

FCC Test Report

Product Name : Tire Pressure Monitoring System
Trade Name : ORO
Model No. : W410
FCC ID. : W55410FM1B2

Applicant : Oro Technology Co., LTD
Address : 3F, No.29, 21th Road, Industrial Park,
Taichung 408, Taiwan

Date of Receipt : Mar. 15, 2017
Issued Date : Jun. 03, 2017
Report No. : 1730243R-RFUSP14V00
Report Version : V1.0



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Test Report Certification

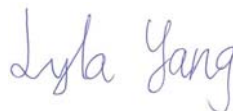
Issued Date : Jun. 03, 2017

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Product Name : Tire Pressure Monitoring System
Applicant : Oro Technology Co., LTD
Address : 3F, No.29, 21th Road, Industrial Park, Taichung 408, Taiwan
Manufacturer : Oro Technology Co., LTD
Model No. : W410
FCC ID. : W55410FM1B2
EUT Voltage : DC 3V (Power by Battery)
Testing Voltage : DC 3V (Power by Battery)
Trade Name : ORO
Applicable Standard : FCC 15 Subpart C Section 15.231(b): 2015
Laboratory Name : Hsin Chu Laboratory
Address : No. 75-2, 3rd Lin, WangYe Keng, Yonghxing Tsuen, Qionglin
Shiang, Hsinchu County 307, Taiwan (R.O.C.)
TEL: +886-3-592-8858 / FAX: +886-3-592-8859
Test Result : Complied

Documented By :



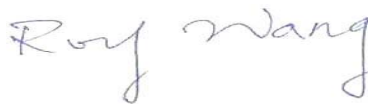
(Lyla Yang / Engineering Adm. Specialist)

Tested By :



(Elwin Lin / Assistant Engineer)

Approved By :



(Roy Wang / Director)

Revision History

Report No.	Version	Description	Issued Date
1730243R-RFUSP14V00	V1.0	Initial issue of report.	Jun. 03, 2017

Laboratory Information

We, **DEKRA Testing and Certification Co., Ltd.**, are an independent RF consultancy that was established the whole facility in our laboratories. The test facility has been accredited/accepted (audited or listed) by the following related bodies in compliance with ISO 17025 specified testing scopes:

Taiwan R.O.C.	:	TAF, Accreditation Number: 3024
USA	:	FCC, Registration Number: 834100
Canada	:	IC, Submission No: 181665 / IC Registration Number: 22397-1 / 22397-2 / 22397-3

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

If you have any comments, Please don't hesitate to contact us. Our test sites as below:

- 1 No. 75-2, 3rd Lin, WangYe Keng, Yonghxing Tsuen, Qionglin Shiang, Hsinchu County 307, Taiwan (R.O.C.)
TEL:+886-3-592-8858 / FAX:+886-3-592-8859 E-Mail : info.tw@dekra.com
- 2 No.372, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County 31061, Taiwan
TEL: +886-3-582-8001 / FAX: +886-3-582-8958 E-Mail : info.tw@dekra.com
- 3 No.372-2, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County 31061, Taiwan
TEL: +886-3-582-8001 / FAX: +886-3-582-8958 E-Mail : info.tw@dekra.com

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1. General Information

1.1. EUT Description

Product Name	Tire Pressure Monitoring System
Trade Name	ORO
Model No.	W410
Frequency Range	433.92 MHz
Channel Number	1
Type of Modulation	FSK, ASK

Antenna Information	
Antenna Type	Monopole Antenna
Antenna Gain	0 dBi

Working Frequency of Each Channel	
Channel	Frequency
001	433.92 MHz

Note:

1. This device is a Tire Pressure Monitoring System included a 433.92MHz transceiver function.
2. These tests are conducted on a sample for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.231.
3. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.
4. This device is a composite device in accordance with Part 15 regulations. The function receiving was measured and made a test report that the report number is 1730243R-RFUSP01V00 under Declaration of Conformity.

1.2. Test Mode

DEKRA verified the construction and function in typical operation. All the test modes are performed in normal operation and are defined as:

Test Mode	
TX	Mode 1: Transmit

Emission		
Performed Item	Mode 1	Test Site
Conducted Emission	No	--
Radiated Emission	Yes	2
Occupied Bandwidth	Yes	3
Duty cycle	Yes	3
Transmitter time	Yes	3

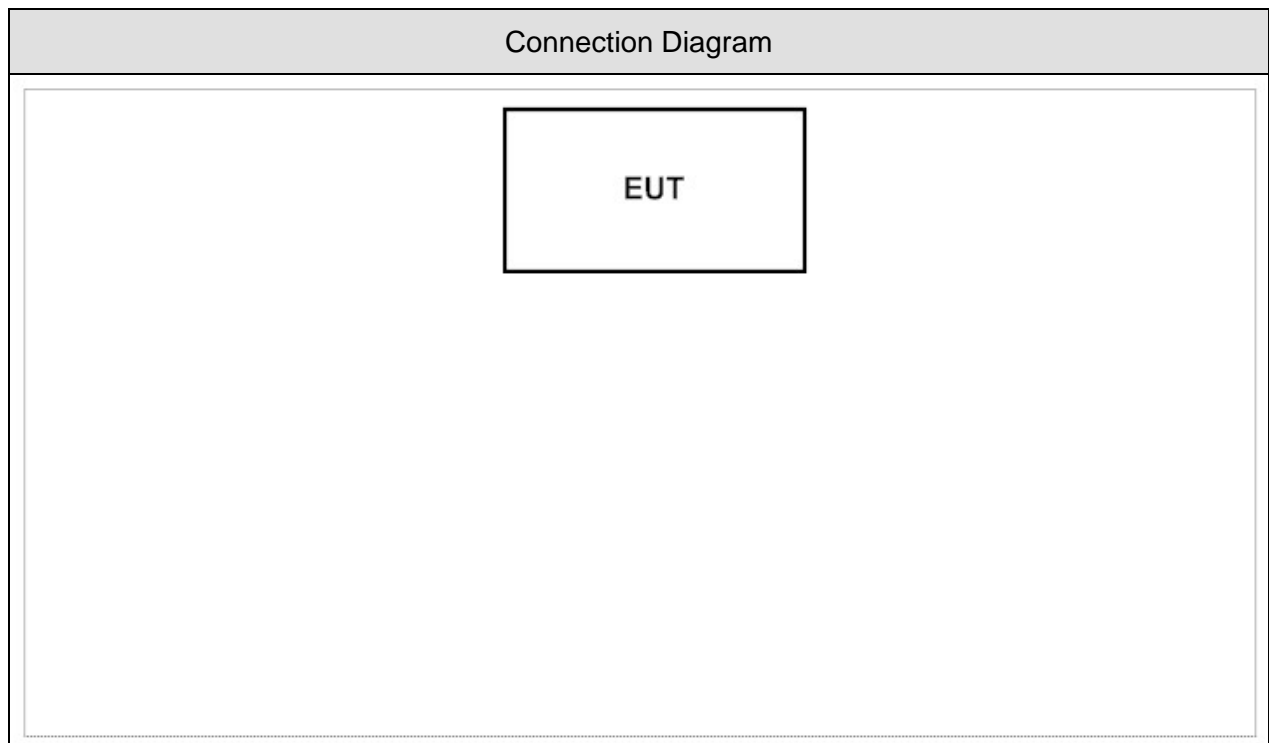
Note: Test site information refers to Laboratory Information.

1.3. Tested System Details

The types for all equipment, 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	N/A				

1.4. Configuration of tested System



1.5. EUT Exercise Software

1	Setup the EUT as shown in section 1.4.
2	The EUT will transmit automatically.
3	Verify that the EUT works properly.

2. Radiated Emission

2.1. Test Equipment

The following test equipment are used during the test:

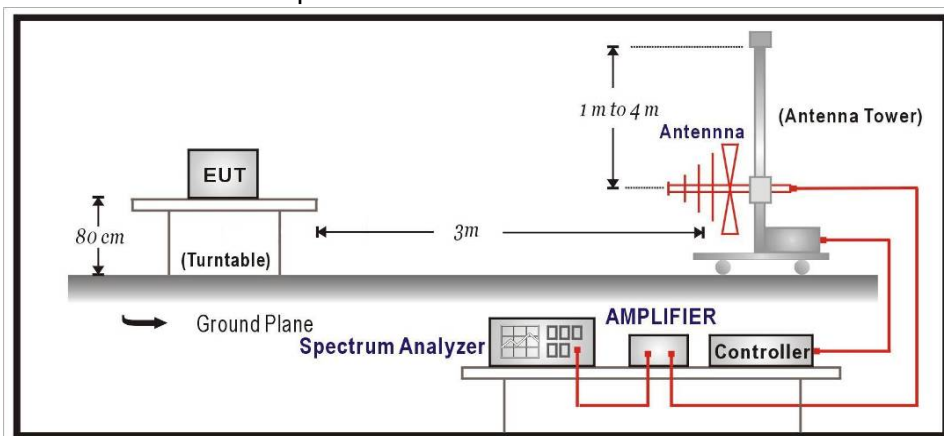
Radiated Emission / CB4-H

Instrument	Manufacturer	Model No.	Serial No	Next Cal. Date
Bilog Antenna	Schaffner	CBL6112B	2891	2017/08/14
Horn Antenna	Schwarzbeck	BBHA 9120	D312	2017/10/25
Pre-Amplifier	EMCI	EMC0031835	980233	2018/02/02
Pre-Amplifier	Schwarzbeck	DBL-1840N506	013	2017/09/29
Pre-Amplifier	Miteq	JS41-001040000-58-5P	1573954	2017/10/04
Horn Antenna	Schwarzbeck	BBHA 9170	203	2017/08/28
Signal & Spectrum Analyzer	R&S	FSV40	101049	2018/01/22

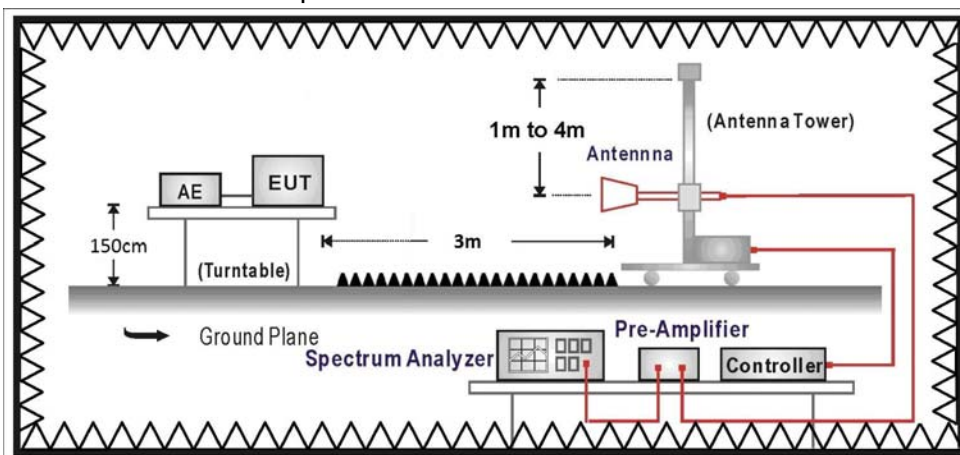
Note: All equipment that need to calibrate are with calibration period of 1 year.

2.2. Test Setup

Under 1GHz Test Setup:



Above 1GHz Test Setup:



2.3. Limits

➤ Fundamental and Harmonics Emission Limits

FCC Part 15 Subpart C Paragraph 15.231(b) Limits				
Fundamental Frequency MHz	Field Strength of Fundamental		Field Strength of Harmonics	
	uV/m	dBuV/m	uV/m	dBuV/m
40.66 - 40.70	2250	67.04	225	47.04
70 - 130	1250	61.94	125	41.94
130 - 174	1250 - 3750	61.94 - 71.48	125 - 375	41.94 - 51.48
174 - 260	3750	71.48	375	51.48
260 - 470	3750 - 12500	71.48 - 81.94	375 - 1250	51.48 - 61.94
above 470	12500	81.94	1250	61.94

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.

2.4. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 and 1.5 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 polarizations 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.

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 beamwidth of the antenna.

The worst radiated emission is measured on the Final Measurement.

The frequency range from 30MHz to 10th harmonics is checked.

2.5. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.231(b): 2015

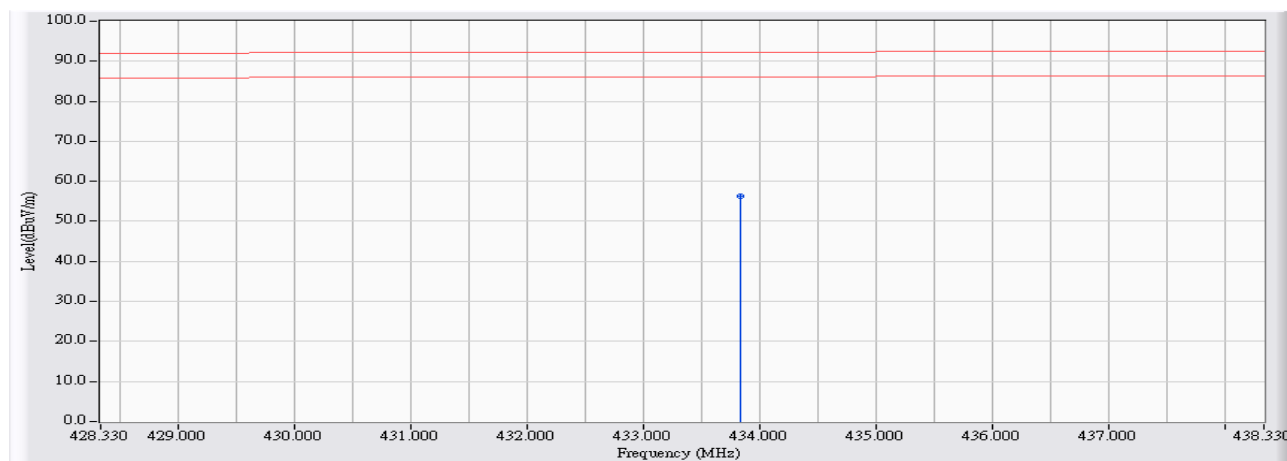
2.6. Uncertainty

± 3.8 dB below 1GHz

± 3.9 dB above 1GHz

2.7. Test Result

Site : CB4-H	Time : 2017/05/09
Limit : FCC_SpartC_15.231(e)_F_03M_PK	Margin : 6
Probe : CB4-H_FCC_EFS_S2_30M-1GHz_1116 - HORIZONTAL	Power : DC 3V (Power by Battery)
EUT : Tire Pressure Monitoring System	Note : 15.231_433.92MHz_X axis

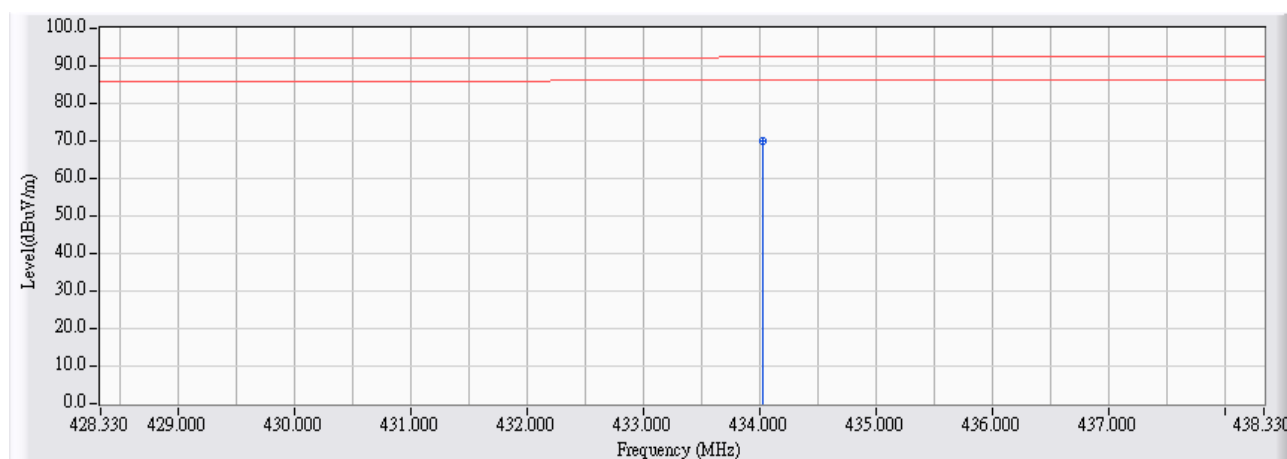


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	433.830	26.242	30.010	56.252	-35.918	92.170	PEAK

Note:

1. All Reading Levels are Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB4-H	Time : 2017/05/09
Limit : FCC_SpartC_15.231(e)_F_03M_PK	Margin : 6
Probe : CB4-H_FCC_EFS_S2_30M-1GHz_1116 - VERTICAL	Power : DC 3V (Power by Battery)
EUT : Tire Pressure Monitoring System	Note : 15.231_433.92MHz_X axis

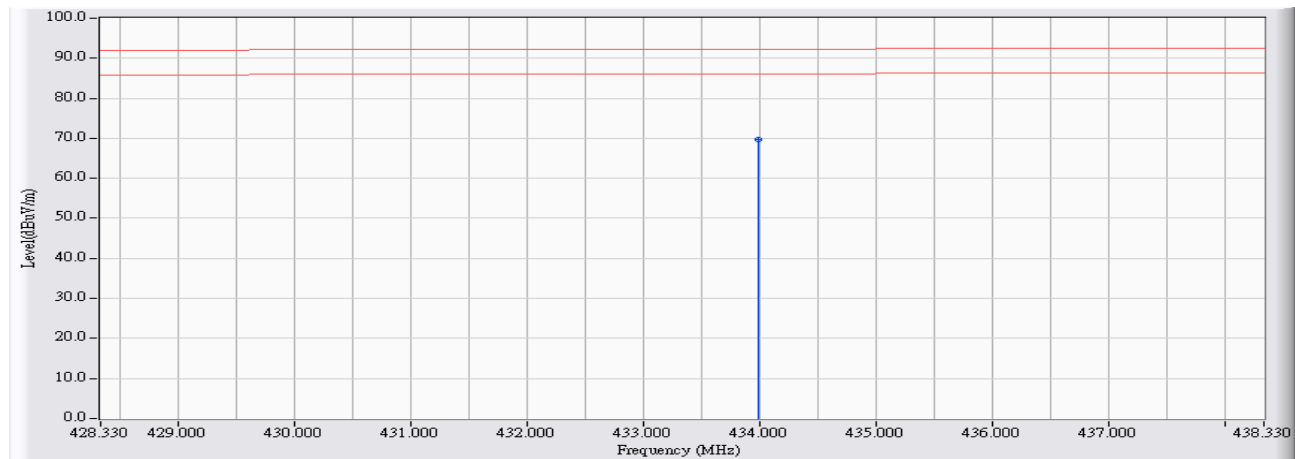


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	434.025	26.245	43.790	70.035	-22.145	92.180	PEAK

Note:

1. All Reading Levels are Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB4-H	Time : 2017/05/09
Limit : FCC_SpartC_15.231(e)_F_03M_PK	Margin : 6
Probe : CB4-H_FCC_EFS_S2_30M-1GHz_1116 - HORIZONTAL	Power : DC 3V (Power by Battery)
EUT : Tire Pressure Monitoring System	Note : 15.231_433.92MHz_Y axis

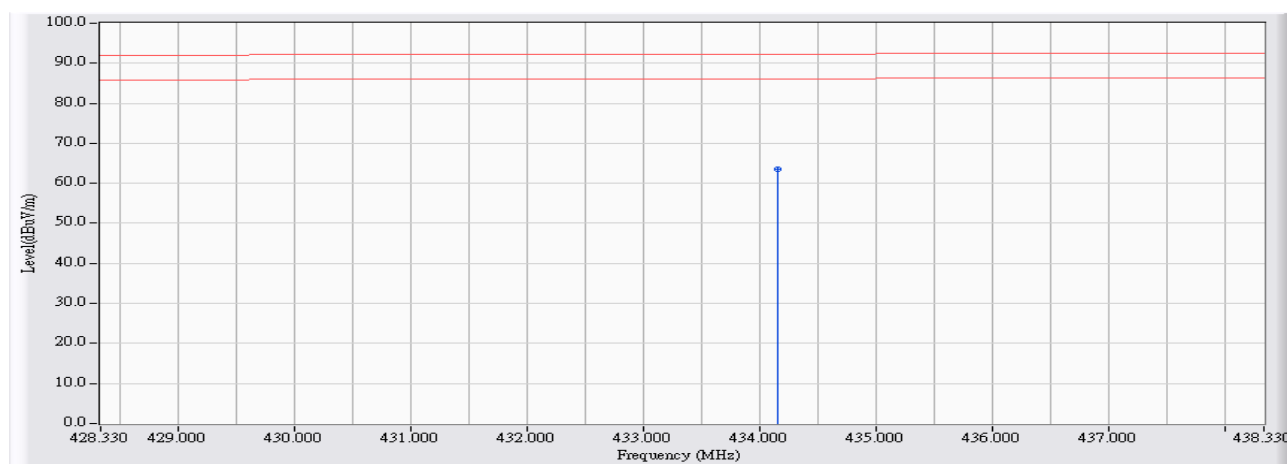


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	433.980	26.245	43.450	69.694	-22.483	92.178	PEAK

Note:

1. All Reading Levels are Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB4-H	Time : 2017/05/09
Limit : FCC_SpartC_15.231(e)_F_03M_PK	Margin : 6
Probe : CB4-H_FCC_EFS_S2_30M-1GHz_1116 - VERTICAL	Power : DC 3V (Power by Battery)
EUT : Tire Pressure Monitoring System	Note : 15.231_433.92MHz_Y axis



		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	*	434.155	26.247	37.320	63.568	-28.619	92.186	PEAK

Note:

1. All Reading Levels are Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Product	Tire Pressure Monitoring System		
Test Item	Fundamental Radiated Emission		
Test Mode	Mode 1: Transmit		
Date of Test	2017/05/09	Test Site	CB4-H

Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Peak Measurement Level (dBuV/m)	Average Measurement Level (dBuV/m)	Average Limit (dBuV/m)
Horizontal					
433.920(X-axis)	26.242	30.010	56.252	36.252	72.870
433.920(Y-axis)	26.245	43.450	69.694	49.694	72.870
Vertical					
433.920(X-axis)	26.245	43.790	70.035	50.035	72.870
433.920(Y-axis)	26.247	37.320	63.568	43.568	72.870

Note1:

Peak Measurement Level = Reading Level +Correct factor

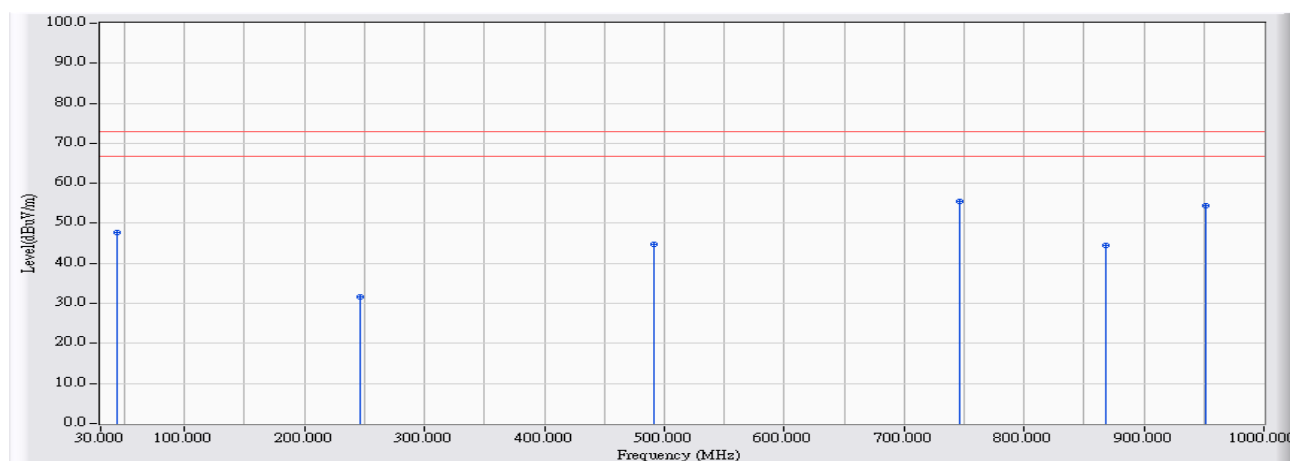
Average Measurement Level = Peak Measurement Level +20Log(Duty Cycle)

(Duty Cycle)=(Ton/(Ton+Toff))=0.15/5.00=0.3

20Log(Duty Cycle)= -30.457

30MHz-1GHz Spurious :

Site : CB4-H	Time : 2017/05/09
Limit : FCC_SpartC_15.231(e)_H_433.92MHz_03M_PK	Margin : 6
Probe : CB4-H_FCC_EFS_S2_30M-1GHz_1116 - HORIZONTAL	Power : DC 3V (Power by Battery)
EUT : Tire Pressure Monitoring System	Note : 15.231_433.92MHz

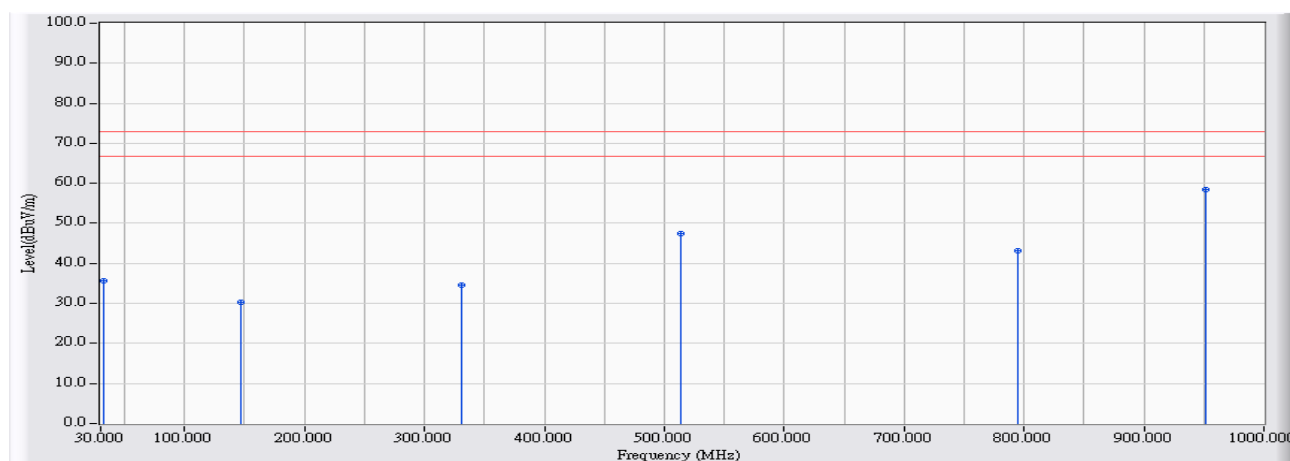


	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	44.065	-21.394	69.215	47.822	-25.048	72.870	QUASIPeAK
2	245.825	-20.417	51.970	31.553	-41.317	72.870	QUASIPeAK
3	491.720	-14.168	58.986	44.818	-28.052	72.870	QUASIPeAK
4	* 745.860	-11.072	66.501	55.428	-17.442	72.870	QUASIPeAK
5	868.080	-9.609	53.996	44.387	-28.483	72.870	QUASIPeAK
6	951.015	-7.173	61.530	54.357	-18.513	72.870	QUASIPeAK

Note:

1. All Reading Levels are Quasi-Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB4-H	Time : 2017/05/09
Limit : FCC_SpartC_15.231(e)_H_433.92MHz_03M_PK	Margin : 6
Probe : CB4-H_FCC_EFS_S2_30M-1GHz_1116 - VERTICAL	Power : DC 3V (Power by Battery)
EUT : Tire Pressure Monitoring System	Note : 15.231_433.92MHz



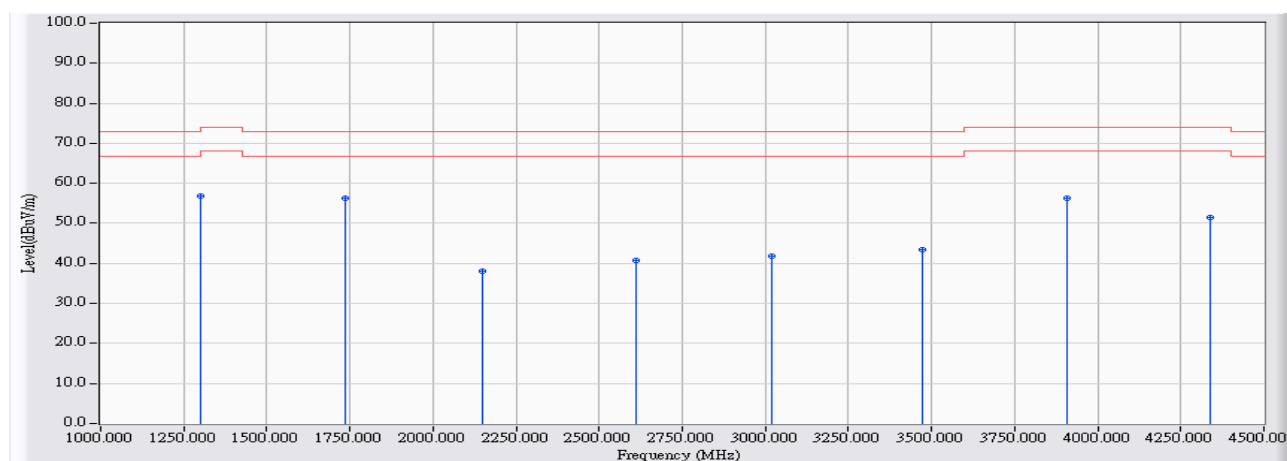
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		31.940	-16.694	52.339	35.646	-37.224	72.870	QUASIPeAK
2		147.370	-22.044	52.408	30.364	-42.506	72.870	QUASIPeAK
3		330.700	-18.256	52.810	34.553	-38.317	72.870	QUASIPeAK
4		513.545	-13.578	61.059	47.481	-25.389	72.870	QUASIPeAK
5		794.845	-10.147	53.342	43.195	-29.675	72.870	QUASIPeAK
6	*	951.015	-7.173	65.572	58.399	-14.471	72.870	QUASIPeAK

Note:

1. All Reading Levels are Quasi-Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Above 1GHz Spurious:

Site : CB4-H	Time : 2017/05/09
Limit : FCC_SpartC_15.231(e)_H_433.92MHz_03M_PK	Margin : 6
Probe : CB4-H_FCC_EFS_B432_1-18GHz_3M_1116 - HORIZONTAL	Power : DC 3V (Power by Battery)
EUT : Tire Pressure Monitoring System	Note : 15.231_433.92MHz



	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	1301.000	-4.826	61.530	56.704	-17.296	74.000	PEAK
2	* 1735.000	-3.056	59.290	56.234	-16.636	72.870	PEAK
3	2149.000	-1.527	39.690	38.163	-34.707	72.870	PEAK
4	2609.000	0.194	40.590	40.783	-32.087	72.870	PEAK
5	3020.000	1.728	40.170	41.898	-30.972	72.870	PEAK
6	3471.000	2.480	41.050	43.530	-29.340	72.870	PEAK
7	3906.000	4.757	51.600	56.357	-17.643	74.000	PEAK
8	4338.000	6.086	45.290	51.376	-22.624	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. " * ", means this data is the worst emission level.
4. Measurement Level = Reading Level + Correct Factor.
5. Average Measurement Level = Peak Measurement Level + 20Log (Duty Cycle)
 $\text{Duty Cycle(Only Ton)} = \text{Ton} / (\text{Ton} + \text{off}) = 0.15 / 5.00 = 0.3$
 $20 * \text{Log}(\text{Duty Cycle}) = -21.463$
6. The average measurement was not performed when the peak measured data under the limit of peak detection.

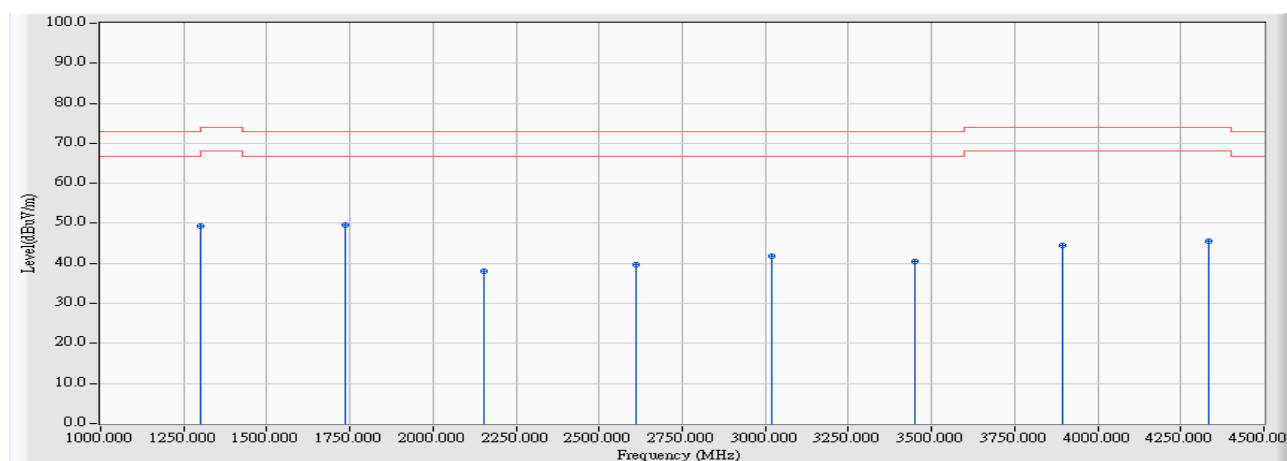
Frequency	Peak	Duty Cycle	Measurement	Margin	Limit
	Measurement	Factor	Level		
MHz	dBuV/m	dB	dBuV/m	dB	dBuV/m

Horizontal

Average Detector:

1301	56.704	-20.000	36.704	-17.296	54.000
1735	56.234	-20.000	36.234	-16.636	52.870
3906	56.357	-20.000	36.357	-17.643	54.000

Site : CB4-H	Time : 2017/05/09
Limit : FCC_SpartC_15.231(e)_H_433.92MHz_03M_PK	Margin : 6
Probe : CB4-H_FCC_EFS_B432_1-18GHz_3M_1116 - VERTICAL	Power : DC 3V (Power by Battery)
EUT : Tire Pressure Monitoring System	Note : 15.231_433.92MHz



	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	1301.000	-4.826	54.170	49.344	-24.656	74.000	PEAK
2	* 1736.000	-3.052	52.700	49.648	-23.222	72.870	PEAK
3	2153.000	-1.511	39.490	37.979	-34.891	72.870	PEAK
4	2612.000	0.204	39.590	39.794	-33.076	72.870	PEAK
5	3020.000	1.728	40.010	41.738	-31.132	72.870	PEAK
6	3451.000	2.449	38.140	40.589	-32.281	72.870	PEAK
7	3893.000	4.686	39.740	44.426	-29.574	74.000	PEAK
8	4335.000	6.078	39.550	45.627	-28.373	74.000	PEAK

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. " * ", means this data is the worst emission level.
4. Measurement Level = Reading Level + Correct Factor.
5. Average Measurement Level = Peak Measurement Level + 20Log (Duty Cycle)
Duty Cycle(Only Ton)= Ton/ (Ton+off)=0.15/5.00=0.3
20*Log(Duty Cycle) = -30.4575
6. The average measurement was not performed when the peak measured data under the limit of peak detection.

3. Occupied Bandwidth

3.1. Test Equipment

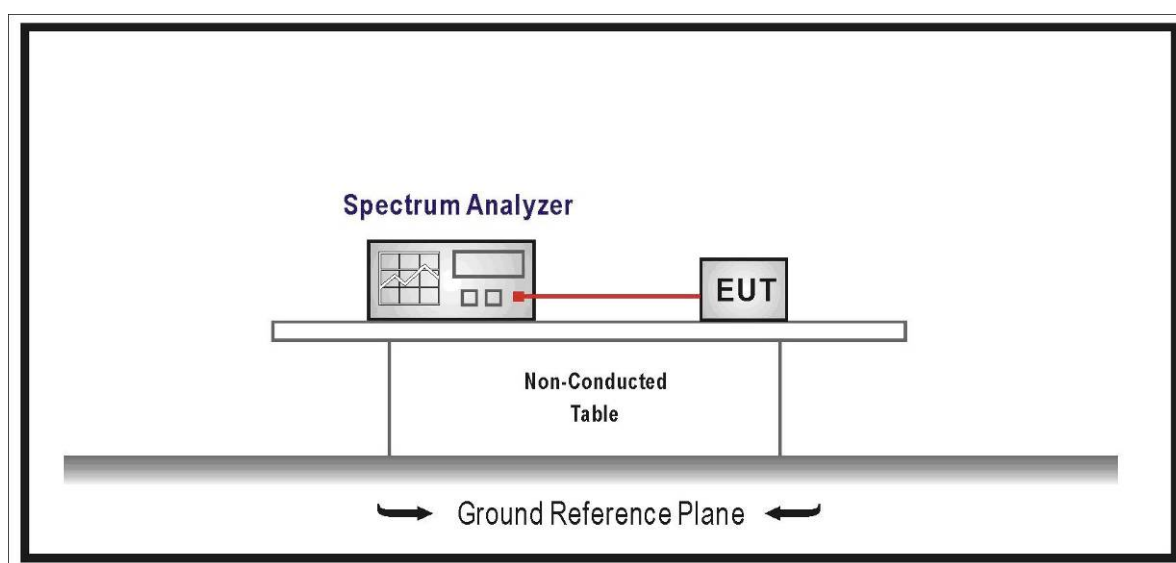
The following test equipment are used during the radiated emission tests:

Occupied Bandwidth / SR10-H

Instrument	Manufacturer	Model No.	Serial No	Next Cal. Date
Spectrum Analyzer	Agilent	N9010A	US47140172	2017/08/08
Signal & Spectrum Analyzer	R&S	FSV40	101049	2018/01/22

Note: All equipment that need to calibrate are with calibration period of 1 year.

3.2. Test Setup



3.3. Limits

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.

3.4. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.231(b): 2015

3.5. Uncertainty

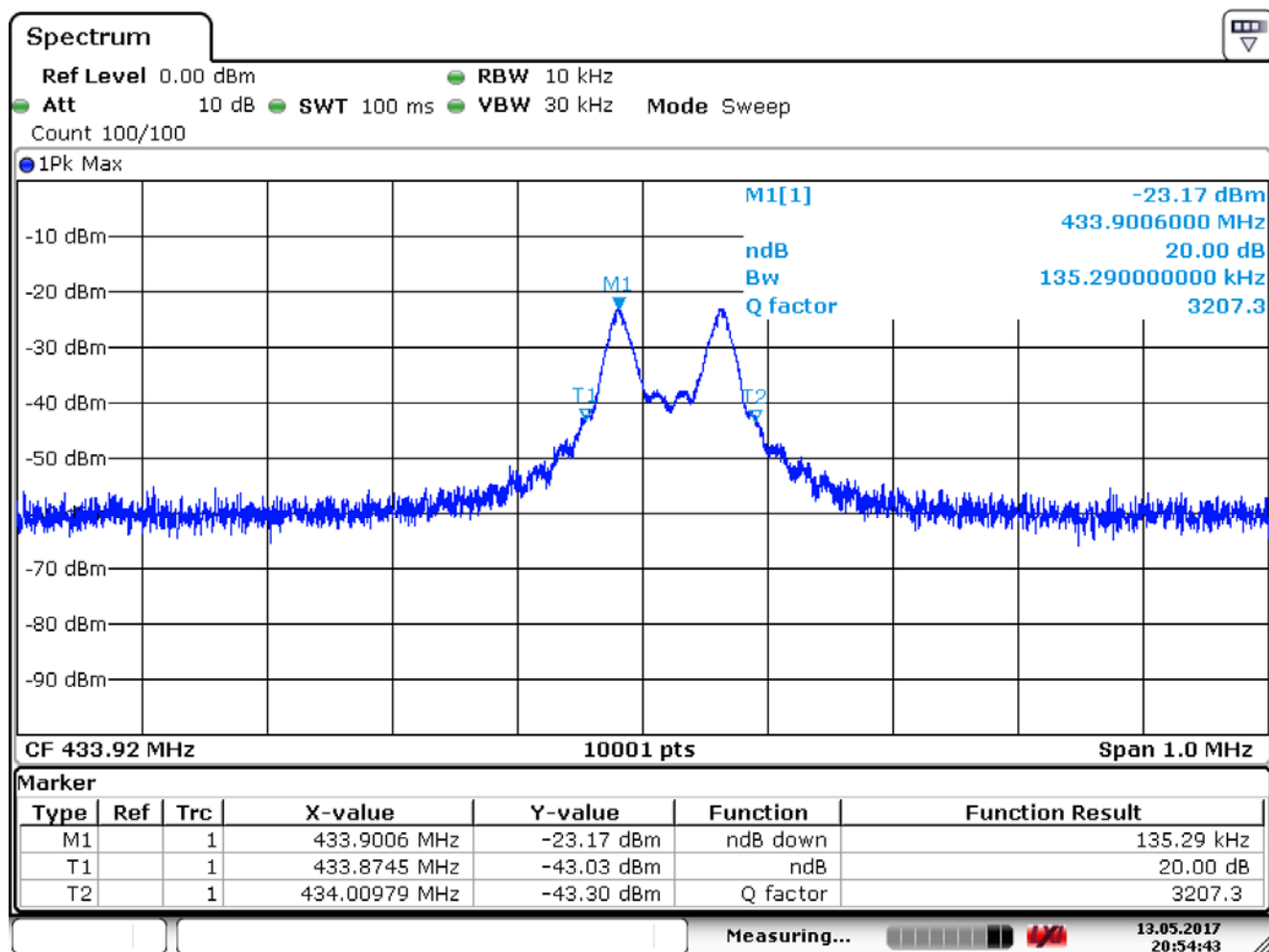
$\pm 150\text{Hz}$

3.6. Test Result

Product	Tire Pressure Monitoring System		
Test Item	Occupied Bandwidth		
Test Mode	Mode 1: Transmit		
Date of Test	2017/05/13	Test Site	SR10-H

Channel No.	Frequency (MHz)	Measure Level (kHz)	Limit (MHz)
01	433.92	135.29	1.0848

*Allowable Bandwidth (70-900 MHz, Above 900MHz: 0.5%)



Date: 13.MAY.2017 20:54:43

4. Duty cycle

4.1. Test Equipment

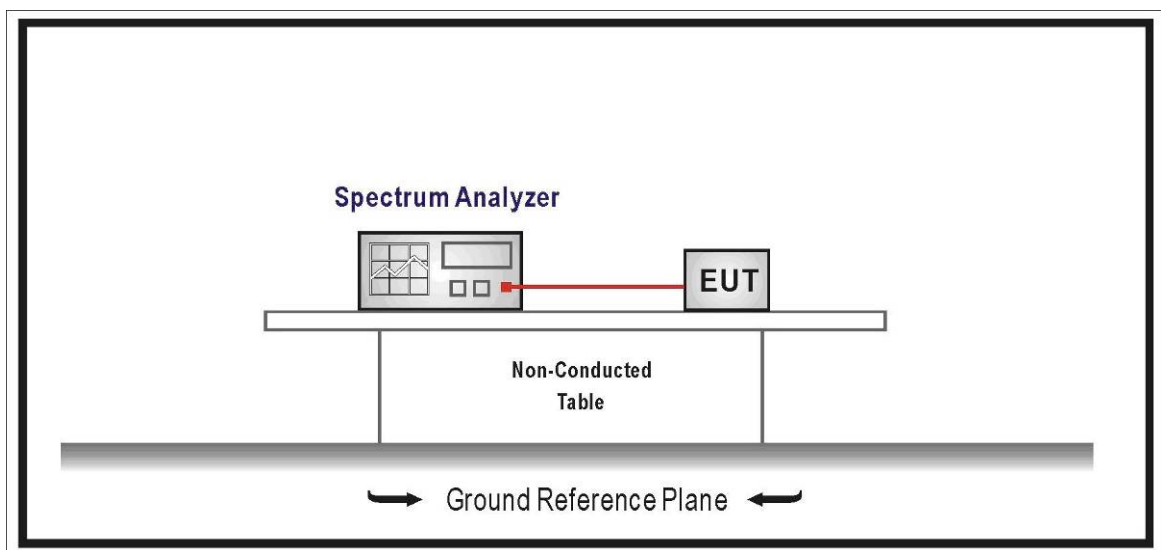
The following test equipment are used during the radiated emission tests:

Duty cycle / SR10-H

Instrument	Manufacturer	Model No.	Serial No	Next Cal. Date
Spectrum Analyzer	Agilent	N9010A	US47140172	2017/08/08
Signal & Spectrum Analyzer	R&S	FSV40	101049	2018/01/22

Note: All equipment that need to calibrate are with calibration period of 1 year.

4.2. Test Setup



4.3. Limits

N/A

4.4. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.231(b): 2015

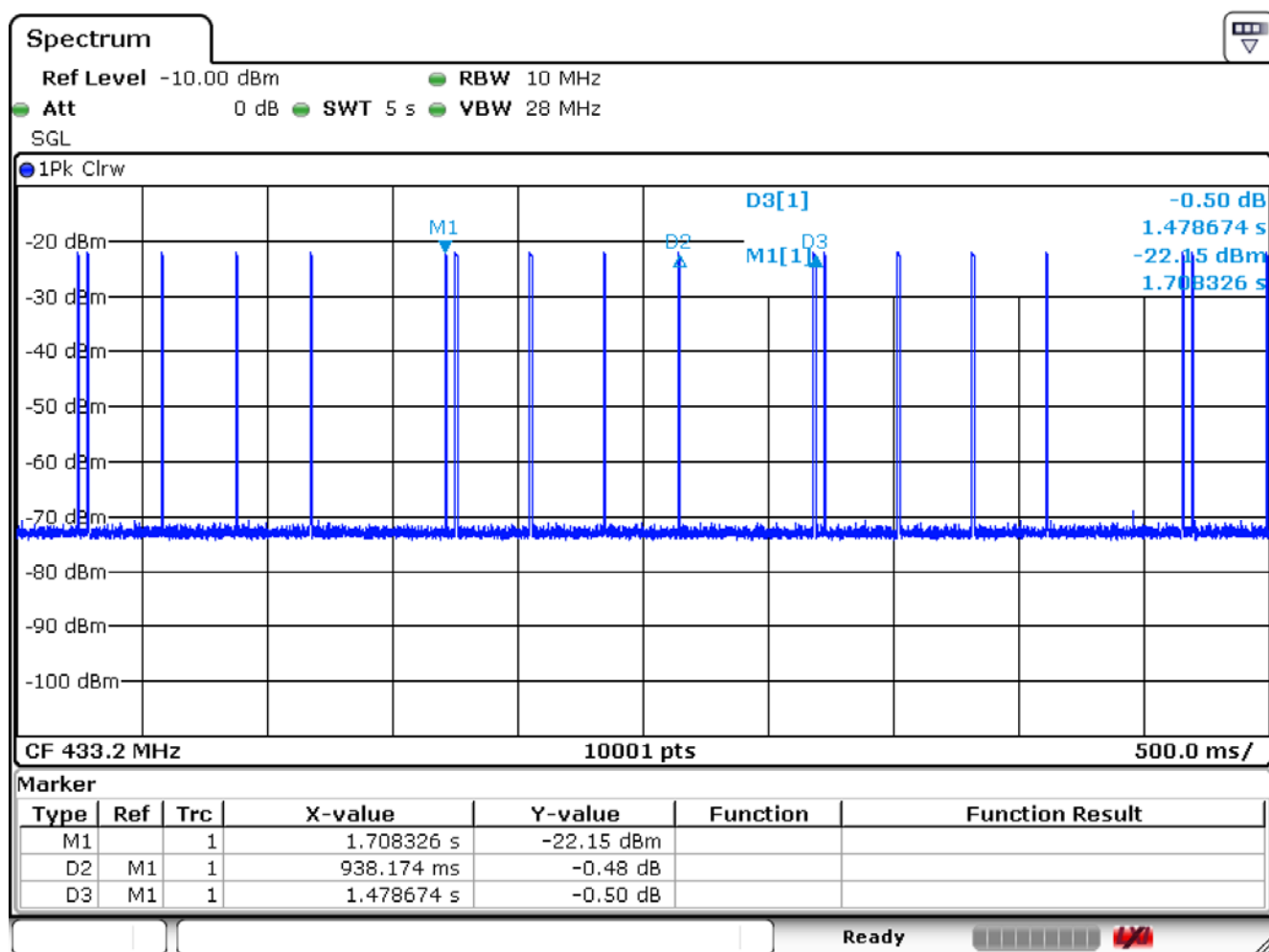
4.5. Uncertainty

± 25msec

4.6. Test Result

Product	Tire Pressure Monitoring System		
Test Item	Duty Cycle		
Test Mode	Mode 1: Transmit		
Date of Test	2017/05/18	Test Site	SR10-H

Mode	On Time(ms)	On+Off Time(s)	Duty Cycle(%)	Duty Factor(dB)
433.92MHz	938.174	1.478674	3.00	30.458



Date: 18.MAY.2017 21:29:20

5. Transmitter time

5.1. Test Equipment

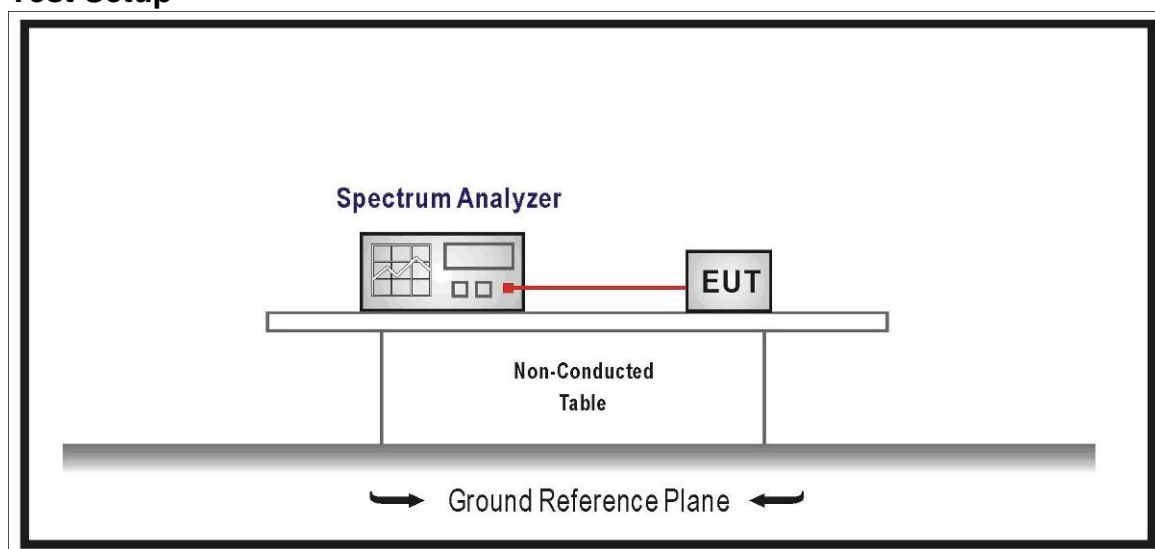
The following test equipment are used during the radiated emission tests:

Transmitter time / SR10-H

Instrument	Manufacturer	Model No.	Serial No	Next Cal. Date
Spectrum Analyzer	Agilent	N9010A	US47140172	2017/08/08
Signal & Spectrum Analyzer	R&S	FSV40	101049	2018/01/22

Note: All equipment that need to calibrate are with calibration period of 1 year.

5.2. Test Setup



5.3. Limits

- (1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.
- (2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.
- (3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds 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.
- (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 condition

(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 transmissions 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.

5.4. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.231(b): 2015

5.5. Uncertainty

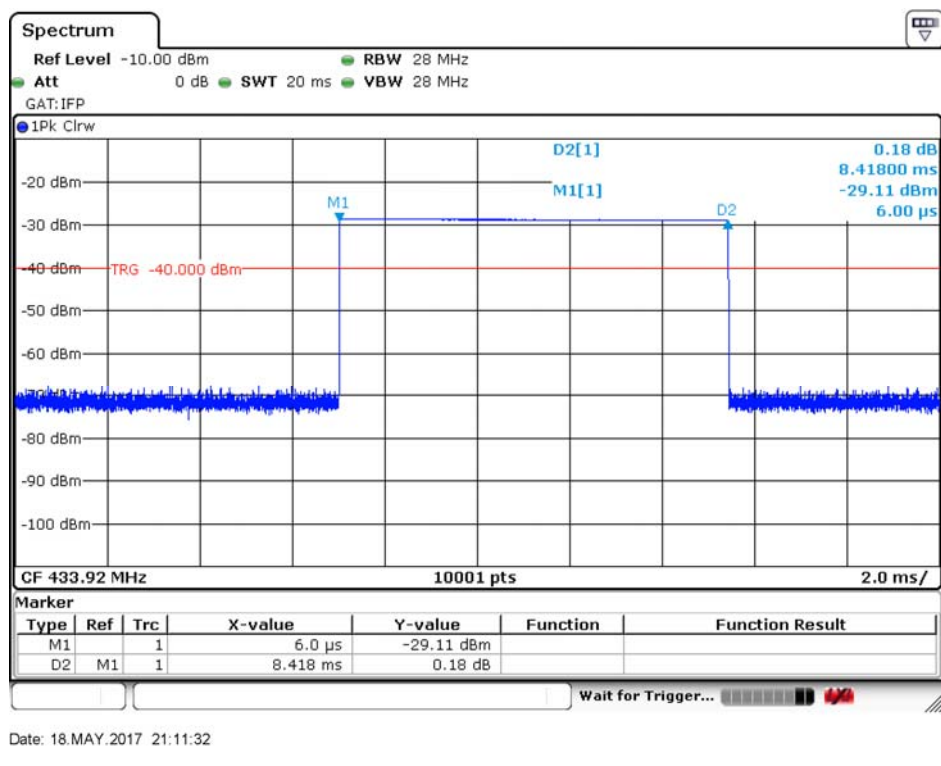
$\pm 25\text{msec}$

5.6. Test Result

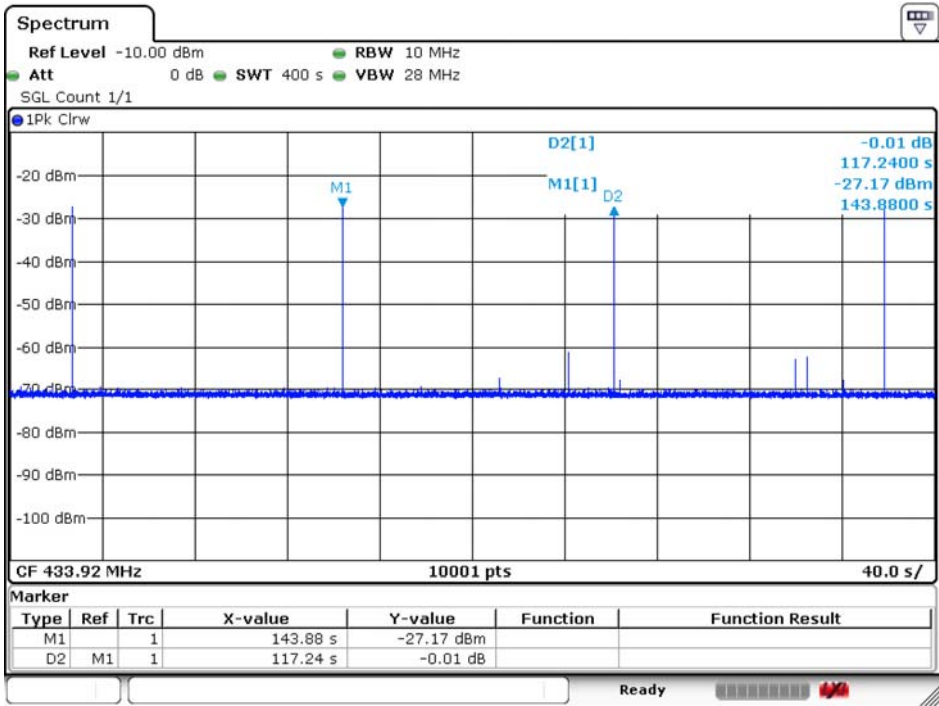
Product	Tire Pressure Monitoring System		
Test Item	Transmitter time		
Test Mode	Mode 1: Transmit		
Date of Test	2017/05/16	Test Site	SR10-H

Frequency (MHz)	Transmitter time (ms.)	
	Measure value	Limit
433.92	8.41	≤ 5000
Frequency (MHz)	Silent period (sec.)	
	Measure value	Limit
433.92	117.240	≥ 10
Frequency (MHz)	Total duration of transmissions per hour (sec.)	
	Measure value	Limit
433.92	0.12	≤ 2

Transmitter time



Transmitter time



Date: 18.MAY.2017 11:39:29