Report No.	A8315058
Specifications Test Method	FCC Part 15.231(e), Certification ANSI C63.4 1992
Applicant	Asia Pacific Microsystems, Inc.
Applicant address	No. 2, R&D Road 6, Science-Based Industrial Park, Hsinchu, Taiwan
Items tested Model	Tire Pressure Monitoring System WP101L (Sample # A83058)
Results	**Compliance** (As detailed within this report)
Date	01/19/2004 (month / day / year) (Sample received) 02/18/2004 (month / day / year) (Test)
Prepared by	Project Engineer (Jack Tsai)
Authorized by	General Manager (Frank Tsai)
Issue date	*February 20, 2004* (month / day / year)
Modifications	**None**
Tested by	Training Research Co., Ltd.
Office at	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 test report, measurements made by TRC are traceable to the NIST only Conducted and Radiated Method.***

★ *FCC ID: RU5CARETRON*

Table of 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 and C of the Commission's Rules and Regulations.

1.2 Description of EUT

Product Name	**:**	Wireless Tire Pressure Monitoring System
Model	**:**	WP101L
FCC ID	**:**	RU5CARETRON
Frequency Range	**:**	433MHz ~ 434MHz
Power Type	**:**	Powered by 3V battery (BR2335 * 1)

The fundamental frequency of transmitter emitted is due to a setting of the EUT. 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.

1.3 Description of Support Equipment

In order to construct the minimum testing, following equipment were used as the support units.

Tadial Tubeless	**:**	**PIRELLI**
Model No.	:	P6000
Type	:	195/50 R 15 82 T
		Tread: 1 Rayon 2 Steel + Nylon
		Sidewall: 1 Rayon

1.4 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

1.5 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 Highest, Middle and Lowest of EUT were all tested. 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 an annechoic chamber. The EUT was placed on a wooded table which is 0.8 meters height and a Small Biconical 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:

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

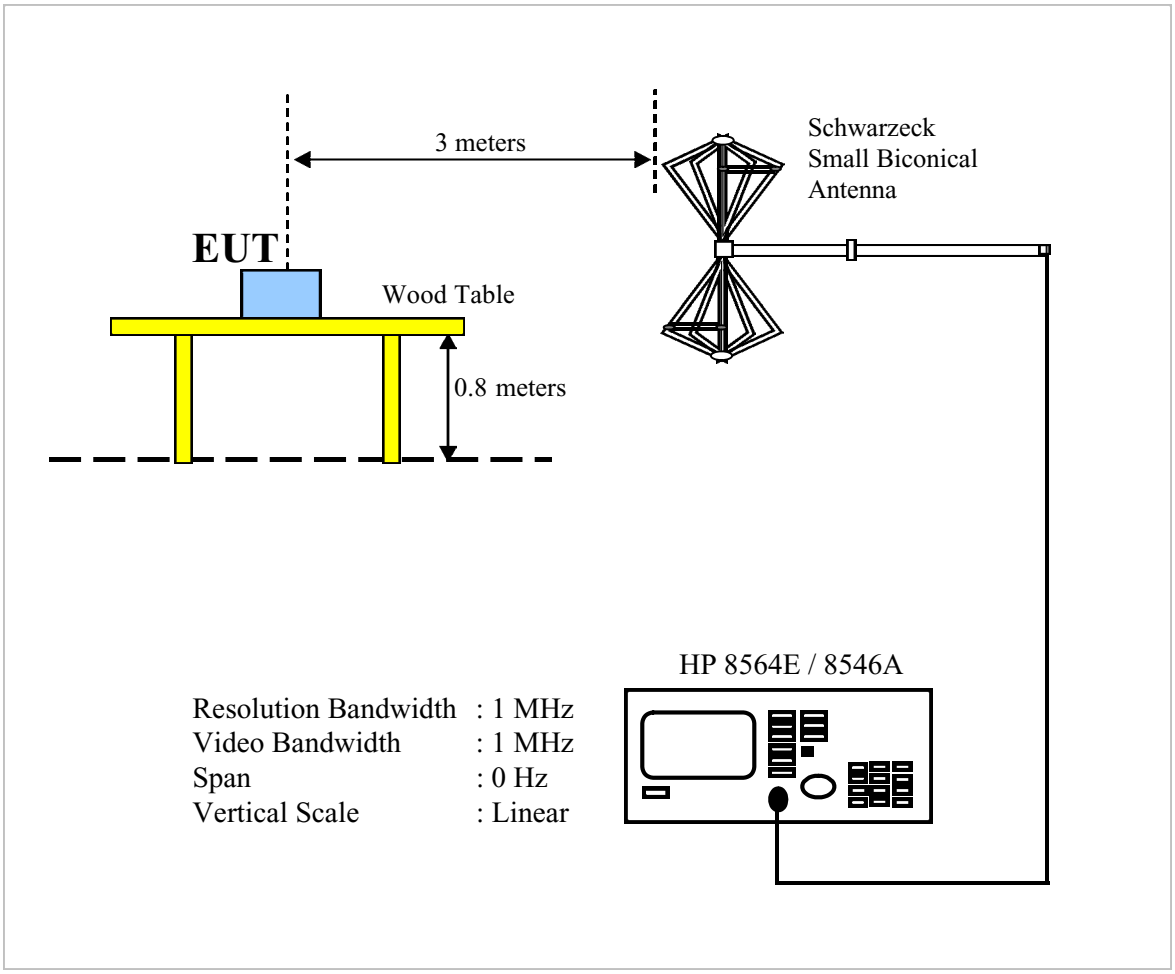
To calculate the actual field intensity, the duty cycle correction factor in decibel is needed for later use and be obtained from following conversion:

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

2.2 List of Test Instruments

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
Spectrum Analyzer	8564E	HP	3720A00840	07/23/03	07/23/04
Microwave Preamplifier	84125C	HP	US36433002	07/30/03	07/30/04
Small Biconical Antenna	UBAA9114 & BBVU9135	Schwarzeck	127	06/21/03	06/21/04
EMI Receiver	8546A	HP	3520A00242	07/28/03	07/28/04
RF Filter Section	85460A	HP	3448A00217	07/28/03	07/28/04

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

= 233.3ms (33.3+40+40+40+40+40)

Length of a complete pulse train

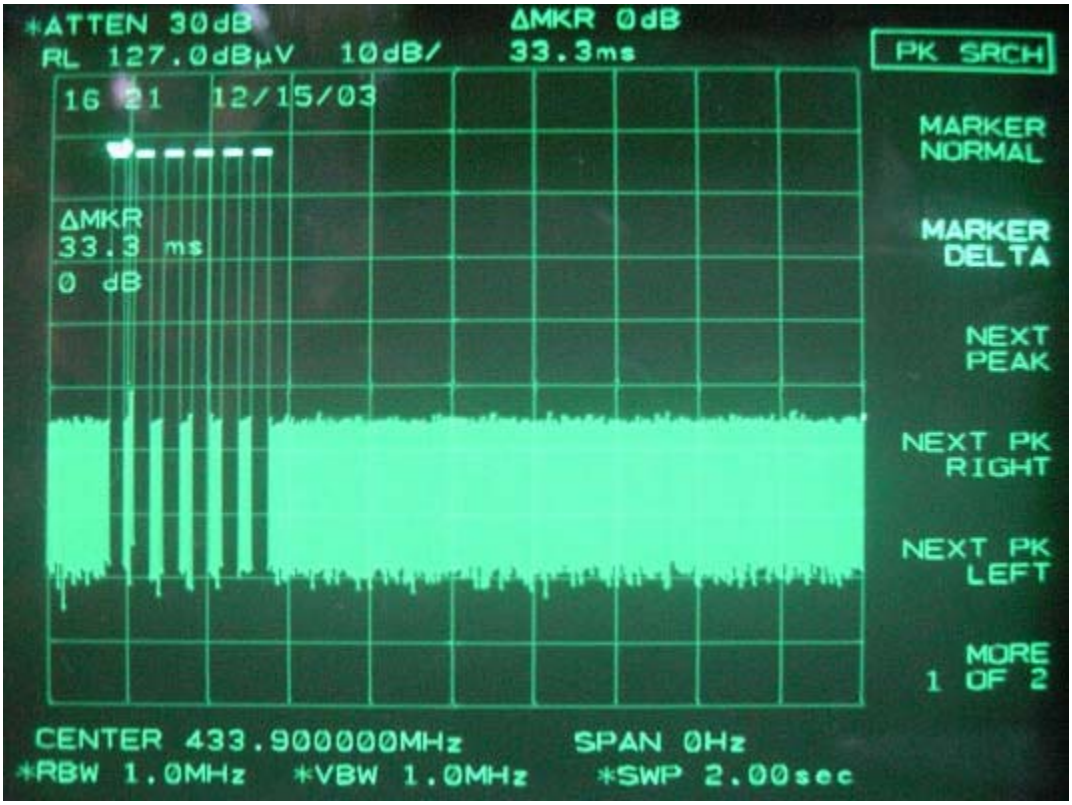
= 437ms

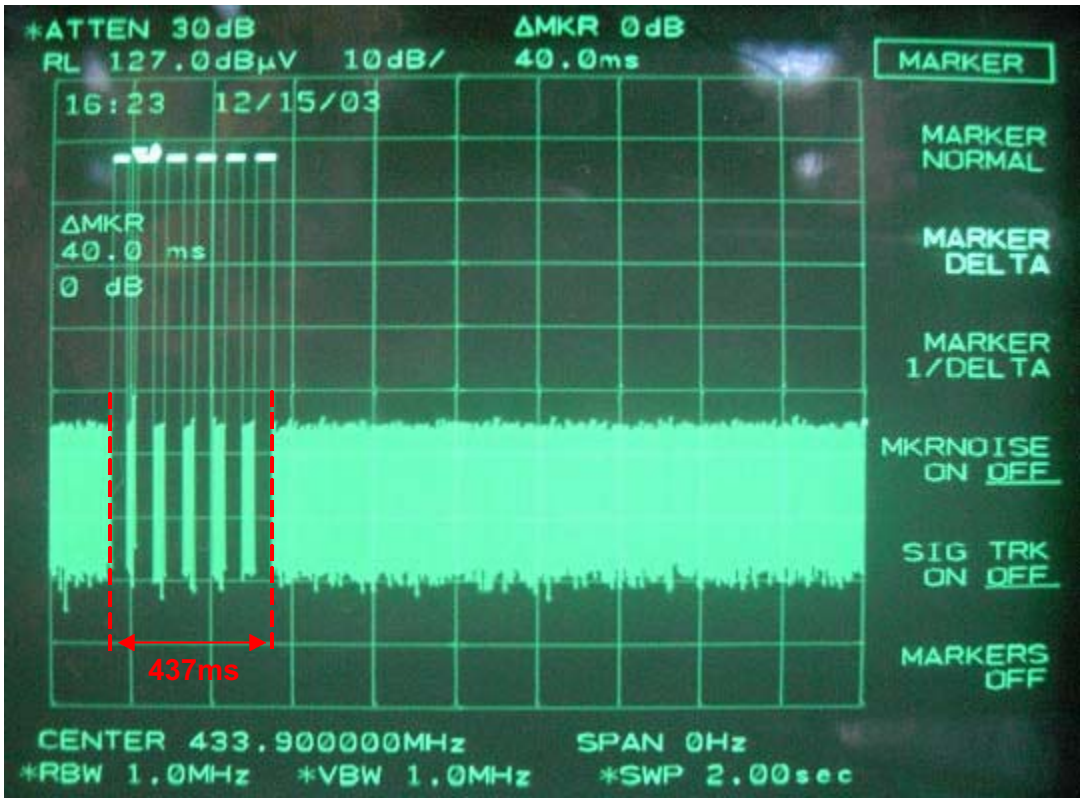
Duty Cycle (%) = 233.3ms / 437ms * 100% = 0.5338

Duty Cycle Correction Factor (dB) = 20 * Log (0.5338) = -5.45

A plot is attached on the following page.

Duty Cycle Test Picture





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

3.1 Test Condition & Setup

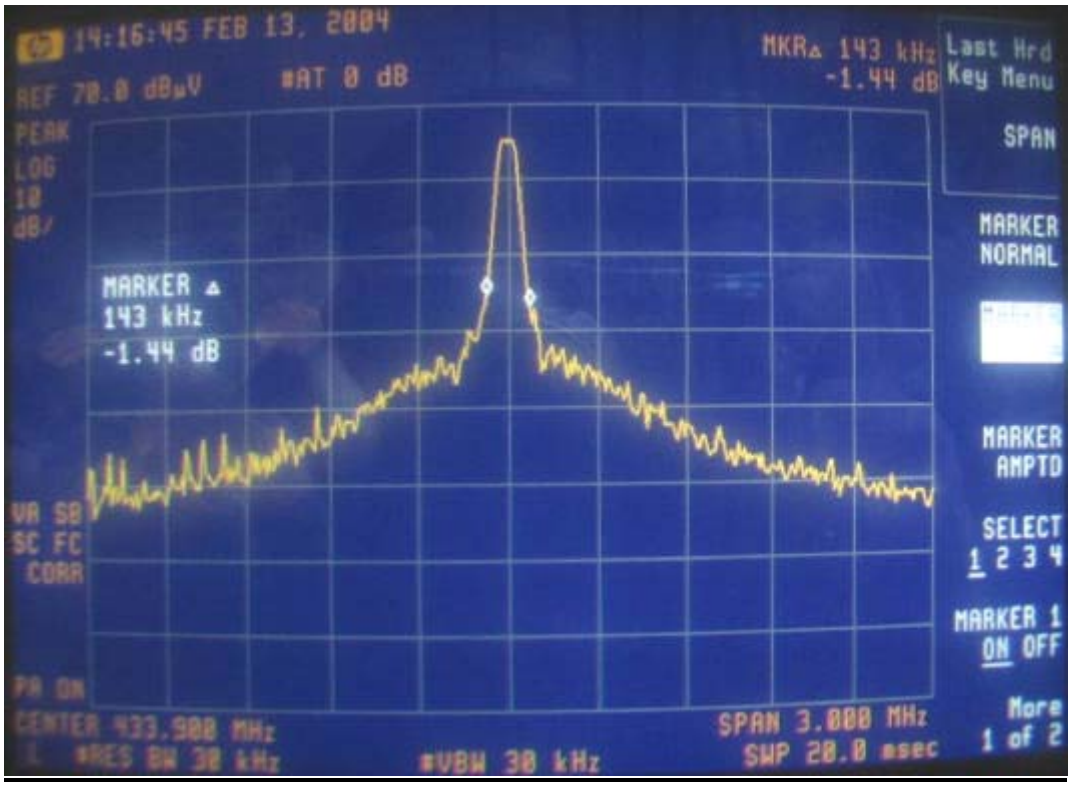
The test setup used to transmitter bandwidth measurement was the same with duty cycle test, except there is no need for digital oscilloscope in the bandwidth test. For detailed description, please reference to section 2.1, 2.2 and 2.3 of this report.

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 0.5% of the center frequency of the EUT, e.g. 433.90MHz * 0.25% = 1.08475MHz. The detector function was set to peak and hold mode to clearly observe the components.

3.2 Test Result

Measured Transmitter Bandwidth: 143kHz
Permitted Maximum Bandwidth: 1.08475MHz
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 (BR2035 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 25GHz 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 M 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:

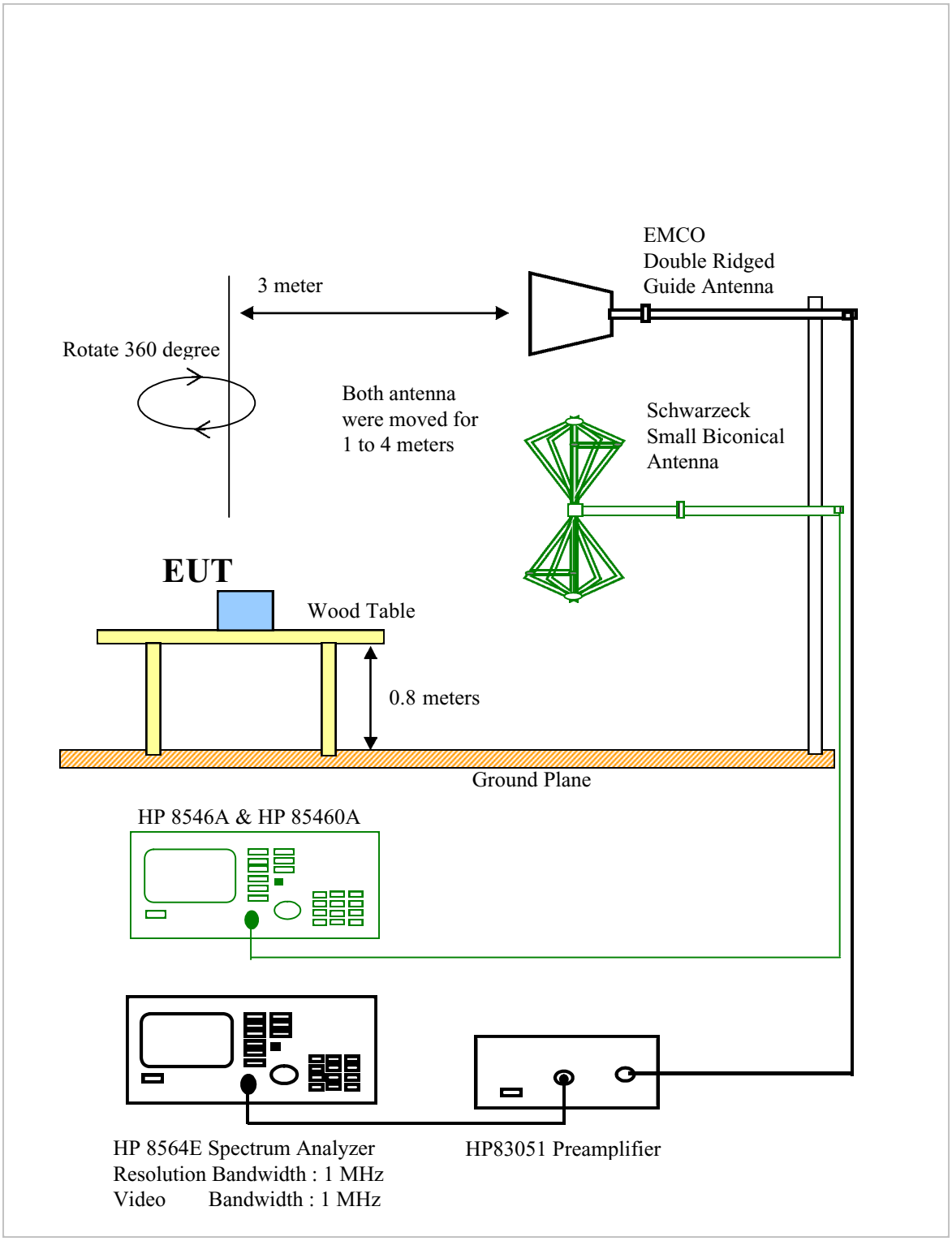
Fundamental Frequency (MHz)	Field strength of fundamental (microvolts / meter)	Field strength of spurious emissions (microvolts / meter)
40.66 – 40.70	1,000	100
70 – 130	500	50
130 – 174	* 500 to 1,500	* 50 to 150
174 – 260	1,500	150
260 – 470	* 1,500 to 5,000	* 150 to 500
Above 470	5,000	500

Note: The "*" means linear interpolations

5.3 List of Test Instruments

				Calibration Date	
Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
EMI Receiver	8546A	HP	3520A00242	07/28/03	07/28/04
RF Filter Section	85460A	HP	3448A00217	07/28/03	07/28/04
Small Biconical Antenna	UBAA9114 & BBVU9135	SCHWARZECK	127	06/21/03	06/21/04
Pre-amplifier	PA1F	TRC	1FAC	05/20/03	05/20/04
Auto Switch Box (>30MHz)	ASB-01	TRC	9904-01	05/20/03	05/20/04
Coaxial Cable (Double shielded, 15 meter)	A30A30-0058-50FS-15M	JYEBAO	SMA-01	05/20/03	05/20/04
Coaxial Cable (1.1 meter)	A30A30-0058-50FS-1M	JYEBAO	SMA-02	05/20/03	05/20/04
Spectrum Analyzer	8564E	HP	3720A00840	07/23/03	07/23/04
Microwave Preamplifier	84125C	HP	US36433002	07/30/03	07/30/04
Horn Antenna	3115	EMCO	9104-3668	12/18/03	12/18/04
Standard Guide Horn Antenna	84125-80008	HP	18-26.5GHz	09/18/03	09/18/04
Standard Guide Horn Antenna	84125-80001	HP	26.5-40GHz	09/18/03	09/18/04
Pre-amplifier	84125C	HP	US36433002	11/19/03	11/19/04
Horn Antenna	1196E (3115)	HP (EMCO)	9704-5178	12/12/03	12/12/04
Pre-amplifier	PA2F	TRC	2F1GZ	05/20/03	05/20/04
Coaxial Cable (3 miter)	A30A30-0058-50FST118	JYEBAO	MSA-05	05/20/03	05/20/04
Coaxial Cable (1 meter)	A30A30-0058-50FST118	JYEBAO	MSA-04	05/20/03	05/20/04

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.

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

Table 1 Radiated Emissions of Horizontal for 30MHz to 4.5GHz

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)**
433.90	66.82	1.00	156	1.69	68.51	-5.45	63.06	72.86	-9.80
869.05	21.55	1.00	124	16.01	37.56	-5.45	32.11	52.86	-20.75
1735.00	42.67	1.00	294	2.80	45.47	-5.45	40.02	52.86	-12.84
2169.58	40.84	1.00	307	2.40	43.24	-5.45	37.79	52.86	-15.07
2604.17	35.83	1.00	302	3.64	39.47	-5.45	34.02	52.86	-18.84

Table 2 Radiated Emissions of Vertical for 30MHz to 4.5GHz

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)**
433.90	71.60	1.00	6	1.72	73.32	-5.45	67.87	72.86	-4.99
866.62	19.94	1.00	128	15.91	35.85	-5.45	30.40	52.86	-22.46
1736.46	39.17	1.00	124	2.79	41.96	-5.45	36.51	52.86	-16.35
2169.58	36.17	1.00	15	2.40	38.57	-5.45	33.12	52.86	-19.74
2602.71	37.16	1.00	63	3.64	40.80	-5.45	35.35	52.86	-17.51
3829.17	35.00	1.00	35	7.08	42.08	-5.45	36.63	52.86	-16.23

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

Chapter 6 AUTOMATICALLY LIMIT OF TRANSMISSION

6.1 Test Condition and Setup

The automatically limit of transmission measurements were performed in an annechoic chamber. The EUT was placed on a wooded table which is 0.8 meters height and a Small Biconical 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 period.

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 duration of each transmission shall not be greater than one second and the silent period between transmissions shall be at least 30 times the duration of the transmission but in no case less than 10 seconds.

6.2 List of Test Instruments

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
Spectrum Analyzer	8564E	HP	3720A00840	07/23/03	07/23/04
Microwave Preamplifier	84125C	HP	US36433002	07/30/03	07/30/04
Small Biconical Antenna	UBAA9114 & BBVU9135	Schwarzeck	127	06/21/03	06/21/04
EMI Receiver	8546A	HP	3520A00242	07/28/03	07/28/04
RF Filter Section	85460A	HP	3448A00217	07/28/03	07/28/04

6.3 Test Result