TEST REPORT

Reference No.	:	WTS17S0579265E
FCC ID	:	WUI-LM56123
Applicant	:	Winplus Co., Ltd.
Address	:	Suites 6-11, 7th Floor, Corporation Park, 11 On La, Shatin, Hong Kong.
Manufacturer	:	The same as above
Address	:	The same as above
Product Name	:	LED CEILING LIGHT
Model No	:	LM56123
Standards	:	FCC CFR47 Part 15 Section 15.249: 2016
Date of Receipt sample	:	May. 15, 2017
Date of Test	:	May. 16 – May. 26, 2017
Date of Issue	:	Jun. 01, 2017
Test Result	:	Pass

Remarks:
The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

Prepared By:
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Compiled by:

Jack Wen / Test Engineer

Approved by:

Philo Zhong / Manager

2 Revision History

Test report #	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS17S0579265E	May. 15, 2017	May. 16 – May. 26, 2017	Jun. 01, 2017	original	-	Valid

3 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	PASS
Radiated Emission	15.249(a) 15.209 15.205(a)	PASS
Periodic Operation	15.35(c)	PASS
Outside Restricted band	15.249 15.205 15.209	PASS
20dB Bandwidth	15:215(c)	PASS
Antenna Requirement	15.203	PASS

4 content

5 General Information

5.1 General Description of E.U.T.

Product Name:	LED CEILING LIGHT
Model No.:	LM56123
Model Differences:	N/A
Type of Modulation:	FSK
Frequency Range:	5857MHz
Antenna installation:	PCB Printed Antenna

5.2 Details of E.U.T.

Technical Data: AC 120V 60Hz 22W

5.3 Channel List

Channel No.	Frequency (MHz)
1	5857

5.4 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **IC – Registration No.:7760A**

  Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration number 7760A, Oct 15, 2015.

- **FCC Test Site – Registration No.: 328995**

  Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 328995, December 3, 2014.

5.4.1 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Lower channel	Middle channel	Upper channel
Transmitting	N/A	5857MHz	N/A

6 Equipment Used during Test

6.1 Equipments List

Conducted Emissions Test Site 1#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMI Test Receiver	R&S	ESCI	100947	Sep.12, 2016	Sep.11, 2017
2.	LISN	R&S	ENV216	101215	Sep.12, 2016	Sep.11, 2017
3.	Cable	Top	TYPE16(3.5M)	-	Sep.12, 2016	Sep.11, 2017
3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	Spectrum Analyzer	R&S	FSP	100091	Apr.29, 2017	Apr.28, 2018
2	Amplifier	Agilent	8447D	2944A10178	Jan.12, 2017	Jan.11, 2018
3	Active Loop Antenna	Beijing Dazhi	ZN30900A	0703	Oct.17, 2016	Oct.16, 2017
4	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.07, 2017	Apr.06, 2018
5	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.12, 2016	Sep.11, 2017
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr.07, 2017	Apr.06, 2018
7	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	Apr.09, 2017	Apr.08, 2018
8	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Apr.07, 2017	Apr.06,2018
9	Coaxial Cable (above 1GHz)	Top	1GHz-18GHz	EW02014-7	Apr.07,2017	Apr.06,2018
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No**	**Last Calibration Date**	**Calibration Due Date**
1	Test Receiver	R&S	ESCI	101296	Apr.06,2017	Apr.05,2018
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Apr.07,2017	Apr.06,2018
3	Amplifier	ANRITSU	MH648A	M43381	Apr.07,2017	Apr.06,2018
4	Cable	HUBER+SUHNER	CBL2	525178	Apr.07,2017	Apr.08,2018
RF Conducted Testing						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	Apr.13, 2017	Apr.12, 2018
2.	Spectrum Analyzer	R&S	FSL6	100959	Sep,12,2016	Sep,11,2017

	(9k-6GHz)					
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	Apr.06,2017	Apr.05,2018
4.	Humidity Chamber	GF	GTH-225-40-1P	IAA061213	Apr.13, 2017	Apr.12, 2018

6.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	± 1 x 10^{-6}
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)

6.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by GUANG ZHOU GRG METROLOGY & TEST CO. , LTD. address is No.163, Pingyun Rd. West of Huangpu Ave,Tianhe District, Guangzhou, Guangdong, China.

7 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI 63.10: 2013
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class/Severity:	Class B
Limit:	66-56 dBμV between 0.15MHz & 0.5MHz
	56 dBμV between 0.5MHz & 5MHz
	60 dBμV between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)

7.1 E.U.T. Operation

Operating Environment **:**

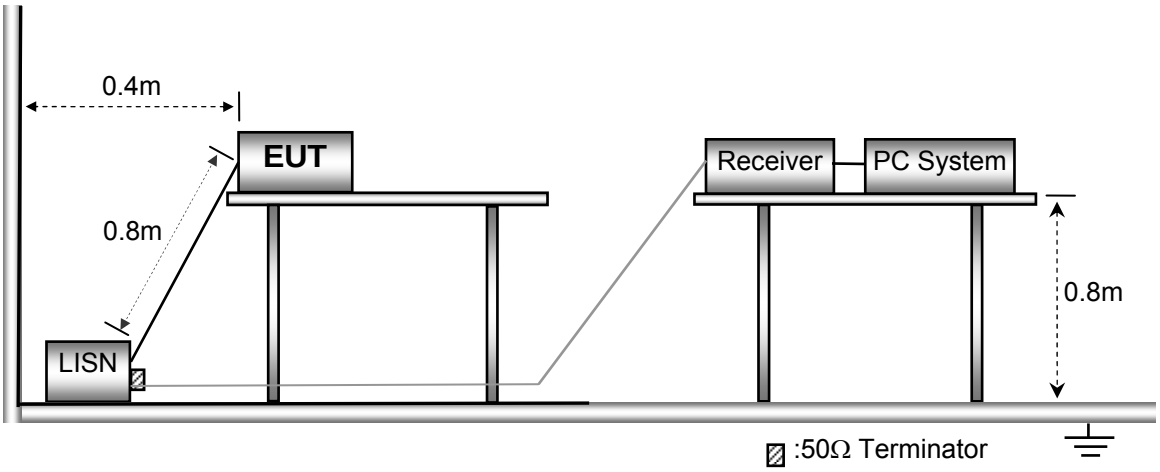
Temperature:	25.5 °C
Humidity:	51 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation **:**

The test was performed in Transmitting mode, the test data were shown in the report.

7.2 EUT Setup

The EUT was placed on the test table in shielding room.



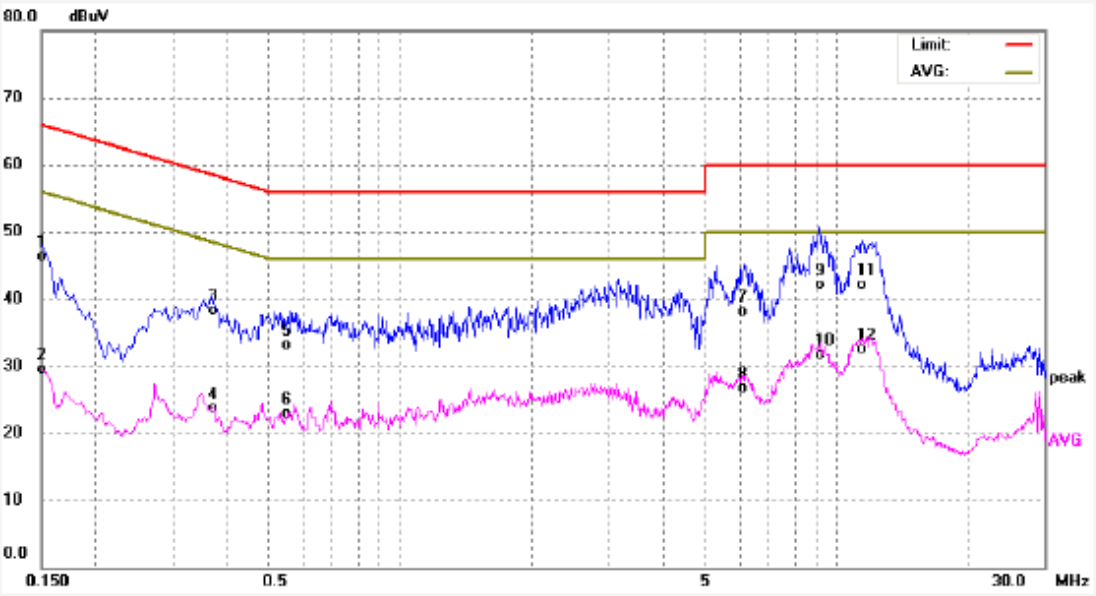
7.3 Measurement Description

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

7.4 Conducted Emission Test Result

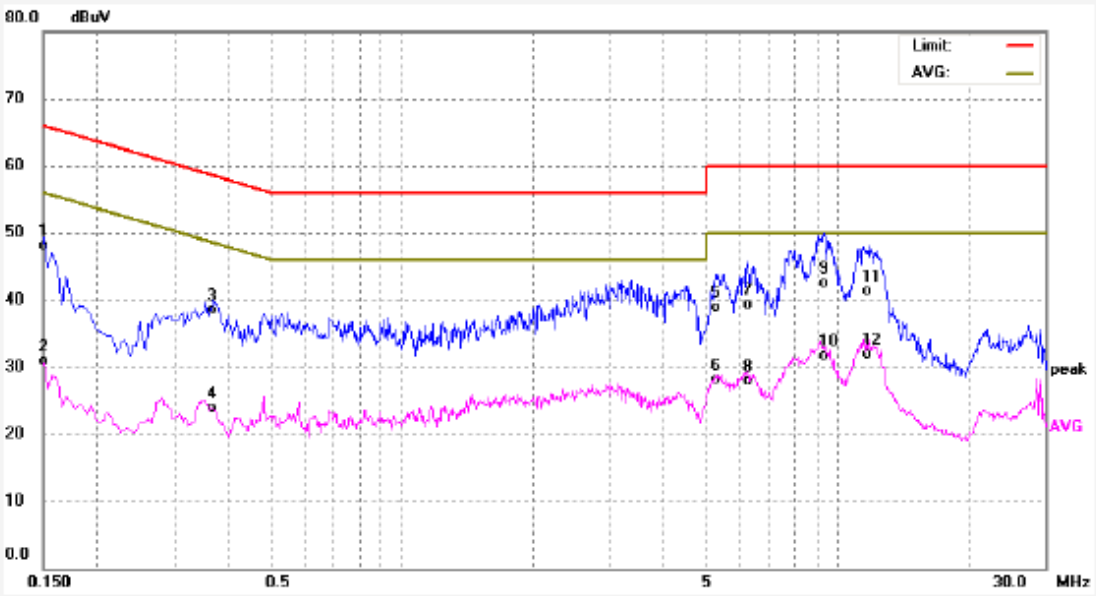
An initial pre-scan was performed on the live and neutral lines.

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1500	36.28	10.06	46.34	65.99	-19.65	QP	
2	0.1500	19.51	10.06	29.57	55.99	-26.42	AVG	
3	0.3700	28.25	10.05	38.30	58.50	-20.20	QP	
4	0.3700	13.75	10.05	23.80	48.50	-24.70	AVG	
5	0.5580	23.07	10.07	33.14	56.00	-22.86	QP	
6	0.5580	12.74	10.07	22.81	46.00	-23.19	AVG	
7	6.1740	27.92	10.27	38.19	60.00	-21.81	QP	
8	6.1740	16.46	10.27	26.73	50.00	-23.27	AVG	
9	9.1180	31.82	10.34	42.16	60.00	-17.84	QP	
10	9.1180	21.45	10.34	31.79	50.00	-18.21	AVG	
11	11.4900	31.66	10.37	42.03	60.00	-17.97	QP	
12	11.4900	22.12	10.37	32.49	50.00	-17.51	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1500	38.02	10.06	48.08	65.99	-17.91	QP	
2	0.1500	20.79	10.06	30.85	55.99	-25.14	AVG	
3	0.3700	28.52	10.05	38.57	58.50	-19.93	QP	
4	0.3700	13.82	10.05	23.87	48.50	-24.63	AVG	
5	5.2660	28.75	10.25	39.00	60.00	-21.00	QP	
6	5.2660	17.85	10.25	28.10	50.00	-21.90	AVG	
7	6.2300	28.95	10.27	39.22	60.00	-20.78	QP	
8	6.2300	17.62	10.27	27.89	50.00	-22.11	AVG	
9	9.3220	32.08	10.35	42.43	60.00	-17.57	QP	
10	9.3220	21.32	10.35	31.67	50.00	-18.33	AVG	
11	11.8340	30.88	10.37	41.25	60.00	-18.75	QP	
12	11.8340	21.57	10.37	31.94	50.00	-18.06	AVG	

8 Radiation Emission Test

Test Requirement: FCC Part15 Paragraph 15.249&15.209&15.205

Test Method: ANSI 63.10: 2013

Measurement Distance: 3m

Test Result: PASS

15.249(a)Limit:

Fundamental frequency	Field strength of fundamental		Field strength of harmonics	
	mV/m	dBuV/m	uV/m	dBuV/m
902-928 MHz	50	94	500	54
2400-2483.5 MHz	50	94	500	54
5725-5875 MHz	50	94	500	54
24.0-24.25 GHz	250	108	2500	68

15.209 Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

Note: RF Voltage(dBuV)=20 $\log_{10}$ RF Voltage(uV)

8.1 EUT Operation

Operating Environment **:**

Temperature: 23.5 °C

Humidity: 51.1 % RH

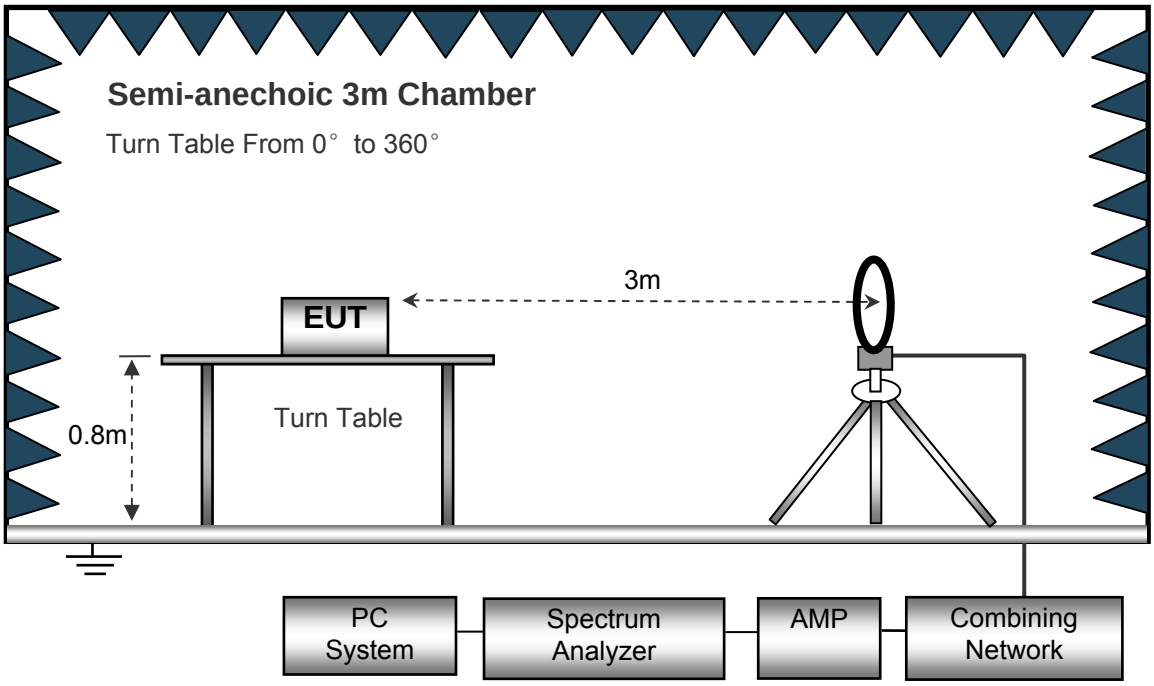
Atmospheric Pressure: 101.2kPa

EUT Operation **:**

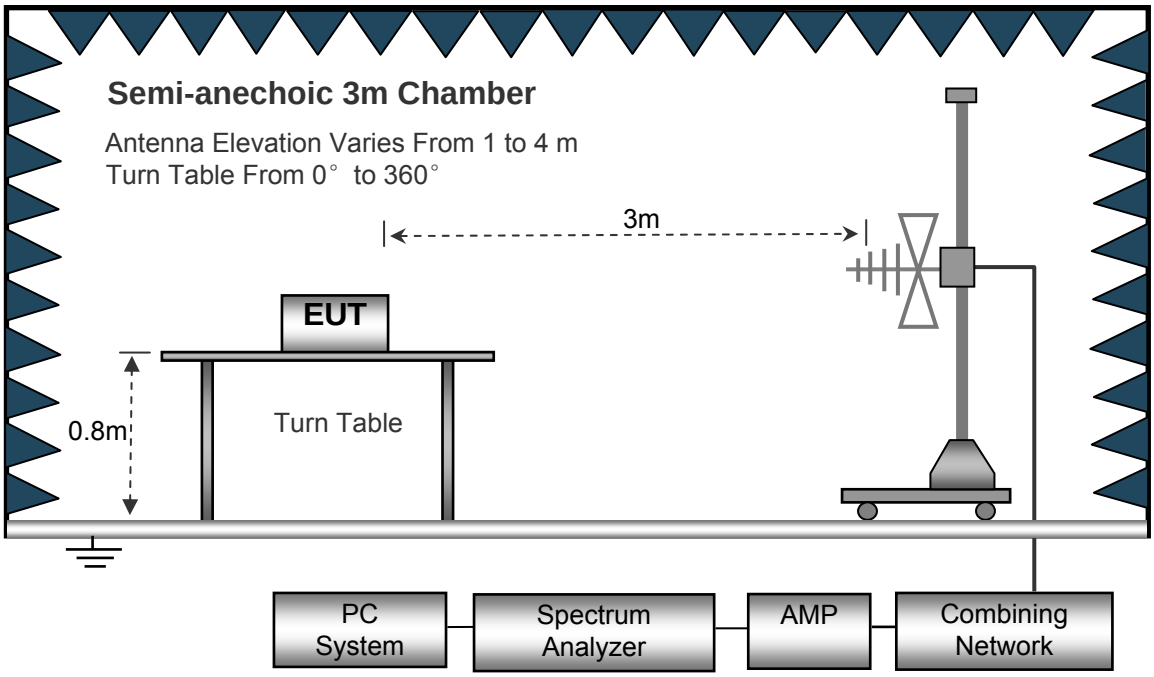
The test was performed in transmitting mode, the test data were shown in the report.

8.2 Test Setup

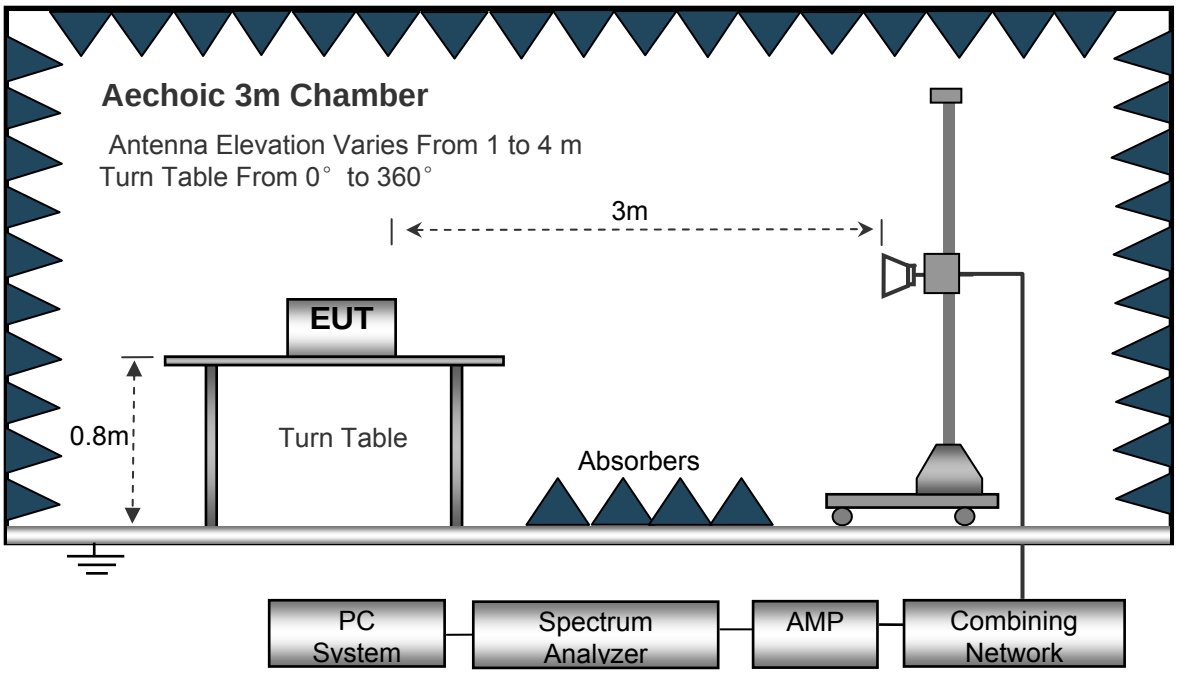
The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10.
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30MHz to 1GHz.



The test setup for emission measurement above 1 GHz.



8.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed	Auto
IF Bandwidth	10kHz
Video Bandwidth	10kHz
Resolution Bandwidth	10kHz

30MHz ~ 1GHz

Sweep Speed	Auto
Detector	PK
Resolution Bandwidth	100kHz
Video Bandwidth	300kHz

Above 1GHz

Sweep Speed	Auto
Detector	PK
Resolution Bandwidth	1MHz
Video Bandwidth	3MHz
Detector	Ave.
Resolution Bandwidth	1MHz
Video Bandwidth	10Hz

8.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane for below 1GHz and 1.5m above 1GHz.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

8.5 Test Result

Test Frequency : 9KHz~ 30MHz
The measurements were more than 20 dB below the limit and not reported.

Test Frequency: 30MHz ~ 40GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.249/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)
5857.00	79.41	PK	181	1.4	H	-2.13	77.28	114	-36.72
5857.00	92.11	PK	72	1.2	V	-2.13	89.98	114	-24.02
2321.59	45.15	PK	24	1.7	H	-13.19	31.96	74	-41.58
2321.59	44.32	PK	24	1.7	V	-13.19	31.13	74	-42.82
2358.99	43.52	PK	304	1.6	H	-13.14	30.38	74	-43.46
2358.99	42.36	PK	304	1.6	V	-13.14	29.22	74	-45.14
2495.44	42.54	PK	171	2	H	-13.08	29.46	74	-44.93
2495.44	42.54	PK	171	2	V	-13.08	29.46	74	-44.20
11568.00	44.14	PK	293	1.1	H	0.09	44.23	74	-30.79
11568.00	42.36	PK	313	1.8	V	0.09	42.45	74	-33.61
17352.00	46.57	PK	55	1.3	H	3.01	49.58	74	-27.83
17352.00	45.31	PK	65	1.6	V	3.01	48.32	74	-29.77

AV = Peak +20Log10(duty cycle) =PK+(0) [refer to section 8 for more detail]

Frequency	PK	Turn table Angle	RX Antenna		Duty cycle Factor	AV	FCC Part 15.249/209/205	
			Height	Polar			Limit	Margin
(MHz)	(dBμV/m)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
5857.00	77.28	181	1.4	H	0.00	77.28	94.00	-16.72
5857.00	89.98	72	1.2	V	0.00	89.98	94.00	-4.02
2321.59	31.96	24	1.7	H	0.00	31.96	54	-22.04
2321.59	31.13	24	1.7	V	0.00	31.13	54	-22.87
2358.99	30.38	304	1.6	H	0.00	30.38	54	-23.62
2358.99	29.22	304	1.6	V	0.00	29.22	54	-24.78
2495.44	29.46	171	2.0	H	0.00	29.46	54	-24.54
2495.44	29.46	171	2.0	V	0.00	29.46	54	-24.54
11568.00	44.23	293	1.1	H	0.00	44.23	54	-9.77
11568.00	42.45	313	1.8	V	0.00	42.45	54	-11.55
17352.00	49.58	55	1.3	H	0.00	49.58	54	-4.42
17352.00	48.32	65	1.6	V	0.00	48.32	54	-5.68

9 Periodic Operation

The duty cycle was determined by the following equation:

To calculate the actual field intensity,the duty cycle correction factor in decibel is needed for later use and can be obtained from following conversion

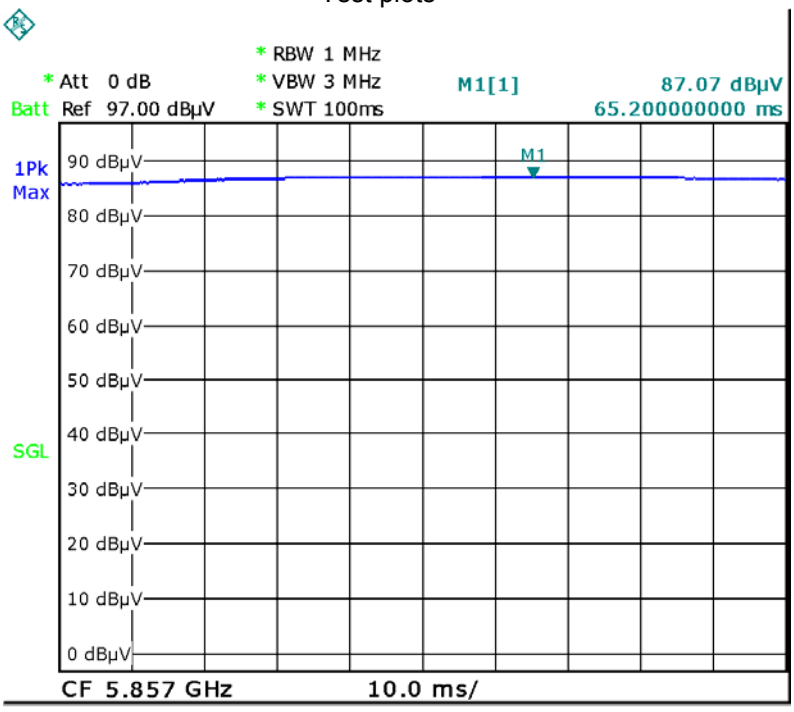
Duty Cycle(%)=Total On interval in a complete pulse train/ Length of a complete pulse train * %

Duty Cycle Correction Factor(dB)=20 * Log_{10}(Duty Cycle)

Total transmission time(ms)	100
Length of a complete transmission period(ms)	100
Duty Cycle(%)	1
Duty Cycle Correction Factor(dB)	0

Refer to the duty cycle plot (as below)

Test plots



10 Restricted band

Test Requirement: FCC Part15 Paragraph 15.205

Test Method: ANSI C63.10: 2013

Test Result: N/A

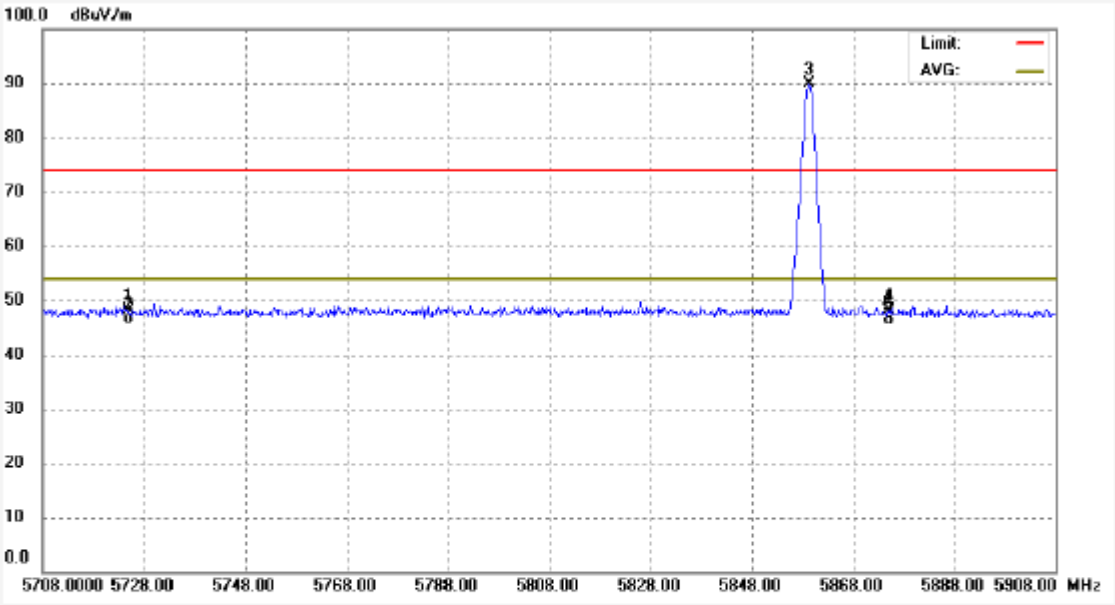
10.1 Requiments:

emissions that fall in the restricted bands(15.205).Above 1000MHz, compliance with the emissions limits in section 15.209 shall be demonstrated based on the average value of the measured emissions,The provisions in section 15.35apply to these measurements.

10.2 Test Result

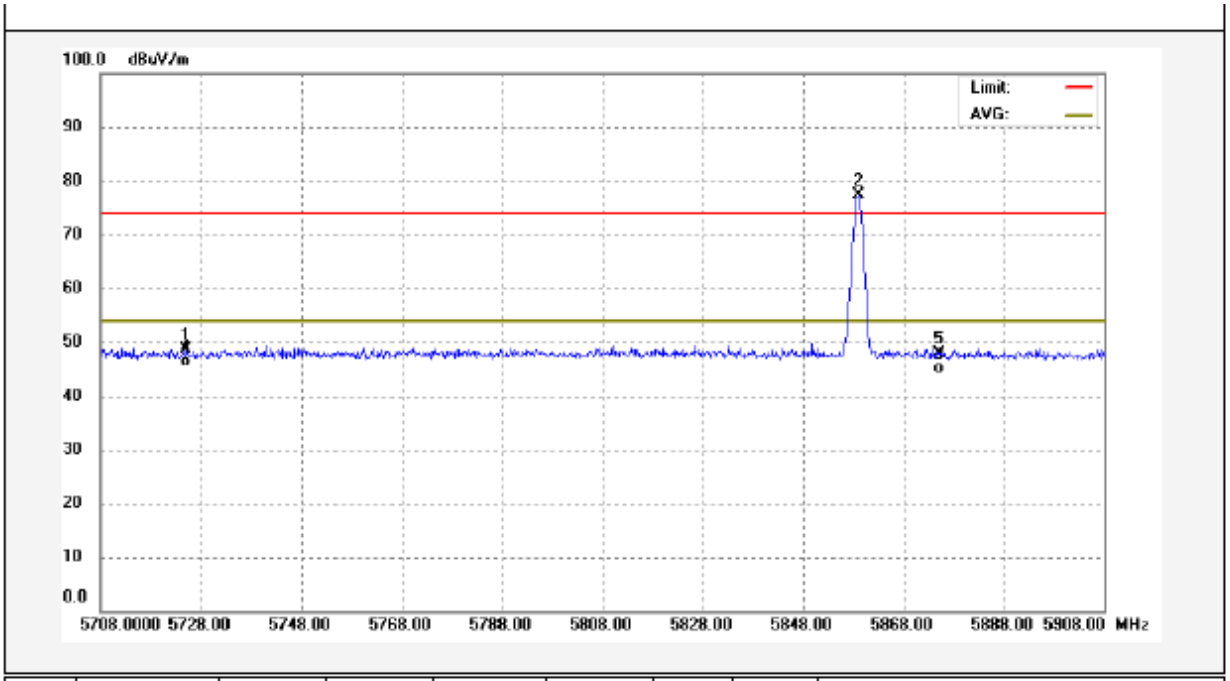
Mode: Continuously Transmitting

Antenna Polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	5725.000	51.72	-3.59	48.13	74.00	-25.87	peak	
2	5725.000	50.14	-3.59	46.55	54.00	-7.45	AVG	
3	5857.000	93.36	-3.38	89.98	114.00	-24.02	peak	
4	5875.000	51.49	-3.35	48.14	74.00	-25.86	peak	
5	5875.000	49.69	-3.35	46.34	54.00	-7.66	AVG	

Antenna Polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	5725.000	52.25	-3.59	48.66	74.00	-25.34	peak	
2	5857.000	80.66	-3.38	77.28	114.00	-36.72	peak	
3	5875.000	48.60	-3.35	45.25	54.00	-8.75	AVG	
4	5725.000	49.92	-3.59	46.33	54.00	-7.67	AVG	
5	5875.000	51.24	-3.35	47.89	74.00	-26.11	peak	

11 20 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.215(c)

Test Method: ANSI C63.10:2013

Test Mode: Transmitting

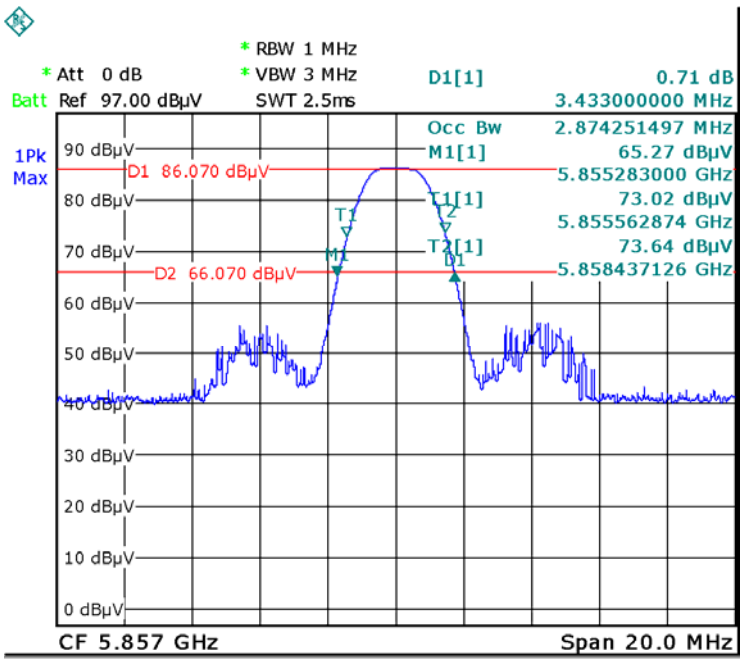
11.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 1MHz, VBW = 3MHz

11.2 Test Result

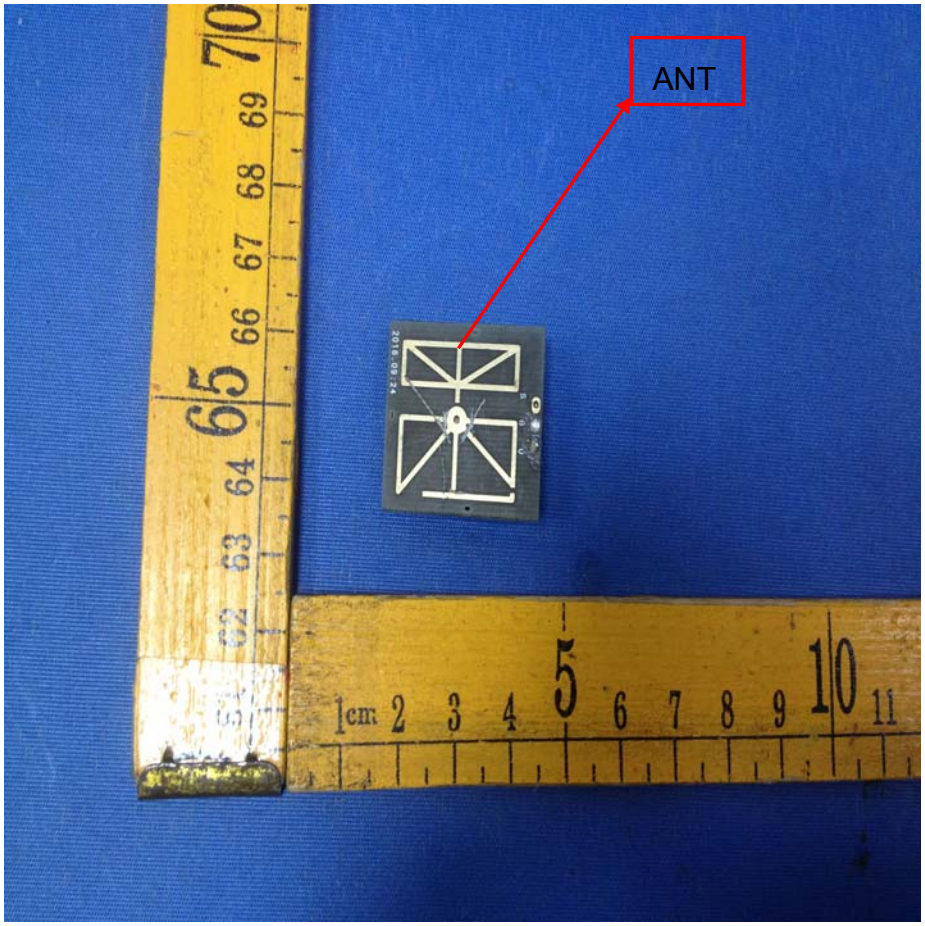
Frequency (MHz)	Bandwidth Emission (MHz)
5857	3.433

Test plots



12 Antenna Requirement

According to the FCC Part 15 Paragraph 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. This product has a PCB Printed Antenna , fulfil the requirement of this section.



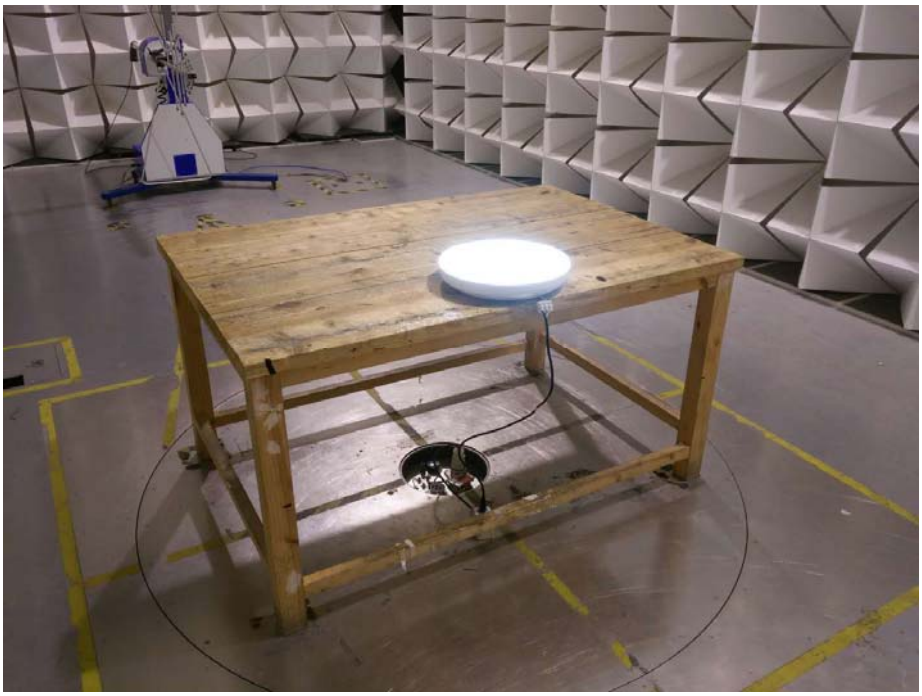
13 Photographs- Model LM56123 Test Setup

13.1 Photograph –Conducted Emissions

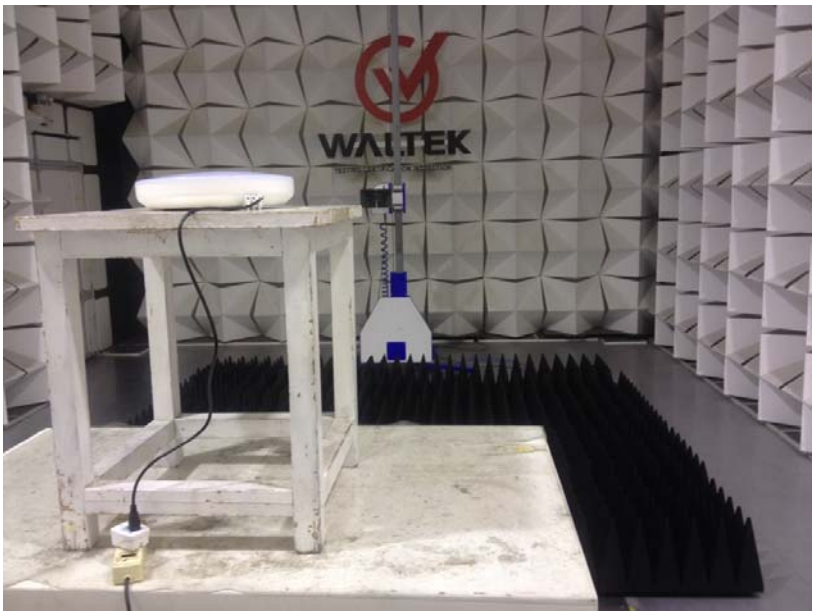
13.2 Photograph – Radiation Emission

Test frequency from 9KHz to 30MHz

Test frequency from 30MHz to 1GHz

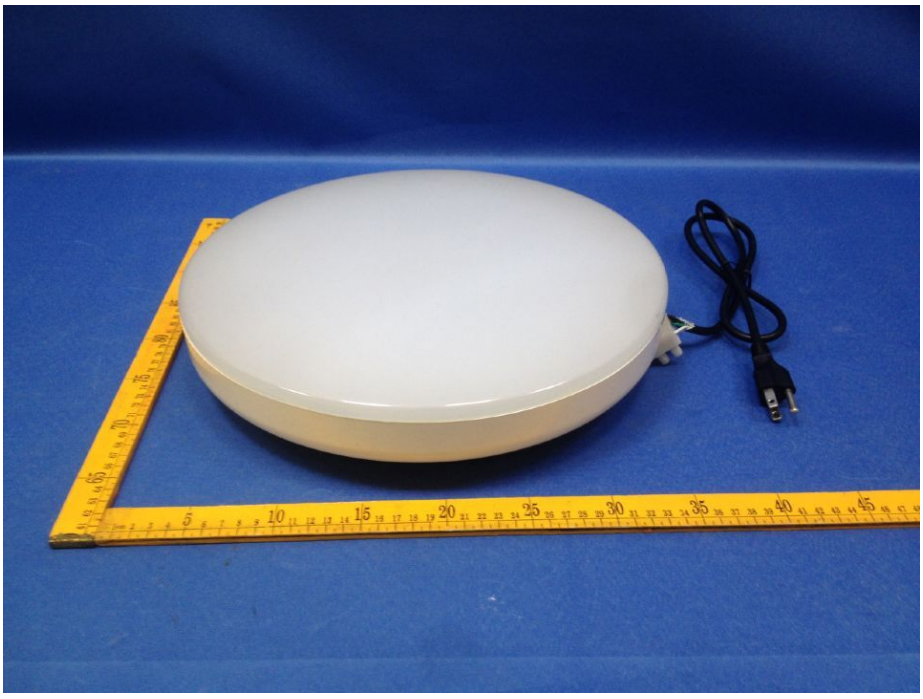


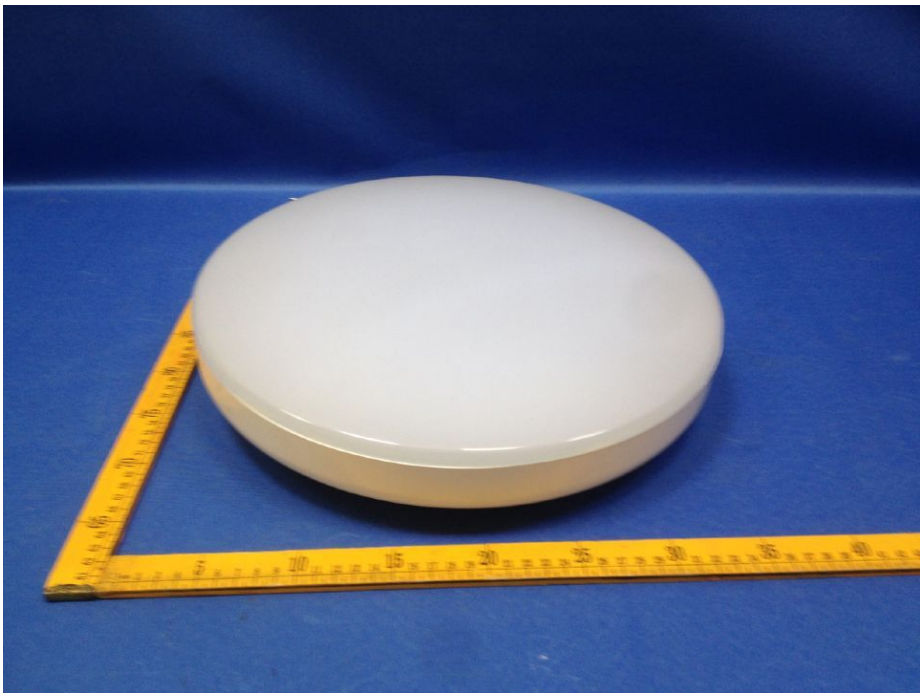
Test frequency above 1GHz

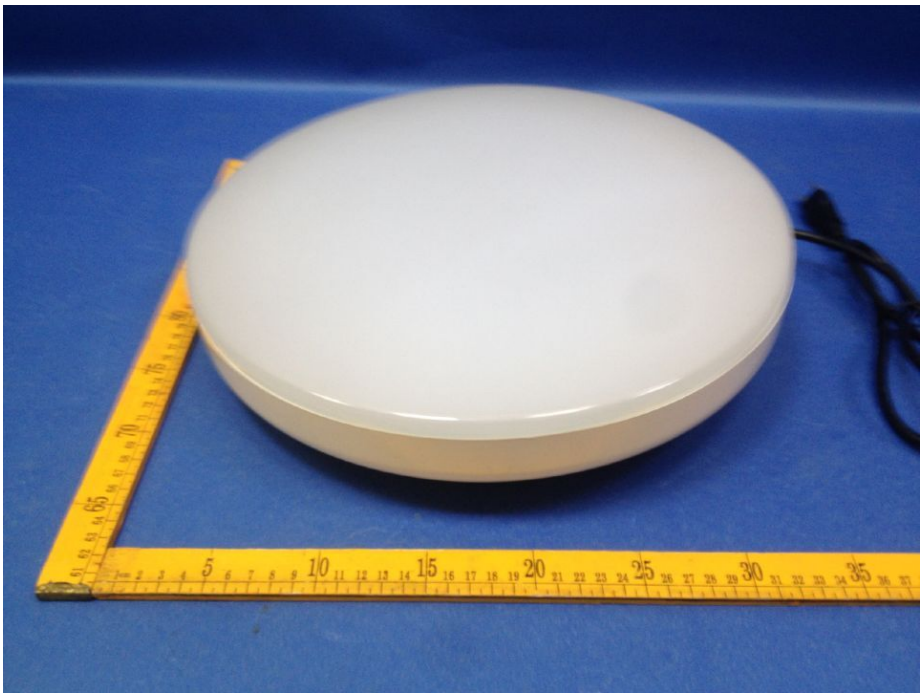


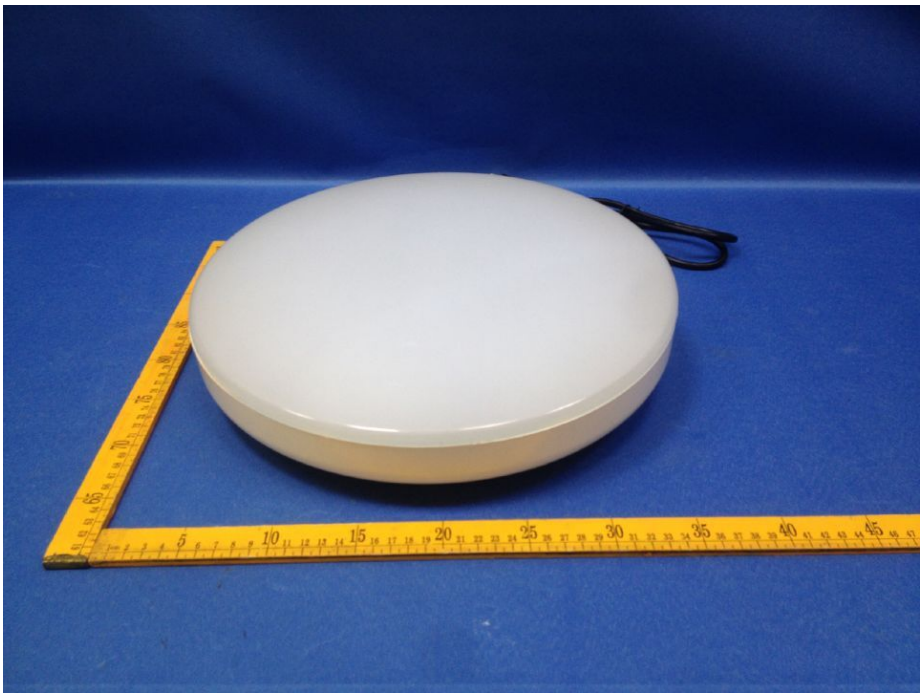
14 Photographs - Constructional Details

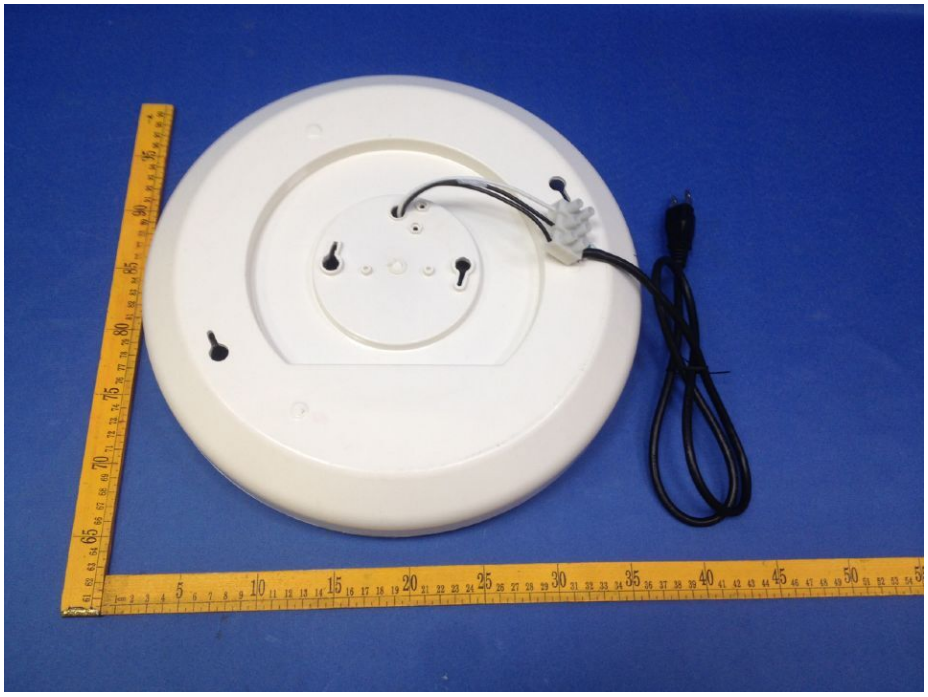
14.1 Model LM56123-External Photos



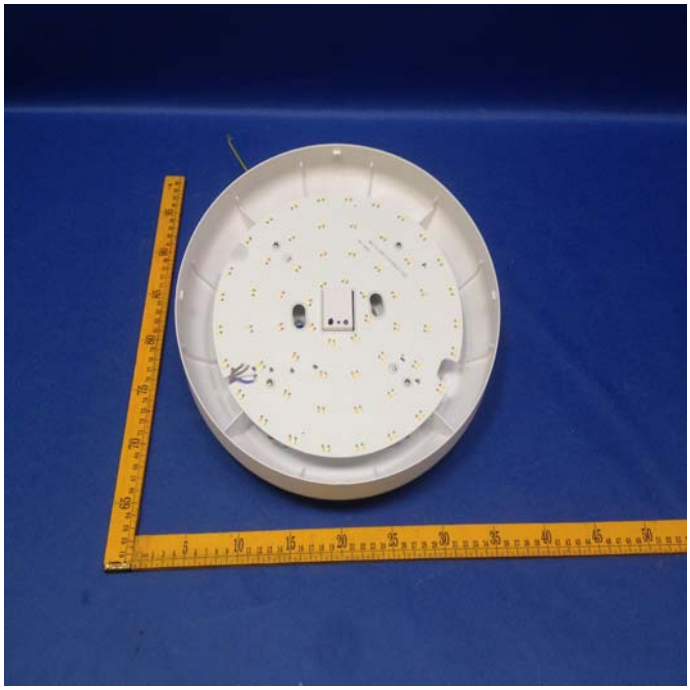


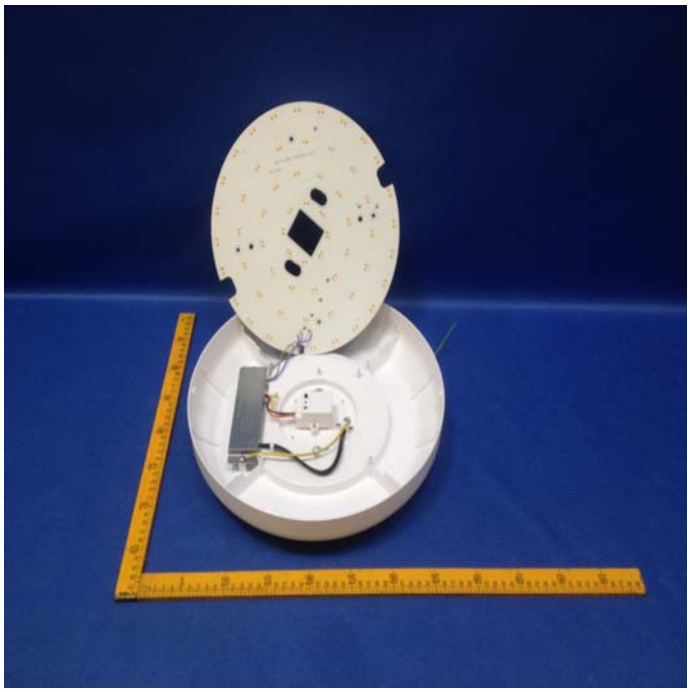


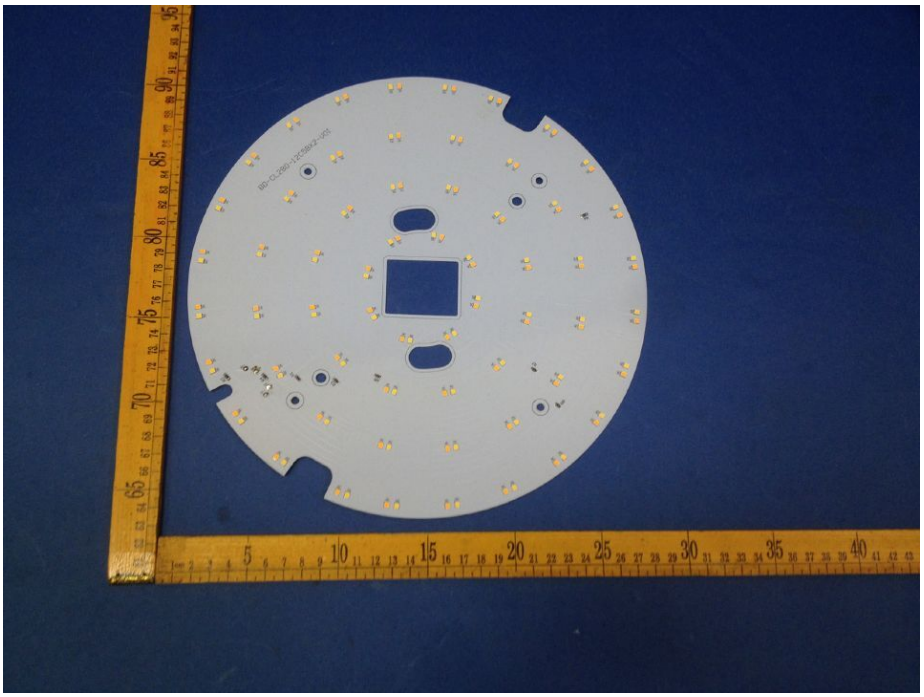


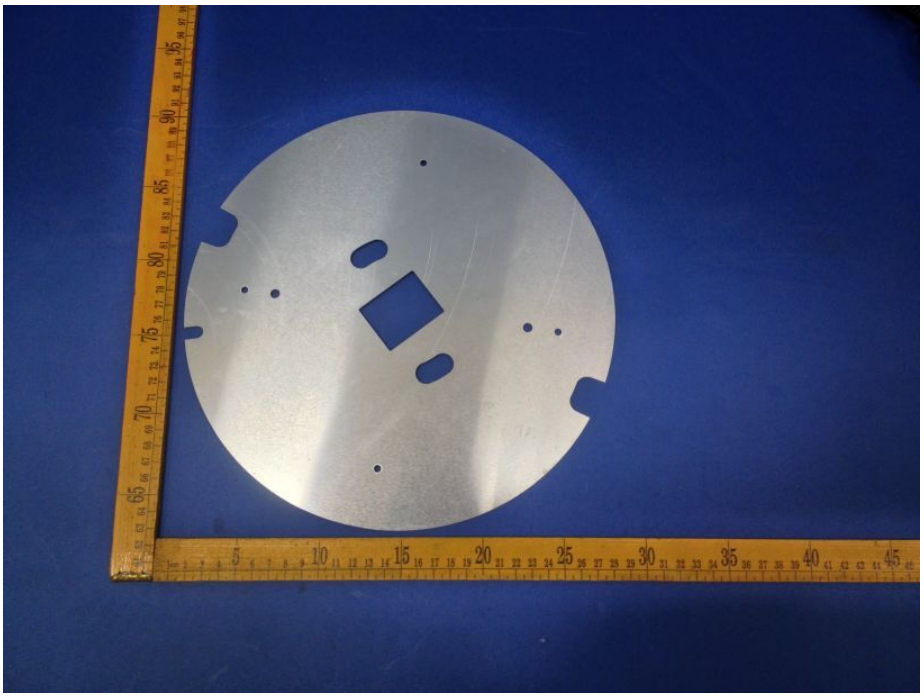


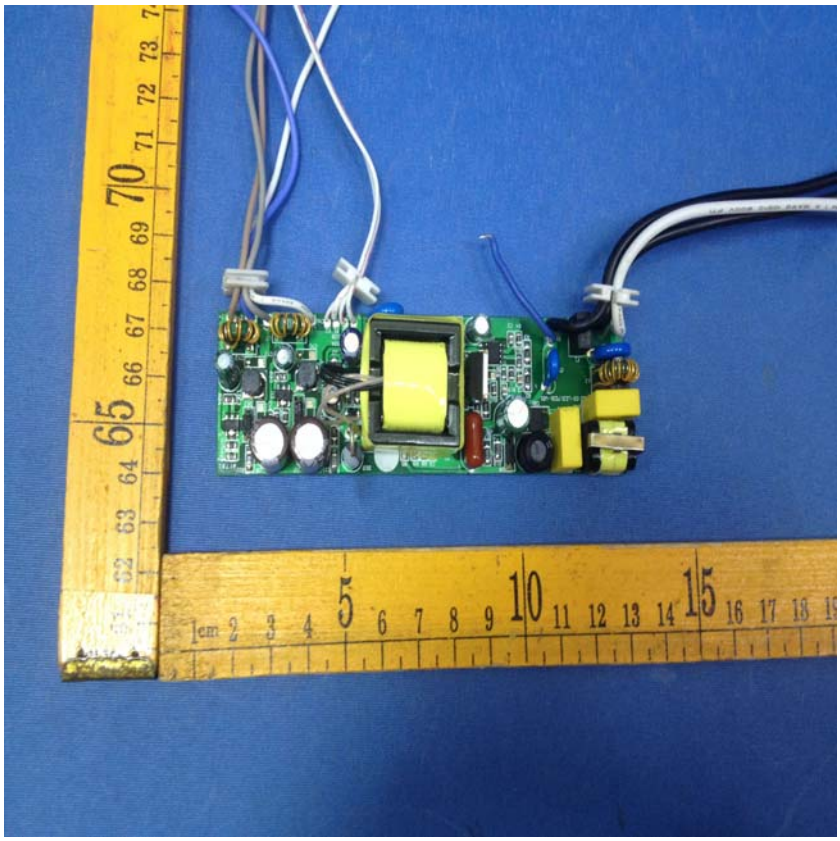
14.2 Model LM56123-Internal Photos

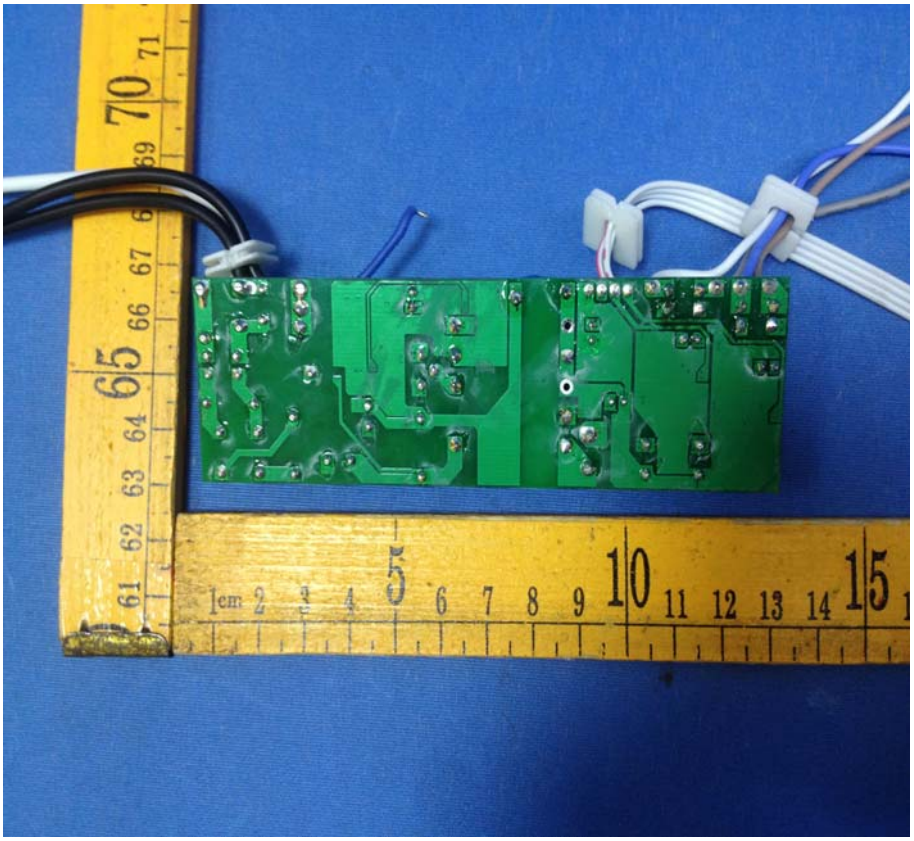


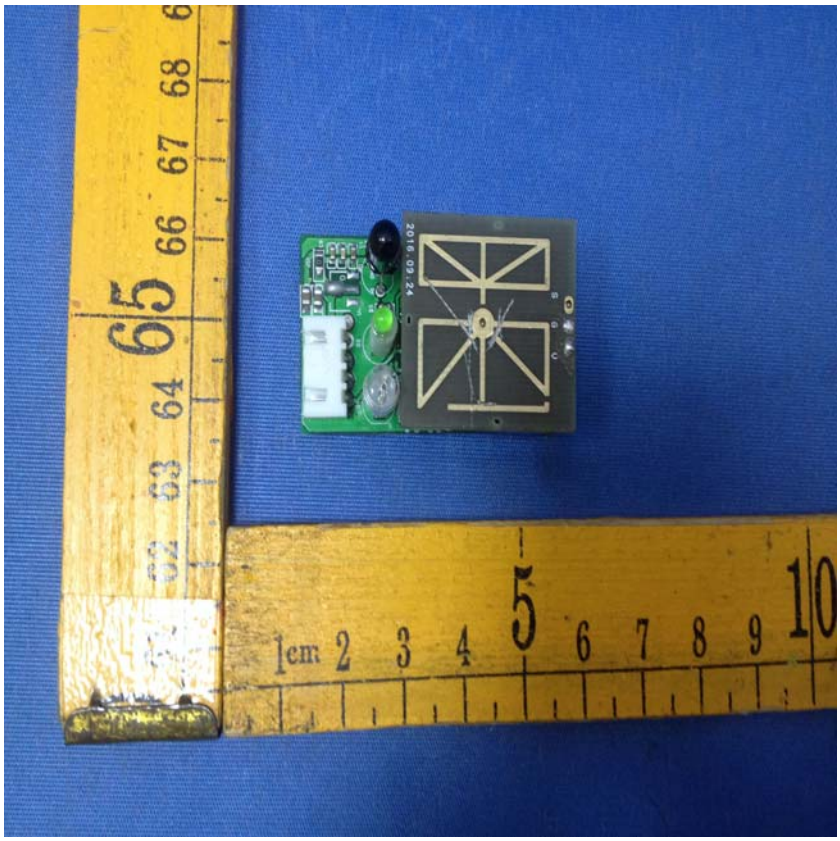


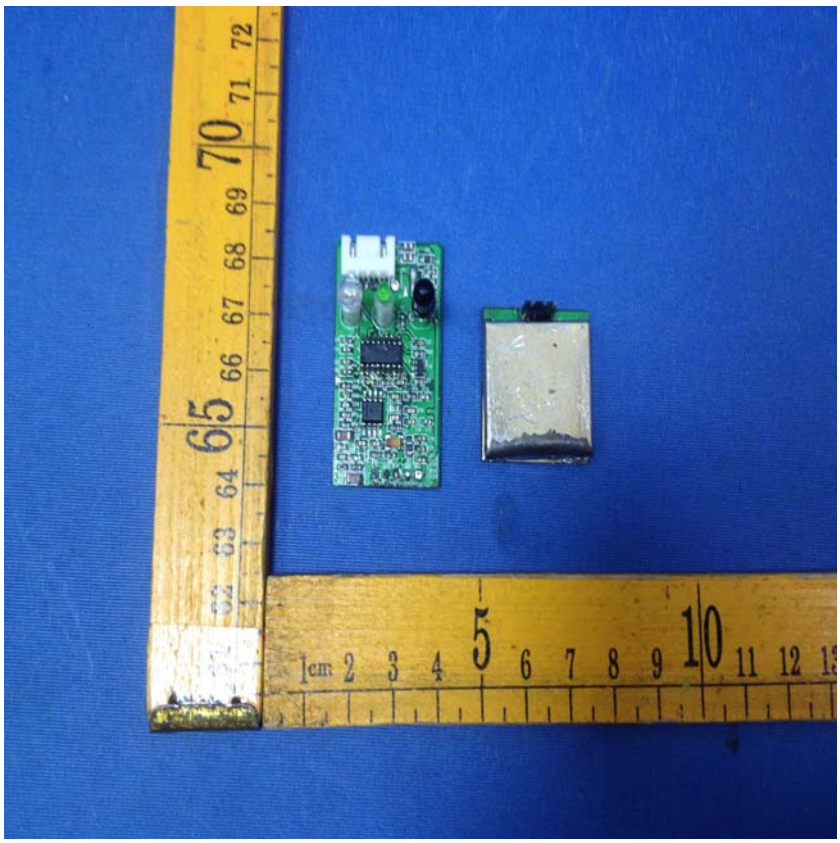


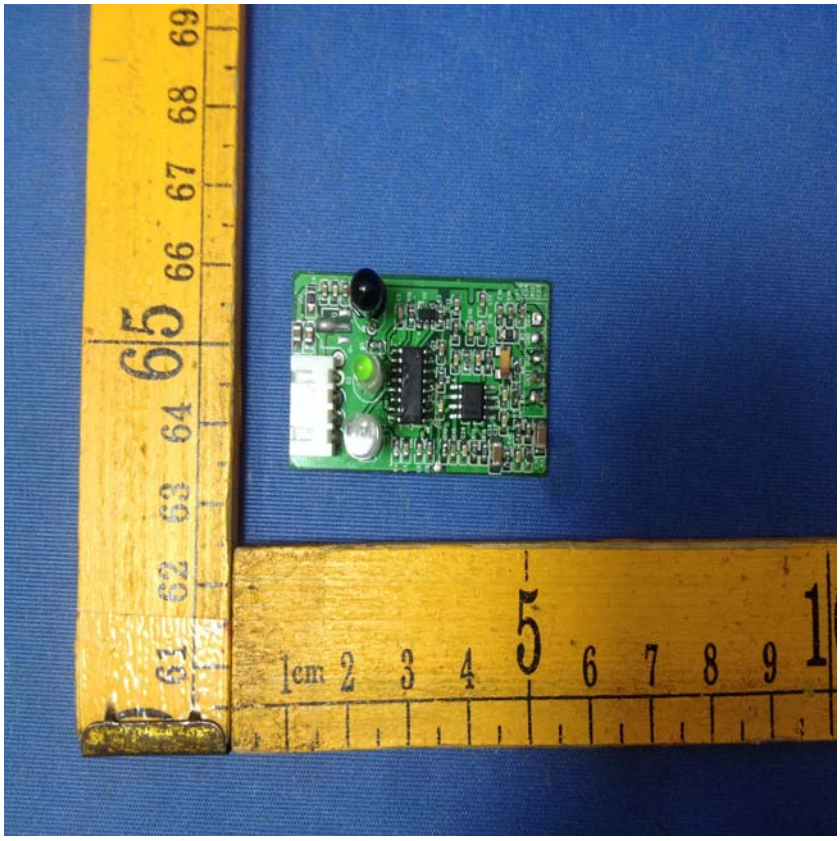


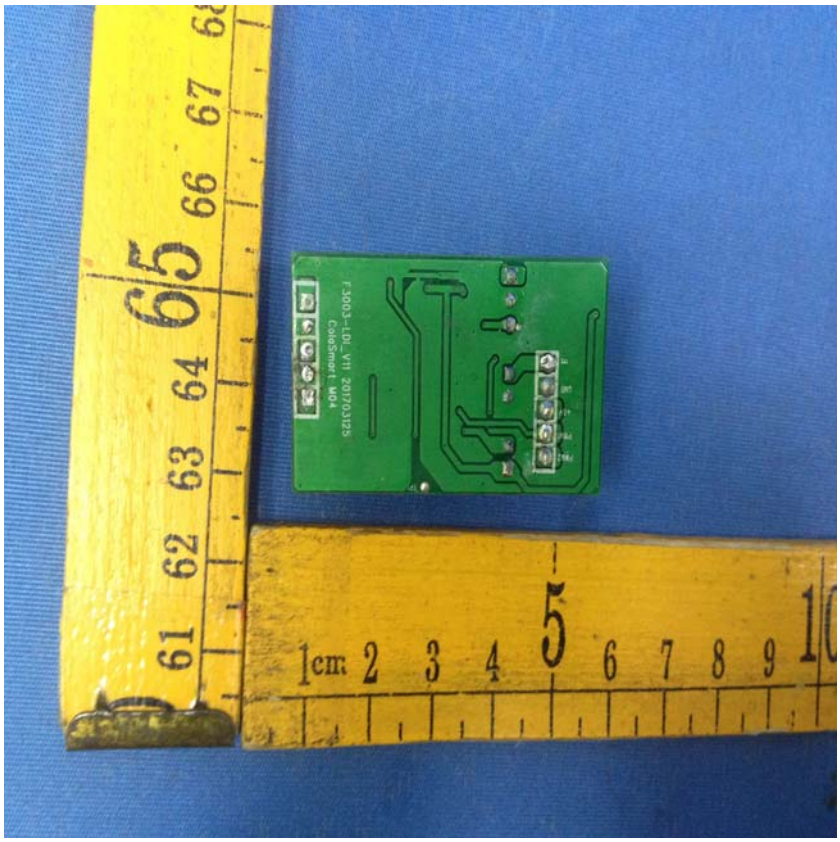


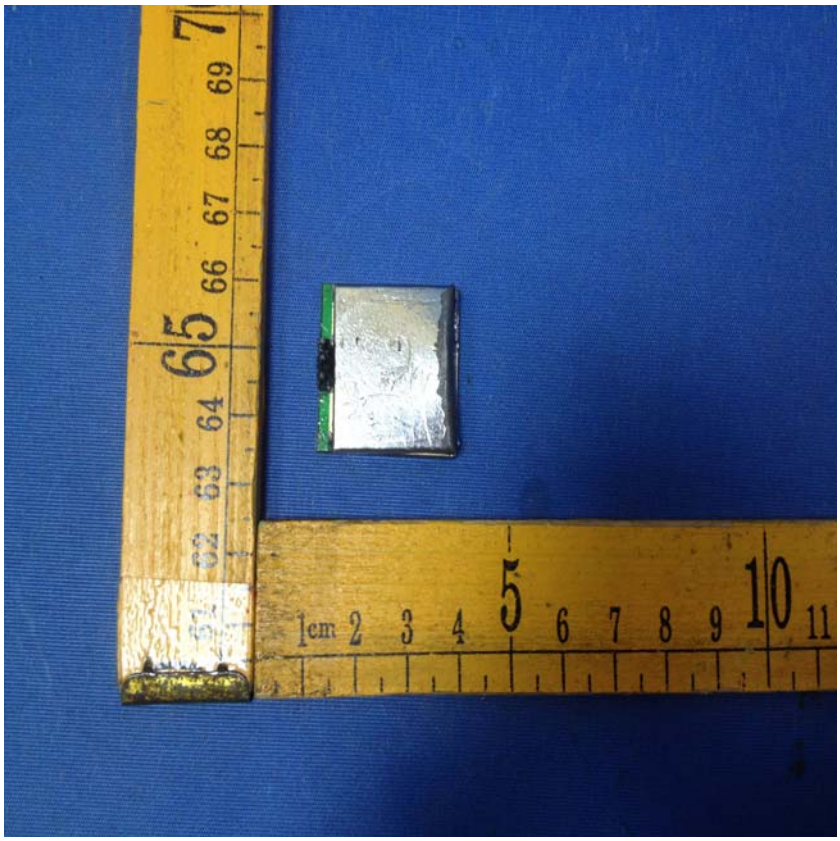








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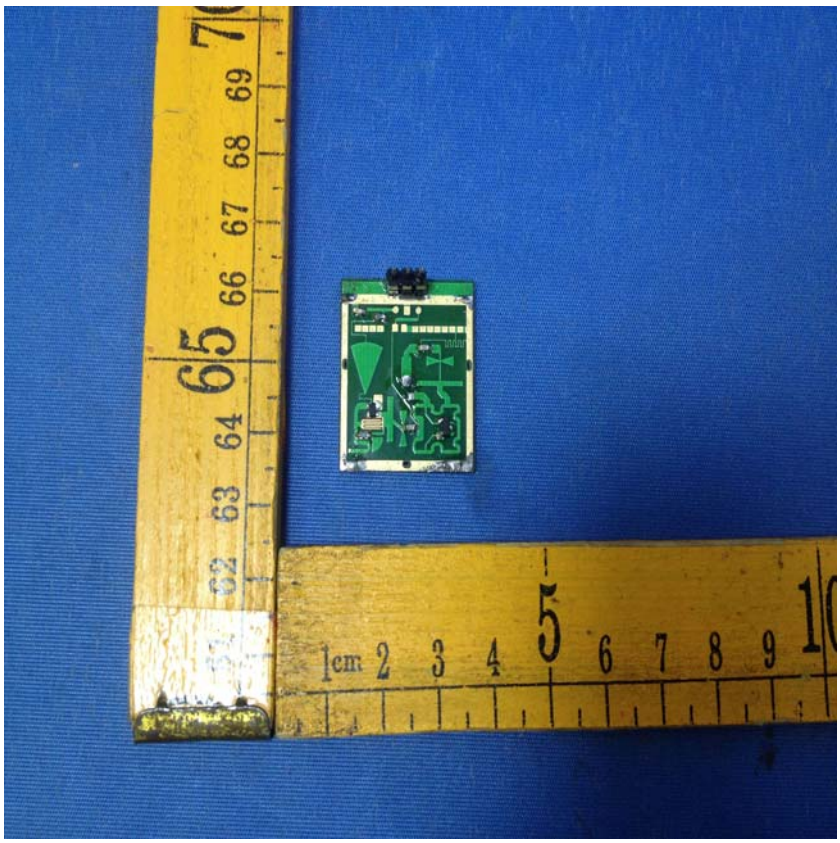
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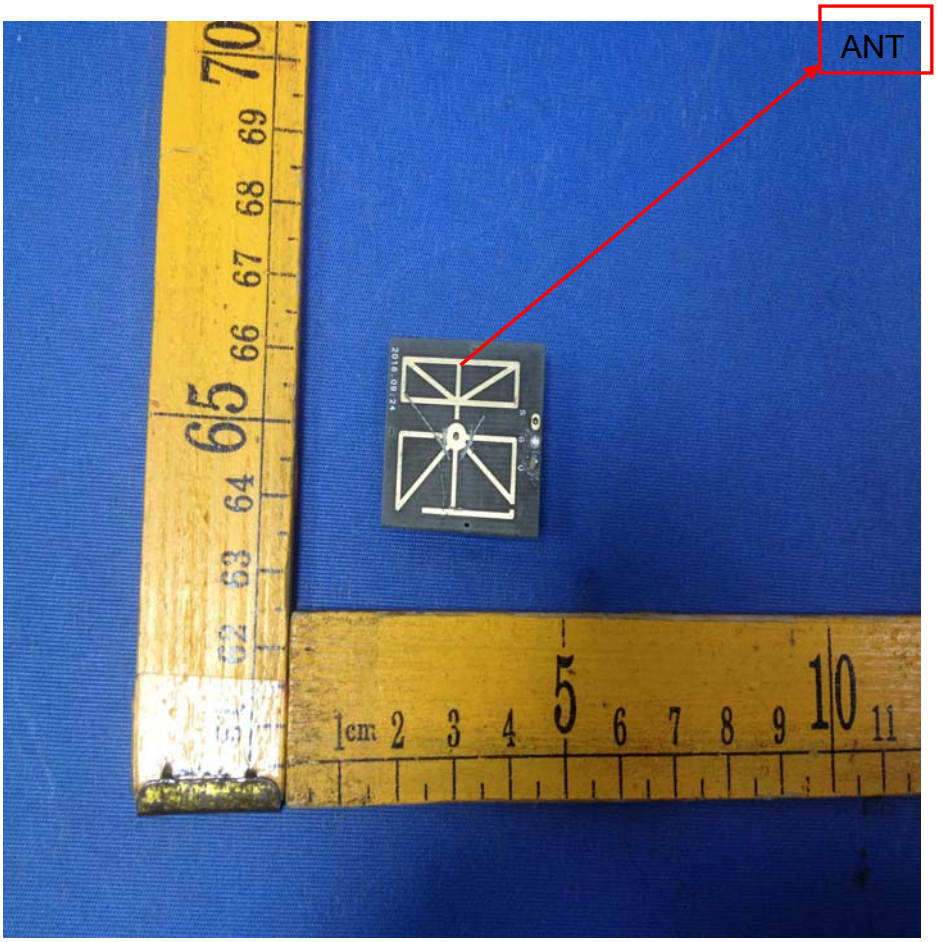

======End of Report======