Report No.: ET-24111749E

TEST REPORT

Applicant:	IconiQ group inc
Address of Applicant:	3857 birch st suite 406. Newport Beach CA 92660
Manufacturer/Factory:	WONGLI INDUSTRIAL LIMITED
Address of Manufacturer/Factory:	Rooms 1318-19,Hollywood Plaza,610 Nathan Road,Mongkok,Kowloon,HK
Product Name:	IconiQ Bluetooth Speaker
Model No.:	Q10, ICONIQ Q
Trade Mark:	N/A
FCC ID:	2BL6U-Q10
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247
Date of Test:	Nov.05, 2024-Nov.22, 2024
Date of report issued:	Dec.02, 2024

Remark:

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The report would be invalid without specific stamp of test institute and the signatures of compiler and approver

Prepared By

Shenzhen ETR Standard Technology Co., Ltd.

Address: No.103, No.10, Phase I, Zone 3, Xinxing Industrial Park, Xinhe, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Compiled by:	Reviewed by:	Approved by:
Project Engineer	Project Manager	Authorized Signature

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Report Revision History		
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1 Test Summary

Test Item	Section in CFR 47	Result	Test by
Antenna Requirement	15.203/15.247 (c)	Pass	/
AC Power Line Conducted Emission	15.207	Pass	Carr Kang
Conducted Peak Output Power	15.247 (b)(1)	Pass	Yvan Fan
20dB Occupied Bandwidth	15.247 (a)(1)	Pass	Yvan Fan
Carrier Frequencies Separation	15.247 (a)(1)	Pass	Yvan Fan
Hopping Channel Number	15.247 (a)(1)(iii)	Pass	Yvan Fan
Dwell Time	15.247 (a)(1)(iii)	Pass	Yvan Fan
Radiated Emission	15.205/15.209	Pass	Carr Kang
Band Edge	15.247(d)	Pass	Yvan Fan

Remarks:

1. *Pass: The EUT complies with the essential requirements in the standard.*
2. *Test according to ANSI C63.10:2013*

Measurement Uncertainty

Test Item	Uncertainty Criterion	Measurement Uncertainty	Notes
Occupied Channel Bandwidth	±5%	±0.55%	(1)
RF output power, conducted	±1.5dB	±0.99dB	(1)
Dewll Time	±5%	±0.05%	(1)
Power Spectral Density, conducted	±3dB	±0.61dB	(1)
Unwanted Emissions, conducted	±3dB	±0.64dB	(1)
AC Power Line Conducted Emission	±6dB	± 2.64 dB	(1)
Radiated emissions Below 1GHz	±6dB	±4.32 dB	(1)
Radiated emissions Above 1GHz	±6dB	±4.56dB	(1)
Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.			

2 General Information

2.1 General Description of EUT

Product Name:	IconiQ Bluetooth Speaker
Model No.:	Q10, ICONIQ Q
Test Model:	Q10
Difference of model(s)	All the model are the same circuit and RF module, except the model names
Hardware Version:	2.1 BTS PCB 1.2V
Software Version:	WS300 2.0V
Operation Frequency:	2402MHz~2480MHz
Channel numbers:	79
Channel separation:	1MHz
Modulation type:	GFSK,π/4-DQPSK,8DPSK
Antenna Type:	PCB antenna
Antenna gain:	Antenna Gain: 2dBi Note: Antenna information is provided by applicant, Testing lab is not responsible for the accuracy of the information.
Battery	DC 14.8V 6000mAh
Power supply:	DC 19V From adapter or DC 14.8V From Battery
Adapter information:	Model: NT136-1900630D1 INPUT:100-240V 50/60Hz 2A OUTPUT:DC 19V 6.3A

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402MHz	21	2422MHz	41	2442MHz	61	2462MHz
2	2403MHz	22	2423MHz	42	2443MHz	62	2463MHz
3	2404MHz	23	2424MHz	43	2444MHz	63	2464MHz
4	2405MHz	24	2425MHz	44	2445MHz	64	2465MHz
5	2406MHz	25	2426MHz	45	2446MHz	65	2466MHz
6	2407MHz	26	2427MHz	46	2447MHz	66	2467MHz
7	2408MHz	27	2428MHz	47	2448MHz	67	2468MHz
8	2409MHz	28	2429MHz	48	2449MHz	68	2469MHz
9	2410MHz	29	2430MHz	49	2450MHz	69	2470MHz
10	2411MHz	30	2431MHz	50	2451MHz	70	2471MHz
11	2412MHz	31	2432MHz	51	2452MHz	71	2472MHz
12	2413MHz	32	2433MHz	52	2453MHz	72	2473MHz
13	2414MHz	33	2434MHz	53	2454MHz	73	2474MHz
14	2415MHz	34	2435MHz	54	2455MHz	74	2475MHz
15	2416MHz	35	2436MHz	55	2456MHz	75	2476MHz
16	2417MHz	36	2437MHz	56	2457MHz	76	2477MHz
17	2418MHz	37	2438MHz	57	2458MHz	77	2478MHz
18	2419MHz	38	2439MHz	58	2459MHz	78	2479MHz
19	2420MHz	39	2440MHz	59	2460MHz	79	2480MHz
20	2421MHz	40	2441MHz	60	2461MHz		

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel	2402MHz
The middle channel	2441MHz
The Highest channel	2480MHz

2.2 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode.
Remark: For battery operated equipment, the EUT was performed using a new DC 3.7V battery.	

2.3 Description of Support Units

Equipment	Model	S/N	Manufacturer
/	/	/	/

2.4 Deviation from Standards

None.

2.5 Abnormalities from Standard Conditions

None.

2.6 Test Facility

Test laboratory:	Shenzhen ETR Standard Technology Co., Ltd.
CNAS Registration Number:	L11864
A2LA Certificate Number:	6640.01
FCC Designation Number:	CN1326
FCC Test Firm Registration:	183064

2.7 Test Location

All tests were performed at:	
Laboratory location:	No.103, No.10, Phase I, Zone 3, Xinxing Industrial Park, Xinhe, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Telephone:	+86 755 85259392
Fax:	+86 755 27219460

2.8 Additional Instructions

Test Software	FCC_V1.2.0
Power level setup	Default

3 Test Instruments list

Item	Equipment name	Manufacturer	Model	Serial No.	Calibration date	Due date
1	EMI Test Receiver	Rohde&schwarz	ESCI7	100605	2024.3.12	2025.3.11
2	EMI Test Receiver	Rohde&schwarz	ESCI3	102696	2024.3.12	2025.3.11
3	Loop Antenna	schwarabeck	FMZB 1519 B	FMZB 1519 B	2024.3.19	2026.3.21
4	Broadband antenna	schwarabeck	VULB9168	1064	2024.3.19	2026.3.21
5	Horn antenna	schwarabeck	BBHA9120D	9120D-1145	2024.3.19	2026.3.21
6	amplifier	EMtrace	RP01A	50117	2024.3.12	2025.3.11
7	Artificial power network	schwarabeck	NSLK8127	8127483	2024.3.12	2025.3.11
8	Artificial power network	ETS	3186/2NM	1132	2024.3.12	2025.3.11
9	10dB attenuator	HUBER+SUHNER	10dB	/	2024.3.12	2025.3.11
10	amplifier	Space-Dtronics	EWLAN0118G-P40	19113001	2024.3.12	2025.3.11
11	Filter	Xingbo	XBLBQ-GTA19	210410-3-1	2024.3.12	2025.3.11
12	Spectrum analyzer	KEYSIGHT	N9020A	MY55370280	2024.3.12	2025.3.11
13	Power detector box	MWRFtest	MW100-PSB	MW201020JYT	2024.3.12	2025.3.11
14	Power meter	Rohde&Schwarz	NRP-Z11	1138.3004.02-117725-vh	2024.3.12	2025.3.11
15	amplifier	SKET	LNPA_1840-50 (18-40GHz)	SK2019040302	2024.3.12	2025.3.11
16	Horn antenna	schwarabeck	BBHA 9170	946	2024.3.19	2026.3.21
17	Spectrum analyzer	Rohde&schwarz	FSU40	1166.1660K43	2024.3.12	2025.3.11

Note: the calibration interval of the above test instruments is 12 or 24 months and the calibrations are traceable to international system unit (SI).

Software Name	Manufacturer	Model	Version
RF test software	MWRFtest	MTS 8310	V2.0.0.0
Conducted test software	EZ-EMC	Farad	Ver.EMC-CON 3A1.1
Radiated test software	EZ-EMC	Farad	Ver.FA-03A2 RE

4 Test results and Measurement Data

4.1 Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. **15.247(c) (1)(i) requirement:** (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.	
E.U.T Antenna:	
The antenna is PCB antenna, the best case gain of the antenna is 2dBi, reference to the appendix II for details.	

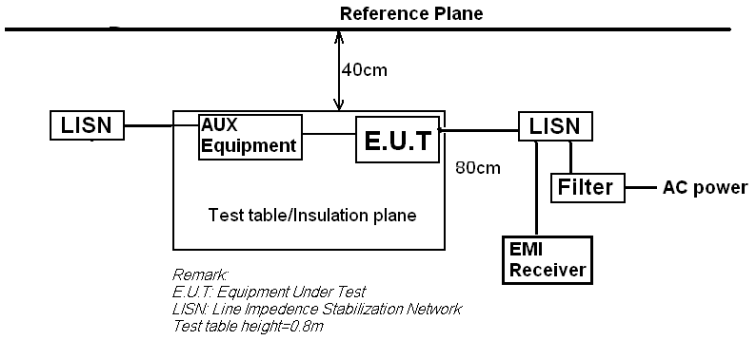
4.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207
Test Method:	ANSI C63.10:2013
Test Frequency Range:	150KHz to 30MHz
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto
Limit:	

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

Test setup:



Test procedure:

1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.
2. 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).
3. 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 of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement.

Test Instruments:	Refer to section 3.0 for details					
Test mode:	Refer to section 2.2 for details					
Test environment:	Temp.:	24.7°C	Humid.:	51%	Press.:	1017mbar
Test voltage:	DC 19V from adapter					
Test results:	Pass					

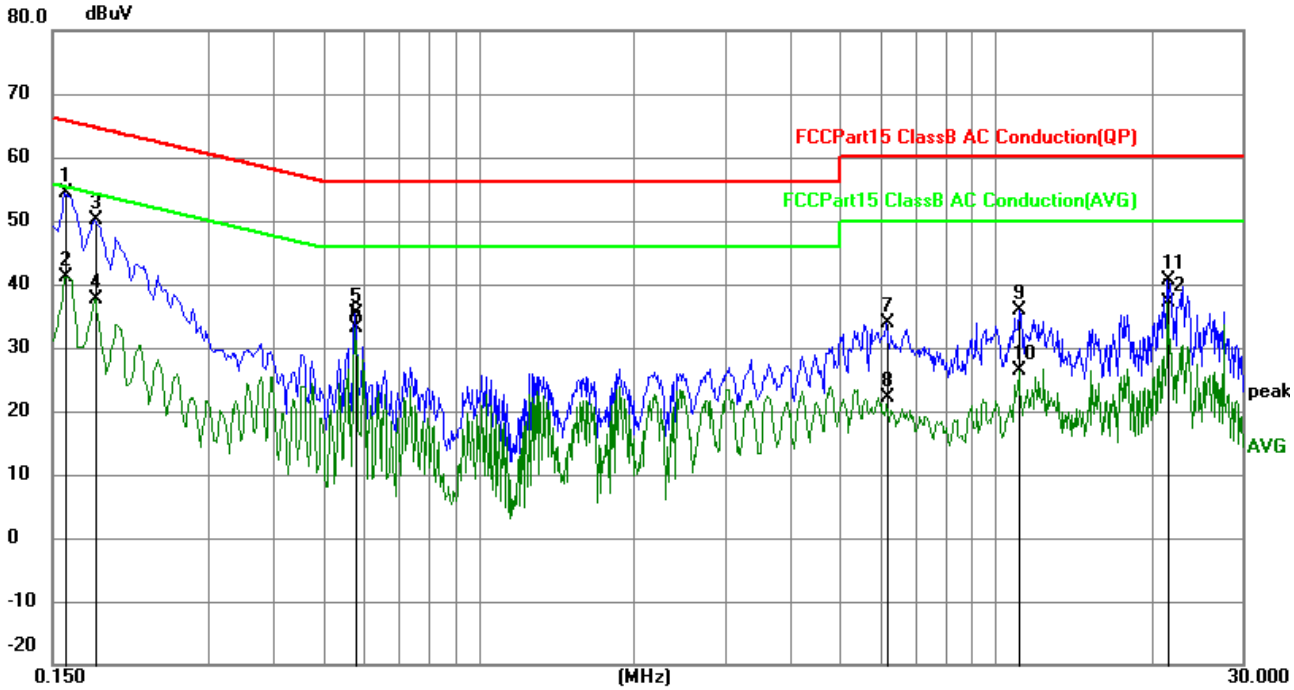
Remark:

1. Both high voltage and low voltage have been tested, and the report only shows the worst case data with AC 120V/60Hz.

2. Pre-scan all test modes and report data for the worst mode 8-DPSK (2480MHz) where only modules WS300 and TWS300 work simultaneously.

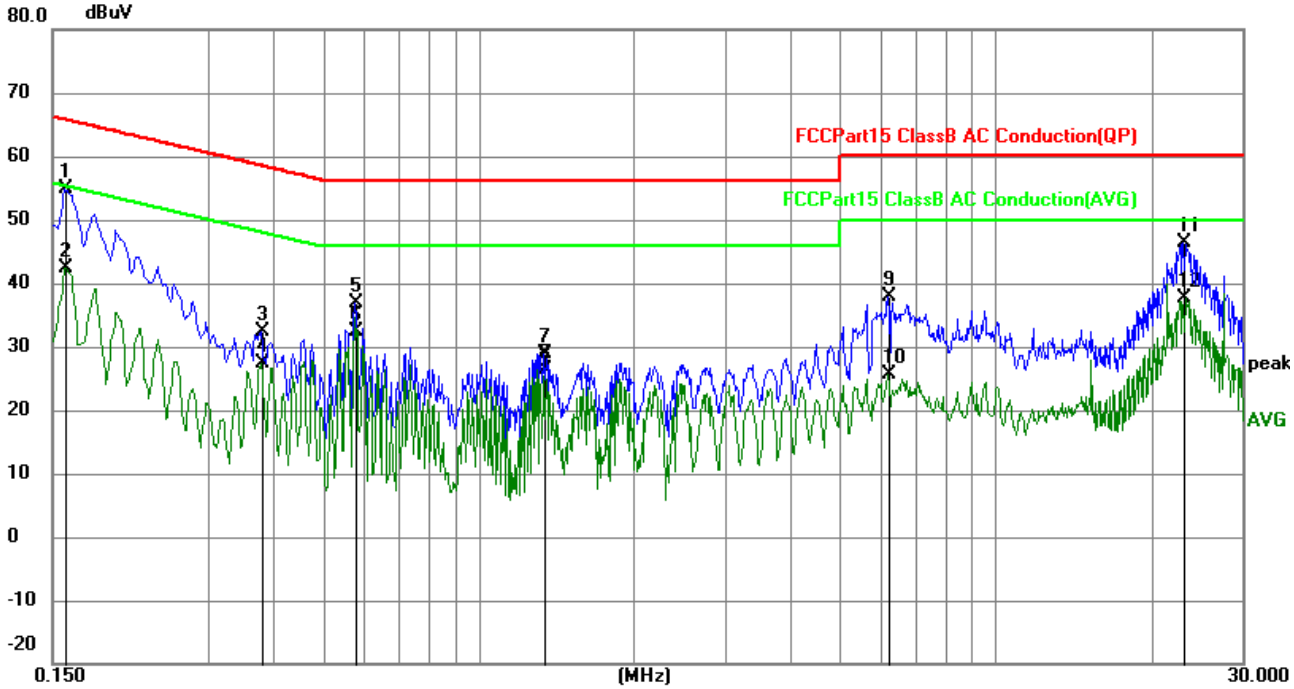
Measurement data:

Line:



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1590	44.58	9.80	54.38	65.52	-11.14	QP
2	0.1590	31.42	9.80	41.22	55.52	-14.30	AVG
3	0.1814	40.29	9.81	50.10	64.42	-14.32	QP
4	0.1814	27.88	9.81	37.69	54.42	-16.73	AVG
5	0.5774	25.32	9.94	35.26	56.00	-20.74	QP
6	0.5774	23.07	9.94	33.01	46.00	-12.99	AVG
7	6.1710	24.09	9.83	33.92	60.00	-26.08	QP
8	6.1710	12.42	9.83	22.25	50.00	-27.75	AVG
9	11.1165	26.02	9.82	35.84	60.00	-24.16	QP
10	11.1165	16.61	9.82	26.43	50.00	-23.57	AVG
11	21.5069	30.90	9.64	40.54	60.00	-19.46	QP
12	21.5069	27.46	9.64	37.10	50.00	-12.90	AVG

Neutral:

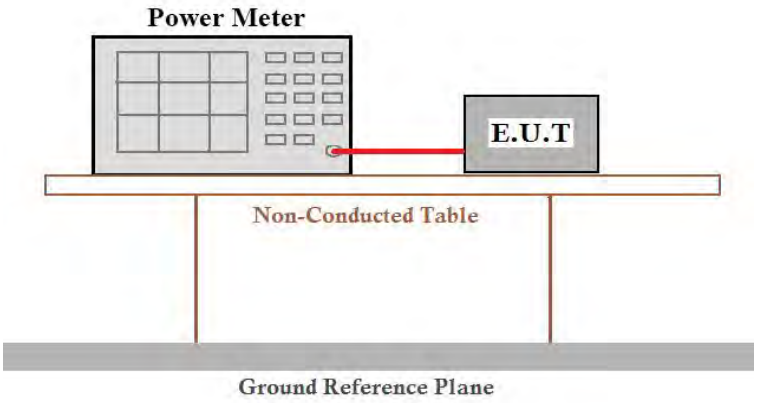


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1590	45.08	9.80	54.88	65.52	-10.64	QP
2	0.1590	32.47	9.80	42.27	55.52	-13.25	AVG
3	0.3795	22.48	9.89	32.37	58.29	-25.92	QP
4	0.3795	17.50	9.89	27.39	48.29	-20.90	AVG
5	0.5774	27.01	9.94	36.95	56.00	-19.05	QP
6	0.5774	22.44	9.94	32.38	46.00	-13.62	AVG
7	1.3379	19.01	9.92	28.93	56.00	-27.07	QP
8	1.3379	16.39	9.92	26.31	46.00	-19.69	AVG
9	6.1979	28.01	9.83	37.84	60.00	-22.16	QP
10	6.1979	15.76	9.83	25.59	50.00	-24.41	AVG
11	23.0910	36.73	9.62	46.35	60.00	-13.65	QP
12	23.0910	28.07	9.62	37.69	50.00	-12.31	AVG

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level =Receiver Read level + LISN Factor + Cable Loss

4.3 Conducted Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(1)	
Test Method:	ANSI C63.10:2013 and KDB558074 D01 15.247 Meas Guidance v05r02	
Limit:	20.97dBm	
Test setup:		
Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 26.2°C	Humid.: 52%RH
Test voltage:	DC 14.8V From battery	
Test results:	Pass	

Measurement Result

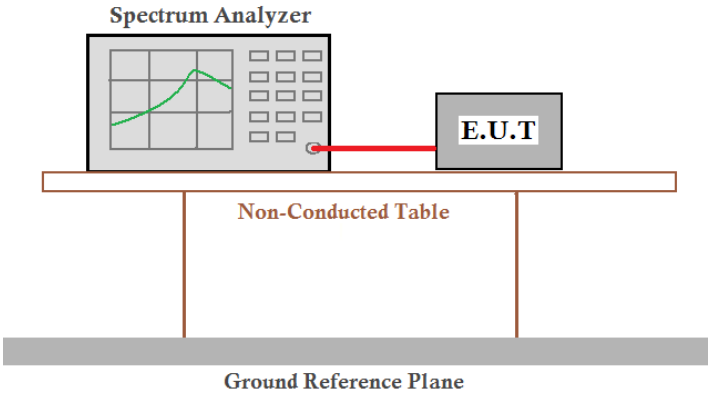
Modular:WS300

Mode	Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
GFSK	Lowest	3.41	20.97	Pass
	Middle	3.56		
	Highest	3.63		
π/4-DQPSK	Lowest	3.48	20.97	Pass
	Middle	3.52		
	Highest	3.61		
8-DPSK	Lowest	3.60	20.97	Pass
	Middle	3.73		
	Highest	3.66		

Modular: TWS300

Mode	Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
GFSK	Lowest	3.40	20.97	Pass
	Middle	2.54		
	Highest	2.63		
π/4-DQPSK	Lowest	3.40	20.97	Pass
	Middle	3.19		
	Highest	3.33		
8-DPSK	Lowest	3.34	20.97	Pass
	Middle	3.36		
	Highest	3.50		

4.4 20dB Emission Bandwidth

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)	
Test Method:	ANSI C63.10:2013 and KDB558074 D01 15.247 Meas Guidance v05r02	
Limit:	N/A	
Test setup:		
Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 26.2°C	Humid.: 52%RH
Test voltage:	DC 14.8V From battery	
Test results:	Pass	

Measurement Result

Modular: WS300

Mode	Test channel	20dB Emission Bandwidth (MHz)	Result
GFSK	Lowest	0.9453	Pass
	Middle	0.9417	
	Highest	0.9437	
π/4-DQPSK	Lowest	1.536	Pass
	Middle	1.529	
	Highest	1.425	
8-DPSK	Lowest	1.432	Pass
	Middle	1.476	
	Highest	1.469	

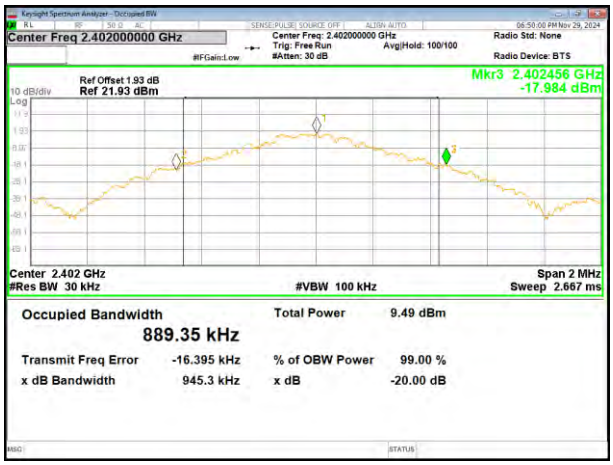
Modular: TWS300

Mode	Test channel	20dB Emission Bandwidth (MHz)	Result
GFSK	Lowest	0.9541	Pass
	Middle	0.9433	
	Highest	0.9552	
π/4-DQPSK	Lowest	1.426	Pass
	Middle	1.525	
	Highest	1.428	
8-DPSK	Lowest	1.506	Pass
	Middle	1.519	
	Highest	1.517	

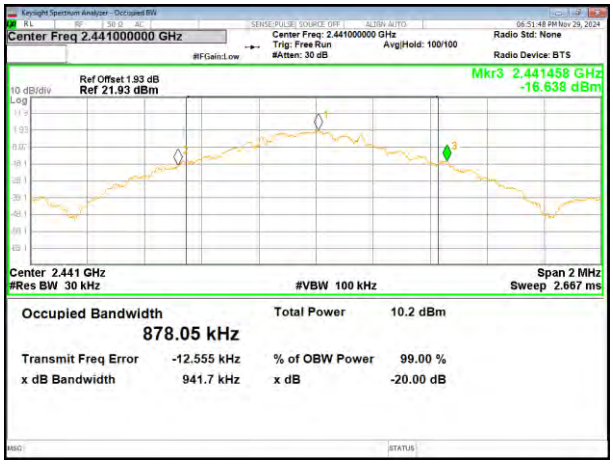
Modular: WS300

Test plot as follows:

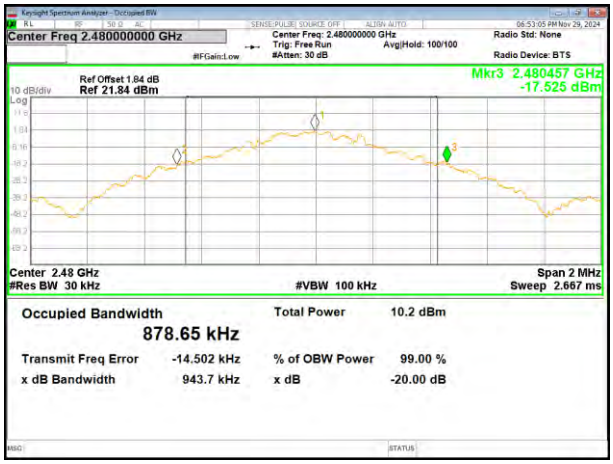
Test mode:	GFSK mode



Lowest channel



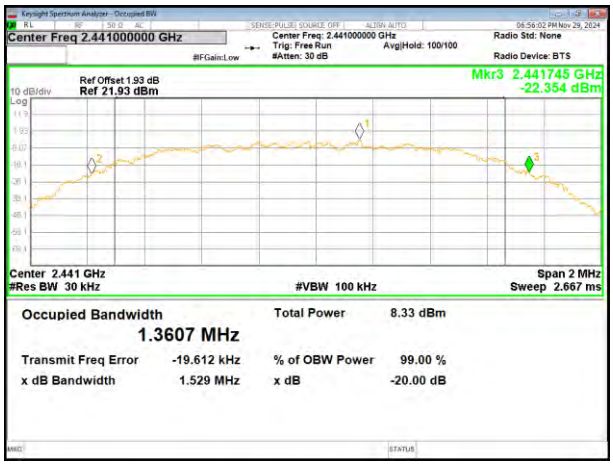
Middle channel



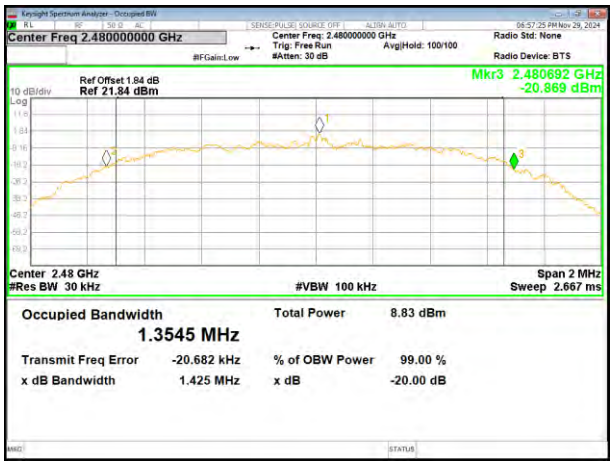
Highest channel

Test mode:	π/4-DQPSK mode

Lowest channel

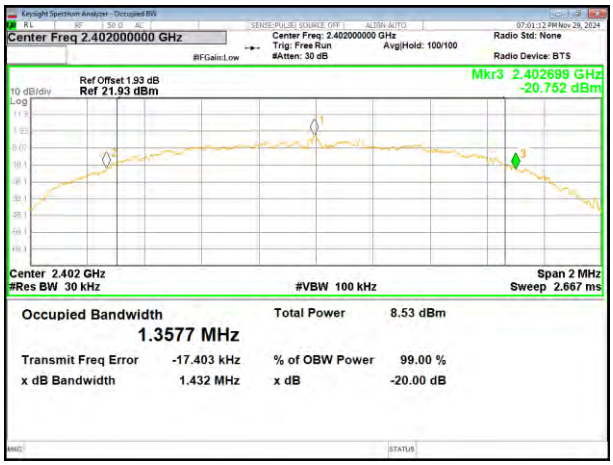


Middle channel

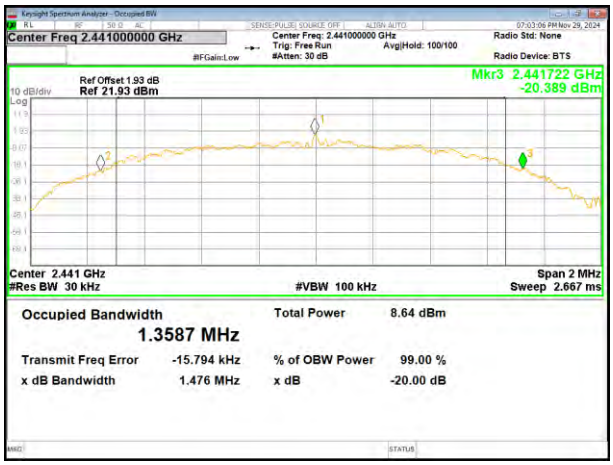


Highest channel

Test mode:	8-DPSK mode



Lowest channel



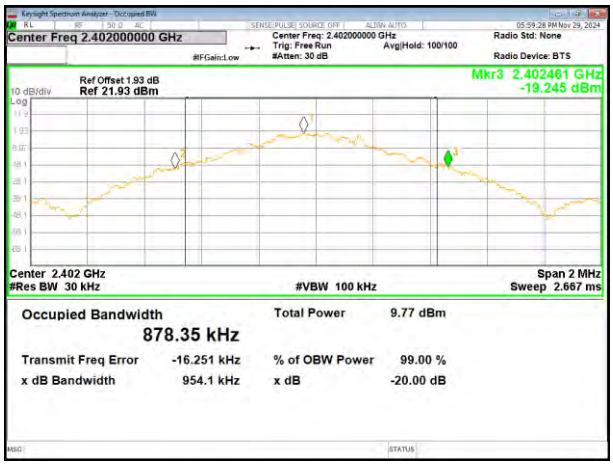
Middle channel

Highest channel

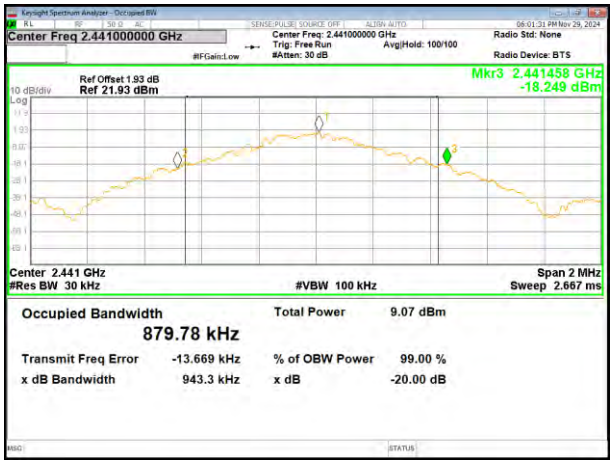
Modular: TWS300

Test plot as follows:

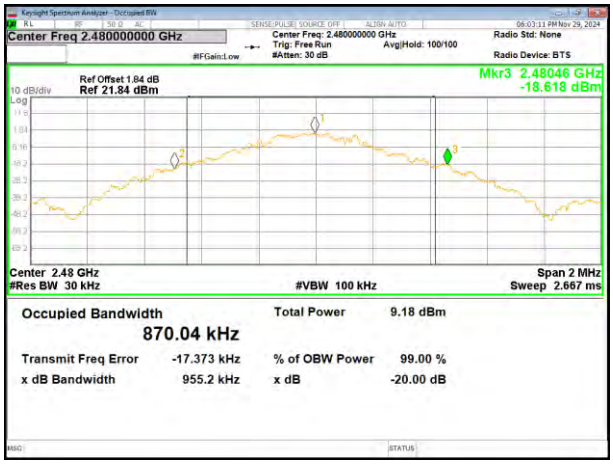
Test mode:	GFSK mode



Lowest channel

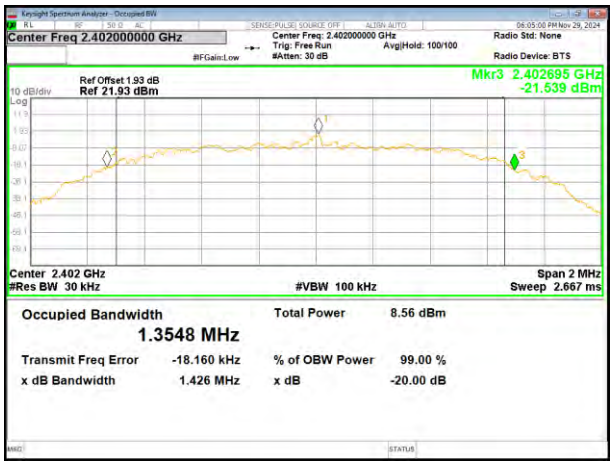


Middle channel

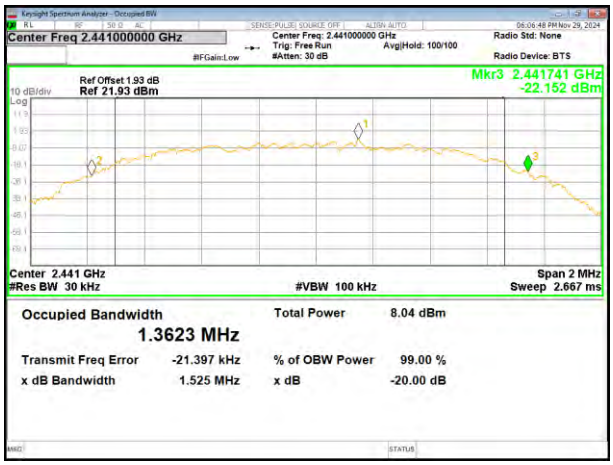


Highest channel

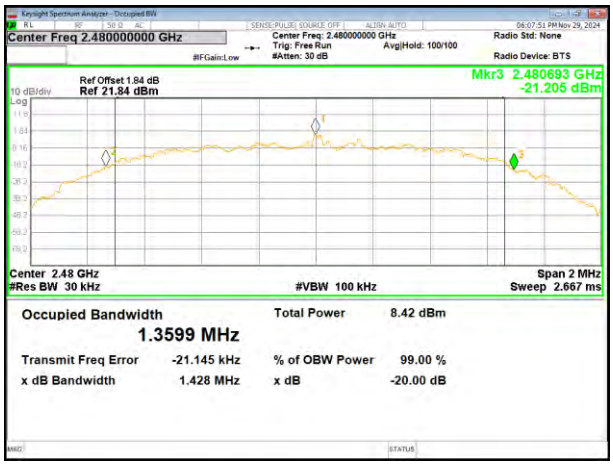
Test mode:	π/4-DQPSK mode



Lowest channel

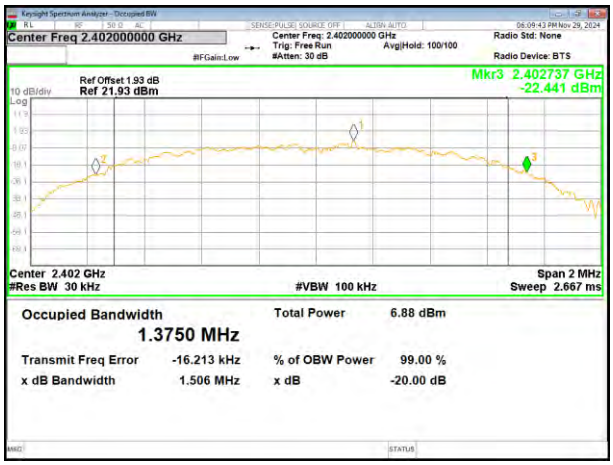


Middle channel

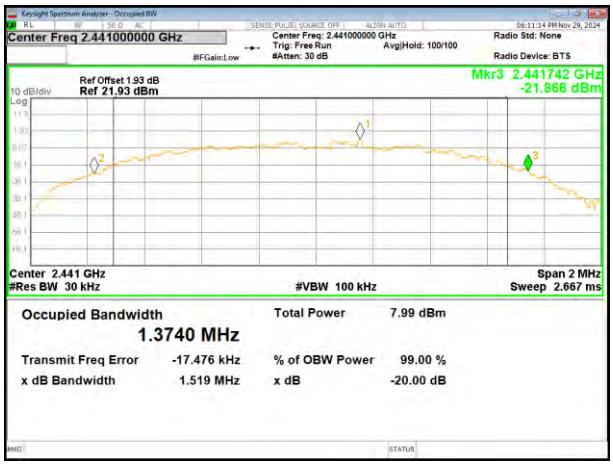


Highest channel

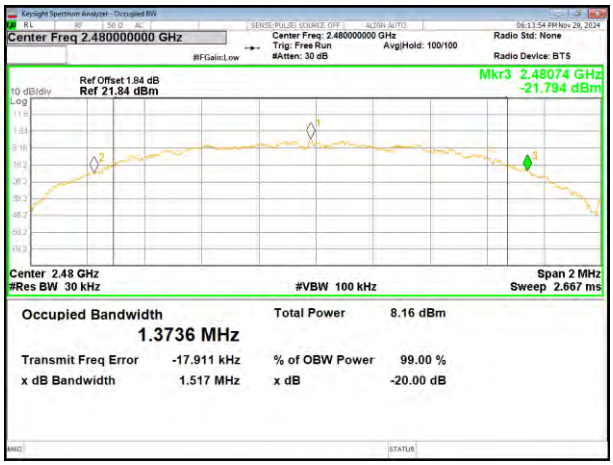
Test mode:	8-DPSK mode



Lowest channel

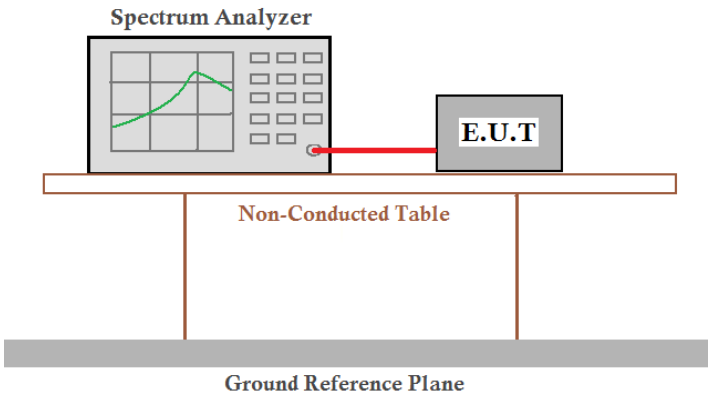


Middle channel



Highest channel

4.5 Carrier Frequencies Separation

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)	
Test Method:	ANSI C63.10:2013	
Receiver setup:	RBW=300KHz, VBW=1000KHz, detector=Peak	
Limit:	>0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)	
Test setup:		
Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 26.2°C	Humid.: 52%RH
Test voltage:	DC 14.8V From battery	
Test results:	Pass	

Measurement Result

Modular: WS300

Mode	Test channel	Carrier Frequencies Separation (MHz)	Limit (MHz)	Result
GFSK	Lowest	1.0020	0.630	Pass
	Middle	1.0005	0.628	Pass
	Highest	1.0275	0.629	Pass
π/4-DQPSK	Lowest	1.314	1.024	Pass
	Middle	1.260	1.019	Pass
	Highest	1.278	0.950	Pass
8-DPSK	Lowest	1.287	0.955	Pass
	Middle	1.233	0.984	Pass
	Highest	1.014	0.979	Pass

Measurement Result

Modular: TWS300

Mode	Test channel	Carrier Frequencies Separation (MHz)	Limit (MHz)	Result
GFSK	Lowest	1.0395	0.636	Pass
	Middle	1.0080	0.629	Pass
	Highest	1.0035	0.637	Pass
π/4-DQPSK	Lowest	1.038	0.951	Pass
	Middle	1.251	1.017	Pass
	Highest	1.005	0.952	Pass
8-DPSK	Lowest	1.206	1.004	Pass
	Middle	1.284	1.013	Pass
	Highest	1.074	1.011	Pass

Note: According to section 4.4

Modular: WS300

Test plot as follows:

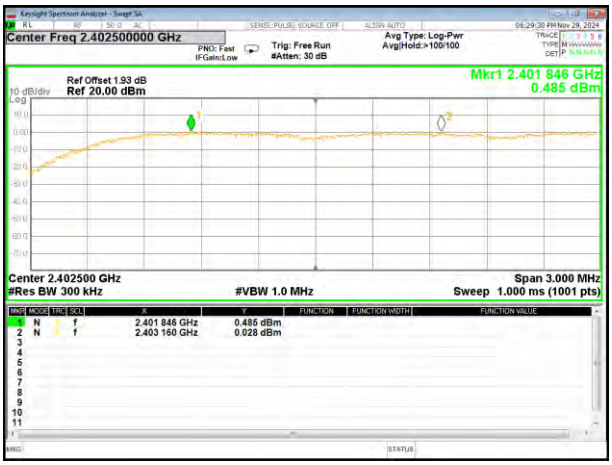
Modulation mode:	GFSK

Lowest channel

Middle channel

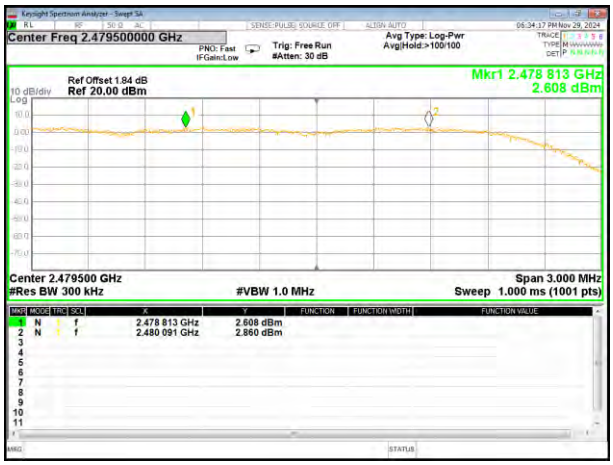
Highest channel

Test mode:	π/4-DQPSK



Lowest channel

Middle channel



Highest channel

Test mode:	8-DPSK

Lowest channel

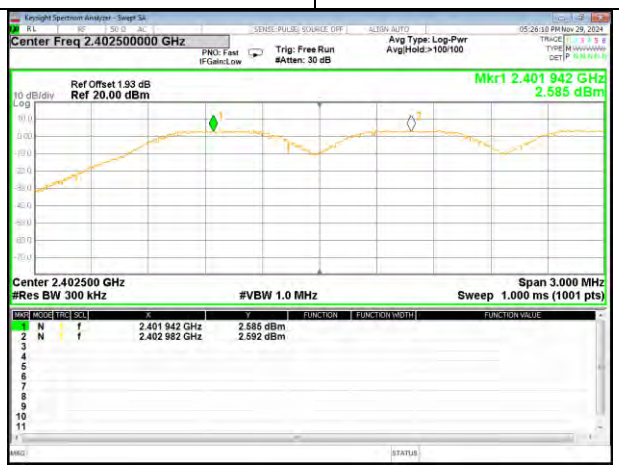
Middle channel

Highest channel

Modular: TWS300

Test plot as follows:

Modulation mode:	GFSK

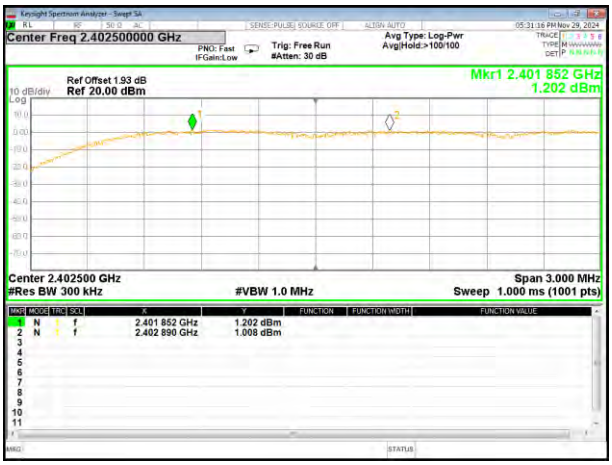


Lowest channel

Middle channel

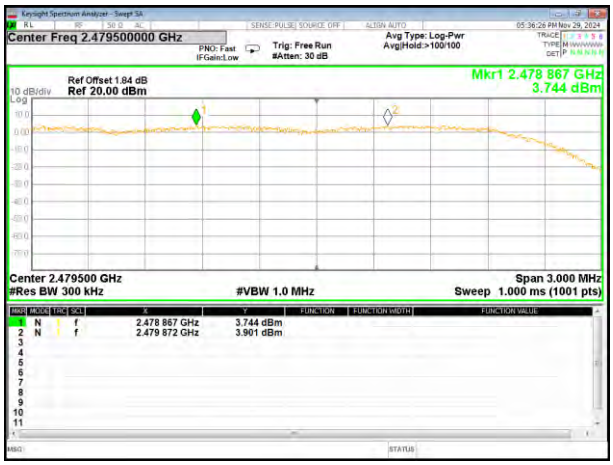
Highest channel

Test mode:	π/4-DQPSK



Lowest channel

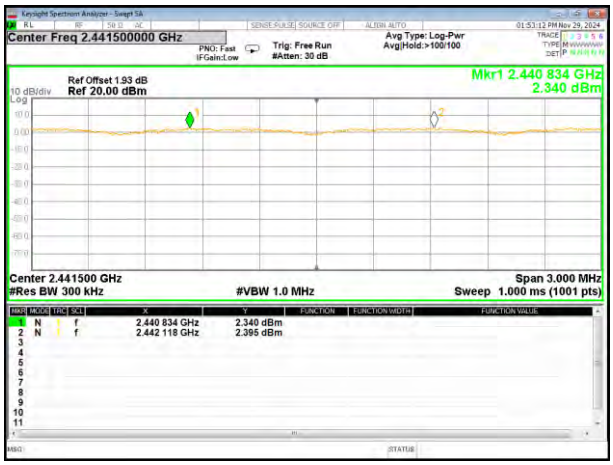
Middle channel



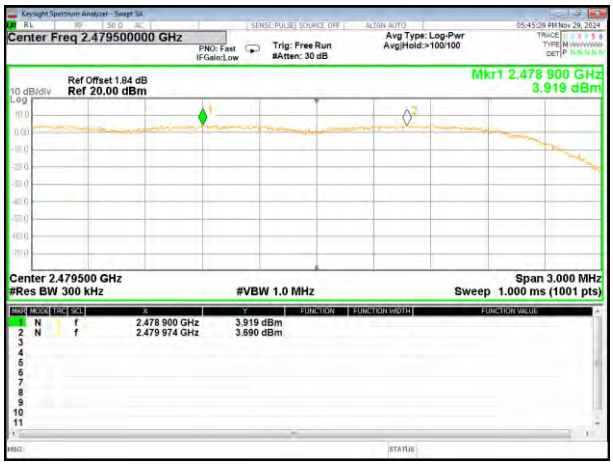
Highest channel

Test mode:	8-DPSK

Lowest channel

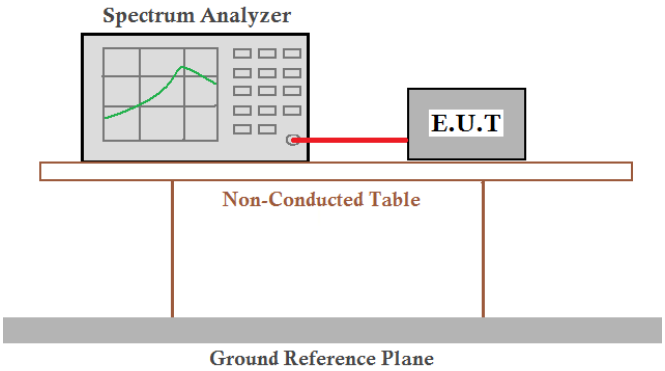


Middle channel



Highest channel

4.6 Hopping Channel Number

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)	
Test Method:	ANSI C63.10:2013	
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak	
Limit:	15 channels	
Test setup:		
Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 26.2°C	Humid.: 52%RH
Test voltage:	DC 14.8V From battery	
Test results:	Pass	

Measurement Data:

Modular: WS300

Mode	Hopping channel numbers	Limit	Result
GFSK	79	15	Pass
π/4-DQPSK	79	15	Pass
8-DPSK	79	15	Pass

Modular: TWS300

Mode	Hopping channel numbers	Limit	Result
GFSK	79	15	Pass
π/4-DQPSK	79	15	Pass
8-DPSK	79	15	Pass

Modular: WS300

Test plot as follows:

Test mode:	GFSK

Test mode:	π/4-DQPSK

Test mode:	8-DPSK

Modular: TWS300

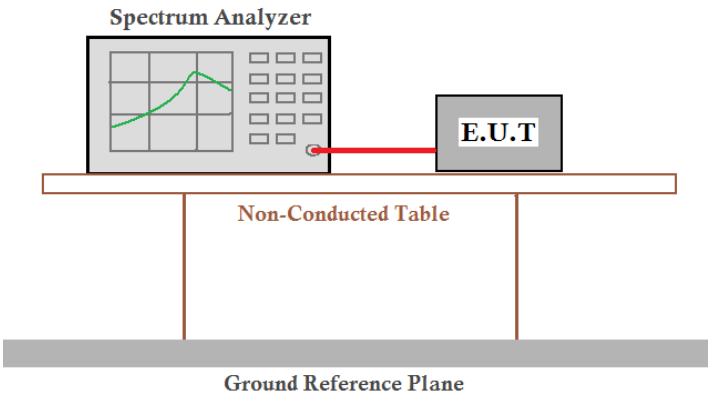
Test plot as follows:

Test mode:	GFSK

Test mode:	π/4-DQPSK

Test mode:	8-DPSK

4.7 Dwell Time

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)(iii)	
Test Method:	ANSI C63.10:2013	
Receiver setup:	RBW=1MHz, VBW=3MHz, Span=0Hz, Detector=Peak	
Limit:	0.4 Second	
Test setup:		
Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 26.2°C	Humid.: 52%RH
Test voltage:	DC 14.8V From battery	
Test results:	Pass	

Modular: WS300

Measurement Result

GFSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	DH1	121.92	400	Pass
2441MHz	DH3	261.76	400	Pass
2441MHz	DH5	307.74	400	Pass

Remarks:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

Test channel: 2441MHz as blow

DH1 time slot=0.381 (ms)*(1600/ (2*79))*31.6=121.92ms

DH3 time slot=1.636 (ms)*(1600/ (4*79))*31.6=261.76ms

DH5 time slot=2.885 (ms)*(1600/ (6*79))*31.6=307.74ms

π/4-DQPSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	DH1	124.48	400	Pass
2441MHz	DH3	262.72	400	Pass
2441MHz	DH5	308.16	400	Pass

Remarks:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

Test channel: 2441MHz as blow

DH1 time slot=0.389 (ms)*(1600/ (2*79))*31.6=124.48ms

DH3 time slot=1.642 (ms)*(1600/ (4*79))*31.6=262.72ms

DH5 time slot=2.889 (ms)*(1600/ (6*79))*31.6=308.16ms

8-DPSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	DH1	124.48	400	Pass
2441MHz	DH3	262.40	400	Pass
2441MHz	DH5	308.26	400	Pass

Remarks:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

Test channel: 2441MHz as blow

DH1 time slot=0.389 (ms)*(1600/ (2*79))*31.6=124.48ms

DH3 time slot=1.640 (ms)*(1600/ (4*79))*31.6=262.40ms

DH5 time slot=2.890 (ms)*(1600/ (6*79))*31.6=308.26ms

Modular: TWS300

Measurement Result

GFSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	DH1	121.92	400	Pass
2441MHz	DH3	261.76	400	Pass
2441MHz	DH5	307.74	400	Pass

Remarks:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

Test channel: 2441MHz as blow

DH1 time slot=0.381 (ms)*(1600/ (2*79))*31.6=121.92ms

DH3 time slot=1.636 (ms)*(1600/ (4*79))*31.6=261.76ms

DH5 time slot=2.885 (ms)*(1600/ (6*79))*31.6=307.74ms

π/4-DQPSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	DH1	124.80	400	Pass
2441MHz	DH3	262.56	400	Pass
2441MHz	DH5	308.16	400	Pass

Remarks:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

Test channel: 2441MHz as blow

DH1 time slot=0.390 (ms)*(1600/ (2*79))*31.6=124.80ms

DH3 time slot=1.641 (ms)*(1600/ (4*79))*31.6=262.56ms

DH5 time slot=2.889 (ms)*(1600/ (6*79))*31.6=308.16ms

8-DPSK mode:

Frequency	Packet	Dwell time(ms)	Limit(ms)	Result
2441MHz	DH1	124.48	400	Pass
2441MHz	DH3	262.56	400	Pass
2441MHz	DH5	308.48	400	Pass

Remarks:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

Test channel: 2441MHz as blow

DH1 time slot=0.389 (ms)*(1600/ (2*79))*31.6=124.48ms

DH3 time slot=1.641 (ms)*(1600/ (4*79))*31.6=262.56ms

DH5 time slot=2.892 (ms)*(1600/ (6*79))*31.6=308.48ms

Modular: WS300

Test plot as follows:

GFSK mode:

Test channel:	2441MHz

DH1

DH3

DH5

π/4-DQPSK mode

Test channel:	2441MHz

DH1

DH3

DH5

8-DPSK

Test channel:	2441MHz

DH1

DH3

DH5

Modular: TWS300

Test plot as follows:

GFSK mode:

Test channel:	2441MHz

DH1

DH3

DH5

π/4-DQPSK mode

Test channel:	2441MHz

DH1

DH3

DH5

8-DPSK

Test channel:	2441MHz

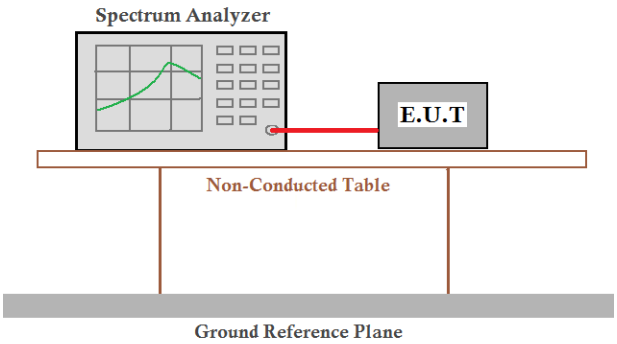
DH1

DH3

DH5

4.8 Band Edge

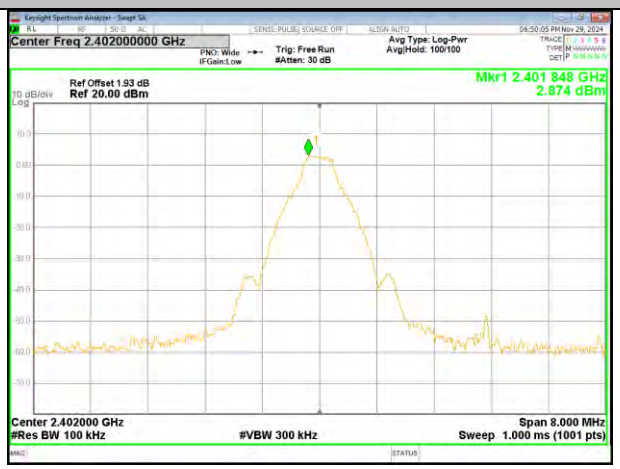
4.8.1 Conducted Emission Method

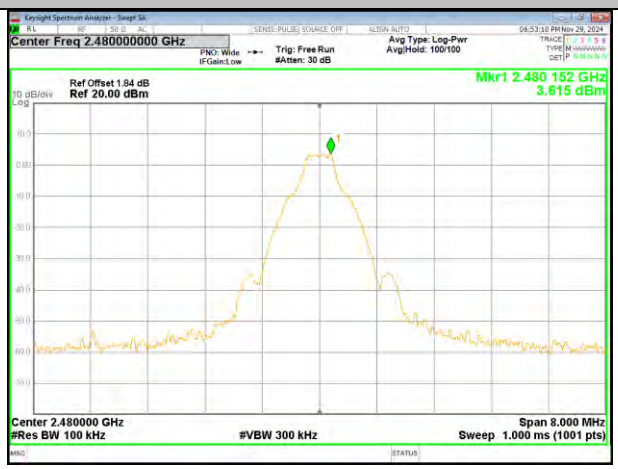
Test Requirement:	FCC Part15 C Section 15.247 (d)	
Test Method:	ANSI C63.10:2013	
Receiver setup:	RBW=100kHz, VBW=300kHz, Detector=Peak	
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced 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.	
Test setup:		
Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 26.2°C	Humid.: 52%RH
Test voltage:	DC 14.8V From battery	
Test results:	Pass	

Modular: WS300

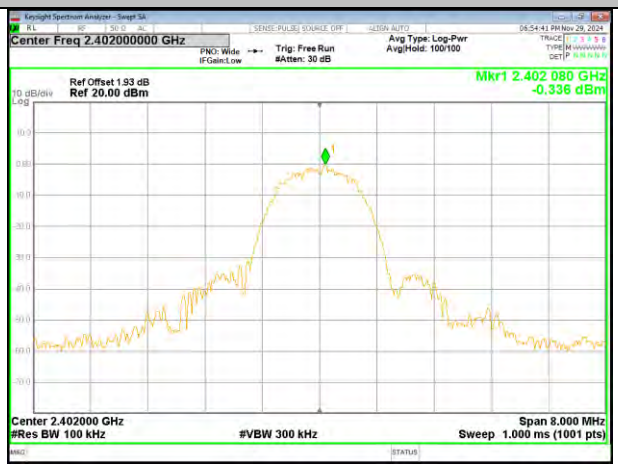
Test plot as follows:

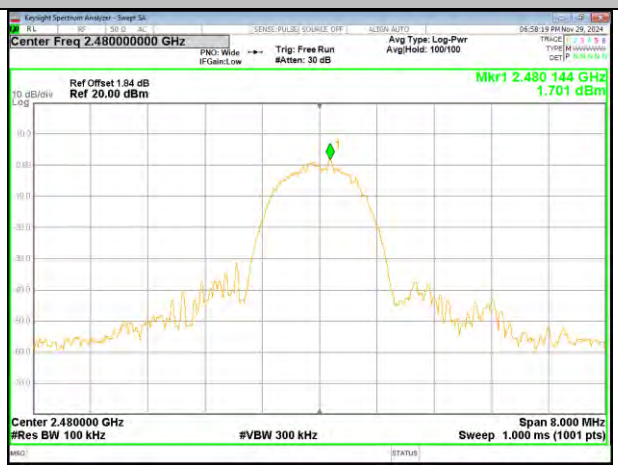
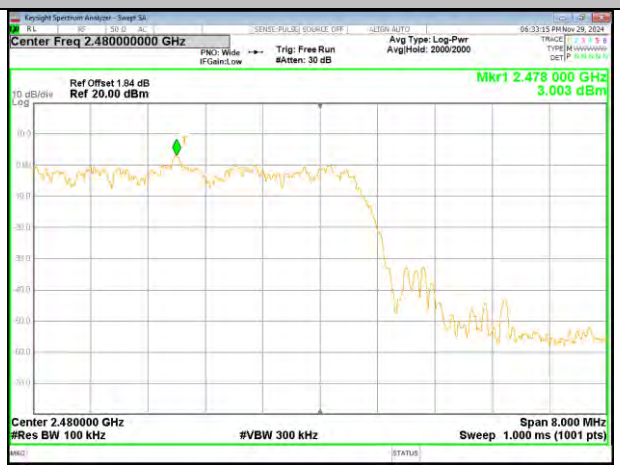
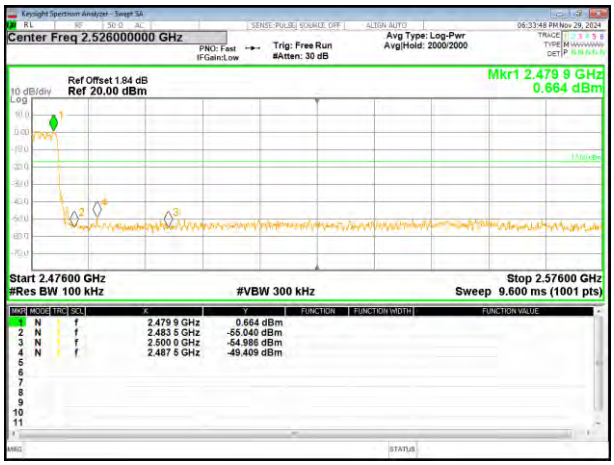
GFSK Mode:

Test channel:	Lowest channel
	
No-hopping mode	Hopping mode

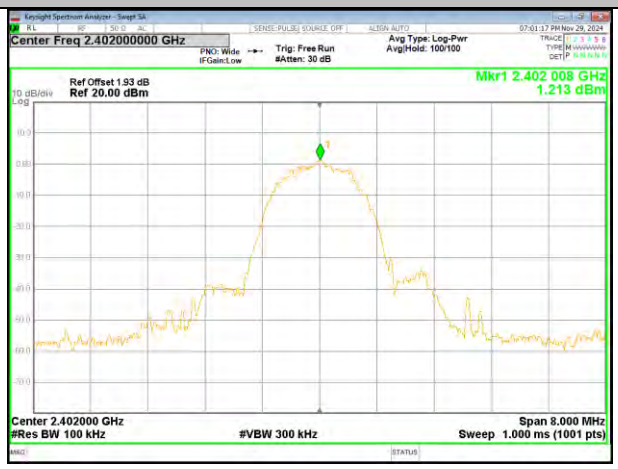
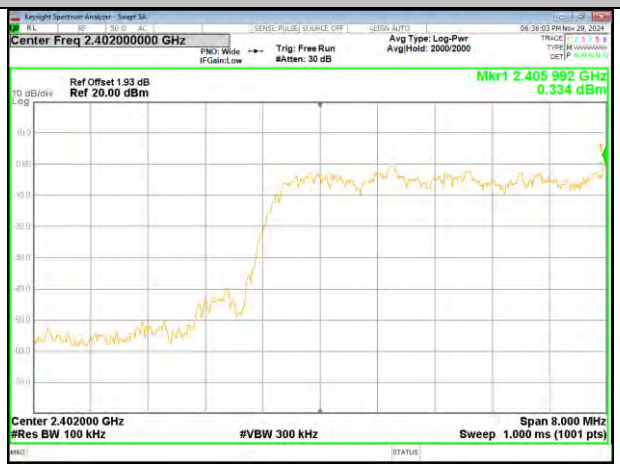
Test channel:	Highest channel
	
No-hopping mode	Hopping mode

π/4-DQPSK Mode:

Test channel:	Lowest channel
	
No-hopping mode	Hopping mode

Test channel:	Highest channel
	
	
No-hopping mode	Hopping mode

8-DPSK Mode:

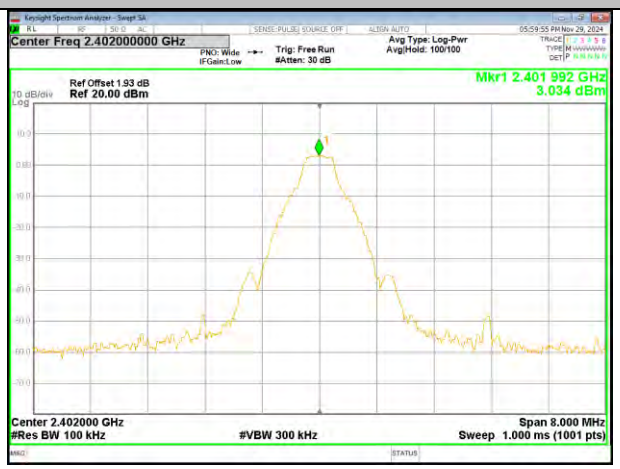
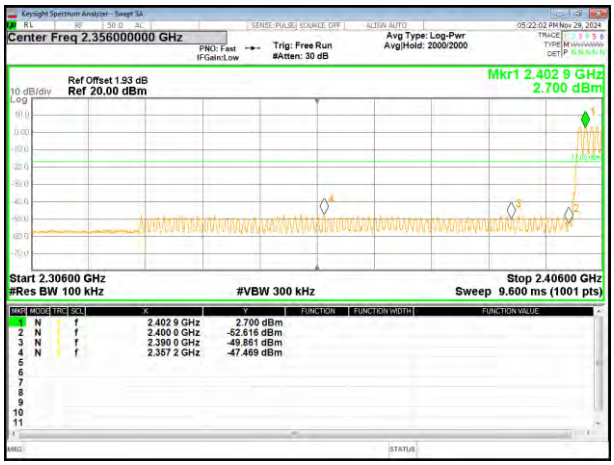
Test channel:	Lowest channel
	
No-hopping mode	Hopping mode

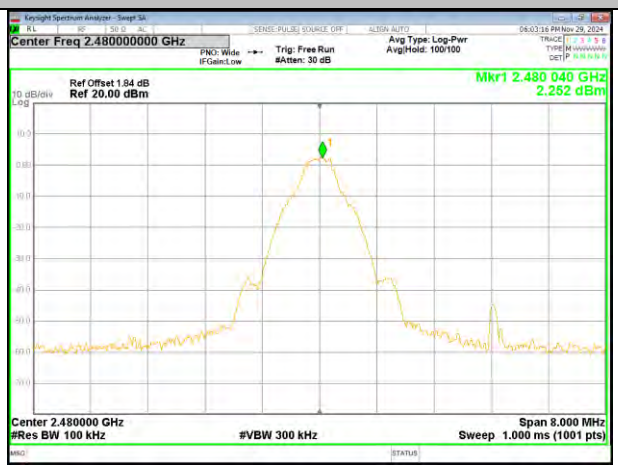
Test channel:	Highest channel

Modular: TWS300

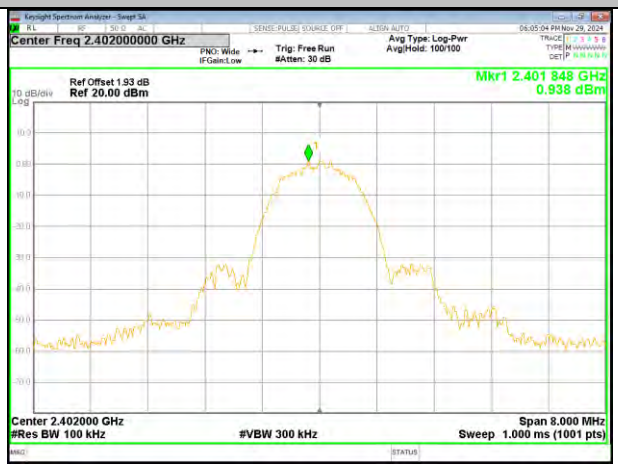
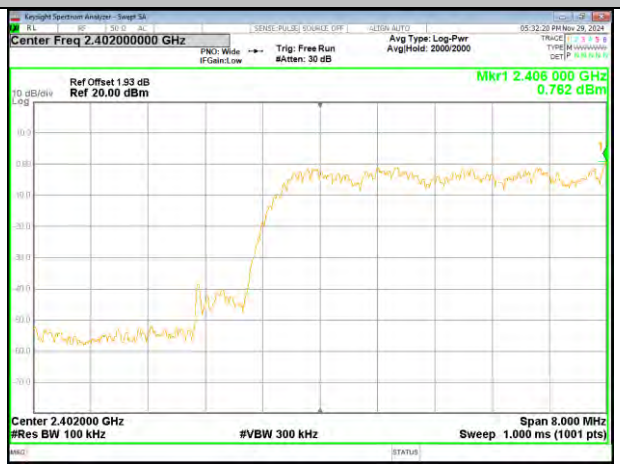
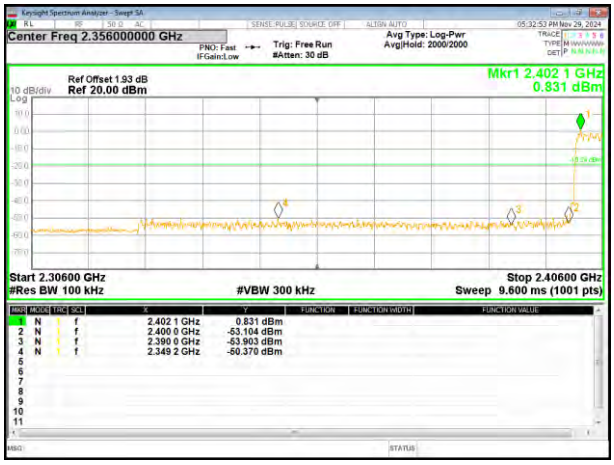
Test plot as follows:

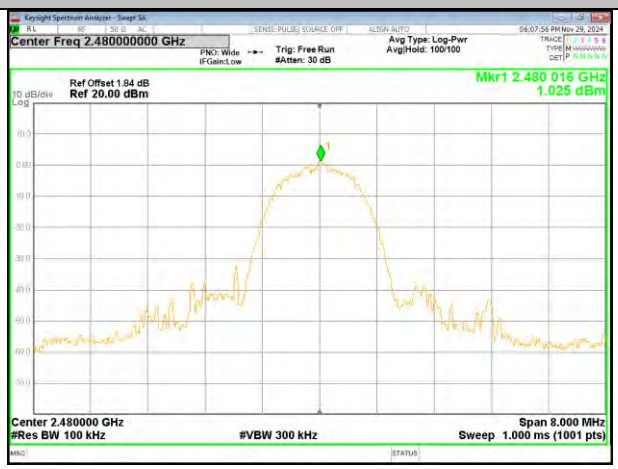
GFSK Mode:

Test channel:	Lowest channel
	
	
No-hopping mode	Hopping mode

Test channel:	Highest channel
	
No-hopping mode	Hopping mode

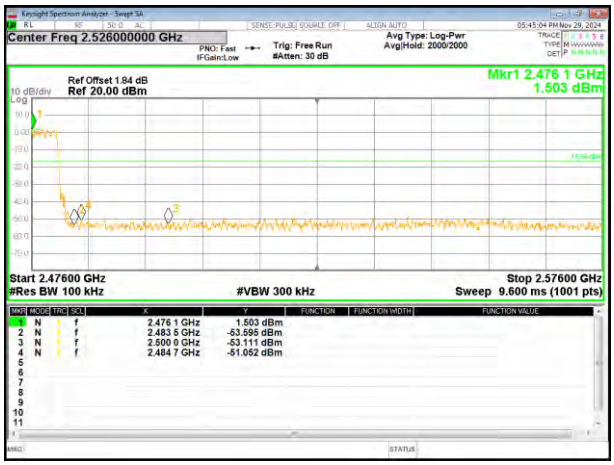
π/4-DQPSK Mode:

Test channel:	Lowest channel
	
	
No-hopping mode	Hopping mode

Test channel:	Highest channel
	
No-hopping mode	Hopping mode

8-DPSK Mode:

Test channel:	Lowest channel
No-hopping mode	Hopping mode

Test channel:	Highest channel
	
No-hopping mode	Hopping mode

4.8.2 Radiated Emission Method

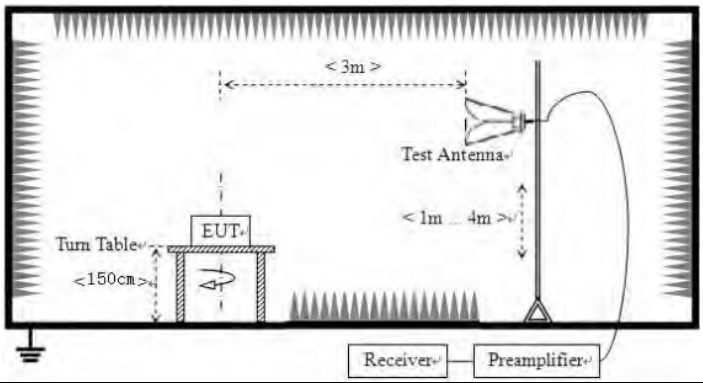
Test Requirement:	FCC Part15 C Section 15.209 and 15.205
Test Method:	ANSI C63.10:2013
Test Frequency Range:	All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed.
Test site:	Measurement Distance: 3m
Receiver setup:	

Frequency	Detector	RBW	VBW	Remark
Above 1GHz	Peak	1MHz	3MHz	Peak Value
	Peak	1MHz	10Hz	Average Value

Limit:

Frequency	Limit (dBuV/m @3m)	Remark
Above 1GHz	54.00	Average Value
	74.00	Peak Value

Test setup:



Test Procedure:

1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 26.2°C	Humid.: 52%RH
Test voltage:	DC 14.8V From battery	
Test results:	Pass	

Remark:
During the test, pre-scan the GFSK, π/4-DQPSK, 8-DPSK modulation, and found the 8-DPSK modulation which it is worse case.

Measurement Data

Test channel:	Lowest

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310.00	68.19	27.40	3.41	45.40	53.60	74.00	-20.40	Horizontal
2390.00	68.81	27.10	3.43	45.40	53.94	74.00	-20.06	Horizontal
2400.00	72.13	27.10	3.43	45.40	57.26	74.00	-16.74	Horizontal
2310.00	68.90	27.40	3.41	45.40	54.31	74.00	-19.69	Vertical
2390.00	71.07	27.10	3.43	45.40	56.20	74.00	-17.80	Vertical
2400.00	71.83	27.10	3.43	45.40	56.96	74.00	-17.04	Vertical

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310.00	49.03	27.40	3.41	45.40	34.44	54.00	-19.56	Horizontal
2390.00	50.03	27.10	3.43	45.40	35.16	54.00	-18.84	Horizontal
2400.00	52.55	27.10	3.43	45.40	37.68	54.00	-16.32	Horizontal
2310.00	48.41	27.40	3.41	45.40	33.82	54.00	-20.18	Vertical
2390.00	51.01	27.10	3.43	45.40	36.14	54.00	-17.86	Vertical
2400.00	54.49	27.10	3.43	45.40	39.62	54.00	-14.38	Vertical

Test channel:	Highest

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	61.36	27.80	3.56	45.40	47.32	74.00	-26.68	Horizontal
2500.00	60.35	27.80	3.56	45.40	46.31	74.00	-27.69	Horizontal
2483.50	62.88	27.80	3.56	45.40	48.84	74.00	-25.16	Vertical
2500.00	59.28	27.80	3.56	45.40	45.24	74.00	-28.76	Vertical

Average value:

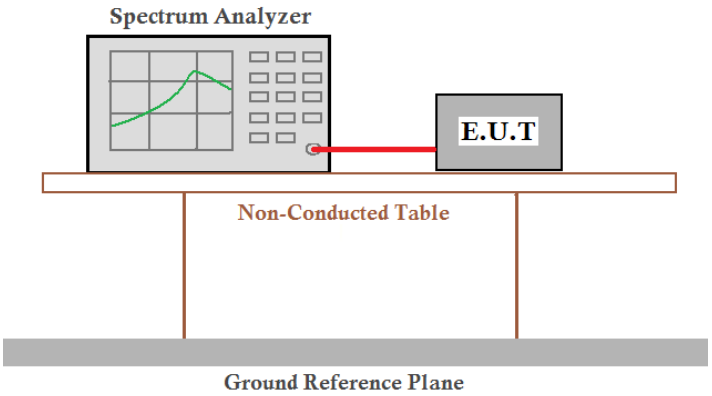
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	52.80	27.80	3.56	45.40	38.76	54.00	-15.24	Horizontal
2500.00	50.59	27.80	3.56	45.40	36.55	54.00	-17.45	Horizontal
2483.50	52.87	27.80	3.56	45.40	38.83	54.00	-15.17	Vertical
2500.0	50.01	27.80	3.56	45.40	35.97	54.00	-18.03	Vertical

Remarks:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*
3. *The pre-test were performed on lowest, middle and highest frequencies, only the worst case's (lowest and highest frequencies) data was showed.*

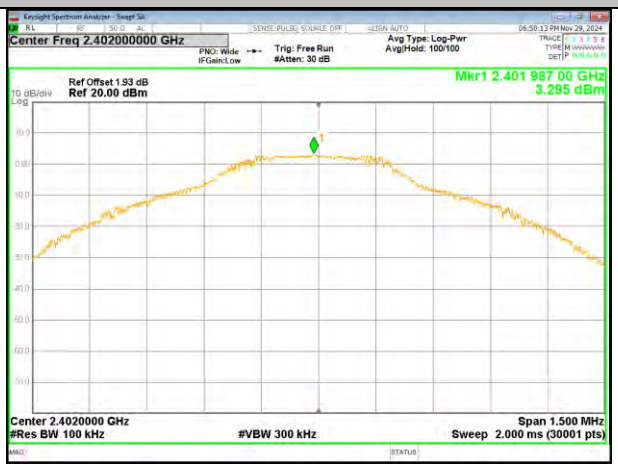
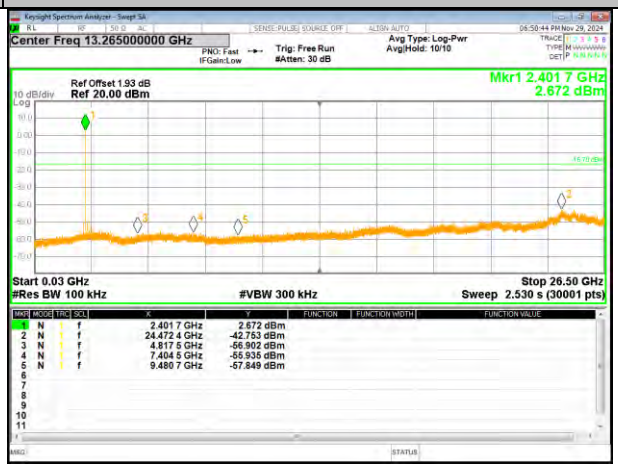
4.9 Spurious Emission

4.9.1 Conducted Emission Method

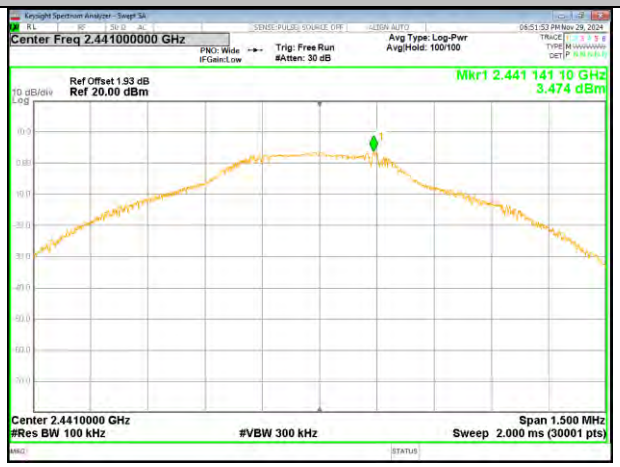
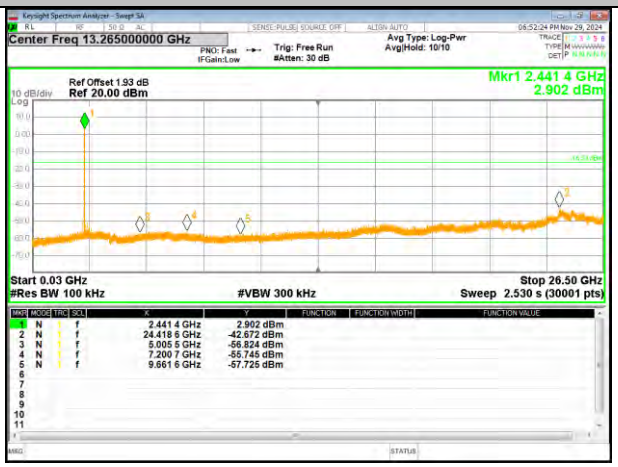
Test Requirement:	FCC Part15 C Section 15.247 (d)	
Test Method:	ANSI C63.10:2013	
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below 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.	
Test setup:		
Test Instruments:	Refer to section 3.0 for details	
Test mode:	Refer to section 2.2 for details	
Test environment:	Temp.: 26.2°C	Humid.: 52%RH
Test voltage:	DC 14.8V From battery	
Test results:	Pass	

Modular: WS300

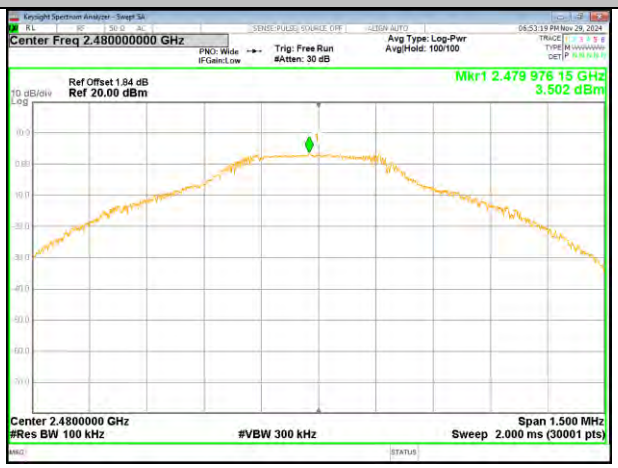
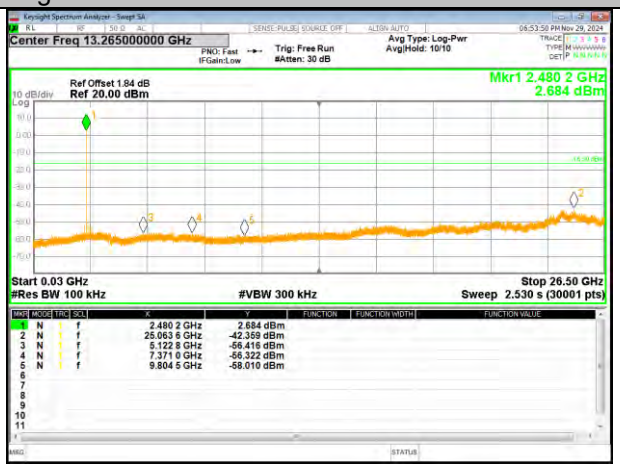
GFSK mode:

Test channel:	Lowest channel
	

30MHz~25GHz

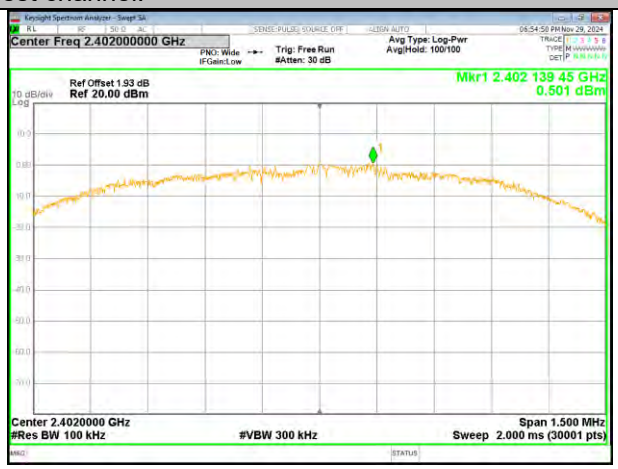
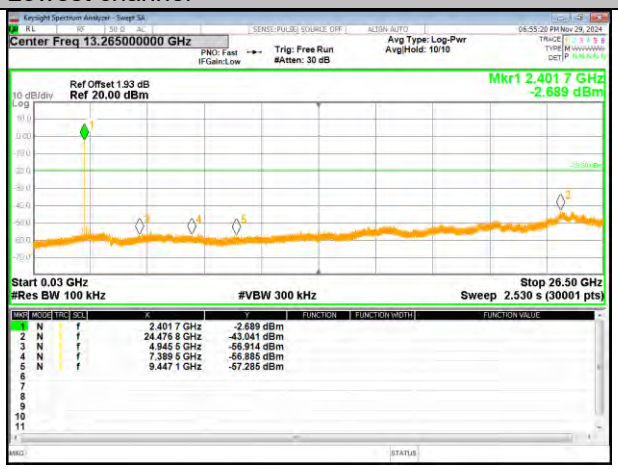
Test channel:	Middle channel
	

30MHz~25GHz

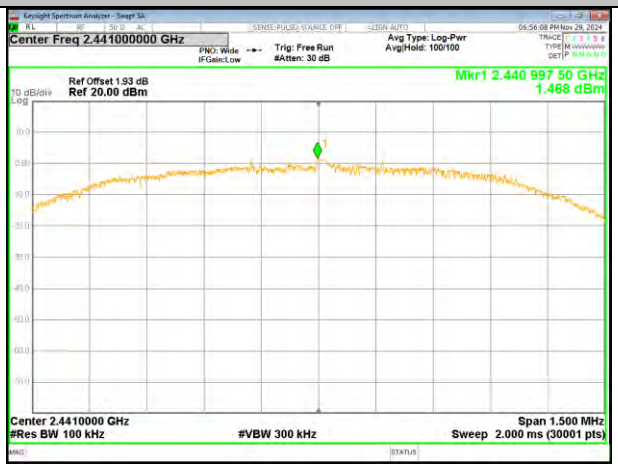
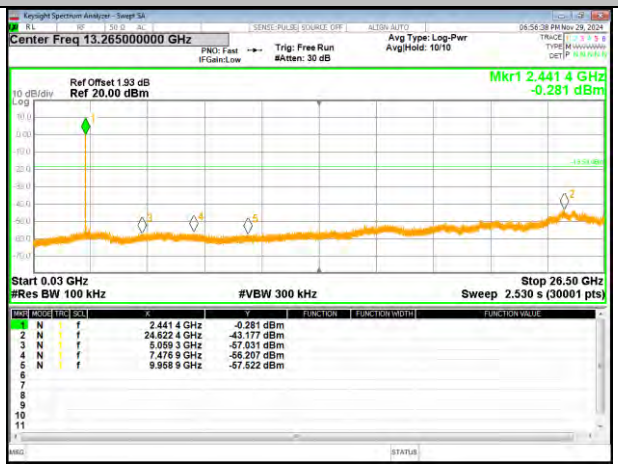
Test channel:	Highest channel
	

30MHz~25GHz

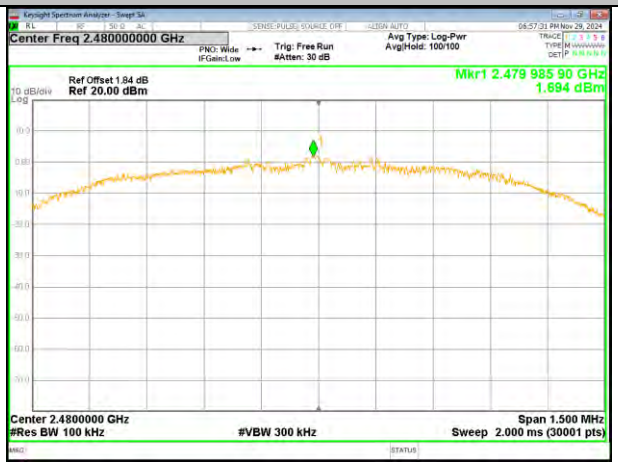
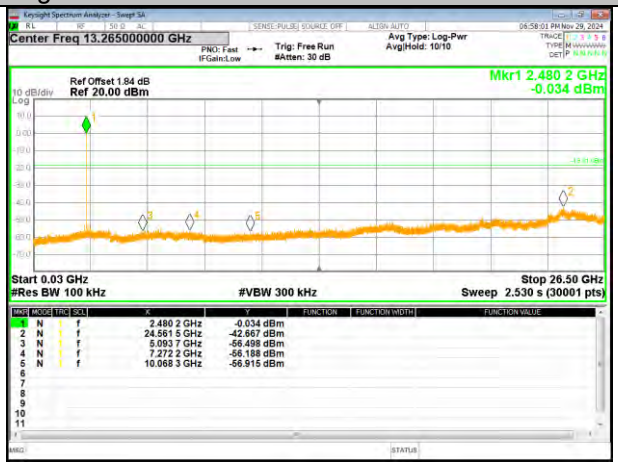
π/4-DQPSK mode:

Test channel:	Lowest channel
	

30MHz~25GHz

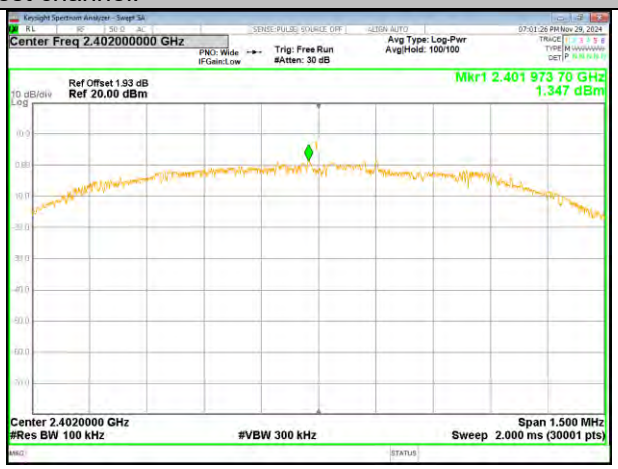
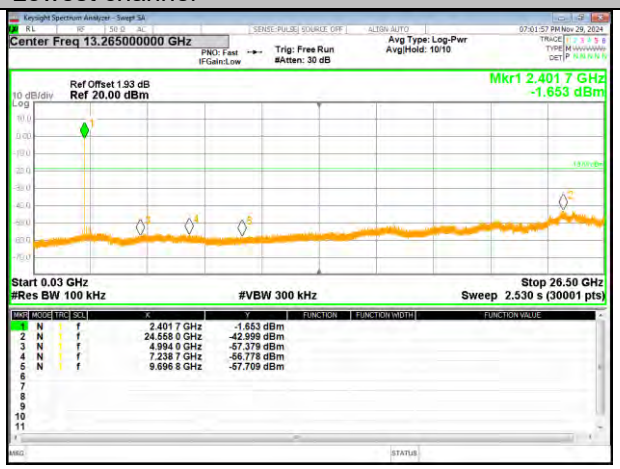
Test channel:	Middle channel
	

30MHz~25GHz

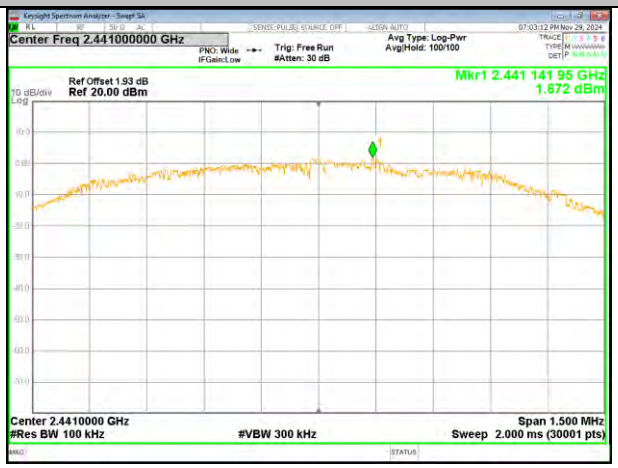
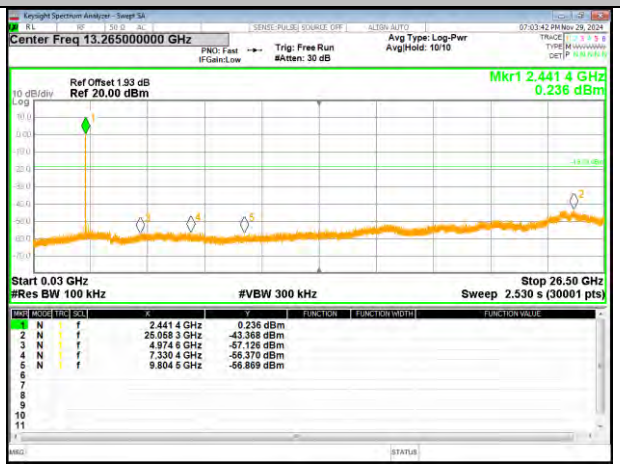
Test channel:	Highest channel
	

30MHz~25GHz

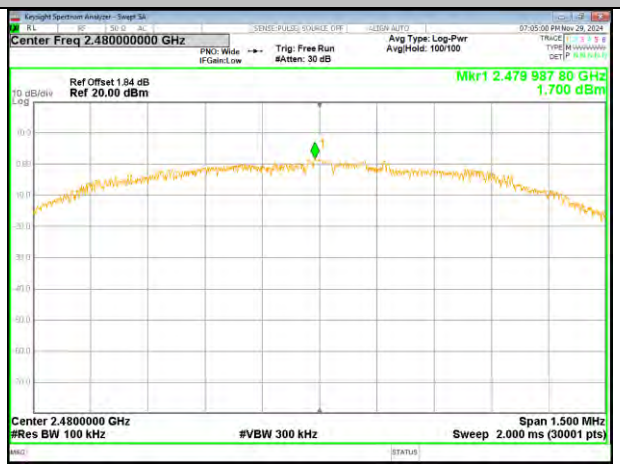
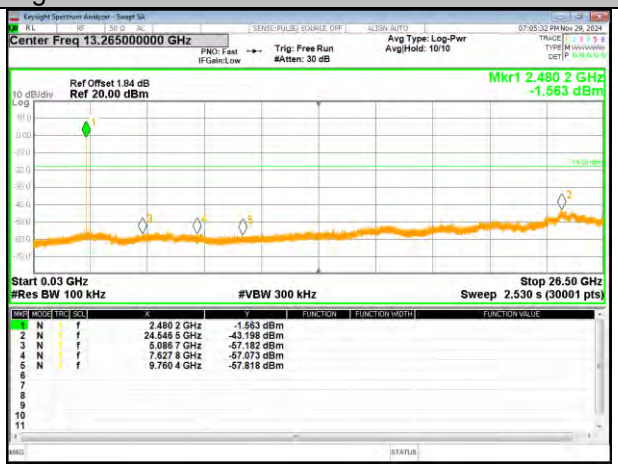
8-DPSK mode:

Test channel:	Lowest channel
	

30MHz~25GHz

Test channel:	Middle channel
	

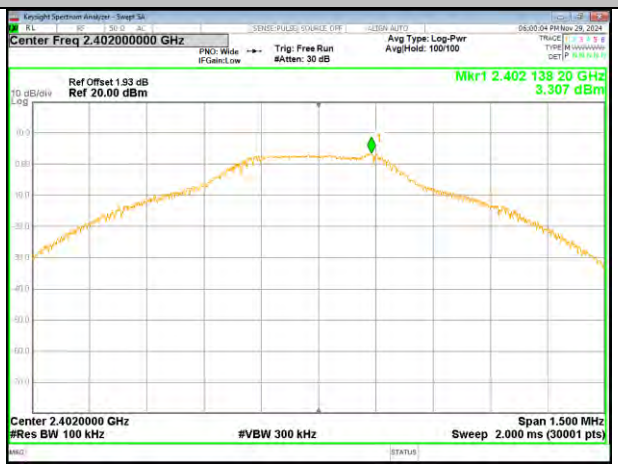
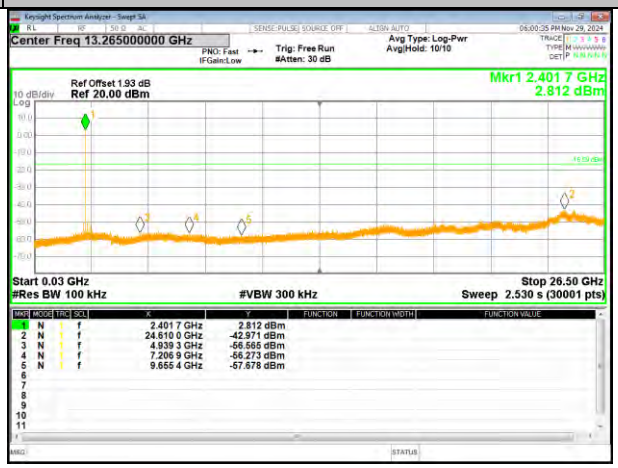
30MHz~25GHz

Test channel:	Highest channel
	

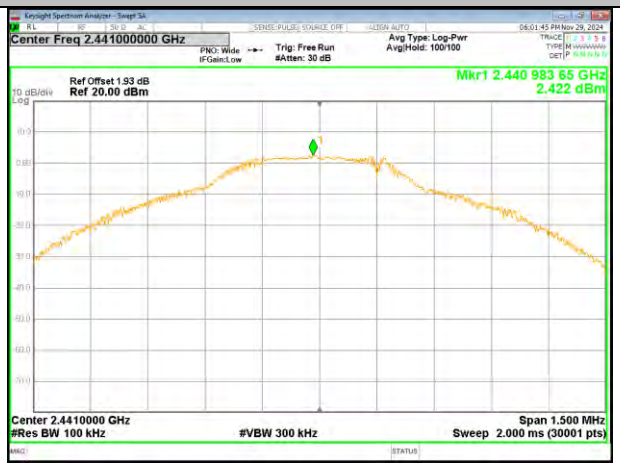
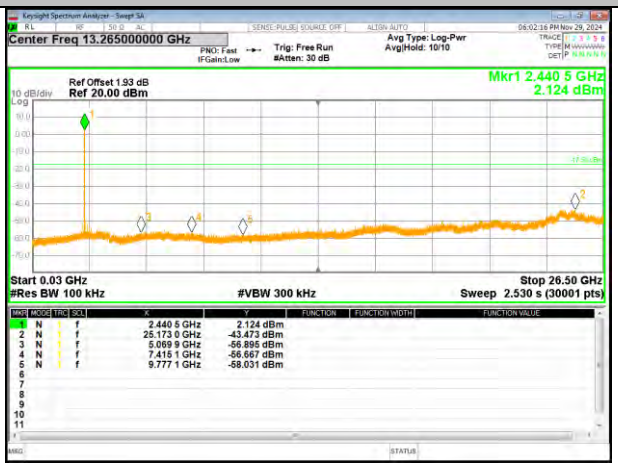
30MHz~25GHz

Modular: TWS300

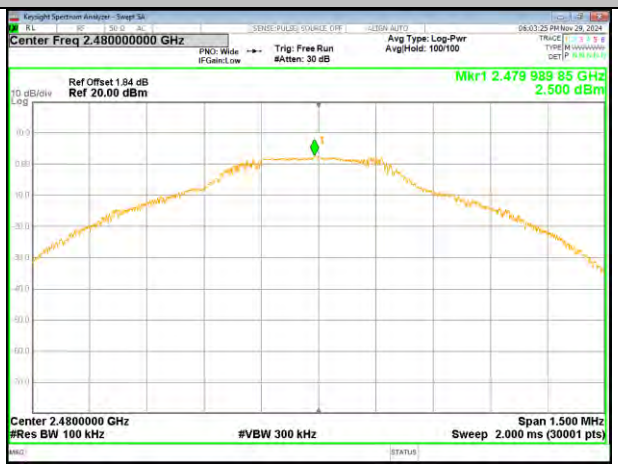
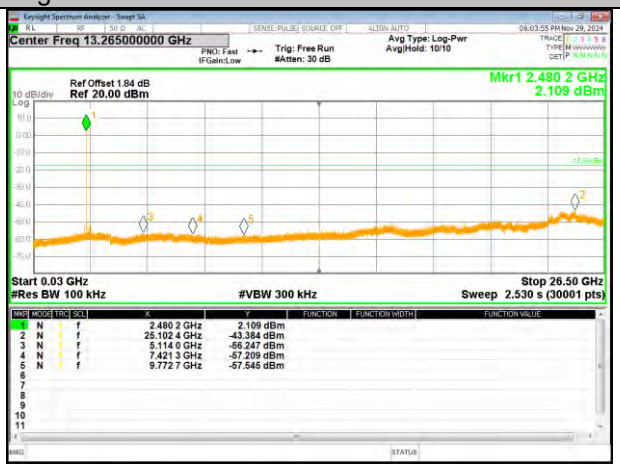
GFSK mode:

Test channel:	Lowest channel
	

30MHz~25GHz

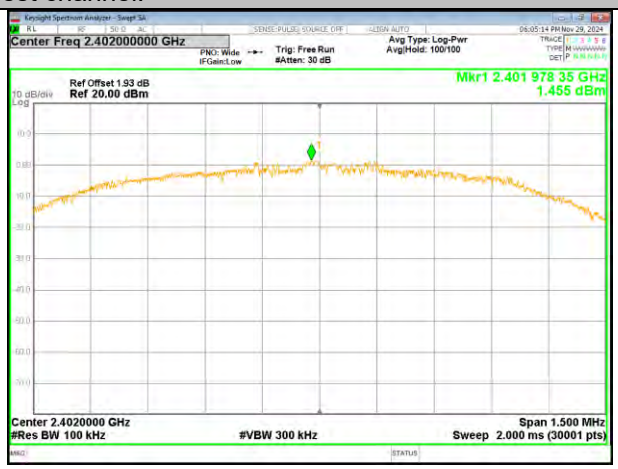
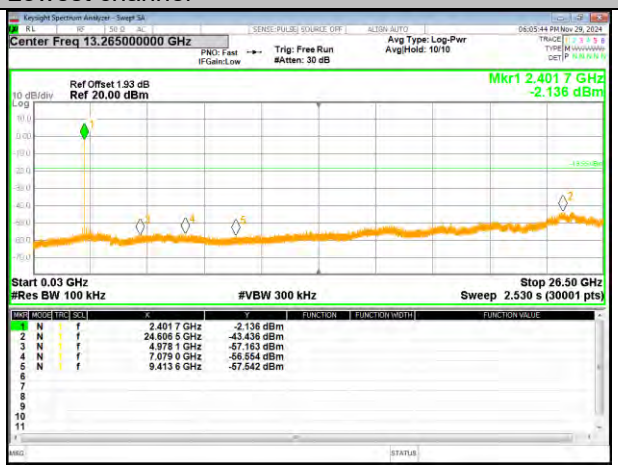
Test channel:	Middle channel
	

30MHz~25GHz

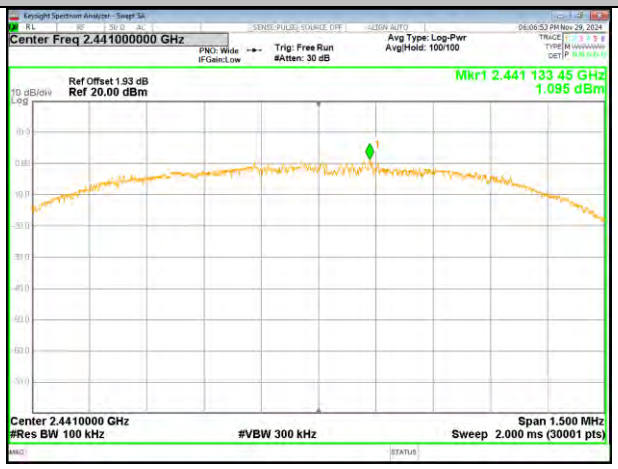
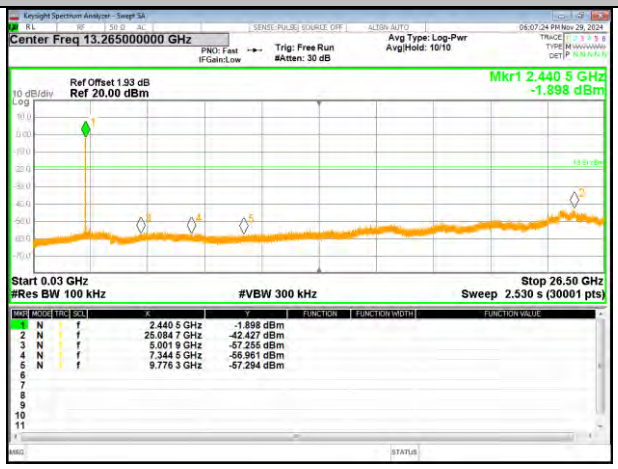
Test channel:	Highest channel
	

30MHz~25GHz

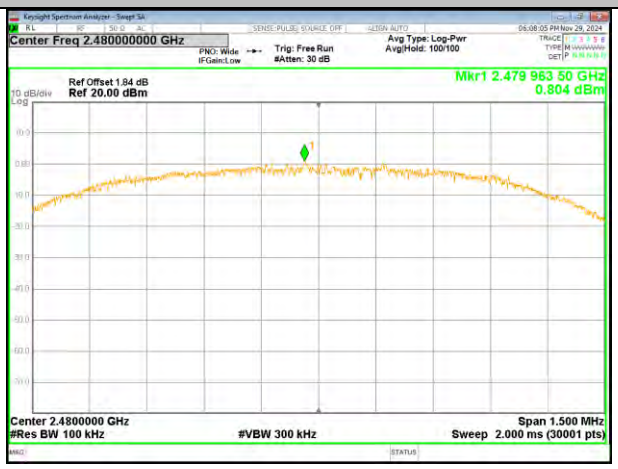
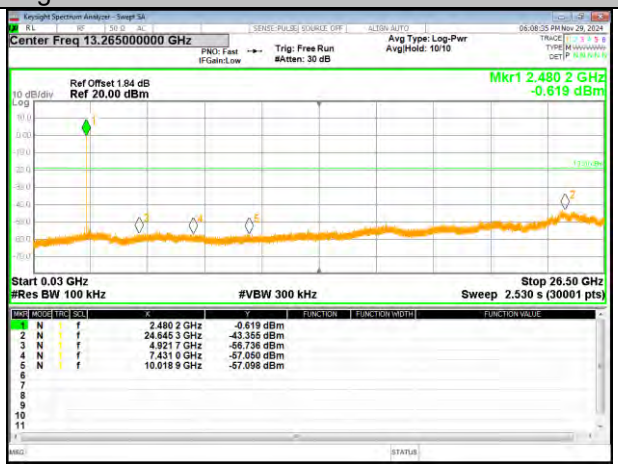
π/4-DQPSK mode:

Test channel:	Lowest channel
	

30MHz~25GHz

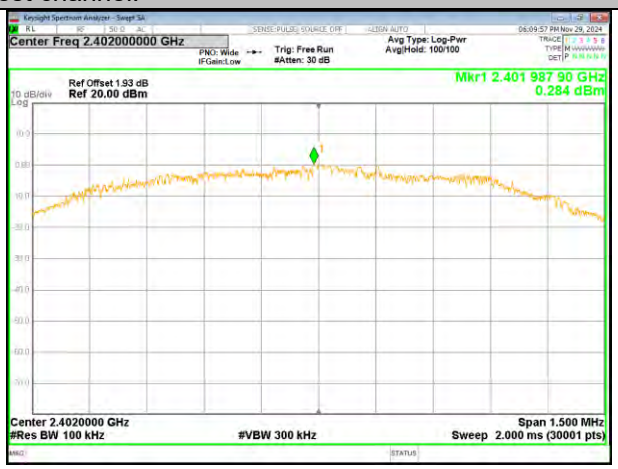
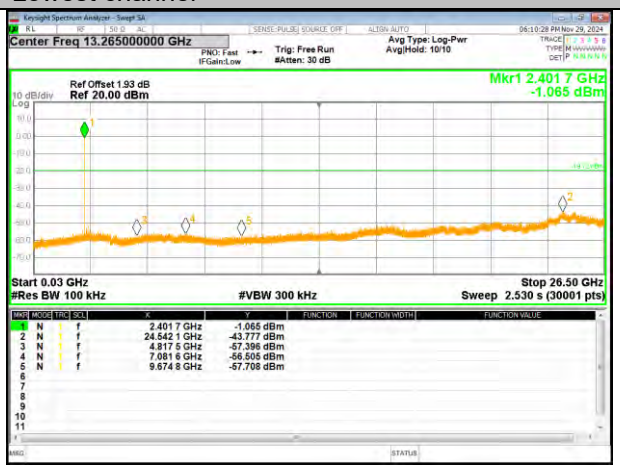
Test channel:	Middle channel
	

30MHz~25GHz

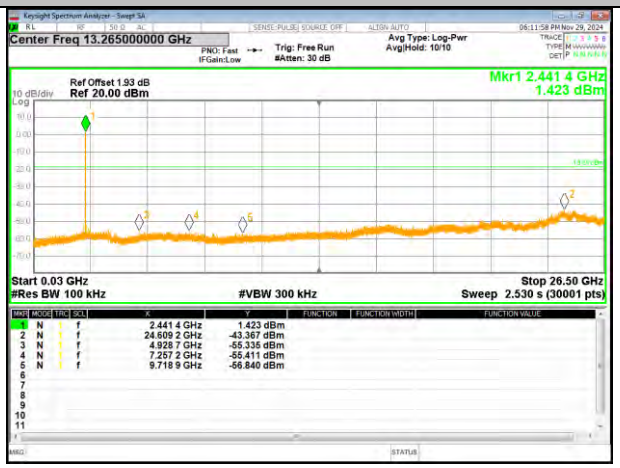
Test channel:	Highest channel
	

30MHz~25GHz

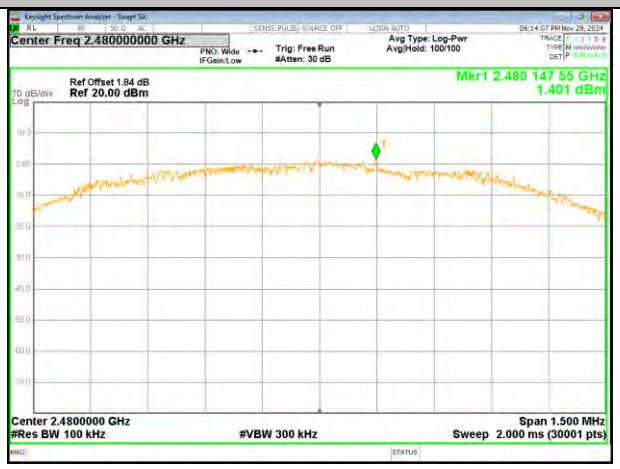
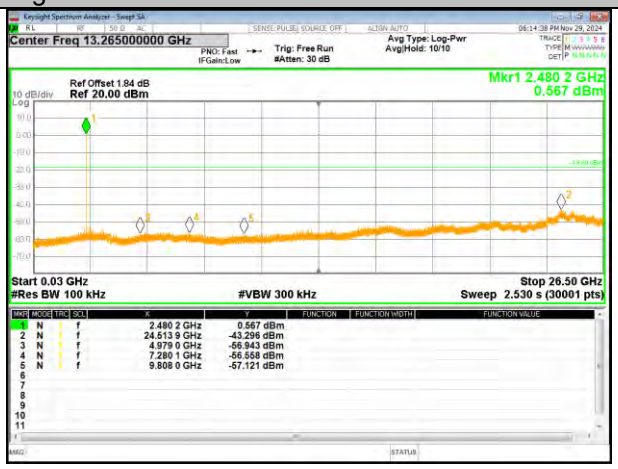
8-DPSK mode:

Test channel:	Lowest channel
	

30MHz~25GHz

Test channel:	Middle channel
	

30MHz~25GHz

Test channel:	Highest channel
	

30MHz~25GHz

4.9.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209
Test Method:	ANSI C63.10:2013
Test Frequency Range:	9kHz to 25GHz
Test site:	Measurement Distance: 3m
Receiver setup:	

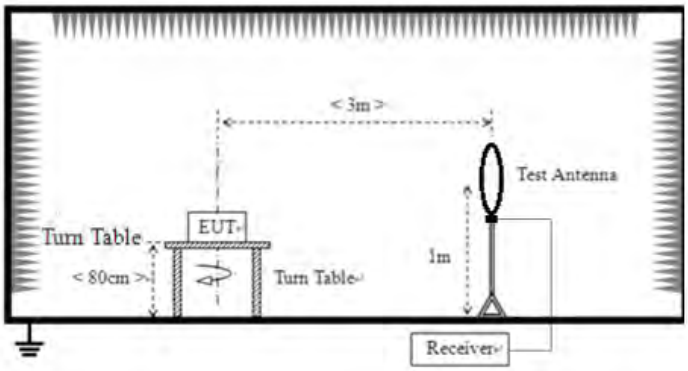
Frequency	Detector	RBW	VBW	Value
9KHz-150KHz	Quasi-peak	200Hz	600Hz	Quasi-peak
150KHz-30MHz	Quasi-peak	9KHz	30KHz	Quasi-peak
30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

Limit:

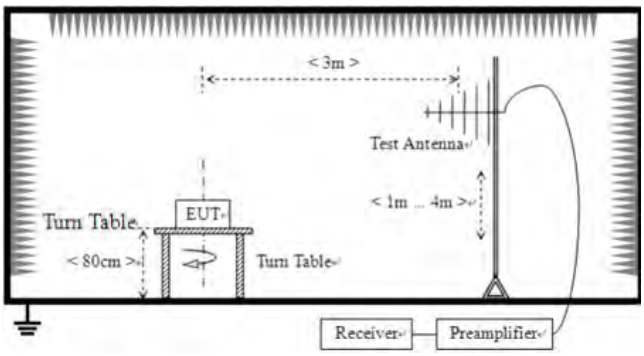
Frequency	Limit (uV/m)	Value	Measurement Distance
0.009MHz-0.490MHz	2400/F(KHz)	QP	300m
0.490MHz-1.705MHz	24000/F(KHz)	QP	30m
1.705MHz-30MHz	30	QP	30m
30MHz-88MHz	100	QP	3m
88MHz-216MHz	150	QP	
216MHz-960MHz	200	QP	
960MHz-1GHz	500	QP	
Above 1GHz	500	Average	
	5000	Peak	

Test setup:

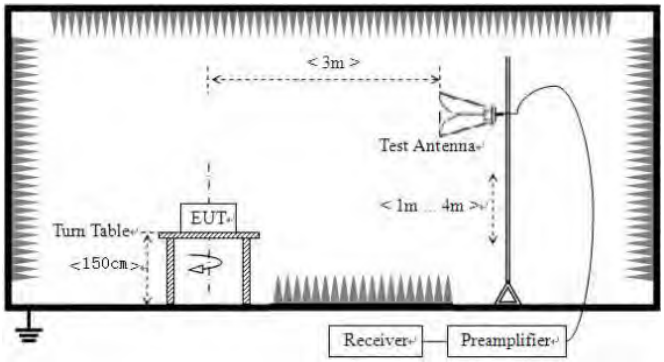
For radiated emissions from 9kHz to 30MHz



For radiated emissions from 30MHz to1GHz



For radiated emissions above 1GHz



Test Procedure:	1. The EUT was placed on the top of a rotating table (0.8m for below 1G and 1.5m for above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.					
Test Instruments:	Refer to section 3.0 for details					
Test mode:	Refer to section 2.2 for details					
Test environment:	Temp.:	26.2 °C	Humid.:	52%	Press.:	1012mbar
Test results:	Pass					

Measurement data:

Remarks:

1. *During the test, pre-scan the GFSK, π/4-DQPSK, 8-DPSK modulation, and found the 8-DPSK modulation which it is worse case.*
2. *Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.*

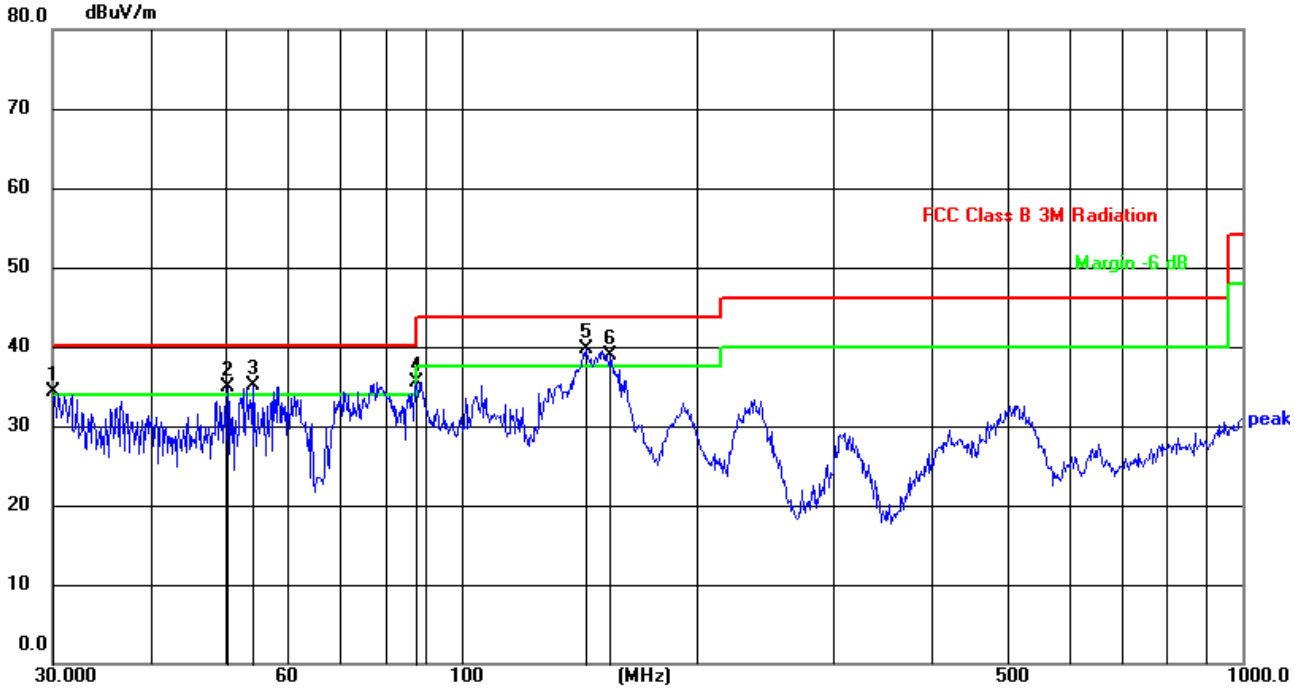
■ **9kHz~30MHz**

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

■ **Below 1GHz**

Pre-scan all test modes and report data for the worst mode 8-DPSK (2480MHz) where only modules WS300 and TWS300 work simultaneously.

Test polarization:	Vertical	Test voltage:	DC 14.8V From Battery

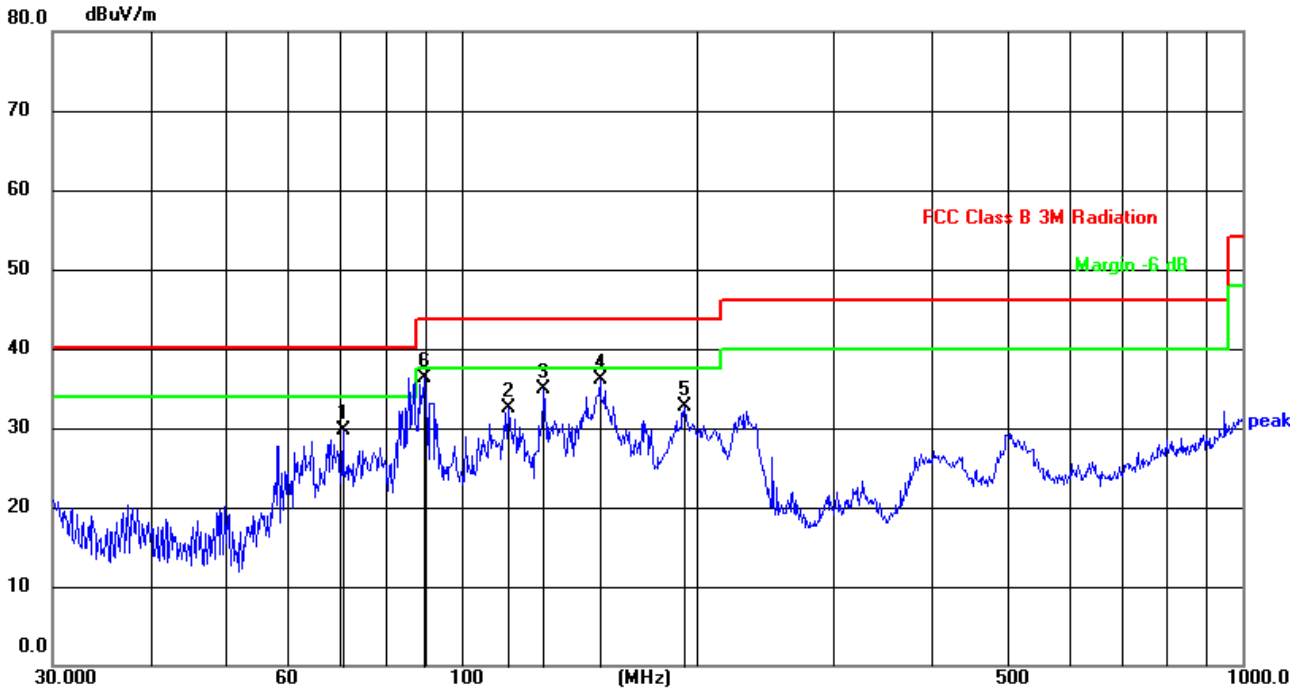


No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	30.0000	57.07	-22.77	34.30	40.00	-5.70	QP
2	50.2323	56.71	-21.84	34.87	40.00	-5.13	QP
3	54.2608	57.14	-22.13	35.01	40.00	-4.99	QP
4	87.7246	61.15	-25.56	35.59	40.00	-4.41	QP
5	144.3346	60.84	-21.14	39.70	43.50	-3.80	QP
6	155.3642	59.45	-20.55	38.90	43.50	-4.60	QP

Level = Reading + Factor, Margin=level-Limit

Factor= Antenna Factor + Cable Loss – Preamplifier Factor

Test polarization:	Horizontal	Test voltage:	DC 14.8V From Battery



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	70.5835	54.02	-24.27	29.75	40.00	-10.25	QP
2	114.9168	56.08	-23.64	32.44	43.50	-11.06	QP
3	127.6645	57.55	-22.70	34.85	43.50	-8.65	QP
4	150.5377	56.70	-20.51	36.19	43.50	-7.31	QP
5	193.0944	55.95	-23.19	32.76	43.50	-10.74	QP
6	89.5899	61.72	-25.42	36.30	43.50	-7.20	QP

Level = Reading + Factor, Margin=level-Limit
Factor= Antenna Factor + Cable Loss – Preamplifier Factor

■ **Above 1GHz**

Pre-scan all test modes and report data for the worst mode 8-DPSK (2480MHz) where only modules WS300 and TWS300 work simultaneously.

Test channel:	Lowest	Test voltage:	DC 14.8V From Battery

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4804.00	58.25	32.10	5.96	45.70	50.61	74.00	-23.39	Vertical
7206.00	54.05	36.10	6.86	45.50	51.51	74.00	-22.49	Vertical
9608.00	53.39	38.30	8.25	46.20	53.74	74.00	-20.26	Vertical
12010.00	*	--	--	--	--	74.00	--	Vertical
14412.00	*	--	--	--	--	74.00	--	Vertical
4804.00	61.02	32.10	5.96	45.70	53.38	74.00	-20.62	Horizontal
7206.00	55.72	36.10	6.86	45.50	53.18	74.00	-20.82	Horizontal
9608.00	55.13	38.30	8.25	46.20	55.48	74.00	-18.52	Horizontal
12010.00	*	--	--	--	--	74.00	--	Horizontal
14412.00	*	--	--	--	--	74.00	--	Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4804.00	50.73	32.10	5.96	45.70	43.09	54.00	-10.91	Vertical
7206.00	44.57	36.10	6.86	45.50	42.03	54.00	-11.97	Vertical
9608.00	43.48	38.30	8.25	46.20	43.83	54.00	-10.17	Vertical
12010.00	*	--	--	--	--	54.00	--	Vertical
14412.00	*	--	--	--	--	54.00	--	Vertical
4804.00	51.37	32.10	5.96	45.70	43.73	54.00	-10.27	Horizontal
7206.00	44.70	36.10	6.86	45.50	42.16	54.00	-11.84	Horizontal
9608.00	42.85	38.30	8.25	46.20	43.20	54.00	-10.80	Horizontal
12010.00	*	--	--	--	--	54.00	--	Horizontal
14412.00	*	--	--	--	--	54.00	--	Horizontal

Test channel:	Middle	Test voltage:	DC 14.8V From Battery

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4882.00	58.62	32.10	5.96	45.70	50.98	74.00	-23.02	Vertical
7323.00	53.39	36.80	6.86	45.50	51.55	74.00	-22.45	Vertical
9764.00	51.89	38.40	8.25	46.20	52.34	74.00	-21.66	Vertical
12205.00	*	--	--	--	--	74.00	--	Vertical
14646.00	*	--	--	--	--	74.00	--	Vertical
4882.00	59.80	32.10	5.96	45.70	52.16	74.00	-21.84	Horizontal
7323.00	55.78	36.80	6.86	45.50	53.94	74.00	-20.06	Horizontal
9764.00	52.90	38.40	8.25	46.20	53.35	74.00	-20.65	Horizontal
12205.00	*	--	--	--	--	74.00	--	Horizontal
14646.00	*	--	--	--	--	74.00	--	Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4882.00	46.23	32.10	5.96	45.70	38.59	54.00	-15.41	Vertical
7323.00	44.69	36.80	6.86	45.50	42.85	54.00	-11.15	Vertical
9764.00	43.03	38.40	8.25	46.20	43.48	54.00	-10.52	Vertical
12205.00	*	--	--	--	--	54.00	--	Vertical
14646.00	*	--	--	--	--	54.00	--	Vertical
4882.00	46.70	32.10	5.96	45.70	39.06	54.00	-14.94	Horizontal
7323.00	43.38	36.80	6.86	45.50	41.54	54.00	-12.46	Horizontal
9764.00	42.52	38.40	8.25	46.20	42.97	54.00	-11.03	Horizontal
12205.00	*	--	--	--	--	54.00	--	Horizontal
14646.00	*	--	--	--	--	54.00	--	Horizontal

Test channel:	Highest	Test voltage:	DC 14.8V From Battery

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	59.03	32.70	5.96	45.70	51.99	74.00	-22.01	Vertical
7440.00	52.05	36.40	6.86	45.50	49.81	74.00	-24.19	Vertical
9920.00	51.69	38.00	8.25	46.20	51.74	74.00	-22.26	Vertical
12400.00	*	--	--	--	--	74.00	--	Vertical
14880.00	*	--	--	--	--	74.00	--	Vertical
4960.00	59.05	32.70	5.96	45.70	52.01	74.00	-21.99	Horizontal
7440.00	54.61	36.40	6.86	45.50	52.37	74.00	-21.63	Horizontal
9920.00	53.78	38.00	8.25	46.20	53.83	74.00	-20.17	Horizontal
12400.00	*	--	--	--	--	74.00	--	Horizontal
14880.00	*	--	--	--	--	74.00	--	Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	44.40	32.70	5.96	45.70	37.36	54.00	-16.64	Vertical
7440.00	40.29	36.40	6.86	45.50	38.05	54.00	-15.95	Vertical
9920.00	41.23	38.00	8.25	46.20	41.28	54.00	-12.72	Vertical
12400.00	*	--	--	--	--	54.00	--	Vertical
14880.00	*	--	--	--	--	54.00	--	Vertical
4960.00	45.60	32.70	5.96	45.70	38.56	54.00	-15.44	Horizontal
7440.00	40.34	36.40	6.86	45.50	38.10	54.00	-15.90	Horizontal
9920.00	40.52	38.00	8.25	46.20	40.57	54.00	-13.43	Horizontal
12400.00	*	--	--	--	--	54.00		Horizontal
14880.00	*	--	--	--	--	54.00		Horizontal

Remarks:

1. *Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *"*", means this data is the too weak instrument of signal is unable to test.*
3. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

5 Test Setup Photo

Reference to the **appendix I** for details.

6 EUT Constructional Details

Reference to the **appendix II** for details.

------End------