| | |
|---|---|
| Report No. | G2115510 |
| Specifications<br>Test Method | FCC Part 15.231, Certification<br>ANSI C63.4 1992 |
| Applicant | POWERTECH INDUSTRIAL CO., LTD. |
| Applicant address | 10F, No. 403, Chang Shan Road, Sec. 2, Chung Ho City, Taipei Hsien, Taiwan, R.O.C. |
| Items tested<br>Model No. | Wireless Outdoor Motion-Sensing Transmitter<br>PT462A；PT462B (Sample # G21509) |
| Results<br>Date | **Compliance** (As detailed within this report)<br>03/21/2003 (month / day / year) (Sample received)<br>04/11/2003 (month / day / year) (Test) |
| Prepared by | Project Engineer (Jack Tsai) |
| Authorized by | General Manager (Frank Tsai) |
| Issue date | *April 15, 2003* (month / day / year) |
| **Modifications** | **None** |
| Tested by | Training Research Co., Ltd. |
| Office at | 1F, No. 255, Nan Yang Street, Hsichih, Taipei Hsien 221, Taiwan |
| Chamber at | 1F, No. 255, Nan Yang Street, Hsichih, Taipei Hsien 221, Taiwan |

***Conditions of issue:***

**(1)** ***This test report shall not be reproduced except in full, without written approval of TRC. And the test result contained within this report only relate to the sample submitted for testing.***

**(2)** ***This report must not be used by the client to claim product endorsement by NVLAP or any agency of U.S. Government.***

★ ***NVLAP LAB CODE: 200174-0***

★ ***FCC ID: NHS- PT462***

# Contents

# *Chapter 1 GENERAL*

## *1.1 Introduction*

The following measurement report is submitted on behalf of applicant in support of an International Periodic Radiator certification with Part 2 Subpart J and Part 15 Subpart A, Subpart B and C of the Commission's Rules and Regulations.

## *1.2 Description of EUT*

| | | |
|---|---|---|
| **Product Name** | : | Wireless Outdoor Motion-Sensing Transmitter |
| **Model No.** | : | PT462A, PT462B |
| **FCC ID** | : | NHS–PT462 |
| **Frequency Range** | : | 319.10MHz ~ 319.90MHz |
| **Power Type** | : | Powered by (1)AC Source and (2)9V Battery |

## *1.3 Test method*

The fundamental frequency of transmitter emitted is due to a press on button of the EUT. **The emitting time of fundamental frequency is less than 5 seconds** pursuant to FCC Part 15.231(a). 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.

## *1.4 Description of Support Equipment*

| | | |
|---|---|---|
| **Bulb** | : | **60Watt, 100Watt** |

## *1.5 Test Procedure*

All measurements contained in this report were performed according to the techniques described in measurement procedure of ANSI C63.4 1992 section 13

## *1.6 Location of the Test Site*

The radiated emissions measurements required by the rules were performed on the **three-meter**, **Anechoic Chamber (Registration Number: 93906)** maintained by *Training Research Co., Ltd.* 1F, No. 255, Nan Yang Street, Hsi-chih, 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 a anechoic chamber also located at Training Research Co., Ltd.

1F, No. 255, Nan Yang Street, Hsi-chih, 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.

## *1.7 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 were chosen as that which produced highest emission levels. However, only those conditions that the EUT was considered likely encounter in normal use were investigated.

# *Chapter 2 TRANSMITTER DUTY CYCLE MEASUREMENTS*

## *2.1 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 pules 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:

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

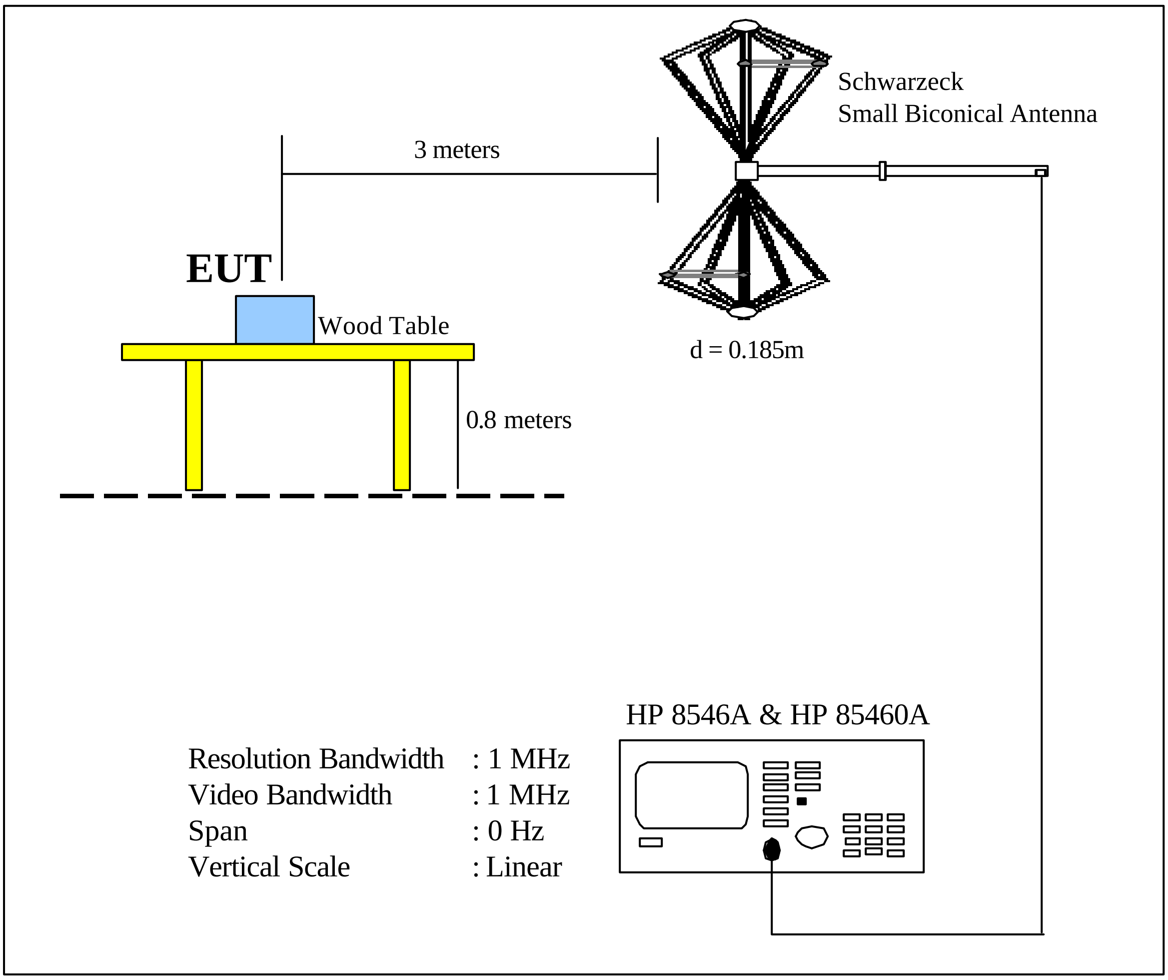
To calculate the actual field intensity, the duty cycle correction factor in decibel is needed for later use and be obtained from following conversion:

Duty Cycle Correction Factor (dB) = 20 X $\text{Log}_{10}$ Duty Cycle

## *2.2 List of Test Instruments*

| Instrument Name | Model No. | Brand | Serial No. | Last time | Next time |
|---|---|---|---|---|---|
| EMI Receiver | 8546A | H P | 3520A00242 | 06/28/02 | 06/28/03 |
| RF Filter Section | 85460A | H P | 3448A00217 | 06/28/02 | 06/28/03 |
| Small Biconical | UBAA9114 with BBVU9135 | Schwarzeck | 127 | 05/07/02 | 05/07/03 |

## *3.3 Test Instruments Configuration*




## *3.4 Test Result*

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

Total on interval in a complete pulse train

= 30.00 mS

Length of a complete pulse train

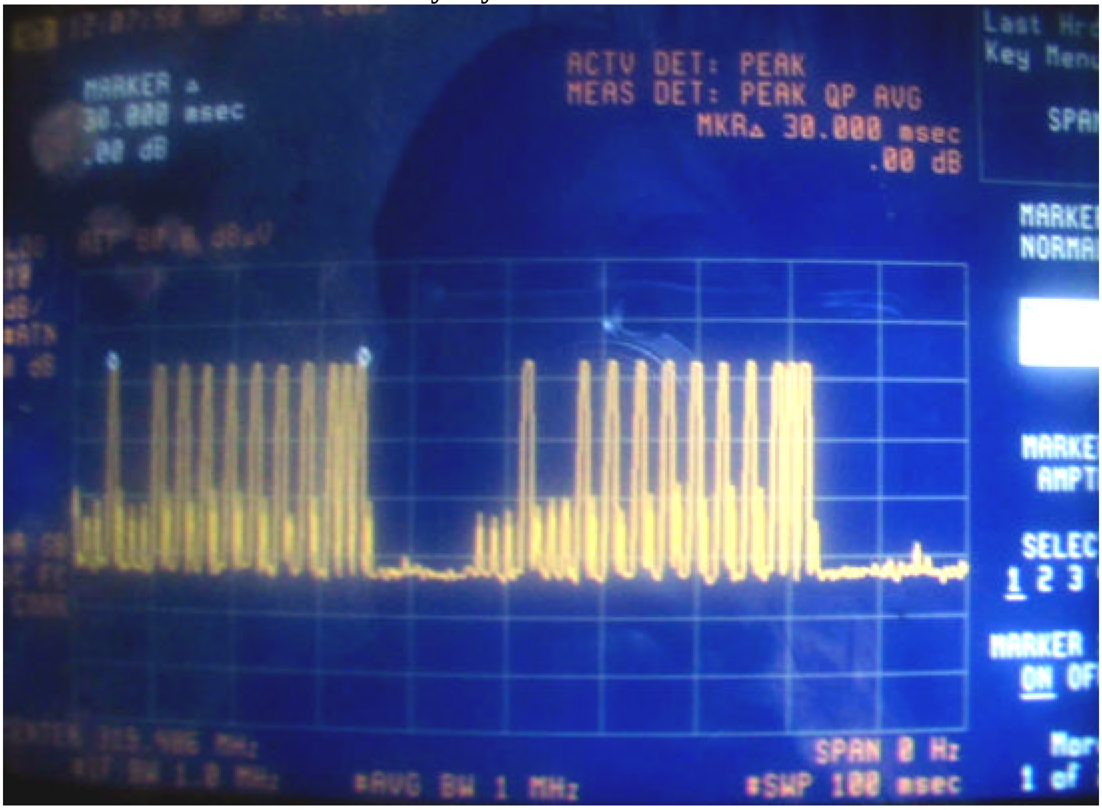
= 47.25 mS

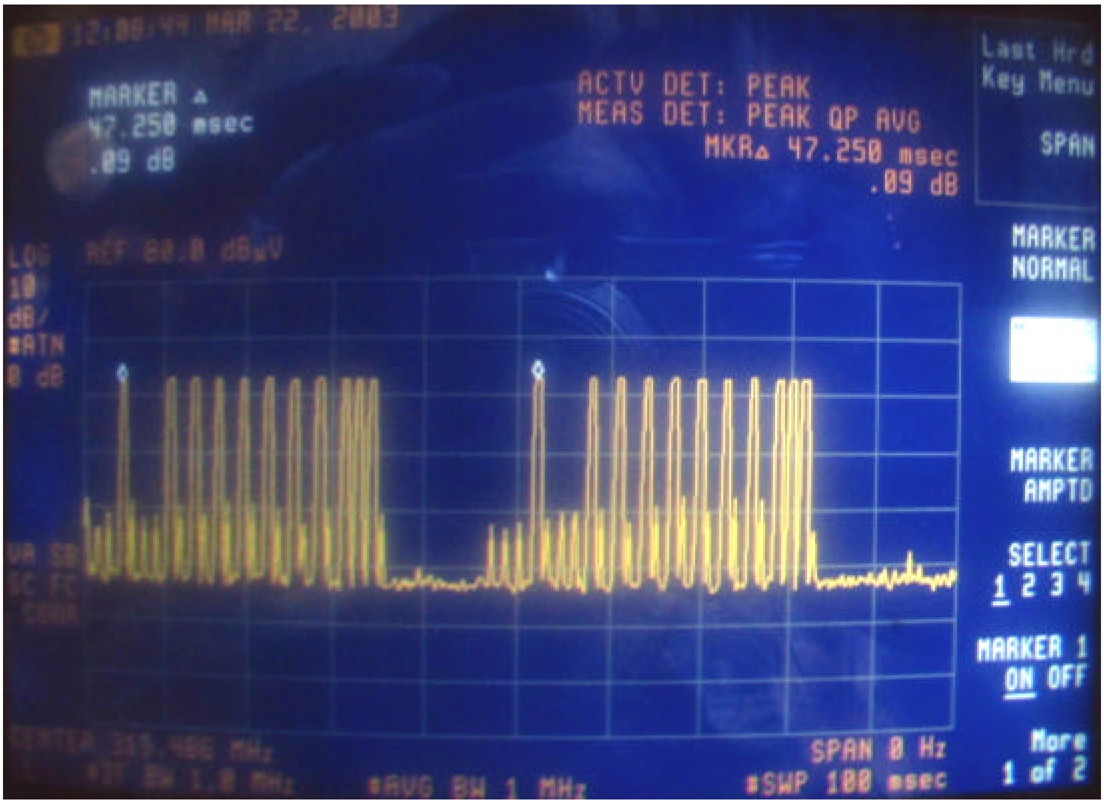
Duty Cycle (%) = 30.00 ms / 47.25 ms * 100% = 0.63492

Duty Cycle Correction Factor (dB) = 20 * Log (0.63492) = -3.946

The picture are attached on the following page.

**Duty Cycle Test Picture**



# *Chapter 3 TRANSMITTER BANDWIDTH MEASUREMENTS, FCC PART 15.231(C)*

## *3.1 Test Condition & Setup*

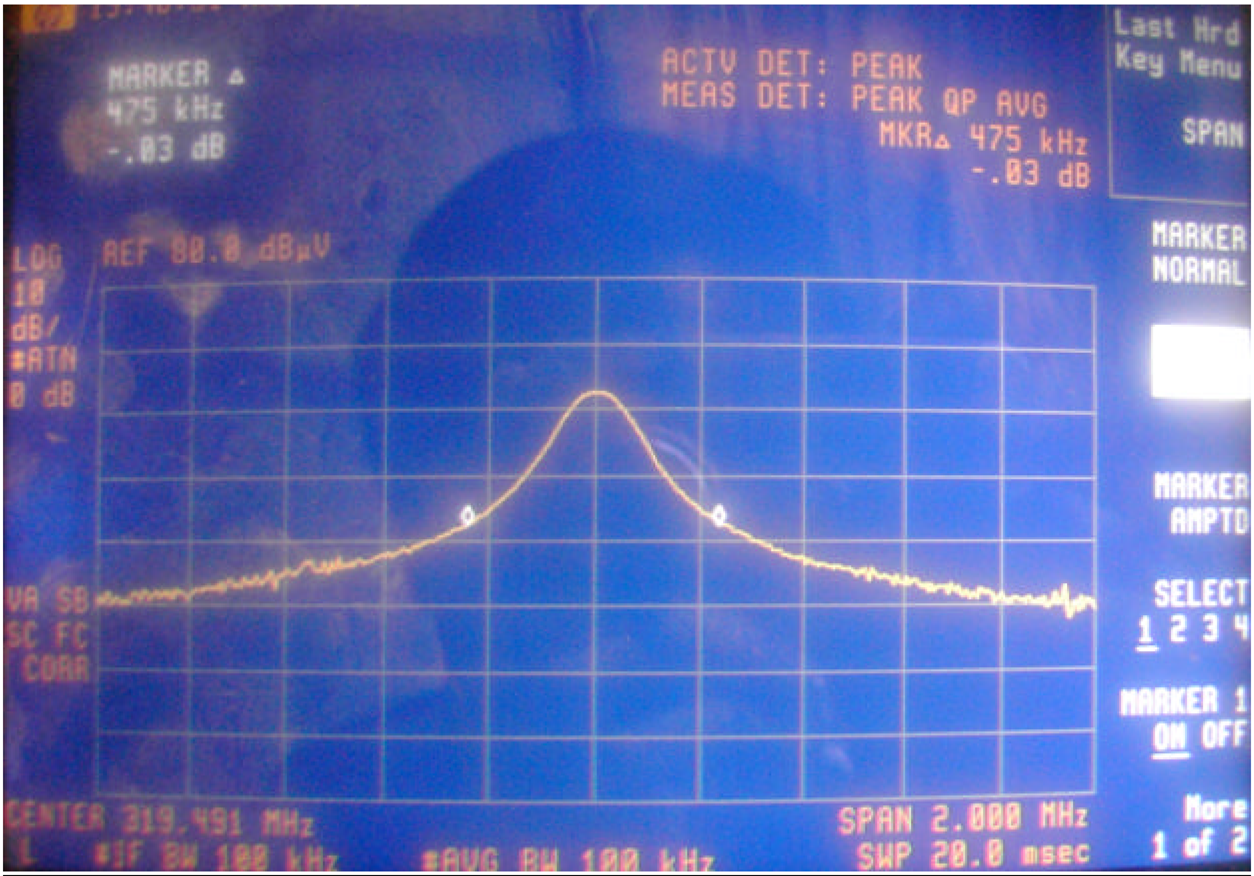
The test setup used to transmitter bandwidth measurement was the same with duty cycle test, except there is no need for digital oscilloscope in the bandwidth test. For detailed description, please reference to section 3.1, 3.2 and 3.3 on page 7 and 8 of this report.

The resolution bandwidth of the spectrum analyzer was set to 100KHz, which is greater 5 percent of the maximum permitted bandwidth that required by the ANSI C63.4 section13. Bandwidth is determined at the point 20dB down from the modulator carrier. The maximum permitted bandwidth specified by the rule was 0.25% of the center frequency of the EUT, e.g. 319.50MHz * 0.25% = 798.75kHz. The detector function was set to peak and hold mode to clearly observe the components.

## *3.2 Test Result*

Measured Transmitter Bandwidth: 475 kHz
Permitted Maximum Bandwidth: 798.75 kHz
A picture attached on the following page.

**Picture of the Transmitter Bandwidth Measurement**





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# *Chapter 4 CONDUCTED EMISSIONS MEASUREMENTS*

## *4.1 Test condition and setup*

All the equipment is placed and setup according to ANSI C63.4--1992.

The EUT is assembled on a wooden table, which is 80 cm high and placed 40 cm from the back-wall, which is a vertical conducting plane. One LISN is for EUT, the other LISN is for support equipment. They are all placed on the conductive ground. The EUT' s LISN connect a line switch box for selecting L1 or L2, then connect to a preamplifier and spectrum.

The spectrum scans from 150KHz to 30MHz. Conducted emission levels are detected at *maximum peak mode*. But if the maximum peak mode failed or over *average limit*, it will be measured by *average detection mode*.

While testing the worst-emission plot printed in the *peak detection mode*, and there are up to 6 highest emissions to be recorded. The plot is kept as the original data and not included in the test report.

## *4.2 List of test Instrument*

| | | | | **Calibration Date** | |
|---|---|---|---|---|---|
| Instrument Name | Model No. | Brand | Serial No. | Last time | Next time |
| EMI Receiver | 8546A | H P | 3520A00242 | 06/28/02 | 06/28/03 |
| RF Filter Section | 85460A | H P | 3448A00217 | 06/28/02 | 06/28/03 |
| LISN (EUT) | LISN-01 | TRC | 9912-03,04 | 06/04/02 | 06/04/03 |
| LISN (Support E.) | LISN-01 | TRC | 9912-05 | 07/15/02 | 07/15/03 |
| Auto Switch Box (< 30MHz) | ASB-01 | TRC | 9904-01 | 11/20/02 | 11/20/03 |

The level of confidence of 95%, the uncertainty of measurement of conducted emission is ± 2.02 dB.

## *4.3 Test Result*

Testing room : Temperature : 19.6 ° C Humidity : 52.3 % RH

***Line 1***

| Frequency (kHz) | READING AMPLITUDE | | | LIMIT | | Margin (dB) |
|---|---|---|---|---|---|---|
| | Peak (dBmV) | Quasi-Peak (dBmV) | Average (dBmV) | Quasi-Peak (dBmV) | Average (dBmV) | |
| 210.000 | 46.77 | --- | --- | 64.29 | 54.29 | -7.52 |
| 352.000 | 35.24 | --- | --- | 60.23 | 50.23 | -14.99 |
| 409.000 | 40.60 | --- | --- | 58.60 | 48.60 | -8.00 |
| 452.000 | 36.31 | --- | --- | 57.37 | 47.37 | -11.06 |
| 504.000 | 34.56 | --- | --- | 56.00 | 46.00 | -11.44 |
| 558.000 | 28.92 | --- | --- | 56.00 | 46.00 | -17.08 |

***Line 2***

| Frequency (kHz) | READING AMPLITUDE | | | LIMIT | | Margin (dB) |
|---|---|---|---|---|---|---|
| | Peak (dBmV) | Quasi-Peak (dBmV) | Average (dBmV) | Quasi-Peak (dBmV) | Average (dBmV) | |
| 208.000 | 47.38 | --- | --- | 64.34 | 54.34 | -6.96 |
| 352.000 | 35.14 | --- | --- | 60.23 | 50.23 | -15.09 |
| 409.000 | 41.05 | --- | --- | 58.60 | 48.60 | -7.55 |
| 452.000 | 36.56 | --- | --- | 57.37 | 47.37 | -10.81 |
| 504.000 | 34.82 | --- | --- | 56.00 | 46.00 | -11.18 |
| 558.000 | 27.44 | --- | --- | 56.00 | 46.00 | -18.56 |

****The reading amplitudes are all under limit.***

# *Chapter 5 RADIATED EMISSIONS MEASUREMENTS*

## *5.1 General Configuration*

Prior to final testing, the EUT was placed in a three-meter annechoic chamber and scanned at a close 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 that produced the highest emissions was noted so it could be reproduced later during the final tests. This was done to ensure that the final measurements would demonstrate the worst-case interference potential of the EUT.

## *5.2 Test Condition and Setup*

Final radiation measurements were made on a three-meter, annechoic chamber. The EUT was placed on a nonconductive turntable that is 0.8 meters height, top surface 1.0 x 1.5 meter. The spectrum was examined from 30MHz to 3.5GHz order to check the whole spectrum that could be generated from the EUT. During the test, EUT was set to transmit continuously and the switch was positioned to yield the maximum duty cycle that had measured before radiated emissions test. The test battery was a totally brand-new one.

A nonconductive material surrounded the EUT to supporting the EUT for standing on three orthogonal planes. At each condition, 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 polarizations.

**Note: Setting the EUT to transmit continuously was just for the testing**

The field strength below 1GHz was measured by SCHWARZECK Small Biconical Antenna (model: UBAA9114 with BBVU9135) at 3 meter, and the EMCO Double Ridged Guide Antenna (model: 3115) was used in frequencies 1 ~ 3.5GHz at a distance of 3 meter.

Appropriate preamplifiers were used for improving sensitivity and precautions were taken to avoid overloading or desensitizing the spectrum analyzer. No post-detector video filters were used in the test. The spectrum analyzer' s 6dB bandwidth was set to 3M and the spectrum was operated in the peak detection mode, for frequencies both below and up 1GHz. The peak levels were obtained by subtracting the duty cycle correction factor from the peak readings.

The following procedures were used to convert the emission levels measured in decibels referenced to 1 micro-volt (dBμV) into field intensity in micro-volts pre meter (μV/m).

(1) The actual field intensity in decibels referenced to 1 micro-volt per meter (dBμV/m) is determined by algebraically adding the measured reading in dBμV, the correction factor(dB), duty cycle correction factor (dB), and distance extrapolation factor (dB) at the appropriate frequency:

**30 MHz ~ 1GHz**:
Correction factor = Antenna factor + (Cable loss – Amplitude gain)
Peak Value = Reading Amplitude + Correction Factors
True Value = Peak Value + Duty Cycle

**Above 1GHz**
Correction Factors = Antenna Factor + (Cable Loss – Amplifier Gain)
Peak Value = Reading Amplitude + Correction Factors
True Value = Peak Value + Duty Cycle

(2) The field intensity in micro-volts per meter can then be determined by the following equation:

$FI(\mu V/m) = 10^{FI(dB\mu V/m)/20}$

The FCC specified emission limits were calculated according the EUT operating frequency and obtained by following linear interpolation equations:

**(a) For fundamental frequency:**

$f_{EUT}$ : EUT Operating Frequency Emission Limit (μV/m)

$$= [f_{EUT}(MHz) - 260(MHz)] \times \frac{12500(\mu V/m) - 3750(\mu V/m)}{470(MHz) - 260(MHz)} + 3750(\mu V/m)$$

**(b) For spurious frequencies:**

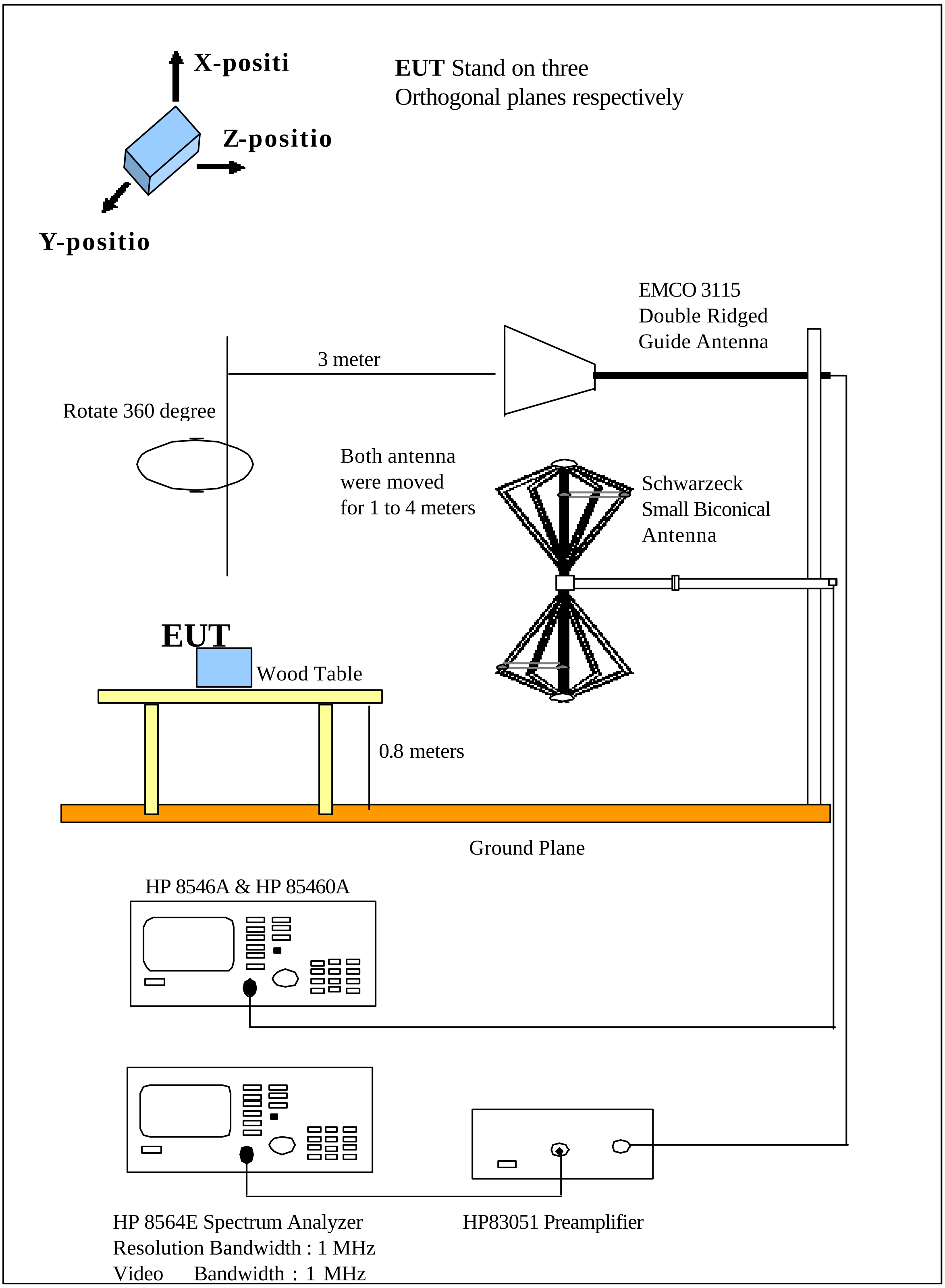
$f_{EUT}$ : EUT Operating Frequency Emission Limit (μV/m)

$$= [f_{EUT}(MHz) - 260(MHz)] \times \frac{1250(\mu V/m) - 375(\mu V/m)}{470(MHz) - 260(MHz)} + 375(\mu V/m)$$

## *5.3 List of Test Instruments*

| | | | | Calibration Date | |
|---|---|---|---|---|---|
| Instrument Name | Model No. | Brand | Serial No. | Last time | Next time |
| EMI Receiver | 8546A | H P | 3520A00242 | 06/28/02 | 06/28/03 |
| RF Filter Section | 85460A | H P | 3448A00217 | 06/28/02 | 06/28/03 |
| Small Biconical | UBAA9114<br>BBVU9135 | Schwarzeck | 127 | 05/07/02 | 05/07/03 |
| Switch/Control Unit (> 30MHz) | 3488A | HP | N/A | 11/20/02 | 11/20/03 |
| Auto Switch Box (> 30MHz) | ASB-01 | TRC | 9904-01 | 11/20/02 | 11/20/03 |
| Spectrum Analyzer | 8564E | HP | US36433002 | 08/01/02 | 08/01/03 |
| Microwave Preamplifier | 83051A | HP | 3232A00347 | 08/01/02 | 08/01/03 |
| Horn Antenna | 3115 | EMCO | 9704 – 5178 | 08/01/02 | 08/01/03 |
| Anechoic Chamber (cable calibrated together) | | | | 05/20/02 | 05/20/03 |

## *5.4 Test Instruments Configuration*





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## *5.6 Test Result of Radiated Emissions*

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

Test Conditions: Testing Room: Temperature: 19.6 ° C Humidity: 52.3 % RH

***Table 1 Radiated Emissions for 30MHz to 3.5GHz [Ant. Horizontal, X-axis]***

| Radiated Emission | | | | CF | Peak Value | Duty Cycle | True Value | FCC Class B ( 3 M ) | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Amplitude (dBµV) | Ant. H. (m) | Angle | (dB) | (dBµV/m) | (dB) | (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
| 319.50 | 77.16 | 1.00 | 299 | -1.97 | 75.19 | -3.94 | 71.25 | 75.88 | -4.63 |

***Table 2 Radiated Emissions for 30MHz to 3.5GHz [Ant. Horizontal, Y-axis]***

| Radiated Emission | | | | CF | Peak Value | Duty Cycle | True Value | FCC Class B ( 3 M ) | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Amplitude (dBµV) | Ant. H. (m) | Angle | (dB) | (dBµV/m) | (dB) | (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
| 319.50 | 71.22 | 1.00 | 274 | -1.92 | 69.30 | -3.94 | 65.36 | 75.88 | -10.52 |

***Table 3 Radiated Emissions for 30MHz to 3.5GHz [Ant. Horizontal, Z-axis]***

| Radiated Emission | | | | CF | Peak Value | Duty Cycle | True Value | FCC Class B ( 3 M ) | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Amplitude (dBµV) | Ant. H. (m) | Angle | (dB) | (dBµV/m) | (dB) | (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
| 319.50 | 76.97 | 1.00 | 287 | -1.97 | 75.00 | -3.94 | 71.06 | 75.88 | -4.82 |

***Table 4 Radiated Emissions for 30MHz to 3.5GHz [Ant. Vertical, X-axis]***

| Radiated Emission | | | | CF | Peak Value | Duty Cycle | True Value | FCC Class B ( 3 M ) | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Amplitude (dBµV) | Ant. H. (m) | Angle | (dB) | (dBµV/m) | (dB) | (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
| 319.50 | 66.71 | 1.00 | 158 | -1.92 | 64.79 | -3.94 | 60.85 | 75.88 | -15.03 |
| 639.89 | 25.64 | 1.00 | 55 | 9.95 | 35.59 | -3.94 | 31.65 | 55.88 | -24.23 |

***Table 5 Radiated Emissions for 30MHz to 3.5GHz [Ant. Vertical, Y-axis]***

| Radiated Emission | | | | CF | Peak Value | Duty Cycle | True Value | FCC Class B ( 3 M ) | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Amplitude (dBµV) | Ant. H. (m) | Angle | (dB) | (dBµV/m) | (dB) | (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
| 319.50 | 66.77 | 1.00 | 333 | -1.92 | 64.85 | -3.94 | 60.91 | 75.88 | -14.97 |

***Table 6 Radiated Emissions for 30MHz to 3.5GHz [Ant. Vertical, Z-axis]***

| Radiated Emission | | | | CF | Peak Value | Duty Cycle | True Value | FCC Class B ( 3 M ) | |
|---|---|---|---|---|---|---|---|---|---|
| Frequency (MHz) | Amplitude (dBµV) | Ant. H. (m) | Angle | (dB) | (dBµV/m) | (dB) | (dBµV/m) | Limit (dBµV/m) | Margin (dB) |
| 319.50 | 62.69 | 1.00 | 335 | -1.92 | 60.77 | -3.94 | 56.83 | 75.88 | -19.05 |
| 639.89 | 22.81 | 1.00 | 129 | 9.95 | 32.76 | -3.94 | 28.82 | 55.88 | -27.06 |

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


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