# FCC TEST REPORT

| | | |
|---|---|---|
| **CATEGORY** | : | Portable |
| **PRODUCT NAME** | : | Bluetooth v2.0+EDR class1 USB Adapter |
| **FCC ID.** | : | QW3-BTUD201X |
| **FILING TYPE** | : | Certification |
| **BRAND NAME** | : | Formosa Teletek |
| **MODEL NAME** | : | FB-UD201X (X:0~9, a~z, A~Z)、 FB-UD201F、FB-UD201R、FB-UD201B、BT-2200TP (Trust)、ACB20、SD515 GBU321 (Iogear) 、UB13 、BT-410U 、BT-01UDR1 、WL-BTD201 、BT201A-USBBT2000C-USB、BT-USB plus |
| **APPLICANT** | : | **Formosa Teletek Corporation**<br>No. 358, Hwaya 2nd Rd., Gueishan Shiang, Taoyuan, Taiwan |
| **MANUFACTURER** | : | **Formosa Teletek Corporation**<br>No. 358, Hwaya 2nd Rd., Gueishan Shiang, Taoyuan, Taiwan |
| **ISSUED BY** | : | **SPORTON INTERNATIONAL INC.**<br>6F, No. 106, Sec. 1, Hsin Tai Wu Rd., His Chih, Taipei Hsien, Taiwan, R.O.C. |

## Statements:

The test result in this report refers exclusively to the presented test model / sample.
Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.

Certificate or Test Report could not be used by the applicant to claim the product endorsement by CNLA 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

# Table of Contents

# HISTORY OF THIS TEST REPORT

Received Date: Jul. 20, 2005
Test Date: Jul. 26, 2005
Original Report Issue Date: Jul. 28, 2005
Report No.: FR572022

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

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

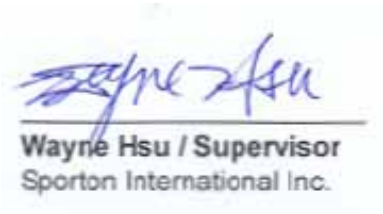
with

## 47 CFR FCC Part 15 Subpart C

| | | |
|---|---|---|
| **PRODUCT NAME** | : | Bluetooth v2.0+EDR class1 USB Adapter |
| **BRAND NAME** | : | Formosa Teletek |
| **MODEL NAME** | : | FB-UD201X (X:0~9, a~z, A~Z)、 FB-UD201F、FB-UD201R、FB-UD201B、BT-2200TP (Trust)、ACB20、SD515 GBU321 (Iogear) 、UB13 、BT-410U 、BT-01UDR1 、WL-BTD201 、BT201A-USBBT2000C-USB、BT-USB plus |
| **APPLICANT** | : | **Formosa Teletek Corporation**<br>No. 358, Hwaya 2nd Rd., Gueishan Shiang, Taoyuan, Taiwan |
| **MANUFACTURER** | : | **Formosa Teletek Corporation**<br>No. 358, Hwaya 2nd Rd., Gueishan Shiang, Taoyuan, Taiwan |

I **HEREBY** CERTIFY THAT:

The measurements shown in this test report were made in accordance with the procedures given in ANSI C63.4-2003 and all test are performed according to 47 CFR FCC Part 15 Subpart C. Testing was carried out on July 26, 2005 at SPORTON International Inc. LAB.



# 1. General Description of Equipment under Test

## 1.1. Applicant

**Formosa Teletek Corporation**
No. 358, Hwaya 2nd Rd., Gueishan Shiang, Taoyuan, Taiwan

## 1.2. Manufacturer

**Formosa Teletek Corporation**
No. 358, Hwaya 2nd Rd., Gueishan Shiang, Taoyuan, Taiwan

## 1.3. Basic Description of Equipment under Test

This product is a Class 1 Bluetooth USB Adapter. The technical data has been listed on section " Features of Equipment under Test ".

## 1.4. Technical Specifications

| Items | Description |
|---|---|
| Modulation Type | Frequency Hopping Spread Spectrum (FHSS) |
| Bluetooth v2.0 | GFSK – 1Mbps |
| | QPSK – 2Mbps |
| | 8PSK – 3Mbps |
| Frequency Range | 2404 –2480 MHz |
| Number of Channels | 79 maximum |
| Max. Output Power | 10.07 dBm (Conducted)) |
| Channel Space | 1MHz |
| Power Supply | DC 5.00V from host |
| Antenna Type | Printed Antenna / 2.95 dBi |
| Testing Duty Cycle | 41.27% |
| Temperature Range (Operating) | -10 ~ 50 °C |

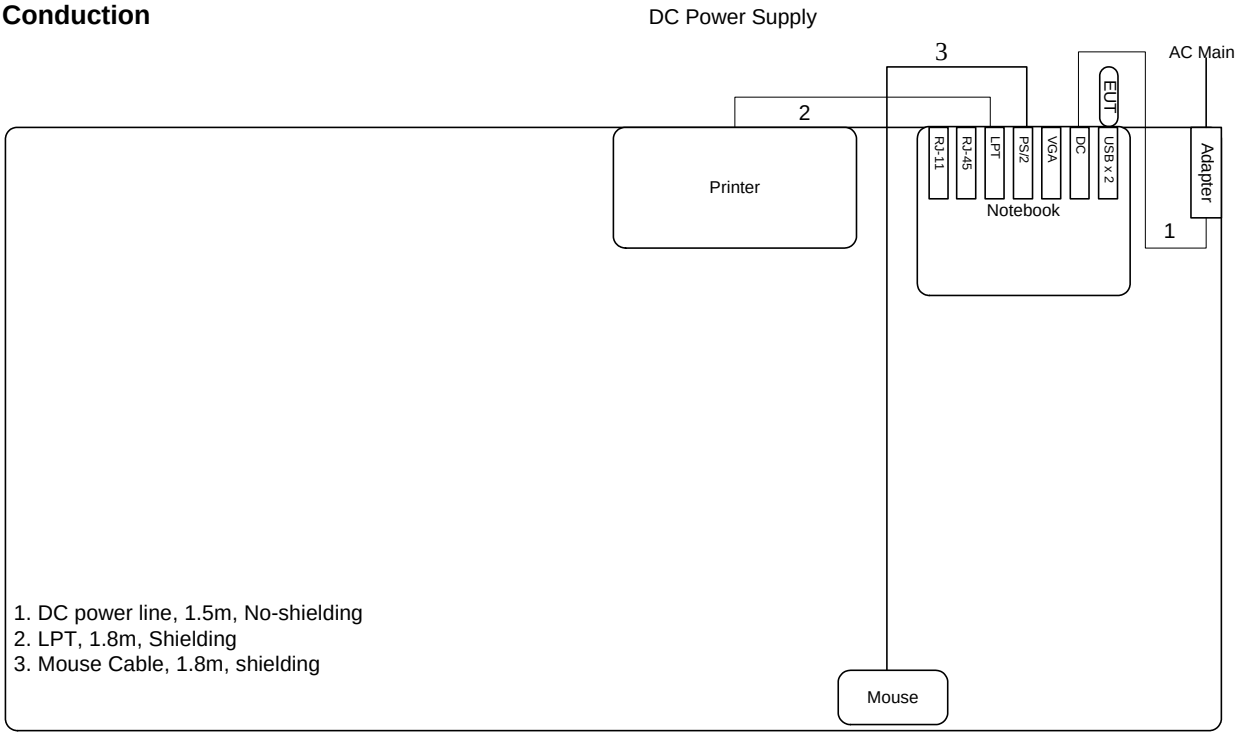
### 1.5. Table for Carrier Frequencies

| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
|---|---|---|---|---|---|---|---|
| 00 | 2402 MHz | 20 | 2422 MHz | 40 | 2442 MHz | 60 | 2462 MHz |
| 01 | 2403 MHz | 21 | 2423 MHz | 41 | 2443 MHz | 61 | 2463 MHz |
| 02 | 2404 MHz | 22 | 2424 MHz | 42 | 2444 MHz | 62 | 2464 MHz |
| 03 | 2405 MHz | 23 | 2425 MHz | 43 | 2445 MHz | 63 | 2465 MHz |
| 04 | 2406 MHz | 24 | 2426 MHz | 44 | 2446 MHz | 64 | 2466 MHz |
| 05 | 2407 MHz | 25 | 2427 MHz | 45 | 2447 MHz | 65 | 2467 MHz |
| 06 | 2408 MHz | 26 | 2428 MHz | 46 | 2448 MHz | 66 | 2468 MHz |
| 07 | 2409 MHz | 27 | 2429 MHz | 47 | 2449 MHz | 67 | 2469 MHz |
| 08 | 2410 MHz | 28 | 2430 MHz | 48 | 2450 MHz | 68 | 2470 MHz |
| 09 | 2411 MHz | 29 | 2431 MHz | 49 | 2451 MHz | 69 | 2471 MHz |
| 10 | 2412 MHz | 30 | 2432 MHz | 50 | 2452 MHz | 70 | 2472 MHz |
| 11 | 2413 MHz | 31 | 2433 MHz | 51 | 2453 MHz | 71 | 2473 MHz |
| 12 | 2414 MHz | 32 | 2434 MHz | 52 | 2454 MHz | 72 | 2474 MHz |
| 13 | 2415 MHz | 33 | 2435 MHz | 53 | 2455 MHz | 73 | 2475 MHz |
| 14 | 2416 MHz | 34 | 2436 MHz | 54 | 2456 MHz | 74 | 2476 MHz |
| 15 | 2417 MHz | 35 | 2437 MHz | 55 | 2457 MHz | 75 | 2477 MHz |
| 16 | 2418 MHz | 36 | 2438 MHz | 56 | 2458 MHz | 76 | 2478 MHz |
| 17 | 2419 MHz | 37 | 2439 MHz | 57 | 2459 MHz | 77 | 2479 MHz |
| 18 | 2420 MHz | 38 | 2440 MHz | 58 | 2460 MHz | 78 | 2480 MHz |
| 19 | 2421 MHz | 39 | 2441 MHz | 59 | 2461 MHz | | |

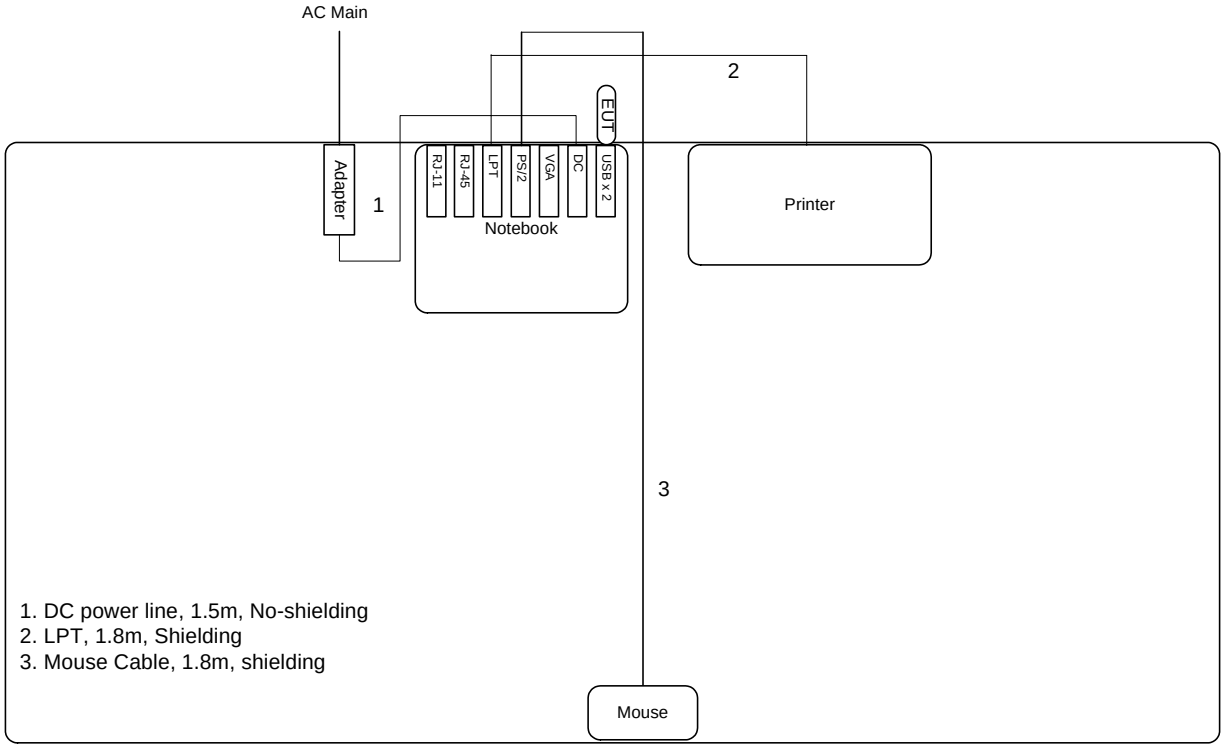
# 2. Test Configuration of the Equipment under Test

## 2.1. Connection Diagram of Test System

**Conduction**




**Radiation**



## 2.2. The Test Mode Description

1. For FHSS modulation, GFSK is the worst case on all test items.
2. According to ANSI C63.4-2003: Frequency range of EUT is more than 10 MHz, we have to test the lowest, middle and highest channels of EUT.
3. Spurious emission below 1GHz is independent of channel selection and there will be no effect on test results so only channel 39 with GFSK modulation was tested.
4. AC conduction emission is measured when EUT links with the notebook.

## 2.3. Description of Test Supporting Units

| Support unit | Brand | Model No. | FCC ID |
|---|---|---|---|
| Notebook | COMPAQ | PP2150 (1500) | DoC |
| Printer | EPSON | LQ-680 | DoC |
| Mouse (PS2) | LOGITECH | M-S34 | DoC |

# 3. General Information of Test

## 3.1. Test Facility

**Test Site Location** : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiag, Tao Yuan Hsien, Taiwan, R.O.C.
: TEL 886-3-327-3456
: FAX 886-3-318-0055
**Test Site No** : 03CH03-HY, 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. Frequency Range Investigated

Radiated emission test: from 9 kHz to 10th carrier harmonic.

## 3.4. Test Distance

The test distance of radiated emission (9kHz~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.

## 3.5. Test Software

An executive program, EMITEST.EXE under WIN XP, which generates a complete line of continuously repeating “H“ pattern was used as the test software.
Power Parameters of Bluetooth

| Test Software Version | Broadcom blue tool | | |
|---|---|---|---|
| Frequency | 2402 MHz | 2441 MHz | 2480 MHz |
| Parameters | 0 | 0 | 0 |

# 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)(1) | Hopping Channel Bandwidth | Pass |
| 5.2 | 15.247(a)(1) | Hopping Channel Separation | Pass |
| 5.3 | 15.247(b)(1) | Number of Hopping Frequency Used | Pass |
| 5.4 | 15.247(a)(1)(iii) | Dwell Time of Each Frequency | Pass |
| 5.5 | 15.247(b)(1) | Maximum Peak Output Power | Pass |
| 5.6 | 15.247(d) | Band Edges Emission | Pass |
| 5.7 | 15.207 | AC Power Line Conducted Emission | Pass |
| 5.8 | 15.247(d) | Spurious Radiated Emission | Pass |
| 5.9 | 15.203/15.247(b)/(c) | Antenna Requirement | Pass |

# 5. Test Result

## 5.1. Test of Hopping Channel Bandwidth

5.1.1 Applicable Standard

Section 15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

5.1.2 Measuring Instruments

Item 16 of the table on section 6.

5.1.3 Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP30
  Attenuation : Auto
  Center Frequency : 2402 MHz / 2441 MHz / 2480 MHz
  Span Frequency : > 20dB Bandwidth
  RB : 30 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 30KHz and VBW to 100KHz.
3. Set Detector to Peak, Trace to Max Hold and Sweep Time to Auto.
4. The 20dB spectrum width is the spectrum with level higher than 20dB below the peak level.
5. Repeat above point 1~3 for the lowest, middle and highest channel of the EUT.

5.1.5 Test Setup Layout


5.1.6 Test Criteria

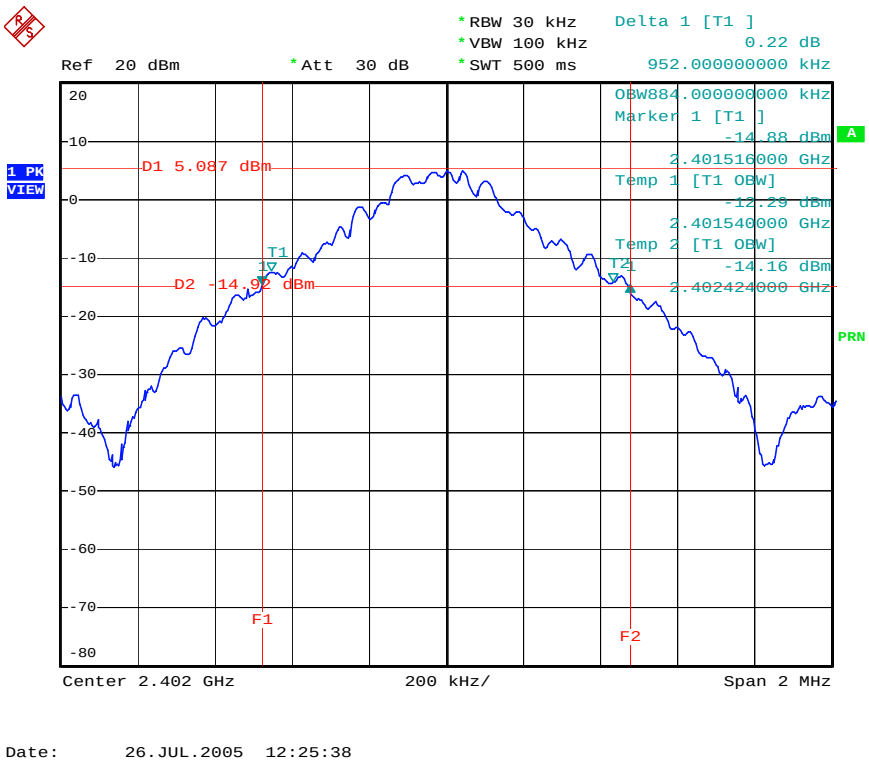
All test results complied with the requirements of Section 15.247(a)(1). Measurement Uncertainty is $1x10^{-5}$.

5.1.7 Test Result

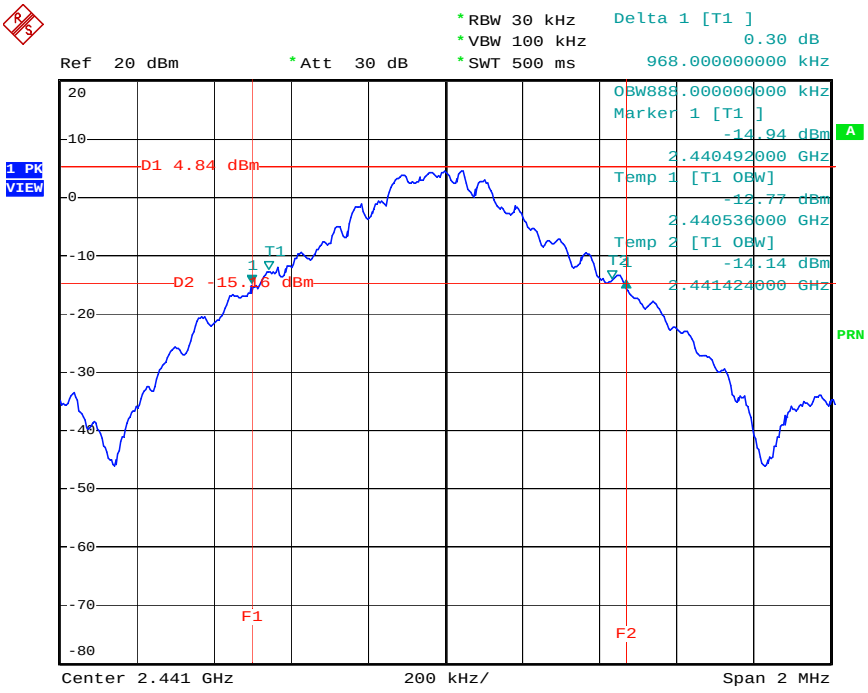
- Temperature: 25°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 41.27%
- Test Engineer: Eason Lu

| Modulation Type | Channel No. | Frequency (MHz) | 20dB Bandwidth (kHz) | 99% Occupied BW (kHz) | Min. Limit (kHz) |
|---|---|---|---|---|---|
| GFSK | 00 | 2402 MHz | 952.00 | 884.00 | 25 |
| GFSK | 39 | 2441 MHz | 968.00 | 888.00 | 25 |
| GFSK | 78 | 2480 MHz | 952.00 | 888.00 | 25 |

Modulation Type: GFSK (Channel 00)：



Modulation Type: GFSK (Channel 39)：

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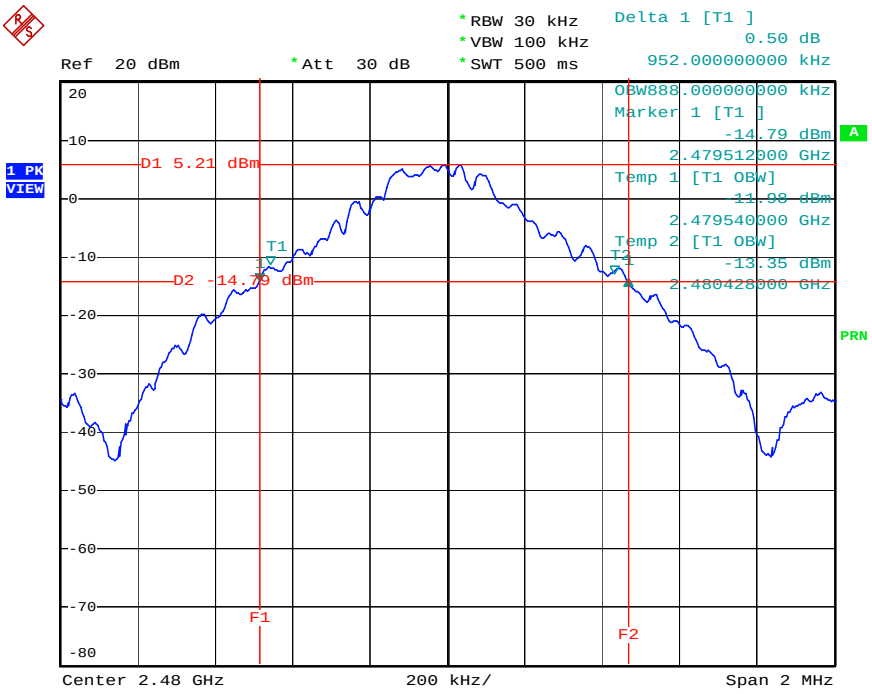
Modulation Type: GFSK (Channel 78)：

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## 5.2. Test of Hopping Channel Separation

5.2.1 Applicable Standard

Section 15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

5.2.2 Measuring Instruments

Item 16 of the table on section 6.

5.2.3 Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP30
  Attenuation : Auto
  Center Frequency : 2402 MHz / 2441 MHz / 2480 MHz
  Span Frequency : > One time channel separation
  RB : 100 kHz
  VB : 100 kHz
  Detector : Peak
  Trace : Max Hold
  Sweep Time : Auto

5.2.4 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.
3. Set Detector to Peak, Trace to Max Hold and Sweep Time to Auto.
4. The Hopping Channel Separation is defined as the separation between 2 neighboring hopping frequencies.
5. Repeat above point 1~3 for the lowest, middle and highest channel of the EUT.

5.2.5 Test Setup Layout


5.2.6 Test Criteria

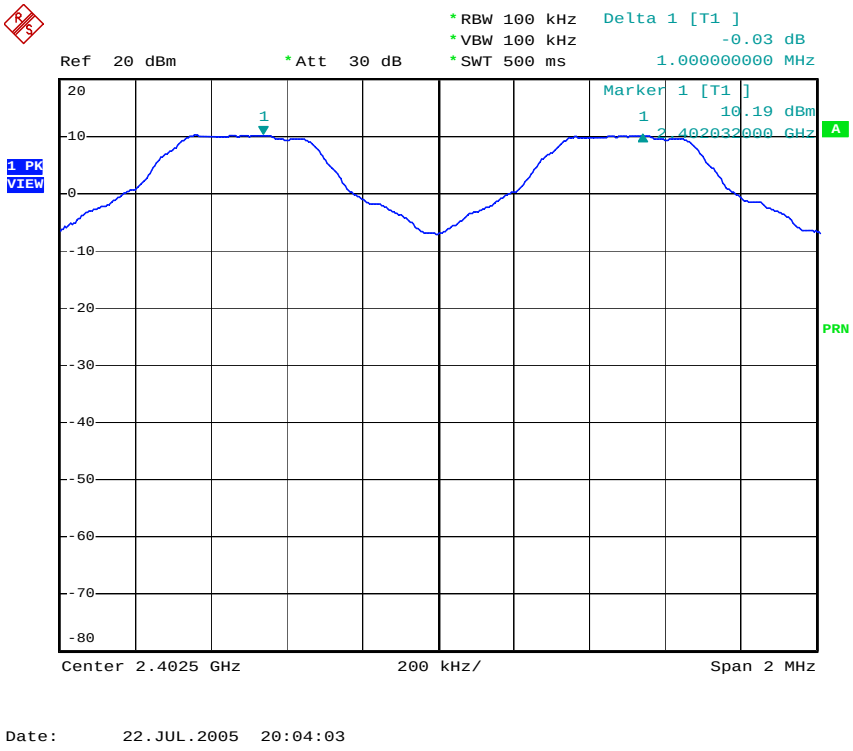
All test results complied with the requirements of Section 15.247(a)(1). Measurement Uncertainty is $1x10^{-5}$.

5.2.7 Test Result

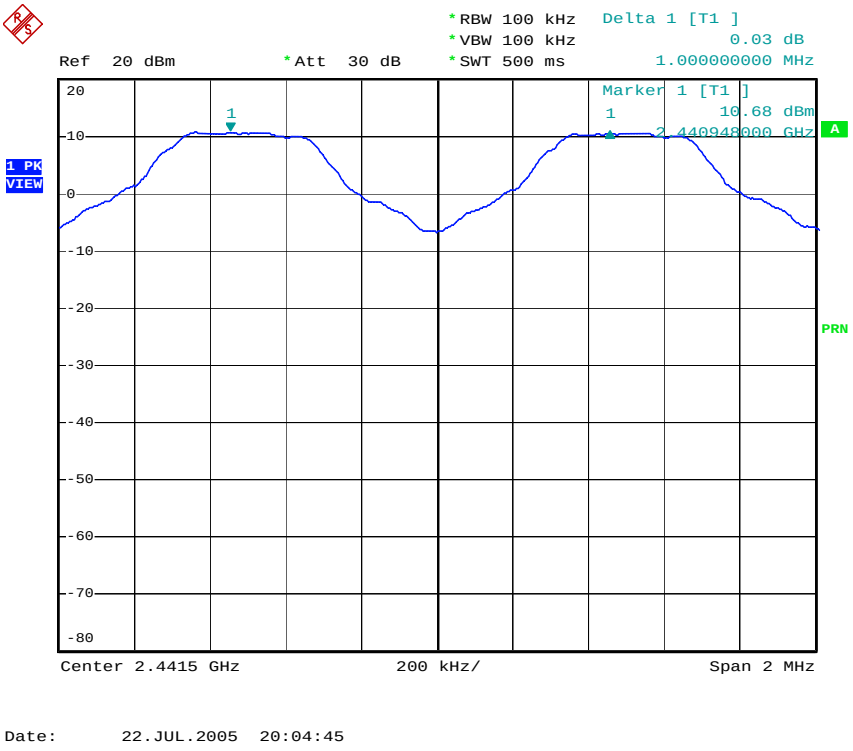
- Temperature: 25°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 41.27%
- Test Engineer: Eason Lu

| Modulation Type | Channel No. | Frequency (MHz) | Hopping Channel Separation (kHz) | Min. Limit (kHz) |
|---|---|---|---|---|
| GFSK | 00 | 2402 MHz | 1000 | 952.00 |
| GFSK | 39 | 2441 MHz | 1000 | 968.00 |
| GFSK | 78 | 2480 MHz | 1000 | 952.00 |

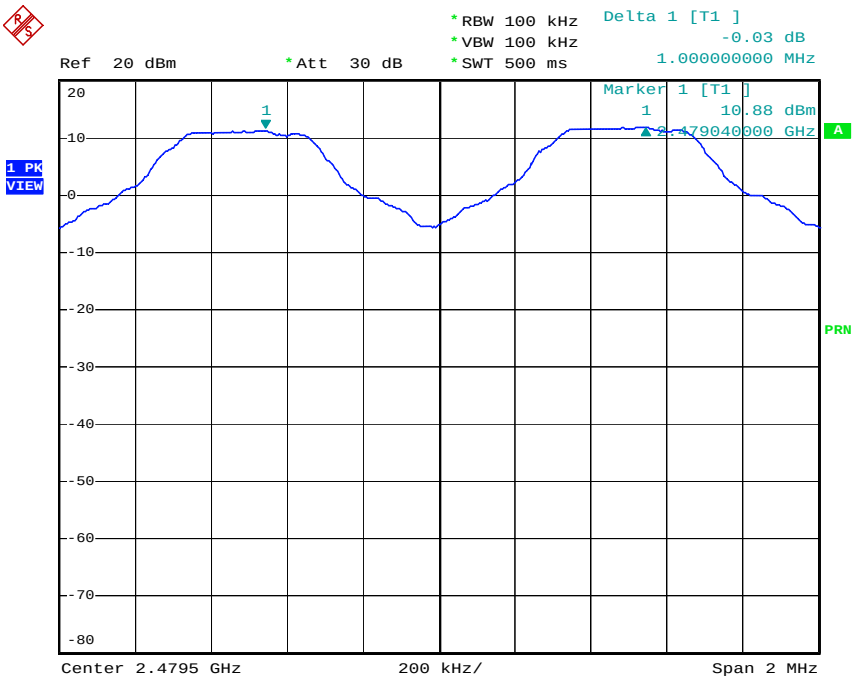
Modulation Type: GFSK (Channel 00)：



Modulation Type: GFSK (Channel 39)：




Modulation Type: GFSK (Channel 78)：



## 5.3. Test of Number of Hopping Frequency

5.3.1 Applicable Standard

Section 15.247(b)(1): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels.

5.3.2 Measuring Instruments

Item 16 of the table on section 6.

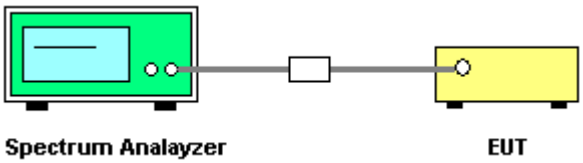
5.3.3 Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP30
  Attenuation : Auto
  Center Frequency : 2402 MHz ~ 2480 MHz
  Span Frequency : > Operation frequency range
  RB : 100 kHz
  VB : 100 kHz

5.3.4 Test Procedures

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 100KHz and VBW to 100KHz.
3. Set Detector to Peak, Trace to Max Hold and Sweep Time to Auto.
4. Observe hopping frequency in 2400MHz~2483.5MHz, there are at least 75 non-overlapping channels.

5.3.5 Test Setup Layout




5.3.6 Test Criteria

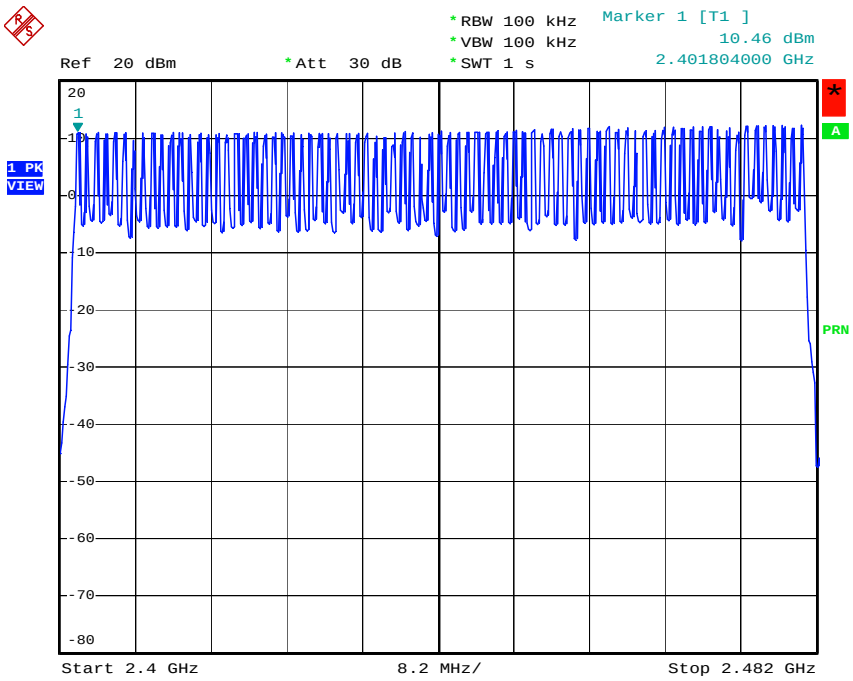
All test results complied with the requirements of Section 15.247(b)(1). Measurement Uncertainty is $1x10^{-5}$.

5.3.7 Test Result

- Temperature: 27°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 41.27%
- Test Engineer: Eason Lu

| Modulation Type | Channel No. | Frequency (MHz) | Number of Hopping Ch. (Channels) | Min. Limit (Channels) |
|---|---|---|---|---|
| GFSK | 00 ~ 78 | 2402 MHz ~ 2480 MHz | 79 | 75 |

Modulation Type: GFSK (Channel 00 ~ Channel 78)：



## 5.4. Test of Test of Dwell Time of Each Frequency

5.4.1 Applicable Standard

Section 15.247 (a)(1): Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

5.4.2 Measuring Instruments

Item 16 of the table on section 6.

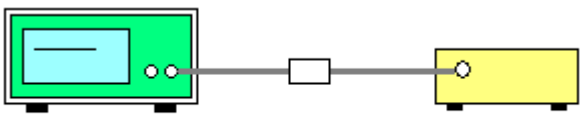
5.4.3 Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP30
  Attenuation : Auto
  Center Frequency : 2402 MHz / 2441 MHz / 2480 MHz
  Span Frequency : 0MHz
  RB : 1 MHz
  VB : 1 MHz
  Detector : Peak
  Trigger : Video
  Sweep Time : > One pulse time

5.4.4 Test Procedures and Test Instruments Setting

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. Set RBW of spectrum analyzer to 1000kHz and VBW to 1000kHz.
3. Set Detector to Peak, Trace to Max Hold and Sweep Time is more than once pulse time.
4. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
5. Set the EUT for DH5, DH3 and DH1 packet transmitting.
6. Measure the maximum time duration of one single pulse.
7. DH5 Packet permit maximum 3.37 hops per second in each channel. So, the dwell time is the time duration of the pulse times 106.6 within 31.6 seconds.
8. DH3 Packet permit maximum 5.06 hops per second in each channel. So, the dwell time is the time duration of the pulse times 160 within 31.6 seconds.
9. DH1 Packet permit maximum 10.12 hops per second in each channel. So, the dwell time is the time duration of the pulse times 320 within 31.6 seconds.

5.4.5 Test Setup Layout




5.4.6 Test Criteria

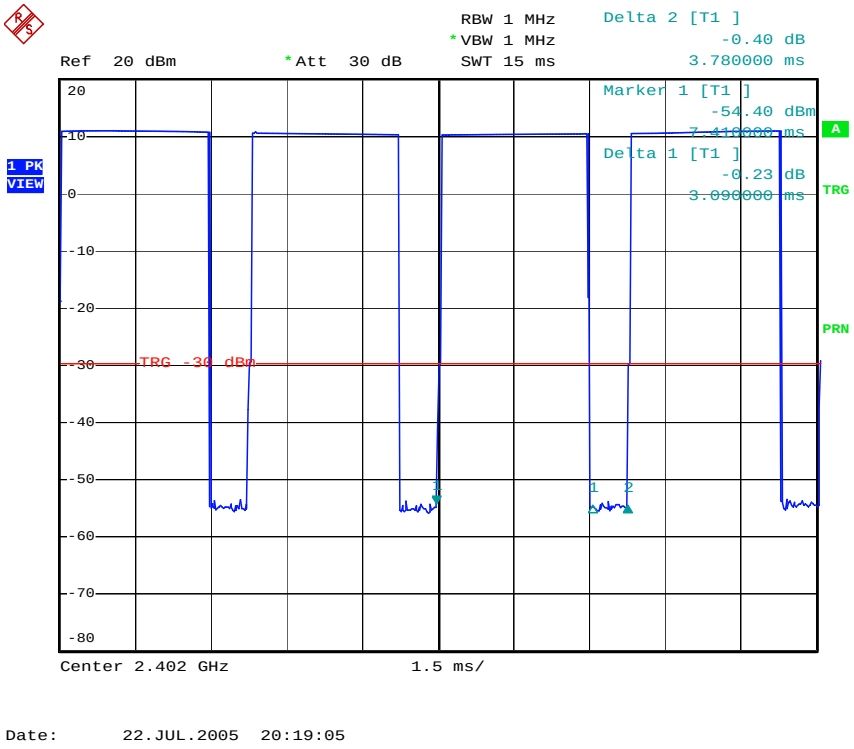
All test results complied with the requirements of Section 15.247(a)(1)(iii). Measurement Uncertainty is $1x10^{-5}$.

5.4.7 Test Result

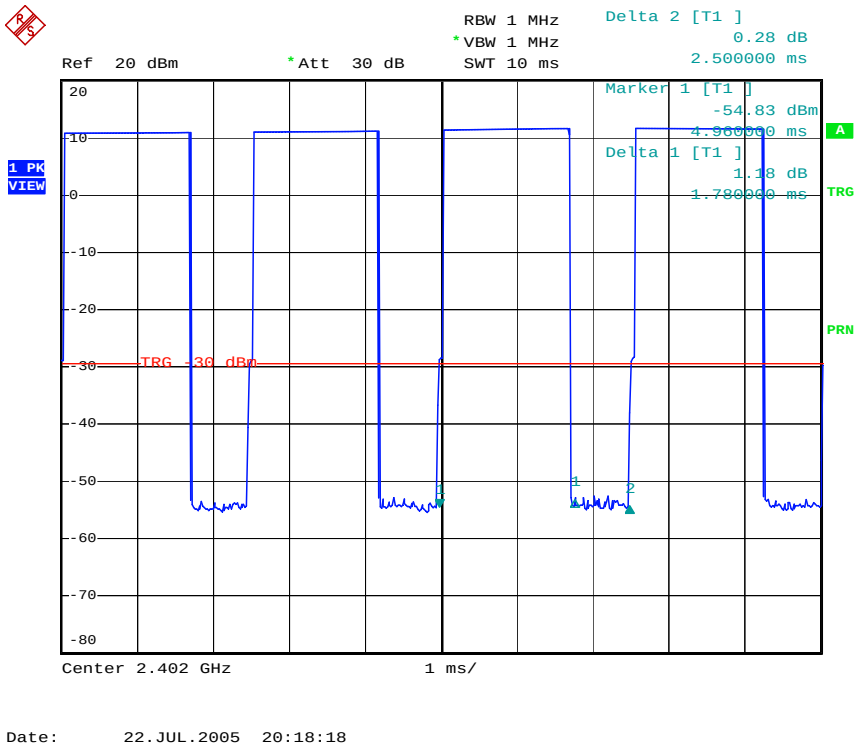
- Temperature: 25°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 41.27%
- Test Engineer: Eason Lu

| Data Packet | Frequency (MHz) | Pulse Duration (ms) | Dwell Time (s) | Limits (s) |
|---|---|---|---|---|
| DH5 | 2402 MHz | 3.0900 | 0.3296 | 0.4000 |
| DH3 | 2402 MHz | 1.7800 | 0.2848 | 0.4000 |
| DH1 | 2402 MHz | 0.5200 | 0.1664 | 0.4000 |
| DH5 | 2441 MHz | 3.0500 | 0.3253 | 0.4000 |
| DH3 | 2441 MHz | 1.7800 | 0.2848 | 0.4000 |
| DH1 | 2441 MHz | 0.5100 | 0.1632 | 0.4000 |
| DH5 | 2480 MHz | 3.0500 | 0.3253 | 0.4000 |
| DH3 | 2480 MHz | 1.7900 | 0.2864 | 0.4000 |
| DH1 | 2480 MHz | 0.5300 | 0.1696 | 0.4000 |

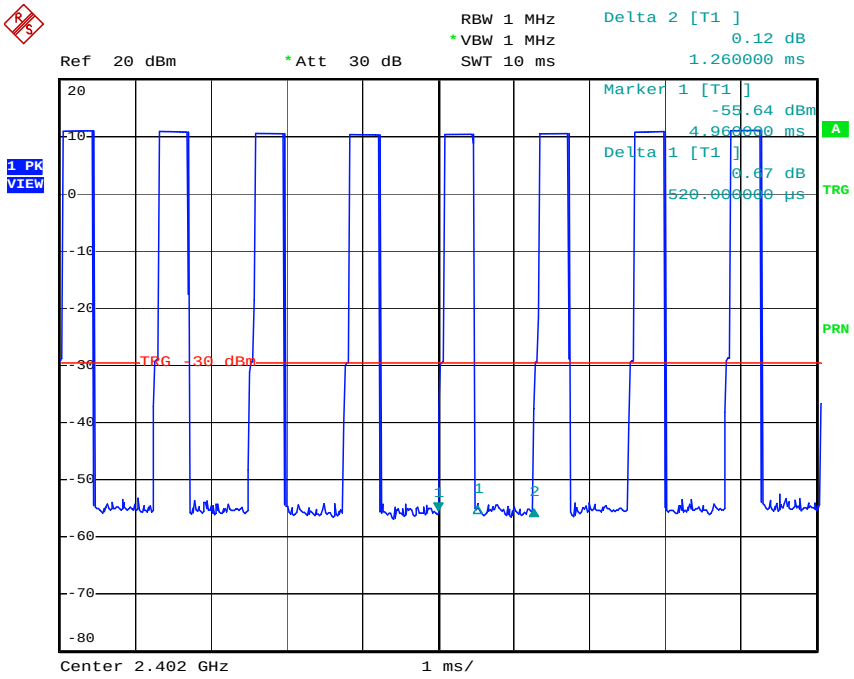
DH5 Modulation Type: GFSK (Channel 00)：




DH3 Modulation Type: GFSK (Channel 00)：

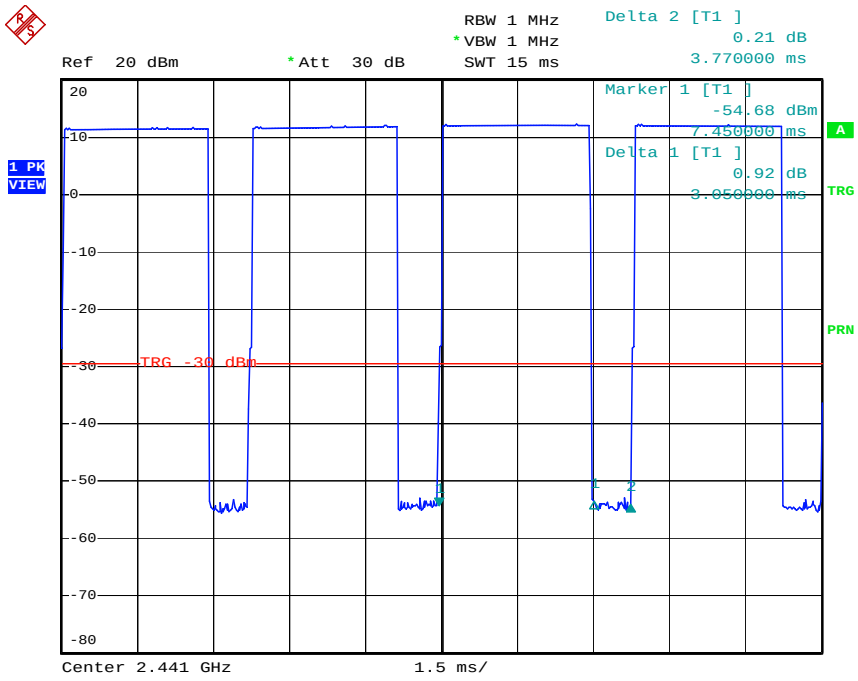


DH1 Modulation Type: GFSK (Channel 00)：




Date: 22.JUL.2005 20:17:36

DH5 Modulation Type: GFSK (Channel 39)：

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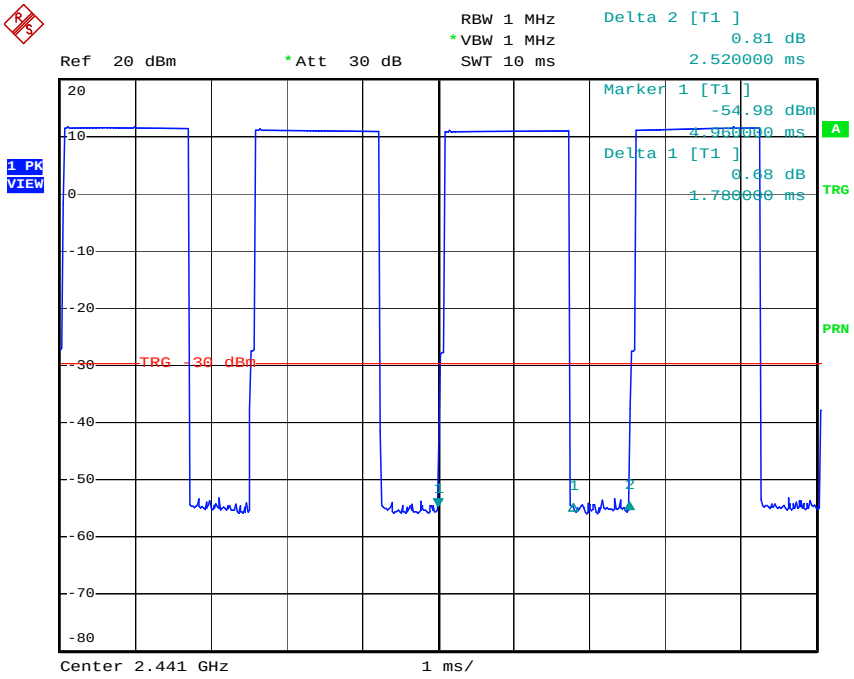
DH3 Modulation Type: GFSK (Channel 39)：

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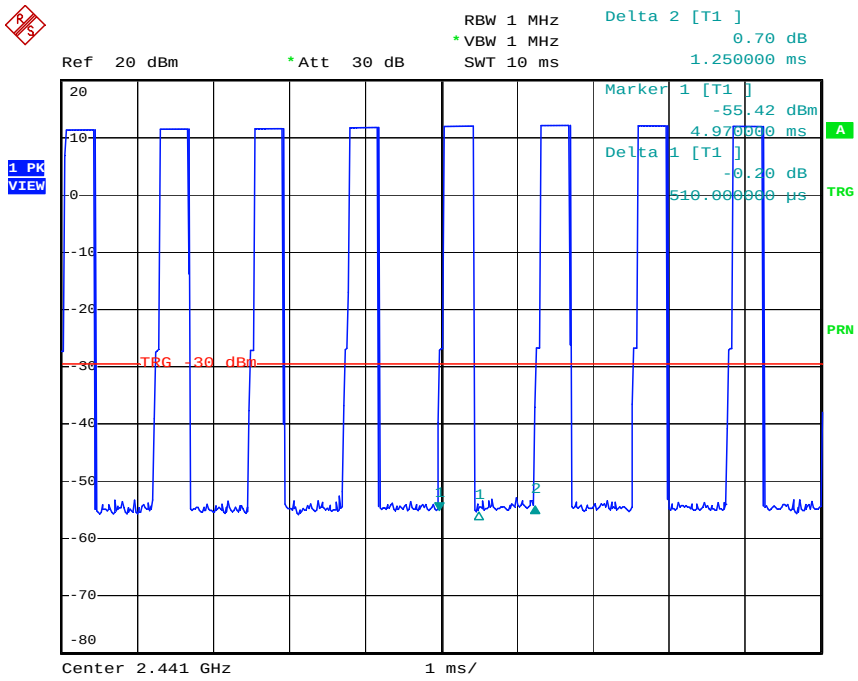
DH1 Modulation Type: GFSK (Channel 39)：

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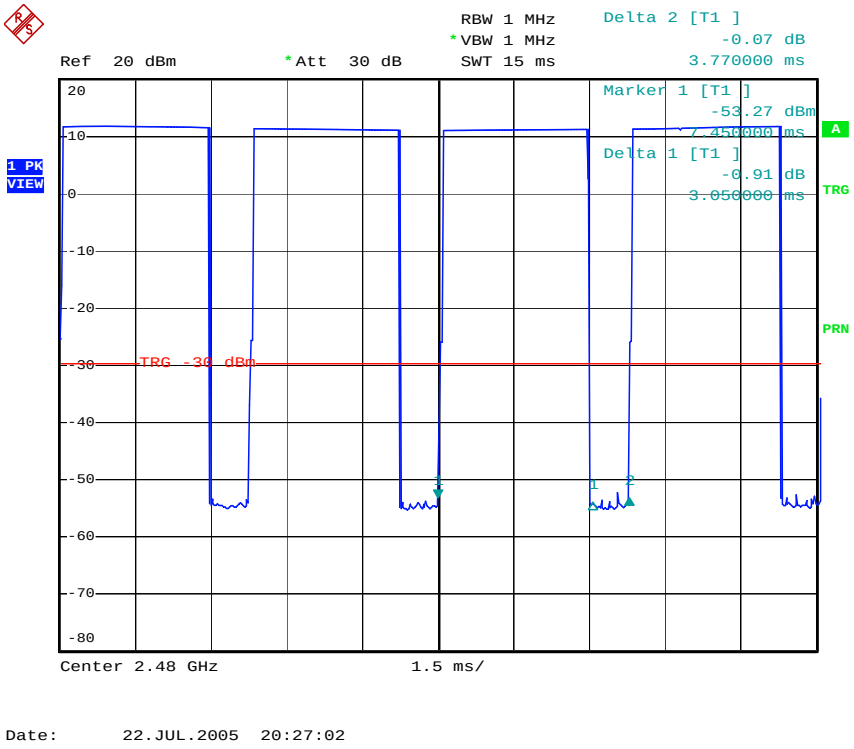
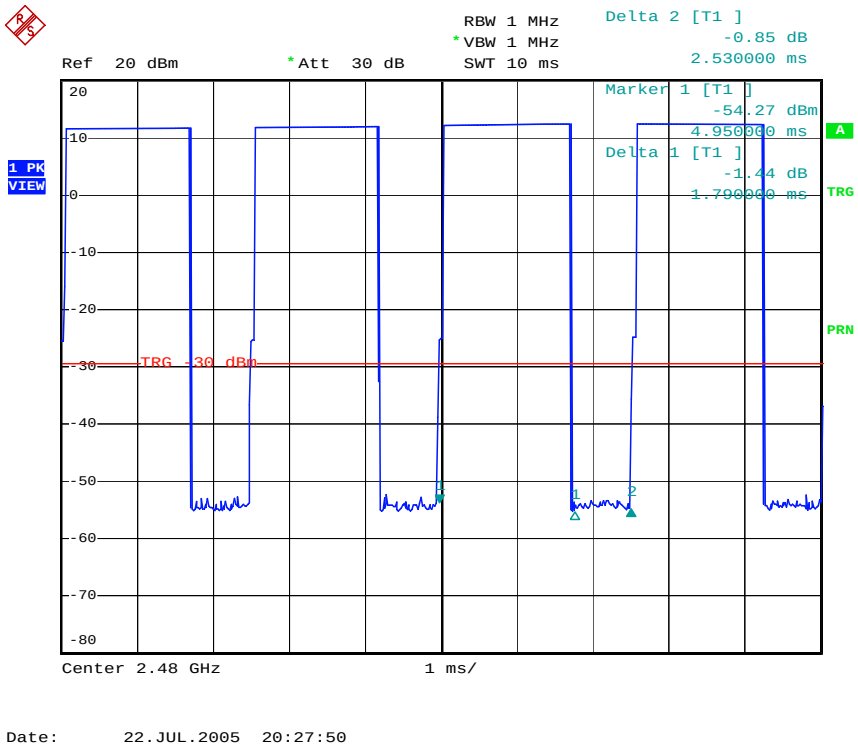
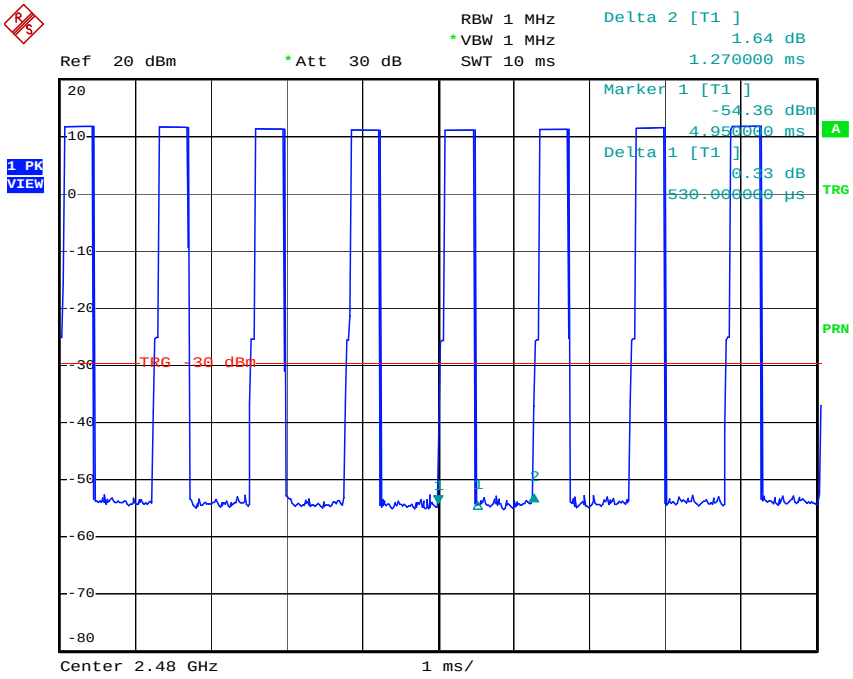
DH5 Modulation Type: GFSK (Channel 78)：




DH3 Modulation Type: GFSK (Channel 78)：



DH1 Modulation Type: GFSK (Channel 78)：



## 5.5. Maximum Peak Output Power

5.5.1 Applicable Standard

Section 15.247(b)(1): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels and The maximum peak output power shall not exceed 1 watt.

5.5.2 Measuring Instruments

Item 17, 19 of the table on section 6.

5.5.3 Test Procedures and Test Instruments Setting

1. The transmitter output was connected to the peak power meter and recorded the peak value.
2. Repeated point 1 for the lowest middle and highest channel of the EUT.

5.5.4 Test Setup Layout


5.5.5 Test Criteria

All test results complied with the requirements of 15.247(b)(1). Measurement Uncertainty is 1.5dB.

5.5.6 Test Result of Conducted Peak Power

- Temperature: 25°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 41.27%
- Test Engineer: Eason Lu

| Modulation Type | Channel No. | Frequency (MHz) | Output Power (dBm) | Limits (dBm) |
|---|---|---|---|---|
| GFSK | 00 | 2402 MHz | 9.54 | 30 |
| GFSK | 39 | 2441 MHz | 9.92 | 30 |
| GFSK | 78 | 2480 MHz | 10.07 | 30 |

## 5.6. Test of Band Edges 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

Item 1~15 of the table on section 6 for radiated measurement.
Item 16 of the table on section 6 for conducted measurement.

5.6.3 Description of Major Test Instruments Setting

- Spectrum Analyzer : R&S FSP30 (Conducted Measurement)
  Attenuation : Auto
  Center Frequency : 2402 MHz / 2480 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 : 2402 MHz / 2480 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

5.6.4 Test Procedures

**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 point 2~4.

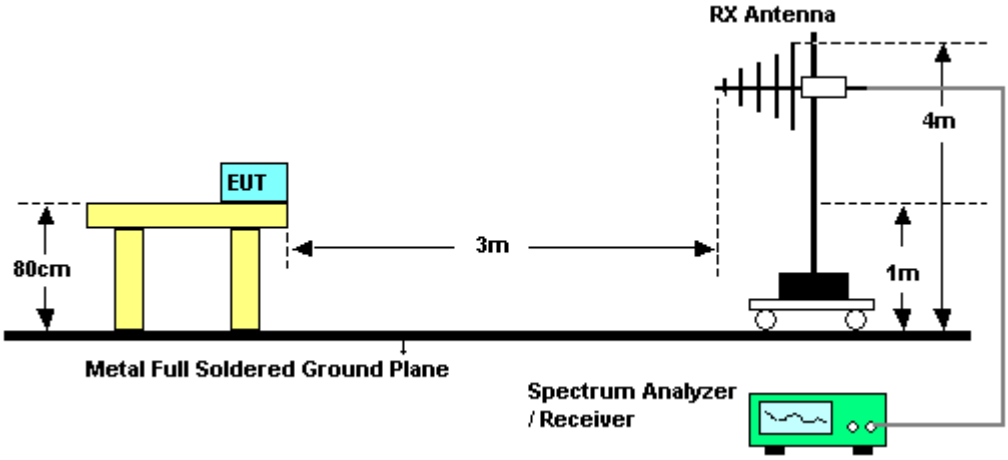
**Radiated Measurement**

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, use 10Hz VBW and 1MHz RBW for reading under AV and use 1MHz VBW and 1 MHz RBW for reading under PK.
6. The transmitter set to the highest channel and repeated point 2~5.

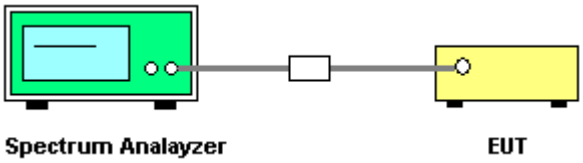
When pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. So duty factor is shown below:
Duty factor = 20 x $\log_{10}$(0.085) = -21dB
Average value = Peak value + Duty factor

5.6.5 Test Setup

**Radiated Method**




**Conducted Method**




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 00 / 2402 MHz

- Modulation Type: GFSK
- Temperature: 27°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 41.27%
- Test Engineer: Ted Chiu

| | Freq | Level | Over Limit | Read Level | Limit Line | Factor | Cable Loss | Preamp Factor | Remark | Ant Pos | Table Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | | cm | deg |
| 1 | 2390.000 | 22.02 | -31.98 | -8.10 | 54.00 | 30.12 | 1.90 | 0.00 | Average | --- | --- |
| 2 | 2390.000 | 54.83 | -19.17 | 24.71 | 74.00 | 30.12 | 1.90 | 0.00 | Peak | --- | --- |

5.6.8 Test Results for CH 78 / 2480 MHz

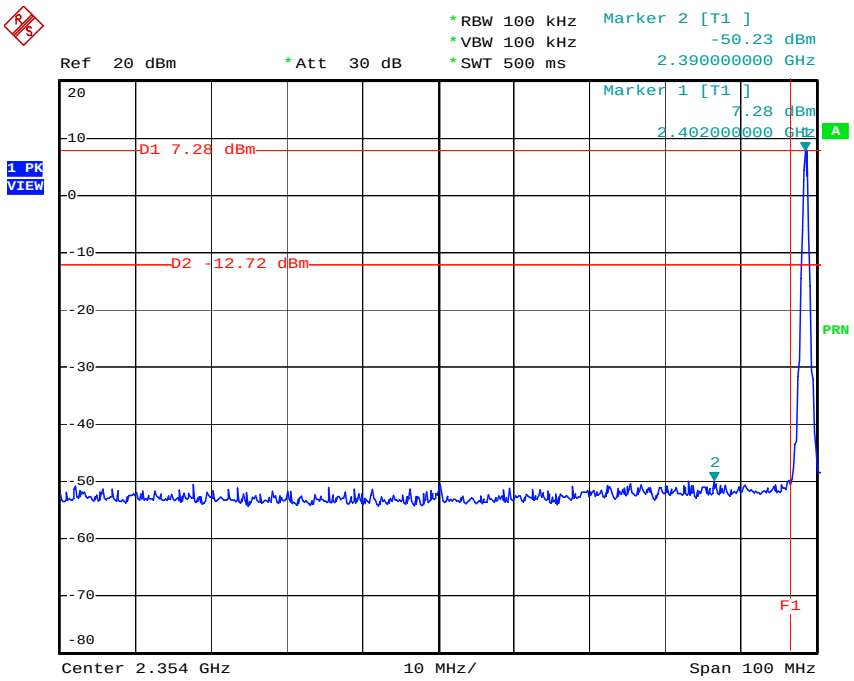
- Modulation Type: GFSK
- Temperature: 27°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 41.27%
- Test Engineer: Ted Chiu

| | Freq | Level | Over Limit | Read Level | Limit Line | Factor | Cable Loss | Preamp Factor | Remark | Ant Pos | Table Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | | cm | deg |
| 1 @ | 2483.500 | 69.68 | -4.32 | 39.35 | 74.00 | 30.33 | 1.96 | 0.00 | Peak | --- | --- |
| 2 @ | 2483.500 | 48.28 | -5.72 | 17.95 | 54.00 | 30.33 | 1.96 | 0.00 | Average | --- | --- |

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

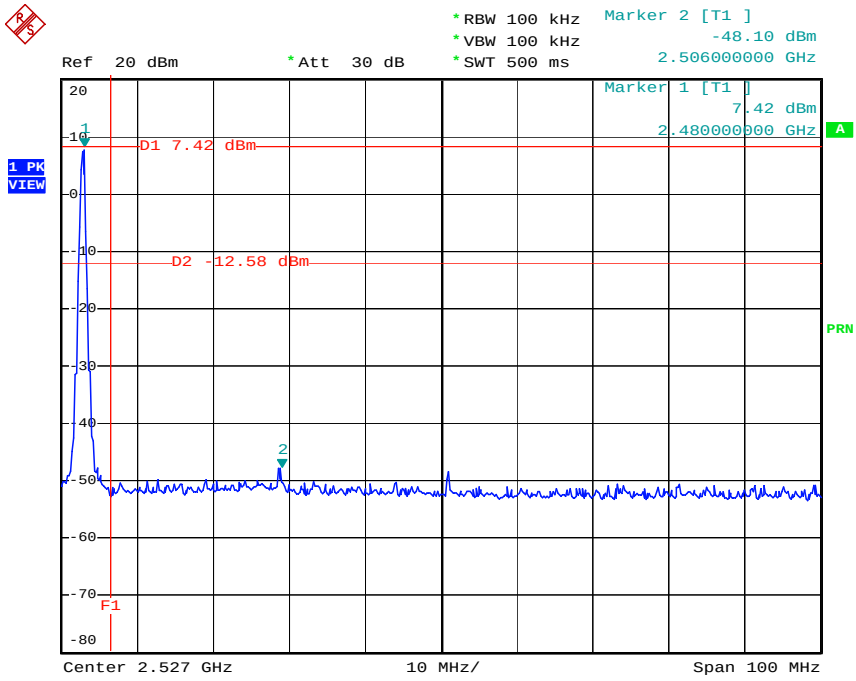
5.6.9 Test Result of Conducted Emission

Modulation Type: GFSK (Channel 00)：




Date: 26.JUL.2005 12:32:02

Modulation Type: GFSK (Channel 78)：




Date: 26.JUL.2005 12:30:25

## 5.7. Test of AC Power Line Conducted Emission

5.7.1 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 |

5.7.2 Measuring Instruments

Please reference item 28~32 in chapter 6 for the instruments used for testing.

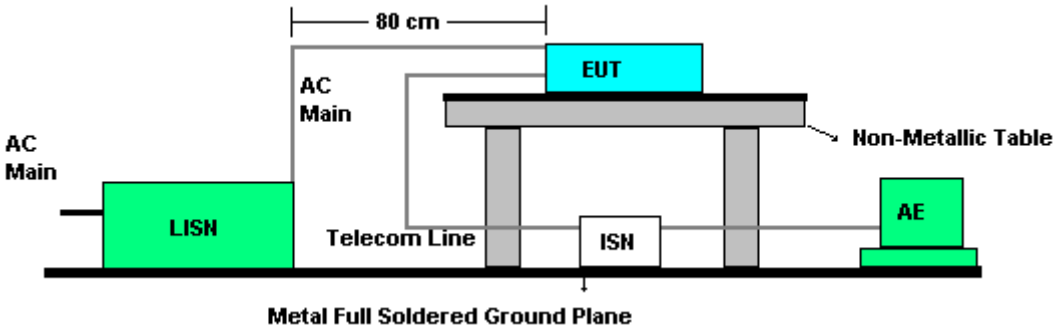
5.7.3 Description of Major Test Instruments Setting

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

5.7.4 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 provide 50uH/50ohms coupling impedance.
5. The frequency range from 150 KHz to 30 MHz was searched.
6. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
7. The measurement has to be done between each power line and ground at the power terminal for each RF channel. Only one RF channel has to be investigated since this test is independent with the RF channel selection.

5.7.5 Test Setup Layout



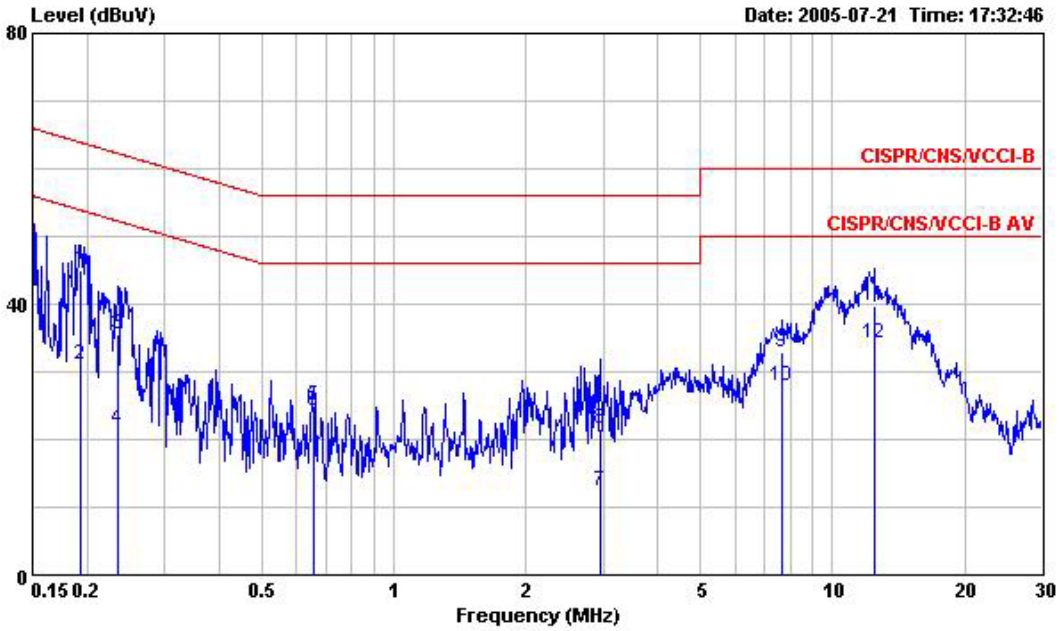

5.7.6 Test Criteria

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

5.7.7 Test Result of Conducted Emission

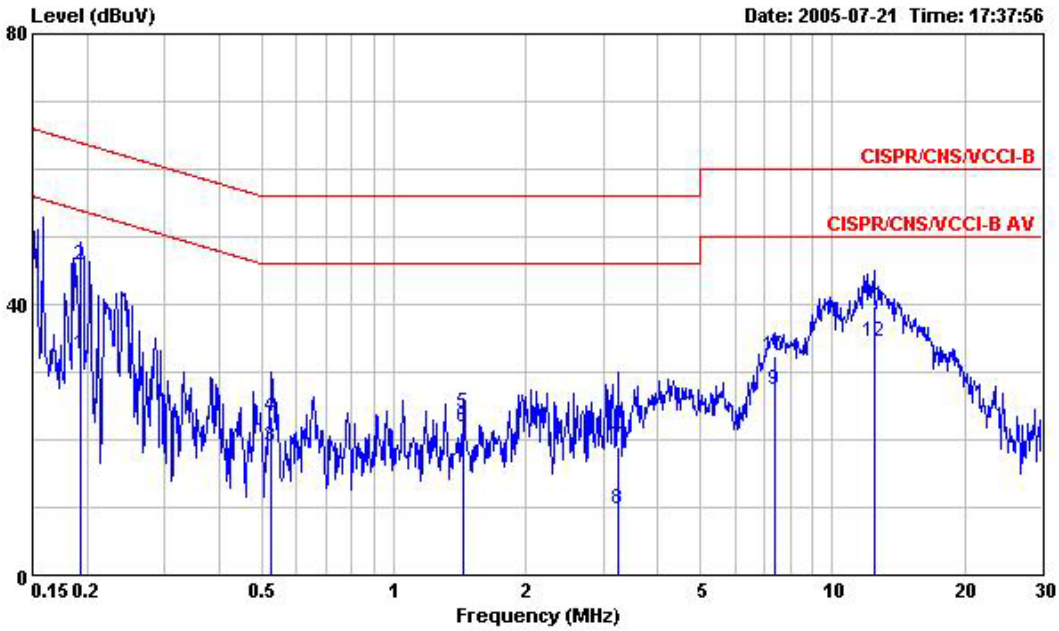
- Temperature: 25°C
- Relative Humidity: 46%
- Test Engineer: Sky Wu

***Line to Ground***




| | Freq | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV | dBuV | dB | dB | |
| 1 | 0.1934380 | 45.05 | -18.84 | 63.89 | 44.75 | 0.06 | 0.24 | QP |
| 2 | 0.1934380 | 31.03 | -22.86 | 53.89 | 30.73 | 0.06 | 0.24 | Average |
| 3 | 0.2353310 | 35.47 | -26.79 | 62.26 | 35.16 | 0.06 | 0.25 | QP |
| 4 | 0.2353310 | 21.69 | -30.57 | 52.26 | 21.38 | 0.06 | 0.25 | Average |
| 5 | 0.6555010 | 25.10 | -30.90 | 56.00 | 24.37 | 0.11 | 0.62 | QP |
| 6 | 0.6555010 | 24.15 | -21.85 | 46.00 | 23.42 | 0.11 | 0.62 | Average |
| 7 | 2.951 | 12.36 | -33.64 | 46.00 | 11.93 | 0.17 | 0.26 | Average |
| 8 | 2.951 | 21.61 | -34.39 | 56.00 | 21.18 | 0.17 | 0.26 | QP |
| 9 | 7.649 | 32.99 | -27.01 | 60.00 | 32.52 | 0.21 | 0.26 | QP |
| 10 | 7.649 | 27.91 | -22.09 | 50.00 | 27.44 | 0.21 | 0.26 | Average |
| 11 | 12.449 | 39.61 | -20.39 | 60.00 | 38.41 | 0.21 | 0.99 | QP |
| 12 | 12.449 | 34.27 | -15.73 | 50.00 | 33.07 | 0.21 | 0.99 | Average |

***Neutral to Ground***




| | Freq | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV | dBuV | dB | dB | |
| 1 | 0.1934380 | 32.55 | -21.34 | 53.89 | 32.20 | 0.11 | 0.24 | Average |
| 2 | 0.1934380 | 45.76 | -18.13 | 63.89 | 45.41 | 0.11 | 0.24 | QP |
| 3 | 0.5265450 | 18.95 | -27.05 | 46.00 | 18.44 | 0.23 | 0.28 | Average |
| 4 | 0.5265450 | 23.43 | -32.57 | 56.00 | 22.92 | 0.23 | 0.28 | QP |
| 5 | 1.440 | 24.06 | -31.94 | 56.00 | 23.41 | 0.23 | 0.42 | QP |
| 6 | 1.440 | 21.91 | -24.09 | 46.00 | 21.26 | 0.23 | 0.42 | Average |
| 7 | 3.239 | 18.82 | -37.18 | 56.00 | 18.31 | 0.23 | 0.28 | QP |
| 8 | 3.239 | 9.77 | -36.23 | 46.00 | 9.26 | 0.23 | 0.28 | Average |
| 9 | 7.411 | 27.39 | -22.61 | 50.00 | 26.84 | 0.30 | 0.25 | Average |
| 10 | 7.411 | 32.47 | -27.53 | 60.00 | 31.92 | 0.30 | 0.25 | QP |
| 11 | 12.450 | 39.77 | -20.23 | 60.00 | 38.45 | 0.33 | 0.99 | QP |
| 12 | 12.450 | 34.44 | -15.56 | 50.00 | 33.12 | 0.33 | 0.99 | Average |

5.7.8 Photographs of Conducted Emission Test Configuration

FRONT VIEW

REAR VIEW

## 5.8. Test of Spurious Radiated Emission

5.8.1 Applicable Standard

Section 15.247(d): Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

5.8.2 Measuring Instruments

Please reference item 1~15 in chapter 6 for the instruments used for testing.

5.8.3 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

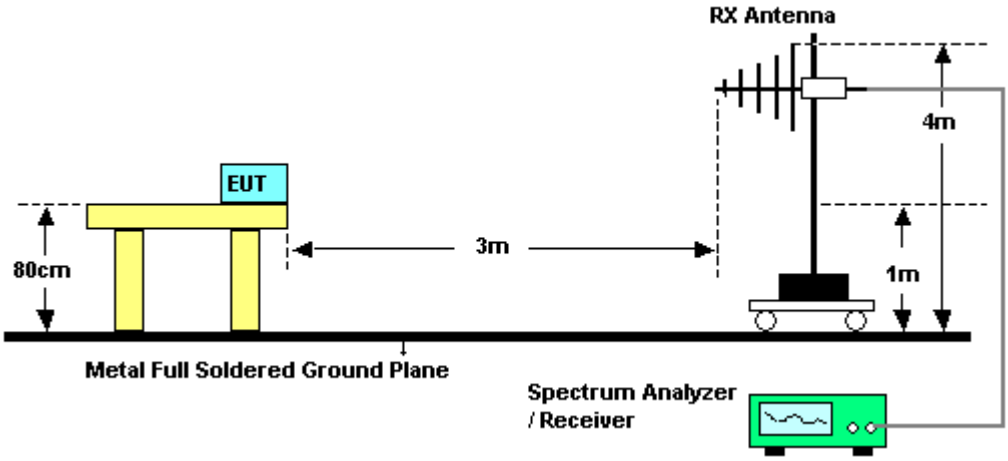
- Test Receiver : R&S ESCS 30
  Attenuation : Auto
  Start Frequency : 9 kHz
  Stop Frequency : 1000 MHz
  RB : 120 KHz for QP or PK

5.8.4 Test Procedures

1. Configure the EUT according to ANSI C63.4-2003.
2. The EUT was placed on the top of the turntable 0.8 meter above ground.
3. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
4. Power on the EUT and all the supporting units.
5. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
6. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.
7. For each suspected emission, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
8. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
9. For emission above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
10. If the emission level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz and average method for above the 1GHz. the reported.

11. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB higher than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

5.8.5 Test Setup Layout



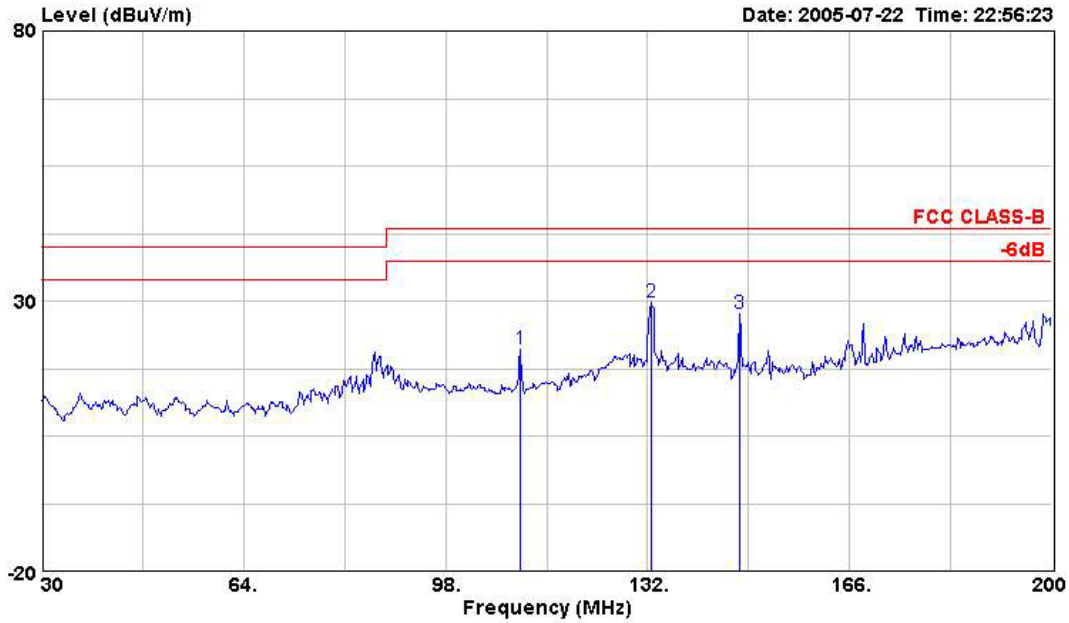

5.8.6 Test Criteria

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

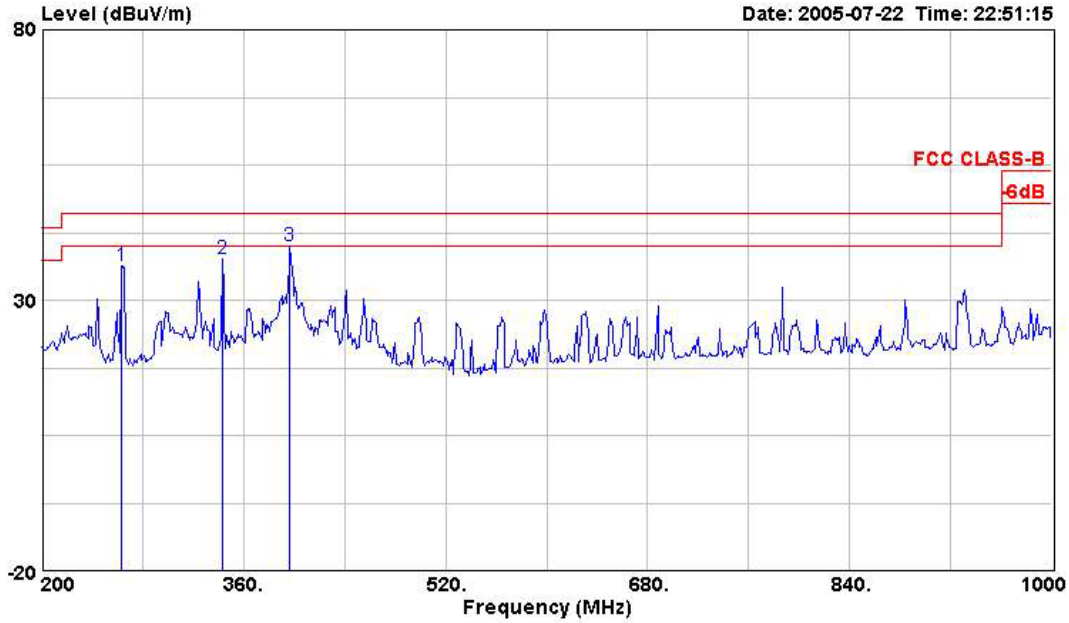
5.8.7 Test Results for CH 39 / 2441 MHz (for emission below 1GHz)

- Temperature: 28°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 41.27%
- Test Engineer: Ted Chiu

***(A) Polarization: Horizontal***

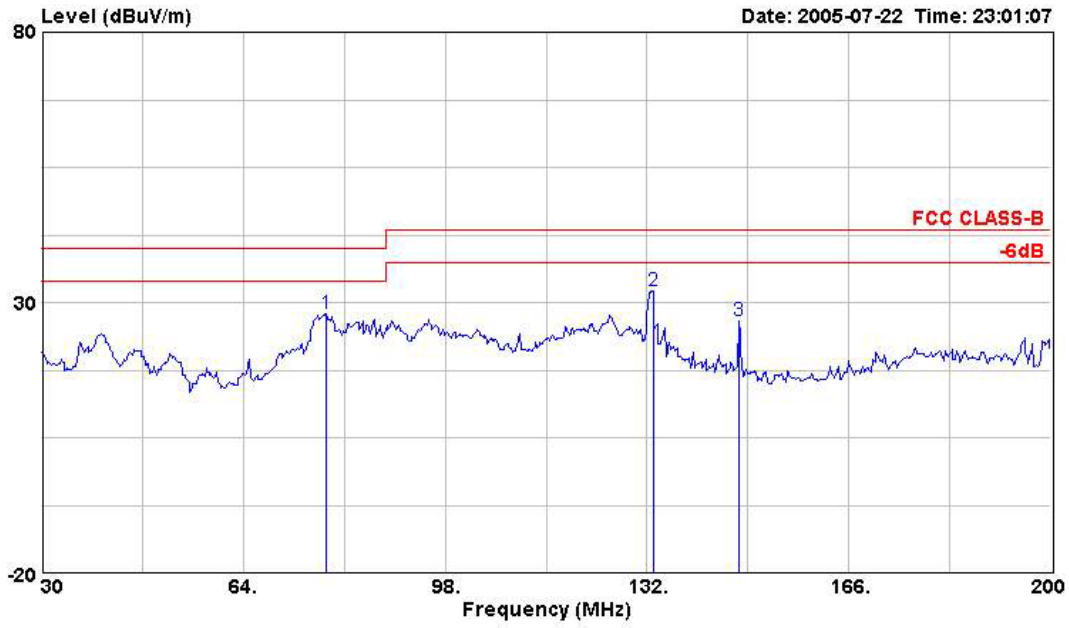



| | Freq | Level | Over Limit | Read Level | Limit Line | Factor | Cable Loss | Preamp Factor | Remark | Ant Pos | Table Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | | cm | deg |
| 1 | 110.580 | 20.99 | -22.51 | 39.72 | 43.50 | -18.73 | 1.04 | 30.29 | Peak | --- | --- |
| 2 | 132.510 | 29.77 | -13.73 | 46.93 | 43.50 | -17.16 | 1.15 | 30.71 | Peak | --- | --- |
| 3 | 147.470 | 27.60 | -15.90 | 44.84 | 43.50 | -17.24 | 1.19 | 30.50 | Peak | --- | --- |

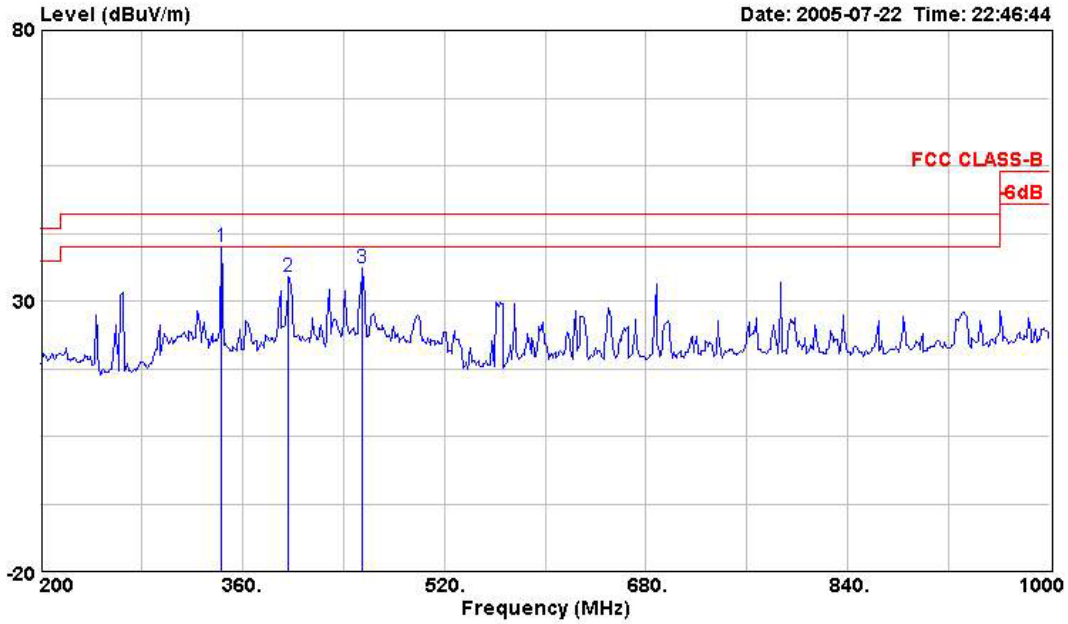



| | Freq | Level | Over Limit | Read Level | Limit Line | Factor | Cable Loss | Preamp Factor | Remark | Ant Pos | Table Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | | cm | deg |
| 1 | 263.200 | 36.38 | -9.62 | 52.55 | 46.00 | -16.17 | 1.62 | 30.48 | Peak | --- | --- |
| 2 | 343.200 | 37.74 | -8.26 | 51.79 | 46.00 | -14.05 | 1.78 | 30.94 | Peak | --- | --- |
| 3 ! | 396.800 | 40.04 | -5.96 | 52.55 | 46.00 | -12.51 | 1.96 | 31.18 | Peak | --- | --- |

***(B) Polarization: Vertical***




| | Freq | Level | Over Limit | Read Level | Limit Line | Factor | Cable Loss | Preamp Factor | Remark | Ant Pos | Table Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | | cm | deg |
| 1 | 77.940 | 27.90 | -12.10 | 47.61 | 40.00 | -19.71 | 0.88 | 30.15 | Peak | --- | --- |
| 2 | 133.020 | 32.13 | -11.37 | 49.28 | 43.50 | -17.15 | 1.15 | 30.72 | Peak | --- | --- |
| 3 | 147.470 | 26.52 | -16.98 | 43.76 | 43.50 | -17.24 | 1.19 | 30.50 | Peak | --- | --- |




| | Freq | Level | Over Limit | Read Level | Limit Line | Factor | Cable Loss | Preamp Factor | Remark | Ant Pos | Table Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | | cm | deg |
| 1 | 343.200 | 39.97 | -6.03 | 54.02 | 46.00 | -14.05 | 1.78 | 30.94 | Peak | --- | --- |
| 2 | 396.800 | 34.37 | -11.63 | 46.88 | 46.00 | -12.51 | 1.96 | 31.18 | Peak | --- | --- |
| 3 | 455.200 | 35.97 | -10.03 | 48.61 | 46.00 | -12.64 | 2.13 | 31.12 | Peak | --- | --- |

Note:

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

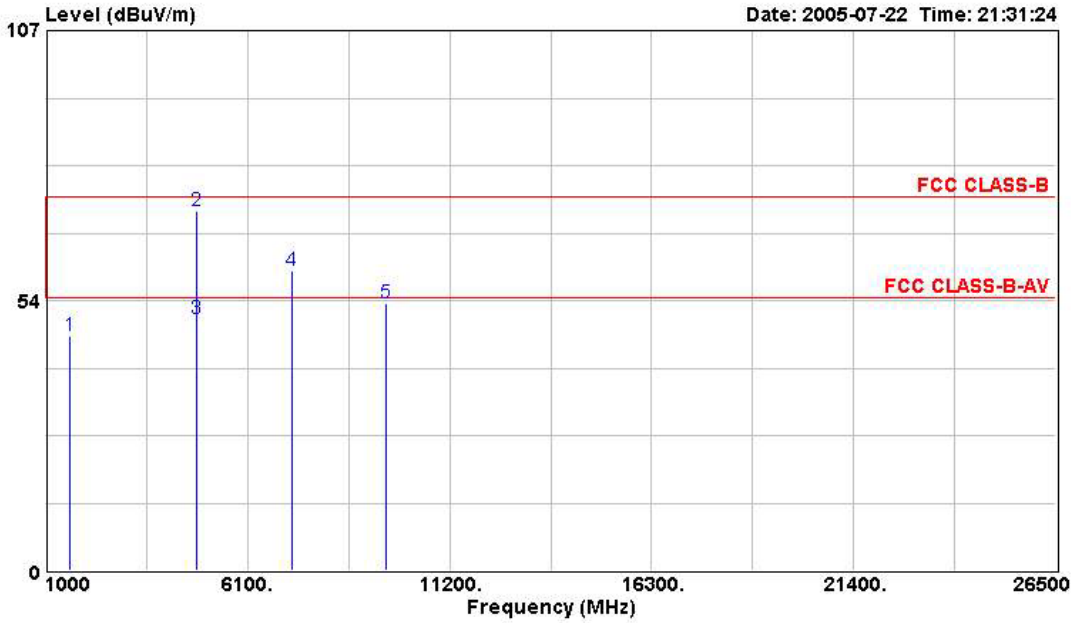
Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level

Results for the radiated measurement below 30MHz, no emissions found and caused by the EUT. The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

5.8.8 Test Results for CH 00 / 2402 MHz (for emission above 1GHz)

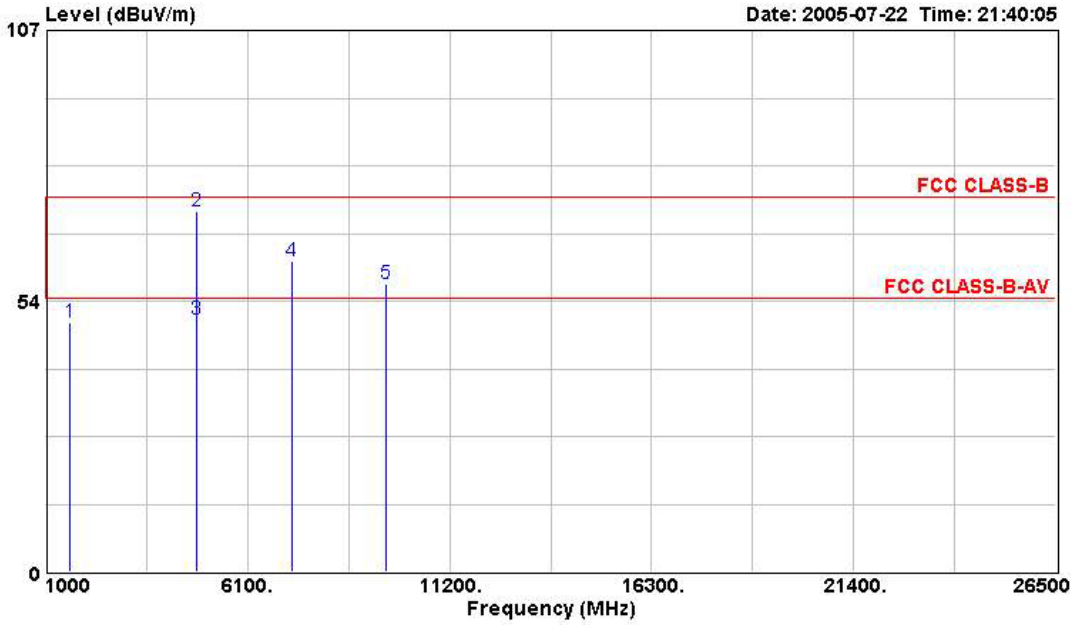
- Temperature: 28°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 41.27%
- Test Engineer: Ted Chiu

***(A) Polarization: Horizontal***




| | Freq | Level | Over Limit | Read Level | Limit Line | Factor | Cable Loss | Preamp Factor | Remark | Ant Pos | Table Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | | cm | deg |
| 1 | 1598.000 | 46.47 | -27.53 | 52.19 | 74.00 | -5.72 | 1.52 | 32.98 | Peak | --- | --- |
| 2 | 4808.000 | 71.36 | -2.64 | 67.97 | 74.00 | 3.40 | 2.84 | 32.54 | PEAK | --- | --- |
| 3 | 4808.000 | 49.96 | -4.04 | 46.56 | 54.00 | 3.40 | 2.84 | 32.54 | Average | --- | --- |
| 4 | 7204.000 | 59.45 | -14.55 | 52.30 | 74.00 | 7.15 | 3.61 | 32.35 | PEAK | --- | --- |
| 5 | 9608.000 | 53.02 | -20.98 | 44.14 | 74.00 | 8.88 | 4.01 | 33.42 | PEAK | --- | --- |

***(B) Polarization: Vertical***



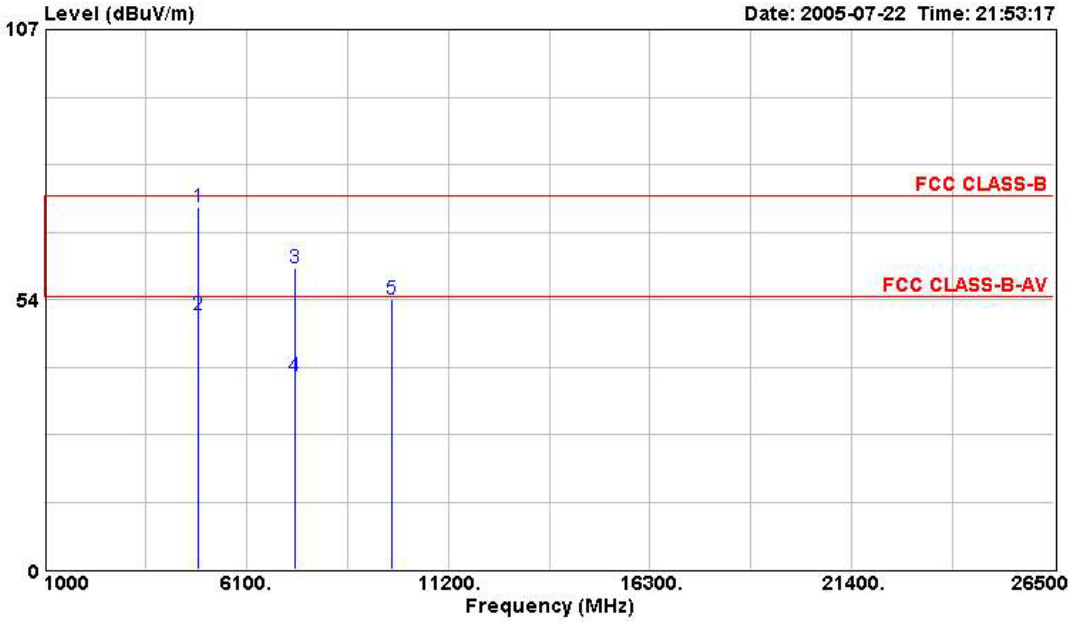

| | Freq | Level | Over Limit | Read Level | Limit Line | Factor | Cable Loss | Preamp Factor | Remark | Ant Pos | Table Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | | cm | deg |
| 1 | 1598.000 | 49.31 | -24.69 | 55.03 | 74.00 | -5.72 | 1.52 | 32.98 | Peak | --- | --- |
| 2 | 4804.000 | 71.23 | -2.77 | 67.84 | 74.00 | 3.40 | 2.84 | 32.54 | Peak | --- | --- |
| 3 | 4804.000 | 49.83 | -4.17 | 46.43 | 54.00 | 3.40 | 2.84 | 32.54 | Average | --- | --- |
| 4 | 7204.000 | 61.51 | -12.49 | 54.36 | 74.00 | 7.15 | 3.61 | 32.35 | Peak | --- | --- |
| 5 | 9608.000 | 56.87 | -17.13 | 48.00 | 74.00 | 8.88 | 4.01 | 33.42 | Peak | --- | --- |

Note:
Emission level (dBuV/m) = 20 log Emission level (uV/m)
Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level
If any spurious emissions are in non-restriction bands, these emissions could be with 20dB down of fundamental emissions.

5.8.9 Test Results for CH 39 / 2441 MHz (for emission above 1GHz)

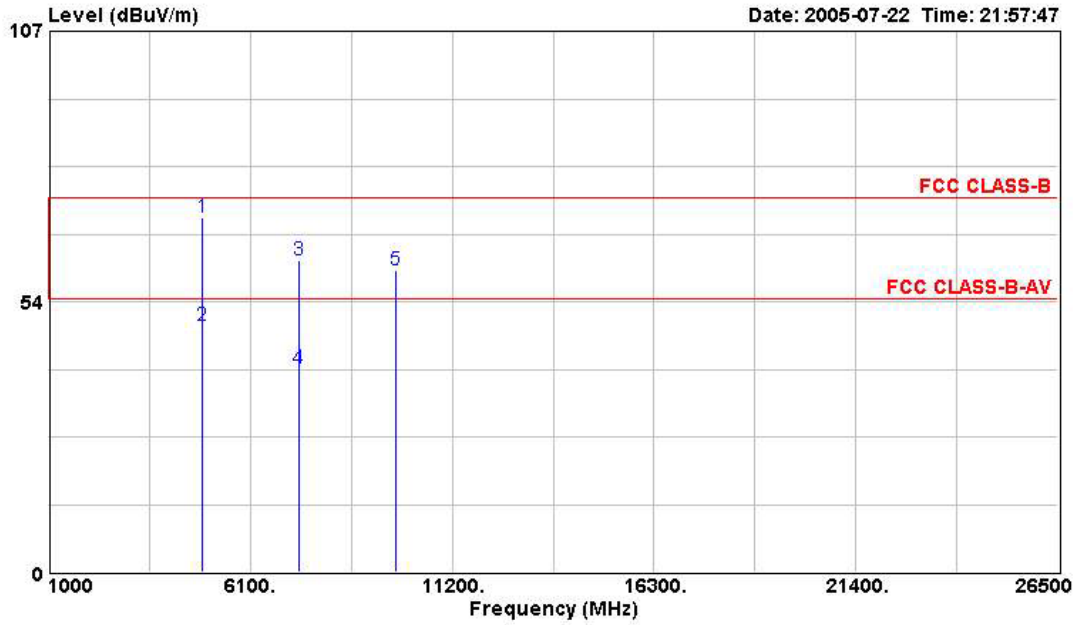
- Temperature: 27°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 41.27%
- Test Engineer: Ted Chiu

***(A) Polarization: Horizontal***




| | Freq | Level | Over Limit | Read Level | Limit Line | Factor | Cable Loss | Preamp Factor | Remark | Ant Pos | Table Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | | cm | deg |
| 1 | 4884.000 | 71.81 | -2.19 | 68.28 | 74.00 | 3.53 | 2.87 | 32.55 | PEAK | --- | --- |
| 2 | 4884.000 | 50.41 | -3.59 | 46.88 | 54.00 | 3.53 | 2.87 | 32.55 | Average | --- | --- |
| 3 | 7320.000 | 59.82 | -14.18 | 52.59 | 74.00 | 7.23 | 3.65 | 32.61 | PEAK | --- | --- |
| 4 | 7320.000 | 38.40 | -15.60 | 31.17 | 54.00 | 7.23 | 3.65 | 32.61 | Average | --- | --- |
| 5 | 9764.000 | 53.50 | -20.50 | 44.34 | 74.00 | 9.15 | 3.99 | 33.44 | PEAK | --- | --- |

***(B) Polarization: Vertical***



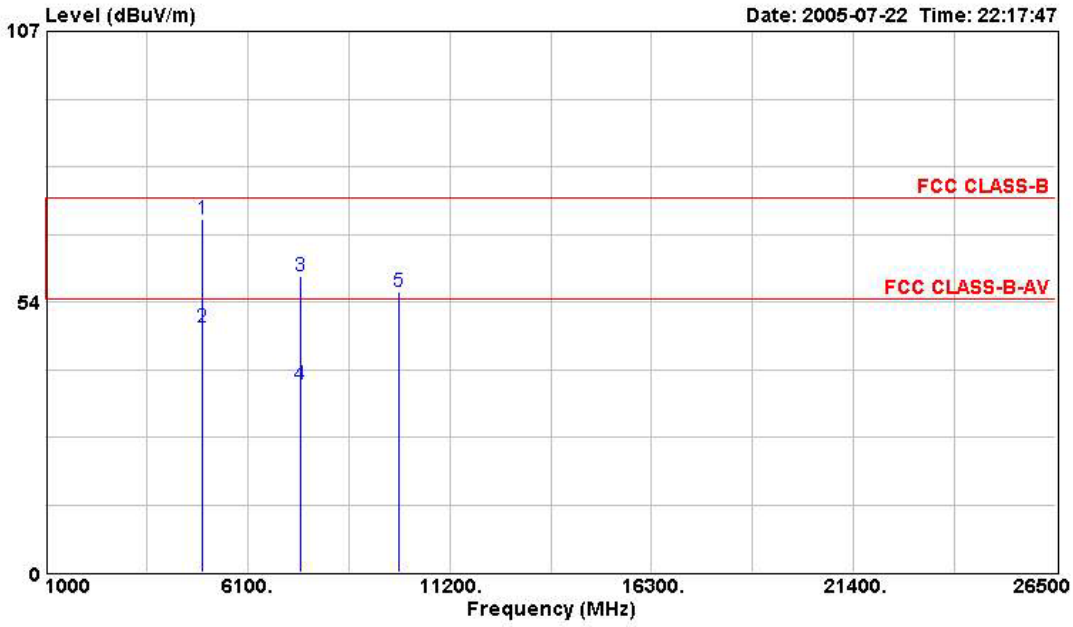

| | Freq | Level | Over Limit | Read Level | Limit Line | Factor | Cable Loss | Preamp Factor | Remark | Ant Pos | Table Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | | cm | deg |
| 1 | 4884.000 | 70.04 | -3.96 | 66.50 | 74.00 | 3.53 | 2.87 | 32.55 | PEAK | --- | --- |
| 2 | 4884.000 | 48.63 | -5.37 | 45.10 | 54.00 | 3.53 | 2.87 | 32.55 | Average | --- | --- |
| 3 | 7320.000 | 61.63 | -12.37 | 54.40 | 74.00 | 7.23 | 3.65 | 32.61 | PEAK | --- | --- |
| 4 | 7320.000 | 40.22 | -13.78 | 32.99 | 54.00 | 7.23 | 3.65 | 32.61 | Average | --- | --- |
| 5 | 9764.000 | 59.59 | -14.41 | 50.43 | 74.00 | 9.15 | 3.99 | 33.44 | PEAK | --- | --- |

Note:
Emission level (dBuV/m) = 20 log Emission level (uV/m)
Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level
If any spurious emissions are in non-restriction bands, these emissions could be with 20dB down of fundamental emissions.

5.8.10 Test Results for CH 78 / 2480 MHz (for emission above 1GHz)

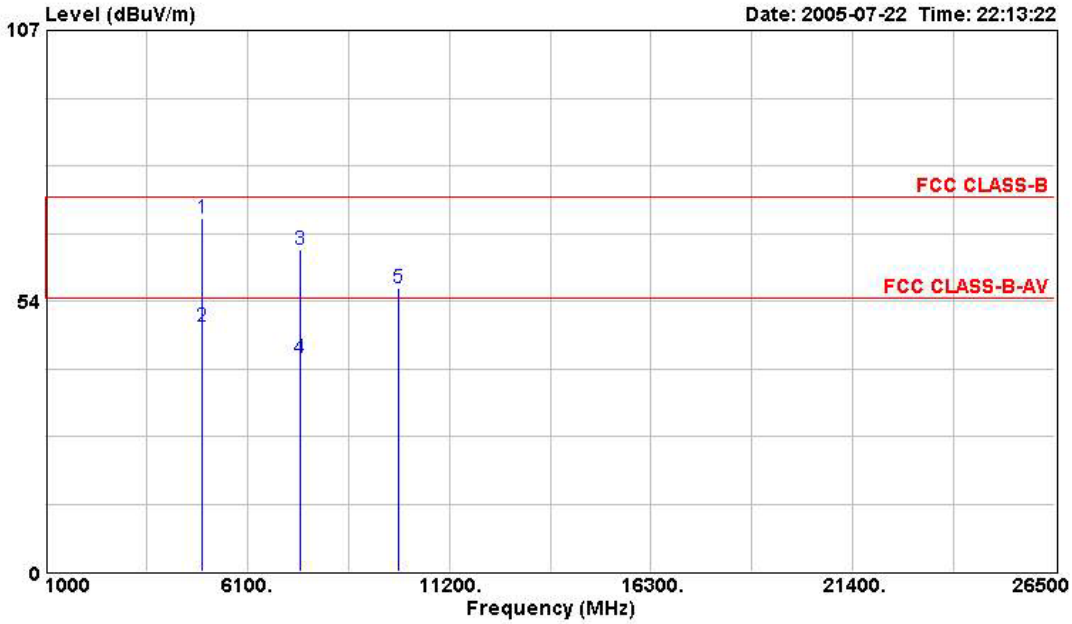
- Temperature: 27°C
- Relative Humidity: 60%
- Duty Cycle of the Equipment During the Test: 41.27%
- Test Engineer: Ted Chiu

***(A) Polarization: Horizontal***




| | Freq | Level | Over Limit | Read Level | Limit Line | Factor | Cable Loss | Preamp Factor | Remark | Ant Pos | Table Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | | cm | deg |
| 1 | 4964.000 | 69.75 | -4.25 | 66.06 | 74.00 | 3.70 | 2.91 | 32.56 | PEAK | --- | --- |
| 2 | 4964.000 | 48.35 | -5.65 | 44.65 | 54.00 | 3.70 | 2.91 | 32.56 | Average | --- | --- |
| 3 | 7440.000 | 58.46 | -15.54 | 51.16 | 74.00 | 7.30 | 3.69 | 32.87 | PEAK | --- | --- |
| 4 | 7440.000 | 37.06 | -16.94 | 29.76 | 54.00 | 7.30 | 3.69 | 32.87 | Average | --- | --- |
| 5 | 9920.000 | 55.52 | -18.48 | 46.12 | 74.00 | 9.40 | 3.98 | 33.46 | PEAK | --- | --- |

***(B) Polarization: Vertical***

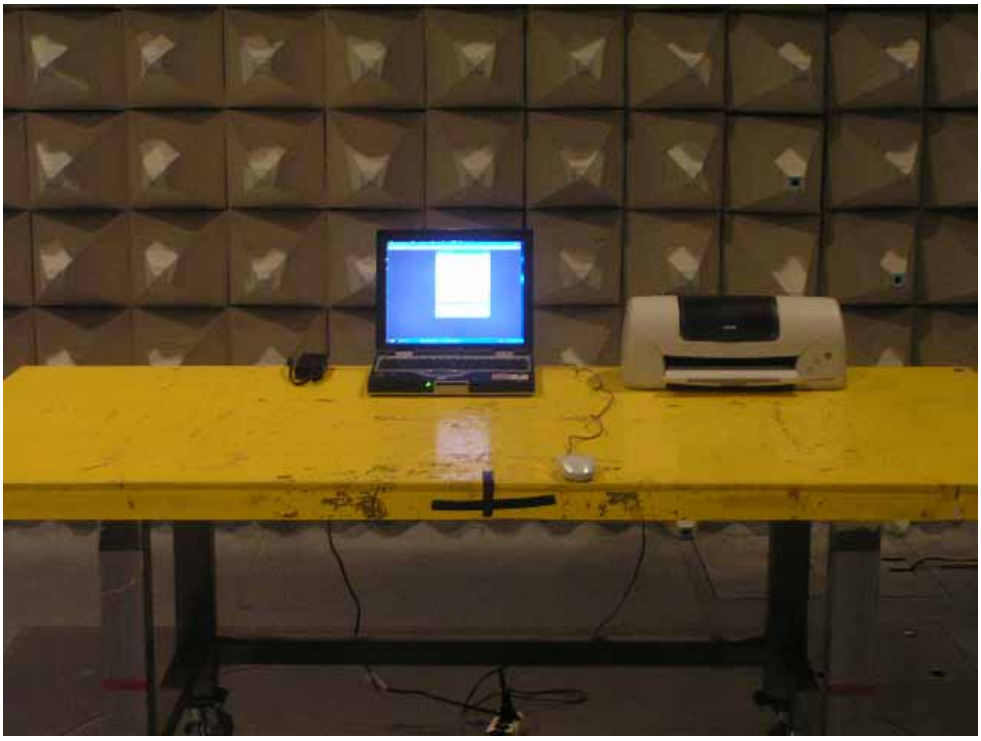



| | Freq | Level | Over Limit | Read Level | Limit Line | Factor | Cable Loss | Preamp Factor | Remark | Ant Pos | Table Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV | dBuV/m | dB | dB | dB | | cm | deg |
| 1 | 4960.000 | 69.85 | -4.15 | 66.16 | 74.00 | 3.70 | 2.91 | 32.56 | PEAK | --- | --- |
| 2 | 4960.000 | 48.45 | -5.55 | 44.75 | 54.00 | 3.70 | 2.91 | 32.56 | Average | --- | --- |
| 3 | 7440.000 | 63.67 | -10.33 | 56.37 | 74.00 | 7.30 | 3.69 | 32.87 | PEAK | --- | --- |
| 4 | 7440.000 | 42.27 | -11.73 | 34.97 | 54.00 | 7.30 | 3.69 | 32.87 | Average | --- | --- |
| 5 | 9920.000 | 56.06 | -17.94 | 46.66 | 74.00 | 9.40 | 3.98 | 33.46 | PEAK | --- | --- |

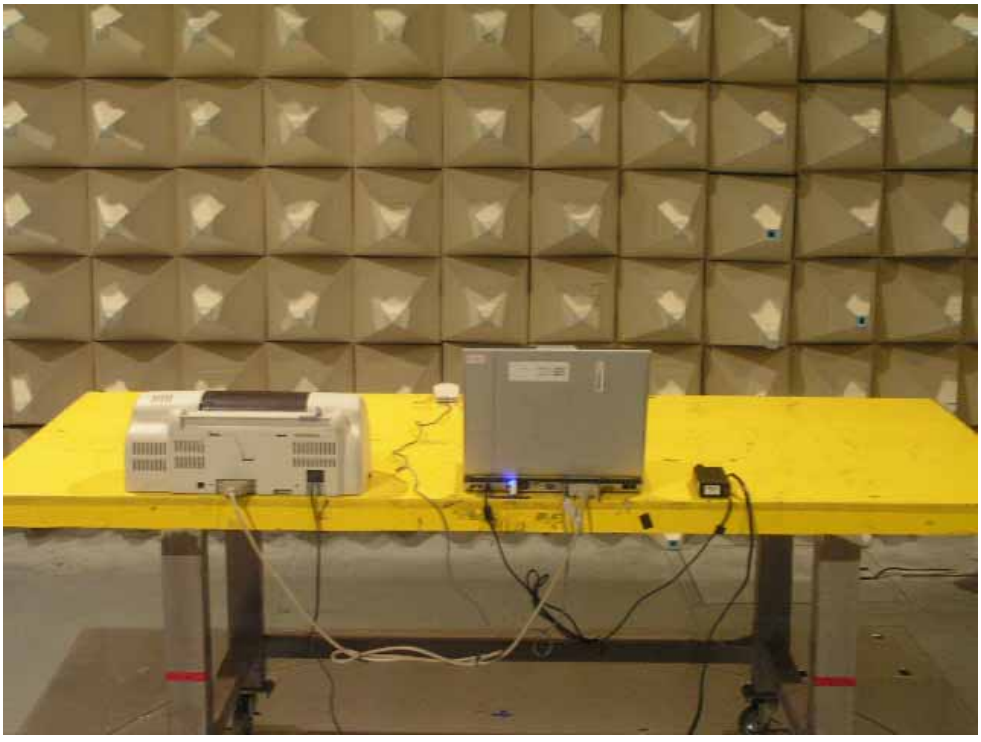
Note:
Emission level (dBuV/m) = 20 log Emission level (uV/m)
Corrected Reading: Probe Factor + Cable Loss + Read Level - Preamp Factor = Level
If any spurious emissions are in non-restriction bands, these emissions could be with 20dB down of fundamental emissions.

5.8.11 Photographs of Radiated Emission Test Configuration

FRONT VIEW



REAR VIEW



## 5.9. RF Exposure

5.9.1 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.

Limits for Occupational / Controlled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/ cm²) | Averaging Time \|E\|²,\|H\|² or S (minutes) |
|---|---|---|---|---|
| 0.3-3.0 | 614 | 1.63 | (100)* | 6 |
| 3.0-30 | 1842 / f | 4.89 / f | (900 / f)* | 6 |
| 30-300 | 61.4 | 0.163 | 1.0 | 6 |
| 300-1500 | | | F/300 | 6 |
| 1500-100,000 | | | 5 | 6 |

Limits for General Population / Uncontrolled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/cm²) | Averaging Time \|E\|²,\|H\|² or S ( minutes ) |
|---|---|---|---|---|
| 0.3-1.34 | 614 | 1.63 | (100)* | 30 |
| 1.34-30 | 824/f | 2.19/f | (180/f)* | 30 |
| 30-300 | 27.5 | 0.073 | 0.2 | 30 |
| 300-1500 | | | F/1500 | 30 |
| 1500-100,000 | | | 1.0 | 30 |

F = frequency in MHz
*Plane-wave equivalent power density

5.9.2 MPE Calculation Method

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

**E** = Electric field (V/m)
**P** = Peak RF output power (mW)
**G** = EUT Antenna numeric gain (numeric)
**d** = Separation distance between radiator and human body (m)

The formula can be changed to

$Pd = \frac{30 \times P \times G}{377 \times d^2}$

From the peak EUT RF output power, the minimum mobile separation distance, d=20cm, as well as the gain of the used antenna, the RF power density can be obtained.

5.9.3 Calculated Result and Limit

- Modulation Type: GFSK
- Temperature: 26°C
- Relative Humidity: 50%
- Duty Cycle of the Equipment During the Test: 41.27%
- Test Engineer: Ted Chiu

| Antenna Gain (dBi) | Antenna Gain (numeric) | Peak Output Power (dBm) | Peak Output Power ( mW ) | Power Density (S) ($mW/cm^2$) | Limit of Power Density (S) ($mW/cm^2$) |
|---|---|---|---|---|---|
| 2.95 | 1.9724 | 10.0700 | 10.1625 | 0.003990 | 1 |

## 5.10. Antenna Requirements

5.10.1 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.

5.10.2 Antenna Connected Construction

There is no antenna connector for this printed antenna.

5.10.3 Antenna Gain

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

5.10.4 Test Criteria

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

# 6. List of Measuring Equipments Used

| Items | Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|---|---|---|---|---|---|---|---|
| 1 | 3m Semi Anechoic Chamber | SIDT FRANKONIA | SAC-3M | 03CH03-HY | 30MHz ~ 1GHz 3m | Jun. 16, 2005 | Radiation (03CH03-HY) |
| 2 | Spectrum analyzer | R&S | FSP40 | 100004 | 9KHZ ~ 40GHz | Aug. 31, 2004 | Radiation (03CH03-HY) |
| 3 | Amplifier | SCHAFFNER | CPA9231A | 18667 | 9KHz ~ 2GHz | Jan. 10, 2005 | Radiation (03CH03-HY) |
| 4 | Amplifier | Agilent | 8449B | 3008A02120 | 1GHz ~ 26.5GHz | May 31, 2005 | Radiation (03CH03-HY) |
| 5 | Biconical Antenna | SCHWARZBECK | VHBB 9124 | 301 | 30MHz ~ 200MHz | Jul. 28, 2004 | Radiation (03CH03-HY) |
| 6 | Log Antenna | SCHWARZBECK | VUSLP 9111 | 221 | 200MHz ~ 1GHz | Jul. 28, 2004 | Radiation (03CH03-HY) |
| 7 | Horn Antenna | EMCO | 3115 | 6741 | 1GHz ~ 18GHz | Apr. 22, 2005 | Radiation (03CH03-HY) |
| 9 | RF Cable-R03m | Jye Bao | RG142 | CB021 | 30MHz ~ 1GHz | Feb. 22, 2005 | Radiation (03CH03-HY) |
| 10 | RF Cable-HIGH | SUHNER | SUCOFLEX 106 | 03CH03-HY | 1GHz ~ 40GHz | Dec.01, 2004 | Radiation (03CH03-HY) |
| 11 | Turn Table | HD | DS 420 | 420/650/00 | 0 ~ 360 degree | N/A | Radiation (03CH03-HY) |
| 12 | Antenna Mast | HD | MA 240 | 240/560/00 | 1 m - 4 m | N/A | Radiation (03CH03-HY) |

※ Calibration Interval of instruments listed above is one year.

| Items | Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|---|---|---|---|---|---|---|---|
| 13 | Amplifier | MITEQ | AMF-6F-260400 | 923364 | 26.5GHz ~ 40GHz | Jan. 05, 2004* | Radiation (03CH03-HY) |
| 14 | Loop Antenna | R&S | HFH2-Z2 | 860004/001 | 9kHz ~ 30MHz | May 24, 2004* | Radiation (03CH03-HY) |
| 15 | Horn Antenna | SCHWARZBECK | BBHA9170 | BBHA9170154 | 15GHz ~ 40GHz | Jun. 09, 2004* | Radiation (03CH03-HY) |

※ Calibration Interval of instruments listed above is two years.

| Items | Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|---|---|---|---|---|---|---|---|
| 16 | Spectrum analyzer | R&S | FSP30 | 100023 | 9kHz ~ 30GHz | Aug. 02, 2004 | Conducted (TH01-HY) |
| 17 | Power meter | R&S | NRVS | 100444 | DC ~ 40GHz | Jul. 06, 2005 | Conducted (TH01-HY) |
| 18 | Power sensor | R&S | NRV-Z55 | 100049 | DC ~ 40GHz | Jul. 06, 2005 | Conducted (TH01-HY) |
| 19 | Power Sensor | R&S | NRV-Z32 | 100057 | 30MHz ~ 6GHz | Apr. 28, 2005 | Conducted (TH01-HY) |
| 20 | AC power source | HPC | HPA-500W | HPA-9100024 | AC 0 ~ 300V | Apr. 21, 2005 | Conducted (TH01-HY) |
| 21 | DC power source | G.W. | GPC-6030D | C671845 | DC 1V ~ 60V | Nov. 28, 2004 | Conducted (TH01-HY) |
| 22 | Temp. and Humidity Chamber | KSON | THS-C3L | 612 | N/A | Oct. 01, 2004 | Conducted (TH01-HY) |
| 23 | RF CABLE-1m | Jye Bao | RG142 | CB034-1m | 20MHz ~ 7GHz | Jan. 01, 2005 | Conducted (TH01-HY) |
| 24 | RF CABLE-2m | Jye Bao | RG142 | CB035-2m | 20MHz ~ 1GHz | Jan. 01, 2005 | Conducted (TH01-HY) |
| 25 | Oscilloscope | Tektronix | TDS1012 | CO38515 | 100MHz / 1GS/s | Apr. 15, 2005 | Conducted (TH01-HY) |
| 26 | Signal Generator | R&S | SMR40 | 100116 | 10MHz ~ 40GHz | Dec. 31, 2004 | Conducted (TH01-HY) |
| 27 | Data Generator | Tektronix | DG2030 | 063-2920-50 | 0.1Hz~400MHz | Jun. 02, 2005 | Conducted (TH01-HY) |
| 28 | EMC Receiver | R&S | ESCS 30 | 100174 | 9kHz – 2.75GHz | Feb. 16, 2005 | Conduction (CO04-HY) |
| 29 | LISN | MessTec | NNB-2/16Z | 2001/004 | 9kHz – 30MHz | Apr. 20, 2005 | Conduction (CO04-HY) |
| 30 | LISN (Support Unit) | MessTec | NNB-2/16Z | 99041 | 9kHz – 30MHz | May. 05, 2005 | Conduction (CO04-HY) |
| 31 | RF Cable-CON | UTIFLEX | 3102-26886-4 | CB049 | 9kHz – 30MHz | Apr. 20, 2005 | Conduction (CO04-HY) |
| 32 | EMI Filter | LINDGREN | LRE-2030 | 2651 | < 450 Hz | N/A | Conduction (CO04-HY) |

※ Calibration Interval of instruments listed above is one year.

# 7. Company Profile

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

## 7.1. Certificate of Accreditation

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

## 7.2. Test Location

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

# 8. CNLA Certificate of Accreditation

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

Taiwan Accreditation Foundation
Chinese National Laboratory Accreditation
Certificate of Accreditation

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

President, Taiwan Accreditation Foundation
Date:July 19, 2004

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