

MEASUREMENT REPORT

of

USB RF Receiver

Applicant : TopSeed Technology Corp.
FCC ID : PTITSCV-2402
EUT : USB RF Receiver
Model : TSCV-2402

Test by :

Training Research Co., Ltd.

TEL : 886-2-26935155

FAX : 886-2-26934440

No. 255, Nan-yang Street, Shijr, Taipei Hsien 221, Taiwan

CERTIFICATION

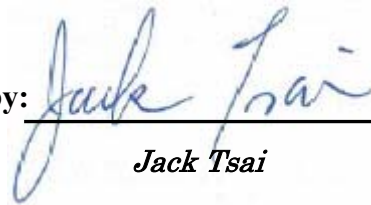
We here by verify that:

The test data, data evaluation, test procedures and equipment configurations shown in this report were made mainly in accordance with the procedures given in ANSI C63.4 (2003) as a reference. All tests were conducted by **Training Research Co., Ltd.**, No. 255, Nan-yang Street, Shijr, Taipei Hsien 221, Taiwan. Also, we attest to the accuracy of each.

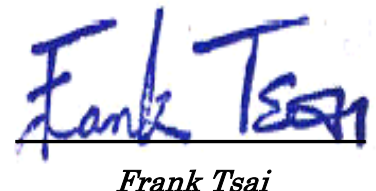
We further submit that the energy emitted by the sample EUT tested as described in the report is **in compliance with** the technical requirements set forth in the FCC Rules Part 15 Subpart C Section 15.249.

Applicant : TopSeed Technology Corp.
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Report No. : AA515080282
Test Date : March 12, 2009

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Approved by:


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- (2) **This report must not be used by the client to claim product endorsement by NVLAP or any agency of U.S. Government.**
- (3) **This test report, measurements made by TRC are traceable to the NIST only Conducted and Radiated Method.**



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Chapter 1 General

1.1 Introduction

The following measurement report is submitted on behalf of Applicant in support of a wireless mouse certification in accordance with Part 2 Subpart J and Part 15 Subpart C of the Commission's Rules and Regulations.

1.2 Description of EUT

| | |
|----------------------------|-----------------------|
| FCC ID | : PTITSCV-2402 |
| Product Name | : USB RF Receiver |
| Model | : TSCV-2402 |
| Frequency Range | : 2400MHz ~ 2483.5MHz |
| Operating Frequency | : 2402MHz ~ 2479MHz |
| Modulation Skill | : GFSK |
| Power Type | : Powered by PC. |

1.3 Test method

The EUT is connected to the USB port of PC by USB cable.

The fundamental frequency of transmitter emitted is due to test fixture by notebook PC. There are security codes for avoiding the possibility of duplicating codes in adjacent systems. The coding must be matching with the companion receiver.

While testing the EUT was adjusted at a position, which transmits the maximum emission.

Test setting:

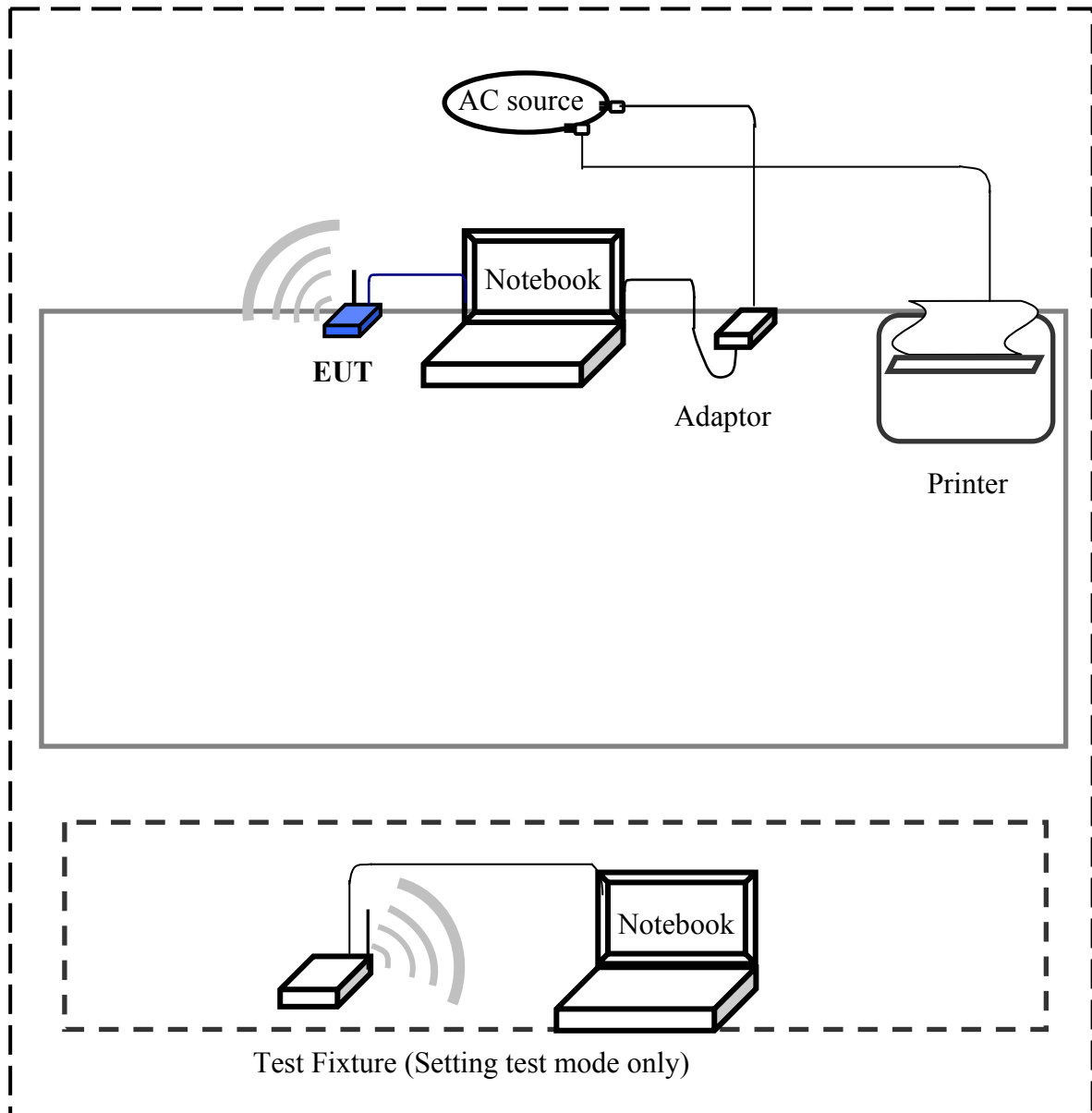
- (1) The test fixture is connected to notebook PC and setting test channel, transmission on by wireless of test fixture then EUT is setting test mode for radiated of intentional testing. When EUT is setting finish then test fixture is power off.
- (2) Set different channel (Lowest/Middle/Highest) being tested and repeat the procedures above.
 - (a) Radiated for intentional test:
making EUT to the mode of continuously transmission

1.4 Description of Support Equipment

| | | |
|----------------------|---|--|
| Notebook PC | : | IBM |
| Model No. | : | 2373-IMV |
| Serial No. | : | 99R3H1H |
| FCC ID | : | N/A, DoC (Declaration of Confirmation) Approved |
| BSMI | : | R33026 |
| DGT | : | 92LP0137 |
| Power adaptor | : | IBM |
| Part No. | : | 08K8202 |
| Serial No. | : | 11S08K8202Z1Z6LR459001A REV 06 |
| BSMI | : | D33190 |
| Power type | : | 100 ~ 240VAC / 50 ~ 60Hz, 1.5 ~ 0.5A, Switching |
| Power cord | : | Primary: Non-shielded, 1.0m length, Plastic hood, No ferrite core Secondary: Shielded, 1.84m length, Plastic hood, ferrite core |
| Printer | : | HP |
| Model No. | : | C6464A |
| Serial No. | : | TH16LEB5PK |
| FCC ID | : | N/A, DoC Approved |
| BSMI | : | 3892H381 |
| Power type | : | Switching adaptor |
| Power cord | : | Non-shielded, 173cm long, No ferrite core (between adaptor and AC source) Non-shielded, 180cm long, with ferrite core (between printer and adaptor) |
| Data cable | : | Shielded, 1.70m long, No ferrite core |
| Test fixture | : | Cypress MTK |
| Power type | : | Switching adaptor |
| Power cord | : | Non-shielded, 183cm long, No ferrite core |
| Data cable | : | Shielded, 1.50m long, No ferrite core |

1.5 Configuration of System Under Test

1.5.1 Radiated of test setup for EUT



Connections of Equipment

Notebook:

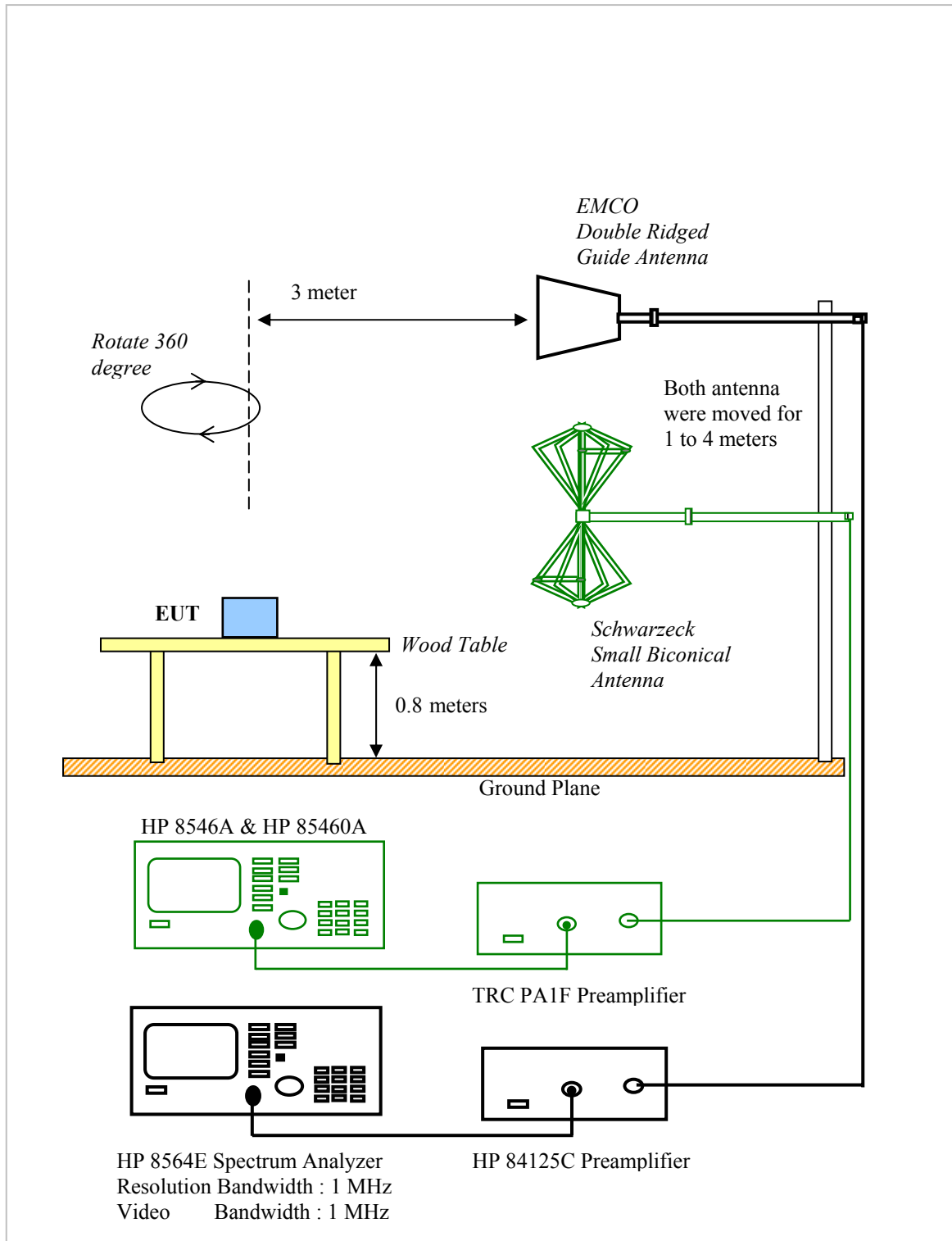
*Parallel Port --- a printer

*USB Port --- EUT

EUT:

*USB cable --- Shielded, 1.60m length, without ferrite core

1.5.2 Radiated of test setup for measurement system



1.6 Test Procedure

All measurements contained in this report were performed mainly according to the techniques described in Measurement procedure ANSI C63.4 (2003).

1.7 Location of the Test Site

The radiated emissions measurements required by the rules were performed on the **three-meter, Semi-anechoic Chamber (FCC Registration Number: 93906)** maintained by *Training Research Co., Ltd.* 1F, No. 255, Nan-yang Street, Shijr, Taipei Hsien 221, Taiwan, R.O.C. Complete description and measurement data have been placed on file with the commission. The conducted power line emissions tests and other test items were performed in an semi-anechoic chamber also located at Training Research Co., Ltd. 1F, No. 255, Nan-yang Street, Shijr, Taipei Hsien 221, Taiwan, R.O.C. *Training Research Co., Ltd.* is listed by the FCC as a facility available to do measurement work for others on a contract basis.

1.8 General Test Condition

The conditions under which the EUT operates were varied to determine their effect on the equipment's emission characteristics. The final configuration of the test system and the mode of operation used during these tests was chosen as that which produced the highest emission levels. However, only those conditions which the EUT was considered likely to encounter in normal use were investigated.

In test, they were set in high power and continuously transmitting mode. The Highest, Middle and Lowest of EUT were all tested. The setting up procedure is recorded on 1.3 Test Method.

Chapter 2 Section 15.203: Antenna requirement

The EUT can be equipped with detachable antenna. The external antenna is affixed to the EUT using a unique connector, which allows for replacement of a broken antenna, but does not use a standard antenna jack or electrical connector. The antenna requirement stated in Section 15.203 is inapplicable to this EUT.

The custom antenna specification of list as below:

| | | |
|--------------|---|--------------------------|
| Manufacturer | : | Wha Yu Group |
| Part No | : | C1100-510001-A SSR-81319 |
| Connector | : | Dipole |
| Antenna Gain | : | 1.8dBi (MAX.) |

Chapter 3 Conducted Emissions Measurements

3.1 Test Condition & Setup

The power line conducted emission measurements were performed in an semi-anechoic chamber. The EUT was assembled on a wooden table, which is 80 centimeters high, was placed 40 centimeters from the backwall and at least 1 meter from the sidewall.

Power was fed to the EUT from the public utility power grid through a line filter and Line Impedance Stabilization Networks (LISNs). The LISN housing, measuring instrumentation case, ground plane, etc., were electrically bonded together at the same RF potential. The Spectrum analyzer (or EMI receiver) was connected to the AC line through an isolation transformer. The 50-ohm output of the LISN was connected to the spectrum analyzer directly. Conducted emission levels were in the CISPR quasi-peak and average detection mode. The analyzer's 6 dB bandwidth was set to 9 KHz. No post-detector video filter was used.

The spectrum was scanned from 150KHz to 30MHz. The physical arrangement of the test system and associated cabling was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude and frequency. All spurious emission frequencies were observed. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in paragraph 4.3

There is a test condition apply in this test item, the test procedure description as <1.3 test method>. Three channels were tested, one in the top (CH Lowest), one in the middle (CH Middle) and the other in bottom (CH Highest).

3.2 List of Test Instruments

| Instrument Name | Model | Brand | Serial No. | Calibration Date |
|------------------------------|---------------------|--------------------|---------------------|------------------|
| | | | | Next time |
| EMI Receiver | 8546A | HP | 3520A00242 | 04/15/09 |
| RF Filter Section | 85460A | HP | 3448A00217 | 04/15/09 |
| LISN (EUT) | LISN-01 | TRC | 99-05 | 05/10/09 |
| LISN (Support E.) | LISN-01 | TRC | 9912-03, 04 | 03/22/09 |
| Pre-amplifier | 15542 ZFL-500 | Mini – Circuits | 0 0117 | 04/10/09 |
| 6dB Attenuator | MCL BW-S6W2 | Mini – Circuits | 9915 – Conducted | 04/10/09 |
| 10dB Attenuator | A5542 VAT010 | Mini – Circuits | 0215 – Conducted | 04/10/09 |
| Coaxial Cable (2.0 meter) | A30A30-0058-50FS-2M | Jyebao | SMA-08 | 04/10/09 |
| Coaxial Cable (1.1 meter) | A30A30-0058-50FS-1M | Jyebao | SMA-09 | 04/10/09 |
| Coaxial Cable (20 meter) | RG-214/U | Jyebao | NP-01 | 04/10/09 |
| Coaxial Cable (20 meter) | RG-214/U | Jyebao | NP-02 | 04/10/09 |
| Auto Switch Box (< 30MHz) | ASB-01 | TRC | 9904-01 | 04/10/09 |

3.3 Test Result of Conducted Emissions

The following table shows a summary of the highest emissions of power line conducted emissions on the LIVE and NETURAL conductors of the EUT power cord. Show as follows.

Test Conditions: Temperature : 25 °C Humidity : 73 % RH

Test mode: Channel Lowest

| Power Connected Emissions | | | | | Class B | | |
|----------------------------------|----------------------------|------------------------|----------------------|---------------------------|----------------------------|-----------------------------|------------------------|
| Conductor | Frequency (KHz) | Peak (dBμV) | QP (dBμV) | Average (dBμV) | QP-limit (dBμV) | AVG-limit (dBμV) | Margin (dB) |
| Line 1 | 161.735 | 77.93 | 56.08 | 32.76 | 66.00 | 56.00 | -9.92 |
| | 213.180 | 54.24 | 52.14 | 31.68 | 63.94 | 53.94 | -11.80 |
| | 552.360 | 49.29 | 46.24 | 44.08 | 56.00 | 46.00 | -1.92 |
| | 768.755 | 48.57 | 44.10 | 43.09 | 56.00 | 46.00 | -2.91 |
| | 2866.550 | 47.27 | 45.42 | 43.09 | 56.00 | 46.00 | -2.91 |
| | 3085.865 | 46.91 | 45.64 | 44.42 | 56.00 | 46.00 | -1.58 |
| Line 2 | 154.770 | 60.85 | 57.19 | 37.31 | 65.94 | 55.94 | -8.75 |
| | 160.180 | 60.86 | 56.17 | 34.28 | 65.63 | 55.63 | -9.46 |
| | 552.810 | 48.79 | 46.41 | 44.83 | 56.00 | 46.00 | -1.17 |
| | 661.635 | 49.12 | 47.57 | 43.82 | 56.00 | 46.00 | -2.18 |
| | 772.490 | 49.55 | 48.18 | 44.46 | 56.00 | 46.00 | -1.54 |
| | 882.840 | 47.03 | 45.20 | 43.32 | 56.00 | 46.00 | -2.68 |

NOTE:

(1)Margin = Peak Amplitude – Limit, The reading amplitudes are all under limit.

(2)A "+" sign in the margin column means the emission is OVER the Class B Limit
and "-" sign of means UNDER the Class B limit

Test mode: Channel Middle

| Power Connected Emissions | | | | | Class B | | |
|----------------------------------|----------------------------|------------------------|----------------------|---------------------------|----------------------------|-----------------------------|------------------------|
| Conductor | Frequency (KHz) | Peak (dBμV) | QP (dBμV) | Average (dBμV) | QP-limit (dBμV) | AVG-limit (dBμV) | Margin (dB) |
| Line 1 | 552.585 | 48.84 | 46.56 | 44.80 | 56.00 | 46.00 | -1.20 |
| | 662.040 | 48.97 | 46.70 | 41.79 | 56.00 | 46.00 | -4.21 |
| | 768.935 | 48.73 | 44.51 | 44.49 | 56.00 | 46.00 | -1.51 |
| | 2866.090 | 47.34 | 45.52 | 43.22 | 56.00 | 46.00 | -2.78 |
| | 3086.130 | 47.28 | 45.64 | 44.26 | 56.00 | 46.00 | -1.74 |
| | 3526.395 | 45.89 | 44.23 | 42.73 | 56.00 | 46.00 | -3.27 |
| Line 2 | 153.590 | 60.92 | 57.73 | 37.52 | 66.00 | 56.00 | -8.27 |
| | 162.355 | 61.12 | 56.82 | 40.89 | 65.54 | 55.54 | -8.72 |
| | 552.135 | 48.24 | 46.05 | 44.51 | 56.00 | 46.00 | -1.49 |
| | 768.395 | 51.29 | 46.03 | 44.32 | 56.00 | 46.00 | -1.68 |
| | 992.960 | 46.90 | 45.14 | 39.00 | 56.00 | 46.00 | -7.00 |
| | 3413.000 | 44.37 | --- | --- | 56.00 | 46.00 | -1.63 |

Test mode: Channel Highest

| Power Connected Emissions | | | | | Class B | | |
|----------------------------------|----------------------------|------------------------|----------------------|---------------------------|----------------------------|-----------------------------|------------------------|
| Conductor | Frequency (KHz) | Peak (dBμV) | QP (dBμV) | Average (dBμV) | QP-limit (dBμV) | AVG-limit (dBμV) | Margin (dB) |
| Line 1 | 160.920 | 60.34 | 59.80 | 42.73 | 65.77 | 55.77 | -5.97 |
| | 662.315 | 51.59 | 49.10 | 41.98 | 56.00 | 46.00 | -4.02 |
| | 772.805 | 50.37 | 48.09 | 44.05 | 56.00 | 46.00 | -1.95 |
| | 2646.925 | 46.33 | 43.94 | 43.20 | 56.00 | 46.00 | -2.80 |
| | 2866.640 | 47.15 | 45.28 | 42.93 | 56.00 | 46.00 | -3.07 |
| | 3086.405 | 46.93 | 45.65 | 44.79 | 56.00 | 46.00 | -1.21 |
| Line 2 | 552.675 | 48.86 | 46.44 | 44.58 | 56.00 | 46.00 | -1.42 |
| | 661.905 | 50.76 | 48.98 | 41.80 | 56.00 | 46.00 | -4.20 |
| | 772.400 | 49.91 | 48.14 | 44.13 | 56.00 | 46.00 | -1.87 |
| | 881.040 | 48.28 | 44.73 | 42.93 | 56.00 | 46.00 | -3.07 |
| | 992.915 | 47.04 | 45.53 | 40.39 | 56.00 | 46.00 | -5.61 |
| | 3526.325 | 46.38 | 44.68 | 43.01 | 56.00 | 46.00 | -2.99 |

Chapter 4 Transmitter Duty Cycle Measurements

4.1 Test Condition and Setup

The duty cycle measurements were performed in a shielded enclosure. The EUT was placed on a wooded table which is 0.8 meters height and a bi-log periodic antenna was used distance about 3 meters for receiving. While testing EUT was set to transmit continuously. Various key configurations were also investigated to find the maximum duty cycle.

The resolution bandwidth and video bandwidth of the spectrum analyzer was all set to 1MHz to encompass all significant spectral components during the test. The analyzer operated in linear scale and zero span mode after tuning to the transmitter carrier frequency. The spectrum analyzer measured pulses width. The pulse width was determined by the difference between the two half voltage points on a pulse.

The duty cycle was determined by the following equation:

$$\text{Duty Cycle (\%)} = \frac{\text{Total on interval in a complete pulse train}}{\text{Length of a complete pulse train}} \times 100\%$$

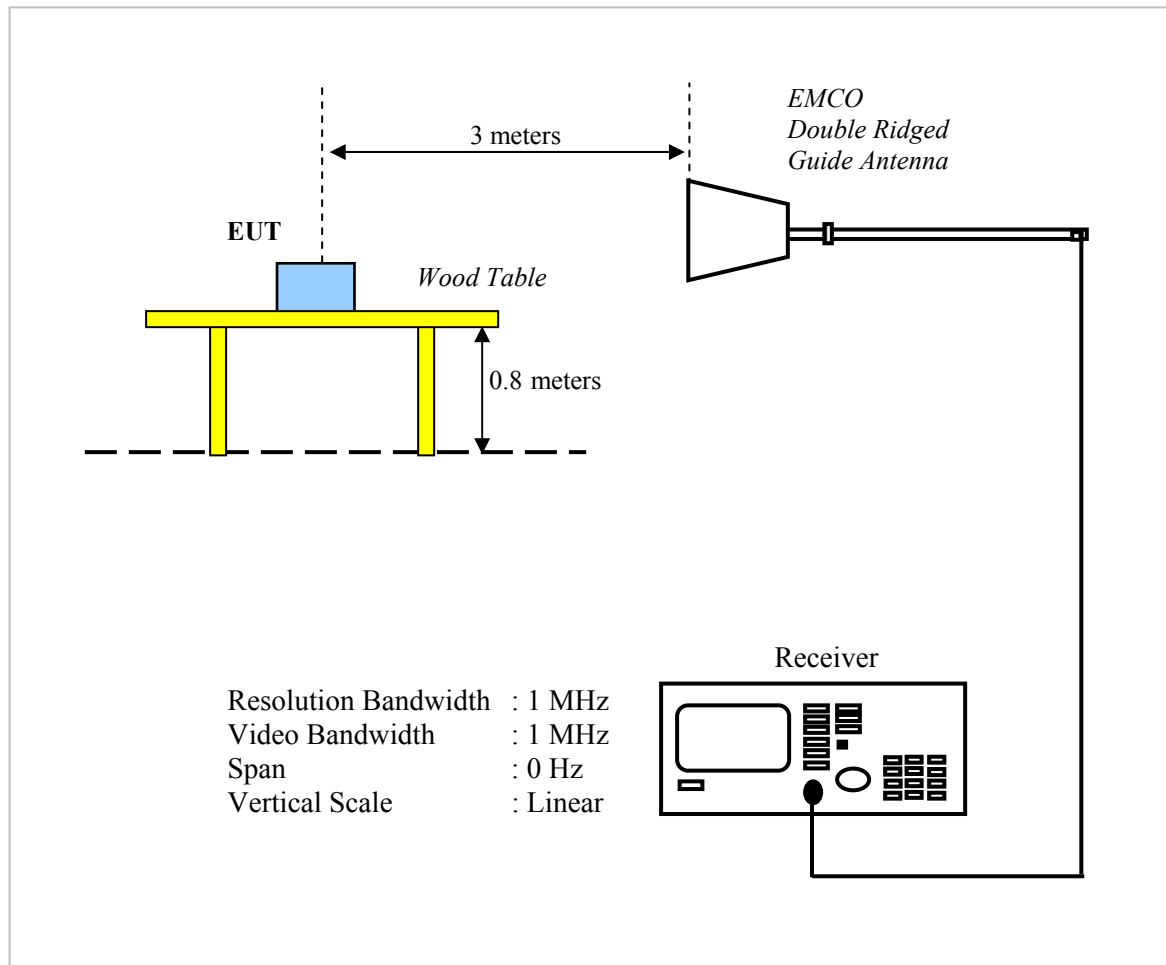
To calculate the actual field intensity, the duty cycle correction factor in decibel is needed for later use and be obtained from following conversion:

$$\text{Duty Cycle Correction Factor (dB)} = 20 \times \log_{10} \text{Duty Cycle}$$

4.2 List of Test Instruments

| Instrument Name | Model No. | Brand | Serial No. | <u>Calibration Date</u> |
|-------------------------|------------------------|------------|------------|-------------------------|
| | | | | Next time |
| EMI Receiver | 8546A | HP | 3520A00242 | 04/15/09 |
| RF Filter Section | 85460A | HP | 3448A00217 | 04/15/09 |
| Spectrum Analyzer | MS2665C | ANRITSU | 6200175476 | 03/19/09 |
| Spectrum Analyzer | 8564E | HP | 3720A00840 | 03/17/09 |
| Microwave Preamplifier | 84125C | HP | US36433002 | 05/05/09 |
| Small Biconical Antenna | UBAA9114 & BBVU9135 | SCHWARZECK | 127 | 04/10/09 |

4.3 Test Instruments Configuration



4.4 Test Result

Following is the test result, which produce maximum duty cycle:

Total on interval in a complete pulse train

= 168 μ s

Length of a complete pulse train

= 67.40ms

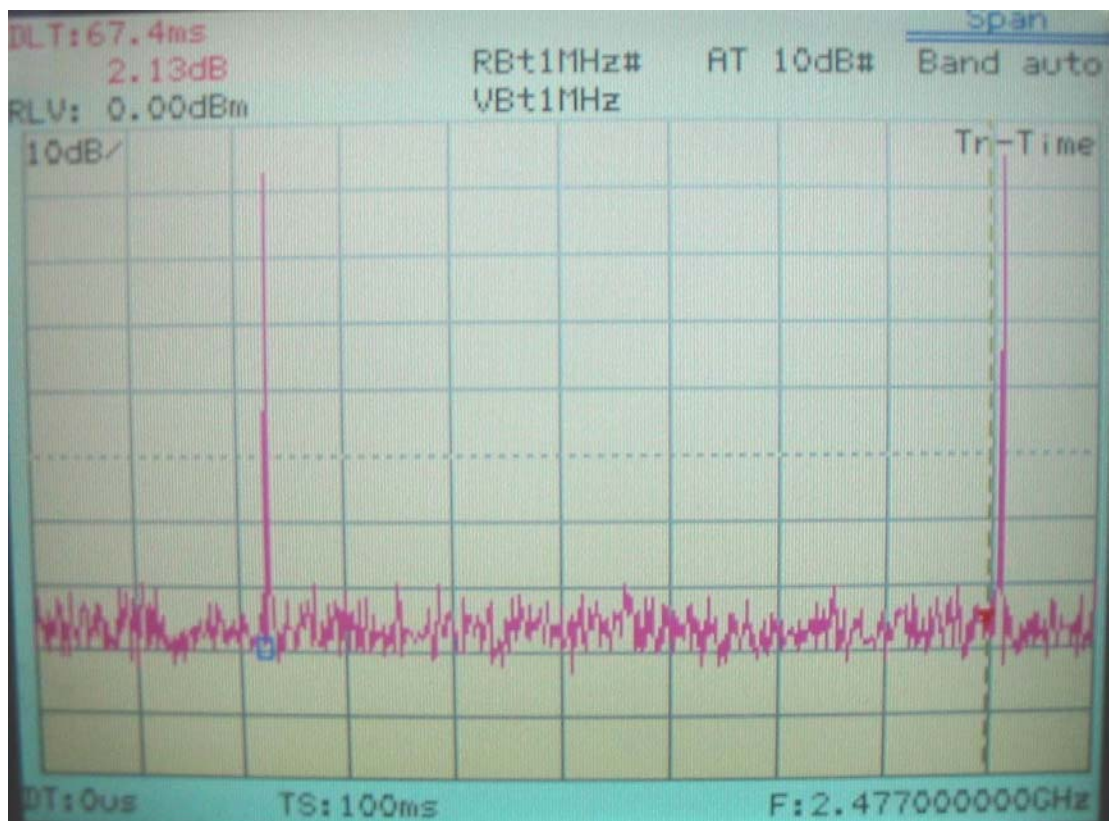
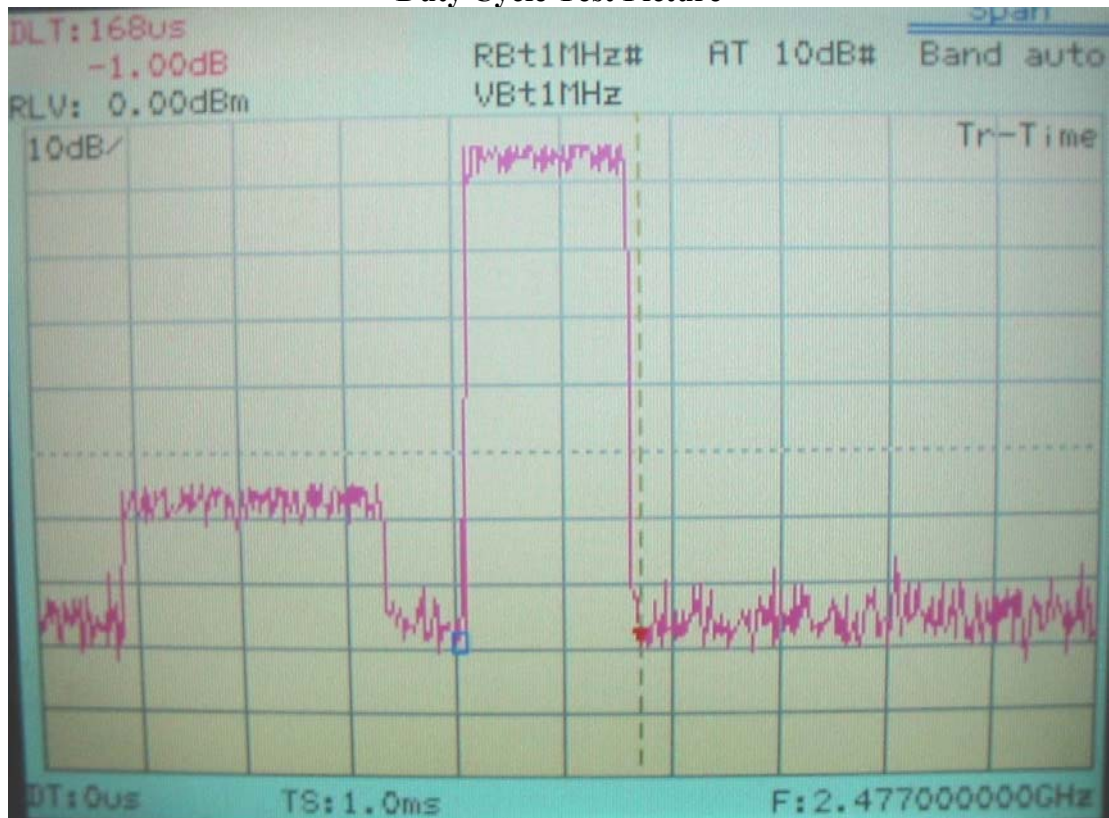
Duty Cycle (%) = $0.168\text{ms} / 67.40\text{ms} * 100\% = 0.00249$

Duty Cycle Correction Factor (dB) = $20 * \text{Log} (0.00249) = -52.08$

Maximum duty cycle according to FCC part 15.35(b): -20dB

A plot is attached on the following page.

Duty Cycle Test Picture



Chapter 5 Radiated Emissions Measurements

5.1 Test Condition & Setup

We'd performed the test by the radiated emission skill: The EUT was placed in an semi-anechoic chamber, and set the EUT transmitting continuously and scanned at 3-meter distance to determine its emission characteristics. The physical arrangement of the EUT was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude, directivity, and frequency. The exact system configuration, which produced the highest emissions was noted so it could be reproduced later during the final tests. For the measurement above 1GHz, according to the guidance we'd set the spectrum analyzer's 6dB bandwidth RBW to 1MHz.

This was done to ensure that the final measurements would demonstrate the worst-case interference potential of the EUT.

Final radiation measurements were made on a three-meter, semi-anechoic chamber. The EUT system was placed on a nonconductive turntable, which is 0.8 meters height, top surface 1.0 x 1.5 meter.

The spectrum was examined from 30 MHz to 1000 MHz using an Hewlett Packard 85460A EMI Receiver, SCHWARZECK whole range Small Biconical Antenna (model: UBAA9114 & BBVU9135) is used to measure frequency from 30 MHz to 1GHz. The final test is used the HP 85460A spectrum and 8564E spectrum was examined from 1GHz to 25GHz using an Hewlett Packard Spectrum Analyzer, EMCO/HP Horn Antenna (Model 3115 / 84125-80008) for 1G - 25GHz.

A nonconductive material surrounded the EUT to supporting the EUT for standing on three orthogonal planes. At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters to find the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarization.

Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. There are two spectrum analyzers use on this testing, HP 85460A for frequency 30MHz to 1000MHz, and 8564E for frequency 1GHz to 25GHz. No post-detector video filters were used in the test. The spectrum analyzer's 6dB bandwidth was set to 120KHz (spectrum was examined from 30 MHz to 1000 MHz), the spectrum analyzer's 6 dB bandwidth was set to 1 MHz (spectrum was examined from 1GHz to 25GHz) and the analyzer was operated in the maximum hold mode. There is a test condition applies in this test item, the test procedure description as the following:

Three channels were tested, one in the top, one in the middle and the other in bottom. The setting up procedure is recorded on <1.3>

With the transmitter operating from a AC source and using the internal of EUT, radiates spurious emissions falling within the restricted bands of 15.209 were measured at operating frequencies corresponding to upper, middle and bottom channels in the 2400 ~ 2483.5 MHz band.

The actual field intensity in decibels referenced to 1 microvolt per meter (dBμV/m) is determined by algebraically adding the measured reading in dBμV, the antenna factor (dB), and cable loss (dB) at the appropriate frequency. Since the EUT was set to transmit continuously, with *duty cycle* is present.

For frequency between 30MHz to 1000MHz

$F_{Ia} \text{ (dBμV/m)} = F_{Ir} \text{ (dBμV)} + \text{Correction Factors} + \text{Duty Cycle}$

F_{Ia} : Actual Field Intensity

F_{Ir} : Reading of the Field Intensity

Correction Factors = Antenna factor + (Cable loss – Amplitude gain) + Switching box loss

For frequency between 1GHz to 25GHz

$F_{Ia} \text{ (dBμV/m)} = F_{Ir} \text{ (dBμV)} + \text{Correction Factor} + \text{Duty Cycle}$

F_{Ia} : Actual Field Intensity

F_{Ir} : Reading of the Field Intensity

Correction Factors = Antenna factor + (Cable loss – Amplitude gain) + Switching box loss

5.2 List of Test Instruments

| Instrument Name | Model | Brand | Serial No. | Calibration Date |
|---|----------------------|------------|------------|------------------|
| | | | | Next time |
| EMI Receiver | 8546A | HP | 3520A00242 | 04/15/09 |
| RF Filter Section | 85460A | HP | 3448A00217 | 04/15/09 |
| Small Biconical Antenna | UBAA9114 & BBVU9135 | SCHWARZECK | 127 | 04/10/09 |
| Pre-amplifier | PA1F | TRC | 1FAC | 04/10/09 |
| Coaxial Cable (Double shielded, 15 meter) | A30A30-0058-50FS-15M | JYEBAO | SMA-01 | 04/10/09 |
| Coaxial Cable (1.1 meter) | A30A30-0058-50FS-1M | JYEBAO | SMA-02 | 04/10/09 |
| Spectrum Analyzer | 8564E | HP | 3720A00840 | 03/17/09 |
| Microwave Preamplifier | 84125C | HP | US36433002 | 05/05/09 |
| Horn Antenna | 3115 | EMCO | 9104-3668 | 08/06/09 |
| Standard Guide Horn Antenna | 84125-80008 | HP | 18-26.5GHz | 03/14/09 |
| Standard Guide Horn Antenna | 84125-80001 | HP | 26.5-40GHz | 05/12/09 |
| Horn Antenna | 1196E (3115) | HP (EMCO) | 9704-5178 | 08/13/09 |
| Pre-amplifier | PA2F | TRC | 2F1GZ | 04/10/09 |
| Coaxial Cable (3 miter) | A30A30-0058-50FST118 | JYEBAO | MSA-05 | 04/10/09 |
| Coaxial Cable (1 meter) | A30A30-0058-50FST118 | JYEBAO | MSA-04 | 04/10/09 |

5.3 Test Result of Radiated Emissions

The peak values of fundamental emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following.

Testing room : Temperature : 25 ° C Humidity : 73 % RH

Fundamental Emissions

| Channel | Frequency (MHz) | A. P. (H/V) | A.H. (m) | Table (degree) | Peak (dBμV/m) | Duty Cycle | True Value (dBμV/m) | Limit (dBμV) | Margin (dBμV) |
|---------|-----------------|-------------|----------|----------------|---------------|------------|---------------------|--------------|---------------|
| Lowest | 2402 | H | 1.00 | 81 | 90.22 | -20.00 | 70.22 | 94.00 | -23.78 |
| | | V | 1.00 | 478 | 97.88 | -20.00 | 77.88 | 94.00 | -16.12 |
| Middle | 2441 | H | 1.00 | 136 | 89.49 | -20.00 | 69.49 | 94.00 | -24.51 |
| | | V | 1.00 | 118 | 97.83 | -20.00 | 77.83 | 94.00 | -16.17 |
| Highest | 2479 | H | 1.00 | 90 | 89.60 | -20.00 | 69.60 | 94.00 | -24.40 |
| | | V | 1.00 | 134 | 97.43 | -20.00 | 77.43 | 94.00 | -16.57 |

Note:

1. A. P. means antenna polarization, horizontal and vertical.
2. A. H. means antenna height.
3. Table means turntable turning position.
4. Peak amplitude means the fundamental emission measured.
5. True Value = Peak Value + Duty Cycle
6. Margin = True Value – Limit

5.4 Test Result of Spurious Radiated Emissions

The highest peak values of radiated emissions from the EUT at various antenna heights, antenna polarization, EUT orientation, etc. are recorded on the following.

Testing room : Temperature : 25 °C Humidity : 73% RH

Radiated Emissions of Horizontal for 30MHz to 25GHz [Lowest Channel]

| Radiated Emission | | | | CF | Peak Value | Duty Cycle | True Value | FCC Class B | |
|-------------------|------------------|-------------|-------|-------|------------|------------|------------|-----------------------|-------------|
| Frequency (MHz) | Amplitude (dBμV) | Ant. H. (m) | Angle | (dB) | (dBμV/m) | (dB) | (dBμV/m) | Limit (Avg.) (dBμV/m) | Margin (dB) |
| 192.47 | 36.38 | 1.00 | 175 | -3.63 | 32.75 | --- | 32.75 | 43.50 | -10.75 |
| 409.51 | 33.99 | 1.00 | 199 | -0.65 | 33.34 | --- | 33.34 | 46.00 | -12.66 |
| 825.40 | 31.24 | 1.00 | 217 | 12.46 | 43.70 | --- | 43.70 | 46.00 | -2.30 |
| 1600.80 | 40.14 | 1.00 | 209 | 14.32 | 54.46 | -20.00 | 34.46 | 53.96 | -19.50 |
| 3202.08 | 38.33 | 1.00 | 173 | 11.40 | 49.73 | -20.00 | 29.73 | 53.96 | -24.23 |
| 7203.54 | 38.61 | 1.00 | 104 | 9.91 | 48.52 | -20.00 | 28.52 | 53.96 | -25.44 |
| 19214.79 | 48.32 | 1.00 | 201 | 1.60 | 49.92 | -20.00 | 29.92 | 53.96 | -24.04 |
| 24020.83 | 45.99 | 1.00 | 274 | 3.14 | 49.13 | -20.00 | 29.13 | 53.96 | -24.83 |

Radiated Emissions of Vertical for 30MHz to 25GHz [Lowest Channel]

| Radiated Emission | | | | CF | Peak Value | Duty Cycle | True Value | FCC Class B | |
|-------------------|------------------|-------------|-------|-------|------------|------------|------------|-----------------------|-------------|
| Frequency (MHz) | Amplitude (dBμV) | Ant. H. (m) | Angle | (dB) | (dBμV/m) | (dB) | (dBμV/m) | Limit (Avg.) (dBμV/m) | Margin (dB) |
| 168.22 | 33.16 | 1.00 | 225 | -4.10 | 29.06 | --- | 29.06 | 43.50 | -14.44 |
| 192.47 | 34.92 | 1.00 | 145 | -3.63 | 31.29 | --- | 31.29 | 43.50 | -12.21 |
| 825.40 | 31.13 | 1.00 | 197 | 12.46 | 43.59 | --- | 43.59 | 46.00 | -2.41 |
| 1602.08 | 35.66 | 1.00 | 148 | 14.30 | 49.96 | -20.00 | 29.96 | 53.96 | -24.00 |
| 3201.58 | 40.83 | 1.00 | 360 | 11.40 | 52.23 | -20.00 | 32.23 | 53.96 | -21.73 |
| 7207.55 | 45.75 | 1.00 | 275 | 9.94 | 55.69 | -20.00 | 35.69 | 53.96 | -18.27 |
| 12012.71 | 39.60 | 1.00 | 25 | 10.01 | 49.61 | -20.00 | 29.61 | 53.96 | -24.35 |
| 19214.79 | 46.32 | 1.00 | 340 | 1.60 | 47.92 | -20.00 | 27.92 | 53.96 | -26.04 |

Radiated Emissions of Horizontal for 30MHz to 25GHz [Middle Channel]

| Radiated Emission | | | | CF | Peak Value | Duty Cycle | True Value | FCC Class B | |
|-------------------|------------------|-------------|-------|-------|------------|------------|------------|-----------------------|-------------|
| Frequency (MHz) | Amplitude (dBμV) | Ant. H. (m) | Angle | (dB) | (dBμV/m) | (dB) | (dBμV/m) | Limit (Avg.) (dBμV/m) | Margin (dB) |
| 193.69 | 37.96 | 1.00 | 283 | -3.58 | 34.38 | --- | 34.38 | 43.50 | -9.12 |
| 433.76 | 34.07 | 1.00 | 205 | 0.45 | 34.52 | --- | 34.52 | 46.00 | -11.48 |
| 825.40 | 31.24 | 1.00 | 215 | 12.46 | 43.70 | --- | 43.70 | 46.00 | -2.30 |
| 1626.79 | 40.83 | 1.00 | 220 | 13.91 | 54.74 | -20.00 | 34.74 | 53.96 | -19.22 |
| 7322.60 | 40.28 | 1.00 | 191 | 10.32 | 50.60 | -20.00 | 30.60 | 53.96 | -23.36 |
| 19526.46 | 48.16 | 1.00 | 289 | 1.70 | 49.86 | -20.00 | 29.86 | 53.96 | -24.10 |
| 21970.21 | 46.99 | 1.00 | 112 | 2.95 | 49.94 | -20.00 | 29.94 | 53.96 | -24.02 |
| 24410.42 | 47.99 | 1.00 | 51 | 3.10 | 51.09 | -20.00 | 31.09 | 53.96 | -22.87 |

Radiated Emissions of Vertical for 30MHz to 25GHz [Middle Channel]

| Radiated Emission | | | | CF | Peak Value | Duty Cycle | True Value | FCC Class B | |
|-------------------|------------------|-------------|-------|-------|------------|------------|------------|-----------------------|-------------|
| Frequency (MHz) | Amplitude (dBμV) | Ant. H. (m) | Angle | (dB) | (dBμV/m) | (dB) | (dBμV/m) | Limit (Avg.) (dBμV/m) | Margin (dB) |
| 192.47 | 34.97 | 1.00 | 133 | -3.63 | 31.34 | --- | 31.34 | 43.50 | -12.16 |
| 408.30 | 30.22 | 1.00 | 297 | -0.70 | 29.52 | --- | 29.52 | 46.00 | -16.48 |
| 825.40 | 30.25 | 1.00 | 197 | 12.46 | 42.71 | --- | 42.71 | 46.00 | -3.29 |
| 1626.78 | 37.00 | 1.00 | 247 | 13.91 | 50.91 | -20.00 | 30.91 | 53.96 | -23.05 |
| 3253.59 | 40.00 | 1.00 | 3 | 11.65 | 51.65 | -20.00 | 31.65 | 53.96 | -22.31 |
| 4061.87 | 48.28 | 1.00 | 239 | 1.45 | 49.73 | -20.00 | 29.73 | 53.96 | -24.23 |
| 7322.62 | 44.45 | 1.00 | 92 | 10.32 | 54.77 | -20.00 | 34.77 | 53.96 | -19.19 |
| 24410.42 | 46.82 | 1.00 | 247 | 3.10 | 49.92 | -20.00 | 29.92 | 53.96 | -24.04 |

Radiated Emissions of Horizontal for 30MHz to 25GHz [Highest Channel]

| Radiated Emission | | | | CF | Peak Value | Duty Cycle | True Value | FCC Class B | |
|-------------------|------------------|-------------|-------|-------|------------|------------|------------|-----------------------|-------------|
| Frequency (MHz) | Amplitude (dBμV) | Ant. H. (m) | Angle | (dB) | (dBμV/m) | (dB) | (dBμV/m) | Limit (Avg.) (dBμV/m) | Margin (dB) |
| 192.47 | 37.14 | 1.00 | 163 | -3.63 | 33.51 | --- | 33.51 | 43.50 | -9.99 |
| 409.51 | 37.11 | 1.00 | 187 | -0.65 | 36.46 | --- | 36.46 | 46.00 | -9.54 |
| 825.40 | 31.46 | 1.00 | 210 | 12.46 | 43.92 | --- | 43.92 | 46.00 | -2.08 |
| 1652.12 | 42.50 | 1.00 | 209 | 13.52 | 56.02 | -20.00 | 36.02 | 53.96 | -17.94 |
| 7439.17 | 39.94 | 1.00 | 188 | 10.33 | 50.27 | -20.00 | 30.27 | 53.96 | -23.69 |
| 19831.04 | 47.49 | 1.00 | 267 | 1.90 | 49.39 | -20.00 | 29.39 | 53.96 | -24.57 |
| 22310.21 | 45.99 | 1.00 | 300 | 3.30 | 49.29 | -20.00 | 29.29 | 53.96 | -24.67 |
| 24789.37 | 47.16 | 1.00 | 92 | 2.23 | 49.39 | -20.00 | 29.39 | 53.96 | -24.57 |

Radiated Emissions of Vertical for 30MHz to 25GHz [Highest Channel]

| Radiated Emission | | | | CF | Peak Value | Duty Cycle | True Value | FCC Class B | |
|-------------------|------------------|-------------|-------|-------|------------|------------|------------|-----------------------|-------------|
| Frequency (MHz) | Amplitude (dBμV) | Ant. H. (m) | Angle | (dB) | (dBμV/m) | (dB) | (dBμV/m) | Limit (Avg.) (dBμV/m) | Margin (dB) |
| 192.47 | 35.76 | 1.00 | 160 | -3.63 | 32.13 | --- | 32.13 | 43.50 | -11.37 |
| 409.51 | 32.39 | 1.00 | 303 | -0.65 | 31.74 | --- | 31.74 | 46.00 | -14.26 |
| 825.40 | 29.76 | 1.00 | 258 | 12.46 | 42.22 | --- | 42.22 | 46.00 | -3.78 |
| 1652.12 | 39.33 | 1.00 | 110 | 13.52 | 52.85 | -20.00 | 32.85 | 53.96 | -21.11 |
| 3304.25 | 39.83 | 1.00 | 20 | 11.89 | 51.72 | -20.00 | 31.72 | 53.96 | -22.24 |
| 4128.33 | 48.11 | 1.00 | 186 | 1.57 | 49.68 | -20.00 | 29.68 | 53.96 | -24.28 |
| 7438.57 | 44.28 | 1.00 | 360 | 10.33 | 54.61 | -20.00 | 34.61 | 53.96 | -19.35 |
| 22310.21 | 44.99 | 1.00 | 308 | 3.30 | 48.29 | -20.00 | 28.29 | 53.96 | -25.67 |

Note:

1. Margin = Amplitude – limit, *if margin is minus means under limit.*
2. Correction factor = Antenna factor + (Cable Loss – Amplitude gain)
3. Peak Value = Reading Amplitude + Correction Factors
4. True Value = Peak Value + Duty Cycle

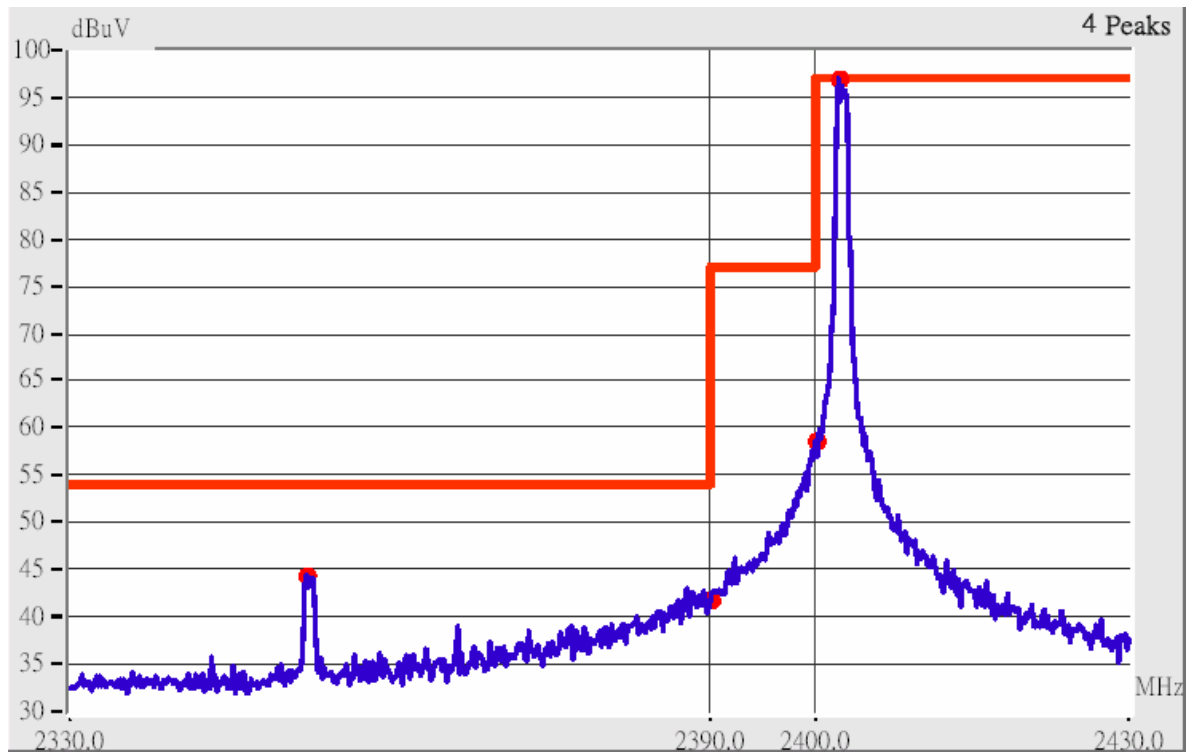
5.5 Test Result of the Bandedge

§ 15.249 (c) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

We perform this section by the *radiated manner*, the RBW is set to 100kHz and VBW>RBW. We'd made the observation *up to 10th harmonics and the criterion is all the harmonic/spurious emissions must be 50dB below the highest emission level measured*. If the emissions fall in the restricted bands stated in the Part15.205(a) must also *comply with the radiated emission limits specified in Part15.209(a)*. (Peak mode: RBW=VBW=1MHz, Average mode: RBW=1MHz; VBW=10Hz)

The following pages show our observations referring to the lowest channel and highest channel respectively. Test Condition & Setup: same as 4.1 to 4.2.

Lowest

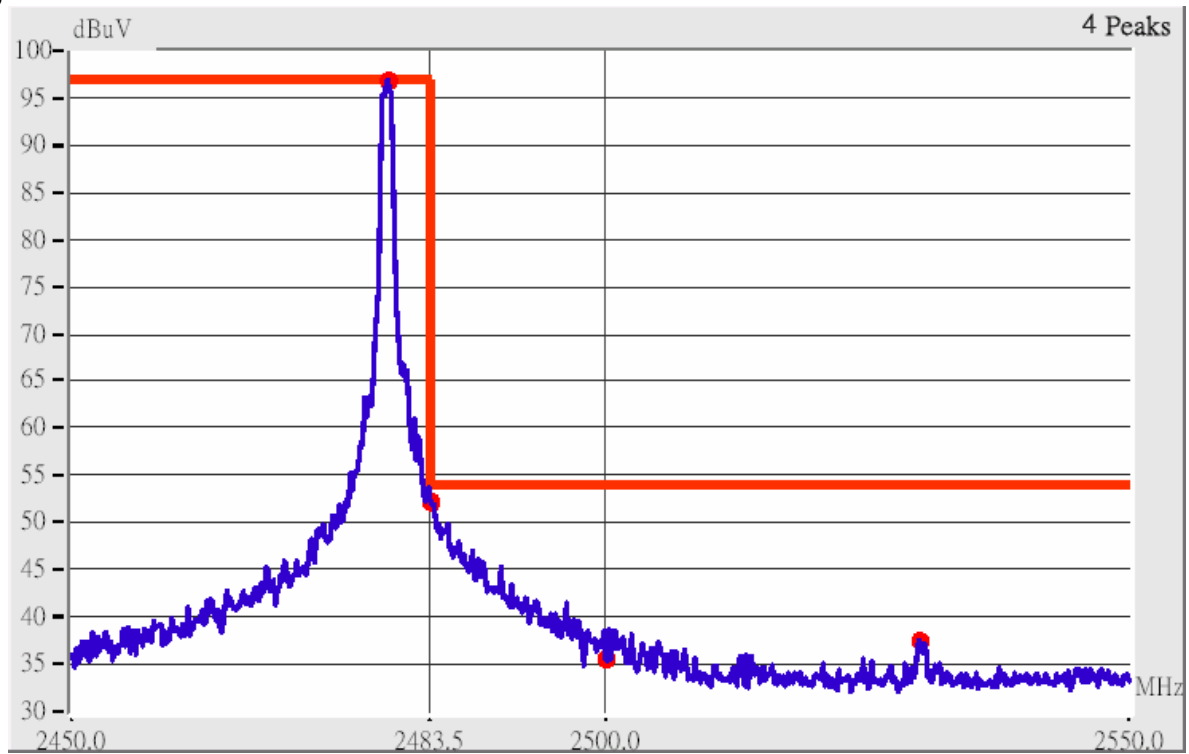


This is the hard copy of our bandedge measurement generated by our bandedge testing program. The plot shown above is the bandedge of lowest channel.

1. The lobe left by the fundamental side is already 50dB below the highest emission level.
2. The emissions recorded in the restricted band is do comply with the Part 15.209(a) – as below.

| <i>Radiated Emission</i> | | | | <i>CF</i> | <i>Peak Value</i> | <i>Duty Cycle</i> | <i>True Value</i> | <i>FCC Class B</i> | |
|--------------------------|---------|-------------|-------|-----------|-------------------|-------------------|-------------------|-----------------------|-------------|
| Frequency (MHz) | Ant. P. | Ant. H. (m) | Angle | (dB) | (dBμV/m) | (dB) | (dBμV/m) | Limit (Avg.) (dBμV/m) | Margin (dB) |
| 2351.78 | Hor | 1.00 | 64 | 9.07 | 45.07 | -20.00 | 25.07 | 53.96 | -28.89 |
| 2387.85 | Hor | 1.00 | 114 | 9.18 | 51.34 | -20.00 | 31.34 | 53.96 | -22.62 |
| 2389.96 | Hor | 1.00 | 122 | 9.18 | 53.52 | -20.00 | 33.52 | 53.96 | -20.44 |
| 2352.48 | Ver | 1.00 | 187 | 9.08 | 53.58 | -20.00 | 33.58 | 53.96 | -20.38 |
| 2387.25 | Ver | 1.00 | 82 | 9.17 | 59.67 | -20.00 | 39.67 | 53.96 | -14.29 |
| 2389.91 | Ver | 1.00 | 144 | 9.18 | 61.68 | -20.00 | 41.68 | 53.96 | -12.28 |

Highest



This is the hard copy of our bandedge measurement generated by our bandedge testing program. The plot shown above is the bandedge of highest channel.

1. The lobe right by the fundamental side is already 50dB below the highest emission level.
2. The emissions recorded in the restricted band is do comply with the Part 15.209(a) – as below

| <i>Radiated Emission</i> | | | | <i>CF</i> | <i>Peak Value</i> | <i>Duty Cycle</i> | <i>True Value</i> | <i>FCC Class B</i> | |
|--------------------------|---------|-------------|-------|-----------|-------------------|-------------------|-------------------|-----------------------|-------------|
| Frequency (MHz) | Ant. P. | Ant. H. (m) | Angle | (dB) | (dBμV/m) | (dB) | (dBμV/m) | Limit (Avg.) (dBμV/m) | Margin (dB) |
| 2483.50 | Hor | 1.00 | 198 | 9.44 | 59.94 | -20.00 | 39.94 | 53.96 | -14.02 |
| 2486.42 | Hor | 1.00 | 224 | 9.45 | 59.29 | -20.00 | 39.29 | 53.96 | -14.67 |
| 2499.89 | Hor | 1.00 | 221 | 9.49 | 50.49 | -20.00 | 30.49 | 53.96 | -23.47 |
| 2502.34 | Hor | 1.00 | 224 | 9.49 | 49.99 | -20.00 | 29.99 | 53.96 | -23.97 |
| 2483.50 | Ver | 1.00 | 206 | 9.44 | 67.44 | -20.00 | 47.44 | 53.96 | -6.52 |
| 2487.23 | Ver | 1.00 | 213 | 9.45 | 65.45 | -20.00 | 45.45 | 53.96 | -8.51 |
| 2500.01 | Ver | 1.00 | 192 | 9.49 | 53.16 | -20.00 | 33.16 | 53.96 | -20.80 |
| 2503.39 | Ver | 1.00 | 218 | 9.50 | 55.16 | -20.00 | 35.16 | 53.96 | -18.80 |