FCC Test Report

Report No.: AGC00927200402FE05

FCC ID	:	2AJ9T-QR500
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	QR Code Reader
BRAND NAME	:	ZKTeco
MODEL NAME	:	QR500-B, QR500-W, QR500-B-CL, QR500-B-AR, QR500S-B, QR500S-W, R400-A-S, R400-B-S, R400-S-S, R400-A-S, R400(Z)-A-S, R400(Z)-B-S, R400(Z)-S-S, QR400-B, QR401-B, QR402-B, QR400-W, QR401-W, QR402-W, H420-S-S, HT420-S-S, R401-B-S, R401-S-S, R401-B-S-N, R401-B-S-V, R401-B-S-NV, R401-S-S-NV, R401-S-S-V, RT411-B-S, RT411-B-S-V, RT411-B-S-N, RT411-B-S-NV, R411-B-S, QR377-B-S, QR378-B-S, QRT378-B-S, QR387-B-S, QR388-B-S, QRT388-B-S
APPLICANT	:	ZKTECO CO., LTD.
DATE OF ISSUE	:	Jun. 01, 2020
STANDARD(S)	:	FCC Part 15.225
REPORT VERSION	:	V1.0

***A**ttestation of **G**lobal **C**ompliance (Shenzhen) Co., Ltd*

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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jun. 01, 2020	Valid	Initial Release

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1. VERIFICATION OF CONFORMITY

Applicant	ZKTECO CO., LTD.
Address	No.26, Pingshan 188 Industry zone, Tangxia Town, Dongguan City, Guangdong Province, China 523728
Manufacturer	Guangdong ZK Radio Electronic Tech Co., Ltd
Address	1004 Room, 3 block B, Tian-an-Yun-Gu, Ban Tian Longgang, Shenzhen, China
Factory	Guangdong ZK Radio Electronic Tech Co., Ltd
Address	1004 Room, 3 block B, Tian-an-Yun-Gu, Ban Tian Longgang, Shenzhen, China
Product Designation	QR Code Reader
Brand Name	N/A
Test Model	QR500-B
Series Model	QR500-W, QR500-B-CL, QR500-B-AR, QR500S-B, QR500S-W, R400-A-S, R400-B-S, R400-S-S, R400-A-S, R400(Z)-A-S, R400(Z)-B-S, R400(Z)-S-S, QR400-B, QR401-B, QR402-B, QR400-W, QR401-W, QR402-W, H420-S-S, HT420-S-S, R401-B-S, R401-S-S, R401-B-S-N, R401-B-S-V, R401-B-S-NV, R401-S-S-NV, R401-S-S-V, RT411-B-S, RT411-B-S-V, RT411-B-S-N, RT411-B-S-NV, R411-B-S, QR377-B-S, QR378-B-S, QRT378-B-S, QR387-B-S, QR388-B-S, QRT388-B-S
Model Difference	All the same except for the model name
Date of test	Apr. 21, 2020 to May. 29, 2020
Deviation	No any deviation from the test method
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BR/RF

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 15.225.

Prepared By	John Zeng Project Engineer	May 29, 2020
Reviewed By	Max Zhang Reviewer	Jun. 01, 2020
Approved By	Forrest Lei Authorized Officer	Jun. 01, 2020

2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

Operation Frequency	13.56MHz
Modulation(NFC)	ASK
Antenna Designation(NFC)	Integral Antenna(Comply with requirements of the FCC part 15.203)
Antenna Gain(NFC)	0dBi
Hardware Version	V3.02
Software Version	V3.01
Power Supply	DC 5V by USB

3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

- Uncertainty of Conducted Emission, Uc = ±3.1 dB
- Uncertainty of Radiated Emission below 1GHz, Uc = ±4.0 dB
- Uncertainty of Radiated Emission above 1GHz, Uc = ±4.8 dB
- Uncertainty of Occupied Channel Bandwidth: Uc = ±2 %

4. DESCRIPTION OF TEST MODES

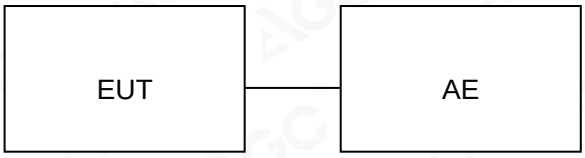
NO.	TEST MODE DESCRIPTION
1	Transmitting mode

Note: 1. For Radiated Emission, 3axis were chosen for testing for each applicable mode.

5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Configure :



5.2 EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	QR Code Reader	QR500	2AJ9T-QR500	EUT
2	PC	16301-01	N/A	AE
3	PC Adapter	ADC6501TM	Input: 100~240V/ 50~60Hz Output: DC 5V2A /DC 12V2A /DC15V3A /DC 9V2A /DC 20V 3.25A	AE

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
FCC Part 15.225	Radiated Emission	Compliant
FCC Part 15.207	Conducted Emission	Compliant
FCC Part 15.225	Frequency Tolerance	Compliant
FCC Part 15.225	Bandwidth	Compliant

6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, 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	N9020A	MY52090123	Sep. 09, 2019	Sep. 08, 2020
Attenuator	Wariors	W13	11324	Sep. 09, 2019	Sep. 08, 2020
Horn antenna	ETS-LINDGREN	3117	00154520	Oct. 21, 2018	Oct. 20, 2020
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	Jun. 14, 2018	Jun. 13, 2020
Double-Ridged Waveguide Horn	ETS-LINDGREN	3117	00034609	May 17, 2019	May 16, 2021
Broadband Preamplifier	ETS-LINDGREN	3117PA	00225134	Oct. 15, 2019	Oct. 14, 2020
ANTENNA	SCHWARZBECK	VULB9168	494	Jan. 09, 2019	Jan. 08, 2021
Test software	FARA	EZ_EMC (Ver. RA-03A)	N/A	N/A	N/A

7. RADIATED EMISSION

7.1. TEST LIMIT

Within the 13.110MHz-14.010MHz band

Frequencies (MHz)	Field Strength at 30m (microvolts/meter)	Field Strength at 30m (dBuV/m)	Field Strength at 3m (dBuV/m)
13.553~13.567	15.848	84	124
13.410~13.553 13.567~13.710	334	50.5	90.5
13.110~13.410 13.710~14.010	106	40.5	80.5

According to 15.35, on any frequency or frequencies below or equal to 1000 MHz, the limits Shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test.

Outside of the 13.110MHz-14.010MHz band

Frequency (MHz)	Distance Meters	Field Strengths Limit	
		μV/m	dB(μV)/m
0.009 ~ 0.490	300	2400/F(kHz)	---
0.490 ~ 1.705	30	24000/F(kHz)	---
1.705 ~ 30	30	30	---
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	Other:74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

Remark: (1) Emission level dBμV = 20 log Emission level μV/m

(2) The smaller limit shall apply at the cross point between two frequency bands.

(3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

7.2. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 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.
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.

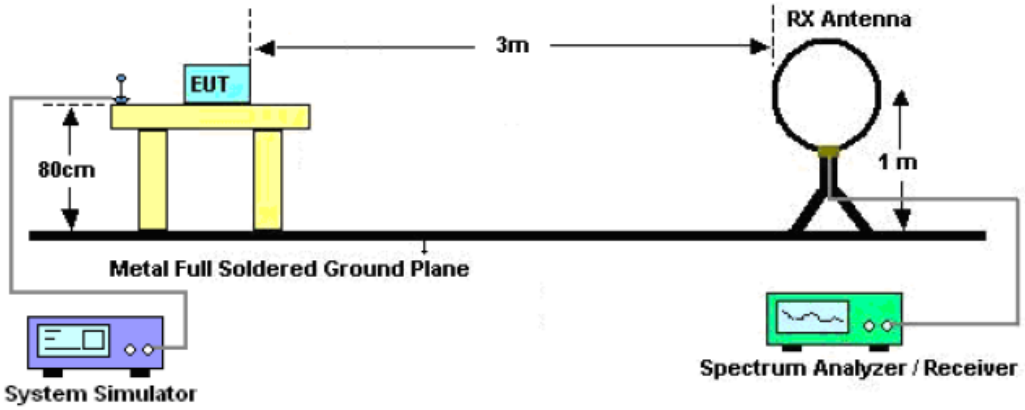
The following table is the setting of spectrum analyzer and receiver.

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/1MHz for Peak, 1MHz/10Hz for Average

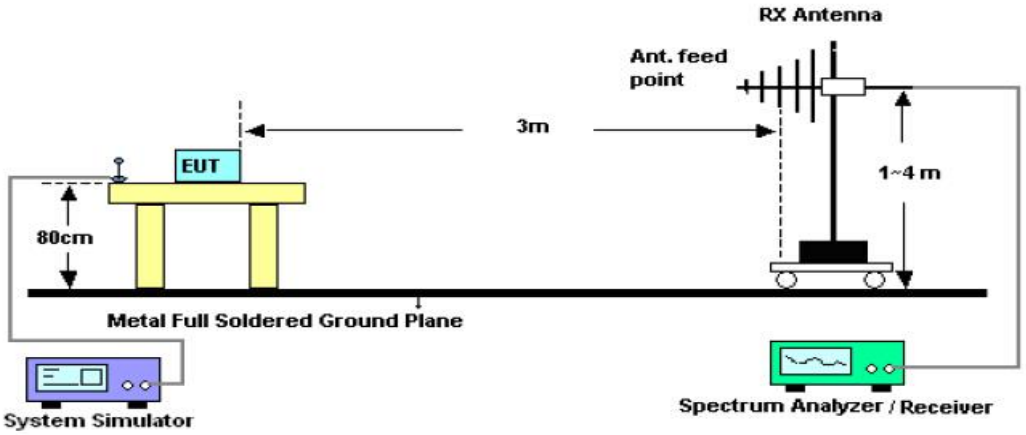
Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

7.3. TEST SETUP

Radiated Emission Test-Setup Frequency Below 30MHz



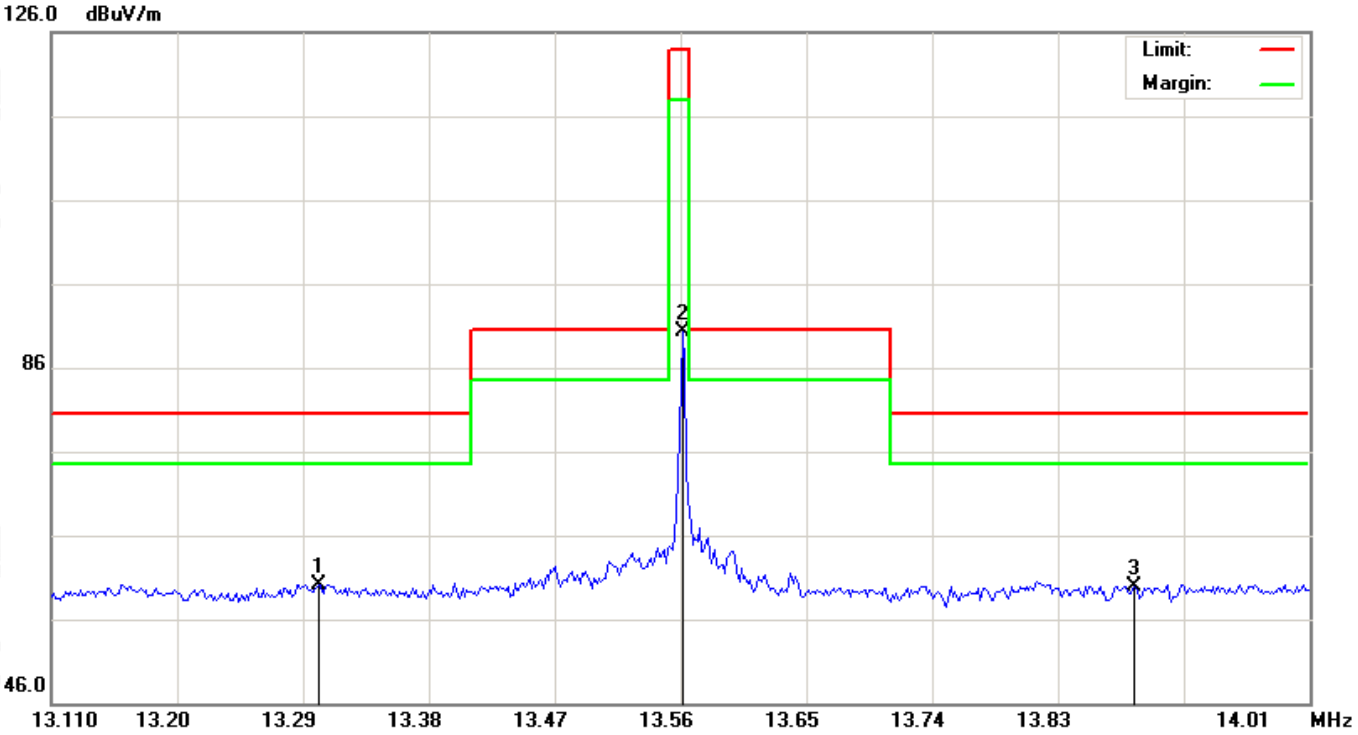
RADIATED EMISSION TEST SETUP 30MHz-1000MHz



7.4. TEST SETUP

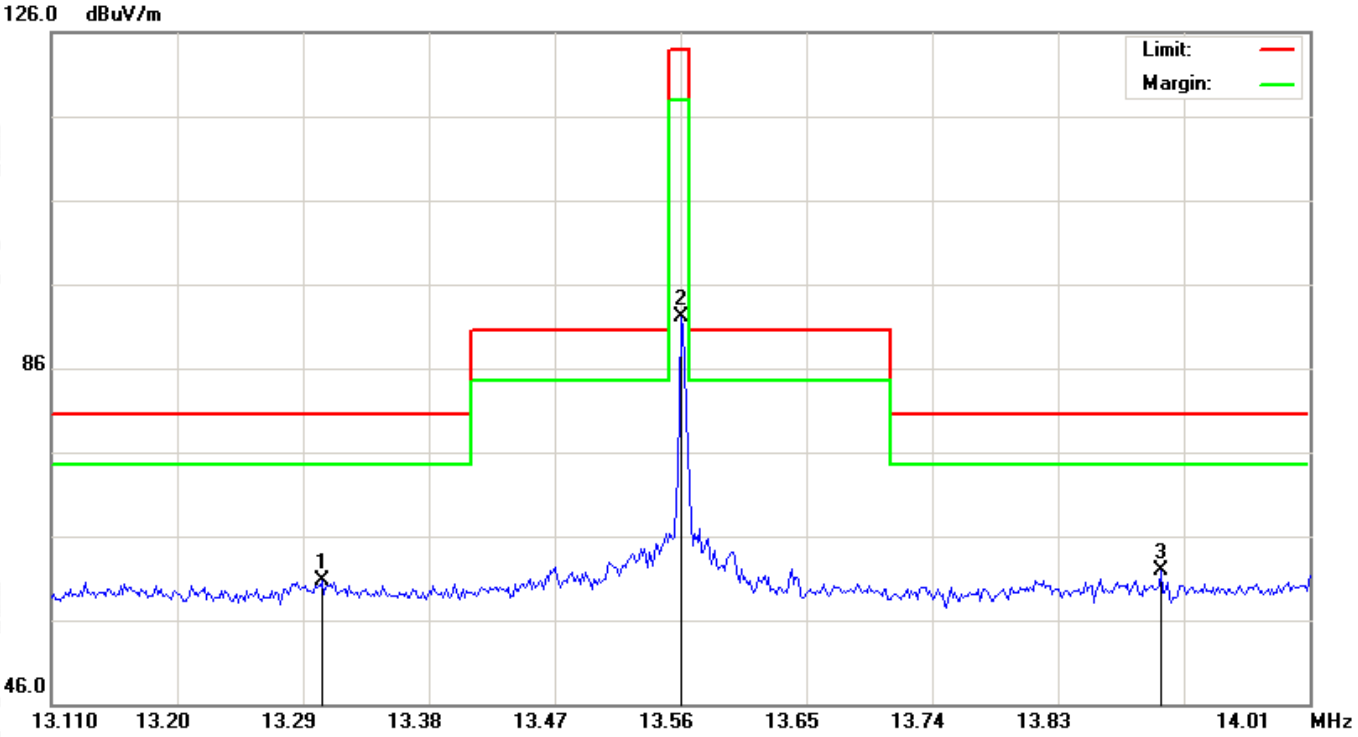
RADIATED EMISSION BELOW 30MHZ

EUT	QR Code Reader	Model Name	QR500
Temperature	20.5 ℃	Relative Humidtity	50.6%
Pressure	1010 hPa	Test Voltage	DC 5V
Test Mode	Mode 1	Polarization	Face



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1	*	13.3019	36.56	23.61	60.17	80.50	-20.33	peak
2		13.5615	66.52	23.70	90.22	124.00	-33.78	peak
3		13.8840	36.85	23.03	59.88	80.50	-20.62	peak

EUT	QR Code Reader	Model Name	QR500
Temperature	20.5 ℃	Relative Humidtity	50.6%
Pressure	1010 hPa	Test Voltage	DC 5V
Test Mode	Mode 1	Polarization	Side

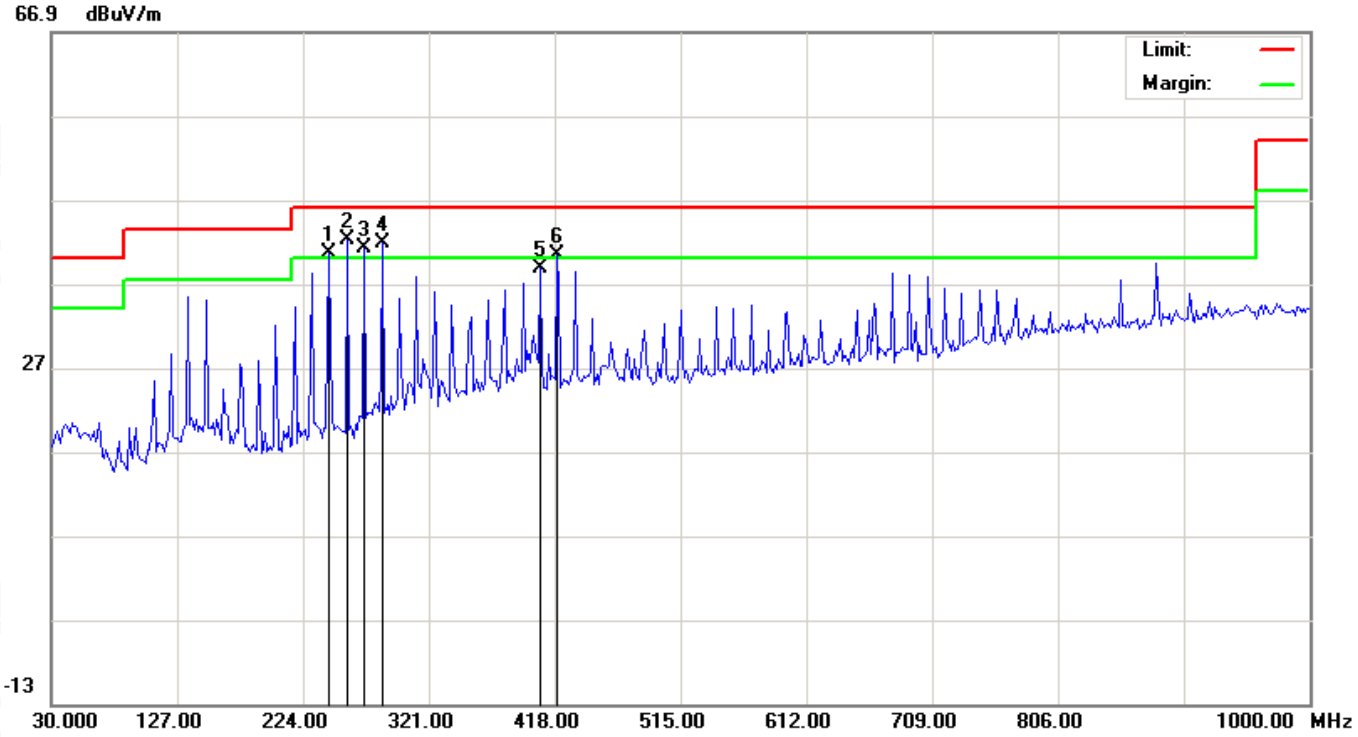


No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1		13.3033	37.16	23.61	60.77	80.50	-19.73	peak
2		13.5600	68.17	23.96	92.13	124.00	-31.87	peak
3	*	13.9032	38.86	23.03	61.89	80.50	-18.61	peak

Note: Other emissions from 9 kHz to 30 MHz are considered as ambient noise. No recording in the test report.

RADIATED EMISSION 30MHz- 1GHZ

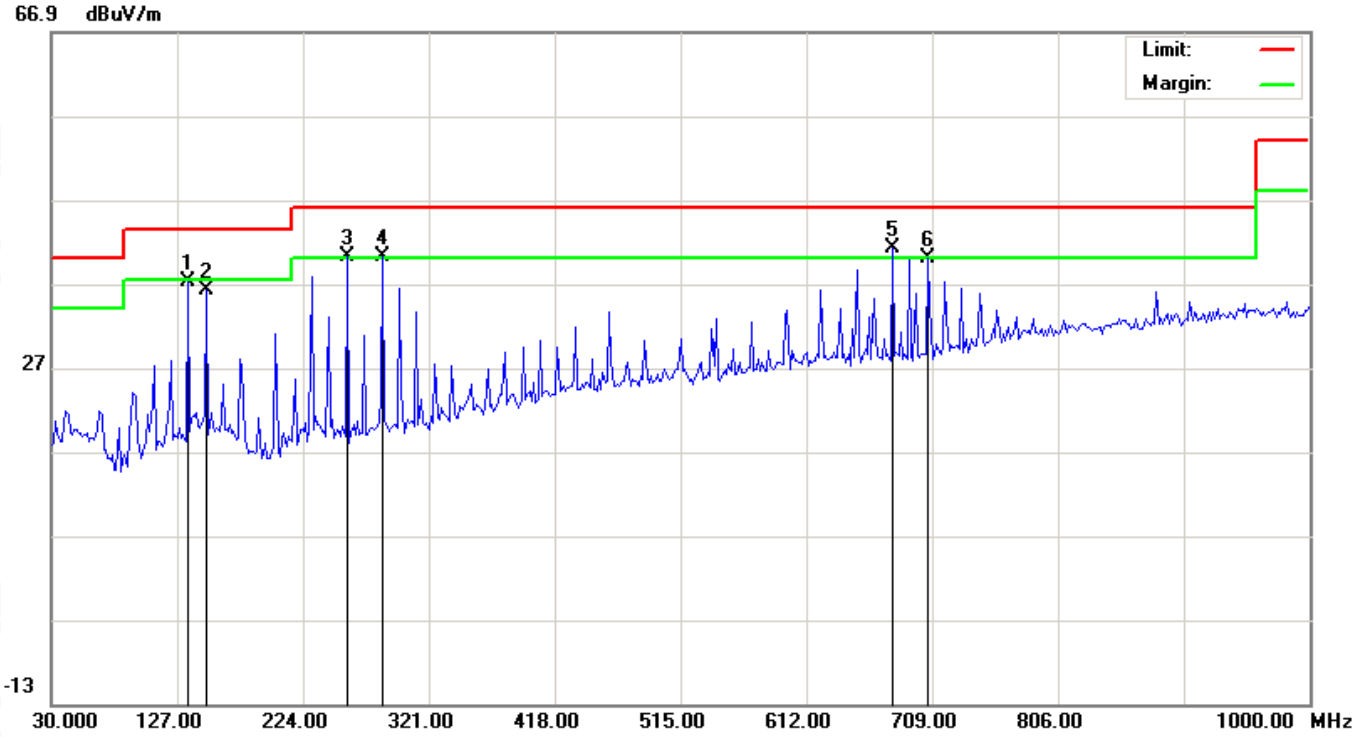
EUT	QR Code Reader	Model Name	QR500
Temperature	20.5 ℃	Relative Humidtity	50.6%
Pressure	1010 hPa	Test Voltage	DC 5V
Test Mode	Mode 1	Polarization	Horizontal



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1	!	243.4000	21.98	18.60	40.58	46.00	-5.42	peak
2	*	257.9500	23.91	18.35	42.26	46.00	-3.74	peak
3	!	270.8833	21.93	19.20	41.13	46.00	-4.87	peak
4	!	285.4333	21.92	19.81	41.73	46.00	-4.27	peak
5		406.6833	15.74	23.11	38.85	46.00	-7.15	peak
6	!	419.6167	17.04	23.37	40.41	46.00	-5.59	peak

RESULT: PASS

EUT	QR Code Reader	Model Name	QR500
Temperature	20.5 ℃	Relative Humidtity	50.6%
Pressure	1010 hPa	Test Voltage	DC 5V
Test Mode	Mode 1	Polarization	Vertical



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1		135.0833	18.38	18.92	37.30	43.50	-6.20	peak
2		149.6333	16.99	19.21	36.20	43.50	-7.30	peak
3	!	257.9500	21.76	18.35	40.11	46.00	-5.89	peak
4	!	285.4333	20.44	19.81	40.25	46.00	-5.75	peak
5	*	678.2833	13.41	27.89	41.30	46.00	-4.70	peak
6	!	705.7667	11.80	28.28	40.08	46.00	-5.92	peak

RESULT: PASS

Note: Factor=Antenna Factor + Cable loss, Over=Measurement-Limit.

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

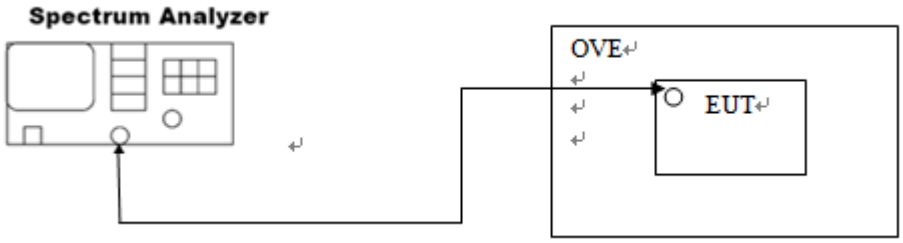
The mode 1 is the worst case, and only the data of the worst case recorded in this test report.

8. FREQUENCY STABILITY

8.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the operation frequency.
3. Set SPA Centre Frequency = Operation Frequency, RBW= 1 KHz, VBW≥3×RBW.
4. Set SPA Trace 1 Max hold, then View.
5. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
6. Extreme temperature rule is -20°C~50°C.

8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



8.3. MEASUREMENT RESULTS

Operating frequency: 13.56MHz

Voltage vs. Frequency Stability (Test Temperature: 20℃)

Voltage(V)	Measurement Frequency (MHz)	Max. Deviation (MHz)	Limit(MHz)	Conclusion
5.0	13.56052	0.00055	0.001356	PASS
5.5	13.56055			
4.5	13.56054			

Temperature vs. Frequency Stability (Test Voltage: 5V)

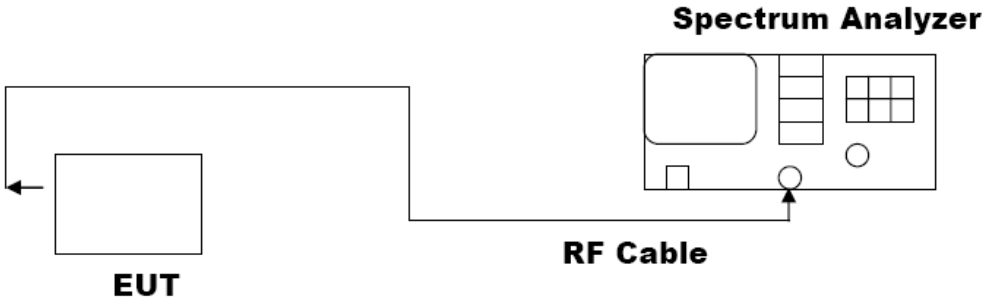
Temperature	Measurement Frequency (MHz)	Max. Deviation (MHz)	Limit(MHz)	Conclusion
- 20℃	13.56063	0.00064	0.001356	PASS
-10℃	13.56061			
0℃	13.56064			
10℃	13.56053			
20℃	13.56055			
30℃	13.56060			
40℃	13.56061			
50℃	13.56063			

9. BANDWIDTH

9.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the operation frequency.
3. Set SPA Centre Frequency = Operation Frequency, RBW= 10 KHz, VBW≥3×RBW.
4. Set SPA Trace 1 Max hold, then View.

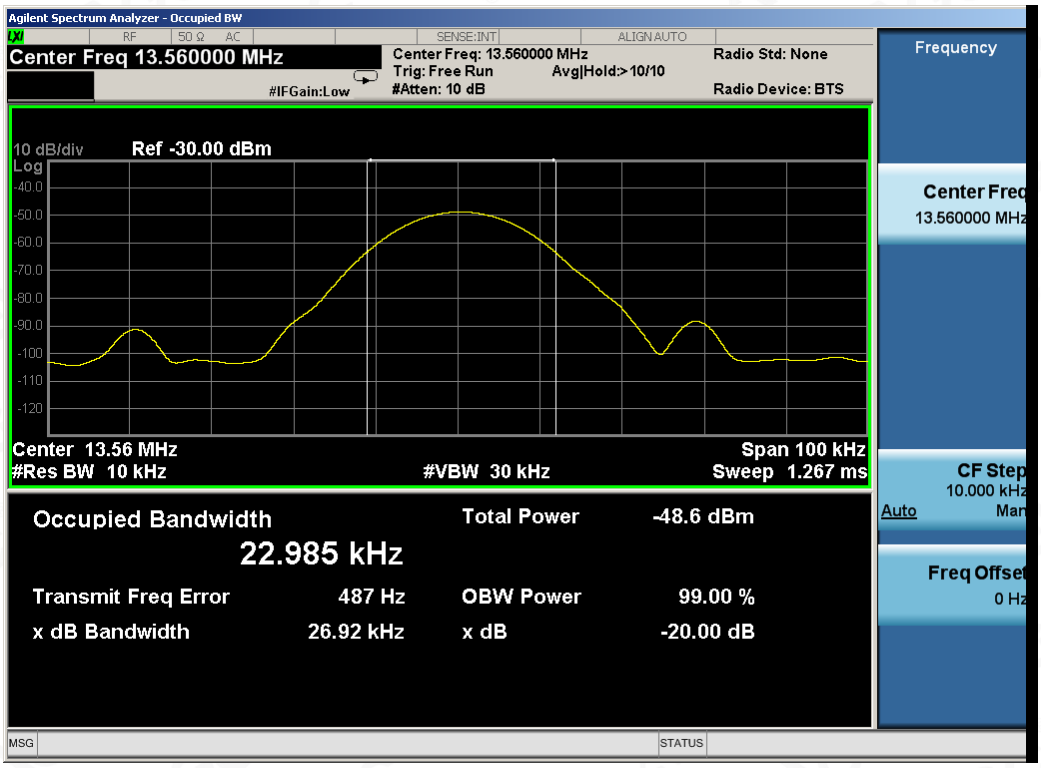
9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



9.3. MEASUREMENT RESULTS

TEST ITEM	BANDWIDTH
TEST MODE	Mode1

Test Data (kHz)		Criteria
Occupied Bandwidth	22.985	PASS
-20dB Bandwidth	26.920	PASS



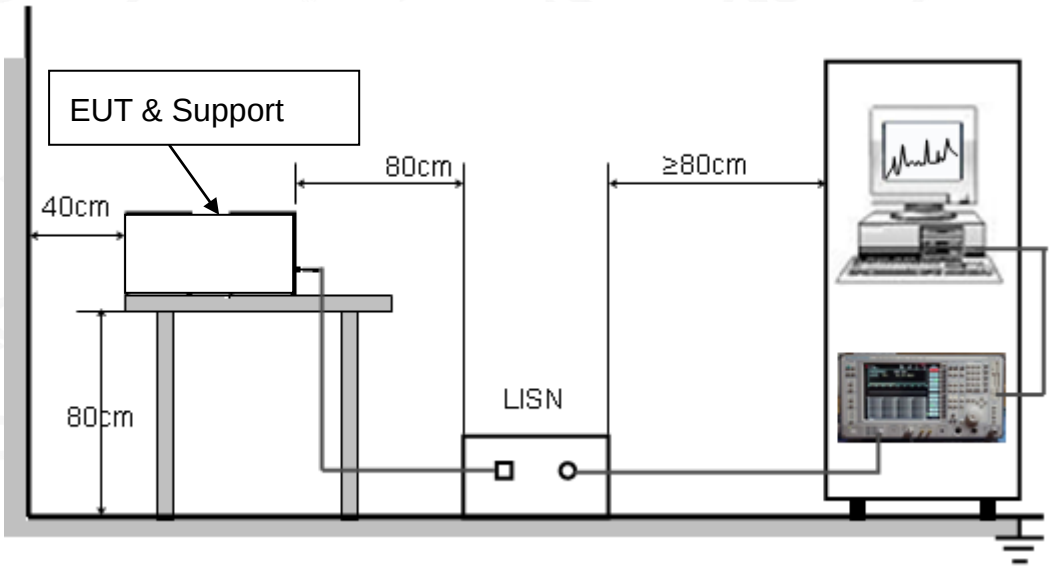
10. LINE CONDUCTED EMISSION TEST

10.1. 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 0.50 MHz.

10.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST



10.3. 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 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.

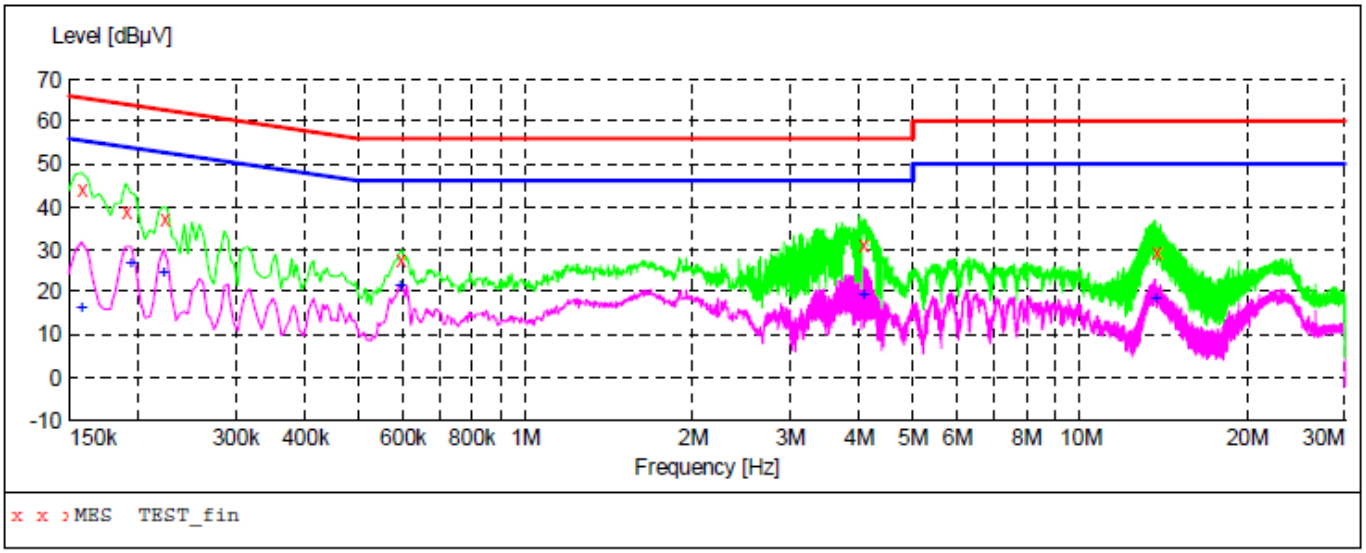
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

10.4. 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.

10.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

LINE CONDUCTED EMISSION TEST LINE 1-L



MEASUREMENT RESULT: "TEST_fin"

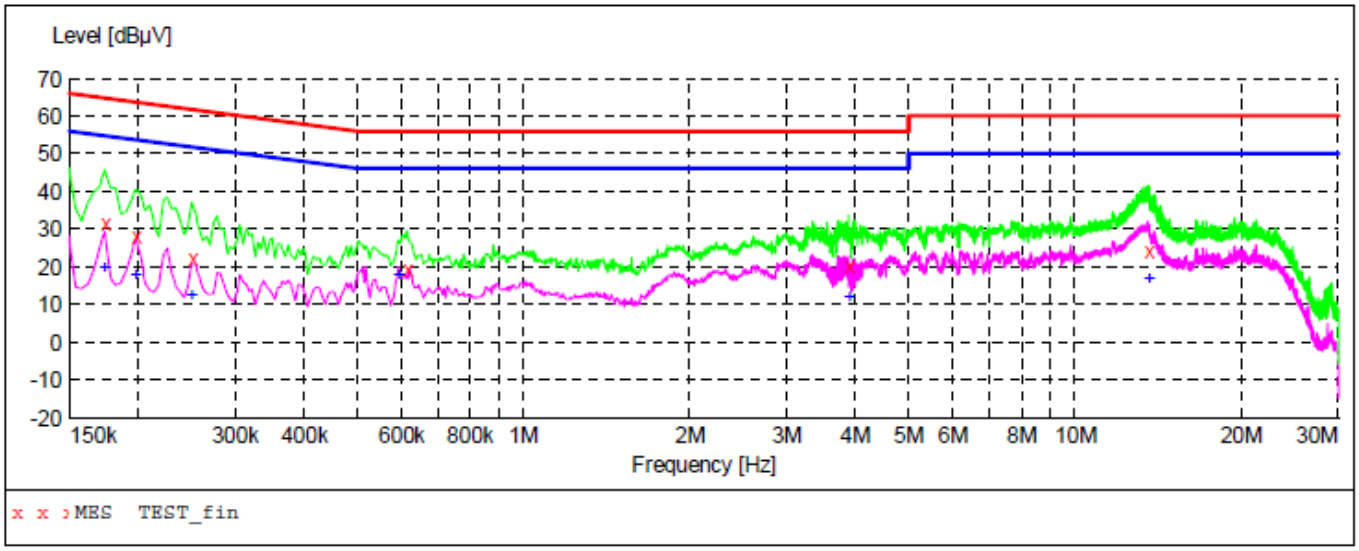
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.158000	44.10	10.8	66	21.5	QP	L1	FLO
0.190000	39.00	10.9	64	25.0	QP	L1	FLO
0.222000	37.20	10.9	63	25.5	QP	L1	FLO
0.594000	27.40	10.8	56	28.6	QP	L1	FLO
4.054000	31.10	11.6	56	24.9	QP	L1	FLO
13.678000	29.10	12.1	60	30.9	QP	L1	FLO

MEASUREMENT RESULT: "TEST_fin2"

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.158000	16.20	10.8	56	39.4	AV	L1	FLO
0.194000	26.50	10.9	54	27.4	AV	L1	FLO
0.222000	24.70	10.9	53	28.0	AV	L1	FLO
0.594000	21.50	10.8	46	24.5	AV	L1	FLO
4.066000	19.30	11.6	46	26.7	AV	L1	FLO
13.678000	18.60	12.1	50	31.4	AV	L1	FLO

RESULT: PASS

Line Conducted Emission Test Line 2-N



MEASUREMENT RESULT: "TEST_fin"

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.174000	31.70	10.9	65	33.1	QP	N	FLO
0.198000	27.90	10.9	64	35.8	QP	N	FLO
0.250000	22.20	10.9	62	39.6	QP	N	FLO
0.614000	19.40	10.7	56	36.6	QP	N	FLO
3.890000	20.20	11.6	56	35.8	QP	N	FLO
13.618000	24.20	12.1	60	35.8	QP	N	FLO

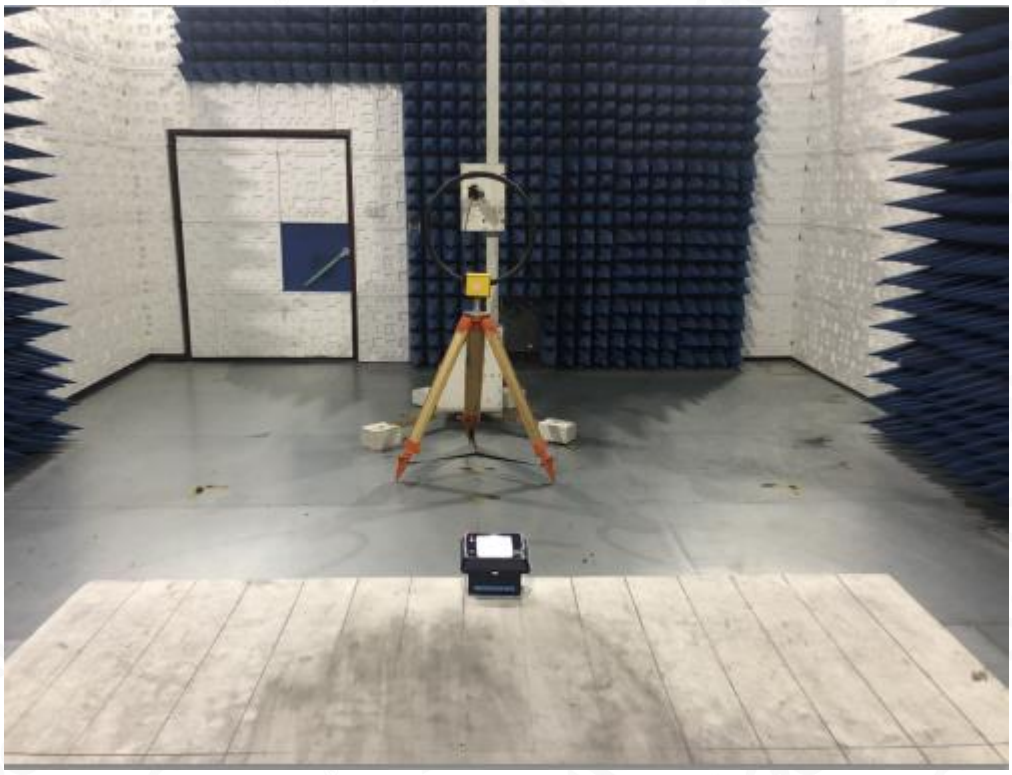
MEASUREMENT RESULT: "TEST_fin2"

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.174000	19.70	10.9	55	35.1	AV	N	FLO
0.198000	17.80	10.9	54	35.9	AV	N	FLO
0.250000	12.50	10.9	52	39.3	AV	N	FLO
0.594000	17.70	10.8	46	28.3	AV	N	FLO
3.890000	12.00	11.6	46	34.0	AV	N	FLO
13.618000	17.00	12.1	50	33.0	AV	N	FLO

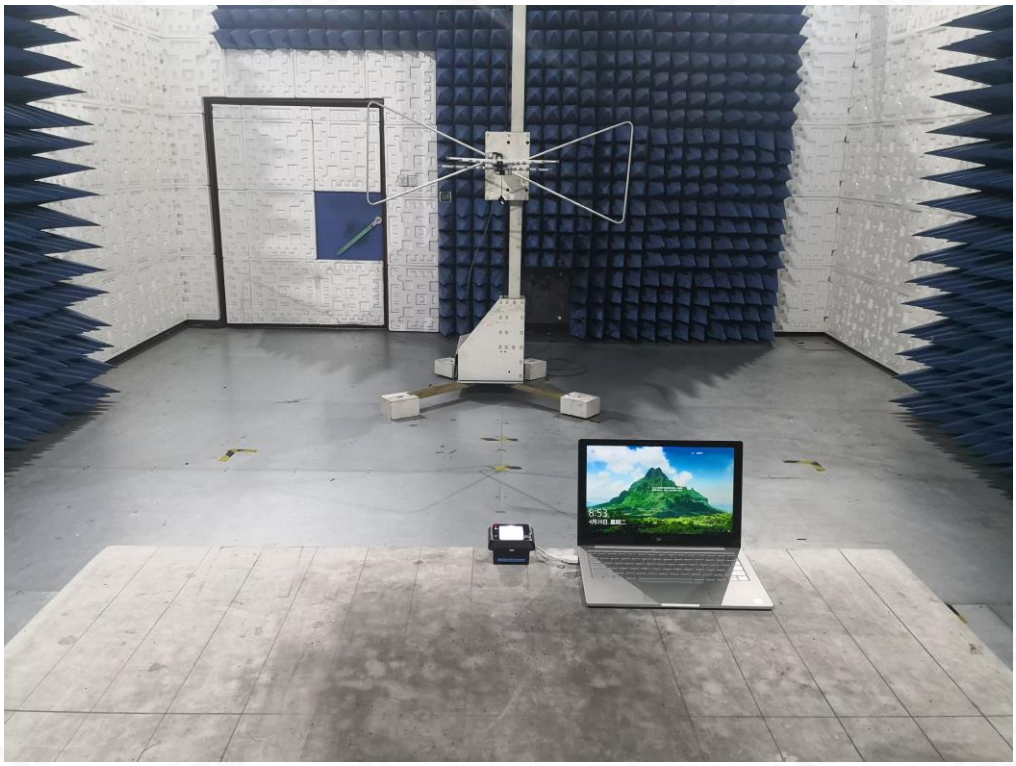
RESULT: PASS

APPENDIX A: PHOTOGRAPHS OF TEST SETUP

RADIATED EMISSION TEST SETUP BELOW 30MHz



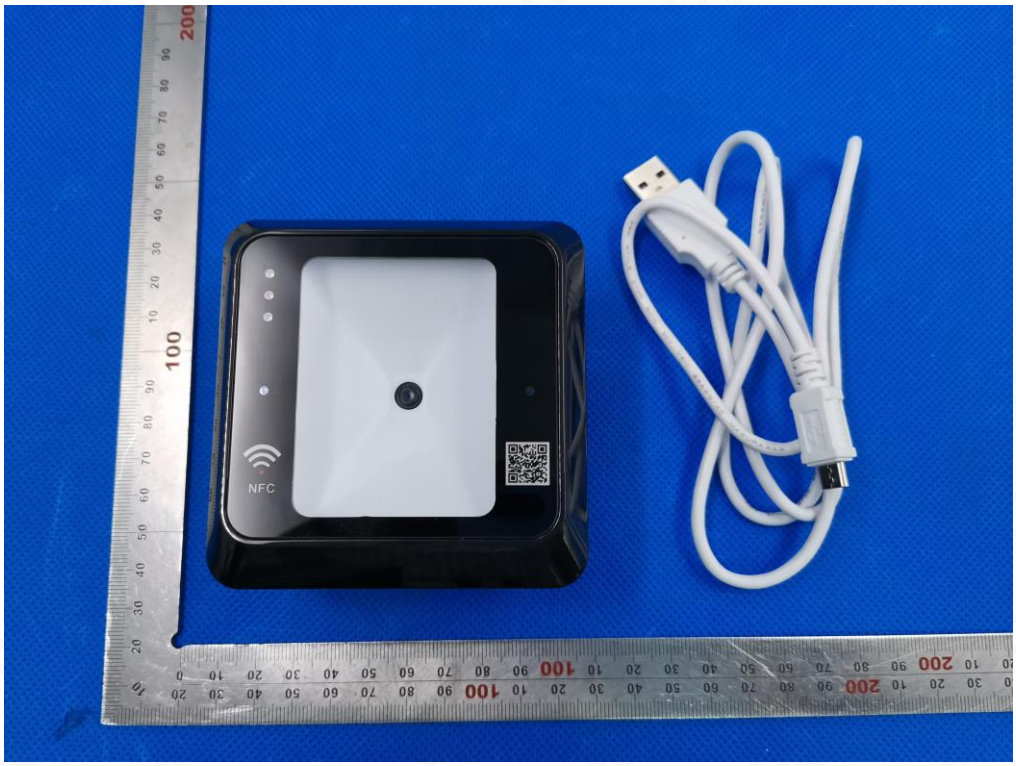
RADIATED EMISSION TEST SETUP BELOW 1GHz



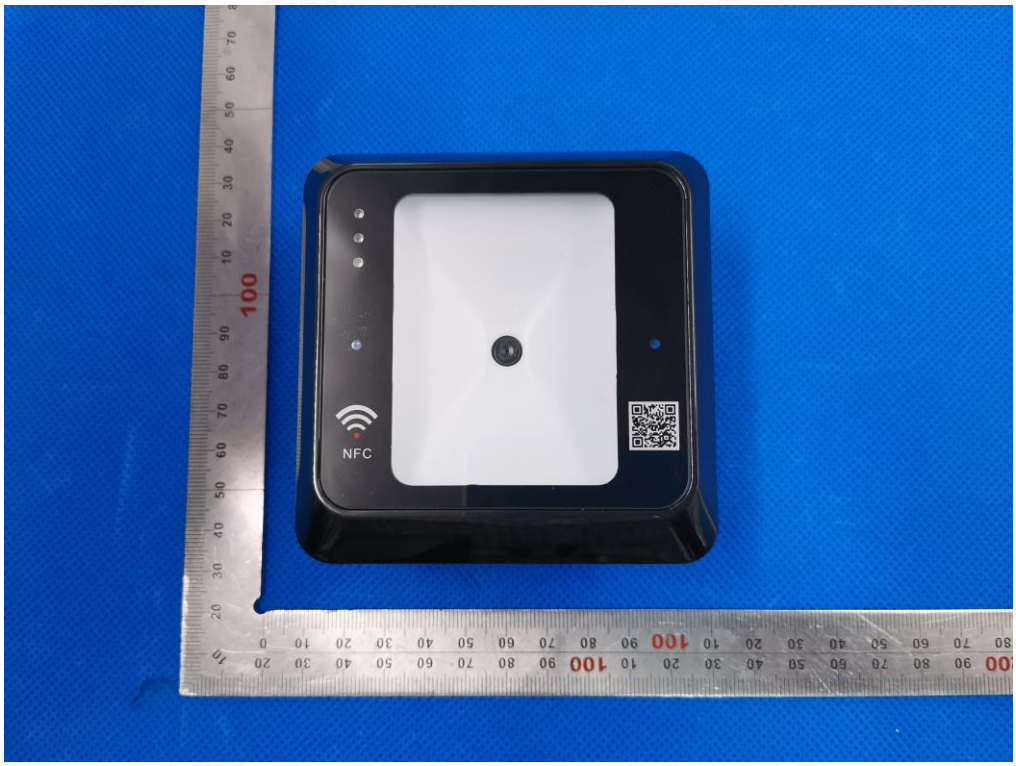
FCC LINE CONDUCTED EMISSION TEST SETUP

APPENDIX B: PHOTOGRAPHS OF EUT

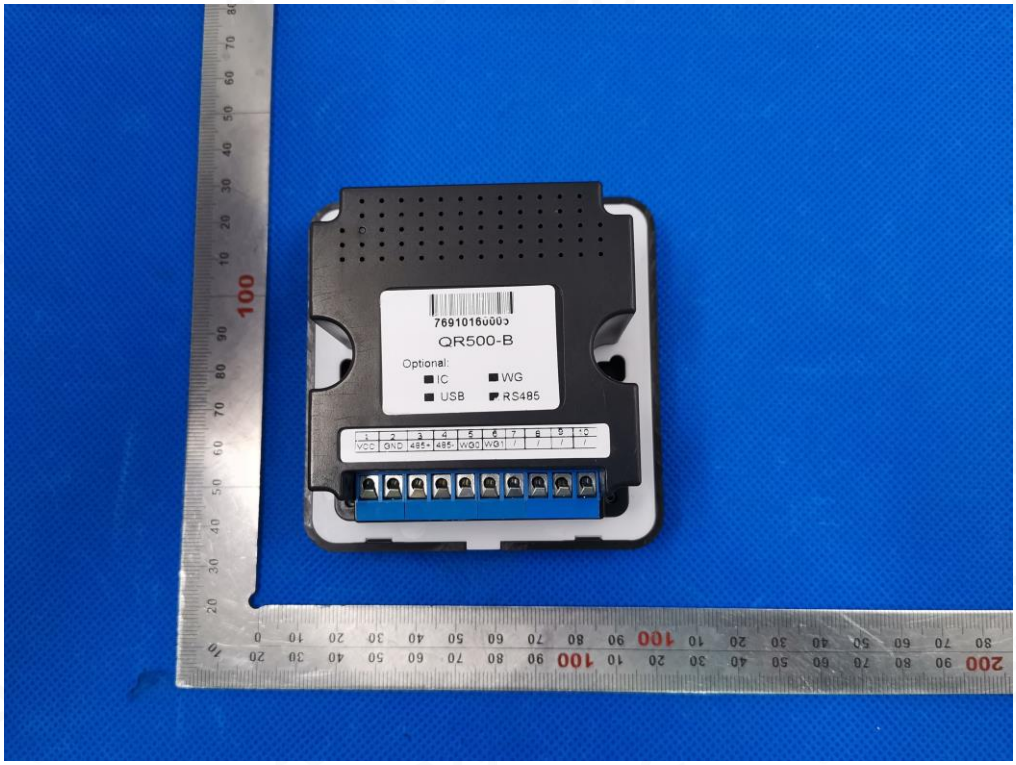
ALL VIEW OF EUT



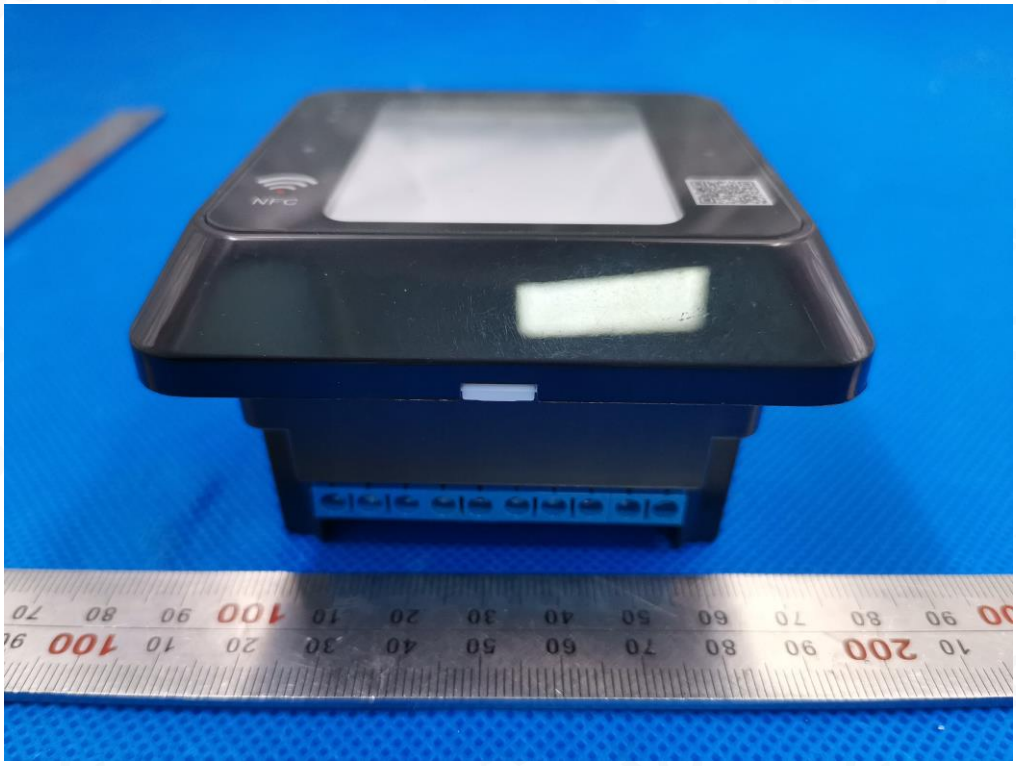
TOP VIEW OF EUT



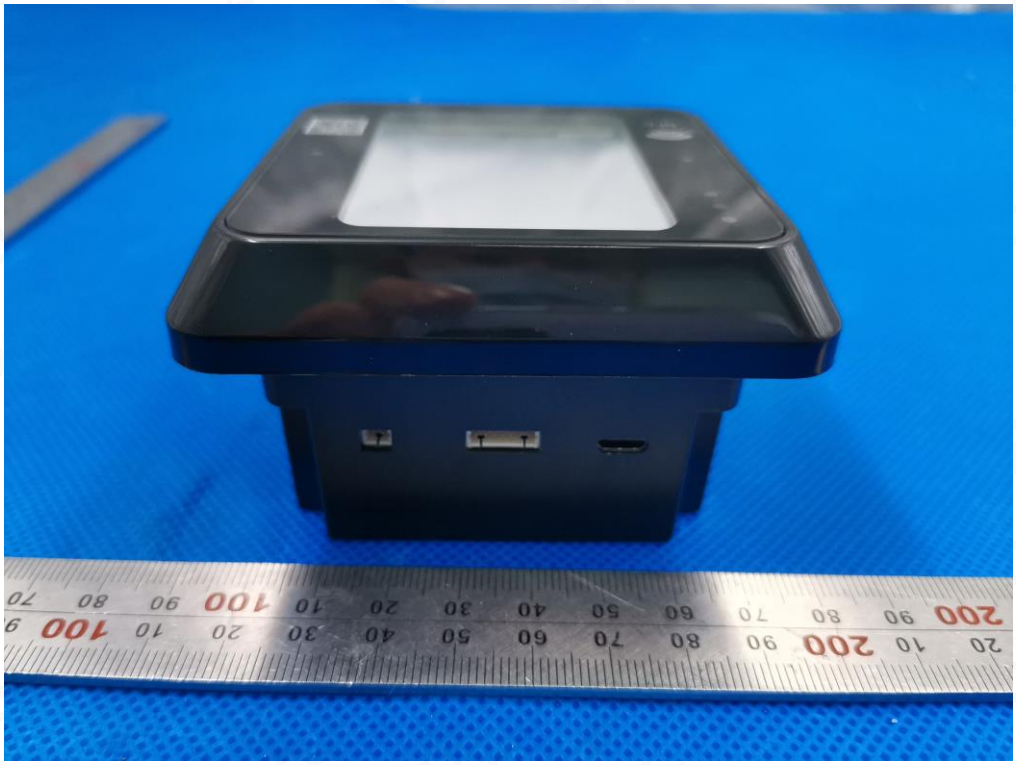
BOTTOM VIEW OF EUT



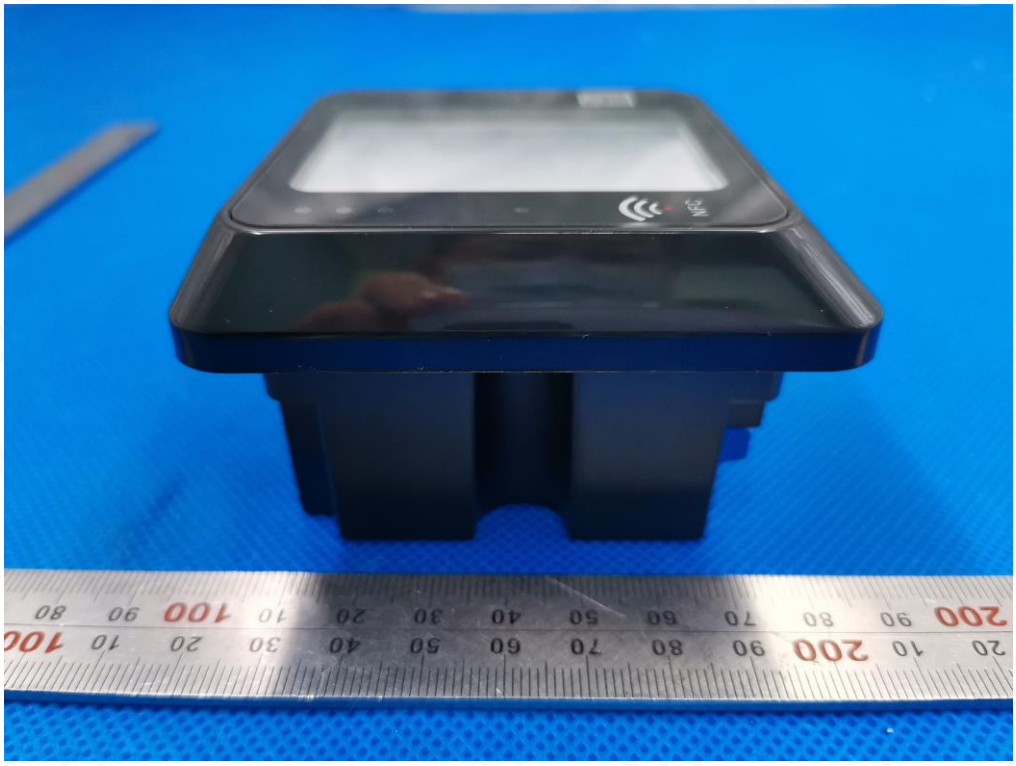
FRONT VIEW OF EUT



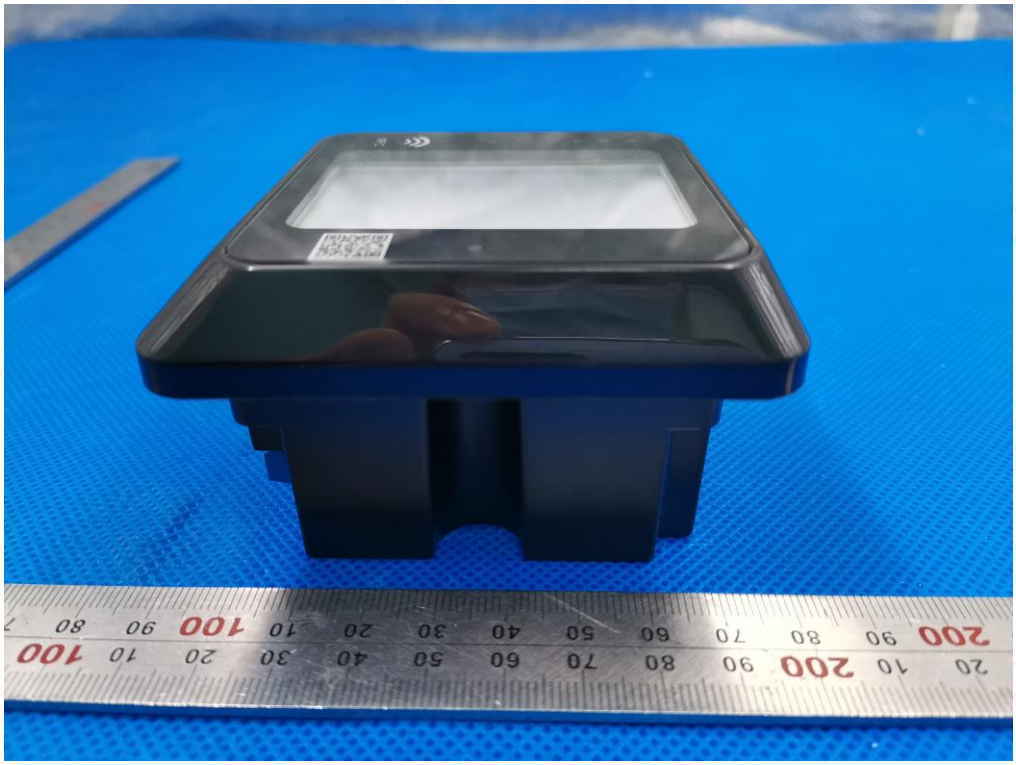
BACK VIEW OF EUT



LEFT VIEW OF EUT

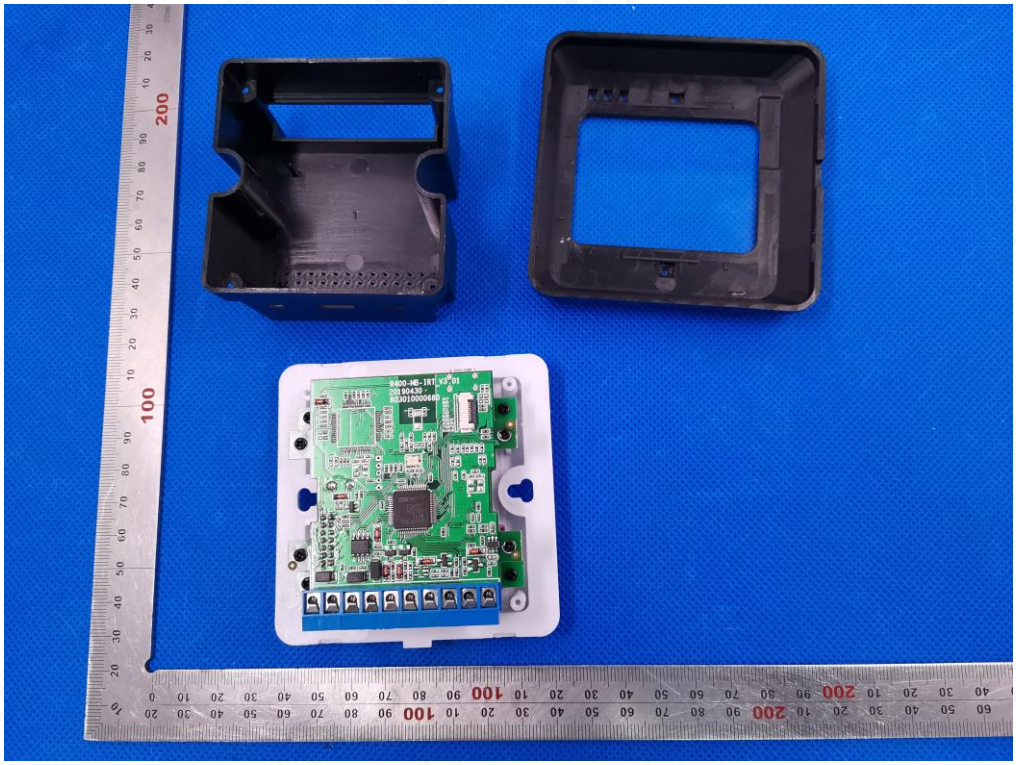


RIGHT VIEW OF EUT

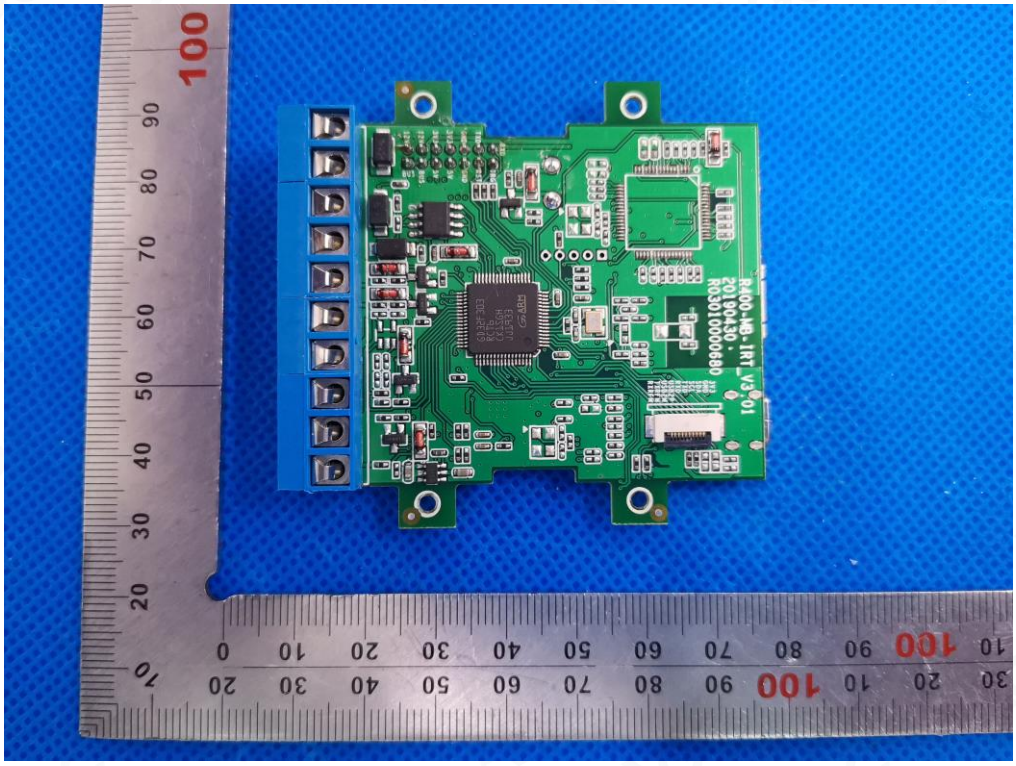


VIEW OF EUT(PORT)

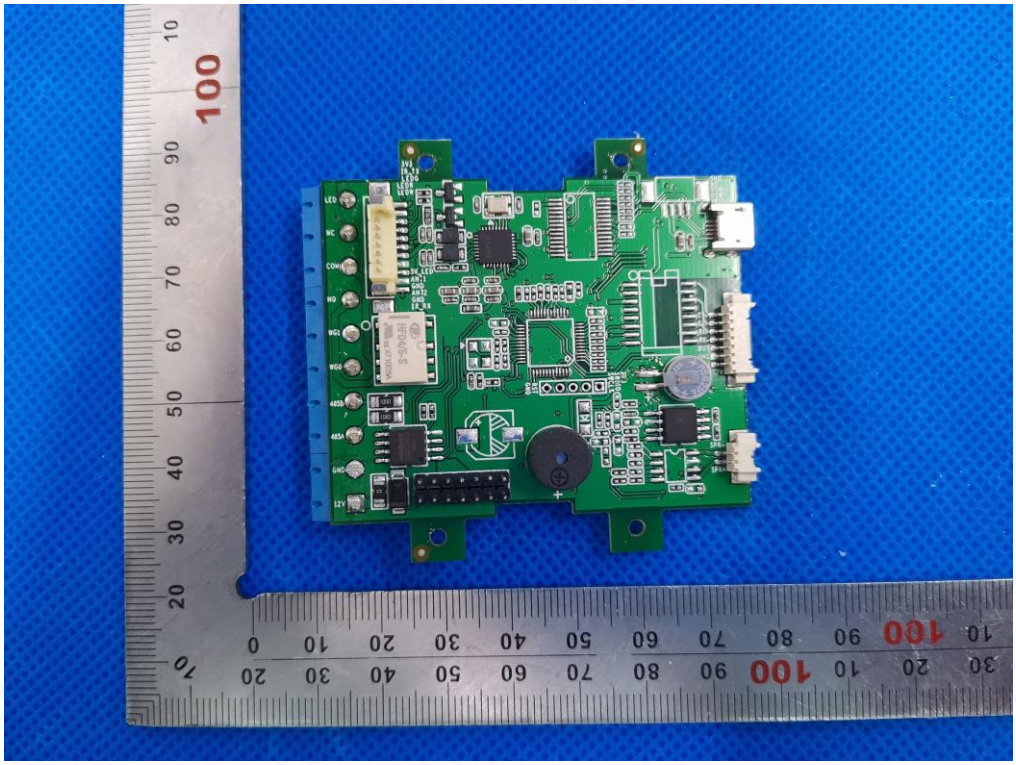
OPEN VIEW OF EUT



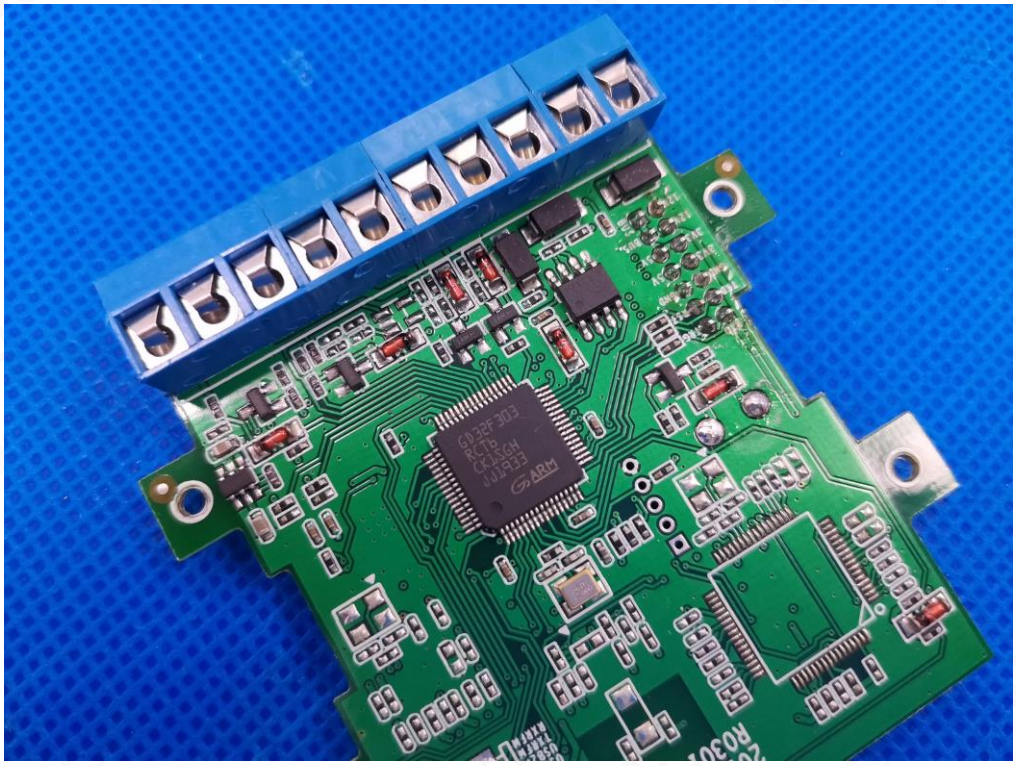
INTERNAL VIEW OF EUT-1



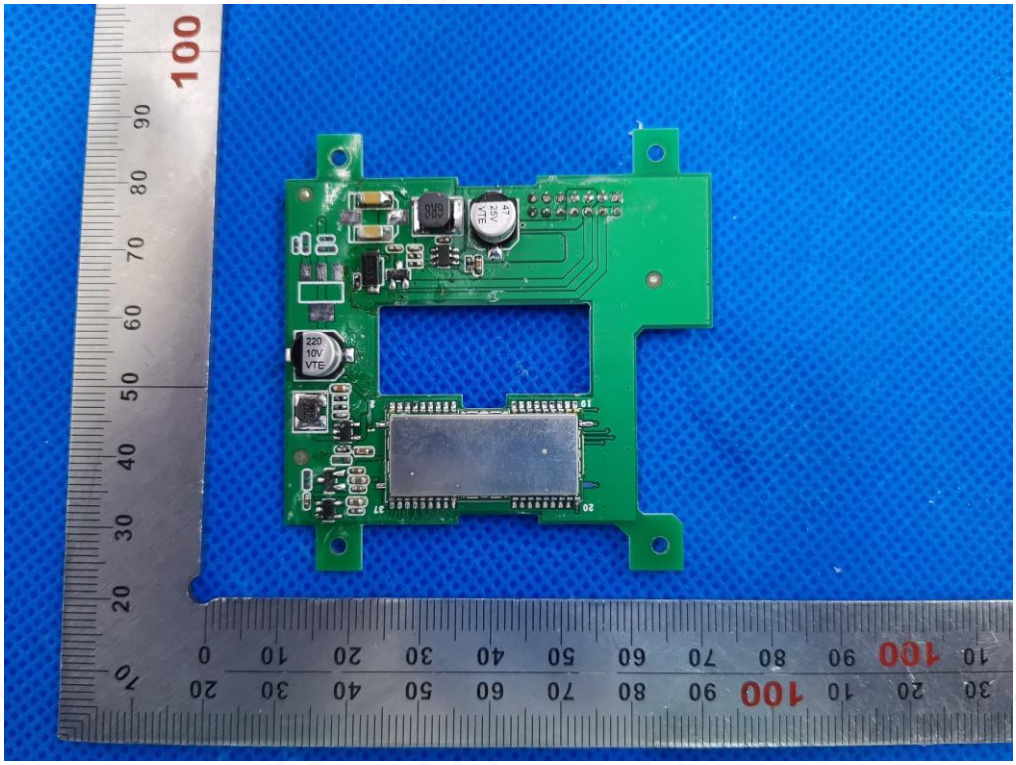
INTERNAL VIEW OF EUT-2



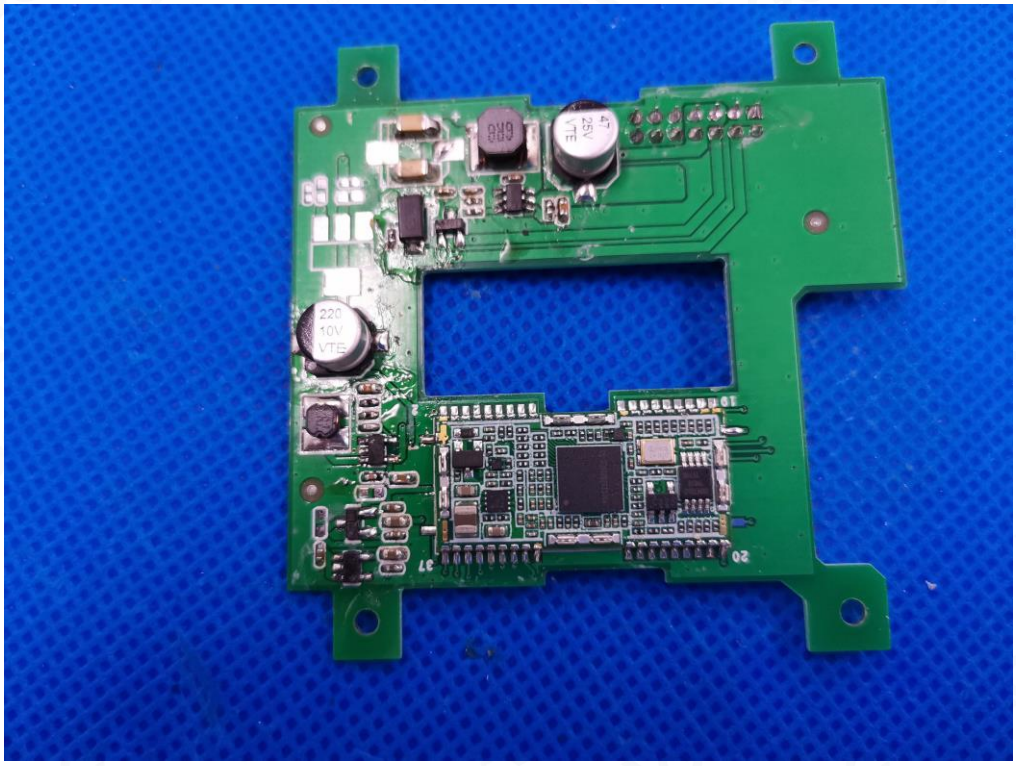
INTERNAL VIEW OF EUT-3



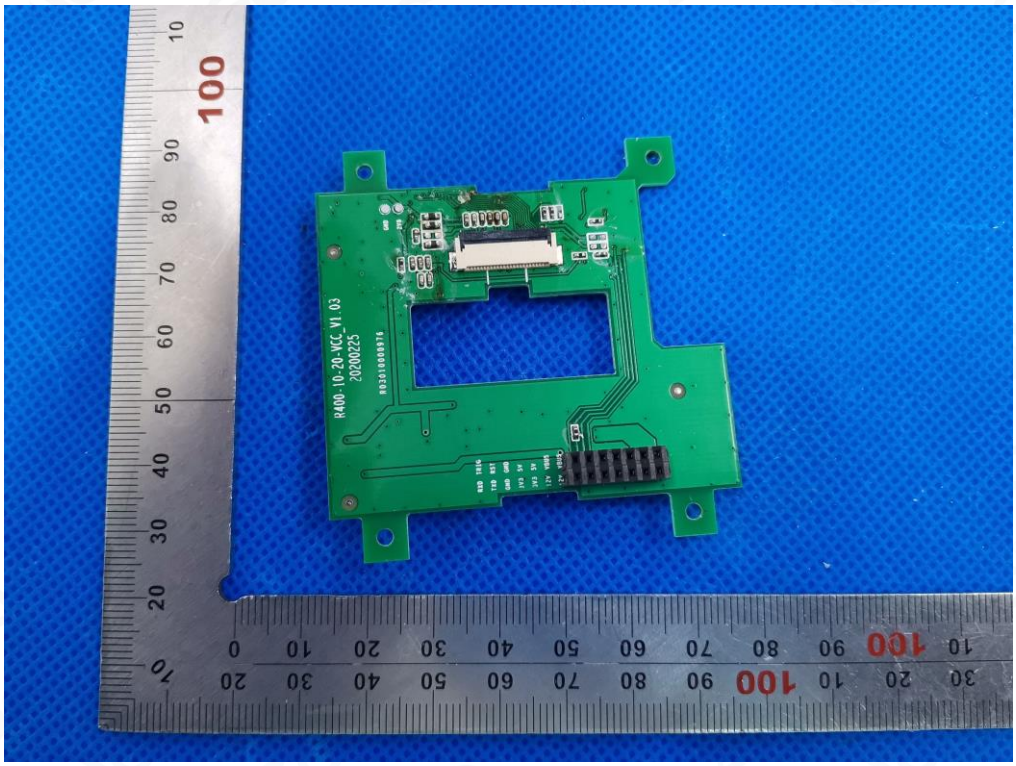
INTERNAL VIEW OF EUT-4



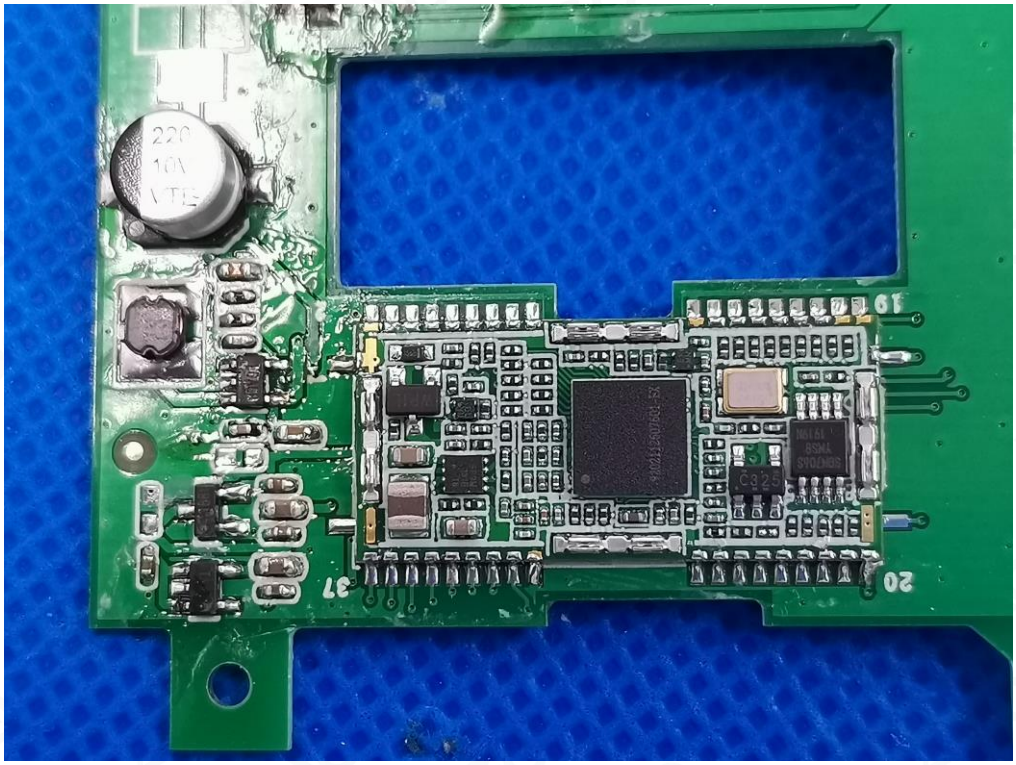
INTERNAL VIEW OF EUT-5



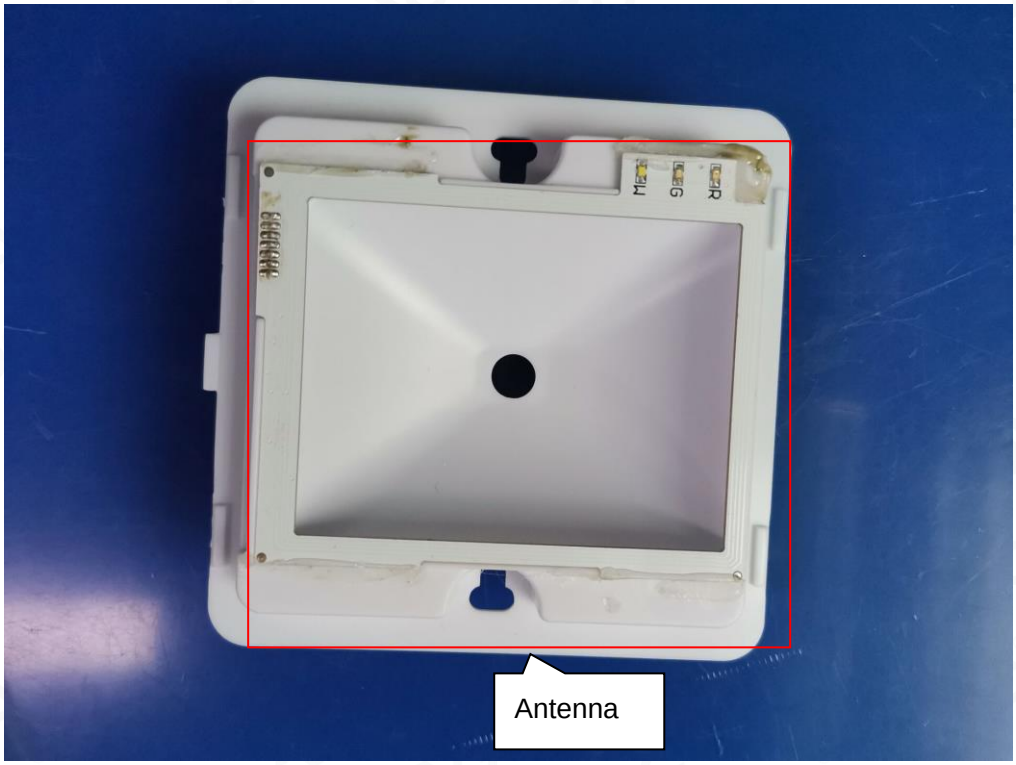
INTERNAL VIEW OF EUT-6



INTERNAL VIEW OF EUT-7



ANTENNA



----END OF REPORT----