

FCC Part 15 EMI TEST REPORT of

E.U.T. : ZigBee/IEEE802.15.4 RF
Module

FCC ID. : NRH-ZB-Z110PA

Model No. : Z110PA

for

APPLICANT : NETVOX TECHNOLOGY CO., LTD.

ADDRESS : No. 21-1, Sec. 1, Chung Hua West Road,
Tainan, Taiwan

Test Performed by

ELECTRONICS TESTING CENTER, TAIWAN

NO. 34. LIN 5. DINGFU, LINKOU DIST.,
NEW TAIPEI COUNTY, TAIWAN, 24442, R.O.C.

Tel : (02)26023052 Fax : (02)26010910

<http://www.etc.org.tw> ; e-mail: emc@etc.org.tw

Report Number : 11-05-RBF-158

TEST REPORT CERTIFICATION

Applicant : NETVOX TECHNOLOGY CO., LTD.
No. 21-1, Sec. 1, Chung Hua West Road, Tainan, Taiwan

Manufacturer : NETVOX TECHNOLOGY CO., LTD.
No. 21-1, Sec. 1, Chung Hua West Road, Tainan, Taiwan

Description of EUT

- a) Type of EUT : ZigBee/IEEE802.15.4 RF Module
- b) Trade Name : NETVOX
- c) Model No. : Z110PA
- d) Power Supply : DV 5C (Power From PC)
- e) Frequency Range : 2405.000-2480.000 MHz

Regulation Applied : FCC Rules and Regulations Part 15 Subpart C

I HEREBY CERTIFY THAT: The data shown in this report were made in accordance with the procedures given in ANSI C63.4, and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

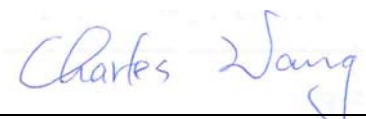
Note: 1. The result of the testing report relate only to the item tested.
2. The testing report shall not be reproduced expect in full, without the written approval of ETC.

Date Test Item Received : May 25, 2011

Date Test Campaign Completed : Jul. 05, 2011

Date of Issue : Jul. 12, 2011

Test Engineer : 
(Falcon Shi, Engineer)

Check By : 
(Charles Wang, Supervisor)

Approve & Authorized Signer : 
Will Yauo, Manager
EMC Dept. II of ELECTRONICS
TESTING CENTER, TAIWAN

Table of Contents	Page
1 GENERAL INFORMATION.....	1
1.1 Product Description.....	1
1.2 Characteristics of Device	1
1.3 Test Methodology.....	1
1.4 Test Facility.....	1
2 PROVISIONS APPLICABLE.....	2
2.1 Definition	2
2.2 Requirement for Compliance	3
2.3 Restricted Bands of Operation	5
2.4 Labeling Requirement	5
2.5 User Information	6
3. SYSTEM TEST CONFIGURATION.....	7
3.1 Justification	7
3.2 Devices for Tested System	7
4 RADIATED EMISSION MEASUREMENT	8
4.1 Applicable Standard	8
4.2 Measurement Procedure.....	8
4.3 Measuring Instrument.....	10
4.4 Radiated Emission Data	11
4.5 Field Strength Calculation.....	24
4.6 Photos of Radiation Measuring Setup.....	25
5 CONDUCTED EMISSION MEASUREMENT.....	28
5.1 Standard Applicable	28
5.2 Measurement Procedure.....	28
5.3 Conducted Emission Data	29
5.4 Result Data Calculation.....	35
5.5 Conducted Measurement Equipment	35
5.6 Photos of Conduction Measuring Setup.....	36
6 ANTENNA REQUIREMENT	39
6.1 Standard Applicable	39
6.2 Antenna Construction and Directional Gain	39
7 EMISSION BANDWIDTH MEASUREMENT.....	40
7.1 Standard Applicable	40
7.2 Measurement Procedure.....	40

7.3 Measurement Equipment.....	40
7.4 Measurement Data.....	41
8 OUTPUT POWER MEASUREMENT	45
8.1 Standard Applicable	45
8.2 Measurement Procedure	45
8.3 Measurement Equipment.....	45
8.4 Measurement Data.....	46
9 100 kHz BANDWIDTH OF BAND EDGES MEASUREMENT	50
9.1 Standard Applicable	50
9.2 Measurement Procedure	50
9.3 Measurement Equipment.....	50
9.4 Measurement Data.....	51
10 POWER DENSITY MEASUREMENT	54
10.1 Standard Applicable	54
10.2 Measurement Procedure	54
10.3 Measurement Equipment.....	54
10.4 Measurement Data.....	55
11. OUT-OF-BAND CONDUCTED EMISSION MEASUREMENT	59
11.1 Standard Applicable	59
11.2 Measurement Procedure	59
11.3 Measurement Equipment.....	59
11.4 Measurement Data.....	60

1 GENERAL INFORMATION

1.1 Product Description

- a) Type of EUT : ZigBee/IEEE802.15.4 RF Module
- b) Trade Name : NETVOX
- c) Model No. : Z110PA
- d) Power Supply : DV 5C (Power From PC)

1.2 Characteristics of Device

ZigBee/IEEE802.15.4 RF Module

1.3 Test Methodology

Both conducted and radiated emissions were performed according to the procedures illustrated in ANSI C63.4 (2003). Other required measurements were illustrated in separate sections of this test report for details.

For radiated emission test, the antenna of EUT was swiveled to 180 degree horizontal and 90 degree of up, down, right and left respectively for pretesting. The worst case, antenna 90 degree up, was chosen to perform the final test and the data was reported.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the roof top of Building at NO.34, LIN 5, DINGFU TSUEN, LINKOU SHIANG TAIPEI COUNTY, TAIWAN, 24442, R.O.C.

This site has been fully described in a report submitted to your office, and accepted in a letter dated Jan. 11, 2011.

2 PROVISIONS APPLICABLE

2.1 Definition

Unintentional radiator:

A device that intentionally generates and radio frequency energy for use within the device, or that sends radio frequency signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction.

Class A Digital Device:

A digital device which is marketed for use in commercial or business environment; exclusive of a device which is market for use by the general public, or which is intended to be used in the home.

Class B Digital Device :

A digital device which is marketed for use in a residential environment notwithstanding use in a commercial, business of industrial environment. Example of such devices that are marketed for the general public.

Note : A manufacturer may also qualify a device intended to be marketed in a commercial, business, or industrial environment as a Class B digital device, and in fact is encouraged to do so, provided the device complies with the technical specifications for a Class B Digital Device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B Digital Device, Regardless of its intended use.

Intentional radiator:

A device that intentionally generates and emits radio frequency energy by radiation or induction.

2.2 Requirement for Compliance

(1) Conducted Emission Requirement

Except for Class A digital devices, for equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency MHz	Quasi Peak dB μ V	Average dB μ V
0.15 - 0.5	66-56*	56-46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

* Decreases with the logarithm of the frequency

(2) Radiated Emission Requirement

For unintentional device, according to §15.109(a), except for Class A digital devices, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency MHz	Distance Meters	Radiated dB μ V/m	Radiated μ V/m
30 - 88	3	40.0	100
88 - 216	3	43.5	150
216 - 960	3	46.0	200
Above 960	3	54.0	500

For intentional device, according to §15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the above table.

(3) Antenna Requirement

For intentional device, according to §15.203, 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.

(4) Bandwidth Requirement

For direct sequence system, according to 15.247(a)(2), the minimum 6dB bandwidth shall be at least 500 kHz.

(5) Output Power Requirement

For direct sequence system, according to 15.247(b), the maximum peak output power of the transmitter shall not exceed 1 Watt. If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(6) 100 kHz Bandwidth of Frequency Band Edges Requirement

According to 15.247(c), if any 100 kHz bandwidth outside these frequency bands, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in §15.209(a), whichever results in the lesser attenuation.

(7) Power Density Requirement

According to 15.247(d), for direct sequence systems, the transmitted power density averaged over any 1 second interval shall not be greater than 8 dBm in any 3 kHz bandwidth within these bands.

2.3 Restricted Bands of Operation

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
0.495 - 0.505 **	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	2655-2900	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	3360-4400	Above 38.6
13.36-13.41			

** : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

2.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device :

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions : (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual.

The Federal Communications Commission Radio Frequency Interference Statement includes the following paragraph.

This equipment has been tested and found to comply with the limits for a Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction may cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio / TV technician for help.

3. SYSTEM TEST CONFIGURATION

3.1 Justification

For both radiated and conducted emissions below 1 GHz, the system was configured for testing in a typical fashion as a customer would normally use it. The peripherals other than EUT were connected in normally standing by situation. Measurement was performed under the condition that a computer program was exercised to simulate data communication of EUT, and the transmission rate was set to maximum allowed by EUT. Three highest emissions were verified with varying placement of the cables connected to EUT to maximize the emission from EUT.

For conducted and radiated spurious emissions, whichever RF channel is operated, the digital circuits function identically. As the reason, measurement of radiated emissions from digital circuits is only performed with channel 7 by transmitting mode.

3.2 Devices for Tested System

Device	Manufacture	Model	Cable Description
ZigBee/IEEE802.15.4 RF Module *	NETVOX TECHNOLOGY CO., LTD.	Z110PA /NRH-ZB-Z110PA	----

Remark “*” means equipment under test.

4 RADIATED EMISSION MEASUREMENT

4.1 Applicable Standard

For unintentional radiator, the radiated emission shall comply with §15.109(a).

For intentional radiators, according to §15.247 (a), operation under this provision is limited to frequency hopping and direct sequence spread spectrum, and the out band emission shall be comply with §15.247 (c)

4.2 Measurement Procedure

1. Setup the configuration per figure 1 and 2 for frequencies measured below and above 1 GHz respectively.
2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.
3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.
4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 ° to 360 ° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.
5. Repeat step 4 until all frequencies need to be measured were complete.
6. Repeat step 5 with search antenna in vertical polarized orientations.
7. Check the three frequencies of highest emission with varying the placement of cables associated with EUT to obtain the worse case and record the result.

Figure 1 : Frequencies measured below 1 GHz configuration

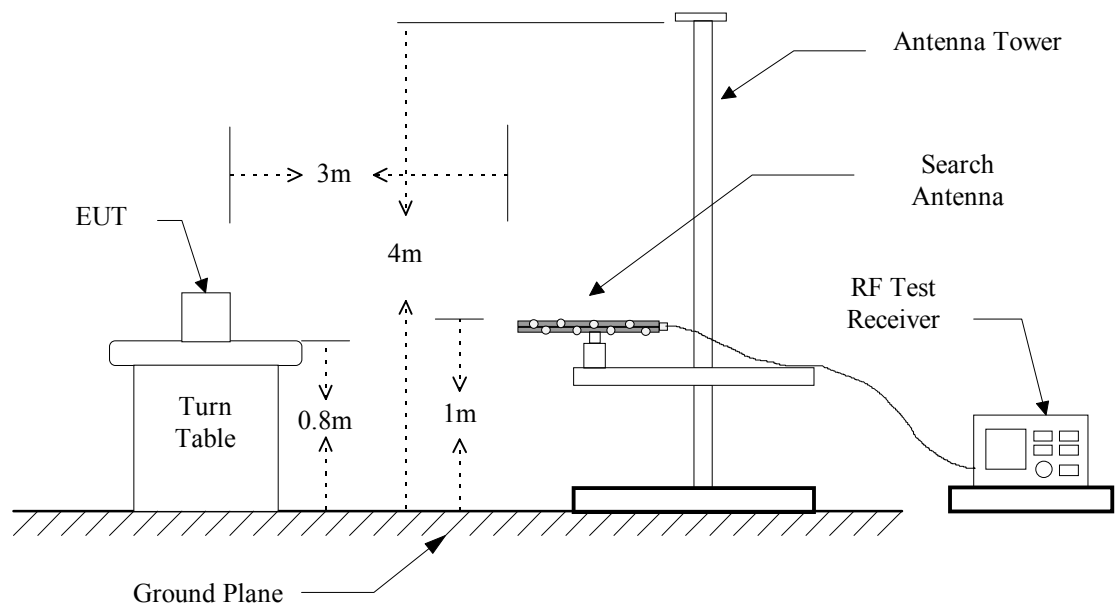
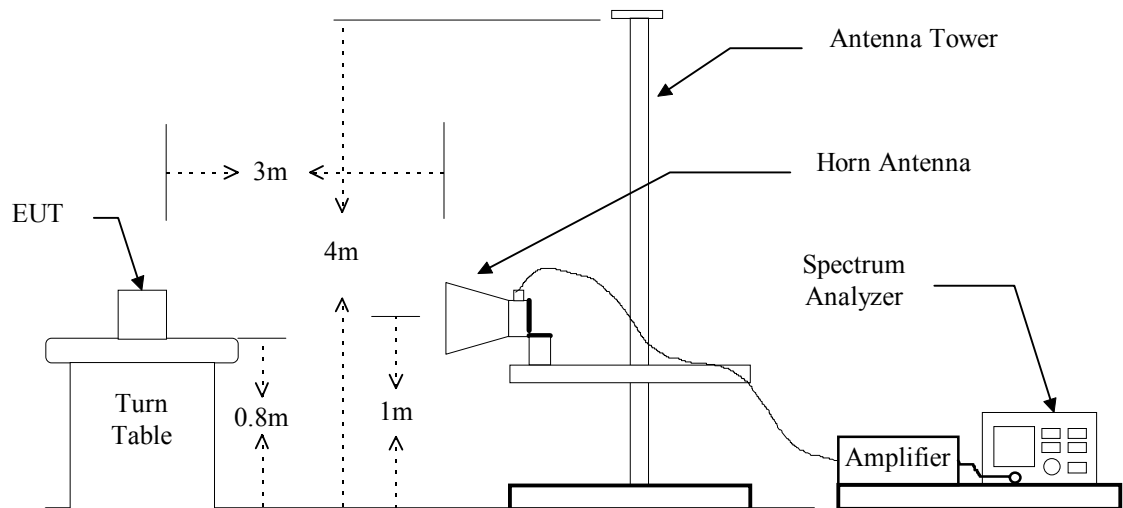


Figure 2 : Frequencies measured above 1 GHz configuration



4.3 Measuring Instrument

The following instrument are used for radiated emissions measurement:

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum	Rohde & Schwarz	FSP40	2010/09/17	2011/09/16
EMI Test Receiver	Rohde & Schwarz	ESCI	2011/02/03	2012/02/02
Double Ridged Antenna	EMCO	3115	2011/05/11	2012/05/10
Log-periodic Antenna	EMCO	3146	2010/10/11	2011/10/10
Biconical Antenna	EMCO	3110B	2010/10/11	2011/10/10
Amplifier	HP	8449B	2010/12/29	2011/12/28
Amplifier	HP	8447D	2010/10/08	2011/10/07
Amplifier	HP	83051A	2011/05/13	2012/05/12

Measuring instrument setup in measured frequency band when specified detector function is used :

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	RF Test Receiver	Quasi-Peak	120 kHz	N/A
	Spectrum Analyzer	Peak	100 kHz	100 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	10 Hz

4.4 Radiated Emission Data

4.4.1 RF Portion

4.4.1.1 EUT with SMD Antenna

A. Channel Low

Operation Mode : Transmitting, EUT orientation: keep flat horizontally

Fundamental Frequency : 2405.000 MHz

Test Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H		V			Peak	Ave	Peak	Ave			
	Peak	Ave	Peak	Ave								
4809.439	48.7	***	60.3	35.7	0.9	61.2	36.6	114.0	94.0	-52.8	56	1.1
7216.234	52.5	34.0	55.7	34.6	5.7	61.4	40.3	74.0	54.0	-12.6	39	1.1
9621.955	63.7	36.4	64.8	36.1	9.1	73.9	45.5	74.0	54.0	-0.1	72	1.0
12027.572	---	---	---	---	---	---	---	74.0	54.0	---	---	---
14433.338	---	---	---	---	---	---	---	74.0	54.0	---	---	---
16839.104	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19244.870	---	---	---	---	---	---	---	74.0	54.0	---	---	---
21650.636	---	---	---	---	---	---	---	74.0	54.0	---	---	---
24056.402	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Operation Mode : Receiving

Fundamental Frequency : Local Frequency : 2405.000 MHz

Test Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H		V			Peak	Ave	Peak	Ave			
	Peak	Ave	Peak	Ave								
* 2405.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 4810.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 7215.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 9620.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 12025.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Note :

1. Item of margin shown in above table refer to average limit.
2. It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.
3. Remark "---" means that the emissions level is too low to be measured.
4. Remark "*" means the local oscillator frequency and its harmonics.
5. Item "Margin" referred to Average limit while there is only peak result.
6. The expanded uncertainty of the radiated emission tests is 3.53 dB.

B. CH Middle

Operation Mode : Transmitting, EUT orientation: keep flat horizontally

Fundamental Frequency : 2440.000 MHzTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H Peak	V Ave	H Peak	V Ave		Peak	Ave	Peak	Ave			
4880.149	47.6	***	59.9	34.5	1.1	61.0	35.6	114.0	94.0	-53.0	67	1.0
7321.659	54.2	34.0	52.9	34.2	5.9	60.1	40.1	74.0	54.0	-13.9	52	1.0
9761.899	62.1	35.5	59.3	34.8	9.3	71.4	44.8	74.0	54.0	-2.6	41	1.1
12202.729	---	---	---	---	---	---	---	74.0	54.0	---	---	---
14643.449	---	---	---	---	---	---	---	74.0	54.0	---	---	---
17084.170	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19524.891	---	---	---	---	---	---	---	74.0	54.0	---	---	---
21965.611	---	---	---	---	---	---	---	74.0	54.0	---	---	---
24406.332	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Operation Mode : ReceivingFundamental Frequency : Local Frequency : 2440.000 MHzTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H Peak	V Ave	H Peak	V Ave		Peak	Ave	Peak	Ave			
* 2440.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 4880.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 7320.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 9760.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 12200.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Note :

1. Item of margin shown in above table refer to average limit.
2. It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.
3. Remark "---" means that the emissions level is too low to be measured.
4. Remark "*" means the local oscillator frequency and its harmonics.
5. Item "Margin" referred to Average limit while there is only peak result.
6. The expanded uncertainty of the radiated emission tests is 3.53 dB.

C. Channel High

Operation Mode : Transmitting, EUT orientation: keep flat horizontally

Fundamental Frequency : 2480.000 MHzTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H		V			Peak	Ave	Peak	Ave			
	Peak	Ave	Peak	Ave								
4959.022	48.7	***	59.2	35.9	1.4	60.6	37.3	114.0	94.0	-53.4	56	1.0
7438.622	51.1	33.7	54.1	34.1	6.3	60.4	40.4	74.0	54.0	-13.6	83	1.0
9922.035	59.0	34.9	59.3	33.5	9.5	68.8	44.4	74.0	54.0	-5.2	21	1.0
12401.346	---	---	---	---	---	---	---	74.0	54.0	---	---	---
14881.917	---	---	---	---	---	---	---	74.0	54.0	---	---	---
17362.487	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19843.058	---	---	---	---	---	---	---	74.0	54.0	---	---	---
22323.628	---	---	---	---	---	---	---	74.0	54.0	---	---	---
24804.199	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Operation Mode : ReceivingFundamental Frequency : Local Frequency : 2480.000 MHzTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H		V			Peak	Ave	Peak	Ave			
	Peak	Ave	Peak	Ave								
* 2480.000	---	---	---	---	-2.8	---	---	74.0	54.0	---	---	---
* 4960.000	---	---	---	---	2.8	---	---	74.0	54.0	---	---	---
* 7440.000	---	---	---	---	6.1	---	---	74.0	54.0	---	---	---
* 9920.000	---	---	---	---	7.4	---	---	74.0	54.0	---	---	---
* 12400.000	---	---	---	---	9.4	---	---	74.0	54.0	---	---	---

Note :

1. Item of margin shown in above table refer to average limit.
2. It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "****" means that Peak result is meet average limit.
3. Remark "---" means that the emissions level is too low to be measured.
4. Remark "*" means the local oscillator frequency and its harmonics.
5. Item "Margin" referred to Average limit while there is only peak result.
6. The expanded uncertainty of the radiated emission tests is 3.53 dB.

4.4.1.2 EUT with PIFA Antenna**A. CH Low**

Operation Mode : Transmitting, EUT orientation: keep flat horizontally

Fundamental Frequency : 2405.000 MHzTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H Peak	V Ave	H Peak	V Ave		Peak	Ave	Peak	Ave			
4808.872	63.8	36.7	71.4	39.9	0.9	72.3	40.8	114.0	94.0	-41.7	55	1.0
7213.606	47.3	***	56.6	34.4	5.7	62.3	40.1	74.0	54.0	-11.7	82	1.0
9622.083	48.2	32.9	52.2	33.2	9.1	61.3	42.3	74.0	54.0	-11.7	39	1.0
12026.386	---	---	---	---	---	---	---	74.0	54.0	---	---	---
14431.984	---	---	---	---	---	---	---	74.0	54.0	---	---	---
16837.583	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19243.181	---	---	---	---	---	---	---	74.0	54.0	---	---	---
21648.779	---	---	---	---	---	---	---	74.0	54.0	---	---	---
24054.378	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Operation Mode : ReceivingFundamental Frequency : Local Frequency : 2405.000 MHzTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H Peak	V Ave	H Peak	V Ave		Peak	Ave	Peak	Ave			
* 2405.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 4810.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 7215.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 9620.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 12025.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Note :

1. Item of margin shown in above table refer to average limit.
2. It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "****" means that Peak result is meet average limit.
3. Remark "---" means that the emissions level is too low to be measured.
4. Remark "*" means the local oscillator frequency and its harmonics.
5. Item "Margin" referred to Average limit while there is only peak result.
6. The expanded uncertainty of the radiated emission tests is 3.53 dB.

B. CH Middle

Operation Mode : Transmitting, EUT orientation: keep flat horizontally

Fundamental Frequency : 2440.000 MHzTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H		V			Peak	Ave	Peak	Ave			
	Peak	Ave	Peak	Ave								
4879.093	61.8	36.5	70.4	39.3	1.1	71.5	40.4	114.0	94.0	-42.5	62	1.1
7318.317	47.4	***	54.2	34.2	5.9	60.1	40.1	74.0	54.0	-13.9	53	1.0
9761.859	46.3	32.1	50.7	32.4	9.3	60.0	41.7	74.0	54.0	-12.3	96	1.1
12201.018	---	---	---	---	---	---	---	74.0	54.0	---	---	---
14641.498	---	---	---	---	---	---	---	74.0	54.0	---	---	---
17081.978	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19522.458	---	---	---	---	---	---	---	74.0	54.0	---	---	---
21962.938	---	---	---	---	---	---	---	74.0	54.0	---	---	---
24403.418	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Operation Mode : ReceivingFundamental Frequency : Local Frequency : 2440.000 MHzTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H		V			Peak	Ave	Peak	Ave			
	Peak	Ave	Peak	Ave								
* 2440.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 4880.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 7320.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 9760.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 12200.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Note :

1. Item of margin shown in above table refer to average limit.
2. It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "****" means that Peak result is meet average limit.
3. Remark "---" means that the emissions level is too low to be measured.
4. Remark "*" means the local oscillator frequency and its harmonics.
5. Item "Margin" referred to Average limit while there is only peak result.
6. The expanded uncertainty of the radiated emission tests is 3.53 dB.

C. CH High

Operation Mode : Transmitting, EUT orientation: keep flat horizontally

Fundamental Frequency : 2480.000 MHzTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBUV)				Factor (dB) Corr.	Result @3m (dBUV/m)		Limit @3m (dBUV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H		V			Peak	Ave	Peak	Ave			
	Peak	Ave	Peak	Ave								
4960.894	57.5	36.1	70.8	38.6	1.4	72.2	40.0	114.0	94.0	-41.8	67	1.1
7438.414	46.9	***	55.2	34.7	6.3	61.5	41.0	74.0	54.0	-12.5	93	1.0
9917.975	45.7	32.0	46.9	32.3	9.5	56.4	41.8	74.0	54.0	-12.2	21	1.1
12397.182	---	---	---	---	---	---	---	74.0	54.0	---	---	---
14876.327	---	---	---	---	---	---	---	74.0	54.0	---	---	---
17355.471	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19834.616	---	---	---	---	---	---	---	74.0	54.0	---	---	---
22313.760	---	---	---	---	---	---	---	74.0	54.0	---	---	---
24792.905	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Operation Mode : ReceivingFundamental Frequency : Local Frequency : 2480.000 MHzTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBUV)				Factor (dB) Corr.	Result @3m (dBUV/m)		Limit @3m (dBUV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H		V			Peak	Ave	Peak	Ave			
	Peak	Ave	Peak	Ave								
* 2480.000	---	---	---	---	-2.8	---	---	74.0	54.0	---	---	---
* 4960.000	---	---	---	---	2.8	---	---	74.0	54.0	---	---	---
* 7440.000	---	---	---	---	6.1	---	---	74.0	54.0	---	---	---
* 9920.000	---	---	---	---	7.4	---	---	74.0	54.0	---	---	---
* 12400.000	---	---	---	---	9.4	---	---	74.0	54.0	---	---	---

Note :

1. Item of margin shown in above table refer to average limit.
2. It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark “***” means that Peak result is meet average limit.
3. Remark “---” means that the emissions level is too low to be measured.
4. Remark “*” means the local oscillator frequency and its harmonics.
5. Item “Margin” referred to Average limit while there is only peak result.
6. The expanded uncertainty of the radiated emission tests is 3.53 dB.

4.4.1.3 EUT with Dipole Antenna**A. CH Low**

Operation Mode : Transmitting, EUT orientation: keep flat horizontally

Fundamental Frequency : 2405.000 MHzTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H		V			Peak	Ave	Peak	Ave			
	Peak	Ave	Peak	Ave								
4809.984	47.2	***	56.3	34.5	0.9	57.2	35.4	114.0	94.0	-56.8	39	1.0
7216.555	52.8	33.7	55.3	34.6	5.7	61.0	40.3	74.0	54.0	-13.0	72	1.1
9622.868	45.9	31.0	47.7	32.7	9.1	56.8	41.8	74.0	54.0	-12.2	57	1.1
12028.646	---	---	---	---	---	---	---	74.0	54.0	---	---	---
14434.663	---	---	---	---	---	---	---	74.0	54.0	---	---	---
16840.681	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19246.698	---	---	---	---	---	---	---	74.0	54.0	---	---	---
21652.716	---	---	---	---	---	---	---	74.0	54.0	---	---	---
24058.733	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Operation Mode : Receiving

Fundamental Frequency : Local Frequency : 2405.000 MHz

Test Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H		V			Peak	Ave	Peak	Ave			
	Peak	Ave	Peak	Ave								
* 2405.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 4810.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 7215.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 9620.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 12025.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Note :

1. Item of margin shown in above table refer to average limit.
2. It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "****" means that Peak result is meet average limit.
3. Remark "---" means that the emissions level is too low to be measured.
4. Remark "*" means the local oscillator frequency and its harmonics.
5. Item "Margin" referred to Average limit while there is only peak result.
6. The expanded uncertainty of the radiated emission tests is 3.53 dB.

B. CH Middle

Operation Mode : Transmitting, EUT orientation: keep flat horizontally

Fundamental Frequency : 2440.000 MHzTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H		V			Peak	Ave	Peak	Ave			
	Peak	Ave	Peak	Ave								
4884.728	46.5	***	56.0	33.4	1.1	57.1	34.5	114.0	94.0	-56.9	55	1.1
7321.266	51.1	33.2	55.4	34.4	5.9	61.3	40.3	74.0	54.0	-12.7	61	1.0
9755.850	45.3	31.8	47.5	31.6	9.3	56.8	41.1	74.0	54.0	-12.9	39	1.1
12196.483	---	---	---	---	---	---	---	74.0	54.0	---	---	---
14634.892	---	---	---	---	---	---	---	74.0	54.0	---	---	---
17073.301	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19511.709	---	---	---	---	---	---	---	74.0	54.0	---	---	---
21950.118	---	---	---	---	---	---	---	74.0	54.0	---	---	---
24388.527	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Operation Mode : ReceivingFundamental Frequency : Local Frequency : 2440.000 MHzTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H		V			Peak	Ave	Peak	Ave			
	Peak	Ave	Peak	Ave								
* 2440.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 4880.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 7320.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 9760.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
* 12200.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Note :

1. Item of margin shown in above table refer to average limit.
2. It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "****" means that Peak result is meet average limit.
3. Remark "---" means that the emissions level is too low to be measured.
4. Remark "*" means the local oscillator frequency and its harmonics.
5. Item "Margin" referred to Average limit while there is only peak result.
6. The expanded uncertainty of the radiated emission tests is 3.53 dB.

C. CH High

Operation Mode : Transmitting, EUT orientation: keep flat horizontally

Fundamental Frequency : 2480.000 MHzTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H Peak	V Ave	H Peak	V Ave		Peak	Ave	Peak	Ave			
4959.055	47.5	***	56.0	35.1	1.4	57.4	36.5	114.0	94.0	-56.6	39	1.1
7441.458	49.2	33.7	55.3	34.6	6.3	61.6	40.9	74.0	54.0	-12.4	54	1.0
9915.529	45.8	32.0	45.5	31.5	9.5	55.3	41.5	74.0	54.0	-12.5	36	1.0
12396.258	---	---	---	---	---	---	---	74.0	54.0	---	---	---
14875.157	---	---	---	---	---	---	---	74.0	54.0	---	---	---
17354.056	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19832.955	---	---	---	---	---	---	---	74.0	54.0	---	---	---
22311.854	---	---	---	---	---	---	---	74.0	54.0	---	---	---
24790.753	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Operation Mode : ReceivingFundamental Frequency : Local Frequency : 2480.000 MHzTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H Peak	V Ave	H Peak	V Ave		Peak	Ave	Peak	Ave			
* 2480.000	---	---	---	---	-2.8	---	---	74.0	54.0	---	---	---
* 4960.000	---	---	---	---	2.8	---	---	74.0	54.0	---	---	---
* 7440.000	---	---	---	---	6.1	---	---	74.0	54.0	---	---	---
* 9920.000	---	---	---	---	7.4	---	---	74.0	54.0	---	---	---
* 12400.000	---	---	---	---	9.4	---	---	74.0	54.0	---	---	---

Note :

1. Item of margin shown in above table refer to average limit.
2. It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark “***” means that Peak result is meet average limit.
3. Remark “---” means that the emissions level is too low to be measured.
4. Remark “*” means the local oscillator frequency and its harmonics.
5. Item “Margin” referred to Average limit while there is only peak result.
6. The expanded uncertainty of the radiated emission tests is 3.53 dB.

4.4.2 Radiated Emission of Restricted bands**EUT with SMD Antenna**Test Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %**Operation Mode : CH 01****Restricted Frequency band: 2310MHz – 2390MHz**

Frequency (MHz)	Reading (dBUV)				Factor (dB) Corr.	Result @3m (dBUV/m)		Limit @3m (dBUV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H		V			Peak	Ave	Peak	Ave.			
	Peak	Ave	Peak	Ave								
2389.647	28.7	16.0	29.2	16.0	30.4	59.6	46.4	74.0	54.0	-7.6	83	1.00
2389.872	29.2	16.1	28.7	16.1	30.4	59.6	46.5	74.0	54.0	-7.5	21	1.10

Operation Mode : CH 11**Restricted Frequency band: 2483.5MHz – 2500MHz**

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H		V			Peak	Ave	Peak	Ave.			
	Peak	Ave	Peak	Ave								
2483.540	40.6	20.0	35.5	17.5	30.6	71.2	50.6	74.0	54.0	-2.8	57	1.10
2483.639	41.0	20.1	34.1	18.0	30.6	71.6	50.7	74.0	54.0	-2.4	29	1.00

Note :

1. Item of margin shown in above table refer to average limit.
2. It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark “****” means that Peak result is meet average limit.
3. Remark “---” means that the emissions level is too low to be measured.
4. Item “Margin” referred to Average limit while there is only peak result.
5. The expanded uncertainty of the radiated emission tests is 3.53 dB.

EUT with PIFA AntennaTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %**Operation Mode : CH 01****Restricted Frequency band: 2310MHz – 2390MHz**

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H Peak	V Ave	H Peak	V Ave		Peak	Ave	Peak	Ave.			
2388.124	29.8	16.5	29.6	16.4	30.4	60.2	46.9	74.0	54.0	-7.1	14	1.00
2389.615	28.9	16.5	28.5	16.3	30.4	59.3	46.9	74.0	54.0	-7.1	26	1.10

Operation Mode : CH 11**Restricted Frequency band: 2483.5MHz – 2500MHz**

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H Peak	V Ave	H Peak	V Ave		Peak	Ave	Peak	Ave.			
2483.530	42.0	17.6	37.1	17.3	30.6	72.6	48.2	74.0	54.0	-1.4	65	1.10
2483.760	41.2	17.8	37.1	17.9	30.6	71.8	48.5	74.0	54.0	-2.2	82	1.00

Note :

1. Item of margin shown in above table refer to average limit.
2. It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark “****” means that Peak result is meet average limit.
3. Remark “---” means that the emissions level is too low to be measured.
4. Item “Margin” referred to Average limit while there is only peak result.
5. The expanded uncertainty of the radiated emission tests is 3.53 dB.

EUT with Dipole AntennaTest Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %**Operation Mode : CH 01****Restricted Frequency band: 2310MHz – 2390MHz**

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H Peak	V Ave	H Peak	V Ave		Peak	Ave	Peak	Ave.			
2388.365	29.5	16.1	29.7	16.2	30.4	60.1	46.6	74.0	54.0	-7.4	55	1.00
2389.664	29.4	16.1	29.5	16.1	30.4	59.9	46.5	74.0	54.0	-7.5	63	1.00

Operation Mode : CH 11**Restricted Frequency band: 2483.5MHz – 2500MHz**

Frequency (MHz)	Reading (dBuV)				Factor (dB) Corr.	Result @3m (dBuV/m)		Limit @3m (dBuV/m)		Margin (dB)	Table Deg. (Deg.)	Ant. High (m)
	H Peak	V Ave	H Peak	V Ave		Peak	Ave	Peak	Ave.			
2483.572	38.6	17.9	42.3	21.1	30.6	72.9	51.7	74.0	54.0	-1.1	51	1.00
2483.639	38.1	18.5	41.0	20.3	30.6	71.6	50.9	74.0	54.0	-2.4	39	1.00

Note :

1. Item of margin shown in above table refer to average limit.
2. It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark “****” means that Peak result is meet average limit.
3. Remark “---” means that the emissions level is too low to be measured.
4. Item “Margin” referred to Average limit while there is only peak result.
5. The expanded uncertainty of the radiated emission tests is 3.53 dB.

4.4.3 Other Emission

a) Emission frequencies below 1 GHz

Operation Mode : EUT with SMD Antenna

Test Date : May 27, 2011 Temperature : 21 °C Humidity : 63 %

Frequency (MHz)	Ant-Pol H/V	Meter Reading (dBuV)	Corrected Factor (dB)	Result @3m (dBuV/m)	Limit @3m (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (m)
44.630	V	20.8	11.9	32.7	40.0	-7.3	327	1.0
95.850	H	25.5	11.2	36.7	43.5	-6.8	340	1.4
131.350	H	24.1	13.6	37.7	43.5	-5.8	247	1.2
138.130	H	21.5	13.9	35.4	43.5	-8.1	225	1.3
160.890	H	17.9	14.7	32.6	43.5	-10.9	76	1.4
199.650	V	15.4	18.5	33.9	43.5	-9.6	131	1.0

Operation Mode : EUT with PIFA Antenna

Test Date : May 27, 2011 Temperature : 21 °C Humidity : 63 %

Frequency (MHz)	Ant-Pol H/V	Meter Reading (dBuV)	Corrected Factor (dB)	Result @3m (dBuV/m)	Limit @3m (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (m)
44.630	V	20.8	11.9	32.7	40.0	-7.3	351	1.0
95.850	H	25.5	11.2	36.7	43.5	-6.8	36	1.4
131.350	H	24.1	13.6	37.7	43.5	-5.8	233	1.2
138.130	H	21.5	13.9	35.4	43.5	-8.1	126	1.3
160.890	H	17.9	14.7	32.6	43.5	-10.9	58	1.4
199.650	V	15.4	18.5	33.9	43.5	-9.6	301	1.0

Note :

1. Remark "---" means that the emissions level is too low to be measured.
2. The expanded uncertainty of the radiated emission tests is 3.53 dB.

Operation Mode : EUT with Dipole AntennaTest Date : May 27, 2011 Temperature : 21 °C Humidity : 63 %

Frequency (MHz)	Ant-Pol H/V	Meter Reading (dBuV)	Corrected Factor (dB)	Result @3m (dBuV/m)	Limit @3m (dBuV/m)	Margin (dB)	Table Degree (Deg.)	Ant. High (m)
44.630	V	20.8	11.9	32.7	40.0	-7.3	71	1.0
95.850	H	25.5	11.2	36.7	43.5	-6.8	208	1.4
131.350	H	24.1	13.6	37.7	43.5	-5.8	102	1.2
138.130	H	21.5	13.9	35.4	43.5	-8.1	329	1.3
160.890	H	17.9	14.7	32.6	43.5	-10.9	126	1.4
199.650	V	15.4	18.5	33.9	43.5	-9.6	251	1.0

Note :

1. Remark "---" means that the emissions level is too low to be measured.
2. The expanded uncertainty of the radiated emission tests is 3.53 dB.

4.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss(if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

$$\text{Result} = \text{Reading} + \text{Corrected Factor}$$

where

Corrected Factor = Antenna FACTOR + Cable Loss + High Pass Filter Loss - Amplifier Gain

4.6 Photos of Radiation Measuring Setup

EUT with SMD Antenna



EUT with PIFA Antenna



EUT with Dipole Antenna



5 CONDUCTED EMISSION MEASUREMENT

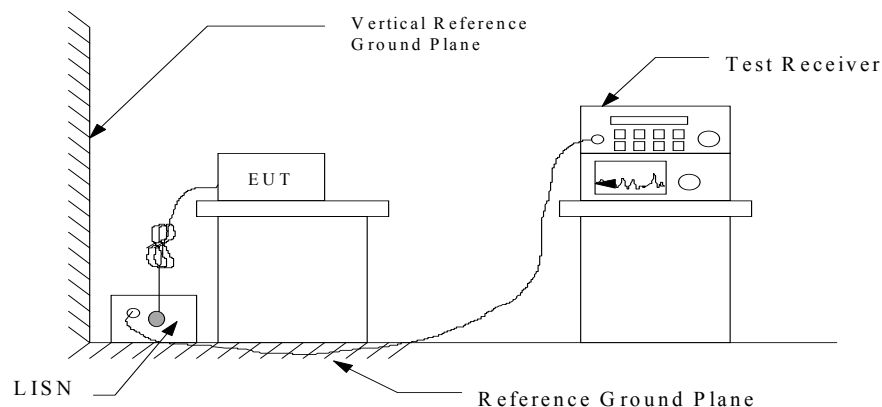
5.1 Standard Applicable

For unintentional and intentional device, Line Conducted Emission Limits are in accordance to §15.107(a) and §15.207(a) respectively. Both Limits are identical specification.

5.2 Measurement Procedure

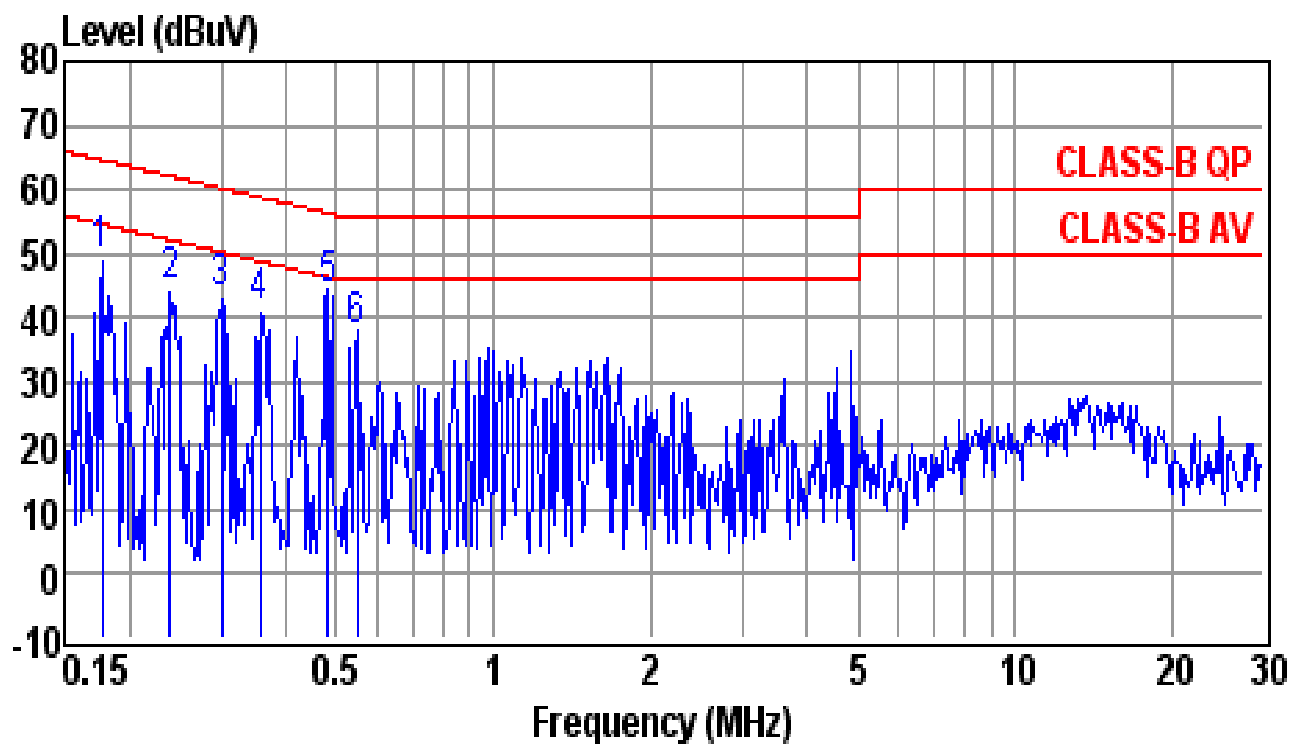
1. Setup the configuration per figure 3.
2. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.
3. Record the 6 or 8 highest emissions relative to the limit.
4. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then record the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.
5. Confirm the highest three emissions with variation of the EUT cable configuration and record the final data.
6. Repeat all above procedures on measuring each operation mode of EUT.

Figure 3 : Conducted emissions measurement configuration



5.3 Conducted Emission Data

EUT with SMD Antenna



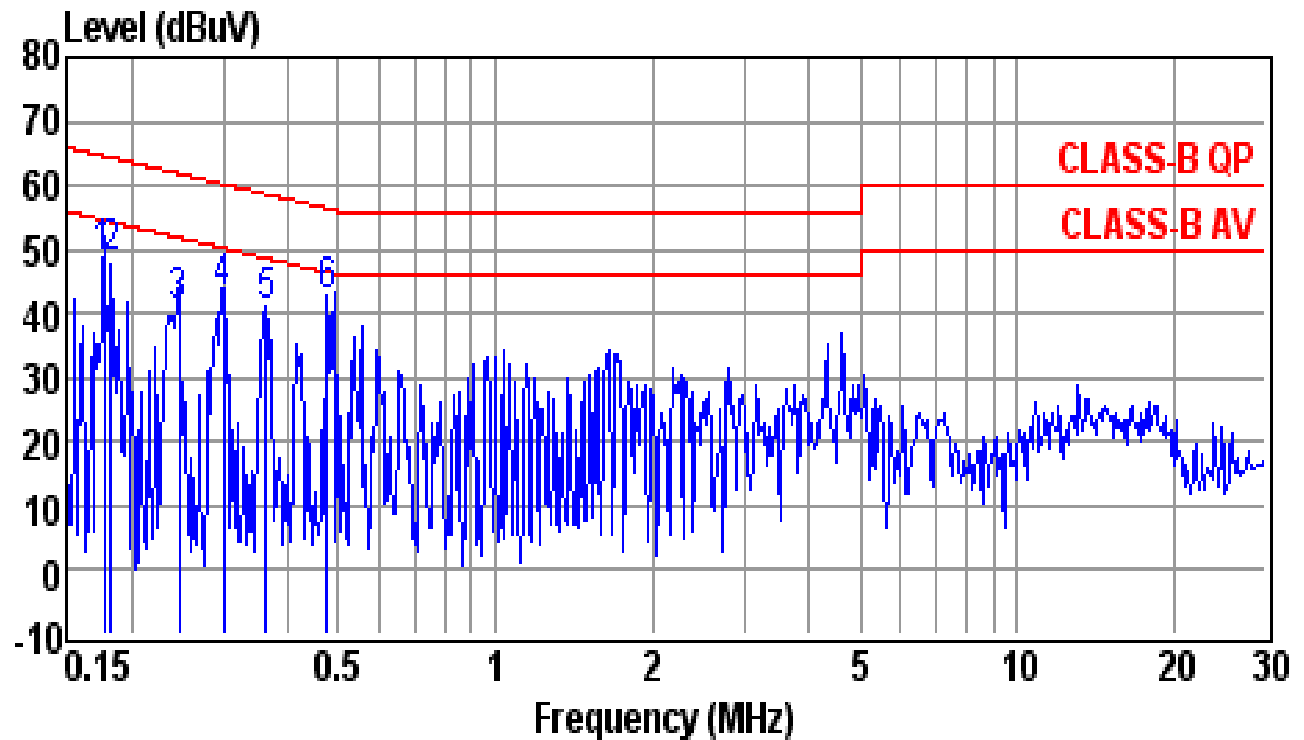
Site : conducted #1
 Condition : CLASS-B QP
 Tem / Hum : 22 °C / 63%
 EUT :
 Memo :

Date : 2011-06-01
 LISN : NEUTRAL
 Test Mode :
 Power Rating :
 Memo :

Freq (MHz)	Reading (dBUV)	Factor (dB)	Emission Level (dBUV)	Limit Line (dBUV)	Over Limit (dB)	Remark
0.1777	38.59	10.81	49.40	64.59	-15.19	QP
0.2391	33.61	10.75	44.36	62.13	-17.77	QP
0.3003	32.65	10.72	43.37	60.24	-16.87	QP
0.3558	30.64	10.69	41.33	58.83	-17.50	QP
0.4812	33.30	10.68	43.98	56.32	-12.34	QP
0.5464	26.78	10.68	37.46	56.00	-18.54	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss



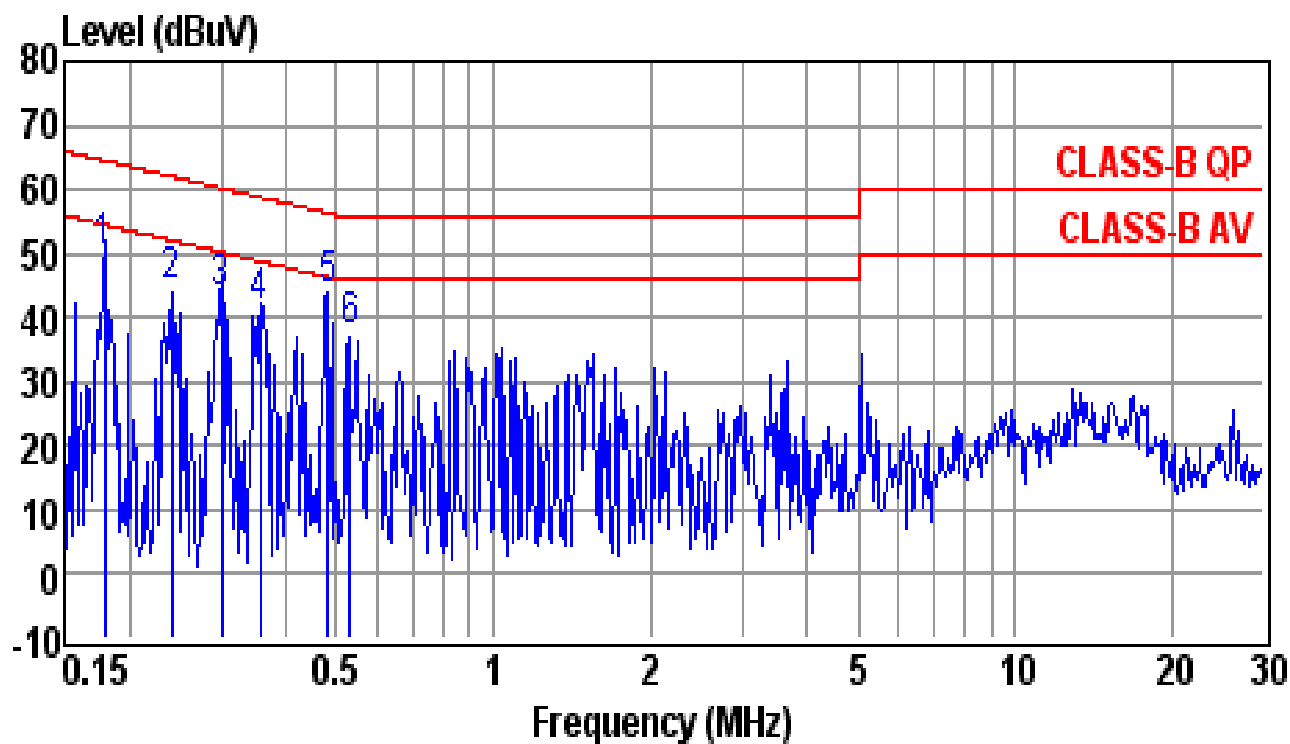
Site : conducted #1
 Condition : CLASS-B QP
 Tem / Hum : 22 °C / 63%
 EUT :
 Memo :

Date : 2011-06-01
 LISN : LINE
 Test Mode :
 Power Rating :
 Memo :

Freq (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Remark
0.1777	37.74	10.73	48.47	64.59	-16.12	QP
0.1835	37.62	10.73	48.35	64.33	-15.98	QP
0.2468	30.24	10.68	40.92	61.86	-20.94	QP
0.3003	32.18	10.66	42.84	60.24	-17.40	QP
0.3634	29.80	10.63	40.43	58.65	-18.22	QP
0.4761	31.70	10.63	42.33	56.41	-14.08	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss

EUT with PIFA Antenna

Site : conducted #1

Date : 2011-06-01

Condition : CLASS-B QP

LISN : NEUTRAL

Tem / Hum : 22 °C / 63%

Test Mode :

EUT :

Power Rating :

Memo :

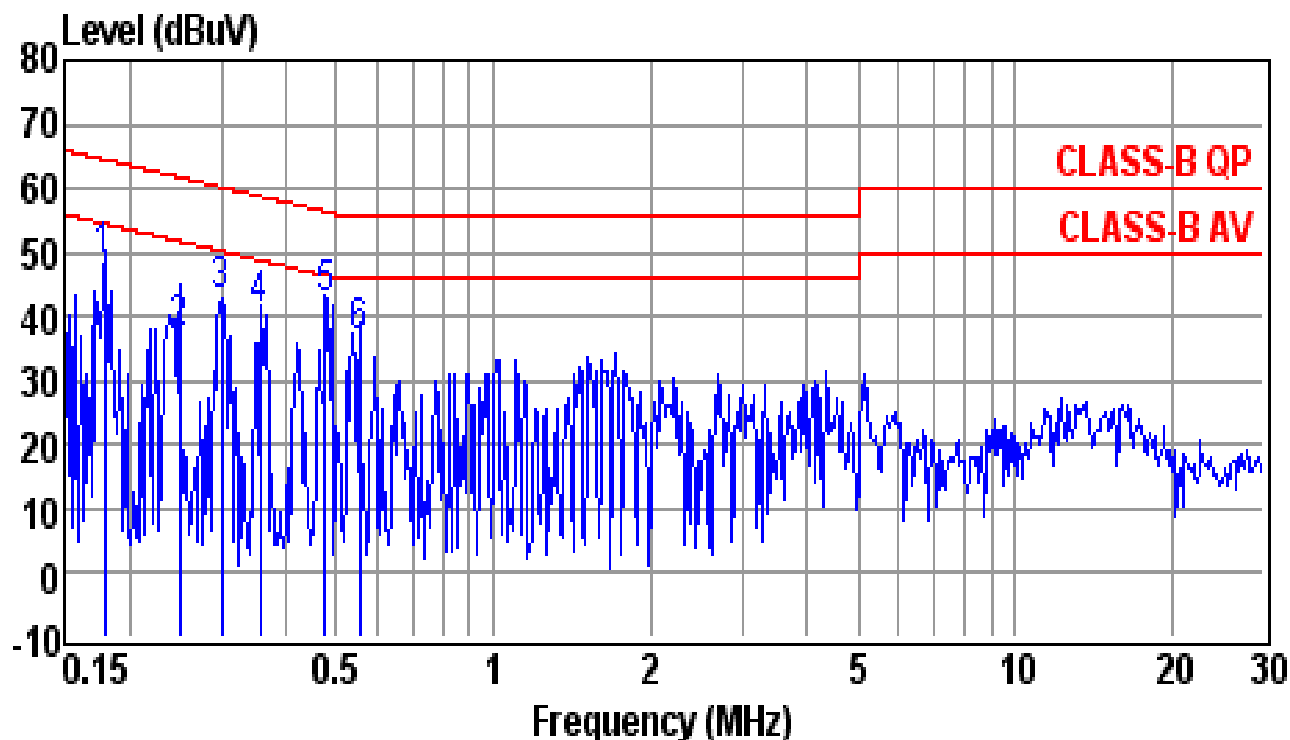
Memo :

Freq (MHz)	Reading (dBuV)	Factor (dB)	Emission Level (dBuV)	Limit Line (dBuV)	Over Limit (dB)	Remark
0.1796	39.01	10.81	49.82	64.50	-14.68	QP
0.2417	33.44	10.75	44.19	62.04	-17.85	QP
0.3003	32.55	10.72	43.27	60.24	-16.97	QP
0.3558	30.46	10.69	41.15	58.83	-17.68	QP
0.4812	33.21	10.68	43.89	56.32	-12.43	QP
0.5293	26.50	10.68	37.18	56.00	-18.82	QP

Note :

1. Result = Reading + Factor

2. Factor = LISN Factor + Cable Loss



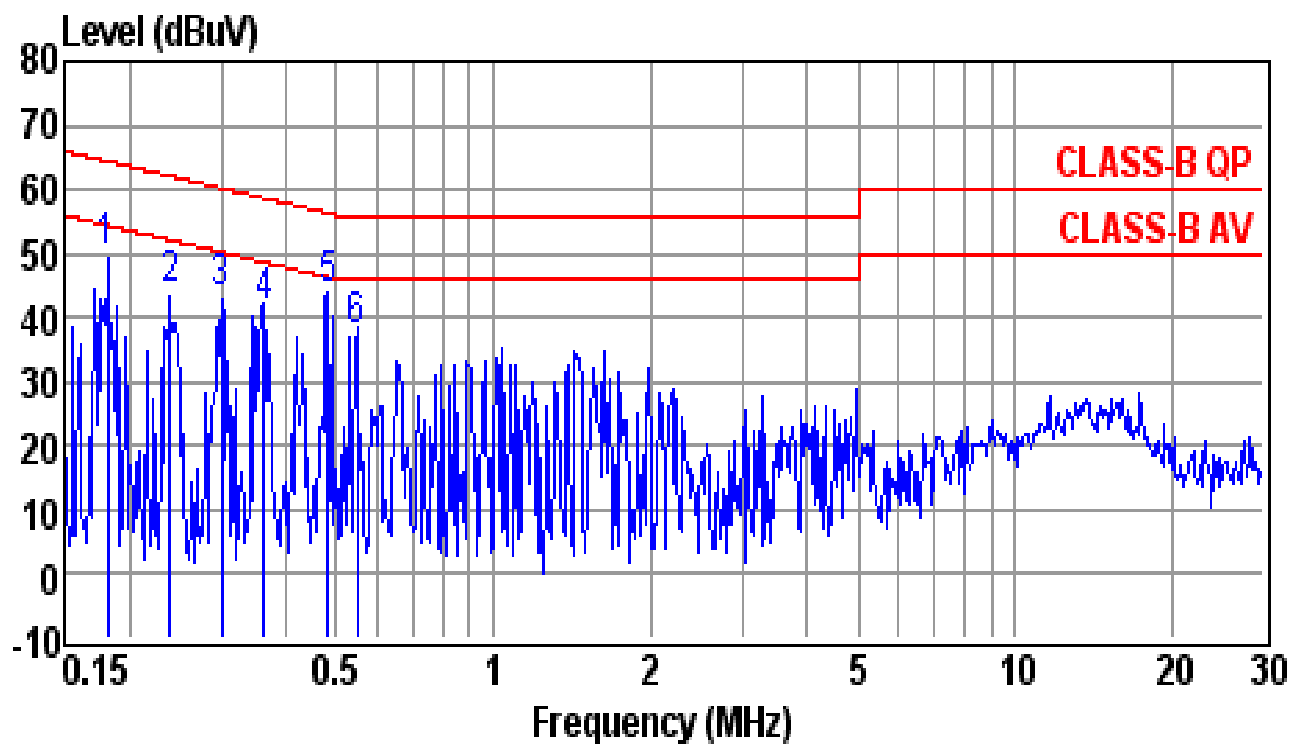
Site : conducted #1
 Condition : CLASS-B QP
 Tem / Hum : 22 °C / 63%
 EUT :
 Memo :

Date : 2011-06-01
 LISN : LINE
 Test Mode :
 Power Rating :
 Memo :

Freq (MHz)	Reading (dBUV)	Factor (dB)	Emission Level (dBUV)	Limit Line (dBUV)	Over Limit (dB)	Remark
0.1796	37.73	10.73	48.46	64.50	-16.04	QP
0.2495	26.10	10.68	36.78	61.78	-25.00	QP
0.3003	31.92	10.66	42.58	60.24	-17.66	QP
0.3558	30.13	10.63	40.76	58.83	-18.07	QP
0.4761	31.77	10.63	42.40	56.41	-14.01	QP
0.5523	25.95	10.63	36.58	56.00	-19.42	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss

EUT with Dipole Antenna

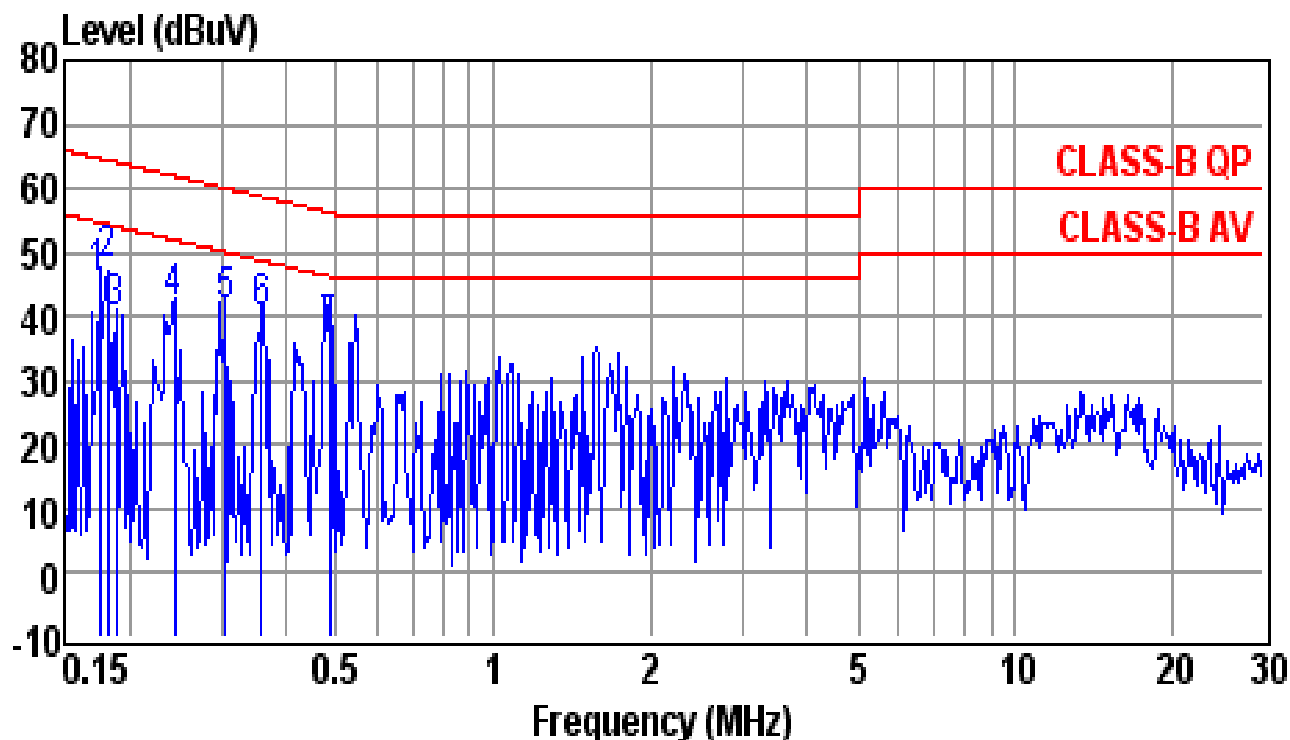
Site : conducted #1
 Condition : CLASS-B QP
 Tem / Hum : 22 °C / 63%
 EUT :
 Memo :

Date : 2011-06-01
 LISN : NEUTRAL
 Test Mode :
 Power Rating :
 Memo :

Freq (MHz)	Reading (dBUV)	Factor (dB)	Emission Level (dBUV)	Limit Line (dBUV)	Over Limit (dB)	Remark
0.1815	39.04	10.80	49.84	64.42	-14.58	QP
0.2391	33.40	10.75	44.15	62.13	-17.98	QP
0.3003	32.82	10.72	43.54	60.24	-16.70	QP
0.3634	30.60	10.68	41.28	58.65	-17.37	QP
0.4812	33.31	10.68	43.99	56.32	-12.33	QP
0.5464	26.62	10.68	37.30	56.00	-18.70	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss



Site : conducted #1
 Condition : CLASS-B QP
 Tem / Hum : 22 °C / 63%
 EUT :
 Memo :

Date : 2011-06-01
 LISN : LINE
 Test Mode :
 Power Rating :
 Memo :

Freq (MHz)	Reading (dBUV)	Factor (dB)	Emission Level (dBUV)	Limit Line (dBUV)	Over Limit (dB)	Remark
0.1758	34.98	10.74	45.72	64.68	-18.96	QP
0.1815	37.11	10.73	47.84	64.42	-16.58	QP
0.1884	29.23	10.72	39.95	64.11	-24.16	QP
0.2442	31.18	10.68	41.86	61.95	-20.09	QP
0.3067	30.75	10.66	41.41	60.06	-18.65	QP
0.3596	29.63	10.63	40.26	58.74	-18.48	QP
0.4838	26.43	10.63	37.06	56.27	-19.21	QP

Note :

1. Result = Reading + Factor
2. Factor = LISN Factor + Cable Loss

5.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

$$\text{RESULT} = \text{READING} + \text{LISN FACTOR}$$

Assume a receiver reading of 22.5 dB μ V is obtained, and LISN Factor is 0.1 dB, then the total of disturbance voltage is 22.6 dB μ V.

$$\text{RESULT} = 22.5 + 0.1 = 22.6 \text{ dB } \mu \text{ V}$$

$$\begin{aligned} \text{Level in } \mu \text{ V} &= \text{Common Antilogarithm}[(22.6 \text{ dB } \mu \text{ V})/20] \\ &= 13.48 \mu \text{ V} \end{aligned}$$

5.5 Conducted Measurement Equipment

The following test equipment are used during the conducted test .

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	ESCI	2011/02/03	2012/02/02
LISN	EMCO	3625/2	2011/03/01	2012/02/28
LISN	Rohde & Schwarz	ESH2-Z5	2010/08/10	2011/08/09

5.6 Photos of Conduction Measuring Setup

EUT with SMD Antenna



EUT with PIFA Antenna



EUT with Dipole Antenna



6 ANTENNA REQUIREMENT

6.1 Standard Applicable

For intentional device, according to §15.203, 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.

And according to §15.247 (b), if transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.2 Antenna Construction and Directional Gain

Please see photos submitted in Exhibit B.

The antenna specifications are provided in Exhibit L. The maximum antenna gain is 4.0 dBi.

No need to reduce the peak output power.

7 EMISSION BANDWIDTH MEASUREMENT

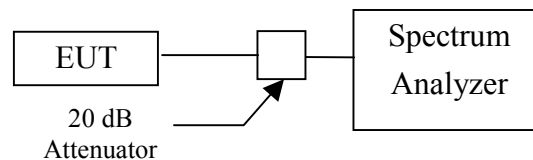
7.1 Standard Applicable

According to 15.247(a)(2), for direct sequence system, the minimum 6dB bandwidth shall be at least 500 kHz.

7.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Figure 4: Emission bandwidth measurement configuration.



7.3 Measurement Equipment

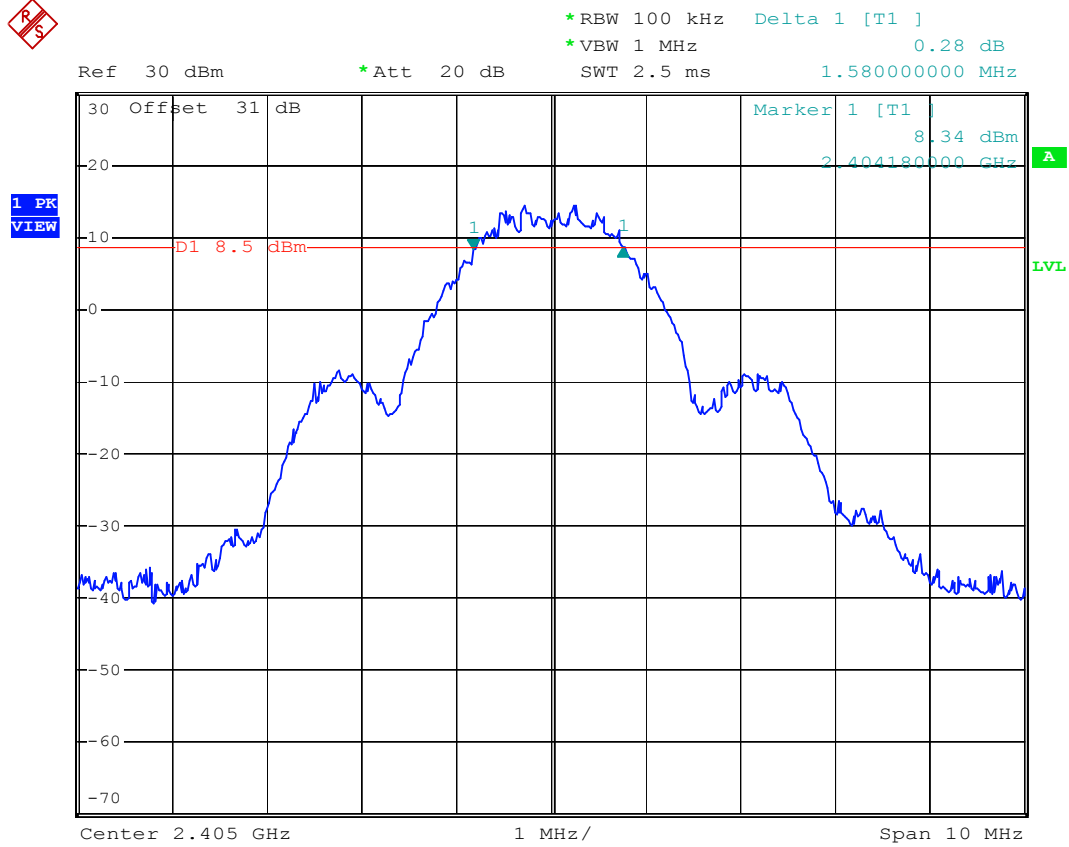
Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2010/09/17	2011/09/16

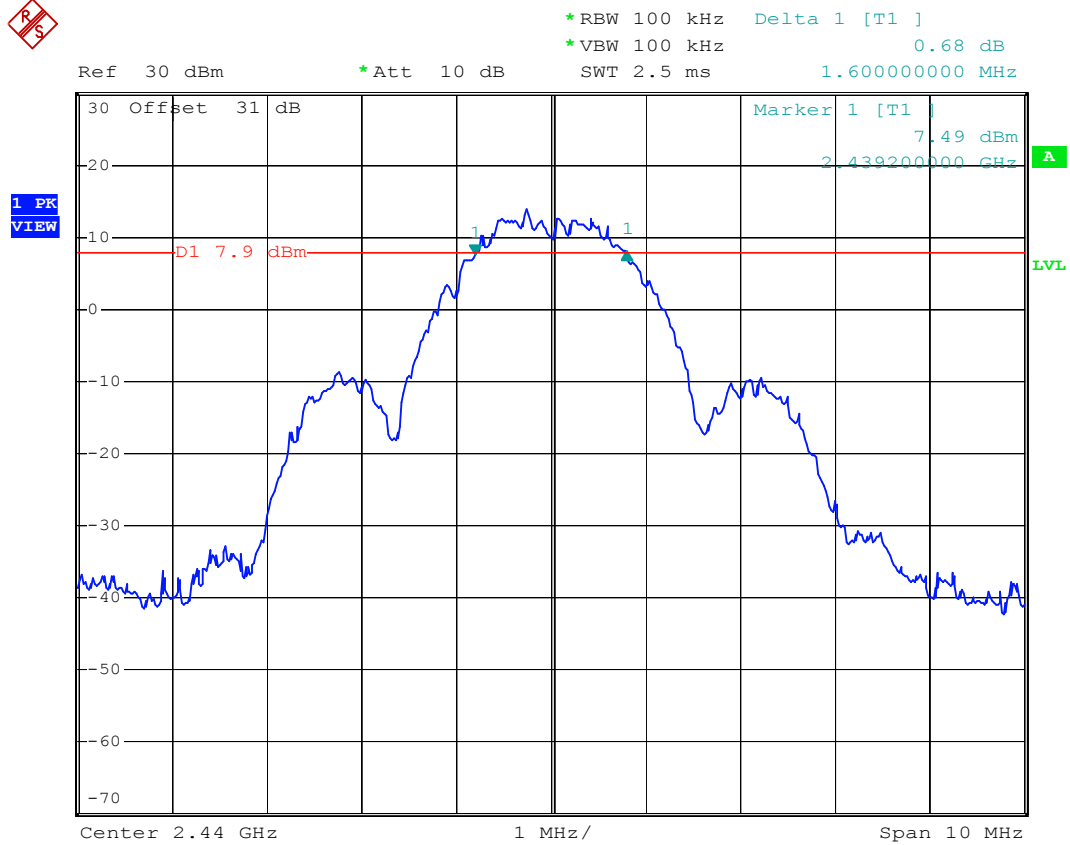
7.4 Measurement Data

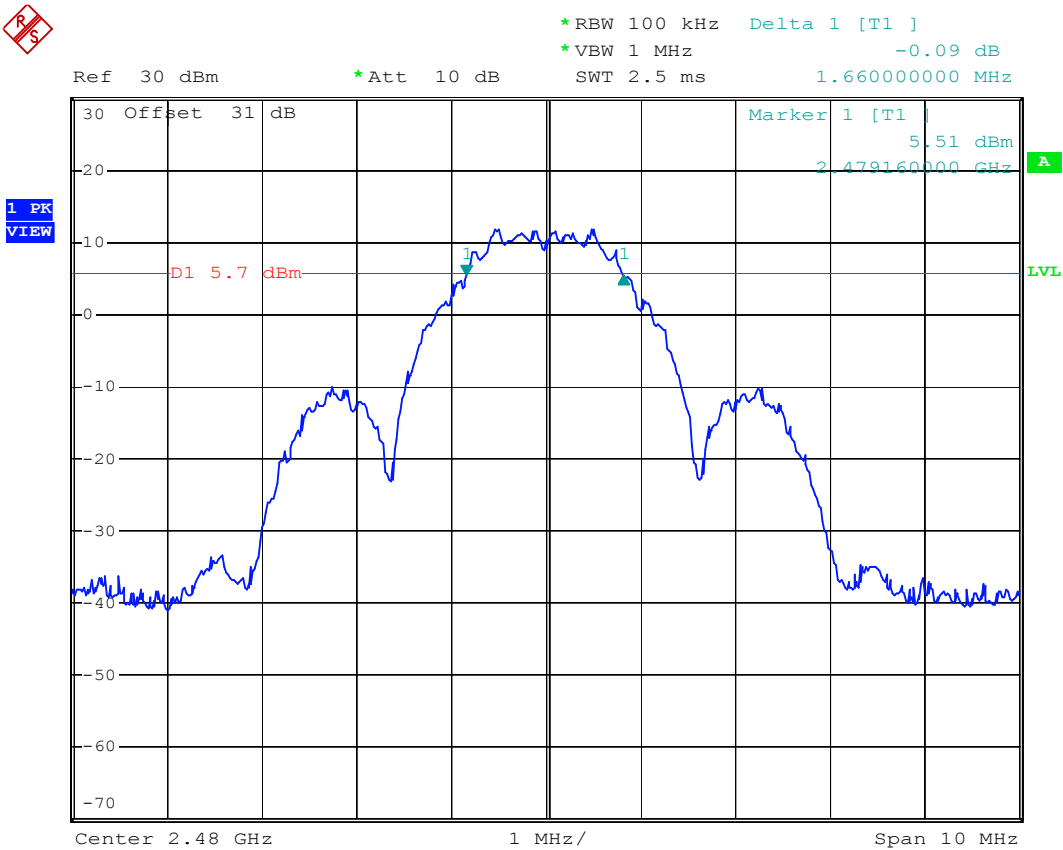
Test Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

- a) Channel Low: 6 dB Emission Bandwidth is 1.58 MHz
- b) Channel Mid: 6 dB Emission Bandwidth is 1.60 MHz
- c) Channel High: 6 dB Emission Bandwidth is 1.66 MHz

Note : The expanded uncertainty of the emission bandwidth tests is 1500Hz.







8 OUTPUT POWER MEASUREMENT

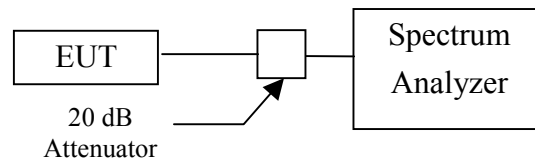
8.1 Standard Applicable

For direct sequence system, according to 15.247(b), the maximum peak output power of the transmitter shall not exceed 1 Watt. If transmitting antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 5 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable.
3. Record the level displayed.
4. Repeat above procedures until all frequencies measured were complete.

Figure 4: Emission bandwidth measurement configuration.



8.3 Measurement Equipment

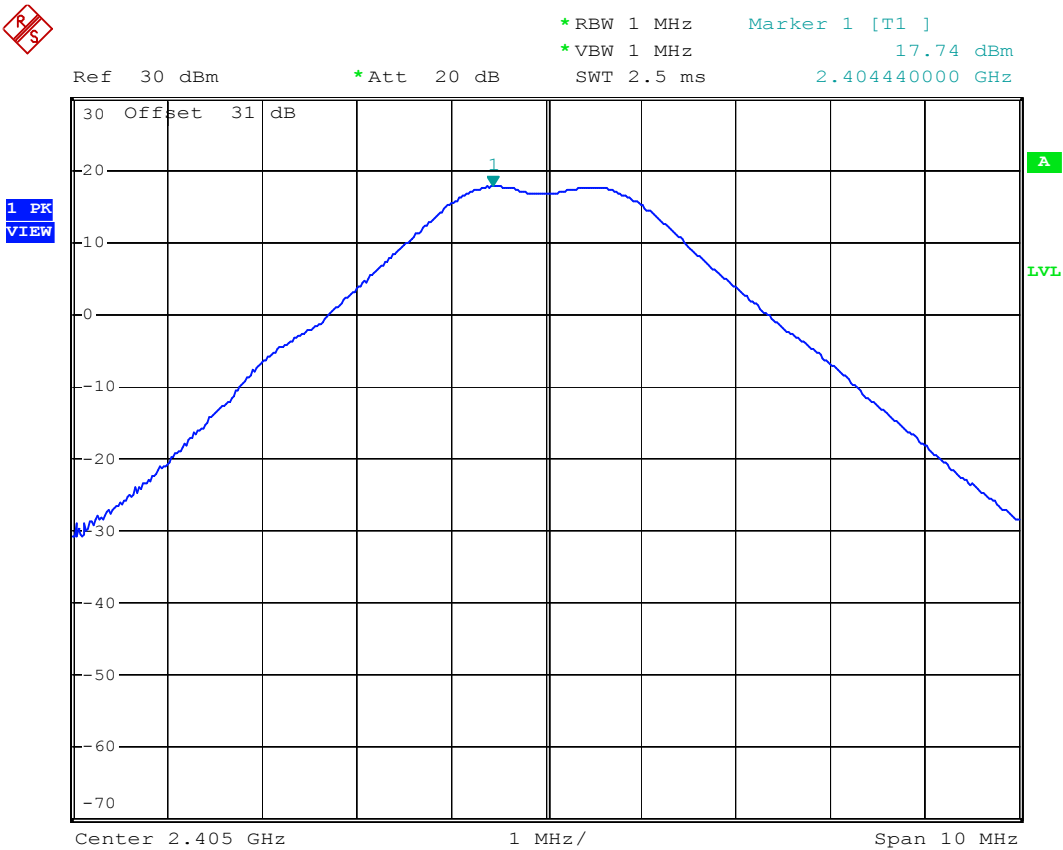
Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2010/09/17	2011/09/16

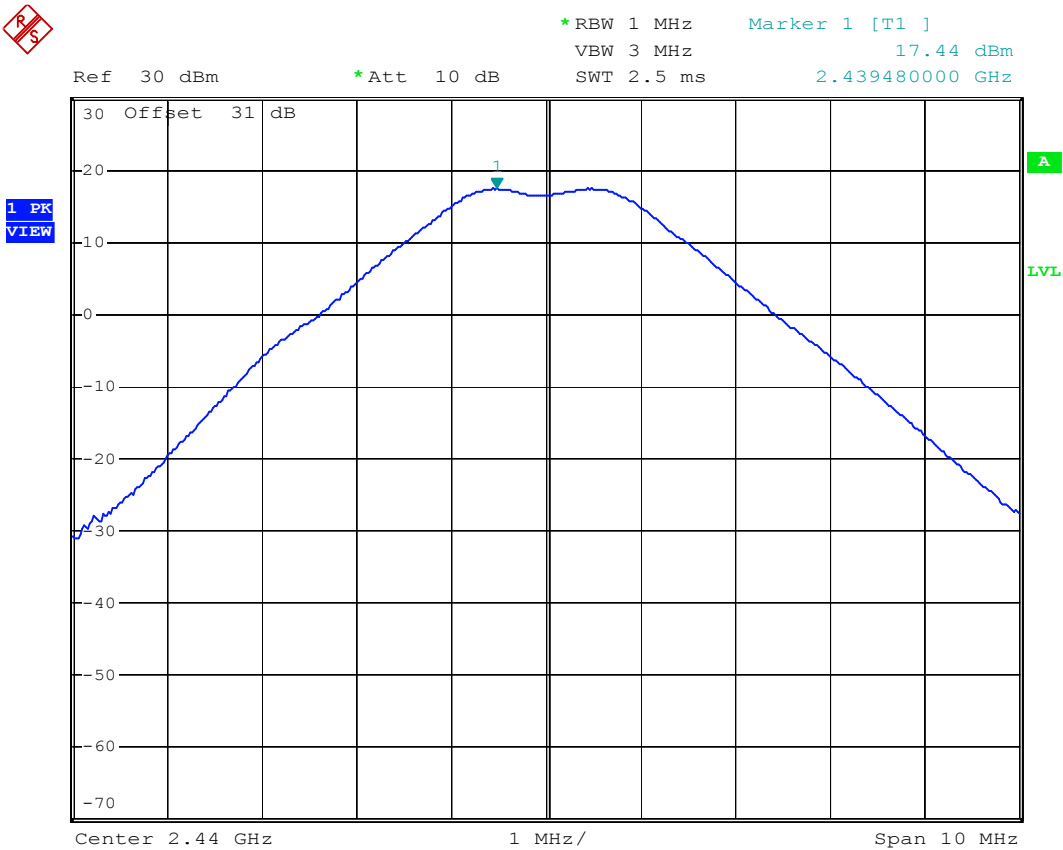
8.4 Measurement Data

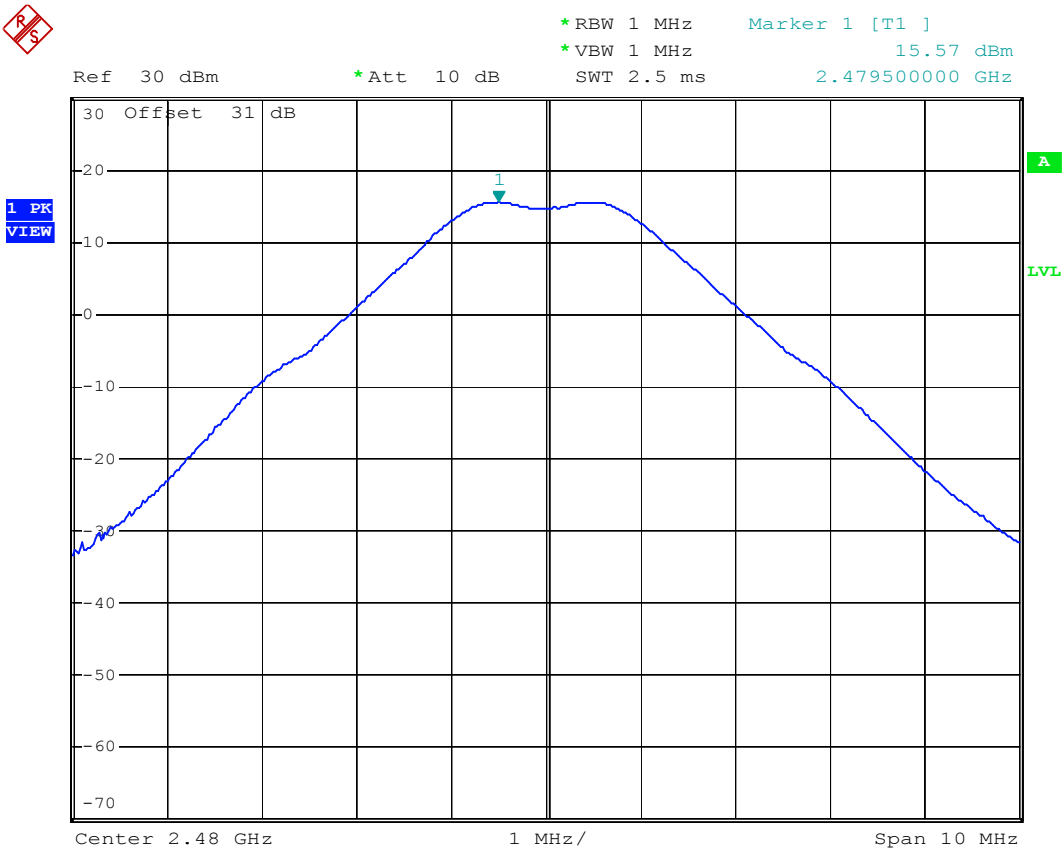
Test Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

- a) Channel Low: Output Peak Power is 17.74 dBm **59.429** mW
- b) Channel Mid: Output Peak Power is 17.44 dBm **55.463** mW
- c) Channel High: Output Peak Power is 15.57 dBm **36.058** mW

Note : The expanded uncertainty of the output power tests is 2dB.







9 100 kHz BANDWIDTH OF BAND EDGES MEASUREMENT

9.1 Standard Applicable

According to 15.247(c), if any 100 kHz bandwidth outside these frequency bands, the radio frequency power that is produced by the modulation products of the spreading sequence, the information sequence and the carrier frequency shall be either at least 20 dB below that in any 100 kHz bandwidth within the band that contains the highest level of the desired power or shall not exceed the general levels specified in §15.209(a), whichever results in the lesser attenuation.

9.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 5 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set both RBW of spectrum analyzer to 100kHz and VBW to 1 MHz with a convenient frequency span including 100kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

9.3 Measurement Equipment

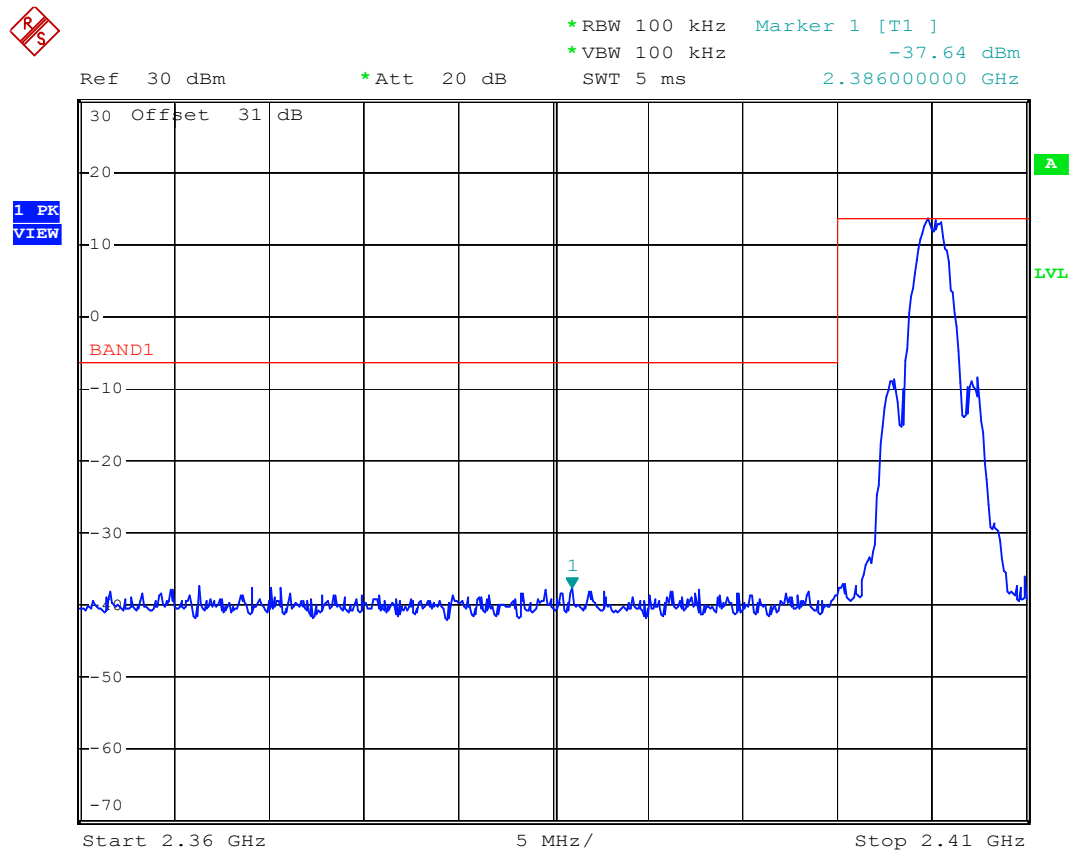
Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2010/09/17	2011/09/16

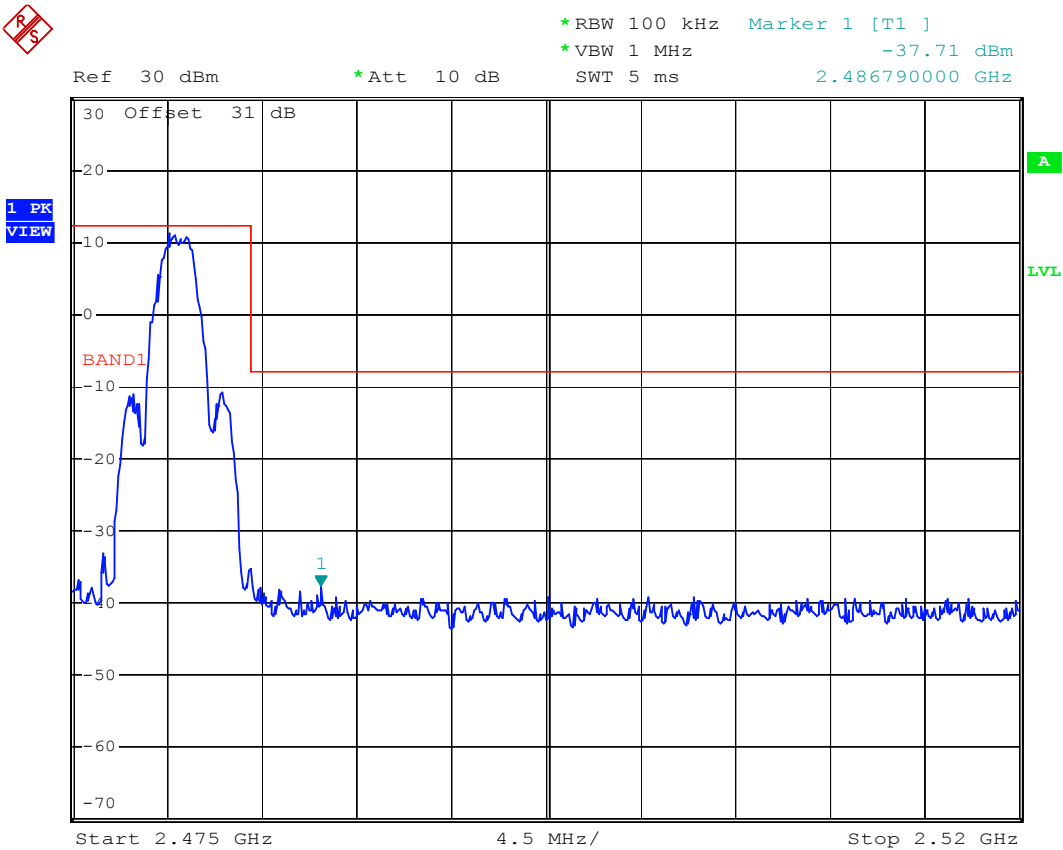
9.4 Measurement Data

Test Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

- a) Lower Band Edge : All emissions in this 100kHz bandwidth are attenuated more than 20dB from the carrier.
- b) Upper Band Edge : All emissions in this 100kHz bandwidth are attenuated more than 20dB from the carrier.

Note : The expanded uncertainty of the 100 khz bandwidth of band edges tests is 2dB.





10 POWER DENSITY MEASUREMENT

10.1 Standard Applicable

According to 15.247(d), for direct sequence systems, the transmitted power density averaged over any 1 second interval shall not be greater than 8 dBm in any 3 kHz bandwidth within these bands.

10.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set EUT to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of spectrum analyzer on highest level appearing on spectral display within a 300 kHz frequency span.
4. Set the spectrum analyzer on a 3 kHz resolution bandwidth and 300 kHz video bandwidth as well as max hold function.
5. Repeat above procedures until all measured frequencies were complete.

10.3 Measurement Equipment

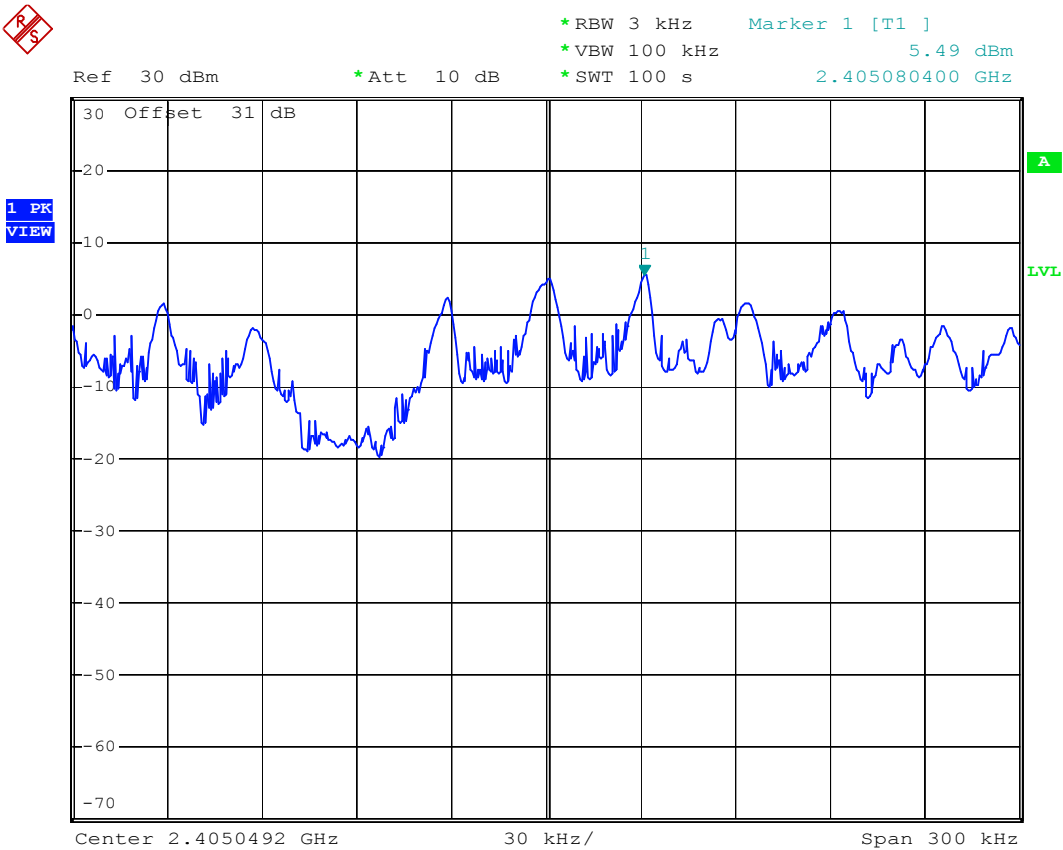
Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2010/09/17	2011/09/16

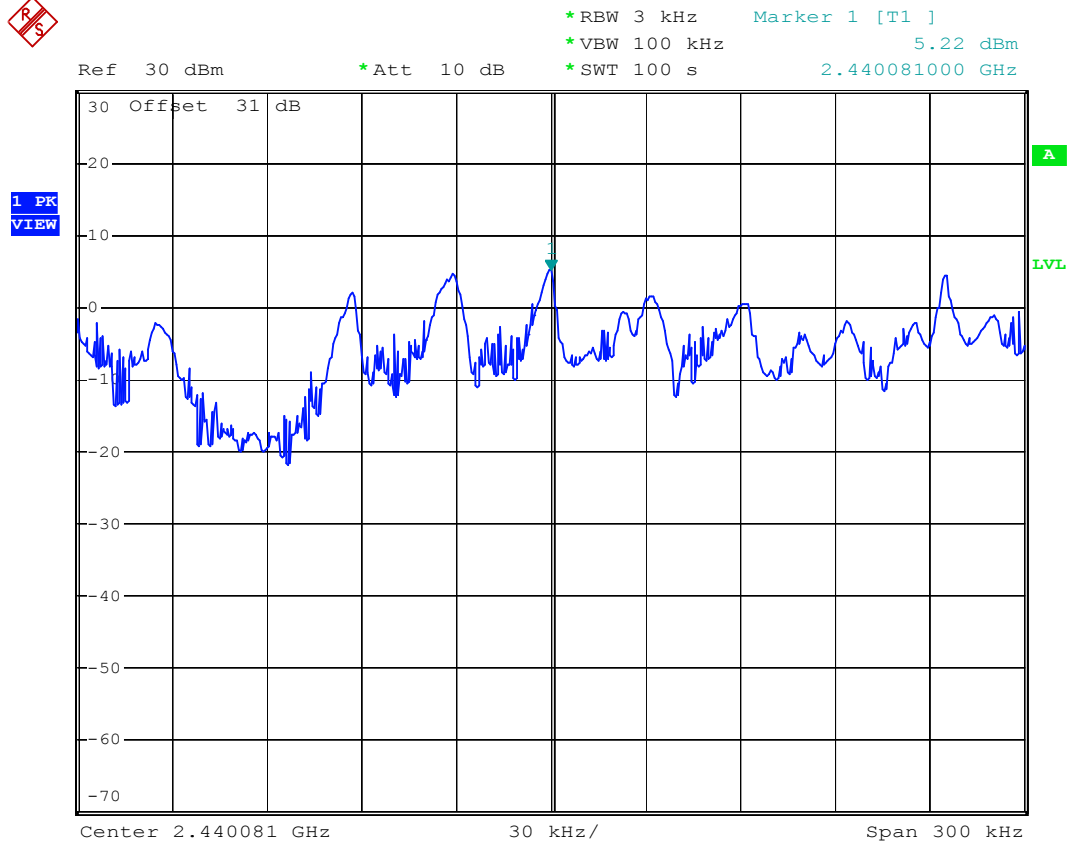
10.4 Measurement Data

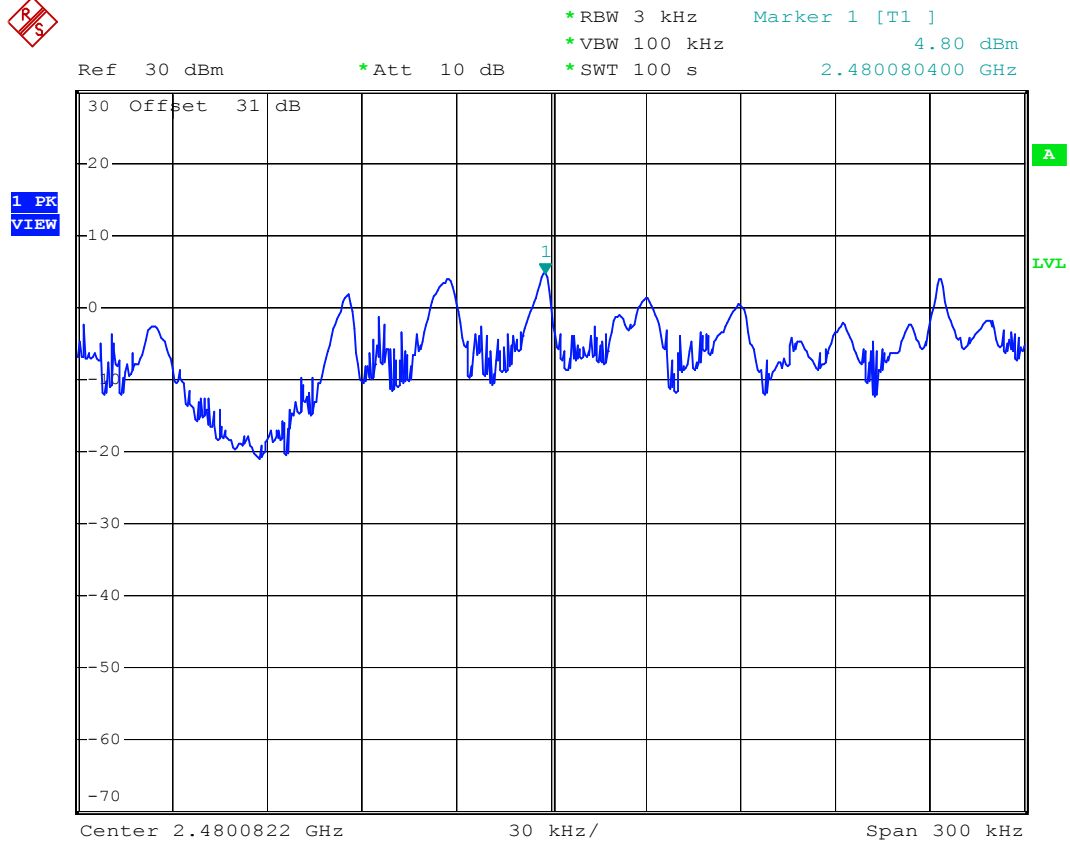
Test Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

- a) Channel Low: Maximun Power Density of 3 kHz Bandwidth is 5.49 dBm
- b) Channel Mid: Maximun Power Density of 3 kHz Bandwidth is 5.22 dBm
- c) Channel High: Maximun Power Density of 3 kHz Bandwidth is 4.80 dBm

Note : The expanded uncertainty of the power density tests is 2dB.







11. OUT-OF-BAND CONDUCTED EMISSION MEASUREMENT

11.1 Standard Applicable

According to 15.247(c), 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. Attenuation below the general limits specified in Section 15.209(a) is not required.

11.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.

3. Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW $\geq$ RBW

Sweep = auto

Detector function = peak

Trace = max hold.

4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. Plot the result on the screen of spectrum analyzer.
5. Repeat above procedures until all measured frequencies were complete.

11.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Calibration Date	Next Cal. Date
Spectrum Analyzer	Rohde & Schwarz	FSP40	2010/09/17	2011/09/16

11.4 Measurement Data

Test Date : Jul. 05, 2011 Temperature : 21 °C Humidity : 58 %

Model : Channel Low

- a) 1 GHz to 3 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.
- b) 3 GHz to 25 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

Model : Channel Mid

- a) 1 GHz to 3 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.
- b) 3 GHz to 25 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

Model : Channel High

- a) 1 GHz to 3 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.
- b) 3 GHz to 25 GHz frequency band: All emissions are attenuated more than 20dB from the carrier.

