APPLICATION FOR CERTIFICATION

On Behalf of

OPCOM O.E.(DONGGUAN) INC.

Lighting Controller

Model Number: OPL102

FCC ID: 2ADUM-OPL102

Prepared for	:	OPCOM O.E.(DONGGUAN) INC.
Address	:	Gu Cun Industry Estate Dajing Countryside Committee Houjie Town, Dongguan City Guangdong, China

Prepared By	:	EST Technology Co., Ltd.
Address	:	Santun(guantai Road), Houjie Town, DongGuan City,GuangDong, China

Tel: +86-769-83081888
Fax: +86-769-83081878

Report Number	:	ESTE-R1609020
Date of Test	:	August.18~ September.02.2016
Date of Report	:	September.07.2016

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EST Technology Co., Ltd.

Applicant: **Address:**	OPCOM O.E.(DONGGUAN) INC. Gu Cun Industry Estate Dajing Countryside Committee Houjie Town, Dongguan City Guangdong, China		
Manufacturer: **Address:**	OPCOM O.E.(DONGGUAN) INC. Gu Cun Industry Estate Dajing Countryside Committee Houjie Town, Dongguan City Guangdong, China		
E.U.T:	Lighting Controller		
Model Number:	OPL102		
Power Supply:	DC 4.5V For Internal Battery		
Test Voltage:	DC 4.5V		
Trade Name:	-----	**Operating Frequency:**	433MHz
Date of Receipt:	August.18,2016	**Date of Test:**	August.18~September.07.2016
Test Specification:	FCC Rules and Regulations Part 15 Subpart C:2016 ANSI C63.10:2013		
Test Result:	The equipment under test was found to be compliance with the requirements of the standards applied. **Issue Date:** September.07.2016		

Tested by:	Reviewed by:	Approved by:
Ada / Assistant	Tony / Engineer	Iceman Hu / Manager

Other Aspects:

None.

Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested

This test report is based on a single evaluation of one sample of above mentioned products ,It is not permitted to be duplicated in extracts without written approval of EST Technology Co., Ltd.

1. GENERAL PRODUCT INFORMATION

1.1. Product Function

The EUT is used to transmit control command only. The operation frequency is 433MHz. Press the button on remote transmitter. Please refer to the user's manual for the details.

1.2. Description of Device (EUT)

E.U.T.	:	Lighting Controller
Model No.	:	OPL102
Operating Frequency	:	433MHz
Number of Channels	:	1 Channels
Type of Modulation	:	FSK
Antenna and Gain	:	Integral antenna, 1 dBi Gain.
System Input Voltage	:	Nominal Voltage: DC 4.5V(Battery)

1.3. Measurement uncertainty

Test Item	Uncertainty
Uncertainty for Conduction emission test	2.54dB
Uncertainty for Radiation Emission test (30MHz-1GHz)	3.62 dB
Uncertainty for Radiation Emission test (1GHz to 18GHz)	4.86 dB
Uncertainty for radio frequency	7×10-8
Uncertainty for conducted RF Power	0.20dB
Uncertainty for Power density test	0.26dB

Note：This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.4. Difference between Model Numbers

None

1.5. Independent Operation Modes

The basic operation modes are: TX mode

2. TEST SITES

2.1. Description of Standards and Results

The EUT have been tested according to the applicable standards as referenced below.

No.	Item	Specification	Results
1	Conducted emissions	FCC Part15.207	PASS
2	Radiated emissions	FCC Part 15.231(b)	PASS
3	20dB Occupied Bandwidth	FCC Part 15.231(c)	PASS
4	Deactivate time	FCC Part 15.231(a) (1)	PASS
5	antenna requirement	FCC Part 15.203	PASS

2.2. List of Test and Measurement Instruments

2.2.1. For radiated emission test(30-1000MHz)

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
EMI Test Receiver	Rohde & Schwarz	ESVS10	100004	Jun,28,16	1 Year
Spectrum Analyzer	Agilent	E4411B	MY50140697	Jun,28,16	1 Year
Bilog Antenna	Teseq	CBL 6111D	27090	Jun,28,16	1 Year
Signal Amplifier	Agilent	310N	187037	Jun,28,16	1 Year

2.2.2. For radiated emission test(above 1GHz)

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Horn Antenna	SCHWARZBECK	BBHA 9120 D	BBHA9120D 1002	Jun,28,16	1 Year
Signal Amplifier	SCHWARZBECK	BBV9718	9718-212	Jun,28,16	1 Year
Spectrum Analyzer	Agilent	E4408B	MY44211139	Jun,28,16	1 Year

2.2.3. For 20dB Occupied Bandwidth test

Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Spectrum Analyzer	Agilent	E4408B	MY44211139	Jun,28,16	1 Year

2.2.4. For Deactivate time test

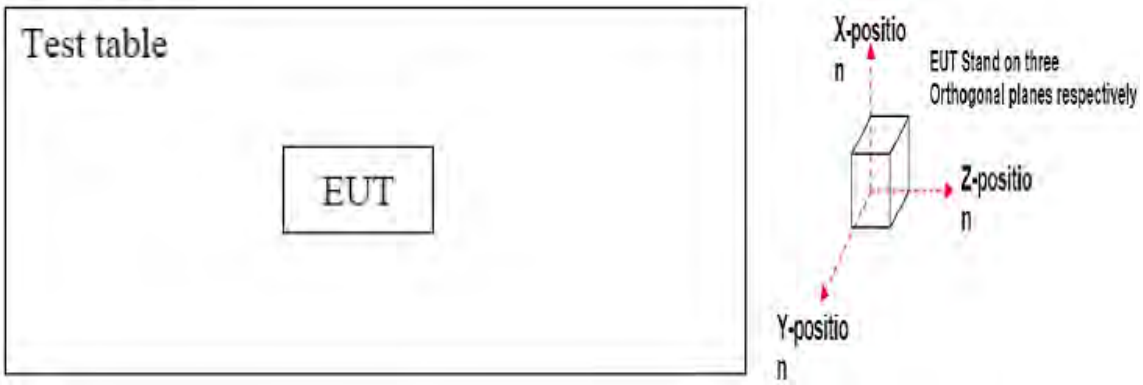
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
Spectrum Analyzer	Agilent	E4408B	MY44211139	Jun,28,16	1 Year

3. TEST SET-UP AND OPERATION MODES

3.1. Principle of Configuration Selection

The equipment under test (EUT) was configured to measure its highest possible radiated level. The test modes were adapted accordingly in reference to the Operating Instructions.

3.2. Block Diagram of Test Set-up



(EUT: Wireless Remote Control)

Note: We test X-axis, Y-axis, and Z-axis,. The Y-axis is the worst mode, so only the worst mode test data was included in the report.

3.3. Test Operation Mode and Test Software

Refer to clause 1.5

3.4. Special Accessories and Auxiliary Equipment

None.

3.5. Countermeasures to Achieve EMC Compliance

None.

4. EMISSION TEST RESULTS

4.1. Conducted Emissions

According to paragraph(f) of FCC Part 15 Section 15.207, measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation, and which do not operate from the AC power lines or contain provision for operation while connected to the AC power.

4.2. Radiated emissions

4.2.1. Applied Standard

According to 15.231(b), the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

Fundamental Frequencies (MHz)	Field strength of Fundamental (uV/meter at 3m)	Unwanted emissions (uV/meter at 3m)
40.66-40.70	2250	225
70-130	1250(470nW)	125
130-174	1250 to 3750**	125 to 375**
174-260	3750(4.2uW)	375
260-470	3750 to 12500**	375 to 1250**
Above470	12500(47uW)	1250

**Linear interpolation with frequency F in MHz
For the band 130-174MHz: Field strength=56.81818(F)-6136.3636
For the band 260-470MHz: Field strength=41.6667(F)-7083.3333
The maximum permitted unwanted emissions level is 20dB below the maximum permitted fundamental level

The field strength of spurious emissions which appear outside of this band shall not exceed the general radiated emission limits in Section 15.209 as following:

Frequencies (MHz)	Field strength uV/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

According to 15.35(b), for frequencies above 1000MHz,the field strength limits are based on average detector, however,the peak field strength of any emission shall not exceed the maximum permitted average limits,specified above by more than 20dB under any condition fo modulation.

4.2.2. Test procedure

The EUT was placed on a turn table which was 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on a antenna tower. At the frequency band of 30MHz to 1GHz,The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 to 4 m for horizontal and vertical polarizations. The broadband antenna (calibrated by dipole antenna) was used as a receiving antenna. At the frequency band of 1GHz to 5GHz,The measuring antenna moved from 1 to 4 m for horizontal and vertical polarization. The horn antenna was used as a receiving antenna.

The resolution bandwidth and video bandwidth of the test receiver was 120 KHz and 300KHz for Quasi-peak detection at frequency below 1GHz.

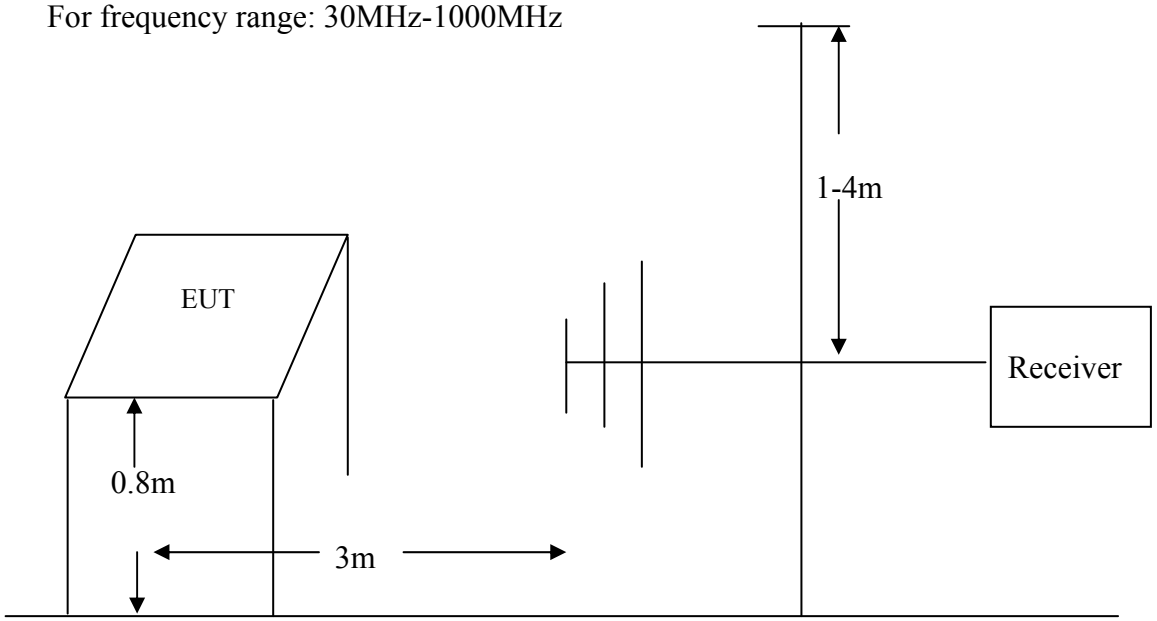
The resolution bandwidth and video bandwidth of the test receiver was1MHz and 1MHz for Peak detection at frequency above 1GHz.

The EUT position(X.-axis, Y-axis, Z-axis) were checked and worse case was happened in Y-axis position.So Y-axis position was chose for find measurement.

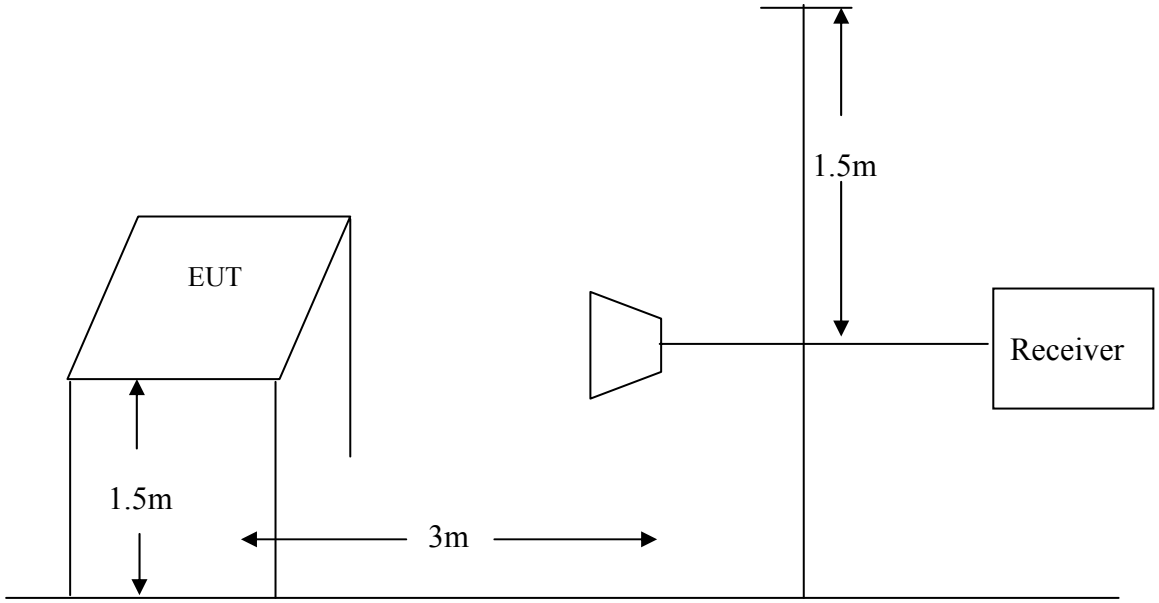
The EUT was tested in Chamber Site.

4.2.3. Test Setup Diagram

For frequency range: 30MHz-1000MHz



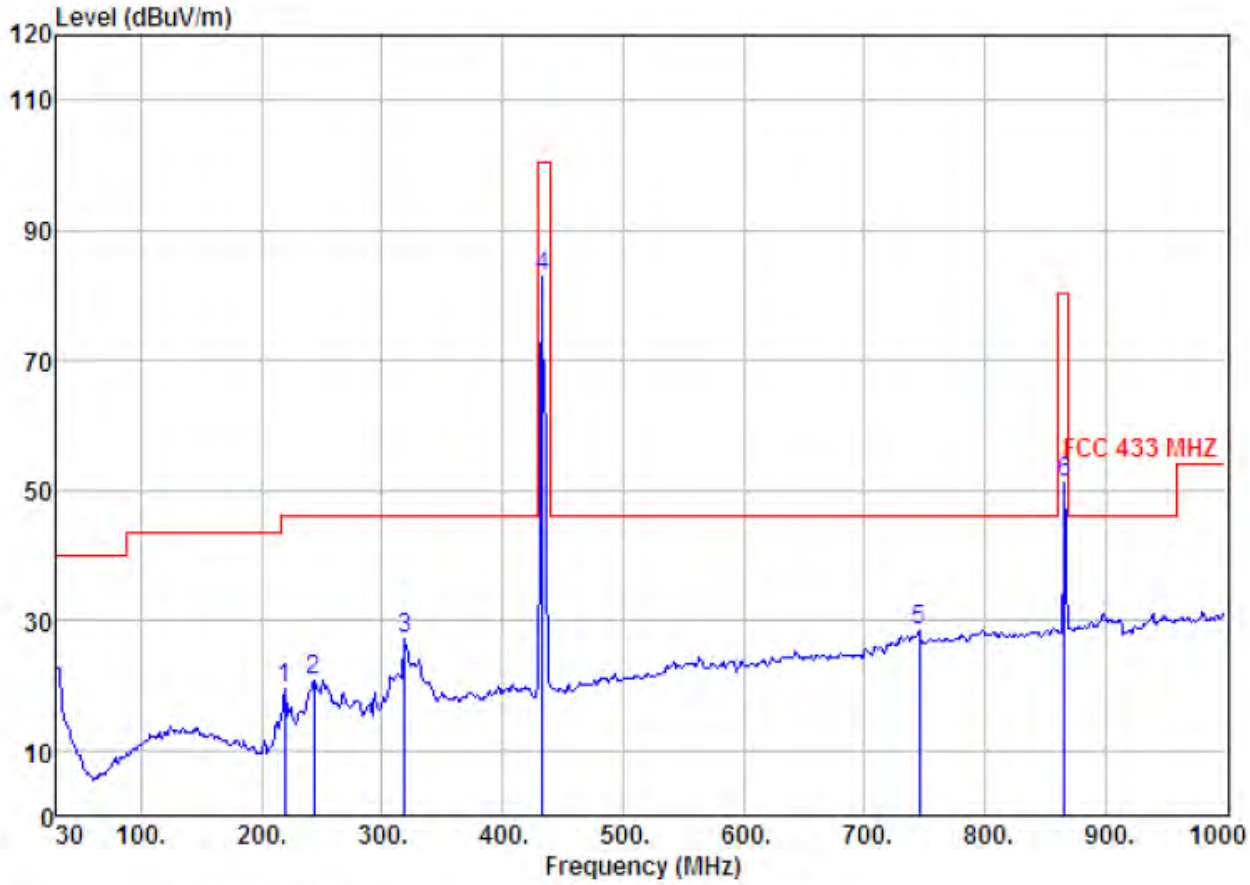
For frequency range: 1 GHz -5GHz



4.2.4. Test result

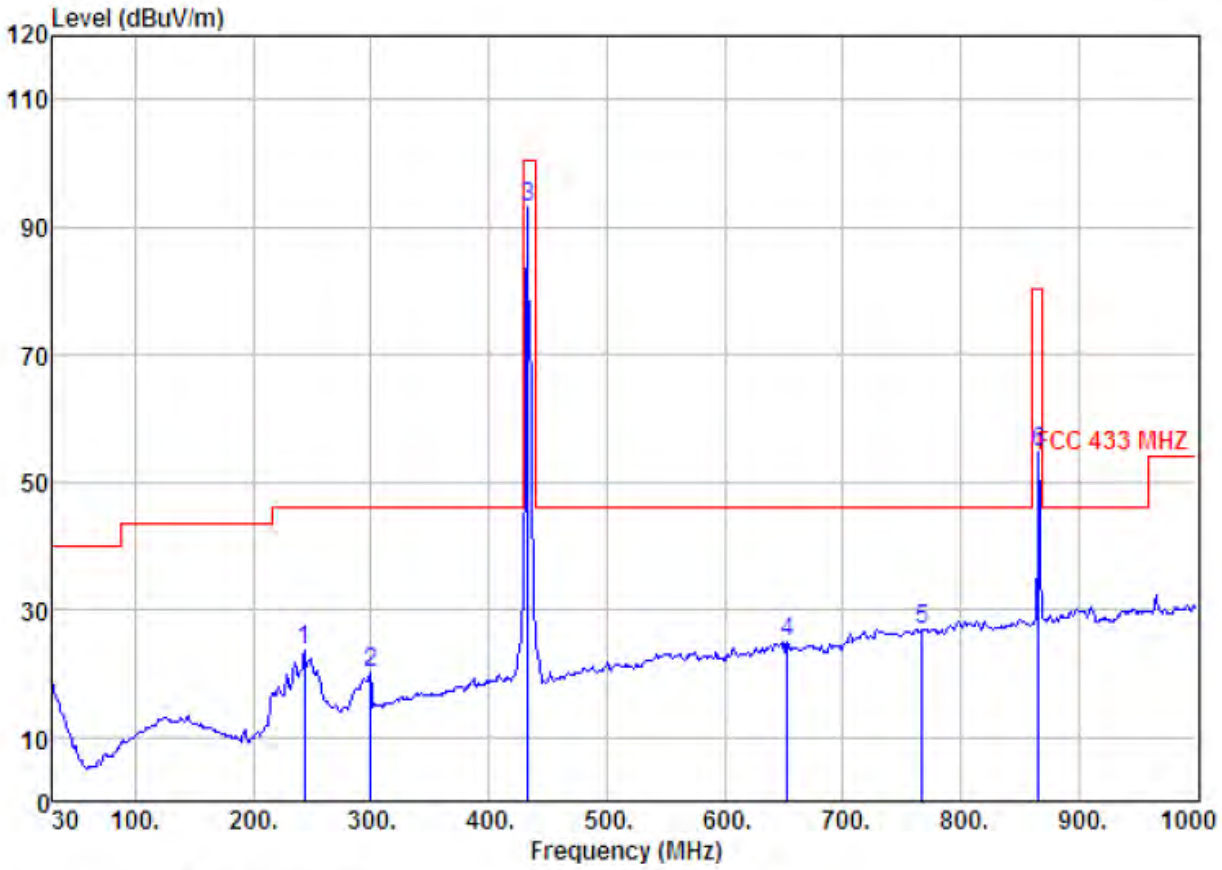
Pass.

Test Data (worst mode: Y-axis)



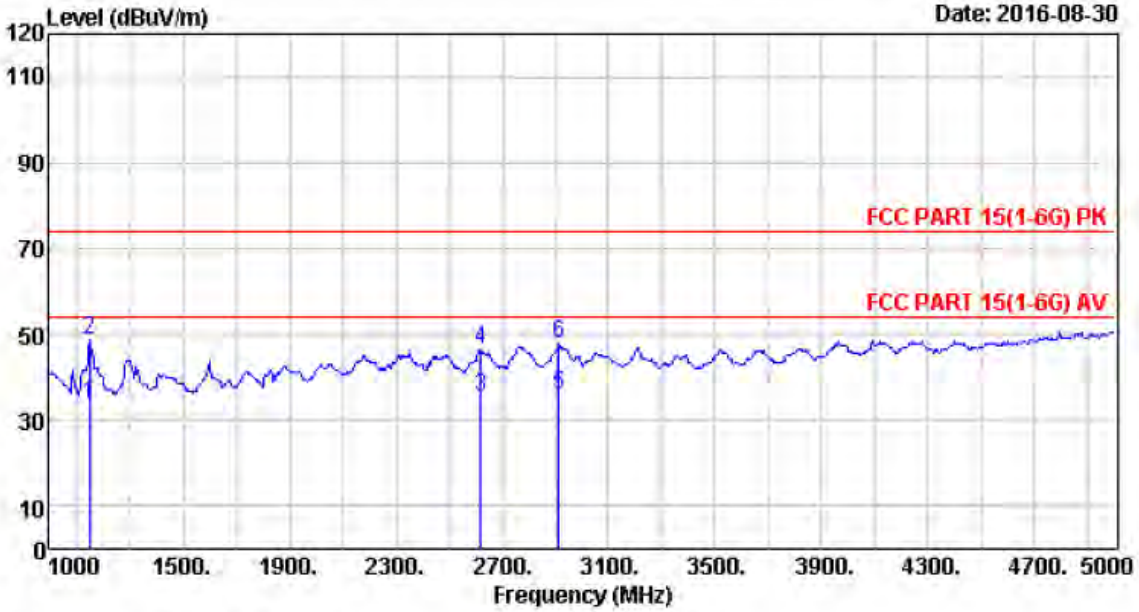
Site no. : 1# 966 chamber Data no. : 385
Dis. / Ant. : 3m 27137 Ant. pol. : VERTICAL
Limit : FCC 433 MHZ
Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
Engineer : Tony
EUT : Lighting Controller
Power : DC 4.5V
M/N : OPL102
Test Mode : 433Mhz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	219.15	9.10	1.94	39.48	19.67	46.00	26.33	QP
2	243.40	10.78	2.14	38.51	20.67	46.00	25.33	QP
3	319.06	13.53	2.40	42.10	27.20	46.00	18.80	QP
4	433.00	16.11	2.78	95.08	82.91	100.40	17.49	Peak
5	745.86	22.26	3.90	33.44	28.53	46.00	17.47	QP
6	866.00	22.87	3.79	55.06	51.06	80.40	29.34	Peak



Site no. : 1# 966 chamber Data no. : 386
Dis. / Ant. : 3m 27137 Ant. pol. : HORIZONTAL
Limit : FCC 433 MHZ
Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
Engineer : Tony
EUT : Lighting Controller
Power : DC 4.5V
M/N : OPL102
Test Mode : 433Mhz

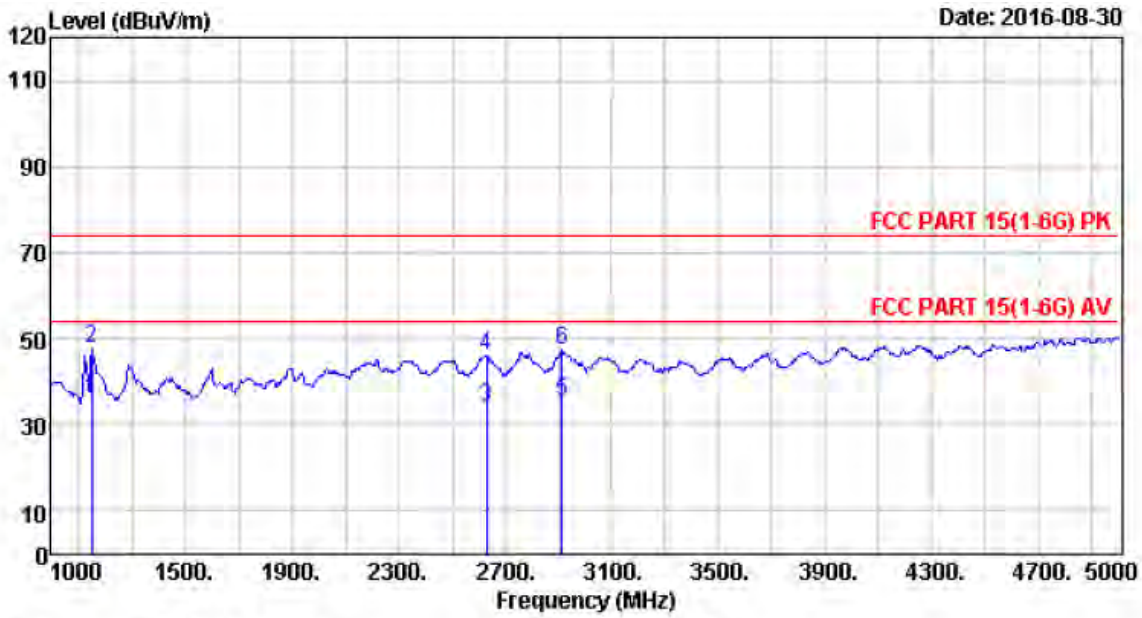
	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	243.40	10.78	2.14	10.73	23.65	46.00	22.35	QP
2	299.66	13.01	2.38	4.89	20.28	46.00	25.72	QP
3	433.00	16.11	2.78	74.25	93.14	100.40	7.26	Peak
4	652.74	20.09	3.58	1.31	24.98	46.00	21.02	QP
5	767.20	22.04	3.87	1.06	26.97	46.00	19.03	QP
6	866.00	22.87	3.79	28.00	54.66	80.40	25.74	Peak



Site no. : 966 1# chamber Data no. : 383
Dis. / Ant. : 3m ANT 1-18G Ant. pol. : HORIZONTAL
Limit : FCC PART 15(1-6G) PK
Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
Engineer : Tony
EUT : Lighting Controller
Power : DC 4.5V
M/N : OPL102
Test Mode : TX 433MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	1152.00	24.24	3.71	35.21	40.82	33.56	54.00	20.44	Average
2	1152.00	24.24	3.71	35.21	55.82	48.56	74.00	25.44	Peak
3	2620.00	27.77	7.27	36.22	36.52	35.34	54.00	18.66	Average
4	2620.00	27.77	7.27	36.22	47.52	46.34	74.00	27.66	Peak
5	2912.00	28.05	8.59	37.24	36.26	35.66	54.00	18.34	Average
6	2912.00	28.05	8.59	37.24	48.26	47.66	74.00	26.34	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.



Site no. : 966 1# chamber Data no. : 384
Dis. / Ant. : 3m ANT 1-18G Ant. pol. : VERTICAL
Limit : FCC PART 15(1-6G) PK
Env. / Ins. : Temp:23.6';Humi:56%;Press:101.52kPa
Engineer : Tony
EUT : Lighting Controller
Power : DC 4.5V
M/N : OPL102
Test Mode : TX 433MHz

	Freq. (MHz)	Ant. Factor (dB/m)	Cable Loss (dB)	Amp Factor (dB)	Reading (dBuV)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
1	1152.00	24.24	3.71	35.21	43.15	35.89	54.00	18.11	Average
2	1152.00	24.24	3.71	35.21	55.15	47.89	74.00	26.11	Peak
3	2632.00	27.79	7.35	36.22	35.22	34.14	54.00	19.86	Average
4	2632.00	27.79	7.35	36.22	47.22	46.14	74.00	27.86	Peak
5	2912.00	28.05	8.59	37.24	36.04	35.44	54.00	18.56	Average
6	2912.00	28.05	8.59	37.24	48.04	47.44	74.00	26.56	Peak

Remarks: 1. Emission Level= Antenna Factor + Cable Loss - Amp Factor + Reading.
2. The emission levels that are 20dB below the official limit are not reported.

Fundamental and Harmonics Average Result						
Frequency MHz	Peak Level (dBμV/m)	PDCF (dBμV/m) (see Section 5)	Average Level (dBμV/m)	Limit (dBμV/m) (average)	Over Limits dB	Polarity
433	**93.14**	-20.729	**72.41**	**80.80**	**8.39**	**H**
866	54.66	-20.729	33.93	60.80	26.87	H
433	**82.91**	-20.729	**62.18**	**80.80**	**18.62**	**V**
866	51.06	-20.729	30.33	60.80	30.47	V

Remark: The worst emission was detected at **433MHz** with corrected signal level of **72.411dBμV/m**(Limit is **80.80 dBμV/m**) when the antenna was at **Horizontal** polarization and at **1.15m** high and the turn table was at **250°**

Remark: The worst emission was detected at **433MHz** with corrected signal level of **62.181dBμV/m** (Limit is **80.80dBμV/m**) when the antenna was at **Vertical** polarization and at **2.0m** high and the turn table was at **255°**.

Remark:

1. Emission Level = Antenna Factor + Cable Loss + Reading
2. Peak Limit=Average Limit+20dB

4.3. 20dB Occupied Bandwidth

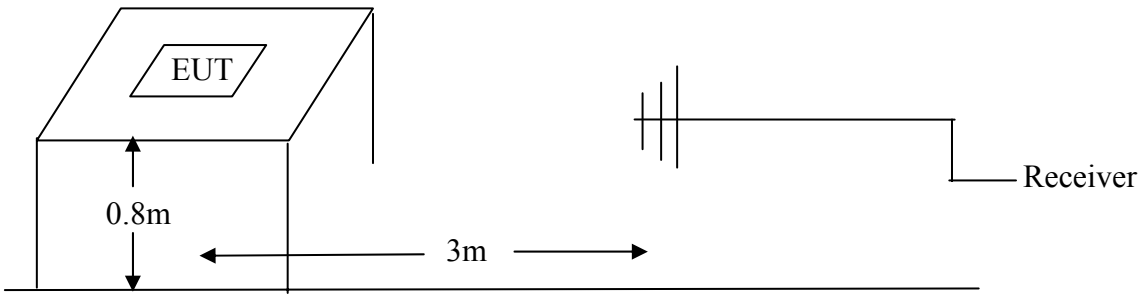
4.3.1. Applied Standard

According to 15.231(c), The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

4.3.2. Test procedure

Step 1: The EUT was placed on a table which is 0.8m above ground plane.
Step 2: EUT was set to transmit continuously.
Step 3: Set SA Center Frequency = fundamental frequency , RBW=100kHz,VBW=300kHz
Step 4:. Set SA trace max hold, then view.

4.3.3. Test Setup Diagram



4.3.4. Test Result

Pass.

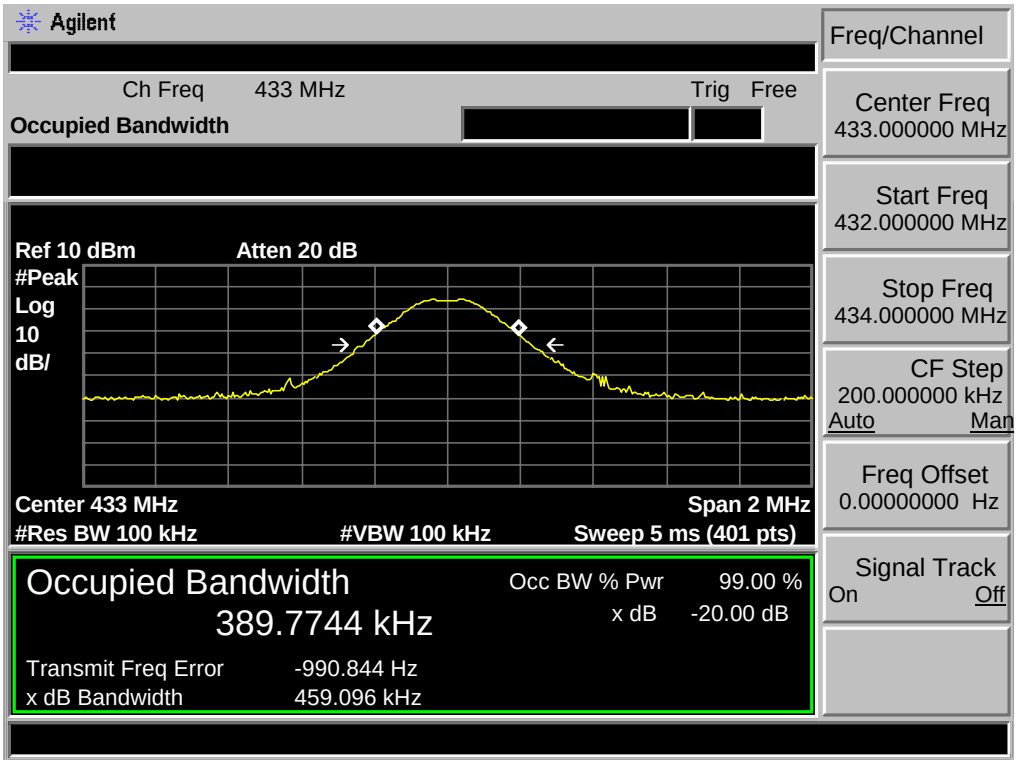
Test Data

EUT	:	Lighting Controller	Temperature:	25.4℃
Model No.	:	OPL102	Humidity	:	55%
Test Mode	:	TX mode	Test Engineer	:	Tony

Fundamental frequency (MHz)	Bandwidth Measurement (kHz)	Limit (kHz)	Result
433MHz	459.096	1084.8	PASS

Note: Limit= Fundamental frequency×0.25%=433×0.25%=1084.8kHz

The test plots as following:



4.4. Deactivation time

4.4.1. Applied Standard

According to 15.231(a) (1), A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released. A transmitter activated automatically shall cease transmission within 5 seconds after activation.

4.4.2. Test procedure

Step 1: The EUT was placed on a table which is 0.8m above ground plane.
Step 2: Set EUT as normal operation.
Step 3: Set SA Center Frequency = fundamental frequency , RBW=100kHz,VBW=300kHz
Step 4:. Set SA trace max hold, then view.

4.4.3. Test Setup Diagram

Refer to clause 4.3.3

4.4.4. Test Result

Pass.

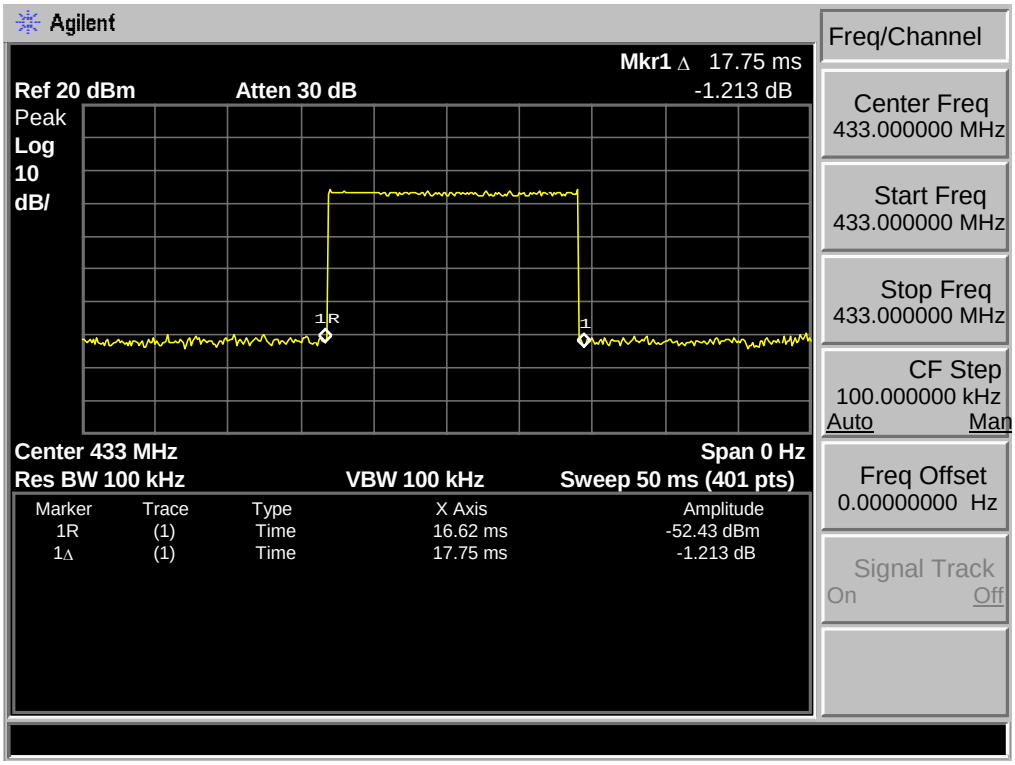
Test Data

EUT	:	Lighting Controller	Temperature:		25.4℃
Model No.	:	OPL102	Humidity	:	55%
Test Mode	:	TX mode	Test Engineer	:	Tony

Set the spectrum to zero span, activated the EUT by manually, And then, we could see the transmitting wave in the spectrum, when the time marker went to “1”, released the EUT, After 50ms, we could see the EUT stop transmitting.

Fundamental frequency (MHz)	Transmission time (ms)	Limit (s)	Result
433MHz	17.75ms	5s	PASS

The test plots as following:

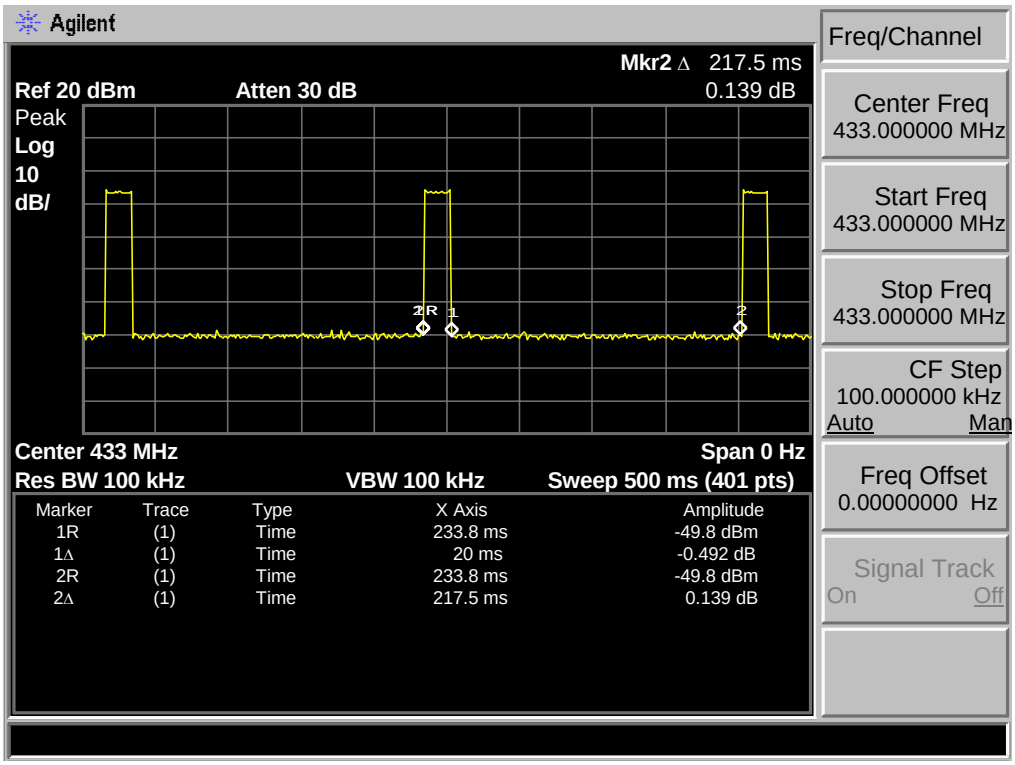


4.5. antenna requirement

4.5.1 .15.203 requirement:for intentional device,according to 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

4.5.2. the EUT antenna is Integral antenna .lt comply with the standard requirement

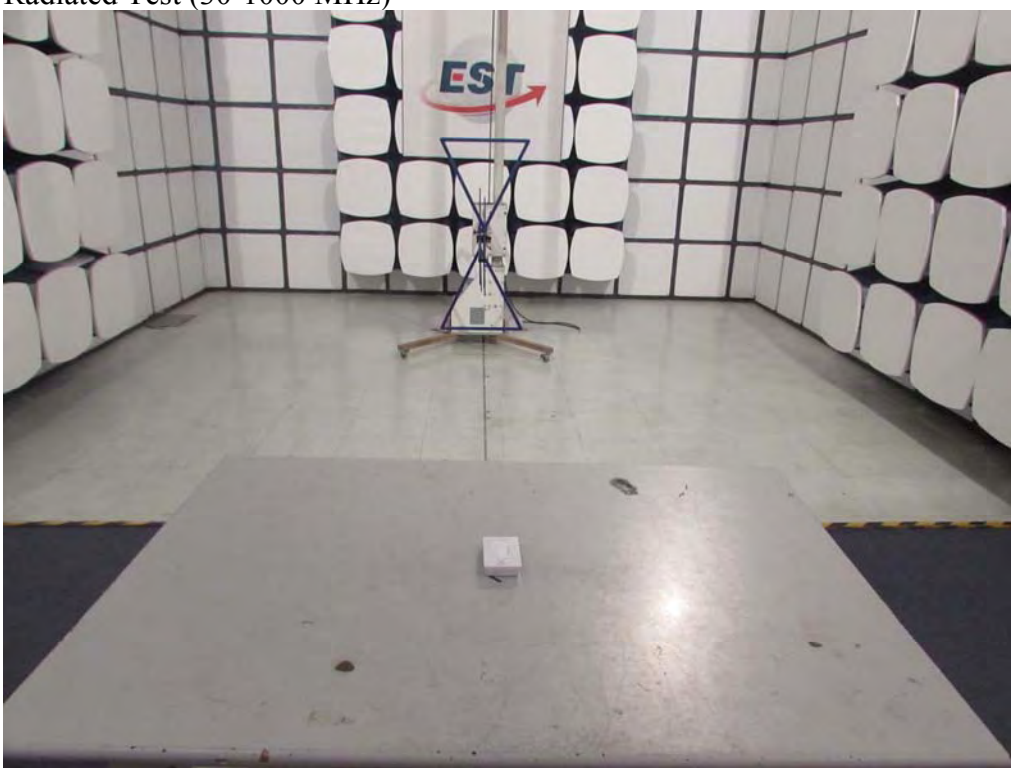
5. DUTY CYCLE CORRECTION FACTOR



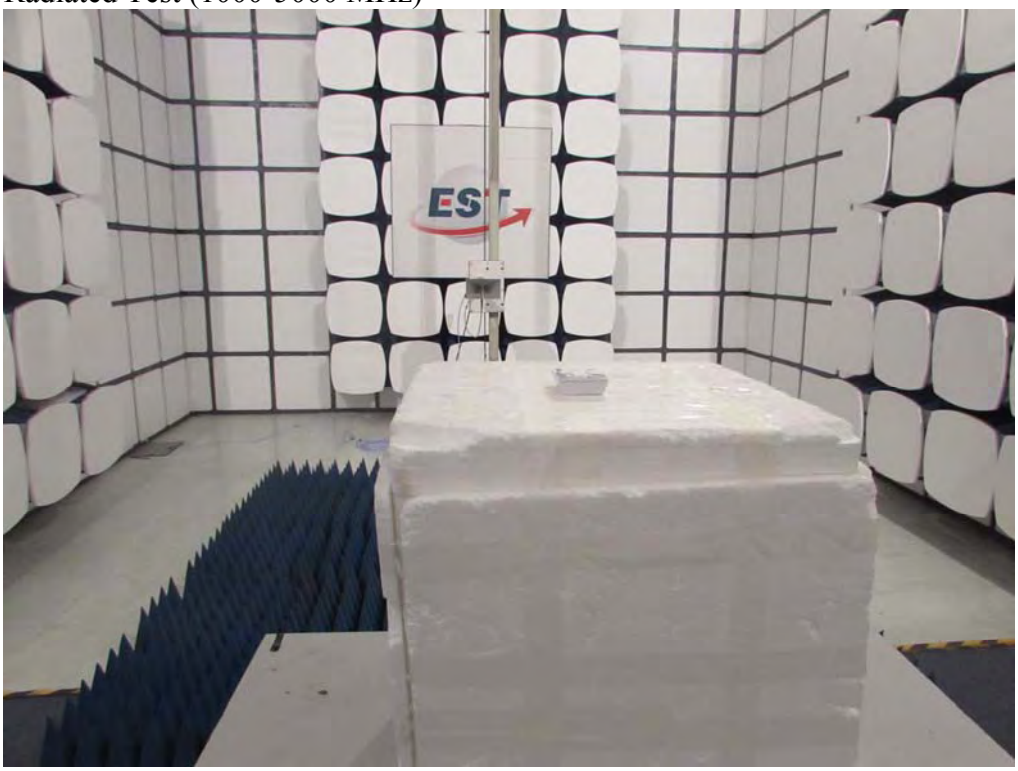
Duty cycle= T ontime / T period=20ms/217.5ms= 0.09195
PDCF=20*log(Duty cycle)=20*log(0.09195)= -20.729

6. PHOTOGRAPHS OF TEST SET-UP

Radiated Test (30-1000 MHz)



Radiated Test (1000-5000 MHz)



7. POHTO OF EUT

External Photos

M/N: OPL102

External Photos

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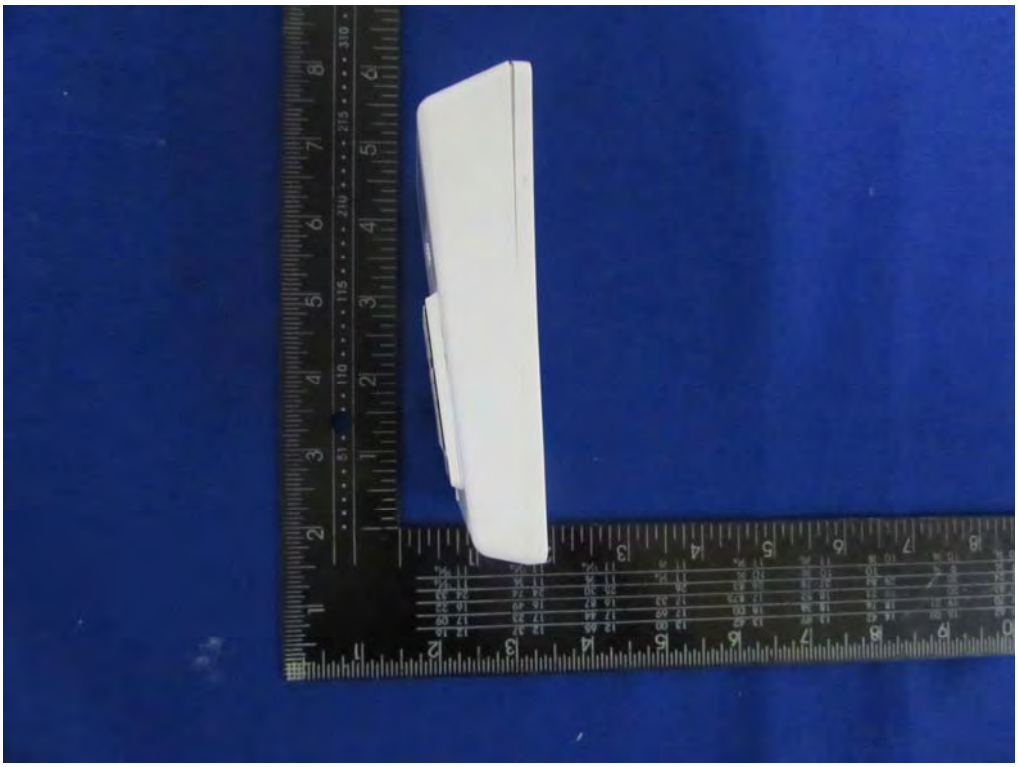

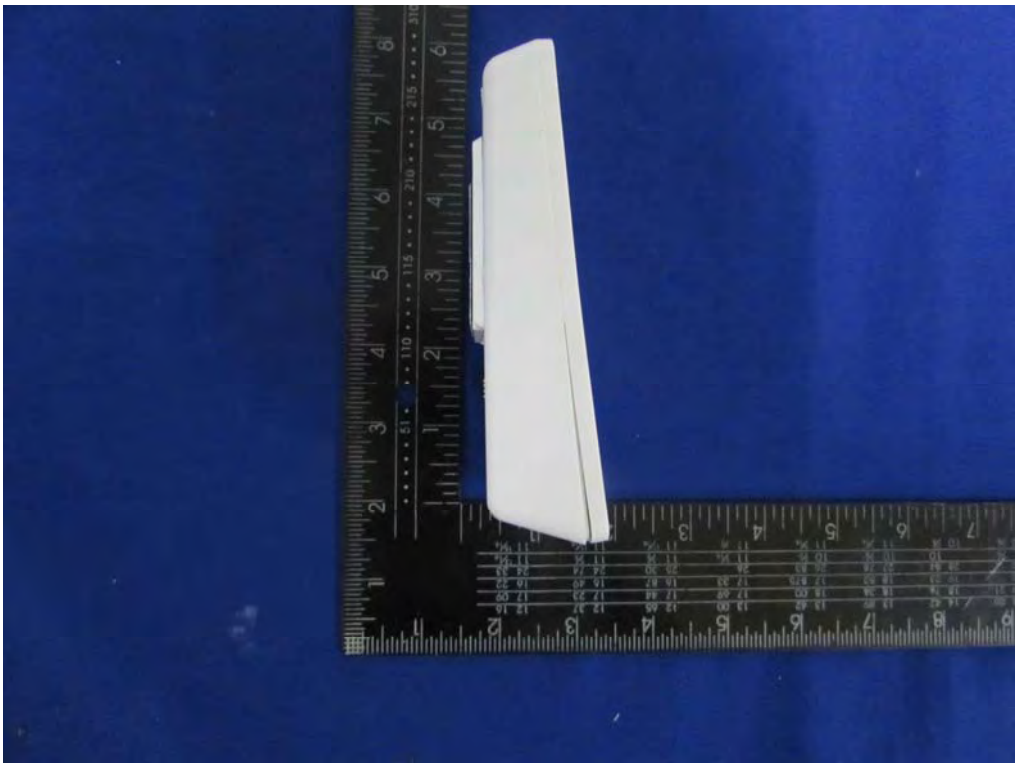

External Photos

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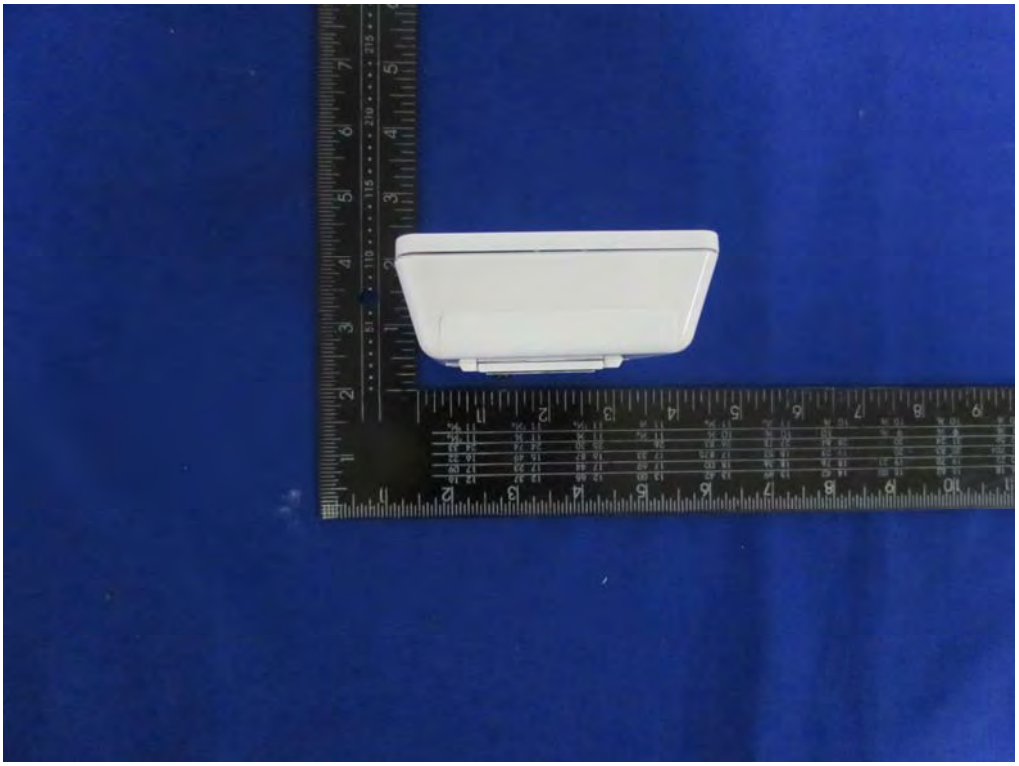
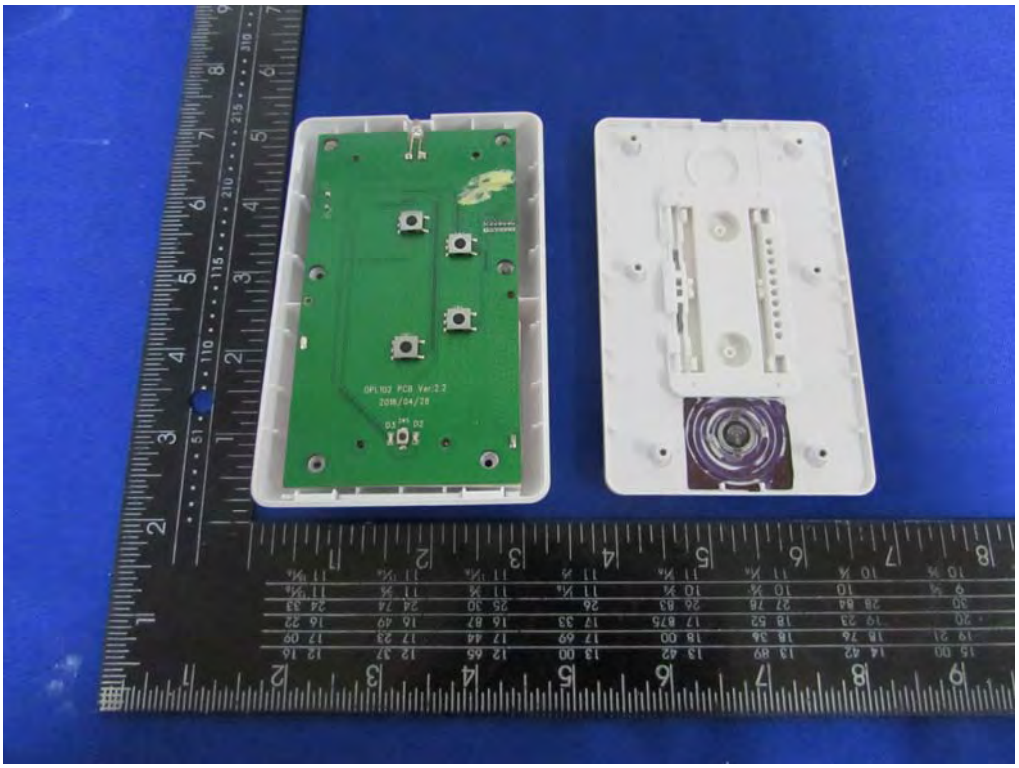


Internal Photos

M/N: OPL102



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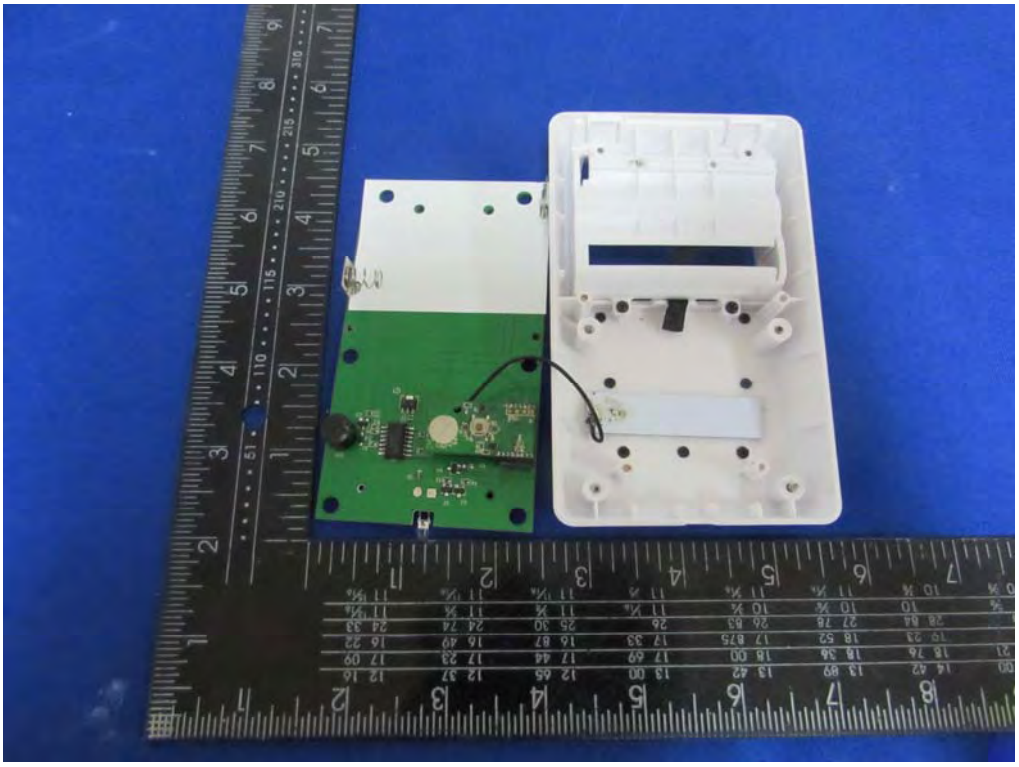
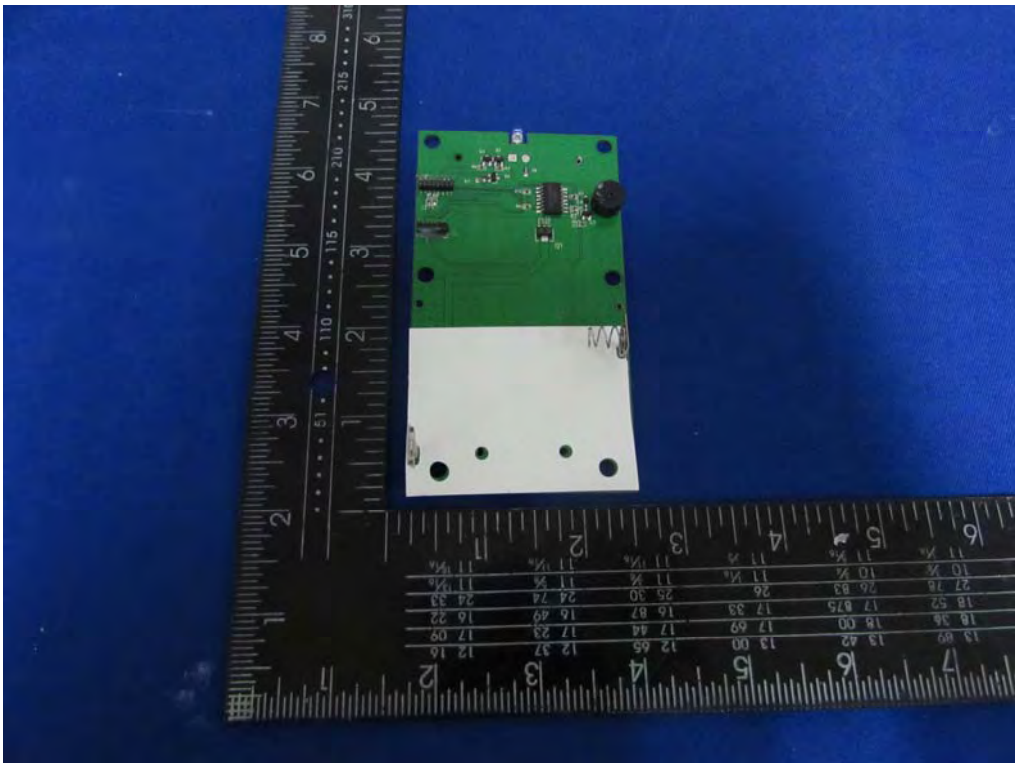
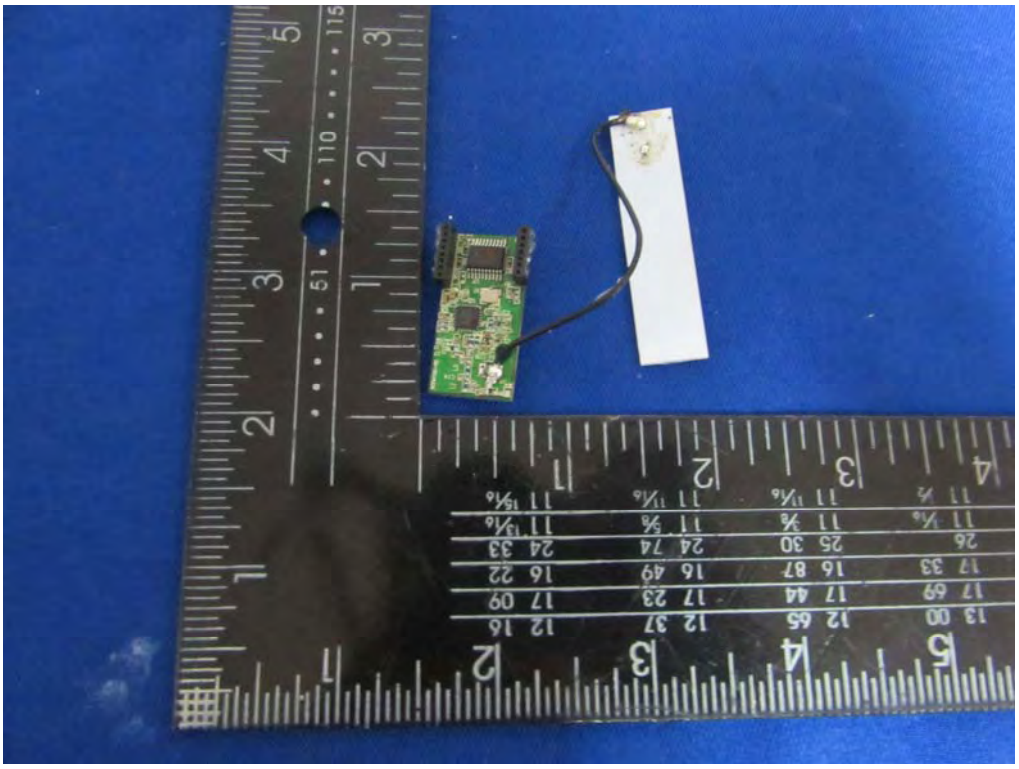
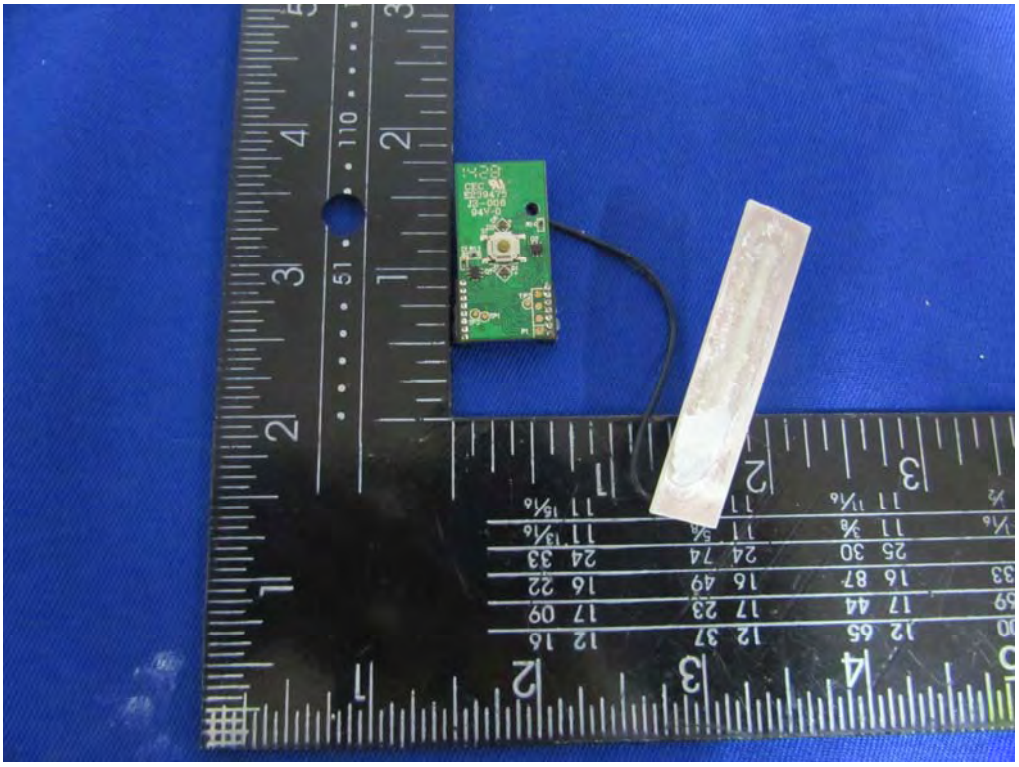




Internal Photos
M/N: OPL102





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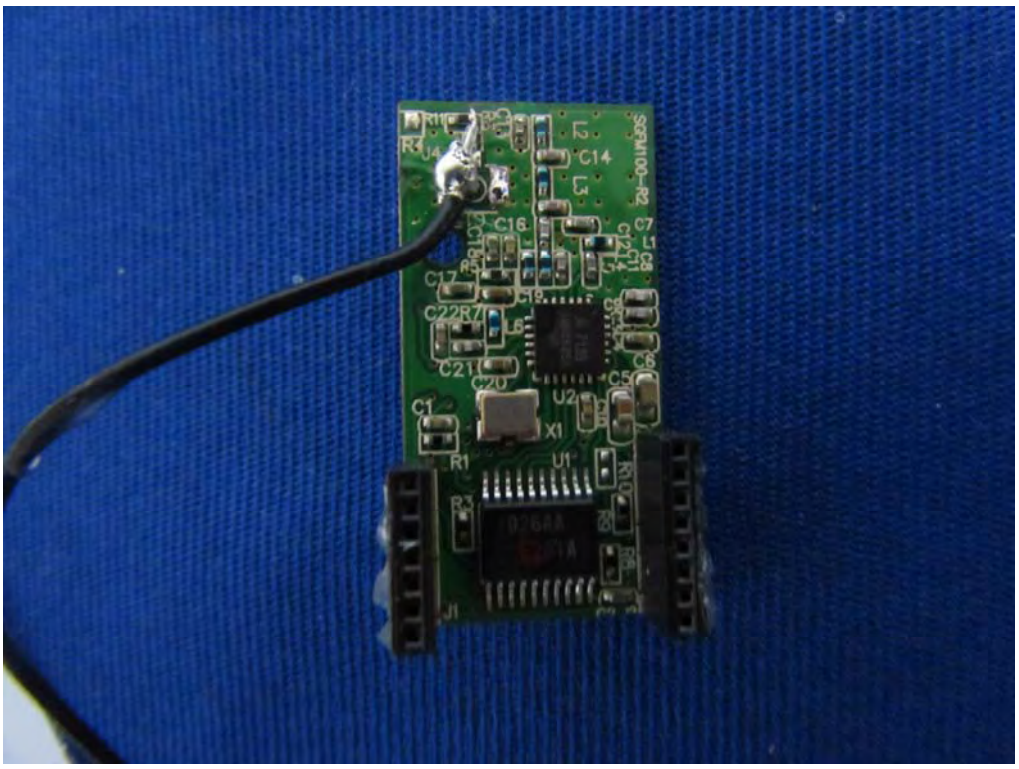

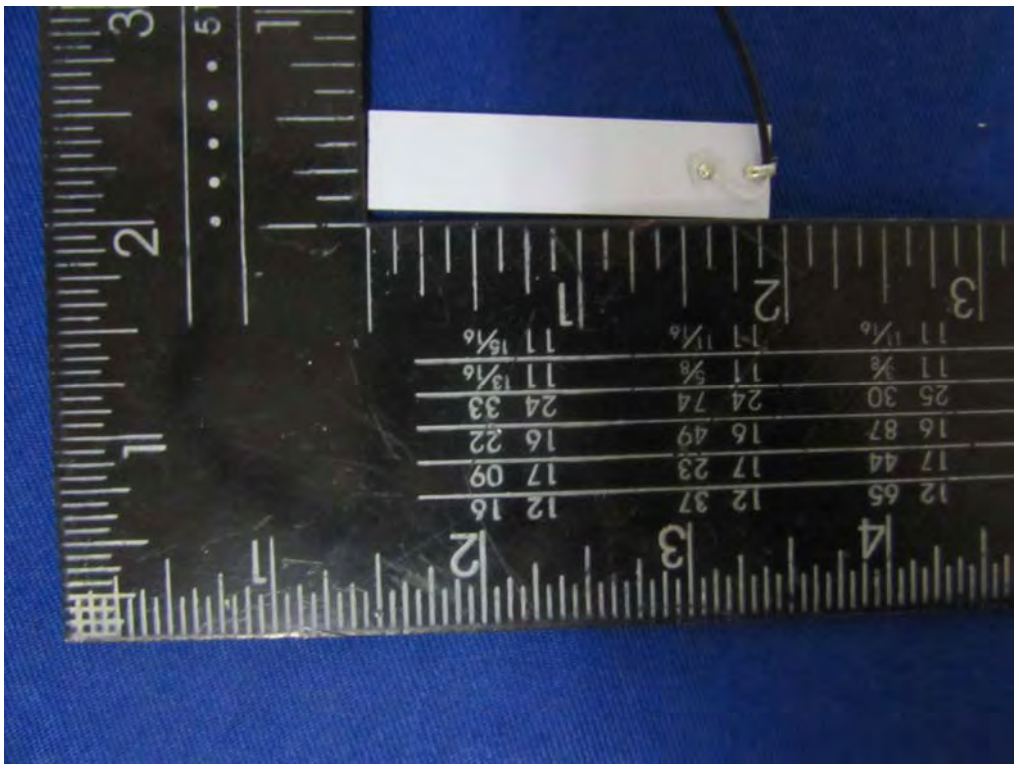

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