FCC Test Report

Report No.: AGC05278170601FE03

FCC ID	:	2AFZB-ZUTMBKRAVS
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	ZUS SMART TIRE SENSOR
BRAND NAME	:	ZUS
MODEL NAME	:	ZUTMBKRAV
CLIENT	:	No NDA Inc.
DATE OF ISSUE	:	July 05, 2017
STANDARD(S)	:	FCC Part 15 Rules
REPORT VERSION	:	V1.0

*A*ttestation of *G*lobal *C*ompliance(Shenzhen) Co., Ltd

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	July 05, 2017	Valid	Original Report

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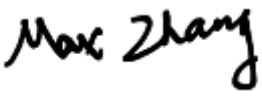
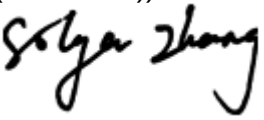
1. VERIFICATION OF CONFORMITY

Applicant	No NDA Inc.
Address	320 Mountain View Ave., Mountain View, CA 94041
Manufacturer	WBE Industrail
Address	Gaotian Area, Zhenlong Town, Huiyang, Huizhou City, Guangdong 516200 PRC
Product Designation	ZUS SMART TIRE SENSOR
Brand Name	ZUS
Test Model:	ZUTMBKRAV
Date of test	Jun.28, 2017
Deviation	None
Condition of Test Sample	Normal
Report Template	AGCRT-US-BR/RF(2013-03-01)

We hereby certify that:
The above equipment was tested by Dongguan Precise Testing Service Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC Rules Part 15.231.

Testedby 
Max Zhang(Zhang Yi) Jun.28, 2017

Reviewed by 
Bart Xie(XieXiaobin)) July 05, 2017

Approved by 
Solger Zhang(Zhang Hongyi) July 05, 2017
Authorized Officer

2. GENERAL INFORMATION

2.1.PRODUCT DESCRIPTION

A major technical description of EUT is described as following

Operation Frequency	433.92MHz
Field Strength(3m)	72.72dBuV/m(Peak)@3m
Modulation	ASK
Number of channels	1
Hardware Version	1.0
Software Version	1.0
Antenna Designation	Fixed antenna
Antenna Gain	0dBi
Power Supply	DC3V by Battery

2.2. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2AFZB-ZUTMBKRAVS** filing to comply with Section 15.231of the FCC Part 15, Subpart C Rules.

2.3. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013). Radiated testing was performed at an antenna to EUT distance 3 meters.

2.4. SPECIAL ACCESSORIES

Refer to section 5.1.

2.5. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ±U，where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2，providing a level of confidence of approximately 95 %。

No.	Item	Uncertainty
1	Conducted Emission Test	±3.18dB
2	All emissions,radiated	±3.91dB
3	Temperature	±0.5°C
4	Humidity	±2%

4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Transmitting mode

Note:
1. Onlythe data of the worst case recorded in the test report.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.

5. SYSTEM TEST CONFIGURATION

5.1. EQUIPMENT USED IN EUT SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	ZUS SMART TIRE SENSOR	ZUTMBKRAV	2AFZB-ZUTMBKRAVS	EUT

5.2. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.203	Antenna Requirement	Compliant
§15.231(a)(1)	Manually	N/A
§15.231(a)(2)	automatically	N/A
§15.231(a)(3)	periodic	Compliant
§15.231(a)(4)	emergency(alarm)	N/A
§15.231(a)(5)	security	N/A
§15.231(b)	Average Factor	Compliant
§15.231(b)&§15.209	Field Strength of Fundamental and Spurious Emission	N/A
§15.231(c)	Bandwidth	Compliant
§15.231(d)	Frequency Tolerance	N/A
§15.231(e)	Field Strength(periodic transmitter)	Compliant
§15.207	Conducted Emission	N/A

6. TEST FACILITY

Site	Dongguan Precise Testing Service Co., Ltd.
Location	Building D,Baoding Technology Park,Guangming Road2,Dongcheng District, Dongguan, Guangdong, China.
FCC Registration No.	371540
Description	The test site is constructed and calibrated to meet the FCC requirements in documents ANSI C63.4:2014.

ALL TEST EQUIPMENT LIST

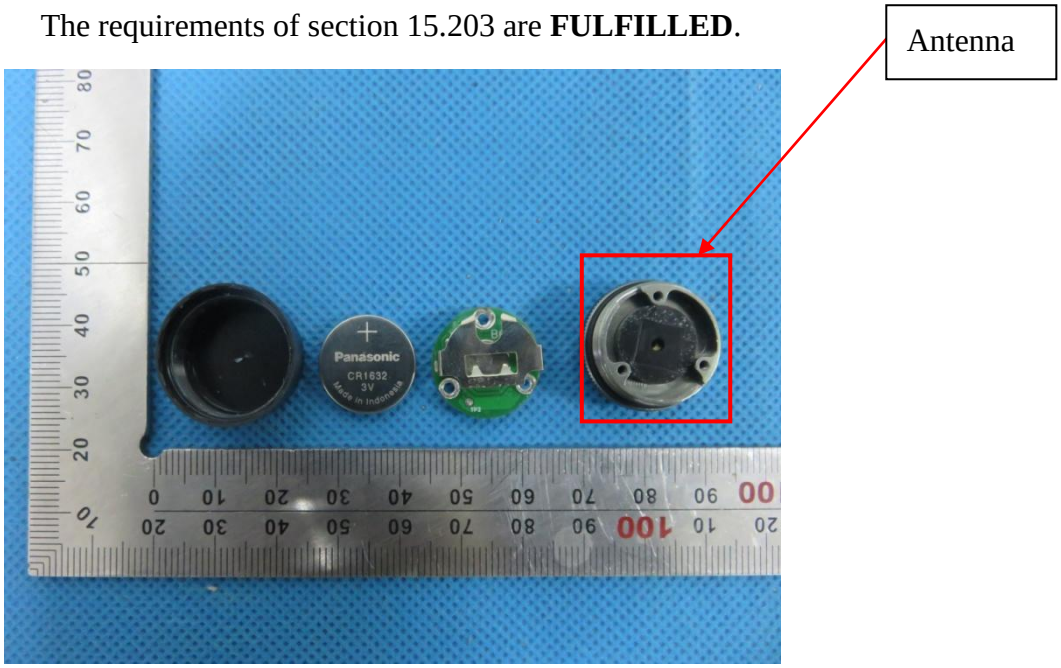
Radiated Emission Test Site					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
EMI Test Receiver	Rohde & Schwarz	ESCI	101417	July 3, 2016	July 2, 2017
Trilog Broadband Antenna (25M-1GHz)	SCHWARZBECK	VULB9160	9160-3355	July 3, 2016	July 2, 2017
Signal Amplifier	SCHWARZBECK	BBV 9475	9745-0013	July 3, 2016	July 2, 2017
RF Cable	SCHWARZBECK	AK9515E	96221	July 3, 2016	July 2, 2017
3m Anechoic Chamber	CHENGYU	966	PTS-001	June 3, 2017	June 2, 2018
MULTI-DEVICE Positioning Controller	Max-Full	MF-7802	MF780208339	N/A	N/A
Active loop antenna (9K-30MHz)	Schwarzbeck	FMZB1519	1519-038	June 3, 2017	June 2, 2018
Spectrum analyzer	Agilent	E4407B	MY46185649	June 3, 2017	June 2, 2018
Power Sensor	Agilent	U2021XA	MY55050474	June 3, 2017	June 2, 2018
Horn Antenna (1G-18GHz)	SCHWARZBECK	BBHA9120D	9120D-1246	June 3, 2017	June 2, 2018
Horn Ant (18G-40GHz)	Schwarzbeck	BBHA 9170	9170-181	June 3, 2017	June 2, 2018

7. ANTENNA REQUIREMENT

According to §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 EuT has fixed antenna, which accordance to the above sections, is considered sufficient to comply with the provisions of these sections. Please see EuT photo for details.

The requirements of section 15.203 are **FULFILLED**.

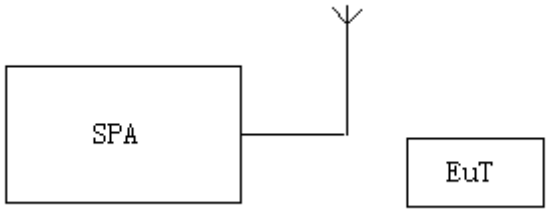


8.PROVISION FOR MOMENTARY OPERATION

8.1 MEASUREMENT PROCEDURE

1. Set the parameters of SPA as below:
Centrefrequency = Operation Frequency
RBW=1MHz; VBW=1MHz
Span: 0Hz
2.SettheEUTto transmit by provisionoperated. Use the “View” function of SPA to find the transmission time of being released.
3. Record the data and Reported.

8.2 TEST SETUP

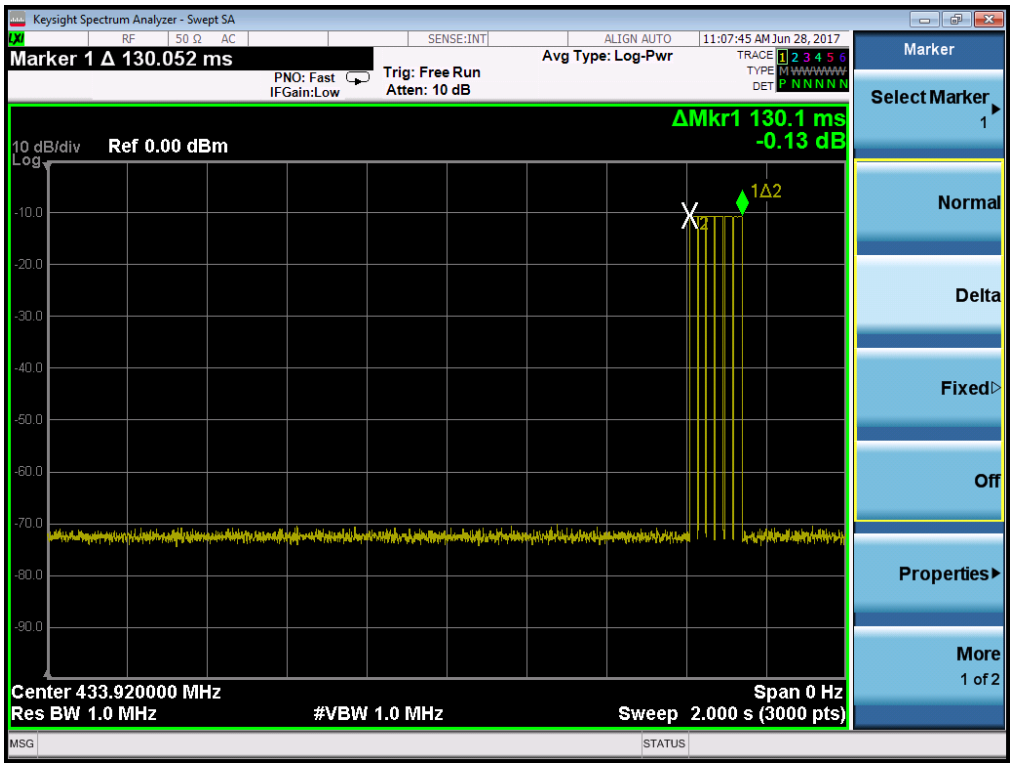


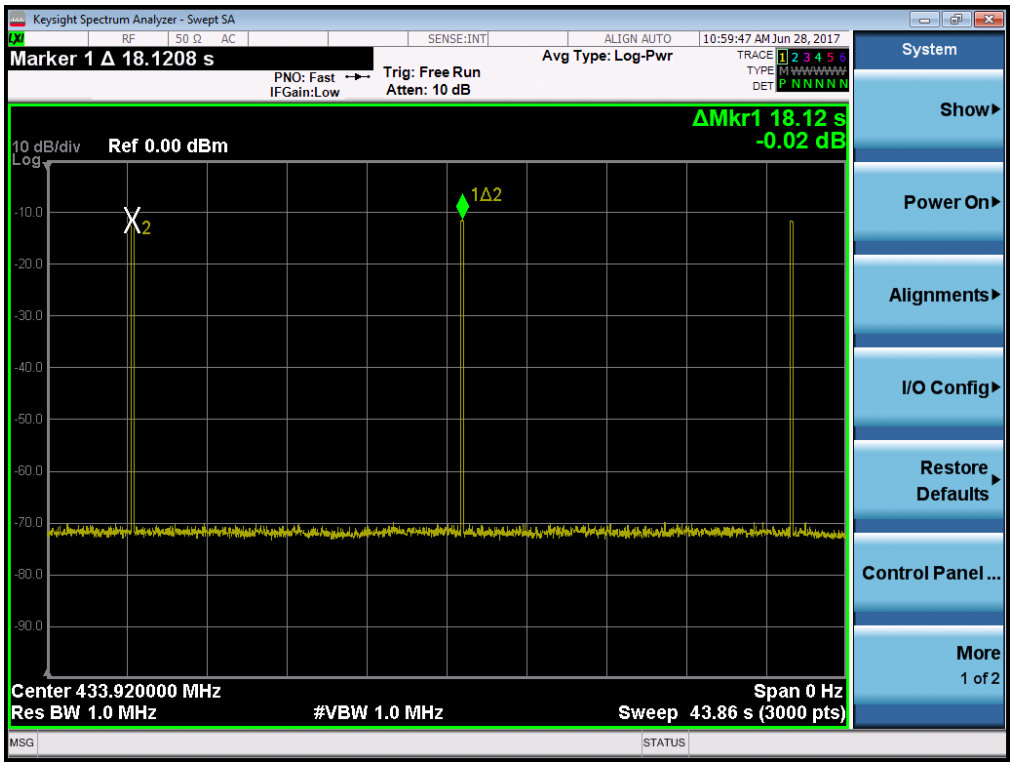
8.3 TEST RESULT

Test Mode: EUT @ 433.92MHz for RF Transmitter

Test Item	Time	Limit (s)
The time of stopping transmission after activation (s)	18.12s	Silent period>10s
Transmission Time	130.1ms	Duration of each transmission<=1s

RESULT: PASS



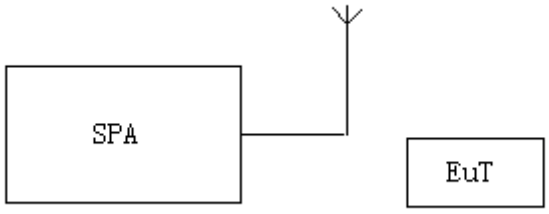

Keysight Spectrum Analyzer - Swept SA
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
10:59:47 AM Jun 28, 2017
Marker 1 Δ 18.1208 s
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
TRACE 1 2 3 4 5 6
TYPE M WWWWW
DET P N N N N N
ΔMkr1 18.12 s
-0.02 dB
10 dB/div
Log
Ref 0.00 dBm
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
-70.0
-80.0
-90.0
1Δ2
X2
Center 433.920000 MHz
Res BW 1.0 MHz
#VBW 1.0 MHz
Span 0 Hz
Sweep 43.86 s (3000 pts)
MSG
STATUS
System
Show
Power On
Alignments
I/O Config
Restore Defaults
Control Panel ...
More
1 of 2

9. DUTY CYCLE CORRECTION FACTOR

9.1 MEASUREMENT PROCEDURE

1. Set the parameters of SPA as below:
Centrefrequency = Operation Frequency
RBW=1MHz; VBW=1MHz
Span: 0Hz
Sweep time: 100ms
2.SettheEUTto transmit. Use the “Delta mark” function of SPA to find the periodtime between two pulse trains and each type of pulse occupancy time.
3. Record the plots and Reported.

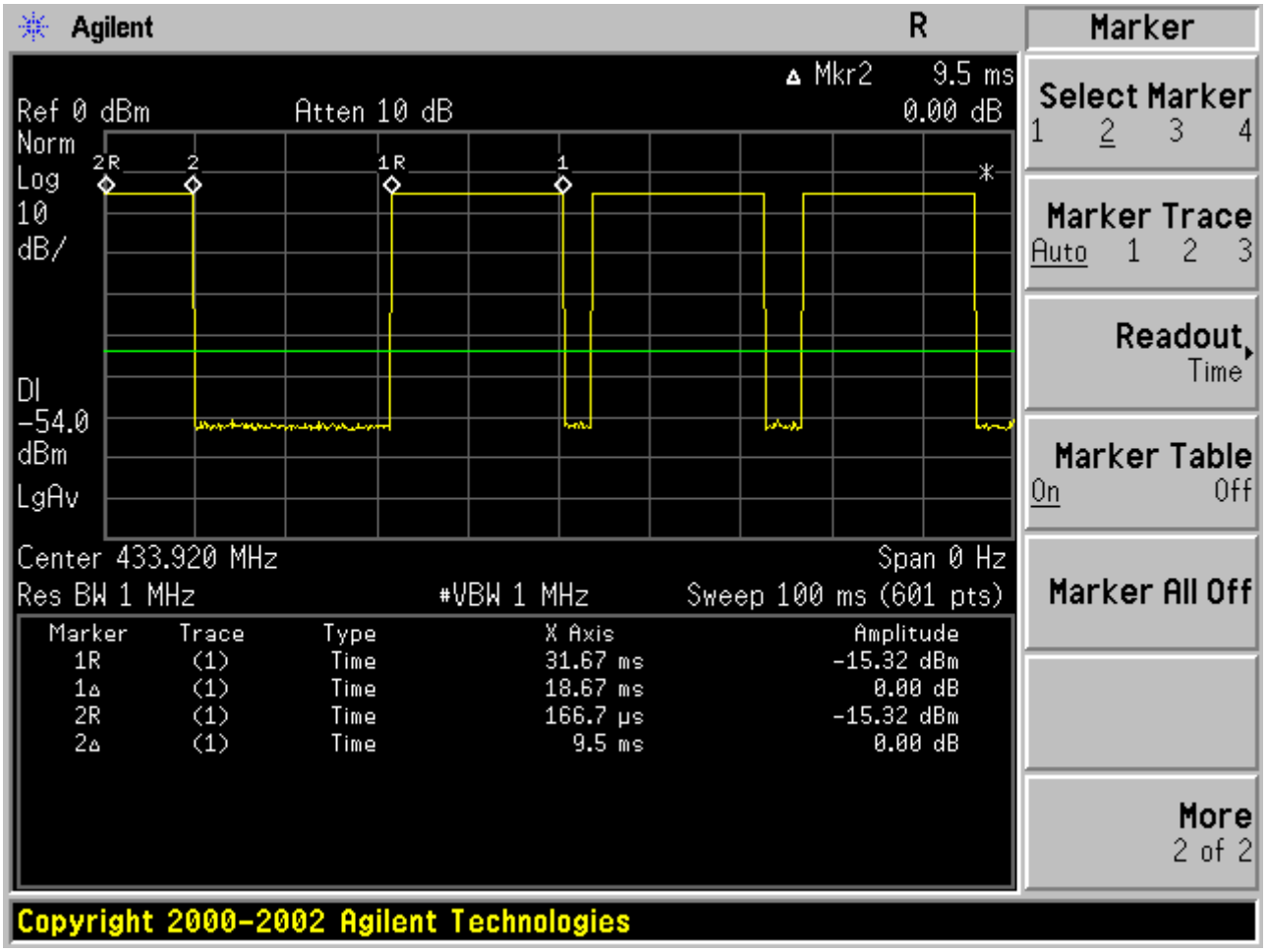
9.2 TEST SETUP



9.3 TEST RESULT

Test Mode: EUT @ 433.92MHz for RF Transmitter

Duty Cycle:	[9.5+(18.67*3)]/100=0.6551
Duty Cycle Correction Factor:	20lg(0.6551)=-3.67dB



10. RADIATED EMISSION

10.1. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

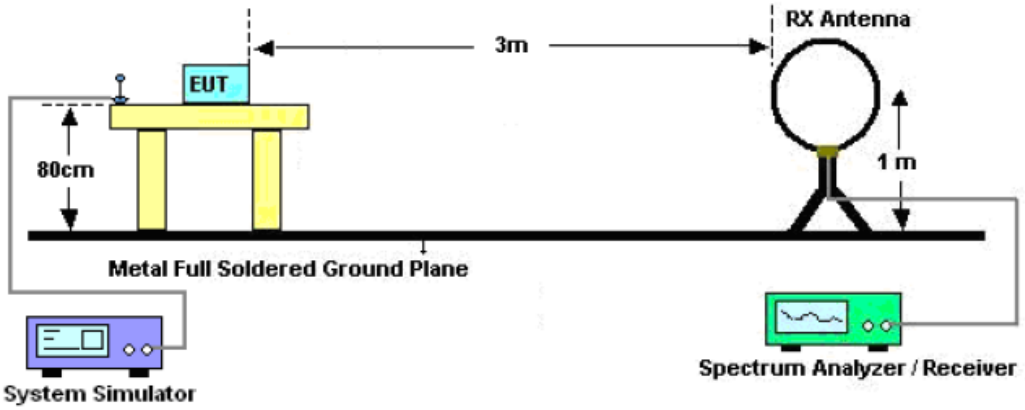
The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RBW 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RBW 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RBW 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz 1MHz/1MHz for Peak, 1MHz/10Hz for Average

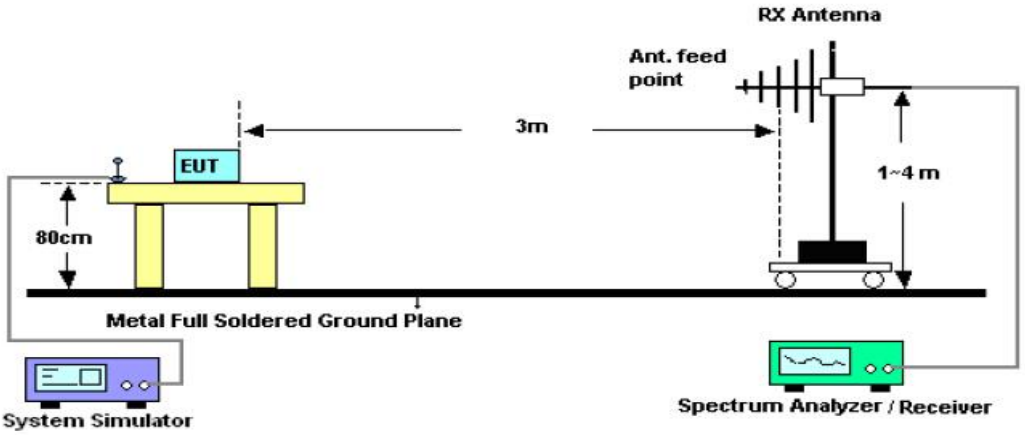
Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RBW 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RBW 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RBW 120KHz for QP

10.2.TEST SETUP

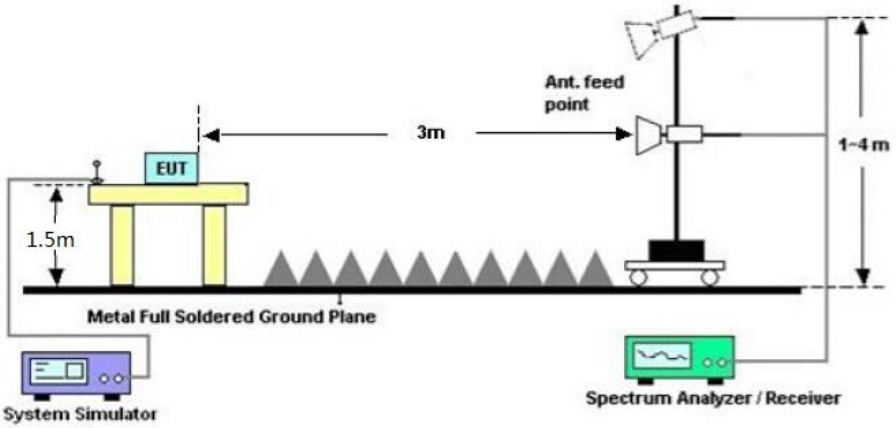
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



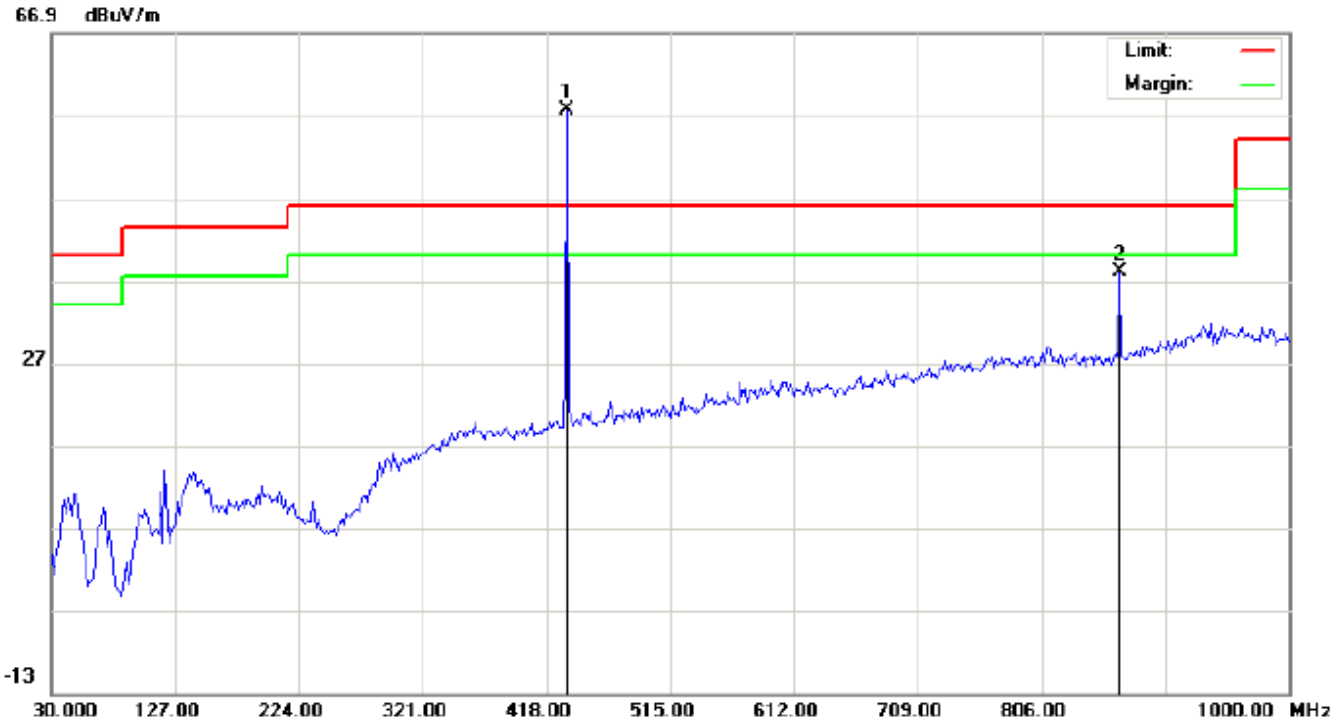
10.3.TEST RESULT

Test Mode: EUT @ 433.92MHz for RF Transmitter

RADIATED EMISSION BELOW 30MHz

No emission found between lowest internal used/generated frequencies to 30MHz.

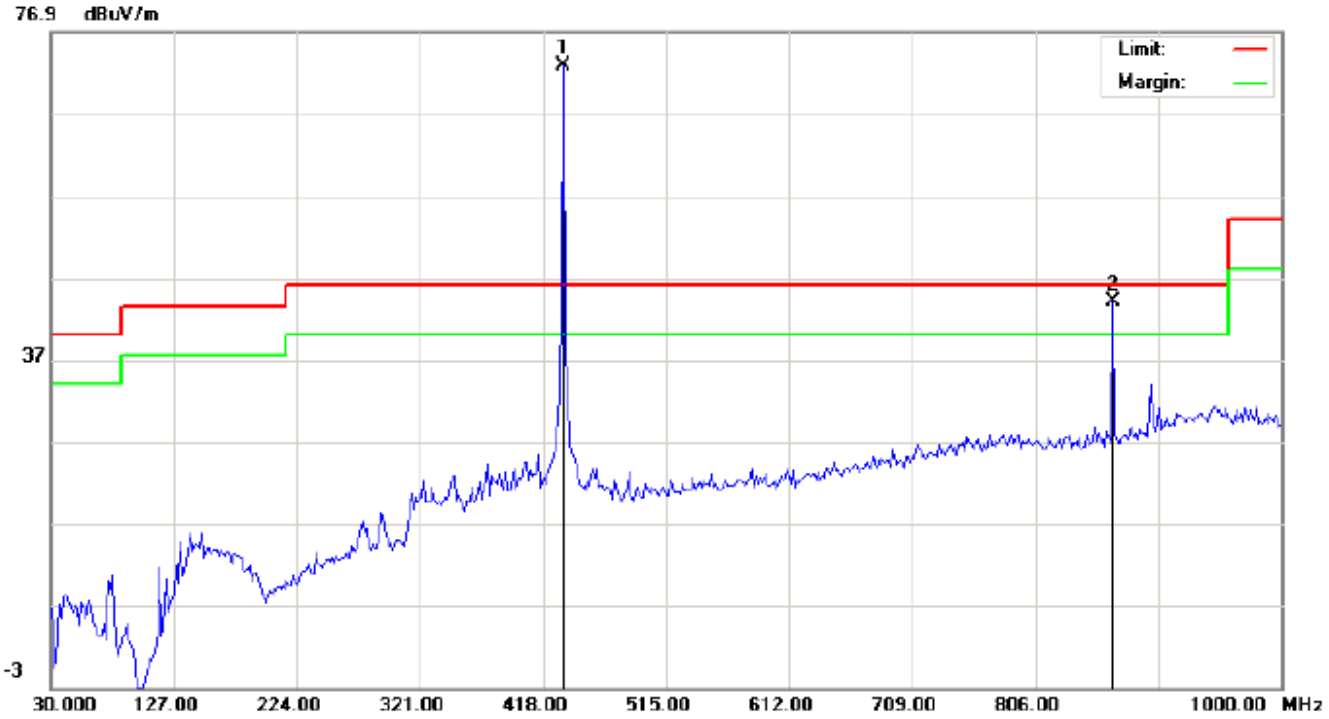
RADIATED EMISSION BELOW 1GHZ-Horizontal



Frequency MHz	Polarization	Reading dB(uV)	Factor dB(1/m)	PK Level dB(uV/m)	Limit dB(uV/m) PK	Margin dB PK	Pass/Fail	Detector	Remark
433.923	H	37.48	20.11	57.59	92.86	-35.27	Pass	PK	Fundamental
867.433	H	10.22	27.76	37.98	72.86	-34.88	Pass	PK	

Frequency MHz	Polarization	PK Level dB(uV/m)	Duty Cycle Correction Factor: dB	AV Level dB(uV/m)	Limit dB(uV/m) AV	Margin dB	Pass/Fail	Remark
433.923	H	57.59	-3.67	53.92	72.86	-18.94	Pass	Fundamental
867.433	H	37.98	-3.67	34.31	52.86	-18.55	Pass	

RADIATED EMISSION BELOW 1GHZ-Vertical



Frequency MHz	Polarization	Reading dB(uV)	Factor dB (1/m)	PK Level dB(uV/m)	Limit dB(uV/m) PK	Margin dB PK	Pass/Fail	Detector	Remark
433.923	V	52.61	20.11	72.72	92.86	-20.14	Pass	PK	Fundamental
867.433	V	16.23	27.76	43.99	72.86	-28.87	Pass		

Frequency MHz	Polarization	Level dB(uV/m)	Duty Cycle Correction Factor: dB	AV Level dB(uV/m)	Limit dB(uV/m) AV	Margin dB	Pass/Fail	Remark
433.923	V	72.72	-3.67	69.05	72.86	-3.81	Pass	Fundamental
867.433	V	43.99	-3.67	40.32	52.86	-12.54	Pass	

RESULT: PASS

Note: 1. Factor=Antenna Factor+ Cable loss-Amplifier gain, Margin=Measurement-Limit.

2.AV Level = PK Level + Duty cycle correction factor.

3. The “Factor”valuecan be calculated automatically by software of measurement system.

4.Emissionsoffrequency range from 1GHz to 5GHz have 20dB margin. No recording in the test report.

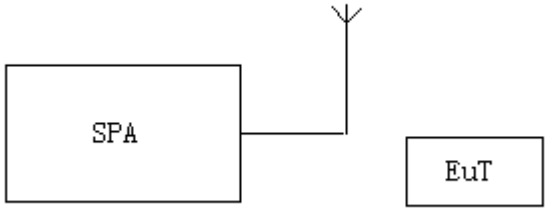
RESULT: PASS

11. BANDWIDTH

11.1. MEASUREMENT PROCEDURE

1. Set the parameters of SPA as below:
Centrefrequency = Operation Frequency
RBW=200Hz
VBW=620Hz
Span: 1000kHz
Sweep time: Auto
2.SettheEUTtocontinue transmitting mode.Allow the trace to stabilize. Use the “N dB down” function of SPA to define the bandwidth.
3. Record the plots and Reported.

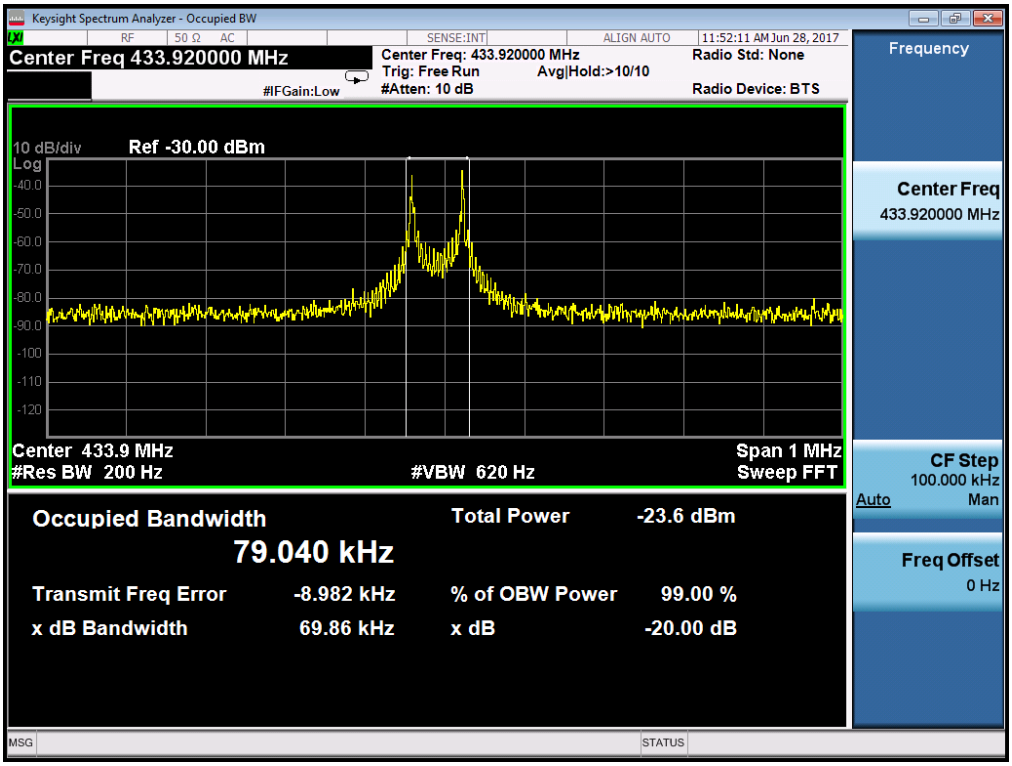
11.2. TEST SETUP



11.3. TEST RESULT

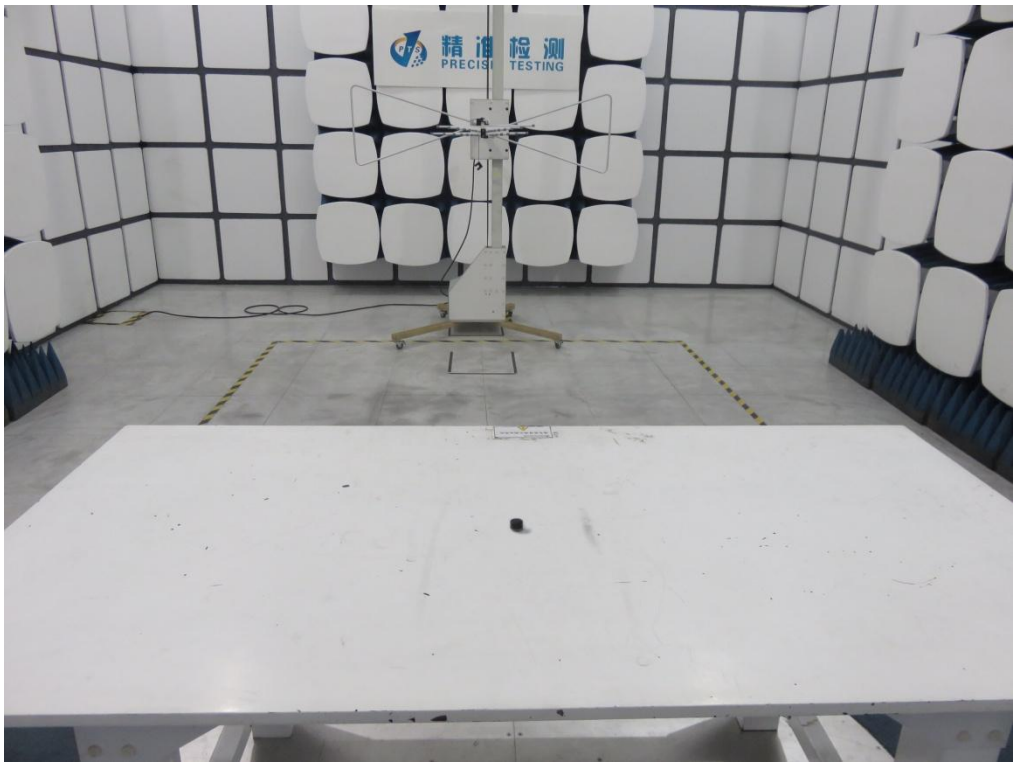
Test Mode: EUT @ 433.92MHz for RF Transmitter

-20dB bandwidth	LIMIT	RESULT
69.86kHz	1084.8KHz	Pass
Note: Limit= Operation Frequency×0.25%		

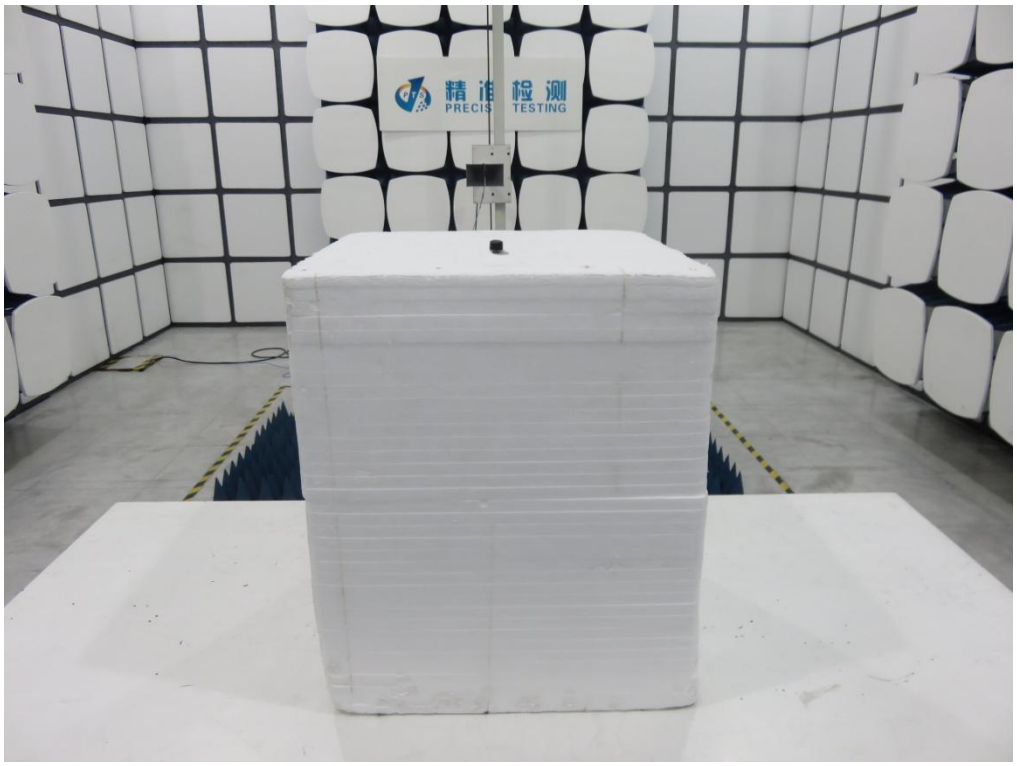


APPENDIX A:PHOTOGRAPHS OF TEST SETUP

RADIATED EMISSION TEST SETUPBELOW 1GHz

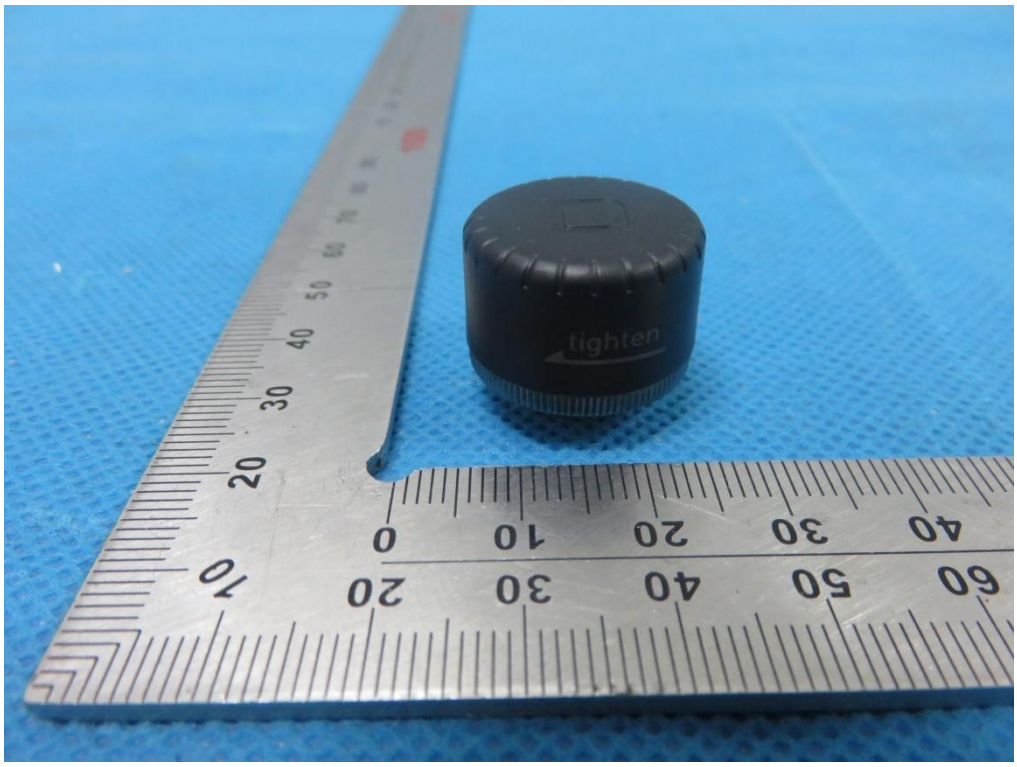


RADIATED EMISSION TEST SETUP ABOVE 1GHz

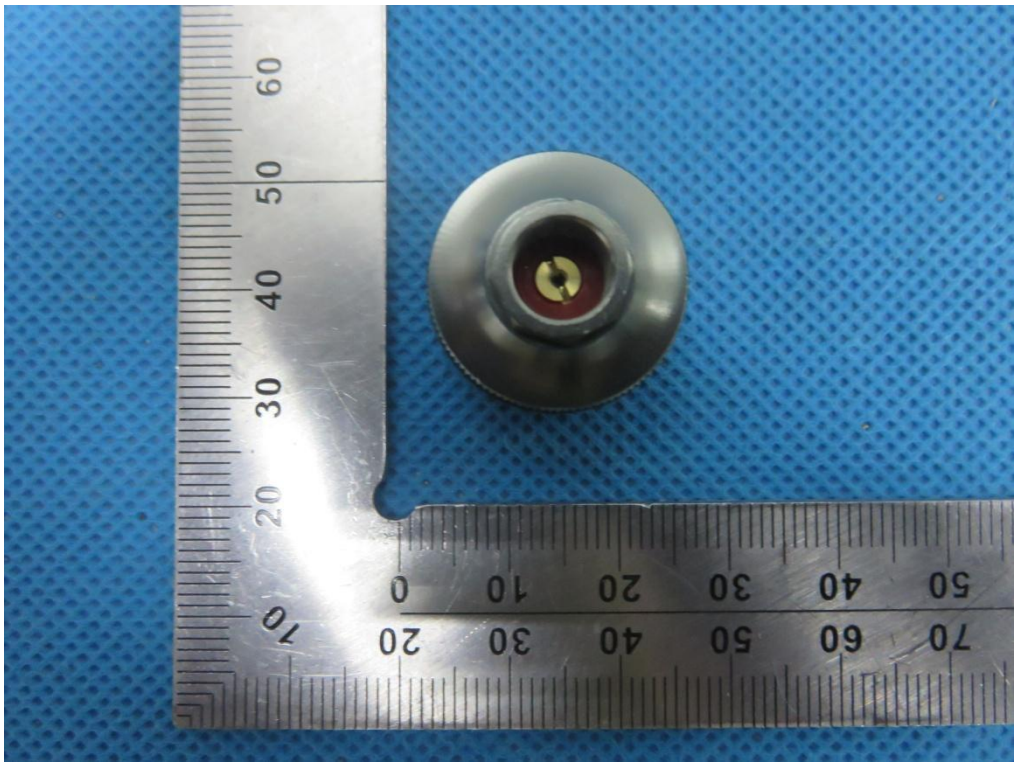


APPENDIX B:PHOTOGRAPHS OF EUT

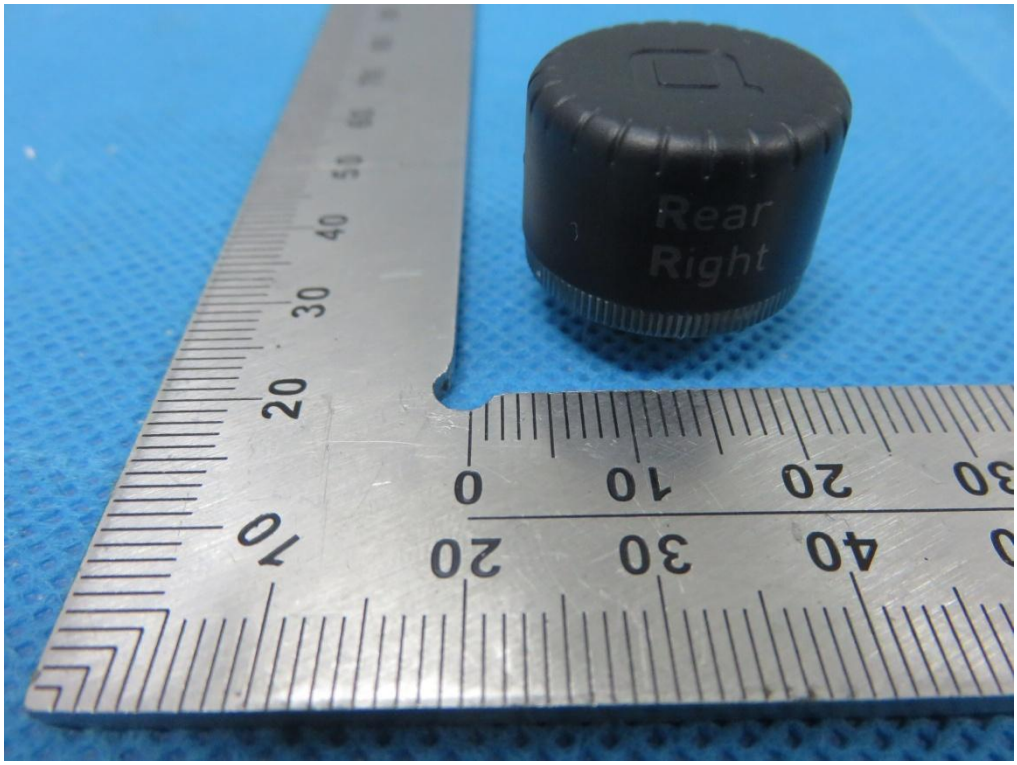
TOP VIEW OF EUT



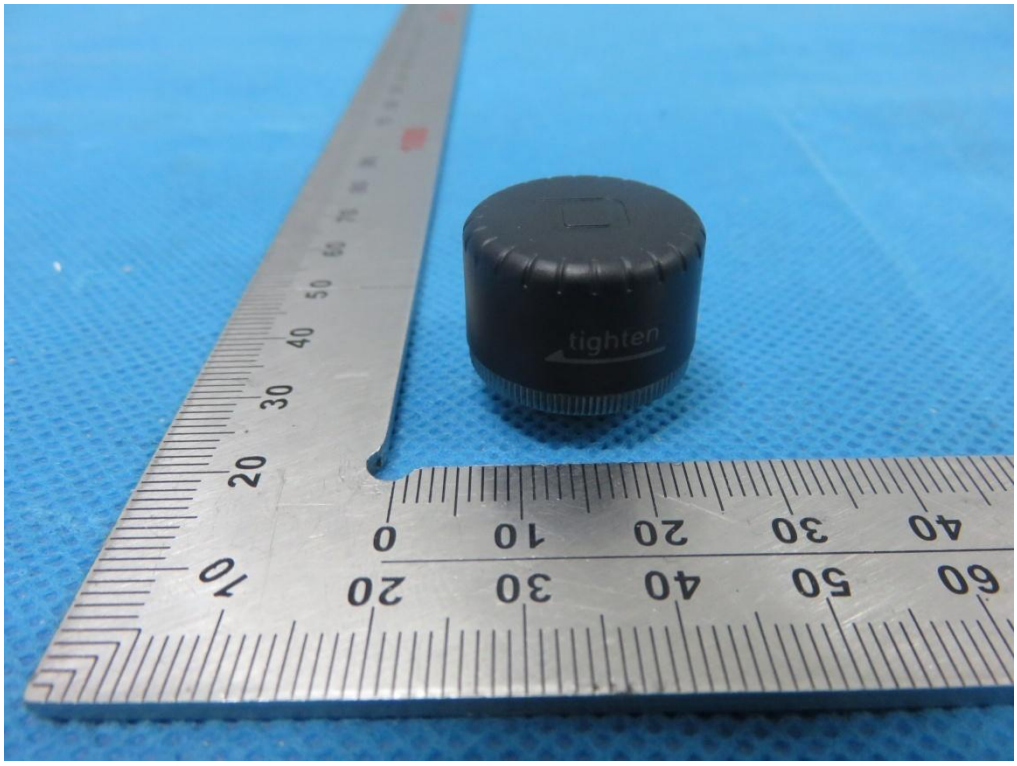
BOTTOM VIEW OF EUT



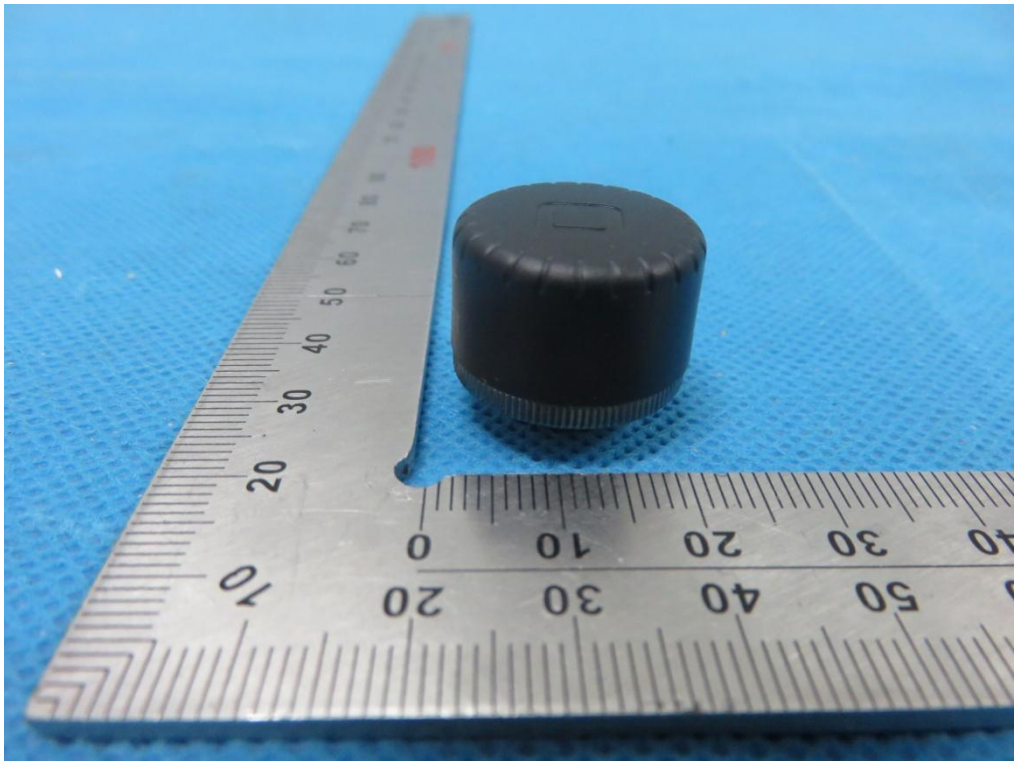
FRONT VIEW OF EUT



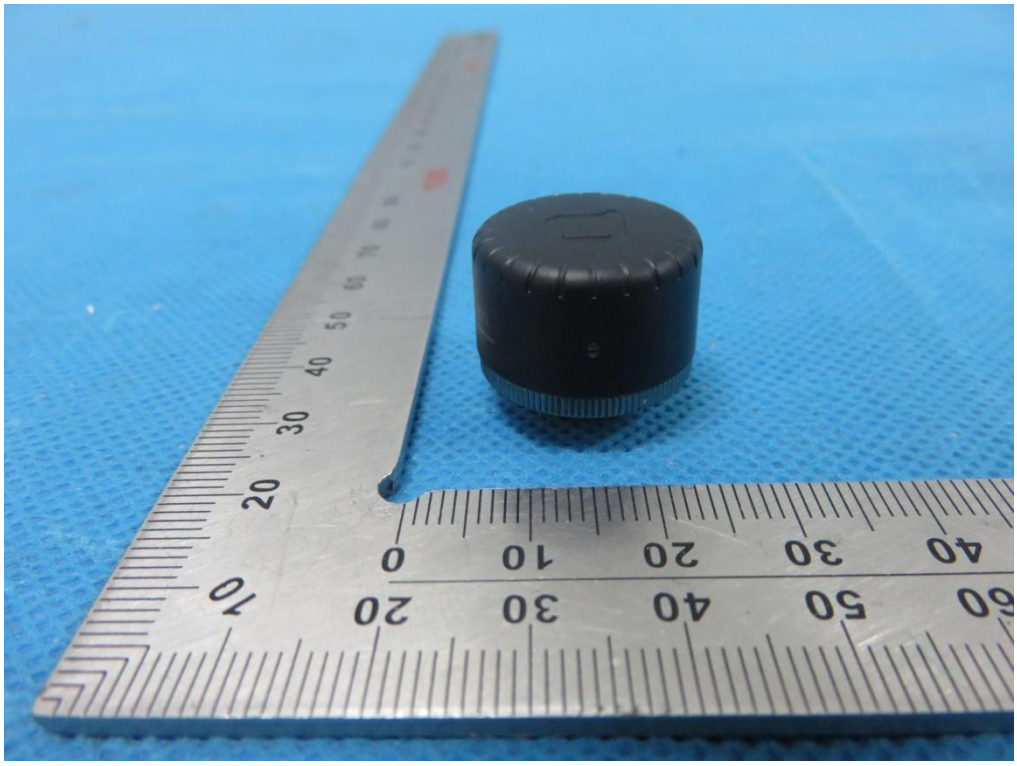
BACK VIEW OF EUT



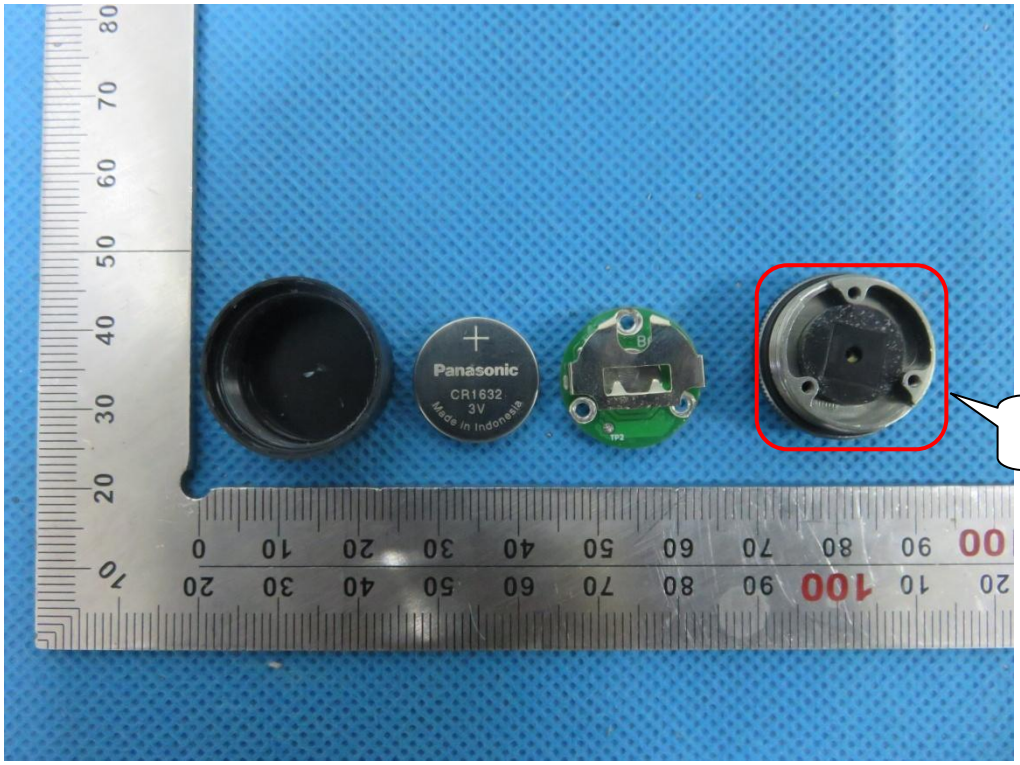
LEFT VIEW OF EUT



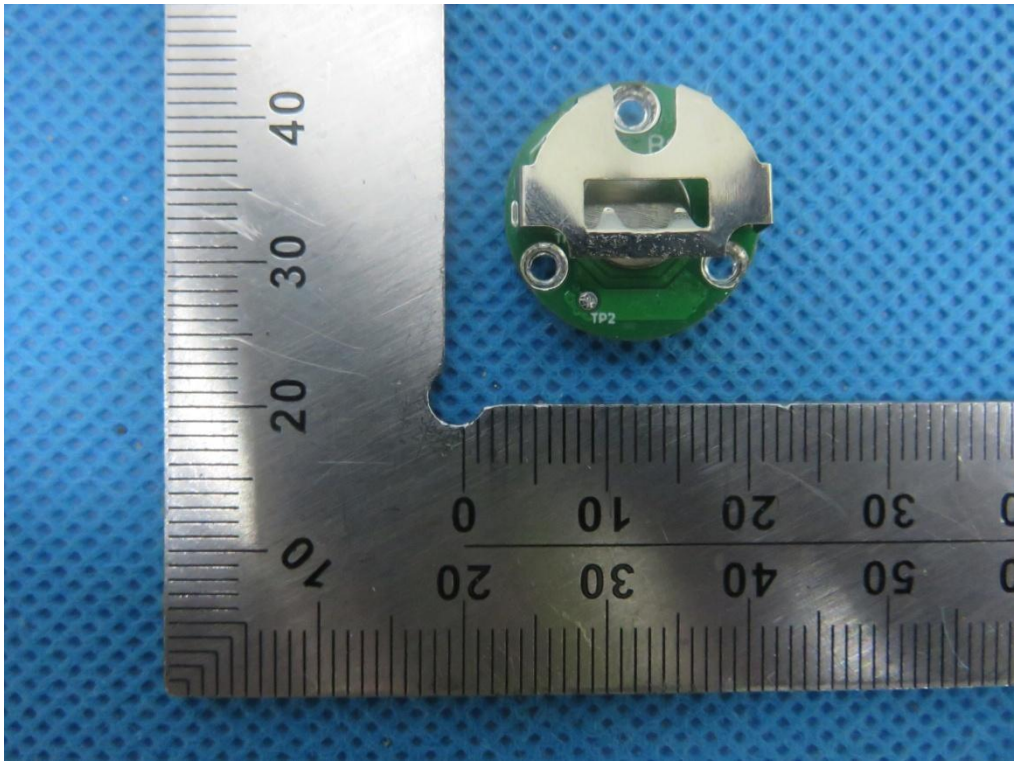
RIGHT VIEW OF EUT



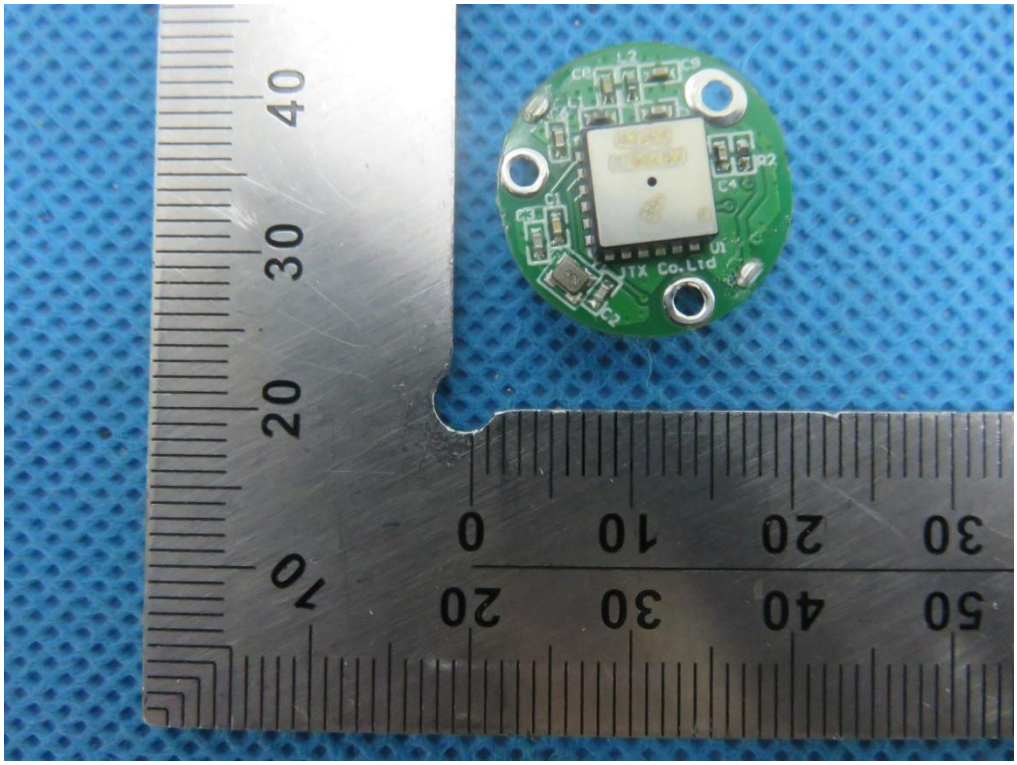
OPEN VIEW OF EUT



INTERNAL VIEW OF EUT-1



INTERNAL VIEW OF EUT-2



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