FCC TEST REPORT

FCC PART 15 SUBPART C 15.231

Test report

On Behalf of

AQUATIC AV

For

SW6+

Model No.: SW6+, SW620, SW621

FCC ID: WBQSW6PLUS

Prepared for :	**AQUATIC AV** **282 KINNEY DRIVE, SAN JOSE, CA 95112, USA**
Prepared By :	**Shenzhen HUAK Testing Technology Co., Ltd.** **1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China**

Date of Test:	**Jan. 03, 2019 ~ Jan. 10, 2019**
Date of Report:	**Jan. 10, 2019**
Report Number:	**HK1901090059E**

TEST RESULT CERTIFICATION

Applicant's name	:	AQUATIC AV
Address	:	282 KINNEY DRIVE, SAN JOSE, CA 95112, USA
Manufacture's Name	:	AQUATIC AV
Address	:	China Hui Zho Shi Boluo Shi Wan Luan Gangbu Xiewu Industrial Zone
Product description		
Trade Mark:		AQUATIC AV
Product name	:	SW6+
Model and/or type reference	:	SW6+, SW620, SW621
Difference description		All the same except for the model name
Standards	:	FCC Rules and Regulations Part 15 Subpart C Section 15.231 ANSI C63.10: 2013

Date of Test	:	
Date (s) of performance of tests	:	Jan. 03, 2019 ~ Jan. 10, 2019
Date of Issue	:	Jan. 10, 2019
Test Result	:	**Pass**

Testing Engineer : 

(Gary Qian)

Technical Manager : 

(Eden Hu)

Authorized Signatory : 

(Jason Zhou)

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1. TEST SUMMARY

1.1 TEST PROCEDURES AND RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.203	Antenna Requirement	Compliant
§15.231(a)(1)	Manually operated transmitter	Compliant
§15.231(b)	Average Factor	N/A
§15.231(e) & §15.209	Field Strength of Fundamental and Spurious Emission	Compliant
§15.231(c)	Bandwidth	Compliant

1.2 TEST FACILITY

Test Firm : Shenzhen HUAK Testing Technology Co., Ltd.

Address : 1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Designation Number: : CN1229

Test Firm Registration Number : 616276

1.3 MEASUREMENT UNCERTAINTY

Measurement Uncertainty

Conducted Emission Expanded Uncertainty	=	2.23dB, k=2
Radiated emission expanded uncertainty(9kHz-30MHz)	=	3.08dB, k=2
Radiated emission expanded uncertainty(30MHz-1000MHz)	=	4.42dB, k=2
Radiated emission expanded uncertainty(Above 1GHz)	=	4.06dB, k=2

2. GENERAL INFORMATION

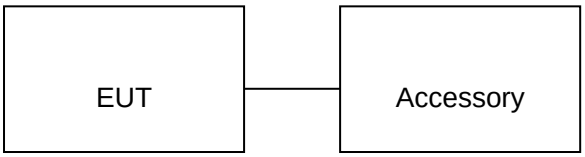
2.1 GENERAL DESCRIPTION OF EUT

Operation Frequency	433.4MHz
Field Strength(3m)	71.59dBuV/m(Peak)@3m
Modulation	ASK
Number of channels	1
Hardware Version	BM20SPK01
Software Version	20171124
Antenna Designation	PCB antenna
Antenna Gain	2dBi
Power Supply	DC 12V

2.2 OPERATION OF EUT DURING TESTING

NO.	TEST MODE DESCRIPTION
1	Transmitting mode
Note: 1. All the test modes can be supply by new battery, and only the data of the worst case recorded in the test report. 2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.	

2.3 DESCRIPTION OF TEST SETUP



Item	Equipment	Mfr/Brand	Model/Type No.	Remark
1	SW6+	AQUATIC AV	SW6+	EUT
2	Speaker	My Music	B61	A.E
3	Mobile phone	HUAWEI	V9	A.E
4	DC Source	SAIL	12V 60Ah 356A	A.E
5	DC Power Supply	LW	LW-6020KD	A.E
6	U-Disk	Kingston	DT 101G2/16GB	A.E

2.4 MEASUREMENT INSTRUMENTS LIST

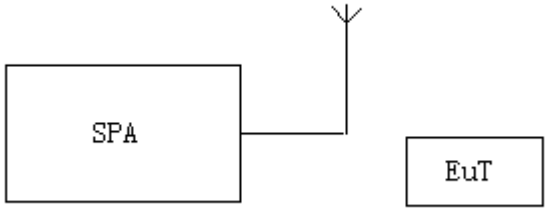
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	R&S	ENV216	HKE-002	Dec. 27, 2018	1 Year
2.	Receiver	R&S	ESCI 7	HKE-010	Dec. 27, 2018	1 Year
3.	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 27, 2018	1 Year
4.	Spectrum analyzer	R&S	FSP40	HKE-025	Dec. 27, 2018	1 Year
5.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 27, 2018	1 Year
6.	Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Dec. 27, 2018	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESCI 7	HKE-010	Dec. 27, 2018	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Dec. 27, 2018	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 27, 2018	1 Year
10.	Horn Antenna	Schewarzbeck	9120D	HKE-013	Dec. 27, 2018	1 Year
11.	Pre-amplifier	EMCI	EMC051845 SE	HKE-015	Dec. 27, 2018	1 Year
12.	Pre-amplifier	Agilent	83051A	HKE-016	Dec. 27, 2018	1 Year
13.	EMI Test Software EZ-EMC	Tonscend	JS1120-B Version	HKE-083	Dec. 27, 2018	N/A
14.	Shielded room	Shiel Hong	4*3*3	HKE-039	Dec. 27, 2018	3 Year

3. PROVISION FOR MOMENTARY OPERATION

3.1 MEASUREMENT PROCEDURE

1. Set the parameters of SPA as below:
   Centre frequency = Operation Frequency
   RBW=1MHz, VBW=3MHz
   Span: 0Hz
   Sweep time: 1000S
2. Set the EUT to transmit by manually operated. Use the “View” function of SPA to find the transmission time of being released.
3. Record the data and Reported.

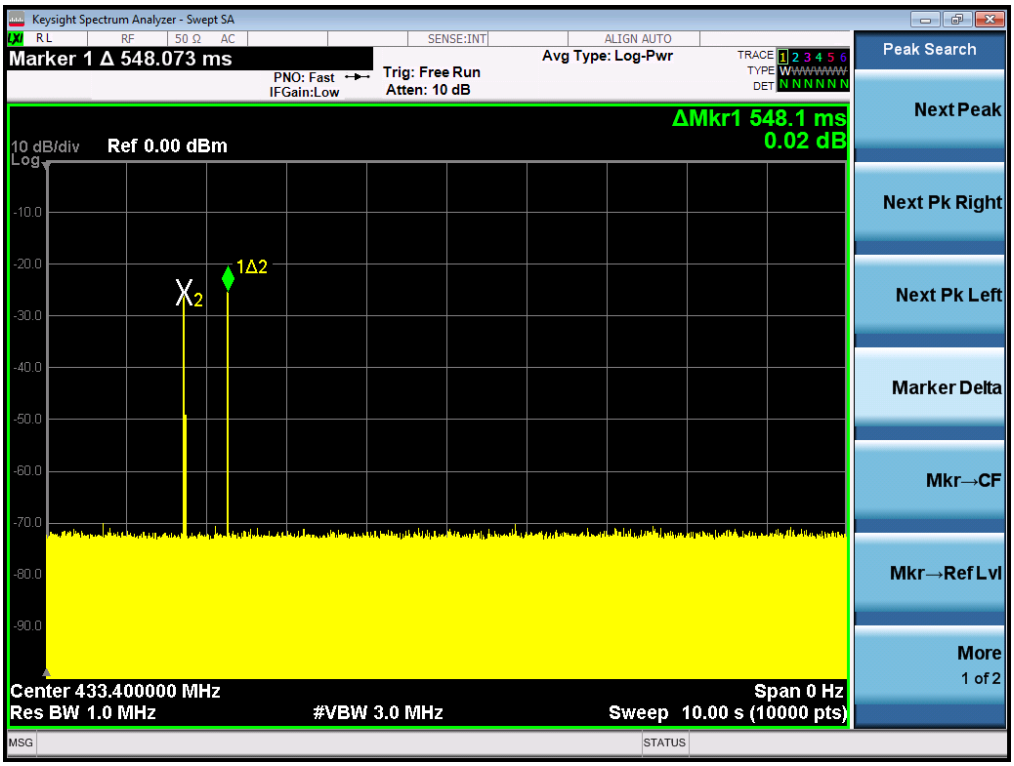
3.2 TEST SETUP



3.3 TEST RESULT

Test Mode: EUT @ 433.4MHz for RF Transmitter

The time of stopping transmission	Limit (s)
0.5481	5.00



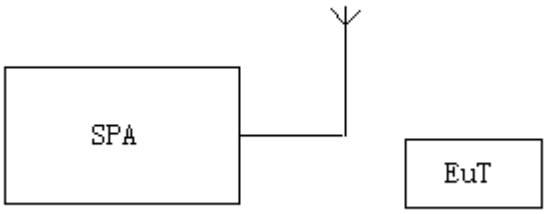
RESULT: PASS

4. DUTY CYCLE CORRECTION FACTOR

4.1 MEASUREMENT PROCEDURE

1. Set the parameters of SPA as below:
   Centre frequency = Operation Frequency
   RBW=1MHz; VBW=3MHz
   Span: 0Hz
   Sweep time: more than two pulse trains or more than each type of pulse occupancy time
2. Set the EUT to transmit by manually operated. Use the “Delta mark” function of SPA to find the period time between two pulse trains and each type of pulse occupancy time.
3. Record the plots and Reported.

4.2 TEST SETUP



4.3 TEST RESULT

Note: The level of the peak emission are less than the average limit, so the average factor need not to be tested.

5. RADIATED EMISSION

5.1. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

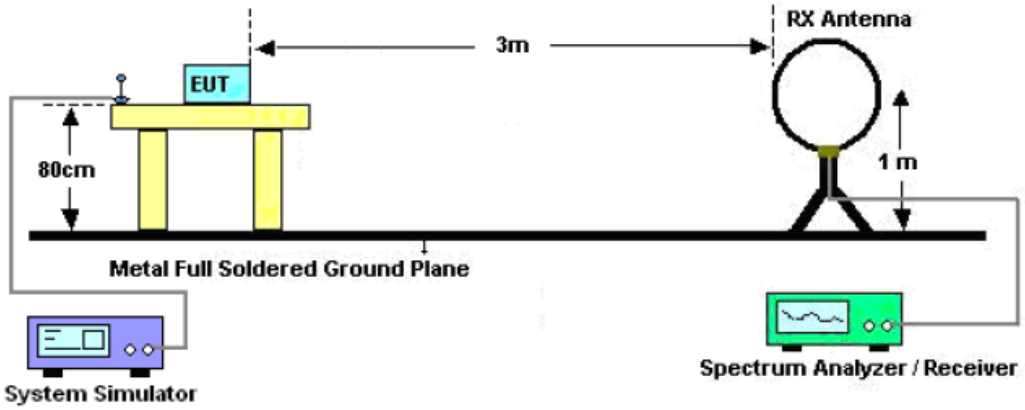
The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RBW 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RBW 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RBW 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz 1MHz/1MHz for Peak, 1MHz/10Hz for Average

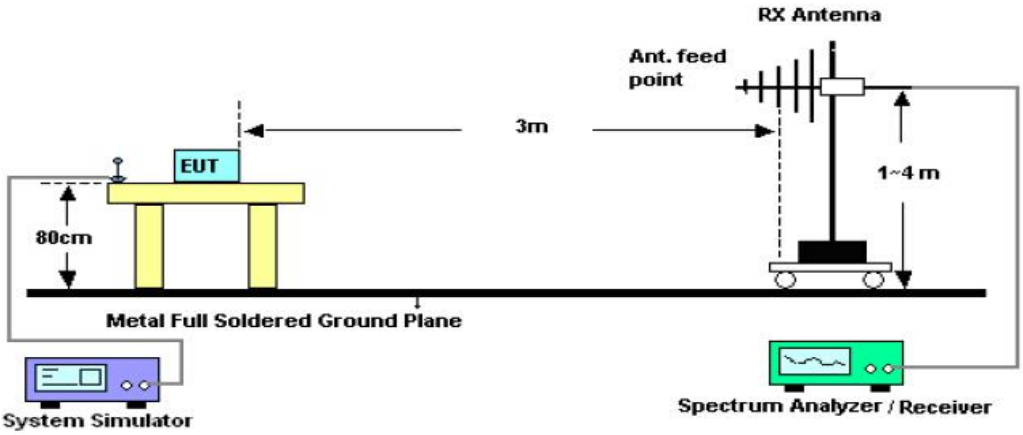
Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RBW 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RBW 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RBW 120KHz for QP

5.2. TEST SETUP

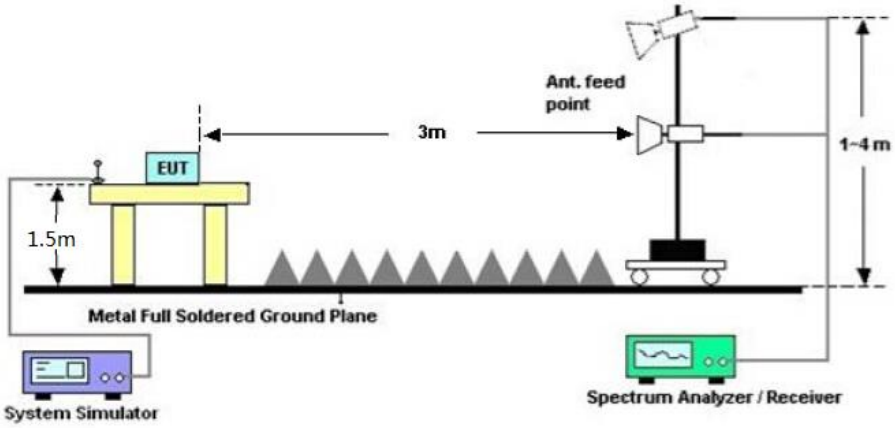
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



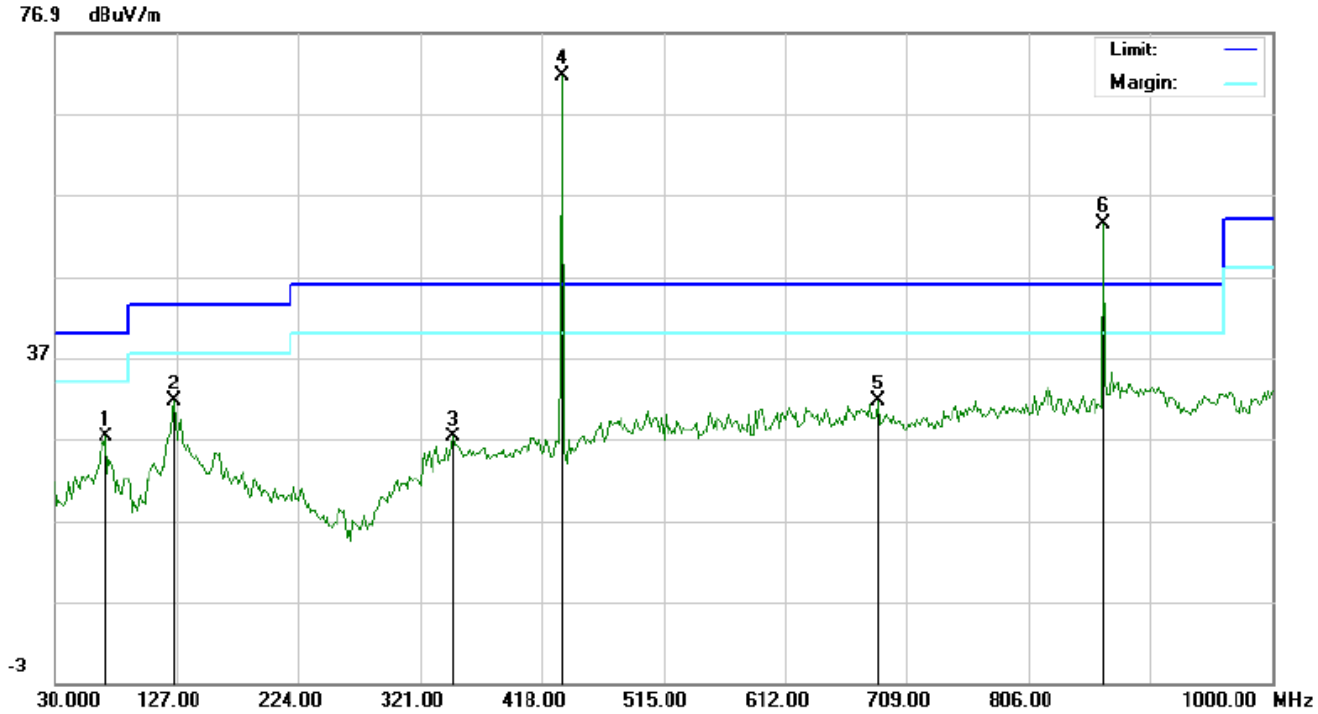
5.3. TEST RESULT

Test Mode: EUT @ 433.4MHz for RF Transmitter

RADIATED EMISSION BELOW 30MHz

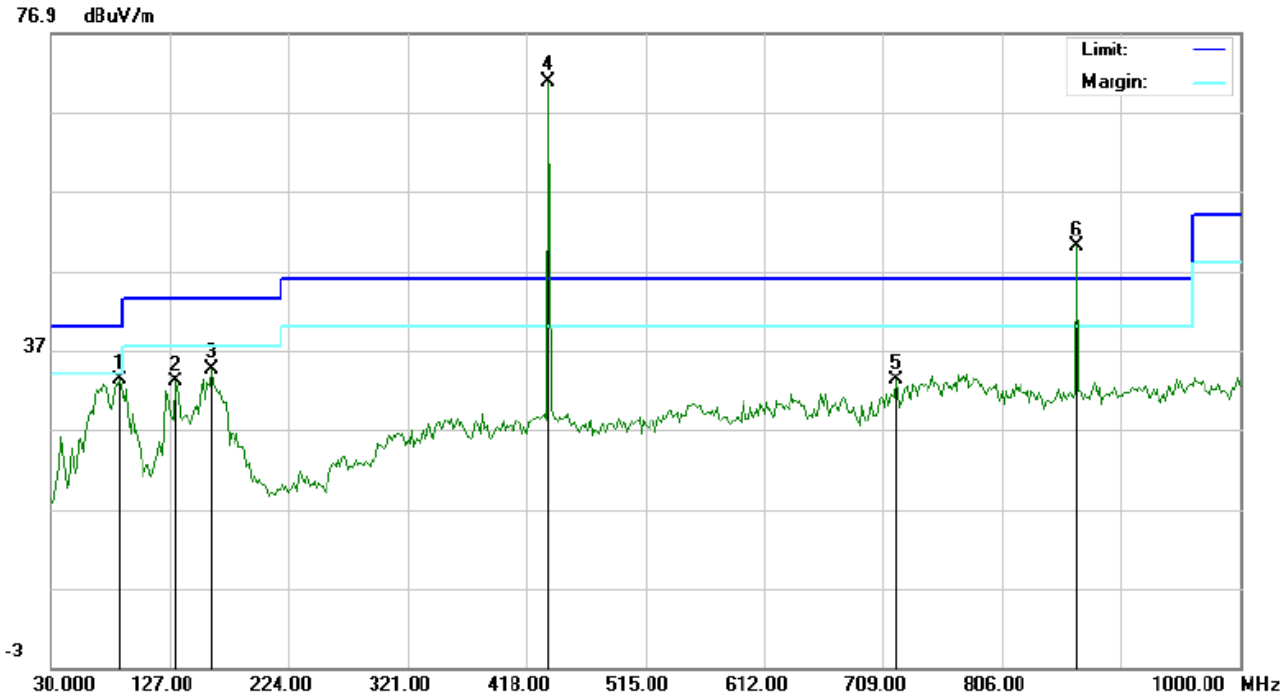
No emission found between lowest internal used/generated frequencies to 30MHz.

RADIATED EMISSION BELOW 1GHZ-Horizontal



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dBuV/m	dBuV/m	dBuV/m	dB		cm	degree	
1		70.4167	17.33	9.85	27.18	40.00	-12.82	peak			
2		125.3833	23.17	8.37	31.54	43.50	-11.96	peak			
3		346.8666	8.72	18.53	27.25	46.00	-18.75	peak			
4	*	433.4005	51.48	20.11	71.59	80.80	-9.21	peak			
5		686.3665	6.72	24.85	31.57	46.00	-14.43	peak			
6	X	866.8005	25.59	27.72	53.31	60.80	-7.49	peak			

RADIATED EMISSION BELOW 1GHZ-Vertical



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dBuV/m	dBuV/m	dBuV/m	dB		cm	degree	
1		86.5830	29.05	4.16	33.21	40.00	-6.79	peak			
2		131.8497	21.22	11.80	33.02	43.50	-10.48	peak			
3		160.9499	19.28	15.27	34.55	43.50	-8.95	peak			
4	*	433.4002	50.69	20.16	70.85	80.80	-9.95	peak			
5		720.3165	7.35	25.77	33.12	46.00	-12.88	peak			
6	X	866.8002	22.20	27.76	49.96	60.80	-10.84	peak			

RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss - Amplifier gain, Margin=Measurement-Limit.

2. The “Factor” value can be calculated automatically by software of measurement system.

3. Emissions of frequency range from 1GHz to 5GHz have 20dB margin. No recording in the test report.

6. FCC LINE CONDUCTED EMISSION TEST

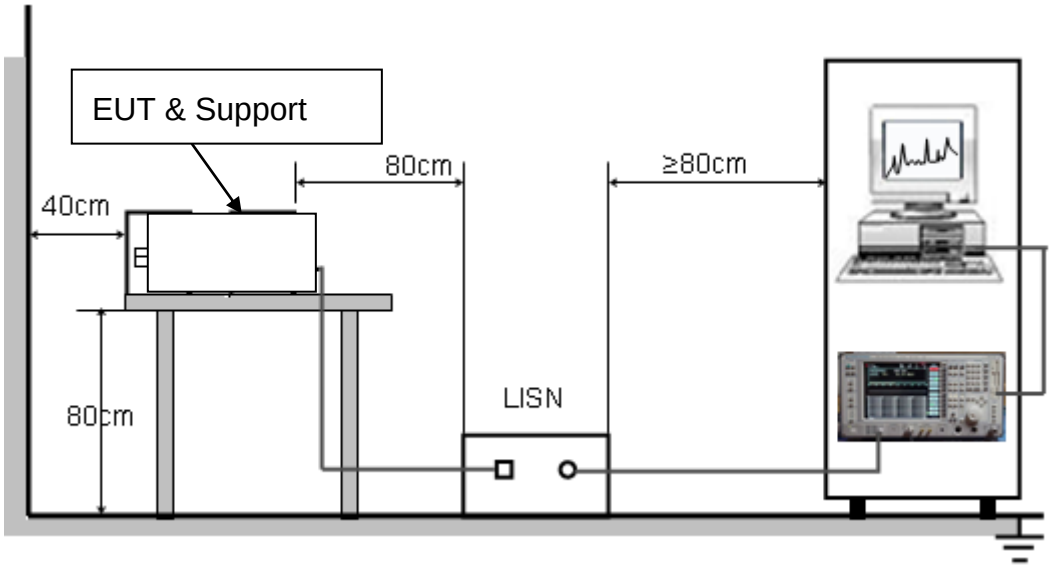
6.1. LIMITS OF LINE CONDUCTED EMISSION TEST

Frequency	Maximum RF Line Voltage	
	Q.P.(dBuV)	Average(dBuV)
150kHz~500kHz	66-56	56-46
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Note:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50MHz.

6.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST



6.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. All support equipments received AC120V/60Hz power from a LISN, if any.
5. The EUT received charging voltage by adapter which received 120V/60Hzpower by a LISN..
6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.
9. The test mode(s) were scanned during the preliminary test.

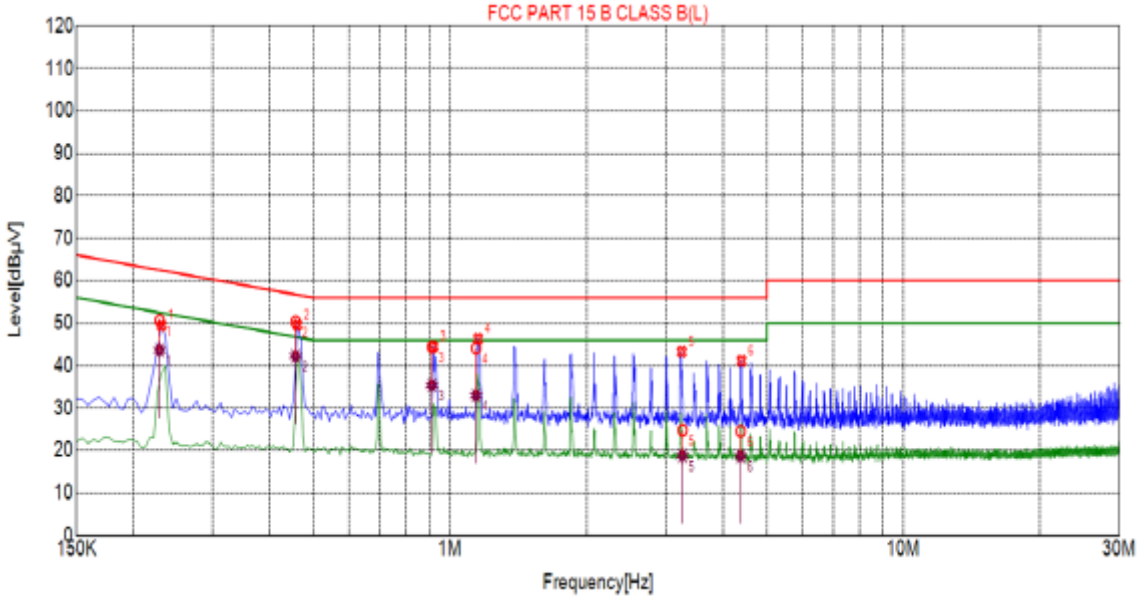
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

6.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less –2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
3. The test data of the worst case condition(s) was reported on the Summary Data page.

6.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

LINE CONDUCTED EMISSION TEST-L



Suspected List

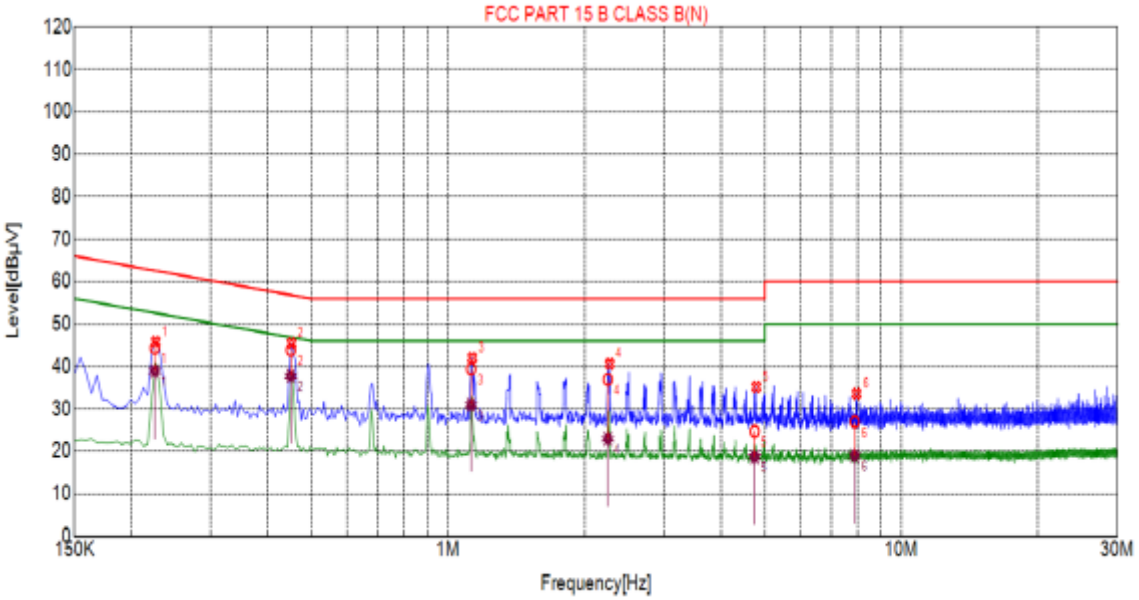
NO.	Freq. [MHz]	Level [dBµV]	Factor [dB]	Limit [dBµV]	Margin [dB]	Detector
1	0.2310	49.44	10.03	62.41	12.97	PK
2	0.4605	49.55	10.04	56.68	7.13	PK
3	0.9195	44.48	10.06	56.00	11.52	PK
4	1.1535	46.33	10.09	56.00	9.67	PK
5	3.2460	43.23	10.23	56.00	12.77	PK
6	4.3980	41.10	10.25	56.00	14.90	PK

Final Data List

NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]
1	0.2267	10.03	50.63	62.50	11.87	43.62	52.50	8.88
2	0.4564	10.04	50.32	56.76	6.44	42.25	46.76	4.51
3	0.9126	10.06	44.45	56.00	11.55	35.40	46.00	10.60
4	1.1420	10.09	44.13	56.00	11.87	32.98	46.00	13.02
5	3.2582	10.23	24.82	56.00	31.18	18.78	46.00	27.22
6	4.3790	10.25	24.58	56.00	31.42	18.70	46.00	27.30

RESULT: PASS

LINE CONDUCTED EMISSION TEST-N



Suspected List						
NO.	Freq. [MHz]	Level [dBµV]	Factor [dB]	Limit [dBµV]	Margin [dB]	Detector
1	0.2265	45.80	10.03	62.58	16.78	PK
2	0.4515	45.46	10.04	56.85	11.39	PK
3	1.1310	42.07	10.08	56.00	13.93	PK
4	2.2740	40.63	10.18	56.00	15.37	PK
5	4.7895	35.19	10.26	56.00	20.81	PK
6	7.9665	33.59	10.15	60.00	26.41	PK

Final Data List								
NO.	Freq. [MHz]	Factor [dB]	QP Value [dBµV]	QP Limit [dBµV]	QP Margin [dB]	AV Value [dBµV]	AV Limit [dBµV]	AV Margin [dB]
1	0.2254	10.04	44.42	62.62	18.20	38.90	52.62	13.72
2	0.4499	10.04	43.90	56.88	12.98	37.81	46.88	9.07
3	1.1242	10.08	39.42	56.00	16.58	30.98	46.00	15.02
4	2.2521	10.18	36.95	56.00	19.05	22.96	46.00	23.04
5	4.7487	10.26	24.76	56.00	31.24	18.69	46.00	27.31
6	7.8957	10.15	27.00	60.00	33.00	19.00	50.00	31.00

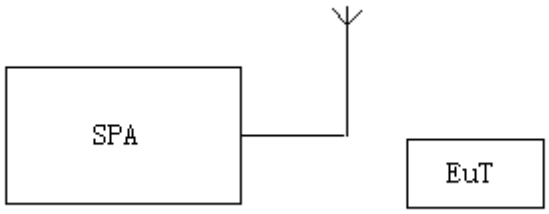
RESULT: PASS

7. BANDWIDTH

7.1. MEASUREMENT PROCEDURE

1. Set the parameters of SPA as below:
   Centre frequency = Operation Frequency
   RBW=3KHz
   VBW=10KHz
   Span: 300kHz
   Sweep time: Auto
2. Set the EUT to continue transmitting mode. Allow the trace to stabilize. Use the “N dB down” function of SPA to define the bandwidth.
3. Record the plots and Reported.

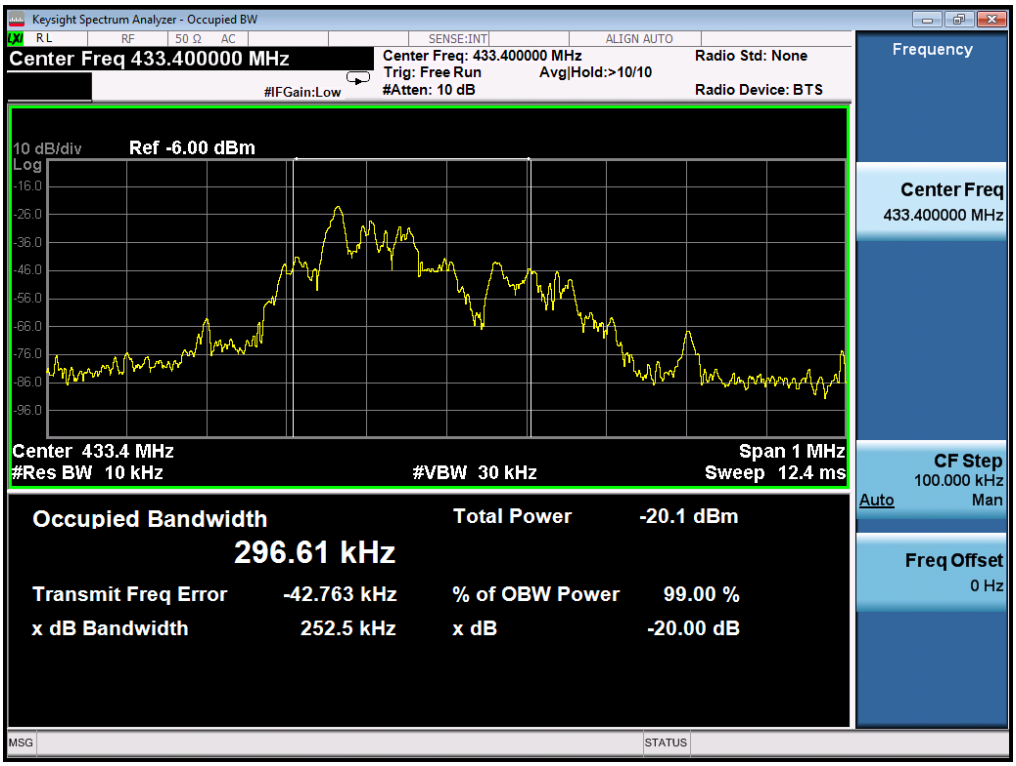
7.2. TEST SETUP



7.3. TEST RESULT

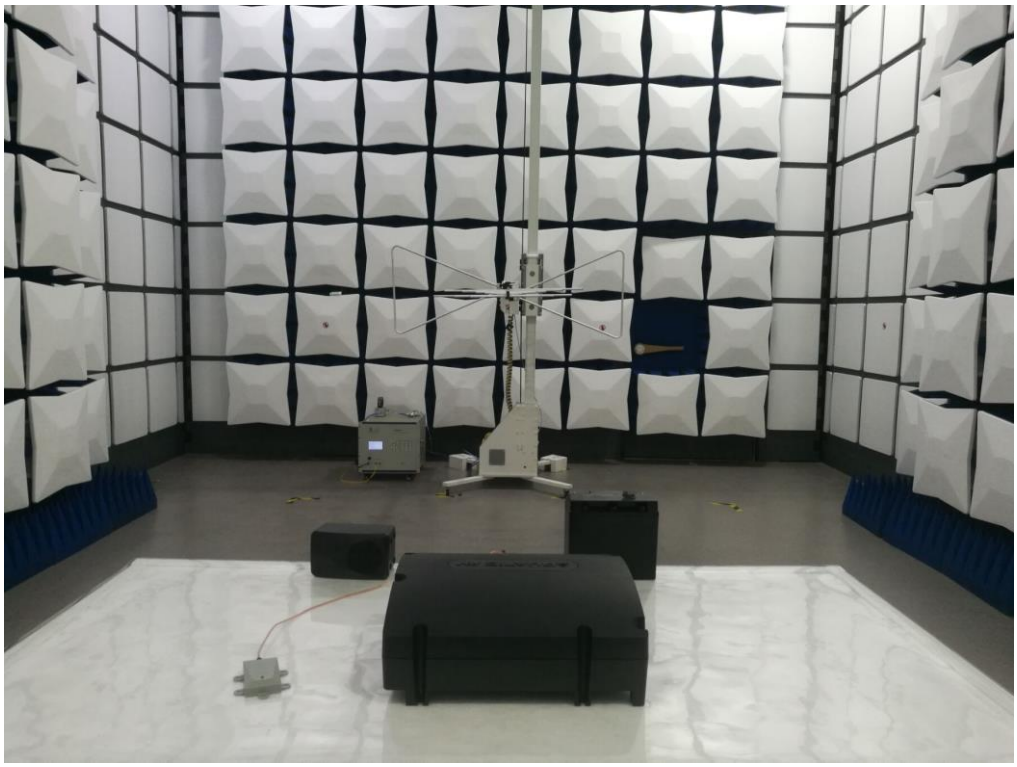
Test Mode: EUT @ 433.4MHz for RF Transmitter

-20dB bandwidth	LIMIT	RESULT
252.5kHz	1083.5KHz	Pass
Note: Limit= Operation Frequency ×0.25%		

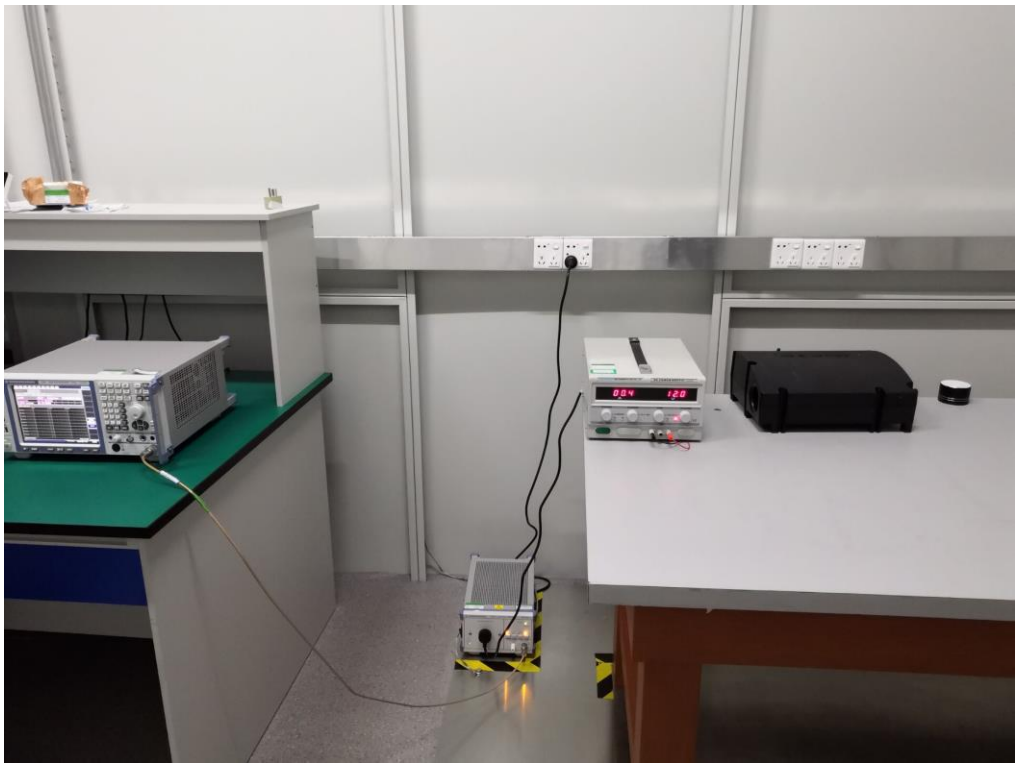


8. PHOTOGRAPH OF TEST

Radiated Emission



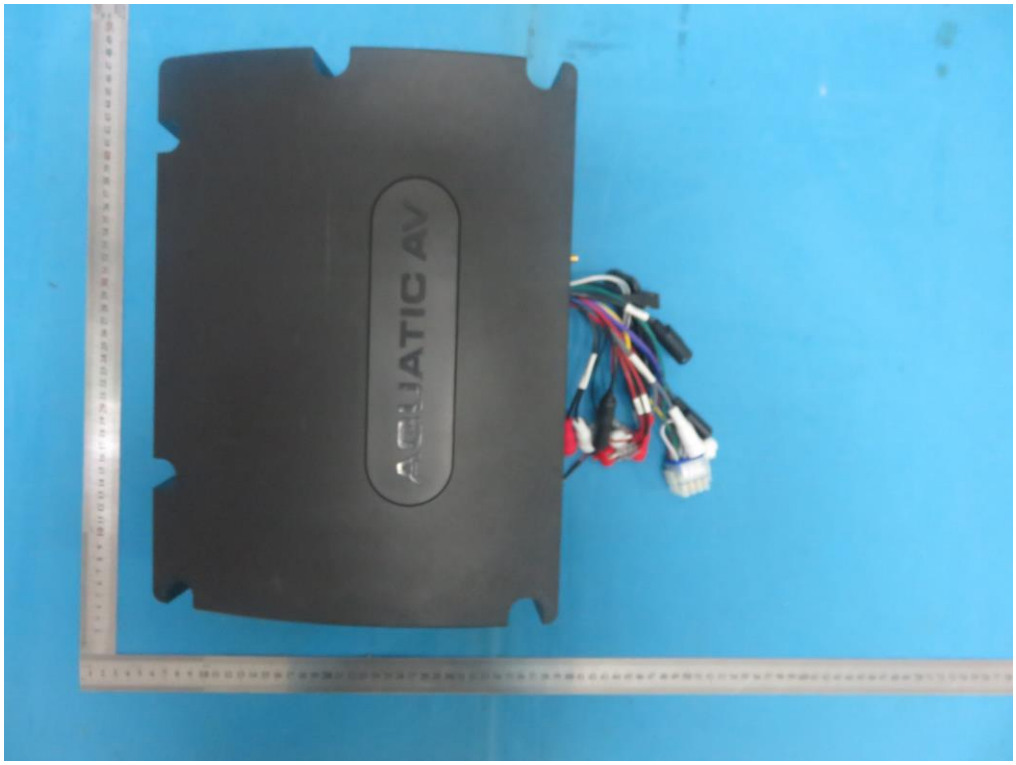
Conducted Emission



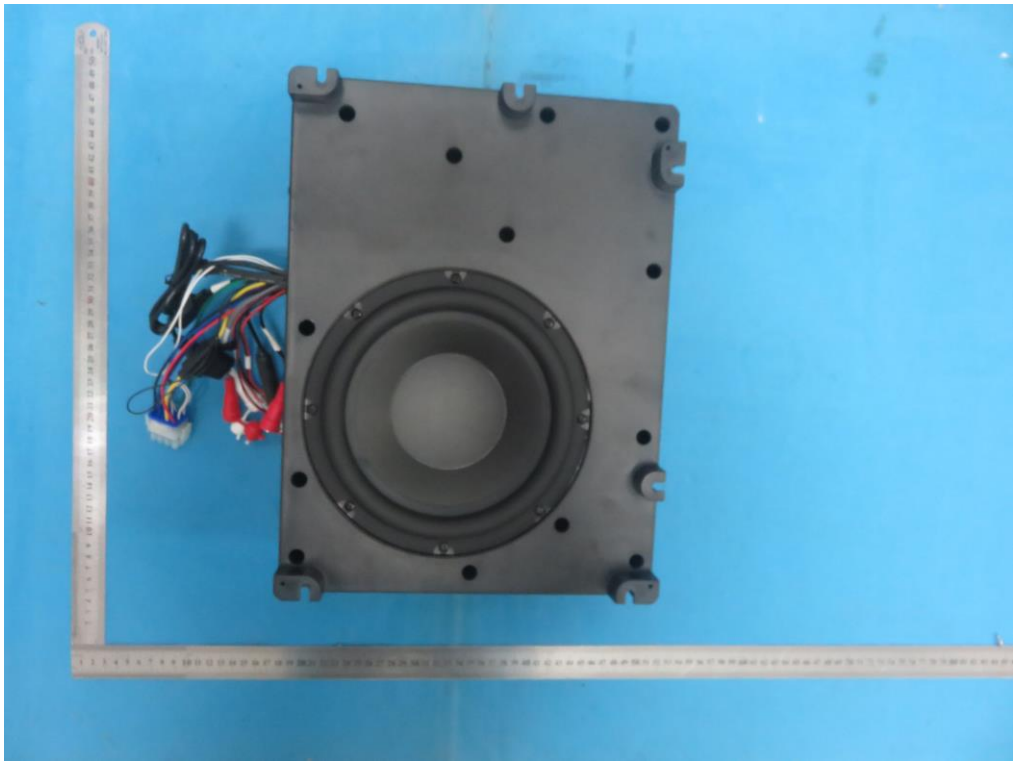
9. PHOTOGRAPH OF EUT

TOTAL VIEW OF EUT

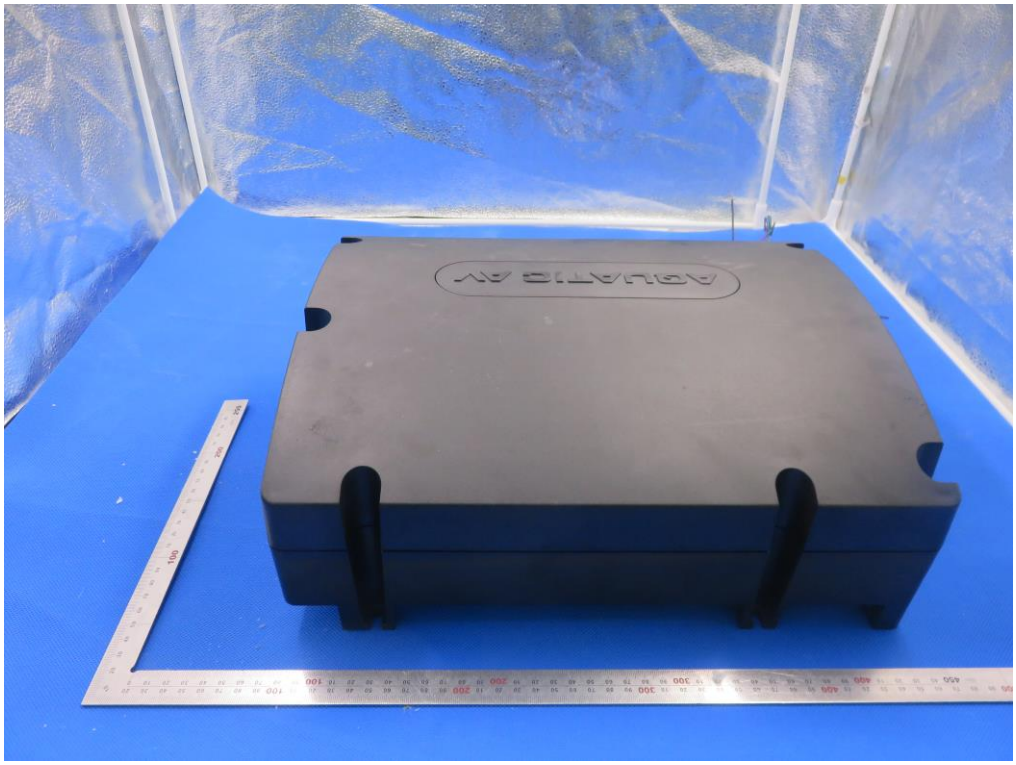
TOP VIEW OF EUT



BOTTOM VIEW OF EUT

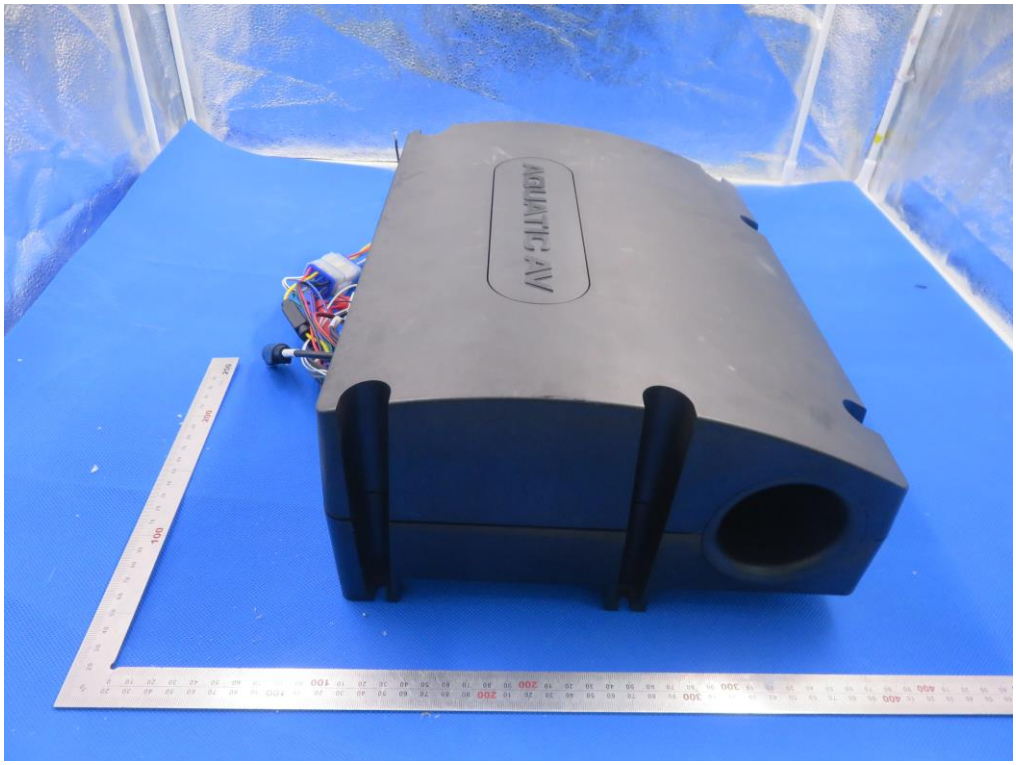


FRONT VIEW OF EUT

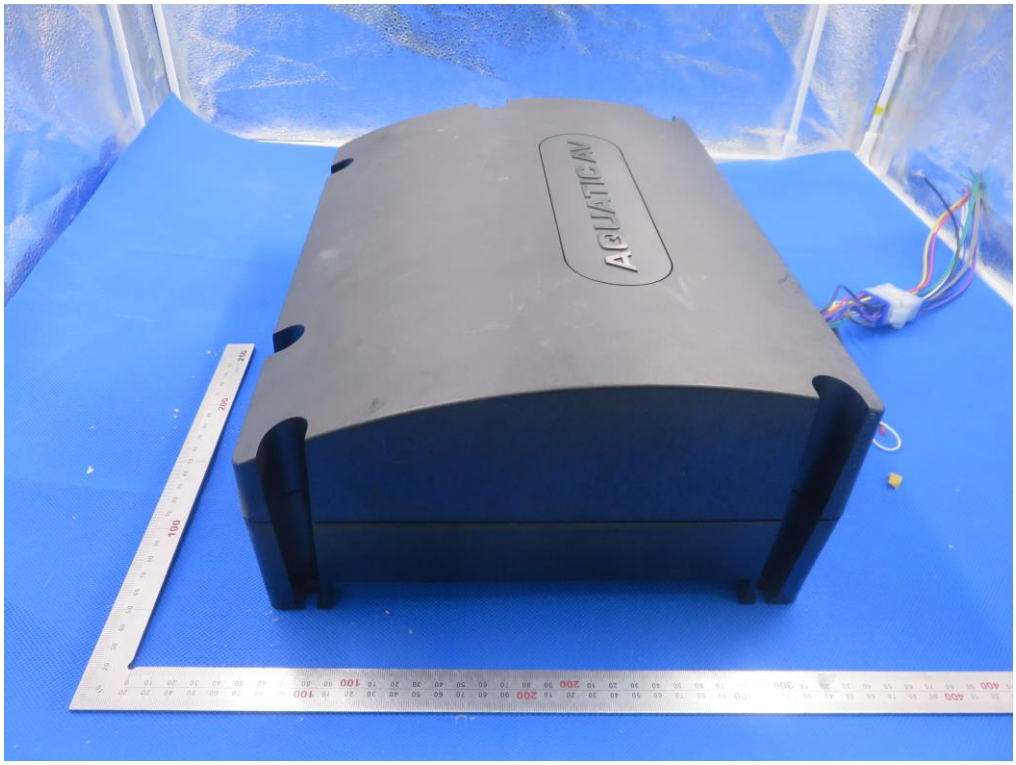


BACK VIEW OF EUT

LEFT VIEW OF EUT

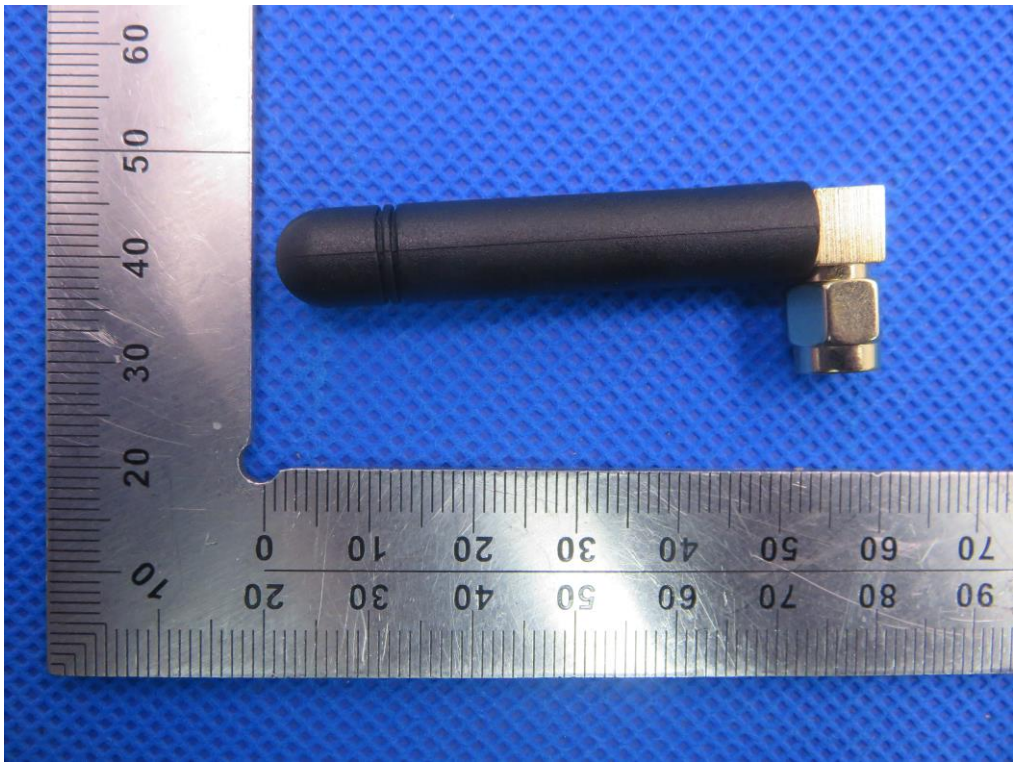


RIGHT VIEW OF EUT

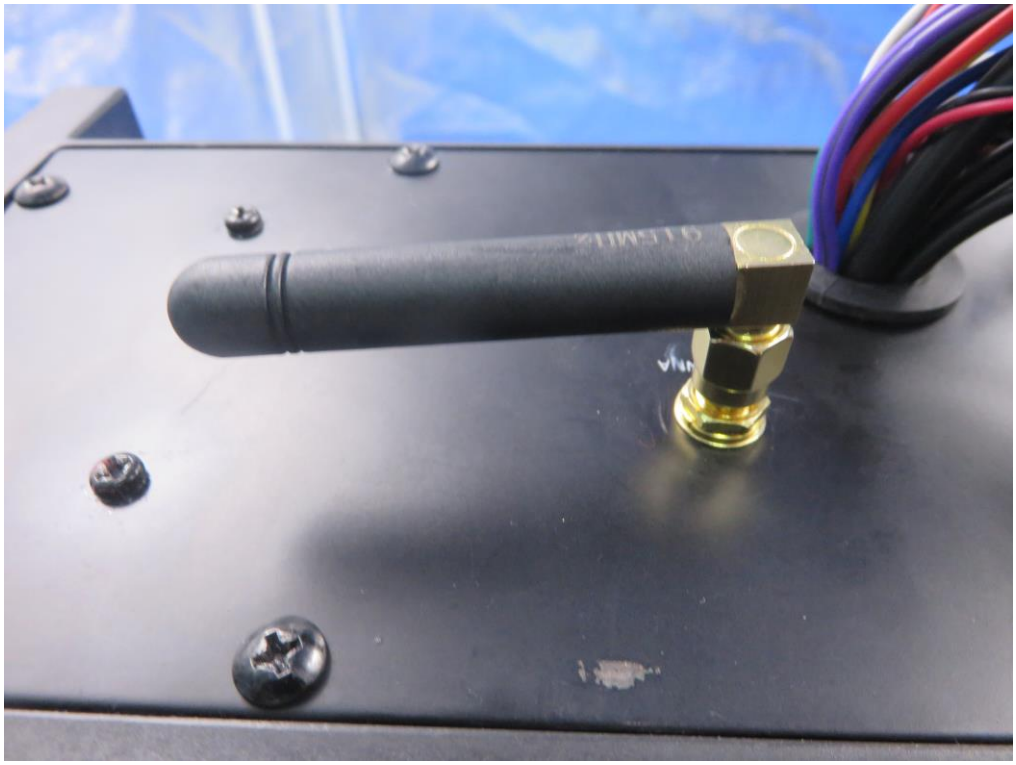


VIEW OF EUT (PORT)-1

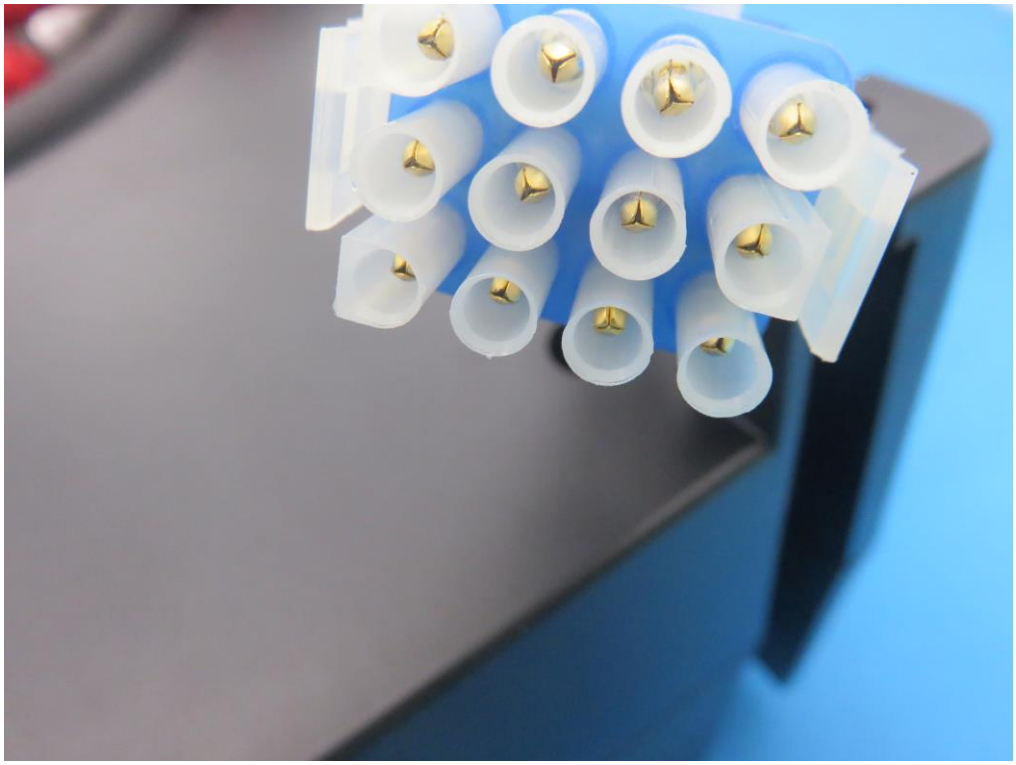
VIEW OF BT ANTENNA-1



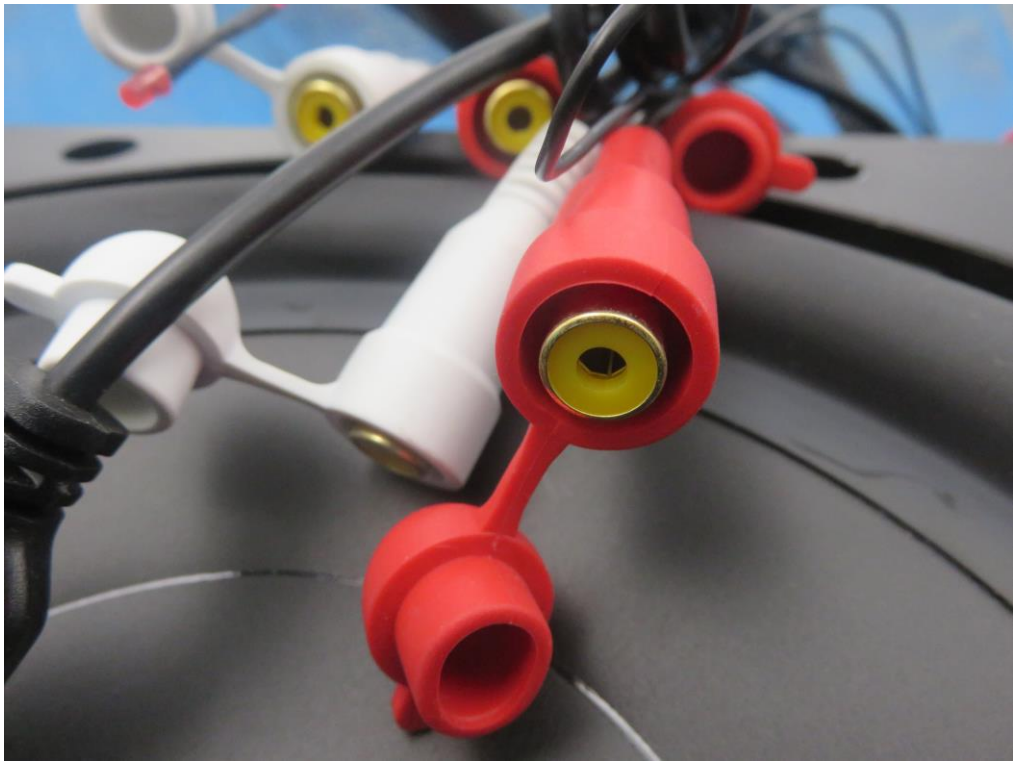
VIEW OF BT ANTENNA-2



VIEW OF EUT (PORT)-2

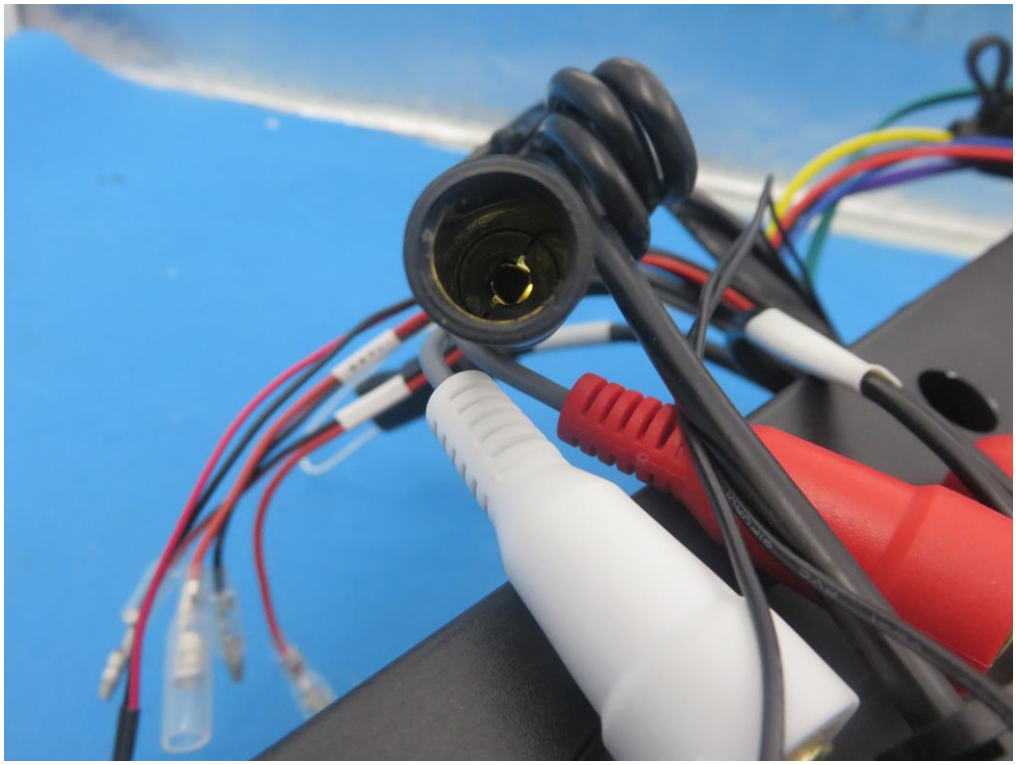


VIEW OF EUT (PORT)-3



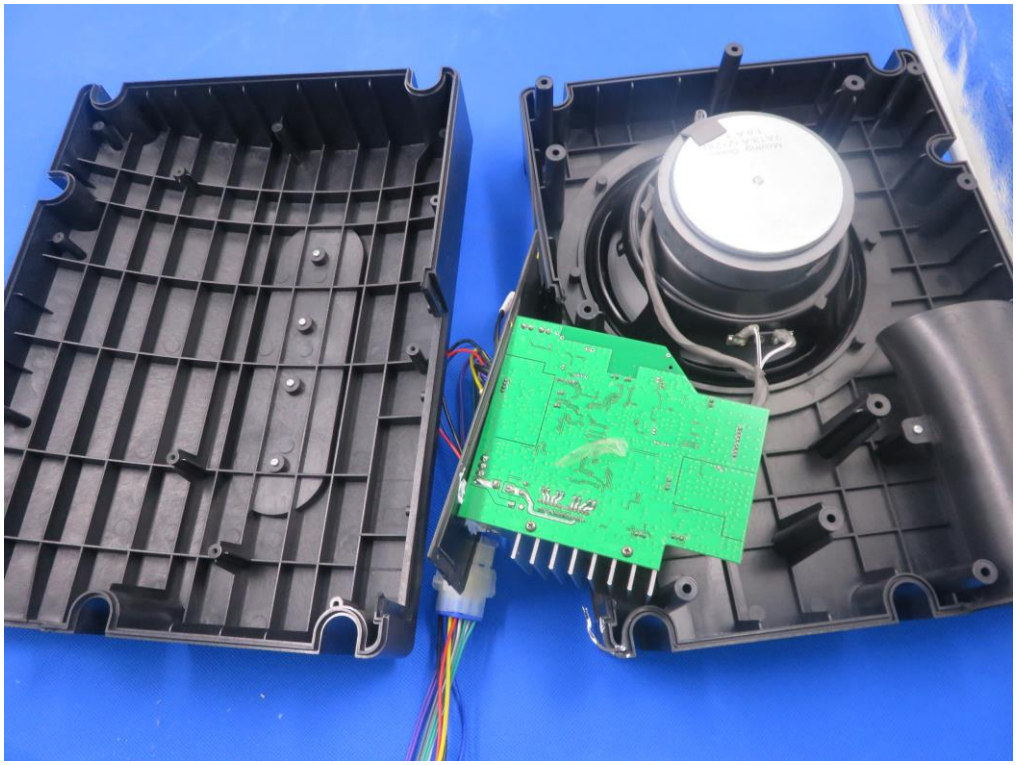
VIEW OF EUT (PORT)-4

VIEW OF EUT (PORT)-5

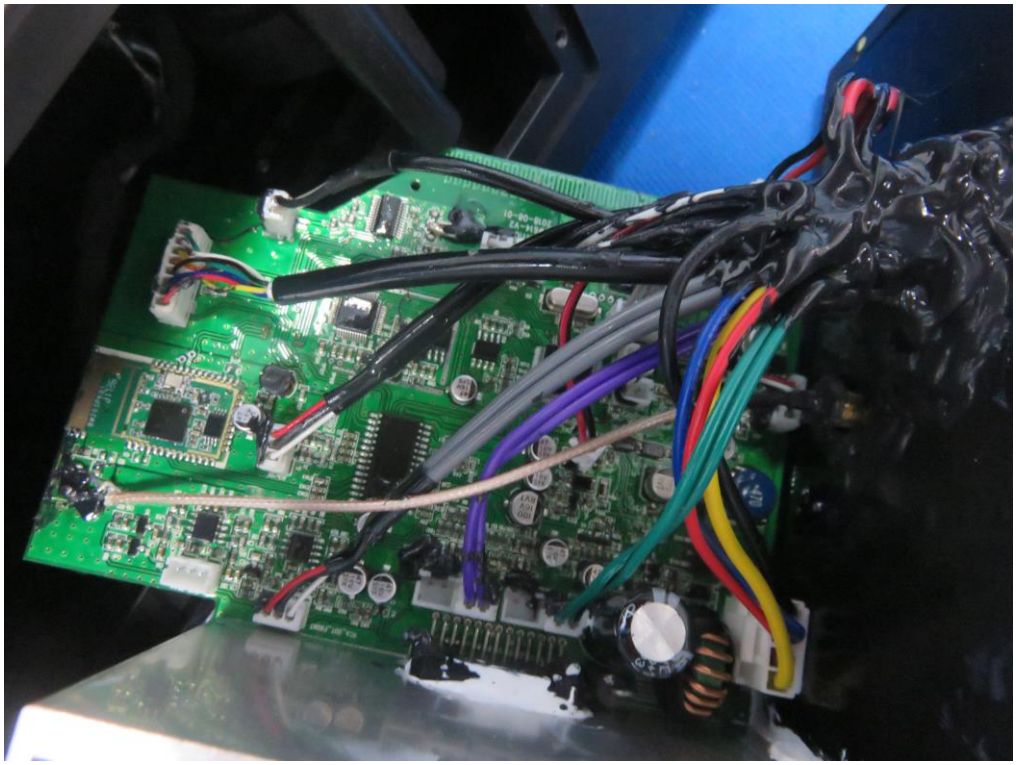


VIEW OF EUT (PORT)-6

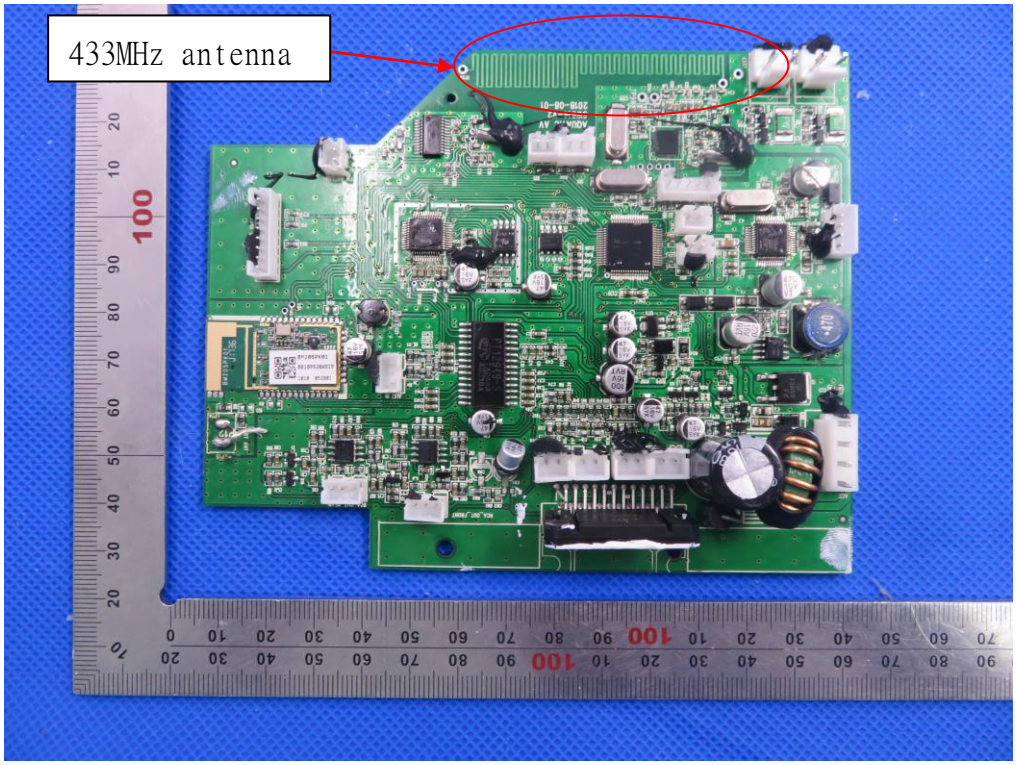
OPEN VIEW OF EUT-1



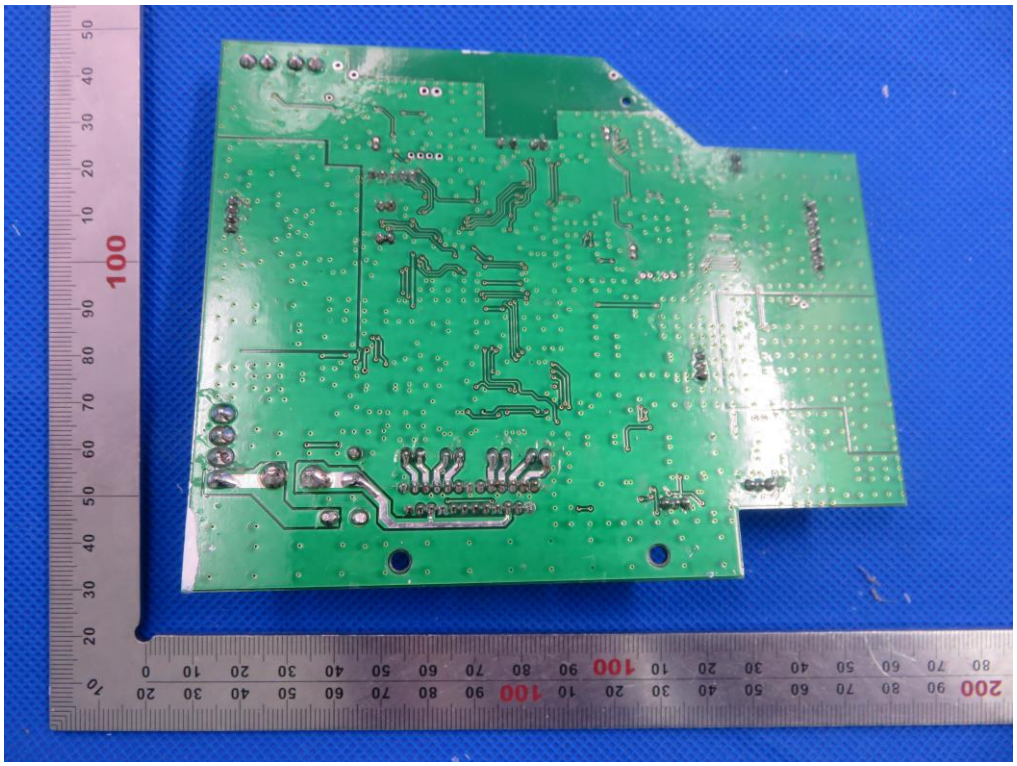
OPEN VIEW OF EUT-2



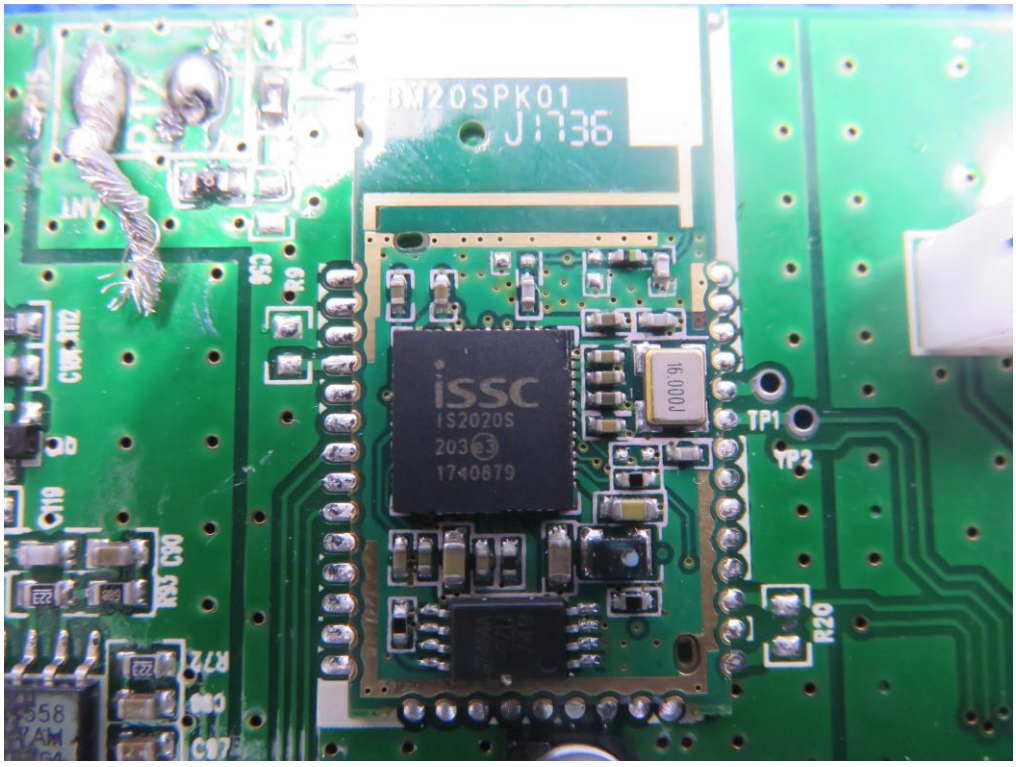
INTERNAL VIEW OF EUT-1



INTERNAL VIEW OF EUT-2



INTERNAL VIEW OF EUT-3



----END OF REPORT----