FCC TEST REPORT

FCC PART 15 SUBPART C 15.231

Test report

On Behalf of

GUANGDONG ROULE ELECTRONICS CO., LTD

For

Car Warning Indicator

Model No.: RL-9816C1

FCC ID: YI6RL9816C1

Prepared for : GUANGDONG ROULE ELECTRONICS CO., LTD
No. 12 Pingdong 3rd Road, Nanping Industry Park, Zhuhai

Prepared By : Shenzhen HUAK Testing Technology Co., Ltd.
1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China

Date of Test: Aug. 30, 2018 ~ Sep. 11, 2018
Date of Report: Sep. 11, 2018
Report Number: HUAK1809111032E

TEST RESULT CERTIFICATION

Applicant's name .....: GUANGDONG ROULE ELECTRONICS CO., LTD

Address .....: No. 12 Pingdong 3rd Road, Nanping Industry Park, Zhuhai

Manufacture's Name .....: GUANGDONG ROULE ELECTRONICS CO., LTD

Address .....: No. 12 Pingdong 3rd Road, Nanping Industry Park, Zhuhai

Product description

Trade Mark: RL

Product name.....: Car Warning Indicator

Model and/or type reference ...: RL-9816C1

Standards.....: FCC Rules and Regulations Part 15 Subpart C Section 15.231
ANSI C63.10: 2013

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Date of Test .....:

Date (s) of performance of tests .....: Aug. 30, 2018 ~ Sep. 11, 2018

Date of Issue .....: Sep. 11, 2018

Test Result .....: **Pass**

Testing Engineer : Gary Qian

(Gary Qian)

Technical Manager : Eden Hu

(Eden Hu)

Authorized Signatory : Jason Zhou

(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) (2)	Transmitter activated automatically	Compliant
§15.231(b)	Average Factor	Compliant
§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 : 1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, 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	433.99MHz
Field Strength(3m)	77.97dBuV/m(Average)@3m
Modulation	ASK
Number of channels	1
Hardware Version	RL-R41A1 V2.0
Software Version	V1.0
Antenna Designation	Fixed antenna
Antenna Gain	0dBi
Power Supply	DC 4.5V by Battery

2.2 OPERATION OF EUT DURING TESTING

NO.	TEST MODE DESCRIPTION
1	Transmitting mode

Note:
1. All the test modes can be supply by battery, only the result of the worst case was recorded in the report, if no other cases.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.

2.3 DESCRIPTION OF TEST SETUP

Operation of EUT during Radiation and Above1GHz Radiation testing:

EUT

2.4 MEASUREMENT INSTRUMENTS LIST

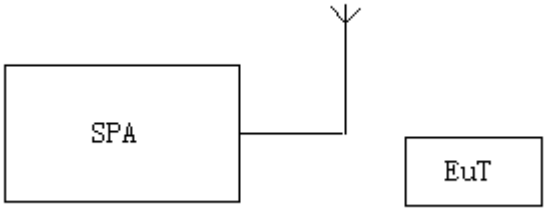
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	R&S	ENV216	HKE-002	Dec. 28, 2017	1 Year
2.	Receiver	R&S	ESCI 7	HKE-010	Dec. 28, 2017	1 Year
3.	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 28, 2017	1 Year
4.	Spectrum analyzer	R&S	FSP40	HKE-025	Dec. 28, 2017	1 Year
5.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 28, 2017	1 Year
6.	Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Dec. 28, 2017	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESCI 7	HKE-010	Dec. 28, 2017	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Dec. 28, 2017	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 28, 2017	1 Year
10.	Horn Antenna	Schewarzbeck	9120D	HKE-013	Dec. 28, 2017	1 Year
11.	Pre-amplifier	EMCI	EMC051845 SE	HKE-015	Dec. 28, 2017	1 Year
12.	Pre-amplifier	Agilent	83051A	HKE-016	Dec. 28, 2017	1 Year
13.	EMI Test Software EZ-EMC	Tonscend	JS1120-B Version	HKE-083	Dec. 28, 2017	N/A
14.	Power Sensor	Agilent	E9300A	HKE-086	Dec. 28, 2017	1 Year
15.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 28, 2017	1 Year
16.	Signal generator	Agilent	N5182A	HKE-029	Dec. 28, 2017	1 Year
17.	Signal Generator	Agilent	83630A	HKE-028	Dec. 28, 2017	1 Year
18.	Shielded room	Shiel Hong	4*3*3	HKE-039	Dec. 28, 2017	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.

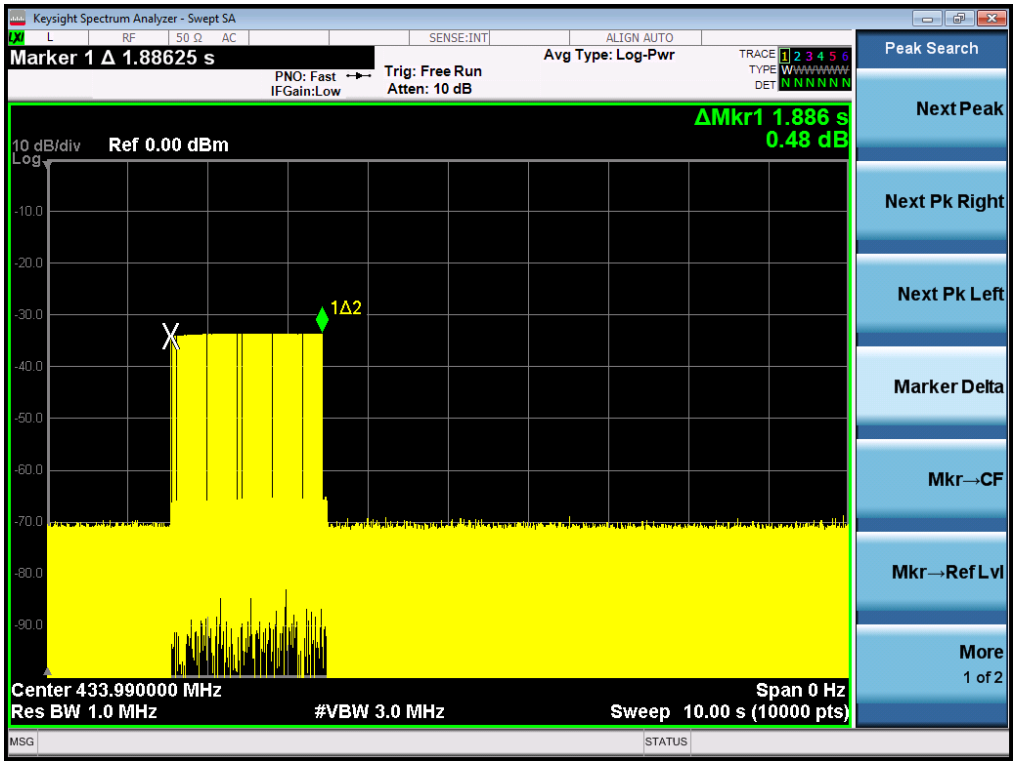
3.2 TEST SETUP



3.3 TEST RESULT

Test Mode: EUT @ 433.99MHz for RF Transmitter

The time of stopping transmission after automatically activation by alarm sensor(s)	Limit (s)
1.886	5.00



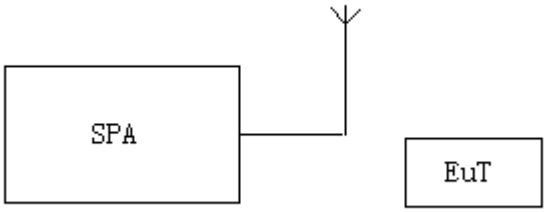
RESULT: PASS

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.

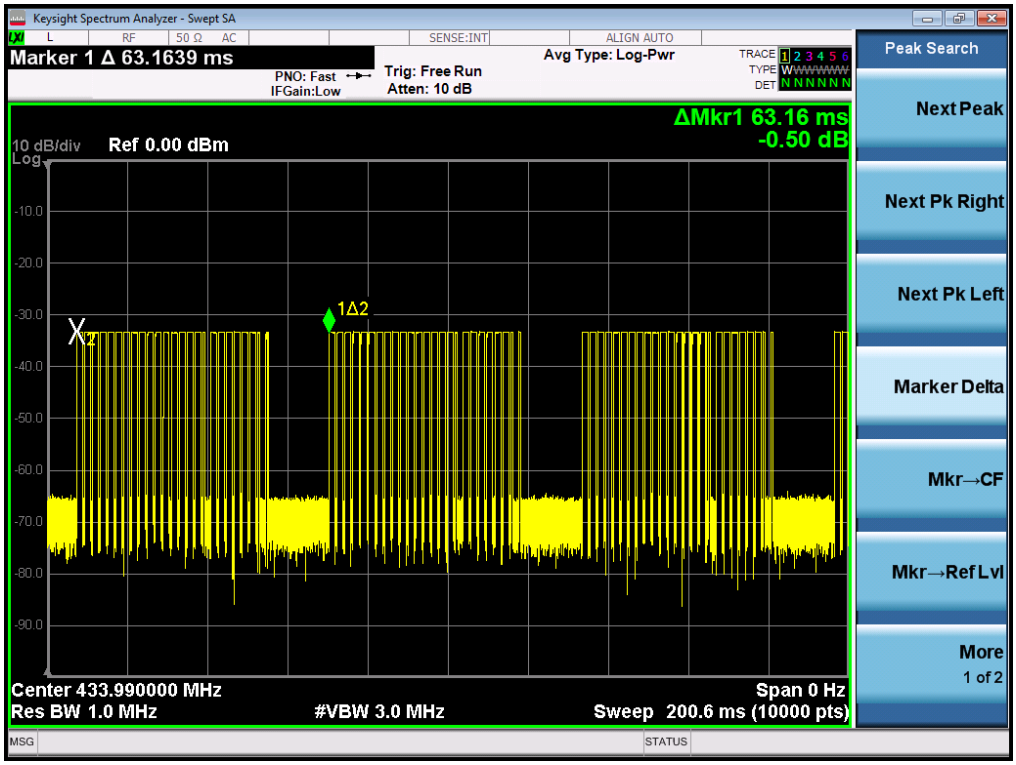
4.2 TEST SETUP

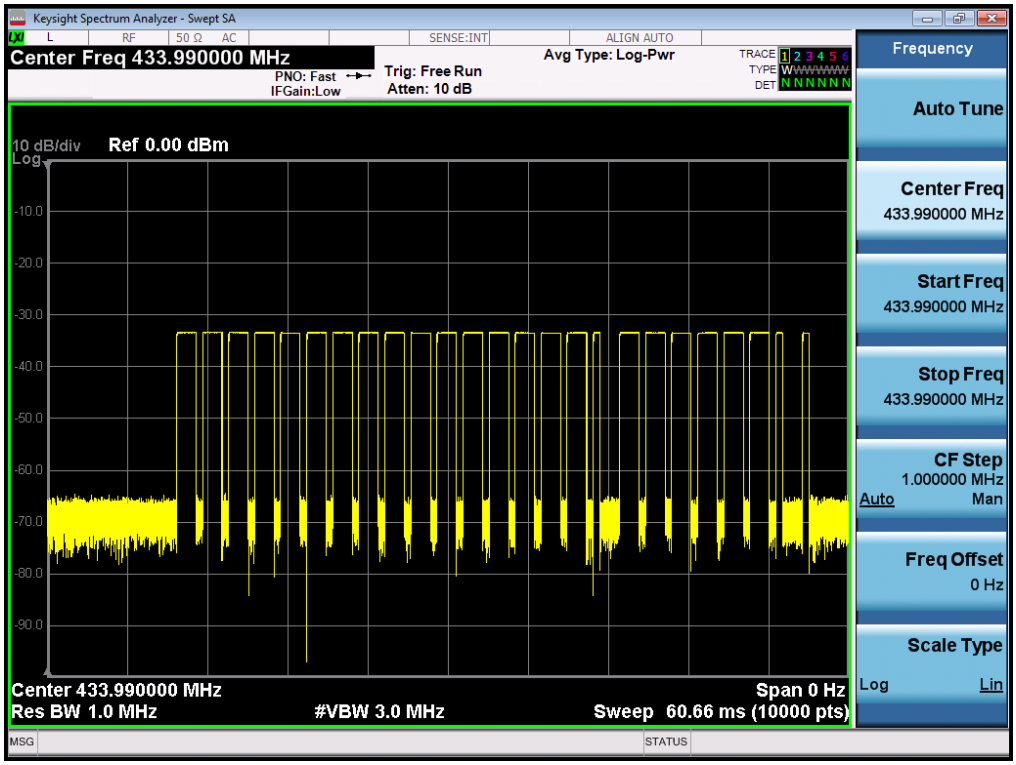


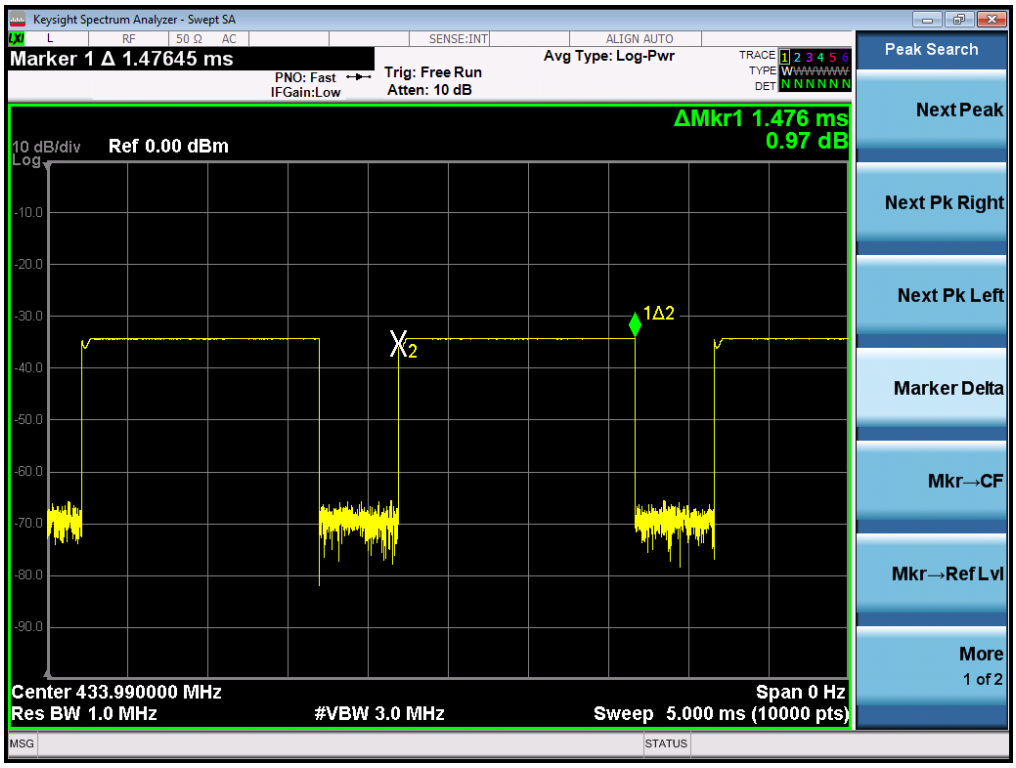
4.3 TEST RESULT

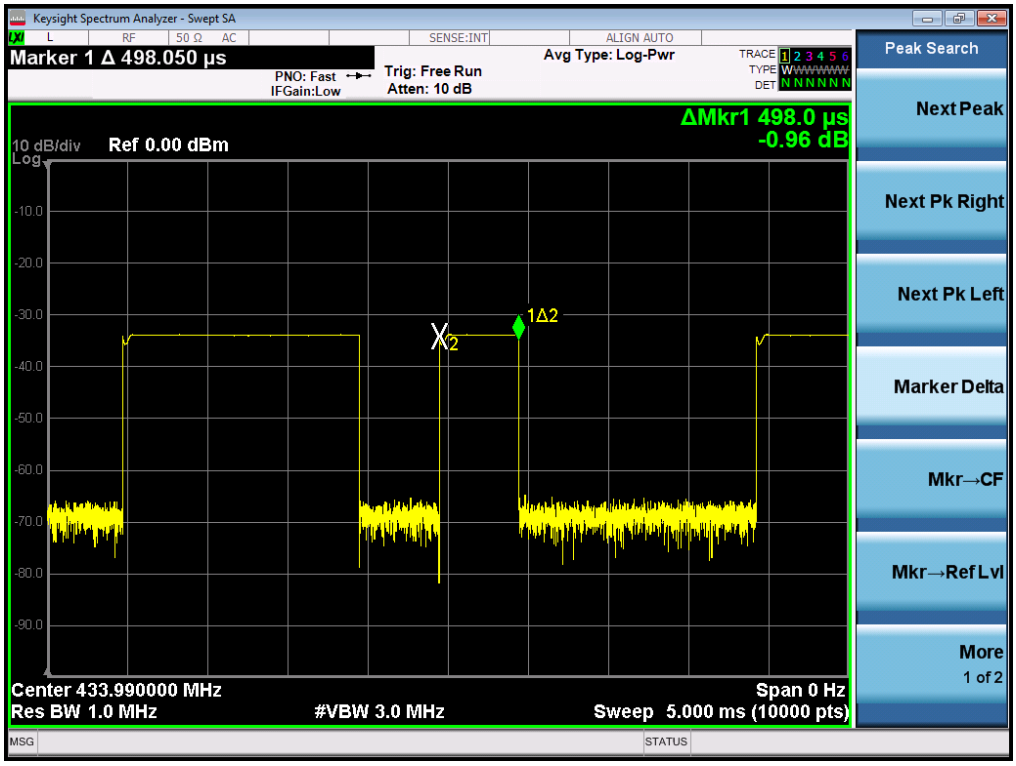
Test Mode: EUT @ 433.99MHz for RF Transmitter

Duty Cycle:	(1.476ms*22+0.498ms*3)/63.16ms=0.5378
Duty Cycle Correction Factor:	20lg(0.5309)=-5.39dB






Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 1.47645 ms
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
ΔMkr1 1.476 ms
0.97 dB
10 dB/div
Ref 0.00 dBm
1Δ2
Center 433.990000 MHz
Span 0 Hz
Res BW 1.0 MHz
#VBW 3.0 MHz
Sweep 5.000 ms (10000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2


Keysight Spectrum Analyzer - Swept SA
Marker 1 Δ 498.050 µs
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
ΔMkr1 498.0 µs
-0.96 dB
10 dB/div
Ref 0.00 dBm
1Δ2
Center 433.990000 MHz
Span 0 Hz
Res BW 1.0 MHz
#VBW 3.0 MHz
Sweep 5.000 ms (10000 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

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.

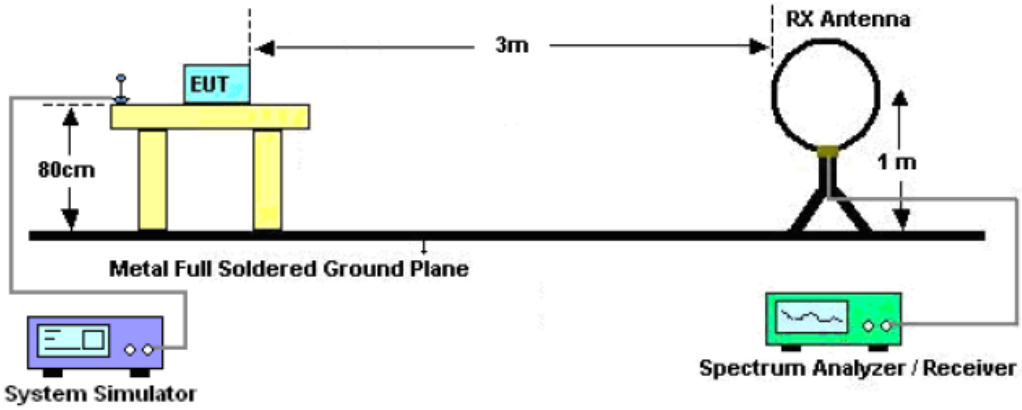
The following table is the setting of spectrum analyzer and receiver.

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

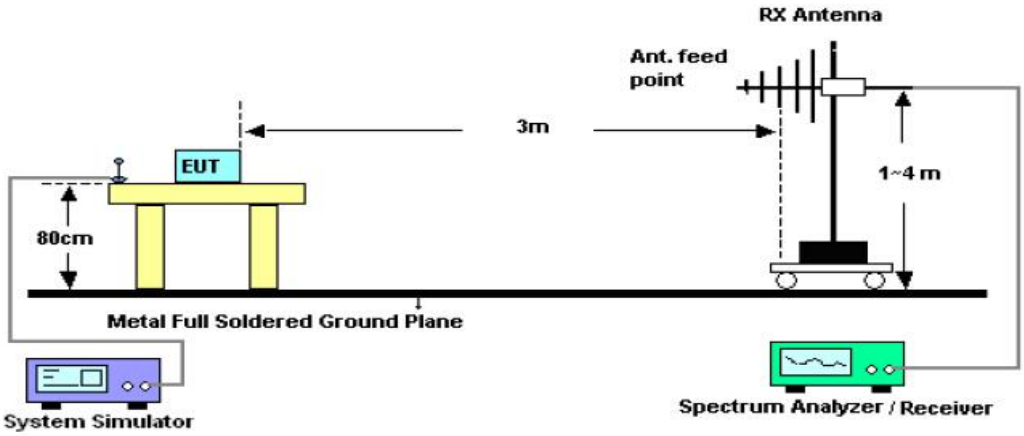
Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RBW 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RBW 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RBW 120KHz for QP

5.2. TEST SETUP

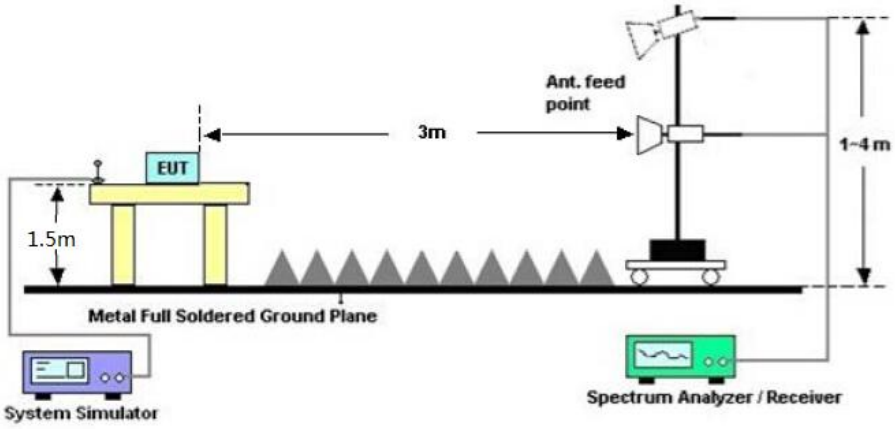
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



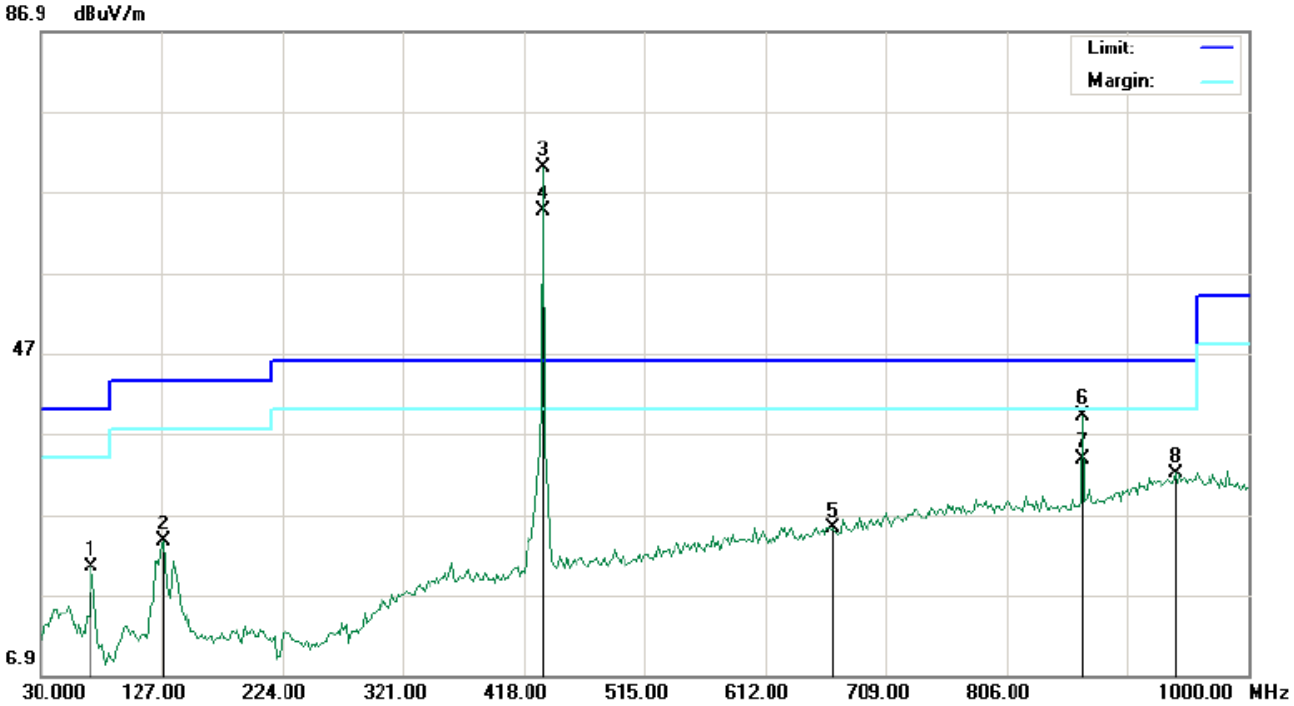
5.3. TEST RESULT

Test Mode: EUT @ 433.99MHz for RF Transmitter

RADIATED EMISSION BELOW 30MHz

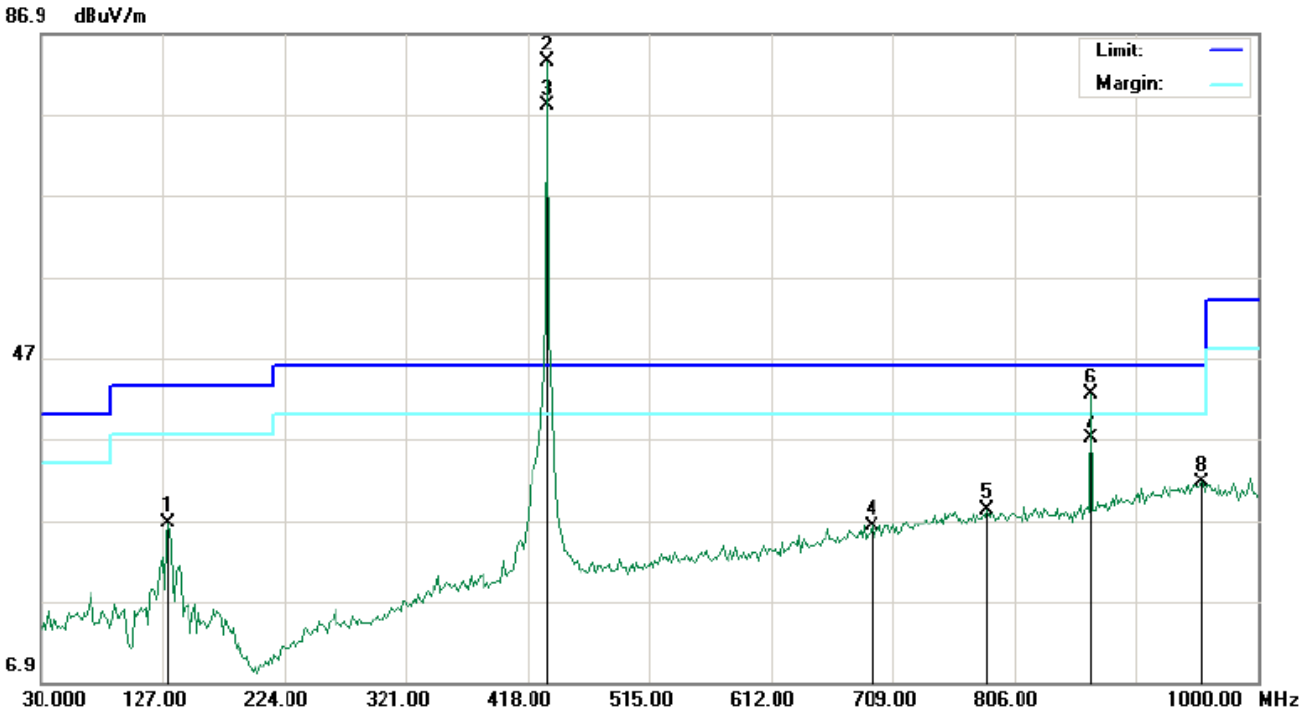
No emission found between lowest internal used/generated frequencies to 30MHz.

RADIATED EMISSION BELOW 1GHZ-Horizontal



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1		70.4167	10.46	9.85	20.31	40.00	-19.69	peak
2		128.6167	13.79	9.88	23.67	43.50	-19.83	peak
3	*	433.9950	49.95	20.11	70.06	100.83	-30.77	peak
4	X	433.9950	44.56	20.11	64.67	80.83	-16.16	AVG
5		666.9666	0.98	24.31	25.29	46.00	-20.71	peak
6		867.9900	11.44	27.76	39.20	80.83	-41.63	peak
7		867.9900	6.05	27.76	33.81	60.83	-27.02	AVG
8		941.8000	2.29	29.77	32.06	46.00	-13.94	peak

RADIATED EMISSION BELOW 1GHZ-Vertical



No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector
	.	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	
1		131.8500	14.81	11.80	26.61	43.50	-16.89	peak
2	*	433.9950	63.25	20.11	83.36	100.83	-17.47	peak
3	X	433.9950	57.86	20.11	77.97	80.83	-2.86	AVG
4		692.8333	1.19	25.00	26.19	46.00	-19.81	peak
5		784.9833	1.00	27.11	28.11	46.00	-17.89	peak
6	!	867.9900	14.68	27.76	42.44	80.83	-38.39	peak
7		867.9900	9.29	27.76	37.05	60.83	-23.78	AVG
8		954.7333	1.68	29.95	31.63	46.00	-14.37	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.

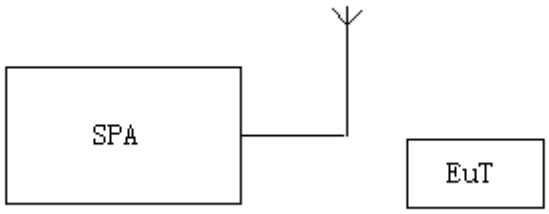
3. Emissions of frequency range from 1GHz to 5GHz have 20dB margin. No recording in the test report.

6. BANDWIDTH

6.1. 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.

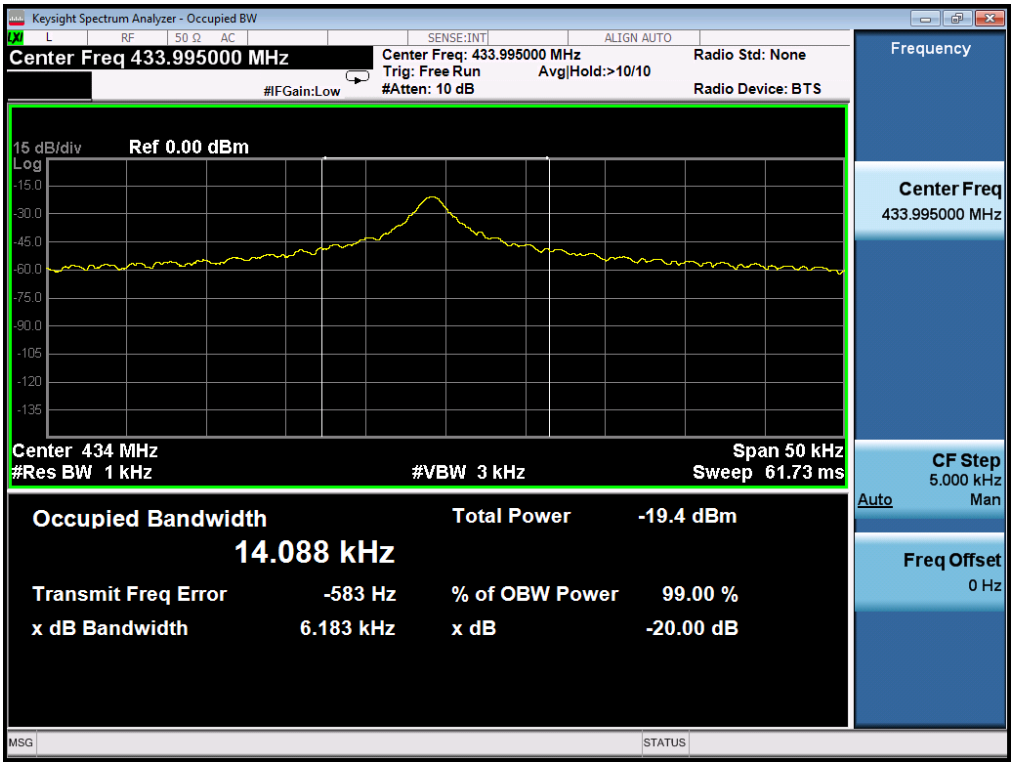
6.2. TEST SETUP



6.3. TEST RESULT

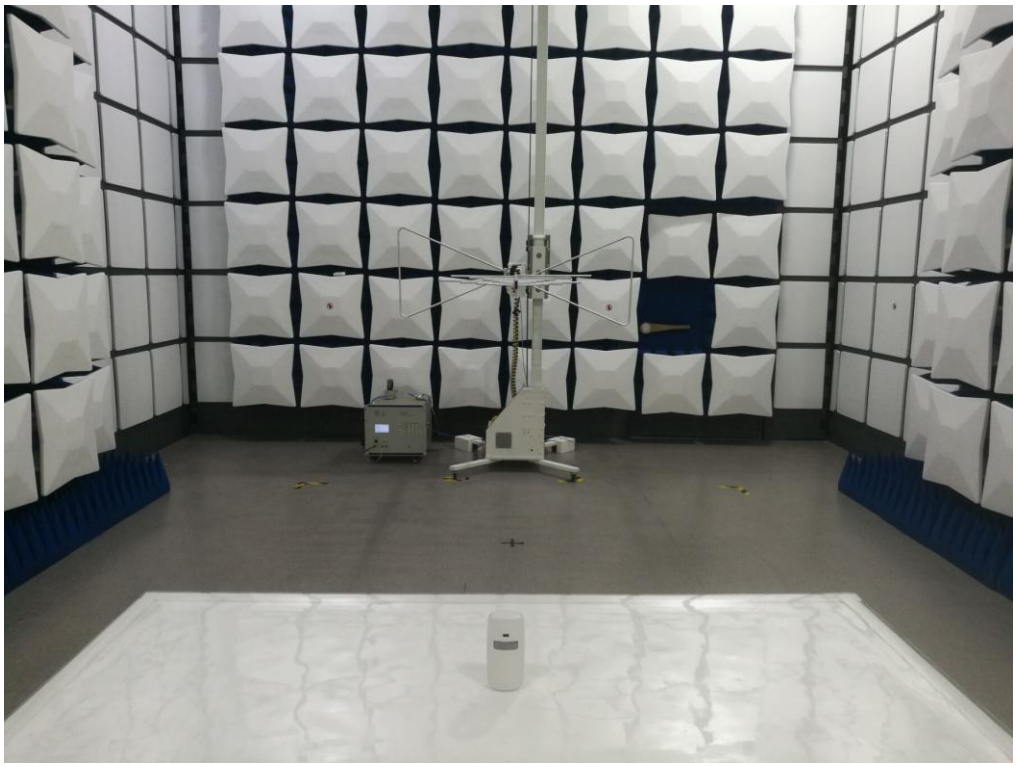
Test Mode: EUT @ 433.99MHz for RF Transmitter

-20dB bandwidth	LIMIT	RESULT
6.183kHz	1084.975KHz	Pass
Note: Limit= Operation Frequency ×0.25%		



7. PHOTOGRAPH OF TEST

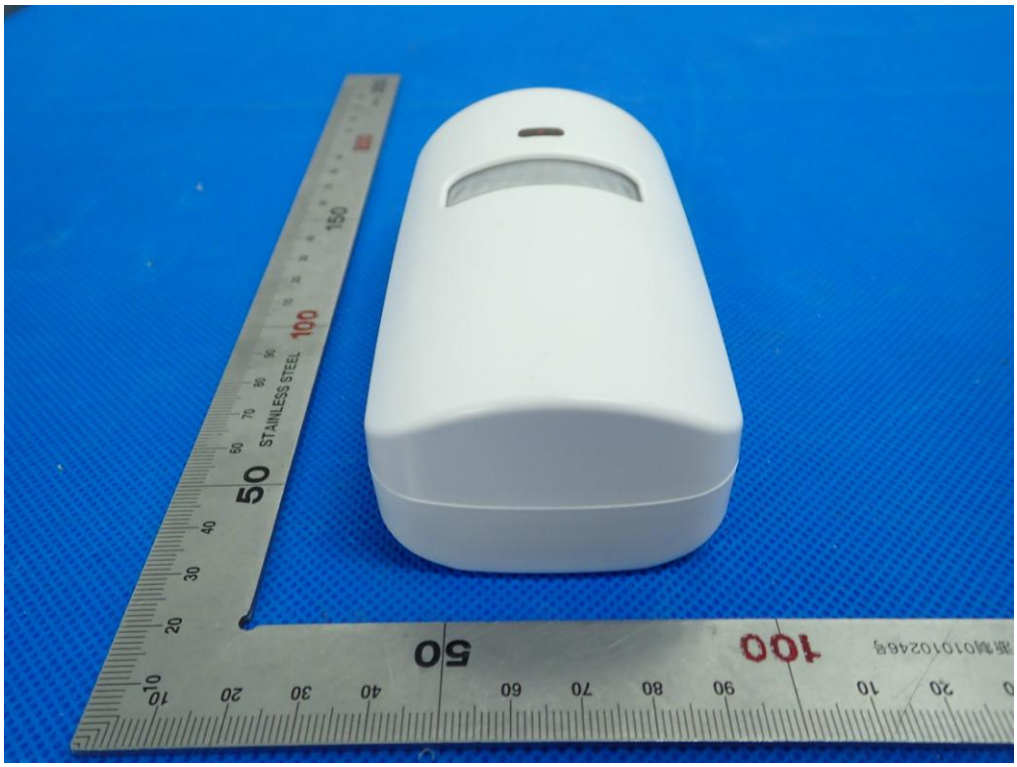
Radiated Emission



8. PHOTOGRAPH OF EUT

TOP VIEW OF EUT

BOTTOM VIEW OF EUT



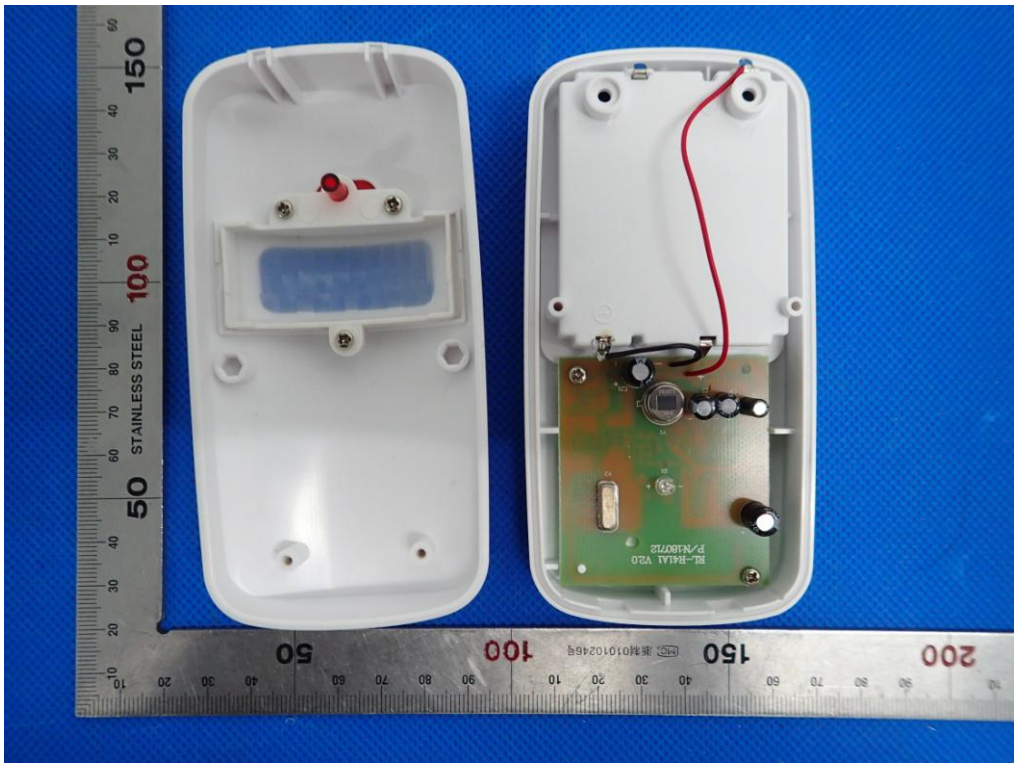
FRONT VIEW OF EUT

BACK VIEW OF EUT

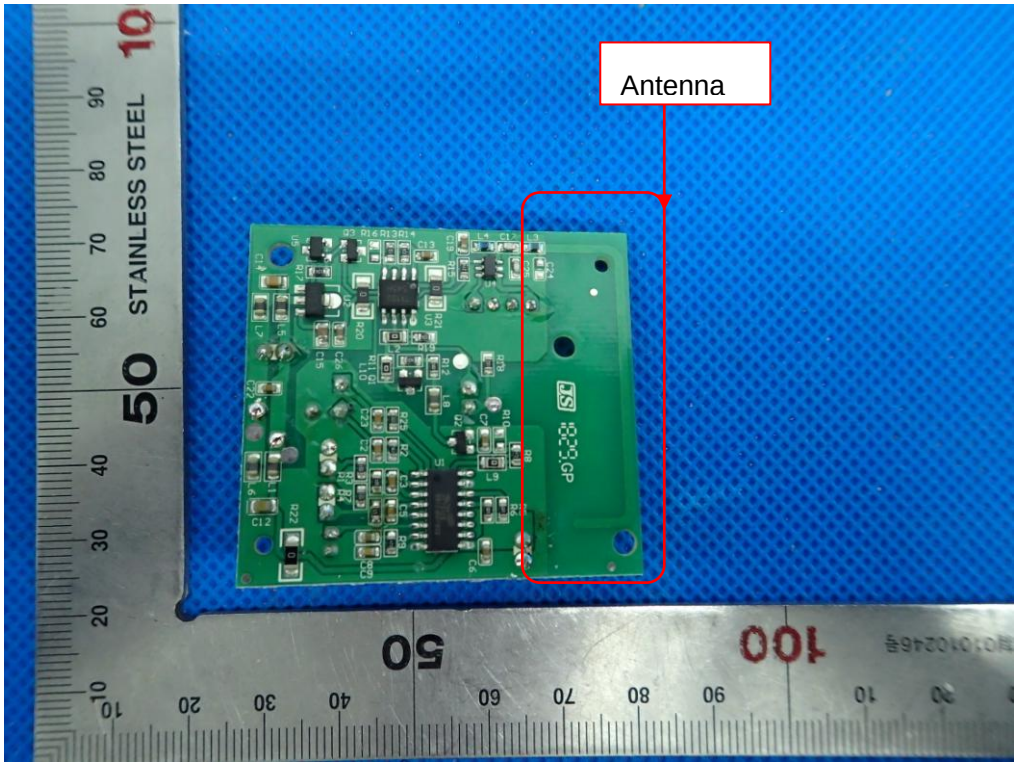
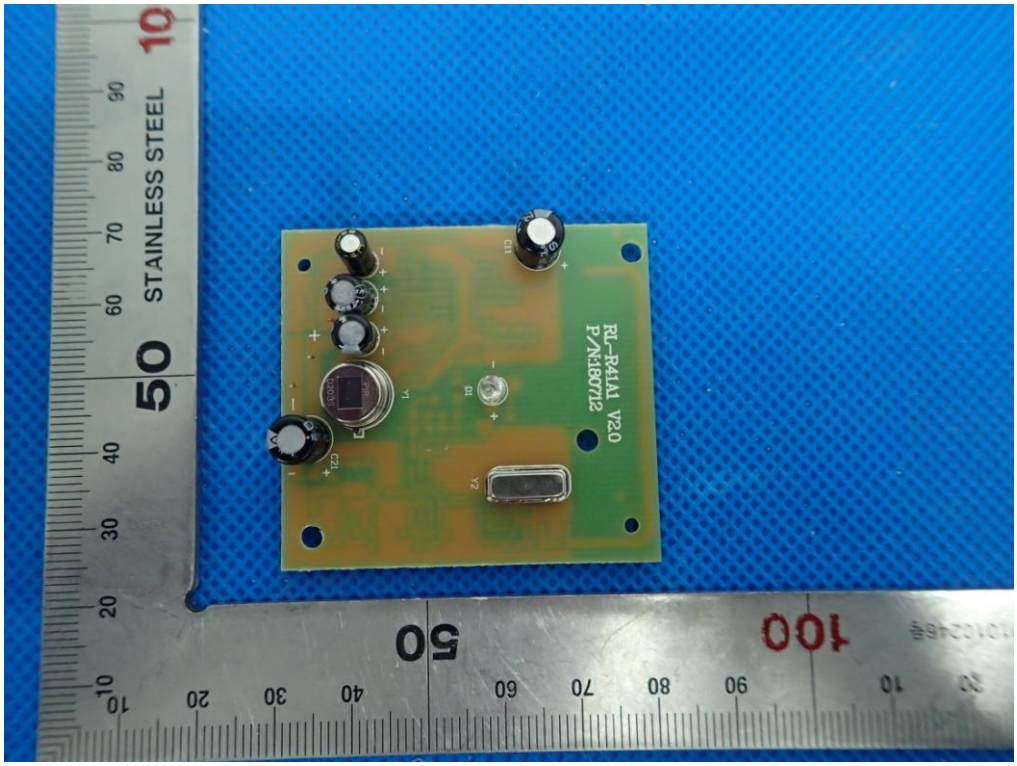
LEFT VIEW OF EUT

RIGHT VIEW OF EUT

OPEN VIEW-1 OF EUT



INTERNAL VIEW-1 OF EUT



INTERNAL VIEW-2 OF EUT