

TEST REPORT

Reference No...... : WTD21D03021969W001 V1
FCC ID : 2AZDF-R4060
Applicant..... : Shenzhen Venz Technology Co., Ltd
Address..... : 1008, 10/F, Jinqizhigu building, 1 road Tangling, NanShan District, Shenzhen, China
Manufacturer : Shenzhen Venz Technology Co., Ltd
Address..... : 1008, 10/F, Jinqizhigu building, 1 road Tangling, NanShan District, Shenzhen, China
Product..... : Multi Functional Gateway
Model(s) : R4060
Standards..... : FCC CFR47 Part 15.247
Date of Receipt sample : 2021-03-22
Date of Test : 2021-03-22 to 2021-04-08
Date of Issue..... : 2021-04-14
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 Testing Group Co., Ltd.

Address: No. 77, Houjie Section, Guantai Road, Houjie Town, Dongguan City, Guangdong, China

Tel: +86-769-2267 6998

Fax: +86-769-2267 6828

Compiled by:

Levi Xiao

Levi Xiao / Project Engineer

Approved by:



Daniel Liu

Daniel Liu / Designated Reviewer

2 Contents

	Page
1 COVER PAGE	1
2 CONTENTS	2
3 REVISION HISTORY	3
4 GENERAL INFORMATION	4
4.1 GENERAL DESCRIPTION OF E.U.T.	4
4.2 DETAILS OF E.U.T.	4
4.3 CHANNEL LIST.....	5
4.4 TEST MODE.....	6
4.5 TEST FACILITY.....	6
5 TEST SUMMARY	7
6 EQUIPMENT USED DURING TEST	8
6.1 EQUIPMENTS LIST.....	8
6.2 DESCRIPTION OF SUPPORT UNITS.....	9
6.3 MEASUREMENT UNCERTAINTY.....	9
6.4 TEST EQUIPMENT CALIBRATION.....	9
7 CONDUCTED EMISSION	10
7.1 E.U.T. OPERATION.....	10
7.2 EUT SETUP.....	10
7.3 MEASUREMENT DESCRIPTION.....	11
7.4 CONDUCTED EMISSION TEST RESULT.....	11
8 RADIATED EMISSIONS	13
8.1 EUT OPERATION.....	13
8.2 TEST SETUP.....	14
8.3 SPECTRUM ANALYZER SETUP.....	15
8.4 TEST PROCEDURE.....	16
8.5 CORRECTED AMPLITUDE & MARGIN CALCULATION.....	16
8.6 SUMMARY OF TEST RESULTS.....	17
9 CONDUCTED SPURIOUS EMISSIONS	20
9.1 TEST PROCEDURE.....	20
9.2 TEST RESULT.....	21
10 BAND EDGE MEASUREMENT	25
10.1 TEST PROCEDURE.....	25
10.2 TEST RESULT.....	26
11 6 DB BANDWIDTH AND 99% BANDWIDTH MEASUREMENT	27
11.1 TEST PROCEDURE:.....	27
11.2 TEST RESULT:.....	27
12 MAXIMUM PEAK OUTPUT POWER	31
12.1 TEST PROCEDURE:.....	31
12.2 TEST RESULT:.....	32
13 POWER SPECTRAL DENSITY	35
13.1 TEST PROCEDURE:.....	35
13.2 TEST RESULT:.....	35
14 ANTENNA REQUIREMENT	38
15 RF EXPOSURE	39
16 PHOTOGRAPHS OF TEST SETUP AND EUT	40

3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTD21D03021969 W001	2021-03-22	2021-03-22 to 2021-04-08	2021-04-09	Original	-	replaced
WTD21D03021969 W001 V1	2021-03-22	2021-03-22 to 2021-04-08	2021-04-14	Version 1	Update	Valid

4 General Information

4.1 General Description of E.U.T.

Product:	Multi Functional Gateway
Model(s):	R4060
Wi-Fi Specification:	2.4G-802.11b/g/n HT20
Bluetooth Version:	Bluetooth v4.2 with BLE
Zigbee :	Support
SRD(433.92Mhz)	Support
Hardware Version:	VENZ_C03 JIEMABAN_V1.2
Software Version:	1.3.1

4.2 Details of E.U.T.

Operation Frequency:	2405MHz ~ 2480MHz
Max. RF output power:	5.84dBm
Type of Modulation:	OPQSK
Number of Channels:	16
Channel Spacing:	5MHz
Crystal Oscillator frequency	26MHz
Antenna installation:	internal permanent antenna
Antenna Gain:	2.2dBi
Powered from adapter:	DC 5V/2A(Micro USB)
Adapter information	Manufacturer: andsmips Model:AS013Z-0502000UU Input:100-240VAC, 50/60Hz 0.45A

4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
11	2405	12	2410	13	2415	14	2420
15	2425	16	2430	17	2435	18	2440
19	2445	20	2450	21	2455	22	2460
23	2465	24	2470	25	2475	26	2480

4.4 Test Mode

Table 2 Tests Carried Out Under FCC part 15.247

Test Items	Mode	Data Rate	Channel	TX/RX
Maximum Peak Output Power	ZIGBEE (OPQSK)	250Kbps	11/18/26	TX
Power Spectral Density	ZIGBEE(OPQSK)	250Kbps	11/18/26	TX
6dB Bandwidth	ZIGBEE(OPQSK)	250Kbps	11/18/26	TX
Band Edge	ZIGBEE(OPQSK)	250Kbps	11/18/26	TX
Transmitter Spurious Emissions	ZIGBEE(OPQSK)	250Kbps	11/18/26	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 .

4.5 Test Facility

The test facility has a test site registered with the following organizations:

ISED CAB identifier: CN0013. Test Firm Registration No.: 7760A.

Waltek Testing Group Co., Ltd. Has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files.

Registration number 7760A, October 15, 2016.

FCC Designation No.: CN1201. Test Firm Registration No.: 523476.

Waltek Testing Group Co., Ltd. EMC Laboratory `has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration number 523476, September 10, 2019.

5 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.247(d) 15.205(a) 15.209(a)	PASS
Conducted Spurious Emissions	15.247(d)	PASS
Conducted Emissions	15.207(a)	PASS
6dB Bandwidth	15.247(a)(2)	PASS
Maximum Peak Output Power	15.247(b)(3),(4)	PASS
Power Spectral Density	15.247(e)	PASS
Band Edge	15.247(d)	PASS
Antenna Requirement	15.203	PASS

6 Equipment Used during Test

6.1 Equipments List

Conducted Emissions Test Site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	100947	2020-07-30	2021-07-29
2.	LISN	R&S	ENV216	101215	2020-07-30	2021-07-29
3.	Cable	Top	TYPE16(3.5M)	-	2020-07-30	2021-07-29
Conducted Emissions Test Site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	101155	2020-07-30	2021-07-29
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	2020-07-30	2021-07-29
3.	Limiter	York	MTS-IMP-136	261115-001-0024	2020-07-30	2021-07-29
4.	Cable	LARGE	RF300	-	2020-07-30	2021-07-29
3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Spectrum Analyzer	R&S	FSP	100091	2020-04-20	2021-04-19
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	2020-04-20	2021-04-19
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2020-08-22	2021-08-21
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2020-04-20	2021-04-19
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2020-04-25	2021-04-24
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2020-04-20	2021-04-19
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	2020-04-20	2021-04-19
8	Coaxial Cable (above 1GHz)	ZT26-NJ-NJ-8M/FA	1GHz-18GHz	NA	2020-04-20	2021-04-19
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	2020-04-20	2021-04-19
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2020-04-25	2021-04-24
3	Amplifier	Compliance pirection	PAP-0203	22024	2020-04-20	2021-04-19

		systems inc				
4	Cable	HUBER+SUHNER	CBL2	525178	2020-04-20	2021-04-19
RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	2020-04-20	2021-04-19
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	2020-04-20	2021-04-19
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	2020-04-20	2021-04-19

6.2 Description of Support Units

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

6.3 Measurement Uncertainty

Parameter	Uncertainty
Conducted Emission	± 3.64 dB(AC mains 150KHz~30MHz)
Radiated Spurious Emissions	± 5.08 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)
Radio Frequency	± 1 x 10 ⁻⁷ Hz
RF Power	± 0.42 dB
RF Power Density	± 0.7dB
Conducted Spurious Emissions	± 2.76 dB (9kHz~26500MHz)
Confidence interval: 95%. Confidence factor:k=2	

6.4 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

7 Conducted Emission

Test Requirement: FCC CFR 47 Part 15 Section 15.207

Test Method: ANSI C63.10:2013

Test Result: PASS

Frequency Range: 150kHz to 30MHz

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: 22.4 °C

Humidity: 53.7 % RH

Atmospheric Pressure: 101.8kPa

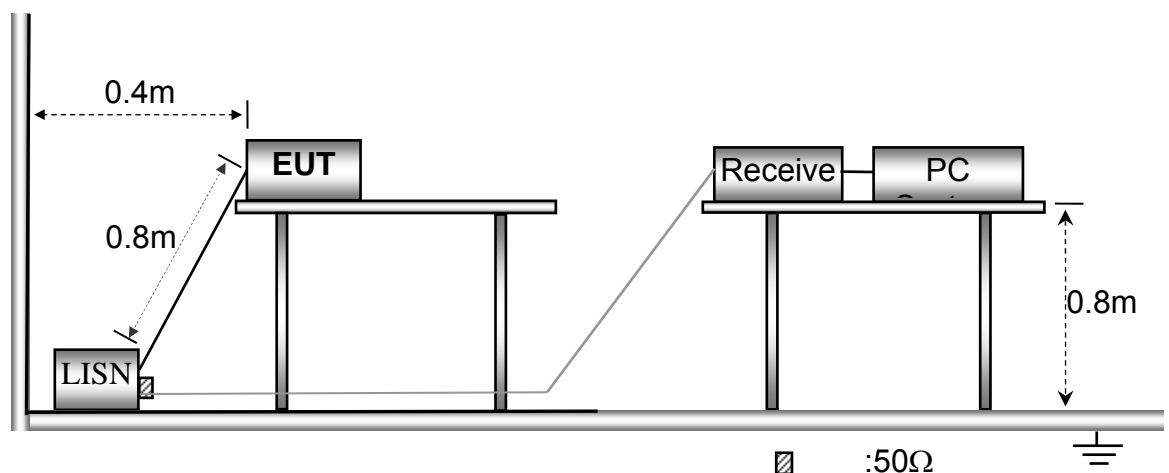
Test Voltage: AC 120V, 60Hz

EUT Operation:

The test was performed in Transmitting mode, the worst test data (High 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.



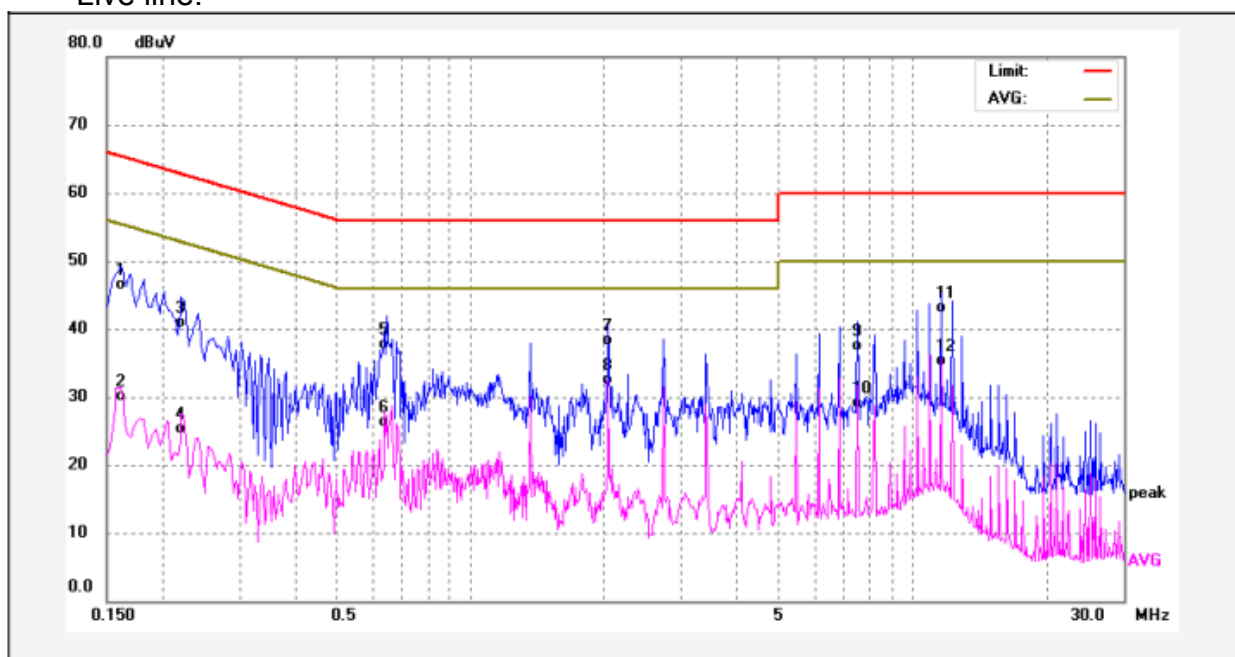
7.3 Measurement Description

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

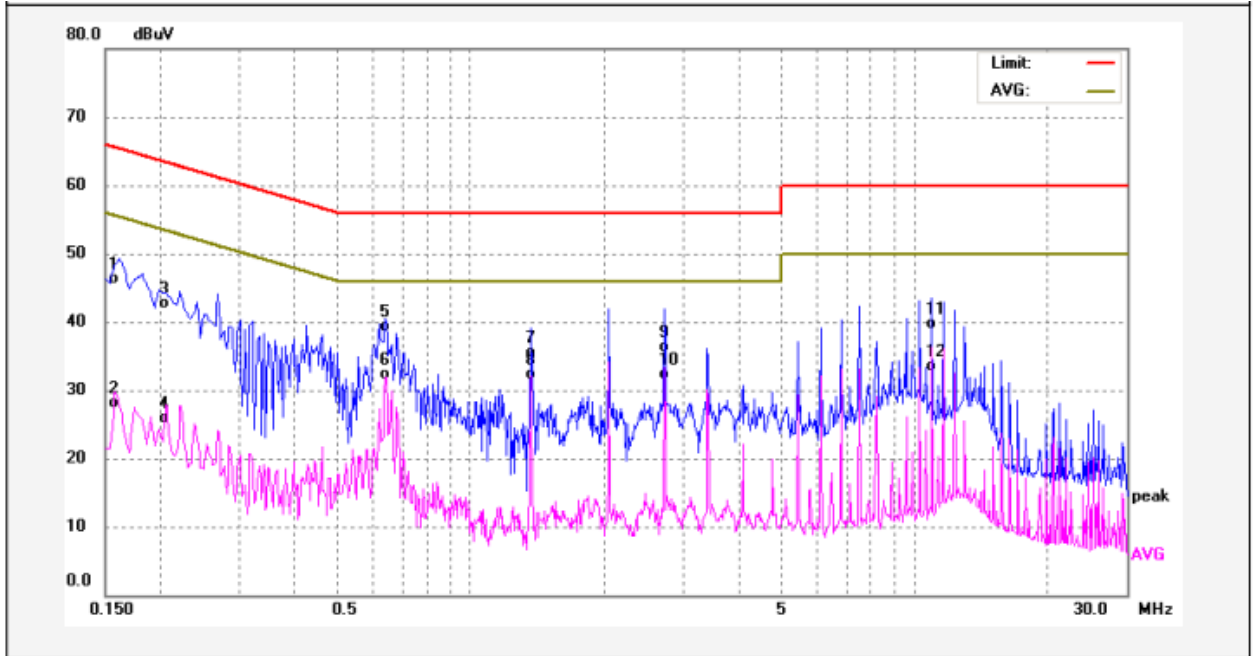
Remark: only the worst data (High channel mode) were reported

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1620	35.81	10.78	46.59	65.36	-18.77	QP	
2	0.1620	19.24	10.78	30.02	55.36	-25.34	AVG	
3	0.2220	30.27	10.66	40.93	62.74	-21.81	QP	
4	0.2220	14.60	10.66	25.26	52.74	-27.48	AVG	
5	0.6460	27.21	10.58	37.79	56.00	-18.21	QP	
6	0.6460	15.82	10.58	26.40	46.00	-19.60	AVG	
7	2.0500	27.72	10.60	38.32	56.00	-17.68	QP	
8	2.0500	21.86	10.60	32.46	46.00	-13.54	AVG	
9	7.5100	26.74	10.67	37.41	60.00	-22.59	QP	
10	7.5100	18.52	10.67	29.19	50.00	-20.81	AVG	
11	11.6100	32.40	10.80	43.20	60.00	-16.80	QP	
12	11.6100	24.47	10.80	35.27	50.00	-14.73	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector	Remark
1	0.1580	35.43	10.80	46.23	65.56	-19.33	QP	
2	0.1580	17.32	10.80	28.12	55.56	-27.44	AVG	
3	0.2060	32.08	10.67	42.75	63.36	-20.61	QP	
4	0.2060	15.18	10.67	25.85	53.36	-27.51	AVG	
5	0.6419	28.65	10.58	39.23	56.00	-16.77	QP	
6	0.6419	21.82	10.58	32.40	46.00	-13.60	AVG	
7	1.3660	25.00	10.60	35.60	56.00	-20.40	QP	
8	1.3660	21.79	10.60	32.39	46.00	-13.61	AVG	
9	2.7340	25.60	10.67	36.27	56.00	-19.73	QP	
10	2.7340	21.68	10.67	32.35	46.00	-13.65	AVG	
11	10.9300	28.88	10.80	39.68	60.00	-20.32	QP	
12	10.9300	22.65	10.80	33.45	50.00	-16.55	AVG	

8 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: ANSI C63.10:2013

Test Result: PASS

Measurement Distance: 3m

Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	$2400/F(\text{kHz})$	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: 23.5 °C

Humidity: 52.1 % RH

Atmospheric Pressure: 101.2kPa

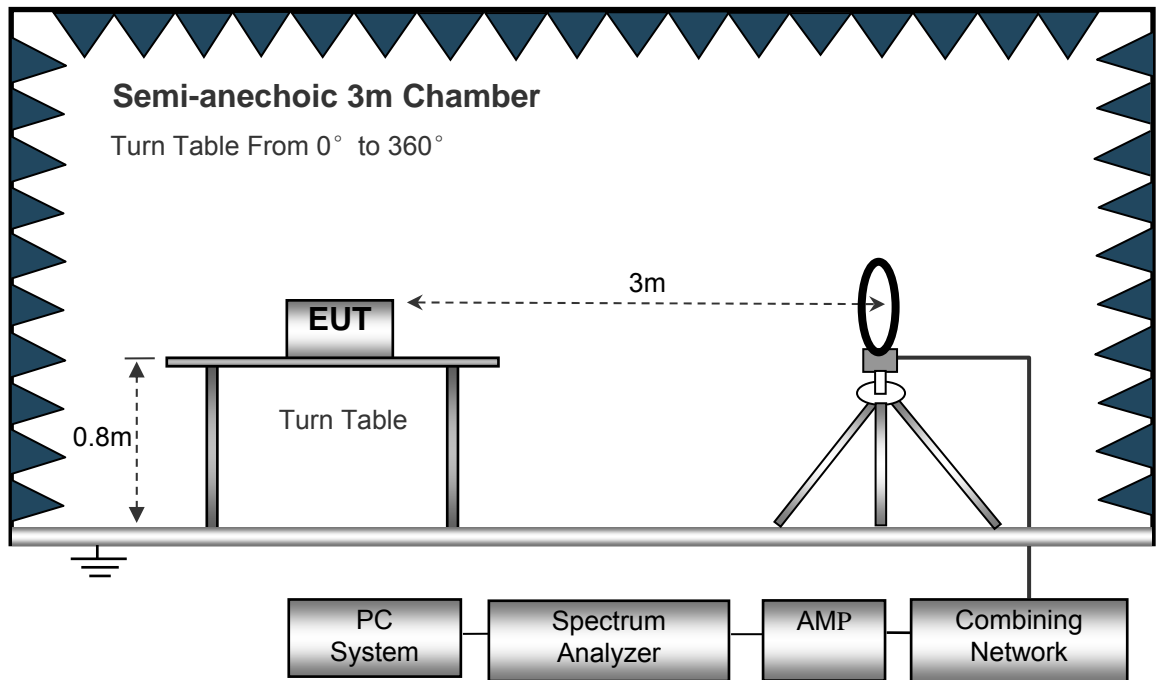
EUT Operation :

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

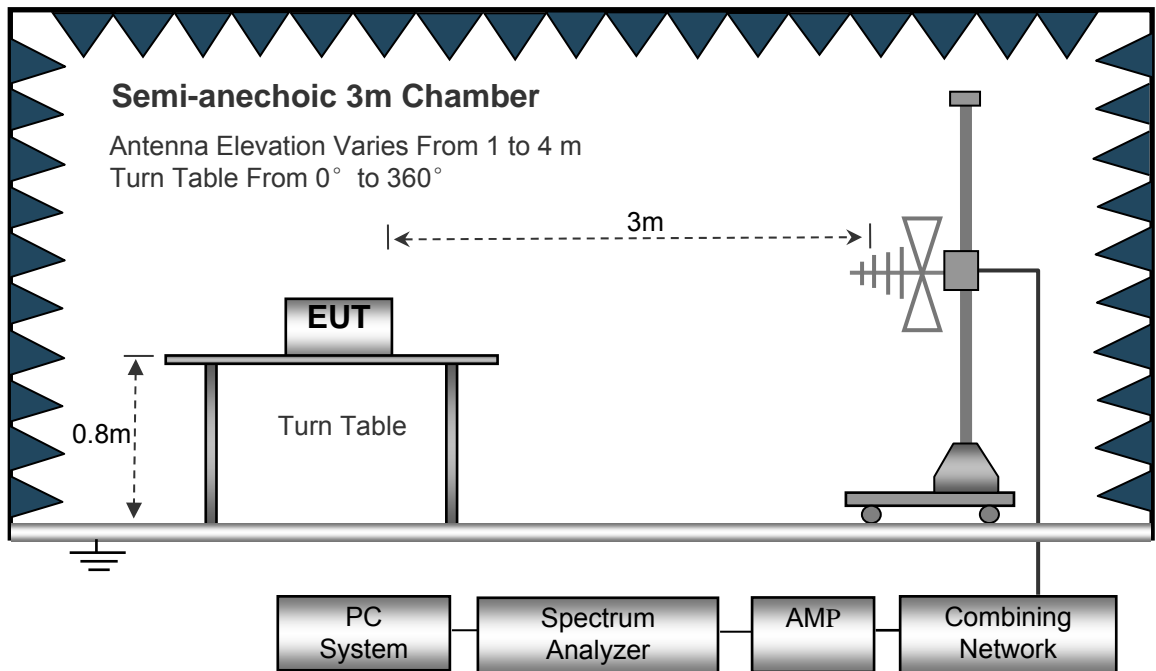
8.2 Test Setup

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

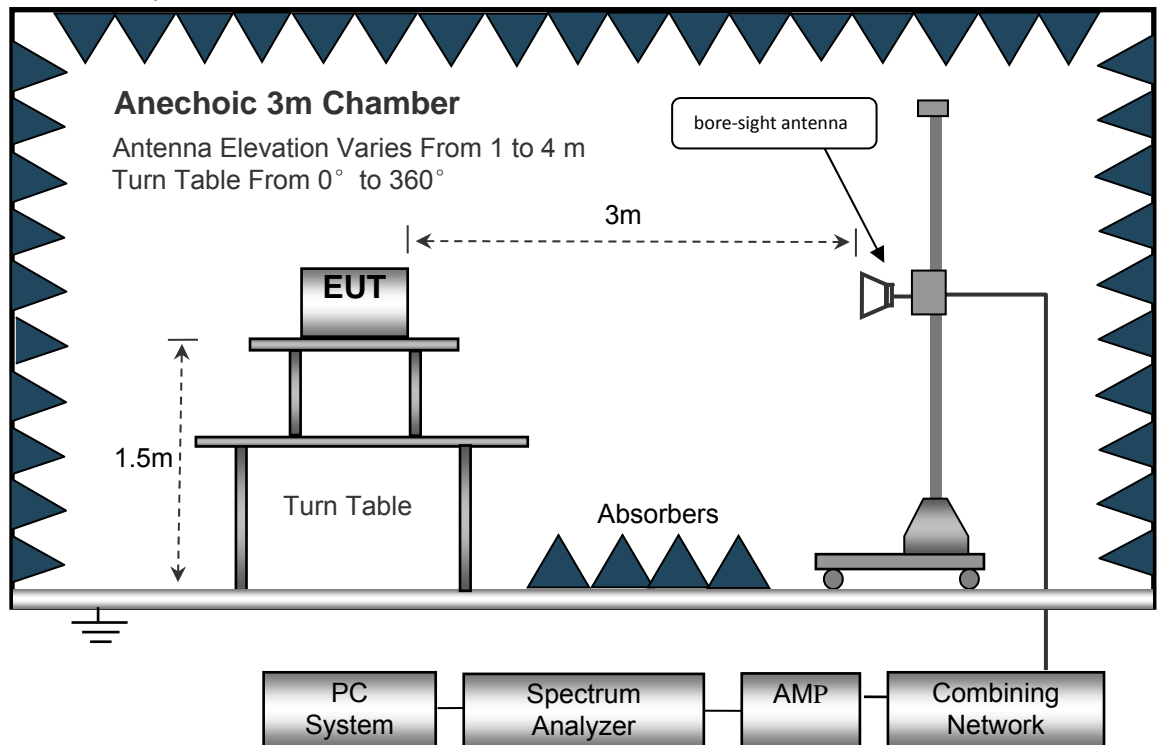
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



8.3 Spectrum Analyzer Setup

Below 30MHz

Sweep Speed Auto
 IF Bandwidth..... 10kHz
 Video Bandwidth..... 10kHz
 Resolution Bandwidth..... 10kHz

30MHz ~ 1GHz

Sweep Speed Auto
 Detector PK
 Resolution Bandwidth..... 100kHz
 Video Bandwidth..... 300kHz

Above 1GHz

Sweep Speed Auto
 Detector PK
 Resolution Bandwidth..... 1MHz
 Video Bandwidth..... 3MHz
 Detector Ave.
 Resolution Bandwidth..... 1MHz
 Video Bandwidth..... 10Hz

8.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane for below 1GHz and 1.5m for above 1GHz.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are performed in X,Y and Z axis positioning(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand),the worst condition was tested putting the eut in Z 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

ZIGBEE(OPQSK):

Test Frequency: 9KHz~26MHz

Remark: only the worst data (OPQSK modulation Low channel mode) were recorded.

Frequency	Measurement results dB μ V @3m	Detector PK/QP	Correct factor dB/m	Extrapolation factor dB	Measurement results (calculated) dB μ V/m @30m	Limits dB μ V/m @30m	Margin dB
(MHz)	Measurement results	Detector	Correct factor	Extrapolation factor	Measurement results (calculated)	Limits	Margin
6.020	25.46	QP	21.84	40.00	7.30	29.54	-22.24
15.730	24.28	QP	21.35	40.00	5.63	29.54	-23.91
25.680	25.78	QP	20.67	40.00	6.45	29.54	-23.09

Test Frequency : 26MHz ~ 30MHz

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

Test Frequency : 30MHz ~ 8GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
OPQSK Low Channel 2405MHz									
269.33	35.14	QP	310	1.5	H	-13.35	21.79	46.00	-24.21
269.33	38.46	QP	107	1.6	V	-13.35	25.11	46.00	-20.89
4804.00	43.73	PK	292	1.7	V	-1.06	42.67	74.00	-31.33
4804.00	44.53	Ave	292	1.7	V	-1.06	43.47	54.00	-10.53
7206.00	44.01	PK	103	1.4	H	1.33	45.34	74.00	-28.66
7206.00	36.29	Ave	103	1.4	H	1.33	37.62	54.00	-16.38
2337.00	46.50	PK	61	1.8	V	-13.19	33.31	74.00	-40.69
2337.00	37.15	Ave	61	1.8	V	-13.19	23.96	54.00	-30.04
2364.94	44.46	PK	206	1.3	H	-13.14	31.32	74.00	-42.68
2364.94	36.37	Ave	206	1.3	H	-13.14	23.23	54.00	-30.77
2487.76	44.28	PK	309	1.6	V	-13.08	31.20	74.00	-42.80
2487.76	38.18	Ave	309	1.6	V	-13.08	25.10	54.00	-28.90

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
OPQSK Middle Channel 2440MHz									
269.33	35.33	QP	345	1.3	H	-13.35	21.98	46.00	-24.02
269.33	38.03	QP	217	1.5	V	-13.35	24.68	46.00	-21.32
4880.00	43.46	PK	255	1.7	V	-0.62	42.84	74.00	-31.16
4880.00	45.76	Ave	255	1.7	V	-0.62	45.14	54.00	-8.86
7320.00	42.94	PK	152	1.6	H	2.21	45.15	74.00	-28.85
7320.00	37.42	Ave	152	1.6	H	2.21	39.63	54.00	-14.37
2340.78	46.68	PK	73	1.1	V	-13.19	33.49	74.00	-40.51
2340.78	39.21	Ave	73	1.1	V	-13.19	26.02	54.00	-27.98
2384.84	44.54	PK	199	1.4	H	-13.14	31.40	74.00	-42.60
2384.84	37.77	Ave	199	1.4	H	-13.14	24.63	54.00	-29.37
2490.36	43.13	PK	112	1.9	V	-13.08	30.05	74.00	-43.95
2490.36	38.15	Ave	112	1.9	V	-13.08	25.07	54.00	-28.93

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	Limit	Margin
				Height	Polar				
(MHz)	(dB μ V)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
OPQSK High Channel 2480MHz									
269.33	34.60	QP	176	1.3	H	-13.35	21.25	46.00	-24.75
269.33	38.46	QP	110	1.1	V	-13.35	25.11	46.00	-20.89
4960.00	42.43	PK	242	1.5	V	-0.24	42.19	74.00	-31.81
4960.00	45.43	Ave	242	1.5	V	-0.24	45.19	54.00	-8.81
7440.00	43.79	PK	34	1.4	H	2.84	46.63	74.00	-27.37
7440.00	36.29	Ave	34	1.4	H	2.84	39.13	54.00	-14.87
2347.86	46.43	PK	144	1.2	V	-13.19	33.24	74.00	-40.76
2347.86	38.92	Ave	144	1.2	V	-13.19	25.73	54.00	-28.27
2357.65	44.75	PK	286	2.0	H	-13.14	31.61	74.00	-42.39
2357.65	37.10	Ave	286	2.0	H	-13.14	23.96	54.00	-30.04
2486.08	42.80	PK	235	1.2	V	-13.08	29.72	74.00	-44.28
2486.08	38.62	Ave	235	1.2	V	-13.08	25.54	54.00	-28.46

Test Frequency: 8GHz~25GHz

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

9 Conducted Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.247
Test Method: KDB 558074 D01 DTS Meas Guidance v03r05 April 8, 2016
Test Result: PASS

Limit:

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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

9.1 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:

Below 30MHz:

RBW = 100kHz, VBW = 300kHz, Sweep = auto

Detector function = peak, Trace = max hold

Above 30MHz:

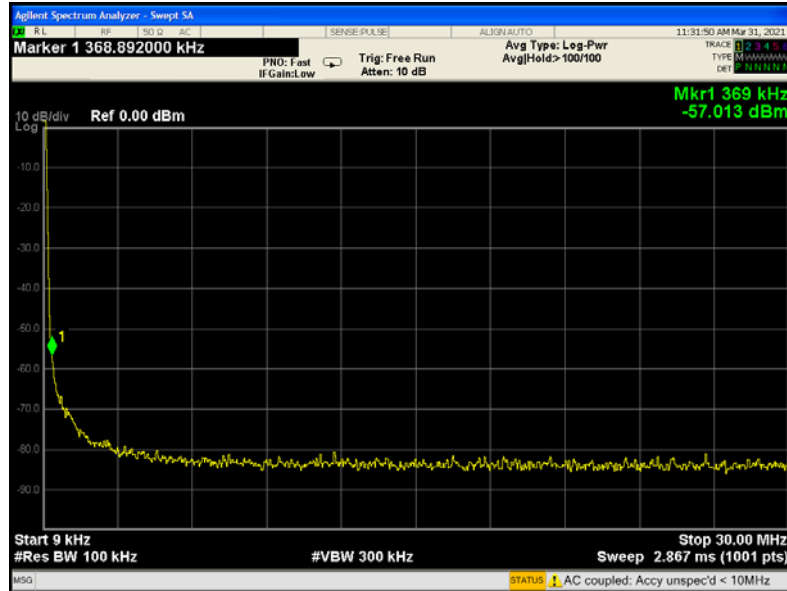
RBW = 100kHz, VBW = 300kHz, Sweep = auto

Detector function = peak, Trace = max hold

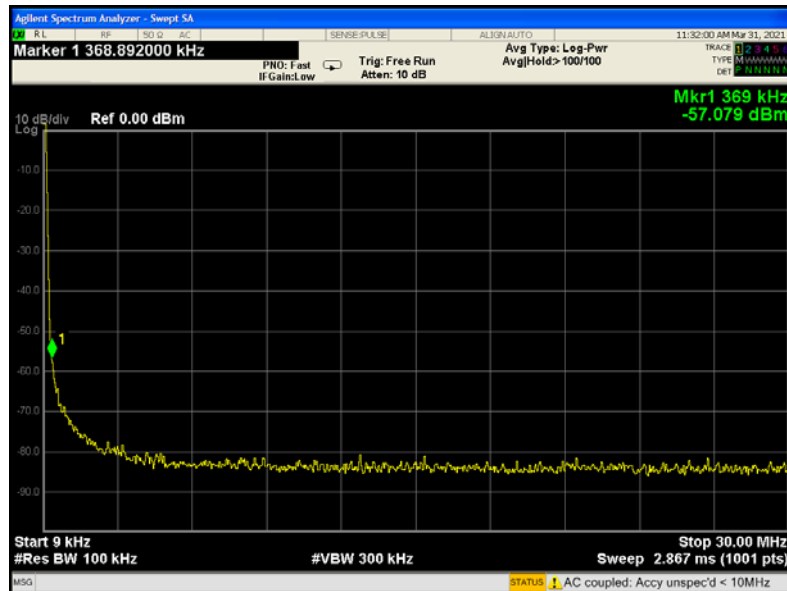
9.2 Test Result

9KHz – 30MHz

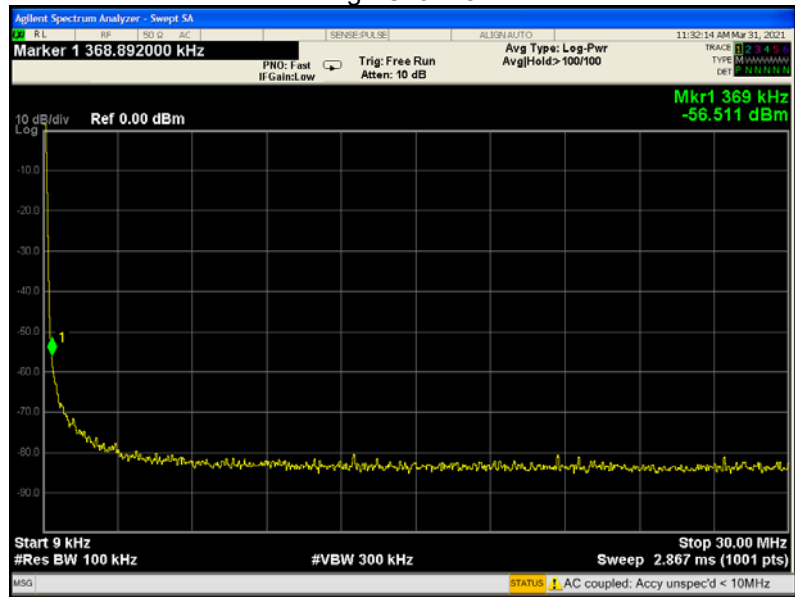
Low Channel



Middle Channel



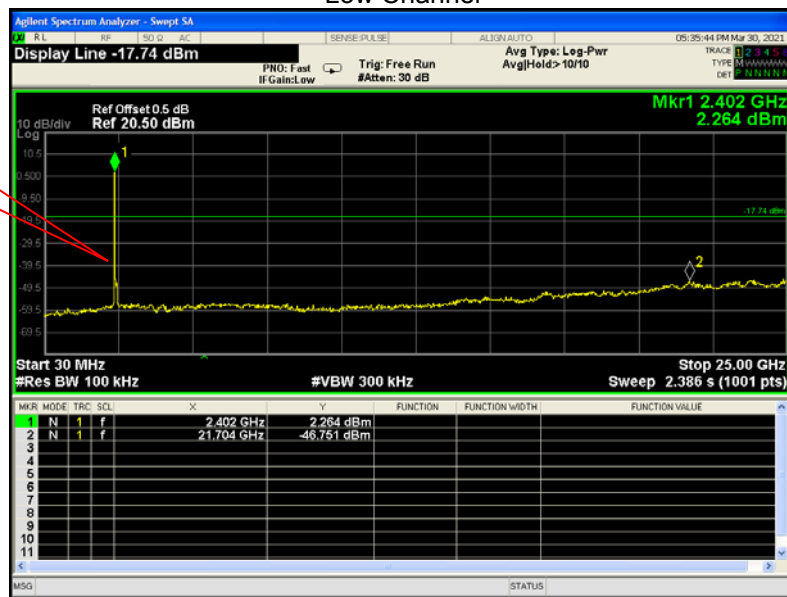
High Channel



Above 30MHz

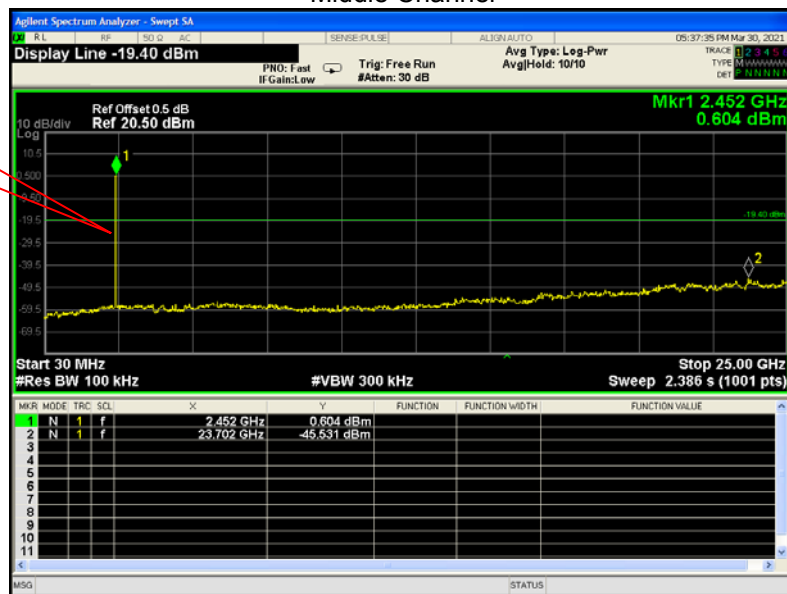
Low Channel

Fundamental



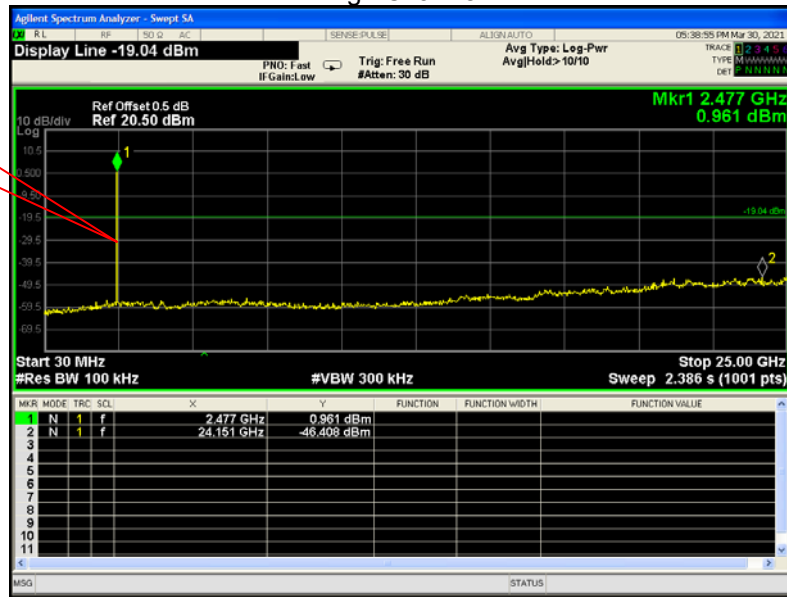
Middle Channel

Fundamental



High Channel

Fundamental



10 Band Edge Measurement

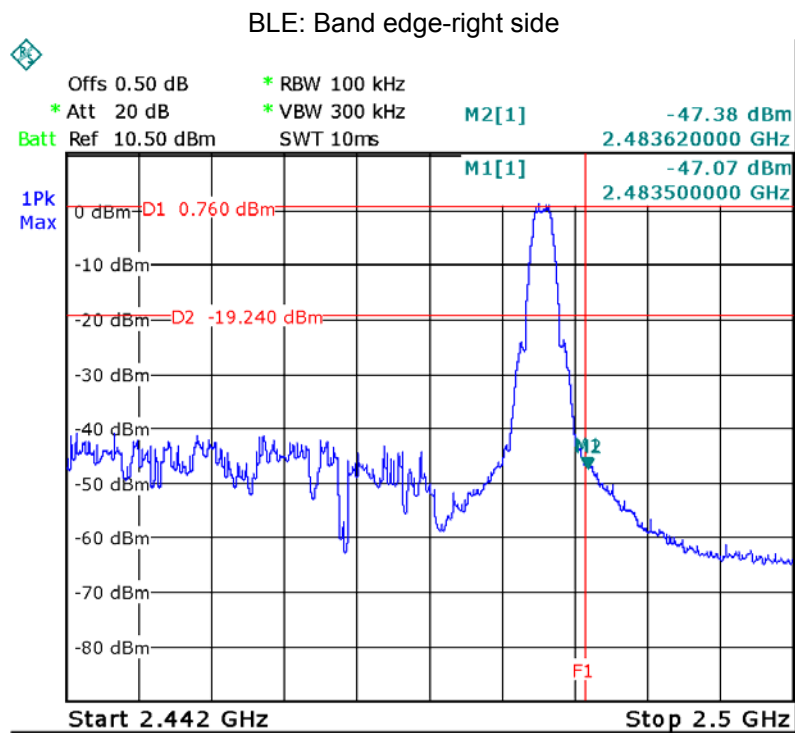
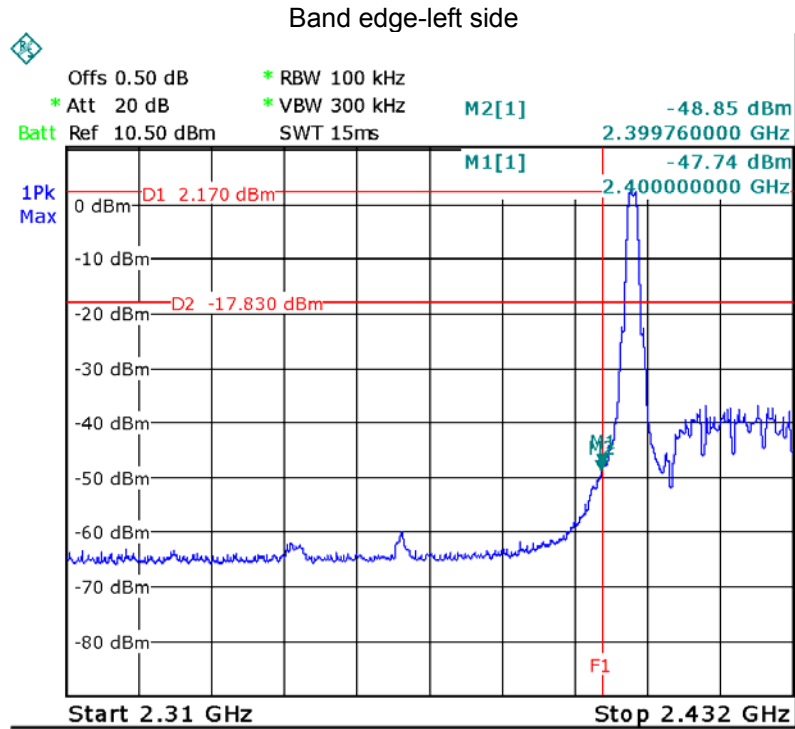
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	KDB 558074 D01 DTS Meas Guidance v03r05 April 8, 2016
Test Limit:	Regulation 15.247 (d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio 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:



11 6 dB Bandwidth and 99% Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 DTS Meas Guidance v03r05 April 8, 2016

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

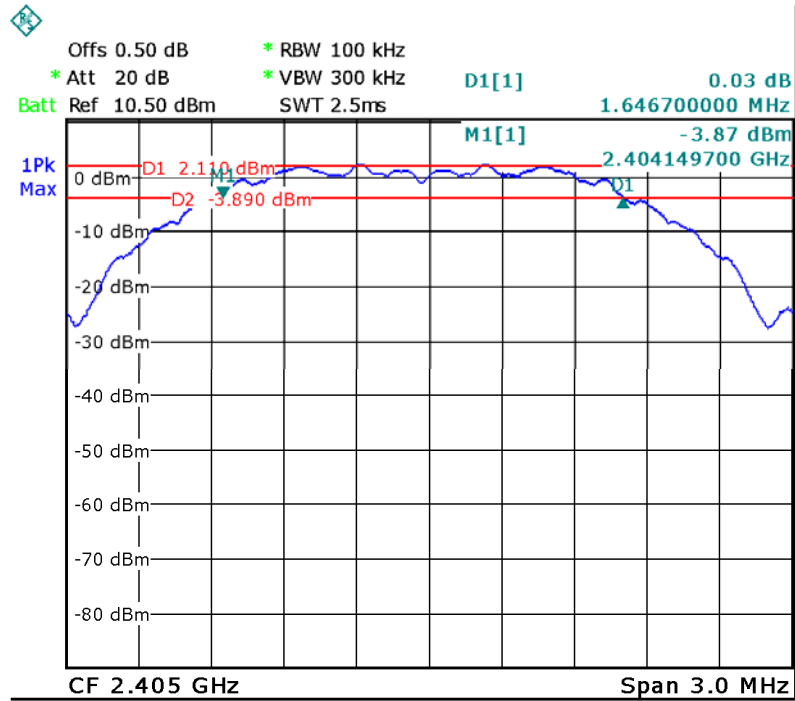
11.2 Test Result:

Operation mode	Test Channel	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
OPQSK	Channel 11	1.647	2.222
	Channel 18	1.647	2.216
	Channel 26	1.653	2.216

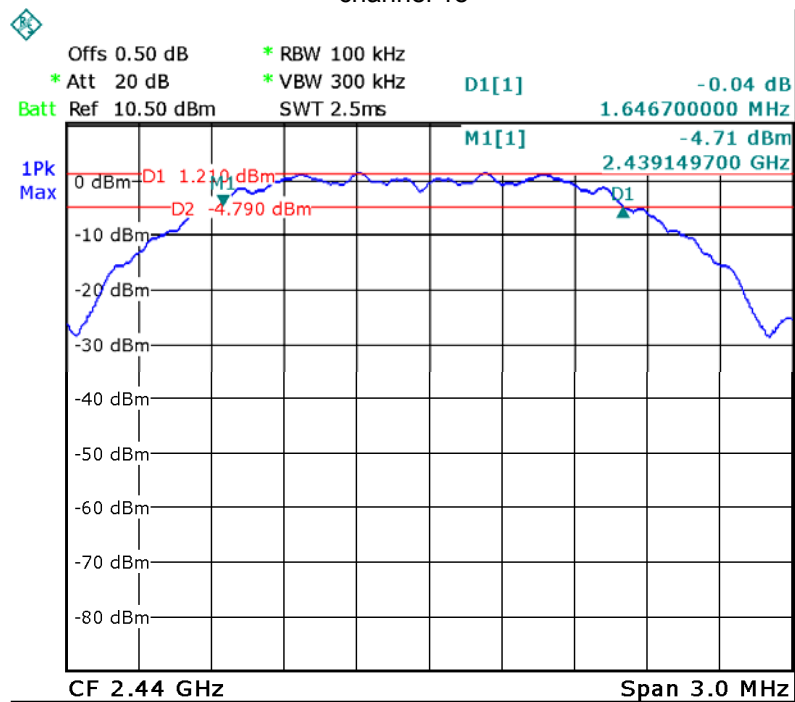
Test result plot:

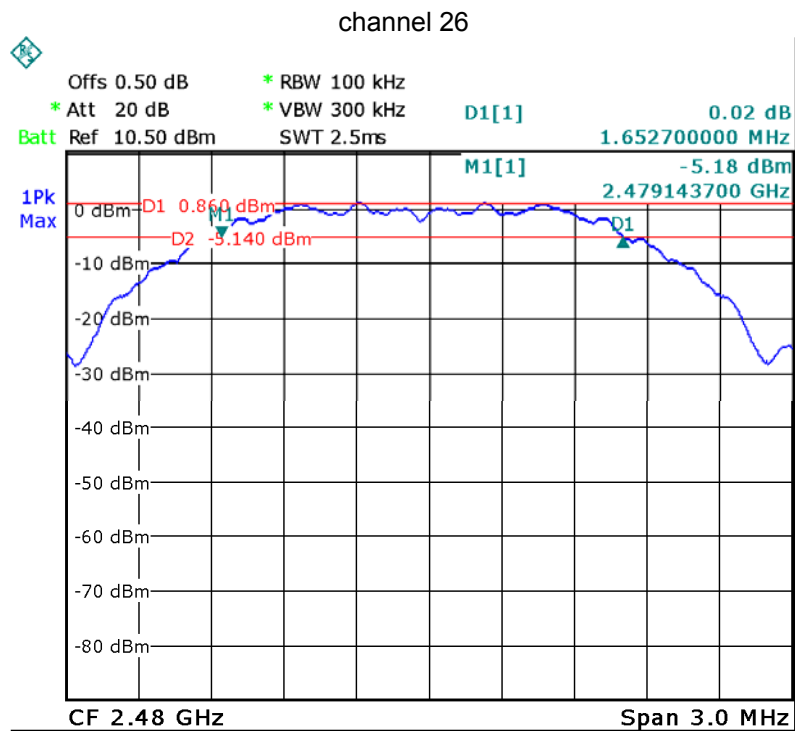
6 dB Bandwidth

channel 11

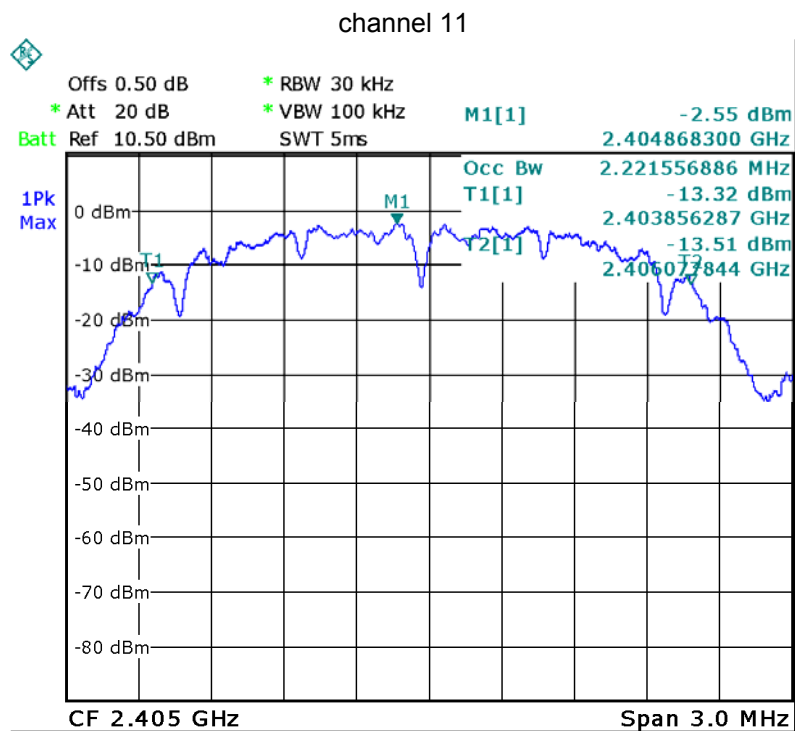


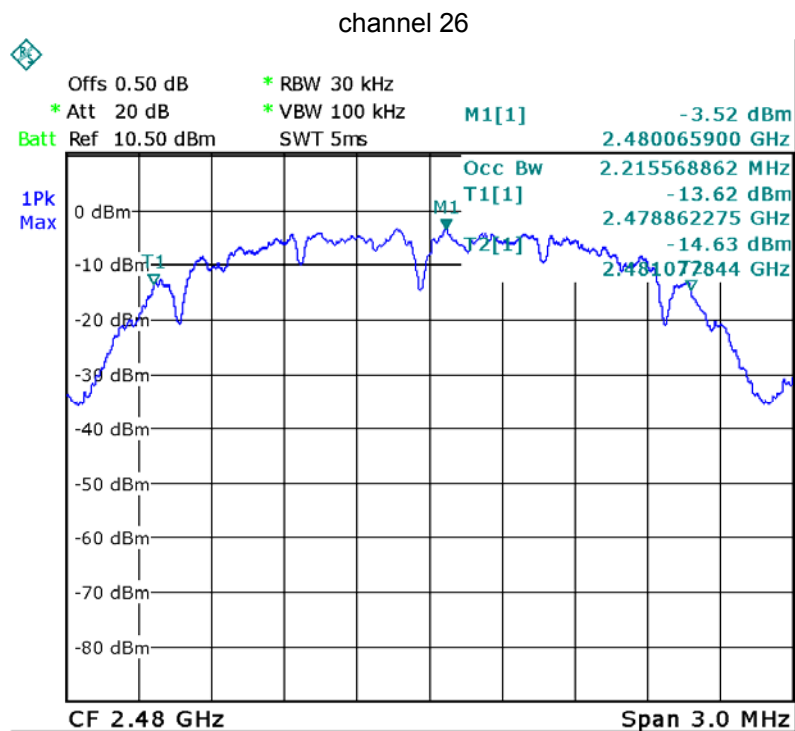
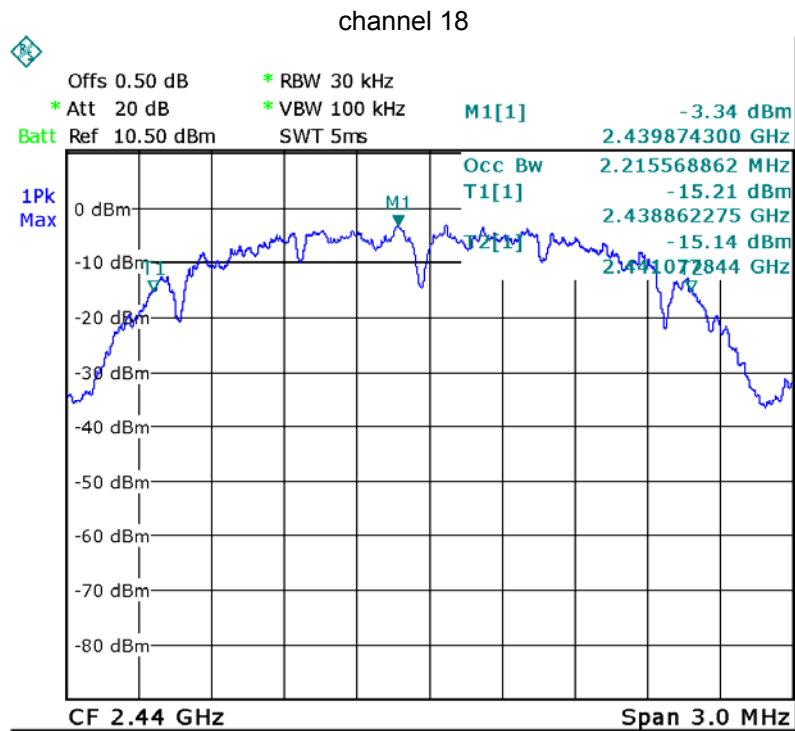
channel 18





99% Bandwidth





12 Maximum Peak Output Power

Test Requirement:

FCC CFR47 Part 15 Section 15.247

Test Method:

KDB 558074 D01 DTS Meas Guidance v03r05 April 8, 2016

12.1 Test Procedure:

KDB 558074 D01 DTS Meas Guidance v03r05 April 8, 2016

section 9.1.1 (For BLE)

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

- a) Set the $RBW \geq DTS$ bandwidth.
- b) Set $VBW \geq 3 \times RBW$.
- c) Set span $\geq 3 \times RBW$
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use peak marker function to determine the peak amplitude level.

section 9.1.2 (For WIFI)

This procedure may be used when the maximum available RBW of the measurement instrument is less than the DTS bandwidth.

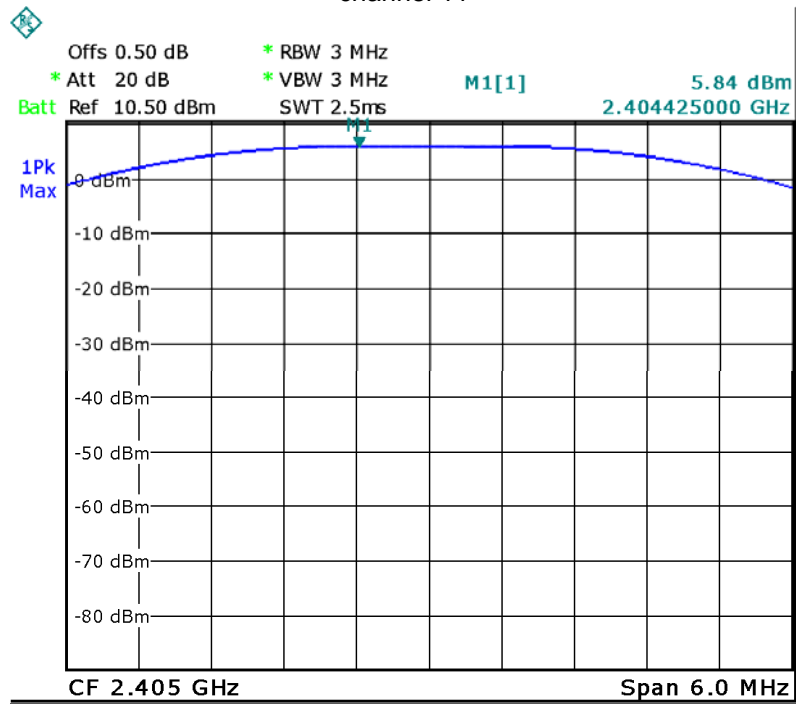
- a) Set the $RBW = 1 \text{ MHz}$.
- b) Set the $VBW \geq 3 \times RBW$
- c) Set the span $\geq 1.5 \times DTS$ bandwidth.
- d) Detector = peak.
- e) Sweep time = auto couple.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select peak detector). If the instrument does not have a band power function, sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS bandwidth.

12.2 Test Result:

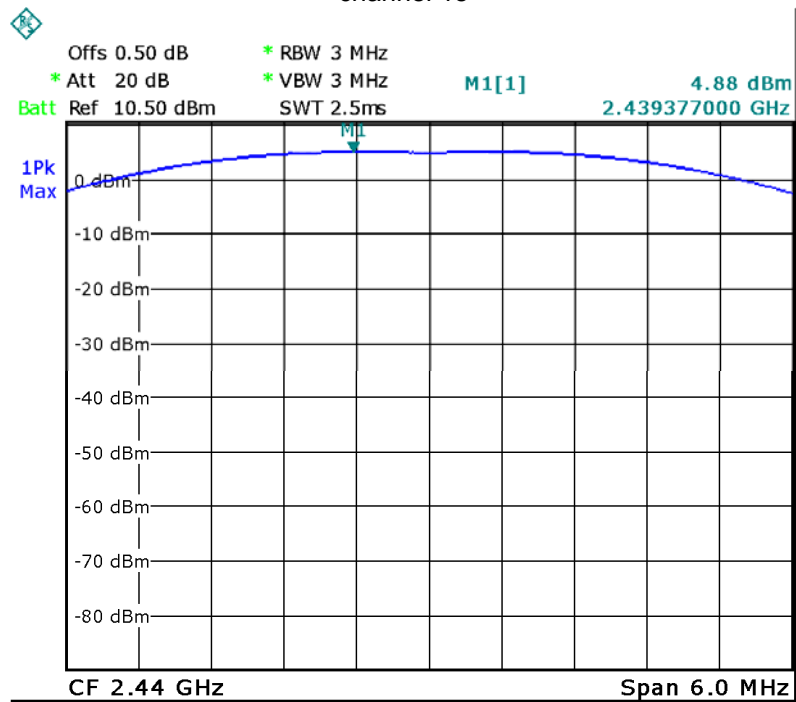
Operation mode	Channel Frequency (MHz)	Maximum Peak Output Power (dBm)	Limit
OPQSK	Low-2405	5.84	1W/30dBm
	Middle-2440	4.88	1W/30dBm
	High-2480	4.61	1W/30dBm

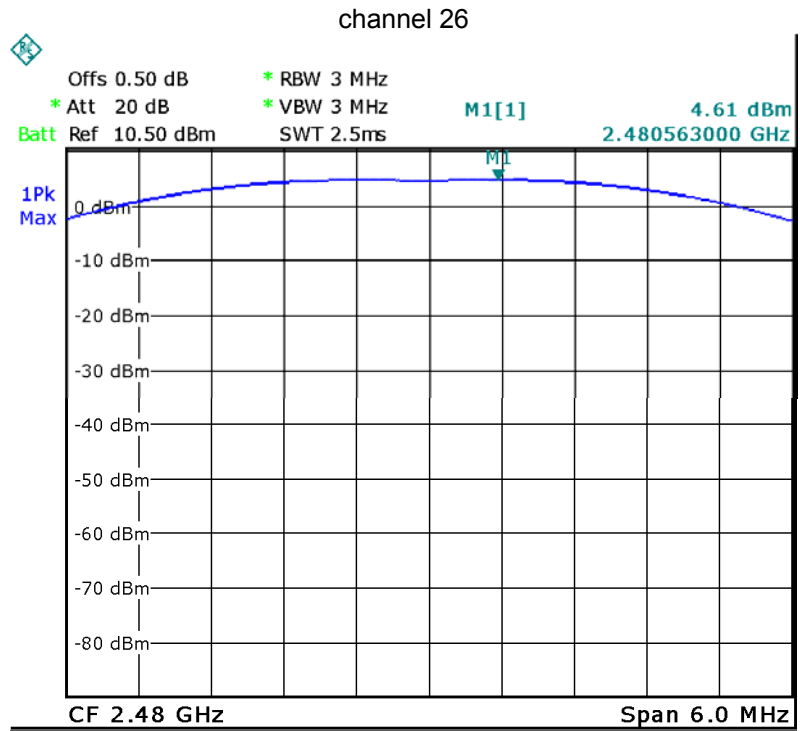
Test Plot

channel 11



channel 18





13 Power Spectral density

Test Requirement: FCC CFR47 Part 15 Section 15.247

Test Method: KDB 558074 D01 DTS Meas Guidance v03r05 April 8, 2016

13.1 Test Procedure:

KDB 558074 D01 DTS Meas Guidance v03r05 April 8, 2016 section 10.2

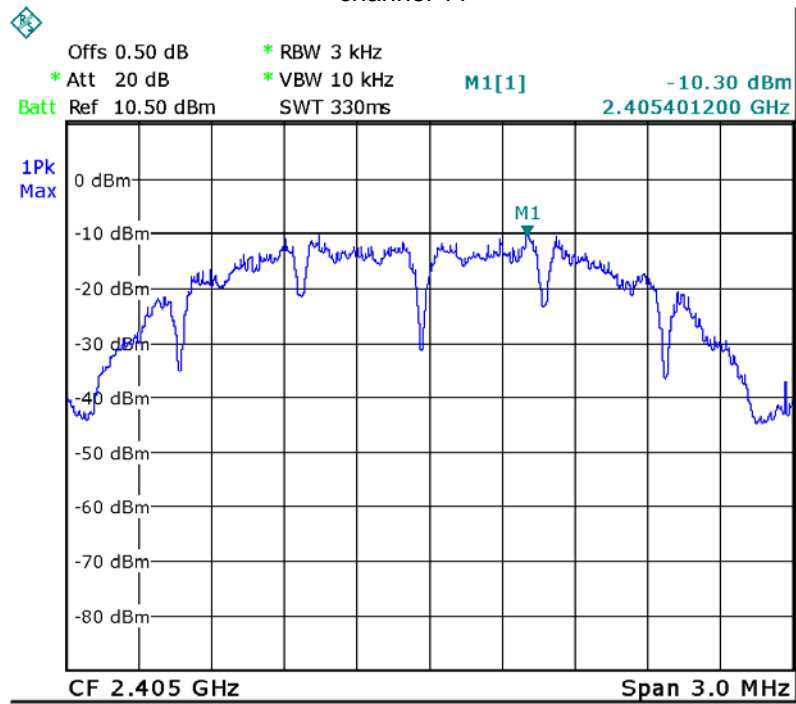
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 3kHz. VBW = 10kHz , Span = 1.5 times the DTS channel bandwidth(6 dB bandwidth). Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section
Submit this plot.

13.2 Test Result:

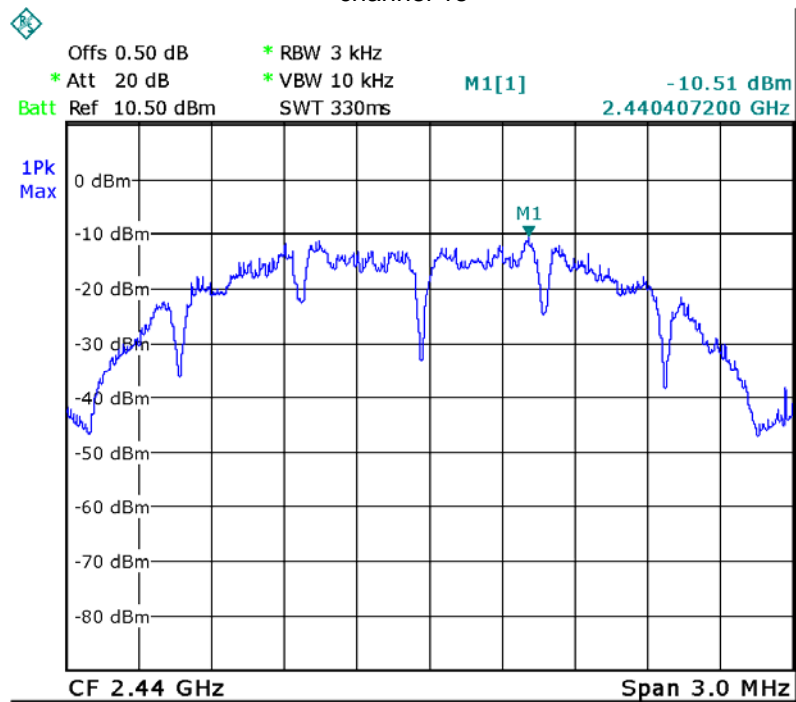
Operation mode	Channel Frequency (MHz)	Power Spectral (dBm per 3kHz)	Limit
OPQSK	Low-2405	-10.30	8dBm per 3kHz
	Middle-2440	-10.51	8dBm per 3kHz
	High-2480	-10.95	8dBm per 3kHz

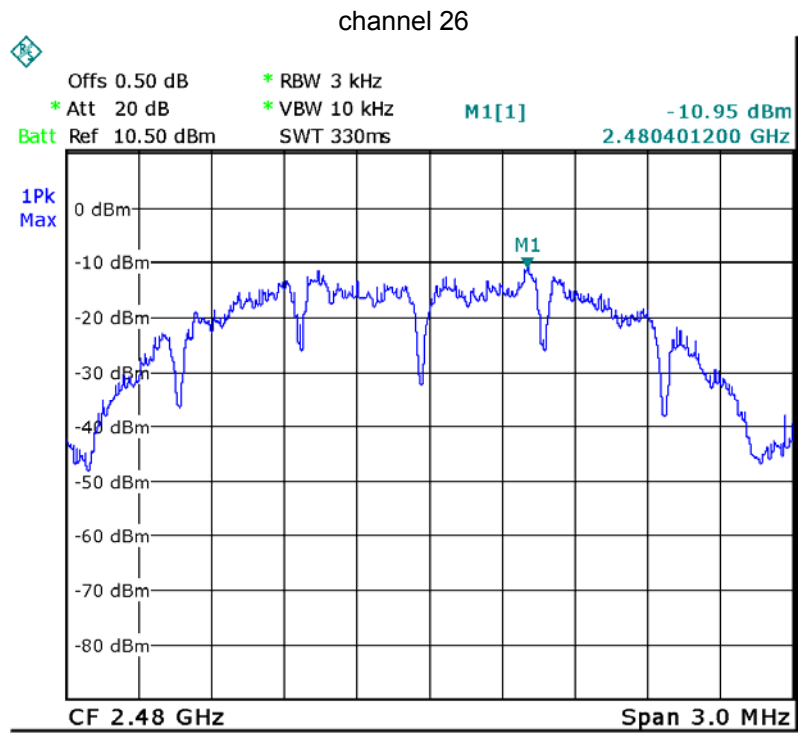
Test Plot

channel 11



channel 18





14 Antenna Requirement

According to the FCC Part 15 Paragraph 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. This product has an internal permanent antenna fulfill the requirement of this section.



ANT

15 RF Exposure

Remark: refer to MPE test report: WTD21D03021969W005

16 Photographs of test setup and EUT.

Note: Please refer to appendix: Appendix- R4060-Photos.

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