

RF TEST REPORT



Report No.: 15070538-FCC-R

Supersede Report No.: N/A

Applicant	Xiamen Highdart Electronic Information Co.,LTD.	
Product Name	Wireless Tire Pressure Sensor	
Model No.	TPMS-S1	
Serial Model Name.	TPMS-S2、TPMS-S3、TPMS-S5	
Test Standard	FCC 15.231:2014, ANSI C63.4:2009	
Test Date	July 12 to July 23, 2015	
Issue Date	July 24, 2015	
Test Result	☒ Pass ☐ Fail	
Equipment complied with the specification	☒	
Equipment did not comply with the specification	☐	
<i>Winnie Zhang</i>	<i>David Huang</i>	
Winnie Zhang Test Engineer	David Huang Checked By	
This test report may be reproduced in full only Test result presented in this test report is applicable to the tested sample only		

Issued by:

SIEMIC (SHENZHEN-CHINA) LABORATORIES

Zone A, Floor 1, Building 2 Wan Ye Long Technology Park

South Side of Zhoushi Road, Bao' an District, Shenzhen, Guangdong China 518108

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Laboratories Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.



In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Scope
USA	EMC, RF/Wireless, SAR, Telecom
Canada	EMC, RF/Wireless, SAR, Telecom
Taiwan	EMC, RF, Telecom, SAR, Safety
Hong Kong	RF/Wireless, SAR, Telecom
Australia	EMC, RF, Telecom, SAR, Safety
Korea	EMI, EMS, RF, SAR, Telecom, Safety
Japan	EMI, RF/Wireless, SAR, Telecom
Singapore	EMC, RF, SAR, Telecom
Europe	EMC, RF, SAR, Telecom, Safety

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1. Report Revision History

Report No.	Report Version	Description	Issue Date
15070538-FCC-R	NONE	Original	July 24, 2015

2. Customer information

Applicant Name	Xiamen Highdart Electronic Information Co.,LTD.
Applicant Add	Room N403A Weiye Building,Pioneer Park,Torch High-Tech Zone,Xiamen,China
Manufacturer	Xiamen Highdart Electronic Information Co.,LTD.
Manufacturer Add	Room N403A Weiye Building,Pioneer Park,Torch High-Tech Zone,Xiamen,China

3. Test site information

Lab performing tests	SIEMIC (Shenzhen-China) LABORATORIES
Lab Address	Zone A, Floor 1, Building 2 Wan Ye Long Technology Park South Side of Zhoushi Road, Bao' an District, Shenzhen, Guangdong China 518108
FCC Test Site No.	718246
IC Test Site No.	4842E-1
Test Software	Radiated Emission Program-To Shenzhen v2.0

4. Equipment under Test (EUT) Information

Description of EUT:	Wireless Tire Pressure Sensor
Main Model:	TPMS-S1
Serial Model:	TPMS-S2、TPMS-S3、TPMS-S5
Date EUT received:	July 11, 2015
Test Date(s):	July 12 to July 23, 2015
RF Operating Frequency (ies):	Tx: 433.92 MHz
Number of Channels :	1 CH
Equipment Category:	DSC
Antenna Gain:	15.231: 1.82 dBi
Input Power:	Model:TPMS-H6 DC 3.3V/20mA
Trade Name :	N/A
FCC ID:	2AFEF55581851
Port:	N/A
Type of Modulation:	15.231: FSK

5. Test Summary

The product was tested in accordance with the following specifications.

All testing has been performed according to below product classification:

Test Results Summary

Test Standard	Description	Pass / Fail
CFR 47 Part 15.231: 2014		
15.203	Antenna Requirement	Pass
15.207	Conducted Emissions Voltage	N/A
15.231(e)	Fundamental & Radiated Spurious Emission	Pass
15.231(c)	20dB Bandwidth	Pass
15.231(e)	Deactivation	Pass
ANSI C63.4: 2009		
PS: All measurement uncertainties are not taken into consideration for all presented test result.		

6. MEASUREMENTS, EXAMINATION AND DERIVED RESULTS

6.1 Antenna Requirement

Requirement(s): 47 CFR §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.

Antenna requirement must meet at least one of the following:

- a) Antenna must be permanently attached to the device.
- b) Antenna must use a unique type of connector to attach to the device.
- c) Device must be professionally installed. Installer shall be responsible for ensuring that the correct antenna is employed with the device.

Test result: Pass

The antenna is permanently attached to the device which meets the requirement.

6.2 Conducted Emissions Voltage

Temperature	24°C
Relative Humidity	62%
Atmospheric Pressure	1012mbar
Test date :	-----
Tested By :	Winnie Zhang

Requirement:

Frequency of emission (MHz)	Conducted limit (dBμ V)	
	Quasi-peak	Average
0.15– 0.5	66 to 56*	56 to 46*
0.5– 5	56	46
5– 30	60	50

*Decreases with the logarithm of the frequency.

Procedures:

1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR and Average detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Conducted Emissions Measurement Uncertainty
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 9kHz – 30MHz (Average & Quasi-peak) is ±3.5dB.

Test result: N/A (Batteries operated)

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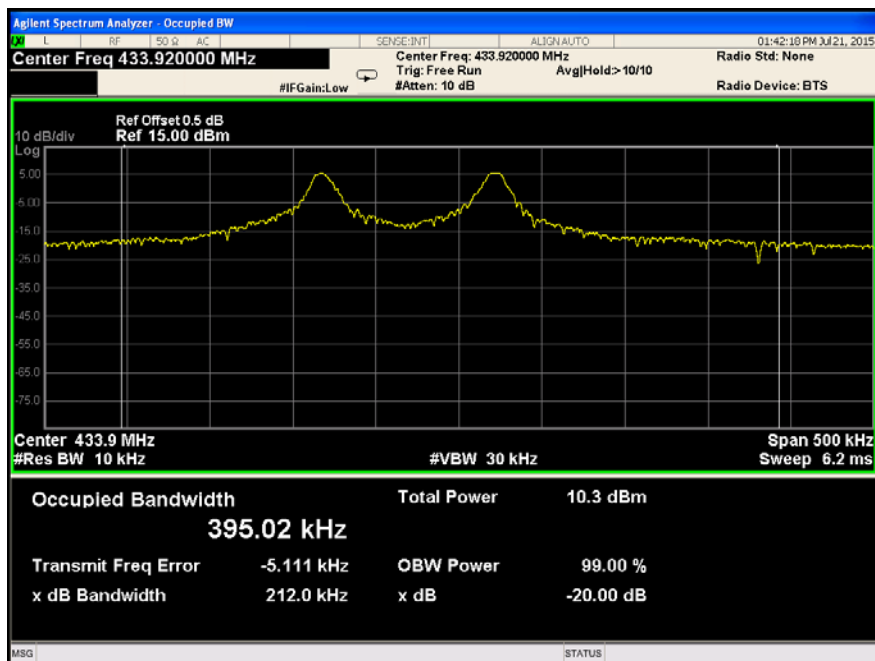
6.3 20dB Occupied Bandwidth

Temperature	22oC
Relative Humidity	54%
Atmospheric Pressure	1021mbar
Test date :	July 21, 2015
Tested By :	Winnie Zhang

20dB bandwidth was measured by conducted method using a spectrum analyzer.

Test Result:

Fundamental Frequency (MHz)	Measured 20dB Bandwidth (kHz)	FCC 15.231 Limit (kHz)	Result
433.92	212.0	1084.80	Pass



6.4 Radiated Fundamental and Spurious Emission

Temperature	22 °C
Relative Humidity	54%
Atmospheric Pressure	1021mbar
Test date :	July 21, 2015
Tested By :	Winnie Zhang

- Radiated emissions were measured according to ANSI C63.4. The EUT was set 3 meter away from the measuring antenna. The loop antenna was positioned 1meter above the ground from the center of the loop. The measuring bandwidth was set to 10kHz. All possible modes of operation were investigated. Only the worst case emissions measured, All other emissions were relatively insignificant.
- A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
- Sample Calculation: Corrected Amplitude=Raw Amplitude(dBuV/m)+ACF(dB)+Cable Loss(dB)-Distance Correction Factor.
Sample Calculation:
1) Corrected Amplitude= Raw Amplitude(dBuV/m)+ACF(dB)+Cable Loss(dB)-Distance Correction Factor
2) Average = peak reading + 20log(duty cycle)
- Radiated Emissions Measurement Uncertainty
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 1GHz(QP only3m & 10m) is +5.6/-4.5dB(for EUTs<0.5m×0.5m×0.5m).In range of 1-40GHz) is ±3.6dB.

Standard Requirement:

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70	1000	100
70-130	500	50
130-174	500 to 1,500	50 to 150
174-260	1,500	150
260-470	1,500-5,000	150-500
Above 470	5,000	500

Test Result : Pass

Frequency (MHz)	Average Factor (dB)	Field Strength(PK) (dBuV/m)	Field Strength(AV) (dBuV/m)	Limit(PK) (dBuV/m)	Limit(AV) (dBuV/m)
433.92	-5.46	75.93	70.47	92.87	72.87
863.3	-5.46	50.97	45.51	72.87	52.87
1303.58	-5.46	56.3	50.84	74	54
1732.94	-5.46	55.27	49.81	74	54
2169.66	-5.46	54.43	48.97	74	54

Notes:

- Duty cycle is 53.32%, $20\log(\text{duty cycle}) = -5.46\text{dB}$ correction was used to determine the average level from the peak
- reading. Average = peak reading + $20\log(\text{duty cycle})$, Final Average= peak reading -5.46
- All the data measurement of peak values.
- FCC Limit for Average Measurement= $1,500+(5,000-1,500)/(470-260)*(433.92-260) \mu \text{ V/m}$
= $4398.67 \mu \text{ V/m}=72.87\text{dB} \mu \text{ V/m}$
- Average pulsed signal over one complete pulse train or 100 ms time frame if pulse train exceeds 100 ms
- Maximum average in 100 ms
- Calculate duty cycle for pulse train or 100 ms
- Duty cycle = $(t_1 + t_2 + t_3 + \dots t_n)/T$ where t_n = pulse width, T = pulse train length or 100 ms
- Pulse width (PW) = 26.82ms
 $2/PW = 2/26.82\text{ms} = 0.07457 \text{ kHz}$
 $\text{RBW} > 2/PW (0.0534759 \text{ kHz})$
Therefore PDCF is not needed.

Pulse Duty Cycle:

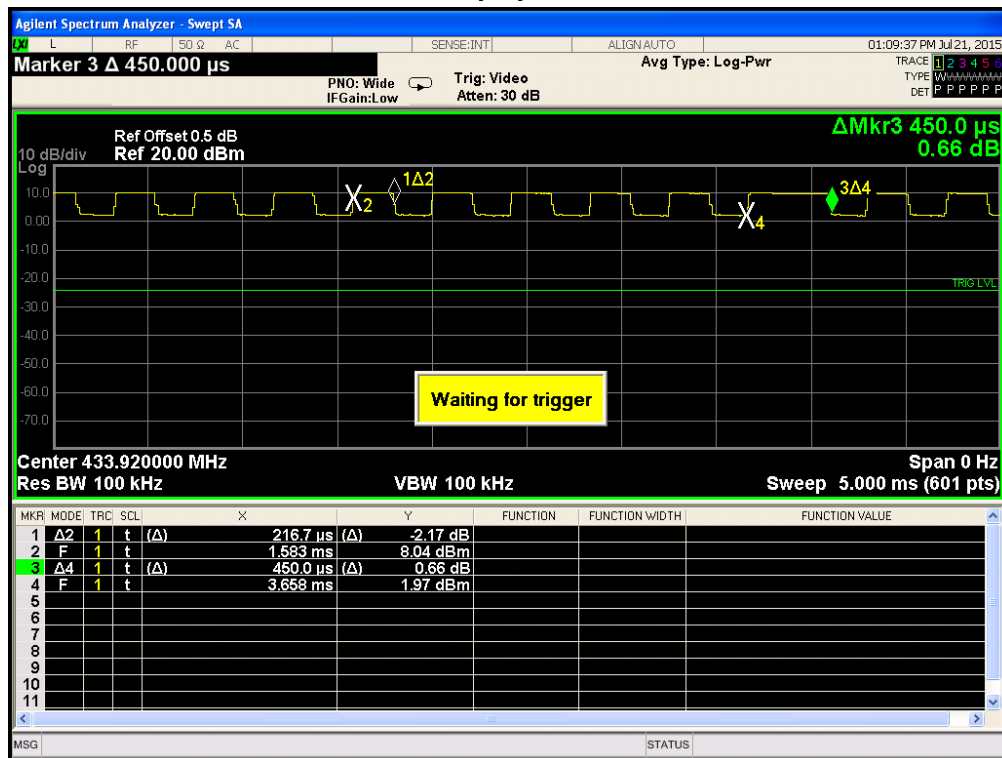
Wide Pulse: 0.45ms

Narrow Pulse: 0.2167ms

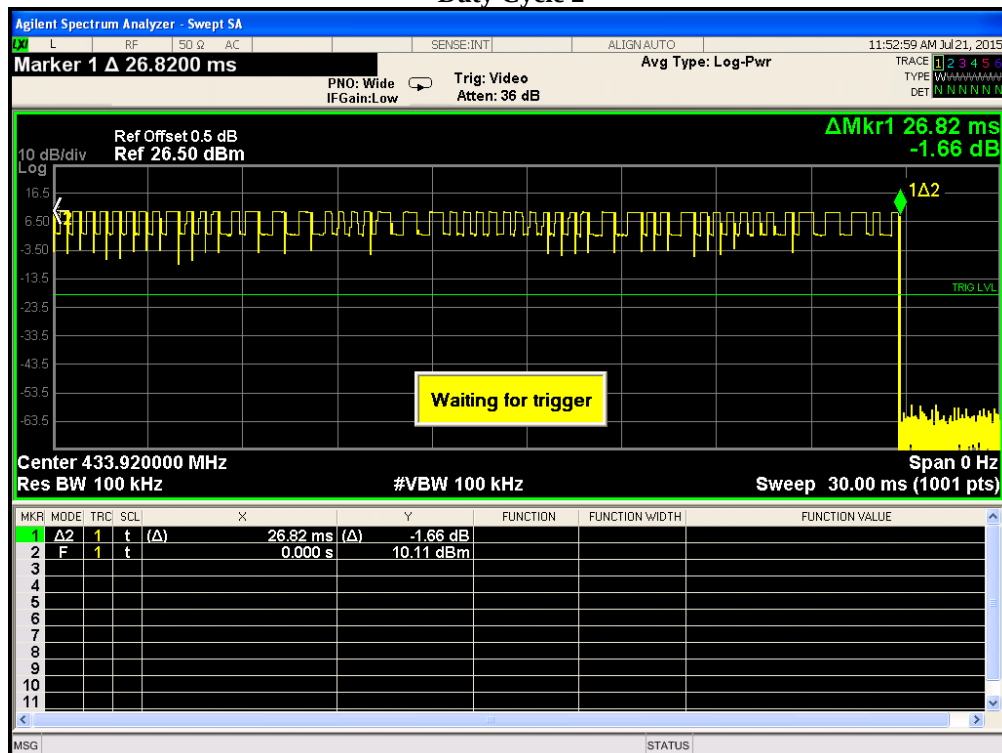
Duty cycle= $(0.2167 \times 39 + 0.45 \times 13) / 26.82 = 53.32\%$

Average Duty Factor: $20 \times \log(\text{Duty Cycle}) = -5.46 \text{ dB}$

Duty Cycle 1



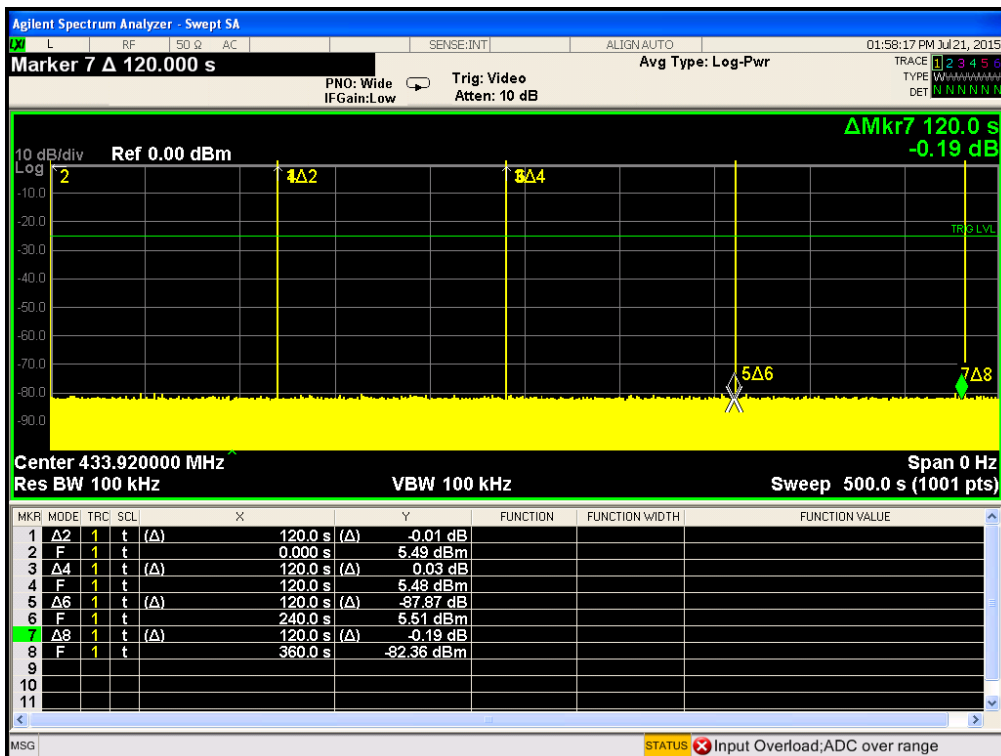
Duty Cycle 2



Duty Cycle 3



Duty Cycle5



6.5 Deactivation

Temperature	25°C
Relative Humidity	59%
Atmospheric Pressure	1010 mbar
Test date :	May 13, 2015
Tested By :	Winnie Zhang

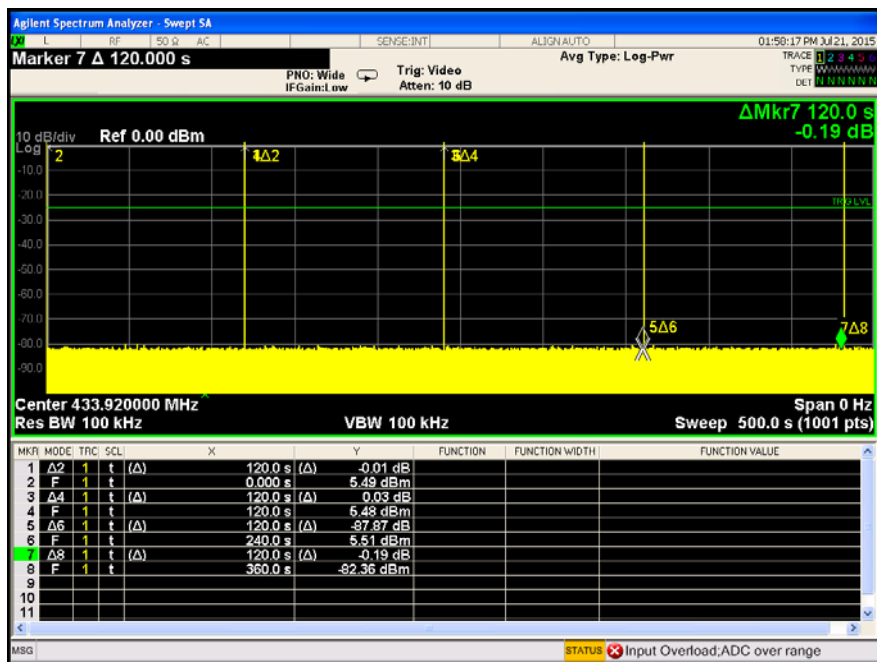
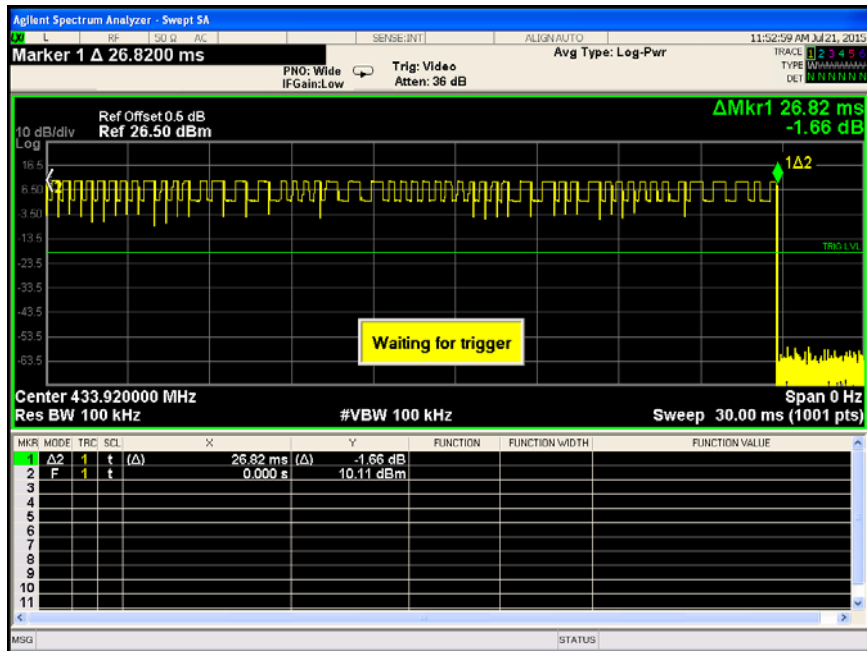
Deactivation was measured by conducted method using a spectrum analyzer.

Standard requirement: 47 CFR §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

Test Result: Pass

Frequency (MHz)	Transmission time	Silent time	Silent time / Transmission time	Limit(Transmission time)	Limit(Silent time)
433.92	26.82(ms)	120(s)	4472.61	$\leq 1s$	Silent time ≥ 10 s and Silent time / Transmission time ≥ 30

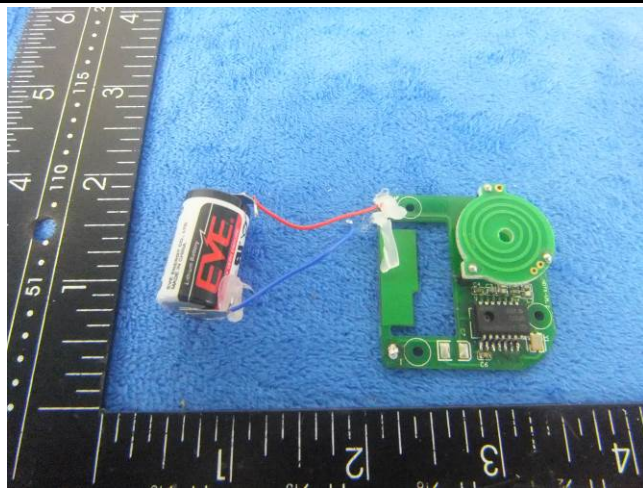


Annex A. TEST INSTRUMENT

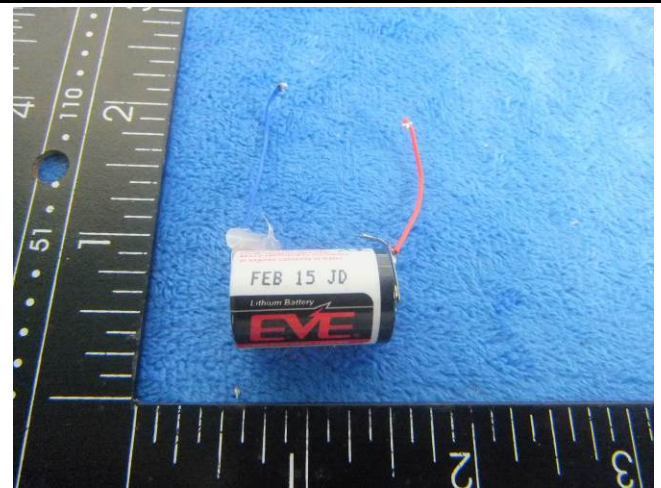
Instrument	Model	Serial #	Cal Date	Cal Due	In use
AC Line Conducted					
EMI test receiver	ESCS30	8471241027	09/18/2014	09/17/2015	☒
Line Impedance	LI-125A	191106	09/26/2014	09/25/2015	☒
Line Impedance	LI-125A	191107	09/26/2014	09/25/2015	☒
LISN	ISN T800	34373	09/26/2014	09/25/2015	☒
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/25/2014	09/24/2015	☒
Transient Limiter	LIT-153	531118	09/02/2014	09/01/2015	☒
RF conducted test					
Agilent ESA-E SERIES	E4407B	MY45108319	09/18/2014	09/17/2015	☒
Power Splitter	1#	1#	09/02/2014	09/01/2015	☒
DC Power Supply	E3640A	MY40004013	09/18/2014	09/17/2015	☒
Radiated Emissions					
EMI test receiver	ESL6	100262	09/18/2014	09/17/2015	☒
Positioning Controller	UC3000	MF780208282	11/20/2014	11/19/2015	☒
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	09/02/2014	09/01/2015	☒
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/25/2015	03/24/2016	☒
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/22/2014	09/21/2015	☒
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/25/2014	09/24/2015	☒
Universal Radio Communication Tester	CMU200	121393	09/26/2014	09/25/2015	☒

Annex B. EUT And Test Setup Photographs

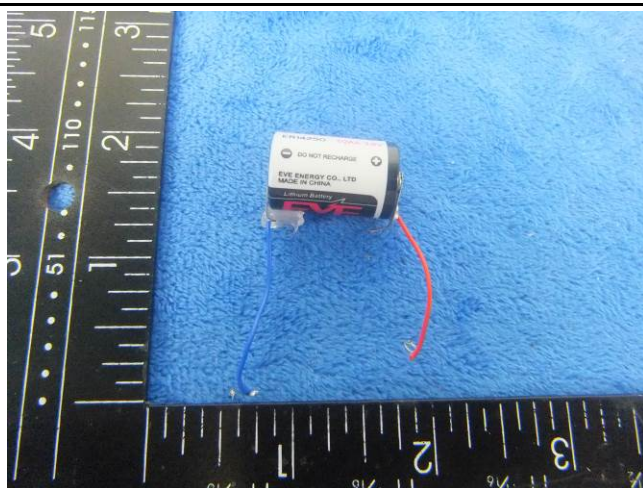
Annex B.i. Photograph: EUT External Photo



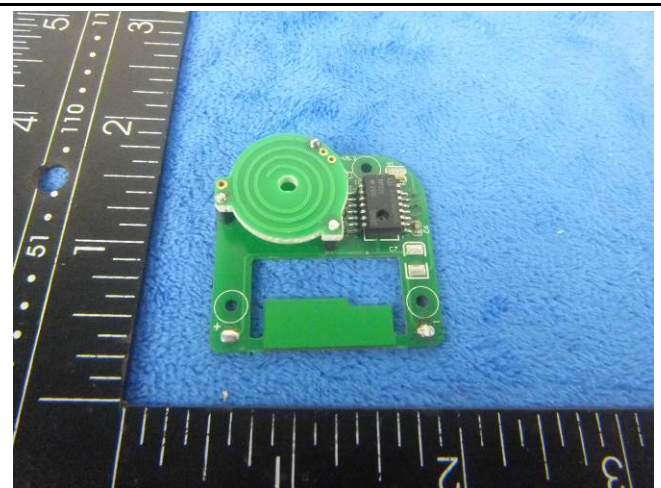
EUT - All



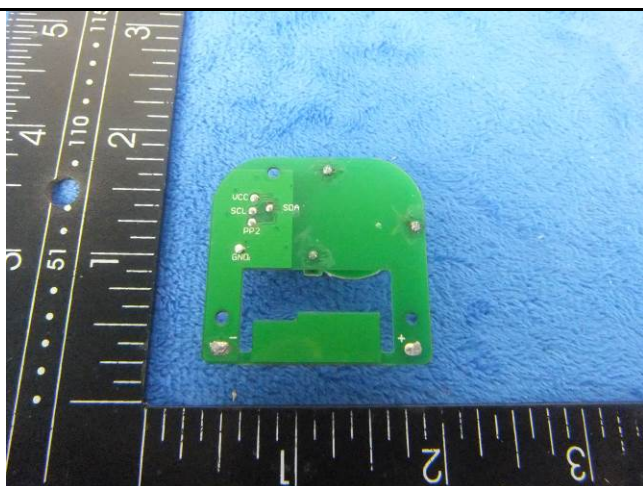
Battery - Front View



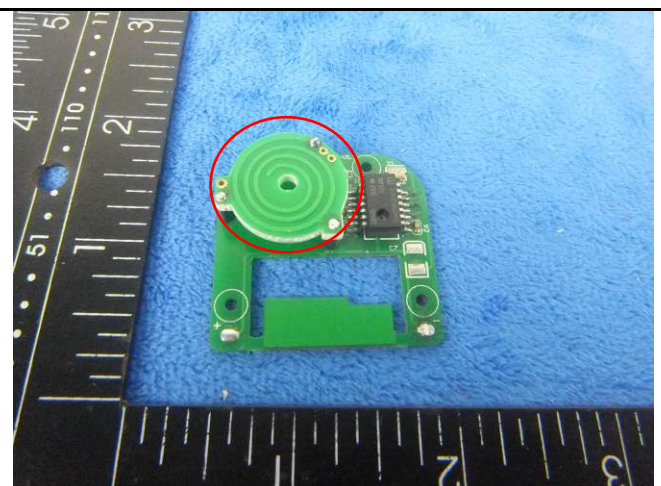
Battery - Rear View



Mainboard - Front View



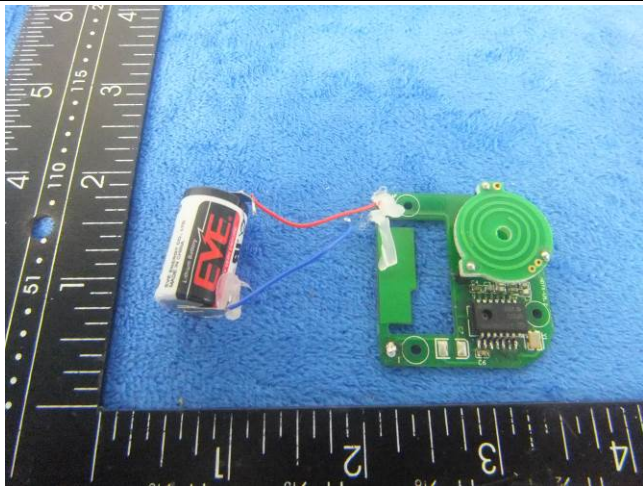
Mainboard - Rear View



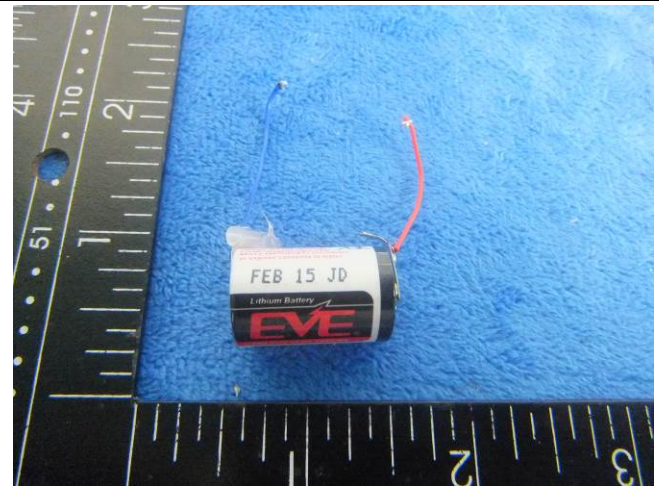
Antenna

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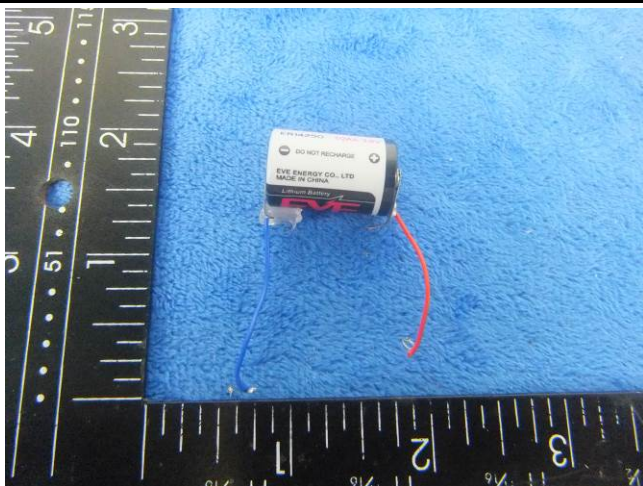
Annex B.ii. Photograph: EUT Internal Photo



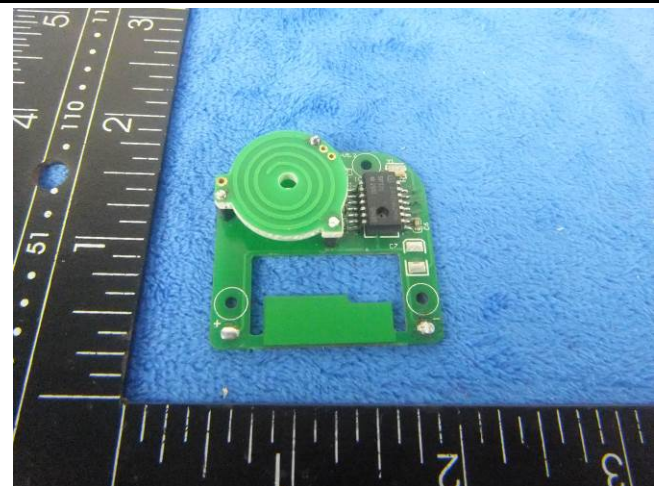
EUT - All



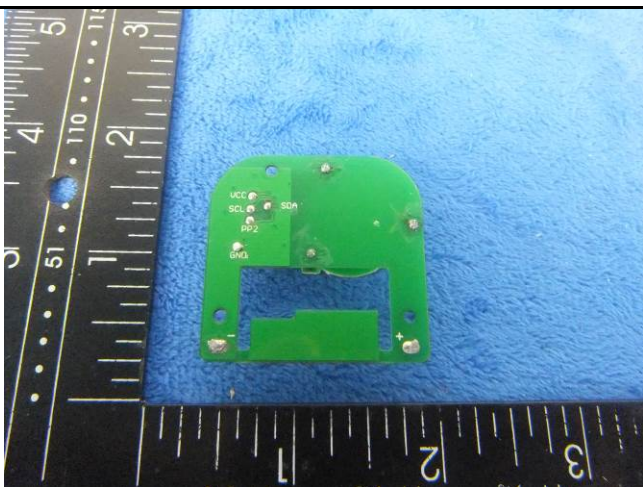
Battery - Front View



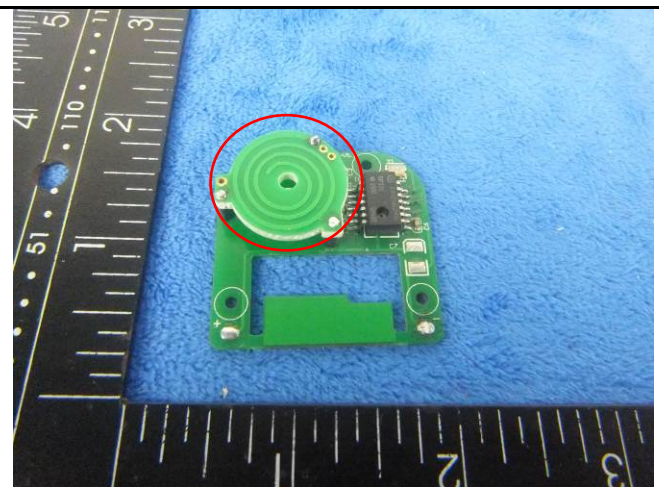
Battery - Rear View



Mainboard - Front View



Mainboard - Rear View

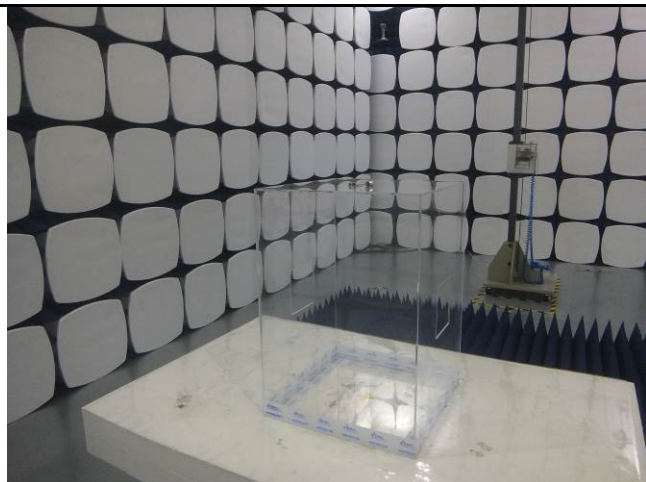


Antenna

Annex B.iii. Photograph: Test Setup Photo



Radiated Spurious Emissions Test Setup Below 1GHz

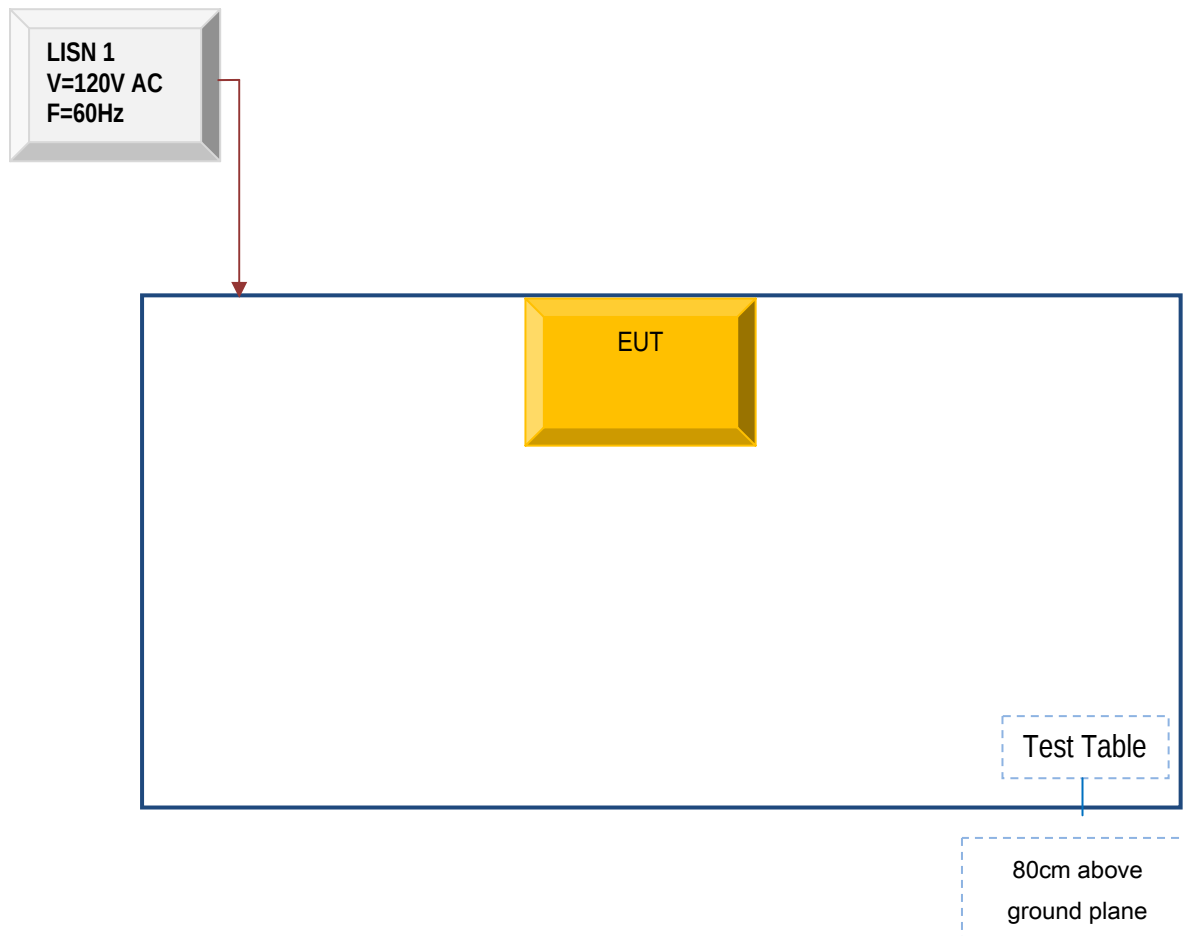


Radiated Spurious Emissions Test Setup Above
1GHz

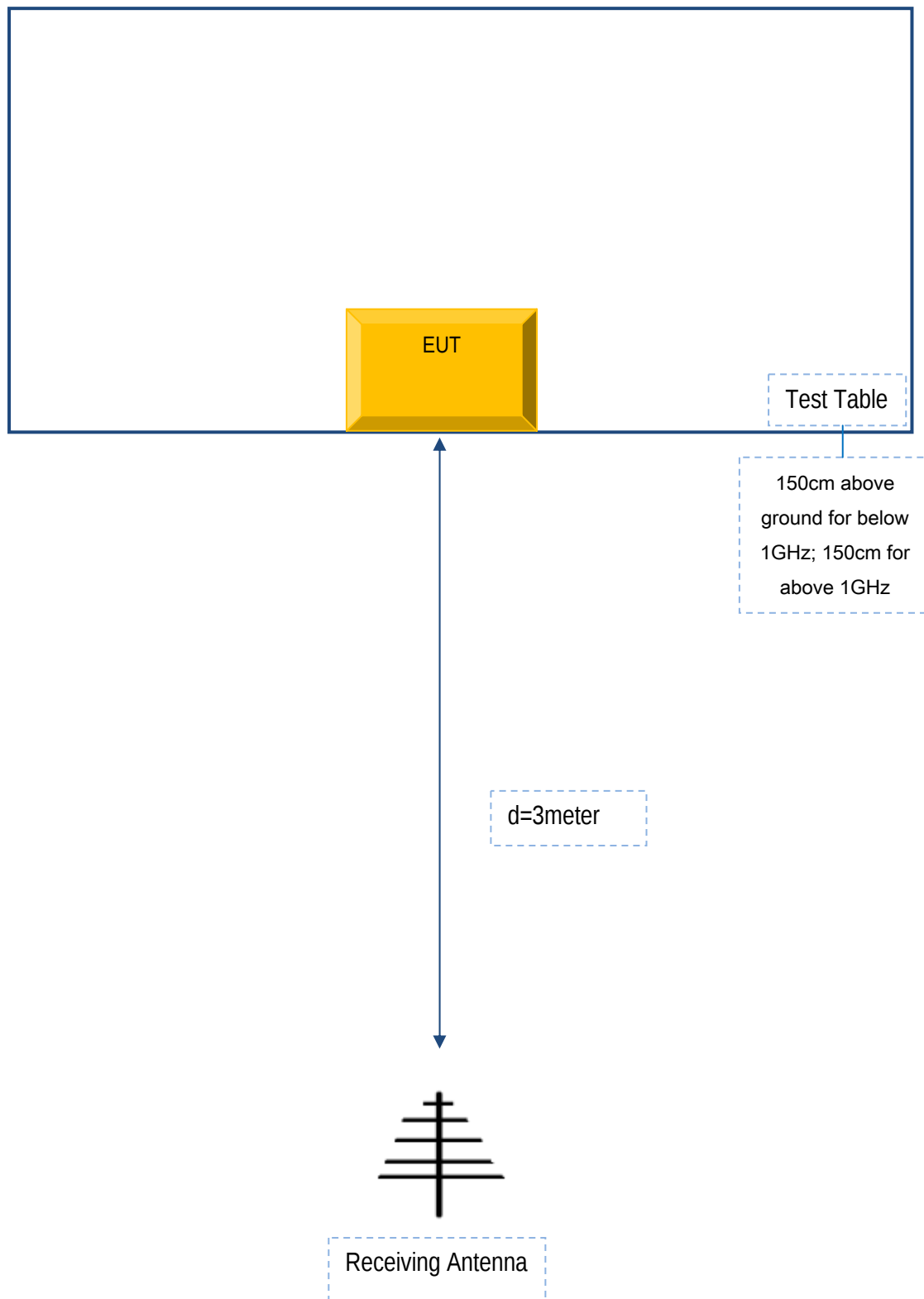
Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

Annex C.ii. TEST SET UP BLOCK

Block Configuration Diagram for AC Line Conducted Emissions



Block Configuration Diagram for Radiated Emissions



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Annex C. ii. SUPPORTING EQUIPMENT DESCRIPTION

The following is a description of supporting equipment and details of cables used with the EUT.

Manufacturer	Equipment Description	Model	Calibration Date	Calibration Due Date
N/A	N/A	N/A	N/A	N/A

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Annex D. User Manual / Block Diagram / Schematics / Partlist

Please see attachment

Annex E. DECLARATION OF SIMILARITY

Xiamen Highdart Electronic Information Co.,LTD.

To: 775 Montague Expressway Milpitas,CA 95035,USA

Declaration Letter

Dear Sir,

For our business issue and marketing requirement, we would like to list 4 model numbers on The FCC reports, as following:

Model No.: TPMS-S1, TPMS-S2, TPMS-S3, TPMS-S5

We declare that : TPMS-S1, TPMS-S2, TPMS-S3, TPMS-S5, All models the same PCB and Appearance shape, accessories .the difference of these is listed as below:

Main Model No	Serial Model No	Difference
TPMS-S1,	TPMS-S2 , TPMS-S3 , TPMS-S5	The model No. are different

Thank you!

Sincerely,

Client's signature: *Ji Xiaowu*

Client's name / title: *Ji Xiaowu* / Manager

Contact information: *0592-53581851*

Address : Room N403A Weiye Building,Pioneer Park,Torch High-Tech Zone,Xiamen,China