FCC TEST REPORT

On Behalf of

RAKO Security - Label Produktsicherungs GmbH

FCC ID: 2ASU9-MERKUR

RF Aisle Security System – 8.2MHz

Model No.: MERKUR O_410 - LTM(KTM)- B/G

Prepared for	:	RAKO Security - Label Produktsicherungs GmbH
Address	:	Moellner Landstrasse 15, 22969 Witzhave, GER

Prepared By	:	Shenzhen Alpha Product Testing Co., Ltd.
Address	:	Building i, No.2, Lixin Road, Fuyong Street, Bao'an District, 518103, Shenzhen, Guangdong, China

Report Number	:	T1904143-C01-R01
Date of Receipt	:	April 19, 2019
Date of Test	:	April 19, 2019-May 09, 2019
Date of Report	:	May 09, 2019
Version Number	:	V0

Contents

TEST REPORT DECLARATION

Applicant	:	RAKO Security - Label Produktsicherungs GmbH
Address	:	Moellner Landstrasse 15, 22969 Witzhave, GER
Manufacturer	:	RAKO Security - Label Produktsicherungs GmbH
Address	:	Moellner Landstrasse 15, 22969 Witzhave, GER
EUT Description	:	RF Aisle Security System – 8.2MHz
	(A) Model No.	: MERKUR O_410 - LTM(KTM)- B/G
	(B) Trademark	: N/A

Measurement Standard Used:

FCC Rules and Regulations Part 15 Subpart C Section 15.223 ,

ANSI C63.4: 2014, ANSI C63.10: 2013

The device described above is tested by Shenzhen Alpha Product Testing Co., Ltd. to determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 15 Subpart B Class B limits both conducted and radiated emissions. The test results are contained in this test report and Shenzhen Alpha Product Testing Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.
After the test, our opinion is that EUT compliance with the requirement of the above standards.

This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Shenzhen Alpha Product Testing Co., Ltd.

Tested by (name + signature).....…..:	Ella Liang Project Engineer	Ella Liang
Approved by (name + signature)…....:	Simple Guan Project Manager	
Date of issue…… ……..:	May 09, 2019	

1. General Information

1.1. Description of Device (EUT)

EUT	:	RF Aisle Security System – 8.2MHz
Model No.	:	MERKUR O_410 - LTM(KTM)- B/G
DIFF	:	N/A
Trade mark	:	N/A
Power supply	:	DC 24V from adapter with AC 120V/60Hz
Adapter	:	Model: BYX-2403000E Input: AC100-240V, 50/60Hz, 1.5A Max Output: DC 12V/3A
Operation frequency	:	8.2MHz
Antenna Type and Gain	:	Internal antenna, -40dBi Max

1.2. Accessories of device (EUT)

Accessories 1 : /

M/N : /

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

1.4. Measurement Uncertainty

(95% confidence levels, k=2)

Item	MU	Remark
Uncertainty for Conducted Emission Test	2.74dB	
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)	3.77dB	Polarize: V
	3.80dB	Polarize: H
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	4.16dB	Polarize: H
	4.13dB	Polarize: V
Uncertainty for radio frequency	5.4×10^{-8}	
Uncertainty for conducted RF Power	0.37dB	

2. Summary of test

2.1. Summary of test result

Description of Test Item	Standard	Results
Radiated Emission (9KHz-1.0GHz)	FCC Part 15: 209 ANSI C63.4 :2014	PASS
6dB Bandwidth	FCC Part 15.223	PASS
Power Line Conducted Emissions (150KHz-30MHz)	FCC Part 15: 15.207 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

2.4. Test mode

Tested mode, channel, and data rate information		
Mode	Channel	Frequency (MHz)
1	CH1	8.2
Note: According exploratory test, EUT will have maximum output power in those data rate. so those data rate were used for all test.		

2.5. Test Conditions

Items	Required	Actual
Temperature range:	15-35℃	27℃
Humidity range:	25-75%	56%
Pressure range:	86-106kPa	98kPa

2.6. Test Equipment

Equipment	Manufacture	Model No.	Serial No.	Last cal.	Cal Interval
3m Semi-Anechoic	ETS-LINDGREN	N/A	SEL0017	2018.09.21	1Year
Spectrum analyzer	Agilent	E4407B	MY46185649	2018.09.21	1Year
Receiver	R&S	ESCI	1166.5950K03-1011	2018.09.21	1Year
Receiver	R&S	ESCI	101202	2018.09.21	1Year
Bilog Antenna	Schwarzbeck	VULB 9168	VULB9168-438	2018.04.13	2Year
Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00059	2018.09.26	2Year
Cable	Resenberger	N/A	No.1	2018.09.21	1Year
Cable	SCHWARZBECK	N/A	No.2	2018.09.21	1Year
Cable	SCHWARZBECK	N/A	No.3	2018.09.21	1Year
Pre-amplifier	Schwarzbeck	BBV9743	9743-019	2018.09.21	1Year
Pre-amplifier	R&S	AFS33-18002650-30-8P-44	SEL0080	2018.09.21	1Year
Temperature controller	Terchy	MHQ	120	2018.09.21	1Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	8126466	2018.09.21	1Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	101043	2018.09.21	1 Year
20db Attenuator	ICPROBING	IATS1	82347	2018.09.21	1 Year

3. Radiated emissions

3.1. 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:

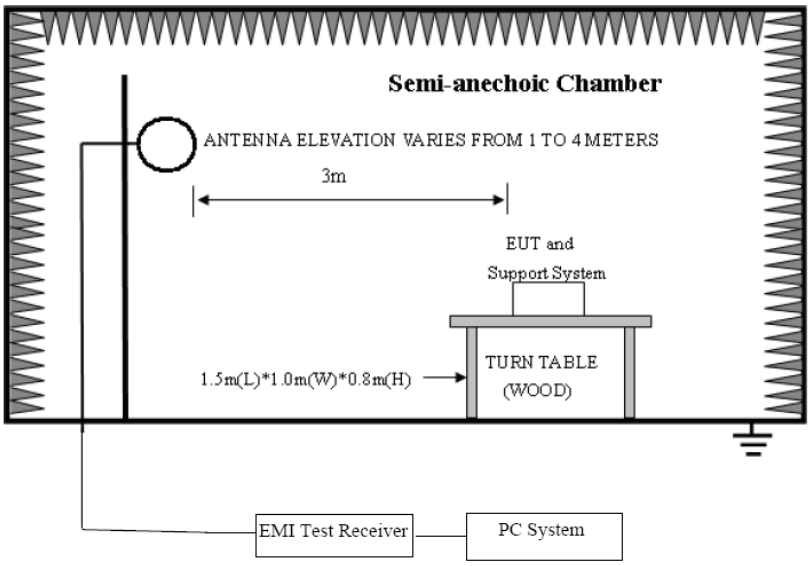
a) The tighter limit applies at the band edges.
For example: F.S limit at 88MHz is 100uV/m

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

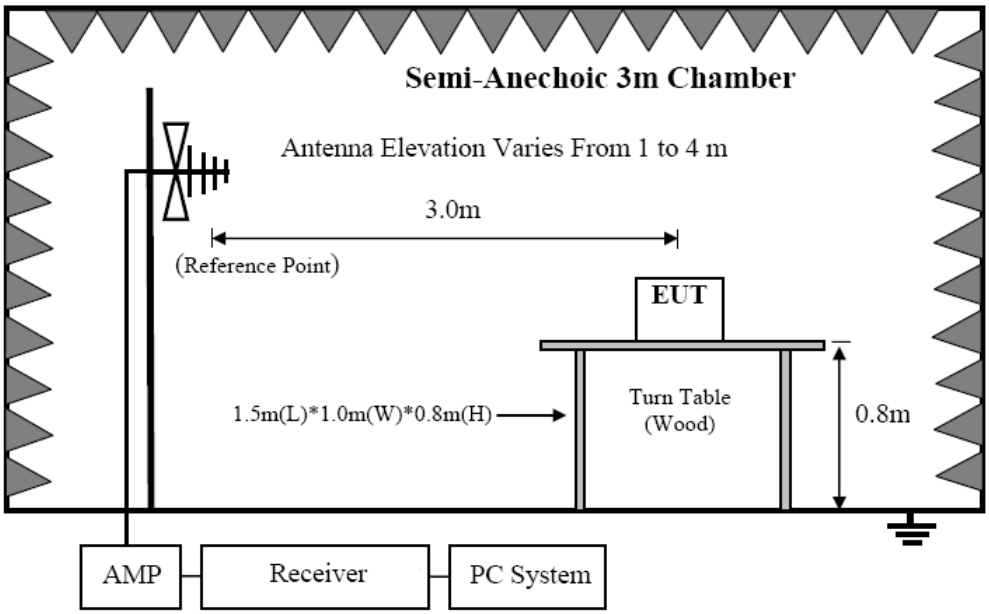
3.2. Block Diagram of Test setup

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



3.3. 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.

All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4:2014.

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.

3.4. Test Result

PASS. (See below detailed test result)

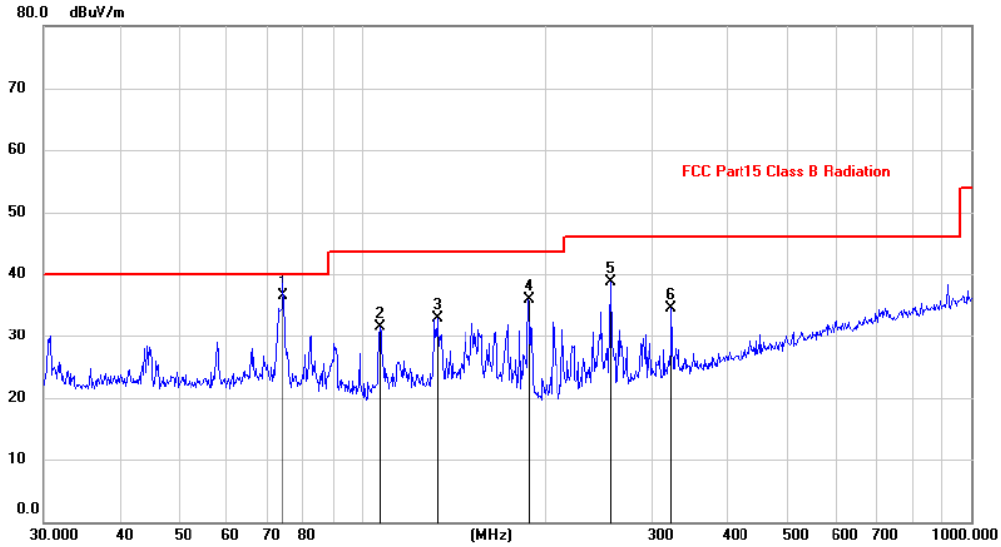
Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
0.110	--	23.73	---	24.80	48.53	---	126.77	---	78.24	Peak
1.7050	--	20.99	---	25.06	46.05	---	69.50	---	23.45	Peak
8.200	--	27.46	---	25.03	52.49	---	100.00	80.00	47.51	Peak
8.291	--	20.01	---	25.02	45.03	---	69.50	---	24.47	Peak
8.294	--	23.90	---	25.01	48.91	---	69.50	---	20.59	Peak
8.362	--	22.69	---	25.01	47.70	---	69.50	---	21.80	Peak
10.000	--	21.80	---	25.10	46.90	---	69.50	---	22.60	Peak
16.400	--	21.42	---	25.06	46.48	---	69.50	---	23.02	Peak
24.600	--	23.24	---	25.14	48.38	---	69.50	---	21.12	Peak
N/A										

Note:

8.2MHz Limit: (the bandwidth of the device in kHz)divided by (the center frequency of the device in MHz)=383.9kHz/8.2MHz=46.82＞15,

So the limits 30m is (20log100 microvolts/meter)+40=80dBuV/m

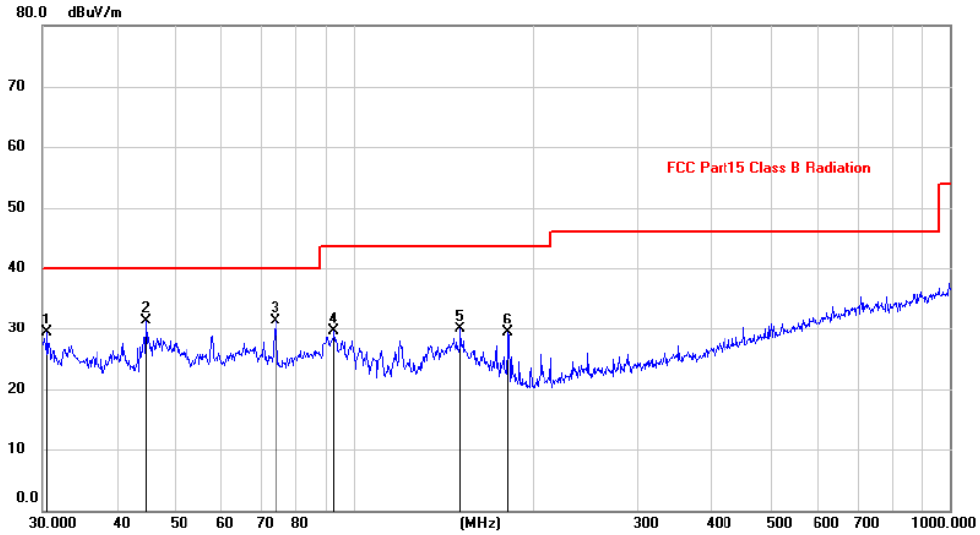
Horizontal:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1	*	74.1351	24.97	11.45	36.42	40.00	-3.58	QP			
2		107.1337	19.14	12.27	31.41	43.50	-12.09	peak			
3		132.6850	18.25	14.72	32.97	43.50	-10.53	peak			
4		187.7530	23.10	12.78	35.88	43.50	-7.62	peak			
5		255.6231	24.74	13.95	38.69	46.00	-7.31	peak			
6		323.3204	18.55	15.88	34.43	46.00	-11.57	peak			

Note:1. *:Maximum data; x:Over limit; !:over margin.
2.Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

Vertical:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		30.5306	15.04	14.25	29.29	40.00	-10.71	peak			
2		44.7433	16.51	14.71	31.22	40.00	-8.78	peak			
3	*	73.8756	19.90	11.49	31.39	40.00	-8.61	peak			
4		92.4624	18.58	10.92	29.50	43.50	-14.00	peak			
5		151.0666	13.89	16.02	29.91	43.50	-13.59	peak			
6		181.2834	15.82	13.54	29.36	43.50	-14.14	peak			

Note:1. *:Maximum data; x:Over limit; !:over margin.
2.Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

4. 6dB bandwidth

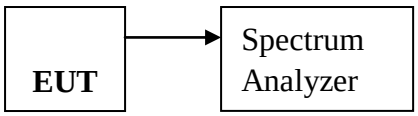
4.1. Limit

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.223, must be designed to ensure that the 6dB 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.

4.2. Test Procedure

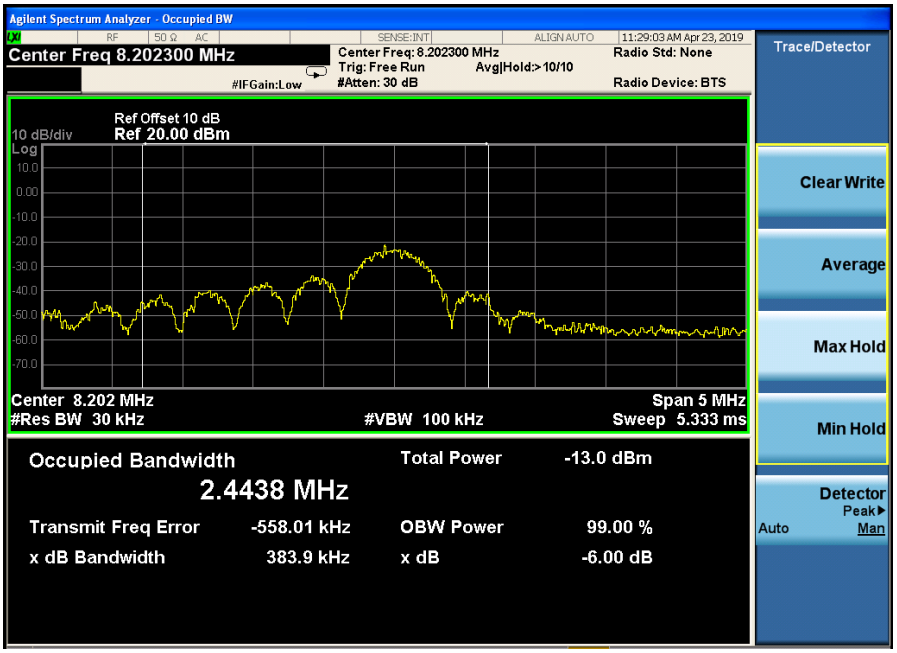
The transmitter output was coupled to a spectrum analyzer via a antenna. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 3KHz RBW and 10kHz VBW. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.

4.3. Test Setup



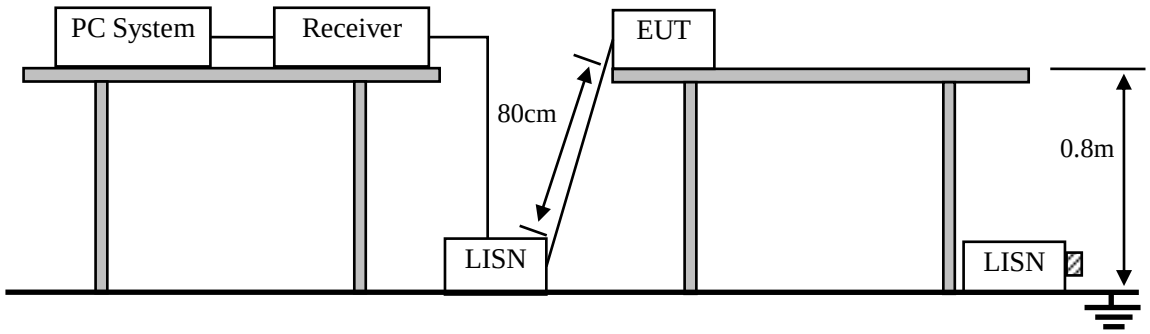
4.4. Test Result

Mode	Freq (MHz)	6dB Bandwidth (KHz)	Limit (kHz)	Conclusion
Tx Mode	8.2	383.9	/	PASS



5. Power Line Conducted Emissions

5.1. Block Diagram of Test Setup



:50Ω Terminator

5.2. 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.

5.3. 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 C63.10:2013 on conducted Emission test.

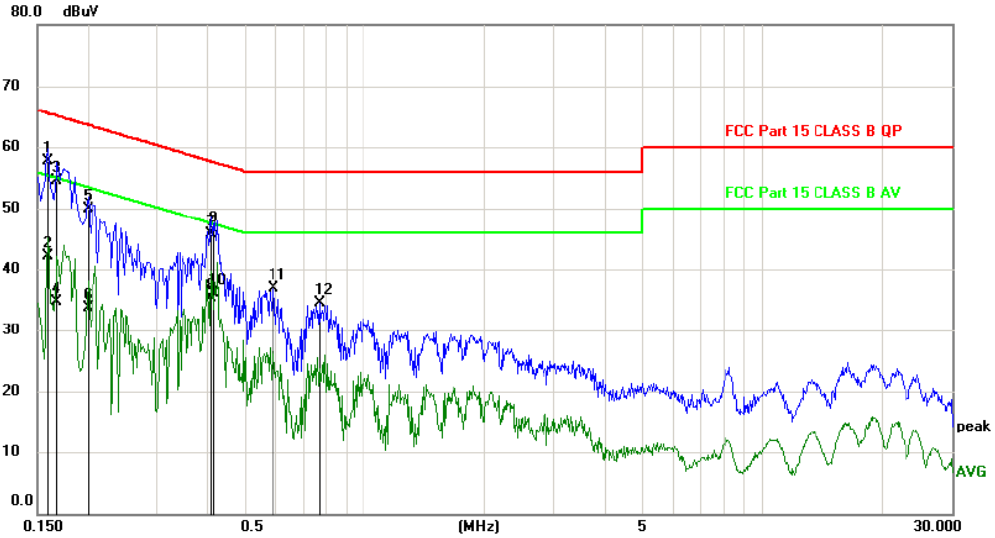
(4) The bandwidth of test receiver is set at 10KHz.

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

5.4. Test Result

PASS. *(Test result for Channel 8.2MHz, AC 120V/ 60Hz)*

Line:

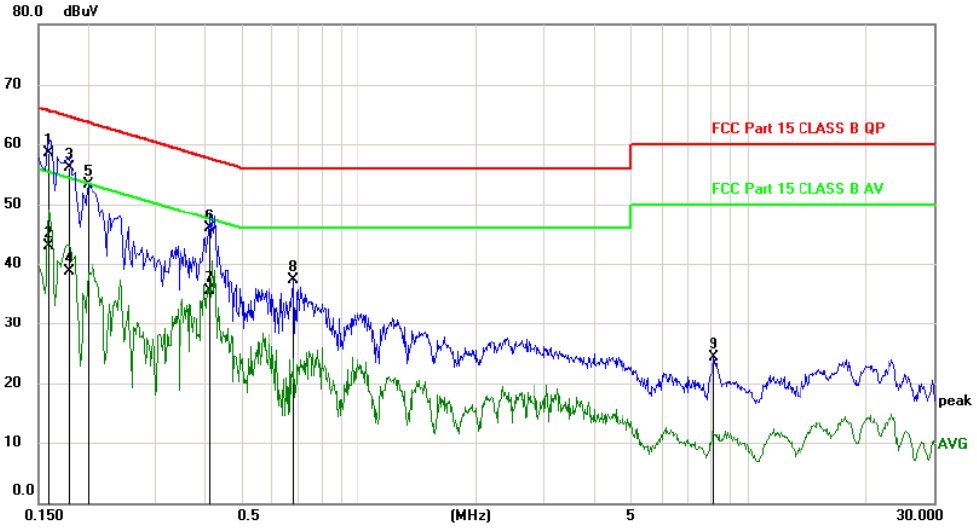


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1590	48.09	9.66	57.75	65.52	-7.77	QP	
2		0.1590	32.52	9.66	42.18	55.52	-13.34	AVG	
3		0.1680	44.87	9.66	54.53	65.06	-10.53	QP	
4		0.1680	24.98	9.66	34.64	55.06	-20.42	AVG	
5		0.2010	40.19	9.67	49.86	63.57	-13.71	QP	
6		0.2010	24.08	9.67	33.75	53.57	-19.82	AVG	
7		0.4110	35.97	9.71	45.68	57.63	-11.95	QP	
8		0.4110	25.50	9.71	35.21	47.63	-12.42	AVG	
9		0.4140	36.62	9.71	46.33	57.57	-11.24	QP	
10		0.4140	26.40	9.71	36.11	47.57	-11.46	AVG	
11		0.5910	27.15	9.72	36.87	56.00	-19.13	peak	
12		0.7680	24.78	9.74	34.52	56.00	-21.48	peak	

*:Maximum data x:Over limit I:over margin

Note: Measurement=Reading Level+Correc Factor. Factor=(LISN or ISN or PLC or Current Probe)Factor+Cable

Neutral:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1590	48.94	9.66	58.60	65.52	-6.92	QP	
2		0.1590	33.23	9.66	42.89	55.52	-12.63	AVG	
3		0.1800	46.43	9.67	56.10	64.49	-8.39	QP	
4		0.1800	28.94	9.67	38.61	54.49	-15.88	AVG	
5		0.2010	43.60	9.67	53.27	63.57	-10.30	peak	
6		0.4140	36.17	9.71	45.88	57.57	-11.69	QP	
7		0.4140	25.74	9.71	35.45	47.57	-12.12	AVG	
8		0.6809	27.55	9.74	37.29	56.00	-18.71	peak	
9		8.1600	14.03	10.27	24.30	60.00	-35.70	peak	

*:Maximum data x:Over limit !:over margin

Note: Measurement=Reading Level+Correc Factor. Factor=(LISN or ISN or PLC or Current Probe)Factor+Cable

6. Antenna Requirements

6.1. 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.

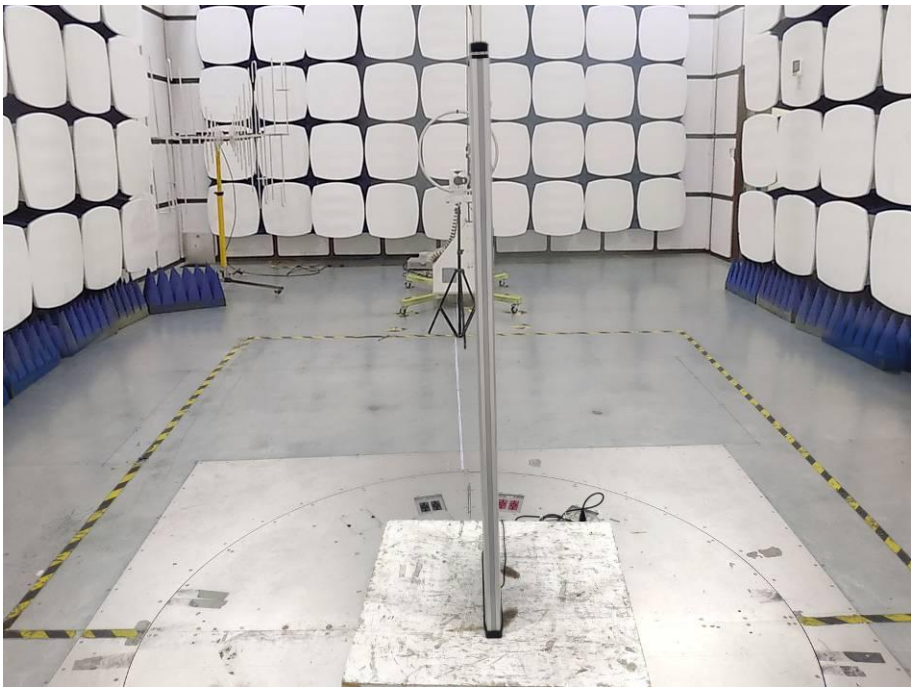
6.2. Result

The antennas used for this product are internal 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 -40dBi.

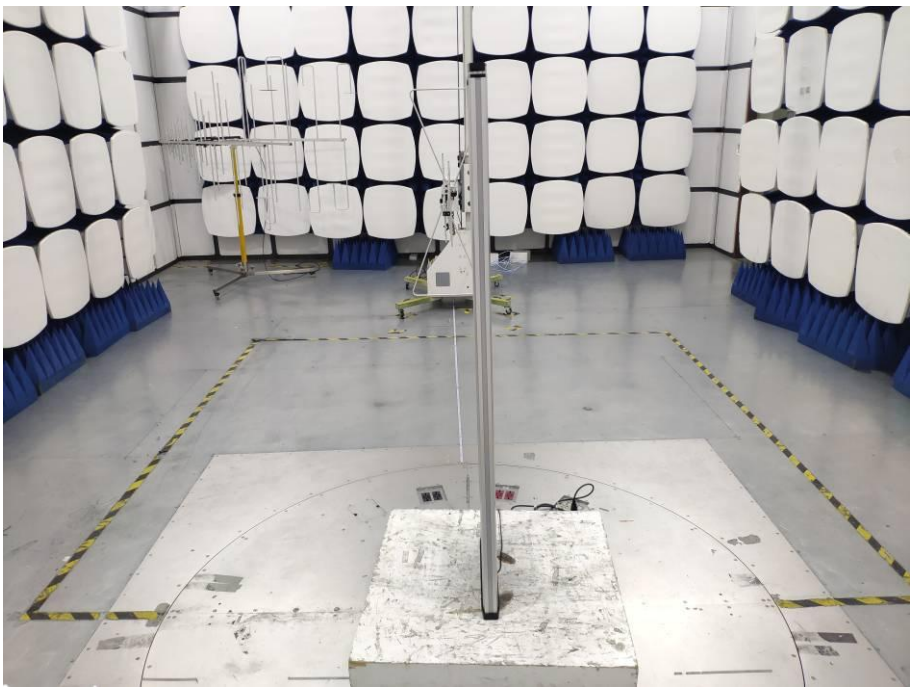
7. Test setup photo

Photographs-Radiated Emission Test Setup in Chamber

Below 30M

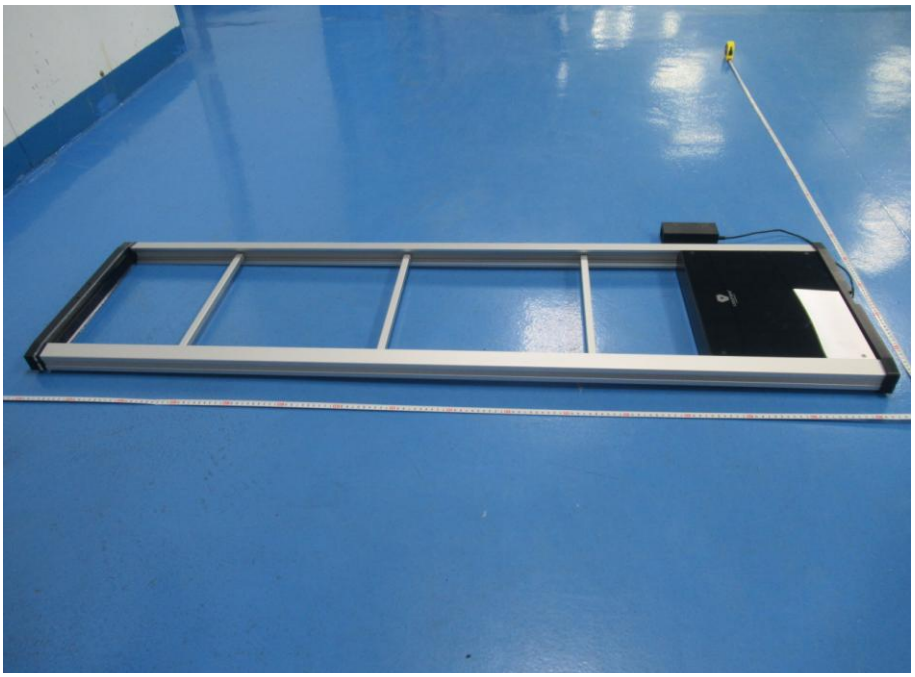


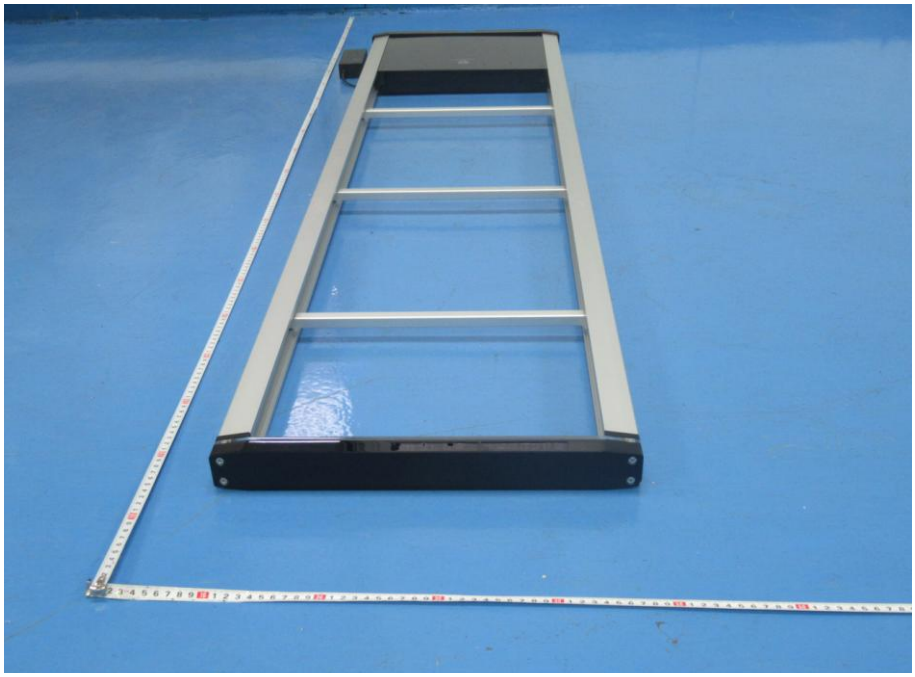
30M-1G

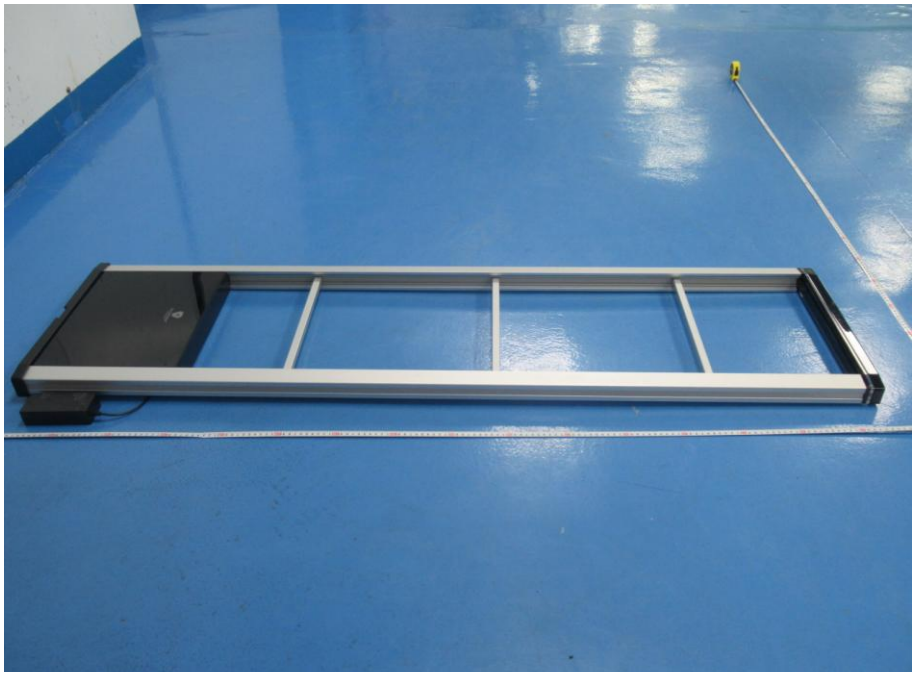


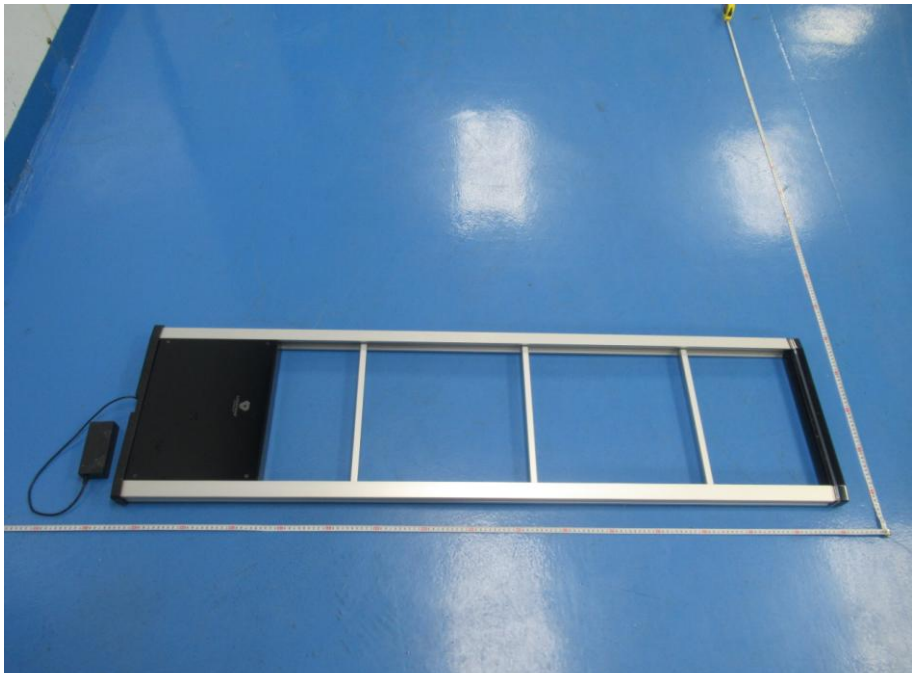
Photographs-Conducted Emission Test Setup

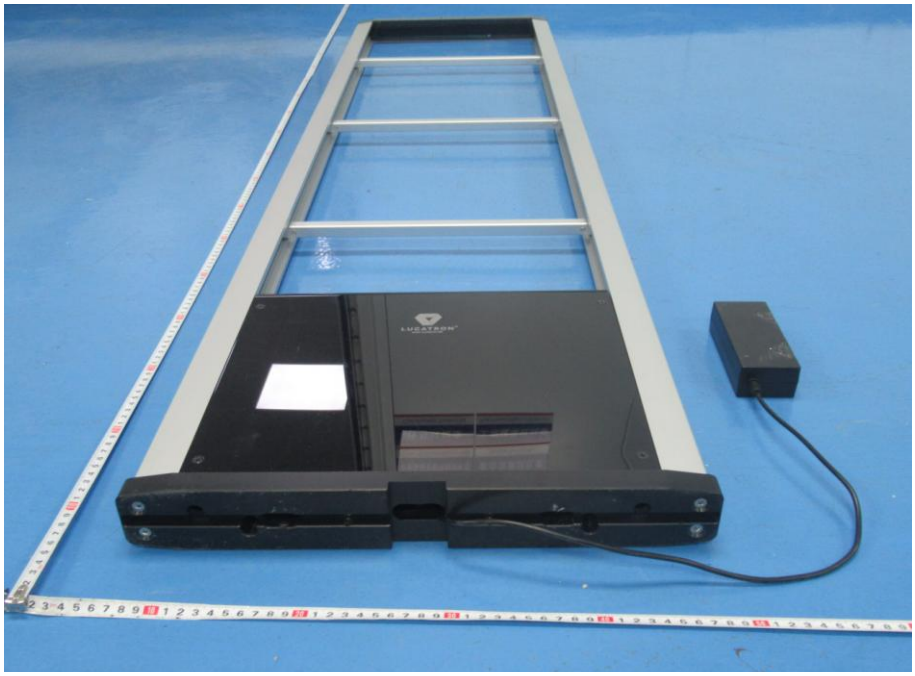
8. Photos of EUT

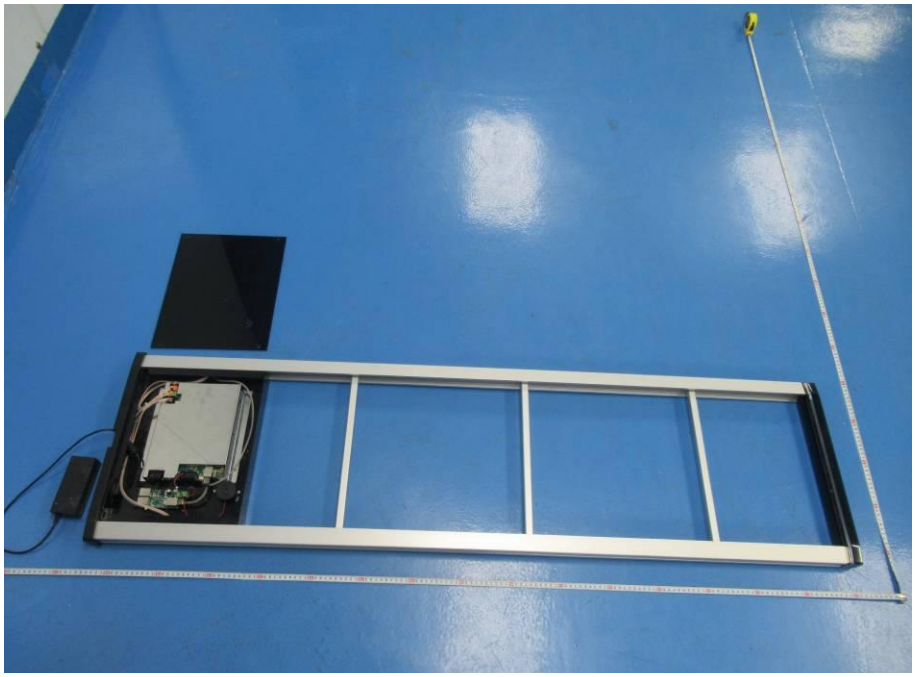


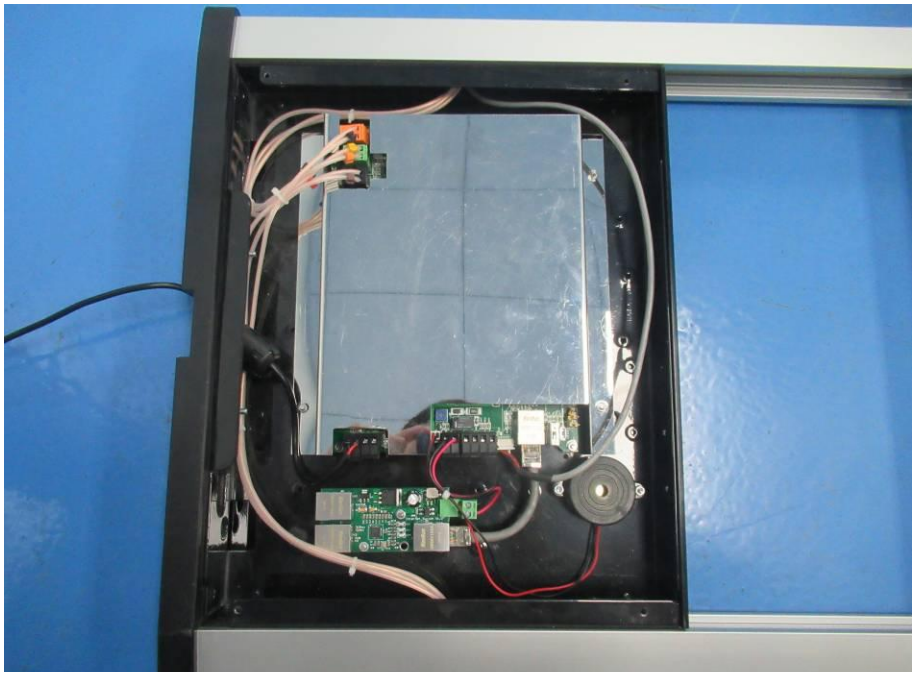


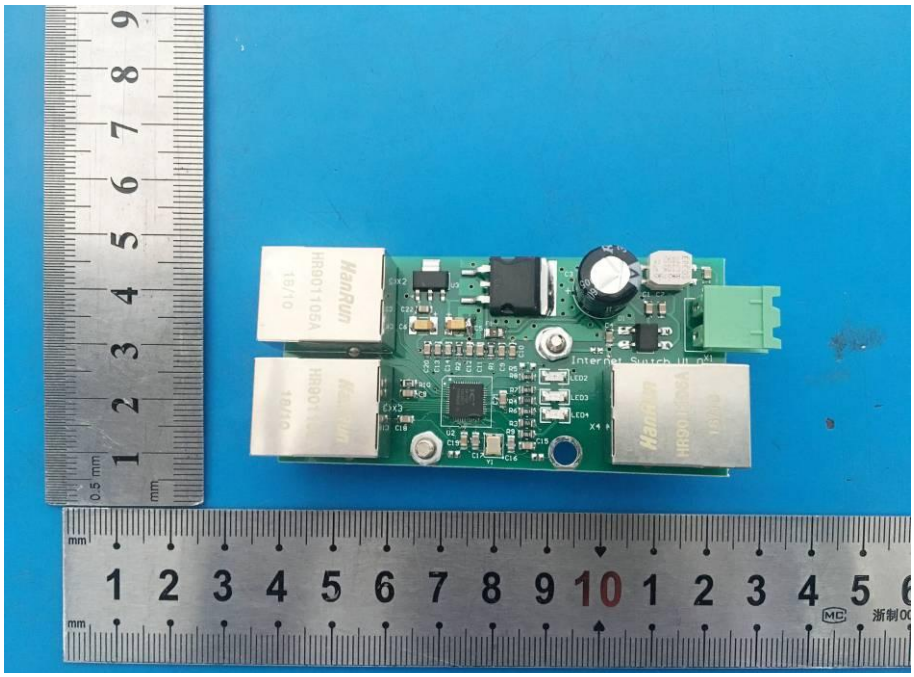


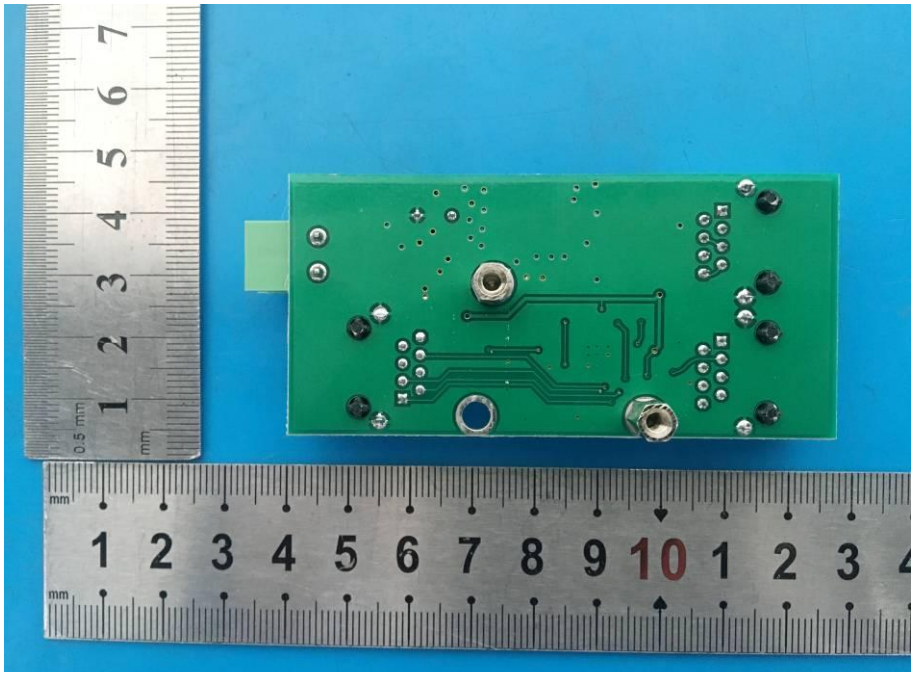


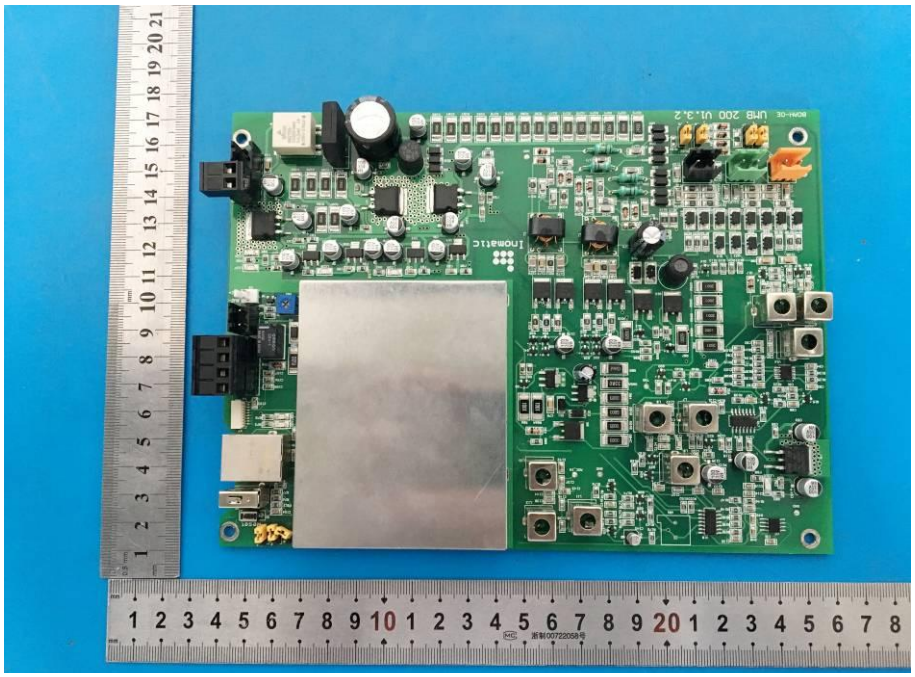


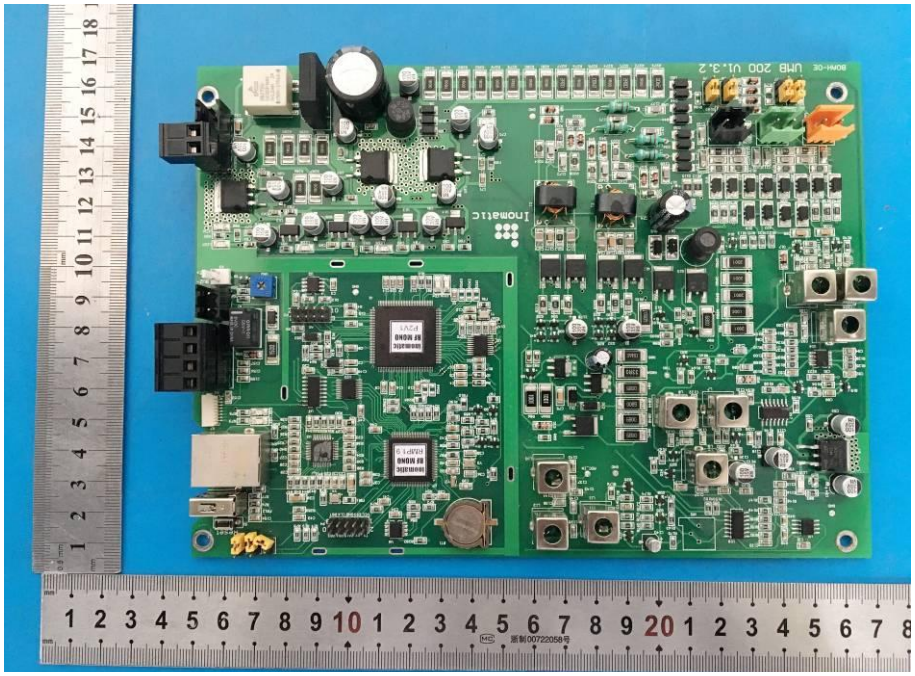


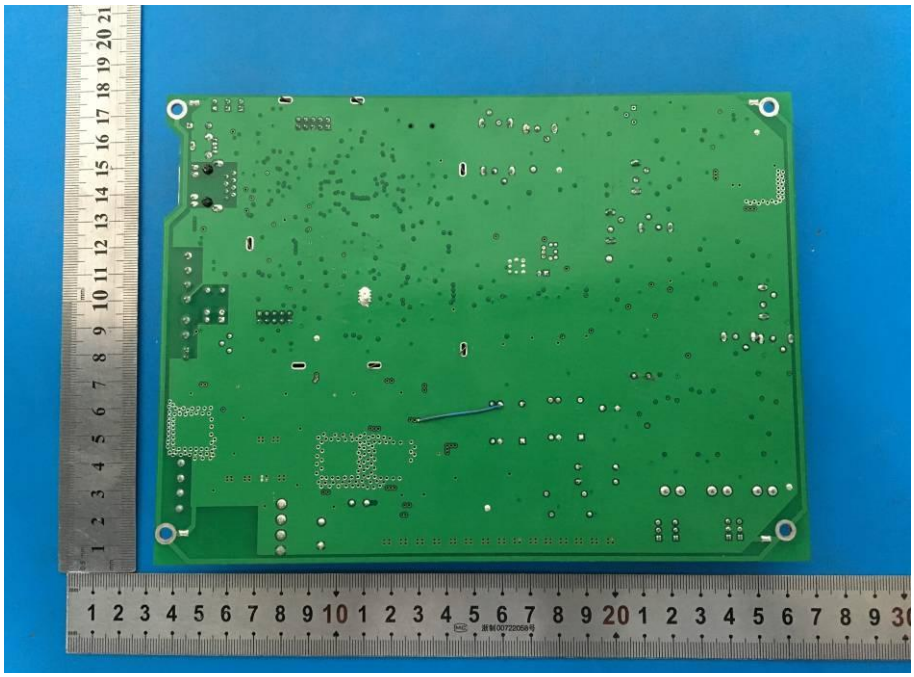












--------END OF THE REPORT-------