FCC TEST REPORT

CATEGORY	:	Mobile
PRODUCT NAME	:	2.4/5.0 GHz IEEE 802.11 Super a+g 108Mbps Wireless LAN Router
FCC ID.	:	SJ9-BLW54SAG
FILING TYPE	:	Certification
BRAND NAME	:	PLANEX
MODEL NAME	:	BLW-54SAG
APPLICANT	:	**Planex Communication Inc.** 7F, No.108, Min-Chyuan Rd., Hsin-Tien, Taipei Hsien, Taiwan, R.O.C.
MANUFACTURER	:	**Gemtek Technology Co., Ltd.** No.1, Jen-Ai Road, HsinChu Industrial Park, HuKou Hsiang, HsinChu Hsien, Taiwan, R.O.C.
ISSUED BY	:	**SPORTON INTERNATIONAL INC.** 6F, No. 106, Sec. 1, Hsin Tai Wu Rd., His Chih, Taipei Hsien, Taiwan, R.O.C.

Statements:

This report is only for the 802.11b/g part of the test result.

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 and any agency of U.S. government.

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

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ILAC MRA

Table of Contents

HISTORY OF THIS TEST REPORT ..... **II**

CERTIFICATE OF COMPLIANCE ..... **III**

1. GENERAL DESCRIPTION OF EQUIPMENT UNDER TEST **1**

1.1. Applicant 1
1.2. Manufacturer 1
1.3. Basic Description of Equipment under Test 1
1.4. Features of Equipment under Test 1
1.5. Antenna Description 1
1.6. Table for Carrier Frequencies 2

2. TEST CONFIGURATION OF THE EQUIPMENT UNDER TEST **3**

2.1. Connection Diagram of Test System 3
2.2. The Test Mode Description 3
2.3. Description of Test Supporting Units 3

3. GENERAL INFORMATION OF TEST **4**

3.1. Test Facility 4
3.2. Standards for Methods of Measurement 4
3.3. DoC Statement 4
3.4. Frequency Range Investigated 4
3.5. Test Distance 4
3.6. Test Software 4

4. LIST OF MEASUREMENTS **5**

4.1. Summary of the Test Results 5

5. TEST RESULT **6**

5.1. Test of 6dB Spectrum Bandwidth 6
5.2. Test of Maximum Peak Conducted Output Power 12
5.3. Test of Peak Power Spectral Density 13
5.4. Test of Band Edges Emission 19
5.5. Test of AC Power Line Conducted Emission 25
5.6. Test of Spurious Radiated Emission 36
5.7. Antenna Requirements 48
5.8. RF Exposure 49

6. LIST OF MEASURING EQUIPMENTS USED **51**

7. COMPANY PROFILE **53**

7.1. Certificate of Accreditation 53
7.2. Test Location 53

8. CNLA CERTIFICATE OF ACCREDITATION **54**

APPENDIX A. PHOTOGRAPHS OF EUT ..... **A1 ~ A16**

HISTORY OF THIS TEST REPORT

Received Date: Feb. 23, 2005
Test Date: Mar. 30, 2005
Original Report Issue Date: Mar. 30, 2005
Report No.: FR522308

■ No additional attachment.
☐ Additional attachment were issued as following record:

Attachment No.	Issue Date	Description

CERTIFICATE OF COMPLIANCE

with

47 CFR FCC Part 15 Subpart C

PRODUCT NAME	:	2.4/5.0 GHz IEEE 802.11 Super a+g 108Mbps Wireless LAN Router
BRAND NAME	:	PLANEX
MODEL NAME	:	BLW-54SAG
APPLICANT	:	**Planex Communication Inc.** 7F, No.108, Min-Chyuan Rd., Hsin-Tien, Taipei Hsien, Taiwan, R.O.C.
MANUFACTURER	:	**Gemtek Technology Co., Ltd.** No.1, Jen-Ai Road, HsinChu Industrial Park, HuKou Hsiang, HsinChu Hsien, Taiwan, R.O.C.

I **HEREBY** CERTIFY THAT:

The measurements shown in this test report were made in accordance with the procedures given in ANSI C63.4-2003 and all test are performed according to 47 CFR FCC Part 15 Subpart C. Testing was carried out on Mar. 30, 2005 at SPORTON International Inc. LAB.

Wayne Hsu

1. General Description of Equipment under Test

1.1. Applicant

Planex Communication Inc.
7F, No.108, Min-Chyuan Rd., Hsin-Tien, Taipei Hsien, Taiwan, R.O.C.

1.2. Manufacturer

Gemtek Technology Co., Ltd.
No.1, Jen-Ai Road, HsinChu Industrial Park, HuKou Hsiang, HsinChu Hsien, Taiwan, R.O.C.

1.3. Basic Description of Equipment under Test

This product is a wireless router with 802.11a/b/g wireless solution. The technical data has been listed on section " Features of Equipment under Test ". This report is for the 802.11b/g part.

1.4. Features of Equipment under Test

Items	Description
Type of Modulation	DSSS (CCK / DQPSK / DBPSK) OFDM (64QAM / 16QAM / DQPSK / DBPSK)
Number of Channels	11
Frequency Band	2400MHz ~ 2483.5 MHz
Carrier Frequency	See section 1.6 for details
Data Rate	1, 2, 5.5, 11 Mbps – DSSS 6,12,18,24,36,48,54, 108 Mbps – OFDM
Max. Conducted Output Power	DSSS : 20.00 dBm OFDM : 18.00 dBm
Antenna Type	See section 1.5 for details
Testing Duty Cycle	100.00%
EUT Power Source	5V DC from power adapter (110.00V AC)
Temperature Range (Operating)	0 ~ 40 °C
Power Adapter	Mode 1: LEADER (MU15-050250-C5), 100-240VAC Mode 2: LINKSYS (MU15-050250-C5), 100-240VAC Mode 3: LEADER (MT15-5050250A1), 100-120VAC

1.5. Antenna Description

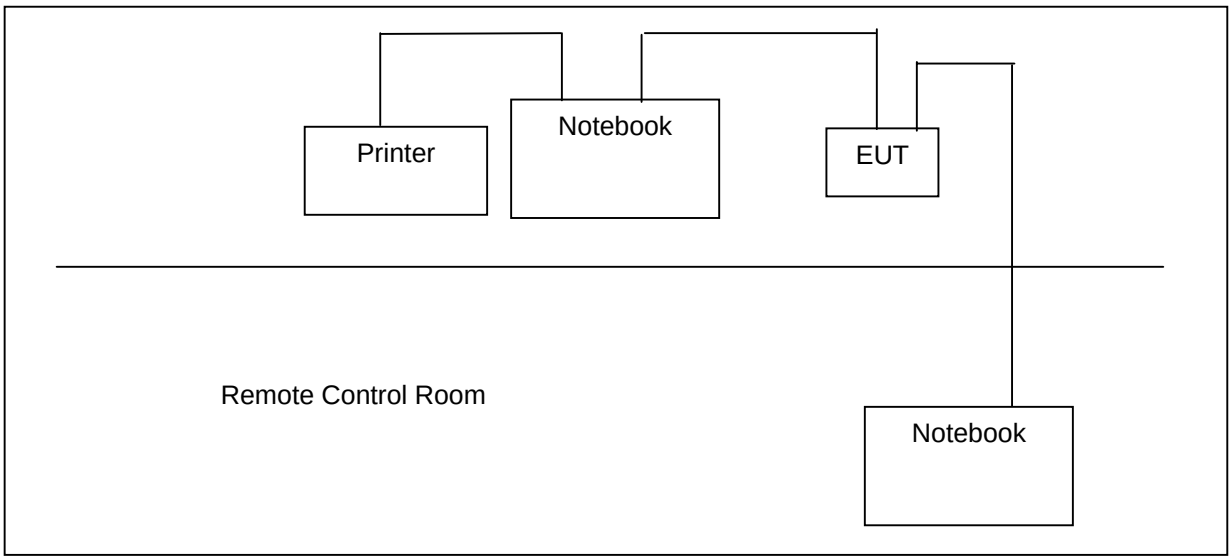
No.	Antenna Type	Gain (dBi)
1	Dipole Antenna	2.00

1.6. Table for Carrier Frequencies

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
01	2412 MHz	05	2432 MHz	09	2452 MHz	-	-
02	2417 MHz	06	2437 MHz	10	2457 MHz	-	-
03	2422 MHz	07	2442 MHz	11	2462 MHz	-	-
04	2427 MHz	08	2447 MHz	-	-	-	-

2. Test Configuration of the Equipment under Test

2.1. Connection Diagram of Test System



2.2. The Test Mode Description

1. For DSSS modulation, CCK (11 Mbps) is the worst case on all test items.
2. For OFDM modulation, BPSK (6 Mbps) is the worst case on all test items.
3. According to ANSI C63.4-2003: If frequency range of EUT is more than 10 MHz, lowest, middle and highest channels of EUT has to be tested.
4. Spurious emission below 1GHz is independent of channel selection and modulation types. So only channel 11 with OFDM modulation was tested.
5. AC conduction emission is independent of channel selection and modulation types. So only channel 11 with OFDM modulation was tested.
6. There are 3 power adapters used for AC conduction:
   Mode 1: LEADER (MU15-050250-C5), 100-240VAC
   Mode 2: LINKSYS (MU15-050250-C5), 100-240VAC
   Mode 3: LEADER (MT15-5050250A1), 100-120VAC
7. There are 2 modes for radiation (below 1GHz) measurement:
   Mode 1: LEADER (MU15-050250-C5), 100-240VAC, LINKSYS (MU15-050250-C5), 100-240VAC
   Mode 2: LEADER (MT15-5050250A1), 100-120VAC

2.3. Description of Test Supporting Units

Support unit	Brand	Model No.	FCC ID	Data cable (m)
Notebook	DELL	D505	DoC	10
Printer	EPSON	Stylus Color 680	DoC	1.35

3. General Information of Test

3.1. Test Facility

Test Site Location : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiag, Tao Yuan Hsien, Taiwan, R.O.C.
: TEL 886-3-327-3456
: FAX 886-3-318-0055

Test Site No : 03CH03-HY / TH01-HY / CO01-HY

3.2. Standards for Methods of Measurement

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

ANSI C63.4-2003

47 CFR FCC Part 15 Subpart C

3.3. 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.

3.4. Frequency Range Investigated

Radiated emission test: from 30 MHz to 10th carrier harmonic

3.5. Test Distance

The test distance of radiated emission (30MHz~1GHz) test from antenna to EUT is 3 M.
The test distance of radiated emission (1GHz~10th carrier harmonic) test from antenna to EUT is 3 M.

3.6. Test Software

During testing, 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.

Power Parameter Table

Test Software	**ART**		
Test Channel	CH 01	CH 06	CH 11
Test Frequency	2412MHz	2442MHz	2472MHz
TX Power of DSSS	17	20	17
TX Power of OFDM	9.5	12	9.5
TX Power of 11g Turbo Mode	-	9	-

4. List of Measurements

4.1. Summary of the Test Results

Applied Standard: 47 CFR FCC Part 15 Subpart C			
Paragraph	**FCC Section**	**Description of Test**	**Result**
5.1	15.247(a)(2)	6dB Spectrum Bandwidth	Pass
5.2	15.247(b)(3)	Maximum Peak Conducted Output Power	Pass
5.3	15.247(e)	Peak Power Spectral Density	Pass
5.4	15.247(d)	Band Edges Emission	Pass
5.5	15.207	AC Power Line Conducted Emission	Pass
5.6	15.247(d)	Spurious Radiated Emission	Pass
5.7	15.203/15.247(b)/(c)	Antenna Requirement	Pass

5. Test Result

5.1. Test of 6dB Spectrum Bandwidth

5.1.1. Applicable Standard

Section 15.247(a)(2): For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

5.1.2. Measuring Instruments

Item 18 of the table on section 6.

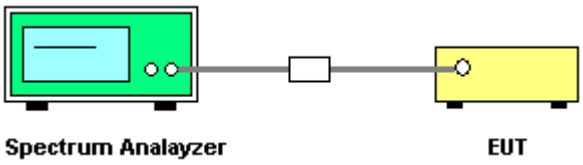
5.1.3. Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP30
  Attenuation : Auto
  Center Frequency : 2412 MHz / 2437 MHz / 2462 MHz
  Span Frequency : > 6dB Bandwidth
  RB : 100 kHz
  VB : 100 kHz
  Detector : Peak
  Trace : Max Hold
  Sweep Time : Auto

5.1.4. 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.Trace to Max hold and Detector PK.
3. The 6dB spectrum width is the spectrum range with level higher than 6dB below the peak.
4. Repeat above 1~3 points for the middle and highest channel of the EUT.

5.1.5. Test Setup Layout



5.1.6. Test Criteria

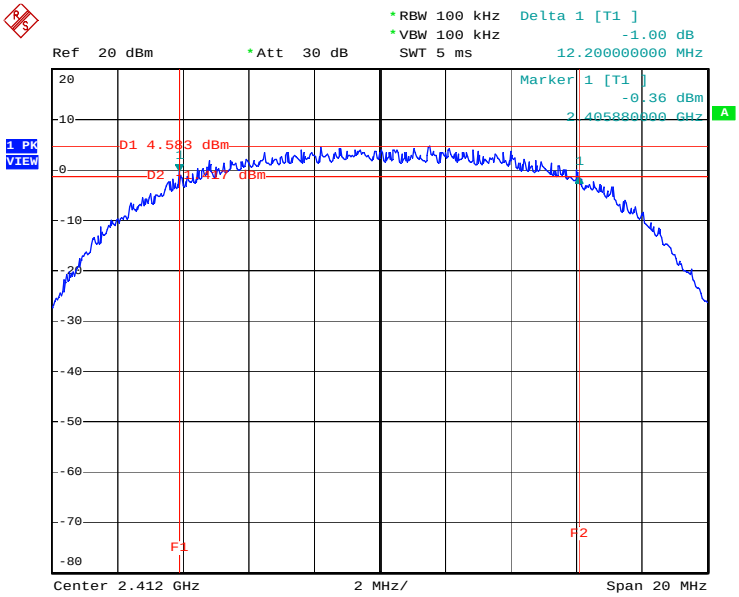
All test results complied with the requirements of 15.247(a)(2). Measurement Uncertainty is $1x10^{-5}$.

5.1.7. Test Result

- Temperature: 16°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Leo Hung

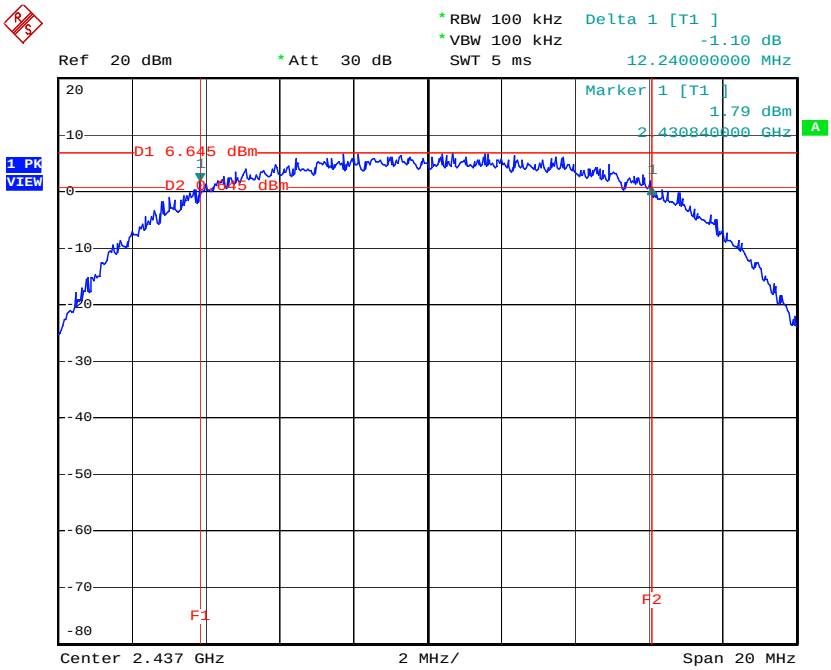
Modulation Type	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	Min. Limit (MHz)
DSSS	01	2412 MHz	12.20	0.5
DSSS	06	2437 MHz	12.24	0.5
DSSS	11	2462 MHz	11.04	0.5
OFDM	01	2412 MHz	16.40	0.5
OFDM	06	2437 MHz	16.36	0.5
OFDM	11	2462 MHz	16.40	0.5
11g Turbo Mode	06	2437 MHz	32.64	0.5

Modulation Type: DSSS (Channel 01)：



Date: 25.MAR.2005 08:11:05

Modulation Type: DSSS (Channel 06)：



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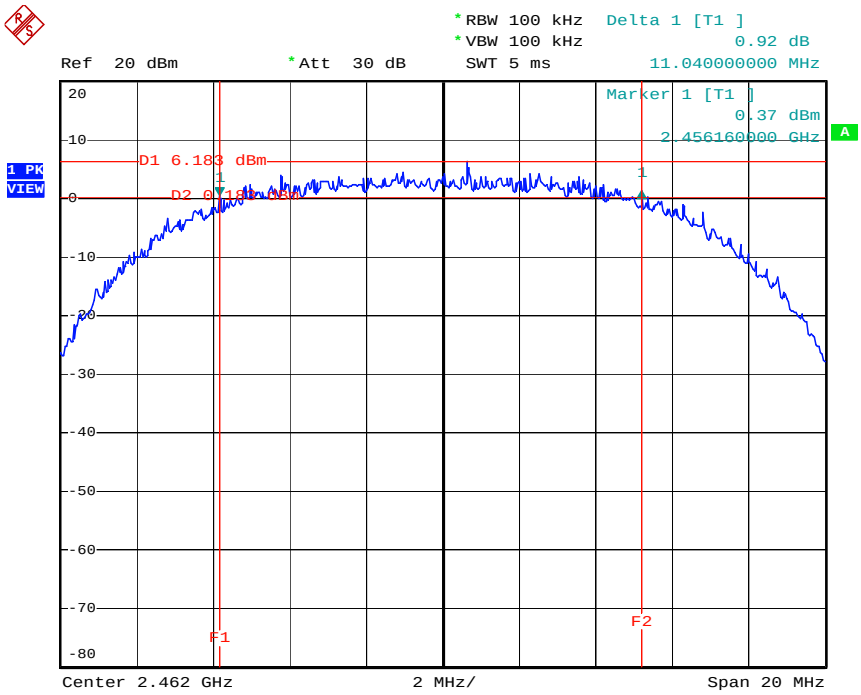
Modulation Type: DSSS (Channel 11)：



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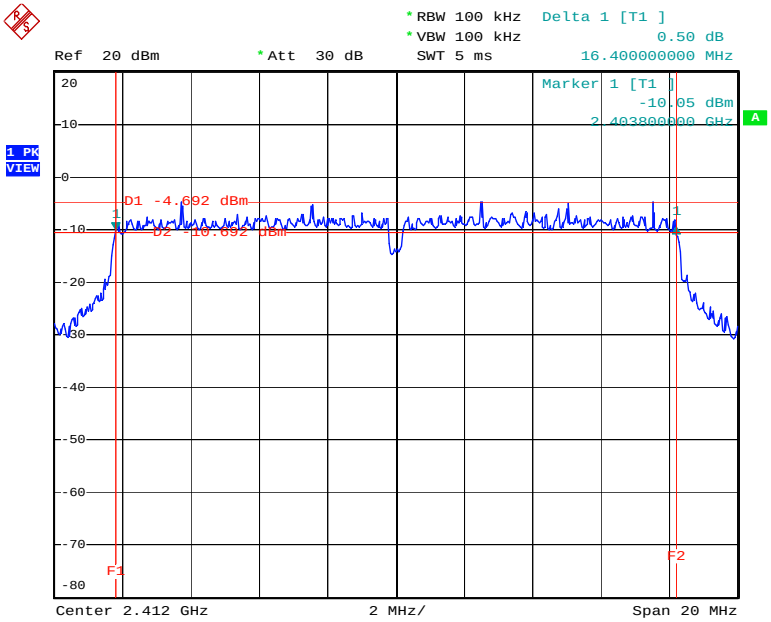
Modulation Type: OFDM (Channel 01)：



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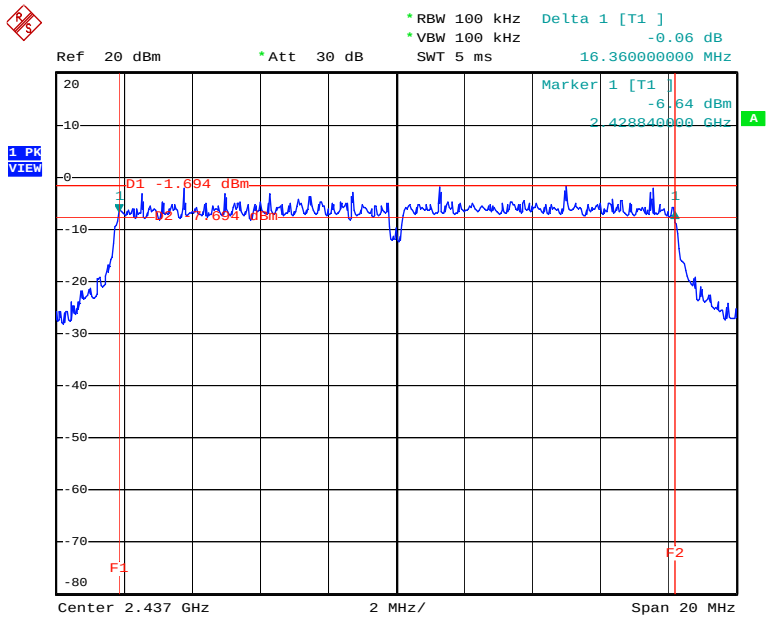
Modulation Type: OFDM (Channel 06)：



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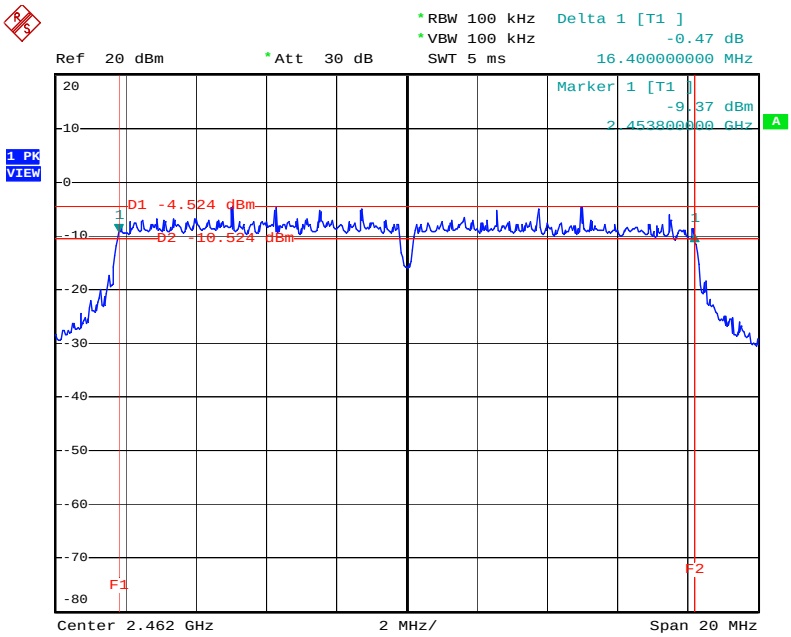
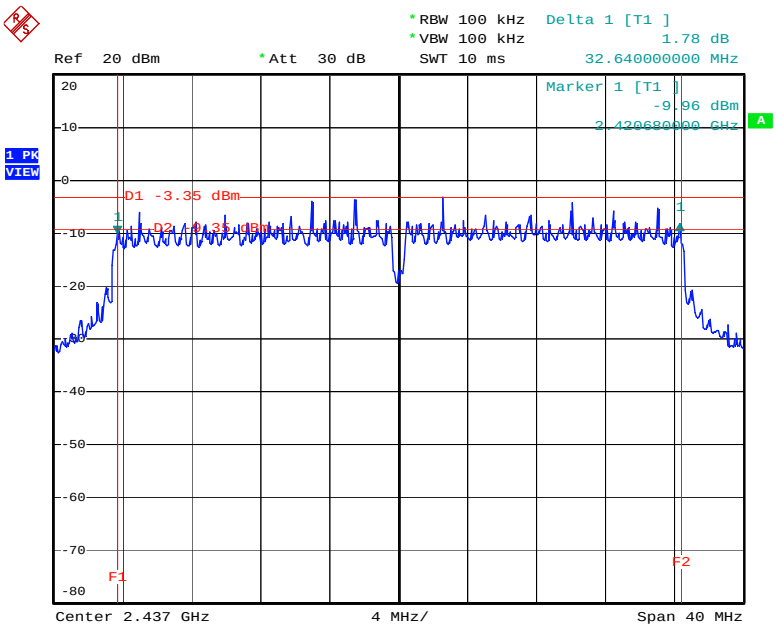
Modulation Type: OFDM (Channel 11)：



Date: 25.MAR.2005 08:15:19

Modulation Type: 11g Turbo Mode (Channel 06)：



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5.2. Test of Maximum Peak Conducted Output Power

5.2.1. Applicable Standard

Section 15.247(b)(3): The maximum peak output power shall not exceed 1 watt (30dBm). Except as shown below, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the above stated values by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

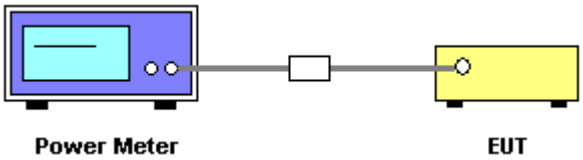
5.2.2. Measuring Instruments

Item 19, 21 of the table on section 6.

5.2.3. Test Procedures and Test Instruments Setting

1. The transmitter output was connected to the peak power meter through an attenuator.
2. Repeated the 1 for the middle and highest channel of the EUT.

5.2.4. Test Setup Layout



5.2.5. Test Criteria

All test results complied with the requirements of 15.247(b)(3). Measurement Uncertainty is 1.5dB.

5.2.6. Test Result of Conducted Power

- Temperature: 16°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Leo Hung

Modulation Type	Channel No.	Frequency (MHz)	Output Power (dBm)	Limits (dBm)
DSSS	01	2412 MHz	17.00	30
DSSS	06	2437 MHz	20.00	30
DSSS	11	2462 MHz	17.00	30
OFDM	01	2412 MHz	15.00	30
OFDM	06	2437 MHz	18.00	30
OFDM	11	2462 MHz	15.00	30
11g Turbo Mode	06	2437 MHz	15.00	30

5.3. Test of Peak Power Spectral Density

5.3.1. Applicable Standard

Section 15.247(e): For digital modulation systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

5.3.2. Measuring Instruments

Item 18 of the table on section 6.

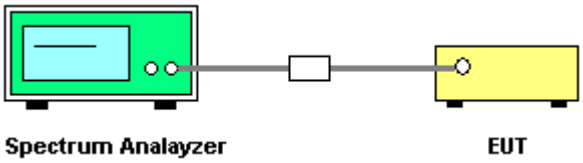
5.3.3. Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP30
  Attenuation : Auto
  Center Frequency : 2412 MHz / 2437 MHz / 2462 MHz
  Span Frequency : 1.5MHz
  RB : 3 kHz
  VB : 30 kHz
  Detector : Peak
  Trace : Max Hold
  Sweep Time : 500s

5.3.4. Test Procedures

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 3kHz and VBW to 30kHz. Set Detector to Peak, Trace to Max Hold.
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.

5.3.5. Test Setup Layout



5.3.6. Test Criteria

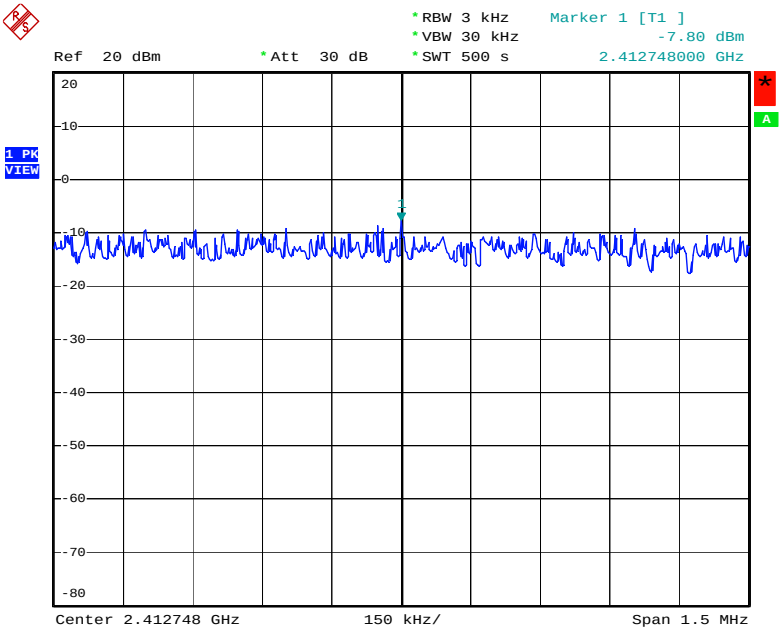
All test results complied with the requirements of 15.247(e). Measurement Uncertainty is 1.5dB.

5.3.7. Test Result

- Temperature: 16°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Leo Hung

Modulation Type	Channel No.	Frequency (MHz)	Power Density (dBm)	Limits (dBm)
DSSS	01	2412 MHz	-7.80	8
DSSS	06	2437 MHz	-5.86	8
DSSS	11	2462 MHz	-9.26	8
OFDM	01	2412 MHz	-17.65	8
OFDM	06	2437 MHz	-15.66	8
OFDM	11	2462 MHz	-17.60	8
11g Turbo Mode	06	2437 MHz	-19.97	8

Modulation Type: DSSS (Channel 01)：



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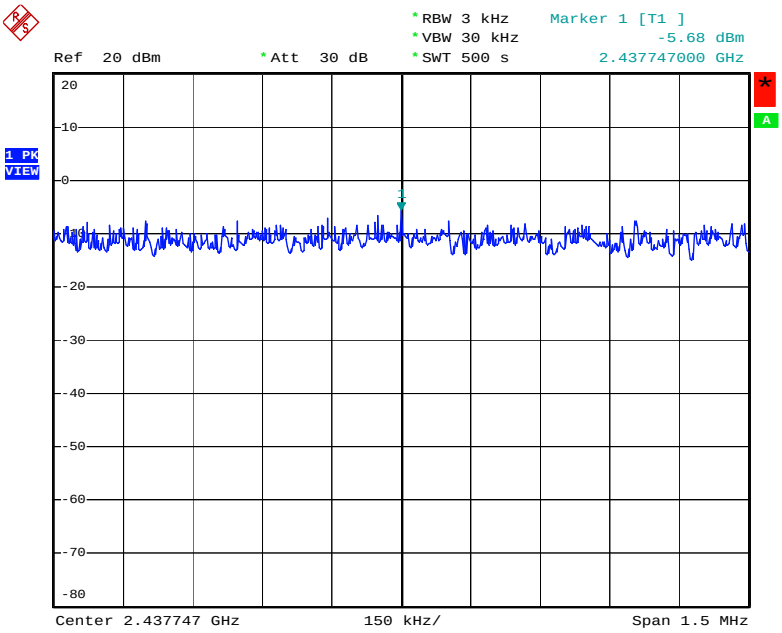
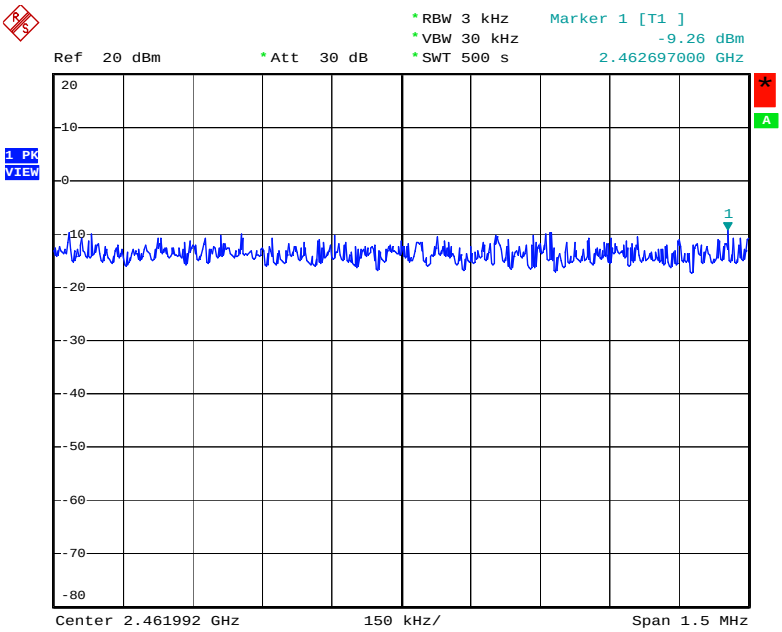
Modulation Type: DSSS (Channel 06)：



Date: 25.MAR.2005 08:13:15

Modulation Type: DSSS (Channel 11)：



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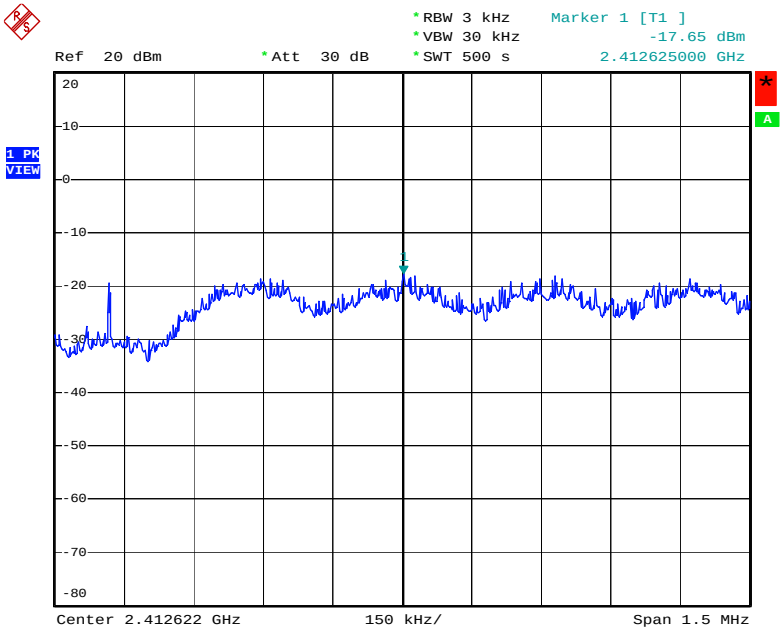
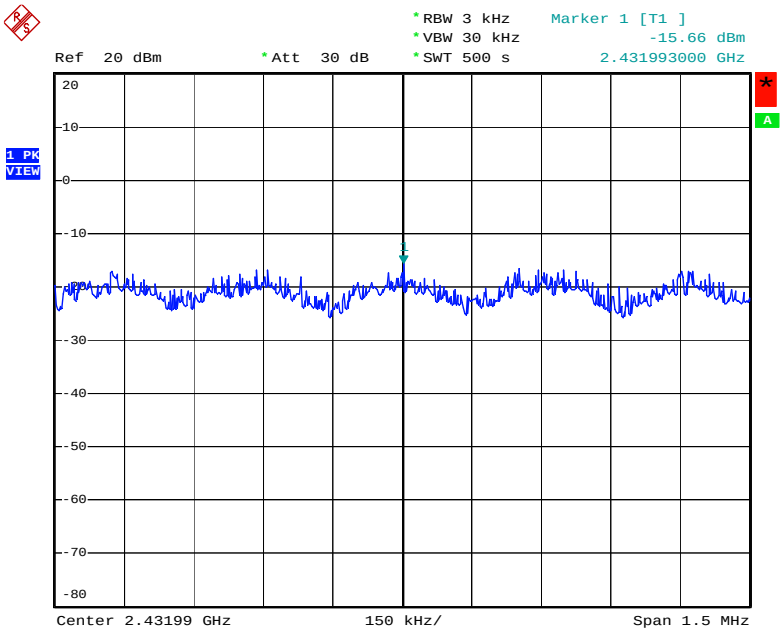
Modulation Type: OFDM (Channel 01)：



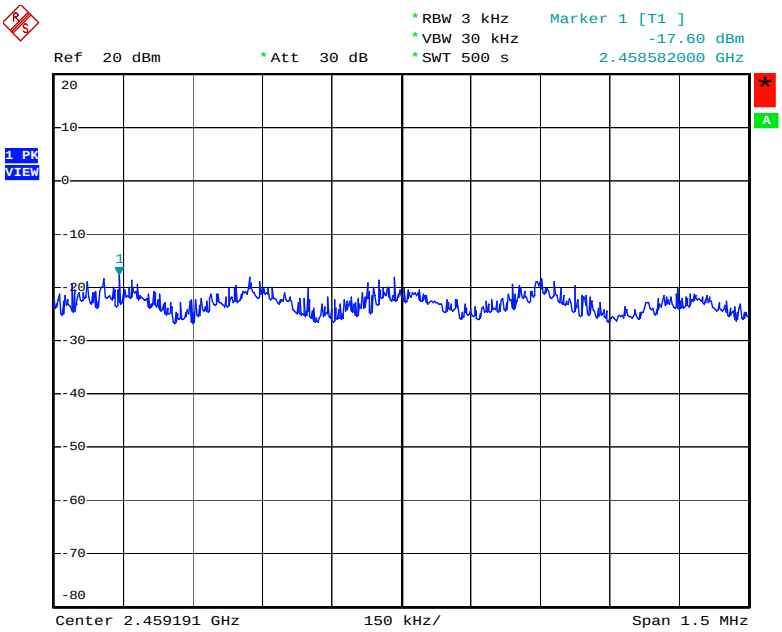
Date: 25.MAR.2005 08:14:42

Modulation Type: OFDM (Channel 06)：



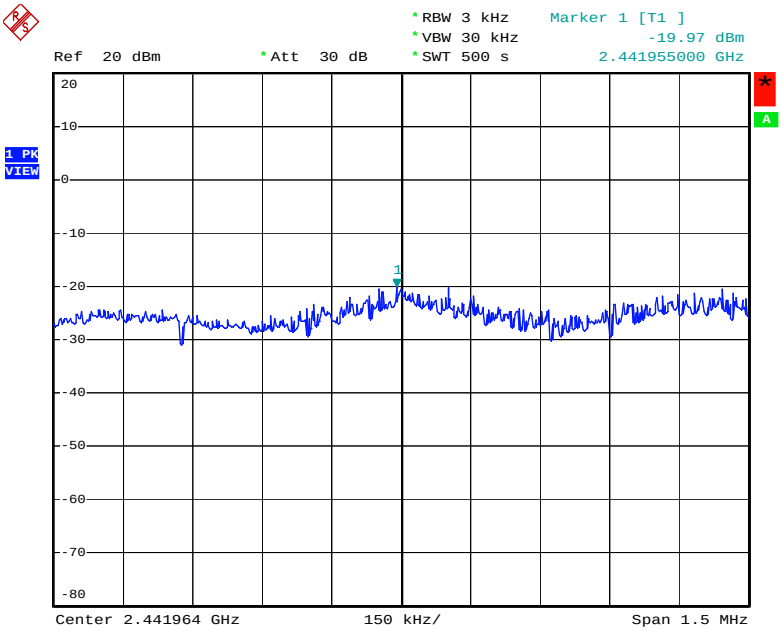
Date: 25.MAR.2005 08:16:30

Modulation Type: OFDM (Channel 11)：



Date: 25.MAR.2005 08:15:33

Modulation Type: 11g Turbo Mode(Channel 06)：



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5.4. Test of Band Edges Emission

5.4.1. Applicable Standard

Section 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions that fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209.

5.4.2. Measuring Instruments

Item 6~17 of the table on section 6 for radiated measurement.
Item 18 of the table on section 6 for conducted measurement.

5.4.3. Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP30 (Conducted Measurement)
  Attenuation : Auto
  Center Frequency : 2412 MHz / 2462 MHz
  Span Frequency : 100MHz
  RB : 100 kHz
  VB : 100 kHz
  Detector : Peak
  Trace : Max Hold
  Sweep Time : Auto

- Spectrum Analyzer : R&S FSP40 (Radiated Measurement)
  Attenuation : Auto
  Center Frequency : 2412 MHz / 2462 MHz
  Span Frequency : 100MHz
  RB : 1 MHz for PK value / 1 MHz for AV value
  VB : 1 MHz for PK value / 10 Hz for AV value
  Detector : Peak
  Trace : Max Hold
  Sweep Time : Auto

5.4.4. Test Procedures and Test Instruments Setting

Conducted Measurement

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. Then detector set to peak and max hold this trace.

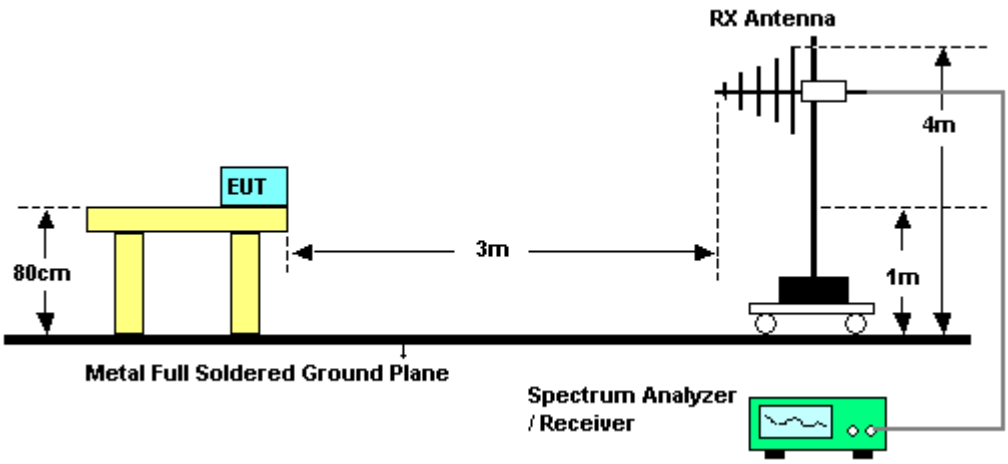
4. The lowest band edges emission was measured and recorded.
5. The transmitter set to the highest channel and repeated 2~4.

Radiated Measurement

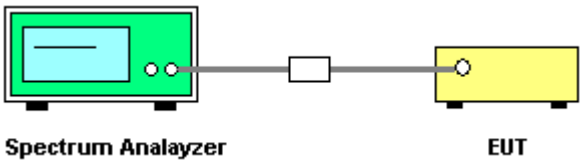
1. Configure the EUT according to ANSI C63.4.
2. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.
4. For band edge 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.
5. For band edge emission in restriction bands, use 10Hz VBW and 1MHz RBW for reading under AV and use 1MHz VBW and 1 MHz RBW for reading under PK.

5.4.5. Test Setup

Radiated Method



Conducted Method



5.4.6. Test Criteria

All test results complied with the requirements of 15.247(d). Measurement Uncertainty is $1x10^{-5}$.

5.4.7. Test Result of Radiated Emission

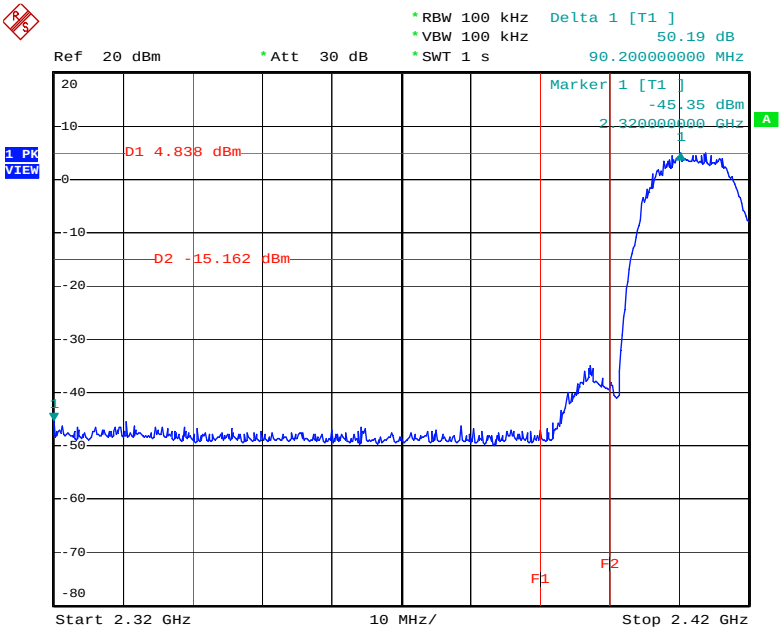
- Temperature: 16°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Leo Hung

Modulation Type	Test Channel	Freq. (MHz)	Level* (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Trace (PK/AV)
DSSS	01	2390.00	59.83	-14.17	74	PK
DSSS	01	2390.00	48.32	-5.68	54	AV
DSSS	11	2487.50	57.88	-16.12	74	PK
DSSS	11	2487.50	48.25	-5.75	54	AV
OFDM	01	2390.00	59.97	-14.03	74	PK
OFDM	01	2390.00	49.88	-4.12	54	AV
OFDM	11	2483.50	63.27	-10.73	74	PK
OFDM	11	2390.00	51.66	-2.34	54	AV
11g Turbo Mode	6	2390.00	62.36	-11.64	74	PK
11g Turbo Mode	6	2390.00	51.22	-2.78	54	AV
11g Turbo Mode	6	2483.50	59.25	-14.75	74	PK
11g Turbo Mode	6	2483.50	50.33	-3.67	54	AV

Level*: The max field strength in the restricted bands.

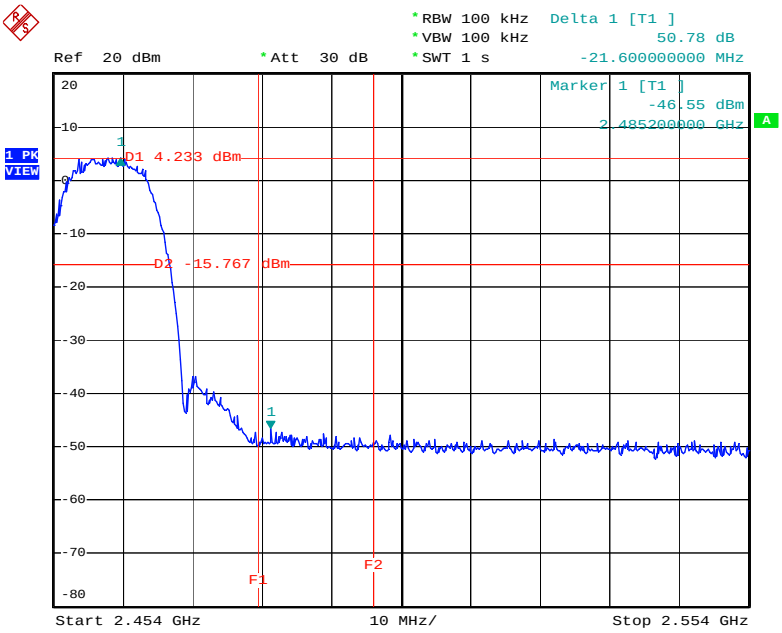
Test Result of Conducted Emission

Modulation Type: DSSS (Channel 01)：



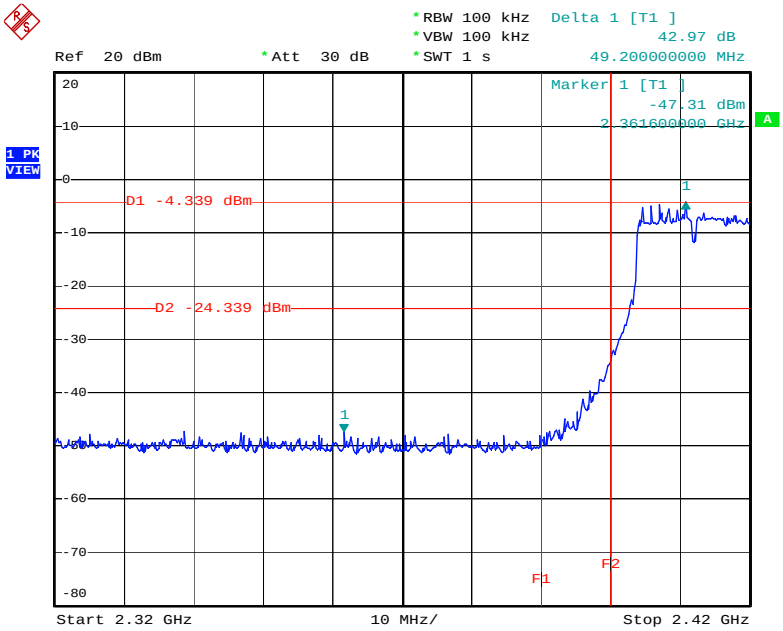
Date: 25.MAR.2005 08:11:37

Modulation Type: DSSS (Channel 11)：



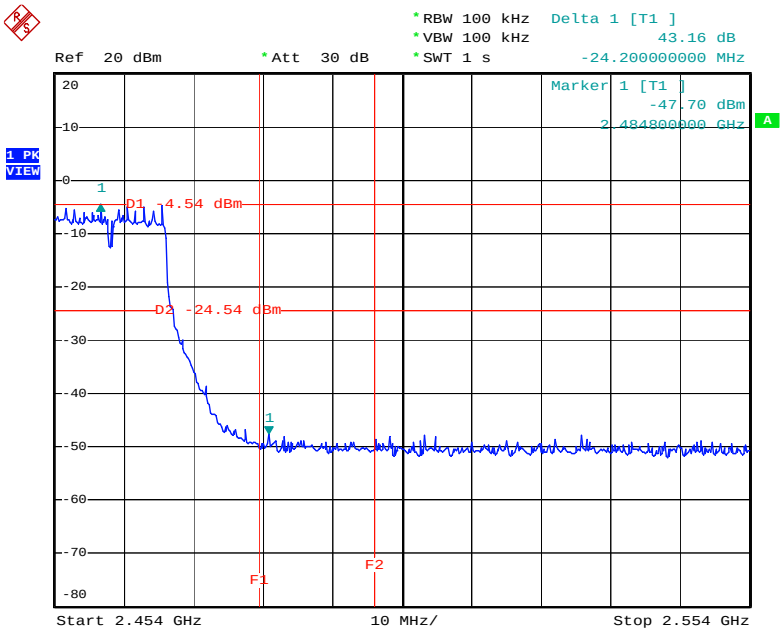
Date: 25.MAR.2005 08:12:33

Modulation Type: OFDM (Channel 01)：



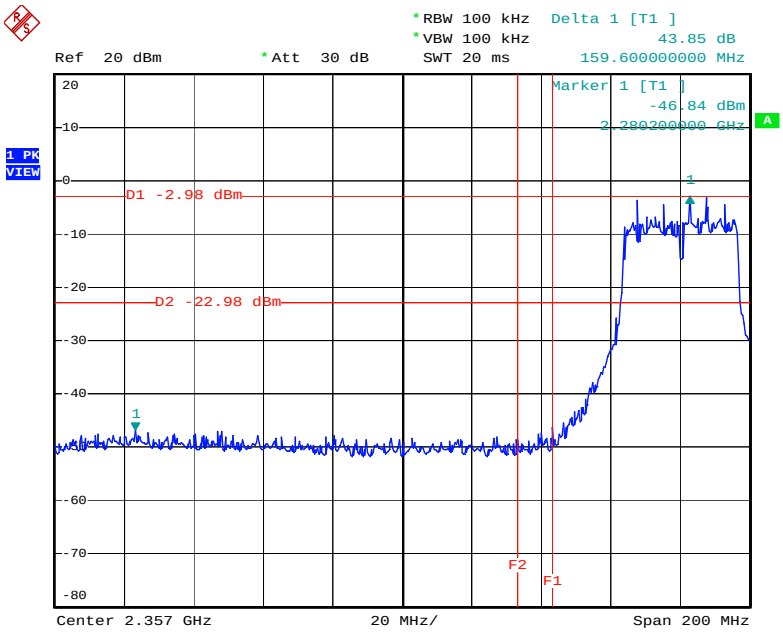
Date: 25.MAR.2005 08:14:49

Modulation Type: OFDM (Channel 11)：



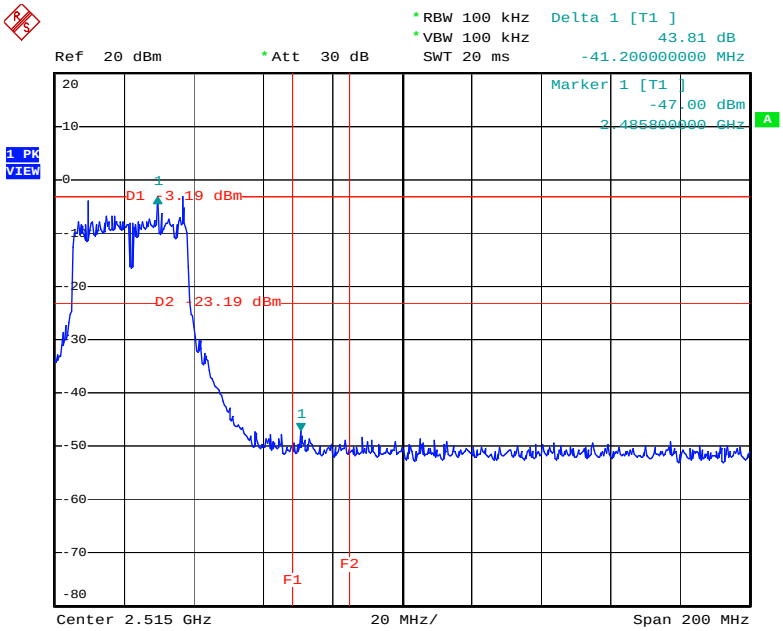
Date: 25.MAR.2005 08:15:41

Modulation Type: 11g Turbo Mode (Channel 06)：



Date: 25.MAR.2005 08:30:19

Modulation Type: 11g Turbo Mode (Channel 06)：



Date: 25.MAR.2005 08:30:53

5.5. Test of AC Power Line Conducted Emission

5.5.1. Applicable Standard

Section 15.207: For a Low-power Radio-frequency Device is designed to be connected to the AC power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed below limits table.

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

5.5.2. Measuring Instruments

Please reference item 1~5 in chapter 6 for the instruments used for testing.

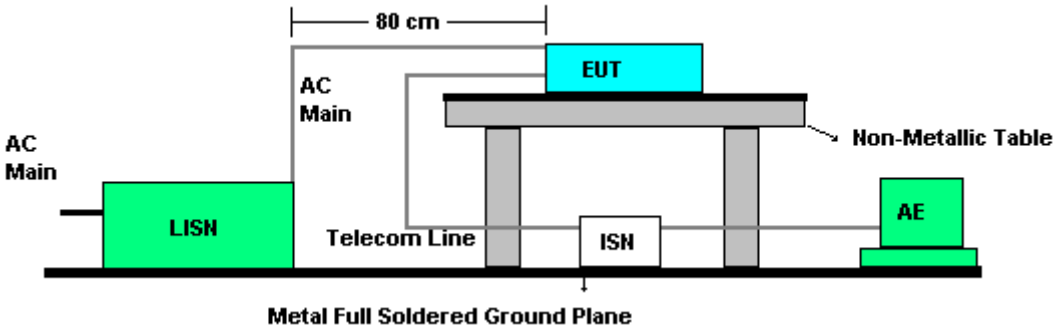
5.5.3. Description of Major Test Instruments Setting

- Test Receiver : R&S ESCS 30
  Attenuation : 10 dB
  Start Frequency : 0.15 MHz
  Stop Frequency : 30 MHz
  IF Bandwidth : 9 KHz

5.5.4. 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 provide 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.

5.5.5. Test Setup Layout



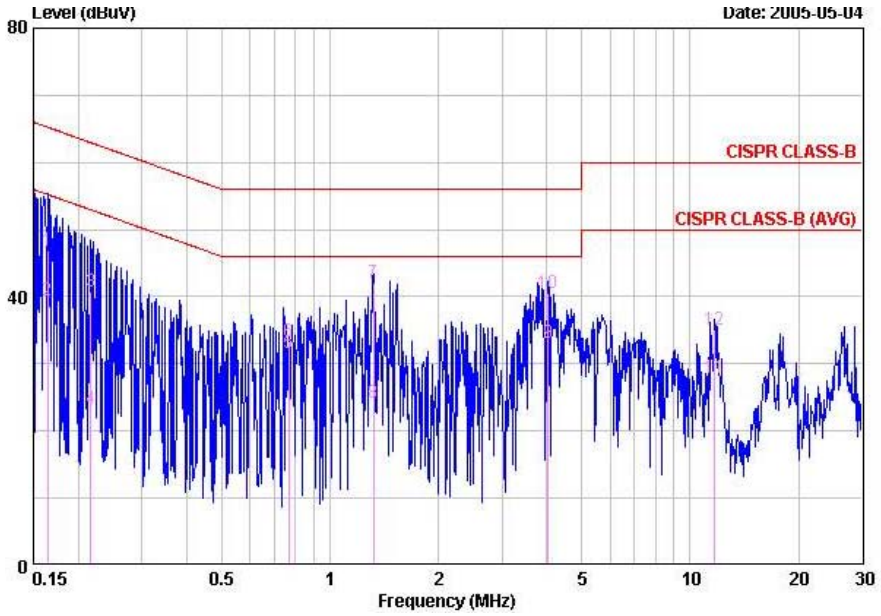
5.5.6. Test Criteria

All test results complied with the requirements of 15.207. Measurement Uncertainty is 2.54dB.

5.5.7. Test Result of Conducted Emission for CH 11 / 2462 MHz

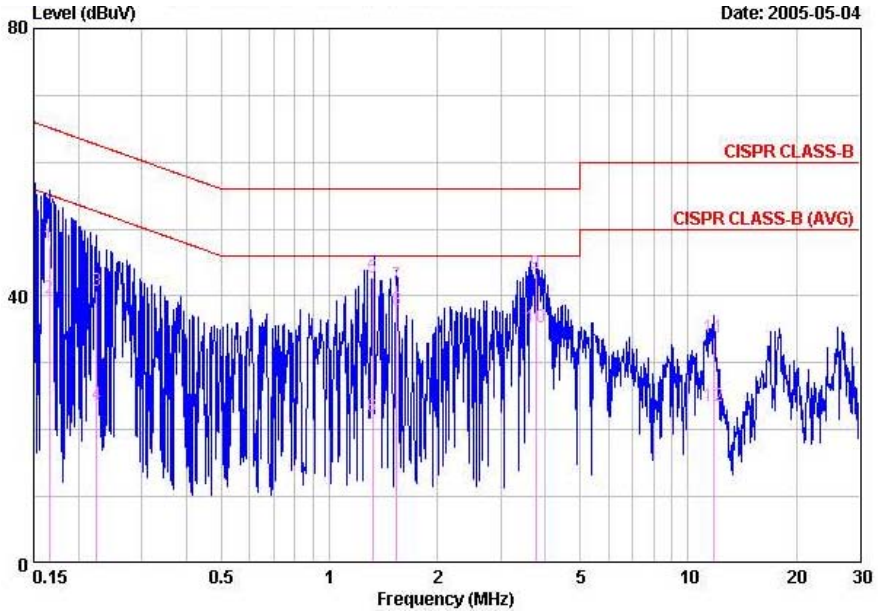
- Mode 1
- Temperature: 20°C
- Relative Humidity: 68%
- Test Engineer: Steven Lu

Line to Ground



	Frequency (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Read Level (dBuV)	LISN Factor (dB)	Cable Loss (dB)	Remark
1	0.16414	46.92	-18.33	65.25	46.72	0.20	0	QP
2	0.16414	39.44	-15.81	55.25	39.24	0.20	0	AVERAGE
3	0.2162	40.68	-22.28	62.96	40.49	0.19	0	QP
4	0.2162	23.32	-29.64	52.96	23.13	0.19	0	AVERAGE
5	0.7679	31.53	-14.47	46.00	31.43	0.10	0	AVERAGE
6	0.7679	33.27	-22.73	56.00	33.17	0.10	0	QP
7	1.318	41.97	-14.03	56.00	41.87	0.10	0	QP
8	1.318	24.29	-21.71	46.00	24.19	0.10	0	AVERAGE
9	4.033	33.21	-12.79	46.00	33.11	0.10	0	AVERAGE
10	4.033	40.44	-15.56	56.00	40.34	0.10	0	QP
11	11.694	27.92	-22.08	50.00	27.82	0.10	0	AVERAGE
12	11.694	35.04	-24.96	60.00	34.94	0.10	0	QP

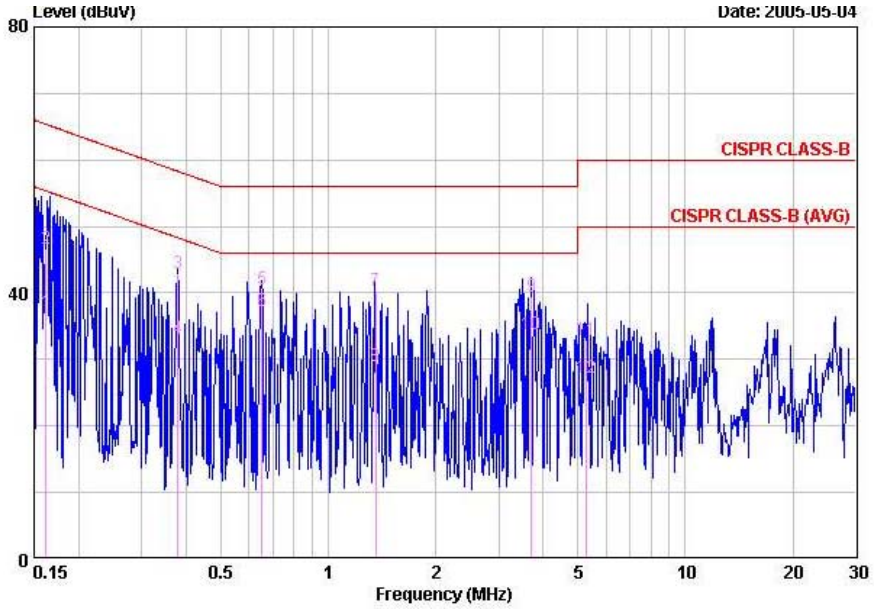
Neutral to Ground



	Frequency (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Read Level (dBuV)	LISN Factor (dB)	Cable Loss (dB)	Remark
1	0.16589	47.41	-17.75	65.16	47.15	0.26	0	QP
2	0.16589	39.60	-15.56	55.16	39.34	0.26	0	AVERAGE
3	0.22437	40.77	-21.89	62.66	40.59	0.18	0	QP
4	0.22437	23.70	-28.96	52.66	23.52	0.18	0	AVERAGE
5	1.32000	42.80	-13.20	56.00	42.7	0.1	0	QP
6	1.32000	22.01	-23.99	46.00	21.91	0.1	0	AVERAGE
7	1.54400	41.68	-14.32	56.00	41.58	0.1	0	QP
8	1.54400	37.93	-8.07	46.00	37.83	0.1	0	AVERAGE
9	3.75900	43.44	-12.56	56.00	43.34	0.1	0	QP
10	3.75900	35.31	-10.69	46.00	35.21	0.1	0	AVERAGE
11	11.78700	33.86	-26.14	60.00	33.76	0.1	0	QP
12	11.78700	23.55	-26.45	50.00	23.45	0.1	0	AVERAGE

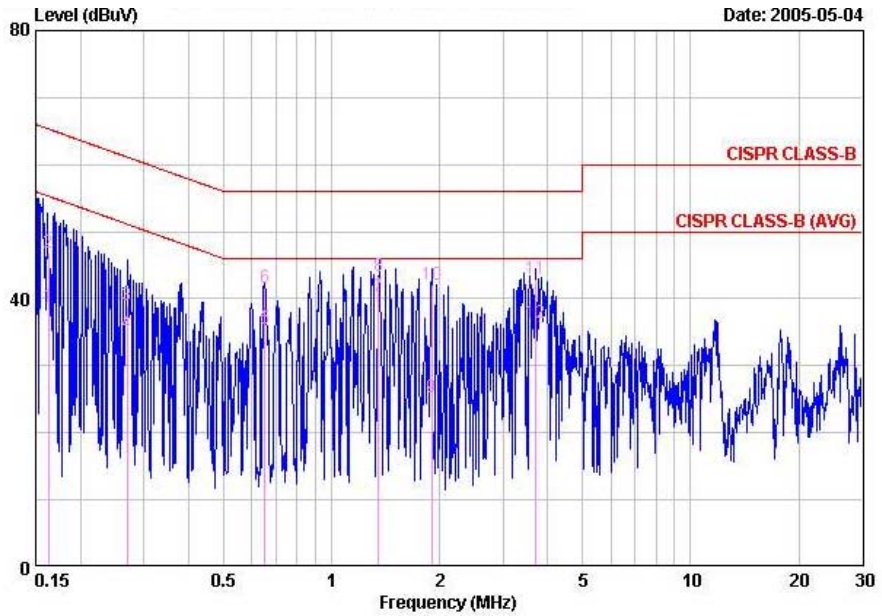
- Mode 2
- Temperature: 20°C
- Relative Humidity: 68%
- Test Engineer: Steven Lu

Line to Ground



	Frequency (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Read Level (dBuV)	LISN Factor (dB)	Cable Loss (dB)	Remark
1	0.16239	37.13	-18.21	55.34	36.93	0.20	0	AVERAGE
2	0.16239	46.64	-18.70	65.34	46.44	0.20	0	QP
3	0.37912	43.05	-15.25	58.30	42.94	0.11	0	QP
4	0.37912	33.12	-15.18	48.30	33.01	0.11	0	AVERAGE
5	0.65084	40.53	-15.47	56.00	40.43	0.10	0	QP
6	0.65084	37.30	-8.70	46.00	37.20	0.10	0	AVERAGE
7	1.35500	40.37	-15.63	56.00	40.27	0.10	0	QP
8	1.35500	28.97	-17.03	46.00	28.87	0.10	0	AVERAGE
9	3.7000	39.55	-16.45	56.00	39.45	0.10	0	QP
10	3.7000	33.70	-12.30	46.00	33.60	0.10	0	AVERAGE
11	5.28300	32.97	-27.03	60.00	32.87	0.10	0	QP
12	5.28300	27.26	-22.74	50.00	27.16	0.10	0	AVERAGE

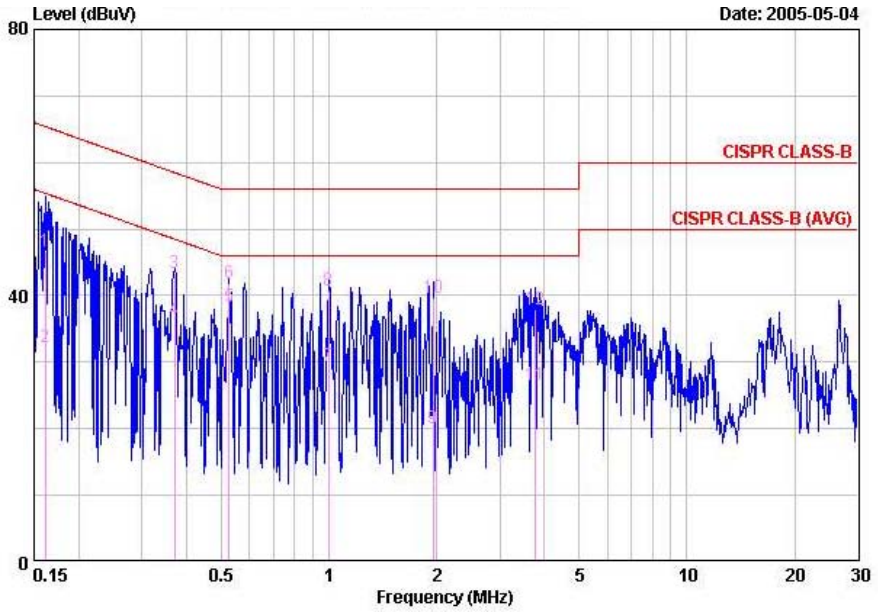
Neutral to Ground



	Frequency (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Read Level (dBuV)	LISN Factor (dB)	Cable Loss (dB)	Remark
1	0.1627	38.81	-16.51	55.32	38.54	0.27	0	AVERAGE
2	0.1627	46.83	-18.49	65.32	46.56	0.27	0	QP
3	0.27009	38.97	-22.15	61.12	38.81	0.16	0	QP
4	0.27009	34.96	-16.16	51.12	34.80	0.16	0	AVERAGE
5	0.65084	35.46	-10.54	46.00	35.36	0.10	0	AVERAGE
6	0.65084	41.60	-14.40	56.00	41.50	0.10	0	QP
7	1.35400	40.33	-5.67	46.00	40.23	0.10	0	AVERAGE
8	1.35400	43.28	-12.72	56.00	43.18	0.10	0	QP
9	1.89800	25.31	-20.69	46.00	25.21	0.10	0	AVERAGE
10	1.89800	42.17	-13.83	56.00	42.07	0.10	0	QP
11	3.70000	42.93	-13.07	56.00	42.83	0.10	0	QP
12	3.70000	36.46	-9.54	46.00	36.36	0.10	0	AVERAGE

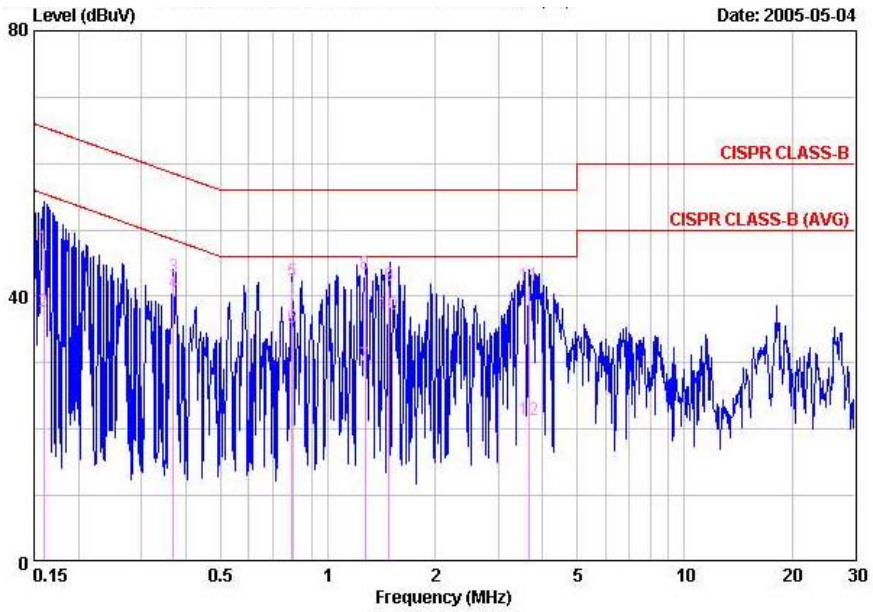
- Mode 3
- Temperature: 20°C
- Relative Humidity: 68%
- Test Engineer: Steven Lu

Line to Ground



	Frequency (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Read Level (dBuV)	LISN Factor (dB)	Cable Loss (dB)	Remark
1	0.16155	46.64	-18.74	65.38	46.44	0.20	0	QP
2	0.16155	32.32	-23.06	55.38	32.12	0.20	0	AVERAGE
3	0.37117	43.35	-15.12	58.47	43.24	0.11	0	QP
4	0.37117	36.39	-12.08	48.47	36.28	0.11	0	AVERAGE
5	0.52655	38.35	-7.65	46.00	38.25	0.10	0	AVERAGE
6	0.52655	41.82	-14.18	56.00	41.72	0.10	0	QP
7	0.99968	29.46	-16.54	46.00	29.36	0.10	0	AVERAGE
8	0.99968	40.70	-15.30	56.00	40.60	0.10	0	QP
9	1.95900	20.15	-25.85	46.00	20.05	0.10	0	AVERAGE
10	1.95900	39.65	-16.35	56.00	39.55	0.10	0	QP
11	3.77300	26.52	-19.48	46.00	26.42	0.10	0	AVERAGE
12	3.77300	37.83	-18.17	56.00	37.73	0.10	0	QP

Neutral to Ground



	Frequency (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Read Level (dBuV)	LISN Factor (dB)	Cable Loss (dB)	Remark
1	0.15985	47.29	-18.18	65.47	47.01	0.28	0	QP
2	0.15985	37.82	-17.65	55.47	37.54	0.28	0	AVERAGE
3	0.3692	43.05	-15.47	58.52	42.94	0.11	0	QP
4	0.3692	40.51	-8.01	48.52	40.40	0.11	0	AVERAGE
5	0.7918	42.27	-13.73	56.00	42.17	0.10	0	QP
6	0.7918	35.40	-10.60	46.00	35.30	0.10	0	AVERAGE
7	1.2700	29.75	-16.25	46.00	29.65	0.10	0	AVERAGE
8	1.2700	43.38	-12.62	56.00	43.28	0.10	0	QP
9	1.4830	41.68	-14.32	56.00	41.58	0.10	0	QP
10	1.4830	37.34	-8.66	46.00	37.24	0.10	0	AVERAGE
11	3.6740	41.62	-14.38	56.00	41.52	0.10	0	QP
12	3.6740	21.31	-24.69	46.00	21.21	0.10	0	AVERAGE

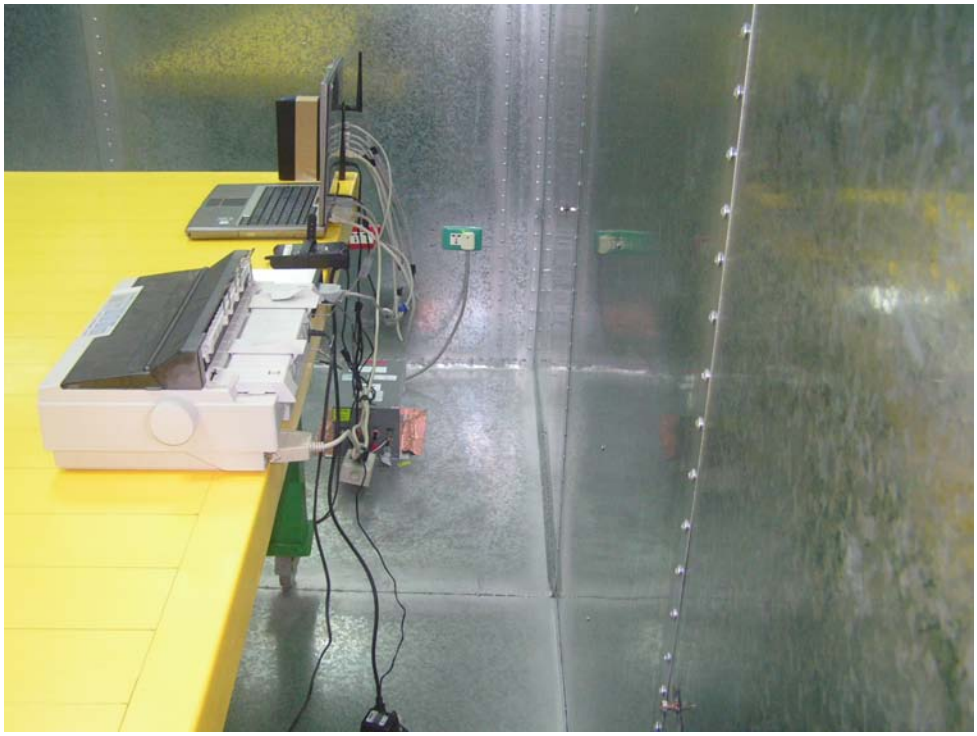
Note:
Corrected Reading: Probe (LISN / ISN) Factor + Cable Loss + Read Level = Level.

5.5.8. Photographs of Conducted Emission Test Configuration

Mode 1

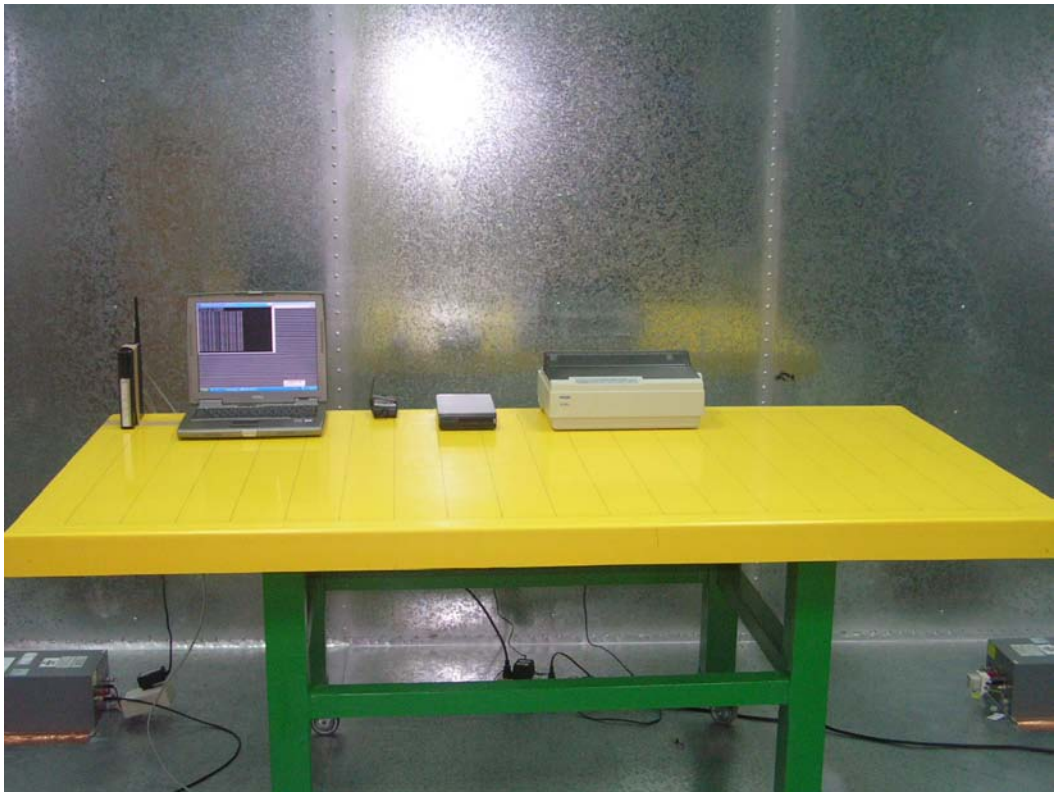
FRONT VIEW

REAR VIEW

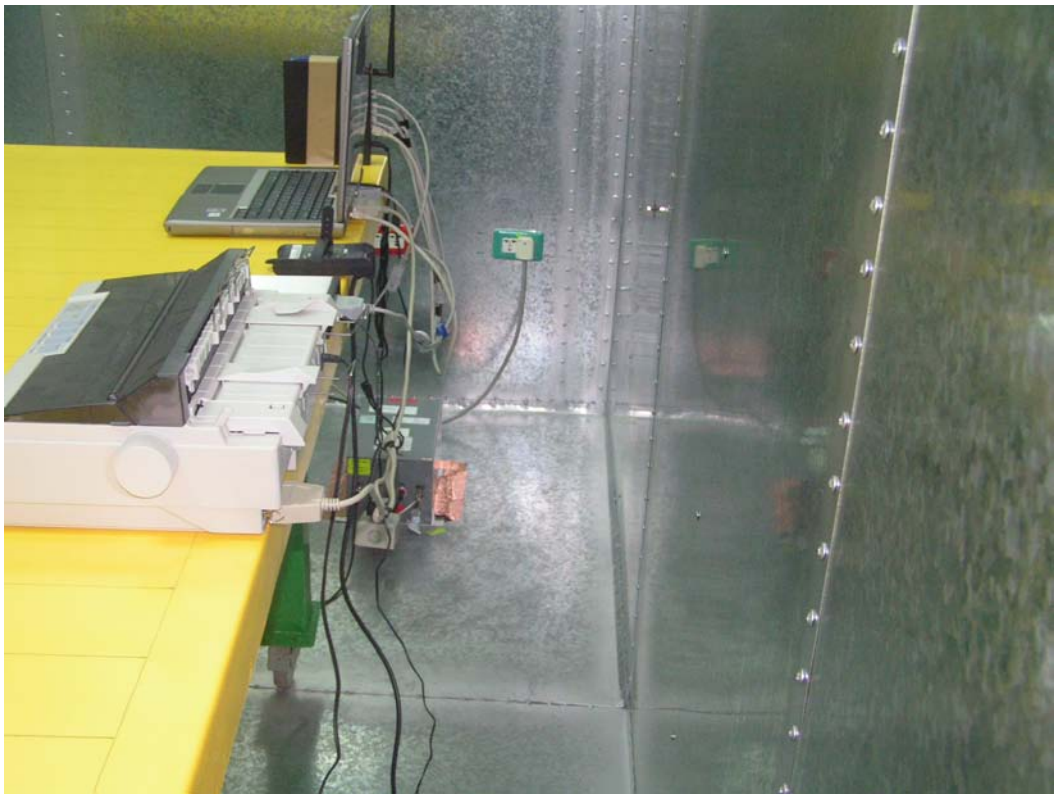


Mode 2

FRONT VIEW



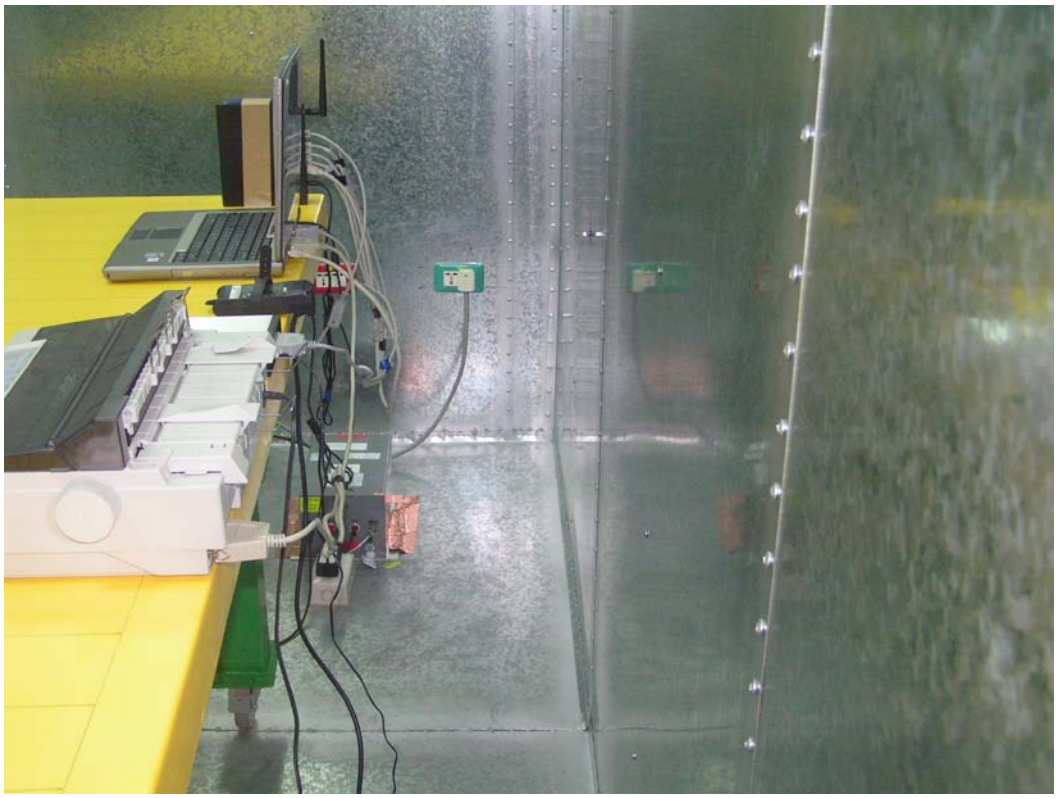
REAR VIEW



Mode 3

FRONT VIEW

REAR VIEW



5.6. Test of Spurious Radiated Emission

5.6.1. Applicable Standard

Section 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions that fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209.

5.6.2. Measuring Instruments

Please reference item 1~17 in chapter 6 for the instruments used for testing.

5.6.3. Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP40
  Attenuation : Auto
  Start Frequency : 1000 MHz
  Stop Frequency : 10th carrier harmonic
  RB / VB : 1 MHz / 1MHz for Peak
  RB / VB : 1 MHz / 10Hz for Average

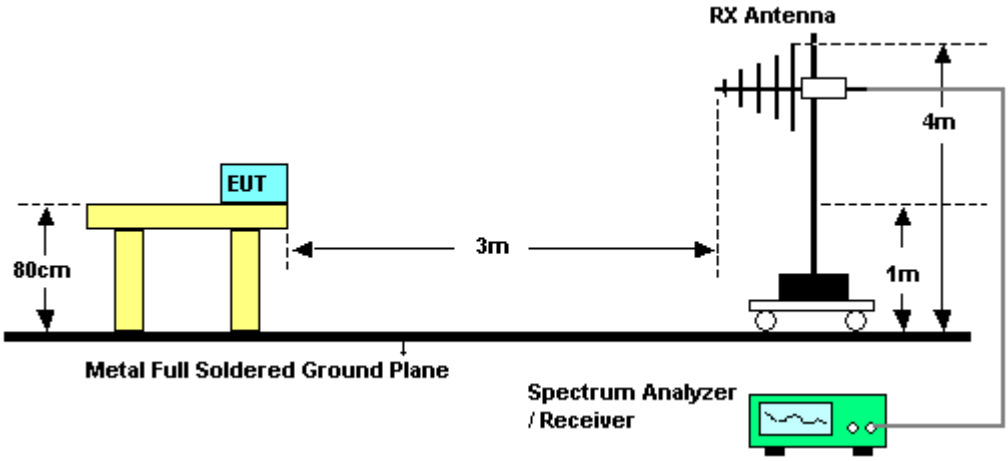
- Test Receiver : R&S ESCS 30
  Attenuation : Auto
  Start Frequency : 30 MHz
  Stop Frequency : 1000 MHz
  RB : 120 KHz for QP or PK

5.6.4. Test Procedures

1. Configure the EUT according to ANSI C63.4.
2. The EUT was placed on the top of the turntable 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 turntable.
4. Power on the EUT and all the supporting units.
5. The turntable 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 turntable 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.

5.6.5. Test Setup Layout



5.6.6. Test Criteria

All test results complied with the requirements of 15.247(d). Measurement Uncertainty is 2.26dB.

5.6.7. Test Results for CH 11 / 2462 MHz (for emission below 1GHz)

- Mode 1
- Modulation Type: OFDM
- Temperature: 16°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Ming Ta, Kao

(A) Polarization: Horizontal

Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
249.220	35.46	-10.54	46.00	11.99	1.24	30.13	52.36	HORIZONTAL	Peak
327.790	35.25	-10.75	46.00	13.82	1.43	30.48	50.48	HORIZONTAL	Peak
498.510	40.47	-5.53	46.00	17.36	1.77	30.53	51.87	HORIZONTAL	Peak
770.110	36.10	-9.90	46.00	19.92	2.19	30.09	44.07	HORIZONTAL	Peak
881.660	40.77	-5.23	46.00	20.32	2.39	29.18	47.23	HORIZONTAL	Peak
990.300	40.71	-13.29	54.00	20.90	2.52	28.66	45.95	HORIZONTAL	Peak

(B) Polarization: Vertical

Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
249.220	34.99	-11.01	46.00	11.99	1.24	30.13	51.89	HORIZONTAL	Peak
327.790	35.38	-10.62	46.00	13.82	1.43	30.48	50.61	HORIZONTAL	Peak
498.510	40.24	-5.76	46.00	17.36	1.77	30.53	51.64	HORIZONTAL	Peak
770.110	35.77	-10.23	46.00	19.92	2.19	30.09	43.75	HORIZONTAL	Peak
881.660	39.40	-6.60	46.00	20.32	2.39	29.18	45.87	HORIZONTAL	Peak
990.300	40.08	-13.92	54.00	20.90	2.52	28.66	45.31	HORIZONTAL	Peak

Note:

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

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

All emissions are peak value.

- Mode 2
- Modulation Type: OFDM
- Temperature: 16°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Ming Ta, Kao

(B) Polarization: Horizontal

	Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
	MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1	319.060	29.85	-16.15	46.00	13.67	1.41	30.39	45.16	HORIZONTAL	Peak
2	330.700	31.28	-14.72	46.00	13.87	1.43	30.50	46.48	HORIZONTAL	Peak
3	400.540	33.63	-12.37	46.00	15.94	1.59	30.35	46.45	HORIZONTAL	Peak
4	498.510	36.32	-9.68	46.00	17.36	1.77	30.53	47.72	HORIZONTAL	Peak
5	548.950	30.93	-15.07	46.00	18.28	1.87	30.63	41.41	HORIZONTAL	Peak
6	770.110	37.07	-8.93	46.00	19.92	2.19	30.09	45.05	HORIZONTAL	Peak
7	881.660	37.59	-8.41	46.00	20.32	2.39	29.18	44.06	HORIZONTAL	Peak
8	991.270	37.84	-16.16	54.00	20.90	2.52	28.65	43.06	HORIZONTAL	Peak
9	1000.000	40.42	-13.58	54.00	20.90	2.53	28.56	45.55	HORIZONTAL	Peak

(B) Polarization: Vertical

	Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
	MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1 @	43.580	37.34	-2.66	40.00	10.30	0.56	29.83	56.31	VERTICAL	Peak
2 !	83.350	36.14	-3.86	40.00	7.40	0.73	29.97	57.98	VERTICAL	Peak
3	109.540	33.41	-10.09	43.50	11.50	0.84	30.07	51.14	VERTICAL	Peak
4	249.220	30.03	-15.97	46.00	11.99	1.24	30.13	46.93	VERTICAL	Peak
5	498.510	39.17	-6.83	46.00	17.36	1.77	30.53	50.58	VERTICAL	Peak
6 !	548.950	40.81	-5.19	46.00	18.28	1.87	30.63	51.29	VERTICAL	Peak
7	660.500	34.38	-11.62	46.00	18.90	2.05	30.34	43.78	VERTICAL	Peak
8	991.270	38.88	-15.12	54.00	20.90	2.52	28.65	44.11	VERTICAL	Peak

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

5.6.8. Test Results for CH 01 / 2412 MHz (for emission above 1GHz)

- Modulation Type: DSSS
- Temperature: 16°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Ming Ta, Kao

(A) Polarization: Horizontal

Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1119.910	46.01	-27.99	74.00	24.14	1.04	39.43	60.26	HORIZONTAL	PEAK
1120.000	45.25	-8.75	54.00	24.14	1.04	39.43	59.50	HORIZONTAL	AVERAGE
2287.000	50.25	-3.75	54.00	27.86	1.94	39.89	60.33	HORIZONTAL	Average
2287.000	58.02	-15.98	74.00	27.86	1.94	39.89	68.10	HORIZONTAL	PEAK
4823.952	53.94	-20.06	74.00	33.22	3.20	40.78	58.29	HORIZONTAL	PEAK
4824.060	46.72	-7.28	54.00	33.22	3.20	40.78	51.07	HORIZONTAL	AVERAGE

(B) Polarization: Vertical

Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1119.910	43.44	-30.56	74.00	24.14	1.04	39.43	57.69	VERTICAL	Peak
1120.030	40.84	-13.16	54.00	24.14	1.04	39.43	55.09	VERTICAL	AVERAGE
2289.000	52.78	-1.22	54.00	27.86	1.94	39.89	62.86	VERTICAL	Average
2289.000	56.50	-17.50	74.00	27.86	1.94	39.89	66.58	VERTICAL	Peak
4823.920	49.76	-4.24	54.00	33.22	3.20	40.78	54.11	VERTICAL	AVERAGE
4823.960	56.99	-17.01	74.00	33.22	3.20	40.78	61.35	VERTICAL	Peak

Note:

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

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

- Modulation Type: OFDM
- Temperature: 16°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Ming Ta, Kao

(A) Polarization: Horizontal

Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1120.000	48.11	-25.89	74.00	24.14	1.04	39.43	62.36	HORIZONTAL	Peak
1120.000	44.25	-9.75	54.00	24.14	1.04	39.43	58.50	HORIZONTAL	Average
1320.000	38.22	-15.78	54.00	24.72	1.20	39.44	51.74	HORIZONTAL	Average
1320.000	52.36	-21.64	74.00	24.72	1.20	39.44	65.88	HORIZONTAL	Peak
4824.000	52.33	-21.67	74.00	33.22	3.20	40.78	56.68	HORIZONTAL	Peak
4824.000	38.58	-15.42	54.00	33.22	3.20	40.78	42.93	HORIZONTAL	Average

(B) Polarization: Vertical

Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1120.000	47.84	-26.16	74.00	24.14	1.04	39.43	62.09	VERTICAL	Peak
1120.000	43.25	-10.75	54.00	24.14	1.04	39.43	57.50	VERTICAL	Average
1320.000	36.58	-17.42	54.00	24.72	1.20	39.44	50.10	VERTICAL	Average
1320.000	44.55	-29.45	74.00	24.72	1.20	39.44	58.07	VERTICAL	Peak
4824.000	55.58	-18.42	74.00	33.22	3.20	40.78	59.93	VERTICAL	Peak
4824.000	41.36	-12.64	54.00	33.22	3.20	40.78	45.71	VERTICAL	Average

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

5.6.9. Test Results for CH 06 / 2437 MHz (for emission above 1GHz)

- Modulation Type: DSSS
- Temperature: 16°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Ming Ta, Kao

(A) Polarization: Horizontal

Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1120.000	46.58	-27.42	74.00	24.14	1.04	39.43	60.83	HORIZONTAL	Peak
1120.000	42.58	-11.42	54.00	24.14	1.04	39.43	56.83	HORIZONTAL	Average
2298.000	53.66	-20.34	74.00	27.86	1.94	39.89	63.74	HORIZONTAL	Peak
2298.000	49.66	-4.34	54.00	27.86	1.94	39.89	59.74	HORIZONTAL	Average
4874.000	45.12	-8.88	54.00	33.33	3.22	40.63	49.20	HORIZONTAL	Average
4874.000	54.21	-19.79	74.00	33.33	3.22	40.63	58.29	HORIZONTAL	Peak

(B) Polarization: Vertical

Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1120.000	46.85	-27.15	74.00	24.14	1.04	39.43	61.10	HORIZONTAL	Peak
1120.000	42.36	-11.64	54.00	24.14	1.04	39.43	56.61	HORIZONTAL	Average
2289.000	49.32	-4.68	54.00	27.86	1.94	39.89	59.40	HORIZONTAL	Average
2289.000	53.33	-20.67	74.00	27.86	1.94	39.89	63.41	HORIZONTAL	Peak
4874.000	54.25	-19.75	74.00	33.33	3.22	40.63	58.33	HORIZONTAL	Peak
4874.000	45.36	-8.64	54.00	33.33	3.22	40.63	49.44	HORIZONTAL	Average

Note:

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

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

- Modulation Type: OFDM
- Temperature: 16°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Ming Ta, Kao

(A) Polarization: Horizontal

Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1120.000	45.57	-28.43	74.00	24.14	1.04	39.43	59.82	VERTICAL	Peak
1120.000	40.15	-13.85	54.00	24.14	1.04	39.43	54.40	VERTICAL	Average
1320.000	44.11	-29.89	74.00	24.72	1.20	39.44	57.63	VERTICAL	Peak
1320.000	36.55	-17.45	54.00	24.72	1.20	39.44	50.07	VERTICAL	Average
4874.000	58.36	-15.64	74.00	33.33	3.22	40.63	62.44	VERTICAL	Peak
4874.000	44.32	-9.68	54.00	33.33	3.22	40.63	48.40	VERTICAL	Average

(B) Polarization: Vertical

Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1120.000	46.33	-27.67	74.00	24.14	1.04	39.43	60.58	HORIZONTAL	Peak
1120.000	40.36	-13.64	54.00	24.14	1.04	39.43	54.61	HORIZONTAL	Average
1320.000	38.69	-15.31	54.00	24.72	1.20	39.44	52.21	HORIZONTAL	Average
1320.000	45.88	-28.12	74.00	24.72	1.20	39.44	59.40	HORIZONTAL	Peak
4874.000	55.12	-18.88	74.00	33.33	3.22	40.63	59.20	HORIZONTAL	Peak
4874.000	41.28	-12.72	54.00	33.33	3.22	40.63	45.36	HORIZONTAL	Average

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

5.6.10. Test Results for CH 11 / 2462 MHz (for emission above 1GHz)

- Modulation Type: DSSS
- Temperature: 16°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Ming Ta, Kao

(A) Polarization: Horizontal

Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1120.000	47.85	-26.15	74.00	24.14	1.04	39.43	62.10	HORIZONTAL	Peak
1120.000	43.25	-10.75	54.00	24.14	1.04	39.43	57.50	HORIZONTAL	Average
2289.000	48.66	-5.34	54.00	27.86	1.94	39.89	58.74	HORIZONTAL	Average
2289.000	53.25	-20.75	74.00	27.86	1.94	39.89	63.33	HORIZONTAL	Peak
4924.000	53.25	-20.75	74.00	33.45	3.25	40.53	57.08	HORIZONTAL	Peak
4924.000	46.58	-7.42	54.00	33.45	3.25	40.53	50.41	HORIZONTAL	Average

(B) Polarization: Vertical

Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1120.000	45.54	-28.46	74.00	24.14	1.04	39.43	59.79	VERTICAL	Peak
1120.000	38.25	-15.75	54.00	24.14	1.04	39.43	52.50	VERTICAL	Average
2289.000	57.45	-16.55	74.00	27.86	1.94	39.89	67.53	VERTICAL	Peak
2289.000	52.12	-1.88	54.00	27.86	1.94	39.89	62.20	VERTICAL	Average
4924.000	50.25	-3.75	54.00	33.45	3.25	40.53	54.08	VERTICAL	Average
4924.000	55.69	-18.31	74.00	33.45	3.25	40.53	59.52	VERTICAL	Peak

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

- Modulation Type: OFDM
- Temperature: 16°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Ming Ta, Kao

(A) Polarization: Horizontal

Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1120.000	50.22	-23.78	74.00	24.14	1.04	39.43	64.47	HORIZONTAL	Peak
1120.000	45.69	-8.31	54.00	24.14	1.04	39.43	59.94	HORIZONTAL	Average
1320.000	45.66	-28.34	74.00	24.72	1.20	39.44	59.18	HORIZONTAL	Peak
1320.000	38.25	-15.75	54.00	24.72	1.20	39.44	51.77	HORIZONTAL	Average
4924.000	50.00	-24.00	74.00	33.45	3.25	40.53	53.83	HORIZONTAL	Peak
4924.000	38.66	-15.34	54.00	33.45	3.25	40.53	42.49	HORIZONTAL	Average

(B) Polarization: Vertical

Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1120.000	46.63	-27.37	74.00	24.14	1.04	39.43	60.88	VERTICAL	Peak
1120.000	41.26	-12.74	54.00	24.14	1.04	39.43	55.51	VERTICAL	Average
1320.000	37.55	-16.45	54.00	24.72	1.20	39.44	51.07	VERTICAL	Average
1320.000	44.25	-29.75	74.00	24.72	1.20	39.44	57.77	VERTICAL	Peak
4924.000	51.58	-22.42	74.00	33.45	3.25	40.53	55.41	VERTICAL	Peak
4924.000	38.68	-15.32	54.00	33.45	3.25	40.53	42.51	VERTICAL	Average

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

5.6.11. Test Results for CH 06 / 2437 MHz (for emission above 1GHz)

- Modulation Type: OFDM- 11g Turbo Mode
- Temperature: 16°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Ming Ta, Kao

(A) Polarization: Horizontal

Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1120.000	44.25	-29.75	74.00	24.14	1.04	39.43	58.50	HORIZONTAL	Peak
1120.000	38.22	-15.78	54.00	24.14	1.04	39.43	52.47	HORIZONTAL	Average
4874.000	38.66	-15.34	54.00	33.33	3.22	40.63	42.74	HORIZONTAL	Average
4874.000	50.22	-23.78	74.00	33.33	3.22	40.63	54.30	HORIZONTAL	Peak

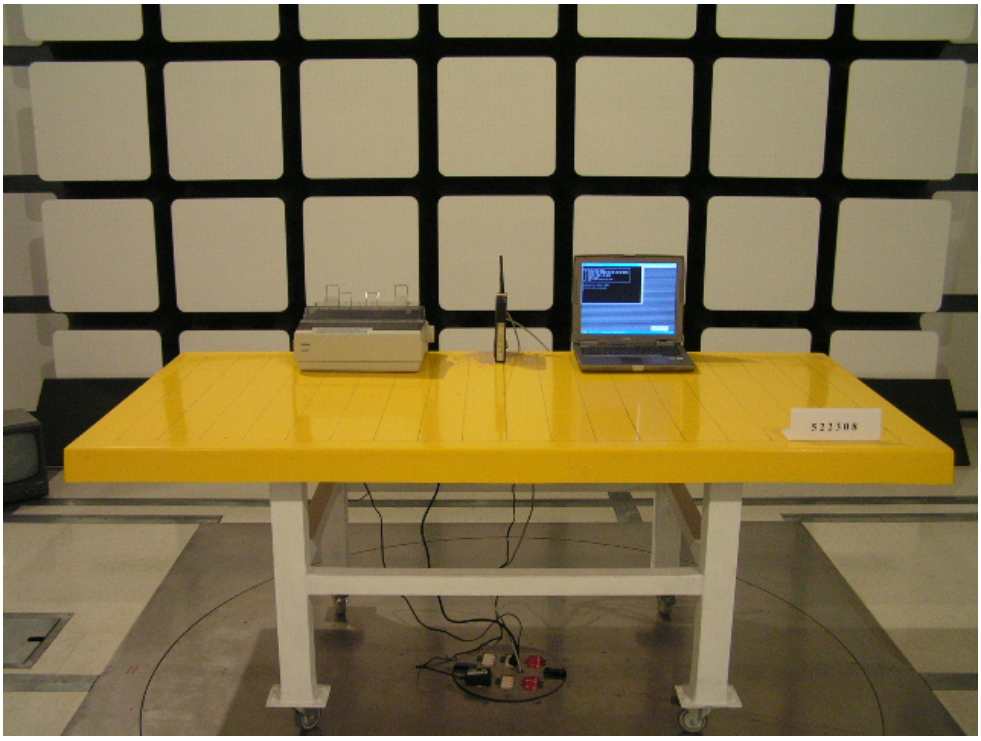
(B) Polarization: Vertical

Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1120.000	44.88	-29.12	74.00	24.14	1.04	39.43	59.13	VERTICAL	Peak
1120.000	39.22	-14.78	54.00	24.14	1.04	39.43	53.47	VERTICAL	Average
4874.000	54.25	-19.75	74.00	33.33	3.22	40.63	58.33	VERTICAL	Peak
4874.000	50.36	-3.64	54.00	33.33	3.22	40.63	54.44	VERTICAL	Average

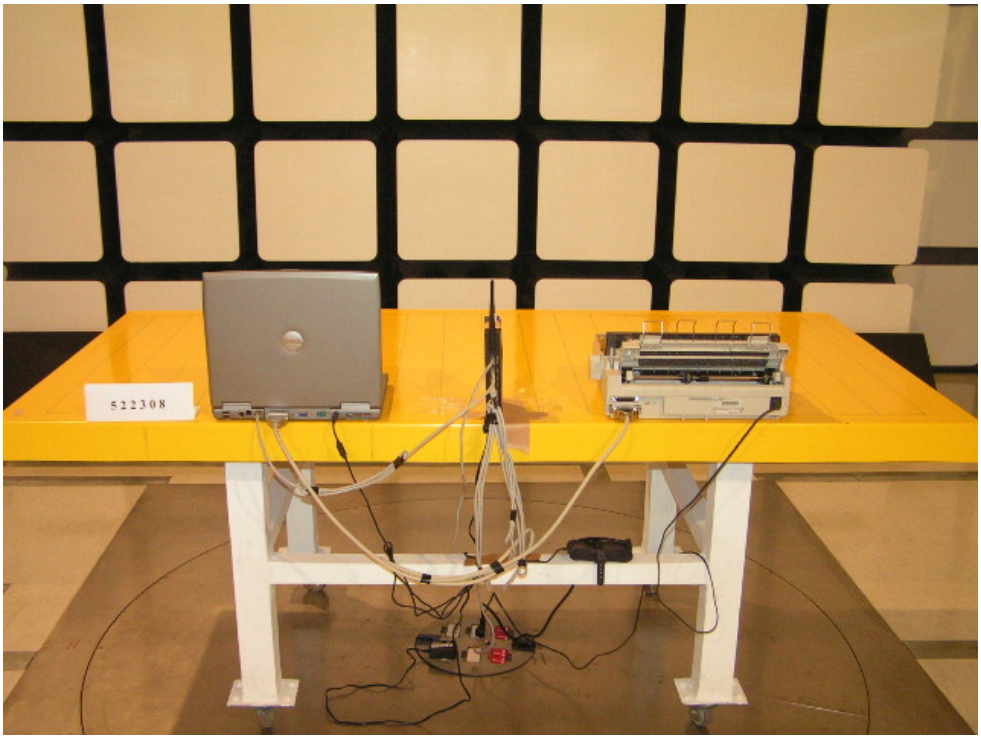
Note:
Emission level (dBuV/m) = 20 log Emission level (uV/m)
Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

5.6.12. Photographs of Radiated Emission Test Configuration

FRONT VIEW



REAR VIEW



5.7. Antenna Requirements

5.7.1. Standard Applicable

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Section 15.247(b)/(c):
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

There is reversed SMA connector for this dipole antenna.

5.7.3. Antenna Gain

Antenna gain of EUT is less than 6dBi. Therefore peak conducted power limit shall not be degraded any more. Antenna report of manufacturer will have more detail antenna gain or antenna pattern.

5.7.4. Test Criteria

All test results complied with the requirements of 15.203/15.247(b)/(c).

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) $= \frac{\sqrt{30 \times P \times G}}{d}$ Power Density: *Pd* (mW/cm²) $= \frac{E^2}{377}$

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: DSSS
- Temperature: 16°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Ming Ta, Kao

Channel No.	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)
01	2.00	1.58	17.00	50.12	0.0158	1
06	2.00	1.58	20.00	100.00	0.0314	1
11	2.00	1.58	17.00	50.12	0.0158	1

- Modulation Type: OFDM
- Temperature: 16°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Ming Ta, Kao

Channel No.	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)
01	2.00	1.58	15.00	31.62	0.0099	1
06	2.00	1.58	18.00	63.10	0.0198	1
11	2.00	1.58	15.00	31.62	0.0099	1

- Modulation Type: OFDM- Turbo
- Temperature: 16°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Ming Ta, Kao

Channel No.	Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm²)	Limit of Power Density (S) (mW/cm²)
06	2.00	1.58	18.00	63.10	0.0198	1

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. 23, 2004	Conduction (CO01-HY)
2	LISN	MessTec	NNB-2/16Z	2001/008	9 KHz – 30 MHz	Jun. 09, 2004	Conduction (CO01-HY)
3	LISN (Support Unit)	MessTec	NNB-2/16Z	2001/009	9 KHz – 30 MHz	Apr. 19, 2004	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 Switzerland	RG223/U	CB029	9KHz~30MHz	Dec. 23, 2004	Conduction (CO01-HY)
7	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz~1GHz 3m	Jun. 21, 2004	Radiation (03CH03-HY)
8	Spectrum analyzer	R&S	FSP40	100004	9KHZ~40GHz	Aug. 31, 2004	Radiation (03CH03-HY)
9	Amplifier	HP	8447D	2944A09072	100KHz – 1.3GHz	Nov. 04, 2004	Radiation (03CH03-HY)
10	Biconical Antenna	SCHWARZBECK	VHBB 9124	301	30MHz –200MHz	Jul. 28, 2004	Radiation (03CH03-HY)
11	Log Antenna	SCHWARZBECK	VUSLP 9111	221	200MHz -1GHz	Jul. 28, 2004	Radiation (03CH03-HY)
12	RF Cable-R03m	Jye Bao	RG142	CB021	30MHz~1GHz	Dec. 02, 2004	Radiation (03CH03-HY)
13	Amplifier	MITEQ	AFS44	849984	100MHz~26.5GHz	Nov. 04, 2004	Radiation (03CH03-HY)
14	Horn Antenna	EMCO	3115	6741	1GHz – 18GHz	Apr. 07, 2004	Radiation (03CH03-HY)
15	Turn Table	HD	DS 420	420/650/00	0 ~ 360 degree	N/A	Radiation (03CH03-HY)
16	Antenna Mast	HD	MA 240	240/560/00	1 m - 4 m	N/A	Radiation (03CH03-HY)
17	Horn Antenna	Schwarzbeck	BBHA9170	154	18GHz~40GHz	Jun. 09, 2004	Radiation (03CH03-HY)
18	RF Cable-HIGH	Jye Bao	RG142	CB030-HIGH	1GHz~29.5GHz	Dec. 04, 2004	Radiation (03CH03-HY)

※ Calibration Interval of instruments listed above is one year.

Items	Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
18	Spectrum analyzer	R&S	FSP7	838858/014	9KHZ~7GHZ	Sep. 02, 2004	Conducted (TH01-HY)
19	Power meter	R&S	NRVS	100444	DC~40GHz	Jun. 15, 2004	Conducted (TH01-HY)
20	Power sensor	R&S	NRV-Z55	100049	DC~40GHz	Jun. 15, 2004	Conducted (TH01-HY)
21	Power Sensor	R&S	NRV-Z32	100057	30MHz-6GHz	Jun. 15, 2004	Conducted (TH01-HY)
22	AC power source	HPC	HPA-500W	HPA-9100024	AC 0~300V	Jun. 16, 2004	Conducted (TH01-HY)
23	AC power source	G.W.	GPC-6030D	C671845	DC 1V~60V	Nov. 05, 2004	Conducted (TH01-HY)
24	Temp. and Humidity Chamber	KSON	THS-C3L	612	N/A	Sep. 30, 2004	Conducted (TH01-HY)
25	RF CABLE-1m	Jye Bao	RG142	CB034-1m	20MHz~7GHz	Jan. 01, 2005	Conducted (TH01-HY)
26	RF CABLE-2m	Jye Bao	RG142	CB035-2m	20MHz~1GHz	Jan. 01, 2005	Conducted (TH01-HY)

※ Calibration Interval of instruments listed above is one year.

7. Company Profile

SPORTON Lab. was established in 1986 with one shielded room: the first private EMI test facility, offering local manufacturers an alternative EMI test familial apart from ERSO. In 1988, one 3M and 10M/3M open area test site were setup and also obtained official accreditation from FCC, VCCI and NEMKO. In 1993, a Safety laboratory was founded and obtained accreditation from UL of USA, CSA of Canada and TUV (Rhineland & PS) of Germany. In 1995, one EMC lab, including EMI and EMS test facilities was setup. In 1997, SPORTON Group has provided financial expense to relocate the headquarter to Orient Scientific Park in Taipei Hsien to offer more comprehensive, more qualified and better service to local suppliers and manufactures. In 1999, Safety Group and Component Group were setup. In 2001, SPORTON has established 3M/10M chamber in Hwa Ya Technology Park.

7.1. Certificate of Accreditation

Taiwan	BSMI, CNLA, DGT
USA	FCC, NVLAP, UL
EU	Nemko, TUV
Japan	VCCI
Canada	Industry Canada

7.2. Test Location

SHIJR	ADD： 6Fl., No. 106, Sec. 1, Shintai 5th Rd., Shijr City, Taipei, Taiwan 221, R.O.C. TEL： 02-2696-2468 FAX： 02-2696-2255
HWA YA	ADD： No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL： 03-327-3456 FAX： 03-318-0055
LINKOU	ADD： No. 30-2, Dingfu Tsuen, Linkou Shiang, Taipei, Taiwan 244, R.O.C TEL： 02-2601-1640 FAX： 02-2601-1695
DUNGHU	ADD： No. 3, Lane 238, Kangle St., Neihu Chiu, Taipei, Taiwan 114, R.O.C. TEL： 02-2631-4739 FAX： 02-2631-9740
JUNGHE	ADD： 7Fl., No. 758, Jungjeng Rd., Junghe City, Taipei, Taiwan 235, R.O.C. TEL： 02-8227-2020 FAX： 02-8227-2626
NEIHU	ADD： 4Fl., No. 339, Hsin Hu 2nd Rd., Taipei 114, Taiwan, R.O.C. TEL： 02-2794-8886 FAX： 02-2794-9777

8. CNLA Certificate of Accreditation

Test Lab.	:	Sporton International Inc.
Accreditation Number	:	1190
Originally Accredited	:	2003/12/15
Effective Period	:	2003/12/15~2006/12/14
Accredited Scope	:	47 CFR FCC Part 15 Subpart C (9kHz~40GHz)

Taiwan Accreditation Foundation
Chinese National Laboratory Accreditation
Certificate of Accreditation

Accreditation Criteria:	ISO 17025
Accreditation Number:	1190
Organization/Laboratory:	EMC & Wireless Communications Laboratory,Sporton International Inc.
Originally Accredited:	December 15, 2003
Effective Period:	December 15, 2003 To December 14, 2006
Accredited Scope:	Electrical Testing Field, 7 items, details shown in the following pages.
Specific Accreditation Program:	Recognition and Approval of Designated Laboratory for Commodities Inspection

President, Taiwan Accreditation Foundation
Date:July 19, 2004

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CNLA-ZL03191E Page 1 of 4