

EMC REPORT

Applicant: Balena Ltd.

Address of Applicant: 6th Floor, One London Wall London, London, EC2Y 5EB
United Kingdom

Equipment Under Test (EUT)

Product Name: balenaFin

Model No.: v1.1

Trade mark: balenaFin

Applicable standards: ETSI EN 301 489-1 V2.2.3 (2019-11)
Draft ETSI EN 301 489-17 V3.2.2 (2019-12)

Date of sample receipt: 23 Aug., 2019

Date of Test: 24 Aug., 2019 to 21 Aug., 2020

Date of report issue: 24 Aug., 2020

Test Result: PASS*

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

The CE mark as shown below can be used, under the responsibility of the manufacturer, after completion of an EC Declaration of Conformity and compliance with all relevant EC Directives. The protection requirements with respect to electromagnetic compatibility contained in Directive 2014/53/EU are considered.



Bruce Zhang
Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the CCIS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. 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.

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2 Version

Version No.	Date	Description
00	05 Aug., 2020	Original
01	24 Aug., 2020	Update Page 5, 26~31, 34~35

Tested by: Carey Chen
Test Engineer

Date: 24 Aug., 2020

Reviewed by: Winner Zhang
Project Engineer

Date: 24 Aug., 2020

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4 Test Summary

Test Item	Test Requirement	Test Method	Application	Result
EMI Test Items				
Radiated Emission	ETSI EN301 489-1	EN 55032	Enclosure	PASS
Conducted Emission	ETSI EN301 489-1	EN 55032	AC port	PASS
Harmonic Current Emissions	ETSI EN301 489-1	EN 61000-3-2	AC port	Not Required
Voltage Fluctuations and Flicker	ETSI EN301 489-1	EN 61000-3-3	AC port	Not Required
EMS Test Items				
ESD (Electrostatic Discharge)	ETSI EN301 489-1	EN 61000-4-2	Enclosure	PASS
Radiated Immunity	ETSI EN301 489-1	EN 61000-4-3	Enclosure	PASS
EFT (Electrical Fast Transients)	ETSI EN301 489-1	EN 61000-4-4	AC port	N/A
Surge Immunity	ETSI EN301 489-1	EN 61000-4-5	AC port	N/A
Injected Currents	ETSI EN301 489-1	EN 61000-4-6	AC port	N/A
Voltage Dips and Interruptions	ETSI EN301 489-1	EN 61000-4-11	AC port	N/A
Remark:				
1. Pass: Meet the requirement.				
2. N/A: Not Applicable.				

5 General Information

5.1 Client Information

Applicant:	Balena Ltd.
Address:	6th Floor, One London Wall London, London, EC2Y 5EB United Kingdom
Manufacturer:	Balena Ltd.
Address:	6th Floor, One London Wall London, London, EC2Y 5EB United Kingdom
Factory:	Fae Technology S.p.a.
Address:	Via C. Battisti, 136 Gazzaniga (BG) 24025 - Italia

5.2 General Description of E.U.T.

Product Name:	balenaFin
Model No.:	v1.1
Tx Frequency:	Wi-Fi: 2412MHz~2472MHz, 5180MHz~5240MHz, 5260MHz~5320MHz, 5500MHz~5700MHz Bluetooth/ BLE: 2402MHz~2480MHz
Rx Frequency	Wi-Fi: 2412MHz~2472MHz, 5180MHz~5240MHz, 5260MHz~5320MHz, 5500MHz~5700MHz Bluetooth/ BLE: 2402MHz~2480MHz
Hardware version:	v10
Software version:	v2.51
Modulation technology:	Wi-Fi: <input checked="" type="checkbox"/> 802.11b(DSSS) <input checked="" type="checkbox"/> 802.11a/g/n/ac (OFDM) Bluetooth: <input checked="" type="checkbox"/> BDR(GFSK) <input checked="" type="checkbox"/> EDR($\pi/4$ -DQPSK, 8DPSK) <input checked="" type="checkbox"/> LE(GFSK)
Antenna Type:	Internal Antenna External Antenna
Antenna Gain:	Internal Antenna: 1dBi External Antenna: 2dBi
Power supply:	DC6V-30V

5.3 Test mode and test samples plans

TM1:	Keep the EUT in Wi-Fi link(2.4G Wi-Fi and 5G Wi-Fi) + Bluetooth link + LAN link
Remark:	The report only reflects the test data of worst mode.

5.4 Description of Support Units

Manufacturer	Description	Model	S/N	FCC ID/DoC
MERCURY	Wireless router	MW150R	12922104015	FCC ID
NAKAMICHI	Bluetooth earphone	T8	N/A	FCC ID
Skyworth	Color LCD TV	24E12HR	K026709	N/A
HUAWEI	Wireless Router	HiRouter-H1	N/A	N/A

5.5 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%)
Conducted Emission (9kHz ~ 30MHz)	±1.60 dB
Radiated Emission (9kHz ~ 30MHz)	±3.12 dB
Radiated Emission (30MHz ~ 1000MHz)	±4.32 dB
Radiated Emission (1GHz ~ 18GHz)	±5.16 dB
Radiated Emission (18GHz ~ 26.5GHz)	±3.20 dB

5.6 Description of Cable Used

N/A

5.7 Laboratory Facility

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

- **FCC- Designation No.: CN1211**

Shenzhen ZhongjianNanfang Testing Co., Ltd.has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

- **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber of Shenzhen ZhongjianNanfang Testing Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: <https://portal.a2la.org/scopepdf/4346-01.pdf>

5.8 Laboratory Location

Shenzhen ZhongjianNanfang Testing Co.,Ltd. Address: No.110~116, Building B, Jinyuan Business Building, Xixiang Road, Bao'an District, Shenzhen, Guangdong, China Tel: +86-755-23118282, Fax:+86-755-23116366 Email: info@ccis-cb.com, Website: http://www.ccis-cb.com
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5.9 Monitoring of EUT for the Immunity Test

Visual:	Monitored the display of EUT
Sound:	Monitored the sound of EUT
Other:	Monitored the data link of EUT

5.10 Test Instruments list

Radiated Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
3m SAC	SAEMC	9m*6m*6m	966	07-22-2017	07-21-2020
				07-22-2020	07-21-2023
BiConiLog Antenna	SCHWARZBECK	VULB9163	497	03-07-2019	03-06-2020
				03-07-2020	03-06-2021
Horn Antenna	SCHWARZBECK	BBHA9120D	916	03-07-2019	03-06-2020
				03-07-2020	03-06-2021
EMI Test Software	AUDIX	E3	Version: 6.110919b		
Pre-amplifier	HP	8447D	2944A09358	03-07-2019	03-06-2020
				03-07-2020	03-06-2021
Pre-amplifier	CD	PAP-1G18	11804	03-07-2019	03-06-2020
				03-07-2020	03-06-2021
Spectrum analyzer	Rohde & Schwarz	FSP30	101454	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
EMI Test Receiver	Rohde & Schwarz	ESRP7	101070	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
Simulated Station	Anritsu	MT8820C	6201026545	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
Cable	ZDECL	Z108-NJ-NJ-81	1608458	03-07-2019	03-06-2020
				03-07-2020	03-06-2021
Cable	MICRO-COAX	MFR64639	K10742-5	03-07-2019	03-06-2020
				03-07-2020	03-06-2021
Cable	SUHNER	SUCAFLEX100	58193/4PE	03-07-2019	03-06-2020
				03-07-2020	03-06-2021

Conducted Emission:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
EMI Test Receiver	Rohde & Schwarz	ESCI	101189	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
Pulse Limiter	SCHWARZBECK	OSRAM 2306	9731	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
LISN	CHASE	MN2050D	1447	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
LISN	Rohde & Schwarz	ESH3-Z5	8438621/010	07-21-2017	07-20-2020
				07-21-2020	07-20-2021
ISN	Schwarzbeck	CAT3 8158	#96	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
ISN	Schwarzbeck	CAT5 8158	#166	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
ISN	Schwarzbeck	NTFM 8158	#126	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
Cable	HP	10503A	N/A	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
EMI Test Software	AUDIX	E3	Version: 6.110919b		

ESD:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
ESD Simulator	Haefely	ONYX30	183900	03-17-2019	03-16-2020
				03-17-2020	03-16-2021

Radiated Immunity:					
Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (mm-dd-yy)	Cal. Due date (mm-dd-yy)
Signal Generator	Rohde & Schwarz	SMR20	1104.002.20	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
RF Amplifier 80M-1GHz	Amplifier Research	AR 150W1000	115243	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
RF Amplifier 1GHz-4.2GHz	Amplifier Research	AR 25S1G4AM1	145863	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
RF Amplifier 4GHz-6GHz	Amplifier Research	35S4G8A	247443	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
Power Meter	Rohde & Schwarz	NRVS	1020.1809.02	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
Software EMC32	Rohde & Schwarz	EMC32-S	N/A	N/A	N/A
Log-periodic Antenna	Amplifier Research	AT1080	3654	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
Antenna Tripod	Amplifier Research	TP1000A	7412	N/A	N/A
High Gain Horn Antenna	Amplifier Research	AT4002A	6987	03-05-2019	03-04-2020
				03-05-2020	03-04-2021
Nexus Conduuining Amplifier	B&K	2690	3003552	N/A	N/A
MUTH Simulator	B&K	4227	N/A	N/A	N/A
Sound Level Calibrator	B&K	4231	N/A	N/A	N/A
Audio Analyzer	Rohde & Schwarz	UPL 16	100150	03-05-2019	03-04-2020
				03-05-2020	03-04-2021

6 EMC Requirements Specification in ETSI EN 301489

6.1 EMI (Emission)

6.1.1 Radiated Emission

Test Requirement:	ETSI EN301 489-1								
Test Method:	EN55032								
Test Frequency Range:	30MHz to 6GHz								
Test Distance:	3m								
Receiver setup:	Frequency	Detector	RBW	VBW	Remark				
	30MHz-1GHz	Quasi-peak	100kHz	300kHz	QP Value				
	Above 1GHz	Peak	1MHz	3MHz	PK Value				
		Average	1MHz	3MHz	AV Value				
Limit:	Frequency	Limit (dBuV/m @3m)		Remark					
	30MHz-230MHz	40.0		QP Value					
	230MHz-1GHz	47.0		QP Value					
	1GHz-3GHz	50.0		AV Value					
		70.0		PK Value					
	3GHz-6GHz	54.0		AV Value					
		74.0		PK Value					
Test setup:	<p>Below 1GHz:</p> <p>Above 1GHz:</p> <p>EUT setup:</p>								
Test Procedure:	<p>30MHz to 1GHz:</p> <ol style="list-style-type: none"> The radiated emissions test was conducted in a semi-anechoic chamber. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation. Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emissions spectrum plots of the EUT. The frequencies of maximum emission were determined in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization. 								

	<p>Above 1GHz:</p> <ol style="list-style-type: none">1. The radiated emissions test was conducted in a fully-anechoic chamber.2. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.3. Before final measurements of radiated emissions, a pre-scan was performed in the spectrum mode with the peak detector to find out the maximum emission spectrum plots of the EUT.4. The frequencies of maximum emission were determined in the final radiated emissions measurement. At each frequency, the EUT was rotated 360°, and the antenna was raised and lowered from 1 to 4 meters in order to determine the maximum disturbance. Measurements were performed for both horizontal and vertical antenna polarization.
Test Instruments:	Refer to section 5.10 for details
Testmode:	Refer to section 5.3 for details
Test results:	Passed

Measurement Data:**Below 1GHz:**

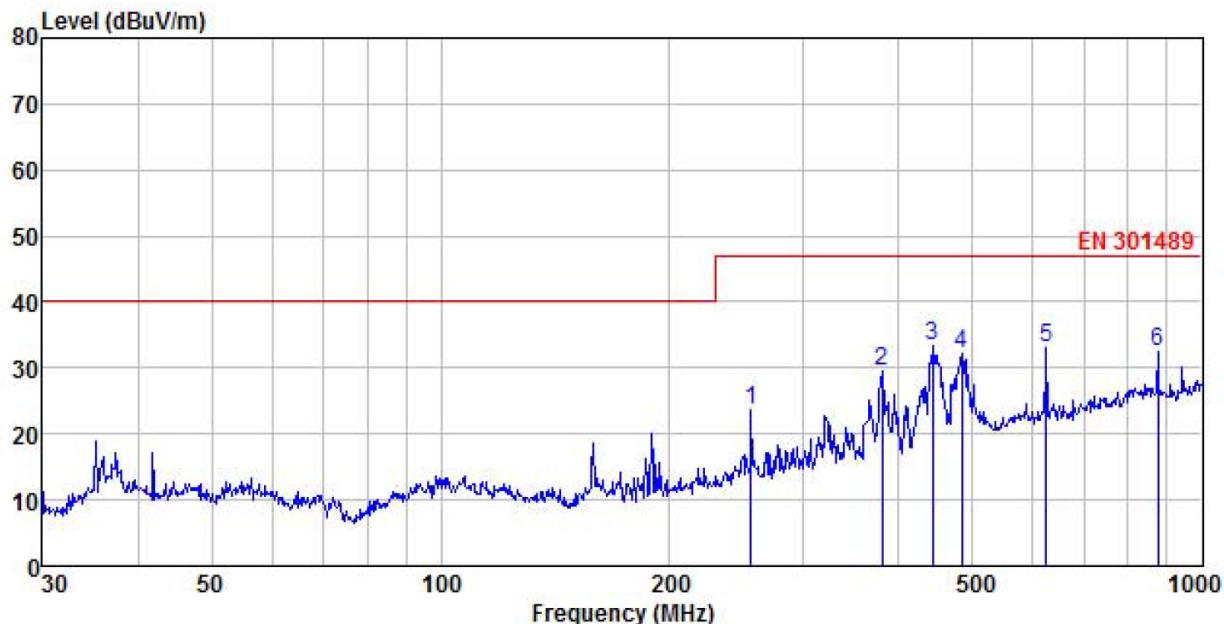
Product Name:	balenaFin		Product Model:	v1.1
Test By:	Carey		Test mode:	TM 1
Test Frequency:	30 MHz ~ 1 GHz		Polarization:	Vertical
Test Voltage:	AC 230/50Hz		Environment:	Temp: 24°C Huni: 57%

Freq	Read Antenna Level	Antenna Factor	Cable Loss	Preamp Factor	Limit Level	Line Limit	Over Line Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	158.668	42.65	9.24	2.57	29.14	25.32	40.00	-14.68 QP
2	321.061	40.81	14.03	3.01	28.50	29.35	47.00	-17.65 QP
3	389.355	41.69	15.15	3.08	28.73	31.19	47.00	-15.81 QP
4	443.294	47.35	16.33	3.18	28.86	38.00	47.00	-9.00 QP
5	483.910	45.23	17.66	3.48	28.93	37.44	47.00	-9.56 QP
6	584.790	37.03	19.17	3.92	28.99	31.13	47.00	-15.87 QP

Remark:

- Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
- The emission levels of other frequencies are very lower than the limit and not show in test report.
- The Aux Factor is a notch filter switch box loss, this item is not used.

Product Name:	balenaFin	Product Model:	v1.1
Test By:	Carey	Test mode:	TM 1
Test Frequency:	30 MHz ~ 1 GHz	Polarization:	Horizontal
Test Voltage:	AC 230/50Hz	Environment:	Temp: 24°C Huni: 57%



Freq MHz	Read Level dBuV	Antenna Factor dB/m	Cable Loss Factor dB	Preamp Level dB	Limit Line dBuV/m	Over Line dB	Remark
	MHz	dBuV	dB/m	dB	dBuV/m	dBuV/m	dB
1 255.623	36.61	12.80	2.82	28.53	23.70	47.00	-23.30 QP
2 379.914	40.21	15.04	3.09	28.69	29.65	47.00	-17.35 QP
3 443.294	42.85	16.33	3.18	28.86	33.50	47.00	-13.50 QP
4 483.910	39.91	17.66	3.48	28.93	32.12	47.00	-14.88 QP
5 625.078	38.45	19.61	3.90	28.86	33.10	47.00	-13.90 QP
6 875.247	34.01	22.55	3.95	27.94	32.57	47.00	-14.43 QP

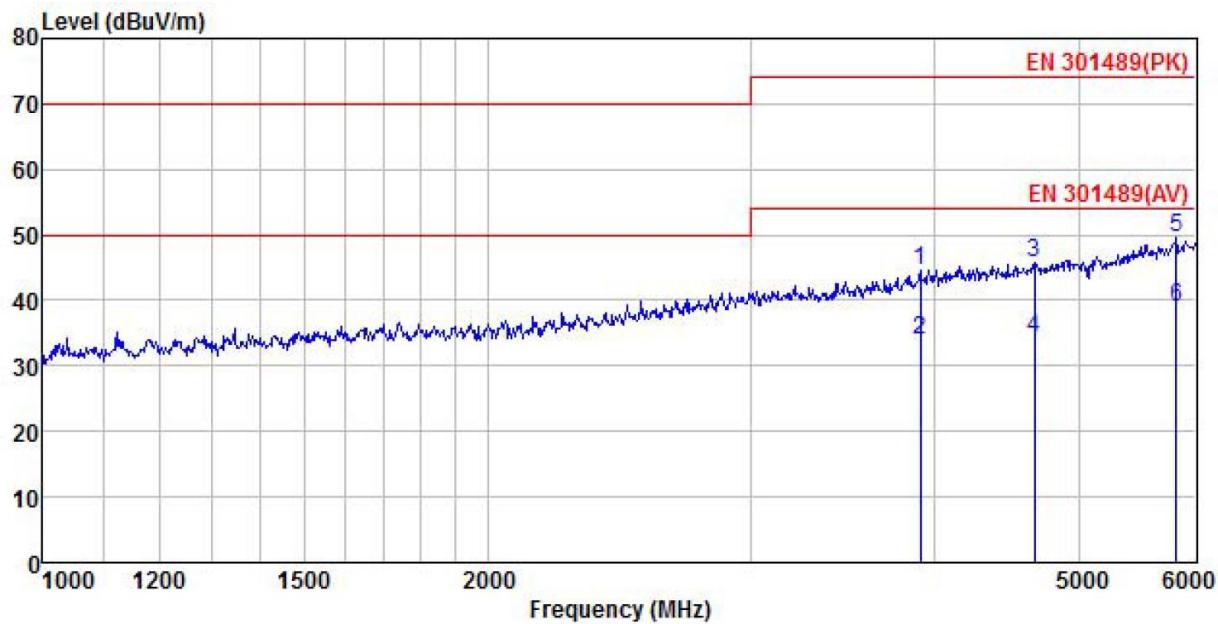
Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
2. The emission levels of other frequencies are very lower than the limit and not show in test report.
3. The Aux Factor is a notch filter switch box loss, this item is not used.

Above 1GHz:

Product Name:	balenaFin			Product Model:	v1.1																																																																												
Test By:	Carey			Test mode:	TM 1																																																																												
Test Frequency:	1 GHz ~ 6 GHz			Polarization:	Vertical																																																																												
Test Voltage:	AC 230/50Hz			Environment:	Temp: 24°C Huni: 57%																																																																												
<p>Level (dBuV/m)</p> <p>EN 301489(PK)</p> <p>EN 301489(AV)</p> <p>Frequency (MHz)</p>																																																																																	
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2">Freq</th> <th colspan="2">ReadAntenna</th> <th colspan="2">Cable Preamp</th> <th rowspan="2">Limit Line</th> <th rowspan="2">Over Limit</th> <th rowspan="2">Remark</th> </tr> <tr> <th>Freq</th> <th>Level</th> <th>Factor</th> <th>Loss</th> <th>Factor</th> </tr> <tr> <th>MHz</th> <th>dBuV</th> <th>dB/m</th> <th>dB</th> <th>dB</th> <th>dBuV/m</th> <th>dBuV/m</th> <th>dB</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>4408.687</td> <td>48.75</td> <td>30.38</td> <td>6.71</td> <td>41.97</td> <td>46.20</td> <td>74.00</td> <td>-27.80 Peak</td> </tr> <tr> <td>2</td> <td>4408.687</td> <td>37.97</td> <td>30.38</td> <td>6.71</td> <td>41.97</td> <td>35.42</td> <td>54.00</td> <td>-18.58 Average</td> </tr> <tr> <td>3</td> <td>4804.636</td> <td>48.32</td> <td>31.02</td> <td>6.80</td> <td>41.81</td> <td>46.77</td> <td>74.00</td> <td>-27.23 Peak</td> </tr> <tr> <td>4</td> <td>4804.636</td> <td>37.59</td> <td>31.02</td> <td>6.80</td> <td>41.81</td> <td>36.04</td> <td>54.00</td> <td>-17.96 Average</td> </tr> <tr> <td>5</td> <td>5696.195</td> <td>47.44</td> <td>32.64</td> <td>7.60</td> <td>41.90</td> <td>48.48</td> <td>74.00</td> <td>-25.52 Peak</td> </tr> <tr> <td>6</td> <td>5696.195</td> <td>36.91</td> <td>32.64</td> <td>7.60</td> <td>41.90</td> <td>37.95</td> <td>54.00</td> <td>-16.05 Average</td> </tr> </tbody> </table>							Freq	ReadAntenna		Cable Preamp		Limit Line	Over Limit	Remark	Freq	Level	Factor	Loss	Factor	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	1	4408.687	48.75	30.38	6.71	41.97	46.20	74.00	-27.80 Peak	2	4408.687	37.97	30.38	6.71	41.97	35.42	54.00	-18.58 Average	3	4804.636	48.32	31.02	6.80	41.81	46.77	74.00	-27.23 Peak	4	4804.636	37.59	31.02	6.80	41.81	36.04	54.00	-17.96 Average	5	5696.195	47.44	32.64	7.60	41.90	48.48	74.00	-25.52 Peak	6	5696.195	36.91	32.64	7.60	41.90	37.95	54.00	-16.05 Average
Freq	ReadAntenna		Cable Preamp		Limit Line	Over Limit		Remark																																																																									
	Freq	Level	Factor	Loss			Factor																																																																										
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1	4408.687	48.75	30.38	6.71	41.97	46.20	74.00	-27.80 Peak																																																																									
2	4408.687	37.97	30.38	6.71	41.97	35.42	54.00	-18.58 Average																																																																									
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5	5696.195	47.44	32.64	7.60	41.90	48.48	74.00	-25.52 Peak																																																																									
6	5696.195	36.91	32.64	7.60	41.90	37.95	54.00	-16.05 Average																																																																									
<p>Remark:</p> <ol style="list-style-type: none"> Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor. The emission levels of other frequencies are very lower than the limit and not show in test report. 																																																																																	

Product Name:	balenaFin	Product Model:	v1.1
Test By:	Carey	Test mode:	TM 1
Test Frequency:	1 GHz ~ 6 GHz	Polarization:	Horizontal
Test Voltage:	AC 230/50Hz	Environment:	Temp: 24°C Huni: 57%



Freq	Read	Antenna	Cable	Preamp	Limit	Over	Remark	
	Freq	Level	Factor	Loss	Factor	Line	Line	
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB
1	3909.967	48.06	30.01	6.10	41.80	44.57	74.00	-29.43 Peak
2	3909.967	37.35	30.01	6.10	41.80	33.86	54.00	-20.14 Average
3	4668.852	47.81	30.75	6.87	42.03	45.81	74.00	-28.19 Peak
4	4668.852	36.18	30.75	6.87	42.03	34.18	54.00	-19.82 Average
5	5819.996	48.34	32.66	7.89	42.02	49.62	74.00	-24.38 Peak
6	5819.996	37.72	32.66	7.89	42.02	39.00	54.00	-15.00 Average

Remark:

- Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor.
- The emission levels of other frequencies are very lower than the limit and not show in test report.

6.1.2 Conducted Emissions

Test Requirement:	ETSI EN301 489-1		
Test Method:	EN 55032		
Test Frequency Range:	150kHz to 30MHz		
Class / Severity:	Class B		
Receiver setup:	RBW=9kHz, VBW=30kHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
		0.15-0.5	66 to 56*
		0.5-5	56
	5-30	60	50
	* Decreases with the logarithm of the frequency.		
Test setup:	<p style="text-align: center;">Reference Plane</p> <p><i>Remark:</i> E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p>		
Test procedure	<p>The E.U.T and simulators are connected to the main power through a line impedance stabilization network(L.I.S.N.). Which provide a 50ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs). Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to EN55032 Class B on conducted measurement.</p>		
Test Instruments:	Refer to section 5.10 for details		
Test mode:	Refer to section 5.3 for details		
Test results:	Passed		

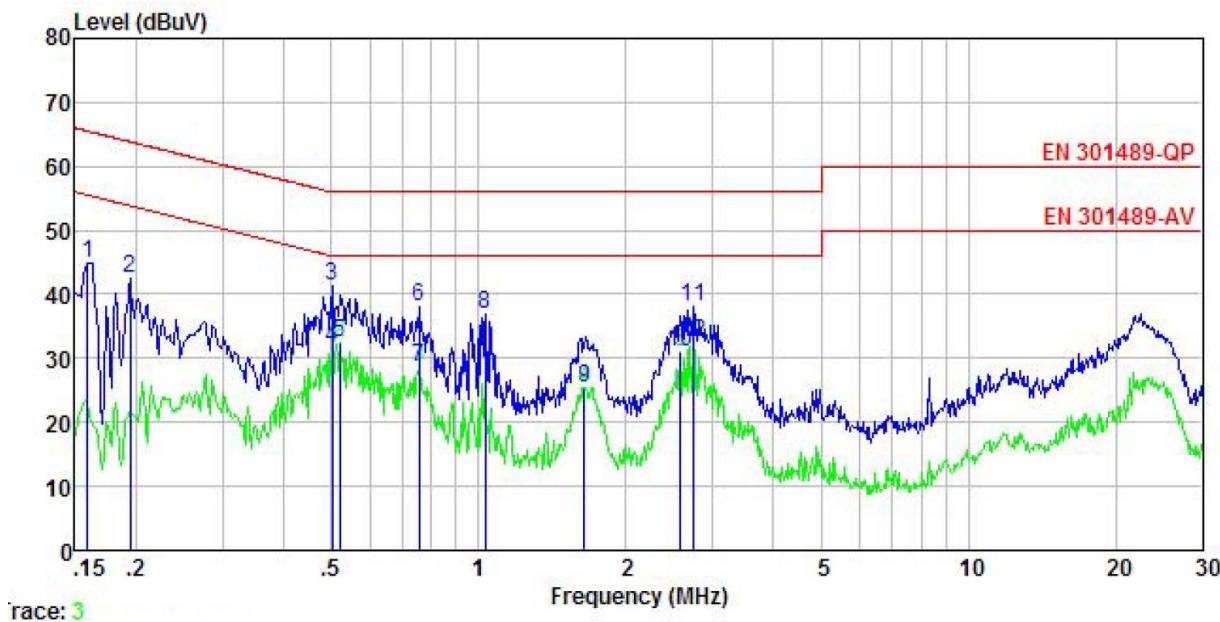
Measurement Data:

Product name:	balenaFin			Product model:	v1.1			
Test by:	Carey			Test mode:	TM 1			
Test frequency:	150 kHz ~ 30 MHz			Phase:	Line			
Test voltage:	AC 230 V/50 Hz			Environment:	Temp: 22.5°C Huni: 55%			
Freq	Read Level	LISN Factor	Aux Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB	dB	dB	dBuV	dBuV	dB	
1	0.154	37.09	-0.45	-0.06	10.78	47.36	65.78	-18.42 QP
2	0.513	30.29	-0.39	-0.35	10.76	40.31	56.00	-15.69 QP
3	0.535	21.99	-0.39	-0.36	10.76	32.00	46.00	-14.00 Average
4	1.021	26.84	-0.38	0.44	10.87	37.77	56.00	-18.23 QP
5	1.021	17.26	-0.38	0.44	10.87	28.19	46.00	-17.81 Average
6	2.736	20.60	-0.43	-0.23	10.93	30.87	46.00	-15.13 Average
7	2.946	34.86	-0.44	-0.21	10.92	45.13	56.00	-10.87 QP
8	2.946	23.28	-0.44	-0.21	10.92	33.55	46.00	-12.45 Average
9	8.822	28.22	-0.58	1.72	10.89	40.25	60.00	-19.75 QP
10	8.822	17.76	-0.58	1.72	10.89	29.79	50.00	-20.21 Average
11	12.784	28.74	-0.65	2.95	10.92	41.96	60.00	-18.04 QP
12	12.784	20.84	-0.65	2.95	10.92	34.06	50.00	-15.94 Average

Notes:

- An initial pre-scan was performed on the line and neutral lines with peak detector.
- Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
- Final Level = Receiver Read level + LISN Factor + Cable Loss + Aux Factor.

Product name:	balenaFin	Product model:	v1.1
Test by:	Carey	Test mode:	TM 1
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	AC 230 V/50 Hz	Environment:	Temp: 22.5°C Huni: 55%

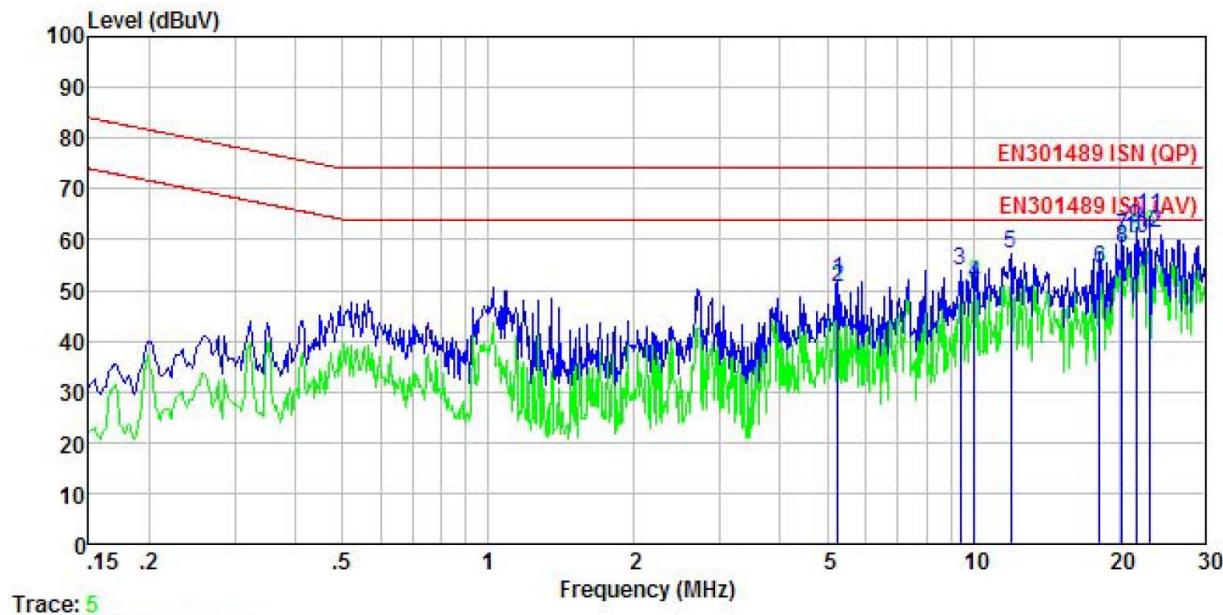


Freq	Read	LISN	Aux	Cable	Limit	Over	Remark
	Level	Factor	Factor	Loss			
	MHz	dBuV	dB	dB	dBuV	dBuV	dB
1	0.159	34.83	-0.68	0.01	10.77	44.93	65.52 -20.59 QP
2	0.194	32.30	-0.69	0.00	10.76	42.37	63.84 -21.47 QP
3	0.502	31.28	-0.65	0.03	10.76	41.42	56.00 -14.58 QP
4	0.502	21.56	-0.65	0.03	10.76	31.70	46.00 -14.30 Average
5	0.521	22.32	-0.65	0.03	10.76	32.46	46.00 -13.54 Average
6	0.755	27.83	-0.64	0.05	10.79	38.03	56.00 -17.97 QP
7	0.755	18.54	-0.64	0.05	10.79	28.74	46.00 -17.26 Average
8	1.032	26.50	-0.63	0.08	10.87	36.82	56.00 -19.18 QP
9	1.645	15.08	-0.66	0.14	10.93	25.49	46.00 -20.51 Average
10	2.581	20.38	-0.67	0.26	10.93	30.90	46.00 -15.10 Average
11	2.736	27.53	-0.67	0.28	10.93	38.07	56.00 -17.93 QP
12	2.736	22.00	-0.67	0.28	10.93	32.54	46.00 -13.46 Average

Notes:

- An initial pre-scan was performed on the line and neutral lines with peak detector.
- Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
- Final Level = Receiver Read level + LISN Factor + Cable Loss + Aux Factor.

Product name:	balenaFin	Product model:	v1.1
Test by:	Carey	Test mode:	TM 1
Test frequency:	150 kHz ~ 30 MHz	Phase:	/
Test voltage:	AC 230 V/50 Hz	Environment:	Temp: 22.5°C Huni: 55%



Freq MHz	Read Level dBuV	LISN Factor	Aux Factor	Cable Loss	Level dB	Limit Line dBuV	Over Limit dB	Remark
					dBuV			
1	5.249	31.78	9.55	0.00	10.84	52.17	74.00	-21.83 QP
2	5.249	30.07	9.55	0.00	10.84	50.46	64.00	-13.54 Average
3	9.401	33.43	9.54	0.00	10.92	53.89	74.00	-20.11 QP
4	10.072	30.68	9.54	0.00	10.94	51.16	64.00	-12.84 Average
5	11.933	36.57	9.53	0.00	10.92	57.02	74.00	-16.98 QP
6	18.232	33.97	9.51	0.00	10.92	54.40	64.00	-9.60 Average
7	20.270	39.92	9.51	0.00	10.93	60.36	74.00	-13.64 QP
8	20.270	37.77	9.51	0.00	10.93	58.21	64.00	-5.79 Average
9	21.715	42.03	9.51	0.00	10.91	62.45	74.00	-11.55 QP
10	21.715	39.67	9.51	0.00	10.91	60.09	64.00	-3.91 Average
11	23.140	44.09	9.51	0.00	10.89	64.49	74.00	-9.51 QP
12	23.140	41.00	9.51	0.00	10.89	61.40	64.00	-2.60 Average

Notes:

- An initial pre-scan was performed on the line and neutral lines with peak detector.
- Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
- Final Level = Receiver Read level + LISN Factor + Cable Loss + Aux Factor.

6.1.3 Harmonics Test Results

Test Requirement:	ETSI EN 301 489-1/17: EN61000-3-2
Test Method:	N/A: See Remark Below
Remark:	<p>There is no need for Harmonics test to be performed on this product (rated power is less than 75W) in accordance with EN 61000-3-2.</p> <p>For further details, please refer to Clause 7, Note 1 of EN 61000-3-2 which states:</p> <p>“For the following categories of equipment limits are not specified in this edition of the standard.</p> <p>Note 1: Equipment with a rated power of 75W or less, other than lighting equipment.”</p>

6.1.4 Flicker Test Results

Test Requirement:	ETSI EN 301 489-1/17: EN61000-3-3
Test Method:	N/A: See Remark Below
Remark:	<ol style="list-style-type: none">1. The appropriate requirements of EN 61000-3-3 [9] for voltage fluctuations and flicker apply for equipment covered by the scope of the present document with an input current up to and including 16A per phase. For equipment with an input current of greater than 16A per phase EN 61000-3-11 [12] applies.2. As the section 6.1 of EN 61000-3-3, “Devices and Equipment that do (with the utmost probability) not generate relevant voltage fluctuations or flicker need not to be tested”.

6.2 EMS (Immunity)

Performance Criteria of ETSI EN 301 489-1/17, sub clause 6

Criteria	Performance Criteria of EN 301 489-1 clause 6
CT/CR	<p>During the test, the equipment shall:</p> <ul style="list-style-type: none">• continue to operate as intended;• not unintentionally transmit;• not unintentionally change its operating state;• not unintentionally change critical stored data.
TT/TR	<p>For all ports and transient phenomena with the exception described below, the following applies:</p> <ul style="list-style-type: none">• The application of the transient phenomena shall not result in a change of the mode of operation (e.g. unintended transmission) or the loss of critical stored data.• After application of the transient phenomena, the equipment shall operate as intended. <p>For surges applied to symmetrically operated wired network ports intended to be connected directly to outdoor lines the following criteria applies:</p> <ul style="list-style-type: none">• For products with only one symmetrical port intended for connection to outdoor lines, loss of function is allowed, provided the function is self-recoverable, or can be otherwise restored. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.• For products with more than one symmetrical port intended for connection to outdoor lines, loss of function on the port under test is allowed, provided the function is self-recoverable. Information stored in non-volatile memory, or protected by a battery backup, shall not be lost.

Criteria	Performance Criteria of EN 301 489-17 clause 6
CT	The performance criteria A shall apply. Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an ACKnowledgement (ACK) or Not ACKnowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.
TT	The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration, for which performance criteria C shall apply. Tests shall be repeated with the EUT in standby mode (if applicable) to ensure that unintentional transmission does not occur. In systems using acknowledgement signals, it is recognized that an acknowledgement (ACK) or not-acknowledgement (NACK) transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.
CR	The performance criteria A shall apply. Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.
TR	The performance criteria B shall apply, except for voltage dips of 100 ms and voltage interruptions of 5 000 ms duration for which performance criteria C shall apply. Where the EUT is a transceiver, under no circumstances, shall the transmitter operate unintentionally during the test. In systems using acknowledgement signals, it is recognized that an ACK or NACK transmission may occur, and steps should be taken to ensure that any transmission resulting from the application of the test is correctly interpreted.

Table 1: Performance criteria

Criteria	During test	After test (i.e. as a result of the application of the test)
A	Shall operate as intended. (see note). Shall be no loss of function. Shall be no unintentional transmissions.	Shall operate as intended. Shall be no degradation of performance. Shall be no loss of function. Shall be no loss of critical stored data.
B	May be loss of function.	Functions shall be self-recoverable. Shall operate as intended after recovering. Shall be no loss of critical stored data.
C	May be loss of function.	Functions shall be recoverable by the operator. Shall operate as intended after recovering. Shall be no loss of critical stored data.

NOTE: Operate as intended during the test allows a level of degradation in accordance with clause 6.2.2.

6.2.2 Minimum performance level

For equipment that supports a PER or FER, the minimum performance level shall be a PER or FER less than or equal to 10 %.

For equipment that does not support a PER or a FER, the minimum performance level shall be no loss of the wireless transmission function needed for the intended use of the equipment.

6.2.1 Electrostatic Discharge

Test Requirement:	ETSI EN301489-1					
Test Method:	EN61000-4-2					
Discharge Voltage:	Contact Discharge, HCP and VCP: $\pm 2\text{kV}$, $\pm 4\text{kV}$, Air Discharge: $\pm 2\text{kV}$, $\pm 4\text{kV}$, $\pm 8\text{kV}$					
Polarity:	Positive & Negative					
Number of Discharge:	Contact Discharge: Minimum 25 times at each test point, Air Discharge: Minimum 10 times at each test point.					
Discharge Mode:	Single Discharge					
Discharge Period:	1 second minimum					
Testsetup:	<p>Ground Reference Plane</p>					
Test Procedure:	<p>1) Air discharge: The test was applied on non-conductive surfaces of EUT. The round discharge tip of the discharge electrode was approached as fast as possible to touch the EUT. After each discharge, the discharge electrode was removed from the EUT. The generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. This procedure was repeated until all the air discharge completed</p> <p>2) Contact discharge: The test was applied on conductive surfaces of EUT. the generator was re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. the tip of the discharge electrode was touch the EUT before the discharge switch was operated.</p> <p>3) Indirect discharge for horizontal coupling plane At least 10 single discharges shall be applied at the front edge of each HCP opposite the centre point of each unit of the EUT and 0.1m from the front of the EUT. The long axis of the discharge electrode shall be in the plane of the HCP and perpendicular to its front edge during the discharge.Consideration should be given to exposing all sides of the EUT.</p> <p>4) Indirect discharge for vertical coupling plane At least 10 single discharges were applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, was placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges were applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.</p>					
Testenvironment:	Temp.:	26°C	Humid.:	54%	Press.:	101kPa
Test Instruments:	Refer to section 5.10 for details					
Test mode:	Refer to section 5.3 for details					
Test results:	Passed					

Measurement Record:

Test mode:	TM 1			
Test points:	I: N/A			
	II: N/A			
Direct discharge				
Discharge Voltage (KV)	Type of discharge	Test points	Observations (Performance Criterion)	Result
± 2,± 4	Contact	II	TT/TR	N/A
± 2,± 4,± 8	Air	I	TT/TR	N/A
Indirect discharge				
Discharge Voltage (KV)	Type of discharge	Test points	Observation Performance	Result
± 2,± 4	HCP-Bottom/Top/ Front/Back/Left/Right	Edge of the HCP	TT/TR	Pass
± 2,± 4	VCP-Front/Back /Left/Right	Center of the VCP	TT/TR	Pass

6.2.2 Radiated Immunity

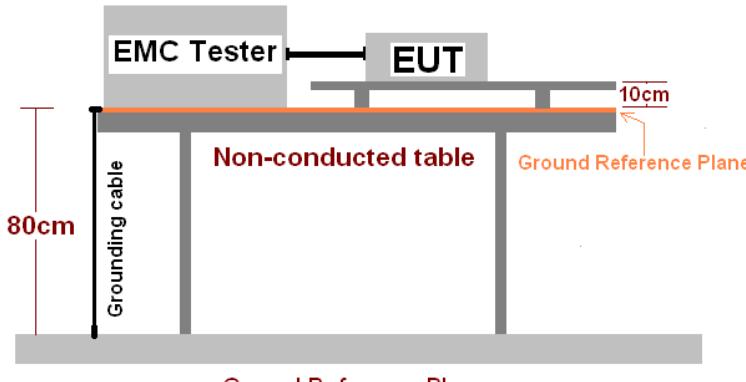
Test Requirement:	ETSI EN 301 489-1					
Test Method:	EN61000-4-3					
Frequency range:	80MHz to 6GHz					
Test Level:	3V/m					
Modulation:	80%, 1kHz Amplitude Modulation					
Testsetup:						
Test Procedure:	<ol style="list-style-type: none"> For table-top equipment, the EUT was placed in the chamber on a non-conductive table 0.8m high. For arrangement of floor-standing equipment, the EUT was mounted on a non-conductive support 0.1m above the supporting plane. For human body-mounted equipment, the EUT may be tested in the same manner as table-top items. If possible, a minimum of 1 m of cable is exposed to the electromagnetic field. Excess length of cables interconnecting units of the EUT shall be bundled low-inductively in the approximate center of the cable to form a bundle 30 cm to 40 cm in length. The EUT was initially placed with one face coincident with the calibration plane. The EUT face being illuminated was contained within the UFA (Uniform Field Area). The frequency ranges to be considered were swept with the signal modulated and pausing to adjust the RF signal level or to switch oscillators and antennas as necessary. Where the frequency range was swept incrementally, the step size was not exceed 1 % of the preceding frequency value. The dwell time of the amplitude modulated carrier at each frequency was not be less than the time necessary for the EUT to be exercised and to respond, and was not less than 0,5 s. The test normally was performed with the generating antenna facing each side of the EUT. The polarization of the field generated by each antenna necessitates testing each selected side twice, once with the antenna positioned vertically and again with the antenna positioned horizontally. The EUT was performed in a configuration to actual installation conditions, a video camera and/or audio monitor were used to monitor the performance of the EUT. 					
Test environment:	Temp.:	26°C	Humid.:	54%	Press.:	101kPa
Test Instruments:	Refer to section 5.10 for details					
Test mode:	Refer to section 5.3 for details					
Test results:	Passed					

Measurement Record:

Test mode: TM 1

Frequency	Level	Modulation	Antenna Polarization	EUT Face	Observations (Performance Criterion)	Result		
80MHz-6GHz	3V/m	1kHz, 80% Amp. Mod, 1% increment, dwell time=3seconds	V	Front	CT/CR	Pass		
			H					
			V	Rear				
			H					
			V	Left				
			H					
			V	Right				
			H					
			V	Top				
			H					
			V	Bottom				
			H					

6.2.3 Electrical Fast Transients

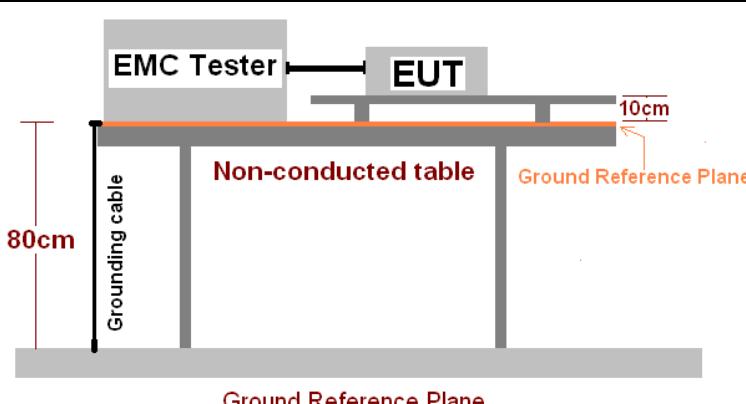
Test Requirement:	ETSI EN 301 489-1					
Test Method:	EN 61000-4-4					
Test Level:	$\pm 1.0\text{kV}$ on AC port $\pm 0.5\text{kV}$ on wired network ports					
Polarity:	Positive & Negative					
Repetition Frequency:	5kHz					
Burst Duration:	15ms					
Burst Period:	300ms					
Test Duration:	2 minute per level & polarity					
Testsetup:						
Test Procedure:	<p>The EUT and its simulators were placed on the ground reference plane and were insulated from it by a wood support 0.1m + 0.01m thick. The ground reference plane was a 1m*1m metallic sheet with 0.65mm minimum thickness. This reference ground plane was positioned beyond the EUT by at least 0.1m on all sides and the minimum distance between EUT and all other conductive structures, except the ground plane was more than 0.5m. All cables to the EUT were placed on the wood support, cables not subject to EFT/B were routed as far as possible from the cable under test to minimize the coupling between the cables.</p> <p>Test on Signal Ports, Telecommunication Ports and Control Ports: The EFT interference signal is through a coupling clamp device coupled to the signal and control lines of the EUT with burst noise for 2 minutes.</p> <p>Test on power supply ports: The EUT is connected to the power mains through a coupling device that directly couples the EFT/B interference signal. Each of the Line and Neutral conductors is impressed with burst noise for 2 minutes. The length of the signal and power lines between the coupling device and the EUT is 0.5m</p>					
Test environment:	Temp.:	26°C	Humid.:	54%	Press.:	101kPa
Test Instruments:	Refer to section 5.10 for details					
Test mode:	Refer to section 5.3 for details					
Test results:	Passed					

Measurement Record:

Test mode: TM 1

Lead under Test	Level(kV)	Coupling Direct/Clamp	Observations (Performance Criterion)	Result
LAN port	± 0.5	Direct	TT/TR	Pass

6.2.4 Surge

Test Requirement:	ETSI EN 301 489-1					
Test Method:	EN61000-4-5					
Test Level:	$\pm 1\text{kV}$ Live to Neutral: Differential mode $\pm 2\text{kV}$ Live to Earth or Neutral to Earth: Common mode $\pm 0.5\text{kV}$ on wired network ports					
Polarity:	Positive & Negative					
Test Interval:	60s between each surge					
No. of surges:	5 positive, 5 negative at 0° , 90° , 180° , 270° .					
Performance Criterion:	B					
Testsetup:						
Test Procedure:	<ol style="list-style-type: none"> For line-to-line coupling mode, provide a $1\text{kV} 1.2/50\mu\text{s}$ voltage surge (at open-circuit condition) and $8/20\mu\text{s}$ current surge to EUT selected points, and for active line / neutral lines to ground are same except test level is 2kV. At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are applied during test. Different phase angles are done individually. Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test. 					
Testenvironment:	Temp.:	26°C	Humid.:	53%	Press.:	101kPa
Test Instruments:	Refer to section 5.10 for details					
Test mode:	Refer to section 5.3 for details					
Test results:	Passed					

Measurement Record:

Test mode: TM 1

Location	Level(kV)	Pulse No	Surge Interval	Phase(deg)	Observations (Performance Criterion)	Result
LAN port	± 0.5	5	60s	/	TT/TR	Pass

6.2.5 Injected Currents susceptibility Test

Test Requirement:	ETSI EN301489-1					
Test Method:	EN61000-4-6					
Frequency range:	0.15MHz to 80MHz					
Test Level:	3V rms on AC Ports (unmodulated emf into 150 Ω)					
Modulation:	80%, 1kHz Amplitude Modulation					
Testsetup:	<p>Shielding Room</p> <p>The diagram shows a 'Shielding Room' setup. On the left, a 'Signal Generator' and 'Power Amplifier' are connected to a 'Non-conducted Table'. A 'Fixed Pad' is connected to the table. A 'CDN' (coupling and decoupling device) is placed on the ground reference plane about 0.3m from the EUT. The EUT is placed on an 'Insulating Support' 0.1m high above the ground reference plane. The distance between the CDN and the EUT is 10cm. Cables between the CDN and EUT are as short as possible.</p>					
Test Procedure:	<ol style="list-style-type: none"> Let the EUT work in test mode and test it. The EUT are placed on an insulating support 0.1m high above a groundreference plane. CDN (coupling and decoupling device) is placed on theground plane about 0.3m from EUT. Cables between CDN and EUT are asshort as possible, and their height above the ground reference plane shall bebetween 30 and 50 mm (where possible). The disturbance signal described below is injected to EUT through CDN. The EUT operates within its operational mode(s) under intended climaticconditions after power on. The frequency range is swept from 0.150MHz to 80MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 1kHz sinewave. The rate of sweep shall not exceed 1.5×10^{-3} decades/s. Where the frequency isswept incrementally; the step size shall not exceed 1% of the start andthereafter 1% of the preceding frequency value. Recording the EUT operating situation during compliance testing and decidethe EUT immunity criterion. 					
Testenvironment:	Temp.:	26°C	Humid.:	53%	Press.:	101kPa
Test Instruments:	Refer to section 5.10 for details					
Test mode:	Refer to section 5.3 for details					
Test results:	Passed					

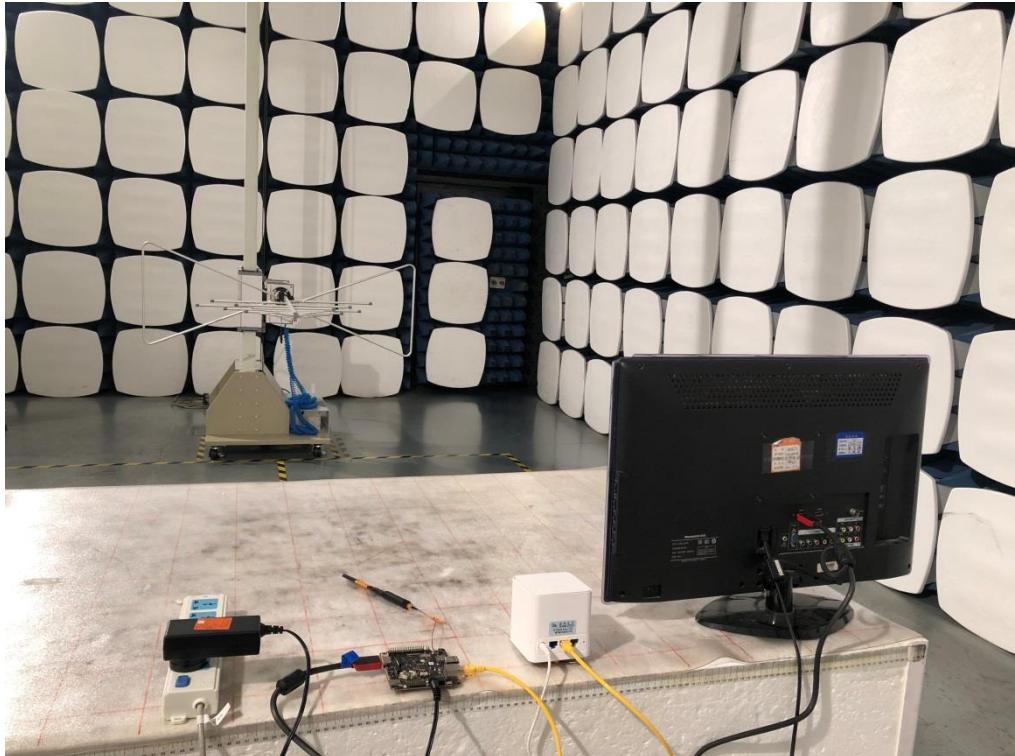
Measurement Record:

Test mode: TM 1

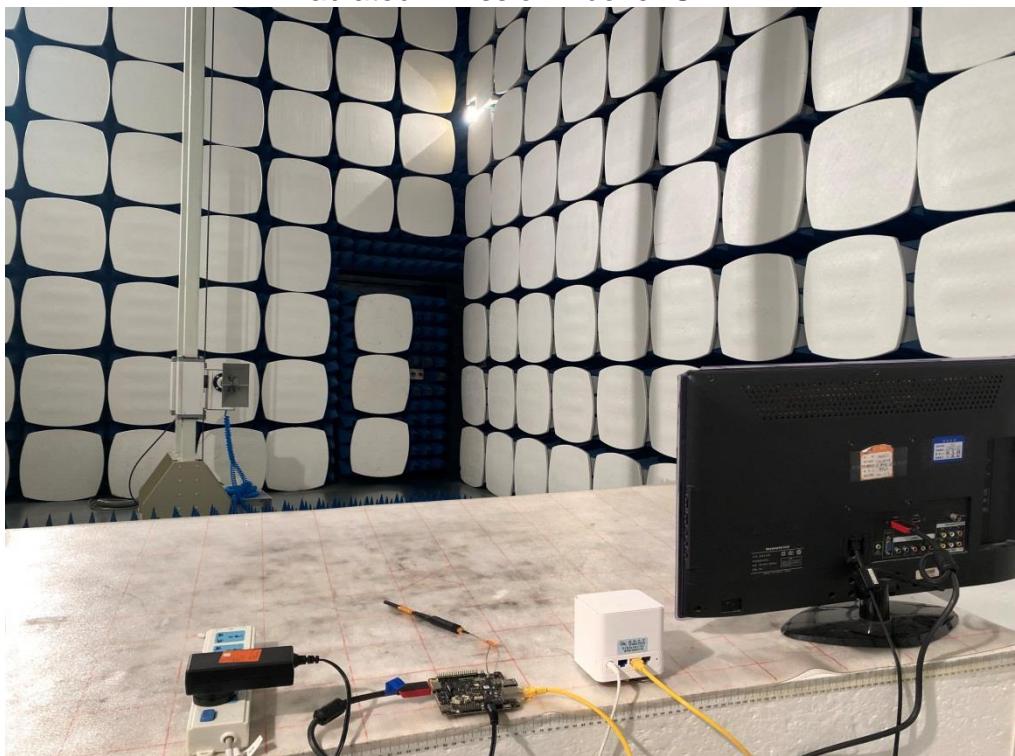
Frequency	Injected Position	Test Level	Modulation	Step Size	Dwell Time	Observations (Performance Criterion)	Result
150kHz to 80MHz	LAN Port	3Vrms	80%, 1kHz Amp. Mod.	1%	2s	CT/CR	Pass

7 Test Setup Photo

Radiated Emission Below1GHz



Radiated Emission Above1GHz

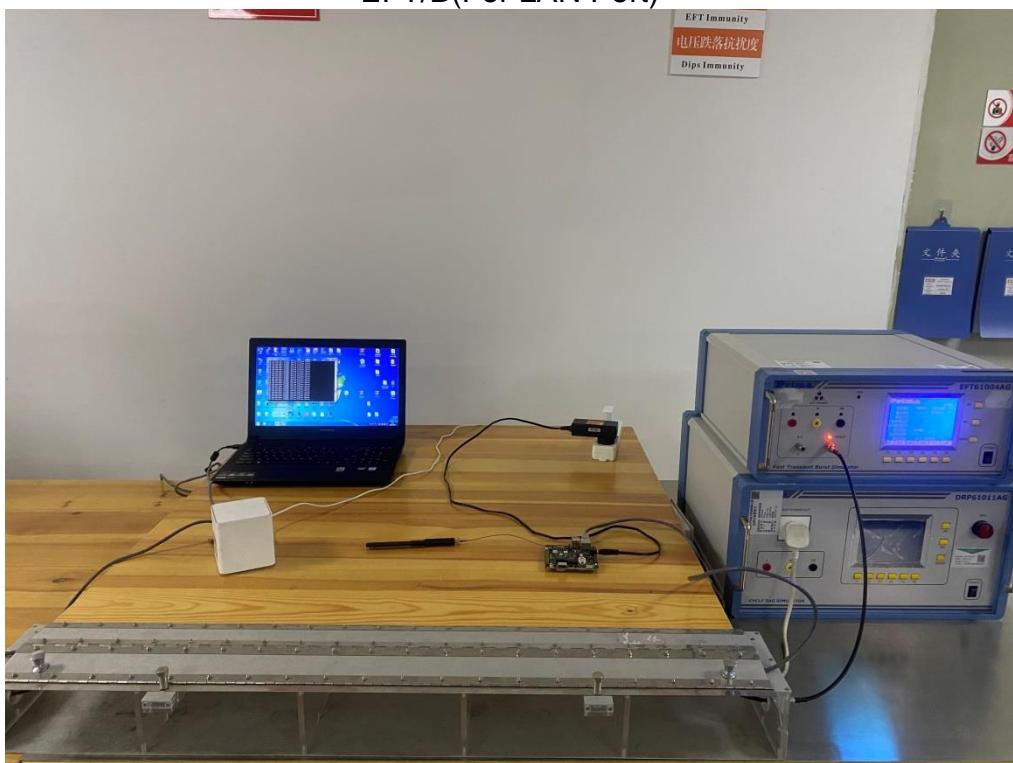
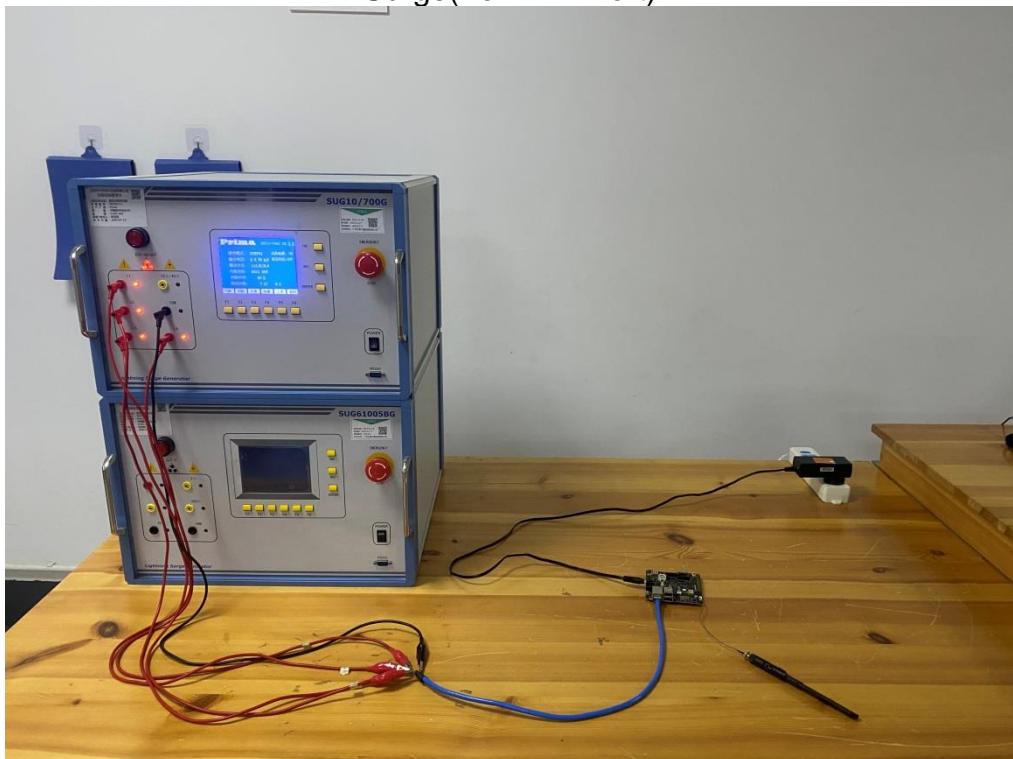


Conducted Emission

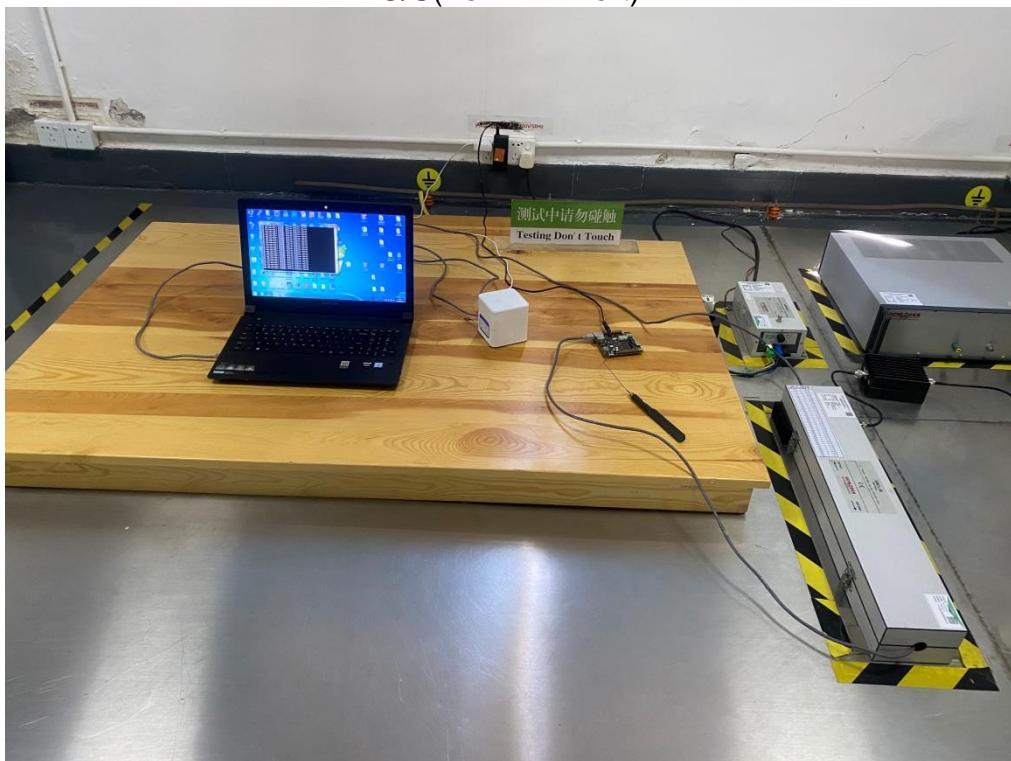


R/S

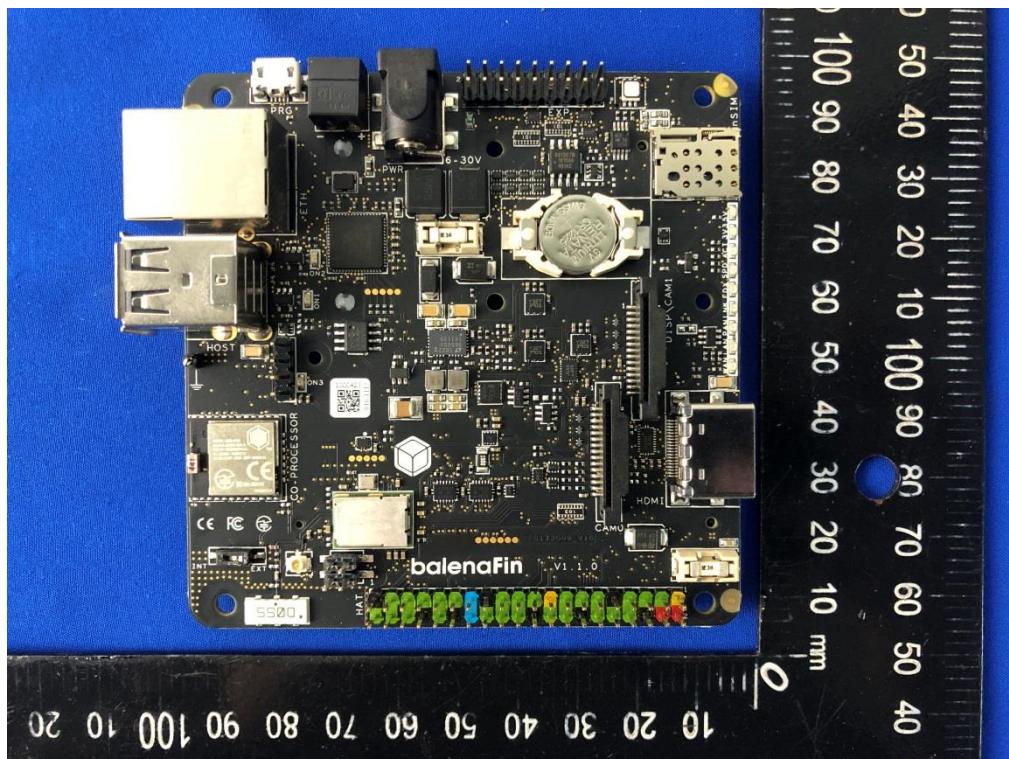


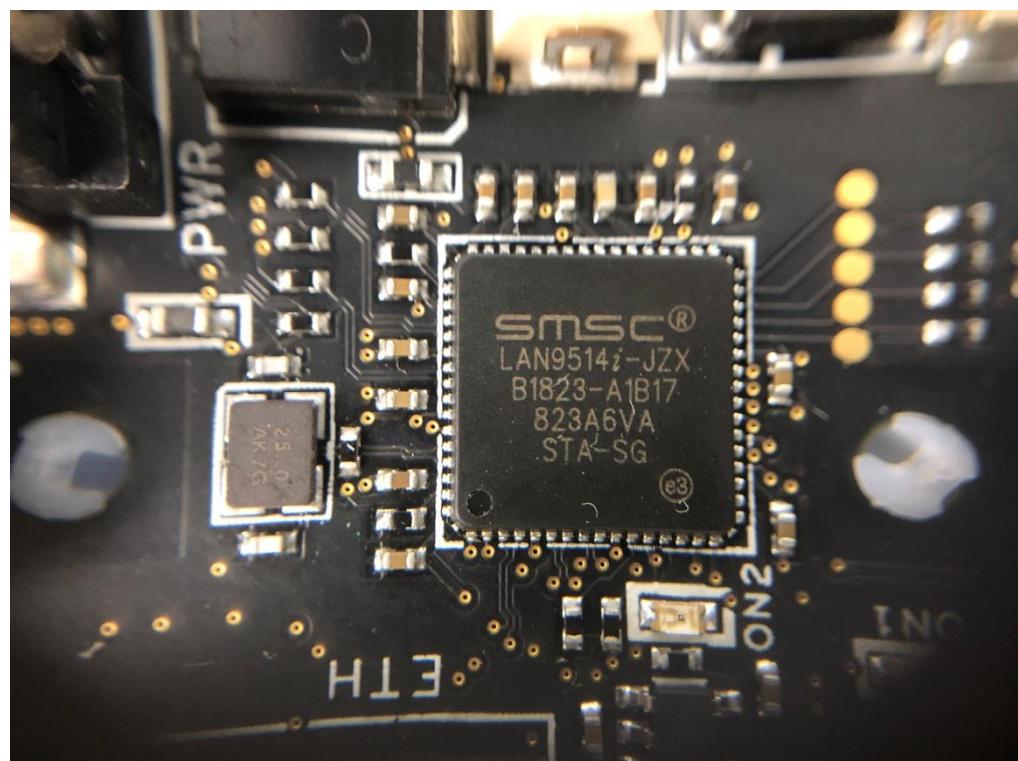
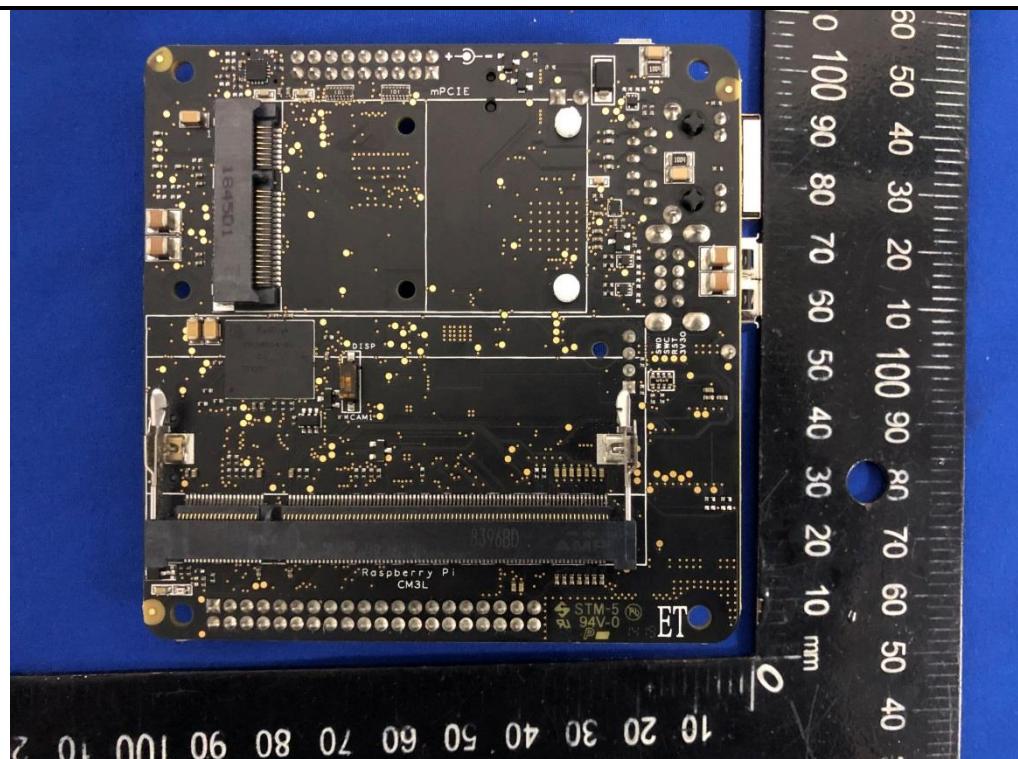
EFT/B(For LAN Port)**Surge(For LAN Port)**

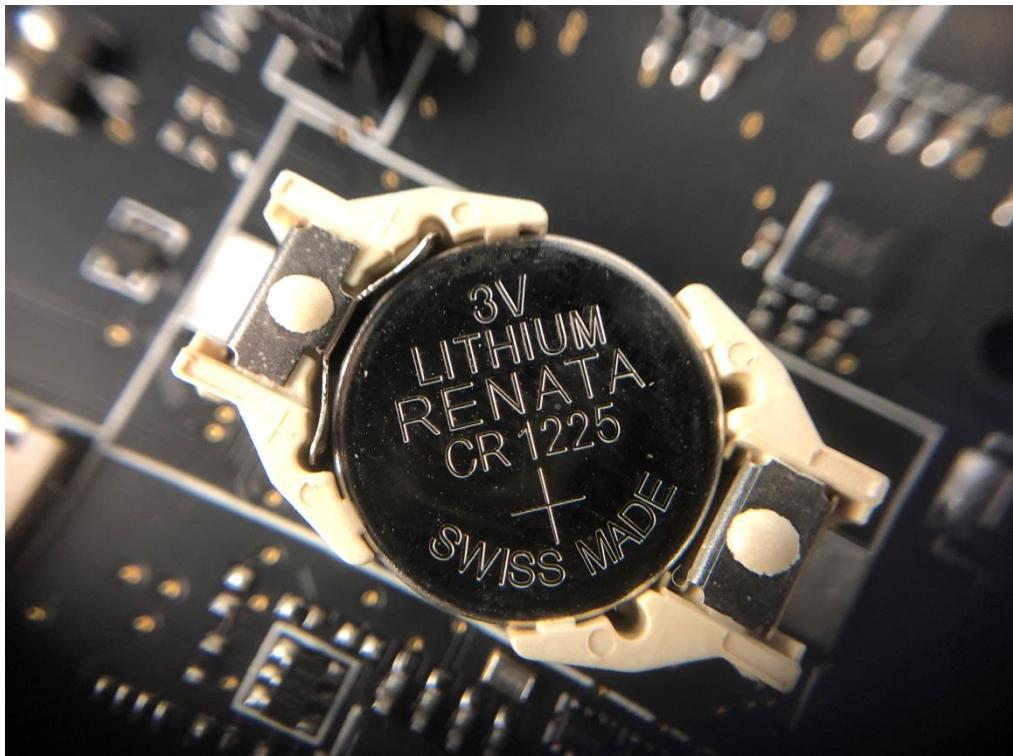
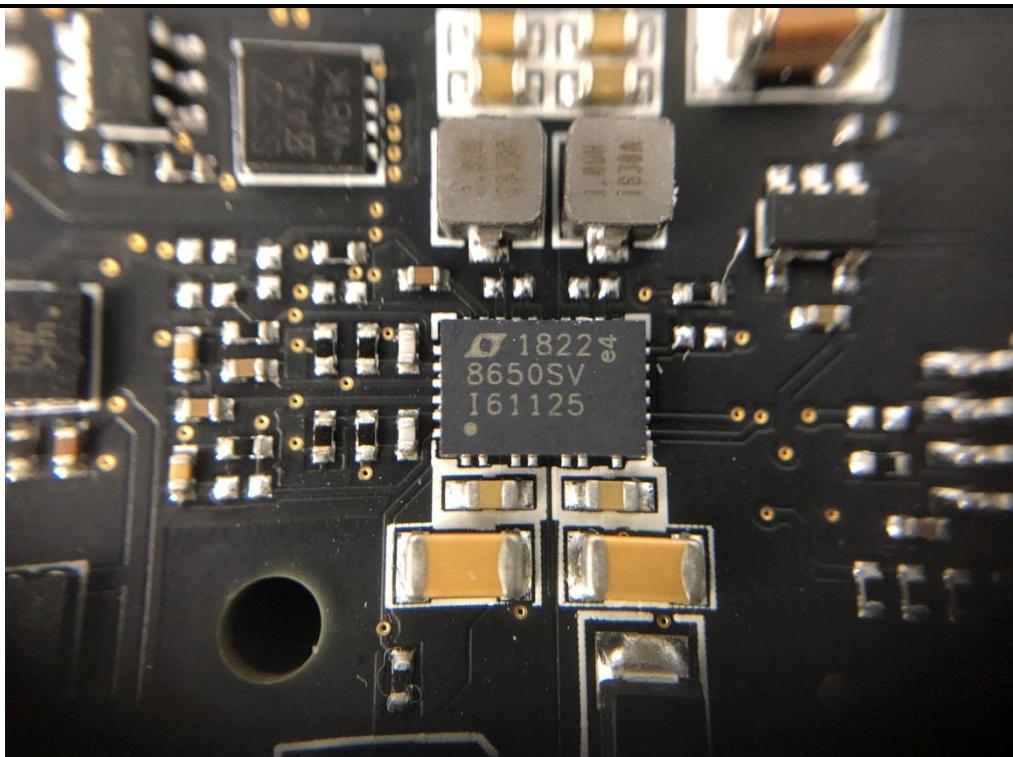
C/S(For LAN Port)

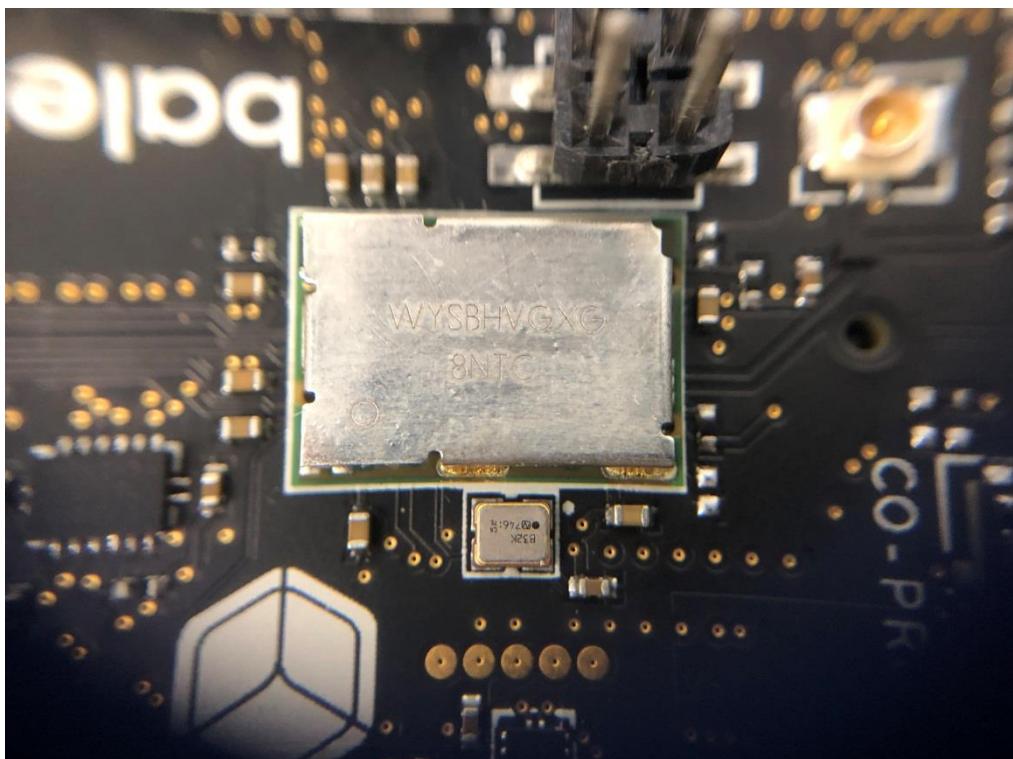
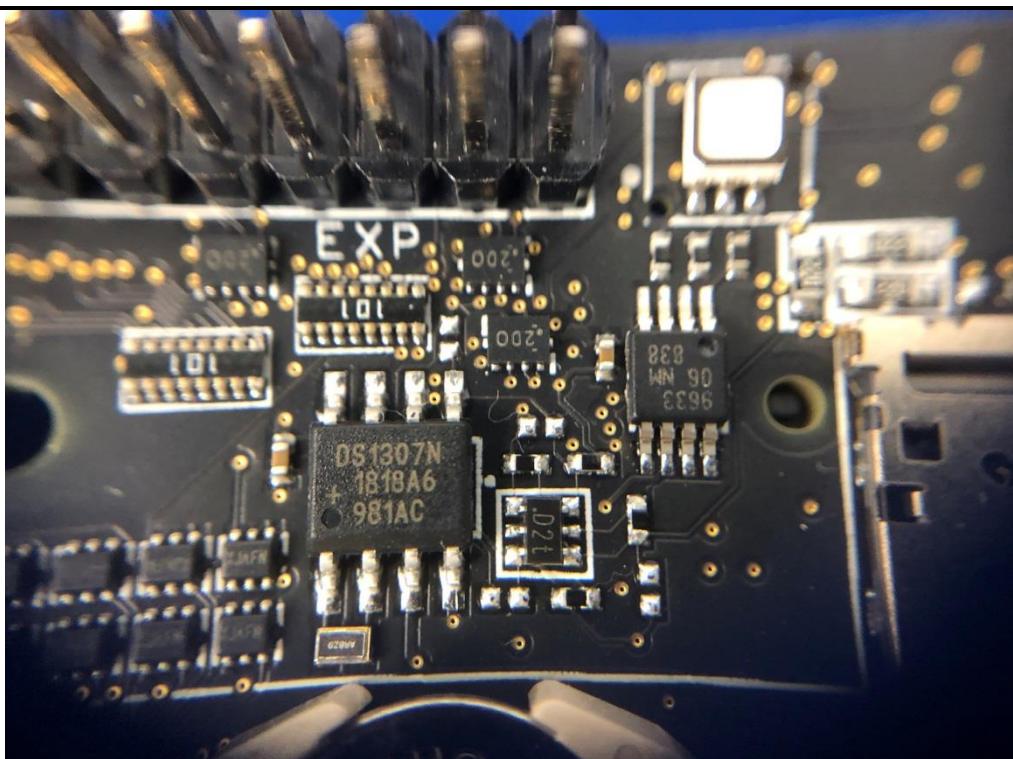


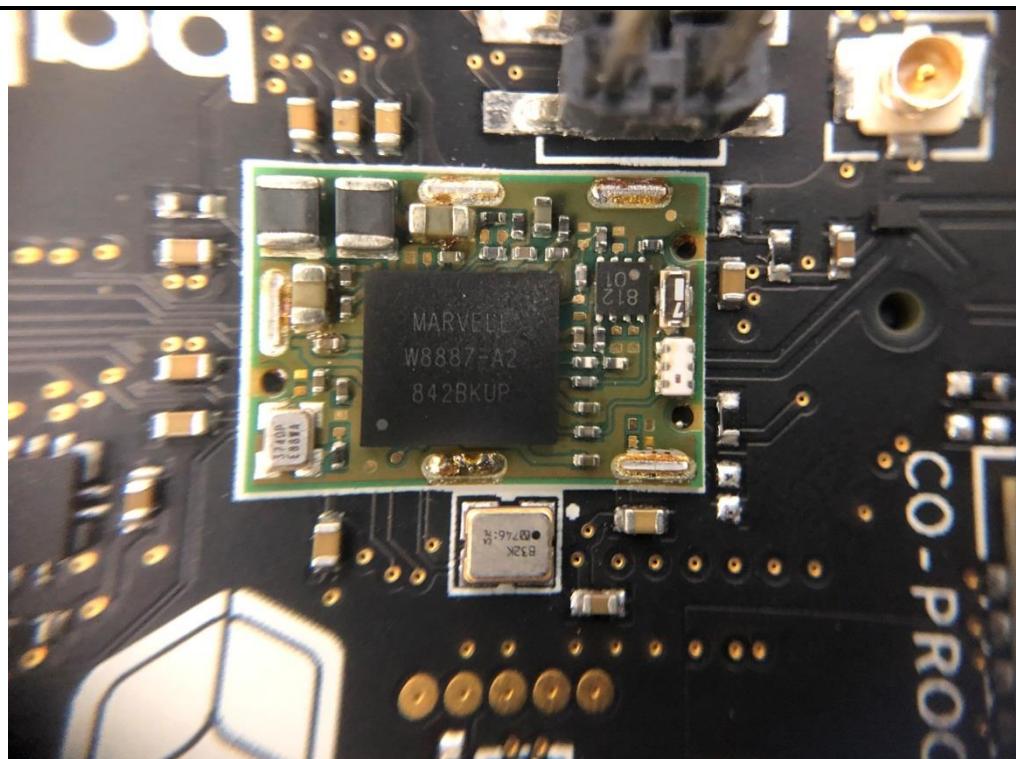
8 EUT Constructional Details

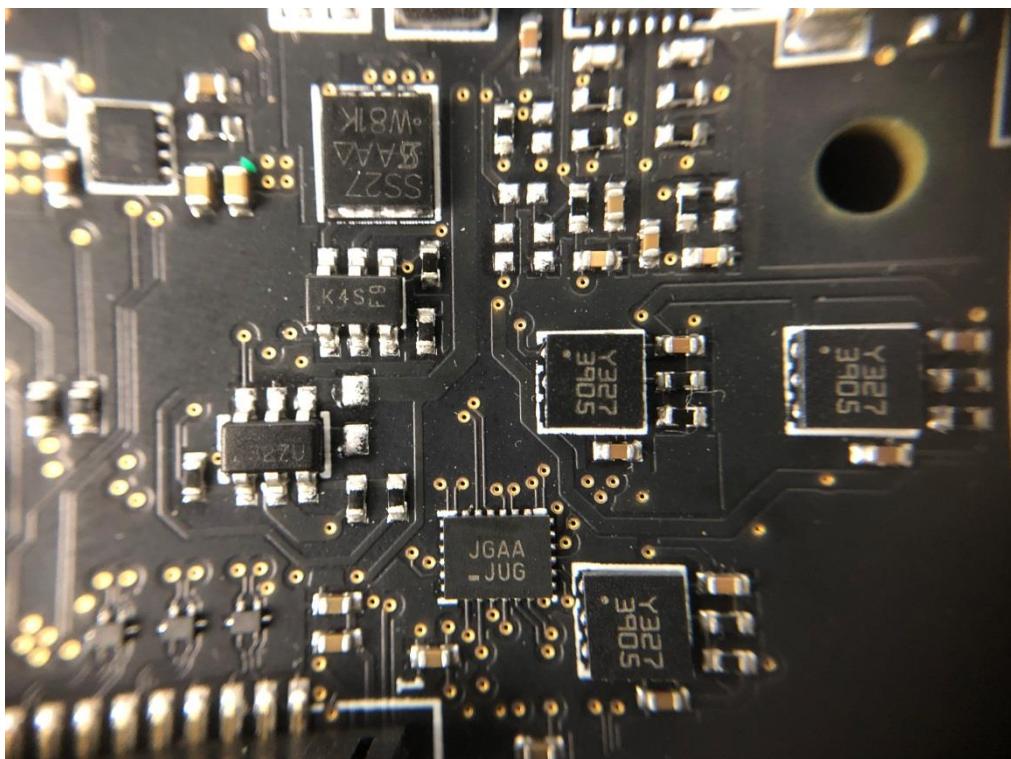
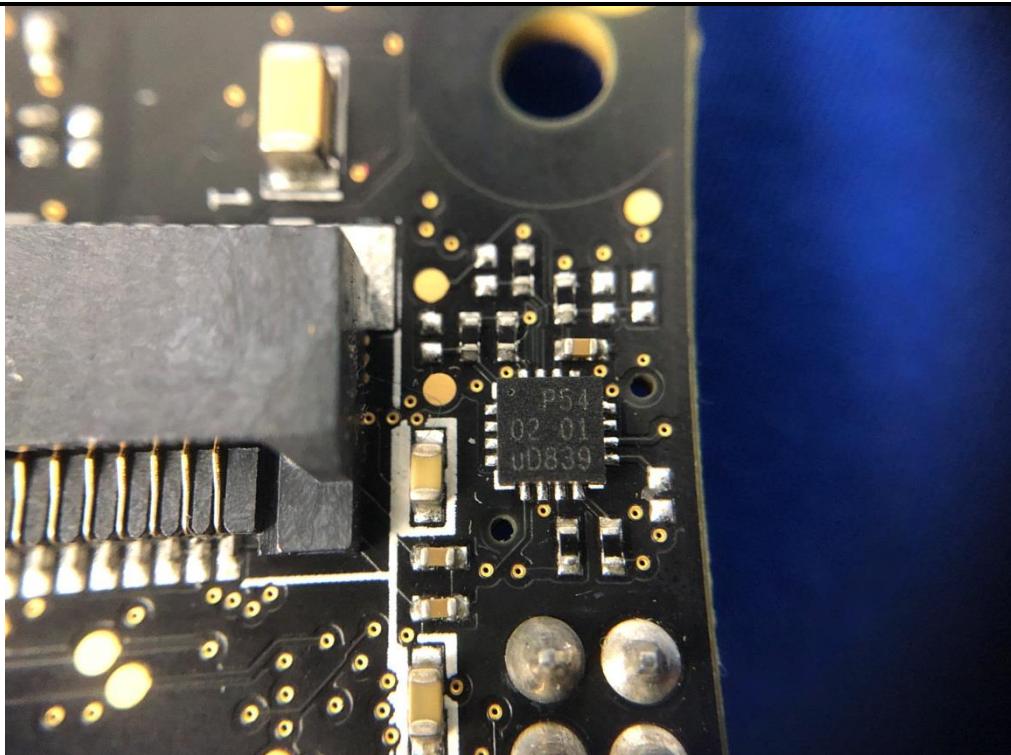


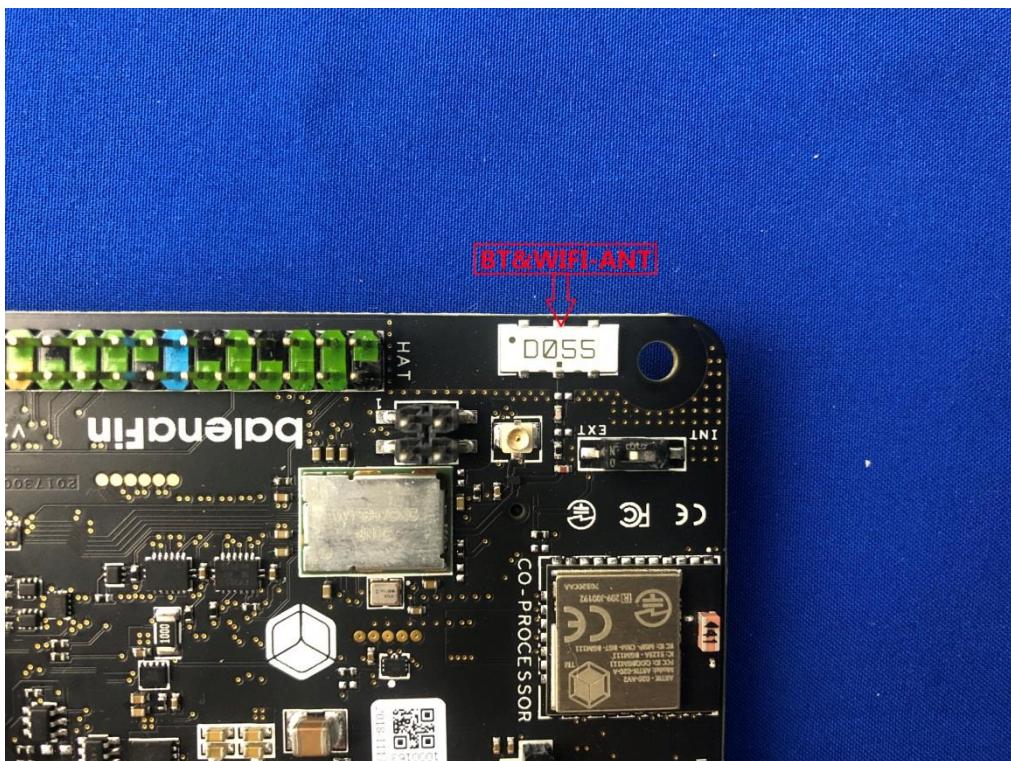
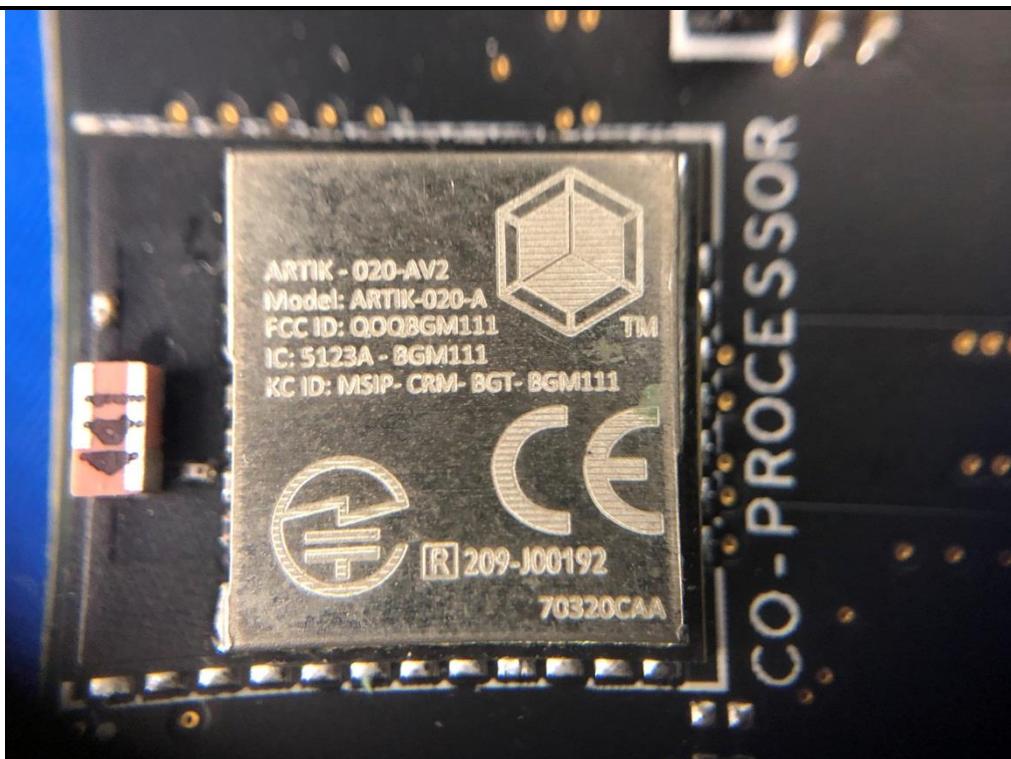














-----End of report-----