



FCC TEST REPORT

FCC ID: 2ATYV-IF8R

On Behalf of

Scangrip A/S

iF8R

Model No.: 502002

Prepared for : Scangrip A/S
Address : Rytterhaven 9 DK-5700 Svendborg

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

Applicant : Scangrip A/S
 Address : Rytterhaven 9 DK-5700 Svendborg
 Manufacturer : AEC Lighting Solutions Co., Ltd.
 Address : 2548 Baoan Road, Jiading District, Shanghai 201801, China
 EUT Description : iF8R
 (A) Model No. : 502002
 (B) Trademark : LEDLENSER

Measurement Standard Used:

FCC Rules and Regulations Part 15 Subpart C Section 15.247
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 C 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).....: Lucas Pang
 Project Engineer



Approved by (name + signature).....: Simple Guan
 Project Manager



Date of issue.....: August 14, 2019

Revision History

Revision	Issue Date	Revisions	Revised By
V0	August 14, 2019	Initial released Issue	Simple Guan

1. SUMMARY OF STANDARDS AND RESULTS

1.1. Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below:

Test Item	Test Requirement	Standards Paragraph	Result
Conducted Emission	FCC PART 15	15.207	P
6dB Bandwidth	FCC PART 15	15.247 (a)(2)	P
Output Power	FCC PART 15	15.247 (b)(3)	P
Radiated Spurious Emission	FCC PART 15	15.247 (c)	P
Conducted Spurious & Band Edge Emission	FCC PART 15	15.247 (d)	P
Power Spectral Density	FCC PART 15	15.247 (e)	P
Radiated Band Edge Emission	FCC PART 15	15.205	P
Antenna Requirement	FCC PART 15	15.203	P
Note:	1. P is an abbreviation for Pass. 2. F is an abbreviation for Fail. 3. N/A is an abbreviation for Not Applicable.		

2. GENERAL INFORMATION

2.1. Description of Device (EUT)

Description	:	iF8R
Model No.	:	502002
DIFF	:	N/A
Power supply	:	DC 10.95V from battery, DC 12.6V from adapter with AC 120V/60Hz
Radio Technology	:	Bluetooth V4.1 BLE
Operation frequency	:	2402 MHz -2480 MHz
Modulation	:	GFSK
Channel spacing	:	2MHz
Antenna Type	:	PCB Antenna, Maximum Gain is 0dBi
Software	:	V1.0
Hardware	:	V1.0
Intend use environment	:	Residential, commercial and light industrial environment

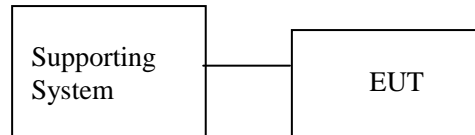
2.2. Accessories of Device (EUT)

Accessories1 : AC ADAPTER
 Manufacturer : SUZHOU ZHONGPEN ELECTRONIC CO., LTD
 Model : ZPP301200000
 Ratings : Input:100-240V ~0.5A 50/60Hz
 Output: 12.6V=1.4A

2.3. Tested Supporting System Details

No.	Description	Manufacturer	Model	Serial Number	Certification or DOC
1	Notebook PC	ACER	ASPIRE M1830	PTSF90C00305005C AC3000	DOC

2.4. Block Diagram of connection between EUT and simulators



2.5. Test Mode Description

Tested mode, channel, and data rate information		
Mode	Channel	Frequency (MHz)
GFSK	Low :CH1	2402
	Middle: CH20	2440
	High: CH40	2480

2.6. Test Conditions

Items	Required	Actual
Temperature range:	15-35°C	27°C
Humidity range:	25-75%	56%
Pressure range:	86-106kPa	980kPa

2.7. Test Facility

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

June 21, 2018 File on Federal Communication Commission
 Registration Number: 293961

July 25, 2017 Certificated by IC
 Registration Number: 12135A

2.8. Measurement Uncertainty

(95% confidence levels, k=2)

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

2.9. Test Equipment List

Equipment	Manufacture	Model No.	Serial No.	Last cal.	Cal Interval
3m Semi-Anechoic	ETS-LINDGREN	N/A	SEL0017	2018.09.21	1 Year
Spectrum analyzer	Agilent	E4407B	MY46185649	2018.09.21	1 Year
Receiver	R&S	ESCI	1166.5950K03-1011	2018.09.21	1 Year
Receiver	R&S	ESCI	101202	2018.09.21	1 Year
Bilog Antenna	Schwarzbeck	VULB 9168	VULB9168-438	2018.04.13	2 Year
Horn Antenna	EMCO	3115	640201028-06	2018.04.13	2 Year
Active Loop Antenna	Beijing Daze	ZN30900A	SEL0097	2018.04.13	2 Year
Cable	Resenberger	N/A	No.1	2018.09.21	1 Year
Cable	SCHWARZBECK	N/A	No.2	2018.09.21	1 Year
Cable	SCHWARZBECK	N/A	No.3	2018.09.21	1 Year
Pre-amplifier	Schwarzbeck	BBV9743	9743-019	2018.09.21	1 Year
Pre-amplifier	R&S	AFS33-18002650-30-8P-44	SEL0080	2018.09.21	1 Year
Temperature controller	Terchy	MHQ	120	2018.09.21	1 Year
L.I.S.N.#1	Schwarzbeck	NSLK8126	8126466	2018.09.21	1 Year
L.I.S.N.#2	ROHDE&SCHWARZ	ENV216	101043	2018.09.21	1 Year
20db Attenuator	ICPROBING	IATS1	82347	2018.09.21	1 Year
Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA 9170294	2018.04.13	2 Year
Power meter	Agilent	E4419B	GB40202122	2018.09.11	1 Year

3. SPURIOUS EMISSION

3.1. Test Limits

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Harmonic emissions limits comply with below 54 dBuV/m at 3m. Other emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or comply with the radiated emissions limits specified in section 15.209(a) limit in the table below has to be followed.

NOTE:

- a) The tighter limit applies at the band edges.
- b) Emission Level(dB uV/m)=20log Emission Level(uv/m)

3.2. Test Procedure

The measuring distance of 3m shall be used for measurements at frequency up to 1GH and above 1GHz, The EUT was placed on a rotating 0.8 m high above ground for below 1GHz and 1.5m high for above 1GHz testing, The table was rotated 360 degrees to determine the position of the highest radiation

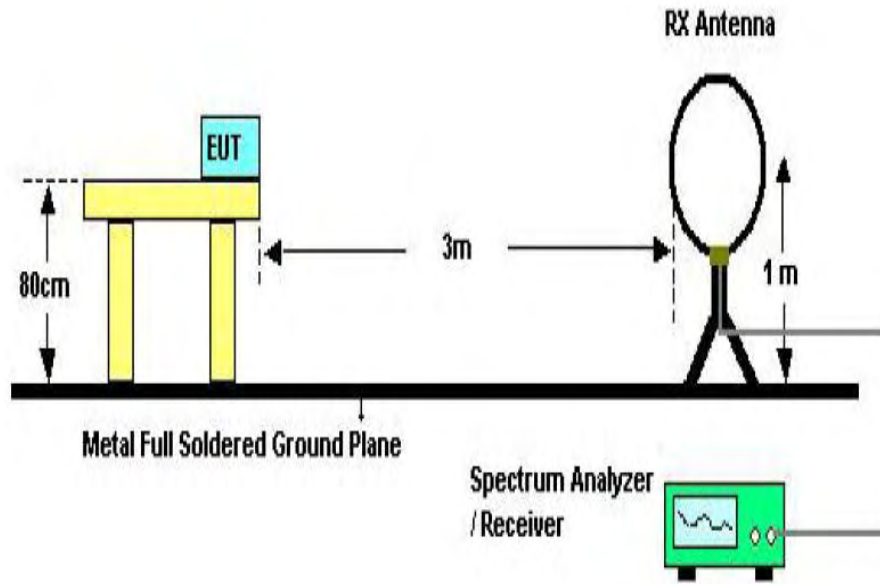
The Test antenna shall vary between 1m and 4m, Both Horizontal and Vertical antenna are set of make measurement.

The initial step in collecting conducted emission data is a spectrum analyzer Peak detector mode pre-scanning the measurement frequency range. Significant Peaks are then marked. and then Qusia Peak Detector mode premeasured

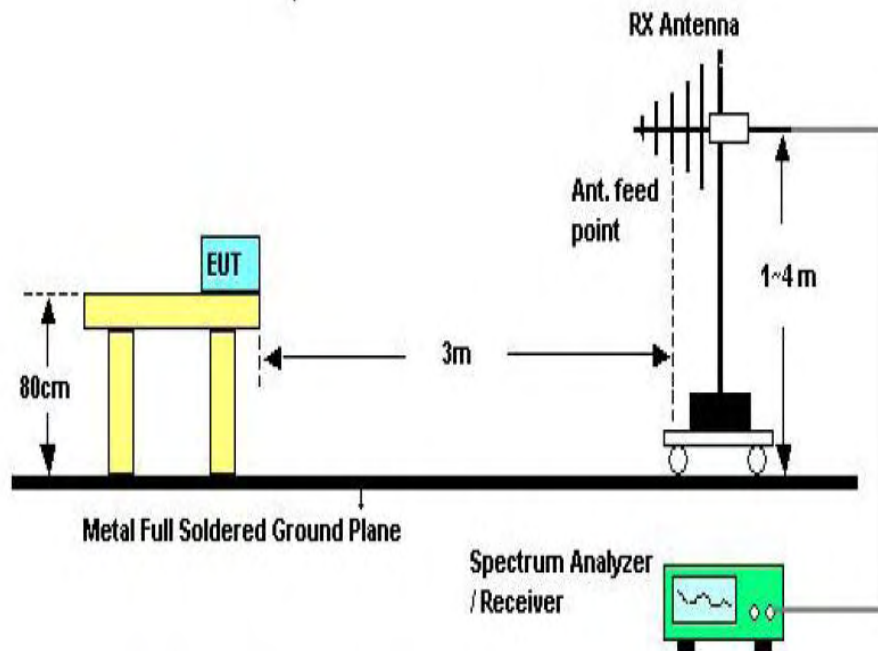
If Peak value comply with QP limit Below 1GHz. The EUT deemed to comply with QP limit. But the Peak value and average value both need to comply with applicable limit above 1GHz.

For the actual test configuration, please see the test setup photo.

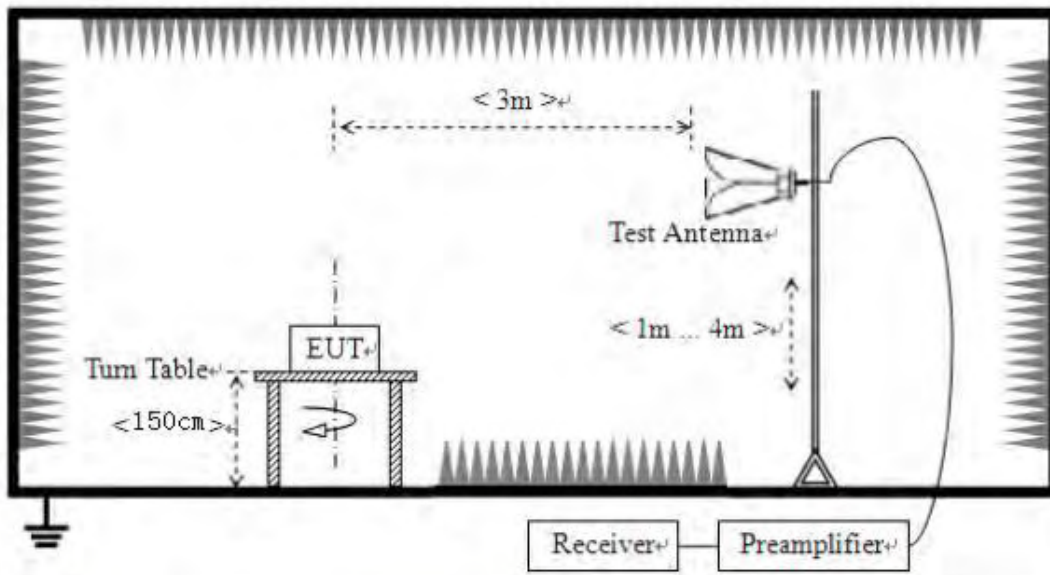
3.3. Test Setup



Below 30MHz Test Setup



Above 30MHz Test Setup



Above 1GHz Test Setup

3.4. Test Results

Test Condition

Continual Transmitting in maximum power.

9KHz~150KHz	RBW200Hz	VBW1KHz
150KHz~30MHz	RBW9KHz	VBW 30KHz
30MHz~1GHz	RBW120KHz	VBW 300KHz
Above1GHz	RBW1MHz	VBW 3MHz

We have scanned the 10th harmonic from 9 kHz to the EUT.

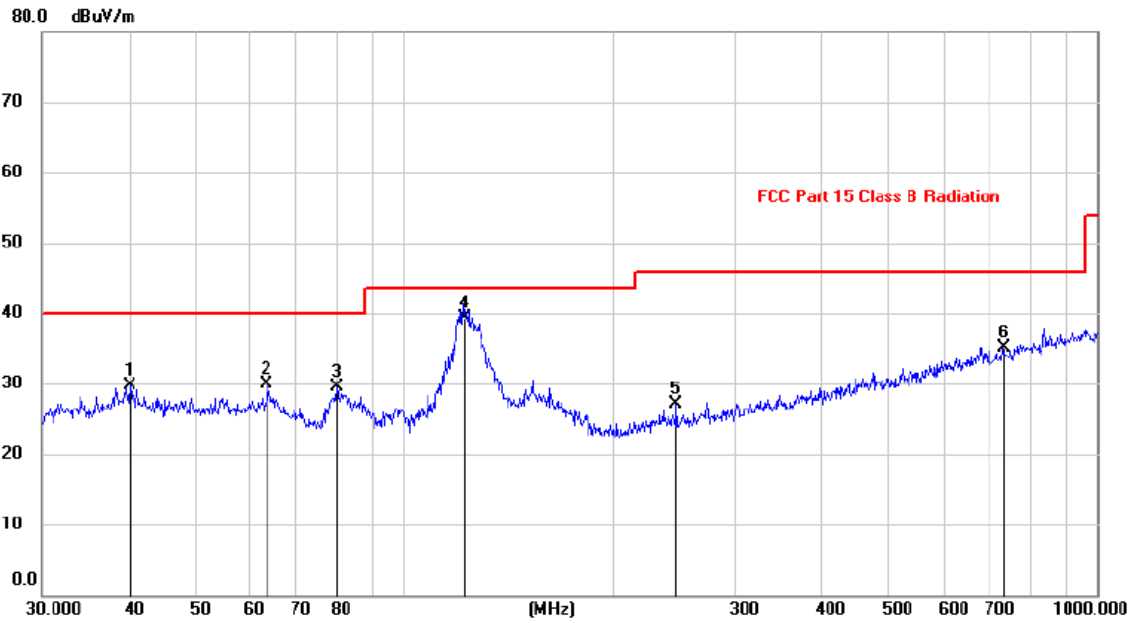
Detailed information please see the following page.

From 9KHz to 30MHz: Conclusion: PASS

Note: 1. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

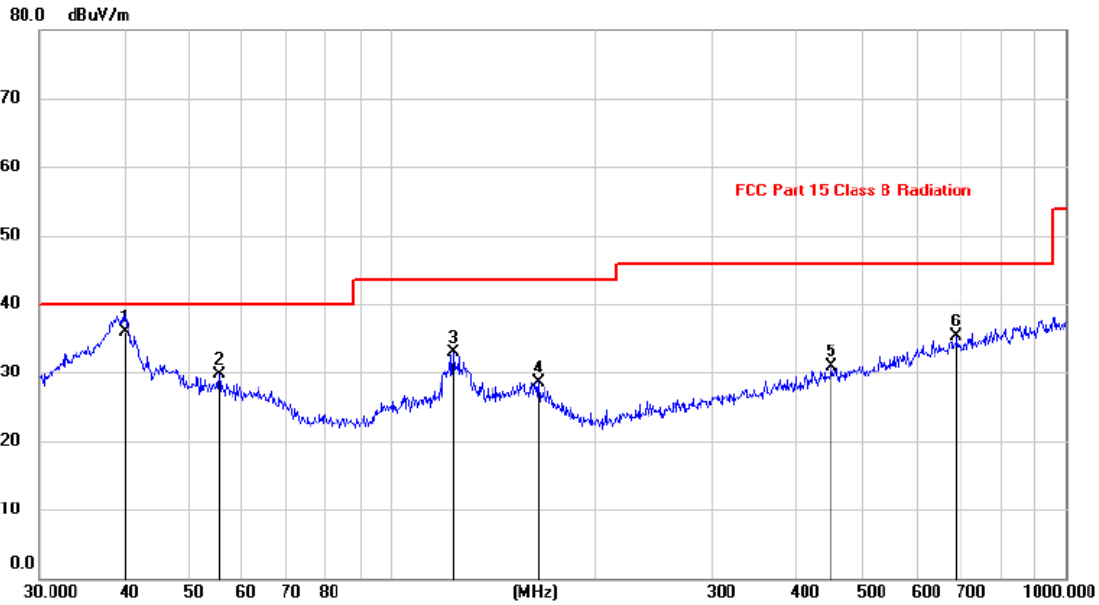
2. Only show the test data of the worst Channel in this report.

H



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Antenna Height cm	Table Degree degree	Detector	Comment
1		40.1347	15.44	14.22	29.66	40.00	-10.34			peak	
2		63.3132	17.61	12.20	29.81	40.00	-10.19			peak	
3		80.0806	20.12	9.43	29.55	40.00	-10.45			peak	
4	*	122.6694	26.62	12.77	39.39	43.50	-4.11			QP	
5		246.8149	14.98	12.03	27.01	46.00	-18.99			peak	
6		731.9203	13.82	21.37	35.19	46.00	-10.81			peak	

V



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	40.1347	21.67	14.22	35.89	40.00	-4.11			QP
2		55.4147	16.50	13.24	29.74	40.00	-10.26			peak
3		123.6985	20.15	12.83	32.98	43.50	-10.52			peak
4		164.9075	14.42	14.18	28.60	43.50	-14.90			peak
5		447.9822	13.91	16.92	30.83	46.00	-15.17			peak
6		687.1507	14.27	20.95	35.22	46.00	-10.78			peak

Notes: Above is below 1GHz test data. This report only shall the worst case mode for TX 2402MHz.

From 1G-25GHz

Test Mode: TX Low									
Freq (MHz)	Read Level (dBuV/m)	Polar (H/V)	Antenna Factor (dB/m)	Cable loss(dB)	Amp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4804	43.96	V	33.95	10.18	34.26	53.83	74	20.17	PK
4804	30.12	V	33.95	10.18	34.26	39.99	54	14.01	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
4804	42.96	H	33.95	10.18	34.26	52.83	74	21.17	PK
4804	31.93	H	33.95	10.18	34.26	41.80	54	12.20	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
Test Mode: TX Mid									
4880	44.07	V	33.93	10.18	34.26	53.92	74	20.08	PK
4880	32.94	V	33.93	10.18	34.26	42.79	54	11.21	AV
7320	/	/	/	/	/	/	/	/	/
9760	/	/	/	/	/	/	/	/	/
4880	43.03	H	33.93	10.18	34.26	52.88	74	21.12	PK
4880	31.39	H	33.93	10.18	34.26	41.24	54	12.76	AV
7320	/	/	/	/	/	/	/	/	/
9760	/	/	/	/	/	/	/	/	/
Test Mode: TX High									
4960	42.80	V	33.98	10.18	34.26	52.70	74	21.30	PK
4960	34.67	V	33.98	10.18	34.26	44.57	54	9.43	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/
4960	43.56	H	33.98	10.18	34.26	53.46	74	20.54	PK
4960	31.95	H	33.98	10.18	34.26	41.85	54	12.15	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/
Note:									
1, Result = Read level + Antenna factor + cable loss-Amp factor									
2, All the other emissions not reported were too low to read and deemed to comply with FCC limit.									

4. POWER LINE CONDUCTED EMISSION

4.1. Test Limits

Frequency MHz	Limits dB(μ V)	
	Quasi-peak Level	Average Level
0.15 -0.50	66 -56*	56 - 46*
0.50 -5.00	56	46
5.00 -30.00	60	50

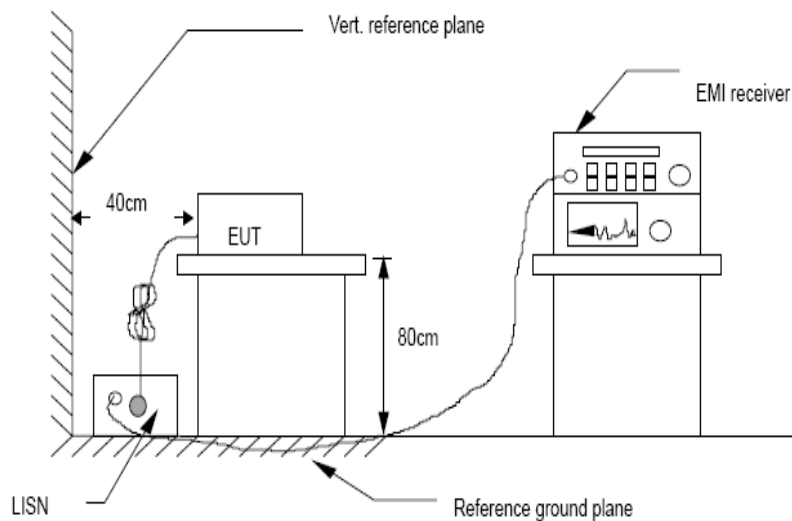
- Notes: 1. *Decreasing linearly with logarithm of frequency.
 2. The lower limit shall apply at the transition frequencies.
 3. The limit decreases in line with the logarithm of the frequency in rang of 0.15 to 0.50 MHz.

4.2. Test Procedure

The EUT is put on the plane 0.8m high above the ground by insulating support and is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC lines are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to ANSI ANSI C63.10:2013 on Conducted Emission Measurement.

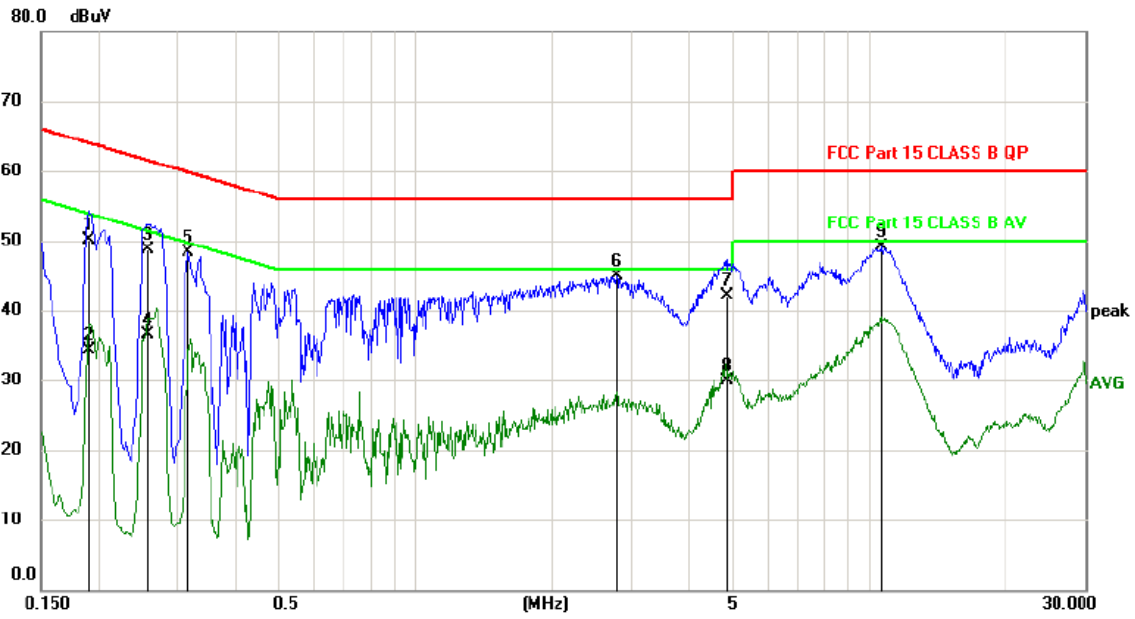
The bandwidth of test receiver is set at 9 kHz.

4.3. Test Setup



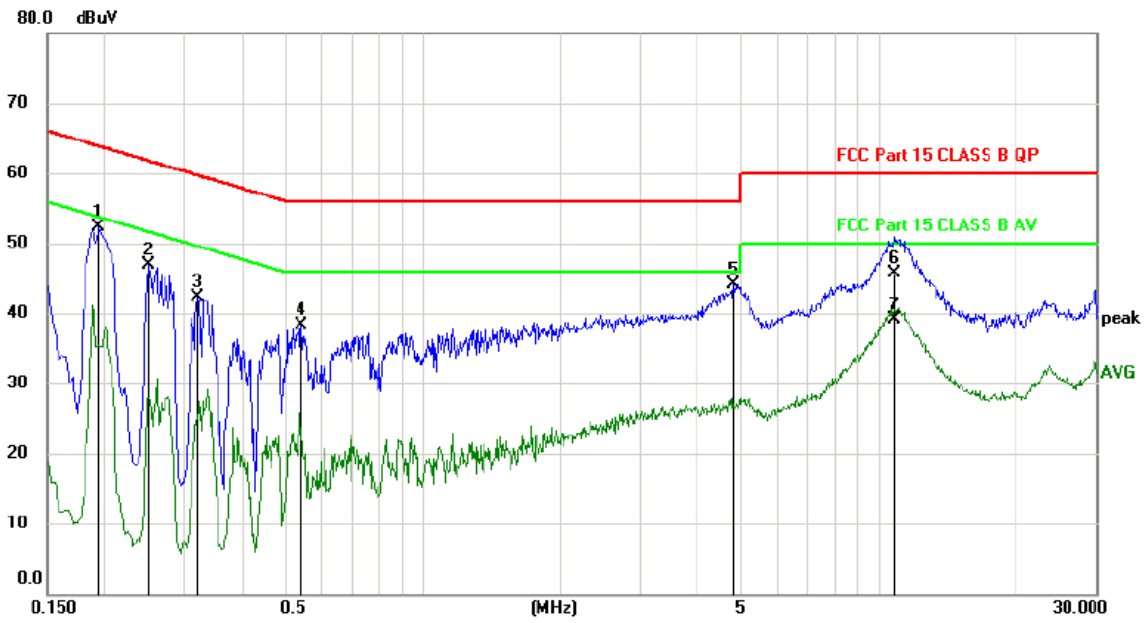
4.4. Test Results

L



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.1920	40.53	9.67	50.20	63.95	-13.75	QP	
2		0.1920	24.70	9.67	34.37	53.95	-19.58	AVG	
3		0.2580	39.10	9.69	48.79	61.50	-12.71	QP	
4		0.2580	26.74	9.69	36.43	51.50	-15.07	AVG	
5		0.3180	38.69	9.70	48.39	59.76	-11.37	peak	
6		2.7869	34.85	9.97	44.82	56.00	-11.18	peak	
7		4.8930	31.98	10.15	42.13	56.00	-13.87	QP	
8		4.8930	19.69	10.15	29.84	46.00	-16.16	AVG	
9	*	10.6590	38.75	10.35	49.10	60.00	-10.90	peak	

N



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.1949	42.70	9.67	52.37	63.83	-11.46	peak	
2		0.2519	37.27	9.69	46.96	61.69	-14.73	peak	
3		0.3209	32.64	9.70	42.34	59.68	-17.34	peak	
4		0.5429	28.49	9.72	38.21	56.00	-17.79	peak	
5		4.8000	34.01	10.15	44.16	56.00	-11.84	peak	
6		10.8210	35.34	10.35	45.69	60.00	-14.31	QP	
7	*	10.8210	28.80	10.35	39.15	50.00	-10.85	AVG	

Remark: All modes and channels have been tested and only listed TX 2402MHz mode that is worst data

5. CONDUCTED MAXIMUM OUTPUT POWER

5.1. Test limits

Please refer section RSS-247 & 15.247.

5.2. Test Procedure

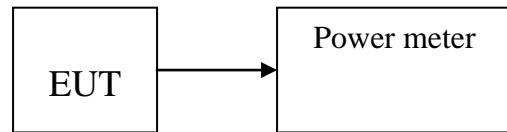
Details see the KDB 558074 D01 15.247 Meas Guidance v05r01

5.2.1 Place the EUT on the table and set it in transmitting mode.

5.2.2 Measure out each mode and each bands peak output power of EUT.

Note: The cable loss and attenuator loss were offset into measure device as amplitude offset.

5.3. Test Setup



5.4. Test Results

Channel	Frequency (MHz)	PK Output Power (dBm)	PK Output Power (mW)	Limit (dBm)
CH1	2402	1.053	1.274	30
CH20	2440	2.384	1.731	30
CH40	2480	3.099	2.041	30
Conclusion: PASS				

6. PEAK POWER SPECTRAL DENSITY

6.1. Test limits

6.1.1 Please refer section RSS-247 & 15.247.

6.1.2 For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

6.1.3 The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

6.2. Test Procedure

Details see the KDB 558074 D01 15.247 Meas Guidance v05r01

6.2.1 Place the EUT on the table and set it in transmitting mode.

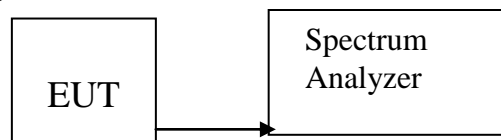
6.2.2 Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

6.2.3 Set the spectrum analyzer as RBW = 3kHz(Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.), VBW = 10kHz(Set the VBW $\geq 3 \times \text{RBW}$), span= $1.5 \times \text{DTS bandwidth}$., detail see the test plot.

6.2.4 Record the max reading.

6.2.5 Repeat the above procedure until the measurements for all frequencies are completed.

6.3. Test Setup



6.4. Test Results

Channel	Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm)	Result
CH1	2402	-16.333	8	PASS
CH20	2440	-14.781	8	PASS
CH40	2480	-10.975	8	PASS
Conclusion: PASS				

PSD NVNT BLE 2402MHz Ant1



PSD NVNT BLE 2440MHz Ant1



PSD NVNT BLE 2480MHz Ant1



7. BANDWIDTH

7.1. Test limits

Please refer section RSS-247 & 15.247

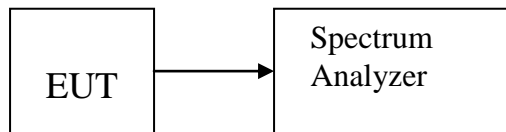
For direct sequence systems, the minimum 6dB bandwidth shall be at least 500 kHz.

7.2. Test Procedure

Details see the KDB 558074 D01 15.247 Meas Guidance v05r01

- a) The bandwidth is measured at an amplitude level reduced 20dB from the reference level. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.
- b) The test receiver set RBW = 100kHz, VBW $\geq 3 \cdot$ RBW = 300kHz,, Sweep time set auto, detail see the test plot.

7.3. Test Setup



7.4. Test Results

Frequency (MHz)	Antenna	99% OBW (MHz)	-6 dB Bandwidth (MHz)	Limit -6 dB Bandwidth (MHz)	Verdict
2402	Ant 1	1.0230	0.6301	0.5	Pass
2440	Ant 1	1.0220	0.6408	0.5	Pass
2480	Ant 1	1.0225	0.6376	0.5	Pass

-6dB BW NVNT BLE 2402MHz Ant 1



-6dB BW NVNT BLE 2440MHz Ant 1



-6dB BW NVNT BLE 2480MHz Ant 1



8. BAND EDGE CHECK

8.1. Test limits

Please refer section RSS-GEN&15.247.

8.2. Test Procedure

Details see the KDB 558074 D01 15.247 Meas Guidance v05r01

8.2.1 Put the EUT on a 0.8m high table, power on the EUT. Emissions were scanned and measured rotating the EUT to 360 degrees, Find the maximum Emission

8.2.2 Check the spurious emissions out of band.

8.2.3 RBW 1MHz ,VBW 3MHz ,peak detector for peak value , RBW 1MHz ,VBW 3MHz ,RMS detector for AV value.

8.3. Test Setup

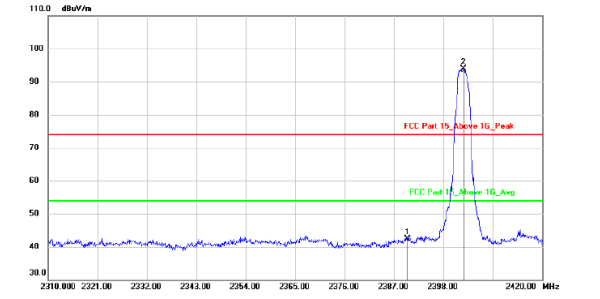
Same as 5.2.2.

8.4. Test Results

Radiated Method:

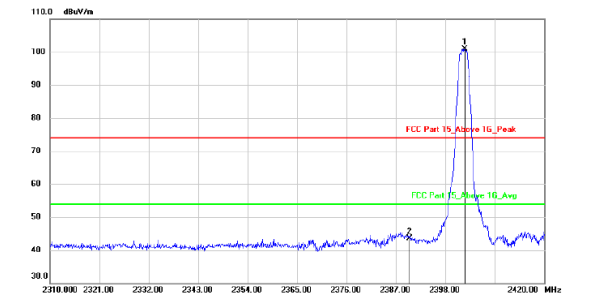
Test Mode: Low

Polarization: Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		2390.000	45.60	-3.40	42.20	74.00	-31.80			peak
2	*	2402.510	97.27	-3.41	93.86	74.00	19.86			peak

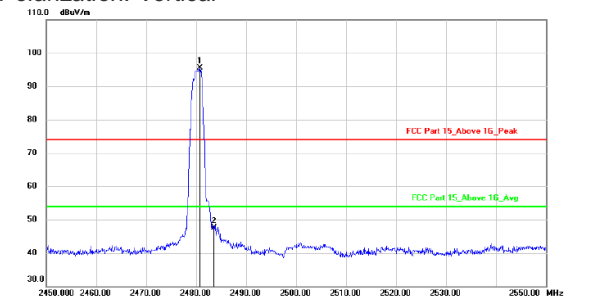
Polarization: Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	2402.290	104.35	-3.41	100.94	74.00	26.94			peak
2		2390.000	47.00	-3.40	43.60	74.00	-30.40			peak

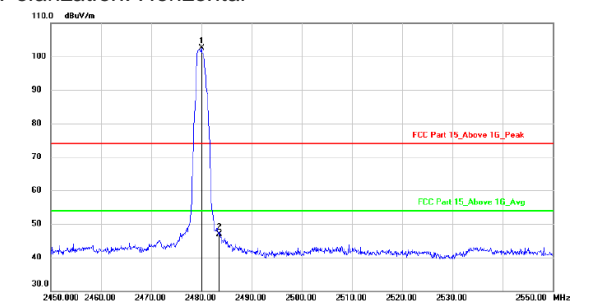
Test Mode: High

Polarization: Vertical



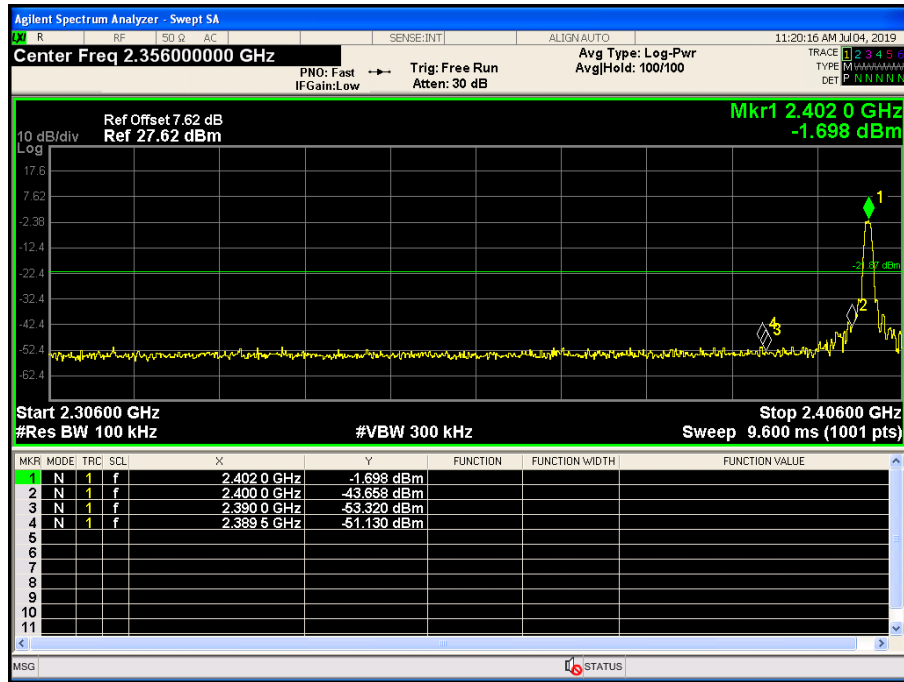
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	2480.700	98.80	-3.38	95.42	74.00	21.42			peak
2		2483.500	50.89	-3.38	47.51	74.00	-26.49			peak

Polarization: Horizontal

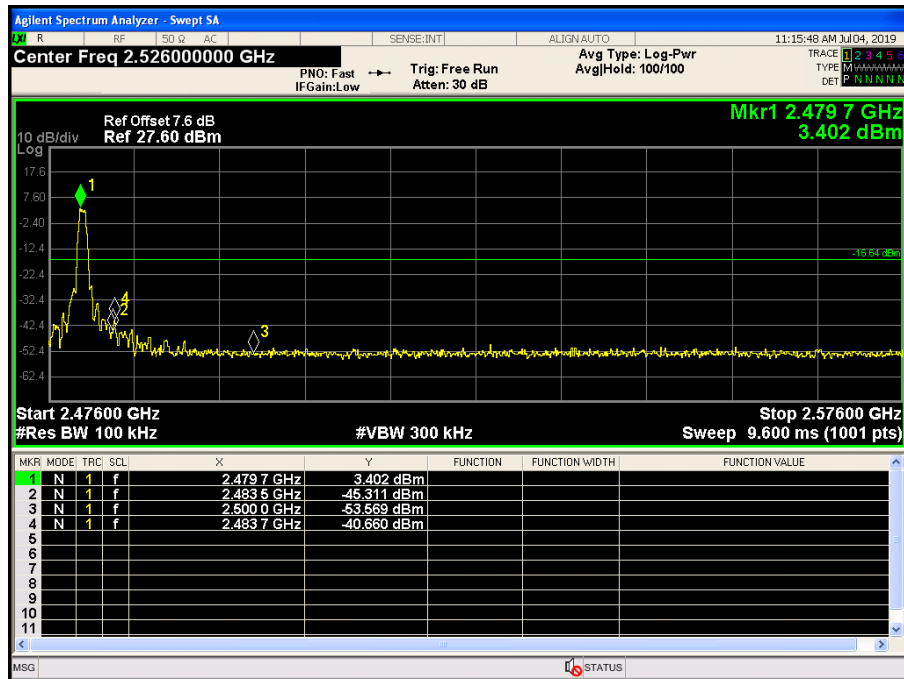


No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Margin	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1	*	2480.000	105.83	-3.38	102.45	74.00	28.45			peak
2		2483.500	50.34	-3.38	46.96	74.00	-27.04			peak

Conducted Method:



Lowest channel



Highest channel

9. ANTENNA REQUIREMENT

9.1. Standard Requirement

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

9.2. Antenna Connected Construction

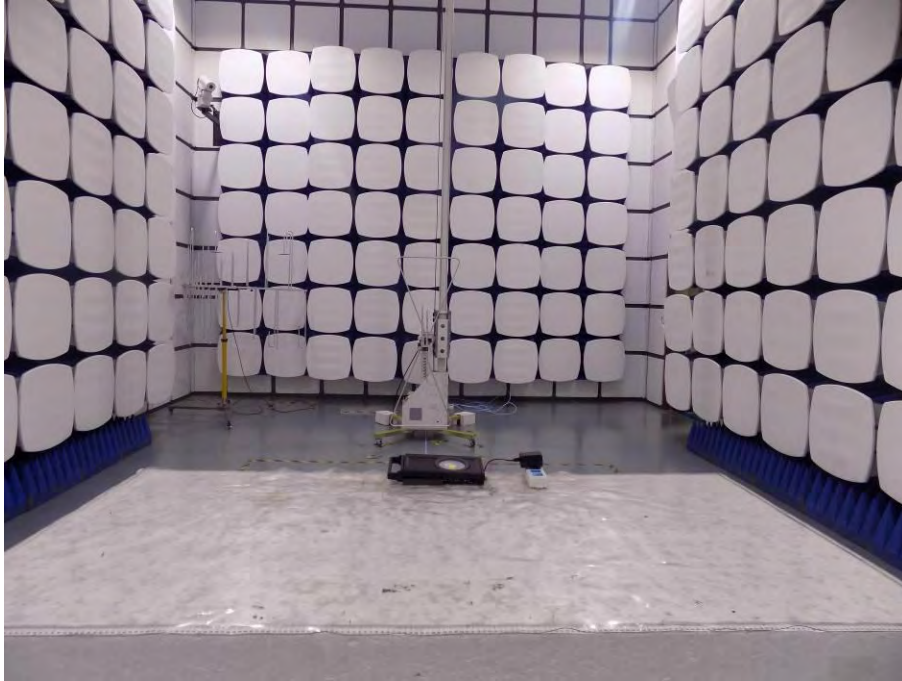
The antenna is internal antenna and no consideration of replacement. Please see EUT photo for details.

9.3. Results

The EUT antenna is internal Antenna. It complies with the standard requirement.

10. TEST SETUP PHOTO

10.1. Photos of Radiated emission

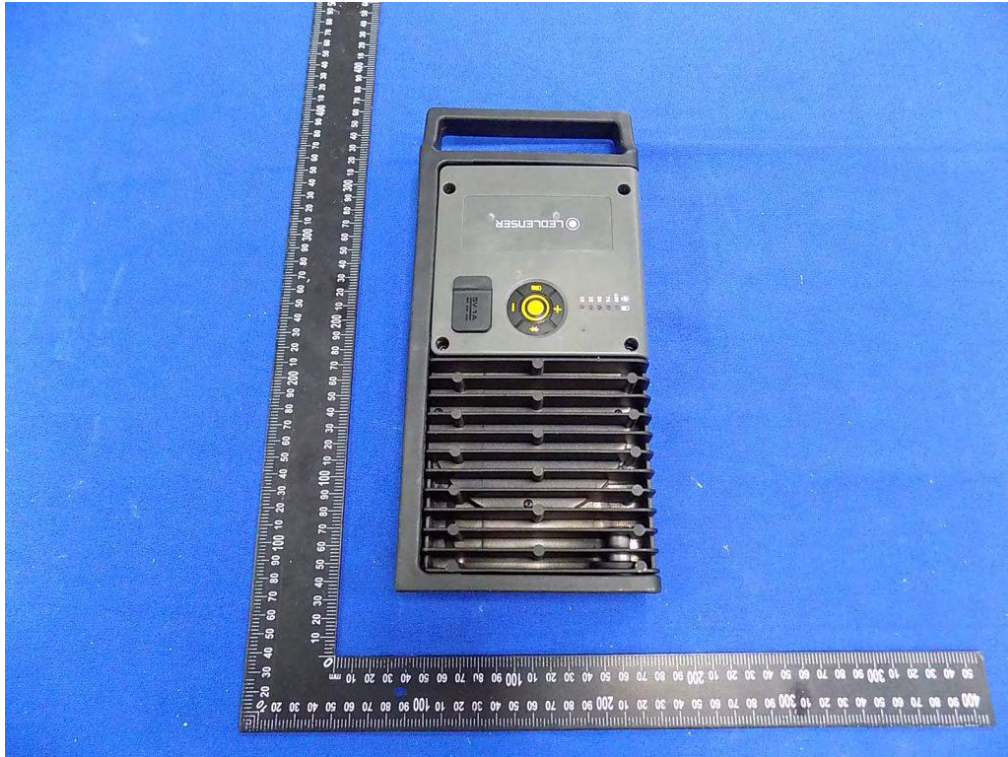


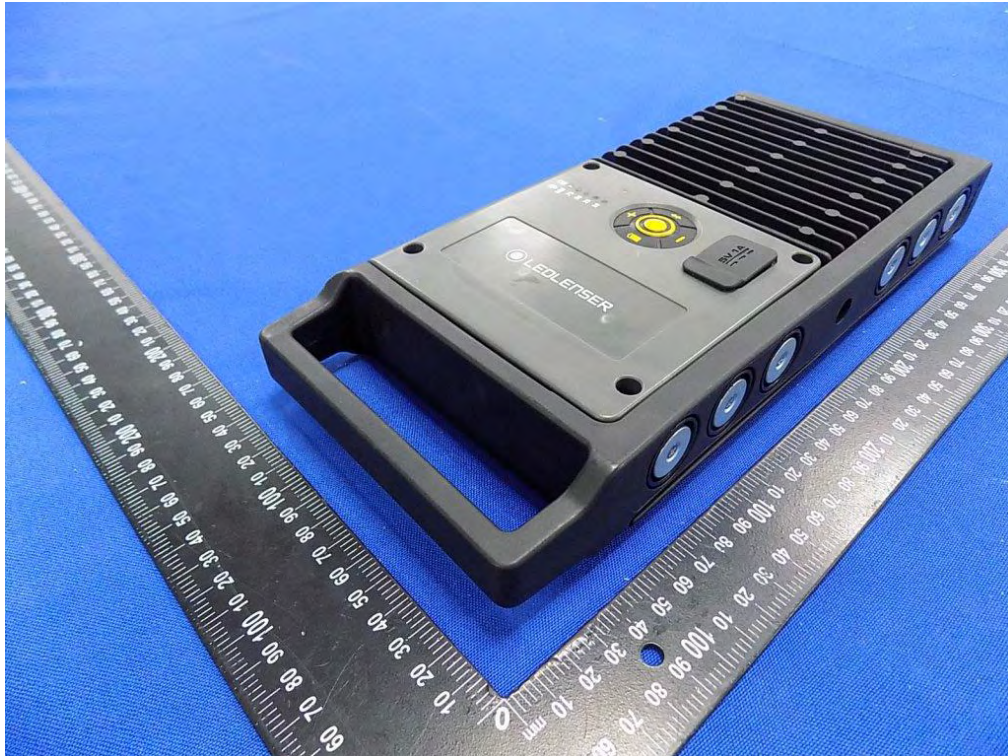
10.2.Photos of Conducted Emission test



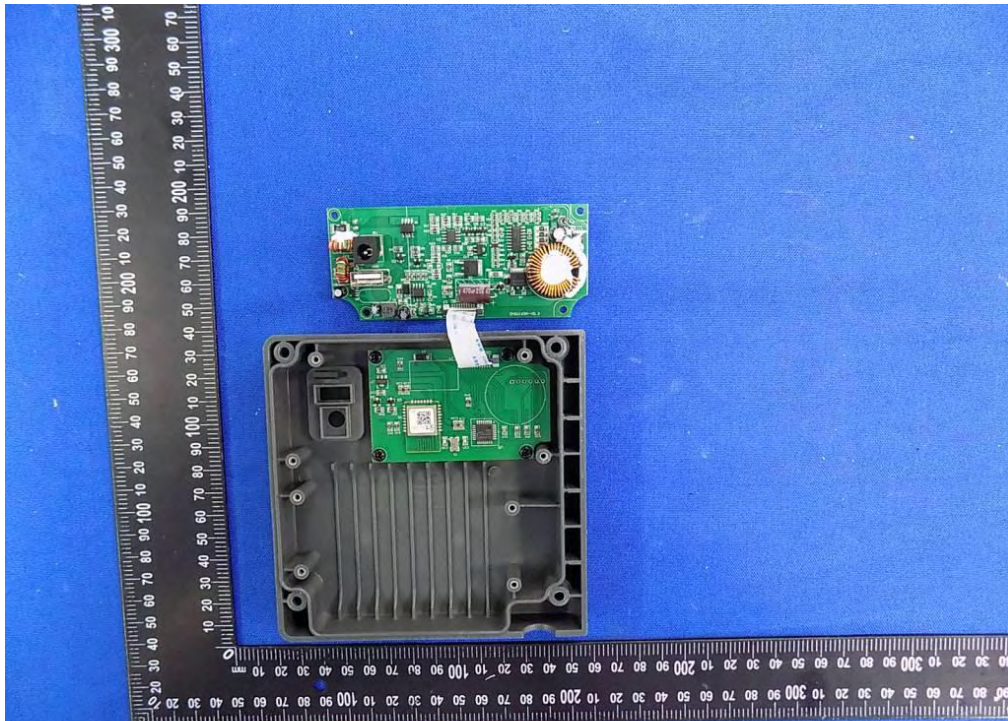
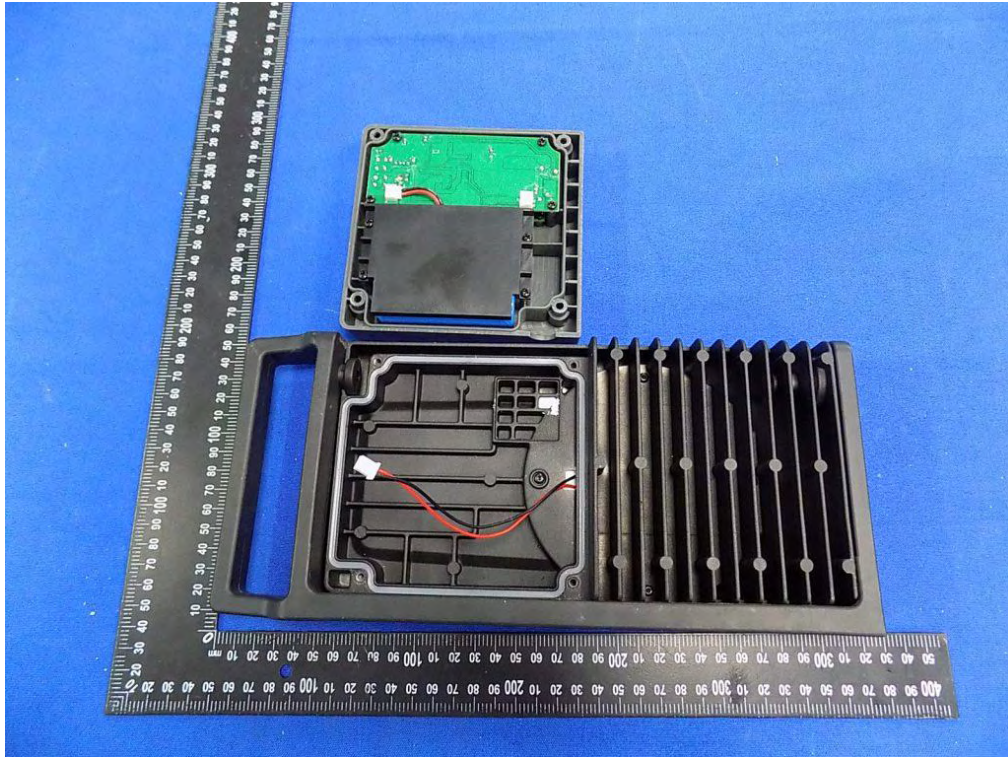
11.EUT PHOTO

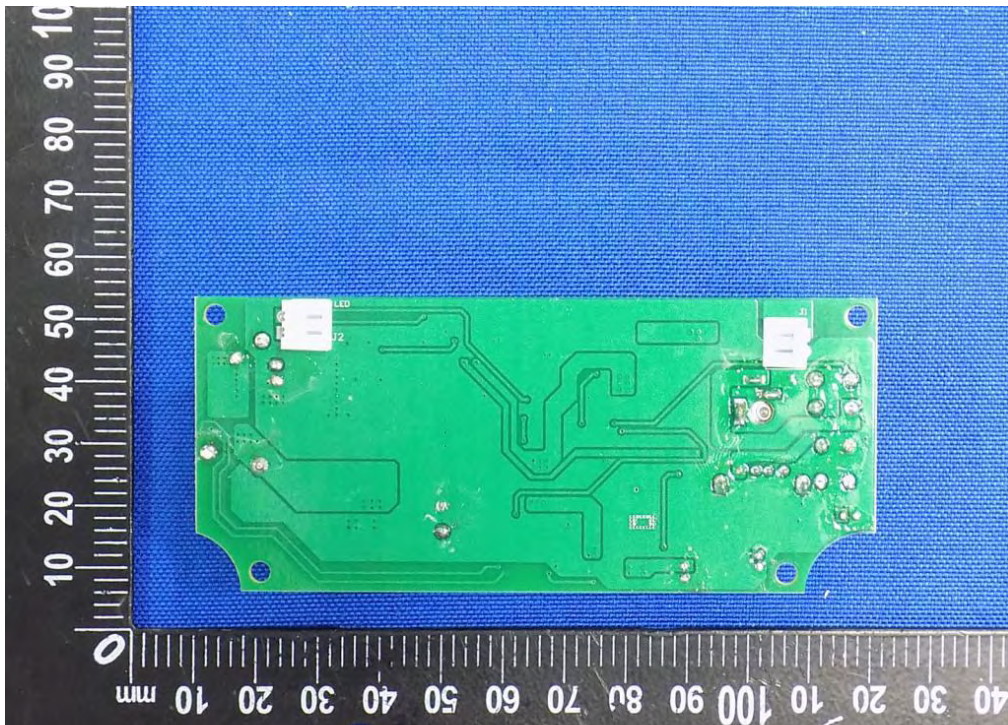
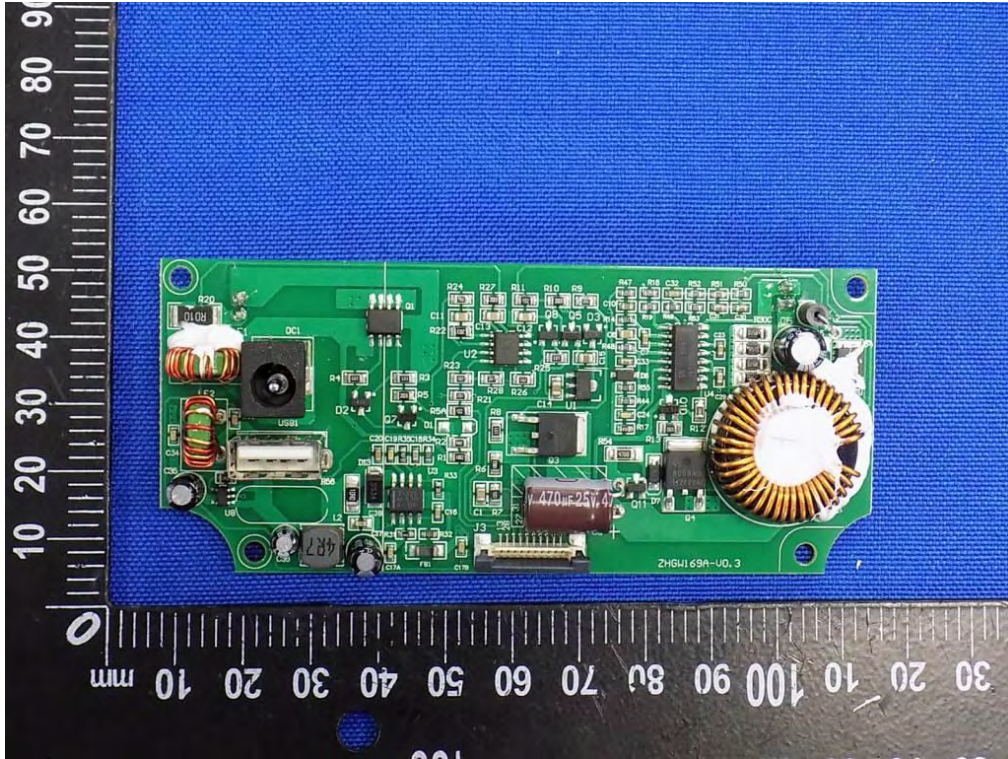


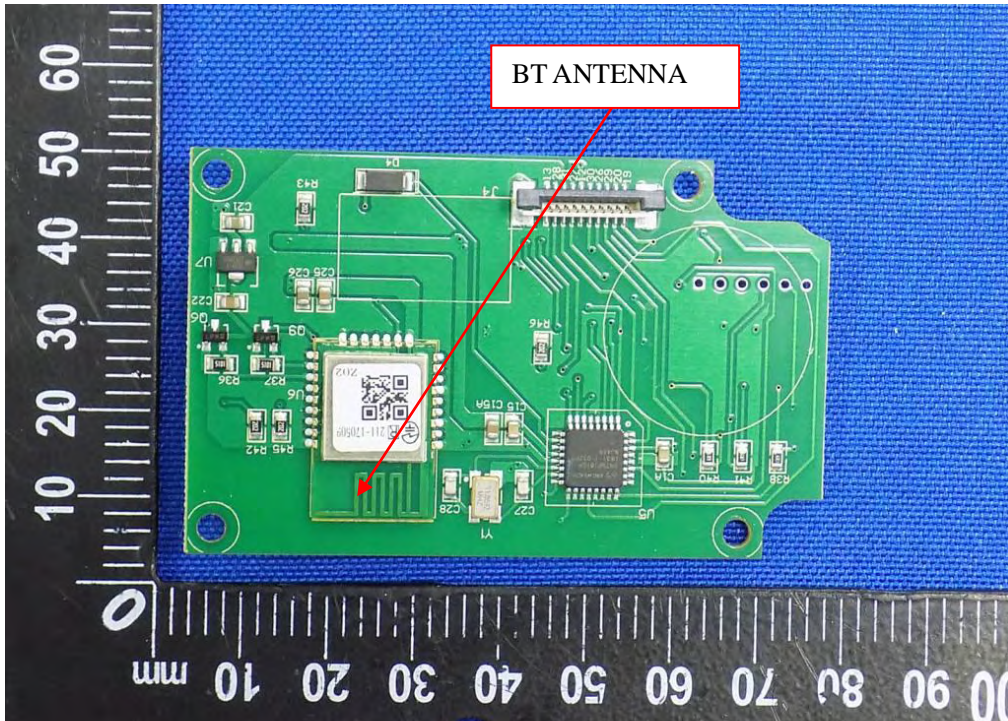
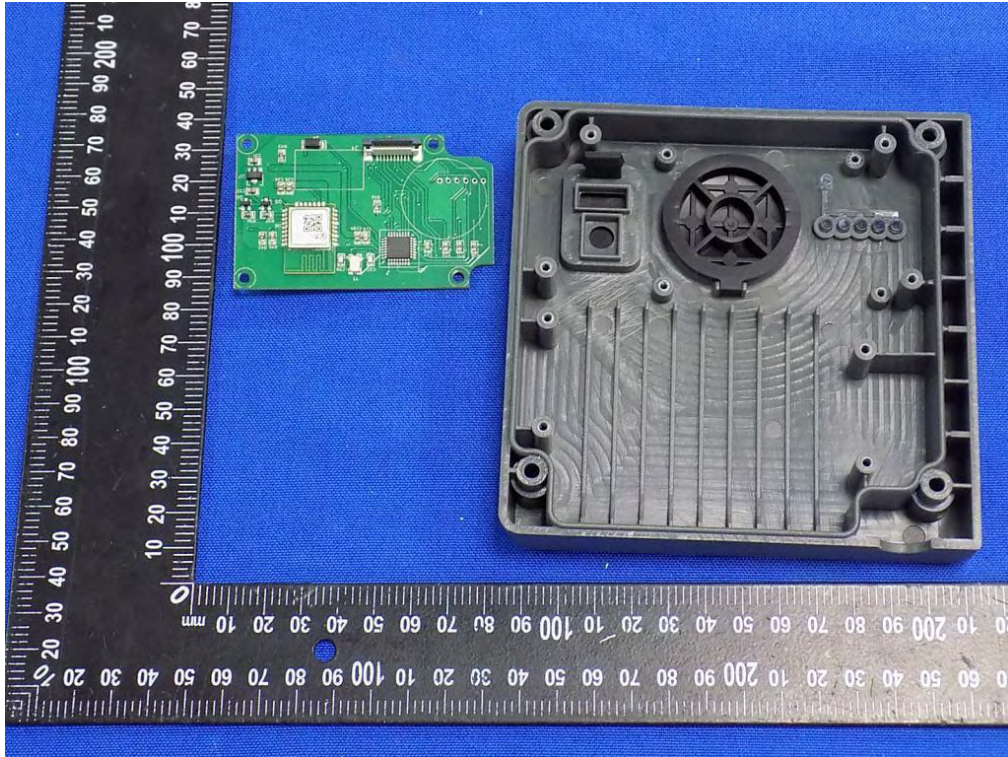


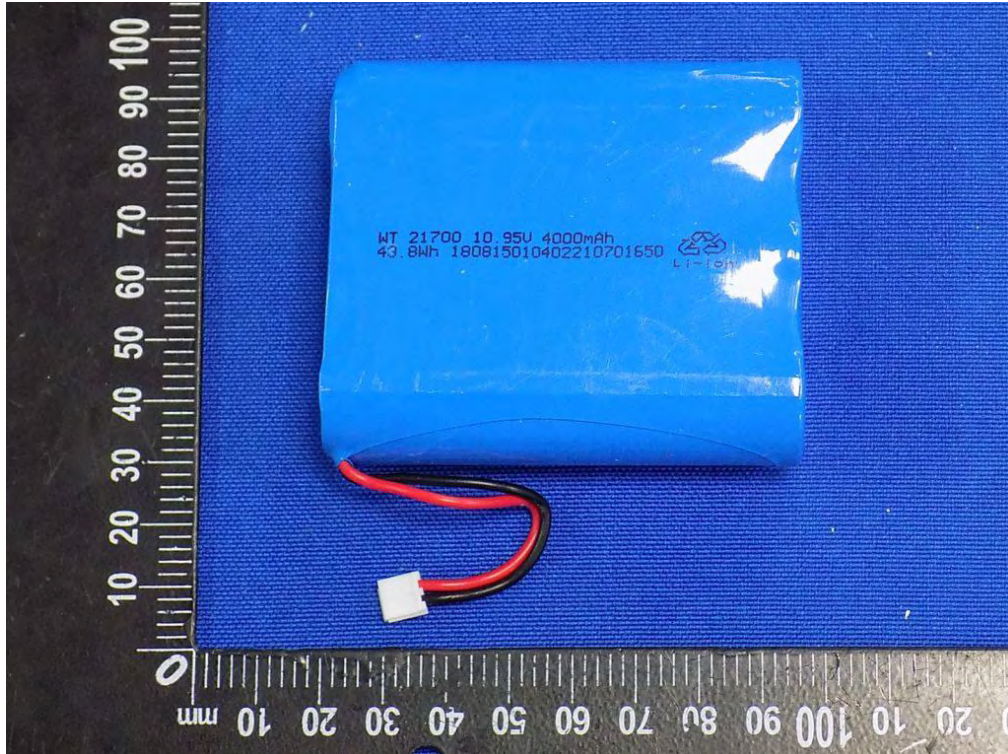
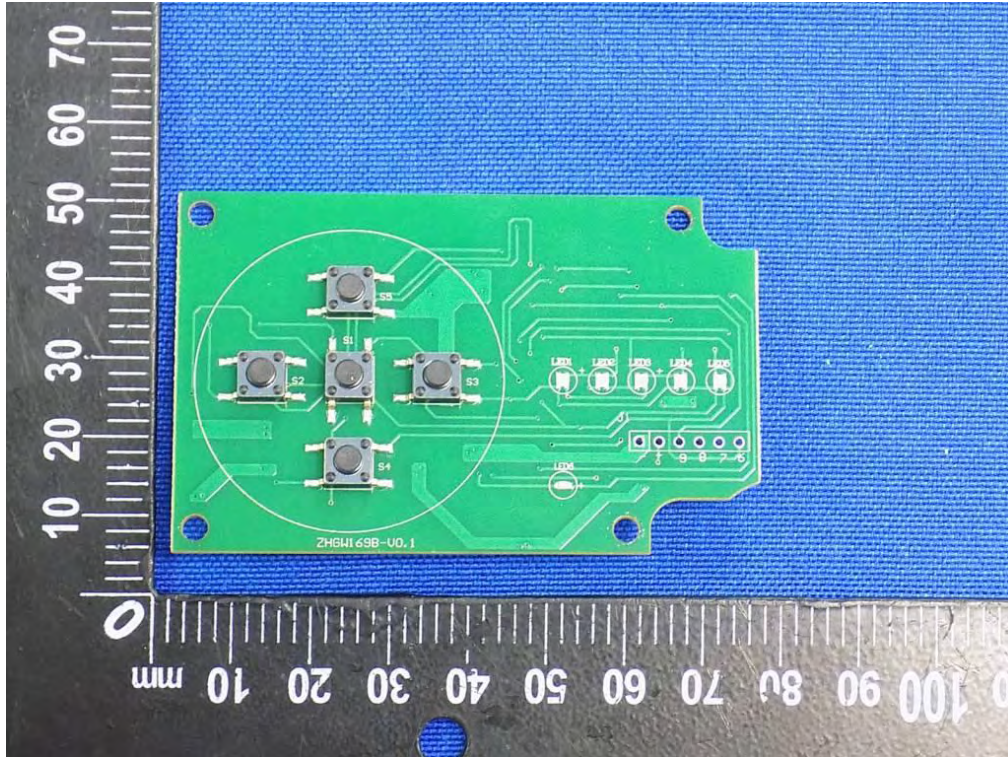


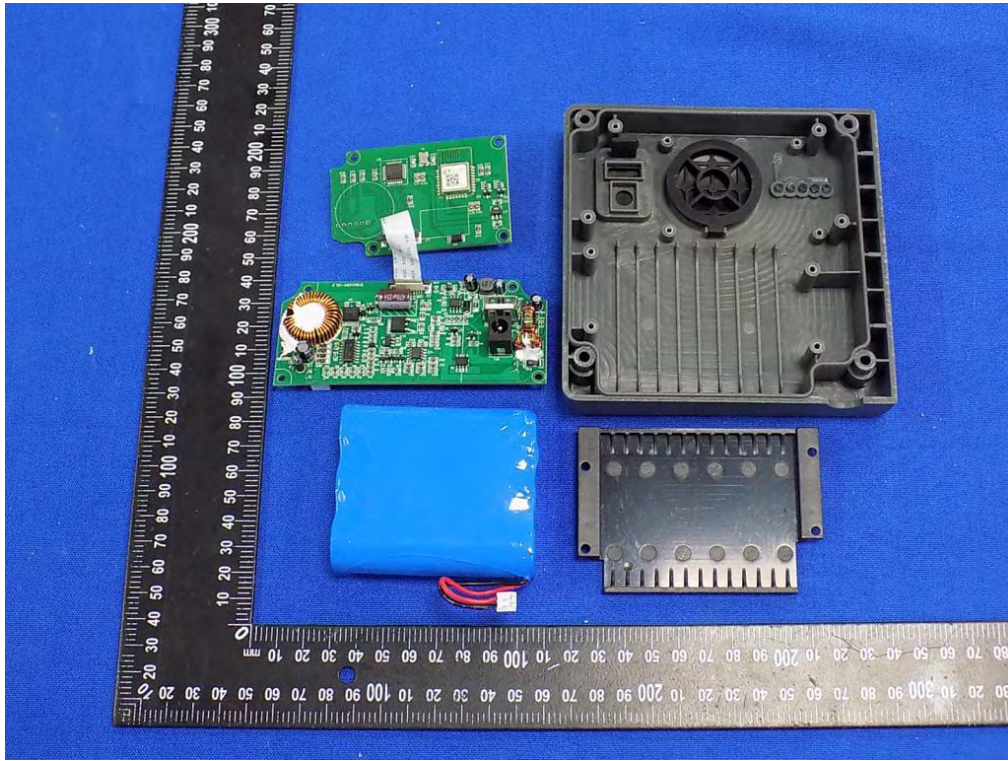


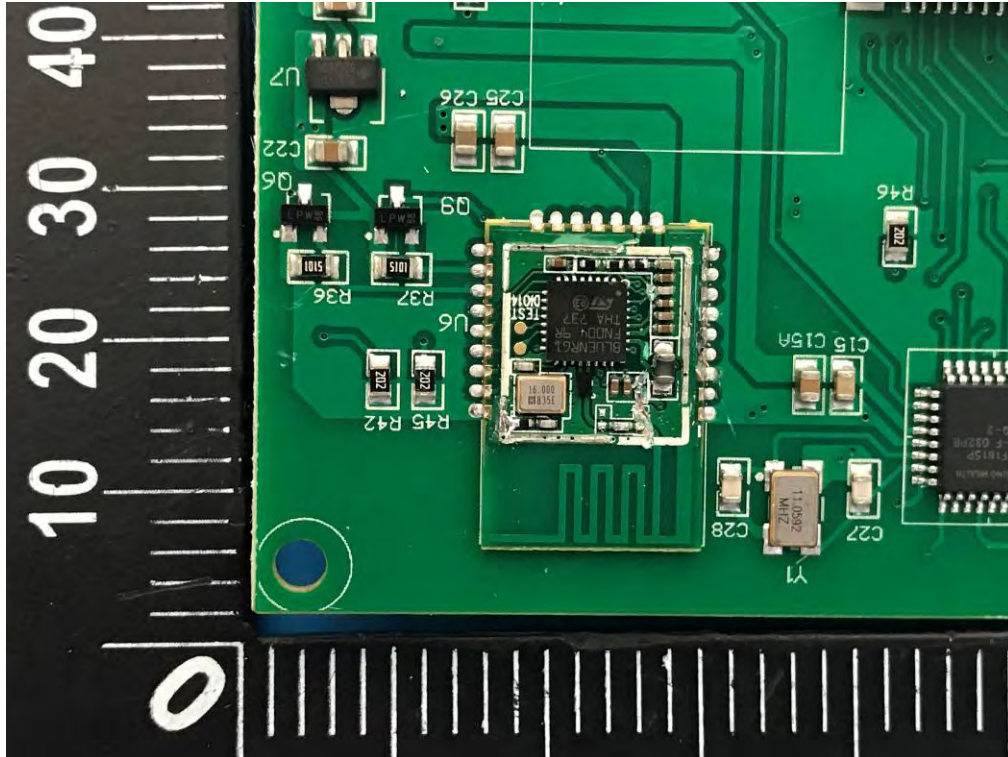












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