

TEST REPORT

Reference No. : WTS20S03009202W V1
FCC ID..... : 2AIOC-RGB03W
Applicant..... : HANK ELECTRONICS CO., LTD.
Address : Floor 2nd-7th, A8, Hongye Industry City, Lezhujiao, Zhoushi Road,
Baoan District, Shenzhen, China
Manufacturer : HANK ELECTRONICS CO., LTD.
Address : Floor 2nd-7th, A8, Hongye Industry City, Lezhujiao, Zhoushi Road,
Baoan District, Shenzhen, China
Product..... : SMART BULB
Model(s)..... : HKWL-RGB03W
Standards : FCC CFR47 Part 15 Section 15.247:2019
Date of Receipt sample..... : 2020-03-12
Date of Test..... : 2020-03-12 to 2020-03-20
Date of Issue : 2020-03-23
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 Revision History

Test Report No.	Date of Receipt Sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS20S03009202W	2020-03-12	2020-03-12 to 2020-03-20	2020-03-20	Original	-	Replaced
WTS20S03009202W V1	2020-03-12	2020-03-12 to 2020-03-20	2020-03-23	Revision 1	Updated the report	Valid

3 General Information

3.1 General Description of E.U.T

Product:	SMART BULB
Model(s):	HKWL-RGB03W
Model Description:	N/A
Operation Frequency:	802.11b/g/n HT20: 2412MHz ~ 2462MHz
Antenna installation:	PCB Printed Antenna
Antenna Gain:	0 dBi
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.)
Ratings	Input: 120-240V~ 50/60Hz, Max 0.12A, 7W

3.2 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	-

3.3 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
Frequency Range	802.11b	11 Mbps	1/11	TX
	802.11g	54 Mbps	1/11	TX
	802.11n HT20	108 Mbps	1/11	TX
Radiated 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.

4 Equipment Used during Test

4.1 Equipments List

Conducted Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	EMI Test Receiver	R&S	ESCI	101155	2019-09-17	2020-09-16
2	LISN	SCHWARZBECK	NSLK 8128	8128-259	2019-09-17	2020-09-16
3	Limiter	CYBERTEK	EM5010	261115-001-0024	2019-09-17	2020-09-16
4	Cable	Laplace	RF300	-	2019-09-17	2020-09-16
3m Semi-anechoic Chamber for Radiation Emissions(SAEMC)						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSP30	100091	2019-04-19	2020-04-18
2	Broad-band Horn Antenna(1-18GHz)	SCHWARZBECK	BBHA 9120 D	667	2019-04-19	2020-04-18
3	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2019-04-19	2020-04-18
4	Coaxial Cable (above 1GHz)	Top	1GHz-18GHz	EW02014-7	2019-04-19	2020-04-18
5	Spectrum Analyzer	R&S	FSP40	100501	2019-09-17	2020-09-16
6	Broad-band Horn Antenna(18-40GHz)	SCHWARZBECK	BBHA 9170	335	2019-09-17	2020-09-16
7	Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	100472	2019-09-17	2020-09-16
8	Cable	Top	18-40GHz	-	2019-09-17	2020-09-16
3m Semi-anechoic Chamber for Radiation Emissions(TDK)						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	2019-04-20	2020-04-19
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2019-05-24	2020-05-23
3	Active Loop Antenna	Com-power	AL-130R	10160007	2019-04-28	2020-04-27
4	Amplifier	ANRITSU	MH648A	M43381	2019-04-19	2020-04-18
5	Cable	HUBER+SUHNER	CBL2	525178	2019-04-20	2020-04-19
6	Coaxial Cable (below 1GHz)	Top	TYPE16 (13M)	-	2019-09-12	2020-09-11

RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	EXG Analog Signal Generator	Malaysia Keysight	FSL6	MY53050845	2019-09-17	2020-09-16
2	Coaxial Cable	Top	10Hz-30GHz	-	2019-09-12	2020-09-11
3	Antenna Connector*	Realacc	45RSm	-	2019-09-12	2020-09-11
4	DC Block	Gwave	GDCB-3G-N-SMA	140307001	2019-09-12	2020-09-11
**": The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.						

4.2 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 Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)

4.3 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.

5 Test Facility

FCC Designation No.: CN1201. Test Firm Registration No.: 523476.
ISED CAB identifier: CN0013. Test Firm Registration No.: 7760A.

6 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.247 15.205(a) 15.209(a)	Pass
Conducted Emissions	15.207(a)	Pass
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
RF Exposure	1.1307(b)(1)	Pass
Note: Pass=Compliance; NC=Not Compliance; NT=Not Tested; N/A=Not Applicable.		

7 Conducted Emissions

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:

Frequency (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5.0	56	46
5.0 to 30	60	50

*Decreases with the logarithm of the frequency.

7.1 E.U.T. Operation

Operating Environment :

Temperature: 23.1 °C

Humidity: 52.8 % RH

Atmospheric Pressure: 101.3 kPa

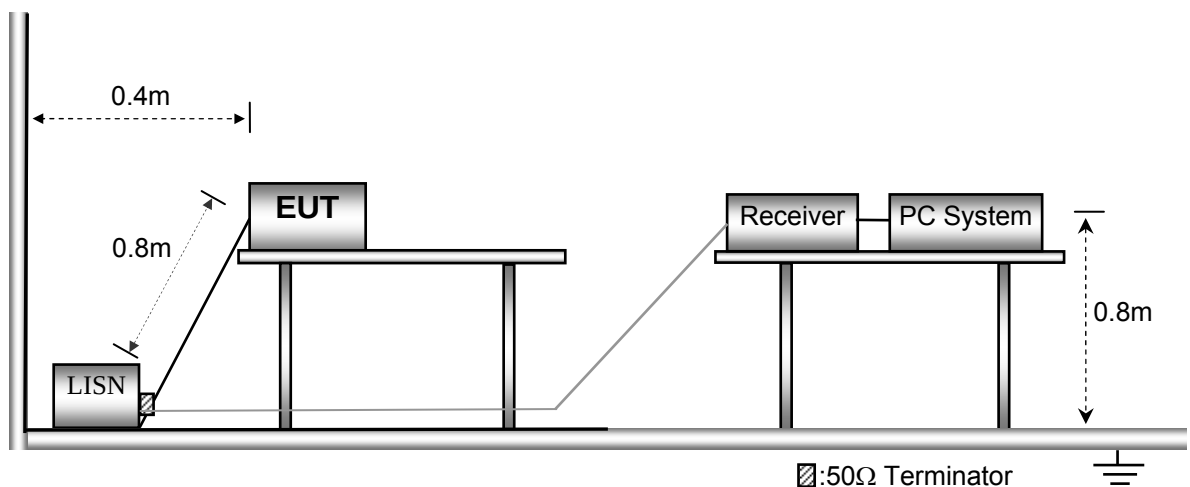
Test Voltage: AC 120V, 60Hz

EUT Operation :

The test was performed in Wi-Fi Transmitting mode, the worst test data (Wi-Fi b mode low channel) were shown in the report.

7.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.10:2013.



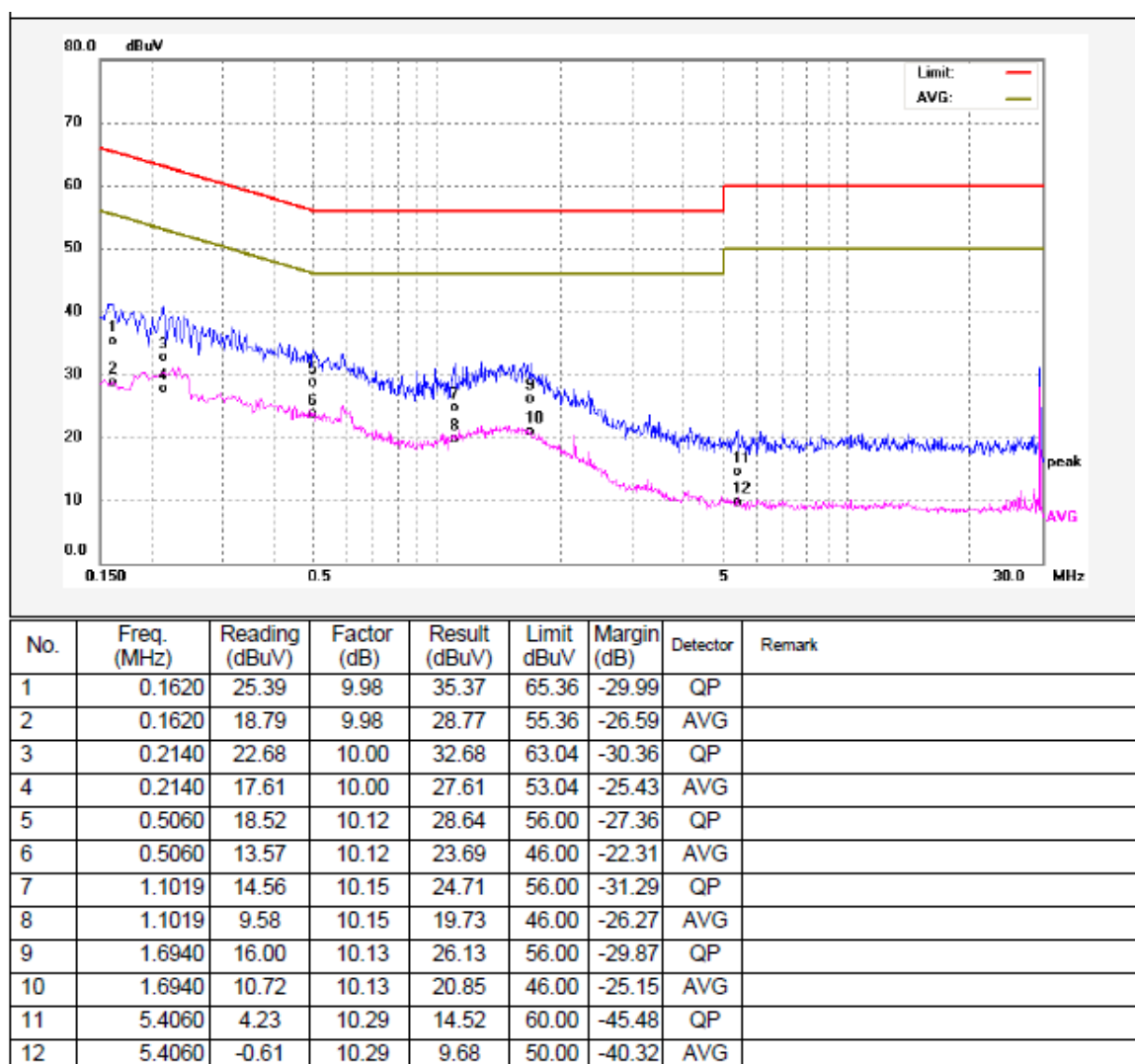
7.3 Measurement Description

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.

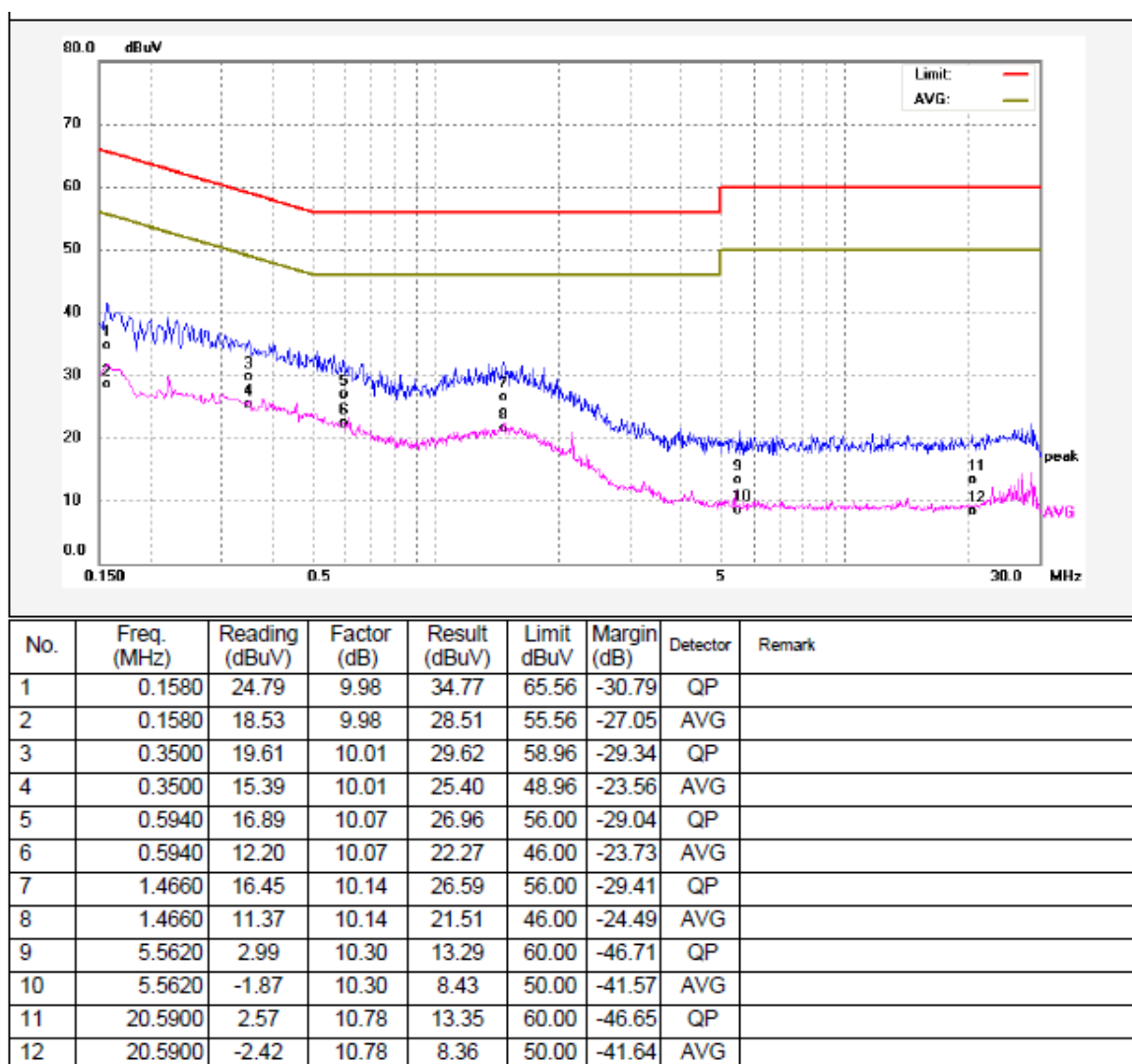
7.4 Conducted Emission Test Result

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

Live line:



Neutral line:



8 Radiated Spurious 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	$2400/F(\text{kHz})$	300	$10000 * 2400/F(\text{kHz})$	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	$24000/F(\text{kHz})$	30	$100 * 24000/F(\text{kHz})$	$20\log^{(24000/F(\text{kHz}))} + 40$
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: 23.2 °C

Humidity: 54.1 % RH

Atmospheric Pressure: 101.5 kPa

Test Voltage: AC 120V, 60Hz

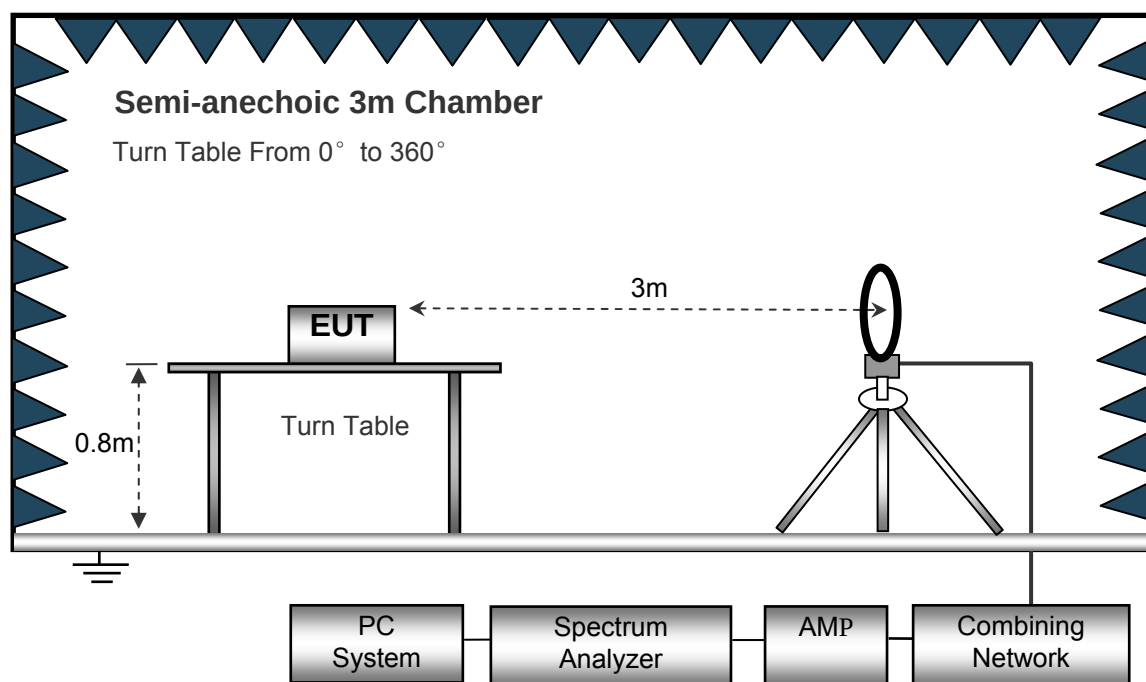
EUT Operation :

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

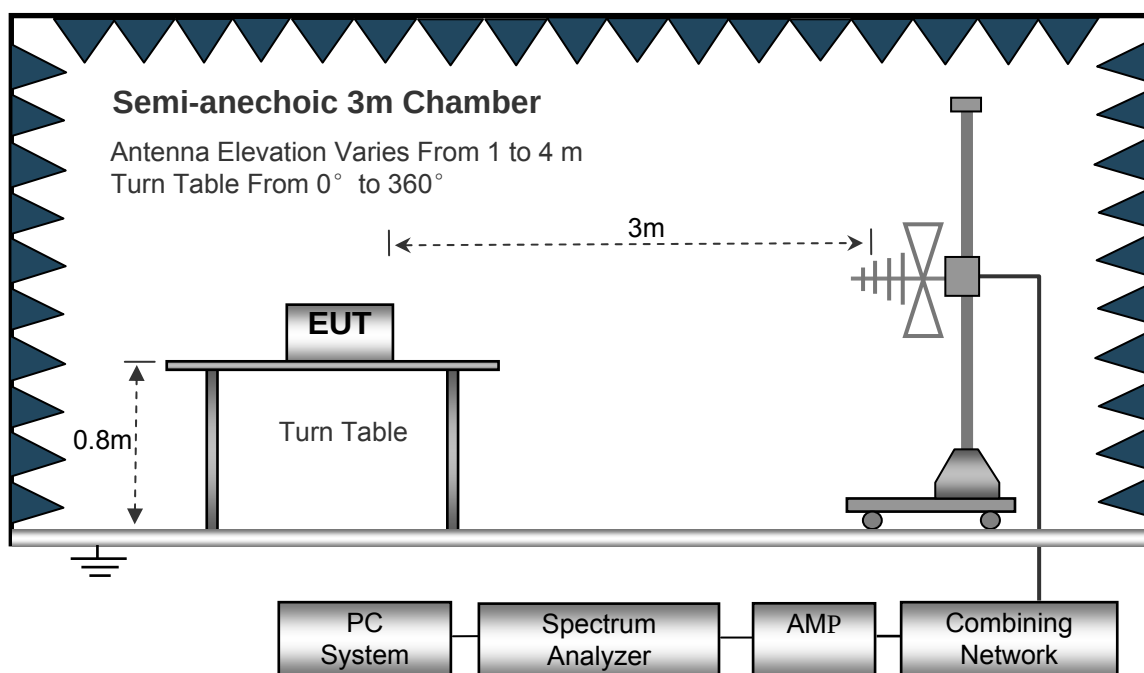
8.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.10:2013.

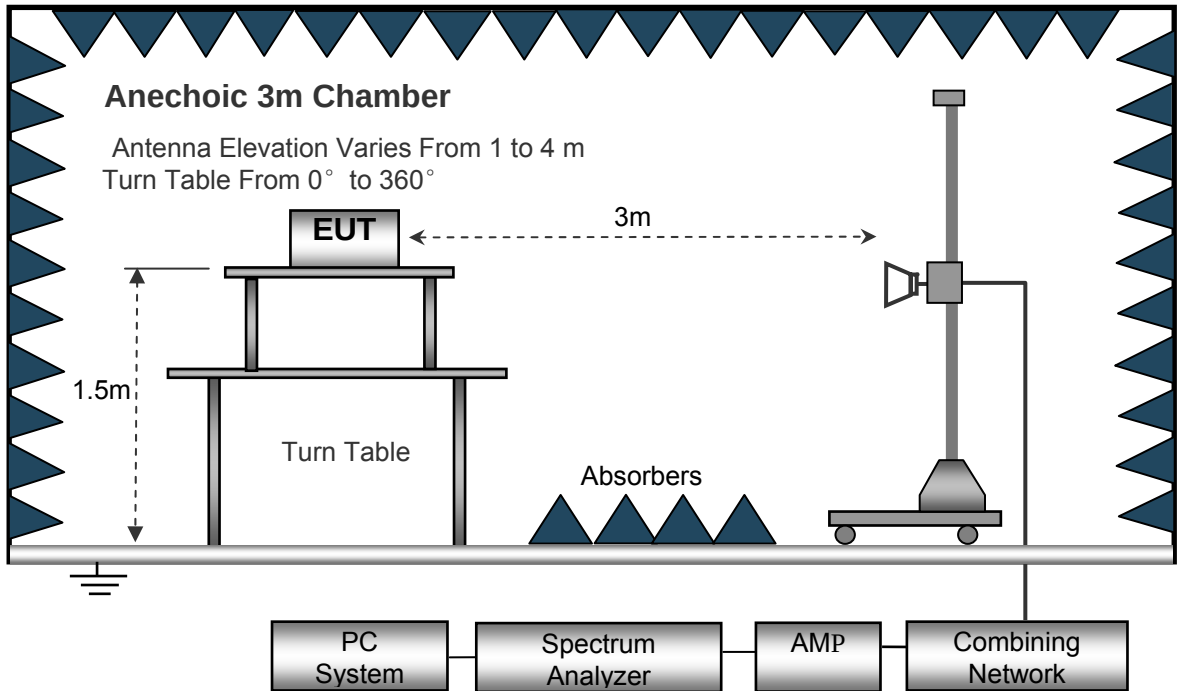
The test setup for emission measurement below 30MHz.



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. For below 1GHz, the EUT is 0.8m above ground plane;
For above 1GHz, the EUT is 1.5m above ground plane.
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: 9 kHz ~ 25 GHz

Only the worst case GFSK mode and the worst frequency test data were recorded in the report, other frequency are attenuated more than 20 dB below the permissible value and not reported.

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: Low Channel 2412MHz									
326.74	55.27	QP	339	1.6	H	-17.38	37.89	46.00	-8.11
326.74	57.18	QP	127	1.5	V	-17.38	39.80	46.00	-6.20
4824.00	48.64	PK	179	1.2	V	-1.06	47.58	74.00	-26.42
4824.00	44.58	Ave	179	1.2	V	-1.06	43.52	54.00	-10.48
7236.00	48.01	PK	59	1.9	H	1.33	49.34	74.00	-24.66
7236.00	43.25	Ave	59	1.9	H	1.33	44.58	54.00	-9.42
2320.25	46.90	PK	257	1.1	V	-13.19	33.71	74.00	-40.29
2320.25	39.14	Ave	257	1.1	V	-13.19	25.95	54.00	-28.05
2372.10	43.08	PK	157	1.1	H	-13.14	29.94	74.00	-44.06
2372.10	37.74	Ave	157	1.1	H	-13.14	24.60	54.00	-29.40
2493.35	44.31	PK	334	1.7	V	-13.08	31.23	74.00	-42.77
2493.35	36.58	Ave	334	1.7	V	-13.08	23.50	54.00	-30.50

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									
326.74	54.53	QP	40	1.3	H	-17.38	37.15	46.00	-8.85
326.74	56.83	QP	193	1.5	V	-17.38	39.45	46.00	-6.55
4874.00	49.10	PK	160	1.8	V	-0.62	48.48	74.00	-25.52
4874.00	43.51	Ave	160	1.8	V	-0.62	42.89	54.00	-11.11
7311.00	47.75	PK	278	1.1	H	2.21	49.96	74.00	-24.04
7311.00	44.20	Ave	278	1.1	H	2.21	46.41	54.00	-7.59
2316.36	46.36	PK	224	1.5	V	-13.19	33.17	74.00	-40.83
2316.36	38.18	Ave	224	1.5	V	-13.19	24.99	54.00	-29.01
2355.11	42.81	PK	55	1.9	H	-13.14	29.67	74.00	-44.33
2355.11	37.01	Ave	55	1.9	H	-13.14	23.87	54.00	-30.13
2490.32	42.06	PK	74	1.1	V	-13.08	28.98	74.00	-45.02
2490.32	38.24	Ave	74	1.1	V	-13.08	25.16	54.00	-28.84

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: High Channel 2462MHz									
326.74	54.86	QP	248	1.4	H	-17.38	37.48	46.00	-8.52
326.74	58.32	QP	336	1.5	V	-17.38	40.94	46.00	-5.06
4924.00	50.54	PK	199	1.7	V	-0.24	50.30	74.00	-23.70
4924.00	42.92	Ave	199	1.7	V	-0.24	42.68	54.00	-11.32
7386.00	47.52	PK	259	1.8	H	2.84	50.36	74.00	-23.64
7386.00	43.84	Ave	259	1.8	H	2.84	46.68	54.00	-7.32
2348.26	45.95	PK	11	1.2	V	-13.19	32.76	74.00	-41.24
2348.26	37.56	Ave	11	1.2	V	-13.19	24.37	54.00	-29.63
2360.86	44.02	PK	160	1.7	H	-13.14	30.88	74.00	-43.12
2360.86	37.73	Ave	160	1.7	H	-13.14	24.59	54.00	-29.41
2498.19	44.95	PK	149	1.1	V	-13.08	31.87	74.00	-42.13
2498.19	37.21	Ave	149	1.1	V	-13.08	24.13	54.00	-29.87

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)
11g: Low Channel 2412MHz									
326.74	54.34	QP	104	1.1	H	-17.38	36.96	46.00	-9.04
326.74	55.12	QP	62	1.0	V	-17.38	37.74	46.00	-8.26
4824.00	51.75	PK	212	1.4	V	-1.06	50.69	74.00	-23.31
4824.00	43.34	Ave	212	1.4	V	-1.06	42.28	54.00	-11.72
7236.00	48.25	PK	238	1.5	H	1.33	49.58	74.00	-24.42
7236.00	45.39	Ave	238	1.5	H	1.33	46.72	54.00	-7.28
2319.72	45.51	PK	58	1.5	V	-13.19	32.32	74.00	-41.68
2319.72	39.69	Ave	58	1.5	V	-13.19	26.50	54.00	-27.50
2378.54	43.04	PK	6	1.1	H	-13.14	29.90	74.00	-44.10
2378.54	38.17	Ave	6	1.1	H	-13.14	25.03	54.00	-28.97
2485.26	43.59	PK	101	1.3	V	-13.08	30.51	74.00	-43.49
2485.26	38.33	Ave	101	1.3	V	-13.08	25.25	54.00	-28.75

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)
11g: Middle Channel 2437MHz									
326.74	54.27	QP	148	1.4	H	-17.38	36.89	46.00	-9.11
326.74	54.73	QP	358	1.5	V	-17.38	37.35	46.00	-8.65
4874.00	50.53	PK	48	1.5	V	-0.62	49.91	74.00	-24.09
4874.00	42.04	Ave	48	1.5	V	-0.62	41.42	54.00	-12.58
7311.00	47.10	PK	119	1.5	H	2.21	49.31	74.00	-24.69
7311.00	44.55	Ave	119	1.5	H	2.21	46.76	54.00	-7.24
2327.22	47.00	PK	266	1.0	V	-13.19	33.81	74.00	-40.19
2327.22	39.69	Ave	266	1.0	V	-13.19	26.50	54.00	-27.50
2382.13	43.56	PK	40	1.3	H	-13.14	30.42	74.00	-43.58
2382.13	38.71	Ave	40	1.3	H	-13.14	25.57	54.00	-28.43
2495.94	42.55	PK	311	1.4	V	-13.08	29.47	74.00	-44.53
2495.94	38.41	Ave	311	1.4	V	-13.08	25.33	54.00	-28.67

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)
11g: High Channel 2462MHz									
326.74	53.37	QP	85	1.9	H	-17.38	35.99	46.00	-10.01
326.74	54.65	QP	259	1.6	V	-17.38	37.27	46.00	-8.73
4924.00	51.77	PK	266	1.6	V	-0.24	51.53	74.00	-22.47
4924.00	43.29	Ave	266	1.6	V	-0.24	43.05	54.00	-10.95
7386.00	48.38	PK	228	2.0	H	2.84	51.22	74.00	-22.78
7386.00	45.35	Ave	228	2.0	H	2.84	48.19	54.00	-5.81
2335.27	45.79	PK	19	1.5	V	-13.19	32.60	74.00	-41.40
2335.27	38.91	Ave	19	1.5	V	-13.19	25.72	54.00	-28.28
2365.39	44.06	PK	51	1.3	H	-13.14	30.92	74.00	-43.08
2365.39	36.45	Ave	51	1.3	H	-13.14	23.31	54.00	-30.69
2493.68	43.29	PK	139	1.2	V	-13.08	30.21	74.00	-43.79
2493.68	37.70	Ave	139	1.2	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)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
n20: Low Channel 2412MHz									
326.74	53.64	QP	79	1.8	H	-17.38	36.26	46.00	-9.74
326.74	55.25	QP	217	1.1	V	-17.38	37.87	46.00	-8.13
4824.00	51.27	PK	45	1.4	V	-1.06	50.21	74.00	-23.79
4824.00	42.57	Ave	45	1.4	V	-1.06	41.51	54.00	-12.49
7236.00	45.81	PK	313	1.7	H	1.33	47.14	74.00	-26.86
7236.00	43.87	Ave	313	1.7	H	1.33	45.20	54.00	-8.80
2311.82	46.92	PK	15	1.5	V	-13.19	33.73	74.00	-40.27
2311.82	39.42	Ave	15	1.5	V	-13.19	26.23	54.00	-27.77
2368.39	43.55	PK	84	1.6	H	-13.14	30.41	74.00	-43.59
2368.39	38.50	Ave	84	1.6	H	-13.14	25.36	54.00	-28.64
2497.09	44.91	PK	57	1.0	V	-13.08	31.83	74.00	-42.17
2497.09	36.31	Ave	57	1.0	V	-13.08	23.23	54.00	-30.77

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)
n20: Middle Channel 2437MHz									
326.74	52.56	QP	94	1.6	H	-17.38	35.18	46.00	-10.82
326.74	55.02	QP	19	1.2	V	-17.38	37.64	46.00	-8.36
4874.00	52.05	PK	56	1.8	V	-0.62	51.43	74.00	-22.57
4874.00	41.17	Ave	56	1.8	V	-0.62	40.55	54.00	-13.45
7311.00	46.83	PK	50	1.4	H	2.21	49.04	74.00	-24.96
7311.00	42.60	Ave	50	1.4	H	2.21	44.81	54.00	-9.19
2325.49	46.83	PK	224	1.8	V	-13.19	33.64	74.00	-40.36
2325.49	39.04	Ave	224	1.8	V	-13.19	25.85	54.00	-28.15
2354.47	43.31	PK	78	1.7	H	-13.14	30.17	74.00	-43.83
2354.47	36.93	Ave	78	1.7	H	-13.14	23.79	54.00	-30.21
2492.08	44.19	PK	319	1.7	V	-13.08	31.11	74.00	-42.89
2492.08	37.70	Ave	319	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)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
n20: High Channel 2462MHz									
326.74	51.22	QP	57	1.5	H	-17.38	33.84	46.00	-12.16
326.74	55.58	QP	162	1.4	V	-17.38	38.20	46.00	-7.80
4924.00	51.70	PK	280	1.9	V	-0.24	51.46	74.00	-22.54
4924.00	40.45	Ave	280	1.9	V	-0.24	40.21	54.00	-13.79
7386.00	46.34	PK	326	1.8	H	2.84	49.18	74.00	-24.82
7386.00	42.49	Ave	326	1.8	H	2.84	45.33	54.00	-8.67
2323.11	46.96	PK	53	2.0	V	-13.19	33.77	74.00	-40.23
2323.11	39.31	Ave	53	2.0	V	-13.19	26.12	54.00	-27.88
2389.26	42.54	PK	73	1.2	H	-13.14	29.40	74.00	-44.60
2389.26	38.04	Ave	73	1.2	H	-13.14	24.90	54.00	-29.10
2488.95	42.61	PK	348	1.8	V	-13.08	29.53	74.00	-44.47
2488.95	38.31	Ave	348	1.8	V	-13.08	25.23	54.00	-28.77

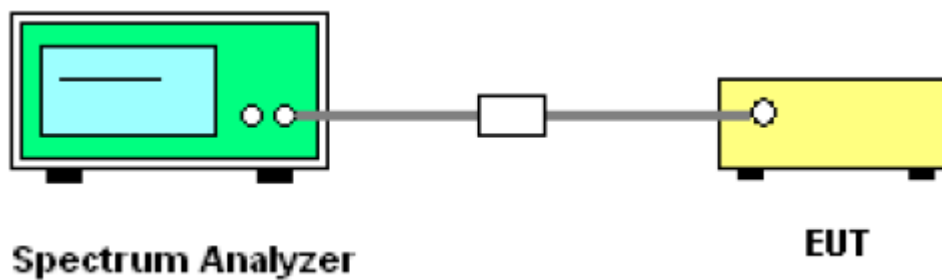
9 Band Edge Measurement

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	558074 D01 15.247 Meas Guidance v05r02, ANSI C63.10:2013
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 Produce

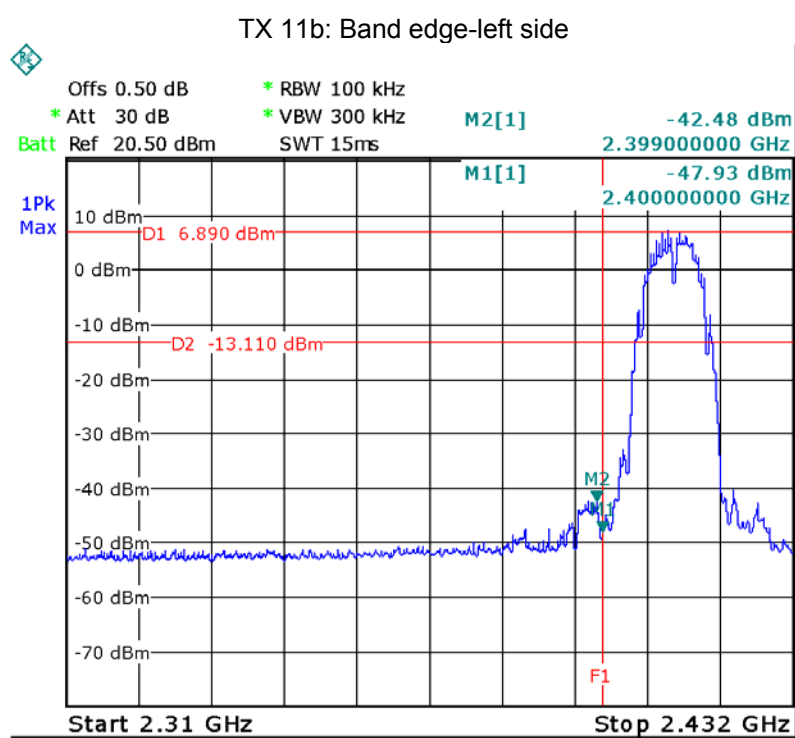
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then 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 Setup

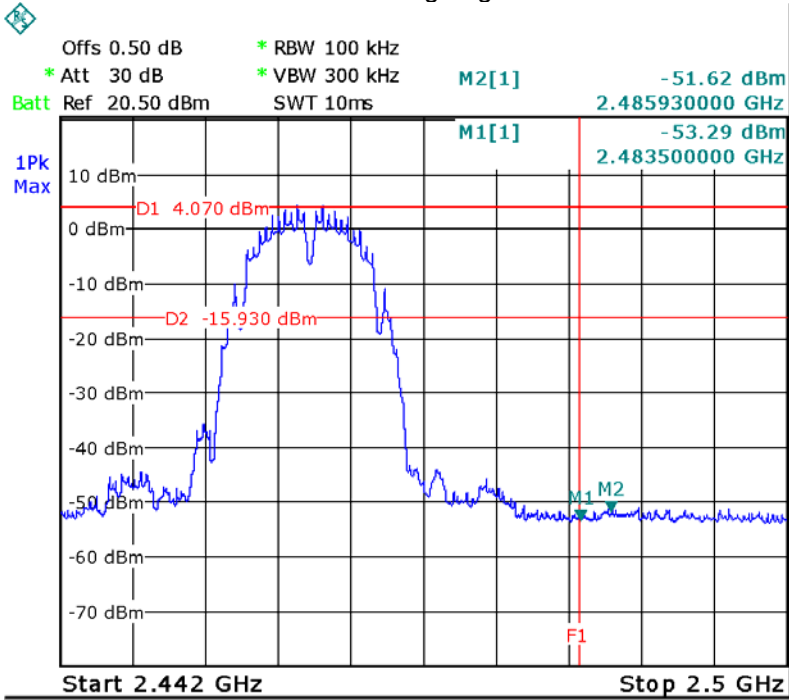


9.3 Test Result

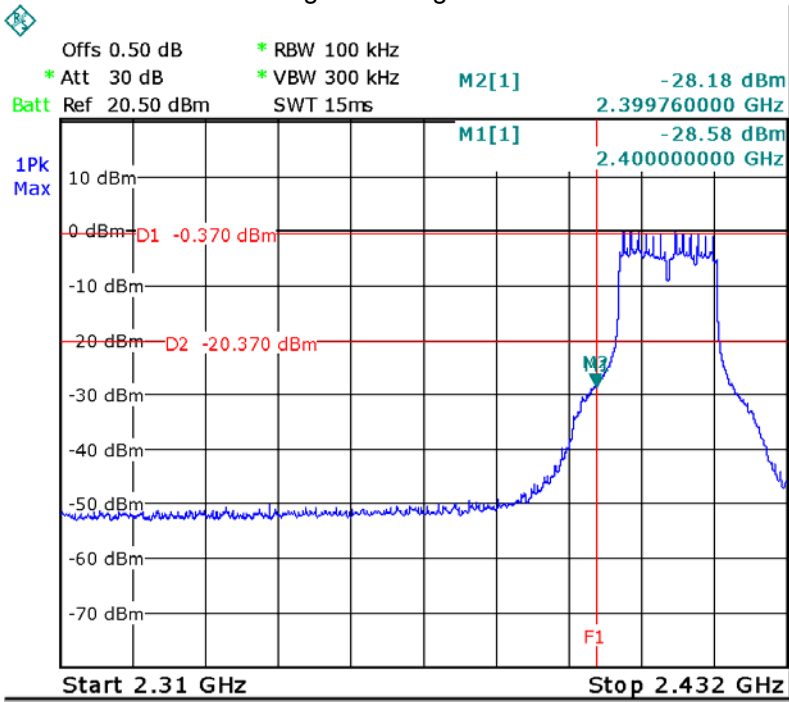
Test result plots shown as follows:



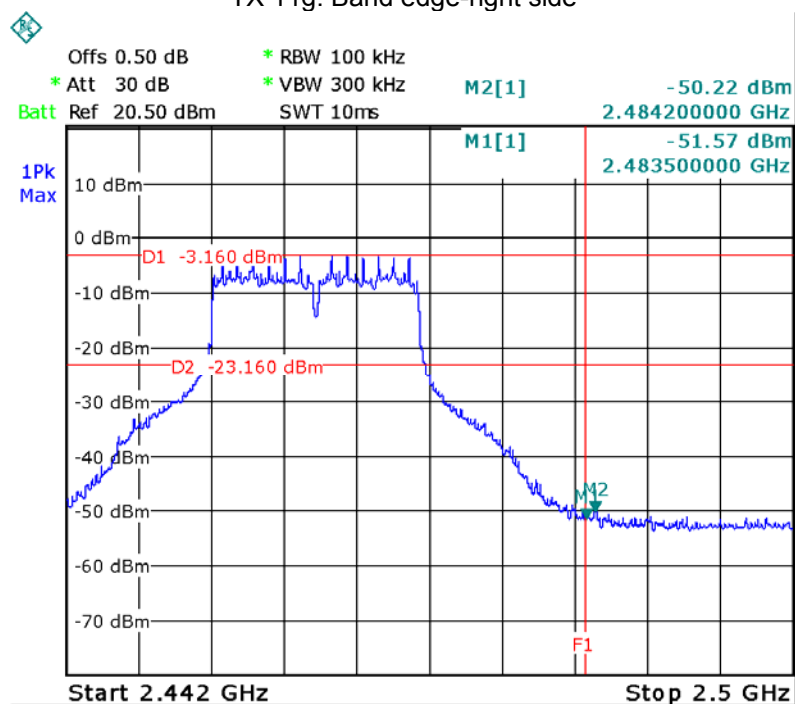
TX 11b: Band edge-right side



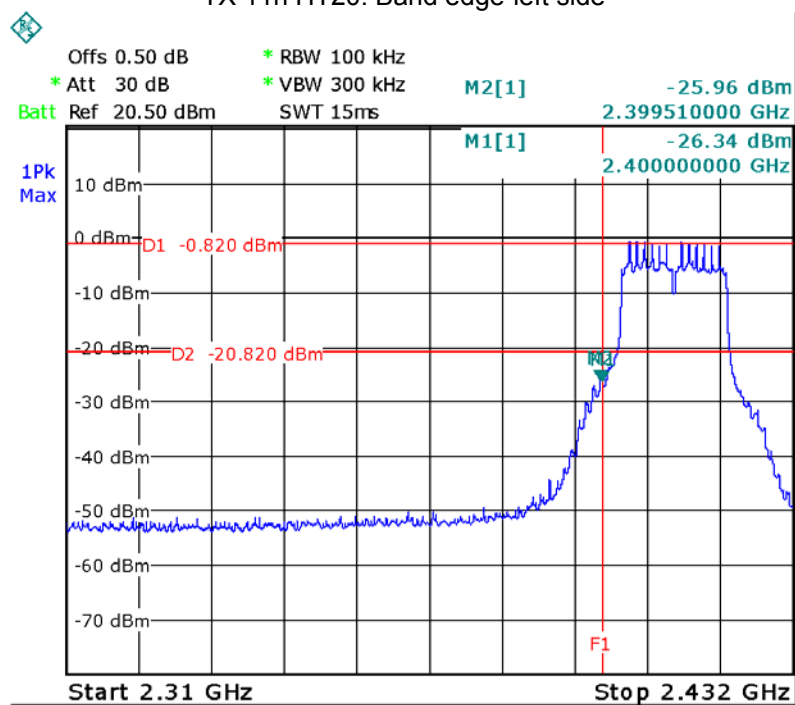
TX 11g: Band edge-left side

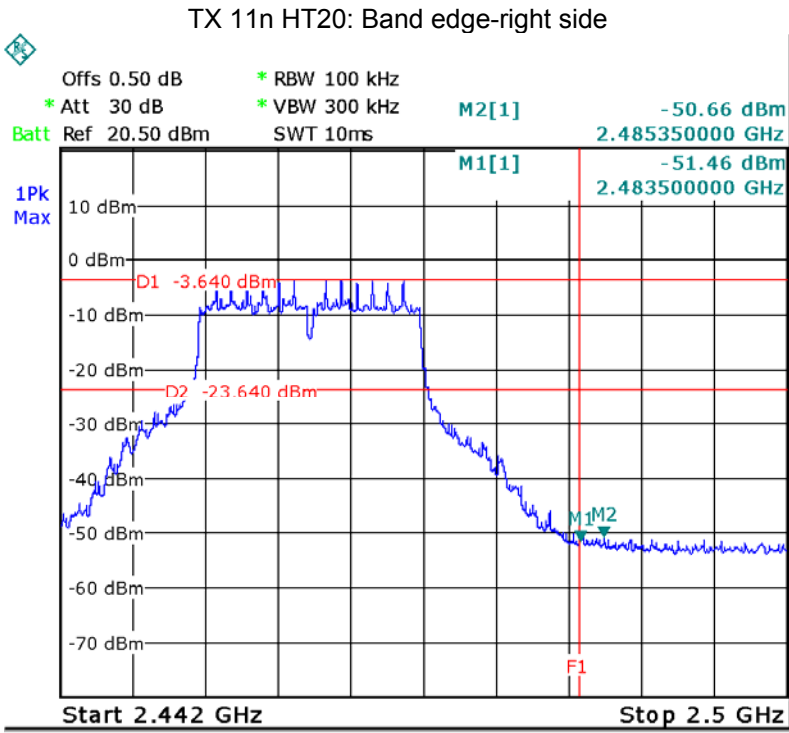


TX 11g: Band edge-right side



TX 11n HT20: Band edge-left side





10 Bandwidth Measurement

Test Requirement:

FCC CFR47 Part 15 Section 15.247

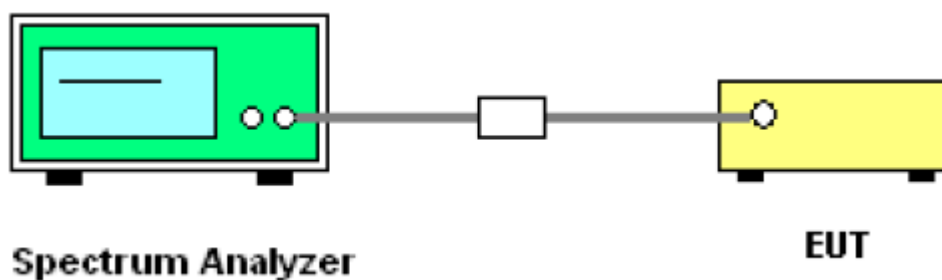
Test Method:

558074 D01 15.247 Meas Guidance v05r02, ANSI C63.10:2013

10.1 Test Procedure

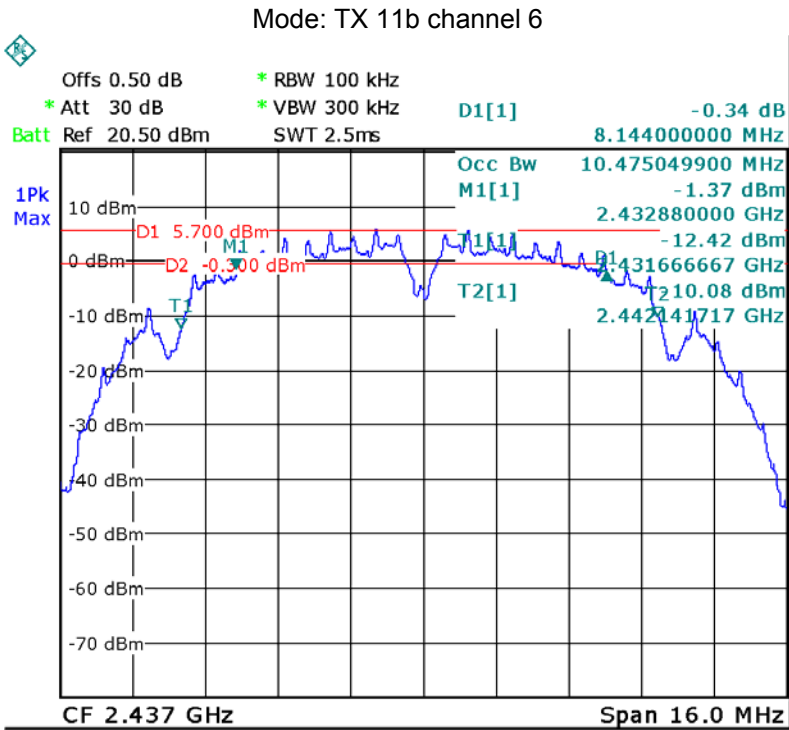
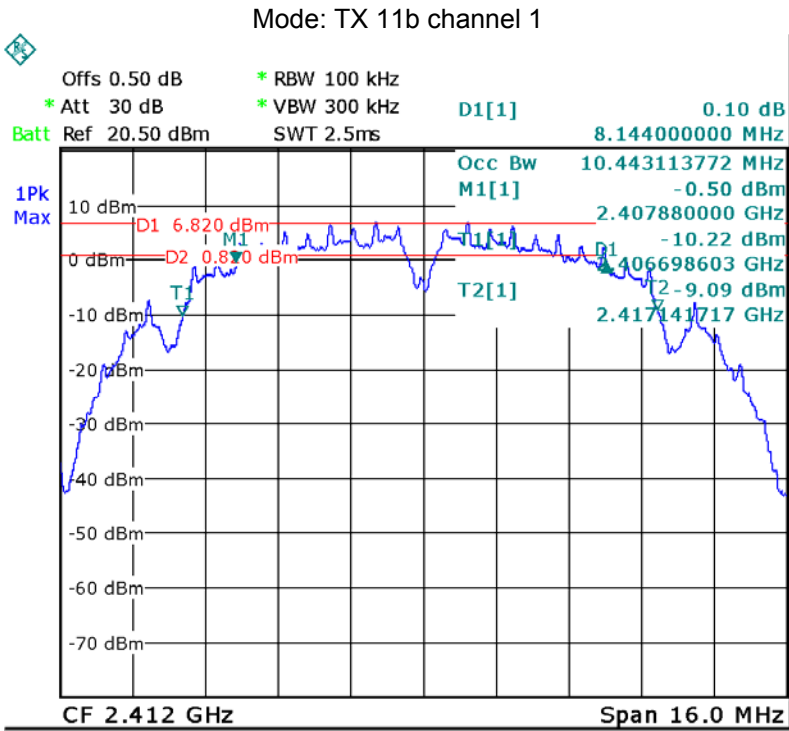
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

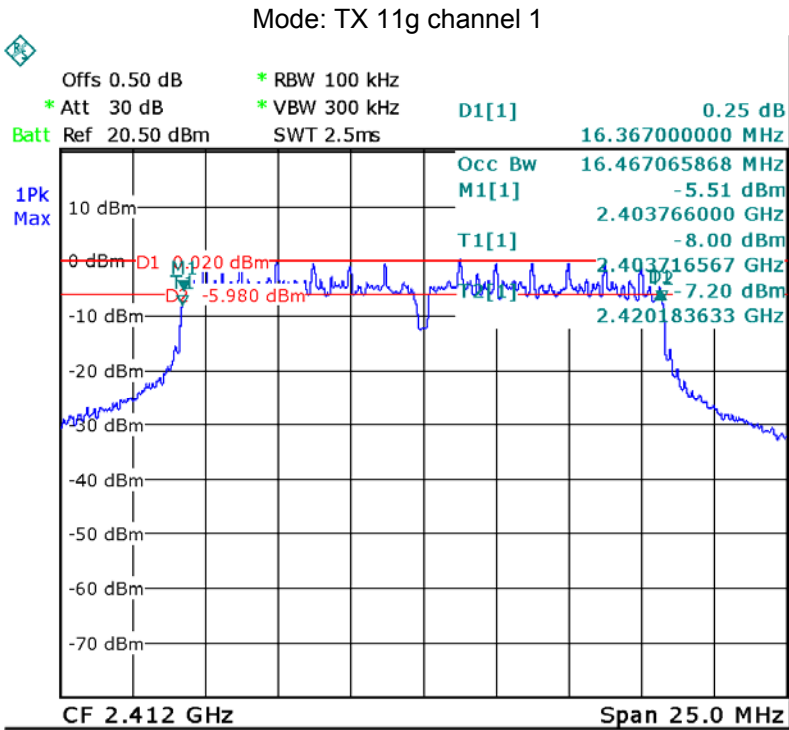
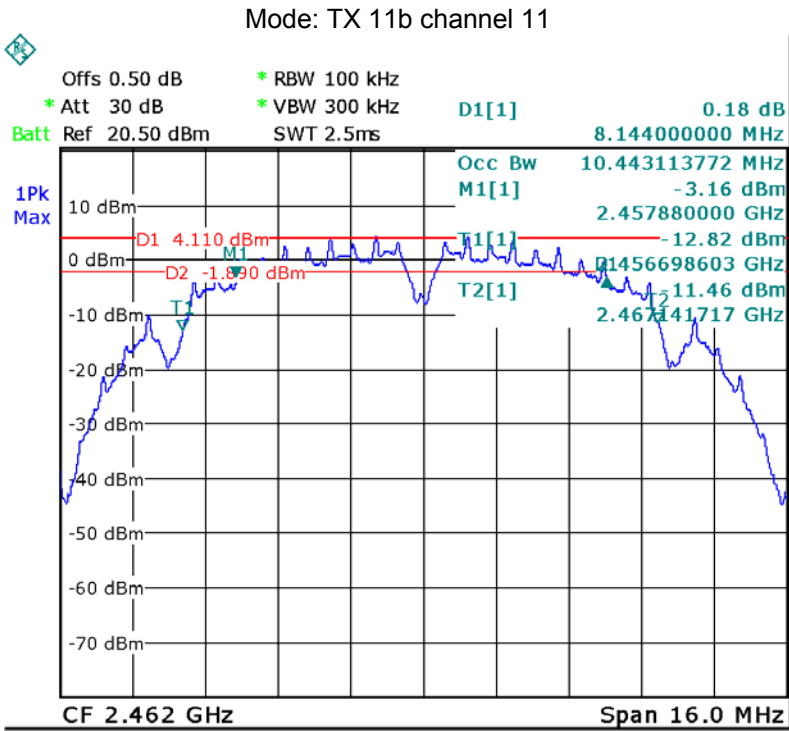
10.2 Test Setup

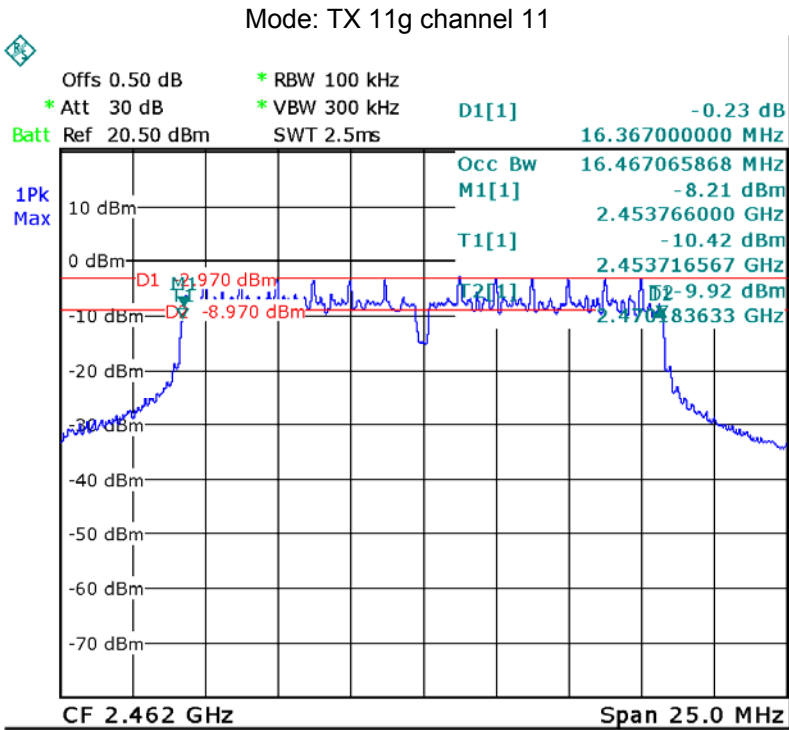
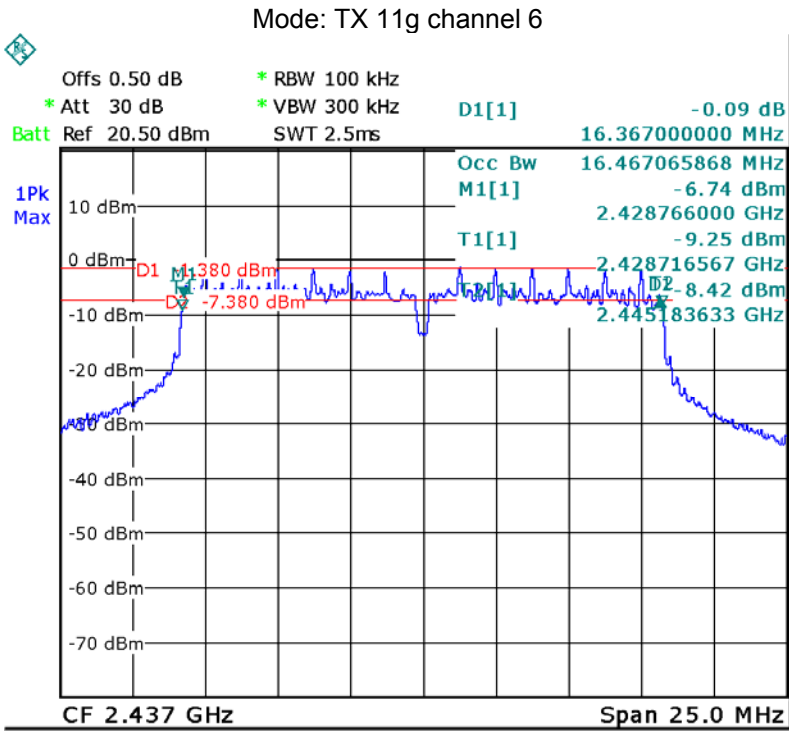


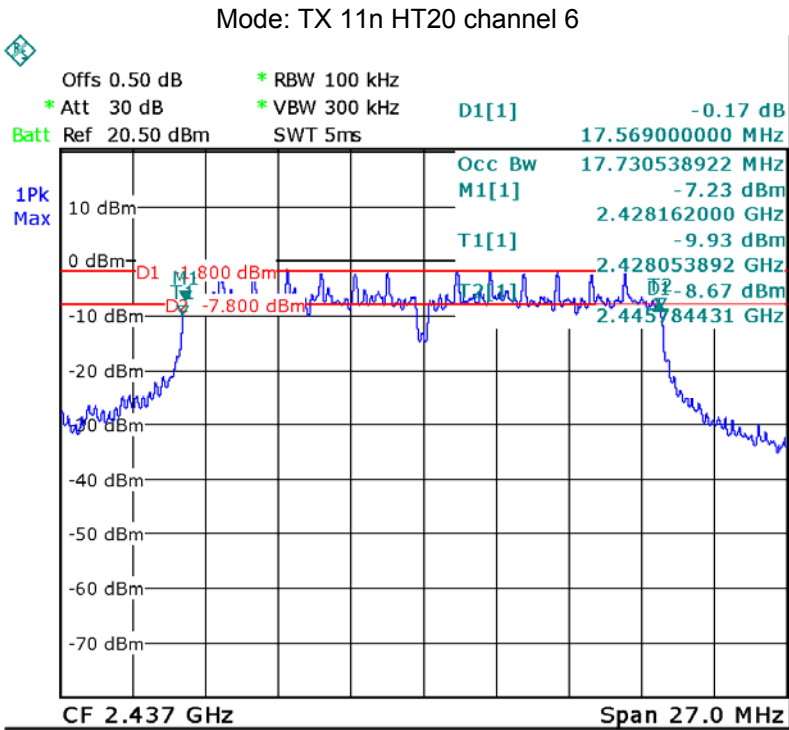
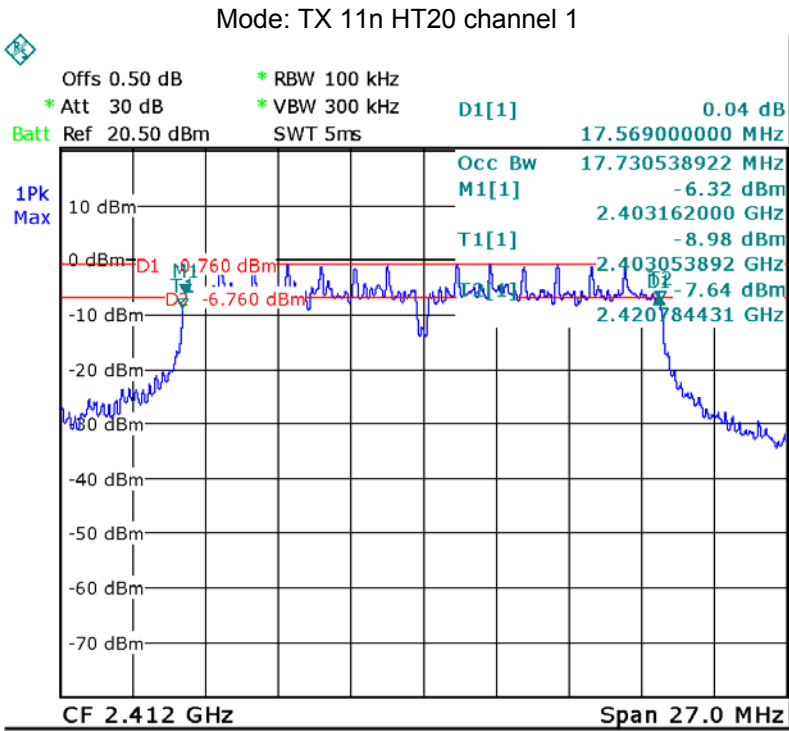
10.3 Test Result

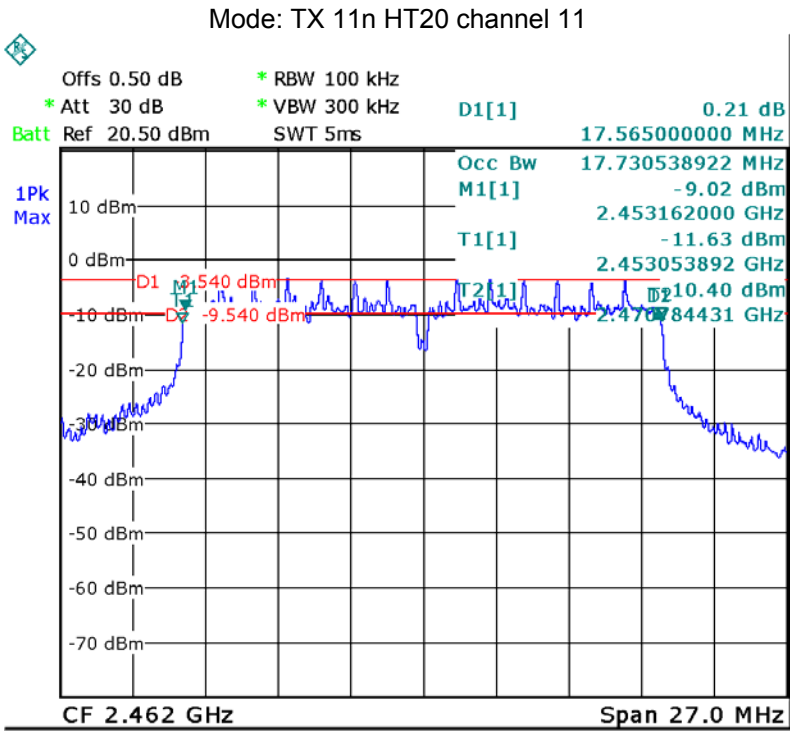
Operation mode	6dB Bandwidth (MHz)			99% Bandwidth (MHz)		
TX 11b	Channel 1	Channel 6	Channel 11	Channel 1	Channel 6	Channel 11
	8.144	8.144	8.144	10.443	10.475	10.443
TX 11g	Channel 1	Channel 6	Channel 11	Channel 1	Channel 6	Channel 11
	16.367	16.367	16.367	16.467	16.467	16.467
TX 11n HT20	Channel 1	Channel 6	Channel 11	Channel 1	Channel 6	Channel 11
	17.569	17.569	17.565	17.731	17.731	17.731











11 Maximum Peak Output Power

Test Requirement:

FCC CFR47 Part 15 Section 15.247

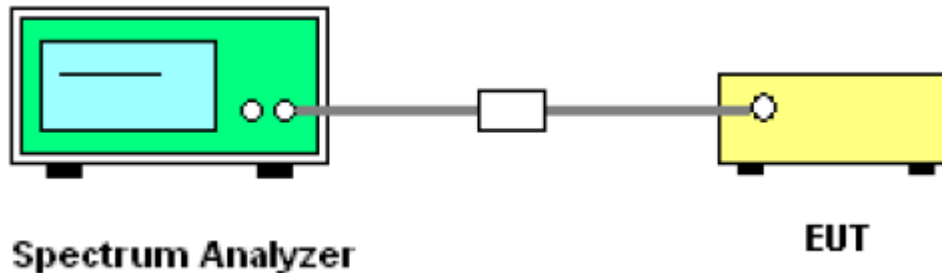
Test Method:

558074 D01 15.247 Meas Guidance v05r02, ANSI C63.10:2013

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 = 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 Setup

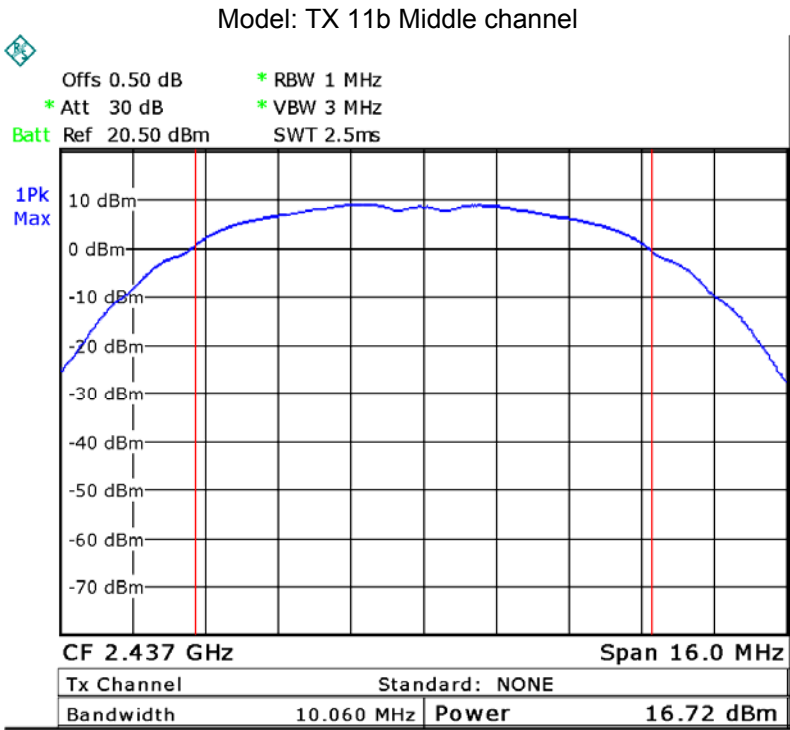
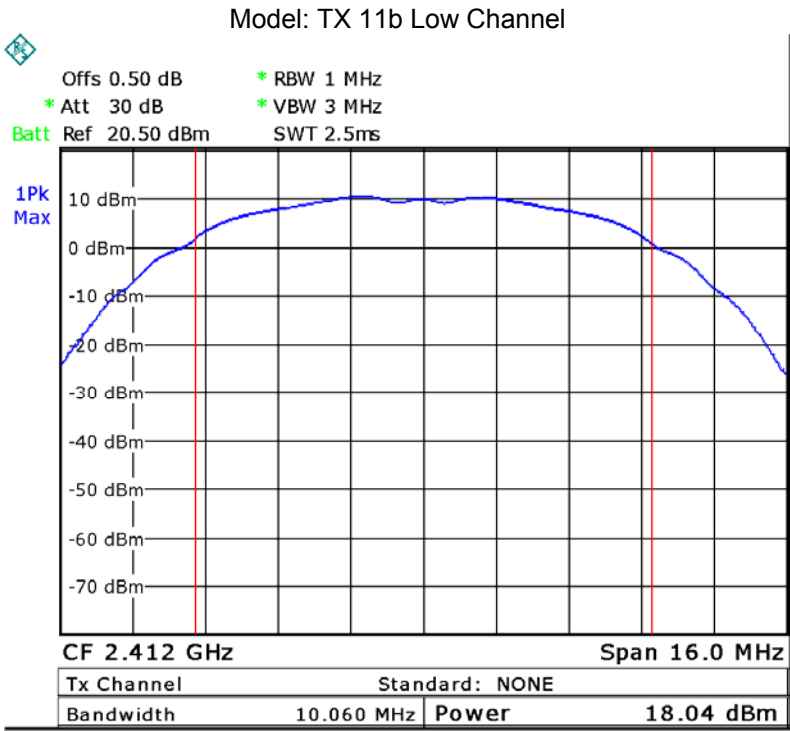


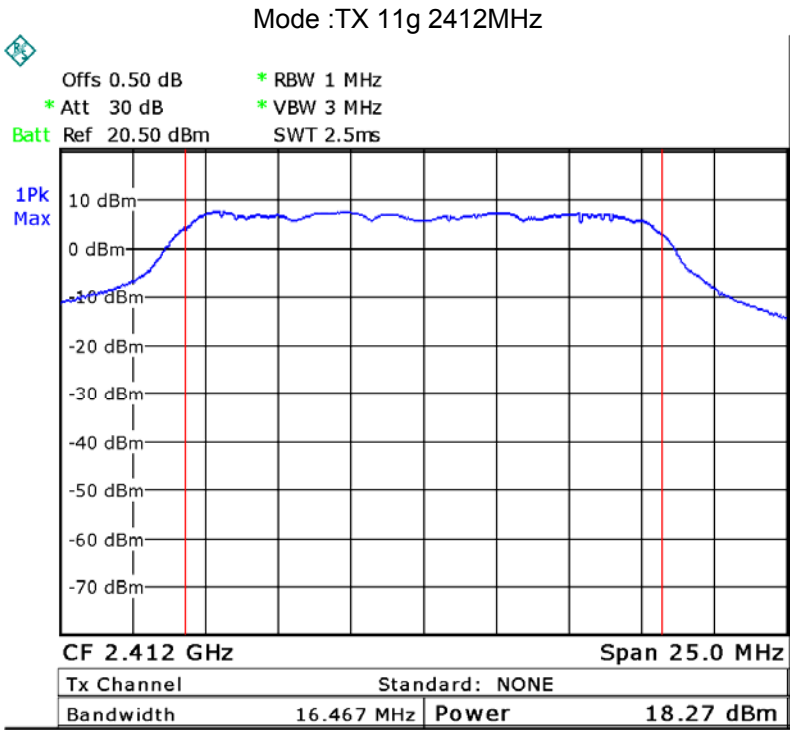
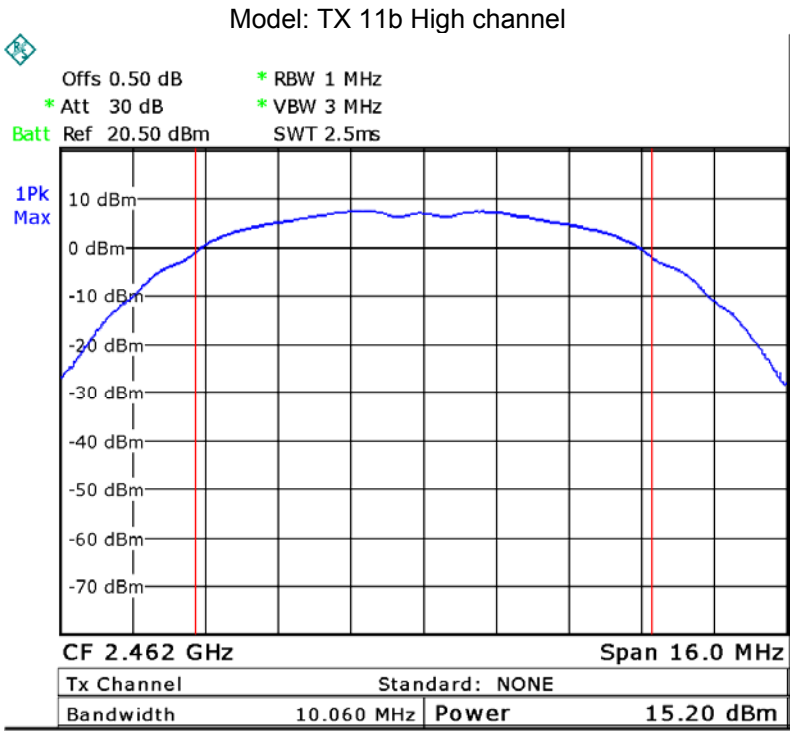
11.3 Test Result

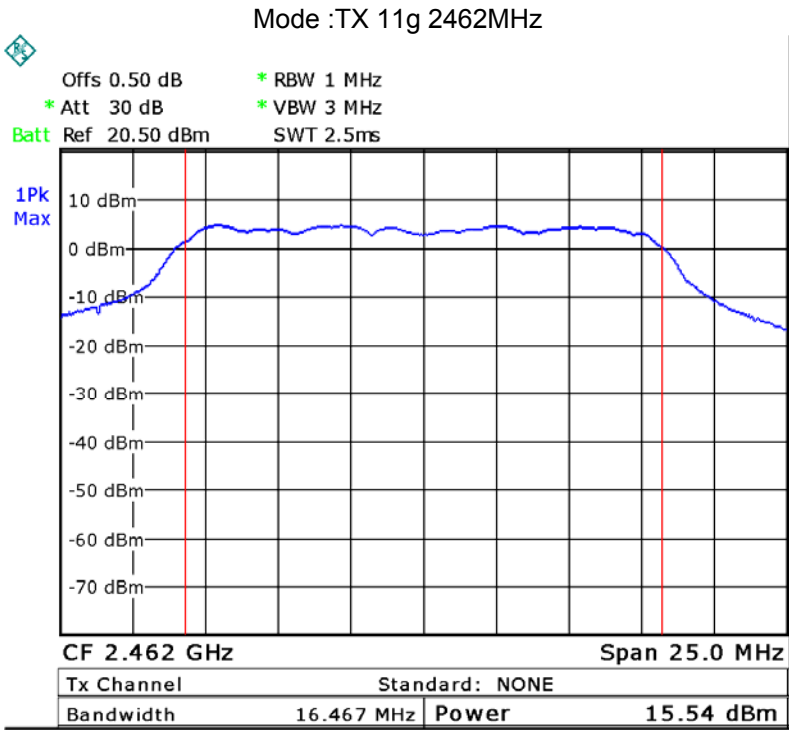
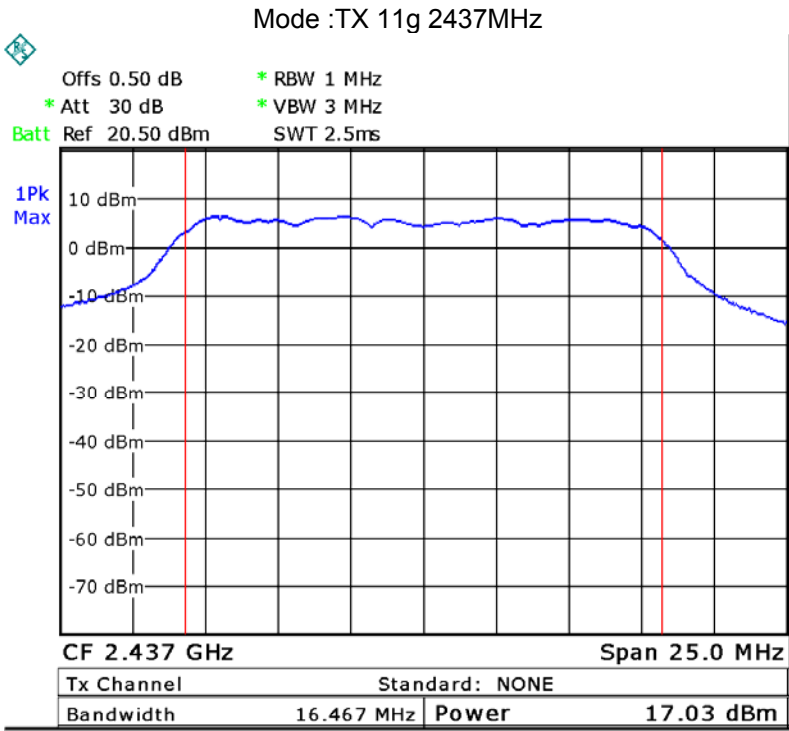
Test mode :TX 11b		
Maximum Peak Output Power (dBm)		
2412MHz	2437MHz	2462MHz
18.04	16.72	15.20
Limit: 1W/30dBm		

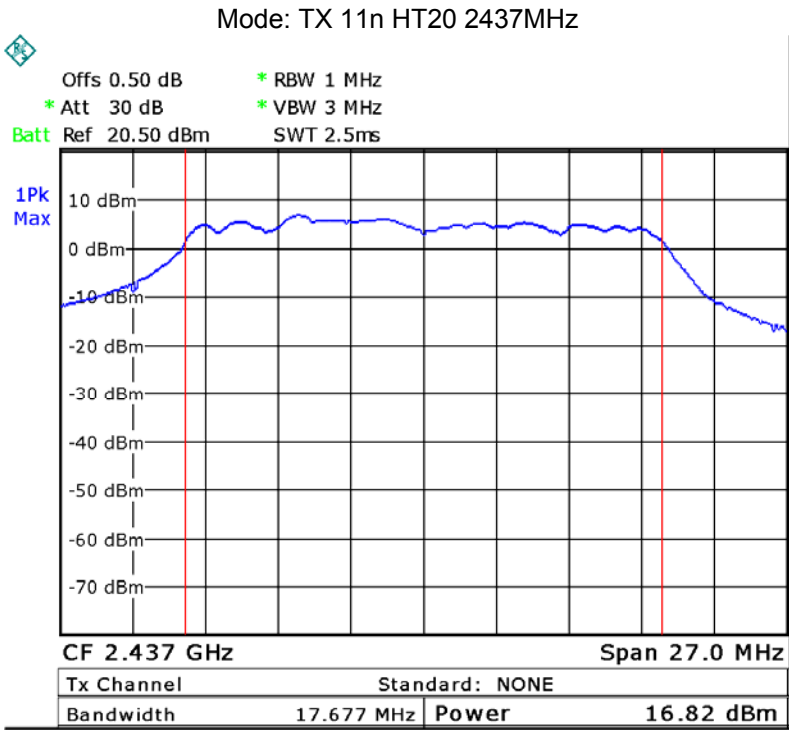
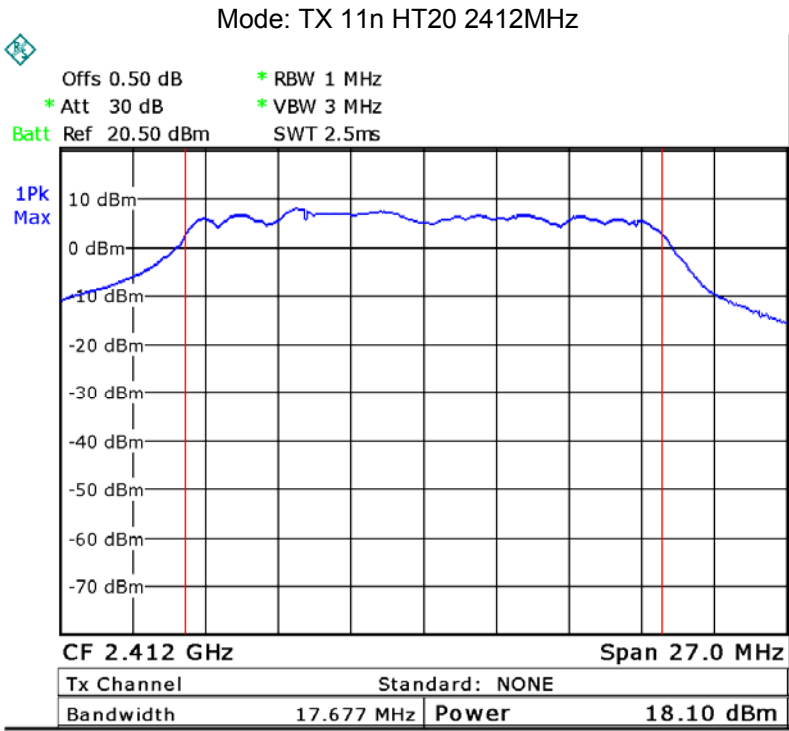
Test mode :TX 11g		
Maximum Peak Output Power (dBm)		
2412MHz	2437MHz	2462MHz
18.27	17.03	15.54
Limit: 1W/30dBm		

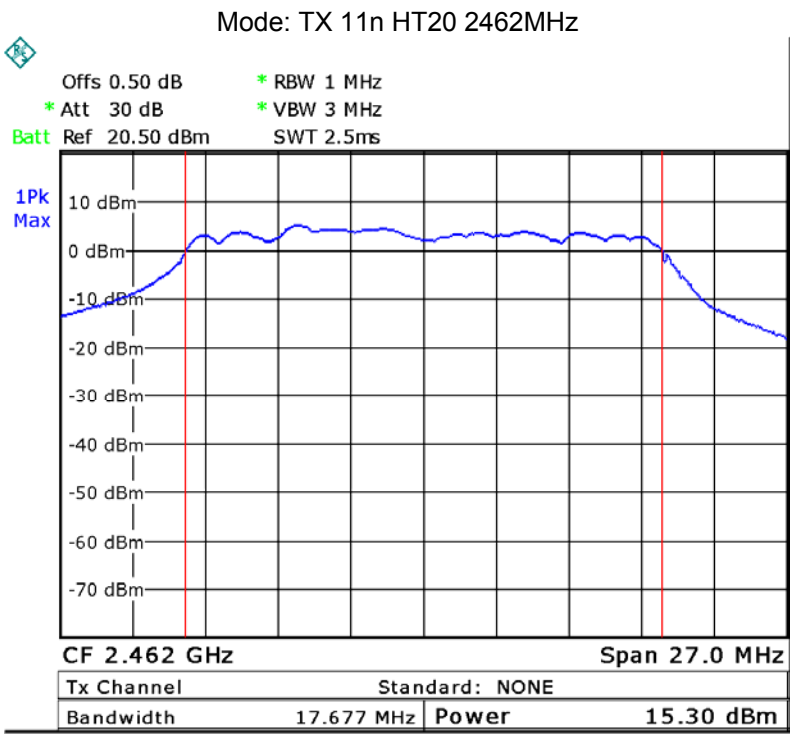
Test mode :TX 11n HT20		
Maximum Peak Output Power (dBm)		
2412MHz	2437MHz	2462MHz
18.10	16.82	15.30
Limit: 1W/30dBm		











12 Power Spectral density

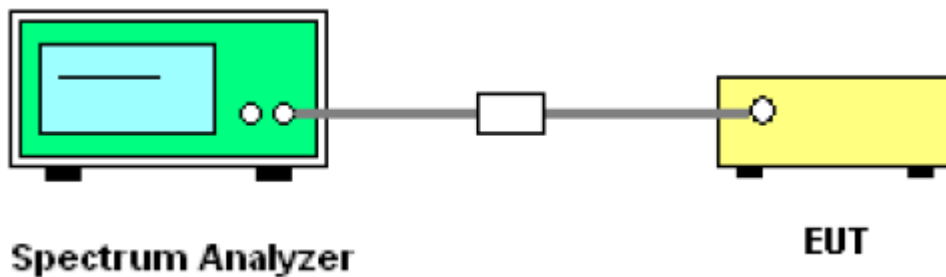
Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: 558074 D01 15.247 Meas Guidance v05r02, ANSI C63.10:2013

12.1 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 = 3kHz. VBW = 10kHz , Span =30M. 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 Setup

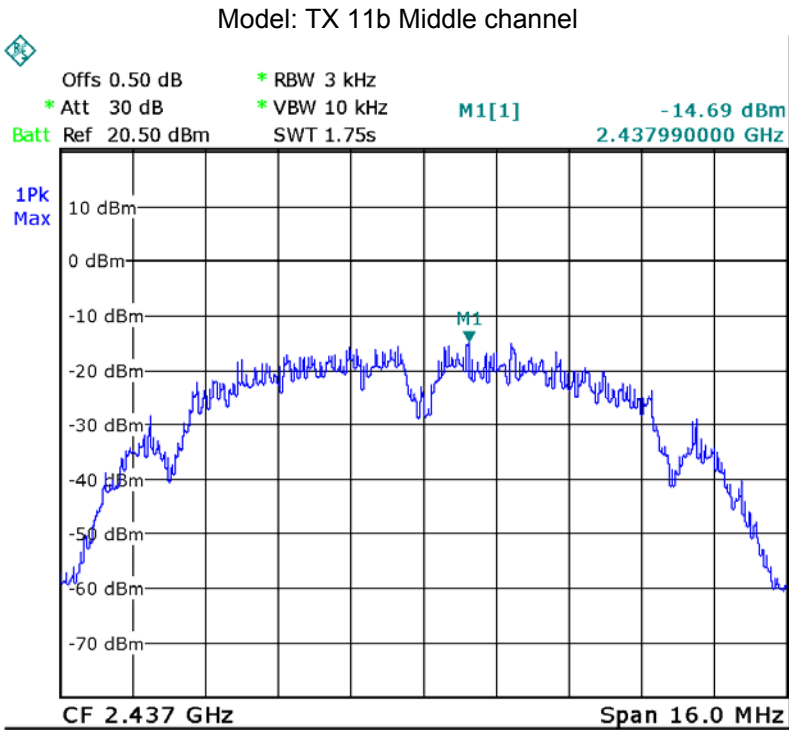
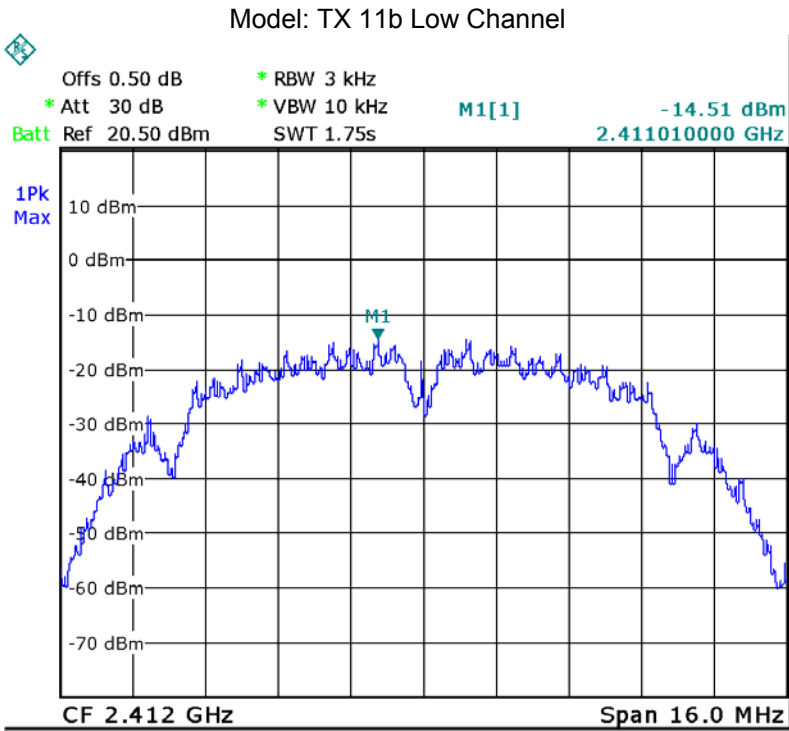


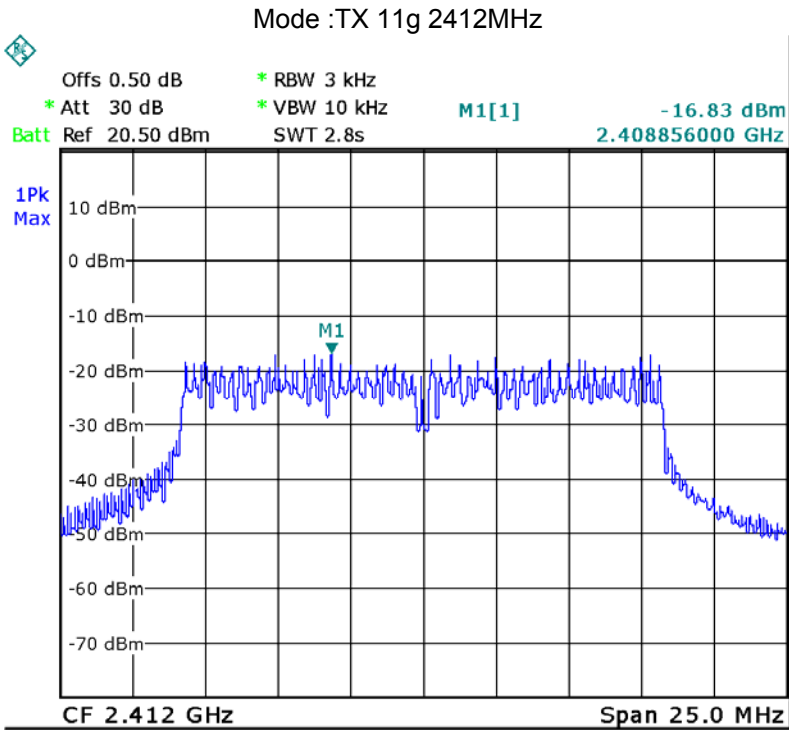
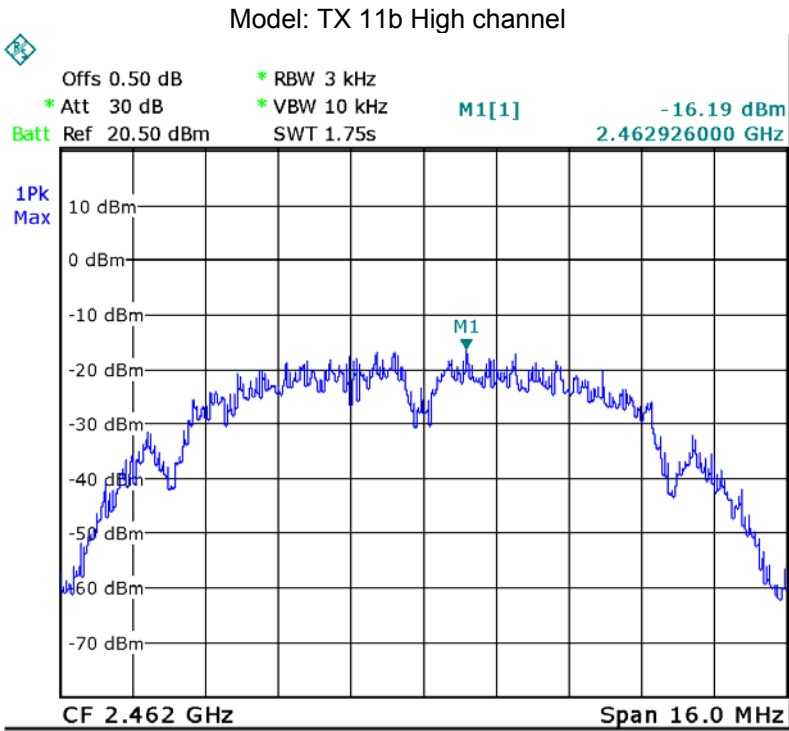
12.3 Test Result

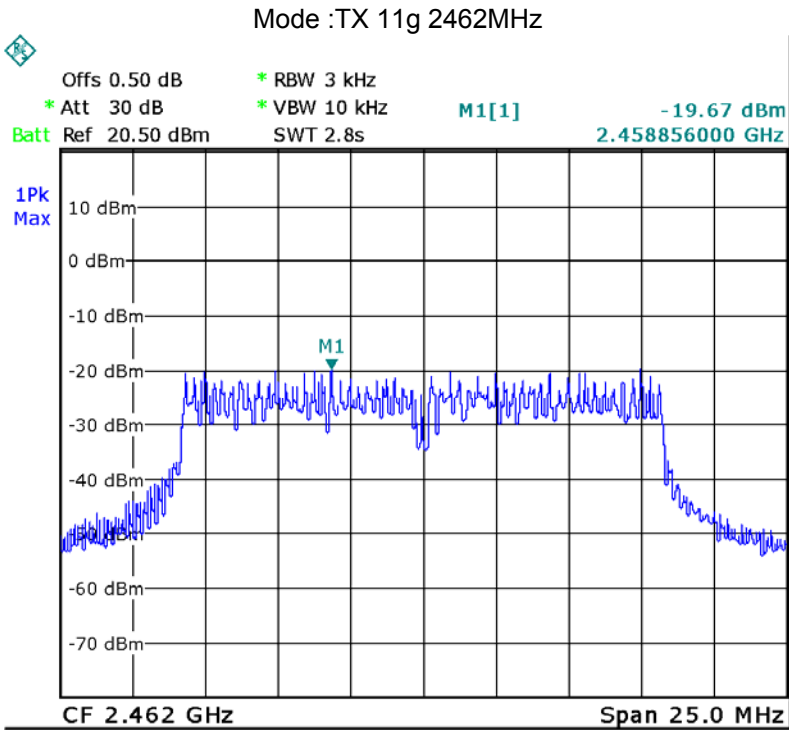
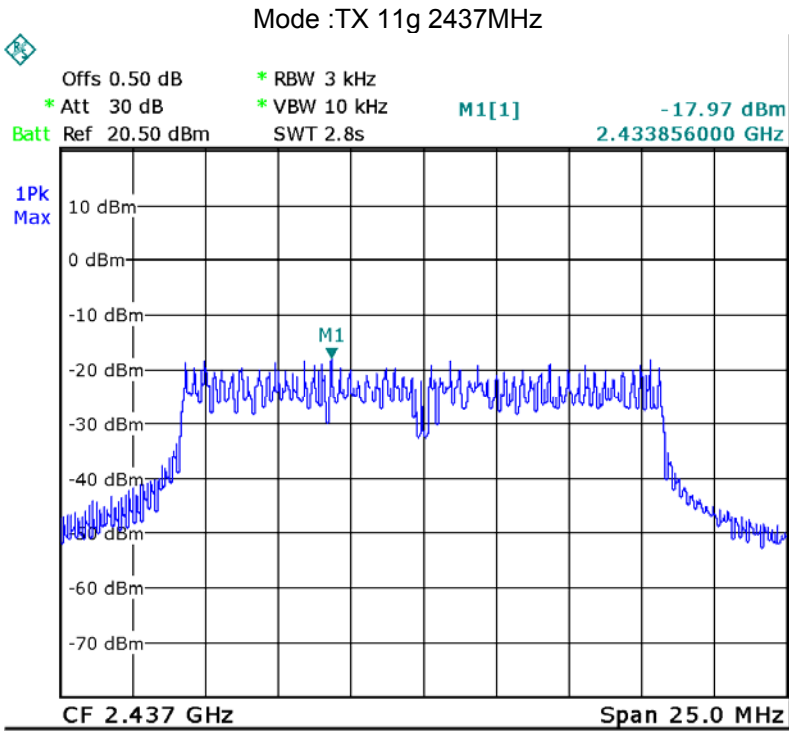
Test mode :TX 11b		
Power Spectral (dBm per 3kHz)		
2412MHz	2437MHz	2462MHz
-14.51	-14.69	-16.19
Limit: 8dBm per 3kHz		

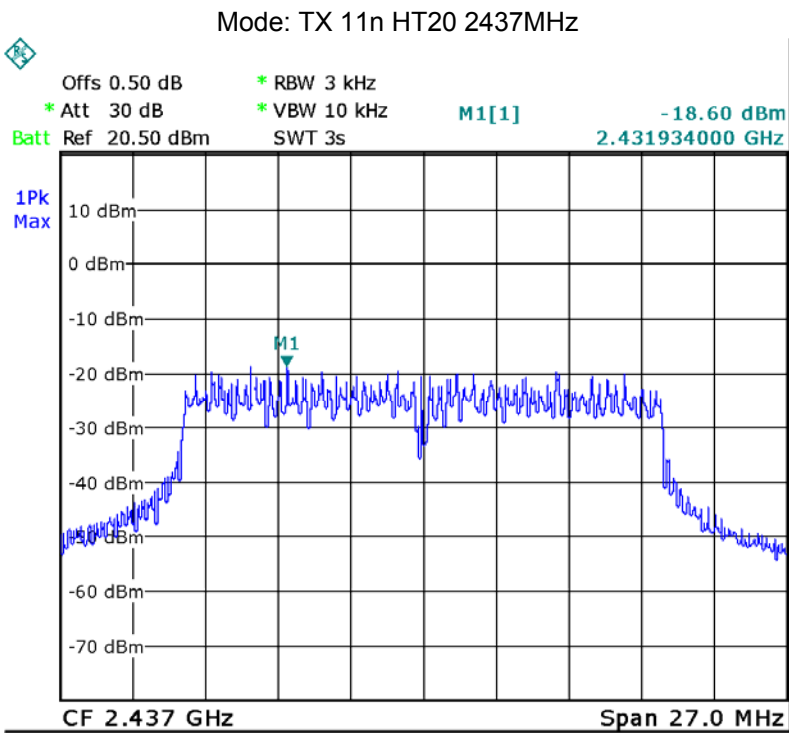
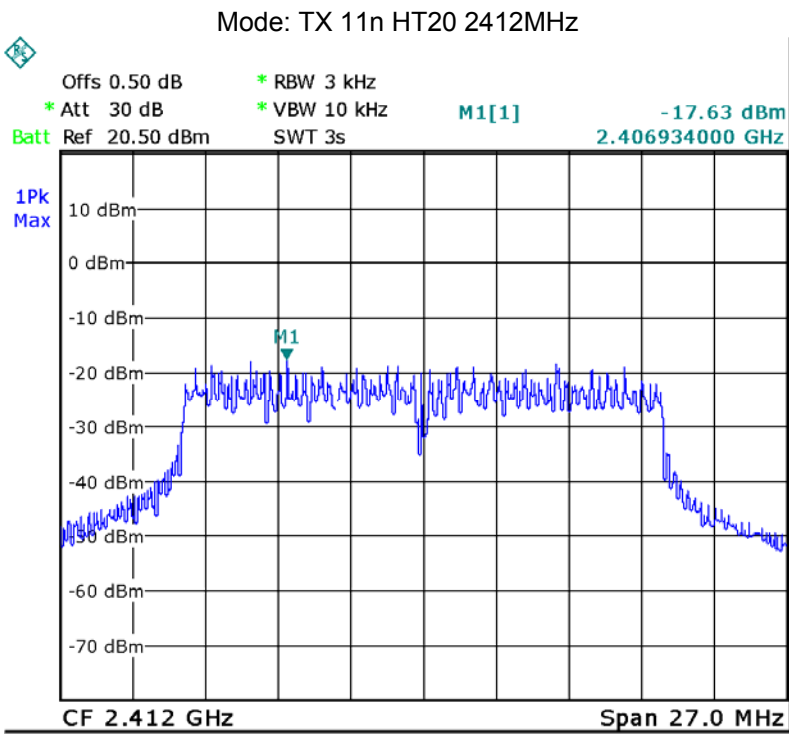
Test mode :TX 11g		
Power Spectral (dBm per 3kHz)		
2412MHz	2437MHz	2462MHz
-16.83	-17.97	-19.67
Limit: 8dBm per 3kHz		

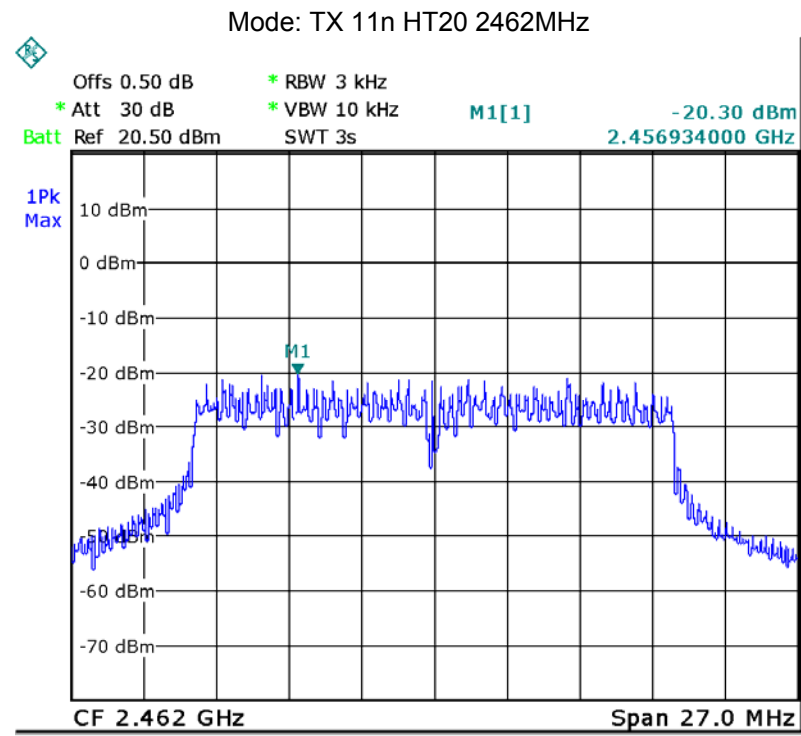
Test mode :TX 11n HT20		
Power Spectral (dBm per 3kHz)		
2412MHz	2437MHz	2462MHz
-17.63	-18.60	-20.30
Limit: 8dBm per 3kHz		











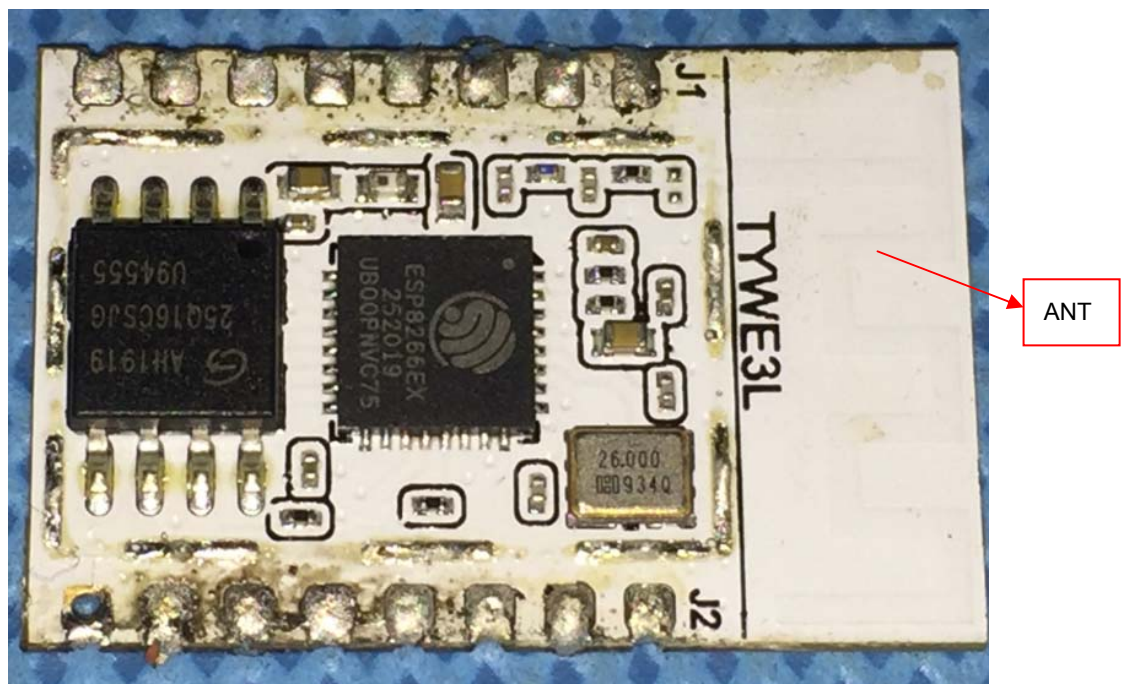
13 Antenna Requirement

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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 47 CFR Section 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.

Result:

The EUT have one PCB Printed Antenna, meets the requirements of FCC 15.203.



14 FCC ID: 2AIOC-RGB03W RF Exposure Report

Test Requirement: FCC Part 1.1307

Evaluation Method: FCC Part 2.1091 & KDB 447498 D01 General RF Exposure Guidance v06

14.1 Requirements

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

14.2 Evaluation Result

$$S = \frac{P \times G}{4 \times \pi \times R^2}$$

S = power density (in appropriate units, e.g. mW/cm²)

P = output power to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator,
the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

From the peak EUT RF output power, the minimum mobile separation distance, R=20cm, as well as the gain of the used antenna, the RF power density can be obtained

Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (mW/cm ²)	Limit of Power Density (mW/cm ²)
0.0	1.0	18.27	67.14	0.013	1

14.3 Result: Compliance

No SAR measurement is required.

15 Photographs –HKWL-RGB03W Test Setup Photos

15.1 Photograph-Conducted Emissions Test Setup Photos

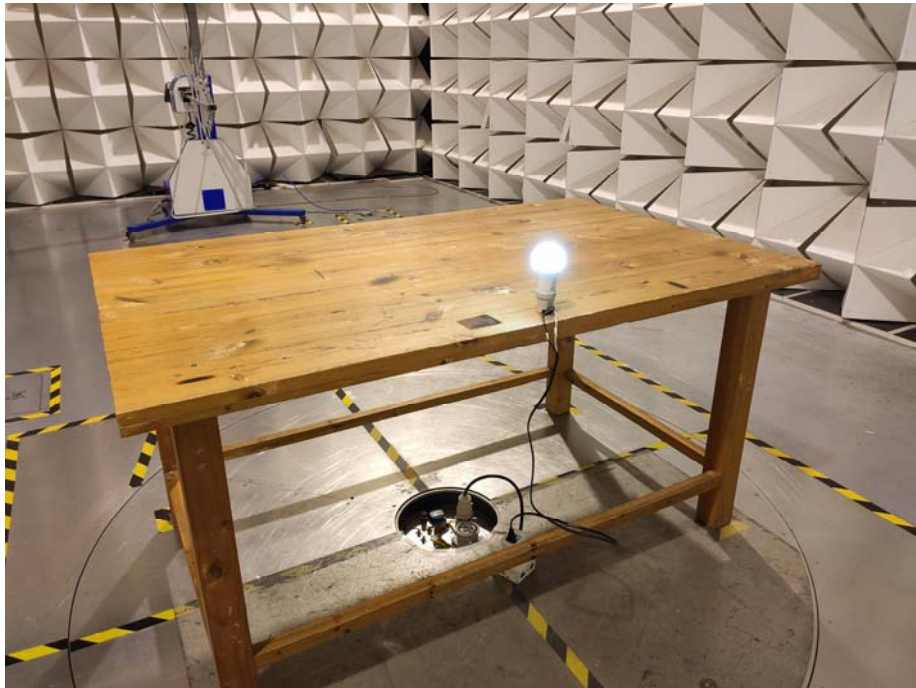


15.2 Photograph – Radiated Spurious Emissions Test Setup Photos

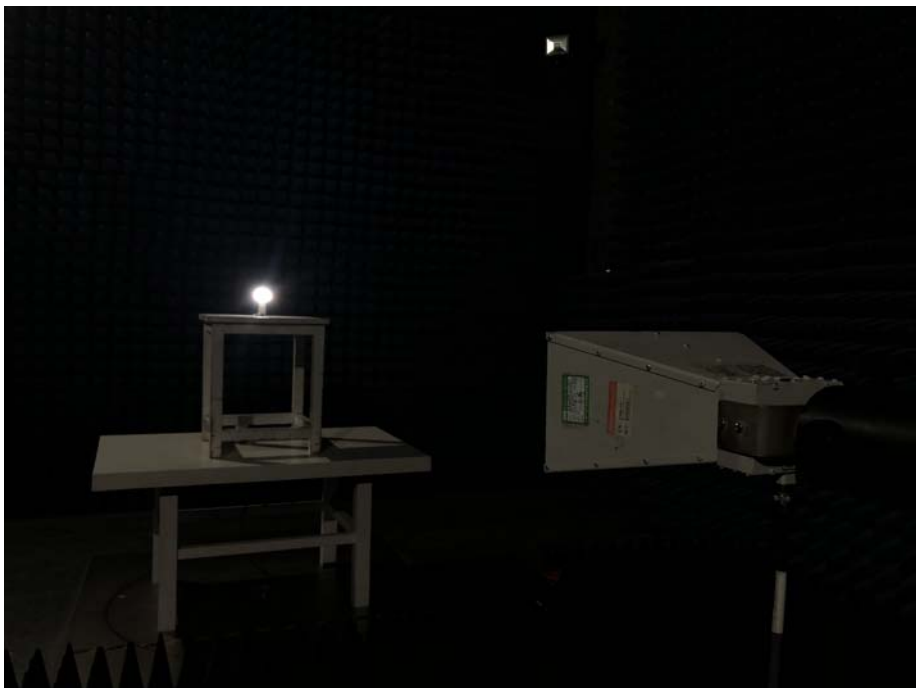
9 kHz to 30 MHz



From 30 MHz to 1GHz



Above 1GHz



16 Photographs - Constructional Details

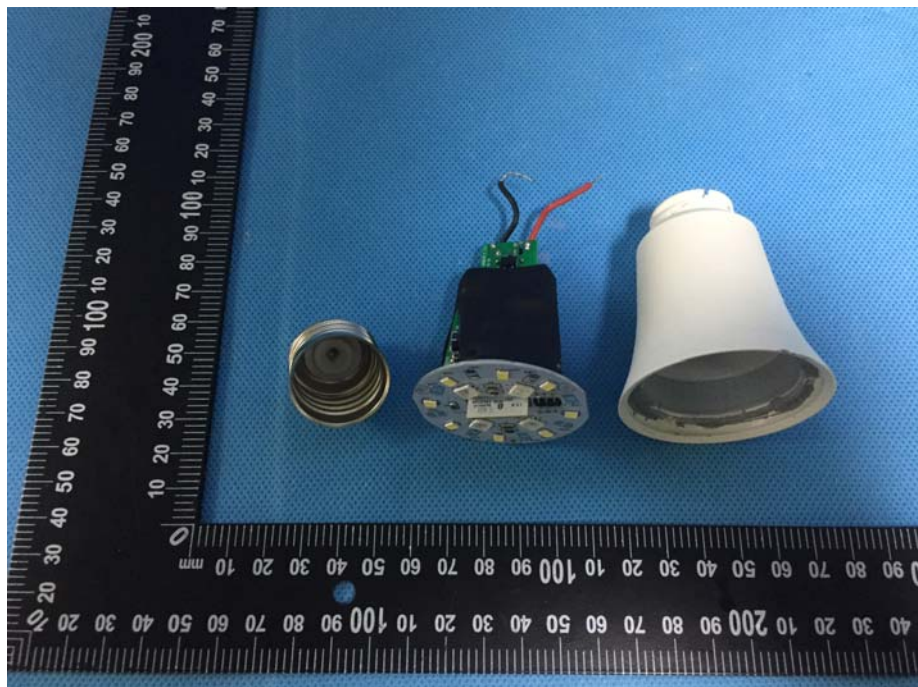
16.1 Model HKWL-RGB03W - External Photos

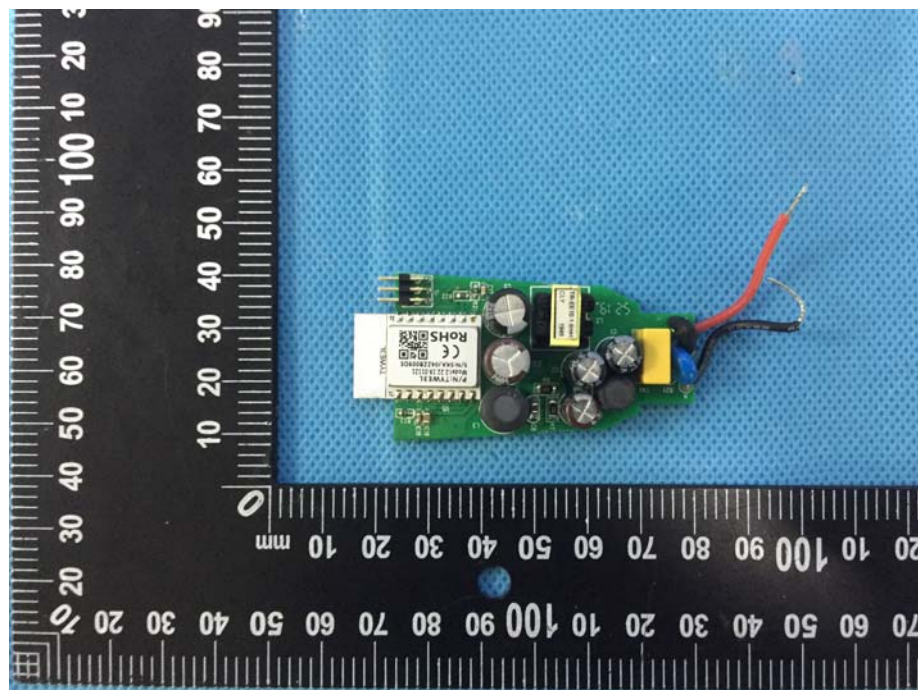
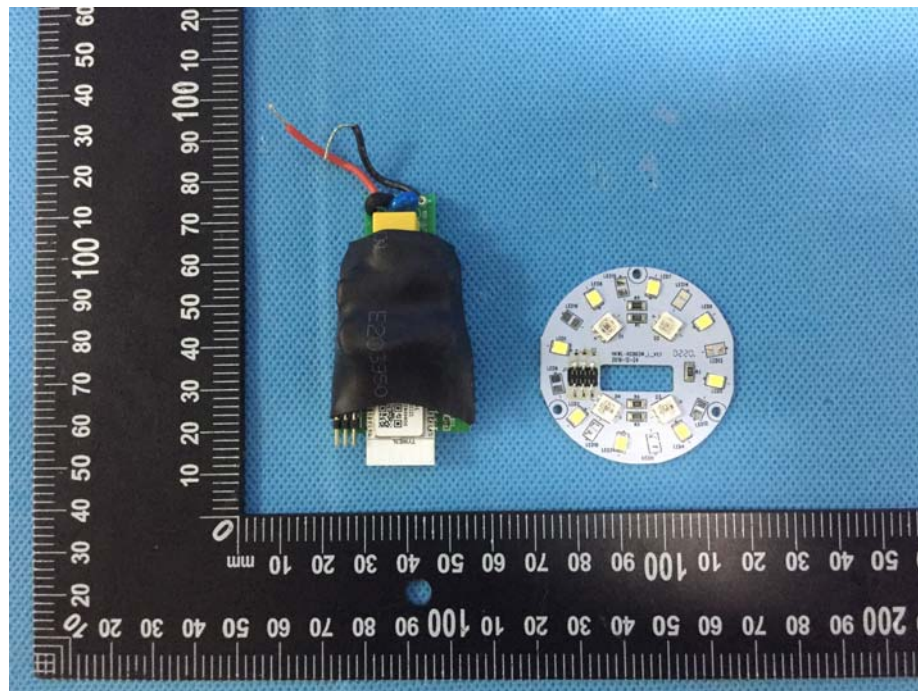


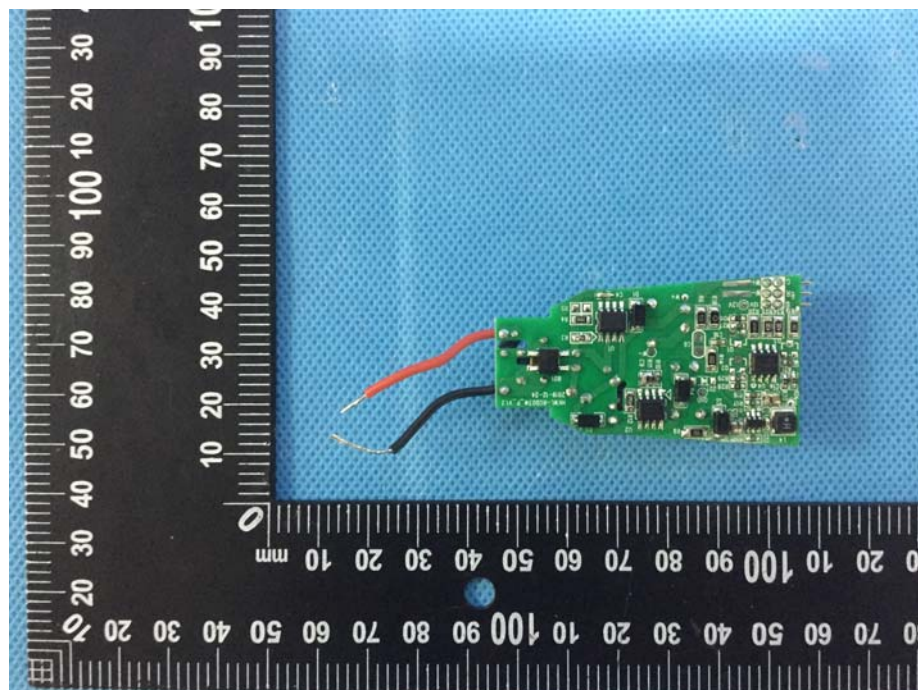
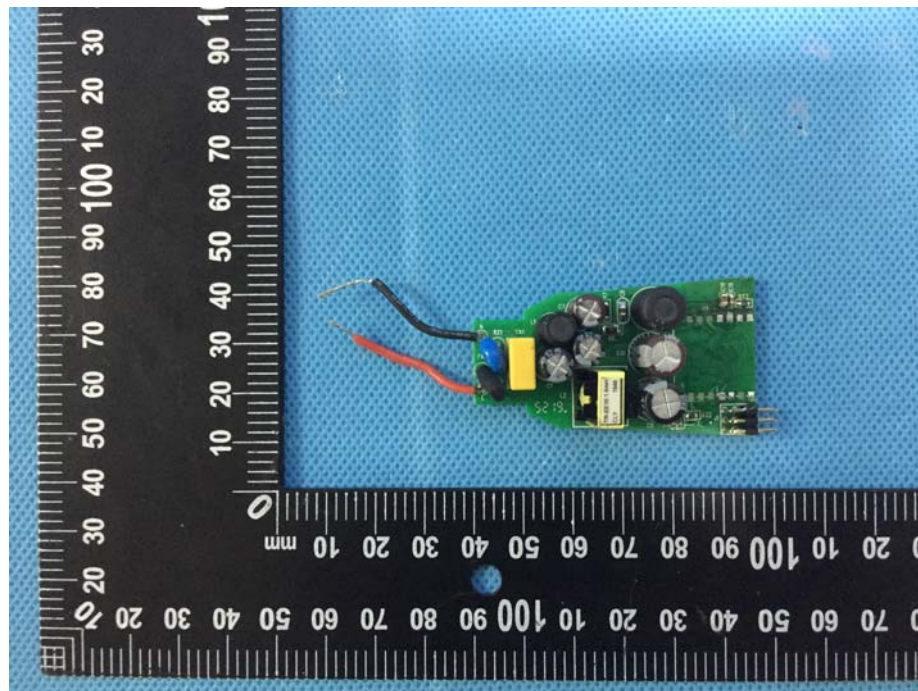


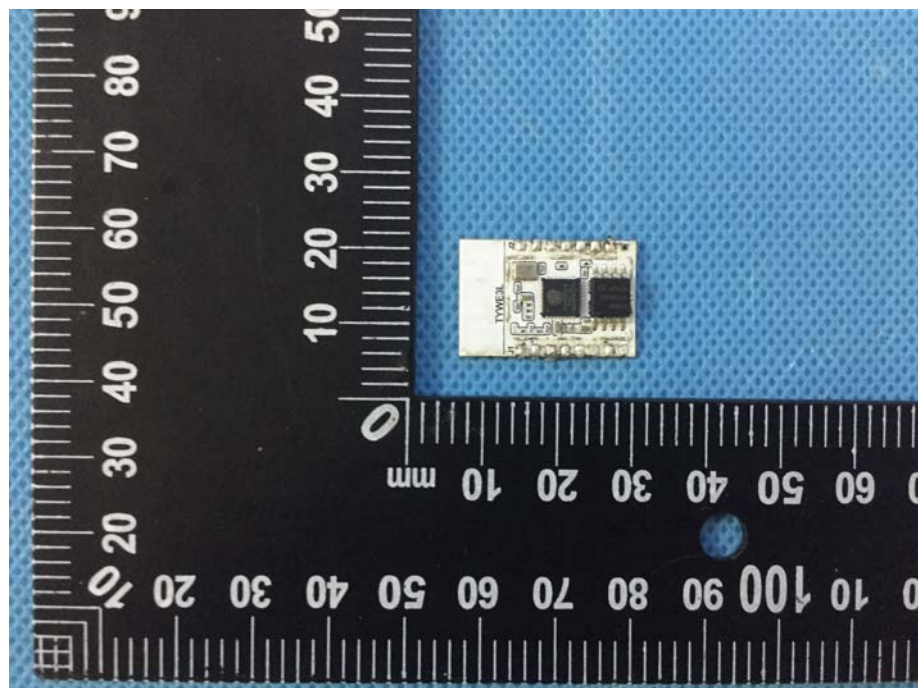
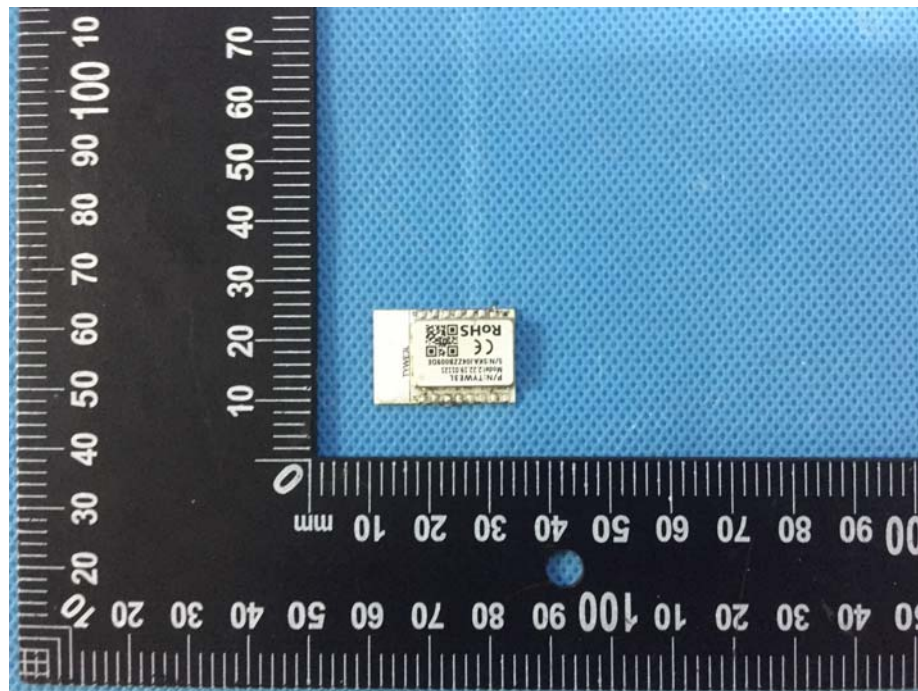


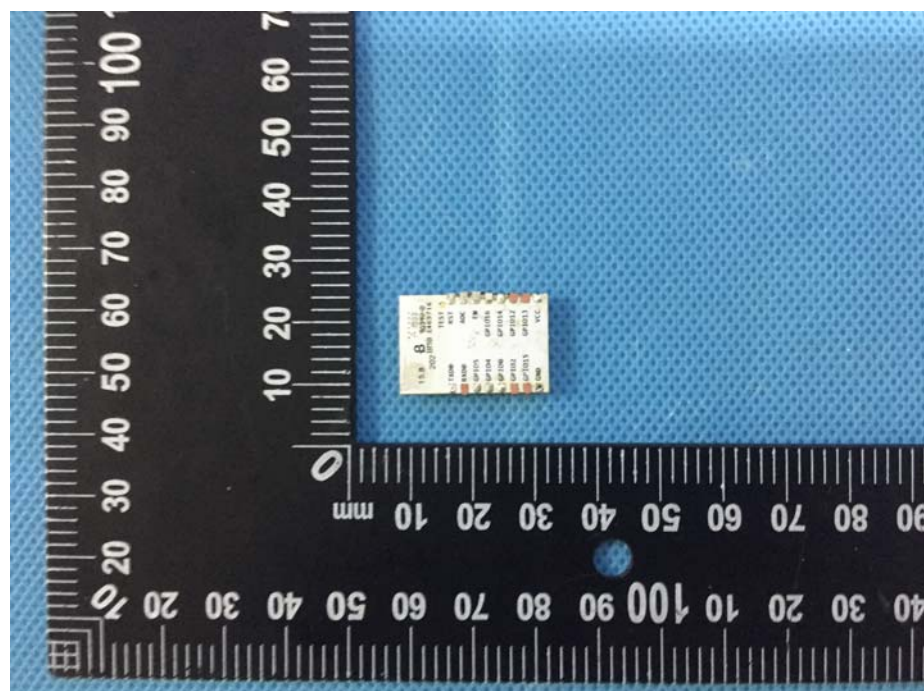
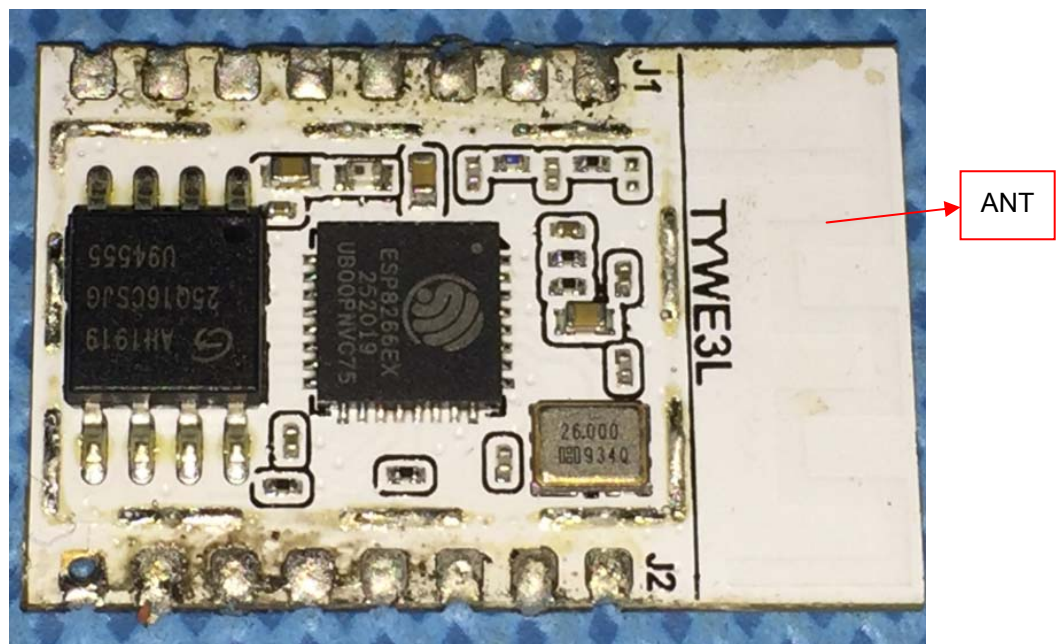
16.2 Model HKWL-RGB03W - Internal Photos

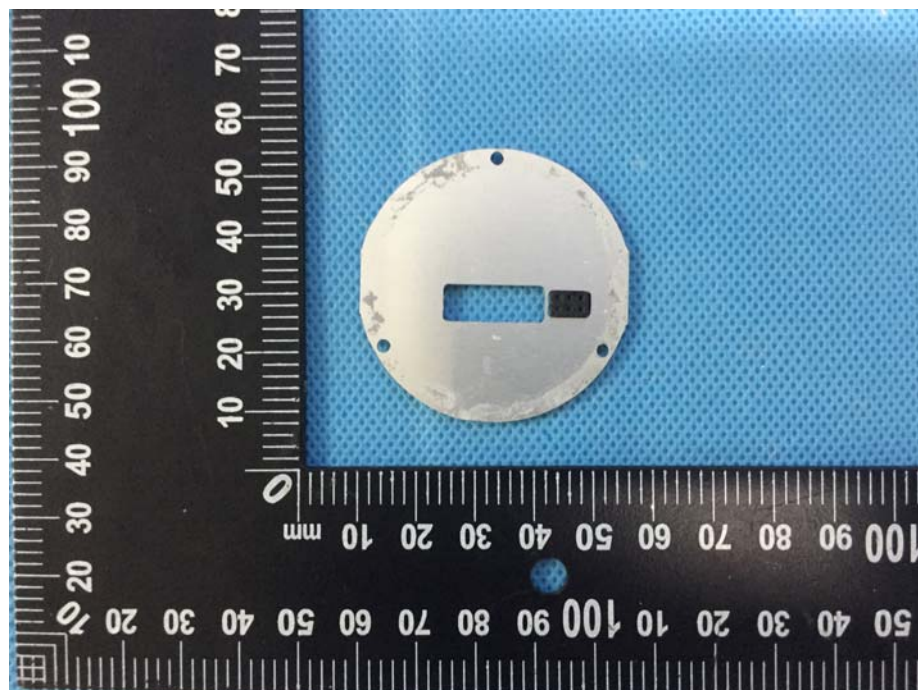












=====End of Report=====