

## FCC 47 CFR PART 15 SUBPART C

## **TEST REPORT**

For

**Tai-Safety-H Tire Pressure Monitoring System** 

Model: TPV03

**Trade Name : MOBILETRON** 

**Issued for** 

## **MOBILETRON ELECTRONICS CO., LTD.**

39,Sec.3,Chung-Ching Rd.,Ta-Ya,Taichung Hsien,Taiwan 428

Issued by



Compliance Certification Services Inc. Hsinchu Lab. Rm. 258, Bldg. 17, NO.195, Sec.4 Chung HsingRd., ChuTung Chen, Hsinchu, Taiwan 310, R.O.C TEL: (03) 591-0068 FAX: (03) 582-5720



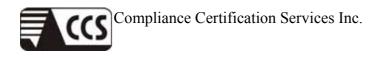
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# **1. TEST REPORT CERTIFICATION**

Applicant	:	MOBILETRON ELECTRONICS CO., LTD.
Address	:	39,Sec.3,Chung-Ching Rd.,Ta-Ya,Taichung Hsien,Taiwan
		428
Equipment Under Test	:	Tai-Safety-H Tire Pressure Monitoring System
Model	:	TPV03
Trade Name	:	MOBILETRON
<b>Tested Date</b>	:	August 21 ~ 28, 2006

APPLICABLE STANDARD			
STANDARD	TEST RESULT		
FCC Part 15 Subpart C:2004 AND ANSI C63.4:2003	No non-compliance noted		

Approved by:	· ···································
C.F.Wu	# # 用事 ) Chan Wu
C. F. Wu Manager of Hsinchu Laboratory Compliance Certification Service	s Inc. C C C C C C C C C C C C C C C C C C C

WE HEREBY CERTIFY THAT: The measurements shown in the attachment were made in accordance with the procedures indicated, and the energy emitted by the equipment was found to be within the limits applicable. We assume full responsibility for the accuracy and completeness of these measurements and vouch for the qualifications of all persons taking them.

# 2. EUT DESCRIPTION

## 2.1 DESCRIPTION OF EUT & POWER

Product Name	Tai-Safety-H Tire Pressure Monitoring System		
Model Number	TPV03		
Trade Name	MOBILETRON		
Channel Number	1		
Frequency Range	433.92 MHz		
Modulation Technique	FSK		
Transmitter Classification	Mobile		
Antenna Type	Print PCB Antenna, Antenna Gain : 1 dBi		
Power Source	Mercury Battery : 3.6V		

Remark:

1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.

2. This submittal(s) (test report) is intended for FCC ID: ULZ-TPV03 filing to comply with Section 15.207,15.209 and 15.231 of the FCC Part 15, Subpart C Rules.

3. For more details, please refer to the User's manual of the EUT.

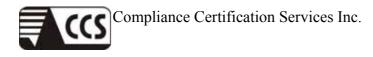
# **3. DESCRIPTION OF TEST MODES**

The EUT had been tested under operating condition.

There are one channel have been tested as following :

Channel	Frequency (MHz)
1	433.92

Note : The field strength of spurious emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in lie-down position(X axis) and the worst case was recorded.



# 4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4 and FCC CRF 47 2.1046, 2046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.231.

# 5. FACILITIES AND ACCREDITATIONS

# **5.1 FACILITIES**

All measurement facilities used to collect the measurement data are located at Rm.258, Bldg.17, NO.195, Sec. 4, Chung Hsing Rd., Chu-Tung Chen. Hsin-Chu, Taiwan 310 R.O.C.

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

## **5.2 EQUIPMENT**

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

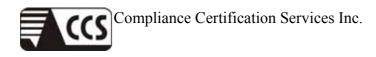
# **5.3 LABORATORY ACCREDITATIONS LISTINGS**

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code: 200118-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (registration no: 90585 and 90584).

# 5.4 TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	NVLAP	EN 55014-1, AS/NZS 1044, CNS 13783-1, IEC/CISPR 14-1, IEC/CISPR 22, EN 55022, EN 61000-3-2, EN 61000-3-3, ANSI C63.4, AS/NZS CISPR 22, AS/NZS 3548, IEC 61000-4-2/3/4/5/6/8/11	200118-0
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	<b>FC</b> 90585, 90584
Japan	VCCI	3/10 meter Open Area Test Sites to perform conducted/radiated measurements	<b>VCCI</b> R-1229/1189 C-1250/1294
Taiwan	TAF	FCC Method-47 CFR Part 15 Subpart C,D,E CISPR 11, FCC METHOD-47 CFR Part 18, EN 55011, CNS 13803, CISPR 13, CNS 13439, FCC Method-47 CFR Part 15 Subpart B, CISPR 14-1, EN 55014-1, CNS 13783-1, EN 55015, CNS 14115, CISPR 22, EN 55022, VCCI CNS 13438, EN 61000-4-2/3/4/5/6/8/11	Testing Laboratory 0240
Taiwan	BSMI	CNS 13803, CNS 13438, CNS 13439, CNS 13783-1, CNS 14115	SL2-IS-E-0002 SL2-IN-E-0002 SL2-A1-E-0002 SL2-R1-E-0002 SL2-R2-E-0002 SL2-L1-E-0002
Canada	Industry Canada	RSS212, Issue 1	Canada IC 4417-1

\* No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government.



# 6. CALIBRATION AND UNCERTAINTY

## 6.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

## **6.2 MEASUREMENT UNCERTAINTY**

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 1000 MHz	+/- 3.2 dB
Radiated Emission, 1 to 26.5 GHz	+/- 3.2 dB
Power Line Conducted Emission	+/- 2.1 dB

Uncertainty figures are valid to a confidence level of 95%



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# 7. SETUP OF EQUIPMENT UNDER TEST

#### SUPPORT EQUIPMENT

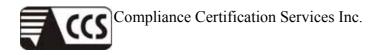
None

#### SETUP DIAGRAM FOR TESTS

EUT & peripherals setup diagram is shown in appendix setup photos.

#### **EUT OPERATING CONDITION**

- 1. Setup all equipments like the setup diagram.
- 2. EUT is in operation.
- 3. All of the functions are under run.
- 4. Start test.



# 8. FCC PART 15.231 REQUIREMENTS

# 8.1 20DB BANDWIDTH

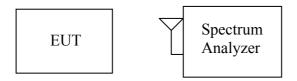
## **LIMIT**

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

#### **TEST EQUIPMENTS**

Description & Manufacturer	Model No.	Serial No.	Date of Calibration
ROHDE & SCHWARZ SPECTRUM ANALYZER	FSEK30	835253/002	September 24, 2005
AGILENT SPECTRUM ANALYZER	E4446A	MY433601.32	March 22, 2006

### **Test Configuration**



### TEST PROCEDURE

The spectrum analyzer center frequency is set to the transmitter frequency. The RBW is set to 10 kHz and VBW is set 30kHz.

### TEST RESULTS

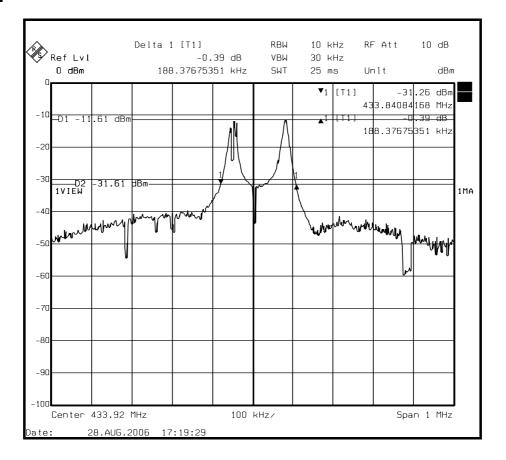
No non-compliance noted

#### Test Data

Frequency	20dB Bandwidth	Limit	Result	
(MHz)	(kHz)	(MHz)		
433.92	188	1.0848	PASS	



### **Test Plot**



# 8.2 LIMIT OF TRANSMISSION TIME

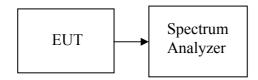
### **LIMIT**

According to 15.231(e), in addition, devices operated under the provisions of this paragraph shall be provided with a means for automatically limiting operation so that 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.

#### TEST EQUIPMENTS

Description & Manufacturer	Model No.	Serial No.	Date of Calibration
ROHDE & SCHWARZ SPECTRUM ANALYZER	FSEK30	835253/002	September 24, 2005
AGILENT SPECTRUM ANALYZER	E4446A	MY433601.32	March 22, 2006

#### **Test Configuration**



#### **TEST PROCEDURE**

The transmitter output is connected to the spectrum analyzer. The spectrum analyzer center frequency is set to the transmitter frequency. The RBW and VBW are set to 1MHz.

#### TEST RESULTS

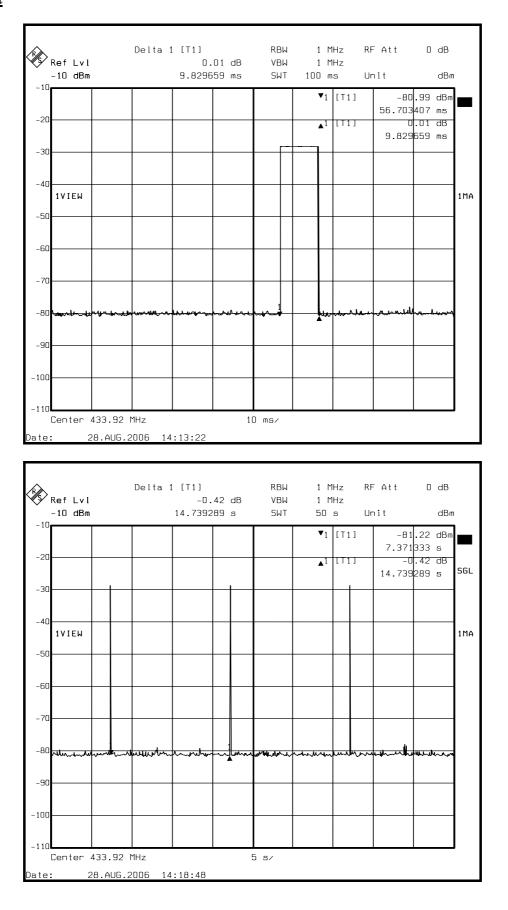
No non-compliance noted

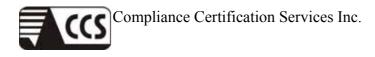
#### Test Data

Frequency (MHz)	Transmission Time (s)	Maximum Transmission Limit (s)	Silent Duration (s)	Mimimum Silent Duration Limit (s)	Silent Period Versus Transmission Time Ratio	Minimum Ratio Limit	Result
433.92	0.0098	1.00	14.7392	10.00	1504	30	PASS



#### **Test Plot**





# **8.3 DUTY CYCLE CORRECTION FACTOR**

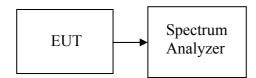
## **LIMIT**

Nil (No dedicated limit specified in the Rules)

### **TEST EQUIPMENTS**

<b>Description &amp; Manufacturer</b>	Model No.	Serial No.	Date of Calibration
ROHDE & SCHWARZ SPECTRUM ANALYZER	FSEK30	835253/002	September 24, 2005
AGILENT SPECTRUM ANALYZER	E4446A	MY433601.32	March 22, 2006

### **Test Configuration**



## **TEST PROCEDURE**

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 3. Set center frequency of spectrum analyzer = operating frequency.
- 4. Set the spectrum analyzer as RBW, VBW=1MHz, Span = 0Hz, Adjust Sweep = 50s.
- 5. Repeat above procedures until all frequency measured were complete.

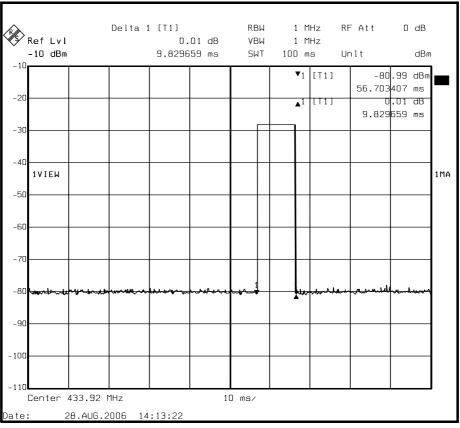
## TEST RESULTS

No non-compliance noted

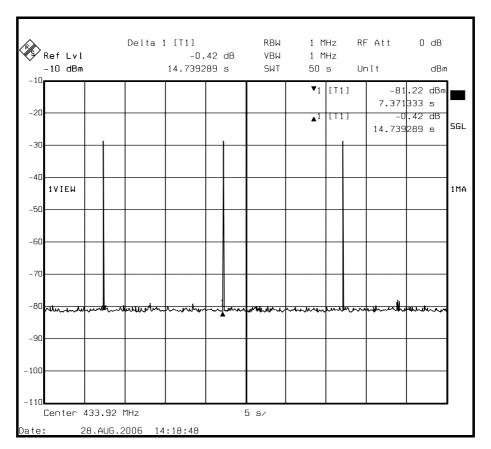
### <u>Test Data</u>

Tp = 100ms Ton =9.82 (ms) Duty Cycle Correction Factor =  $20* \log (Ton / Tp) = 20* \log (9.82 / 100) = -20.15 \text{ dBuV}$ 

#### <u>Test Plot</u> <u>Ton</u>



#### <u>Tp in 100ms</u>



## **8.4 RADIATED EMISSIONS**

## **LIMIT**

 According to §15.231(e), intentional radiators may operate at a periodic rate exceeding that specified in paragraph (a) and may be employed for any type of operation, including operation prohibited in paragraph (a), provided the intentional radiator complies with the provisions of paragraphs (b) through (d) of this Section, except the field strength table in paragraph (b) is replaced by the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (microvolts/meter)	Field Strength of Spurious Emissions (microvolts/meter)
40.66 - 40.70	1000	100
70 - 130	500	50
130 - 174	500 to 1500 **	50 to 150 **
174 - 260	1500	150
260 - 470	1500 to 5000 **	150 to 500 **
Above 470	5000	500

*Remark:* \*\* linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, uV/m at 3 meters = 22.72727(F) - 2454.545; for the band 260-470 MHz, uV/m at 3 meters = 16.6667(F) - 2833.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

2.Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (mV/m)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

**Remark:** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

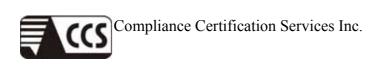


## 3. In the above emission table, the tighter limit applies at the band edges.

Frequency (MHz)	Field Strength (µV/m at 3-meter)	Field Strength (dBµV/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

### **TEST EQUIPMENTS**

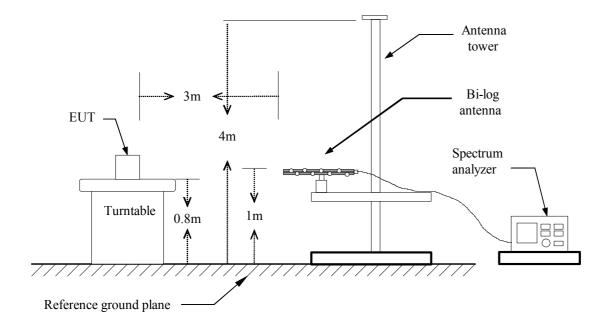
Manufacturer or Type	Model No.	Serial No.	Date of Calibration	Calibration Period	Remark
CHASE BI-LOG ANTENNA	CBL6112B	2817	August 28, 2006	1 Year	FINAL
R/S SPECTRUM ANALYZER	FSEK30	835253/002	September 24, 2005	1 Year	FINAL
AGILENT SPECTRUM ANALYZER	E4446A	MY433601.32	March 22, 2006	1 Year	FINAL
R/S EMI TEST RECEIVER	ESCS30	835418/008	September 02, 2006	1 Year	FINAL
OPEN SITE		No.2	May 07, 2006	1 Year	FINAL
N TYPE COAXIAL CABLE	9913-30M		August 21, 2006	1 Year	FINAL
Horn Antenna	AH-118	10089	August 30, 2006	1 Year	FINAL
Horn Antenna	AH-840	03077	February 25, 2006	1 Year	FINAL
Agilent Pre-amplifier	8449B	3008A01471	December 07, 2005	1 Year	FINAL
HP Amplifier	8447D	1937A02748	December 07, 2005	1 Year	FINAL
HP High pass filter	84300/80038	002	CAL. ON USE	1 Year	FINAL
HP High pass filter	84300/80039	003	CAL. ON USE	1 Year	FINAL



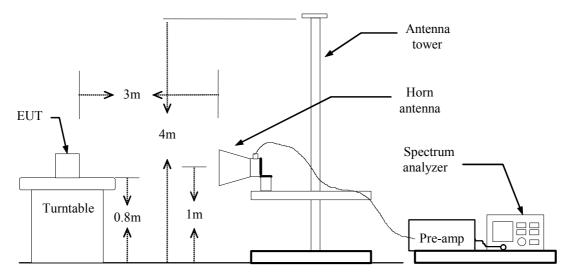
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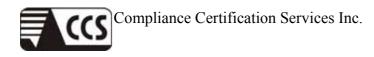
## **Test Configuration**

#### Below 1 GHz



Above 1 GHz





## **TEST PROCEDURE**

- 1. The EUT is placed on a turntable, which is 0.8m above ground plane.
- 2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
- 3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
- 4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
- 5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
- 6. Set the spectrum analyzer in the following setting as: Below 1GHz:

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Above 1GHz:

(a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

(b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO

7. Repeat above procedures until the measurements for all frequencies are complete.

## 8.4.1 TRANSMITTER RADIATED EMISSION BELOW 1 GHz

Product Name	Tai-Safety-H Tire Pressure Monitoring System	Test Date	2006/08/22	
Model Name	TPV03	Test By	Angus Wu	
Test Mode	CH Low TX	<b>TEMP &amp; Humidity</b>	26°C, 72%	

Freq- Uency	Antenna Factor	Cable Loss	Duty Cycle		Reading dB µ V)		nits ssB)	at 3	on Level 3 m V/m)		rgin B)	
(MHz)	(dB/m)	( <b>dB</b> )	Factor (dB)	Horiz	zontal	Peak	Avg.	Horiz	zontal	Horiz	ontal	
			(UD)	Peak	Avg.	(dB µ	V/m)	Peak	Avg.	Peak	Avg.	
433.92	17.14	5.31	-20	57.70		92.87	72.87	80.15	60.15	-12.72	-12.72	
867.72	21.54	7.69	-20	39.40		72.87	52.87	68.63	48.63	-4.24	-4.24	
Freq- Uency	Antenna Factor	Cable Loss	Duty Cycle		Meter Reading at 3m (dB µ V)		e e		Emission Level at 3 m (dBµV/m)		Margin (dB)	
(MHz)	( <b>dB</b> / <b>m</b> )	( <b>dB</b> )	Factor (dB)	Ver	tical	Peak	Avg.	Ver	tical	Ver	tical	
			(uD)	Peak	Avg.	(dB µ	V/m)	Peak	Avg.	Peak	Avg.	
433.92	17.14	5.31	-20	52.20		92.87	72.87	74.65	54.65	-18.22	-18.22	
867.72	21.54	7.69	-20	31.20		72.87	52.87	60.43	40.43	-12.44	-12.44	

#### Remark:

- 1. Measuring frequencies from 30 MHz to the 1GHz.
- 2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using peak/quasi-peak/average detector mode.
- 3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
- 4. Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- 5. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with "N/A" remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.
- 6. Margin(dB) = Remark result(dBuV/m) Limit(dBuV/m).

## 8.4.2 TRANSMITTER RADIATED EMISSION ABOVE 1 GHz

Product Name	Tai-Safety-H Tire Pressure Monitoring System	Test Date	2006/08/22
Model Name	TPV03	Test By	Angus Wu
Test Mode	TX	<b>TEMP &amp; Humidity</b>	26°C, 52%

	Measurement Distance at 1m Horizontal polarity									
Freq. (MHz)	Reading (dBµV)	Correction Factor (dB/m)	Dist (dB)	Duty Cyde Factor (dB)	Level 3m (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Mark (P/Q/A)	Height (Meter)	
1301.60	30.54	29.31	9.50		50.35	74.00	-23.65	Р	1.00	
1301.60		29.31	9.50	-20.00	30.35	54.00	-23.65	А	1.00	
2168.60	28.21	34.02	9.50		52.73	74.00	-21.27	Р	1.00	
2168.60		34.02	9.50	-20.00	32.73	54.00	-21.27	А	1.00	

	Measurement Distance at 1m Vertical polarity										
Freq. (MHz)	Reading (dBµV)	Correction Factor (dB/m)	Dist (dB)	Duty Cyde Factor (dB)	Level 3m (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Mark (P/Q/A)	Height (Meter)		
1301.60	25.47	29.31	9.50		45.28	74.00	-28.72	Р	1.00		
1301.60		29.31	9.50	-20.00	25.28	54.00	-28.72	А	1.00		
2168.60	24.87	34.98	9.50		50.35	74.00	-23.65	Р	1.00		
2168.60		34.98	9.50	-20.00	30.35	54.00	-23.65	А	1.00		

Remark:

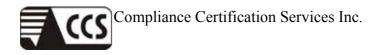
1. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz

2. Dist : correction to extra plate reading to 3m specification distance 1m measurement distance = -9.5dB3. The result basic equation calculation is as follow:

Level = Reading + Correction factor – Dist, Average level=Peak level+ Duty cycle factor, Margin = Level-Limit

4. The other emission levels were 20dB below the limit

5. The test limit distance is 3M limit.



## **8.5 POWERLINE CONDUCTED EMISSIONS**

## LIMITS

§ 15.207 (a) Except as shown in paragraph (b) and (c) this section, for an intentional radiator that is designed to be connected to the public utility (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 the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

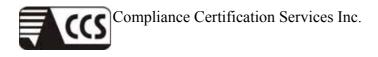
The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted limit (dBµv)				
	Quasi-peak	Average			
0.15 - 0.5	66 to 56	56 to 46			
0.5 - 5	56	46			
5 - 30	60	50			

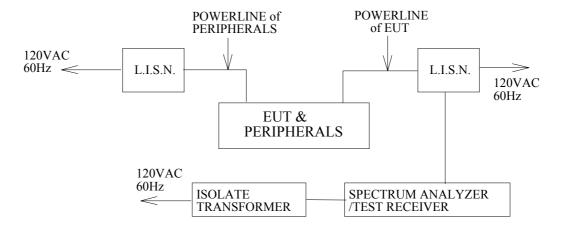
#### TEST EQUIPMENTS

The following test equipments are used during the conducted powerline tests :

Manufacturer or Type	Model No.	Serial No.	Date of Calibration	Calibration Period	Remark
EMCO L.I.S.N.	3850/2	9311-1025	January 16, 2006	1 Year	FINAL
CHASE L.I.S.N	NNLK 8129	8129118	January 16, 2006	1 Year	FINAL
R & S TEST RECEIVER	ESHS30	838550/003	February 27, 2006	1 Year	FINAL
KEENE SHIELDED ROOM	5983	No.1	N/A	N/A	FINAL
R & S PULSE LIMIT	EHS3Z2	357.8810.52	July 10, 2006	1 Year	FINAL
N TYPE COAXIAL CABLE			August 21, 2006	1 Year	FINAL
50Ω TERMINATOR			July 10, 2006	1 Year	FINAL



## TEST SETUP



### TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80cm above the horizontal ground plane. The EUT IS CONFIGURED IN ACCORDANCE WITH ANSI C63.4.

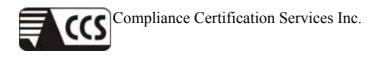
The resolution bandwidth is set to 9 kHz for both quasi-peak detection and average detection measurements.

Line conducted data is recorded for both NEUTRAL and LINE.

### TEST RESULTS

No non-compliance noted

Sine this EUT is powered by DC Source, this test item is not applicable.



# 9. ANTENNA REQUIREMENT

# 9.1 STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR 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.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

# 9.2 ANTENNA CONNECTED CONSTRUCTION

The antenna used in this product is Print PCB antenna. The maximum Gain of the antenna is 1 dBi.



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# **APPENDIX SETUP PHOTOS**

## **RADIATED RF MEASUREMENT SETUP**







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