FCC Test Report

Report No.: AGC03767190801FE05

FCC ID	:	Z52NAS-AB02Z
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	Z-Wave Siren
BRAND NAME	:	NEO
MODEL NAME	:	NAS-AB02Z
APPLICANT	:	SHENZHEN NEO ELECTRONICS CO.,LTD
DATE OF ISSUE	:	Sep. 12, 2019
STANDARD(S) **TEST PROCEDURE(S)**	:	FCC Part 15.249
REPORT VERSION	:	V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd

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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Sep. 12, 2019	Valid	Initial Release

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1. VERIFICATION OF CONFORMITY

Applicant	SHENZHEN NEO ELECTRONICS CO.,LTD
Address	East 6/F, Building 2 LaoBing Industry, No.44 TieZai Road, Baoan District, Shenzhen
Manufacturer	SHENZHEN NEO ELECTRONICS CO.,LTD
Address	East 6/F, Building 2 LaoBing Industry, No.44 TieZai Road, Baoan District, Shenzhen
Factory Name	SHENZHEN NEO ELECTRONICS CO.,LTD
Address	East 6/F, Building 2 LaoBing Industry, No.44 TieZai Road, Baoan District, Shenzhen
Product Designation	Z-Wave Siren
Brand Name	NEO
Test Model	NAS-AB02Z
Date of test	Aug. 30, 2019 to Sep. 11, 2019
Deviation	None
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BGN/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 15.249.

Prepared By	Jeast Zhan	
	Jeast Zhan (Project Engineer)	Sep. 11, 2019
Reviewed By	Max Zhang	
	Max Zhang (Reviewer)	Sep. 12, 2019
Approved By	Forrest Lei	
	Forrest Lei (Authorized Officer)	Sep. 12, 2019

2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as “Z-Wave Siren”. It is designed by way of utilizing the OQPSK technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	908.4MHz
Output Power	76.26dBuV/m @ 3m(Average)
Modulation	OQPSK
Number of channels	2
Hardware Version	NAS-AB02ZU_E_V10 20190118
Software Version	06 04 18 02 67 32 00
Antenna Designation	Fixed Antenna (Met 15.203 Antenna requirement)
Antenna Gain	0dBi
Power Supply	DC 5V 1A by Adapter or DC 6.0V by Battery

2.2. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: Z52NAS-AB02Z** filing to comply with the FCC PART 15.249 requirements.

2.3. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013). Radiated testing was performed at an antenna to EUT distance 3 meters.

2.4. SPECIAL ACCESSORIES

Refer to section 5.2.

2.5. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

3. MEASUREMENT UNCERTAINTY

The uncertainty is calculated using the methods suggested in the “Guide to the Expression of Uncertainty in measurement” (GUM) published by CISPR and ANSI.

- Uncertainty of Conducted Emission, Uc = ±3.2 dB
- 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	908.4MHz

Note:

1. The EUT has been set to operate continuously on the lowest, middle and highest operation frequency Individually, and the EUT is operating at its maximum duty cycle>or equal 98%
2. All modes under which configure applicable have been tested and the worst mode test data recording in the test report, if no other mode data.
3. For Radiated Emission, 3axis were chosen for testing for each applicable mode.

5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Radiated Emission Configure:

Conducted Emission Configure:

5.2. EQUIPMENT USED IN EUT SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	Z-Wave Siren	NAS-AB02Z	Z52NAS-AB02Z	EUT
2	Adapter	MDY-08-ES	DC 5V/1A	AE

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.249	Radiated Emission	Compliant
§15.215	20dB bandwidth	Compliant
§15.207	Conducted Emission	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 CONDUCTED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESPI	101206	Jun. 12, 2019	Jun. 11, 2020
LISN	R&S	ESH2-Z5	100086	Aug. 26, 2019	Aug. 25, 2020

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. 20, 2018	Dec. 19, 2019
Attenuator	Weinachel Corp	58-30-33	N/A	Jun. 12, 2019	Jun. 11, 2020
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	Jun. 12, 2019	Jun. 11, 2020
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May. 26, 2018	May. 25, 2020
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Oct. 25, 2018	Oct. 24, 2019
ANTENNA	SCHWARZBECK	VULB9168	D69250	Sep. 28, 2017	Sep. 27, 2019

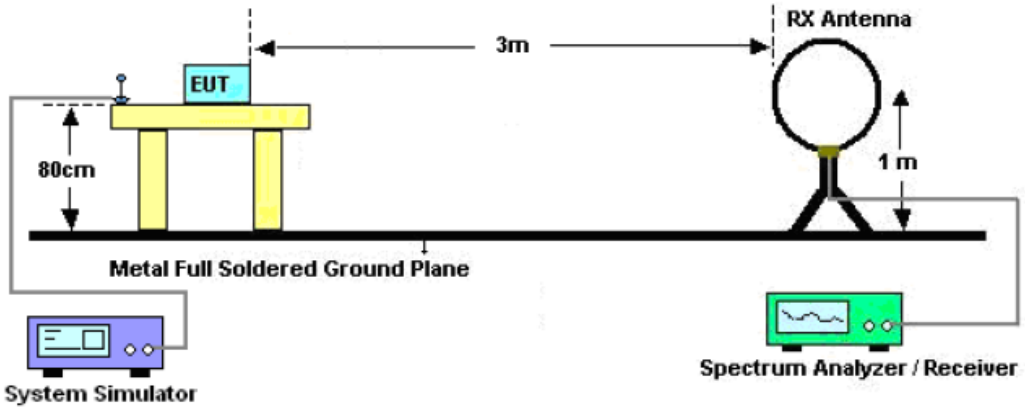
7. RADIATED EMISSION

7.1. MEASUREMENT PROCEDURE

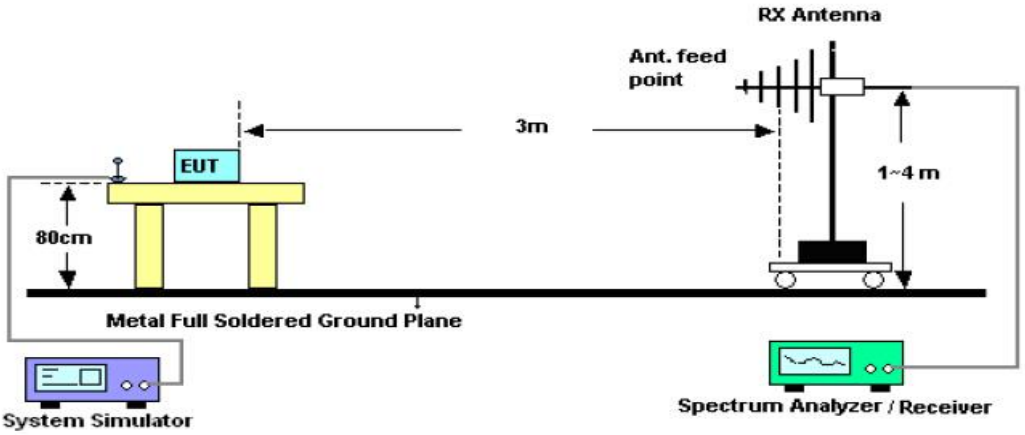
1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated 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 VBW and 3MHz 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.

7.2. TEST SETUP

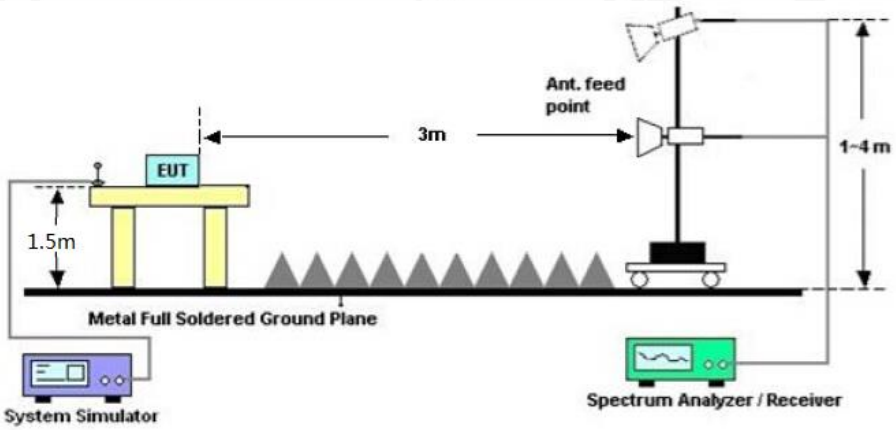
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



7.3. LIMITS AND MEASUREMENT RESULT

FCC part 15.209 Limit in the below table has to be followed

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

Note: All modes were tested For restricted band radiated emission,
the test records reported below are the worst result compared to other modes.

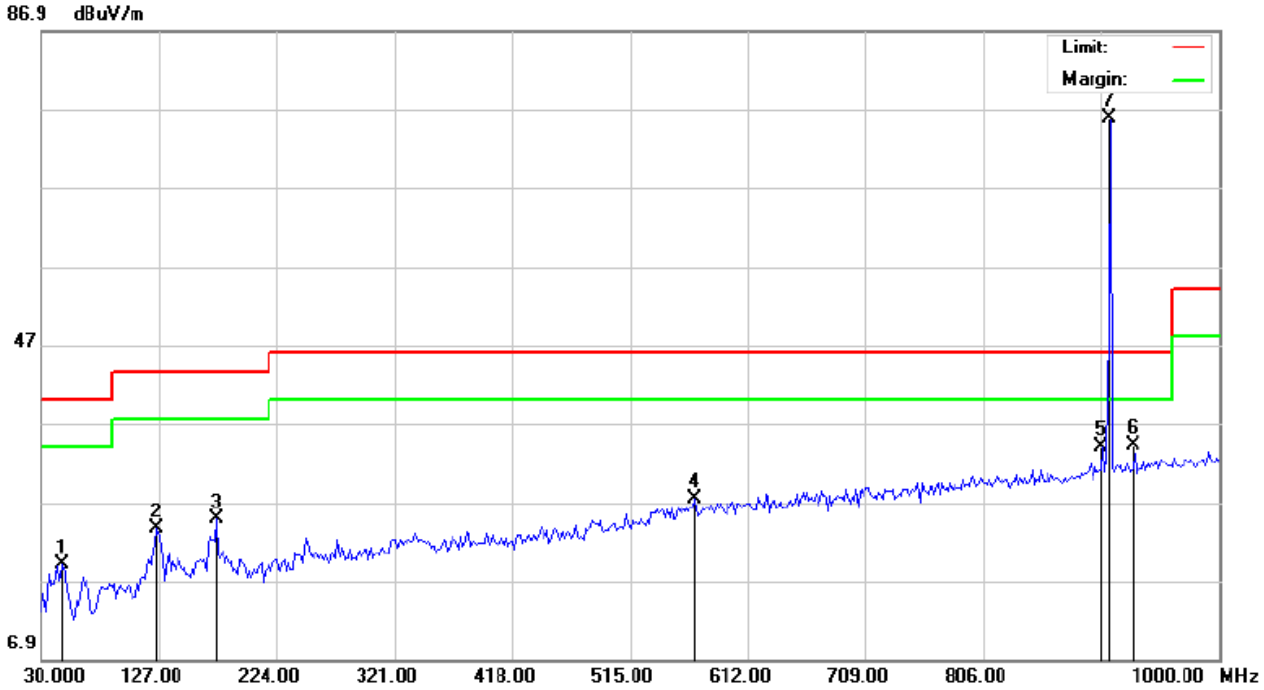
7.4. TEST RESULT

RADIATED EMISSION BELOW 30MHZ

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

Emissions radiated outside of the specified frequency bands, except for harmonic emissions

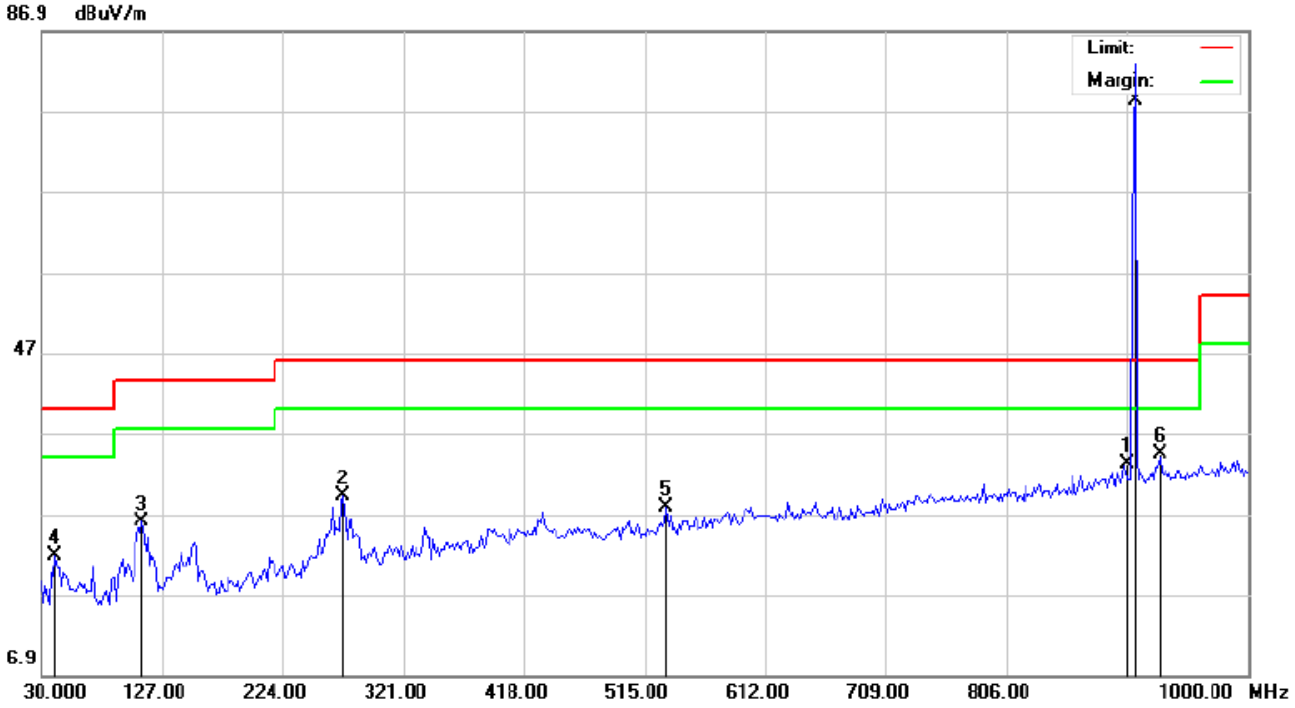
EUT	Z-Wave Siren	**Model Name**	NAS-AB02Z
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Horizontal



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		47.7831	10.60	8.39	18.99	40.00	-21.01	peak			
2		125.3833	14.59	9.10	23.69	43.50	-19.81	peak			
3		173.8831	10.39	14.46	24.85	43.50	-18.65	peak			
4		568.3499	4.82	22.57	27.39	46.00	-18.61	peak			
5		902.5000	5.25	28.68	33.93	46.00	-12.07	peak			
6		928.0000	4.74	29.39	34.13	46.00	-11.87	peak			
7	*	908.4000	46.91	28.84	75.75	46.00	29.75	peak			

RESULT: PASS

EUT	Z-Wave Siren	Model Name	NAS-AB02Z
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	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		902.5000	4.52	28.68	33.20	46.00	-12.80	peak			
2		272.5000	18.50	10.73	29.23	46.00	-16.77	peak			
3		110.8330	17.95	7.98	25.93	43.50	-17.57	peak			
4		41.3166	9.92	11.81	21.73	40.00	-18.27	peak			
5		532.7833	5.69	22.02	27.71	46.00	-18.29	peak			
6		928.0000	5.09	29.39	34.48	46.00	-11.52	peak			
7	*	908.4000	49.39	28.84	78.23	46.00	32.23	peak			

RESULT: PASS

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

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

3. The emission signal above the limit is the fundamental wave.

The field strength of fundamental and harmonic emissions

EUT	Z-Wave Siren	**Model Name**	NAS-AB02Z
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Horizontal

Frequency	Reading Level	Factor	Emission Level	Limit	Margin	Value type
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	
908.400	45.13	28.5	73.63	114.00	40.37	Peak
908.400	43.22	28.3	71.52	94.00	22.48	Average
1816.800	28.35	21.72	50.07	74.00	23.93	Peak
1816.800	32.68	10.72	43.4	54.00	-10.6	Average
2725.200	35.94	9.42	45.36	74.00	24.64	Peak
2725.200	35.53	9.42	44.95	54.00	9.05	Average

EUT	Z-Wave Siren	**Model Name**	NAS-AB02Z
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 1	**Antenna**	Vertical

Frequency	Reading Level	Factor	Emission Level	Limit	Margin	Value type
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	
908.400	49.31	28.5	77.81	114.00	36.19	Peak
908.400	47.96	28.3	76.26	94.00	17.74	Average
1816.800	39.11	11.72	50.83	74	23.17	Peak
1816.800	33.85	10.72	44.57	54	9.43	Average
2725.200	30.27	9.42	39.69	74	34.31	Peak
2725.200	24.89	9.42	34.31	54	19.69	Average

Note: Other harmonic emissions from 1G to 9.3 GHz are considered as ambient noise. No recording in the test report.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

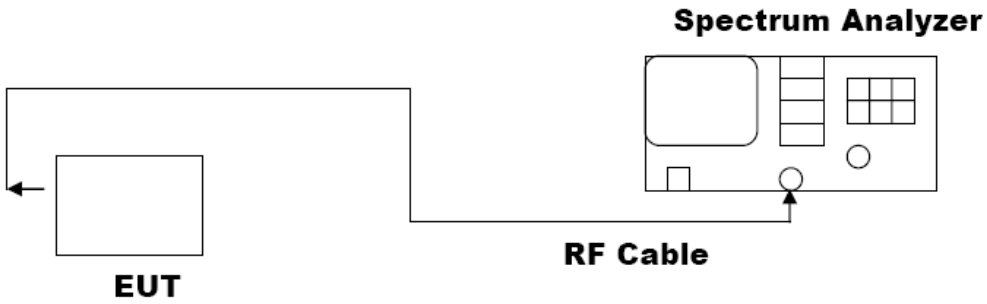
The “Factor” value can be calculated automatically by software of measurement system.

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 top, the middle and the bottom operation frequency individually.
3. Set SPA Centre Frequency = Operation Frequency, RBW= 3 KHz, VBW≥3×RBW.
4. Set SPA Trace 1 Max hold, then View.

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

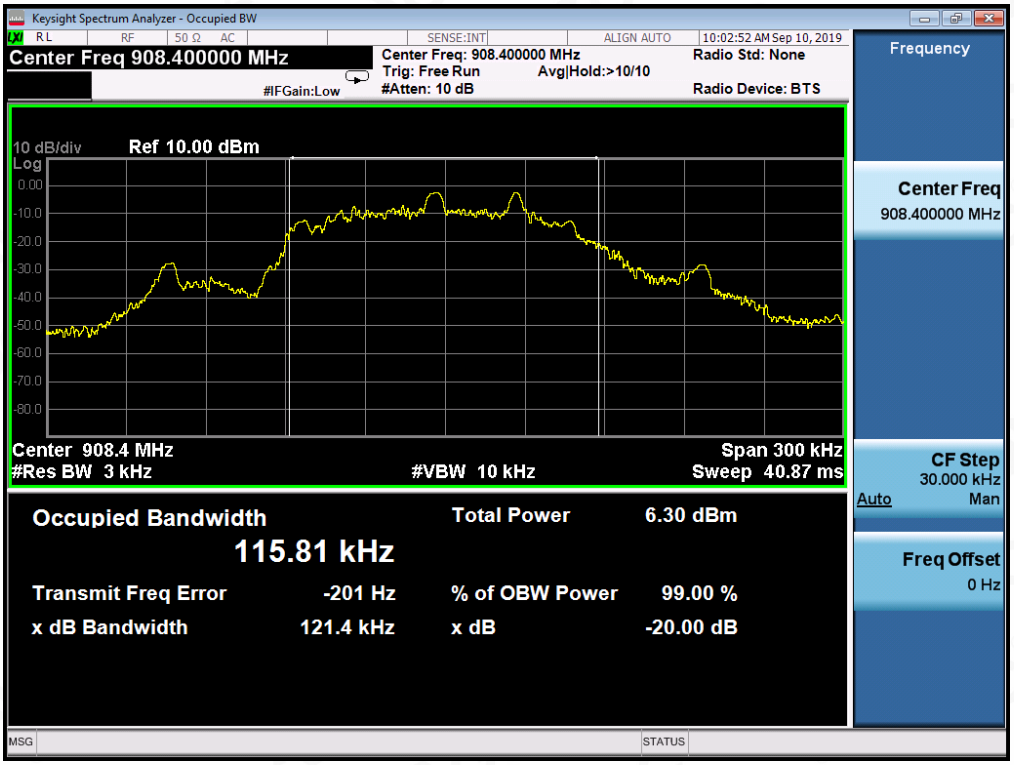


9.3. MEASUREMENT RESULTS

TEST ITEM	20dB BANDWIDTH
TEST MODULATION	OQPSK

Test Data (KHz)		**Criteria**
908.4MHz	121.4	PASS

TEST PLOT OF BANDWIDTH FOR 908.4MHz



10. FCC LINE CONDUCTED EMISSION TEST

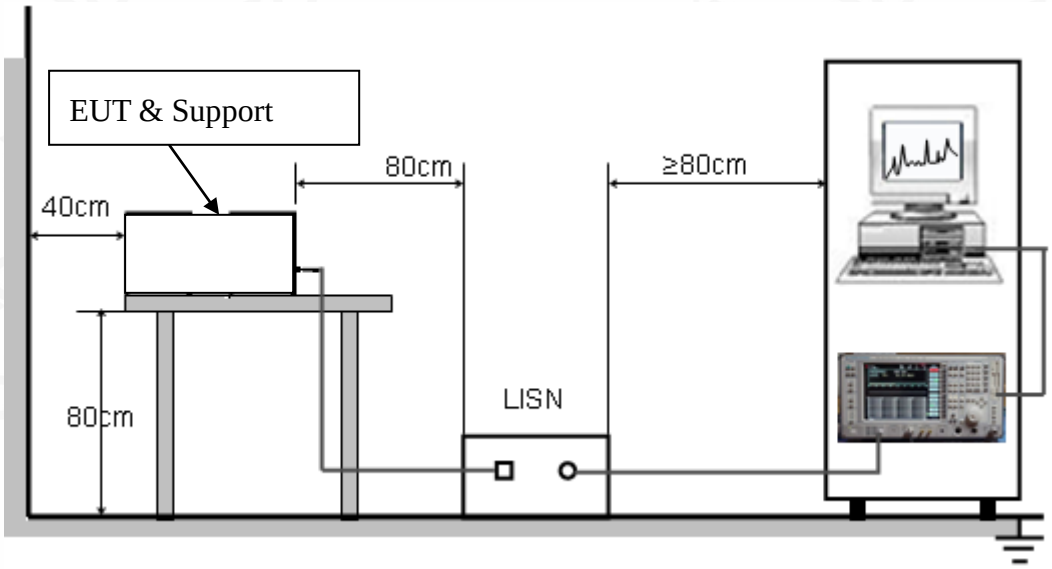
10.1 LIMITS OF LINE CONDUCTED EMISSION TEST

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 0.50MHz.

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 DC 5V power from adapter which received AC120V/60Hz power from 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.

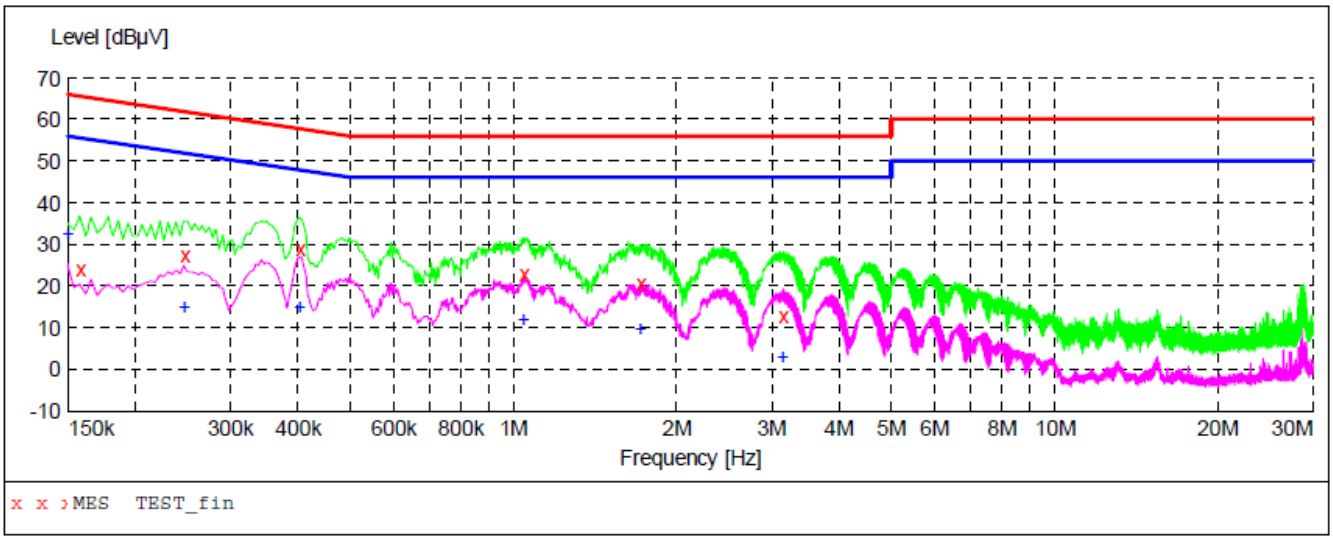
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

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"

9/3/2019 4:19PM

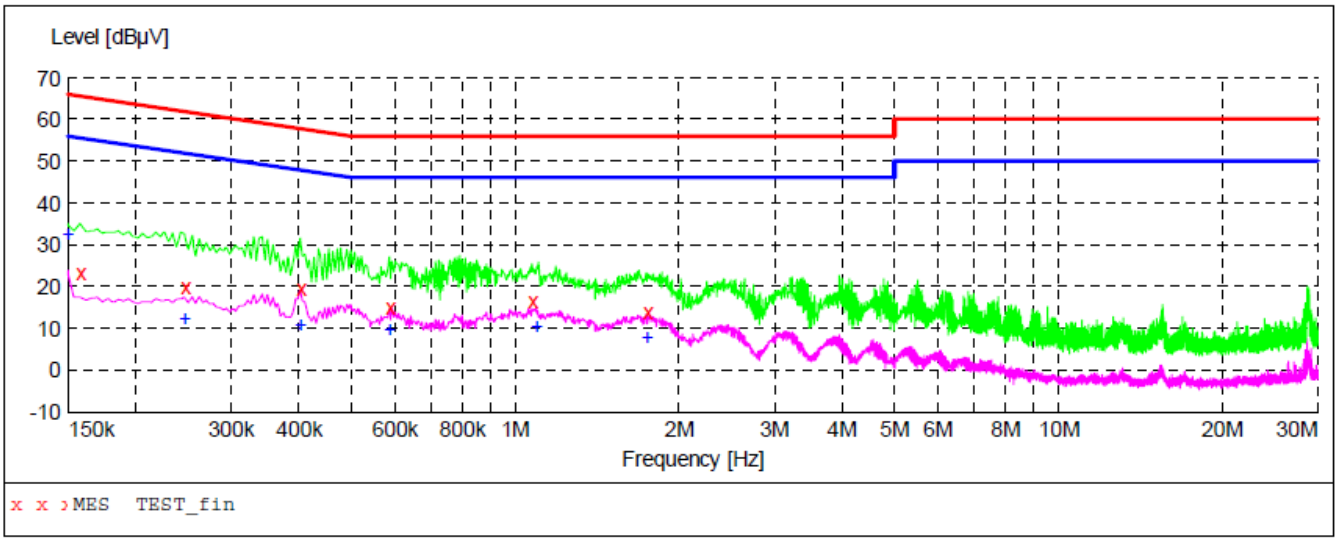
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.158000	24.10	10.8	66	41.5	QP	L1	FLO
0.246000	27.30	10.9	62	34.6	QP	L1	FLO
0.402000	28.80	10.3	58	29.0	QP	L1	FLO
1.042000	22.90	11.4	56	33.1	QP	L1	FLO
1.718000	20.60	11.5	56	35.4	QP	L1	FLO
3.142000	12.90	11.5	56	43.1	QP	L1	FLO

MEASUREMENT RESULT: "TEST_fin2"

9/3/2019 4:19PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.150000	32.80	10.8	56	23.2	AV	L1	FLO
0.246000	15.20	10.9	52	36.7	AV	L1	FLO
0.402000	15.10	10.3	48	32.7	AV	L1	FLO
1.042000	12.30	11.4	46	33.7	AV	L1	FLO
1.718000	10.00	11.5	46	36.0	AV	L1	FLO
3.142000	2.90	11.5	46	43.1	AV	L1	FLO

Line Conducted Emission Test Line 2-N



MEASUREMENT RESULT: "TEST_fin"

9/3/2019 4:23PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.158000	23.20	10.8	66	42.4	QP	N	FLO
0.246000	20.10	10.9	62	41.8	QP	N	FLO
0.402000	19.80	10.3	58	38.0	QP	N	FLO
0.586000	15.10	10.8	56	40.9	QP	N	FLO
1.074000	16.50	11.4	56	39.5	QP	N	FLO
1.750000	14.00	11.5	56	42.0	QP	N	FLO

MEASUREMENT RESULT: "TEST_fin2"

9/3/2019 4:23PM

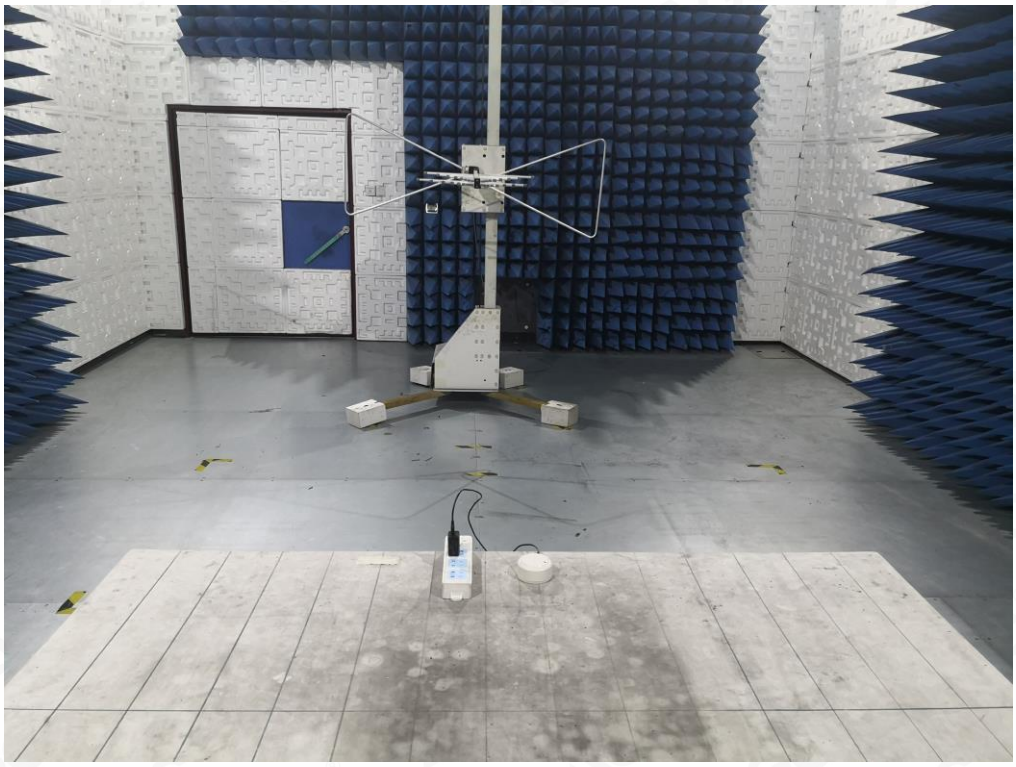
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.150000	32.80	10.8	56	23.2	AV	N	FLO
0.246000	12.50	10.9	52	39.4	AV	N	FLO
0.402000	10.80	10.3	48	37.0	AV	N	FLO
0.586000	9.70	10.8	46	36.3	AV	N	FLO
1.094000	10.60	11.5	46	35.4	AV	N	FLO
1.750000	7.80	11.5	46	38.2	AV	N	FLO

RESULT: PASS

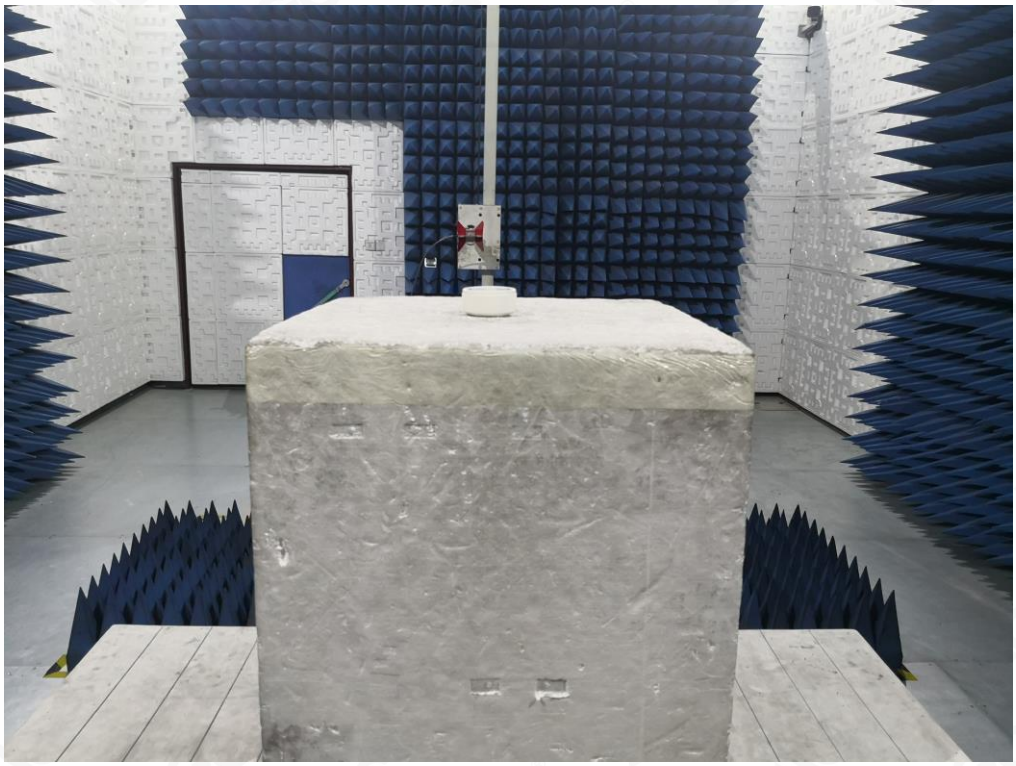
Note: The mode 1 is the worst case, and only the data of the worst case recorded in this test report.

APPENDIX A: PHOTOGRAPHS OF TEST SETUP

RADIATED EMISSION TEST SETUP BELOW 1GHZ



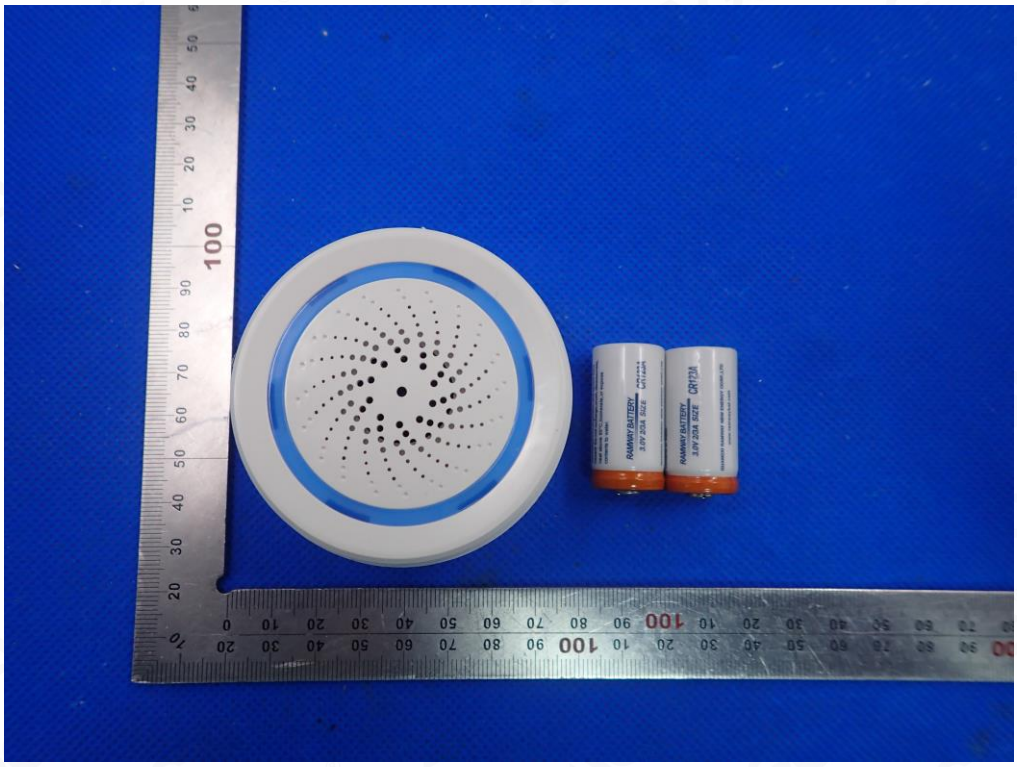
RADIATED EMISSION TEST SETUP ABOVE 1GHZ



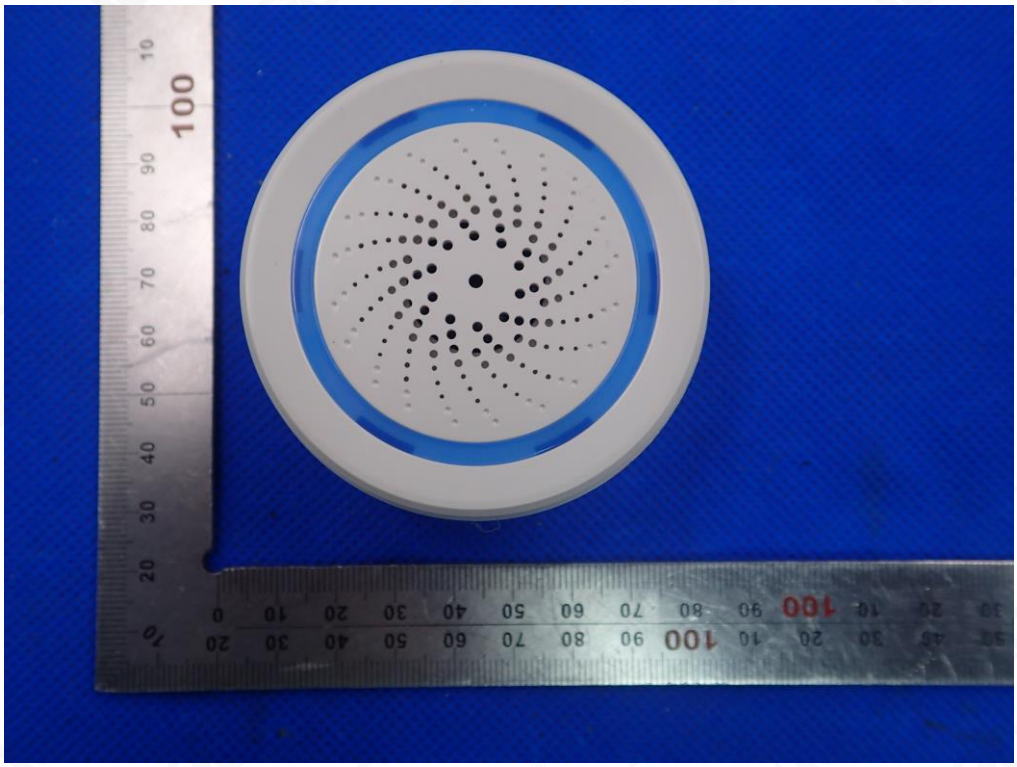
FCC LINE CONDUCTED EMISSION TEST SETUP

APPENDIX B: PHOTOGRAPHS OF EUT

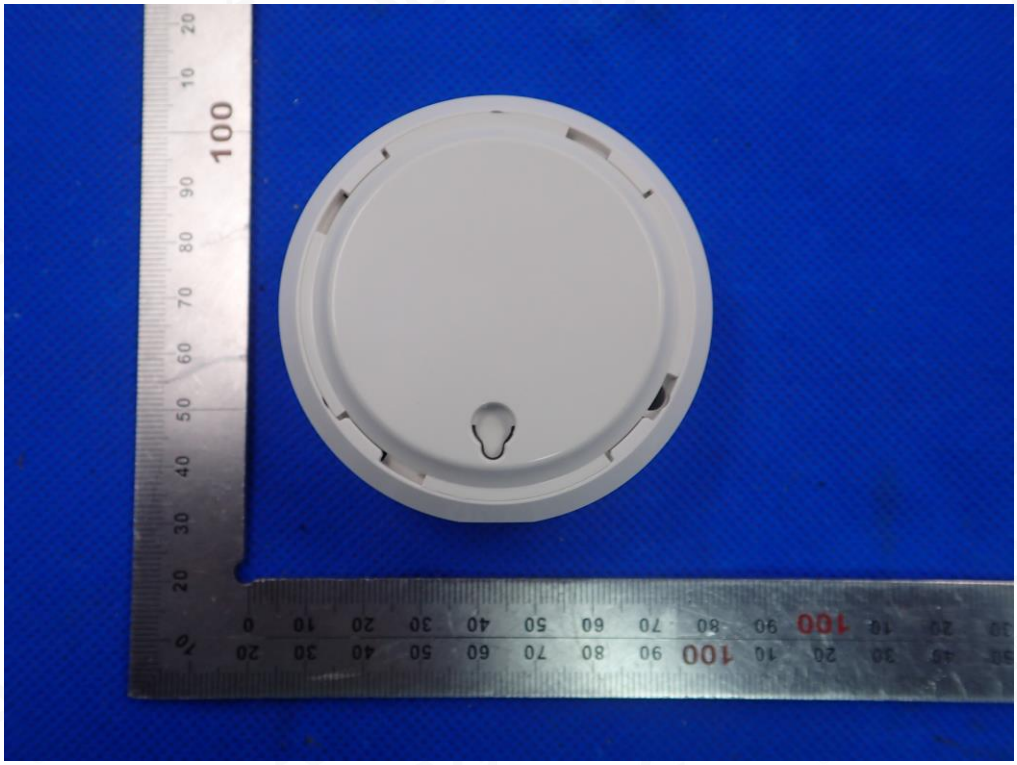
ALL VIEW OF EUT



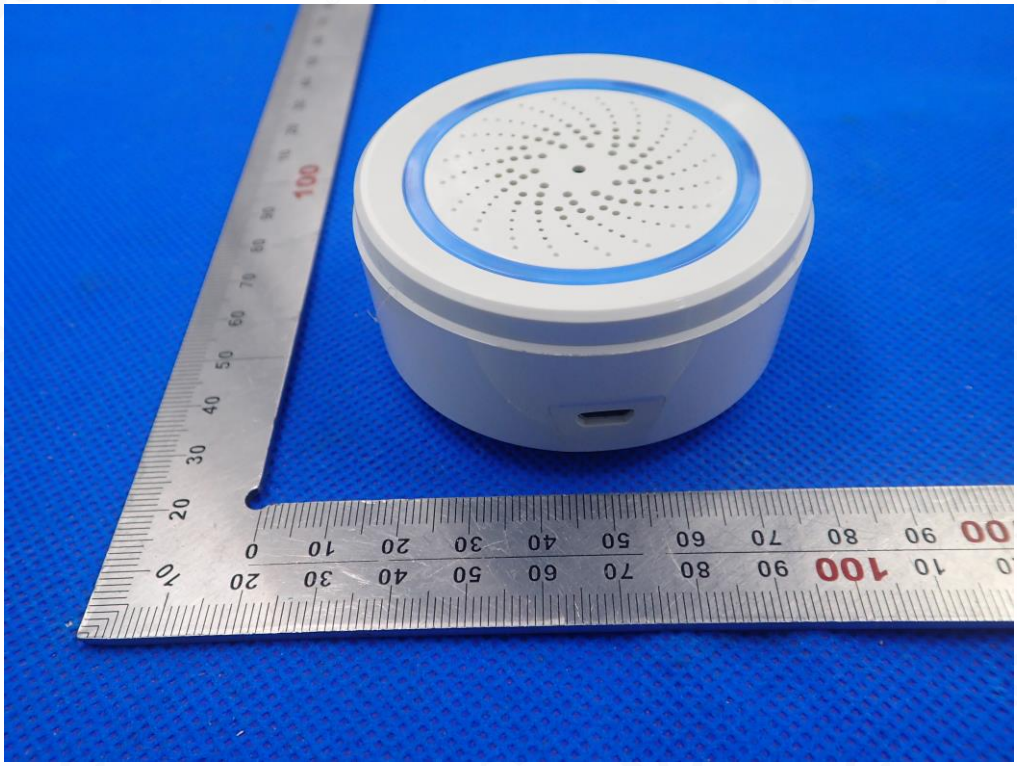
TOP VIEW OF EUT



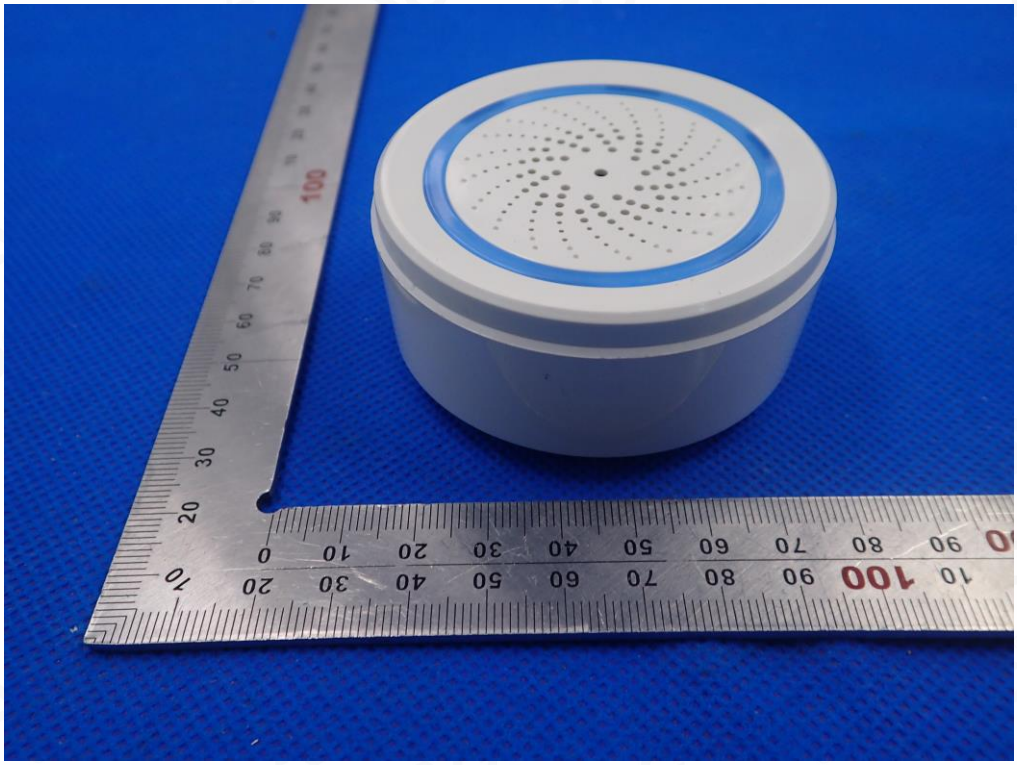
BOTTOM VIEW OF EUT



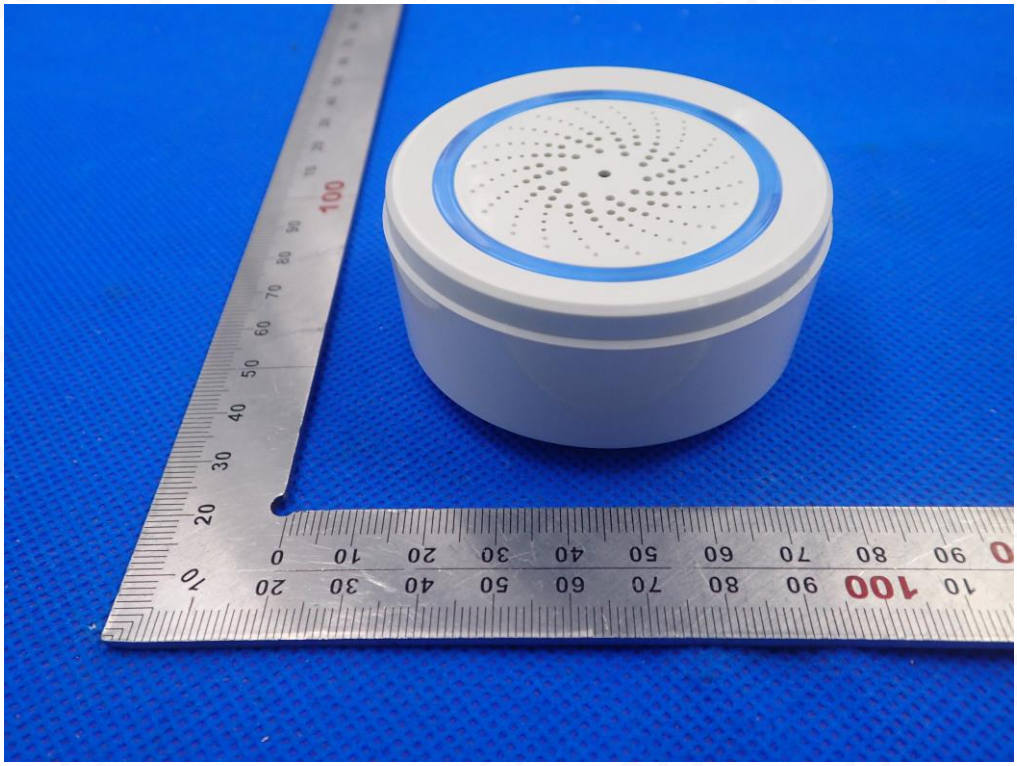
FRONT VIEW OF EUT



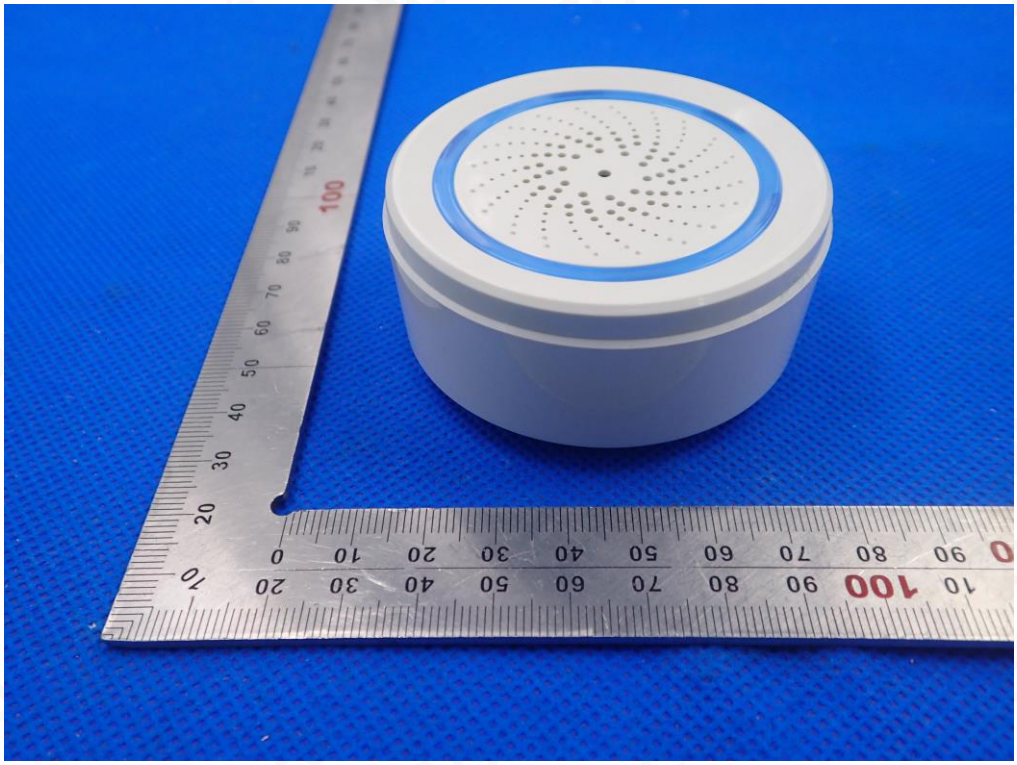
BACK VIEW OF EUT



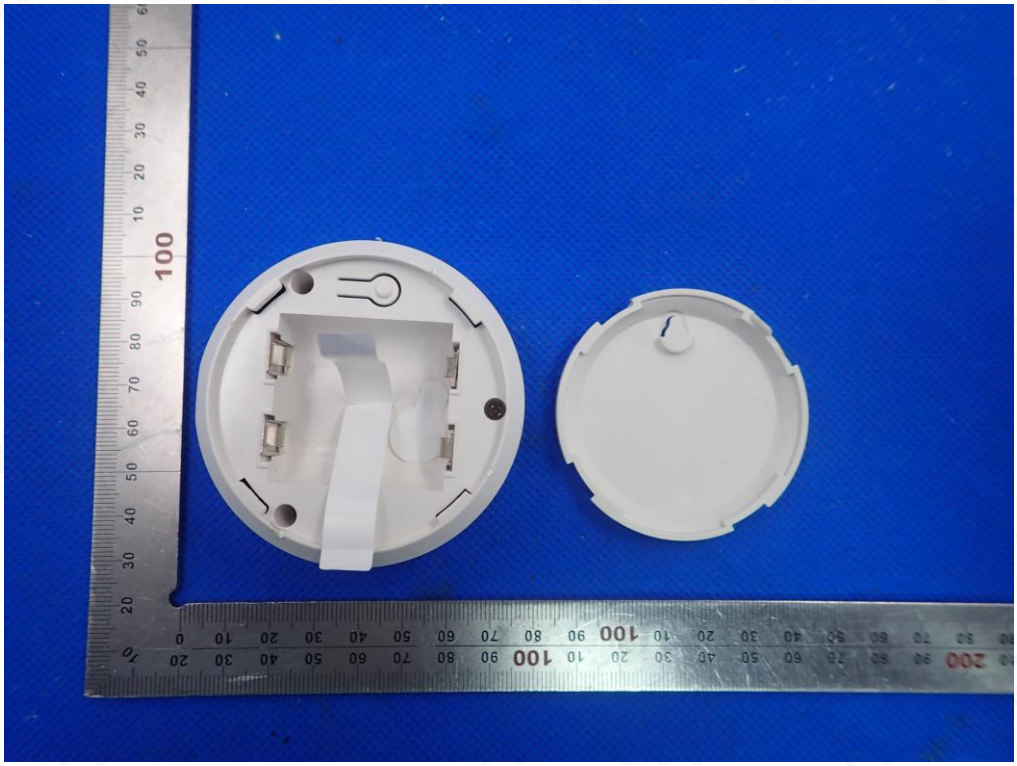
LEFT VIEW OF EUT



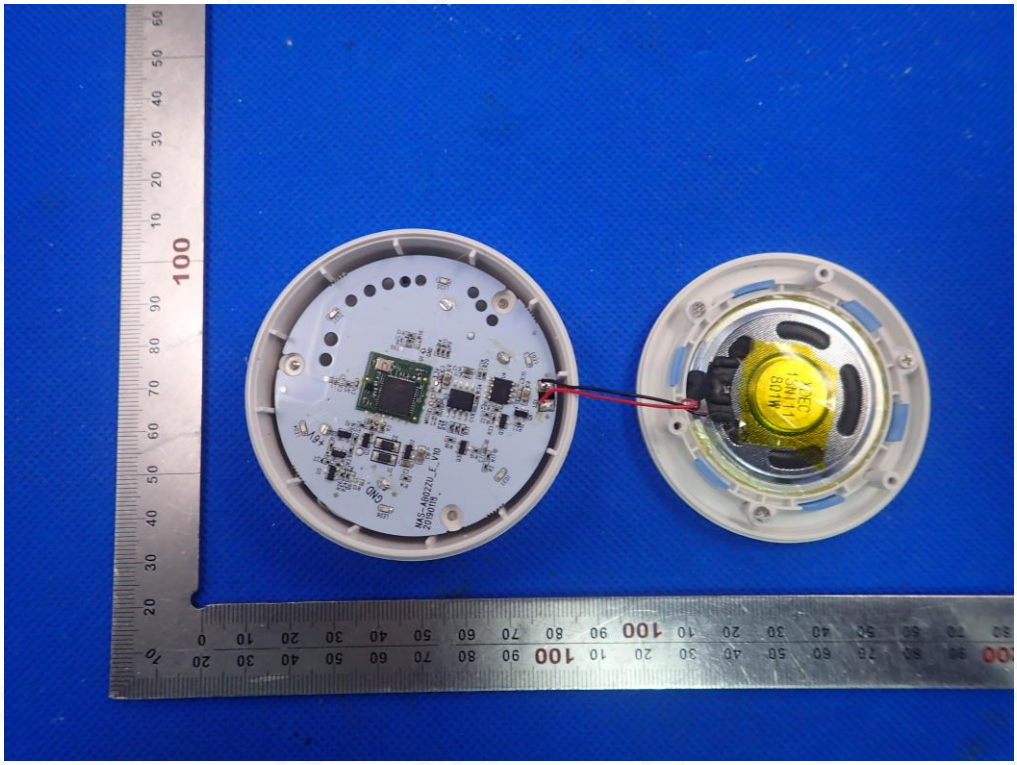
RIGHT VIEW OF EUT



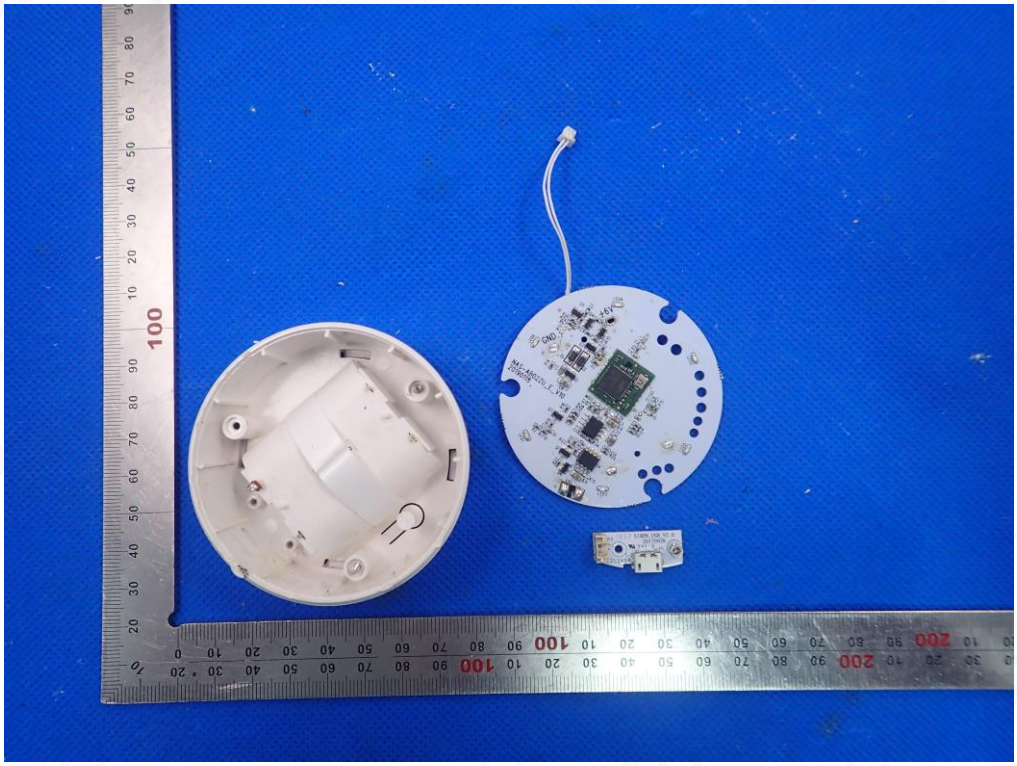
OPEN VIEW OF EUT (FIGURE 1)



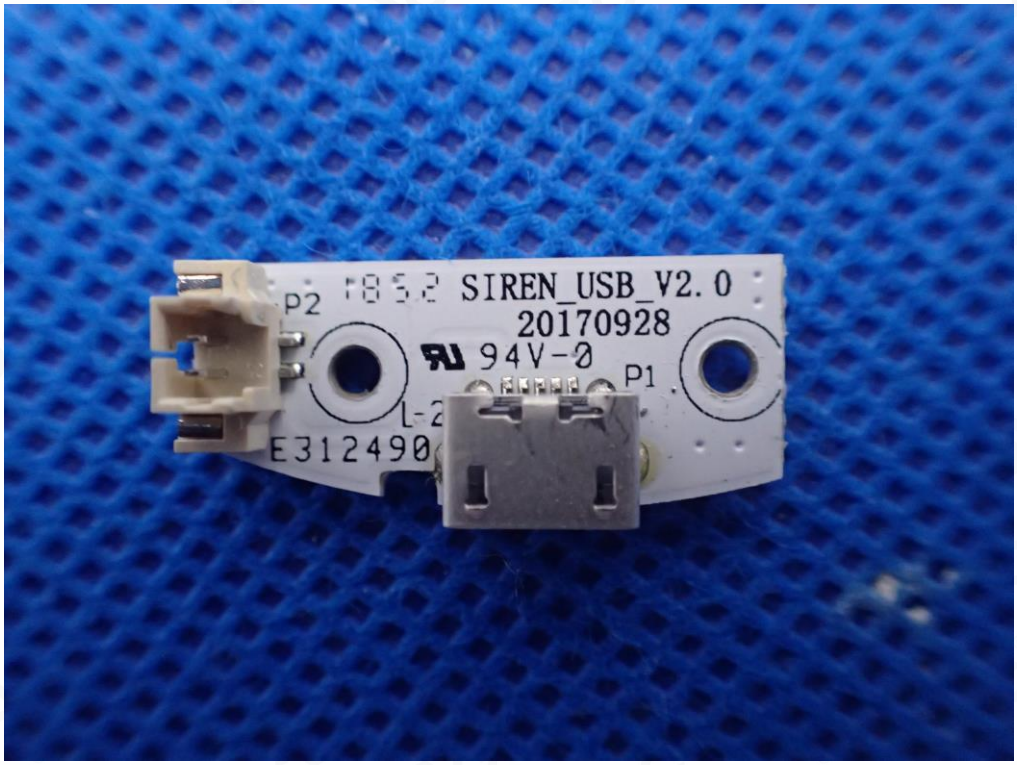
OPEN VIEW OF EUT (FIGURE 2)



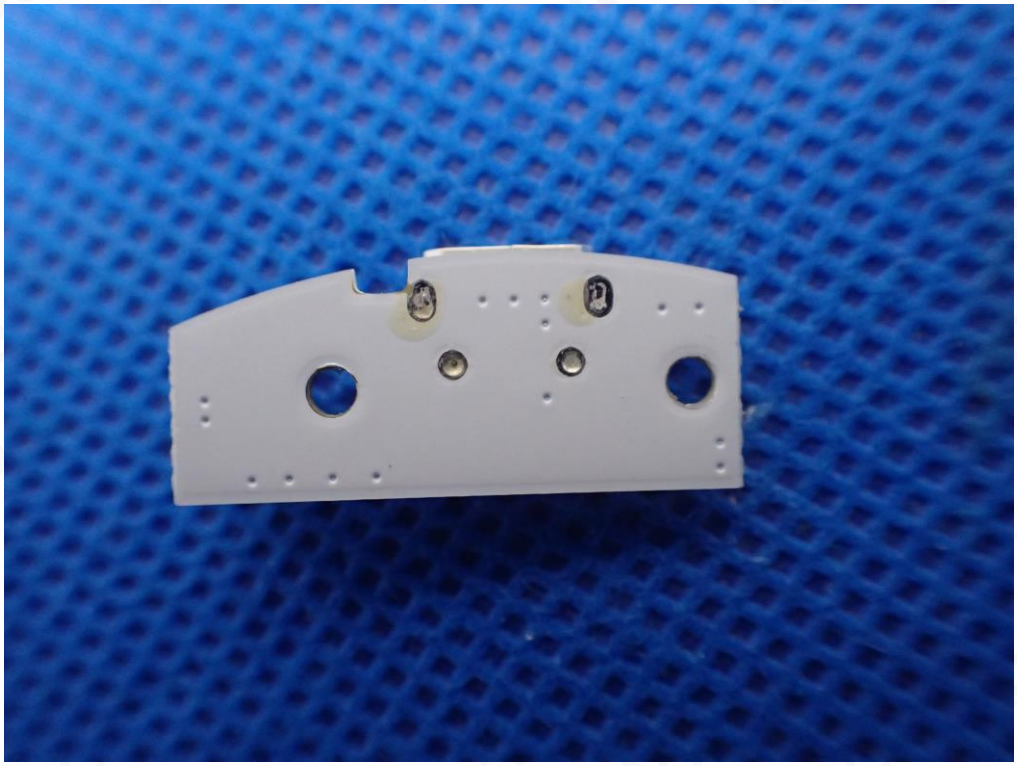
OPEN VIEW OF EUT (FIGURE 3)



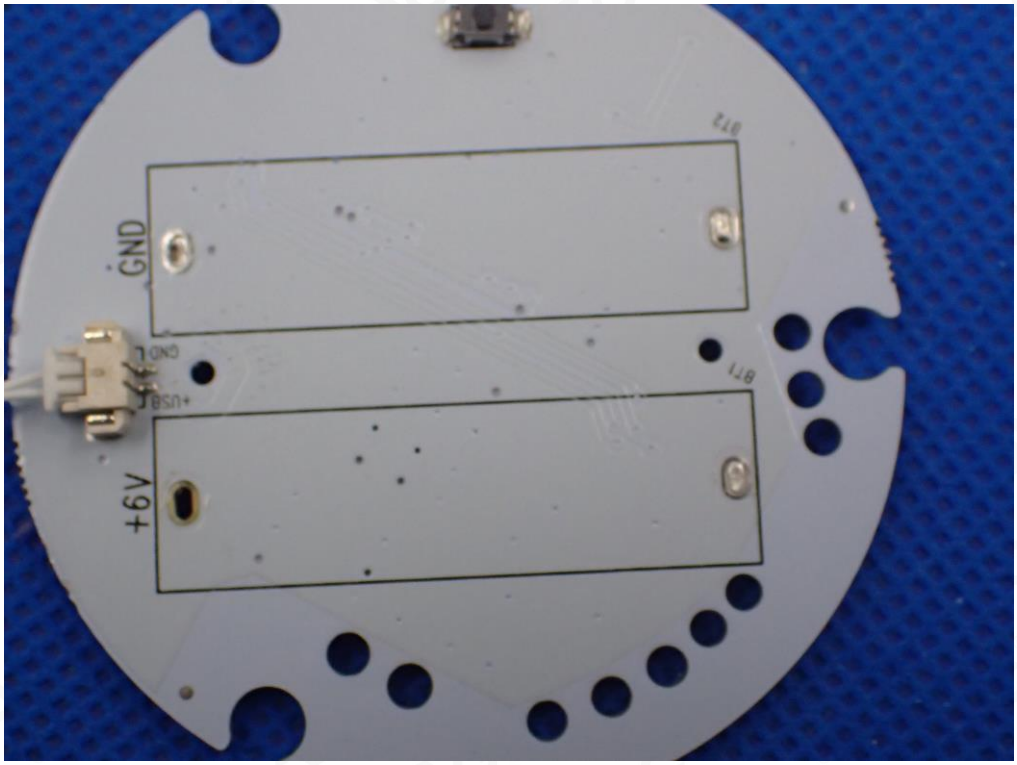
INTERNAL VIEW OF EUT (FIGURE 1)



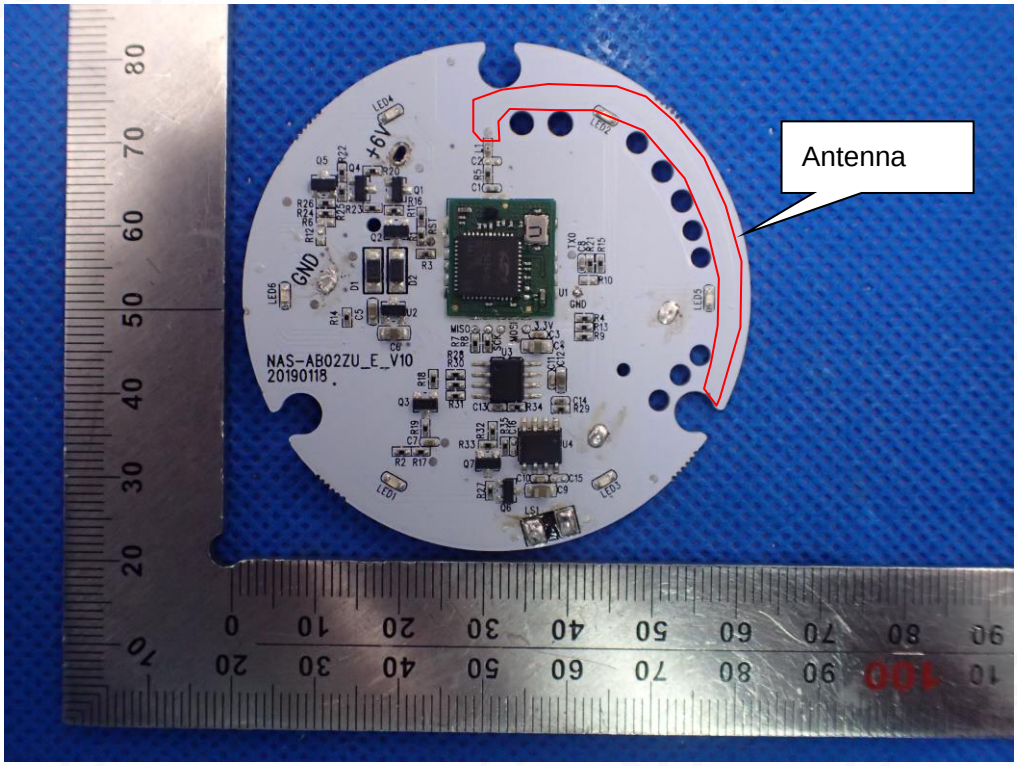
INTERNAL VIEW OF EUT (FIGURE 2)



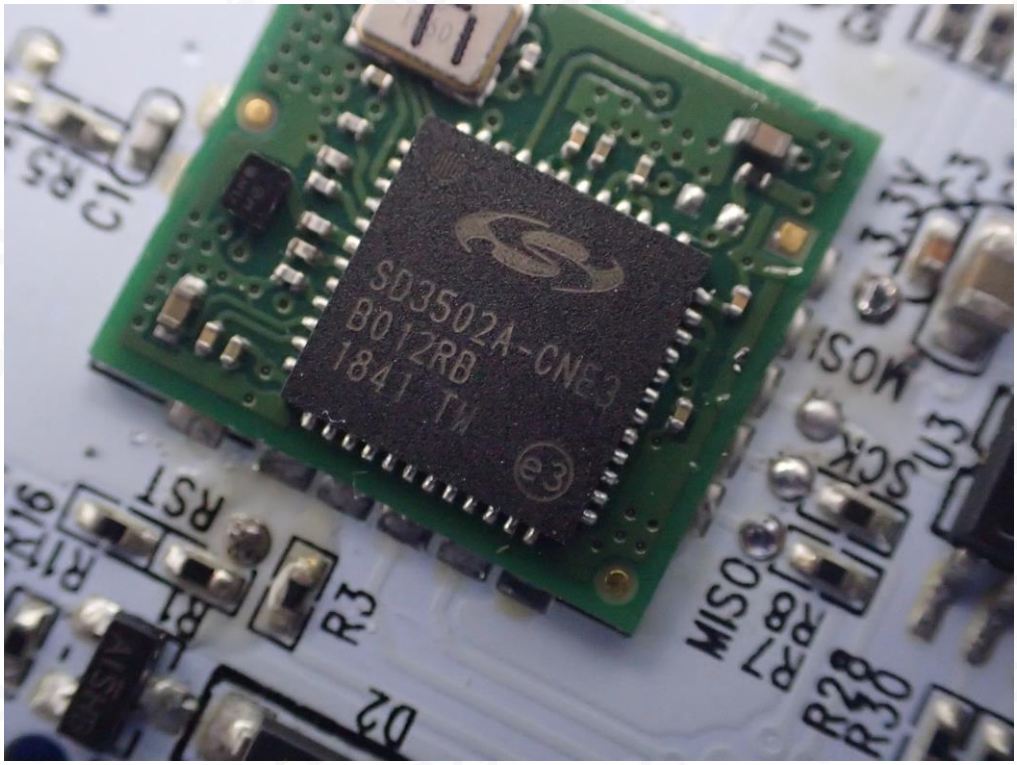
INTERNAL VIEW OF EUT (FIGURE 3)



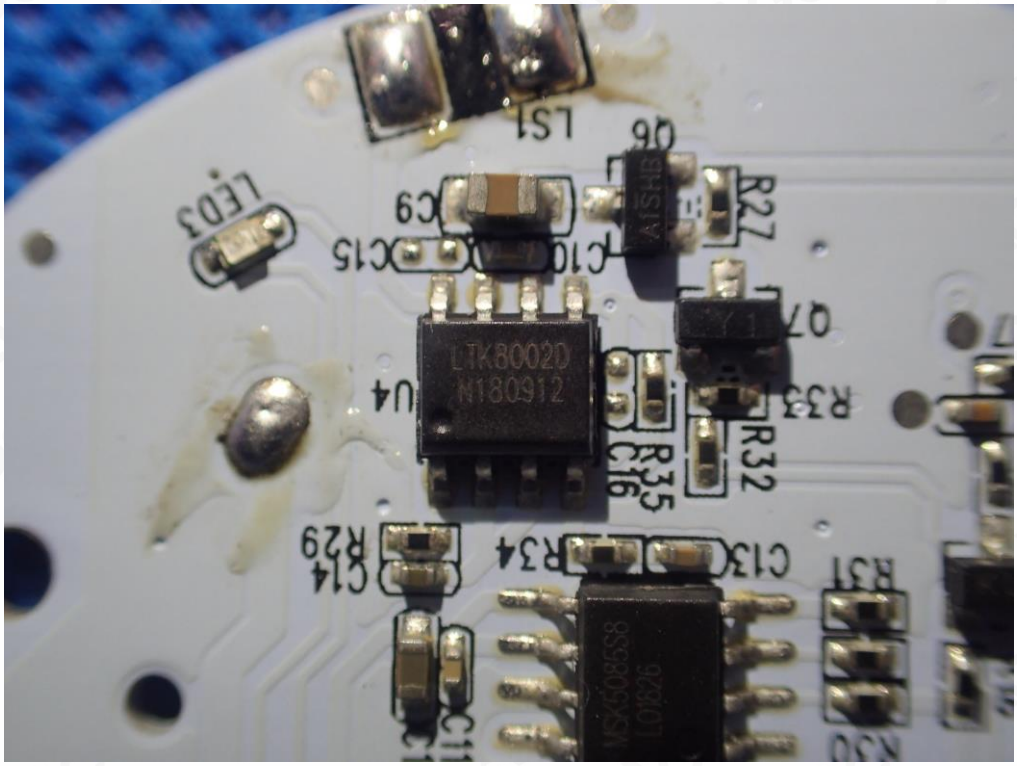
INTERNAL VIEW OF EUT (FIGURE 4)



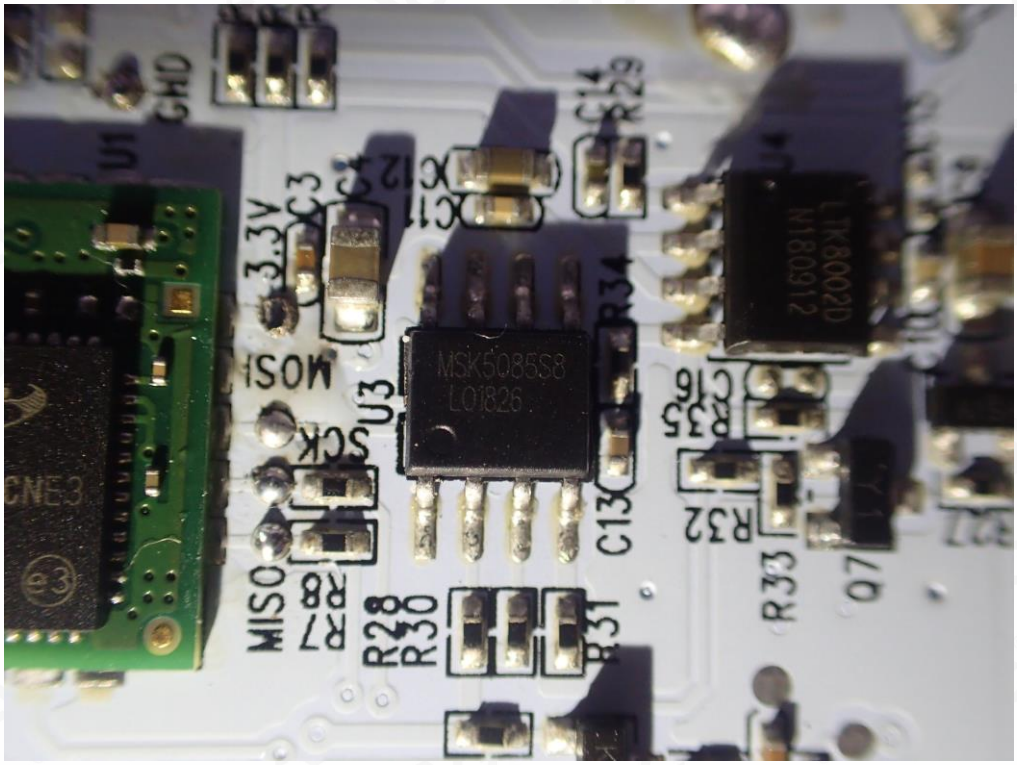
INTERNAL VIEW OF EUT (FIGURE 5)



INTERNAL VIEW OF EUT (FIGURE 6)



INTERNAL VIEW OF EUT (FIGURE 7)



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