

TEST REPORT

Reference No. : WTD18S12133784W
FCC ID..... : DC9-IVPCDS
Applicant..... : OPTEX CO., LTD.
Address : 5-8-12, Ogoto Otsu-Shi, Shifa-Ken Japan 520-0101
Manufacturer : OPTEX CO., LTD.
Address : 5-8-12, Ogoto Otsu-Shi, Shifa-Ken Japan 520-0101
Product Name : Door Station
Model No. : IVPC-DS
Standards..... : FCC CFR47 Part 15 C Section 15.247:2018
Date of Receipt sample..... : 2018-12-26
Date of Test..... : 2018-12-26 to 2019-01-04
Date of Issue : 2019-01-04
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 (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.

2.1 Test Facility

A. Accreditations for Conformity Assessment (International)

Country/Region	Scope Covered By	Scope	Note
USA	ISO/IEC 17025	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		NTC	-
Singapore		IDA	-
Note:			
1. FCC Designation No.: CN1201. Test Firm Registration No.: 523476.			
2. ISED 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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4 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTD18S12133784W	2018-12-26	2018-12-26 to 2019-01-04	2019-01-04	original	-	Valid

5 General Information

5.1 General Description of E.U.T

Product Name:	Door Station
Model No.:	IVPC-DS
Model Difference:	N/A
Operation Frequency:	802.11b/g/n HT20: 2412MHz ~ 2462MHz
RF output power	10.70dBm
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.)
Antenna installation:	External antenna with RP-SMA connector

5.2 Details of E.U.T

Ratings:	Input: 10 to 24V 0.6A Battery: DC 3.7V 5000mAh 18.5Wh
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5.3 Channel List

WIFI

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

6 Equipment Used during Test

6.1 Equipments List

Conducted Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Valid
1	EMI Test Receiver	R&S	ESCI	100947	2018-09-15	1Year
2	LISN	R&S	ENV216	100115	2018-09-15	1Year
3	Cable	Top	TYPE16(3.5M)	-	2018-09-15	1Year
3m Semi-anechoic Chamber for Radiation Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Valid
1	Spectrum Analyzer	R&S	FSP	100091	2018-04-20	1Year
2	Amplifier	Agilent	8447D	2944A10178	2018-01-10	1Year
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2018-05-18	1Year
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2018-10-15	1Year
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2018-05-18	1Year
6	Broad-band Horn Antenna (FCC/IC ID 才放)	SCHWARZBECK	BBHA 9170	335	2018-10-24	1Year
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2018-04-07	1Year
8	Coaxial Cable (above 1GHz)	Top	1GHz-18GHz	EW02014-7	2018-04-07	1Year
9	Signal Generater	R&S	SMP22	100102	2018-09-15	1Year
3m Semi-anechoic Chamber for Radiation Emissions(TDK)						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Valid
1	Test Receiver	R&S	ESCI	101296	2018-04-20	1Year
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2018-04-19	1Year
3	Active Loop Antenna	Com-Power Corp.	AL-130R	10160007	2018-04-17	1Year
4	Amplifier	ANRITSU	MH648A	M43381	2018-04-20	1Year
5	Cable	HUBER+SUHNER	CBL2	525178	2018-04-20	1Year
RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Valid
1.	EMC Analyzer	Agilent	E7405A	MY45114943	2018-09-13	1Year

	(9k~26.5GHz)					
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	2018-09-13	1Year
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	2018-09-13	1Year

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

6.3 Test Equipment Calibration

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

7 Test Summary

Test Items	Test Requirement	Result
Radiated Emissions	15.247 15.205(a) 15.209(a)	C
Conducted Emissions	15.207(a)	C
Bandwidth	15.247(a)(2)	C
Maximum Peak Output Power	15.247(b)(3),(4)	N/A
Power Spectral Density	15.247(e)	C
Band Edge	15.247(d)	C
Antenna Requirement	15.203	C
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	C
Note: C=Compliance; NC=Not Compliance; NT=Not Tested; N/A=Not Applicable.		

8 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.10:2013,ANSI C63.4:2014
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)

8.1 E.U.T. Operation

Operating Environment :

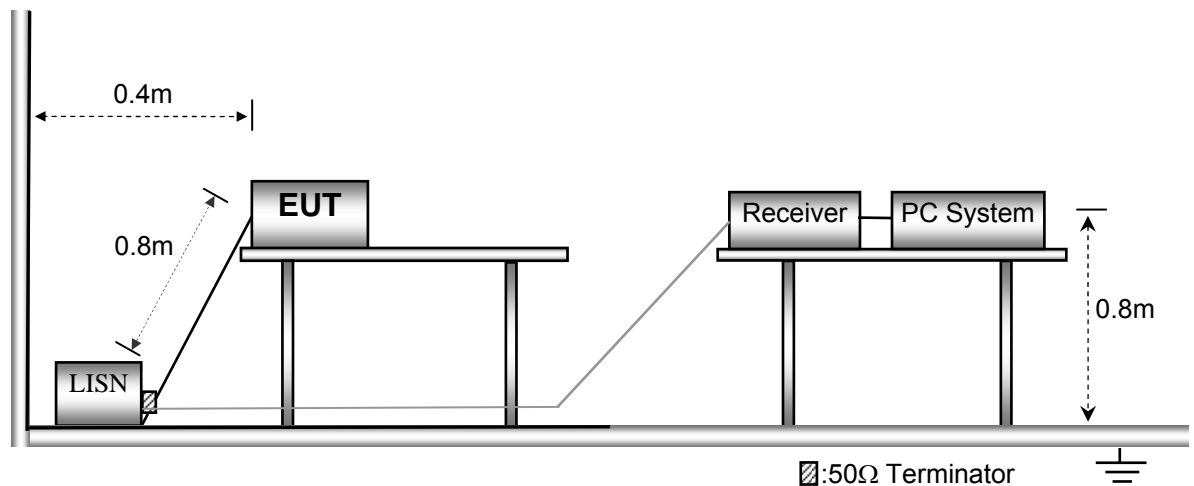
Temperature:	21.5 °C
Humidity:	51.9 % RH
Atmospheric Pressure:	101.2kPa

EUT Operation :

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

8.2 EUT Setup

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



8.3 Measurement Description

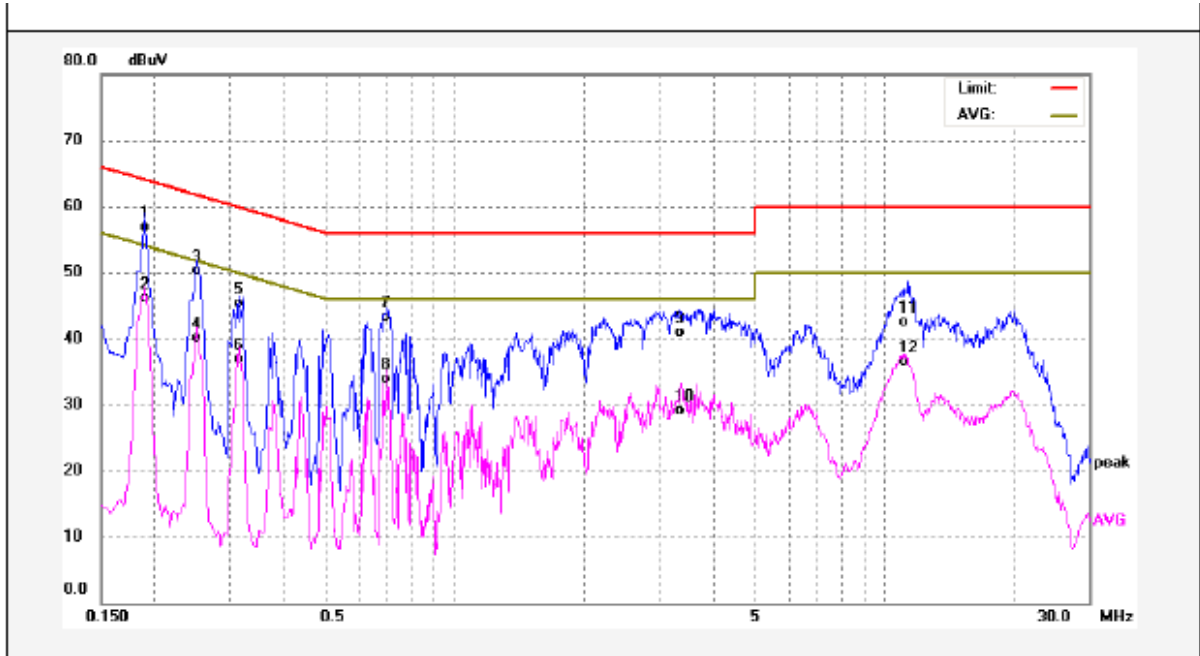
The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

8.4 Conducted Emission Test Result

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

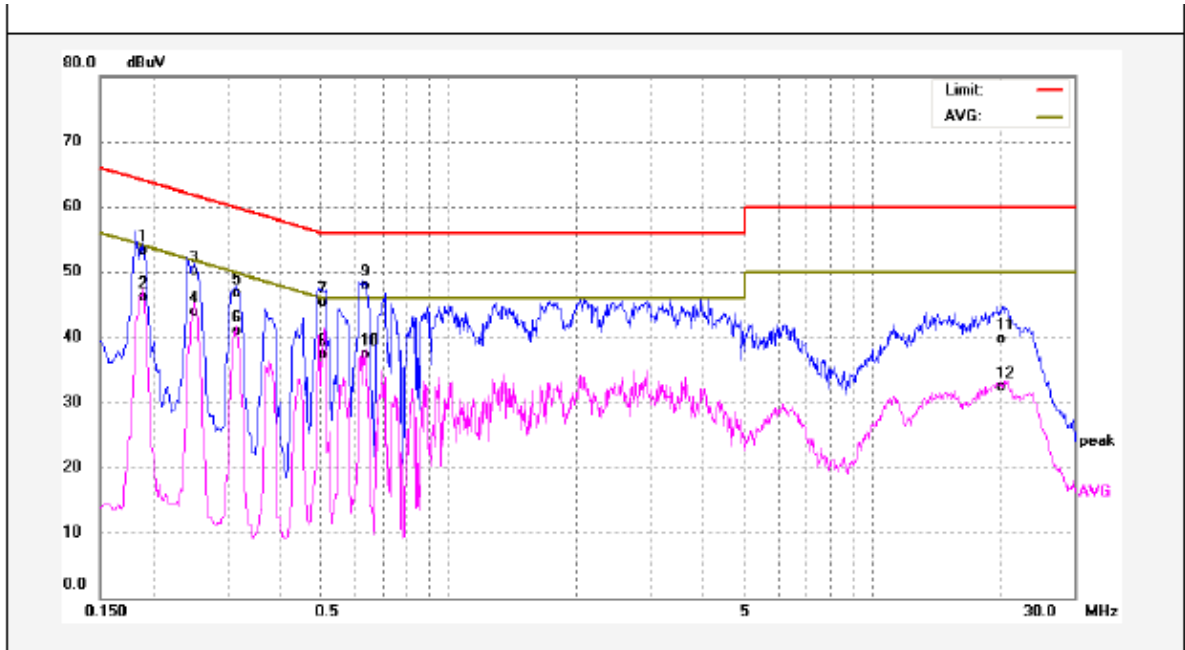
Only the worst case (WIFI transmitting mode) test data were record in the report.

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1900	47.07	9.77	56.84	64.03	-7.19	QP	
2	0.1900	36.25	9.77	46.02	54.03	-8.01	AVG	
3	0.2500	40.64	9.76	50.40	61.75	-11.35	QP	
4	0.2500	30.43	9.76	40.19	51.75	-11.56	AVG	
5	0.3140	35.57	9.81	45.38	59.86	-14.48	QP	
6	0.3140	27.02	9.81	36.83	49.86	-13.03	AVG	
7	0.6940	33.50	9.83	43.33	56.00	-12.67	QP	
8	0.6940	24.04	9.83	33.87	46.00	-12.13	AVG	
9	3.3660	30.98	9.93	40.91	56.00	-15.09	QP	
10	3.3660	19.26	9.93	29.19	46.00	-16.81	AVG	
11	11.1260	32.39	10.08	42.47	60.00	-17.53	QP	
12	11.1260	26.36	10.08	36.44	50.00	-13.56	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1900	43.44	9.77	53.21	64.03	-10.82	QP	
2	0.1900	36.33	9.77	46.10	54.03	-7.93	AVG	
3	0.2500	40.31	9.76	50.07	61.75	-11.68	QP	
4	0.2500	34.12	9.76	43.88	51.75	-7.87	AVG	
5	0.3140	36.94	9.81	46.75	59.86	-13.11	QP	
6	0.3140	31.14	9.81	40.95	49.86	-8.91	AVG	
7	0.5100	35.43	9.81	45.24	56.00	-10.76	QP	
8	0.5100	27.54	9.81	37.35	46.00	-8.65	AVG	
9	0.6340	38.05	9.84	47.89	56.00	-8.11	QP	
10	0.6340	27.56	9.84	37.40	46.00	-8.60	AVG	
11	20.0700	29.46	10.29	39.75	60.00	-20.25	QP	
12	20.0700	21.99	10.29	32.28	50.00	-17.72	AVG	

9 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: ANSI C63.10:2013,ANSI C63.4:2014

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	$20\log^{(500)}$

9.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 52.1 % RH

Atmospheric Pressure: 101.2kPa

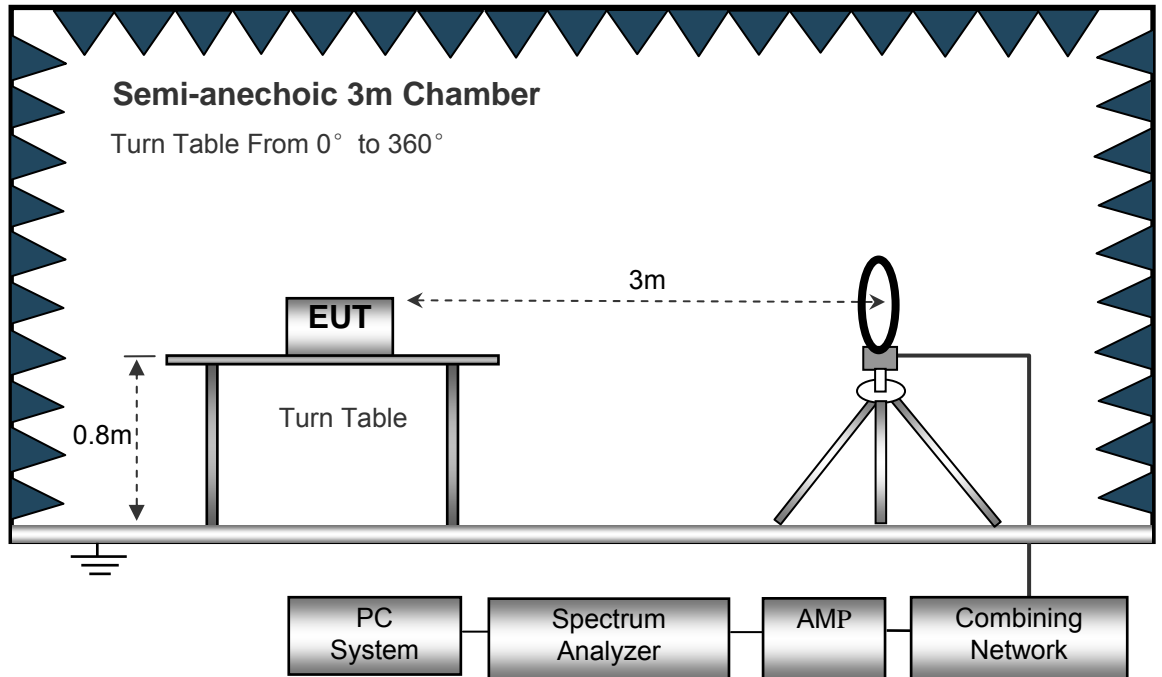
EUT Operation :

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

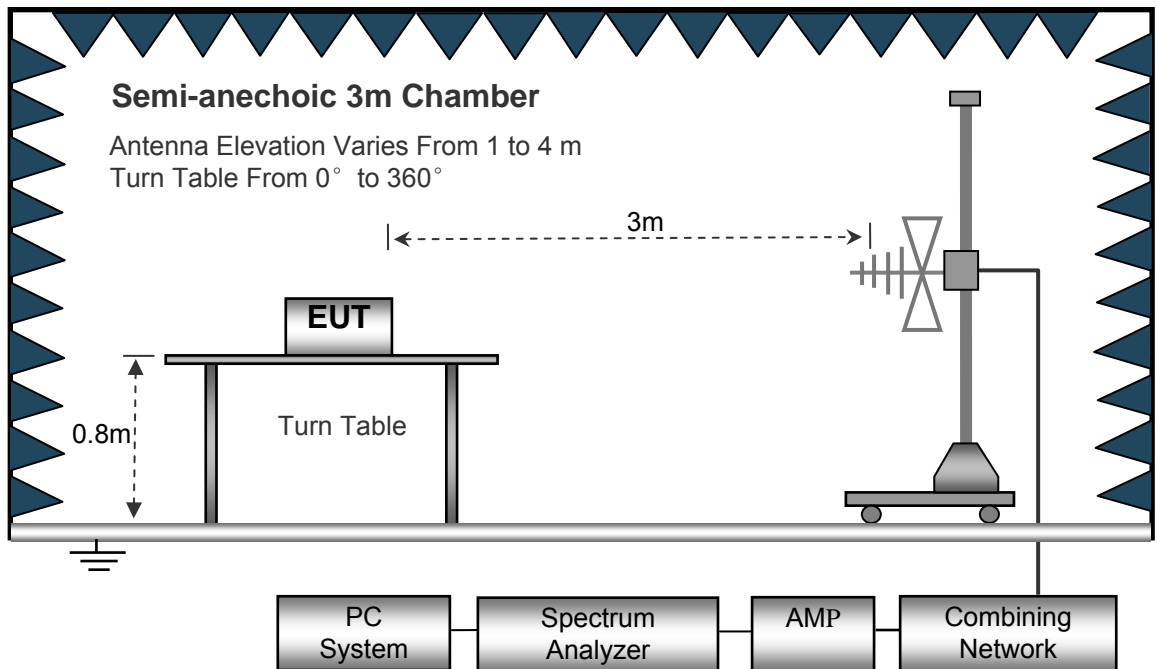
9.2 Test Setup

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

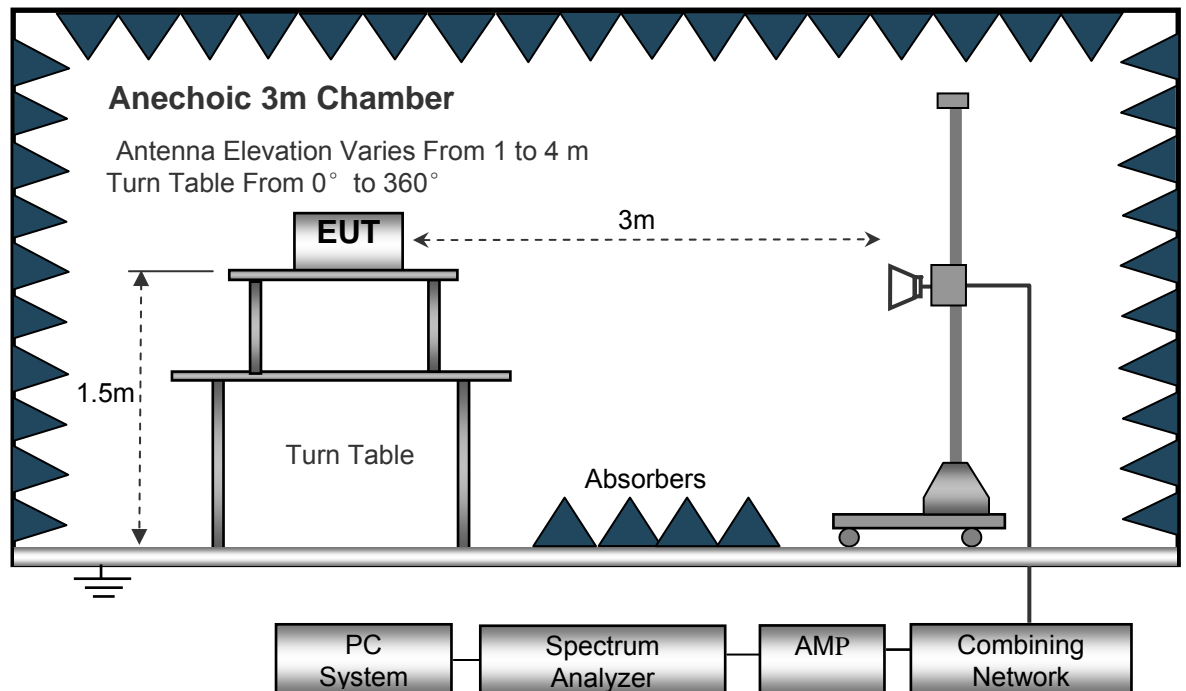
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



9.3 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

9.4 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.

9.5 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:

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

9.6 Summary of Test Results

Test Frequency : 12.8MHz ~ 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									
485.61	12.81	PK	356	1.7	H	21.09	33.90	45.00	-11.10
485.61	12.22	PK	43	1.6	V	21.09	33.31	45.00	-11.69
4824.00	50.49	PK	327	1.6	V	-1.05	49.44	74.00	-24.56
4824.00	42.74	Ave	327	1.6	V	-1.05	41.69	54.00	-12.31
7236.00	46.19	PK	112	1.2	H	1.34	47.53	74.00	-26.47
7236.00	41.24	Ave	112	1.2	H	1.34	42.58	54.00	-11.42
2331.88	46.23	PK	314	1.9	V	-13.19	33.04	74.00	-40.96
2331.88	37.75	Ave	314	1.9	V	-13.19	24.56	54.00	-29.44
2357.69	43.65	PK	14	1.0	H	-13.15	30.50	74.00	-43.50
2357.69	36.25	Ave	14	1.0	H	-13.15	23.10	54.00	-30.90
2499.36	43.72	PK	214	1.9	V	-13.08	30.64	74.00	-43.36
2499.36	38.20	Ave	214	1.9	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)
11b: Middle Channel 2437MHz									
485.61	14.09	PK	296	1.5	H	21.09	35.18	45.00	-9.82
485.61	13.96	PK	101	2.0	V	21.09	35.05	45.00	-9.95
4874.00	49.46	PK	262	1.2	V	-0.63	48.83	74.00	-25.17
4874.00	44.24	Ave	262	1.2	V	-0.63	43.61	54.00	-10.39
7311.00	45.24	PK	169	1.9	H	2.21	47.45	74.00	-26.55
7311.00	42.79	Ave	169	1.9	H	2.21	45.00	54.00	-9.00
2315.72	46.30	PK	310	1.6	V	-13.19	33.11	74.00	-40.89
2315.72	37.05	Ave	310	1.6	V	-13.19	23.86	54.00	-30.14
2388.98	43.24	PK	179	1.5	H	-13.14	30.10	74.00	-43.90
2388.98	37.52	Ave	179	1.5	H	-13.14	24.38	54.00	-29.62
2494.77	42.79	PK	28	1.9	V	-13.09	29.70	74.00	-44.30
2494.77	36.06	Ave	28	1.9	V	-13.09	22.97	54.00	-31.03

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)
11b: High Channel 2462MHz									
485.61	13.07	PK	76	1.6	H	21.09	34.16	45.00	-10.84
485.61	13.42	PK	320	1.9	V	21.09	34.51	45.00	-10.49
4924.00	50.34	PK	315	1.6	V	-0.25	50.09	74.00	-23.91
4924.00	44.75	Ave	315	1.6	V	-0.25	44.50	54.00	-9.50
7386.00	48.22	PK	189	1.3	H	2.85	51.07	74.00	-22.93
7386.00	41.31	Ave	189	1.3	H	2.85	44.16	54.00	-9.84
2334.93	46.08	PK	118	1.3	V	-13.19	32.89	74.00	-41.11
2334.93	39.75	Ave	118	1.3	V	-13.19	26.56	54.00	-27.44
2371.22	42.01	PK	245	1.3	H	-13.14	28.87	74.00	-45.13
2371.22	38.01	Ave	245	1.3	H	-13.14	24.87	54.00	-29.13
2491.04	44.24	PK	15	1.5	V	-13.09	31.15	74.00	-42.85
2491.04	37.06	Ave	15	1.5	V	-13.09	23.97	54.00	-30.03

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: Low Channel 2412MHz									
485.61	12.97	PK	212	2.0	H	21.09	34.06	45.00	-10.94
485.61	12.69	PK	156	1.7	V	21.09	33.78	45.00	-11.22
4824.00	51.66	PK	36	1.1	V	-1.06	50.60	74.00	-23.40
4824.00	48.37	Ave	36	1.1	V	-1.06	47.31	54.00	-6.69
7236.00	47.10	PK	156	1.7	H	1.35	48.45	74.00	-25.55
7236.00	46.46	Ave	156	1.7	H	1.35	47.81	54.00	-6.19
2310.38	46.41	PK	277	1.9	V	-13.19	33.22	74.00	-40.78
2310.38	39.35	Ave	277	1.9	V	-13.19	26.16	54.00	-27.84
2377.82	44.11	PK	267	1.5	H	-13.14	30.97	74.00	-43.03
2377.82	38.13	Ave	267	1.5	H	-13.14	24.99	54.00	-29.01
2486.27	44.19	PK	332	1.3	V	-13.08	31.11	74.00	-42.89
2486.27	36.93	Ave	332	1.3	V	-13.08	23.85	54.00	-30.15

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									
485.61	13.47	PK	87	1.6	H	21.09	34.56	45.00	-10.44
485.61	14.10	PK	248	1.2	V	21.09	35.19	45.00	-9.81
4874.00	49.64	PK	270	1.6	V	-0.62	49.02	74.00	-24.98
4874.00	48.79	Ave	270	1.6	V	-0.62	48.17	54.00	-5.83
7311.00	47.47	PK	260	1.9	H	2.20	49.67	74.00	-24.33
7311.00	46.28	Ave	260	1.9	H	2.20	48.48	54.00	-5.52
2317.76	46.90	PK	45	1.1	V	-13.19	33.71	74.00	-40.29
2317.76	37.13	Ave	45	1.1	V	-13.19	23.94	54.00	-30.06
2365.86	42.79	PK	174	1.9	H	-13.15	29.64	74.00	-44.36
2365.86	37.78	Ave	174	1.9	H	-13.15	24.63	54.00	-29.37
2493.46	44.83	PK	259	1.6	V	-13.09	31.74	74.00	-42.26
2493.46	38.16	Ave	259	1.6	V	-13.09	25.07	54.00	-28.93

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
11g: High Channel 2462MHz									
485.61	13.92	PK	296	1.3	H	21.09	35.01	45.00	-9.99
485.61	12.91	PK	58	1.2	V	21.09	34.00	45.00	-11.00
4924.00	50.76	PK	299	1.7	V	-0.25	50.51	74.00	-23.49
4924.00	46.47	Ave	299	1.7	V	-0.25	46.22	54.00	-7.78
7386.00	47.69	PK	356	1.1	H	2.86	50.55	74.00	-23.45
7386.00	42.41	Ave	356	1.1	H	2.86	45.27	54.00	-8.73
2337.20	46.35	PK	127	1.1	V	-13.19	33.16	74.00	-40.84
2337.20	37.89	Ave	127	1.1	V	-13.19	24.70	54.00	-29.30
2384.00	42.33	PK	146	1.4	H	-13.14	29.19	74.00	-44.81
2384.00	38.64	Ave	146	1.4	H	-13.14	25.50	54.00	-28.50
2499.76	42.05	PK	86	1.2	V	-13.08	28.97	74.00	-45.03
2499.76	37.50	Ave	86	1.2	V	-13.08	24.42	54.00	-29.58

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
n20: Low Channel 2412MHz									
485.61	12.88	PK	176	1.0	H	21.09	33.97	45.00	-11.03
485.61	13.21	PK	276	1.3	V	21.09	34.30	45.00	-10.70
4824.00	50.58	PK	51	1.7	V	-1.06	49.52	74.00	-24.48
4824.00	48.90	Ave	51	1.7	V	-1.06	47.84	54.00	-6.16
7236.00	47.07	PK	3	1.5	H	1.34	48.41	74.00	-25.59
7236.00	45.54	Ave	3	1.5	H	1.34	46.88	54.00	-7.12
2329.82	45.28	PK	21	1.9	V	-13.19	32.09	74.00	-41.91
2329.82	37.90	Ave	21	1.9	V	-13.19	24.71	54.00	-29.29
2363.47	42.59	PK	184	1.0	H	-13.14	29.45	74.00	-44.55
2363.47	37.81	Ave	184	1.0	H	-13.14	24.67	54.00	-29.33
2492.32	44.70	PK	318	1.5	V	-13.08	31.62	74.00	-42.38
2492.32	37.58	Ave	318	1.5	V	-13.08	24.50	54.00	-29.50

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
n20: Middle Channel 2437MHz									
485.61	13.40	PK	39	2.0	H	21.09	34.49	45.00	-10.51
485.61	14.03	PK	16	1.8	V	21.09	35.12	45.00	-9.88
4874.00	50.37	PK	8	1.1	V	-0.61	49.76	74.00	-24.24
4874.00	48.41	Ave	8	1.1	V	-0.61	47.80	54.00	-6.20
7311.00	47.65	PK	349	1.6	H	2.21	49.86	74.00	-24.14
7311.00	45.35	Ave	349	1.6	H	2.21	47.56	54.00	-6.44
2327.36	45.92	PK	13	1.0	V	-13.19	32.73	74.00	-41.27
2327.36	38.30	Ave	13	1.0	V	-13.19	25.11	54.00	-28.89
2389.90	44.94	PK	330	1.8	H	-13.14	31.80	74.00	-42.20
2389.90	37.88	Ave	330	1.8	H	-13.14	24.74	54.00	-29.26
2487.25	42.43	PK	212	1.3	V	-13.09	29.34	74.00	-44.66
2487.25	38.28	Ave	212	1.3	V	-13.09	25.19	54.00	-28.81

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)
n20: High Channel 2462MHz									
485.61	13.75	PK	149	1.0	H	21.09	34.84	45.00	-10.16
485.61	13.75	PK	259	1.5	V	21.09	34.84	45.00	-10.16
4924.00	50.65	PK	29	1.4	V	-0.24	50.41	74.00	-23.59
4924.00	48.86	Ave	29	1.4	V	-0.24	48.62	54.00	-5.38
7386.00	47.37	PK	175	2.0	H	2.83	50.20	74.00	-23.80
7386.00	45.05	Ave	175	2.0	H	2.83	47.88	54.00	-6.12
2317.48	46.31	PK	58	1.3	V	-13.19	33.12	74.00	-40.88
2317.48	39.89	Ave	58	1.3	V	-13.19	26.70	54.00	-27.30
2365.30	44.94	PK	227	1.3	H	-13.14	31.80	74.00	-42.20
2365.30	37.42	Ave	227	1.3	H	-13.14	24.28	54.00	-29.72
2499.88	42.38	PK	183	1.9	V	-13.08	29.30	74.00	-44.70
2499.88	38.67	Ave	183	1.9	V	-13.08	25.59	54.00	-28.41

Test Frequency: 18GHz~25GHz

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

10 Band Edge Measurement

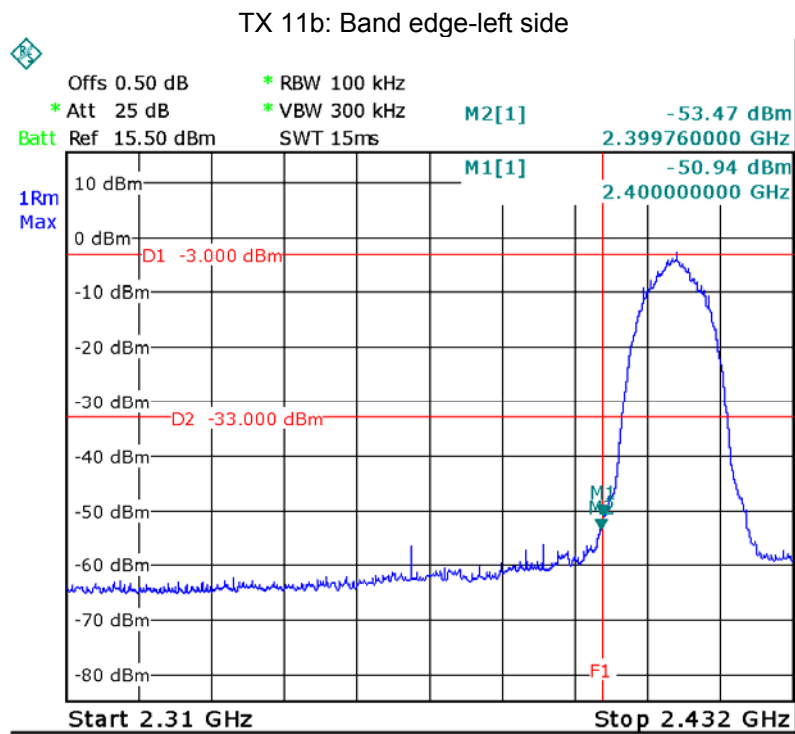
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	558074 D01 DTS Meas Guidance V04
Test Limit:	Regulation 15.247 (d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that 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

10.1 Test Produce

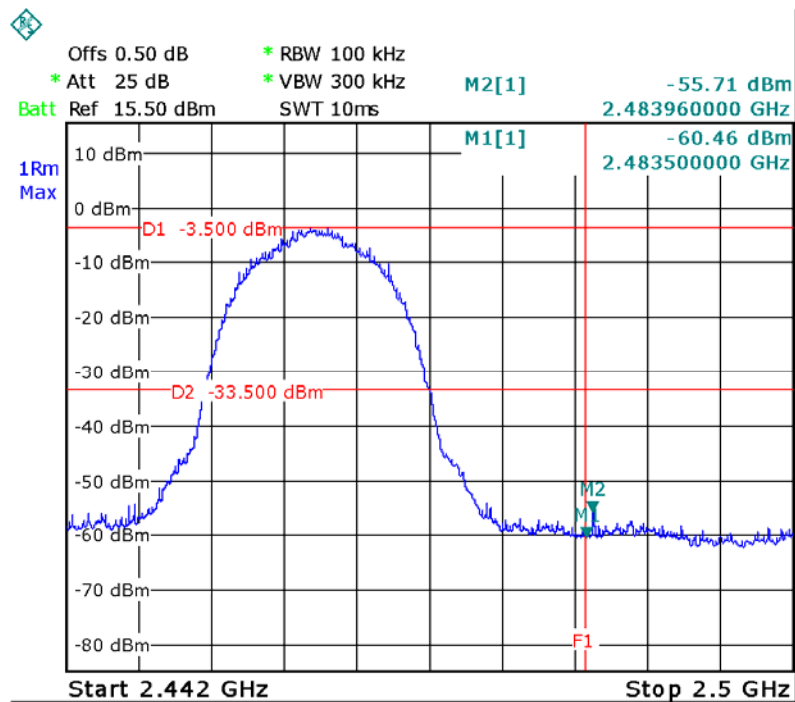
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then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

10.2 Test Result

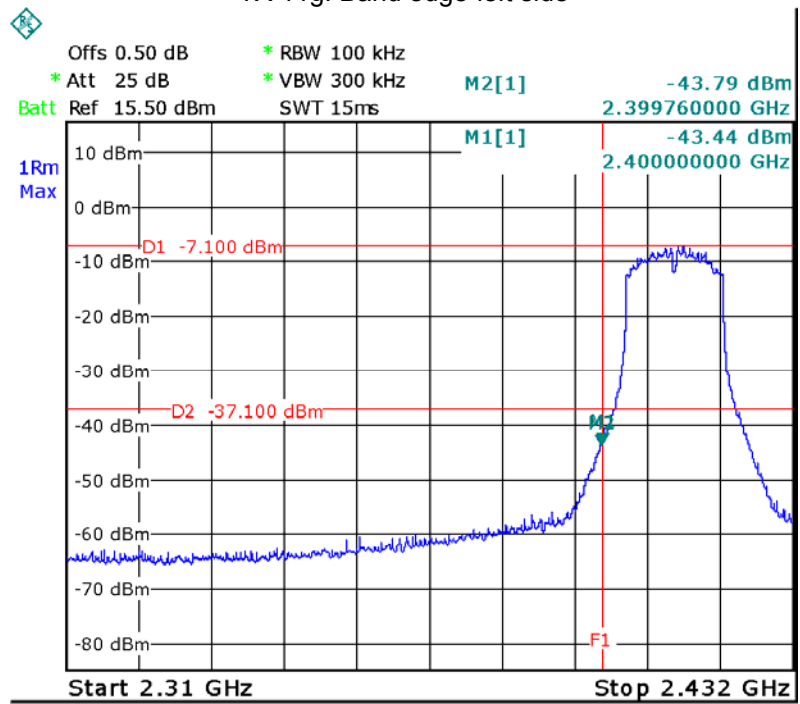
Test result plots shown as follows:



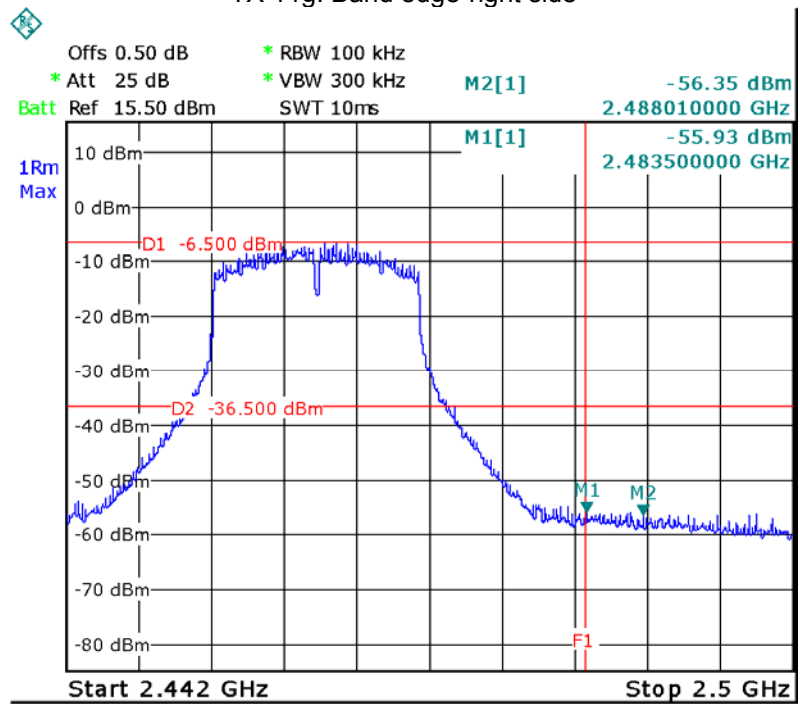
TX 11b: Band edge-right side



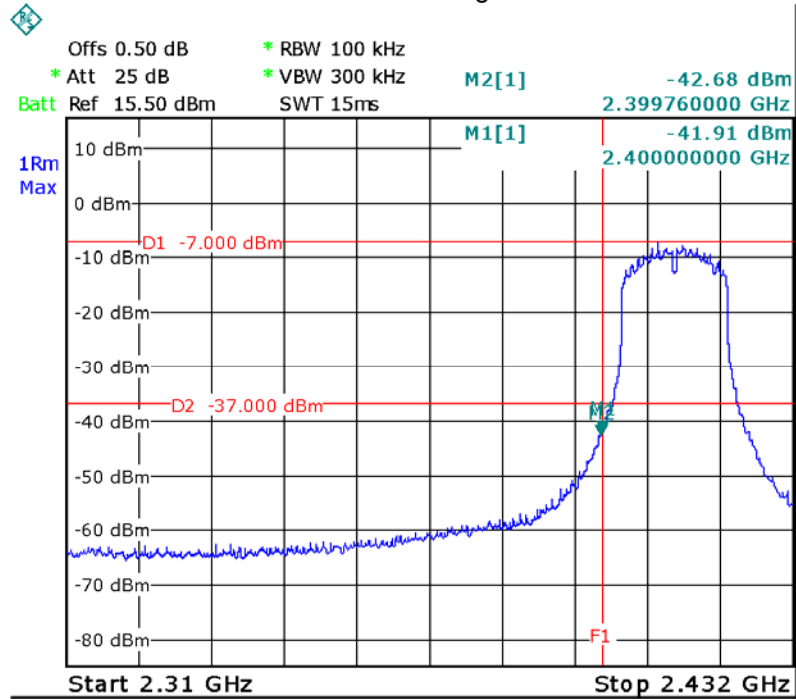
TX 11g: Band edge-left side



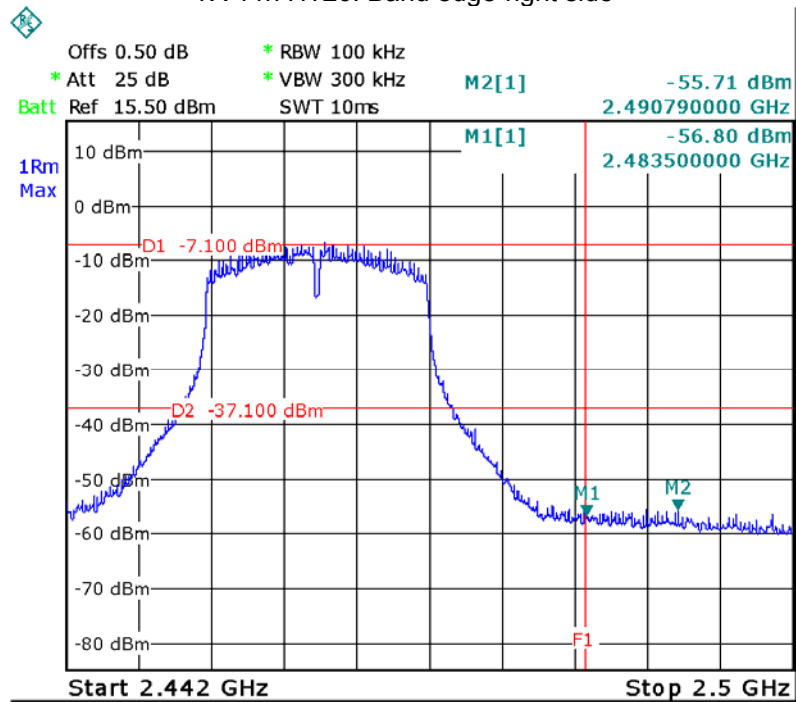
TX 11g: Band edge-right side



TX 11n HT20: Band edge-left side



TX 11n HT20: Band edge-right side



11 Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

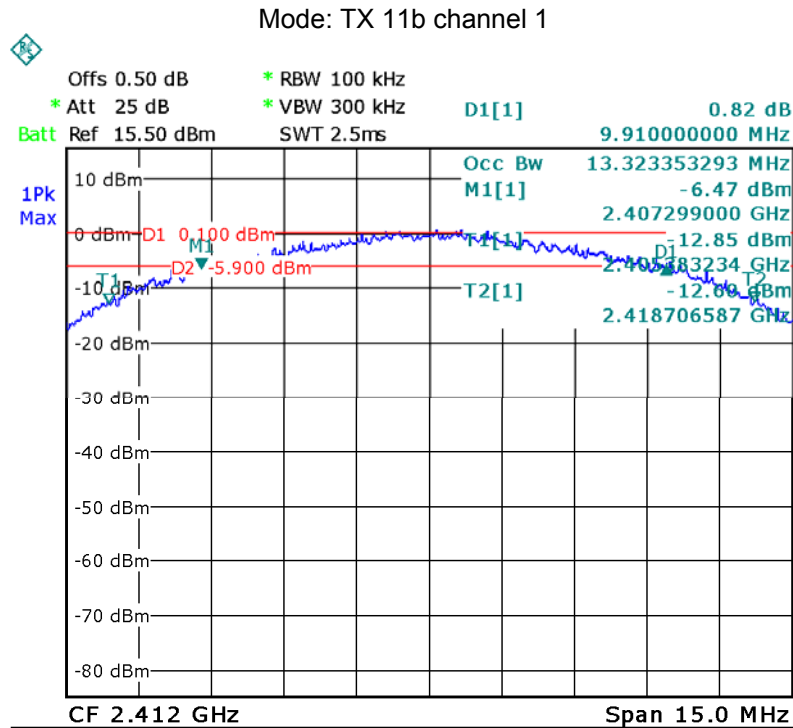
Test Method: 558074 D01 DTS Meas Guidance V04

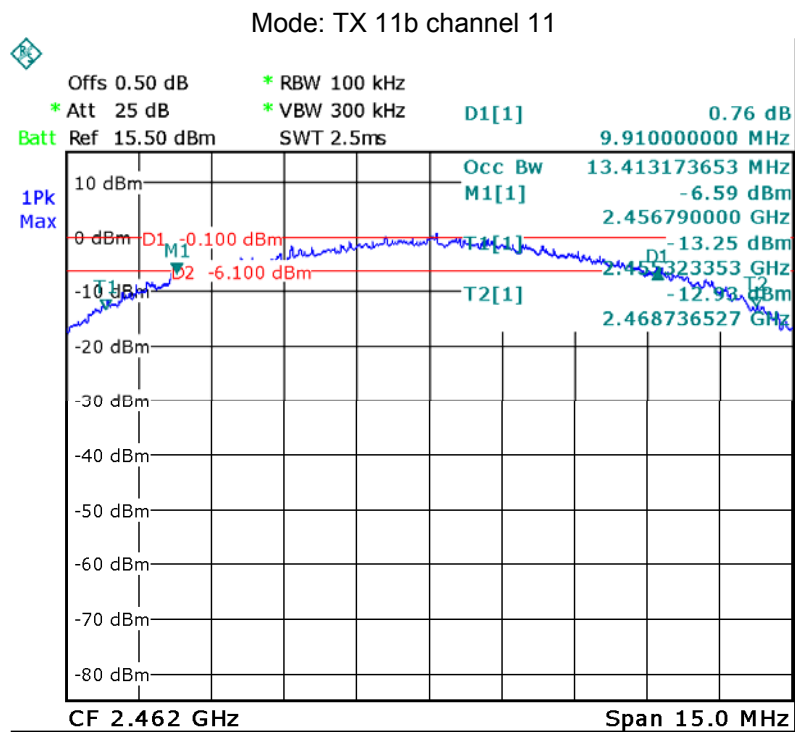
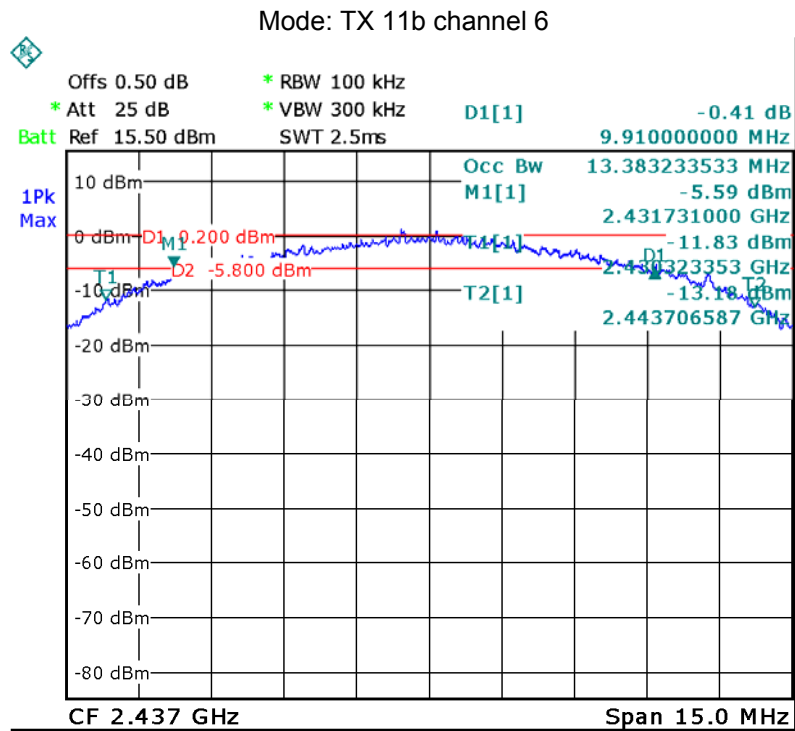
11.1 Test Procedure:

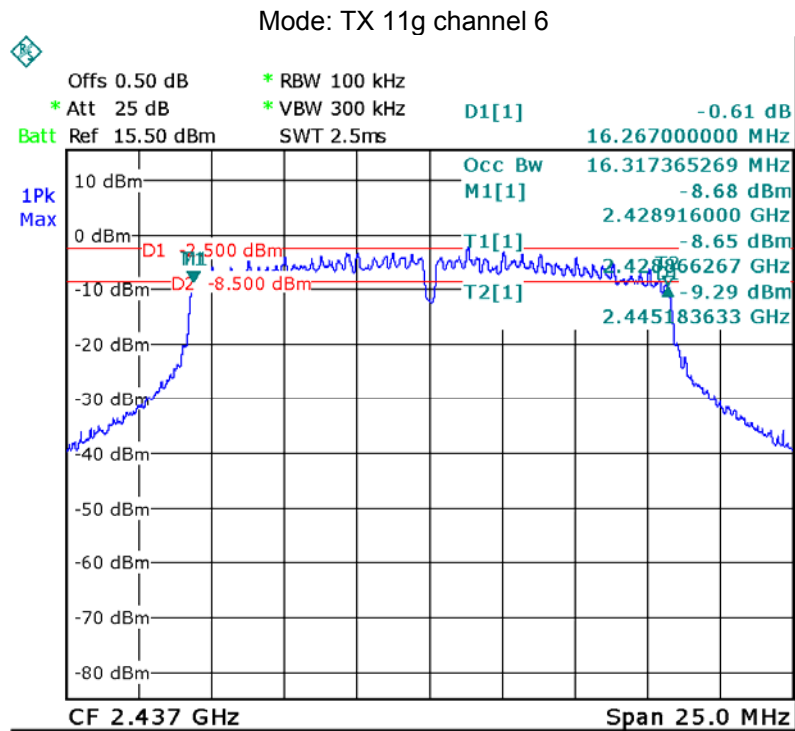
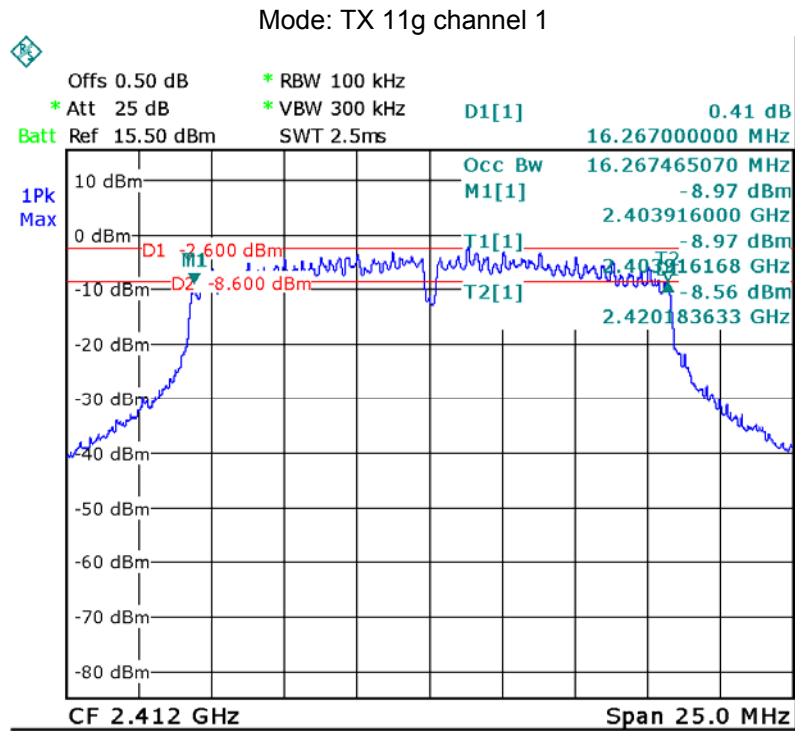
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz

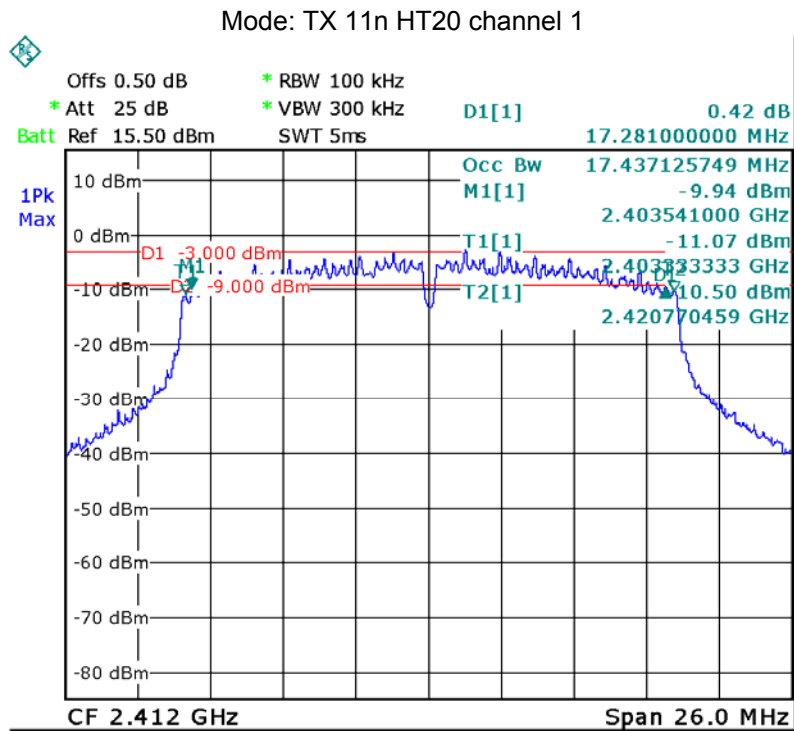
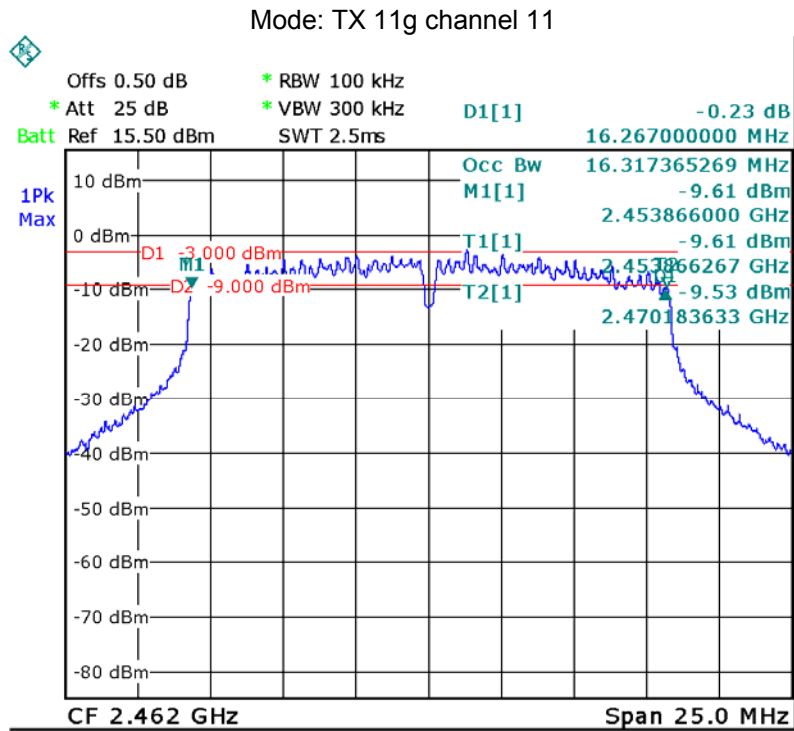
11.2 Test Result:

Operation mode	6dB Bandwidth (MHz)			99% Bandwidth (MHz)		
	Channel 1	Channel 6	Channel 11	Channel 1	Channel 6	Channel 11
TX 11b	Channel 1	Channel 6	Channel 11	Channel 1	Channel 6	Channel 11
	9.910	9.910	9.910	13.323	13.383	13.413
TX 11g	Channel 1	Channel 6	Channel 11	Channel 1	Channel 6	Channel 11
	16.267	16.267	16.267	16.267	16.317	16.317
TX 11n HT20	Channel 1	Channel 6	Channel 11	Channel 1	Channel 6	Channel 11
	17.281	17.281	17.281	17.437	17.489	17.489

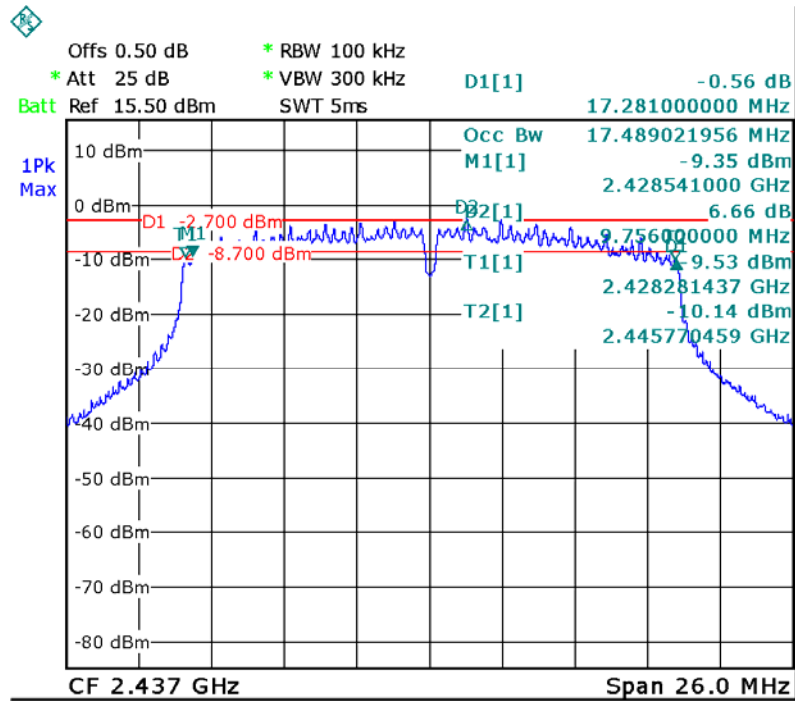




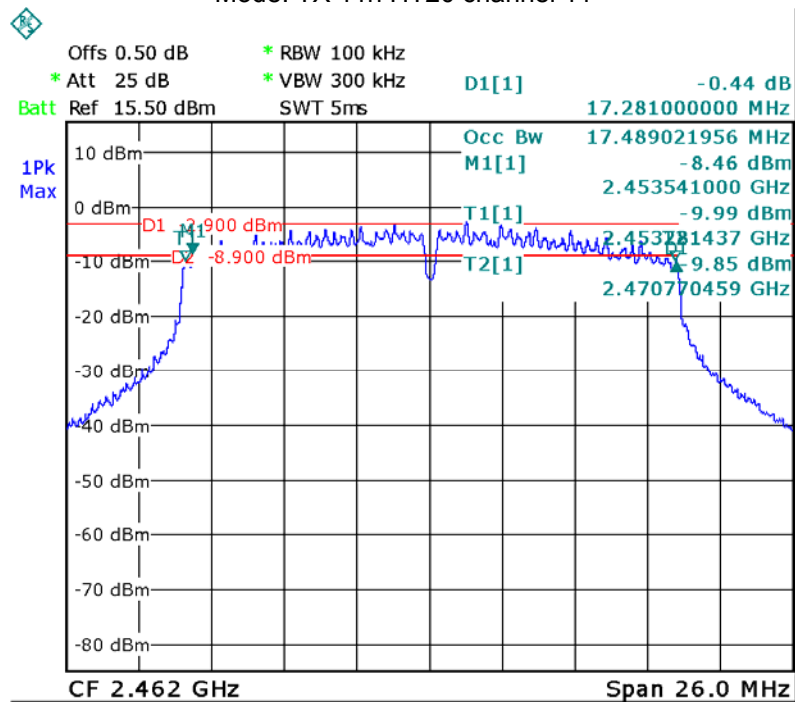




Mode: TX 11n HT20 channel 6



Mode: TX 11n HT20 channel 11



12 Power Spectral density

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: 558074 D01 DTS Meas Guidance V04

12.1 Test Procedure:

558074 D01 DTS Meas Guidance V04

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.

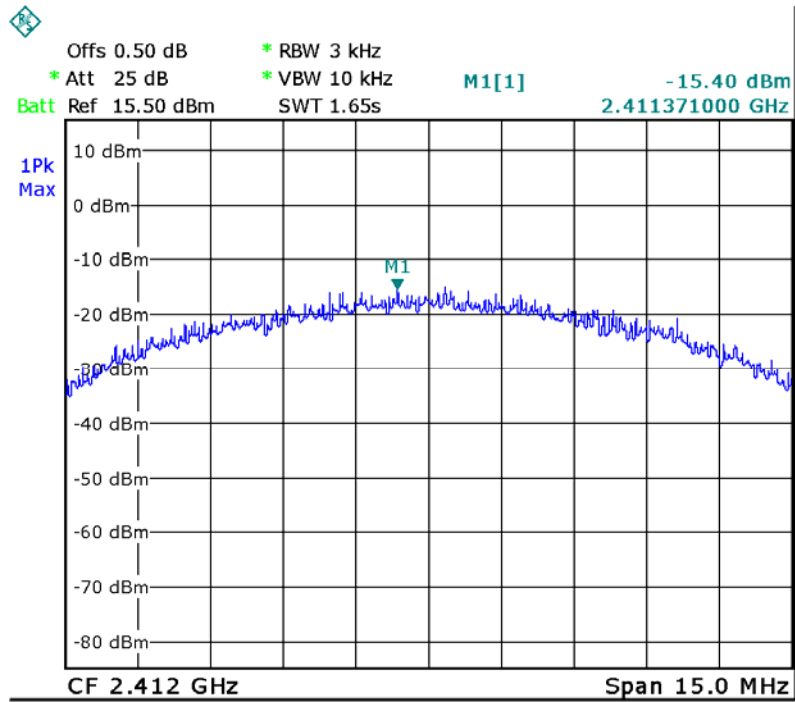
12.2 Test Result:

Test mode :TX 11b		
Power Spectral (dBm per 3kHz)		
2412MHz	2437MHz	2462MHz
-15.40	-15.15	-14.87
Limit: 8dBm per 3kHz		

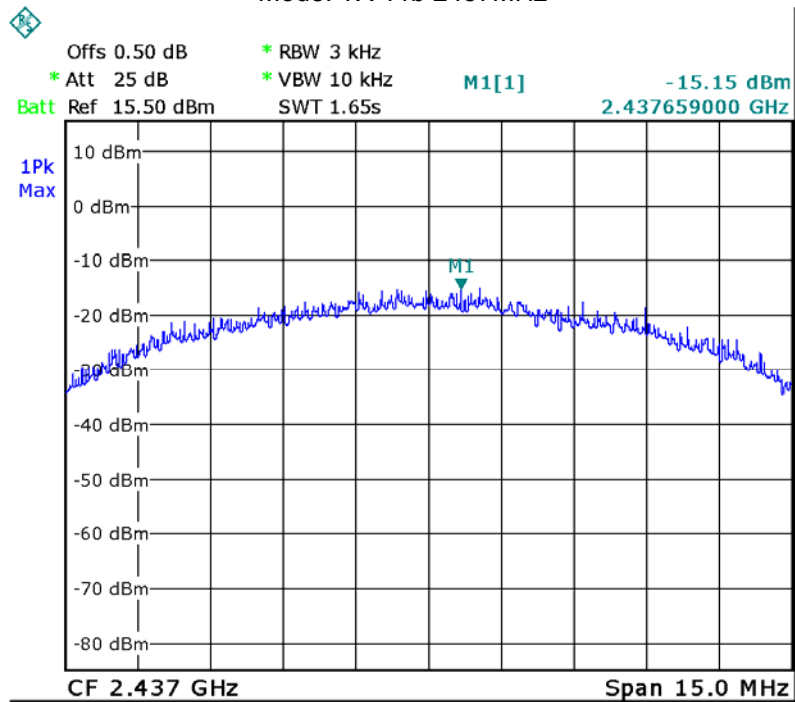
Test mode :TX 11g		
Power Spectral (dBm per 3kHz)		
2412MHz	2437MHz	2462MHz
-18.08	-18.49	-18.77
Limit: 8dBm per 3kHz		

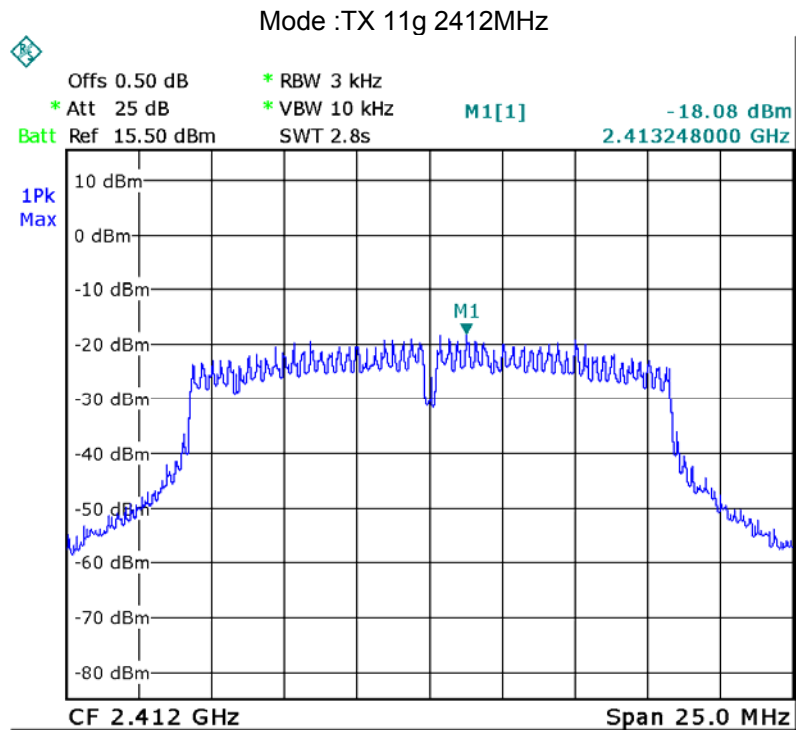
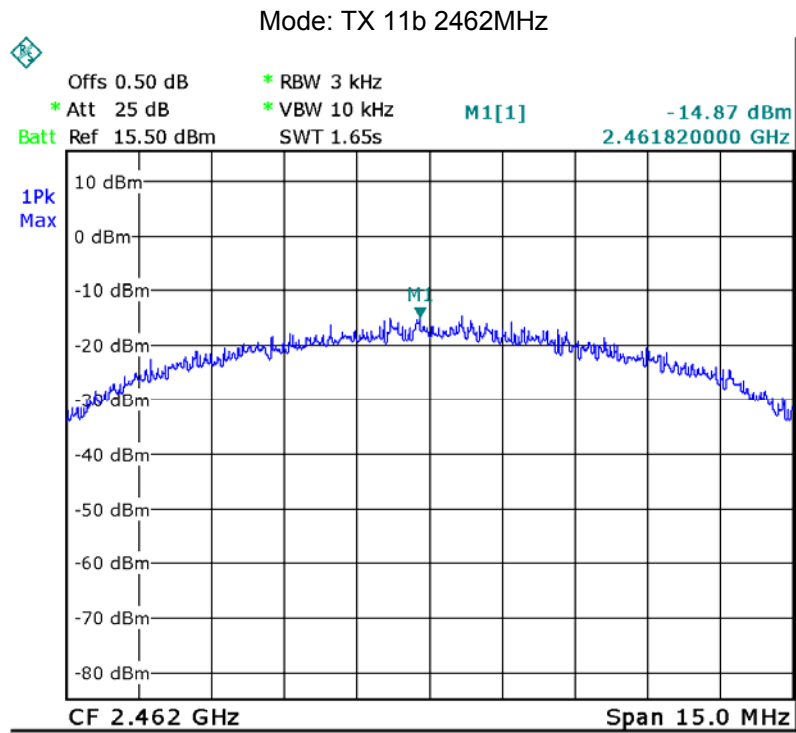
Test mode :TX 11n HT20		
Power Spectral (dBm per 3kHz)		
2412MHz	2437MHz	2462MHz
-18.98	-19.06	-19.09
Limit: 8dBm per 3kHz		

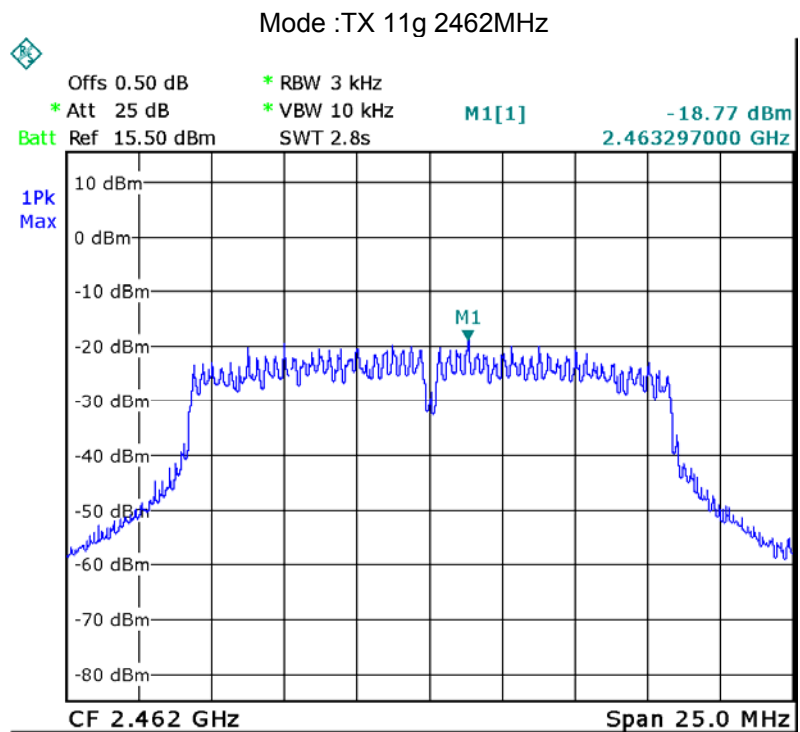
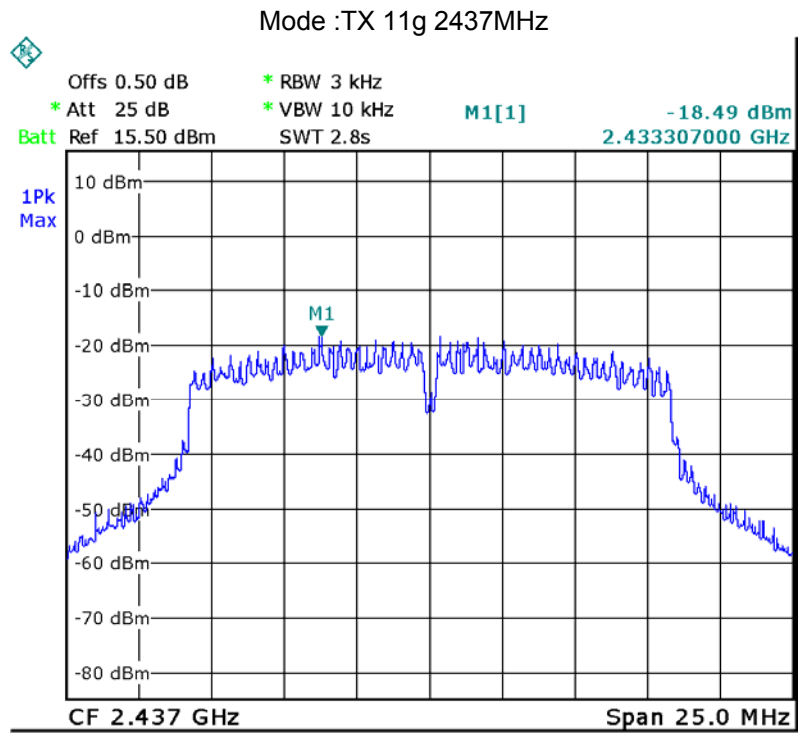
Mode: TX 11b 2412MHz

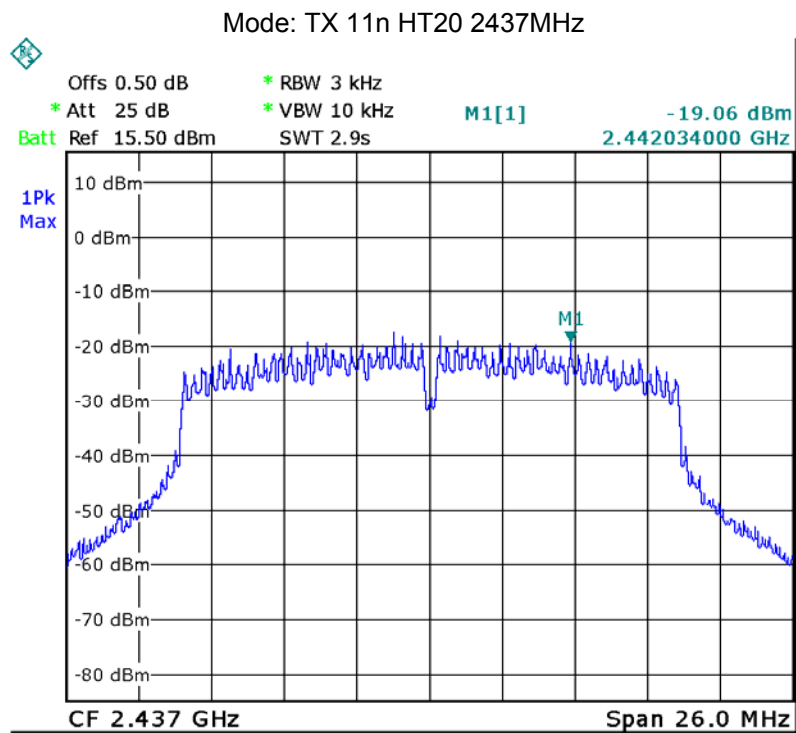
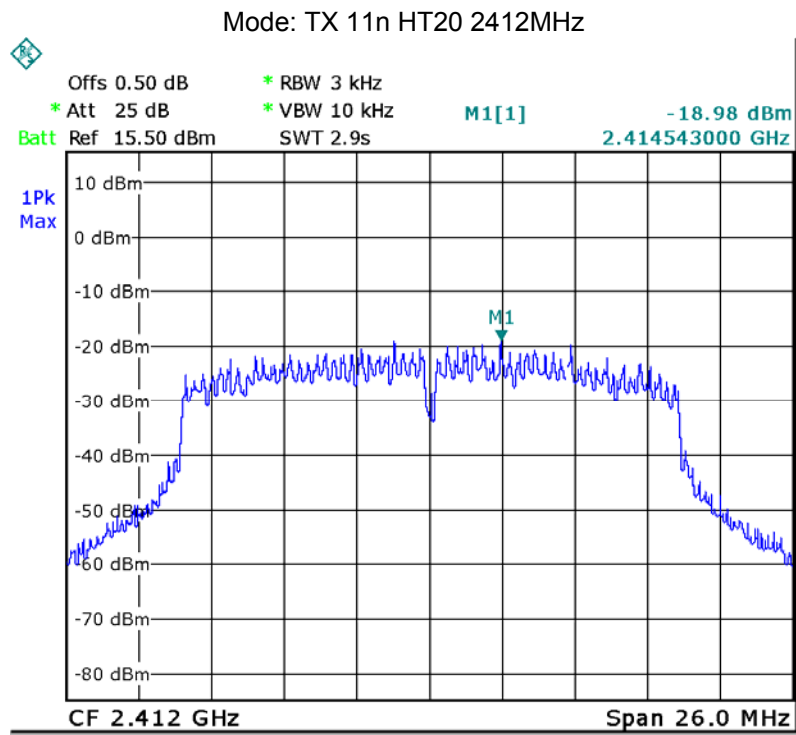


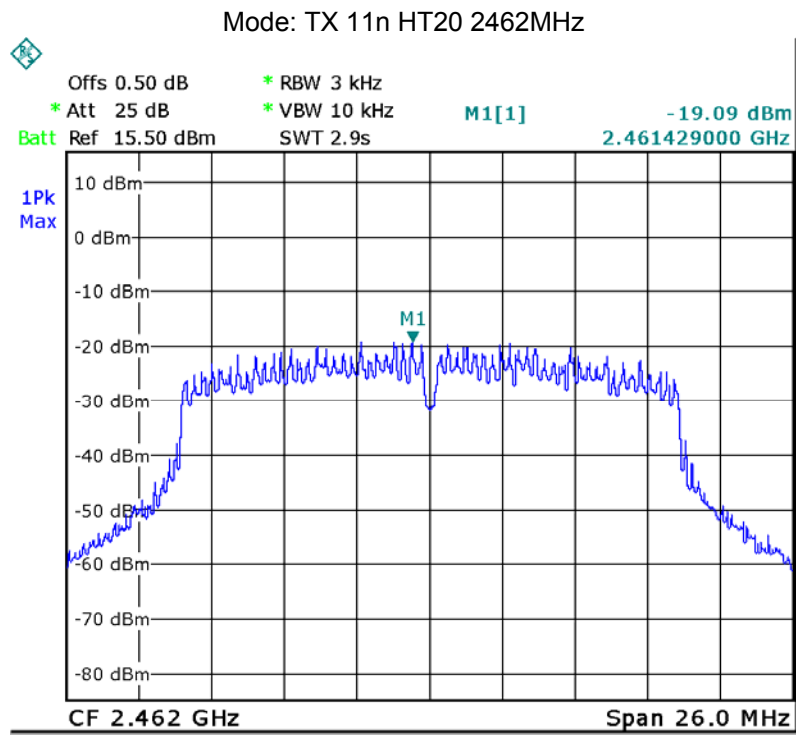
Mode: TX 11b 2437MHz











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 has a External antenna with RP-SMA connector, meets the requirements of FCC 15.203.



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14 RF Exposure

Test Requirement: FCC Part 1.1307

Evaluation Method: FCC Part 2.1091

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.

14.2 The procedures / limit

(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

14.3 MPE Calculation Method

P = Peak RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = P_{out} * G / (4 * \pi * R^2)$$

From the peak EUT RF output power, the minimum mobile separation distance, $d=0.2\text{m}$, 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)
5.00	3.162	10.62	11.53	0.0073	1

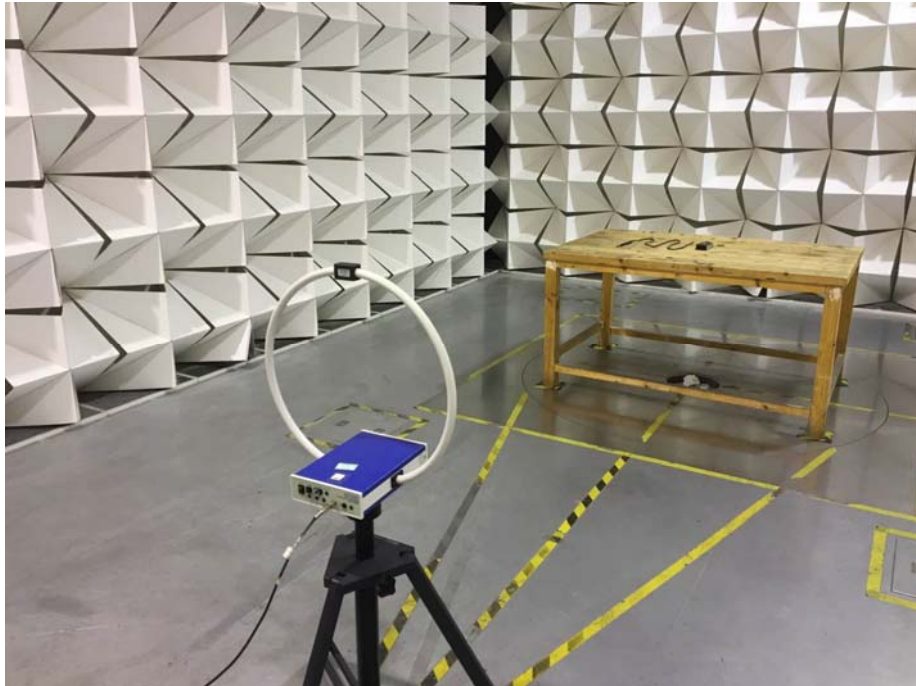
Result: Compliance

No SAR measurement is required.

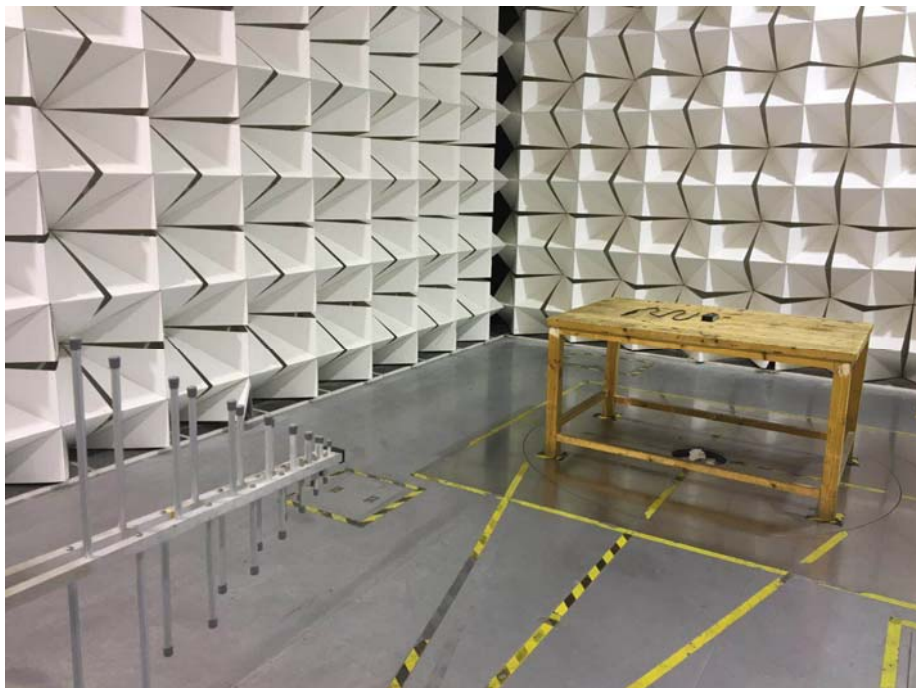
15 Photographs – Test Setup Photos

15.1 Radiated Emission

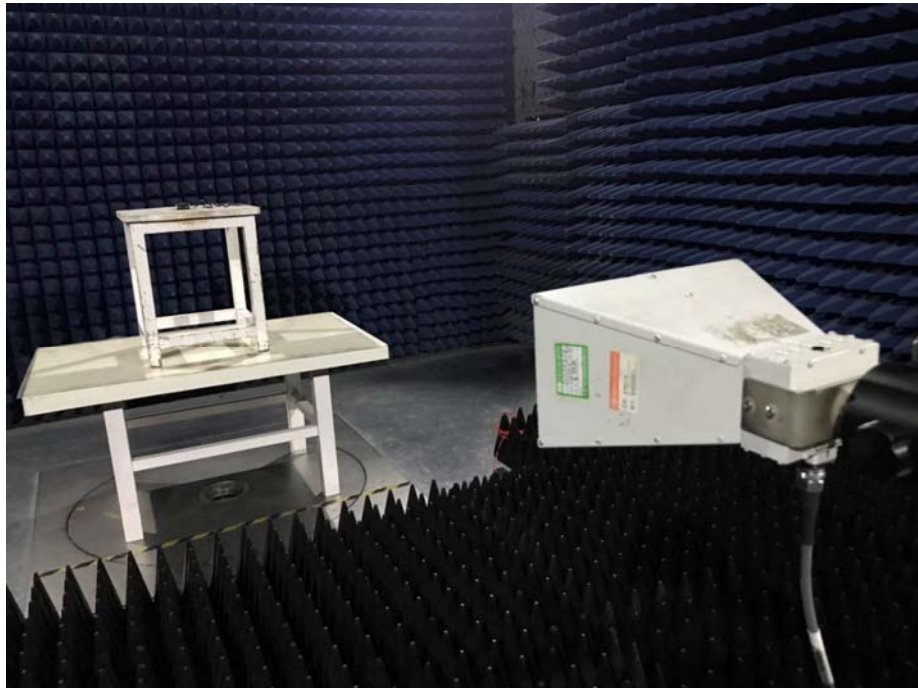
Test frequency Below 30MHz



Test frequency from 30MHz to 1GHz



Test frequency above 1GHz



15.2 Conducted Emission



16 Photographs - Constructional Details

16.1 EUT – External View



WIFI ANT

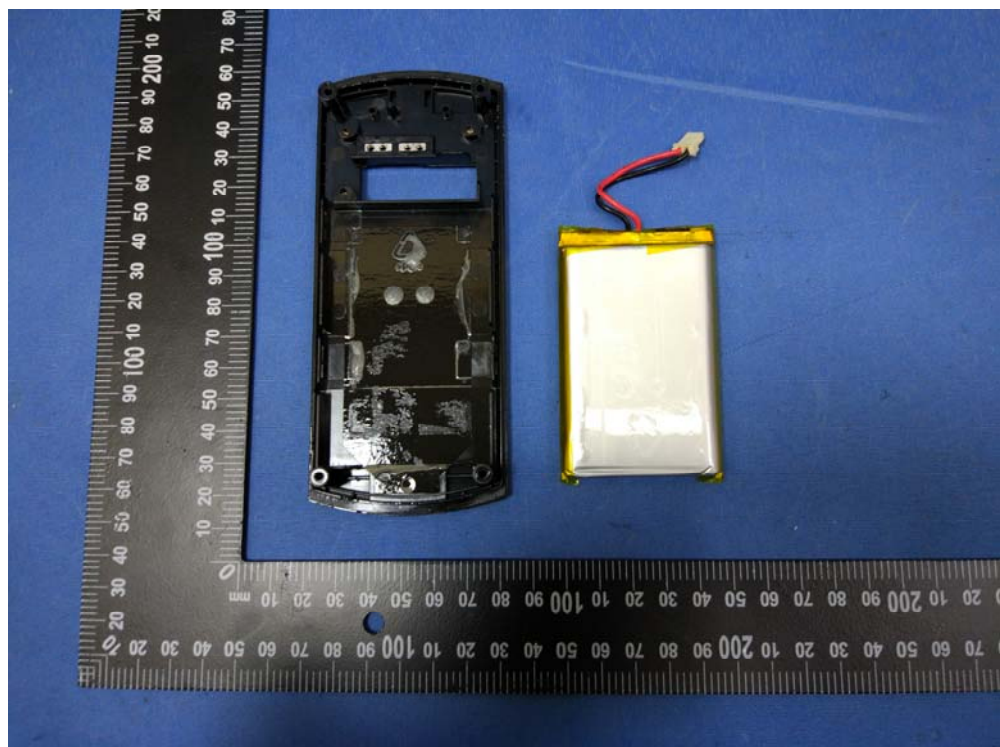


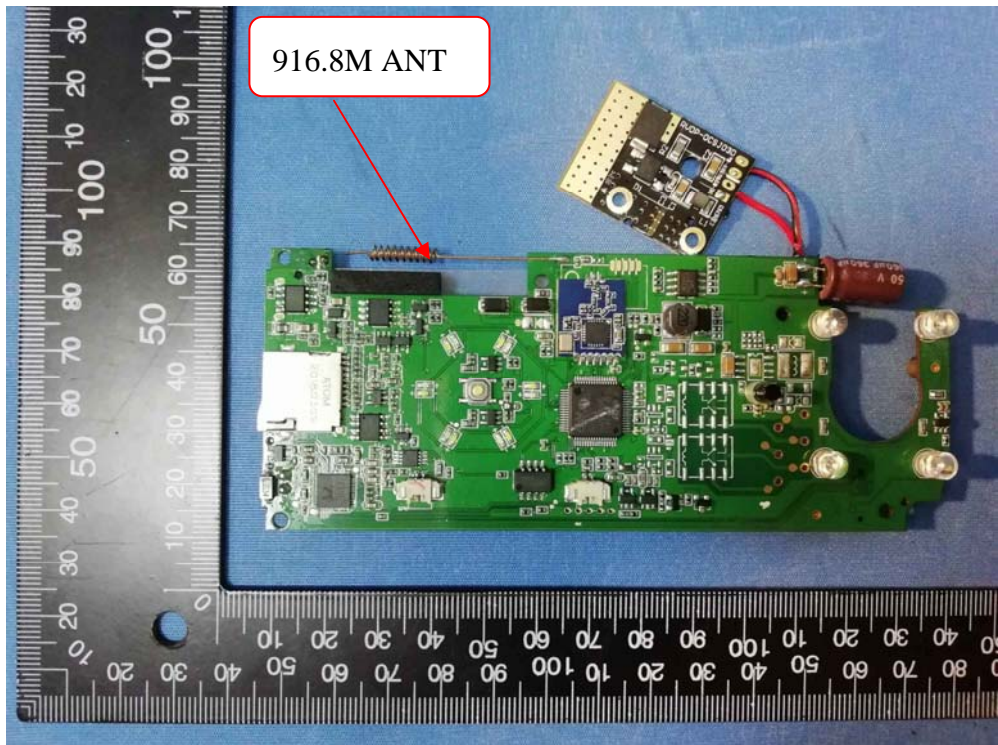
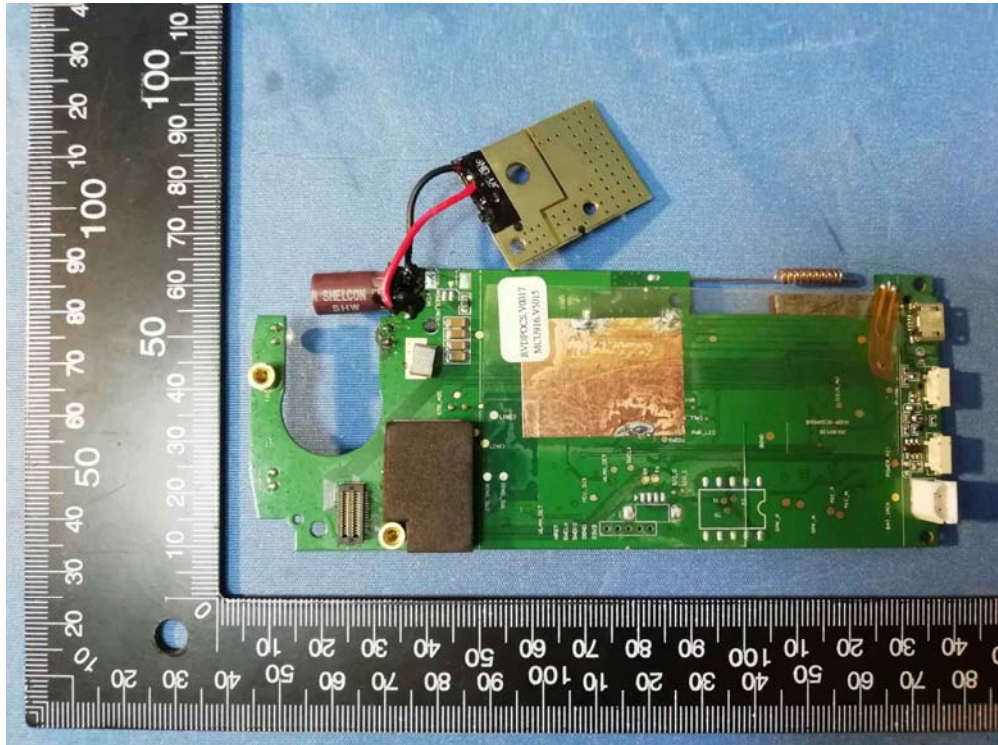


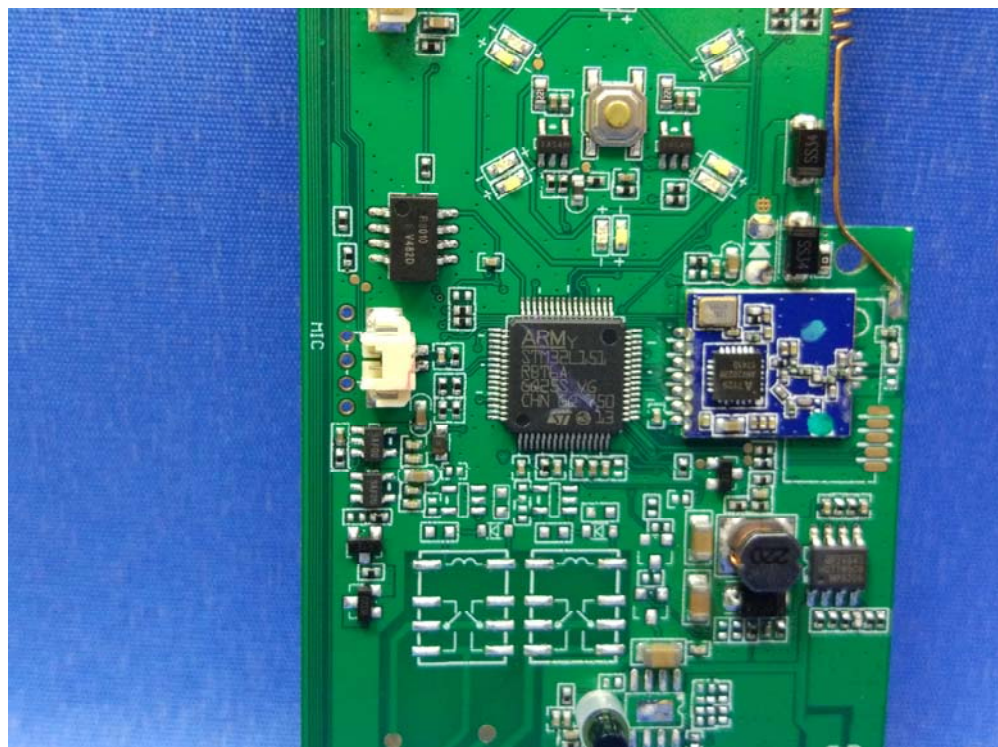
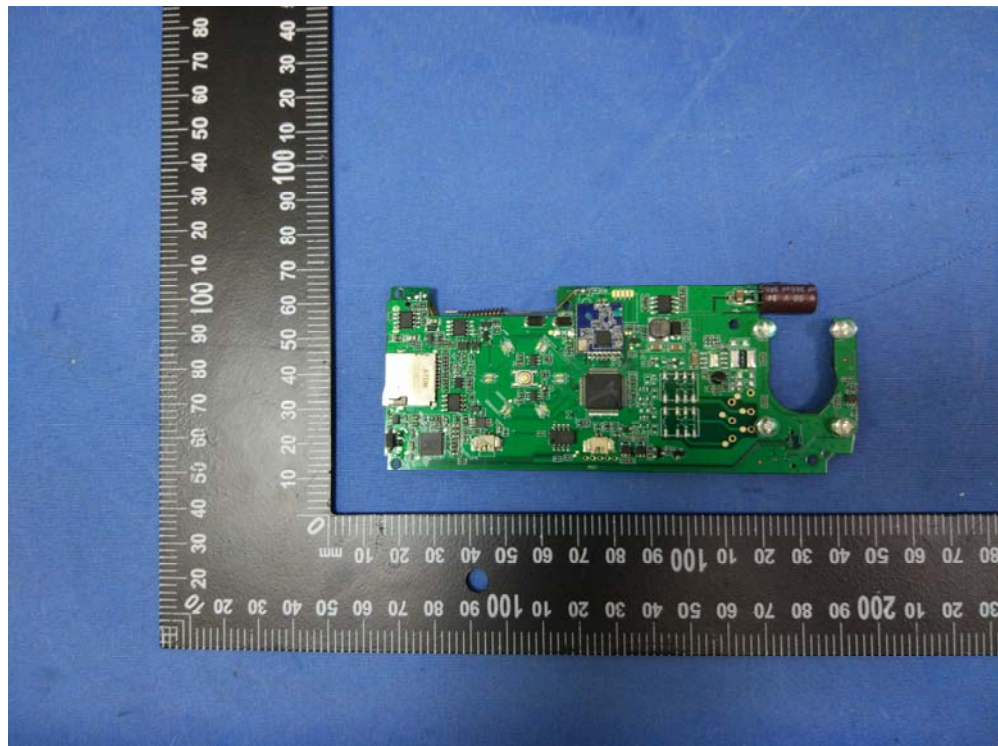




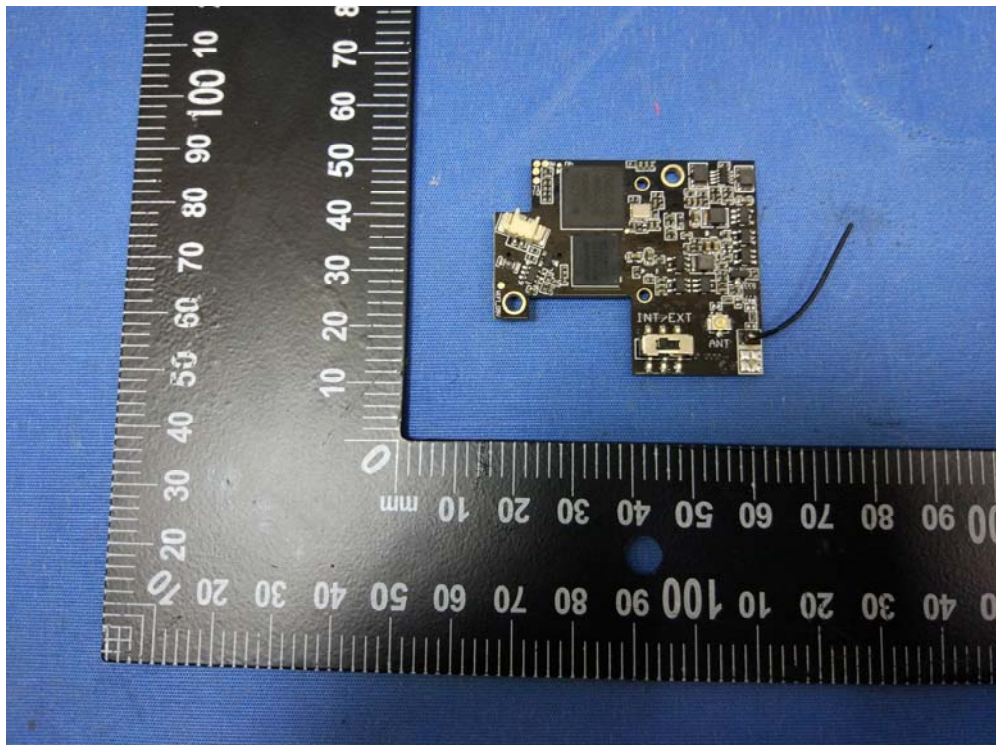
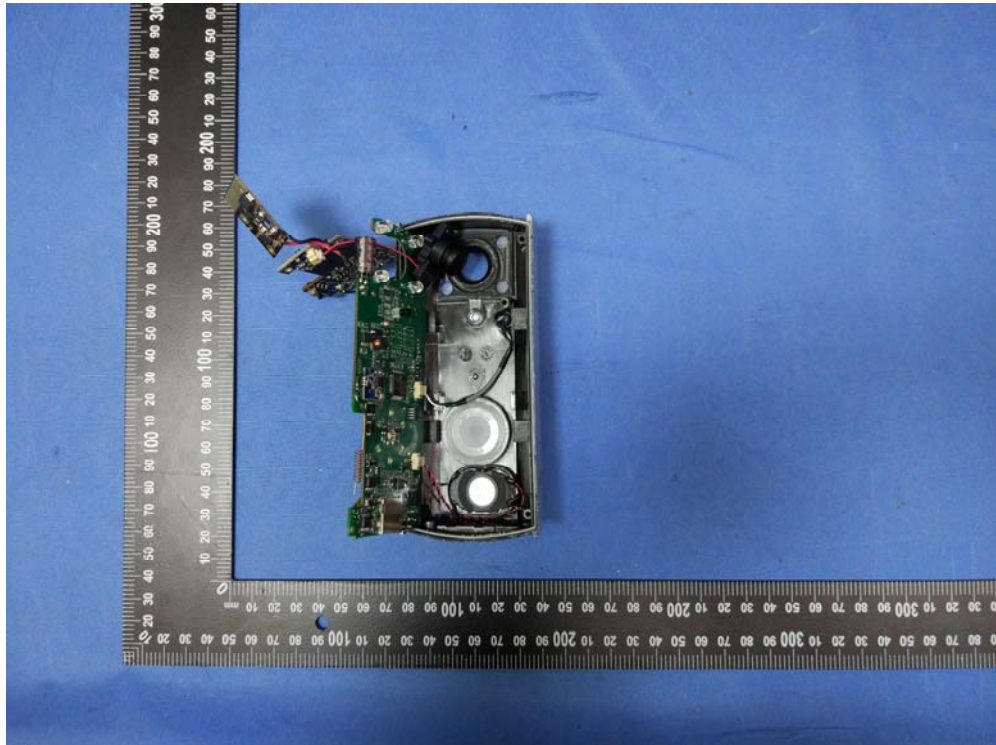
16.2 EUT – Internal View

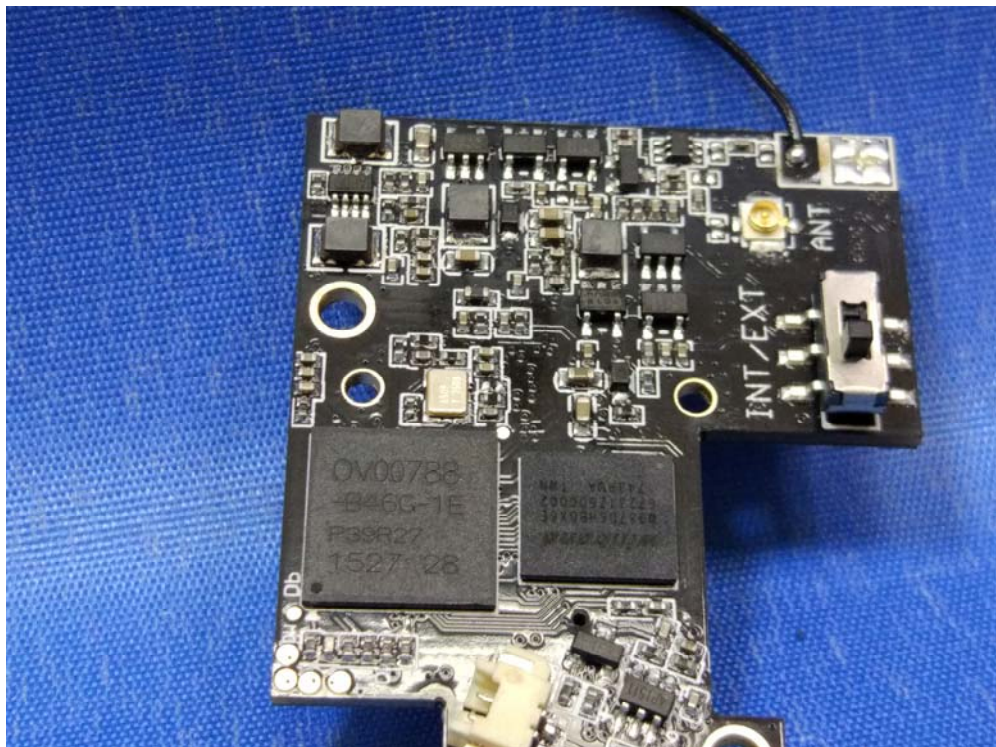
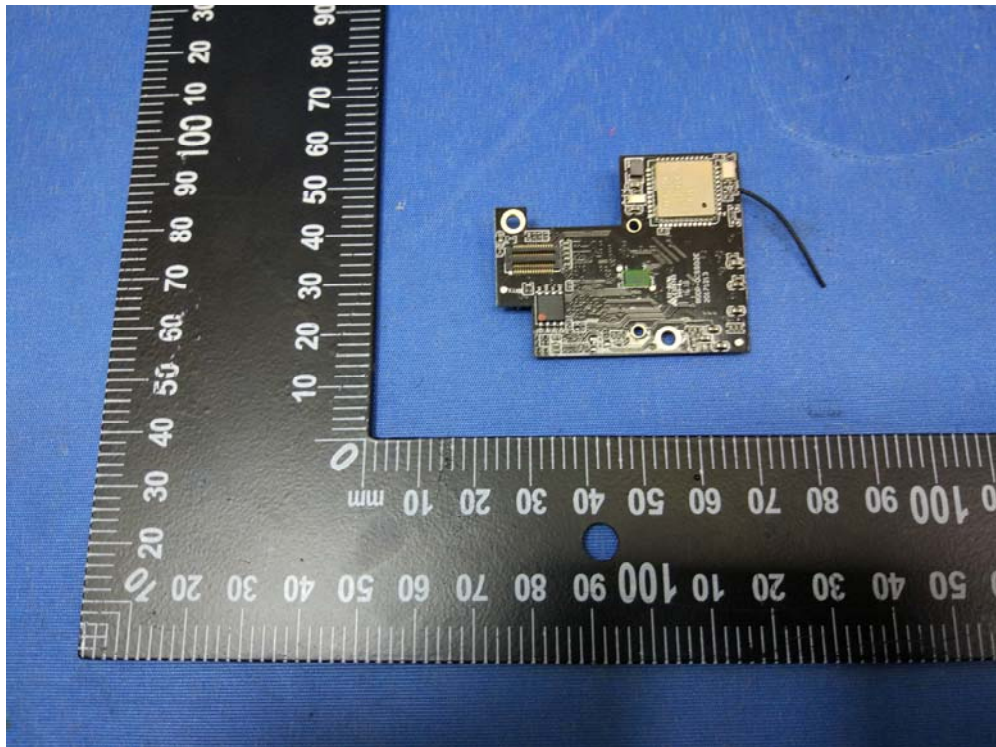


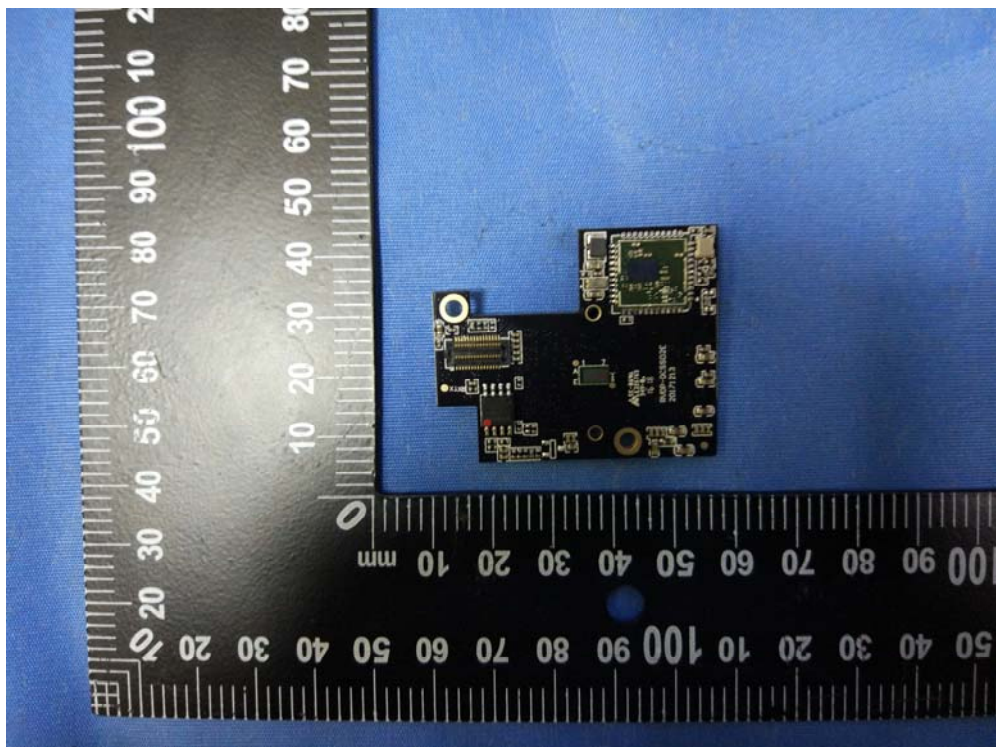


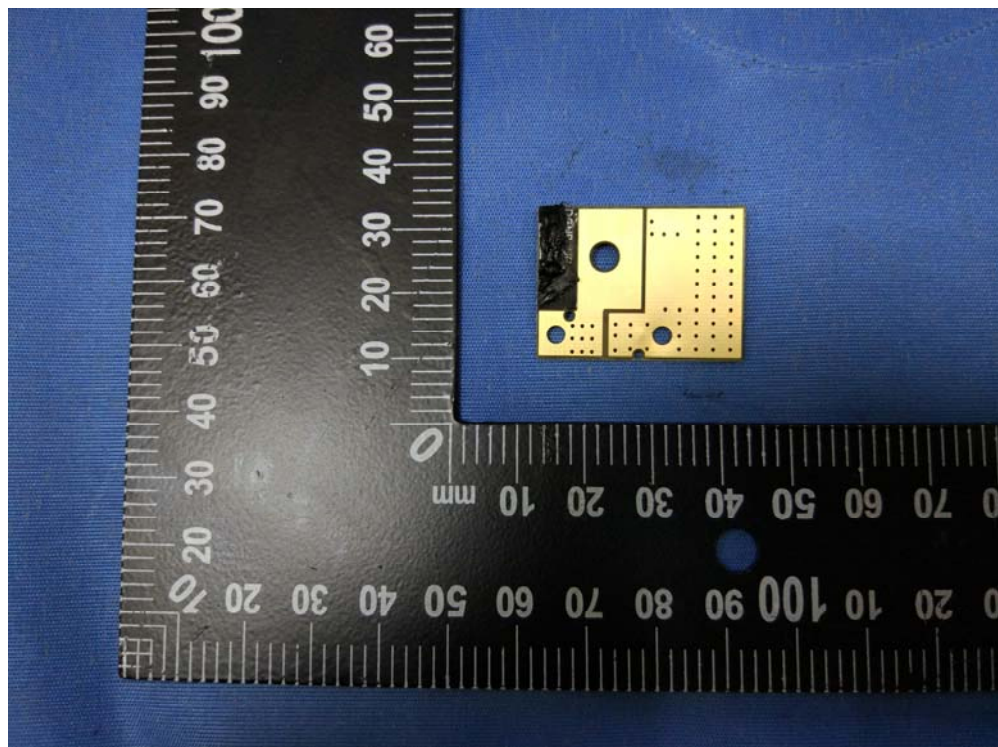


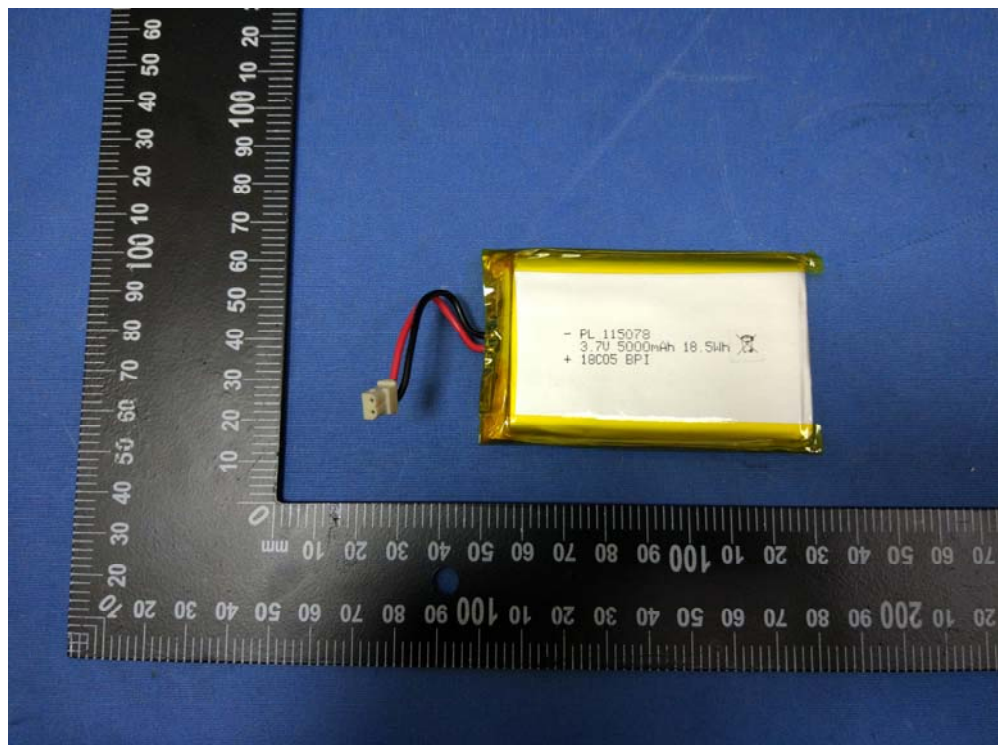
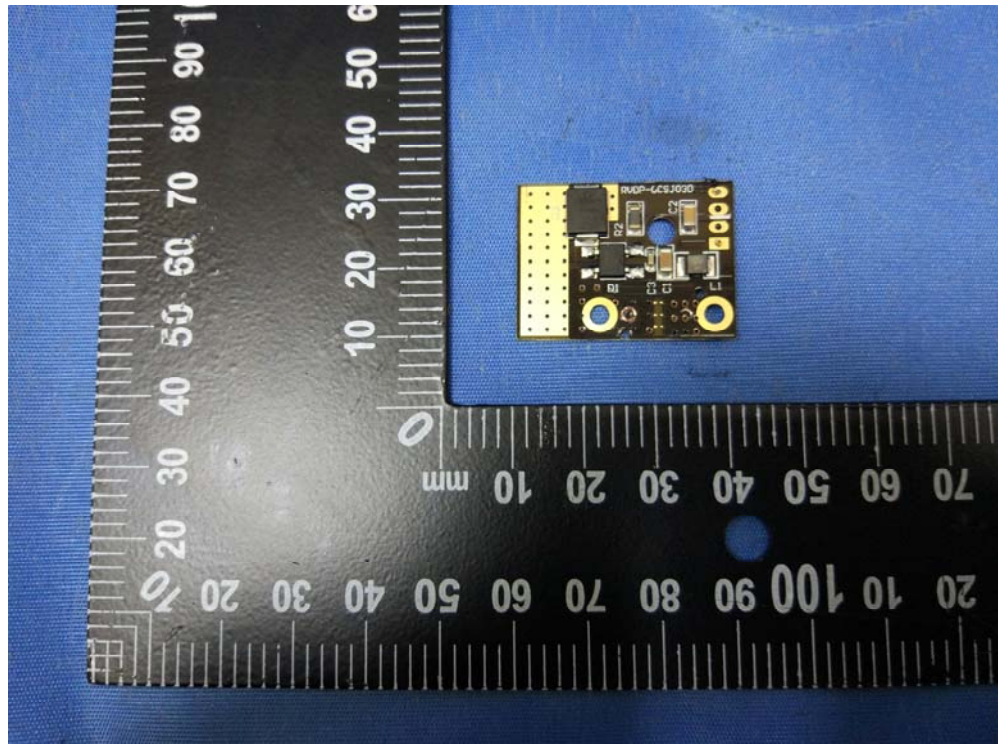


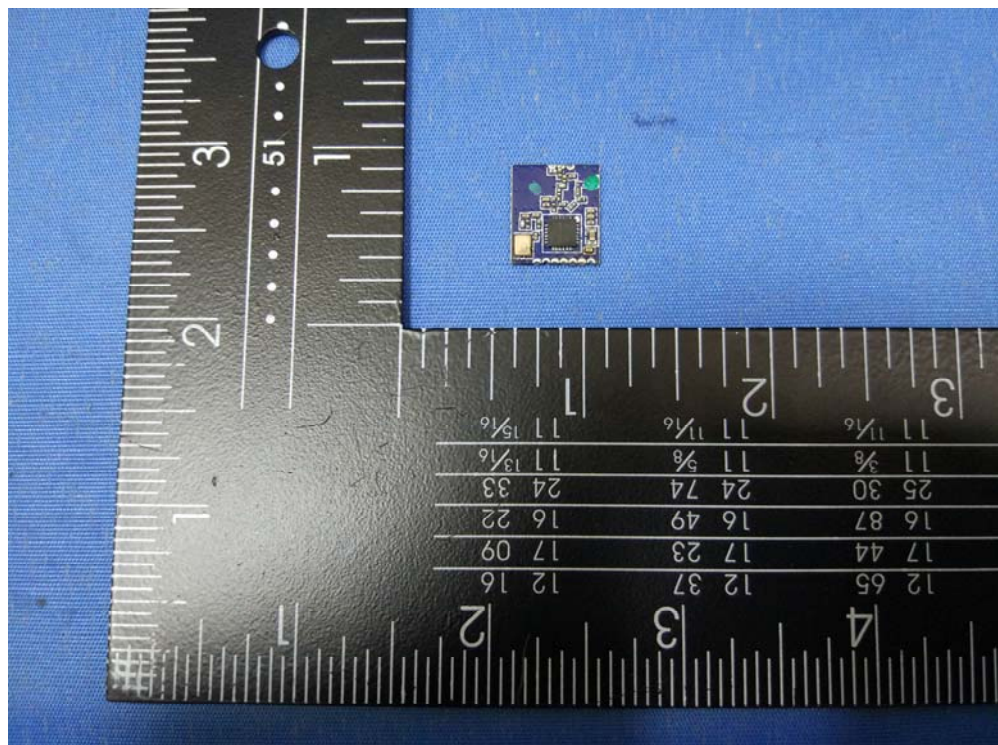
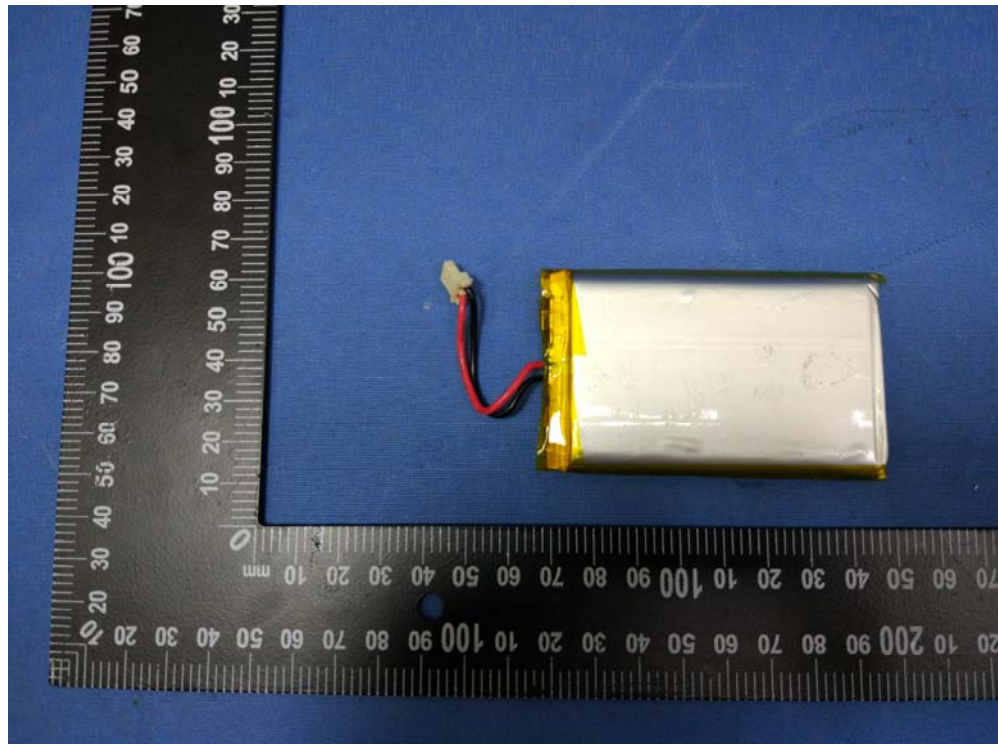


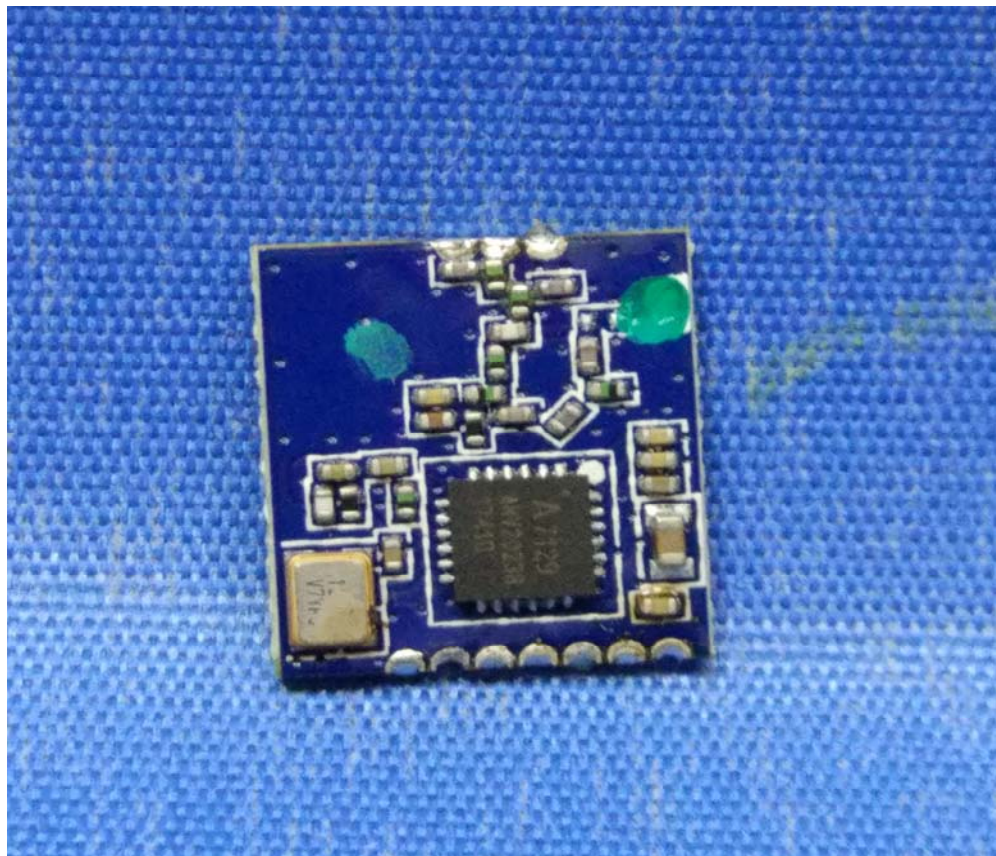
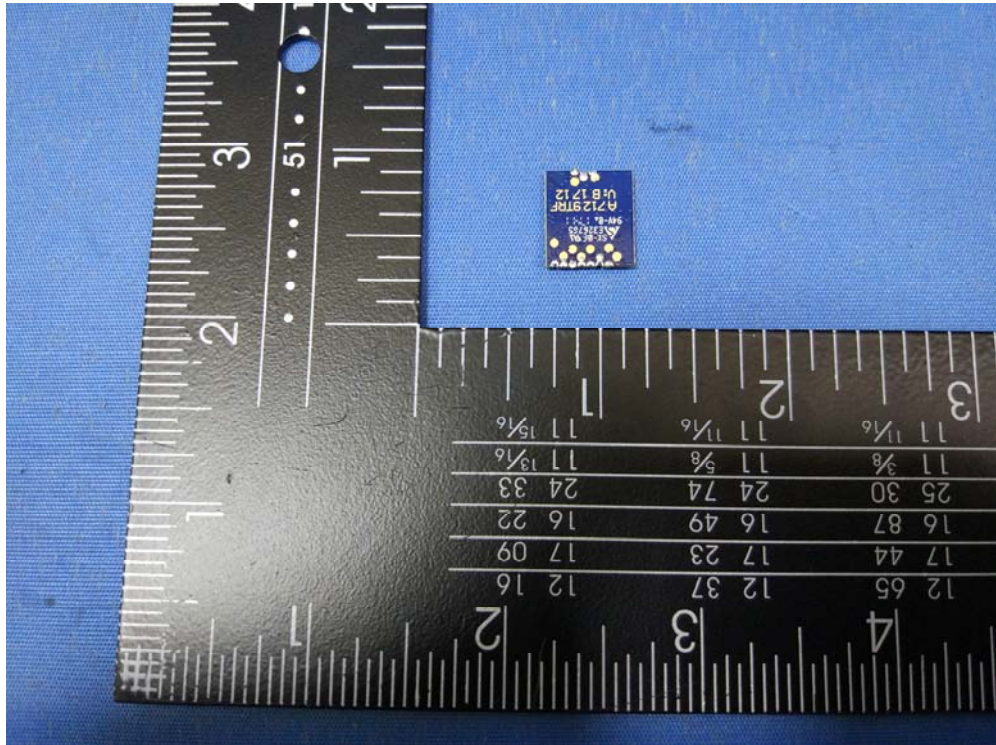












====End of Report====