

FCC Test Report

Product Name	Tire Pressure Monitoring Sensor
Model No.	TIS-10DH
FCC ID.	KR5TIS-10DH

Applicant	Continental Automotive GmbH
Address	Siemensstrasse 12, SV C TS RBG EMC-Laboratory, 93055 Regensburg, Germany

Date of Receipt	Nov. 08, 2018
Issued Date	Dec. 12, 2018
Report No.	18B0104R-RFUSP14V00
Report Version	V1.0



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.

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Test Report

Issued Date : Dec. 12, 2018

Report No. : 18B0104R-RFUSP14V00



Product Name	Tire Pressure Monitoring Sensor
Applicant	Continental Automotive GmbH
Address	Siemensstrasse 12, SV C TS RBG EMC-Laboratory, 93055 Regensburg, Germany
Manufacturer	Continental Automotive GmbH
Model No.	TIS-10DH
FCC ID.	KR5TIS-10DH
EUT Rated Voltage	DC 3V(Power by Battery)
EUT Test Voltage	DC 3V(Power by Battery)
Trade Name	Continental
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2017 ANSI C63.4: 2014, ANSI C63.10: 2013
Test Result	Complied

Documented By :



(Senior Adm. Specialist / Rita Huang)

Tested By :



(Senior Engineer / Paul Jiang)

Approved By :



(Director / Vincent Lin)

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Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs

1. General Information

1.1. EUT Description

Product Name	Tire Pressure Monitoring Sensor
Trade Name	Continental
Model No.	TIS-10DH
FCC ID	KR5TIS-10DH
Frequency Range	315 MHz
Number of Channels	1
Type of Modulation	FSK, ASK
Antenna Type	Internal

Frequency of Each Channel:

Channel	Frequency
Channel 1:	315 MHz

Note:

1. The EUT is a Tire Pressure Monitoring Sensor with a built-in 315 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 of transmitter with Part 15 Subpart C Paragraph 15.231.
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: Transmitter - FSK Mode 2: Transmitter - ASK
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Emission	
Performed Item	Test
Conducted Emission	Not performed (see note)
Radiated Emission	Pass
Transmit time	Pass
Occupied Bandwidth	Pass

Note: Owing to the Battery operation of EUT, this Conducted Emission is not performed.

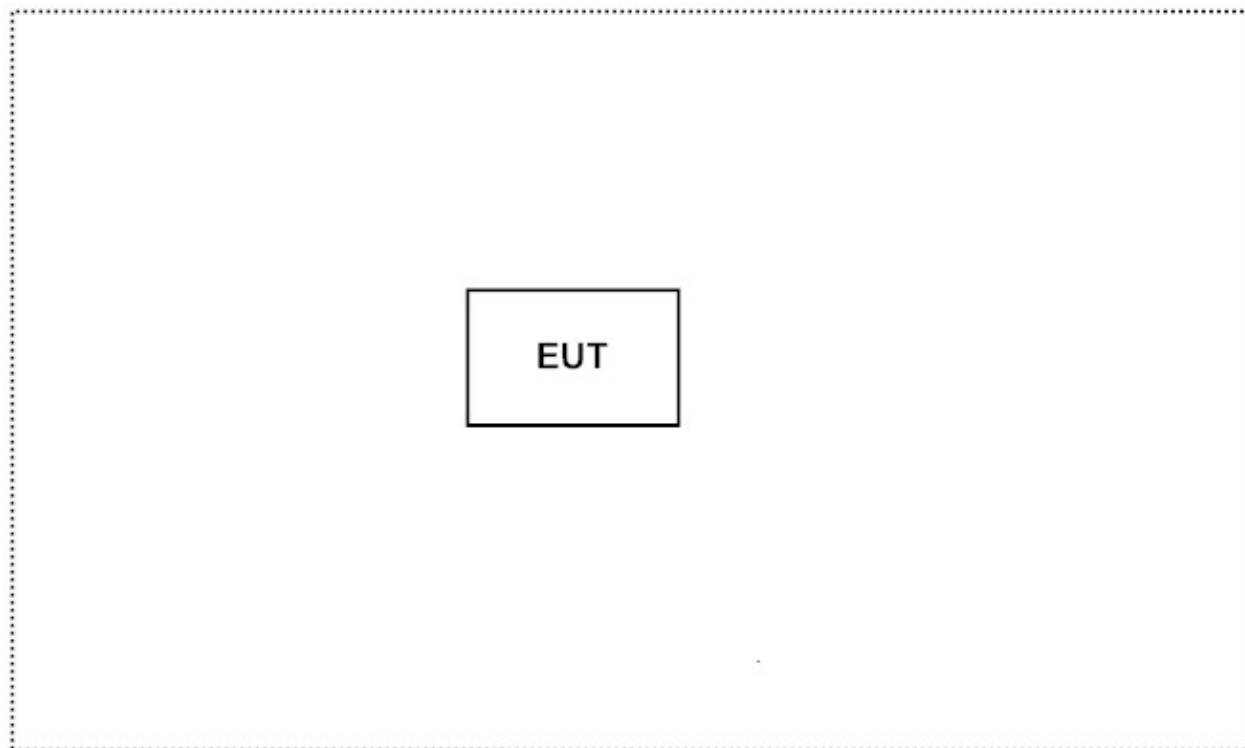
1.3. Tested System Details

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
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	Install the battery.
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. Date	Due. Date
	Temperature Chamber	WIT GROUP	TH-1S-B	EQ-201-00146	2018/02/12	2019/02/11
X	Spectrum Analyzer	Agilent	N9010A	MY48030495	2018/10/13	2019/10/12
	Peak Power Analyzer	Keysight	8990B	MY51000410	2018/08/01	2019/07/31
	Wideband Power Sensor	Keysight	N1923A	MY56080003	2018/07/25	2019/07/24
	Wideband Power Sensor	Keysight	N1923A	MY56080004	2018/07/25	2019/07/24
	EMI Test Receiver	R&S	ESCS 30	100369	2018/11/07	2019/11/06
	LISN	R&S	ESH3-Z5	836679/017	2018/02/09	2019/02/08
	LISN	R&S	ENV216	100097	2018/02/09	2019/02/08

For Radiated measurements /Site3/CB8

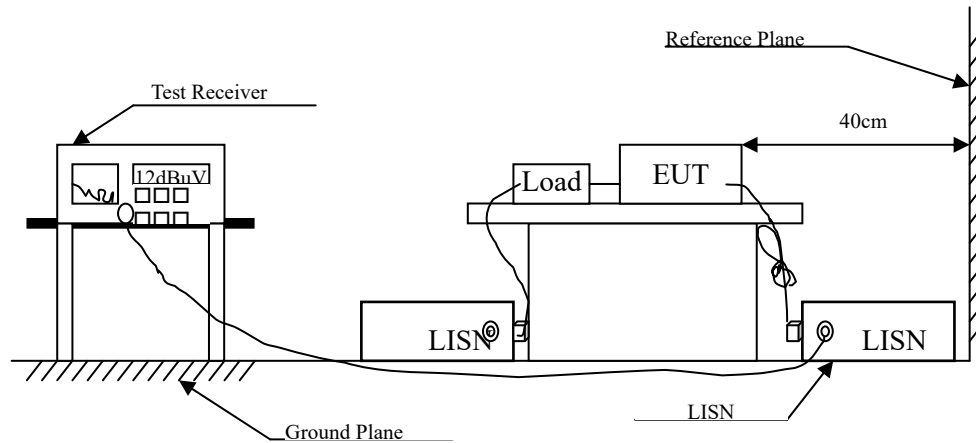
	Equipment	Manufacturer	Model No.	Serial No.	Cali. Date	Due. Date
X	Spectrum Analyzer	R&S	FSP40	100170	2018/03/12	2019/03/11
X	Loop Antenna	Teseq	HLA6121	37133	2018/10/13	2019/10/12
X	Bilog Antenna	Schaffner Chase	CBL6112B	2707	2018/06/24	2019/06/23
X	Coaxial Cable	DEKRA	RG 214	LC003-RG	2018/06/14	2019/06/13
X	Pre-Amplifier	Jet-Power	JPA-10M1G33	170101000330010	2018/06/14	2019/06/13
X	Horn Antenna	ETS-Lindgren	3117	00135205	2018/05/03	2019/05/02
X	Horn Antenna	SCHWARZBECK	9120D	576	2018/11/30	2019/11/29
X	Pre-Amplifier	EMCI	EMC012630SE	980210	2018/04/10	2019/04/09
	Horn Antenna	Com-Power	AH-840	101043	2018/01/09	2019/01/08
	Amplifier + Cable	EMCI	EMC184045SE	980370	2018/03/21	2019/03/20
X	Filter	MICRO-TRONICS	BRM50702	G270	2018/08/06	2019/08/05
	Filter	MICRO-TRONICS	BRM50716	G196	2018/08/06	2019/08/05

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 investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

2.4. Uncertainty

± 2.26 dB

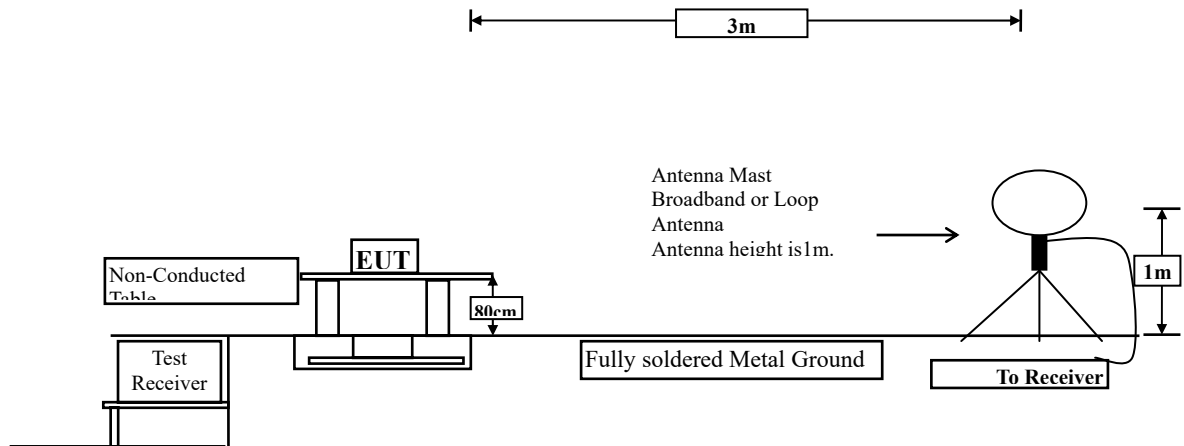
2.5. Test Result

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

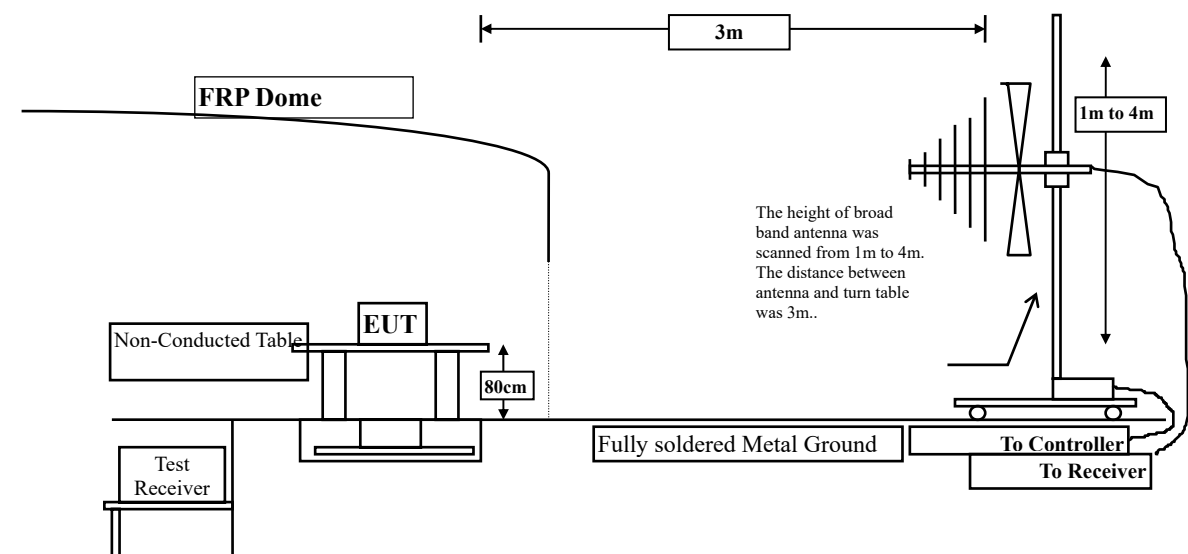
3. Radiated Emission

3.1. Test Setup

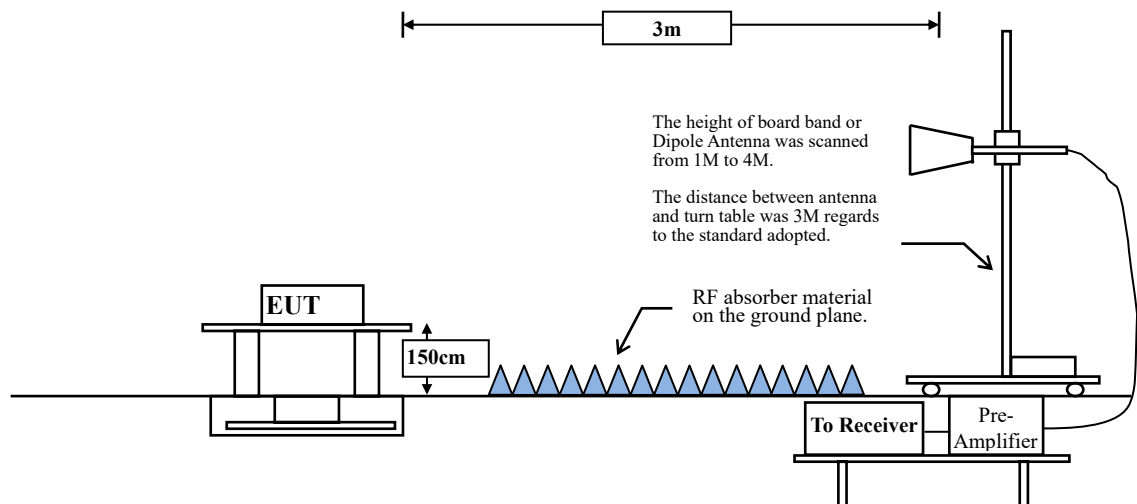
Radiated Emission Under 30MHz



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.

The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The turn table is rotated 360 degrees to determine the position of the maximum emission level.

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: 2013 on radiated measurement.

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

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~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 measurement frequency range from 9kHz - 10th Harmonic of fundamental was investigated.

3.4. Test Specification

According to FCC Part 15 Subpart C Paragraph 15.231

3.5. Uncertainty

± 4.08 dB above 1GHz

± 4.22 dB below 1GHz

3.6. Test Result

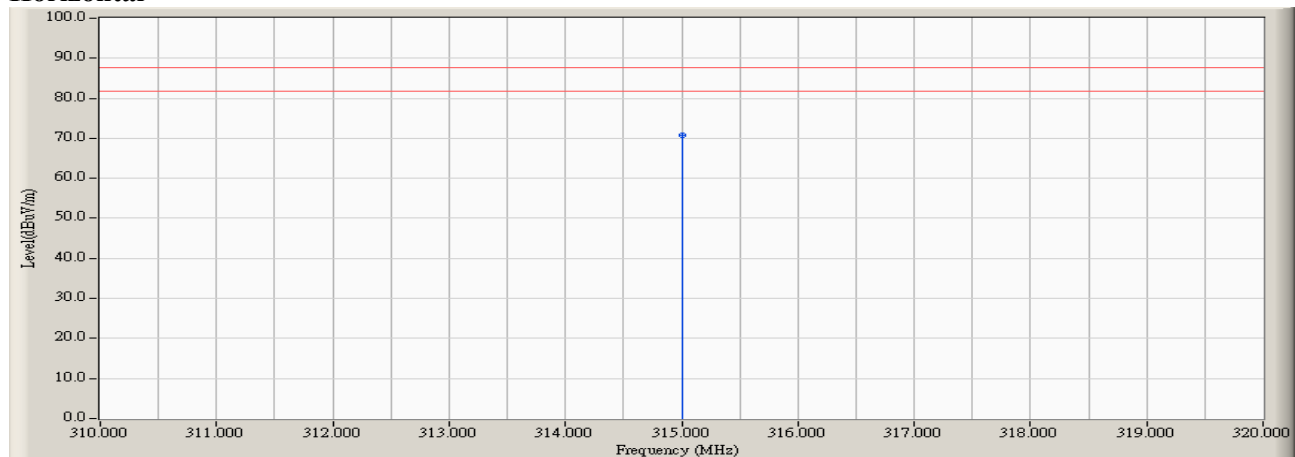
Product	Tire Pressure Monitoring Sensor
Test Item	Fundamental Radiated Emission
Test Mode	Mode 1: Transmitter - FSK
Date of Test	2018/11/14

Fundamental Power (X-Line)

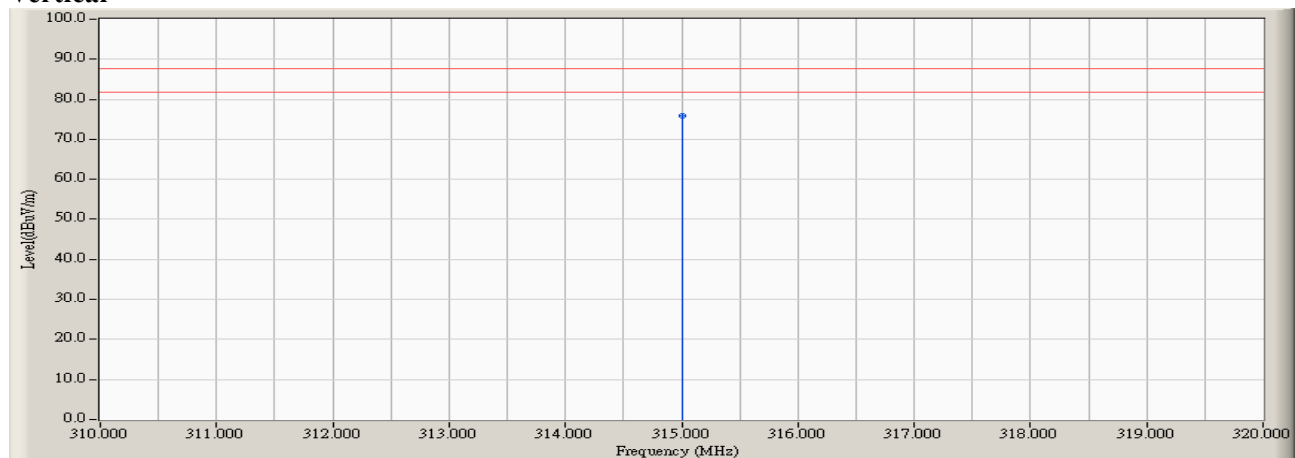
Peak Detector:

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
315.000	-4.099	74.890	70.790	-16.875	87.665
Vertical					
315.000	-5.301	81.170	75.869	-11.796	87.665

Horizontal



Vertical



Note:

1. Measurement Level = Reading Level + Correct Factor
2. Average Limit=20log(2416.68)=67.665dBuV 、 Peak Limit=87.665dBuV

Product	Tire Pressure Monitoring Sensor
Test Item	Fundamental Radiated Emission
Test Mode	Mode 1: Transmitter - FSK
Date of Test	2018/11/14

Fundamental Power (X-Line)

Average Detector:

Frequency MHz	Duty Cycle Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
315.000	-13.723	70.790	57.067	-10.598	67.665
Vertical					
315.000	-13.723	75.869	62.146	-5.519	67.665

Note:

1. Measurement Level = Reading Level + Duty Cycle Correct Factor
2. Average Limit=20log(2416.68)=67.665dBuV 、Peak Limit=87.665dBuV

Product	Tire Pressure Monitoring Sensor
Test Item	Fundamental Radiated Emission
Test Mode	Mode 1: Transmitter - FSK
Date of Test	2018/11/14

Fundamental Power (Y-Line)

Peak Detector:

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
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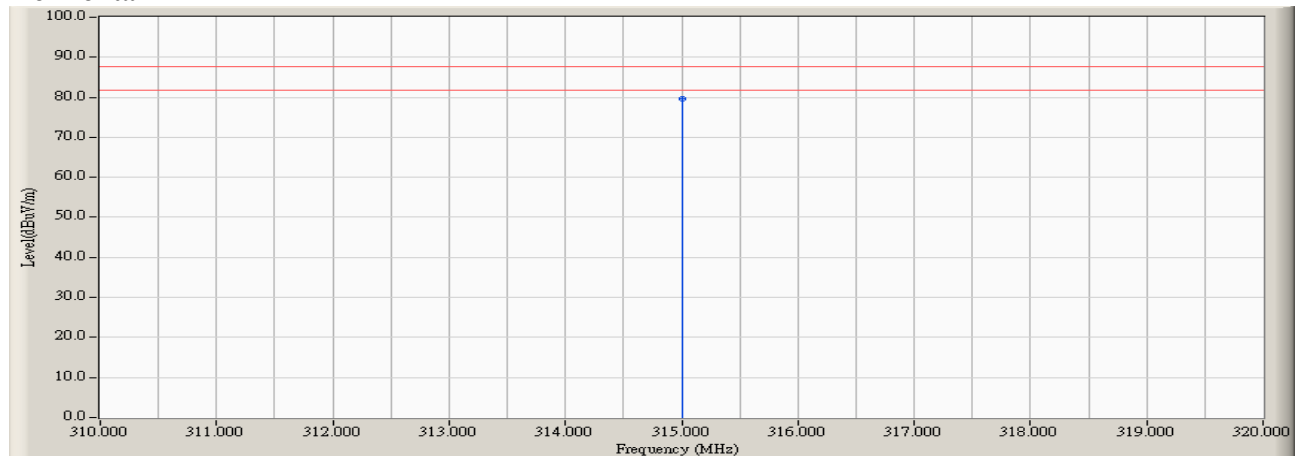
Horizontal

315.000	-4.099	83.750	79.650	-8.015	87.665
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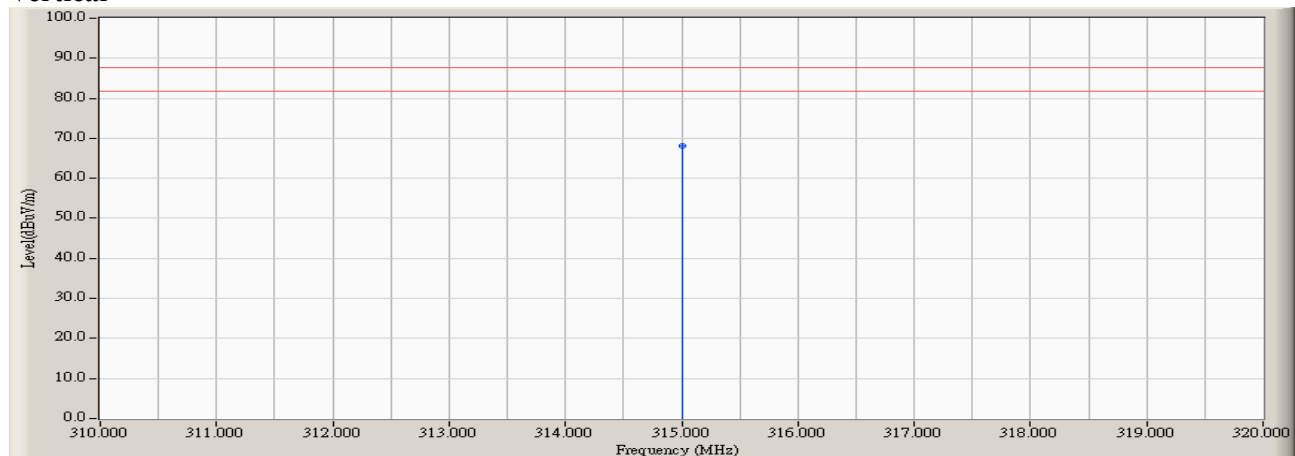
Vertical

315.000	-5.301	73.420	68.119	-19.546	87.665
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Horizontal



Vertical



Note:

1. Measurement Level = Reading Level + Correct Factor
2. Average Limit=20log(2416.68)=67.665dBuV 、 Peak Limit=87.665dBuV

Product	Tire Pressure Monitoring Sensor
Test Item	Fundamental Radiated Emission
Test Mode	Mode 1: Transmitter - FSK
Date of Test	2018/11/14

Fundamental Power (Y-Line)

Average Detector:

Frequency MHz	Duty Cycle Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
315.000	-13.723	79.650	65.927	-1.738	67.665
Vertical					
315.000	-13.723	68.119	54.396	-13.269	67.665

Note:

1. Measurement Level = Reading Level + Duty Cycle Correct Factor
2. Average Limit=20log(2416.68)=67.665dBuV 、Peak Limit=87.665dBuV

Product	Tire Pressure Monitoring Sensor
Test Item	Fundamental Radiated Emission
Test Mode	Mode 1: Transmitter - FSK
Date of Test	2018/11/14

Fundamental Power (Z-Line)

Peak Detector:

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
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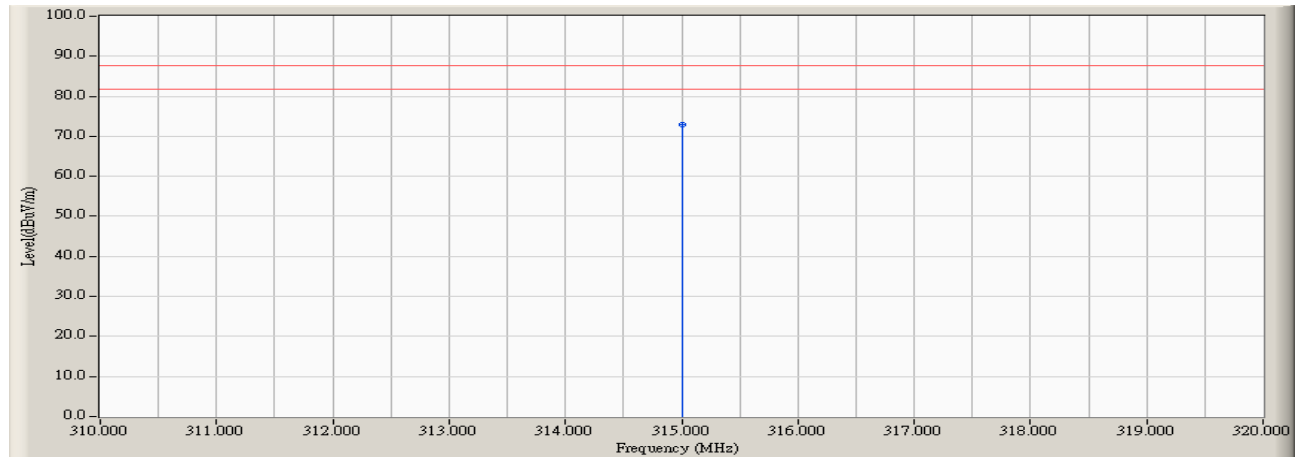
Horizontal

315.000	-4.099	77.060	72.960	-14.705	87.665
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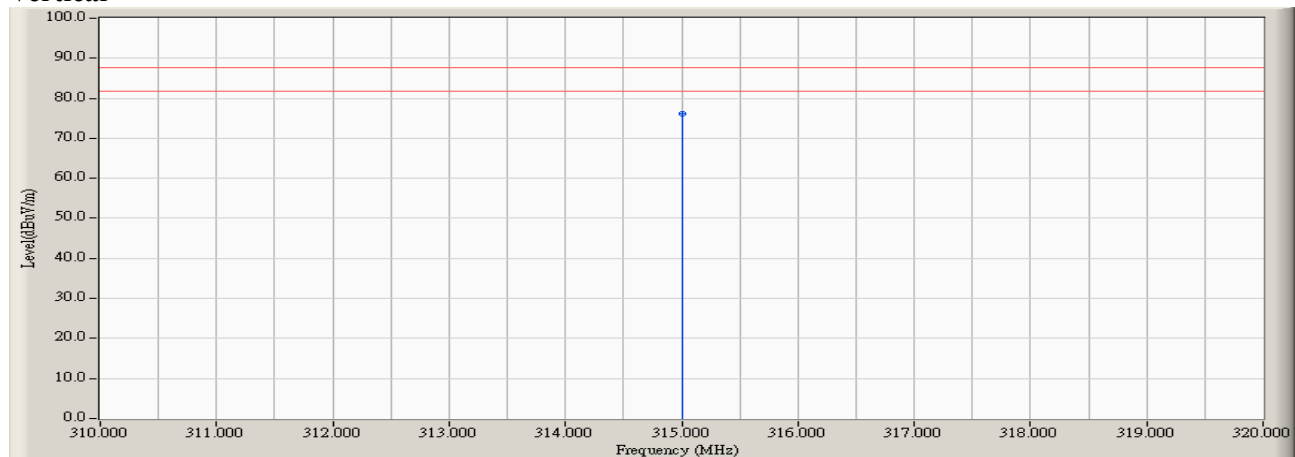
Vertical

315.000	-5.301	81.360	76.059	-11.606	87.665
---------	--------	--------	--------	---------	--------

Horizontal



Vertical



Note:

1. Measurement Level = Reading Level + Correct Factor
2. Average Limit=20log(2416.68)=67.665dBuV 、 Peak Limit=87.665dBuV

Product	Tire Pressure Monitoring Sensor
Test Item	Fundamental Radiated Emission
Test Mode	Mode 1: Transmitter - FSK
Date of Test	2018/11/14

Fundamental Power (Z-Line)

Average Detector:

Frequency MHz	Duty Cycle Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
315.000	-13.723	72.960	59.237	-8.428	67.665
Vertical					
315.000	-13.723	76.059	62.336	-5.329	67.665

Note:

1. Measurement Level = Reading Level + Duty Cycle Correct Factor
2. Average Limit=20log(2416.68)=67.665dBuV 、Peak Limit=87.665dBuV

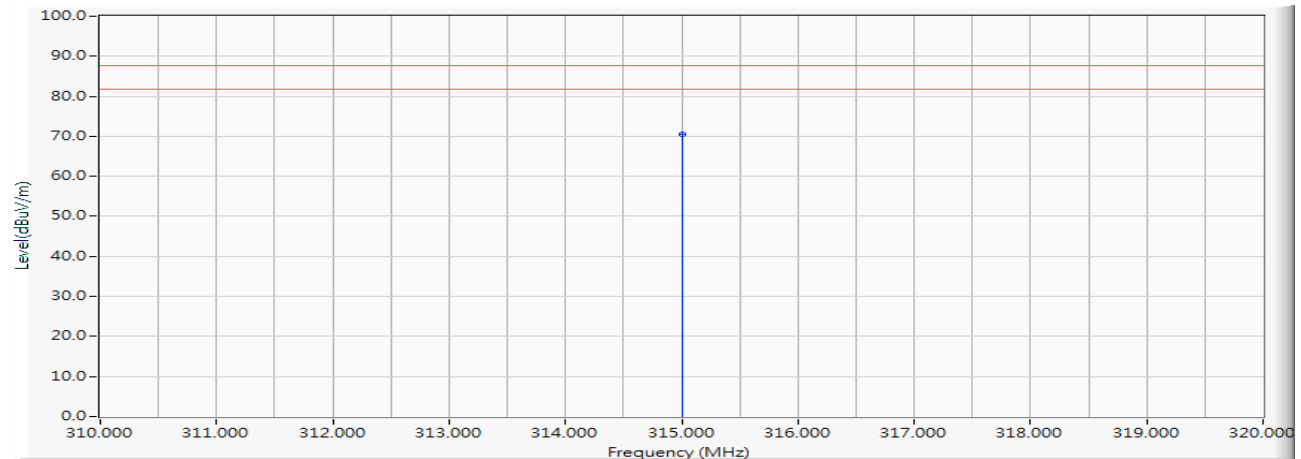
Product	Tire Pressure Monitoring Sensor
Test Item	Fundamental Radiated Emission
Test Mode	Mode 2: Transmitter - ASK
Date of Test	2018/12/11

Fundamental Power (X-Line)

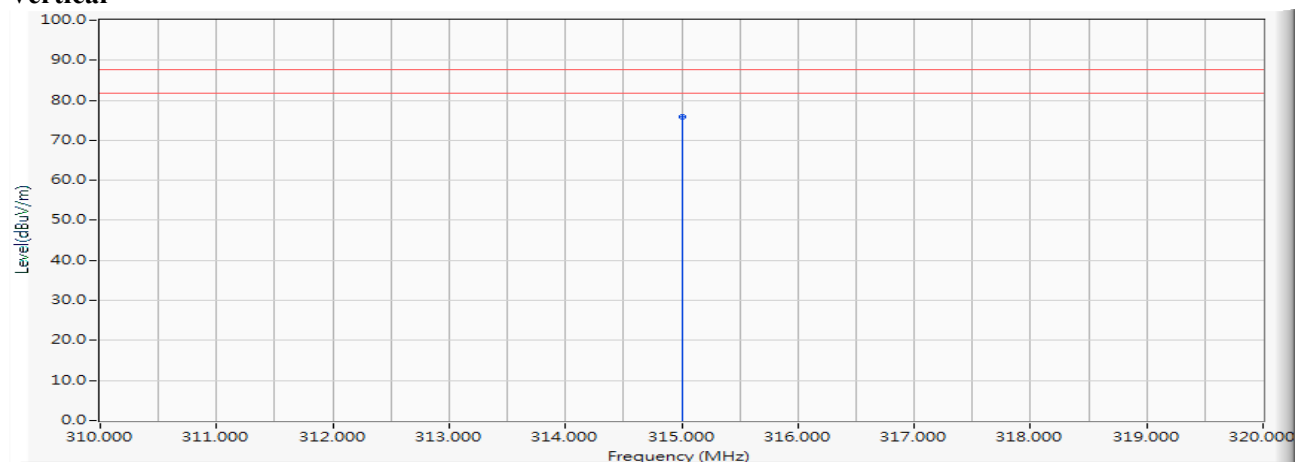
Peak Detector:

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
315.000	-4.099	74.520	70.420	-17.245	87.665
Vertical					
315.000	-5.301	81.050	75.749	-11.916	87.665

Horizontal



Vertical



Note:

1. Measurement Level = Reading Level + Correct Factor
2. Average Limit=20log(2416.68)=67.665dBuV 、Peak Limit=87.665dBuV

Product	Tire Pressure Monitoring Sensor
Test Item	Fundamental Radiated Emission
Test Mode	Mode 2: Transmitter - ASK
Date of Test	2018/12/11

Fundamental Power (X-Line)

Average Detector:

Frequency MHz	Duty Cycle Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
315.000	-13.723	70.420	56.697	-10.968	67.665
Vertical					
315.000	-13.723	75.749	62.026	-5.639	67.665

Note:

1. Measurement Level = Reading Level + Duty Cycle Correct Factor
2. Average Limit=20log(2416.68)=67.665dBuV 、Peak Limit=87.665dBuV

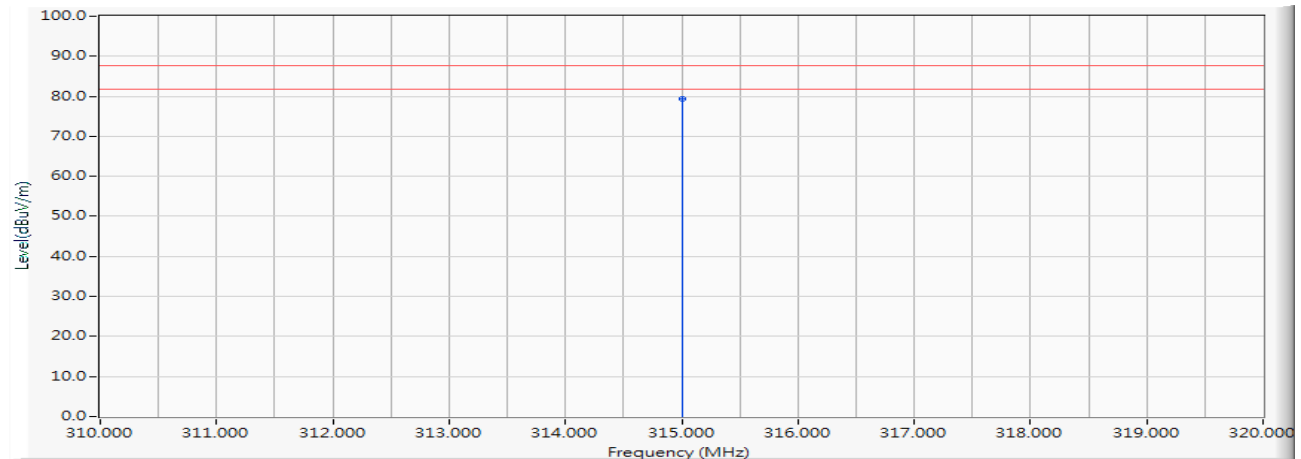
Product	Tire Pressure Monitoring Sensor
Test Item	Fundamental Radiated Emission
Test Mode	Mode 2: Transmitter - ASK
Date of Test	2018/12/11

Fundamental Power (Y-Line)

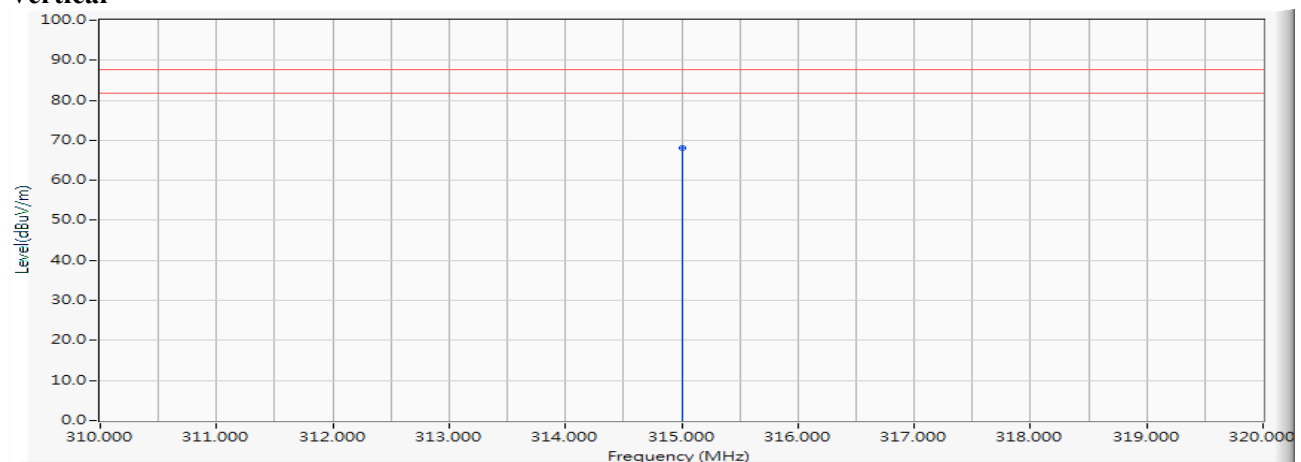
Peak Detector:

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
315.000	-4.099	83.420	79.320	-8.345	87.665
Vertical					
315.000	-5.301	73.310	68.009	-19.656	87.665

Horizontal



Vertical



Note:

1. Measurement Level = Reading Level + Correct Factor
2. Average Limit=20log(2416.68)=67.665dBuV 、 Peak Limit=87.665dBuV

Product	Tire Pressure Monitoring Sensor
Test Item	Fundamental Radiated Emission
Test Mode	Mode 2: Transmitter - ASK
Date of Test	2018/12/11

Fundamental Power (Y-Line)

Average Detector:

Frequency MHz	Duty Cycle Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
315.000	-13.723	79.320	65.597	-2.068	67.665
Vertical					
315.000	-13.723	68.009	54.286	-13.379	67.665

Note:

1. Measurement Level = Reading Level + Duty Cycle Correct Factor
2. Average Limit=20log(2416.68)=67.665dBuV 、Peak Limit=87.665dBuV

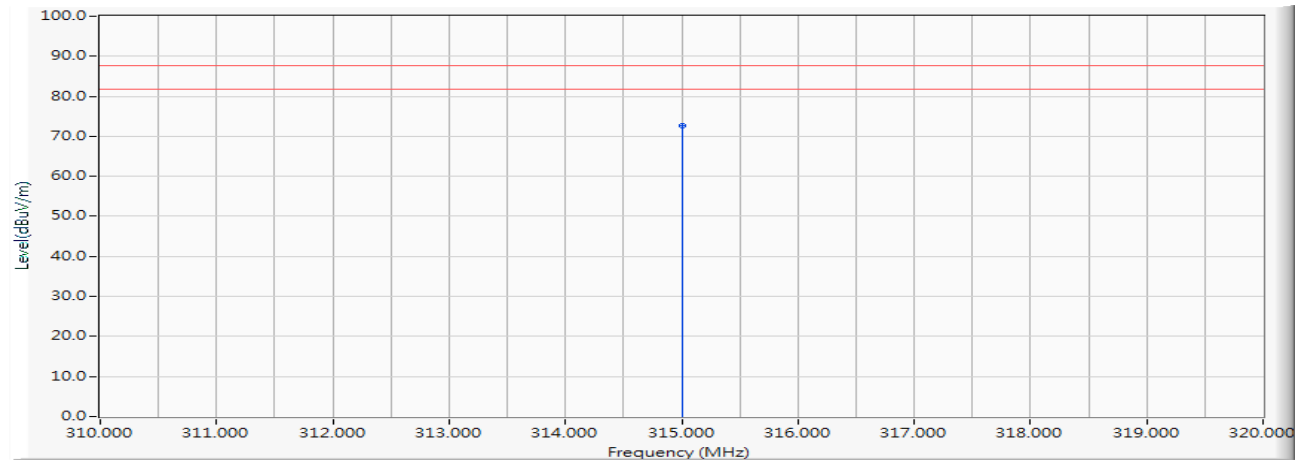
Product	Tire Pressure Monitoring Sensor
Test Item	Fundamental Radiated Emission
Test Mode	Mode 2: Transmitter - ASK
Date of Test	2018/12/11

Fundamental Power (Z-Line)

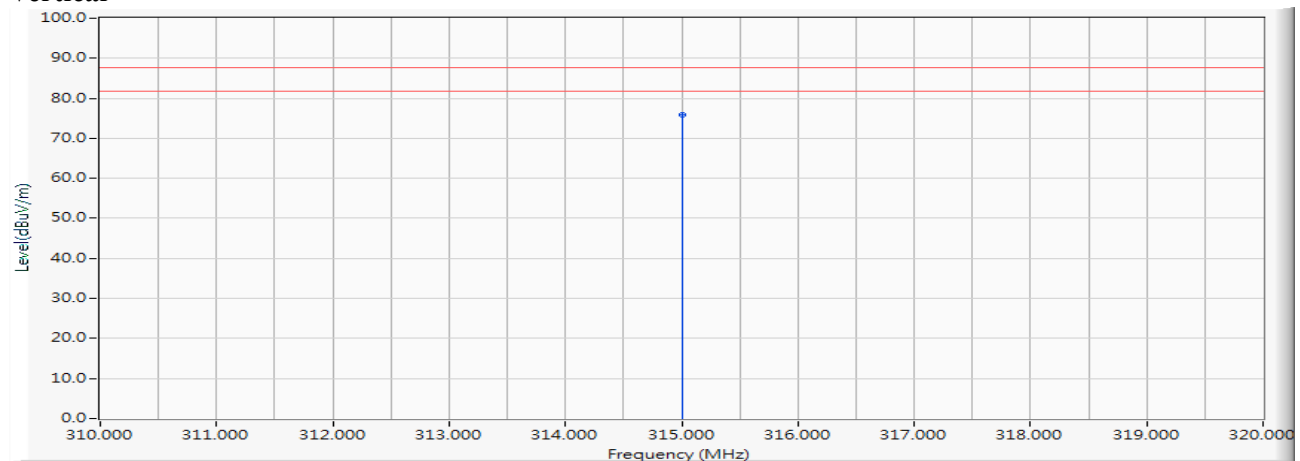
Peak Detector:

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
315.000	-4.099	76.720	72.620	-15.045	87.665
Vertical					
315.000	-5.301	81.090	75.789	-11.876	87.665

Horizontal



Vertical



Note:

1. Measurement Level = Reading Level + Correct Factor
2. Average Limit=20log(2416.68)=67.665dBuV 、 Peak Limit=87.665dBuV

Product	Tire Pressure Monitoring Sensor
Test Item	Fundamental Radiated Emission
Test Mode	Mode 2: Transmitter - ASK
Date of Test	2018/12/11

Fundamental Power (Z-Line)

Average Detector:

Frequency MHz	Duty Cycle Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
315.000	-13.723	72.620	58.897	-8.768	67.665
Vertical					
315.000	-13.723	75.789	62.066	-5.599	67.665

Note:

1. Measurement Level = Reading Level + Duty Cycle Correct Factor
2. Average Limit=20log(2416.68)=67.665dBuV 、Peak Limit=87.665dBuV

Fundamental Radiated Emission	PASS
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Product	Tire Pressure Monitoring Sensor
Test Item	Harmonic Radiated Emission
Test Mode	Mode 1: Transmitter - FSK
Date of Test	2018/11/14

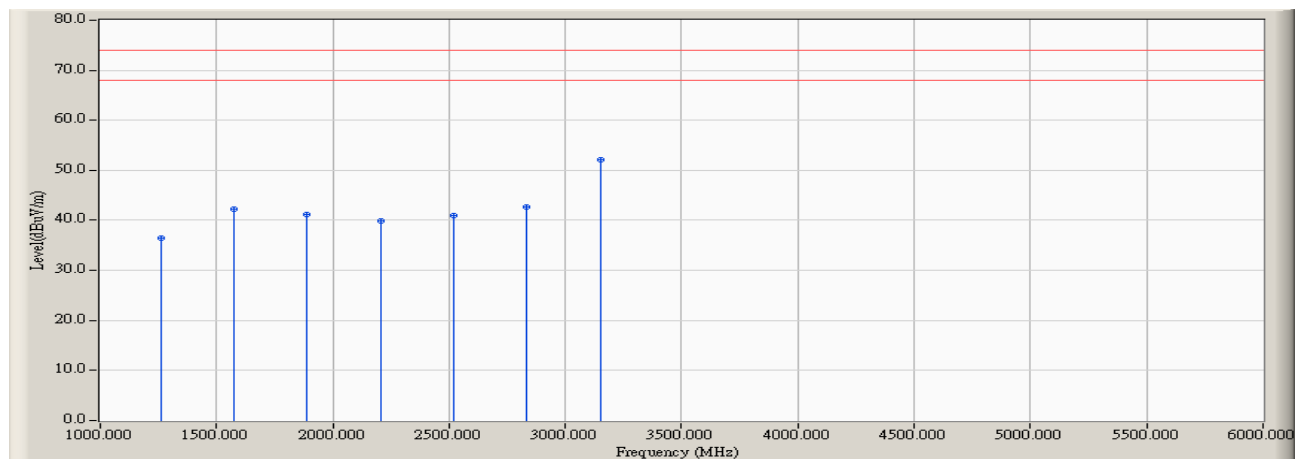
Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Peak Limit dBuV/m	Average Limit dBuV/m
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Horizontal**Peak**

1260.000	-14.116	50.640	36.524	-37.476	74.000	54.000
1575.000	-13.622	55.910	42.288	-31.712	74.000	54.000
1890.000	-10.471	51.720	41.249	-32.751	74.000	54.000
2205.000	-9.205	49.050	39.845	-34.155	74.000	54.000
2520.000	-8.295	49.160	40.865	-33.135	74.000	54.000
2835.000	-7.615	50.340	42.726	-31.274	74.000	54.000
3150.000	-6.493	58.600	52.107	-21.893	74.000	54.000

Average

--

**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	Tire Pressure Monitoring Sensor
Test Item	Harmonic Radiated Emission
Test Mode	Mode 1: Transmitter - FSK
Date of Test	2018/11/14

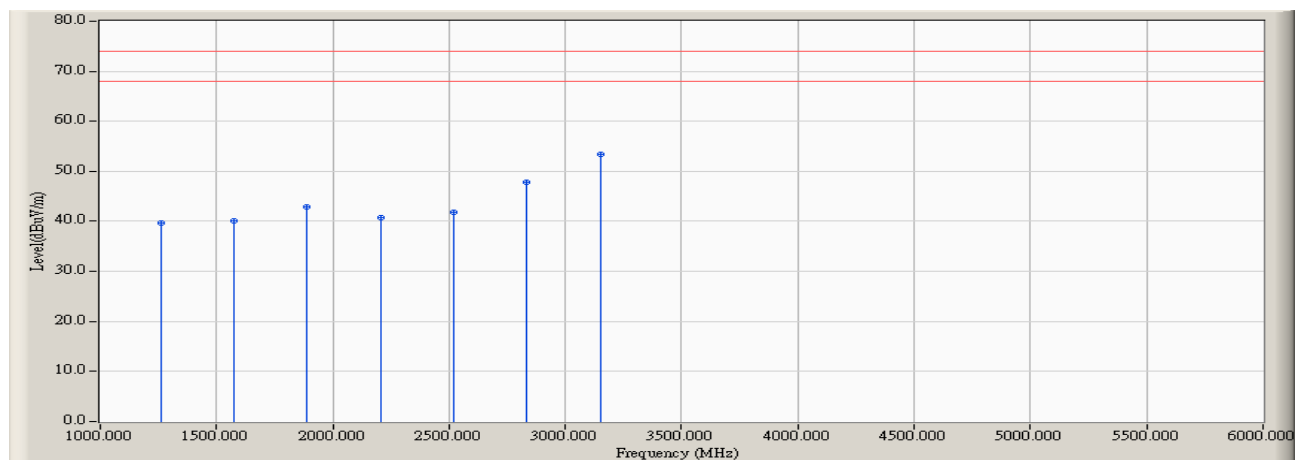
Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Peak Limit dBuV/m	Average Limit dBuV/m
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Vertical**Peak**

1260.000	-14.116	53.860	39.744	-34.256	74.000	54.000
1575.000	-13.622	53.820	40.198	-33.802	74.000	54.000
1890.000	-10.471	53.350	42.879	-31.121	74.000	54.000
2205.000	-9.205	49.900	40.695	-33.305	74.000	54.000
2520.000	-8.295	50.180	41.885	-32.115	74.000	54.000
2835.000	-7.615	55.340	47.726	-26.274	74.000	54.000
3150.000	-6.493	59.940	53.447	-20.553	74.000	54.000

Average

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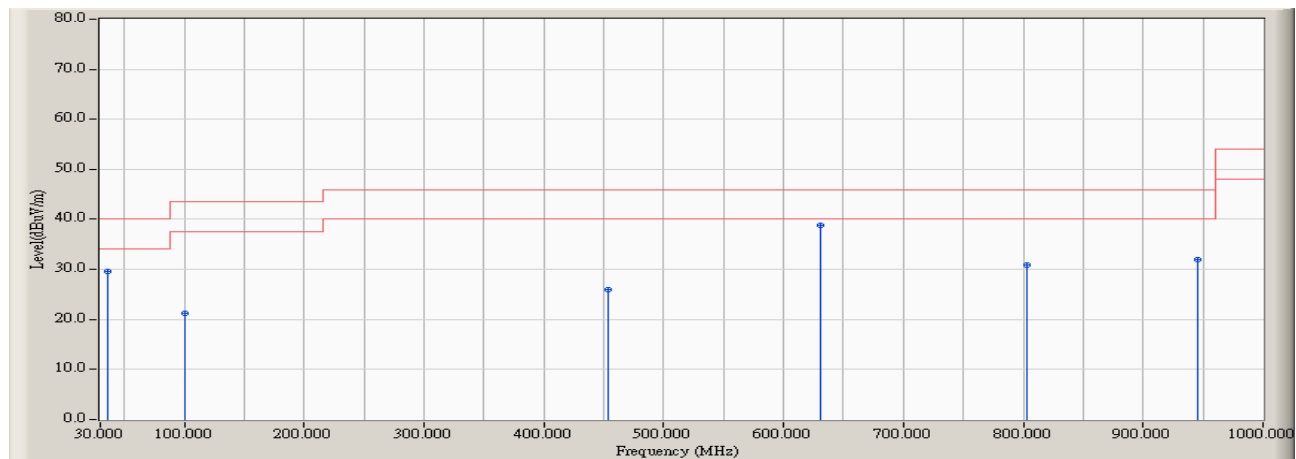
**Note:**

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.

Harmonic Radiated Emission**PASS**

Product	Tire Pressure Monitoring Sensor
Test Item	General Radiated Emission
Test Mode	Mode 1: Transmitter - FSK
Date of Test	2018/11/14

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Quasi-Peak					
35.623	4.514	24.978	29.492	-10.508	40.000
100.290	-2.671	23.872	21.201	-22.299	43.500
453.145	2.103	23.894	25.997	-20.003	46.000
630.275	6.891	32.024	38.916	-7.084	46.000
803.188	7.890	22.999	30.889	-15.111	46.000
945.174	8.278	23.605	31.882	-14.118	46.000

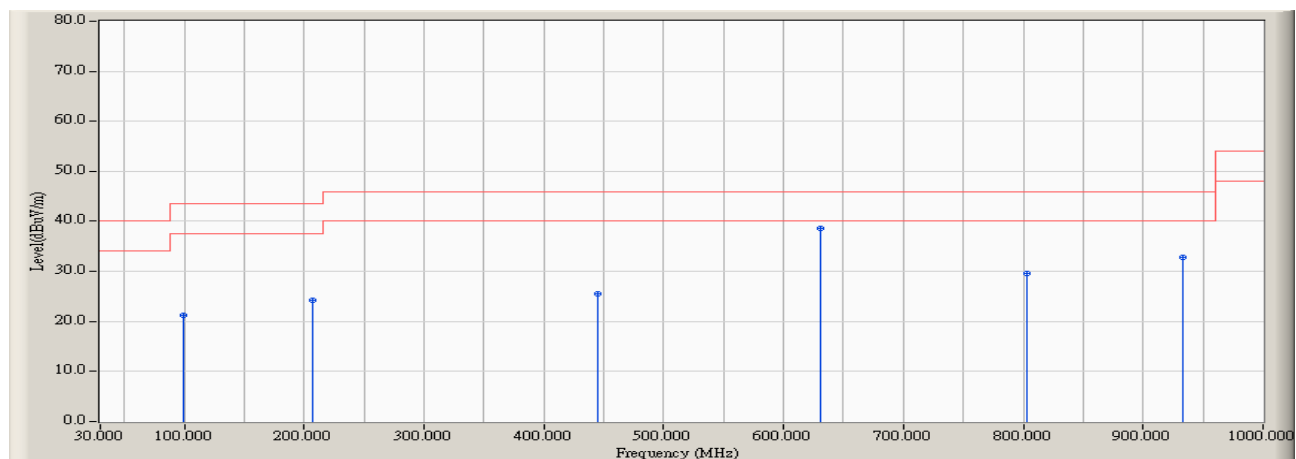


Note:

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

Product	Tire Pressure Monitoring Sensor
Test Item	General Radiated Emission
Test Mode	Mode 1: Transmitter - FSK
Date of Test	2018/11/14

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Vertical					
Quasi-Peak					
98.884	-2.908	24.234	21.325	-22.175	43.500
207.130	0.225	23.977	24.202	-19.298	43.500
444.710	1.035	24.506	25.541	-20.459	46.000
630.275	4.038	34.535	38.573	-7.427	46.000
803.188	6.094	23.432	29.526	-16.474	46.000
932.522	9.087	23.781	32.868	-13.132	46.000



Note:

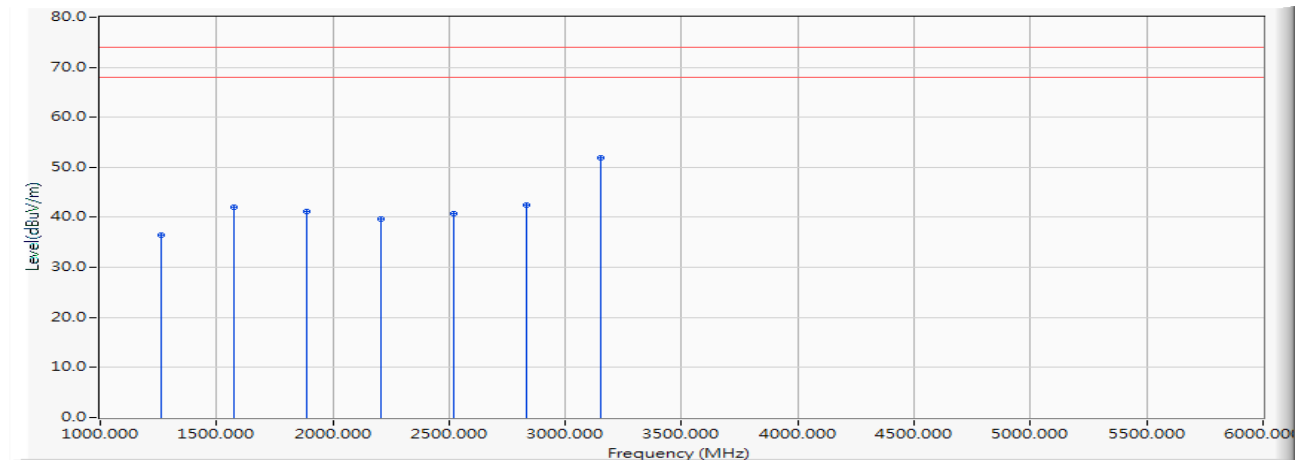
1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. 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.
8. No emission found between lowest internal used/generated frequency to 30MHz.

General Radiated Emission	PASS
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Product	Tire Pressure Monitoring Sensor
Test Item	Harmonic Radiated Emission
Test Mode	Mode 2: Transmitter - ASK
Date of Test	2018/12/11

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Peak Limit dBuV/m	Average Limit dBuV/m
Horizontal						
Peak						
1260.000	-14.116	50.490	36.374	-37.626	74.000	54.000
1575.000	-13.622	55.620	41.998	-32.002	74.000	54.000
1890.000	-10.471	51.520	41.049	-32.951	74.000	54.000
2205.000	-9.205	48.810	39.605	-34.395	74.000	54.000
2520.000	-8.295	49.020	40.725	-33.275	74.000	54.000
2835.000	-7.615	50.120	42.505	-31.495	74.000	54.000
3150.000	-6.493	58.410	51.917	-22.083	74.000	54.000
Average						

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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	Tire Pressure Monitoring Sensor
Test Item	Harmonic Radiated Emission
Test Mode	Mode 2: Transmitter - ASK
Date of Test	2018/12/11

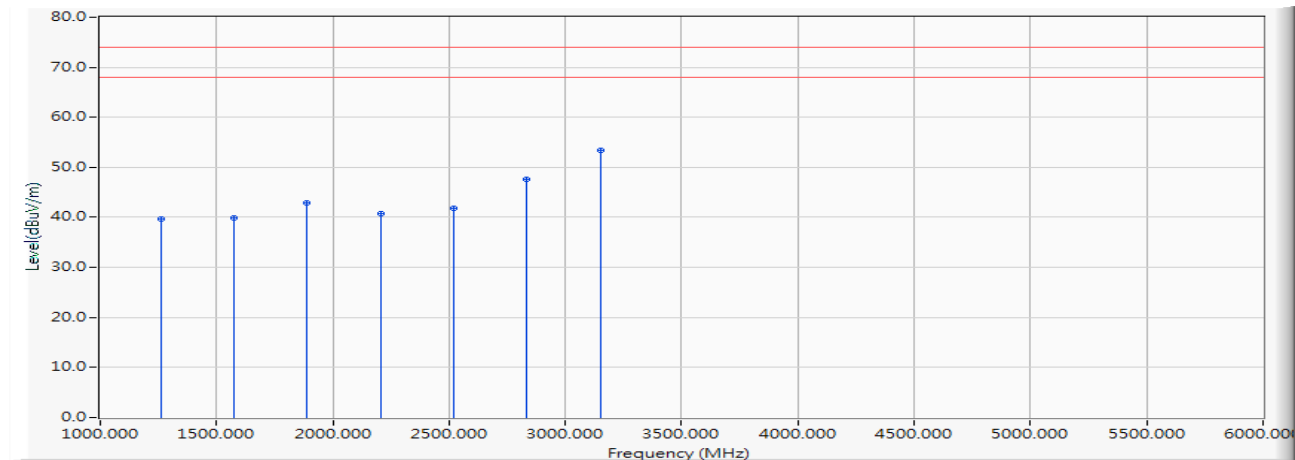
Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Peak Limit dBuV/m	Average Limit dBuV/m
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Vertical**Peak**

1260.000	-14.116	53.790	39.674	-34.326	74.000	54.000
1575.000	-13.622	53.540	39.918	-34.082	74.000	54.000
1890.000	-10.471	53.270	42.799	-31.201	74.000	54.000
2205.000	-9.205	49.870	40.665	-33.335	74.000	54.000
2520.000	-8.295	49.970	41.675	-32.325	74.000	54.000
2835.000	-7.615	55.080	47.465	-26.535	74.000	54.000
3150.000	-6.493	59.790	53.297	-20.703	74.000	54.000

Average

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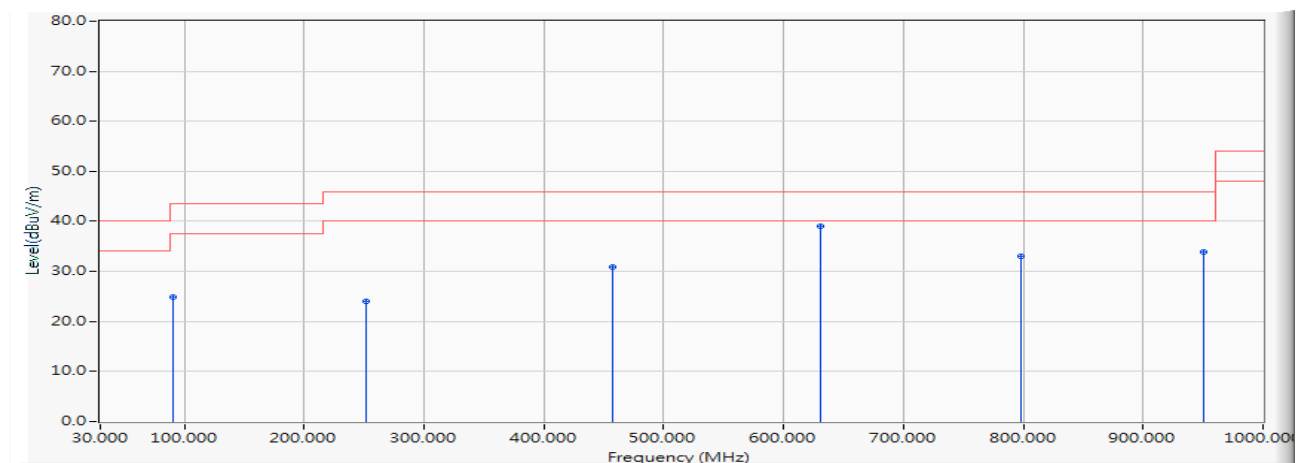
**Note:**

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.

Harmonic Radiated Emission**PASS**

Product	Tire Pressure Monitoring Sensor
Test Item	General Radiated Emission
Test Mode	Mode 2: Transmitter - ASK
Date of Test	2018/12/11

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Quasi-Peak					
90.449	-8.163	32.980	24.818	-18.682	43.500
252.116	-5.246	29.231	23.985	-22.015	46.000
457.362	2.133	28.815	30.948	-15.052	46.000
630.275	6.891	32.081	38.973	-7.027	46.000
797.565	7.837	25.254	33.091	-12.909	46.000
950.797	8.343	25.647	33.989	-12.011	46.000
90.449	-8.163	32.980	24.818	-18.682	43.500

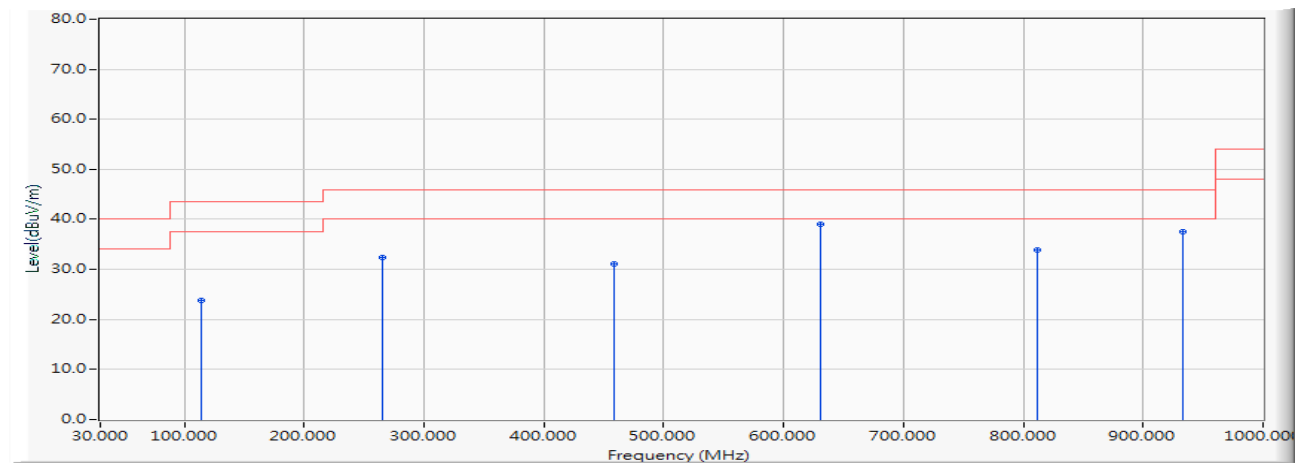


Note:

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.

Product	Tire Pressure Monitoring Sensor
Test Item	General Radiated Emission
Test Mode	Mode 2: Transmitter - ASK
Date of Test	2018/12/11

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Vertical					
Quasi-Peak					
114.348	-5.983	29.807	23.824	-19.676	43.500
264.768	-2.099	34.583	32.484	-13.516	46.000
458.768	1.102	29.973	31.075	-14.925	46.000
630.275	4.038	35.059	39.097	-6.903	46.000
811.623	6.339	27.511	33.850	-12.150	46.000
932.522	9.087	28.479	37.566	-8.434	46.000
114.348	-5.983	29.807	23.824	-19.676	43.500



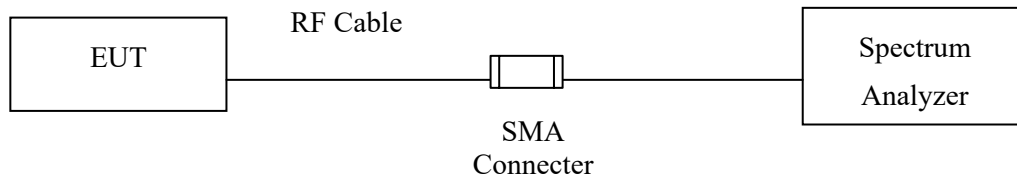
Note:

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.

General Radiated Emission	PASS
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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

4.4. Uncertainty

$\pm 2.31\text{ms}$

4.5. Test Result

Product Tire Pressure Monitoring Sensor

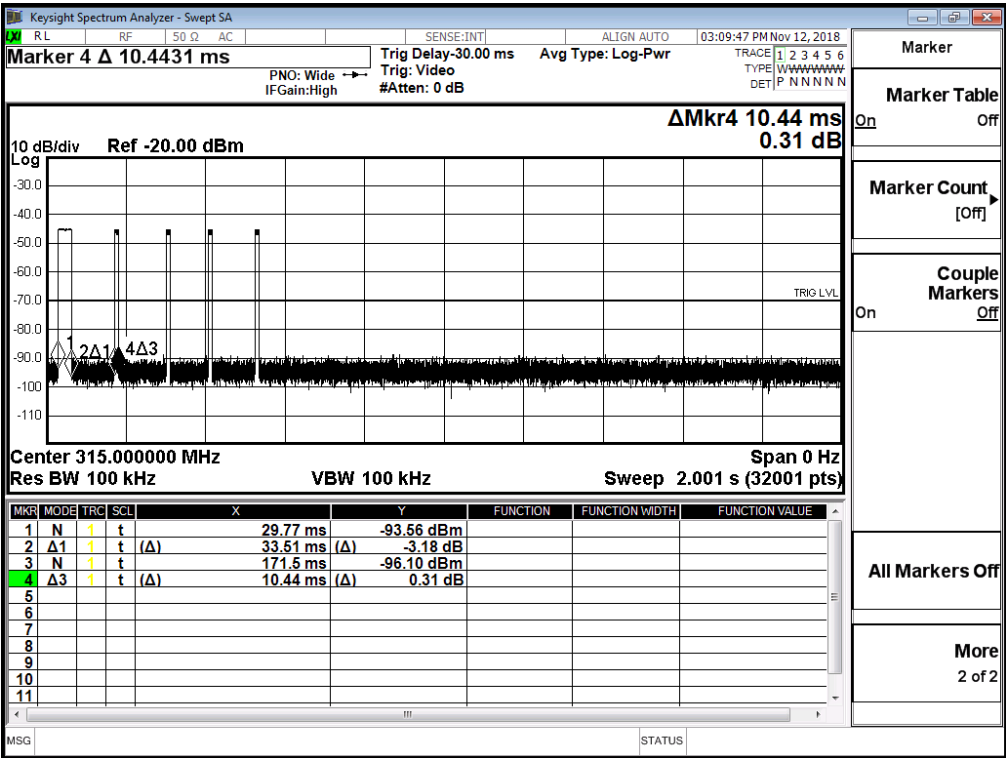
Test Item Transmit time

Test Mode Mode 1: Transmitter - FSK

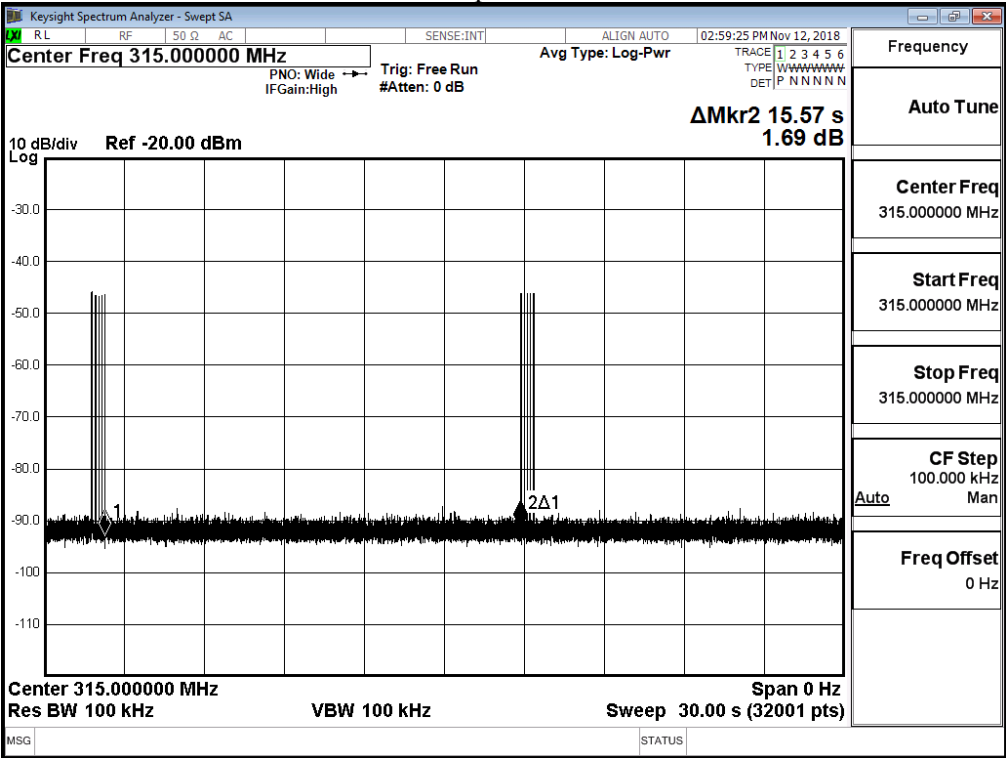
Channel No.	Frequency (MHz)	Measurement Value (Sec)	Limit (Sec)	Result
1 (Transmit time)	315	0.07527	< 1	Pass
1 (Silent period time)	315	15.57	> 10	Pass
1 (Silent period time)	315	15.57	> 2.2581	Pass

Note: Silent period time Limit = 10s and Transmissions * 30 times = $0.07527\text{s} * 30 = 2.2581\text{s}$

Transmit time



Silent period time



Transmit Time

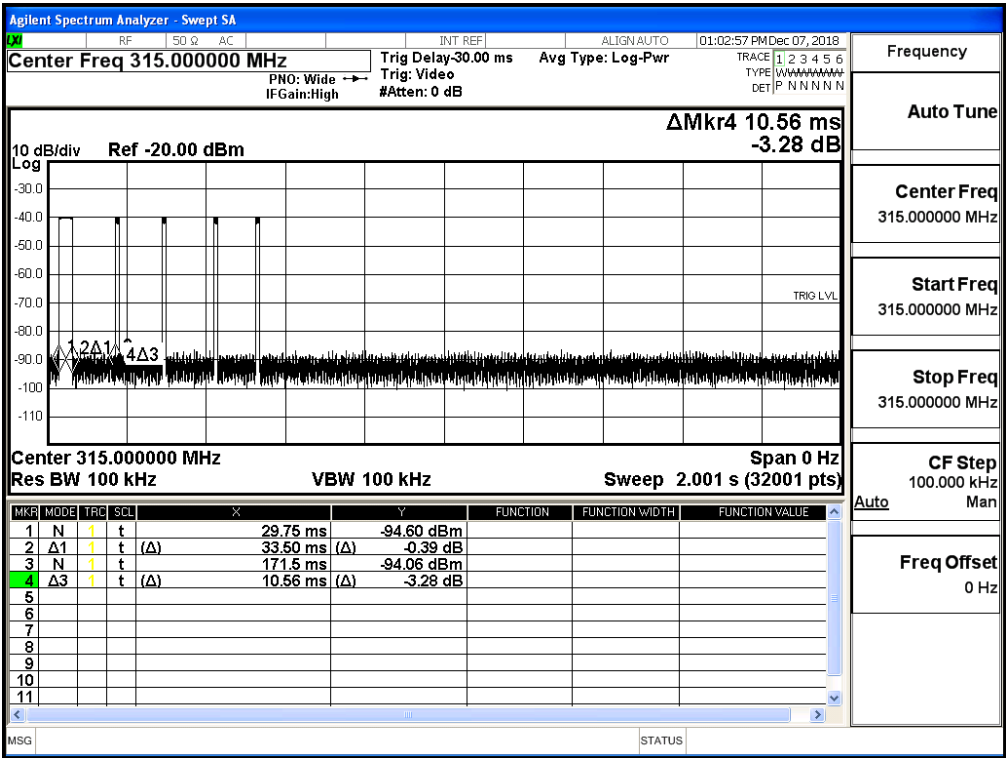
PASS

Product Tire Pressure Monitoring Sensor
Test Item Transmit time
Test Mode Mode 2: Transmitter - ASK

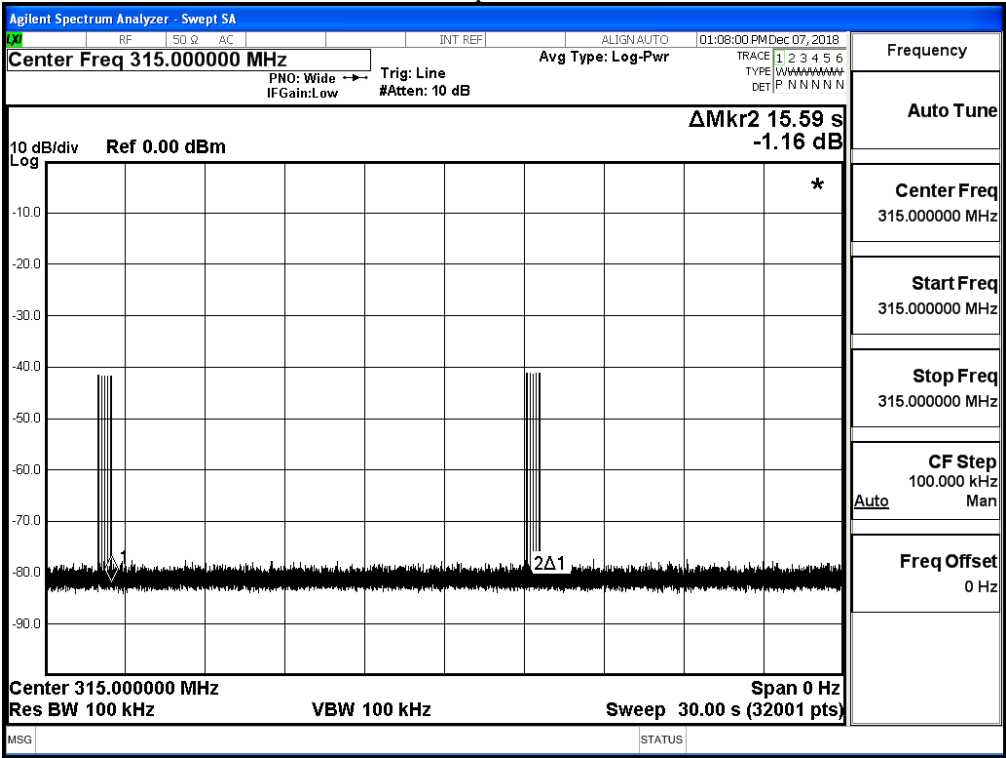
Channel No.	Frequency (MHz)	Measurement Value (Sec)	Limit (Sec)	Result
1 (Transmit time)	315	0.07574	< 1	Pass
1 (Silent period time)	315	15.59	> 10	Pass
1 (Silent period time)	315	15.59	> 2.2722	Pass

Note: Silent period time Limit = 10s and Transmissions * 30 times = $0.07574s * 30 = 2.2722s$

Transmit time



Silent period time

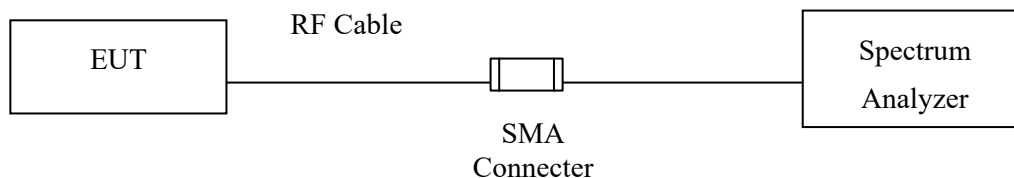


Transmit Time

PASS

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

5.4. Uncertainty

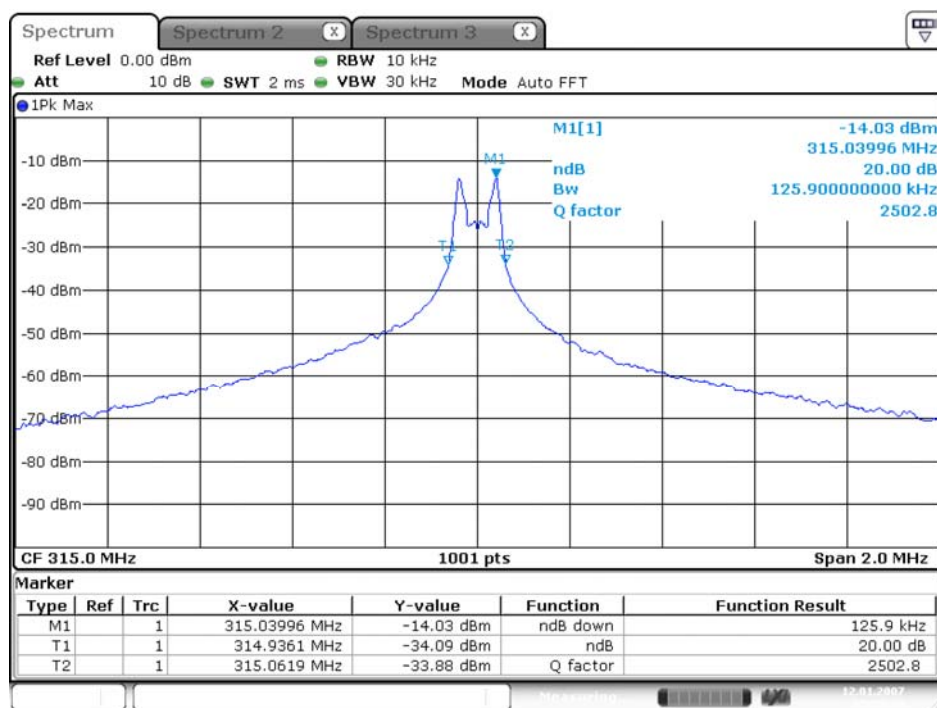
$\pm 283\text{Hz}$

5.5. Test Result

Product Tire Pressure Monitoring Sensor
 Test Item Occupied Bandwidth
 Test Mode Mode 1: Transmitter - FSK

Channel No.	Frequency (MHz)	Measurement Value (MHz)	Limit (MHz)	Result
1	315	0.1259	0.7875	Pass

Note: Limit = 315MHz * 0.25%= 0.7875MHz



Date: 12.JAN.2007 05:18:43

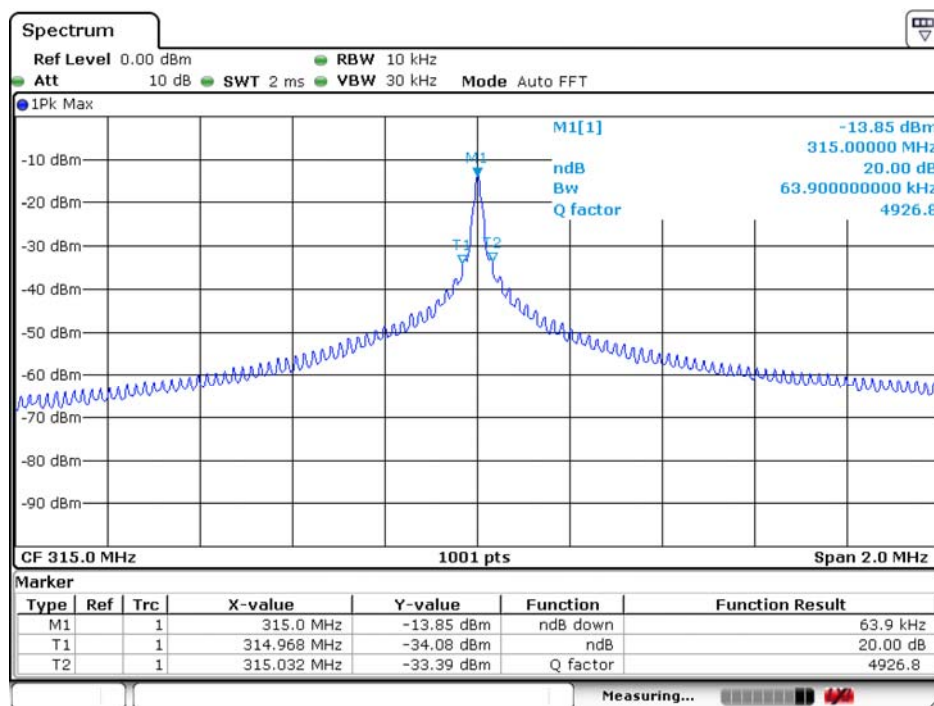
Occupied Bandwidth

PASS

Product Tire Pressure Monitoring Sensor
 Test Item Occupied Bandwidth
 Test Mode Mode 2: Transmitter - ASK

Channel No.	Frequency (MHz)	Measurement Value (MHz)	Limit (MHz)	Result
1	315	0.0639	0.7875	Pass

Note: Limit = 315MHz * 0.25%= 0.7875MHz



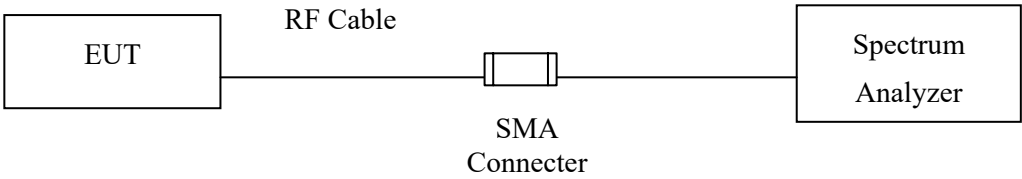
Date: 7.DEC.2018 06:57:44

Occupied Bandwidth

PASS

6. Duty Cycle

6.1. Test Setup

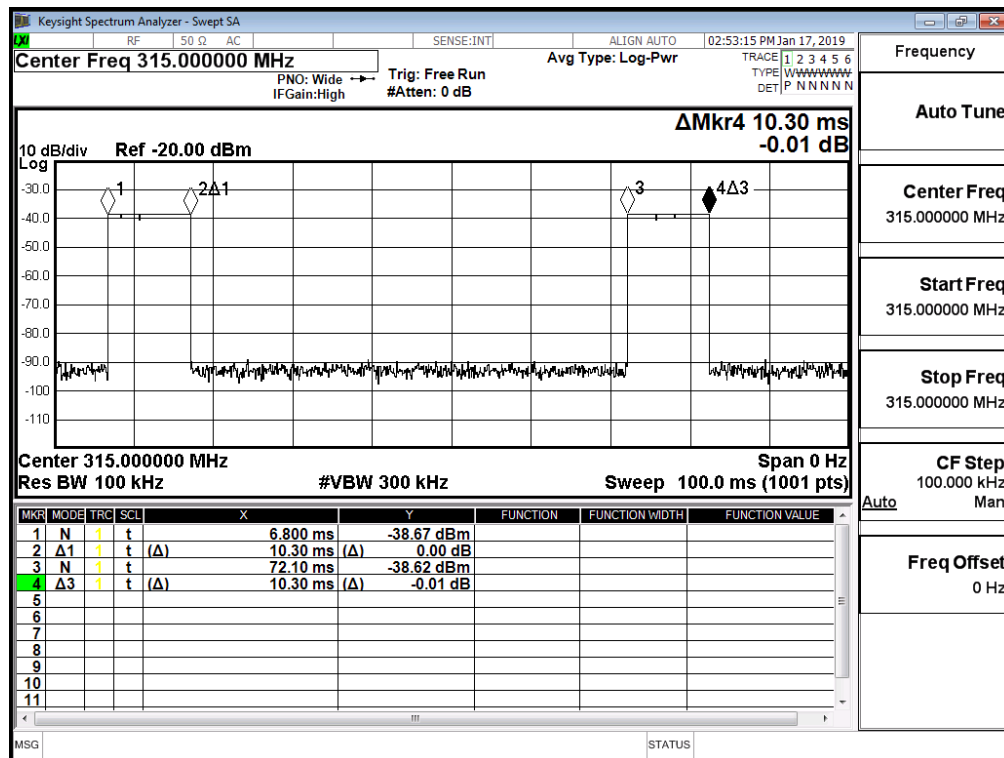


6.2. Uncertainty

$\pm 283\text{Hz}$

6.3. Test Result of Duty Cycle

Product Tire Pressure Monitoring Sensor
 Test Item Duty Cycle
 Test Mode Mode 1: Transmitter - FSK



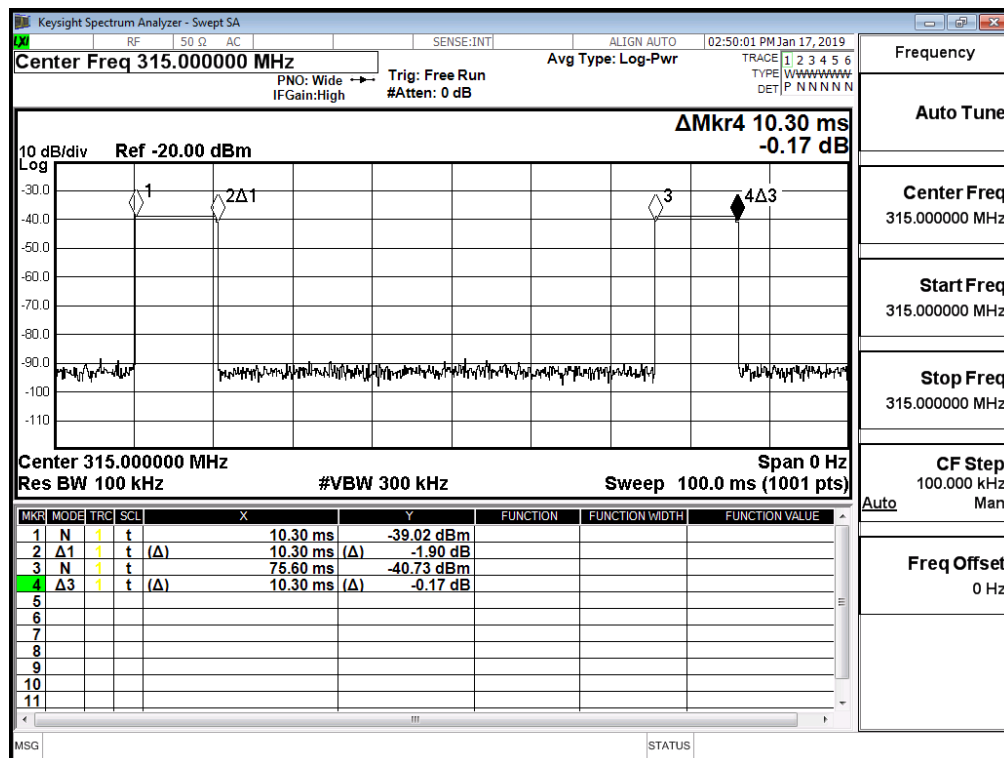
Time on of 100ms = 20.600 ms

Duty Cycle= 20.6ms / 100ms= 0.206

Duty Cycle correction factor= 20 LOG 0.206= -13.723 dB

Duty Cycle correction factor	-13.723	dB
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Product Tire Pressure Monitoring Sensor
 Test Item Duty Cycle
 Test Mode Mode 2: Transmitter - ASK



Time on of 100ms = 20.600 ms

Duty Cycle= 20.6ms / 100ms= 0.206

Duty Cycle correction factor= 20 LOG 0.206= -13.723 dB

Duty Cycle correction factor	-13.723	dB
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7. EMI Reduction Method During Compliance Testing

No modification was made during testing.