



FCC REPORT

Applicant: STEELMATE CO., LTD.

Address of Applicant: Steelmate Industrial Park, Heping Street, Dongfu Road,
Dongfeng Town, Zhongshan 528425, China

Equipment Under Test (EUT)

Product Name: Tire Pressure Monitoring System

Model No.: BSE112

Trade Mark: STEELMATE

FCC ID: Q6WBSE112

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.231:2014

Date of sample receipt: March 28, 2016

Date of Test: March 29-April 08, 2016

Date of report issued: April 11, 2016

Test Result : PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Robinson Lo

Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the GTS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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2 Version

Version No.	Date	Description
00	April 11, 2016	Original

Prepared By:

Sam. Gao

Date:

April 11, 2016

Project Engineer

Check By:

hank. yan

Date:

April 11, 2016

Reviewer

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4 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	15.203	Pass
Field strength of the fundamental signal	15.231 (e)	Pass
Spurious emissions	15.231 (e)/15.209	Pass
20dB Bandwidth	15.231 (c)	Pass
Dwell time	15.231 (e)	Pass
Silent period time	15.231 (e)	Pass

Pass: The EUT complies with the essential requirements in the standard.

4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz ~ 30MHz	$\pm 4.34\text{dB}$	(1)
Radiated Emission	30MHz ~ 1000MHz	$\pm 4.24\text{dB}$	(1)
Radiated Emission	1GHz ~ 26.5GHz	$\pm 4.68\text{dB}$	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	$\pm 3.45\text{dB}$	(1)
Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.			

5 General Information

5.1 Client Information

Applicant:	STEELMATE CO., LTD.
Address of Applicant:	Steelmate Industrial Park, Heping Street, Dongfu Road, Dongfeng Town, Zhongshan 528425, China
Manufacturer/ Factory:	STEELMATE CO., LTD.
Address of Manufacturer/ Factory:	Steelmate Industrial Park, Heping Street, Dongfu Road, Dongfeng Town, Zhongshan 528425, China

5.2 General Description of EUT

Product Name:	Tire Pressure Monitoring System
Model No.:	BSE112
Operation Frequency:	433.92MHz
Modulation technology:	OOK
Antenna Type:	Integrity Antenna
Antenna gain:	1.5dBi (declare by Manufacturer)
Power supply:	DC 3V Lithium Battery

5.3 Test mode

Transmitting mode	Keep the EUT in transmitting mode.
<i>Remark: During the test, the New Battery was used.</i>	

Per-test mode.

We have verified the construction and function in typical operation, The EUT was placed on three different polar directions; i.e. X axis, Y axis, Z axis. which was shown in this test report and defined as follows:

Axis	X	Y	Z
Field Strength(dBuV/m)	77.35	79.10	78.01

Final Test Mode:

According to ANSI C63.10 standards, the test results are both the “worst case” and “worst setup”:
Y axis (see the test setup photo)

5.4 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC —Registration No.: 600491**

Global United Technology Services Co., Ltd., Shenzhen 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 files. Registration 600491, June 28, 2013.

- **Industry Canada (IC) —Registration No.: 9079A-2**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, June 26, 2013.

5.5 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.
No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone,
Xixiang Road, Baoan District, Shenzhen, Guangdong, China
Tel: 0755-27798480
Fax: 0755-27798960

5.6 Other Information Requested by the Customer

None.

6 Test Instruments list

Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	Mar. 27 2016	Mar. 26 2017
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	Spectrum Analyzer	Agilent	E4440A	GTS533	Jun 30 2015	Jun 29 2016
4	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	Jun 30 2015	Jun 29 2016
5	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	Jun 30 2015	Jun 29 2016
6	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	June 26 2015	June 25 2016
7	Horn Antenna	ETS-LINDGREN	3160	GTS217	Mar. 26 2016	Mar. 25 2017
8	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
9	Coaxial Cable	GTS	N/A	GTS213	Mar. 27 2016	Mar. 26 2017
10	Coaxial Cable	GTS	N/A	GTS211	Mar. 27 2016	Mar. 26 2017
11	Coaxial cable	GTS	N/A	GTS210	Mar. 27 2016	Mar. 26 2017
12	Coaxial Cable	GTS	N/A	GTS212	Mar. 27 2016	Mar. 26 2017
13	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	Jun. 30, 2015	Jun 29 2016
14	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	Jun. 30, 2015	Jun 29 2016
15	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June 26 2015	June 25 2016
16	Band filter	Amindeon	82346	GTS219	Mar. 27 2016	Mar. 26 2017
17	D.C. Power Supply	Instek	PS-3030	GTS232	Mar. 28 2016	Mar. 27 2017
18	Thermo meter	KTJ	TA328	GTS256	Dec. 04 2015	Dec. 03 2016

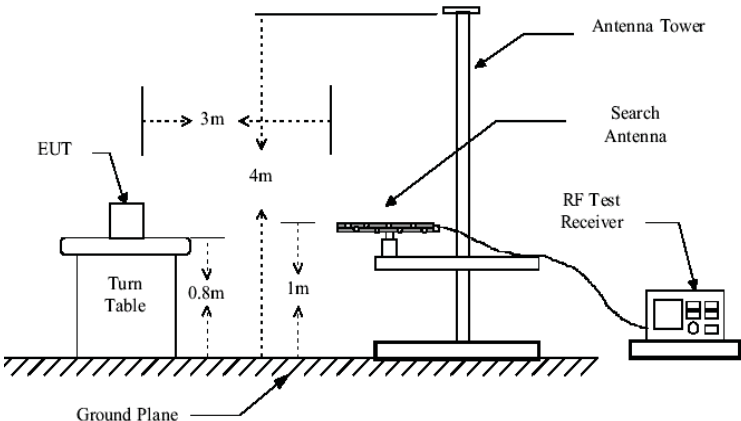
General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (dd-mm-yy)	Cal.Due date (dd-mm-yy)
1	Barometer	ChangChun	DYM3	GTS257	July 07 2015	July 06 2016

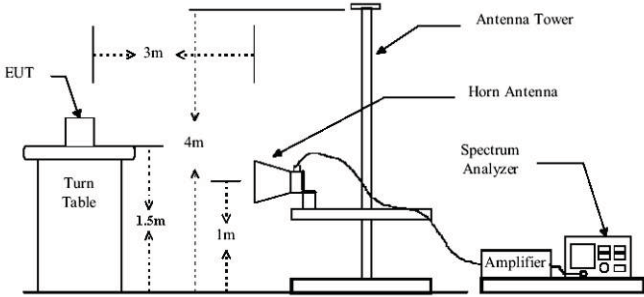
7 Test results and Measurement Data

7.1 Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203
15.203 requirement: 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.	
EUT Antenna:	
The EUT make use of a Integrity Antenna, the typical gain of the antenna is 1.5dBi.	
	

7.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	30MHz to 5000MHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
Limit: (Field strength of the fundamental signal)	Frequency	Limit (dBuV/m @3m)		Remark	
	433.92MHz	72.87		Average Value	
		92.87		Peak Value	
Limit: (Spurious Emissions)	Frequency	Limit (dBuV/m @3m)		Remark	
	30MHz-88MHz	40.00		Quasi-peak Value	
	88MHz-216MHz	43.50		Quasi-peak Value	
	216MHz-960MHz	46.00		Quasi-peak Value	
	960MHz-1GHz	54.00		Quasi-peak Value	
	Above 1GHz	54.00		Average Value	
		74.00		Peak Value	
Or The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level whichever limit permits a higher field strength.					
Test setup:	Below 1GHz				
					
Above 1GHz					

	 The diagram illustrates the test setup. An EUT (Equipment Under Test) is placed on a Turn Table. The Turn Table is positioned 3m horizontally from the Antenna Tower. The Antenna Tower has a Horn Antenna mounted at a height of 4m. The Spectrum Analyzer is connected to the Antenna Tower via an Amplifier. The Spectrum Analyzer is also connected to the Antenna Tower. The diagram shows the EUT on the Turn Table, the Antenna Tower, the Horn Antenna, the Spectrum Analyzer, and the Amplifier. Dimensions are indicated: 3m horizontal distance, 4m antenna height, 1.5m vertical offset from the ground to the turn table, and 1m vertical offset from the ground to the antenna.
Test Procedure:	1. During the test, the New Battery was used. 2. The EUT was placed on the top of a rotating table (0.8 meters for below 1GHz and 1.5 meters for above 1GHz) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 3. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 4. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 5. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 6. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 7. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

Measurement data:

7.2.1 Field Strength of The Fundamental Signal

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
433.92	87.98	17.53	3.02	29.43	79.10	92.87	-13.77	Horizontal
433.92	84.63	17.53	3.02	29.43	75.75	92.87	-17.12	Vertical

Average value:

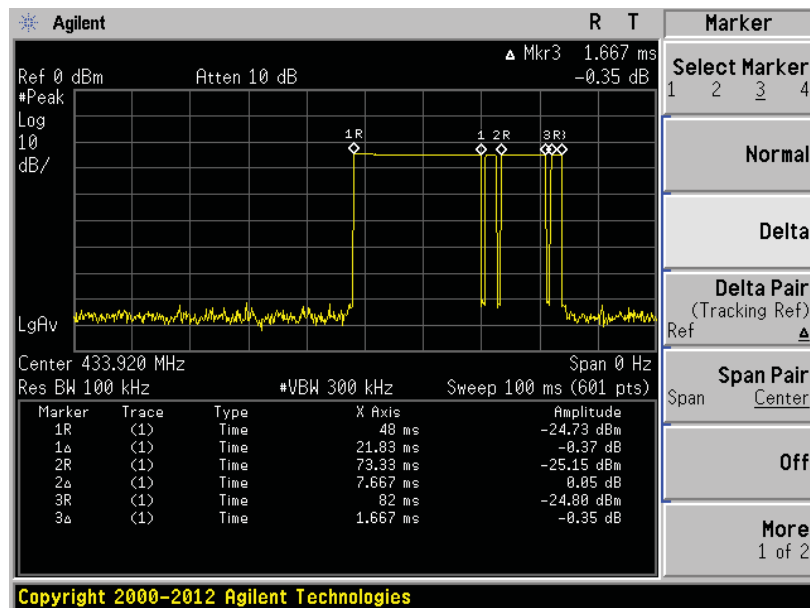
Frequency (MHz)	Peak Value (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
433.92	79.10	-9.674	69.43	72.87	-3.44	Horizontal
433.92	75.75	-9.674	66.08	72.87	-6.79	Vertical

Average value:

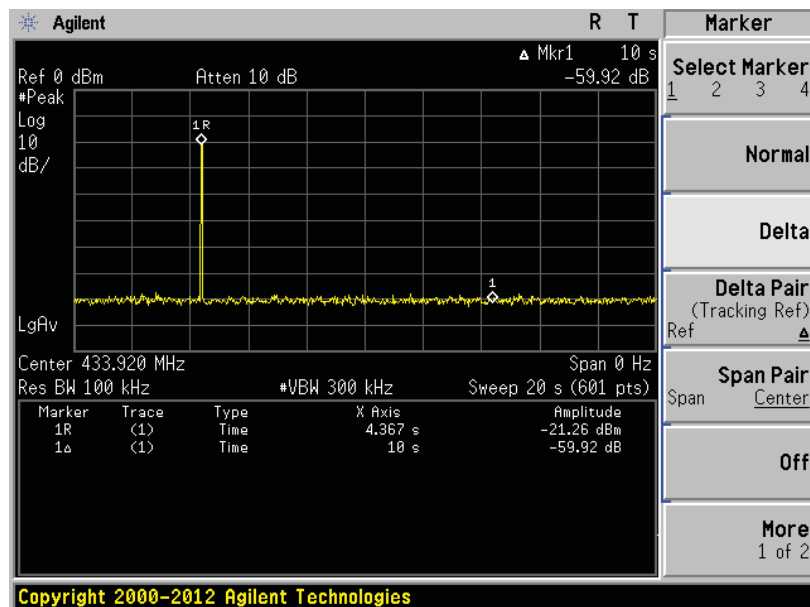
Calculate Formula:	Average value=Peak value + Duty Cycle Factor
	Duty cycle factor=20 log(Duty cycle)
	Duty cycle=on time/100 milliseconds or period, whichever is less
Test data:	T on time =21.83(ms)+7.667(ms)+1.667(ms)*2=32.831(ms)
	T period =100ms
	Duty cycle=32.831/100=0.32831
	duty cycle factor=-9.674

Test plot as follows:

Ton time:



T period:



7.2.2 Spurious emissions

Quasi-peak Value

Quasi-peak Value Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
38.89	27.49	15.30	0.65	30.05	13.39	40.00	-26.61	Vertical
112.13	27.41	13.83	1.30	29.62	12.92	43.50	-30.58	Vertical
204.96	26.54	12.74	1.87	29.26	11.89	43.50	-31.61	Vertical
385.28	26.47	16.73	2.79	29.57	16.42	46.00	-29.58	Vertical
537.59	25.99	19.36	3.47	29.30	19.52	46.00	-26.48	Vertical
790.62	27.20	21.96	4.42	29.20	24.38	46.00	-21.62	Vertical
39.16	25.80	15.34	0.65	30.05	11.74	40.00	-28.26	Horizontal
57.59	26.58	14.85	0.84	29.94	12.33	40.00	-27.67	Horizontal
100.23	25.84	15.11	1.19	29.70	12.44	43.50	-31.06	Horizontal
219.85	26.45	13.17	1.96	29.39	12.19	46.00	-33.81	Horizontal
341.98	24.49	16.15	2.58	29.77	13.45	46.00	-32.55	Horizontal
677.58	25.52	20.73	4.00	29.22	21.03	46.00	-24.97	Horizontal

Harmonic emissions

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
867.84	58.99	22.78	4.73	29.13	57.37	72.87	-15.50	Vertical
1301.76	43.06	25.63	4.54	33.27	39.96	74.00	-34.04	Vertical
1735.68	60.62	25.05	4.82	34.00	56.49	74.00	-17.51	Vertical
2169.60	54.51	27.67	5.15	34.27	53.06	74.00	-20.94	Vertical
2603.52	42.28	27.82	5.58	33.78	41.90	74.00	-32.10	Vertical
3037.44	52.97	28.61	6.02	33.28	54.32	74.00	-19.68	Vertical
3471.36	50.02	28.90	6.91	32.79	53.04	74.00	-20.96	Vertical
3905.28	49.82	29.52	7.71	32.29	54.76	74.00	-19.24	Vertical
4339.20	39.03	30.88	8.19	31.86	46.24	74.00	-27.76	Vertical
867.84	60.44	22.78	4.73	29.13	58.82	72.87	-14.05	Horizontal
1301.76	53.26	25.63	4.54	33.27	50.16	74.00	-23.84	Horizontal
1735.68	60.10	25.05	4.82	34.00	55.97	74.00	-18.03	Horizontal
2169.60	60.23	27.67	5.15	34.27	58.78	74.00	-15.22	Horizontal
2603.52	44.48	27.82	5.58	33.78	44.10	74.00	-29.90	Horizontal
3037.44	46.60	28.61	6.02	33.28	47.95	74.00	-26.05	Horizontal
3471.36	44.46	28.90	6.91	32.79	47.48	74.00	-26.52	Horizontal
3905.28	39.93	29.52	7.71	32.29	44.87	74.00	-29.13	Horizontal
4339.20	32.92	30.88	8.19	31.86	40.13	74.00	-33.87	Horizontal

Average value:

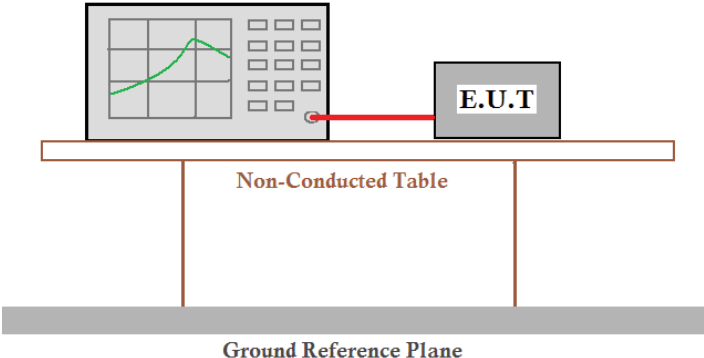
Frequency (MHz)	Level (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
867.84	58.82	-9.674	49.15	52.87	-3.72	Horizontal
2169.60	58.78	-9.674	49.11	54.00	-4.89	Horizontal

Note : only worse case is reported

Remark:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *Average value=Peak value + Duty cycle factor*

7.3 20dB Occupy Bandwidth

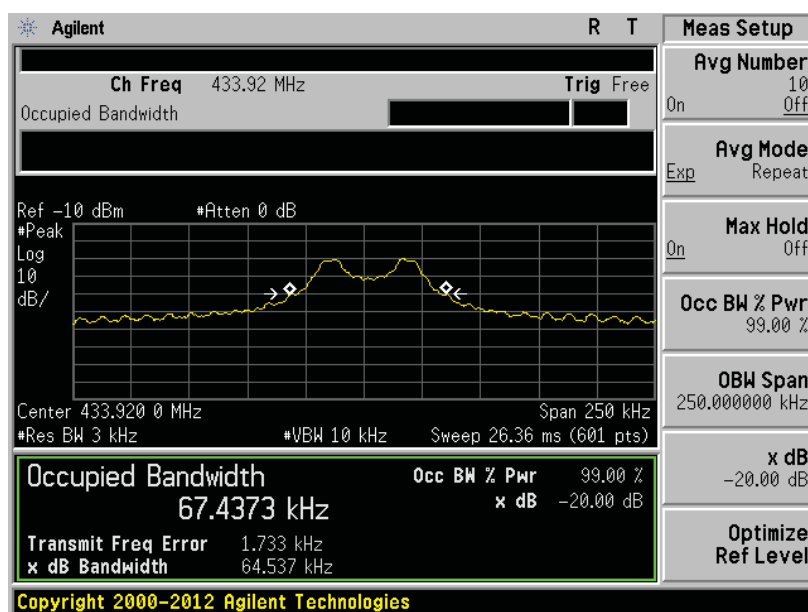
Test Requirement:	FCC Part15 C Section 15.231 (c)
Test Method:	ANSI C63.10:2013
Limit:	The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.
Test setup:	 The diagram illustrates the test setup for non-conducted emissions. It shows a Spectrum Analyzer connected to an Equipment Under Test (E.U.T.) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table, which is supported by two vertical legs. Below the table is a thick grey bar representing the Ground Reference Plane.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

Measurement Data

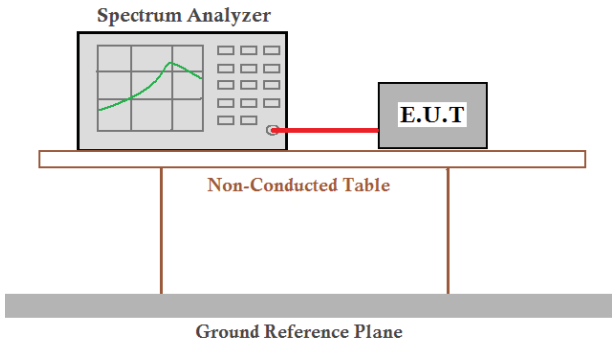
Test Frequency (MHz)	20dB bandwidth (MHz)	Limit (MHz)	Result
433.92	0.0645	1.0848 MHz	Pass

Note: Limit= Fundamental frequency $\times 0.25\%$ = $433.92 \times 0.25\%$ =1.0848MHz

Test plot as follows:



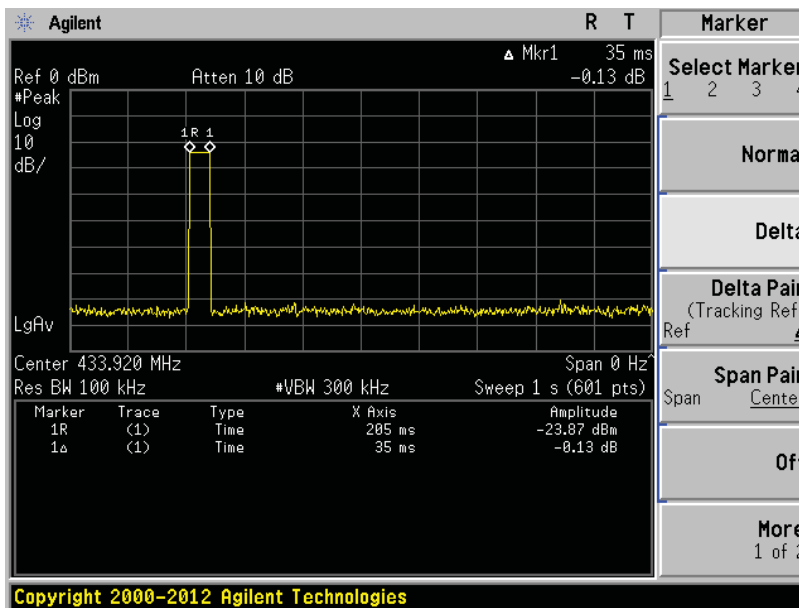
7.4 Dwell time

Test Requirement:	FCC Part15 C Section 15.231 (e)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100KHz, VBW=300KHz, span=0Hz, detector: Peak
Limit:	Not more than 1 seconds
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

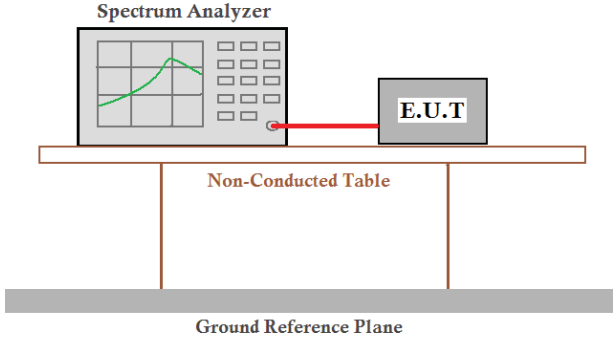
Measurement data:

Duration of each TX(second):	Limit (second)	Result
0.035	<1.0	Pass

Test plot as follows:



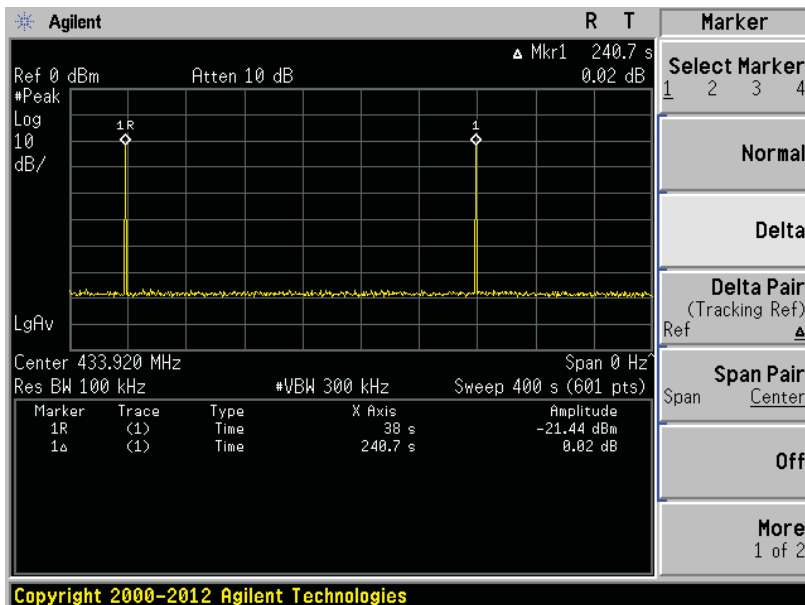
7.5 Silent period

Test Requirement:	FCC Part15 C Section 15.231 (e)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100KHz, VBW=300KHz, span=0Hz, detector: Peak
Limit:	at least 30 times the duration of the transmission or more than 10 seconds
Test Procedure:	1. According to the follow Test-setup, keep the relative position between the artificial antenna and the EUT. 2. Set the EUT to proper test channel. 3. Single scan the transmit, and read the transmission time.
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

Measurement data:

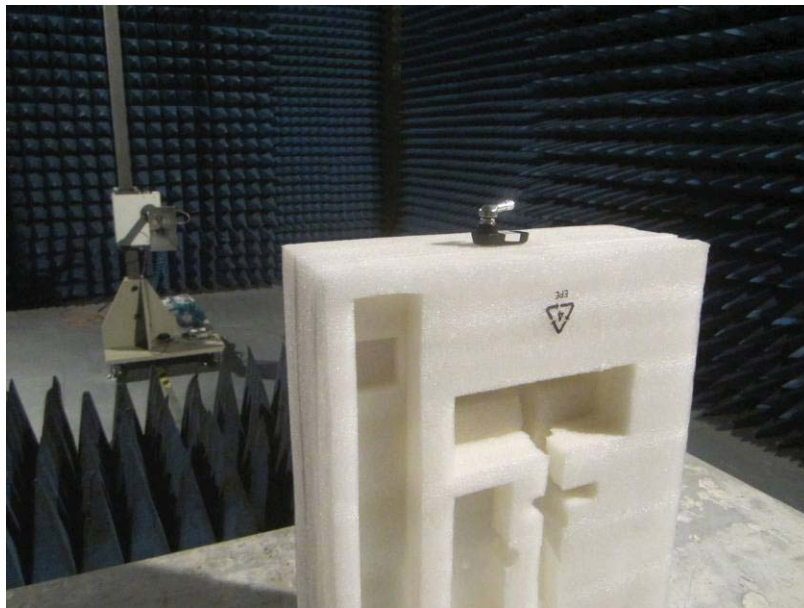
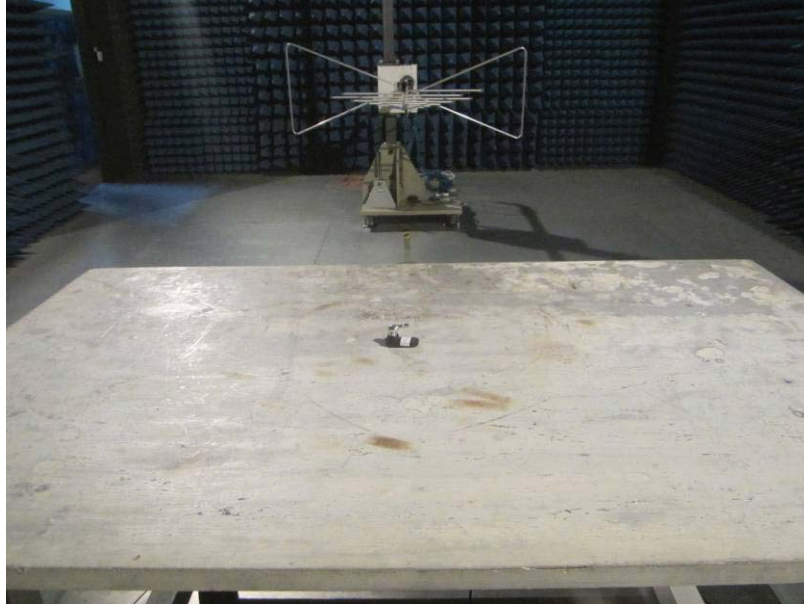
Silent period (second)	Limit (second)	Result
240.7	>10	Pass
Remark	The manufacturer declared that the silent time is 4 minutes in normal working condition.	

Test plot as follows:



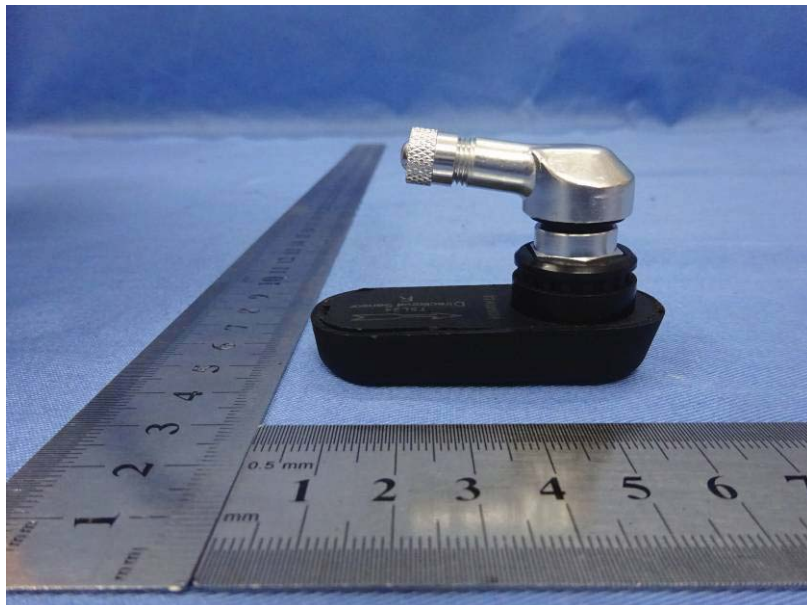
8 Test Setup Photo

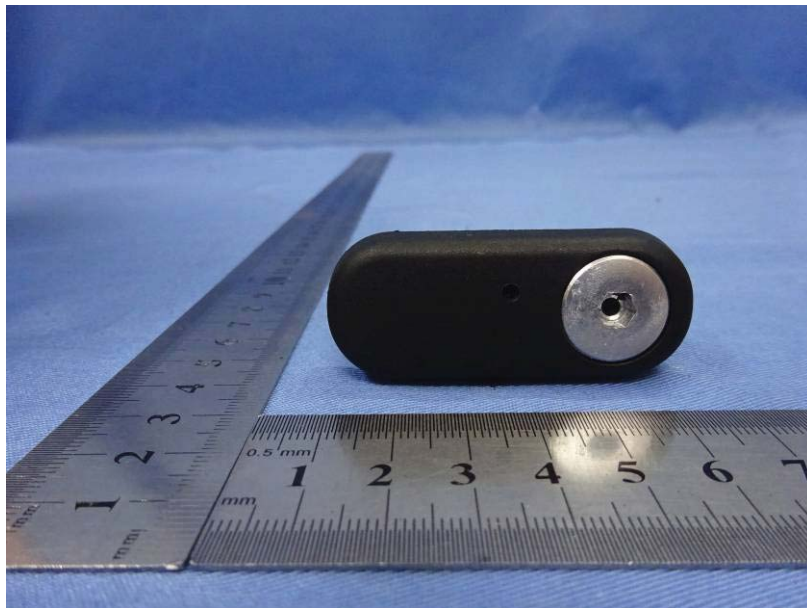
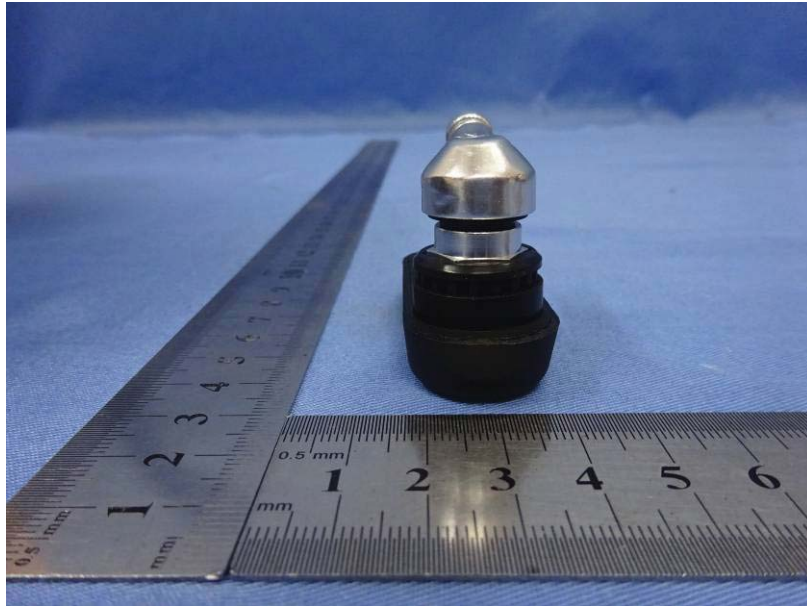
Radiated Emission



9 EUT Constructional Details











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