FCC Test Report

Product Name	Tyre Pressure Monitoring Sensor
Model No.	DG6W2D4
FCC ID.	MRXDG6W2D4

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

Date of Receipt	Oct. 06, 2017
Issued Date	Oct. 30, 2017
Report No.	17A0090R-RFUSP14V00
Report Version	V1.0

Testing Laboratory
3023

The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration of the equipment and evaluated measurement uncertainty herein.

This report must not be used to claim product endorsement by TAF or any agency of the government.

Test Report

Issued Date : Oct. 30, 2017
Report No. : 17A0090R-RFUSP14V00

Product Name	Tyre Pressure Monitoring Sensor
Applicant	Schrader Electronics Ltd.
Address	11 Technology Park, Belfast Road, Antrim, BT41 1QS, United Kingdom
Manufacturer	Schrader Electronics Ltd.
Model No.	DG6W2D4
FCC ID.	MRXDG6W2D4
EUT Rated Voltage	DC 3V(Power by Battery)
EUT Test Voltage	DC 3V(Power by Battery)
Trade Name	SCHRADER ELECTRONICS
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2016 ANSI C63.4: 2014, ANSI C63.10: 2013
Test Result	Complied

Documented By : Rita Huang

(Senior Adm. Specialist / Rita Huang)

Tested By : Paul Jiang

(Engineer / Paul Jiang)

Approved By :

(Director / Vincent Lin)

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1. General Information

1.1. EUT Description

Product Name	Tyre Pressure Monitoring Sensor
Trade Name	SCHRADER ELECTRONICS
Model No.	DG6W2D4
FCC ID	MRXDG6W2D4
Frequency Range	433.92MHz
Number of Channels	1
Type of Modulation	ASK
Antenna Type	Integral Antenna
Serial number(s) of tested item(s)	F6BFB

Frequency of Each Channel:

Channel	Frequency
Channel 1:	433.92 MHz

Note:

1. The EUT is a Tyre Pressure Monitoring Sensor with a built-in 433.92 MHz transmitter.
2. The antenna of EUT is conform to FCC 15.203
3. These tests are conducted on a sample for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.231(e).
4. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

Test Mode	Mode 1: Transmit

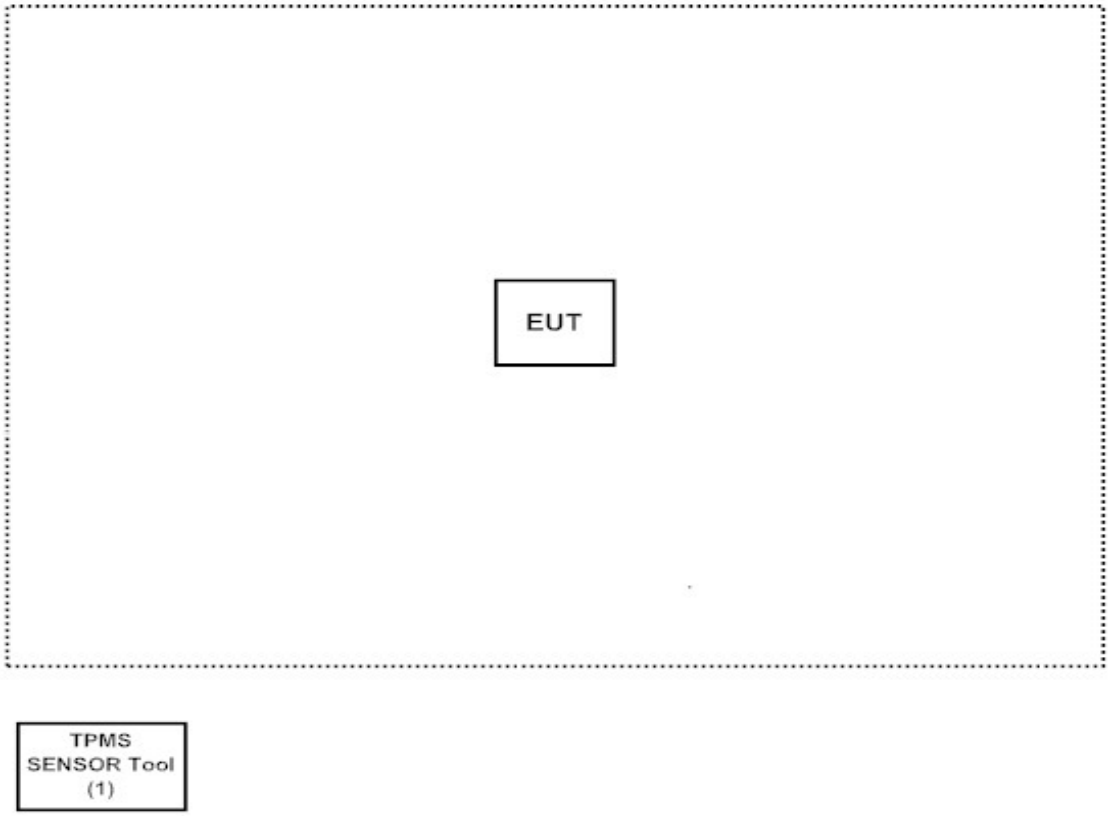
1.3. Tested System Details

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

Product		Manufacturer	Model No.	Serial No.	FCC ID	Power Cord
1	TPMS SENSOR Tool	Schrader Electronics Ltd.	8C2T-1A203-AB	N/A	N/A	N/A

Signal Cable Type	Signal cable Description
N/A	

1.4. Configuration of tested System



1.5. EUT Exercise Software

1	Setup the EUT as shown in section 1.4.
2	Press and hold the button of TPMS SENSOR Tool.
3	Start transmits continually.
4	Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	30-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:
http://www.dekra.com.tw/english/about/certificates.aspx?bval=5
The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: http://www.dekra.com.tw/index_en.aspx

Site Description: Accredited by TAF
Accredited Number: 3023

Site Name: DEKRA Testing and Certification Co., Ltd
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 : info.tw@dekra.com

FCC Accreditation Number: TW3023

1.7. List of Test Equipment

For Conducted measurements /CB3/SR8

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
	Temperature Chamber	WIT GROUP	TH-1S-B	EQ-201-00146	2016/11/28	2017/11/27
X	Spectrum Analyzer	Agilent	N9010A	MY48030495	2017/7/22	2018/7/21
X	Power Meter	Anritsu	ML2495A	6K00003357	2017/6/23	2018/6/22
X	Pulse power sensor	Anritsu	MA2411B	0846193	2017/6/23	2018/6/22
X	EMI Test Receiver	R&S	ESCS 30	100369	2017/10/13	2018/10/12
X	LISN	R&S	ESH3-Z5	836679/017	2017/1/18	2018/1/17
X	LISN	R&S	ENV216	100097	2017/1/18	2018/1/17
X	Coaxial Cable	QTK(Arnist)	RG 400	LC018-RG	2017/6/25	2018/6/24

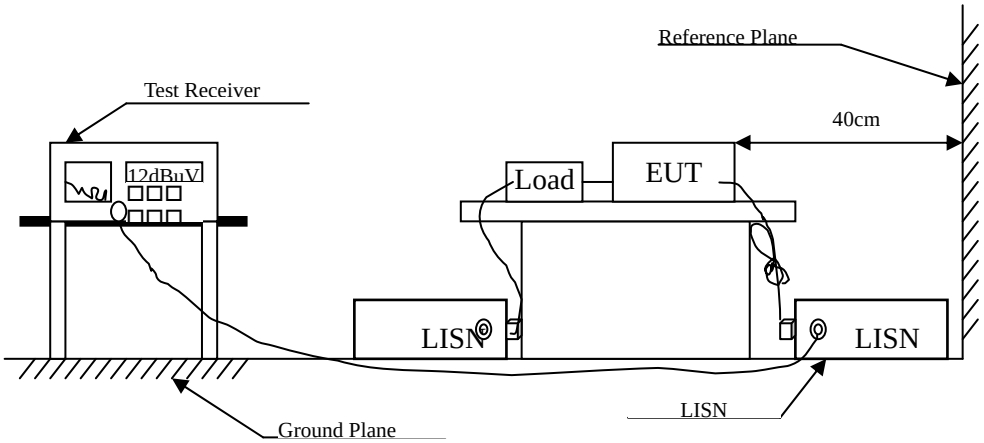
For Radiated measurements /Site3/CB8

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Data	Due. Data
X	Spectrum Analyzer	R&S	FSP40	100170	2017/1/18	2018/1/17
X	Loop Antenna	Teseq	HLA6121	37133	2017/3/18	2018/3/17
X	Bi-Log Antenna	Schaffner Chase	CBL6112B	2707	2017/6/11	2018/6/10
X	Horn Antenna	ETS-Lindgren	3117	00135205	2017/4/6	2018/4/5
X	Horn Antenna	Schwarzbeck	BBHA9170	209	2017/4/14	2018/4/13
X	Pre-Amplifier	QTK	AP/0100A	CHM/0901069	2017/6/23	2018/6/22
X	Pre-Amplifier	EMCI	EMC012630SE	980210	2017/1/26	2018/1/24
X	Pre-Amplifier	NARDA WE	DBL-1840N506	013	2017/9/30	2018/9/29
X	Filter	MicroTRON	BRM50701	019	2016/11/2	2017/11/1
X	Filter	Microwave Circuits	N0257881	36681	2017/1/3	2018/1/2
X	EMI Test Receiver	R&S	ESR26	101385	2017/9/29	2018/9/28
X	Coaxial Cable	QTK(Arnist)	SUCOFLEX 106	L1606-015C	2017/6/23	2018/6/22
X	EMI Test Receiver	R&S	ESCS 30	838251/001	2017/7/21	2018/7/20
X	Coaxial Cable	QTK(Arnist)	RG 214	LC003-RG	2017/6/16	2018/6/15
X	Coaxial signal switch	Anritsu	MP59B	6201415889	2017/6/16	2018/6/15

Note:
1. All equipments are calibrated every one year.
2. The test instruments marked with “X” are used to measure the final test results.
3. Test Software version :QuieTek EMI 2.0 V2.1.113.

2. Conducted Emission

2.1. Test Setup



2.2. Limits

FCC Part 15 Subpart C Paragraph 15.207 Limits (dBuV)		
Frequency MHz	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.

2.3. 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: 2014 on conducted measurement.

Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

2.4. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.207(a)

2.5. Uncertainty

± 2.26 dB

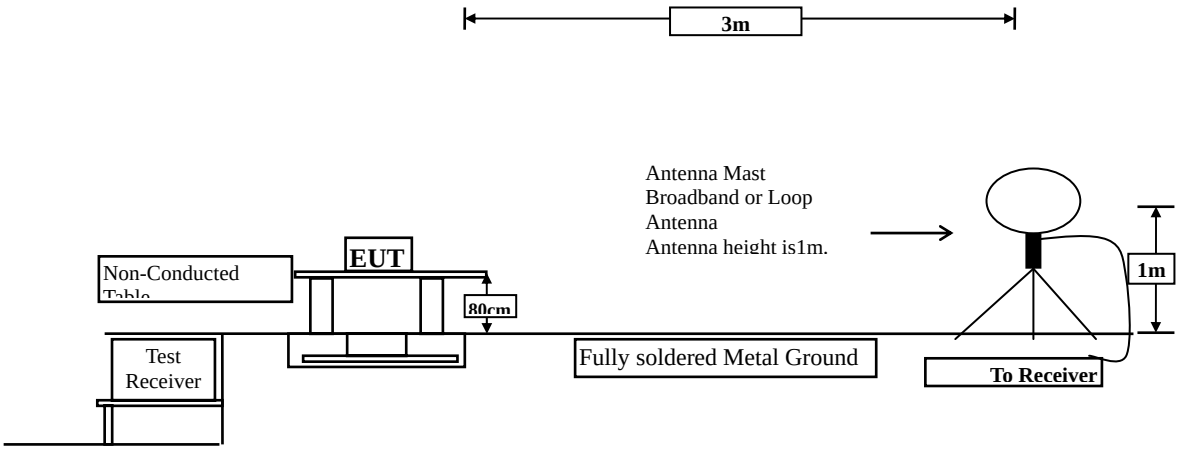
2.6. Test Result

Owing to the DC operation of EUT, this test item is not performed.

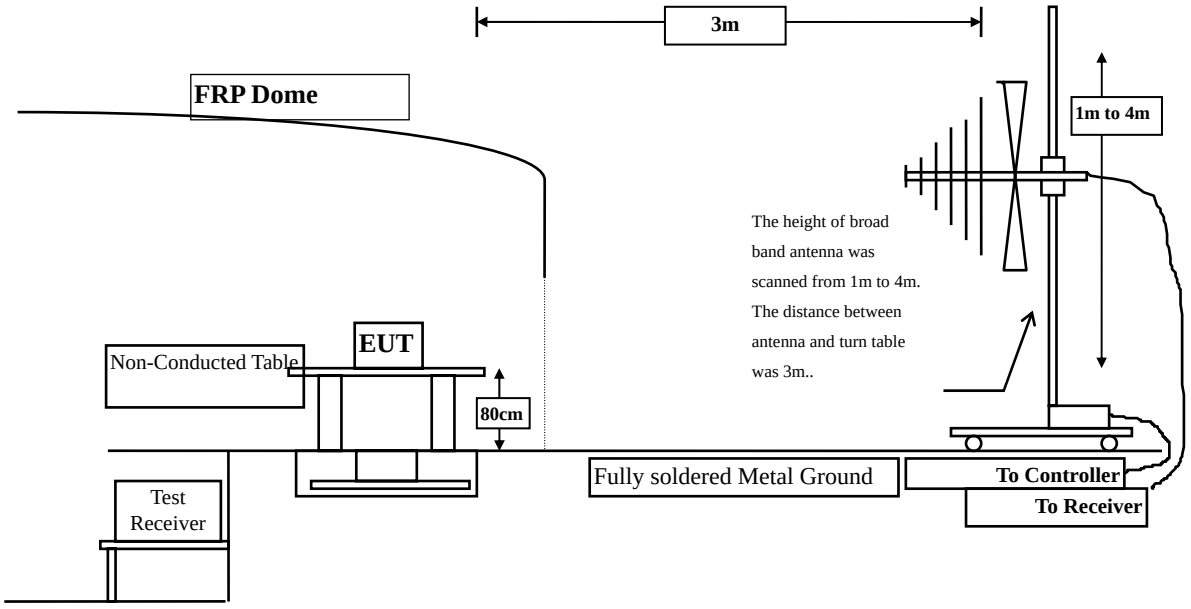
3. Radiated Emission

3.1. Test Setup

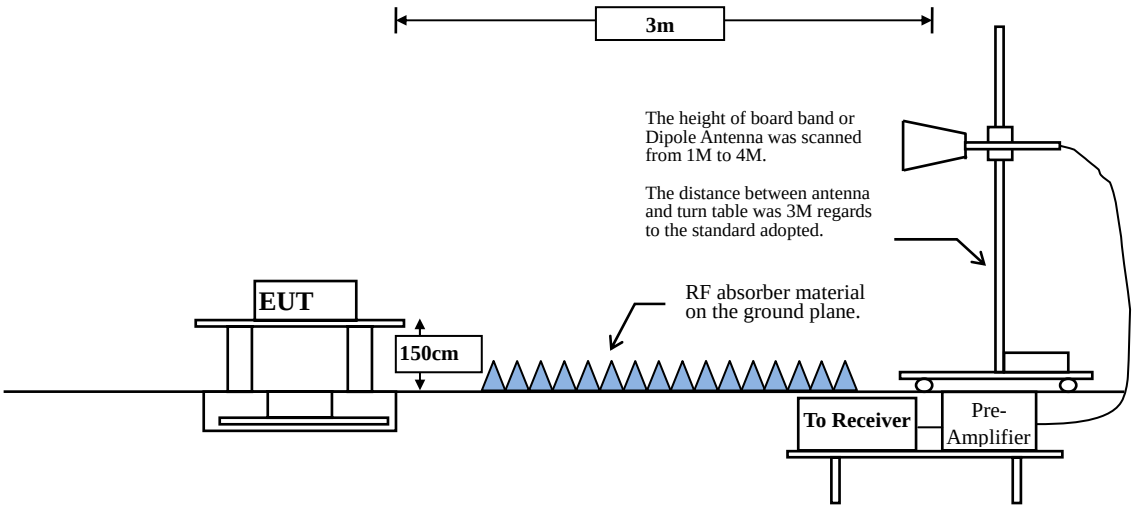
Radiated Emission Under 30MHz



Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



3.2. Limits

➢ Fundamental and Harmonics Emission Limits

FCC Part 15 Subpart C Paragraph 15.231(e) Limits		
Fundamental Frequency MHz	Field Strength of Fundamental	Field Strength of Spurious Emission
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

Remarks : 1. RF Voltage (dBuV) = 20 log RF Voltage (uV)

2. 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. The emission limit in this paragraph is based on measurement instrumentation employing an average detector.

➢ Spurious electric field strength limits

FCC Part 15 Subpart C Paragraph 15.209 Limits			
Frequency MHz	uV/m	dBuV/m	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	See Remark[1]	300
0.490-1.705	24000/F(kHz)	See Remark[1]	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

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.

3.3. Test Procedure

Measuring the frequency range below 1GHz, the EUT is placed on a turn table which is 0.8 meter above ground,when measuring the frequency range above 1GHz, the EUT is placed on a turn table which is 1.5 meter above ground.

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, 2013 on radiated measurement.

On the field strength of fundamental and harmonics, the limits shown are based on measuring equipment employing a average detector function. As an alternative, compliance with the limits may be based on the use of measurement instrumentation with a CISPR quasi-peak detector.

On the field strength of spurious electric, on any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a quasi-peak detector function and on any frequency or frequencies above 1000 MHz the radiated limits shown are based upon the use of measurement instrumentation employing an average detector function.

When average radiated emission measurement are included emission measurement below 1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

The bandwidth The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.

3.4. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.231(e).

3.5. Uncertainty

± 4.08 dB above 1GHz

± 4.22 dB below 1GHz

3.6. Test Result

Product	Tyre Pressure Monitoring Sensor		
Test Item	Fundamental Radiated Emission		
Test Mode	Mode 1: Transmit		
Date of Test	2017/10/23	Test Site	No.3 OATS

Fundamental Power (X-Line)

Peak Detector:

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
433.920	-6.934	78.770	71.836	-21.030	92.866
Vertical					
433.950	-6.931	86.520	79.589	-13.277	92.866

Average Detector:

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
433.920	-6.934	57.700	50.766	-22.100	72.866
Vertical					
433.920	-6.934	64.900	57.966	-14.900	72.866

Note:

1. Correct factor = Antenna Factor + Cable Loss – Pre-amplifier Gain
2. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.
3. Limit = 20log (4398uv) =72.86dBuV.

Product	Tyre Pressure Monitoring Sensor		
Test Item	Fundamental Radiated Emission		
Test Mode	Mode 1: Transmit		
Date of Test	2017/10/23	Test Site	No.3 OATS

Fundamental Power (Y-Line)

Peak Detector:

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
433.920	-6.934	86.650	79.716	-13.150	92.866
Vertical					
433.920	-6.934	74.210	67.276	-25.590	92.866

Average Detector:

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
433.920	-6.934	65.200	58.266	-14.600	72.866
Vertical					
433.920	-6.934	52.700	45.766	-27.100	72.866

Note:

1. Correct factor = Antenna Factor + Cable Loss – Pre-amplifier Gain
2. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.
3. Limit = 20log (4398uv) =72.86dBuV.

Product	Tyre Pressure Monitoring Sensor		
Test Item	Fundamental Radiated Emission		
Test Mode	Mode 1: Transmit		
Date of Test	2017/10/23	Test Site	No.3 OATS

Fundamental Power (Z-Line)

Peak Detector:

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
433.920	-6.934	83.370	76.436	-16.430	92.866
Vertical					
433.920	-6.934	78.320	71.386	-21.480	92.866

Average Detector:

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
433.920	-6.934	61.800	54.866	-18.000	72.866
Vertical					
433.920	-6.934	56.700	49.766	-23.100	72.866

Note:

1. Correct factor = Antenna Factor + Cable Loss – Pre-amplifier Gain
2. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.
3. Limit = 20log (4398uv) =72.86dBuV.

Product	Tyre Pressure Monitoring Sensor		
Test Item	Harmonic Radiated Emission		
Test Mode	Mode 1: Transmit		
Date of Test	2017/10/17	Test Site	No.3 OATS

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Peak Limit	Average Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m	dBuV/m
Harmonic Radiated Emission						
Horizontal						
Peak						
1301.760	-3.771	46.510	42.739	-31.261	74.000	54.000
1735.680	-1.391	44.860	43.469	-30.531	74.000	54.000
2169.600	1.425	47.390	48.815	-25.185	74.000	54.000
2603.520	2.764	45.960	48.725	-25.275	74.000	54.000
3037.440	3.794	51.390	55.183	-18.817	74.000	54.000
3471.360	4.165	48.610	52.775	-21.225	74.000	54.000
3905.280	5.317	51.190	56.507	-17.493	74.000	54.000
4339.200	6.166	46.960	53.126	-20.874	74.000	54.000
Average						
3037.440	3.794	29.700	33.493	-20.507	74.000	54.000
3905.280	5.317	28.800	34.117	-19.883	74.000	54.000

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.

Product	Tyre Pressure Monitoring Sensor		
Test Item	Harmonic Radiated Emission		
Test Mode	Mode 1: Transmit		
Date of Test	2017/10/17	Test Site	No.3 OATS

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Peak Limit	Average Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m	dBuV/m
Harmonic Radiated Emission						
Vertical						
Peak						
1301.760	-3.771	45.340	41.569	-32.431	74.000	54.000
1735.680	-1.391	44.970	43.579	-30.421	74.000	54.000
2169.600	1.425	45.280	46.705	-27.295	74.000	54.000
2603.520	2.764	45.170	47.935	-26.065	74.000	54.000
3037.440	3.794	47.870	51.663	-22.337	74.000	54.000
3471.360	4.165	50.170	54.335	-19.665	74.000	54.000
3905.280	5.317	53.820	59.137	-14.863	74.000	54.000
4339.200	6.166	48.890	55.056	-18.944	74.000	54.000
Average						
3471.360	4.165	28.800	32.965	-21.035	74.000	54.000
3905.280	5.317	30.800	36.117	-17.883	74.000	54.000
4339.200	6.166	29.500	35.666	-18.334	74.000	54.000

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.

Product	Tyre Pressure Monitoring Sensor		
Test Item	General Radiated Emission		
Test Mode	Mode 1: Transmit		
Date of Test	2017/10/17	Test Site	No.3 OATS

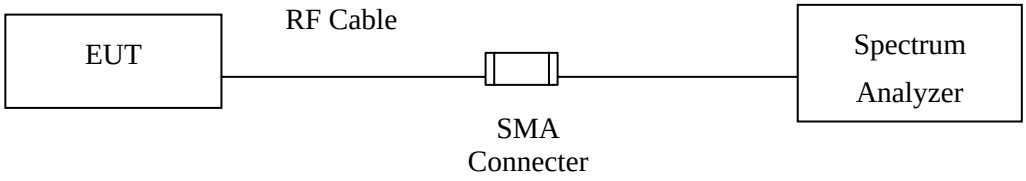
Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
Quasi-Peak					
35.623	1.254	27.683	28.938	-11.062	40.000
162.145	-4.026	28.721	24.696	-18.804	43.500
270.391	-6.099	28.640	22.542	-23.458	46.000
588.101	1.814	30.229	32.043	-13.957	46.000
867.840	2.965	30.510	33.475	-12.525	46.000
925.493	5.416	30.429	35.844	-10.156	46.000
Vertical					
Quasi-Peak					
37.029	0.241	32.928	33.170	-6.830	40.000
155.116	-4.054	29.457	25.403	-18.097	43.500
308.348	-8.690	29.917	21.227	-24.773	46.000
607.783	2.083	30.336	32.419	-13.581	46.000
867.840	2.965	33.791	36.756	-9.244	46.000
977.507	8.547	29.968	38.515	-15.485	54.000

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.
8. No emission found between lowest internal used/generated frequency to 30MHz.

4. Transmit time

4.1. Test Setup



4.2. Limits

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.

4.3. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.231(e).

4.4. Uncertainty

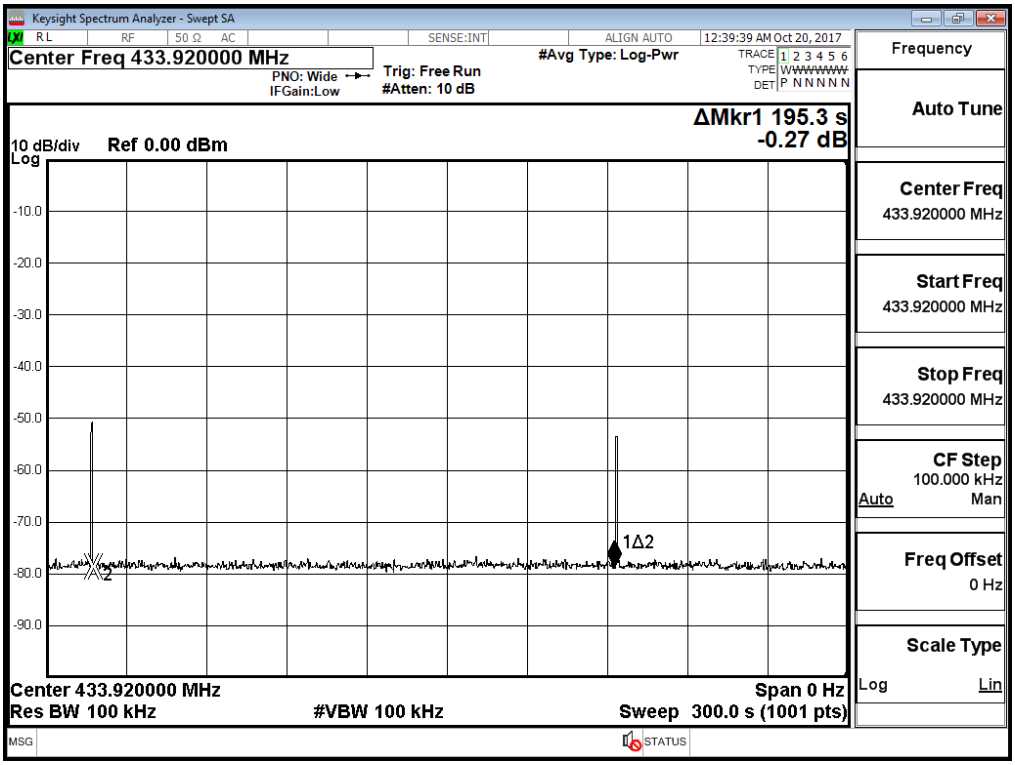
± 2.31ms

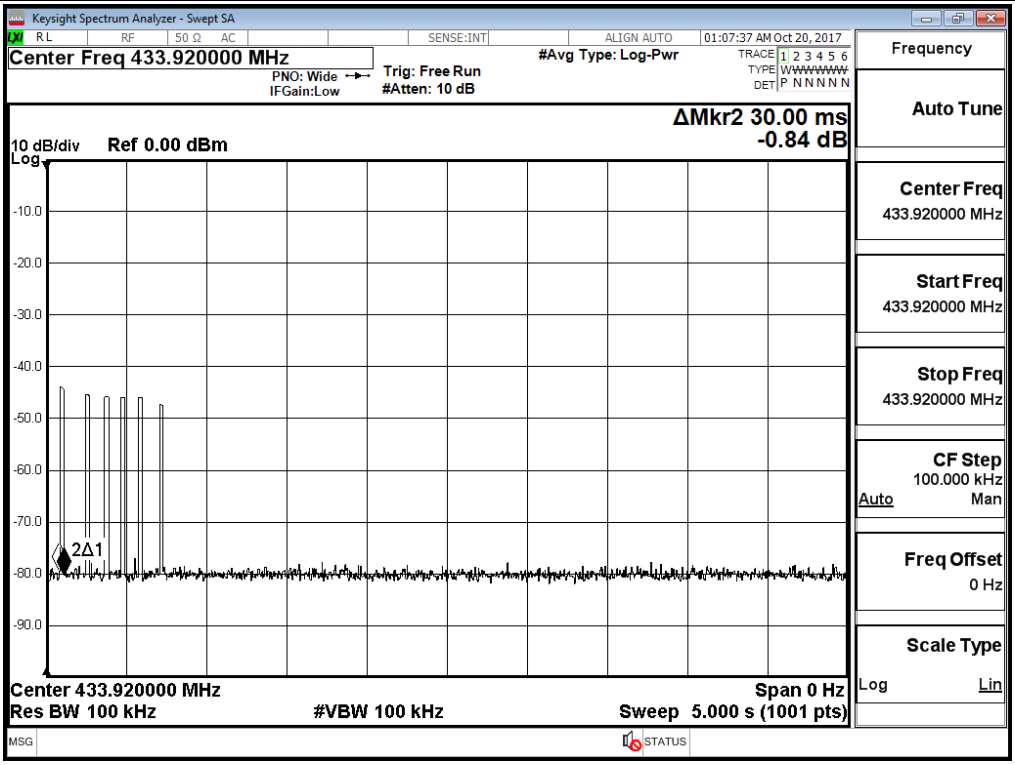
4.5. Test Result

Product Tyre Pressure Monitoring Sensor
Test Item Transmit time
Test Site No.3 OATS
Test Mode Mode 1: Transmit

Channel No.	Frequency (MHz)	Measurement Value (Sec)	Limit (Sec)	Result
1 (Transmit time)	433.92	0.18	< 1	Pass
1 (Silent period time)	433.92	195.3	> 10	Pass
1 (Silent period time)	433.92	195.3	> 5.4note	Pass

Note: Silent period time= Transmissions * 30 times =0.18s * 30 =5.4s




Keysight Spectrum Analyzer - Swept SA
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
01:07:37 AM Oct 20, 2017
Center Freq 433.920000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 10 dB
#Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE WWWWWW
DET P N N N N N
ΔMkr2 30.00 ms
-0.84 dB
10 dB/div
Log
Ref 0.00 dBm
-10.0
-20.0
-30.0
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Res BW 100 kHz
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Span 0 Hz
Sweep 5.000 s (1001 pts)
MSG
STATUS
Frequency
Auto Tune
Center Freq
433.920000 MHz
Start Freq
433.920000 MHz
Stop Freq
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100.000 kHz
Auto
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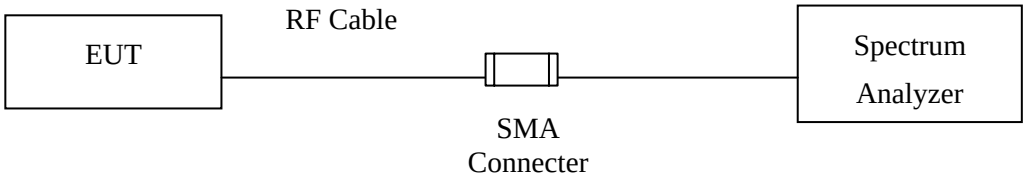
0 Hz
Scale Type
Log
Lin

5. Occupied Bandwidth

5.1. Test Setup



5.2. Limits

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz 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

5.3. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.231(c).

5.4. Uncertainty

± 283Hz

5.5. Test Result

Product	Tyre Pressure Monitoring Sensor
Test Item	Occupied Bandwidth
Test Site	No.3 OATS
Test Mode	Mode 1: Transmit

Channel No.	Frequency (MHz)	Measurement Value (MHz)	Limit (MHz)	Result
1	433.92	0.081	1.0848	Pass

Note: Limit = 433.92MHz * 0.25%= 1.0848MHz

Figure Channel 1: