FCC TEST REPORT

CATEGORY	:	Mobile Product
PRODUCT NAME	:	ADSL Wireless Router
FCC ID.	:	RK9-ARW800
FILING TYPE	:	Certification
BRAND NAME	:	CastleNet
MODEL NAME	:	AR800, ARW800
APPLICANT	:	**CastleNet Technology Inc.** 16F, No.957, Chung-Cheng Rd. Chung-Ho City, Taipei 235 Taiwan R.O.C.
MANUFACTURER	:	Same as Applicant
ISSUED BY	:	**SPORTON International Inc.** 6F, No. 106, Sec. 1, Hsin Tai Wu Rd., Hsi 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

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Appendix A. Photographs of EUT ..... A1 ~ A14

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

CastleNet Technology Inc.
16F, No.957, Chung-Cheng Rd. Chung-Ho City, Taipei 235 Taiwan R.O.C.

1.2. Manufacturer

Same as 1.1

1.3. Basic Description of Equipment under Test

This product is a wireless ADSL router with IEEE 802.11g wireless module. The radio technical data has been listed on section " Features of Equipment under Test ". The 10/100 Base T interface is provided for connection to LAN or Ethernet equipment. USB interface can be used to operate with networking printer.

1.4. Features of Equipment under Test

ITEM	DESCRIPTION
Type of Modulation	DSSS (CCK / DQPSK / DBPSK), OFDM
Number of Channels	11
Frequency Band	2400MHz ~ 2483.5MHz
Carrier Frequency of Each Channel	Please reference table below.
Channel Bandwidth	11MHz
Output Power	CCK : 19.79dBm (peak) OFDM : 18.27 dBm (peak)
Antenna Type / Gain	Monopole Antenna / 4.5dBi
Function Type	Transceiver
Duty Cycle	100%
Power Rating (DC/AC, Voltage)	230VAC / 12VDC
Temperature Range (Operating)	0 ~ 55℃

1.5. Table for Carrier Frequencies

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

2. Test Configuration of the Equipment under Test

2.1. Description of the Test

a. During testing, the equipment was placed on a non-conducting support.
b. The following test modes were performed:
   Mode 1 : CH 01 2412MHz
   Mode 2 : CH 06 2437MHz
   Mode 3 : CH 11 2462MHz
c. Spurious emission below 1GHz is independent of channel selection, so only Channel 11 with OFDM modulation was tested.
d. For spurious emission above 1GHz, lowest, middle and highest channel with 11Mbps data rate was tested.
e. The EUT has been programmed to continuously transmit or receive during testing. The used peripherals as well as the configuration fulfill the requirements of ANSI C63.4:2001.
f. The configuration is operated in a manner which tends to maximize its emission characteristics in a typical application.
g. 3 meters measurement distance in semi-anechoic chamber was used in this test.

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. Description of Test Supporting Units

Support Unit 1. – Notebook (COMPAQ)

FCC ID	: N/A
Model No.	: PRESARIO 1500
Serial No.	: SP0004
Remark	: This support device was tested to comply with FCC standards and authorized under Declaration of Conformity.

Support Unit 2. -- Printer (EPSON)

FCC ID	: N/A
Model No.	: STYLUS COLOR 680
Power Supply Type	: Linear
Power Cord	: Non-Shielded
Serial No.	: SP0046
Data Cable	: Shielded, 360 degree via metal backshells, 1.35m

Support Unit 3. – Personal Computer (COMPAQ) – for local workstation

FCC ID	: N/A
Model No.	: D380mx
Power Supply Type	: Switching
Power Cord	: Non-Shielded
Serial No.	: SP0004

Support Unit 4. -- Monitor (COMPAQ) – for local workstation

FCC ID	: N/A
Model No.	: S510
Power Supply Type	: Switching
Power Cord	: Non-Shielded
Serial No.	: SP0006
Data Cable	: Shielded, 1.7m
Remark	: This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

Support Unit 5. –PS/2 Keyboard (COMPAQ) – for local workstation

FCC ID	: N/A
Model No.	: 6511-VA
Serial No.	: SP0013
Data Cable	: Shielded, 360 degree via metal backshells, 1.7m
Remark	: This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

Support Unit 6. – PS/2 Mouse (COMPAQ) – for local workstation

FCC ID	: N/A
Model No.	: M-S69
Serial No.	: SP0014
Data Cable	: Shielded, 1.8m
Remark	: This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

Support Unit 7. -- Printer (HP) – for local workstation

FCC ID	: N/A
Model No.	: DJ400
Power Supply Type	: Linear
Power Cord	: Non-Shielded
Serial No.	: SP0017
Data Cable	: Shielded, 360 degree via metal backshells, 1.7m

Support Unit 8. -- Modem (ACEEX) – for local workstation

FCC ID	: IFAXDM141
Model No.	: DM141
Power Supply Type	: Linear
Power Cord	: Non-Shielded
Serial No.	: SP0049
Data Cable	: Shielded, 1.15m
Remark	: This support device was tested to comply with FCC standards and authorized under a declaration of conformity.

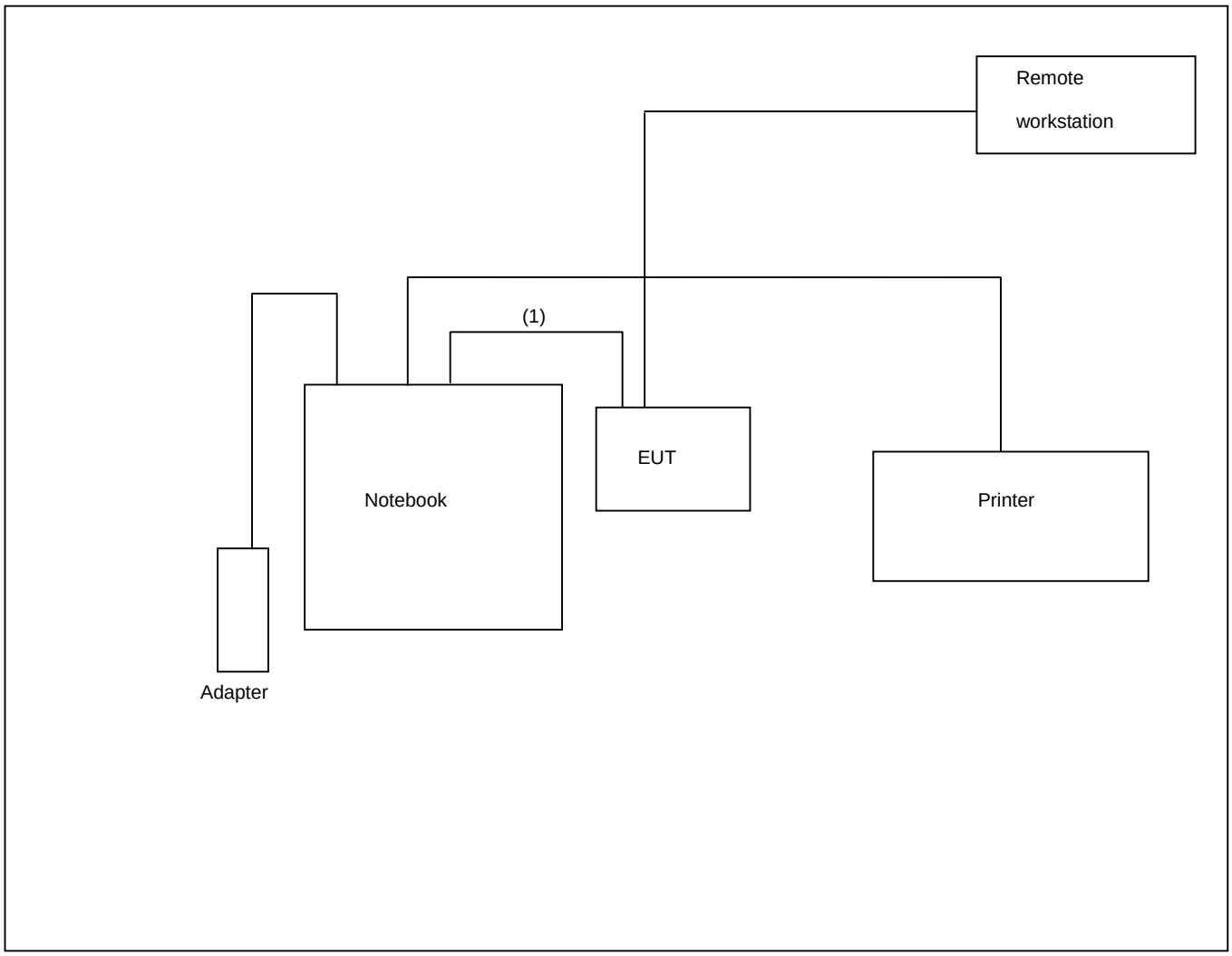
Support Unit 9. – CO. (XAVi) – for remote workstation

FCC ID	: N/A
Model No.	: Sliver Card

Support Unit 10. – Notebook (DELL) – for remote workstation

FCC ID	: N/A
Model No.	: PP01L
Serial No.	: SP0001
Remark	: This support device was tested to comply with FCC standards and authorized under Declaration of Conformity.

2.4. Connection Diagram of Test System



Remark : (1) 100/10M RJ45 for LAN Mode or USB Cable for USB link Mode.

2.5. 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.

c. At the same time, "PING.EXE" to link with the remote workstation to receive and transmit data by wireless, and the PC reads and writes message in EUT.

3. Test Location and Standards

3.1. 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-LK, 03CH03-HY

3.2. Test Conditions

Normal Voltage	: 120V/60Hz
Extreme Voltage	: 138V and 102V
Normal Temperature	: 20 ℃
Extreme Temperature	: -20 ℃ and 50 ℃

3.3. Standards for Methods of Measurement

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)

3.4. 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.

4. List of Measurements

4.1. Summary of the Test Results

Applied Standard: 47 CFR Part 15 and Part 2			
Paragraph	**FCC Rule**	**Description of Test**	**Result**
5.1	15.247(a)(2)	6dB Spectrum Bandwidth (DSSS System)	Pass
5.2	15.247(b)	Maximum Peak Output Power	Pass
5.3	15.247(d)	Peak Power Spectral Density	Pass
5.4	15.247(c)	Band Edges Emission	Pass
5.5	15.107/15.207	AC Power Line Conducted Emission	Pass
5.6	15.209/15.247(c)	Spurious Radiated Emission	Pass
5.7	15.203	Antenna Requirement	Pass
5.8	2.1091/2.1093	Maximum Permissible Exposure for the EUT	Pass

5. Test Result

5.1. Test of 6dB Spectrum Bandwidth (DSSS System)

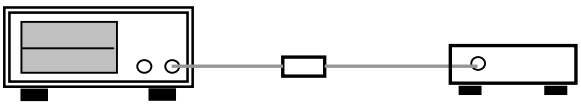
5.1.1 Measuring Instruments

Item 16 of the table on section 6.

5.1.2 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 6dB bandwidth is defined as the spectrum width with level higher than 6dB below the peak level.
4. Repeat above 1~3 points for the middle and highest channel of the EUT.

5.1.3 Test Setup Layout



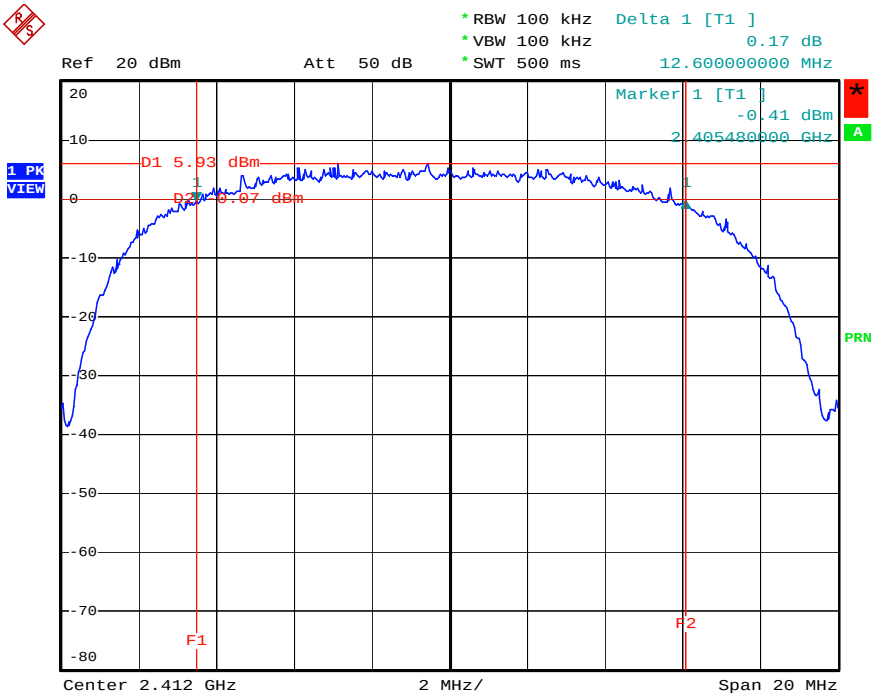
Spectrum analyzer **EUT**

5.1.4 Test Result : See spectrum analyzer plots below

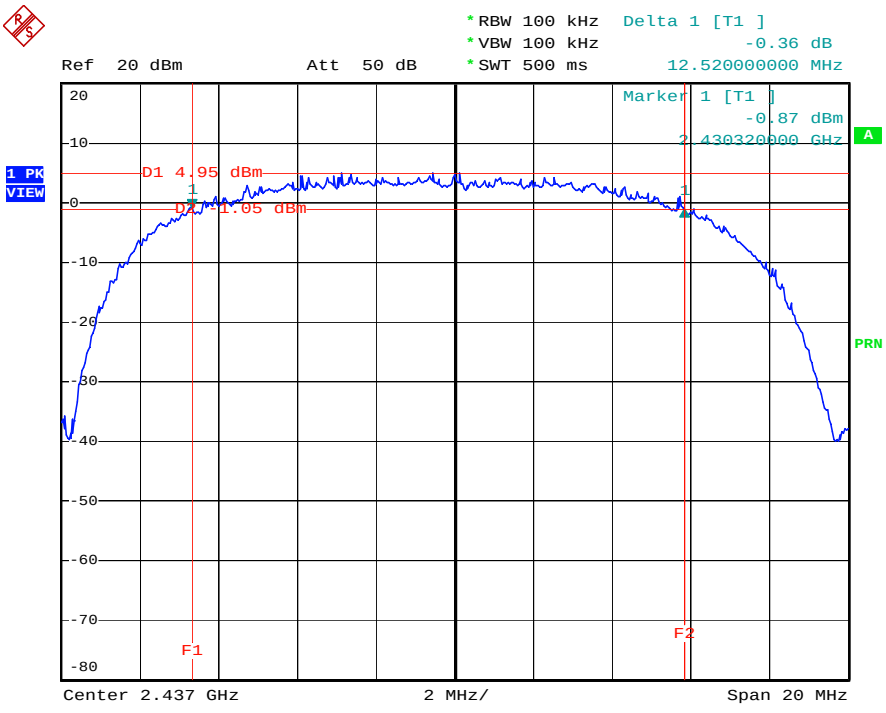
- Modulation Type: CCK
- Temperature: 25°C
- Relative Humidity: 65%
- Duty Cycle of the Equipment During the Test: 100%
- Test Engineer: Sam Lee

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Min. Limit (MHz)
01	2412	12.60	0.5
06	2437	12.52	0.5
11	2462	12.60	0.5

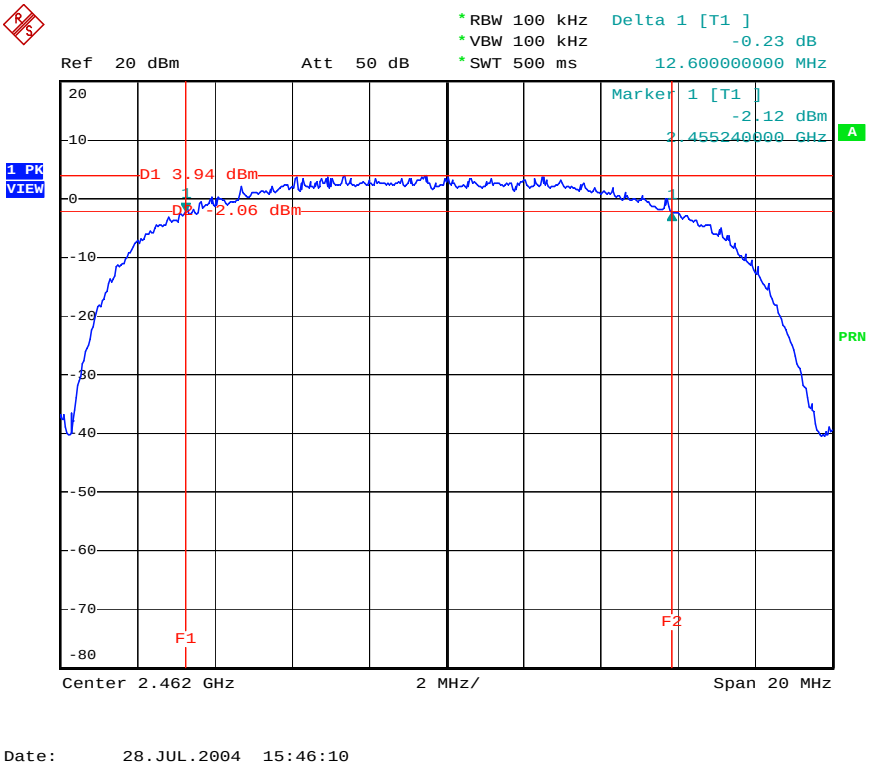
Modulation Type: CCK (Channel 01)：



Modulation Type: CCK (Channel 06)：



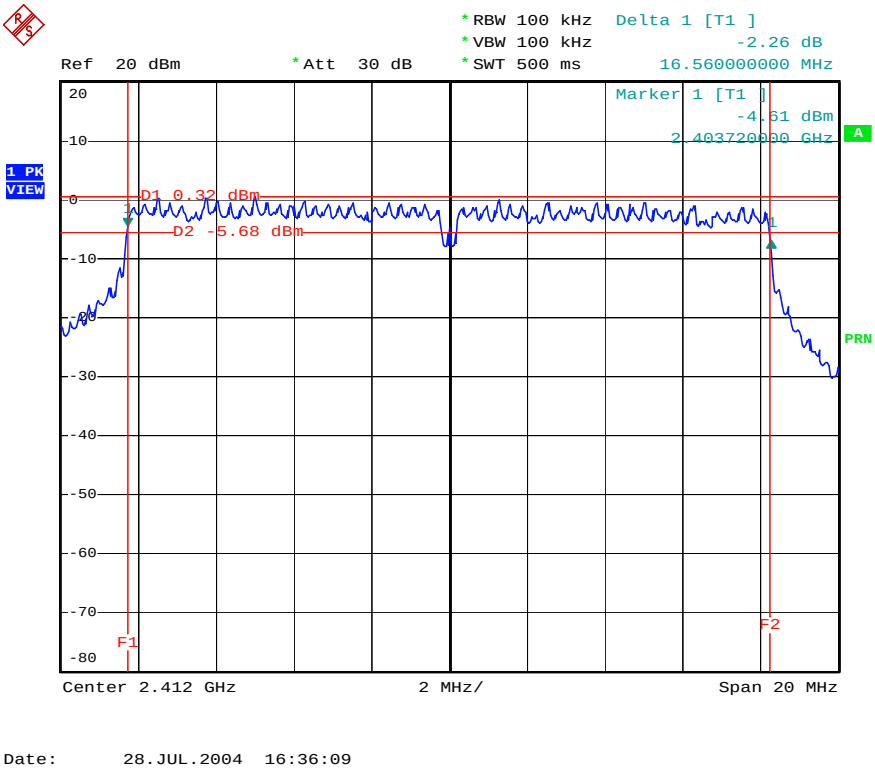
Modulation Type: CCK (Channel 11)：



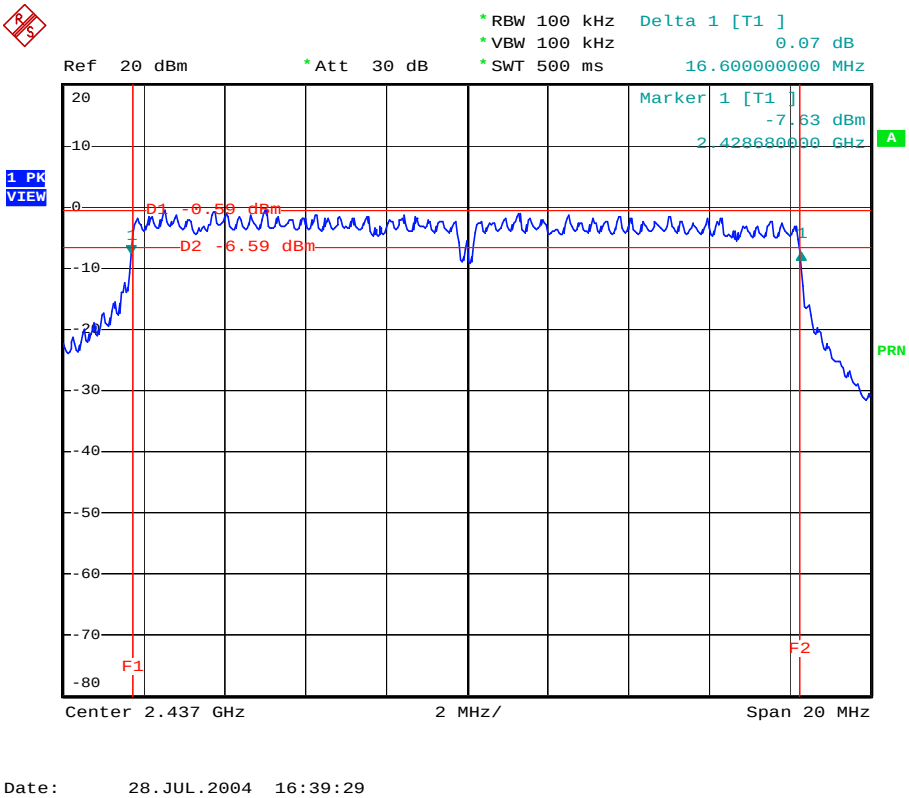
- Modulation Type: OFDM
- Temperature: 25°C
- Relative Humidity: 65%
- Duty Cycle of the Equipment During the Test: 100%
- Test Engineer: Sam Lee

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Min. Limit (MHz)
01	2412	16.56	0.5
06	2437	16.60	0.5
11	2462	16.60	0.5

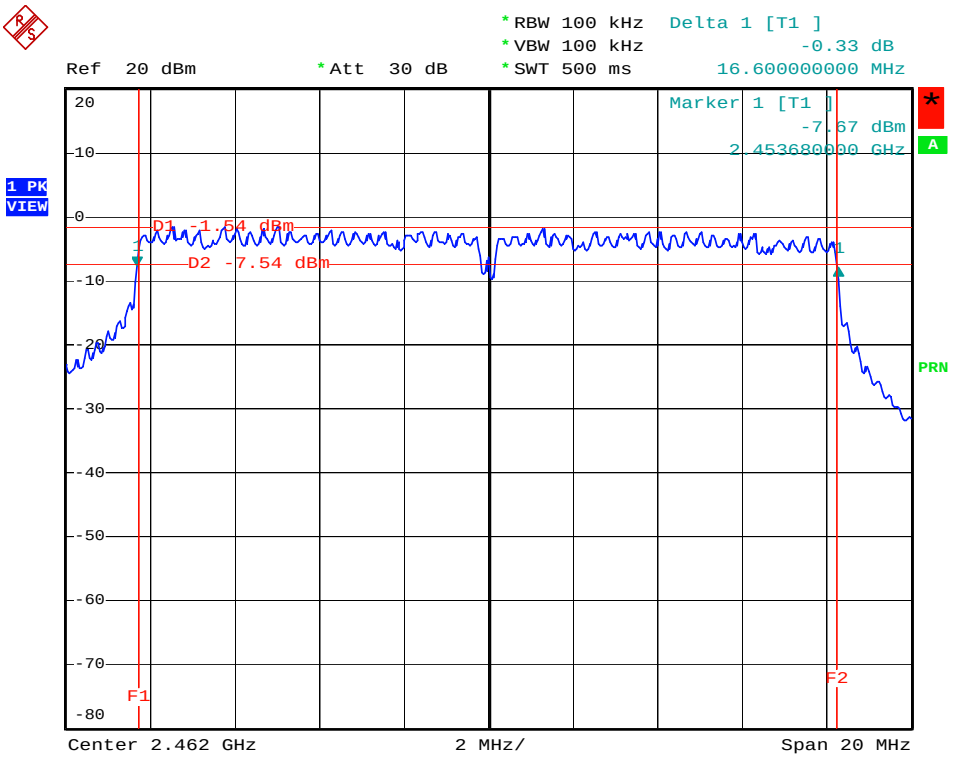
Modulation Type: OFDM (Channel 01)：



Modulation Type: OFDM (Channel 06)：



Modulation Type: OFDM (Channel 11)：



5.2. Test of Maximum Peak Output Power

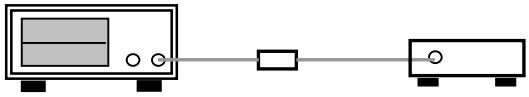
5.2.1 Measuring Instruments

Item 17, 19 of the table on section 6.

5.2.2 Test Procedures

1. The transmitter output was connected to the power meter through a peak detector.
2. Record peak value from the meter.
3. Repeated the 1~2 for the middle and highest channel of the EUT.

5.2.3 Test Setup Layout



Power meter **EUT**

5.2.4 Test Result：See spectrum analyzer plots below

- Modulation Type: CCK
- Temperature: 25°C
- Relative Humidity: 65 %
- Duty Cycle of the Equipment During the Test: 100%
- Test Engineer: Sam Lee

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (mWatt)	Limits (dBm)
01	2412	19.79	60.12	30 dBm
06	2437	16.81	47.97	30 dBm
11	2462	16.01	39.90	30 dBm

- Modulation Type: OFDM
- Temperature: 25°C
- Relative Humidity: 65 %
- Duty Cycle of the Equipment During the Test: 100%
- Test Engineer: Sam Lee

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (mWatt)	Limits (dBm)
01	2412	18.27	67.14	30 dBm
06	2437	17.09	51.17	30 dBm
11	2462	17.18	52.24	30 dBm

5.3. Test of Peak Power Spectral Density

5.3.1 Measuring Instruments

Item 16 of the table on section 6.

5.3.2 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.

5.3.3 Test Setup Layout

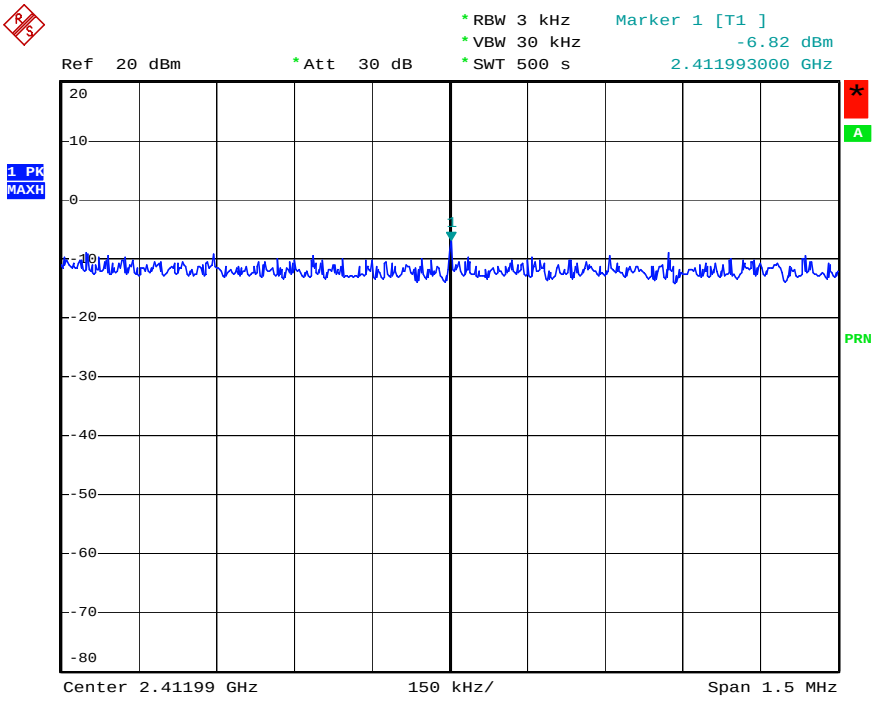
Spectrum analyzer **EUT**

5.3.4 Test Result : See spectrum analyzer plots below

- Modulation Type: CCK
- Temperature: 25°C
- Relative Humidity: 65 %
- Duty Cycle of the Equipment During the Test: 100%
- Test Engineer: Sam Lee

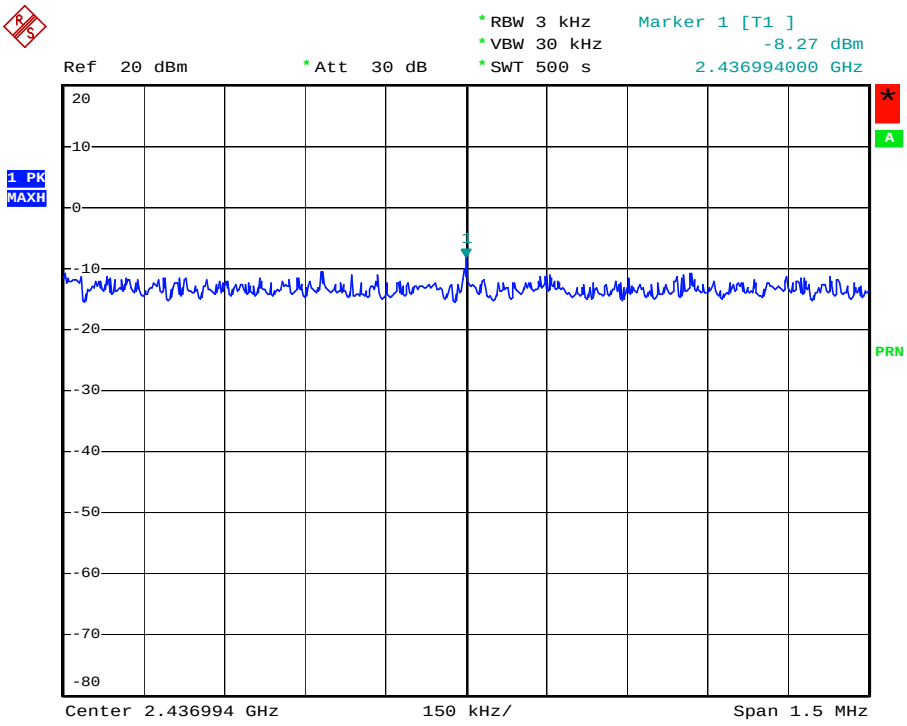
Channel	Frequency (MHz)	Power Density (dBm)	Limits (dBm)
01	2412	-6.82	8
06	2437	-8.27	8
11	2462	-9.09	8

Modulation Type: CCK (Channel 01)：



Date: 28.JUL.2004 16:01:44

Modulation Type: CCK (Channel 06)：



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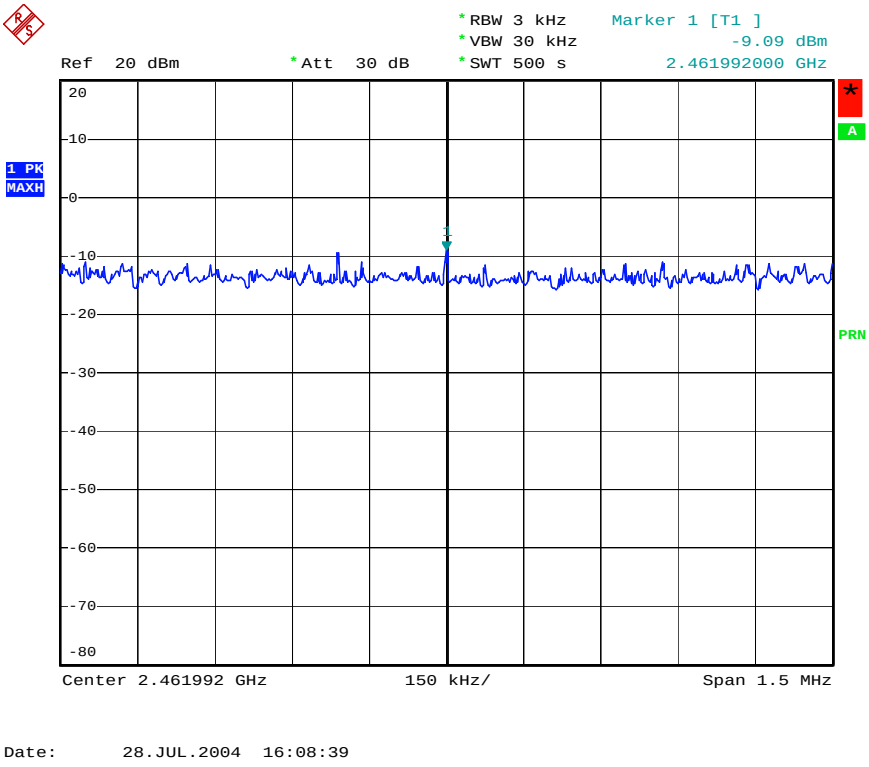
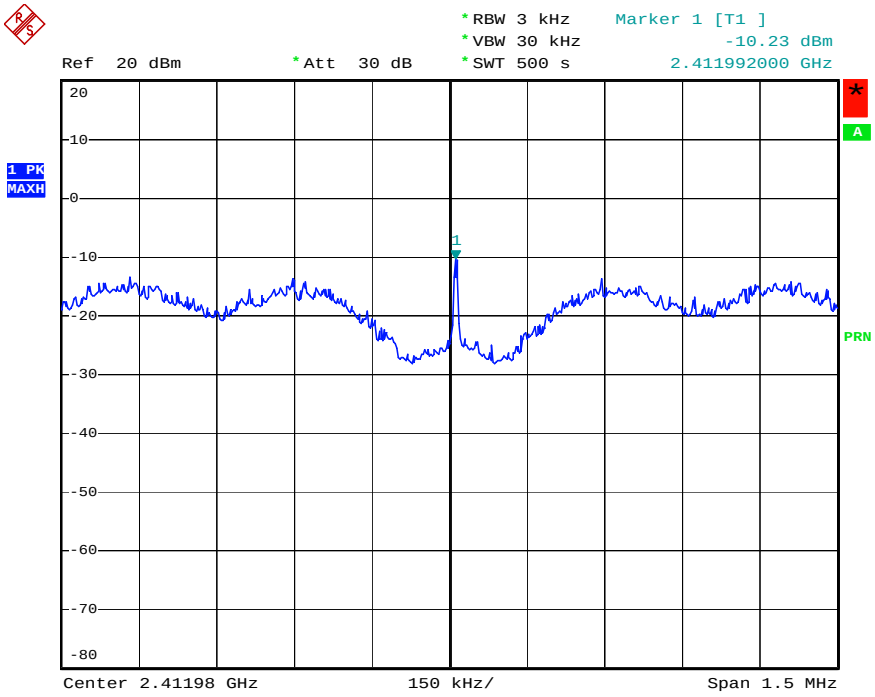
Modulation Type: CCK (Channel 11)：



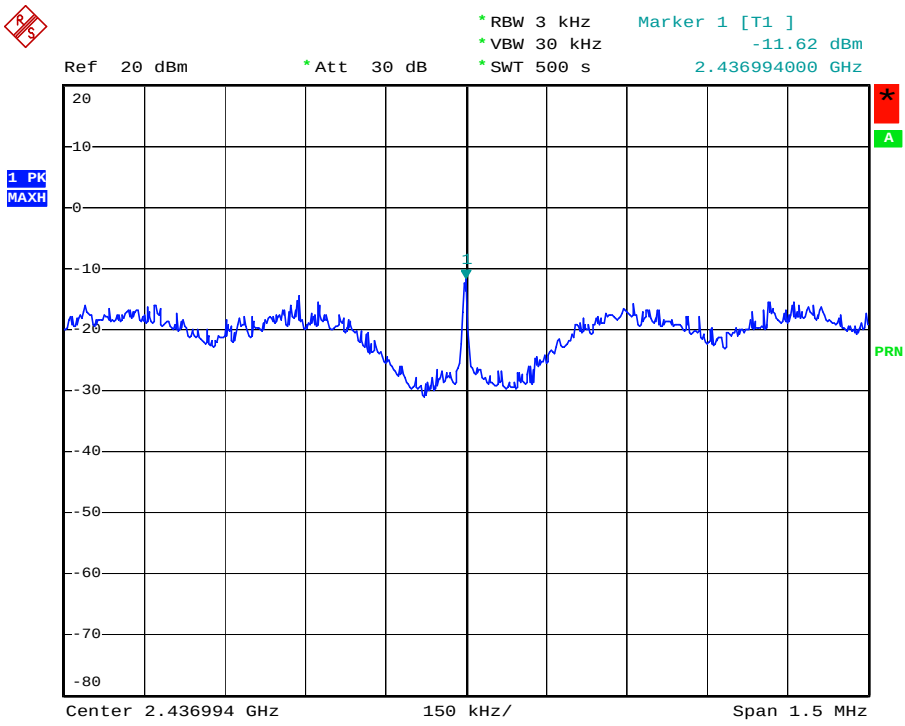
- Modulation Type: OFDM
- Temperature: 25°C
- Relative Humidity: 65 %
- Duty Cycle of the Equipment During the Test: 100%
- Test Engineer: Sam Lee

Channel	Frequency (MHz)	Power Density (dBm)	Limits (dBm)
01	2412	-10.23	8
06	2437	-11.62	8
11	2462	-12.13	8

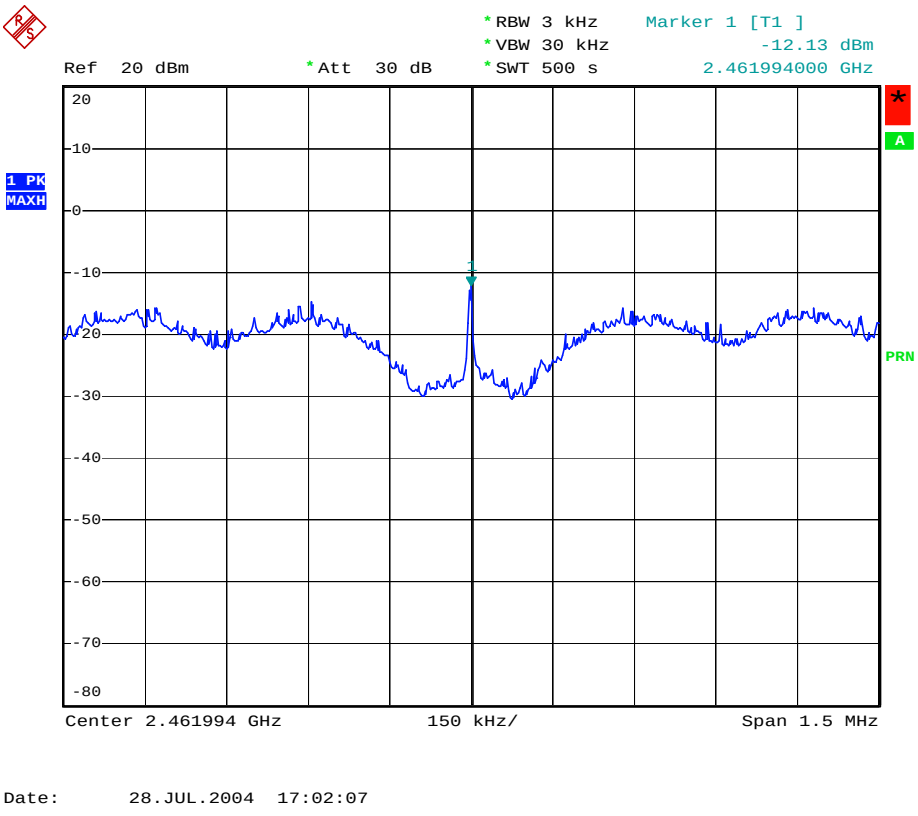
Modulation Type: OFDM (Channel 01)：



Modulation Type: OFDM (Channel 06)：



Modulation Type: OFDM(Channel 11)：



5.4. Test of Band Edges Emission

5.4.1 Measuring Instruments

Item 16 of the table on section 6.

5.4.2 Test Procedures

1. The transmitter is set to the lowest channel.
2. The transmitter output was connected to the spectrum analyzer via a cable and cable loss is used as the offset of the spectrum analyzer.
3. Set both RBW and VBW of spectrum analyzer to 100KHz with convenient frequency span including 100MHz bandwidth from lower band edge.
4. The lowest band edges emission was measured and recorded.
5. The transmitter set to the highest channel and repeated 2~4.

5.4.3 Test Result :

- Modulation Type: CCK
- Test Engineer: Sam Lee

(A) Left Edge

The band edge emission plot shows 54.65dB delta between carrier maximum power and local maximum emission in the restricted band.

CH01 Carrier power strength (dBuV/m)	Delta (dB)	The maximum field strength in restrict band (dBuV/m)	Limit (dBuV/m)	Margin (dB)
103.56	54.65	48.91	54.00	-5.09

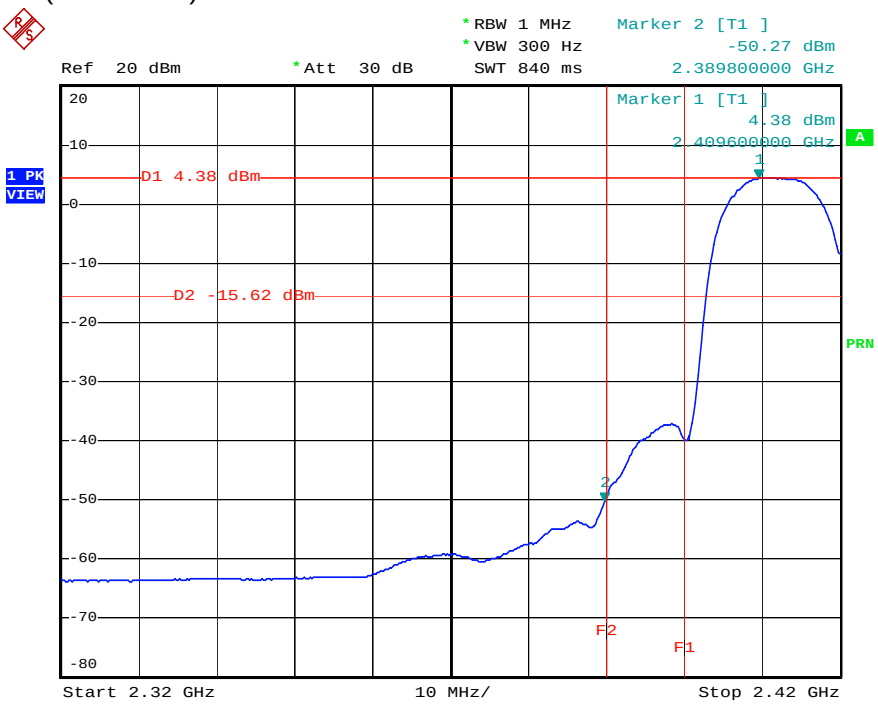
(B) Right Edge

The band edge emission plot shows 57.71 dB delta between carrier maximum power and local maximum emission in the restricted band.

CH11 Carrier power strength (dBuV/m)	Delta (dB)	The maximum field strength in restrict band (dBuV/m)	Limit (dBuV/m)	Margin (dB)
101.61	57.71	43.90	54.00	-10.10

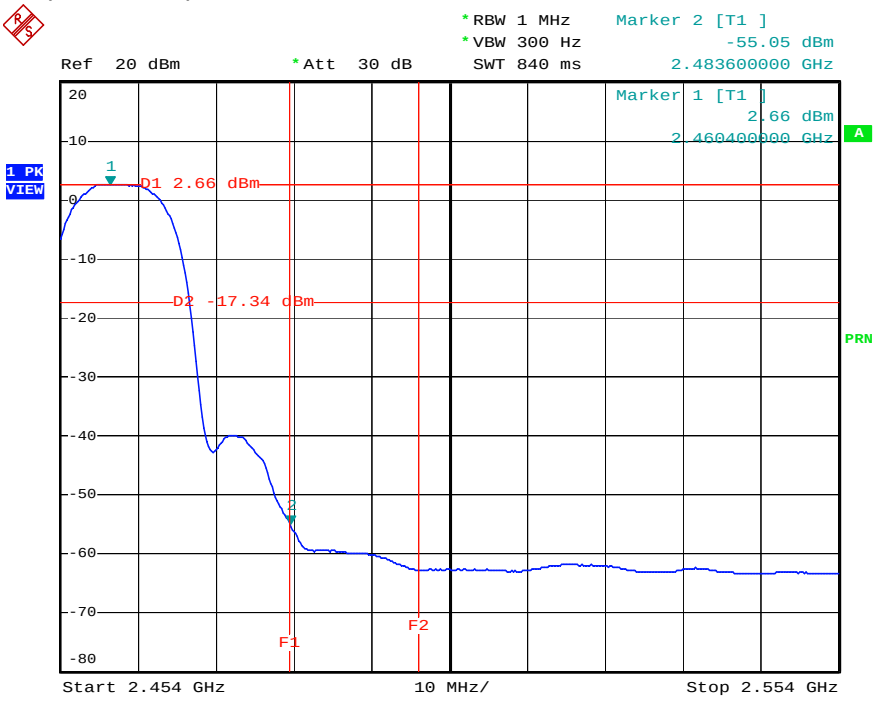
＊The maximum field strength in restricted band is the emission of carrier power strength subtract to the delta between carrier maximum power and local maximum emission in the restricted band

Modulation Type: CCK (Channel 01)：



Date: 28.JUL.2004 16:17:38

Modulation Type: CCK (Channel 11)：



Date: 28.JUL.2004 16:24:10

Observation： All emissions in the 100kHz bandwidth are 20dB lower than the carrier strength.

5.4.4 Test Result :

- Modulation Type: OFDM
- Test Engineer: Sam Lee

(A) Left Edge

The band edge emission plot shows 45.81dB delta between carrier maximum power and local maximum emission in the restricted band.

CH01 Carrier power strength (dBuV/m)	Delta (dB)	The maximum field strength in restrict band (dBuV/m)	Limit (dBuV/m)	Margin (dB)
96.41	45.81	50.60	54.00	-3.40

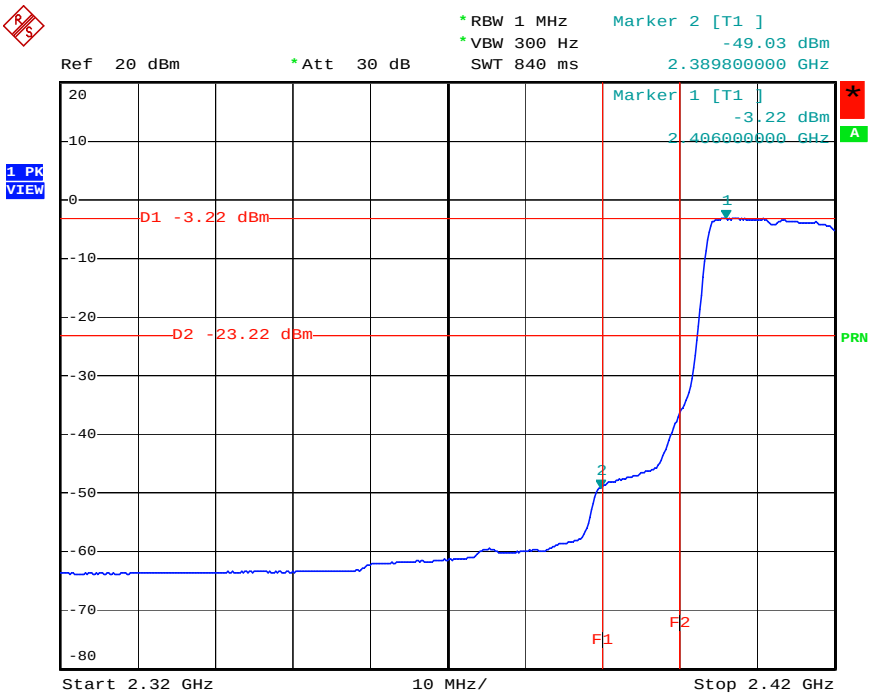
(B) Right Edge

The band edge emission plot shows 48.80 dB delta between carrier maximum power and local maximum emission in the restricted band.

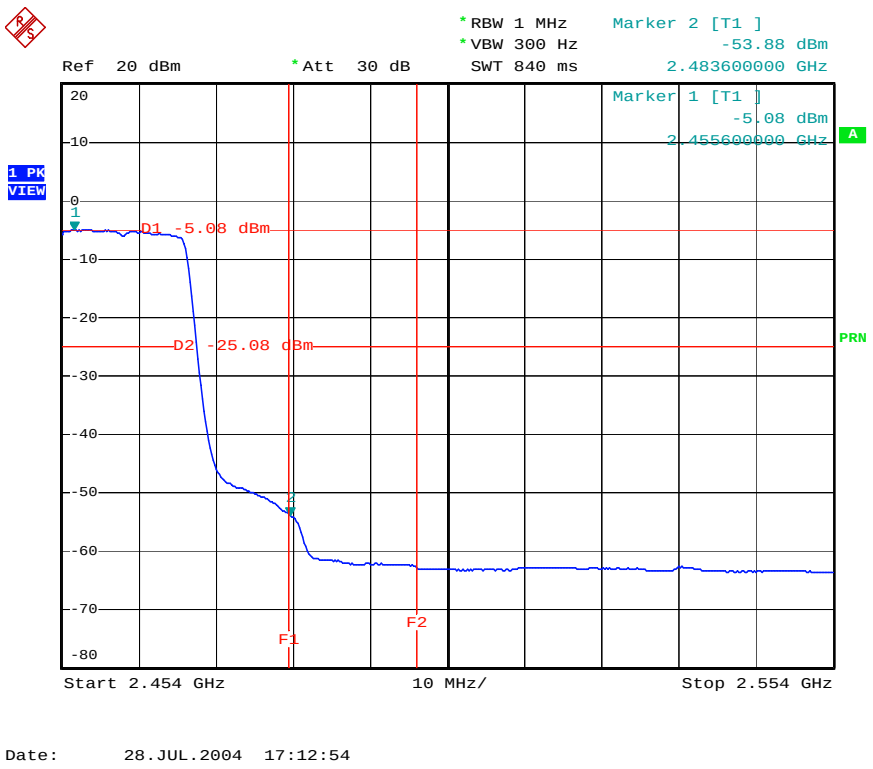
CH11 Carrier power strength (dBuV/m)	Delta (dB)	The maximum field strength in restrict band (dBuV/m)	Limit (dBuV/m)	Margin (dB)
95.22	48.80	46.42	54.00	-7.58

∗ 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

Modulation Type: OFDM(Channel 01)：



Modulation Type: OFDM(Channel 11)：



Observation： All emissions in the 100kHz bandwidth are 20dB lower than the carrier strength.

5.5. Test of AC Power Line Conducted Emission

5.5.1 Measuring Instruments

Please reference item 1~4 in chapter 6 for the instruments used for testing.

5.5.2 Test Procedures

1. Configure the EUT according to ANSI C63.4.
2. The EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
3. Connect EUT to the power mains through a line impedance stabilization network (LISN).
4. All the support units are connected to the other LISNs. The LISN should provides 50uH/50ohms coupling impedance.
5. The frequency range from 150 KHz to 30 MHz was searched.
6. Use the Channel & Power Controlling software to make the EUT working on selected channel and expected output power, then use the “H” Patter Generator software to make the supporting equipments stay on working condition.
7. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
8. The measurement has to be done between each power line and ground at the power terminal for each RF channel. Only one RF channel has to be investigated since this test is independent with the RF channel selection.

5.5.3 Test Result of Conducted Emission

Test Mode	USB Mode	Tested By	Neil Huang
Temperature / Humidity	24deg. C / 59%		

Line to Ground

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1 @	0.151	51.23	-14.70	65.93	51.13	0.10	0.00	QP
2 @	0.151	42.54	-13.39	55.93	42.44	0.10	0.00	Average
3 @	0.189	50.12	-13.96	64.08	50.02	0.10	0.00	QP
4 @	0.189	38.11	-15.97	54.08	38.01	0.10	0.00	Average
5 @	0.264	47.89	-13.40	61.29	47.79	0.10	0.00	QP
6	0.264	30.00	-21.29	51.29	29.90	0.10	0.00	Average
7 @	0.378	44.98	-13.33	58.31	44.88	0.10	0.00	QP
8	0.378	21.86	-26.45	48.31	21.76	0.10	0.00	Average
9	0.679	32.22	-23.78	56.00	32.06	0.10	0.06	QP
10	0.679	12.03	-33.97	46.00	11.87	0.10	0.06	Average
11	4.870	17.83	-38.17	56.00	17.53	0.20	0.10	QP
12	4.870	12.78	-33.22	46.00	12.48	0.20	0.10	Average

Neutral to Ground

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1 @	0.151	51.21	-14.72	65.93	51.11	0.10	0.00	QP
2	0.151	30.21	-25.72	55.93	30.11	0.10	0.00	Average
3 @	0.220	49.32	-13.50	62.82	49.22	0.10	0.00	QP
4	0.220	21.08	-31.74	52.82	20.98	0.10	0.00	Average
5 @	0.348	46.76	-12.25	59.01	46.66	0.10	0.00	QP
6	0.348	20.01	-29.00	49.01	19.91	0.10	0.00	Average
7	0.535	35.21	-20.79	56.00	35.08	0.10	0.03	QP
8	0.535	12.20	-33.80	46.00	12.07	0.10	0.03	Average
9	0.708	31.69	-24.31	56.00	31.53	0.10	0.06	QP
10	0.708	11.73	-34.27	46.00	11.57	0.10	0.06	Average
11	12.116	27.54	-32.46	60.00	27.09	0.30	0.15	QP
12	12.116	24.05	-25.95	50.00	23.60	0.30	0.15	Average

Test Mode	LAN : 100M Mode	Tested By	Neil Huang
Temperature / Humidity	24deg. C / 59%		

Line to Ground

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1 @	0.151	51.31	-14.62	65.93	51.21	0.10	0.00	QP
2	0.151	28.89	-27.04	55.93	28.79	0.10	0.00	Average
3 @	0.244	48.84	-13.12	61.96	48.74	0.10	0.00	QP
4	0.244	20.65	-31.31	51.96	20.55	0.10	0.00	Average
5 @	0.381	45.96	-12.30	58.26	45.86	0.10	0.00	QP
6	0.381	18.28	-29.98	48.26	18.18	0.10	0.00	Average
7	0.644	32.31	-23.69	56.00	32.16	0.10	0.05	QP
8	0.644	10.19	-35.81	46.00	10.04	0.10	0.05	Average
9 @	12.061	34.91	-15.09	50.00	34.56	0.20	0.15	Average
10	12.061	34.93	-25.07	60.00	34.58	0.20	0.15	QP
11 @	22.568	35.41	-14.59	50.00	34.85	0.31	0.25	Average
12	22.568	36.26	-23.74	60.00	35.70	0.31	0.25	QP

Neutral to Ground

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1 @	0.150	51.25	-14.75	66.00	51.15	0.10	0.00	QP
2	0.150	27.69	-28.31	56.00	27.59	0.10	0.00	Average
3 @	0.226	48.99	-13.61	62.60	48.89	0.10	0.00	QP
4	0.226	21.56	-31.04	52.60	21.46	0.10	0.00	Average
5 @	0.377	45.25	-13.10	58.35	45.15	0.10	0.00	QP
6	0.377	17.55	-30.80	48.35	17.45	0.10	0.00	Average
7	0.634	32.71	-23.29	56.00	32.56	0.10	0.05	QP
8	0.634	10.44	-35.56	46.00	10.29	0.10	0.05	Average
9	10.963	32.95	-27.05	60.00	32.53	0.30	0.12	QP
10	10.963	32.49	-17.51	50.00	32.07	0.30	0.12	Average
11 @	22.567	42.91	-17.09	60.00	42.31	0.35	0.25	QP
12 @	22.567	42.71	-7.29	50.00	42.11	0.35	0.25	Average

Test Mode	LAN : 10M Mode	Tested By	Neil Huang
Temperature / Humidity	24deg. C / 59%		

Line to Ground

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1 @	0.150	51.29	-14.71	66.00	51.19	0.10	0.00	QP
2	0.150	25.15	-30.85	56.00	25.05	0.10	0.00	Average
3 @	0.205	49.79	-13.60	63.39	49.69	0.10	0.00	QP
4	0.205	23.63	-29.76	53.39	23.53	0.10	0.00	Average
5 @	0.309	47.55	-12.45	60.00	47.45	0.10	0.00	QP
6	0.309	22.06	-27.94	50.00	21.96	0.10	0.00	Average
7	0.697	31.85	-24.15	56.00	31.69	0.10	0.06	QP
8	0.697	10.96	-35.04	46.00	10.80	0.10	0.06	Average
9 @	12.306	35.26	-14.74	50.00	34.91	0.20	0.15	Average
10	12.306	35.43	-24.57	60.00	35.08	0.20	0.15	QP
11	17.695	36.57	-23.43	60.00	36.17	0.20	0.20	QP
12 @	17.695	34.05	-15.95	50.00	33.65	0.20	0.20	Average

Neutral to Ground

	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1 @	0.150	51.29	-14.71	66.00	51.19	0.10	0.00	QP
2	0.150	30.42	-25.58	56.00	30.32	0.10	0.00	Average
3 @	0.208	49.53	-13.75	63.28	49.43	0.10	0.00	QP
4	0.208	22.92	-30.36	53.28	22.82	0.10	0.00	Average
5 @	0.309	47.03	-12.96	59.99	46.93	0.10	0.00	QP
6	0.309	21.35	-28.64	49.99	21.25	0.10	0.00	Average
7	0.654	32.53	-23.47	56.00	32.38	0.10	0.05	QP
8	0.654	10.63	-35.37	46.00	10.48	0.10	0.05	Average
9	12.061	31.95	-28.05	60.00	31.50	0.30	0.15	QP
10	12.061	31.82	-18.18	50.00	31.37	0.30	0.15	Average
11	17.694	30.95	-29.05	60.00	30.45	0.30	0.20	QP
12	17.694	28.20	-21.80	50.00	27.70	0.30	0.20	Average

5.5.4 Photographs of Conducted Emission Test Configuration

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

USB Mode

5.6. Test of Spurious Radiated Emission

5.6.1 Measuring Instruments

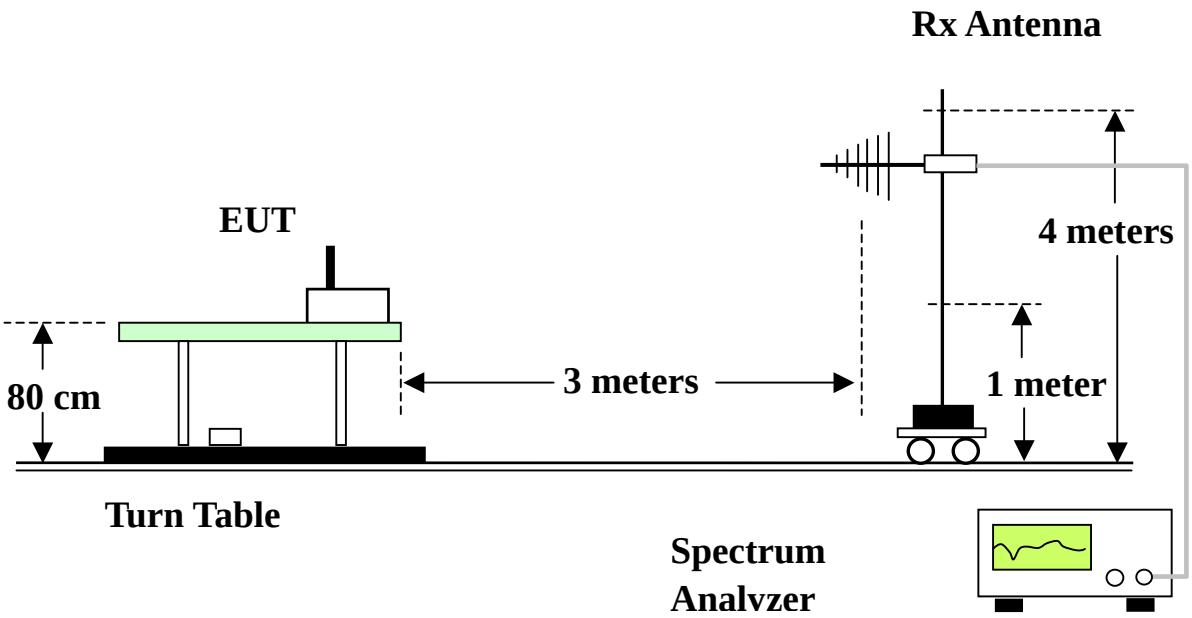
Please reference item 5~16 in chapter 6 for the instruments used for testing.

5.6.2 Test Procedures

1. Configure the EUT according to ANSI C63.4.
2. The EUT was placed on the top of the turn table 0.8 meter above ground.
3. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turn table.
4. Power on the EUT and all the supporting units.
5. The turn table was rotated by 360 degrees to determine the position of the highest radiation.
6. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.

7. For each suspected emission, the antenna tower was scan (from 1 M to 4 M) and then the turn table was rotated (from 0 degree to 360 degrees) to find the maximum reading.
8. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
9. For emission above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
10. If the emission level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz and average method for above the 1GHz. the reported.
11. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB higher 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.

5.6.3 Test Setup Layout



5.6.4 Test Results and Limit

Note:
Emission level (dBuV/m) = 20 log Emission level (uV/m)
Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

Test Mode	CH11 OFDM	**Temperature**	24 deg. C	**Tested By**	Steve Chen
Freq. Range	30MHz~1GHz	**Humidity**	65%		

(A) Polarization: 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 !	148.150	38.40	-5.10	43.50	51.70	12.27	2.23	27.80	QP	---	---
2	151.550	37.00	-6.50	43.50	50.11	12.43	2.26	27.80	QP	---	---
3 !	155.630	40.44	-3.06	43.50	53.41	12.55	2.27	27.79	QP	---	---
1 !	343.200	43.68	-2.32	46.00	52.68	15.30	3.21	27.51	QP	---	---
2 !	374.400	44.47	-1.53	46.00	53.41	15.35	3.38	27.67	QP	---	---
3 !	499.200	41.13	-4.87	46.00	48.60	17.34	3.88	28.69	QP	---	---

(B) Polarization: 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 !	34.420	38.70	-1.30	40.00	52.55	13.18	1.01	28.04	QP	---	---
2 !	151.550	42.02	-1.48	43.50	55.13	12.43	2.26	27.80	QP	---	---
3 !	155.630	42.27	-1.23	43.50	55.24	12.55	2.27	27.79	QP	123	157
1 !	343.200	40.86	-5.14	46.00	49.86	15.30	3.21	27.51	QP	---	---
2 !	374.400	42.40	-3.60	46.00	51.34	15.35	3.38	27.67	QP	---	---
3 !	499.200	40.85	-5.15	46.00	48.32	17.34	3.88	28.69	QP	---	---

Modulation Type	CCK				
Test Mode	CH 01 2412MHz	Temperature	24 deg. C	Tested By	Steve Chen
Freq. Range	1GHz~25GHz	Humidity	65%		

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	1572.000	47.93	-6.07	54.00	63.54	25.52	1.49	42.62	Average	---	---
2	2570.000	46.20	-7.80	54.00	58.26	28.69	1.90	42.65	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	1598.000	48.24	-5.76	54.00	63.73	25.62	1.51	42.62	Average	104	156
2	2212.000	46.11	-7.89	54.00	59.39	27.67	1.70	42.65	Average	---	---

Modulation Type	CCK				
Test Mode	CH 06 2437MHz	Temperature	24 deg. C	Tested By	Steve Chen
Freq. Range	1GHz~25GHz	Humidity	65%		

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	1504.000	44.35	-9.65	54.00	60.22	25.27	1.46	42.60	Average	---	---
2	2000.000	45.77	-8.23	54.00	59.83	27.11	1.53	42.70	Average	---	---
3	2552.000	49.36	-4.64	54.00	61.50	28.62	1.88	42.64	Average	103	216

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	1344.000	46.77	-7.23	54.00	63.16	24.80	1.35	42.54	Average	---	---
2	1602.000	42.62	-11.38	54.00	58.09	25.64	1.51	42.62	Average	---	---
3	1812.000	44.24	-9.76	54.00	58.88	26.42	1.60	42.66	Average	---	---

Modulation Type	CCK				
Test Mode	CH 11 2462MHz	Temperature	24 deg. C	Tested By	Steve Chen
Freq. Range	1GHz~25GHz	Humidity	65%		

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	1364.000	47.95	-6.05	54.00	64.30	24.86	1.34	42.55	Average	102	259
2	2280.000	46.35	-7.65	54.00	59.40	27.85	1.74	42.64	Average	---	---
3	2804.000	46.85	-7.15	54.00	58.18	29.51	1.95	42.79	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	1450.000	42.05	-11.95	54.00	58.07	25.10	1.46	42.58	Average	---	---
2	2000.000	45.91	-8.09	54.00	59.97	27.11	1.53	42.70	Average	---	---
3	2210.000	48.13	-5.87	54.00	61.42	27.67	1.70	42.66	Average	---	---

Modulation Type	OFDM				
Test Mode	CH 01 2412MHz	Temperature	24 deg. C	Tested By	Steve Chen
Freq. Range	1GHz~25GHz	Humidity	65%		

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	1472.000	45.93	-8.07	54.00	61.90	25.16	1.46	42.59	Average	---	---
2	1888.000	43.89	-10.11	54.00	58.29	26.70	1.58	42.68	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	1598.000	45.32	-8.68	54.00	60.81	25.62	1.51	42.62	Average	---	---
2	1980.000	46.83	-7.17	54.00	60.97	27.04	1.52	42.70	Average	102	229

Modulation Type	OFDM				
Test Mode	CH 06 2437MHz	Temperature	24 deg. C	Tested By	Steve Chen
Freq. Range	1GHz~25GHz	Humidity	65%		

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	1708.000	46.16	-7.84	54.00	61.28	26.03	1.49	42.64	Average	101	181
2	1966.000	43.36	-10.64	54.00	57.54	26.99	1.53	42.70	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	1544.000	45.38	-8.62	54.00	61.10	25.42	1.47	42.61	Average	---	---
2	2370.000	44.20	-9.80	54.00	57.03	28.09	1.70	42.62	Average	---	---

Modulation Type	OFDM				
Test Mode	CH 11 2462MHz	Temperature	24 deg. C	Tested By	Steve Chen
Freq. Range	1GHz~25GHz	Humidity	65%		

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	1358.000	44.02	-9.98	54.00	60.38	24.84	1.34	42.54	Average	---	---
2	2538.000	46.23	-7.77	54.00	58.42	28.57	1.87	42.63	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	1608.000	44.80	-9.20	54.00	60.25	25.66	1.51	42.62	Average	---	---
2	2370.000	46.50	-7.50	54.00	59.33	28.09	1.70	42.62	Average	104	167

Remark: all other emission except listed above are under limit by more than 20dB.

5.6.5 Photographs of Radiated Emission Test Configuration

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

5.7. Antenna Requirements

5.7.1 Standard Applicable

47 CFR Part15 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.

47 CFR Part15 Section 15.247 (b):
If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
If the intentional radiator is used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

5.7.2 Antenna Connected Construction

The antenna used in this product is Monopole Antenna, and the antenna connector is UFL.

5.8. RF Exposure

5.8.1 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/ cm²)	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/cm²)	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

5.8.2 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.

5.8.3 Calculated Result and Limit

Modulation Type: CCK

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 00	4.5	2.82	19.7900	60.12	0.0337	1
Channel 39	4.5	2.82	16.8100	47.97	0.0269	1
Channel 78	4.5	2.82	16.0100	39.90	0.0224	1

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

Modulation Type: OFDM

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 00	4.5	2.82	18.27	67.14	0.0377	1
Channel 39	4.5	2.82	17.09	51.17	0.0287	1
Channel 78	4.5	2.82	17.18	52.24	0.0293	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	Receiver	R&S	ESCS 30	838251/003	9 KHz - 2.75 GHz	Jan. 29, 2004	Conduction (CO01-LK)
2	LISN	EMCO	3810/2	9703-1838	9KHz ~ 30MHz	Sep. 05, 2003	Conduction (CO01-LK)
3	LISN	Rolf Hoine	NNB-2/16Z	98087	9KHz ~ 30MHz	Aug. 25, 2003	Conduction (CO01-LK)
4	RF Cable-CON	Suhner Switzerland	RG223/U	CB017	9KHz~30MHz	Dec. 18, 2003	Conduction (CO01-LK)
5	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz~1GHz 3m	Jun. 21, 2004	Radiation (03CH03-HY)
6	Spectrum analyzer	R&S	FSP40	100004	9KHZ~40GHz	Aug. 23, 2003	Radiation (03CH03-HY)
7	Amplifier	HP	8447D	2944A09072	100KHz – 1.3GHz	Nov. 05, 2003	Radiation (03CH03-HY)
8	Biconical Antenna	SCHWARZBECK	VHBB 9124	301	30MHz –200MHz	Jul. 28, 2004	Radiation (03CH03-HY)
9	Log Antenna	SCHWARZBECK	VUSLP 9111	221	200MHz -1GHz	Jul. 28, 2004	Radiation (03CH03-HY)
10	RF Cable-R03m	Jye Bao	RG142	CB021	30MHz~1GHz	Dec. 03, 2003	Radiation (03CH03-HY)
11	Amplifier	MITEQ	AFS44	849984	100MHz~26.5GHz	Mar. 26, 2004	Radiation (03CH03-HY)
12	Horn Antenna	EMCO	3115	6821	1GHz – 18GHz	Sep. 12, 2003	Radiation (03CH03-HY)
13	Turn Table	HD	DS 420	420/650/00	0 ~ 360 degree	N/A	Radiation (03CH03-HY)
14	Antenna Mast	HD	MA 240	240/560/00	1 m - 4 m	N/A	Radiation (03CH03-HY)
15	Horn Antenna	Schwarzbeck	BBHA9170	154	15GHz~40GHz	Jun. 09, 2004	Radiation (03CH03-HY)
16	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
16	Spectrum analyzer	R&S	FSP7	838858/014	9KHZ~7GHZ	Sep. 03, 2003	Conducted (TH01-HY)
17	Power meter	R&S	NRVS	100967	DC~40GHz	Mar. 02, 2004	Conducted (TH01-HY)
18	Power sensor	R&S	NRV-Z51	100666	DC~40GHz	Mar 18, 2004	Conducted (TH01-HY)
19	Power Sensor	R&S	NRV-Z32	836953/060	30MHz-6GHz	Mar. 11, 2004	Conducted (TH01-HY)
20	AC power source	G.W.	GPC-6030D	C671845	DC 1V~60V	Nov. 06, 2003	Conducted (TH01-HY)
21	Temp. and Humidity Chamber	KSON	THS-C3L	612	N/A	Oct. 01, 2003	Conducted (TH01-HY)
22	RF CABLE-1m	Jye Bao	RG142	CB034-1m	20MHz~7GHz	Jan. 01, 2004	Conducted (TH01-HY)
23	RF CABLE-2m	Jye Bao	RG142	CB035-2m	20MHz~1GHz	Jan. 01, 2004	Conducted (TH01-HY)

※ Calibration Interval of instruments listed above is one year.