FCC Test Report

Product Name	Tyre Pressure Monitoring Sensor ECU
Model No.	MFR
FCC ID	MRXMFR

Applicant	Schrader Electronics Ltd.
Address	11 Technology Park, Belfast Road, Antrim, BT41 1QS, Northern Ireland

Date of Receipt	May 12, 2015
Issued Date	June 09, 2015
Report No.	1550297R-RFUSP14V00
Report Version	V2.0

Testing Laboratory
3023

Test Report

Issued Date: June 09, 2015
Report No.: 1550297R-RFUSP14V00

Product Name	Tyre Pressure Monitoring Sensor ECU
Applicant	Schrader Electronics Ltd.
Address	11 Technology Park, Belfast Road, Antrim, BT41 1QS, Northern Ireland
Manufacturer	Schrader Electronics Ltd.
Model No.	MFR
EUT Rated Voltage	DC 12V (Power by Battery)
EUT Test Voltage	DC 12V (Power by Battery)
Trade Name	SCHRADER ELECTRONICS
Applicable Standard	FCC CFR Title 47 Part 15 Subpart B: 2014 ANSI C63.4: 2009, ANSI C63.10: 2009 RSS-Gen Issue 4 (Nov, 2014) ANSI C63.4: 2014, ANSI C63.10: 2013
Test Result	Complied

Documented By : Rita Huang
(Senior Adm. Specialist / Rita Huang)

Tested By : Ivan Chuang
(Assistant Engineer / Ivan Chuang)

Approved By :
(Director / Vincent Lin)

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1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Tyre Pressure Monitoring Sensor ECU
Trade Name	SCHRADER ELECTRONICS
Model No.	MFR
Frequency Range	433.92 MHz
Type of Modulation	FSK
Number of Channels	1
Antenna Type	Integral Antenna
Channel Control	Auto

Frequency of Each Channel

Channel	Frequency
Channel 1:	433.92 MHz

Note:

1. The EUT is a Tyre Pressure Monitoring Sensor ECU with a built-in Z-wave Receiver module.
2. These tests are conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart B.

Test Mode	Mode 1: Receive Mode

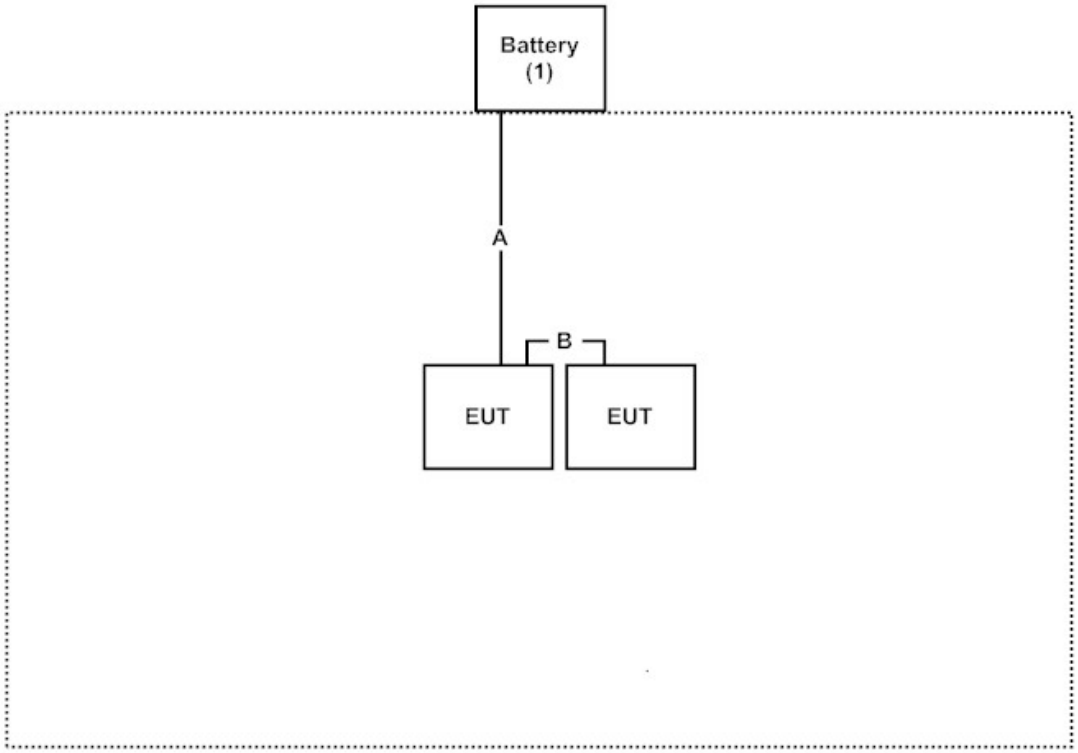
1.2. Test System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

1	Monitor	Dell	ST2320L3	CN-0M2NN672872-22I-C9WWS	Non-Shielded, 1.8m
2	Battery	TRANE	12B50PE	N/A	N/A

Signal Cable Type		Signal cable Description
A	Power Cable	Non-Shielded, 1.2m
B	Signal Cable	Non-Shielded, 3.4m

1.3. Configuration of Test System



1.4. EUT Exercise Software

(1) Setup the EUT as shown in section 1.3.

(2) Porvide the DC Power Source.

(3) Start receives mode continually.

(4) Verify that the EUT works properly.

1.5. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from QuieTek Corporation's Web Site: http://www.quietek.com/chinese/about/certificates.aspx?bval=5

The address and introduction of QuieTek Corporation's laboratories can be founded in our Web site: http://www.quietek.com/

Site Description: Federal Communications Commission
FCC Engineering Laboratory
7435 Oakland Mills Road
Columbia, MD 21046
Registration Number: 92195

Site Name: Quietek Corporation
Site Address: No.5-22, Ruishukeng,
Linkou Dist. New Taipei City 24451,
Taiwan, R.O.C.
TEL: 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : service@quietek.com

FCC Accreditation Number: TW1014

2. Conducted Emission

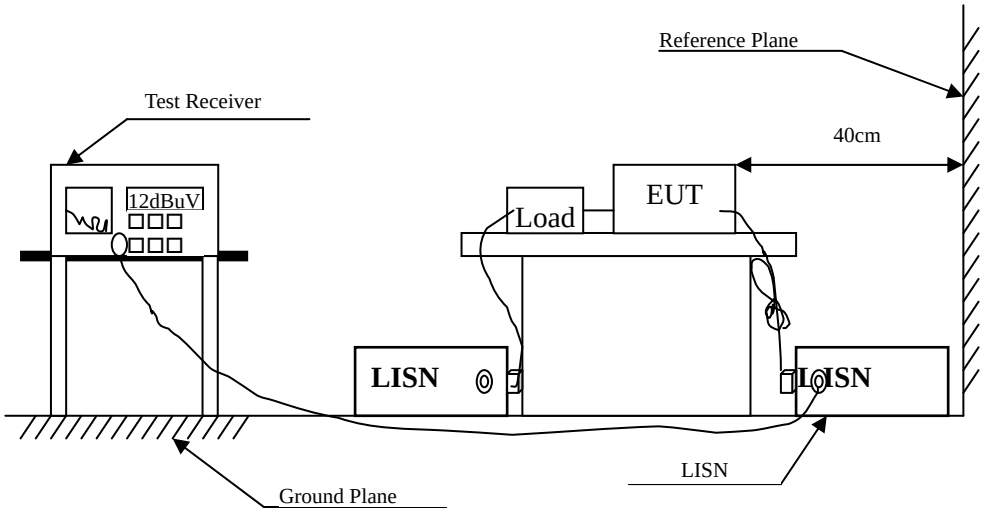
2.1. Test Equipment

The following test equipment are used during the conducted emission test:

	Equipment	Manufacturer	Model No. / Serial No.	Last Cal.	Remark
X	Test Receiver	R & S	ESCS 30 / 825442/018	Sep., 2014	
X	Artificial Mains Network	R & S	ENV4200 / 848411/10	Feb., 2015	Peripherals
X	LISN	R & S	ESH3-Z5 / 825562/002	Feb., 2015	EUT
	DC LISN	Schwarzbeck	8226 / 176	Mar, 2015	EUT
X	Pulse Limiter	R & S	ESH3-Z2 / 357.8810.52	Feb., 2015	
	No.1 Shielded Room				

Note: All equipments are calibrated every one year.

2.2. Test Setup



2.3. Limits

FCC Part 15 Subpart B Paragraph 15.107 (dBuV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

Remarks: In the above table, the tighter limit applies at the band edges.

2.4. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)
Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2009 on conducted measurement.
Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

2.5. Uncertainty

± 2.26 dB

2.6. Test Result of Conducted Emission

The EUT is powered by batteries Owing to the DC operation. This test item is not performed

3. Radiated Emission

3.1. Test Equipment

The following test equipments are used during the radiated emission test:

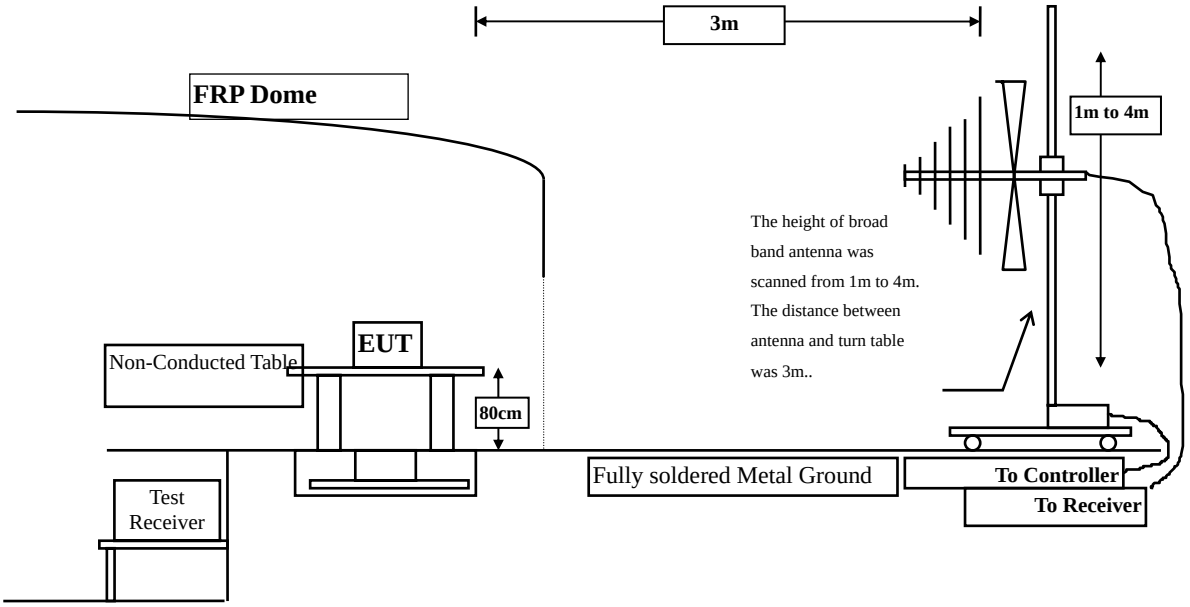
Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒Site # 3	X	Magnetic Loop Antenna	Teseq	HLA6121/ 37133	Sep, 2014
	X	Bilog Antenna	Schaffner Chase	CBL6112B/ 2707	Jun, 2015
	X	EMI Test Receiver	R&S	ESCS 30/838251/ 001	Jun, 2015
	X	Coaxial Cable	QTK(Arnist)	RG 214/ LC003-RG	Jun, 2015
	X	Coaxial signal switch	Arnist	MP59B/ 6200798682	Jun, 2015

Test Site		Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒CB # 8	X	Spectrum Analyzer	R&S	FSP40/ 100339	Oct, 2014
	X	Horn Antenna	ETS-Lindgren	3117/ 35205	Mar, 2015
	X	Horn Antenna	Schwarzbeck	BBHA9170/209	Jan, 2015
	X	Horn Antenna	TRC	AH-0801/95051	Aug, 2014
	X	Pre-Amplifier	EMCI	EMC012630SE/980210	Jan, 2015
	X	Pre-Amplifier	MITEQ	JS41-001040000-58-5P/153945	Jul, 2014
	X	Pre-Amplifier	NARDA	DBL-1840N506/013	Jul, 2014

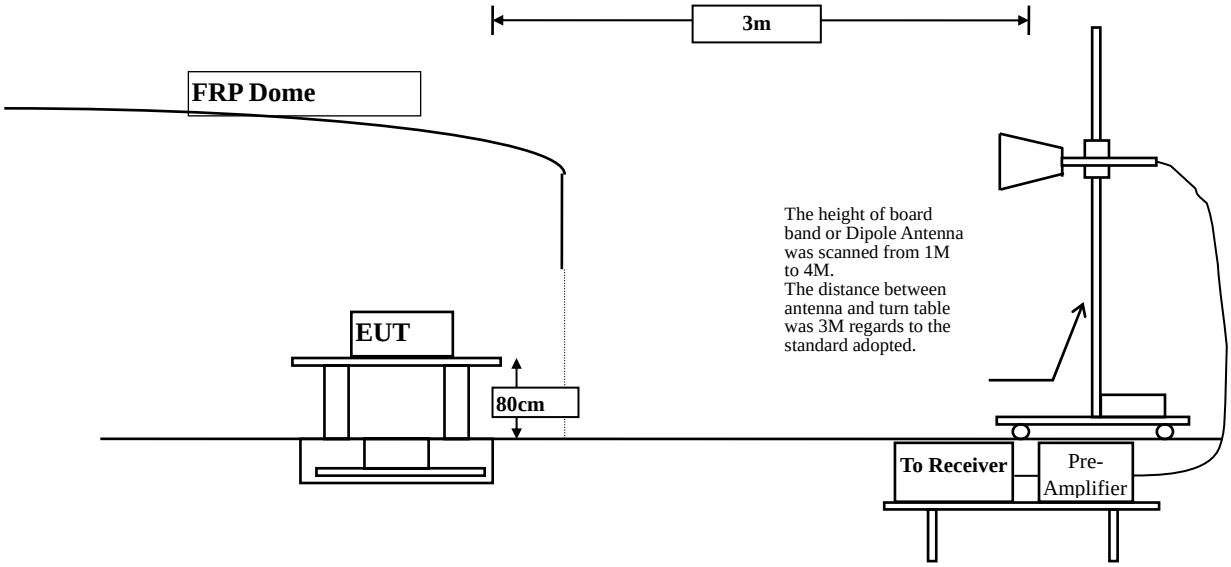
Note: 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with “X” are used to measure the final test results.

3.2. Test Setup

Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



3.3. Limits

FCC Part 15 Subpart B Paragraph 15.109 Limits		
Frequency MHz	uV/m @3m	DBuV /m@3m
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Remarks : 1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

3.4. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.
Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2009 on radiated measurement.
The resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz. Radiated emission measurements below 1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.
The measurement is divided into the Preliminary Measurement and the Final Measurement.
The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.
The worst radiated emission is measured on the Final Measurement.
The measurement frequency range form 30MHz - 10th Harmonic of fundamental was investigated.

3.5. Uncertainty

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz

3.6. Test Result of Radiated Emission

Product : Tyre Pressure Monitoring Sensor ECU
Test Item : Harmonic Radiated Emission
Test Site : No.3 OATS
Test Mode : Mode 1: Receive Mode (433.92MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Peak Detector:					
1301.760	-4.795	37.309	32.514	-41.486	74.000
1735.680	-3.977	36.823	32.846	-41.154	74.000
2384.000	-1.154	37.442	36.288	-37.712	74.000
3176.000	-1.102	39.403	38.301	-35.699	74.000
4160.000	1.541	39.683	41.224	-32.776	74.000
Average Detector:					
--					
Peak Detector:					
1301.760	-4.143	34.812	30.669	-43.331	74.000
1735.680	-2.068	36.225	34.157	-39.843	74.000
3280.000	-0.711	36.301	35.590	-38.410	74.000
3832.000	1.320	35.868	37.188	-36.812	74.000
4752.000	6.430	35.988	42.418	-31.582	74.000
Average Detector:					
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Tyre Pressure Monitoring Sensor ECU
Test Item : General Radiated Emission
Test Site : No.3 OATS
Test Mode : Mode 1: Receive Mode (433.92MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
35.820	-7.910	34.373	26.463	-13.537	40.000
70.740	-20.410	37.693	17.283	-22.717	40.000
103.720	-16.300	33.392	17.092	-26.408	43.500
410.240	-11.310	31.722	20.412	-25.588	46.000
604.240	-6.380	30.622	24.242	-21.758	46.000
780.780	-6.580	31.247	24.667	-21.333	46.000
Vertical					
41.640	-18.690	47.332	28.642	-11.358	40.000
70.740	-22.810	46.182	23.372	-16.628	40.000
196.840	-12.820	30.592	17.772	-25.728	43.500
416.060	-12.110	31.555	19.445	-26.555	46.000
540.220	-11.020	30.871	19.851	-26.149	46.000
679.900	-9.600	31.991	22.391	-23.609	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss –Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

4. EMI Reduction Method During Compliance Testing

No modification was made during testing.

Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs