FCC Test Report

Report No.: AGC08073200302FE06

FCC ID	:	2ATZS-HUD001
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	Car Head Up Display
BRAND NAME	:	N/A
MODEL NAME	:	HUD001, HUD002, HUD003, HUD004, HUD005
APPLICANT	:	SHENZHEN LEADINWAY TECHNOLOGY CO.,LTD
DATE OF ISSUE	:	May 12, 2020
STANDARD(S)	:	FCC Part 15.239
REPORT VERSION	:	V1.0

Attestation of Global Compliance(Shenzhen) Co., Ltd

CAUTION:
This report shall not be reproduced except in full without the written permission of the test laboratory and shall not be quoted out of context.

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	May 12, 2020	Valid	Original Report

TABLE OF CONTENTS

1. VERIFICATION OF CONFORMITY 4

2. GENERAL INFORMATION 5

2.1.PRODUCT DESCRIPTION 5

3. MEASUREMENT UNCERTAINTY 5

4. DESCRIPTION OF TEST MODES 5

5. SYSTEM TEST CONFIGURATION 6

5.1. EQUIPMENT USED IN EUT SYSTEM 6

5.2. SUMMARY OF TEST RESULTS 6

6. TEST FACILITY 7

7. RADIATED EMISSION 8

7.1. MEASUREMENT PROCEDURE 8

7.2.TEST SETUP 10

7.3. TEST RESULTFOR FIELD STRENGTH OF FUNDAMENTAL 11

7.4. TEST RESULT FOR FIELD STRENGTH OF BAND EDGE EMISSION 11

7.5. TEST RESULT FOR SPURIOUS EMISSION 12

8. BANDWIDTH 14

8.1. MEASUREMENT PROCEDURE 14

8.2. TEST SETUP 14

8.3. TEST RESULT 15

APPENDIX A: PHOTOGRAPHS OF TEST SETUP 17

APPENDIX B:PHOTOGRAPHS OF EUT 18

1. VERIFICATION OF CONFORMITY

Applicant	SHENZHEN LEADINWAY TECHNOLOGY CO.,LTD
Address	5F, baotian industrial zone, chentian community, xixiang town, bao'an district, shenzhen, China
Manufacturer	SHENZHEN LEADINWAY TECHNOLOGY CO.,LTD
Address	5F, baotian industrial zone, chentian community, xixiang town, bao'an district, shenzhen, China
Factory	SHENZHEN LEADINWAY TECHNOLOGY CO.,LTD
Address	5F, baotian industrial zone, chentian community, xixiang town, bao'an district, shenzhen, China
Product Designation	Car Head Up Display
Brand Name	N/A
Test Model	HUD001
Series Model	HUD002, HUD003, HUD004, HUD005
Difference Description	All the same except for the model name.
Date of test	Apr. 01, 2020 to May 12, 2020
Deviation	No any deviation from the test method
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BR/RF (2013-03-01)

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC part 15.239.

Prepared By	Thea Huang (Project Engineer)	May 12, 2020
Reviewed By	Max Zhang (Reviewer)	May 12, 2020
Approved By	Forrest Lei (Authorized Officer)	May 12, 2020

2. GENERAL INFORMATION

2.1.PRODUCT DESCRIPTION

A major technical description of EUT is described as following

Operation Frequency	88.1MHz-107.9MHz
Field Strength(3m)	43.89dBuV/m(AVG)@3m
Modulation	FM
Number of channels	199(Channel spacing 100kHz)
Hardware Version	YHW-HUD01_V2
Software Version	General20191118(EQ)
Antenna Designation	Integral Antenna (Met 15.203 Antenna requirement)
Antenna Gain	0dBi
Power Supply	DC 12/24V

NOTE: About the EUT, please refer to User's Manual.

3. MEASUREMENT UNCERTAINTY

- Uncertainty of Radiated Emission below 1GHz, Uc = ±3.9 dB
- Uncertainty of Radiated Emission above 1GHz, Uc = ±4.8 dB

4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Transmitting mode(Low channel)
2	Transmitting mode(Middle channel)
3	Transmitting mode(High channel)

Note: 1. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
2. All the requirements have been tested by modulating the transmitter with a 2.5 kHz tone at a fixed level which set to the manufacturer's maximum rated input to the modulator.
3. Only the result of the worst case was recorded in the report, if no other cases.

5. SYSTEM TEST CONFIGURATION

5.1. EQUIPMENT USED IN EUT SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	Bluetooth FM Transmitter	BT21L	2ATZS-HUD001	EUT
2	U-disk	Kingston	DT 101G2	A.E
3	Car battery	N/A	12V 60Ah	AE
4	Car battery	N/A	12V 60Ah	AE
5	Earphone	N/A	S370	AE
6	load	N/A	1ohm	AE
7	load	N/A	1ohm	AE

5.2. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
15.239	Field Strength of Fundamental and Spurious Emission	Compliant
15.215	Bandwidth	Compliant
15.209	Line Conducted Emission	N/A

Note: The EUT was supplied by car battery.

6. TEST FACILITY

TestSite	Attestation of Global Compliance(Shenzhen) Co., Ltd
Location	1-2/F,Building19,JunfengIndustrialPark,ChongqingRoad,HepingCommunity,Fuhai Street,Bao'anDistrict,Shenzhen,Guangdong,China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	Jun. 12, 2019	Jun. 11, 2020
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec. 12, 2019	Dec. 11, 2020
Attenuator	ZHINAN	E-002	N/A	Sep. 09, 2019	Sep. 08, 2020
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	Jun. 13, 2018	Jun. 12, 2020
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May. 17, 2018	May 16, 2020
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Oct. 15, 2019	Oct. 16, 2020
ANTENNA	SCHWARZBECK	VULB9168	494	Sep. 20, 2019	Sep. 19, 2021
Test software	FARA	EZ-EMC (Ver RA-03A)	N/A	N/A	N/A

7. RADIATED EMISSION

7.1. 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 RBW and 3MHz VBW for peak reading. 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.

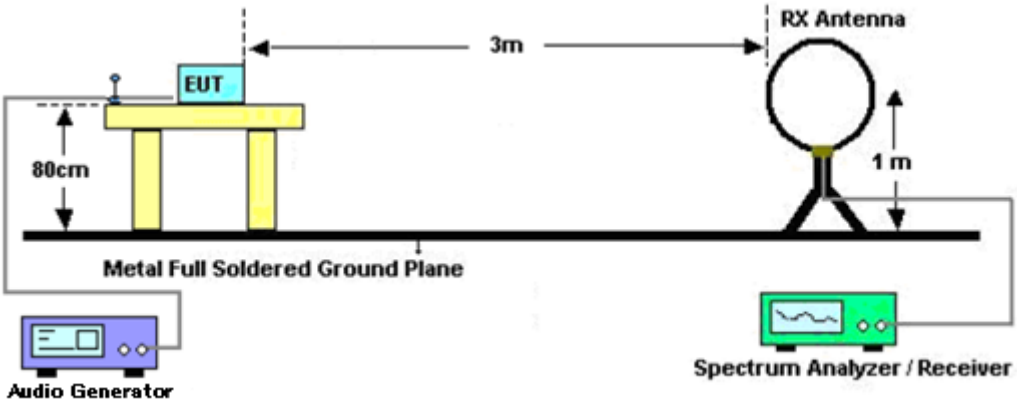
The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz 1MHz/3MHz for Peak, 1MHz/3MHz for Average

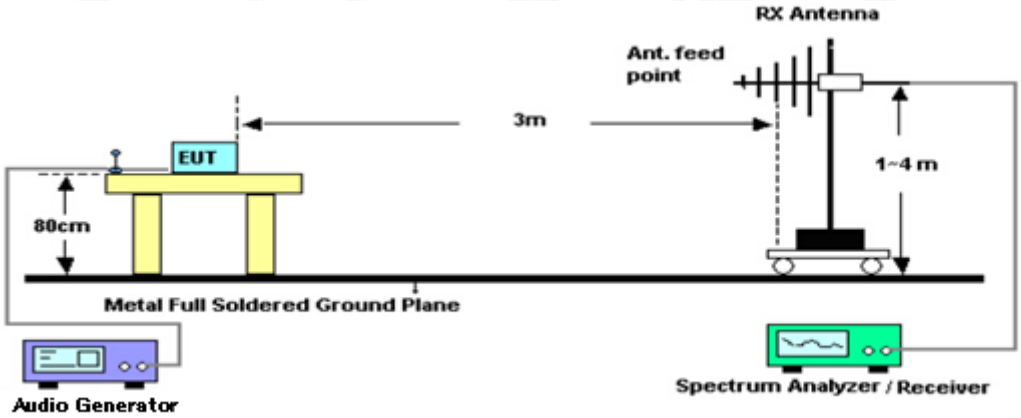
Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

7.2.TEST SETUP

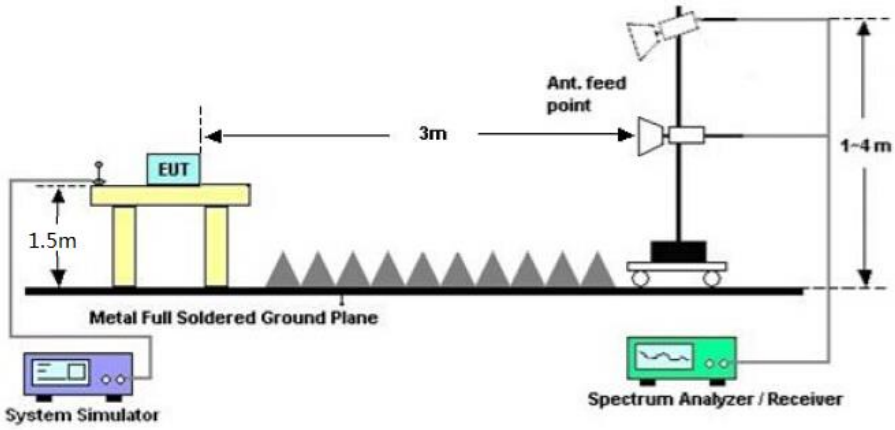
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



7.3. TEST RESULTFOR FIELD STRENGTH OF FUNDAMENTAL

Frequency MHz	Polarization	Level dB(uV/m) PK	Limit dB(uV/m) PK	Margin dB	Pass/Fail	Detector
88.100	H	45.45	67.96	22.51	Pass	PK
88.100	V	44.04	67.96	23.92	Pass	PK
98.000	H	31.85	67.96	36.11	Pass	PK
98.000	V	34.63	67.96	33.33	Pass	PK
107.900	H	29.97	67.96	37.99	Pass	PK
107.900	V	32.21	67.96	35.75	Pass	PK
Frequency MHz	Polarization	Level dB(uV/m) AV	Limit dB(uV/m) AV	Margin dB	Pass/Fail	Detector
88.100	H	43.89	47.96	4.07	Pass	AV
88.100	V	42.96	47.96	5.00	Pass	AV
98.000	H	30.96	47.96	17.00	Pass	AV
98.000	V	31.56	47.96	16.40	Pass	AV
107.900	H	28.36	47.96	19.60	Pass	AV
107.900	V	30.55	47.96	17.41	Pass	AV

7.4. TEST RESULT FOR FIELD STRENGTH OF BAND EDGE EMISSION

Frequency MHz	Polarization	Level dB(uV/m) QP	Limit dB(uV/m) QP	Margin dB	Pass/Fail	Detector
88.000	H	34.12	40	5.88	Pass	QP
88.000	V	33.02	40	6.98	Pass	QP
108.000	H	26.12	43.5	17.38	Pass	QP
108.000	V	28.36	43.5	15.14	Pass	QP

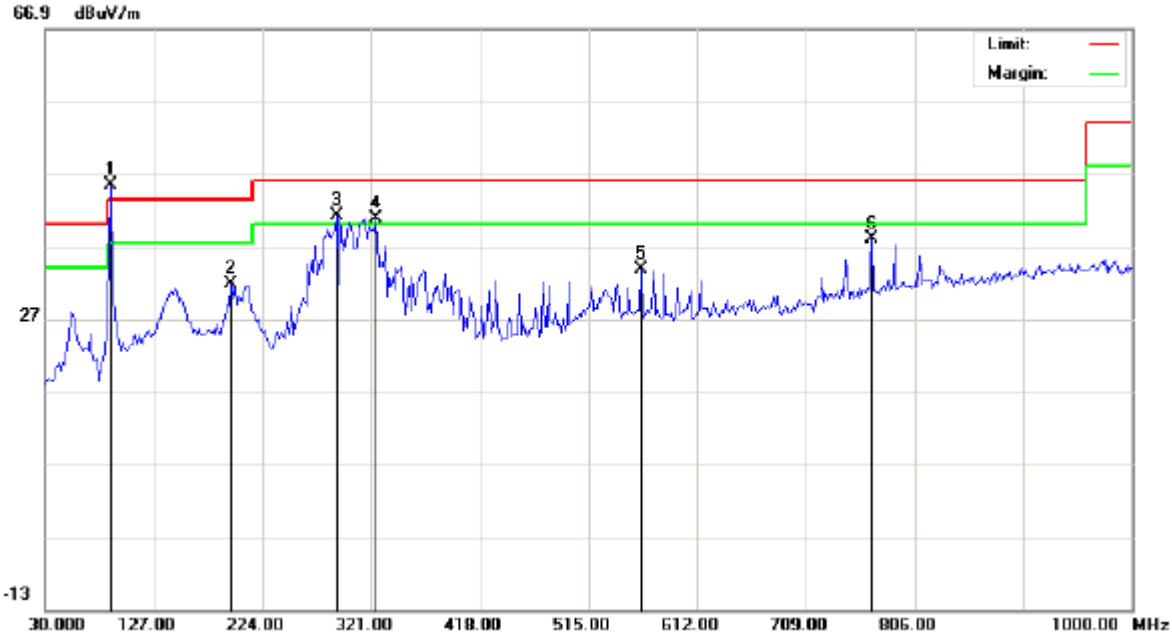
Note: The above two frequencies are the worst case for the band edge emission test.

7.5. TEST RESULT FOR SPURIOUS EMISSION

RADIATED EMISSION BELOW 30MHz

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

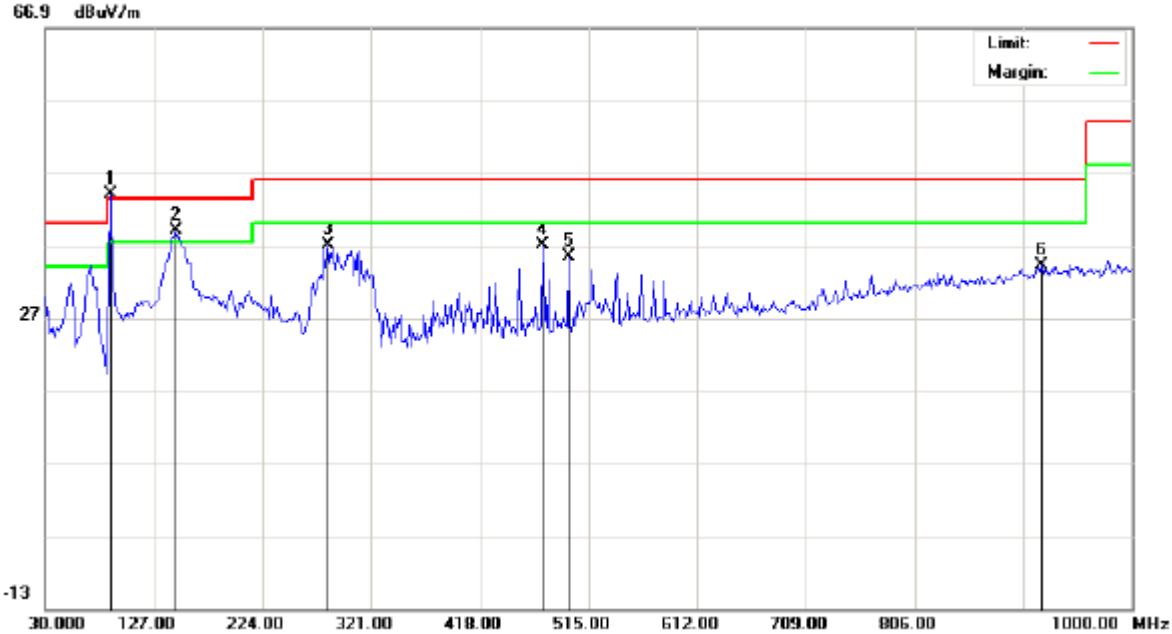
RADIATED EMISSION BELOW 1GHZ-Horizontal



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	88.1000	30.48	14.97	45.45	47.96	-2.51	peak			
2		196.5166	15.59	16.25	31.84	43.50	-11.66	peak			
3	!	290.2832	21.43	19.70	41.13	46.00	-4.87	peak			
4	!	325.8500	20.51	20.38	40.89	46.00	-5.11	peak			
5		561.8832	7.54	26.20	33.74	46.00	-12.26	peak			
6		767.2000	8.41	29.67	38.08	46.00	-7.92	peak			

RESULT: PASS

RADIATED EMISSION BELOW 1GHZ-Vertical



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	88.1000	29.07	14.97	44.04	47.96	-3.92	peak			
2	!	146.4000	19.69	19.22	38.91	43.50	-4.59	peak			
3		282.2000	17.21	19.89	37.10	46.00	-8.90	peak			
4		474.5833	12.61	24.48	37.09	46.00	-8.91	peak			
5		497.2167	10.57	24.93	35.50	46.00	-10.50	peak			
6		919.1666	2.38	31.86	34.24	46.00	-11.76	peak			

RESULT: PASS

Note:

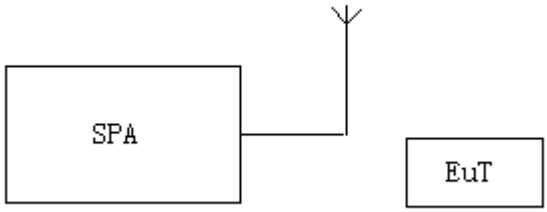
1. Factor=Antenna Factor+ Cable loss-Amplifier gain, Margin=Measurement-Limit.
2. The “Factor” value can be calculated automatically by software of measurement system.
3. All test modes had been tested. The Low channel is the worst case and recorded in the report.
4. Other emissions from 1G to 1.08GHz are considered as ambient noise. No recording in the test report.

8. BANDWIDTH

8.1. MEASUREMENT PROCEDURE

1. Set the parameters of SPA as below:
   Centre frequency = Operation Frequency
   RBW=3KHz
   VBW=10KHz
   Span: 300kHz
   Sweep time: Auto
   For the occupied bandwidth measurements, the input signal shall be a 2.5 kHz tone.
   ☐The level of the tone shall be 16 dB higher than that required to produce a frequency deviation of 75 kHz, or 50% of the manufacturer's rated deviation, whichever is less.
   ☒Alternatively, in the event that a 16 dB increase cannot be achieved, the level of the tone shall be set to the manufacturer's maximum rated input to the modulator.
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.

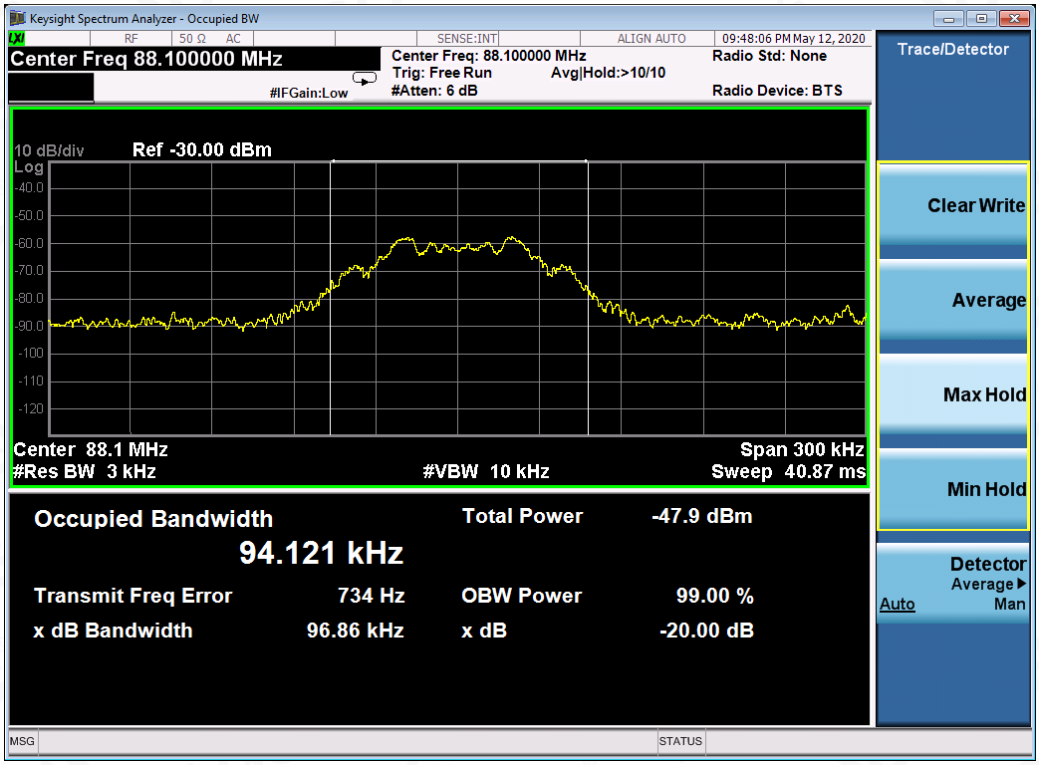
8.2. TEST SETUP



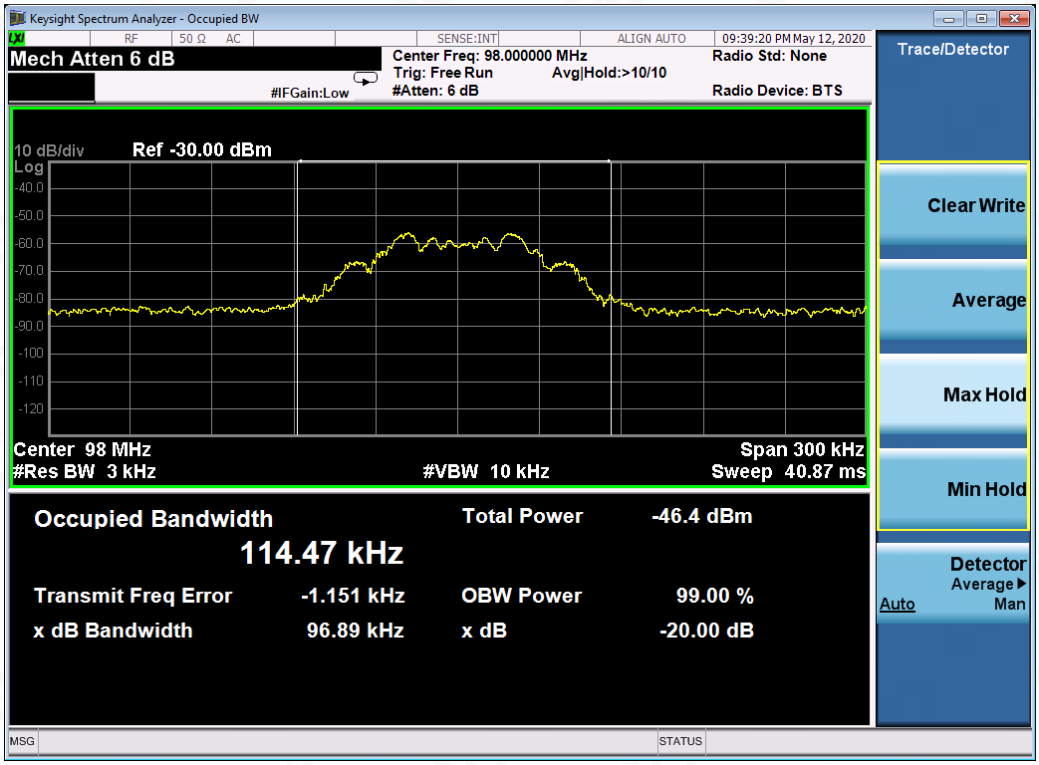
8.3. TEST RESULT

Channel	Channel Frequency(MHz)	-20dB bandwidth (kHz)	Limit(kHz)
Low	88.1	96.86	200
Middle	98.0	96.89	200
High	107.9	96.71	200

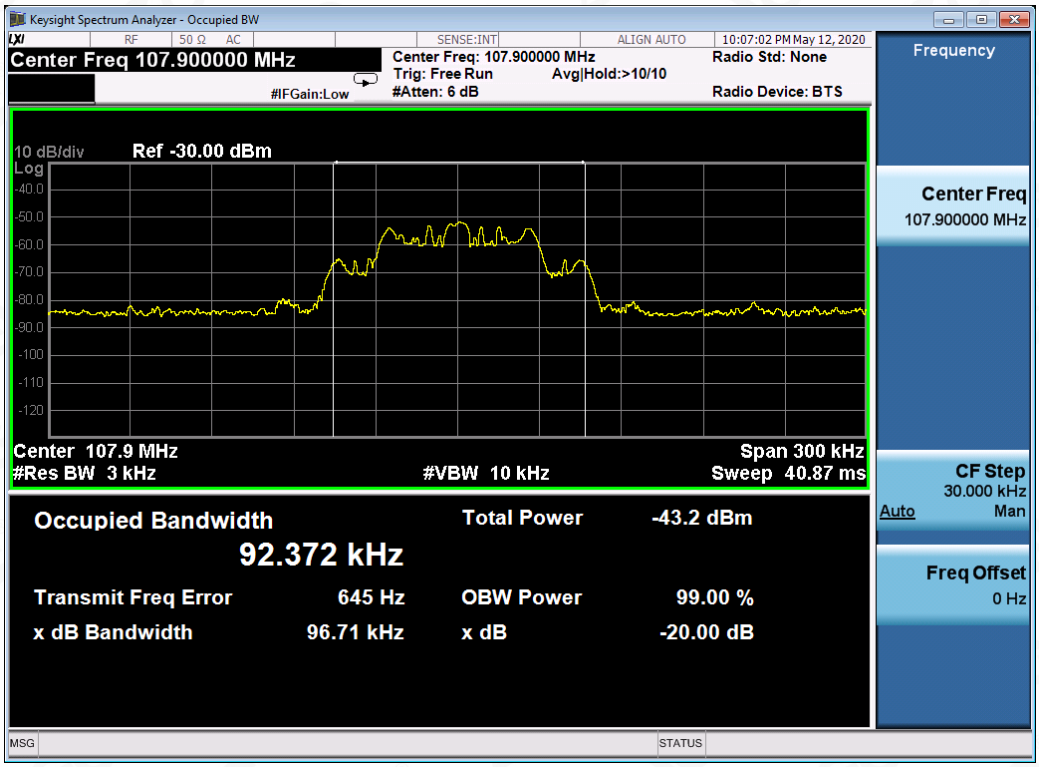
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

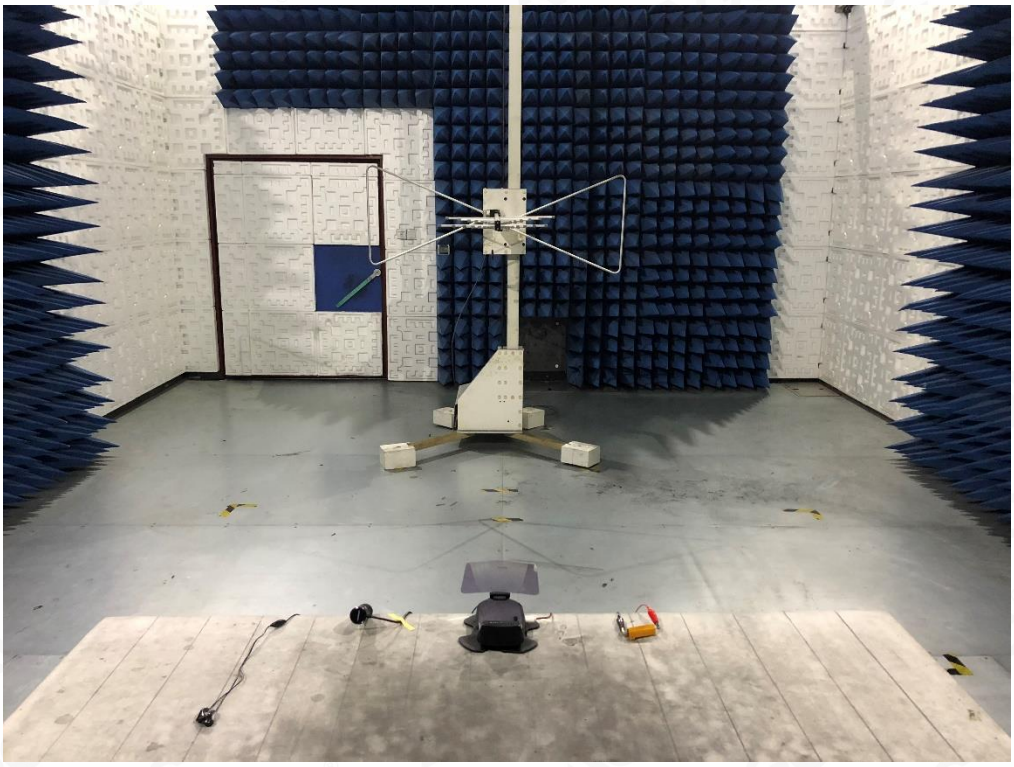


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

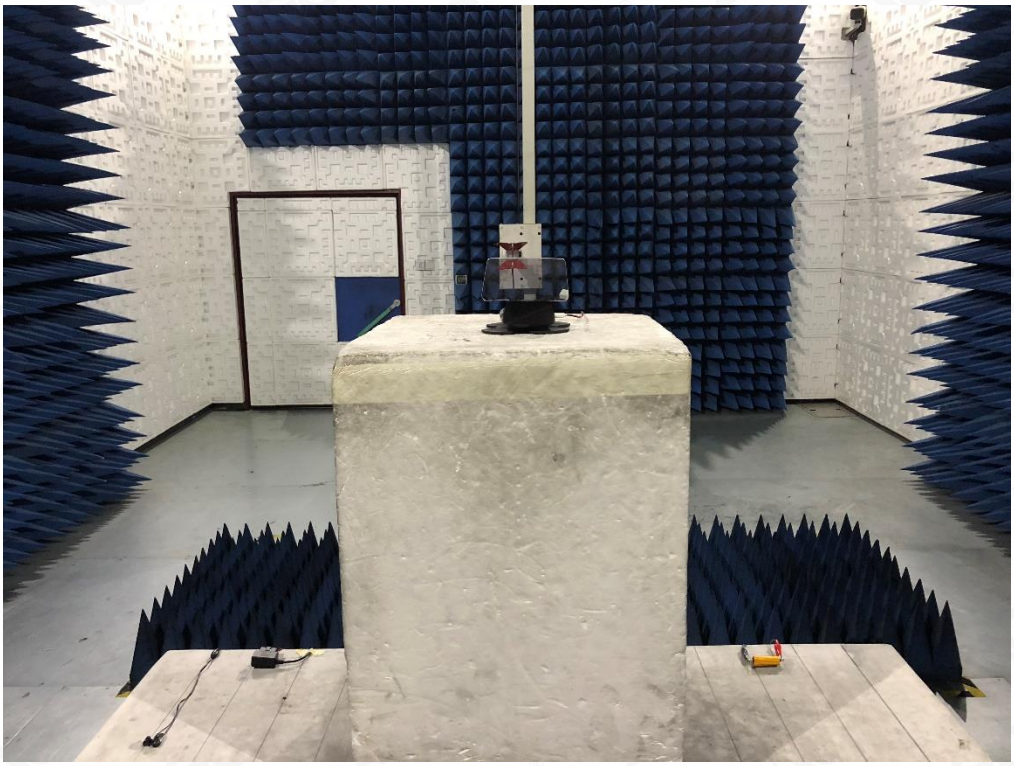


APPENDIX A: PHOTOGRAPHS OF TEST SETUP

RADIATED EMISSION TEST SETUP BELOW 1G

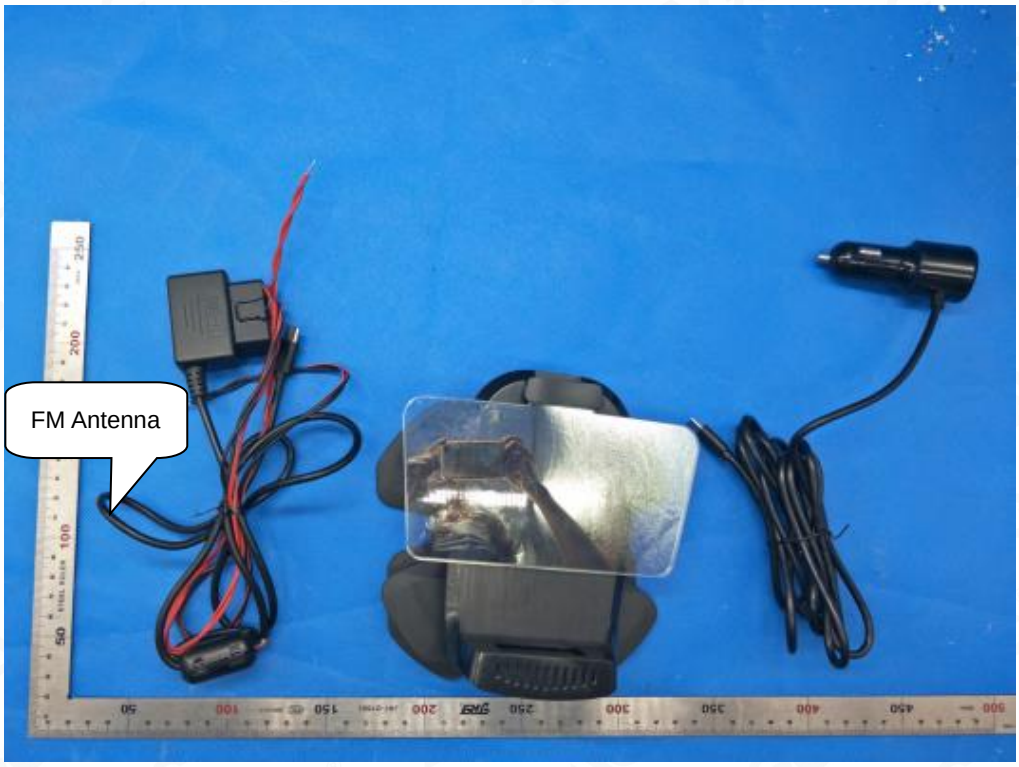


RADIATED EMISSION TEST SETUP ABOVE 1G

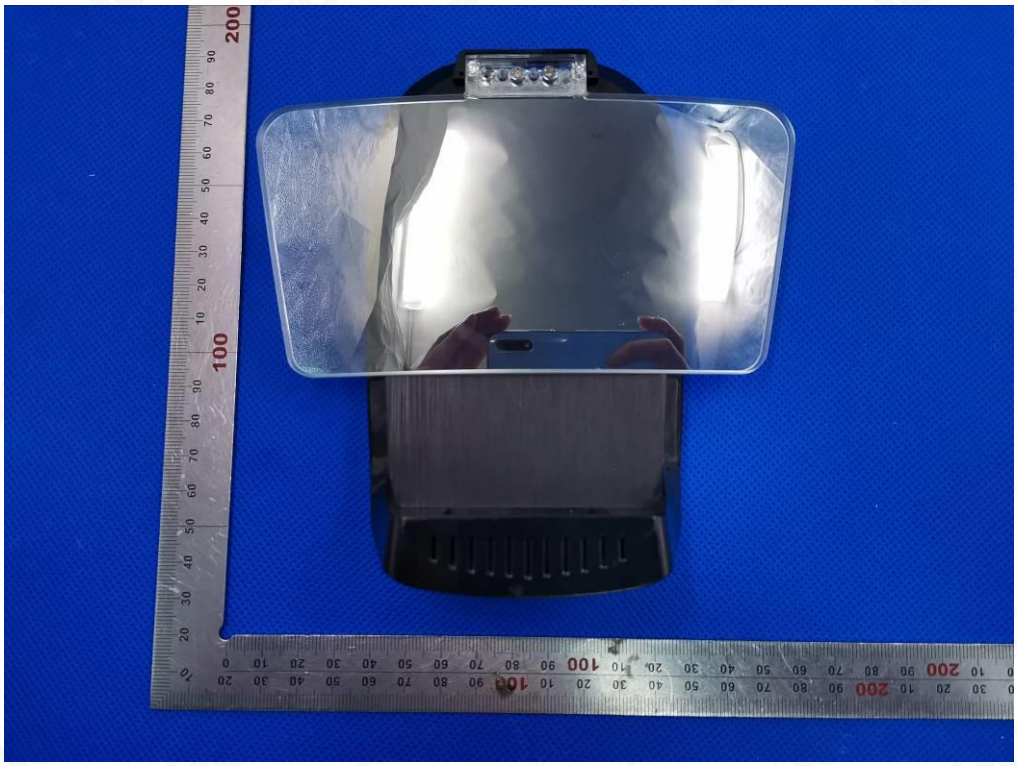


APPENDIX B:PHOTOGRAPHS OF EUT

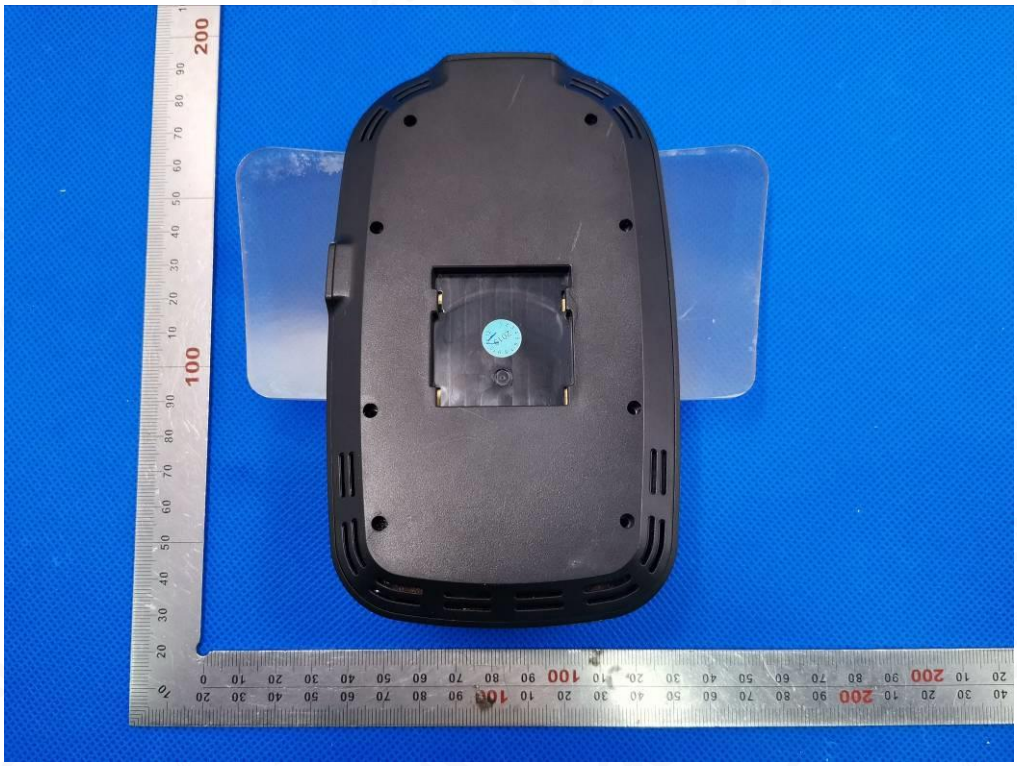
TOTAL VIEW OF EUT



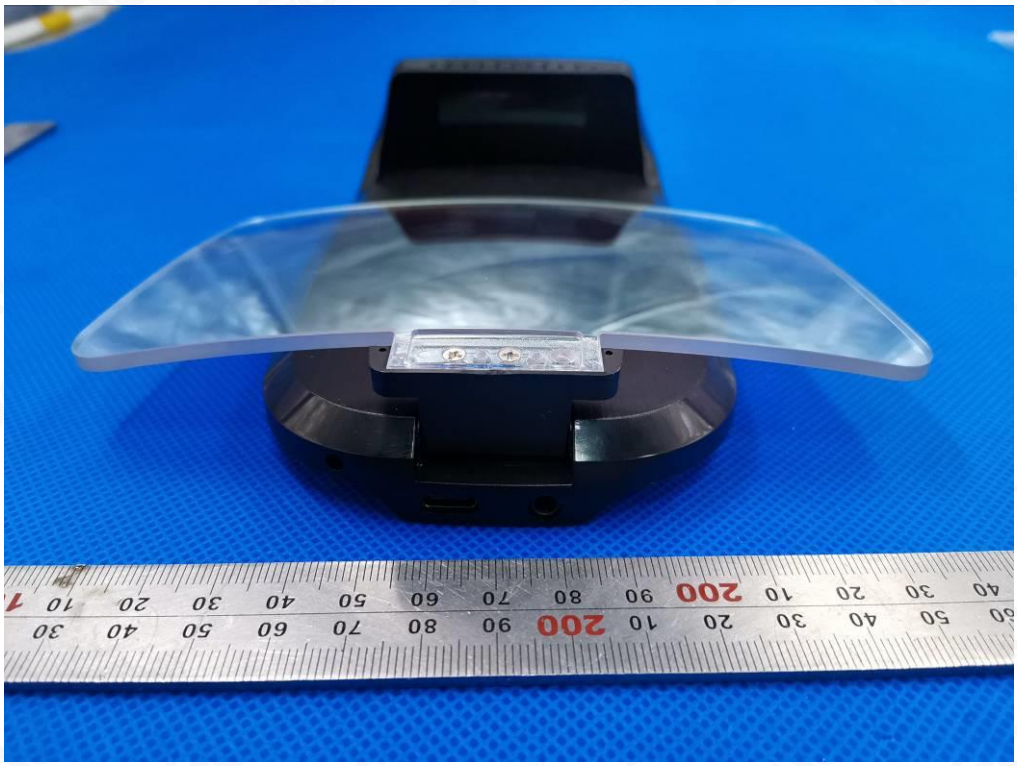
TOP VIEW OF EUT



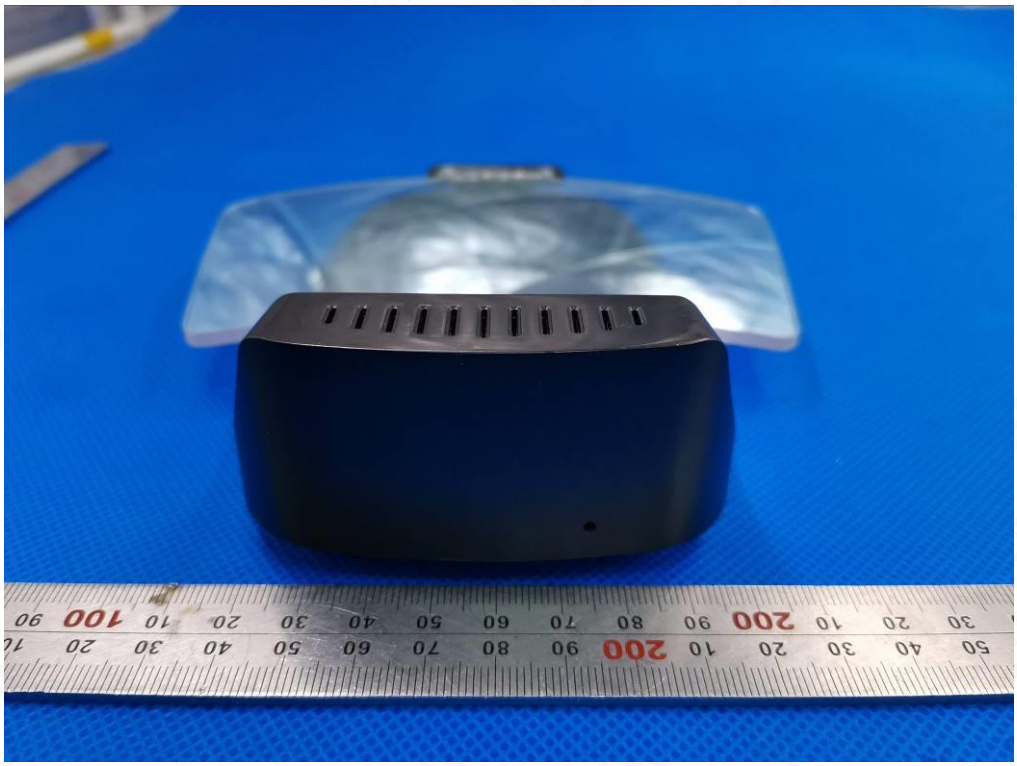
BOTTOM VIEW OF EUT



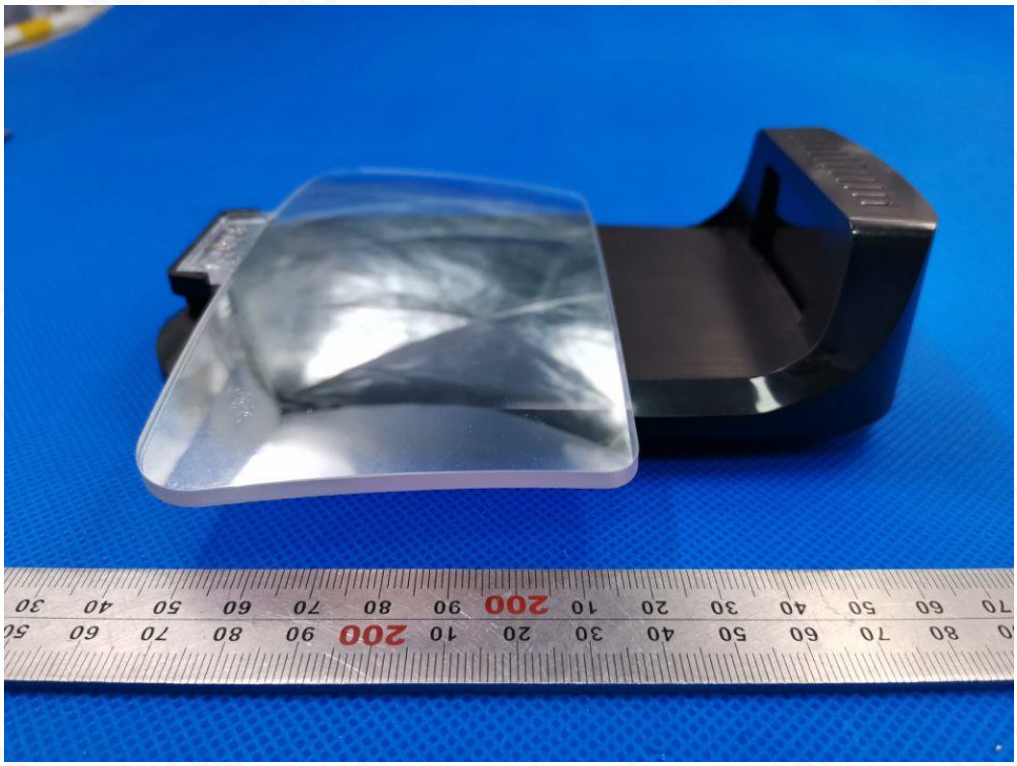
FRONT VIEW OF EUT



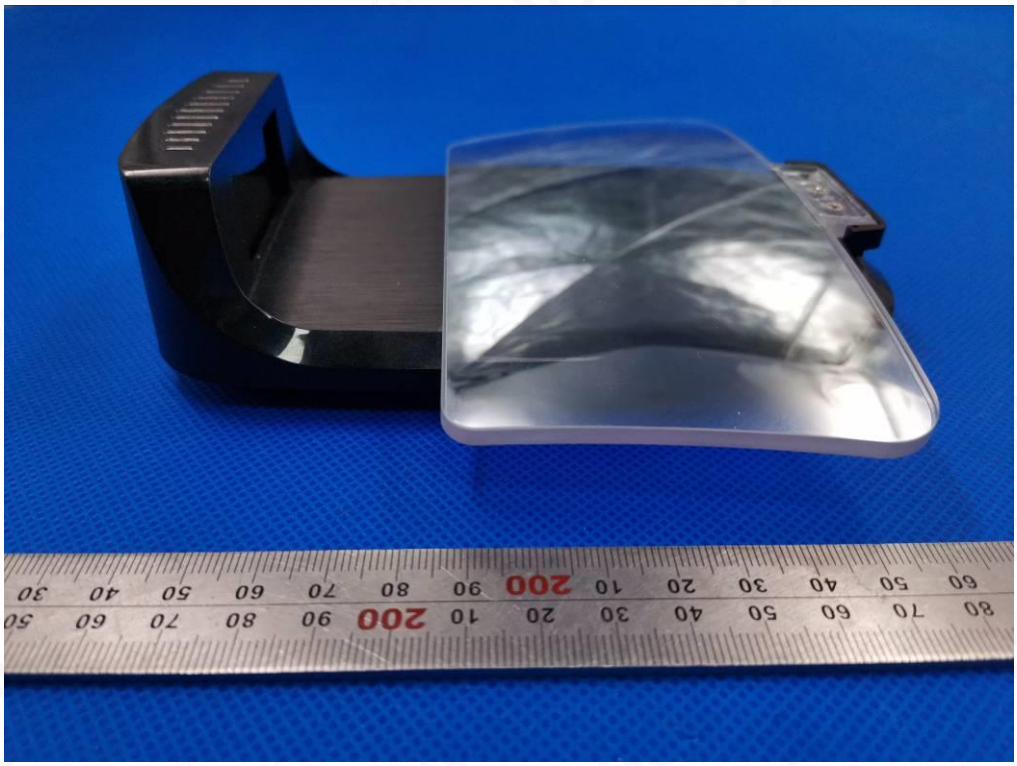
BACK VIEW OF EUT



LEFT VIEW OF EUT



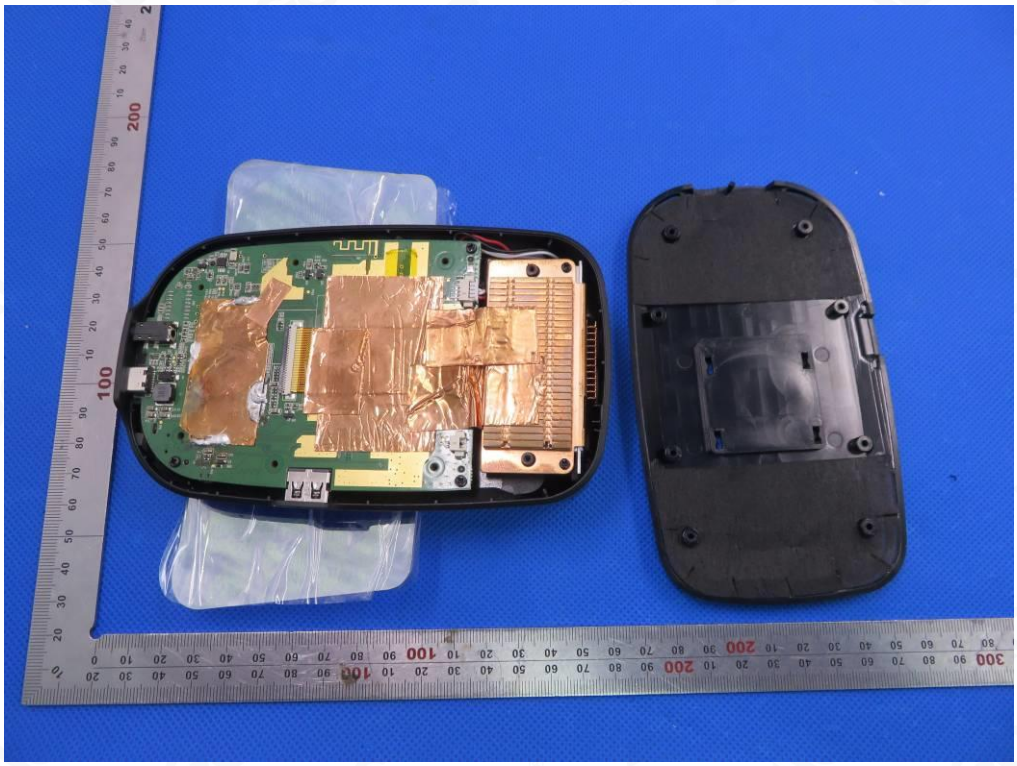
RIGHT VIEW OF EUT



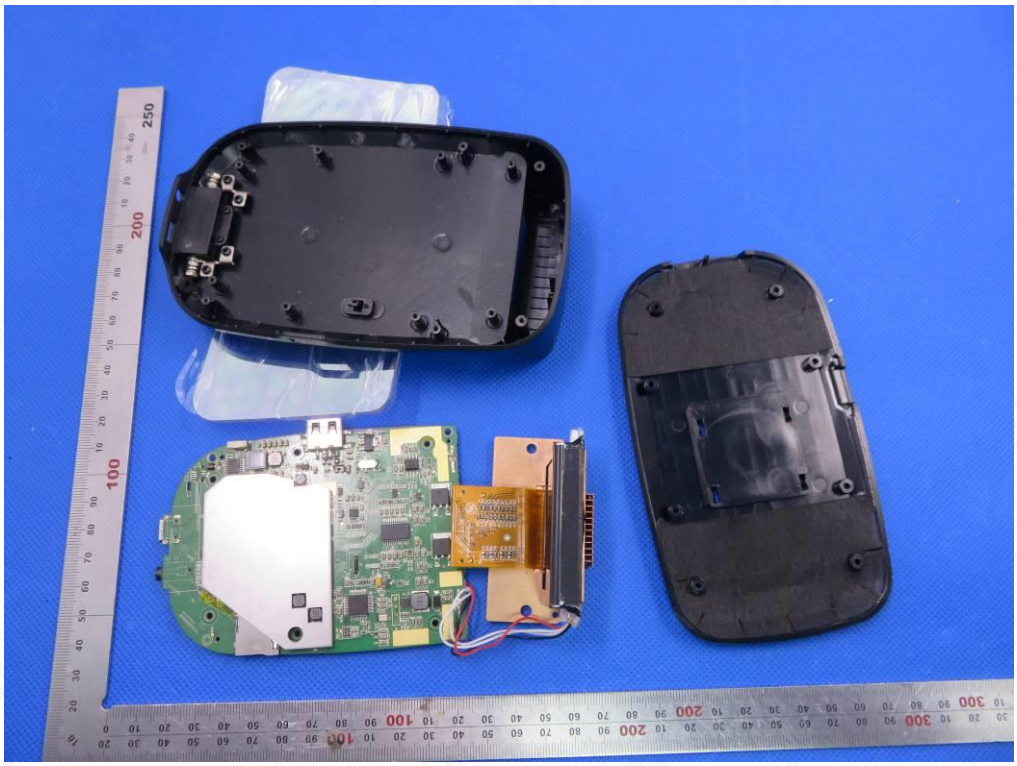
VIEW OF EUT(PORT)-1

VIEW OF EUT(PORT)-2

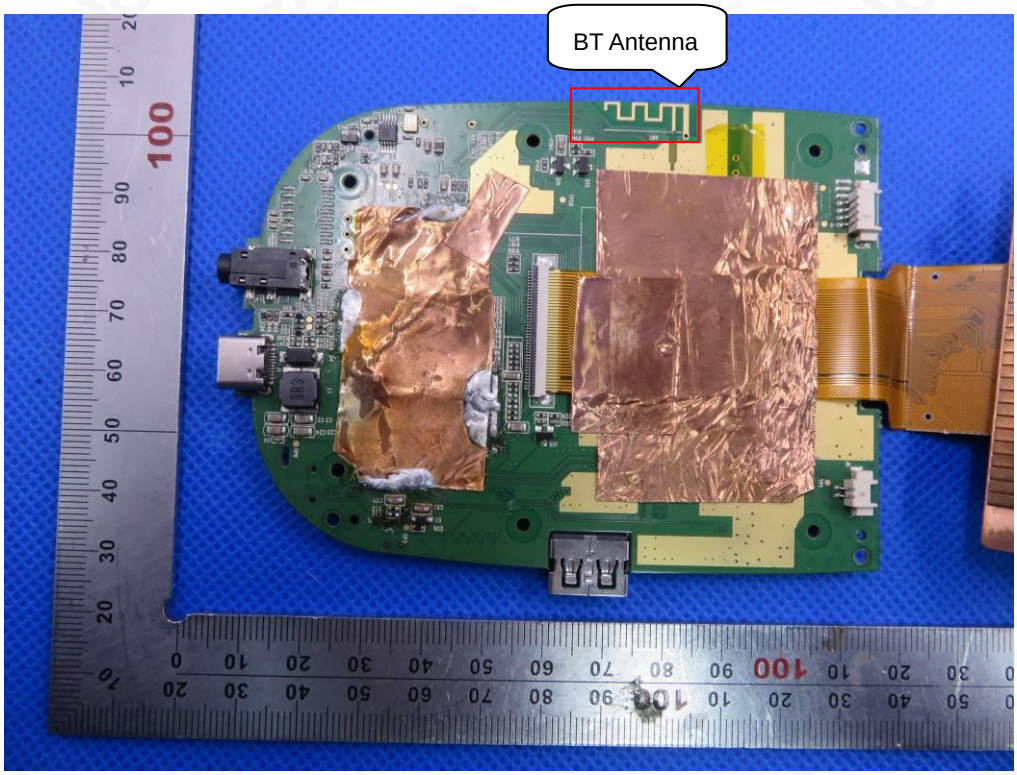
OPEN VIEW OF EUT-1



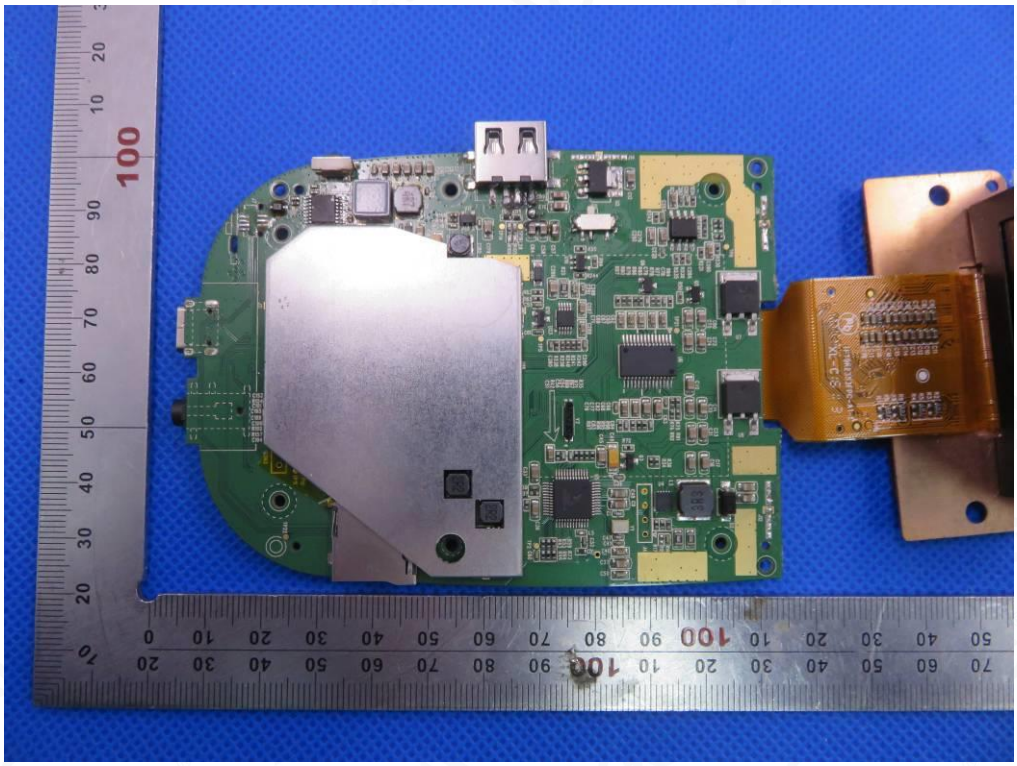
OPEN VIEW OF EUT-2



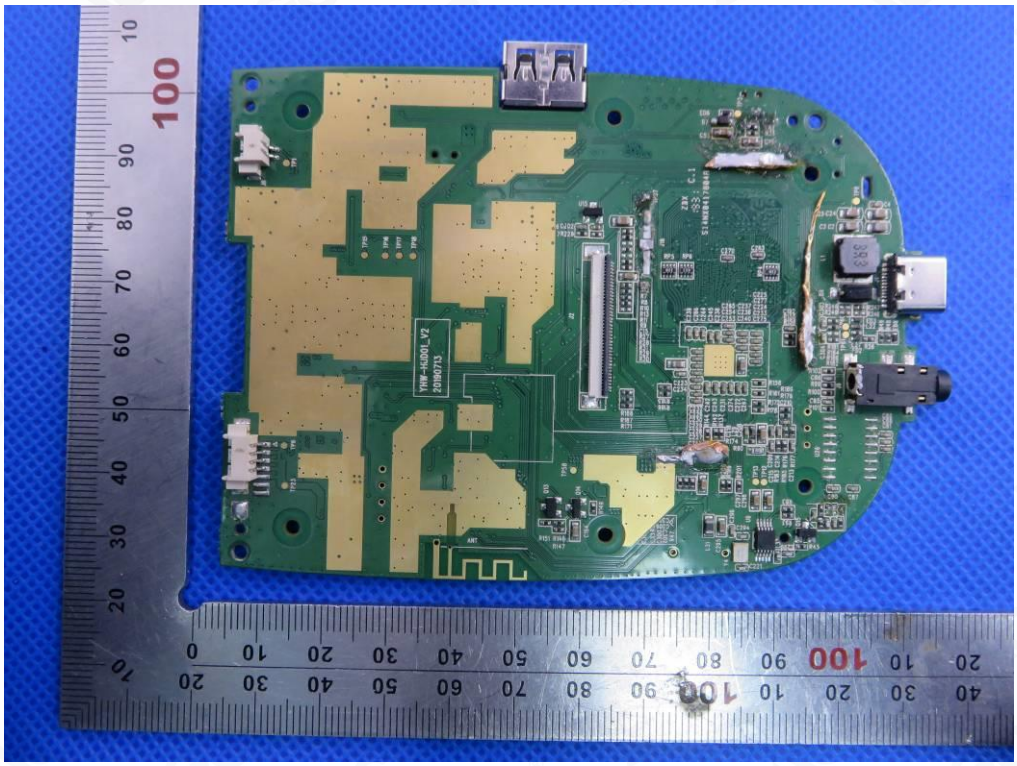
INTERNAL VIEW OF EUT-1



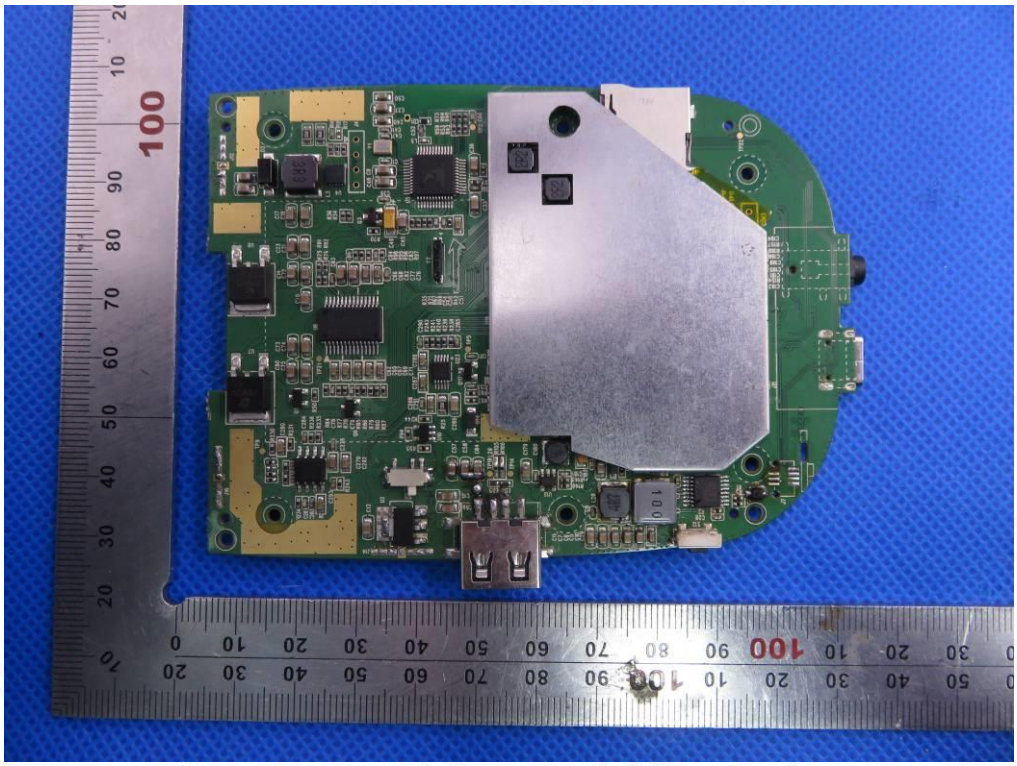
INTERNAL VIEW OF EUT-2



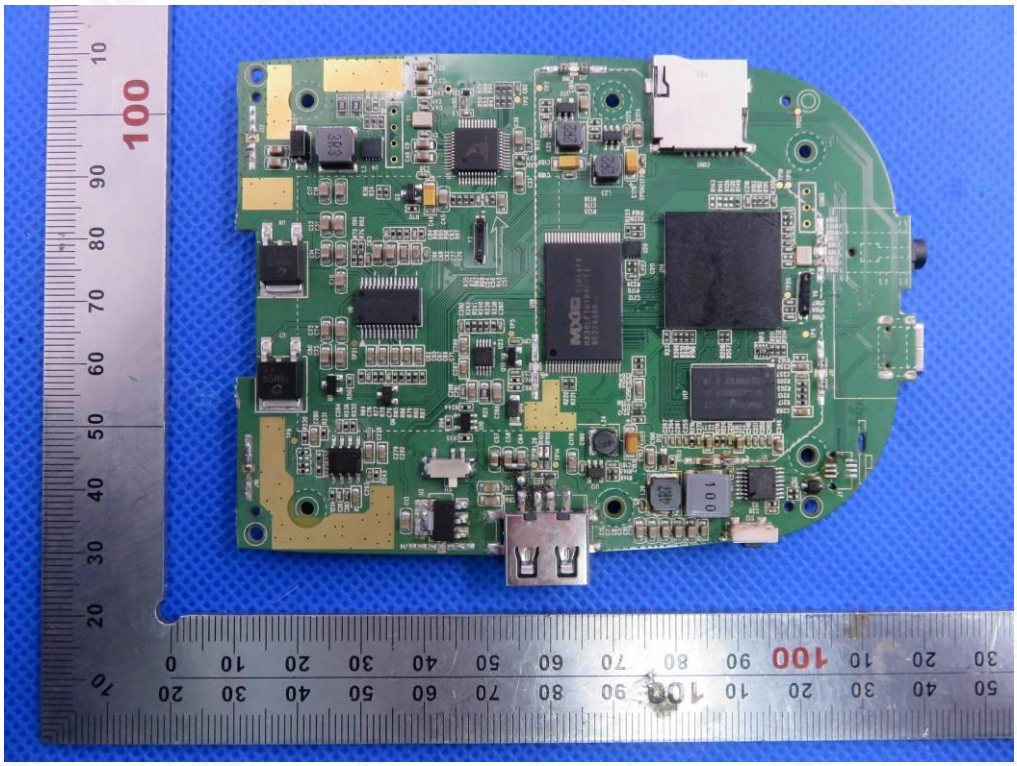
INTERNAL VIEW OF EUT-3



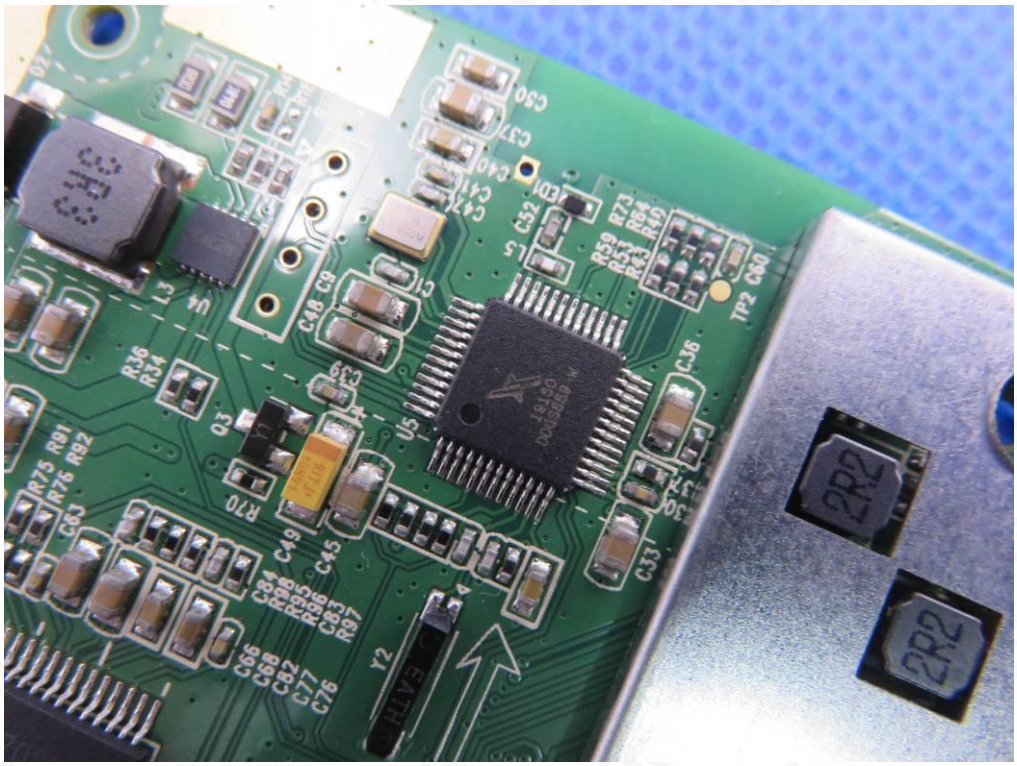
INTERNAL VIEW OF EUT-4



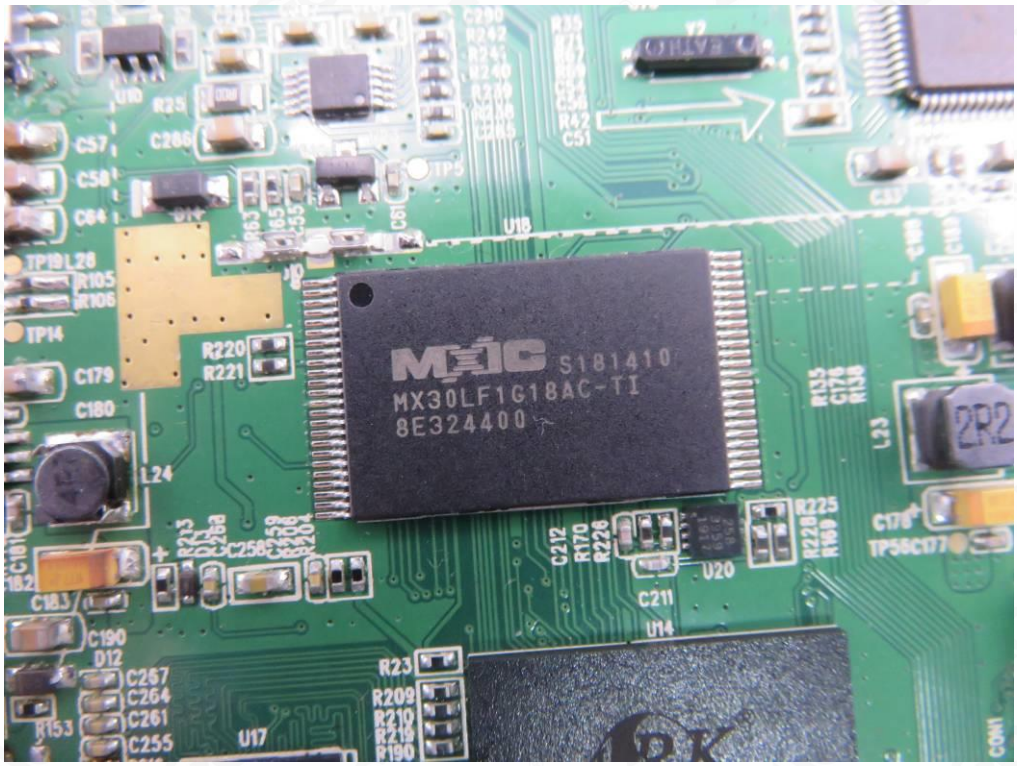
INTERNAL VIEW OF EUT-5



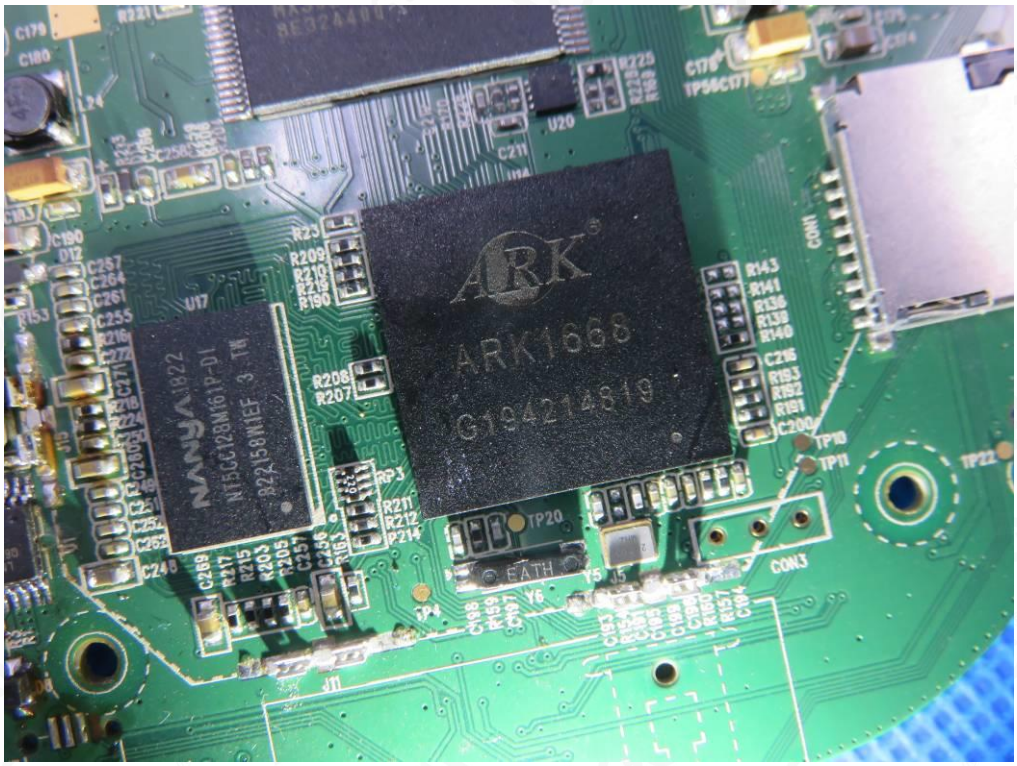
INTERNAL VIEW OF EUT-6



INTERNAL VIEW OF EUT-7



INTERNAL VIEW OF EUT-8



----END OF REPORT----