Report No.	G2115050321
Specifications Test Method	FCC Part 15.231, Certification ANSI C63.4 2003
Applicant	POWERTECH INDUSTRIAL CO., LTD.
Applicant address	10F, No. 407, Chang Shan Road, Sec. 2, Chung Ho City, Taipei Hsien, Taiwan, R.O.C.
Items tested Model No. EUT Condition	Transmitter R6G001 ☒Engineering sample; ☐Pre-production; ☐Final production (Sample # G21050321)
Results	**Compliance** (As detailed within this report)
Date	05/05/2005 (month / day / year) (Sample received) 05/30/2005 (month / day / year) (Test)
Prepared by	Project Engineer (Jack Tsai)
Authorized by	General Manager (Frank Tsai)
Issue date	*May 31, 2005* (month / day / year)
Modifications	**None**
Tested by	Training Research Co., Ltd.
Office at	No. 255, Nan Yang Street, Shijr, Taipei Hsien 221, Taiwan
Chamber at	1F, No. 255, Nan Yang Street, Shijr, Taipei Hsien 221, Taiwan

Conditions of issue :

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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 and C of the Commission's Rules and Regulations.

1.2 Description of EUT

EUT	**:**	Transmitter
Model No.	**:**	R6G001
FCC ID	**:**	NHS-R6G001
Frequency Range	**:**	319.00MHz ~ 319.95MHz
Operating Frequency	**:**	319.5MHz
Modulation Skill	**:**	AM/FM
Power Type	**:**	Powered by 12V/23A battery (L1028 battery * 1)

The fundamental frequency of transmitter emitted is due to a EUT is sensor by light. **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.

The device is setting test mode by applicant. During testing, the EUT was operated at continuous transmission mode. The EUT was adjusted at a position, which transmits the maximum emission.

1.3 Description of Support Equipment

No support equipment:

The EUT itself forms a system. No support equipment is requited for its normal operation

1.4 Test Procedure

All measurements contained in this report were performed according to the techniques described in measurement procedure of ANSI C63.4 2003 section 13

1.5 Location of the Test Site

The radiated emissions measurements required by the rules were performed on the **three-meter**, **Anechoic Chamber (FCC 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.

1.6 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.

In test, they were set in high power and continuously transmitting mode. The setting up procedure is recorded on 1.2 Test Description.

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:

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

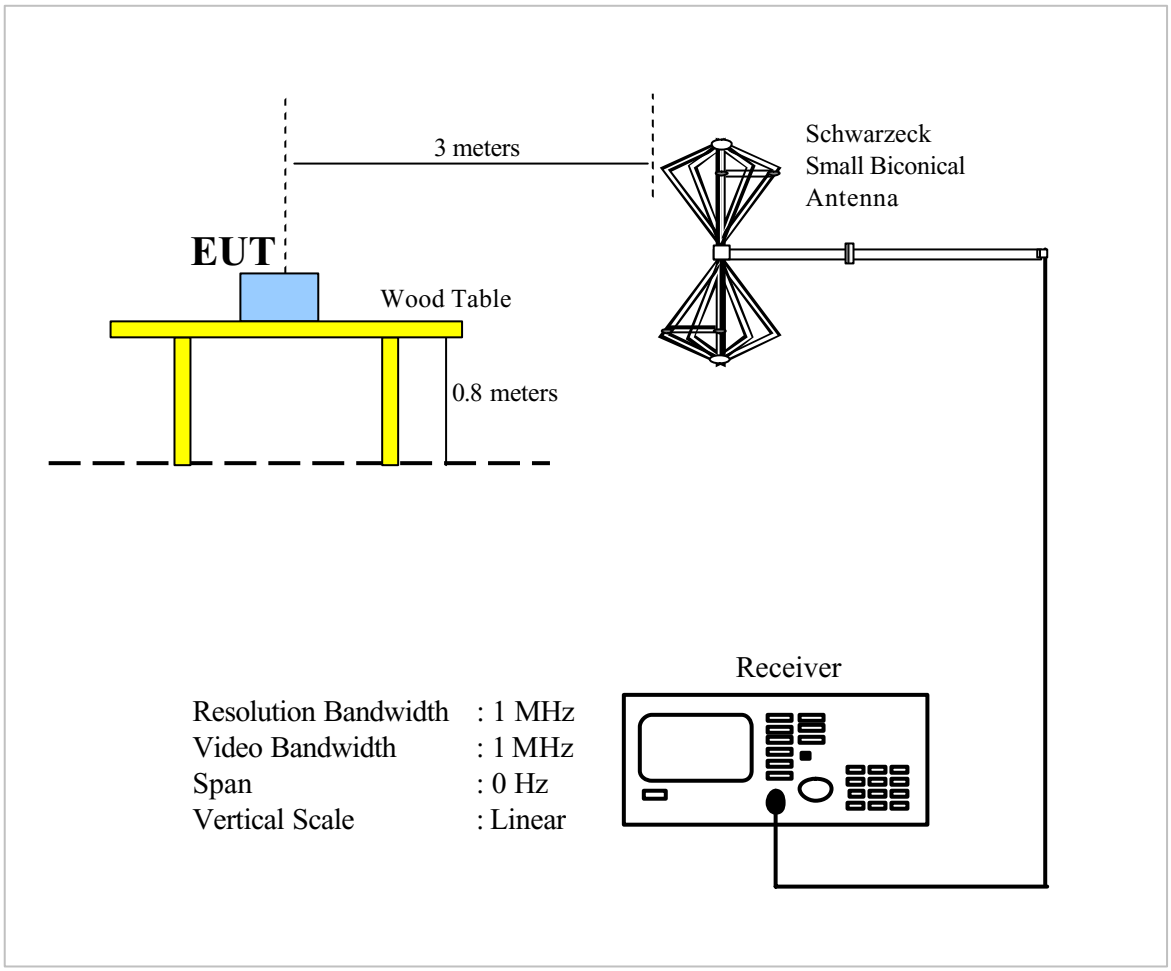
To calculate the actual field intensity, the duty cycle correction factor in decibel is needed for later use and be obtained from following conversion:

Duty Cycle Correction Factor (dB) = 20 X Log_{10} Duty Cycle

2.2 List of Test Instruments

				Calibration Date
Instrument Name	Model No.	Brand	Serial No.	Next time
EMI Receiver	8546A	H P	3520A00242	08/05/05
RF Filter Section	85460A	H P	3448A00217	08/05/05
Spectrum Analyzer	MS2665C	ANRITSU	6200175476	11/02/05
Spectrum Analyzer	8564E	HP	3720A00840	08/13/05
Microwave Preamplifier	84125C	HP	US36433002	08/13/05
Small Biconical Antenna	UBAA9114 & BBVU9135	SCHWARZECK	127	10/11/05

2.3 Test Instruments Configuration



2.4 Test Result

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

Total on interval in a complete pulse train

= 17.30ms [Wide pulse 980uS * 13 + Narrow pulse 380uS * 12, refer to page-8]

Length of a complete pulse train

= 40.20ms [refer to page-7]

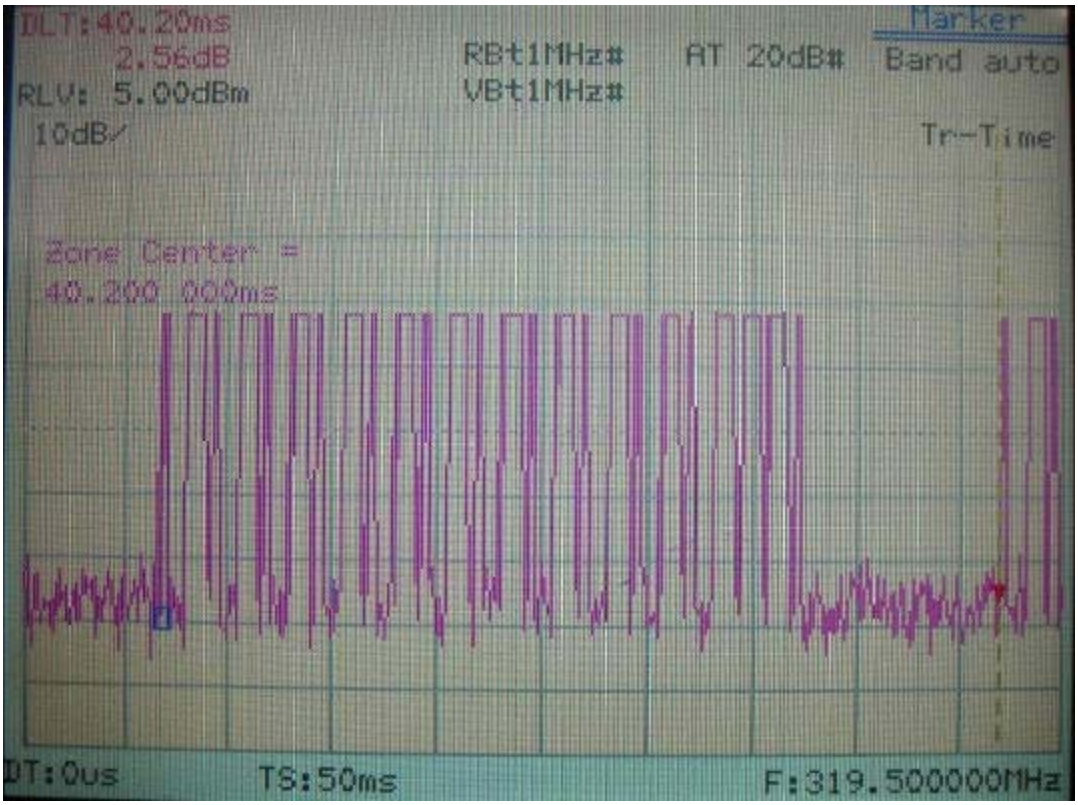
Duty Cycle (%) = 17.3ms / 40.2ms * 100% = 0.43035

Duty Cycle Correction Factor (dB) = 20 * Log (0.43035) = -7.32

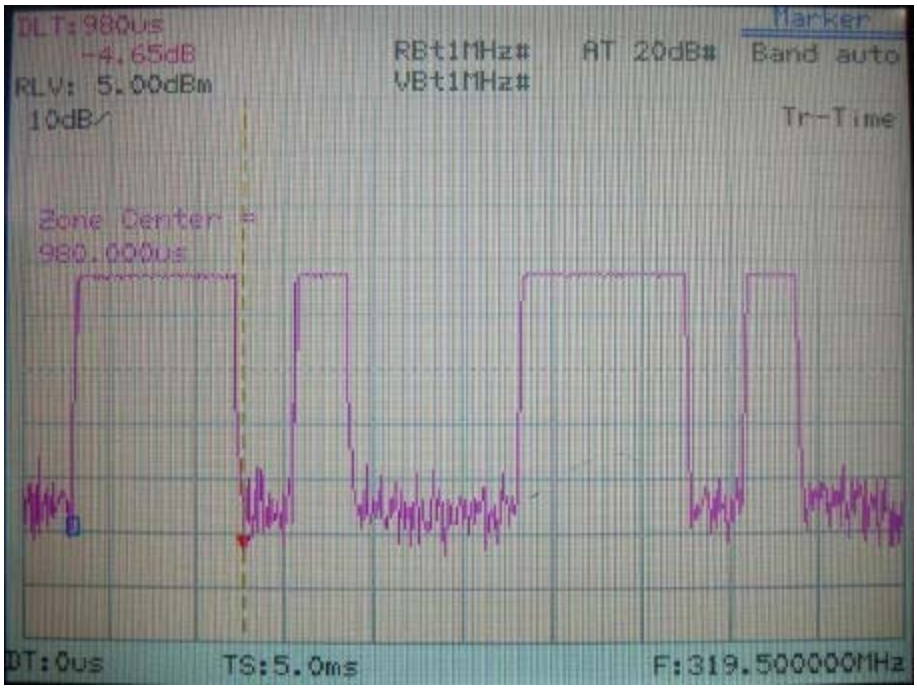
The plots are attached on the following page.

Duty Cycle Test Picture

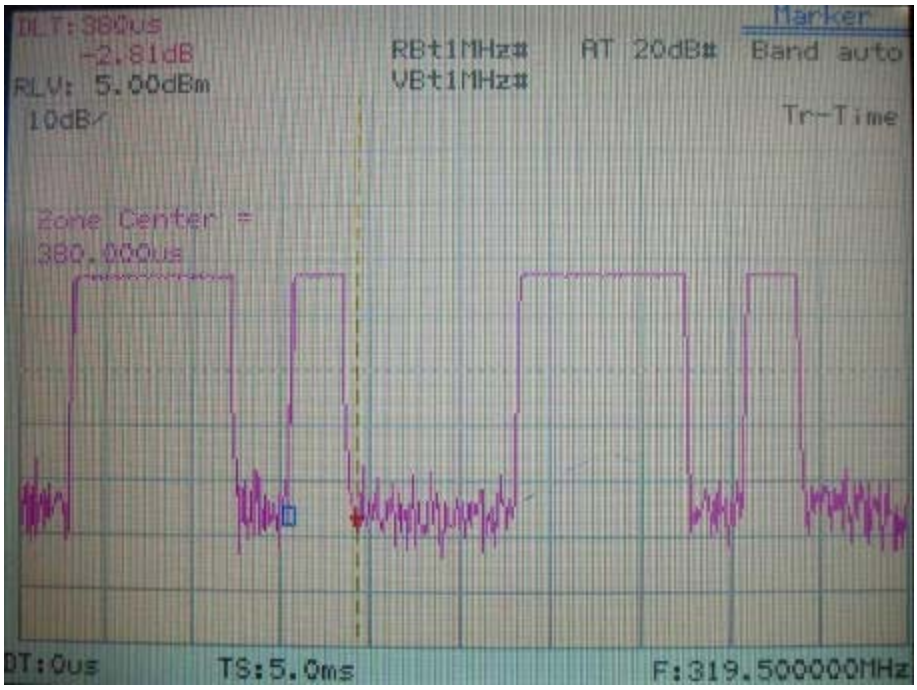
Length of a complete pulse train



Wide Pulse of Train



Narrow Pulse of Train



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

3.1 Test Condition & Setup

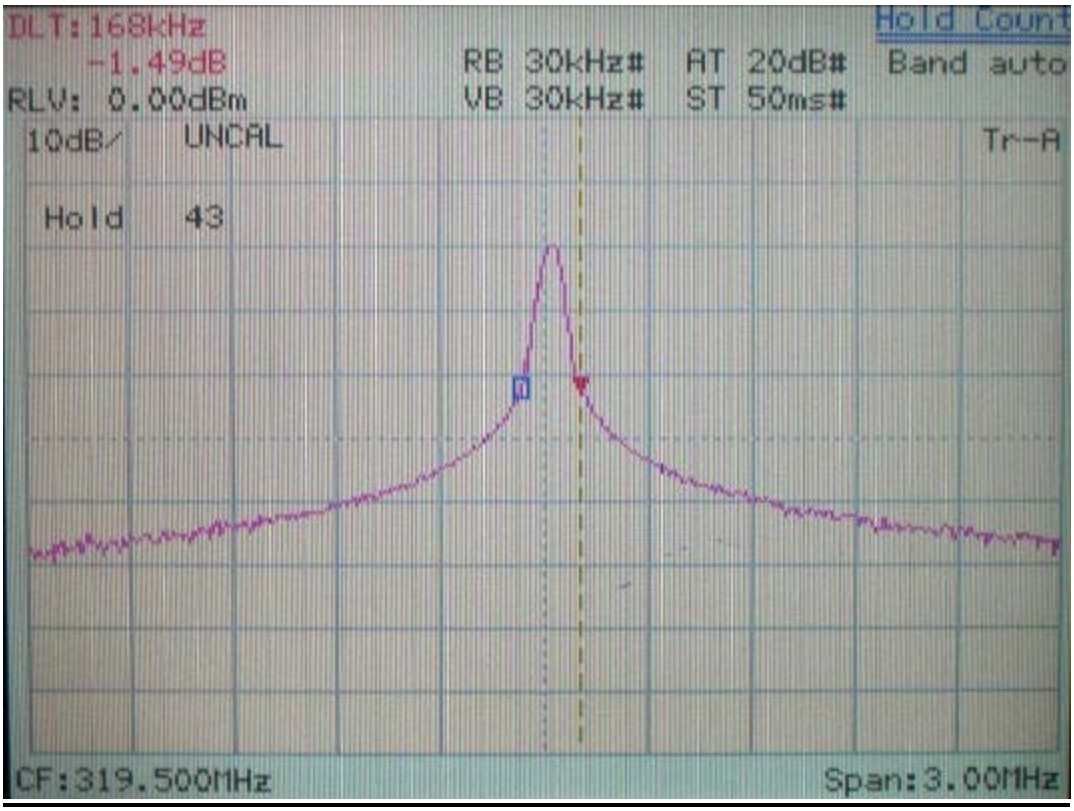
The test setup used to transmitter bandwidth measurement was the same with duty cycle test, except there is no need for digital oscilloscope in the bandwidth test. For detailed description, please reference to section 2.1, 2.2 and 2.3 of this report.

The resolution bandwidth of the spectrum analyzer was set to 30kHz, 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 0.5% of the center frequency of the EUT, e.g. 319.5MHz * 0.25% = 798.75MHz. The detector function was set to peak and hold mode to clearly observe the components.

3.2 Test Result

Measured Transmitter Bandwidth: 168 kHz
Permitted Maximum Bandwidth: 798.75 MHz
A plot attached on the following page.

Plot of the Transmitter Bandwidth Measurement



Chapter 4 CONDUCTED EMISSIONS MEASUREMENTS

4.1 Test Condition

The EUT operates solely by the battery (23A/ 12V battery * 1).
According to the rule of section 15.207(c). The EUT exempt to the power line conducted test.

4.2 Test Result

Test Result: N/A (not applicable)

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 4.5GHz 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 ~ 4.5GHz 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 3-meter 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) + Switching box loss
Peak Value = Reading Amplitude + Correction Factors
True Value = Peak Value + Duty Cycle

Above 1GHz
Correction Factors = Antenna factor + (Cable loss – Amplifier gain) + Switching box loss
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:

Fundamental Frequency (MHz)	Field strength of fundamental (microvolts / meter)	Field strength of spurious emissions (microvolts / meter)
40.66 – 40.70	2,250	225
70 – 130	1,250	125
130 – 174	* 1,250 to 3,750	* 125 to 375
174 – 260	3,750	375
260 – 470	* 3,750 to 12,500	* 375 to 1,250
Above 470	12,500	1,250

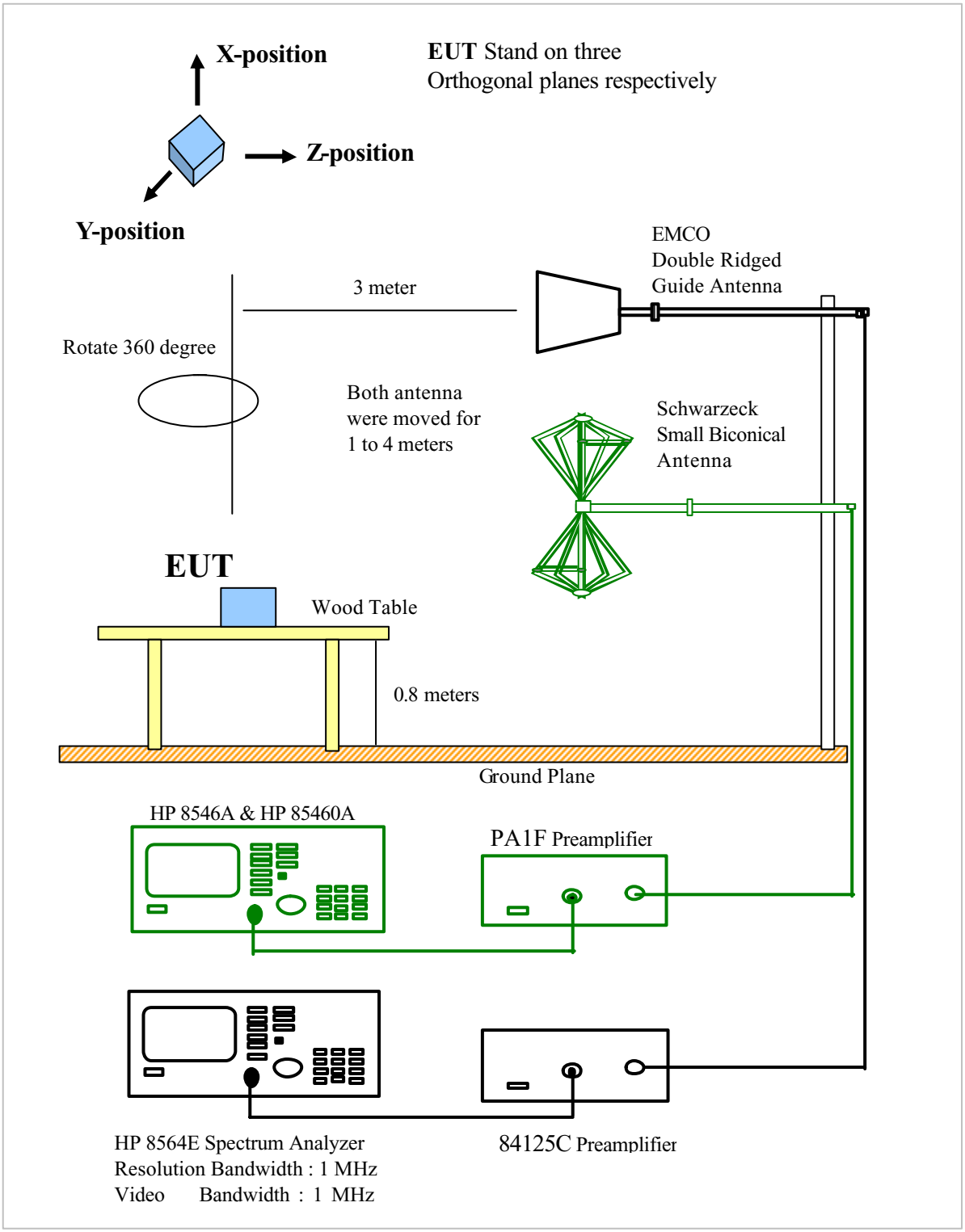
Note: The "*" means linear interpolations

5.3 List of Test Instruments

Calibration date

Instrument Name	Model	Brand	Serial No.	Next time
EMI Receiver	8546A	HP	3520A00242	08/05/05
RF Filter Section	85460A	HP	3448A00217	08/05/05
Small Biconical Antenna	UBAA9114 & BBVU9135	SCHWARZECK	127	10/11/05
Pre-amplifier	PA1F	TRC	1FAC	05/20/06
Auto Switch Box (>30MHz)	ASB-01	TRC	9904-01	05/20/06
Coaxial Cable (Double shielded, 15 meter)	A30A30-0058-50FS-15M	JYEBAO	SMA-01	05/20/06
Coaxial Cable (1.1 meter)	A30A30-0058-50FS-1M	JYEBAO	SMA-02	05/20/06
Spectrum Analyzer	8564E	HP	3720A00840	08/13/05
Microwave Preamplifier	84125C	HP	US36433002	08/13/05
Horn Antenna	3115	EMCO	9104-3668	12/27/05
Standard Guide Horn Antenna	84125-80008	HP	18-26.5GHz	10/15/05
Standard Guide Horn Antenna	84125-80001	HP	26.5-40GHz	10/15/05
Horn Antenna	1196E (3115)	HP (EMCO)	9704-5178	01/11/06
Pre-amplifier	PA2F	TRC	2F1GZ	06/20/05
Coaxial Cable (3 miter)	A30A30-0058-50FST118	JYEBAO	MSA-05	06/20/05
Coaxial Cable (1 meter)	A30A30-0058-50FST118	JYEBAO	MSA-04	06/20/05

5.4 Test Instruments Configuration



5.5 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. (worst case)

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

Table 1 Radiated Emissions of Horizontal for 30MHz to 4.5GHz [X-plane]

Radiated Emission				CF	Peak Value	Duty Cycle	True Value	Class B	
Frequency (MHz)	**Amplitude (dBμV)**	**Ant. H. (m)**	**Angle**	**(dB)**	**(dBμV/m)**	**(dB)**	**(dBμV/m)**	**Limit (dBμV/m)**	**Margin (dB)**
319.50	84.43	1.00	202	-3.32	81.11	-7.32	73.79	75.88	-2.09
639.16	37.47	1.00	185	8.07	45.54	-7.32	38.22	55.88	-17.66
1278.17	36.08	1.00	70	0.88	36.96	-7.32	29.64	55.88	-26.24
*1597.92	37.41	1.00	228	0.31	37.72	-7.32	30.40	53.96	-23.56
*2235.42	35.08	1.00	114	5.44	40.52	-7.32	33.20	53.96	-20.76
*2875.00	29.57	1.00	217	8.90	38.47	-7.32	31.15	53.96	-22.81

Table 2 Radiated Emissions of Vertical for 30MHz to 4.5GHz [Z-plane]

Radiated Emission				CF	Peak Value	Duty Cycle	True Value	Class B	
Frequency (MHz)	**Amplitude (dBμV)**	**Ant. H. (m)**	**Angle**	**(dB)**	**(dBμV/m)**	**(dB)**	**(dBμV/m)**	**Limit (dBμV/m)**	**Margin (dB)**
53.28	27.71	1.00	229	3.16	30.87	---	30.87	40.00	-9.13
319.50	76.04	1.00	65	-3.32	72.72	-7.32	65.40	75.88	-10.48
639.16	29.08	1.00	142	8.07	37.15	-7.32	29.83	55.88	-26.05
*1597.92	37.41	1.00	158	0.31	37.72	-7.32	30.40	53.96	-23.56
*2235.42	34.24	1.00	194	5.44	39.68	-7.32	32.36	53.96	-21.60
*2875.00	29.41	1.00	230	8.90	38.31	-7.32	30.99	53.96	-22.97

Note:

1. Margin = Amplitude – Limit, *if margin is minus means under limit.*
2. Correction Factor = Antenna factor + (Cable loss – Amplitude gain) + Switching box loss
3. Peak Value = Reading amplitude + Correction factors
4. True Value = Peak value + Duty cycle
5. The "*" means in restricted bands