Korea EMC Laboratory Co., Ltd.

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Report Ref. No :

KEL06 – F11056

KEL
Korea EMC Laboratory

TEST REPORT

1. Client
- Name : SEETRON Inc.
- Address : 201-403 BUCHEON Techno-Park, 192 Yakdae-Dong, Wonmi-Gu, Bucheon City, 420-733, KOREA
- Date of Receipt : Nov. 30, 2006

2. Name of Product / Model : TIRE SENSOR / TP2-RV1-TX

3. Manufacturer /Country of Origin : SEETRON Inc. / KOREA

4. Date of Test : Nov. 30, 2006 ~ Dec. 29, 2006

5. Test Regulation : FCC Title 47, Part 15 Subpart C § 15.231

6. Equipment Class : DSC – Part 15 Security / Remote Control Transmitter

7. FCC ID : UVNTP2-RV1

8. Testing Environment
- Environment : Temperature : (22.3 ± 1.0) ℃ , Relative Humidity : (42. ± 3.0) % R.H.
- Location : ■ In Laboratory □ In Chamber □ On Site Test

9 Test Results : ☒ Pass ☐ Fail

Affirmation	Tested by Name : Jae-Pil Seo (Signature)	Technical Manager Name : Su-Gil Moon (Signature)

Jan. 10, 2007

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TABLE OF CONTENTS

DESCRIPTION **Page**

1. GENERAL

These tests were performed using the test procedure outlined in ANSI C63.4, 2003 for intentional radiators, and in accordance with the limits set forth in FCC Part 15.231 for Remote Control / Security Device Transceiver. The EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards.

We attest to the accuracy of data. All measurements reported herein were performed by KOREA EMC LABORATORY CO., LTD. and were made under Chief Engineer's supervision.
We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

2. TEST FACILITY

Location : Korea EMC Laboratory Co., Ltd.
390 Bora-ri, Giheung-eup, Yongin-si, Gyeunggi-do, Republic of Korea
(Zip Code:449-904)

Site : - 3 m/10 m Open Area Testing Site No.1
- 3 m Semi-Anechoic Chamber No.1
- Shielded Room No.1

This test site is in compliance with ISO/IEC 17025 for the general requirements for the competence of testing and calibration laboratories.

2.1 List of Test Equipment

Equipment	Manufacturer	Model #	Serial #	Use
Spectrum Analyzer	Advantest	R3273	110600584	☒
Spectrum Analyzer	H.P	8560E	3517A01551	☒
Modulation Analyzer	H.P	8901B	3438A05241	☐
Audio Analyzer	H.P	8903B	3011A08331	☐
Frequency Counter	EIP Microwave	28B	9205-004723	☐
CDMA Mobile Station Test Set	H.P	8924C	US37261566	☐
Digital Oscilloscope	Tecktronics	TDS380	B011855	☐
Digital Multimeter	Fluke	8842A	6585251	☐
Test Receiver	Rohde&Schwarz	ESVS10	825120/006	☐
Test Receiver	Rohde&Schwarz	ESCS30	100054	☒
Signal Generator	H.P	E4421A	US37230495	☐
Function Generator	H.P	33120A	US36030957	☐
Dual Directional Coupler	H.P	778D	14903	☐
L.I.S.N (for E.U.T)	SCHWARZBECK	NSLK8128	8128144	☐
L.I.S.N (for Peripheral)	Kyoritsu	KNW-407	8-8833-14	☐
Pre-amplifier	H.P	8447E	2434A02093	☒
Pre-amplifier	A.H Systems, Inc.	PAM-0118	2641	☒
Power Meter	Agilent	E4416A	GB41290751	☐
Power Sensor	Agilent	E9323A	US40410488	☐
Active Loop Antenna	EMCO	6507	1435	☐
Bi-Log Antenna	Schwarzbeck	VULB9160	3121	☐
Bi-Log Antenna	Schwarzbeck	VULB9160	3049	☒
Double Ridge Horn Antenna	A.H Systems, Inc.	SAS-571	500	☒
DC Power Supply	H.P	E3611A	KR41808575	☐
Temperature/Humidity Chamber	HANYOUNG	HY-LTH2	A33-051216	☐
Temperature/Humidity Chamber	HANYOUNG	HY-LTH-3	A34-970616	☐
Attenuator	H.P	8498A	1801A04842	☐
Attenuator	H.P	8491A	30907	☐

2.2 Test Environment

See each test item's description.

3. DESCRIPTION OF THE EQUIPMENT UNDER TEST

The product specification described herein was obtained from the product data sheet or user's manual.

3.1 Rating and Physical Characteristics

Type / Model No.	Tire Pressure Monitoring System (Tire Sensor) / TP2-RV1-TX
Power Source	DC 3.6 V (Lithium Battery)
Oscillating Method	PLL
Transmit Frequency	447.4 MHz
Antenna Type	Integral
Type of Modulation	FSK
RF Output power	70 dBuV under
Interface Ports	N / A

4. TEST CONDITIONS

4.1 Condition of Test Setup

For the testing of the Radiation emission and the Occupied bandwidth, the EUT was set for the modulated continuous transmission mode by software. During the testing of the Time between periodic transmission, the EUT transmits periodically.

4.2 List of Peripherals

Equipment Type	FCC ID	Manufacture	Model	Serial No.
None				

4.3 Type of Used Cables

Cable	Length	Type of shield	Manufacturer	Remark
None				

4.4 Uncertainty

■ **Radiated disturbance**

- Uc (Combined standard Uncertainty) = ± 2.52 dB
- Expanded uncertainty U = KUc = ± 5.05 dB (K = 2)

5. TEST RESULTS

5.1 Summary of Test Results

Requirement	CFR Section	Test Result
Antenna Requirement	15.203	PASS
Transmission Requirements	15.231(a)	PASS
Radiated Spurious Emissions	15.231(b)	N / A (1)
Occupied bandwidth	15.231(c)	PASS
Frequency Tolerance	15.231(d)	N / A (2)
Periodic Alternate Field Strength Requirements	15.231(e)	PASS

■ Justification of N/A's :
(1) The EUT transmits periodically, therefore it was required to comply with the limits of 15.231(e).
(2) The EUT does not operate in the frequency range of 40.66 MHz ~ 40.70 MHz.

5.2 Antenna Requirement

5.2.1 Regulation

FCC 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31 (d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

5.2.2 Result : PASS

The transmitter has an integral antenna and meets the requirements of this section.

5.3 Transmission Requirements

5.3.1 Regulation

§ 15.231(a)(1)

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds after being released.

§ 15.231(a)(2)

A transmitter activated automatically shall cease transmission within 5 seconds of activation.

§ 15.231(a)(3)

Periodic transmissions at regular pre-determined intervals are not permitted. However polling or supervisory transmissions to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

§ 15.231(a)(4)

Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm.

§ 15.231 (a)(5)

Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmission are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

5.3.2 Result : PASS

§ 15.231(a)(1) :

The apparatus is not manually controlled.

§ 15.231(a)(2) :

The apparatus automatically cease transmission within 5 seconds of activation.

§ 15.231(a)(3) :

The apparatus does transmit periodically but this is covered under 15.231(e).

§ 15.231(a)(4) :

The apparatus is not manually controlled.

§ 15.231 (a)(5) :

The apparatus is not under control of a professional installer.

5.4 Occupied Bandwidth

5.4.1 Regulation

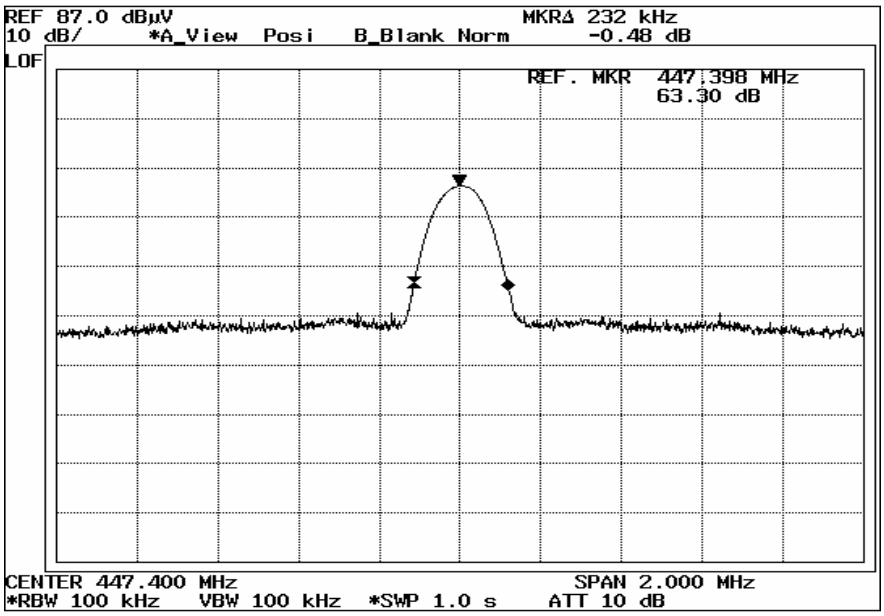
According to §15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900MHz. For devices operating above 900MHz, the emission shall be no wider than 0.5% of the center frequency.
Bandwidth is determined at the points 20 dB down from the modulated carrier.

5.4.2 Test Procedure

ANSI C63.4-2003 Section 13.1.7, Occupied Bandwidth Measurements. The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the un-modulated carrier, even if atypical. Once the reference level is established, the equipment is conditioned with typical modulating signals to produce worst-case (i.e., the widest) bandwidth. The measurements were performed at operating Frequency (447.4 MHz). The spectrum trace data around fundamental frequency of the EUT was obtained with the spectrum analyzer in “Max Hold” mode. The bandwidth value was determined between the two points of 20dB down from the reference level.

5.4.3 Test Result : PASS

Occupied bandwidth		
Center frequency (MHz)	Limit (kHz)	Test Result (kHz)
447.4	1118.5	232



5.5 Periodic Alternate Field Strength Requirements

5.5.1 Regulation

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

Fundamental frequency (MHz)	Field strength of fundamental (uV/m @ 3m)	Field strength of Spurious Emissions (uV/m @ 3m)
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

** linear interpolations

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.

5.5.2 Test Procedure

The final measurement of radiated field strength was carried out in a 3 m Semi-Anechoic Chamber that was listed up at FCC according to the “Radiated Emissions Testing” procedure specified by ANSI C63.4.

Based on the test results in the preliminary test, measurement was made in the same test set up and configuration which produced maximum emission level. The receiving antenna was installed at 3-meter distance from the EUT, and was connected to an EMI receiver or spectrum analyzer with a RF amplifier. The antenna polarization was also changed from vertical to horizontal. The spectrum was scanned from 30 MHz to 1000 MHz using the Bi-Log antenna. Above 1 GHz, linearly polarized double ridge horn antenna was used. The turntable was rotated through 360 degrees and receiving antenna height was varied from 1 to 4 meters above the ground plane to read maximum emission level.

To obtain the final test data, each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector function with specified bandwidth.

5.5.3 Test Results : PASS

Field strength									
Frequency (MHz)	Pol. (V/H)	AH/TA (m)/(°)	Reading (dBuV)	Amp Gain (dB)	AF + CL (dB/m)	Actual (dBuV/m)		Limit (dBuV/m)	Margin (dB)
						Peak	Average		
447.4	H	1.7 / 0	61.8	22.0	23.4	63.3	63.2	73.3	10.1
894.8	H	1.0 / 100	20.6	22.0	32.4	37.4	31.0	53.9	22.9
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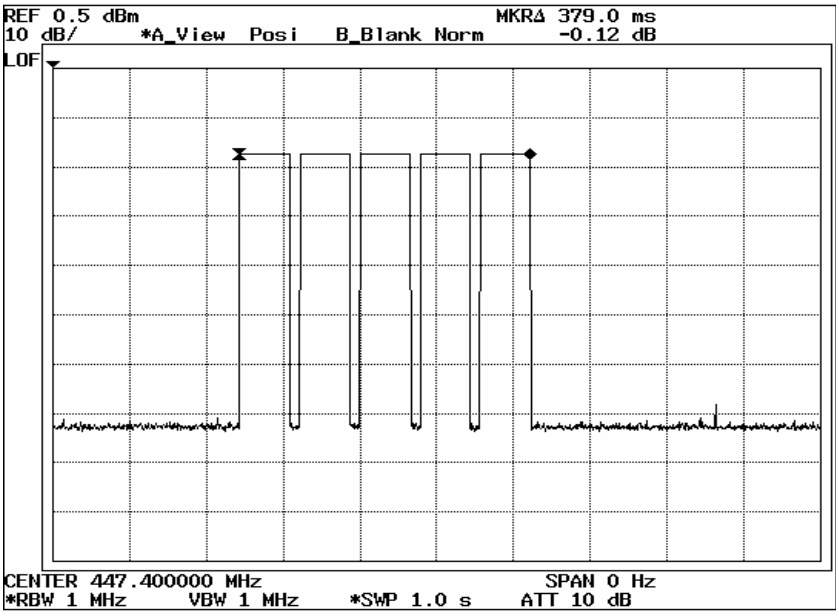
Note :

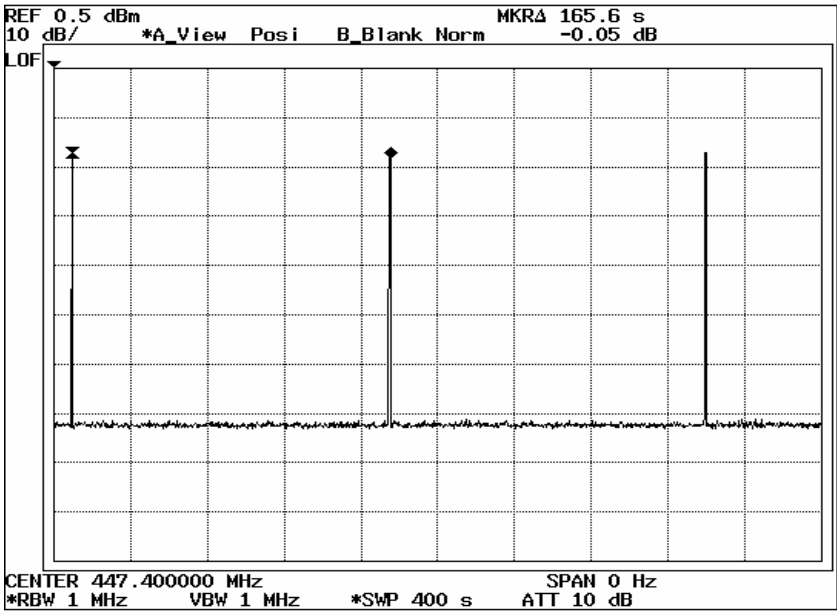
H = Horizontal, V = Vertical Polarization.
AH= Antenna Height, TA=Table Angle
AF / CL = Antenna Factor and Cable Loss.
Resolution Bandwidth: 120 kHz for ranges below 1 GHz, 1 MHz for ranges over 1 GHz.
The frequency range was scanned from 30 MHz to 5 GHz.

Margin (dB) = Limit – Actual
[Actual = Reading – Amp Gain + AF + CL]

■ On-time for Periodic transmissions



■ **Time between Periodic transmissions**



■ **Time between transmissions > 30 x Transmission on-time**

: 165.6 s > 30 x 379.0 msec