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-V1
Date of Receipt	:	August 12, 2024
Date of Test	:	August 12, 2024- August 16, 2024
Date of Report	:	August 19, 2024
Version Number	:	V1
Result		**Pass**

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

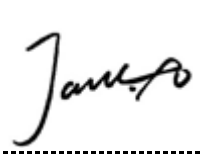
Measurement Standard Used:

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).....…..:	Yannis Wen Project Engineer	
Approved by (name + signature)…....:	Jack Xu Project Manager	
Date of issue…… ……..:	August 19, 2024	

Revision History

Revision	Issue Date	Revisions	Revised By
V0	May 09, 2019	Initial released Issue	Ella Liang
V1	August 19, 2024	Get the sample test again and update BW test result this time	Yannis Wen

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
Software Version	:	V1.0
Hardware Version	:	V1.3.2

Remark: This report is based on report T1904143-C01-R01, this report all test information, test data, test photos and EUT photos refer to original report T1904143-C01-R01, except 6dB bandwidth was retested.

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	Uncertainty
Uncertainty for Power point Conducted Emissions Test	1.63dB
Uncertainty for Radiation Emission test in 3m chamber (below 30MHz)	3.5dB
Uncertainty for Radiation Emission test in 3m chamber (30MHz to 1GHz)	3.74dB(Polarize: V)
	3.76dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (1GHz to 25GHz)	3.77dB(Polarize: V)
	3.80dB(Polarize: H)
Uncertainty for Radiation Emission test in 3m chamber (18GHz to 40GHz)	4.31 dB(Polarize: V)
	4.30 dB(Polarize: H)
Uncertainty for radio frequency	5.06×10^{-8}GHz
Uncertainty for conducted RF Power	0.40dB
Uncertainty for temperature	0.2℃
Uncertainty for humidity	1%
Uncertainty for DC and low frequency voltages	0.06%

2. Summary of test

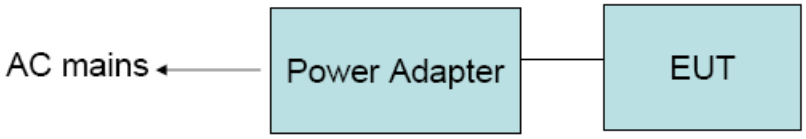
2.1. Summary of test result

Description of Test Item	Standard	Results
Radiated Emission (9KHz-1.25MHz)	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.	Firmware version	Serial No.	Last cal.	Cal Interval
9*6*6 anechoic chamber	CHENYU	9*6*6	/	N/A	2022.05.17	3Year
Spectrum analyzer	ROHDE&SCHWARZ	FSV40-N	2.3	102137	2024.08.08	1Year
Spectrum analyzer	Agilent	N9020A	A.14.16	MY499100060	2024.08.08	1Year
Receiver	ROHDE&SCHWARZ	ESR	2.28 SP1	1316.3003K03-102082-Wa	2024.08.08	1Year
Receiver	R&S	ESCI	4.42 SP1	101165	2024.08.08	1Year
Bilog Antenna	Schwarzbeck	VULB 9168	/	VULB 9168#627	2024.08.08	1Year
Horn Antenna	SCHWARZBECK	BBHA 9120 D	/	2106	2023.08.19	2Year
Loop Antenna	SCHWARZBECK	FMZB 1519B	/	00128	2023.08.19	2Year
RF Cable	Resenberger	Cable 1	/	RE1	2024.08.08	1Year
RF Cable	Resenberger	Cable 2	/	RE2	2024.08.08	1Year
RF Cable	Resenberger	Cable 3	/	CE1	2024.08.08	1Year
Pre-amplifier	HP	HP8347A	/	2834A00455	2024.08.08	1Year
Pre-amplifier	Agilent	8449B	/	3008A02664	2024.08.08	1Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	/	8126-466	2024.08.08	1Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	/	101043	2024.08.08	1Year
Horn Antenna	SCHWARZBECK	BBHA 9170	/	00946	2023.08.19	2Year
Preamplifier	SKET	LNPA_1840-50	/	SK2018101801	2024.08.08	1 Year
Power Meter	Agilent	E9300A	/	MY41496628	2024.08.08	1 Year
Power Sensor	DARE	RPR3006W	/	15100041SNO91	2024.08.08	1 Year
Electronic Thermo-Hygrometer	S.H.Qixiang	HTC-1	/	N/A	2023.08.11	2 Year
Switching Mode Power Supply	JUNKE	JK12010S	/	20140927-6	2024.08.08	1 Year
Adjustable attenuator	MWRFtest	N/A	/	N/A	N/A	N/A
10dB Attenuator	Mini-Circuits	DC-6G	/	N/A	N/A	N/A

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:

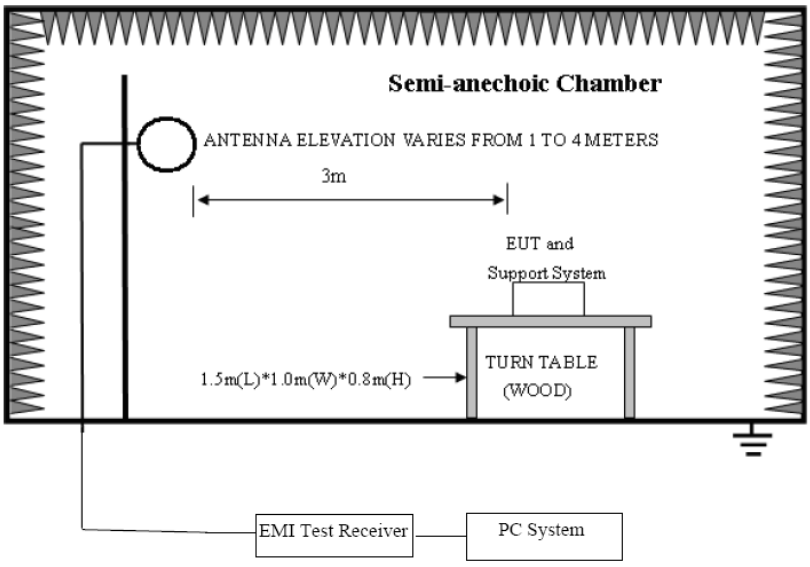
a) The tighter limit applies at the band edges.
For example: F.S limit at 88MHz is 100uV/m

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

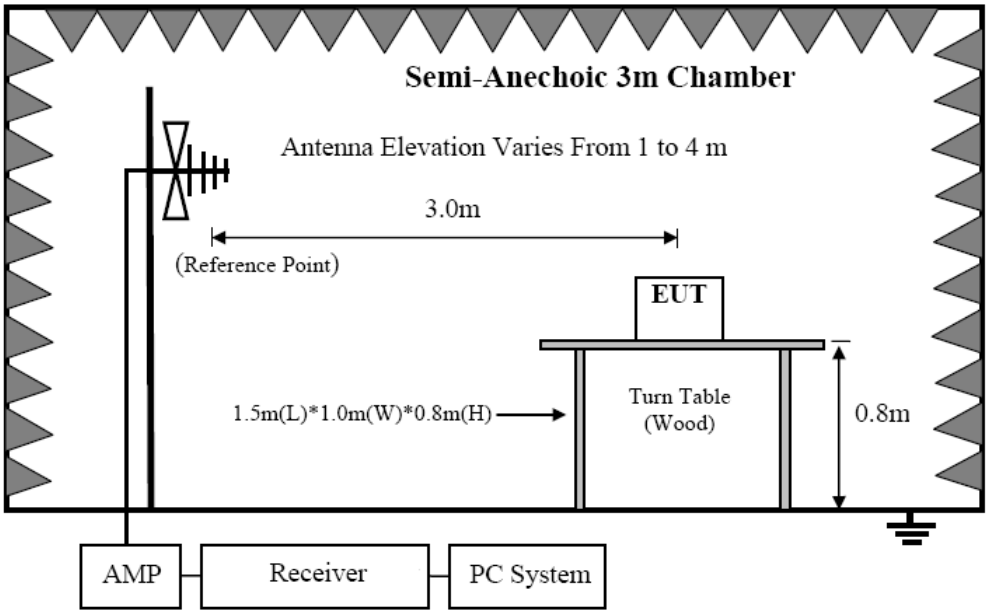
3.2. Block Diagram of Test setup

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)

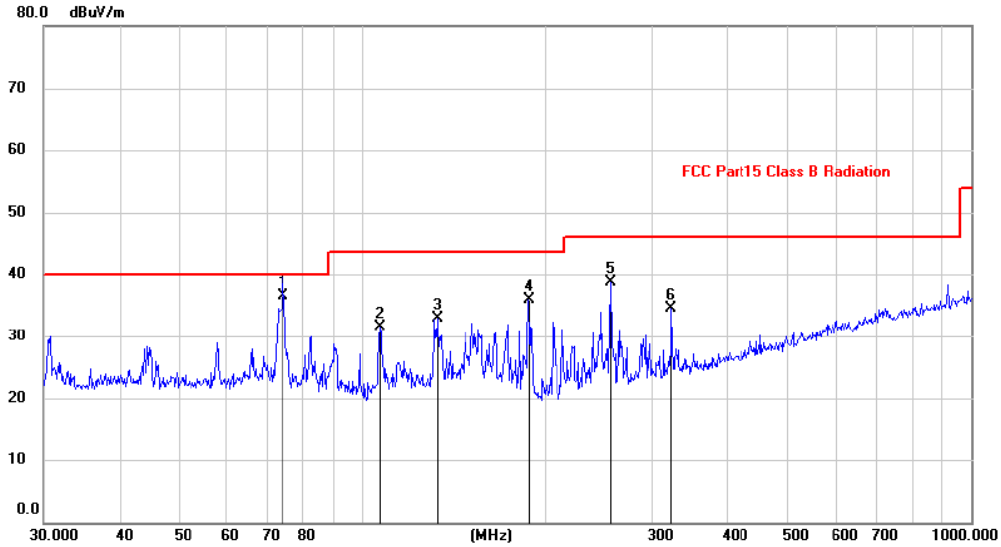
Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
0.110	--	23.73	---	24.80	48.53	---	126.77	---	78.24	Peak
1.7050	--	20.99	---	25.06	46.05	---	69.50	---	23.45	Peak
8.200	--	27.46	---	25.03	52.49	---	83.50	63.50	31.01	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)=14.3kHz/8.2MHz=1.74,

So the AV limits at 3m is (20log15)+40=63.50dBuV/m, PK limit @3m is 63.50+20=83.5 (dBuV/m)

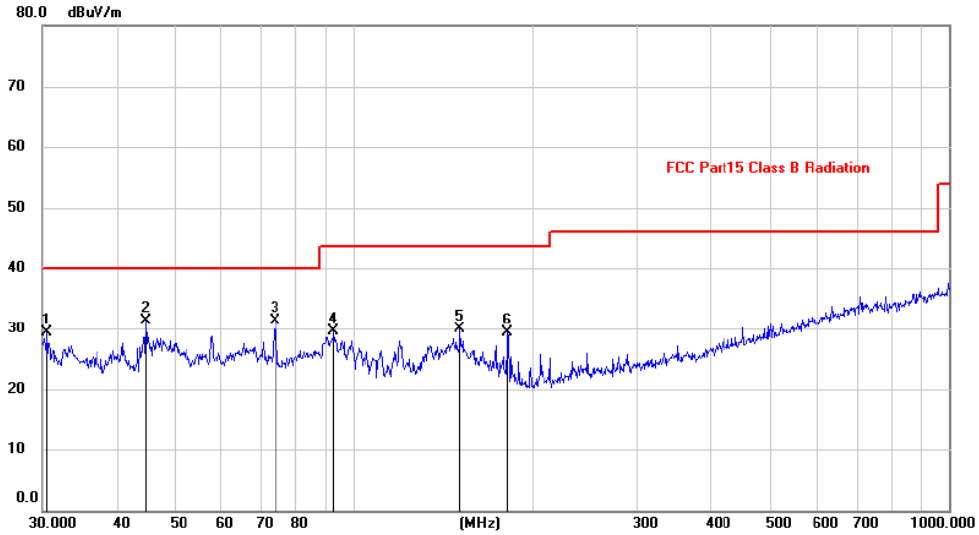
Horizontal:



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

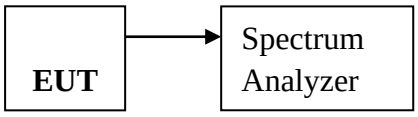
4.1. Limit

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

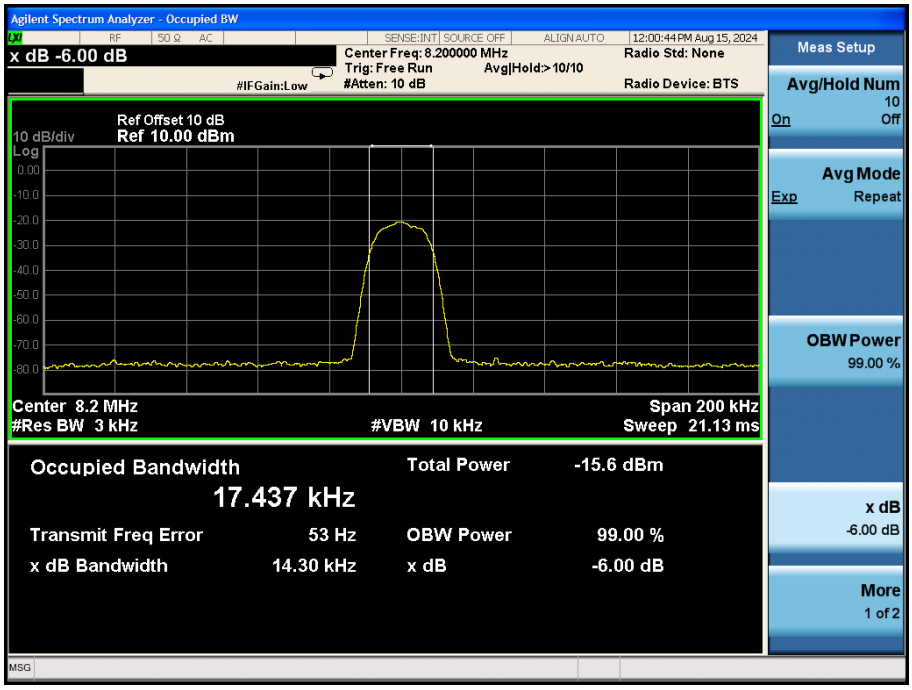
The transmitter output was coupled to a spectrum analyzer via a antenna. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 3KHz RBW and 10kHz VBW. The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.

4.3. Test Setup



4.4. Test Result

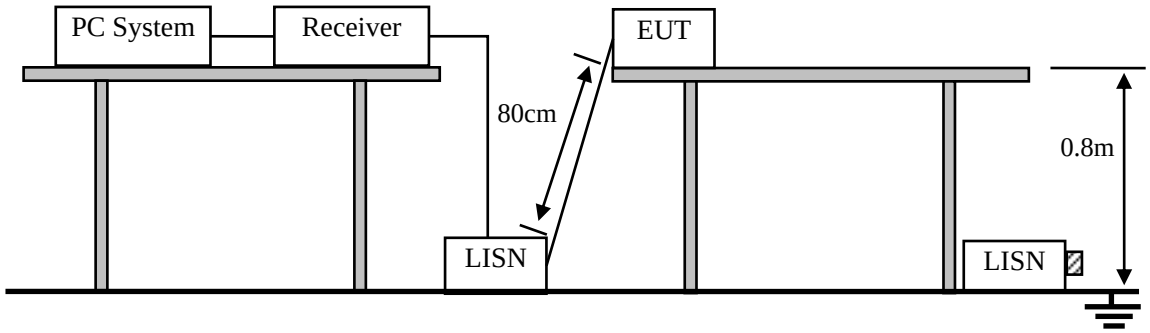
Mode	Freq (MHz)	6dB Bandwidth (KHz)	Limit (kHz)	Conclusion
Tx Mode	8.2	14.30	/	PASS



Note: The operating bandwidth of 14.3 kHz at 8.2MHz demonstrates that the fundamental frequency is not overlapping 15.205 restricted bands.

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.

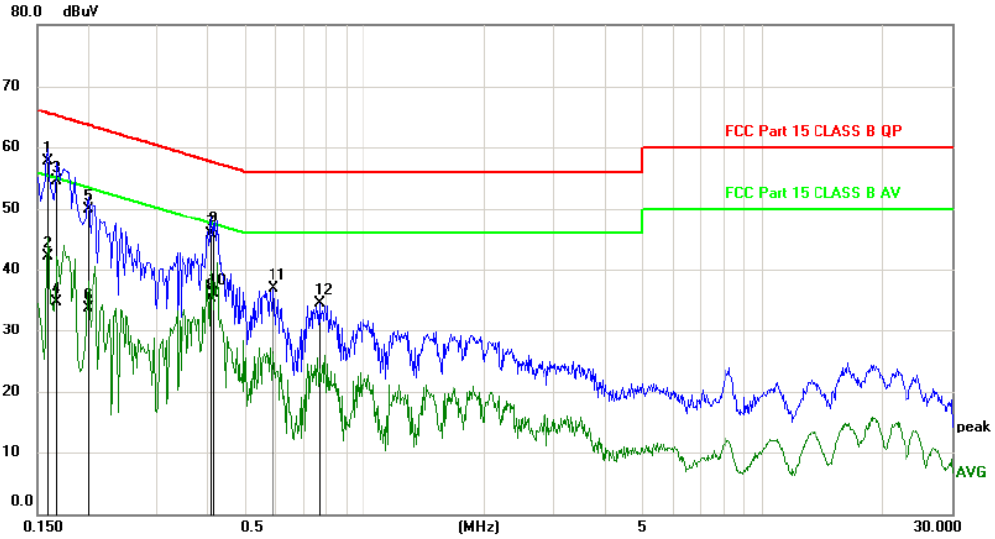
(4) The bandwidth of test receiver is set at 10KHz.

(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:

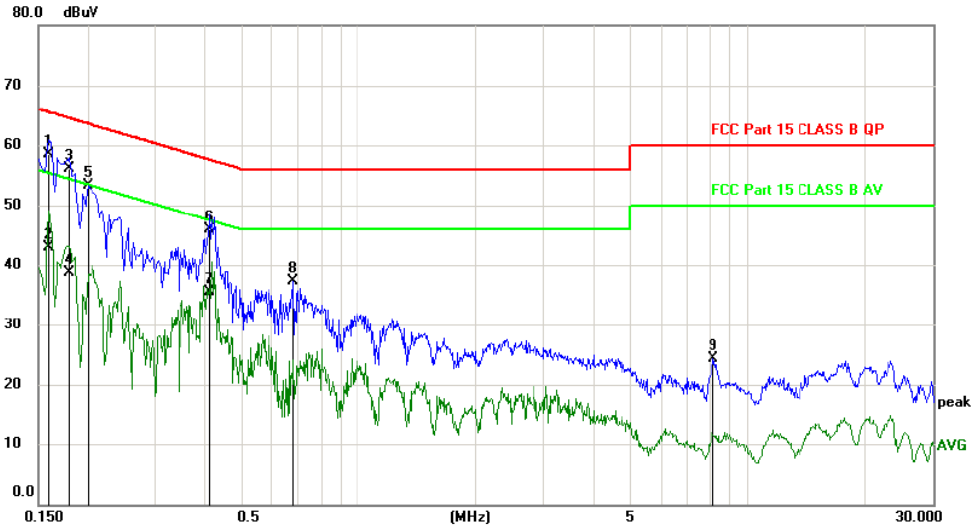


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1590	48.09	9.66	57.75	65.52	-7.77	QP	
2		0.1590	32.52	9.66	42.18	55.52	-13.34	AVG	
3		0.1680	44.87	9.66	54.53	65.06	-10.53	QP	
4		0.1680	24.98	9.66	34.64	55.06	-20.42	AVG	
5		0.2010	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.

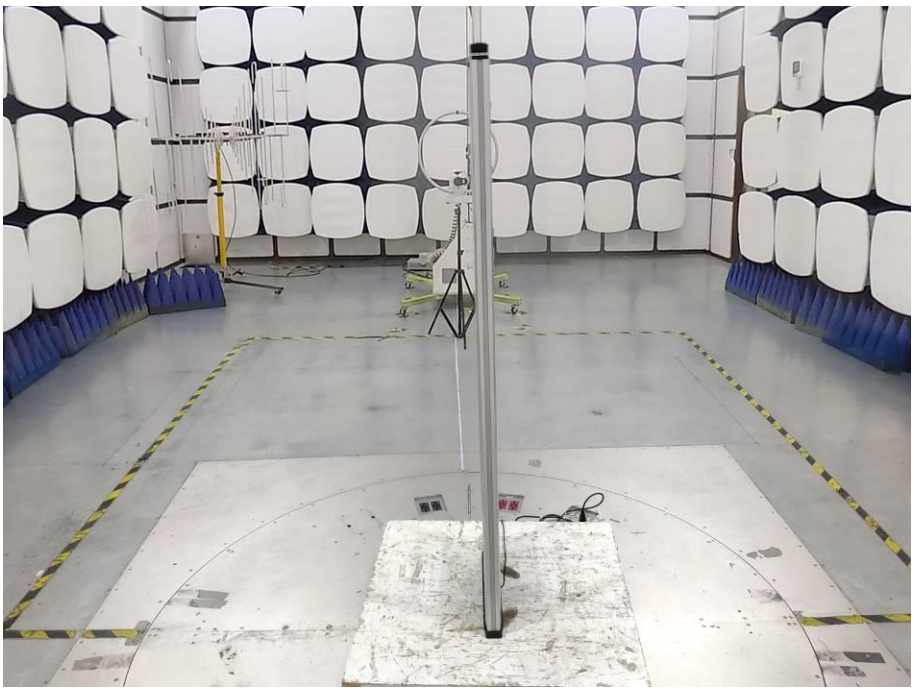
6.2. Result

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 only 1dBi.

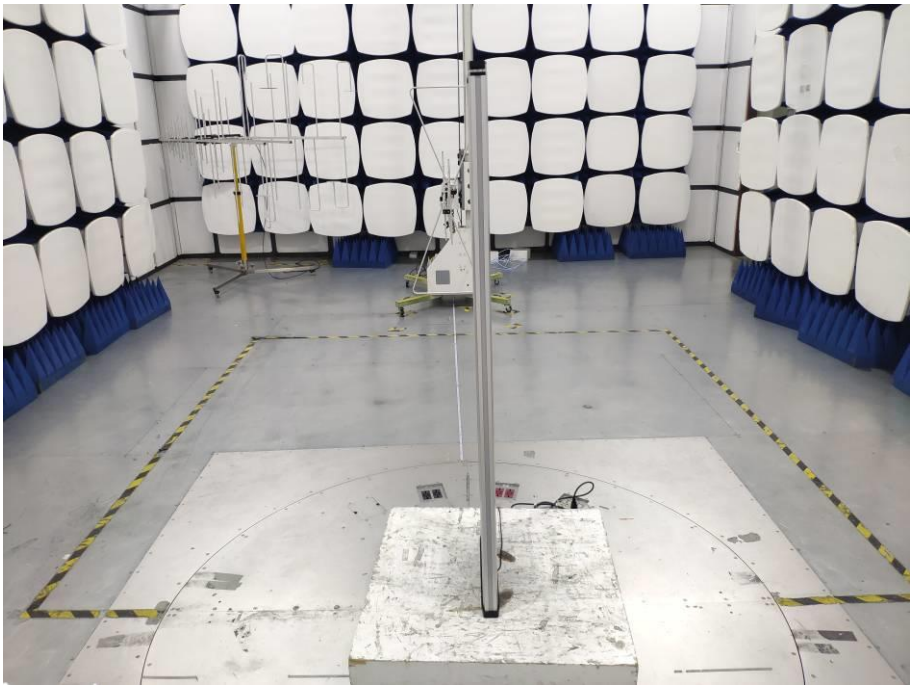
7. Test setup photo

Photographs-Radiated Emission Test Setup in Chamber

Below 30M

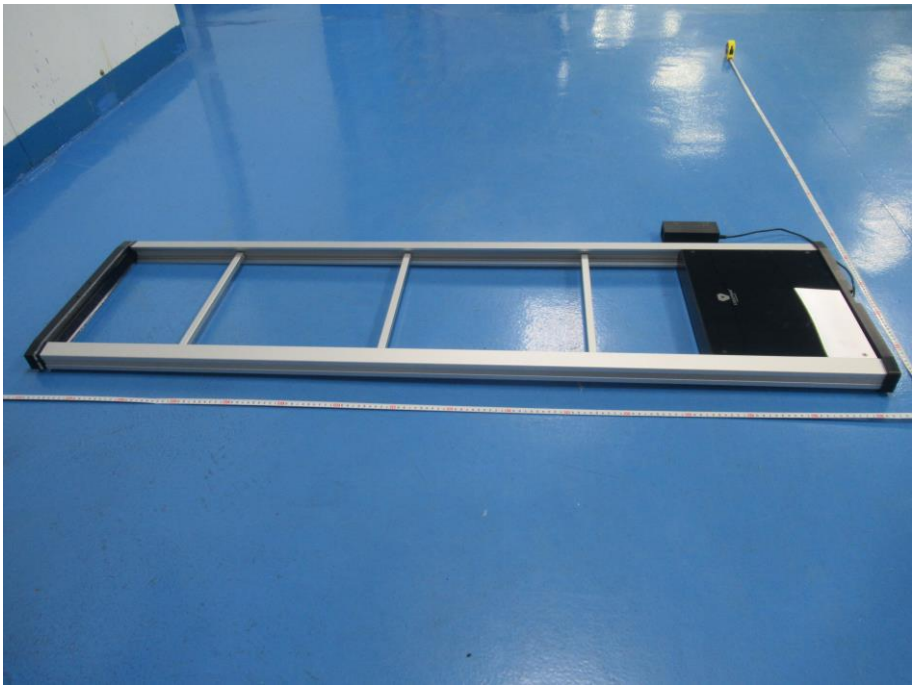


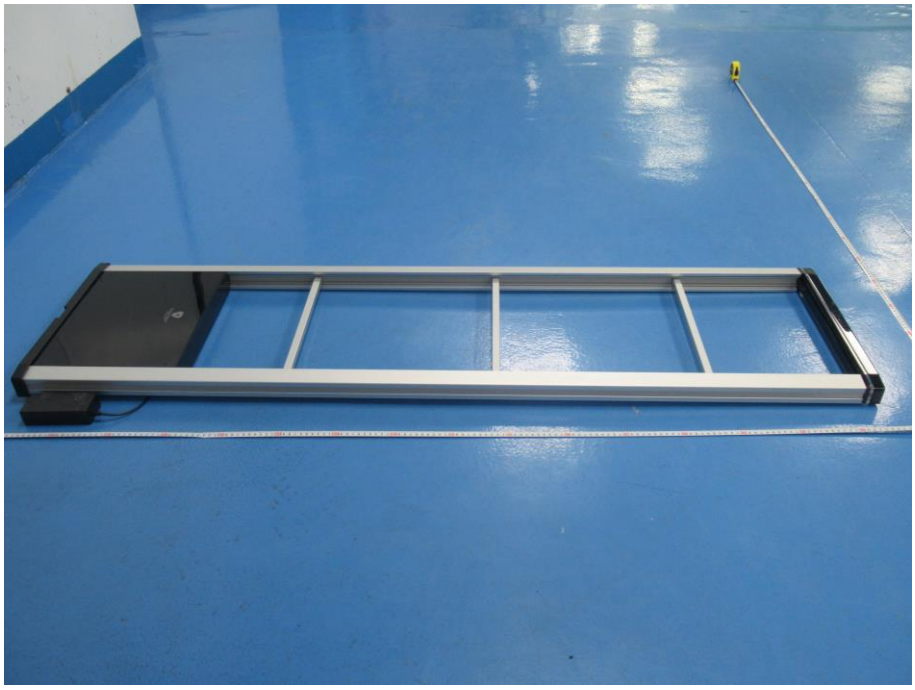
30M-1G

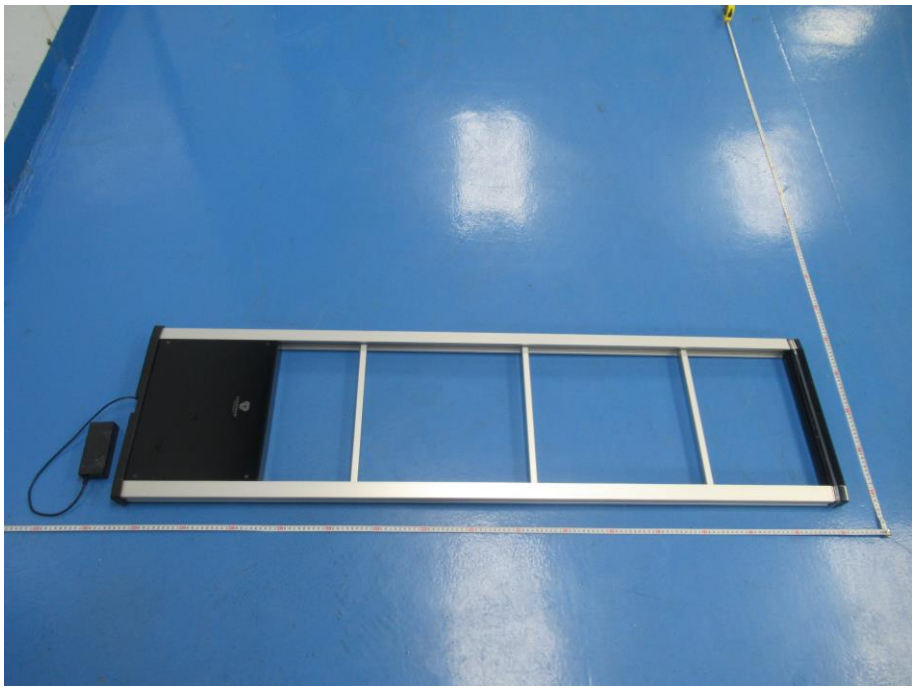


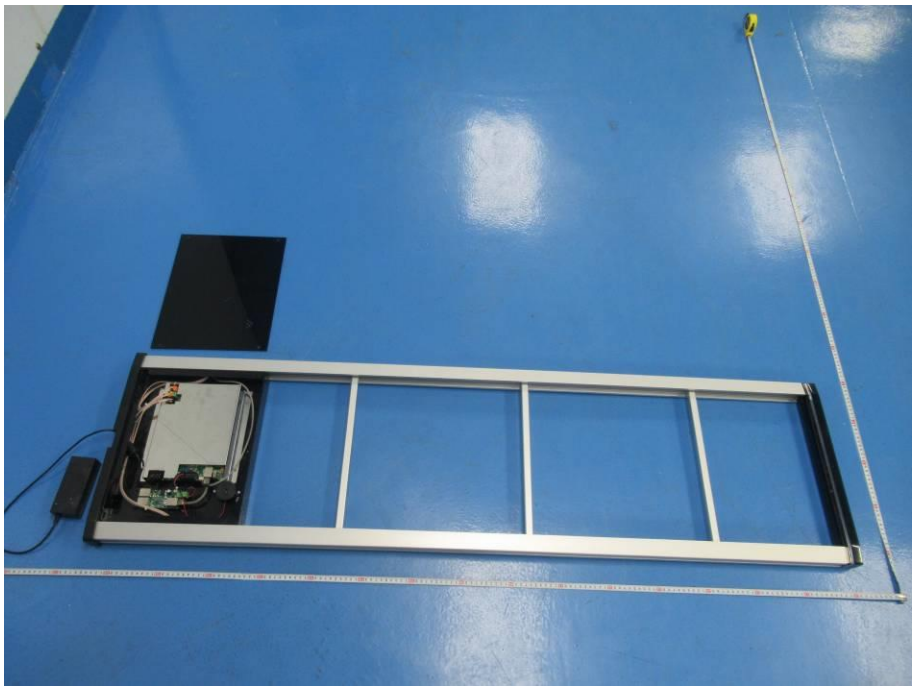
Photographs-Conducted Emission Test Setup

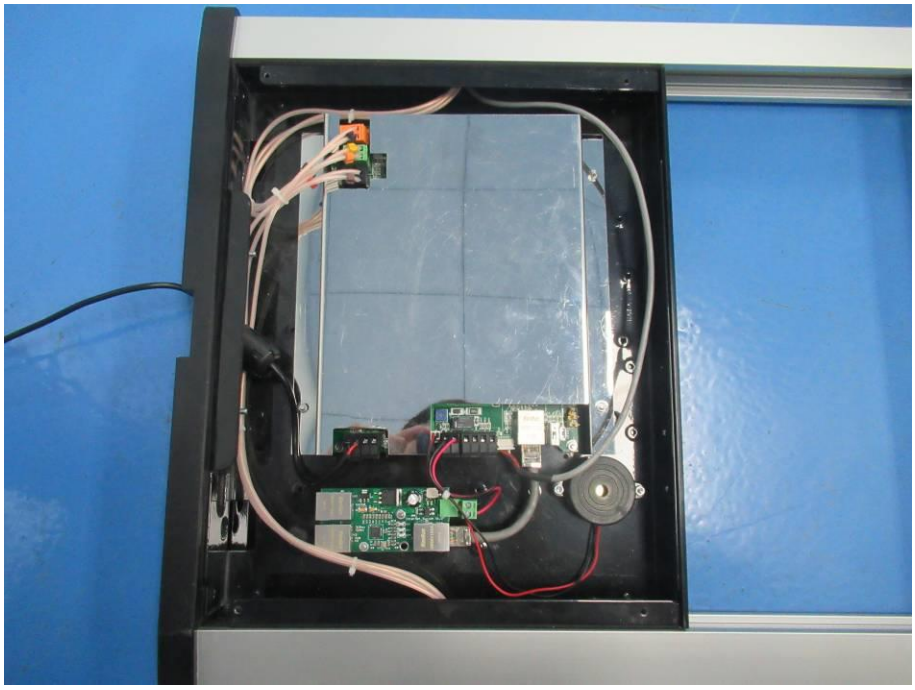
8. Photos of EUT

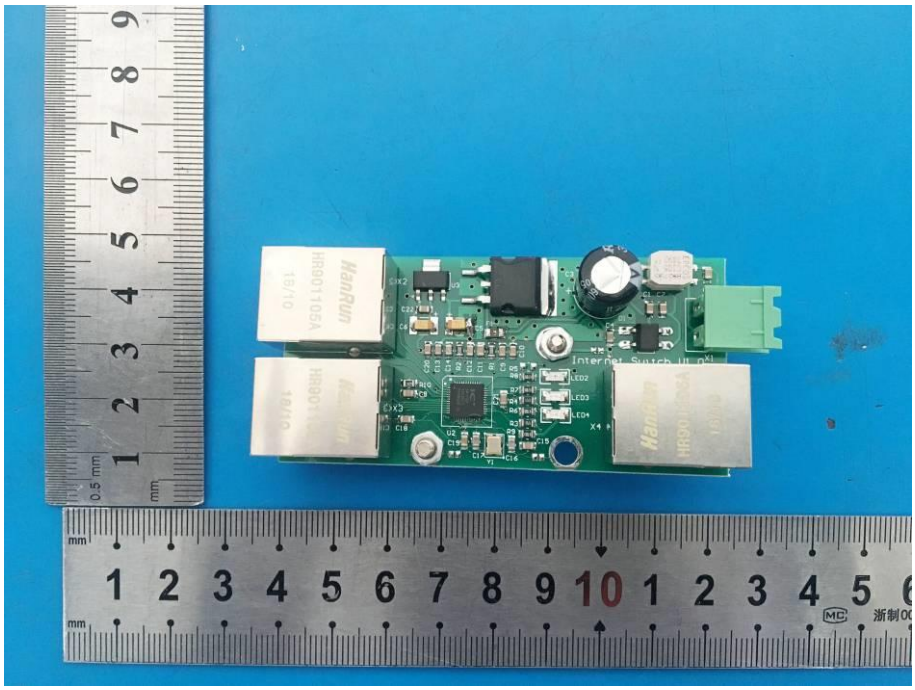


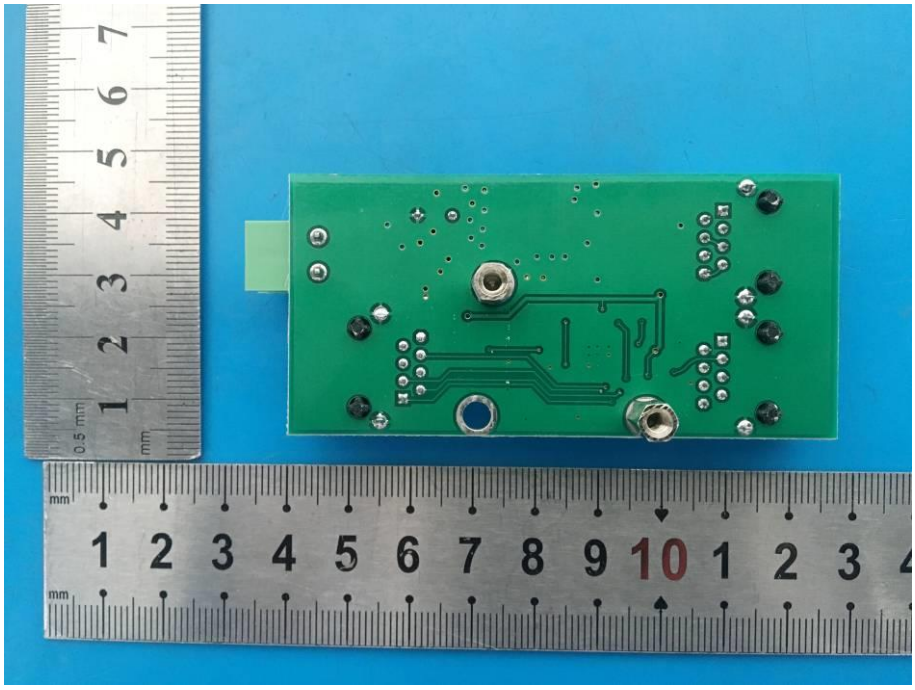


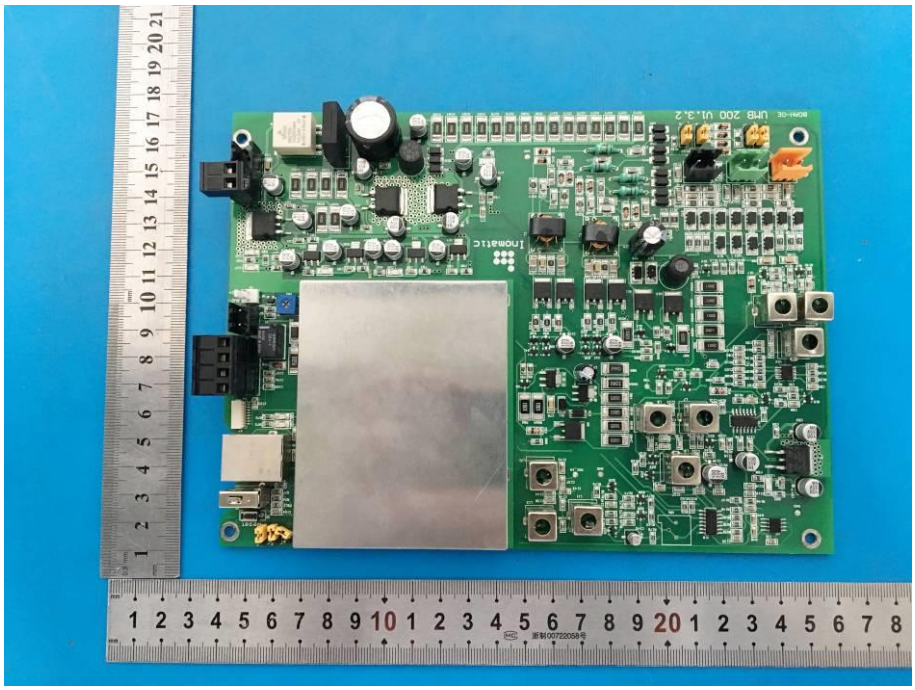


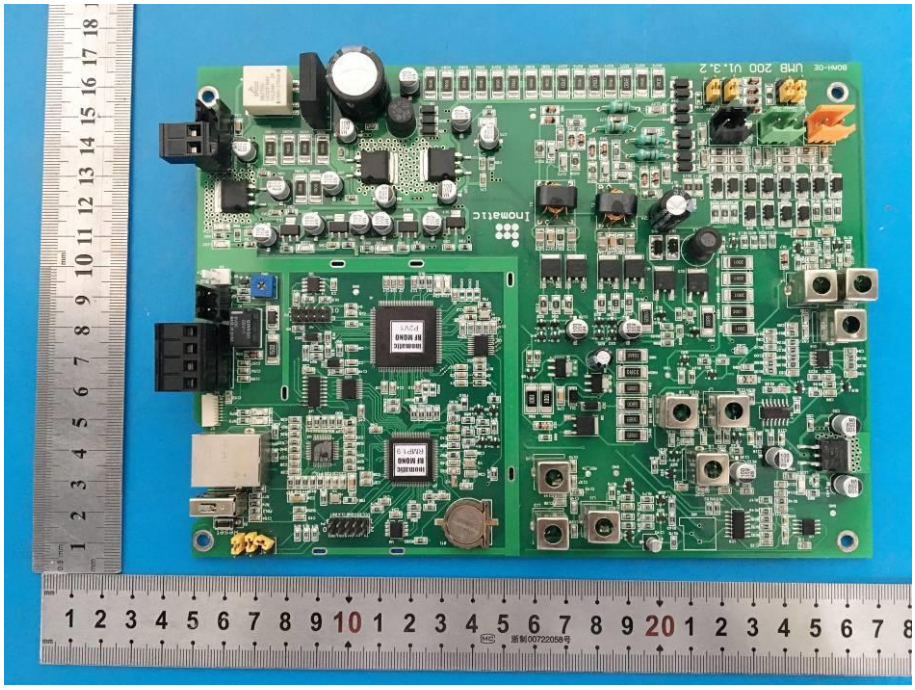


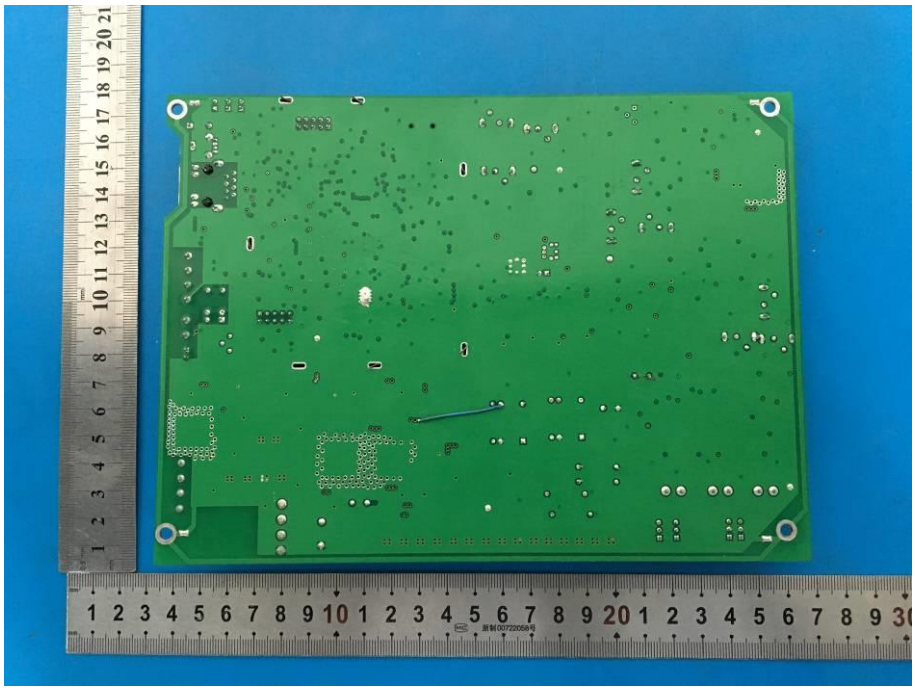












--------END OF THE REPORT-------