FCC TEST REPORT

CATEGORY	:	Mobile
PRODUCT NAME	:	802.11a mini-PCI Module
FCC ID.	:	M4Y-0XA622H
FILING TYPE	:	Certification (For Module Approval)
BRAND NAME	:	ZCOM
MODEL NAME	:	XA-622H
APPLICANT	:	**Z-Com, Inc.** 7F-2, No. 9. Prosperity RD.I Science-Based Industrial, Park Hsinchu, 300 Taiwan
MANUFACTURER	:	**Z-Com, Inc.** 7F-2, No. 9. Prosperity RD.I Science-Based Industrial, Park Hsinchu, 300 Taiwan
ISSUED BY	:	**SPORTON INTERNATIONAL INC.** 6F, No. 106, Sec. 1, Hsin Tai Wu Rd., Hsi Chih, Taipei Hsien, Taiwan, R.O.C.

Statements:

Only the test result of 802.11a part (5725MHz ~ 5850MHz) is shown in this test report.

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 NVLAP 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.

Lab Code: 200079-0

Table of Contents

HISTORY OF THIS TEST REPORT

Received Date: Sep. 13, 2005
Test Date: Sep. 23, 2005
Original Report Issue Date: Sep. 30, 2005
Report No.: FR591307

■ 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 (Section 15.247)

PRODUCT NAME	:	802.11a mini-PCI Module
BRAND NAME	:	ZCOM
MODEL NAME	:	XA-622H
APPLICANT	:	**Z-Com, Inc.** 7F-2, No. 9. Prosperity RD.I Science-Based Industrial, Park Hsinchu, 300 Taiwan
MANUFACTURER	:	**Z-Com, Inc.** 7F-2, No. 9. Prosperity RD.I Science-Based Industrial, Park Hsinchu, 300 Taiwan

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. Testing was carried out on Sep. 23, 2005 at SPORTON International Inc. LAB.

Wayne Hsu / Supervisor
Sporton International Inc.

1. General Description of Equipment under Test

1.1. Applicant

Z-Com, Inc.
7F-2, No. 9. Prosperity RD.I Science-Based Industrial, Park Hsinchu, 300 Taiwan

1.2. Manufacturer

Z-Com, Inc.
7F-2, No. 9. Prosperity RD.I Science-Based Industrial, Park Hsinchu, 300 Taiwan

1.3. Basic Description of Equipment under Test

This product is a Mini PCI module with 802.11a wireless solution. The technical data has been listed on section " Features of Equipment under Test ". This project is for Module Approval.

1.4. Features of Equipment under Test

Items	Description
Type of Modulation	OFDM (16QAM / 64QAM / DQPSK / DBPSK)
Number of Channels	5
Frequency Band	5725 MHz ~ 5850 MHz
Carrier Frequency	See section 1.6 for details
Data Rate	OFDM : 6, 12, 18, 24, 36, 48, 54Mbps
Max. Conducted Output Power	22.76dBm
Antenna Type	See section 1.5 for details
Communication Type	Half-Duplex
Testing Duty Cycle	100.00%
Power Rating (DC/AC, Voltage)	3.3 VDC from Host
Test Power Source	120.00V AC (Host)
Temperature Range (Operating)	0 ~ 55 °C

1.5. Antenna Description

No.	Antenna Type	Gain (dBi)
1	Dipole Antenna	2.22dBi @5.0GHz

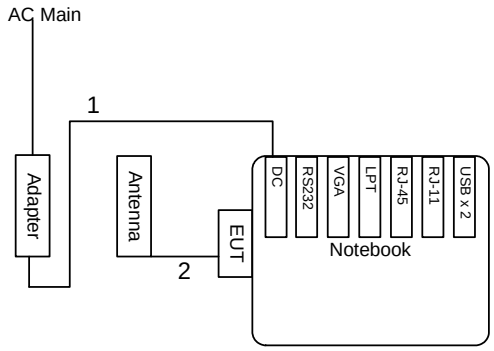
1.6. Table for Carrier Frequencies

Frequency Bands	
5725MHz ~ 5850MHz	
Channel	**Frequency**
149	5745 MHz
153	5765 MHz
157	5785 MHz
161	5805 MHz
165	5825 MHz

2. Test Configuration of the Equipment under Test

2.1. Connection Diagram of Test System

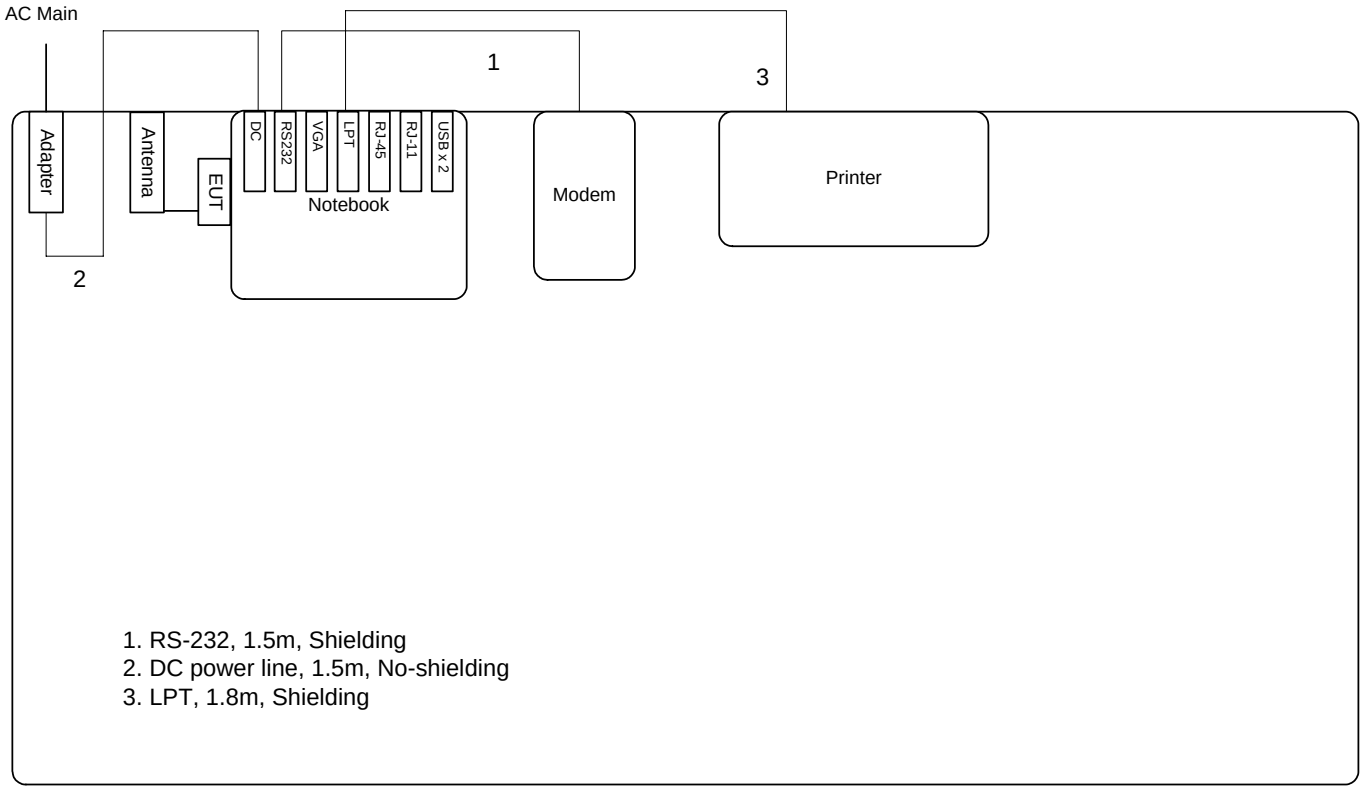
Radiation



1. DC power line, 1.5m, No-shielding

2. RF Cable, 10 cm, Shielding

Conduction



1. RS-232, 1.5m, Shielding
2. DC power line, 1.5m, No-shielding
3. LPT, 1.8m, Shielding

2.2. The Test Mode Description

1. For OFDM modulation, BPSK is the worst case on all test items.
2. According to ANSI C63.4-2003: If frequency range of EUT is more than 10 MHz, we have to test the lowest, middle and highest channels of EUT.
3. Spurious emission below 1GHz is independent of channel selection and modulation types. So only channel 165/5825MHz was tested.
4. AC conduction emission is independent of channel selection and modulation types. So only channel 165/5825MHz with OFDM modulation was tested.

2.3. Description of Test Supporting Units

Support unit	Brand	Model No.	FCC ID
Notebook	DELL	PP01L (D505)	DoC
Modem	ACEEX	DM-1414	IFAXDM1414
Printer	EPSON	LQ-300	DoC

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 / CO04-HY

3.2. Test Conditions

Normal Voltage : 120.00VAC
Normal Temperature : 20℃

3.3. 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

3.4. Frequency Range Investigated

Radiated emission test: from 30 MHz to 10th carrier harmonic or 40GHz at most.

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 or 40GHz at most) test from antenna to EUT is 1 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 Parameters of IEEE 802.11a

Test Software Version	ART			
Frequency	5745 MHz	5785 MHz	5825 MHz	Data Rate
IEEE 802.11a OFDM	18.5	18.5	18.5	6 Mbps

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 Edge Emissions	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 6dB bandwidth shall be at least 500 kHz.

5.1.2. Measuring Instruments

Item 20 of the table on section 6.

5.1.3. Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP40
  Attenuation : Auto
  Center Frequency : 5745MHz / 5785MHz / 5825MHz
  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 bandwidth is the spectrum range with level higher than 6dB below the peak level.
4. Repeat points 1~3 for the lowest, middle and highest channel of the EUT.

5.1.5. Test Setup Layout

5.1.6. Test Criteria

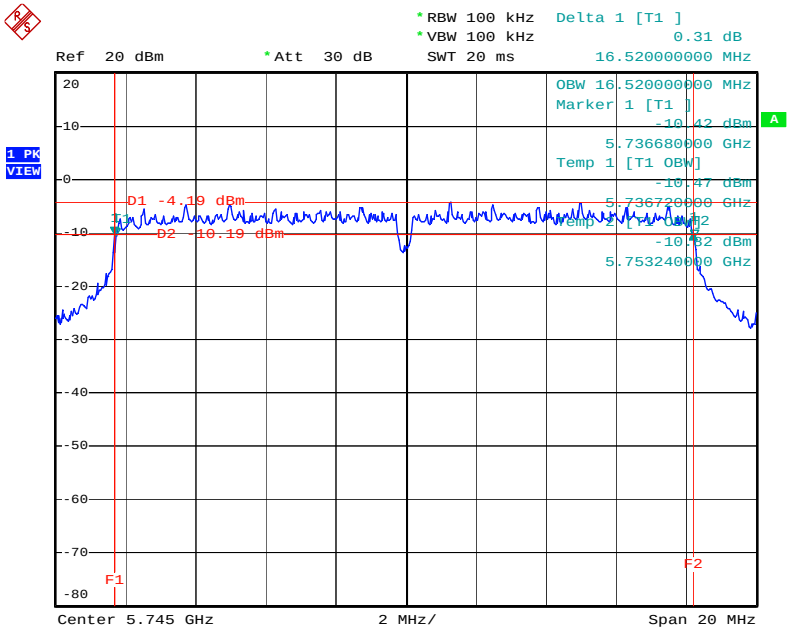
All test results complied with the requirements of 15.247(a)(2). Measurement Uncertainty is $1x10^{-5}$.

5.1.7. Test Result

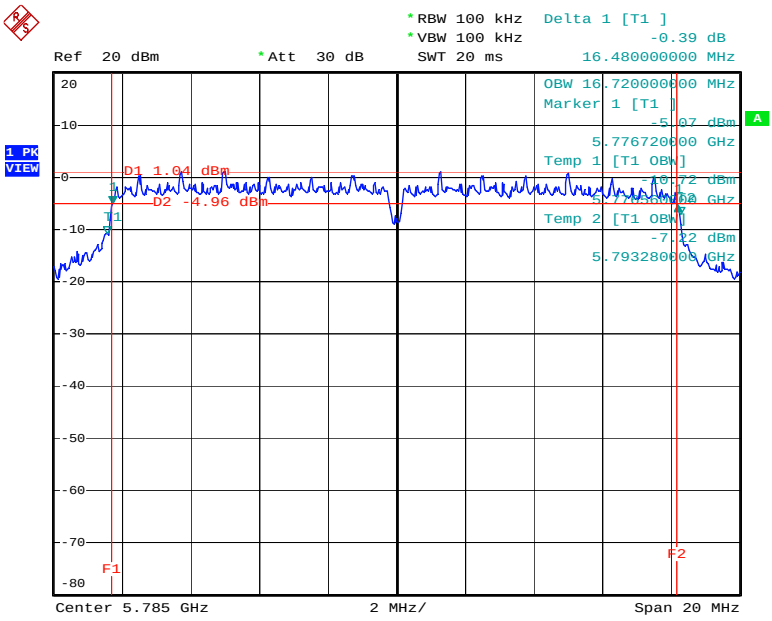
- Temperature: 26°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Steven Lu

Modulation Type	Channel No.	Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Min. Limit (MHz)
OFDM	149	5745 MHz	16.52	16.52	0.5
OFDM	157	5785 MHz	16.48	16.72	0.5
OFDM	165	5825 MHz	16.56	16.56	0.5

Modulation Type: OFDM (Channel 149 / 5745 MHz)：



Modulation Type: OFDM (Channel 157 / 5785 MHz)：



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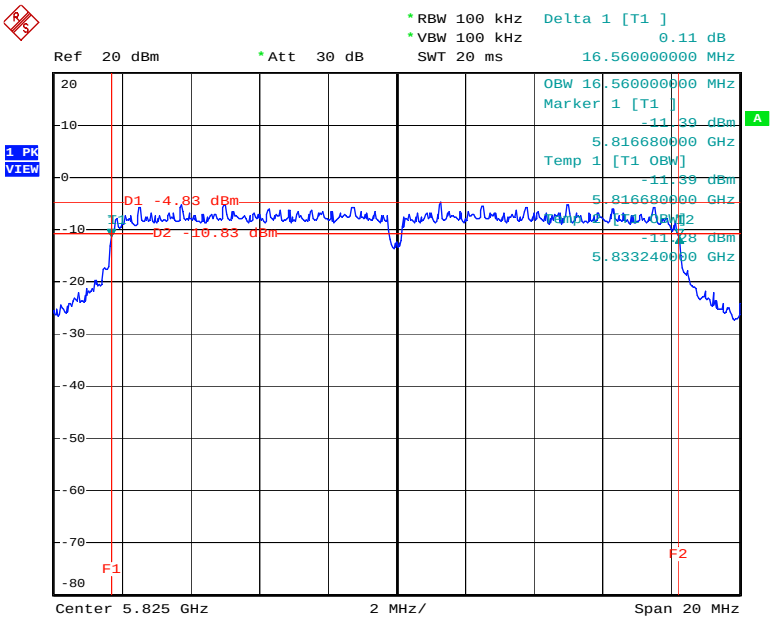
Modulation Type: OFDM (Channel 165 / 5825 MHz)：



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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.

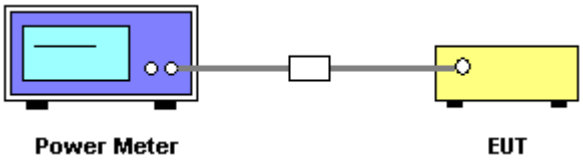
5.2.2. Measuring Instruments

Item 21, 23 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 point 1 for the lowest, 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: 26°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Steven Lu

Modulation Type	Channel No.	Frequency (MHz)	Output Power (dBm)	Limits (dBm)
OFDM	149	5745 MHz	22.76	30
OFDM	157	5785 MHz	22.55	30
OFDM	165	5825 MHz	22.39	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 20 of the table on section 6.

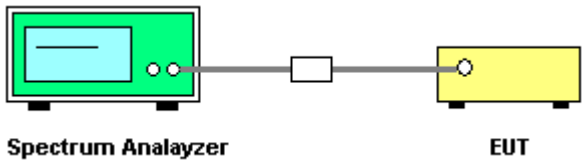
5.3.3. Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP40
  Attenuation : Auto
  Center Frequency : 5745MHz / 5785MHz / 5825MHz
  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 is 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 point 1~4 for the lowest, middle and highest channel of the EUT.

5.3.5. Test Setup Layout



5.3.6. Test Criteria

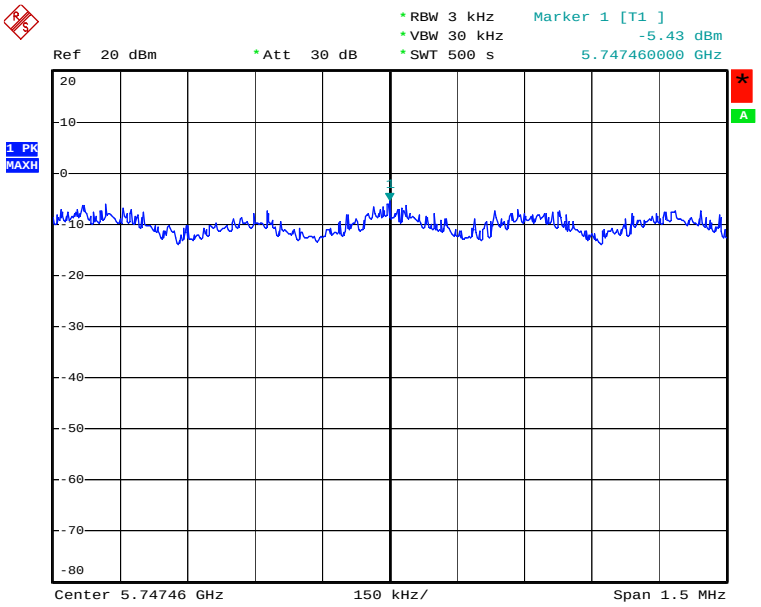
All test results complied with the requirements of 15.247(e). Measurement Uncertainty is 1.5dB.

5.3.7. Test Result

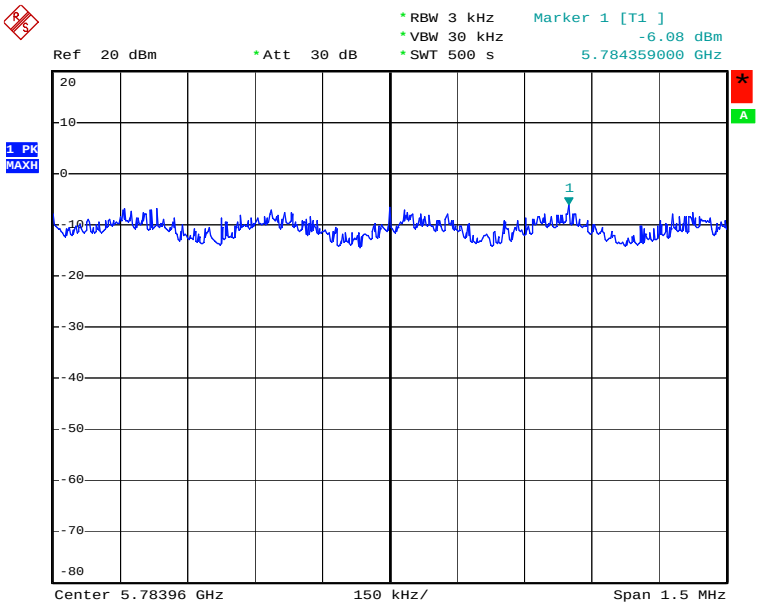
- Temperature: 26°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Steven Lu

Modulation Type	Channel	Frequency (MHz)	Power Density (dBm)	Limits (dBm)
OFDM	149	5745 MHz	-5.43	8
OFDM	157	5785 MHz	-6.08	8
OFDM	165	5825 MHz	-7.35	8

Modulation Type: OFDM (Channel 149 / 5745 MHz)：



Modulation Type: OFDM (Channel 157 / 5785 MHz)：



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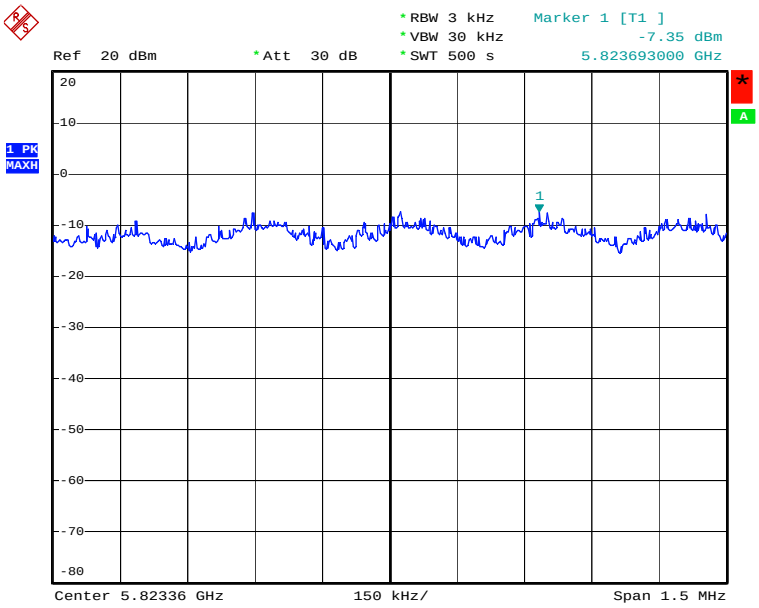
Modulation Type: OFDM (Channel 165 / 5825 MHz)：



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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 20 of the table on section 6 for conducted measurement.

5.4.3. Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP40 (Conducted Measurement)

Attenuation	:	Auto
Center Frequency	:	5745 MHz / 5825 MHz
Span Frequency	:	100MHz
RB	:	100 kHz
VB	:	100 kHz
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 tHsi trace.
4. The lowest band edges emission was measured and recorded.
5. The transmitter set to the highest channel and repeated 2~4.

5.4.5. Test Setup

Conducted Method

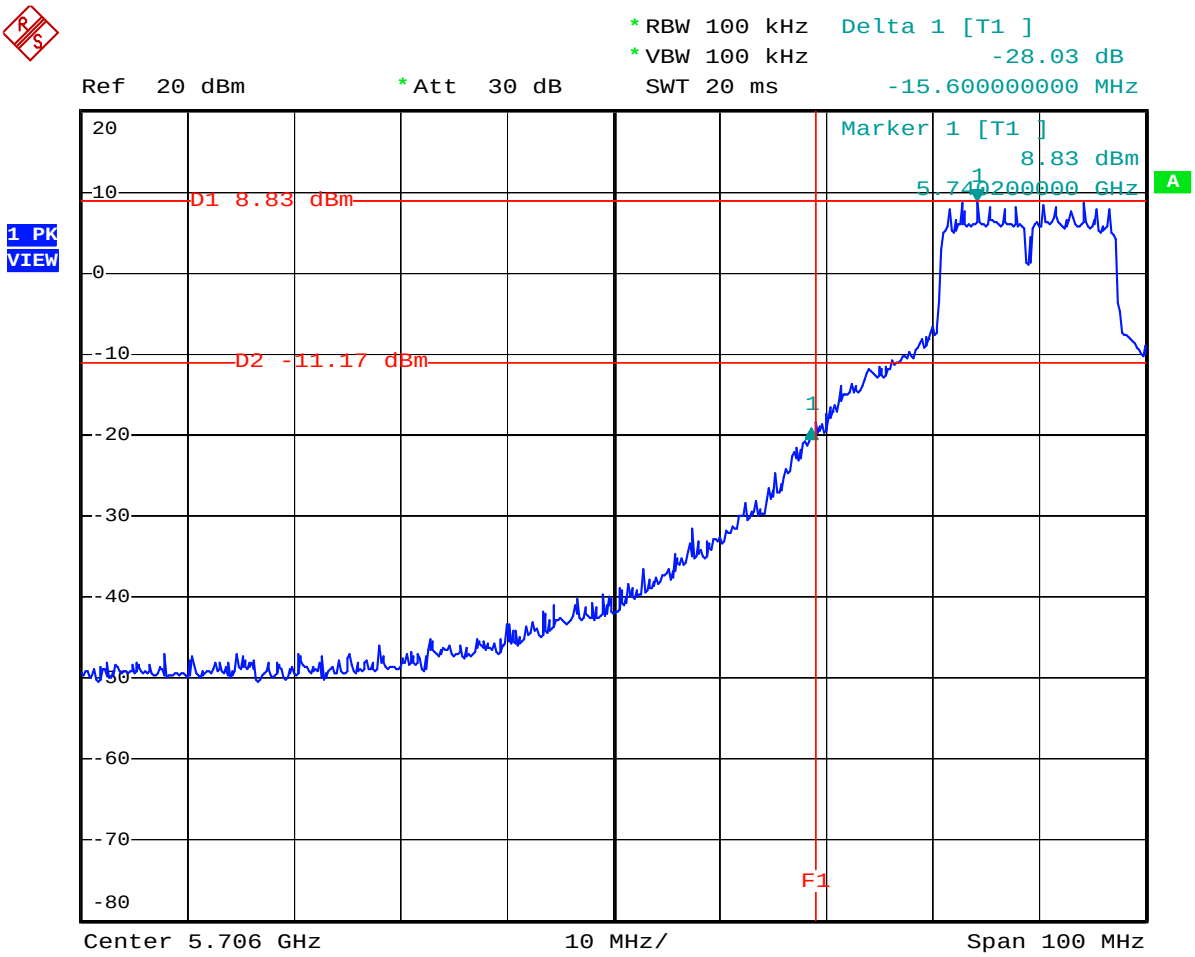
5.4.6. Test Criteria

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

5.4.7. Test Result

Temperature: 26°C
Relative Humidity: 64%
Duty Cycle of the Equipment During the Test: 100.00%
Test Engineer: Steven Lu

Modulation Type: OFDM (Channel 149 / 5745 MHz)：



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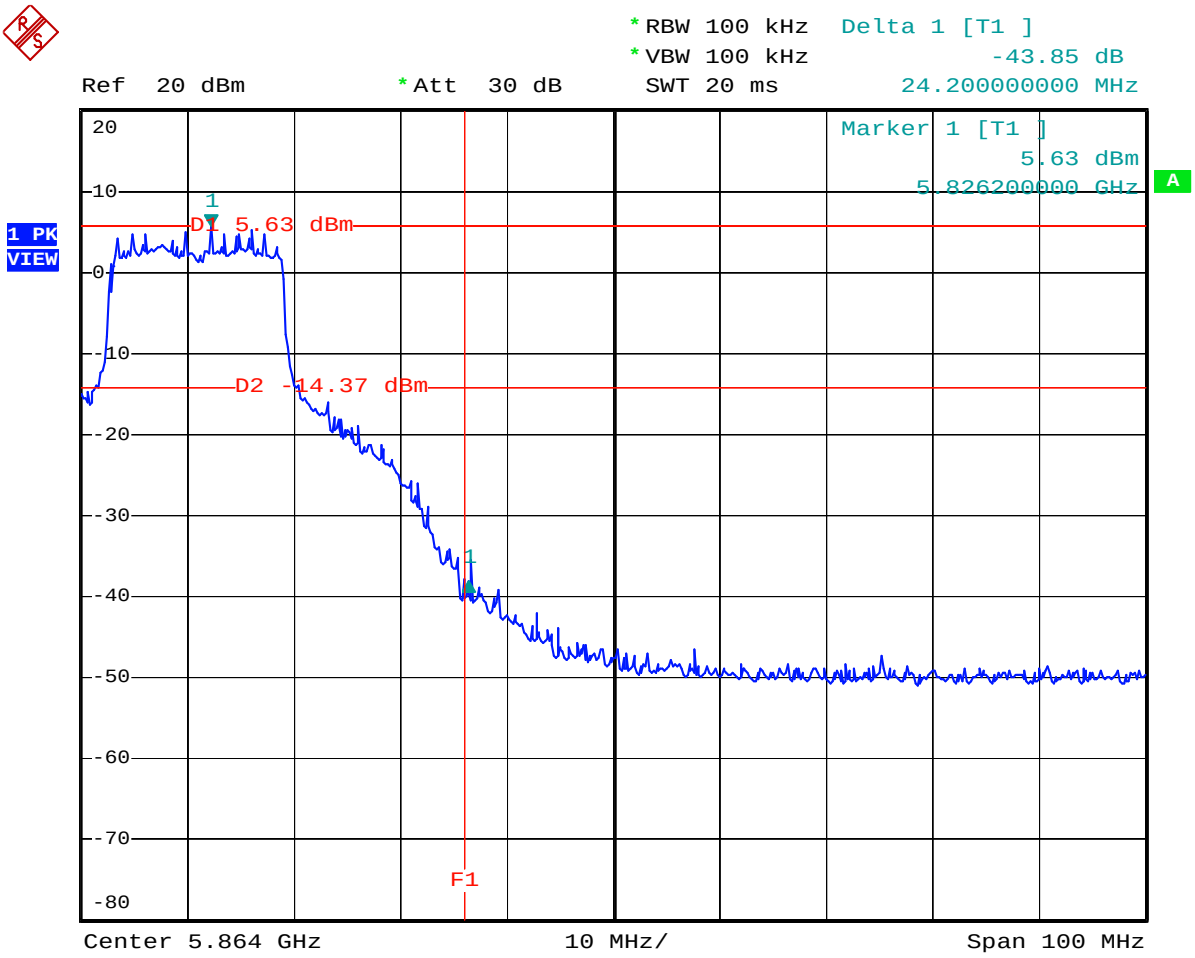
Modulation Type: OFDM (Channel 165 / 5825 MHz)：



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5.5. Test of AC Power Line Conducted Emission

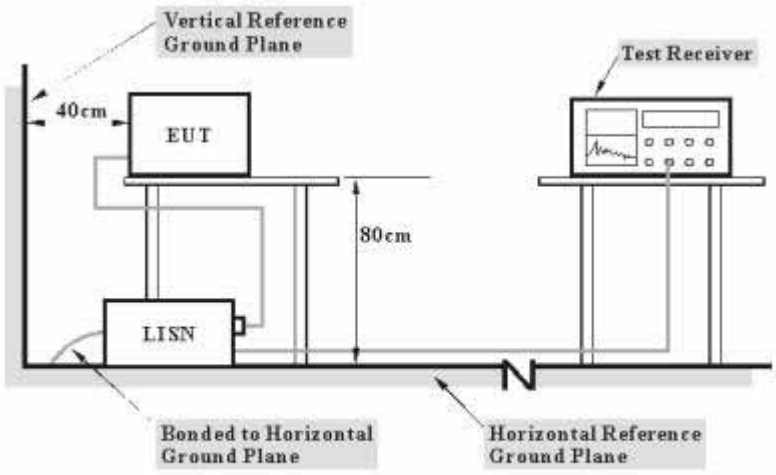
5.5.1. Measuring Instruments

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

5.5.2. Test Procedures

1. Configure the EUT according to ANSI C63.4-2003.
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. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
7. 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 Setup Layout

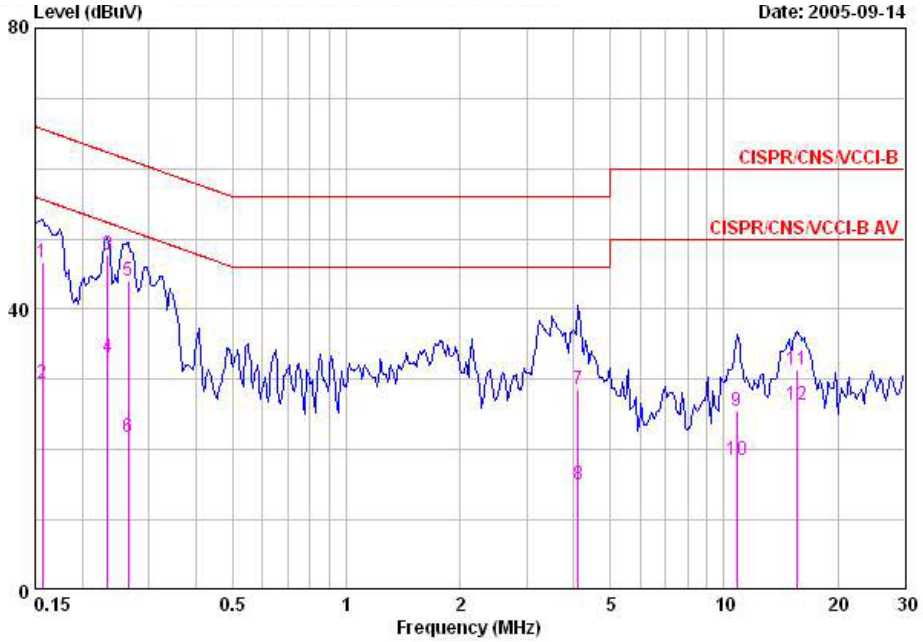


Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

5.5.4. Test Result of Conducted Emission

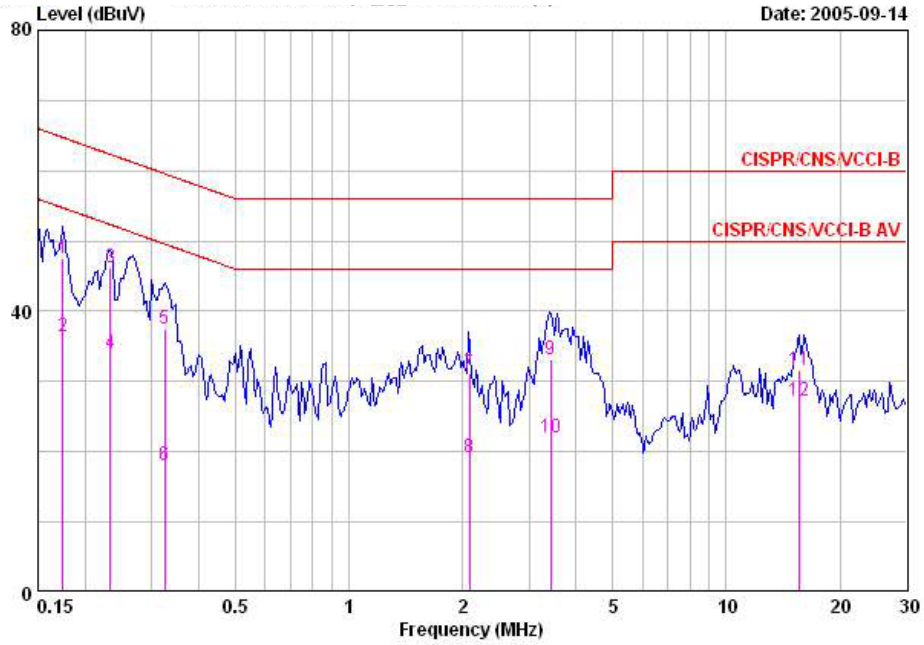
- Temperature: 26°C
- Relative Humidity: 64%
- Test Engineer: Steven Lu

Line to Ground



	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.15650	46.76	-18.89	65.65	44.49	2.07	0.20	QP
2	0.15650	29.49	-26.16	55.65	27.22	2.07	0.20	AVERAGE
3 @	0.23285	47.72	-14.63	62.35	46.52	1.00	0.20	QP
4	0.23285	33.13	-19.22	52.35	31.93	1.00	0.20	AVERAGE
5	0.26442	43.98	-17.31	61.29	42.88	0.90	0.20	QP
6	0.26442	21.88	-29.41	51.29	20.78	0.90	0.20	AVERAGE
7	4.114	28.54	-27.46	56.00	27.86	0.38	0.30	QP
8	4.114	15.12	-30.88	46.00	14.44	0.38	0.30	AVERAGE
9	10.790	25.43	-34.57	60.00	24.67	0.36	0.40	QP
10	10.790	18.44	-31.56	50.00	17.68	0.36	0.40	AVERAGE
11	15.552	31.35	-28.65	60.00	30.65	0.30	0.40	QP
12	15.552	26.37	-23.63	50.00	25.67	0.30	0.40	AVERAGE

Neutral to Ground

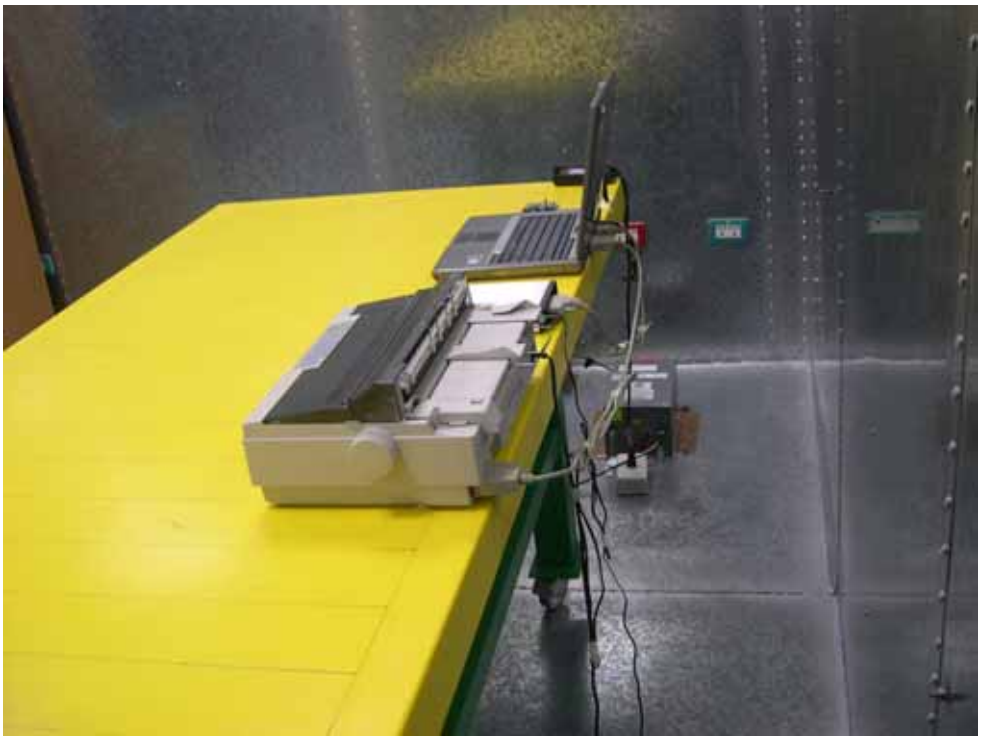


	Freq	Level	Over Limit	Limit Line	Read Level	LISN Factor	Cable Loss	Remark
	MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.17491	47.45	-17.27	64.72	45.65	1.60	0.20	QP
2	0.17491	36.48	-18.24	54.72	34.68	1.60	0.20	AVERAGE
3 @	0.23285	46.24	-16.11	62.35	45.14	0.90	0.20	QP
4	0.23285	34.03	-18.32	52.35	32.93	0.90	0.20	AVERAGE
5	0.32512	37.45	-22.12	59.57	36.60	0.65	0.20	QP
6	0.32512	18.20	-31.37	49.57	17.35	0.65	0.20	AVERAGE
7	2.091	31.25	-24.75	56.00	30.83	0.22	0.20	QP
8	2.091	19.16	-26.84	46.00	18.74	0.22	0.20	AVERAGE
9	3.422	33.11	-22.89	56.00	32.53	0.30	0.28	QP
10	3.422	21.97	-24.03	46.00	21.39	0.30	0.28	AVERAGE
11	15.552	31.68	-28.32	60.00	30.98	0.30	0.40	QP
12	15.552	27.16	-22.84	50.00	26.46	0.30	0.40	AVERAGE

5.5.5. Photographs of Conducted Emission Test Configuration

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 6~19 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

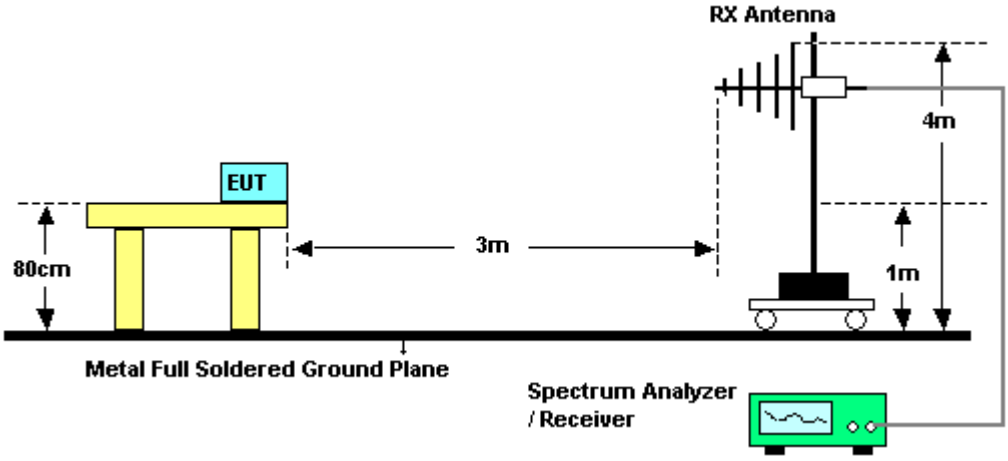
- Test Receiver : R&S ESCS 30
  Attenuation : Auto
  Start Frequency : 30 MHz
  Stop Frequency : 1000 MHz
  RB : 120 KHz for QP or PK

5.6.4. Test Procedures

1. Configure the EUT according to ANSI C63.4-2003.
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



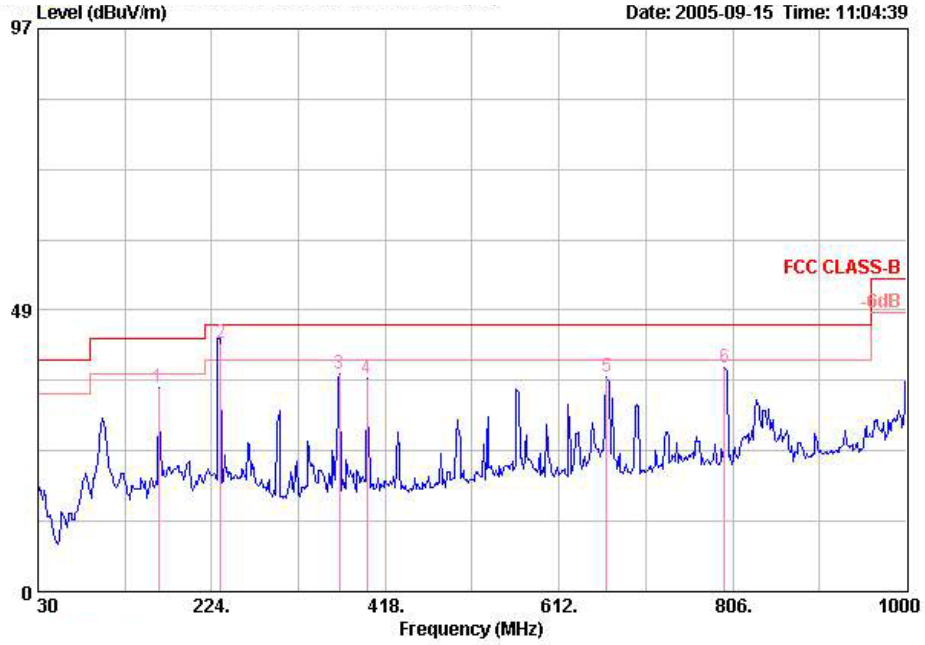
5.6.6. Test Criteria

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

5.6.7. Test Results for CH 165 / 5825MHz (for emission below 1GHz)

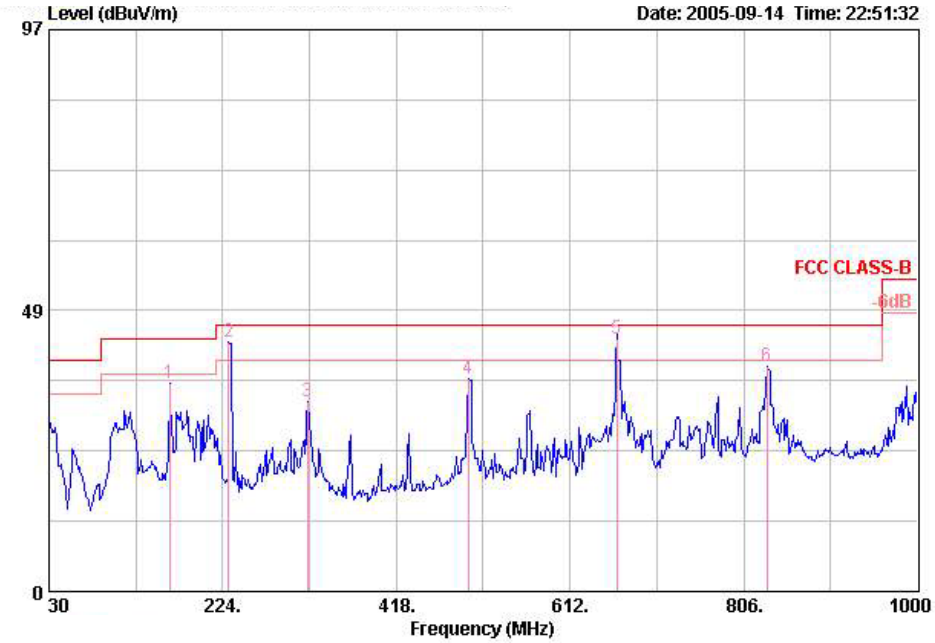
- Temperature: 26°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Steven Lu

(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		
1 @	164.830	35.08	-8.42	43.50	9.35	0.91	30.19	55.01	HORIZONTAL	Peak
2 @	233.700	42.80	-3.20	46.00	10.26	1.01	30.07	61.61	HORIZONTAL	QP
3 @	366.590	37.65	-8.35	46.00	14.83	1.25	30.55	52.11	HORIZONTAL	Peak
4 @	397.630	36.76	-9.24	46.00	15.80	1.38	30.37	49.94	HORIZONTAL	Peak
5 @	665.350	36.87	-9.13	46.00	18.91	1.75	30.35	46.57	HORIZONTAL	Peak
6 @	797.270	38.70	-7.30	46.00	19.96	2.21	30.13	46.66	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 @	164.830	35.89	-7.61	43.50	9.35	0.91	30.19	55.81	VERTICAL	Peak
2 @	230.790	42.95	-3.05	46.00	9.84	0.99	30.07	62.19	VERTICAL	Peak
3 @	319.060	32.82	-13.18	46.00	13.67	1.17	30.39	48.37	VERTICAL	Peak
4 @	498.510	36.66	-9.34	46.00	17.36	1.53	30.53	48.30	VERTICAL	Peak
5 @	664.380	43.73	-2.27	46.00	18.90	1.75	30.35	53.42	VERTICAL	QP
6 @	832.190	38.73	-7.27	46.00	20.30	1.94	30.01	46.51	VERTICAL	Peak

Note:

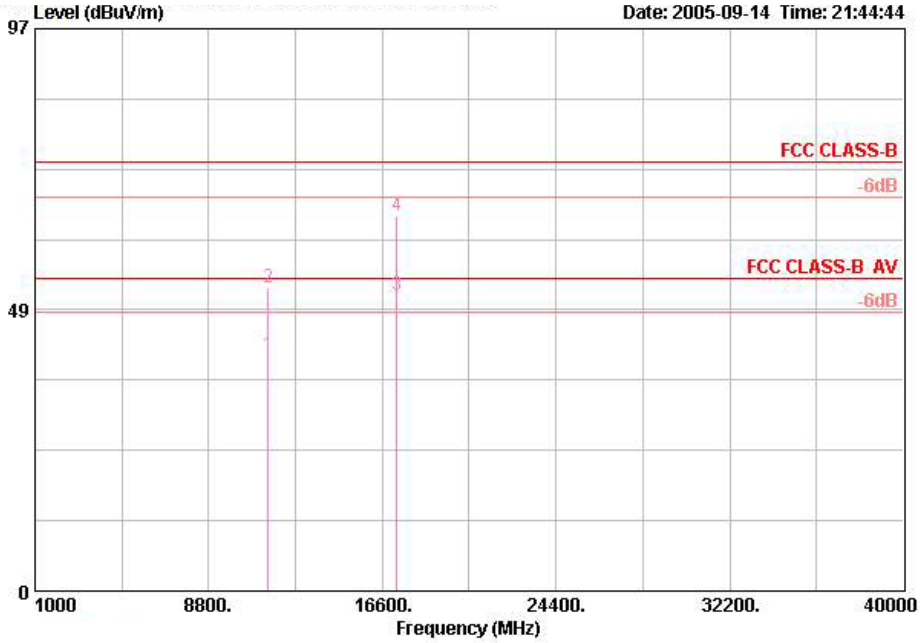
Emission level (dBuV/m) = 20 log Emission level (uV/m)

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

5.6.8. Test Results for CH 149 / 5745MHz (for emission above 1GHz)

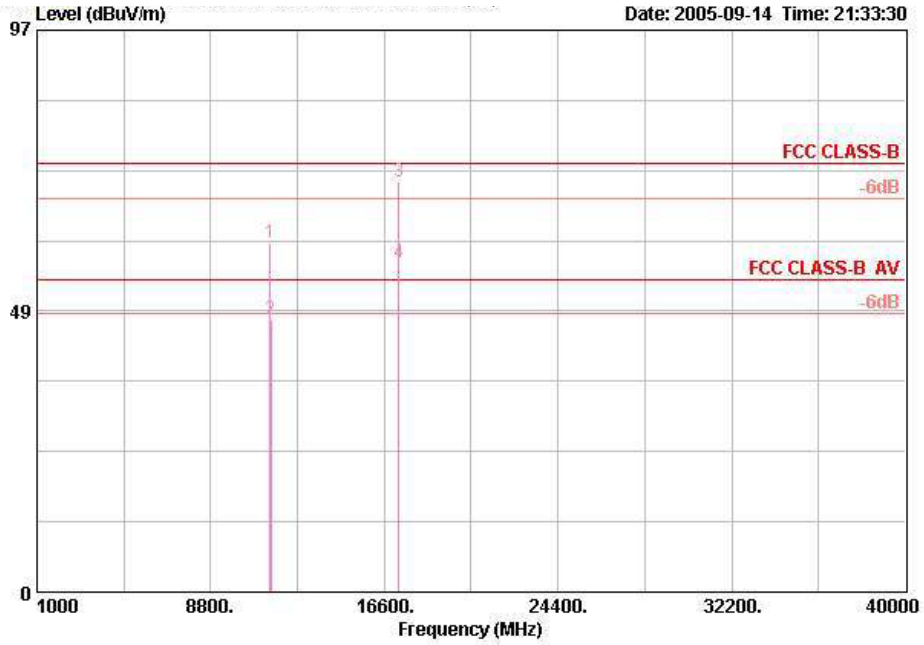
- Modulation Type: OFDM
- Temperature: 26°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Steven Lu

(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		
1 @	11488.260	40.83	-13.17	54.00	39.20	5.57	35.10	31.16	HORIZONTAL	AVERAGE
2 @	11488.260	52.36	-21.64	74.00	39.20	5.57	35.10	42.69	HORIZONTAL	PEAK
3 @	17236.740	51.00	-3.00	54.00	40.93	12.64	35.00	32.44	HORIZONTAL	AVERAGE
4 @	17237.460	64.72	-9.28	74.00	40.93	12.64	35.00	46.16	HORIZONTAL	PEAK

(B) Polarization: Vertical



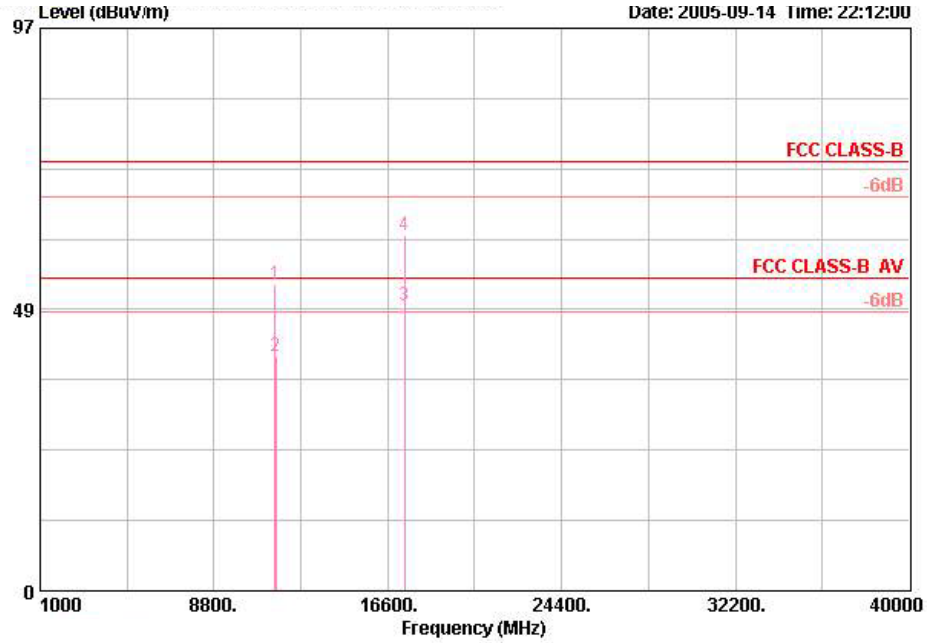
	Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
	MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1	11489.240	60.32	-13.68	74.00	39.20	5.57	35.10	50.65	VERTICAL	PEAK
2	11490.700	47.01	-6.99	54.00	39.20	5.57	35.10	37.34	VERTICAL	AVERAGE
3 !	17236.120	70.96	-3.04	74.00	40.93	12.64	35.00	52.40	VERTICAL	PEAK

Note:
Emission level (dBuV/m) = 20 log Emission level (uV/m)
Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level
For item 3, radiated emissions which do not fall in the restricted bands shall be below 20 dB of fundamental emission.

5.6.9. Test Results for CH 157 / 5785MHz (for emission above 1GHz)

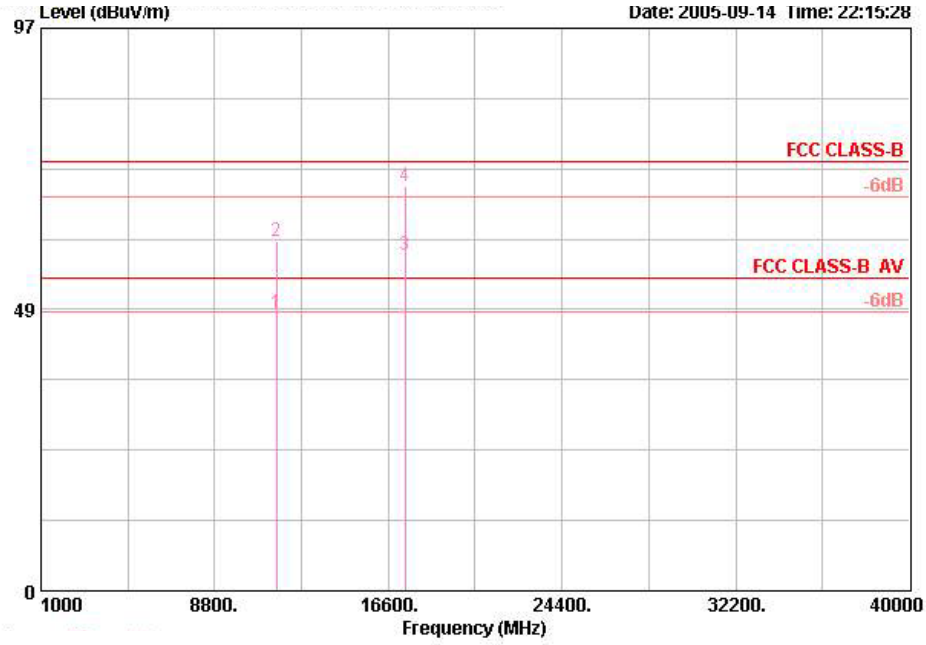
- Modulation Type: OFDM
- Temperature: 26°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Ted Chiu

(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		
1 @	11558.200	52.89	-21.11	74.00	39.21	5.60	35.12	43.21	HORIZONTAL	PEAK
2 @	11575.600	40.35	-13.65	54.00	39.21	5.60	35.13	30.67	HORIZONTAL	AVERAGE
3 @	17344.800	49.11	-4.89	54.00	41.37	10.14	35.04	32.64	HORIZONTAL	AVERAGE
4 @	17363.400	61.25	-12.75	74.00	41.51	9.31	35.05	45.48	HORIZONTAL	PEAK

(B) Polarization: Vertical



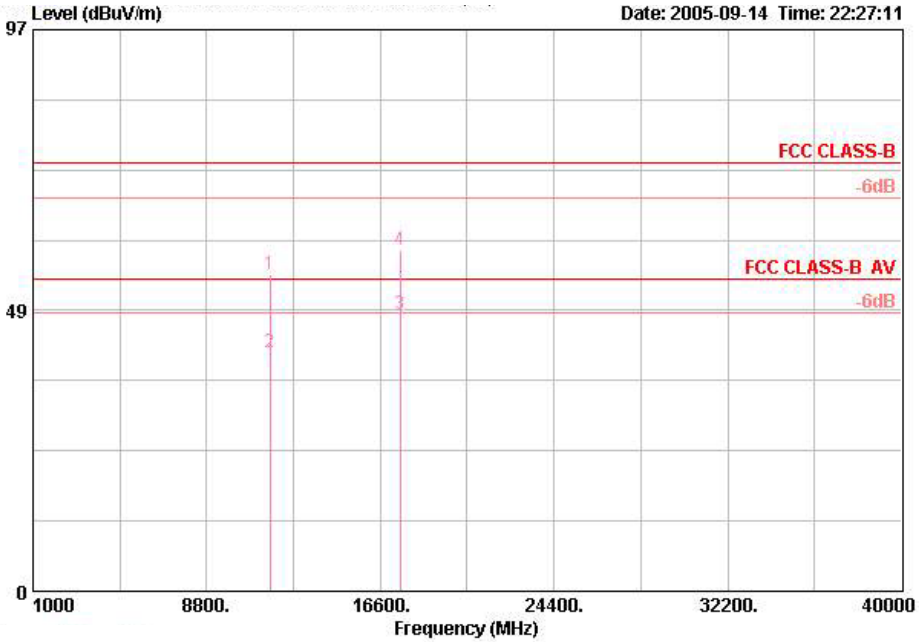
	Freq	Level	Over Limit	Limit Line	Antenna Factor	Cable Loss	Preamp Factor	Read Level	Pol/Phase	Remark
	MHz	dBuV/m	dB	dBuV/m	dB/m	dB	dB	dBuV		
1 @	11571.520	47.91	-6.09	54.00	39.21	5.60	35.13	38.24	VERTICAL	AVERAGE
2 @	11576.240	60.22	-13.78	74.00	39.21	5.60	35.13	50.54	VERTICAL	PEAK
3 @	17360.720	69.89	-4.11	74.00	41.44	9.31	35.05	54.19	VERTICAL	PEAK

Note:
Emission level (dBuV/m) = 20 log Emission level (uV/m)
Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level
For item 3, radiated emissions which do not fall in the restricted bands shall be below 20 dB of fundamental emission.

5.6.10. Test Results for CH 165/ 5825MHz (for emission above 1GHz)

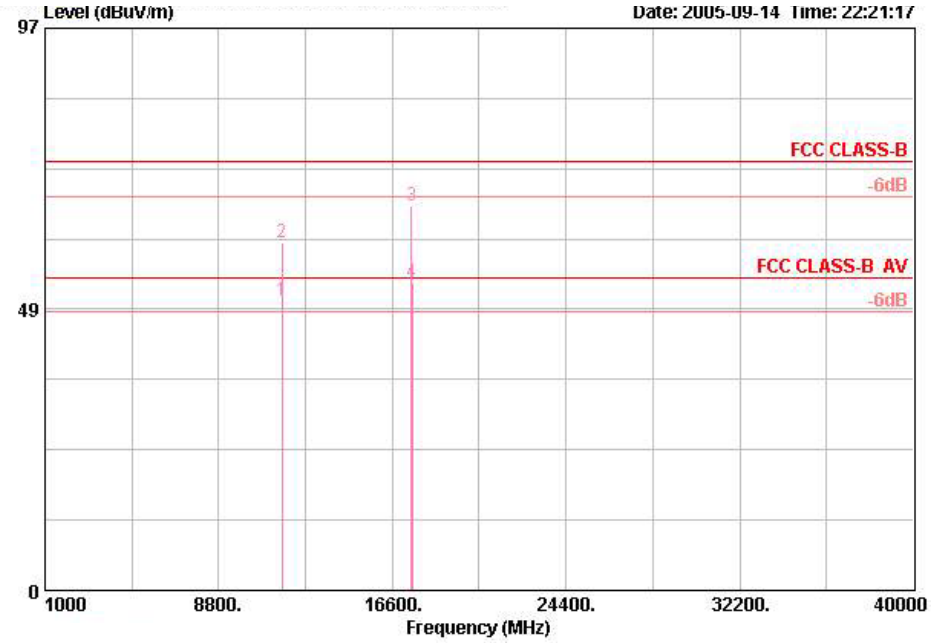
- Temperature: 26°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Ted Chiu

(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		
1 @	11643.360	54.60	-19.40	74.00	39.23	5.63	35.15	44.90	HORIZONTAL	PEAK
2 @	11647.360	41.30	-12.70	54.00	39.23	5.63	35.16	31.61	HORIZONTAL	AVERAGE
3 @	17474.240	47.74	-6.26	54.00	41.95	7.64	35.09	33.23	HORIZONTAL	AVERAGE
4 @	17474.240	58.95	-15.05	74.00	41.95	7.64	35.09	44.44	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 @	11649.760	49.83	-4.17	54.00	39.23	5.63	35.16	40.14	VERTICAL	AVERAGE
2 @	11649.760	59.93	-14.07	74.00	39.23	5.63	35.16	50.25	VERTICAL	PEAK
3 @	17473.440	66.42	-7.58	74.00	41.95	7.64	35.09	51.91	VERTICAL	PEAK

Note:
Emission level (dBuV/m) = 20 log Emission level (uV/m)
Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level
For item 3, radiated emissions which do not fall in the restricted bands shall be below 20 dB of fundamental emission.

5.6.11. Photographs of Radiated Emission Test Configuration

FRONT VIEW

REAR VIEW


591307

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):
Case 1: 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.

Case 2: 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.

Case 3: Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

5.7.2. Antenna Connected Construction

Reverse SMA is used for the Dipole Antenna.
EUT complies with Case 1 situation. Therefore peak conducted power limit shall be degraded accordingly. The antenna gain is 2.22 dBi and the conducted power limit shall be 24dBm.

5.7.3. 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 (cm)

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: OFDM
- Temperature: 26°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Steven Lu

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)
149	2.22	1.67	22.76	188.80	0.0628	1
157	2.22	1.67	22.55	179.89	0.0598	1
165	2.22	1.67	22.39	173.38	0.0576	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	100174	9kHz – 2.75GHz	Feb. 19, 2005	Conduction (CO04-HY)
2	LISN	EMCO	3810/2NM	9703-1839	9kHz – 30MHz	Mar. 15, 2005	Conduction (CO04-HY)
3	LISN (Support Unit)	PIC	NNB-2/16Z	2001/008	9kHz – 30MHz	May 06, 2005	Conduction (CO04-HY)
4	EMI Filter	LINDGREN	LRE-2030	2651	< 450 Hz	N/A	Conduction (CO04-HY)
5	RF Cable-CON	Suhner Switzerland	RG223/U	CB029	9kHz – 30MHz	Dec. 23, 2004	Conduction (CO04-HY)
6	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz ~ 1GHz 3m	Jun. 16, 2005	Radiation (03CH03-HY)
7	Spectrum Analyzer	R&S	FSP40	100019	9KHZ~40GHz	Jul. 21, 2005	Radiation (03CH03-HY)
8	Amplifier	SCHAFFNER	CPA9231A	18667	9KHz ~ 2GHz	Jan. 10, 2005	Radiation (03CH03-HY)
9	Amplifier	Agilent	8449B	3008A02120	1GHz ~ 26.5GHz	May 31, 2005	Radiation (03CH03-HY)
10	Amplifier	MITEQ	AMF-6F-260400	923364	26.5GHz ~ 40GHz	Jan. 05, 2004*	Radiation (03CH03-HY)
11	Loop Antenna	R&S	HFH2-Z2	860004/001	9kHz ~ 30MHz	May 24, 2004*	Radiation (03CH03-HY)
12	Biconical Antenna	SCHWARZBECK	VHBB 9124	301	30MHz ~ 200MHz	Jul. 22, 2005	Radiation (03CH03-HY)
13	Log Antenna	SCHWARZBECK	VUSLP 9111	221	200MHz ~ 1GHz	Jul. 22, 2005	Radiation (03CH03-HY)
14	Horn Antenna	EMCO	3115	6741	1GHz ~ 18GHz	Apr. 22, 2005	Radiation (03CH03-HY)
15	Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	15GHz ~ 40GHz	Jun. 09, 2004*	Radiation (03CH03-HY)
16	RF Cable-R03m	Jye Bao	RG142	CB021	30MHz ~ 1GHz	Feb. 22, 2005	Radiation (03CH03-HY)
17	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	1GHz ~ 40GHz	Dec.01, 2004	Radiation (03CH03-HY)
18	Turn Table	HD	DS 420	420/650/00	0 ~ 360 degree	N/A	Radiation (03CH03-HY)
19	Antenna Mast	HD	MA 240	240/560/00	1 m - 4 m	N/A	Radiation (03CH03-HY)

※ Calibration Interval of instruments listed above is one year.
* Calibration Interval of instruments listed above is two year.

Items	Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
20	Spectrum Analyzer	R&S	FSP40	100019	9KHZ~40GHz	Jul. 21, 2005	Conducted (TH01-HY)
21	Power Meter	R&S	NRVS	100444	DC ~ 40GHz	Jul. 06, 2005	Conducted (TH01-HY)
22	Power Sensor	R&S	NRV-Z55	100049	DC ~ 40GHz	Jul. 06, 2005	Conducted (TH01-HY)
23	Power Sensor	R&S	NRV-Z32	100057	30MHz ~ 6GHz	Apr. 28, 2005	Conducted (TH01-HY)
24	AC Power Source	HPC	HPA-500W	HPA-9100024	AC 0 – 300V	Apr. 21, 2005	Conducted (TH01-HY)
25	DC Power Source	G.W.	GPC-6030D	C671845	DC 1V – 60V	Dec. 28, 2004	Conducted (TH01-HY)
26	Temp. and Humidity Chamber	KSON	THS-C3L	612	N/A	Oct. 01, 2004	Conducted (TH01-HY)
27	RF CABLE-1m	Jye Bao	RG142	CB034-1m	20MHz – 7GHz	Jan. 01, 2005	Conducted (TH01-HY)
28	RF CABLE-2m	Jye Bao	RG142	CB035-2m	20MHz – 1GHz	Jan. 01, 2005	Conducted (TH01-HY)
29	Data Generator	Tektronix	J310345	J310345	400Mbps	Dec. 21, 2004	Conducted (TH01-HY)
30	OscilloScope	Tektronix	TDS1012	C038520	100MHz-1Gs/s	Jan. 02, 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. Certificate of NVLAP Accreditation

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

ISO/IEC 17025:1999
ISO 9002:1994

Certificate of Accreditation

SPORTON INTERNATIONAL, INC.
TAIPEI HSIEN 221
TAIWAN

is recognized by the National Voluntary Laboratory Accreditation Program for satisfactory compliance with criteria set forth in NIST Handbook 150:2001, all requirements of ISO/IEC 17025:1999, and relevant requirements of ISO 9002:1994. Accreditation is awarded for specific services, listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

December 31, 2005
Effective through

For the National Institute of Standards and Technology
NVLAP Lab Code: 200079-0

NVLAP-01C (06-01)