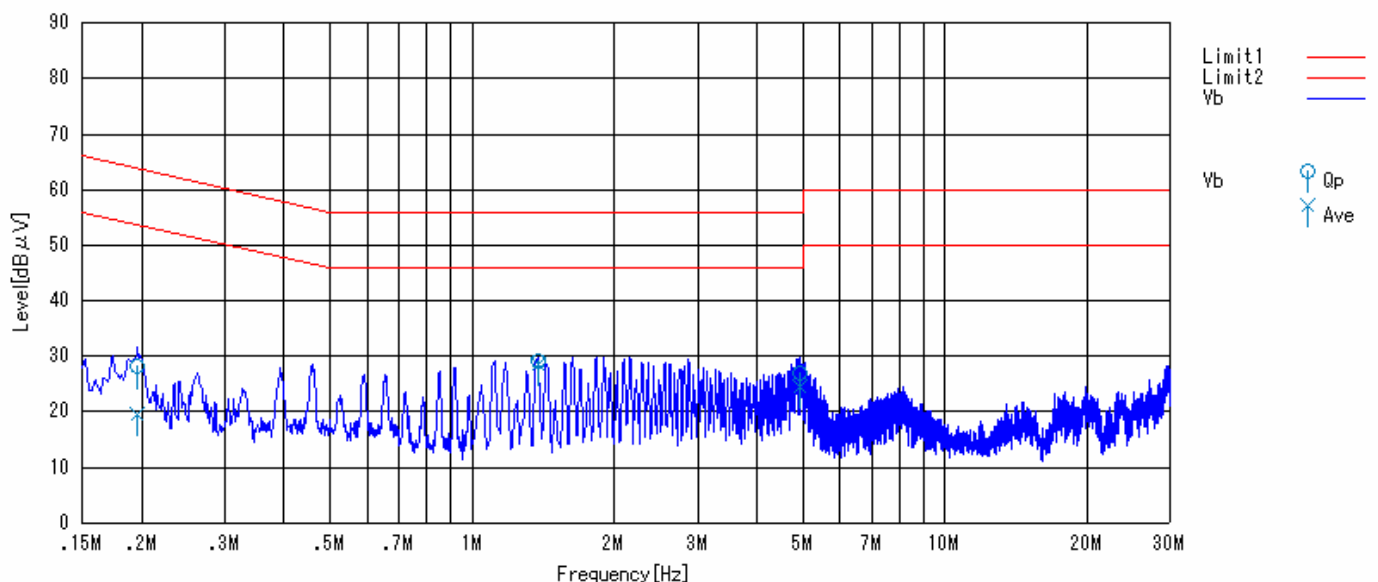
Result [dBuV] = Reading + C.F = 28.3 + 0.2 = 28.5 [dBuV]  
Margin = Limit – Result = 46.0 – 28.5 = 17.5 [dBuV]

## Graphical express of test result (0.15 MHz-30MHz)

### AC Power line conducted emission. (Phase N)



### AC Power line conducted emission. (Phase L)



## 2.9.2 Operating Mode: EDR 2M rate (Worst case configuration)

| No.      | Frequency<br>[MHz] | Reading      |              | C.F.<br>[dB] | Result       |              | Limit        |              | Margin       |              | PHASE    |
|----------|--------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|----------|
|          |                    | QP<br>[dBuV] | AV<br>[dBuV] |              | QP<br>[dBuV] | AV<br>[dBuV] | QP<br>[dBuV] | AV<br>[dBuV] | QP<br>[dBuV] | AV<br>[dBuV] |          |
| 1        | 0.164              | 29.1         | 28.4         | 0.3          | 29.4         | 28.7         | 65.3         | 55.3         | 35.9         | 26.6         | L        |
| 2        | 0.197              | 27.2         | 18.8         | 0.2          | 27.4         | 19.0         | 63.7         | 53.7         | 36.3         | 34.7         | N        |
| 3        | 1.645              | 27.1         | 19.1         | 0.2          | 27.3         | 19.3         | 56.0         | 46.0         | 28.7         | 26.7         | L        |
| <b>4</b> | <b>2.108</b>       | <b>29.0</b>  | <b>28.3</b>  | <b>0.3</b>   | <b>29.3</b>  | <b>28.6</b>  | <b>56.0</b>  | <b>46.0</b>  | <b>26.7</b>  | <b>17.4</b>  | <b>N</b> |
| 5        | 4.677              | 28.7         | 24.2         | 0.4          | 29.1         | 24.6         | 56.0         | 46.0         | 26.9         | 21.4         | N        |
| 6        | 4.740              | 26.9         | 23.9         | 0.4          | 27.3         | 24.3         | 56.0         | 46.0         | 28.7         | 21.7         | L        |

The power line conducted emission voltage is calculated by adding the LISN factor and Cable loss attenuation from the measured reading. The calculation is as follows:

$$\text{Result} = \text{Reading} + \text{C. F}$$

where C.F = LISN Factor + Cable Loss [dB]

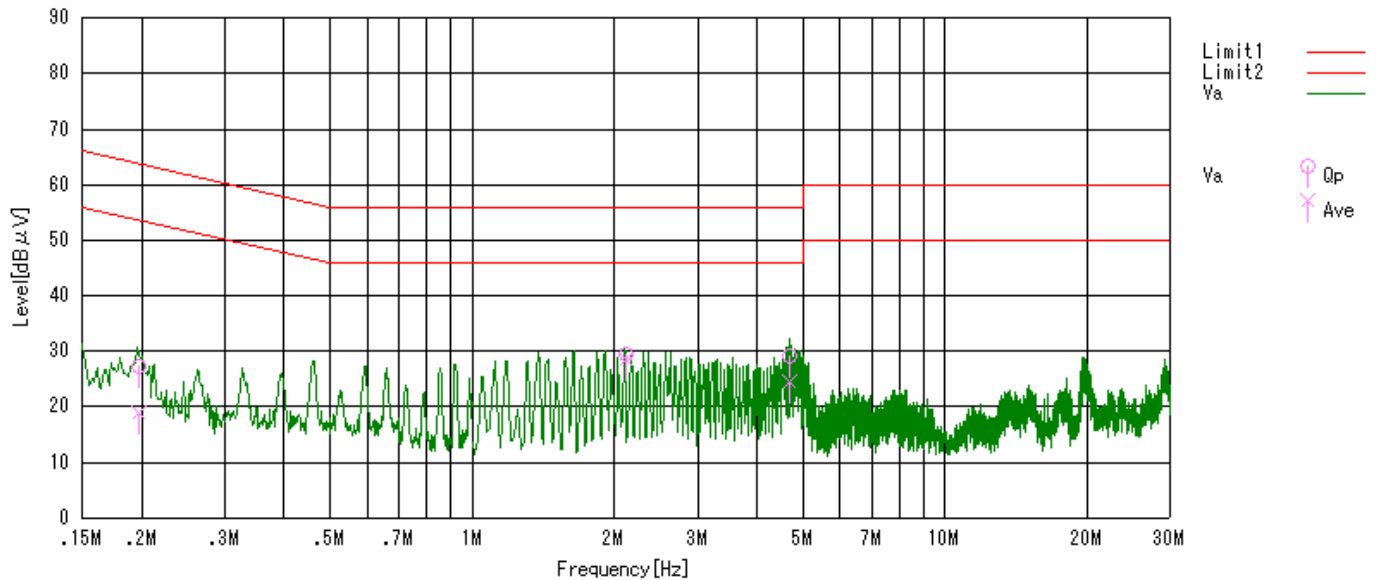
Sample calculation at 2.108MHz Ave. result as follow:

$$\text{Result [dBuV]} = \text{Reading} + \text{C.F} = 28.3 + 0.3 = 28.6 \text{ [dBuV]}$$

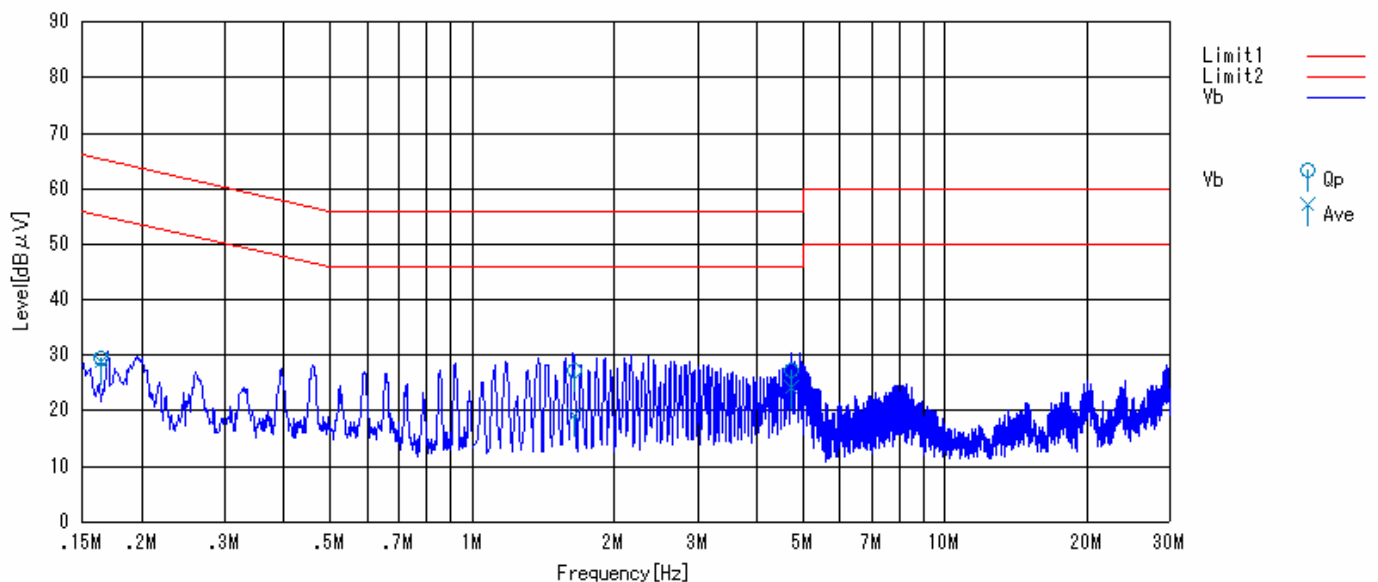
$$\text{Margin} = \text{Limit} - \text{Result} = 46.0 - 28.6 = 17.4 \text{ [dBuV]}$$

## Graphical express of test result (0.15 MHz-30MHz)

### AC Power line conducted emission. (Phase N)



### AC Power line conducted emission.. (Phase L)



## 2.10 Receiver Radiated spurious emissions

Test setup - Same as clause 2.8

Test procedure - Same as clause 2.8

### Applicable rule and limitation at 3m

§15.109 radiated emission limitation

| Frequency (MHz) | Measurement Distance (m) | Field Strength (uV/m) | Field Strength (dBuV/m) |
|-----------------|--------------------------|-----------------------|-------------------------|
| 30 – 88         | 3                        | 100                   | 40.0                    |
| 88 – 216        | 3                        | 150                   | 43.5                    |
| 216 – 960       | 3                        | 200                   | 46.0                    |
| Above 960       | 3                        | 500                   | 54.0                    |

In the emission table above, the tighter limit applies at the band edges.

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector.

Test results - Complied with requirement.

### 2.10.1 Between 30 – 1000 MHz

Test equipment used (refer to List of utilized test equipment)

|      |      |      |      |      |
|------|------|------|------|------|
| BA03 | CL11 | PR03 | SA06 | TR04 |
|------|------|------|------|------|

### Test Data

Tested Date: February 1, 2008

Temperature: 22 °C

Humidity: 32 %

Atmos. Press: 1015 hPa

### Operating Mode: Continuous Reception (Worst case configuration)

| No. | Frequency [MHz] | Reading [dBuV] | Factor [dB/m] | Loss [dB]  | Gain [dB]   | Result [dBuV/m] | Limit [dBuV/m] | Margin [dB] | Antenna Polarization |
|-----|-----------------|----------------|---------------|------------|-------------|-----------------|----------------|-------------|----------------------|
| 1   | 34.714          | 34.6           | 16.1          | 4.1        | 29.9        | 24.9            | 40.0           | 15.1        | Vert.                |
| 2   | 259.368         | 45.0           | 12.8          | 6.7        | 29.8        | 34.7            | 46.0           | 11.3        | Hori.                |
| 3   | 388.461         | 36.2           | 15.5          | 7.7        | 30.0        | 29.4            | 46.0           | 16.6        | Hori.                |
| 4   | <b>389.196</b>  | <b>44.6</b>    | <b>15.6</b>   | <b>7.7</b> | <b>30.0</b> | <b>37.9</b>     | <b>46.0</b>    | <b>8.1</b>  | <b>Vert.</b>         |
| 5   | 451.601         | 36.5           | 17.2          | 7.9        | 30.0        | 31.6            | 46.0           | 14.4        | Hori.                |
| 6   | 453.966         | 39.7           | 17.2          | 7.9        | 30.0        | 34.8            | 46.0           | 11.2        | Vert.                |

### Calculation method

The Correction Factors and RESULT are calculated as followings.

$$\text{Correction Factor [dB]} = \text{FACTOR [dB/m]} + \text{LOSS [dB]} - \text{GAIN [dB]}$$

$$\text{RESULT [dBuV/m]} = \text{READING [dBuV]} + \text{Correction Factor [dB]}$$

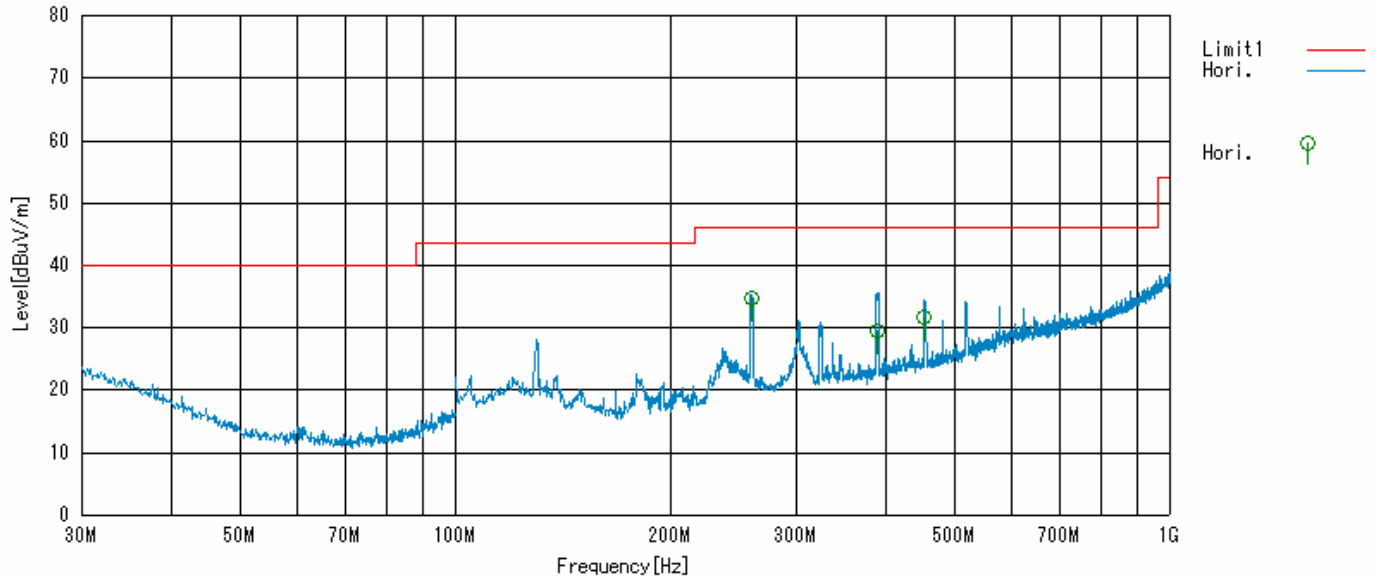
Sample calculation at 258.537 MHz vertical result as follow:

$$\text{Result [dBuV/m]} = \text{Reading} + \text{C.F} = 44.6 + 15.6 + 7.7 - 30.0 = 37.9$$

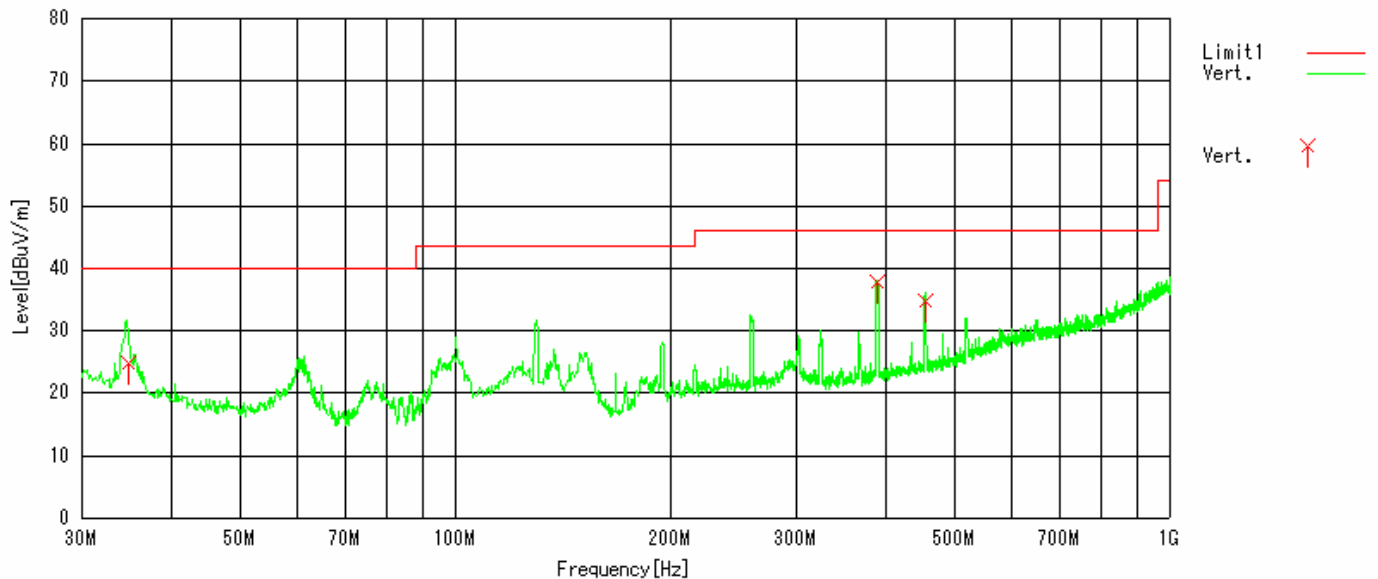
$$\text{Margin} = \text{Limit} - \text{Result} = 46.0 - 37.9 = 8.1 \text{ [dBuV/m]}$$

## Graphical express of test result (30MHz-1000MHz)

Antenna polarization: Horizontal



Antenna polarization: Vertical



## 2.10.2 Above 1000 MHz

### Test equipment used (refer to List of utilized test equipment)

|      |      |      |      |      |  |  |
|------|------|------|------|------|--|--|
| PR04 | SA06 | CL21 | CL22 | DH02 |  |  |
|------|------|------|------|------|--|--|

Tested Date: January 24, 2008

Temperature: 22 °C  
Humidity: 32 %  
Atmos. Press: 1004 hPa

### Operating Mode: Continuous Reception (Worst case configuration)

There are no spurious emissions other than listed below;

| TX<br>CH<br>(MHz) | Freq.<br>(MHz) | Cable<br>Loss<br>(dB) | Antenna<br>Factor<br>(dB) | AMP<br>Gain<br>(dB) | Result (dBuV/m) |       |             |             | Limit<br>(dBuV) |      | Margin<br>(dB) |      |
|-------------------|----------------|-----------------------|---------------------------|---------------------|-----------------|-------|-------------|-------------|-----------------|------|----------------|------|
|                   |                |                       |                           |                     | Ave.            |       | Peak        |             | Ave.            | Peak | Ave.           | Peak |
|                   |                |                       |                           |                     | Hori.           | Vert. | Hori.       | Vert.       |                 |      |                |      |
| 0ch<br>2401       | 1601           | 1.9                   | 25.8                      | 30.1                | <b>51.9</b>     | 51.6  | 55.4        | <b>55.6</b> | 54.0            | 74.0 | 2.1            | 18.4 |
| 39ch<br>2441      | 1626           | 1.9                   | 25.8                      | 30.1                | <b>49.6</b>     | 47.7  | <b>53.7</b> | 52.5        | 54.0            | 74.0 | 4.4            | 20.3 |
| 78ch<br>2480      | 1652           | 2.0                   | 25.8                      | 30.1                | <b>48.5</b>     | 46.5  | <b>53.3</b> | 51.6        | 54.0            | 74.0 | 5.5            | 20.7 |

### Calculation method

The RESULT is calculated as followings.

$$\text{RESULT [dBuV/m]} = \text{READING [dBuV]} + \text{Antenna Factor [dB/m]} + \text{Cable Loss [dB]} - \text{AMP Gain [dB]}$$

## 2.11 Receiver AC power line conducted emissions

Test setup - Same as clause 2.9

Test procedure - Same as clause 2.9

Applicable rule and limitation

§15.107 (a) AC power line conducted limits

| Frequency of Emission (MHz) | Conducted Limit (dBuV) |            |
|-----------------------------|------------------------|------------|
|                             | Quasi-peak             | Average    |
| 0.15-0.5                    | 66 to 56 *             | 56 to 46 * |
| 0.5-5                       | 56                     | 46         |
| 5-30                        | 60                     | 50         |

\* Decreases with the logarithm of the frequency.  
The lower limit applies at the band edges.

Test equipment used (refer to List of utilized test equipment)

|      |      |      |      |
|------|------|------|------|
| TR04 | PL01 | LN05 | CL11 |
|------|------|------|------|

Test results - Complied with requirement.

## Test Data

Tested Date: February 1, 2008

Temperature: 22 °C  
Humidity: 32 %  
Atmos. Press: 1015 hPa

## Operating Mode: Continuous Reception (Worst case configuration)

| No.      | Frequency<br>[MHz] | Reading      |              | C.F.<br>[dB] | Result       |              | Limit        |              | Margin       |              | PHASE    |
|----------|--------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|----------|
|          |                    | QP<br>[dBuV] | AV<br>[dBuV] |              | QP<br>[dBuV] | QP<br>[dBuV] | QP<br>[dBuV] | QP<br>[dBuV] | QP<br>[dBuV] | QP<br>[dBuV] |          |
| 1        | 0.197              | 26.9         | 18.7         | 0.2          | 27.1         | 18.9         | 63.7         | 53.7         | 36.6         | 34.8         | N        |
| 2        | 0.198              | 26.4         | 18.9         | 0.2          | 26.6         | 19.1         | 63.7         | 53.7         | 37.1         | 34.6         | L        |
| <b>3</b> | <b>2.110</b>       | <b>29.1</b>  | <b>28.3</b>  | <b>0.3</b>   | <b>29.4</b>  | <b>28.6</b>  | <b>56.0</b>  | <b>46.0</b>  | <b>26.6</b>  | <b>17.4</b>  | <b>N</b> |
| 4        | 2.111              | 28.3         | 27.5         | 0.3          | 28.6         | 27.8         | 56.0         | 46.0         | 27.4         | 18.2         | L        |
| 5        | 4.485              | 27.4         | 22.7         | 0.4          | 27.8         | 23.1         | 56.0         | 46.0         | 28.2         | 22.9         | N        |
| 6        | 4.883              | 27.2         | 24.6         | 0.5          | 27.7         | 25.1         | 56.0         | 46.0         | 28.3         | 20.9         | L        |

The power line conducted emission voltage is calculated by adding the LISN factor and Cable loss attenuation from the measured reading. The calculation is as follows:

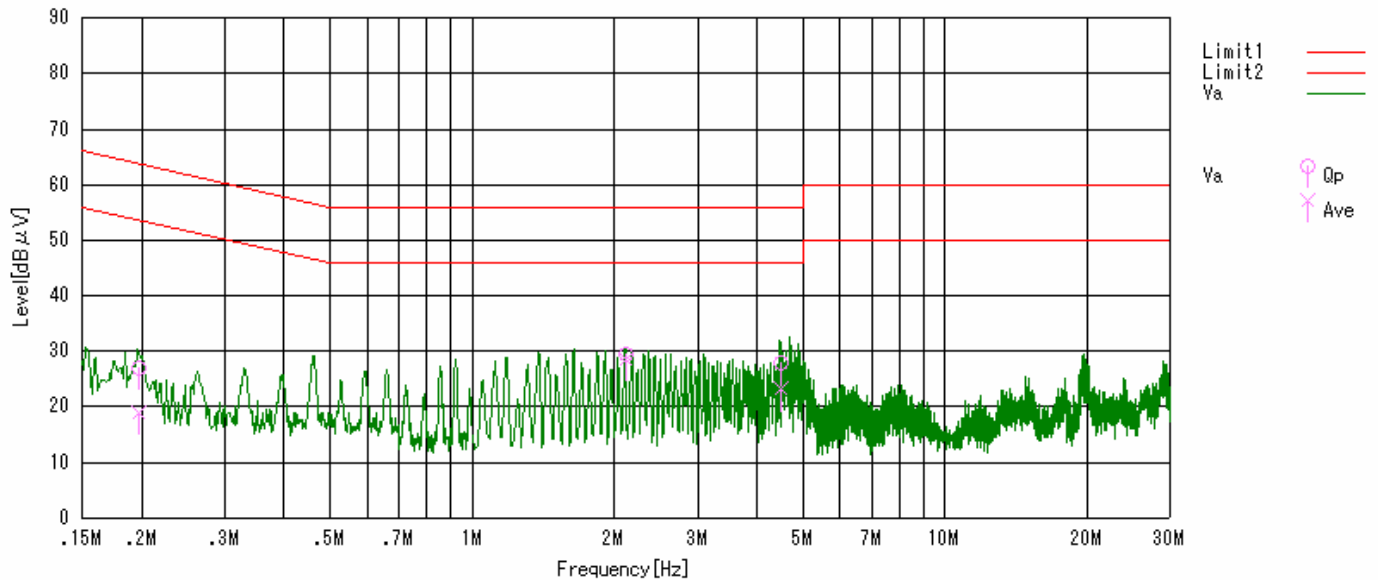
Result = Reading + C. F  
where C.F = LISN Factor + Cable Loss [dB]

Sample calculation at 2.110MHz Ave. result as follow:

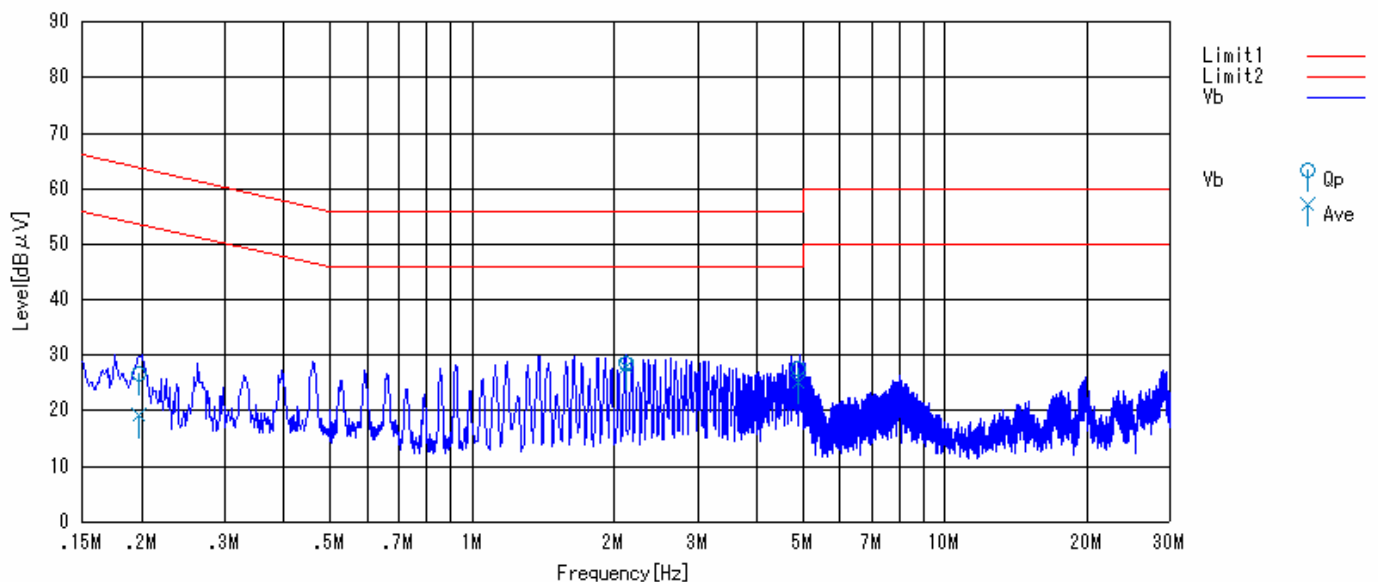
Result [dBuV] = Reading + C.F = 28.3 + 0.3 = 28.6 [dBuV]  
Margin = Limit – Result = 46.0 – 28.6 = 17.4 [dBuV]

## Graphical express of test result (0.15 MHz-30MHz)

### AC Power line conducted emission. (Phase N)



### AC Power line conducted emission. (Phase L)



## 2.12 Maximum Permissible Exposure (Exposure of Humans to RF Fields)

### Limitation

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

See 1.1307(b) (1) of this Chapter.

1.1310 The criteria of "General Population/ Uncontrolled Exposure" listed in the below table shall be used to evaluate the environmental impact of human exposure to radio-frequency radiation as specified in 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of 2.1093 of this chapter.

### Limits for General Population/Uncontrolled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/cm <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> ,  H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|-----------------------------------------|-------------------------------------------------------------------|
| 0.3-1.34              | 614                               | 1.63                              | (100)*                                  | 30                                                                |
| 1.34-30               | 824/f                             | 2.19/f                            | (180/f <sup>2</sup> )*                  | 30                                                                |
| 30-300                | 27.5                              | 0.073                             | 0.2                                     | 30                                                                |
| 300-1500              | --                                | --                                | f/1500                                  | 30                                                                |
| 1500-100,000          | --                                | --                                | 1.0                                     | 30                                                                |

f = frequency in MHz

\*Plane-wave equivalent power density

NOTE 2: *General population/uncontrolled* exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

### The MPE distance calculations:

The Maximum Permissible Exposure (MPE) distance between the EUT's antenna and human body is calculated in accordance with FCC OET Bulletin 65 and Safety Code 6 of IC.

The MPE distance where the exposure level reaches the permitted exposure level can be calculated as below;

$$S = P * G / 4\pi R^2$$

Rearranging terms to calculate the MPE Distance

$$R = (P * G / 4\pi S)^{1/2}$$

Where:

**R = MPE Distance in cm**

**P = Power in dBm (1.967 mW, Refer to page 23 in this report)**

**G = Antenna Gain in numeric**

**(0.847 = -0.72dBi, Max. Antenna Gain, Refer to the submitted antenna spec.)**

**S = Power Density Limit in mW/cm<sup>2</sup>**

**(1.0 mW/cm<sup>2</sup>, Max. permissible exposure limit above)**

Then MPE Distance is 0.364 cm.

**Test results - Complied with requirement.**

#### 4 List of utilized test equipment/ calibration

| RFT ID No. | Kind of Equipment and Precision   | Manufacturer           | Model No.   | Serial Number | Calibration Date | Calibrated until |
|------------|-----------------------------------|------------------------|-------------|---------------|------------------|------------------|
| AC01       | Anechoic Chamber                  | Japan Shield Enclosure | 203397C     | -             | 2007/5/8         | 2008/5/6         |
| BA03       | Biological Antenna                | CHASE                  | CBL6111     | 1309          | 2007/5/14        | 2008/5/12        |
| CL11       | Antenna Cable                     | RFT                    | -           | -             | 2007/6/12        | 2008/6/10        |
| CL21       | RF Cable 0.5m                     | SUCOFLEX               | SF104PE     | 48772/4PE     | 2007/5/25        | 2008/5/23        |
| CL22       | RF Cable 2.0m                     | SUCOFLEX               | SF104       | 274755/4      | 2007/5/25        | 2008/5/23        |
| LN05       | LISN                              | Kyoritsu               | KNW-407     | 8-1773-2      | 2007/5/14        | 2008/5/12        |
| LN06       | LISN                              | Kyoritsu               | KNW-407     | 8-1773-3      | 2007/5/14        | 2008/5/12        |
| PL01       | Pulse Limiter                     | PMM                    | PL-01       | 0000J10109    | 2008/1/17        | 2009/1/15        |
| PR03       | Pre. Amplifier                    | Anritsu                | HM648A      | M41984        | 2007/5/14        | 2008/5/12        |
| PR04       | Pre. Amplifier (1-26G)            | RFT                    | LNP126      | 060208-01     | 2007/6/8         | 2008/6/6         |
| SA06       | Spectrum Analyzer (F/W: 3.60 SP1) | Rohde & Schwarz        | FSP40       | 100071        | 2007/10/25       | 2008/10/23       |
| SH01       | Standard Horn Antenna (18-26G)    | A.H. Systems           | SAS-572     | 208           | 2006/5/3         | 2008/5/1         |
| TR04       | Test Receiver (F/W : 3.82 SP1)    | Rohde & Schwarz        | ESCI        | 100447        | 2007/9/19        | 2008/9/17        |
| DH02       | DRG Horn Antenna                  | A.H. Systems           | SAS-200/571 | 239           | 2007/4/20        | 2009/4/18        |
| TC01       | Temperature Chamber               | ESPEC                  | SH-641      | 92000964      | 2007/4/23        | 2008/4/21        |

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.