

# FCC Part 15C

## Measurement and Test Report

For

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

**Building 36, Loufeng Industrial Park, Yangtai Rd, Suzhou, China**

**FCC ID: TTETSB23**

<b>FCC Rules:</b>	<u>FCC Part 15.231(e)</u>
<b>Product Description:</b>	<u>TPMS Transmitter</u>
<b>Tested Model:</b>	<u>TSB23</u>
<b>Report No.:</b>	<u>STR13038073I</u>
<b>Tested Date:</b>	<u>2013-03-06 to 2013-03-26</u>
<b>Issued Date:</b>	<u>2013-04-08</u>
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Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by SEM.Test Compliance Service Co., Ltd

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## 1. GENERAL INFORMATION

### 1.1 Product Description for Equipment Under Test (EUT)

#### Client Information

Applicant: Suzhou Sate Auto Electronic Co., Ltd.  
 Address of applicant: Building 36, Loufeng Industrial Park, Yangtai Rd,  
 Suzhou, China  
 Manufacturer: Suzhou Sate Auto Electronic Co., Ltd.  
 Address of manufacturer: Building 36, Loufeng Industrial Park, Yangtai Rd,  
 Suzhou, China

General Description of EUT	
Product Name:	TPMS Transmitter
Trade Name:	S&T
Model No.:	TSB23
Adding Model(s):	3641100XKZ16A
Rated Voltage:	DC 3.0V
<p><i>Note: The test data is gathered from a production sample, provided by the manufacturer. The appearance of others models listed in the report is different from main-test model TSB23, but the circuit and the electronic construction do not change, declared by the manufacturer.</i></p>	

Technical Characteristics of EUT	
Frequency Range:	433.92 MHz
Data Rate:	/
Modulation:	ASK
Antenna Type:	Integral Antenna
Antenna Gain:	0dBi
Lowest Internal Frequency of EUT:	18.08MHz
Device Category:	Fixed Device

## 1.2 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 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 result in lowering the emission/immunity, should be checked to ensure compliance has been maintained.

## 1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4-2003, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

## 1.4 Test Facility

- **FCC – Registration No.: 994117**

SEM.Test Compliance Services Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 994117.

- **Industry Canada (IC) Registration No.: 7673A**

The 3m Semi-anechoic chamber of SEM.Test Compliance Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 7673A.

- **CNAS Registration No.: L4062**

Shenzhen SEM.Test Electronics Service Co., Ltd. is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L4062. All measurement facilities used to collect the measurement data are located at 3/F, Jinbao Commerce Building, Xin'an Fanshen Road, Bao'an District, Shenzhen, P.R.C (518101)

### 1.5 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:

<b>Test Mode List</b>		
Test Mode	Description	Remark
TM1	Transmitting	With modulation

<b>Special Cable List and Details</b>			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

<b>Auxiliary Equipment List and Details</b>			
Description	Manufacturer	Model	Serial Number
/	/	/	/

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## 2. SUMMARY OF TEST RESULTS

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<b>FCC Rules</b>	<b>Description of Test Item</b>	<b>Result</b>
§ 15.203	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§ 15.207(a)	Conducted Emission	Compliant
§ 15.209	Radiated Spurious Emissions	Compliant
§15.231(e)	Deactivation Testing	Compliant
§15.231(e)	Radiated Emissions	Compliant
§15.231(c)	20dB Bandwidth Testing	Compliant

### **3. Antenna Requirement**

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#### **3.1 Standard Applicable**

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall 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.

#### **3.2 Test Result**

This product has a permanent antenna, fulfill the requirement of this section.

## 4. Radiated Emissions

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### 4.1 Measurement Uncertainty

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement is  $\pm 5.10$  dB.

### 4.2 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 **	50 to 150 **
174 - 260	1,500	150
260 - 470	1,500 to 5,000 **	150 to 500 **
Above 470	5,000	500

\*\* linear interpolations

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 starting 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.

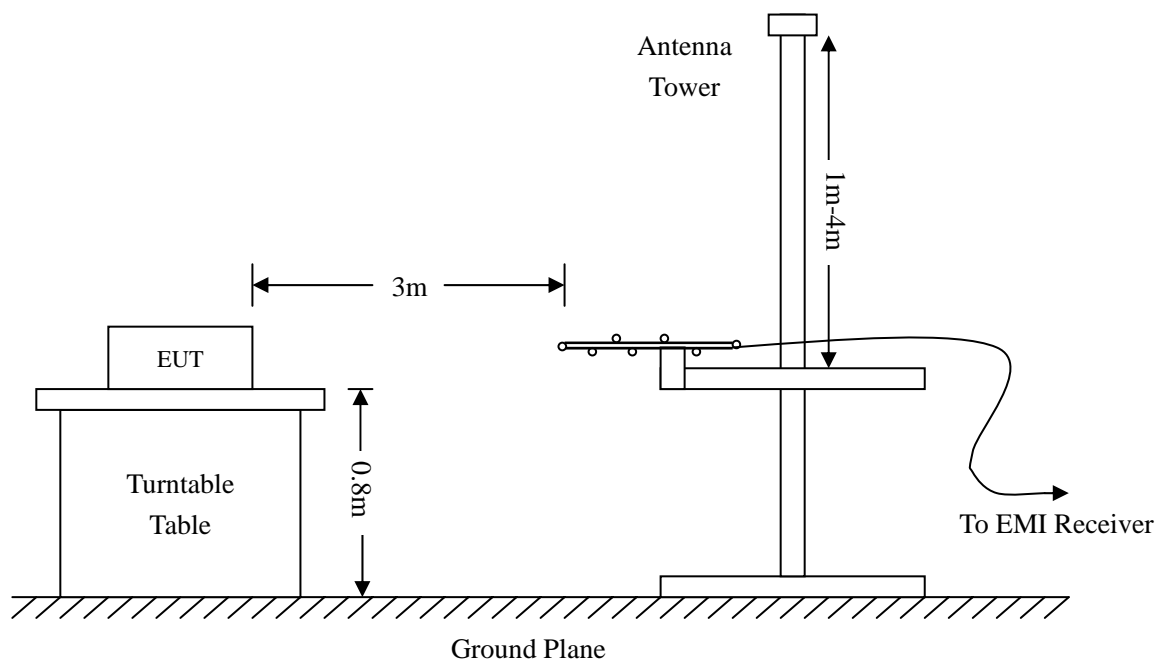


### 4.3 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	R&S	FSP	836079/035	2012-03-28	2013-03-27
EMI Test Receiver	R&S	ESVB	825471/005	2012-03-28	2013-03-27
Pre-amplifier	Agilent	8447F	3113A06717	2012-03-28	2013-03-27
Pre-amplifier	Compliance Direction	PAP-0118	24002	2012-03-28	2013-03-27
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2013-02-25	2014-02-24
Horn Antenna	ETS	3117	00086197	2013-02-25	2014-02-24
Loop Antenna	SCHWARZECK	HFRA 5165	9365	2013-02-25	2014-02-24

### 4.4 Test Procedure

The setup of EUT is according with per ANSI C63.4-2003 measurement procedure. The specification used was with the FCC Part 15.205 15.231(e) and FCC Part 15.209 Limit.



#### 4.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Loss} + \text{Cab. Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dB $\mu$ V means the emission is 6dB $\mu$ V below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15C Limit}$$

#### 4.6 Environmental Conditions

Temperature:	21° C
Relative Humidity:	50%
ATM Pressure:	1011 mbar

#### 4.7 Summary of Test Results/Plots

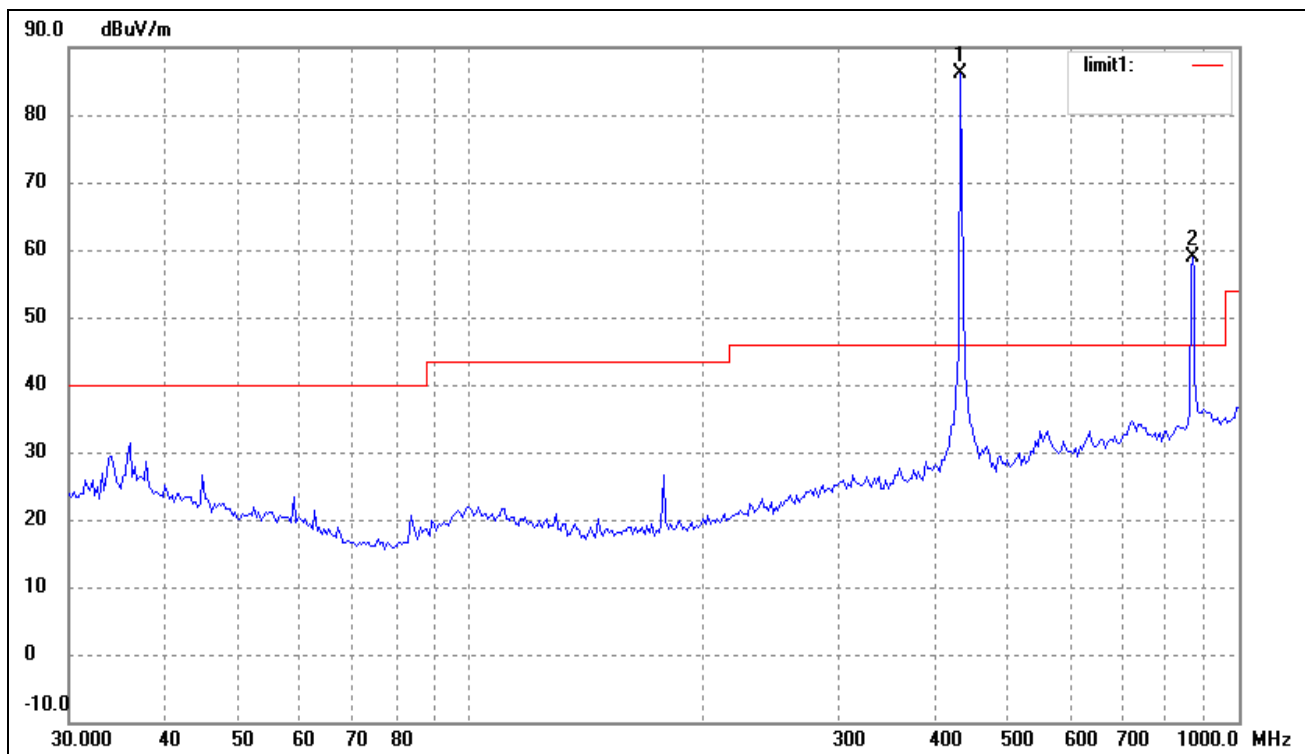
According to the data below, the FCC Part 15.205, 15.209 and 15.231(e) standards, and had the worst margin of:

**-5.37 dB at 1301.76MHz in the Horizontal polarization, Ave Detector, 9 kHz to 5 GHz, 3 Meters**

*Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.*

**Plot of Radiated Emissions Test Data**

EUT: TPMS Transmitter  
 Tested Model: TSB23  
 Operating Condition: Transmitting  
 Comment: DC 3V  
 Test Specification: Horizontal

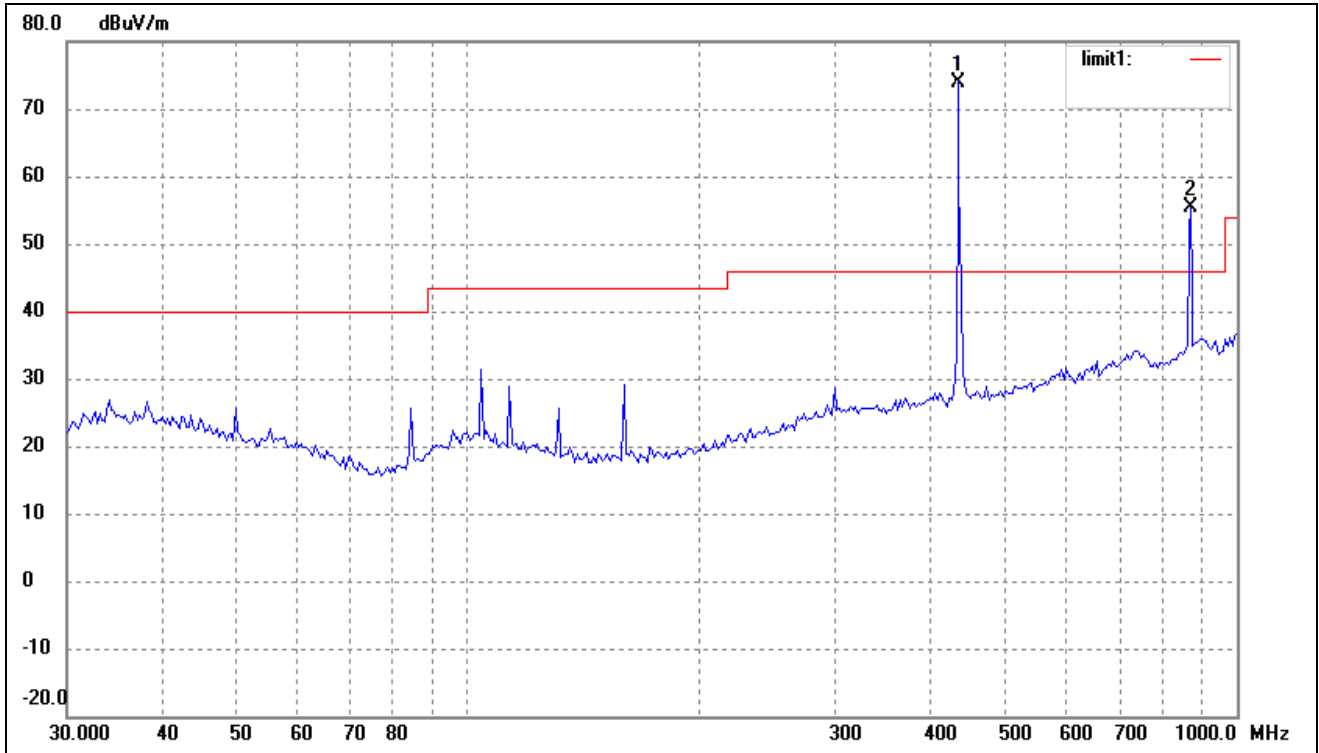


No.	Frequency MHz	Reading dBuV/m	Corr. Factor( dB)	Dutycycle Factor (dB)	Result dBuV/m	Limit dBuV/m	Margin (dB)	Deg. ( ° )	Height (cm)	Remark
1	433.9200	75.31	11.10	N/A	86.41	92.87	-6.46	330	100	peak
	433.9200	/	/	-14.20	72.21	72.87	-0.66	330	100	Ave
2	867.8400	39.62	18.54	N/A	58.16	72.87	-14.71	175	100	peak
	867.8400	/	/	-14.20	43.96	52.87	-8.91	175	100	Ave

*Above 1GHz*

No.	Frequency MHz	Reading dBuV/m	Corr. Factor (dB)	Dutycycle Factor (dB)	Result dBuV/m	Limit dBuV/m	Margin dB	Deg. ( ° )	Height (cm)	Remark
1	1301.76	77.40	-15.07	N/A	62.33	74.00	-11.67	115	100	Peak
2	1735.68	68.95	-13.12	N/A	55.83	74.00	-18.17	20	100	Peak
	1301.76	/	/	-14.20	48.13	54.00	-5.87	115	100	Ave
	1735.68	/	/	-14.20	41.63	54.00	-12.37	20	100	Ave

Test Specification: Vertical



No.	Frequency MHz	Reading dBuV/m	Corr. Factor( dB)	Dutycycle Factor (dB)	Result dBuV/m	Limit dBuV/m	Margin (dB)	Deg. ( ° )	Height (cm)	Remark
1	433.9200	62.85	11.10	N/A	73.95	92.87	-18.92	158	100	peak
	433.9200	/	/	-14.20	59.75	72.87	-13.12	158	100	Ave
2	867.8400	35.83	18.54	N/A	54.37	72.87	-18.50	330	100	peak
	867.8400	/	/	-14.20	40.17	52.87	-12.70	330	100	Ave

Above 1GHz

No.	Frequency MHz	Reading dBuV/m	Corr. Factor (dB)	Dutycycle Factor (dB)	Result dBuV/m	Limit dBuV/m	Margin dB	Deg. ( ° )	Height (cm)	Remark
1	1301.76	74.25	-15.07	N/A	59.18	74.00	-14.82	25	100	Peak
2	1735.68	60.54	-13.12	N/A	47.42	74.00	-26.58	120	100	Peak
	1301.76	/	/	-14.20	44.98	54.00	-9.02	25	100	Ave
	1735.68	/	/	-14.20	33.22	54.00	-20.78	120	100	Ave

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, which above 4<sup>th</sup> Harmonics are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

The measurements greater than 20dB below the limit from 9kHz to 30MHz.

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

## 6. 20dB Bandwidth

### 6.1 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 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

### 6.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	Agilent	E4402B	US41192821	2012-03-28	2013-03-27
Attenuator	ATTEN	ATS100-4-20	/	2012-03-28	2013-03-27

### 6.3 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.

### 6.4 Environmental Conditions

Temperature:	21° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

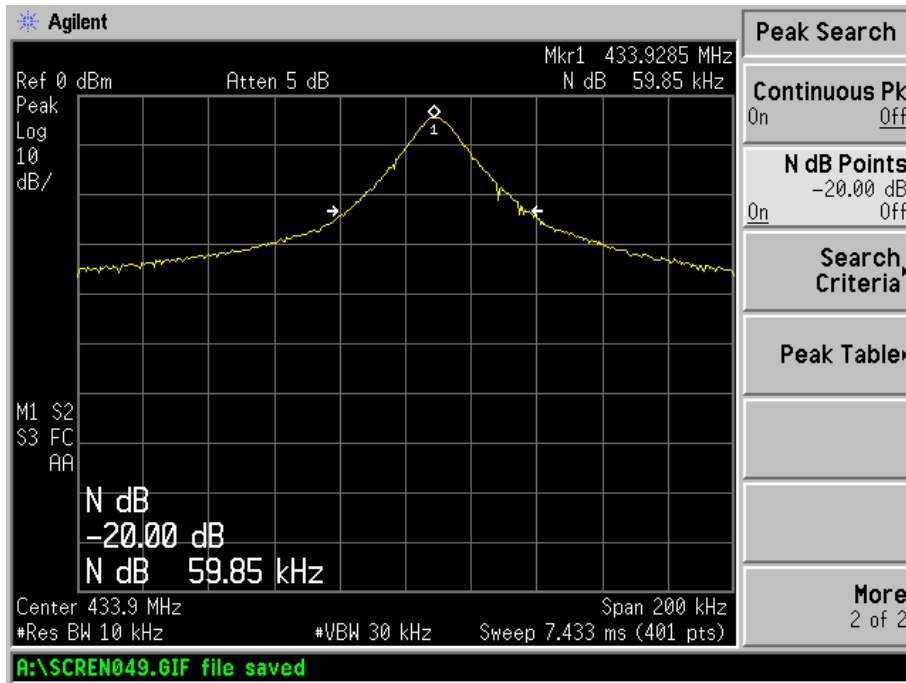
### 6.5 Summary of Test Results/Plots

Test Frequency MHz	20dB Bandwidth kHz	Limit kHz	Result
433.92	59.85	1084	Pass

Limit = Fundamental Frequency X 0.25% = 433.92 MHz X 0.25% = 1084 kHz

*Please refer to the attached plots.*

20dB Bandwidth Test Plot



## 7. Transmission Time

### 7.1 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.

### 7.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	Agilent	E4402B	US41192821	2012-03-28	2013-03-27
Attenuator	ATTEN	ATS100-4-20	/	2012-03-28	2013-03-27

### 7.3 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.

### 7.4 Environmental Conditions

Temperature:	20° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

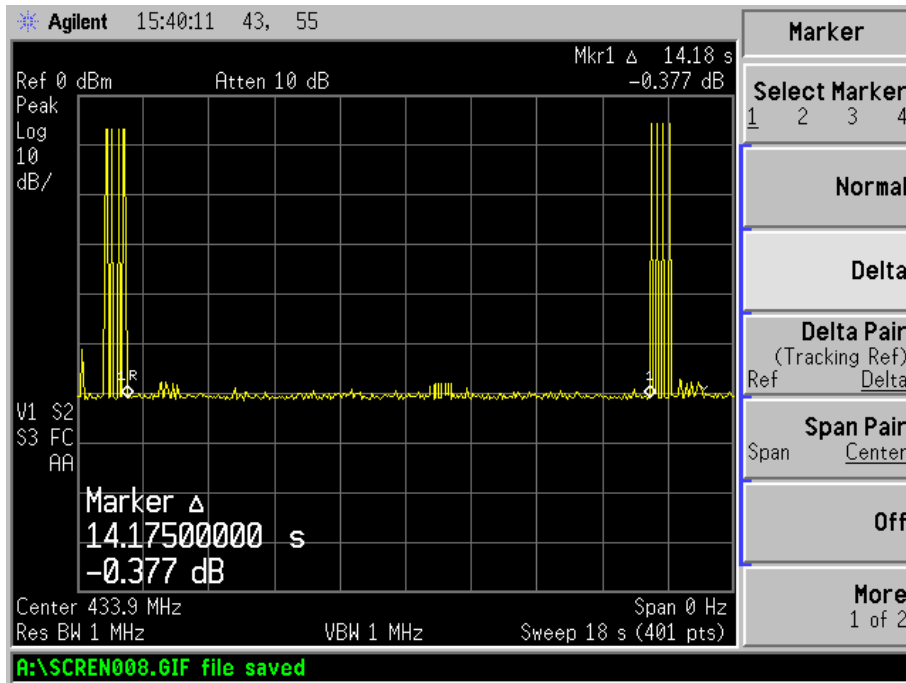
### 7.5 Summary of Test Results/Plots

Item	Measured Value	Limit	Result
Transmission Time(Ton)	0.078 s	1 s	Pass
Silent Time	14.175 s	10 s	Pass
Silent Time/Transmission Time	181.73	30	Pass

Note: Ton= 4\*T1

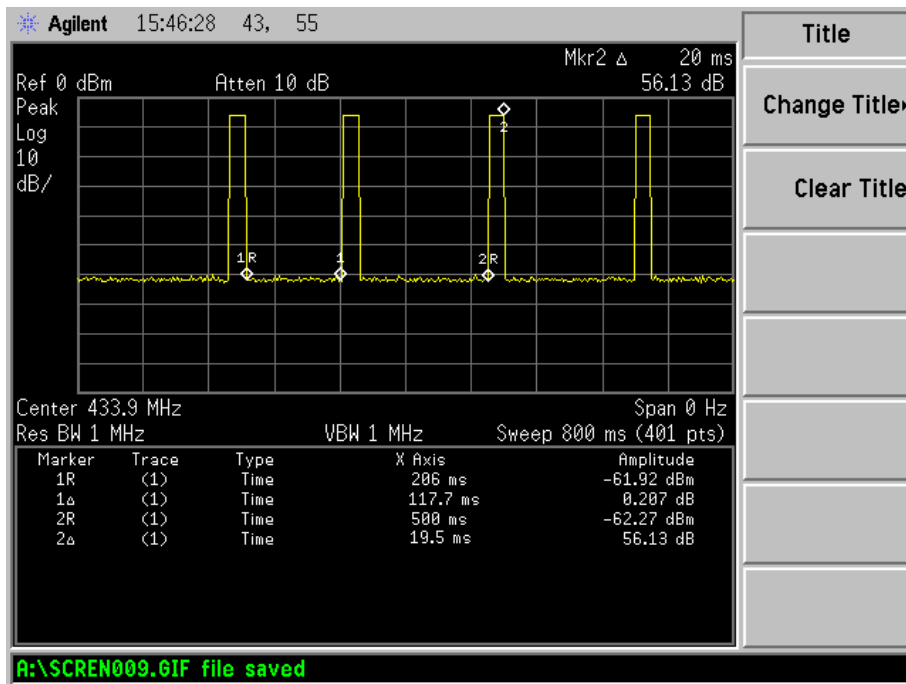
Please refer to the attached plots.

Silent Time



Transmission Time

T1=19.5ms





## 8. Duty Cycle

### 8.1 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.

### 8.2 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
Spectrum Analyzer	Agilent	E4402B	US41192821	2012-03-28	2013-03-27
Attenuator	ATTEN	ATS100-4-20	/	2012-03-28	2013-03-27

### 8.3 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.

### 8.4 Environmental Conditions

Temperature:	20° C
Relative Humidity:	52%
ATM Pressure:	1011 mbar

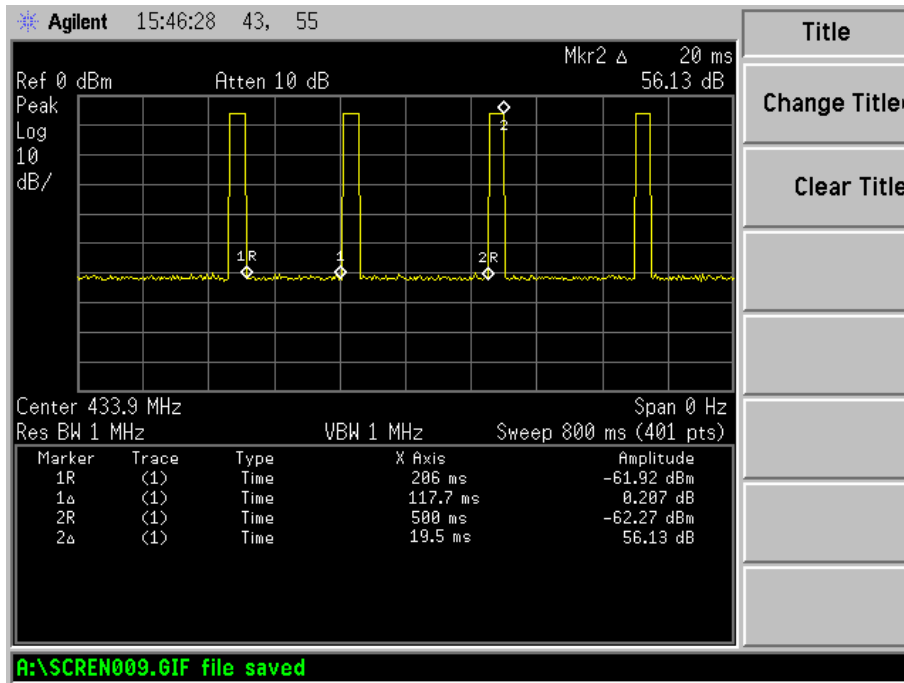
### 8.5 Summary of Test Results/Plots

Type of Pulse	Width of Pulse ms	Quantity of Pulse number	Transmission Time ms	Total Time (T <sub>on</sub> ) ms
Pulse 1	19.5	1	19.5	19.5

Test Period (T <sub>p</sub> ) ms	Total Time (T <sub>on</sub> ) ms	Duty Cycle %	Duty Cycle Factor dB
100	19.5	19.5	-14.20

Please refer to the attached test plots

Width of Pulse



\*\*\*\*\* END OF REPORT \*\*\*\*\*