

TEST REPORT

Reference No...... : WTD21D06058389W001
FCC ID : 2ABH3-FOSFDA
Applicant..... : Furrion Ltd.
Address..... : 4/F, Flat C & D, The Grid, 133 Wai Yip Street, Kwun Tong
Kowloon 999077 Hongkong
Manufacturer : Furrion Ltd.
Address..... : 4/F, Flat C & D, The Grid, 133 Wai Yip Street, Kwun Tong
Kowloon 999077 Hongkong
Product..... : 2.4GHz wireless module
Model(s) : WF8023
Standards..... : FCC CFR47 Part 15.247
Date of Receipt sample : 2021-06-28
Date of Test : 2021-06-28 to 2022-01-17
Date of Issue..... : 2022-01-17
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.

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3 Revision History

Test report No.	Date of Receipt sample	Date of Test	Date of Issue	Purpose	Comment	Approved
WTD21D08091194 W001	2021-06-28	2021-06-28 to 2022-01-17	2022-01-17	Original	-	Valid

4 General Information

4.1 General Description of E.U.T.

Product:	2.4GHz wireless module
Model(s):	WF8023
Model Description:	N/A
Hardware Version	V1.0
Software Version	SFT_WF8023 V1.0

4.2 Details of E.U.T.

Operation Frequency:	2412~2462MHz
Quantity of channel:	11CH
Max. RF output power:	23.01dBm
Type of Modulation:	CCK, OFDM
Antenna installation:	External antenna with RP-SMA connector
Antenna Gain:	3.0dBi
Ratings:	DC 3.3V from Host(powered by DC 12/24V)

4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2412	2	2417	3	2422	4	2427
5	2432	6	2437	7	2442	8	2447
9	2452	10	2457	11	2462	12	-

4.4 Test Mode

Test Items	Mode	Data Rate	Channel	TX/RX
Maximum Peak Output Power	CCK	Normal	1/6/11	TX
	OFDM	Normal	1/6/11	TX
Power Spectral Density	CCK	Normal	1/6/11	TX
	OFDM	Normal	1/6/11	TX
6dB Bandwidth	CCK	Normal	1/6/11	TX
	OFDM	Normal	1/6/11	TX
Band Edge	CCK	Normal	1/6/11	TX
	OFDM	Normal	1/6/11	TX
Transmitter Spurious Emissions	CCK	Normal	1/6/11	TX
	OFDM	Normal	1/6/11	TX

Note: parameters set by test software during channel & power tests, the software provided by the customer was used to set the operating channels as well as the output power level. The RF output power set is the power expected by the manufacturer and is going to be fixed on the firmware of the final product.

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)	N/A
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
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	2.1901	PASS

6 Equipment Used during Test

6.1 Equipments List

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	2021-07-26	2022-07-25
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	2021-07-26	2022-07-25
3.	Limiter	York	MTS-IMP-136	261115-001-0024	2021-07-26	2022-07-25
4.	Cable	LARGE	RF300	-	2021-07-26	2022-07-25
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	2021-04-26	2022-04-25
2	Amplifier	Agilent	8447D	2944A10178	2021-07-26	2022-07-25
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	2021-04-26	2022-04-25
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	2021-08-23	2022-08-22
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	2021-04-26	2022-04-25
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	2021-07-30	2022-07-29
7	Broadband Preamplifier	COMPLIANCE	PAP-1G18	2004	2021-07-26	2022-07-25
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	N/A	2021-04-26	2022-04-25
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	2021-04-26	2022-04-25
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	2021-10-30	2022-10-29
3	Amplifier	Compliance	PAP-0203	22024	2021-05-05	2022-05-04
4	Cable	HUBER+SUHNER	CBL2	525178	2021-04-29	2022-04-28
RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	Signal Generator	Agilent	N5182A	MY46240814	2021-07-26	2022-07-25
2.	Spectrum Analyzer	R&S	FSP30	100091	2021-04-26	2022-04-25
3.	EXA Signal Analyzer	Malaysia Keysight	N9010A	MY50520207	2021-04-26	2022-04-25

6.2 Description of Support Units

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

6.3 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)
Conducted Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)
Conducted Spurious Emissions test	± 3.12 dB (9kHz~30MHz)
	± 4.21 dB (30M~1000MHz)
	± 5.14 dB (1000M~26500MHz)

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 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019;
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	$20\log^{(500)}$

7.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 52.1 % RH

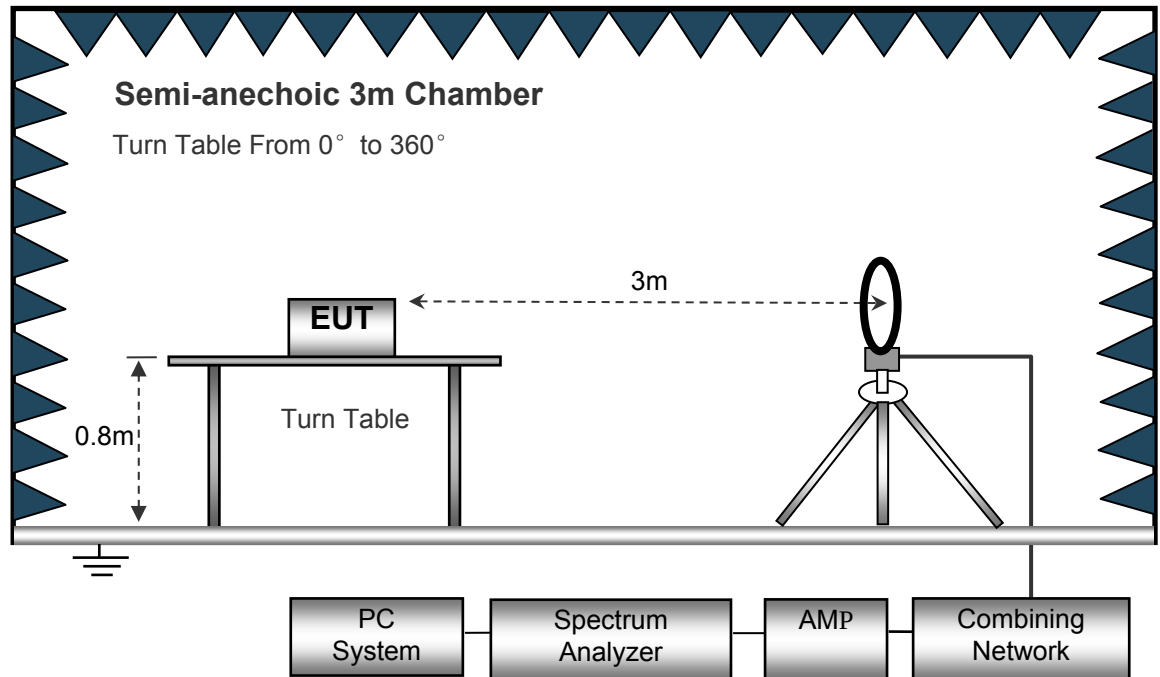
Atmospheric Pressure: 101.2kPa

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

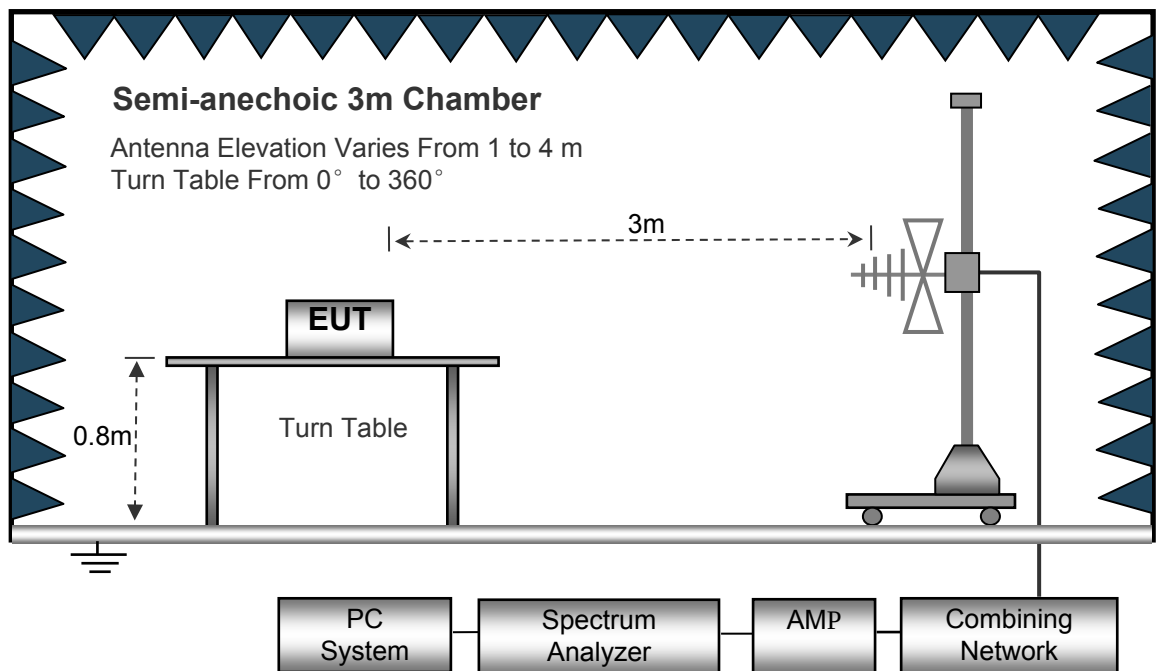
7.2 Test Setup

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

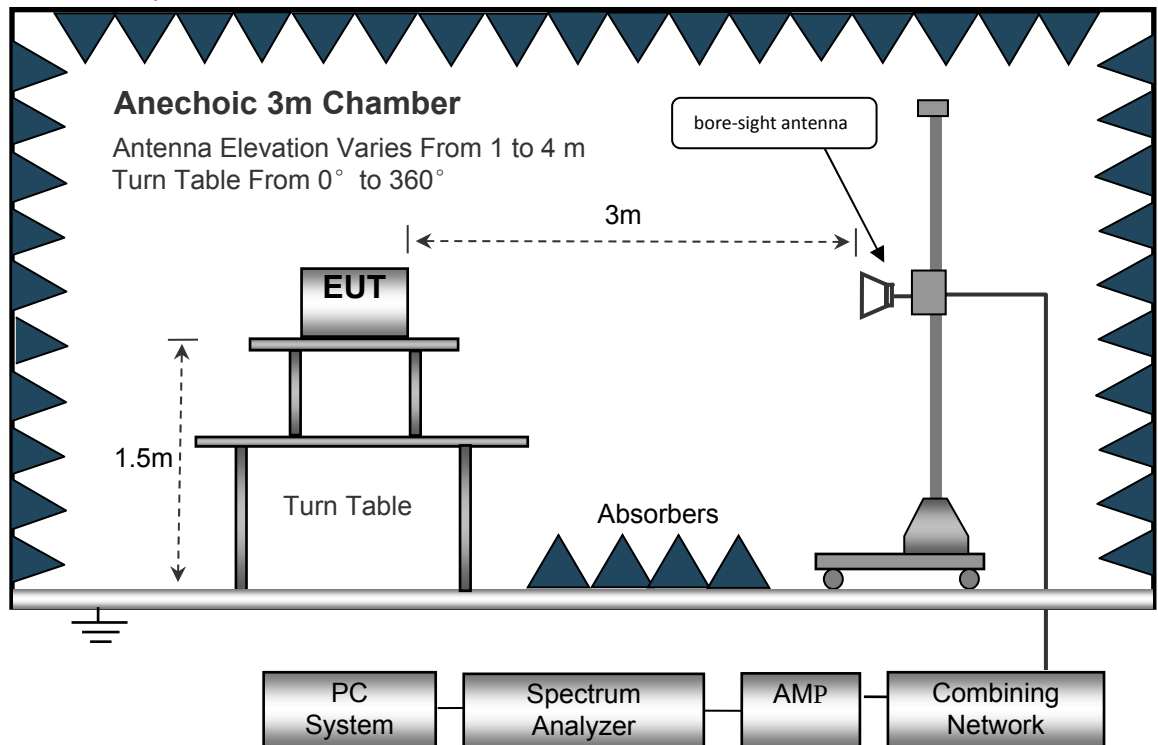
The test setup for emission measurement below 30MHz.



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



The test setup for emission measurement above 1 GHz.



7.3 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

7.4 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.

7.5 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:

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

7.6 Summary of Test Results

Note: Lowest frequency generated in the device is 40MHz, frequency range of measurement should be above 30MHz.

Test Frequency : 30MHz ~ 8GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
CCK: Low Channel 2412MHz									
331.51	41.05	QP	28	1.8	H	-11.62	29.43	46.00	-16.57
331.51	36.26	QP	310	2.0	V	-11.62	24.64	46.00	-21.36
4824.00	60.61	PK	44	2.0	V	-1.06	59.55	74.00	-14.45
4824.00	49.12	Ave	44	2.0	V	-1.06	48.06	54.00	-5.94
7236.00	41.08	PK	14	1.8	H	1.33	42.41	74.00	-31.59
7236.00	41.96	Ave	14	1.8	H	1.33	43.29	54.00	-10.71
2327.13	45.42	PK	250	1.8	V	-13.19	32.23	74.00	-41.77
2327.13	38.06	Ave	250	1.8	V	-13.19	24.87	54.00	-29.13
2380.59	43.05	PK	67	2.0	H	-13.14	29.91	74.00	-44.09
2380.59	37.69	Ave	67	2.0	H	-13.14	24.55	54.00	-29.45
2489.78	44.31	PK	271	1.5	V	-13.08	31.23	74.00	-42.77
2489.78	38.87	Ave	271	1.5	V	-13.08	25.79	54.00	-28.21

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
CCK: Middle Channel 2437MHz									
331.51	41.22	QP	94	1.8	H	-11.62	29.60	46.00	-16.40
331.51	36.59	QP	120	1.8	V	-11.62	24.97	46.00	-21.03
4874.00	61.97	PK	141	1.7	V	-0.62	61.35	74.00	-12.65
4874.00	49.92	Ave	141	1.7	V	-0.62	49.30	54.00	-4.70
7311.00	40.77	PK	206	1.9	H	2.21	42.98	74.00	-31.02
7311.00	42.02	Ave	206	1.9	H	2.21	44.23	54.00	-9.77
2332.57	46.66	PK	90	1.8	V	-13.19	33.47	74.00	-40.53
2332.57	37.20	Ave	90	1.8	V	-13.19	24.01	54.00	-29.99
2368.13	43.56	PK	310	1.1	H	-13.14	30.42	74.00	-43.58
2368.13	38.10	Ave	310	1.1	H	-13.14	24.96	54.00	-29.04
2492.72	43.95	PK	355	1.4	V	-13.08	30.87	74.00	-43.13
2492.72	36.73	Ave	355	1.4	V	-13.08	23.65	54.00	-30.35

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
CCK: High Channel 2462MHz									
331.51	39.85	QP	94	1.9	H	-11.62	28.23	46.00	-17.77
331.51	35.68	QP	97	1.3	V	-11.62	24.06	46.00	-21.94
4924.00	61.87	PK	299	1.9	V	-0.24	61.63	74.00	-12.37
4924.00	50.29	Ave	299	1.9	V	-0.24	50.05	54.00	-3.95
7386.00	41.12	PK	323	1.4	H	2.84	43.96	74.00	-30.04
7386.00	42.25	Ave	323	1.4	H	2.84	45.09	54.00	-8.91
2338.31	45.20	PK	27	1.1	V	-13.19	32.01	74.00	-41.99
2338.31	39.91	Ave	27	1.1	V	-13.19	26.72	54.00	-27.28
2350.68	43.69	PK	139	1.7	H	-13.14	30.55	74.00	-43.45
2350.68	37.06	Ave	139	1.7	H	-13.14	23.92	54.00	-30.08
2488.33	44.94	PK	166	1.4	V	-13.08	31.86	74.00	-42.14
2488.33	36.28	Ave	166	1.4	V	-13.08	23.20	54.00	-30.80

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
OFDM: Low Channel 2412MHz									
331.51	40.42	QP	88	1.3	H	-11.62	28.80	46.00	-17.20
331.51	37.17	QP	223	1.5	V	-11.62	25.55	46.00	-20.45
4824.00	55.87	PK	350	1.1	V	-1.06	54.81	74.00	-19.19
4824.00	43.53	Ave	350	1.1	V	-1.06	42.47	54.00	-11.53
7236.00	41.67	PK	344	2.0	H	1.33	43.00	74.00	-31.00
7236.00	40.86	Ave	344	2.0	H	1.33	42.19	54.00	-11.81
2341.34	45.83	PK	41	1.3	V	-13.19	32.64	74.00	-41.36
2341.34	38.56	Ave	41	1.3	V	-13.19	25.37	54.00	-28.63
2358.06	42.27	PK	161	1.5	H	-13.14	29.13	74.00	-44.87
2358.06	37.29	Ave	161	1.5	H	-13.14	24.15	54.00	-29.85
2490.24	44.17	PK	340	2.0	V	-13.08	31.09	74.00	-42.91
2490.24	37.17	Ave	340	2.0	V	-13.08	24.09	54.00	-29.91

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
OFDM: Middle Channel 2437MHz									
331.51	40.58	QP	292	1.9	H	-11.62	28.96	46.00	-17.04
331.51	38.63	QP	155	1.7	V	-11.62	27.01	46.00	-18.99
4874.00	60.19	PK	230	1.9	V	-0.62	59.57	74.00	-14.43
4874.00	44.09	Ave	230	1.9	V	-0.62	43.47	54.00	-9.53
7311.00	41.67	PK	279	1.2	H	2.21	43.88	74.00	-30.12
7311.00	40.21	Ave	279	1.2	H	2.21	42.42	54.00	-11.58
2324.72	45.19	PK	97	1.5	V	-13.19	32.00	74.00	-42.00
2324.72	39.07	Ave	97	1.5	V	-13.19	25.88	54.00	-28.12
2385.17	43.57	PK	33	1.8	H	-13.14	30.43	74.00	-43.57
2385.17	37.47	Ave	33	1.8	H	-13.14	24.33	54.00	-29.67
2497.47	42.52	PK	244	1.4	V	-13.08	29.44	74.00	-44.56
2497.47	38.31	Ave	244	1.4	V	-13.08	25.23	54.00	-28.77

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247/209/205	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
OFDM: High Channel 2462MHz									
331.51	41.03	QP	103	2.0	H	-11.62	29.41	46.00	-16.59
331.51	39.39	QP	15	1.9	V	-11.62	27.77	46.00	-18.23
4924.00	57.12	PK	216	1.2	V	-0.24	56.88	74.00	-17.12
4924.00	43.41	Ave	216	1.2	V	-0.24	43.17	54.00	-10.83
7386.00	42.84	PK	37	1.4	H	2.84	45.68	74.00	-28.32
7386.00	40.73	Ave	37	1.4	H	2.84	43.57	54.00	-10.43
2337.87	45.86	PK	162	1.3	V	-13.19	32.67	74.00	-41.33
2337.87	39.51	Ave	162	1.3	V	-13.19	26.32	54.00	-27.68
2378.02	44.55	PK	99	1.8	H	-13.14	31.41	74.00	-42.59
2378.02	38.53	Ave	99	1.8	H	-13.14	25.39	54.00	-28.61
2484.89	42.34	PK	143	1.6	V	-13.08	29.26	74.00	-44.74
2484.89	38.92	Ave	143	1.6	V	-13.08	25.84	54.00	-28.16

Test Frequency: 8GHz~25GHz

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

8 Conducted Spurious Emissions

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	ANSI C63.10:2013 KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019
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 20dB below that in the 100kHz 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 30dB instead of 20dB. 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

8.1 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:
 - a) Set instrument center frequency to DTS channel center frequency.
 - b) Set the span to > 1.5 times the OBW.
 - c) Set the RBW = 100 kHz.
 - d) Set the VBW > [3 × RBW].
 - e) Detector = Peak.
 - f) Sweep time = auto couple.
 - g) Trace mode = max hold.
 - h) Allow trace to fully stabilize.
 - i) Use the peak marker function to determine the maximum PSD level.

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

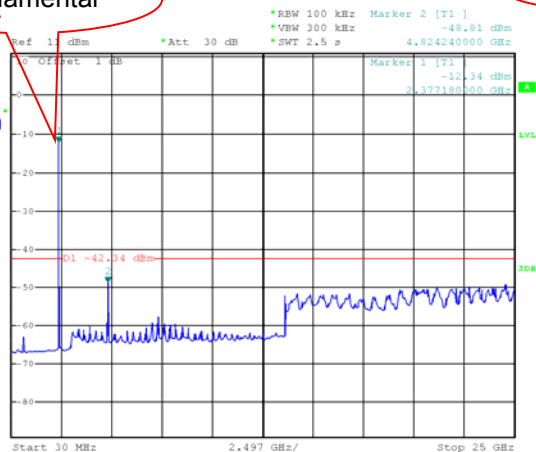
8.2 Test Result

Note: Lowest frequency generated in the device is 40MHz, frequency range of measurement should be above 30MHz.

Above 30MHz

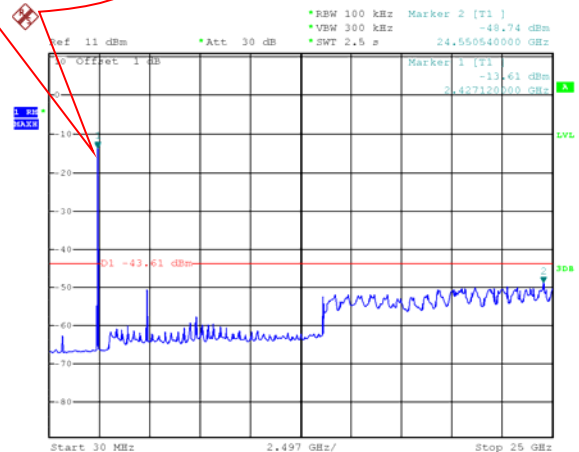
Mode: TX CCK Low channel

Fundamental



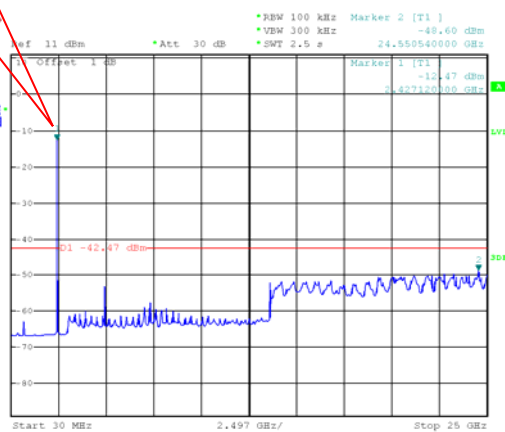
TX CCK Middle channel

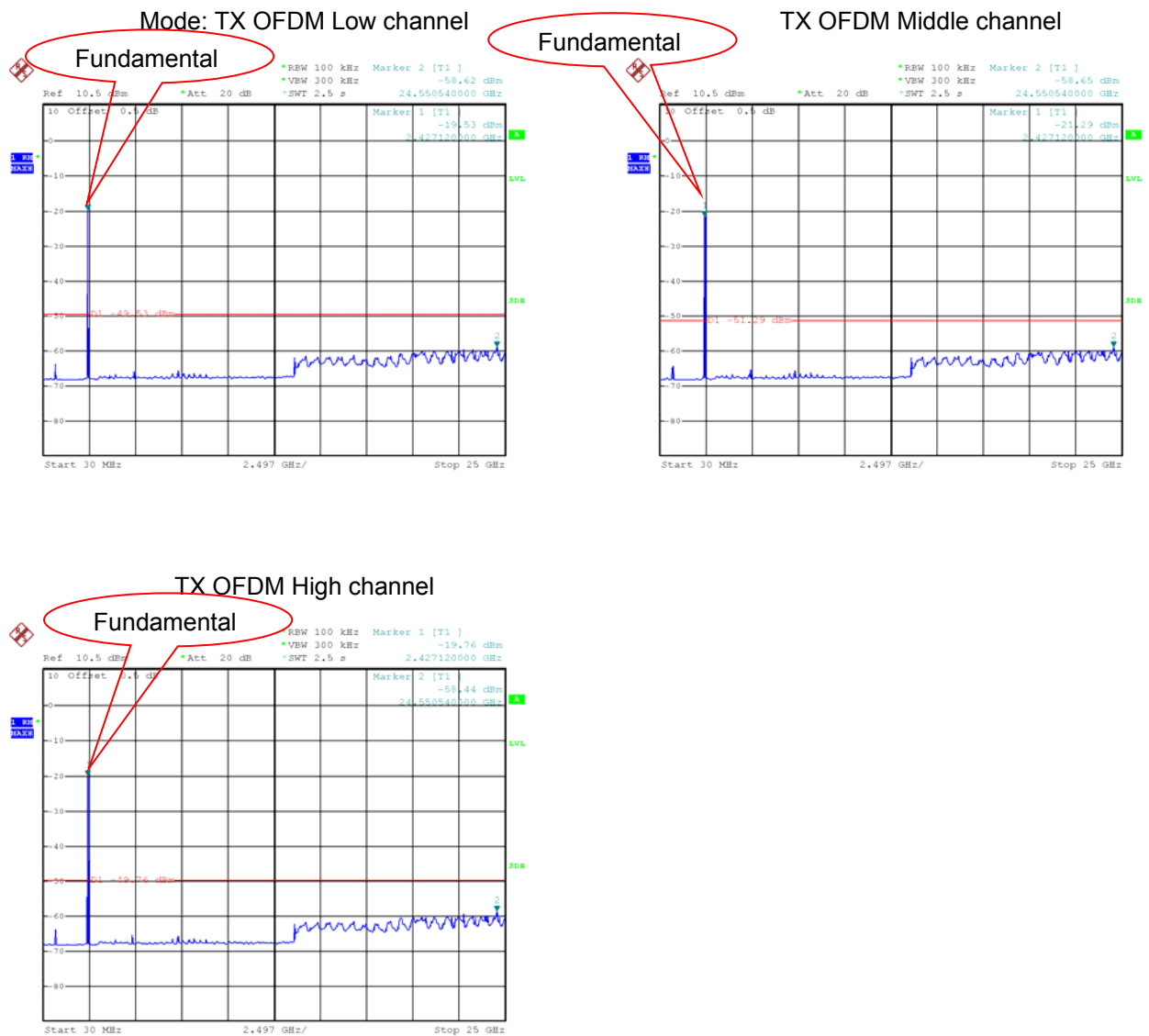
Fundamental



Fundamental

TX CCK High channel





9 Duty Cycle

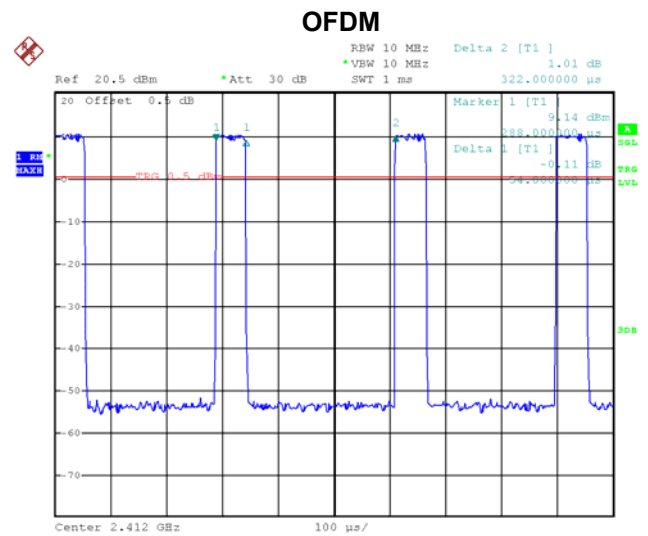
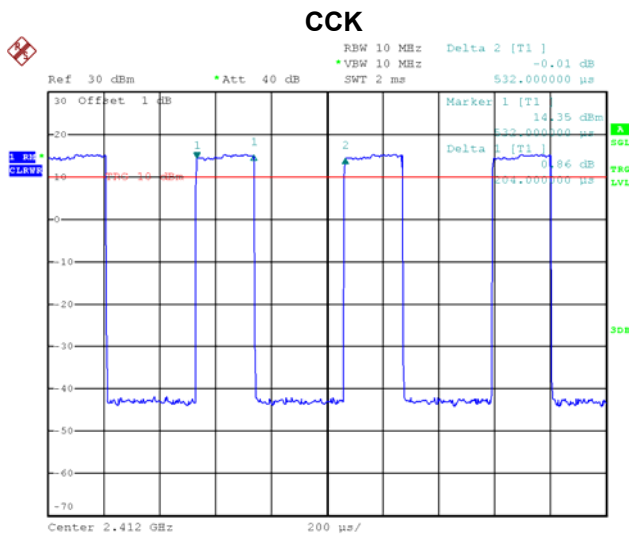
Type of Modulation	On time ms	Period ms	Duty Cycle linear	Duty Cycle %	Duty Cycle Factor(dB)	Average Factor(dB)
CCK	0.2040	0.5320	0.38	38.35	4.16	-8.33
OFDM	0.0540	0.3220	0.17	16.77	7.75	-15.51

Remark:

Duty cycle=On Time/period;

Duty cycle factor=10*log(1/Duty cycle);

Average factor=20log₁₀Duty cycle



10 Band Edge Measurement

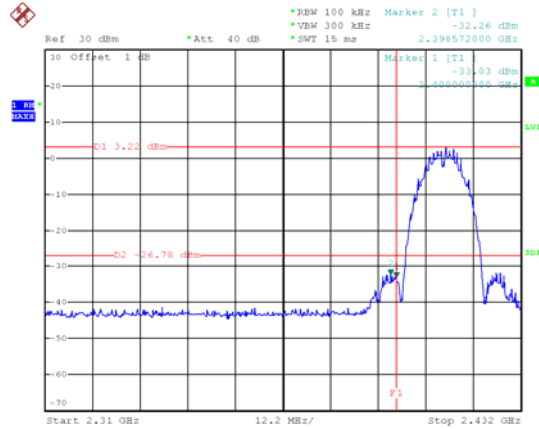
Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	ANSI C63.10:2013 KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019
Test Limit:	Regulation 15.247 (d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is 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

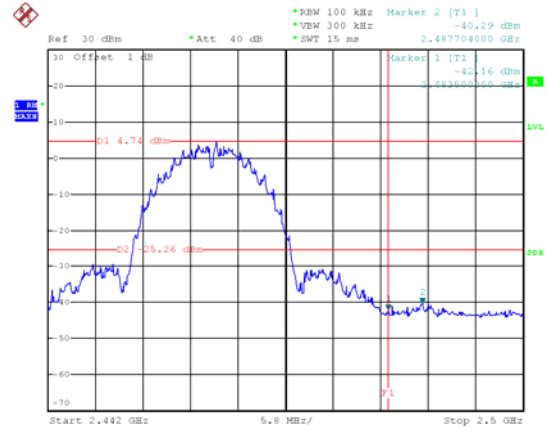
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set spectrum analyzer RBW to 100 kHz and VBW 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

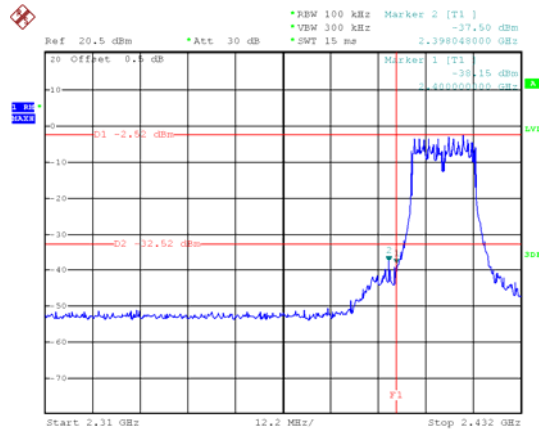
Test result plots shown as follows:
CCK_Band edge-left side



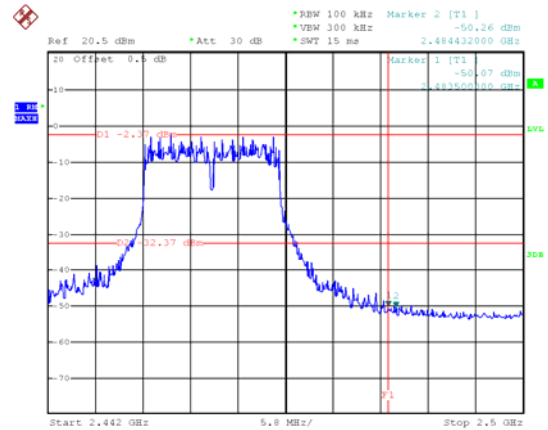
CCK_Band edge-right side



OFDM_Band edge-left side



OFDM_Band edge-right side



11 6 dB Bandwidth and 99% Bandwidth Measurement

Test Requirement: FCC CFR47 Part 15 Section 15.247
Test Method: ANSI C63.10:2013
KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019

Test Limit: §15.247(a)(2)
Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.
Test Mode: Transmitting

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. 6dB Bandwidth Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz
99% Bandwidth Set the spectrum analyzer : RBW = 1~5% DTS OBW, VBW = 3 RBW

11.2 Test Result:

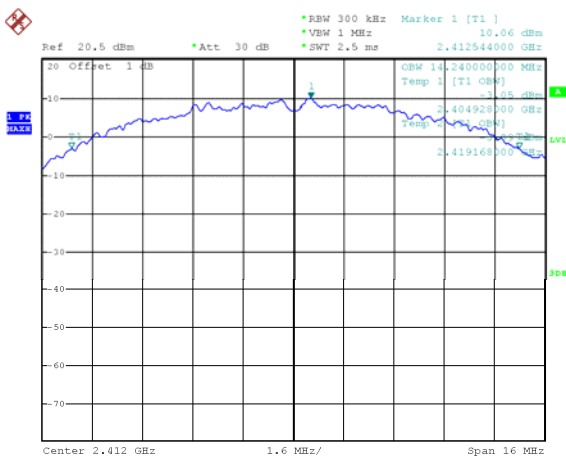
Operation mode	Test Channel	6dB Bandwidth (MHz)	99% Bandwidth (MHz)
TX CCK	Channel 1	9.470	14.240
	Channel 6	10.048	14.176
	Channel 11	10.048	14-144
TX OFDM	Channel 1	16.324	16.588
	Channel 6	16.368	16.632
	Channel 11	16.104	16.632

Test result plot:

6 dB Bandwidth

99% Bandwidth

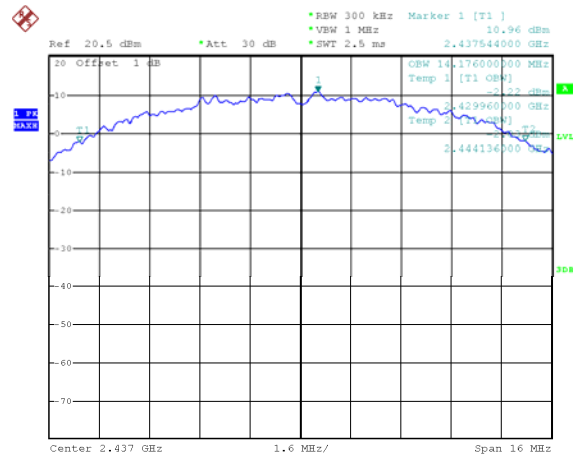
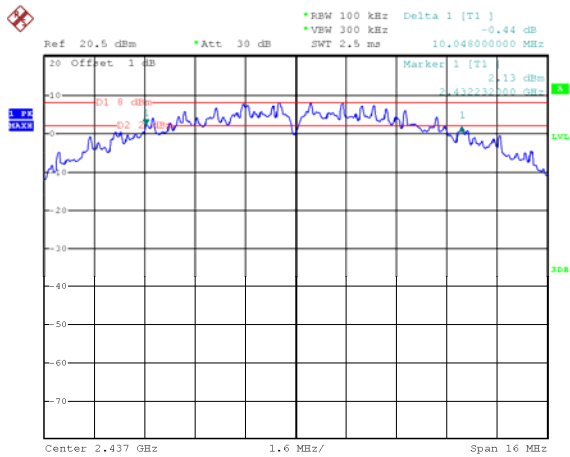
Mode: TX CCK Low channel



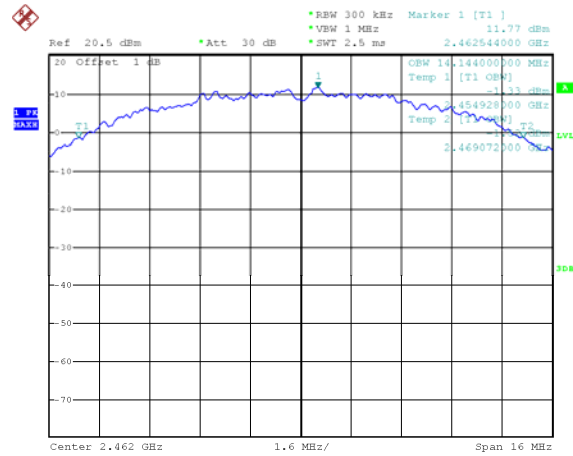
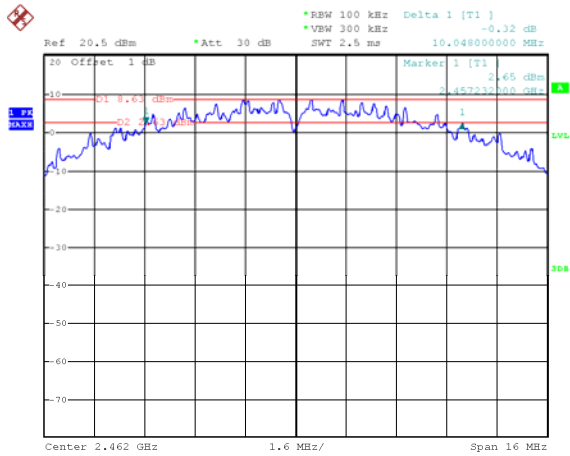
6 dB Bandwidth

99% Bandwidth

Mode: TX CCK Middle channel



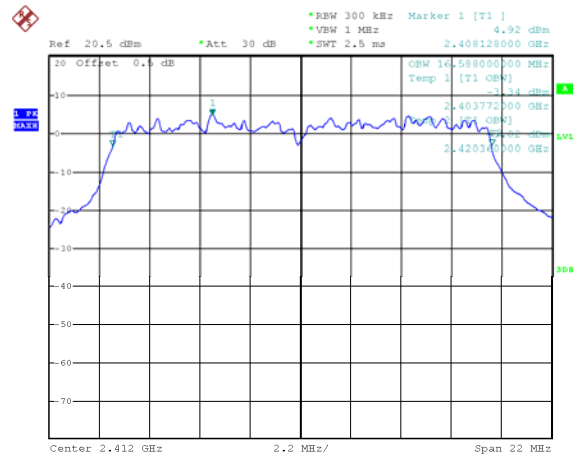
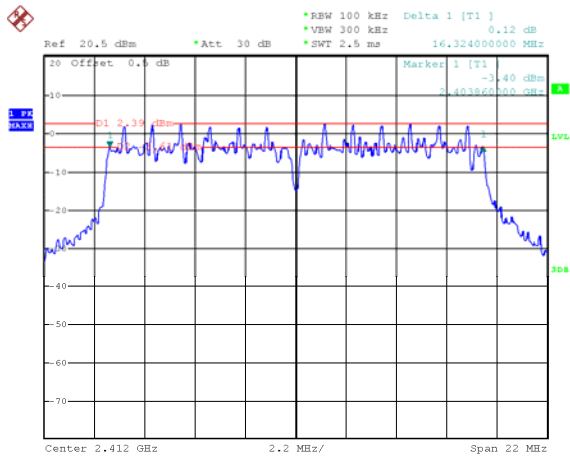
Mode: TX CCK High channel



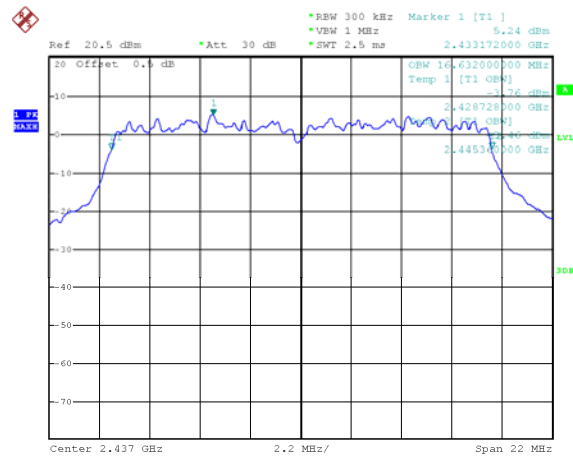
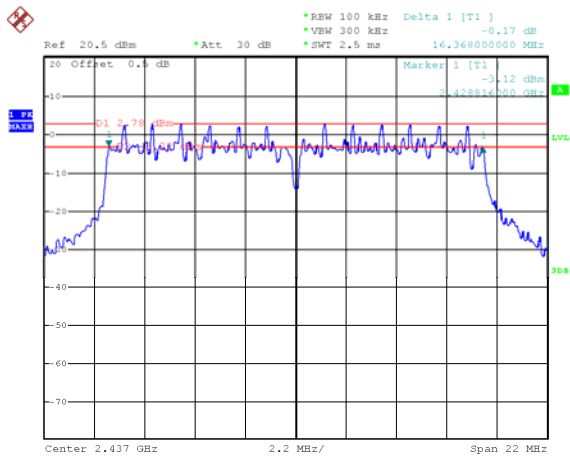
6 dB Bandwidth

99% Bandwidth

Mode: TX OFDM Low channel



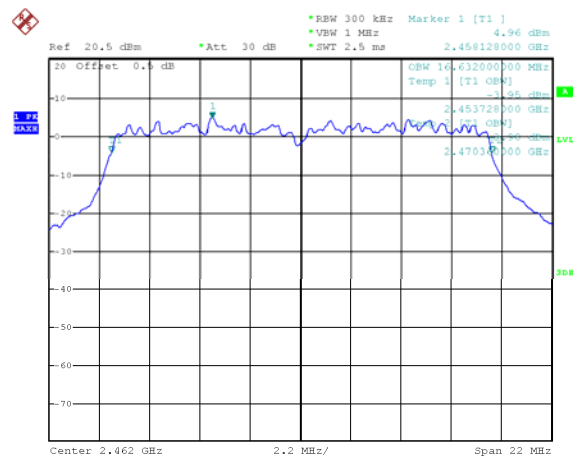
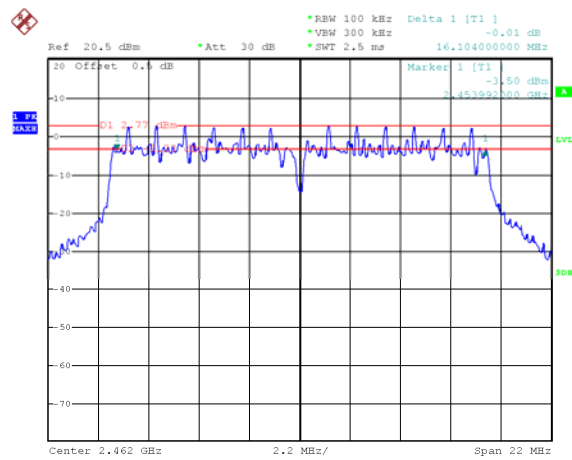
Mode: TX OFDM Middle channel



6 dB Bandwidth

99% Bandwidth

Mode: TX OFDM High channel



12 Maximum Peak Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	ANSI C63.10:2013 KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019 §15.247(b)
Test Limit:	The maximum peak conducted output power of the intentional radiator shall not exceed 1W.
Test Mode:	Transmitting

12.1 Test Procedure:

KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019

Section 8.3.1.1 RBW $\geq$ DTS bandwidth

Subclause 11.9.1.1 of ANSI C63.10 is applicable.

Section 8.3.1.2 Integrated band power method

For measuring the output power of a device transmitting a wide-band noise-like signal where the peak power amplitude is a statistical parameter, the preferred methodology is to use an integrated average power measurement, as described in 8.3.2. The peak integrated band power method of 11.9.1 in ANSI C63.10 is not applicable.

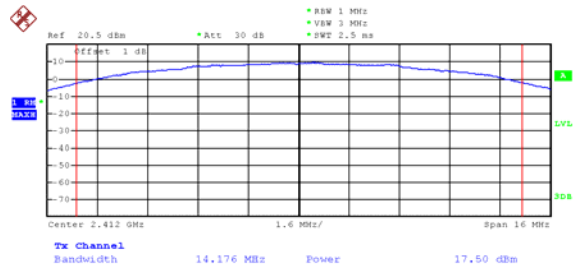
Subclause 11.9.2 of ANSI C63.10 is applicable.

12.2 Test Result:

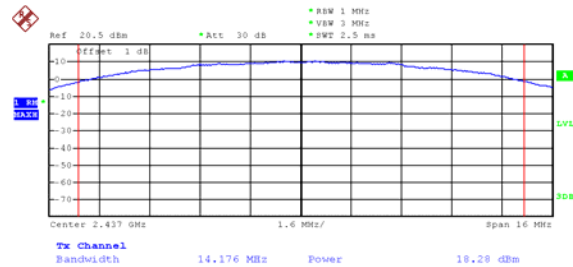
Operation mode	Channel Frequency (MHz)	Measurements (dBm)	Duty Cycle Factor (dB)	Conducted output power (dBm)	Limit
TX CCK	Low-2412	17.50	4.16	21.66	1W/30dBm
	Middle-2437	18.28		22.44	1W/30dBm
	High-2462	18.85		23.01	1W/30dBm
TX OFDM	Low-2412	13.50	7.75	21.25	1W/30dBm
	Middle-2437	13.82		21.57	1W/30dBm
	High-2462	13.61		21.36	1W/30dBm

Test Plot

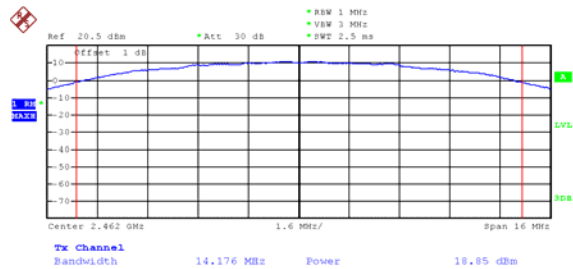
Mode: TX CCK Low channel



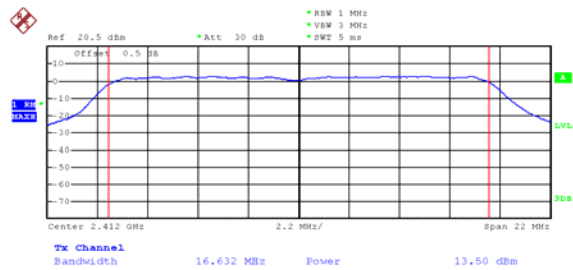
Mode: TX CCK Middle channel



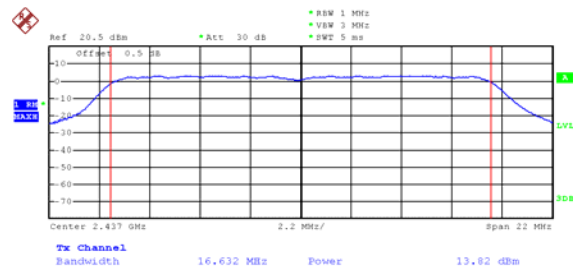
Mode: TX CCK High channel



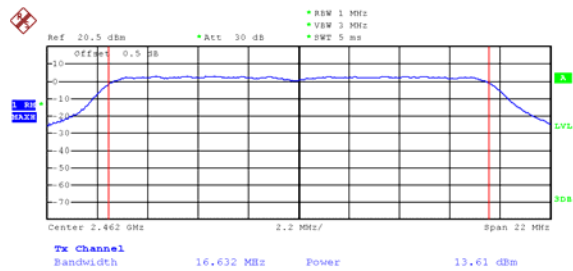
Mode: TX OFDM Low channel



Mode: TX OFDM Middle channel



Mode: TX OFDM High channel



13 Power Spectral density

Test Requirement: FCC CFR47 Part 15 Section 15.247
 Test Method: ANSI C63.10:2013
 KDB 558074 D01 15.247 Meas Guidance v05r02, April 2, 2019
 §15.247(e)
 Test Limit: For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
 Test Mode: Transmitting

13.1 Test Procedure:

KDB 558074 D01 15.247 Meas Guidance v05r02 April 2, 2019 section 8.4

Subclause 11.10 of ANSI C63.10 is applicable.

Choose the test procedure according to the product type

Peak PSD

Subclause 11.10.2 of ANSI C63.10 is applicable.

AVG PSD

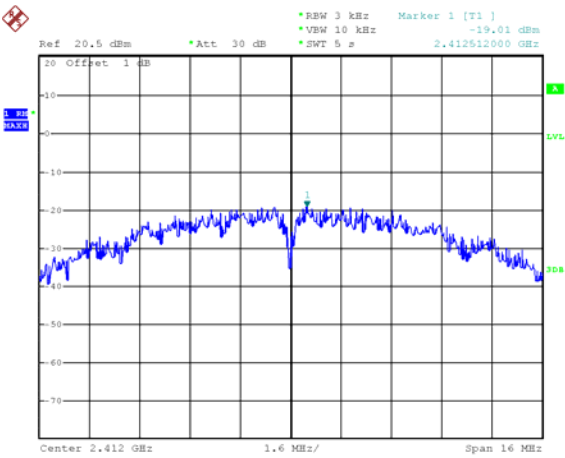
Subclause 11.10.3/4/5/6/7/8 of ANSI C63.10 is applicable.

13.2 Test Result:

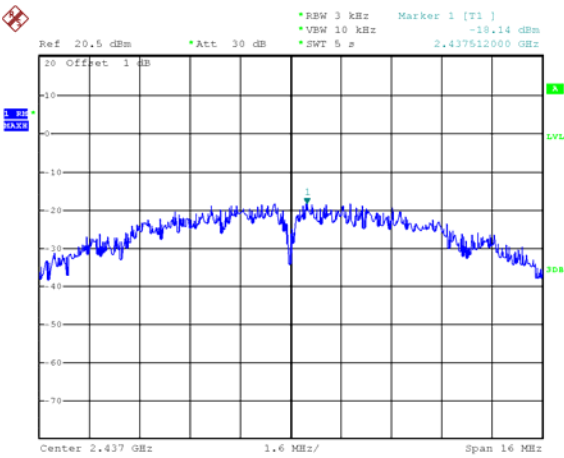
Operation mode	Channel Frequency (MHz)	measured PSD (dBm per 3kHz)	Duty Cycle Factor (dB)	Power Spectral density (dBm per 3kHz)	Limit
TX CCK	Low-2412	-19.01	4.16	-14.84	8dBm per 3kHz
	Middle-2437	-18.14		-13.98	8dBm per 3kHz
	High-2462	-17.46		-13.30	8dBm per 3kHz
TX OFDM	Low-2412	-23.89	7.75	-16.14	8dBm per 3kHz
	Middle-2437	-23.39		-15.64	8dBm per 3kHz
	High-2462	-23.65		-15.90	8dBm per 3kHz

Test Plot

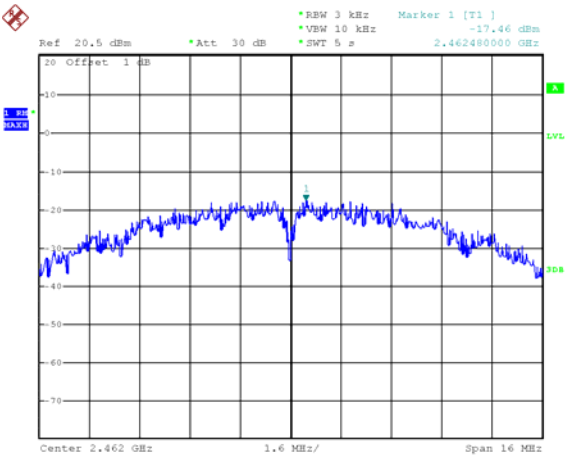
Mode: TX CCK Low channel



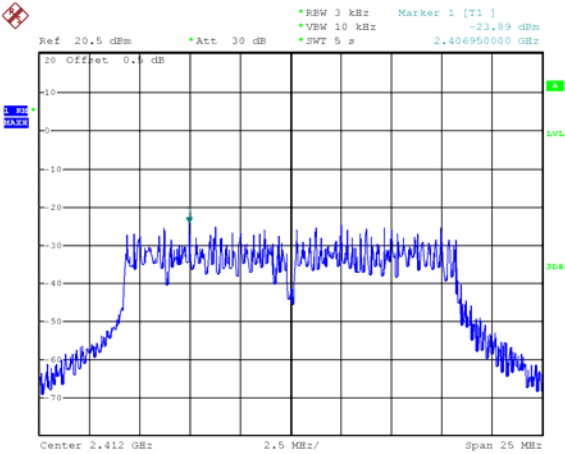
Mode: TX CCK Middle channel



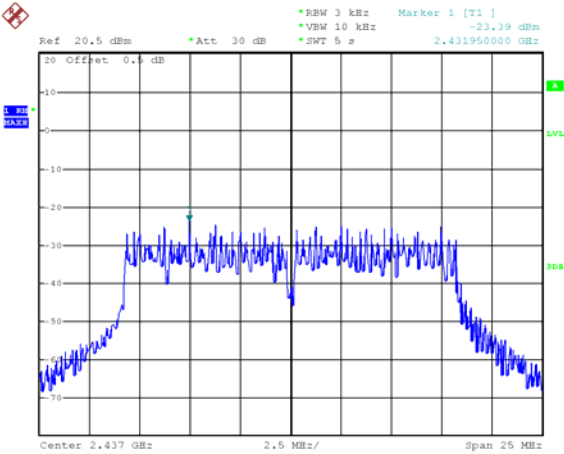
Mode: TX CCK High channel



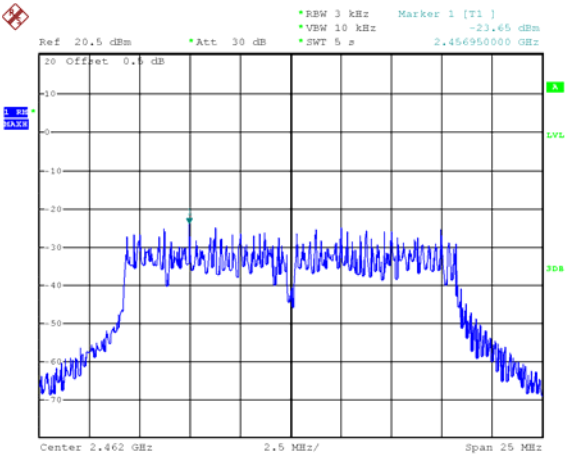
Mode: TX OFDM Low channel



Mode: TX OFDM Middle channel



Mode: TX OFDM High channel



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 external antenna fulfil the requirement of this section.

Note: please refer to EUT photos for more details.

15 RF Exposure

Remark: Please refer to MPE test report: WTD21D06058389W002.

16 Photographs of test setup and EUT.

Note: Please refer to appendix: Appendix-WF8023-Photos.

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