FCC REPORT

Applicant:	SHANGHAI BAOLONG AUTOMOTIVE CORPORATION
Address of Applicant:	5500, Shenzhuan Rd., Songjiang District, Shanghai 201619, China
Manufacturer/Factory:	SHANGHAI BAOLONG AUTOMOTIVE CORPORATION
Address of Manufacturer/Factory:	5500, Shenzhuan Rd., Songjiang District, Shanghai 201619, China

Equipment Under Test (EUT)

Product Name:	TPMS-sensor
Model No.:	TPM-C pro-M
FCC ID:	Z9F-TPMCPROM
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.231
Date of sample receipt:	September 27, 2018
Date of Test:	September 28-October 20, 2018
Date of report issued:	October 20, 2018
Test Result :	PASS *

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

Authorized Signature:

Robinson Lo
Laboratory Manager

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

2 Version

Version No.	Date	Description
01	*October 20, 2018*	*Original*

Prepared By:	Bill. Yuan	***Date:***	*October 20, 2018*
	Project Engineer		
Check By:	Robinson Lo	***Date:***	*October 20, 2018*
	Reviewer		

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4 Test Summary

Test Item	Section in CFR 47	Result
Antenna Requirement	15.203	Pass
Conduction Emission	15.207	N/A
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

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	± 4.34dB	(1)
Radiated Emission	30MHz ~ 1000MHz	± 4.24dB	(1)
Radiated Emission	1GHz ~ 26.5GHz	± 4.68dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	± 3.45dB	(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 General Description of EUT

Product Name:	TPMS-sensor
Model No.:	TPM-C pro-M
Serial No.:	5F01023C
Test sample(s) ID:	GTS201809000176-1
Sample(s) Status:	Engineer sample
Hardware Version:	QY1269-01-001PB-V04
Software Version:	QY1269-A14B13-000
Operation Frequency:	433.92MHz
Modulation technology:	FSK
Antenna Type:	PCB Antenna
Antenna gain:	-5.0dBi(declared by manufacture)
Power supply:	Battery: DC 3.0V

5.2 Test mode

Transmitting mode	Keep the EUT in transmitting mode.

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 only the worst case was shown in this test report and defined as follows:

433.92MHz	Axis	X	Y	Z
	Field Strength(dBuV/m)	80.36	81.24	79.51

5.3 Description of Support Units

Manufacturer	Description	Model	Serial Number
SHANGHAI BAOLONG AUTOMOTIVE CORPORATION	Tire pressure monitoring sensor activation tool	SGMW	1012-1809010009

5.4 Test Facility

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

- **FCC —Registration No.: 381383**

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 381383, January 08, 2018.

- **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, August 15, 2016

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	July. 03 2015	July. 02 2020
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June. 27 2018	June. 26 2019
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June. 27 2018	June. 26 2019
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	June. 27 2018	June. 26 2019
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June. 27 2018	June. 26 2019
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	June. 27 2018	June. 26 2019
9	Coaxial Cable	GTS	N/A	GTS211	June. 27 2018	June. 26 2019
10	Coaxial cable	GTS	N/A	GTS210	June. 27 2018	June. 26 2019
11	Coaxial Cable	GTS	N/A	GTS212	June. 27 2018	June. 26 2019
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June. 27 2018	June. 26 2019
13	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	June. 27 2018	June. 26 2019
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June. 27 2018	June. 26 2019
15	Band filter	Amindeon	82346	GTS219	June. 27 2018	June. 26 2019
16	Power Meter	Anritsu	ML2495A	GTS540	June. 27 2018	June. 26 2019
17	Power Sensor	Anritsu	MA2411B	GTS541	June. 27 2018	June. 26 2019
18	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS588	June. 27 2018	June. 26 2019
19	Splitter	Agilent	11636B	GTS237	June. 27 2018	June. 26 2019
20	Loop Antenna	ZHINAN	ZN30900A	GTS534	June. 27 2018	June. 26 2019
21	Spectrum Analyzer	Agilent	E4440A	GTS533	June. 27 2018	June. 26 2019

General used equipment:

Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Barometer	ChangChun	DYM3	GTS257	June 27 2018	June 26 2019

7 Test results and Measurement Data

7.1 Antenna Requirement

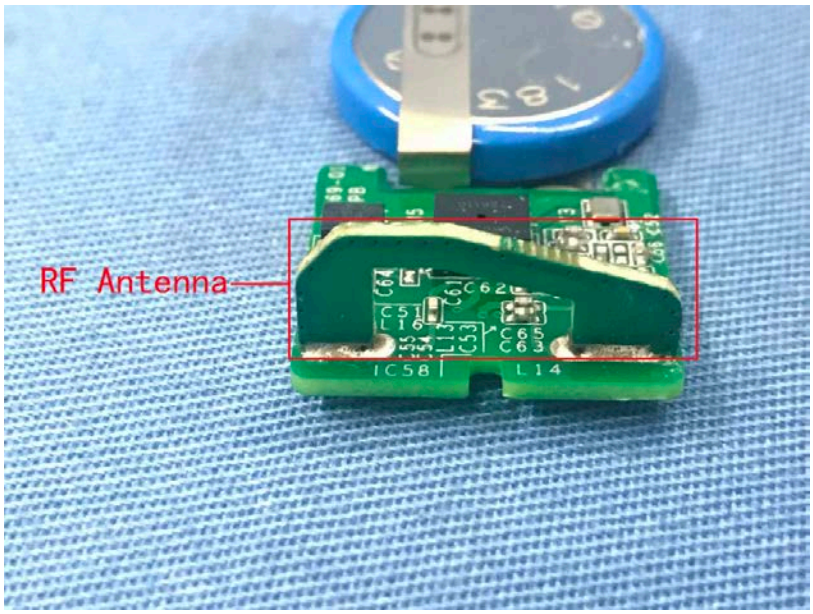
Standard requirement:	FCC Part15 C Section 15.203

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 antenna is PCB antenna, the best case gain of the antenna is -5.0dBi



7.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.231 (e)& Section 15.209
Test Method:	ANSI C63.10:2013
Test Frequency Range:	9kHz to 5000MHz
Test site:	Measurement Distance: 3m

Receiver setup:

Frequency	Detector	RBW	VBW	Value
9KHz-150KHz	Quasi-peak	200Hz	600Hz	Quasi-peak
150KHz-30MHz	Quasi-peak	9KHz	30KHz	Quasi-peak
30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

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)

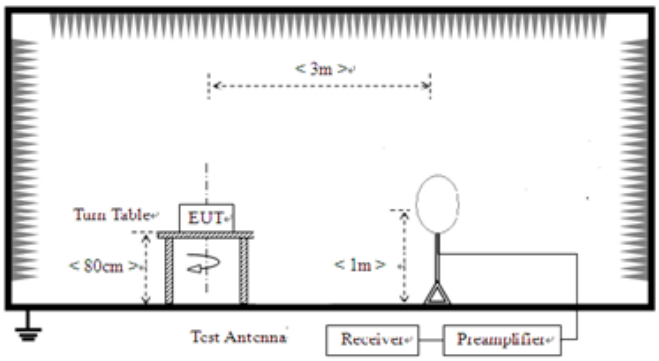
Fundamental Frequency (MHz)	Field Strength of fundamental (microvolts/meter)	Field Strength of Unwanted Emissions (microvolts/meter)
40.66 - 40.70	1,000	100
70 - 130	500	50
130 - 174	500 to 1,500 **	50 to 1,50 **
174 - 260	1,500	1,50
260 - 470	1,500 to 5,000 **	1,50 to 5,00 **
Above 470	5,000	5,00

FREQUENCY (MHz)	Class B (dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

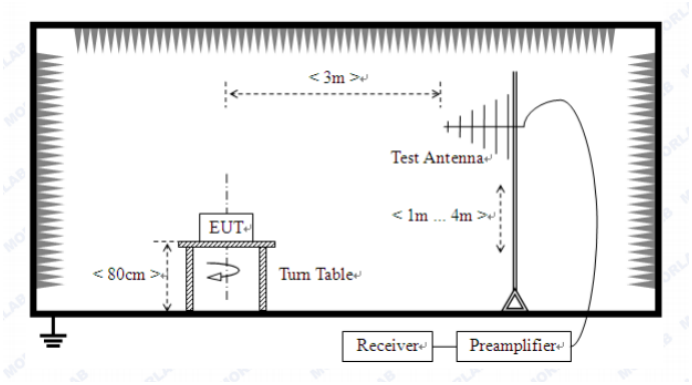
Or The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level whichever limit permits a higher field strength.

Test setup:

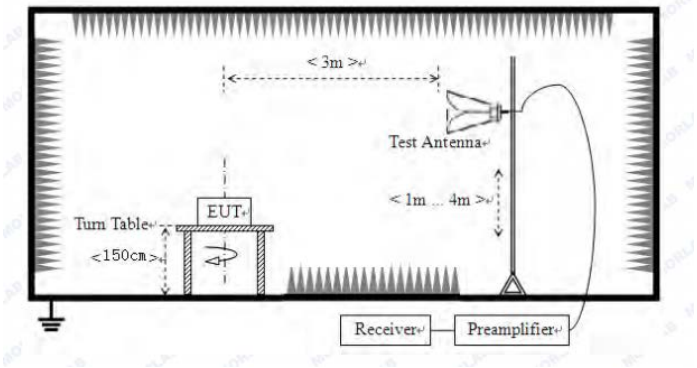
Below 30MHz



Below 1GHz



Above 1GHz



Test Procedure:	1. 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. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. 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. 4. 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. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. 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 5.2 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	87.21	17.53	3.02	29.43	78.33	92.87	-14.54	Horizontal
433.92	90.12	17.53	3.02	29.43	81.24	92.87	-11.63	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	78.33	-14.61	63.72	72.87	-9.15	Horizontal
433.92	81.24	-14.61	66.63	72.87	-6.24	Vertical

Remark:

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

7.2.2 Spurious Emissions

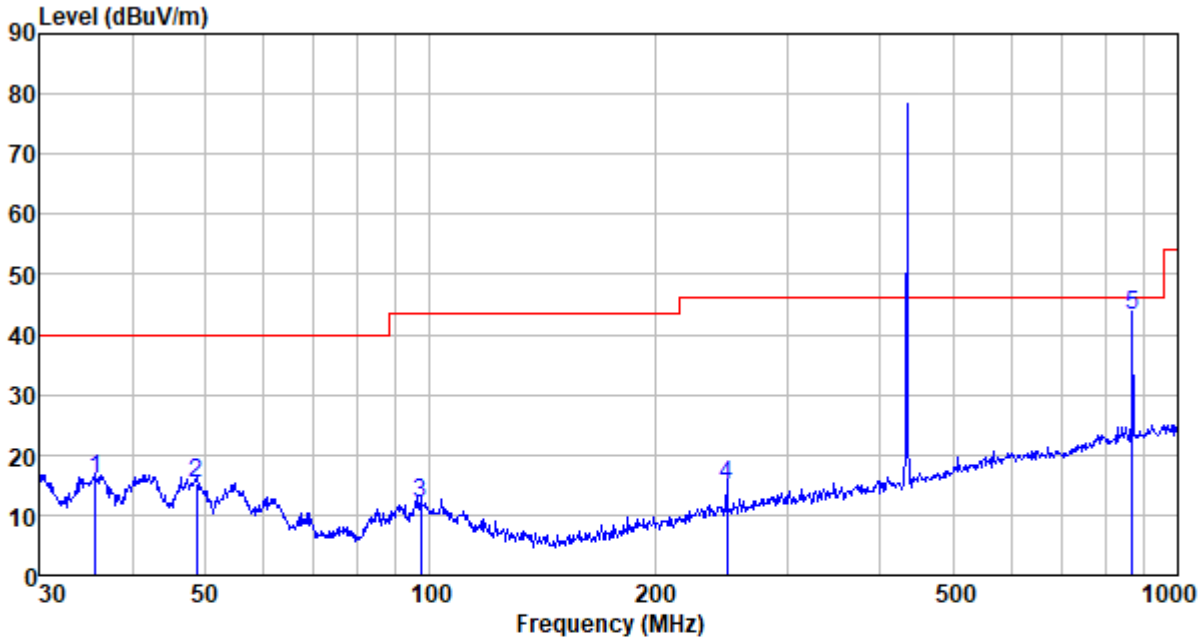
Measurement data:

9 kHz ~ 30 MHz

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

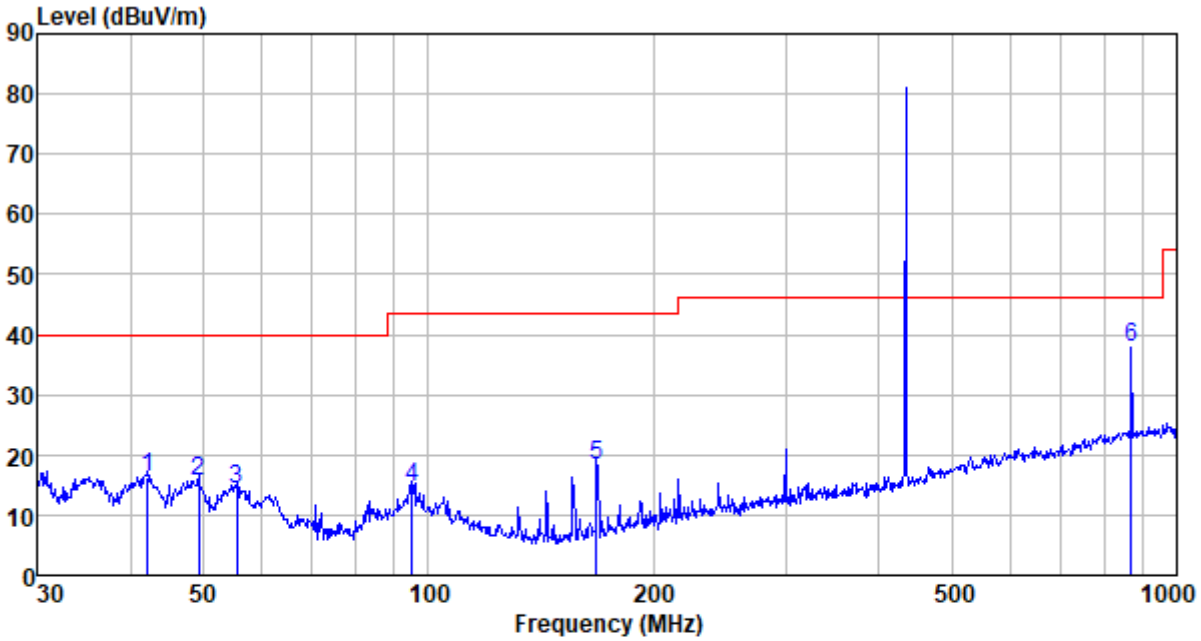
Below 1GHz:

Mode:	**Transmitting mode**	**Test by:**	**Bill**
Temp./Hum.(%H):	**26℃/56%RH**	**Polarziation:**	**Horizontal**



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
35.749	39.26	11.46	0.62	35.41	15.93	40.00	-24.07	QP
48.672	38.40	12.29	0.76	36.12	15.33	40.00	-24.67	QP
97.115	35.67	11.79	1.17	36.70	11.93	43.50	-31.57	QP
249.425	38.00	12.15	2.12	37.38	14.89	46.00	-31.11	QP
869.130	54.11	22.02	4.74	37.61	43.26	46.00	-2.74	QP

Mode:	**Transmitting mode**	**Test by:**	**Bill**
Temp./Hum.(%H):	**26℃/56%RH**	**Polarziation:**	**Vertical**



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
42.154	39.00	12.22	0.69	35.79	16.12	40.00	-23.88	QP
49.359	38.57	12.29	0.77	36.15	15.48	40.00	-24.52	QP
55.415	38.11	11.75	0.82	36.26	14.42	40.00	-25.58	QP
95.093	38.62	11.52	1.15	36.68	14.61	43.50	-28.89	QP
167.824	45.28	8.46	1.67	37.18	18.23	43.50	-25.27	QP
869.130	48.73	22.02	4.74	37.61	37.88	46.00	-8.12	QP

Above 1G:

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
1735.68	53.62	25.05	4.82	34.00	49.49	72.87	-23.38	Vertical
2169.60	40.11	27.74	5.15	34.27	38.73	72.87	-34.14	Vertical
2603.52	40.86	27.82	5.58	33.78	40.48	72.87	-32.39	Vertical
1735.68	50.33	25.05	4.82	34.00	46.20	72.87	-26.67	Horizontal
2169.60	41.55	27.74	5.15	34.27	40.17	72.87	-32.70	Horizontal
2603.52	41.71	27.82	5.58	33.78	41.33	72.87	-31.54	Horizontal

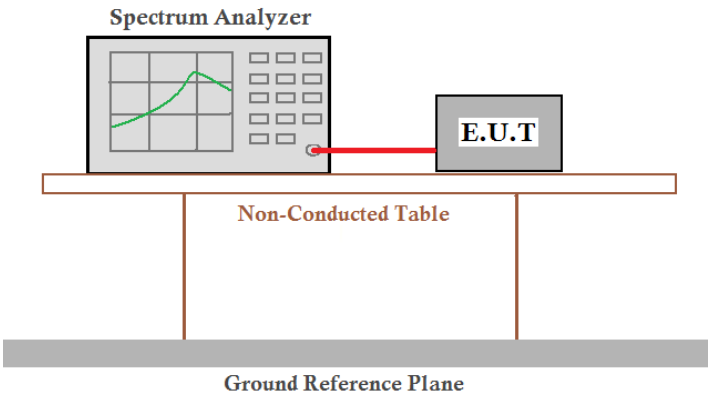
Average value:

Frequency (MHz)	Level (dBuV/m)	Duty cycle factor	Average value (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
1735.68	49.49	-14.61	34.88	52.87	-17.99	Vertical
2169.60	38.73	-14.61	24.12	52.87	-28.75	Vertical
2603.52	40.48	-14.61	25.87	52.87	-27.00	Vertical
1735.68	46.20	-14.61	31.59	52.87	-21.28	Horizontal
2169.60	40.17	-14.61	25.56	52.87	-27.31	Horizontal
2603.52	41.33	-14.61	26.72	52.87	-26.15	Horizontal

Remarks:

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:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

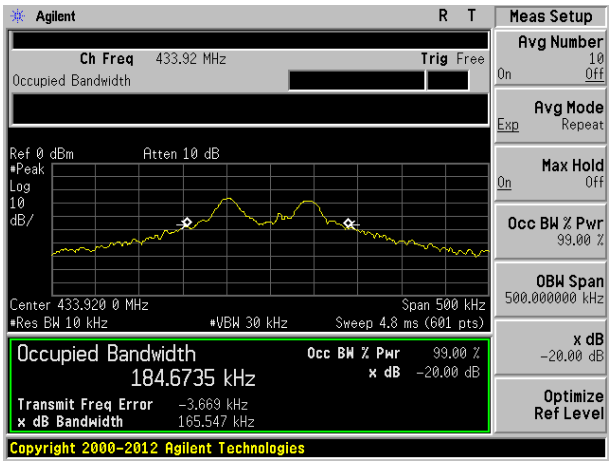
Measurement Data

Test Frequency (MHz)	20dB bandwidth (MHz)	Limit (MHz)	Result
433.92	0.166	1.085	Pass

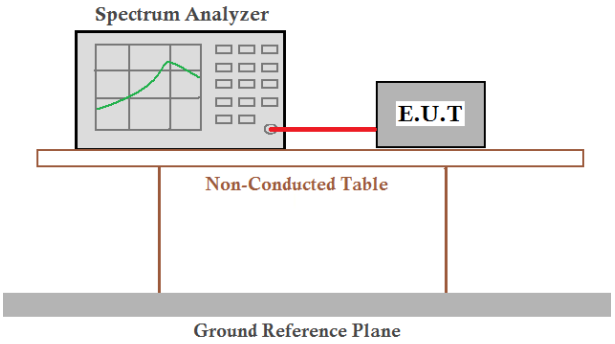
Note: Limit= Fundamental frequency×0.25%

433.92×0.25%=1.085MHz

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=100KHz, span=0Hz, detector: Peak
Limit:	Not more than 1 seconds Silent period: at least 30 times the duration of the transmission or more than 10 seconds
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

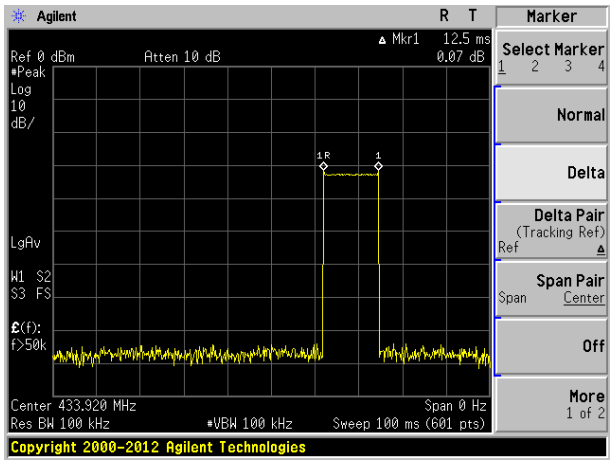
Measurement data:

Frequency (MHz)	Duration of each TX (second)	Limit (second)	Result
433.92	0.0125	<1.0	Pass

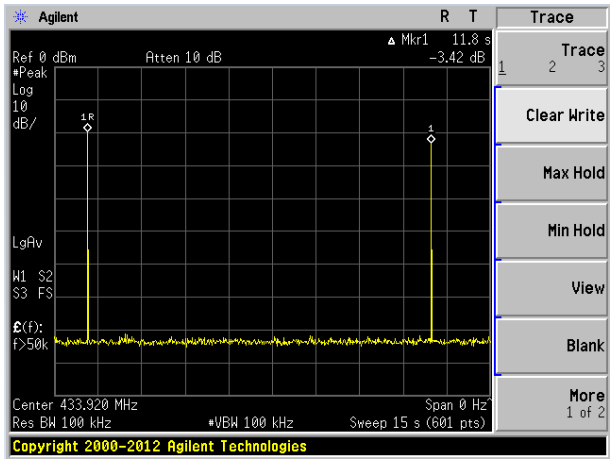
Silent period

Frequency (MHz)	Duration of each TX (seconds):	Limit (seconds)	Result
433.92	11.80	At least 30 times the duration of the transmission or more than 10 seconds	Pass

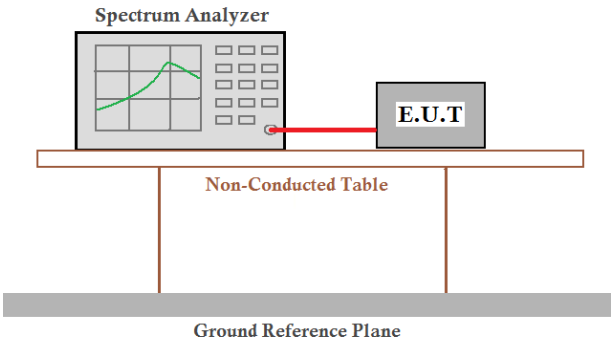
Test plot as follows:



Silent period



7.5 Duty Cycle

Test Requirement:	FCC Part15 C Section 15.231
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100KHz, VBW=100KHz, span=0Hz, detector: Peak
Limit:	No dedicated limit specified in the Rules.
Test Procedure:	1. Place the EUT on the table and set it in transmitting mode. 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer. 3. Set centre frequency of spectrum analyzer=operating frequency. 4. Set the spectrum analyzer as RBW=100kHz, VBW=100KHz, Span=0Hz, Adjust Sweep=100ms to obtain the “worst-case” pulse on time 5. Repeat above procedures until all frequency measured was complete.
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement data:

Calculate Formula: Duty cycle factor =20 log(Duty cycle)

Duty cycle=on time/0.1 seconds or period, whichever is less

Test data:

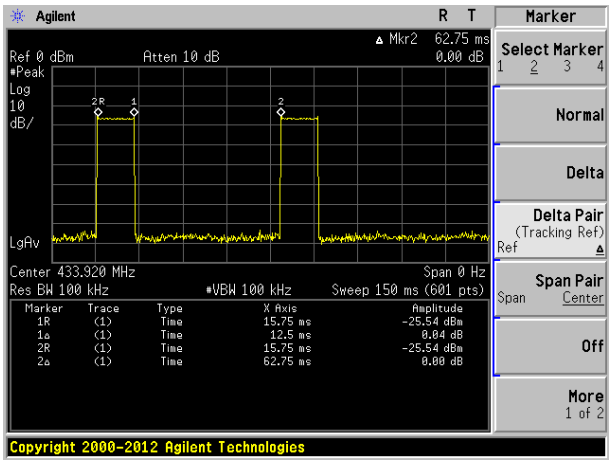
T on time =12.50 (ms)

T period =67.25(ms)

Duty cycle=12.50/67.25=18.59%

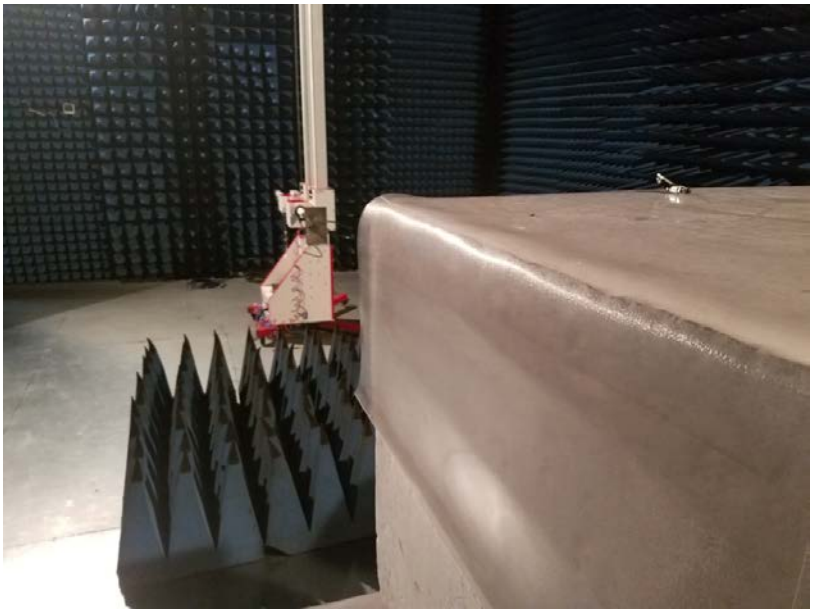
Duty cycle factor =20 log(0.1859)=-14.61

Test plot as follows:

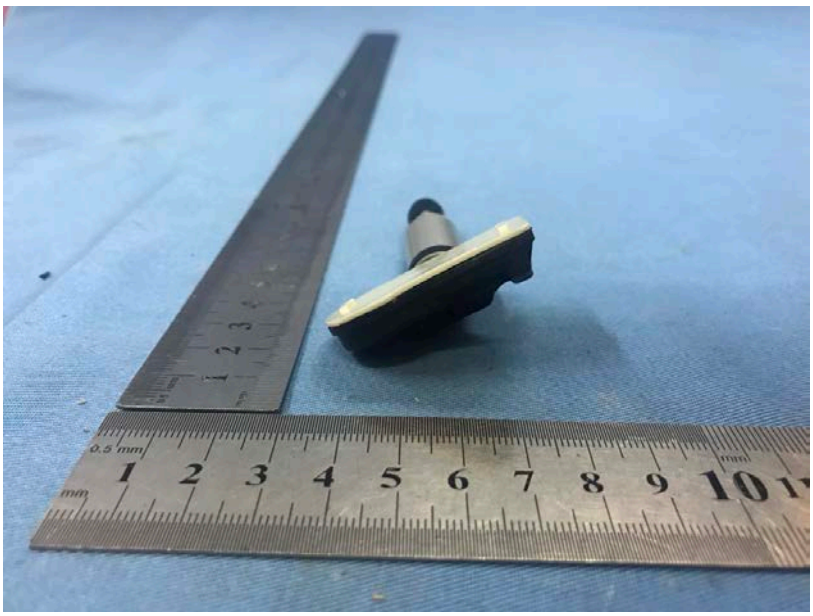


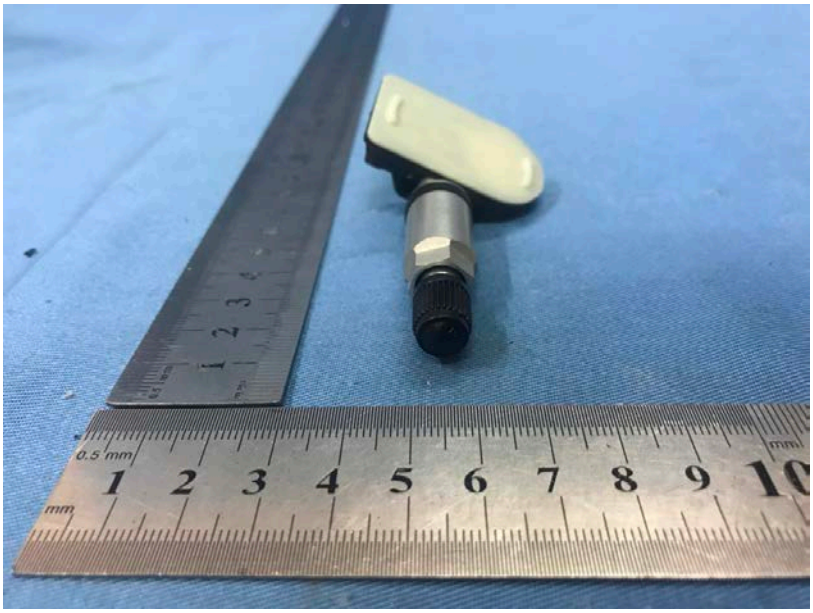
8 Test Setup Photo

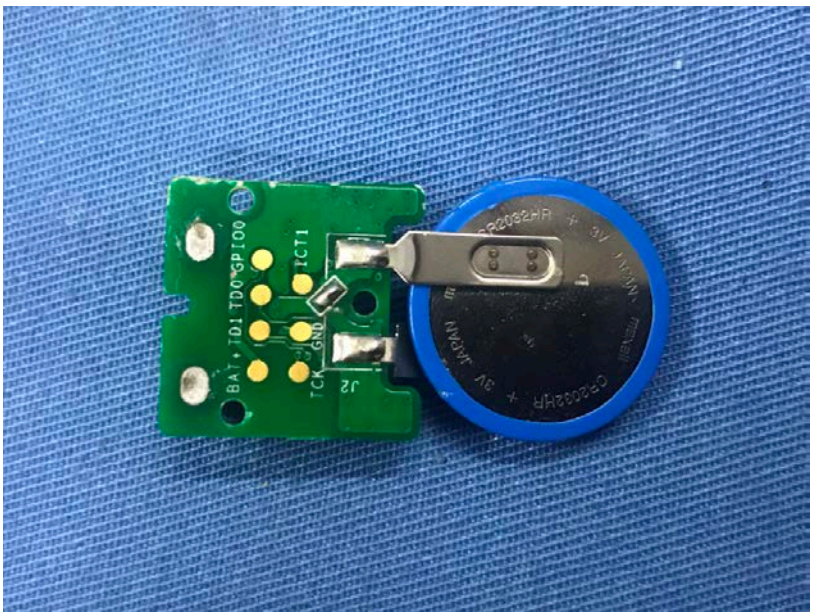
Radiated Emission



9 EUT Constructional Details



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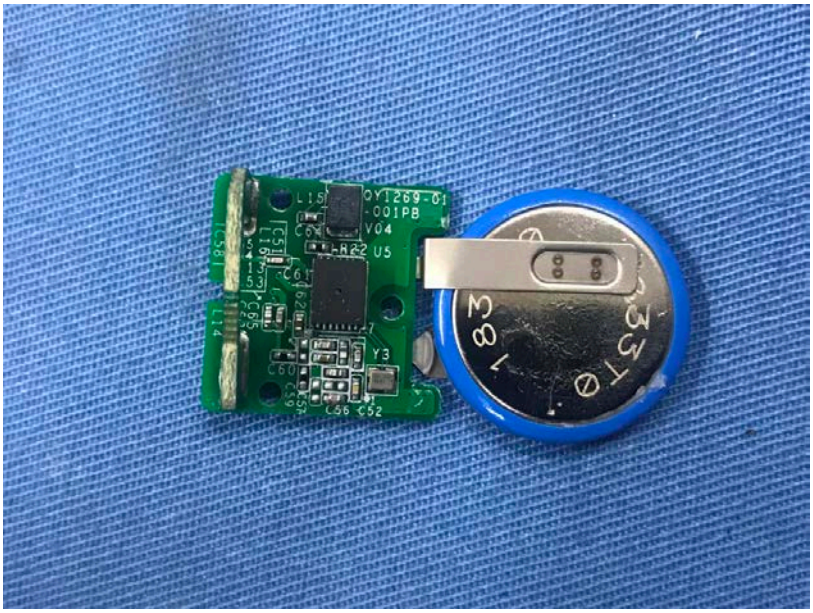
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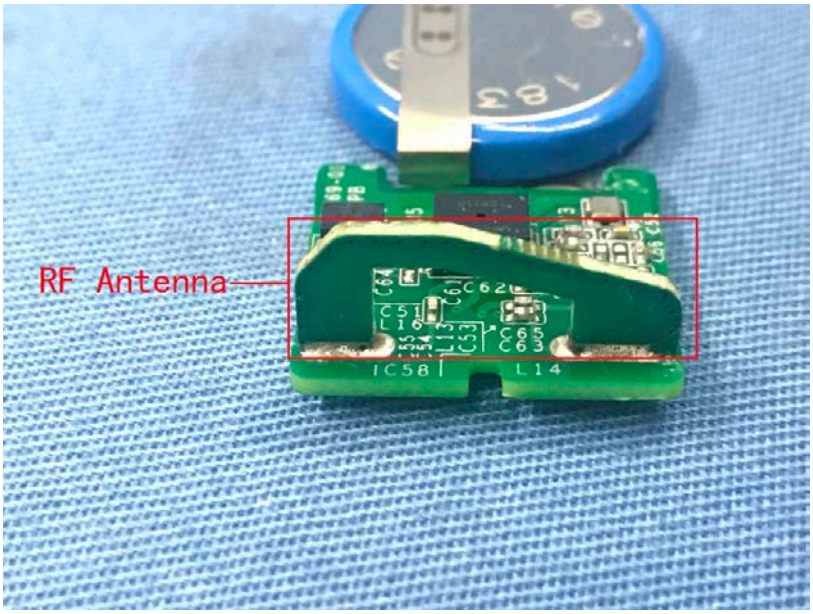

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