

315 MHz-BAND TELEMETER, TELECONTROL AND DATA TRANSMISSION RADIO EQUIPMENT Test Report

Product Name	Tire Pressure Monitoring Sensor
Model No.	TIS-16

Applicant	Continental Automotive GmbH
Address	Siemensstrasse 12, 93055 Regensburg, Germany

Date of Receipt	Oct. 13, 2020
Issued Date	Dec. 24, 2020
Report No.	20A0223R-E3032140416-A
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 report of the equipment and evaluated measurement uncertainty herein.

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Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

Test Report

Issued Date : Dec. 24, 2020

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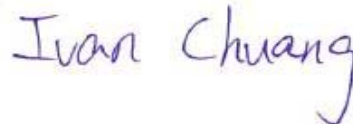
Product Name	Tire Pressure Monitoring Sensor
Applicant	Continental Automotive GmbH
Address	Siemensstrasse 12, 93055 Regensburg, Germany
Manufacturer	Continental Automotive GmbH
Model No.	TIS-16
EUT Rated Voltage	DC 3V(Power by Battery)
EUT Test Voltage	DC 3V(Power by Battery)
Trade Name	Continental
Measurement Standard	Ministry of Internal Affairs and Communications notification Article 88, Annex 22-1
Test Result	Complied

Documented By :



(Adm. Specialist / Ida Tung)

Tested By :



(Senior Engineer / Ivan Chuang)

Approved By :



(Director / Vincent Lin)

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Revision History

Report No.	Version	Description	Issued Date
20A0223R-E3032140416-A	V1.0	Initial issue of report.	Dec. 24, 2020

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Tire Pressure Monitoring Sensor
Trade Name	Continental
Model No.	TIS-16
Serial Number	N/A
Operation Frequency	315MHz
Number of Channels	1
Type of Modulation	FSK 、ASK
Transmission mode	☒ Auto ☐ Manual
Cyclical transmission	☒ Yes ☐ No
Antenna Type	Loop antenna
Declared Output Power	0.1 mW

Frequency of Each Channel:

Channel	Frequency
Channel 1:	315 MHz

Note:

1. The EUT is a Tyre Pressure Monitoring Transmitter with a built-in 315MHz transmitter.
2. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

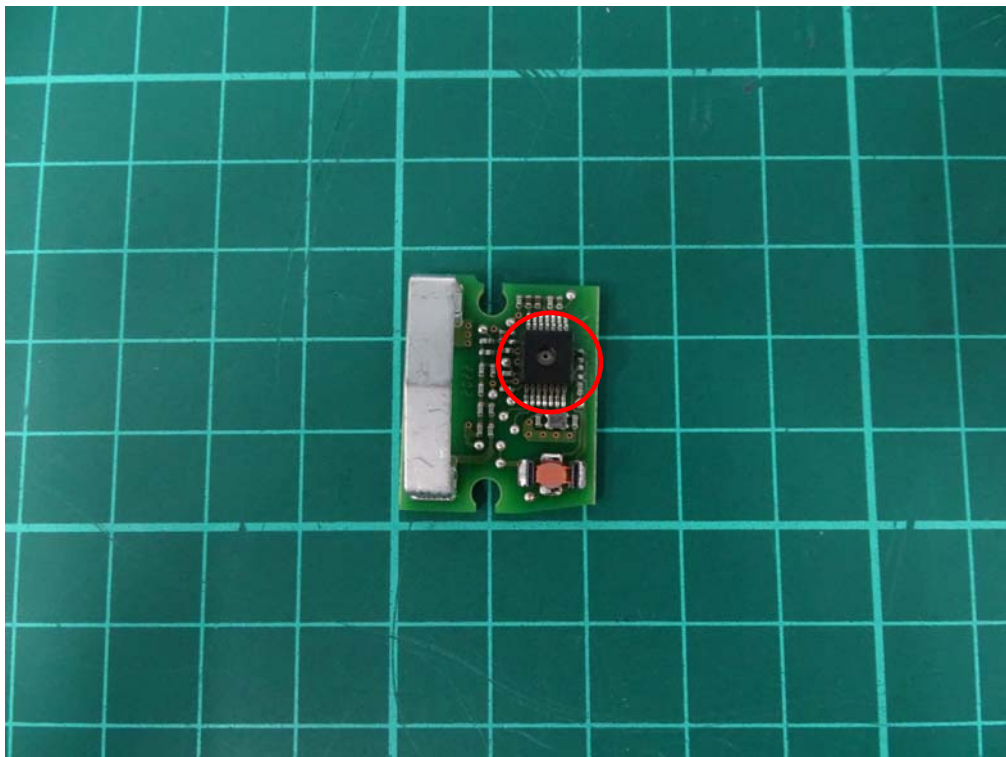
Test Mode	Mode 1: Transmitter (ASK) (Normal Voltage_DC 3V)
	Mode 2: Transmitter (ASK) (High Voltage_DC 3.3V)
	Mode 3: Transmitter (ASK) (Low Voltage_DC 2.7V)
	Mode 4: Transmitter (FSK) (Normal Voltage_DC 3V)
	Mode 5: Transmitter (FSK) (High Voltage_DC 3.3V)
	Mode 6: Transmitter (FSK) (Low Voltage_DC 2.7V)
	Mode 7: Normal Mode (Normal Voltage_DC 3V)
	Mode 8: Normal Mode (High Voltage_DC 3.3V)
	Mode 9: Normal Mode (Low Voltage_DC 2.7V)
	Mode 10: Standby Mode (ASK) (Normal Voltage_DC 3V)
	Mode 11: Standby Mode (ASK) (High Voltage_DC 3.3V)
	Mode 12: Standby Mode (ASK) (Low Voltage_DC 2.7V)
	Mode 13: Standby Mode (FSK) (Normal Voltage_DC 3V)
	Mode 14: Standby Mode (FSK) (High Voltage_DC 3.3V)
	Mode 15: Standby Mode (FSK) (Low Voltage_DC 2.7V)

1.2. EUT Test Setting

- (1) Plug-in a battery on the EUT
- (2) Push the button of test remote control, the EUT start transmit continually.
- (3) Verify that the EUT works properly.

1.3. RF and IF section must be tamper requirement

Requirement	Comments	Result
RF, IF and Modulation section must be tamper	☐ Use Special Screw ☐ Metal Shielding is Soldered (Please see Attachment: EUT Detailed Photographs) ☐ Use Ball Grid Array (BGA) ☒ Other: Case filled with glue	Complete
	☒ RF module/Chip pin >10 ☒ RF module/Chip pins distance <1.5mm (Please see mechanism photograph)	Complete



1.4. Uncertainty

Uncertainties have been calculated according to the DEKRA internal document, and is described in each test chapter of this report.

The reported expanded uncertainties are based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

Measurement uncertainties evaluated for each testing system and associated connections are given here to provide the system information for reference. Compliance determinations do not take into account measurement uncertainties for each testing system, but are based on the results of the compliance measurement.

Test item	Uncertainty	
Output Power and Output Power Tolerance	Under 1GHz ± 4.05 dB	Above 1GHz ± 4.10 dB
Frequency Allocations and Occupied Bandwidth	± 682.83 Hz	
Transmitter Spurious Emissions	Under 1GHz ± 4.05 dB	Above 1GHz ± 4.10 dB
Secondary Radiated Emissions Strength	Under 1GHz ± 4.05 dB	Above 1GHz ± 4.10 dB
Restriction Function of Transmission Time	± 2.31 ms	

1.5. **Test Item**

Emission	
Performed Item	Test
Output Power and Output Power Tolerance	Yes
Frequency Allocations and Occupied Bandwidth	Yes
Transmitter Suprious Emissions	Yes
Secondary Radiated Emissions Strength	Yes
Restriction Function of Transmission Time	Yes

1.6. Test Facility

Ambient conditions in the laboratory:

Performed Item	Items	Required	Actual
Radiated Emission	Temperature (°C)	15~35 °C	19.0 °C
	Humidity (%RH)	20~75 %	69.5 %
Conductive	Temperature (°C)	15~35 °C	20.1 °C
	Humidity (%RH)	20~75 %	69.9%

Site Description : Accredited by TAF
Accredited Number: 3023

Test Laboratory : DEKRA Testing and Certification Co., Ltd
Address : No.159, Sec. 2, Wenhua 1st Rd., Linkou Dist.,
New Taipei City 24457, Taiwan, R.O.C.
Phone number : 886-2-2602-7968
Fax number : 866-2-2602-3286
Email address : info.tw@dekra.com
Website : <http://www.dekra.com.tw>

1.7. List of Test Equipment

For Conducted measurements /ASR4

	Equipment	Manufacturer	Model No.	Serial No.	Calibrated	Cal. Method	Cali. Data	Due. Data
X	Spectrum Analyzer	Keysight	N9010B	MY59071415	ETC	*(c)	2020.08.15	2021.08.14
	Power Meter	Anritsu	ML2496A	1548002	ETC	*(c)	2020.02.10	2021.02.09
	Power Sensor	Anritsu	MA2411B	1531022	ETC	*(c)	2020.02.10	2021.02.09
	Power Sensor	Anritsu	MA2411B	1531023	ETC	*(c)	2020.02.10	2021.02.09

For Radiated measurements /ACB1

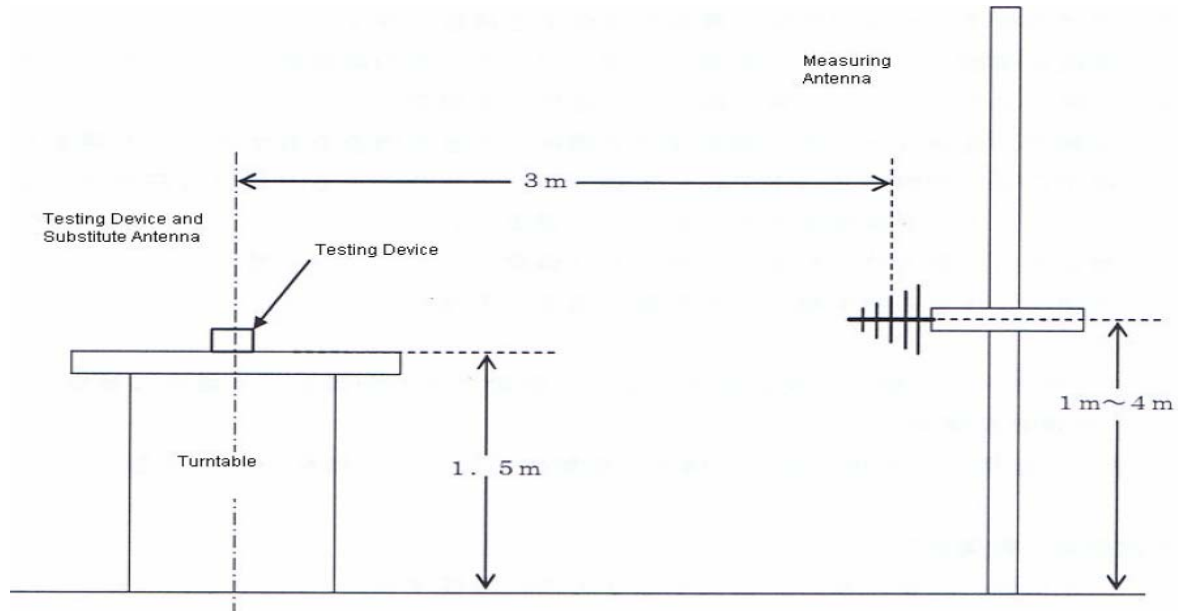
	Equipment	Manufacturer	Model No.	Serial No.	Calibrated	Cal. Method	Cali. Data	Due. Data
	Loop Antenna	AMETEK	HLA6121	49611	ETC	*(c)	2020.03.16	2021.03.15
X	Bi-Log Antenna	SCHWARZBECK	VULB9168	9168-674	SEIBERSDORF	*(c)	2020.01.03	2021.01.02
X	Horn Antenna	ETS-Lindgren	3117	00203761	ETC	*(c)	2020.11.23	2021.11.22
	Horn Antenna	Com-Power	AH-840	101087	ETC	*(c)	2020.06.08	2021.06.07
X	Pre-Amplifier	EMCI	EMC001330	980316	ETC	*(c)	2020.06.23	2021.06.22
X	Pre-Amplifier	EMCI	EMC051835SE	980311	ETC	*(c)	2020.06.23	2021.06.22
	Pre-Amplifier	EMCI	EMC05820SE	980310	ETC	*(c)	2020.06.24	2021.06.23
	Pre-Amplifier	EMCI	EMC184045SE	980314	ETC	*(c)	2020.06.10	2021.06.09
	Filter	MICRO TRONICS	BRM50702	G251	MICRO TRONICS	*(c)	2020.09.17	2021.09.16
	Filter	MICRO TRONICS	BRM50716	G188	MICRO TRONICS	*(c)	2020.09.17	2021.09.16
X	EMI Test Receiver	R&S	ESR7	101601	ETC	*(c)	2020.05.28	2021.05.27
X	Spectrum Analyzer	R&S	FSV40	101149	ETC	*(c)	2020.03.16	2021.03.15
X	Coaxial Cable	SUHNER	SUCOFLEX 106	RF002	QuieTek	*(d)	2020.07.03	2021.07.02
	Mircoflex Cable	HUBER	SUCOFLEX 102	MY3381/2	ETC	*(c)	2020.06.10	2021.06.09

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
4.
 - a) Calibration conducted by the National Institute of Information and Communications Technology(NICT) (hereinafter referred to as "NICT") or a designated calibration agency under Article 102-18 paragraph (1)
 - b) Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law (Law No. 51 of 1992)
 - c) Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted by the NICT or a designated agency under Article 102-18 paragraph (1).
 - d) Calibration conducted by using other equipment that listed above from a) to c).

2. Output Power and Output Power Tolerance

2.1. Test Setup



2.2. Test Procedure

The EUT is placed on a turn table which is 1.5 meters 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.

Broadband antenna (calibrated bi-log and horn antenna) are used as a receiving antenna. Both horizontal and vertical polarization of the antenna are set on measurement. And a high frequency preamplifier were used increase the sensitivity of the measuring. In order to find the maximum emission, all of the interface cables must be manipulated according to Ministry of Internal Affairs and Communications notification Article 88, Annex 41 on radiated measurement.

The additional notch filter below 1GHz was used to measure the level of harmonics radiated emission during field strength of Output Power measurement. The bandwidth setting on the field strength meter is 100 kHz and 1MHz. The frequency range from is checked.

2.3. Limits

Output power

312MHz- 315.05MHz below 0.25mW (-6dBm E.I.R.P)

315.05MHz- 315.25MHz below 0.025mW (-16dBm E.I.R.P)

Power Tolerance

Upper Limit+20%

2.4. Test Result of Output Power and Output Power Tolerance

Product : Tire Pressure Monitoring Sensor
 Test Item : Output Power
 Test Mode : Mode 1: Transmitter (ASK) (Normal Voltage_DC 3V)

X-Axial

Frequency	Measurement Level	Limit	Margin	Reading Level	Correct Factor
MHz	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-34.71	-6.00	-28.71	-35.06	0.35
Vertical					
Peak Detector					
315.000	-28.04	-6.00	-22.04	-28.58	0.54

Y-Axial

Frequency	Measurement Level	Limit	Margin	Reading Level	Correct Factor
MHz	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-36.10	-6.00	-30.10	-36.45	0.35
Vertical					
Peak Detector					
315.000	-27.51	-6.00	-21.51	-28.05	0.54

Z-Axial

Frequency	Measurement Level	Limit	Margin	Reading Level	Correct Factor
MHz	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-26.39	-6.00	-20.39	-26.74	0.35
Vertical					
Peak Detector					
315.000	-36.90	-6.00	-30.90	-37.25	0.35

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : Tire Pressure Monitoring Sensor
 Test Item : Output Power
 Test Mode : Mode 2: Transmitter (ASK) (High Voltage_DC 3.3V)

X-Axial

Frequency	Measurement Level	Limit	Margin	Reading Level	Correct Factor
MHz	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-34.51	-6.00	-28.51	-34.86	0.35
Vertical					
Peak Detector					
315.000	-27.66	-6.00	-21.66	-28.20	0.54

Y-Axial

Frequency	Measurement Level	Limit	Margin	Reading Level	Correct Factor
MHz	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-35.90	-6.00	-29.90	-36.25	0.35
Vertical					
Peak Detector					
315.000	-27.31	-6.00	-21.31	-27.85	0.54

Z-Axial

Frequency	Measurement Level	Limit	Margin	Reading Level	Correct Factor
MHz	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-26.19	-6.00	-20.19	-26.54	0.35
Vertical					
Peak Detector					
315.000	-36.70	-6.00	-30.70	-37.24	0.54

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : Tire Pressure Monitoring Sensor
 Test Item : Output Power
 Test Mode : Mode 3: Transmitter (ASK) (Low Voltage_DC 2.7V)

X-Axial

Frequency	Measurement Level	Limit	Margin	Reading Level	Correct Factor
MHz	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-34.91	-6.00	-28.91	-35.26	0.35
Vertical					
Peak Detector					
315.000	-28.24	-6.00	-22.24	-28.78	0.54

Y-Axial

Frequency	Measurement Level	Limit	Margin	Reading Level	Correct Factor
MHz	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-36.30	-6.00	-30.30	-36.65	0.35
Vertical					
Peak Detector					
315.000	-27.71	-6.00	-21.71	-28.25	0.54

Z-Axial

Frequency	Measurement Level	Limit	Margin	Reading Level	Correct Factor
MHz	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-26.59	-6.00	-20.59	-26.94	0.35
Vertical					
Peak Detector					
315.000	-37.10	-6.00	-31.10	-37.45	0.35

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : Tire Pressure Monitoring Sensor
 Test Item : Output Power
 Test Mode : Mode 4: Transmitter (FSK) (Normal Voltage_DC 3V)

X-Axial

Frequency	Measurement Level	Limit	Margin	Reading Level	Correct Factor
MHz	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-33.47	-6.00	-27.47	-33.82	0.35
Vertical					
Peak Detector					
315.000	-26.70	-6.00	-20.70	-27.24	0.54

Y-Axial

Frequency	Measurement Level	Limit	Margin	Reading Level	Correct Factor
MHz	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-34.69	-6.00	-28.69	-35.04	0.35
Vertical					
Peak Detector					
315.000	-26.34	-6.00	-20.34	-26.88	0.54

Z-Axial

Frequency	Measurement Level	Limit	Margin	Reading Level	Correct Factor
MHz	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-26.04	-6.00	-20.04	-26.39	0.35
Vertical					
Peak Detector					
315.000	-31.35	-6.00	-25.35	-31.89	0.54

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : Tire Pressure Monitoring Sensor
 Test Item : Output Power
 Test Mode : Mode 5: Transmitter (FSK) (High Voltage_DC 3.3V)

X-Axial

Frequency	Measurement Level	Limit	Margin	Reading Level	Correct Factor
MHz	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-33.27	-6.00	-27.27	-33.62	0.35
Vertical					
Peak Detector					
315.000	-26.50	-6.00	-20.50	-27.04	0.54

Y-Axial

Frequency	Measurement Level	Limit	Margin	Reading Level	Correct Factor
MHz	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-34.49	-6.00	-28.49	-34.84	0.35
Vertical					
Peak Detector					
315.000	-26.14	-6.00	-20.14	-26.68	0.54

Z-Axial

Frequency	Measurement Level	Limit	Margin	Reading Level	Correct Factor
MHz	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-25.84	-6.00	-19.84	-26.19	0.35
Vertical					
Peak Detector					
315.000	-31.15	-6.00	-25.15	-31.69	0.54

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : Tire Pressure Monitoring Sensor
 Test Item : Output Power
 Test Mode : Mode 6: Transmitter (FSK) (Low Voltage_DC 2.7V)

X-Axial

Frequency	Measurement	Limit	Margin	Reading	Correct
MHz	Level			Level	Factor
	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-33.49	-6.00	-27.49	-33.84	0.35
Vertical					
Peak Detector					
315.000	-26.72	-6.00	-20.72	-27.26	0.54

Y-Axial

Frequency	Measurement	Limit	Margin	Reading	Correct
MHz	Level			Level	Factor
	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-34.89	-6.00	-28.89	-35.24	0.35
Vertical					
Peak Detector					
315.000	-26.36	-6.00	-20.36	-26.90	0.54

Z-Axial

Frequency	Measurement	Limit	Margin	Reading	Correct
MHz	Level			Level	Factor
	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
315.000	-34.24	-6.00	-28.24	-34.59	0.35
Vertical					
Peak Detector					
315.000	-26.34	-6.00	-20.34	-26.88	0.54

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Test Result	PASS
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Product : Tire Pressure Monitoring Sensor
 Test Item : Output Power Tolerance
 Test Mode : Mode 1: Transmitter (ASK) (Normal Voltage_DC 3V)

X-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0254	-74.614	+20%
V	315	0.100	0.0113	-88.689	+20%

Y-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0102	-89.823	+20%
V	315	0.100	0.0107	-89.272	+20%

Z-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0174	-82.638	+20%
V	315	0.100	0.0078	-92.175	+20%

Note : *H/V= Horizontal or Vertical

$$\text{Tolerance} = (\text{Output Power} - \text{Declared Output Power}) / \text{Declared Output Power} * 100\%$$

Product : Tire Pressure Monitoring Sensor
 Test Item : Output Power Tolerance
 Test Mode : Mode 2: Transmitter (ASK) (High Voltage_DC 3.3V)

X-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0342	-65.755	+20%
V	315	0.100	0.0154	-84.636	+20%

Y-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0132	-86.769	+20%
V	315	0.100	0.0123	-87.655	+20%

Z-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0221	-77.940	+20%
V	315	0.100	0.0400	-59.959	+20%

Note : *H/V= Horizontal or Vertical

$$\text{Tolerance} = (\text{Channel Power} - \text{Declared Output Power}) / \text{Declared Output Power} * 100\%$$

Product : Tire Pressure Monitoring Sensor
 Test Item : Output Power Tolerance
 Test Mode : Mode 3: Transmitter (ASK) (Low Voltage_DC 2.7V)

X-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0194	-80.564	+20%
V	315	0.100	0.0075	-92.492	+20%

Y-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0074	-92.577	+20%
V	315	0.100	0.0070	-92.977	+20%

Z-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0129	-87.100	+20%
V	315	0.100	0.0072	-92.830	+20%

Note : *H/V= Horizontal or Vertical

$$\text{Tolerance} = (\text{Channel Power} - \text{Declared Output Power}) / \text{Declared Output Power} * 100\%$$

Product : Tire Pressure Monitoring Sensor
 Test Item : Output Power Tolerance
 Test Mode : Mode 4: Transmitter (FSK) (Normal Voltage_DC 3V)

X-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0254	-74.614	+20%
V	315	0.100	0.0113	-88.689	+20%

Y-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0102	-89.823	+20%
V	315	0.100	0.0107	-89.272	+20%

Z-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0174	-82.638	+20%
V	315	0.100	0.0078	-92.175	+20%

Note : *H/V= Horizontal or Vertical

$$\text{Tolerance} = (\text{Output Power} - \text{Declared Output Power}) / \text{Declared Output Power} * 100\%$$

Product : Tire Pressure Monitoring Sensor
 Test Item : Output Power Tolerance
 Test Mode : Mode 5: Transmitter (FSK) (High Voltage_DC 3.3V)

X-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0342	-65.755	+20%
V	315	0.100	0.0154	-84.636	+20%

Y-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0132	-86.769	+20%
V	315	0.100	0.0123	-87.655	+20%

Z-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0221	-77.940	+20%
V	315	0.100	0.0400	-59.959	+20%

Note : *H/V= Horizontal or Vertical

$$\text{Tolerance} = (\text{Channel Power} - \text{Declared Output Power}) / \text{Declared Output Power} * 100\%$$

Product : Tire Pressure Monitoring Sensor
 Test Item : Output Power Tolerance
 Test Mode : Mode 6: Transmitter (FSK) (Low Voltage_DC 2.7V)

X-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0194	-80.564	+20%
V	315	0.100	0.0075	-92.492	+20%

Y-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0074	-92.577	+20%
V	315	0.100	0.0070	-92.977	+20%

Z-Axial

H /V*	Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
H	315	0.100	0.0129	-87.100	+20%
V	315	0.100	0.0072	-92.830	+20%

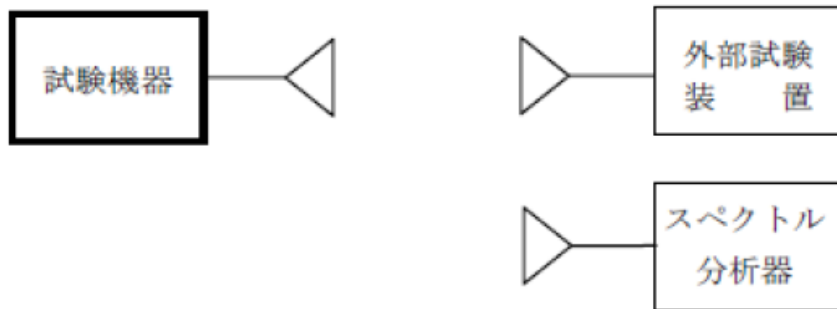
Note : *H/V= Horizontal or Vertical

Tolerance = (Channel Power - Declared Output Power) / Declared Output Power * 100%

Test Result	PASS
--------------------	------

3. Frequency Allocations and Occupied Bandwidth

3.1. Test Setup



3.2. Test Procedure

A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.

- (1) Repeat sweep until variations are not observed in the display, and input all the data point values to the computer array variable.
- (2) Transform dB value to dimensional power antilogarithm, for all the data.
- (3) Starting from the minimum frequency data, power is added in increasing order, this value should be 0.5% of the "Occupied bandwidth", and the critical (limit) data is obtained. The critical point is converted to frequency and registered as "Lower limit frequency".
- (4) Starting from the maximum frequency data, power is added in decreasing order, this value should be 0.5% of the "Occupied bandwidth", and the critical (limit) data is obtained. The critical point is converted to frequency and registered as "Upper limit frequency".

3.3. Limits

Frequency Allocations in 312MHz – 315.25MHz

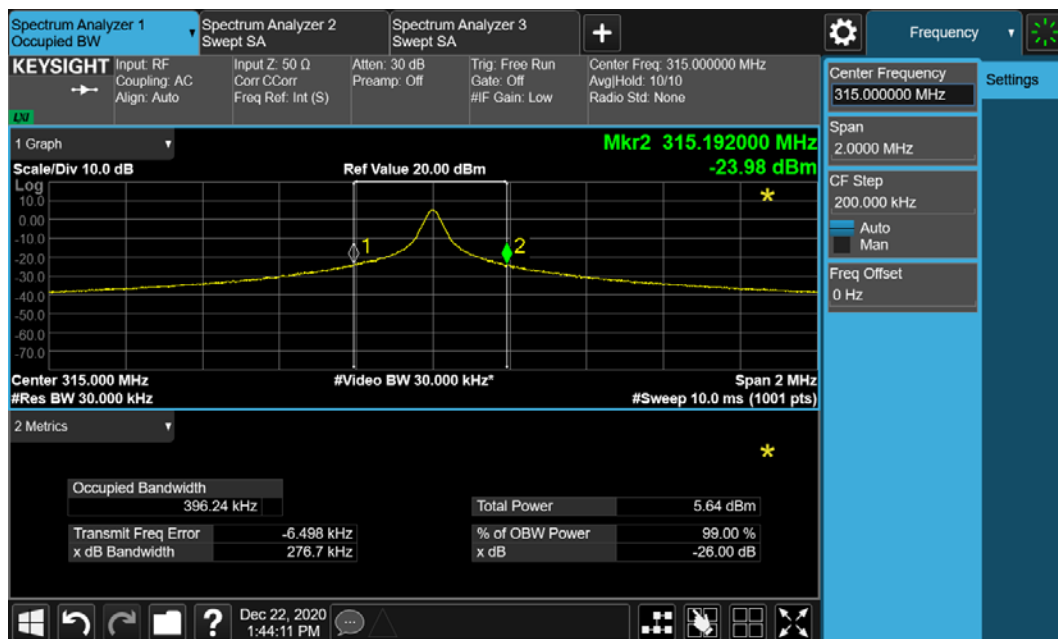
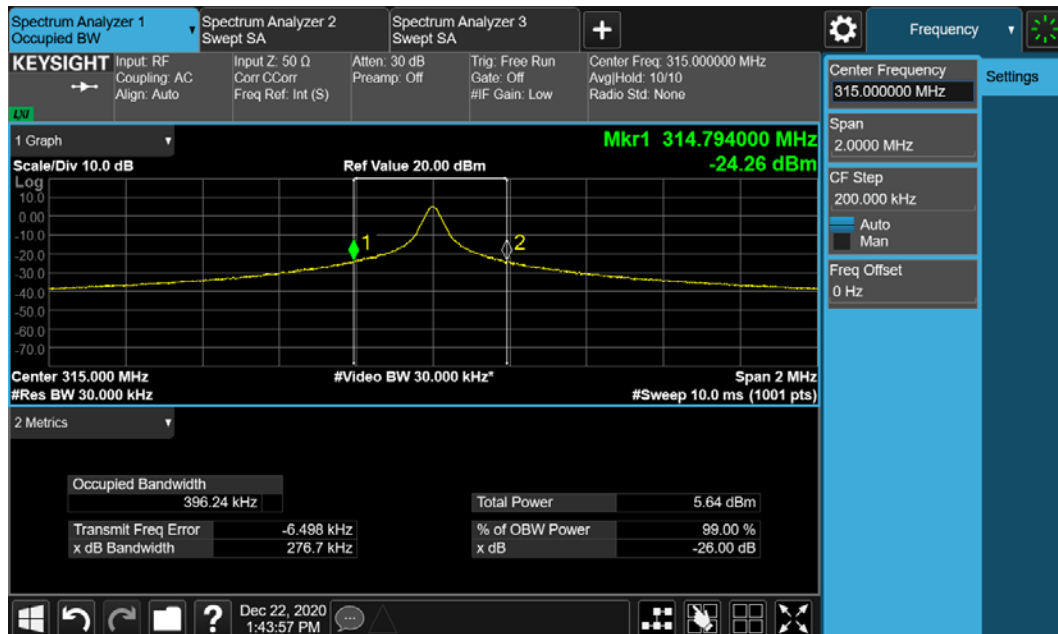
Occupied Bandwidth below 1MHz

3.4. Test Result of Frequency Allocations and Occupied Bandwidth

Product : Tire Pressure Monitoring Sensor
Test Item : Frequency Allocations and Occupied Bandwidth
Test Mode : Mode 1: Transmitter (ASK) (Normal Voltage_DC 3V)

Frequency Range	Frequency (MHz)	Limit (kHz)
FL	314.794	--
FH	315.192	--
Frequency Allocations	Frequency (MHz)	Limit (MHz)
$(FL + FH) / 2$	314.993	312 – 315.25
Occupied Bandwidth	Frequency (MHz)	Limit (MHz)
FH - FL	0.396	≤ 1

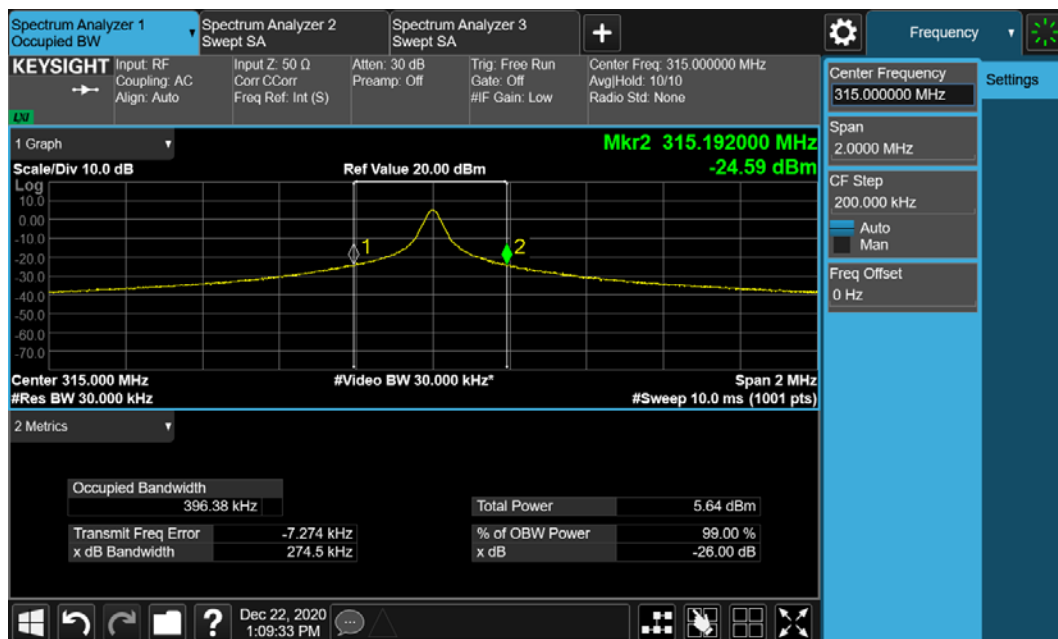
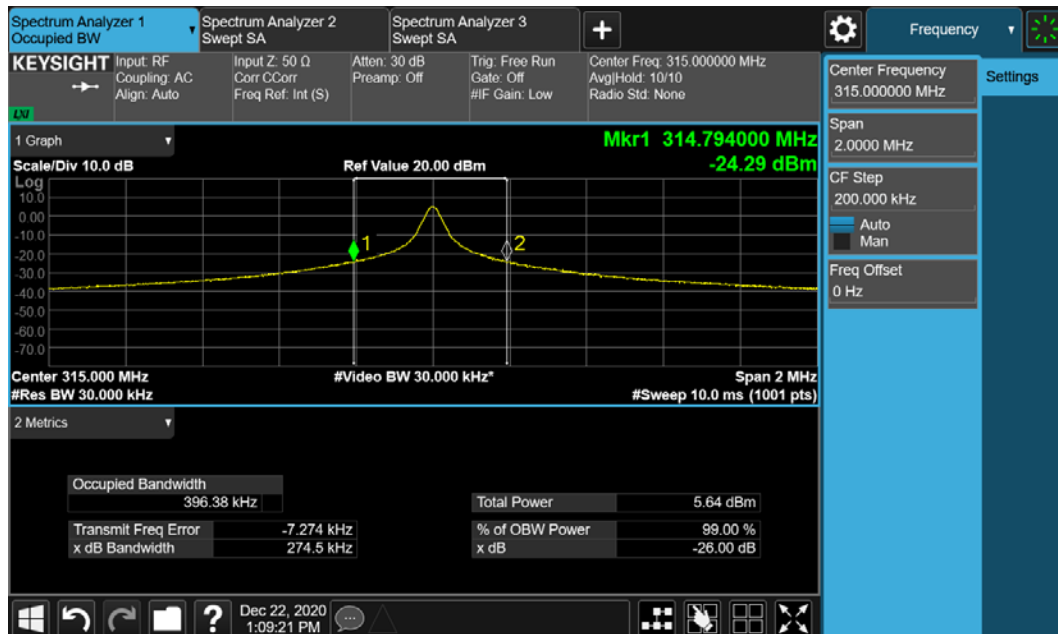
Frequency Allocations



Product : Tire Pressure Monitoring Sensor
Test Item : Frequency Allocations and Occupied Bandwidth
Test Mode : Mode 2: Transmitter (ASK) (High Voltage_DC 3.3V)

Frequency Range	Frequency (MHz)	Limit (kHz)
FL	314.794	--
FH	315.192	--
Frequency Allocations	Frequency (MHz)	Limit (MHz)
(FL+FH) / 2	314.993	312 – 315.25
Occupied Bandwidth	Frequency (MHz)	Limit (MHz)
FH - FL	0.396	≤ 1

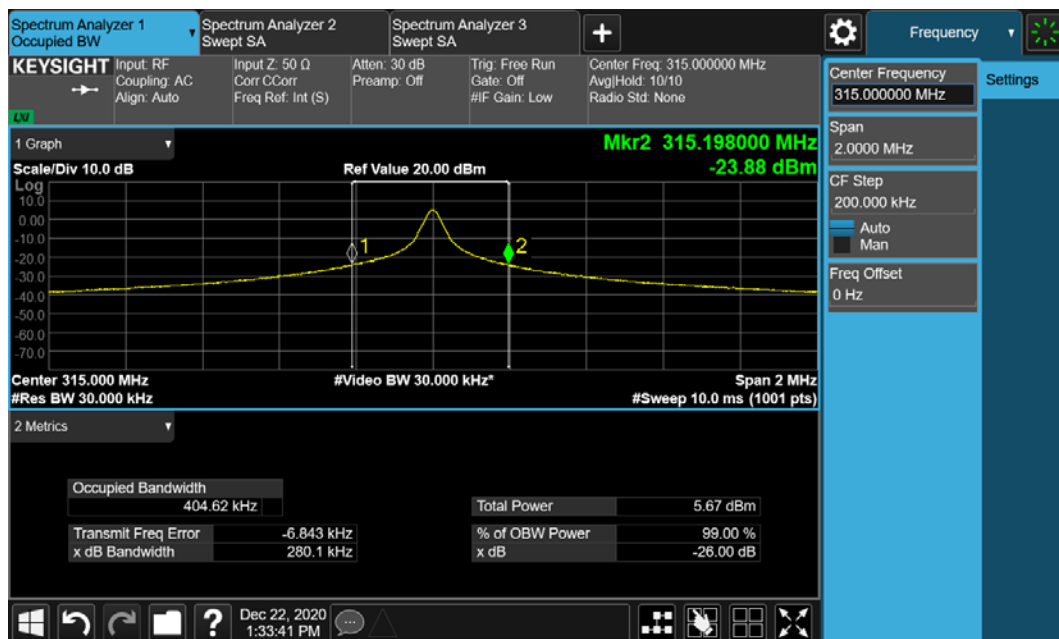
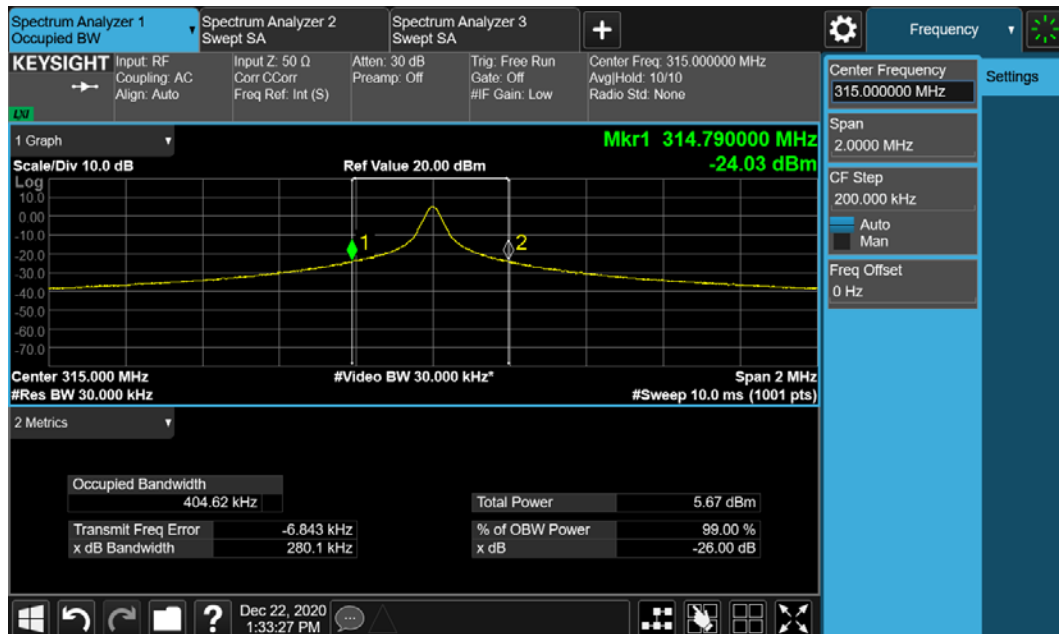
Frequency Allocations



Product : Tire Pressure Monitoring Sensor
Test Item : Frequency Allocations and Occupied Bandwidth
Test Mode : Mode 3: Transmitter (ASK) (Low Voltage_DC 2.7V)

Frequency Range	Frequency (MHz)	Limit (kHz)
FL	314.918	--
FH	314.790	--
Frequency Allocations	Frequency (MHz)	Limit (MHz)
(FL+FH) / 2	314.854	312 – 315.25
Occupied Bandwidth	Frequency (MHz)	Limit (MHz)
FH+FL	0.405	≤ 1

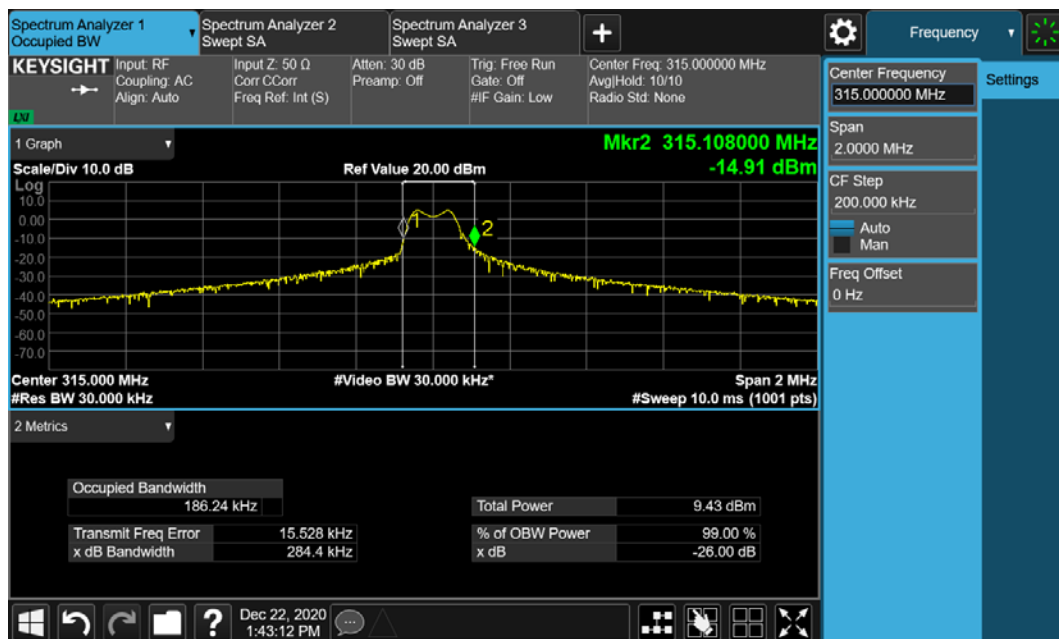
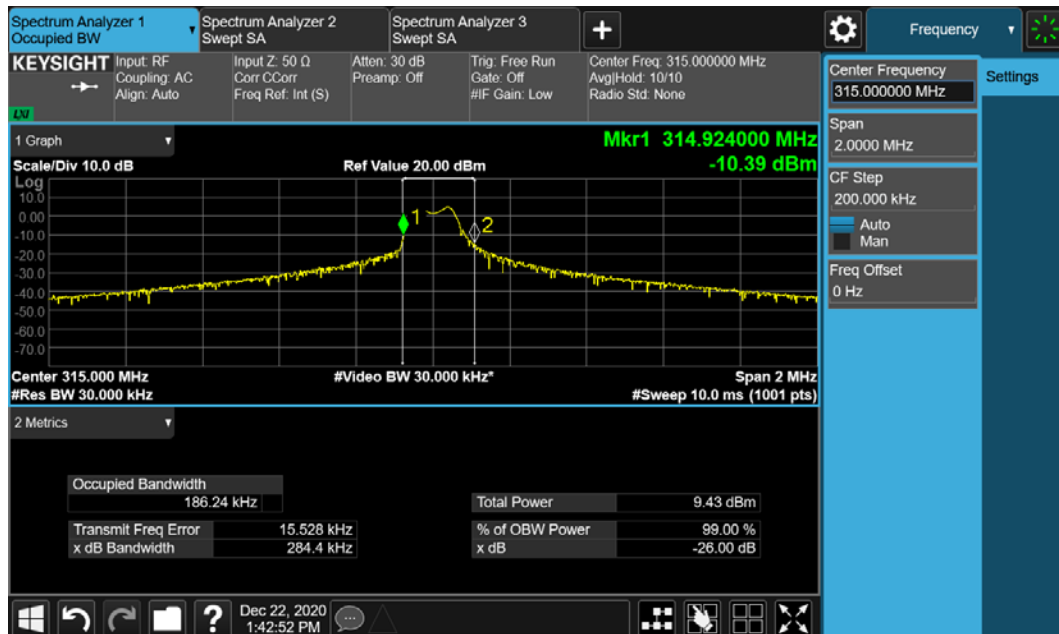
Frequency Allocations



Product : Tire Pressure Monitoring Sensor
Test Item : Frequency Allocations and Occupied Bandwidth
Test Mode : Mode 4: Transmitter (FSK) (Normal Voltage_DC 3V)

Frequency Range	Frequency (MHz)	Limit (kHz)
FL	314.920	--
FH	315.106	--
Frequency Allocations	Frequency (MHz)	Limit (MHz)
(FL+FH) / 2	315.013	312 – 315.25
Occupied Bandwidth	Frequency (MHz)	Limit (MHz)
FH - FL	0.185	≤ 1

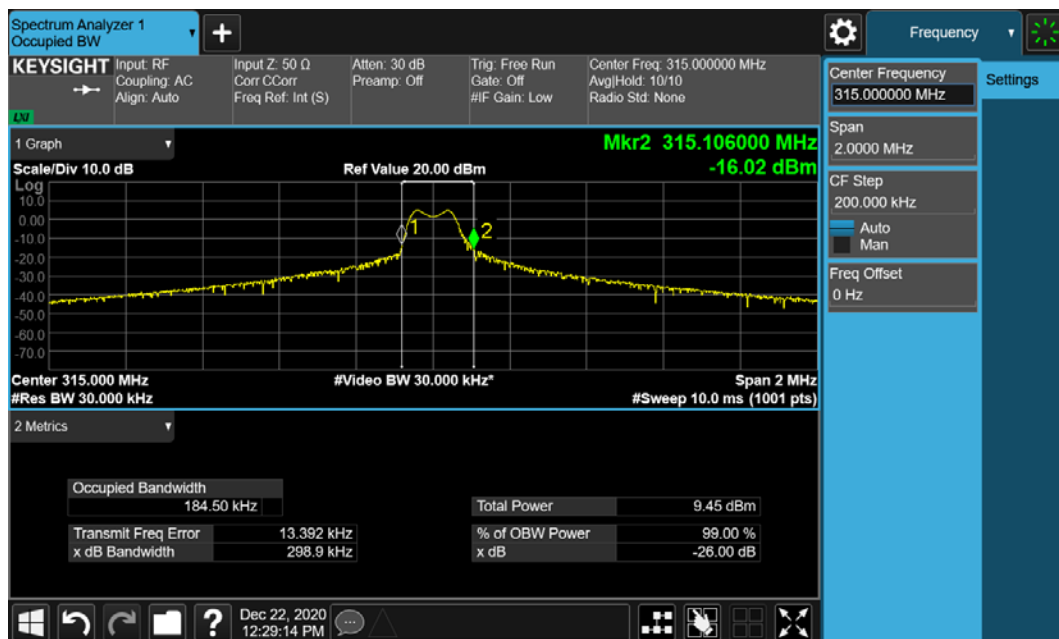
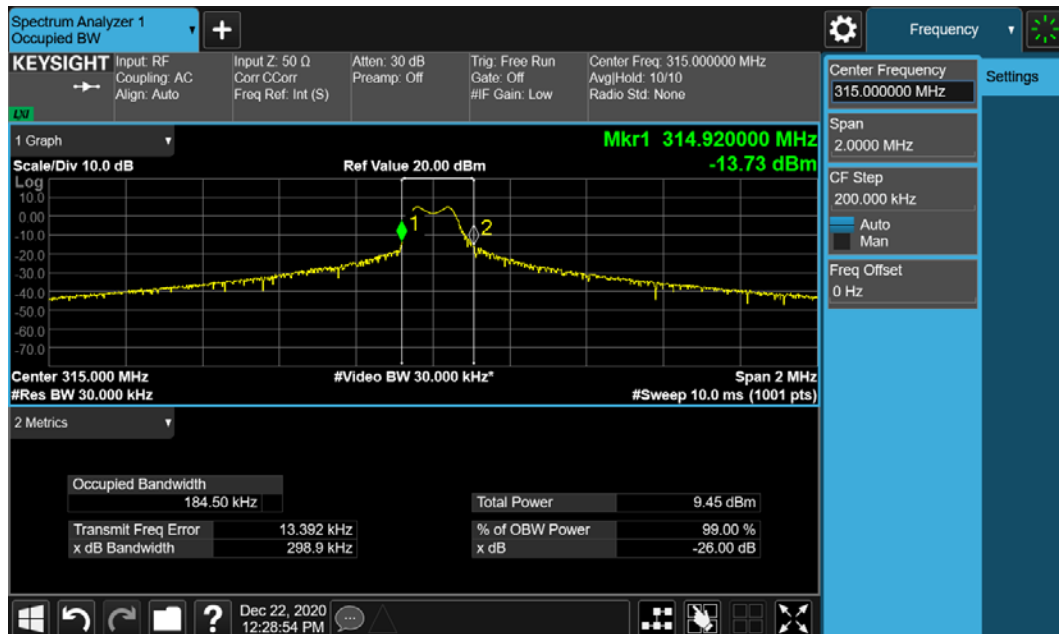
Frequency Allocations



Product : Tire Pressure Monitoring Sensor
Test Item : Frequency Allocations and Occupied Bandwidth
Test Mode : Mode 5: Transmitter (FSK) (High Voltage_DC 3.3V)

Frequency Range	Frequency (MHz)	Limit (kHz)
FL	314.920	--
FH	315.106	--
Frequency Allocations	Frequency (MHz)	Limit (MHz)
(FL+FH) / 2	315.013	312 – 315.25
Occupied Bandwidth	Frequency (MHz)	Limit (MHz)
FH - FL	0.185	≤ 1

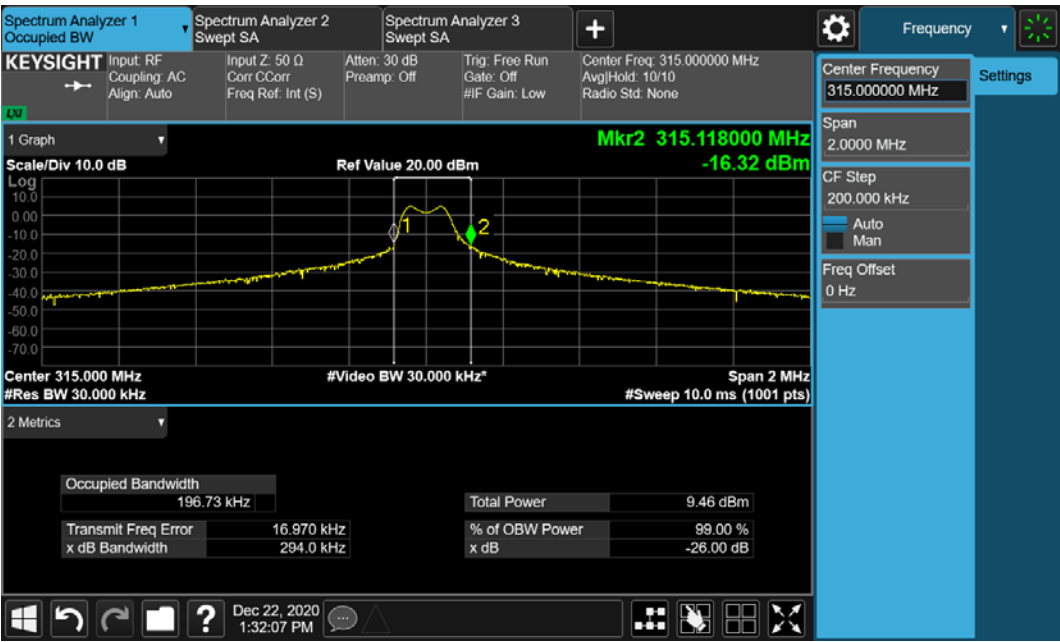
Frequency Allocations



Product : Tire Pressure Monitoring Sensor
Test Item : Frequency Allocations and Occupied Bandwidth
Test Mode : Mode 6: Transmitter (FSK) (Low Voltage_DC 2.7V)

Frequency Range	Frequency (MHz)	Limit (kHz)
FL	314.918	--
FH	315.118	--
Frequency Allocations	Frequency (MHz)	Limit (MHz)
(FL+FH) / 2	315.018	312 – 315.25
Occupied Bandwidth	Frequency (MHz)	Limit (MHz)
FH+FL	0.197	≤ 1

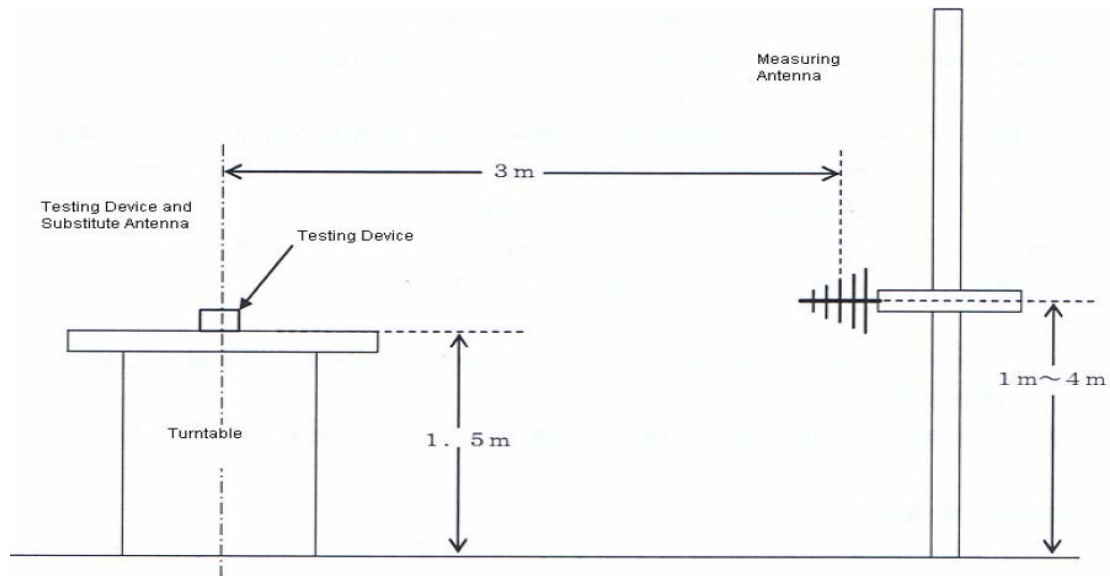
Frequency Allocations



Test Result	PASS
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4. Transmitter Suprious Emissions

4.1. Test Setup



4.2. Test Procedure

A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.

The EUT is placed on a turn table which is 1.5 meters 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.

Broadband antenna (calibrated bi-log and horn antenna) are used as a receiving antenna. Both horizontal and vertical polarization of the antenna are set on measurement. And a high frequency preamplifier were used increase the sensitivity of the measuring. In order to find the maximum emission, all of the interface cables must be manipulated according to Ministry of Internal Affairs and Communications notification Article 88, Annex 41 on radiated measurement.

The additional notch filter below 1GHz was used to measure the level of harmonics radiated emission during field strength of Output Power measurement. The bandwidth setting on the field strength meter is 100 kHz and 1MHz. The frequency range from is checked.

4.3. Limits

30MHz-312MHz : < 250nW/100KHz (-36dBm/100KHz)

315.25MHz-1GHz : < 250nW/100KHz (-36dBm/100KHz)

Above 1GHz : <1uW/1MHz (-30dBm/1MHz)

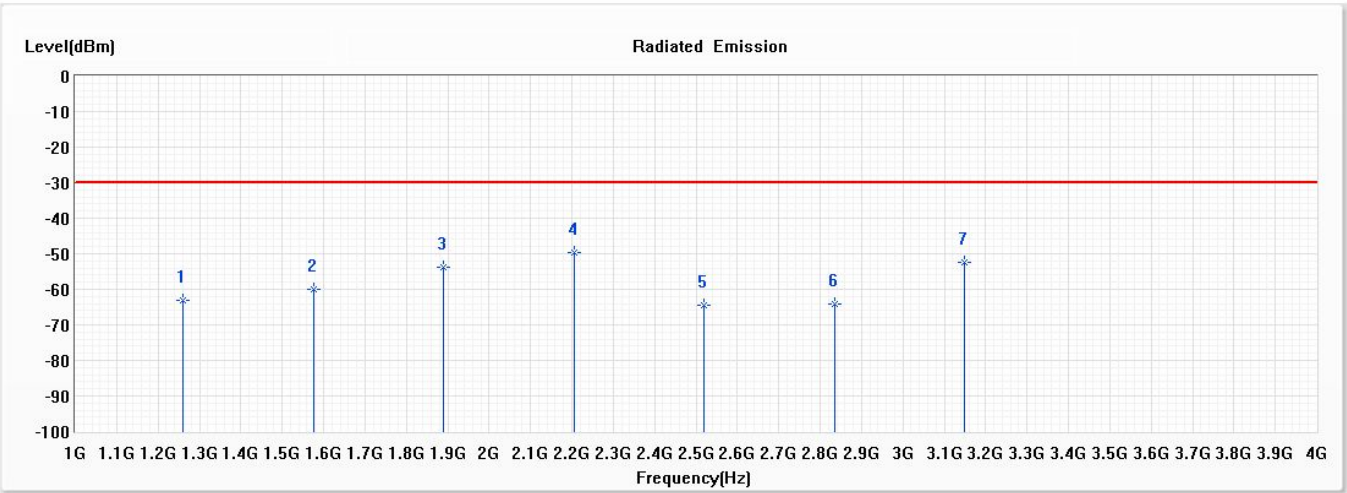
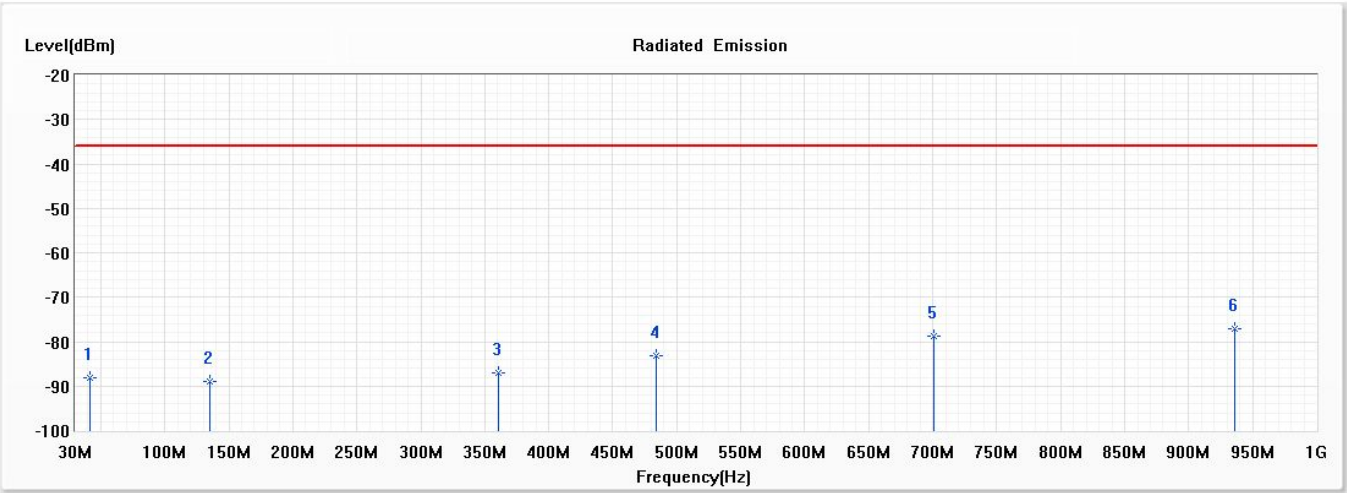
4.4. Test Result of Transmitter Spurious Emissions

Product : Tire Pressure Monitoring Sensor
 Test Item : Transmitter Spurious Emissions
 Test Mode : Mode 1: Transmitter (ASK) (Normal Voltage_DC 3V)

Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Reading Level (dBm)	Correct Factor (dB)
Horizontal					
Peak Detector					
41.640	-88.09	-36.00	-52.09	-77.28	-10.81
134.760	-89.03	-36.00	-53.03	-77.30	-11.73
360.770	-87.10	-36.00	-51.10	-79.13	-7.97
483.960	-83.30	-36.00	-47.30	-78.09	-5.21
701.240	-78.82	-36.00	-42.82	-77.05	-1.77
935.980	-77.02	-36.00	-41.02	-78.33	1.31
1260.000	-63.03	-30.00	-33.03	-59.55	-3.48
1575.000	-60.10	-30.00	-30.10	-54.25	-5.85
1890.000	-53.70	-30.00	-23.70	-51.53	-2.17
2205.000	-49.50	-30.00	-19.50	-49.00	-0.50
2520.000	-64.35	-30.00	-34.35	-63.08	-1.27
2835.000	-64.30	-30.00	-34.30	-63.80	-0.50
3150.000	-52.26	-30.00	-22.26	-52.89	0.63

Note:

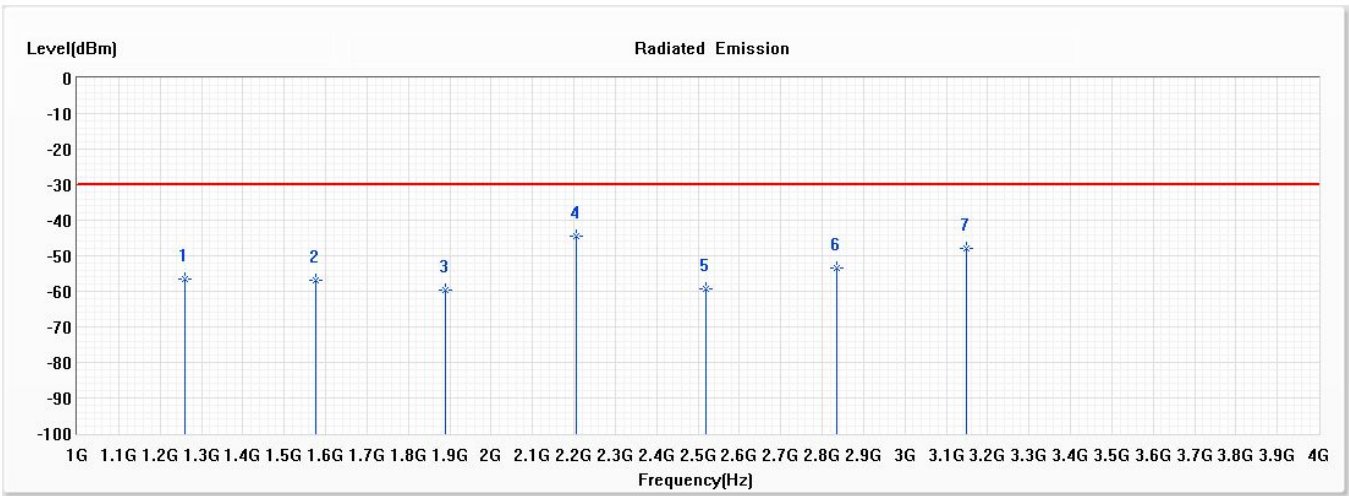
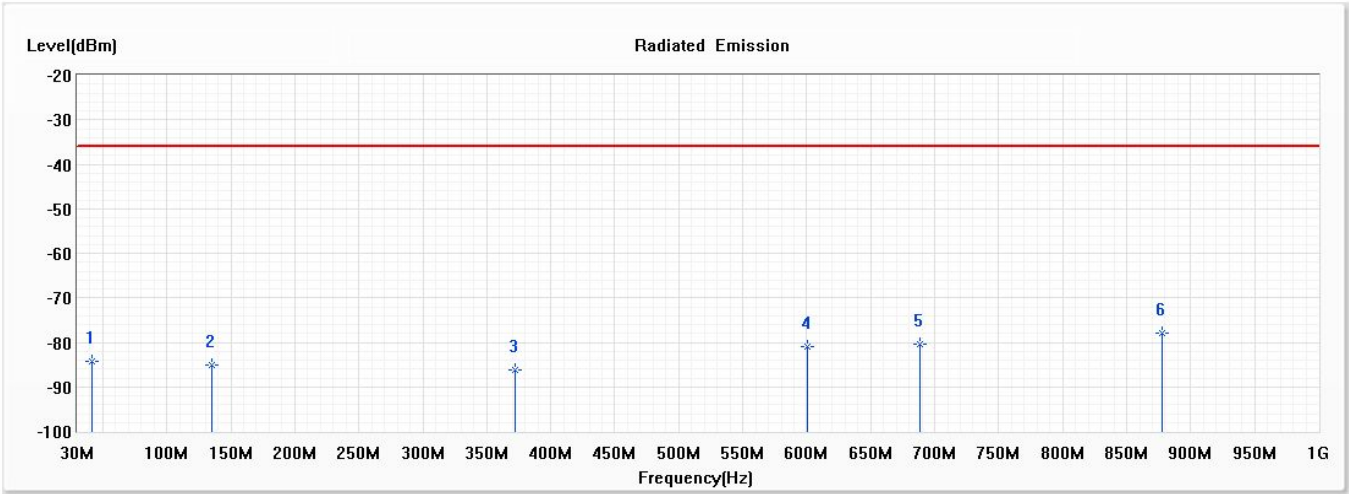
1. All Reading are peak value.
2. “ ” means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.



Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Reading Level (dBm)	Correct Factor (dB)
Vertical					
Peak Detector					
41.640	-84.35	-36.00	-48.35	-73.54	-10.81
134.760	-84.97	-36.00	-48.97	-73.24	-11.73
372.410	-86.20	-36.00	-50.20	-78.59	-7.61
600.360	-80.86	-36.00	-44.86	-77.98	-2.88
688.630	-80.35	-36.00	-44.35	-78.39	-1.96
877.780	-77.81	-36.00	-41.81	-78.27	0.46
1260.000	-56.43	-30.00	-26.43	-52.69	-3.74
1575.000	-56.75	-30.00	-26.75	-50.81	-5.94
1890.000	-59.77	-30.00	-29.77	-57.28	-2.49
2205.000	-44.57	-30.00	-14.57	-43.85	-0.72
2520.000	-59.45	-30.00	-29.45	-59.13	-0.32
2835.000	-53.60	-30.00	-23.60	-52.80	-0.80
3150.000	-48.00	-30.00	-18.00	-48.86	0.86

Note:

1. All Reading are peak value.
2. “ ” means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

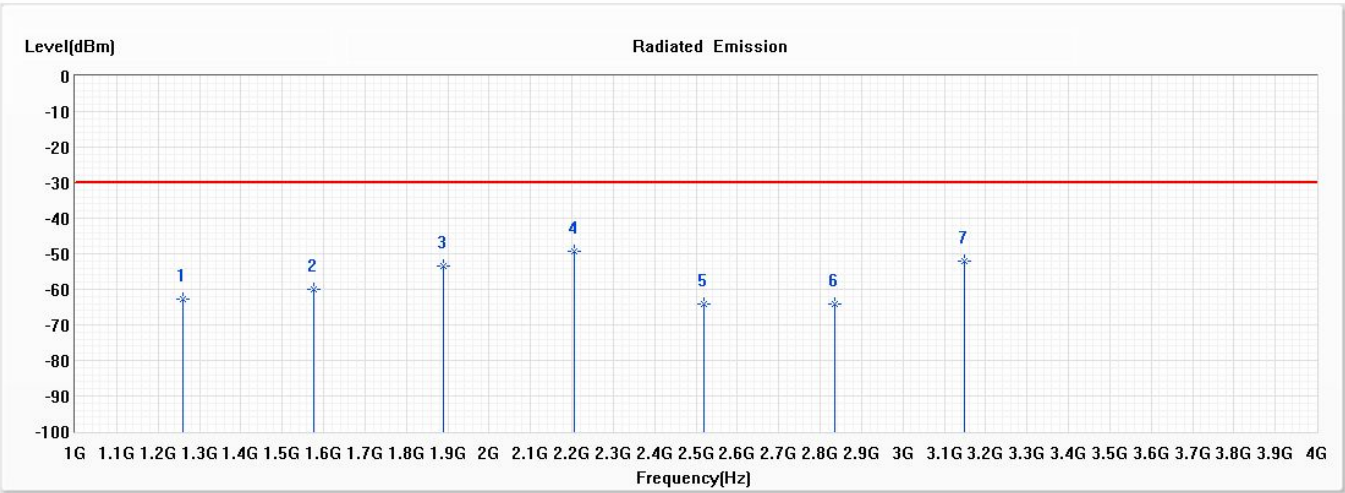
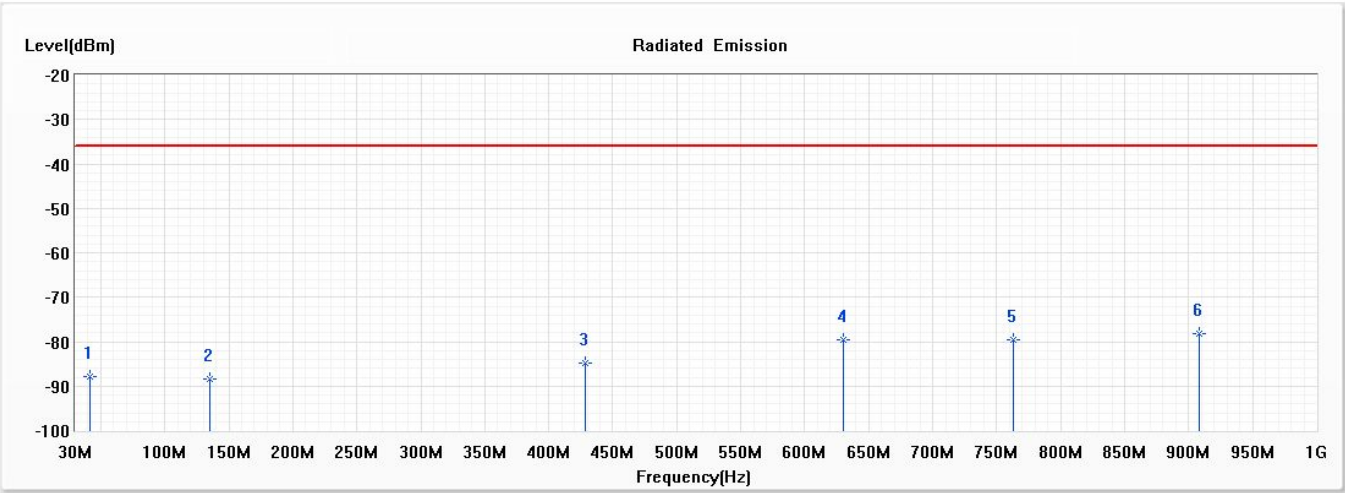


Product : Tire Pressure Monitoring Sensor
 Test Item : Transmitter Spurious Emissions
 Test Mode : Mode 2: Transmitter (ASK) (High Voltage_DC 3.3V)

Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Reading Level (dBm)	Correct Factor (dB)
Horizontal					
Peak Detector					
41.640	-87.87	-36.00	-51.87	-77.06	-10.81
134.760	-88.45	-36.00	-52.45	-76.72	-11.73
428.670	-84.94	-36.00	-48.94	-78.44	-6.50
630.430	-79.46	-36.00	-43.46	-76.91	-2.55
763.320	-79.70	-36.00	-43.70	-79.05	-0.65
907.850	-78.13	-36.00	-42.13	-79.20	1.07
1260.000	-62.83	-30.00	-32.83	-59.35	-3.48
1575.000	-59.90	-30.00	-29.90	-54.05	-5.85
1890.000	-53.50	-30.00	-23.50	-51.33	-2.17
2205.000	-49.30	-30.00	-19.30	-48.80	-0.50
2520.000	-64.15	-30.00	-34.15	-62.88	-1.27
2835.000	-64.10	-30.00	-34.10	-63.60	-0.50
3150.000	-52.06	-30.00	-22.06	-52.69	0.63

Note:

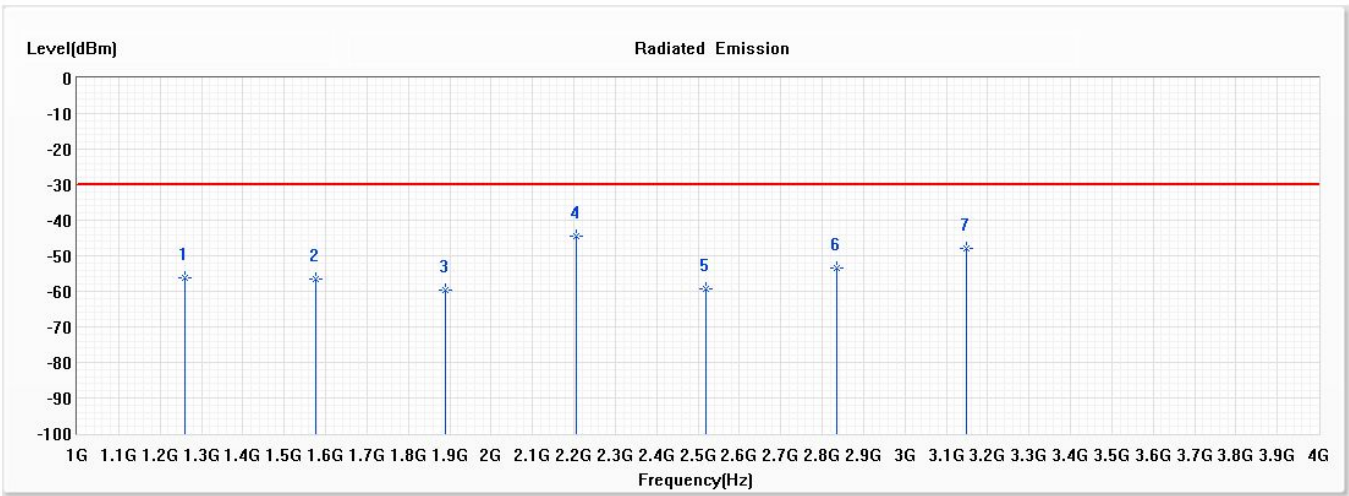
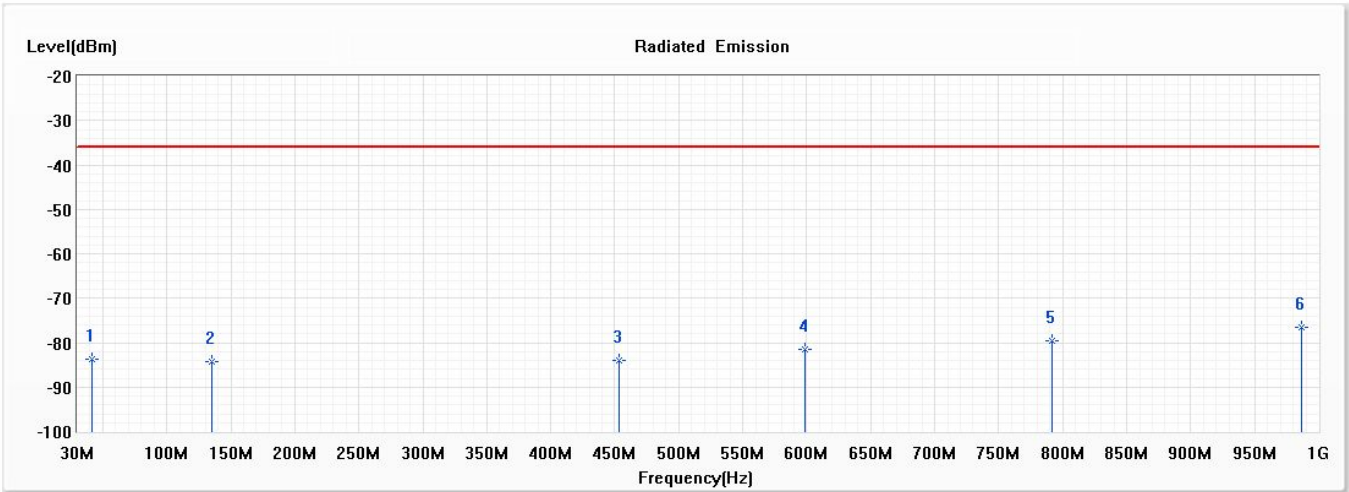
1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.



Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Reading Level (dBm)	Correct Factor (dB)
Vertical					
Peak Detector					
41.640	-83.66	-36.00	-47.66	-72.85	-10.81
134.760	-84.31	-36.00	-48.31	-72.58	-11.73
452.920	-84.13	-36.00	-48.13	-78.34	-5.79
598.420	-81.65	-36.00	-45.65	-78.73	-2.92
791.450	-79.58	-36.00	-43.58	-79.19	-0.39
986.420	-76.55	-36.00	-40.55	-78.42	1.87
1260.000	-56.23	-30.00	-26.23	-52.75	-3.48
1575.000	-56.55	-30.00	-26.55	-50.70	-5.85
1890.000	-59.57	-30.00	-29.57	-57.40	-2.17
2205.000	-44.37	-30.00	-14.37	-43.87	-0.50
2520.000	-59.25	-30.00	-29.25	-57.98	-1.27
2835.000	-53.40	-30.00	-23.40	-52.90	-0.50
3150.000	-47.80	-30.00	-17.80	-48.43	0.63

Note:

1. All Reading are peak value.
2. “ ” means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

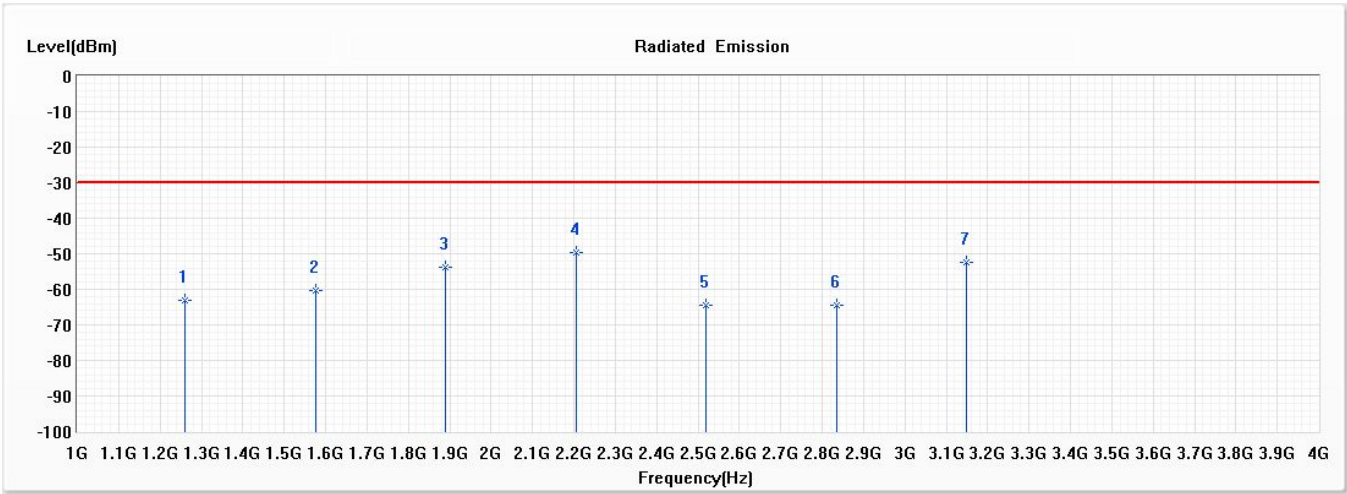
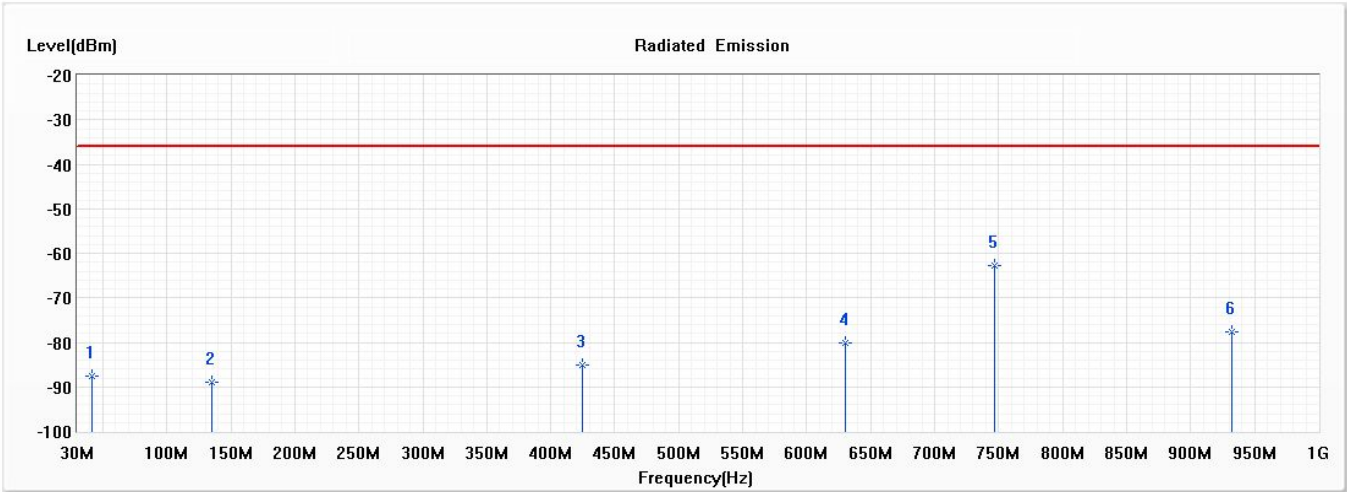


Product : Tire Pressure Monitoring Sensor
 Test Item : Transmitter Spurious Emissions
 Test Mode : Mode 3: Transmitter (ASK) (Low Voltage_DC 2.7V)

Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Reading Level (dBm)	Correct Factor (dB)
Horizontal					
Peak Detector					
41.640	-87.68	-36.00	-51.68	-76.87	-10.81
134.760	-88.97	-36.00	-52.97	-77.24	-11.73
424.790	-85.12	-36.00	-49.12	-78.53	-6.59
630.430	-80.25	-36.00	-44.25	-77.70	-2.55
746.830	-62.76	-36.00	-26.76	-61.88	-0.88
932.100	-77.70	-36.00	-41.70	-78.86	1.16
1260.000	-63.23	-30.00	-33.23	-59.75	-3.48
1575.000	-60.30	-30.00	-30.30	-54.45	-5.85
1890.000	-53.90	-30.00	-23.90	-51.73	-2.17
2205.000	-49.70	-30.00	-19.70	-49.20	-0.50
2520.000	-64.55	-30.00	-34.55	-63.28	-1.27
2835.000	-64.50	-30.00	-34.50	-64.00	-0.50
3150.000	-52.46	-30.00	-22.46	-53.09	0.63

Note:

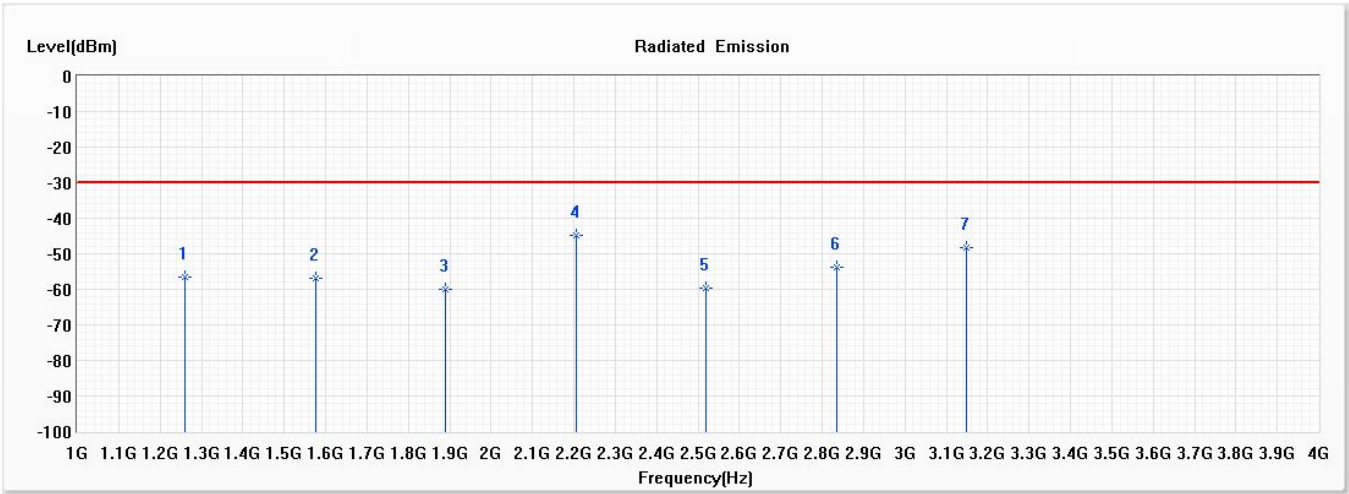
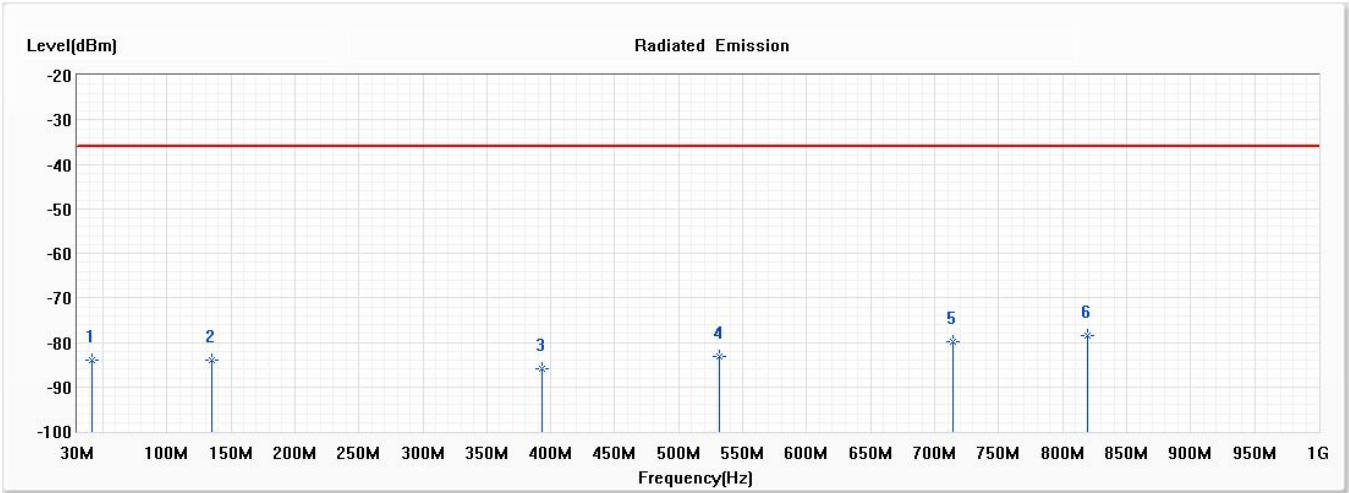
1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.



Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Reading Level (dBm)	Correct Factor (dB)
Vertical					
Peak Detector					
41.640	-84.13	-36.00	-48.13	-73.32	-10.81
134.760	-84.11	-36.00	-48.11	-72.38	-11.73
392.780	-86.00	-36.00	-50.00	-78.76	-7.24
531.490	-83.27	-36.00	-47.27	-78.85	-4.42
713.850	-79.80	-36.00	-43.80	-78.34	-1.46
819.580	-78.61	-36.00	-42.61	-78.48	-0.13
1260.000	-56.63	-30.00	-26.63	-52.89	-3.74
1575.000	-56.95	-30.00	-26.95	-51.01	-5.94
1890.000	-59.97	-30.00	-29.97	-57.48	-2.49
2205.000	-44.77	-30.00	-14.77	-44.05	-0.72
2520.000	-59.65	-30.00	-29.65	-59.33	-0.32
2835.000	-53.80	-30.00	-23.80	-53.00	-0.80
3150.000	-48.20	-30.00	-18.20	-49.06	0.86

Note:

1. All Reading are peak value.
2. “ ” means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

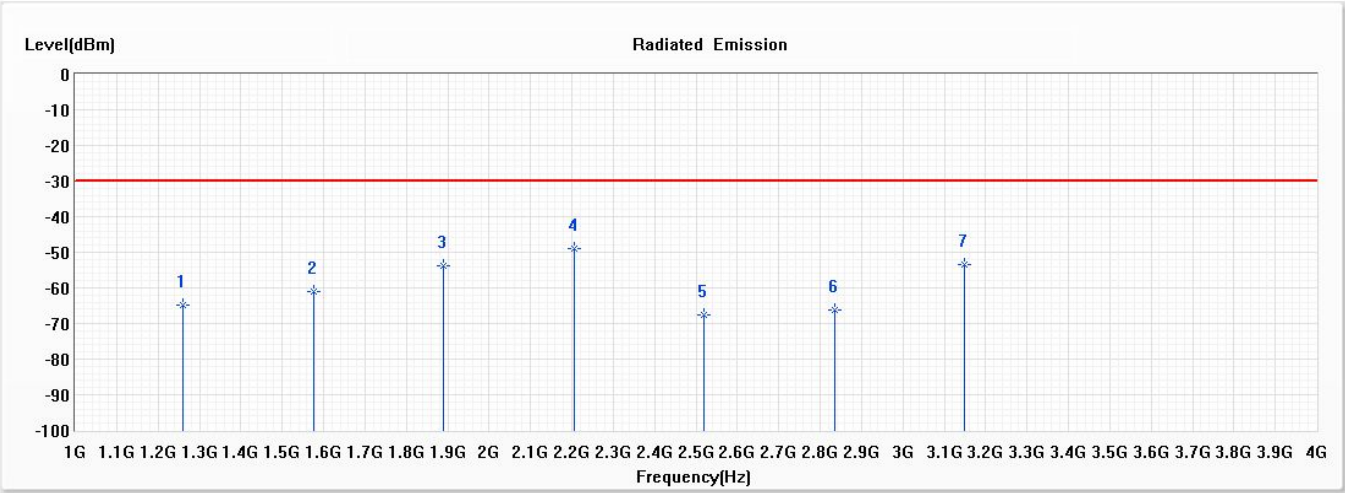
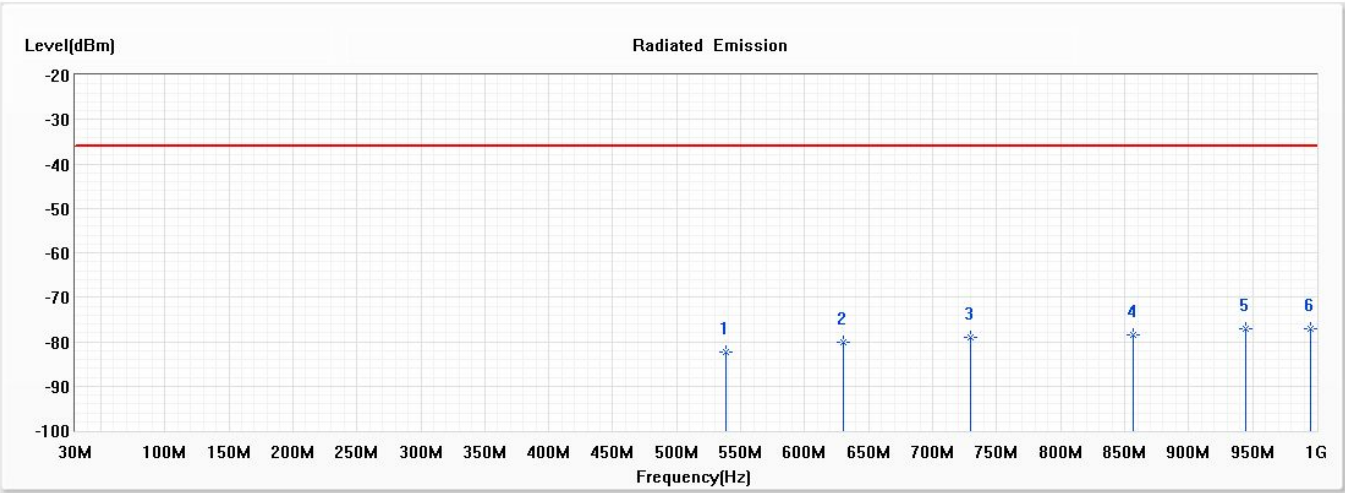


Product : Tire Pressure Monitoring Sensor
 Test Item : Transmitter Spurious Emissions
 Test Mode : Mode 4: Transmitter (FSK) (Normal Voltage_DC 3V)

Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Reading Level (dBm)	Correct Factor (dB)
Horizontal					
Peak Detector					
538.280	-82.26	-36.00	-46.26	-77.99	-4.27
630.430	-80.21	-36.00	-44.21	-77.66	-2.55
729.370	-79.01	-36.00	-43.01	-77.79	-1.22
856.440	-78.60	-36.00	-42.60	-79.03	0.43
944.710	-77.04	-36.00	-41.04	-78.63	1.59
995.150	-76.99	-36.00	-40.99	-78.96	1.97
1260.000	-64.83	-30.00	-34.83	-61.35	-3.48
1575.000	-61.15	-30.00	-31.15	-55.30	-5.85
1890.000	-53.88	-30.00	-23.88	-51.71	-2.17
2205.000	-49.06	-30.00	-19.06	-48.56	-0.50
2520.000	-67.70	-30.00	-37.70	-66.43	-1.27
2835.000	-66.09	-30.00	-36.09	-65.59	-0.50
3150.000	-53.51	-30.00	-23.51	-54.14	0.63

Note:

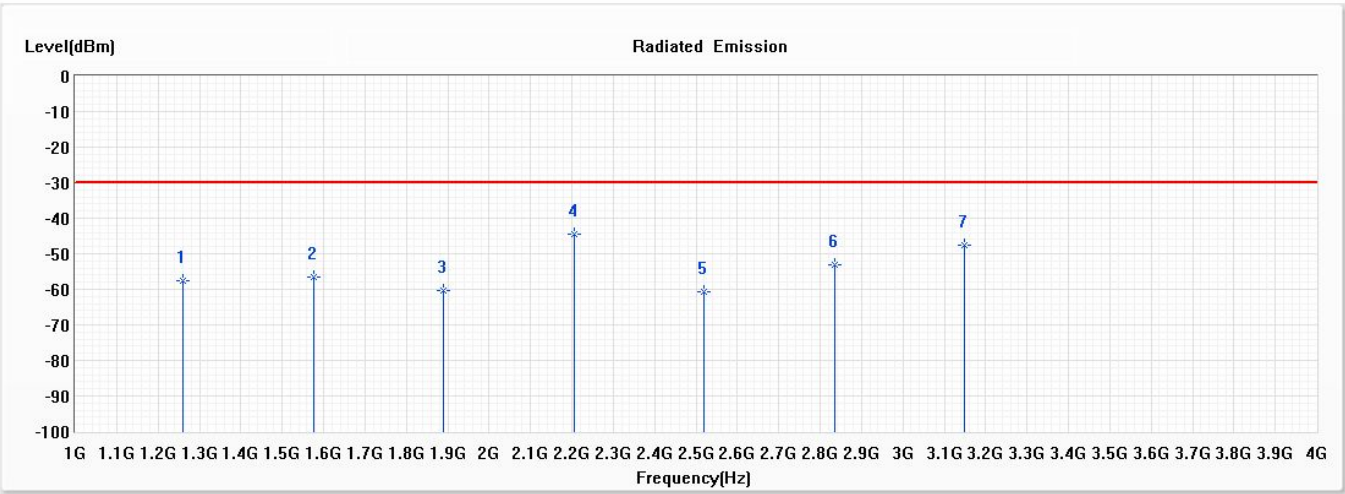
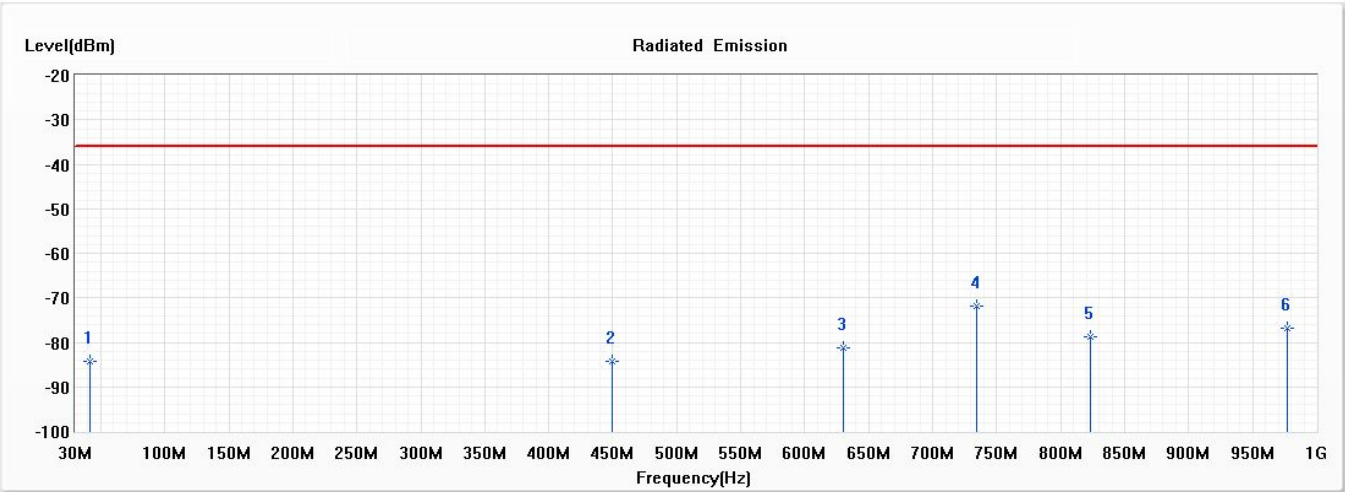
1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.



Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Reading Level (dBm)	Correct Factor (dB)
Vertical					
Peak Detector					
41.640	-84.30	-36.00	-48.30	-73.49	-10.81
450.010	-84.29	-36.00	-48.29	-78.44	-5.85
630.430	-81.11	-36.00	-45.11	-78.56	-2.55
734.220	-71.80	-36.00	-35.80	-70.60	-1.20
823.460	-78.75	-36.00	-42.75	-78.64	-0.11
976.720	-76.84	-36.00	-40.84	-78.55	1.71
1260.000	-57.52	-30.00	-27.52	-53.78	-3.74
1575.000	-56.46	-30.00	-26.46	-50.52	-5.94
1890.000	-60.35	-30.00	-30.35	-57.86	-2.49
2205.000	-44.34	-30.00	-14.34	-43.62	-0.72
2520.000	-60.58	-30.00	-30.58	-60.26	-0.32
2835.000	-53.20	-30.00	-23.20	-52.40	-0.80
3150.000	-47.50	-30.00	-17.50	-48.36	0.86

Note:

1. All Reading are peak value.
2. “ ” means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

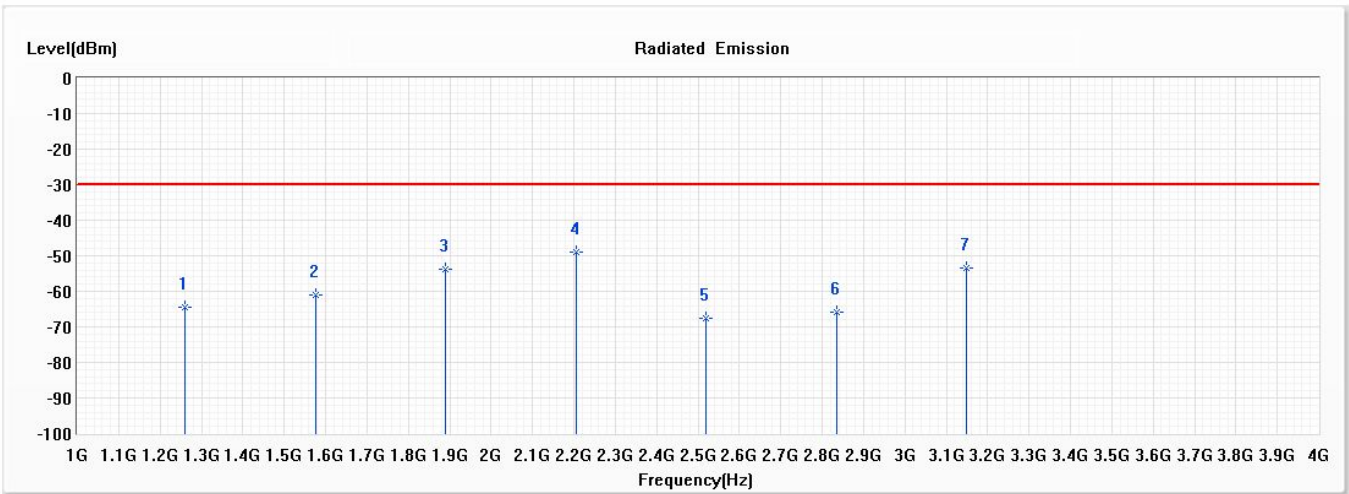
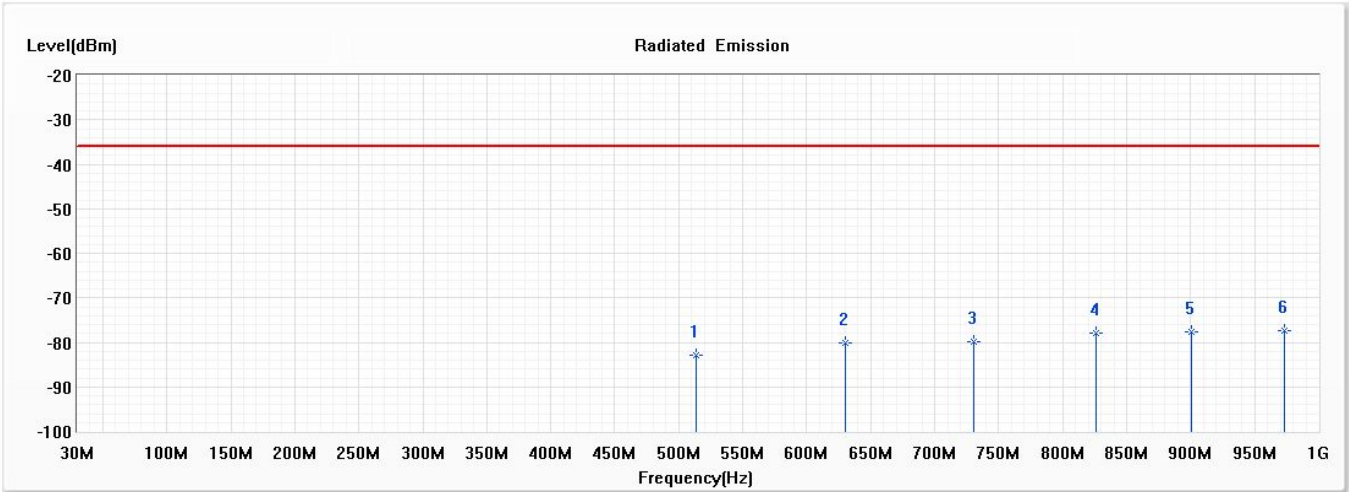


Product : Tire Pressure Monitoring Sensor
 Test Item : Transmitter Spurious Emissions
 Test Mode : Mode 5: Transmitter (FSK) (High Voltage_DC 3.3V)

Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Reading Level (dBm)	Correct Factor (dB)
Horizontal					
Peak Detector					
514.030	-82.88	-36.00	-46.88	-78.26	-4.62
630.430	-80.09	-36.00	-44.09	-77.54	-2.55
730.340	-79.78	-36.00	-43.78	-78.57	-1.21
826.370	-77.97	-36.00	-41.97	-77.86	-0.11
901.060	-77.58	-36.00	-41.58	-78.54	0.96
972.840	-77.38	-36.00	-41.38	-79.12	1.74
1260.000	-64.63	-30.00	-34.63	-61.15	-3.48
1575.000	-60.95	-30.00	-30.95	-55.10	-5.85
1890.000	-53.68	-30.00	-23.68	-51.51	-2.17
2205.000	-48.86	-30.00	-18.86	-48.36	-0.50
2520.000	-67.50	-30.00	-37.50	-66.23	-1.27
2835.000	-65.89	-30.00	-35.89	-65.39	-0.50
3150.000	-53.31	-30.00	-23.31	-53.94	0.63

Note:

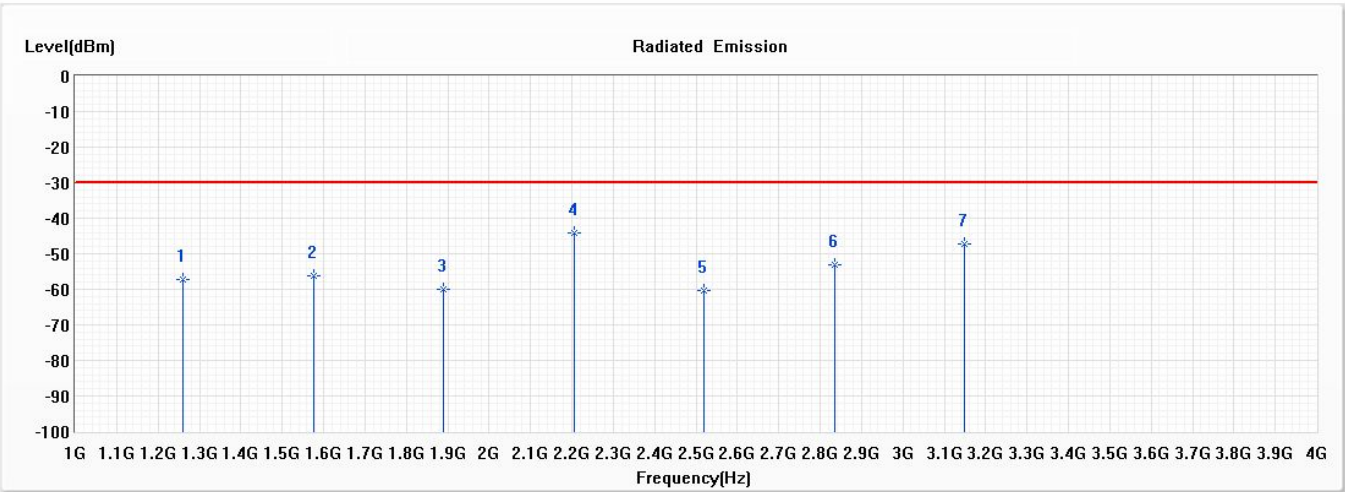
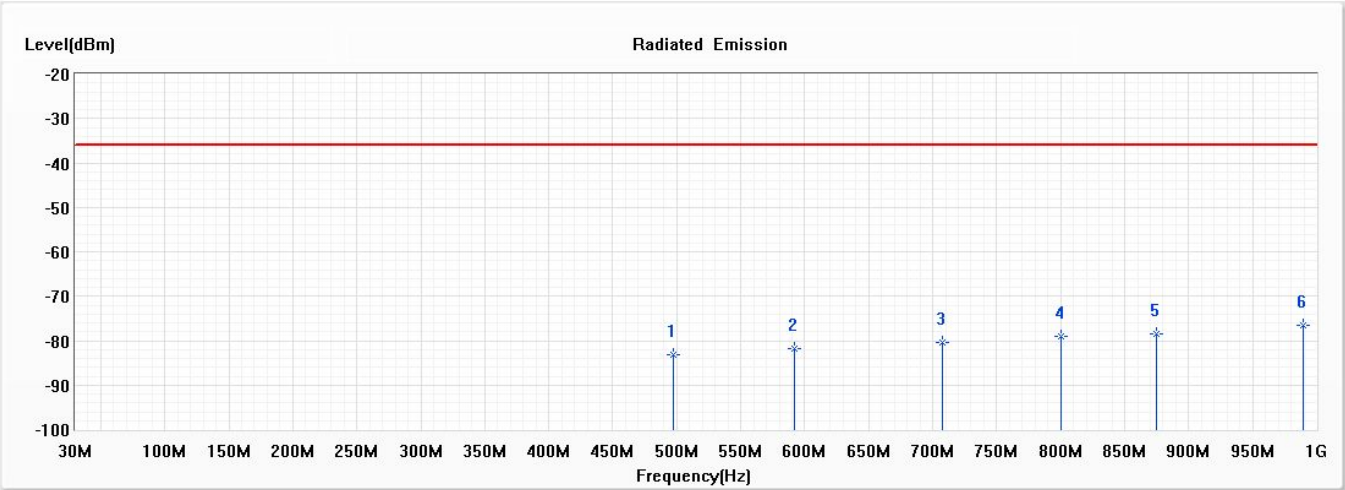
1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.



Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Reading Level (dBm)	Correct Factor (dB)
Vertical					
Peak Detector					
497.540	-83.28	-36.00	-47.28	-78.31	-4.97
591.630	-81.75	-36.00	-45.75	-78.61	-3.14
708.030	-80.33	-36.00	-44.33	-78.69	-1.64
800.180	-79.07	-36.00	-43.07	-78.50	-0.57
874.870	-78.46	-36.00	-42.46	-78.85	0.39
989.330	-76.67	-36.00	-40.67	-78.61	1.94
1260.000	-57.32	-30.00	-27.32	-53.58	-3.74
1575.000	-56.26	-30.00	-26.26	-50.32	-5.94
1890.000	-60.15	-30.00	-30.15	-57.66	-2.49
2205.000	-44.14	-30.00	-14.14	-43.42	-0.72
2520.000	-60.38	-30.00	-30.38	-60.06	-0.32
2835.000	-53.00	-30.00	-23.00	-52.20	-0.80
3150.000	-47.30	-30.00	-17.30	-48.16	0.86

Note:

1. All Reading are peak value.
2. “ ” means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

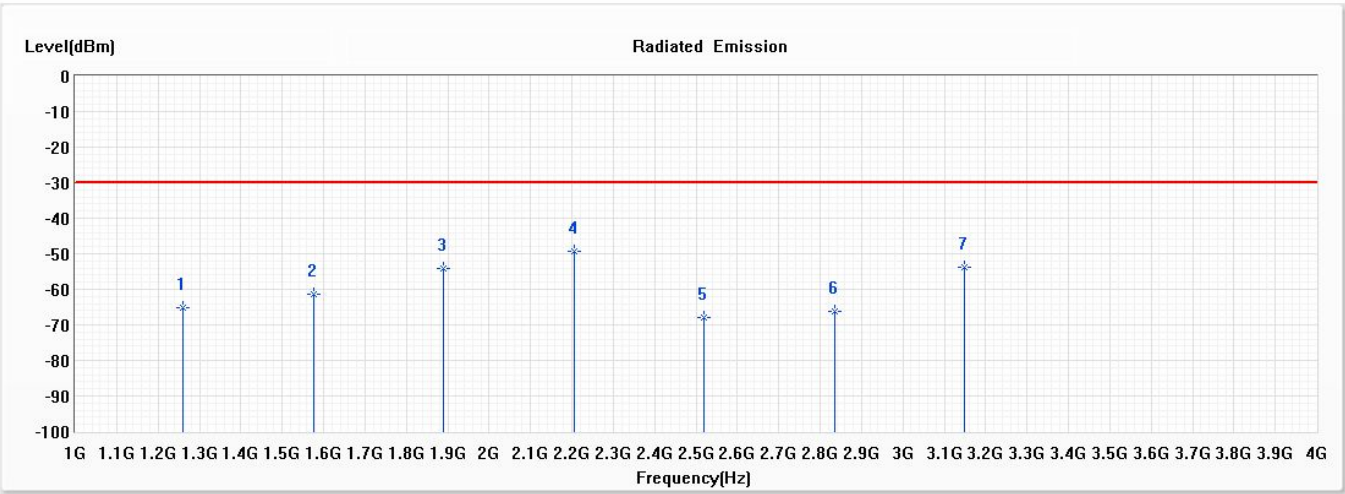
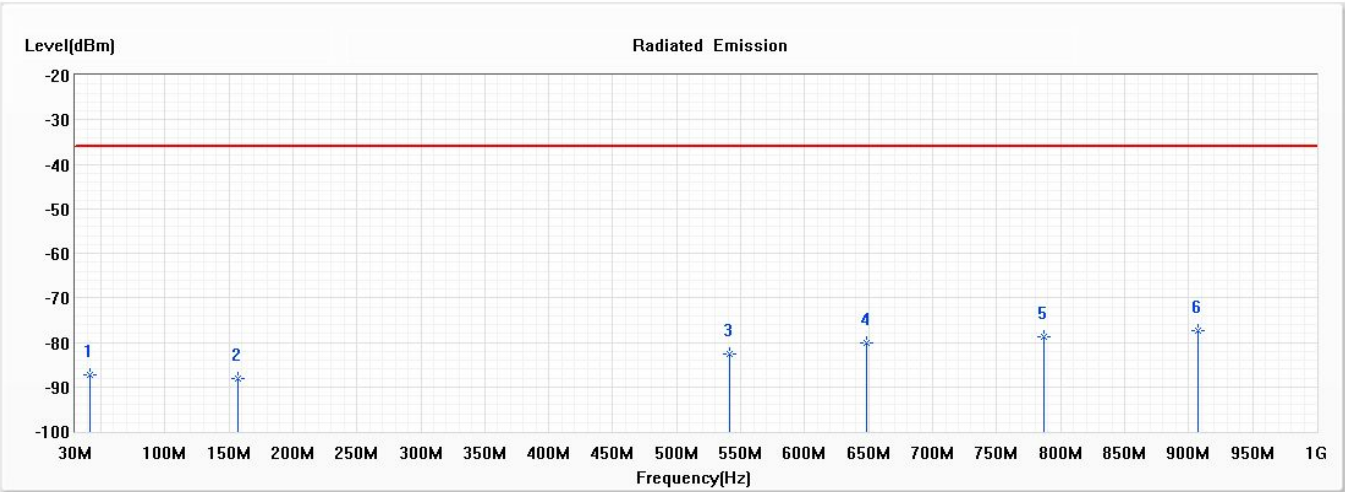


Product : Tire Pressure Monitoring Sensor
 Test Item : Transmitter Spurious Emissions
 Test Mode : Mode 6: Transmitter (FSK) (Low Voltage_DC 2.7V)

Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Reading Level (dBm)	Correct Factor (dB)
Horizontal					
Peak Detector					
41.640	-87.30	-36.00	-51.30	-76.49	-10.81
157.070	-88.19	-36.00	-52.19	-77.61	-10.58
541.190	-82.69	-36.00	-46.69	-78.46	-4.23
647.890	-80.11	-36.00	-44.11	-77.62	-2.49
786.600	-78.68	-36.00	-42.68	-78.27	-0.41
906.880	-77.44	-36.00	-41.44	-78.48	1.04
1260.000	-65.03	-30.00	-35.03	-61.55	-3.48
1575.000	-61.35	-30.00	-31.35	-55.50	-5.85
1890.000	-54.08	-30.00	-24.08	-51.91	-2.17
2205.000	-49.26	-30.00	-19.26	-48.76	-0.50
2520.000	-67.90	-30.00	-37.90	-66.63	-1.27
2835.000	-66.29	-30.00	-36.29	-65.79	-0.50
3150.000	-53.71	-30.00	-23.71	-54.34	0.63

Note:

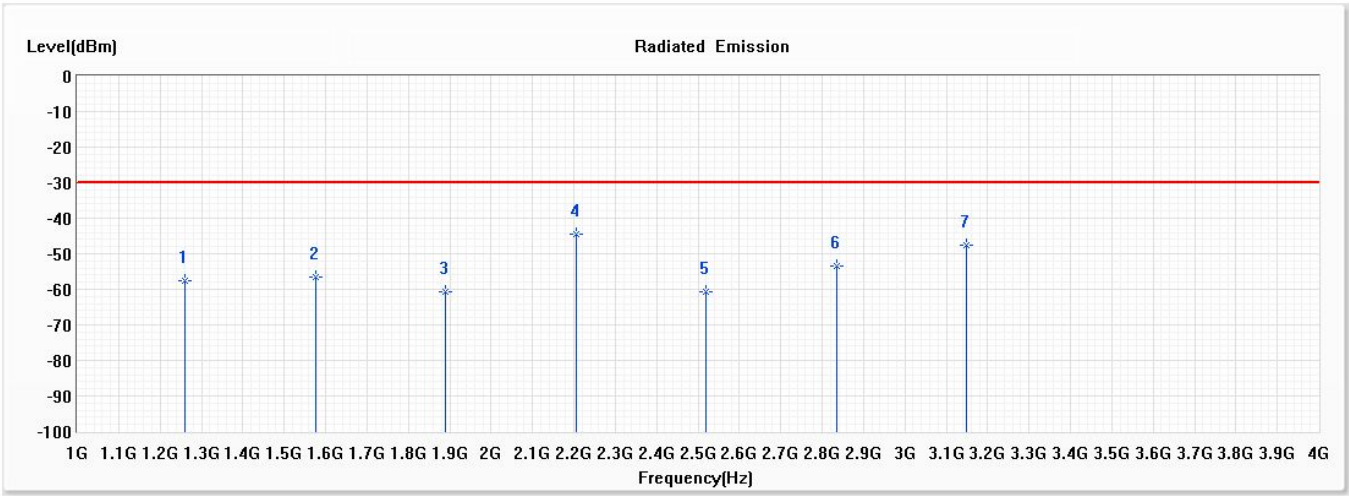
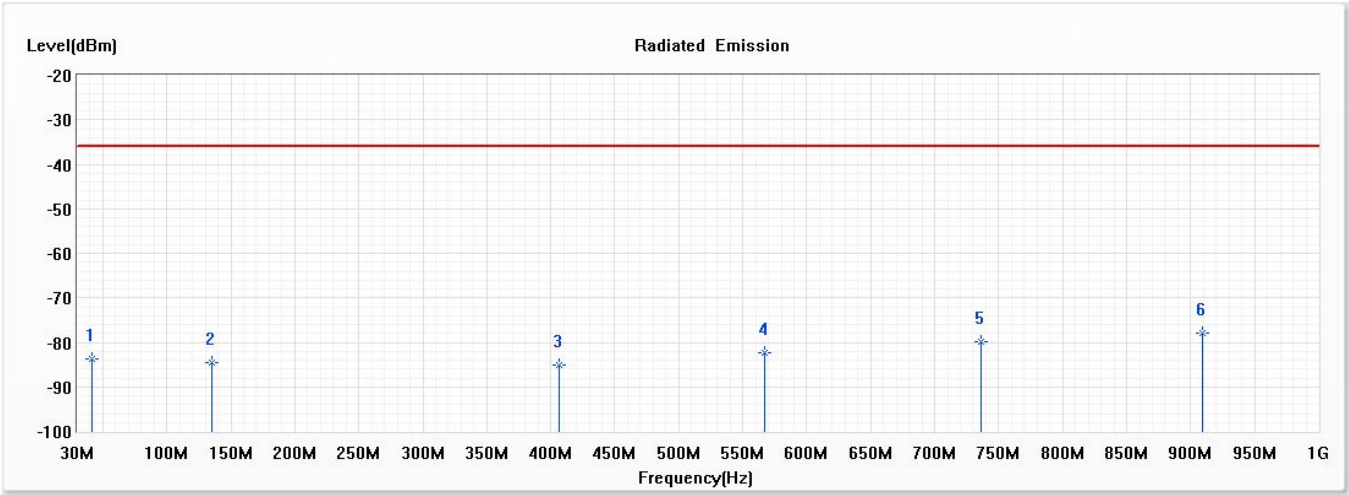
1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.



Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Reading Level (dBm)	Correct Factor (dB)
Vertical					
Peak Detector					
41.640	-83.74	-36.00	-47.74	-72.93	-10.81
134.760	-84.44	-36.00	-48.44	-72.71	-11.73
406.360	-85.09	-36.00	-49.09	-78.01	-7.08
567.380	-82.22	-36.00	-46.22	-78.51	-3.71
736.160	-79.80	-36.00	-43.80	-78.66	-1.14
908.820	-77.91	-36.00	-41.91	-79.03	1.12
1260.000	-57.72	-30.00	-27.72	-53.98	-3.74
1575.000	-56.66	-30.00	-26.66	-50.72	-5.94
1890.000	-60.85	-30.00	-30.85	-58.36	-2.49
2205.000	-44.54	-30.00	-14.54	-43.82	-0.72
2520.000	-60.78	-30.00	-30.78	-60.46	-0.32
2835.000	-53.40	-30.00	-23.40	-52.60	-0.80
3150.000	-47.70	-30.00	-17.70	-48.56	0.86

Note:

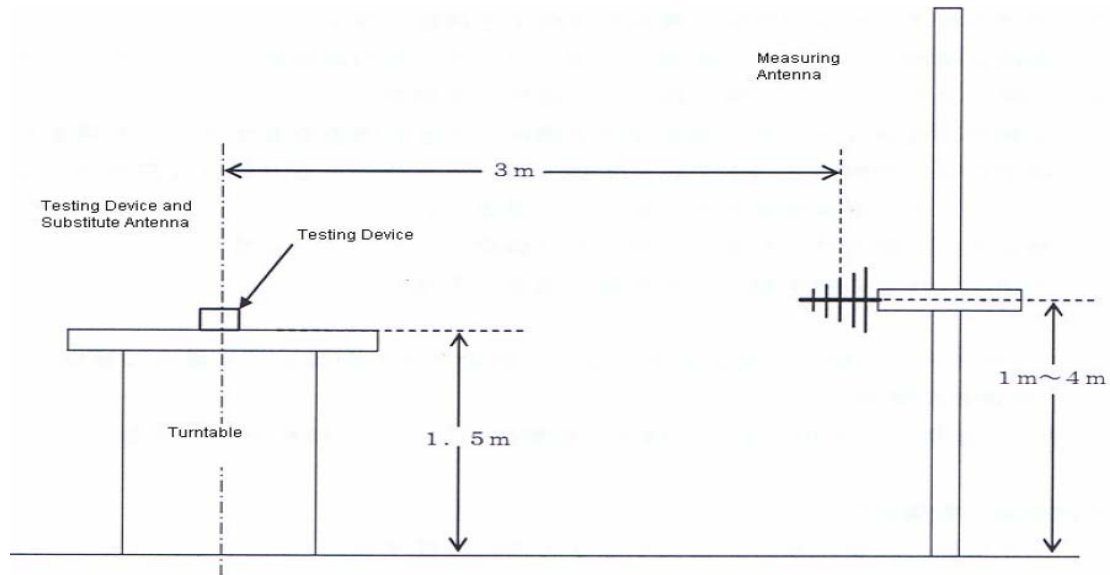
1. All Reading are peak value.
2. “ ” means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.



Test Result	PASS
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5. Secondary Radiated Emissions Strength

5.1. Test Setup



5.2. Test Procedure

A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.

The EUT is placed on a turn table which is 1.5 meters 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.

Broadband antenna (calibrated bi-log and horn antenna) are used as a receiving antenna. Both horizontal and vertical polarization of the antenna are set on measurement. And a high frequency preamplifier were used increase the sensitivity of the measuring. In order to find the maximum emission, all of the interface cables must be manipulated according to Ministry of Internal Affairs and Communications notification Article 88, Annex 41 on radiated measurement.

The additional notch filter below 1GHz was used to measure the level of harmonics radiated emission during field strength of Output Power measurement. The bandwidth setting on the field strength meter is 100 kHz and 1MHz. The frequency range from is checked.

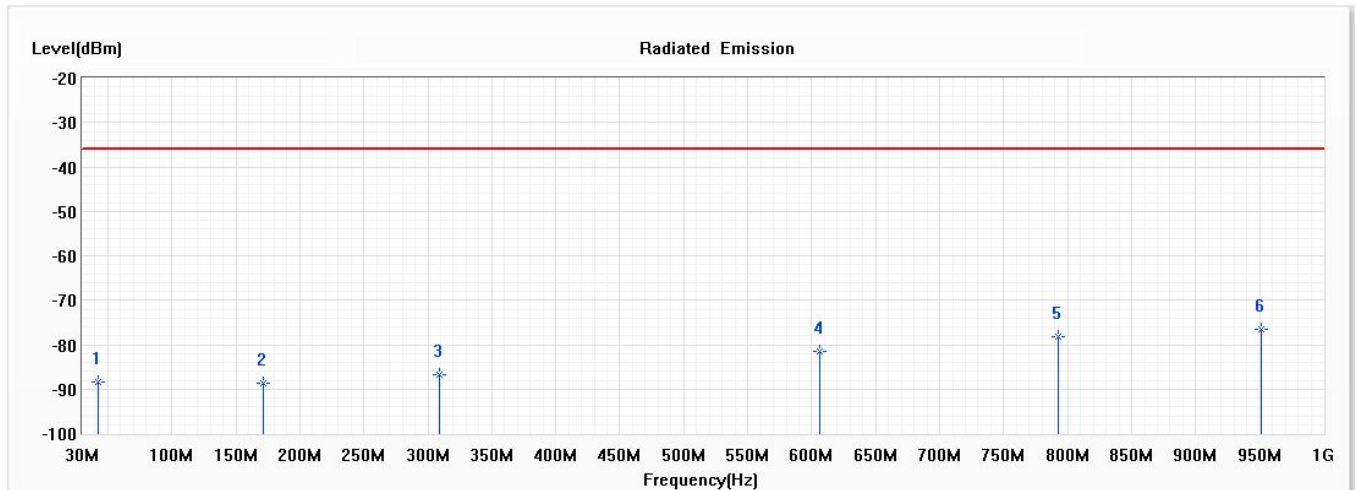
5.3. Limits

30MHz-1GHz : < 4nW/100KHz (-54dBm/100KHz)

Above 1GHz : < 4nW/1MHz (-54dBm/1MHz)

5.4. Test Result of Secondary Radiated Emission Strength

Product : Tire Pressure Monitoring Sensor
 Test Item : Secondary Radiated Emission Strength
 Test Mode : Mode 10: Standby Mode (ASK) (Normal Voltage_DC 3V)

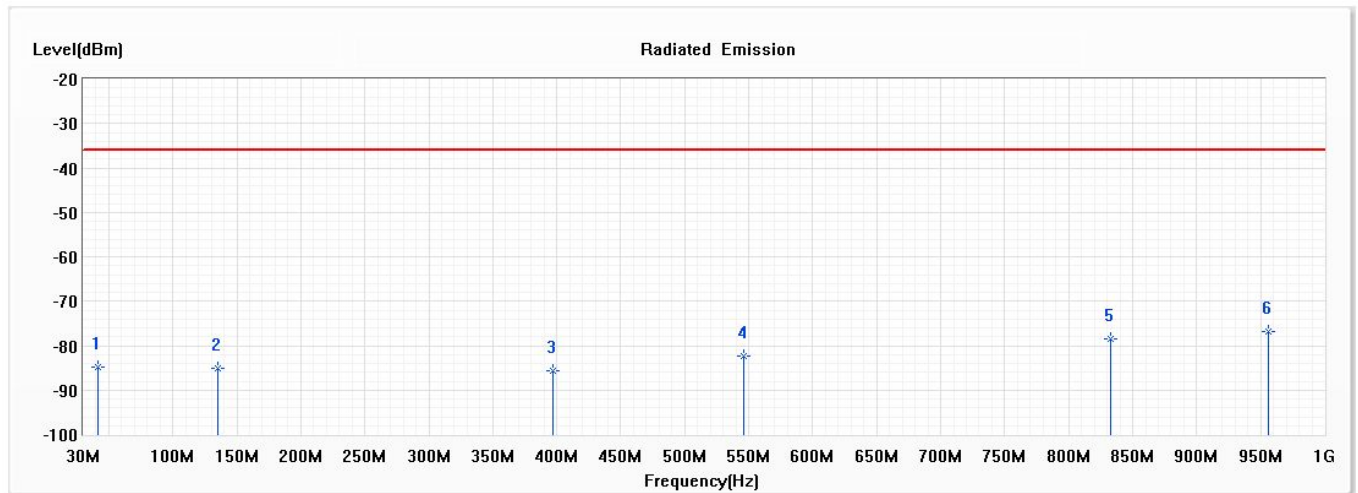


Frequency (MHz)	Emission Level (dBm)	Limit (dBm)	Margin (dB)	Reading Level (dBm)	Correct Factor (dB)
Horizontal					
Peak Detector					
42.610	-88.36	-36.00	-52.36	-77.69	-10.67
171.620	-88.61	-36.00	-52.61	-77.85	-10.76
309.360	-86.84	-36.00	-50.84	-77.62	-9.22
606.180	-81.48	-36.00	-45.48	-78.72	-2.76
792.420	-78.32	-36.00	-42.32	-77.93	-0.39
951.500	-76.53	-36.00	-40.53	-78.17	1.64

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : Tire Pressure Monitoring Sensor
 Test Item : Secondary Radiated Emission Strength
 Test Mode : Mode 10: Standby Mode (ASK) (Normal Voltage_DC 3V)

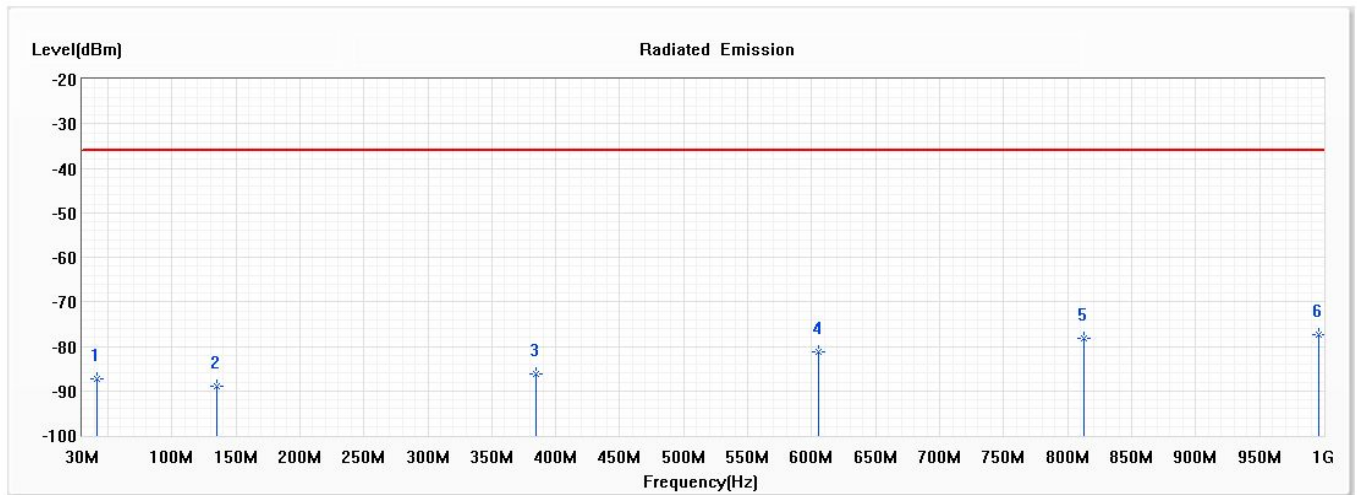


Frequency	Measurement	Limit	Margin	Reading	Correct
MHz	Level			Level	Factor
	dBm	dBm	dB	dBm	dB
Vertical					
Peak Detector					
41.640	-84.73	-36.00	-48.73	-73.92	-10.81
134.760	-84.98	-36.00	-48.98	-73.25	-11.73
396.660	-85.58	-36.00	-49.58	-78.39	-7.19
546.040	-82.46	-36.00	-46.46	-78.26	-4.20
833.160	-78.59	-36.00	-42.59	-78.56	-0.03
956.350	-76.95	-36.00	-40.95	-78.66	1.71

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : Tire Pressure Monitoring Sensor
 Test Item : Secondary Radiated Emission Strength
 Test Mode : Mode 11: Standby Mode (ASK) (High Voltage_DC 3.3V)

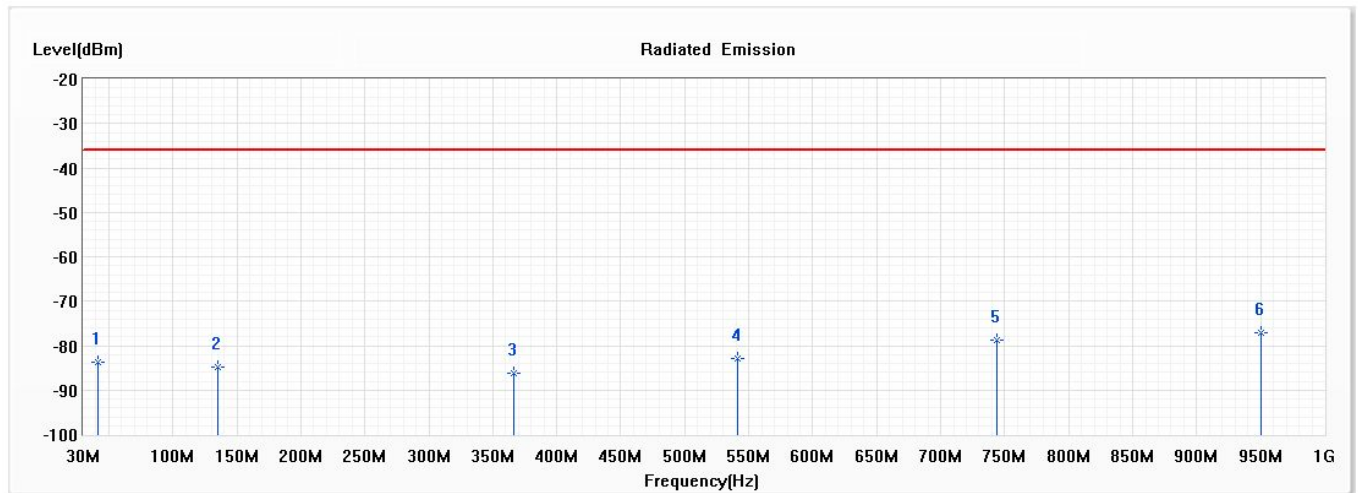


Frequency	Measurement	Limit	Margin	Reading	Correct
MHz	Level			Level	Factor
	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
41.640	-87.21	-36.00	-51.21	-76.40	-10.81
134.760	-88.95	-36.00	-52.95	-77.22	-11.73
385.020	-86.19	-36.00	-50.19	-78.76	-7.43
605.210	-81.32	-36.00	-45.32	-78.53	-2.79
812.790	-78.07	-36.00	-42.07	-77.79	-0.28
996.120	-77.32	-36.00	-41.32	-79.31	1.99

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : Tire Pressure Monitoring Sensor
 Test Item : Secondary Radiated Emission Strength
 Test Mode : Mode 11: Standby Mode (ASK) (High Voltage_DC 3.3V)

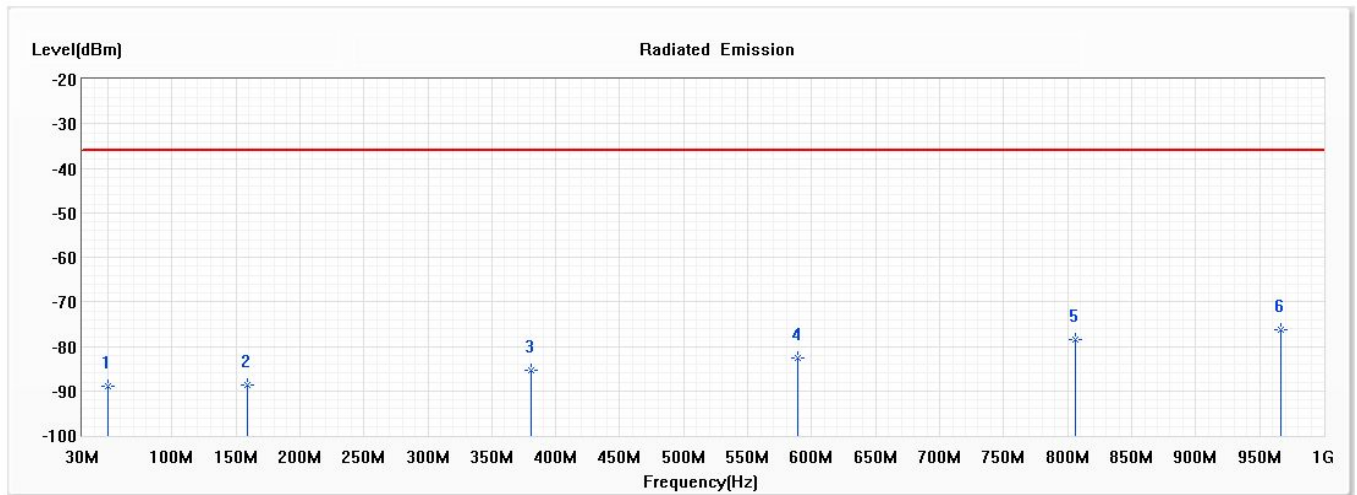


Frequency	Measurement	Limit	Margin	Reading	Correct
MHz	Level			Level	Factor
	dBm	dBm	dB	dBm	dB
Vertical					
Peak Detector					
41.640	-83.82	-36.00	-47.82	-73.01	-10.81
134.760	-84.82	-36.00	-48.82	-73.09	-11.73
366.590	-86.31	-36.00	-50.31	-78.50	-7.81
541.190	-82.90	-36.00	-46.90	-78.67	-4.23
743.920	-78.80	-36.00	-42.80	-77.90	-0.90
950.530	-77.16	-36.00	-41.16	-78.78	1.62

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : Tire Pressure Monitoring Sensor
 Test Item : Secondary Radiated Emission Strength
 Test Mode : Mode 12: Standby Mode (ASK) (Low Voltage_DC 2.7V)

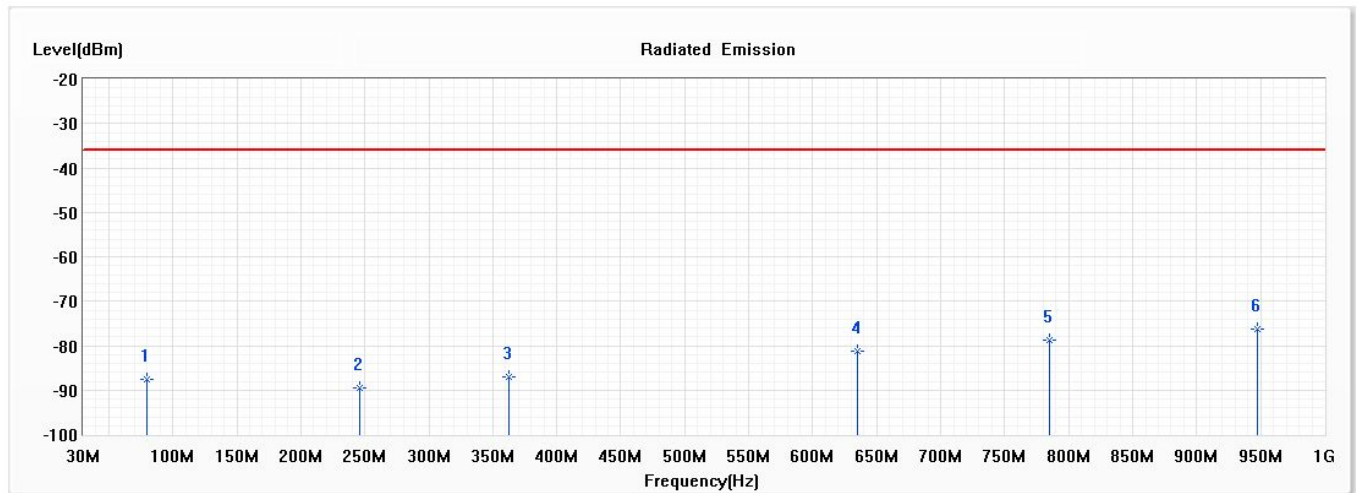


Frequency	Measurement	Limit	Margin	Reading	Correct
MHz	Level			Level	Factor
	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
50.370	-89.09	-36.00	-53.09	-78.81	-10.28
159.010	-88.75	-36.00	-52.75	-78.27	-10.48
381.140	-85.44	-36.00	-49.44	-78.00	-7.44
588.720	-82.57	-36.00	-46.57	-79.30	-3.27
806.000	-78.49	-36.00	-42.49	-78.05	-0.44
967.020	-76.20	-36.00	-40.20	-78.05	1.85

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : Tire Pressure Monitoring Sensor
 Test Item : Secondary Radiated Emission Strength
 Test Mode : Mode 12: Standby Mode (ASK) (Low Voltage_DC 2.7V)

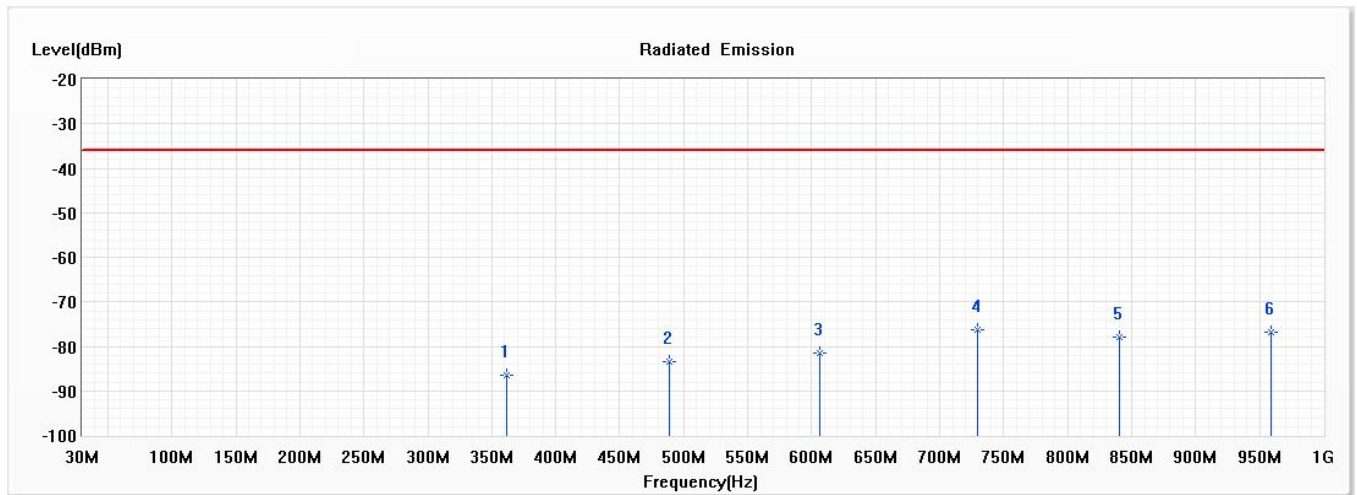


Frequency	Measurement	Limit	Margin	Reading	Correct
MHz	Level			Level	Factor
	dBm	dBm	dB	dBm	dB
Vertical					
Peak Detector					
79.470	-87.53	-36.00	-51.53	-72.60	-14.93
246.310	-89.58	-36.00	-53.58	-78.21	-11.37
362.710	-86.90	-36.00	-50.90	-78.97	-7.93
635.280	-81.21	-36.00	-45.21	-78.67	-2.54
784.660	-78.66	-36.00	-42.66	-78.23	-0.43
947.620	-76.37	-36.00	-40.37	-77.98	1.61

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : Tire Pressure Monitoring Sensor
 Test Item : Secondary Radiated Emission Strength
 Test Mode : Mode 13: Standby Mode (FSK) (Normal Voltage_DC 3V)

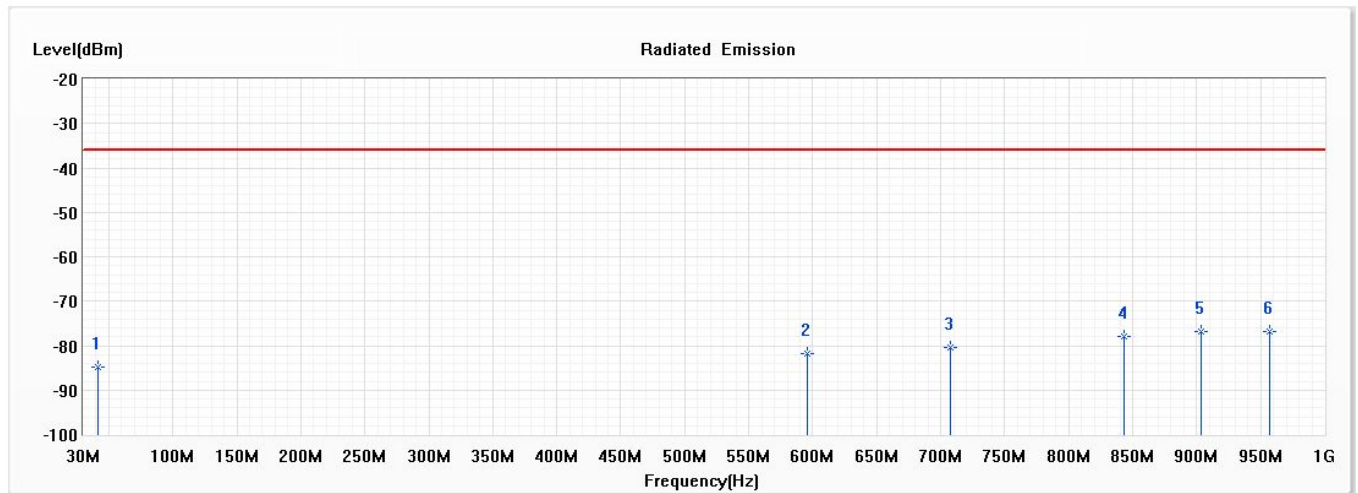


Frequency	Measurement	Limit	Margin	Reading	Correct
MHz	Level			Level	Factor
	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
361.740	-86.47	-36.00	-50.47	-78.51	-7.96
488.810	-83.47	-36.00	-47.47	-78.25	-5.22
606.180	-81.63	-36.00	-45.63	-78.87	-2.76
729.370	-76.41	-36.00	-40.41	-75.19	-1.22
839.950	-78.04	-36.00	-42.04	-78.16	0.12
959.260	-76.85	-36.00	-40.85	-78.57	1.72

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : Tire Pressure Monitoring Sensor
 Test Item : Secondary Radiated Emission Strength
 Test Mode : Mode 13: Standby Mode (FSK) (Normal Voltage_DC 3V)

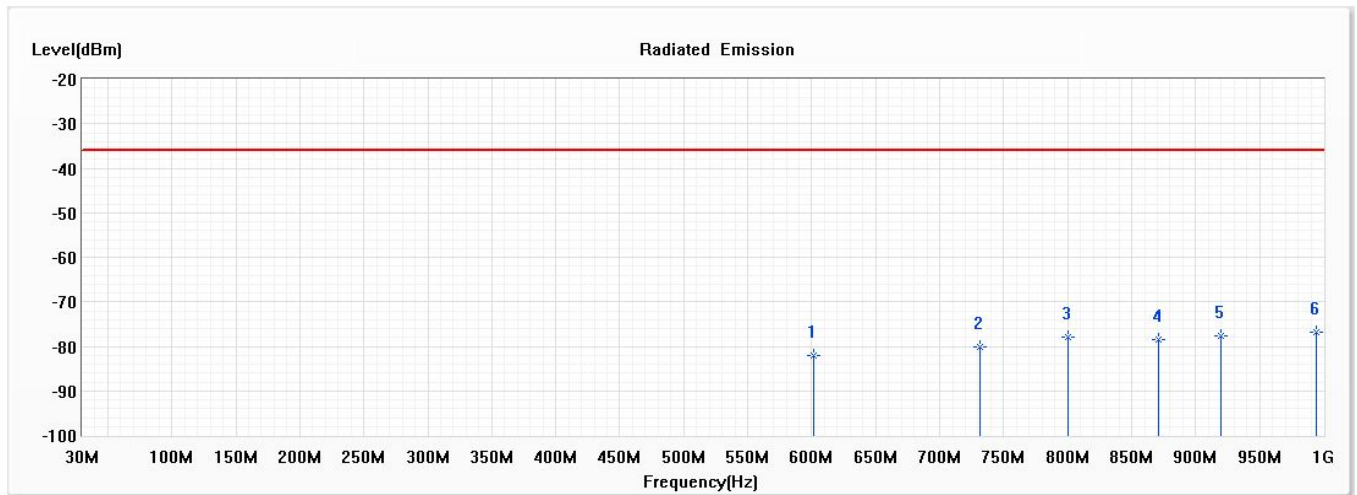


Frequency	Measurement	Limit	Margin	Reading	Correct
MHz	Level dBm	dBm	dB	Level dBm	Factor dB
Vertical					
Peak Detector					
41.640	-84.69	-36.00	-48.69	-73.88	-10.81
595.510	-81.75	-36.00	-45.75	-78.76	-2.99
708.030	-80.46	-36.00	-44.46	-78.82	-1.64
842.860	-78.06	-36.00	-42.06	-78.24	0.18
903.000	-76.85	-36.00	-40.85	-77.81	0.96
957.320	-76.72	-36.00	-40.72	-78.44	1.72

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : Tire Pressure Monitoring Sensor
 Test Item : Secondary Radiated Emission Strength
 Test Mode : Mode 14: Standby Mode (FSK) (High Voltage_DC 3.3V)

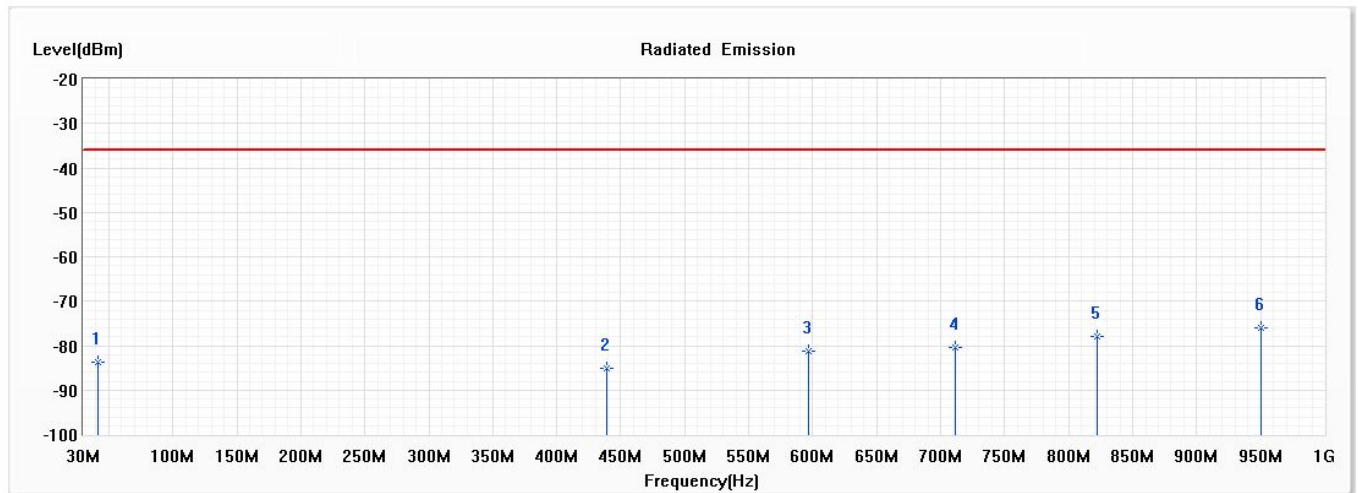


Frequency	Measurement	Limit	Margin	Reading	Correct
MHz	Level			Level	Factor
	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
601.330	-81.96	-36.00	-45.96	-79.10	-2.86
731.310	-80.24	-36.00	-44.24	-79.03	-1.21
800.180	-78.00	-36.00	-42.00	-77.43	-0.57
870.990	-78.62	-36.00	-42.62	-78.93	0.31
919.490	-77.68	-36.00	-41.68	-78.87	1.19
994.180	-76.79	-36.00	-40.79	-78.76	1.97

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : Tire Pressure Monitoring Sensor
 Test Item : Secondary Radiated Emission Strength
 Test Mode : Mode 14: Standby Mode (FSK) (High Voltage_DC 3.3V)

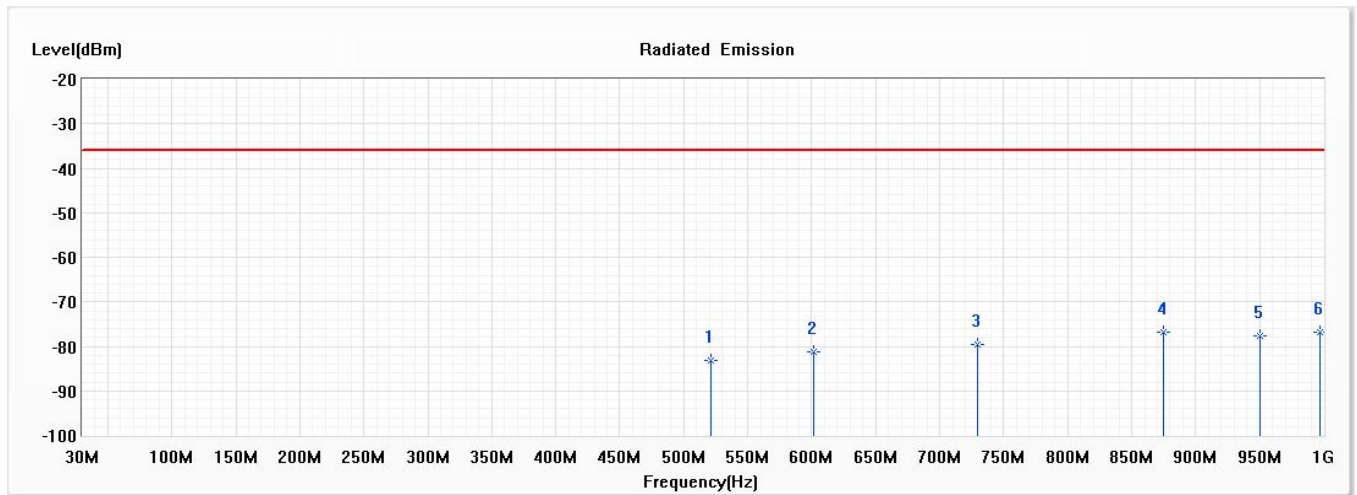


Frequency	Measurement	Limit	Margin	Reading	Correct
MHz	Level			Level	Factor
	dBm	dBm	dB	dBm	dB
Vertical					
Peak Detector					
41.640	-83.68	-36.00	-47.68	-72.87	-10.81
439.340	-85.00	-36.00	-49.00	-78.81	-6.19
596.480	-81.36	-36.00	-45.36	-78.39	-2.97
710.940	-80.31	-36.00	-44.31	-78.78	-1.53
822.490	-77.97	-36.00	-41.97	-77.86	-0.11
950.530	-76.08	-36.00	-40.08	-77.70	1.62

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : Tire Pressure Monitoring Sensor
 Test Item : Secondary Radiated Emission Strength
 Test Mode : Mode 15: Standby Mode (FSK) (Low Voltage_DC 2.7V)

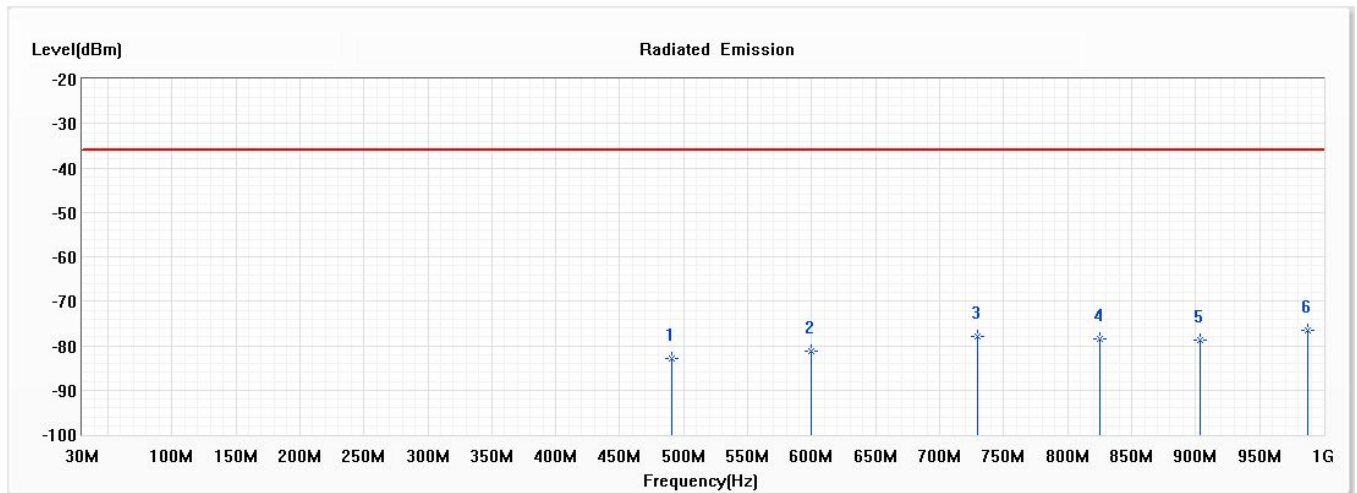


Frequency	Measurement	Limit	Margin	Reading	Correct
MHz	Level			Level	Factor
	dBm	dBm	dB	dBm	dB
Horizontal					
Peak Detector					
520.820	-83.05	-36.00	-47.05	-78.66	-4.39
601.330	-81.12	-36.00	-45.12	-78.26	-2.86
729.370	-79.50	-36.00	-43.50	-78.28	-1.22
874.870	-76.88	-36.00	-40.88	-77.27	0.39
950.530	-77.65	-36.00	-41.65	-79.27	1.62
997.090	-76.73	-36.00	-40.73	-78.74	2.01

Note:

1. All Reading are peak value.
2. " " means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Product : Tire Pressure Monitoring Sensor
 Test Item : Secondary Radiated Emission Strength
 Test Mode : Mode 15: Standby Mode (FSK) (Low Voltage_DC 2.7V)



Frequency	Measurement	Limit	Margin	Reading	Correct
MHz	Level dBm	dBm	dB	Level dBm	Factor dB
Vertical					
Peak Detector					
490.750	-83.00	-36.00	-47.00	-77.81	-5.19
599.390	-81.24	-36.00	-45.24	-78.34	-2.90
729.370	-77.93	-36.00	-41.93	-76.71	-1.22
825.400	-78.50	-36.00	-42.50	-78.39	-0.11
903.000	-78.73	-36.00	-42.73	-79.69	0.96
987.390	-76.68	-36.00	-40.68	-78.58	1.90

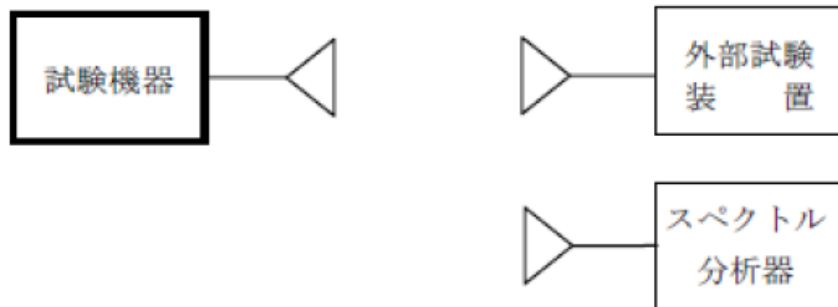
Note:

1. All Reading are peak value.
2. “ ” means this data is the worst emission level.
3. Emission Level = Reading Level + Correction Factor.

Test Result	PASS
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6. Restriction Function of Transmission Time

6.1. Test Setup



6.2. Test Procedure

(1) RF device with cyclical transmission

- (a) Verify wave emission using spectrum analyzer when receiving seizure signal from an external test equipment, and RF device emits waves and receives seizure signal.
- (b) Verify wave emission using spectrum analyzer when not receiving seizure signal from an external test equipment and RF device emits waves.
- (c) Measure maximum transmission time and minimum transmission suspend time.

(2) RF device with no cyclical transmission

- (a) Verify wave emission using spectrum analyzer when receiving seizure signal form external test equipment or manual operation.
- (b) Measure maximum transmission time by receiving once a seizure signal form an external testing equipment or manual operation.

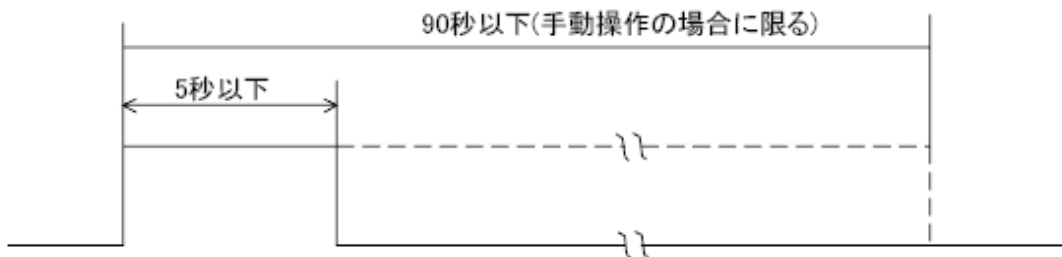
Moreover, verify that does not emit waves exceeding the maximum permissible transmission time.

6.3. Limits

(1) RF equipment with no cyclical:

Transmission time: below 5 s

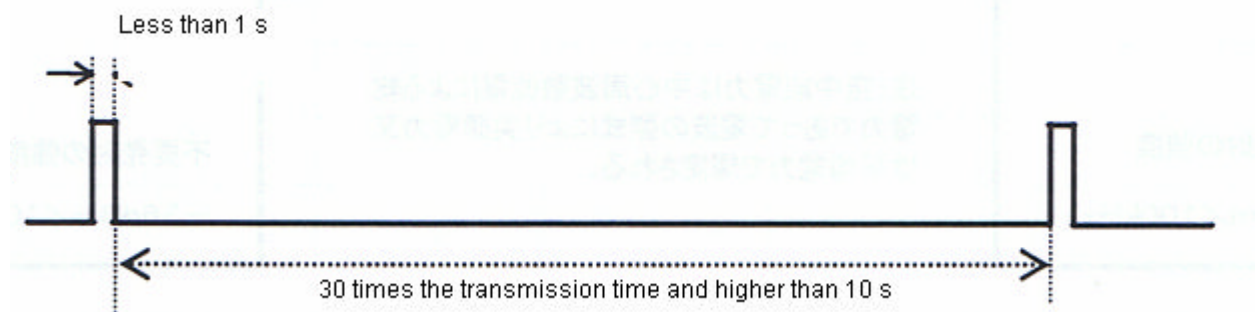
In manual transmission: below 90 s



(2) RF equipment with cyclical transmission:

Transmission time: For each transmission time, below 1 s

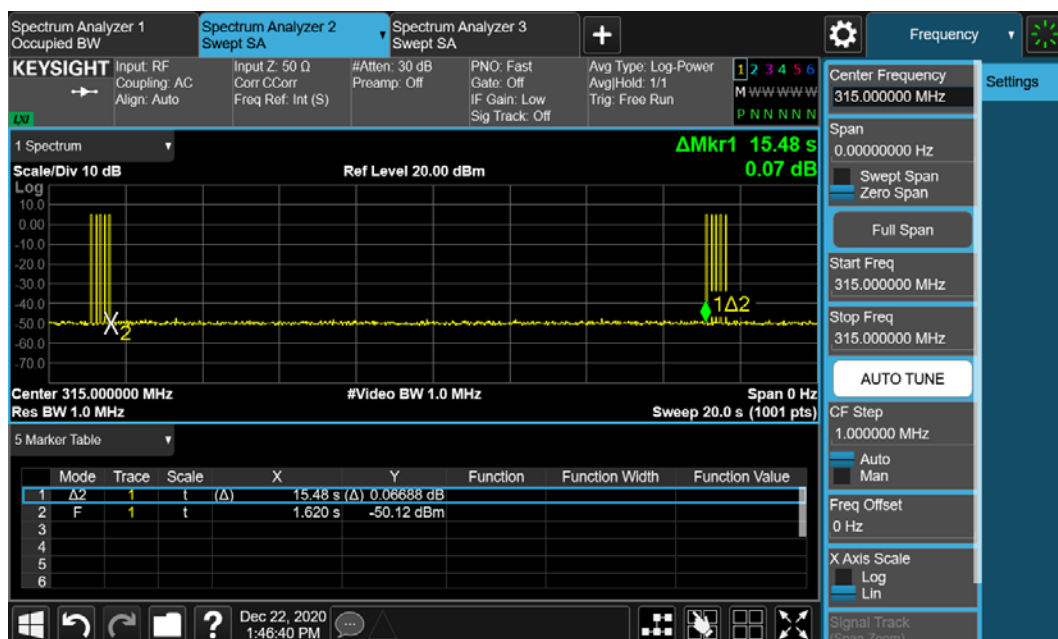
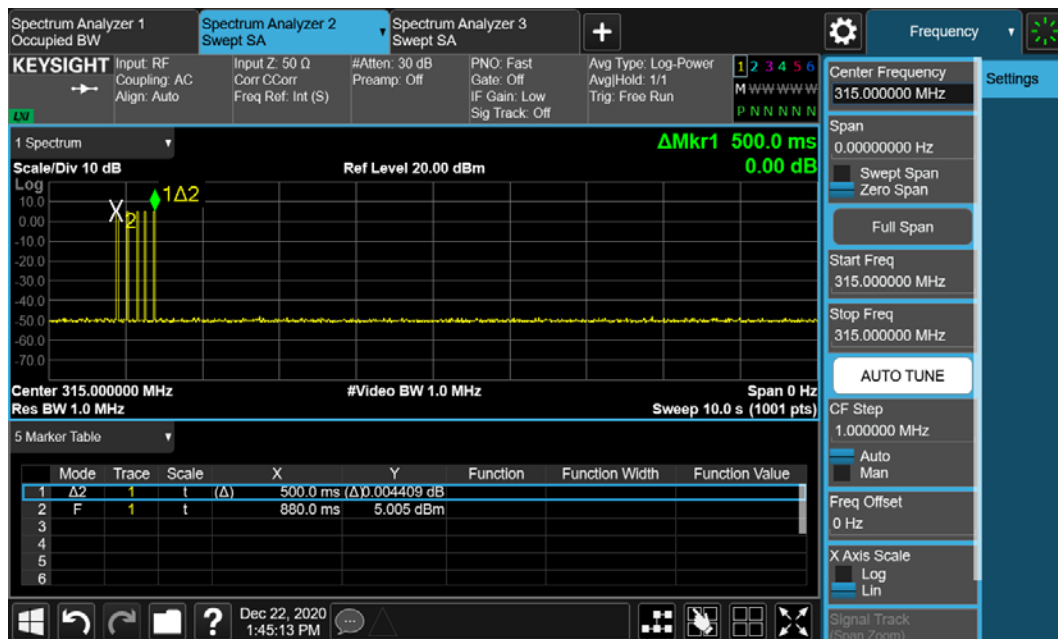
Transmission suspend time 30 times the transmission time, and higher than 10 s



6.4. Test Result of Transmission Time

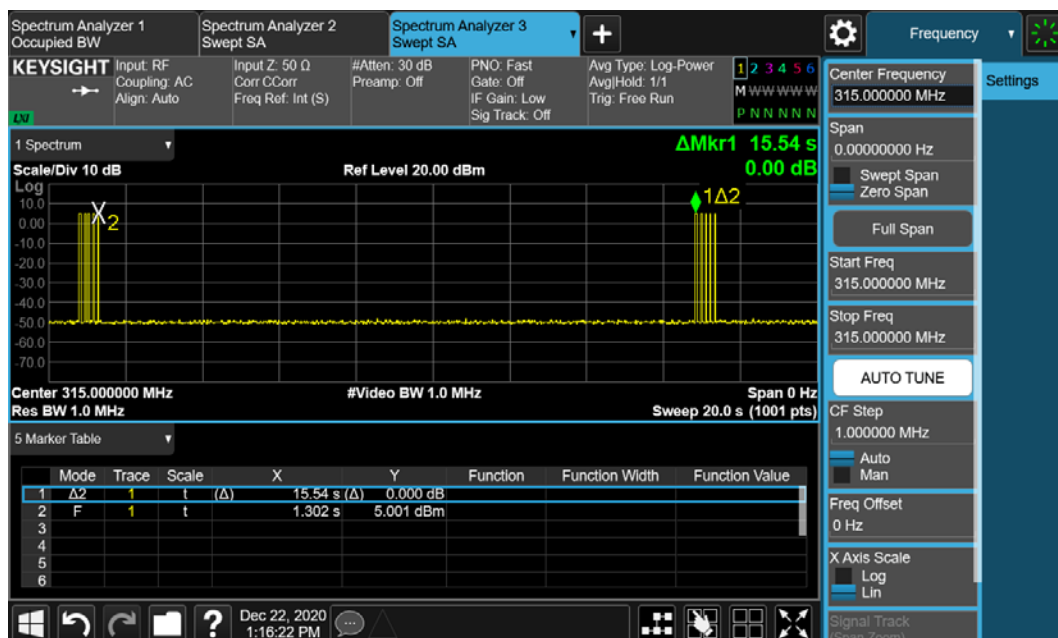
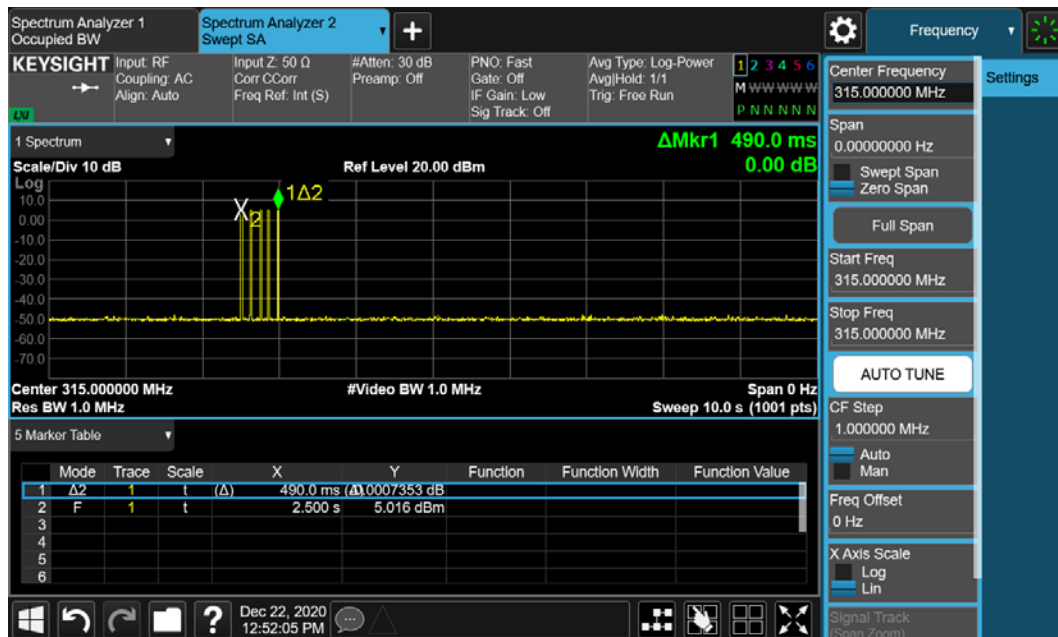
Product : Tire Pressure Monitoring Sensor
 Test Item : Transmission Time
 Test Mode : Mode 7: Normal Mode (Normal Voltage_DC 3V)

Frequency MHz	Manual Transmission Time	Limit
315	500ms	<5s



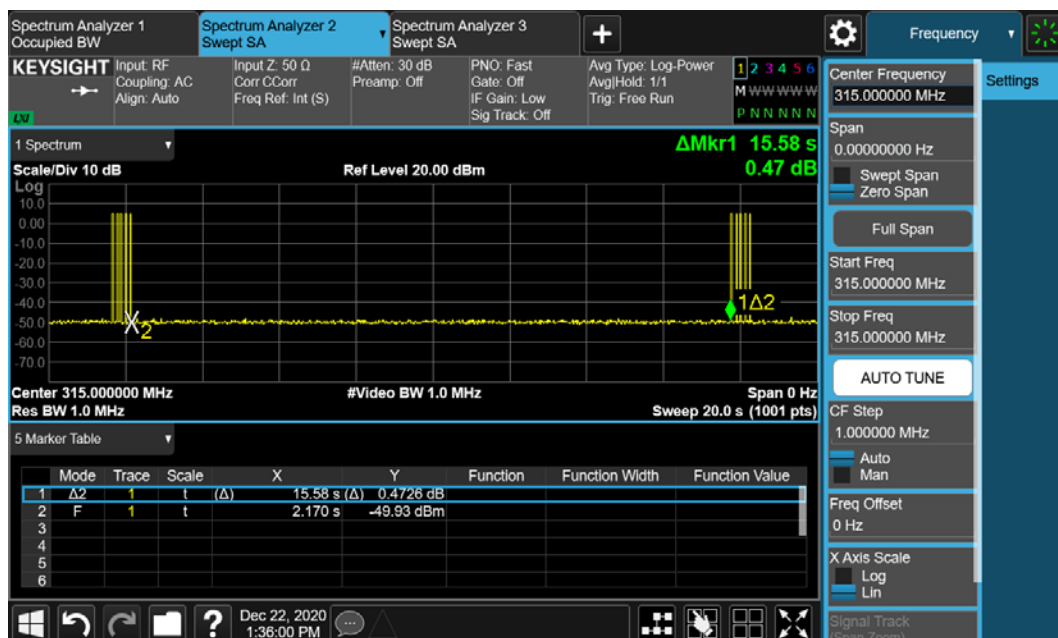
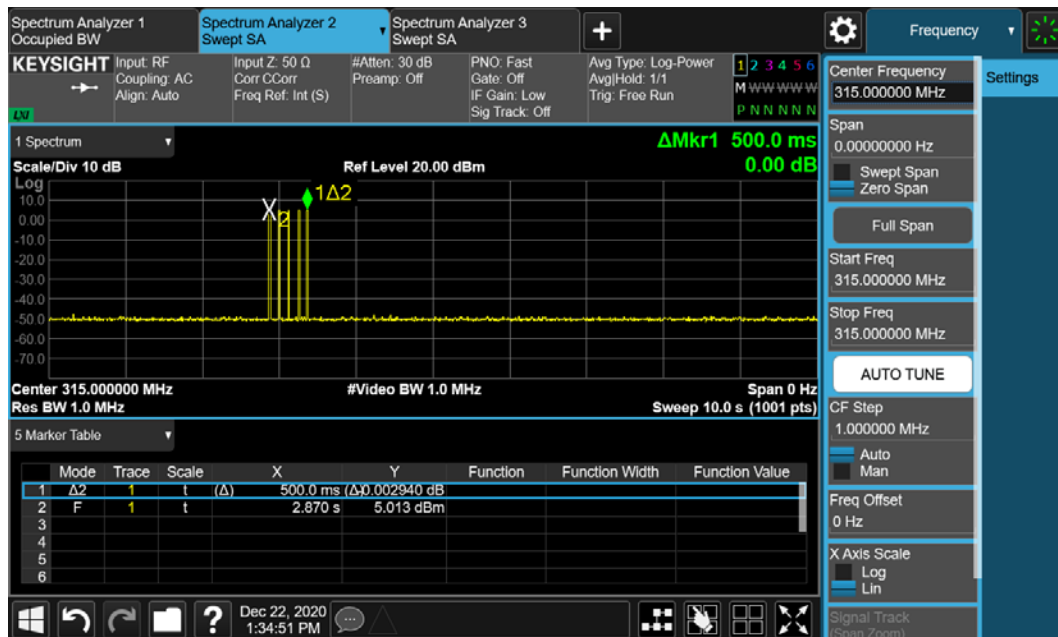
Product : Tire Pressure Monitoring Sensor
 Test Item : Transmission Time
 Test Mode : Mode 8: Normal Mode (High Voltage_DC 3.3V)

Frequency MHz	Manual Transmission Time	Limit
315	490ms	<5s



Product : Tire Pressure Monitoring Sensor
 Test Item : Transmission Time
 Test Mode : Mode 9: Normal Mode (Low Voltage_DC 2.7V)

Frequency MHz	Manual Transmission Time	Limit
315	500ms	<5s



7. EMI Reduction Method During Compliance Testing

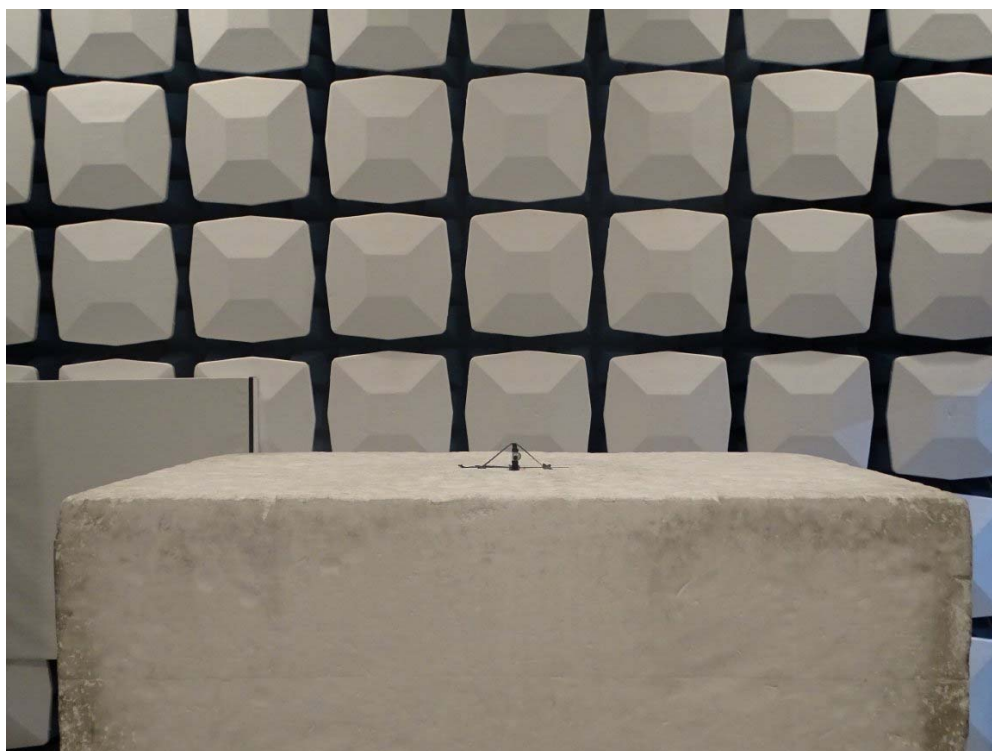
No modification was made during testing.

Attachment 1: EUT Test Setup Photographs

Front View of Radiated Test



Back View of Radiated Test



Front View of Radiated Test (Horn)



Back View of Radiated Test (Horn)

