TEST REPORT

FCC ID: 2AHB5-NFCPCB

Applicant : Zhejiang Hanshow Technology Co., Ltd.
Address : Shanghai JiaoTong University Jiaxing Science Park, No.321, Jiachuang Rd., Xiuzhou District, Jiaxing City, Zhejiang, China

Equipment Under Test (EUT):

Name : NFC Module
Model : NFC-pcb
Trademark : N/A

In Accordance with: FCC CFR47 Part 15 Section 15C: 2014

Report No : T1860065 05
Date of Test : December 29, 2015- January 13, 2016
Date of Issue : January 14, 2016

Test Result: **PASS**

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

Authorized Signature

(Mark Zhu)
General Manager

The manufacture should ensure that all the products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of Shenzhen Alpha Product Testing Co., Ltd. Or test done by Shenzhen Alpha Product Testing Co., Ltd. Approvals in connection with, distribution or use of the product described in this report must be approved by Shenzhen Alpha Product Testing Co., Ltd. Approvals in writing..

Contents

1. General Information

1.1. Description of Device (EUT)

EUT	:	NFC Module
Model No.	:	NFC-pcb
DIFF	:	N/A
Trade mark	:	N/A
Power supply	:	DC 3V from battery
Radio Technology	:	RFID
Operation frequency	:	13.56MHz
Antenna Type and Gain	:	PCB Antenna, max gain 2dBi.
Applicant	:	Zhejiang Hanshow Technology Co., Ltd.
Address	:	Shanghai JiaoTong University Jiaxing Science Park, No.321, Jiachuang Rd., Xiuzhou District, Jiaxing City, Zhejiang, China
Manufacturer	:	Zhejiang Hanshow Technology Co., Ltd.
Address	:	Shanghai JiaoTong University Jiaxing Science Park, No.321, Jiachuang Rd., Xiuzhou District, Jiaxing City, Zhejiang, China

1.2. Accessories of device (EUT)

Accessories 1 : N/A

M/N : N/A

1.3. Test Lab information

Shenzhen Alpha Product Testing Co., Ltd.

Building B, East Area of Nanchang Second, Industrial Zone, Gushu 2nd Road, Bao'an, Shenzhen, China

March 25, 2015 File on Federal Communication Commission
Registration Number: 203110

July 18, 2014 Certificated by IC
Registration Number: 12135A

2. Summary of test

2.1. Summary of test result

Description of Test Item	Standard	Results
20dB Bandwidth	FCC Part 15: 15.225 ANSI C63.4 :2014	PASS
Radiated Emission (9KHz-1GHz)	FCC Part 15: 15. 225&209 ANSI C63.4 :2014	PASS
Power Line Conducted Emissions (150KHz-30MHz)	FCC Part 15: 15.207 ANSI C63.4 :2014	N/A
Frequency stability	FCC Part 15: 15.225 ANSI C63.4 :2014	PASS
Antenna Requirement	FCC Part 15: 15.203	PASS

2.2. Assistant equipment used for test

N/A

2.3. Block Diagram

EUT

2.4. Test mode

Tested mode, channel, and data rate information		
Mode	Channel	Frequency (MHz)
1	CH1	13.56
Note: New battery is used .		

2.5. Test Conditions

Temperature range	21-25℃
Humidity range	40-75%
Pressure range	86-106kPa

Remark： Test according to ANSI C63.10 :2013

2.6. Measurement Uncertainty (95% confidence levels, k=2)

Item	MU	Remark
Uncertainty for Power point Conducted Emissions Test	2.42dB	
Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)	2.13 dB	Polarize: V
	2.57dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.54dB	Polarize: V
	4.1dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	2.08dB	Polarize: H
	2.56dB	Polarize: V
Uncertainty for radio frequency	1×10-9	
Uncertainty for conducted RF Power	0.65dB	
Uncertainty for temperature	0.2℃	
Uncertainty for humidity	1%	
Uncertainty for DC and low frequency voltages	0.06%	

2.7. Test Equipment

Equipment	Manufacture	Model No.	Serial No.	Last cal.	Cal Interval
3m Semi-Anechoic	ETS-LINDGREN	N/A	SEL0017	2015.01.19	1Year
Spectrum analyzer	Agilent	E4407B	MY46185649	2015.01.19	1Year
Receiver	R&S	ESCI	1166.5950K03-1011	2015.01.19	1Year
Receiver	R&S	ESCI	101202	2015.01.19	1Year
Bilog Antenna	Schwarzbeck	VULB 9168	VULB9168-438	2015.01.21	1Year
Horn Antenna	EMCO	3115	640201028-06	2015.01.21	1Year
Active Loop Antenna	Beijing Daze	ZN30900A	SEL0097	2015.01.21	1Year
Cable	Resenberger	N/A	No.1	2015.01.19	1Year
Cable	SCHWARZBECK	N/A	No.2	2015.01.19	1Year
Cable	SCHWARZBECK	N/A	No.3	2015.01.19	1Year
Pre-amplifier	Schwarzbeck	BBV9743	9743-019	2015.01.19	1Year
Pre-amplifier	R&S	AFS33-18002650-30-8P-44	SEL0080	2015.01.19	1Year
Base station	Agilent	E5515C	GB44300243	2015.01.19	1 Year
Temperature controller	Terchy	MHQ	120	2015.01.19	1Year
Power divider	Anritsu	K240C	020346	2015.01.19	1 Year
Signal Generator	HP	83732B	VS3449051	2015.01.19	1 Year
Power Meter	Anritsu	ML2487A	6K00001491	2015.01.19	1Year
Power sensor	Anritsu	ML2491A	32516	2015.01.19	1Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	8126466	2015.01.19	1Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	101043	2015.01.19	1 Year

3. 20dB bandwidth

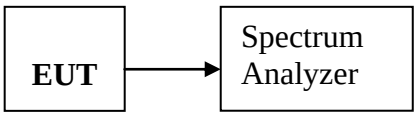
3.1. Limit

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

3.2. Test Procedure

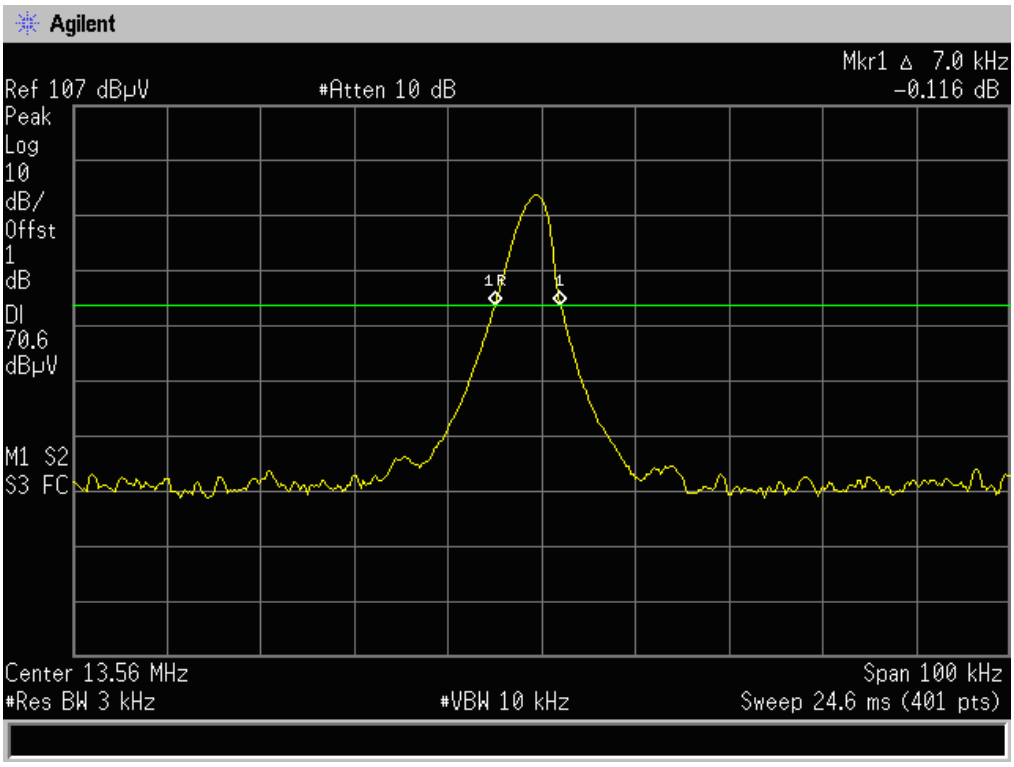
The transmitter output was coupled to a spectrum analyzer via a antenna. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 3KHz RBW and 10kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

3.3. Test Setup



3.4. Test Result

EUT: NFC Module M/N: NFC-pcb				
Test date: 2016-01-11		Test site: RF site		Tested by: Simple
Mode	Freq (MHz)	20dB Bandwidth (KHz)	Limit (kHz)	Conclusion
Tx Mode	13.56	7.0	/	PASS



4. Radiated emissions

4.1. Limit(FCC 15.209)

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

Note:

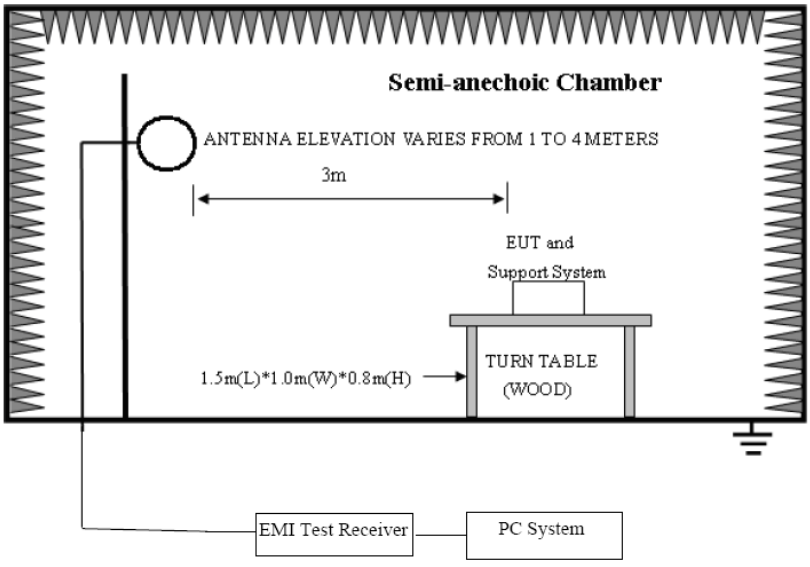
a) The tighter limit applies at the band edges.
For example: F.S limit at 88MHz is 100uV/m

b) If measurement is made at 3m distance, then F.S Limit at 3m distance is adjusted by using the formula of $L_{d1} = L_{d2} * (d2/d1)^2$.
For example:
F.S Limit at 30m(d2) distance is 30uV/m(L_{d2}), then F.S Limit at 3m(d1) distance is
L_{d1} = 30uV/m * $(30/3)^2$ = 100 * 30uV/m = 69.54 dBuV/m

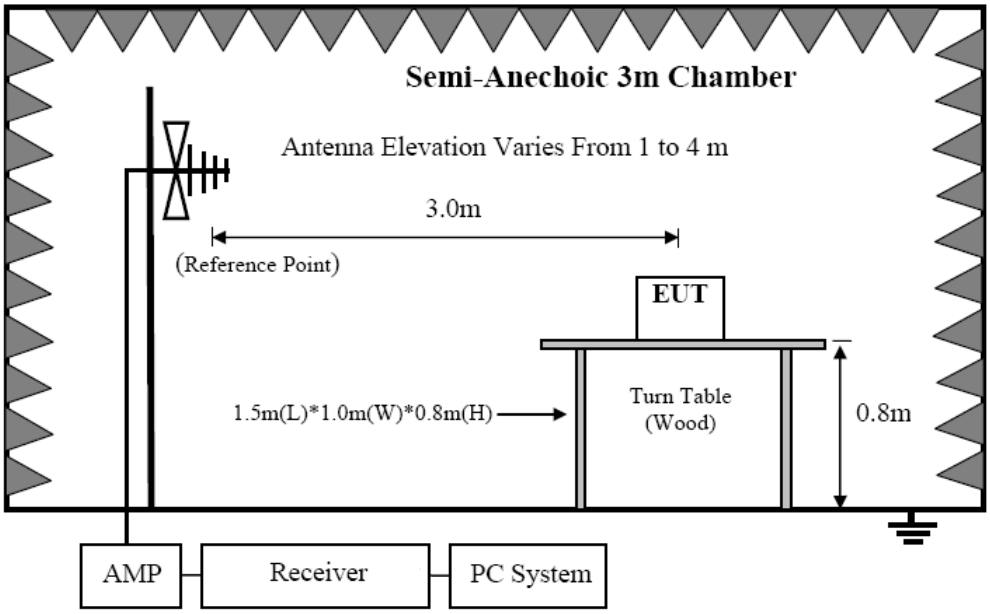
4.2. Block Diagram of Test setup

In 3m Anechoic Chamber Test Setup Diagram for below 30MHz

4.2. Block diagram of test setup



In 3m Anechoic Chamber Test Setup Diagram for frequency 30MHz-1GHz



4.3. Test Procedure

Procedure of Preliminary Test

The EUT and Support equipment, if needed, were put placed on a non-metallic table, 80cm above the ground plane.

Configuration EUT to simulate typical usage as described in clause 2.4 and test equipment as described in clause 4.2 of this report.

All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4:2003.

Mains cables, telephone lines or other connections to auxiliary equipment located outside the test are shall drape to the floor, be fitted with ferrite clamps or ferrite tubes placed on the floor at the point where the cable reaches the floor and then routed to the place where they leave the turntable. No extension cords shall be used to mains receptacle.

The antenna was placed at 3 meter away from the EUT as stated in ANSI C63.10:2013. The antenna connected to the Spectrum Analyzer via a cable and at times a pre-amplifier would be used.

The Receiver quickly scanned from 9KHz to 30MHz and 30MHz to 1GHz The EUT test program was started. Emissions were scanned and measured rotating the EUT to 360 degrees and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.

The test mode(s) described in clause 2.4 were scanned during the preliminary test:

After the preliminary scan, we found the test mode producing the highest emission level. The EUT and cable configuration, antenna position, polarization and turntable position of the above highest emission level were recorded for the final test.

Procedure of Final Test

EUT and support equipment were set up on the turntable as per the configuration with highest emission level in the preliminary test.

The Receiver scanned from9KHz to 30MHz and 30MHz to 1GHz. Emissions were scanned and

measured rotating the EUT to 360 degrees, varying cable placement and positioning the antenna 1 to 4 meters above the ground plane, in both the vertical and the horizontal polarization, to maximize the emission reading level.

Recorded at least the six highest emissions. Emission frequency, amplitude, antenna position, polarization and turntable position were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit and only Q.P. reading is presented.

The test data of the worst-case condition(s) was recorded.

The bandwidth of test receiver is set at 200Hz for 9 KHz to 150 KHz measure, 10 KHz for 150 KHz to 30MHz measure and 120 KHz for 30 MHz to 1GHz measure .

4.4. Test Result

PASS. (See below detailed test result)

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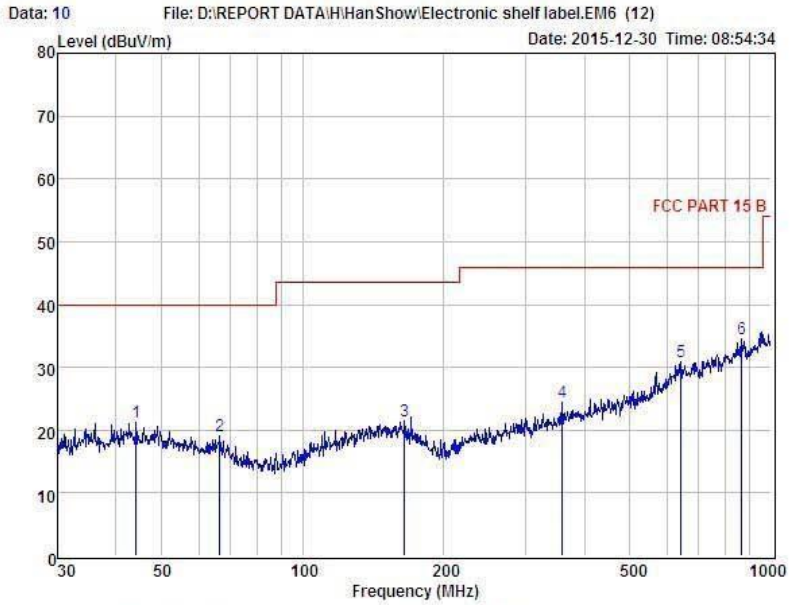

Condition : FCC PART 15 B 3m POL: HORIZONTAL
EUT :
Model No :
Test Mode :
Power : DC 3V
Test Engineer : Reak
Remark :
Temp : 25.2°C
Hum : 56%

Item	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit	Margin	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dBuV	
1	44.12	37.27	13.79	29.96	0.03	21.13	40.00	-18.87	Peak
2	66.50	37.55	11.59	30.39	0.28	19.03	40.00	-20.97	Peak
3	164.91	36.35	13.76	29.14	0.42	21.39	43.50	-22.11	Peak
4	357.93	37.47	13.99	27.69	0.67	24.44	46.00	-21.56	Peak
5	642.86	36.22	19.02	25.53	1.24	30.95	46.00	-15.05	Peak
6	866.09	36.72	21.21	24.87	1.42	34.48	46.00	-11.52	Peak

Remark: Level = Read Level + Antenna Factor - Preamp Factor + Cable Loss

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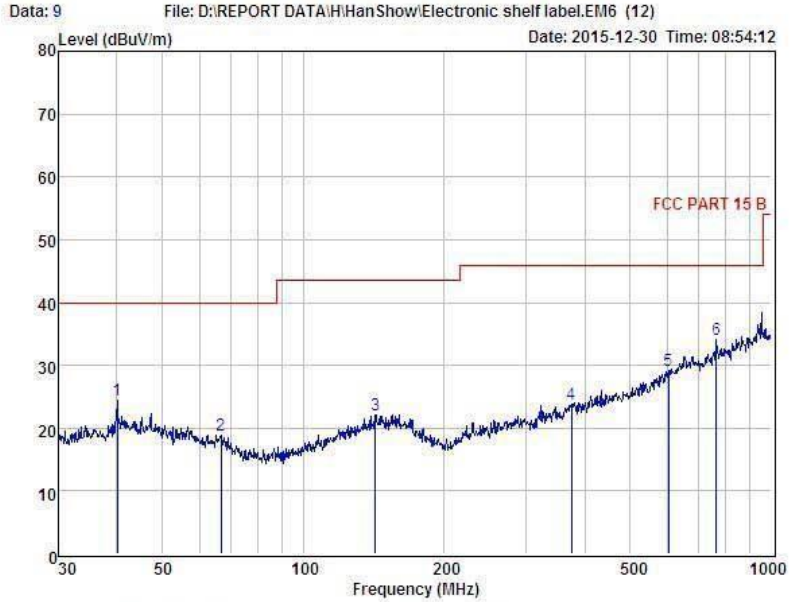

Condition : FCC PART 15 B 3m POL: VERTICAL
EUT :
Model No :
Test Mode :
Power : DC 3V
Test Engineer : Reak
Remark :
Temp : 25.2°C
Hum : 56%

Item	Freq	Read Level	Antenna Factor	Preamp Factor	Cable Loss	Level	Limit	Margin	Remark
	MHz	dBuV	dB	dB	dB	dBuV	dBuV	dBuV	
1	40.13	40.95	14.07	30.85	0.17	24.34	40.00	-15.66	Peak
2	66.73	37.85	11.21	30.39	0.28	18.95	40.00	-21.05	Peak
3	142.82	37.63	13.64	29.39	0.29	22.17	43.50	-21.33	Peak
4	374.62	35.95	14.32	27.43	1.07	23.91	46.00	-22.09	Peak
5	603.54	35.60	18.39	25.89	1.13	29.23	46.00	-16.77	Peak
6	763.38	37.49	20.41	25.34	1.53	34.09	46.00	-11.91	Peak

Remark: Level = Read Level + Antenna Factor - Preamp Factor + Cable Loss

Radiated Emissions Result of Inside band (13.56MHZ)

EUT	NFC Module	**Model Name**	NFC-pcb
Temperature	26°C	**Relative Humidity**	58%
Pressure	960hPa	**Test voltage**	DC 3V from battery
Test Mode	TX	**Antenna polarization**	H/V
Distance	3m		

Channel (13.56MHZ)									
Fre. MHz	**Position H/V**	**Reading dBuV**	**Antenna Factor dB**	**Cable Loss dB**	**Amplifier Gain dB**	**Correct Factor dB**	**Measure Result dBuV/m**	**Limit dBuV/m**	**Margin dB**
13.56	H	91.33（PK）	10.6	0.33	24.65	-13.72	77.61	124	-46.39
13.56	H	81.23(AV)	10.6	0.33	24.65	-13.72	67.51	104	-36.49
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13.56	V	81.09（PK）	10.6	0.33	24.65	-13.72	67.37	124	-56.63
13.56	V	68.17(AV)	10.6	0.33	24.65	-13.72	54.45	104	-49.55
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Notes: --Means other frequency and mode comply with standard requirements and at least have 20dB margin.

Correct Factor=Cable Loss+ Antenna Factor- Amplifier Gain

Measurement Result=Reading + Correct Factor

Margin=Measurement Result-Limit

--Spectrum setting:

a. Peak setting RBW=10KHz, VBW=30KHz.

4.5. Field strength

4.5.1 Limit

Please see the section 15.225(b) and 15.225(c)

15.225(b): Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter (50.5dBuV/m)at 30 meters 15.225©: Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter (40.5dBuV/m) at 30 meters

Note: 30m to 3m correction factor calculation:

40*Log(30m/3m)=40

4.5.2 Test Result:

EUT	NFC Module	**Model Name**	NFC-pcb
Temperature	26°C	**Relative Humidity**	56%
Pressure	960hPa	**Test voltage**	DC 3V from battery
Test Mode	TX	**Distance**	3m

Freq. (MHz)	**Position H/V**	**Detector Mode (PK/QP)**	**Reading (dBuV)**	**Factor (dB)**	**Actual FS (dBuV/m)**	**Limits 3m (dBuV/m)**	**Margin (dBuV/m)**
13.110	H	Peak	40.35	-13.94	26.41	69.5	-43.09
13.410	H	Peak	41.72	-13.94	27.78	80.50	-52.72
13.553	H	Peak	41.58	-13.94	27.64	90.50	-62.86
13.567	H	Peak	44.32	-13.93	30.39	90.50	-60.11
13.710	H	Peak	42.75	-13.93	28.82	80.50	-51.68
14.010	H	Peak	43.36	-13.93	29.43	69.5	-40.07

Freq. (MHz)	**Position H/V**	**Detector Mode (PK/QP)**	**Reading (dBuV)**	**Factor (dB)**	**Actual FS (dBuV/m)**	**Limits 3m (dBuV/m)**	**Margin (dBuV/m)**
13.110	V	Peak	41.67	-13.94	27.73	69.5	-41.77
13.410	V	Peak	44.32	-13.94	30.38	80.5	-50.12
13.553	V	Peak	42.73	-13.94	28.79	90.5	-61.71
13.567	V	Peak	42.57	-13.94	28.63	90.5	-61.87
13.710	V	Peak	43.36	-13.93	29.43	80.5	-51.07
14.010	V	Peak	42.83	-13.93	28.90	69.5	-40.60

5. Frequency stability

5.1. Test limit

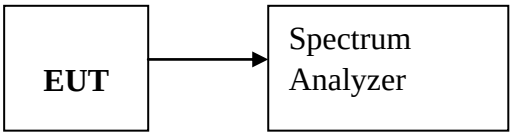
Please refer section15.225e.

Regulation 15.225(e) The frequency tolerance of the carrier signal shall be maintained within +/-0.01%(±100 ppm) of the operating frequency over a temperature variation of –20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

5.2. Test Procedure

The following equipment are installed on the emission measurement to meet the commission requirements and operating regulations in a manner which tends to maximize its emission characteristics in normal application.

5.3. Test Setup



5.4. Test Results

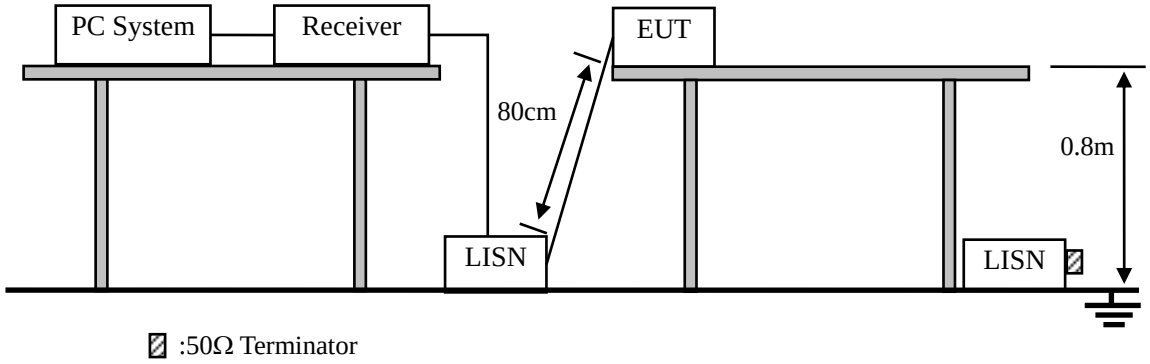
PASS.

Detailed information please see the following page.

Assigned Frequency(MHz): 13.56MHz Voltage: DC 3V from battery				
Voltage	Temperature	Measured Frequency (MHz)	Frequency stability	Limit
Low DC 2.55V	+20℃	13.56057	0.00057	±100 ppm ±0.001356MHz
Normal DC 3V	-20℃	13.56061	0.00061	
	-10℃	13.55957	-0.00043	
	0℃	13.56041	0.00041	
	+10℃	13.55932	-0.00068	
	+20℃	13.56046	0.00046	
	+30℃	13.56052	0.00052	
	+40℃	13.55981	-0.00019	
	+50℃	13.55963	-0.00037	
High DC 3.45V	+20℃	13.56055	0.00052	

6. Power Line Conducted Emissions

6.1. Block Diagram of Test Setup



6.2. Limit

Frequency	Maximum RF Line Voltage	
	Quasi-Peak Level dB(μV)	Average Level dB(μV)
150kHz ~ 500kHz	66 ~ 56*	56 ~ 46*
500kHz ~ 5MHz	56	46
5MHz ~ 30MHz	60	50

Notes: 1. * Decreasing linearly with logarithm of frequency.

2. The lower limit shall apply at the transition frequencies.

6.3. Test Procedure

(1) The EUT was placed on a non-metallic table, 80cm above the ground plane.

(2) Setup the EUT and simulator as shown in 10.1

(3) The EUT Power connected to the power mains through a power adapter and a line impedance stabilization network (L.I.S.N1). The other peripheral devices power cord connected to the power mains through a line impedance stabilization network (L.I.S.N1), this provided a 50-ohm coupling impedance for the EUT (Please refer to the block diagram of the test setup and photographs). Both sides of power line were checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipments and all of the interface cables were changed according to ANSI C63.4 2014 and ANSI C64.10:2009 on conducted Emission test.

(4) The bandwidth of test receiver is set at 10KHz.

(5) The frequency range from 150 KHz to 30MHz is checked.

6.4. Test Result

Not apply to battery operated product.

7. Antenna Requirements

7.1. Limit

For intentional device, according to FCC 47 CFR Section 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. And according to FCC 47 CFR Section 15.209, if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

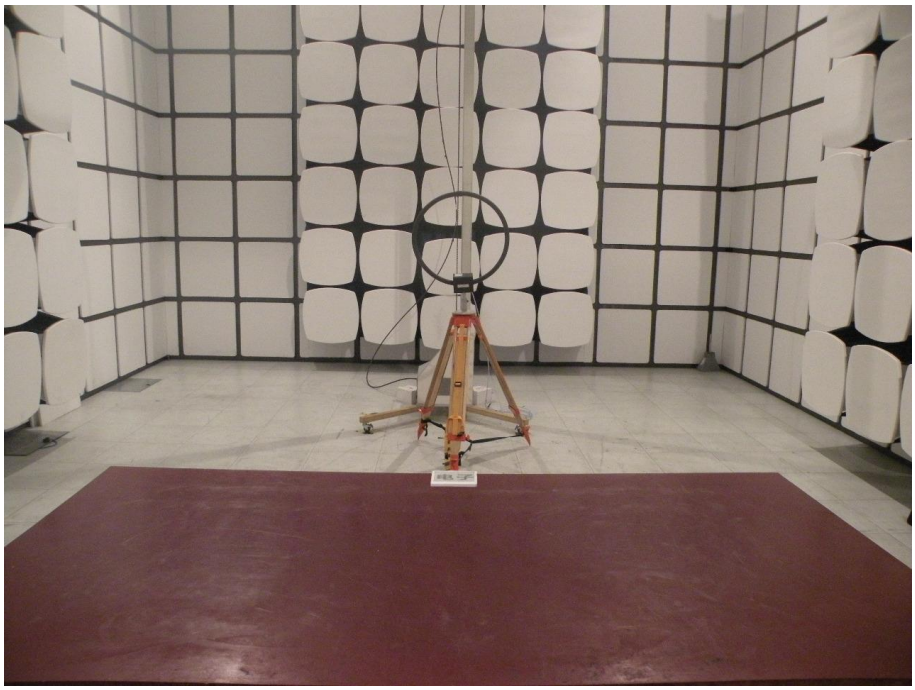
7.2. Result

The antennas used for this product are integral Antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 2dBi.

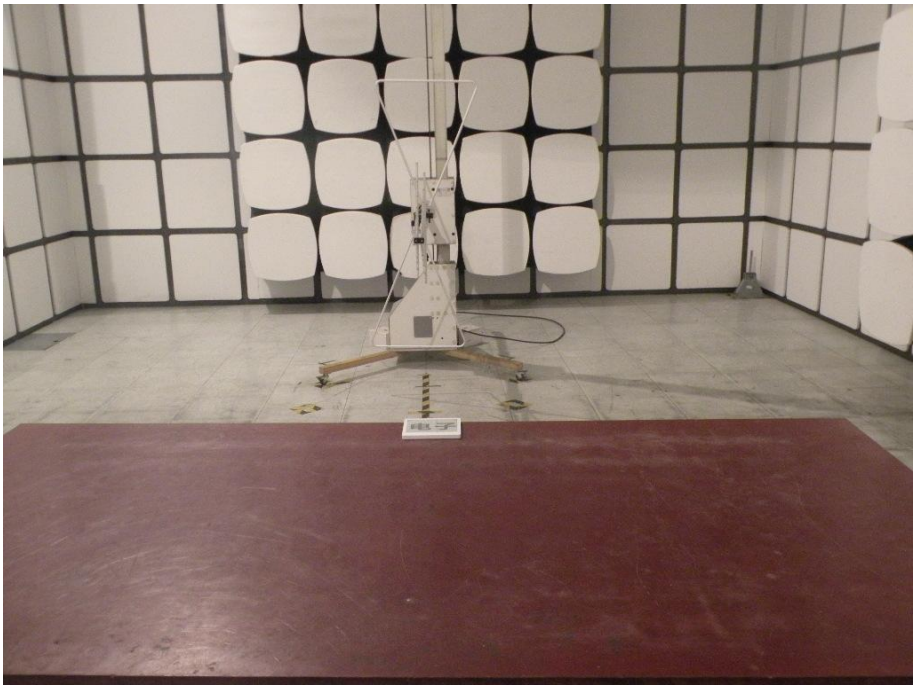
8. Test setup photo

Photographs-Radiated Emission Test Setup in Chamber

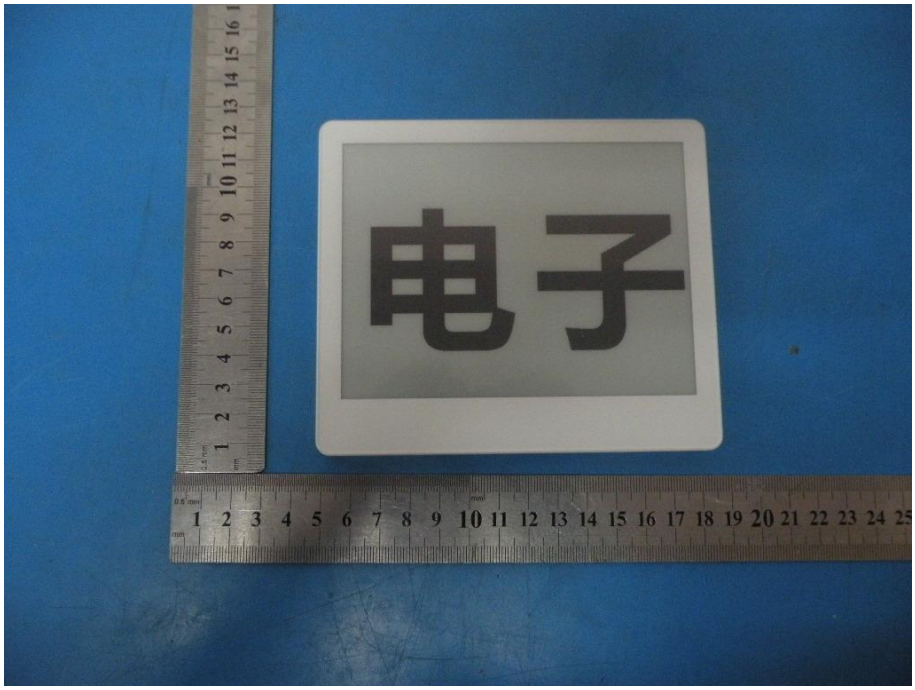
Below 30M

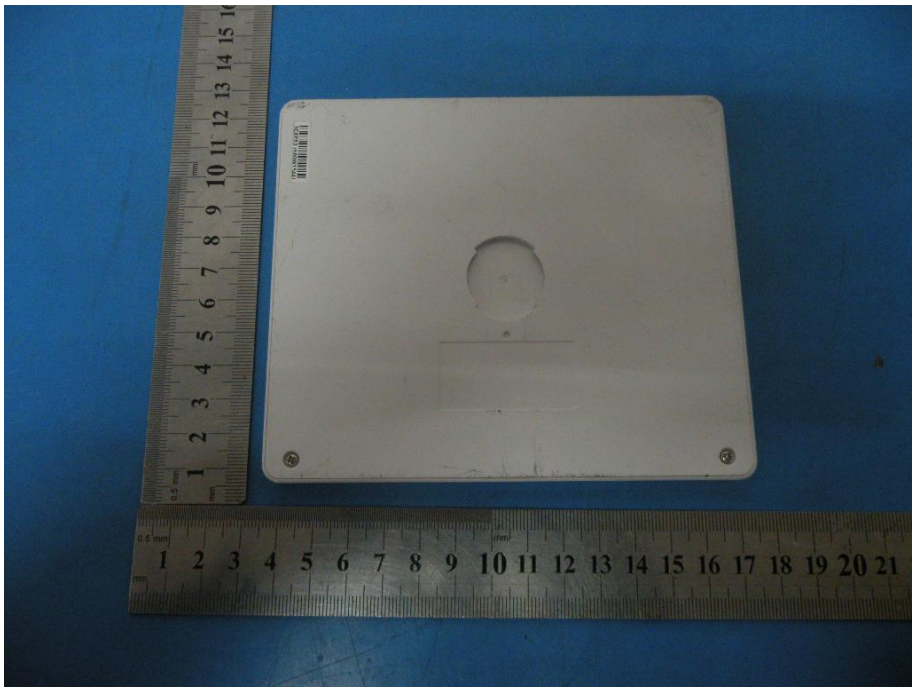


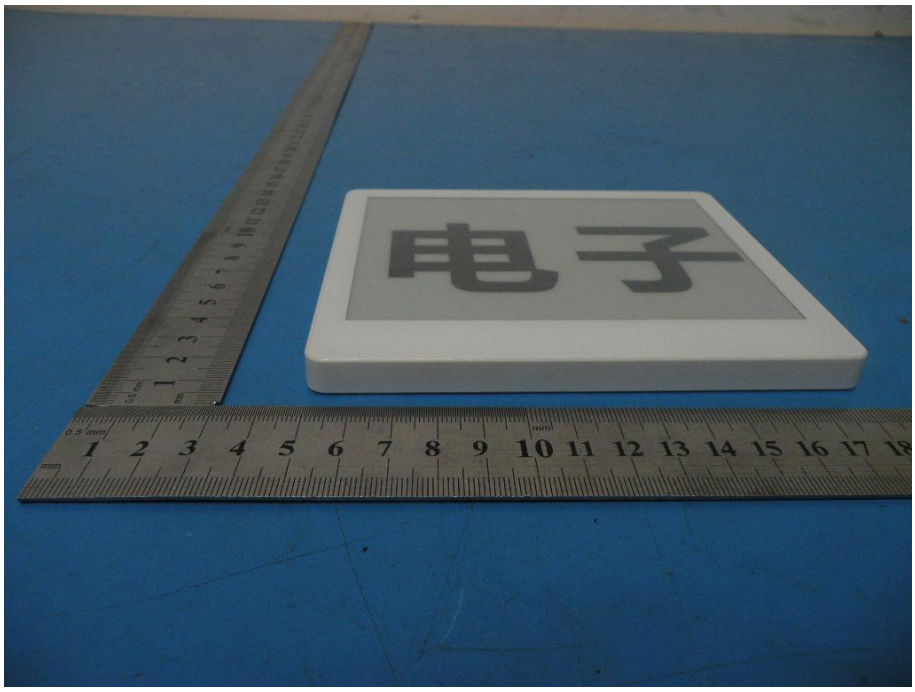
30M-1G



9. Photos of EUT



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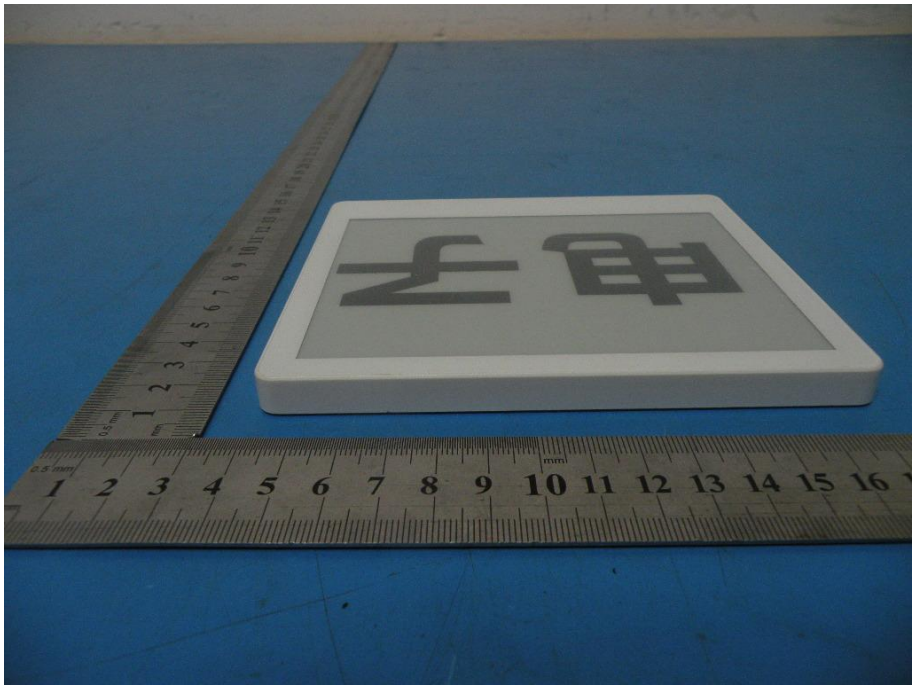

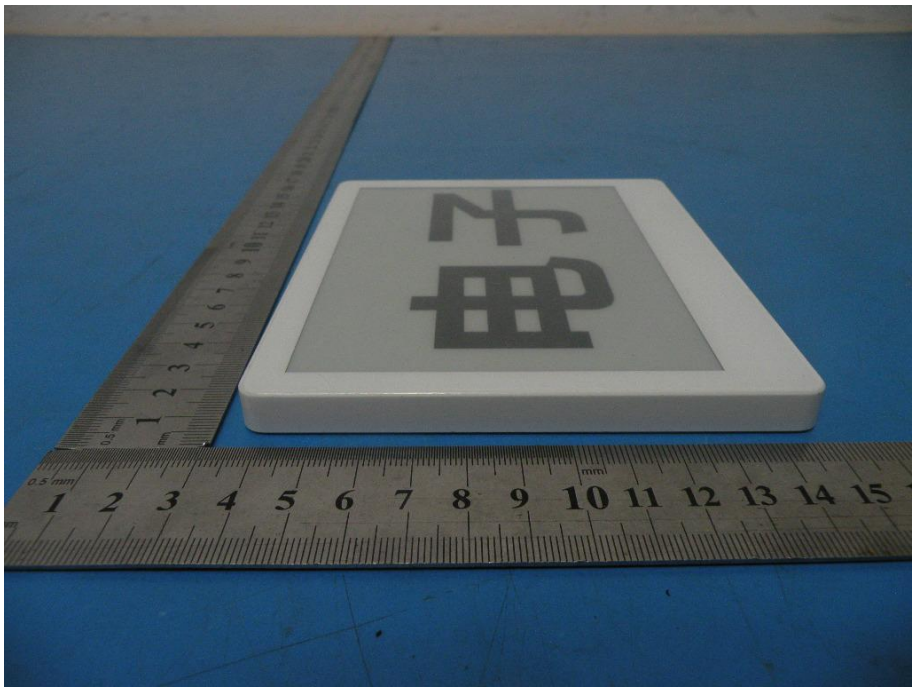

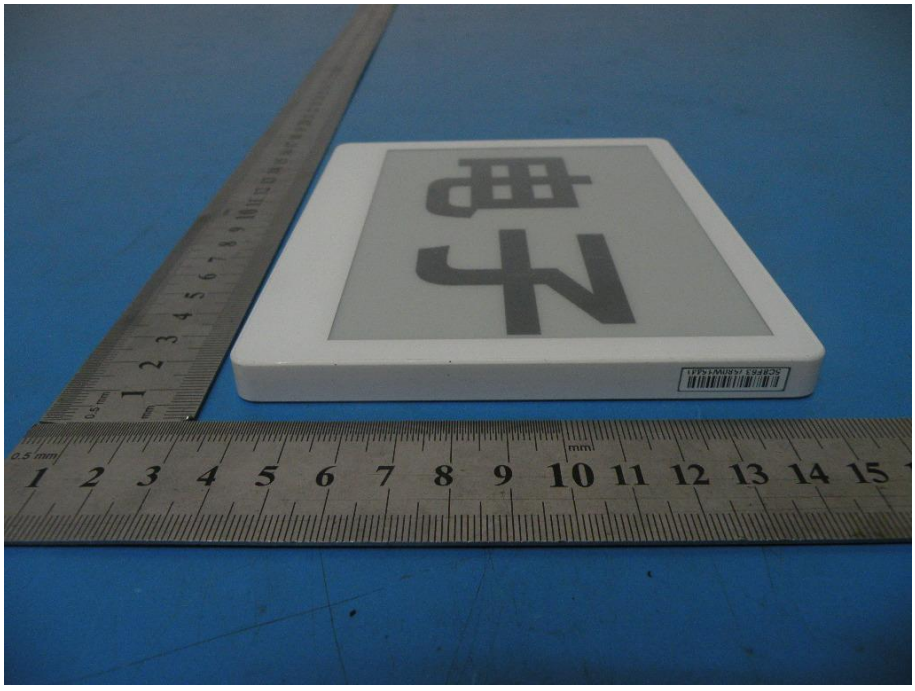

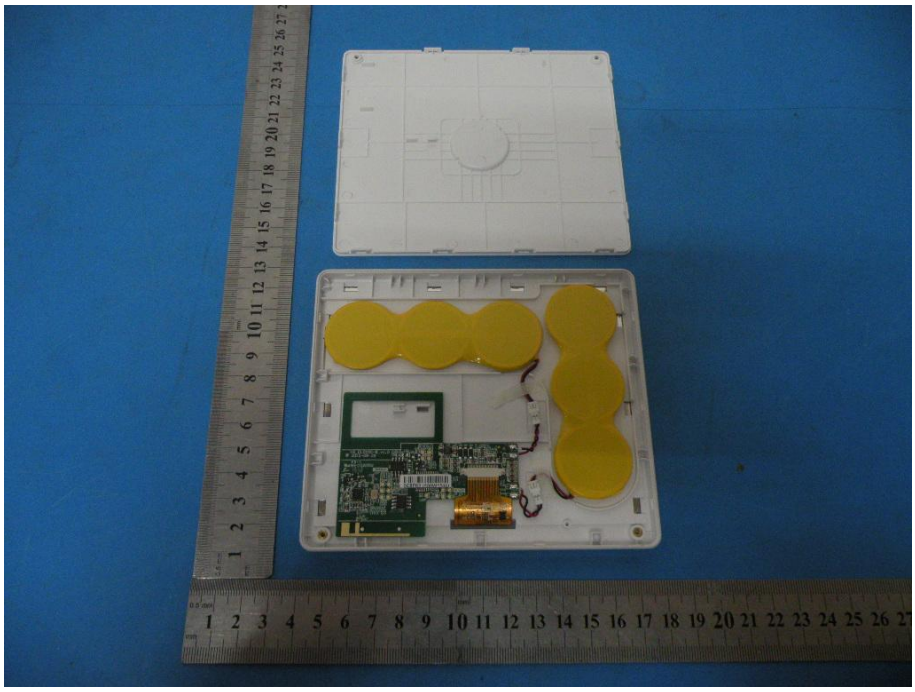

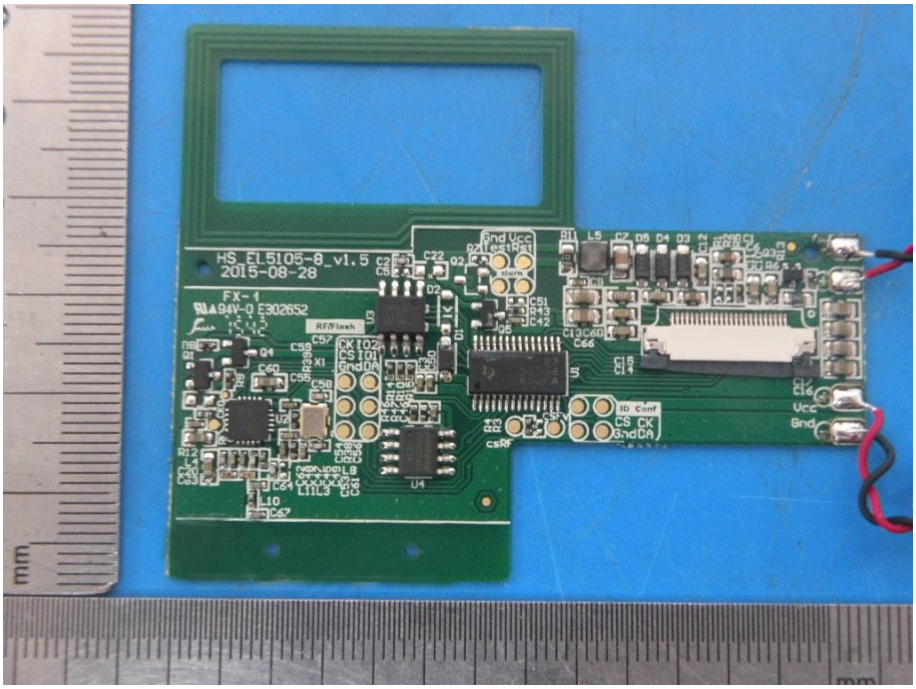
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2015-08-28
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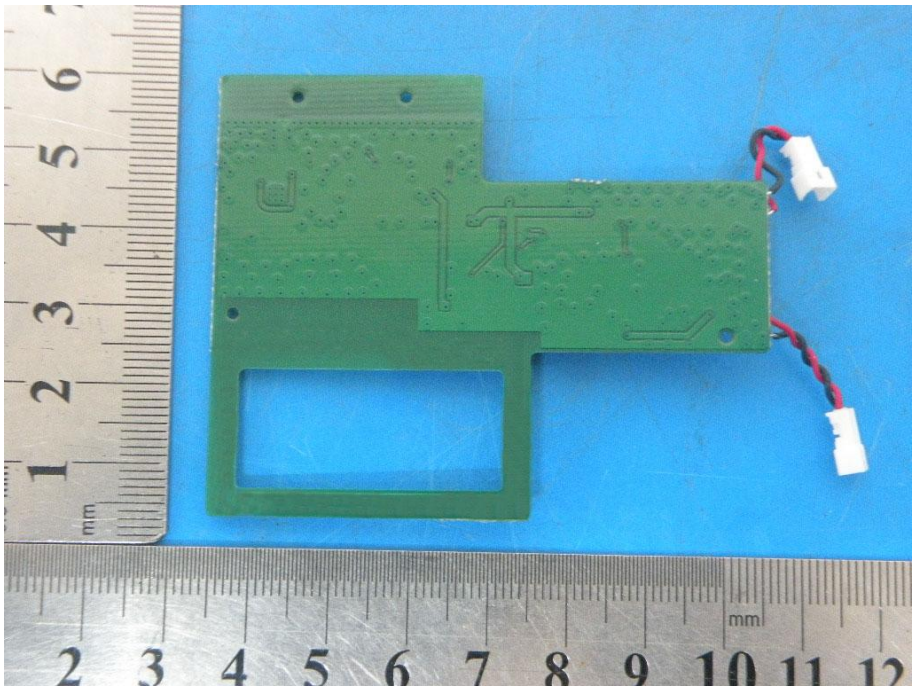

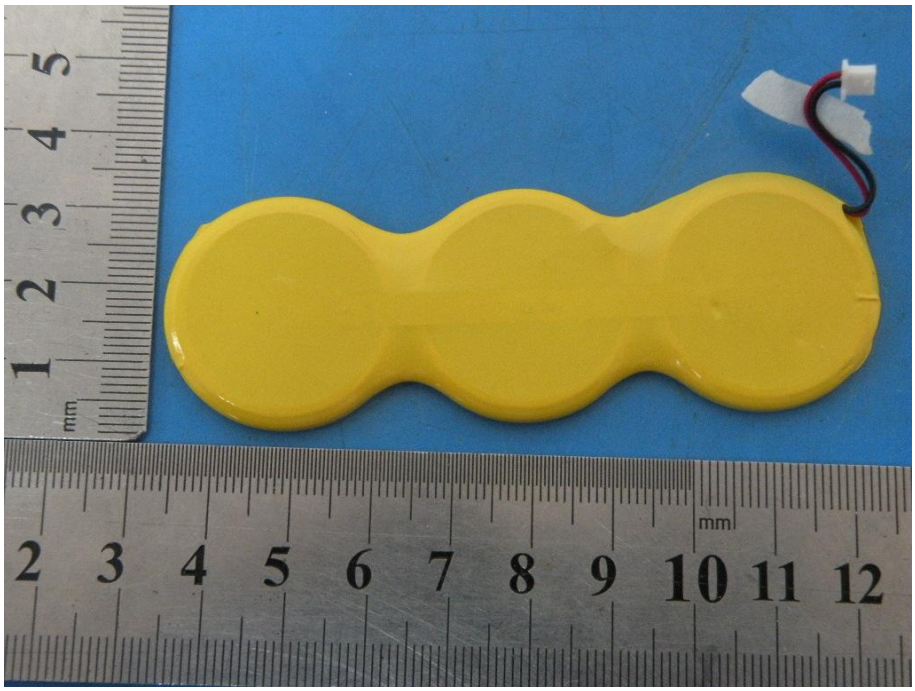

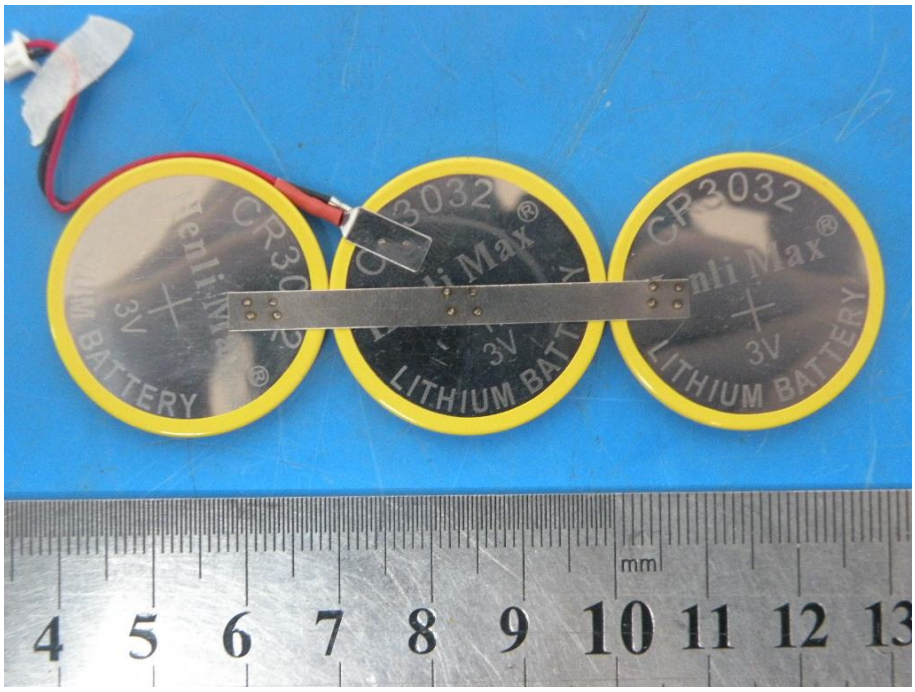

--------END OF THE REPORT-------