TEST REPORT

Reference No.	:	WTS19S08057431W
FCC ID	:	2AIOC-SW02WU
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 Switch
Model(s)	:	HKWL-SW02WU
Standards	:	FCC CFR47 Part 15 Section 15.247:2019
Date of Receipt sample	:	2019-08-19
Date of Test	:	2019-08-20 to 2019-09-12
Date of Issue	:	2019-09-18
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:
Waltek Services (Shenzhen) Co., Ltd.
Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China
Tel :+86-755-83551033
Fax:+86-755-83552400

Compiled by: Robin.Zhou

Robin Zhou / Test Engineer

Approved by: Philo Zhong

Philo Zhong / Manager

1 Laboratories Introduction

Waltek Services (Shenzhen) Co., Ltd is a professional third-party testing and certification laboratory with multi-year product testing and certification experience, established strictly in accordance with ISO/IEC 17025 requirements, and accredited by ILAC (International Laboratory Accreditation Cooperation) member. A2LA (American Association for Laboratory Accreditation, the certification number is 4243.01) of USA, CNAS (China National Accreditation Service for Conformity Assessment, the registration number is L3110) of China.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), CEC(California energy efficiency), ISED (Innovation, Science and Economic Development Canada). It's the strategic partner and data recognition laboratory of international authoritative organizations, such as Intertek(ETL-SEMKO), TÜV Rheinland, TÜV SÜD, etc.

Waltek Services (Shenzhen) Co., Ltd is one of the largest and the most comprehensive third party testing laboratory in China. Our test capability covered four large fields: safety test. ElectroMagnetic Compatibility(EMC), and energy performance, wireless radio. 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.

1.1 Test Facility

A. Accreditations for Conformity Assessment (International)

Country/Region	Scope Covered By	Scope	Note
USA	ISO/IEC 17025	FCC ID \ SDoC	1
Canada		IC ID \ VOC	2
Japan		MIC-T \ MIC-R	-
Europe		EMCD \ RED	-
Taiwan		NCC	-
Hong Kong		OFCA	-
Australia		RCM	-
India		WPC	-
Thailand		NTC	-
Singapore		IDA	-
Note: 1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476. 2. ISED CAB identifier: CN0013. Test Firm 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

2 Contents

3 Revision History

Test Report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTS19S08057431W	2019-08-19	2019-08-20 to 2019-09-12	2019-09-18	Original	-	Valid

4 General Information

4.1 General Description of E.U.T

Product:	Smart Switch
Model(s).:	HKWL-SW02WU
Model Description:	N/A
Operation Frequency:	802.11b/g/n HT20: 2412MHz ~ 2462MHz
Antenna installation:	On-board PCB Antenna
Antenna Gain:	3dBi
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:120V~60Hz, Max 15A Output:120V~60Hz, Max 15A

4.2 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	-

4.3 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.

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions Test Site						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1	EMI Test Receiver	R&S	ESCI	101155	2018-09-15	2019-09-14
2	LISN	SCHWARZBECK	NSLK 8128	8128-259	2018-09-15	2019-09-14
3	Limiter	CYBERTEK	EM5010	261115-001-0024	2018-09-15	2019-09-14
4	Cable	Laplace	RF300	-	2019-07-18	2020-07-17
3m Semi-anechoic Chamber for Radiation Emissions Test site(SAEMC)						
tem	**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)	ZT26-NJ-NJ-8M/FA	1GHz-18GHz	EW02014-7	2019-04-19	2020-04-18
5	Spectrum Analyzer	R&S	FSP40	100501	2018-11-13	2019-11-12
6	Broad-band Horn Antenna(18-40GHz)	SCHWARZBECK	BBHA 9170	335	2018-10-25	2019-10-24
7	Microwave Broadband Preamplifier (18-40GHz)	SCHWARZBECK	BBV 9721	100472	2018-10-25	2019-10-24
8	Cable	Top	18-40GHz	-	2018-10-15	2019-10-14
3m Semi-anechoic Chamber for Radiation Emissions Test site(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)	-	2018-10-15	2019-10-14
RF Conducted Testing						
tem	**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	Coaxial Cable	Top	10Hz-30GHz	-	2018-09-15	2019-09-14
3	Antenna Connector*	Realacc	45RSm	-	2018-09-15	2019-09-14
4	DC Block	Gwave	GDCB-3G-N-SMA	140307001	2018-09-15	2019-09-14
"*": 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.						

5.2 Measurement Uncertainty

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

5.3 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, Guang dong, China.

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 (dBμV)	
	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: 22.5 °C

Humidity: 53.9 % RH

Atmospheric Pressure: 101.6 kPa

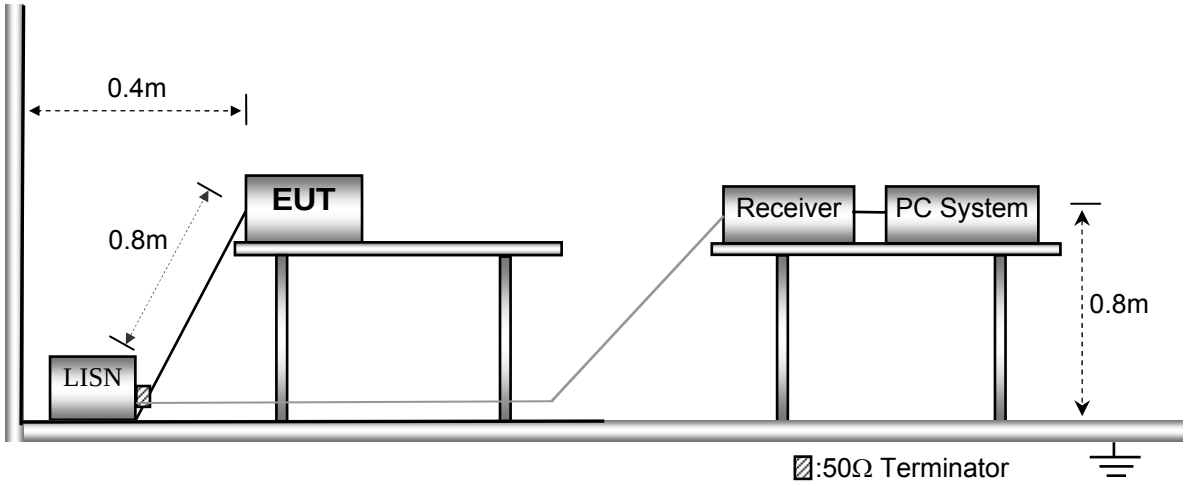
Test Voltage: AC 120V, 60Hz

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.



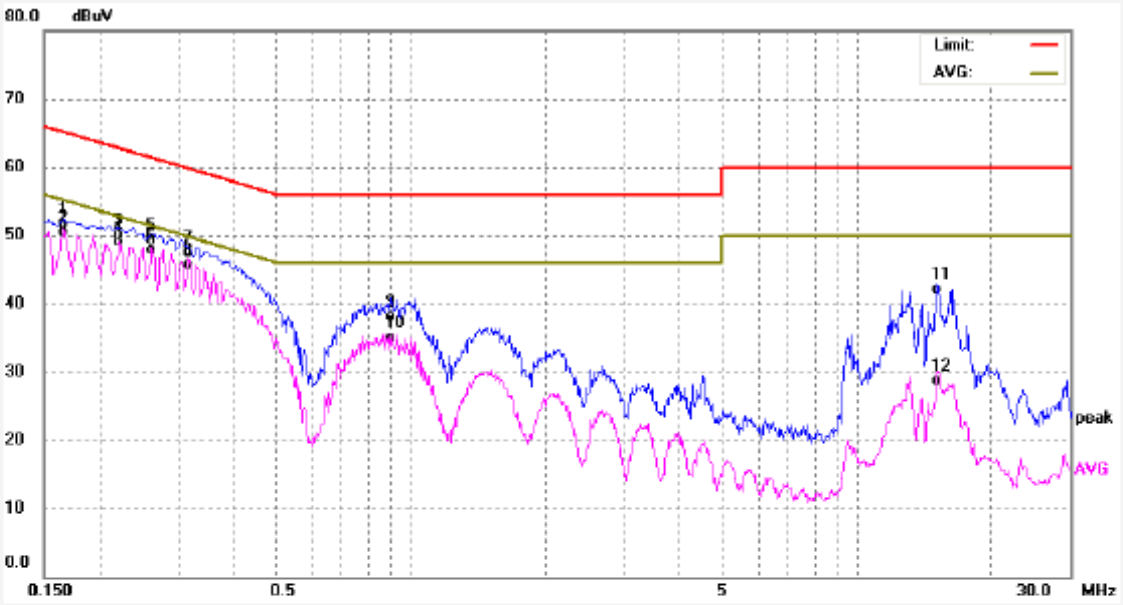
7.3 Measurement Description

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

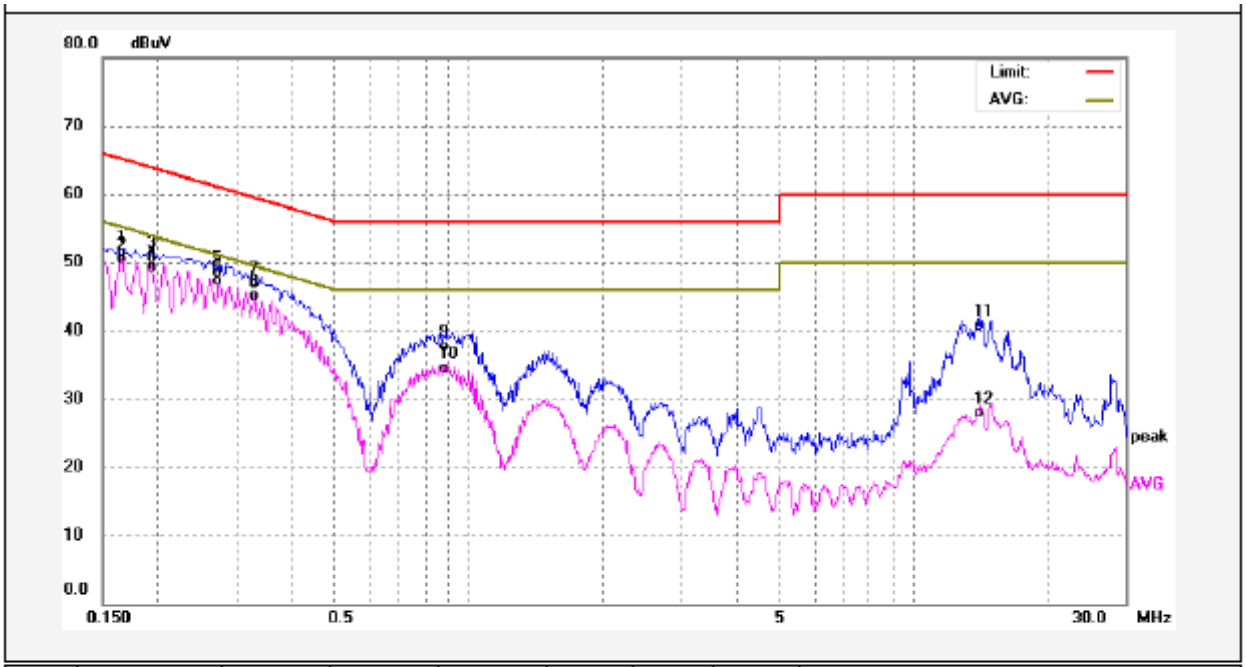
An initial pre-scan was performed on the live and neutral lines.

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1660	41.39	10.28	51.67	65.15	-13.48	QP	
2	0.1660	40.14	10.28	50.42	55.15	-4.73	AVG	
3	0.2220	39.81	10.35	50.16	62.74	-12.58	QP	
4	0.2220	38.73	10.35	49.08	52.74	-3.66	AVG	
5	0.2620	38.92	10.39	49.31	61.36	-12.05	QP	
6	0.2620	37.59	10.39	47.98	51.36	-3.38	AVG	
7	0.3180	37.02	10.41	47.43	59.76	-12.33	QP	
8	0.3180	35.20	10.41	45.61	49.76	-4.15	AVG	
9	0.9060	27.75	10.44	38.19	56.00	-17.81	QP	
10	0.9060	24.62	10.44	35.06	46.00	-10.94	AVG	
11	15.0739	31.15	10.88	42.03	60.00	-17.97	QP	
12	15.0739	17.85	10.88	28.73	50.00	-21.27	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1660	41.13	10.28	51.41	65.15	-13.74	QP	
2	0.1660	40.20	10.28	50.48	55.15	-4.67	AVG	
3	0.1940	40.36	10.32	50.68	63.86	-13.18	QP	
4	0.1940	38.95	10.32	49.27	53.86	-4.59	AVG	
5	0.2740	38.05	10.40	48.45	60.99	-12.54	QP	
6	0.2740	36.93	10.40	47.33	50.99	-3.66	AVG	
7	0.3300	36.42	10.42	46.84	59.45	-12.61	QP	
8	0.3300	34.74	10.42	45.16	49.45	-4.29	AVG	
9	0.8820	27.24	10.44	37.68	56.00	-18.32	QP	
10	0.8820	24.01	10.44	34.45	46.00	-11.55	AVG	
11	14.0539	29.81	10.95	40.76	60.00	-19.24	QP	
12	14.0539	16.94	10.95	27.89	50.00	-22.11	AVG	

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(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: 23.2 °C

Humidity: 54.1 % RH

Atmospheric Pressure: 101.5 kPa

Test Voltage: AC 120V, 60Hz

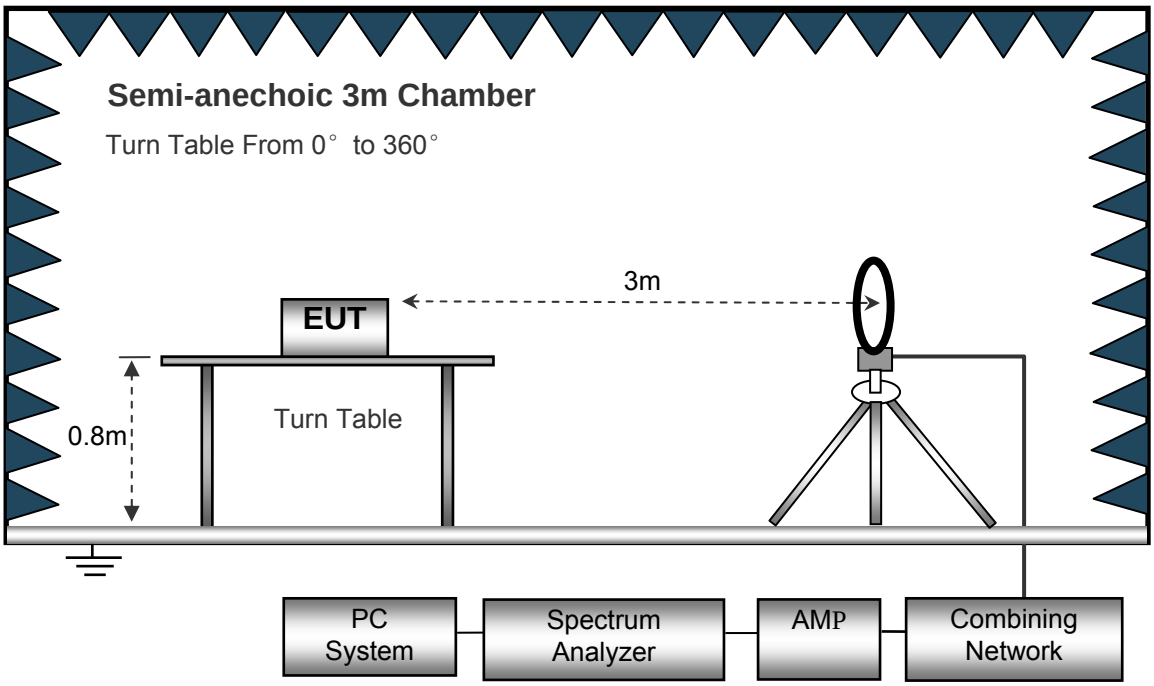
EUT Operation **:**

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

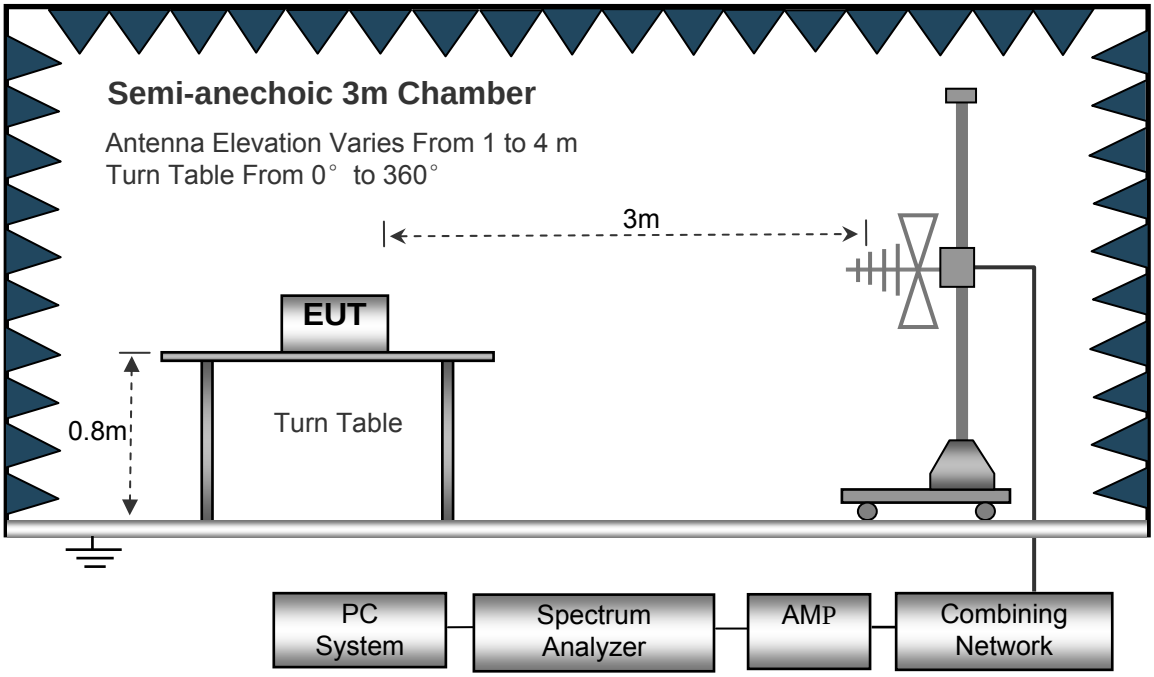
8.2 Test Setup

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

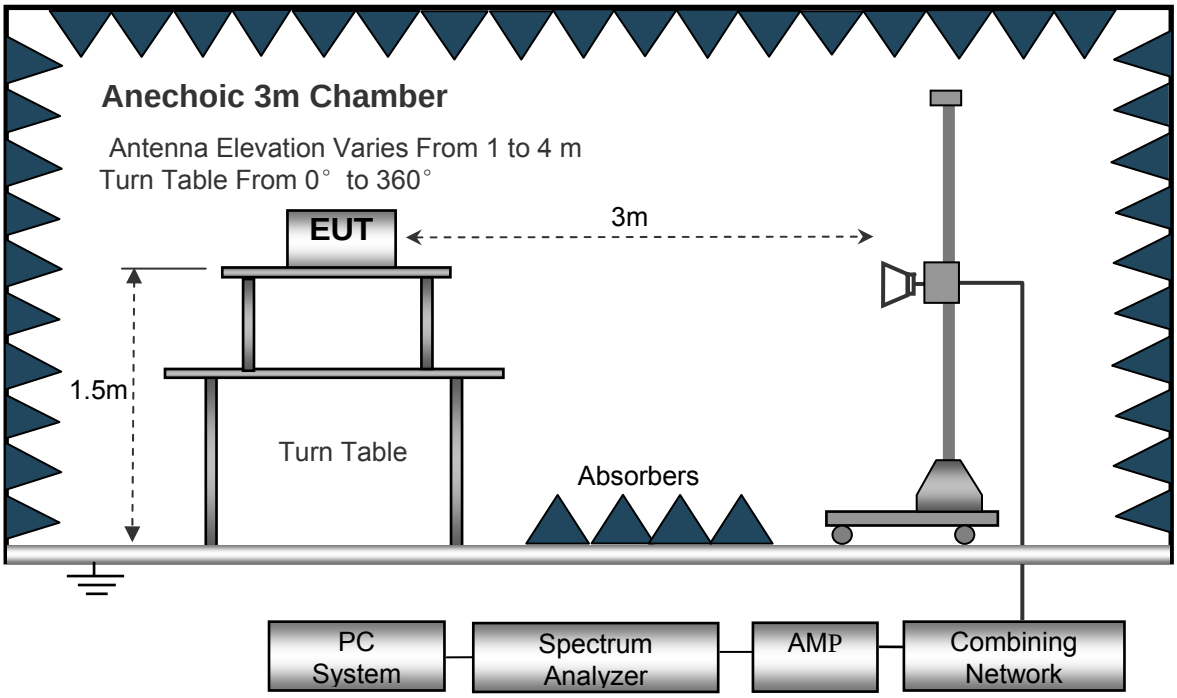
The test setup for emission measurement below 30MHz.



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 above1GHz, 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 druing 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:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - 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:

Margin = Corr. Ampl. – Limit

8.6 Summary of Test Results

Test Frequency: 9kHz ~ 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)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
11b: Low Channel 2412MHz									
82.94	52.13	QP	255	1.2	H	-21.31	30.82	40.00	-9.18
82.94	49.04	QP	223	1.5	V	-21.31	27.73	40.00	-12.27
4824.00	51.62	PK	52	1.1	V	-1.06	50.56	74.00	-23.44
4824.00	44.85	Ave	52	1.1	V	-1.06	43.79	54.00	-10.21
7236.00	49.42	PK	106	1.1	H	1.33	50.75	74.00	-23.25
7236.00	41.30	Ave	106	1.1	H	1.33	42.63	54.00	-11.37
2329.68	46.16	PK	136	1.5	V	-13.19	32.97	74.00	-41.03
2329.68	37.12	Ave	136	1.5	V	-13.19	23.93	54.00	-30.07
2383.19	43.78	PK	193	1.6	H	-13.14	30.64	74.00	-43.36
2383.19	36.59	Ave	193	1.6	H	-13.14	23.45	54.00	-30.55
2494.43	43.02	PK	255	1.4	V	-13.08	29.94	74.00	-44.06
2494.43	38.63	Ave	255	1.4	V	-13.08	25.55	54.00	-28.45

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									
82.94	51.35	QP	156	1.8	H	-21.31	30.04	40.00	-9.96
82.94	50.49	QP	160	1.1	V	-21.31	29.18	40.00	-10.82
4874.00	51.74	PK	206	1.4	V	-0.62	51.12	74.00	-22.88
4874.00	45.20	Ave	206	1.4	V	-0.62	44.58	54.00	-9.42
7311.00	48.96	PK	188	1.8	H	2.21	51.17	74.00	-22.83
7311.00	40.68	Ave	188	1.8	H	2.21	42.89	54.00	-11.11
2311.75	46.57	PK	336	1.6	V	-13.19	33.38	74.00	-40.62
2311.75	38.63	Ave	336	1.6	V	-13.19	25.44	54.00	-28.56
2381.29	43.01	PK	353	1.5	H	-13.14	29.87	74.00	-44.13
2381.29	37.58	Ave	353	1.5	H	-13.14	24.44	54.00	-29.56
2498.06	42.06	PK	297	2.0	V	-13.08	28.98	74.00	-45.02
2498.06	37.92	Ave	297	2.0	V	-13.08	24.84	54.00	-29.16

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									
82.94	51.79	QP	154	2.0	H	-21.31	30.48	40.00	-9.52
82.94	49.71	QP	85	1.6	V	-21.31	28.40	40.00	-11.60
4924.00	51.13	PK	303	1.9	V	-0.24	50.89	74.00	-23.11
4924.00	45.82	Ave	303	1.9	V	-0.24	45.58	54.00	-8.42
7386.00	48.87	PK	175	1.0	H	2.84	51.71	74.00	-22.29
7386.00	42.14	Ave	175	1.0	H	2.84	44.98	54.00	-9.02
2314.65	46.28	PK	325	1.2	V	-13.19	33.09	74.00	-40.91
2314.65	37.98	Ave	325	1.2	V	-13.19	24.79	54.00	-29.21
2359.57	43.31	PK	212	1.5	H	-13.14	30.17	74.00	-43.83
2359.57	36.59	Ave	212	1.5	H	-13.14	23.45	54.00	-30.55
2492.23	44.58	PK	217	1.4	V	-13.08	31.50	74.00	-42.50
2492.23	38.06	Ave	217	1.4	V	-13.08	24.98	54.00	-29.02

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									
82.94	50.96	QP	91	1.3	H	-21.31	29.65	40.00	-10.35
82.94	49.47	QP	71	2.0	V	-21.31	28.16	40.00	-11.84
4824.00	52.21	PK	83	1.9	V	-1.06	51.15	74.00	-22.85
4824.00	45.79	Ave	83	1.9	V	-1.06	44.73	54.00	-9.27
7236.00	47.64	PK	321	1.8	H	1.33	48.97	74.00	-25.03
7236.00	40.96	Ave	321	1.8	H	1.33	42.29	54.00	-11.71
2326.11	46.58	PK	70	1.6	V	-13.19	33.39	74.00	-40.61
2326.11	39.91	Ave	70	1.6	V	-13.19	26.72	54.00	-27.28
2355.21	42.46	PK	255	1.4	H	-13.14	29.32	74.00	-44.68
2355.21	37.23	Ave	255	1.4	H	-13.14	24.09	54.00	-29.91
2485.56	44.23	PK	273	1.2	V	-13.08	31.15	74.00	-42.85
2485.56	38.65	Ave	273	1.2	V	-13.08	25.57	54.00	-28.43

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									
82.94	49.80	QP	45	1.4	H	-21.31	28.49	40.00	-11.51
82.94	50.27	QP	319	1.4	V	-21.31	28.96	40.00	-11.04
4874.00	52.01	PK	200	1.5	V	-0.62	51.39	74.00	-22.61
4874.00	45.05	Ave	200	1.5	V	-0.62	44.43	54.00	-9.57
7311.00	48.71	PK	82	1.3	H	2.21	50.92	74.00	-23.08
7311.00	39.84	Ave	82	1.3	H	2.21	42.05	54.00	-11.95
2324.82	45.45	PK	330	1.8	V	-13.19	32.26	74.00	-41.74
2324.82	38.62	Ave	330	1.8	V	-13.19	25.43	54.00	-28.57
2388.13	43.29	PK	153	1.6	H	-13.14	30.15	74.00	-43.85
2388.13	37.97	Ave	153	1.6	H	-13.14	24.83	54.00	-29.17
2484.14	44.33	PK	198	1.9	V	-13.08	31.25	74.00	-42.75
2484.14	36.15	Ave	198	1.9	V	-13.08	23.07	54.00	-30.93

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									
82.94	51.16	QP	351	1.6	H	-21.31	29.85	40.00	-10.15
82.94	49.70	QP	300	1.9	V	-21.31	28.39	40.00	-11.61
4924.00	51.38	PK	5	1.8	V	-0.24	51.14	74.00	-22.86
4924.00	45.61	Ave	5	1.8	V	-0.24	45.37	54.00	-8.63
7386.00	48.10	PK	79	1.1	H	2.84	50.94	74.00	-23.06
7386.00	39.91	Ave	79	1.1	H	2.84	42.75	54.00	-11.25
2341.04	46.50	PK	36	1.1	V	-13.19	33.31	74.00	-40.69
2341.04	38.13	Ave	36	1.1	V	-13.19	24.94	54.00	-29.06
2360.04	42.96	PK	250	1.5	H	-13.14	29.82	74.00	-44.18
2360.04	37.14	Ave	250	1.5	H	-13.14	24.00	54.00	-30.00
2484.02	42.23	PK	66	1.4	V	-13.08	29.15	74.00	-44.85
2484.02	38.13	Ave	66	1.4	V	-13.08	25.05	54.00	-28.95

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									
82.94	52.65	QP	131	1.7	H	-21.31	31.34	40.00	-8.66
82.94	49.69	QP	77	1.5	V	-21.31	28.38	40.00	-11.62
4824.00	51.59	PK	172	1.9	V	-1.06	50.53	74.00	-23.47
4824.00	46.97	Ave	172	1.9	V	-1.06	45.91	54.00	-8.09
7236.00	47.59	PK	124	1.9	H	1.33	48.92	74.00	-25.08
7236.00	38.94	Ave	124	1.9	H	1.33	40.27	54.00	-13.73
2343.32	46.11	PK	315	1.6	V	-13.19	32.92	74.00	-41.08
2343.32	38.37	Ave	315	1.6	V	-13.19	25.18	54.00	-28.82
2380.62	42.34	PK	120	1.3	H	-13.14	29.20	74.00	-44.80
2380.62	38.30	Ave	120	1.3	H	-13.14	25.16	54.00	-28.84
2495.43	43.28	PK	161	1.8	V	-13.08	30.20	74.00	-43.80
2495.43	38.53	Ave	161	1.8	V	-13.08	25.45	54.00	-28.55

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									
82.94	53.41	QP	60	1.8	H	-21.31	32.10	40.00	-7.90
82.94	50.60	QP	255	1.5	V	-21.31	29.29	40.00	-10.71
4874.00	52.91	PK	17	1.5	V	-0.62	52.29	74.00	-21.71
4874.00	45.74	Ave	17	1.5	V	-0.62	45.12	54.00	-8.88
7311.00	46.31	PK	156	1.8	H	2.21	48.52	74.00	-25.48
7311.00	39.24	Ave	156	1.8	H	2.21	41.45	54.00	-12.55
2311.03	45.16	PK	299	1.7	V	-13.19	31.97	74.00	-42.03
2311.03	39.42	Ave	299	1.7	V	-13.19	26.23	54.00	-27.77
2378.91	43.20	PK	315	1.8	H	-13.14	30.06	74.00	-43.94
2378.91	37.79	Ave	315	1.8	H	-13.14	24.65	54.00	-29.35
2493.74	42.83	PK	40	1.3	V	-13.08	29.75	74.00	-44.25
2493.74	38.50	Ave	40	1.3	V	-13.08	25.42	54.00	-28.58

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									
82.94	51.99	QP	252	1.1	H	-21.31	30.68	40.00	-9.32
82.94	50.16	QP	206	1.4	V	-21.31	28.85	40.00	-11.15
4924.00	51.65	PK	38	1.6	V	-0.24	51.41	74.00	-22.59
4924.00	46.86	Ave	38	1.6	V	-0.24	46.62	54.00	-7.38
7386.00	45.06	PK	327	1.9	H	2.84	47.90	74.00	-26.10
7386.00	39.84	Ave	327	1.9	H	2.84	42.68	54.00	-11.32
2328.85	46.26	PK	352	1.7	V	-13.19	33.07	74.00	-40.93
2328.85	39.41	Ave	352	1.7	V	-13.19	26.22	54.00	-27.78
2379.90	44.16	PK	119	1.8	H	-13.14	31.02	74.00	-42.98
2379.90	38.80	Ave	119	1.8	H	-13.14	25.66	54.00	-28.34
2493.08	42.88	PK	172	1.4	V	-13.08	29.80	74.00	-44.20
2493.08	37.43	Ave	172	1.4	V	-13.08	24.35	54.00	-29.65

Test Frequency: 18GHz~25GHz

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

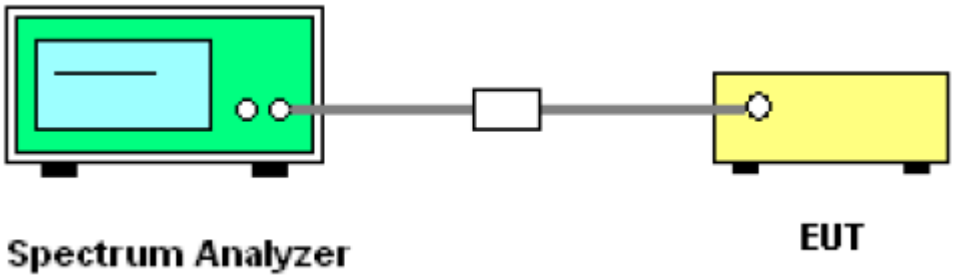
9 Band Edge Measurement

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.

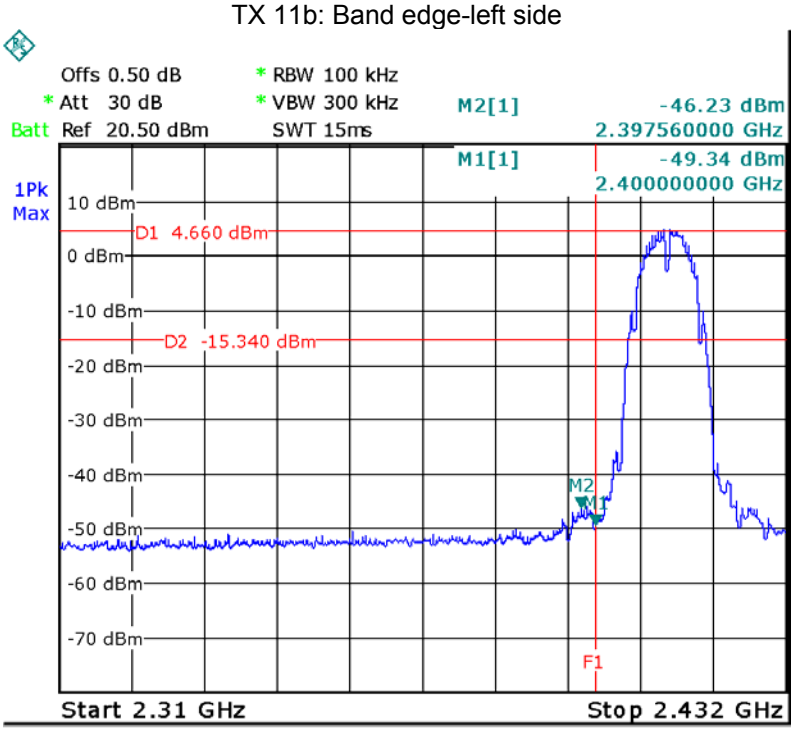
9.2 Test Setup



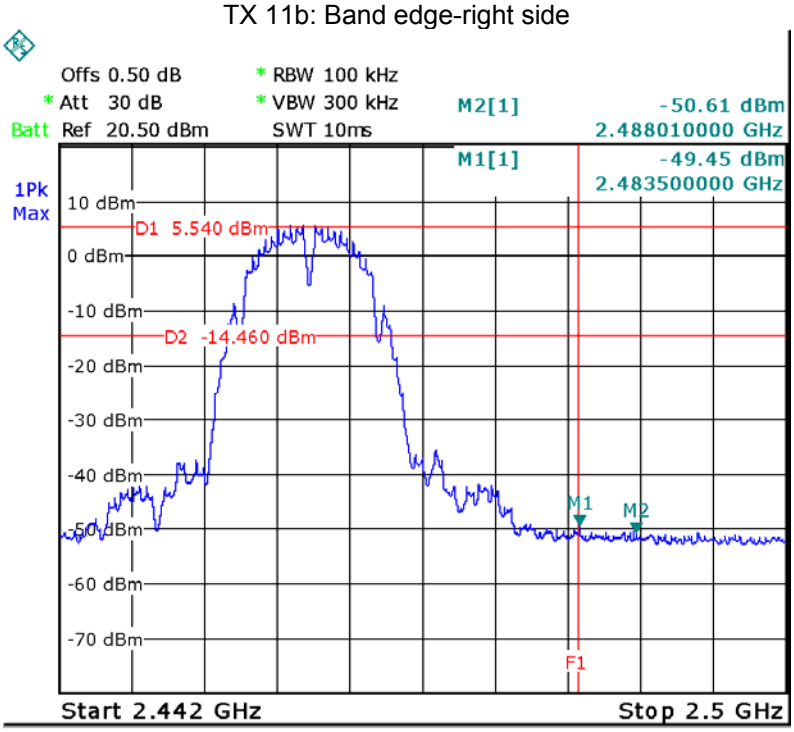
9.3 Test Result

Test result plots shown as follows:

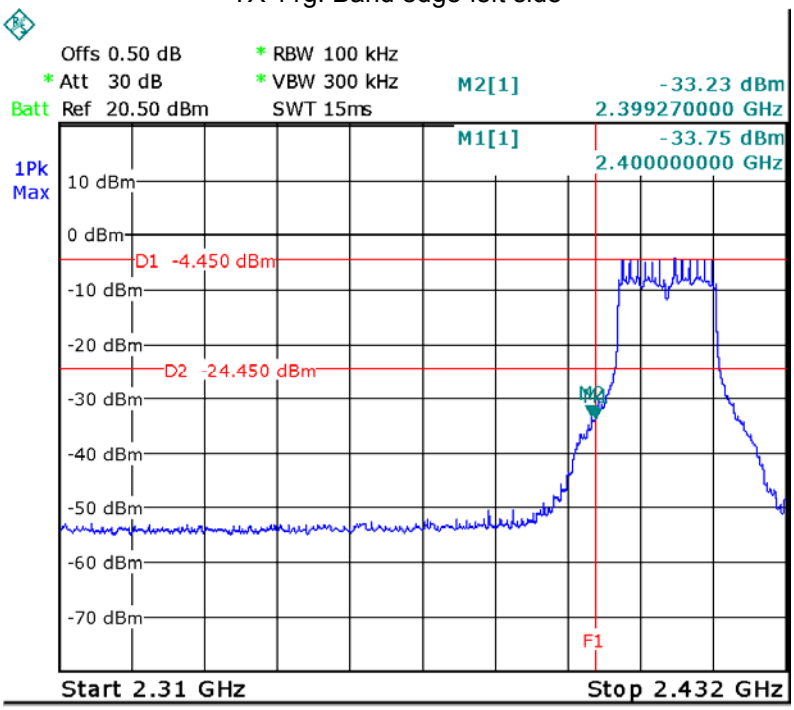
TX 11b: Band edge-left side



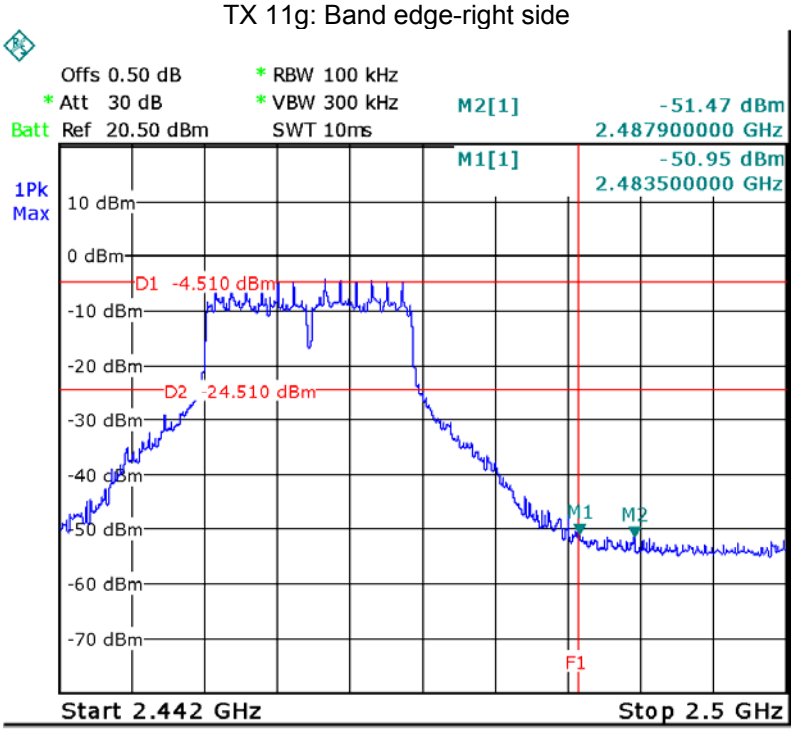
TX 11b: Band edge-right side



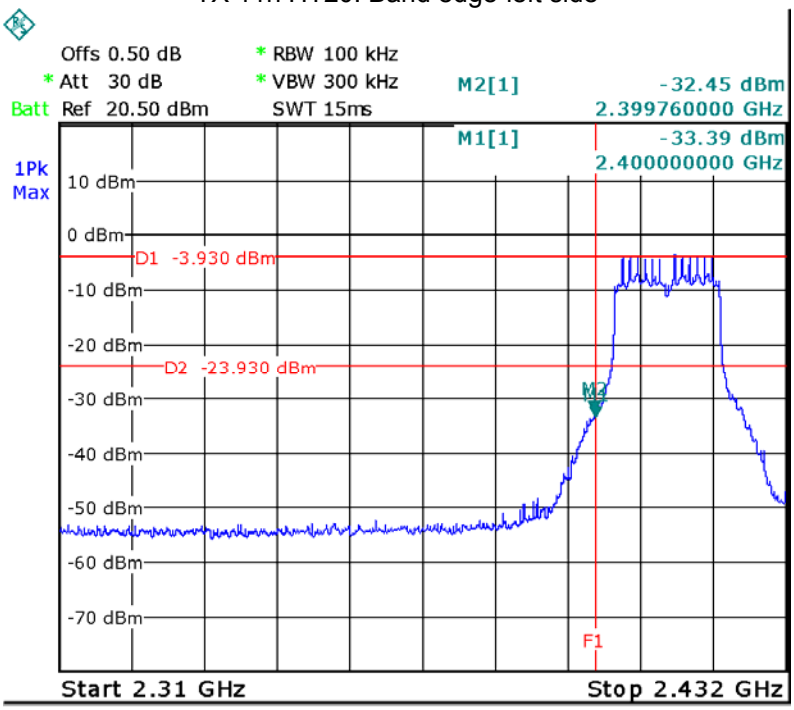
TX 11g: Band edge-left side



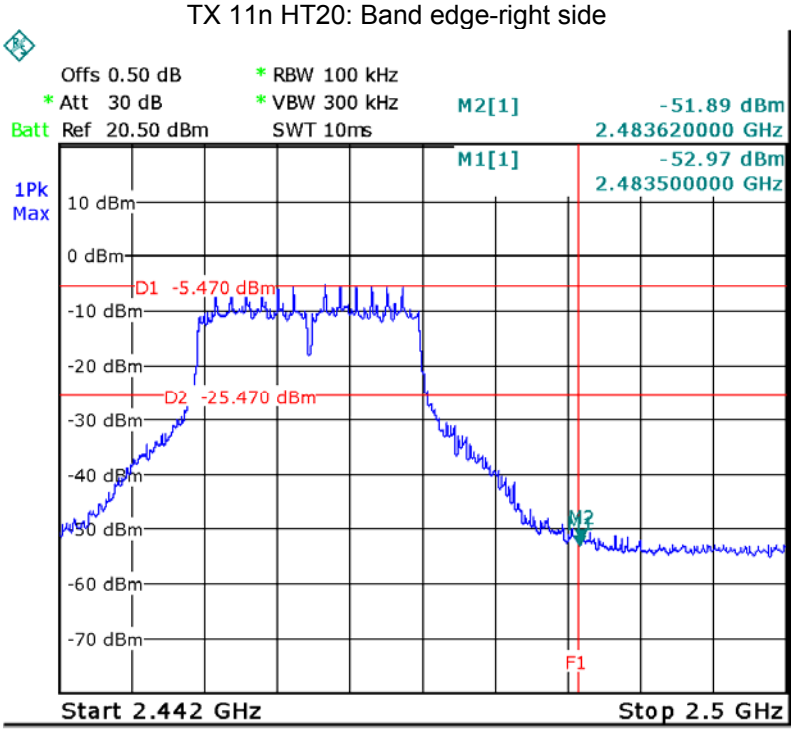
TX 11g: Band edge-right side



TX 11n HT20: Band edge-left side



TX 11n HT20: Band edge-right side



10 Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

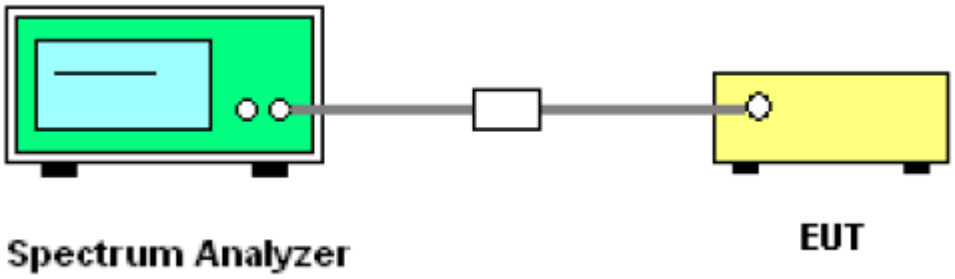
Test Method: 558074 D01 15.247 Meas Guidance v05r02, ANSI C63.10:2013

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

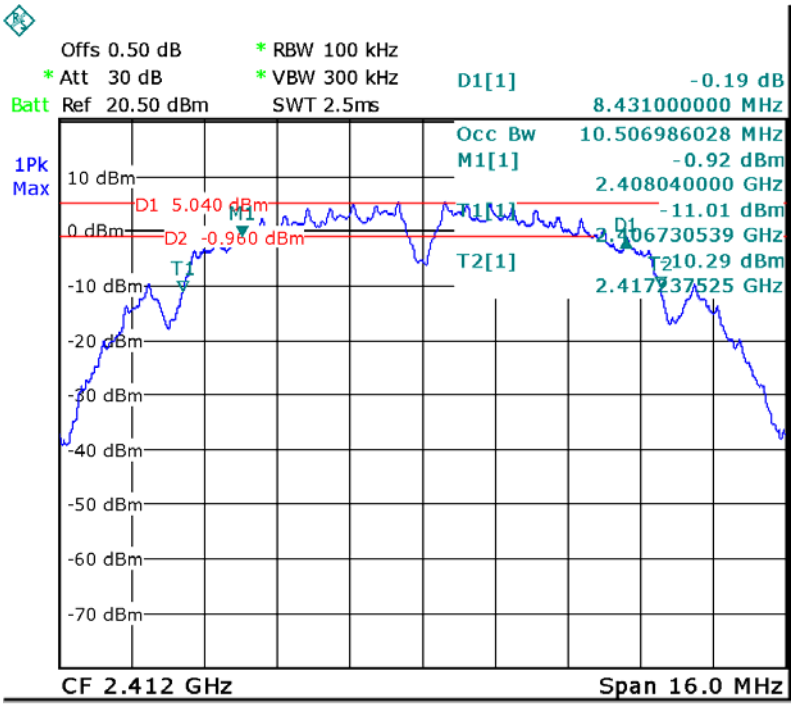
10.2 Test Setup



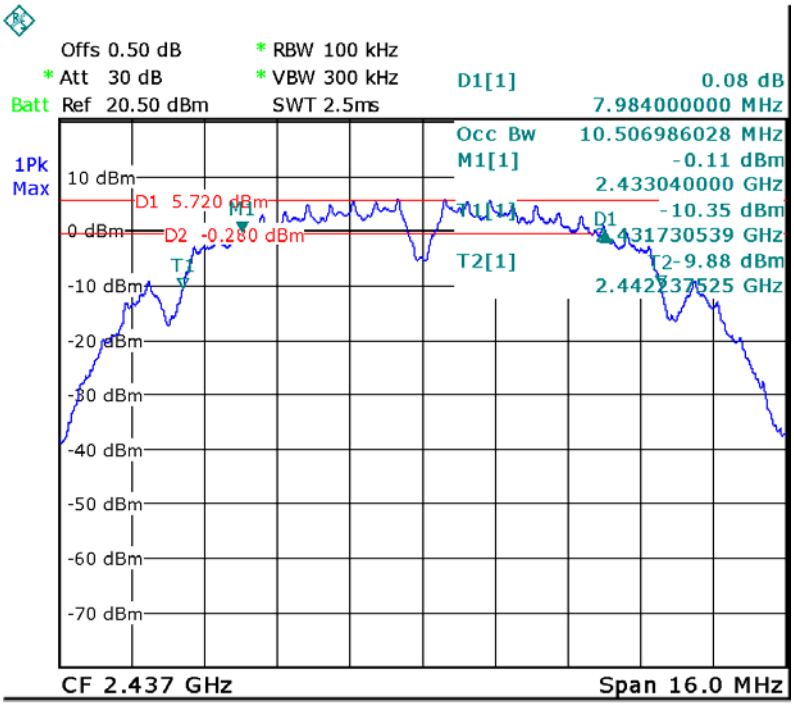
10.3 Test Result

Operation mode	6dB Bandwidth (MHz)			99% Bandwidth (MHz)		
TX 11b	Channel 1	Channel 6	Channel 11	Channel 1	Channel 6	Channel 11
	8.431	7.984	8.974	10.507	10.507	10.826
TX 11g	Channel 1	Channel 6	Channel 11	Channel 1	Channel 6	Channel 11
	16.018	16.267	15.749	16.766	16.517	16.517
TX 11n HT20	Channel 1	Channel 6	Channel 11	Channel 1	Channel 6	Channel 11
	16.491	16.868	17.515	17.838	17.784	17.731

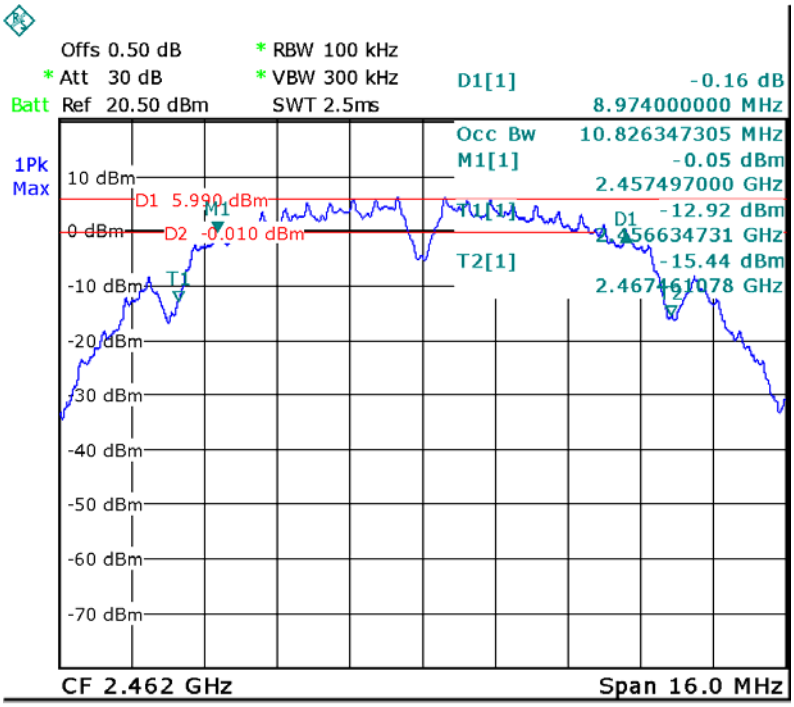
Mode: TX 11b channel 1



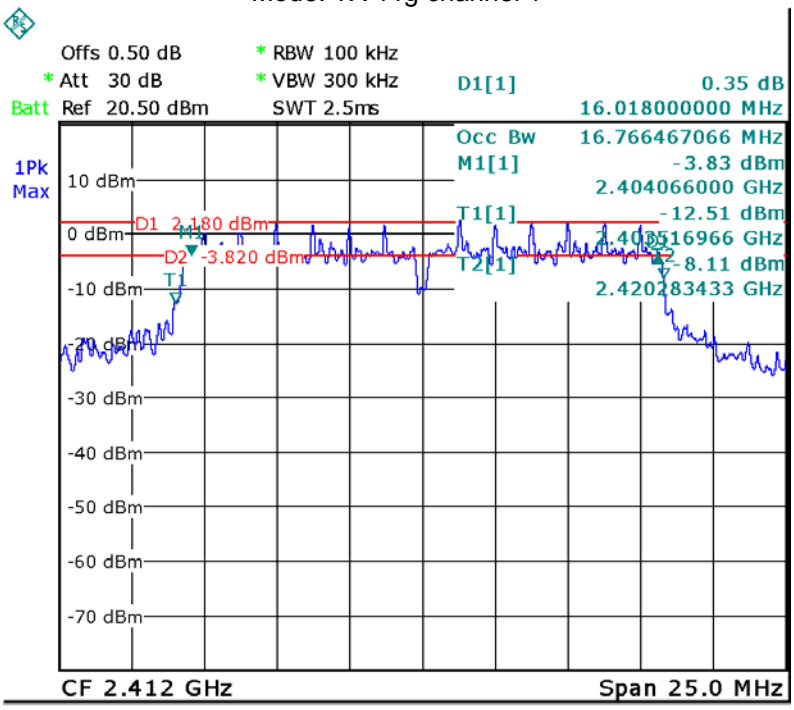
Mode: TX 11b channel 6



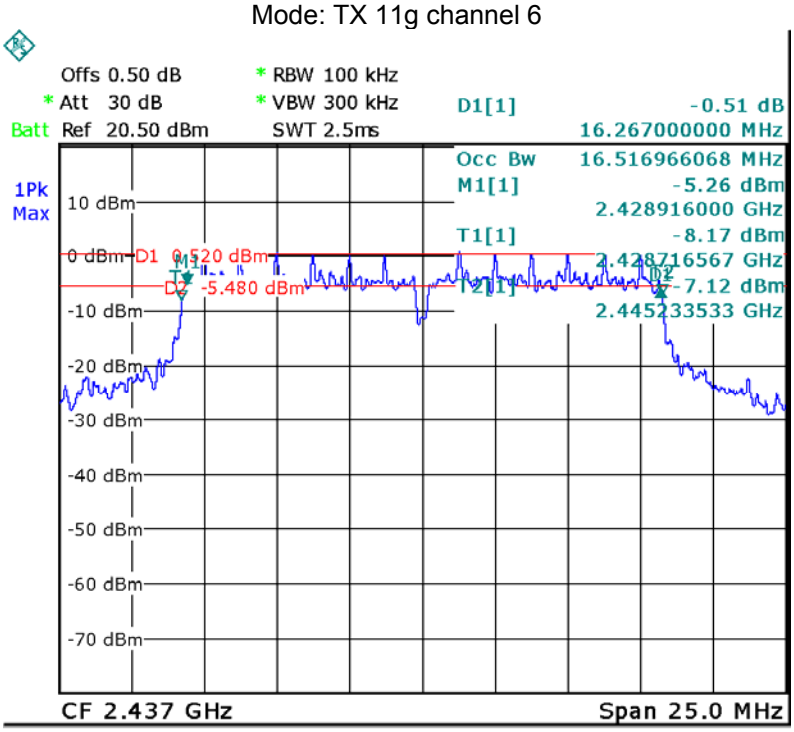
Mode: TX 11b channel 11



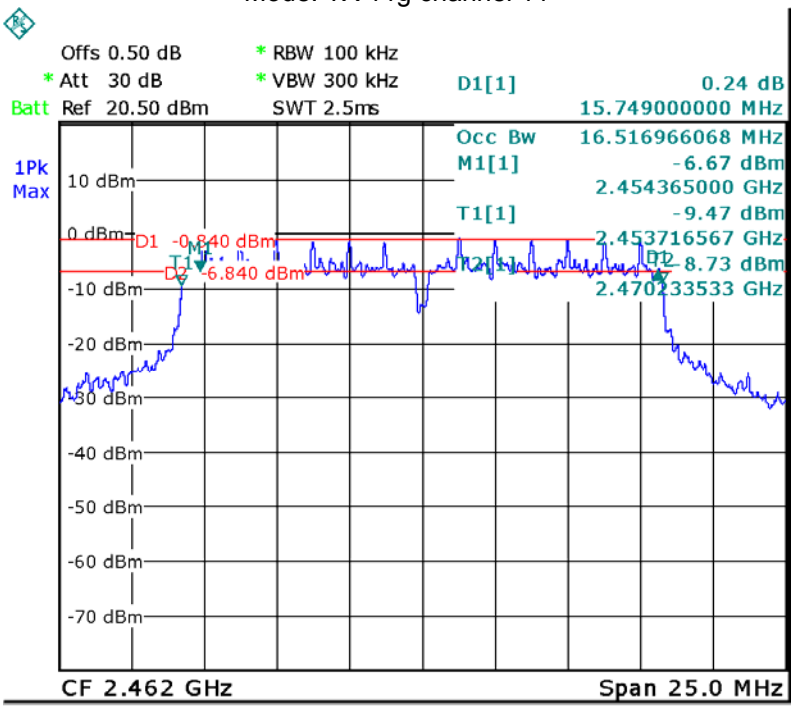
Mode: TX 11g channel 1



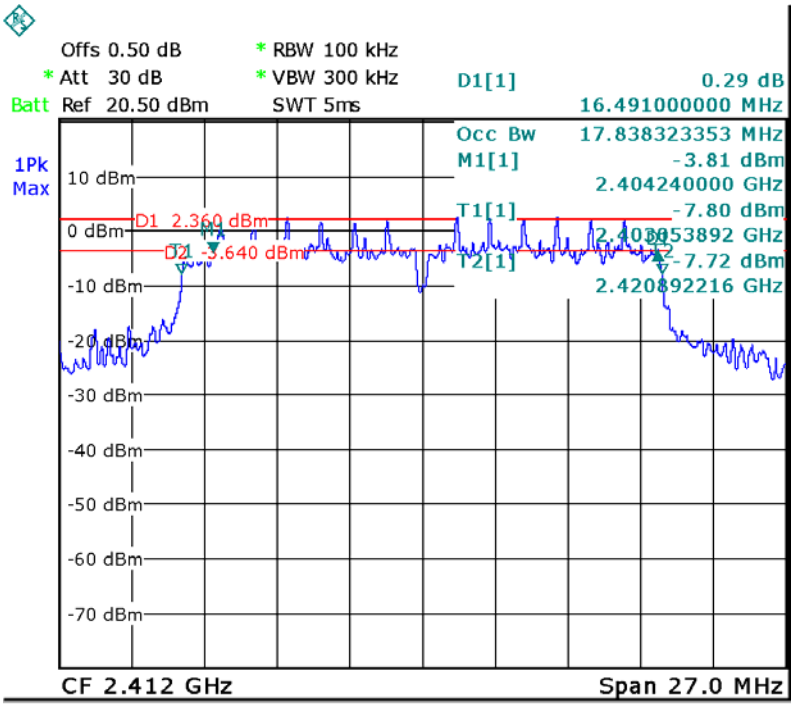
Mode: TX 11g channel 6



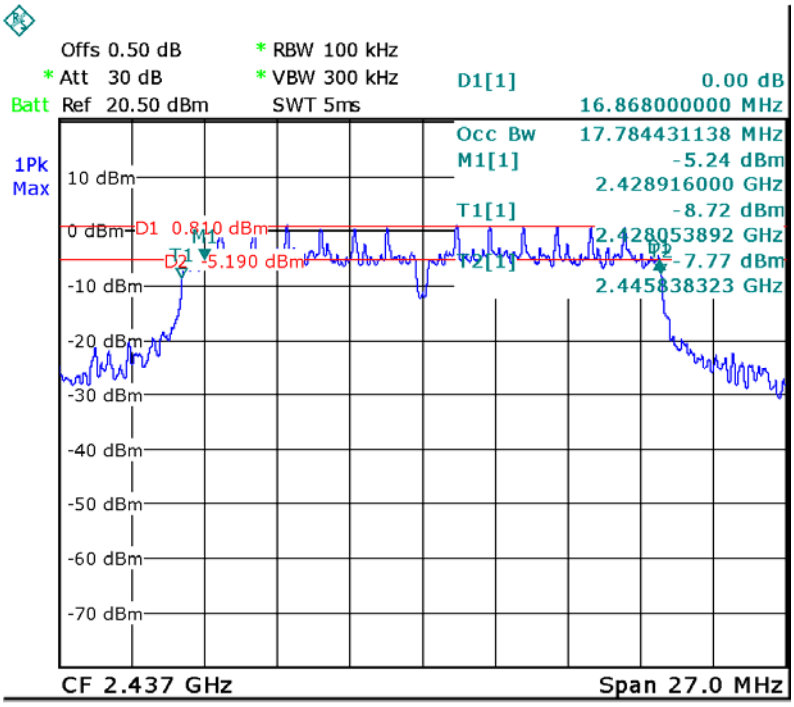
Mode: TX 11g channel 11



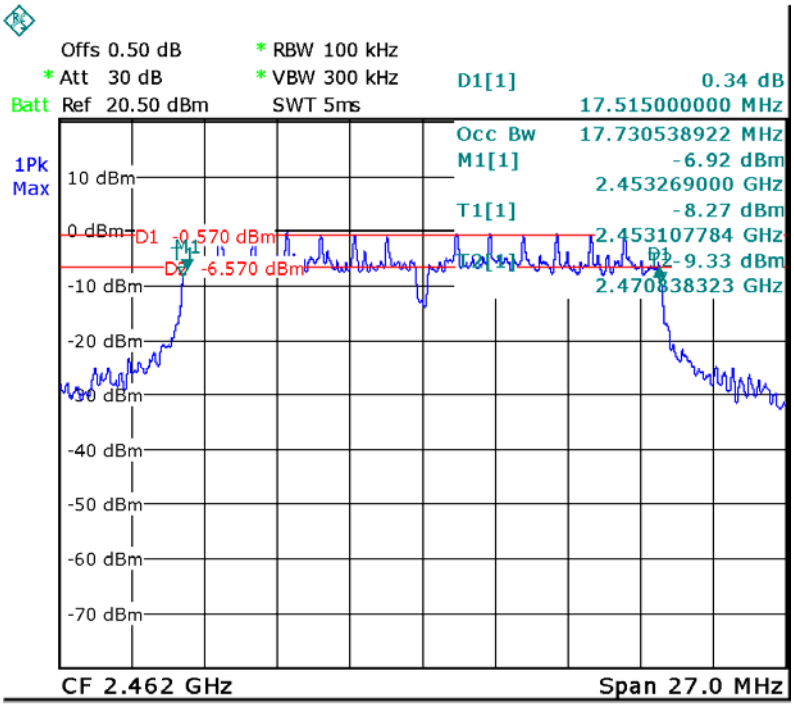
Mode: TX 11n HT20 channel 1



Mode: TX 11n HT20 channel 6



Mode: TX 11n HT20 channel 11



11 Maximum Peak Output Power

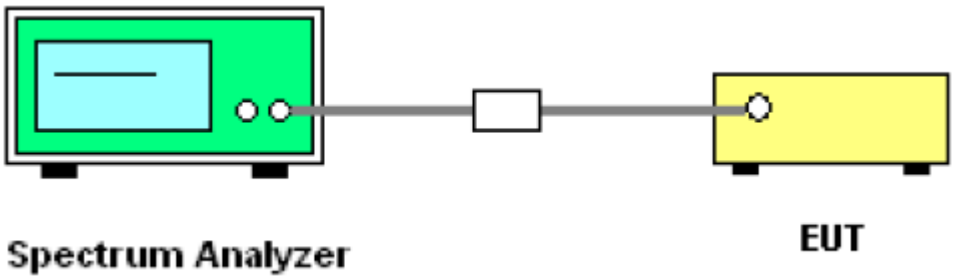
Test Requirement: FCC CFR47 Part 15 Section 15.247

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
17.23	17.42	**17.89**
Limit: 1W/30dBm		

Test mode :TX 11g		
Maximum Peak Output Power (dBm)		
2412MHz	2437MHz	2462MHz
14.46	14.39	14.56
Limit: 1W/30dBm		

Test mode :TX 11n HT20		
Maximum Peak Output Power (dBm)		
2412MHz	2437MHz	2462MHz
14.43	14.65	14.99
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

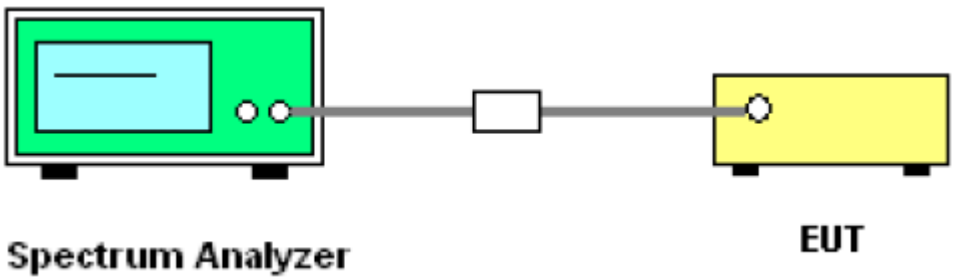
12.1 Test Procedure

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



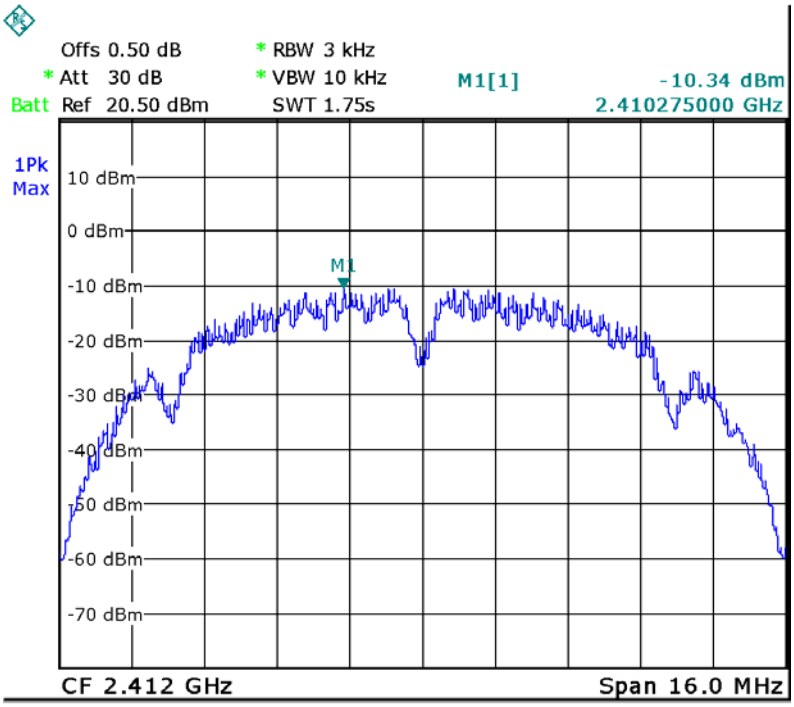
12.3 Test Result

Test mode :TX 11b		
Power Spectral (dBm per 3kHz)		
2412MHz	2437MHz	2462MHz
-10.34	-10.05	-9.11
Limit: 8dBm per 3kHz		

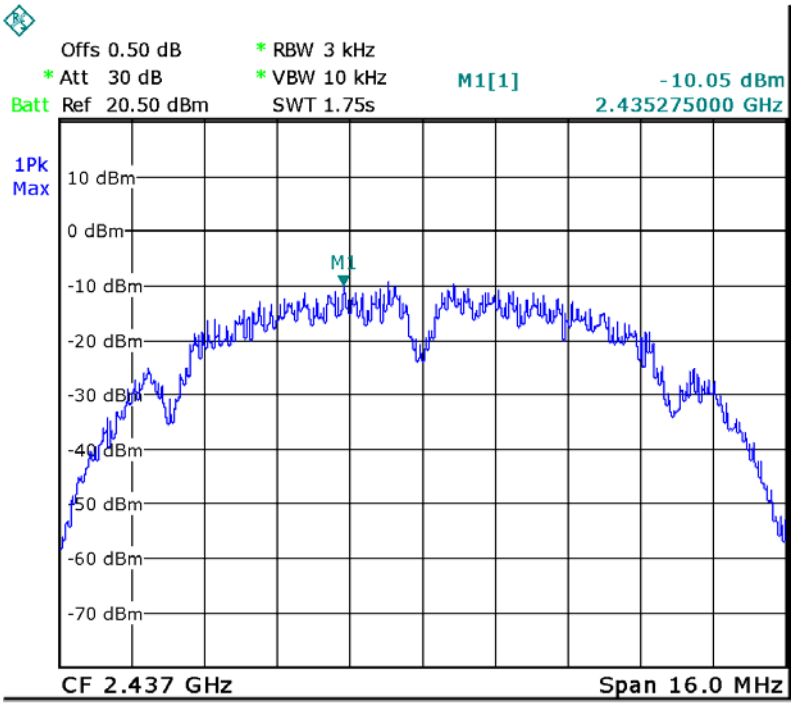
Test mode :TX 11g		
Power Spectral (dBm per 3kHz)		
2412MHz	2437MHz	2462MHz
-20.35	-20.23	-20.12
Limit: 8dBm per 3kHz		

Test mode :TX 11n HT20		
Power Spectral (dBm per 3kHz)		
2412MHz	2437MHz	2462MHz
-20.71	-20.42	-22.39
Limit: 8dBm per 3kHz		

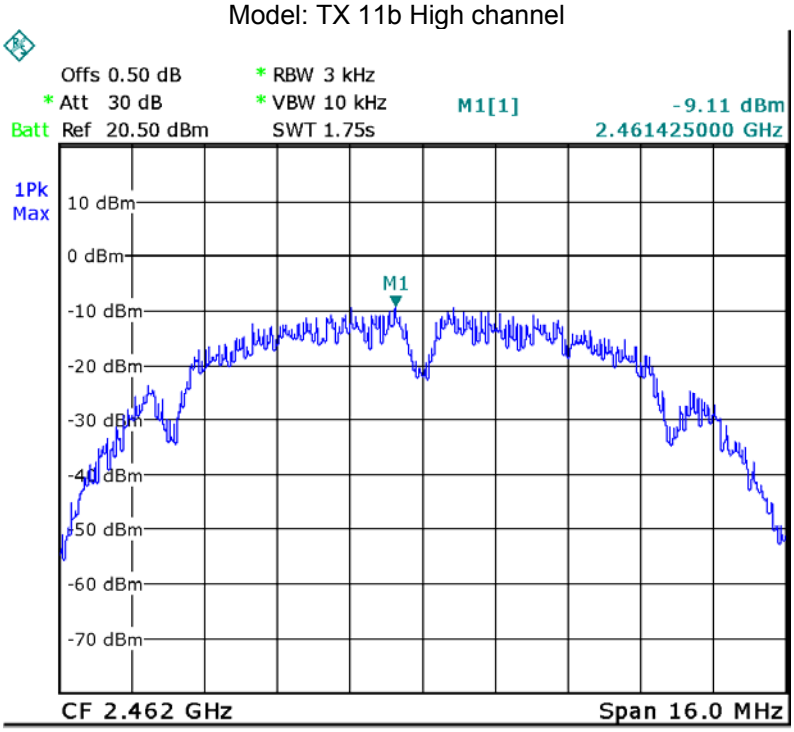
Model: TX 11b Low Channel



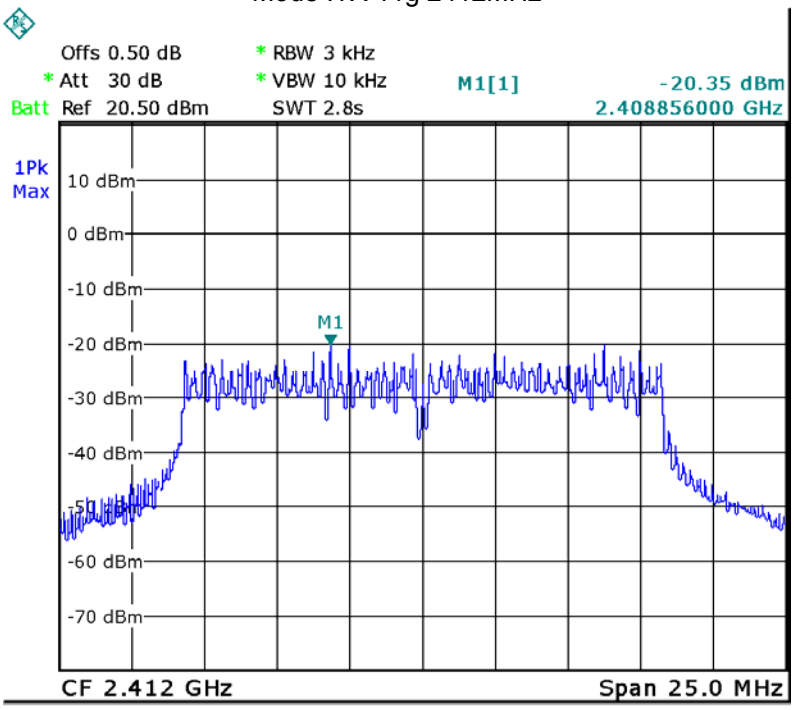
Model: TX 11b Middle channel



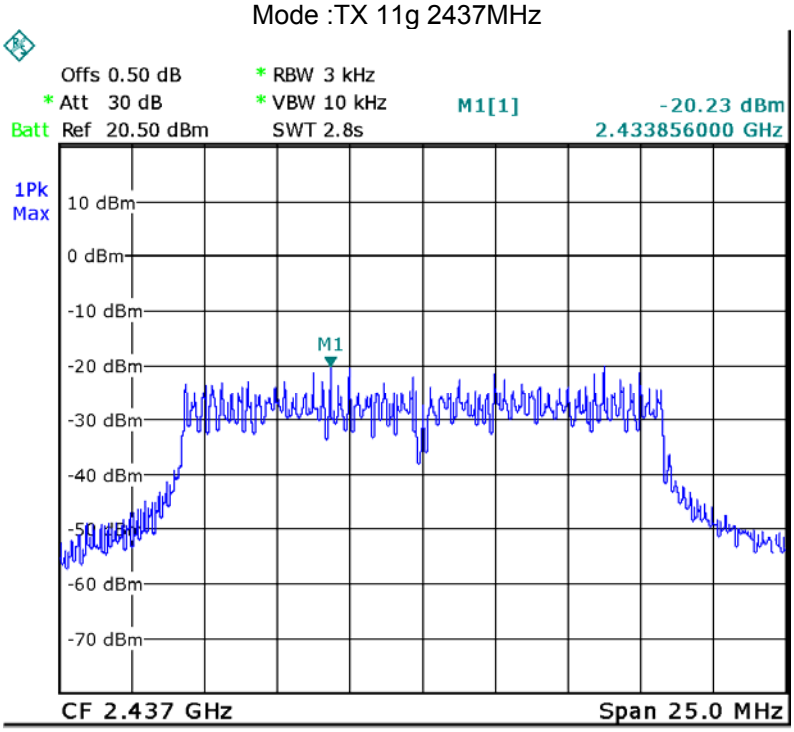
Model: TX 11b High channel



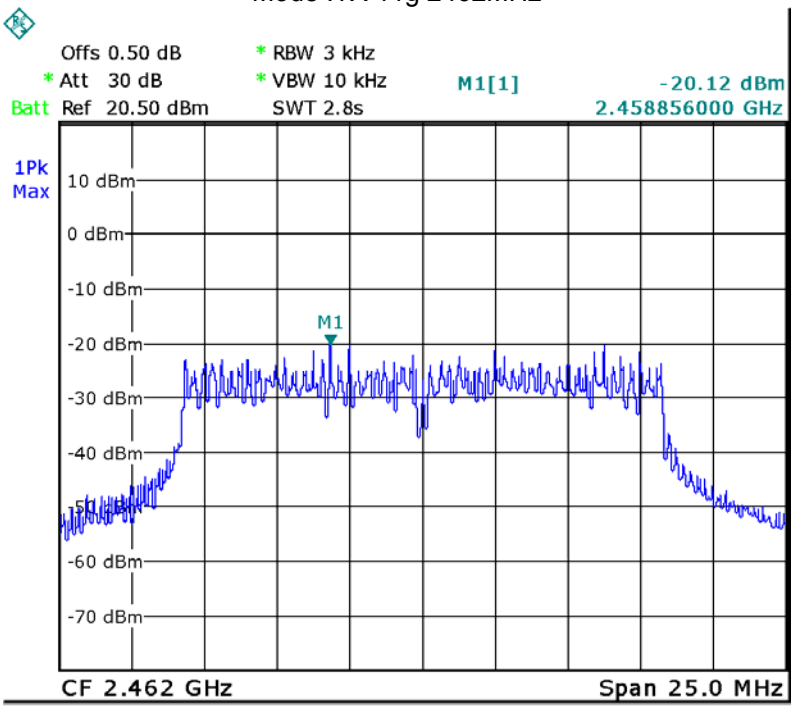
Mode :TX 11g 2412MHz



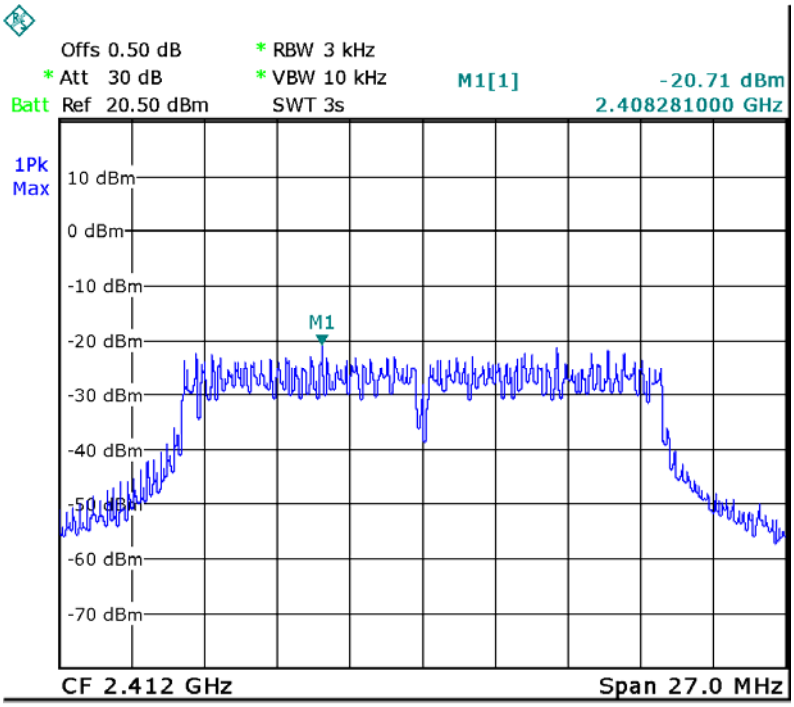
Mode :TX 11g 2437MHz



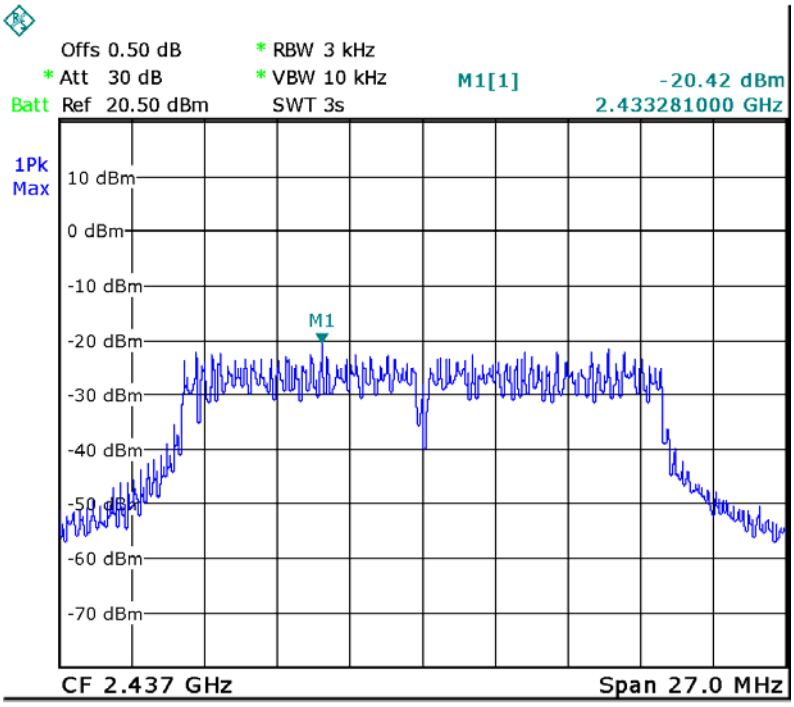
Mode :TX 11g 2462MHz



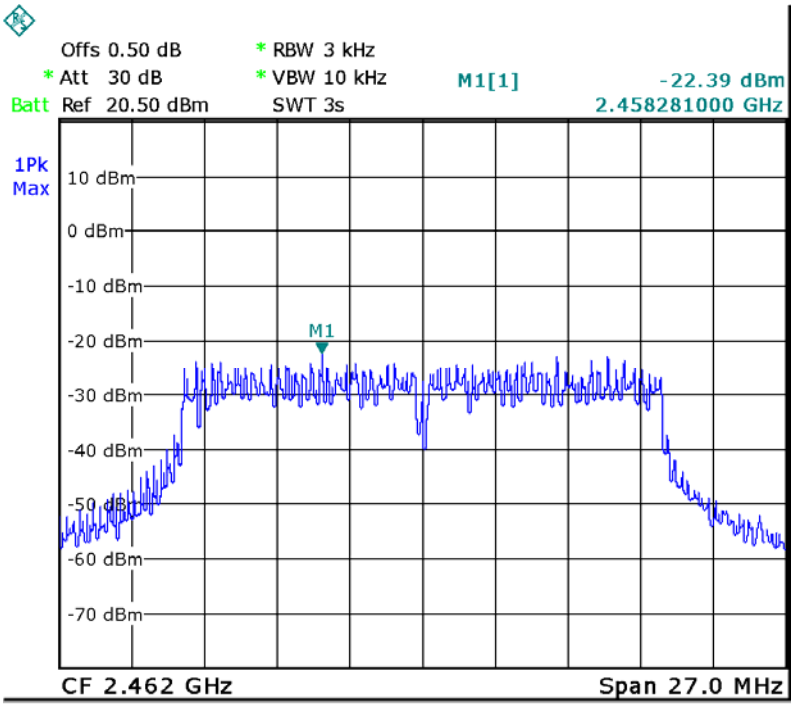
Mode: TX 11n HT20 2412MHz



Mode: TX 11n HT20 2437MHz



Mode: TX 11n HT20 2462MHz



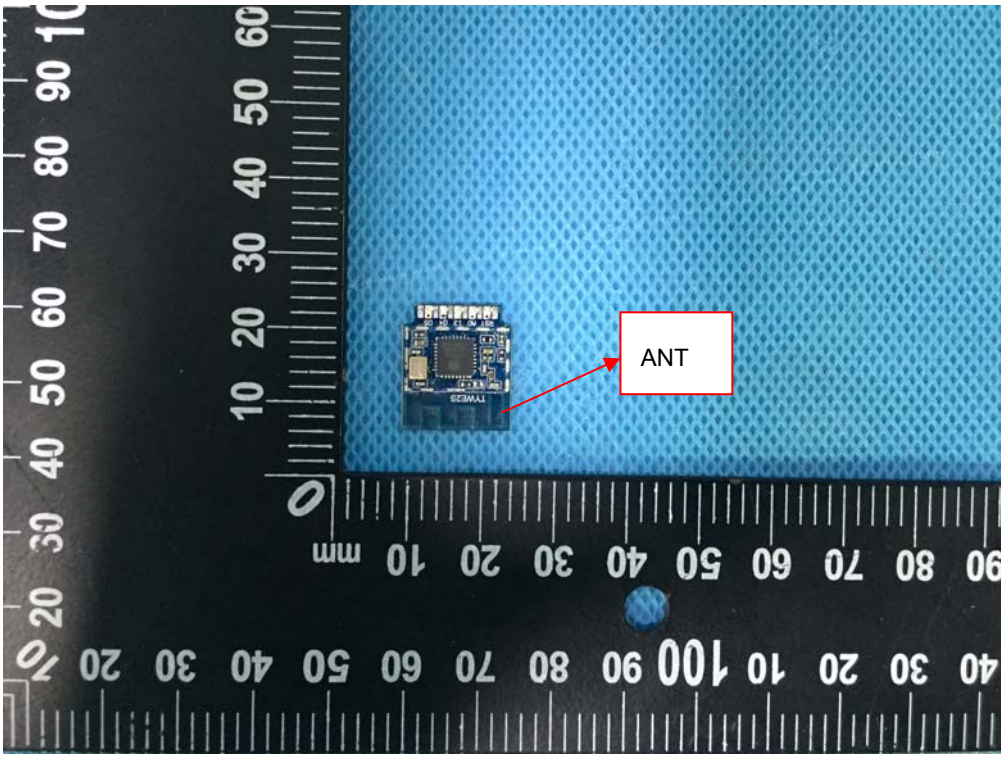
13 Antenna Requirement

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 On-board PCB Antenna, meets the requirements of FCC 15.203.



14 FCC ID: 2AIOC-SW02WU 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/cm^2)
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

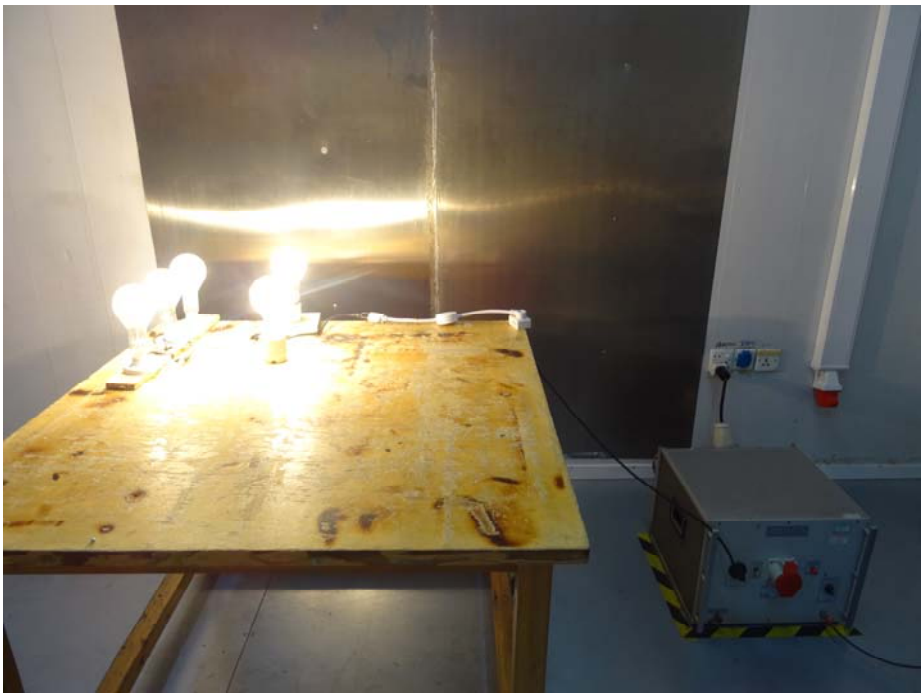
Antenna Gain (dBi)	Antenna Gain (numeric)	Max. Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (mW/cm2)	Limit of Power Density (mW/cm2)
3.0	1.995	17.89	61.52	0.024	1

14.3 Result: Compliance

No SAR measurement is required.

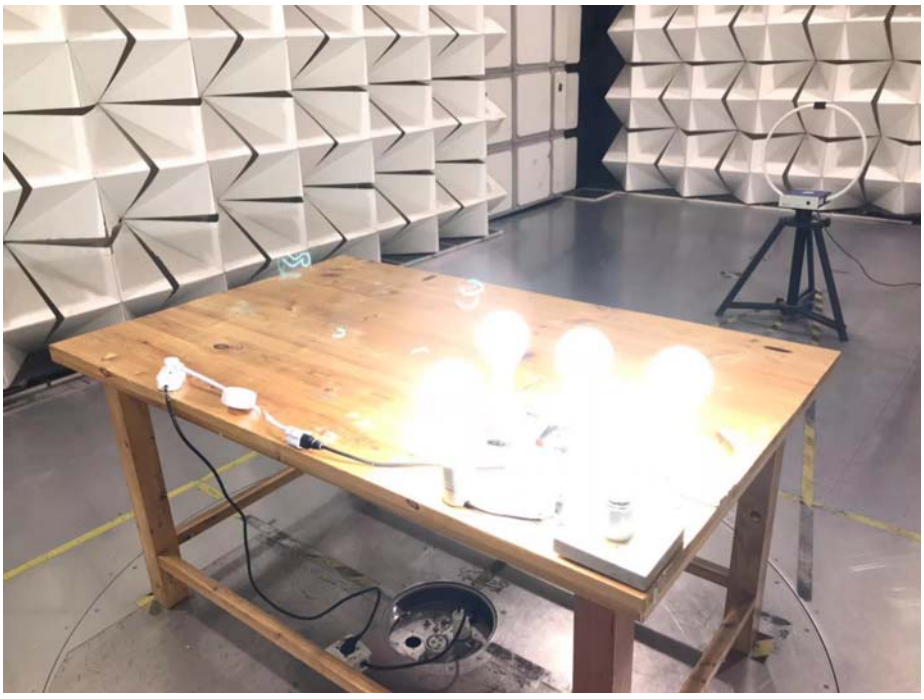
15 Photographs –HKWL-SW02WU Test Setup Photos

15.1 Photograph-Conducted Emissions Test Setup Photos

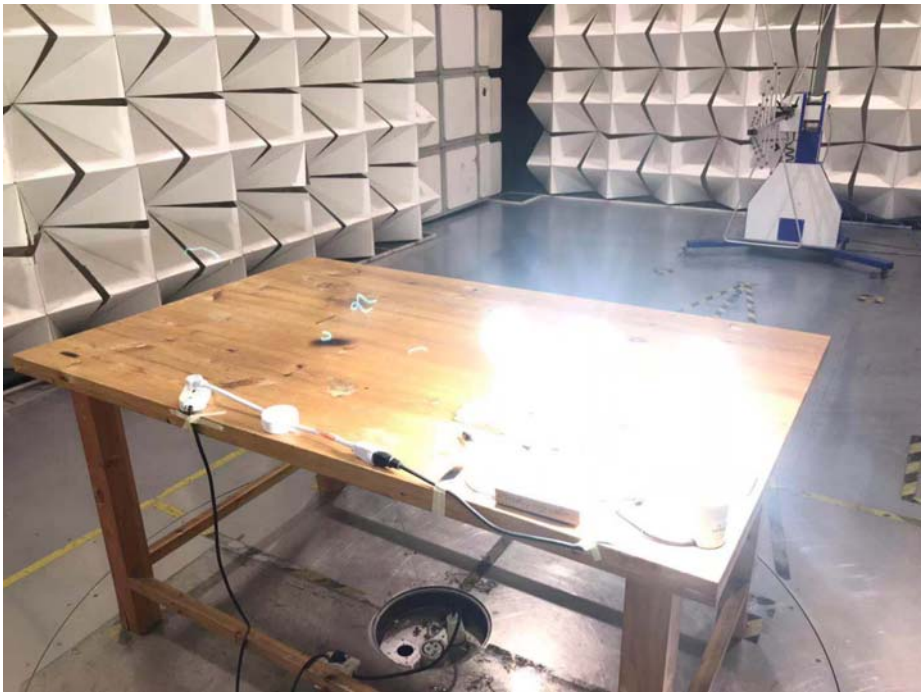


15.2 Photograph – Radiated Spurious Emissions Test Setup Photos

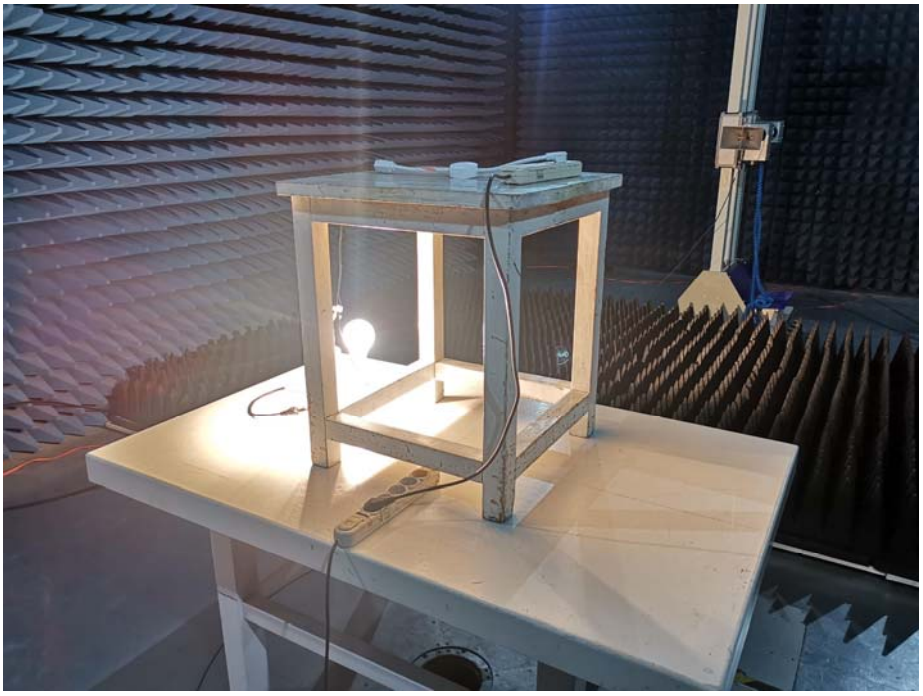
9 kHz to 30 MHz



From 30 MHz to 1GHz

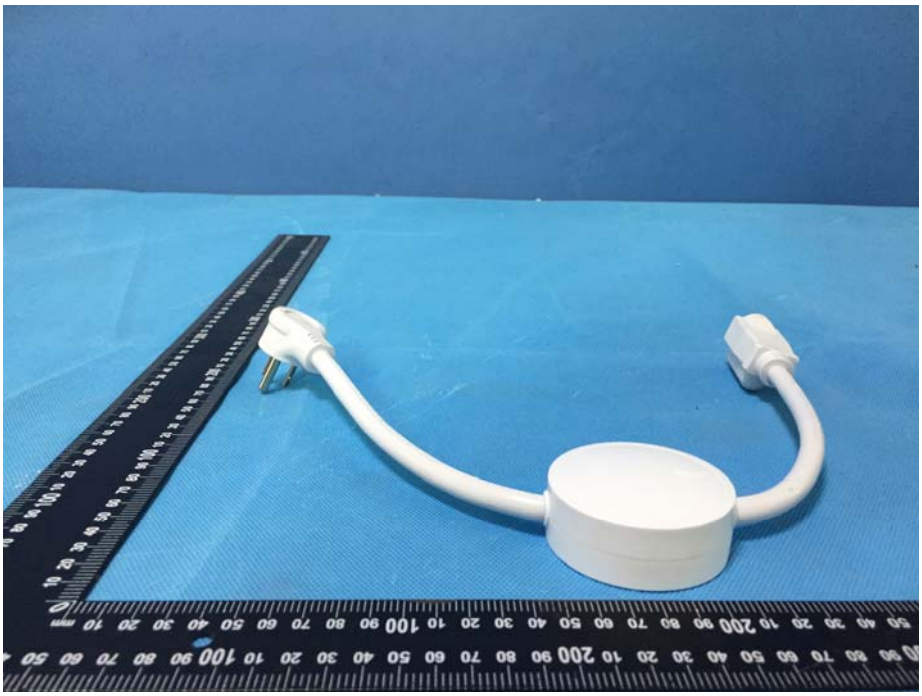


Above 1GHz

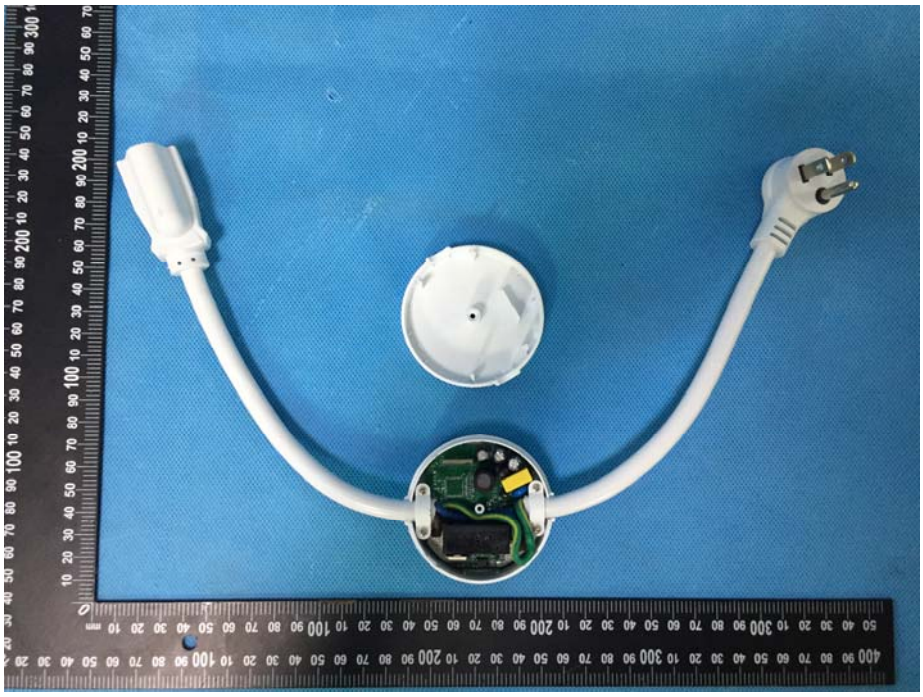


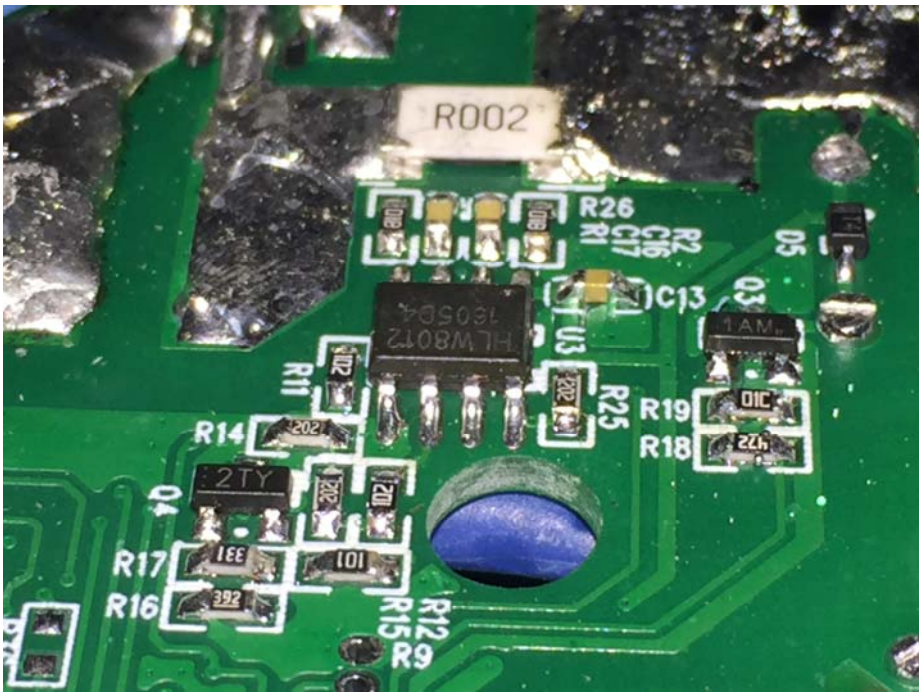
16 Photographs - Constructional Details

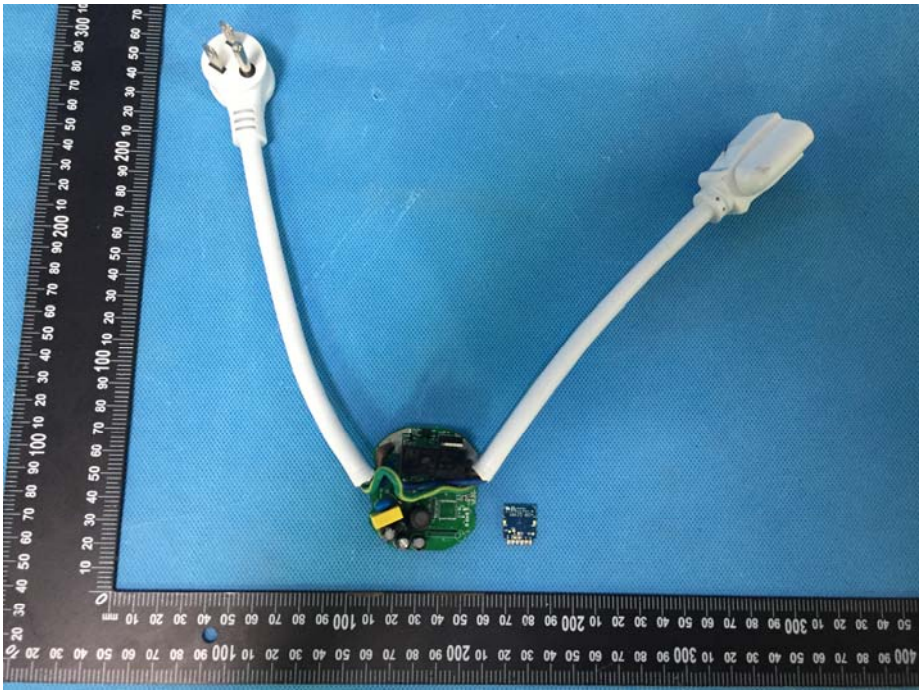
16.1 Model HKWL-SW02WU - External Photos



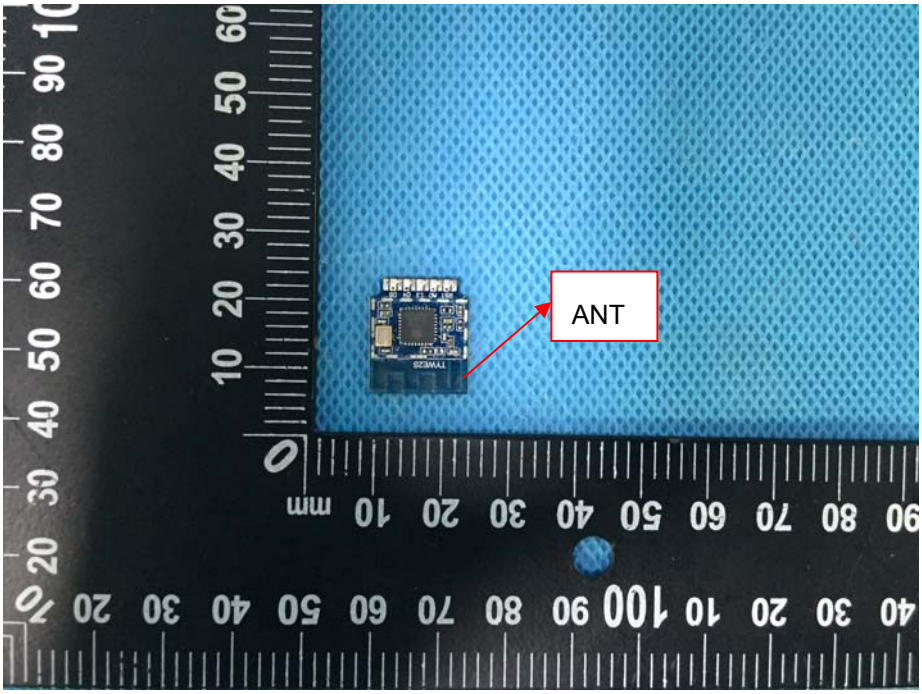
16.2 Model HKWL-SW02WU - Internal Photos

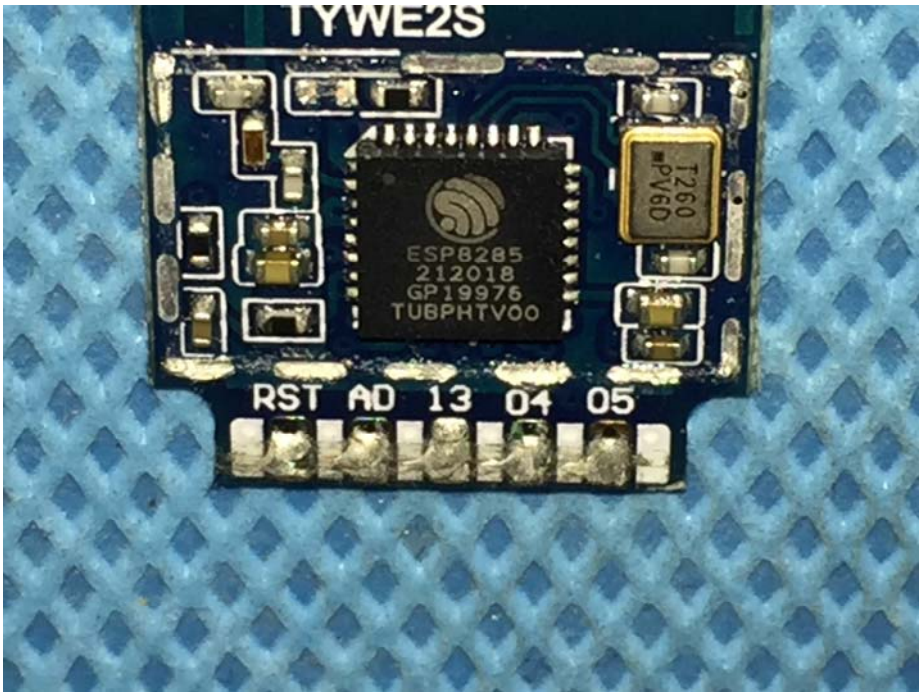


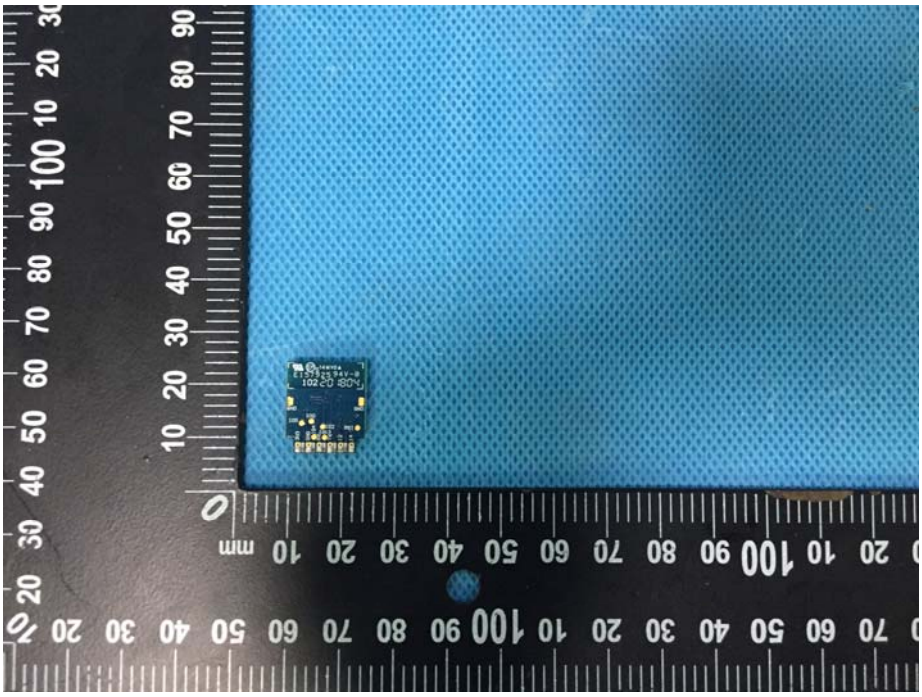

R002
R26
C13
U3
R11
R14
R25
R19
R18
R17
R16
R15
R12
R9




HCR3-S-DC5V-A


ANT





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