MEASUREMENT REPORT

FCC Part 15 Subpart B

Report No.: S2021033082150102
Issue Date: 05-11-2021

Applicant:	DIAS Automotive Electronic Systems Co., Ltd.
Address:	Building 5. Lane 33. Jin Ji Road Pudong Shanghai
Product:	Tire pressure sensor
Model No.:	TPS4.1
FCC Rule Part(s):	FCC Part 15 Subpart B
Test Procedure(s):	ANSI C63.4: 2014
Result:	Pass
Test Date:	April 19 ~ 27, 2021

Line chen

Compiled By

(Line Chen)
Senior Test Engineer

Kerry Zhou

Approved By

(Kerry Zhou)
Engineer Manager

FANGGUANG INSPECTION & TESTING CO.,LTD. APPROVED(02)

The test results relate only to the samples tested

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2014. Test results reported herein relate only to the item(s) tested.

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The test report must not be used by the client to claim product certifications, approval, or endorsement by NVLAP, NIST or any agency of U.S. Government.

Revision History

Report No.	Version	Description	Issue Date
S2021033082150102	Rev. 01	/	05-11-2021

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Description Page

§2.1033 General Information

Applicant:	DIAS Automotive Electronic Systems Co., Ltd.
Applicant Address:	Building 5. Lane 33. Jin Ji Road Pudong Shanghai
Manufacturer:	DIAS Automotive Electronic Systems Co., Ltd.
Manufacturer Address:	Building 5. Lane 33. Jin Ji Road Pudong Shanghai
Factory:	DIAS Automotive Electronic Systems Co., Ltd.
Factory Address:	Building 5. Lane 33. Jin Ji Road Pudong Shanghai
Test Site:	Fangguang Inspection & Testing Co., Ltd. Wuxi Branch
Test Site Address:	200 Linghu Avenue, Xinwu District, Wuxi City, China
Test Device Serial No.:	N/A ☒ Production ☐ Pre-Production ☐ Engineering

1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

1.2. Fangguang Test Location

These measurement tests were performed at the Fangguang Inspection and testing Co.,LTD Wuxi Branch located at 200 Linghu Avenue, Xinwu District, Wuxi City. The detailed description of the measurement facility was found to be in compliance with the requirements of ANSI C63.4-2014.

2. PRODUCT INFORMATION

2.1. Equipment Description

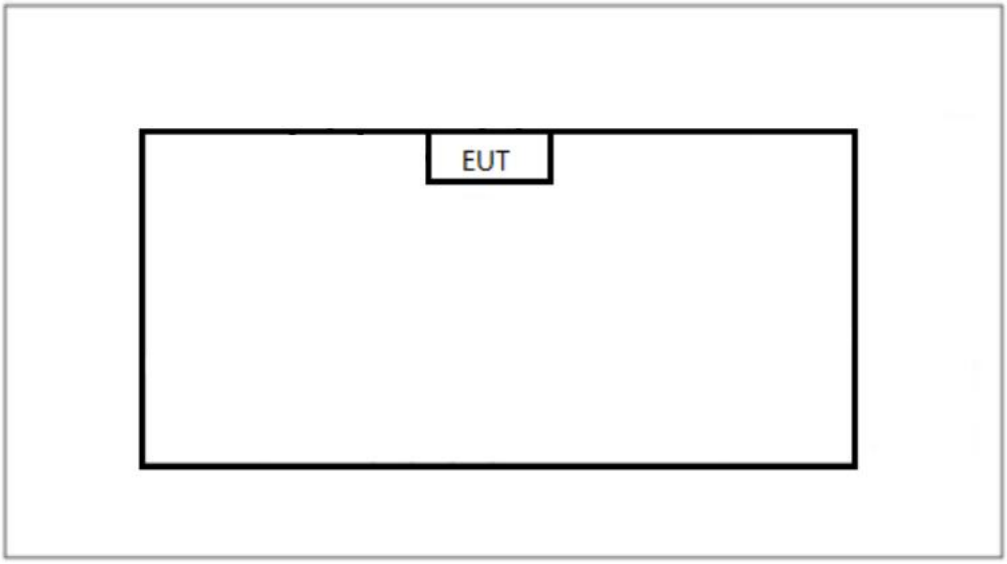
Equipment:	Tire pressure sensor
Model No.:	TPS4.1
Trade Name:	N/A
FCC ID:	2ALJETPS4-1
Power supply:	The EUT was powered by 1*DC 3V Battery
Frequency Range:	433.92MHz
Max Antenna gain:	Integrated Antenna, 3dBi
Sample submitting way:	■Provided by customer □Sampling
Type of Modulation:	FSK
Temperature Range:	-40°C ~ +85 °C
Hardware Version:	V1.0
Software Version:	V1.0
Note:	N/A

2.2. Configuration of Tested System

The **Tire pressure sensor** was tested per the guidance FCC Part 15 Subpart B and ANSI C63.4: 2014 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

2.3. Test Mode

EMI Mode	Mode 1: Normal Operation

Connection Diagram (Mode 1)		
		
Signal Cable Type		Signal Cable Description
/	/	/

2.4. Description of Auxiliary Equipment

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.	Power Cord
1	N/A	N/A	N/A	N/A	N/A

2.5. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.6. Calculation with all conversion and correction factors used

For AC Line Conducted Emissions Test:

Measure Level (dBμV) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB)

For Radiated Emissions Below 1GHz Test:

Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

For Radiated Emissions Above 1GHz Test:

Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB).

3. DESCRIPTION OF TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical Equipment in the Range of 9kHz to 18GHz (ANSI C63.4-2014) was used in the measurement of the **Tire pressure sensor.**

Deviation from measurement procedure…….....None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150 kHz to 30 MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or resolution, clock or data exchange speed, scrolling H pattern to the EUT and/or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. An MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.
For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30 MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30 MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up was placed on top of the 0.8 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, mode of operation, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.
Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB beam-width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. LIST OF USED TEST EQUIPMENT

Conducted Emissions

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	FWXGJC-2016-181	1 year	2022/02/25
Two-Line V-Network	R&S	ENV 216	FWXGJC-2016-182	1 year	2022/01/17
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-385	1 year	2022/01/17

Radiated Emission

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Bi-Log Antenna	R&S	HL562E	FWXGJC-2016-267-06	3 year	2022/03/30
EMI Receiver	R&S	ESR26	FWXGJC-2016-267-01	1 year	2022/04/16
Thermohygrometer	Yuhuaze	HTC-1	FWXDA-2016-386	1 year	2022/01/17
Anechoic Chamber	Aimuke	EMCCT-3	FWXGJC-2016-270	1 year	2023/04/07

Test Software	Manufacturer	Version	Asset No.	Function
EMI Test Software	tonscend	V2.5.0.0	FWXWA-2018-004	Emission Test

5. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

AC Conducted Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 1.28dB
Radiated Emission Measurement
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 2.72dB

6. TEST RESULT

6.1. Summary

FCC Part Section(s)	Test Description	Test Result
15.107	Conducted Emissions	N/A
15.109	Radiated Emissions	Pass

6.2. Conducted Emission Measurement

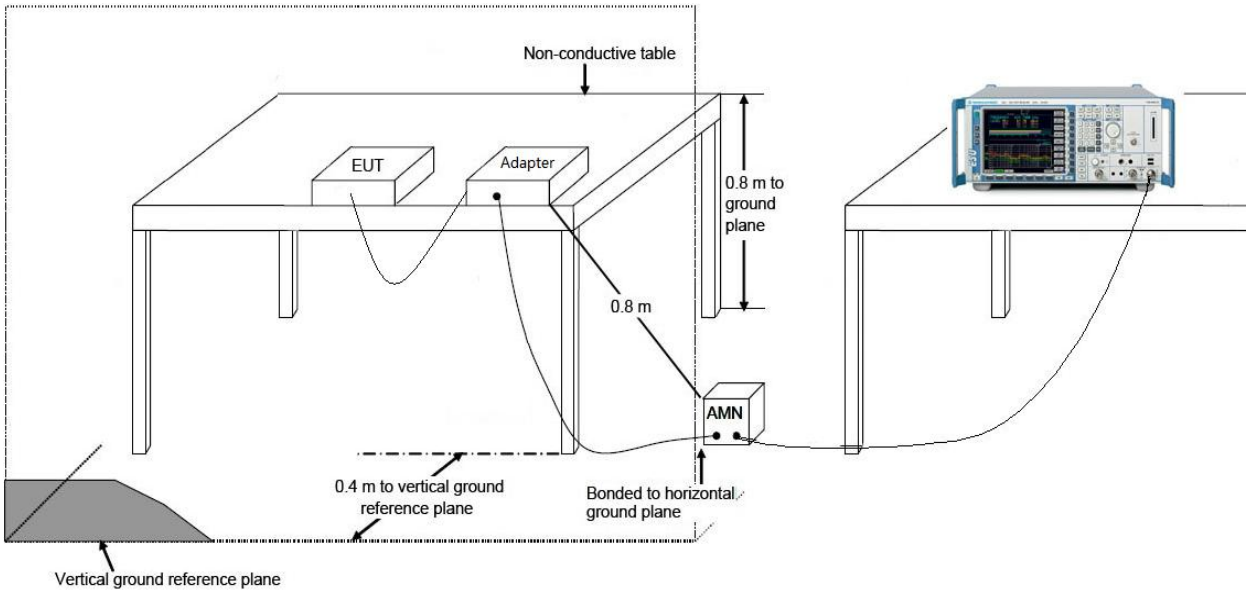
6.2.1. Test Limit

FCC Part 15.107 Limits		
Frequency (MHz)	QP (dBμV)	AV (dBμV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

6.2.2. Test Setup



6.2.3. Test Result of Conducted Emissions

The EUT was powered by 1*DC 3V Battery, This project is not applicable.

6.3. Radiated Emission Measurement

6.3.1. Test Limit

FCC Part 15.109 Limits		
Frequency (MHz)	Distance (m)	Level (dBμV/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

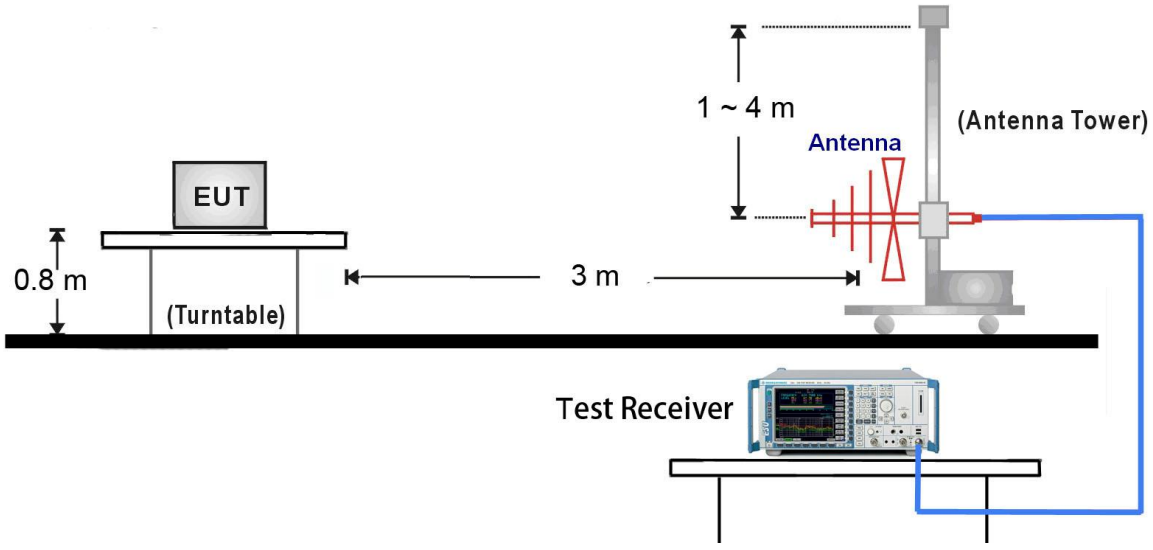
Note 1: The lower limit shall apply at the transition frequency.

Note 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.

Note 3: E field strength (dBμV/m) = 20 log E field strength (uV/m)

6.3.2. Test Setup

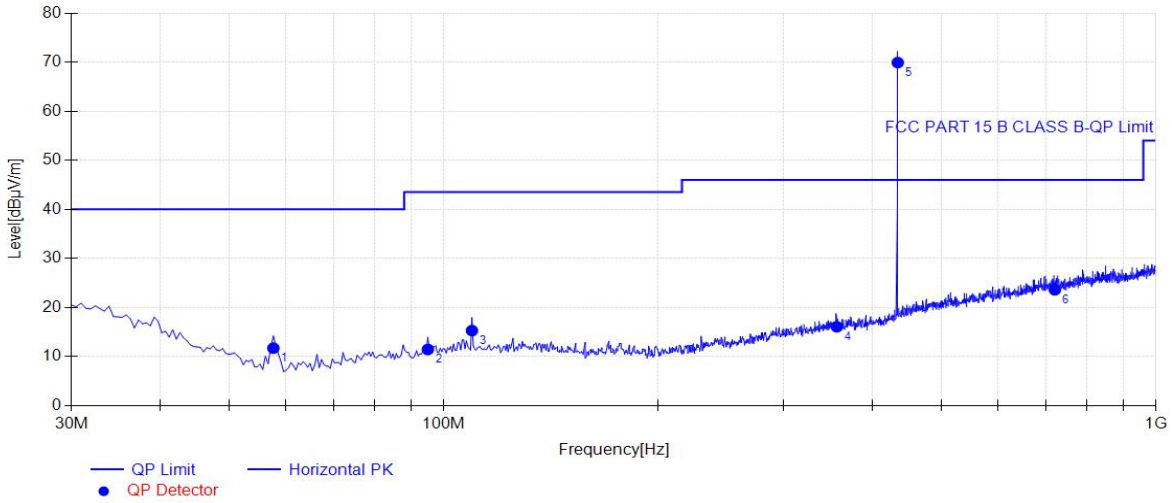
30MHz ~ 1GHz Test Setup:



6.3.3. Test Result of Radiated Emissions

Project Information			
EUT:	Tire pressure sensor	Polarity:	Horizontal
Model:	TPS4.1	SN:	N/A
Mode:	Mode 1	Voltage:	DC 3V
Environment:	Temp: 25℃; Humi:60%	Engineer:	Mark Xia

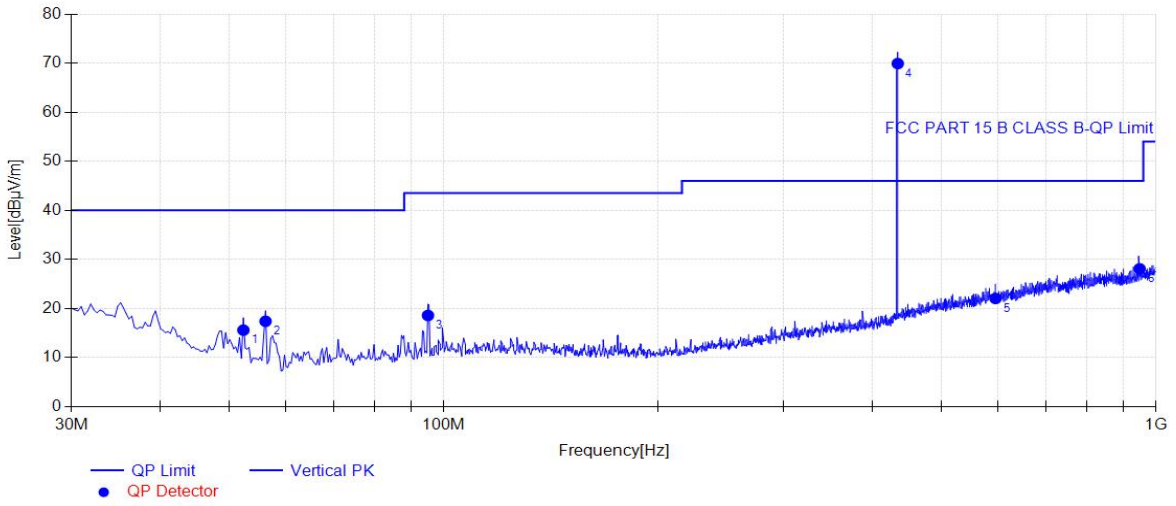
Test Graph



Final Data List								
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	57.6450	7.45	11.73	40.00	28.27	200	38	Horizontal
2	94.9900	10.61	11.46	43.50	32.04	200	1	Horizontal
3	109.5400	11.44	15.30	43.50	28.20	100	23	Horizontal
4	356.4050	15.02	16.08	46.00	29.92	200	81	Horizontal
5	434.0050	17.00	69.92	N/A	N/A	200	111	Horizontal
6	721.1250	22.15	23.61	46.00	22.39	100	359	Horizontal

Project Information			
EUT:	Tire pressure sensor	Polarity:	Vertical
Model:	TPS4.1	SN:	N/A
Mode:	Mode 1	Voltage:	DC 3V
Environment:	Temp: 25℃; Humi:60%	Engineer:	Mark Xia

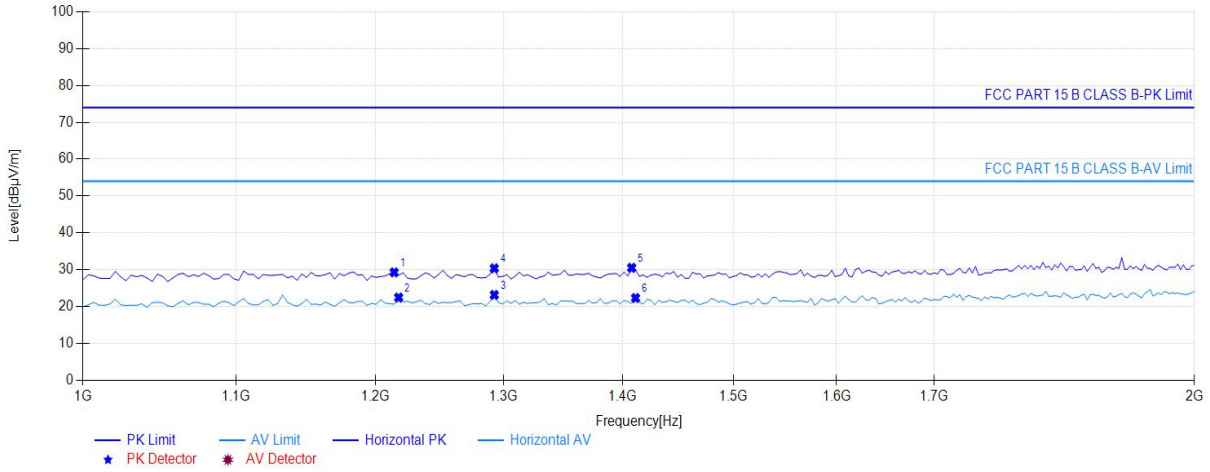
Test Graph



Final Data List								
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV/m]	QP Limit [dBµV/m]	QP Margin [dB]	Height [cm]	Angle [°]	Polarity
1	52.3174	8.89	15.60	40.00	24.40	100	55	Vertical
2	56.1987	7.84	17.40	40.00	22.60	100	55	Vertical
3	95.0117	10.61	18.59	43.50	24.91	100	77	Vertical
4	433.9780	17.00	69.92	N/A	N/A	100	334	Vertical
5	595.3751	20.29	22.05	46.00	23.95	200	88	Vertical
6	948.5729	24.64	28.09	46.00	17.91	100	7	Vertical

Project Information			
EUT:	Tire pressure sensor	Polarity:	Horizontal
Model:	TPS4.1	SN:	N/A
Mode:	Mode 1	Voltage:	DC 3V
Environment:	Temp: 25℃; Humi:60%	Engineer:	Mark Xia

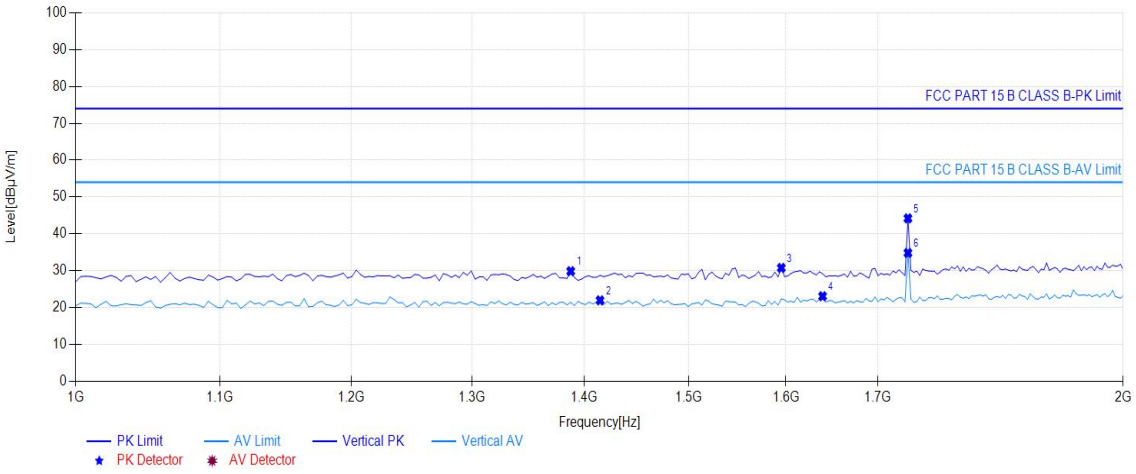
Test Graph



Final Data List								
NO.	Freq. [MHz]	Factor [dB]	Value [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Detection Mode
1	1214.2428	29.26	-7.85	74.00	44.74	100	44	PK
2	1217.6435	22.43	-7.84	54.00	31.57	100	141	AV
3	1292.4585	23.14	-7.79	54.00	30.86	100	248	AV
4	1292.4585	30.36	-7.79	74.00	43.64	100	248	PK
5	1408.0816	30.50	-7.72	74.00	43.50	100	256	PK
6	1411.4823	22.30	-7.72	54.00	31.70	100	292	AV

Project Information			
EUT:	Tire pressure sensor	Polarity:	Vertical
Model:	TPS4.1	SN:	N/A
Mode:	Mode 1	Voltage:	DC 3V
Environment:	Temp: 25℃; Humi:60%	Engineer:	Mark Xia

Test Graph



Final Data List

NO.	Freq. [MHz]	Factor [dB]	Value [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Detection Mode
1	1387.6775	29.85	-7.74	74.00	44.15	100	237	PK
2	1414.8830	21.94	-7.72	54.00	32.06	100	142	AV
3	1595.1190	30.74	-7.30	74.00	43.26	100	304	PK
4	1639.3279	23.05	-7.17	54.00	30.95	100	237	AV
5	1734.5469	44.20	-6.63	74.00	29.80	100	169	PK
6	1734.5469	34.81	-6.63	54.00	19.19	100	169	AV

7. CONCLUSION

The data collected relate only the item(s) tested and show that the **Tire pressure sensor** has been tested to comply with the requirements specified in §15.107 / §15.109 of the FCC Rules.

APPENDIX A. PHOTOGRAPHS OF EUT

TPS4.1

TPS4.1

The End