

FCC Test Report

Product Name	Wi-Fi Module
Model No.	WSDB-741
FCC ID.	W2Z-02100006

Applicant	FUJIFILM CORPORATION
Address	7-3, Akasaka 9-chome, Minato-ku, Tokyo 107-0052, Japan

Date of Receipt	Oct. 12, 2017
Issued Date	Nov. 15, 2017
Report No.	17A0124R-RFUSP73V00
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 standard through the calibration report of the equipment and evaluated measurement uncertainty herein.

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Test Report

Issued Date: Nov. 15, 2017

Report No.: 17A0124R-RFUSP73V00



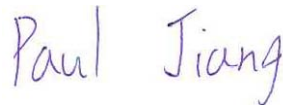
Product Name	Wi-Fi Module
Applicant	FUJIFILM CORPORATION
Address	7-3,Akasaka 9-chome,Minato-ku,Tokyo 107-0052,Japan
Manufacturer	VIEWQUEST Technologies(china)Inc.
Model No.	WSDB-741
FCC ID.	W2Z-02100006
EUT Rated Voltage	DC 3.3V
EUT Test Voltage	DC 3.3V
Trade Name	FUJIFILM
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2016 ANSI C63.4: 2014, ANSI C63.10: 2013 KDB 558074 D01 DTS Meas Guidance v04
Test Result	Complied

Documented By :



(Adm. Assistant / Peggy Tu)

Tested By :



(Engineer / Paul Jiang)

Approved By :



(Director / Vincent Lin)

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1. GENERAL INFORMATION

1.1. EUT Description

Product Name	Wi-Fi Module
Trade Name	FUJIFILM
Model No.	WSDB-741
FCC ID.	W2Z-02100006
Frequency Range	2402 – 2480MHz
Channel Number	V4.1: 40CH
Type of Modulation	V4.1: GFSK(1Mbps)
Antenna Type	Chip Antenna
Channel Control	Auto
Antenna Gain	Refer to the table “Antenna List”

Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	YAGEO	8010 Ceramic Chip Antenna	Chip Antenna	5.88dBi for 2.4 GHz

Note: The antenna of EUT is conforming to FCC 15.203.

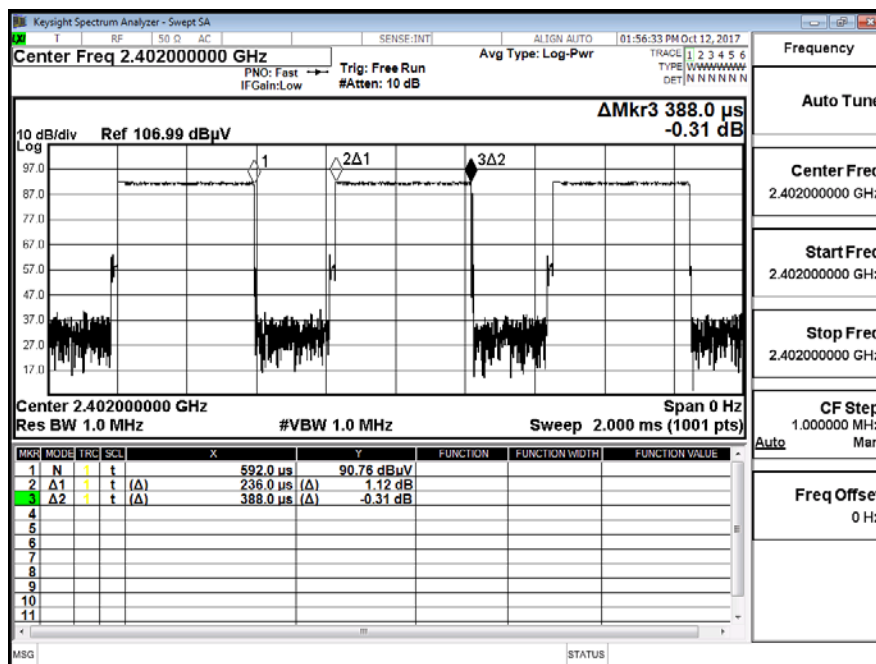
Center Frequency of Each Channel: (For V4.1)

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 00:	2402 MHz	Channel 01:	2404 MHz	Channel 02:	2406 MHz	Channel 03:	2408 MHz
Channel 04:	2410 MHz	Channel 05:	2412 MHz	Channel 06:	2414 MHz	Channel 07:	2416 MHz
Channel 08:	2418 MHz	Channel 09:	2420 MHz	Channel 10:	2422 MHz	Channel 11:	2424 MHz
Channel 12:	2426 MHz	Channel 13:	2428 MHz	Channel 14:	2430 MHz	Channel 15:	2432 MHz
Channel 16:	2434 MHz	Channel 17:	2436 MHz	Channel 18:	2438 MHz	Channel 19:	2440 MHz
Channel 20:	2442 MHz	Channel 21:	2444 MHz	Channel 22:	2446 MHz	Channel 23:	2448 MHz
Channel 24:	2450 MHz	Channel 25:	2452 MHz	Channel 26:	2454 MHz	Channel 27:	2456 MHz
Channel 28:	2458 MHz	Channel 29:	2460 MHz	Channel 30:	2462 MHz	Channel 31:	2464 MHz
Channel 32:	2466 MHz	Channel 33:	2468 MHz	Channel 34:	2470 MHz	Channel 35:	2472 MHz
Channel 36:	2474 MHz	Channel 37:	2476 MHz	Channel 38:	2478 MHz	Channel 39:	2480 MHz

Duty Cycle:

BLE	62.18%
-----	--------

*Duty cycle = $T_{on} / (T_{on} + T_{off})$



Note:

1. The EUT is a Wi-Fi Module with a built-in WLAN&Bluetooth transceiver, this report for Bluetooth.
2. These tests were conducted on a sample for the purpose of demonstrating compliance of Bluetooth transmitter with Part 15 Subpart C Paragraph 15.247 for spread spectrum devices.
3. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
4. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.

Test Mode	Mode 1: Transmit - BLE (GFSK)
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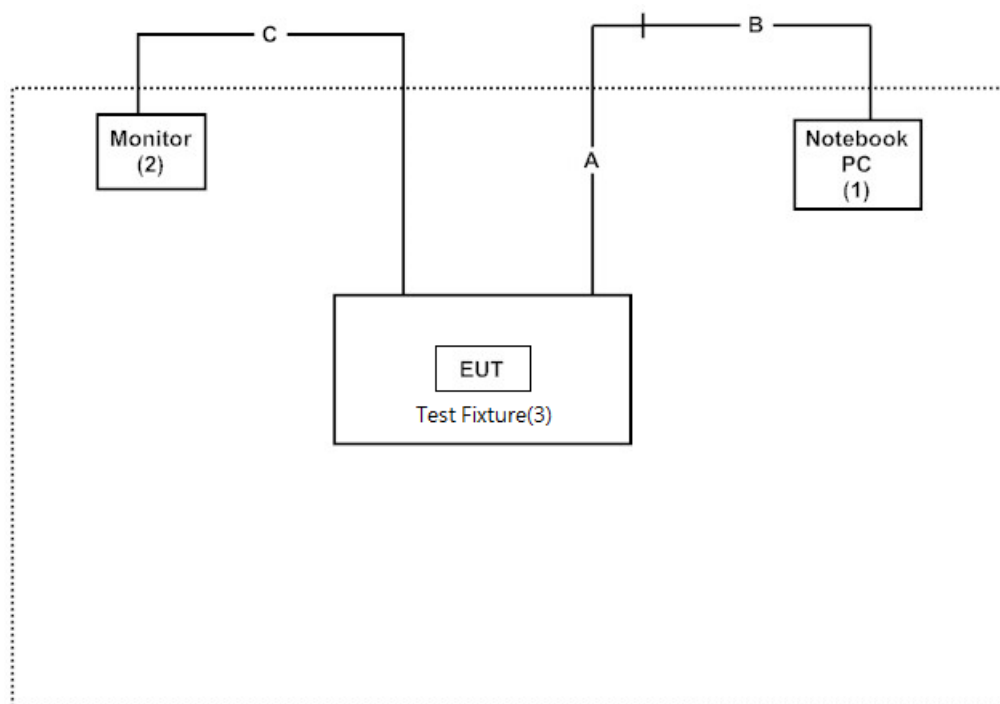
1.3. Tested System Details

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

Product		Manufacturer	Model No.	Serial No.	Power Cord
1	Notebook PC	DELL	Latitude E5440	FS9TK32	Non-Shielded, 1.8m
2	LED Monitor	ViewSonic	VX2257-mhd	UFY163502150	Non-Shielded, 1.8m
3	Test Fixture	FUJIFILM	N/A	N/A	N/A

Signal Cable Type		Signal cable Description
A	Micro USB to USB Cable	Shielded, 0.5m, with one ferrite core bonded.
B	Micro USB Cable	Shielded, 1.8m
C	HDMI Cable	Shielded, 1.8m

1.4. Configuration of Tested System



1.5. EUT Exercise Software

1. Setup the EUT as shown in Section 1.4.
2. Execute software "Vendor Command Read/Write V01.05.20060915.OD" on the Notebook PC.
3. Configure the test mode, the test channel, and the data rate.
4. Press "OK" to start the continuous Transmit.
5. Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	30-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:

<http://www.dekra.com.tw/english/about/certificates.aspx?bval=5>

The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: http://www.dekra.com.tw/index_en.aspx

Site Description: Accredited by TAF
Accredited Number: 3023

Site Name: DEKRA Testing and Certification Co., Ltd
Site Address: No.5-22, Ruishukeng, Linkou Dist., New Taipei City 24451,
Taiwan, R.O.C.
TEL : 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : info.tw@dekra.com

FCC Accreditation Number: TW3023

1.7. List of Test Equipment

For Conducted measurements /CB3/SR8

	Equipment	Manufacturer	Model No.	Serial No.	Cali. Date	Due. Date
X	Spectrum Analyzer	Agilent	N9010A	MY48030495	2017/7/22	2018/7/21
X	Power Meter	Anritsu	ML2495A	6K00003357	2017/6/23	2018/6/22
X	EMI Test Receiver	R&S	ESCS 30	100369	2017/10/13	2018/10/12
X	LISN	R&S	ESH3-Z5	836679/017	2017/1/7	2018/1/6
X	LISN	R&S	ENV216	100097	2017/1/7	2018/1/6
X	Coaxial Cable	QTK(Arnist)	RG 400	LC018-RG	2017/6/25	2018/6/24

For Radiated measurements /Site3/CB8

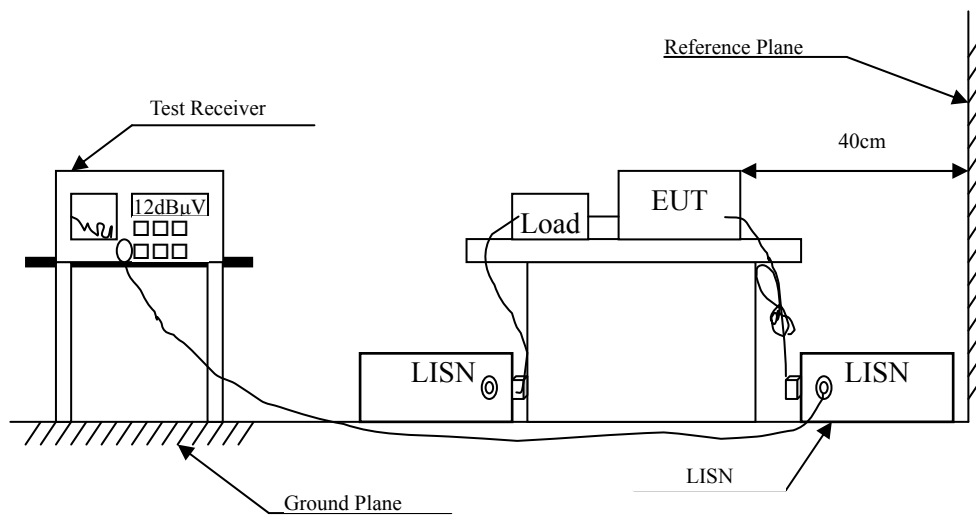
	Equipment	Manufacturer	Model No.	Serial No.	Cali. Date	Due. Date
X	Spectrum Analyzer	R&S	FSP40	100170	2017/1/5	2018/1/4
X	Loop Antenna	Teseq	HLA6121	37133	2017/3/18	2018/3/17
X	Bi-Log Antenna	Schaffner Chase	CBL6112B	2707	2017/9/10	2018/9/9
X	Horn Antenna	ETS-Lindgren	3117	00135205	2017/4/6	2018/4/5
X	Horn Antenna	Schwarzbeck	BBHA9170	9170430	2017/1/11	2018/1/10
X	Pre-Amplifier	QTK	AP/0100A	CHM/0901069	2017/6/28	2018/6/27
X	Pre-Amplifier	EMCI	EMC012630SE	980210	2017/1/27	2018/1/26
X	Pre-Amplifier	NARDA WE	DBL-1840N506	013	2017/9/30	2018/9/29
X	Filter	MicroTRON	BRM50701	019	2017/10/20	2018/10/19
X	Filter	Microwave Circuits	N0257881	36681	2016/12/7	2017/12/6
X	EMI Test Receiver	R&S	ESR26	101385	2017/9/29	2018/9/28
X	Coaxial Cable	QTK(Arnist)	SUCOFLEX 106	L1606-015C	2017/6/25	2018/6/24
X	EMI Test Receiver	R&S	ESCS 30	838251/001	2017/7/21	2018/7/20
X	Coaxial Cable	QTK(Arnist)	RG 214	LC003-RG	2017/6/21	2018/6/20
X	Coaxial signal switch	Anritsu	MP59B	6201415889	2017/6/16	2018/6/15

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : QuieTek EMI 2.0 V2.1.113

2. Conducted Emission

2.1. Test Setup



2.2. Limits

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

Remarks: In the above table, the tighter limit applies at the band edges.

2.3. Test Procedure

The EUT and Peripherals are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all the interface cables must be changed according to ANSI C63.4: 2014 on conducted measurement.

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

The EUT was setup to ANSI C63.4, 2014; tested to DTS test procedure of FCC KDB-558074 for compliance to FCC 47CFR Subpart C requirements.

2.4. Uncertainty

± 2.26 dB

2.5. Test Result of Conducted Emission

Product : Wi-Fi Module
 Test Item : Conducted Emission Test
 Power Line : Line 1
 Test date : 2017/10/30
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

Frequency MHz	Correct Factor dB	Reading Level dBμV	Measurement Level dBμV	Margin dB	Limit dBμV
LINE 1					
Quasi-Peak					
0.209	9.773	29.870	39.643	-24.671	64.314
0.263	9.761	30.490	40.251	-22.520	62.771
0.435	9.737	33.770	43.507	-14.350	57.857
0.584	9.747	29.650	39.397	-16.603	56.000
3.771	9.886	24.300	34.186	-21.814	56.000
8.576	9.948	23.170	33.118	-26.882	60.000
Average					
0.209	9.773	9.140	18.913	-35.401	54.314
0.263	9.761	19.020	28.781	-23.990	52.771
0.435	9.737	18.860	28.597	-19.260	47.857
0.584	9.747	13.860	23.607	-22.393	46.000
3.771	9.886	13.860	23.746	-22.254	46.000
8.576	9.948	16.960	26.908	-23.092	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. "■" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : Wi-Fi Module
 Test Item : Conducted Emission Test
 Power Line : Line 2
 Test date : 2017/10/30
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

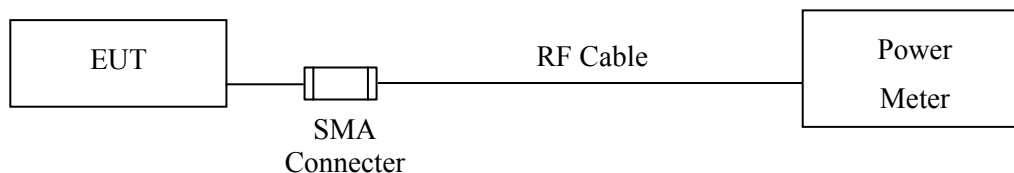
Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dB μ V	dB μ V	dB	dB μ V
LINE 2					
Quasi-Peak					
0.185	9.736	37.500	47.236	-17.764	65.000
0.302	9.759	32.400	42.159	-19.498	61.657
0.447	9.774	31.120	40.894	-16.620	57.514
0.556	9.797	28.130	37.927	-18.073	56.000
3.716	9.954	25.430	35.384	-20.616	56.000
20.709	10.258	18.320	28.578	-31.422	60.000
Average					
0.185	9.736	25.710	35.446	-19.554	55.000
0.302	9.759	13.170	22.929	-28.728	51.657
0.447	9.774	15.010	24.784	-22.730	47.514
0.556	9.797	8.910	18.707	-27.293	46.000
3.716	9.954	15.280	25.234	-20.766	46.000
20.709	10.258	10.830	21.088	-28.912	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. "■" means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

3. Peak Power Output

3.1. Test Setup



3.2. Limit

The maximum peak power shall be less 1Watt.

3.3. Test Procedure

Tested according to DTS test procedure of KDB 558074 for compliance to FCC 47CFR 15.247 requirements. The maximum peak conducted output power using KDB 558074 section 9.1.3 PKPM1 Peak power meter method.

3.4. Uncertainty

± 1.19 dB

3.5. Test Result of Peak Power Output

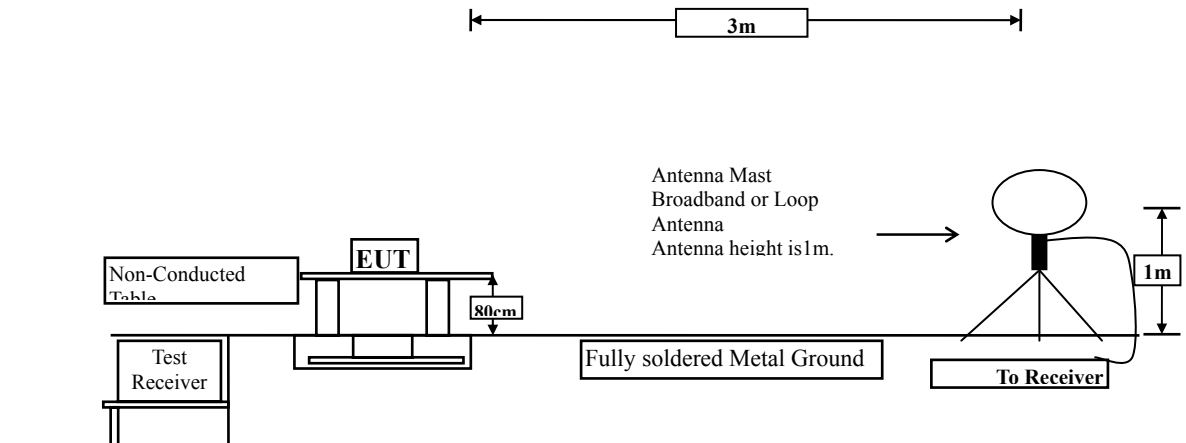
Product : Wi-Fi Module
Test Item : Peak Power Output
Test Site : No.3 OATS
Test date : 2017/11/09
Test Mode : Mode 1: Transmit - BLE (GFSK)

Channel No.	Frequency (MHz)	Measurement (dBm)	Required Limit	Result
Channel 00	2402.00	9.29	1 Watt= 30 dBm	Pass
Channel 19	2440.00	9.26	1 Watt= 30 dBm	Pass
Channel 39	2480.00	8.91	1 Watt= 30 dBm	Pass

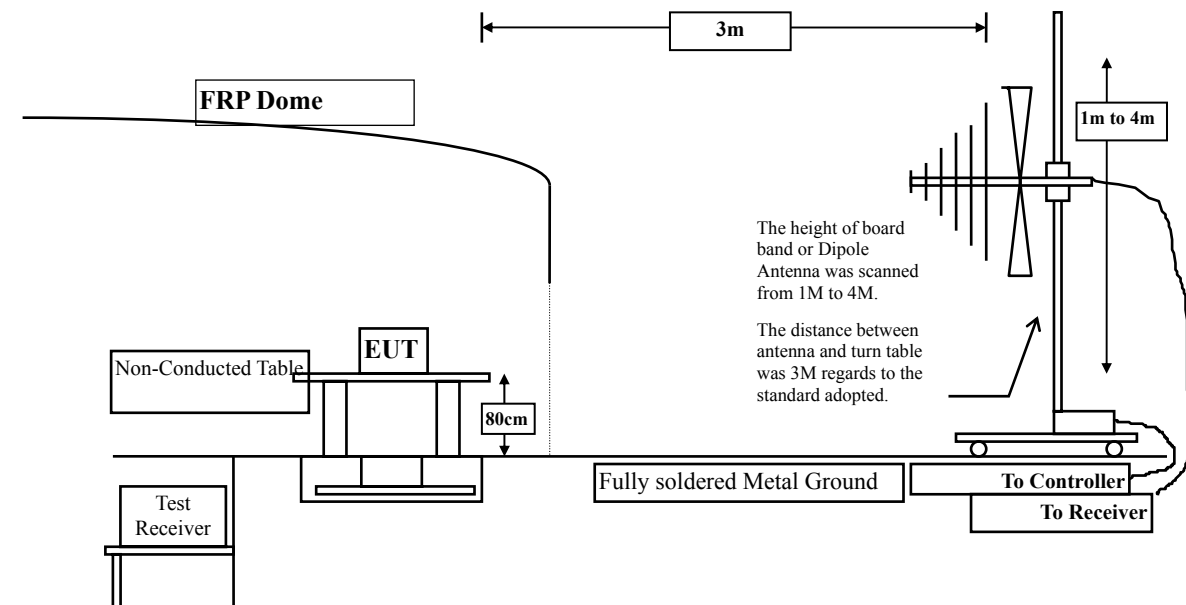
4. Radiated Emission

4.1. Test Setup

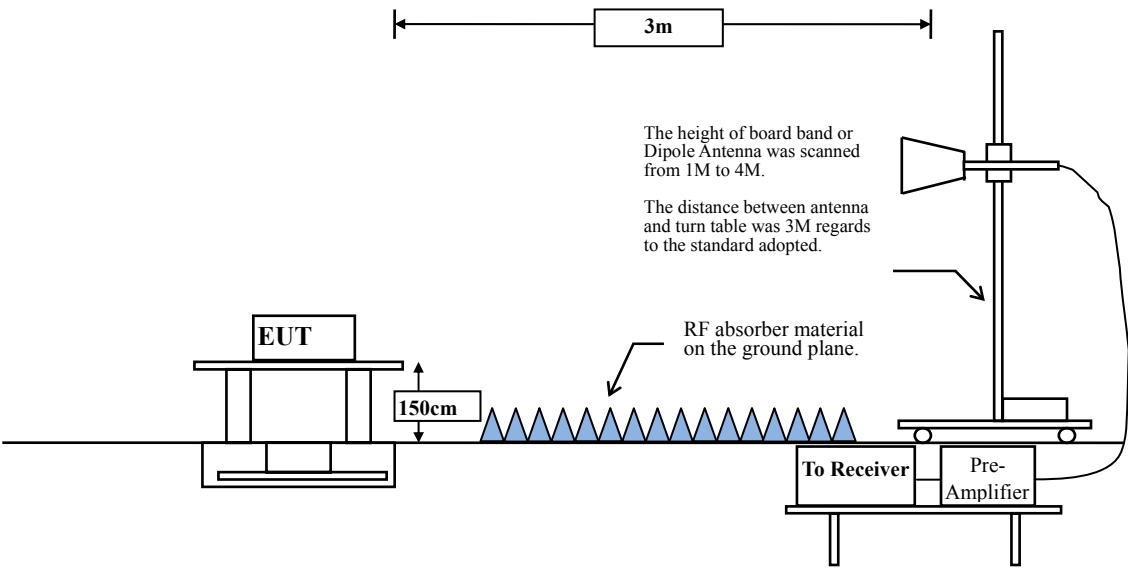
Under 30MHz



Below 1GHz



Above 1GHz



4.2. Limits

➤ General Radiated Emission Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 20dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209 Limits		
Frequency MHz	Field strength (microvolts/meter)	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

- Remarks:
1. RF Voltage (dBμV) = 20 log RF Voltage (uV)
 2. In the Above Table, the tighter limit applies at the band edges.
 3. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

4.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013 and tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Measuring the frequency range below 1GHz, the EUT is placed on a turn table which is 0.8 meter above ground, when measuring the frequency range above 1GHz, the EUT is placed on a turn table which is 1.5 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 between 1 meter and 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 C63.10: 2013 on radiated measurement.

The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz is 1MHz.

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

The worst radiated emission is measured in the Open Area Test Site on the Final Measurement.

The measurement frequency range from 9kHz - 10th Harmonic of fundamental was investigated.

The average measurement tested according to KDB 558074 section 12.2.5.3. Reduced VBW averaging across on- and off-times of the EUT transmissions with max hold.

$VBW \geq 1/T$:

Duty Cycle	T	1/T	VBW Setting
62.18%	0.3880	2577	3K

4.4. Uncertainty

± 4.08 dB above 1GHz

± 4.22 dB below 1GHz

4.5. Test Result of Radiated Emission

Product : Wi-Fi Module
 Test Item : Harmonic Radiated Emission
 Test Site : No.3 OATS
 Test date : 2017/10/28
 Test Mode : Mode 1: Transmit - BLE (GFSK)(2402MHz)

Frequency MHz	Correct Factor dB	Reading Level dBμV	Measurement Level dBμV/m	Margin dB	Limit dBμV/m
Horizontal					
Peak Detector:					
4804.000	2.511	39.715	42.225	-31.775	74.000
7206.000	9.511	38.077	47.588	-26.412	74.000
9608.000	10.394	38.447	48.841	-25.159	74.000
Average Detector:					
--					
Vertical					
Peak Detector:					
4804.000	2.923	39.772	42.694	-31.306	74.000
7206.000	9.988	37.605	47.594	-26.406	74.000
9608.000	10.847	37.027	47.874	-26.126	74.000
Average Detector:					
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 3 KHz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Wi-Fi Module
 Test Item : Harmonic Radiated Emission
 Test Site : No.3 OATS
 Test date : 2017/10/28
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dB μ V	dB μ V/m	dB	dB μ V/m
Horizontal					
Peak Detector:					
4880.000	2.038	40.217	42.255	-31.745	74.000
7320.000	9.699	37.479	47.178	-26.822	74.000
9760.000	9.665	39.230	48.895	-25.105	74.000
Average					
Detector:					
--					
Vertical					
Peak Detector:					
4880.000	2.499	40.826	43.325	-30.675	74.000
7320.000	10.303	37.348	47.651	-26.349	74.000
9760.000	10.299	37.599	47.899	-26.101	74.000
Average					
Detector:					
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 3 KHz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Wi-Fi Module
 Test Item : Harmonic Radiated Emission
 Test Site : No.3 OATS
 Test date : 2017/10/28
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2480MHz)

Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level		
	dB	dB μ V	dB μ V/m	dB	dB μ V/m
Horizontal					
Peak Detector:					
4960.000	2.582	40.669	43.251	-30.749	74.000
7440.000	10.555	38.286	48.841	-25.159	74.000
9920.000	10.206	38.335	48.541	-25.459	74.000
Average					
Detector:					
--					
Vertical					
Peak Detector:					
4960.000	3.398	39.460	42.859	-31.141	74.000
7440.000	11.214	37.380	48.594	-25.406	74.000
9920.000	11.245	37.407	48.652	-25.348	74.000
Average					
Detector:					
--					

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 3 KHz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : Wi-Fi Module
 Test Item : General Radiated Emission
 Test Site : No.3 OATS
 Test date : 2017/10/27
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

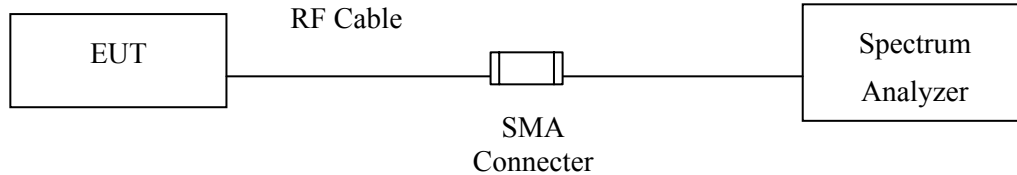
Frequency MHz	Correct Factor dB	Reading Level dB μ V	Measurement Level dB μ V/m	Margin dB	Limit dB μ V/m
Horizontal					
152.220	-7.926	39.595	31.669	-11.831	43.500
195.870	-10.482	42.286	31.804	-11.696	43.500
295.780	-4.747	35.267	30.520	-15.480	46.000
396.660	0.771	32.233	33.004	-12.996	46.000
525.670	3.131	25.518	28.649	-17.351	46.000
702.210	2.753	26.684	29.437	-16.563	46.000
Vertical					
101.780	-5.570	38.244	32.673	-10.827	43.500
196.840	-5.691	39.747	34.056	-9.444	43.500
353.980	-1.124	30.851	29.727	-16.273	46.000
600.360	1.302	27.305	28.607	-17.393	46.000
691.540	2.092	25.021	27.113	-18.887	46.000
826.370	2.879	25.330	28.209	-17.791	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 3 KHz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss – Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.
8. No emission found between lowest internal used/generated frequency to 30MHz.

5. RF Antenna Conducted Test

5.1. Test Setup



5.2. Limits

According to FCC Section 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 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, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

5.3. Test Procedure

The EUT was tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

5.4. Uncertainty

$\pm 1.20\text{dB}$

5.5. Test Result of RF Antenna Conducted Test

Product : Wi-Fi Module
Test Item : RF Antenna Conducted Test
Test Site : No.3 OATS
Test date : 2017/10/26
Test Mode : Mode 1: Transmit - BLE (GFSK)

Figure Channel 00:

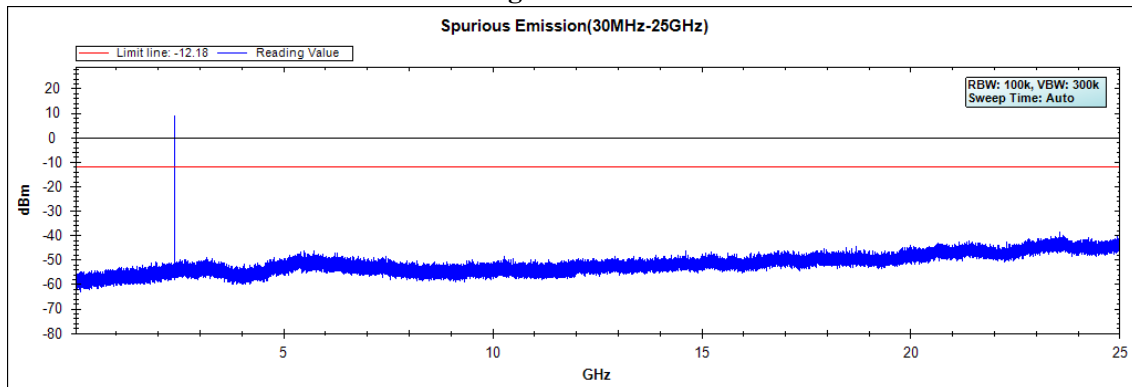


Figure Channel 19:

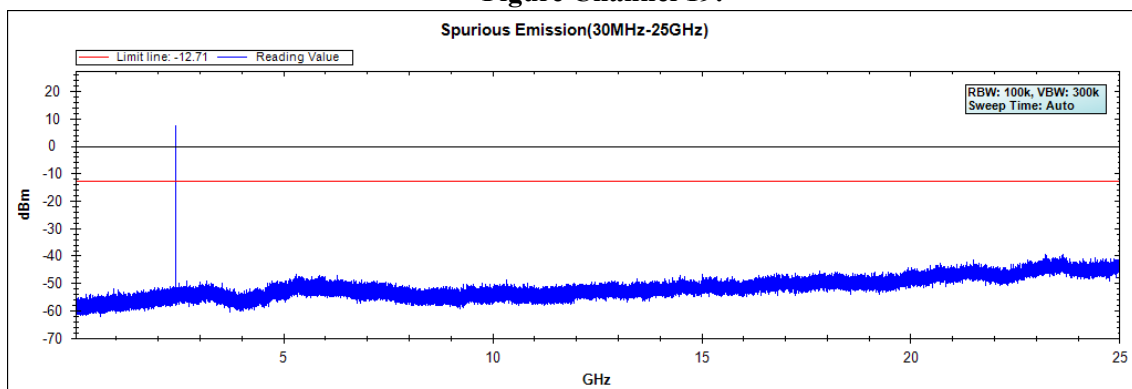
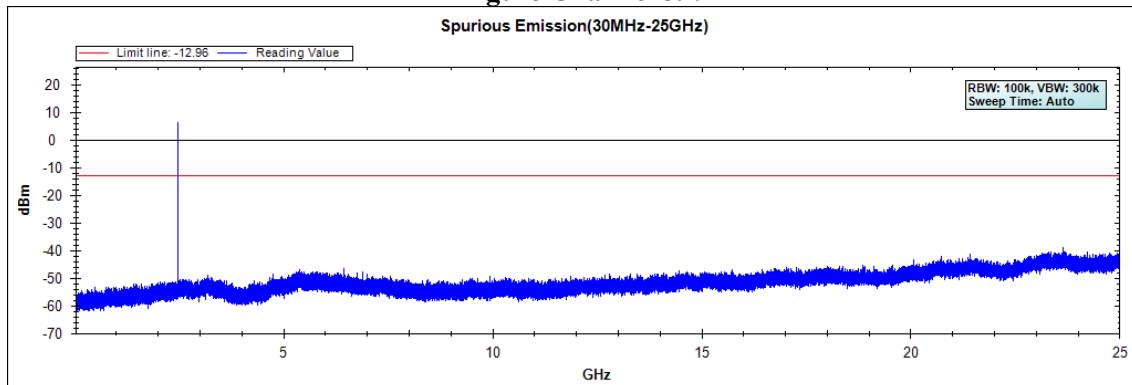


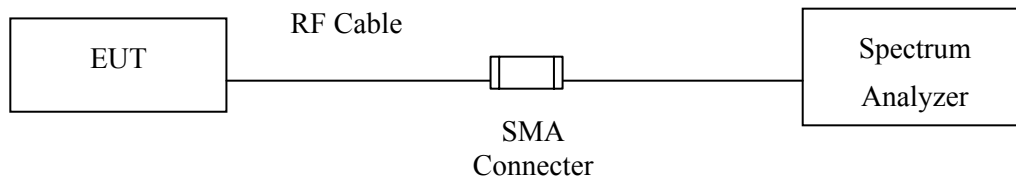
Figure Channel 39:



6. Band Edge

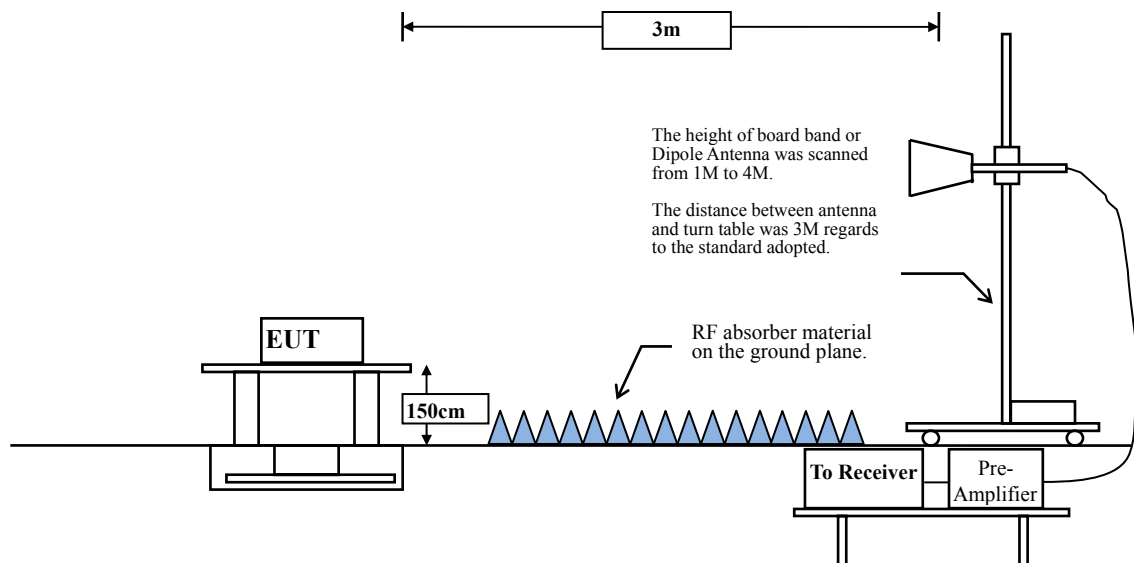
6.1. Test Setup

RF Conducted Measurement



RF Radiated Measurement:

Above 1GHz



6.2. Limit

According to FCC Section 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 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, 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)).

6.3. Test Procedure

The EUT was setup according to ANSI C63.10, 2013 and tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 1.5 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 C63.10:2013 on radiated measurement.

The average measurement tested according to KDB 558074 section 12.2.5.3. Reduced VBW averaging across on- and off-times of the EUT transmissions with max hold.

VBW $\geq 1/T$:

Duty Cycle	T	1/T	VBW Setting
62.18%	0.3880	2577	3K

6.4. Uncertainty

± 4.08 dB above 1GHz

± 4.22 dB below 1GHz

6.5. Test Result of Band Edge

Product : Wi-Fi Module
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2017/10/12
 Test Mode : Mode 1: Transmit - BLE (GFSK)

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dB μ V)	Emission Level (dB μ V/m)	Peak Limit (dB μ V/m)	Average Limit (dB μ V/m)	Result
00 (Peak)	2387.800	-2.697	44.290	41.593	74.00	54.00	Pass
00 (Peak)	2390.000	-2.687	43.004	40.317	74.00	54.00	Pass
00 (Peak)	2400.000	-2.660	63.634	60.974	--	--	--
00 (Peak)	2402.000	-2.657	91.915	89.258	--	--	--
00 (Average)	2389.200	-2.690	32.500	29.810	74.00	54.00	Pass
00 (Average)	2390.000	-2.687	31.951	29.264	74.00	54.00	Pass
00 (Average)	2400.000	-2.660	49.415	46.755	--	--	--
00 (Average)	2402.000	-2.657	91.221	88.564	--	--	--

Figure Channel 00:

Horizontal (Peak)

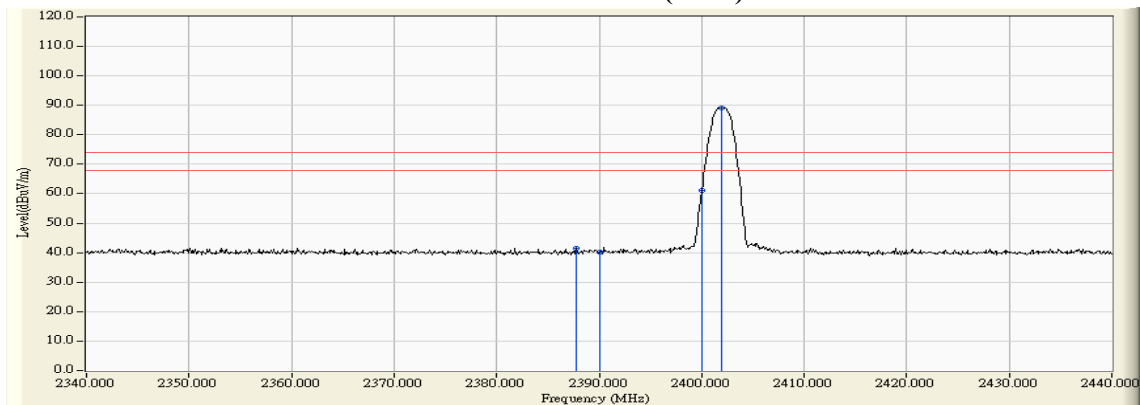
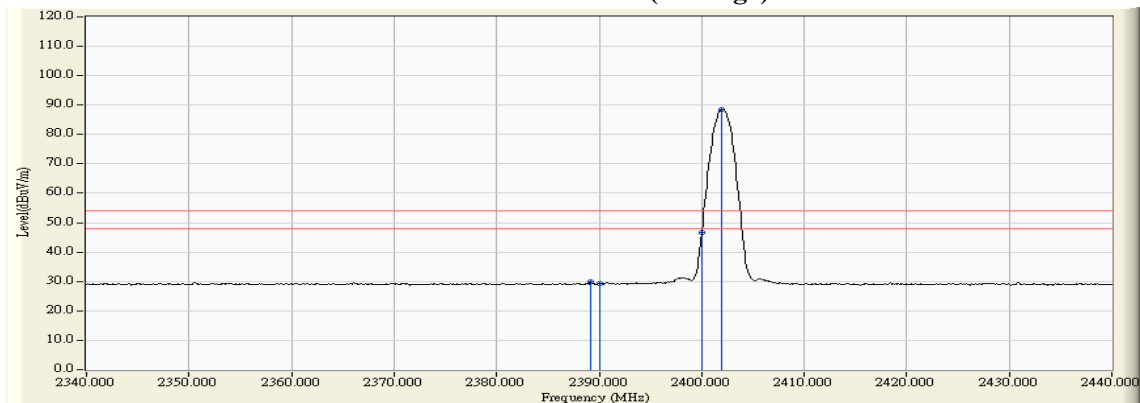


Figure Channel 00:

Horizontal (Average)



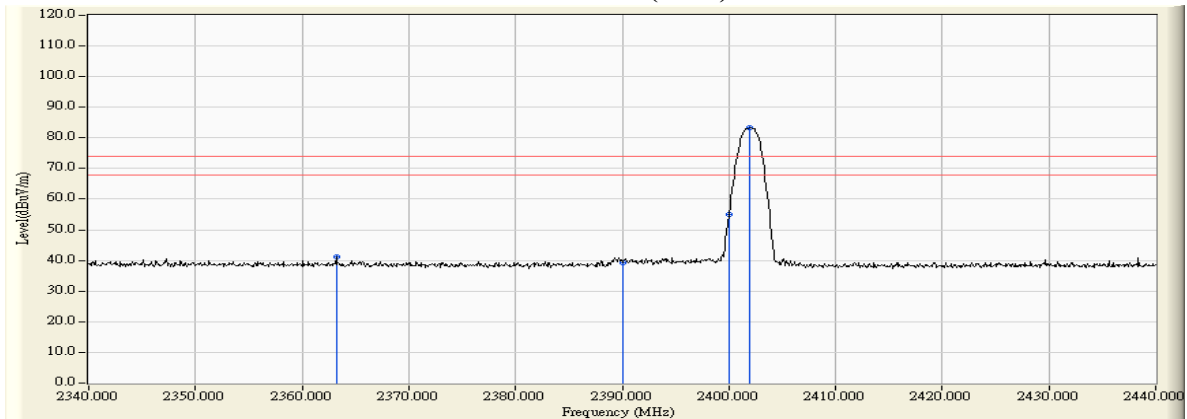
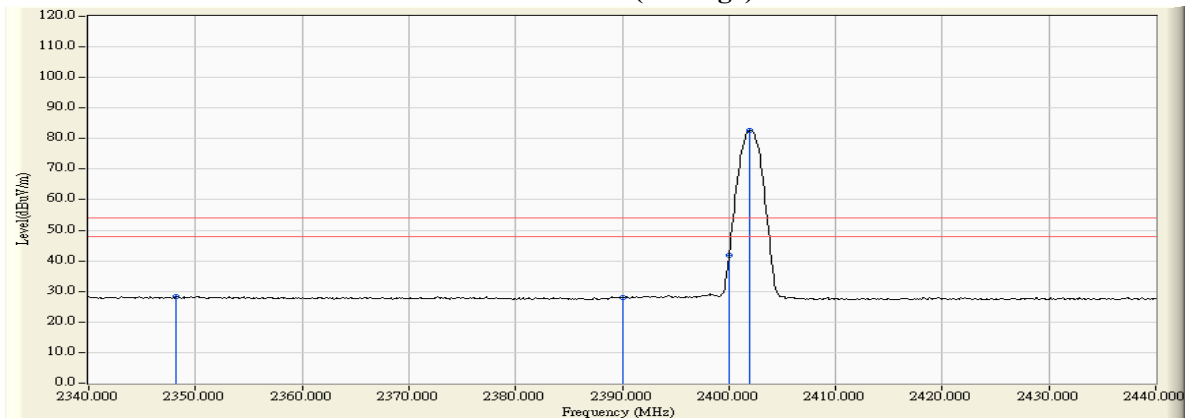
Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 3 KHz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Wi-Fi Module
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2017/10/12
 Test Mode : Mode 1: Transmit - BLE (GFSK)

RF Radiated Measurement (Vertical):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Result
00 (Peak)	2363.200	-4.066	45.099	41.032	74.00	54.00	Pass
00 (Peak)	2390.000	-4.159	43.418	39.259	74.00	54.00	Pass
00 (Peak)	2400.000	-4.171	59.107	54.936	--	--	--
00 (Peak)	2402.000	-4.171	87.449	83.278	--	--	--
00 (Average)	2348.200	-3.976	32.241	28.265	74.00	54.00	Pass
00 (Average)	2390.000	-4.159	32.215	28.056	74.00	54.00	Pass
00 (Average)	2400.000	-4.171	45.910	41.739	--	--	--
00 (Average)	2402.000	-4.171	86.767	82.596	--	--	--

Figure Channel 00: Vertical (Peak)**Figure Channel 00: Vertical (Average)**

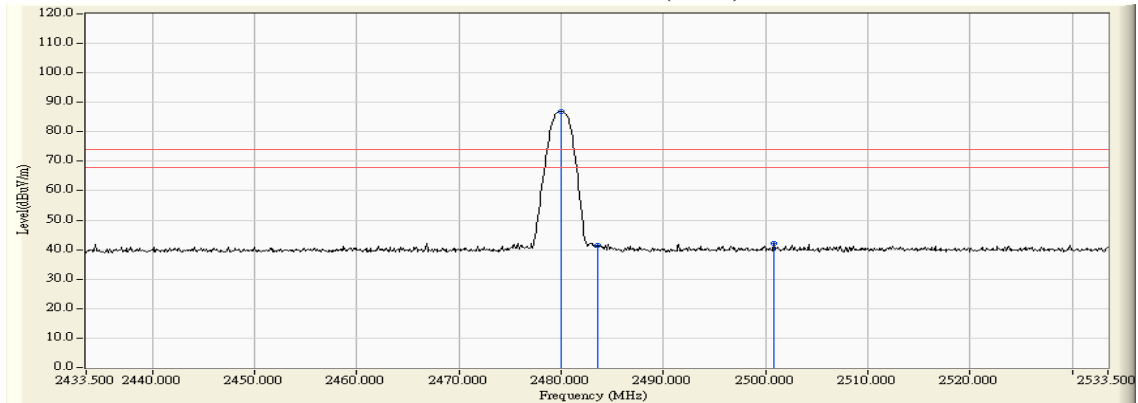
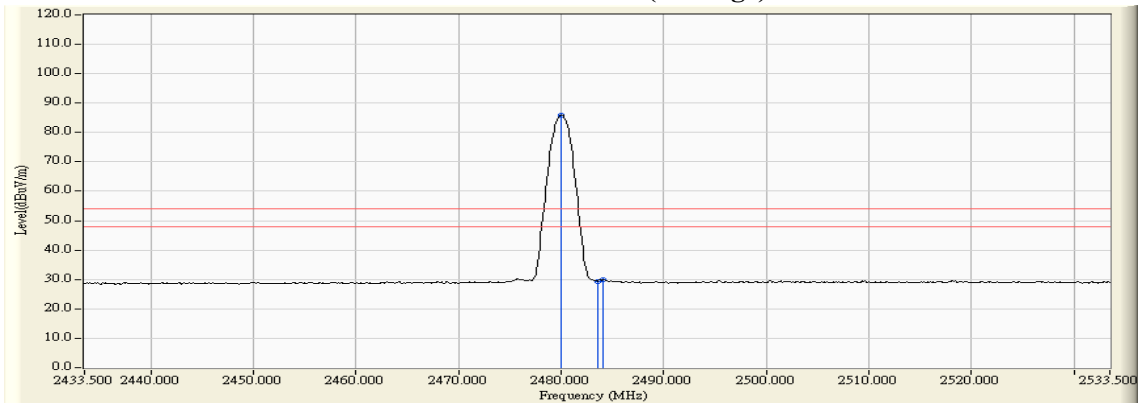
Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 3 KHz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Wi-Fi Module
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2017/10/12
 Test Mode : Mode 1: Transmit - BLE (GFSK)

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Result
39 (Peak)	2480.000	-2.605	89.555	86.950	--	--	--
39 (Peak)	2483.500	-2.601	44.173	41.571	74.00	54.00	Pass
39 (Peak)	2500.800	-2.616	44.610	41.995	74.00	54.00	Pass
39 (Average)	2480.000	-2.605	88.574	85.969	--	--	--
39 (Average)	2483.500	-2.601	31.995	29.393	74.00	54.00	Pass
39 (Average)	2484.100	-2.602	32.648	30.047	74.00	54.00	Pass

Figure Channel 39:**Horizontal (Peak)****Figure Channel 39:****Horizontal (Average)**

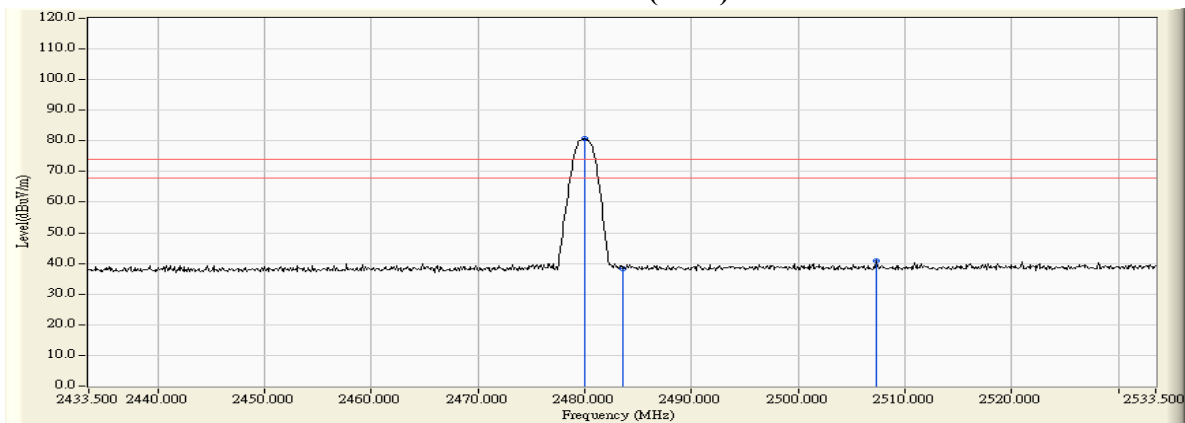
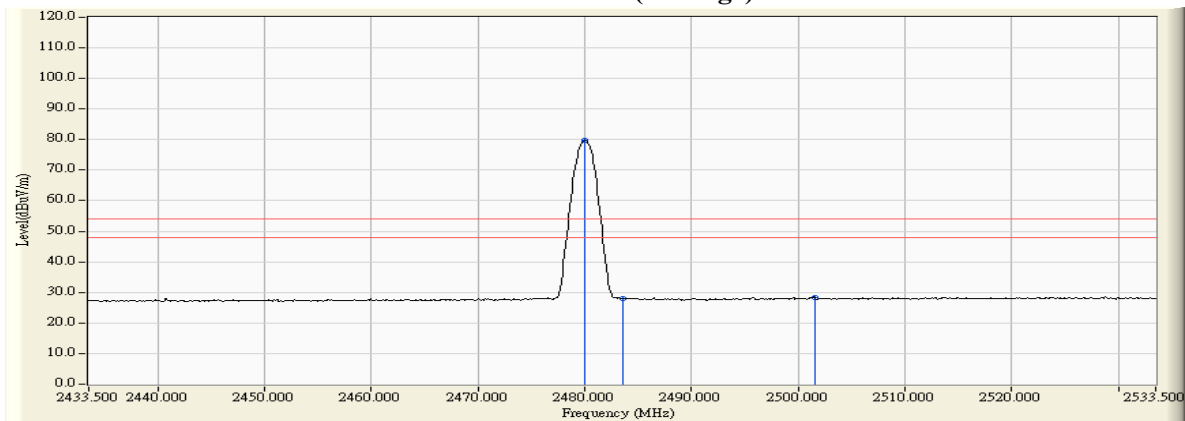
Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 3 KHz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : Wi-Fi Module
 Test Item : Band Edge
 Test Site : No.3 OATS
 Test date : 2017/10/12
 Test Mode : Mode 1: Transmit - BLE (GFSK)

RF Radiated Measurement (Vertical):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Result
39 (Peak)	2480.000	-3.978	84.601	80.623	--	--	--
39 (Peak)	2483.500	-3.966	42.214	38.247	74.00	54.00	Pass
39 (Peak)	2507.300	-3.875	44.662	40.787	74.00	54.00	Pass
39 (Average)	2480.000	-3.978	83.687	79.709	--	--	--
39 (Average)	2483.500	-3.966	31.962	27.995	74.00	54.00	Pass
39 (Average)	2501.600	-3.902	32.211	28.309	74.00	54.00	Pass

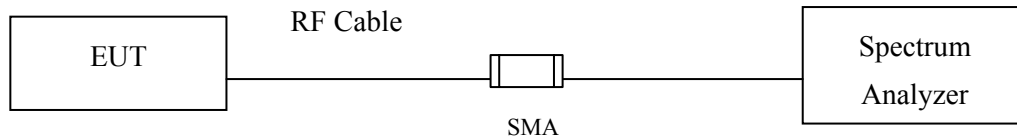
Figure Channel 39:**Vertical (Peak)****Figure Channel 39:****Vertical (Average)**

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 3 KHz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

7. 6dB Bandwidth

7.1. Test Setup



7.2. Limits

The minimum bandwidth shall be at least 500 kHz.

7.3. Test Procedure

The EUT was setup according to ANSI C63.10 2013; tested according to DTS test procedure of KDB558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 1-5% of the emission bandwidth, $VBW \geq 3 \cdot RBW$

7.4. Uncertainty

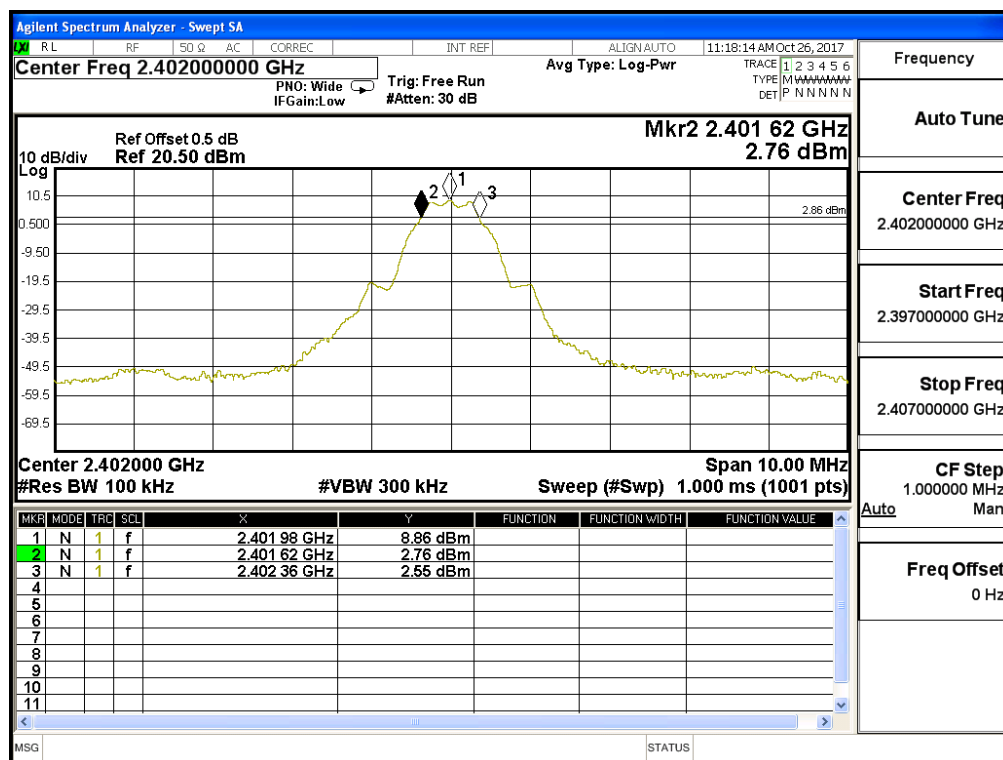
$\pm 283\text{Hz}$

7.5. Test Result of 6dB Bandwidth

Product : Wi-Fi Module
 Test Item : 6dB Bandwidth Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2402MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
00	2402	740	>500	Pass

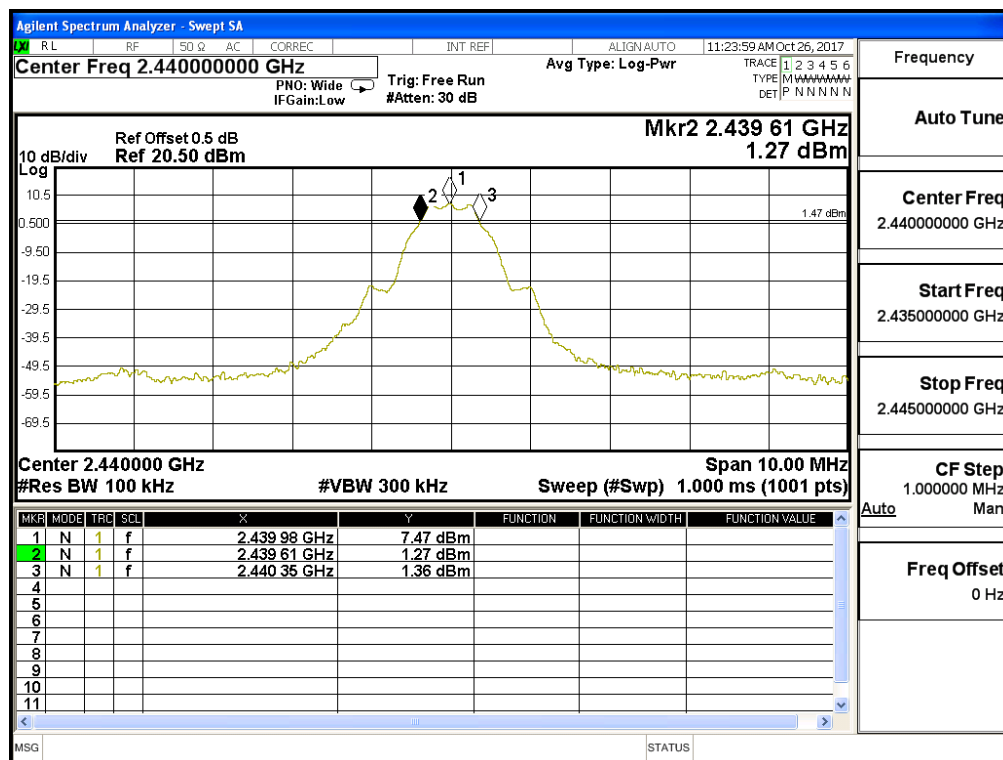
Figure Channel 00:



Product : Wi-Fi Module
 Test Item : 6dB Bandwidth Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2440MHz)

Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
19	2440	740	>500	Pass

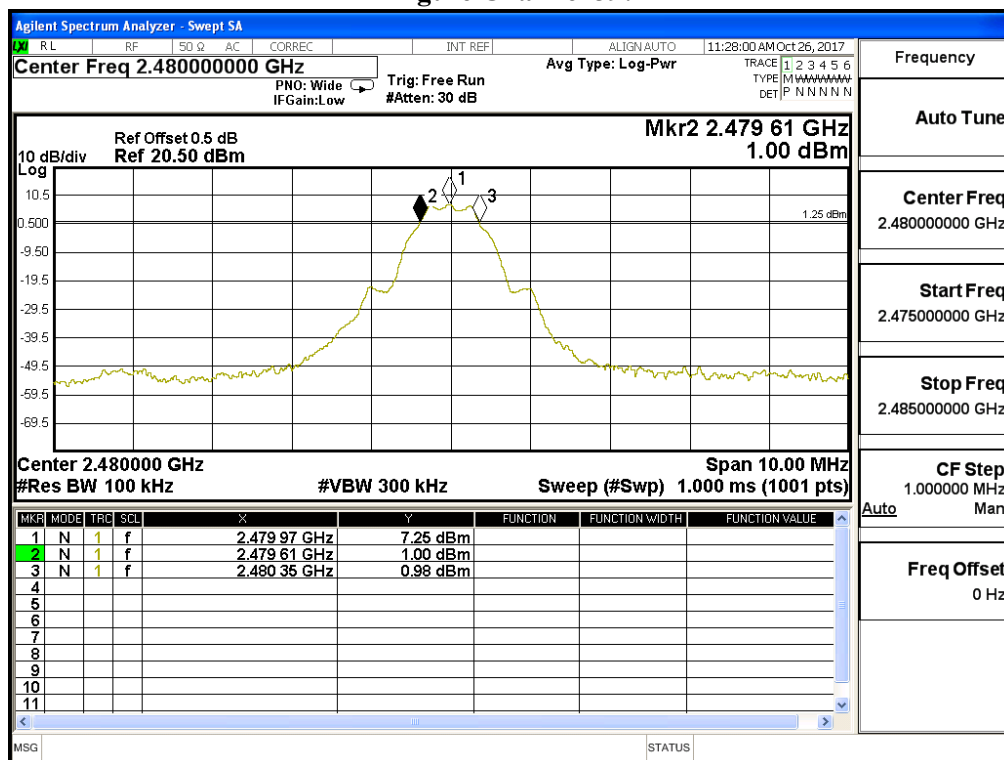
Figure Channel 19:



Product : Wi-Fi Module
 Test Item : 6dB Bandwidth Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2480MHz)

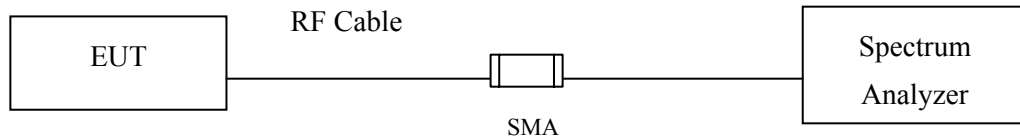
Channel No.	Frequency (MHz)	Measurement Level (kHz)	Required Limit (kHz)	Result
39	2480	740	>500	Pass

Figure Channel 39:



8. Power Density

8.1. Test Setup



8.2. Limits

The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3kHz bandwidth.

8.3. Test Procedure

The EUT was setup according to ANSI C63.10: 2013, the maximum power spectral density using KDB 558074 section 10.2 PKPSD (peak PSD) method.

8.4. Uncertainty

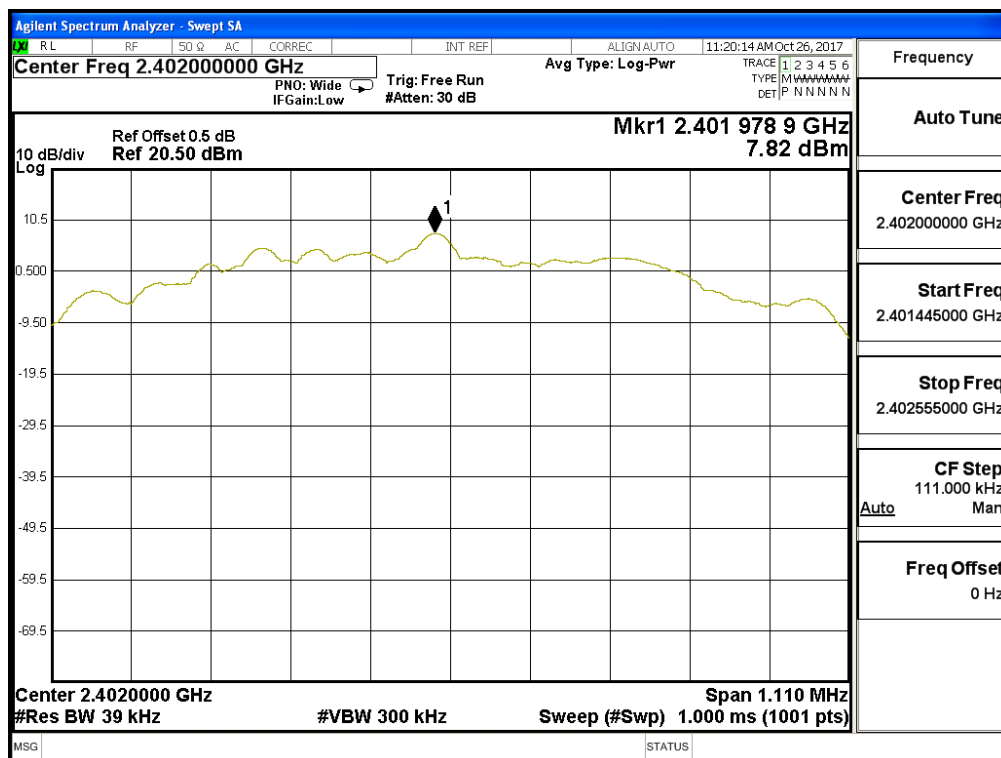
± 1.20 dB

8.5. Test Result of Power Density

Product : Wi-Fi Module
 Test Item : Power Density Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2402MHz)

Channel No.	Frequency (MHz)	Measure Level (dBm)	Limit (dBm)	Result
00	2402	7.820	$\leq 8\text{dBm}$	Pass

Figure Channel 00:



Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
19	2440	7.290	≤ 8dBm	Pass

Agilent Spectrum Analyzer - Swept SA

RL RF 50 Ω AC CORREC INT REF ALIGN AUTO 11:24:20 AM Oct 26, 2017

Center Freq 2.44000000 GHz Avg Type: Log-Pwr

PNO: Wide Trg: Free Run
IF Gain: Low #Atten: 30 dB

TRACE 1 2 3 4 5 6
TYPE M W W W W W W W
DET P N N N N N N

Frequency

Auto Tune

Center Freq
2.440000000 GHz

Start Freq
2.439445000 GHz

Stop Freq
2.440555000 GHz

CF Step
111.000 kHz
Auto Mar

Freq Offset
0 Hz

10 dB/div
Log

Ref Offset 0.5 dB
Ref 20.50 dBm

Mkr1 2.439 971 1 GHz
7.29 dBm

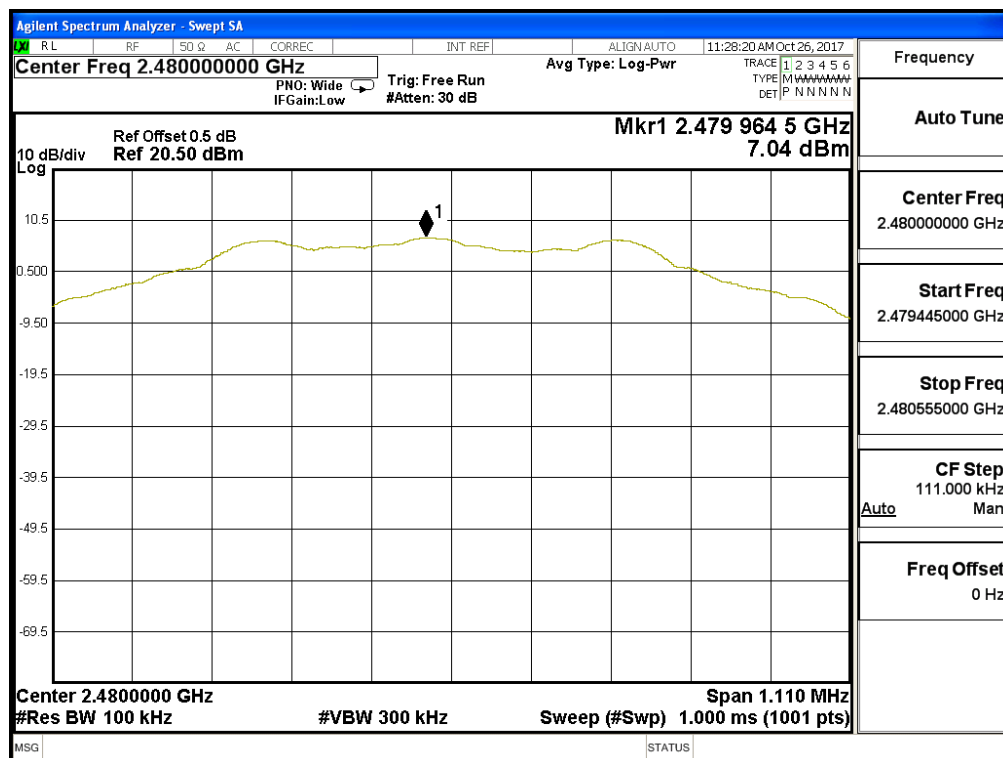
Center 2.440000 GHz Span 1.110 MHz
#Res BW 100 kHz #VBW 300 kHz Sweep (#Swp) 1.000 ms (1001 pts)

MSG STATUS

Product : Wi-Fi Module
 Test Item : Power Density Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit - BLE (GFSK) (2480MHz)

Channel No.	Frequency (MHz)	Measurement Level (dBm)	Required Limit (dBm)	Result
39	2480	7.040	$\leq 8\text{dBm}$	Pass

Figure Channel 39:



9. EMI Reduction Method During Compliance Testing

No modification was made during testing.

Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs