FCC TEST REPORT

CATEGORY:	Mobile Module (802.11b Part)
PRODUCT NAME:	802.11b + Bluetooth COMBO SIP
FCC ID.:	IXMWM-BB-AG-01
FILING TYPE:	Certification
BRAND NAME:	USI
MODEL NAME:	WM-BB-AG-01
APPLICANT:	**Universal Scientific Industrial Co., Ltd.** 135, Lane 351, Taiping, Sec.1, Tsao Yuen, Nan-Tou, Taiwan, R.O.C.
MANUFACTURER:	The same as Applicant.
ISSUED BY:	**SPORTON INTERNATIONAL INC.** 6F, No. 106, Sec. 1, Hsin Tai Wu Rd., His Chih, Taipei Hsien, Taiwan, R.O.C.

Statements:

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

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

Certificate or Test Report could not be used by the applicant to claim the product endorsement by CNLA, NVLAP or any agency of U.S. government.

The test equipment used to perform the test are calibrated and traceable to NML/ROC or NIST/USA.

Dr. Alan Lane
Vice General Manager
Sporton International Inc.

Lab Code: 200079-0

Table of Contents

History of this test report

■ No additional attachment.

☐ Additional attachment were issued as following record:

Attachment No.	Issue Date	Description

1. General Description of Equipment under Test

1.1. Applicant

Universal Scientific Industrial Co., Ltd.

135, Lane 351, Taiping, Sec. 1, Tsao Yuen, Nan-Tou, Taiwan, R.O.C.

1.2. Manufacturer

The same as applicant.

1.3. Basic Description of Equipment under Test

This product is a hybrid module includes wireless LAN of IEEE802.11b and Bluetoth. The technical data has been listed on section below. And this module is specific to host equipment which is classified as mobile device.

1.4. Technical Features

Type of Modulation :	DSSS
Number of Channels :	11
Operating Frequency Band :	2412 MHz ~ 2462 MHz
Carrier Frequencies :	Please reference section 1.5
Channel Bandwidth :	22 MHz
Output Power :	14.5 dBm
Antenna Type / Class and Gain :	Metal Inverted-F Antenna (-0.8dBi)
Function Type :	Transceiver
Data Rate :	11 Mbps (Max)
Power Rating (DC/AC , Voltage) :	3.3 VDC
Temperature Range (Operating) :	0 ~ 55 ℃

1.5. List of the Carrier Frequencies

Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2412 MHz	6	2437 MHz	11	2462 MHz
2	2417 MHz	7	2442 MHz	12	
3	2422 MHz	8	2447 MHz	13	
4	2427 MHz	9	2452 MHz		
5	2432 MHz	10	2457 MHz		

2. TEST CONFIGURATION OF THE EQUIPMENT UNDER TEST

2.1. Description of the Test

a. This test report is only for the 802.11b part of the product. It has been verified that the emission of he 802.11b module is independent of the status of Bluetooth module.

b. The EUT has been associated with notebook and peripherals pursuant to ANSI C63.4-2001 and configuration operated in a manner, which tended to maximize its emission characteristics in a typical application.

c. The 802.11b in this product can be operated on 11 channels. According to FCC rule part 15.31(m), three channels has to be tested. The following 3 channels has been selected for testing.

Mode 1: CH01 2412MHz
Mode 2: CH06 2437MHz
Mode 3: CH11 2462MHz

2.2. Frequency Range Investigated

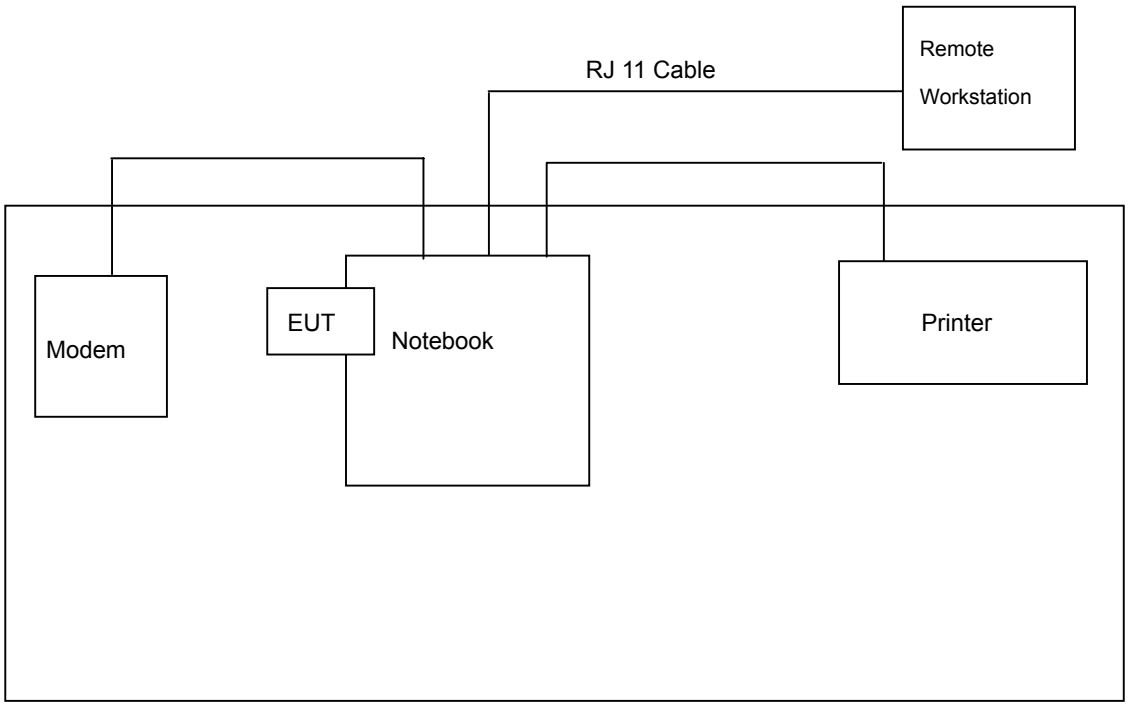
a. Conducted power line test: from 150 kHz to 30 MHz

b. Radiated emission test: from 30 MHz to 25000 MHz

2.3. Details of the Supporting Units

Unit No	Device	Brand	FCC ID /DoC	Model No.	Power Supply	Power Cord	Data Cable
1.	Notebook	IBM	DoC	08N1180	Switching	Non-Shielded	Shielded, 1.8m
2.	Printer	HP	B94C2642X	DJ400	Linear	Non-Shielded	Shielded, 1..35m
3.	Modem	ACEEX	IFAXDM141	DM141	Linear	Non-Shielded	Shielded, 1.15m

2.4. Connection Diagram of Test System



3. TEST SOFTWARE

There are 2 softwares may be used in the testing.

A) Channel & Power Controlling Software: This was provided by the manufacturer and is able to let the test engineer select the operating channel as well as the RF output power. The parameters for channel selection is trying to offer the test engineer the ability to fix the operating channel for testing, both normal data and continuously transmitting modes are allowed, and that for RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

B) “H” Pattern Generator: Except Access Point, the supporting equipment such as monitor or printer is always available. Under testing, these supporting equipment has to also under working condition. “H” Pattern Generator is able to continuously transmitting “H” character to those supporting equipments.

4. TEST LOCATION AND STANDARDS

4.1. Test Location

Test Location : Sporton Hwa Ya Testing Building

Address : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.
Tel: +886 3 327 3456 Fax: +886 3 318 0055

Test Site No. : CO01-HY , 03CH03-HY

4.2. Test Standards

Here is the list of the standards followed in this test report.

ANSI C63.4-2001

47 CFR Part 15 Subpart C (Section 15.247)

4.3. DoC Statement

This EUT is also classified as a device of computer peripheral Class B which DoC has to be followed. It has been verified according to the rule of 47 CFR part 15 Subpart B, and found that all the requirements has been fulfilled.

5. TEST RESULT AND DETAILS

5.1. Summary of the Test Results

FCC Rule	Description of Test	Result
15.207	Conducted Emission	Pass
15.247(a)(2)	6dB Bandwidth	Pass
15.247(b)	Maximum Peak Output Power	Pass
15.209	Radiated Emission	Pass
15.247(c)	100kHz Bandwidth of Frequency Band Edges	Pass
15.247(d)	Power Spectral Density	Pass
15.203	Antenna Requirement	Pass
1.1307 1.1310 2.1091 2.1093	RF Exposure Compliance	Pass

5.2. 6dB Bandwidth

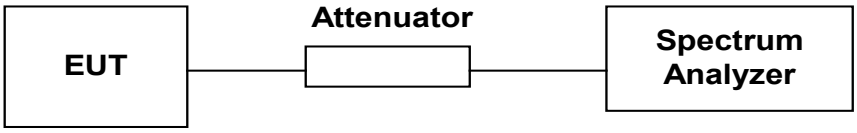
5.2.1. Measuring Instruments

Item 9 of the table on section 6.

5.2.2. Test Procedures

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 100KHz and VBW to 100KHz.
3. The Hopping Channel bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20 dB.

5.2.3. Test Setup Layout

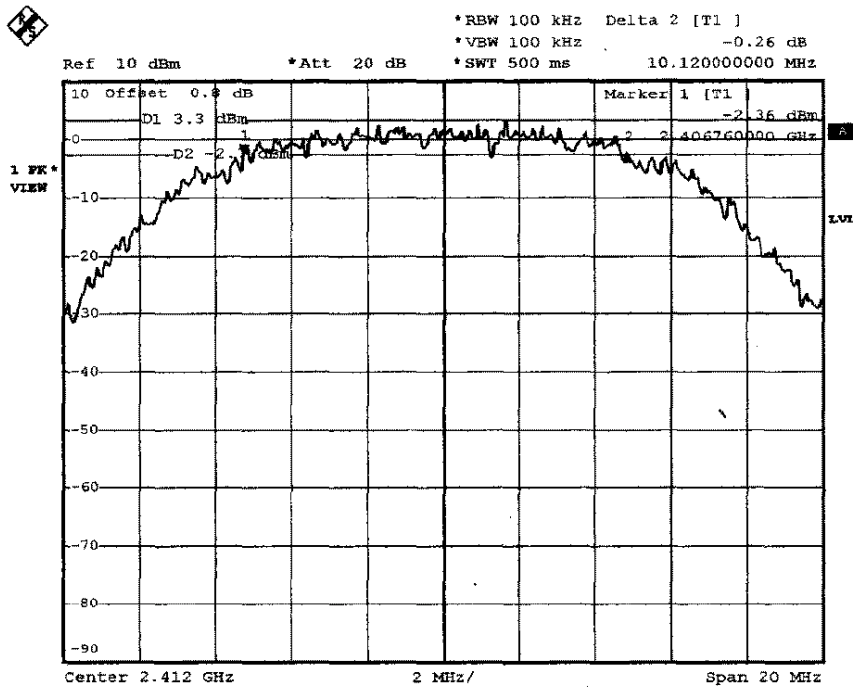


5.2.4. Test Result：See spectrum analyzer plots below

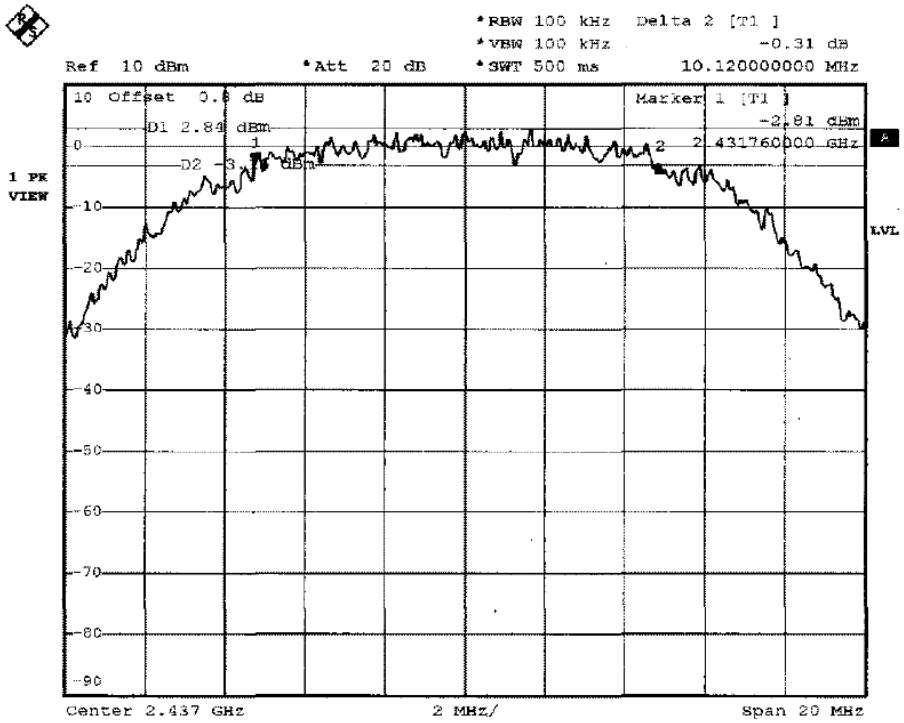
- Operating Mode: continuously transmitting
- Temperature: 26°C
- Relative Humidity: 61 %
- Duty cycle of the equipment during the test: 100%

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Min. Limit (MHz)
01	2412	10.12	0.5
06	2437	10.12	0.5
11	2462	10.12	0.5

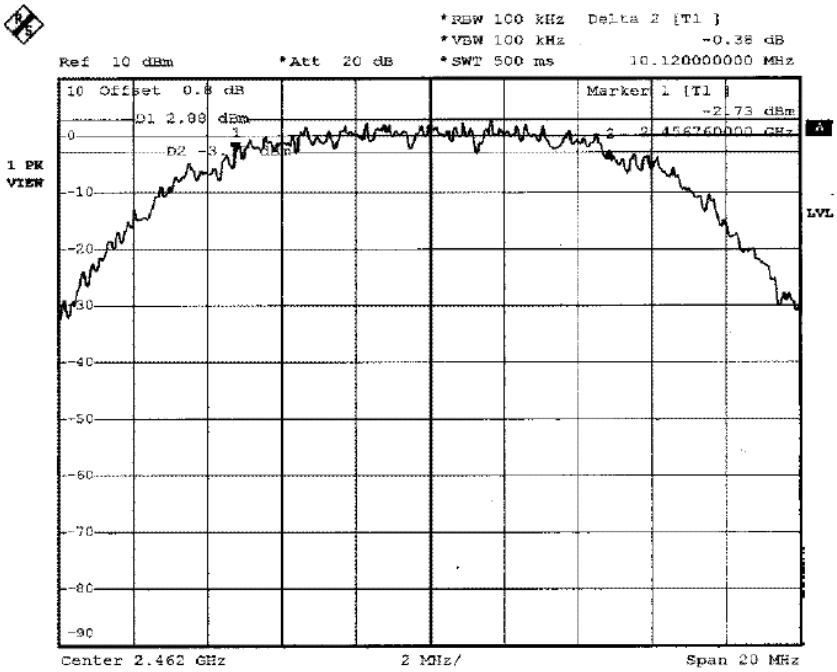
(Channel 01) :



(Channel 06) :



(Channel 11) :



5.2.5. Test Configuration（EUT Operating Condition）

The EUT is directly connected to the spectrum analyzer. The software provided by the customer is able to have the EUT stayed on certain channel for testing.

5.3. Peak Output Power

5.3.1. Measuring Instruments

Item 9, 26, 27 of the table on section 6.

5.3.2. Test Procedures

1. The RF port of this product is connected to a detector the output of which is connected with the oscilloscope.
2. Using signal generator to calibration the reading on the oscilloscope.
3. The output power of the signal generator has to be recorded.

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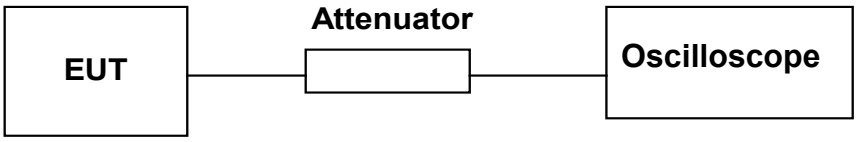
5.3.3. Test Setup Layout



5.3.4. Test Result：See spectrum analyzer plots below

- Operating Mode: continuously transmitting
- Temperature : 27°C
- Relative Humidity : 62 %
- Antenna Gain: -0.8 dBi

Channel	Frequency (MHz)	Measured Output Power (mWatt)	Measured Output Power (dBm)	Limit (Watt/dBm)
01	2412	28.18	14.5	1W/30 dBm
06	2437	28.18	14.5	1W/30 dBm
11	2462	28.18	14.5	1W/30 dBm

5.3.5. Test Configuration（EUT Operating Condition）

The EUT is directly connected to the test equipment. The software provided by the customer is able to have the EUT stayed on certain channel for testing.

5.4. Test of Peak Power Spectral Density

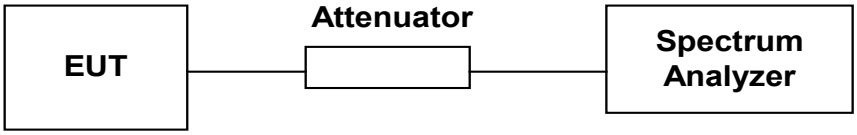
5.4.1. Measuring Instruments

Item 9 of the table on section 6.

5.4.2. Test Procedures

1. The transmitter output is connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 3kHz and VBW to 30kHz.
3. Mark the frequency with maximum peak power as the center of the display of the spectrum
4. Set the span to 1.5MHz and the sweep time to 500s and record the maximum peak value.
5. Repeated the 1~4 for the middle and highest channel of the EUT.

5.4.3. Test Setup Layout

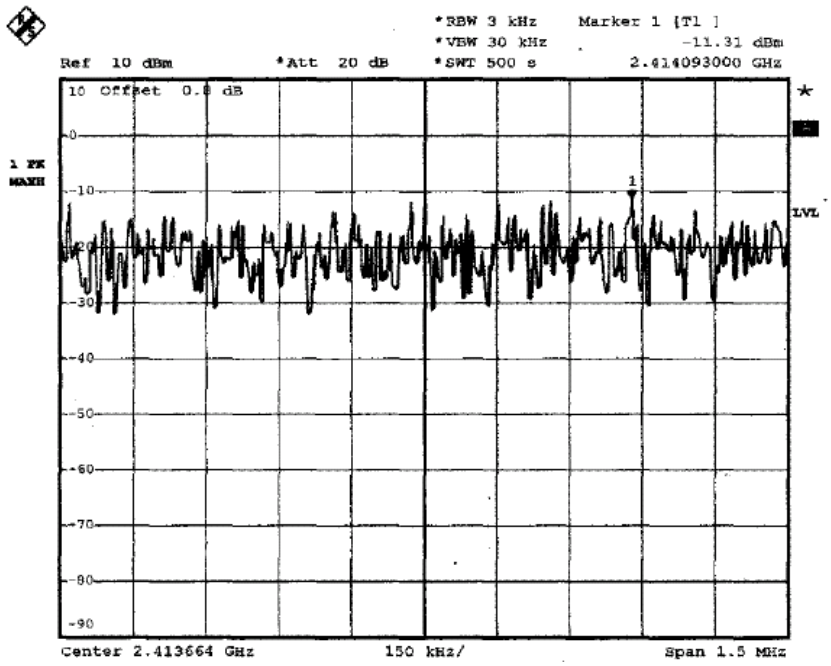


5.4.4. Test Result : See spectrum analyzer plots below

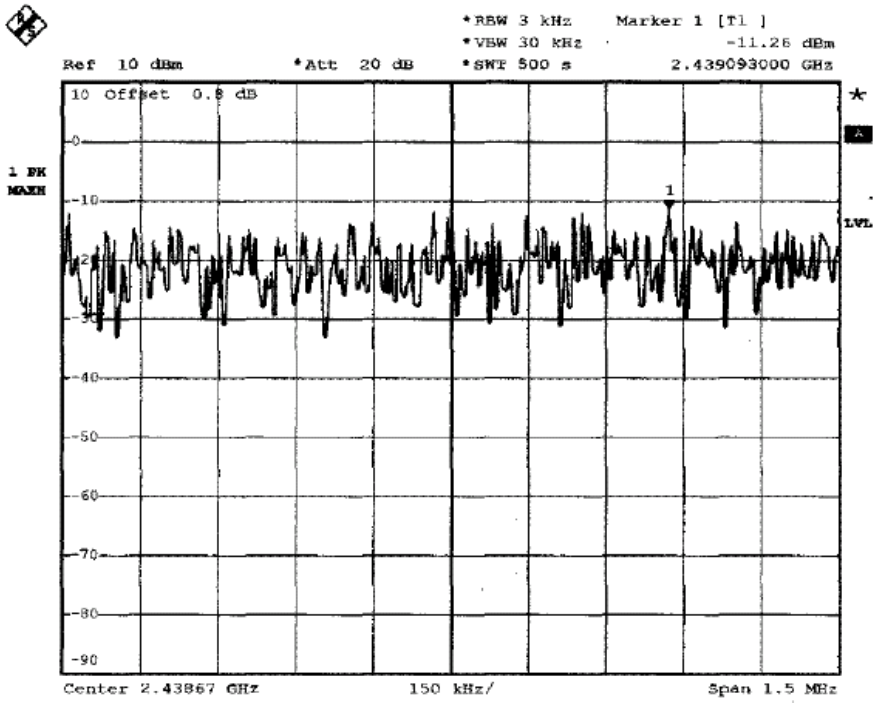
- Operating Mode: continuously transmitting
- Temperature: 25°C
- Relative Humidity: 62 %
- Duty cycle of the equipment during the test: 100%

Channel	Frequency (MHz)	Power Density (dBm)	Limits (dBm)
01	2412	-11.31	8
06	2437	-11.26	8
11	2462	-11.25	8

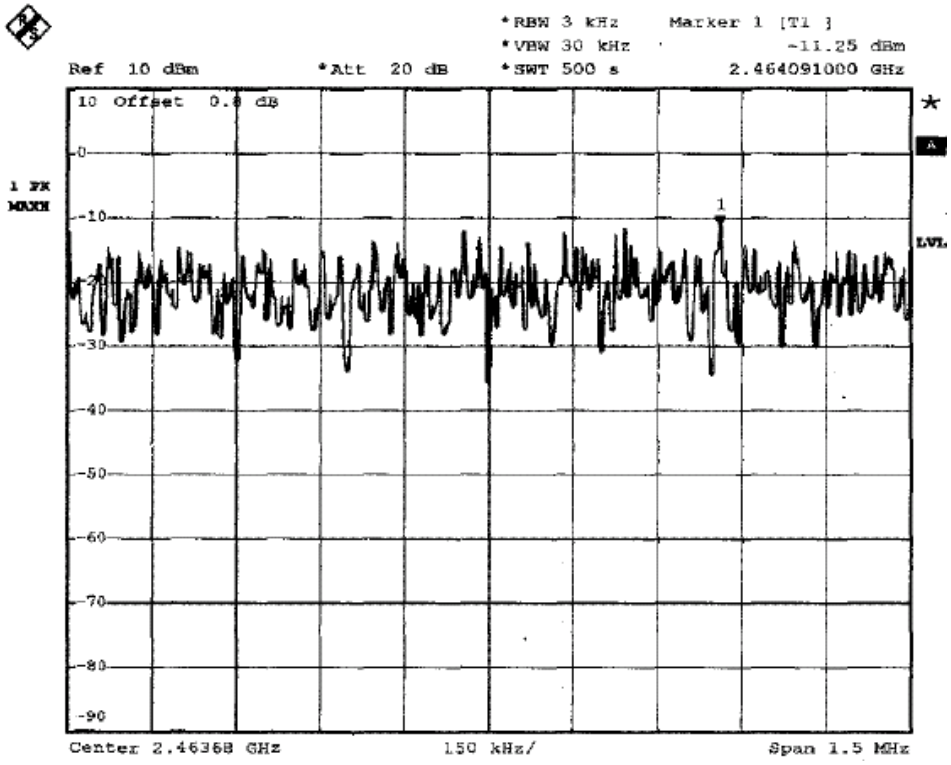
(Channel 01) :



(Channel 06) :



(Channel 11) :



5.4.5. Test Configuration（EUT Operating Condition）

The EUT is directly connected to the spectrum analyzer. The software provided by the customer is able to have the EUT stayed on certain channel for testing.

5.5. Test of Conducted Emission

Conducted Emissions were measured from 150 KHz to 30 MHz with a bandwidth of 9 KHz and return leads of the EUT according to the methods defined in ANSI C63.4-2001 Section 3.1. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

5.5.1 Major Measuring Instruments

Item 1 of the table on section 6.

5.5.2 Test Procedures

a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
b. Connect EUT to the power mains through a line impedance stabilization network (LISN).
c. All the support units are connect to the other LISN.
d. The LISN provides 50 ohm coupling impedance for the measuring instrument.
e. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
f. Both sides of AC line were checked for maximum conducted interference.
g. The frequency range from 150 KHz to 30 MHz was searched.
h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

5.5.3 Test Result of Conducted Emission

Frequency Range of Test : from 150KHz to 30 MHz

6dB Bandwidth : 9KHz

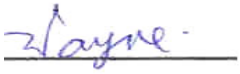
- Test Mode : Mode 1
- Temperature : 26°C
- Relative Humidity : 61 %

Line

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.156	46.30	-19.37	65.67	46.16	0.10	0.04	QP
2	0.156	26.68	-28.99	55.67	26.54	0.10	0.04	Average
3	0.167	45.43	-19.68	65.11	45.30	0.10	0.03	QP
4	0.167	26.13	-28.98	55.11	26.00	0.10	0.03	Average
5	0.226	43.44	-19.16	62.60	43.33	0.10	0.01	QP
6	0.226	37.04	-15.56	52.60	36.93	0.10	0.01	Average
7	0.338	30.35	-18.90	49.25	30.25	0.10	0.00	Average
8	0.338	39.56	-19.69	59.25	39.46	0.10	0.00	QP
9	0.453	26.20	-20.61	46.81	26.10	0.10	0.00	Average
10	0.453	34.31	-22.50	56.81	34.21	0.10	0.00	QP
11	1.120	35.45	-20.55	56.00	35.33	0.10	0.02	QP
12	1.120	25.23	-20.77	46.00	25.11	0.10	0.02	Average

Neutral

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.150	50.05	-15.95	66.00	49.90	0.10	0.05	QP
2	0.150	40.02	-15.98	56.00	39.87	0.10	0.05	Average
3	0.186	20.12	-34.09	54.21	20.00	0.10	0.02	Average
4	0.186	35.53	-28.68	64.21	35.41	0.10	0.02	QP
5	0.249	29.62	-22.17	51.79	29.51	0.10	0.01	Average
6	0.249	41.71	-20.08	61.79	41.60	0.10	0.01	QP
7	0.283	21.76	-28.97	50.73	21.66	0.10	0.00	Average
8	0.283	36.79	-23.94	60.73	36.69	0.10	0.00	QP
9	0.321	24.19	-25.50	49.69	24.09	0.10	0.00	Average
10	0.321	35.20	-24.49	59.69	35.10	0.10	0.00	QP
11	1.540	30.50	-25.50	56.00	30.37	0.10	0.03	QP
12	1.540	21.39	-24.61	46.00	21.26	0.10	0.03	Average

Test Engineer : 

Wayne Hsu

5.5.4. Test Configuration（EUT Operating Condition）

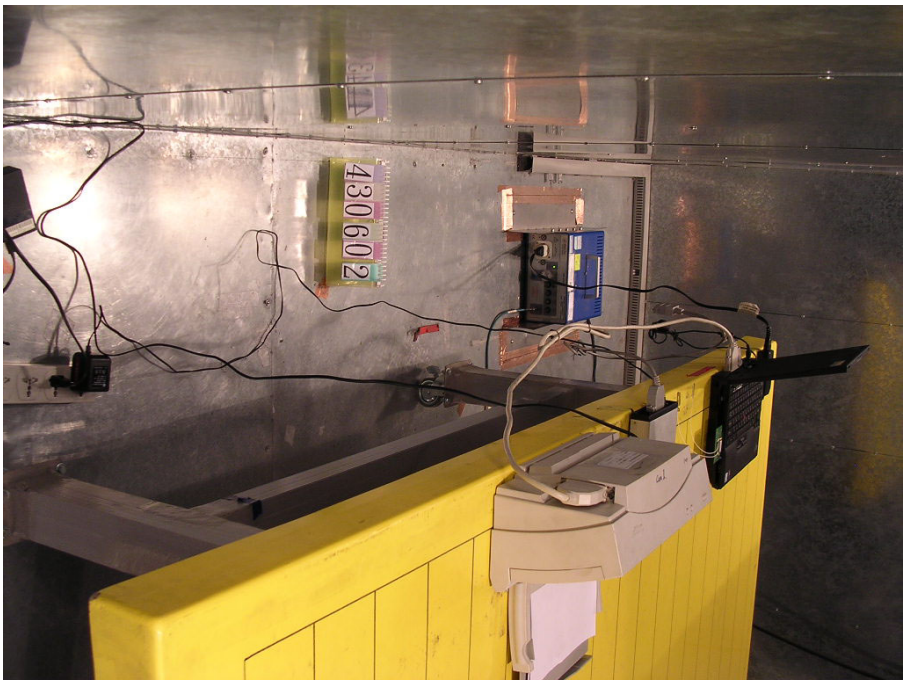
The EUT is directly connected to the test equipment. The software provided by the customer is able to have the EUT stayed on certain channel for testing..

5.5.5 Photographs of Conducted Emission Test Configuration

- The photographs show the configuration that generates the maximum emission.

FRONT VIEW

REAR VIEW



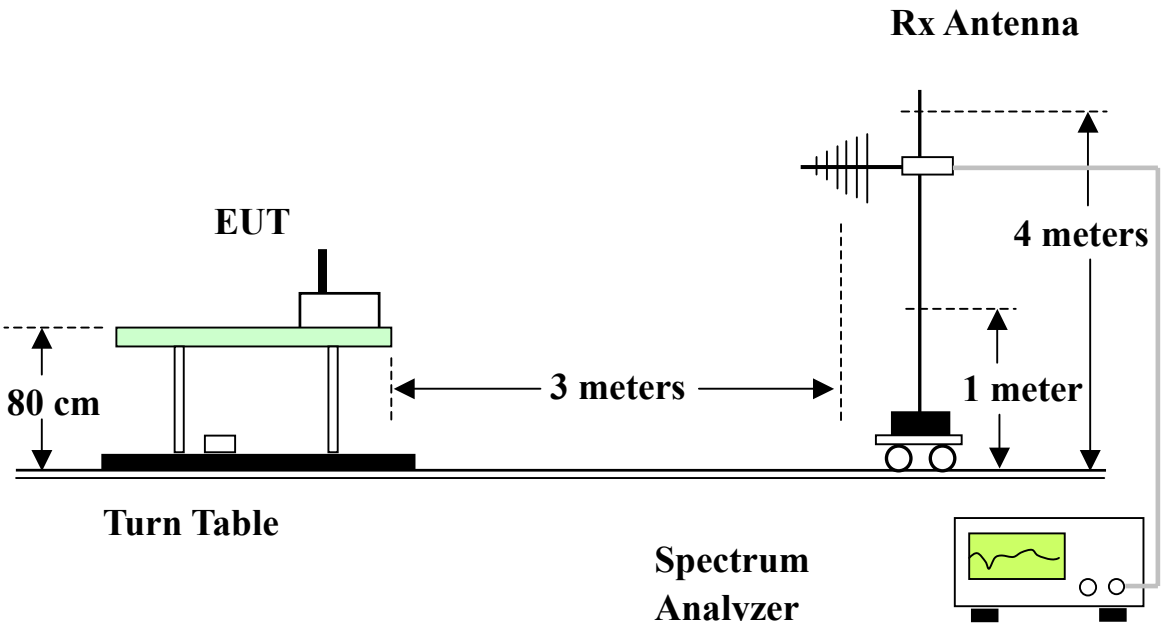
5.6. Test of Radiated Emission

Radiated emissions from 30 MHz to 25 GHz were measured according to the methods defines in ANSI C63.4-2001. The EUT was placed, 0.8 meter above the ground plane. The interface cables and equipment positions were varied within limits of reasonable applications to determine the positions producing maximum radiated emissions

5.6.1. Test Procedures

1. The EUT was placed on a rotatable table top 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.
5. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.
7. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.
8. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported. (For peak measurement, the RB=VB=1MHz, for average measurement, RB=1MHz, VB=10Hz)

5.6.2. Typical Test Setup Layout of Radiated Emission



5.6.3. Test Result of Radiated Emission

For spurious emission below 1GHz

- RF LINK
- Test Distance : 3 M
- Temperature : 27 °C
- Relative Humidity : 62 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

Horizontal

		Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
		MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1		180.110	31.79	-11.71	43.50	43.54	13.56	2.43	27.74	QP	---	---
2		186.230	33.11	-10.39	43.50	44.20	14.18	2.46	27.73	QP	---	---
3		199.660	37.26	-6.24	43.50	47.60	14.79	2.57	27.70	QP	---	---
1	!	231.200	40.53	-5.47	46.00	51.96	13.40	2.75	27.58	QP	100	206
2		240.000	38.52	-7.48	46.00	50.41	12.85	2.80	27.54	QP	---	---
3		298.400	35.31	-10.69	46.00	46.38	13.16	3.08	27.31	QP	---	---

Vertical

		Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
		MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1		132.510	30.26	-13.24	43.50	44.58	11.46	2.05	27.83	QP	---	---
2		135.740	25.61	-17.89	43.50	39.86	11.58	2.00	27.83	QP	---	---
3		200.000	27.62	-15.88	43.50	37.95	14.80	2.57	27.70	QP	---	---
1		230.400	33.70	-12.30	46.00	45.08	13.45	2.75	27.58	QP	---	---
2		400.000	33.96	-12.04	46.00	42.50	15.79	3.47	27.80	QP	---	---
3		663.200	36.44	-9.56	46.00	41.46	19.06	4.66	28.74	QP	---	---

For spurious emission above 1GHz

- Test Mode: Mode 1 (2412MHz)
- Test Distance : 3 M
- Temperature : 27 °C
- Relative Humidity : 62 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

Horizontal

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	4822.000	54.75	-19.25	74.00	61.59	33.06	2.47	42.37	Peak	---	---
2	4822.000	45.24	-8.76	54.00	52.08	33.06	2.47	42.37	Average	---	---

Vertical

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	4828.000	54.52	-19.48	74.00	61.33	33.08	2.49	42.38	Peak	---	---
2	4828.000	45.50	-8.50	54.00	52.31	33.08	2.49	42.38	Average	100	215

- Test Mode: Mode 2 (2437MHz)
- Test Distance : 3 M
- Temperature : 27 °C
- Relative Humidity : 62 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

Horizontal

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	4876.000	52.95	-21.05	74.00	59.70	33.17	2.52	42.44	Peak	---	---
2	4876.000	41.73	-12.27	54.00	48.48	33.17	2.52	42.44	Average	---	---

Vertical

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	4876.000	52.92	-21.08	74.00	59.67	33.17	2.52	42.44	Peak	---	---
2	4876.000	41.85	-12.15	54.00	48.60	33.17	2.52	42.44	Average	---	---

- Test Mode: Mode 3 (2462MHz)
- Test Distance : 3 M
- Temperature : 27 °C
- Relative Humidity : 62 %
- Emission level (dBuV/m) = 20 log Emission level (uV/m)
- Corrected Reading : Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

Horizontal

	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	4926.000	51.34	-22.66	74.00	58.10	33.28	2.47	42.51	Peak	---	---
2	4926.000	39.65	-14.35	54.00	46.41	33.28	2.47	42.51	Average	---	---

Vertical

No emission has been detected.

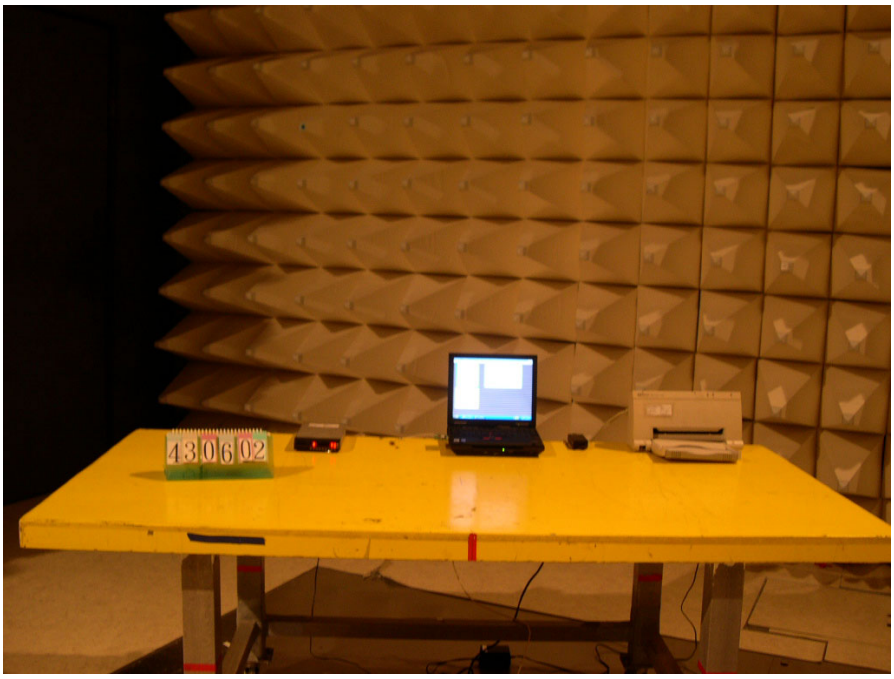
5.6.4. Test Configuration（EUT Operating Condition）

The testing was done on 3 meters test site. The software provided by the customer is able to have the EUT stay on certain channel.

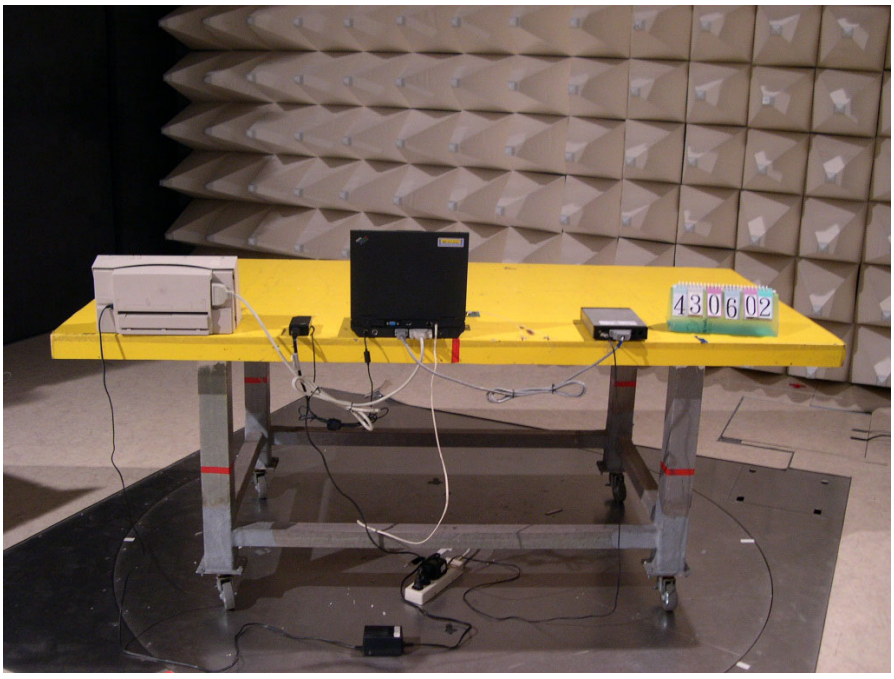
5.6.5. Photographs of Radiated Emission Test Configuration

- The photographs show the configuration that generates the maximum emission.

FRONT VIEW



REAR VIEW



5.7. Band Edges Measurement

5.7.1. Measuring Instruments

Item 9 of the table in section 6.

5.7.2. Test Procedures

1. The transmitter output was connected to the spectrum analyzer via a low lose cable.
2. Set both RBW and VBW of spectrum analyzer to 100KHz with convenient frequency span including 100 KHz bandwidth from band edge.
3. The band edges was measured and recorded.

5.7.3. Test Result

- Test Result in lower band (Channel 1) : PASS
- Test Result in higher band(Channel 11) : PASS

5.7.4. Note on Band edge Emission

Modulation Type: CCK

(A) Left Edge

The band edge emission plot shows 58.53dB delta between carrier maximum power and local maximum emission in the restricted band.

CH 01 Carrier power strength (dB μ V/m)	Delta (dB)	The maximum field strength in restrict band (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
93.21	58.53	42.34	54.00	11.66

(B) Right Edge

The band edge emission plot shows 54.7dB delta between carrier maximum power and local maximum emission in the restricted band.

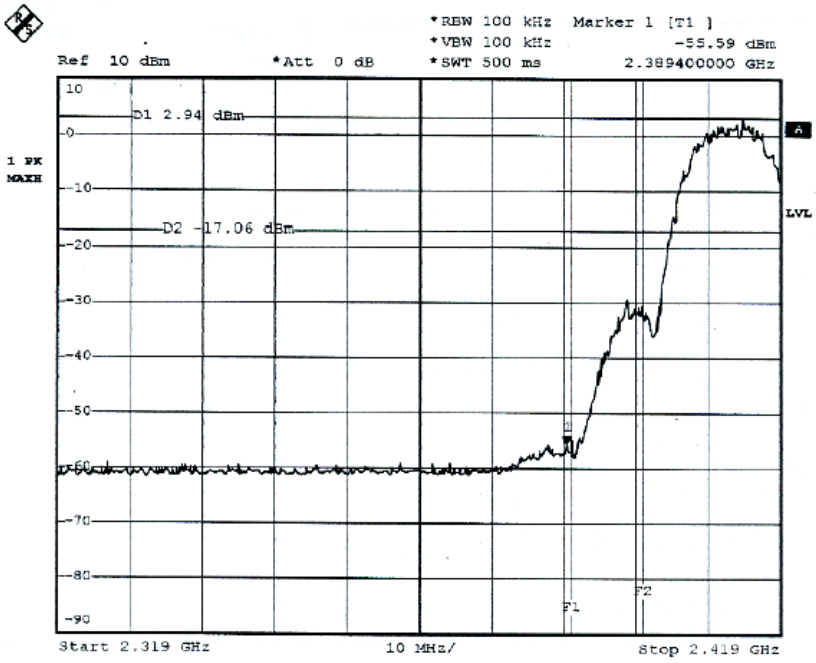
CH 11 Carrier power strength (dB μ V/m)	Delta (dB)	The maximum field strength in restrict band (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
102.67	54.7	47.97	54.00	6.03

＊The maximum field strength in restricted band is the emission of carrier power strength subtract to the delta between carrier maximum power and local maximum emission in the restricted band.

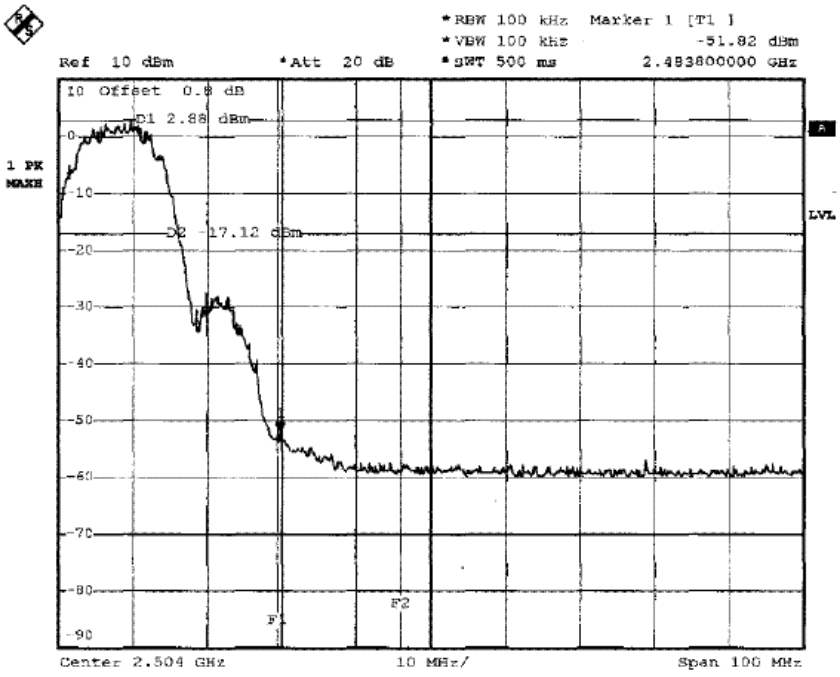
5.7.5. Test Configuration（EUT Operating Condition）

The test configuration is the same as that of radiation spurious emission measurement.

(Channel 00)：



(Channel 78)：



Observation： All emissions in the 100kHz band edge are all lower than carrier by more than 20dB.

5.8. Antenna Requirements

5.8.1. Standard Applicable

For intentional device, according to FCC 47 CFR Section 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 FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

5.8.2. Antenna Connected Construction

The maximum Gain antenna used in this product is ULF antenna connector.

5.9. RF Exposure

5.9.1. Limit For Maximum Permissible Exposure (MPE)

This product can be classified as mobile device, so the 20cm separation distance warning is required.

In this section, the power density at 20cm location is calculated to examine if it is lower than the limit.

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm^2)	Averaging Time $\|E\|^2$,$\|H\|^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) 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^2)	Averaging Time $\|E\|^2$,$\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	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

5.9.2. MPE Calculation Method

$$E\ (V/m) = \frac{\sqrt{30 \times P \times G}}{d} \qquad \text{Power Density: } Pd\ (mW/cm^2) = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Peak RF output power (mW)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=20cm, as well as the gain of the used antenna, the RF power density can be obtained.

5.9.3. Calculated Result and Limit

Channel No.	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)
Channel 01	-0.8	0.83	14.5000	28.1838	0.0046	1
Channel 10	-0.8	0.83	14.5000	28.1838	0.0046	1
Channel 13	-0.8	0.83	14.5000	28.1838	0.0046	1

From the calculated result shown in above table, the power density is lower than limit at location 20cm far away.

6. List of Measuring Equipments Used

Items	Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
1	EMC Receiver	R&S	ESCS 30	100132	9 KHz – 2.75 GHz	Jun. 12, 2003	Conduction (CO01-HY)
2	LISN	MessTec	NNB-2/16Z	2001-008	9 KHz – 30 MHz	Apr. 30, 2003	Conduction (CO01-HY)
3	LISN	MessTec	NNB-2/16Z	2001-009	9 KHz – 30 MHz	Apr. 30, 2003	Conduction (CO01-HY)
4	EMI Filter	LINDGREN	LRE-2060	1004	< 450 Hz	N/A	Conduction (CO01-HY)
5	EMI Filter	LINDGREN	N6006	201052	0 ~ 60 Hz	N/A	Conduction (CO01-HY)
6	RF Cable-CON	Suhner	RG223/U	CB029	9KHz~30MHz	Dec. 24, 2003	Conduction (CO01-HY)
7	50 ohm BNC type	NOBLE	50ohm	TM013	50 ohm	Apr. 24, 2003	Conduction (CO01-HY)
8	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz~1GHz 3m	Jun. 21, 2003	Radiation (03CH03-HY)
9	Spectrum analyzer	R&S	FSP40	100004	9KHZ~40GHz	Aug. 23, 2003	Radiation (03CH03-HY)
10	Amplifier	HP	8447D	2944A09072	100KHz – 1.3GHz	Nov. 05, 2003	Radiation (03CH03-HY)
11	Biconical Antenna	SCHWARZBECK	VHBB 9124	301	30MHz –200MHz	Jul. 24, 2003	Radiation (03CH03-HY)
12	Log Antenna	SCHWARZBECK	VUSLP 9111	221	200MHz -1GHz	Jul. 24, 2003	Radiation (03CH03-HY)
13	RF Cable-R03m	Jye Bao	RG142	CB021	30MHz~1GHz	Dec. 03, 2003	Radiation (03CH03-HY)
14	Amplifier	MITEQ	AFS44	879981	100MHz~26.5GHz	Jul. 23, 2003	Radiation (03CH03-HY)
15	Horn Antenna	COM-POWER	3115	6741	1GHz – 18GHz	Apr. 08, 2003	Radiation (03CH03-HY)
16	Turn Table	HD	DS 420	420/650/00	0 ~ 360 degree	N/A	Radiation (03CH03-HY)
17	Antenna Mast	HD	MA 240	240/560/00	1 m - 4 m	N/A	Radiation (03CH03-HY)
18	Horn Antenna	Schwarzbeck	BBHA9170	154	15GHz~40GHz	Jun. 02, 2003	Radiation (03CH03-HY)
19	RF Cable-HIGH	Jye Bao	RG142	CB030-HIGH	1GHz~29.5GHz	Dec. 05, 2003	Radiation (03CH03-HY)

※ Calibration Interval of instruments listed above is one year.

Items	Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
19	Power meter	R&S	NRVS	100444	DC~40GHz	May 28, 2003	Conducted
20	Power sensor	R&S	NRV-Z55	100049	DC~40GHz	May 28, 2003	Conducted
21	Power Sensor	R&S	NRV-Z32	100057	30MHz-6GHz	May 28, 2003	Conducted
22	AC power source	HPC	HPA-500W	HPA-9100024	AC 0~300V	May 27, 2003	Conducted
23	Temp. and Humidity Chamber	KSON	THS-C3L	612	N/A	Oct. 01, 2003	Conducted
24	Oscilloscope	Tektronix	TDS1012	C038520	100MHz 2Ch.	Jan. 01, 2004	Conducted
25	DC Detector	Narda	FSCM99899	4503A	0.1MHZ~18GHz	Jan. 01, 2004	Conducted
26	Signal Generator	R&S	SMR40	837900/23	1GHz~40GHz	Nov. 06, 2003	Conducted

※ Calibration Interval of instruments listed above is one year.