

EMC TEST REPORT



Report No.: 17070799-FCC-E

Supersede Report No: N/A

Applicant	Roommate Dynamic(Shanghai) Co., Ltd	
Product Name	Robotic Vacuum Cleaner	
Model No.	RMRV10-BL	
Serial No.	RMRV10-XX , RMRV20-XX , RMRV30-XX (X=A-Z)	
Test Standard	FCC Part 15 Subpart B Class B:2016, ANSI C63.4: 2014	
Test Date	August 29 to November 13, 2017	
Issue Date	November 14, 2017	
Test Result	☒ Pass ☐ Fail	
Equipment complied with the specification ☒		
Equipment did not comply with the specification ☐		
<i>Evans He</i>	<i>David Huang</i>	
Evans He 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

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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
17070799-FCC-E	NONE	Original	November 14, 2017

2. Customer information

Applicant Name	Roommate Dynamic(Shanghai) Co., Ltd
Applicant Add	No. 8 workshop , 539 Luoshen, Qianzhong Village, Qingcun Town, Fengxian District,Shanghai,China
Manufacturer	Shanghai Jingxin Auto Parts Co., Ltd
Manufacturer Add	No.1 Building, 3333 Fengzhe Road, Fengxian District, Shanghai,China

3. Test site information

Test Lab :

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.	535293
IC Test Site No.	4842E-1
Test Software	Radiated Emission Program-To Shenzhen v2.0

4. Equipment under Test (EUT) Information

Description of EUT:	Robotic Vacuum Cleaner
Main Model:	RMRV10-BL
Serial Model:	RMRV10-XX , RMRV20-XX , RMRV30-XX (X=A-Z)
Antenna Gain:	2dBi
Antenna Type:	PCB Antenna
Input Power:	Adapter: Model: MR-2401000 Input: AC100-240V~50/60Hz,0.85A Output: 24V~1.0A Battery: Model: LG18650 Spec: 14.4V, 2600mAh, 37.44Wh Charge limiting voltage: 16.8V
Equipment Category :	JBP
Type of Modulation:	802.11b/g/n: DSSS, OFDM
RF Operating Frequency (ies):	WIFI: 802.11b/g/n(20M): 2412-2462 MHz
Number of Channels:	WIFI :802.11b/g/n(20M): 11CH
Port:	Power Port
Trade Name :	ROOMMATE
FCC ID:	2ANKN-RMRV10-BL
Date EUT received:	August 28, 2017

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Test Date(s): August 29 to November 13, 2017

5. Test Summary

The product was tested in accordance with the following specifications.

All testing has been performed according to below product classification:

FCC Rules	Description of Test	Result
§15.107; ANSI C63.4: 2014	AC Power Line Conducted Emissions	Compliance
§15.109; ANSI C63.4: 2014	Radiated Emissions	Compliance

Measurement Uncertainty

Parameter	Uncertainty
AC Power Line Conducted Emissions (150kHz~30MHz)	±3.11dB
Radiated Emission(30MHz~1GHz)	±5.12dB
Radiated Emission(1GHz~6GHz)	±5.34dB

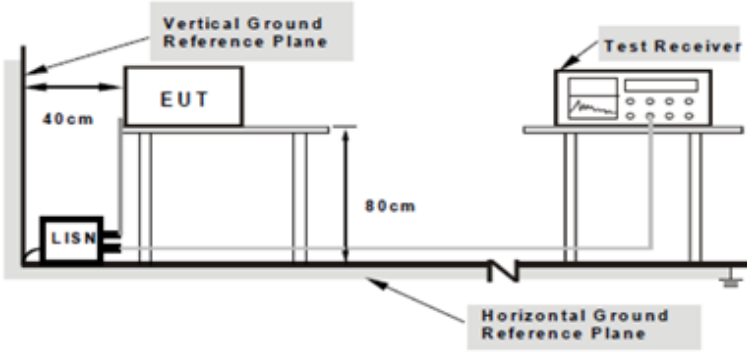
6. Measurements, Examination And Derived Results

6.1 AC Power Line Conducted Emissions

Temperature	25°C
Relative Humidity	50%
Atmospheric Pressure	1008mbar
Test date :	November 08, 2017
Tested By :	Evans He

Requirement(s):

Spec	Item	Requirement	Applicable														
47CFR§15.107	a)	For Low-power radio-frequency devices that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 [mu] H/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequencies ranges.															
		<table><tr><th rowspan="2">Frequency ranges (MHz)</th><th colspan="2">Limit (dBµV)</th></tr><tr><th>QP</th><th>Average</th></tr><tr><td>0.15 ~ 0.5</td><td>66 – 56</td><td>56 – 46</td></tr><tr><td>0.5 ~ 5</td><td>56</td><td>46</td></tr><tr><td>5 ~ 30</td><td>60</td><td>50</td></tr></table>	Frequency ranges (MHz)	Limit (dBµV)		QP	Average	0.15 ~ 0.5	66 – 56	56 – 46	0.5 ~ 5	56	46	5 ~ 30	60	50	
Frequency ranges (MHz)	Limit (dBµV)																
	QP	Average															
0.15 ~ 0.5	66 – 56	56 – 46															
0.5 ~ 5	56	46															
5 ~ 30	60	50															

Test Setup	 Note: 1.Support units were connected to second LISN. 2.Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.
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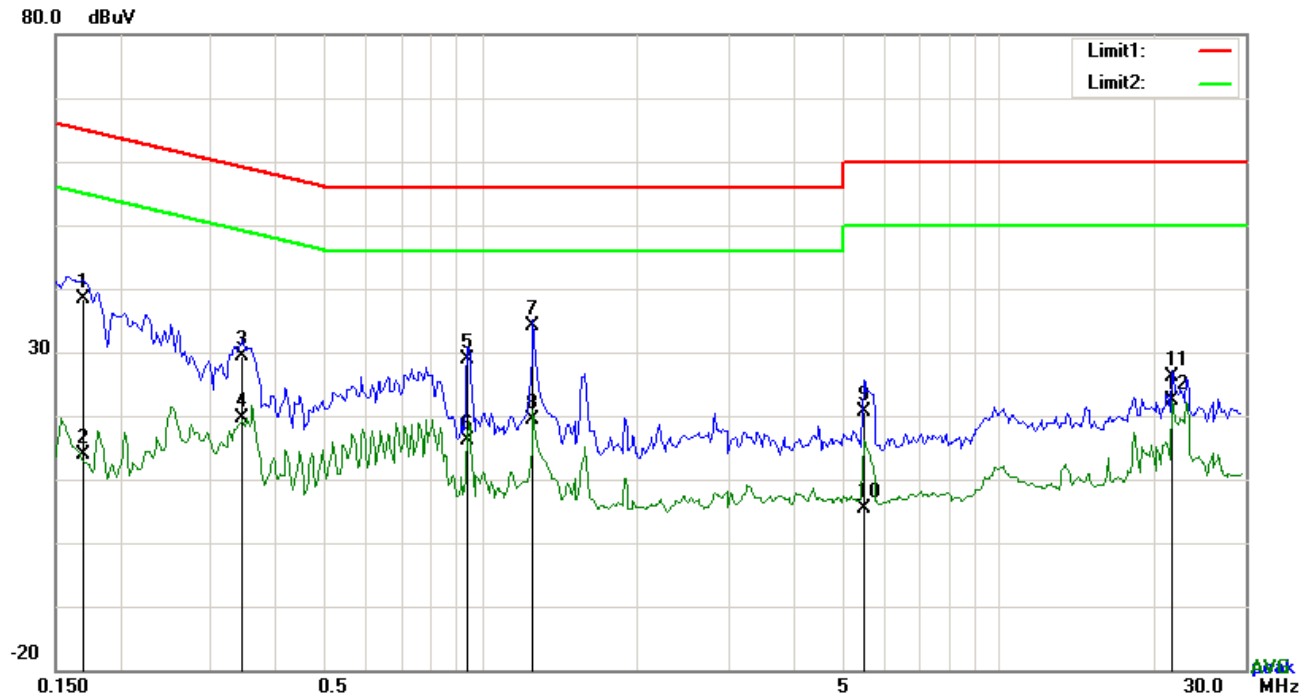
Procedure	- The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table. - The power supply for the EUT was fed through a 50Ω /50mH EUT LISN, connected to filtered mains.
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	3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable. 4. All other supporting equipment were powered separately from another main supply. 5. The EUT was switched on and allowed to warm up to its normal operating condition. 6. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver. 7. High peaks, relative to the limit line, The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz. 8. Step 7 was then repeated for the LIVE line (for AC mains) or DC line (for DC power).
Remark	
Result	☒ Pass ☐ Fail

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test Mode : Charging Mode

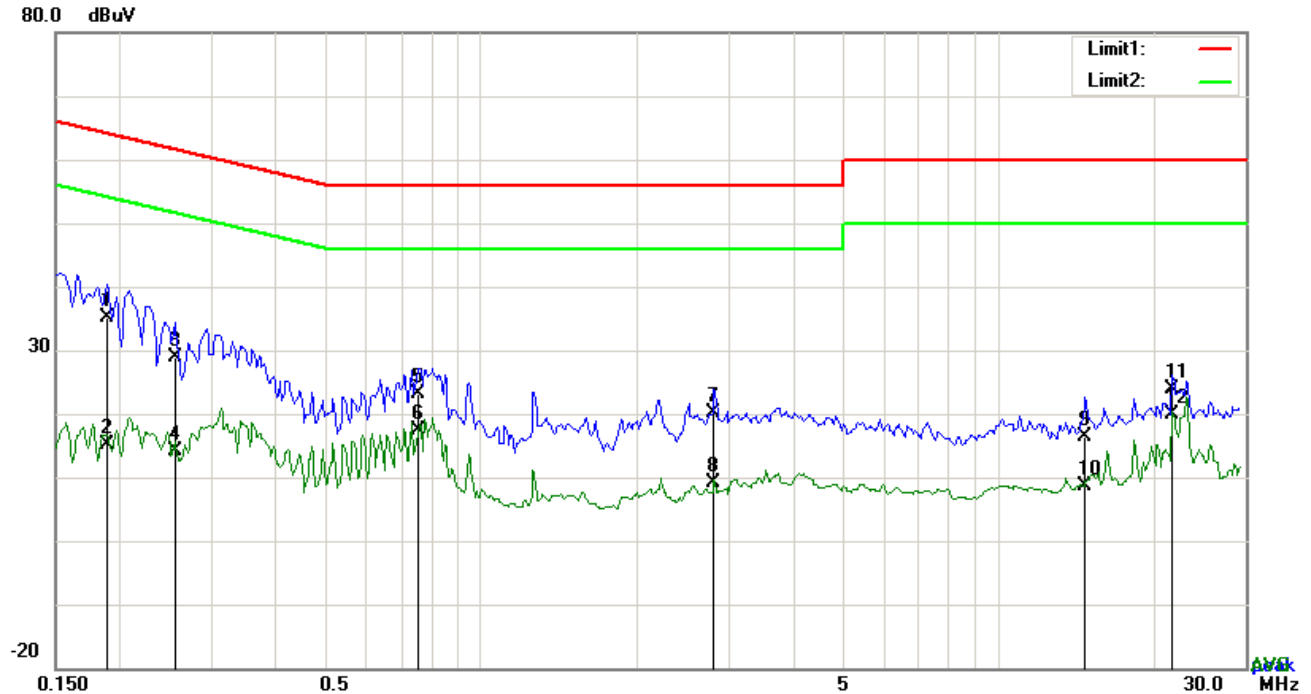


Test Data

Phase Line Plot at 120Vac, 60Hz

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB)	(dBuV)	(dBuV)	(dB)
1	L1	0.1695	28.45	QP	10.03	38.48	64.98	-26.50
2	L1	0.1695	3.97	AVG	10.03	14.00	54.98	-40.98
3	L1	0.3450	19.32	QP	10.03	29.35	59.08	-29.73
4	L1	0.3450	9.54	AVG	10.03	19.57	49.08	-29.51
5	L1	0.9417	18.91	QP	10.03	28.94	56.00	-27.06
6	L1	0.9417	6.18	AVG	10.03	16.21	46.00	-29.79
7	L1	1.2576	24.19	QP	10.03	34.22	56.00	-21.78
8	L1	1.2576	9.39	AVG	10.03	19.42	46.00	-26.58
9	L1	5.4960	10.42	QP	10.09	20.51	60.00	-39.49
10	L1	5.4960	-4.67	AVG	10.09	5.42	50.00	-44.58
11	L1	21.6654	15.68	QP	10.33	26.01	60.00	-33.99
12	L1	21.6654	12.09	AVG	10.33	22.42	50.00	-27.58

Test Mode : Charging Mode

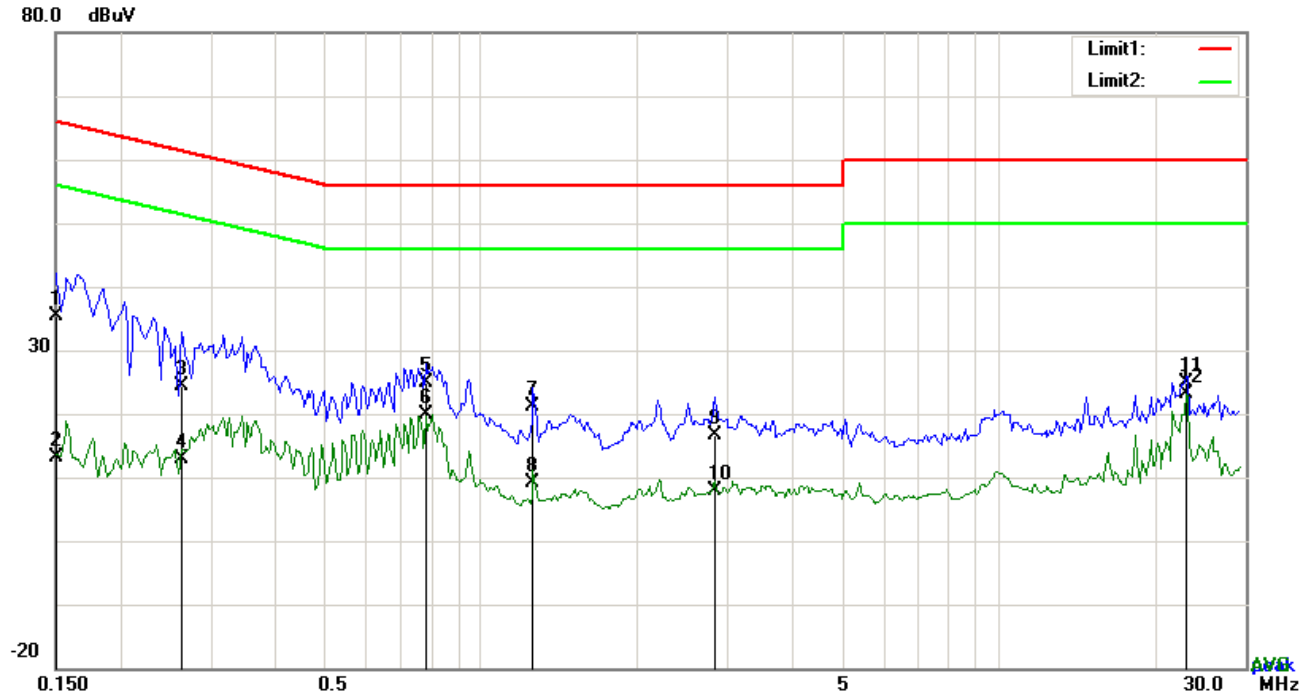


Test Data

Phase Neutral Plot at 120Vac, 60Hz

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB)	(dBuV)	(dBuV)	(dB)
1	N	0.1890	25.11	QP	10.02	35.13	64.08	-28.95
2	N	0.1890	5.22	AVG	10.02	15.24	54.08	-38.84
3	N	0.2553	18.97	QP	10.02	28.99	61.58	-32.59
4	N	0.2553	4.10	AVG	10.02	14.12	51.58	-37.46
5	N	0.7545	13.15	QP	10.03	23.18	56.00	-32.82
6	N	0.7545	7.30	AVG	10.03	17.33	46.00	-28.67
7	N	2.8215	10.05	QP	10.05	20.10	56.00	-35.90
8	N	2.8215	-1.00	AVG	10.05	9.05	46.00	-36.95
9	N	14.7156	6.28	QP	10.20	16.48	60.00	-43.52
10	N	14.7156	-1.48	AVG	10.20	8.72	50.00	-41.28
11	N	21.6654	13.61	QP	10.29	23.90	60.00	-36.10
12	N	21.6654	9.65	AVG	10.29	19.94	50.00	-30.06

Test Mode : Charging Mode

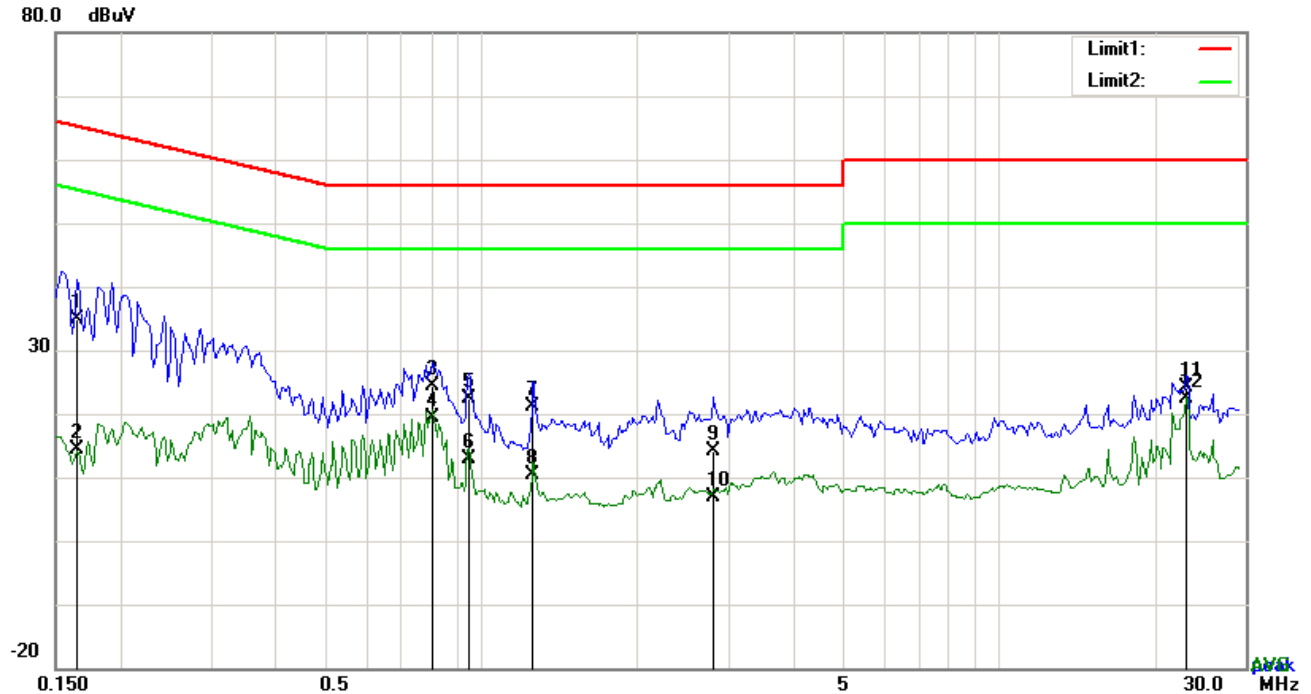


Test Data

Phase Line Plot at 240Vac, 60Hz

No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB}	(dBuV)	(dBuV)	(dB)
1	L1	0.1500	25.32	QP	10.03	35.35	66.00	-30.65
2	L1	0.1500	3.08	AVG	10.03	13.11	56.00	-42.89
3	L1	0.2631	14.33	QP	10.03	24.36	61.33	-36.97
4	L1	0.2631	2.92	AVG	10.03	12.95	51.33	-38.38
5	L1	0.7818	14.88	QP	10.03	24.91	56.00	-31.09
6	L1	0.7818	9.88	AVG	10.03	19.91	46.00	-26.09
7	L1	1.2576	10.98	QP	10.03	21.01	56.00	-34.99
8	L1	1.2576	-0.94	AVG	10.03	9.09	46.00	-36.91
9	L1	2.8293	6.67	QP	10.05	16.72	56.00	-39.28
10	L1	2.8293	-2.13	AVG	10.05	7.92	46.00	-38.08
11	L1	23.1318	14.42	QP	10.36	24.78	60.00	-35.22
12	L1	23.1318	12.81	AVG	10.36	23.17	50.00	-26.83

Test Mode : Charging Mode



Test Data

Phase Neutral Plot at 240Vac, 60Hz

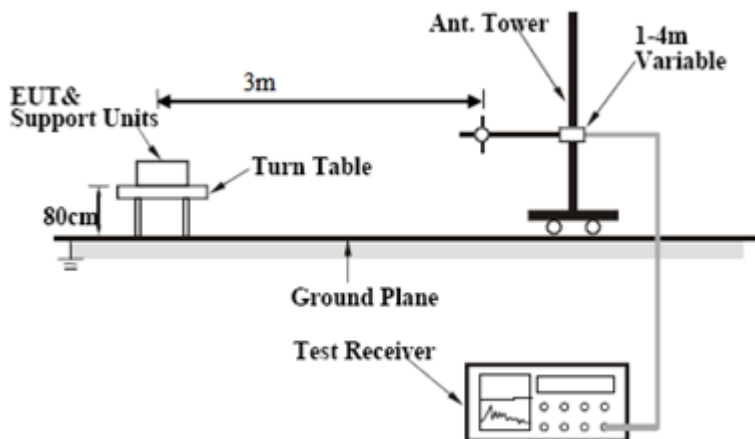
No.	P/L	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
		(MHz)	(dBuV)		(dB}	(dBuV)	(dBuV)	(dB)
1	N	0.1656	24.83	QP	10.03	34.86	65.18	-30.32
2	N	0.1656	4.43	AVG	10.03	14.46	55.18	-40.72
3	N	0.8052	14.33	QP	10.03	24.36	56.00	-31.64
4	N	0.8052	9.38	AVG	10.03	19.41	46.00	-26.59
5	N	0.9456	12.26	QP	10.03	22.29	56.00	-33.71
6	N	0.9456	2.76	AVG	10.03	12.79	46.00	-33.21
7	N	1.2615	11.16	QP	10.03	21.19	56.00	-34.81
8	N	1.2615	0.31	AVG	10.03	10.34	46.00	-35.66
9	N	2.8059	4.16	QP	10.05	14.21	56.00	-41.79
10	N	2.8059	-3.16	AVG	10.05	6.89	46.00	-39.11
11	N	23.1279	13.74	QP	10.36	24.10	60.00	-35.90
12	N	23.1279	12.07	AVG	10.36	22.43	50.00	-27.57

6.2 Radiated Emissions

Temperature	25°C
Relative Humidity	50%
Atmospheric Pressure	1008mbar
Test date :	November 08, 2017
Tested By :	Evans He

Requirement(s):

Spec	Item	Requirement	Applicable	
47CFR§15.109(d)	a)	Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges		
		Frequency range (MHz)		Field Strength (µV/m)
		30 – 88		100
		88 – 216		150
		216 - 960		200
		Above 960		500

Test Setup	
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Procedure	- The EUT was switched on and allowed to warm up to its normal operating condition. - The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner: - Vertical or horizontal polarization (whichever gave the higher emission level
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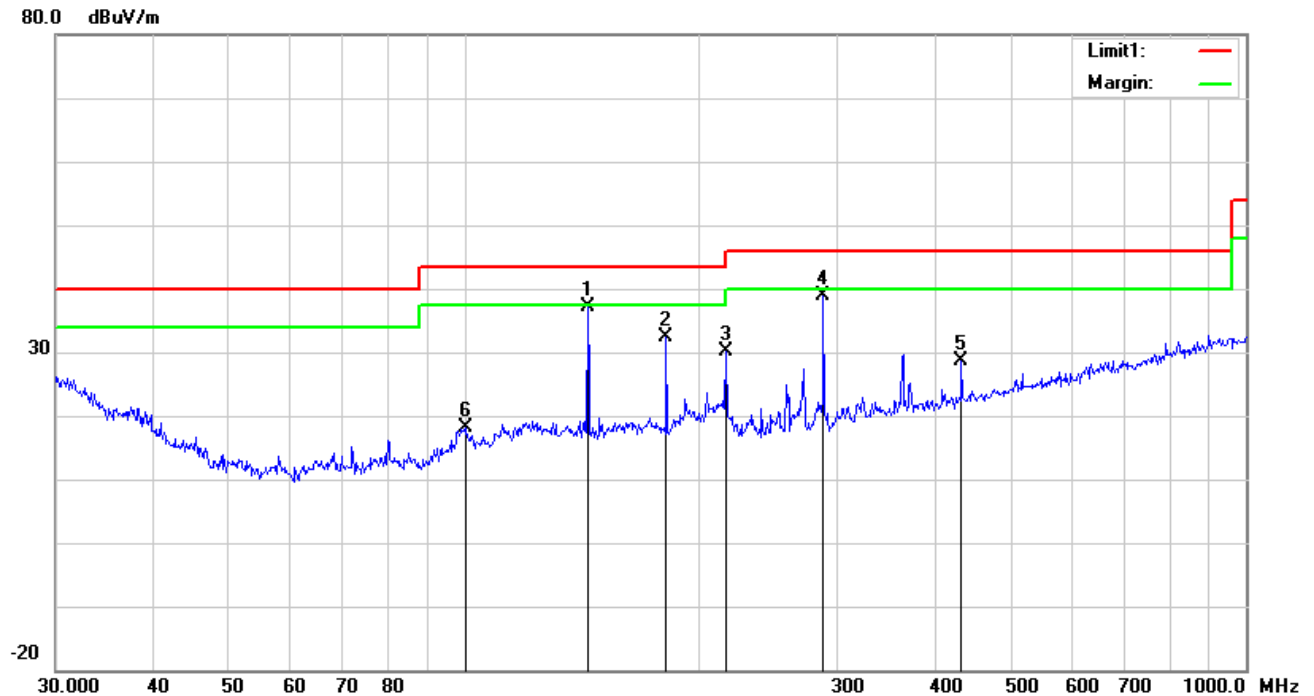
	over a full rotation of the EUT) was chosen. b. The EUT was then rotated to the direction that gave the maximum emission. c. Finally, the antenna height was adjusted to the height that gave the maximum emission. 3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi Peak detection at frequency below 1GHz. 4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak measurement at frequency above 1GHz. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth with Peak detection for Average Measurement as below at frequency above 1GHz. ■ 1 kHz (Duty cycle < 98%) □ 10 Hz (Duty cycle > 98%) 5. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.
Remark	
Result	☒ Pass ☐ Fail

Test Data ☒ Yes ☐ N/A

Test Plot ☒ Yes (See below) ☐ N/A

Test Mode 1: Charging Mode

Below 1GHz

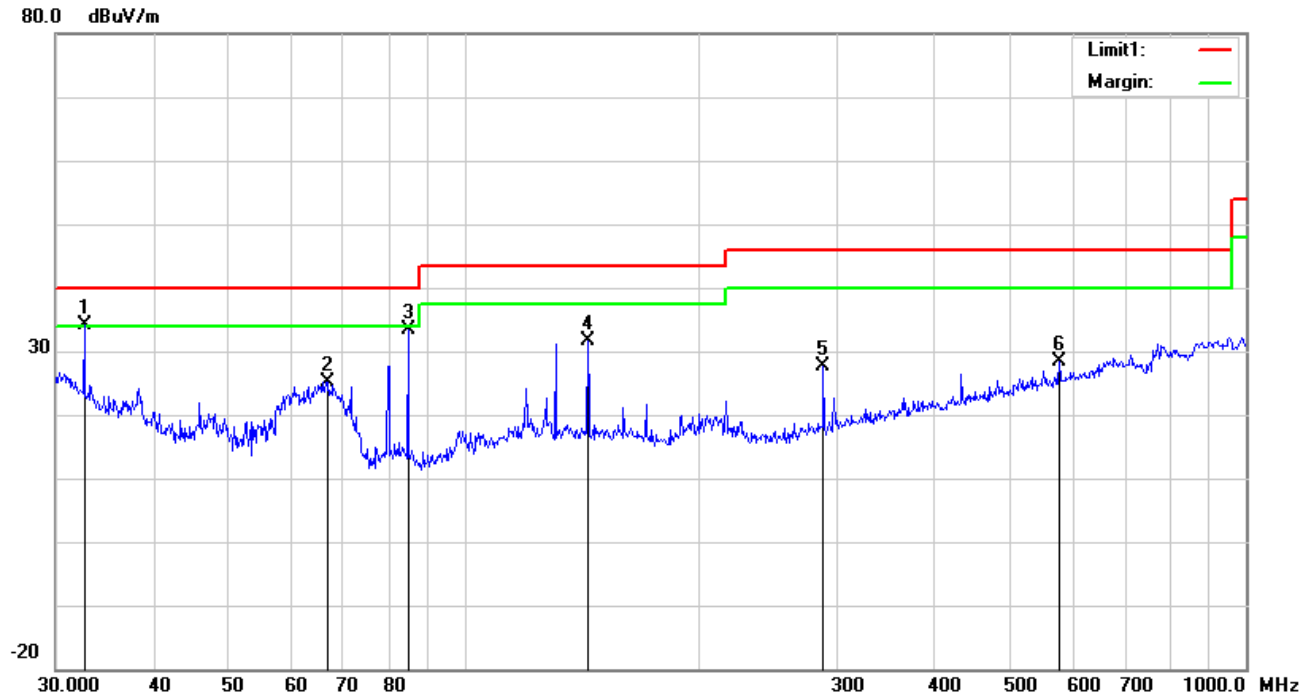


Test Data

Horizontal Polarity Plot @3m

No.	P/L	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	H	143.8295	45.55	peak	12.60	22.38	1.30	37.07	43.50	-6.43	100	227
2	H	181.2834	42.14	peak	11.07	22.26	1.38	32.33	43.50	-11.17	100	338
3	H	216.0240	38.97	peak	11.88	22.35	1.59	30.09	46.00	-15.91	100	58
4	H	287.9904	46.30	peak	13.07	22.29	1.77	38.85	46.00	-7.15	100	194
5	H	432.5457	32.03	peak	16.35	21.94	2.09	28.53	46.00	-17.47	100	222
6	H	100.2286	28.81	peak	10.44	22.32	1.12	18.05	43.50	-25.45	100	147

Below 1GHz



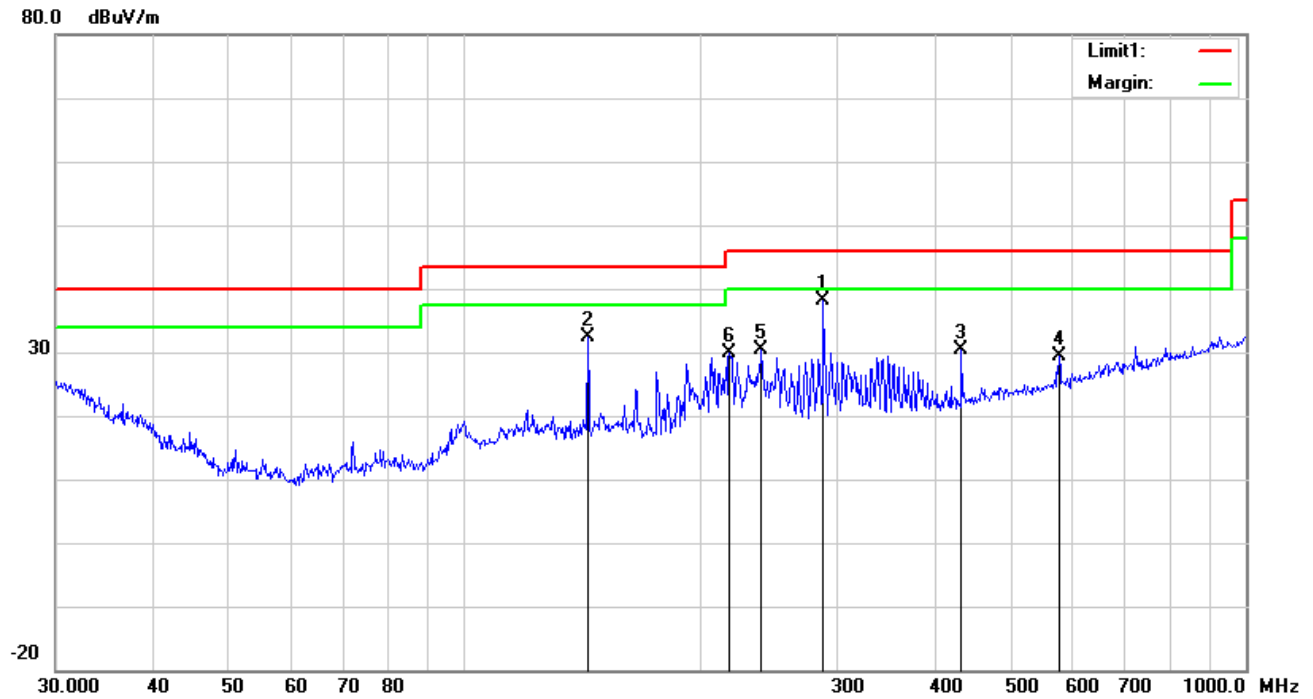
Test Data

Vertical Polarity Plot @3m

No.	P/L	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	V	32.6340	36.28	QP	19.37	22.26	0.69	34.08	40.00	-5.92	100	18
2	V	66.9669	38.97	peak	7.65	22.39	0.92	25.15	40.00	-14.85	100	24
3	V	84.7019	46.80	peak	7.79	22.37	1.07	33.29	40.00	-6.71	200	196
4	V	143.8295	40.09	peak	12.60	22.38	1.30	31.61	43.50	-11.89	100	29
5	V	287.9904	35.18	peak	13.07	22.29	1.77	27.73	46.00	-18.27	100	295
6	V	576.6443	28.85	peak	18.77	21.63	2.49	28.48	46.00	-17.52	200	11

Test Mode 2 : Normal Working Mode

Below 1GHz

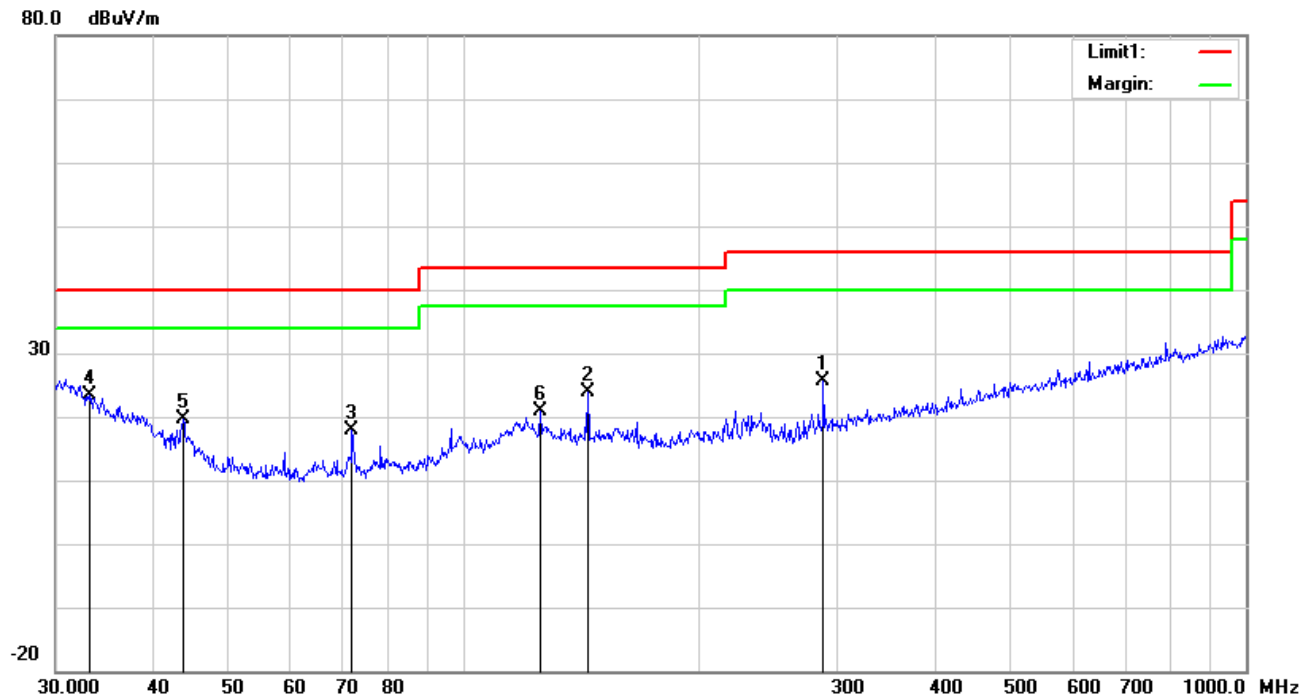


Test Data

Horizontal Polarity Plot @3m

No.	P/L	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	H	287.9904	45.68	peak	13.07	22.29	1.77	38.23	46.00	-7.77	100	305
2	H	143.8295	40.82	peak	12.60	22.38	1.30	32.34	43.50	-11.16	100	350
3	H	432.5457	33.83	peak	16.35	21.94	2.09	30.33	46.00	-15.67	100	201
4	H	576.6443	29.74	peak	18.77	21.63	2.49	29.37	46.00	-16.63	100	30
5	H	239.9873	39.36	peak	11.54	22.31	1.67	30.26	46.00	-15.74	100	238
6	H	218.3085	38.68	peak	11.84	22.35	1.60	29.77	46.00	-16.23	100	237

Below 1GHz



Test Data

Vertical Polarity Plot @3m

No.	P/L	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	V	287.9904	33.09	peak	13.07	22.29	1.77	25.64	46.00	-20.36	100	332
2	V	143.8295	32.46	peak	12.60	22.38	1.30	23.98	43.50	-19.52	100	90
3	V	71.8320	31.46	peak	7.76	22.39	0.97	17.80	40.00	-22.20	100	36
4	V	33.0950	25.94	peak	19.02	22.26	0.71	23.41	40.00	-16.59	100	225
5	V	43.6585	29.59	peak	11.49	22.29	0.76	19.55	40.00	-20.45	100	294
6	V	125.0066	28.48	peak	13.57	22.37	1.18	20.86	43.50	-22.64	100	193

Test Mode 1:	Charging Mode
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Above 1GHz

Frequency (MHz)	Read_level (dBμV/m)	Azimuth	Height (cm)	Polarity (H/V)	Level (dBμV/m)	Factors (dB)	Limit (dBμV/m)	Margin (dB)	Detector (PK/AV)
1892.2	63.5	313	100	V	-15.86	47.64	74	-26.36	PK
2489.2	62.03	210	100	V	-15.61	46.42	74	-27.58	PK
4786.4	56.07	8	100	V	-6.98	49.09	74	-24.91	PK
2134.2	59.84	20	100	H	-16.62	43.22	74	-30.78	PK
4882.1	55.13	40	100	H	-6.58	48.55	74	-25.45	PK
5562	47.68	62	100	H	-4.23	43.45	74	-30.55	PK

*Note1: The highest frequency of the EUT is 2462 MHz, so the testing has been conformed to 5*2462MHz=12,310MHz.*

Note2: The frequency that above 3GHz is mainly from the environment noise.

Note3: The AV measurement performed, more than 20dB below limit so AV test data was not presented.

Test Mode 2 : Normal Working Mode

Above 1GHz

Frequency (MHz)	Read_level (dBμV/m)	Azimuth	Height (cm)	Polarity (H/V)	Level (dBμV/m)	Factors (dB)	Limit (dBμV/m)	Margin (dB)	Detector (PK/AV)
2153.5	65.01	78	100	V	-16.24	48.77	74	-25.23	PK
2704.4	61.63	179	100	V	-15.72	45.91	74	-28.09	PK
4498.1	57.61	258	100	V	-8.82	48.79	74	-25.21	PK
1839.3	60.31	138	100	H	-16.65	43.66	74	-30.34	PK
2633.9	62.82	165	100	H	-15.45	47.37	74	-26.63	PK
3493	57.19	124	100	H	-14.23	42.96	74	-31.04	PK

*Note1: The highest frequency of the EUT is 2462 MHz, so the testing has been conformed to 5*2462MHz=12,310MHz.*

Note2: The frequency that above 3GHz is mainly from the environment noise.

Note3: The AV measurement performed, more than 20dB below limit so AV test data was not presented.

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Due	In use
AC Line Conducted Emissions					
EMI test receiver	ESCS30	8471241027	09/15/2017	09/14/2018	☒
Line Impedance Stabilization Network	LI-125A	191106	09/23/2017	09/22/2018	☒
Line Impedance Stabilization Network	LI-125A	191107	09/23/2017	09/22/2018	☒
ISN	ISN T800	34373	09/23/2017	09/22/2018	☒
Transient Limiter	LIT-153	531118	08/30/2017	08/29/2018	☒
Radiated Emissions					
EMI test receiver	ESL6	100262	09/15/2017	09/14/2018	☒
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	08/30/2017	08/29/2018	☒
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/23/2017	03/22/2018	☒
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/19/2017	09/18/2018	☒
Double Ridge Horn Antenna	AH-118	71259	09/22/2017	09/21/2018	☒
Horn Antenna	BBHA9170	3145226D1	09/27/2017	09/26/2018	☒

Annex B. EUT And Test Setup Photographs

Annex B.i. Photograph: EUT External Photo

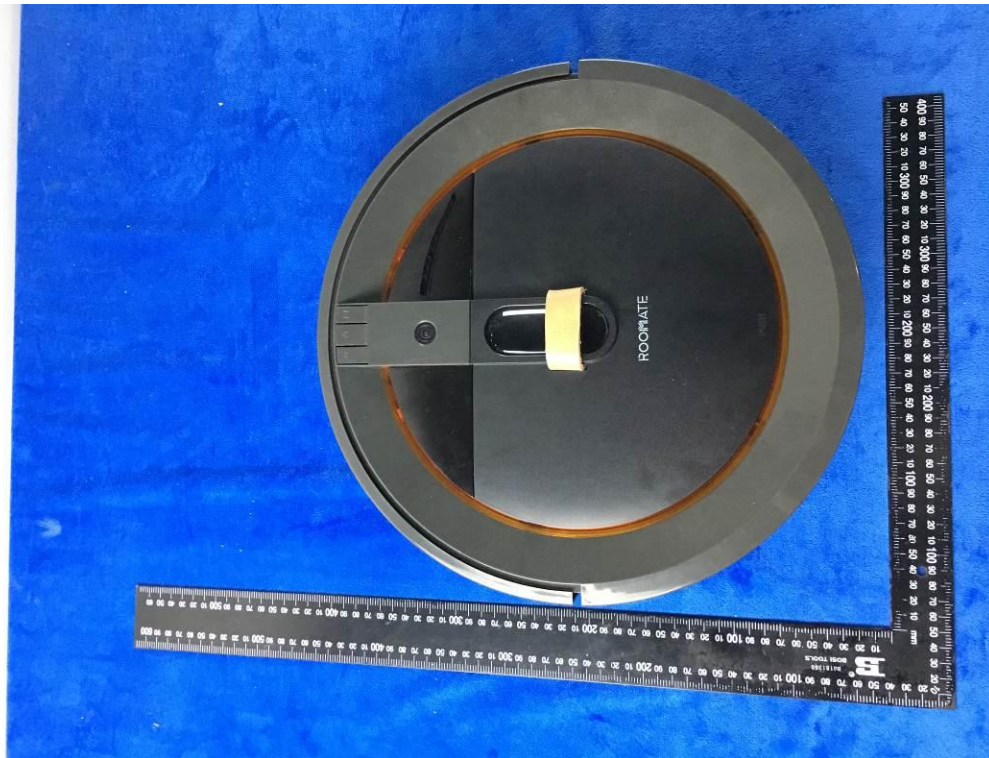
Whole Package View



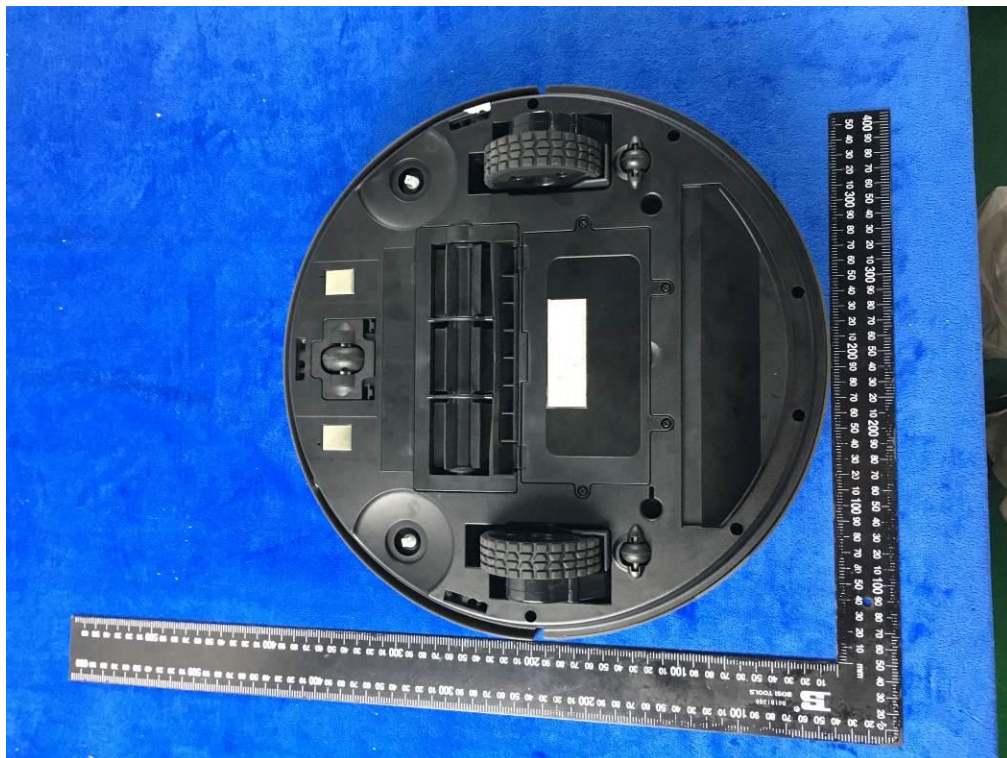
Adapter - Label View



EUT - Front View(EUT)



EUT - Rear View(EUT)



EUT - Top View(EUT)



EUT - Bottom View(EUT)



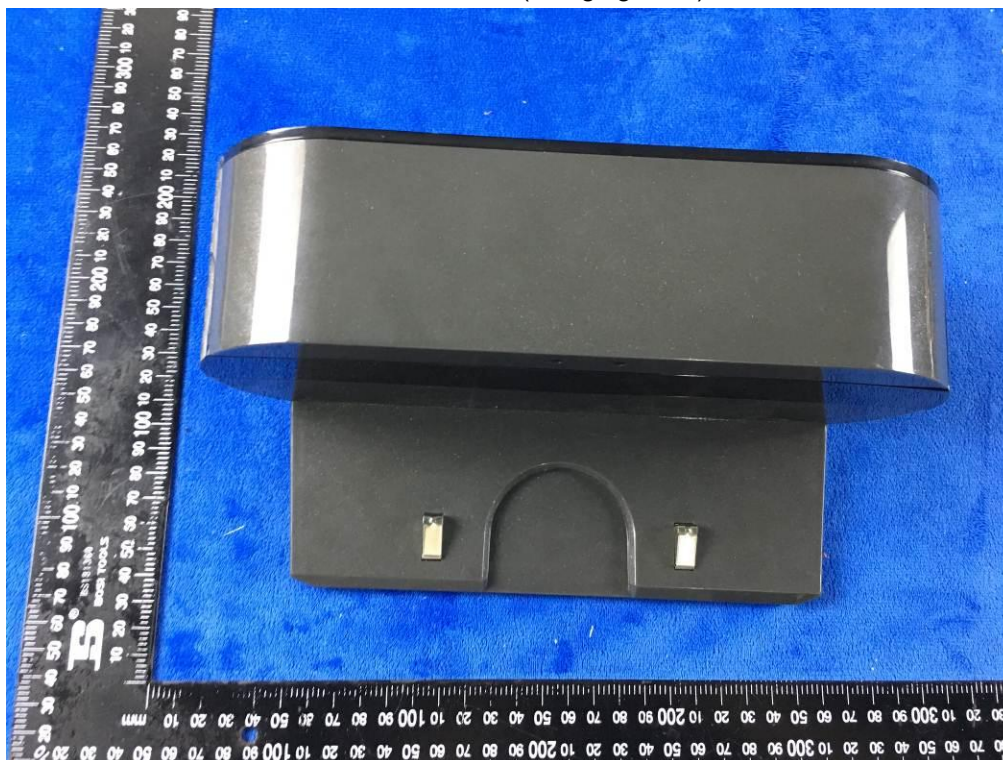
EUT - Left View(EUT)



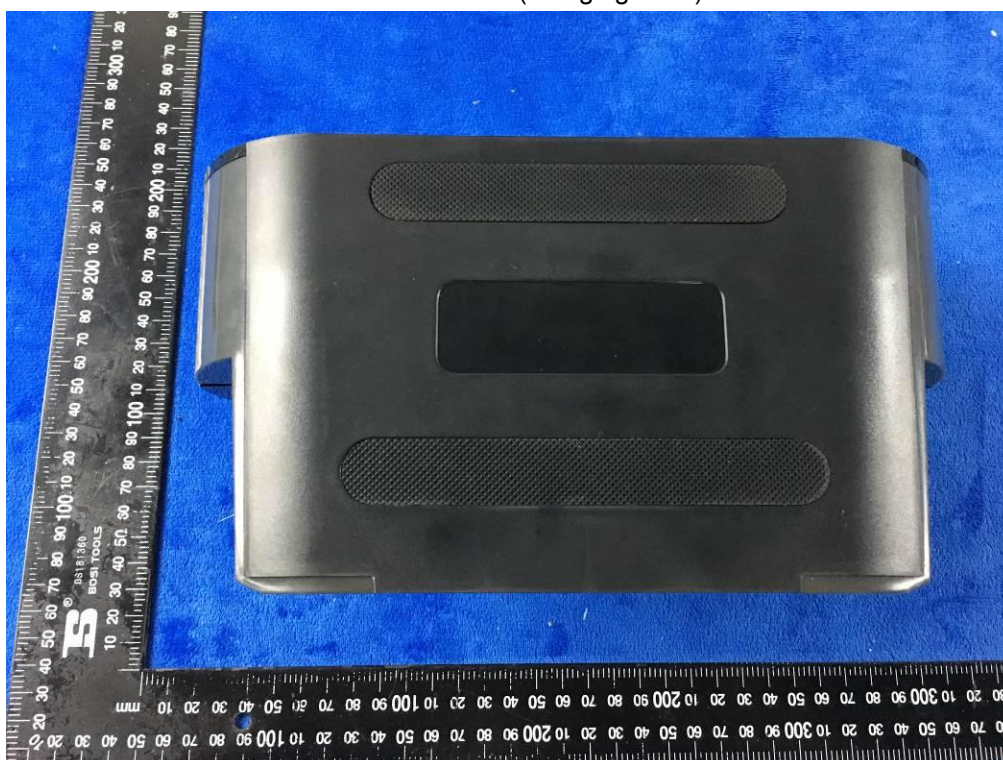
EUT - Right View(EUT)



EUT - Front View(charging base)



EUT - Rear View(charging base)



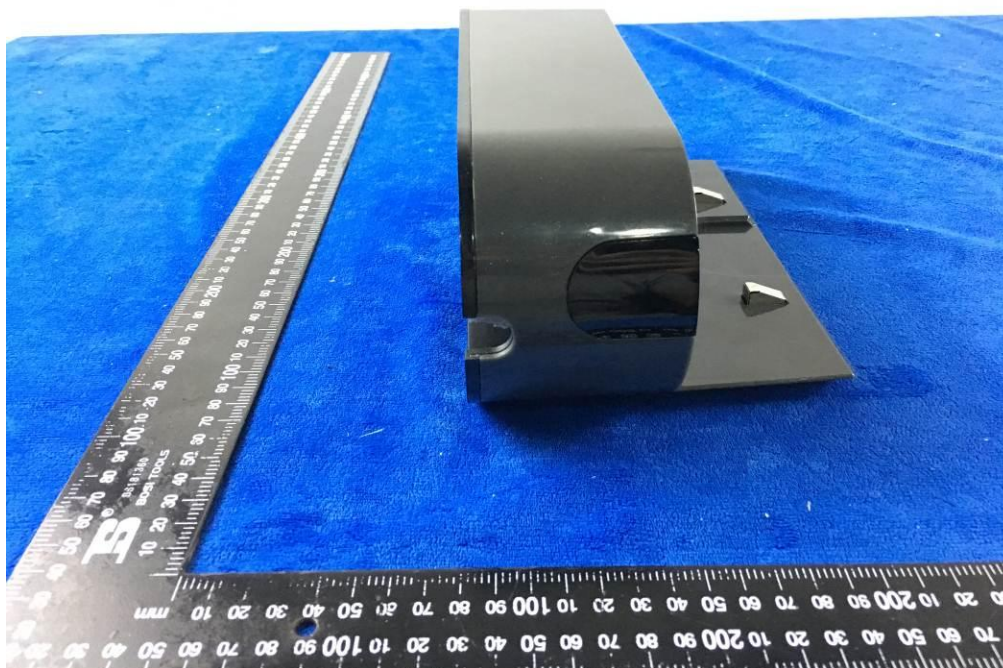
EUT - Top View(charging base)



EUT - Bottom View(EUT)



EUT - Left View(EUT)



EUT - Right View(EUT)



EUT - Front View(Remote control)



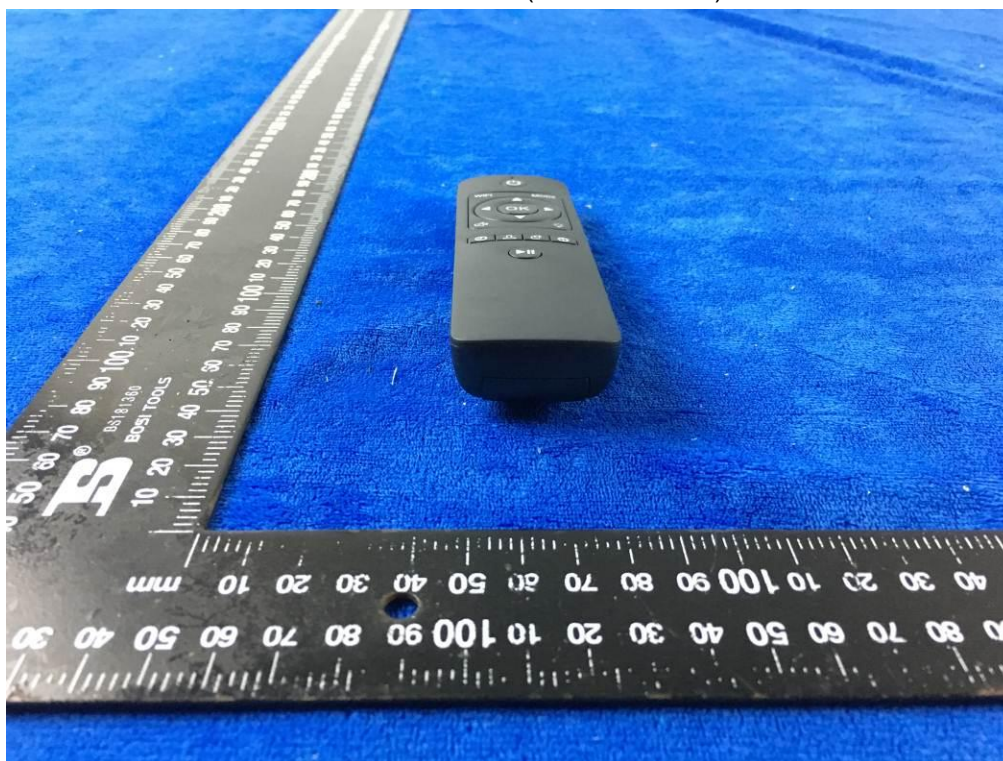
EUT - Rear View(Remote control)



EUT - Top View(Remote control)



EUT - Bottom View(Remote control)



EUT - Left View(Remote control)

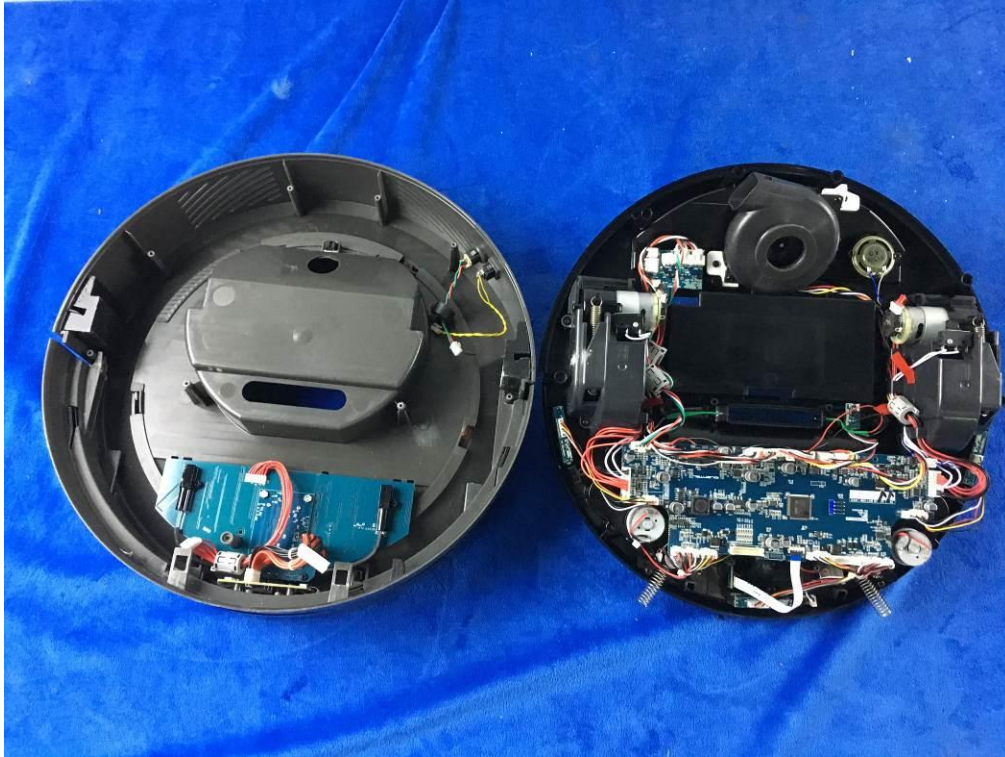


EUT - Right View(Remote control)

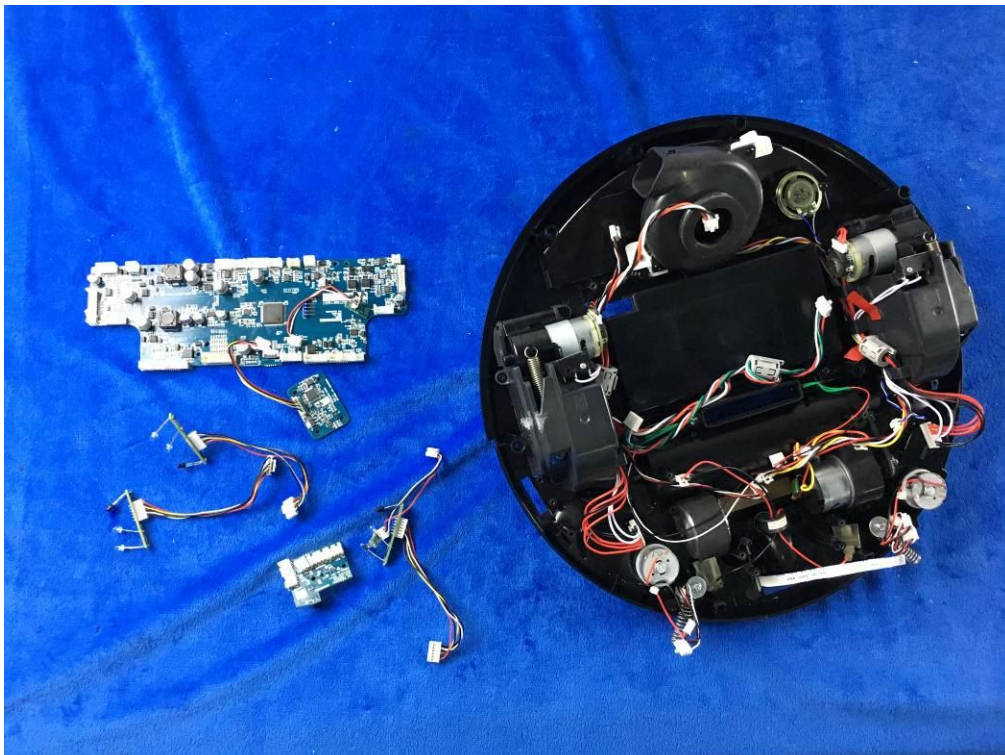


Annex B.ii. Photograph: EUT Internal Photo

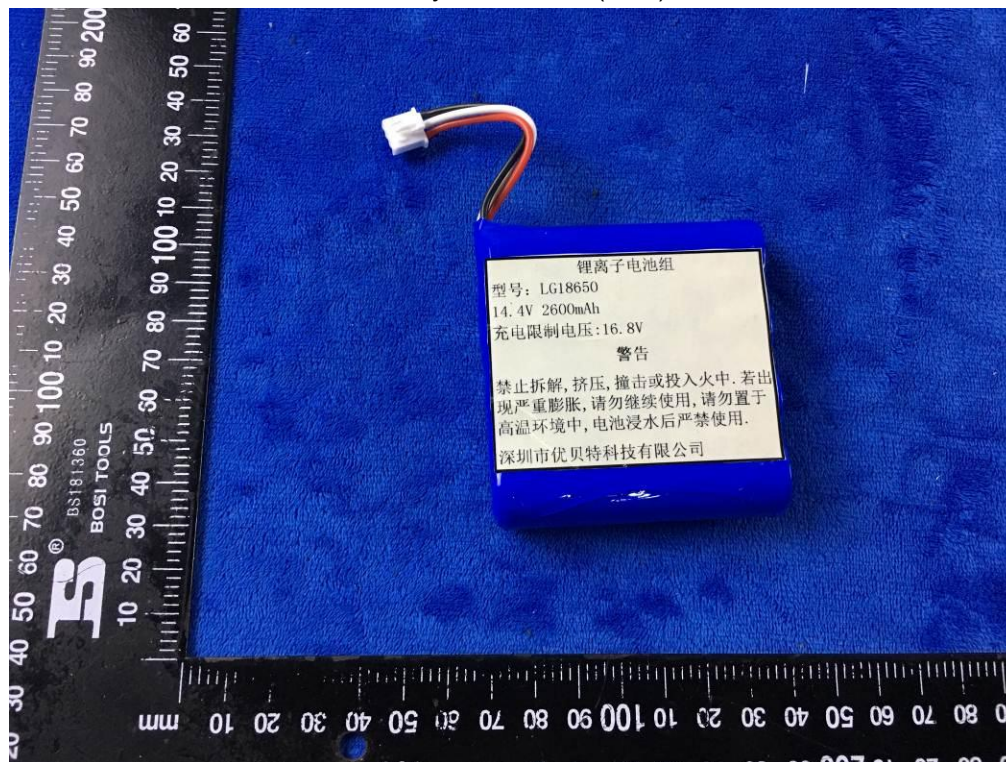
Cover Off - Top View 1(EUT)



Cover Off - Top View 2(EUT)



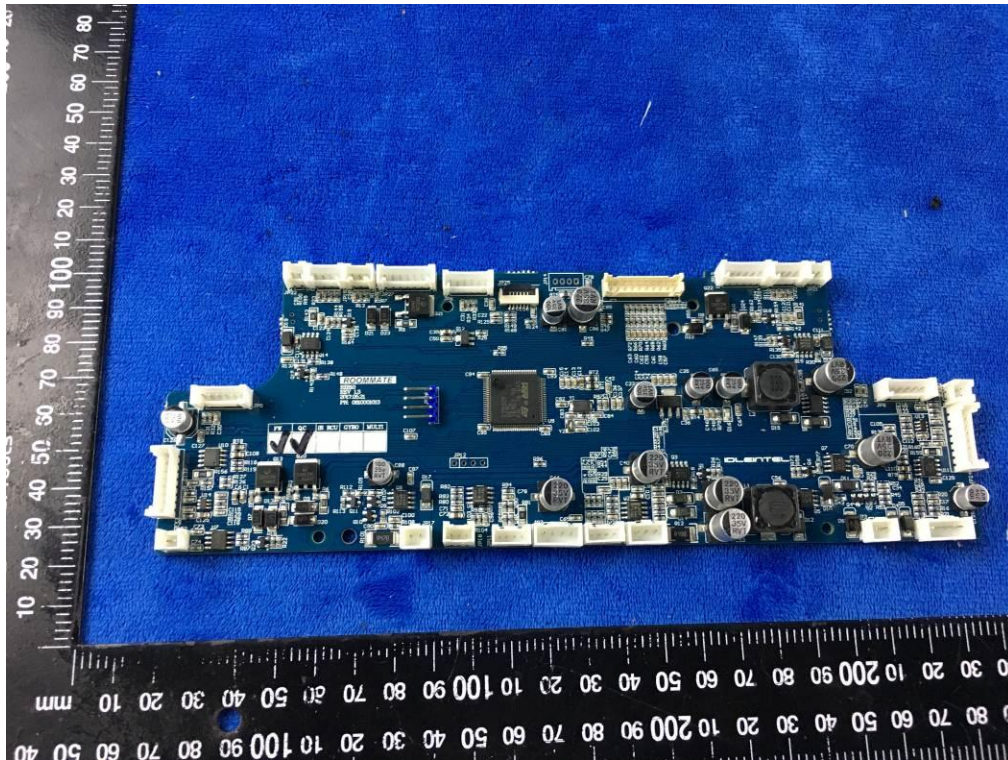
Battery - Front View(EUT)



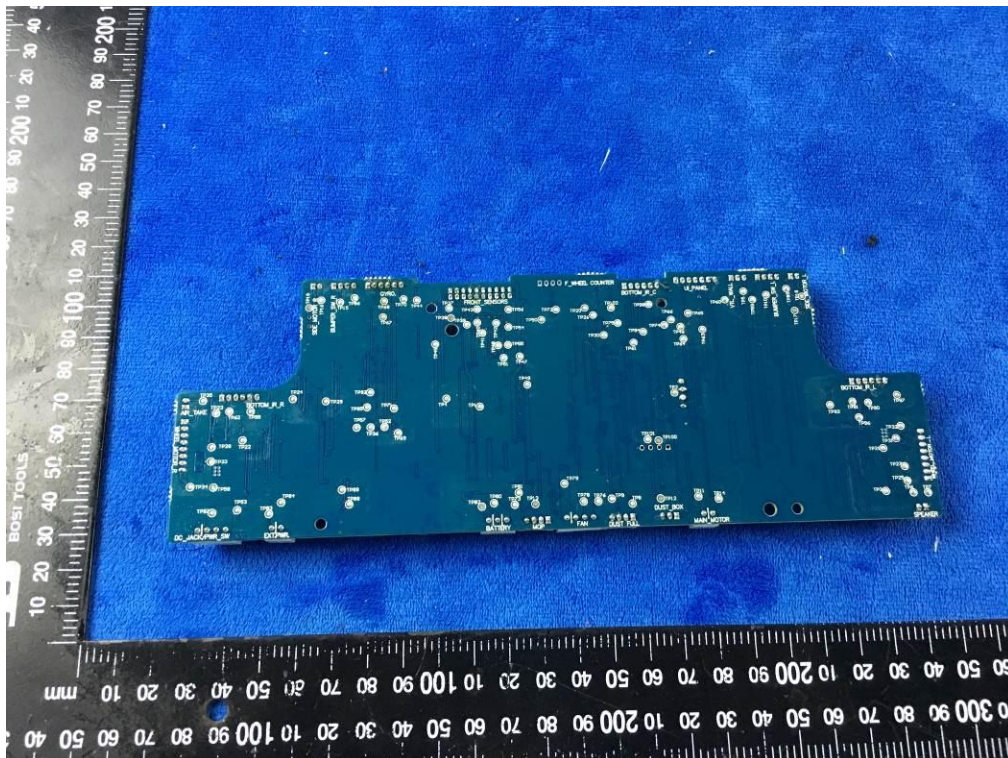
Battery - Rear View(EUT)



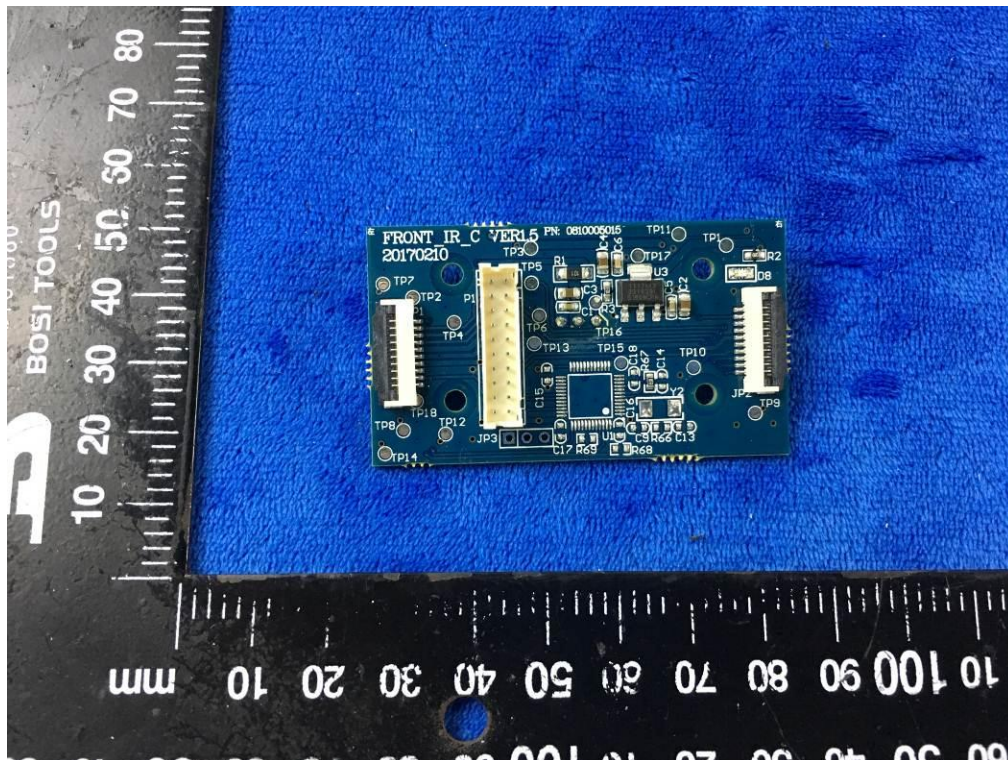
Mainboard - Front View(EUT)



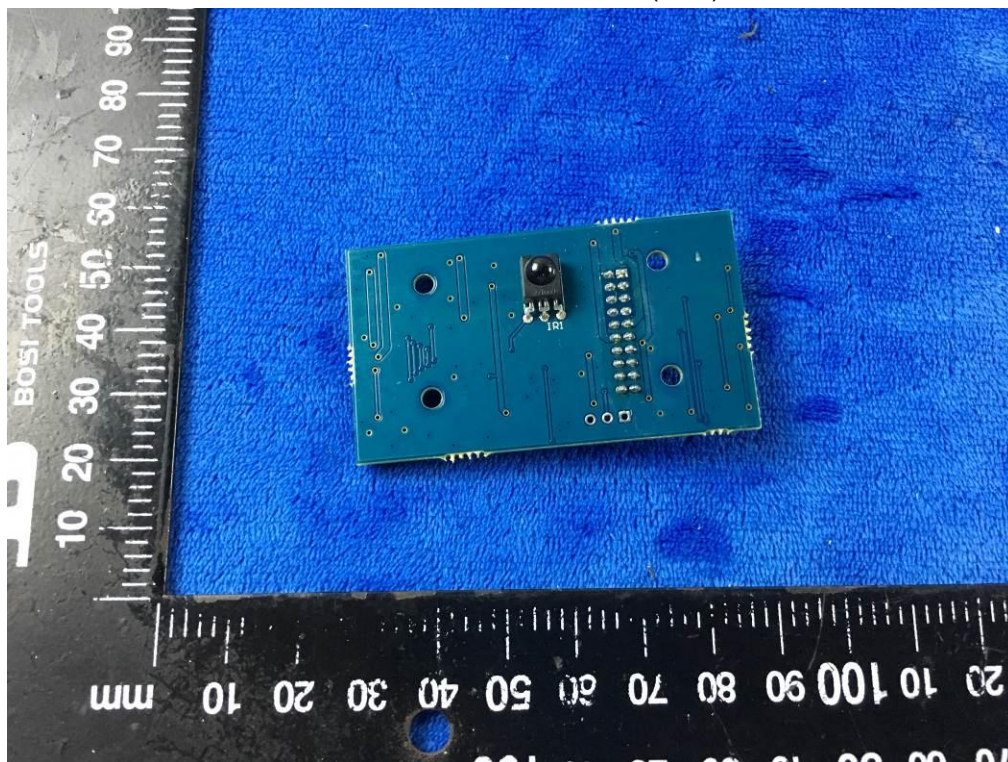
Mainboard – Rear View(EUT)



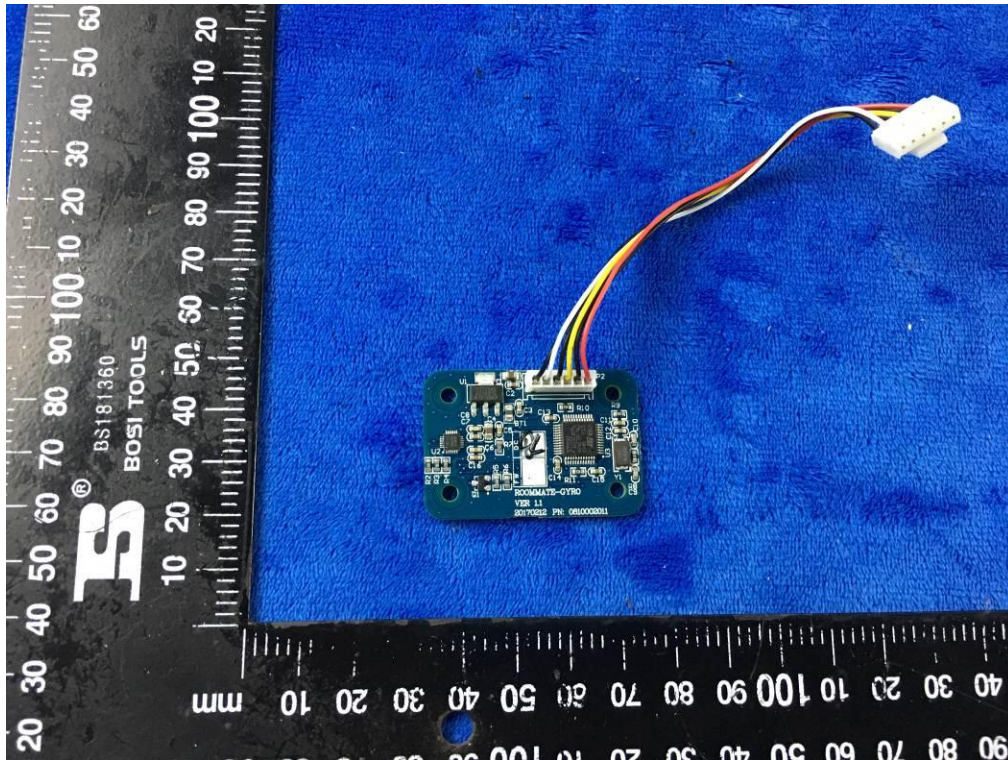
Connect board 1- Front View(EUT)



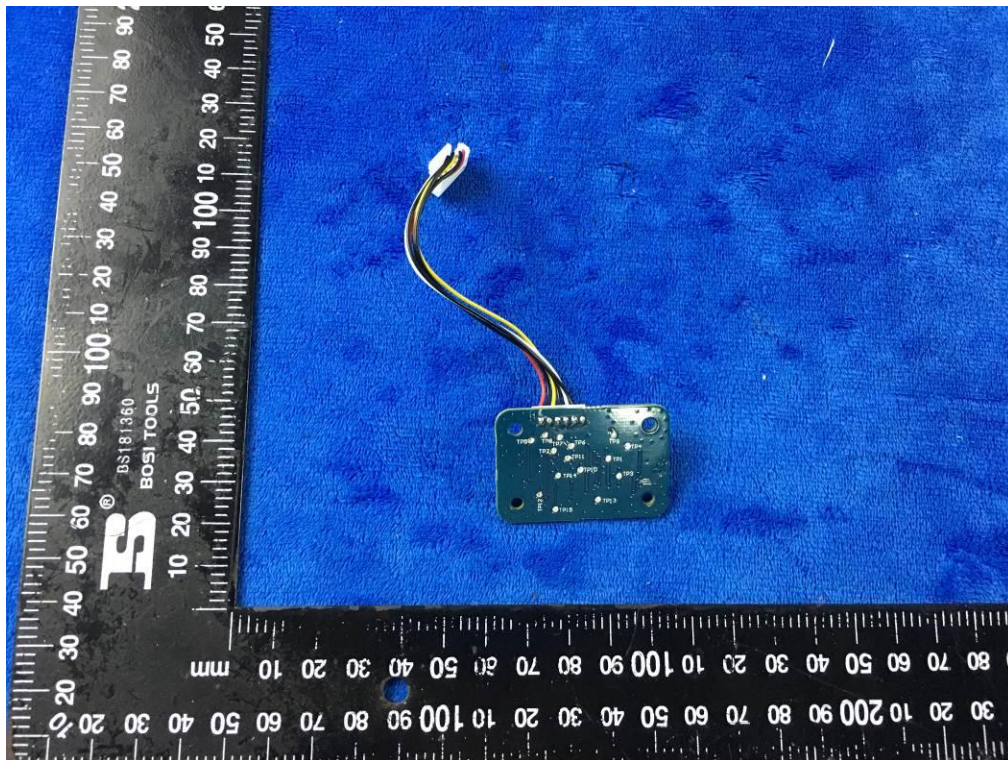
Connect board 1- Rear View(EUT)



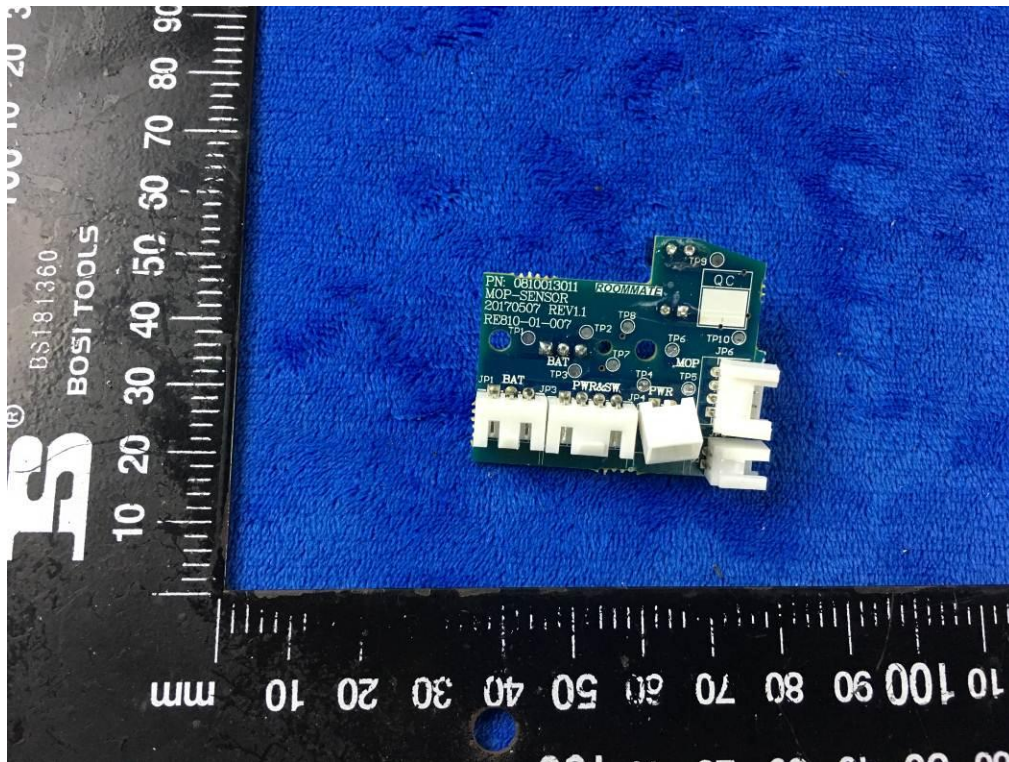
Connect board 2- Front View(EUT)



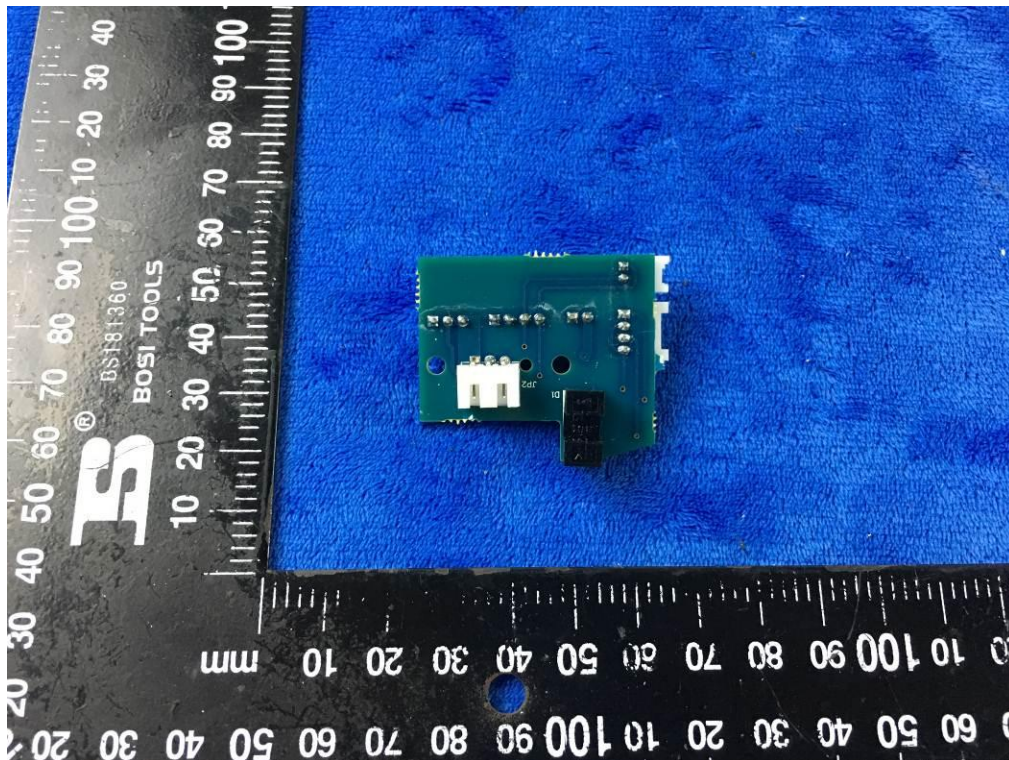
Connect board 2- Rear View(EUT)



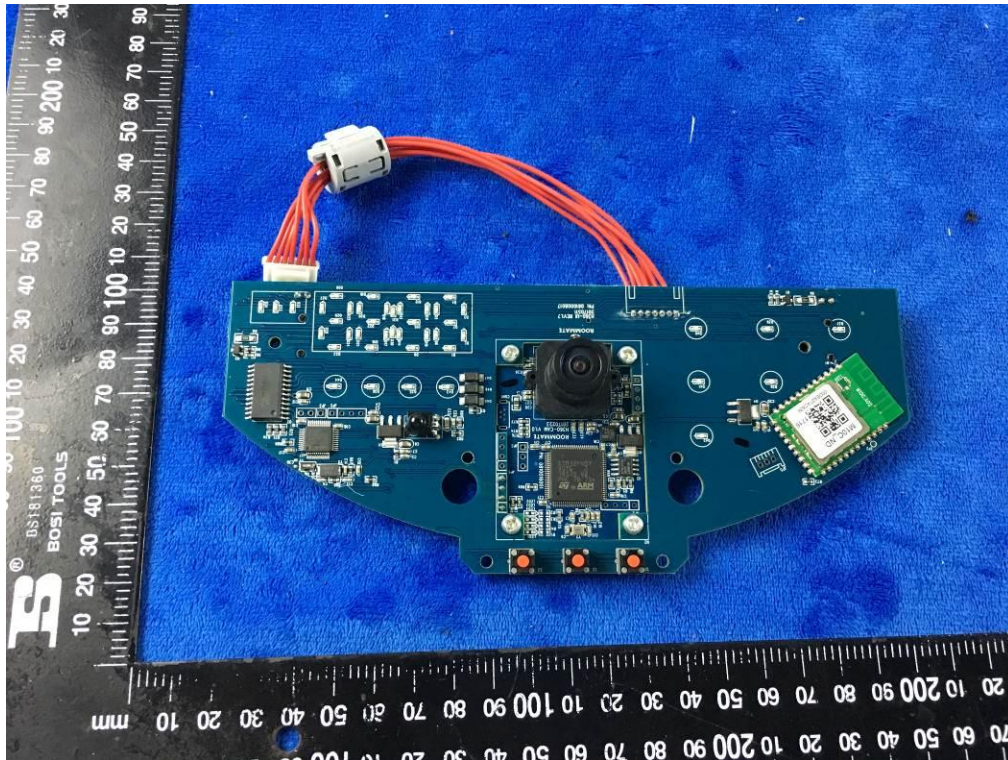
Connect board 3– Front View(EUT)



Connect board 3– Rear View(EUT)



Key board- Front View(EUT)



Key board- Rear View(EUT)

