

# FCC TEST REPORT

**CATEGORY** : Mobile  
**PRODUCT NAME** : IEEE 802.11a/g Wireless PCI Adapter  
**FCC ID.** : KA2DWLAG530A4  
**FILING TYPE** : Certification  
**BRAND NAME** : D-Link  
**MODEL NAME** : DWL-AG510, DWL-AG530, WPC-D16, WPC-D18  
**APPLICANT** : **D-Link Corporation**  
No.8, Li-shing Road VII, Science-based Industrial  
Park, Hsinchu, Taiwan.  
**MANUFACTURER** : Same as applicant  
**ISSUED BY** : **SPORTON INTERNATIONAL INC.**  
6F, No. 106, Sec. 1, Hsin Tai Wu Rd., His Chih, Taipei Hsien,  
Taiwan, R.O.C.

## Statements:

**Only the test result of 802.11b/g part 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 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.



1190  
ILAC MRA



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## HISTORY OF THIS TEST REPORT

Received Date: Mar. 4th, 2005

Test Date: May 24, 2005

Original Report Issue Date: May 24, 2005

Report No.: FR542514

☒ No additional attachment.

☐ Additional attachment were issued as following record:

| Attachment No. | Issue Date | Description |
|----------------|------------|-------------|
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# CERTIFICATE OF COMPLIANCE

with

## 47 CFR FCC Part 15 Subpart C

**PRODUCT NAME** : IEEE 802.11a/g Wireless PCI Adapter

**BRAND NAME** : D-Link

**MODEL NAME** : DWL-AG510, DWL-AG530, WPC-D16, WPC-D18

**APPLICANT** : **D-Link Corporation**

No.8, Li-shing Road VII, Science-based Industrial  
Park, Hsinchu, Taiwan.

**MANUFACTURER** : Same as applicant

### 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 May 24, 2005 at SPORTON International Inc. LAB.

  
Wayne Hsu

## 1. General Description of Equipment under Test

### 1.1. Applicant

**D-Link Corporation**

No.8, Li-shing Road VII, Science-based Industrial Park, Hsinchu, Taiwan.

### 1.2. Manufacturer

Same as applicant

### 1.3. Basic Description of Equipment under Test

This product is a Wireless PCI adapter with 802.11a/b/g wireless solution. The technical data has been listed on section "Features of Equipment under Test". 2 types of antenna are filed in this project for both 2.4GHz and 5GHz operating frequency band. There are 2 pieces of wireless LAN card for the product: one is DWL-AG 530 (WPC-D16) and the other is DWL-AG510 (WPC-D18). The software are the same in both of the two cards, but only DWL-AG 530 (WPC-D16) card has Turbo function. So only DWL-AG 530 (WPC-D16) card was tested in the project.

### 1.4. Features of Equipment under Test

#### EUT

| Items                         | Description                                                                                       |
|-------------------------------|---------------------------------------------------------------------------------------------------|
| Type of Modulation            | DSSS (CCK / DQPSK / DBPSK)<br>OFDM (16QAM / 64QAM / DQPSK / DBPSK )                               |
| Number of Channels            | 11                                                                                                |
| Frequency Band                | 2400 MHz ~ 2483.5 MHz                                                                             |
| Carrier Frequency Range       | 2412.0 MHz ~ 2462.0 MHz                                                                           |
| Carrier Frequency             | See section 1.6 for details                                                                       |
| Data Rate                     | 1, 2, 5.5, 11 Mbps - DSSS<br>6, 12, 18, 24, 36, 48, 54 Mbps - OFDM<br>108 Mbps- OFDM - Turbo Mode |
| Channel Bandwidth             | 16 MHz                                                                                            |
| Max. Conducted Output Power   | DSSS : 18.02 dBm<br>OFDM : 18.00 dBm<br>11g Turbo Mode : 16.00 dBm                                |
| Antenna Type                  | See section 1.5 for details                                                                       |
| Communication Type            | Half-Duplex                                                                                       |
| Testing Duty Cycle            | 100.00%                                                                                           |
| Power Rating (DC/AC, Voltage) | 5VDC from host                                                                                    |
| Test Power Source             | 110.00V AC                                                                                        |
| Temperature Range (Operating) | -10 ~ 50 °C                                                                                       |



### 1.5. Antenna Description

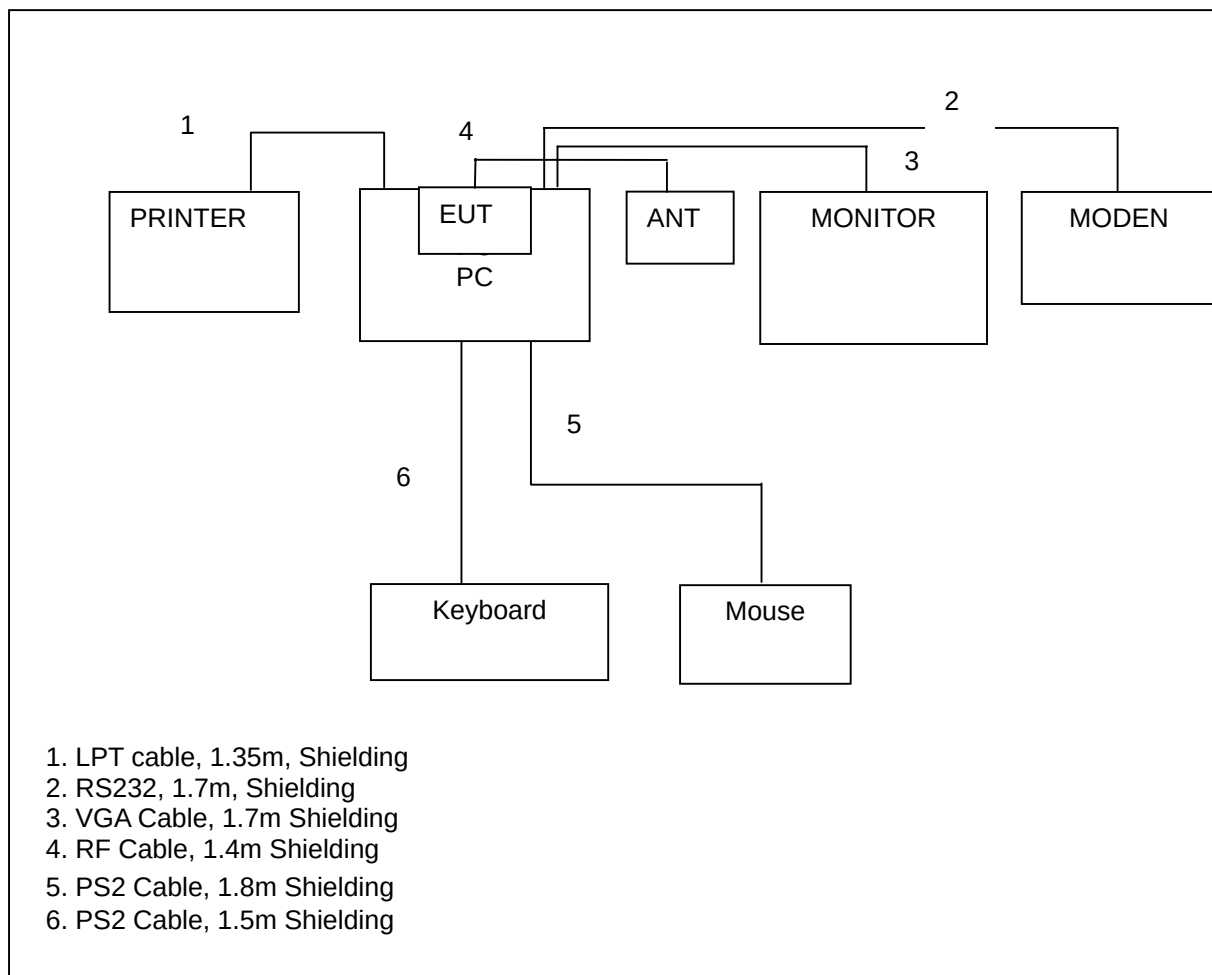
| No. | Antenna Type                               | Gain (dBi) |
|-----|--------------------------------------------|------------|
| 1   | Dipole Antenna                             | 2.00       |
| 2   | Tri- band flying lead and straight Antenna | 4.00       |

### 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, we have to test the lowest, middle and highest channels of EUT.
4. Spurious emission below 1GHz is independent of channel selection and modulation types. So only channel 06 was tested.
5. AC conduction emission is independent of channel selection, modulation types and types of antenna. So only channel 06 tested.
6. There are 2 types of antennas were tested.
  - Mode 1 : Dipole Antenna
  - Mode 2 : Tri- band flying lead and straight Antenna

**2.3. Description of Test Supporting Units**

| Support unit | Brand     | Model No.     | Serial No. | FCC ID | Data cable (m) |
|--------------|-----------|---------------|------------|--------|----------------|
| Monitor      | ViewSonic | VCDTS21553-3P | -          | DoC    | 1.7            |
| PC           | HP COMPAQ | D330ut        | -          | DoC    | -              |
| Keyboard     | LOGITECH  | Y-SP29        | -          | DoC    | 1.5            |
| Mouse        | LOGITECH  | M-S34         | -          | DoC    | 1.8            |
| Printer      | EPSON     | LQ-680        | -          | DoC    | 1.35           |
| MODEM        | ACEEX     | DM141         | -          | DoC    | 1.7            |



### 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. 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.



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### **Power Parameter Table**

Software Version : ART  
Power Set CH01 / DSSS : 18 / TX Power  
Power Set CH06 / DSSS : 18 / TX Power  
Power Set CH11 / DSSS : 18 / TX Power  
Power Set Ch01 / OFDM : 15.0 TX Power  
Power Set Ch06 / OFDM : 18.0 TX Power  
Power Set Ch11 / OFDM : 14.5 / TX Power  
Power Set Ch06(Turbo) : 16.0/ TX Power

## 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                                              | 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   |
| 5.8                                            | 2.1091               | Maximum Permissible Exposure        | 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.

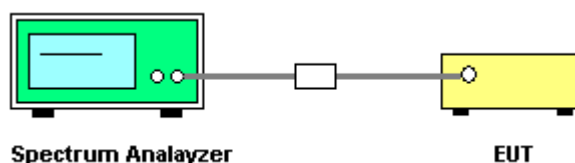
#### 5.1.3. Description of Major Test Instruments Setting

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

#### 5.1.5. Test Setup Layout



#### 5.1.6. Test Criteria

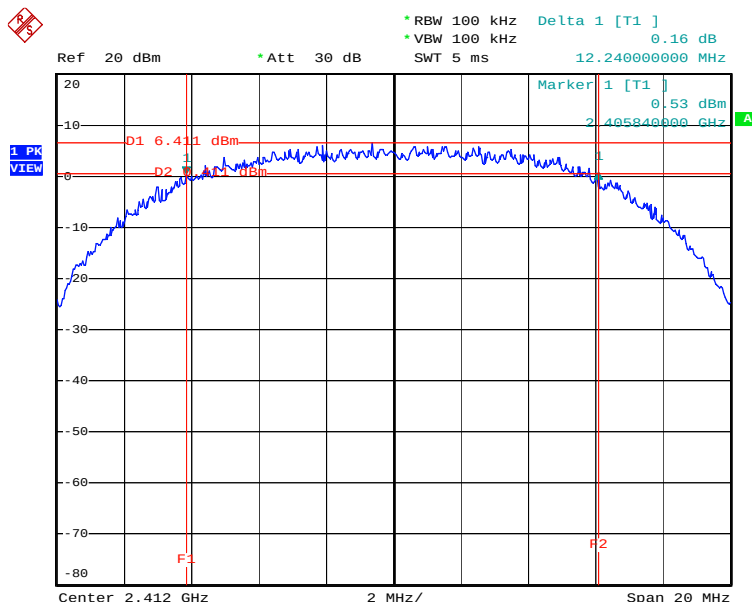
All test results complied with the requirements of 15.247(a)(2). Measurement Uncertainty is  $1 \times 10^{-5}$ .

### 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

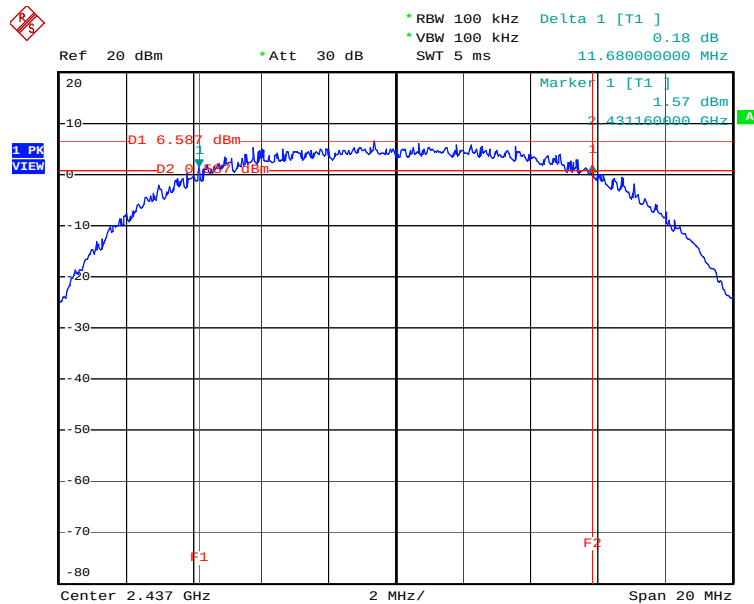
| Modulation Type  | Channel No. | Frequency (MHz) | 6dB Bandwidth | Min. Limit |
|------------------|-------------|-----------------|---------------|------------|
| DSSS             | 01          | 2412 MHz        | 12.24         | 0.5        |
| DSSS             | 06          | 2437 MHz        | 11.68         | 0.5        |
| DSSS             | 11          | 2462 MHz        | 12.40         | 0.5        |
| OFDM             | 01          | 2412 MHz        | 16.36         | 0.5        |
| OFDM             | 06          | 2437 MHz        | 16.32         | 0.5        |
| OFDM             | 11          | 2462 MHz        | 16.40         | 0.5        |
| OFDM- Turbo Mode | 06          | 2437 MHz        | 32.64         | 0.5        |

Modulation Type: DSSS (Channel 01) :



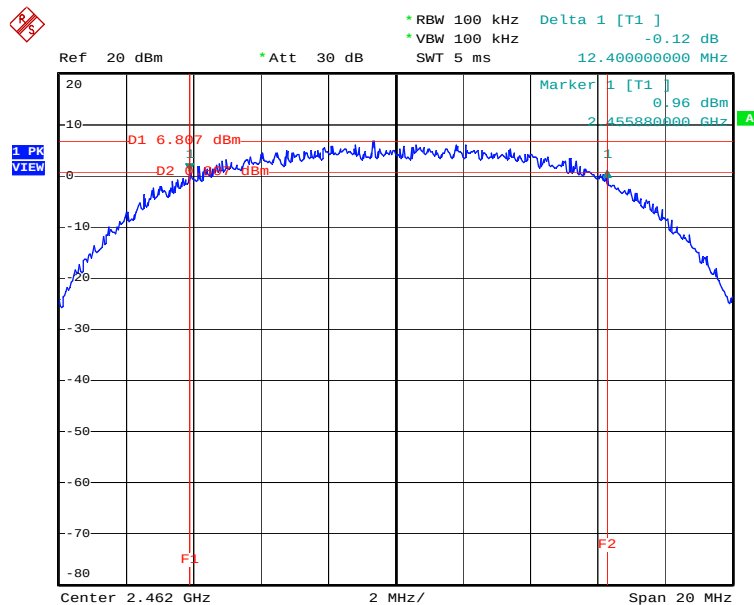
Date: 7.MAY.2005 10:30:01

Modulation Type: DSSS (Channel 06) :



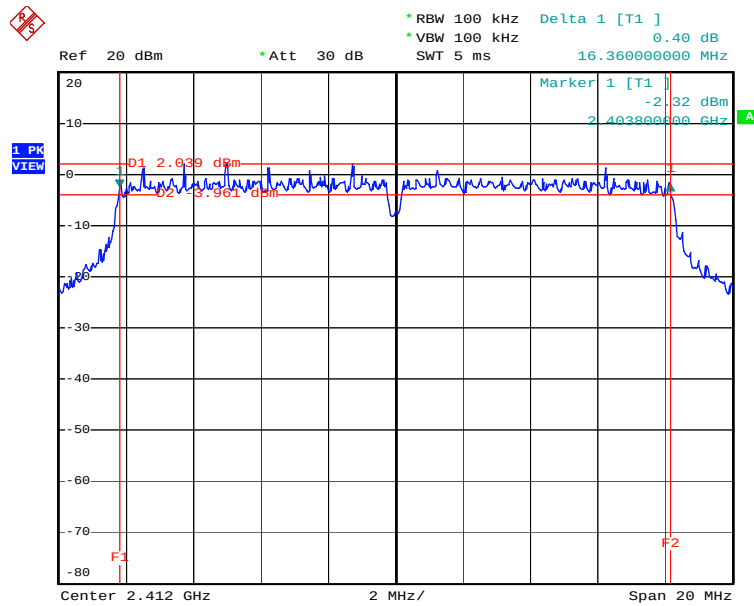
Date: 7.MAY.2005 10:31:34

Modulation Type: DSSS (Channel 11) :



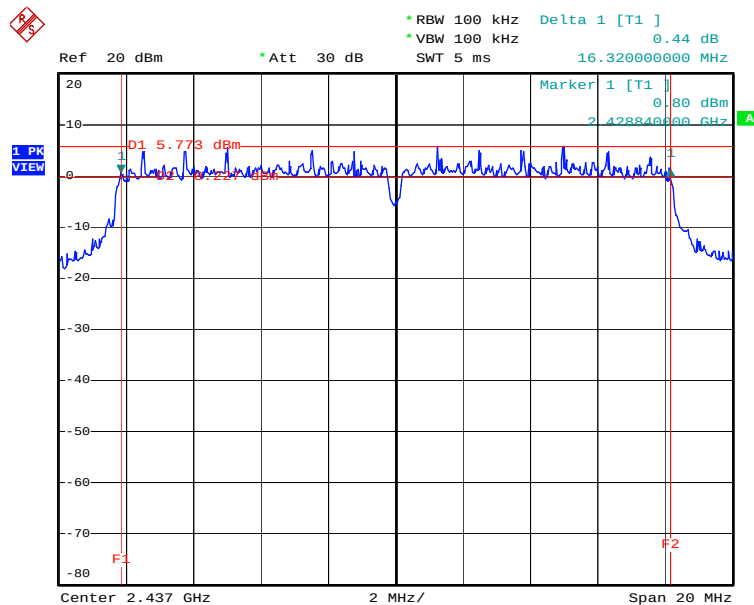
Date: 7.MAY.2005 10:36:02

Modulation Type: OFDM (Channel 01) :



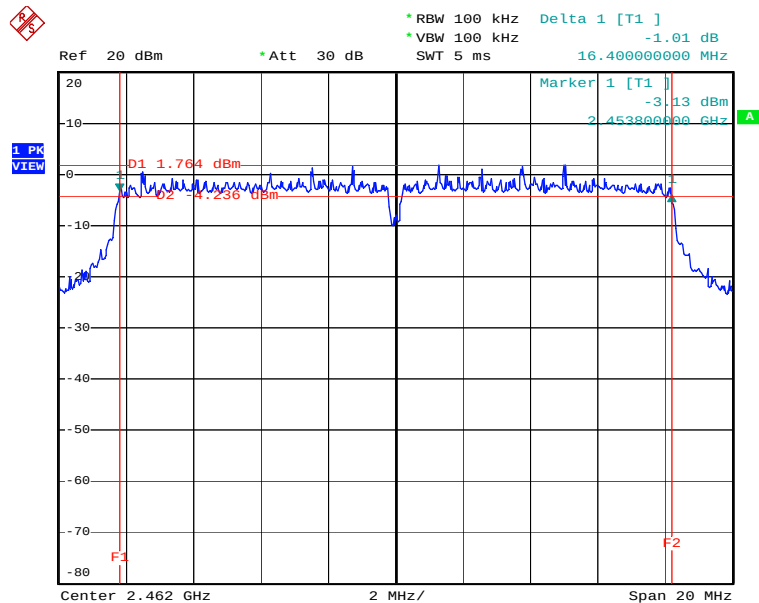
Date: 7.MAY.2005 10:40:56

Modulation Type: OFDM (Channel 06) :



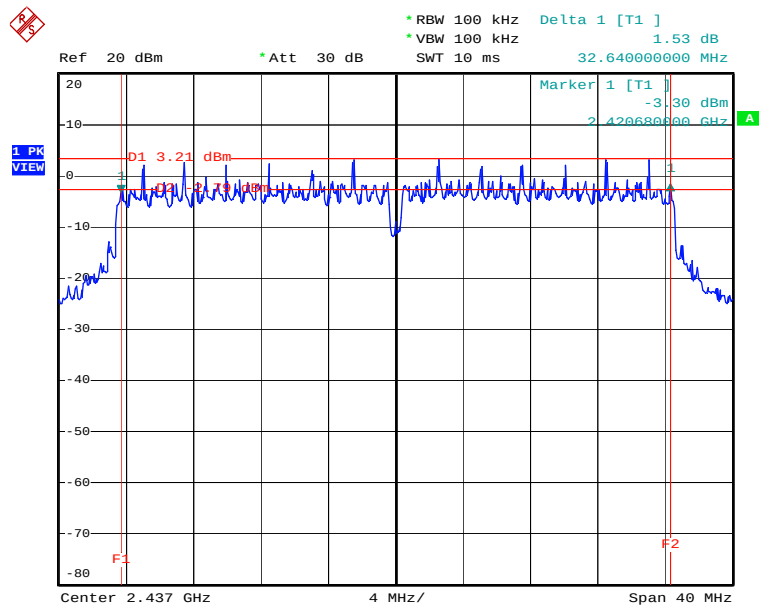
Date: 7.MAY.2005 10:42:06

Modulation Type: OFDM (Channel 11) :



Date: 7.MAY.2005 10:42:48

Modulation Type: OFDM-Turbo Mode (Channel 06) :



Date: 19.MAY.2005 02:10:52

## 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.

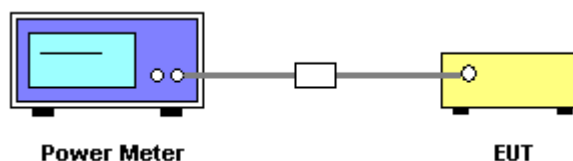
### 5.2.2. Measuring Instruments

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 point 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: 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) |
|------------------|-------------|-----------------|--------------------|--------------|
| DSSS             | 01          | 2412 MHz        | 18.02              | 30           |
| DSSS             | 06          | 2437 MHz        | 18.00              | 30           |
| DSSS             | 11          | 2462 MHz        | 18.01              | 30           |
| OFDM             | 01          | 2412 MHz        | 15.01              | 30           |
| OFDM             | 06          | 2437 MHz        | 18.00              | 30           |
| OFDM             | 11          | 2462 MHz        | 14.50              | 30           |
| OFDM- Turbo Mode | 06          | 2437 MHz        | 16.00              | 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.

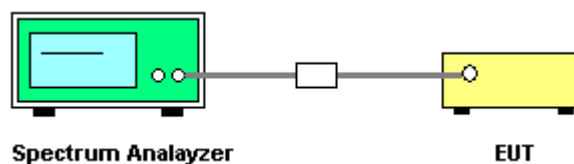
#### 5.3.3. Description of Major Test Instruments Setting

- 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 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 the 1~4 for the middle and highest channel of the EUT.

#### 5.3.5. Test Setup Layout



#### 5.3.6. Test Criteria

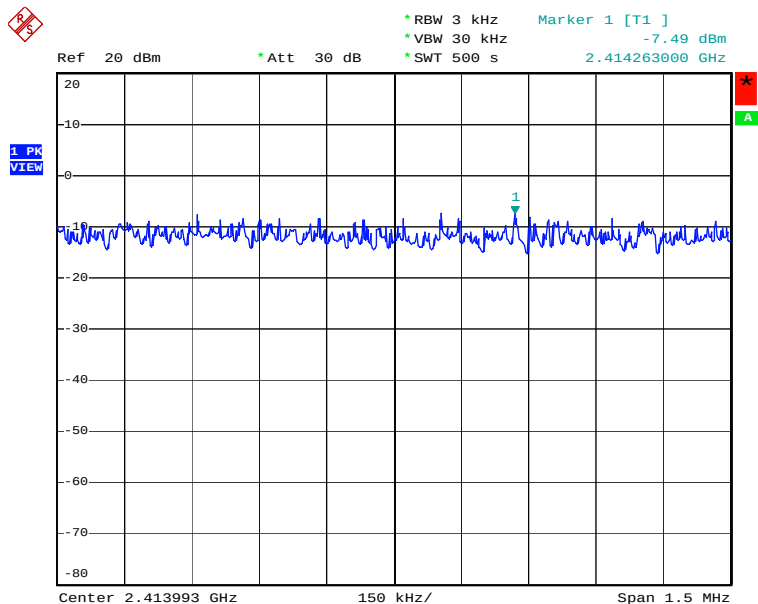
All test results complied with the requirements of 15.247(e). Measurement Uncertainty is 1.5dB.

### 5.3.7. Test Result

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

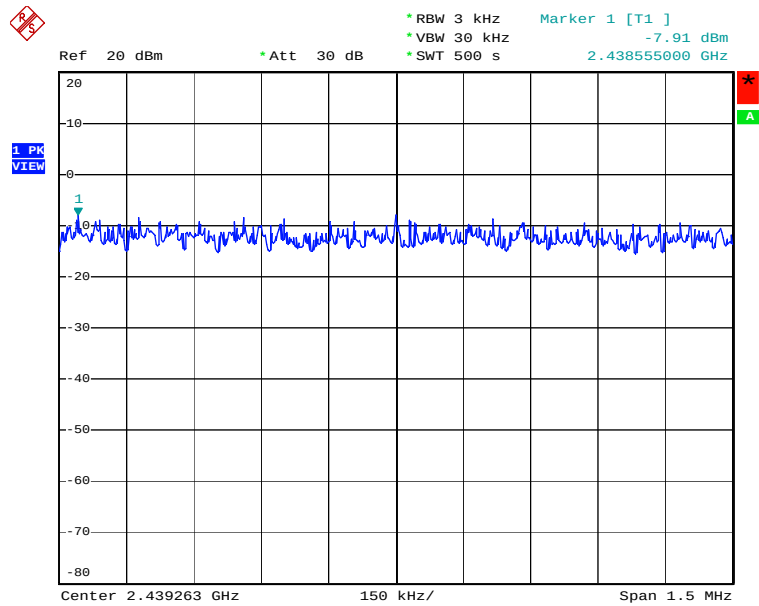
| Modulation Type  | Channel No. | Frequency (MHz) | Power Density (dBm) | Limits (dBm) |
|------------------|-------------|-----------------|---------------------|--------------|
| DSSS             | 01          | 2412 MHz        | -7.49               | 8            |
| DSSS             | 06          | 2437 MHz        | -7.91               | 8            |
| DSSS             | 11          | 2462 MHz        | -8.38               | 8            |
| OFDM             | 01          | 2412 MHz        | -11.35              | 8            |
| OFDM             | 06          | 2437 MHz        | -8.80               | 8            |
| OFDM             | 11          | 2462 MHz        | -12.33              | 8            |
| OFDM- Turbo Mode | 06          | 2437 MHz        | -12.91              | 8            |

Modulation Type: DSSS (Channel 01) :



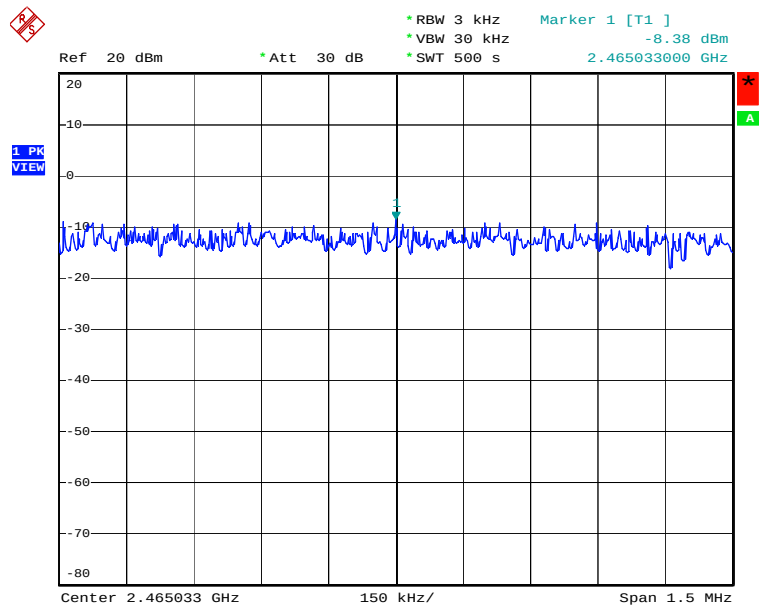
Date: 7.MAY.2005 10:30:26

Modulation Type: DSSS (Channel 06) :



Date: 7.MAY.2005 10:31:49

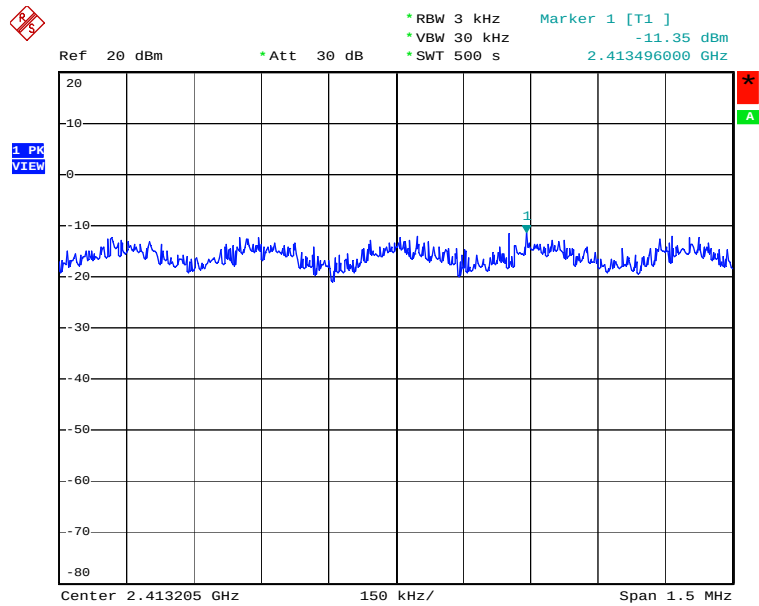
Modulation Type: DSSS (Channel 11) :



Date: 7.MAY.2005 10:36:16

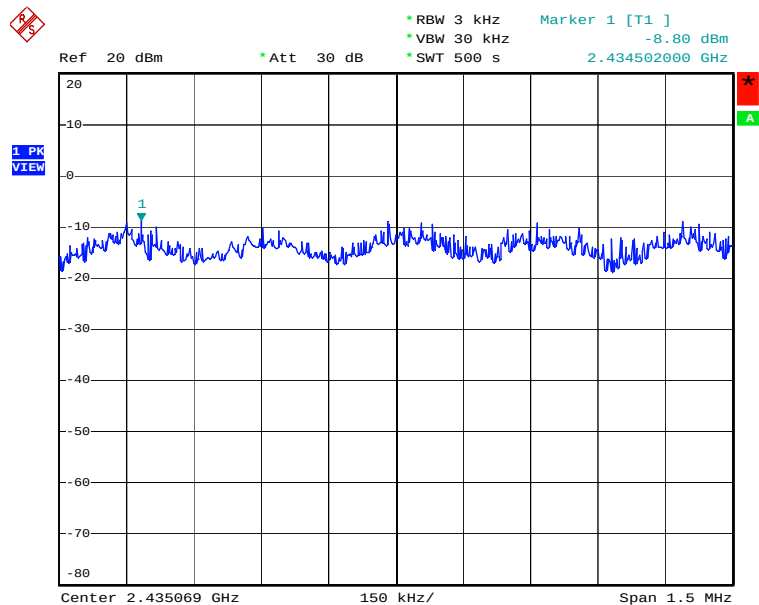


Modulation Type: OFDM (Channel 01) :



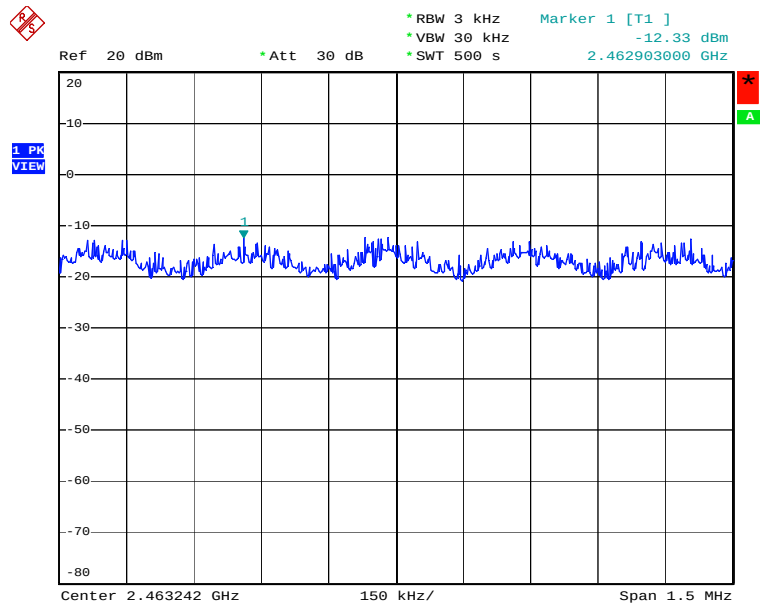
Date: 7.MAY.2005 10:41:21

Modulation Type: OFDM (Channel 06) :



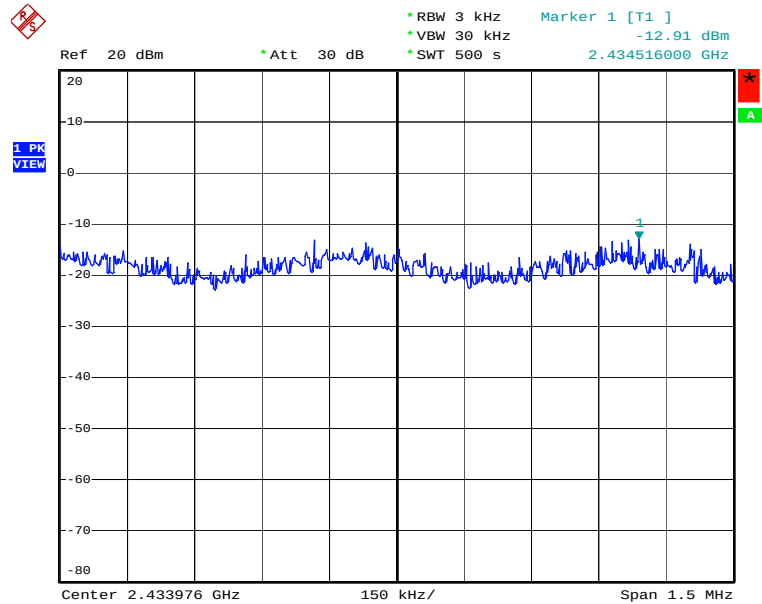
Date: 7.MAY.2005 10:42:21

Modulation Type: OFDM (Channel 11) :



Date: 7.MAY.2005 10:43:02

Modulation Type: OFDM- Turbo Mode (Channel 06) :



Date: 19.MAY.2005 02:12:59

## 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.

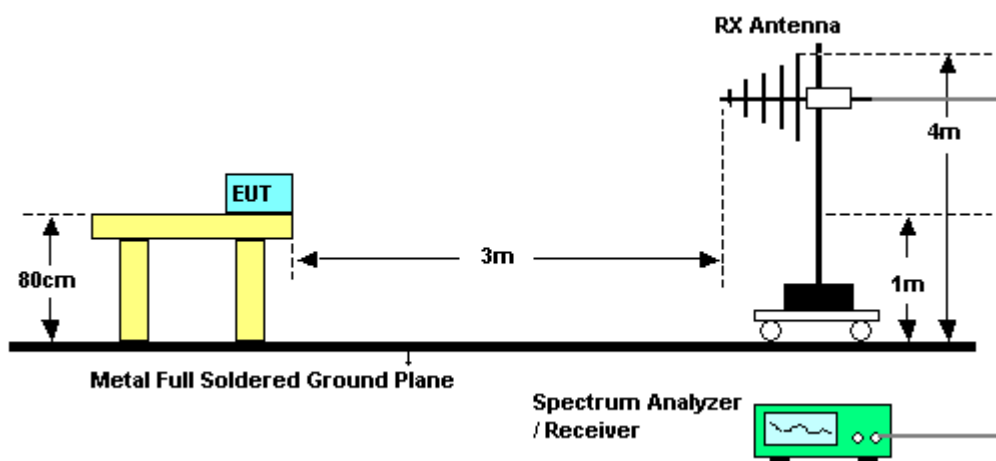
4. The lowest band edges emission was measured and recorded.
5. The transmitter set to the highest channel and repeated 2~4.

#### Radiated Measurement

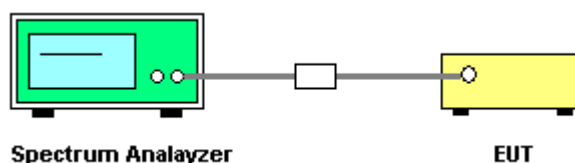
1. Configure the EUT according to ANSI C63.4.
2. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both 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  $1 \times 10^{-5}$ .

**5.4.7. Test Result of Radiated Emission**

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

**Mode 1**

| Modulation Type  | Test Channel | Freq. (MHz) | Level* (dBuV/m) | Margin (dB) | Limit (dBuV/m) | Trace (PK/AV) |
|------------------|--------------|-------------|-----------------|-------------|----------------|---------------|
| DSSS             | 01           | 2390.0      | 57.30           | -16.70      | 74             | PK            |
| DSSS             | 01           | 2390.0      | 50.94           | -3.06       | 54             | AV            |
| DSSS             | 11           | 2483.5      | 56.27           | -17.73      | 74             | PK            |
| DSSS             | 11           | 2483.5      | 45.95           | -8.05       | 54             | AV            |
| OFDM             | 01           | 2390.0      | 67.3            | -6.70       | 74             | PK            |
| OFDM             | 01           | 2390.0      | 52.23           | -1.77       | 54             | AV            |
| OFDM             | 11           | 2483.5      | 68.1            | -5.90       | 74             | PK            |
| OFDM             | 11           | 2483.5      | 52.84           | -1.16       | 54             | AV            |
| OFDM- Turbo Mode | 06           | 2390.0      | 62.03           | -11.97      | 74             | PK            |
| OFDM- Turbo Mode | 06           | 2390.0      | 48.77           | -5.23       | 54             | AV            |
| OFDM- Turbo Mode | 06           | 2437.0      | 61.16           | -12.84      | 74             | PK            |
| OFDM- Turbo Mode | 06           | 2437.0      | 49.91           | -4.09       | 54             | AV            |

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

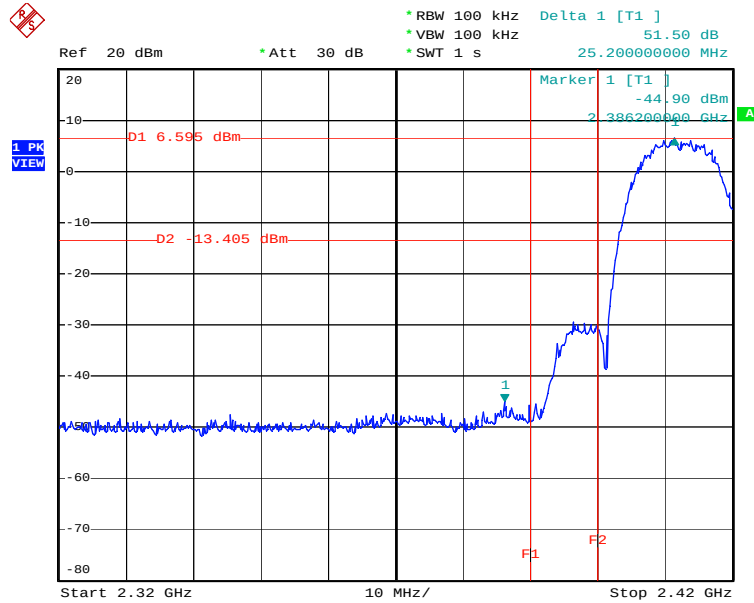
**Mode 2**

| <b>Modulation Type</b> | <b>Test Channel</b> | <b>Freq. (MHz)</b> | <b>Level* (dBuV/m)</b> | <b>Margin (dB)</b> | <b>Limit (dBuV/m)</b> | <b>Trace (PK/AV)</b> |
|------------------------|---------------------|--------------------|------------------------|--------------------|-----------------------|----------------------|
| DSSS                   | 01                  | 2390.0             | 53.60                  | -20.40             | 74                    | PK                   |
| DSSS                   | 01                  | 2390.0             | 43.73                  | -10.27             | 54                    | AV                   |
| DSSS                   | 11                  | 2483.5             | 55.79                  | -18.21             | 74                    | PK                   |
| DSSS                   | 11                  | 2483.5             | 44.15                  | -9.85              | 54                    | AV                   |
| OFDM                   | 01                  | 2390.0             | 68.68                  | -5.32              | 74                    | PK                   |
| OFDM                   | 01                  | 2390.0             | 52.64                  | -1.36              | 54                    | AV                   |
| OFDM                   | 11                  | 2483.5             | 64.60                  | -9.40              | 74                    | PK                   |
| OFDM                   | 11                  | 2483.5             | 52.05                  | -1.95              | 54                    | AV                   |
| OFDM- Turbo Mode       | 06                  | 2390.00            | 55.99                  | -18.01             | 74                    | PK                   |
| OFDM- Turbo Mode       | 06                  | 2390.00            | 47.50                  | -6.50              | 54                    | AV                   |
| OFDM- Turbo Mode       | 06                  | 2483.50            | 58.72                  | -15.28             | 74                    | PK                   |
| OFDM- Turbo Mode       | 06                  | 2483.50            | 48.36                  | -5.64              | 54                    | AV                   |

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

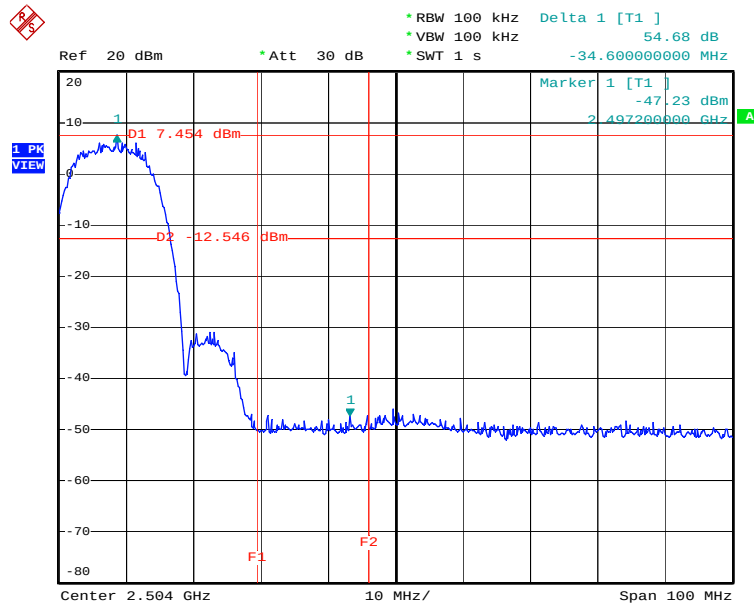
Test Result of Conducted Emission

Modulation Type: DSSS (Channel 01) :



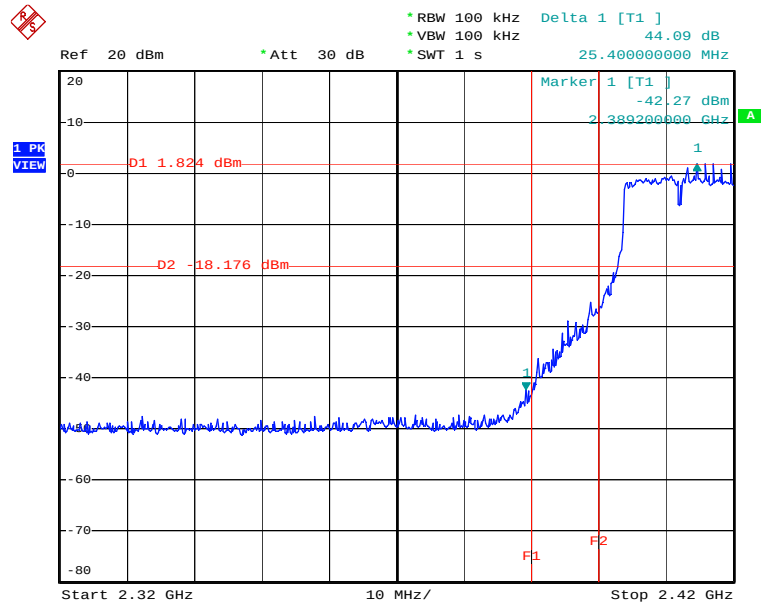
Date: 7.MAY.2005 10:30:33

Modulation Type: DSSS (Channel 11) :



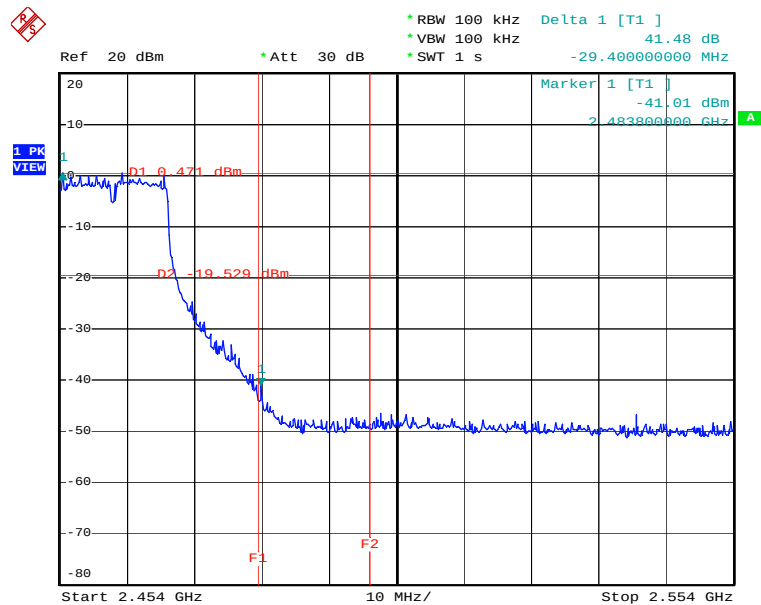
Date: 7.MAY.2005 10:38:11

Modulation Type: OFDM (Channel 01) :



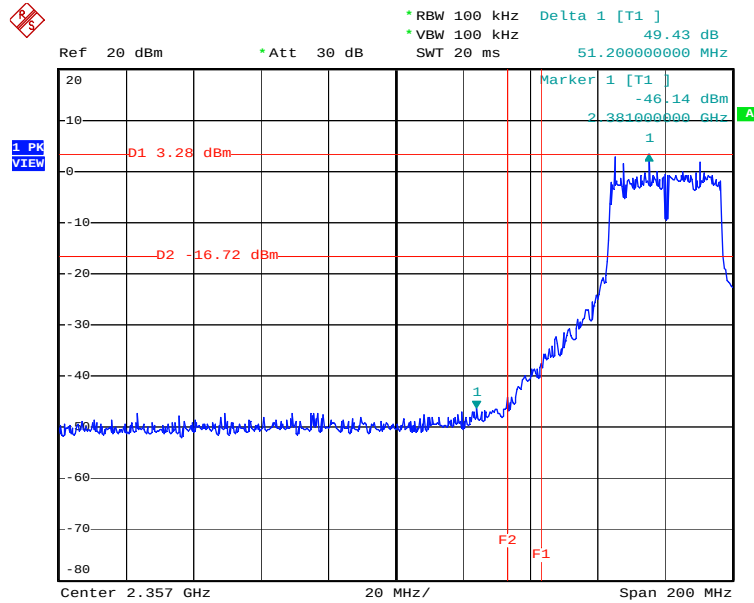
Date: 7.MAY.2005 10:41:28

Modulation Type: OFDM (Channel 11) :



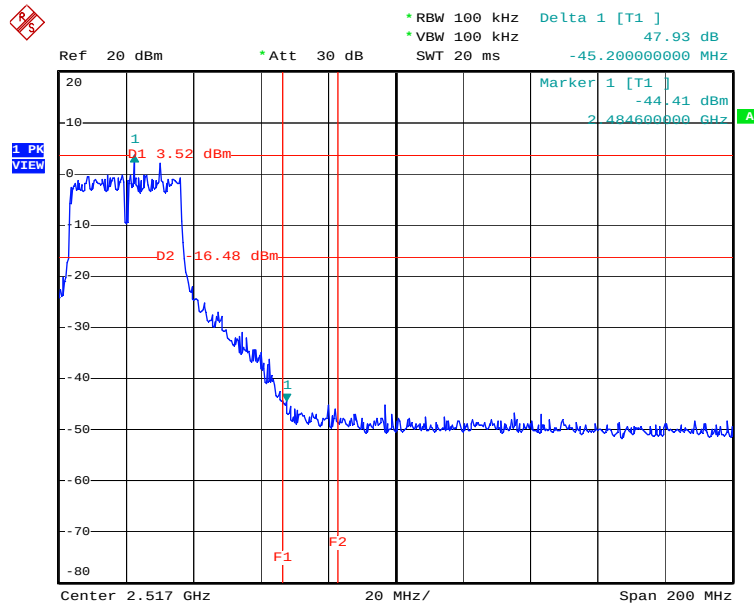
Date: 7.MAY.2005 10:43:10

Modulation Type: OFDM- Turbo Mode (Channel 06) :



Date: 19.MAY.2005 02:11:46

Modulation Type: OFDM- Turbo Mode (Channel 06) :



Date: 19.MAY.2005 02:12:20

## 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.

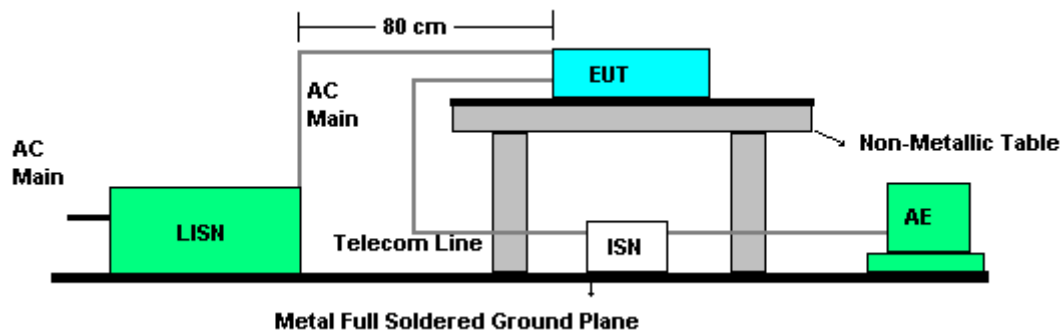
### 5.5.3. Description of Major Test Instruments Setting

- 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



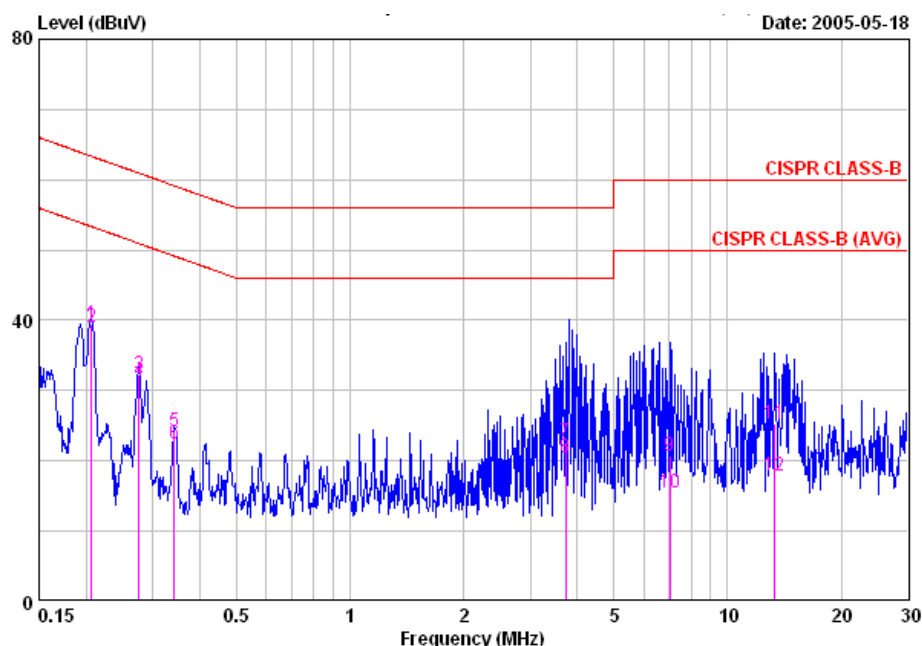
#### 5.5.6. Test Criteria

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

### 5.5.7. Test Result of Conducted Emission

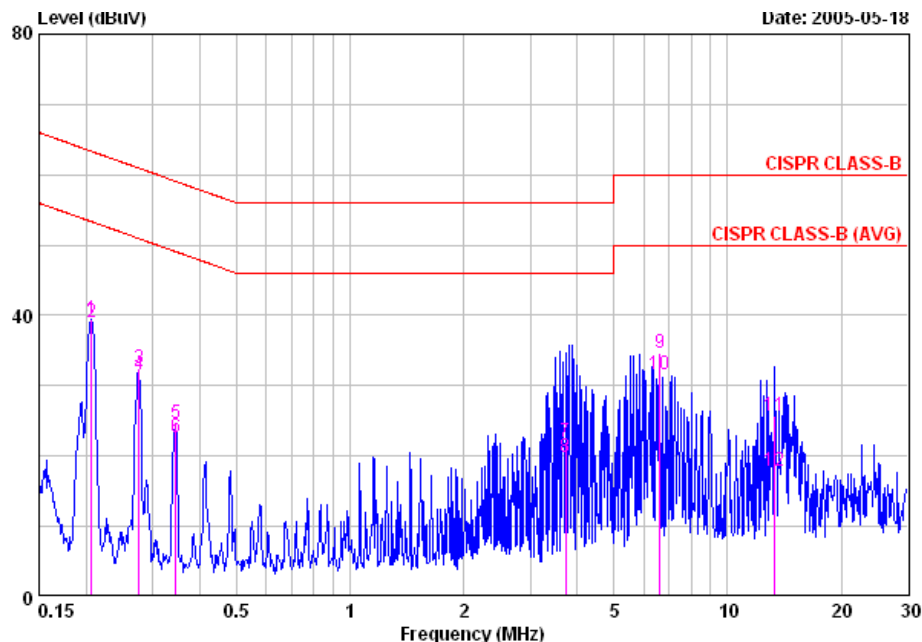
- Mode 1
- Temperature: 26°C
- Relative Humidity: 64%
- Test Engineer: Steven Lu

#### Line to Ground



|    | Freq    | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark  |
|----|---------|-------|------------|------------|------------|-------------|------------|---------|
|    | MHz     | dBuV  | dB         | dBuV       | dBuV       | dB          | dB         |         |
| 1  | 0.20614 | 39.50 | -23.86     | 63.36      | 39.40      | 0.10        | 0.00       | QP      |
| 2  | 0.20614 | 39.06 | -14.30     | 53.36      | 38.96      | 0.10        | 0.00       | AVERAGE |
| 3  | 0.27587 | 32.36 | -28.58     | 60.94      | 32.31      | 0.05        | 0.00       | QP      |
| 4  | 0.27587 | 31.47 | -19.47     | 50.94      | 31.42      | 0.05        | 0.00       | AVERAGE |
| 5  | 0.34281 | 24.15 | -34.98     | 59.13      | 24.13      | 0.02        | 0.00       | QP      |
| 6  | 0.34281 | 22.38 | -26.75     | 49.13      | 22.36      | 0.02        | 0.00       | AVERAGE |
| 7  | 3.720   | 22.65 | -33.35     | 56.00      | 22.55      | 0.00        | 0.10       | QP      |
| 8  | 3.720   | 20.54 | -25.46     | 46.00      | 20.44      | 0.00        | 0.10       | AVERAGE |
| 9  | 7.025   | 20.66 | -39.34     | 60.00      | 20.38      | 0.06        | 0.22       | QP      |
| 10 | 7.025   | 15.51 | -34.49     | 50.00      | 15.23      | 0.06        | 0.22       | AVERAGE |
| 11 | 13.267  | 25.33 | -34.67     | 60.00      | 24.86      | 0.10        | 0.37       | QP      |
| 12 | 13.267  | 17.98 | -32.02     | 50.00      | 17.51      | 0.10        | 0.37       | AVERAGE |

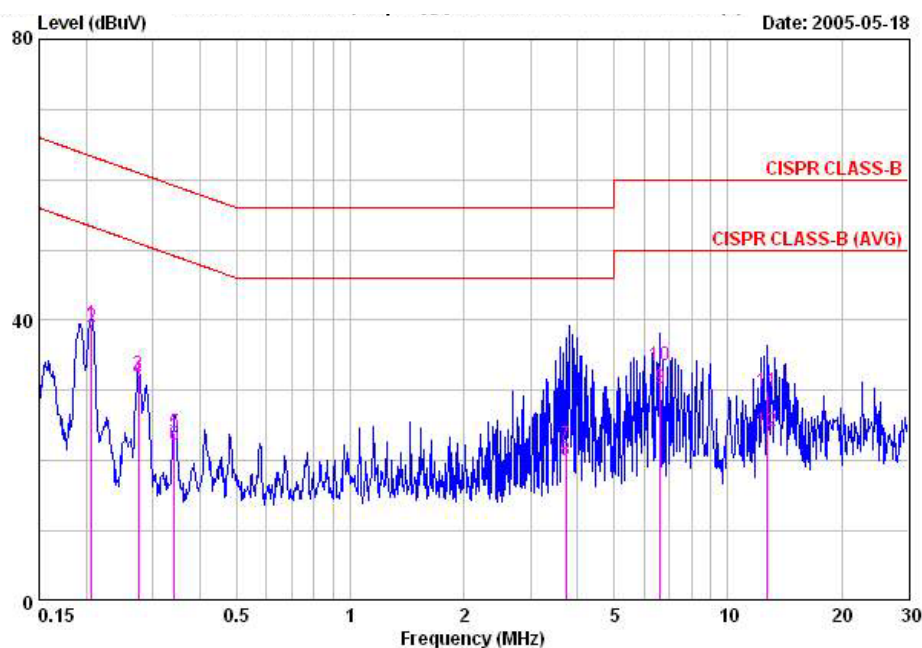
*Neutral to Ground*



|    | Freq    | Level | Over   | Limit | Read  | LISN   | Cable |         |
|----|---------|-------|--------|-------|-------|--------|-------|---------|
|    | MHz     | dBuV  | Limit  | Line  | Level | Factor | Loss  | Remark  |
|    | MHz     | dBuV  | dB     | dBuV  | dBuV  | dB     | dB    |         |
| 1  | 0.20614 | 39.54 | -23.82 | 63.36 | 39.44 | 0.10   | 0.00  | QP      |
| 2  | 0.20614 | 39.11 | -14.25 | 53.36 | 39.01 | 0.10   | 0.00  | AVERAGE |
| 3  | 0.27587 | 32.56 | -28.38 | 60.94 | 32.46 | 0.10   | 0.00  | QP      |
| 4  | 0.27587 | 31.70 | -19.24 | 50.94 | 31.60 | 0.10   | 0.00  | AVERAGE |
| 5  | 0.34463 | 24.57 | -34.52 | 59.09 | 24.47 | 0.10   | 0.00  | QP      |
| 6  | 0.34463 | 22.62 | -26.47 | 49.09 | 22.52 | 0.10   | 0.00  | AVERAGE |
| 7  | 3.720   | 22.06 | -33.94 | 56.00 | 21.96 | 0.00   | 0.10  | QP      |
| 8  | 3.720   | 19.87 | -26.13 | 46.00 | 19.77 | 0.00   | 0.10  | AVERAGE |
| 9  | 6.627   | 34.70 | -25.30 | 60.00 | 34.49 | 0.00   | 0.21  | QP      |
| 10 | 6.627   | 31.71 | -18.29 | 50.00 | 31.50 | 0.00   | 0.21  | AVERAGE |
| 11 | 13.267  | 25.70 | -34.30 | 60.00 | 25.33 | 0.00   | 0.37  | QP      |
| 12 | 13.267  | 17.95 | -32.05 | 50.00 | 17.58 | 0.00   | 0.37  | AVERAGE |

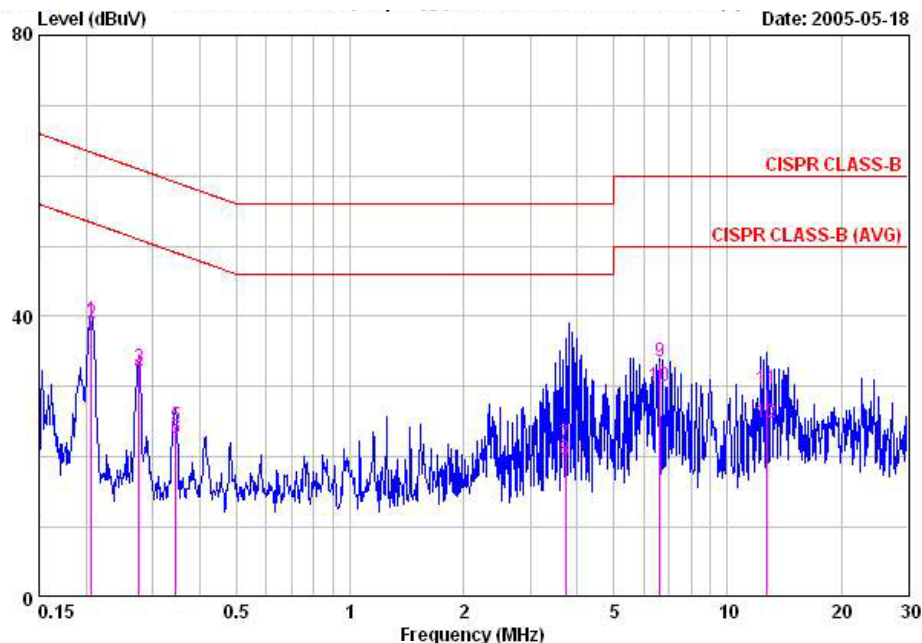
- Mode 2
- Temperature: 26°C
- Relative Humidity: 64%
- Test Engineer: Steven Lu

**Line to Ground**



|    | Freq    | Level | Over   | Limit | Read  | LISN   | Cable | Remark  |
|----|---------|-------|--------|-------|-------|--------|-------|---------|
|    | MHz     | dBuV  | Limit  | Line  | Level | Factor | Loss  |         |
|    |         |       | dB     | dBuV  | dBuV  | dB     | dB    |         |
| 1  | 0.20614 | 39.38 | -23.98 | 63.36 | 39.28 | 0.10   | 0.00  | QP      |
| 2  | 0.20614 | 39.01 | -14.35 | 53.36 | 38.91 | 0.10   | 0.00  | AVERAGE |
| 3  | 0.27442 | 32.32 | -28.66 | 60.98 | 32.27 | 0.05   | 0.00  | QP      |
| 4  | 0.27442 | 31.53 | -19.45 | 50.98 | 31.48 | 0.05   | 0.00  | AVERAGE |
| 5  | 0.34281 | 23.97 | -35.16 | 59.13 | 23.95 | 0.02   | 0.00  | QP      |
| 6  | 0.34281 | 22.21 | -26.92 | 49.13 | 22.19 | 0.02   | 0.00  | AVERAGE |
| 7  | 3.720   | 22.24 | -33.76 | 56.00 | 22.14 | 0.00   | 0.10  | QP      |
| 8  | 3.720   | 20.09 | -25.91 | 46.00 | 19.99 | 0.00   | 0.10  | AVERAGE |
| 9  | 6.627   | 30.24 | -19.76 | 50.00 | 29.98 | 0.05   | 0.21  | AVERAGE |
| 10 | 6.627   | 33.57 | -26.43 | 60.00 | 33.31 | 0.05   | 0.21  | QP      |
| 11 | 12.649  | 29.87 | -30.13 | 60.00 | 29.41 | 0.10   | 0.36  | QP      |
| 12 | 12.649  | 24.23 | -25.77 | 50.00 | 23.77 | 0.10   | 0.36  | AVERAGE |

Neutral to Ground



|    | Freq    | Level | Over   | Limit | Read  | LISN   | Cable | Remark  |
|----|---------|-------|--------|-------|-------|--------|-------|---------|
|    | MHz     | dBuV  | Limit  | Line  | Level | Factor | Loss  |         |
|    |         |       | dB     | dBuV  | dBuV  | dB     | dB    |         |
| 1  | 0.20614 | 39.54 | -23.82 | 63.36 | 39.44 | 0.10   | 0.00  | QP      |
| 2  | 0.20614 | 39.11 | -14.25 | 53.36 | 39.01 | 0.10   | 0.00  | AVERAGE |
| 3  | 0.27587 | 32.64 | -28.30 | 60.94 | 32.54 | 0.10   | 0.00  | QP      |
| 4  | 0.27587 | 31.82 | -19.12 | 50.94 | 31.72 | 0.10   | 0.00  | AVERAGE |
| 5  | 0.34463 | 24.47 | -34.62 | 59.09 | 24.37 | 0.10   | 0.00  | QP      |
| 6  | 0.34463 | 22.71 | -26.38 | 49.09 | 22.61 | 0.10   | 0.00  | AVERAGE |
| 7  | 3.720   | 21.87 | -34.13 | 56.00 | 21.77 | 0.00   | 0.10  | QP      |
| 8  | 3.720   | 19.70 | -26.30 | 46.00 | 19.60 | 0.00   | 0.10  | AVERAGE |
| 9  | 6.627   | 33.66 | -26.34 | 60.00 | 33.45 | 0.00   | 0.21  | QP      |
| 10 | 6.627   | 30.04 | -19.96 | 50.00 | 29.83 | 0.00   | 0.21  | AVERAGE |
| 11 | 12.649  | 29.63 | -30.37 | 60.00 | 29.27 | 0.00   | 0.36  | QP      |
| 12 | 12.649  | 24.90 | -25.10 | 50.00 | 24.54 | 0.00   | 0.36  | AVERAGE |

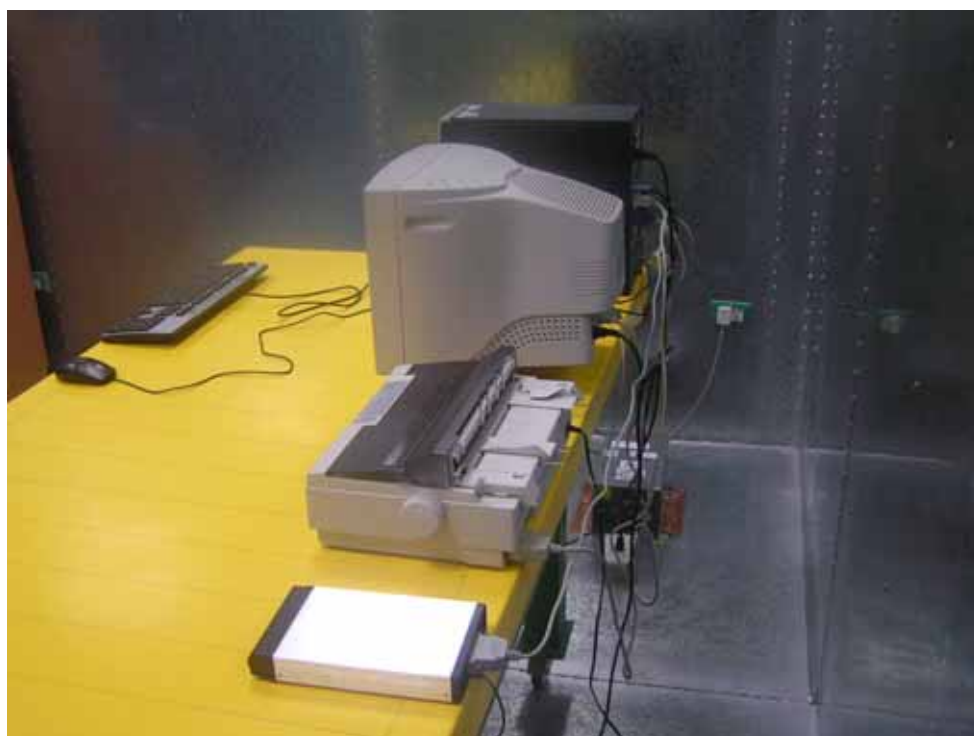
#### 5.5.8. Photographs of Conducted Emission Test Configuration

##### Mode 1

FRONT VIEW



REAR VIEW

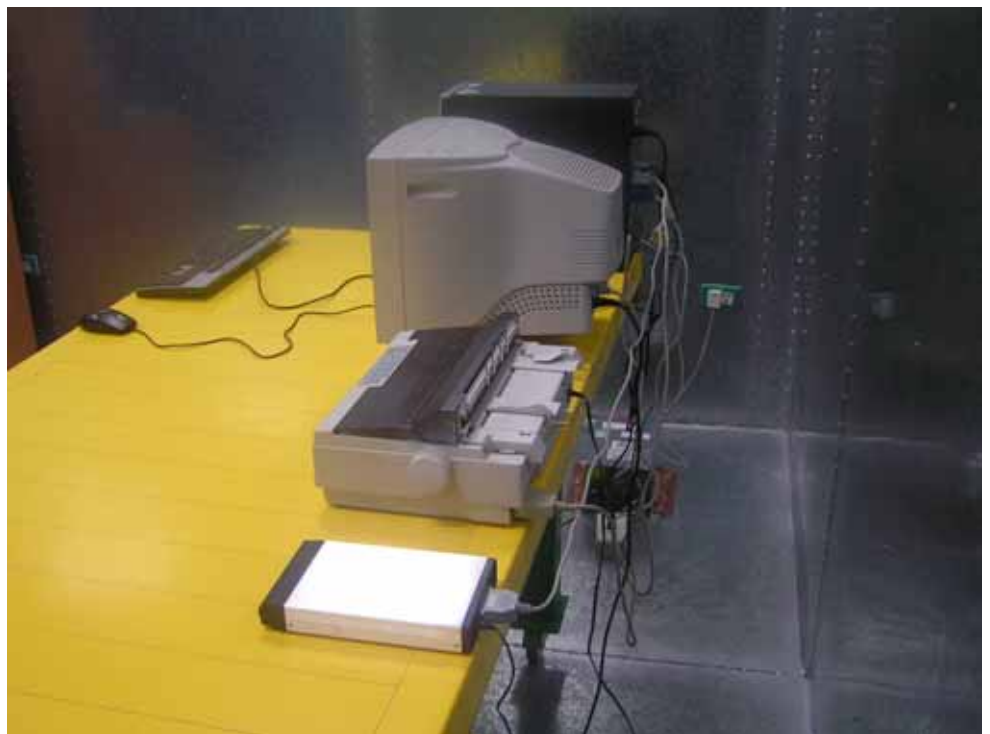


Mode 2

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

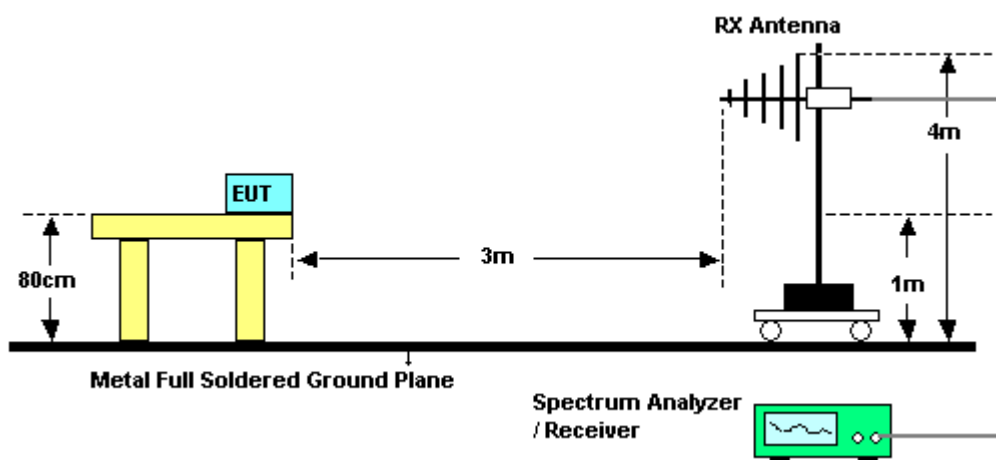
- Spectrum Analyzer : R&S FSP40
  - Attenuation : Auto
  - Start Frequency : 1000 MHz
  - Stop Frequency : 10th carrier harmonic
  - RB / VB : 1 MHz / 1MHz for Peak
  - RB / VB : 1 MHz / 10Hz for Average
- Test Receiver : R&S ESCS 30
  - Attenuation : Auto
  - Start Frequency : 30 MHz
  - Stop Frequency : 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 06 / 2437 MHz (for emission below 1GHz)

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

Mode 1

(A) Polarization: Horizontal

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase  | Remark |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|------------|--------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |            |        |
| 1 @ | 299.660  | 29.40  | -16.60     | 46.00  | 13.00               | 1.37       | 30.16         | 45.19      | HORIZONTAL | Peak   |
| 2 @ | 466.500  | 30.70  | -15.30     | 46.00  | 16.82               | 1.71       | 30.52         | 42.69      | HORIZONTAL | Peak   |
| 3 @ | 766.230  | 31.47  | -14.53     | 46.00  | 19.91               | 2.19       | 30.08         | 39.46      | HORIZONTAL | Peak   |
| 4 @ | 831.220  | 34.76  | -11.24     | 46.00  | 20.30               | 2.32       | 30.02         | 42.16      | HORIZONTAL | Peak   |
| 5   | 960.230  | 31.90  | -22.10     | 54.00  | 20.68               | 2.51       | 28.98         | 37.69      | HORIZONTAL | Peak   |
| 6   | 1000.000 | 32.20  | -21.80     | 54.00  | 20.90               | 2.53       | 28.56         | 37.33      | HORIZONTAL | Peak   |

(B) Polarization: Vertical

|     | Freq    | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase | Remark |
|-----|---------|--------|------------|--------|---------------------|------------|---------------|------------|-----------|--------|
|     | MHz     | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |           |        |
| 1 @ | 40.670  | 37.31  | -2.69      | 40.00  | 11.90               | 0.54       | 29.81         | 54.69      | VERTICAL  | Peak   |
| 2 @ | 66.860  | 30.99  | -9.01      | 40.00  | 5.20                | 0.68       | 29.90         | 55.01      | VERTICAL  | Peak   |
| 3 @ | 141.550 | 26.92  | -16.58     | 43.50  | 10.85               | 0.94       | 30.04         | 45.17      | VERTICAL  | Peak   |
| 4   | 547.980 | 26.52  | -19.48     | 46.00  | 18.25               | 1.87       | 30.63         | 37.03      | VERTICAL  | Peak   |
| 5 @ | 766.230 | 30.84  | -15.16     | 46.00  | 19.91               | 2.19       | 30.08         | 38.83      | VERTICAL  | Peak   |
| 6 @ | 831.220 | 33.34  | -12.66     | 46.00  | 20.30               | 2.32       | 30.02         | 40.73      | VERTICAL  | Peak   |

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

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

Mode 2

(A) Polarization: Horizontal

|     | Freq     | Level  | Over Limit | Limit | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase  | Remark |
|-----|----------|--------|------------|-------|---------------------|------------|---------------|------------|------------|--------|
|     | MHz      | dBuV/m |            | dB    | dBuV/m              | dB/m       | dB            | dB         | dBuV       |        |
| 1   | 218.180  | 27.56  | -18.44     | 46.00 | 8.44                | 1.16       | 30.01         | 47.96      | HORIZONTAL | Peak   |
| 2 @ | 299.660  | 28.84  | -17.16     | 46.00 | 13.00               | 1.37       | 30.16         | 44.63      | HORIZONTAL | Peak   |
| 3 @ | 766.230  | 31.23  | -14.77     | 46.00 | 19.91               | 2.19       | 30.08         | 39.22      | HORIZONTAL | Peak   |
| 4 @ | 831.220  | 34.53  | -11.47     | 46.00 | 20.30               | 2.32       | 30.02         | 41.92      | HORIZONTAL | Peak   |
| 5   | 960.230  | 30.83  | -23.17     | 54.00 | 20.68               | 2.51       | 28.98         | 36.62      | HORIZONTAL | Peak   |
| 6   | 1000.000 | 31.69  | -22.31     | 54.00 | 20.90               | 2.53       | 28.56         | 36.82      | HORIZONTAL | Peak   |

(B) Polarization: Vertical

|     | Freq     | Level  | Over Limit | Limit | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase | Remark |
|-----|----------|--------|------------|-------|---------------------|------------|---------------|------------|-----------|--------|
|     | MHz      | dBuV/m |            | dB    | dBuV/m              | dB/m       | dB            | dB         | dBuV      |        |
| 1 @ | 40.670   | 37.54  | -2.46      | 40.00 | 11.90               | 0.54       | 29.81         | 54.92      | VERTICAL  | Peak   |
| 2 @ | 66.860   | 31.49  | -8.51      | 40.00 | 5.20                | 0.68       | 29.90         | 55.50      | VERTICAL  | Peak   |
| 3 @ | 497.540  | 29.98  | -16.02     | 46.00 | 17.34               | 1.77       | 30.54         | 41.40      | VERTICAL  | Peak   |
| 4 @ | 766.230  | 30.89  | -15.11     | 46.00 | 19.91               | 2.19       | 30.08         | 38.88      | VERTICAL  | Peak   |
| 5 @ | 831.220  | 33.88  | -12.12     | 46.00 | 20.30               | 2.32       | 30.02         | 41.28      | VERTICAL  | Peak   |
| 6   | 1000.000 | 32.22  | -21.78     | 54.00 | 20.90               | 2.53       | 28.56         | 37.35      | VERTICAL  | Peak   |

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 01 / 2412 MHz (for emission above 1GHz)

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

**Mode 1**

**(A) Polarization: Horizontal**

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss Factor | Preamplifier Factor | Read Level | Pol/Phase  | Remark  |
|-----|----------|--------|------------|--------|---------------------|-------------------|---------------------|------------|------------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB                | dB                  | dBuV       |            |         |
| 1 @ | 2287.930 | 42.36  | -11.64     | 54.00  | 27.86               | 1.94              | 35.95               | 48.50      | HORIZONTAL | AVERAGE |
| 2   | 2287.930 | 49.14  | -24.86     | 74.00  | 27.86               | 1.94              | 35.95               | 55.28      | HORIZONTAL | PEAK    |

**(B) Polarization: Vertical**

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss Factor | Preamplifier Factor | Read Level | Pol/Phase | Remark  |
|-----|----------|--------|------------|--------|---------------------|-------------------|---------------------|------------|-----------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB                | dB                  | dBuV       |           |         |
| 1   | 2288.000 | 53.90  | -20.10     | 74.00  | 27.86               | 1.94              | 35.95               | 60.04      | VERTICAL  | Peak    |
| 2 @ | 2288.000 | 46.62  | -7.38      | 54.00  | 27.86               | 1.94              | 35.95               | 52.76      | VERTICAL  | Average |

Note:

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

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



Mode 2

(A) Polarization: Horizontal

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase  | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|------------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |            |         |
| 1   | 2287.900 | 49.67  | -24.33     | 74.00  | 27.86               | 1.94       | 35.95         | 55.81      | HORIZONTAL | PEAK    |
| 2 @ | 2287.900 | 42.28  | -11.72     | 54.00  | 27.86               | 1.94       | 35.95         | 48.42      | HORIZONTAL | AVERAGE |

(B) Polarization: Vertical

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|-----------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |           |         |
| 1   | 2287.890 | 53.20  | -20.80     | 74.00  | 27.86               | 1.94       | 35.95         | 59.34      | VERTICAL  | PEAK    |
| 2 @ | 2287.890 | 46.50  | -7.50      | 54.00  | 27.86               | 1.94       | 35.95         | 52.64      | VERTICAL  | 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: 26°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Steven Lu

**Mode 1**

**(A) Polarization: Horizontal**

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase  | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|------------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |            |         |
| 1 @ | 2287.900 | 56.62  | -17.38     | 74.00  | 27.86               | 1.94       | 35.95         | 62.76      | HORIZONTAL | Peak    |
| 2 @ | 2287.900 | 47.06  | -6.94      | 54.00  | 27.86               | 1.94       | 35.95         | 53.20      | HORIZONTAL | Average |

**(B) Polarization: Vertical**

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|-----------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |           |         |
| 1 @ | 2288.000 | 58.36  | -15.64     | 74.00  | 27.86               | 1.94       | 35.95         | 64.50      | VERTICAL  | Peak    |
| 2 @ | 2288.000 | 48.21  | -5.79      | 54.00  | 27.86               | 1.94       | 35.95         | 54.35      | VERTICAL  | Average |

Note:

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

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



Mode 2

(B) Polarization: Horizontal

|   | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase  | Remark  |
|---|----------|--------|------------|--------|---------------------|------------|---------------|------------|------------|---------|
|   | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |            |         |
| 1 | 2287.880 | 52.23  | -21.77     | 74.00  | 27.86               | 1.94       | 35.95         | 58.37      | HORIZONTAL | PEAK    |
| 2 | 2288.000 | 45.53  | -8.47      | 54.00  | 27.86               | 1.94       | 35.95         | 51.67      | HORIZONTAL | AVERAGE |

(B) Polarization: Vertical

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|-----------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |           |         |
| 1 @ | 2288.020 | 50.93  | -3.07      | 54.00  | 27.86               | 1.94       | 35.95         | 57.07      | VERTICAL  | AVERAGE |
| 2 @ | 2288.120 | 57.09  | -16.91     | 74.00  | 27.86               | 1.94       | 35.95         | 63.23      | VERTICAL  | PEAK    |

Note:

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

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



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

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

**Mode 1**

**(A) Polarization: Horizontal**

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase  | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|------------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |            |         |
| 1 @ | 2240.000 | 42.93  | -11.07     | 54.00  | 27.73               | 1.93       | 35.94         | 49.22      | HORIZONTAL | AVERAGE |
| 2   | 2240.000 | 51.51  | -22.49     | 74.00  | 27.73               | 1.93       | 35.94         | 57.79      | HORIZONTAL | PEAK    |

**(B) Polarization: Vertical**

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|-----------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |           |         |
| 1 @ | 2240.000 | 48.44  | -5.56      | 54.00  | 27.73               | 1.93       | 35.94         | 54.72      | VERTICAL  | AVERAGE |
| 2   | 2240.080 | 55.56  | -18.44     | 74.00  | 27.73               | 1.93       | 35.94         | 61.85      | VERTICAL  | PEAK    |

Note:

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

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



Mode 2

(A) Polarization: Horizontal

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase  | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|------------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |            |         |
| 1   | 2288.100 | 49.00  | -25.00     | 74.00  | 27.86               | 1.94       | 35.95         | 55.14      | HORIZONTAL | PEAK    |
| 2 @ | 2288.100 | 42.00  | -12.00     | 54.00  | 27.86               | 1.94       | 35.95         | 48.14      | HORIZONTAL | AVERAGE |

(B) Polarization: Vertical

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|-----------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |           |         |
| 1   | 2288.240 | 53.00  | -21.00     | 74.00  | 27.86               | 1.94       | 35.95         | 59.14      | VERTICAL  | PEAK    |
| 2 @ | 2288.240 | 46.00  | -8.00      | 54.00  | 27.86               | 1.94       | 35.95         | 52.14      | VERTICAL  | 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: 26°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Steven Lu

**Mode 1**

**(A) Polarization: Horizontal**

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase  | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|------------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |            |         |
| 1   | 2288.000 | 55.80  | -18.20     | 74.00  | 27.86               | 1.94       | 35.95         | 61.94      | HORIZONTAL | Peak    |
| 2 @ | 2288.000 | 46.15  | -7.85      | 54.00  | 27.86               | 1.94       | 35.95         | 52.29      | HORIZONTAL | Average |

**(B) Polarization: Vertical**

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|-----------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |           |         |
| 1 @ | 2288.000 | 57.40  | -16.60     | 74.00  | 27.86               | 1.94       | 35.95         | 63.54      | VERTICAL  | Peak    |
| 2 @ | 2288.000 | 47.34  | -6.66      | 54.00  | 27.86               | 1.94       | 35.95         | 53.48      | VERTICAL  | Average |

Note:

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

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



Mode 2

(A) Polarization: Horizontal

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase  | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|------------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |            |         |
| 1 @ | 2287.900 | 56.20  | -17.80     | 74.00  | 27.86               | 1.94       | 35.95         | 62.34      | HORIZONTAL | PEAK    |
| 2 @ | 2288.080 | 48.33  | -5.67      | 54.00  | 27.86               | 1.94       | 35.95         | 54.47      | HORIZONTAL | AVERAGE |

(B) Polarization: Vertical

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|-----------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |           |         |
| 1 @ | 2287.900 | 59.55  | -14.45     | 74.00  | 27.86               | 1.94       | 35.95         | 65.69      | VERTICAL  | PEAK    |
| 2 @ | 2288.020 | 51.39  | -2.61      | 54.00  | 27.86               | 1.94       | 35.95         | 57.53      | VERTICAL  | AVERAGE |

Note:

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

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



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

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

Mode 1

(A) Polarization: Horizontal

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase  | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|------------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |            |         |
| 1   | 2288.000 | 47.30  | -26.70     | 74.00  | 27.86               | 1.94       | 35.95         | 53.44      | HORIZONTAL | Peak    |
| 2 @ | 2288.000 | 41.10  | -12.90     | 54.00  | 27.86               | 1.94       | 35.95         | 47.24      | HORIZONTAL | Average |

(B) Polarization: Vertical

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|-----------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |           |         |
| 1   | 2288.000 | 51.22  | -22.78     | 74.00  | 27.86               | 1.94       | 35.95         | 57.36      | VERTICAL  | Peak    |
| 2 @ | 2288.000 | 45.21  | -8.79      | 54.00  | 27.86               | 1.94       | 35.95         | 51.35      | VERTICAL  | Average |

Note:

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

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



## Mode 2

## (A) Polarization: Horizontal

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase  | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|------------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |            |         |
| 1   | 2287.940 | 49.97  | -24.03     | 74.00  | 27.86               | 1.94       | 35.95         | 56.11      | HORIZONTAL | PEAK    |
| 2 @ | 2288.020 | 42.56  | -11.44     | 54.00  | 27.86               | 1.94       | 35.95         | 48.70      | HORIZONTAL | AVERAGE |

## (B) Polarization: Vertical

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|-----------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |           |         |
| 1   | 2287.960 | 53.43  | -20.57     | 74.00  | 27.86               | 1.94       | 35.95         | 59.57      | VERTICAL  | PEAK    |
| 2 @ | 2287.970 | 46.80  | -7.20      | 54.00  | 27.86               | 1.94       | 35.95         | 52.94      | VERTICAL  | 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: 26°C
- Relative Humidity: 64%
- Duty Cycle of the Equipment During the Test: 100.00%
- Test Engineer: Steven Lu

**Mode 1****(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   | 2288.000 | 54.22  | -19.78     | 74.00      | 27.86          | 1.94       | 35.95         | 60.36      | HORIZONTAL | Peak    |
| 2 @ | 2288.000 | 44.10  | -9.90      | 54.00      | 27.86          | 1.94       | 35.95         | 50.24      | 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       |           |         |
| 1 @ | 2288.010 | 49.62  | -4.38      | 54.00      | 27.86          | 1.94       | 35.95         | 55.76      | VERTICAL  | AVERAGE |
| 2 @ | 2288.010 | 57.90  | -16.10     | 74.00      | 27.86          | 1.94       | 35.95         | 64.04      | VERTICAL  | PEAK    |

Note:

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

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



Mode 2

(A) Polarization: Horizontal

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase  | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|------------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |            |         |
| 1 @ | 2288.000 | 46.52  | -7.48      | 54.00  | 27.86               | 1.94       | 35.95         | 52.66      | HORIZONTAL | AVERAGE |
| 2   | 2288.060 | 54.31  | -19.69     | 74.00  | 27.86               | 1.94       | 35.95         | 60.45      | HORIZONTAL | PEAK    |

(B) Polarization: Vertical

|     | Freq     | Level  | Over Limit | Limit  | Antenna Line Factor | Cable Loss | Preamp Factor | Read Level | Pol/Phase | Remark  |
|-----|----------|--------|------------|--------|---------------------|------------|---------------|------------|-----------|---------|
|     | MHz      | dBuV/m | dB         | dBuV/m | dB/m                | dB         | dB            | dBuV       |           |         |
| 1 @ | 2287.920 | 57.96  | -16.04     | 74.00  | 27.86               | 1.94       | 35.95         | 64.10      | VERTICAL  | PEAK    |
| 2 @ | 2287.960 | 50.24  | -3.76      | 54.00  | 27.86               | 1.94       | 35.95         | 56.38      | 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. Photographs of Radiated Emission Test Configuration

**Mode 1**

FRONT VIEW



REAR VIEW



Mode 2

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**

Internal Antenna 5745MHz ~ 5825MHz, there are 2 kinds of antenna. External antenna uses SMA connector. Internal antenna has no connector.

### **5.7.3. Antenna Gain**

All antennas gain of EUT are 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/ cm <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|------------------------------------------|------------------------------------------------------------------|
| 0.3-3.0               | 614                               | 1.63                              | (100)*                                   | 6                                                                |
| 3.0-30                | 1842 / f                          | 4.89 / f                          | (900 / f)*                               | 6                                                                |
| 30-300                | 61.4                              | 0.163                             | 1.0                                      | 6                                                                |
| 300-1500              |                                   |                                   | F/300                                    | 6                                                                |
| 1500-100,000          |                                   |                                   | 5                                        | 6                                                                |

#### (B) Limits for General Population / Uncontrolled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/cm <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> 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

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

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

**Mode 1**

| Channel No. | Antenna Gain (dBi) | Antenna Gain (numeric) | Peak Output Power (dBm) | Peak Output Power ( mW ) | Power Density (S) (mW/cm <sup>2</sup> ) | Limit of Power Density (S) (mW/cm <sup>2</sup> ) |
|-------------|--------------------|------------------------|-------------------------|--------------------------|-----------------------------------------|--------------------------------------------------|
| 01          | 2.00               | 1.58                   | 18.02                   | 63.39                    | 0.0199                                  | 1                                                |
| 06          | 2.00               | 1.58                   | 18.00                   | 63.10                    | 0.0198                                  | 1                                                |
| 11          | 2.00               | 1.58                   | 18.01                   | 63.24                    | 0.0199                                  | 1                                                |

**Mode 2**

| Channel No. | Antenna Gain (dBi) | Antenna Gain (numeric) | Peak Output Power (dBm) | Peak Output Power ( mW ) | Power Density (S) (mW/cm <sup>2</sup> ) | Limit of Power Density (S) (mW/cm <sup>2</sup> ) |
|-------------|--------------------|------------------------|-------------------------|--------------------------|-----------------------------------------|--------------------------------------------------|
| 01          | 4.00               | 2.51                   | 18.02                   | 63.39                    | 0.0317                                  | 1                                                |
| 06          | 4.00               | 2.51                   | 18.00                   | 63.10                    | 0.0315                                  | 1                                                |
| 11          | 4.00               | 2.51                   | 18.01                   | 63.24                    | 0.0316                                  | 1                                                |

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

**Mode 1**

| Channel No. | Antenna Gain (dBi) | Antenna Gain (numeric) | Peak Output Power (dBm) | Peak Output Power ( mW ) | Power Density (S) (mW/cm <sup>2</sup> ) | Limit of Power Density (S) (mW/cm <sup>2</sup> ) |
|-------------|--------------------|------------------------|-------------------------|--------------------------|-----------------------------------------|--------------------------------------------------|
| 01          | 2.00               | 1.58                   | 15.01                   | 31.70                    | 0.0100                                  | 1                                                |
| 06          | 2.00               | 1.58                   | 18.00                   | 63.10                    | 0.0198                                  | 1                                                |
| 11          | 2.00               | 1.58                   | 14.50                   | 28.18                    | 0.0089                                  | 1                                                |

**Mode 2**

| Channel No. | Antenna Gain (dBi) | Antenna Gain (numeric) | Peak Output Power (dBm) | Peak Output Power ( mW ) | Power Density (S) (mW/cm <sup>2</sup> ) | Limit of Power Density (S) (mW/cm <sup>2</sup> ) |
|-------------|--------------------|------------------------|-------------------------|--------------------------|-----------------------------------------|--------------------------------------------------|
| 01          | 4.00               | 2.51                   | 15.01                   | 31.70                    | 0.0158                                  | 1                                                |
| 06          | 4.00               | 2.51                   | 18.00                   | 63.10                    | 0.0315                                  | 1                                                |
| 11          | 4.00               | 2.51                   | 14.50                   | 28.18                    | 0.0141                                  | 1                                                |

**Mode 1 and Mode 2. CH 06 (Turbo Mode)**

| Channel No. | Antenna Gain (dBi) | Antenna Gain (numeric) | Peak Output Power (dBm) | Peak Output Power ( mW ) | Power Density (S) (mW/cm <sup>2</sup> ) | Limit of Power Density (S) (mW/cm <sup>2</sup> ) |
|-------------|--------------------|------------------------|-------------------------|--------------------------|-----------------------------------------|--------------------------------------------------|
| 06          | 2.00               | 1.78                   | 16.00                   | 39.81                    | 0.0141                                  | 1                                                |
| 06          | 4.00               | 2.51                   | 16.00                   | 39.81                    | 0.0199                                  | 1                                                |
| 11          | 4.00               | 2.51                   | 14.50                   | 28.18                    | 0.0141                                  | 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     | 9 KHz – 2.75 GHz | Feb. 15, 2005    | Conduction (CO04-HY)  |
| 2     | LISN                     | MessTec        | NNB-2/16Z    | 2001/004   | 9 KHz – 30 MHz   | Jun. 09, 2004    | Conduction (CO04-HY)  |
| 3     | LISN (Support Unit)      | MessTec        | NNB-2/16Z    | 99041      | 9 KHz – 30 MHz   | Apr. 26, 2005    | Conduction (CO04-HY)  |
| 4     | EMI Filter               | LINDGREN       | LRE-2030     | 2651       | < 450 Hz         | N/A              | Conduction (CO04-HY)  |
| 5     | RF Cable-CON             | UTFLEX         | 3102-26886-4 | CB044      | 9KHz~30MHz       | Apr. 20, 2005    | Conduction (CO04-HY)  |
| 6     | 3m Semi Anechoic Chamber | SIDT FRANKONIA | SAC-3M       | 03CH03-HY  | 30MHz~1GHz<br>3m | Jun. 21, 2004    | Radiation (03CH03-HY) |
| 7     | Spectrum analyzer        | R&S            | FSP40        | 100004     | 9KHz~40GHz       | Aug. 31, 2004    | Radiation (03CH03-HY) |
| 8     | Amplifier                | SCHAFFNER      | CPA9231A     | 18667      | 9KHz – 2GHz      | Jan. 10, 2005    | Radiation (03CH03-HY) |
| 9     | Biconical Antenna        | SCHWARZBECK    | VHBB 9124    | 301        | 30MHz –200MHz    | Jul. 28, 2004    | Radiation (03CH03-HY) |
| 10    | Log Antenna              | SCHWARZBECK    | VUSLP 9111   | 221        | 200MHz -1GHz     | Jul. 28, 2004    | Radiation (03CH03-HY) |
| 11    | RF Cable-R03m            | Jye Bao        | RG142        | CB021      | 30MHz~1GHz       | Feb. 22, 2005    | Radiation (03CH03-HY) |
| 12    | Amplifier                | MITEQ          | AFS44        | 849984     | 100MHz~26.5GHz   | Mar. 25, 2005    | Radiation (03CH03-HY) |
| 13    | Horn Antenna             | EMCO           | 3115         | 6741       | 1GHz – 18GHz     | Apr. 06, 2005    | Radiation (03CH03-HY) |
| 14    | Turn Table               | HD             | DS 420       | 420/650/00 | 0 ~ 360 degree   | N/A              | Radiation (03CH03-HY) |
| 15    | Antenna Mast             | HD             | MA 240       | 240/560/00 | 1 m - 4 m        | N/A              | Radiation (03CH03-HY) |
| 16    | Horn Antenna             | Schwarzbeck    | BBHA9170     | 154        | 18GHz~40GHz      | Jun. 09, 2004    | Radiation (03CH03-HY) |
| 17    | RF Cable-HIGH            | Jye Bao        | RG142        | CB030-HIGH | 1GHz~29.5GHz     | Dec.01, 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          | FSP30     | 100023      | 9KHZ~30GHZ      | Aug. 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    | DC 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             | Spe. 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 facility 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 |

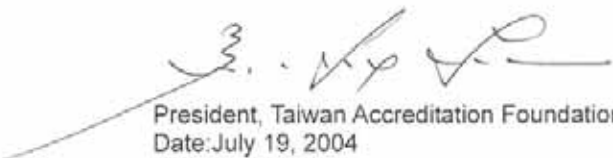
### 7.2. Test Location

|        |                                                                                                                                                  |
|--------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| SHIJR  | ADD : 6Fl., No. 106, Sec. 1, Shintai 5th Rd., Shijr City, Taipei, Taiwan 221, R.O.C.<br>TEL : 02-2696-2468<br>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.<br>TEL : 03-327-3456<br>FAX : 03-318-0055 |
| LINKOU | ADD : No. 30-2, Dingfu Tsuen, Linkou Shiang, Taipei, Taiwan 244, R.O.C<br>TEL : 02-2601-1640<br>FAX : 02-2601-1695                               |
| DUNGHU | ADD : No. 3, Lane 238, Kangle St., Neihu Chiu, Taipei, Taiwan 114, R.O.C.<br>TEL : 02-2631-4739<br>FAX : 02-2631-9740                            |
| JUNGHE | ADD : 7Fl., No. 758, Jungjeng Rd., Junghe City, Taipei, Taiwan 235, R.O.C.<br>TEL : 02-8227-2020<br>FAX : 02-8227-2626                           |
| NEIHU  | ADD : 4Fl., No. 339, Hsin Hu 2 <sup>nd</sup> Rd., Taipei 114, Taiwan, R.O.C.<br>TEL : 02-2794-8886<br>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<br>Chinese National Laboratory Accreditation<br>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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