Shenzhen Centre Quality Accreditation Technology Co., Ltd.

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Report No.: CQASZ161001342E-01
Report Version: V01

MEASUREMENT REPORT
Test Report

Applicant:	Smart Power Technology Co., Ltd.
Address of Applicant:	Area 201#, Entrepreneurial Dream Block, Greenland Rose city, No#129 of North RD of Ai xi hu, High Tech Industrial Development Zone, Nanchang, Jiangxi Province, China
Manufacturer:	Smart Power Technology Co., Ltd.
Address of Manufacturer:	Area 201#, Entrepreneurial Dream Block, Greenland Rose city, No#129 of North RD of Ai xi hu, High Tech Industrial Development Zone, Nanchang, Jiangxi Province, China

Equipment Under Test (EUT):

Product:	Smart Water Leak Sensor
Model No.:	ZNWXZNSJCGQ
Brand Name:	N/A
FCC ID:	2AKIO-ZNSJCGQ
Standards:	47 CFR Part 15, Subpart C
Date of Test:	2016-11-01 to 2016-11-28
Date of Issue:	2016-11-28
Test Result :	**PASS***

Reviewed By: _____
(Aaron Ma)

Approved By: _____
(Owen Zhou)

Shenzhen Centre Quality Accreditation Technology Co., Ltd.

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

2 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ161001342E-01	Rev.01	Initial report	2016-11-28

3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15, Subpart C Section 15.203	ANSI C63.10 (2013)	PASS
Field Strength of the Fundamental Signal	47 CFR Part 15, Subpart C Section 15.249 (a)	ANSI C63.10 (2013)	PASS
Spurious Emissions	47 CFR Part 15, Subpart C Section 15.249 (a)/15.209	ANSI C63.10 (2013)	PASS
Restricted bands around fundamental frequency (Radiated Emission)	47 CFR Part 15, Subpart C Section 15.249(a)/15.205	ANSI C63.10 (2013)	PASS
20dB Occupied Bandwidth	47 CFR Part 15, Subpart C Section 15.215 (c)	ANSI C63.10 (2013)	PASS
AC Power Line Conducted Emission	47 CFR Part 15, Subpart C Section 15.207	ANSI C63.10 (2013)	N/A

Note: The EUT power supply by battery (2XAAA battery), so the EUT don't need to test AC power line conducted

4 Contents

5 General Information

5.1 Client Information

Applicant:	Smart Power Technology Co., Ltd.
Address of Applicant:	Area 201#, Entrepreneurial Dream Block, Greenland Rose city, No#129 of North RD of Ai xi hu, High Tech Industrial Development Zone, Nanchang, Jiangxi Province, China
Manufacturer:	Smart Power Technology Co., Ltd.
Address of Manufacturer:	Area 201#, Entrepreneurial Dream Block, Greenland Rose city, No#129 of North RD of Ai xi hu, High Tech Industrial Development Zone, Nanchang, Jiangxi Province, China

5.2 General Description of EUT

Name:	Smart Water Leak Sensor
Model No.:	ZNWXZNSJCGQ
Trade Mark :	N/A
Hardware Version:	V1.2
Software Version:	V0.50
Frequency Range:	2405 MHz ~ 2480MHz
Modulation Type:	ZigBee, IEEE 802.15.4: OQPSK
Number of Channels:	16 (declared by the client)
Sample Type:	Portable production
Test Software of EUT:	RF test (manufacturer declare)
Antenna Type:	Integral antenna
Antenna Gain:	3.3dBi
Power Supply:	DC3.0V (2 x AAA battery)

Note: The AAA battery is new battery.

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2405MHz	4	2425MHz	8	2445MHz	12	2465MHz
1	2410MHz	5	2430MHz	9	2450MHz	13	2470MHz
2	2415MHz	6	2435MHz	10	2455MHz	14	2475MHz
3	2420MHz	7	2440MHz	11	2460MHz	15	2480MHz

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The Lowest channel(CH0)	2405MHz
The Middle channel(CH07)	2440MHz
The Highest channel(CH15)	2480MHz

5.3 Test Environment and Mode

Operating Environment:	
Temperature:	24.0 °C
Humidity:	52 % RH
Atmospheric Pressure:	1008 mbar
Test Mode:	Use test software (RF test) to set the lowest frequency, the middle frequency and the highest frequency keep transmitting of the EUT.

5.4 Description of Support Units

The EUT has been tested with associated equipment below.

Description	Manufacturer	Model No.	Remark	FCC certification
battery	nanfu	AAA	Provide by lab	/
Notebook	Lenovo	Lenovo ideapad 100-14IBY	Provide by lab	DOC

5.5 Test Location

All tests were performed at:

Shenzhen Tongce Testing Lab,

1F, Leinuo Watch Building, Fuyong Town, Baoan Dist, Shenzhen, China

5.6 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate.

The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities.

The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Tongce Testing Lab quality system acc. to DIN EN ISO/IEC 17025.

Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for TCT laboratory is reported:

Test	Range	Uncertainty	Notes
Radiated Emission	Below 1GHz	±3.92dB	(1)
Radiated Emission	Above 1GHz	±4.28dB	(1)
Conducted Disturbance	0.15~30MHz	±2.56dB	(1)

(1)This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

5.7 Test Facility

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

FCC – Registration No.: 572331

Shenzhen Tongce Testing Lab 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. Registration 572331

5.8 Deviation from Standards

None.

5.9 Abnormalities from Standard Conditions

None.

5.10 Other Information Requested by the Customer

None.

5.11 Equipment List

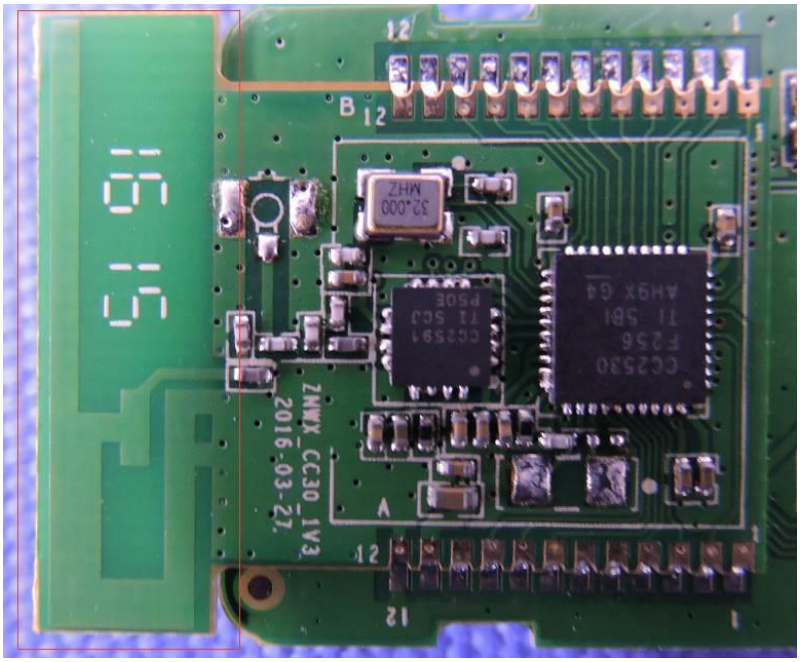
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Due Date
1	ESPI Test Receiver	R&S	ESVD	100008	2017/08/11
2	Spectrum Analyzer	R&S	FSEM	848597/001	2017/08/11
3	Spectrum Analyzer	Agilent	N9020A	MY49100060	2017/08/12
4	Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	2017/08/11
5	Pre-amplifier	HP	8447D	2727A05017	2017/08/11
6	Loop antenna	ZHINAN	ZN30900A	12024	2017/08/13
7	Broadband Antenna	R&S	VULB9163	340	2017/08/13
8	Horn Antenna	R&S	BBHA 9120D	631	2017/08/13
9	Horn Antenna	R&S	BBHA 9170	373	2017/08/13
10	Antenna Mast	CCS	CC-A-4M	N/A	N/A
11	Coax cable (9KHz~40GHz)	TCT	RE-low-01	N/A	2017/08/11
12	Coax cable (9KHz~40GHz)	TCT	RE-high-02	N/A	2017/08/11
13	Coax cable (9KHz~40GHz)	TCT	RE-low-02	N/A	2017/08/11
14	Coax cable (9KHz~40GHz)	TCT	RE-high-04	N/A	2017/08/11
15	Spectrum Analyzer	R&S	FSU	200054	2017/08/11
16	Antenna Connector	TCT	RFC-01	N/A	2017/08/12
17	RF cable(9KHz~40GHz)	TCT	RE-06	N/A	2017/08/12

Note:

The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

6 Test results and Measurement Data

6.1 Antenna Requirement

Standard requirement:	47 CFR Part 15C 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 integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 3.3dBi.	

6.2 Radiated Emission

<table>
<tr><td>Test Requirement:</td><td>47 CFR Part 15C Section 15.249 and 15.209 and 15.205</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10: 2013</td></tr>
<tr><td>Test Site:</td><td>Measurement Distance: 3m (Semi-Anechoic Chamber)</td></tr>
<tr><td>Receiver Setup:</td><td>
<table>
<tr><th>Frequency</th><th>Detector</th><th>RBW</th><th>VBW</th><th>Remark</th></tr>
<tr><td>0.009MHz-0.090MHz</td><td>Peak</td><td>10kHz</td><td>30KHz</td><td>Peak</td></tr>
<tr><td>0.009MHz-0.090MHz</td><td>Average</td><td>10kHz</td><td>30KHz</td><td>Average</td></tr>
<tr><td>0.090MHz-0.110MHz</td><td>Quasi-peak</td><td>10kHz</td><td>30KHz</td><td>Quasi-peak</td></tr>
<tr><td>0.110MHz-0.490MHz</td><td>Peak</td><td>10kHz</td><td>30KHz</td><td>Peak</td></tr>
<tr><td>0.110MHz-0.490MHz</td><td>Average</td><td>10kHz</td><td>30KHz</td><td>Average</td></tr>
<tr><td>0.490MHz -30MHz</td><td>Quasi-peak</td><td>10kHz</td><td>30kHz</td><td>Quasi-peak</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>120 kHz</td><td>300KHz</td><td>Quasi-peak</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average</td></tr>
</table>
Note: For fundamental frequency, RBW=5MHz, VBW=5MHz, Peak detector is for PK value, RMS detector is for Average value.
</td></tr>
<tr><td>Limit:
(Spurious Emissions and band edge)</td><td>
<table>
<tr><th>Frequency</th><th>Field strength (microvolt/meter)</th><th>Limit (dBuV/m)</th><th>Remark</th><th>Measurement distance (m)</th></tr>
<tr><td>0.009MHz-0.490MHz</td><td>2400/F(kHz)</td><td>-</td><td>-</td><td>300</td></tr>
<tr><td>0.490MHz-1.705MHz</td><td>24000/F(kHz)</td><td>-</td><td>-</td><td>30</td></tr>
<tr><td>1.705MHz-30MHz</td><td>30</td><td>-</td><td>-</td><td>30</td></tr>
<tr><td>30MHz-88MHz</td><td>100</td><td>40.0</td><td>Quasi-peak</td><td>3</td></tr>
<tr><td>88MHz-216MHz</td><td>150</td><td>43.5</td><td>Quasi-peak</td><td>3</td></tr>
<tr><td>216MHz-960MHz</td><td>200</td><td>46.0</td><td>Quasi-peak</td><td>3</td></tr>
<tr><td>960MHz-1GHz</td><td>500</td><td>54.0</td><td>Quasi-peak</td><td>3</td></tr>
<tr><td>Above 1GHz</td><td>500</td><td>54.0</td><td>Average</td><td>3</td></tr>
</table>
Note: 1) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.
2) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.
</td></tr>
<tr><td>Limit:
(Field strength of the fundamental signal)</td><td>
<table>
<tr><th>Frequency</th><th>Limit (dBuV/m @3m)</th><th>Remark</th></tr>
<tr><td rowspan="2">2400MHz-2483.5MHz</td><td>94.0</td><td>Average Value</td></tr>
<tr><td>114.0</td><td>Peak Value</td></tr>
</table>
</td></tr>
</table>

Test Setup:	

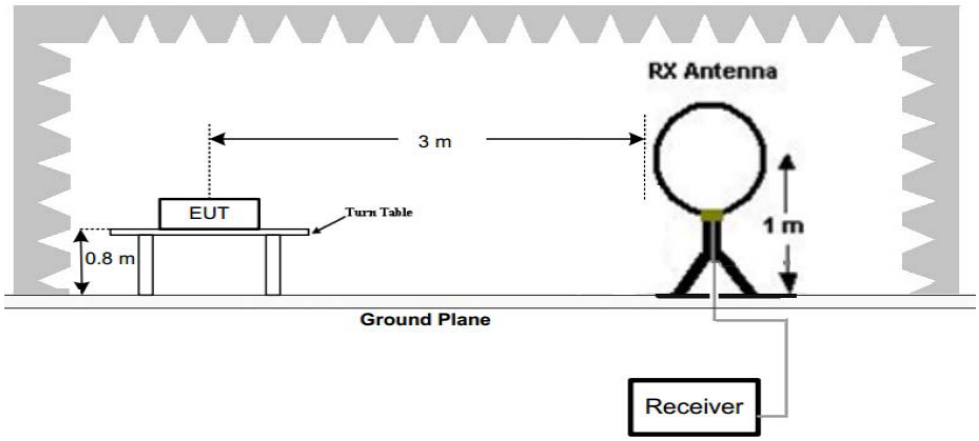


Figure 1. Below 30MHz

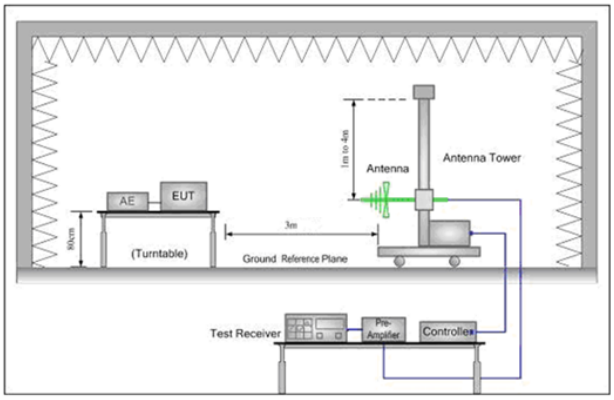


Figure 2. 30MHz to 1GHz

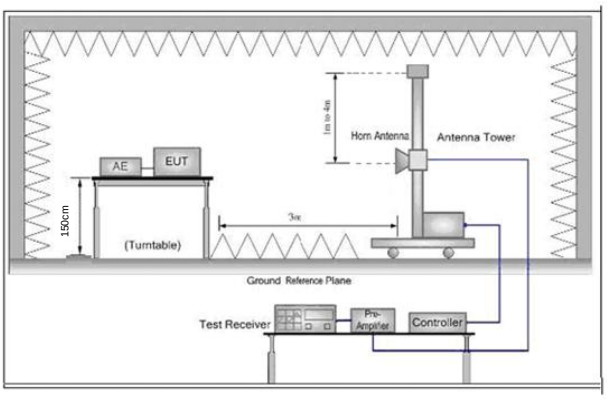


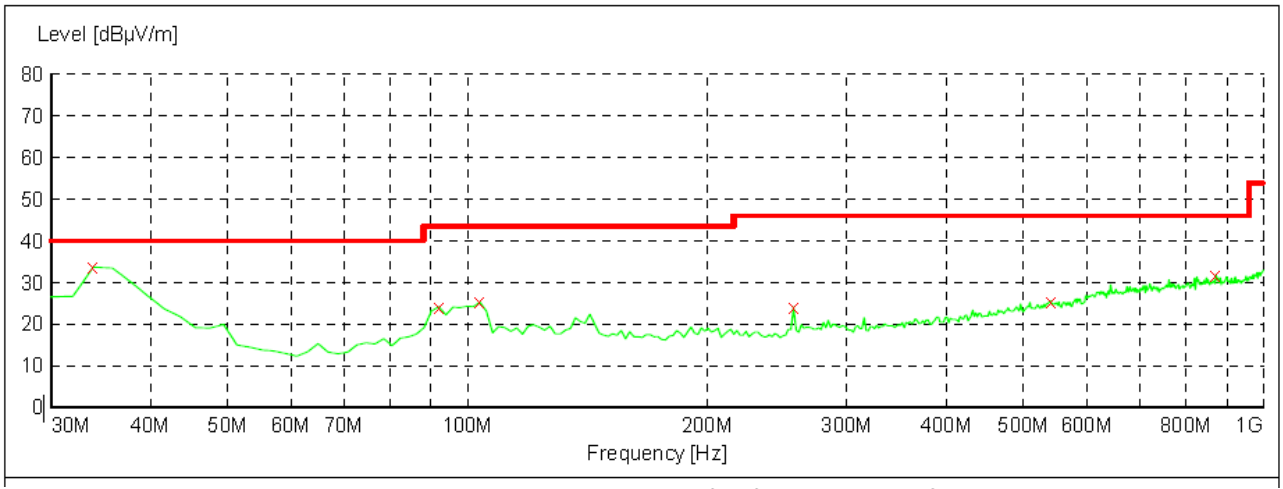
Figure 3. Above 1 GHz

Test Procedure:	a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation. Note: For the radiated emission test above 1GHz: 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. b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. c. 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. d. 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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

	e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. f. 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. g. Test the EUT in the lowest channel,the middle channel,the Highest channel h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode,And found the X axis positioning which it is worse case. i. Repeat above procedures until all frequencies measured was complete.
Instruments Used:	Refer to section 5.10 for details
Exploratory Test Mode:	Transmitting mode
Final Test Mode:	Pretest the EUT at Transmitting mode, found the Transmitting mode which it is worse case Pretest the EUT at Transmitting mode, For below 1GHz part, through pre-scan, the worst case is the lowest channel. Only the worst case is recorded in the report.
Test Voltage:	DC3.0V
Test Results:	Pass

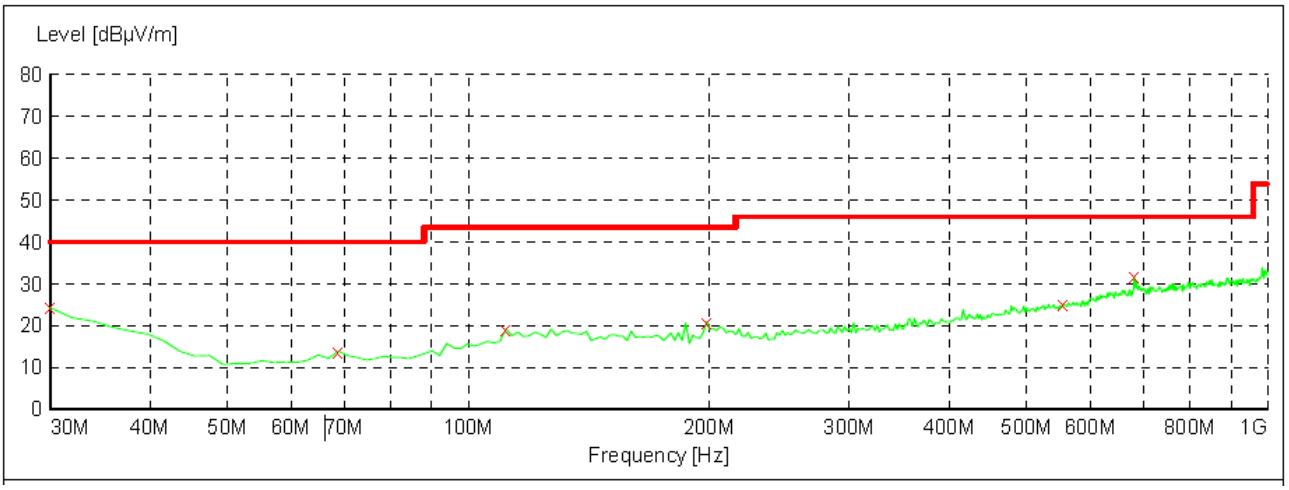
Measurement Data

30MHz~1GHz		
Test mode:	Transmitting (lowest channel)	Vertical



Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.
33.880000	33.70	17.7	40.0	6.3	-PK-
92.080000	24.20	9.6	43.5	19.3	-PK-
103.720000	25.30	12.0	43.5	18.2	-PK-
256.980000	24.10	14.4	46.0	21.9	-PK-
540.220000	25.60	20.7	46.0	20.4	-PK-
871.960000	31.80	25.4	46.0	14.2	-PK-

Test mode:	Transmitting (lowest channel)	Horizontal



Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.
30.000000	24.30	20.8	40.0	15.7	-PK-
68.800000	13.90	8.2	40.0	26.1	-PK-
111.480000	19.20	13.7	43.5	24.3	-PK-
198.780000	20.90	13.9	43.5	22.6	-PK-
555.740000	25.30	21.1	46.0	20.7	-PK-
681.840000	31.80	23.0	46.0	14.2	-PK-

Above 1GHz			
Test mode:	Transmitting	Test channel:	Lowest

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Over (dB)	Detector Type	Ant. Pol. H/V
2390	47.36	-4.36	43.00	74	-31.00	peak	H
2390	34.48	-4.36	30.12	54	-23.88	AVG	H
2400	51.42	-4.36	47.06	74	-26.94	51.42	H
2400	39.88	-4.36	35.52	54	-18.48	39.88	H
2405	**105.32**	**-4.37**	**100.95**	**114**	**-13.05**	**peak**	**H**
2405	96.54	-4.37	92.17	94	-1.83	AVG	H
4810	48.55	-5.18	43.37	74	-30.63	peak	H
4810	36.06	-5.18	30.88	54	-23.12	AVG	H
7215	49.68	-6.45	43.23	74	-30.77	peak	H
7215	36.71	-6.45	30.26	54	-23.74	AVG	H
2390	48.24	-4.36	43.88	74	-30.12	peak	V
2390	36.53	-4.36	32.17	54	-21.83	AVG	V
2400	51.13	-4.36	46.77	74	-27.23	peak	V
2400	39.32	-4.36	34.96	54	-19.04	AVG	V
2405	101.40	-4.37	97.03	114	-16.97	peak	V
2405	92.94	-4.37	88.57	94	-5.43	AVG	V
4810	48.70	-5.18	43.52	74	-30.48	peak	V
4810	36.03	-5.18	30.85	54	-23.15	AVG	V
7215	48.34	-6.45	41.89	74	-32.11	peak	V
7215	36.55	-6.45	30.10	54	-23.90	AVG	V

Test mode:	Transmitting	Test channel:	Middle

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Over (dB)	Detector Type	Ant. Pol. H/V
2440	102.57	-4.39	98.18	114	-15.82	peak	H
2440	93.88	-4.39	89.49	94	-4.51	AVG	H
4880	49.78	-5.19	44.59	74	-29.41	peak	H
4880	37.24	-5.19	32.05	54	-21.95	AVG	H
7320	50.21	-6.47	43.74	74	-30.26	peak	H
7320	35.06	-6.47	28.59	54	-25.41	AVG	H
2440	99.03	-4.39	94.64	114	-19.36	peak	V
2440	87.74	-4.39	83.35	94	-10.65	AVG	V
4880	49.28	-5.19	44.09	74	-29.91	peak	V
4880	36.77	-5.19	31.58	54	-22.42	AVG	V
7320	50.02	-6.47	43.55	74	-30.45	peak	V
7320	36.75	-6.47	30.28	54	-23.72	AVG	V

Test mode:	Transmitting	Test channel:	Highest

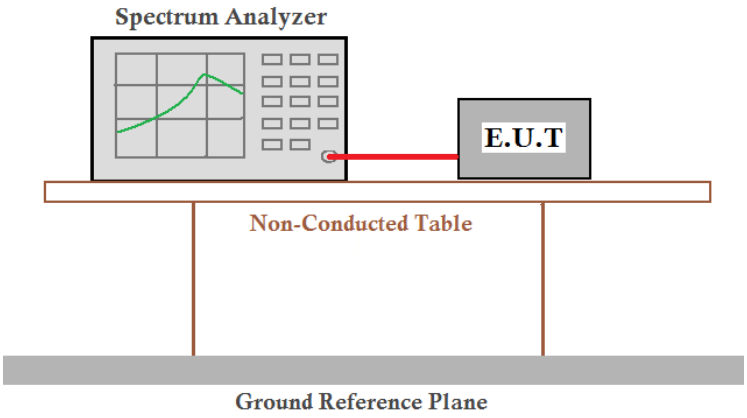
Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Over (dB)	Detector Type	Ant. Pol. H/V
2480	100.70	-4.22	96.48	114	-17.52	peak	H
2480	92.81	-4.22	88.59	94	-5.41	AVG	H
2483.5	57.06	-4.22	52.84	74	-21.16	peak	H
2483.5	46.15	-4.22	41.93	54	-12.07	AVG	H
4960	50.32	-5.2	45.12	74	-28.88	peak	H
4960	38.14	-5.2	32.94	54	-21.06	AVG	H
7440	49.68	-6.47	43.21	74	-30.79	peak	H
7440	37.88	-6.47	31.41	54	-22.59	AVG	H
2480	96.30	-4.22	92.08	114	-21.92	peak	V
2480	88.10	-4.22	83.88	94	-10.12	AVG	V
2483.5	57.13	-4.22	52.91	74	-21.09	peak	V
2483.5	46.55	-4.22	42.33	54	-11.67	AVG	V
4960	51.22	-5.2	46.02	74	-27.98	peak	V
4960	37.34	-5.2	32.14	54	-21.86	AVG	V
7440	50.82	-6.47	44.35	74	-29.65	peak	V
7440	37.74	-6.47	31.27	54	-22.73	AVG	V

Remark:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level =Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor

2) Scan from 9kHz to 25GHz,The disturbance above 10GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported .

6.3 20dB Bandwidth

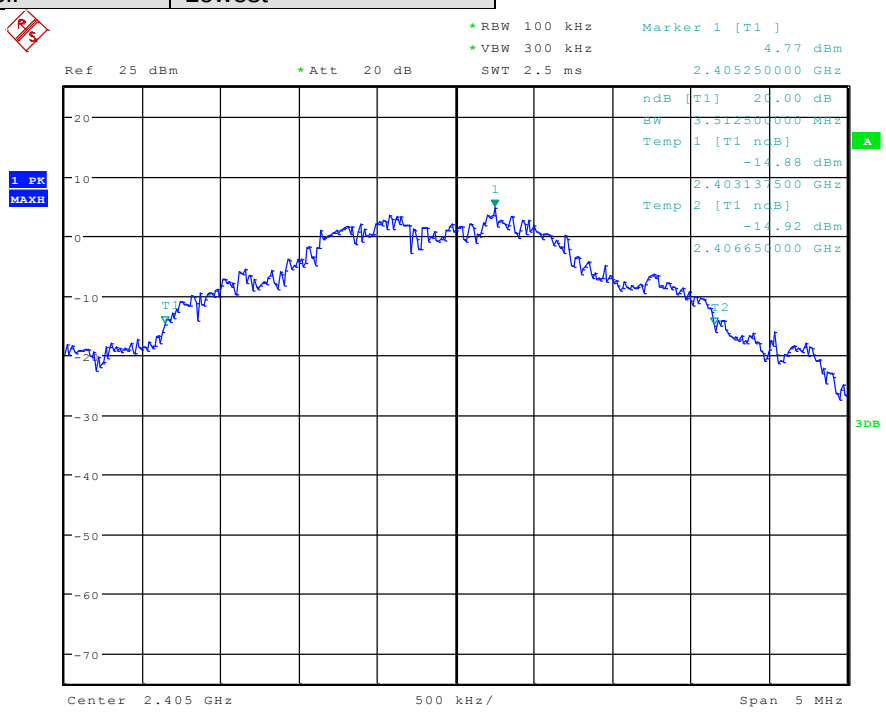
Test Requirement:	47 CFR Part 15C Section 15.215
Test Method:	ANSI C63.10:2013
Test Setup:	
Instruments Used:	Refer to section 5.10 for details
Test Mode:	Transmitting with OQPSK modulation.
Limit:	N/A
Test Results:	Pass

Measurement Data

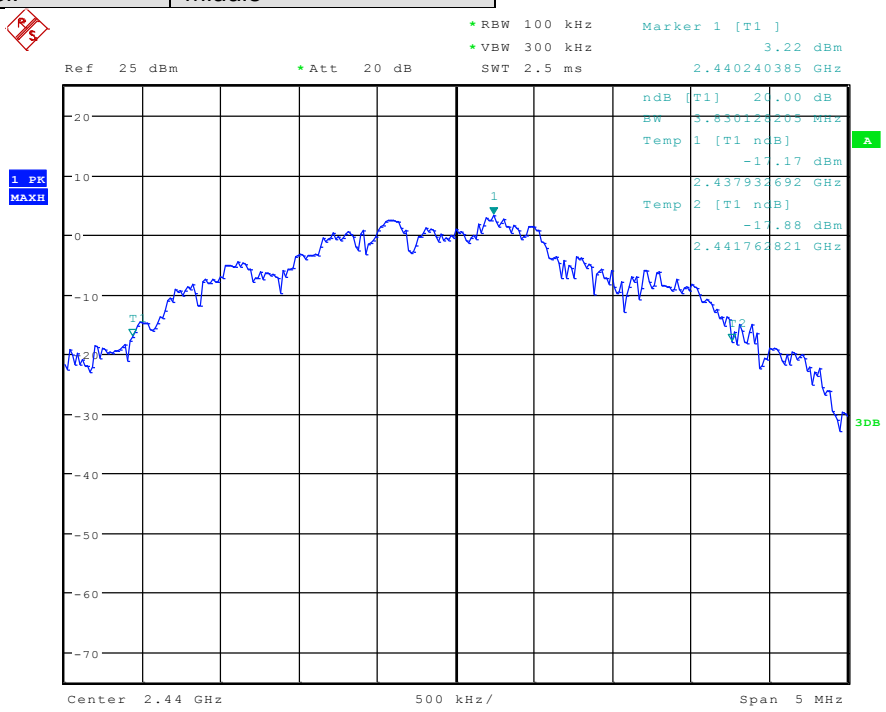
Test channel	20dB bandwidth (MHz)	Results
Lowest	3.513	Pass
Middle	3.830	Pass
Highest	3.221	Pass

Test plot as follows:

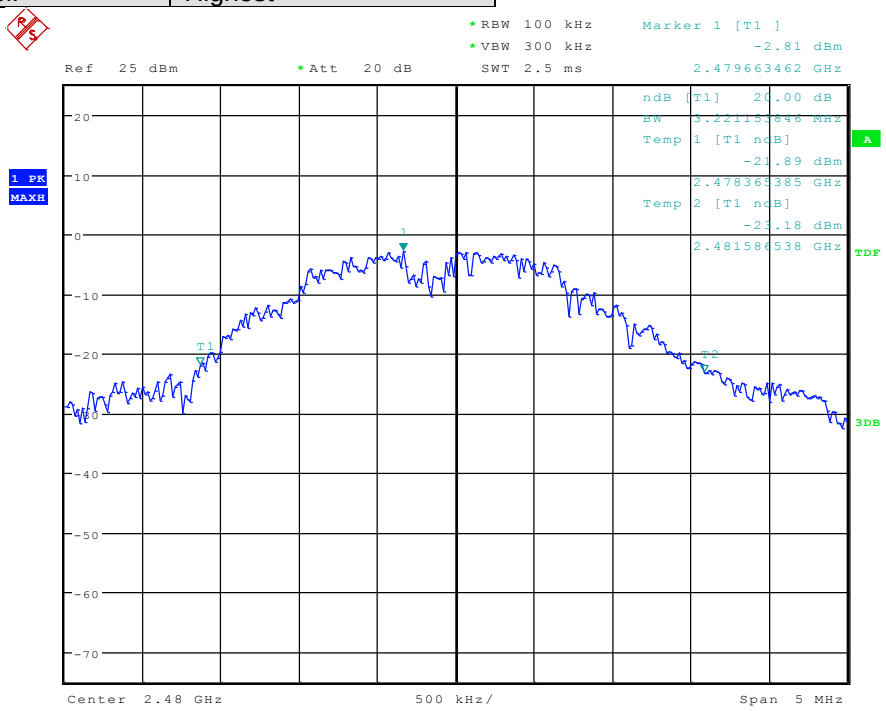
Test channel:	Lowest



Test channel:	Middle



Test channel:	Highest



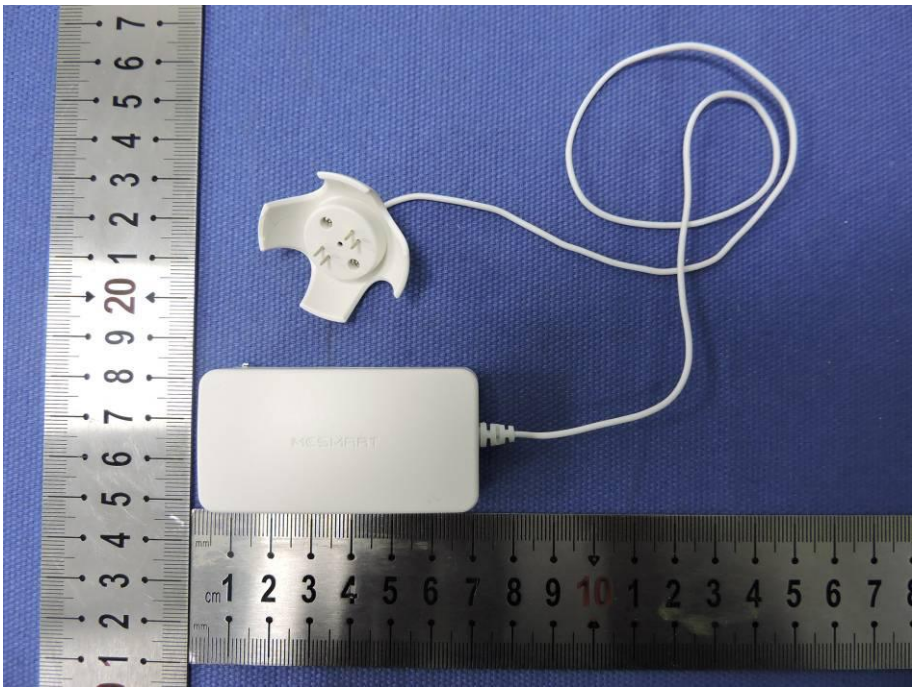
7 Photographs

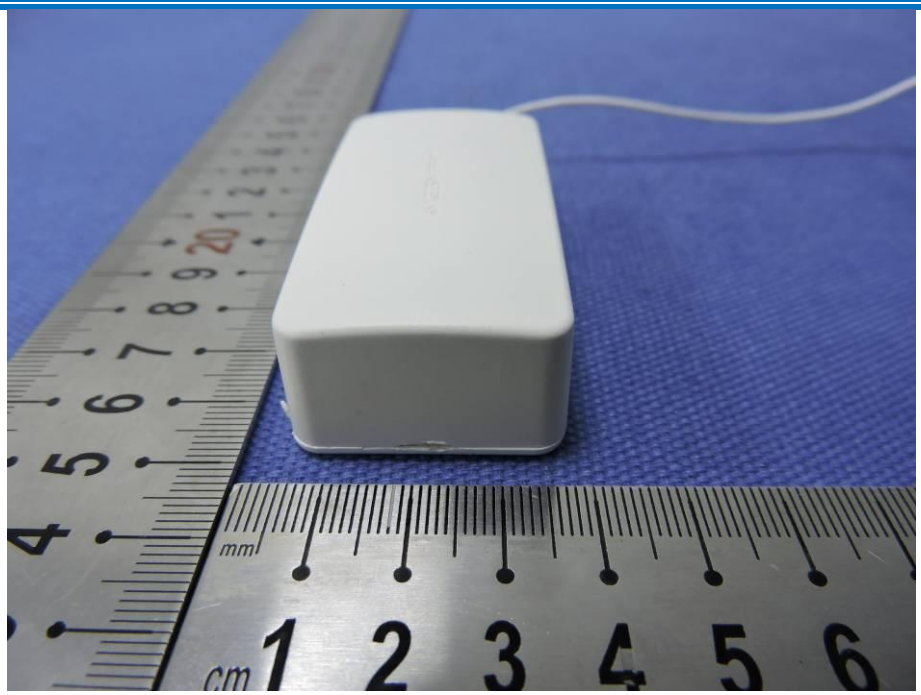
7.1 Radiated Emission Test Setup

Below 1GHz:

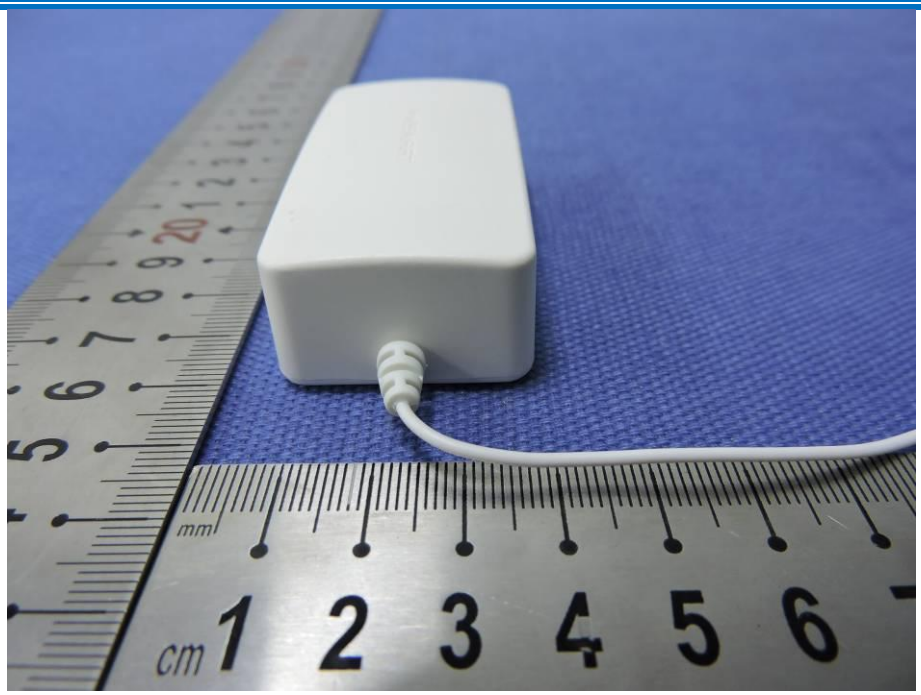
Above 1GHz:

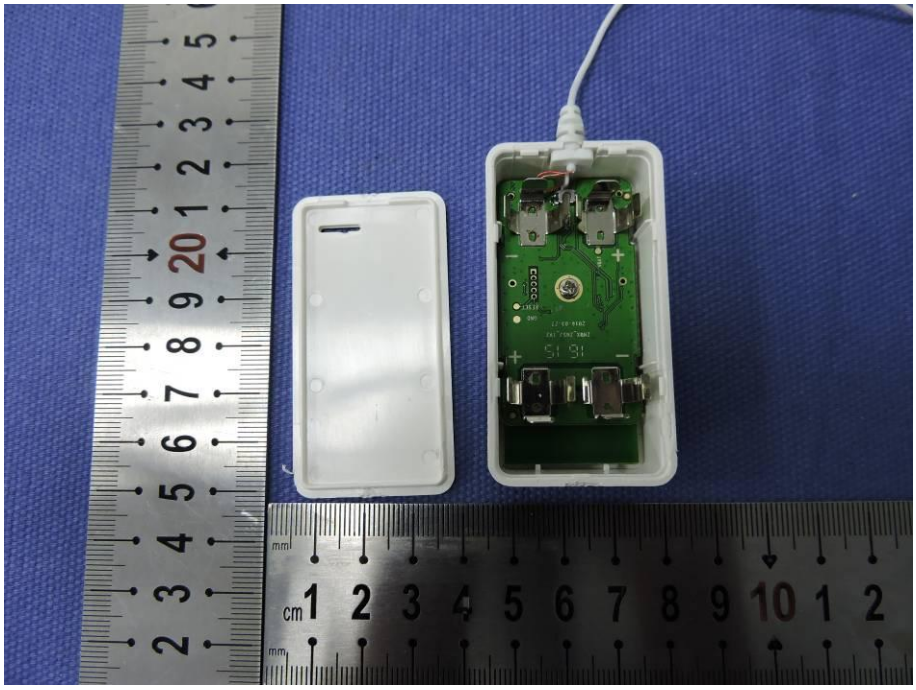
7.2 EUT Constructional Details

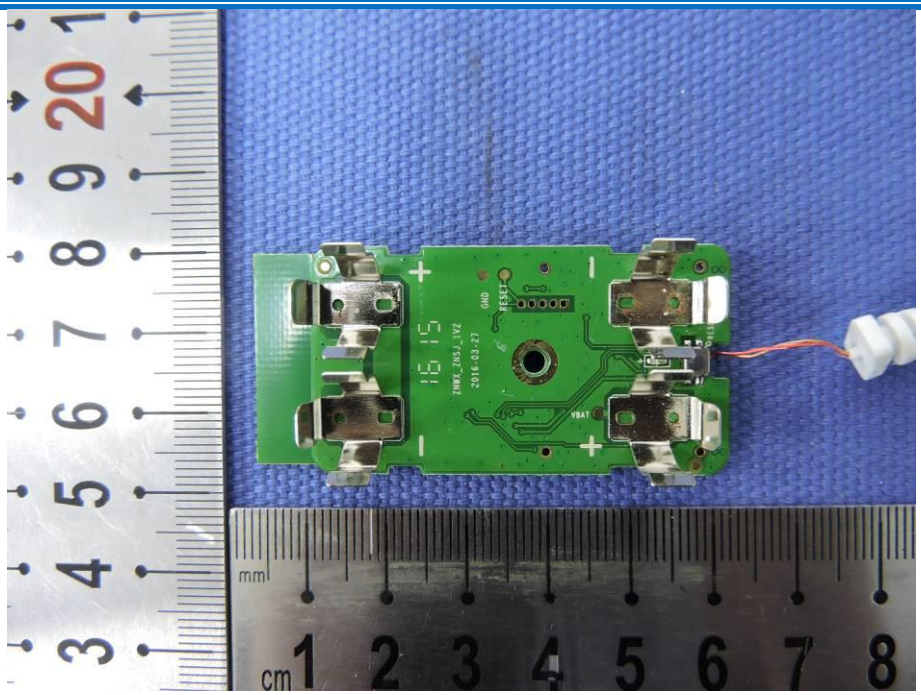


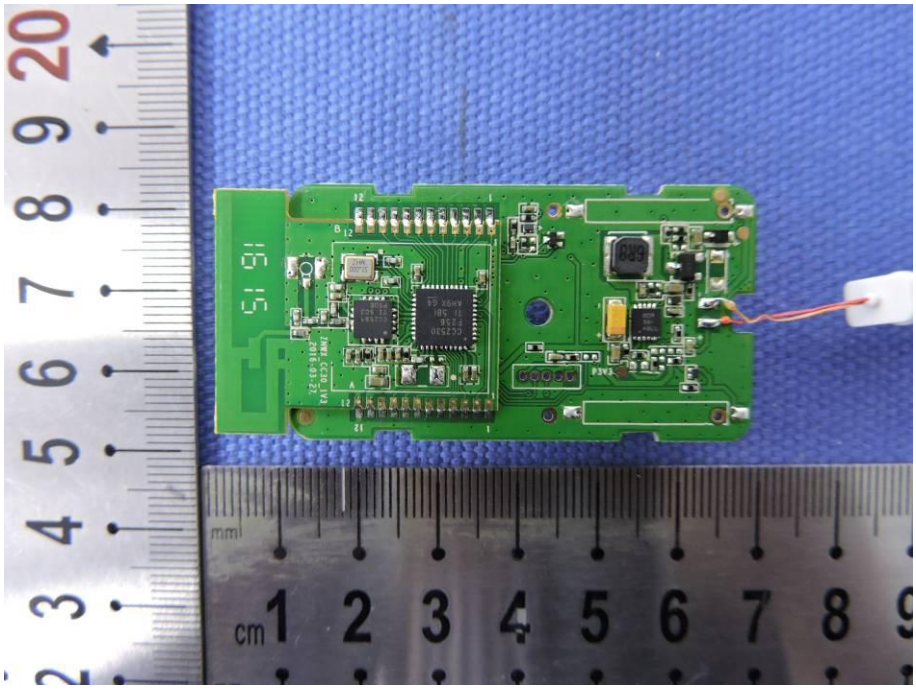

mm
cm 1 2 3 4 5 6

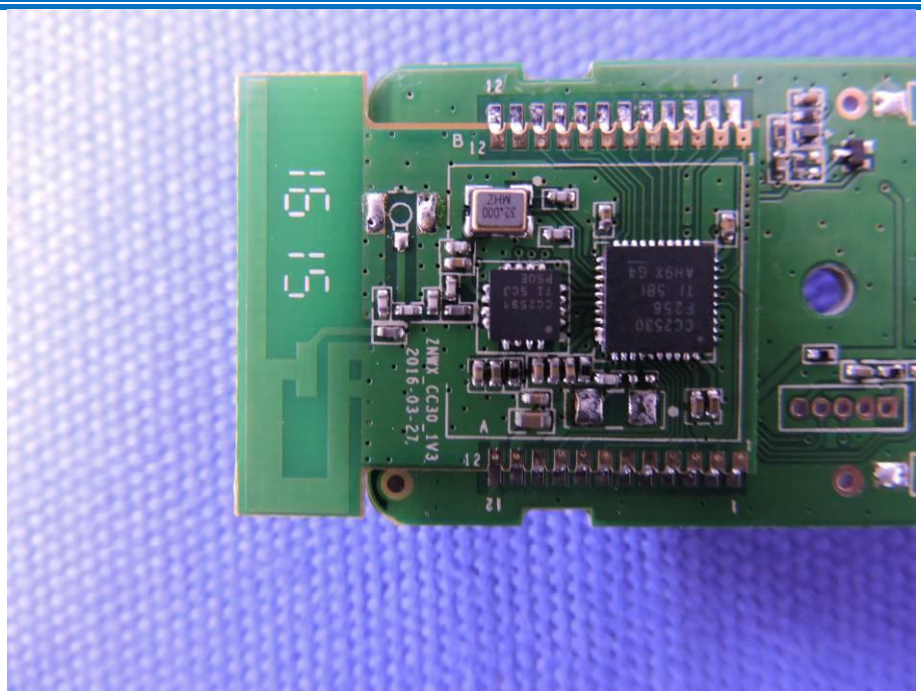

mm
cm 1 2 3 4 5 6 7


mm
cm 1 2 3 4 5 6


cm 1 2 3 4 5 6 7 8 9 10 1 2







END OF THE REPORT