

TEST REPORT

Reference No. : WTS17S0990634E
FCC ID : 2AIOC-LED01W
Applicant : HANK ELECTRONICS CO., LTD.
Address : Floor 2nd-7th,A8,Hongye Industry City, Lezhujiao, Zhoushi Road,
Baoan District, Shenzhen,Guangdong,518000, China.
Manufacturer : The same as above
Address : The same as above
Product : LED Bulb
Model(s) : HKWL-LED01W
Standards : FCC CFR47 Part 15 C Section 15.247:2016
Date of Receipt sample : 2017-09-01
Date of Test : 2017-09-02 to 2017-09-11
Date of Issue : 2017-09-12
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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2 Laboratories Introduction

Waltek Services Test Group Ltd. is one of the largest and the most comprehensive third party testing organizations in China, our headquarter located in Shenzhen (CNAS Registration No. L3110, A2LA Certificate Number: 4243.01) and have branches in Foshan (CNAS Registration No. L6478), Dongguan (CNAS Registration No. L9950), Zhongshan, Suzhou (CNAS Registration No. L7754), Ningbo and Hong Kong, Our test capability covered four large fields: safety test. Electronic Magnetic Compatibility(EMC), reliability and energy performance, Chemical test. Meanwhile, Waltek has got recognition as registration and accreditation laboratory from EMSD (Electrical and Mechanical Services Department), and American Energy star, FCC(The Federal Communications Commission), CPSC(Consumer Product Safety Commission), CEC(California energy efficiency), IC(Industry Canada) and ELI(Efficient Lighting Initiative). It's the strategic partner and data recognition laboratory of international authoritative organizations, such as UL, Intertek(ETL-SEMKO), CSA, TÜV Rheinland, TÜV SÜD, etc. As a professional, comprehensive, justice international test organization, we still keep the scientific and rigorous work attitude to help each client satisfy the international standards and assist their product enter into globe market smoothly.

Waltek Services (Shenzhen) Co., Ltd.

A. Accreditations for Conformity Assessment (International)

Country/Region	Accreditation Body	Scope	Note
USA	CNAS (Registration No.: L3110) A2LA (Certificate No.: 4243.01)	FCC ID \ DOC \ VOC	1
Canada		IC ID \ VOC	2
Japan		MIC-T \ MIC-R	-
Europe		EMCD \ RED	-
Taiwan		NCC	-
Hong Kong		OFCA	-
Australia		RCM	-
India		WPC	-
Thailand	International Services	NTC	-
Singapore		IDA	-
Note:			
1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476.			
2. IC Canada Registration No.: 7760A			

B. TCBs and Notify Bodies Recognized Testing Laboratory.

Recognized Testing Laboratory of ...	Notify body number
TUV Rheinland	Optional.
Intertek	
TUV SUD	
SGS	
Phoenix Testlab GmbH	0700
Element Materials Technology Warwick Ltd	0891
Timco Engineering, Inc.	1177
Eurofins Product Service GmbH	0681

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3 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207(a)	PASS
Radiated Emissions	15.247 15.205(a) 15.209(a)	PASS
6dB Bandwidth	15.247(a)(2)	PASS
Maximum Peak Output Power	15.247(b)(3),(4)	PASS
Power Spectral Density	15.247(e)	PASS
Band Edge	15.247(d)	PASS
Antenna Requirement	15.203	PASS
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

4 Contents

	Page
1 COVER PAGE.....	1
2 LABORATORIES INTRODUCTION.....	2
3 TEST SUMMARY.....	3
4 CONTENTS.....	4
5 GENERAL INFORMATION.....	6
5.1 GENERAL DESCRIPTION OF E.U.T.	6
5.2 DETAILS OF E.U.T.	6
5.3 CHANNEL LIST.....	6
5.4 TEST MODE.....	7
6 EQUIPMENT USED DURING TEST.....	8
6.1 EQUIPMENTS LIST.....	8
6.2 DESCRIPTION OF SUPPORT UNITS.....	9
6.3 MEASUREMENT UNCERTAINTY.....	9
6.4 TEST EQUIPMENT CALIBRATION.....	9
7 CONDUCTED EMISSION.....	10
7.1 E.U.T. OPERATION.....	10
7.2 EUT SETUP.....	10
7.3 MEASUREMENT DESCRIPTION.....	11
7.4 CONDUCTED EMISSION TEST RESULT.....	11
8 RADIATED EMISSIONS.....	13
8.1 EUT OPERATION.....	13
8.2 TEST SETUP.....	14
8.3 SPECTRUM ANALYZER SETUP.....	15
8.4 TEST PROCEDURE.....	16
8.5 CORRECTED AMPLITUDE & MARGIN CALCULATION.....	16
8.6 SUMMARY OF TEST RESULTS.....	17
9 BAND EDGE MEASUREMENT.....	26
9.1 TEST PROCEDURE.....	26
9.2 TEST RESULT.....	27
10 6 DB BANDWIDTH MEASUREMENT.....	32
10.1 TEST PROCEDURE:.....	32
10.2 TEST RESULT:.....	32
11 MAXIMUM PEAK OUTPUT POWER.....	38
11.1 TEST PROCEDURE:.....	38
11.2 TEST RESULT:.....	38
12 POWER SPECTRAL DENSITY.....	39
12.1 TEST PROCEDURE:.....	39
12.2 TEST RESULT:.....	39
13 ANTENNA REQUIREMENT.....	45
14 RF EXPOSURE.....	46
15 PHOTOGRAPHS – MODEL HKWL-LED01W TEST SETUP.....	47
15.1 CONDUCTED EMISSION.....	47
15.2 RADIATED EMISSION.....	47
16 PHOTOGRAPHS - CONSTRUCTIONAL DETAILS.....	49

16.1	MODEL HKWL-LED01W EXTERNAL VIEW.....	49
16.2	MODEL HKWL-LED01W INTERNAL VIEW.....	52

5 General Information

5.1 General Description of E.U.T.

Product:	LED Bulb
Model(s):	HKWL-LED01W
Model Description:	N/A
Operation Frequency:	802.11b/g/n HT20: 2412MHz ~ 2462MHz
The Lowest Oscillator:	26MHz
Antenna type	PCB printed antenna
Antenna Gain:	0dBi
Type of modulation:	IEEE 802.11b (CCK/QPSK/BPSK,11Mbps max.) IEEE 802.11g (BPSK/QPSK/16QAM/64QAM,54Mbps max.) IEEE 802.11n (BPSK/QPSK/16QAM/64QAM,HT20:72Mbps max.)

5.2 Details of E.U.T.

Technical Data:	Input:100-240V,50/60Hz, 7W
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5.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2412	2	2417	3	2422	4	2427
5	2432	6	2437	7	2442	8	2447
9	2452	10	2457	11	2462	12	-

5.4 Test Mode

Table 1 Tests Carried Out Under FCC part 15.247

Test Items	Mode	Data Rate	Channel	TX/RX
Maximum Peak Output Power	802.11b	11 Mbps	1/6/11	TX
	802.11g	54 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX
Power Spectral Density	802.11b	11 Mbps	1/6/11	TX
	802.11g	54 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX
6dB Bandwidth	802.11b	11 Mbps	1/11	TX
	802.11g	54 Mbps	1/11	TX
	802.11n HT20	108 Mbps	1/11	TX
Band Edge	802.11b	11 Mbps	1/6/11	TX
	802.11g	54 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX
Transmitter Spurious Emissions	802.11b	11 Mbps	1/6/11	TX
	802.11g	54 Mbps	1/6/11	TX
	802.11n HT20	108 Mbps	1/6/11	TX

Note :Parameters set by test software during channel & power tests, the software provided by the customer was used to set the operating channels as well as the output power level. The RF output power set is the power expected by the manufacturer and is going to be fixed on the firmware of the final product .

Table 2 Tests Carried Out Under FCC part 15.207 & FCC part 15.209

Test Item	Test Mode
Conduction Emission, 0.15MHz to 30MHz	Transmitting

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	2016-09-15	2017-09-14
2.	LISN	R&S	ENV216	101215	2016-09-15	2017-09-14
3.	Cable	Top	TYPE16(3.5M)	-	2016-09-15	2017-09-14
Conducted Emissions Test Site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	101155	2016-09-15	2017-09-14
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	2016-09-15	2017-09-14
3.	Limitter	York	MTS-IMP-136	261115-001-0024	2016-09-15	2017-09-14
4.	Cable	LARGE	RF300	-	2016-09-15	2017-09-14
3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	EMC Analyzer	Agilent	E7405A	MY45114943	2016-09-15	2017-09-14
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	2016-09-15	2017-09-14
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2016-04-08	2017-04-07
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2016-09-13	2017-09-12
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2016-09-15	2017-09-14
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2016-09-15	2017-09-14
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2016-09-15	2017-09-14
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	2016-09-15	2017-09-14
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	2016-09-15	2017-09-14
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2016-09-15	2017-09-14
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	2016-09-15	2017-09-14
4	Cable	HUBER+SUHNER	CBL2	525178	2016-09-15	2017-09-14

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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	2016-09-15	2017-09-14
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	2016-09-15	2017-09-14
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	2016-09-15	2017-09-14

6.2 Description of Support Units

Equipment	Manufacturer	Model No.	Series No.
/	/	/	/

6.3 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (30M~1000MHz)
	± 5.47 dB (1000M~25000MHz)
Conducted Spurious Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)

6.4 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 C63.10:2013
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Class/Severity:	Class B
Limit:	66-56 dB μ V between 0.15MHz & 0.5MHz 56 dB μ V between 0.5MHz & 5MHz 60 dB μ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)

7.1 E.U.T. Operation

Operating Environment :

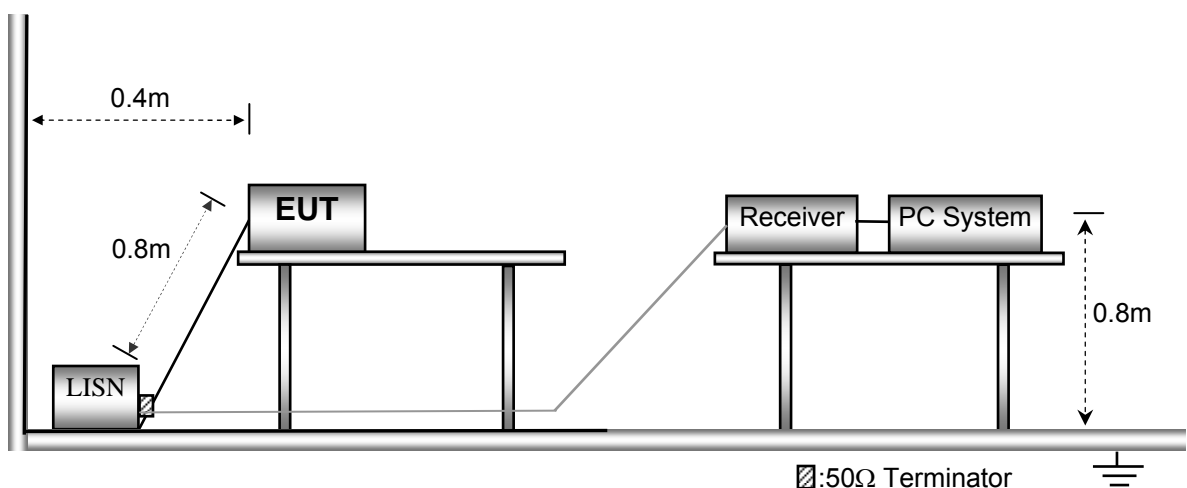
Temperature:	21.5 °C
Humidity:	51.9 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation :

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

7.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10.



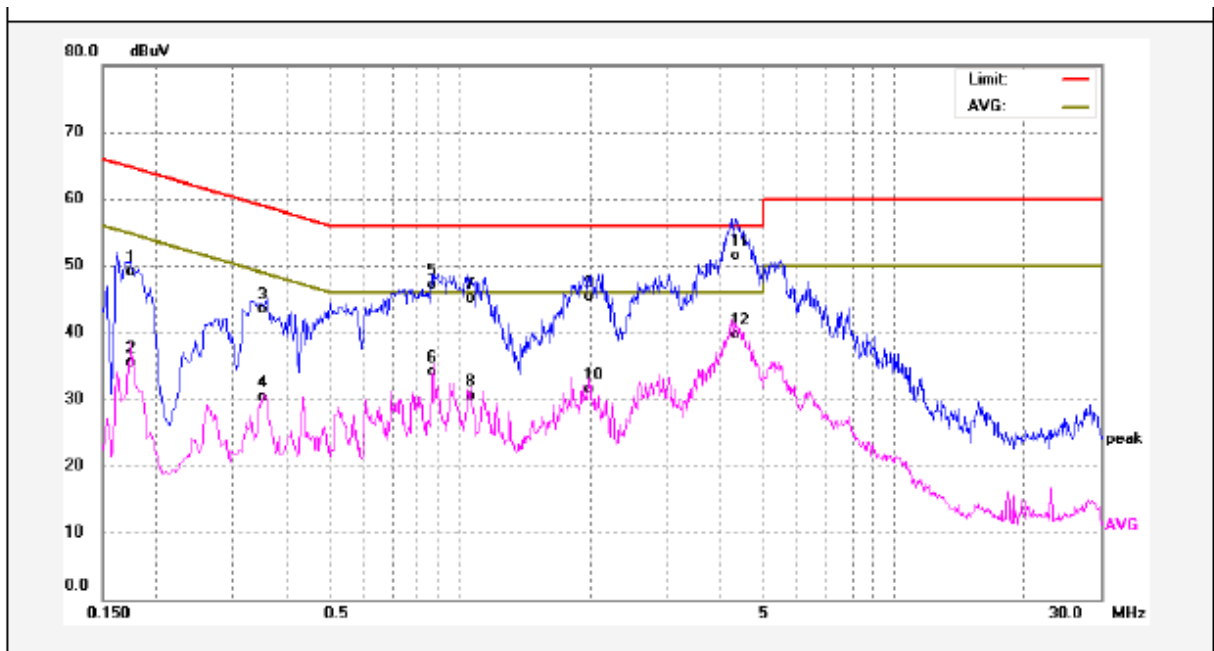
7.3 Measurement Description

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

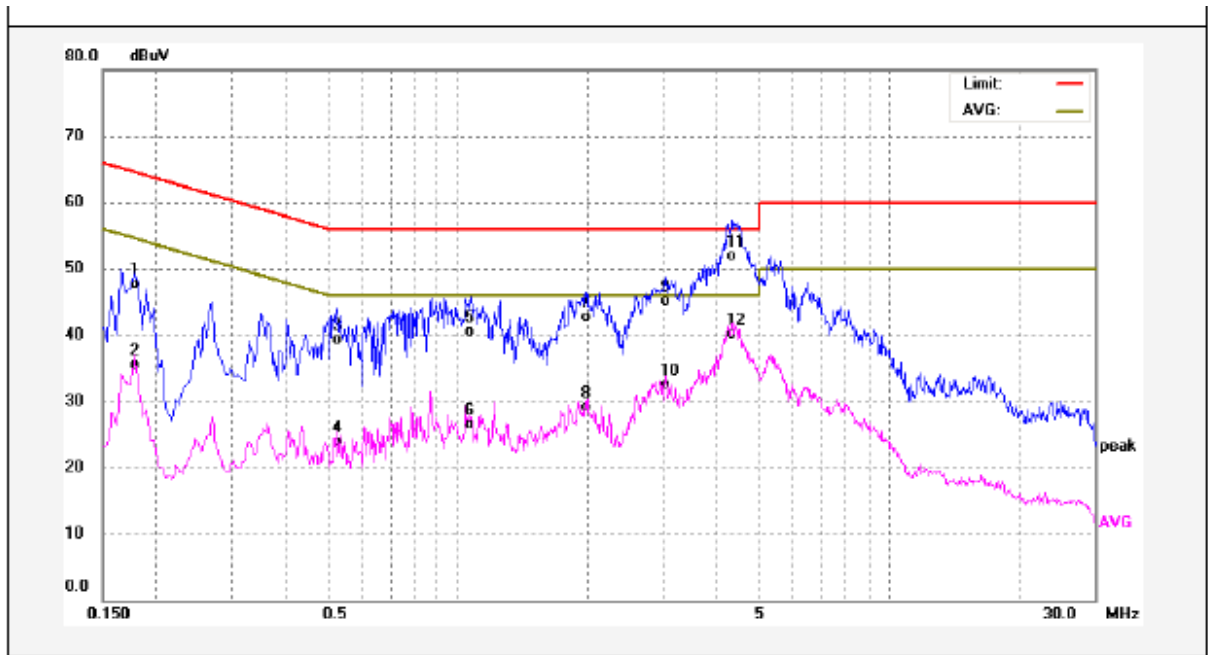
An initial pre-scan was performed on the live and neutral lines.

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1740	39.24	9.87	49.11	64.76	-15.65	QP	
2	0.1740	25.59	9.87	35.46	54.76	-19.30	AVG	
3	0.3540	33.45	10.06	43.51	58.87	-15.36	QP	
4	0.3540	20.30	10.06	30.36	48.87	-18.51	AVG	
5	0.8700	37.08	10.06	47.14	56.00	-8.86	QP	
6	0.8700	24.04	10.06	34.10	46.00	-11.90	AVG	
7	1.0580	34.92	10.19	45.11	56.00	-10.89	QP	
8	1.0580	20.27	10.19	30.46	46.00	-15.54	AVG	
9	1.9940	35.10	10.20	45.30	56.00	-10.70	QP	
10	1.9940	21.28	10.20	31.48	46.00	-14.52	AVG	
11	4.3260	41.29	10.26	51.55	56.00	-4.45	QP	
12	4.3260	29.37	10.26	39.63	46.00	-6.37	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1780	37.74	9.87	47.61	64.57	-16.96	QP	
2	0.1780	25.71	9.87	35.58	54.57	-18.99	AVG	
3	0.5260	29.22	10.07	39.29	56.00	-16.71	QP	
4	0.5260	13.89	10.07	23.96	46.00	-22.04	AVG	
5	1.0740	30.37	10.21	40.58	56.00	-15.42	QP	
6	1.0740	16.34	10.21	26.55	46.00	-19.45	AVG	
7	1.9900	32.60	10.20	42.80	56.00	-13.20	QP	
8	1.9900	18.88	10.20	29.08	46.00	-16.92	AVG	
9	3.0340	34.93	10.24	45.17	56.00	-10.83	QP	
10	3.0340	22.22	10.24	32.46	46.00	-13.54	AVG	
11	4.3340	41.73	10.26	51.99	56.00	-4.01	QP	
12	4.3340	29.79	10.26	40.05	46.00	-5.95	AVG	

8 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: ANSI C63.10:2013

Test Result: PASS

Measurement Distance: 3m

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	$20\log^{(500)}$

8.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 52.1 % RH

Atmospheric Pressure: 101.2kPa

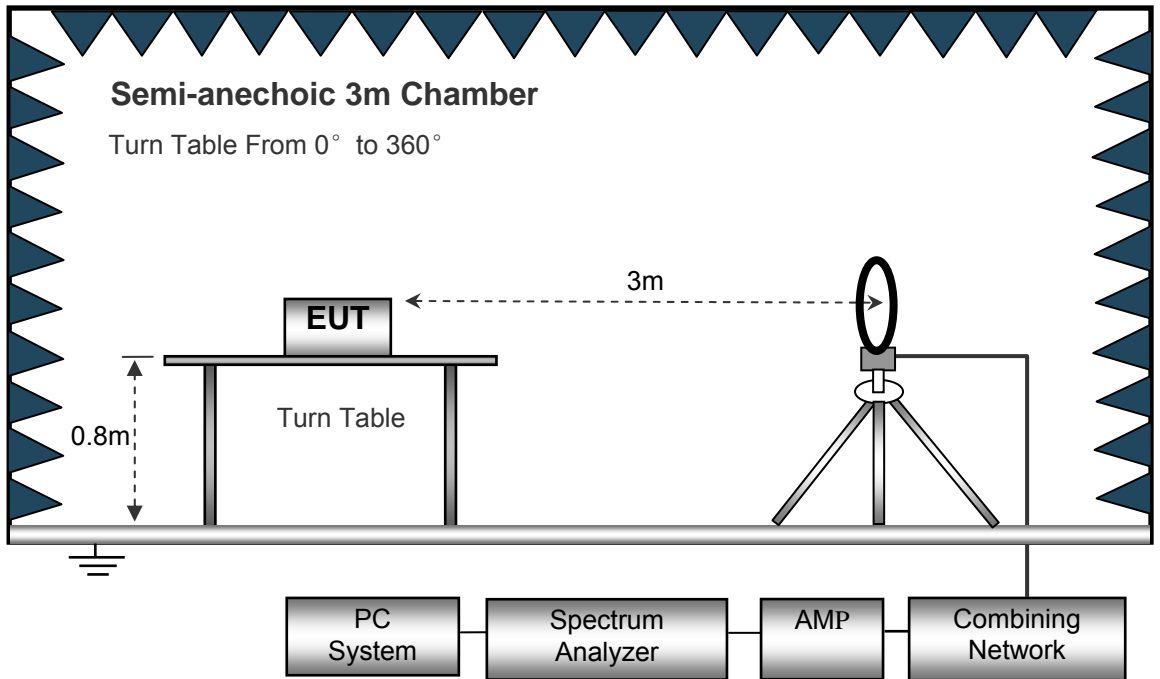
EUT Operation :

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

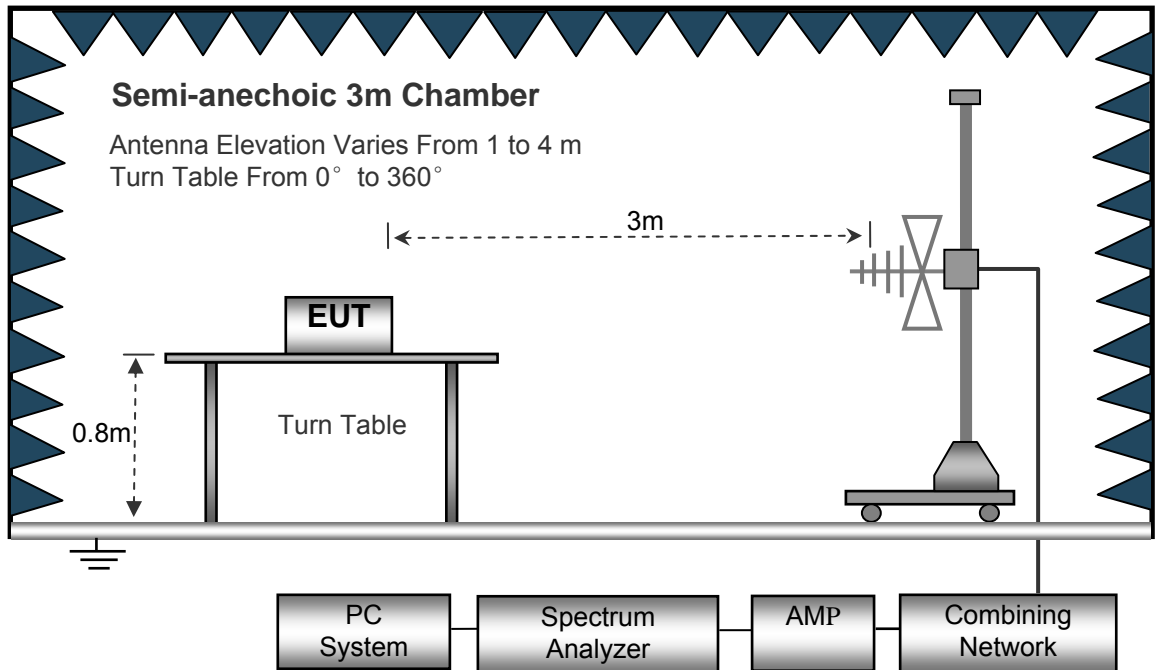
8.2 Test Setup

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

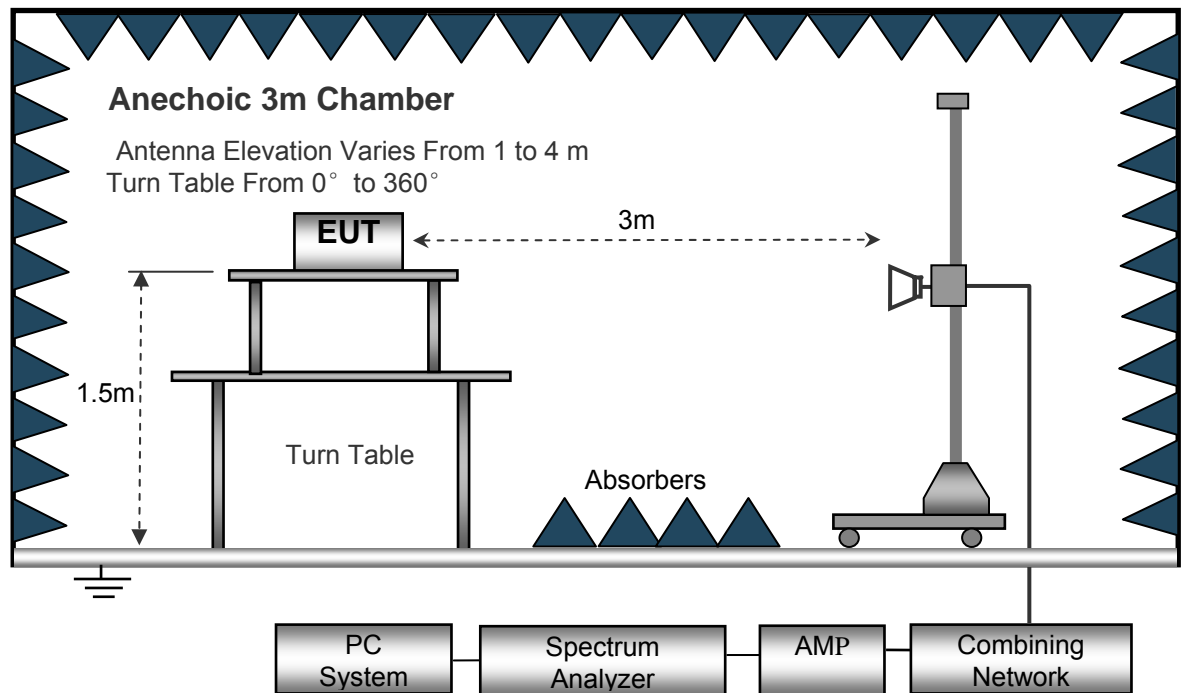
The test setup for emission measurement below 30MHz.



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



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 for 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.
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 performed in X,Y and Z axis positioning(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand),the worst condition was tested putting the eut in X axis,so the worst data were shown as follow.
8. A 2.4GHz high -pass filter is used during radiated emissions above 1GHz measurement.

8.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Limit}$$

8.6 Summary of Test Results

Test Frequency: 26MHz~ 30MHz

The measurements were more than 20 dB below the limit and not reported.

Test Frequency : 30MHz ~ 18GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11b: Low Channel 2412MHz									
226.23	40.14	QP	106	1.5	H	-11.62	28.52	46.00	-17.48
226.23	36.25	QP	19	1.5	V	-11.62	24.63	46.00	-21.37
4824.00	50.19	PK	93	1.5	V	-1.06	49.13	74.00	-24.87
4824.00	46.23	Ave	93	1.5	V	-1.06	45.17	54.00	-8.83
7236.00	41.02	PK	79	1.9	H	1.33	42.35	74.00	-31.65
7236.00	41.90	Ave	79	1.9	H	1.33	43.23	54.00	-10.77
2310.95	46.76	PK	27	1.7	V	-13.19	33.57	74.00	-40.43
2310.95	39.07	Ave	27	1.7	V	-13.19	25.88	54.00	-28.12
2354.97	43.68	PK	106	1.7	H	-13.14	30.54	74.00	-43.46
2354.97	39.00	Ave	106	1.7	H	-13.14	25.86	54.00	-28.14
2494.46	44.14	PK	59	1.2	V	-13.08	31.06	74.00	-42.94
2494.46	37.00	Ave	59	1.2	V	-13.08	23.92	54.00	-30.08

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11b: Middle Channel 2437MHz									
226.23	39.13	QP	262	1.6	H	-11.62	27.51	46.00	-18.49
226.23	37.67	QP	115	1.1	V	-11.62	26.05	46.00	-19.95
4874.00	49.85	PK	53	1.7	V	-0.62	49.23	74.00	-24.77
4874.00	44.74	Ave	53	1.7	V	-0.62	44.12	54.00	-9.88
7311.00	41.47	PK	84	1.1	H	2.21	43.68	74.00	-30.32
7311.00	42.74	Ave	84	1.1	H	2.21	44.95	54.00	-9.05
2345.89	45.05	PK	288	1.3	V	-13.19	31.86	74.00	-42.14
2345.89	39.34	Ave	288	1.3	V	-13.19	26.15	54.00	-27.85
2371.72	44.79	PK	206	1.3	H	-13.14	31.65	74.00	-42.35
2371.72	37.18	Ave	206	1.3	H	-13.14	24.04	54.00	-29.96
2485.93	43.47	PK	182	1.7	V	-13.08	30.39	74.00	-43.61
2485.93	36.94	Ave	182	1.7	V	-13.08	23.86	54.00	-30.14

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11b: High Channel 2462MHz									
226.23	39.42	QP	45	1.3	H	-11.62	27.80	46.00	-18.20
226.23	37.81	QP	253	1.1	V	-11.62	26.19	46.00	-19.81
4924.00	49.89	PK	150	1.6	V	-0.24	49.65	74.00	-24.35
4924.00	43.88	Ave	150	1.6	V	-0.24	43.64	54.00	-10.36
7386.00	40.89	PK	167	1.3	H	2.84	43.73	74.00	-30.27
7386.00	43.21	Ave	167	1.3	H	2.84	46.05	54.00	-7.95
2315.10	45.79	PK	221	1.2	V	-13.19	32.60	74.00	-41.40
2315.10	38.93	Ave	221	1.2	V	-13.19	25.74	54.00	-28.26
2377.03	43.01	PK	229	1.8	H	-13.14	29.87	74.00	-44.13
2377.03	38.32	Ave	229	1.8	H	-13.14	25.18	54.00	-28.82
2489.39	44.73	PK	75	1.4	V	-13.08	31.65	74.00	-42.35
2489.39	37.62	Ave	75	1.4	V	-13.08	24.54	54.00	-29.46

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11g: Low Channel 2412MHz									
226.23	38.07	QP	289	1.4	H	-11.62	26.45	46.00	-19.55
226.23	37.47	QP	83	1.0	V	-11.62	25.85	46.00	-20.15
4824.00	49.57	PK	35	1.2	V	-1.06	48.51	74.00	-25.49
4824.00	44.30	Ave	35	1.2	V	-1.06	43.24	54.00	-10.76
7236.00	40.39	PK	297	1.4	H	1.33	41.72	74.00	-32.28
7236.00	42.53	Ave	297	1.4	H	1.33	43.86	54.00	-10.14
2316.97	46.21	PK	196	1.8	V	-13.19	33.02	74.00	-40.98
2316.97	39.36	Ave	196	1.8	V	-13.19	26.17	54.00	-27.83
2384.77	43.76	PK	302	1.7	H	-13.14	30.62	74.00	-43.38
2384.77	38.64	Ave	302	1.7	H	-13.14	25.50	54.00	-28.50
2490.54	44.41	PK	259	1.1	V	-13.08	31.33	74.00	-42.67
2490.54	38.05	Ave	259	1.1	V	-13.08	24.97	54.00	-29.03

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11g: Middle Channel 2437MHz									
226.23	36.61	QP	31	1.3	H	-11.62	24.99	46.00	-21.01
226.23	37.21	QP	288	1.7	V	-11.62	25.59	46.00	-20.41
4874.00	49.44	PK	353	1.1	V	-0.62	48.82	74.00	-25.18
4874.00	44.15	Ave	353	1.1	V	-0.62	43.53	54.00	-10.47
7311.00	39.46	PK	59	1.1	H	2.21	41.67	74.00	-32.33
7311.00	41.44	Ave	59	1.1	H	2.21	43.65	54.00	-10.35
2342.68	46.16	PK	188	1.8	V	-13.19	32.97	74.00	-41.03
2342.68	39.10	Ave	188	1.8	V	-13.19	25.91	54.00	-28.09
2364.23	43.83	PK	235	1.7	H	-13.14	30.69	74.00	-43.31
2364.23	37.79	Ave	235	1.7	H	-13.14	24.65	54.00	-29.35
2486.00	42.85	PK	107	1.3	V	-13.08	29.77	74.00	-44.23
2486.00	38.20	Ave	107	1.3	V	-13.08	25.12	54.00	-28.88

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11g: High Channel 2462MHz									
226.23	37.56	QP	193	1.7	H	-11.62	25.94	46.00	-20.06
226.23	36.80	QP	255	1.7	V	-11.62	25.18	46.00	-20.82
4924.00	49.62	PK	309	1.6	V	-0.24	49.38	74.00	-24.62
4924.00	43.50	Ave	309	1.6	V	-0.24	43.26	54.00	-10.74
7386.00	39.17	PK	263	1.0	H	2.84	42.01	74.00	-31.99
7386.00	42.27	Ave	263	1.0	H	2.84	45.11	54.00	-8.89
2313.49	45.60	PK	258	1.3	V	-13.19	32.41	74.00	-41.59
2313.49	39.00	Ave	258	1.3	V	-13.19	25.81	54.00	-28.19
2373.94	43.47	PK	235	1.5	H	-13.14	30.33	74.00	-43.67
2373.94	36.83	Ave	235	1.5	H	-13.14	23.69	54.00	-30.31
2486.86	44.32	PK	173	1.6	V	-13.08	31.24	74.00	-42.76
2486.86	38.75	Ave	173	1.6	V	-13.08	25.67	54.00	-28.33

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11n HT20: Low Channel 2412MHz									
226.23	36.27	QP	159	1.9	H	-11.62	24.65	46.00	-21.35
226.23	36.86	QP	320	1.6	V	-11.62	25.24	46.00	-20.76
4824.00	50.55	PK	37	1.2	V	-1.06	49.49	74.00	-24.51
4824.00	44.84	Ave	37	1.2	V	-1.06	43.78	54.00	-10.22
7236.00	38.39	PK	247	1.8	H	1.33	39.72	74.00	-34.28
7236.00	41.56	Ave	247	1.8	H	1.33	42.89	54.00	-11.11
2315.52	45.47	PK	33	1.7	V	-13.19	32.28	74.00	-41.72
2315.52	39.78	Ave	33	1.7	V	-13.19	26.59	54.00	-27.41
2370.73	44.44	PK	241	1.8	H	-13.14	31.30	74.00	-42.70
2370.73	36.98	Ave	241	1.8	H	-13.14	23.84	54.00	-30.16
2485.72	43.99	PK	235	1.7	V	-13.08	30.91	74.00	-43.09
2485.72	37.70	Ave	235	1.7	V	-13.08	24.62	54.00	-29.38

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11n HT20: Middle Channel 2437MHz									
226.23	35.99	QP	335	1.9	H	-11.62	24.37	46.00	-21.63
226.23	38.18	QP	2	1.3	V	-11.62	26.56	46.00	-19.44
4874.00	50.66	PK	125	1.6	V	-0.62	50.04	74.00	-23.96
4874.00	44.17	Ave	125	1.6	V	-0.62	43.55	54.00	-10.45
7311.00	37.12	PK	180	1.4	H	2.21	39.33	74.00	-34.67
7311.00	42.47	Ave	180	1.4	H	2.21	44.68	54.00	-9.32
2331.91	46.71	PK	95	1.7	V	-13.19	33.52	74.00	-40.48
2331.91	37.54	Ave	95	1.7	V	-13.19	24.35	54.00	-29.65
2369.53	42.06	PK	187	2.0	H	-13.14	28.92	74.00	-45.08
2369.53	36.94	Ave	187	2.0	H	-13.14	23.80	54.00	-30.20
2495.59	43.17	PK	44	1.2	V	-13.08	30.09	74.00	-43.91
2495.59	37.64	Ave	44	1.2	V	-13.08	24.56	54.00	-29.44

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11n HT20: High Channel 2462MHz									
226.23	34.75	QP	81	1.2	H	-11.62	23.13	46.00	-22.87
226.23	37.51	QP	158	1.6	V	-11.62	25.89	46.00	-20.11
4924.00	49.50	PK	241	1.1	V	-0.24	49.26	74.00	-24.74
4924.00	43.84	Ave	241	1.1	V	-0.24	43.60	54.00	-10.40
7386.00	37.79	PK	324	1.3	H	2.84	40.63	74.00	-33.37
7386.00	43.58	Ave	324	1.3	H	2.84	46.42	54.00	-7.58
2334.44	45.68	PK	73	1.3	V	-13.19	32.49	74.00	-41.51
2334.44	37.60	Ave	73	1.3	V	-13.19	24.41	54.00	-29.59
2350.13	42.62	PK	247	2.0	H	-13.14	29.48	74.00	-44.52
2350.13	38.19	Ave	247	2.0	H	-13.14	25.05	54.00	-28.95
2488.88	43.39	PK	350	1.8	V	-13.08	30.31	74.00	-43.69
2488.88	37.40	Ave	350	1.8	V	-13.08	24.32	54.00	-29.68

Test Frequency: 18GHz~25GHz

The measurements were more than 20 dB below the limit and not reported.

9 Band Edge Measurement

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	KDB 558074 D01 DTS Meas Guidance v04
Test Limit:	Regulation 15.247 (d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
Test Mode:	Transmitting

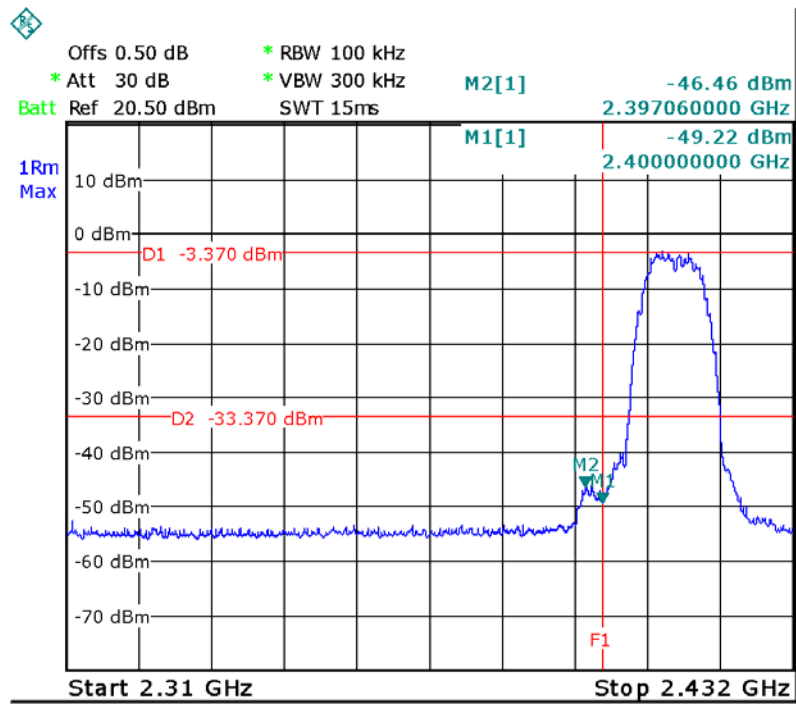
9.1 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

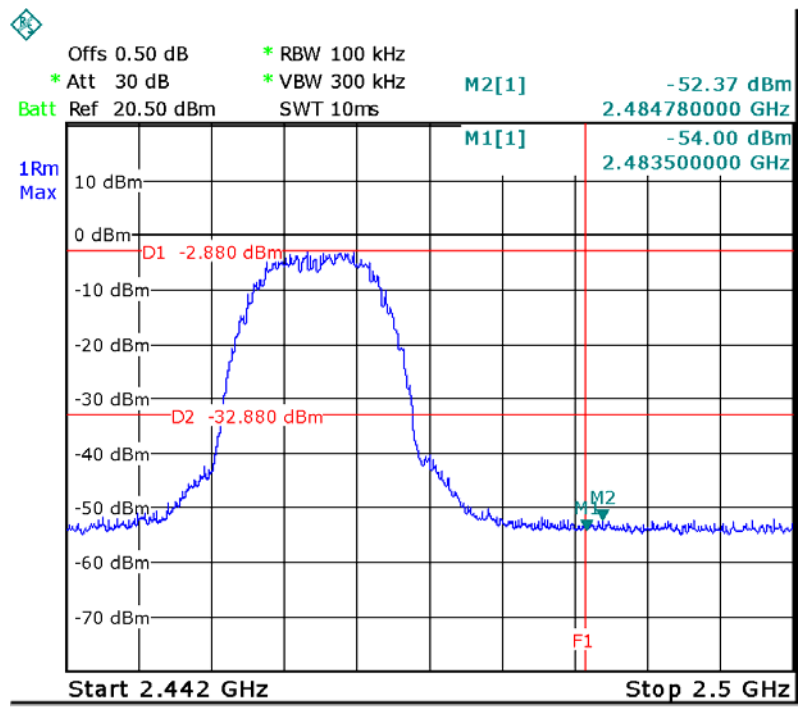
9.2 Test Result

Test result plots shown as follows:

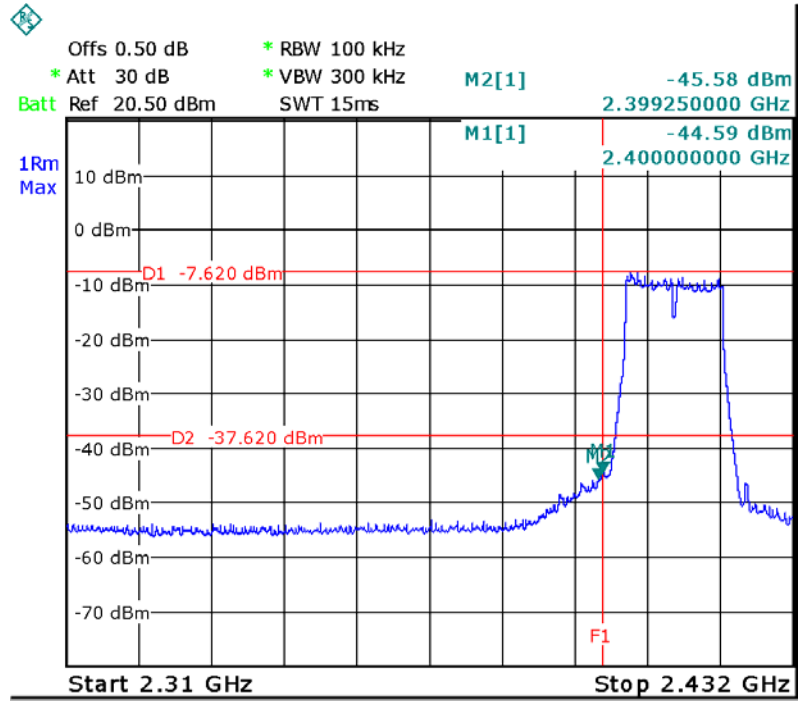
11b: Band edge-left side



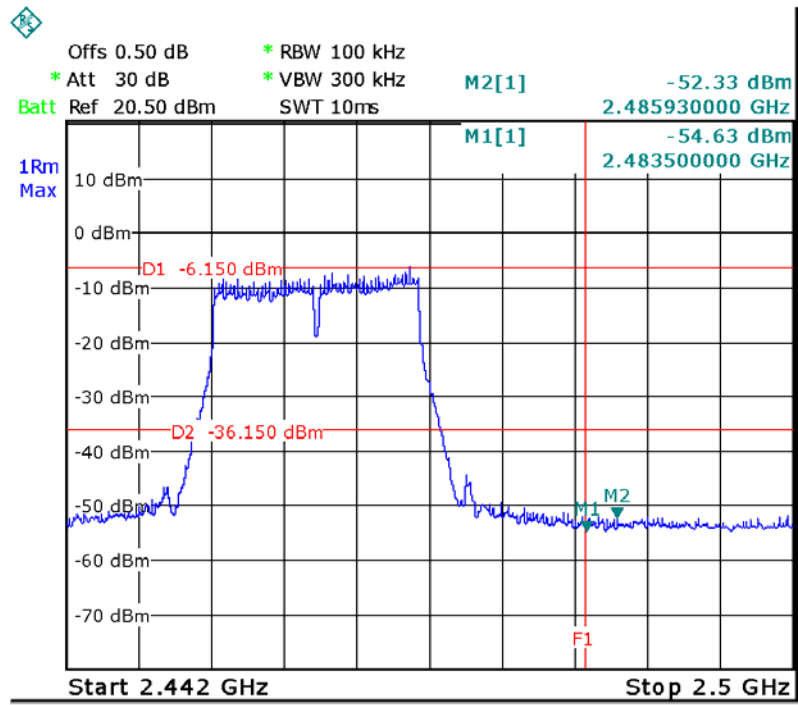
11b: Band edge-right side



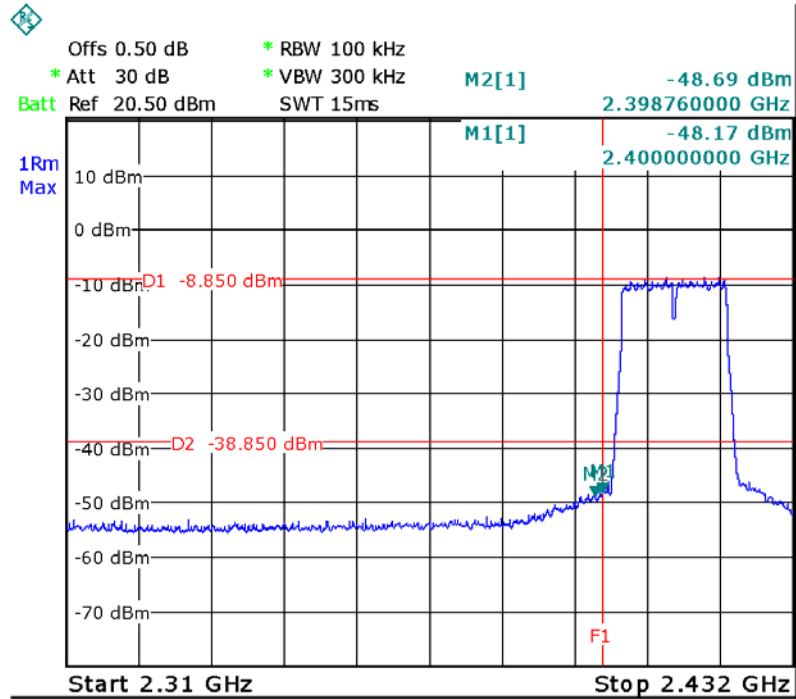
11g: Band edge-left side



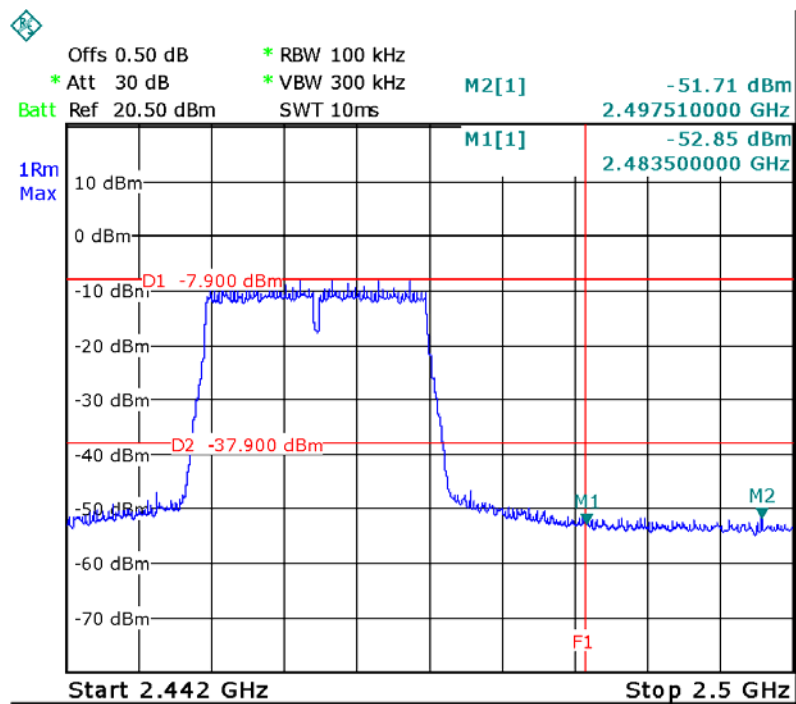
11g: Band edge-right side



11n HT20: Band edge-left side



11n HT20: Band edge-right side



10 6 dB Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 DTS Meas Guidance v04

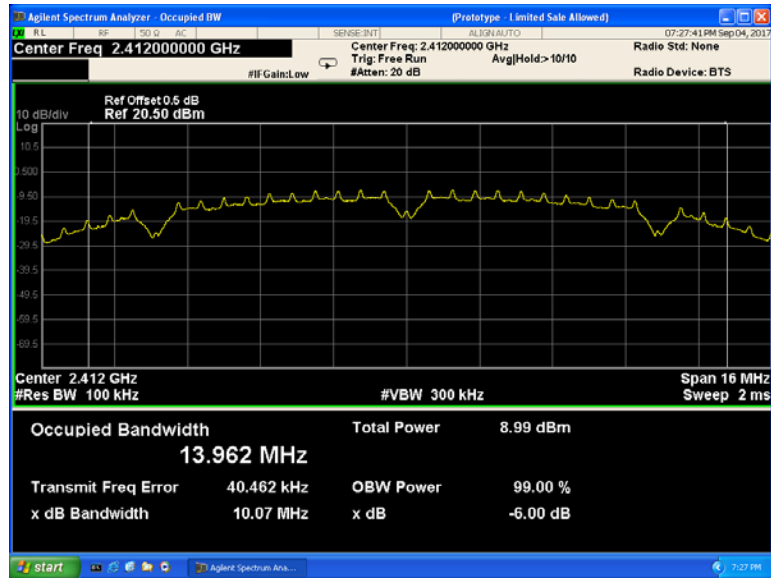
10.1 Test Procedure:

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 = 100kHz, VBW = 300kHz

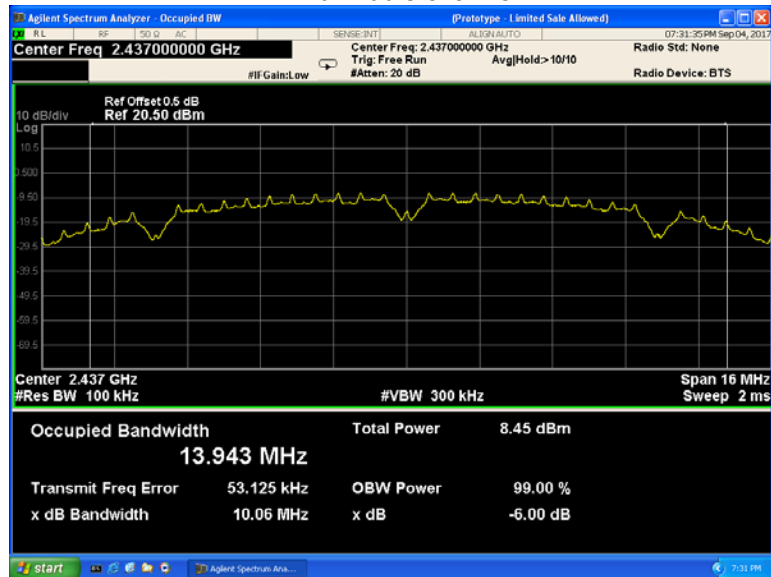
10.2 Test Result:

ANT	Operation mode	Bandwidth (MHz)		
		Low	Middle	High
ANT	11b	10.070	10.060	10.070
	11g	16.360	16.360	16.360
	11n HT20	17.600	17.610	17.750

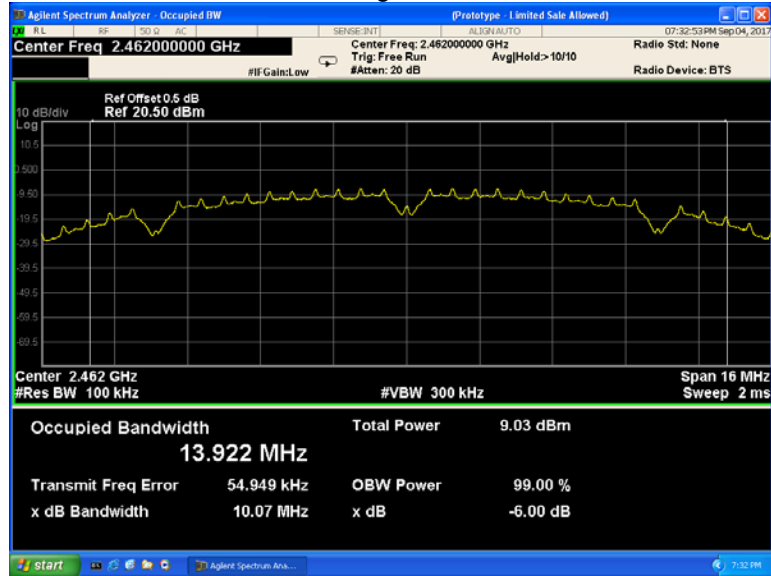
11b Low channel



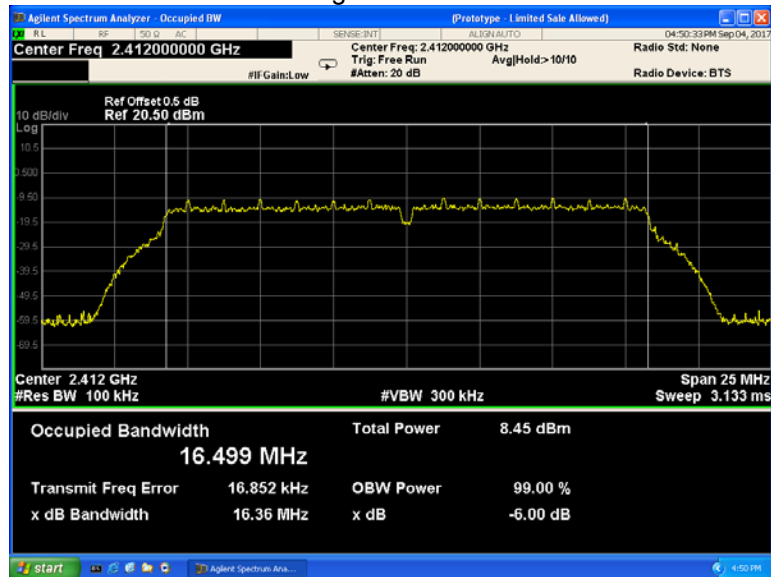
11b Middle channel



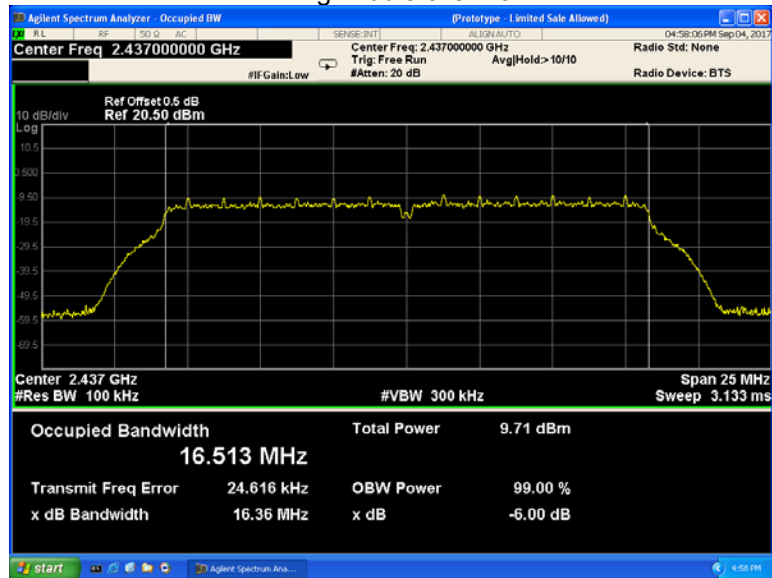
11b High channel



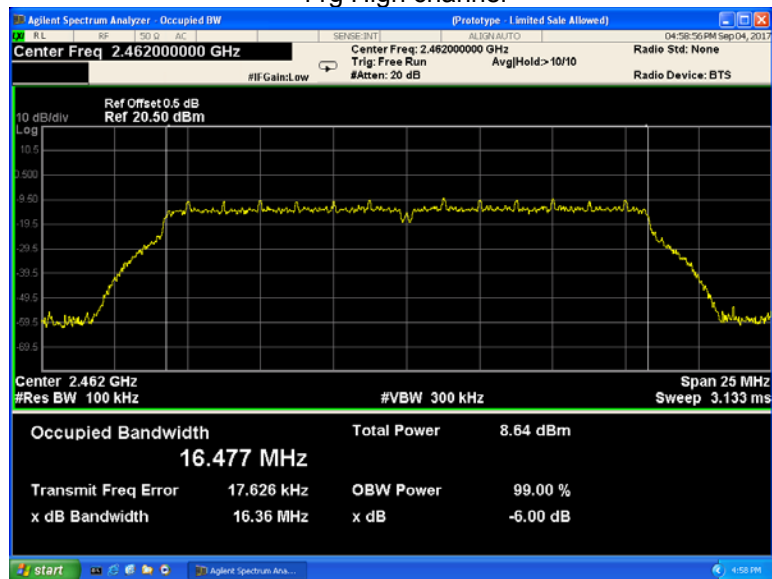
11g Low channel



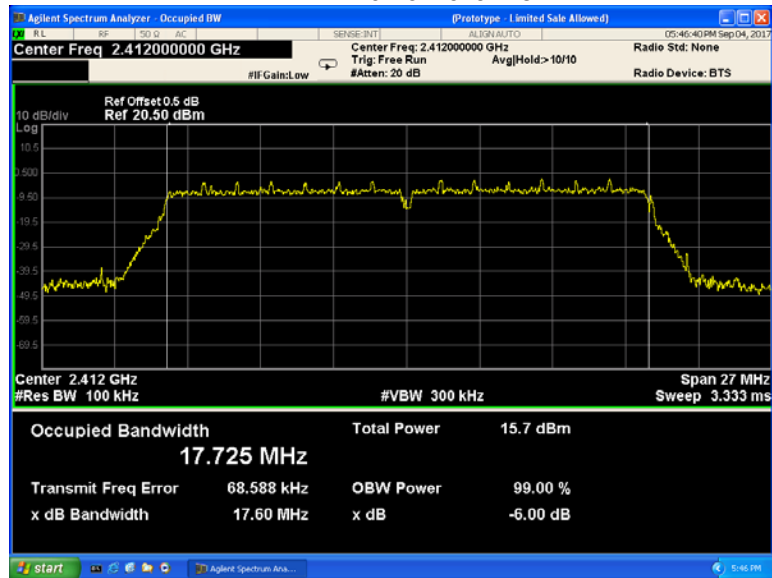
11g Middle channel



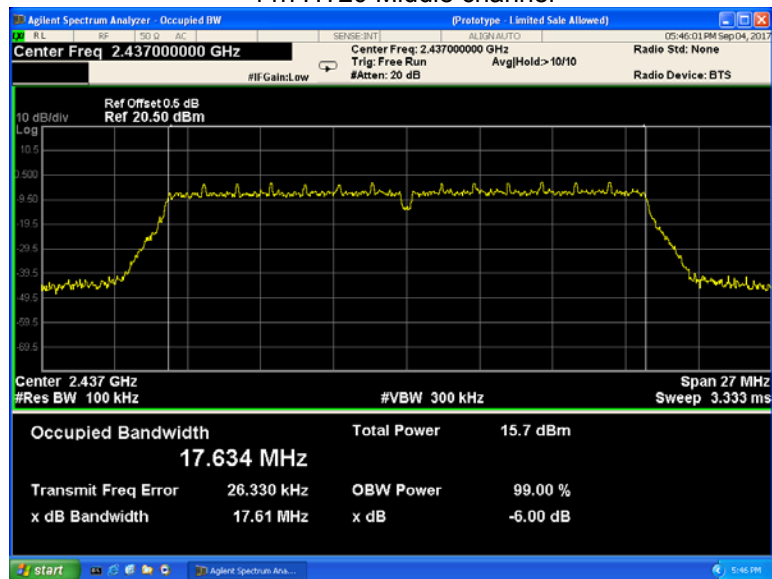
11g High channel



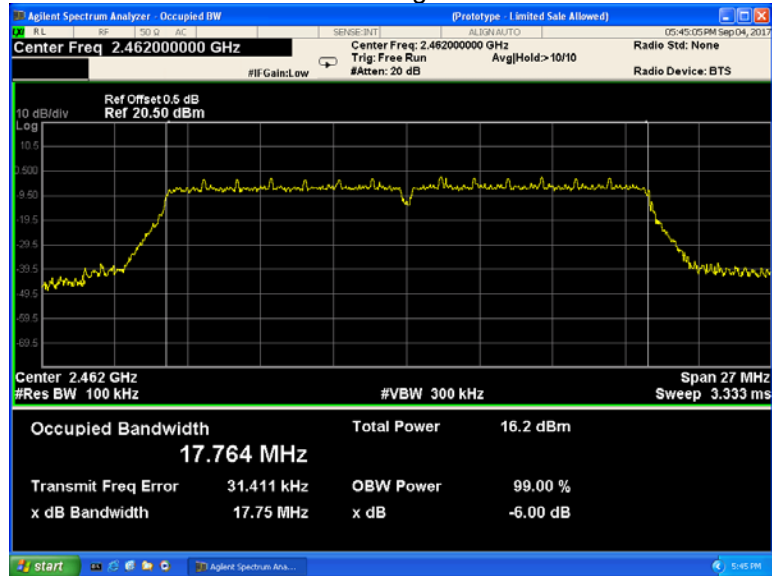
11n HT20 Low channel



11n HT20 Middle channel



11n HT20 High channel



11 Maximum Peak Output Power

Test Requirement:

FCC CFR47 Part 15 Section 15.247

Test Method:

KDB 558074 D01 DTS Meas Guidance v04

11.1 Test Procedure:

KDB 558074 D01 DTS Meas Guidance v03r04 section 9.1.2

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 = 1 MHz. VBW = 3 MHz. Sweep = auto; Detector Function = Peak, Set the span to fully encompass the DTS bandwidth.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

11.2 Test Result:

Operation mode	ANT	Maximum Peak Output Power (dBm)		
		Low	Middle	High
11b	ANT	8.34	8.06	8.09
11g	ANT	8.75	8.13	8.00
11n HT20	ANT	8.60	8.02	8.03
Limit				
1W/30dBm				

12 Power Spectral density

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 DTS Meas Guidance v04

12.1 Test Procedure:

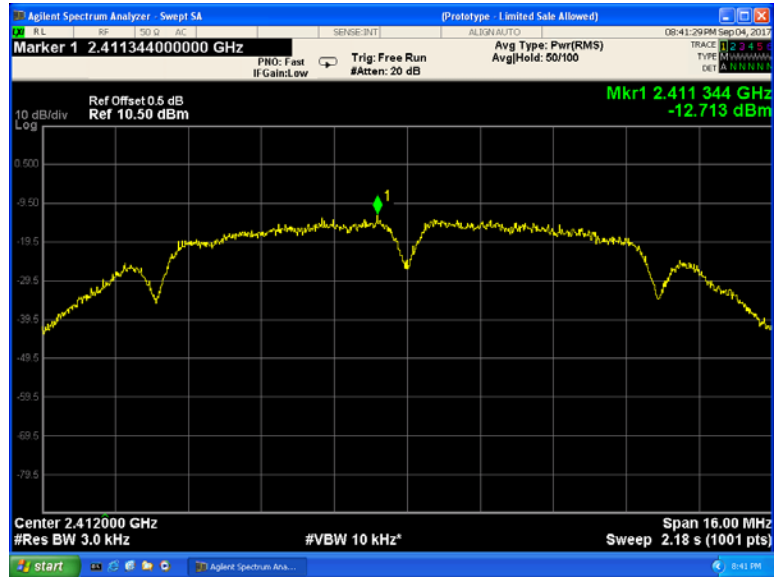
KDB 558074 D01 DTS Meas Guidance v03r04 section 10.2

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 = 3kHz. VBW = 10kHz , Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section
Submit this plot.

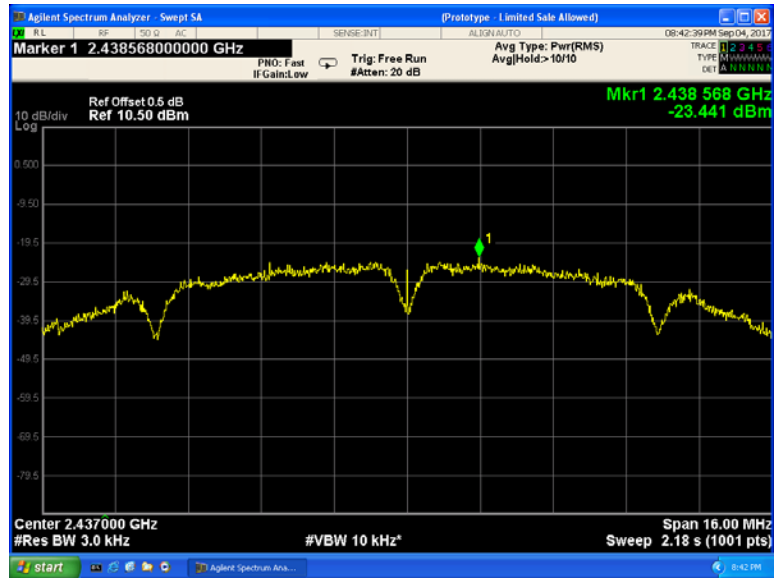
12.2 Test Result:

Operation mode	ANT	Maximum Peak Output Power (dBm per 3kHz)		
		Low	Middle	High
11b	ANT	-12.713	-23.441	-23.891
11g	ANT	-24.385	-19.617	-18.385
11n HT20	ANT	-16.085	-15.183	-16.397
Limit				
8dBm per 3kHz				

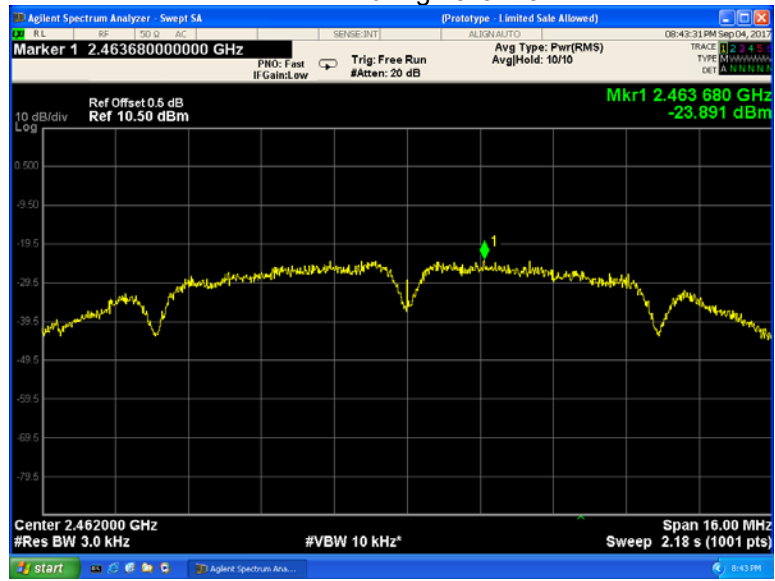
11b Low channel



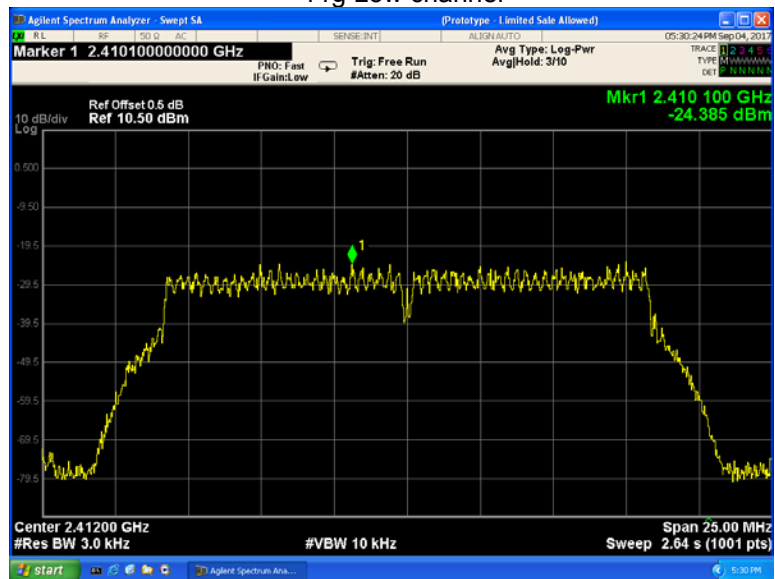
11b Middle channel



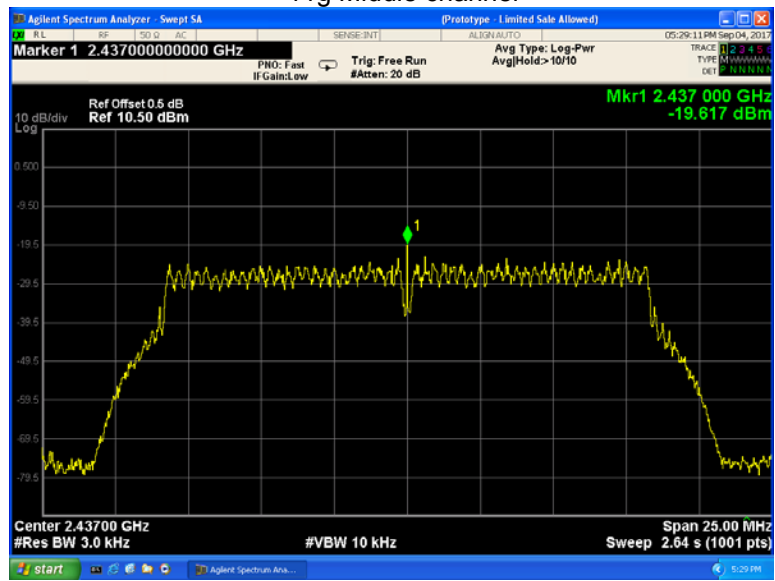
11b High channel



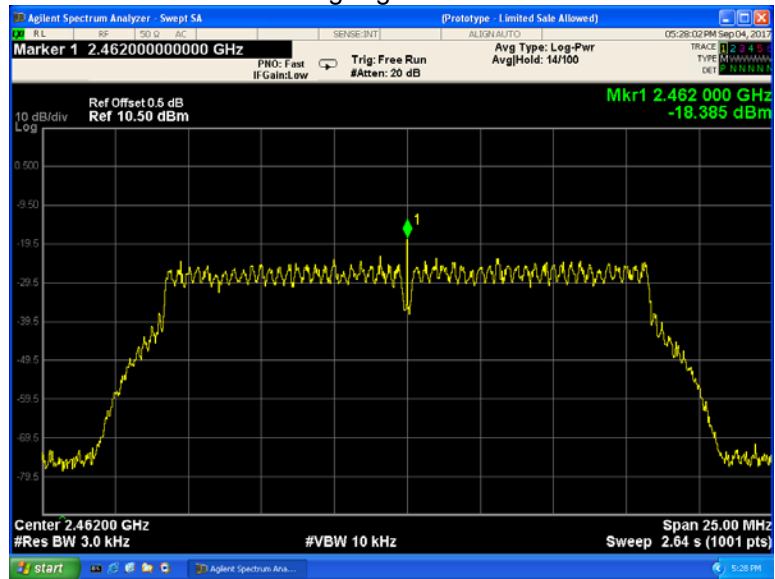
11g Low channel



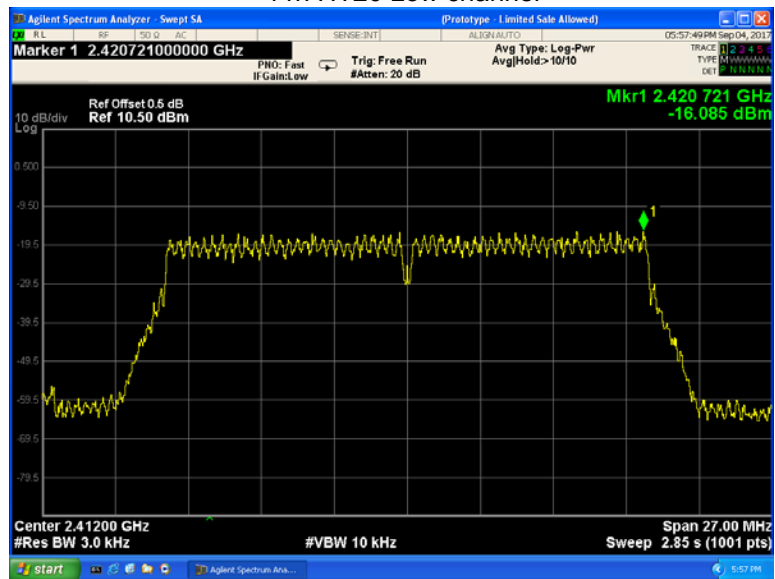
11g Middle channel



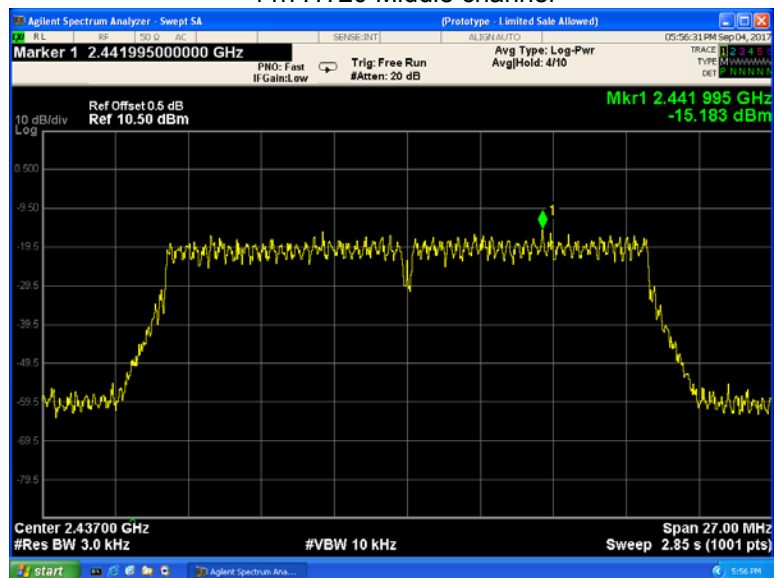
11g High channel



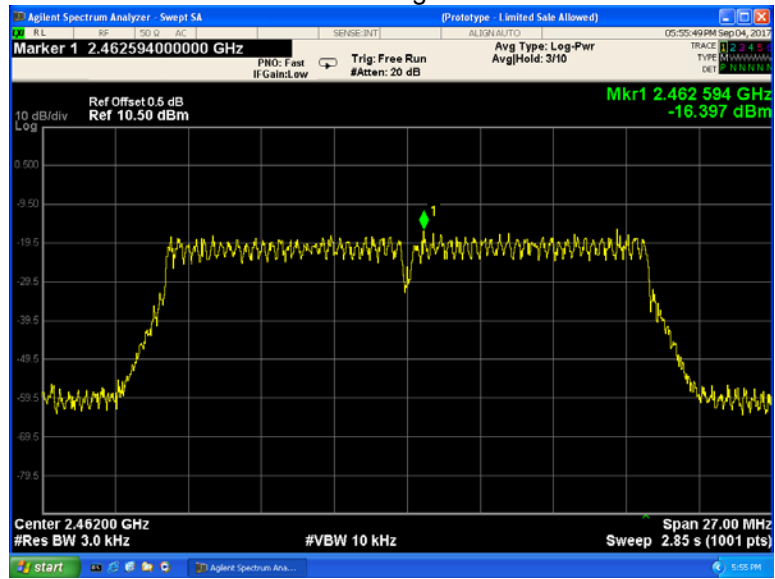
11n HT20 Low channel



11n HT20 Middle channel



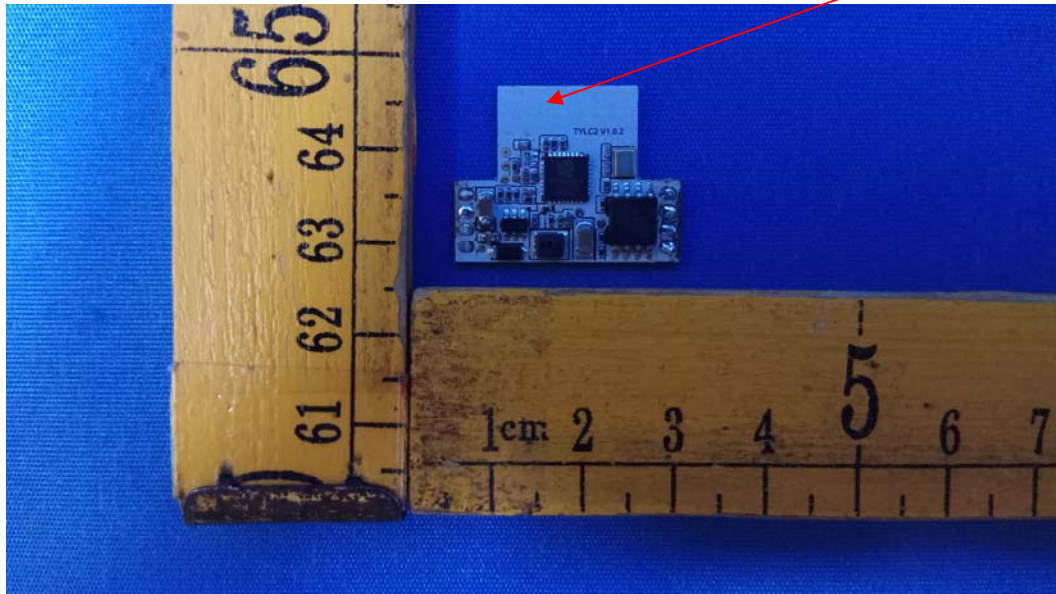
11n HT20 High channel



13 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 fulfill the requirement of this section.

ANT



14 RF Exposure

Please refer to Maximum Permissible Exposure report.

15 Photographs – Model HKWL-LED01W Test Setup

15.1 Conducted Emission



15.2 Radiated Emission

Below 1GHz



Test frequency above 1GHz



16 Photographs - Constructional Details

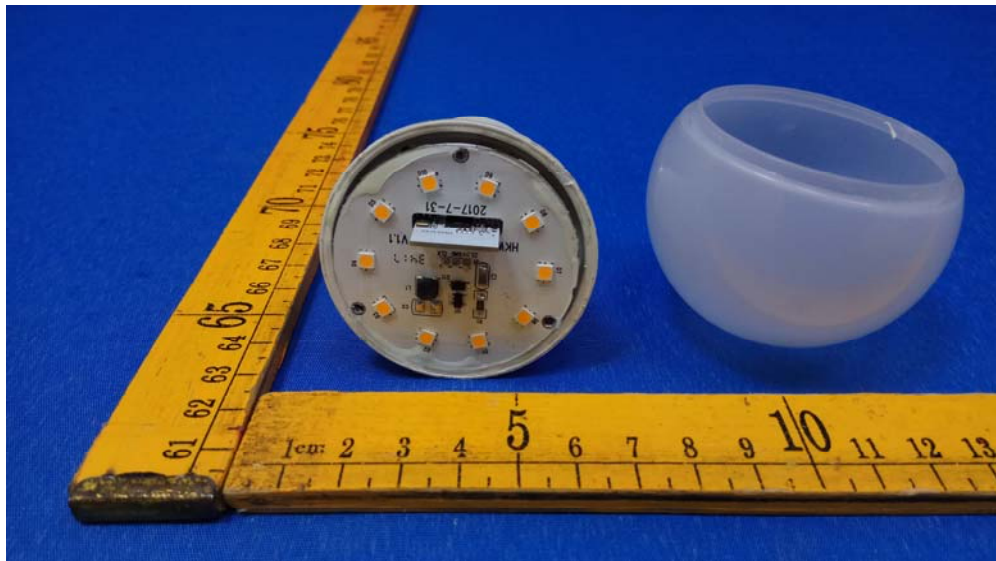
16.1 Model HKWL-LED01W External View

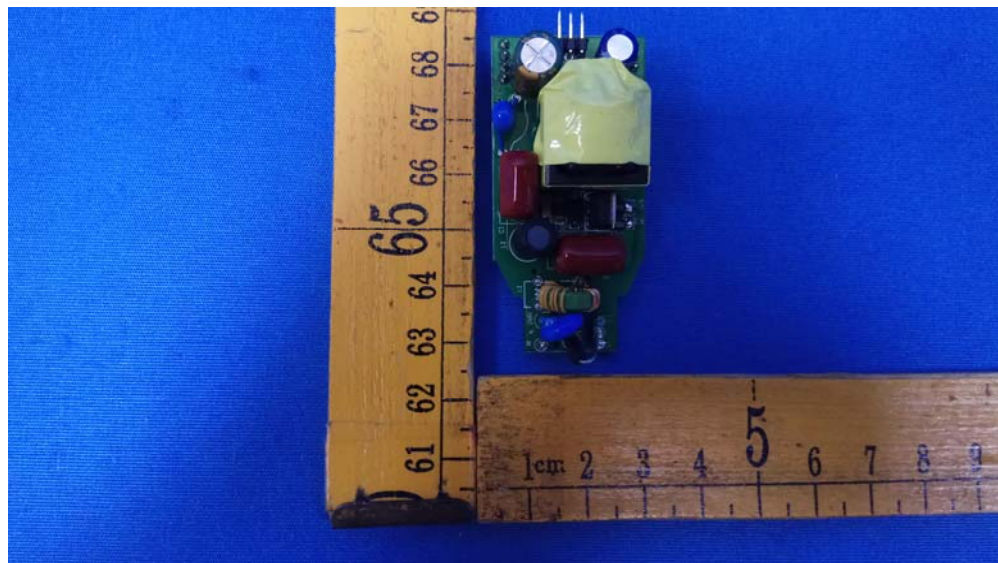
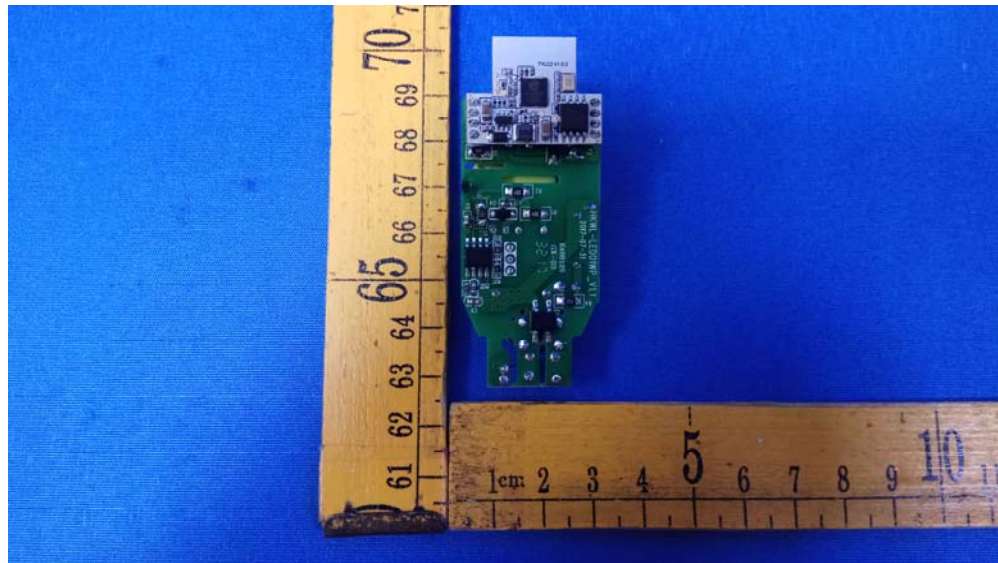


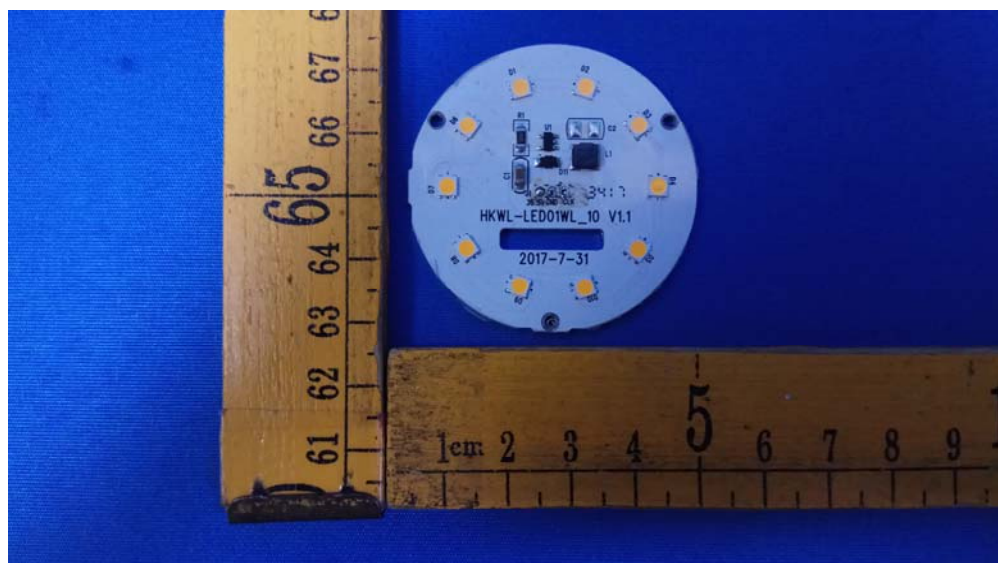
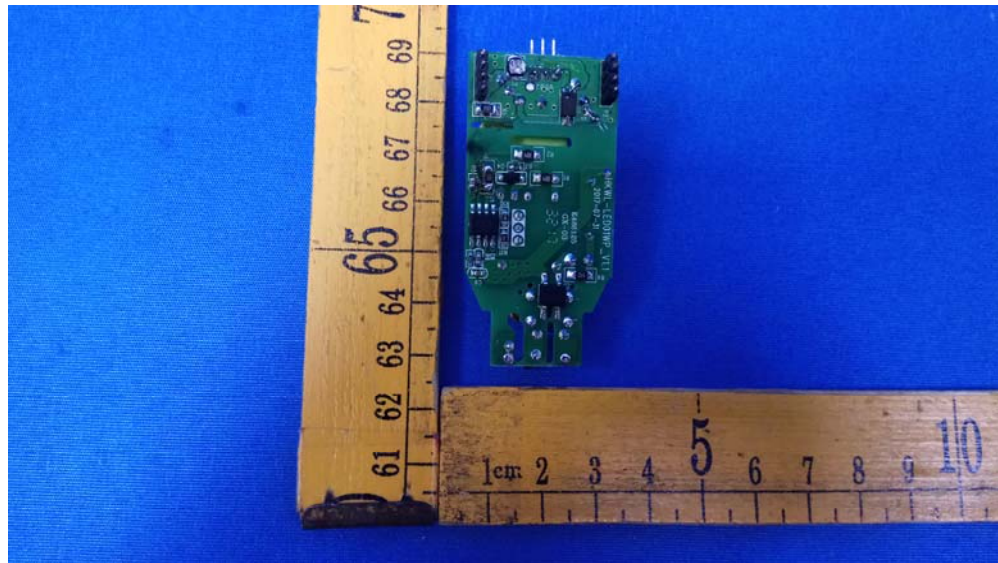


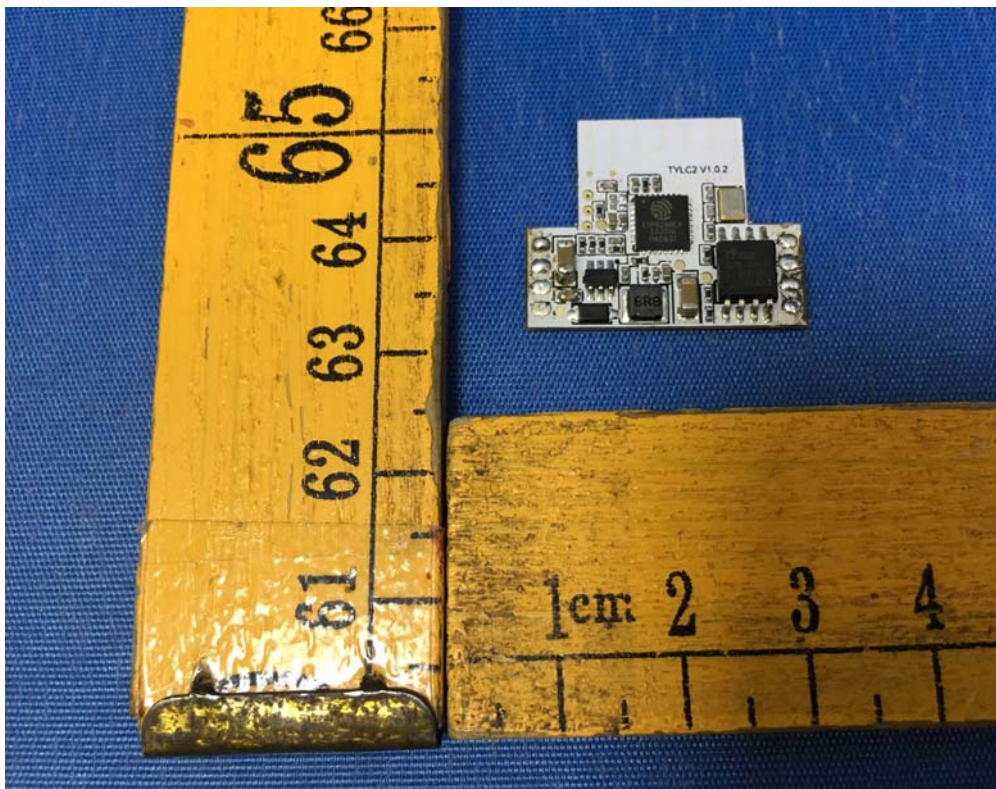
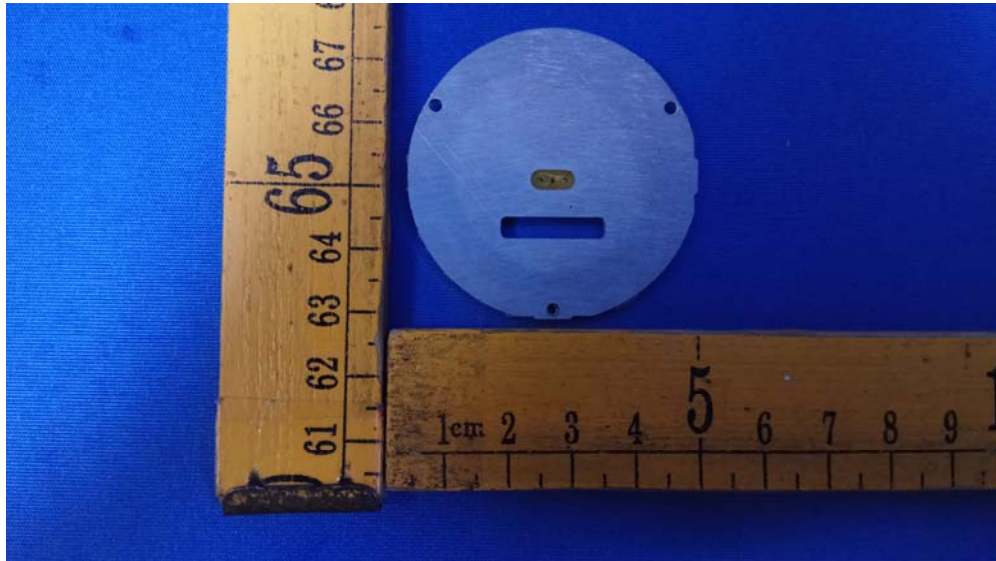


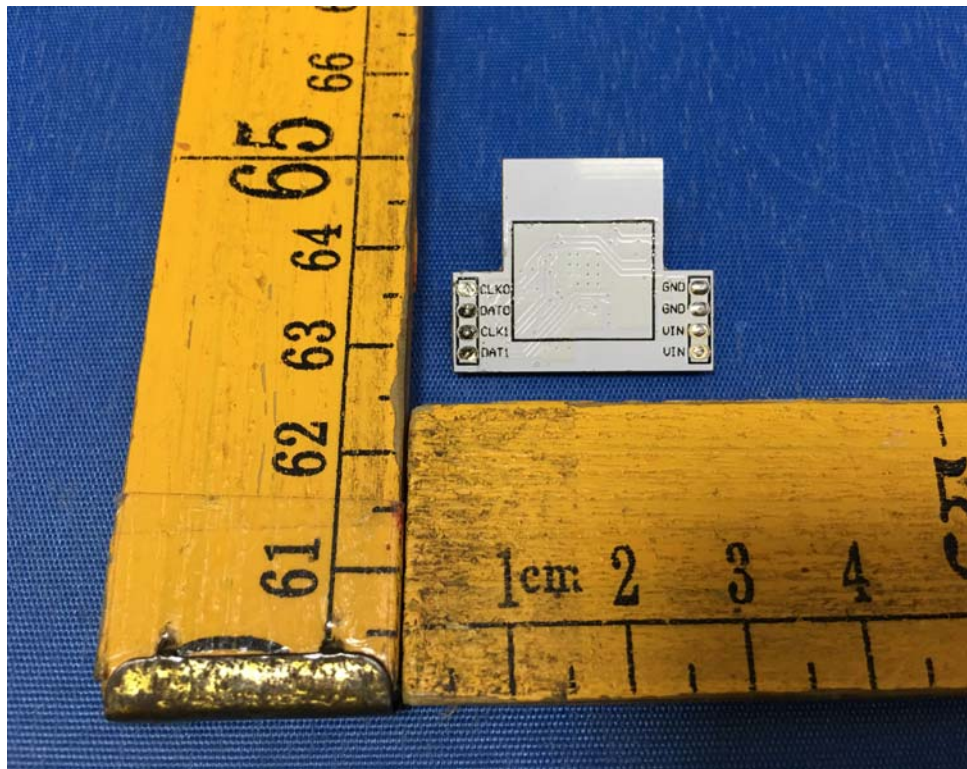
16.2 Model HKWL-LED01W Internal View











====End of Report====