

Test Report

FCC PART 15 Subpart C

Product Name : iPal
Model No. : iPal-B (iPal-P/ iPal-S/ iPal-GD/ iPal-GN)
FCC ID/IC ID : 2APZJ-IPAL/23929-IPAL

Applicant : Nanjing AvatarMind Robot Technology Co., Ltd.
Address : 3 Gutan Road, Gaochun Economic Development Zone,
Nanjing, Jiangsu

Date of Receipt : 26/02/2018
Test Date : 26/03/2018~25/04/2018
Issued Date : 25/04/2018
Report No. : YZ180129-AFDJ-0001-3
Report Version : V1.0

The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standards through the calibration of the equipment and evaluated measurement uncertainty herein.

This report must not be used to claim product endorsement by A2LA or any agency of the Government.

The test report shall not be reproduced except in full without the written approval of YTC Corporation.

Test Report Certification

Issued Date : 25/04/2018

Report No. : YZ180129-AFDJ-0001-3



Product Name : iPal

Applicant : Nanjing AvatarMind Robot Technology Co., Ltd.

Address : 3 Gutan Road, Gaochun Economic Development Zone,
Nanjing, Jiangsu

Manufacturer : Nanjing AvatarMind Robot Technology Co., Ltd.

Address : 3 Gutan Road, Gaochun Economic Development Zone,
Nanjing, Jiangsu

Model No. : iPal-B (iPal-P/ iPal-S/ iPal-GD/ iPal-GN)

Brand Name : AvatarMind

EUT Voltage : +24V, 3.75A

Applicable : FCC CFR Title 47 Part 15 Subpart C: 2017

Standard : ANSI C63.4: 2014
ANSI C63.10: 2013
ICES-003 Issue 6
RSS 247 Issue 2
RSS-Gen Issue 4

Test Result : Complied

Performed : JIANGSU YANGTZE TESTING, CERTIFICATION AND

Location : INSPECTION CORPORATION
No.6-3, Xingzhi Road, Xingzhi Technology Park
Xingang Economic Development Zone Nanjing City,
Jiangsu Province, 210046, People's Republic of China
TEL: +86-025-86797034

Documented By

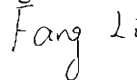
:



(Engineering ADM: Ke Chen)

Reviewed By

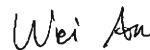
:



(Senior Engineer: Fang Li)

Approved By

:



(Manager: Wei An)

Laboratory Information

We, **YTC Corporation**, are an independent EMC and safety consultancy that was established the whole facility in our laboratories. The test facility has been accredited/accepted(audited or listed) by the following related bodies in compliance with ISO 17025 and specified testing scope:

The address and introduction of YTC Corporation's laboratories can be founded in our Web site : <http://www.yztcic.com/>

If you have any comments, Please don't hesitate to contact us.

TABLE OF CONTENTS

1.	General Information.....	6
1.1.	EUT Description.....	6
1.2.	Mode of Operation.....	9
1.3.	Tested System Details.....	10
1.4.	Configuration of Tested System.....	11
1.5.	EUT Exercise Software.....	12
2.	Technical Test	13
2.1.	Summary of Test Result.....	13
2.2.	Test Environment	14
3.	Conducted Emission	15
3.1.	Test Equipment	15
3.2.	Test Setup.....	15
3.3.	Limit.....	16
3.4.	Test Procedure.....	16
3.5.	Uncertainty.....	16
3.6.	Test Result.....	17
4.	Radiated Emission	18
4.1.	Test Equipment	18
4.2.	Test Setup.....	19
4.3.	Limit.....	20
4.4.	Test Procedure.....	20
4.5.	Uncertainty.....	20
4.6.	Test Result.....	21
5.	6dB and 99% Bandwidth	25
5.1.	Test Equipment	25
5.2.	Test Setup.....	25
5.3.	Limit.....	25
5.4.	Test Procedure.....	25
5.5.	Uncertainty.....	25
5.6.	Test Result.....	26
6.	Peak Output Power	36
6.1.	Test Equipment	36
6.2.	Test Setup.....	36
6.3.	Limit.....	36
6.4.	Test Procedure.....	36
6.5.	Uncertainty.....	36
6.6.	Test Result.....	37
7.	Power Spectral Density	38
7.1.	Test Equipment	38
7.2.	Test Setup.....	38
7.3.	Limit.....	38
7.4.	Test Procedure.....	38

7.5.	Uncertainty.....	38
7.6.	Test Result.....	39
8.	Conducted Band Edges and Spurious Emission	45
8.1.	Test Equipment	45
8.2.	Test Setup.....	45
8.3.	Limit.....	45
8.4.	Test Procedure.....	45
8.5.	Uncertainty.....	45
8.6.	Test Result.....	46
9.	Antenna requirement.....	52
9.1.	The requirement.....	52
9.2.	Antenna construction	52

1. General Information

1.1. EUT Description

Product Name	iPal
Brand Name	AvatarMind
Model No.	iPal-B (iPal-P/ iPal-S/ iPal-GD/ iPal-GN)
EUT Voltage	+24V, 3.75A
Frequency Range	For 2.4GHz Band 802.11b/g/n(20MHz): 2412~2462MHz For 5.0GHz Band 802.11a/n/ac(20MHz): 5180~5240MHz, 5745~5825MHz 802.11n/ac(40MHz): 5190~5230MHz, 5755~5795MHz 802.11ac(80MHz): 5210~5775MHz Bluetooth v3.0 + EDR 2402MHz~2480MHz Bluetooth v4.0 + LE 2402MHz~2480MHz
Channel Number	For 2.4GHz Band 802.11b/g/n(20MHz): 11 For 5.0GHz Band 802.11a/n/ac(20MHz): 9 802.11n/ac(40MHz): 4 802.11ac(80MHz):2 Bluetooth v3.0 + EDR: 79 Bluetooth v4.0 + LE: 40
Type of Modulation	802.11b: DSSS 802.11a/g/n/ac: OFDM Bluetooth v3.0 + EDR: GFSK, $\pi/4$ -DQPSK, 8-DPSK Bluetooth v4.0 + LE: GFSK
Data Rate	802.11a/g: 6/9/12/18/24/36/48/54 Mbps 802.11b: 1/2/5.5/11 Mbps 802.11n: up to 300 Mbps 802.11ac: MCS 0/1/2/3/4/5/6/7/8/9 Bluetooth v3.0 + EDR: 1/2/3 Mbps Bluetooth v4.0 + LE: 1Mbps
Channel Control	Auto
Antenna Delivery	Tx + Rx
Antenna Type	Integral antenna

Peak Antenna Gain	2dBi
Components	
Adapter	Brand Name: Channel Well Technology Model: 2AAL090m Input: 100-240V~1.5A 50/60Hz Output: 24V, 3.75A

For 2.4GHz Band

802.11b/g/n(20MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
01	2412 MHz	02	2417 MHz	03	2422 MHz	04	2427 MHz
05	2432 MHz	06	2437 MHz	07	2442 MHz	08	2447 MHz
09	2452 MHz	10	2457 MHz	11	2462 MHz	N/A	N/A

For 5.0GHz Band

802.11a/n/ac(20MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
36	5180 MHz	40	5200 MHz	44	5220 MHz	48	5240 MHz
149	5745 MHz	153	5765 MHz	157	5785 MHz	161	5805 MHz
165	5825 MHz	N/A	N/A	N/A	N/A	N/A	N/A

802.11n/ac(40MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz	151	5755 MHz	159	5795 MHz

802.11ac(80MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
42	5210MHz	155	5775MHz	N/A	N/A	N/A	N/A

For Bluetooth v3.0 + EDR Band

802.11b/g/n(20MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	39	2441MHz	78	2480 MHz	N/A	N/A

For Bluetooth v4.0 + LE Band

802.11b/g/n(20MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	19	2440MHz	39	2480 MHz	N/A	N/A

802.11a/b/g/n Antenna List

Antenna	Manufacturer	Model No.	Peak Gain
Antenna 1	N/A	N/A	2dBi for 2.4GHz, 1dBi for 5GHz

1.2. Mode of Operation

YTC has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: Transmit by 802.11b
Mode 2: Transmit by 802.11g
Mode 3: Transmit by 802.11n (20MHz)
Mode 4: Transmit by Bluetooth v4.0 + LE

Note:

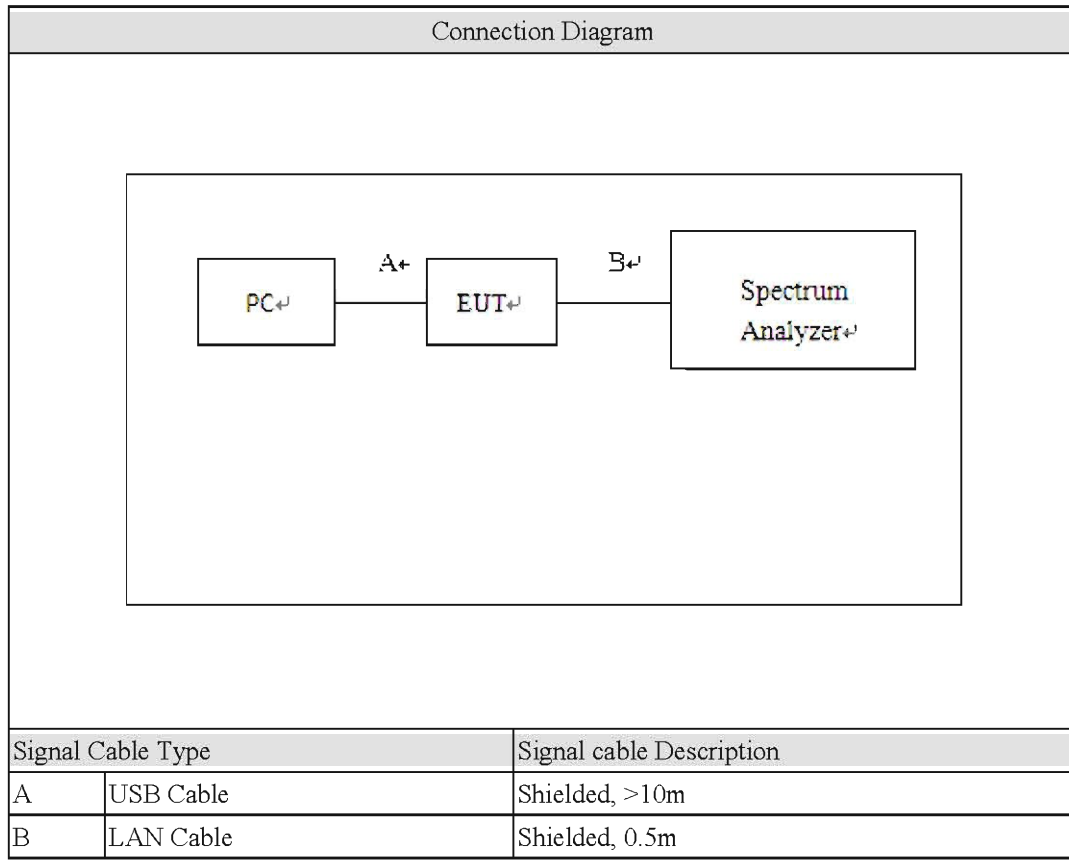
1. Regards to the frequency band operation: the lowest, middle and highest frequency of channel were selected to perform the test, then shown on this report.

1.3. Tested System Details

The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product		Manufacturer	Model No.	Serial No.	Power Cord
1	PC	Lenovo	B41	/	Non-Shielded, 1.8m

1.4. Configuration of Tested System



1.5. EUT Exercise Software

1	Setup the EUT and simulators as shown on above.
2	Turn on the power of equipment.
3	Execute some commands on the PC provided by applicant.
4	Setup the test channel and the test mode press ok to start the continue transmit.

2. Technical Test

2.1. Summary of Test Result

- ☒ No deviations from the test standards
☐ Deviations from the test standards as below description:

Performed Test Item	Normative References	Test Performed	Deviation
Conducted Emission	FCC CFR Title 47 Part 15 Subpart C: 2017 Section 15.207 RSS Gen Issue 4	Yes	No
Radiated Emission	FCC CFR Title 47 Part 15 Subpart C: 2017 Section 15.209 RSS Gen Issue 4	Yes	No
6dB Bandwidth	FCC CFR Title 47 Part 15 Subpart C: 2017 Section 15.247(a)(2) RSS 247 Issue 2	Yes	No
99% Occupied Bandwidth	FCC CFR Title 47 Part 15 Subpart C: 2017 Section 15.247(a)(2) RSS 247 Issue 2	Yes	No
Peak Output Power	FCC CFR Title 47 Part 15 Subpart C: 2017 Section 15.247(b)(1) RSS 247 Issue 2	Yes	No
Power Spectral Density	FCC CFR Title 47 Part 15 Subpart C: 2017 Section 15.247(e) RSS 247 Issue 2	Yes	No
Conducted Band Edges and Spurious	FCC CFR Title 47 Part 15 Subpart C: 2017 Section 15.247(d) RSS 247 Issue 2	Yes	No

2.2. Test Environment

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	21
Humidity (%RH)	25-75	50
Barometric pressure (mbar)	860-1060	950-1000

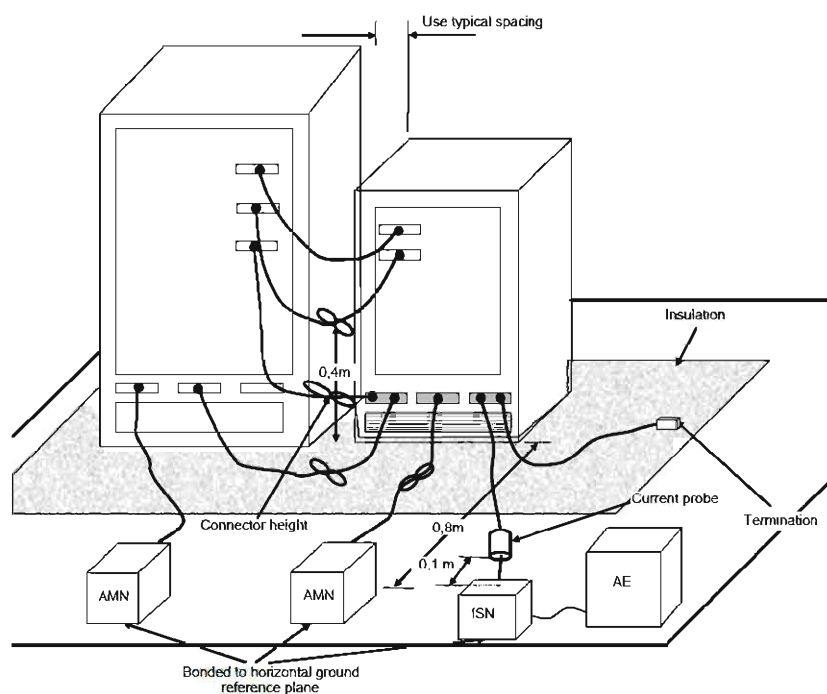
3. Conducted Emission

3.1. Test Equipment

Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
EMI Test Receiver	R&S	ESCI	100862	2017.10.23
Two-Line V-Network	R&S	ENV216	102024	2017.10.23
Temperature/Humidity Meter	/	HTC-1	/	2017.11.08
Shielding Room No. 2	EMC	8m*4m*3m	/	2016.08

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

3.2. Test Setup



3.3. Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dBμV)	AV (dBμV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

3.4. Test Procedure

The EUT was setup according to ANSI C63.4: 2014 and tested according to ANSI C63.10: 2013 for compliance to FCC 47CFR 15.247 requirements. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 10 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs) Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.

The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.

Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.

3.5. Uncertainty

The measurement uncertainty is defined as ± 2.02 dB

Note. Conducted emission was conducted at both 120V and 230V, and emission at 230V represents the worst case.

3.6. Test Result

Test Mode: Mode 7

Phase: L

Table A.9.1 Disturbance Voltage on Mains Class B QP
Table A.9.2 Disturbance Voltage on Mains Class B AV

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.182000	---	40.47	54.39	13.93	1000.0	9.000	L1	ON	10.1
0.186000	42.66	---	64.21	21.55	1000.0	9.000	L1	ON	10.1
0.310000	---	31.14	49.97	18.83	1000.0	9.000	L1	ON	10.1
0.310000	37.01	---	59.97	22.97	1000.0	9.000	L1	ON	10.1
0.858000	---	29.75	46.00	16.25	1000.0	9.000	L1	ON	10.2
0.858000	44.83	---	56.00	11.17	1000.0	9.000	L1	ON	10.2
0.918000	---	30.68	46.00	15.32	1000.0	9.000	L1	ON	10.2
0.922000	45.84	---	56.00	10.16	1000.0	9.000	L1	ON	10.2
2.230000	35.89	---	56.00	20.11	1000.0	9.000	L1	ON	10.2
2.230000	---	27.97	46.00	18.03	1000.0	9.000	L1	ON	10.2
12.234000	39.56	---	60.00	20.44	1000.0	9.000	L1	ON	10.5
12.246000	---	33.85	50.00	16.15	1000.0	9.000	L1	ON	10.5

Test Mode: Mode 7

Phase: N

Table A.9.1 Disturbance Voltage on Mains Class B QP
Table A.9.2 Disturbance Voltage on Mains Class B AV

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.186000	---	39.32	54.21	14.89	1000.0	9.000	N	ON	10.1
0.186000	44.10	---	64.21	20.11	1000.0	9.000	N	ON	10.1
0.306000	---	34.76	50.08	15.32	1000.0	9.000	N	ON	10.1
0.306000	42.79	---	60.08	17.29	1000.0	9.000	N	ON	10.1
0.794000	---	28.39	46.00	17.61	1000.0	9.000	N	ON	10.2
0.794000	42.68	---	56.00	13.32	1000.0	9.000	N	ON	10.2
0.922000	39.77	---	56.00	16.23	1000.0	9.000	N	ON	10.2
0.922000	---	28.32	46.00	17.68	1000.0	9.000	N	ON	10.2
12.134000	43.09	---	60.00	16.91	1000.0	9.000	N	ON	10.5
12.134000	---	38.32	50.00	11.68	1000.0	9.000	N	ON	10.5
28.894000	---	38.48	50.00	11.52	1000.0	9.000	N	ON	10.8
28.894000	40.55	---	60.00	19.45	1000.0	9.000	N	ON	10.8

4. Radiated Emission

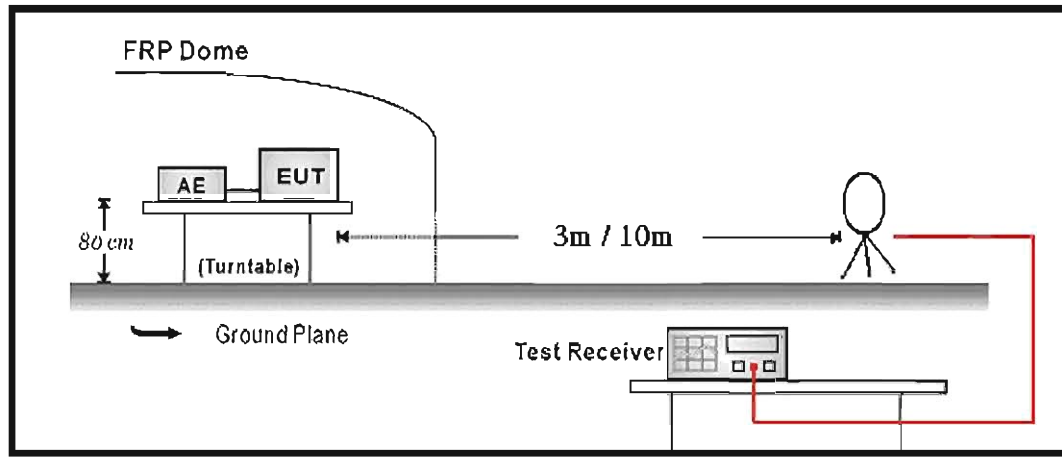
4.1. Test Equipment

Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
EMI Test Receiver	R&S	ESR7	100573	2017.10.24
Loop Antenna	R&S	HFH2-Z2	100477	2017.11.05
Ultralog Antenna	R&S	HL562E	100833	2017.02.28
Broad-Band Horn Antenna	R&S	HF907	102500	2017.11.28
Chamber No. 1	EMC	9m*6m*6m	/	2016.08
Temperature/Humidity Meter	/	HTC-1	/	2017.11.08

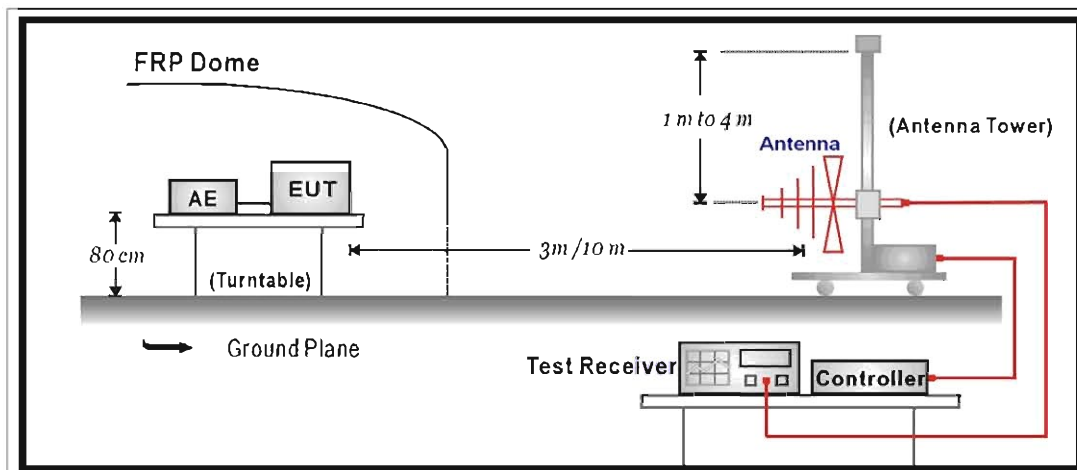
Note 1: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

4.2. Test Setup

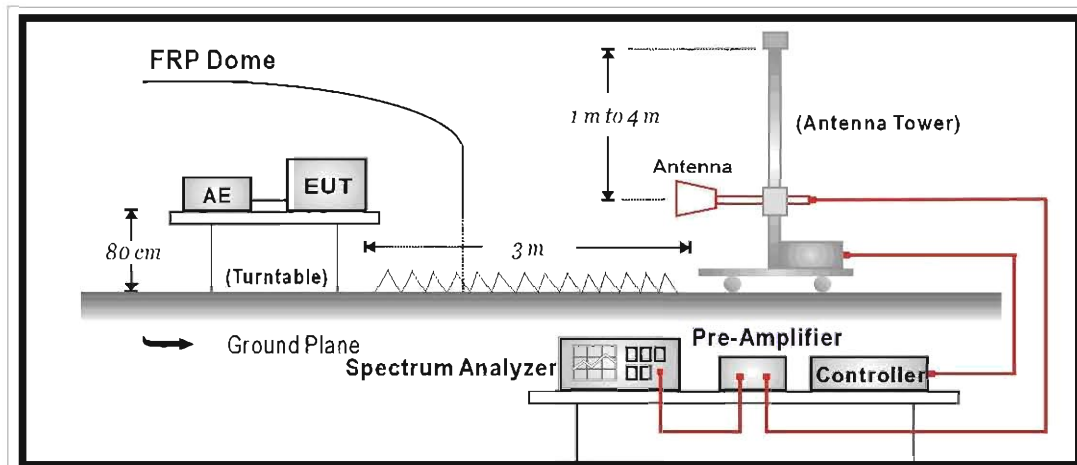
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



4.3. Limit

FCC Part 15 Subpart C Paragraph 15.209		
Frequency (MHz)	Distance (m)	Level (dBμV/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

Note 1: The lower limit shall apply at the transition frequency.

Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

Note 3: $E \text{ field strength (dB}\mu\text{V/m)} = 20 \log E \text{ field strength } (\mu\text{V/m})$

4.4. Test Procedure

The EUT was setup according to ANSI C63.4: 2014 and tested according to ANSI C63.10: 2013 and KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 0.1 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4: 2014 on radiated measurement.

The resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.

The frequency range from 30MHz to 10th harmonic is checked.

Note: When doing emission measurement above 1GHz, the horn antenna will be bended down a little (as horn antenna has the narrow beamwidth) in order to keeping the antenna in the “cone of radiation” of EUT. The 3dB beamwidth is 60 degrees for H-plane and 90 degrees for E-plane.

4.5. Uncertainty

The measurement uncertainty above 1G is defined as $\pm 3.9 \text{ dB}$

below 1G is defined as $\pm 3.8 \text{ dB}$

4.6. Test Result

All of the test result shown indicates the worst case, and spectrum analyzer parameters setting as shown below:

Peak detector: RBW = 1MHz, VBW = 3MHz, sweep time = 200ms;

Average detector: RBW = 1MHz, VBW = 10Hz, sweep time = auto.

Measure Level = Reading Level + Cable Loss + Antenna Factor - Preamplifier Gain

9kHz-30MHz

Frequency(MHz)	Reading(dBμV/m)	Limit(dBμV/m)	Margin(dB)	Pass/Fail
—	—	—	—	Pass
—	—	—	—	Pass

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = 40 log (specific distance/test distance)(dB);

Limit line = specific limits(dBμV) + distance extrapolation factor.

30MHz-1GHz

Polar (H/V)	Frequency (MHz)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
V	73.4539	36.59	40.00	-3.41	QP
V	110.4215	40.01	43.50	-3.49	QP
V	166.7824	39.67	43.50	-3.83	QP
V	254.2845	41.98	46.00	-4.02	QP
V	341.5031	36.10	46.00	-9.9	QP
V	676.8318	40.04	46.00	-5.96	QP
H	77.7086	36.02	40.00	-3.98	QP
H	154.9317	39.71	43.50	-3.79	QP
H	216.4675	37.83	43.50	-5.67	QP
H	338.1848	37.16	46.00	-8.84	QP
H	420.1871	35.64	46.00	-10.36	QP
H	612.1326	38.82	46.00	-7.18	QP

Note: 802.11b mode is the worst mode.

Above 1GHz

802.11b

Polar (H/V)	Frequency (MHz)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
Low Channel(2412MHz)					
V	1189.678	60.97	74	-13.03	Pk
V	4824	61.13	74	-12.87	Pk
V	4824	48.01	54	-5.99	Av
V	7236	57.99	74	-16.01	Pk

V	7236	47.06	54	-6.94	Pk
H	1189.678	59.14	74	-14.86	Pk
H	4824	61.98	74	-12.02	Pk
H	4824	47.12	54	-6.88	Av
H	7236	59.83	74	-11.17	Pk
H	7236	45.97	54	-8.03	Av
Mid Channel(2437MHz)					
V	1189.678	62.98	74	-11.02	Pk
V	1637.834	61.39	74	-12.61	Pk
V	4874	58.99	74	-15.01	Pk
V	7311	62.57	74	-11.43	Pk
H	1189.678	60.01	74	-13.99	Pk
H	2099.787	60.88	74	-13.12	Pk
H	4874	61.87	74	-12.13	Pk
H	4874	50.51	54	-3.49	Av
H	7311	64.02	74	-9.98	Pk
High Channel(2462MHz)					
V	1189.678	59.94	74	-14.06	Pk
V	2453.938	59.01	74	-14.99	Pk
V	4924	61.99	74	-12.01	Pk
V	7386	60.57	74	-13.43	Pk
H	1189.678	55.12	74	-18.88	Pk
H	2453.938	65.17	74	-8.83	Pk
H	4924	61.08	74	-12.92	Pk
H	7386	59.73	74	-14.27	Pk

802.11g

Polar (H/V)	Frequency (MHz)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
Low Channel(2412MHz)					
V	1189.678	60.87	74	-13.13	Pk
V	4824	61.02	74	-12.98	Pk
V	4824	47.93	54	-6.07	Av
V	7236	58.01	74	-15.99	Pk
V	7236	46.10	54	-7.9	Pk
H	1189.678	59.34	74	-14.66	Pk
H	4824	61.89	74	-12.11	Pk
H	4824	47.88	54	-6.12	Av
H	7236	59.83	74	-11.17	Pk
H	7236	45.79	54	-8.21	Av
Mid Channel(2437MHz)					
V	1189.678	61.98	74	-12.02	Pk
V	1637.834	60.93	74	-13.07	Pk

V	4874	59.02	74	-14.98	Pk
V	7311	61.57	74	-10.43	Pk
H	1189.678	60.01	74	-13.99	Pk
H	2099.787	60.68	74	-13.32	Pk
H	4874	61.76	74	-12.24	Pk
H	4874	49.51	54	-4.49	Av
H	7311	62.02	74	-11.98	Pk
High Channel(2462MHz)					
V	1189.678	59.94	74	-14.06	Pk
V	2453.938	59.01	74	-14.99	Pk
V	4924	61.99	74	-12.01	Pk
V	7386	60.57	74	-13.43	Pk
H	1189.678	55.12	74	-18.88	Pk
H	2453.938	65.17	74	-8.83	Pk
H	4924	61.08	74	-12.92	Pk
H	7386	59.73	74	-14.27	Pk

802.11n(20MHz)

Polar (H/V)	Frequency (MHz)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
Low Channel(2412MHz)					
V	1189.678	60.97	74	-13.03	Pk
V	4824	61.13	74	-12.87	Pk
V	4824	48.01	54	-5.99	Av
V	7236	57.99	74	-16.01	Pk
V	7236	47.06	54	-6.94	Pk
H	1189.678	59.14	74	-14.86	Pk
H	4824	61.98	74	-12.02	Pk
H	4824	47.12	54	-6.88	Av
H	7236	59.83	74	-11.17	Pk
H	7236	45.97	54	-8.03	Av
Mid Channel(2437MHz)					
V	1189.678	62.98	74	-11.02	Pk
V	1637.834	61.39	74	-12.61	Pk
V	4874	58.99	74	-15.01	Pk
V	7311	62.57	74	-11.43	Pk
H	1189.678	60.01	74	-13.99	Pk
H	2099.787	60.88	74	-13.12	Pk
H	4874	61.87	74	-12.13	Pk
H	4874	50.51	54	-3.49	Av
H	7311	64.02	74	-9.98	Pk
High Channel(2462MHz)					
V	1189.678	59.97	74	-14.03	Pk

V	2453.938	59.21	74	-14.79	Pk
V	4924	61.67	74	-12.33	Pk
V	7386	60.75	74	-13.25	Pk
H	1189.678	58.07	74	-15.93	Pk
H	2453.938	64.17	74	-9.83	Pk
H	4924	61.08	74	-12.92	Pk
H	7386	59.38	74	-14.62	Pk

BLE

Polar (H/V)	Frequency (MHz)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
Low Channel(2402MHz)					
V	1189.678	58.97	74	-15.03	Pk
V	4804	60.03	74	-13.97	Pk
V	4804	47.51	54	-6.49	Av
V	7206	58.04	74	-15.96	Pk
V	7206	47.06	54	-6.94	Pk
H	1189.678	58.54	74	-15.46	Pk
H	4804	60.98	74	-13.02	Pk
H	4804	47.32	54	-6.68	Av
H	7206	59.03	74	-11.97	Pk
H	7206	45.67	54	-8.33	Av
Mid Channel(2440MHz)					
V	1189.678	60.98	74	-13.02	Pk
V	1637.834	61.36	74	-12.64	Pk
V	4880	58.91	74	-15.09	Pk
V	7320	60.75	74	-12.25	Pk
H	1189.678	60.01	74	-13.99	Pk
H	2099.787	59.88	74	-14.12	Pk
H	4880	60.78	74	-13.22	Pk
H	4880	49.51	54	-4.49	Av
H	7320	62.02	74	-11.98	Pk
High Channel(2480MHz)					
V	1189.678	59.99	74	-14.01	Pk
V	2453.938	59.31	74	-14.69	Pk
V	4960	60.89	74	-13.11	Pk
V	7440	59.57	74	-14.43	Pk
H	1189.678	58.97	74	-15.03	Pk
H	2453.938	62.17	74	-11.83	Pk
H	4960	61.14	74	-12.86	Pk
H	7440	59.33	74	-14.67	Pk

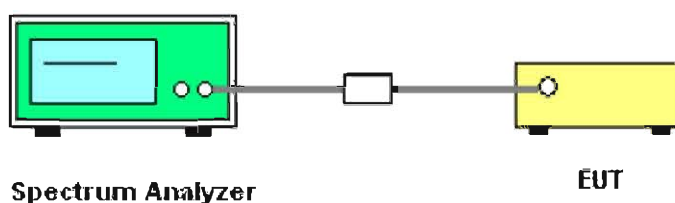
5. 6dB and 99% Bandwidth

5.1. Test Equipment

Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
Spectrum Analyzer	R&S	FSV40	101155	2017.10.24
Shielding Room No. 1	EMC	9m*4m*3m	/	2016.08
Temperature/Humidity Meter	/	HTC-1	/	2017.11.08

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

5.2. Test Setup



5.3. Limit

The minimum 6 dB bandwidth shall be at least 500 kHz.

5.4. Test Procedure

1. The testing follows FCC KDB Publication No.558074 D01 DTS Meas Guidance v04.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement, the 6dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 30 kHz and set the Video bandwidth (VBW) = 100kHz.
6. Measure and record the results in the test report.

5.5. Uncertainty

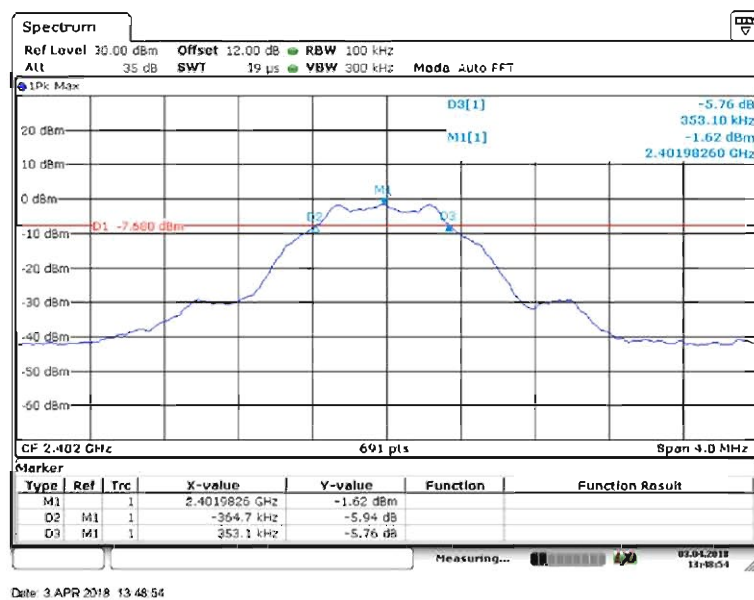
The measurement uncertainty is defined as ± 1.27 dB.

5.6. Test Result

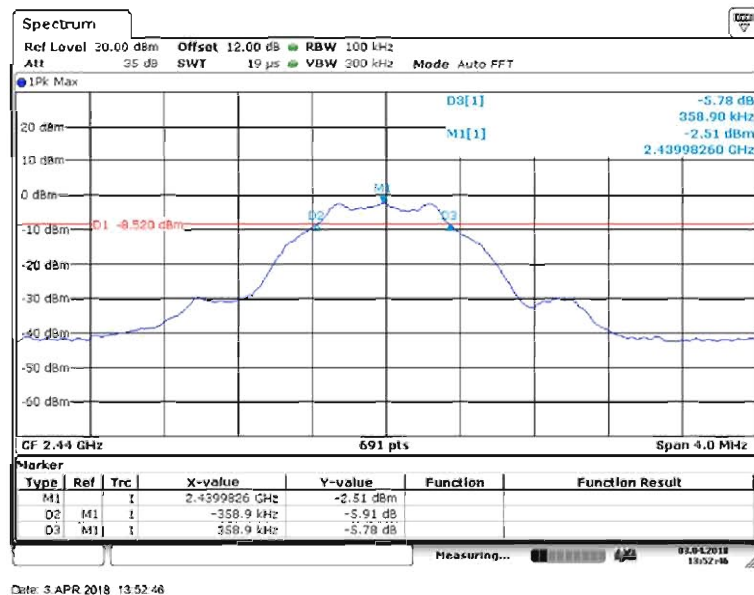
Test Item	: 6 dB Bandwidth
Test Mode	: Mode 4: Transmit by Bluetooth v4.0 + LE

Channel	Frequency(MHz)	6dB Bandwidth(kHz)	Limit(MHz)	Pass/Fail
00	2402	717.8	0.5	Pass
19	2440	717.8	0.5	Pass
39	2480	717.8	0.5	Pass

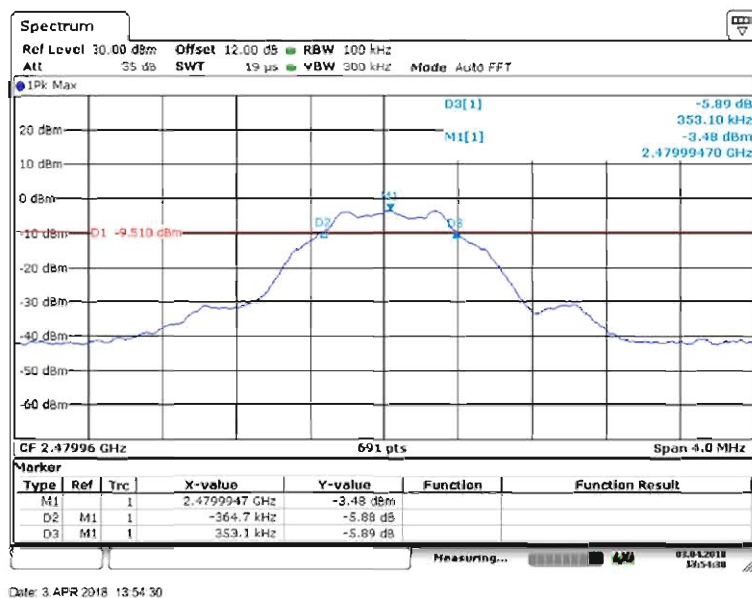
Channel 00 (2402MHz)



Channel 19 (2440MHz)



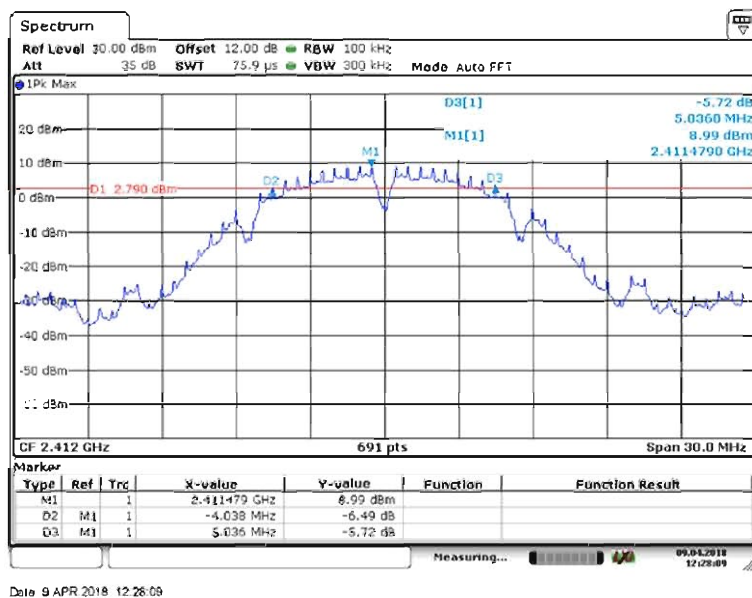
Channel 39 (2480MHz)



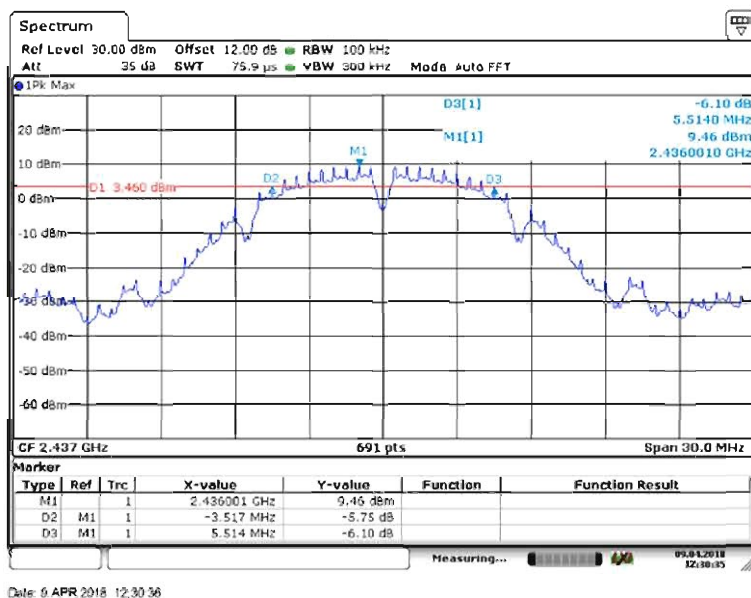
Test Item	: 6 dB Bandwidth
Test Mode	: Mode 1: Transmit by 802.11b

Channel	Frequency(MHz)	6dB Bandwidth(MHz)	Limit(MHz)	Pass/Fail
01	2412	9.074	0.5	Pass
06	2437	9.031	0.5	Pass
11	2462	9.03	0.5	Pass

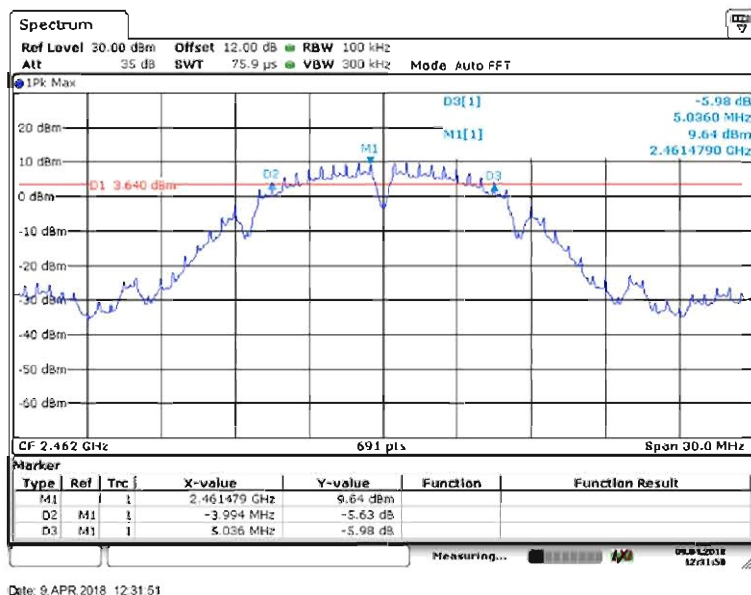
Channel 01 (2412MHz)



Channel 06 (2437MHz)



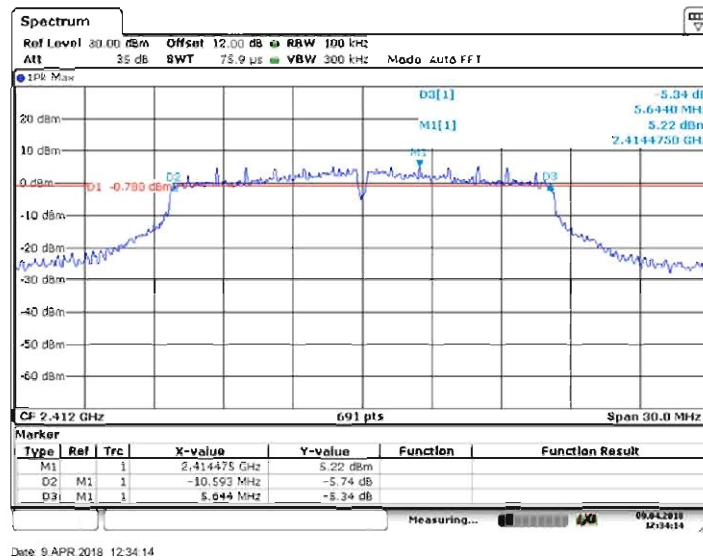
Channel 11 (2462MHz)



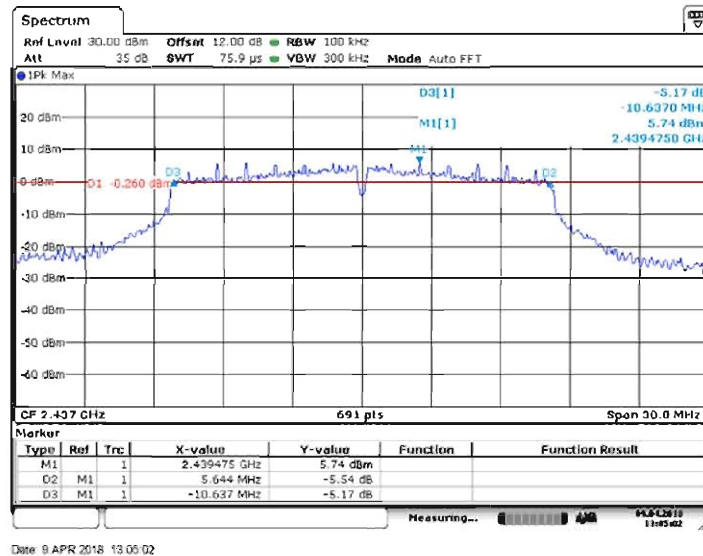
Test Item	: 6 dB Bandwidth
Test Mode	: Mode 2: Transmit by 802.11g

Channel	Frequency(MHz)	6dB Bandwidth(MHz)	Limit(MHz)	Pass/Fail
01	2412	16.237	0.5	Pass
06	2437	16.281	0.5	Pass
11	2462	16.281	0.5	Pass

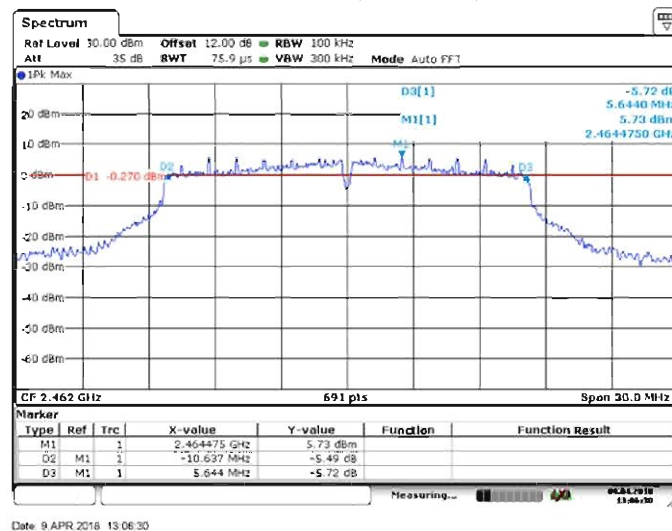
Channel 01 (2412MHz)



Channel 06 (2437MHz)



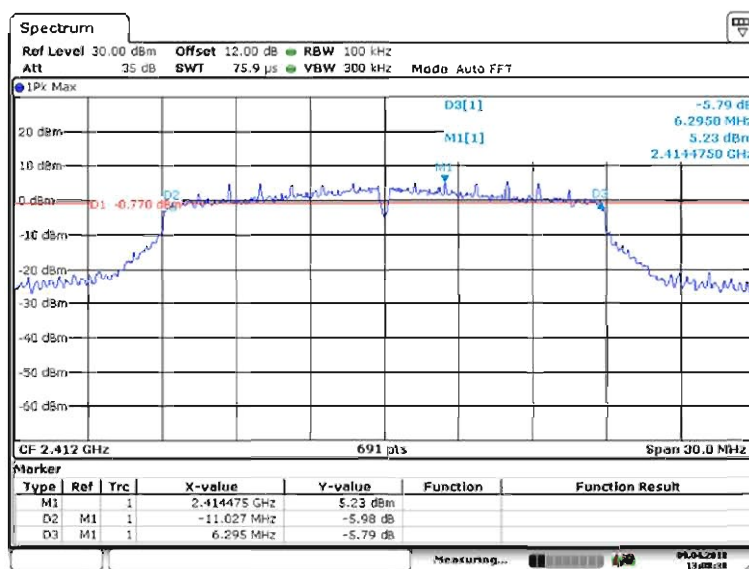
Channel 11 (2462MHz)



Test Item	: 6 dB Bandwidth
Test Mode	: Mode 3: Transmit by 802.11n(20MHz)

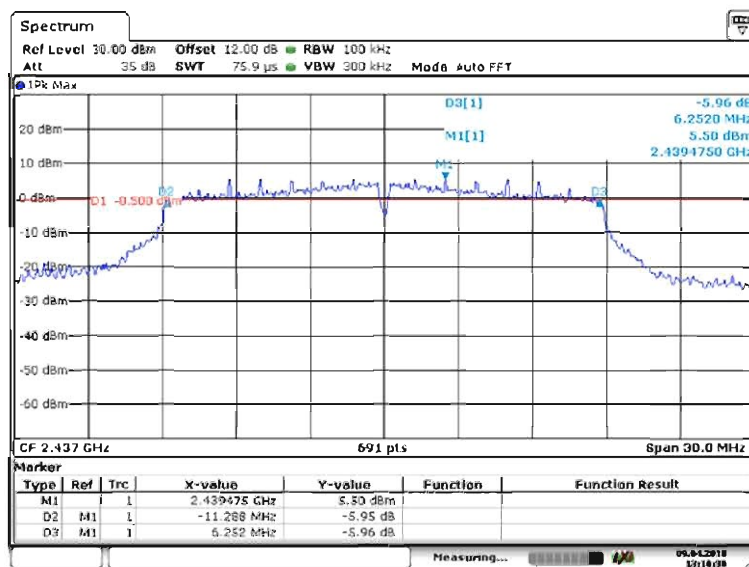
Channel	Frequency(MHz)	6dB Bandwidth(MHz)	Limit(MHz)	Pass/Fail
01	2412	17.322	0.5	Pass
06	2437	17.54	0.5	Pass
11	2462	17.497	0.5	Pass

Channel 01 (2412MHz)



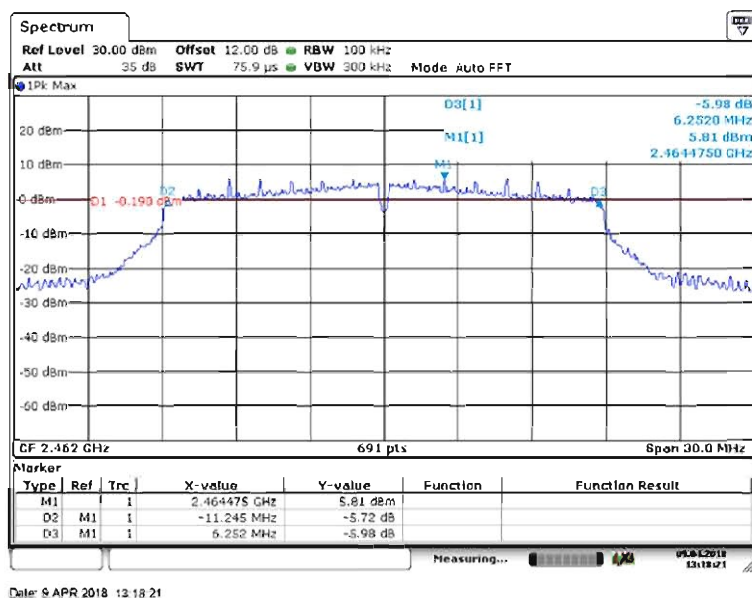
Date: 9 APR 2018 13:08:38

Channel 06 (2437MHz)



Date: 9 APR 2018 13:10:31

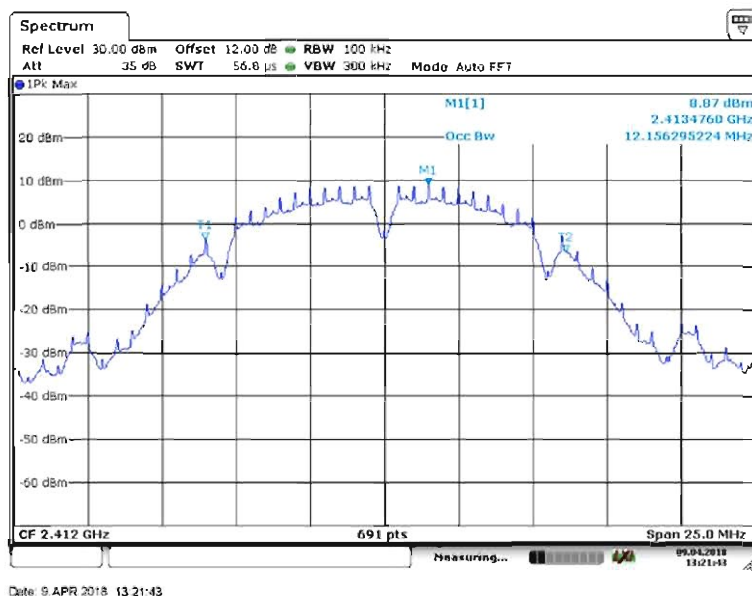
Channel 11 (2462MHz)



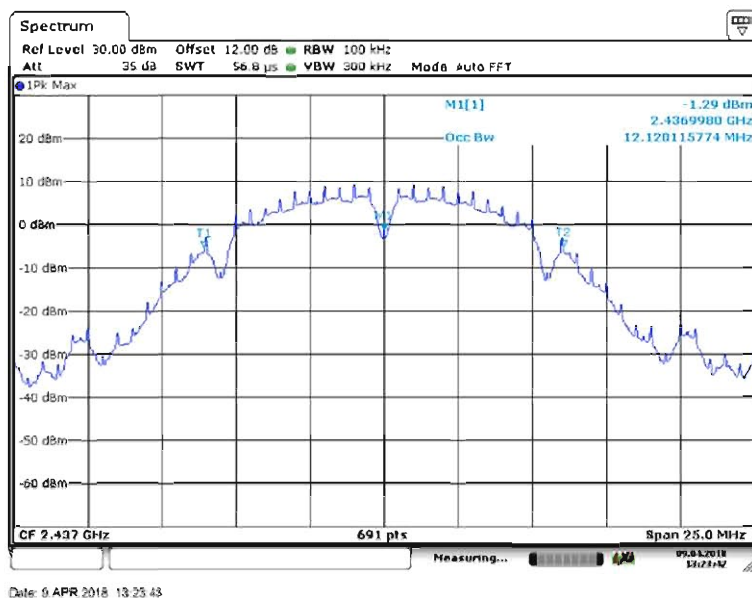
Test Item	: 99% Occupied Bandwidth
Test Mode	: Mode 1: Transmit by 802.11b

Channel	Frequency(MHz)	99% Occupied Bandwidth (MHz)
01	2412	12.156
06	2437	12.120
11	2462	12.192

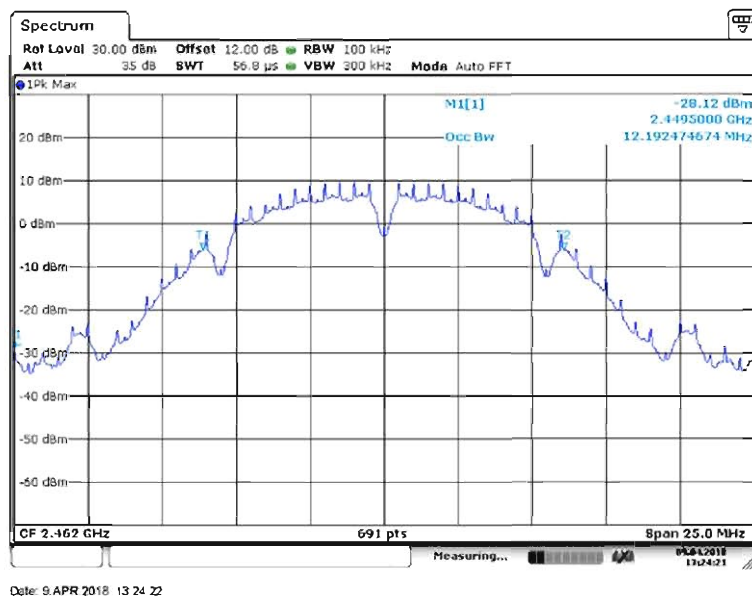
Channel 01 (2412MHz)



Channel 06 (2437MHz)



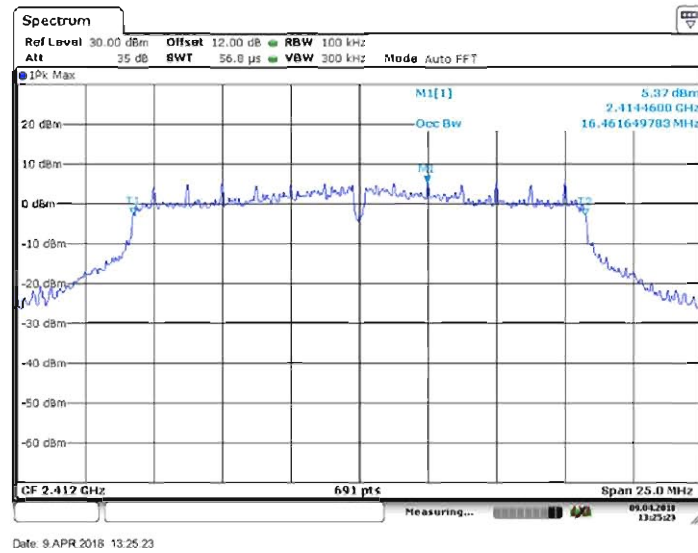
Channel 11 (2462MHz)



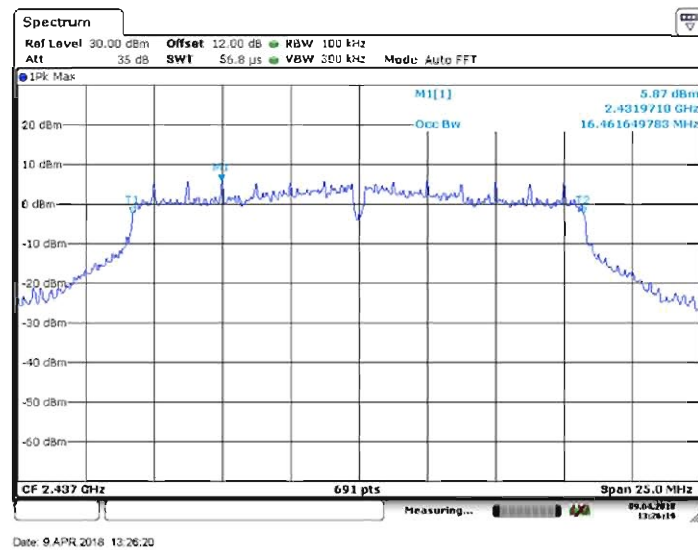
Test Item	: 99% Occupied Bandwidth
Test Mode	: Mode 2: Transmit by 802.11g

Channel	Frequency(MHz)	99% Occupied Bandwidth (MHz)
01	2412	16.462
06	2437	16.462
11	2462	16.425

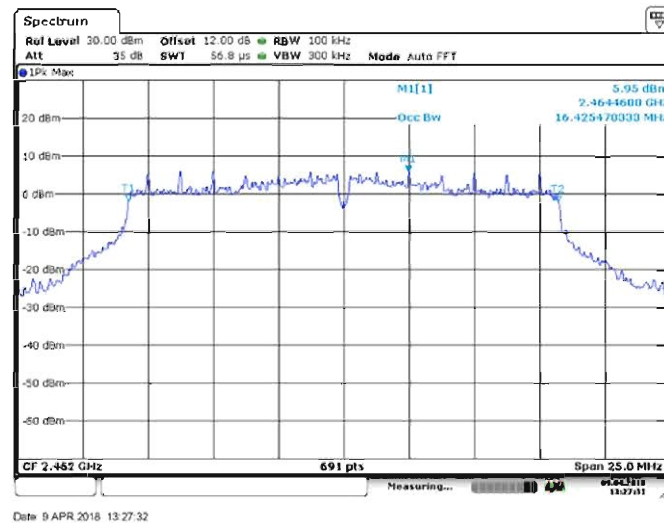
Channel 01 (2412MHz)



Channel 06 (2437MHz)



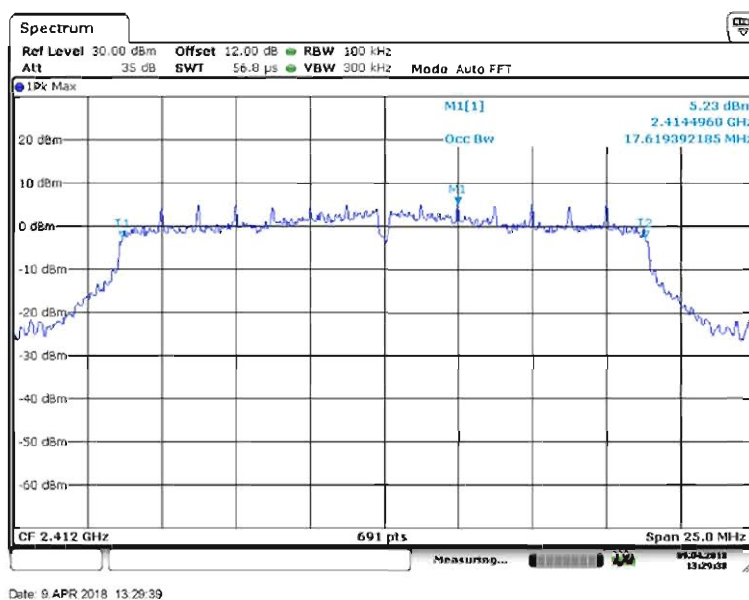
Channel 11 (2462MHz)



Test Item	: 99% Occupied Bandwidth
Test Mode	: Mode 3: Transmit by 802.11n(20MHz)

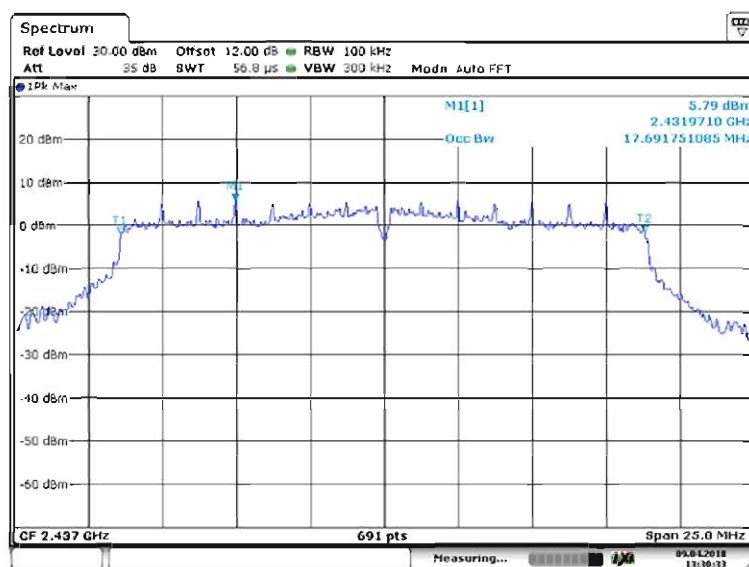
Channel	Frequency(MHz)	99% Occupied Bandwidth (MHz)
01	2412	17.619
06	2437	17.692
11	2462	17.656

Channel 01 (2412MHz)



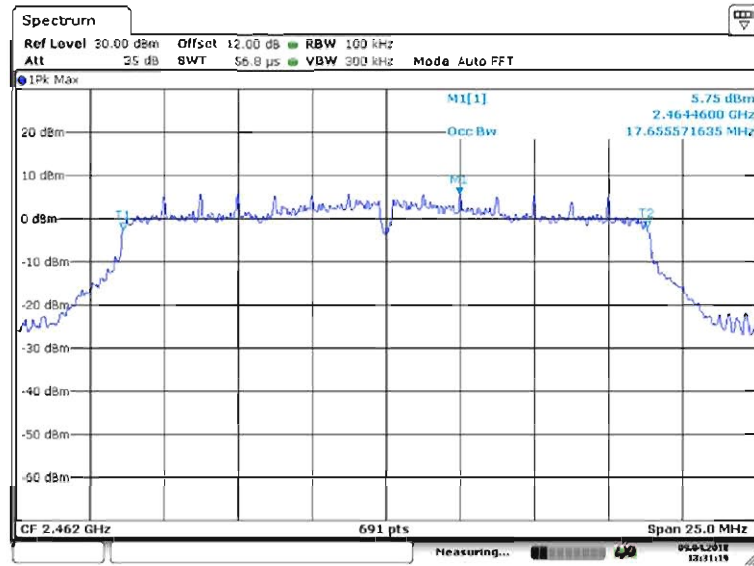
Date: 9 APR 2018 13:29:39

Channel 06 (2437MHz)



Date: 9 APR 2018 13:30:34

Channel 11 (2462MHz)



Date: 9 APR.2018 13:31:19

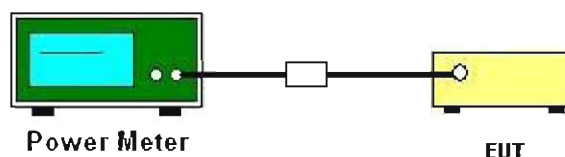
6. Peak Output Power

6.1. Test Equipment

Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
Power Meter	R&S	NRP2	104761	2017.10.24
Shielding Room No. 1	EMC	9m*4m*3m	/	2016.08
Temperature/Humidity Meter	/	HTC-1	/	2017.11.08

Note 1: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

6.2. Test Setup



6.3. Limit

For systems using digital modulation in the 2400-2483.5MHz, the limit for peak output power is 30dBm. If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

6.4. Test Procedure

1. The testing follows FCC KDB No. 558074 D01 DTS Meas Guidance v04.
2. The RF output of EUT was connected to the power meter by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.

6.5. Uncertainty

The measurement uncertainty above 1G is defined as ± 1.27 dB.

6.6. Test Result

Test Item	: Peak Output Power
Test Mode	: Mode 4: Transmit by Bluetooth v4.0 + LE

Channel	Frequency(MHz)	Peak Output Power(dBm)	Max Limit(dBm)	Pass/Fail
00	2402	-0.81	30	Pass
19	2440	-1.48	30	Pass
39	2480	-2.56	30	Pass

Test Item	: Peak Output Power
Test Mode	: Mode 1: Transmit by 802.11b

Channel	Frequency(MHz)	Peak Output Power(dBm)	Max Limit(dBm)	Pass/Fail
01	2412	21.10	30	Pass
06	2437	21.35	30	Pass
11	2462	21.72	30	Pass

Test Item	: Peak Output Power
Test Mode	: Mode 2: Transmit by 802.11g

Channel	Frequency(MHz)	Peak Output Power(dBm)	Max Limit(dBm)	Pass/Fail
01	2412	23.72	30	Pass
06	2437	24.03	30	Pass
11	2462	24.26	30	Pass

Test Item	: Peak Output Power
Test Mode	: Mode 3: Transmit by 802.11n(20MHz)

Channel	Frequency(MHz)	Peak Output Power(dBm)	Max Limit(dBm)	Pass/Fail
01	2412	23.86	30	Pass
06	2437	24.32	30	Pass
11	2462	24.53	30	Pass

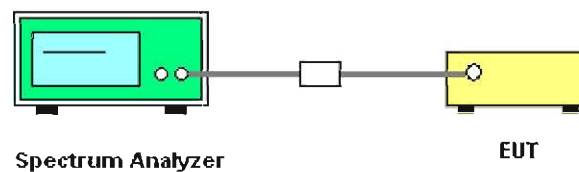
7. Power Spectral Density

7.1. Test Equipment

Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
Spectrum Analyzer	R&S	FSV40	101155	2017.10.24
Shielding Room No. 1	EMC	9m*4m*3m	/	2016.08
Temperature/Humidity Meter	/	HTC-1	/	2017.11.08

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

7.2. Test Setup



7.3. Limit

The peak power spectral density shall not be greater than 8dBm in any 3kHz band at any time interval of continuous transmission.

7.4. Test Procedure

1. The testing follows Measurement Procedure 10.2 Method PKPSD of FCC KDB Publication No. 558074 D01 DTS Meas Guidance v04.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.
7. The Measured power density (dBm)/ 100kHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

7.5. Uncertainty

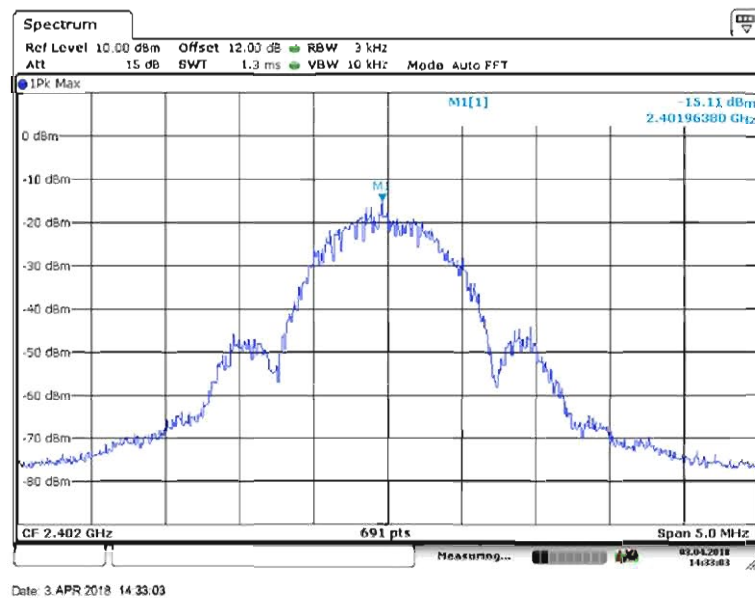
The measurement uncertainty is defined as ± 1 kHz

7.6. Test Result

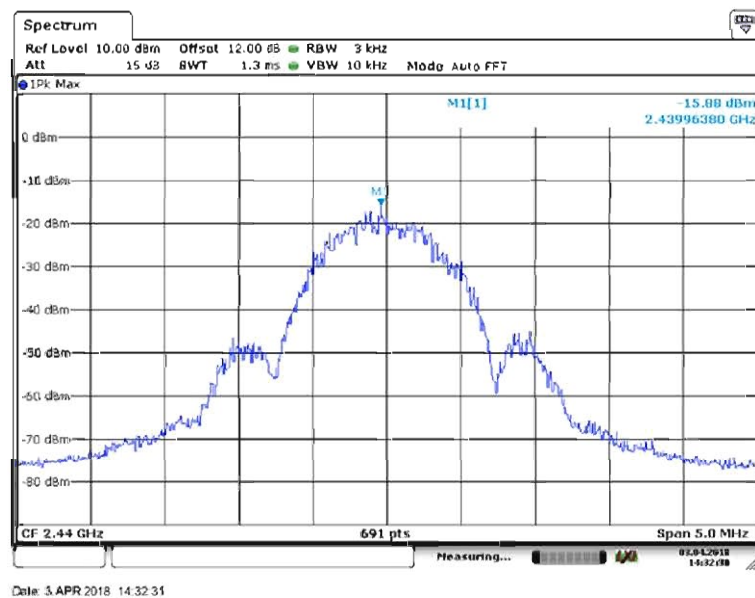
Test Item	: Power Spectral Density
Test Mode	: Mode 4: Transmit by Bluetooth v4.0 + LE

Channel	Frequency(MHz)	Power Spectral Density (dBm)	Max Limit(dBm/3kHz)	Pass/Fail
00	2402	-15.11	8	Pass
19	2440	-15.88	8	Pass
39	2480	-16.88	8	Pass

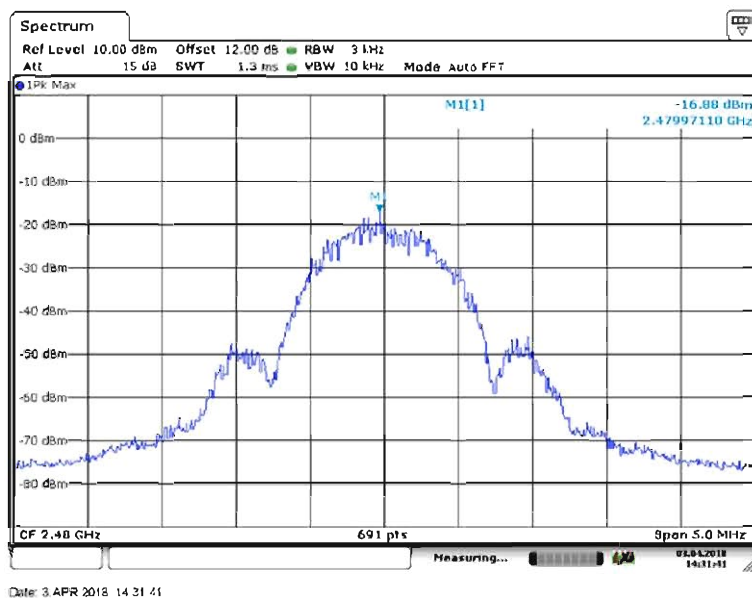
Channel 00 (2402MHz)



Channel 19 (2440MHz)



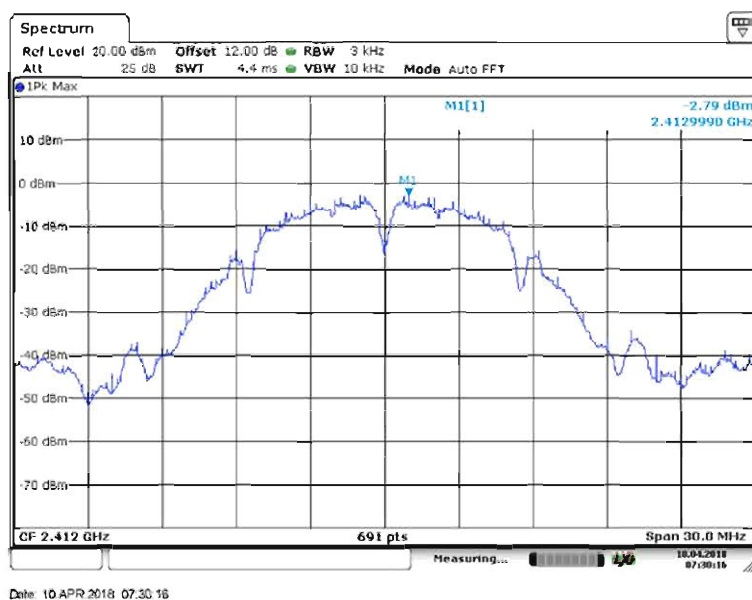
Channel 39 (2480MHz)



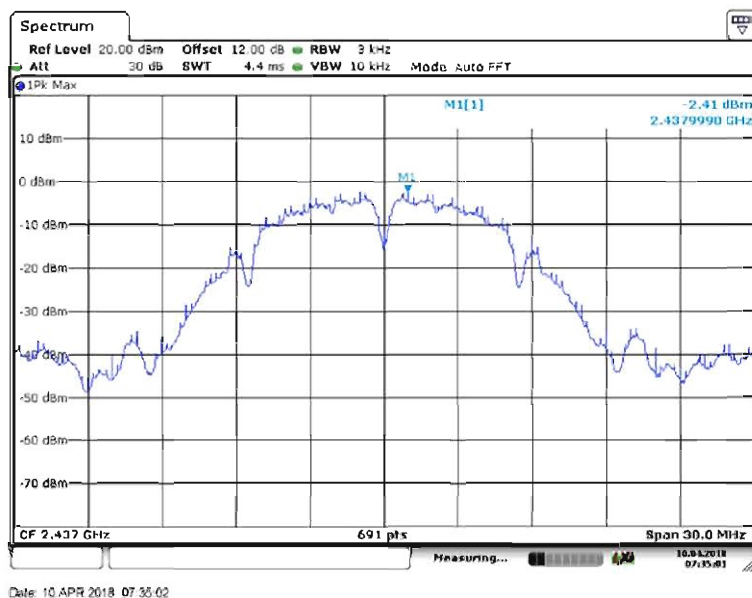
Test Item	: Power Spectral Density
Test Mode	: Mode 1: Transmit by 802.11b

Channel	Frequency(MHz)	Power Spectral Density (dBm)	Max Limit(dBm/3kHz)	Pass/Fail
01	2412	-2.79	8	Pass
06	2437	-2.41	8	Pass
11	2462	-2.38	8	Pass

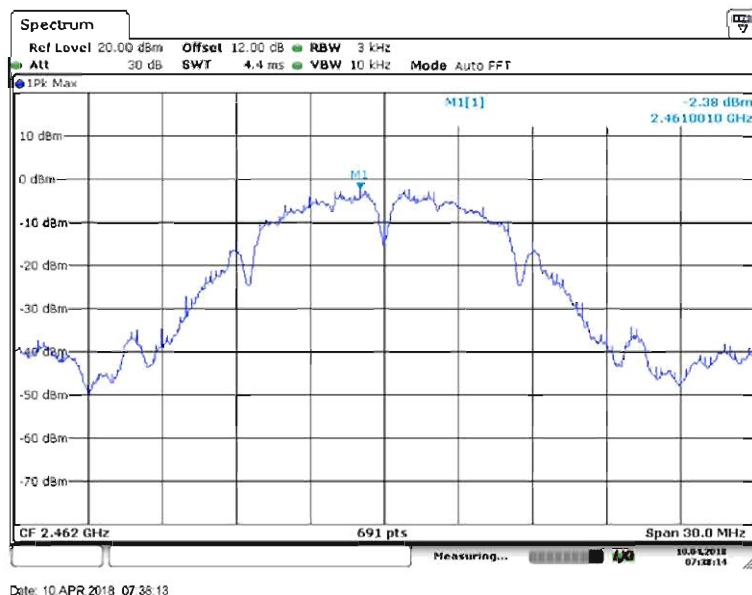
Channel 01 (2412MHz)



Channel 06 (2437MHz)



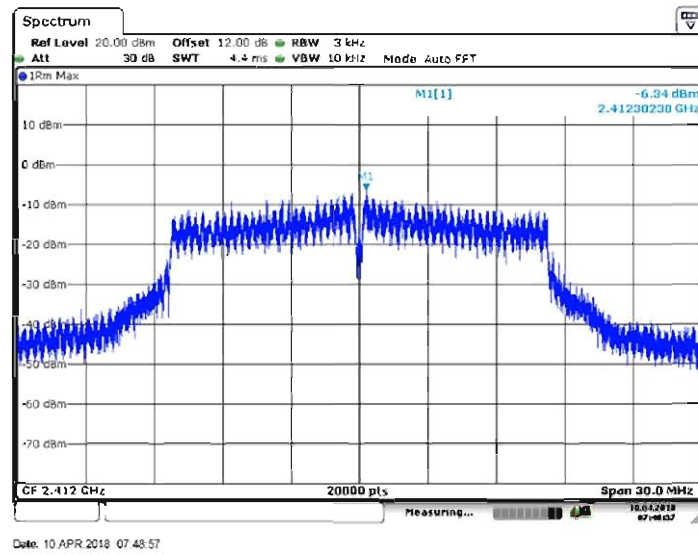
Channel 11 (2462MHz)



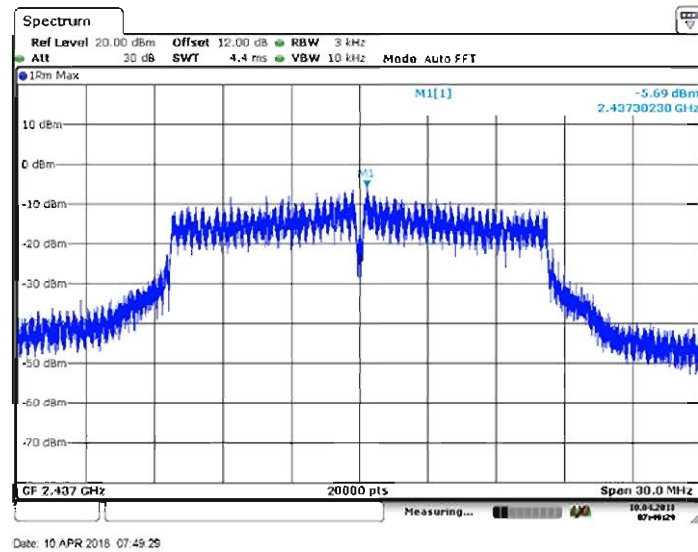
Test Item	: Power Spectral Density
Test Mode	: Mode 2: Transmit by 802.11g

Channel	Frequency(MHz)	Power Spectral Density (dBm)	Max Limit(dBm/3kHz)	Pass/Fail
01	2412	-6.34	8	Pass
06	2437	-5.69	8	Pass
11	2462	-5.85	8	Pass

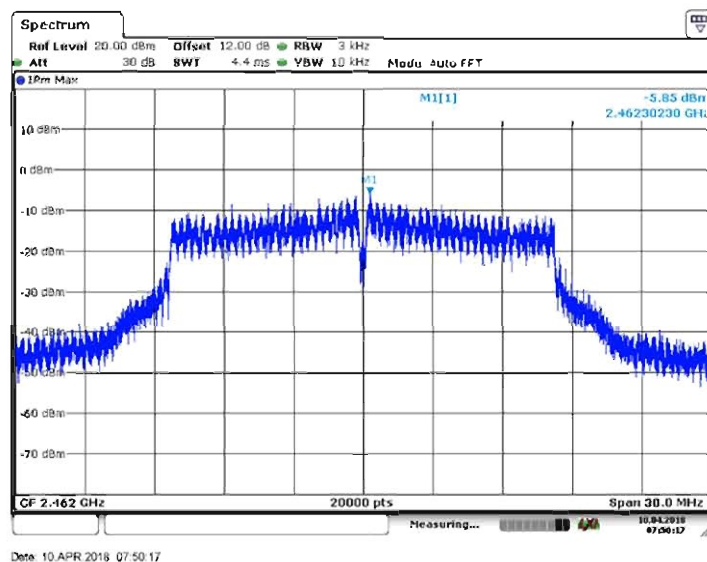
Channel 01 (2412MHz)



Channel 06 (2437MHz)



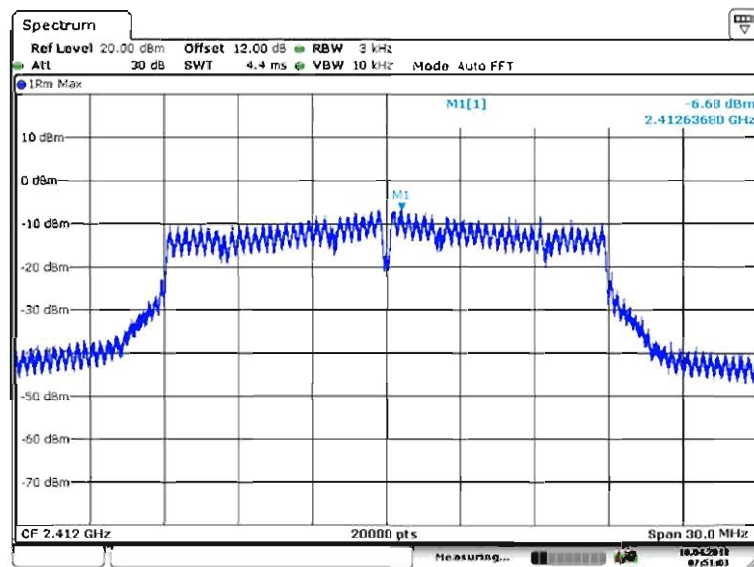
Channel 11 (2462MHz)



Test Item	: Power Spectral Density
Test Mode	: Mode 3: Transmit by 802.11n(20MHz)

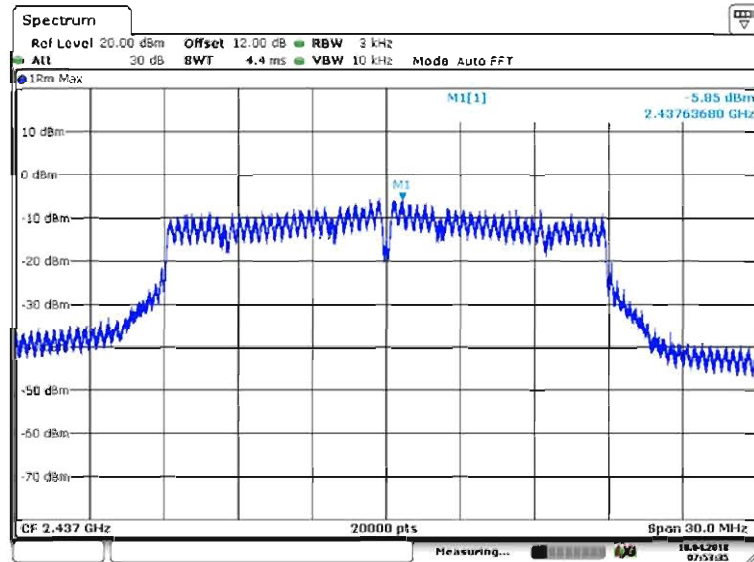
Channel	Frequency(MHz)	Power Spectral Density (dBm)	Max Limit(dBm/3kHz)	Pass/Fail
01	2412	-6.68	8	Pass
06	2437	-5.85	8	Pass
11	2462	-5.88	8	Pass

Channel 01 (2412MHz)



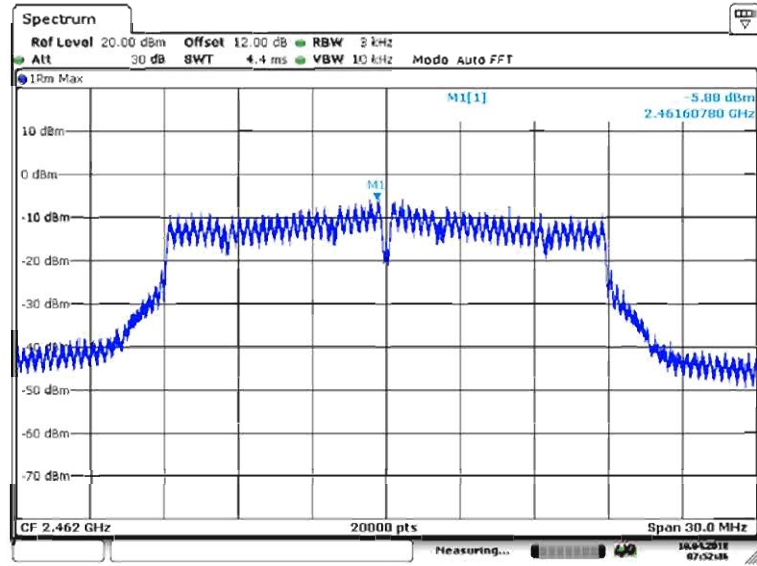
Date: 10 APR 2018 07:51:02

Channel 06 (2437MHz)



Date: 10 APR 2018 07:53:36

Channel 11 (2462MHz)



Date: 10 APR 2018 07:52:36

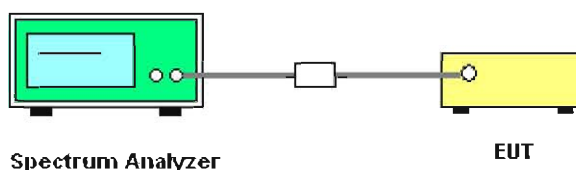
8. Conducted Band Edges and Spurious Emission

8.1. Test Equipment

Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
Spectrum Analyzer	R&S	FSV40	101155	2017.10.24
Shielding Room No. 1	EMC	9m*4m*3m	/	2016.08
Temperature/Humidity Meter	/	HTC-1	/	2017.11.08

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

8.2. Test Setup



8.3. Limit

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

8.4. Test Procedure

1. The testing follows FCC KDB Publication No.558074 D01 DTS Meas Guidance v04.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions measured in any 100kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

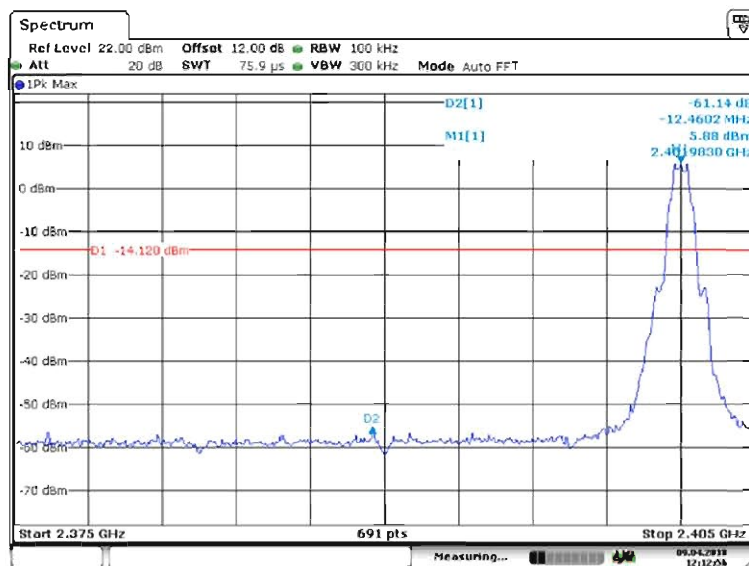
8.5. Uncertainty

The measurement uncertainty is defined as ± 1.27 dB

8.6. Test Result

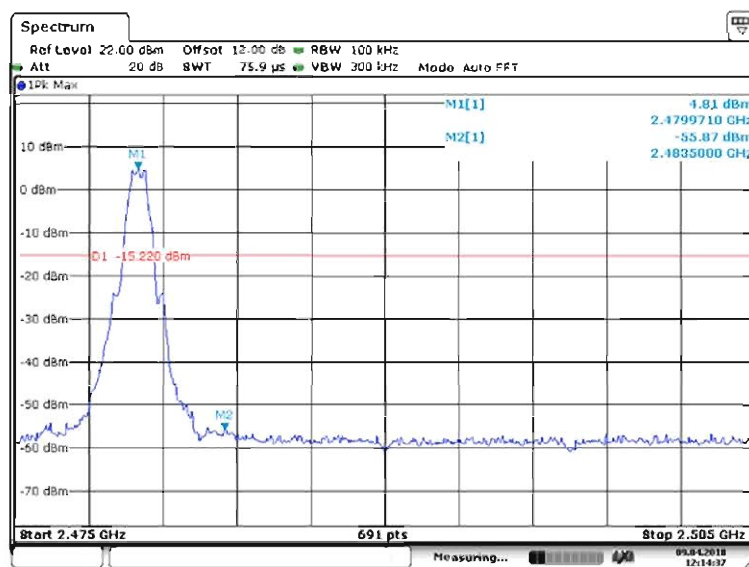
Test Item	: Conducted Band Edges
Test Mode	: Mode 4: Transmit by Bluetooth v4.0 + LE

Channel 00 (2402MHz)



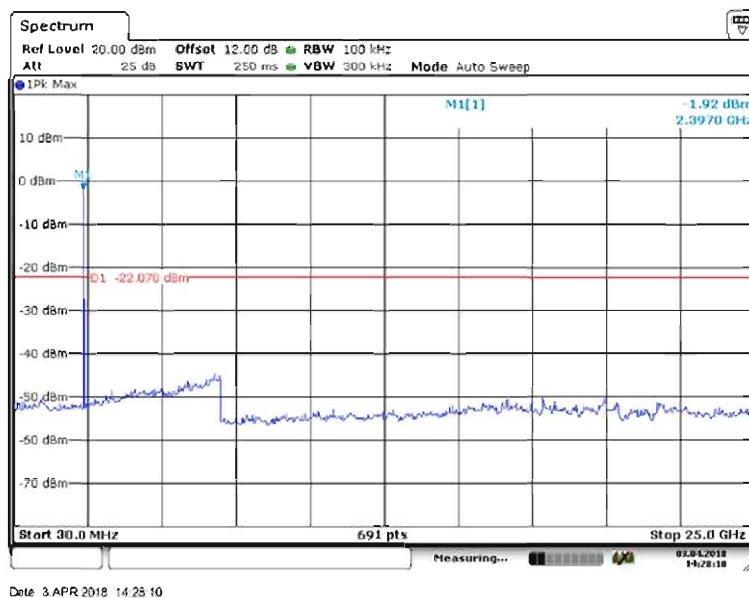
Date: 9 APR 2018 12:12:58

Channel 39 (2480MHz)



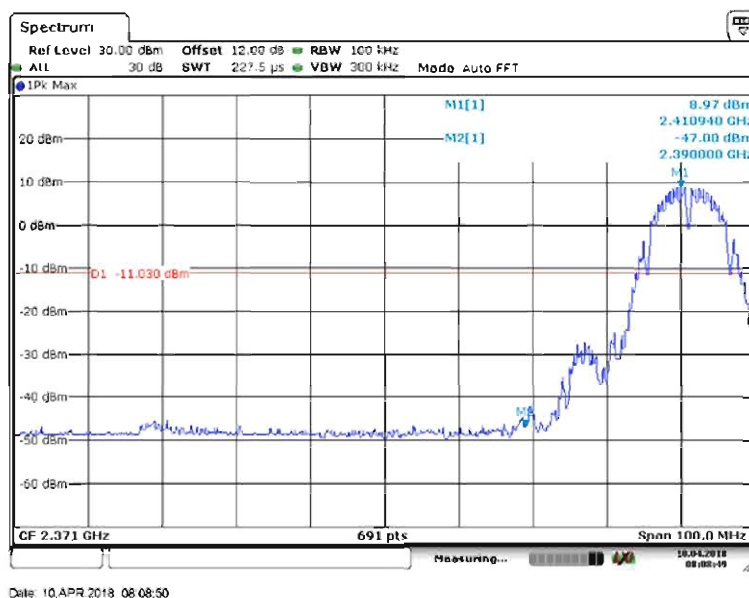
Date: 9 APR 2018 12:14:37

Test Item	: Spurious Emission
Test Mode	: Mode 4: Transmit by Bluetooth v4.0 + LE

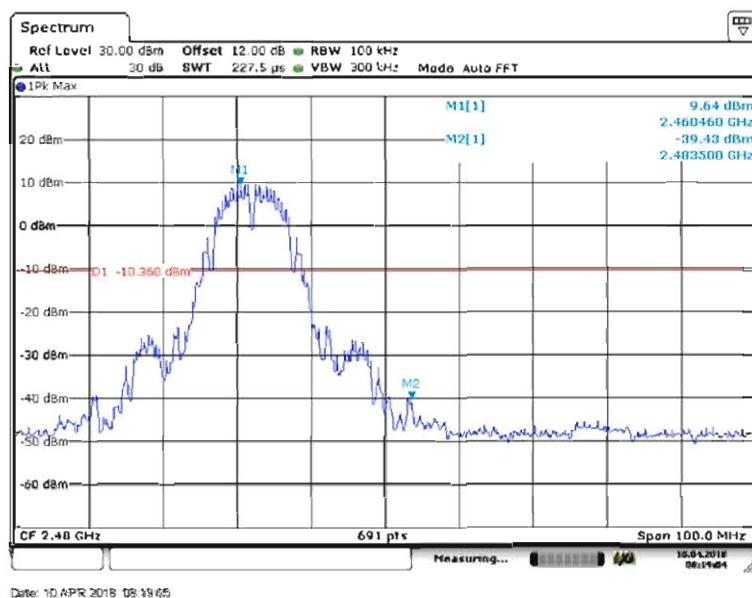


Test Item	: Conducted Band Edges
Test Mode	: Mode 1: Transmit by 802.11b

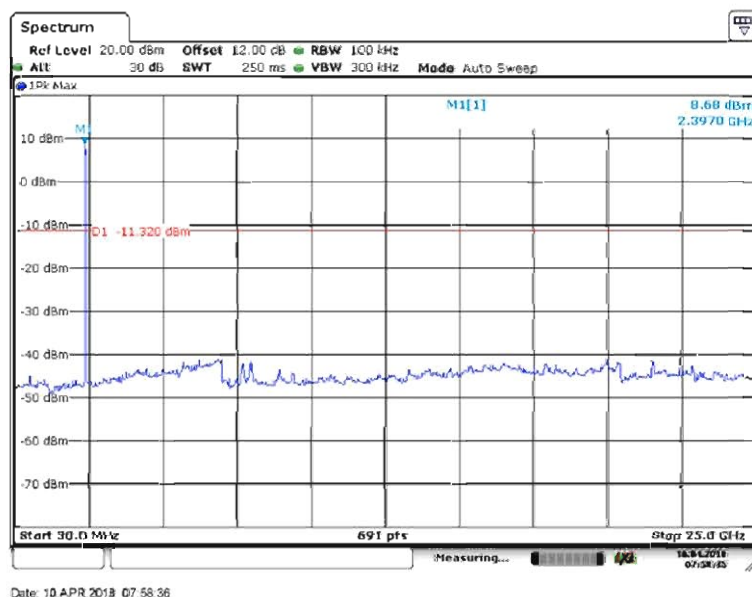
Channel 01 (2412MHz)



Channel 11 (2462MHz)

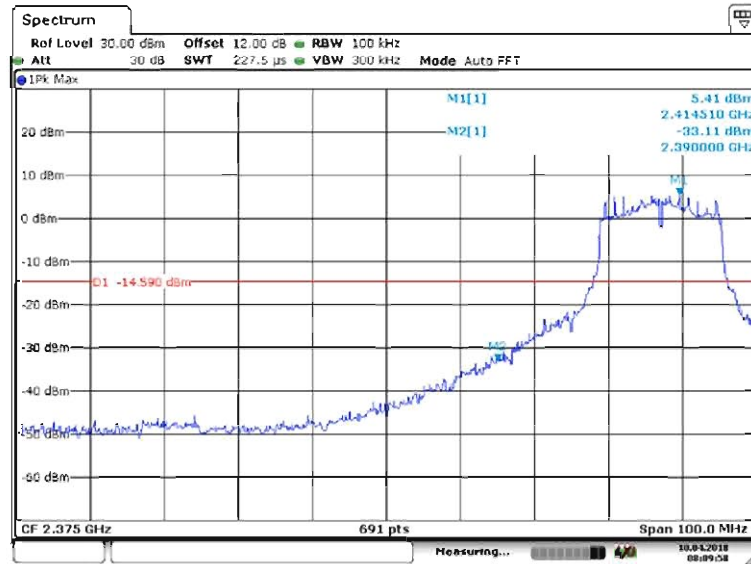


Test Item	: Spurious Emission
Test Mode	: Mode 1: Transmit by 802.11b



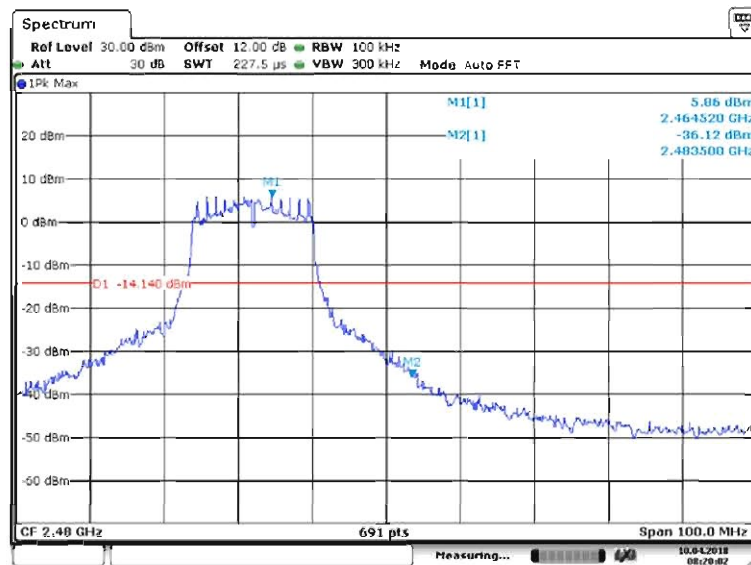
Test Item	: Conducted Band Edges
Test Mode	: Mode 2: Transmit by 802.11g

Channel 01 (2412MHz)



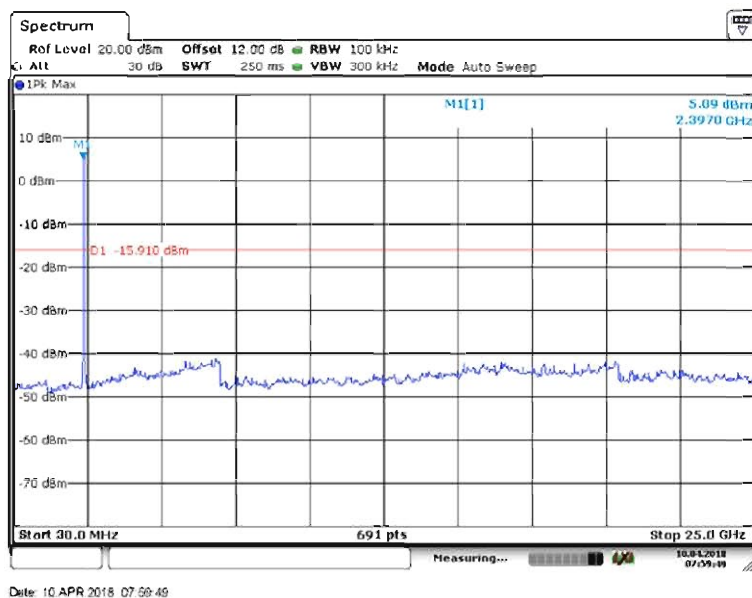
Date: 10 APR 2018 08:09:58

Channel 11 (2462MHz)



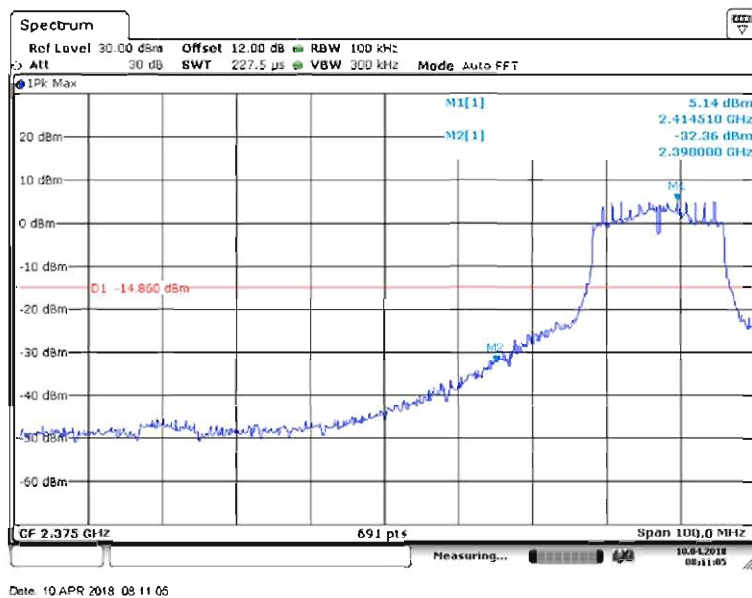
Date: 10 APR 2018 08:20:02

Test Item	: Spurious Emission
Test Mode	: Mode 2: Transmit by 802.11g

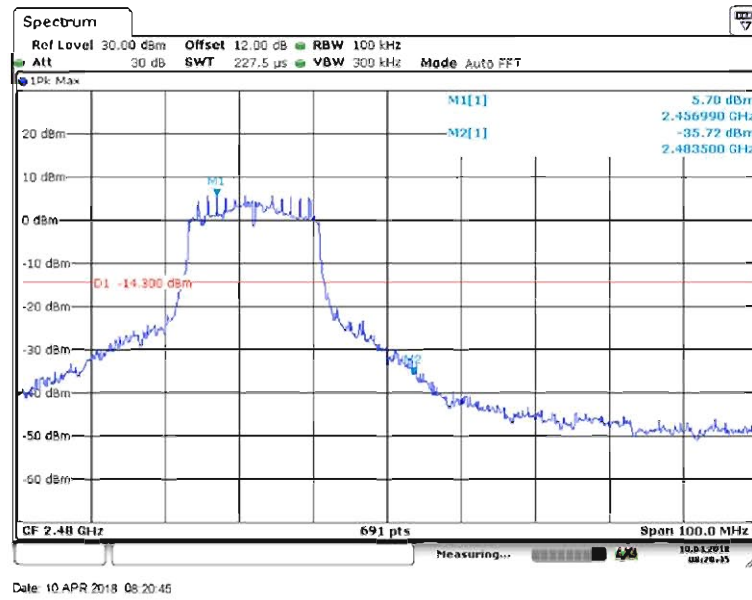


Test Item	: Conducted Band Edges
Test Mode	: Mode 3: Transmit by 802.11n(20MHz)

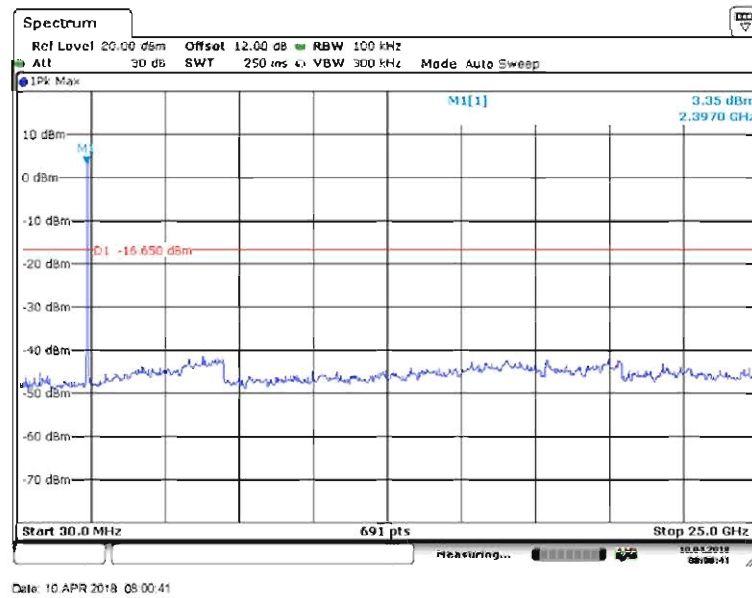
Channel 01 (2412MHz)



Channel 11 (2462MHz)



Test Item	: Spurious Emission
Test Mode	: Mode 3: Transmit by 802.11n(20MHz)



9. Antenna requirement**9.1. The requirement**

According to section 15.203, an intentional radiator shall be designed to ensure that no antenna other than the furnished by the responsible party shall be used with the device.

9.2. Antenna construction

Device is equipped with permanent attached antenna, which isn't displaced by other antenna. The max antenna gain of EUT is 2dBi. Therefore, the equipment complies with the antenna requirement of section 15.203.