



FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

Tire Pressure Monitoring System

Model : TPMS-TX012

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.

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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 : Tire Pressure Monitoring System
Model : TPMS-TX012
Trade Name : MOBILETRON
Tested Date : July 09 ~ 30 ; November 14 ~ 21, 2007

APPLICABLE STANDARD	
STANDARD	TEST RESULT
FCC Part 15 Subpart C:2006 AND ANSI C63.4:2003	No non-compliance noted

Approved by:

S. B. Lu

S. B. Lu
Manager of Hsinchu Laboratory
Compliance Certification Services Inc.

Reviewed by:

Jerry Chang



Jerry Chang
Test Engineer of Hsinchu Laboratory
Compliance Certification Services Inc.

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	Tire Pressure Monitoring System
Model Number	TPMS-TX012
Trade Name	MOBILETRON
Channel Number	1
Frequency Range	433.92 MHz
Modulation Technique	FSK
Transmitter Classification	Mobile
Antenna Type	PCB Antenna, Antenna Gain : 0 dBi
Power Source	3VDC (From Power Battery)

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-TX012 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	 90585, 90584
Japan	VCCI	3/10 meter Open Area Test Sites to perform conducted/radiated measurements	 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	RSS-GEN Issue 2	 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%



7. SETUP OF EQUIPMENT UNDER TEST

SUPPORT EQUIPMENT

N/A

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

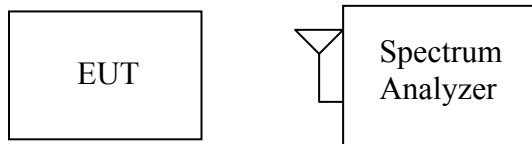
LIMIT

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	October 18, 2007
AGILENT SPECTRUM ANALYZER	E4446A	MY433601.32	June 06, 2007

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.

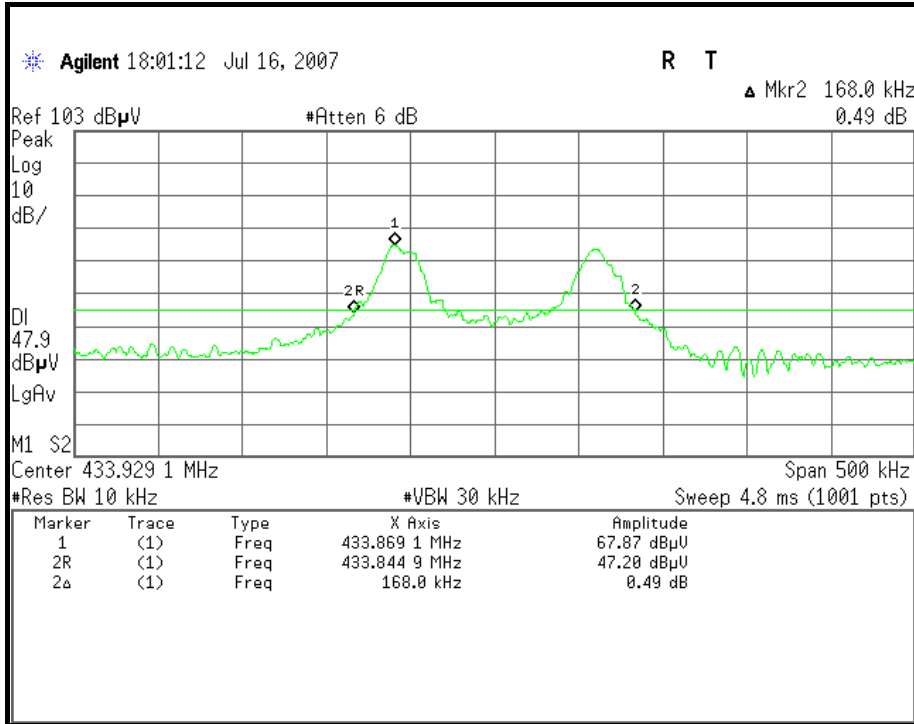
TEST RESULTS

No non-compliance noted

Frequency (MHz)	20dB Bandwidth (kHz)	Limit (KHz)	Result
433.92	168.0	1084.8	PASS



Test Plot





8.2 LIMIT OF TRANSMISSION TIME

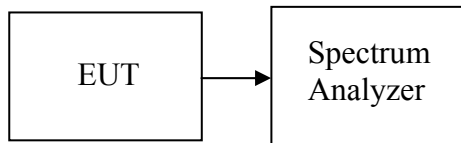
LIMIT

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	October 18, 2007
AGILENT SPECTRUM ANALYZER	E4446A	MY433601.32	June 06, 2007

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 100KHz.

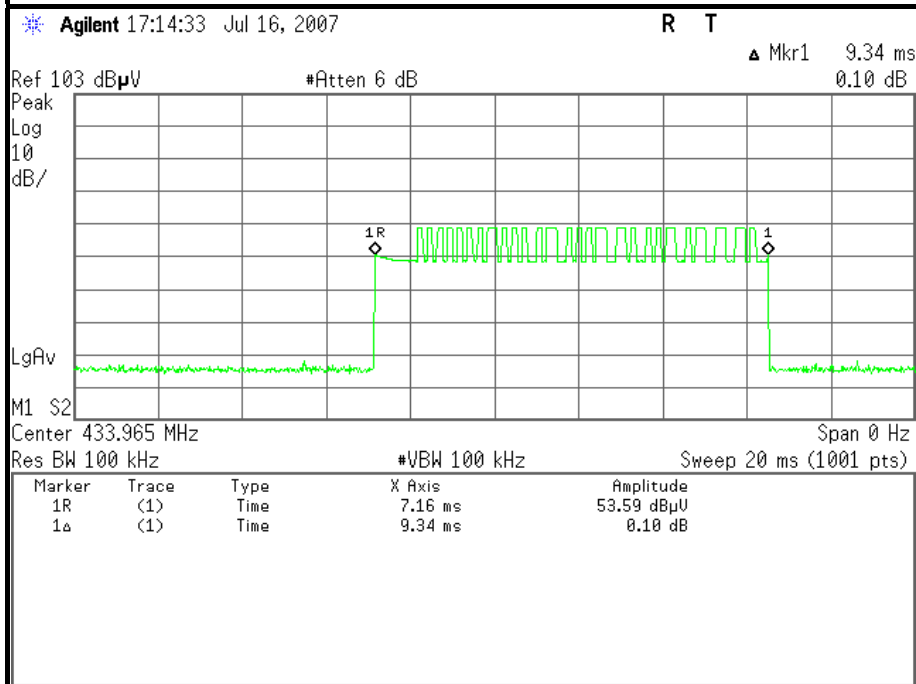
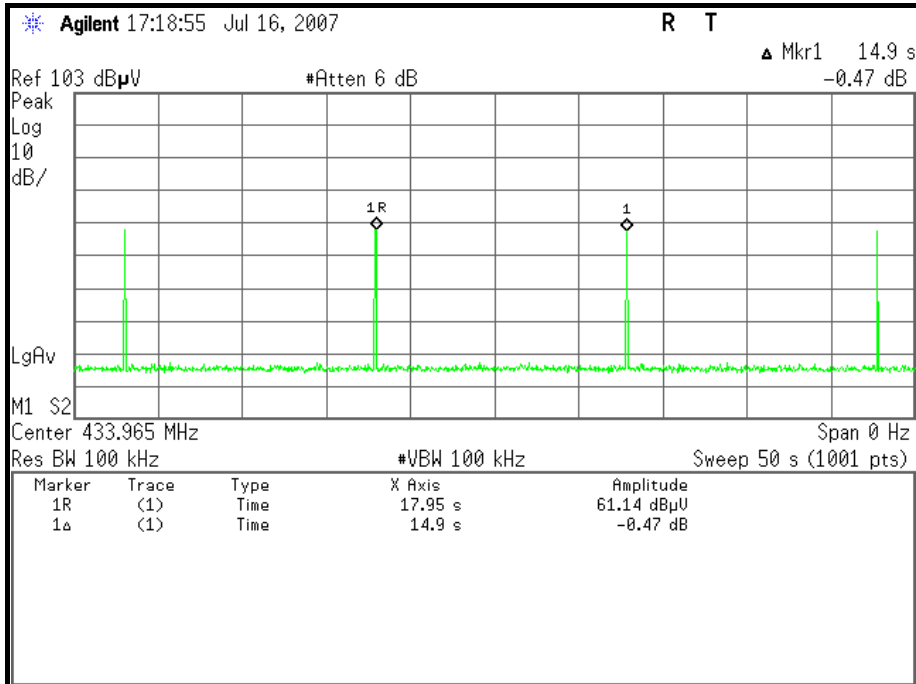
TEST RESULTS

No non-compliance noted

Frequency (MHz)	Transmission Time (s)	Maximum Transmission Limit (s)	Silent Duration (s)	Mimumum Silent Duration Limit (s)	Silent Period Versus Transmission Time Ratio	Minimum Ratio Limit	Result
433.92	0.00934	1.00	14.9	10.00	1520.4	30	PASS



Test Plot





8.3 DUTY CYCLE CORRECTION FACTOR

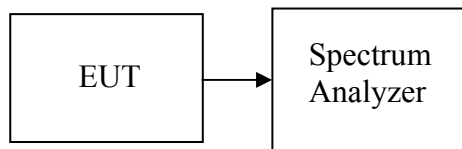
LIMIT

Nil (No dedicated limit specified in the Rules)

TEST EQUIPMENTS

Description & Manufacturer	Model No.	Serial No.	Date of Calibration
ROHDE & SCHWARZ SPECTRUM ANALYZER	FSEK30	835253/002	September 24, 2007
AGILENT SPECTRUM ANALYZER	E4446A	MY433601.32	March 22 , 2007

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=100KHz, Span = 0Hz, Adjust Sweep = 50s.
5. Repeat above procedures until all frequency measured were complete.

TEST RESULTS

No non-compliance noted

Test Data

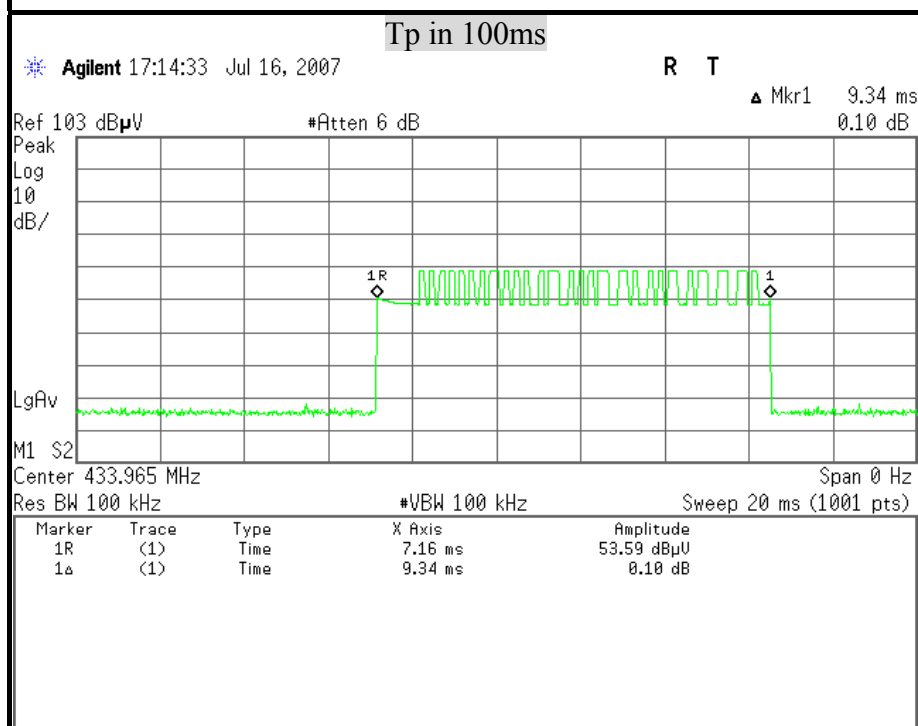
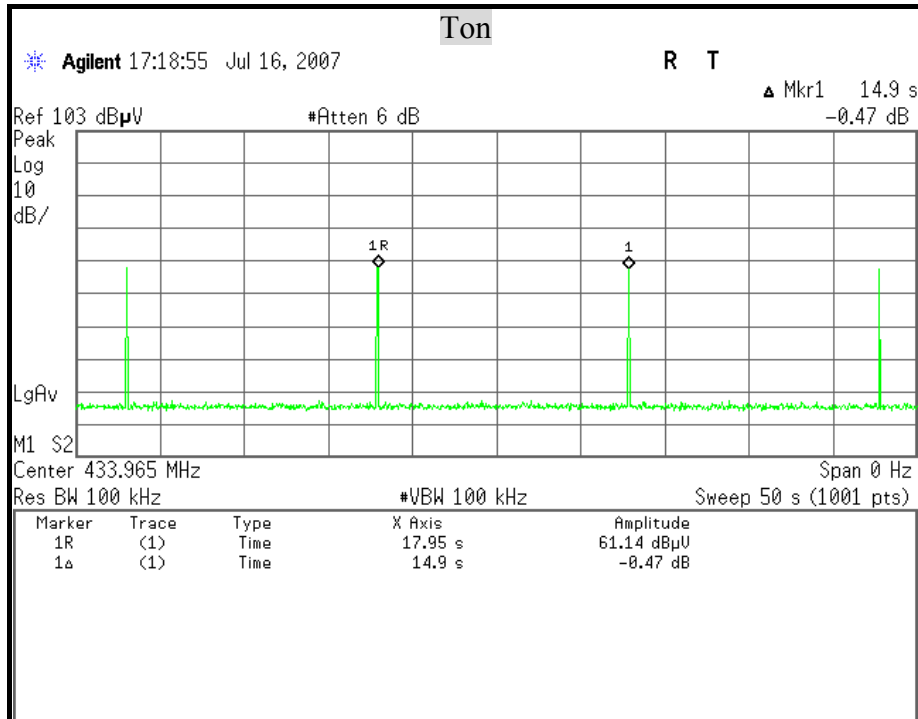
$T_p = 14.9(s)$

$T_{on} = 9.34 (ms)$

Duty Cycle Correction Factor = $20 * \log (T_{on} / T_p)$
 $= 20 * \log (9.34 / 100) = -20.53 < -20$
 $= -20 \text{ dB}$



Test Plot





8.4 RADIATED EMISSIONS

LIMIT

1. 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 ($\mu\text{V}/\text{m}$ at 3-meter)	Field Strength (dB $\mu\text{V}/\text{m}$ at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

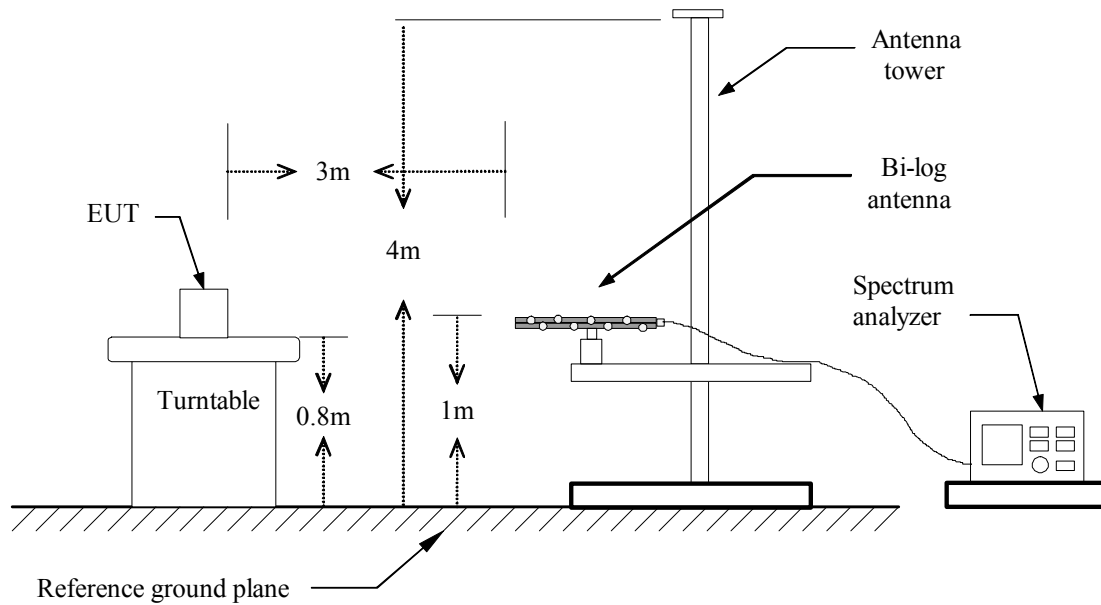
TEST EQUIPMENTS

The following test equipment is utilized in making the measurements contained in this report.

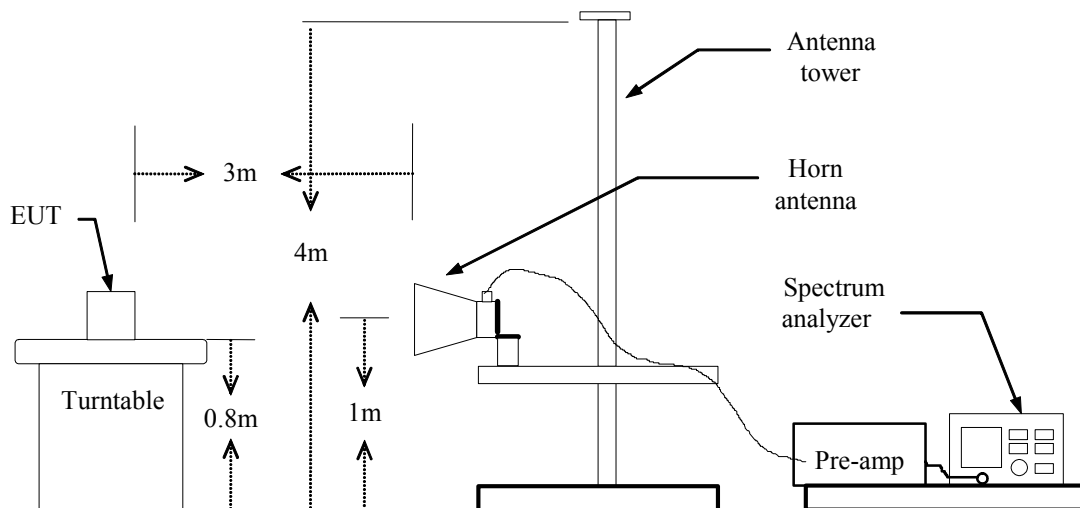
Manufacturer or Type	Model No.	Serial No.	Date of Calibration	Calibration Period	Remark
CHASE BILOG ANTENNA	CBL6112B	2817	August 28, 2007	1 Year	FINAL
R/S SPECTRUM ANALYZER	FSEK30	835253/002	October 18, 2007	1 Year	FINAL
AGILENT SPECTRUM ANALYZER	E4446A	MY433601.32	June 06, 2007	1 Year	FINAL
R/S EMI TEST RECEIVER	ESCS30	835418/008	September 02, 2007	1 Year	FINAL
OPEN SITE	-----	No.2	May 07, 2007	1 Year	FINAL
BELDEN N TYPE COAXIAL CABLE	9913-30M	002	August 21, 2007	1 Year	FINAL
Horn Antenna	AH-118	10089	August 30, 2007	1 Year	FINAL
Horn Antenna	AH-840	03077	February 25, 2007	1 Year	FINAL
Agilent Pre-amplifier	8449B	3008A01471	December 24, 2007	1 Year	FINAL
HP Amplifier	8447D	1937A02748	December 20, 2007	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
Loop Antenna ETS-LINDGREN	6502	2356	June 15, 2007	1 Year	FINAL

TEST SETUP

Below 1 GHz



Above 1 GHz





TEST PROCEDURE

The EUT is placed on a turntable, which is 0.8m above ground plane.

1. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
2. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
3. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
4. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. 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
6. Repeat above procedures until the measurements for all frequencies are complete.

TEST RESULTS

No non-compliance noted

**8.4.1 TRANSMITTER RADIATED EMISSION BELOW 1 GHz**

Product Name	Tai-Safety-H Tire Pressure Monitoring System	Test Date	2007/07/13
Model Name	TPMS-TX012	Test By	Jerry Chang
Test Mode	TX	TEMP & Humidity	26°C, 72%

Horizontal polarity										
Freq. (MHz)	Reading-PK (dBuV)	Reading-AVG (dBuV)	Correction Factor (dB/m)	Duty Factor (dB/m)	Result-PK (dBuV/m)	Result-AVG (dBuV/m)	Limit-PK/QP (dBuV/m)	Limit-AVG (dBuV/m)	Margin PK/QP (dB)	Margin AVG (dB)
433.52	71.89	----	-10.77	-20	61.12	41.12	92.87	72.87	-31.75	-31.75
71.71	39.33	N/A	-17.65	-20	21.68	N/A	40.00	N/A	-18.32	N/A
128.94	45.46	N/A	-14.80	-20	30.66	N/A	43.50	N/A	-12.84	N/A
143.49	39.65	N/A	-13.63	-20	26.02	N/A	43.50	N/A	-17.48	N/A
171.62	34.53	N/A	-14.13	-20	20.40	N/A	43.50	N/A	-23.10	N/A
243.40	33.82	N/A	-14.76	-20	19.07	N/A	46.00	N/A	-26.93	N/A
444.19	32.55	N/A	-10.54	-20	22.01	N/A	46.00	N/A	-23.99	N/A
868.08	51.09	----	-3.43	-20	47.66	27.66	74.00	54.00	-26.34	-26.34
Vertical polarity										
Freq. (MHz)	Reading-PK (dBuV)	Reading-AVG (dBuV)	Correction Factor (dB/m)	Duty Factor (dB/m)	Result-PK (dBuV/m)	Result-AVG (dBuV/m)	Limit-PK/QP (dBuV/m)	Limit-AVG (dBuV/m)	Margin PK/QP (dB)	Margin AVG (dB)
433.52	60.63	----	-10.77	-20	49.86	29.86	92.87	72.87	-43.01	-43.01
71.71	39.22	N/A	-17.65	-20	21.57	N/A	40.00	N/A	-18.43	N/A
100.81	43.74	N/A	-17.63	-20	26.11	N/A	43.50	N/A	-17.39	N/A
128.94	39.97	N/A	-14.80	-20	25.17	N/A	43.50	N/A	-18.33	N/A
444.19	35.80	N/A	-10.54	-20	25.26	N/A	46.00	N/A	-20.74	N/A
457.77	35.80	N/A	-10.37	-20	25.44	N/A	46.00	N/A	-20.56	N/A
868.08	43.16	----	-3.43	-20	39.73	19.73	74.00	54.00	-34.27	-34.27

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average 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).
7. Result-AVG = Result-PK +Duty factor.

**8.4.2 TRANSMITTER RADIATED EMISSION ABOVE 1 GHz**

Product Name	Tai-Safety-H Tire Pressure Monitoring System	Test Date	2007/07/13
Model Name	TPMS-TX012	Test By	Jerry Chang
Test Mode	TX	TEMP & Humidity	26°C, 72%

Horizontal polarity										
Freq. (MHz)	Reading-PK (dBuV)	Reading-AVG (dBuV)	Correction Factor (dB/m)	Duty Factor (dB/m)	Result-PK (dBuV/m)	Result-AVG (dBuV/m)	Limit-PK/QP (dBuV/m)	Limit-AVG (dBuV/m)	Margin PK/QP (dB)	Margin AVG (dB)
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vertical polarity										
Freq. (MHz)	Reading-PK (dBuV)	Reading-AVG (dBuV)	Correction Factor (dB/m)	Duty Factor (dB/m)	Result-PK (dBuV/m)	Result-AVG (dBuV/m)	Limit-PK/QP (dBuV/m)	Limit-AVG (dBuV/m)	Margin PK/QP (dB)	Margin AVG (dB)
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Remark:

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average 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).
7. Result-AVG = Result-PK +Duty factor.



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 μ 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.

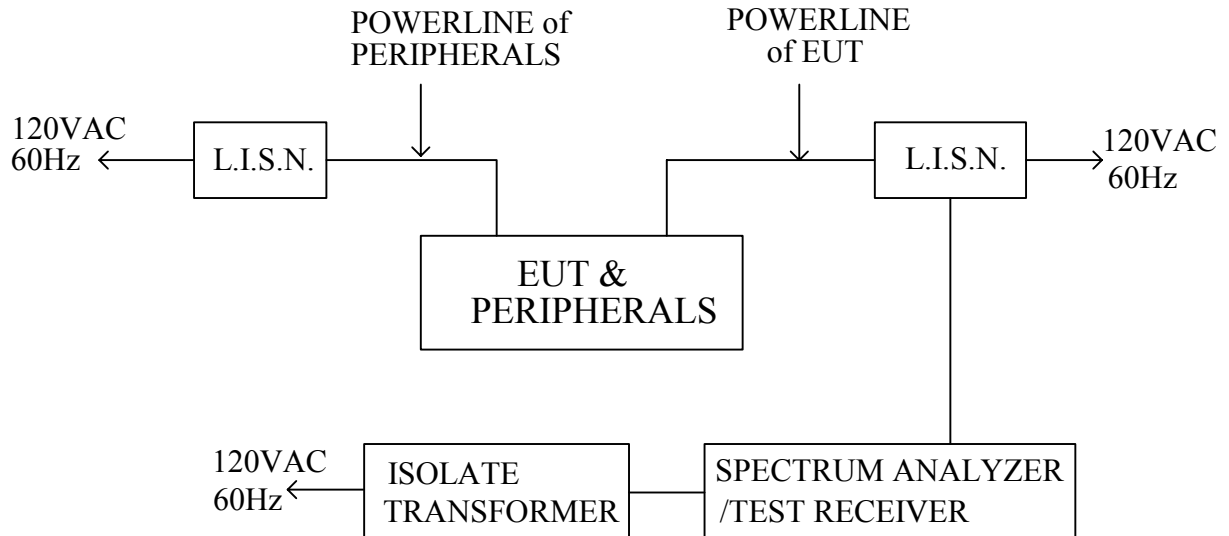
The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted limit (dB μ v)	
	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 equipment is used during the conducted powerline tests :

Manufacturer or Type	Model No.	Serial No.	Date of Calibration	Calibration Period	Remark
EMCO L.I.S.N.	3810/2	9801-1850	February 26, 2007	1 Year	FINAL
CHASE L.I.S.N	NNLK 8129	8129118	January 26, 2007	1 Year	FINAL
R & S TEST RECEIVER	ESHS30	838550/003	January 31, 2007	1 Year	FINAL
KEENE SHIELDED ROOM	5983	No.1	N/A	N/A	FINAL
R & S PULSE LIMIT	EHS3Z2	357.8810.52	July 10, 2007	1 Year	FINAL
N TYPE COAXIAL CABLE	-----	-----	August 21, 2007	1 Year	FINAL
50 Ω TERMINATOR	-----	-----	July 10, 2007	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 PCB antenna. The maximum Gain of the antenna is 0 dBi.