



FCC TEST REPORT

CATEGORY : Module for Portable Host

PRODUCT NAME : 802.11a/b/g RLAN module

FCC ID. : H9P2121160

FILING TYPE : Certification – Class II Permissive Change

BRAND NAME : SYMBOL

TYPE NO. : 21-21160

MODEL OF HOST : MC3090 (with 11a/b/g module)

APPLICANT : **SYMBOL Technologies, Inc.**

One Symbol Plaza Holtsville, New York, 11742-1300 U.S.A

MANUFACTURER : **Universal Scientific Industrial Co., Ltd.**

141, Lane 351, Taiping Road, Sec.1, Tsao Yuen,
Nan-Tou, 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:

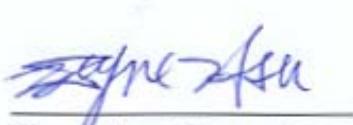
This test report is only for the 802.11b/g part of the product, test result of 802.11a is in another separate test report.

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

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

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

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


Wayne Hsu / Supervisor
Sporton International Inc.

NVLAP[®]

Lab Code: 200079-0

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History of this test report

- No additional attachment.
- Additional attachment were issued as following record:



1. General Description of Equipment under Test

1.1. Applicant

SYMBOL Technologies, Inc.

One Symbol Plaza Holtsville, New York, 11742-1300 U.S.A.

1.2. Manufacturer

Universal Scientific Industrial Co., Ltd.

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

1.3. Basic Description of Equipment under Test

The device supplied for testing was a 21-21160 RF Module which offers 2.4GHz and 5GHz wireless local area network connectivity employing IEEE 802.11 a/b/g technologies intended to be installed in mobile computer which is classified as portable device. The technical data has been listed on section " Features of Equipment under Test ". Accessories for RS232 or USB are available for connection with the computer.

1.4. Features of Equipment under Test

| ITEMS | DESCRIPTION |
|-------------------------------|---|
| Type of Modulation | DSSS (CCK / QPSK / BPSK), OFDM (16, 64 QAM) |
| Number of Channel | 11 |
| Frequency Band | 2400 ~ 2483.5 MHz |
| Carrier Frequencies | Please reference section 1.5. |
| Output Power | CCK :19.30dBm (peak) OFDM :19.07dBm (peak) |
| Channel Bandwidth | 16 MHz |
| Function Type | Transceiver |
| Antenna / Gain | PIFA Antenna / 2.7dBi |
| Power Rating (DC/AC, Voltage) | 3.3 VDC from host |
| Temperature Range (Operating) | -20 ~ +55 °C |



1.5. Table for Carrier Frequencies

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

1.6. Information of EUT Slight Change

This product is an extension of original one reported under Sporton project number: 453101

Differences between the certified equipment and the application equipment:

| Modifications | Description | Confirm Degrading Performance(s) |
|------------------|--|---|
| Relpace antennas | Old antenna : PIFA Antenna / 1dBi New antenna : PIFA Antenna / 2.7dBi | Band Edges of the Operation Frequency. AC Power Line Conducted Emission. Receiver Spurious Emissions. |



2. Test Configuration of the Equipment under Test

2.1. Description of the Test

- a. The EUT has been programmed to continuously transmit or receive during testing. The used peripherals as well as the configuration fulfill the requirements of ANSI C63.4:2003.
- b. Please see section 2.3 for the verified test modes.
- c. 3 meters measurement distance of semi-anechoic chamber was used in this test.

2.2. Frequency Range Investigated

- a. Conducted power line test: from 150 kHz to 30 MHz
- b. Radiated emission test: from 30 MHz to 25000 MHz

2.3. Test Modes

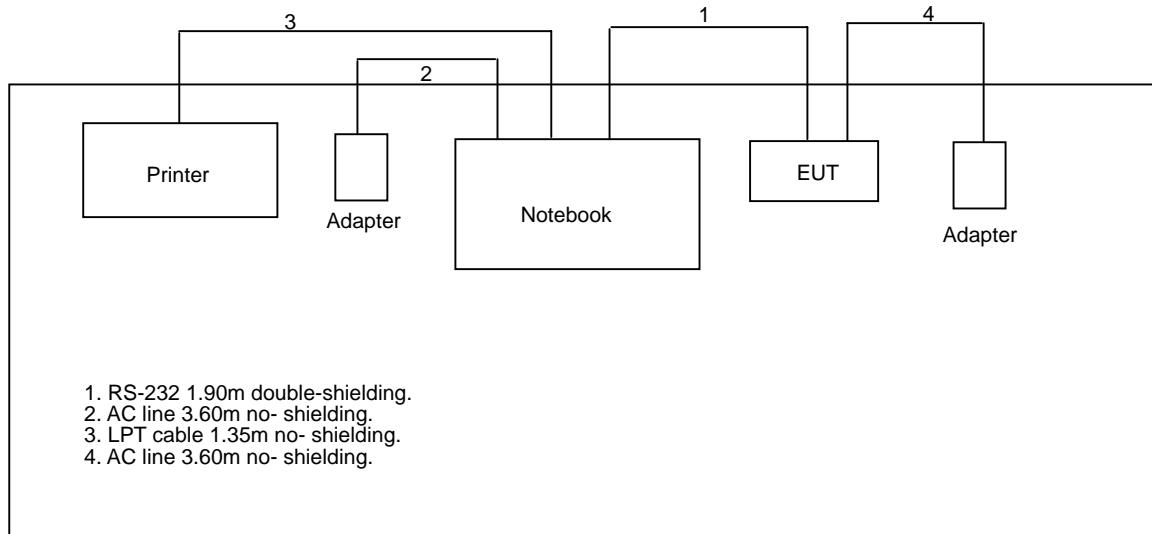
- a. EUT was placed outside the host and continuously transmitting RF modulated signal.
- b. For DSSS modulation, CCK (11Mbps) is the worst case on all test items.
- c. For OFDM modulation, BPSK (6Mbps) is the worst case on all test items.
- d. Frequency range of EUT is more than 10 MHz, the lowest, middle and highest channels of EUT were tested.
- e. Spurious emission below 1GHz is independent of channel selection and modulation types, there will be no effect on test results. So only channel 11 with OFDM modulation was tested.
- f. AC conduction emission is independent of channel selection and modulation types, there will be no effect on test results. So only channel 11 with CCK modulation was tested..

2.4. Description of Test Supporting Units

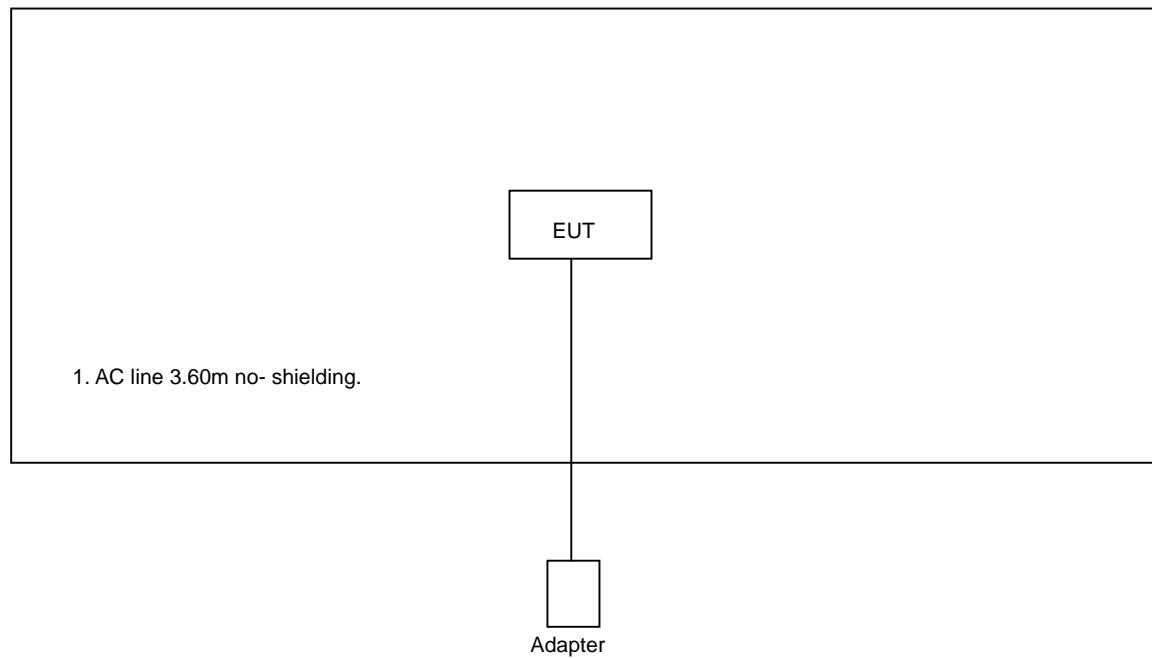
This test has not tested the perimeter.

2.5. Connection Diagram of Test System

Conduction



Radiation





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2.6. Test Software

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.



3. Test Location and Standards

3.1. Test Location

Test Location : Sporton Hwa Ya Testing Building
Address : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.
Tel: +886 3 327 3456 Fax: +886 3 318 0055
Test Site No. : CO02-LK, 03CH03-HY

3.2. Test Conditions

Normal Voltage : 120V/60Hz (power adapter)
Normal Temperature : 20 °C

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 Part 15 Subpart C (Section 15.247)



4. List of Measurements

4.1. Summary of the Test Results

| Applied Standard: 47 CFR Part 15 and Part 2 | | | |
|---|------------------|---------------------------------------|--------|
| Paragraph | FCC Rule | Description of Test | Result |
| 5.1 | 15.247(c) | Band Edges of the Operating Frequency | Pass |
| 5.2 | 15.107/15.207 | AC Power Line Conducted Emission | Pass |
| 5.3 | 15.209/15.247(c) | Spurious Radiated Emission | Pass |
| 5.4 | 15.203 | Antenna Requirement | Pass |



5. Test Result

5.1. Test of Band Edges Emission

5.1.1. 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.

5.1.2. Measuring Instruments

Item 5~18 of the table on section 6 for radiated measurement.

Item 19 of the table on section 6 for conducted measurement.

5.1.3. 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

5.1.4. Test Procedures and Test Instruments Setting

Conducted Measurement

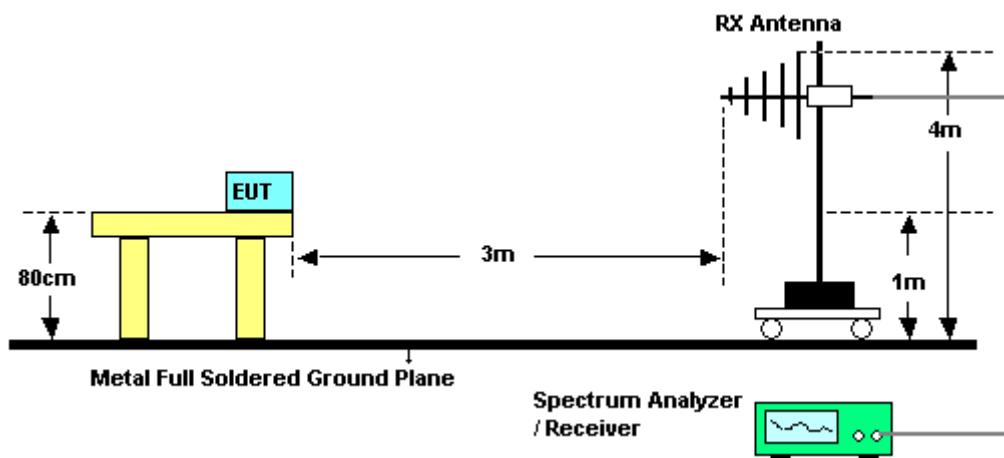
1. The transmitter is set to the lowest channel.
2. The transmitter output was connected to the spectrum analyzer via a cable and cable loss is used as the offset of the spectrum analyzer.
3. Set both RBW and VBW of spectrum analyzer to 100KHz with convenient frequency span including 100MHz bandwidth 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.:2003
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.

5.1.5. Test Setup

Radiated Method

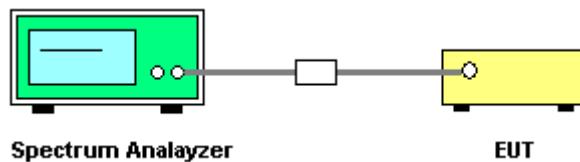




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Conducted Method



5.1.6. Test Criteria

All test results complied with the requirements of 15.247(d). Measurement Uncertainty is 1×10^{-5} .



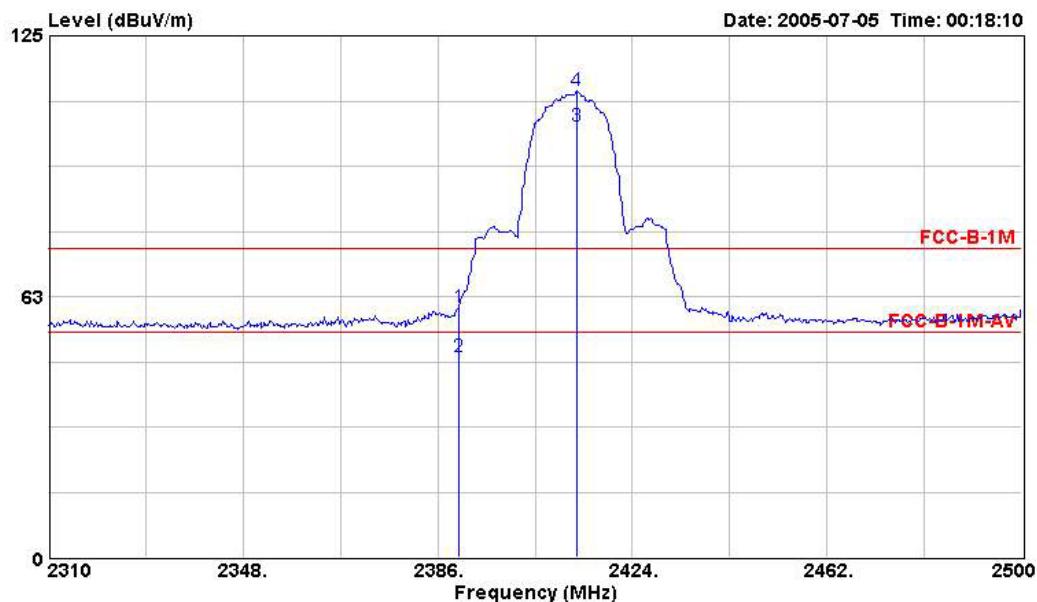
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5.1.7. Note on Band edge Emission

Test Mode : 2412MHz

Modulation Type : CCK



| Freq | Level | Over | Read | Limit | Line Factor | Cable | Preamp | Remark | Ant | Table |
|------|----------|-------|--------|--------|-------------|-------|--------|--------|---------|-------|
| | | Limit | Level | Limit | | | | | Pos | Pos |
| MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | cm | deg | |
| 1 | 2390.000 | 59.78 | -14.22 | 29.66 | 74.00 | 30.12 | 1.90 | 0.00 | Peak | --- |
| 2 | 2390.000 | 47.99 | -6.01 | 17.87 | 54.00 | 30.12 | 1.90 | 0.00 | Average | --- |

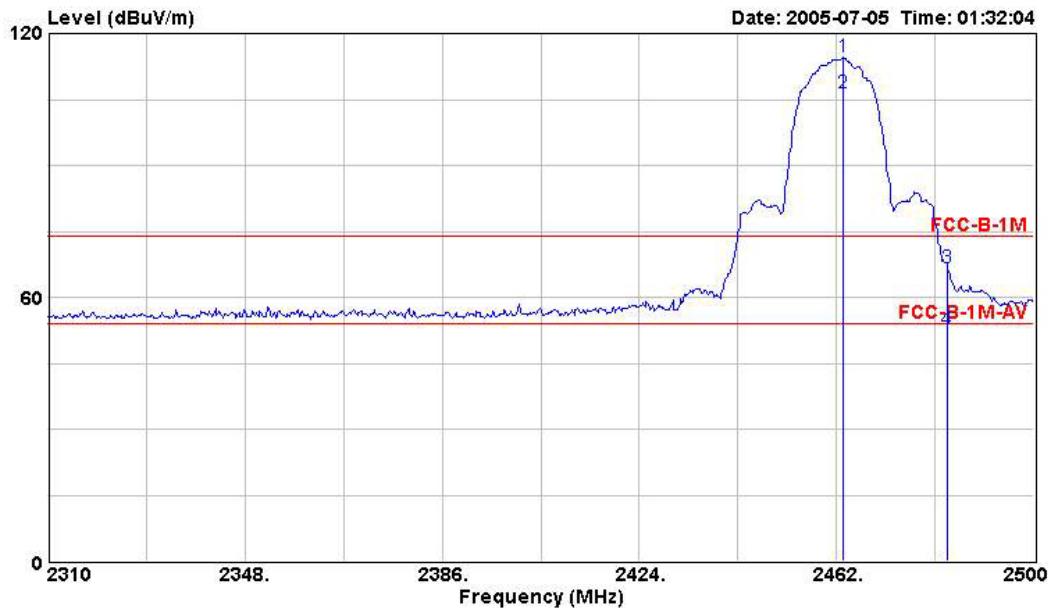


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Test Mode : 2462MHz

Modulation Type : CCK

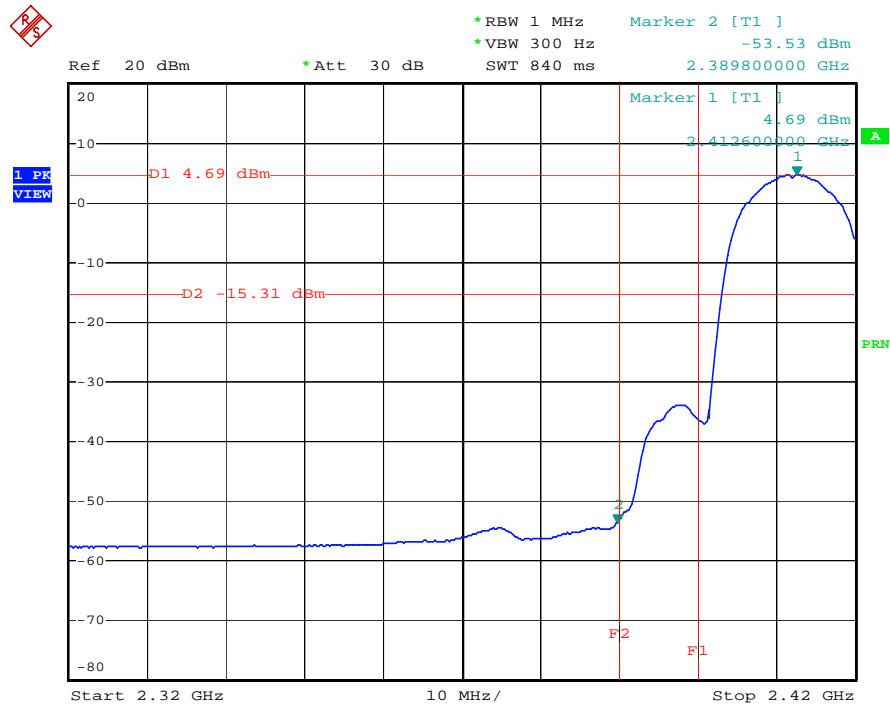


| Freq | Level | Over | Read | Limit | Cable Preamp | | | Ant | Table |
|------|--------|-------|-------|-------------|--------------|---------------|--------|-----|-------|
| | | Limit | Level | Line Factor | Loss | Preamp Factor | Remark | | |
| MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | cm | deg |

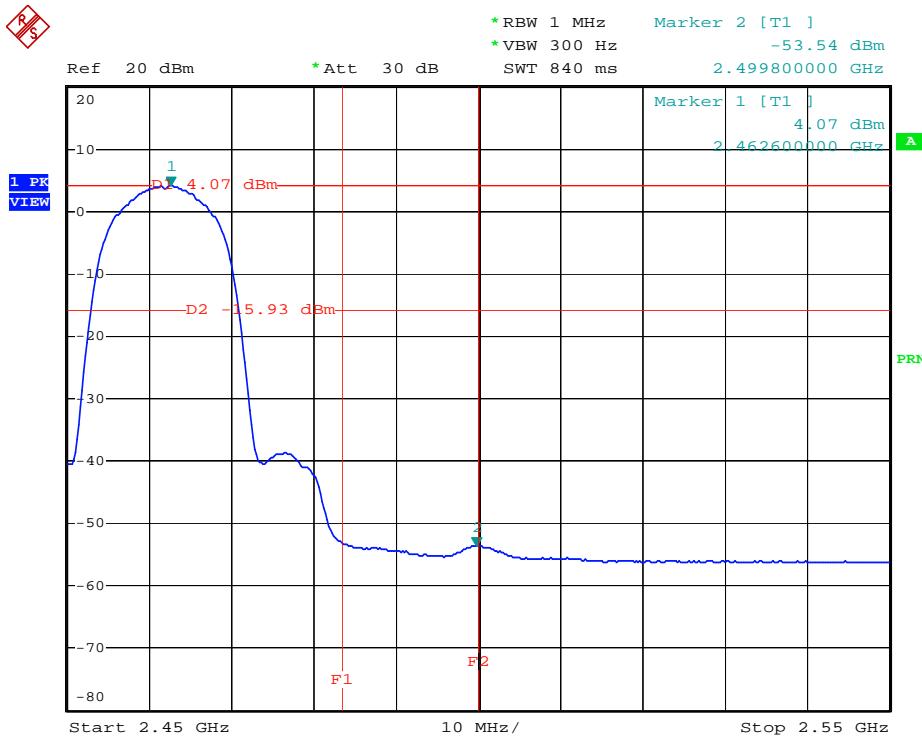
| | | | | | | | | | | | |
|---|----------|-------|-------|-------|-------|-------|------|------|---------|-----|-----|
| 3 | 2483.500 | 66.51 | -7.49 | 36.18 | 74.00 | 30.33 | 1.96 | 0.00 | Peak | --- | --- |
| 4 | 2483.500 | 52.83 | -1.17 | 22.50 | 54.00 | 30.33 | 1.96 | 0.00 | Average | --- | --- |



CCK (Channel 01) : 2412MHz



CCK (Channel 11) : 2462MHz



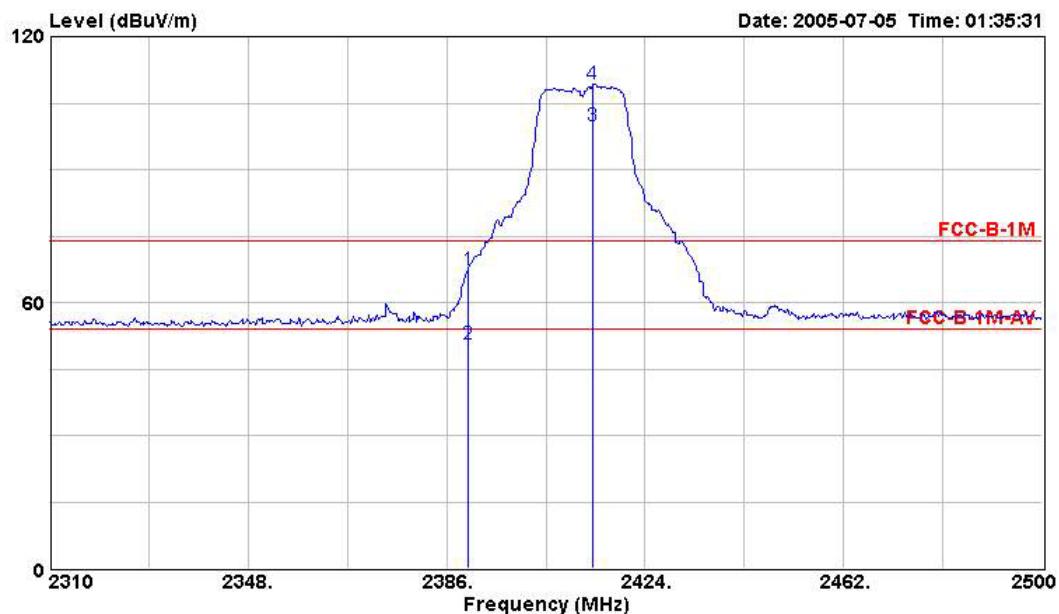
Observation : All emissions in the 100kHz bandwidth are 20dB lower than the carrier strength.



5.1.8. Note on Band edge Emission

Test Mode : 2412MHz

Modulation Type : OFDM



| Freq | Level | Over | Read | Limit | Line Factor | Cable Preamp | | | Ant | Table |
|------|----------|-------|-------|-------------|-------------|--------------|---------------|--------|---------|-------|
| | | Limit | Level | Line Factor | | Cable Loss | Preamp Factor | Remark | | |
| MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | cm | deg | |
| 1 | 2390.000 | 67.29 | -6.71 | 37.17 | 74.00 | 30.12 | 1.90 | 0.00 | Peak | --- |
| 2 | 2390.000 | 50.67 | -3.33 | 20.55 | 54.00 | 30.12 | 1.90 | 0.00 | Average | --- |

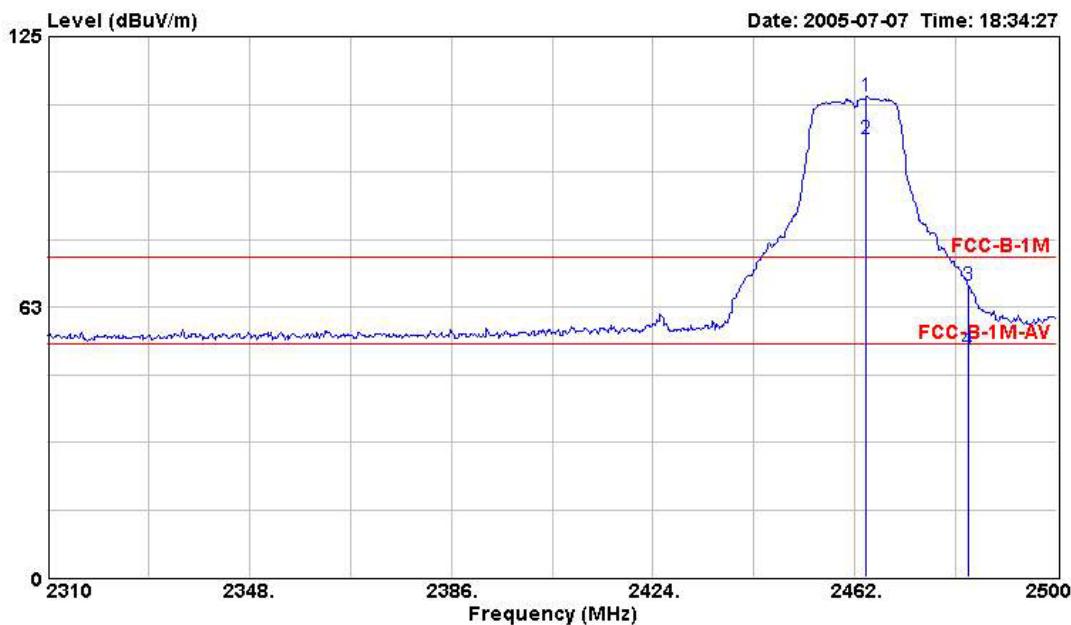


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Test Mode : 2462MHz

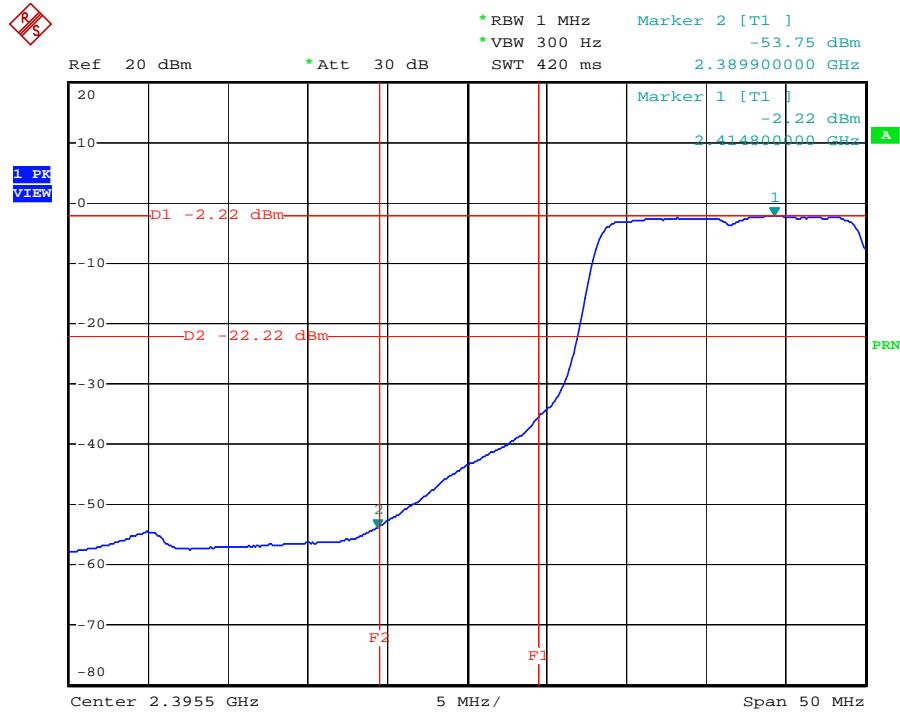
Modulation Type : OFDM



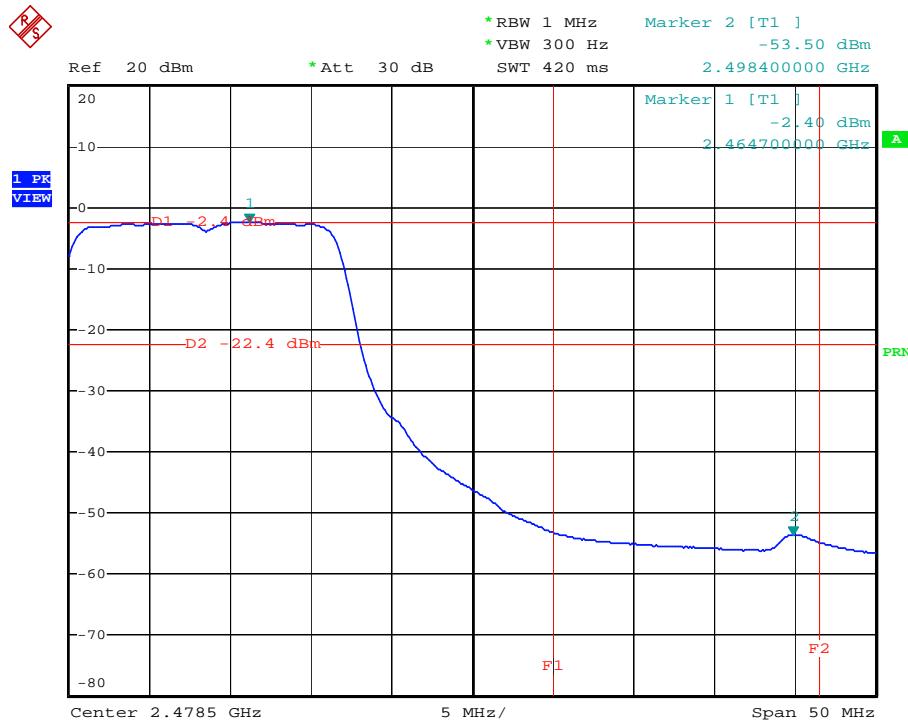
| | Freq | Over Limit | Read Level | Limit Line | Cable Factor | Preamp Factor | Ant Pos | Table Pos |
|---|----------|------------|------------|------------|--------------|---------------|---------|--------------|
| | MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | deg |
| 3 | 2483.500 | 67.44 | -6.56 | 37.11 | 74.00 | 30.33 | 1.96 | 0.00 Peak |
| 4 | 2483.500 | 52.76 | -1.24 | 22.43 | 54.00 | 30.33 | 1.96 | 0.00 Average |



OFDM (Channel 01) : 2412MHz



OFDM (Channel 11) : 2462MHz



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



5.2. Test of AC Power Line Conducted Emission

5.2.1. Measuring Instruments

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

5.2.2. Test Procedures

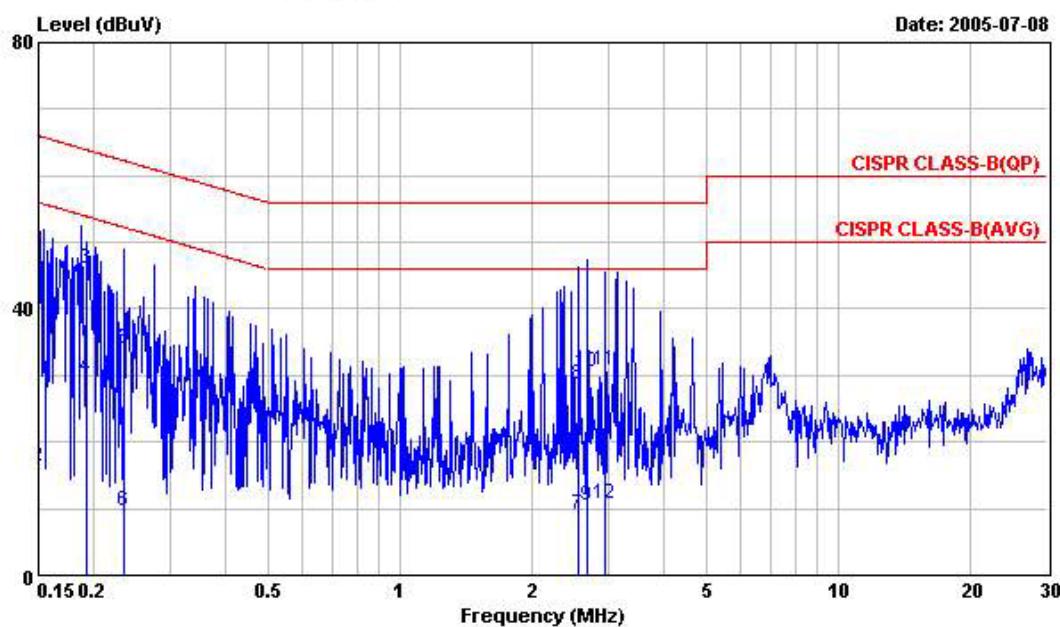
1. Configure the EUT according to ANSI C63.4.:2003
2. The EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
3. Connect EUT to the power mains through a line impedance stabilization network (LISN).
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. 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.



5.2.3. Test Result of Conducted Emission

| | | | |
|------------------------|-----------------|-----------|--------|
| Test Mode | RF Link | Tested By | Sky Wu |
| Temperature / Humidity | 28 deg. C / 40% | | |

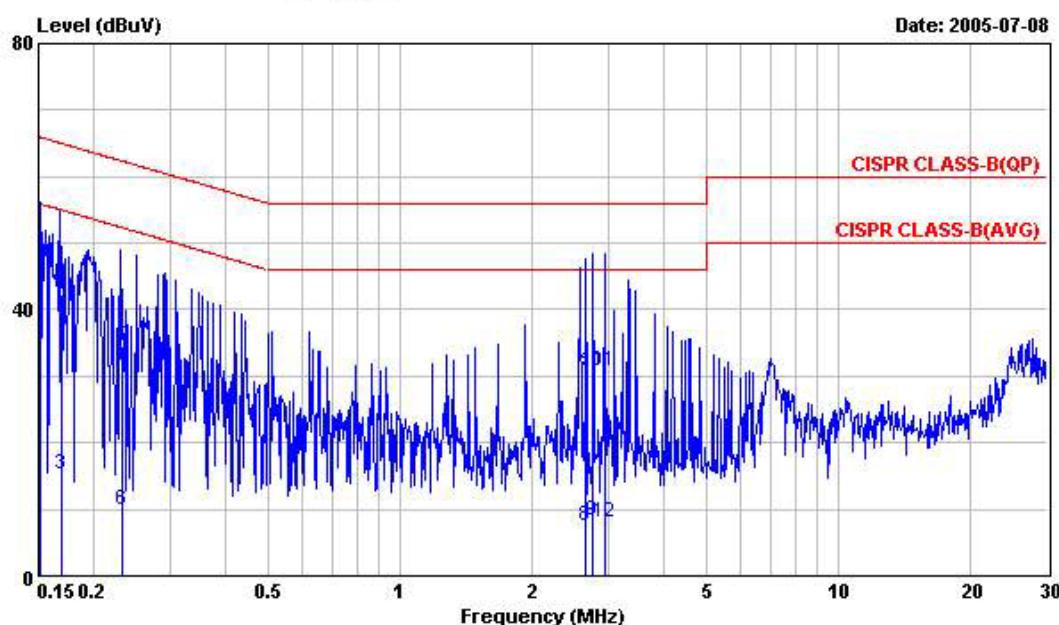
Line to Ground



| Freq | Level | Over Limit | Limit | Read | | Cable | LISN | Remark |
|------|-------|------------|--------|-------|--------------|-------|------|--------------|
| | | | | Line | Level Factor | | | |
| 1 | 0.150 | 43.16 | -22.84 | 66.00 | 43.06 | 0.10 | 0.00 | 0.10 QP |
| 2 | 0.150 | 16.19 | -39.81 | 56.00 | 16.09 | 0.10 | 0.00 | 0.10 Average |
| 3 | 0.193 | 46.10 | -17.79 | 63.89 | 46.00 | 0.10 | 0.00 | 0.10 QP |
| 4 | 0.193 | 29.63 | -24.26 | 53.89 | 29.53 | 0.10 | 0.00 | 0.10 Average |
| 5 | 0.235 | 33.85 | -28.42 | 62.27 | 33.74 | 0.11 | 0.01 | 0.10 QP |
| 6 | 0.235 | 9.74 | -42.53 | 52.27 | 9.63 | 0.11 | 0.01 | 0.10 Average |
| 7 | 2.570 | 9.10 | -36.90 | 46.00 | 8.88 | 0.22 | 0.08 | 0.14 Average |
| 8 | 2.570 | 28.76 | -27.24 | 56.00 | 28.54 | 0.22 | 0.08 | 0.14 QP |
| 9 | 2.690 | 10.38 | -35.62 | 46.00 | 10.17 | 0.21 | 0.07 | 0.14 Average |
| 10 | 2.690 | 30.63 | -25.37 | 56.00 | 30.42 | 0.21 | 0.07 | 0.14 QP |
| 11 | 2.950 | 30.77 | -25.23 | 56.00 | 30.55 | 0.22 | 0.06 | 0.16 QP |
| 12 | 2.950 | 10.62 | -35.38 | 46.00 | 10.40 | 0.22 | 0.06 | 0.16 Average |



Neutral to Ground



| Freq | Level | Over | Limit | Read | Cable | LISN | Remark | |
|------|-------|-------|--------|-------|-------|------|--------|--------------|
| | | Limit | Line | Level | | | | |
| MHz | dBuV | dB | dBuV | dBuV | dB | dB | | |
| 1 | 0.152 | 16.36 | -39.53 | 55.89 | 16.26 | 0.10 | 0.00 | 0.10 Average |
| 2 | 0.152 | 43.76 | -22.13 | 65.89 | 43.66 | 0.10 | 0.00 | 0.10 QP |
| 3 | 0.169 | 15.18 | -39.83 | 55.01 | 15.08 | 0.10 | 0.00 | 0.10 Average |
| 4 | 0.169 | 42.37 | -22.64 | 65.01 | 42.27 | 0.10 | 0.00 | 0.10 QP |
| 5 | 0.232 | 34.48 | -27.90 | 62.38 | 34.37 | 0.11 | 0.01 | 0.10 QP |
| 6 | 0.232 | 9.78 | -42.60 | 52.38 | 9.67 | 0.11 | 0.01 | 0.10 Average |
| 7 | 2.660 | 29.95 | -26.05 | 56.00 | 29.74 | 0.21 | 0.07 | 0.14 QP |
| 8 | 2.660 | 7.53 | -38.47 | 46.00 | 7.32 | 0.21 | 0.07 | 0.14 Average |
| 9 | 2.760 | 8.17 | -37.83 | 46.00 | 7.95 | 0.22 | 0.07 | 0.15 Average |
| 10 | 2.760 | 30.86 | -25.14 | 56.00 | 30.64 | 0.22 | 0.07 | 0.15 QP |
| 11 | 2.930 | 30.68 | -25.32 | 56.00 | 30.47 | 0.21 | 0.06 | 0.15 QP |
| 12 | 2.930 | 7.99 | -38.01 | 46.00 | 7.78 | 0.21 | 0.06 | 0.15 Average |

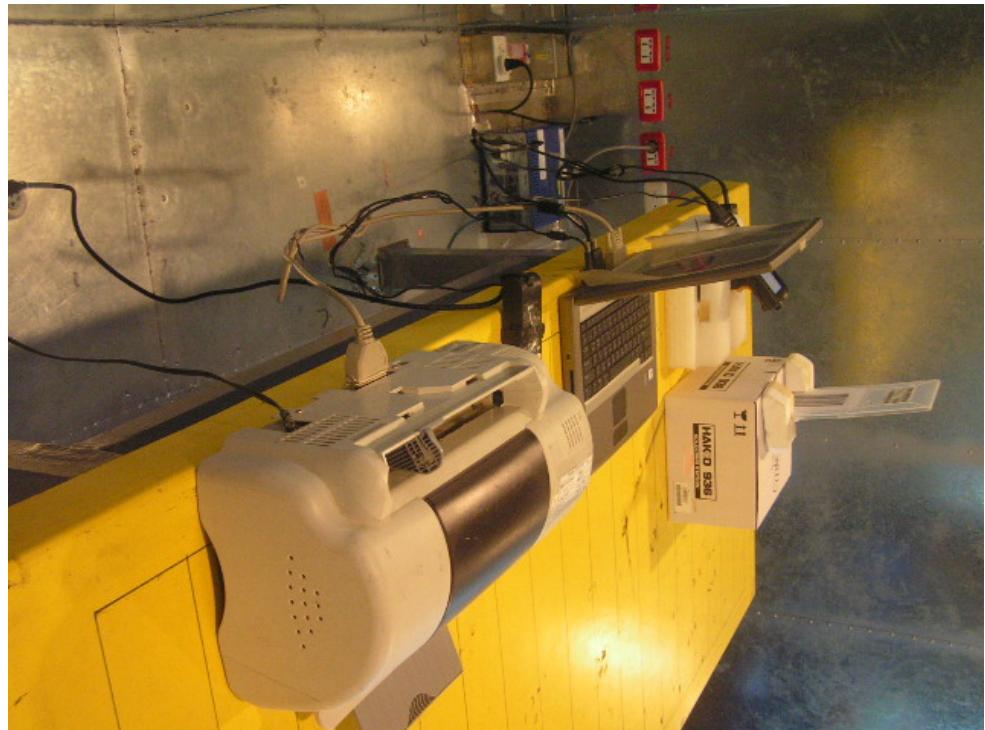
5.2.4. Photographs of Conduction Emission Test Configuration

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

FRONT VIEW



REAR VIEW





5.3. Test of Spurious Radiated Emission

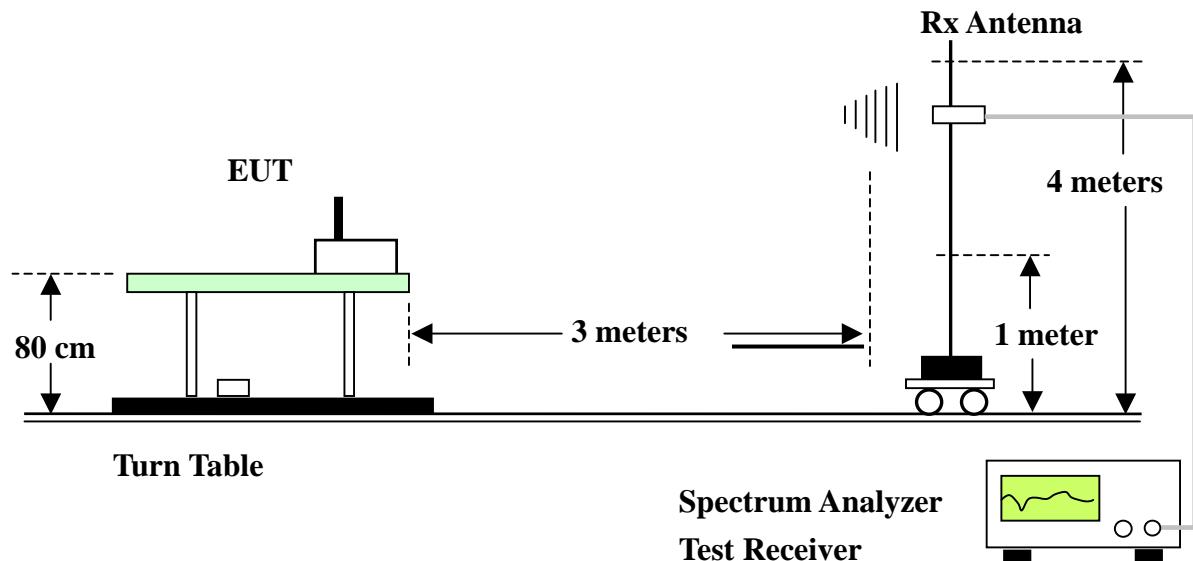
5.3.1. Measuring Instruments

Please reference item 5~18 in chapter 6 for the instruments used for testing.

5.3.2. Test Procedures

1. Configure the EUT according to ANSI C63.4.:2003
2. The EUT was placed on the top of the turn table 0.8 meter above ground.
3. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turn table.
4. Power on the EUT and all the supporting units.
5. The turn table was rotated by 360 degrees to determine the position of the highest radiation.
6. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.
7. For each suspected emission, the antenna tower was scan (from 1 M to 4 M) and then the turn table was rotated (from 0 degree to 360 degrees) to find the maximum reading.
8. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
9. For emission above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 300Hz 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.

5.3.3. Test Setup Layout





5.3.4. Test Results and Limit

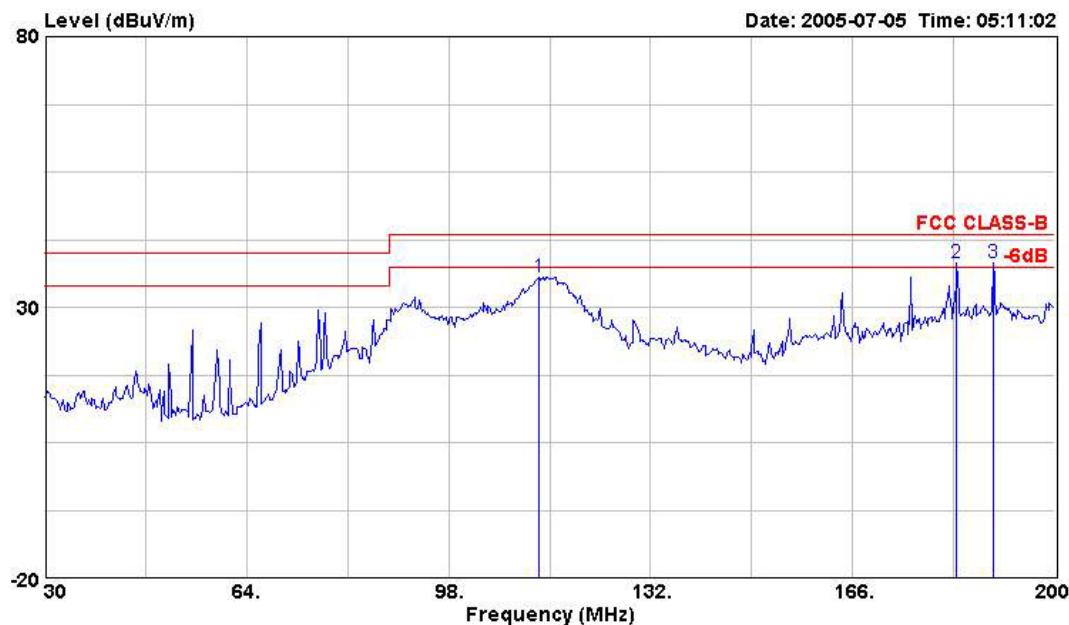
Note:

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

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

| Modulation Type | OFDM | | | | |
|-----------------|------------|-------------|-------------|-----------|----------|
| Test Mode | CH 2437MHz | Temperature | 26.5 deg. C | Tested By | Ted Chiu |
| Freq. Range | 30MHz~1GHz | Humidity | 51% | | |

(A) Polarization: Horizontal

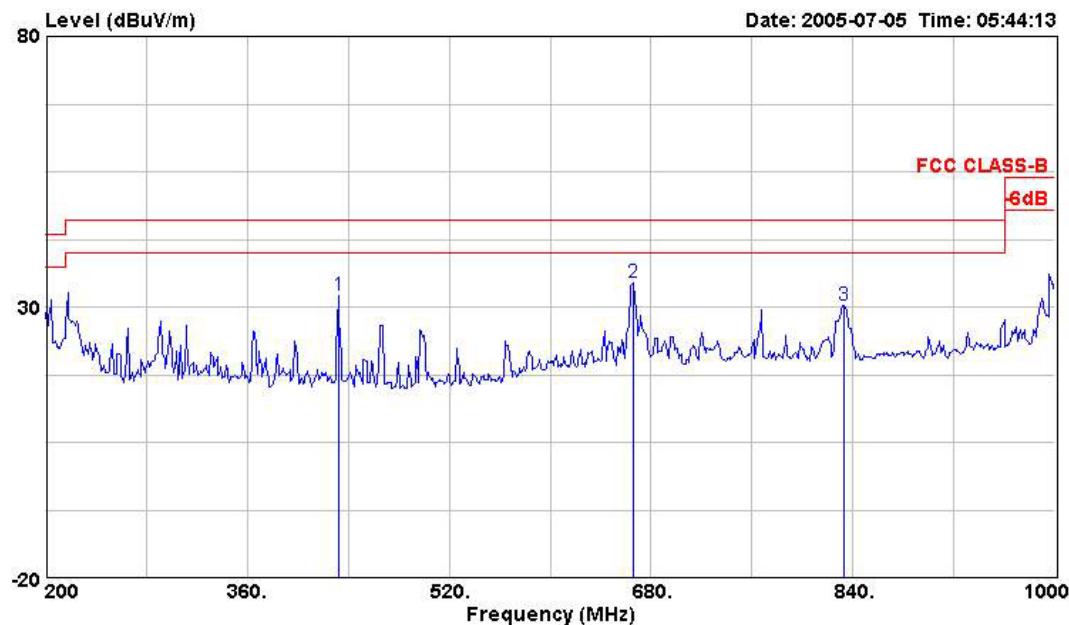


| Freq | Level | Over | Read | Limit | Line Factor | Cable Preamp | | Ant | Table |
|------|---------|-------|-------|-------------|-------------|--------------|--------|-------|-------|
| | | Limit | Level | Line Factor | | Loss Factor | Remark | | |
| MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | cm | deg |
| 1 | 113.300 | 35.63 | -7.87 | 53.93 | 43.50 | -18.30 | 1.05 | 30.29 | Peak |
| 2 | 183.510 | 38.16 | -5.34 | 52.46 | 43.50 | -14.30 | 1.27 | 30.05 | Peak |
| 3 | 189.630 | 38.13 | -5.37 | 51.99 | 43.50 | -13.86 | 1.27 | 30.10 | Peak |



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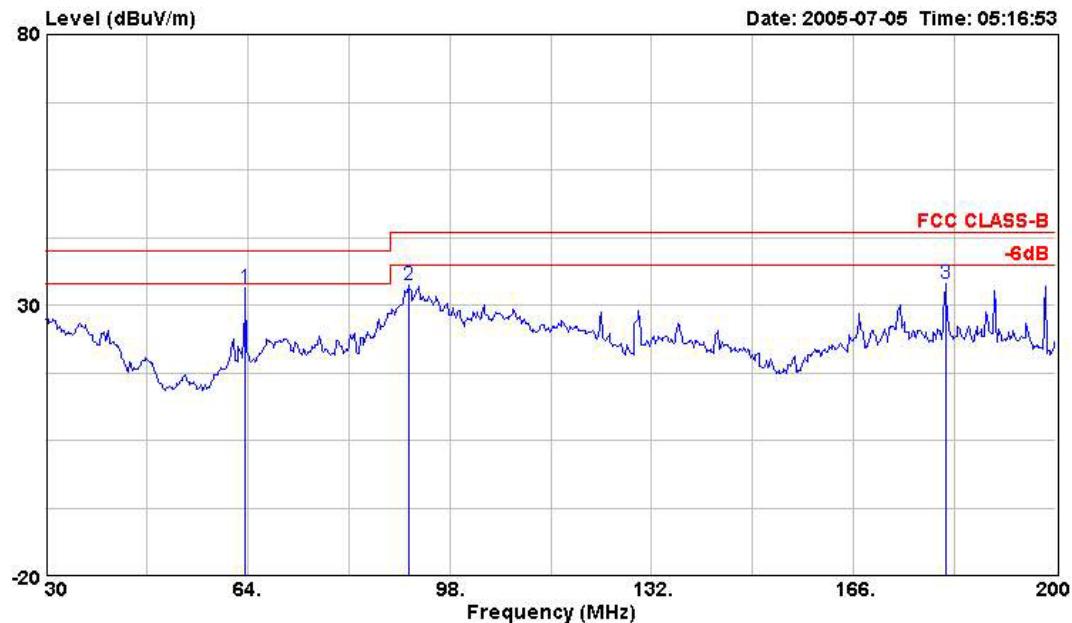
| Freq | Level | Over | Read | Limit | Line Factor | Cable | Preamp | Remark | Ant | Table |
|------|---------|-------|--------|--------|-------------|--------|--------|--------|------|-------|
| | | Limit | Level | Line | | | | | | |
| MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | cm | deg | |
| 1 | 432.000 | 32.19 | -13.81 | 44.27 | 46.00 | -12.08 | 2.04 | 30.66 | Peak | --- |
| 2 | 665.600 | 34.47 | -11.53 | 41.90 | 46.00 | -7.43 | 2.52 | 30.54 | Peak | --- |
| 3 | 832.800 | 30.35 | -15.65 | 36.05 | 46.00 | -5.70 | 2.88 | 30.41 | Peak | --- |



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(B) Polarization: Vertical

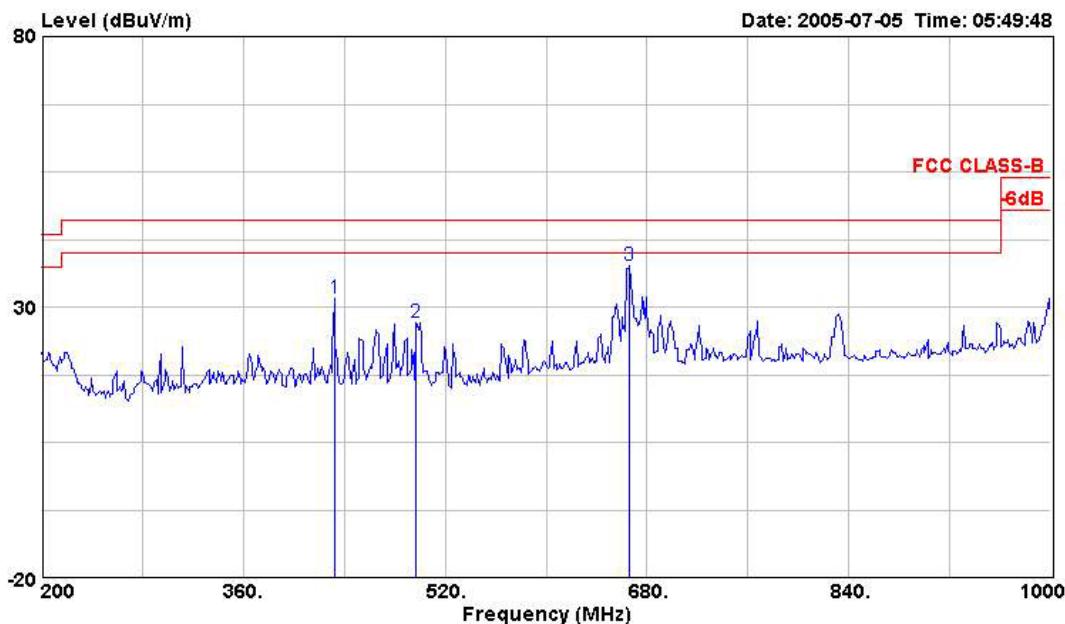


| Freq | Level | Over Limit | Read Level | Limit | | | Cable Preamp | | Ant Pos | Table Pos |
|------|---------|------------|------------|--------|--------|--------|--------------|-------|---------|-----------|
| | | | | Line | Factor | dB | dB | dB | | |
| MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | dB | cm | deg |
| 1 | 63.660 | 33.16 | -6.84 | 52.65 | 40.00 | -19.49 | 0.81 | 30.54 | Peak | --- |
| 2 | 91.030 | 33.59 | -9.91 | 53.62 | 43.50 | -20.03 | 0.91 | 29.49 | Peak | --- |
| 3 | 181.470 | 33.96 | -9.54 | 48.41 | 43.50 | -14.45 | 1.27 | 30.03 | Peak | --- |



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| Freq | Level | Over | Read | Limit | Line Factor | Cable Preamp | | Remark | Ant | Table |
|------|---------|-------|--------|--------|-------------|--------------|------|--------|------|-------|
| | | Limit | Level | dBuV/m | | dB | Loss | | Pos | Pos |
| MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | cm | deg | |
| 1 | 432.000 | 31.52 | -14.48 | 43.60 | 46.00 | -12.08 | 2.04 | 30.66 | Peak | --- |
| 2 | 496.800 | 27.24 | -18.76 | 39.82 | 46.00 | -12.58 | 2.17 | 30.78 | Peak | --- |
| 3 | 666.400 | 37.65 | -8.35 | 45.08 | 46.00 | -7.43 | 2.52 | 30.54 | Peak | --- |

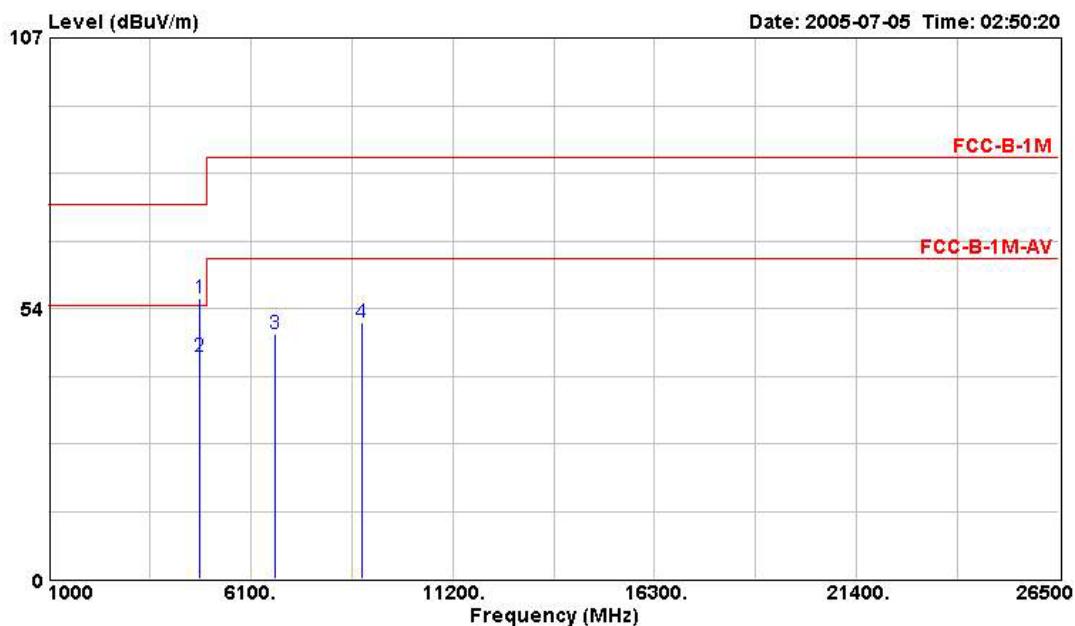


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| | | | | | |
|-----------------|------------|-------------|-------------|-----------|----------|
| Modulation Type | CCK | | | | |
| Test Mode | CH 2412MHz | Temperature | 26.5 deg. C | Tested By | Ted Chiu |
| Freq. Range | 1GHz~25GHz | Humidity | 51% | | |

(A) Polarization: Horizontal



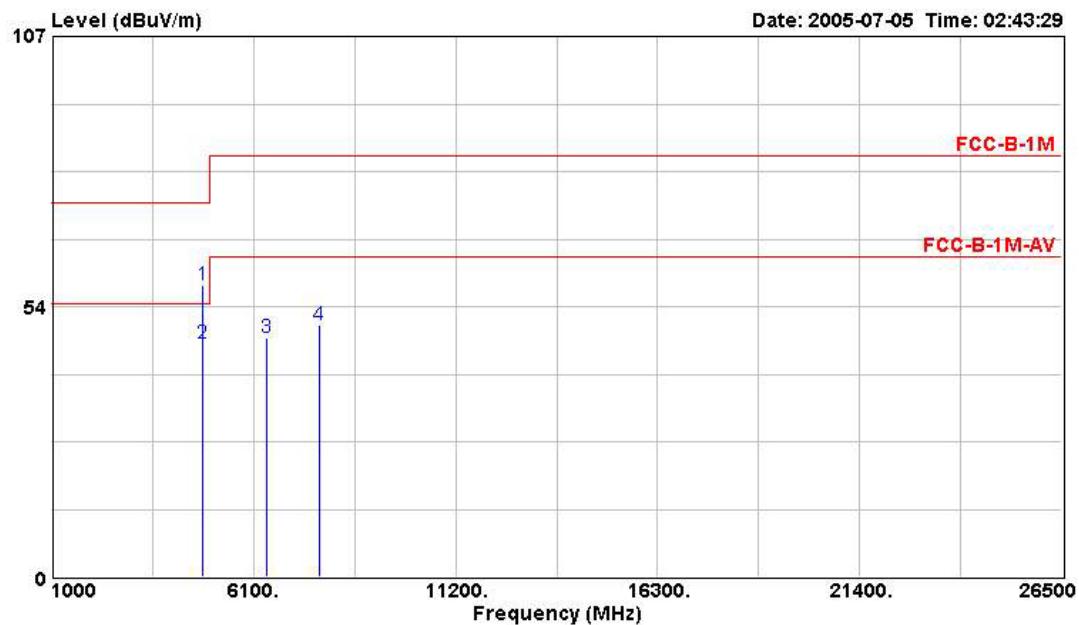
| Freq | Level | Over | Read | Limit | Cable Preamp | | | Ant Pos | Table Pos | |
|------|----------|-------|--------|-------------|--------------|--------|--------|---------------|-----------|-----|
| | | Limit | Level | Line Factor | Loss | Factor | Remark | | | |
| MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | cm | deg | |
| 1 | 4824.000 | 55.56 | -18.44 | 52.14 | 74.00 | 3.42 | 2.84 | 32.54 PEAK | --- | --- |
| 2 | 4824.000 | 44.01 | -9.99 | 40.59 | 54.00 | 3.42 | 2.84 | 32.54 Average | --- | --- |
| 3 | 6732.000 | 48.49 | -34.91 | 42.44 | 83.40 | 6.05 | 3.47 | 32.21 PEAK | --- | --- |
| 4 | 8908.000 | 50.81 | -32.59 | 42.12 | 83.40 | 8.69 | 4.05 | 33.26 PEAK | --- | --- |



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(B) Polarization: Vertical



| Freq | Level | Over | Read | Limit | Line Factor | Cable | | Preamp | Ant | Table |
|------|----------|-------|--------|--------|-------------|-------|--------|---------------|-----|-------|
| | | Limit | Level | dBuV/m | | Loss | Factor | | | |
| MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | cm | deg | |
| 1 | 4824.000 | 57.61 | -16.39 | 54.19 | 74.00 | 3.42 | 2.84 | 32.54 PEAK | --- | --- |
| 2 | 4824.000 | 46.13 | -7.87 | 42.71 | 54.00 | 3.42 | 2.84 | 32.54 Average | --- | --- |
| 3 | 6420.000 | 47.45 | -35.95 | 42.24 | 83.40 | 5.21 | 3.38 | 32.47 PEAK | --- | --- |
| 4 | 7776.000 | 49.81 | -33.59 | 42.09 | 83.40 | 7.72 | 3.81 | 32.98 PEAK | --- | --- |

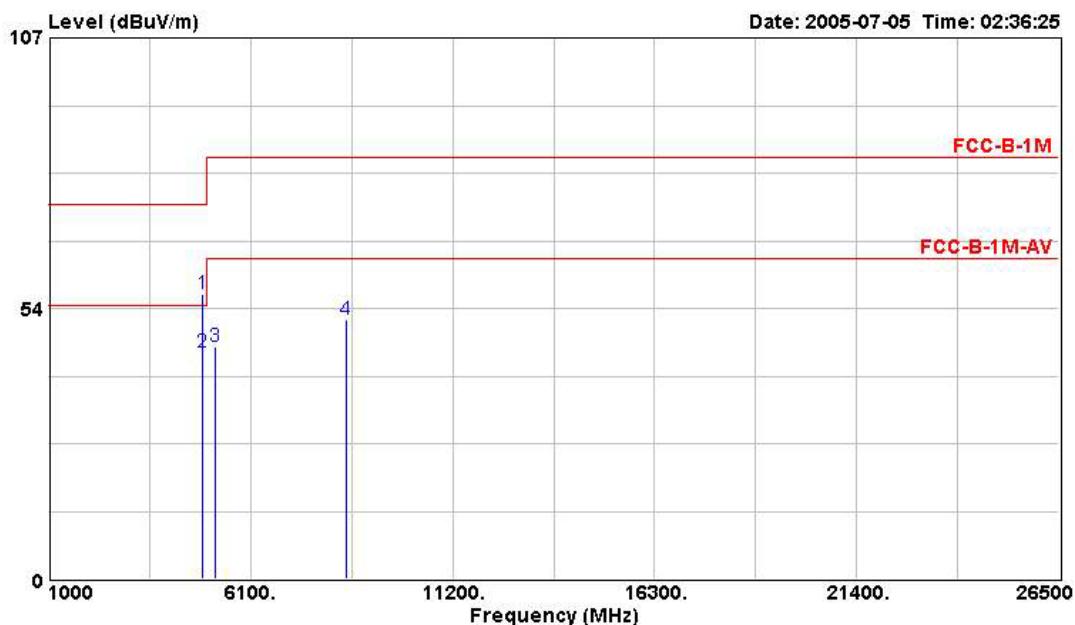


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| | | | | | |
|-----------------|------------|-------------|-------------|-----------|----------|
| Modulation Type | CCK | | | | |
| Test Mode | CH 2437MHz | Temperature | 26.5 deg. C | Tested By | Ted Chiu |
| Freq. Range | 1GHz~25GHz | Humidity | 51% | | |

(A) Polarization: Horizontal



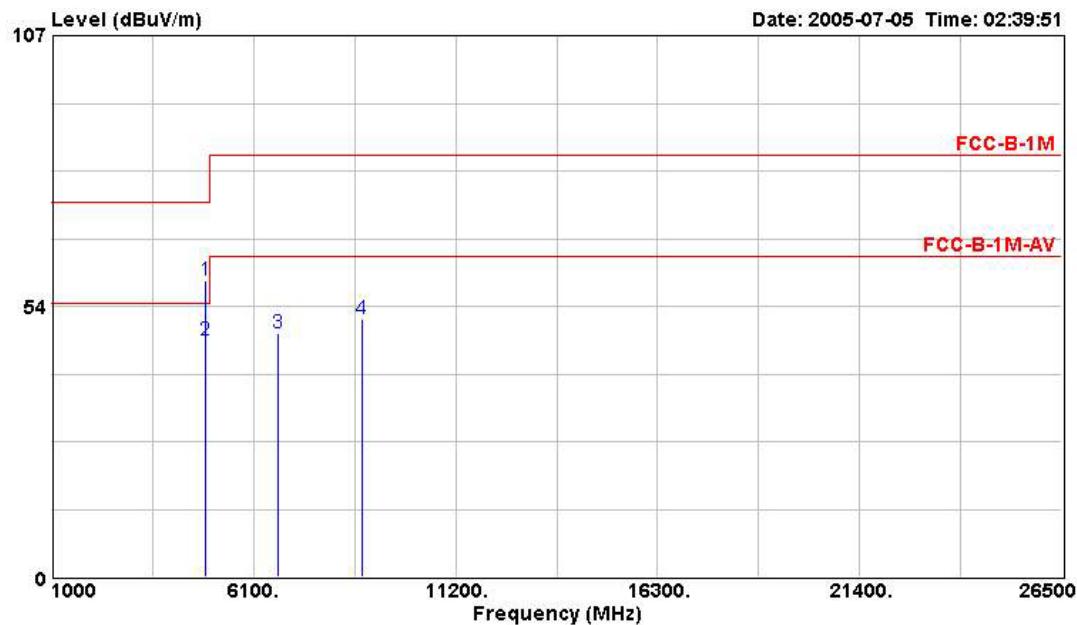
| Freq | Level | Over Limit | Read Level | Limit Line | Cable Preamp | | | Ant Pos | Table Pos |
|------|----------|------------|------------|------------|--------------|------|--------|---------------|-----------|
| | | | | | Factor | Loss | Factor | | |
| 1 | 4876.000 | 56.42 | -17.58 | 52.89 | 74.00 | 3.53 | 2.87 | 32.55 PEAK | --- |
| 2 | 4876.000 | 44.73 | -9.27 | 41.20 | 54.00 | 3.53 | 2.87 | 32.55 Average | --- |
| 3 | 5220.000 | 45.87 | -37.53 | 41.77 | 83.40 | 4.10 | 3.00 | 32.64 PEAK | --- |
| 4 | 8504.000 | 51.16 | -32.24 | 42.28 | 83.40 | 8.88 | 3.98 | 33.00 PEAK | --- |



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(B) Polarization: Vertical



| Freq | Level | Over Limit | Read Level | Limit | | Cable Preamp | | | Ant Pos | Table Pos |
|------|----------|------------|------------|--------|--------|--------------|------|-------|---------|-----------|
| | | | | Line | Factor | dB | dB | dB | | |
| MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | dB | cm | deg |
| 1 | 4876.000 | 58.61 | -15.39 | 55.08 | 74.00 | 3.53 | 2.87 | 32.55 | PEAK | --- |
| 2 | 4876.000 | 46.78 | -7.22 | 43.25 | 54.00 | 3.53 | 2.87 | 32.55 | Average | --- |
| 3 | 6732.000 | 48.16 | -35.24 | 42.11 | 83.40 | 6.05 | 3.47 | 32.21 | PEAK | --- |
| 4 | 8840.000 | 51.07 | -32.33 | 42.34 | 83.40 | 8.73 | 4.04 | 33.21 | PEAK | --- |

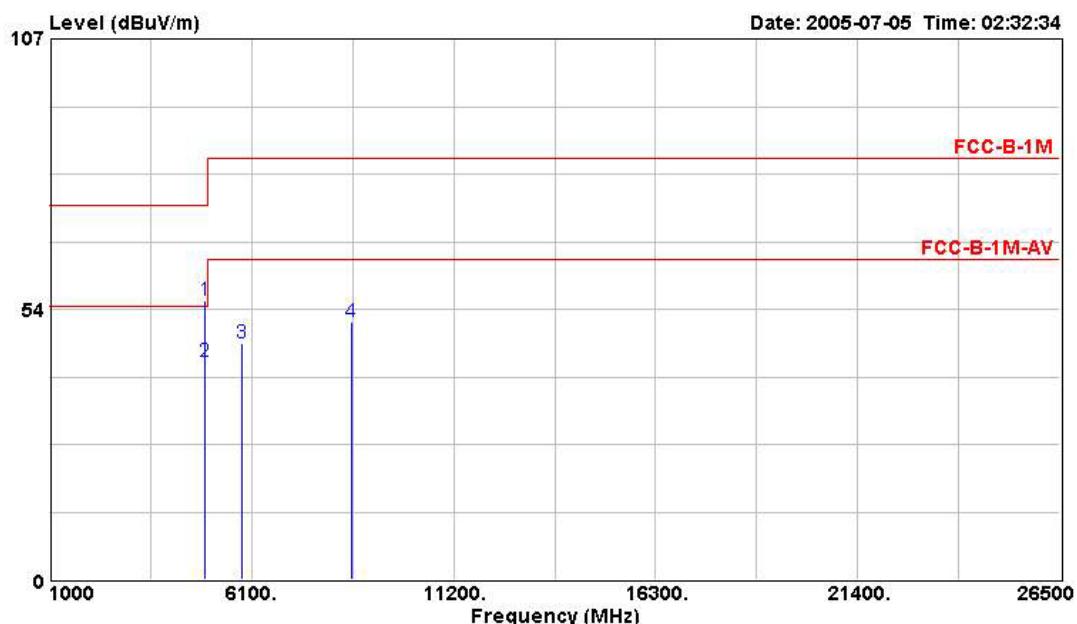


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| | | | | | |
|-----------------|------------|-------------|-------------|-----------|----------|
| Modulation Type | CCK | | | | |
| Test Mode | CH 2462MHz | Temperature | 26.5 deg. C | Tested By | Ted Chiu |
| Freq. Range | 1GHz~25GHz | Humidity | 51% | | |

(A) Polarization: Horizontal



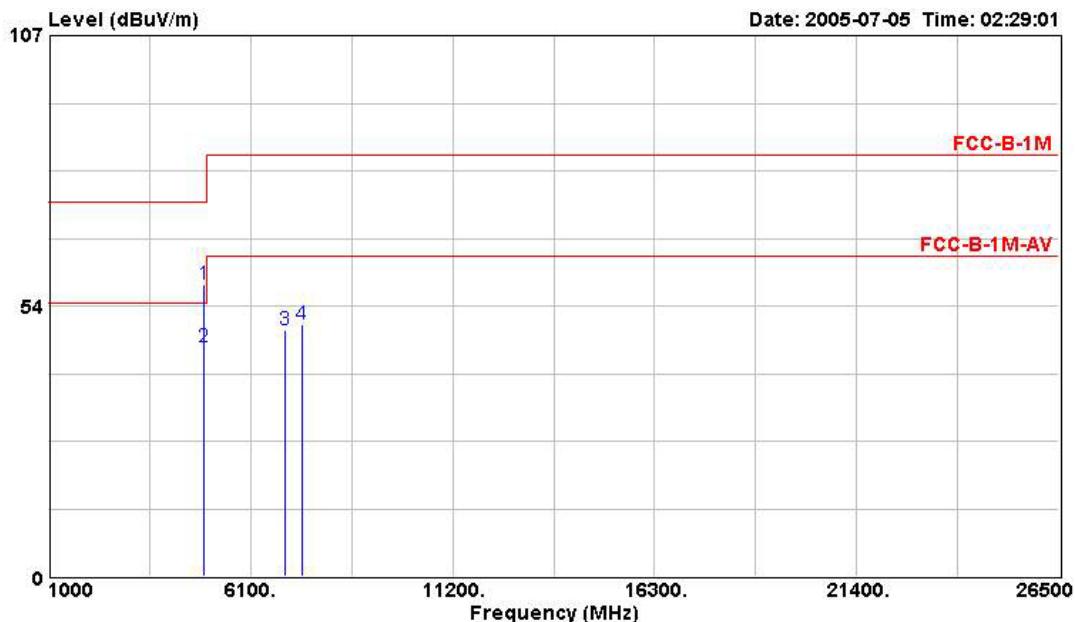
| Freq | Level | Over Limit | Read Level | Limit Line | Cable Preamp | | | Ant Pos | Table Pos |
|------|----------|------------|------------|------------|--------------|------|--------|---------------|-----------|
| | | | | | Factor | Loss | Factor | | |
| 1 | 4928.000 | 55.19 | -18.81 | 51.56 | 74.00 | 3.63 | 2.89 | 32.55 PEAK | --- |
| 2 | 4928.000 | 43.06 | -10.94 | 39.43 | 54.00 | 3.63 | 2.89 | 32.55 Average | --- |
| 3 | 5844.000 | 46.85 | -36.55 | 41.95 | 83.40 | 4.90 | 3.21 | 32.58 PEAK | --- |
| 4 | 8620.000 | 50.86 | -32.54 | 42.04 | 83.40 | 8.82 | 4.00 | 33.08 PEAK | --- |



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(B) Polarization: Vertical



| Freq | Level | Over | Read | Limit | Cable Preamp | | | Ant Pos | Table Pos |
|------|----------|-------|--------|-------------|--------------|--------|------|---------------|-----------|
| | | Limit | Level | Line Factor | Loss | Preamp | | | |
| MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | cm | deg | |
| 1 | 4928.000 | 57.61 | -16.39 | 53.98 | 74.00 | 3.63 | 2.89 | 32.55 PEAK | --- |
| 2 | 4928.000 | 45.42 | -8.58 | 41.79 | 54.00 | 3.63 | 2.89 | 32.55 Average | --- |
| 3 | 6968.000 | 48.85 | -34.55 | 41.97 | 83.40 | 6.89 | 3.53 | 31.97 PEAK | --- |
| 4 | 7384.000 | 49.82 | -33.58 | 42.50 | 83.40 | 7.31 | 3.68 | 32.71 PEAK | --- |

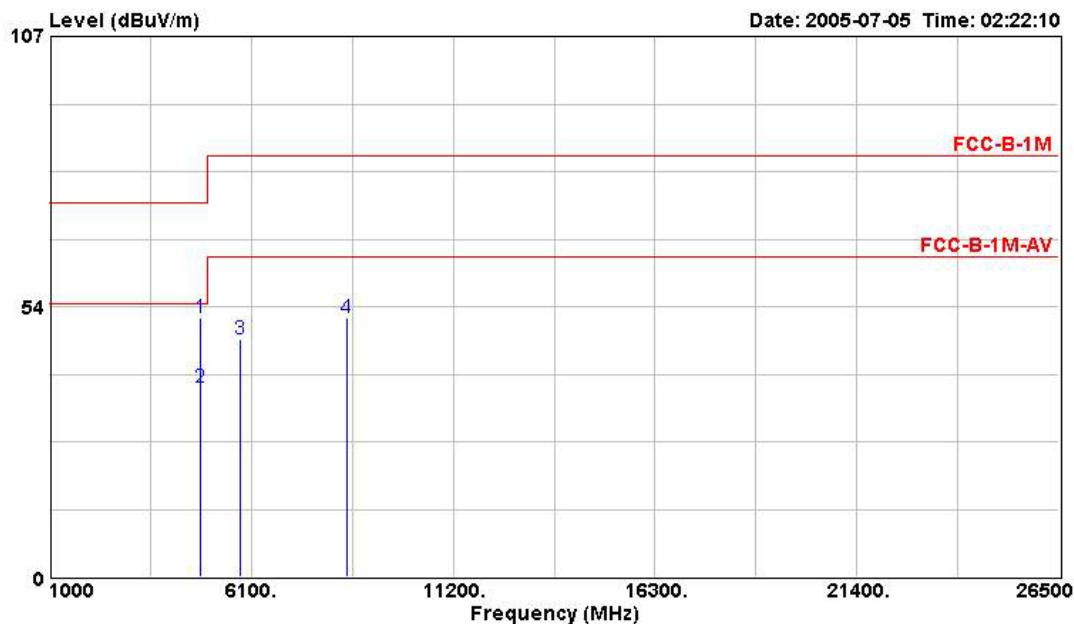


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| | | | | | |
|-----------------|------------|-------------|-------------|-----------|----------|
| Modulation Type | OFDM | | | | |
| Test Mode | CH 2412MHz | Temperature | 26.5 deg. C | Tested By | Ted Chiu |
| Freq. Range | 1GHz~25GHz | Humidity | 51% | | |

(A) Polarization: Horizontal



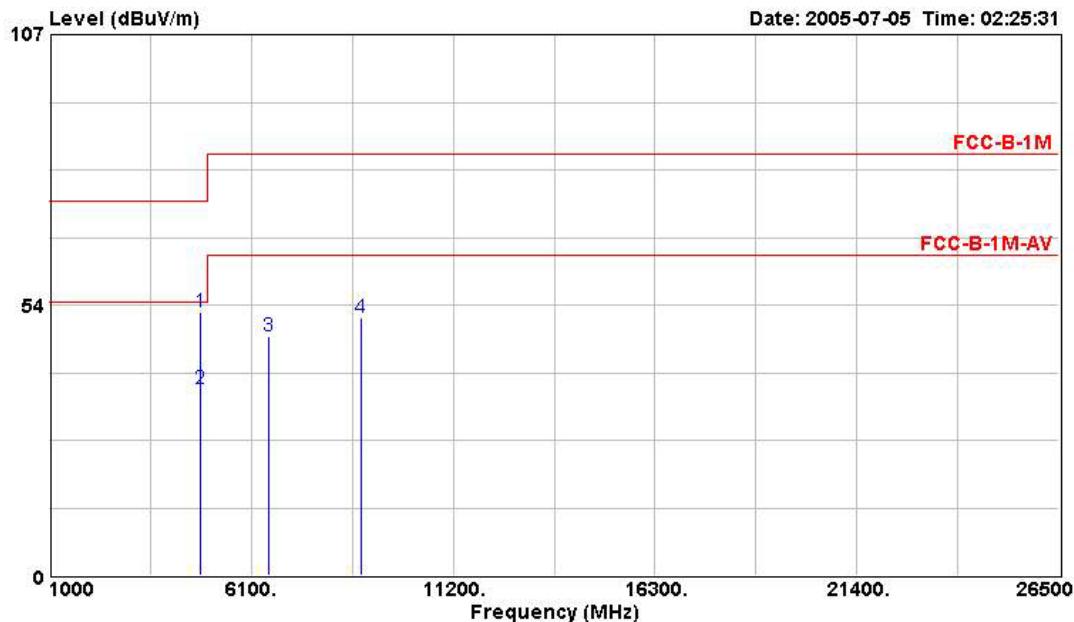
| Freq | Level | Over Limit | Read Level | Limit Line | Cable Preamp | | | Ant Pos | Table Pos |
|------|----------|------------|------------|------------|--------------|------|--------|---------------|-----------|
| | | | | | Factor | Loss | Factor | | |
| 1 | 4828.000 | 51.13 | -22.87 | 47.71 | 74.00 | 3.42 | 2.84 | 32.54 PEAK | --- |
| 2 | 4828.000 | 37.57 | -16.43 | 34.15 | 54.00 | 3.42 | 2.84 | 32.54 Average | --- |
| 3 | 5808.000 | 46.94 | -36.46 | 42.08 | 83.40 | 4.87 | 3.20 | 32.59 PEAK | --- |
| 4 | 8532.000 | 51.32 | -32.08 | 42.45 | 83.40 | 8.87 | 3.98 | 33.02 PEAK | --- |



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(B) Polarization: Vertical



| Freq | Level | Over Limit | Read Level | Limit | | Cable Preamp | | | Int Pos | Table Pos |
|------|----------|------------|------------|--------|--------|--------------|--------|---------------|---------|-----------|
| | | | | Line | Factor | Loss | Factor | Remark | | |
| MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | cm | deg | |
| 1 | 4828.000 | 52.24 | -21.76 | 48.82 | 74.00 | 3.42 | 2.84 | 32.54 PEAK | --- | --- |
| 2 | 4828.000 | 37.03 | -16.97 | 33.61 | 54.00 | 3.42 | 2.84 | 32.54 Average | --- | --- |
| 3 | 6536.000 | 47.25 | -36.15 | 41.90 | 83.40 | 5.36 | 3.41 | 32.43 PEAK | --- | --- |
| 4 | 8876.000 | 50.87 | -32.53 | 42.16 | 83.40 | 8.71 | 4.05 | 33.24 PEAK | --- | --- |

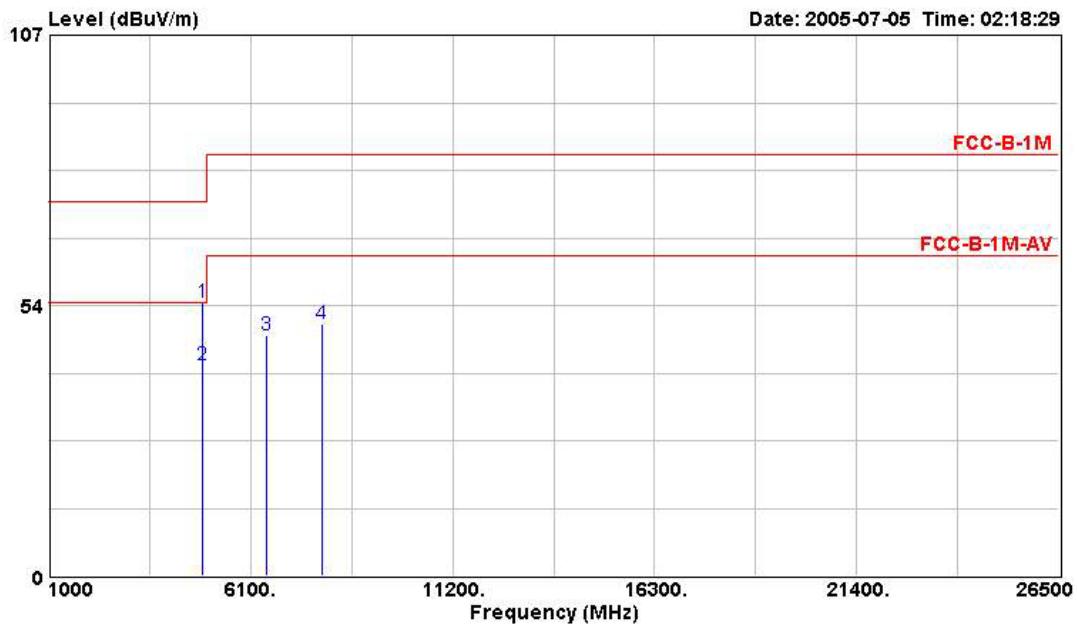


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| | | | | | |
|-----------------|------------|-------------|-------------|-----------|----------|
| Modulation Type | OFDM | | | | |
| Test Mode | CH 2437MHz | Temperature | 26.5 deg. C | Tested By | Ted Chiu |
| Freq. Range | 1GHz~25GHz | Humidity | 51% | | |

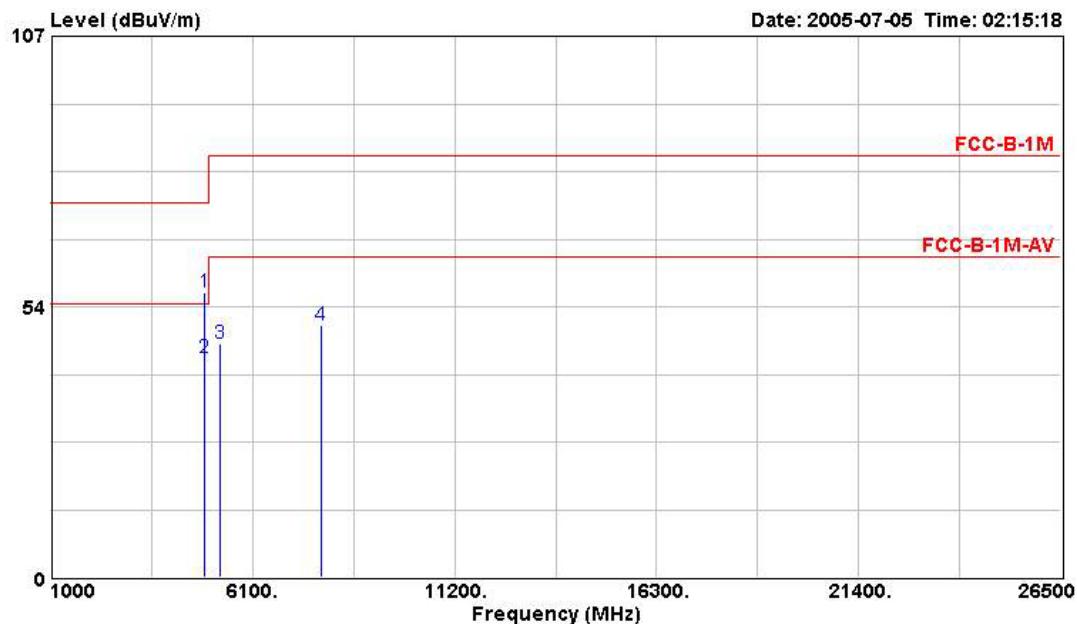
(A) Polarization: Horizontal



| Freq | Level | Over | Read | Limit | Line Factor | Cable Preamp | | | Ant | Table |
|------|----------|-------|--------|--------|-------------|--------------|--------|-------|---------|-------|
| | | Limit | Level | dBuV/m | | Loss Factor | Remark | | | |
| MHz | dBuV/m | dB | dBuV | dB | dB | dB | cm | deg | | |
| 1 | 4876.000 | 54.02 | -19.98 | 50.49 | 74.00 | 3.53 | 2.87 | 32.55 | PEAK | --- |
| 2 | 4876.000 | 41.75 | -12.25 | 38.22 | 54.00 | 3.53 | 2.87 | 32.55 | Average | --- |
| 3 | 6496.000 | 47.66 | -35.74 | 42.42 | 83.40 | 5.24 | 3.40 | 32.46 | PEAK | --- |
| 4 | 7908.000 | 49.90 | -33.50 | 42.03 | 83.40 | 7.87 | 3.85 | 32.98 | PEAK | --- |



(B) Polarization: Vertical



| Freq | Level | Over Limit | Read Level | Limit Line Factor | Cable Preamp | | | Ant Pos | Table Pos |
|------|----------|------------|------------|-------------------|--------------|------|--------|---------------|-----------|
| | | | | | dB | dBuV | dBuV/m | | |
| 1 | 4876.000 | 56.24 | -17.76 | 52.71 | 74.00 | 3.53 | 2.87 | 32.55 PEAK | --- |
| 2 | 4876.000 | 43.48 | -10.52 | 39.95 | 54.00 | 3.53 | 2.87 | 32.55 Average | --- |
| 3 | 5272.000 | 46.18 | -37.22 | 42.01 | 83.40 | 4.16 | 3.01 | 32.68 PEAK | --- |
| 4 | 7816.000 | 49.80 | -33.60 | 42.04 | 83.40 | 7.76 | 3.82 | 32.98 PEAK | --- |

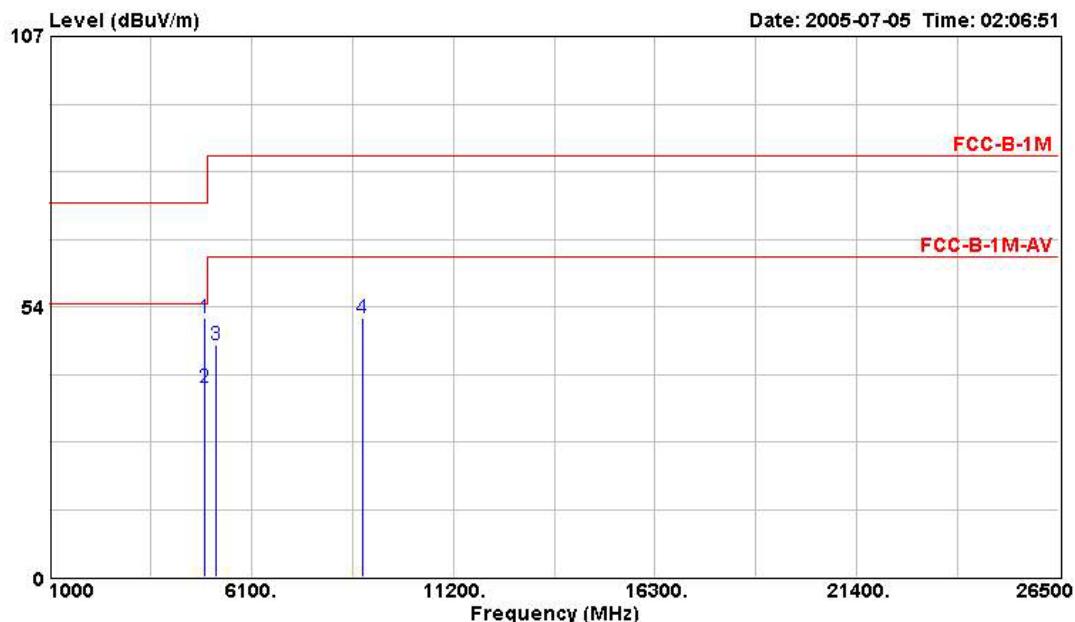


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| | | | | | |
|-----------------|------------|-------------|-------------|-----------|----------|
| Modulation Type | OFDM | | | | |
| Test Mode | CH 2462MHz | Temperature | 26.5 deg. C | Tested By | Ted Chiu |
| Freq. Range | 1GHz~25GHz | Humidity | 51% | | |

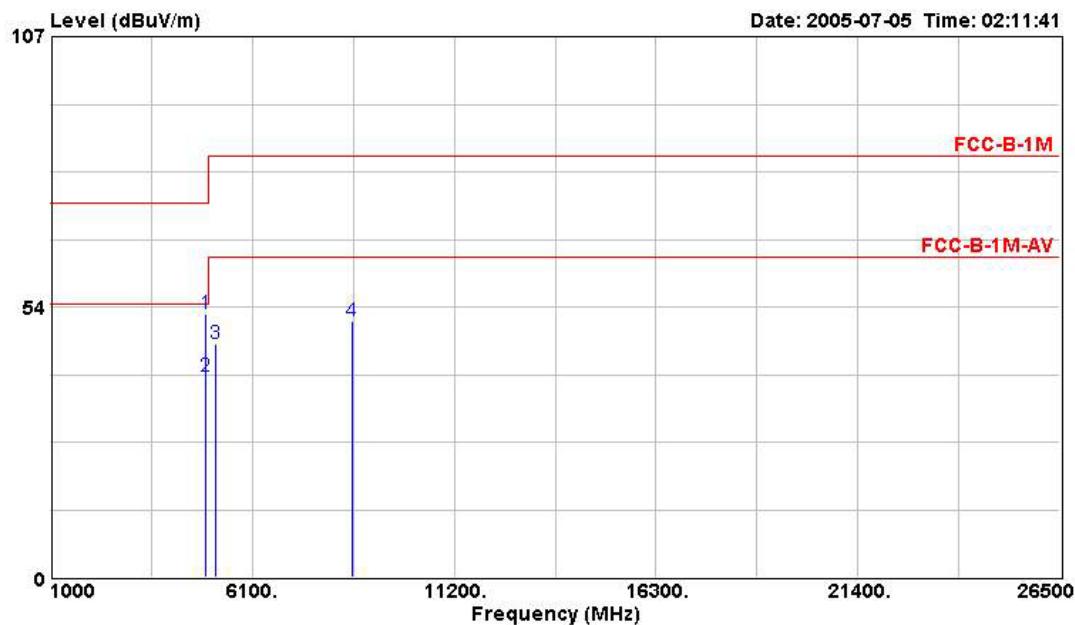
(A) Polarization: Horizontal



| Freq | Level | Over Limit | Read Level | Limit Line Factor | Cable Preamp | | | Ant Pos | Table Pos | | |
|------|----------|------------|------------|-------------------|--------------|--------|------|---------|-----------|-----|-----|
| | | | | | MHz | dBuV/m | dB | dBuV | dB | dB | |
| 1 | 4928.000 | 51.26 | -22.74 | 47.64 | 74.00 | 3.63 | 2.89 | 32.55 | PEAK | --- | --- |
| 2 | 4928.000 | 37.58 | -16.42 | 33.95 | 54.00 | 3.63 | 2.89 | 32.55 | Average | --- | --- |
| 3 | 5200.000 | 46.01 | -37.39 | 41.94 | 83.40 | 4.06 | 2.99 | 32.64 | PEAK | --- | --- |
| 4 | 8896.000 | 51.21 | -32.19 | 42.52 | 83.40 | 8.69 | 4.05 | 33.26 | PEAK | --- | --- |



(B) Polarization: Vertical

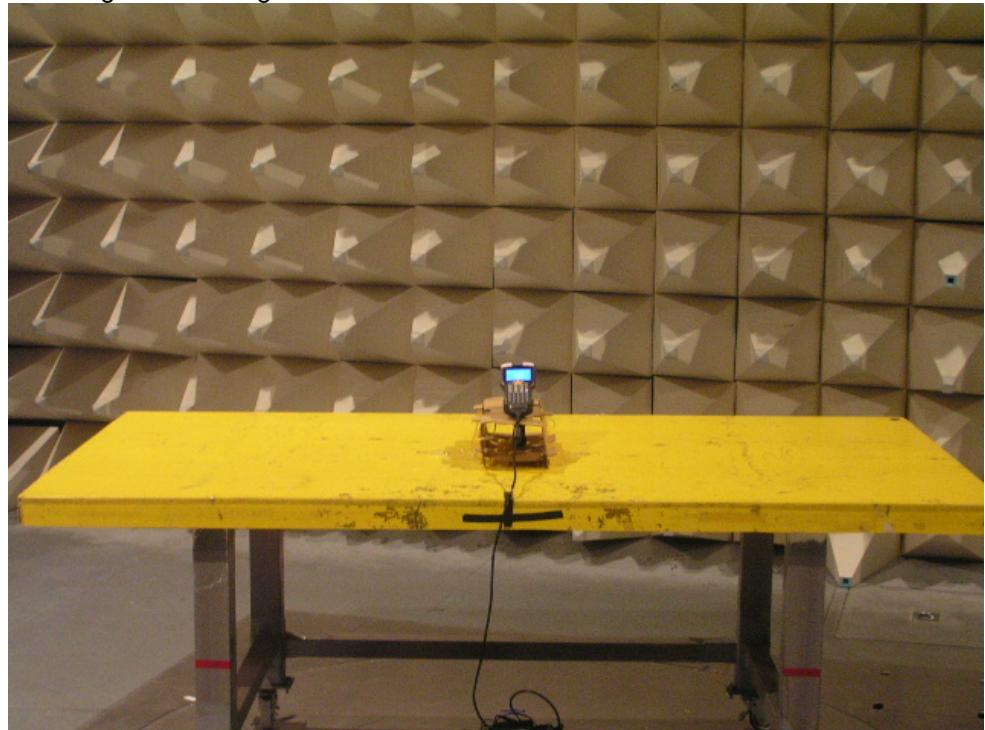


| Freq | Level | Over | Read | Limit | Line Factor | Cable | Preamp | Ant | Table | |
|------|----------|-------|--------|-------------|-------------|-------|--------|-------|---------|-----|
| | | Limit | Level | Line Factor | | | | | | |
| MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | cm | deg | |
| 1 | 4928.000 | 52.18 | -21.82 | 48.55 | 74.00 | 3.63 | 2.89 | 32.55 | PEAK | --- |
| 2 | 4928.000 | 39.62 | -14.38 | 35.99 | 54.00 | 3.63 | 2.89 | 32.55 | Average | --- |
| 3 | 5164.000 | 46.27 | -37.13 | 42.25 | 83.40 | 4.02 | 2.97 | 32.62 | PEAK | --- |
| 4 | 8616.000 | 50.83 | -32.57 | 42.02 | 83.40 | 8.82 | 4.00 | 33.08 | PEAK | --- |

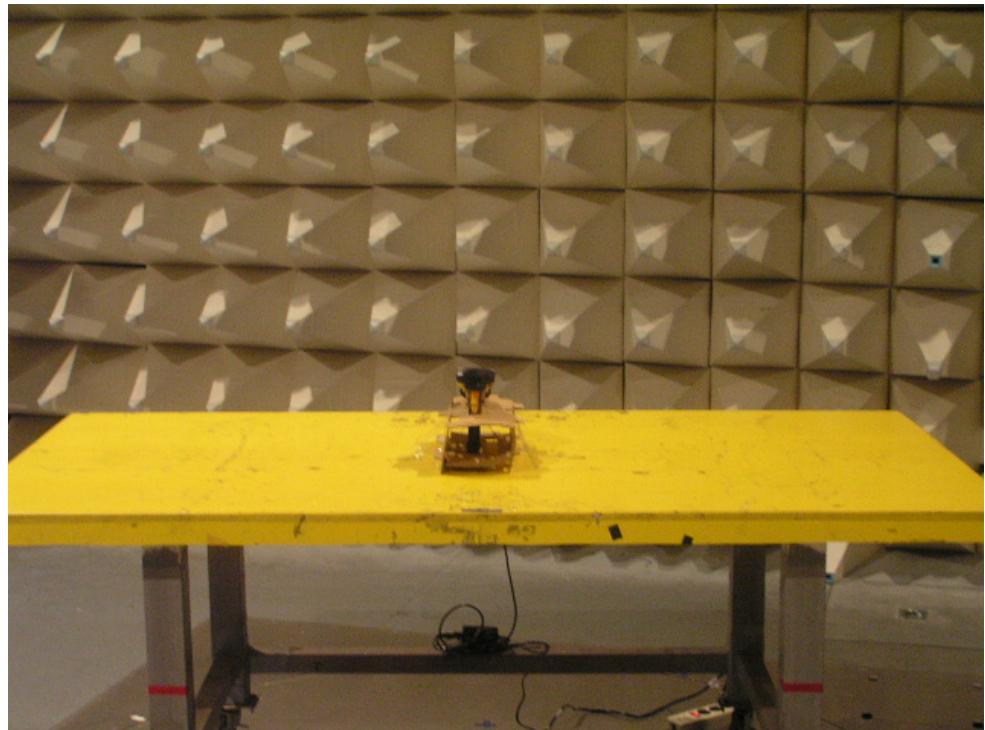
5.3.5. Photographs of Radiated Emission Test Configuration

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

FRONT VIEW



REAR VIEW





5.4. Antenna Requirements

5.4.1. Standard Applicable

47 CFR Part15 Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

47 CFR Part15 Section 15.247 (b):

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

If the intentional radiator is used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

5.4.2. Antenna Connected Construction

The antenna used in this product is PIFA antenna, antenna connector Hirose (U.FL-R-SMT).



6. List of Measuring Equipments Used

| Items | Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|-------|--------------------------|--------------------|---------------|-------------|--------------------|------------------|-----------------------|
| 1 | Receiver | R&S | ESCS 30 | 100168 | 9kHz – 2.75GHz | Dec. 09, 2004 | Conduction (CO02-LK) |
| 2 | LISN | Rolf Heine | NNB-2/16Z | 98087 | 9kHz – 30MHz | Aug. 30, 2004 | Conduction (CO02-LK) |
| 3 | LISN | Rolf Heine | NNB-2/16Z | 98009 | 9kHz – 30MHz | Aug. 30, 2004 | Conduction (CO02-LK) |
| 4 | RF Cable-CON | Suhner Switzerland | RG223/U | CB018 | 9kHz – 30MHz | Feb. 04, 2005 | Conduction (CO02-LK) |
| 5 | 3m Semi Anechoic Chamber | SIDT FRANKONIA | SAC-3M | 03CH03-HY | 30MHz ~ 1GHz 3m | Jun. 16, 2005 | Radiation (03CH03-HY) |
| 6 | Spectrum analyzer | R&S | FSP40 | 100004 | 9KHZ ~ 40GHz | Aug. 31, 2004 | Radiation (03CH03-HY) |
| 7 | Amplifier | SCHAFFNER | CPA9231A | 18667 | 9KHz ~ 2GHz | Jan. 10, 2005 | Radiation (03CH03-HY) |
| 8 | Amplifier | Agilent | 8449B | 3008A02120 | 1GHz ~ 26.5GHz | May 31, 2005 | Radiation (03CH03-HY) |
| 9 | Amplifier | MITEQ | AMF-6F-260400 | 923364 | 26.5GHz ~ 40GHz | Jan. 05, 2004* | Radiation (03CH03-HY) |
| 10 | Loop Antenna | R&S | HFH2-Z2 | 860004/001 | 9kHz ~ 30MHz | May 24, 2004* | Radiation (03CH03-HY) |
| 11 | Biconical Antenna | SCHWARZBECK | VHBB 9124 | 301 | 30MHz ~ 200MHz | Jul. 28, 2004 | Radiation (03CH03-HY) |
| 12 | Log Antenna | SCHWARZBECK | VUSLP 9111 | 221 | 200MHz ~ 1GHz | Jul. 28, 2004 | Radiation (03CH03-HY) |
| 13 | Horn Antenna | EMCO | 3115 | 6741 | 1GHz ~ 18GHz | Apr. 22, 2005 | Radiation (03CH03-HY) |
| 14 | Horn Antenna | SCHWARZBECK | BBHA9170 | BBHA9170154 | 15GHz ~ 40GHz | Jun. 09, 2004* | Radiation (03CH03-HY) |
| 15 | RF Cable-R03m | Jye Bao | RG142 | CB021 | 30MHz ~ 1GHz | Feb. 22, 2005 | Radiation (03CH03-HY) |
| 16 | RF Cable-HIGH | SUHNER | SUCOFLEX 106 | 03CH03-HY | 1GHz ~ 40GHz | Dec.01, 2004 | Radiation (03CH03-HY) |
| 17 | Turn Table | HD | DS 420 | 420/650/00 | 0 ~ 360 degree | N/A | Radiation (03CH03-HY) |
| 18 | Antenna Mast | HD | MA 240 | 240/560/00 | 1 m - 4 m | N/A | Radiation (03CH03-HY) |
| 19 | Spectrum analyzer | R&S | FSP30 | 100023 | 9kHz ~ 30GHz | Aug. 02, 2004 | Conducted (TH01-HY) |

※ Calibration Interval of instruments listed above is one year.

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