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Report No.: 1411RSU00101
Report Version: V02
Issue Date: 11-18-2014

MEASUREMENT REPORT

FCC PART 15.231(e)

FCC ID:	2ADK9TP200
APPLICANT:	Shenzhen Carmate Electronic Technology Co., Ltd.
Application Type:	Certification
Product:	Tyre Pressure Monitoring System
Model No.:	TP200, TP100, TP300
FCC Classification:	FCC Part 15 Security/Remote Control Transmitter(DSC)
FCC Rule Part(s):	Part 15.231(e)
Test Procedure(s):	ANSI C63.10-2009
Test Date:	Nov. 10 ~ 17, 2014

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 C63.10-2009. Test results reported herein relate only to the item(s) tested.

Revision History

Report No.	Version	Description	Issue Date
1411RSU00101	Rev. 01	Initial report	11-17-2014
1411RSU00101	Rev. 02	Update the emission data and the transmission time plot	11-18-2014

CONTENTS

Description Page

§2.1033 General Information

Applicant:	Shenzhen Carmate Electronic Technology Co., Ltd.
Applicant Address:	3/F, Bldg 2, Hong Fa Industrial Park, Tang Tou Road, Shi Yan Town, Bao An District, Shenzhen, Guangdong, China 518108
Manufacturer:	Shenzhen Carmate Electronic Technology Co., Ltd.
Manufacturer Address:	3/F, Bldg 2, Hong Fa Industrial Park, Tang Tou Road, Shi Yan Town, Bao An District, Shenzhen, Guangdong, China 518108
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, Youxin Industrial Park, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
MRT Registration No.:	809388
FCC Rule Part(s):	Part 15.231(e)
Model No.	TP200, TP100, TP300
FCC ID:	2ADK9TP200
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ Engineering
FCC Classification:	FCC Part 15 Security/Remote Control Transmitter(DSC)
Date(s) of Test:	Nov. 11 ~ 17, 2014
Test Report S/N:	1411RSU00101

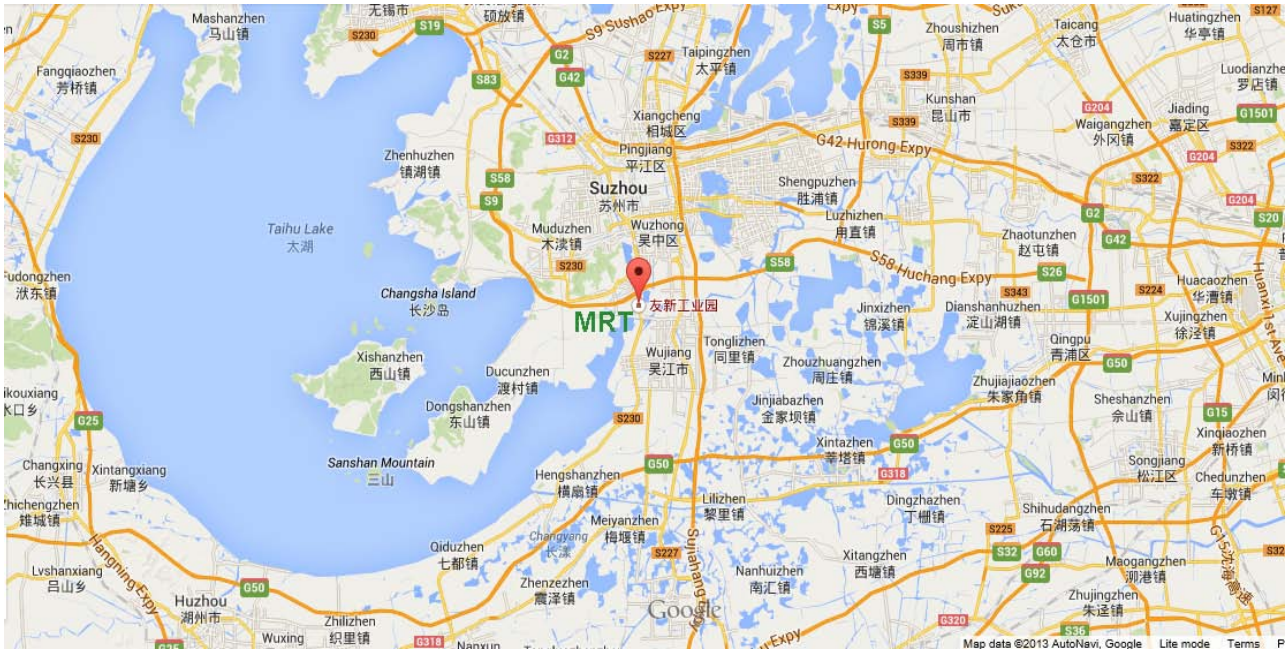
1. INTRODUCTION

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	Tyre Pressure Monitoring System
Model No.	TP200, TP100, TP300
Frequency Range	433.92 MHz
Type of modulation	FSK
Antenna Type	Integral Antenna
Device Category	Fixed Device

2.2. Test Standards

The following report is prepared on behalf of the Shenzhen Carmate Electronic Technology 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 Commissions 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 Commissions 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 C63.10-2009).

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 modulation

Special Cable List and Details			
Cable Description	Length (m)	Shielded / Unshielded	With / Without Ferrite
N/A	N/A	N/A	N/A

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
N/A	N/A	N/A	N/A

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 Tyre Pressure Monitoring System is **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The Tyre Pressure Monitoring System **FCC ID: 2ADK9TP200** unit complies with the requirement of §15.203.

4. TEST EQUIPMENT CALIBRATION DATA

Radiated Emission

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cal. Due. Date
Spectrum Analyzer	Agilent	N9010A	MY5144016A	1 year	2015/01/04
Preamplifier	MRT	AP01G18	1310002	1 year	2015/10/06
TRILOG Antenna	Schwarzbeck	VULB9162	9162-047	1 year	2015/11/08
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	9120D-1167	1 year	2015/11/08
Temperature/Humidity Meter	Anymetre	TH101B	AC1-01	1 year	2015/11/15

20dB Bandwidth

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cal. Due. Date
Spectrum Analyzer	Agilent	N9010A	MY5144016A	1 year	2015/01/04
TRILOG Antenna	Schwarzbeck	VULB9162	9162-047	1 year	2015/11/08
Temperature/Humidity Meter	Anymetre	TH101B	AC1-01	1 year	2015/11/15

Transmission Time

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cal. Due. Date
Spectrum Analyzer	Agilent	N9010A	MY5144016A	1 year	2015/01/04
TRILOG Antenna	Schwarzbeck	VULB9162	9162-047	1 year	2015/11/08
Temperature/Humidity Meter	Anymetre	TH101B	AC1-01	1 year	2015/11/15

Duty Cycle

Instrument	Manufacturer	Type No.	Serial No.	Cali. Interval	Cal. Due. Date
Spectrum Analyzer	Agilent	N9010A	MY5144016A	1 year	2015/01/04
TRILOG Antenna	Schwarzbeck	VULB9162	9162-047	1 year	2015/11/08
Temperature/Humidity Meter	Anymetre	TH101B	AC1-01	1 year	2015/11/15

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
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz ~ 1GHz: ± 4.18dB 1GHz ~ 18GHz: ± 4.76dB

6. TEST RESULT

6.1. Summary

Company Name: **Shenzhen Carmate Electronic Technology Co., Ltd.**

FCC ID: **2ADK9TP200**

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) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.

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 [1]	50 to 150 [1]
174-260	1,500	150
260-470	1,500 to 5,000 [1]	150 to 500 [1]
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.

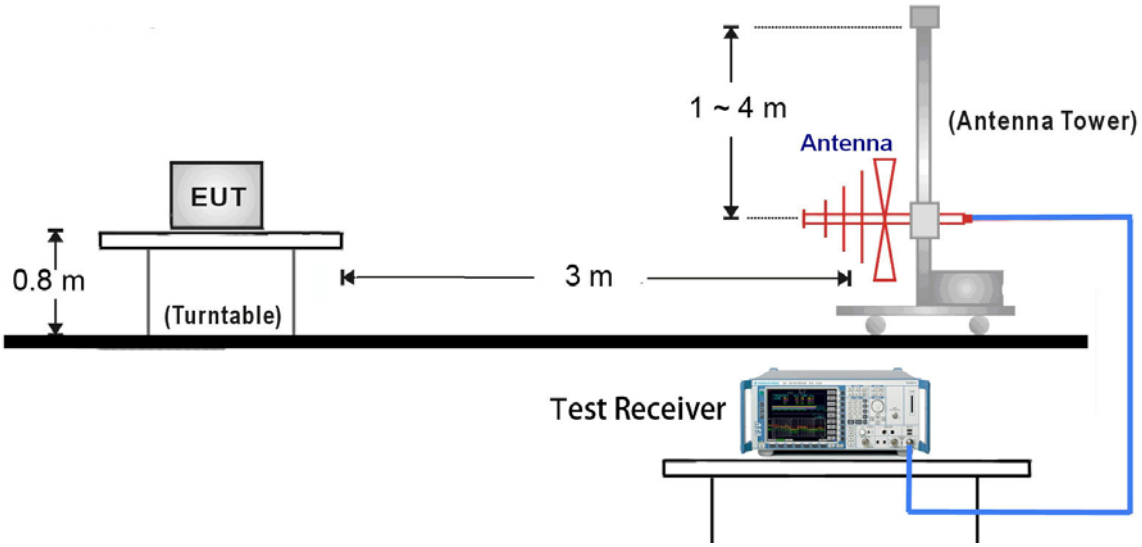
6.2.2. Test Procedure

The setup of EUT is according with per ANSI C63.10-2009 measurement procedure. The specification used was with the FCC Part 15.231(e) and FCC Part 15.209 Limit.

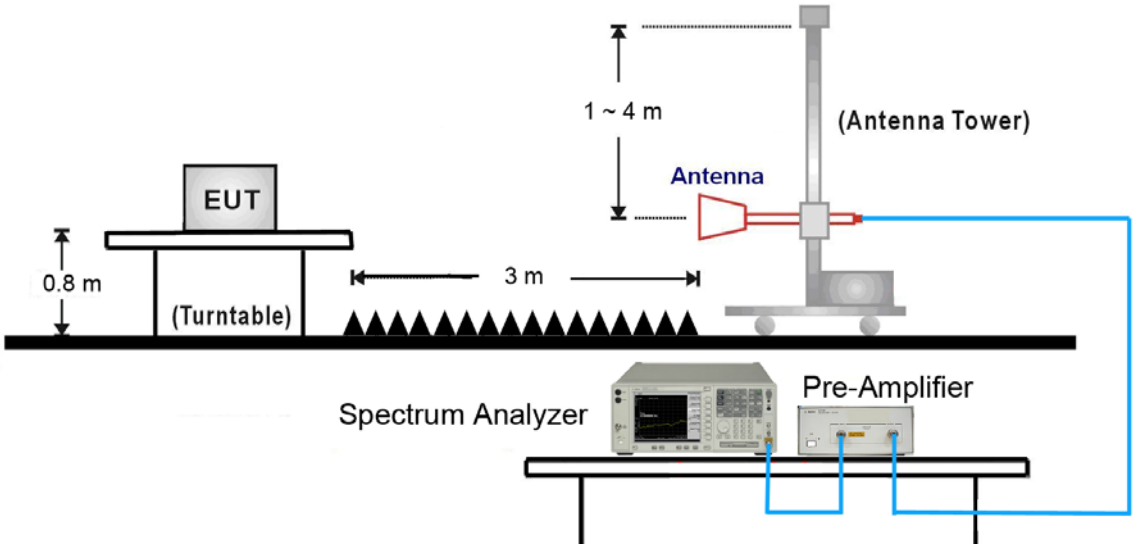
6.2.3. Test Setup

The setup of EUT is according with per ANSI C63.10-2009 measurement procedure. The specification used was with the FCC Part 15.231(e) and FCC Part 15.209 Limit.

30MHz ~ 1GHz Test Setup:

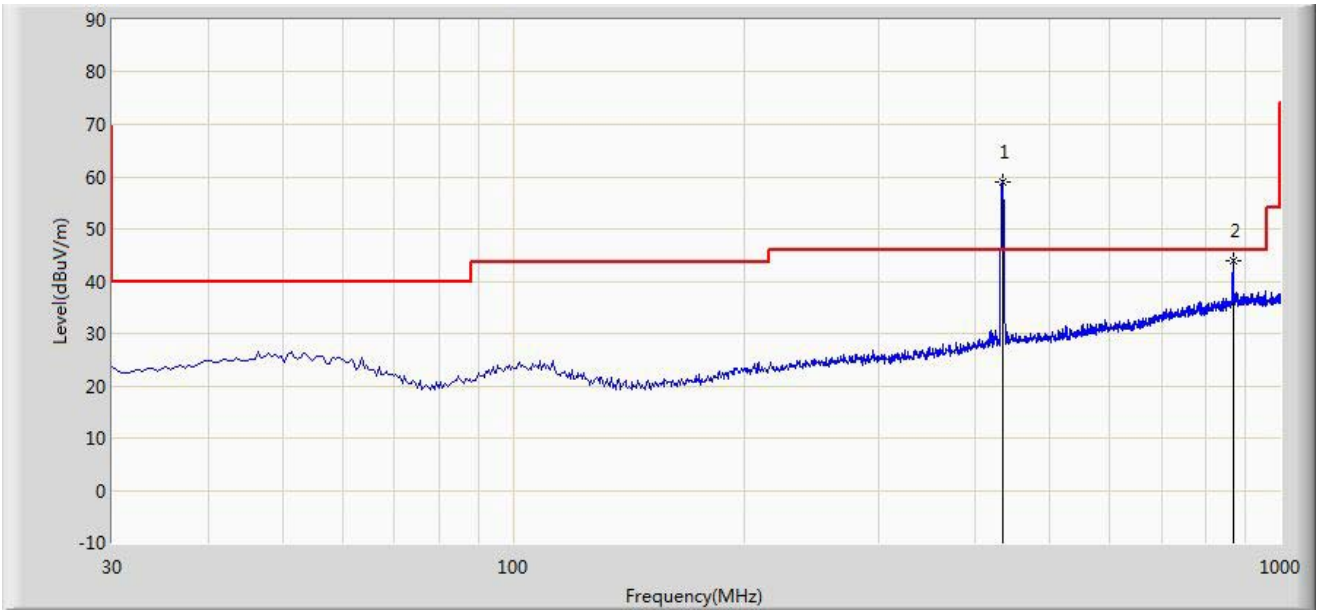


1GHz ~ 25GHz Test Setup:



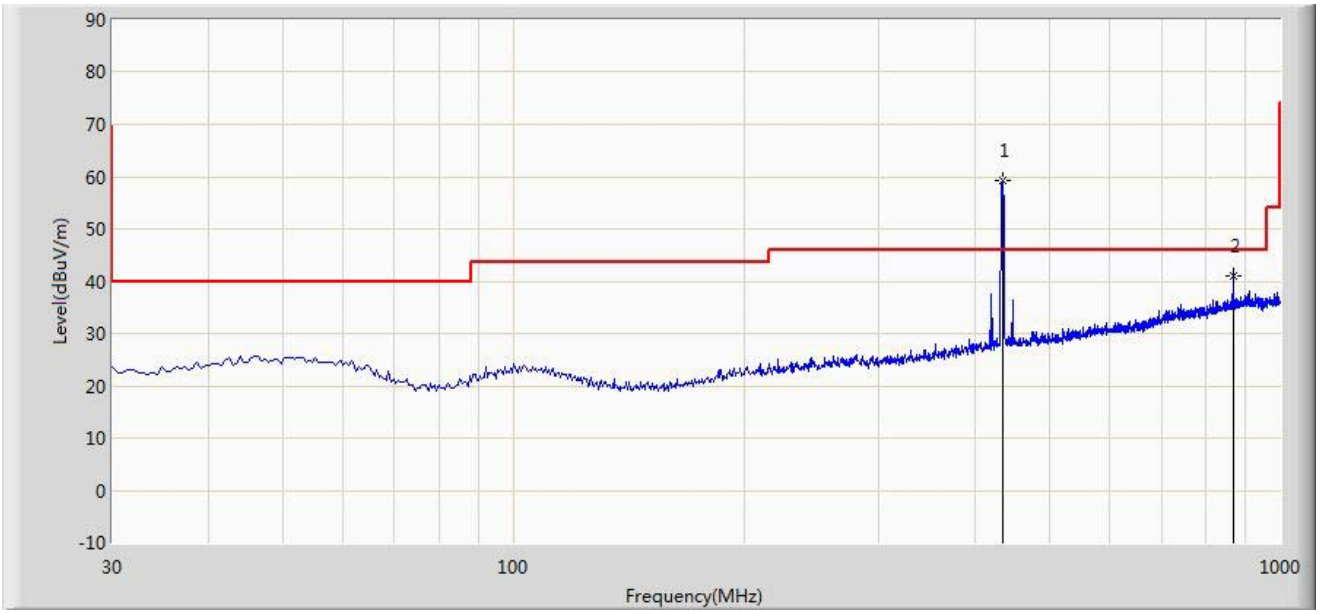
6.2.4. Test Results

Site: AC1	Time: 2014/11/15 - 16:20
Limit: FCC_Part15.209_RE(3 m)	Engineer: Roy Cheng
Probe: VULB9162_0.03-8GHz	Polarity: Horizontal
EUT: Tyre Pressure Monitoring System	Power: DC 3.0V
Note: Normal Operation	



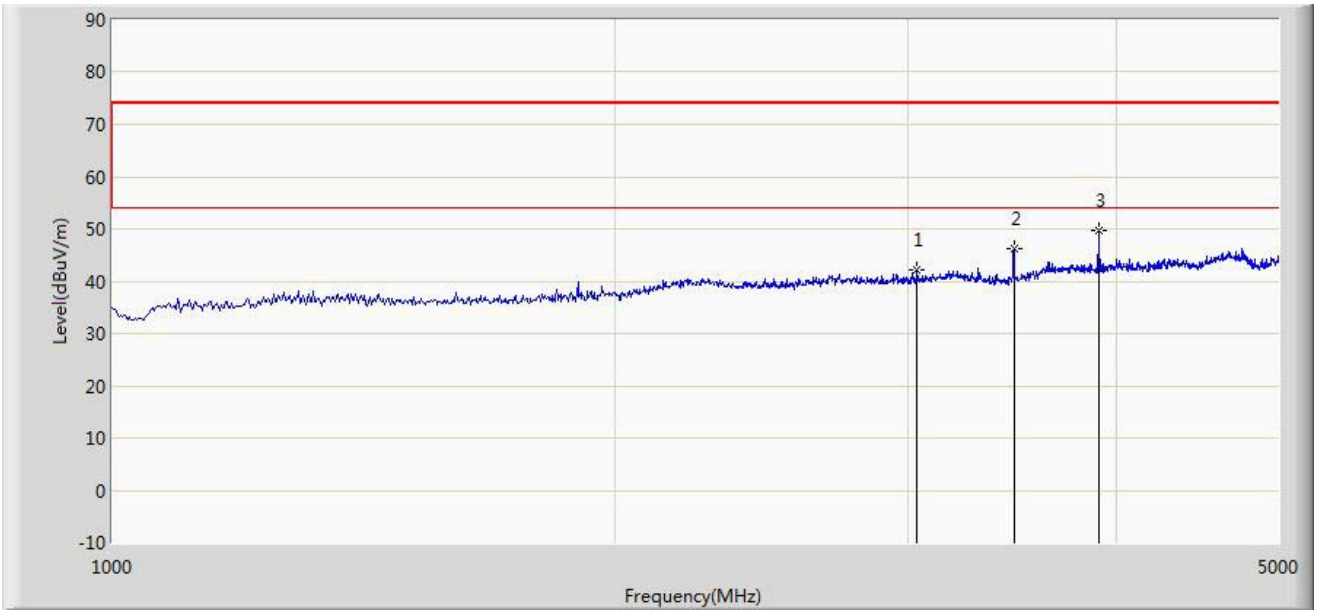
No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	DutyCycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Ant Pos (cm)	Table Pos (deg)	Type
1	433.920	42.417	16.642	N/A	59.059	92.872	-33.813	100	23	PK
	433.920	42.417	16.642	-10.46	48.599	72.872	-24.273	100	23	AV
2	867.840	20.849	23.065	N/A	43.914	72.872	-28.958	100	49	PK
	867.840	20.849	23.065	-10.46	33.454	52.872	-19.418	100	49	AV

Site: AC1	Time: 2014/11/15 - 16:20
Limit: FCC_Part15.209_RE(3 m)	Engineer: Roy Cheng
Probe: VULB9162_0.03-8GHz	Polarity: Vertical
EUT: Tyre Pressure Monitoring System	Power: DC 3.0V
Note: Normal Operation	



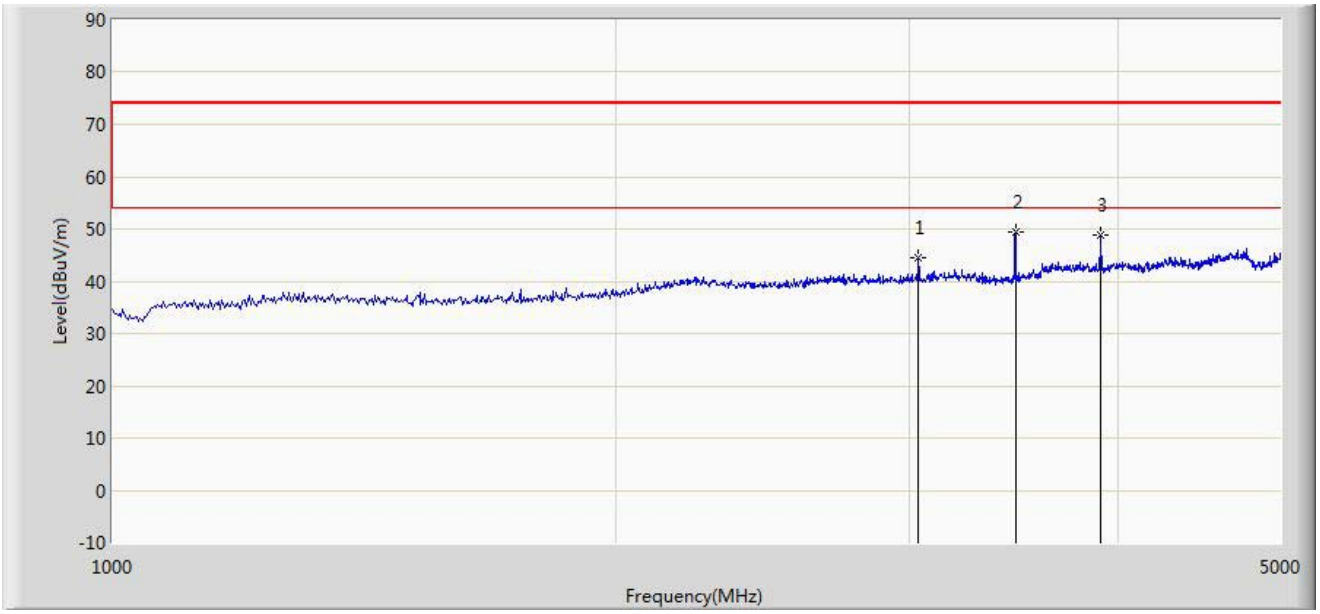
No	Frequency (MHz)	Reading Level (dBuV)	Factor (dB)	DutyCycle Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Over Limit (dB)	Ant Pos (cm)	Table Pos (deg)	Type
1	433.9200	42.495	16.642	N/A	59.137	92.872	-33.735	100	89	PK
	433.9200	42.495	16.642	-10.46	48.677	72.872	-24.195	100	89	AV
2	867.850	17.899	23.066	N/A	40.965	72.872	-31.907	100	102	PK
	867.850	17.899	23.066	-10.46	30.505	52.872	-22.367	100	102	AV

Site: AC1	Time: 2014/11/12 - 10:17
Limit: FCC_Part15.209_RE(3m)	Engineer: Roy Cheng
Probe: BBHA9120D_1-18GHz	Polarity: Horizontal
EUT: Tyre Pressure Monitoring System	Power: DC 3.0V
Note: Normal Operation	



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	3037.500	38.679	3.412	N/A	42.091	72.872	-30.781	100	113	PK
	3037.500	38.679	3.412	-10.46	31.631	52.872	-21.241	100	113	AV
2	3472.500	42.523	3.703	N/A	46.226	72.872	-26.646	100	23	PK
	3472.500	42.523	3.703	-10.46	35.766	52.872	-17.106	100	23	AV
3	3905.000	45.304	4.334	N/A	49.637	74.000	-24.363	100	76	PK
	3905.000	45.304	4.334	-10.46	39.177	54.000	-14.823	100	76	AV

Site: AC1	Time: 2014/11/12 - 10:34
Limit: FCC_Part15.209_RE(3m)	Engineer: Roy Cheng
Probe: BBHA9120D_1-18GHz	Polarity: Vertical
EUT: Tyre Pressure Monitoring System	Power: DC 3.0V
Note: Normal Operation	



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	3037.500	41.203	3.412	N/A	44.615	72.872	-28.257	100	312	PK
	3037.500	41.203	3.412	-10.46	34.155	52.872	-18.717	100	312	AV
2	3472.500	45.588	3.703	N/A	49.291	72.872	-23.581	100	57	PK
	3472.500	45.588	3.703	-10.46	38.831	52.872	-14.041	100	57	AV
3	3905.000	44.556	4.334	N/A	48.889	74.000	-25.111	100	209	PK
	3905.000	44.556	4.334	-10.46	38.429	54.000	-15.571	100	209	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) – Pre_Amplifier Gain (dB).

6.3. 20dB Bandwidth

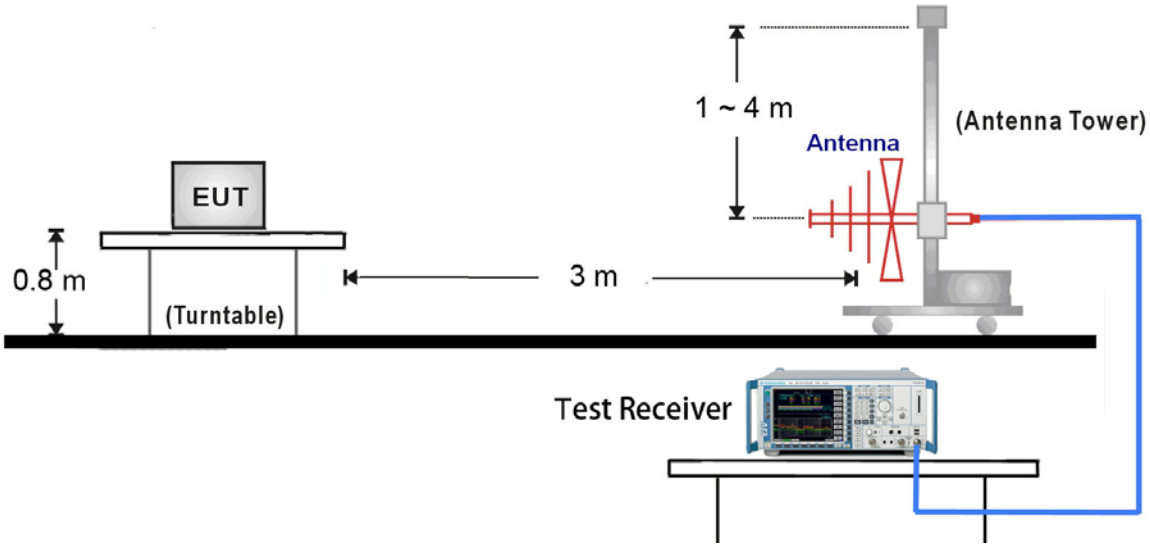
6.3.1. Standard Applicable

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

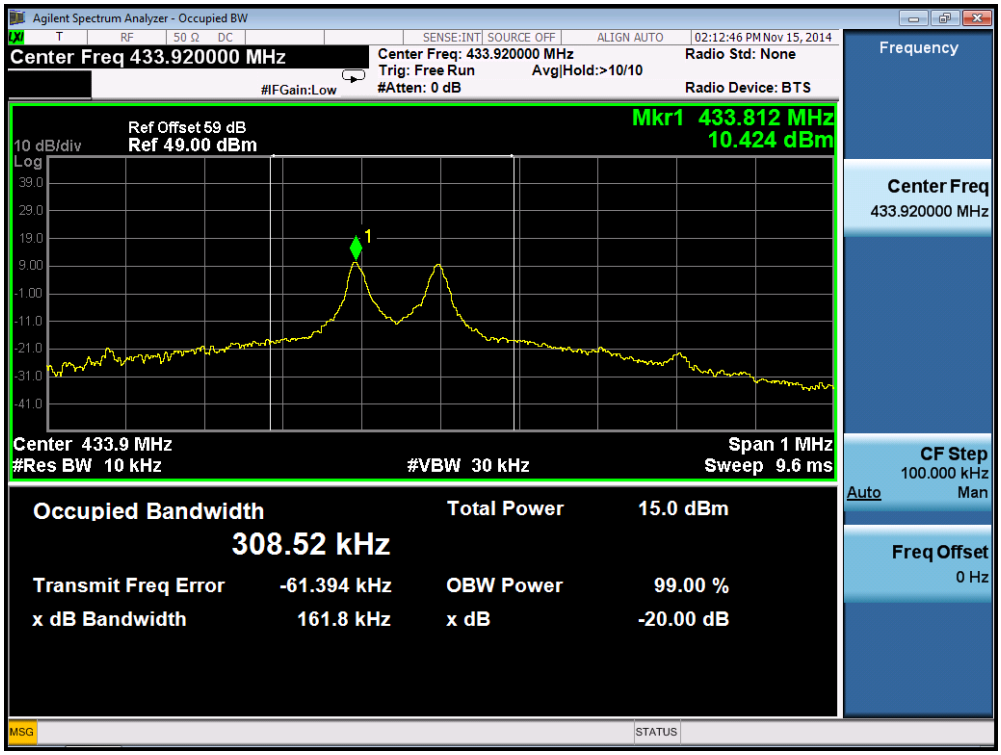


6.3.4. Test Result

Test Frequency (MHz)	20dB Bandwidth (KHz)	Limit (KHz)	Result
433.92	161.8	≤ 1084.8	Pass

Limit = Fundamental Frequency X 0.25% = 433.92 MHz X 0.25% = 1084.8 kHz

20dB Bandwidth Test Plot



6.4. Transmission Time

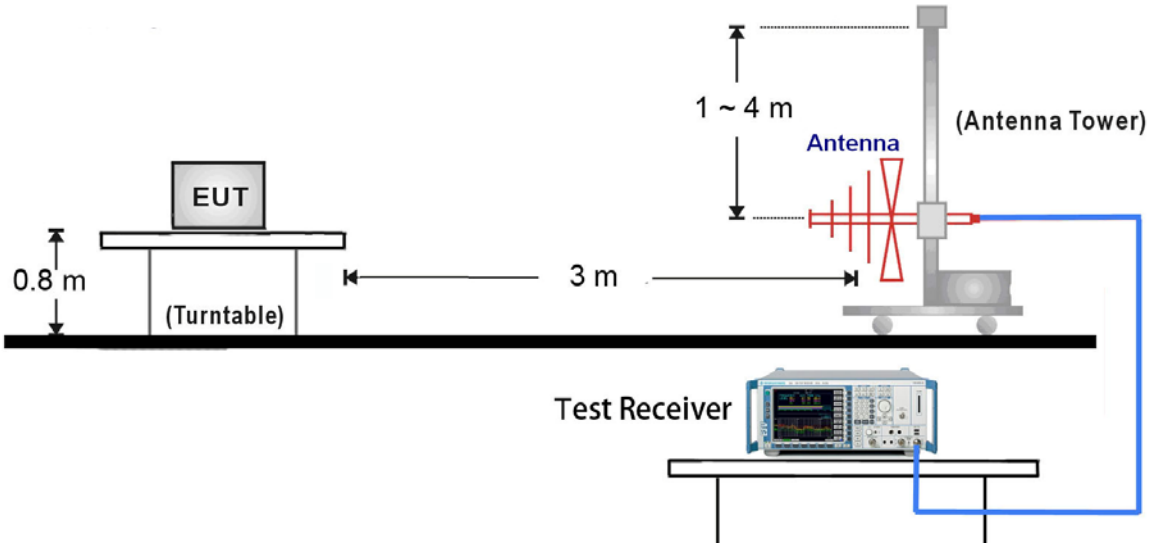
6.4.1. Standard Applicable

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, than set the spectrum analyzer to Zero Span for the release time reading. During the testing, the switch was released then the EUT automatically deactivated.

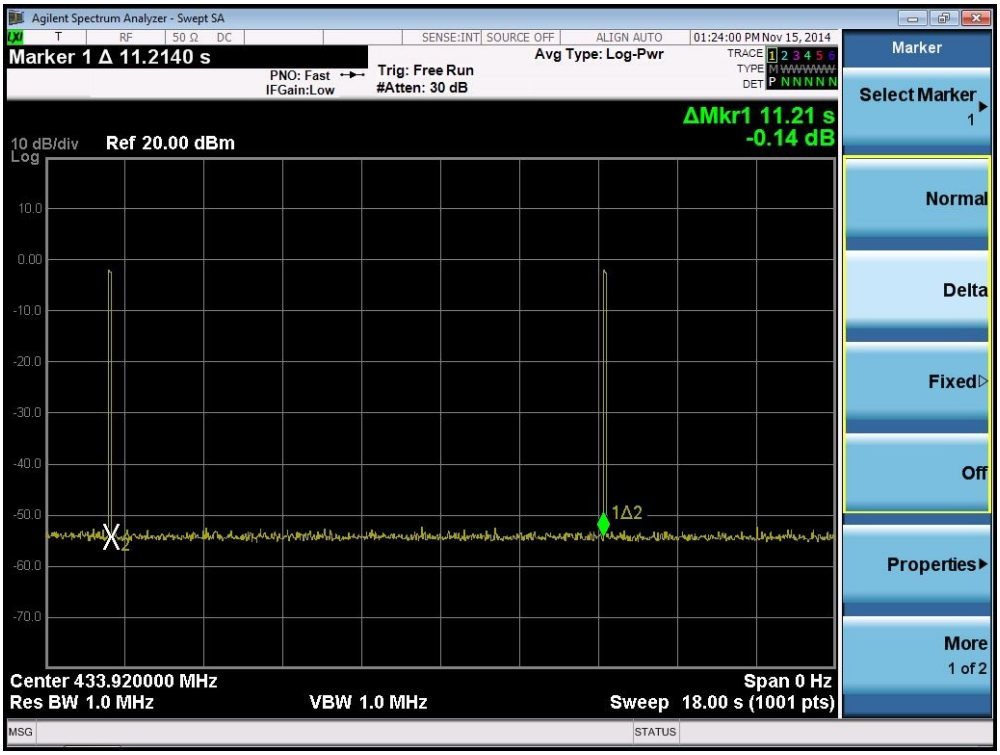
6.4.3. Test Setup



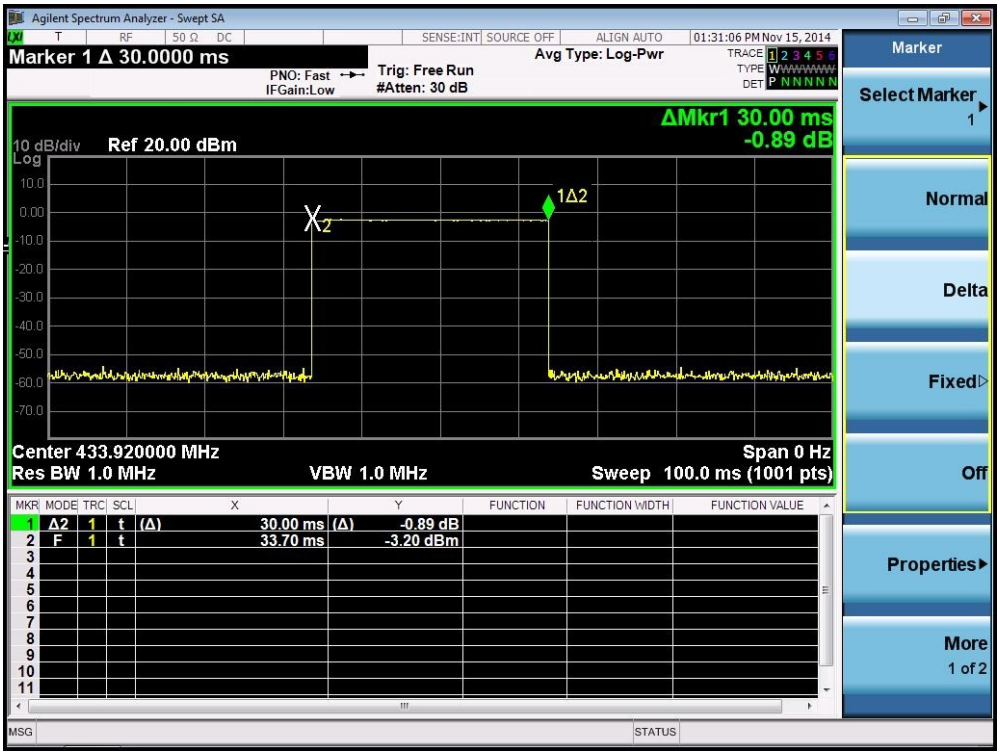
6.4.4. Test Result

Item	Measured Value	Limit	Result
Transmission Time(Ton)	0.03 s	≤ 1 s	Pass
Silent Time	11.21 s	≥ 10 s	Pass
Silent Time/Transmission Time	373.67	≥ 30 times	Pass

Silent Time



Transmission Time



6.5. Duty Cycle

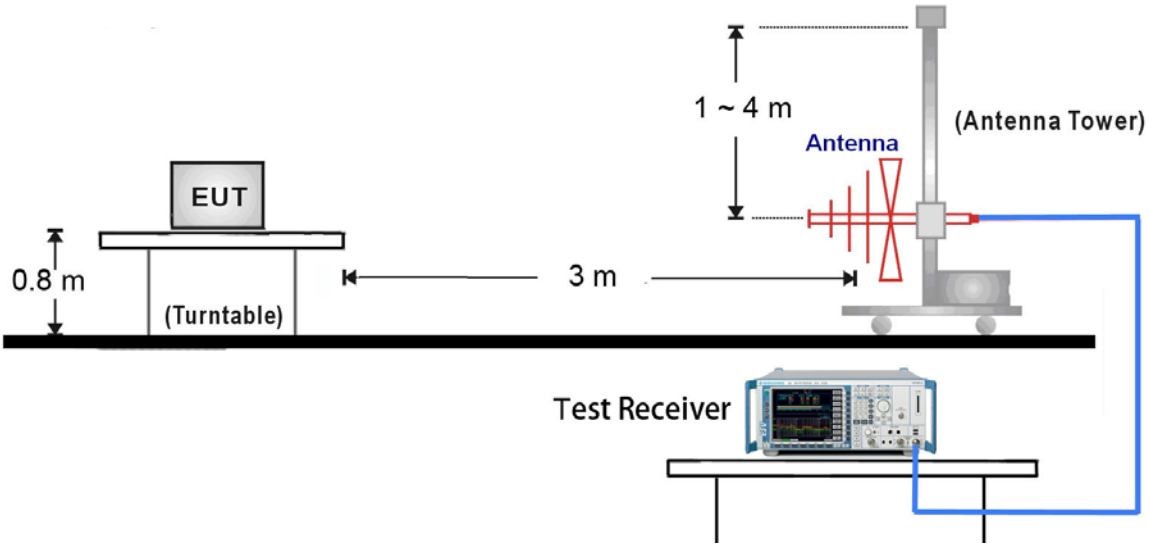
6.5.1. Standard Applicable

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, than 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



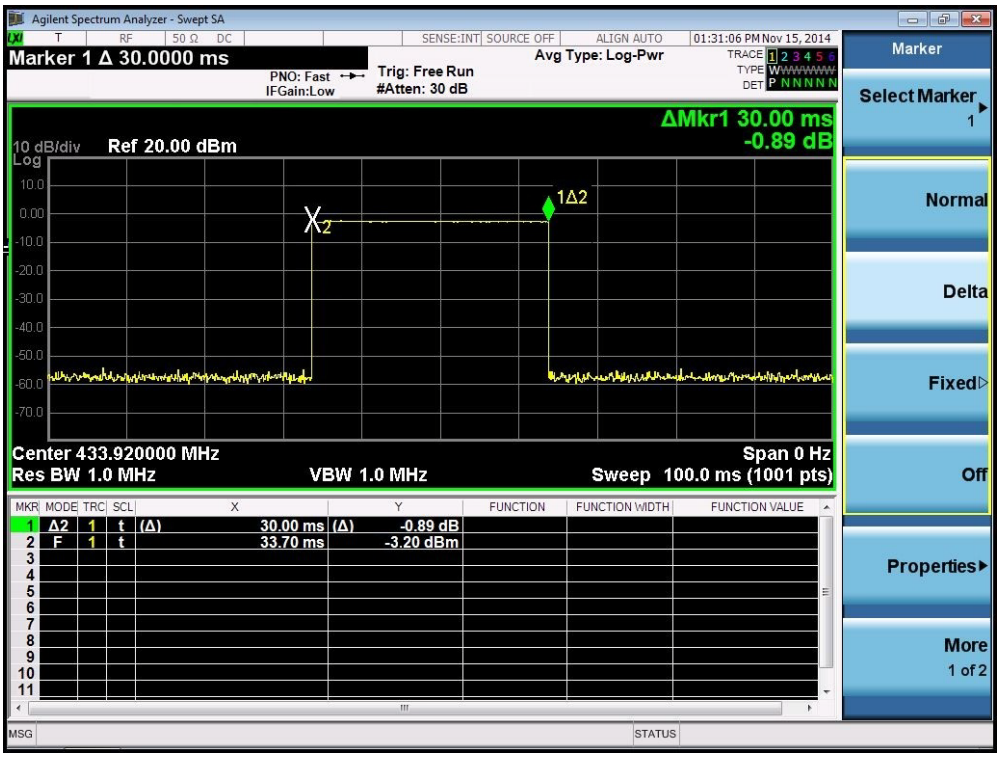
6.5.4. Test Result

Type of Pulse	Width of Pulse (ms)	Quantity of Pulse number	Transmission Time (ms)	Total Time (Ton) (ms)
Pulse 1	30.0	1	30.0	30.0

Test Period (Tp) (ms)	Total Time (Ton) (ms)	Duty Cycle (%)	Duty Cycle Factor (dB)
100.0	30.0	30	-10.46

Note: Duty Cycle Factor = -20*Log(1/Duty Cycle).

Width of Pulse



7. CONCLUSION

The data collected relate only the item(s) tested and show that the **Tyre Pressure Monitoring System FCC ID: 2ADK9TP200** is in compliance with FCC Part 15.231(e) of the FCC Rules.

The End