



## MEASUREMENT REPORT

### FCC PART 15.231(e)

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**FCC ID:** TTETSB23-RE

**APPLICANT:** Suzhou Sate Auto Electronic Co., Ltd.

**Application Type:** Certification

**Product:** Tire Pressure Monitoring System Sensor

**Model No.:** TSB23-RE, TSB25-RE, TSB27-RE, TSB31-RE,  
TSB06-RE

**Brand Name:** S&T

**FCC Classification:** FCC Part 15 Security/Remote Control Transmitter  
(DSC)

**FCC Rule Part(s):** Part 15.231(e)

**Test Procedure(s):** ANSI C63.10-2013

**Test Date:** August 01 ~ 15, 2016

Reviewed By : Robin Wu  
( Robin Wu )

Approved By : Marlin Chen  
( Marlin Chen )



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

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### Revision History

Report No.	Version	Description	Issue Date
1607RSU01801	Rev. 01	Initial report	08-18-2016

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## §2.1033 General Information

<b>Applicant:</b>	Suzhou Sate Auto Electronic Co., Ltd.
<b>Applicant Address:</b>	No.36 Building, Yangtai Road, Suzou Industrial Park, Suzhou, Jiangsu, P.R.China
<b>Manufacturer:</b>	Suzhou Sate Auto Electronic Co., Ltd.
<b>Manufacturer Address:</b>	No.36 Building, Yangtai Road, Suzou Industrial Park, Suzhou, Jiangsu, P.R.China
<b>Test Site:</b>	MRT Technology (Suzhou) Co., Ltd
<b>Test Site Address:</b>	D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
<b>MRT Registration No.:</b>	809388
<b>FCC Rule Part(s):</b>	Part 15.231(e)
<b>Model No.</b>	TSB23-RE, TSB25-RE, TSB27-RE, TSB31-RE, TSB06-RE
<b>FCC ID:</b>	TTETSB23-RE
<b>Test Device Serial No.:</b>	N/A <input type="checkbox"/> Production <input checked="" type="checkbox"/> Pre-Production <input type="checkbox"/> Engineering
<b>FCC Classification:</b>	FCC Part 15 Security/Remote Control Transmitter(DSC)

### Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- MRT facility is a FCC registered (MRT Reg. No. 809388) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules.
- MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.
- MRT facility is a VCCI registered (R-4179, G-814, C-4664, T-2206) test laboratory with the site description on file at VCCI Council.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications and Radio testing for FCC, Industry Canada, EU and TELEC Rules.



## 1. INTRODUCTION

### 1.1. Scope

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

### 1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2009 on September 30, 2013.



## 2. PRODUCT INFORMATION

### 2.1. Equipment Description

Product Name	Tire Pressure Monitoring System Sensor
Model No.	TSB23-RE, TSB25-RE, TSB27-RE, TSB31-RE, TSB06-RE
Frequency Range	433.92 MHz
Type of modulation	ASK, FSK
Antenna Type	Integral Antenna
Device Category	Fixed Device

Note 1: The modulation of Model No. “TSB25-RE, TSB27-RE, TSB31-RE, TSB06-RE” is FSK, and the modulation of Model No. “TSB23-RE” is ASK.

Note 2: We have assessed all the test items with Model No. “TSB23-RE” & “TSB25-RE”.

### 2.2. Test Standards

The following report is prepared on behalf of the **Suzhou Sate Auto Electronic Co., Ltd** in accordance with FCC Part 15, Subpart C, and section 15.231, 15.203, 15.205 and 15.209 of the Federal Communication Commission rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.231, 15.203, 15.205 and 15.209 of the Federal Communication Commission rules.

**Maintenance of compliance** is the responsibility of the manufacturer. Any modification of the product, which results in lowering the emission/immunity, should be checked to ensure compliance has been maintained.

### 2.3. Test Methodology

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013).

**Deviation from measurement procedure.....None**

## 2.4. EUT Setup and Test Mode

The EUT was operated at continuous transmitting mode that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
Mode 1	Transmitting	With ASK Modulation
Mode 2	Transmitting	With FSK Modulation

### 3. ANTENNA REQUIREMENTS

**Excerpt from §15.203 of the FCC Rules/Regulations:**

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.”

- The antenna of the **Tire Pressure Monitoring System Sensor** is permanently attached.
- There are no provisions for connection to an external antenna.

**Conclusion:**

The Tire Pressure Monitoring System Sensor **FCC ID: TTETSB23-RE** unit complies with the requirement of §15.203.



## 4. TEST EQUIPMENT CALIBRATION DATA

### Radiated Emissions – AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2017/05/08
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2016/11/03
Preamplifier	Agilent	83017A	MRTSUE06076	1 year	2017/03/29
Preamplifier	Schwarzbeck	BBV9721	MRTSUE06121	1 year	2017/04/16
Loop Antenna	Schwarzbeck	FMZB1519	MRTSUE06025	1 year	2016/12/14
TRILOG Antenna	Schwarzbeck	VULB9162	MRTSUE06022	1 year	2016/11/07
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06023	1 year	2016/11/07
Broadband Horn Antenna	Schwarzbeck	BBHA9170	MRTSUE06024	1 year	2017/01/04
Temperature/Humidity Meter	Yuhuaze	HTC-2	MRTSUE06183	1 year	2016/12/20
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06212	1 year	2017/05/10

### 20dB Bandwidth

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cal. Due. Date
Spectrum Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2017/05/08
TRILOG Antenna	Schwarzbeck	VULB9162	MRTSUE06022	1 year	2016/11/07
Temperature/Humidity Meter	Yuhuaze	HTC-2	MRTSUE06183	1 year	2016/12/20

### Transmission Time

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cal. Due. Date
Spectrum Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2017/05/08
TRILOG Antenna	Schwarzbeck	VULB9162	MRTSUE06022	1 year	2016/11/07
Temperature/Humidity Meter	Yuhuaze	HTC-2	MRTSUE06183	1 year	2016/12/20

### Duty Cycle

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cal. Due. Date
Spectrum Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2017/05/08
TRILOG Antenna	Schwarzbeck	VULB9162	MRTSUE06022	1 year	2016/11/07
Temperature/Humidity Meter	Yuhuaze	HTC-2	MRTSUE06183	1 year	2016/12/20

Software	Version	Function
e3	V8.3.5	EMI Test Software

## 5. MEASUREMENT UNCERTAINTY

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

Radiated Emission Measurement – AC1
Measuring Uncertainty for a Level of Confidence of 95% ( $U=2U_c(y)$ ): 9kHz ~ 1GHz: 4.18dB 1GHz ~ 18GHz: 4.76dB

## 6. TEST RESULT

### 6.1. Summary

Company Name: Suzhou Sate Auto Electronic Co., Ltd.

FCC ID: TTETSB23-RE

FCC Part Section(s)	Test Description	Test Condition	Test Result
15.205 15.231(e)	Radiated Spurious Emissions	Radiated	Pass
15.231(c)	20dB Bandwidth		Pass
15.231(e)	Transmission Time		Pass
15.231(e)	Duty Cycle		Pass

#### Notes:

- 1) All modes of operation and data rates were investigated. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
- 3) The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

## 6.2. Radiated Emissions

### 6.2.1. Standard Applicable

According to §15.231(e), the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emission (microvolts/meter)
40.66-40.70	1,000	100
70-130	500	50
130-174	500 to 1,500 <sup>1</sup>	50 to 150 <sup>1</sup>
174-260	1,500	150
260-470	1,500 to 5,000 <sup>1</sup>	150 to 500 <sup>1</sup>
Above 470	5,000	500

The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in §15.209, whichever limit permits a higher field strength.

The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements start below or at the lowest crystal frequency.

Compliance with the provisions of §15.205 shall be demonstrated using the measurement instrumentation specified in that section.

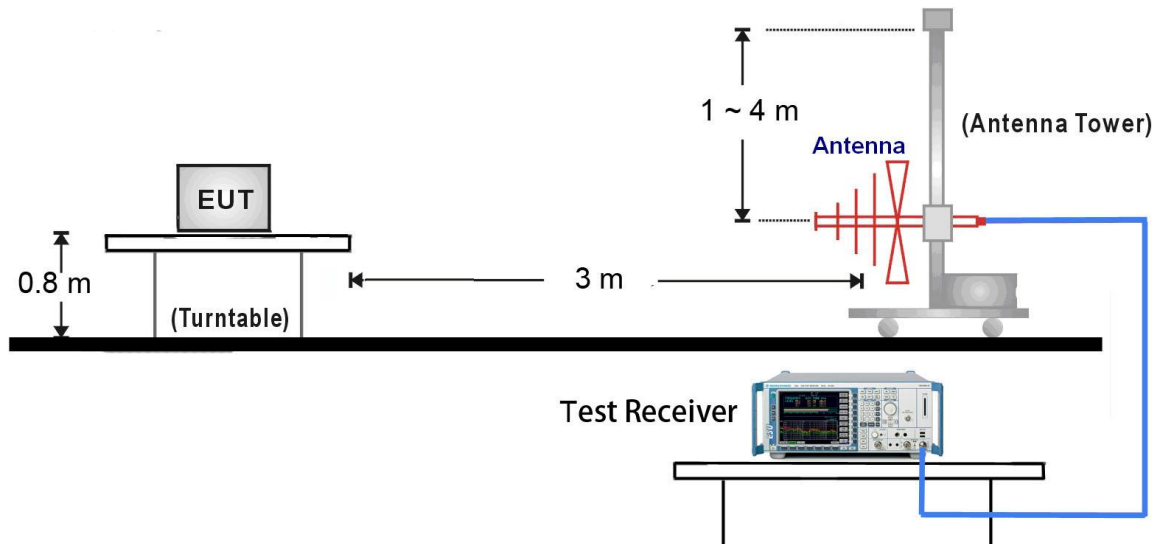
### 6.2.2. Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.231(e) and FCC Part 15.209 Limit.

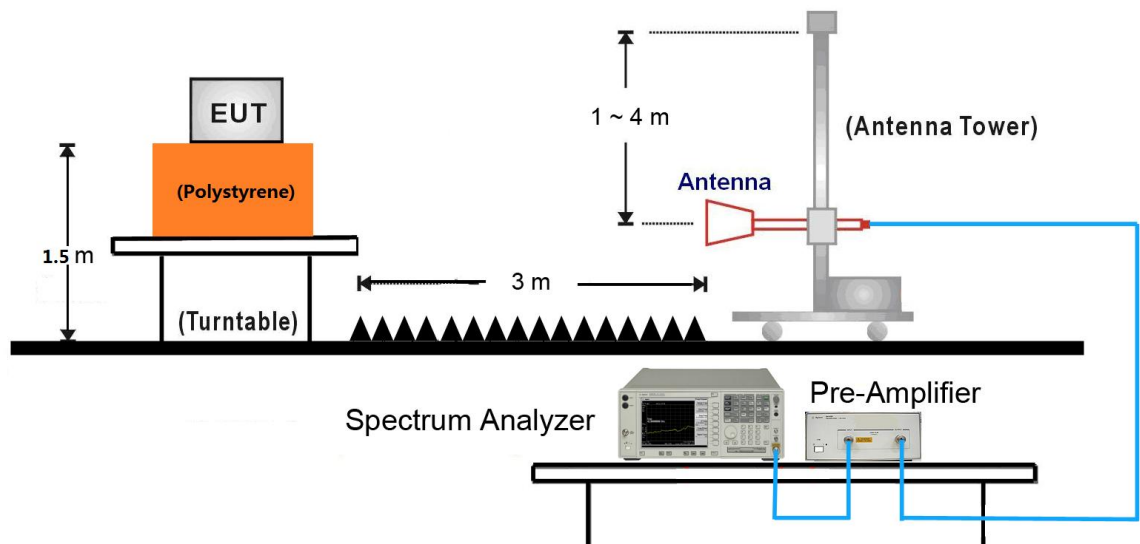
### 6.2.3. Test Setup

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.231(e) and FCC Part 15.209 Limit.

#### 30MHz ~ 1GHz Test Setup:



#### 1GHz ~ 25GHz Test Setup:



#### 6.2.4. Test Results

Site: AC1	Time: 2016/08/07 - 15:13
Limit: FCC_Part15.209_RE(3m)	Engineer: Roy Cheng
Probe: VULB9162_0.03-8GHz	Polarity: Horizontal
EUT: Tire Pressure Monitoring System Sensor	Power: By Battery
Mode 1: Transmit with ASK Mode	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Ant Pos (cm)	Table Pos (deg)	Type
1	434.005	61.895	17.427	N/A	79.322	92.872	-13.550	100	113	PK
	434.005	61.895	17.427	-17.59	61.732	72.872	-11.140	100	113	AV
2	868.080	15.602	23.890	N/A	39.492	72.872	-33.380	100	172	PK
	868.080	15.602	23.890	-17.59	21.902	52.872	-30.970	100	172	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

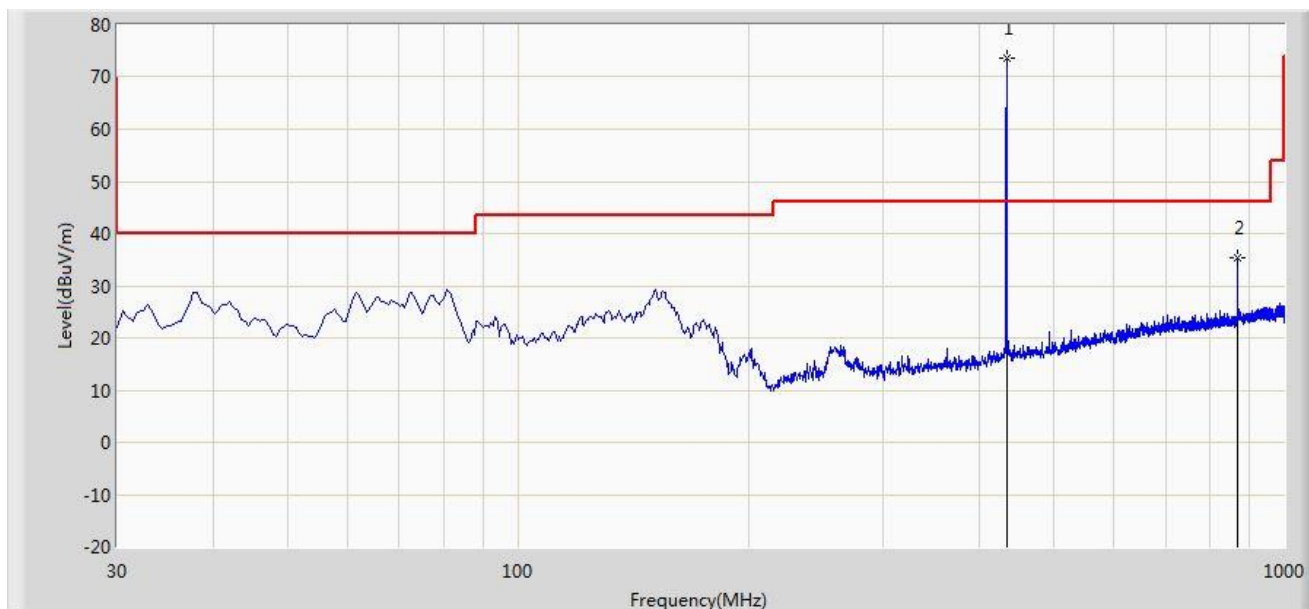
Note 2: The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.92MHz.

Note 3: Peak Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB).

AV Measure Level = Peak Measure Level – Duty Cycle Factor.

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

Site: AC1	Time: 2016/08/07 - 15:32
Limit: FCC_Part15.209_RE(3m)	Engineer: Roy Cheng
Probe: VULB9162_0.03-8GHz	Polarity: Vertical
EUT: Tire Pressure Monitoring System Sensor	Power: By Battery
Note: Transmit with ASK Mode	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	DutyCycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Ant Pos (cm)	Table Pos (deg)	Type
1	434.005	56.131	17.427	N/A	73.558	92.872	-19.314	100	111	PK
	434.005	56.131	17.427	-17.59	55.968	72.872	-16.904	100	111	AV
2	868.080	11.397	23.890	N/A	35.287	72.872	-37.585	100	175	PK
	868.080	11.397	23.890	-17.59	17.697	52.872	-35.175	100	175	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

Note 2: The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.92MHz.

Note 3: Peak Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB).

AV Measure Level = Peak Measure Level – Duty Cycle Factor.

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

Site: AC1	Time: 2016/08/07 - 15:14
Limit: FCC_Part15.209_RE(3m)	Engineer: Roy Cheng
Probe: VULB9162_0.03-8GHz	Polarity: Horizontal
EUT: Tire Pressure Monitoring System Sensor	Power: By Battery
Note: Transmit with FSK Mode	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Duty Cycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Ant Pos (cm)	Table Pos (deg)	Type
1	434.005	45.182	17.427	N/A	62.609	92.872	-30.263	100	111	PK
	434.005	45.182	17.427	-20.83	41.779	72.872	-31.093	100	111	AV
2	868.080	22.127	11.071	N/A	33.198	72.872	-39.674	100	175	PK
	868.080	22.127	11.071	-20.83	12.368	52.872	-40.504	100	175	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

Note 2: The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.92MHz.

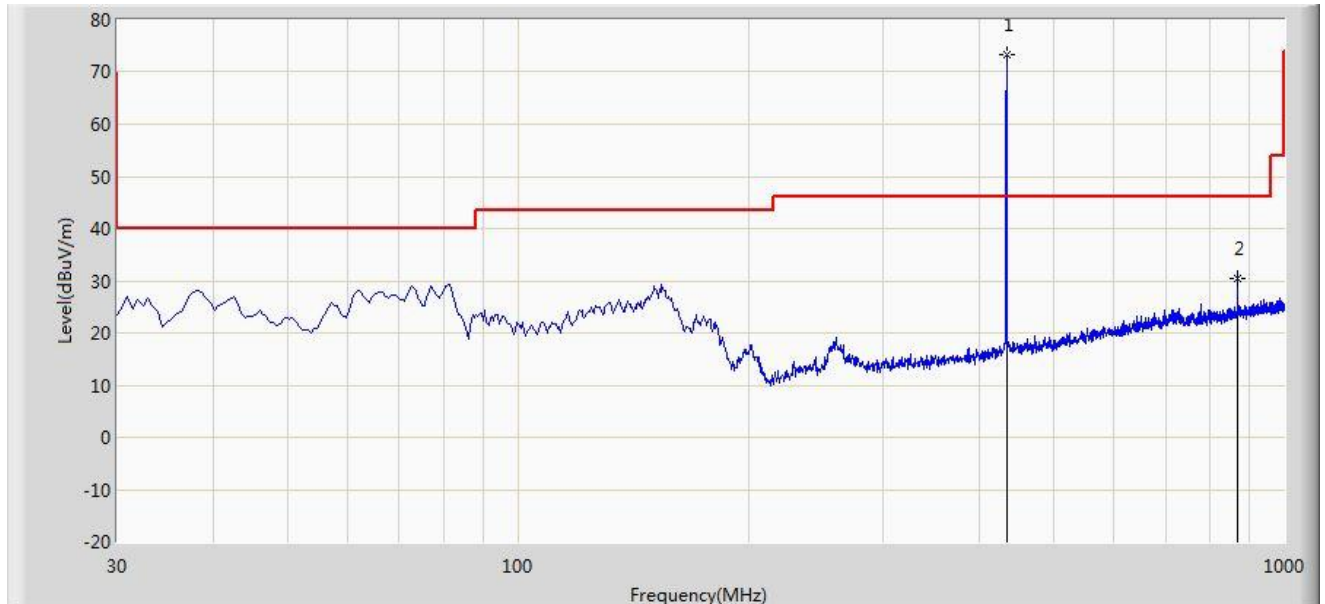
Note 3: Peak Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB).

AV Measure Level = Peak Measure Level – Duty Cycle Factor.

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



Site: AC1	Time: 2016/08/07 - 15:44
Limit: FCC_Part15.209_RE(3m)	Engineer: Roy Cheng
Probe: VULB9162_0.03-8GHz	Polarity: Vertical
EUT: Tire Pressure Monitoring System Sensor	Power: By Battery
Note: Transmit with FSK Mode	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	DutyCycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Ant Pos (cm)	Table Pos (deg)	Type
1	434.005	55.885	17.427	N/A	73.312	92.872	-19.560	100	103	PK
	434.005	55.885	17.427	-20.83	52.482	72.872	-20.390	100	103	AV
2	868.080	6.488	23.890	N/A	30.378	72.872	-42.494	100	181	PK
	868.080	6.488	23.890	-20.83	9.548	52.872	-43.324	100	181	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

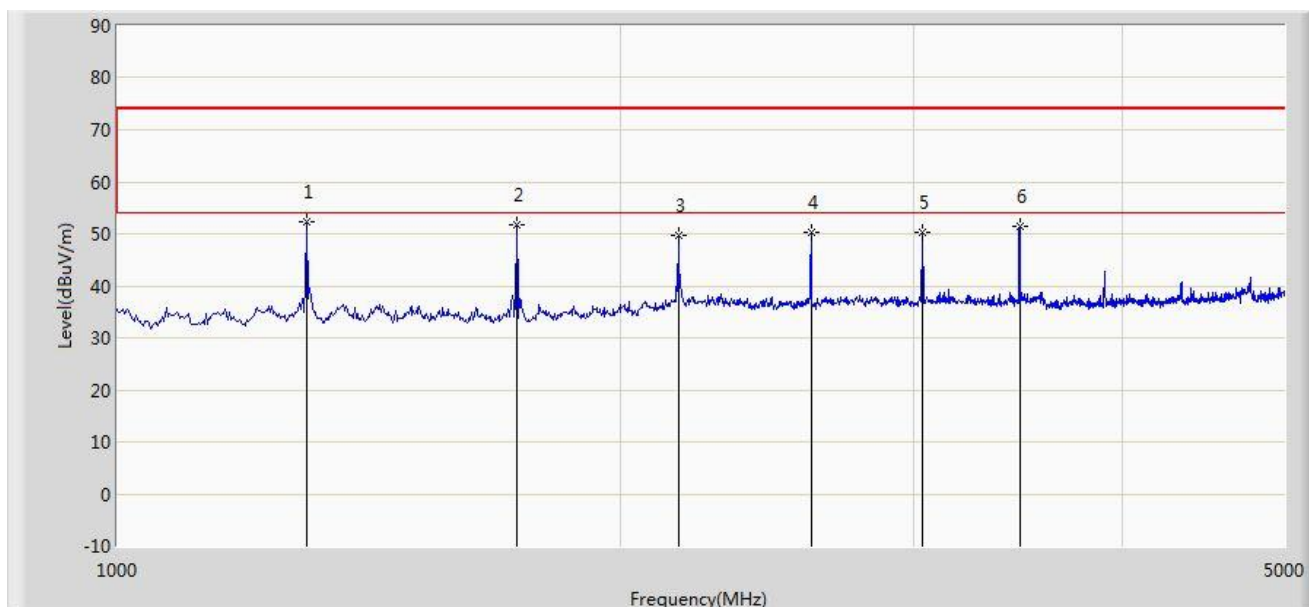
Note 2: The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.92MHz.

Note 3: Peak Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB).

AV Measure Level = Peak Measure Level – Duty Cycle Factor.

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

Site: AC1	Time: 2016/08/07 - 16:08
Limit: FCC_Part15.209_RE(3m)	Engineer: Roy Cheng
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Tire Pressure Monitoring System Sensor	Power: By Battery
Note: Transmit with ASK Mode	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Dutycycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Ant Pos (cm)	Table Pos (deg)	Type
1	1735.000	54.862	-7.319	N/A	47.543	74	-26.457	100	112	PK
	1735.000	54.862	-7.319	-17.59	29.953	54	-24.047	100	112	AV
2	2170.000	48.127	-3.940	N/A	44.187	74	-29.813	100	159	PK
	2170.000	48.127	-3.940	-17.59	26.597	54	-27.403	100	159	AV
3	3037.500	48.478	-2.042	N/A	46.436	74	-27.564	100	77	PK
	3037.500	48.478	-2.042	-17.59	28.846	54	-25.154	100	77	AV
4	3472.500	54.090	-1.284	N/A	52.806	74	-21.194	100	236	PK
	3472.500	54.090	-1.284	-17.59	35.216	54	-18.784	100	236	AV
5	3905.000	52.365	0.208	N/A	52.573	74	-21.427	100	330	PK
	3905.000	52.365	0.208	-17.59	34.983	54	-19.017	100	330	AV
6	4340.000	51.686	1.286	N/A	52.972	74	-21.028	100	171	PK
	4340.000	51.686	1.286	-17.59	35.382	54	-18.618	100	171	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

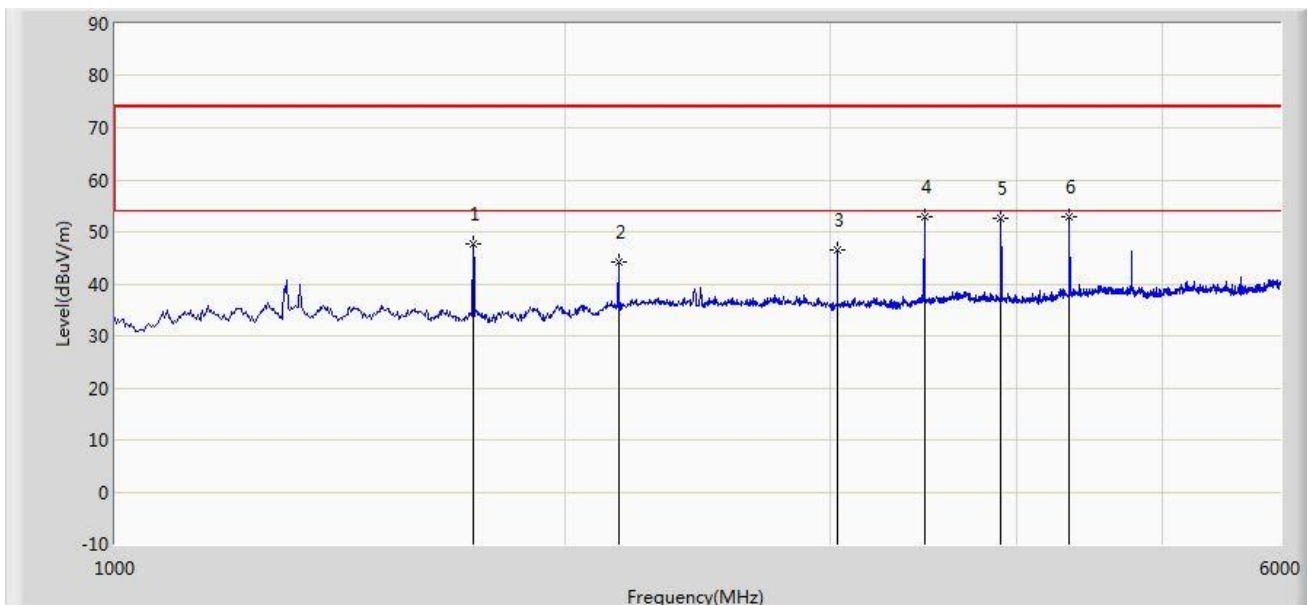
Note 2: The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.92MHz.

Note 3: Peak Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB).

AV Measure Level = Peak Measure Level – Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) – Pre\_Amplifier Gain (dB).

Site: AC1	Time: 2016/08/07 - 16:29
Limit: FCC_Part15.209_RE(3m)	Engineer: Roy Cheng
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Tire Pressure Monitoring System Sensor	Power: By Battery
Note: Transmit with ASK Mode	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Dutycycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Ant Pos (cm)	Table Pos (deg)	Type
1	1735.000	46.020	-7.319	N/A	38.701	74	-35.299	100	117	PK
	1735.000	46.020	-7.319	-17.59	21.111	54	-32.889	100	117	AV
2	2440.000	50.087	-3.789	N/A	46.298	74	-27.702	100	38	PK
	2440.000	50.087	-3.789	-17.59	28.708	54	-25.292	100	38	AV
3	3037.500	43.123	-2.042	N/A	41.081	74	-32.919	100	79	PK
	3037.500	43.123	-2.042	-17.59	23.491	54	-30.509	100	79	AV
4	3472.500	48.511	-1.284	N/A	47.227	74	-26.773	100	239	PK
	3472.500	48.511	-1.284	-17.59	29.637	54	-24.363	100	239	AV
5	3905.000	42.327	0.208	N/A	42.535	74	-31.465	100	328	PK
	3905.000	42.327	0.208	-17.59	24.945	54	-29.055	100	328	AV
6	4340.000	48.042	1.286	N/A	49.328	74	-24.672	100	168	PK
	4340.000	48.042	1.286	-17.59	31.738	54	-22.262	100	168	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

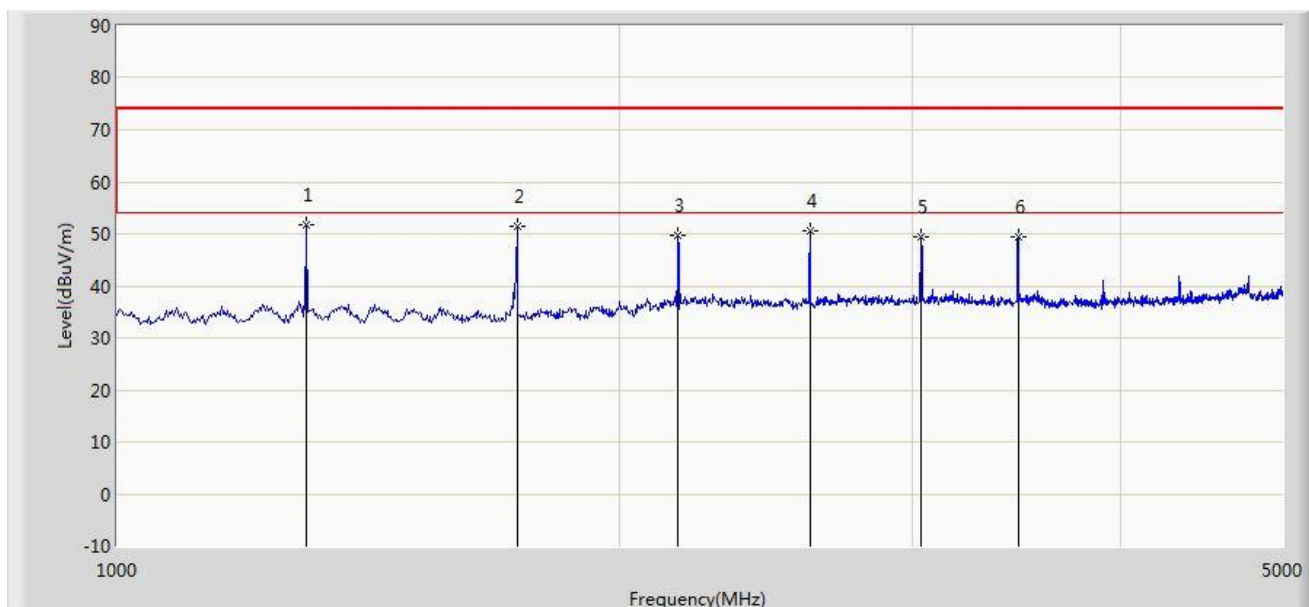
Note 2: The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.92MHz.

Note 3: Peak Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB).

AV Measure Level = Peak Measure Level – Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) – Pre\_Amplifier Gain (dB).

Site: AC1	Time: 2016/08/07 - 16:37
Limit: FCC_Part15.209_RE(3m)	Engineer: Roy Cheng
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Tire Pressure Monitoring System Sensor	Power: By Battery
Note: Transmit with FSK Mode	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Dutycycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Ant Pos (cm)	Table Pos (deg)	Type
1	1302.500	51.034	-8.229	N/A	42.805	74	-31.195	100	54	PK
	1302.500	51.034	-8.229	-20.83	21.975	54	-32.025	100	54	AV
2	1735.000	49.032	-7.319	N/A	41.713	74	-32.287	100	115	PK
	1735.000	49.032	-7.319	-20.83	20.883	54	-33.117	100	115	AV
3	2170.000	48.325	-3.940	N/A	44.385	74	-29.615	100	155	PK
	2170.000	48.325	-3.940	-20.83	23.555	54	-30.445	100	155	AV
4	3037.500	49.142	-2.042	N/A	47.100	74	-26.900	100	83	PK
	3037.500	49.142	-2.042	-20.83	26.270	54	-27.730	100	83	AV
5	3470.000	53.728	-1.300	N/A	52.428	74	-21.572	100	211	PK
	3470.000	53.728	-1.300	-20.83	31.598	54	-22.402	100	211	AV
6	4337.500	58.796	1.281	N/A	60.077	74	-13.923	100	172	PK
	4337.500	58.796	1.281	-20.83	39.247	54	-14.753	100	172	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

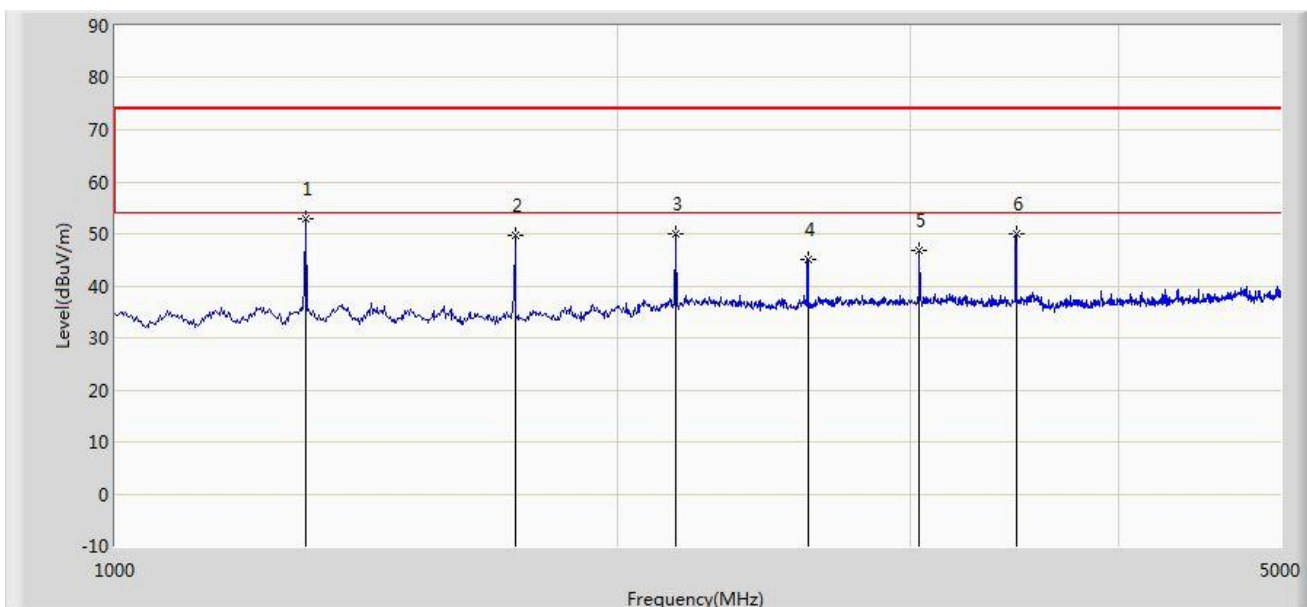
Note 2: The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.92MHz.

Note 3: Peak Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB).

AV Measure Level = Peak Measure Level – Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) – Pre\_Amplifier Gain (dB).

Site: AC1	Time: 2016/08/07 - 16:45
Limit: FCC_Part15.209_RE(3m)	Engineer: Roy Cheng
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Tire Pressure Monitoring System Sensor	Power: By Battery
Note: Transmit with FSK Mode	



No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	Dutycycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Ant Pos (cm)	Table Pos (deg)	Type
1	1302.500	51.034	-8.229	N/A	42.805	74	-31.195	100	56	PK
	1302.500	51.034	-8.229	-20.83	21.975	54	-32.025	100	56	AV
2	2440.000	49.032	-3.789	N/A	45.243	74	-28.757	100	41	PK
	2440.000	49.032	-3.789	-20.83	24.413	54	-29.587	100	41	AV
3	3037.500	48.325	-2.042	N/A	46.283	74	-27.717	100	88	PK
	3037.500	48.325	-2.042	-20.83	25.453	54	-28.547	100	88	AV
4	3470.000	49.142	-1.300	N/A	47.842	74	-26.158	100	209	PK
	3470.000	49.142	-1.300	-20.83	27.012	54	-26.988	100	209	AV
5	4340.000	53.728	1.286	N/A	55.014	74	-18.986	100	168	PK
	4340.000	53.728	1.286	-20.83	34.184	54	-19.816	100	168	AV
6	4772.500	58.796	2.638	N/A	61.434	74	-12.566	100	211	PK
	4772.500	58.796	2.638	-20.83	40.604	54	-13.396	100	211	AV

Note 1: Testing is carried out with frequency rang 9 kHz to the tenth harmonics. There is the ambient noise within frequency range 9 kHz ~ 30 MHz, the permissible value is not show in the report.

Note 2: The fundamental frequency is 433.92MHz, so the fundamental and spurious emissions radiated limit base on the operating frequency 433.92MHz.



Note 3: Peak Measure Level (dB $\mu$ V/m) = Reading Level (dB $\mu$ V) + Factor (dB).

AV Measure Level = Peak Measure Level – Duty Cycle Factor.

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) – Pre\_Amplifier Gain (dB).

### 6.3. 20dB Bandwidth

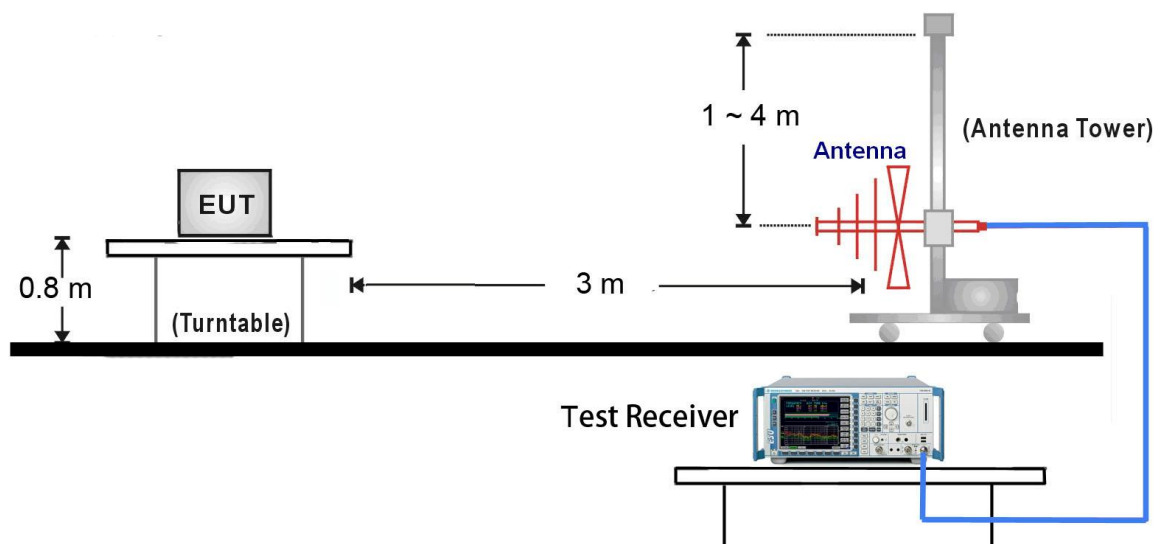
#### 6.3.1. Standard Applicable

According to FCC Part 15.231(c), the bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

#### 6.3.2. Test Procedure

With the EUT's antenna attached, the EUT's 20dB Bandwidth power was received by the test antenna, which was connected to the spectrum analyzer with the START, and STOP frequencies set to the EUT's operation band.

#### 6.3.3. Test Setup

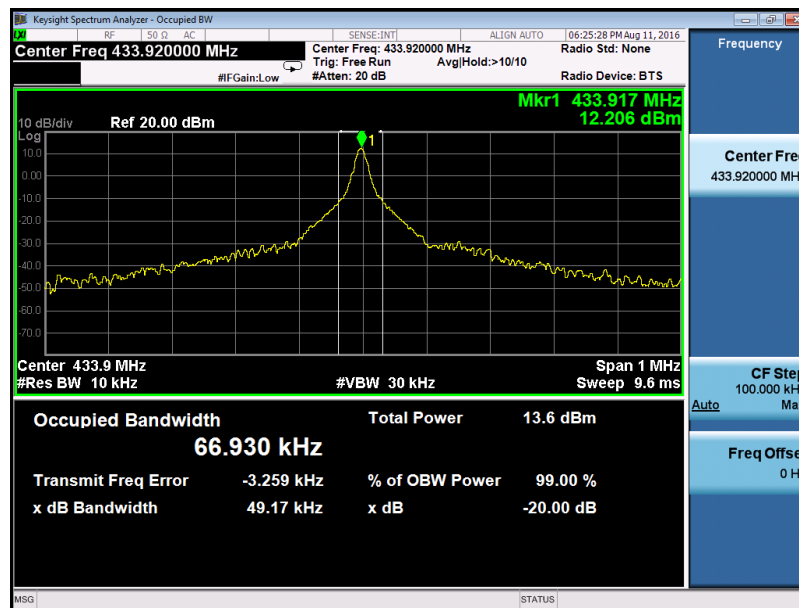


### 6.3.4. Test Result

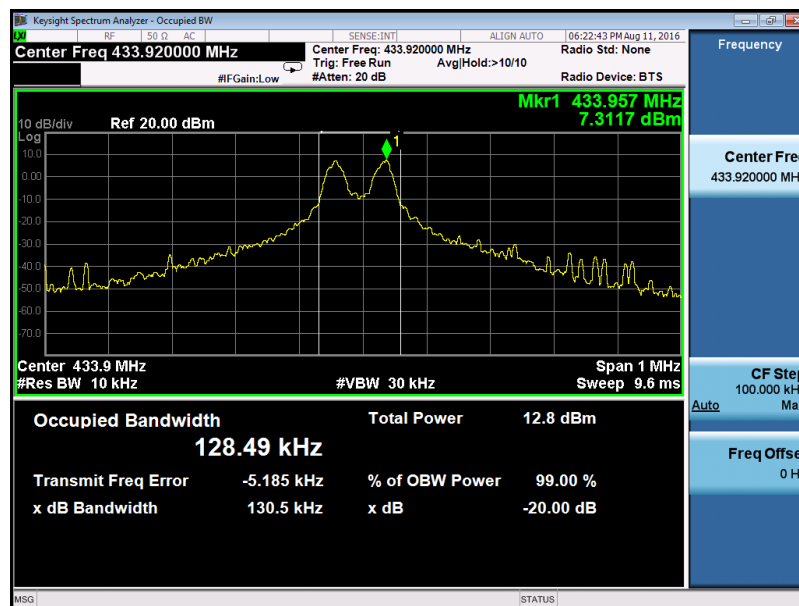
Test Frequency (MHz)	Modulation Type	20dB Bandwidth (KHz)	Limit (KHz)	Result
433.92	ASK	49.17	≤ 1084.8	Pass
	FSK	130.50	≤ 1084.8	Pass

Limit = Fundamental Frequency \* 0.25% = 433.92 MHz \* 0.25% = 1084.8 kHz

20dB Bandwidth Test Plot for ASK



20dB Bandwidth Test Plot for FSK



## 6.4. Transmission Time

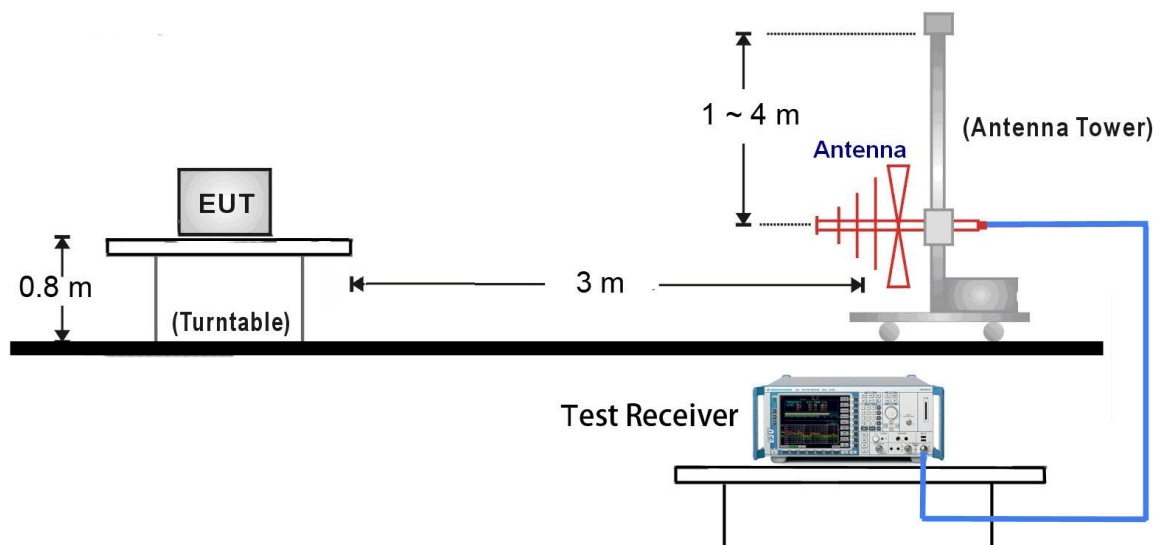
### 6.4.1. Standard Applicable

According to FCC 15.231(e), 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.

### 6.4.2. Test Procedure

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.92MHz, then set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

### 6.4.3. Test Setup

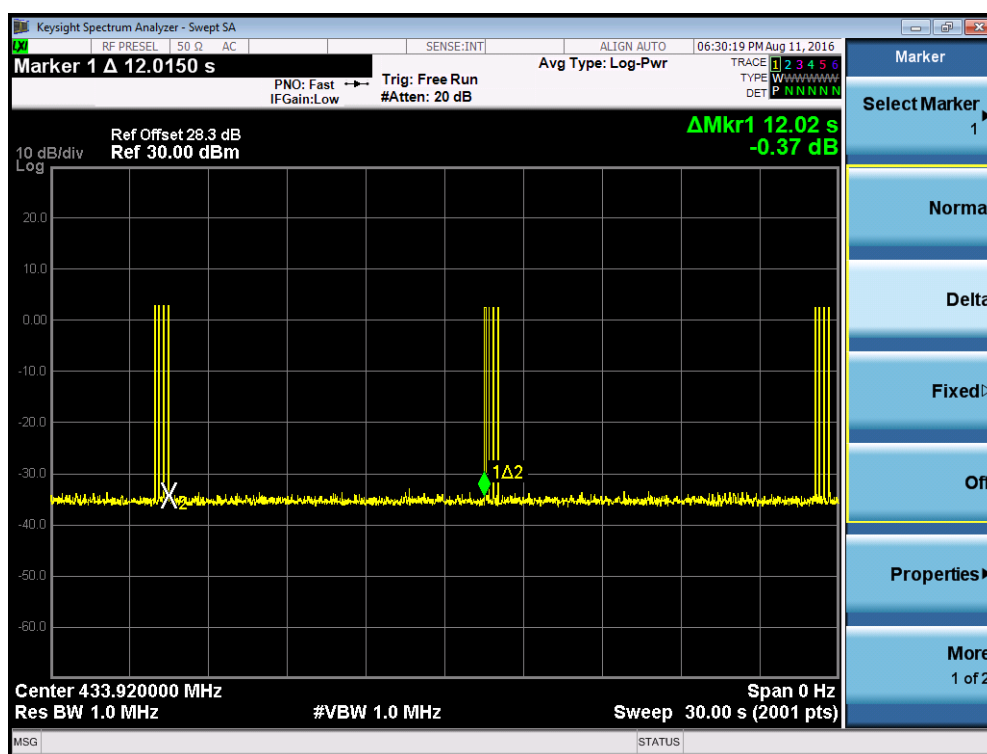


#### 6.4.4. Test Result

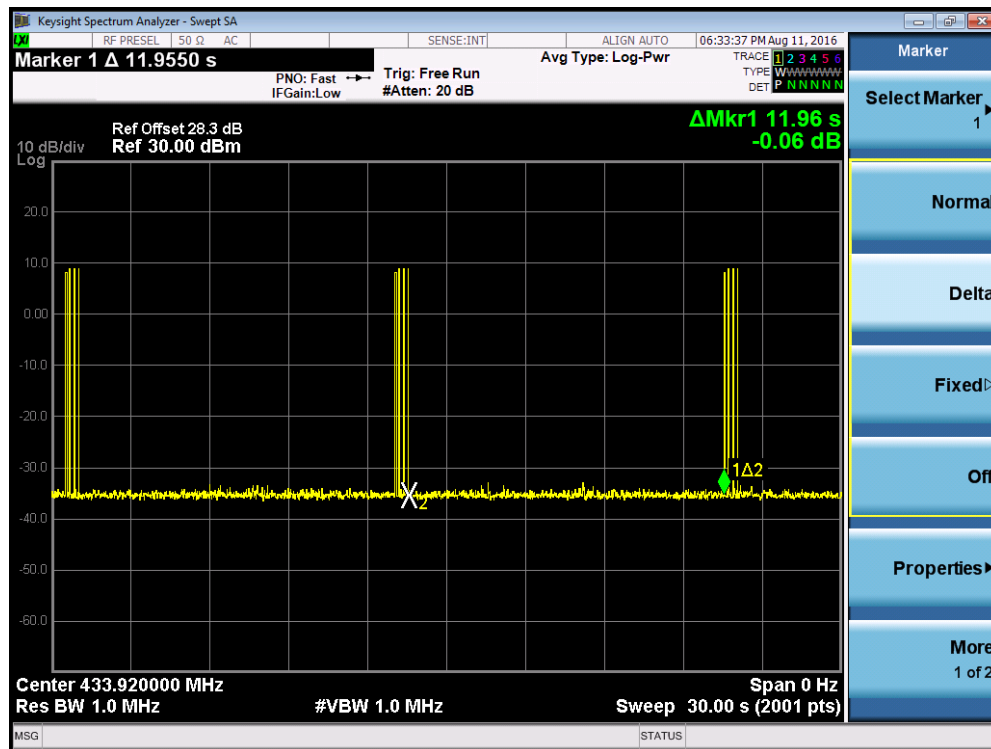
Modulation Type	Item	Measured Value	Limit	Result
ASK	Transmission Time( $T_{on}$ )	0.013 s	$\leq 1$ s	Pass
	Silent Time	12.02 s	$\geq 10$ s	Pass
	Silent Time/Transmission Time	924.6	$\geq 30$ times	Pass
FSK	Transmission Time( $T_{on}$ )	0.009 s	$\leq 1$ s	Pass
	Silent Time	11.96 s	$\geq 10$ s	Pass
	Silent Time/Transmission Time	1328.9	$\geq 30$ times	Pass

Note: For ASK Modulation, Transmission time ( $T_{on}$ ) (ms) =  $55 * 0.188$  (ms) +  $12 * 0.238$  = 13.20 (ms)

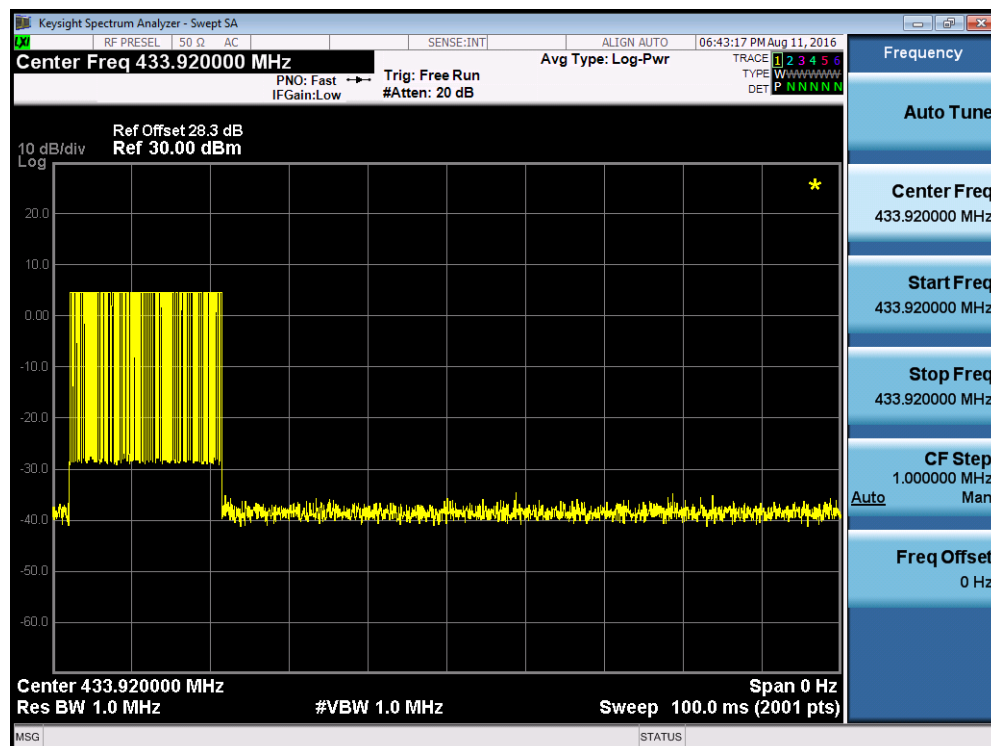
#### Silent Time for ASK

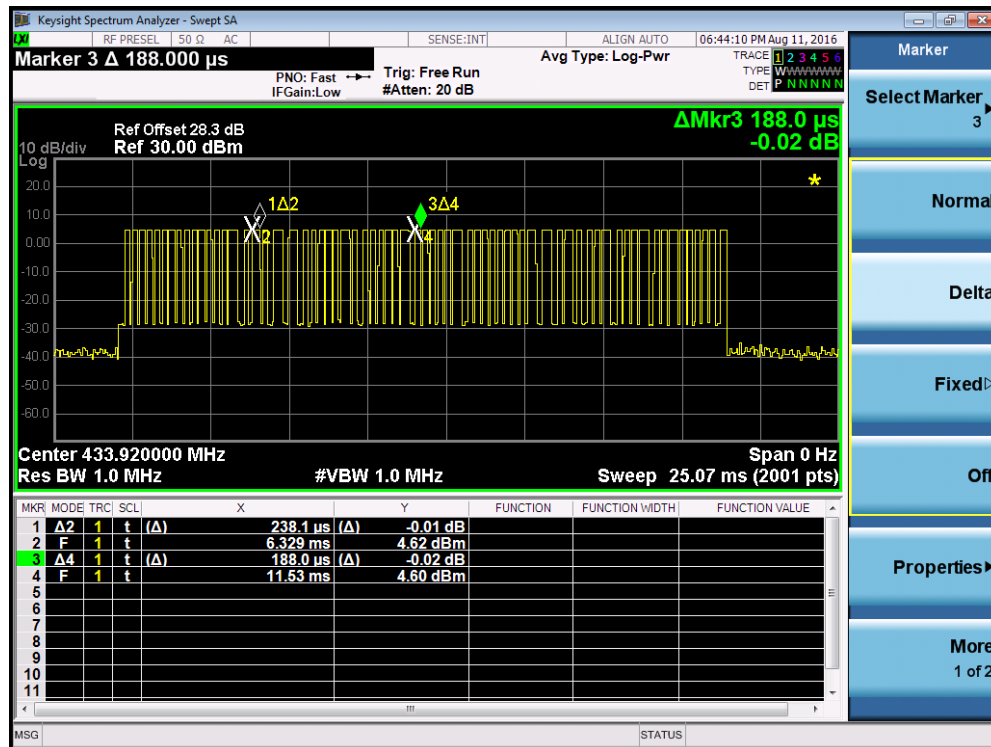


### Silent Time for FSK

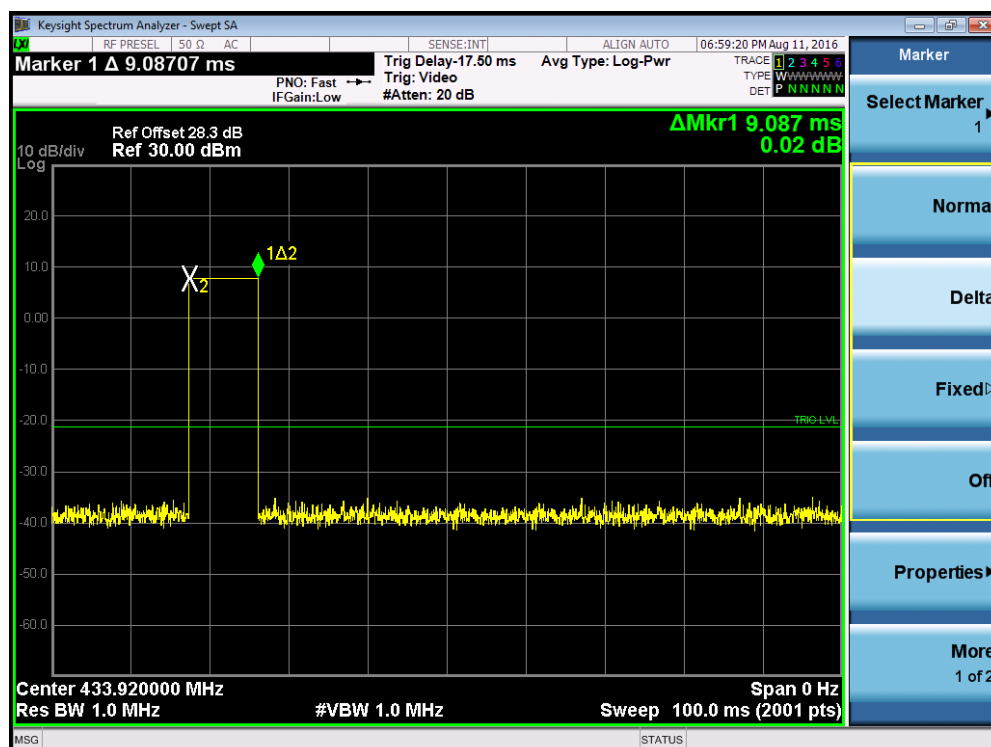


### Transmission Time for ASK





### Transmission Time for FSK



## 6.5. Duty Cycle

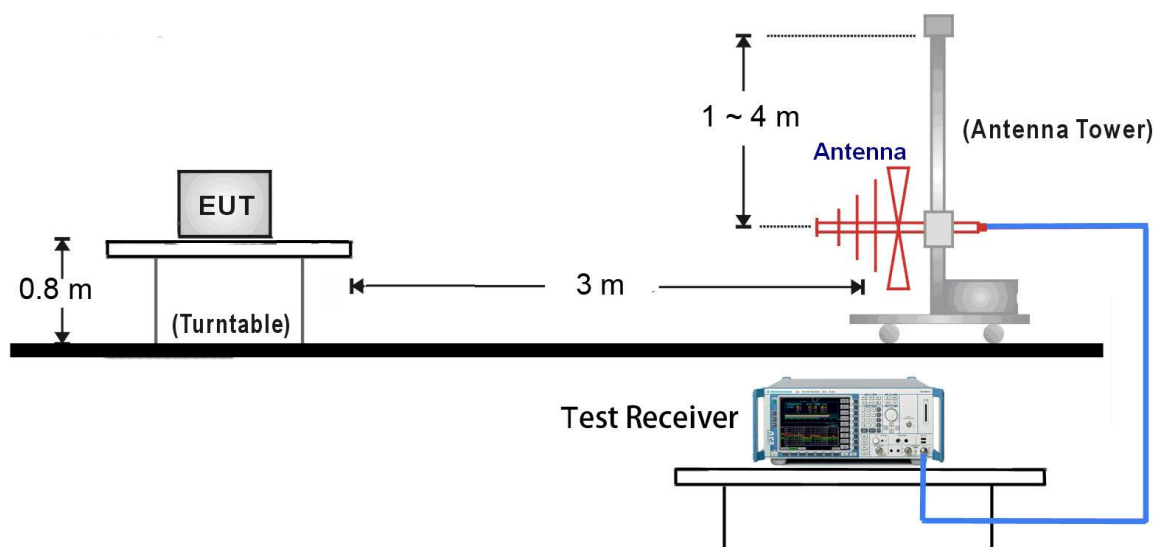
### 6.5.1. Standard Applicable

According to FCC Part 15.231(e) and 15.35(c), for pulse operation transmitter, the averaging pulsed emissions are calculated by peak value of measured emission plus duty cycle factor.

### 6.5.2. Test Procedure

With the EUT's antenna attached, the EUT's output signal was received by the test antenna, which was connected to the spectrum analyzer. Set the center frequency to 433.92MHz, then set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

### 6.5.3. Test Setup





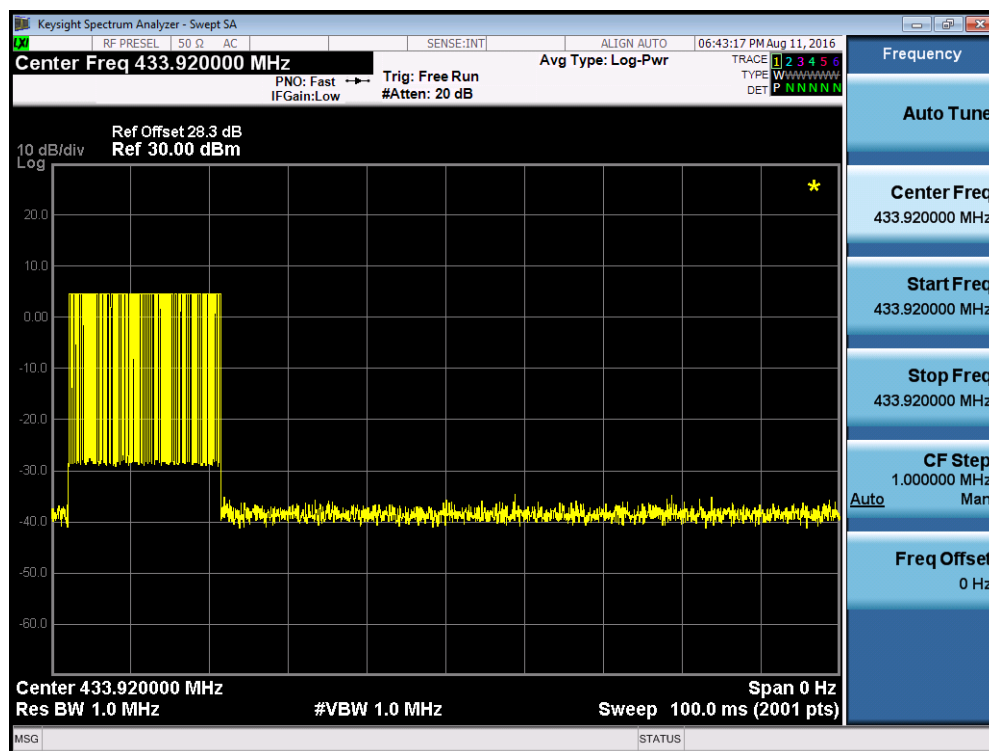
#### 6.5.4. Test Result

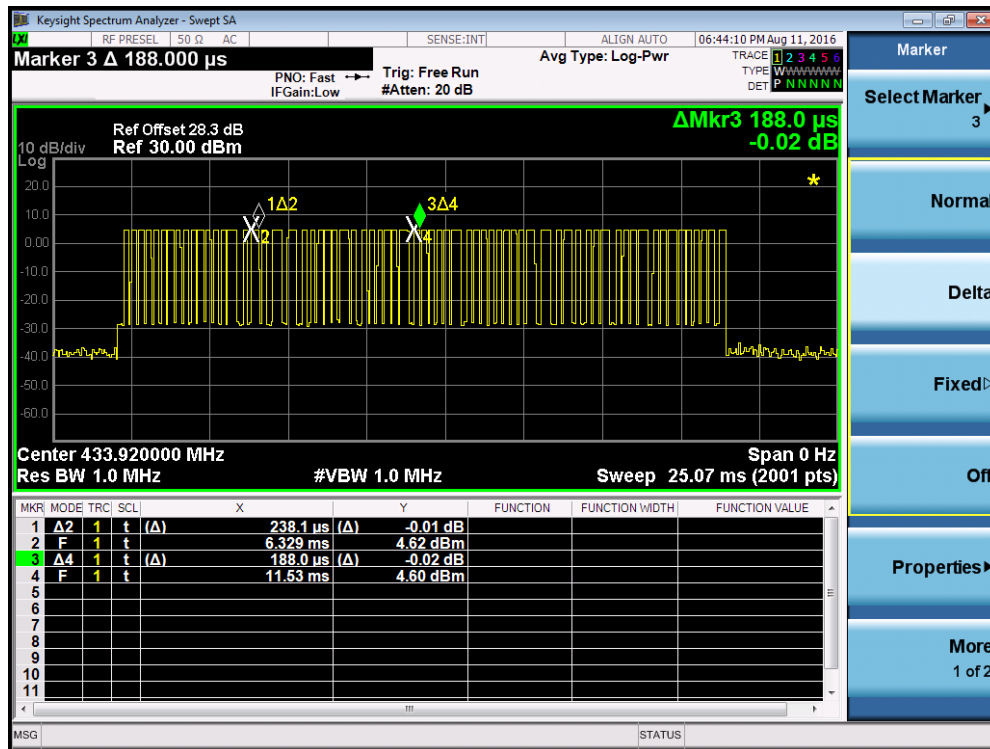
Modulation Type	Total Time ( $T_{on}$ ) (ms)	The duration of one cycle (ms)	Duty Cycle (%)	Duty Cycle Factor (dB)
ASK	13.20	100	13.20	-17.59
FSK	9.09	100	9.09	-20.83

Note 1: Duty Cycle Factor =  $-20 \cdot \log(1/\text{Duty Cycle})$ .

Note 2: For ASK Modulation, Total time ( $T_{on}$ ) (ms) =  $55 \cdot 0.188 \text{ (ms)} + 12 \cdot 0.238 = 13.20 \text{ (ms)}$

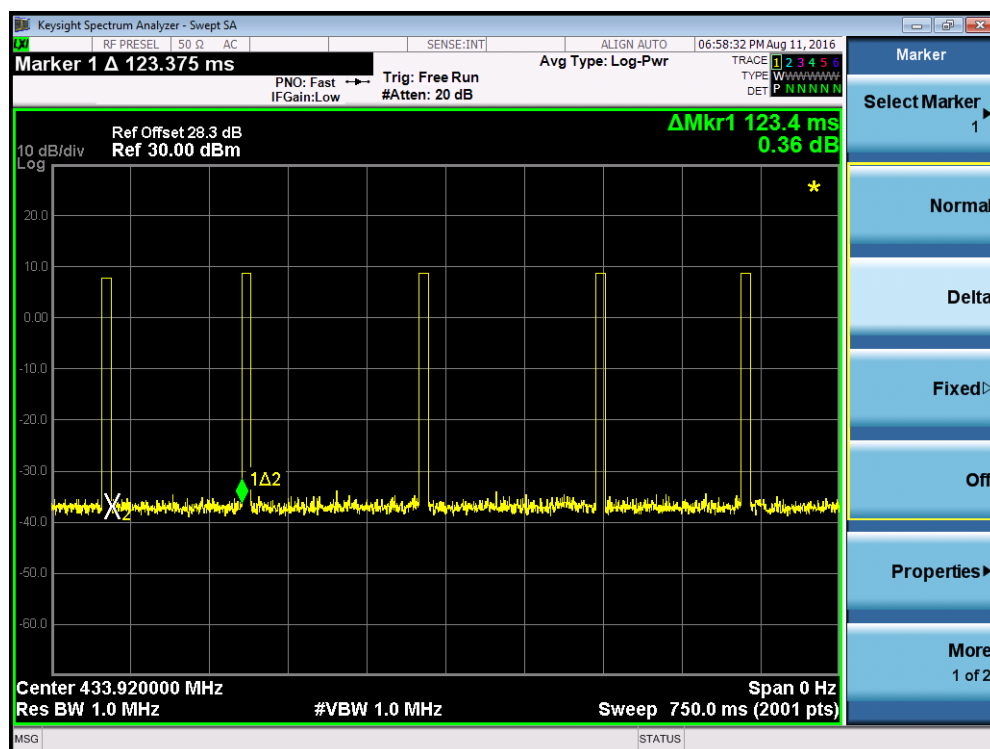
Width of Pulse for ASK





The screenshot displays a Keysight Spectrum Analyzer interface. The main plot area shows a frequency spectrum with a yellow trace. A green horizontal line indicates the reference level (Ref) at -20 dBm. A yellow marker labeled 'X<sub>2</sub>' is positioned at approximately 9.087 MHz. The vertical axis is labeled '10 dB/div' and 'Log'. The horizontal axis is labeled 'Center 433.920000 MHz' and 'Span 0 Hz'. The resolution bandwidth (Res BW) is set to 1.0 MHz, and the sweep time is 100.0 ms. The average type is Log-Pwr. The trigger delay is 17.50 ms, and the trigger source is Video. The attenuation (#Atten) is 20 dB. The PNO is Fast, and the IF Gain is Low. The right-hand side panel contains various controls, including 'Marker', 'Select Marker', 'Normal', 'Delta', 'Fixed', 'Off', 'Properties', and 'More'.

Parameter	Value
Marker 1	$\Delta$ 9.08707 ms
Trig Delay	17.50 ms
Avg Type	Log-Pwr
PNO	Fast
IFGain	Low
#Atten	20 dB
Ref Offset	28.3 dB
Ref	30.00 dBm
$\Delta$ Mkr1	9.087 ms
	0.02 dB
Center Frequency	433.920000 MHz
Res BW	1.0 MHz
Sweep	100.0 ms (2001 pts)
Span	0 Hz



## 7. CONCLUSION

The data collected relate only the item(s) tested and show that the **Tire Pressure Monitoring System Sensor FCC ID: TTETSB23-RE** is in compliance with FCC Part 15.231(e) of the FCC Rules.