

FCC Part 15C Measurement and Test Report

For

Shenzhen Nuohao Technology Co., Ltd

FCC ID:2BCC6-N69

FCC Rule(s): FCC Part 15.247

Product Description: Smart Light Sound Machine

Tested Model: N69

Report No.: BSL230731901601RF

Tested Date: July. 10~Aug.6, 2023

Issued Date: Aug. 7, 2023

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Applicant:	Shenzhen Nuohao Technology Co., Ltd
Address of applicant:	2nd Floor, Building B, Jiaye Industrial Park, No. 11, Jiaye Road, Pinghu Town, Longgang District, Shenzhen ,Guangdong
Manufacturer:	Shenzhen Nuohao Technology Co., Ltd
Address of manufacturer:	2nd Floor, Building B, Jiaye Industrial Park, No. 11, Jiaye Road, Pinghu Town, Longgang District, Shenzhen ,Guangdong
Product Name:	Smart Light Sound Machine
Model No.:	N69
Test Model No:	N70/N71/N72/N73/N75/N76/N77/N78/N79/N80/N68/N67/N66/N65/N62/N61
Remark: All above models are identical in the same PCB layout, interior structure and electrical circuits. The differences are color, appearance and model name for commercial purpose.	
Quantity of tested samples	1
Serial No.:	N69
Operation Frequency:	2402MHz~2480MHz
Channel numbers:	79
Channel separation:	1MHz
Modulation type:	GFSK,Pi/4 QPSK,8DPSK
Antenna Type:	PCB antenna
Antenna gain:	1.3dBi
Power supply:	DC 5V by USB

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.

EUT Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Core/Without Core
/	/	/	/

Auxiliary Equipment List and Details

Description	Manufacturer	Model	Serial Number
Notebook	Lenovo	Lenovo B490	BSTSZEMC-77

Special Cable List and Details

Cable Description	Length (M)	Shielded/Unshielded	With Core/Without Core
/	/	/	/

1.2 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows: During the test, pre-scan N80, N61, N69, and found the N69 model which it is worse case model.

Test Mode List			
Test Mode	Description	Channel	Frequency (MHz)
1	GFSK,	CH1	2402
		CH40	2441
		CH79	2480
2	Pi/4 QPSK	CH1	2402
		CH40	2441
		CH79	2480
3	8DPSK	CH1	2402
		CH40	2441
		CH79	2480

1.3 Test Standards

The following report accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

1.5 Test Facility

BSL Testing Co.,LTD.

1/F, Building B, Xinshidai GR Park, Shiyan Street, Bao'an District, Shenzhen, ShiyanStreet, Bao'an District, Shenzhen,Guangdong,518052,People' s Republic of China

FCC Test Firm Registration Number: 562200

Designation Number: CN1338

Tel: 400-882-9628

Fax: 86-755-26508703

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	$\pm 0.42\text{dB}$
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Power Spectral Density	Conducted	$\pm 1.8\text{dB}$
Conducted Spurious Emission	Conducted	$\pm 2.17\text{dB}$
Conducted Emissions	Conducted	$\pm 2.88\text{dB}$
Transmitter Spurious Emissions	Radiated	$\pm 5.1\text{dB}$

1.7 Test Equipment List and Details

Description	Manufacturer	Model	Serial No.	Cal Date	Due. Date
Communication Tester	Rohde & Schwarz	CMW500	100358	2022-11-08	2023-11-07
Spectrum Analyzer	R&S	FSP40	100550	2022-11-08	2023-11-07
Test Receiver	R&S	ESCI7	US47140102	2022-11-08	2023-11-07
Signal Generator	HP	83630B	3844A01028	2022-11-08	2023-11-07
Test Receiver	R&S	ESPI-3	100180	2022-11-08	2023-11-07
Amplifier	Agilent	8449B	4035A00116	2022-11-08	2023-11-07
Amplifier	HP	8447E	2945A02770	2022-11-08	2023-11-07
Signal Generator	IFR	2023A	202307/242	2022-11-08	2023-11-07
Broadband Antenna	SCHAFFNER	2774	2774	2022-11-08	2023-11-07
Biconical and log periodic antennas	ELECTRO-METRICS	EM-6917B-1	171	2022-11-08	2023-11-07
Horn Antenna	R&S	HF906	100253	2022-11-08	2023-11-07
Horn Antenna	EM	EM-6961	6462	2022-11-08	2023-11-07
LISN	R&S	ESH3-Z5	100196	2022-11-08	2023-11-07
LISN	COM-POWER	LI-115	02027	2022-11-08	2023-11-07
3m Semi-Anechoic Chamber	Chengyu Electron	9 (L)*6 (W)* 6 (H)	BSL086	2022-11-08	2023-11-07
Horn Antenna	A-INFOMW	LB-180400KF	BSL088	2022-11-08	2023-11-07
20dB Attenuator	ICPROBING	IATS1	BSL1003	2022-11-08	2023-11-07
POWER DIVIDER	Mini-circuits	PD-2SF-0010	N/A	2022-11-08	2023-11-07
Loop Antenna	Schwarz beck	FMZB 1516	9773	2022-11-08	2023-11-07
power meter	DARE	RPR3006W	15100041SNO03	2022-11-08	2023-11-07
EZ	EMC test software	/	/	/	/

2. SUMMARY OF TEST RESULTS

Test Item	Section in CFR 47	Result
RF Exposure (SAR)	Part 1.1307 Part 2.1093	Pass* (Please refer to SAR Report)
Antenna Requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(1)	Pass
20dB Occupied Bandwidth	15.247 (a)(1)	Pass
Carrier Frequencies Separation	15.247 (a)(1)	Pass
Hopping Channel Number	15.247 (a)(1)	Pass
Dwell Time	15.247 (a)(1)	Pass
Pseudorandom Frequency Hopping Sequence	15.247(b)(4)	Pass
Radiated Emission	15.205/15.209	Pass
Band Edge	15.247(d)	Pass

Pass: The EUT complies with the essential requirements in the standard.

Remark: Test according to ANSI C63.10:2013

3. RF Exposure

3.1 Standard Applicable

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

3.2 Test Result

This product complied with the requirement of the RF exposure, please see the RF Exposure Report.

4. Antenna Requirement

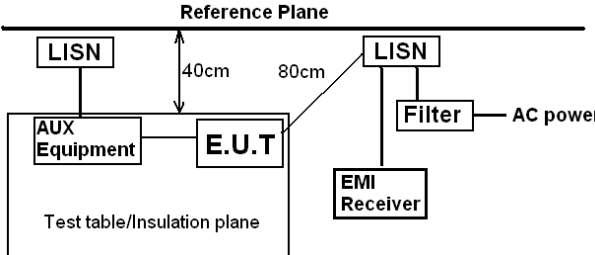
4.1 Standard Applicable

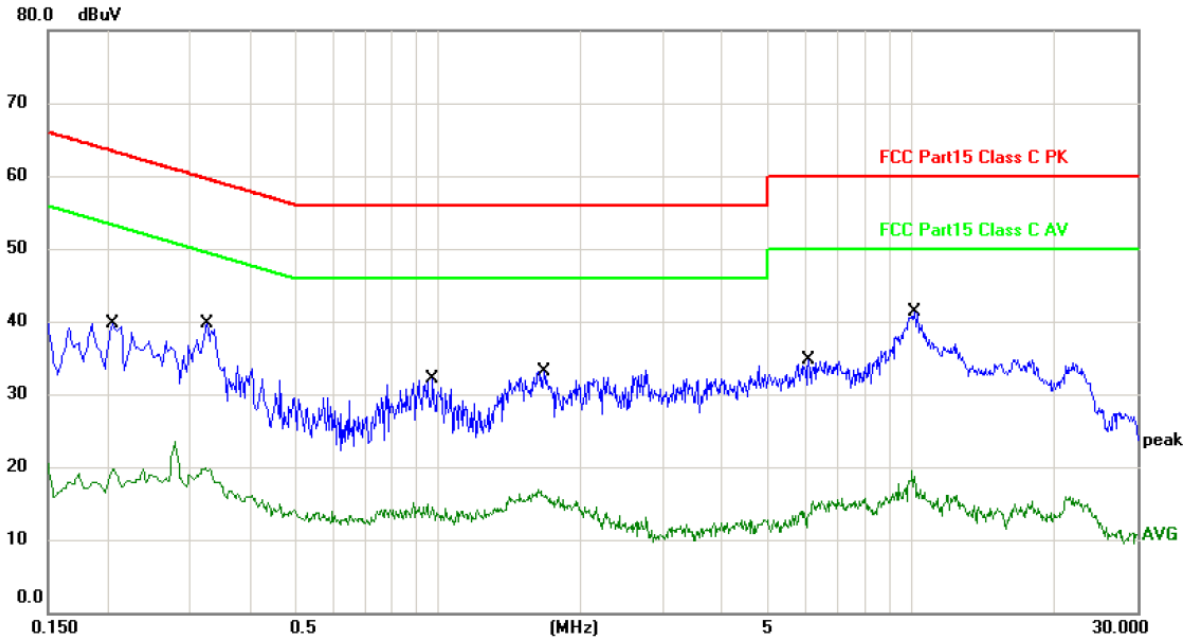
According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

4.2 Evaluation Information

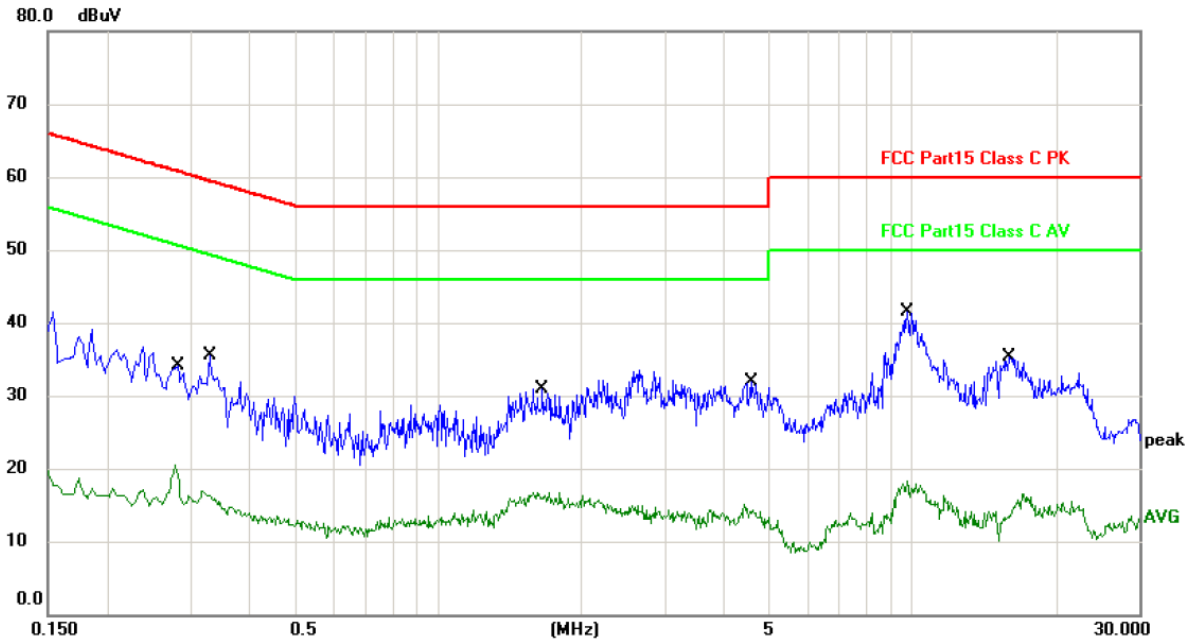
This product has a PCB antenna(1.3dBi), fulfill the requirement of this section.

5. Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207																
Test Method:	ANSI C63.10:2013																
Test Frequency Range:	150KHz to 30MHz																
Class / Severity:	Class B																
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto																
Limit:	<table><tr><th rowspan="2">Frequency range (MHz)</th><th colspan="2">Limit (dBuV)</th></tr><tr><th>Quasi-peak</th><th>Average</th></tr><tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr><tr><td>0.5-5</td><td>56</td><td>46</td></tr><tr><td>5-30</td><td>60</td><td>50</td></tr></table> * Decreases with the logarithm of the frequency.			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
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															
Test setup:	Reference Plane  Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m																
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 1.7 for details																
Test mode:	Refer to section 1.2 for details																
Test results:	Pass																

Test data: *Worst-case CONDUCTED emission***Line:**

No.	Mk.	Freq.	Measure- ment	Limit	Over	Detector	Comment
		MHz	dBuV	dBuV	dB		
1		0.2060	39.65	63.36	-23.71	QP	
2		0.2060	21.14	53.36	-32.22	AVG	
3		0.3260	39.75	59.55	-19.80	QP	
4		0.3260	18.32	49.55	-31.23	AVG	
5		0.9740	32.03	56.00	-23.97	QP	
6		0.9740	13.52	46.00	-32.48	AVG	
7		1.6740	33.08	56.00	-22.92	QP	
8		1.6740	16.19	46.00	-29.81	AVG	
9		6.0699	34.62	60.00	-25.38	QP	
10		6.0699	14.58	50.00	-35.42	AVG	
11	*	10.1379	41.25	60.00	-18.75	QP	
12		10.1379	17.36	50.00	-32.64	AVG	

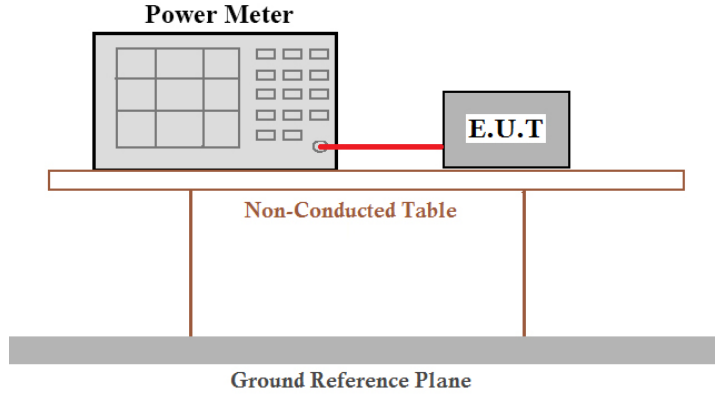
Neutral:

No.	Mk.	Freq. MHz	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.2819	34.05	60.76	-26.71	QP	
2		0.2819	19.67	50.76	-31.09	AVG	
3		0.3300	35.52	59.45	-23.93	QP	
4		0.3300	16.70	49.45	-32.75	AVG	
5		1.6580	30.96	56.00	-25.04	QP	
6		1.6580	15.88	46.00	-30.12	AVG	
7		4.5500	31.84	56.00	-24.16	QP	
8		4.5500	13.95	46.00	-32.05	AVG	
9	*	9.7420	41.51	60.00	-18.49	QP	
10		9.7420	17.24	50.00	-32.76	AVG	
11		15.9780	35.37	60.00	-24.63	QP	
12		15.9780	16.03	50.00	-33.97	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

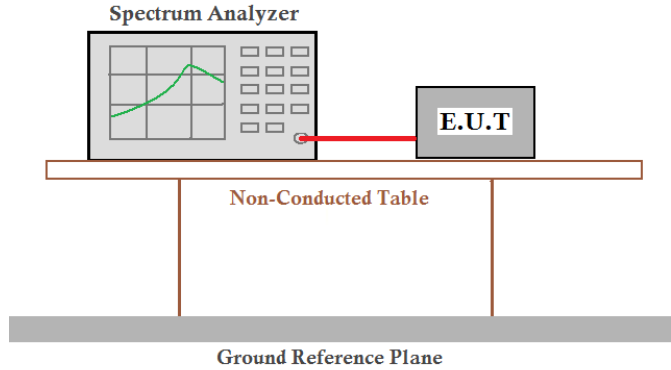
6. Conducted Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.10:2013
Limit:	30dBm(for GFSK),20.97dBm(for EDR)
Test setup:	 The diagram illustrates the test setup. A Power Meter is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Power Meter and the E.U.T. are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.
Test Instruments:	Refer to section 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

Measurement Data:

Mode	Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
GFSK	Lowest	-0.79	30.00	Pass
	Middle	-1.12		
	Highest	-2.93		
Pi/4QPSK	Lowest	1.43	20.97	Pass
	Middle	1.04		
	Highest	-0.82		
8DPSK	Lowest	1.42	20.97	Pass
	Middle	1.07		
	Highest	-0.9		

6. 20dB Emission Bandwidth

Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	ANSI C63.10:2013
Limit:	N/A
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.
Test Instruments:	Refer to section 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

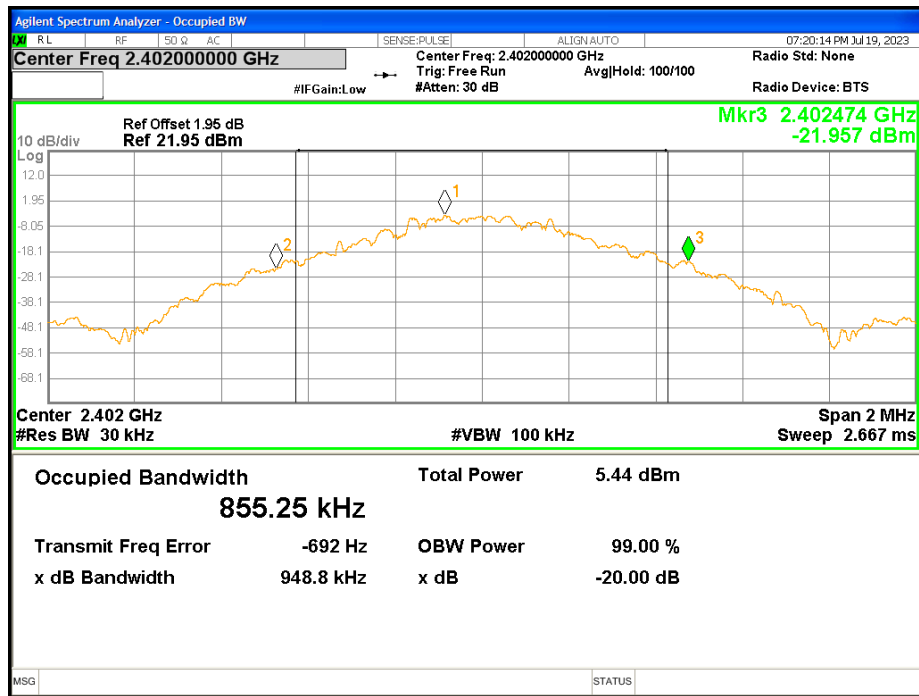
Measurement Data:

Mode	Test channel	20dB Emission Bandwidth (MHz)	Result
GFSK	Lowest	0.949	Pass
	Middle	0.951	
	Highest	0.948	
Pi/4QPSK	Lowest	1.282	Pass
	Middle	1.315	
	Highest	1.316	
8DPSK	Lowest	1.303	Pass
	Middle	1.309	
	Highest	1.321	

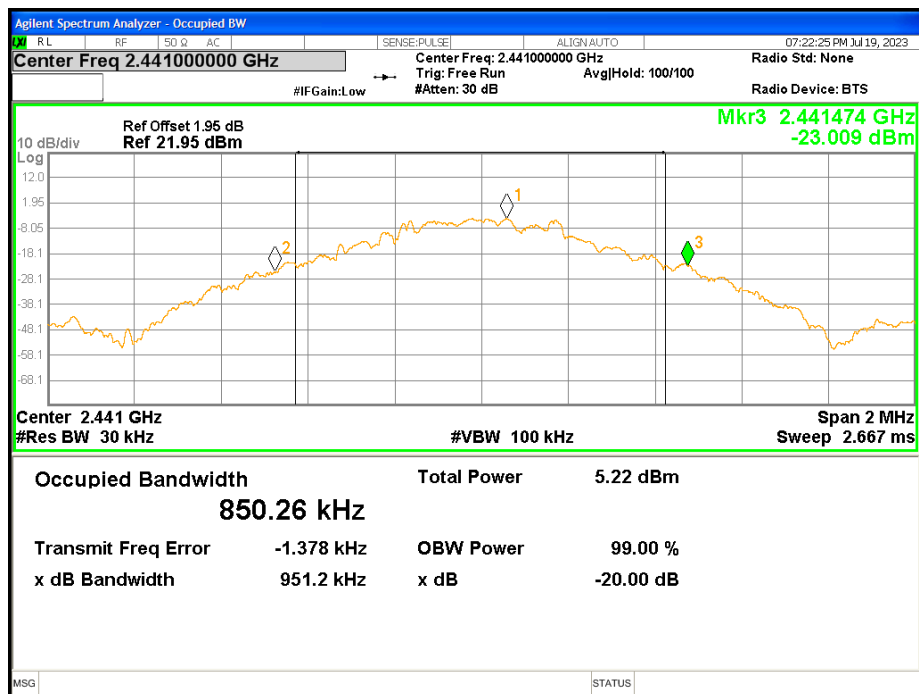
Test plot as follows:

Test mode:

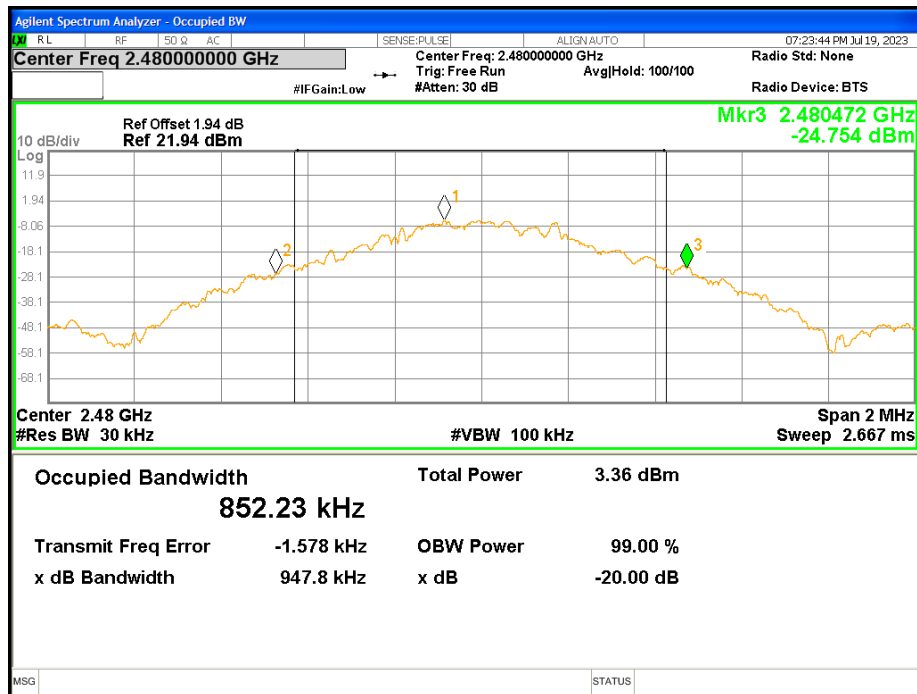
GFSK mode



Lowest channel



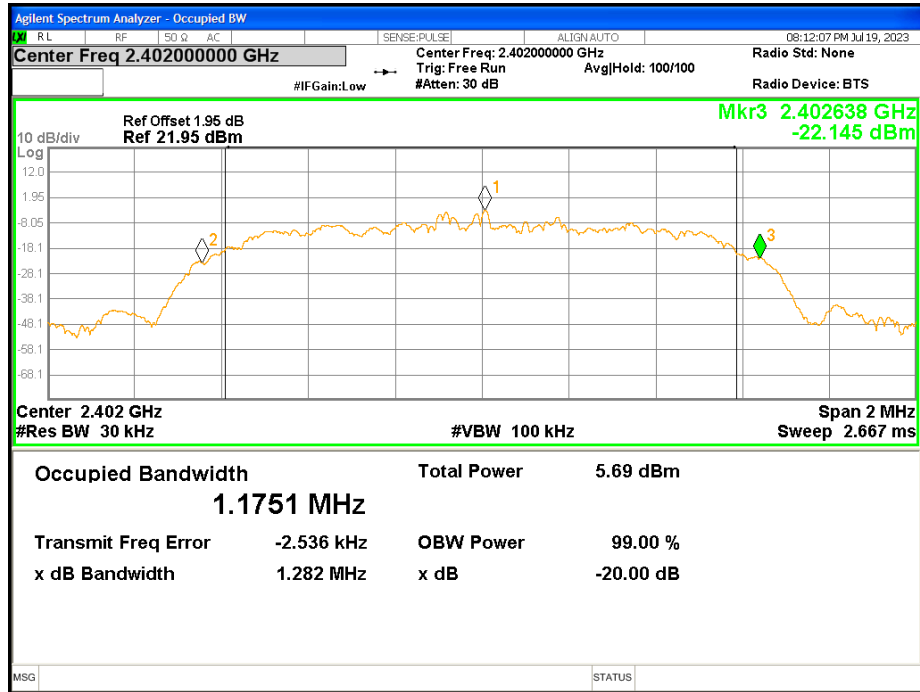
Middle channel



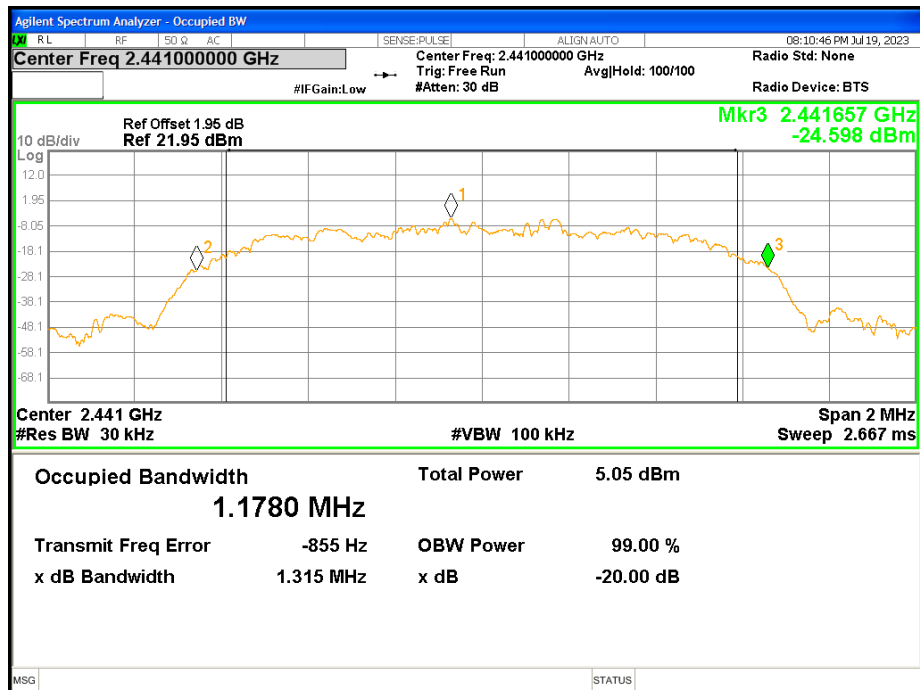
Highest channel

Test mode:

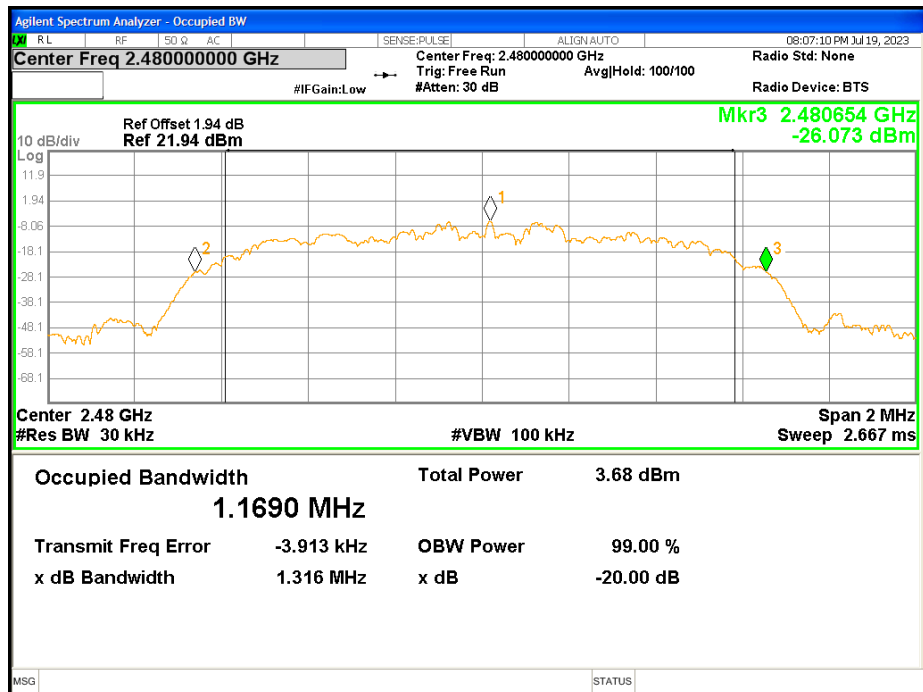
Pi/4QPSK mode



Lowest channel



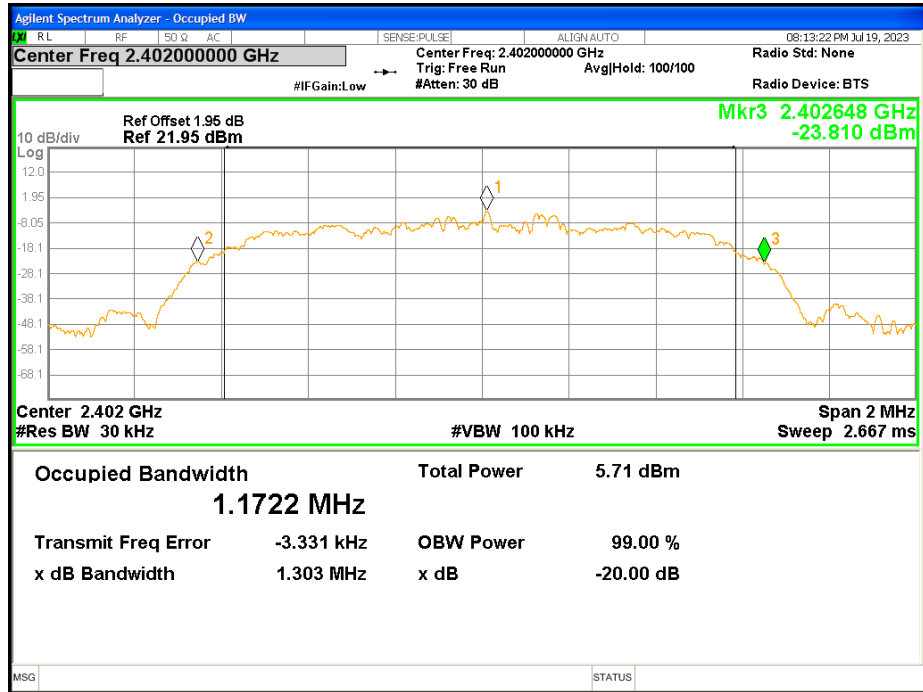
Middle channel



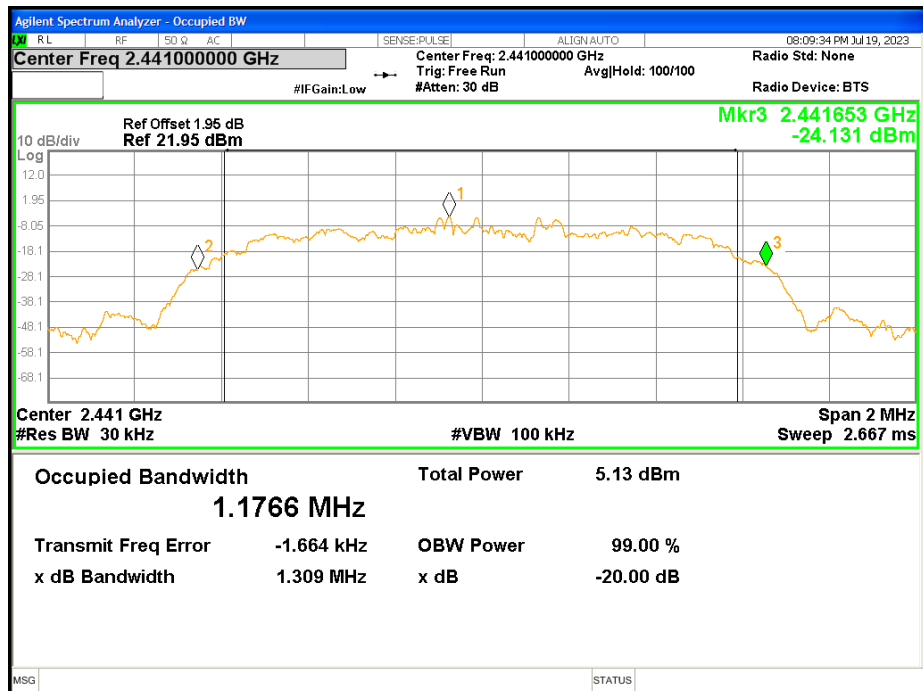
Highest channel

Test mode:

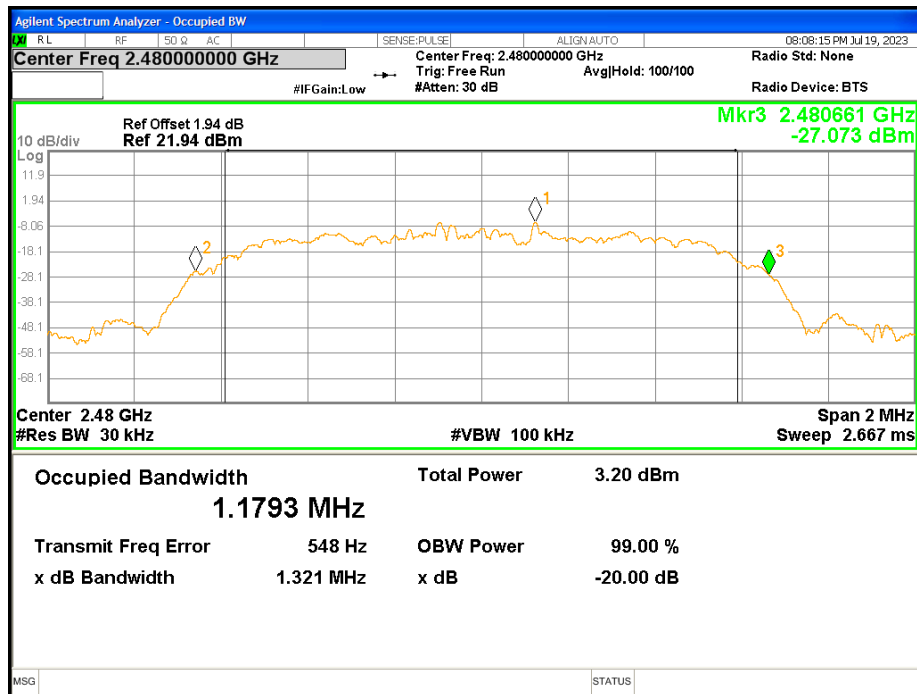
8DPSK mode



Lowest channel

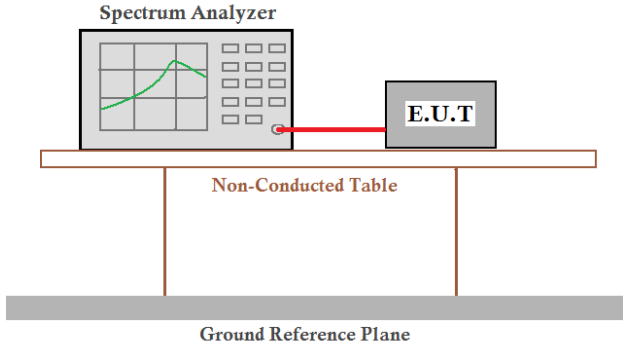


Middle channel



Highest channel

7. Carrier Frequencies Separation

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=20KHz, VBW=62KHz, detector=Peak
Limit:	0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.
Test Instruments:	Refer to section 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

Measurement Data:

Mode	Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
GFSK	Lowest	1.002	0.633	Pass
	Middle	0.998	0.634	Pass
	Highest	0.92	0.632	Pass
Pi/4QPSK	Lowest	1.026	0.877	Pass
	Middle	1.000	0.856	Pass
	Highest	0.918	0.871	Pass
8DSK	Lowest	0.934	0.856	Pass
	Middle	0.988	0.891	Pass
	Highest	1.086	0.853	Pass

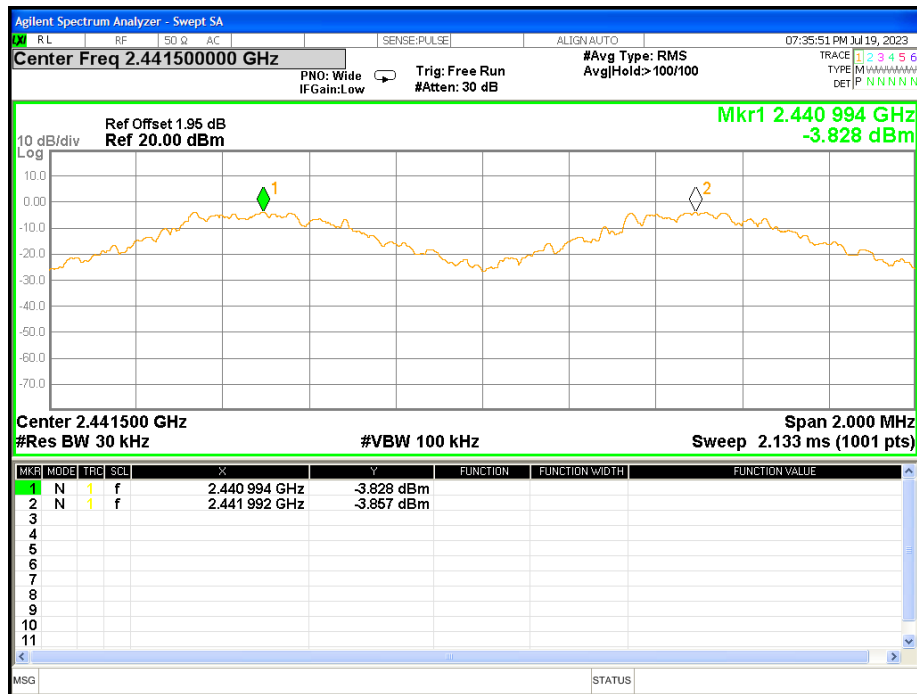
Note: According to section 7.4

Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	951.00	1002
Pi/4QPSK	1316.00	918
8DSK	1321.00	1086

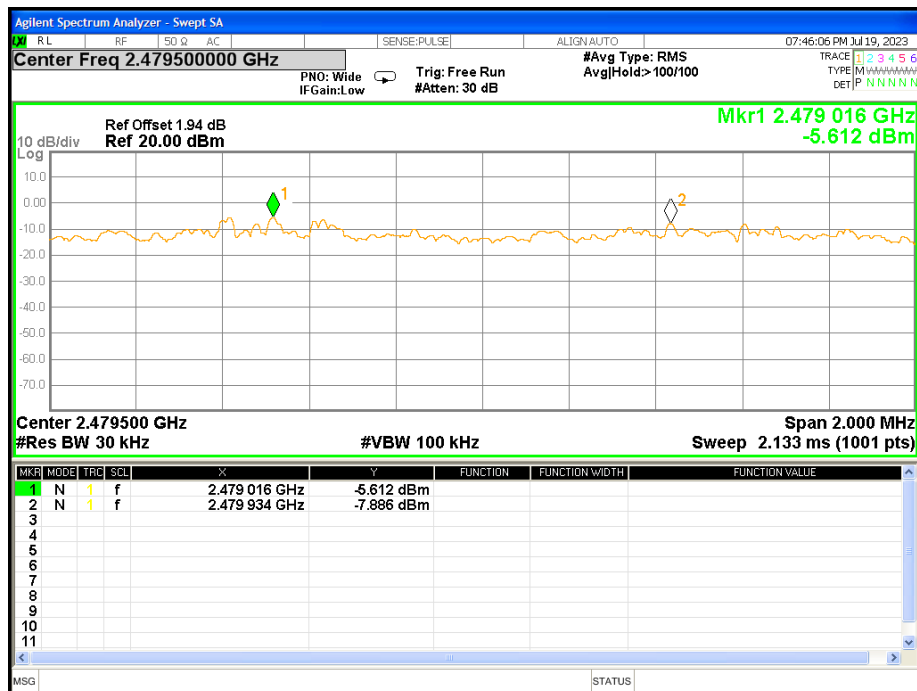
Test plot as follows:

Only show the worst case

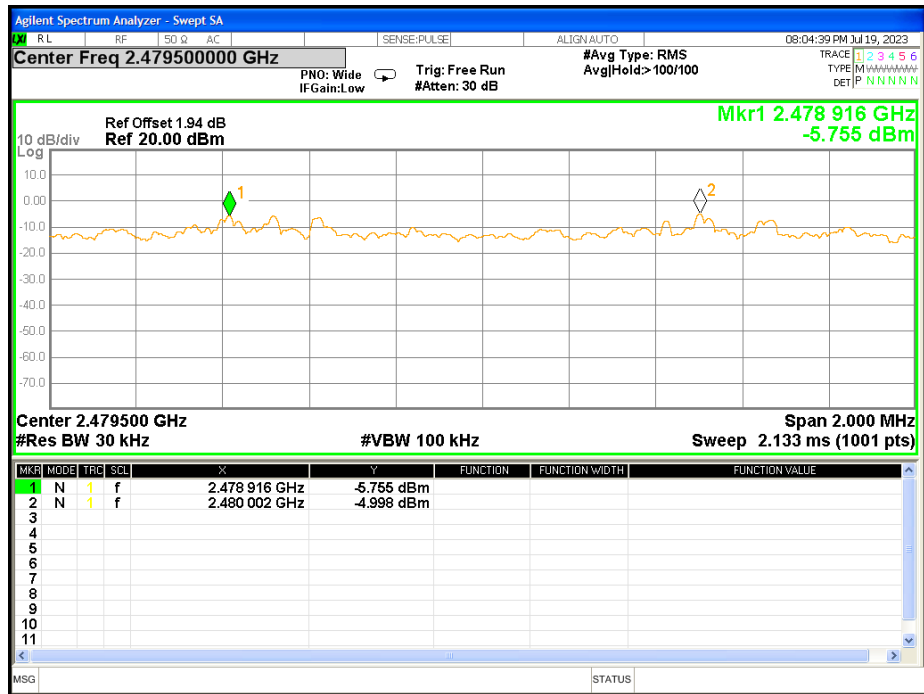
GFSK



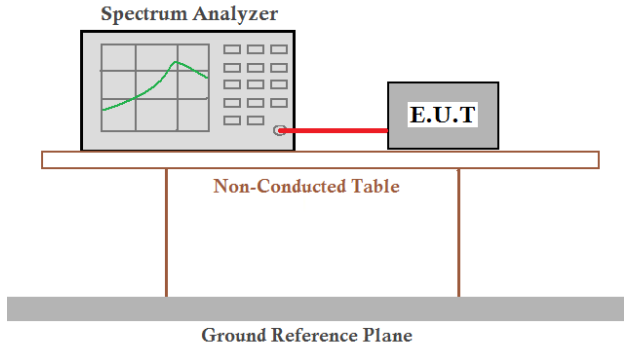
Pi/4QPSK



8DPSK



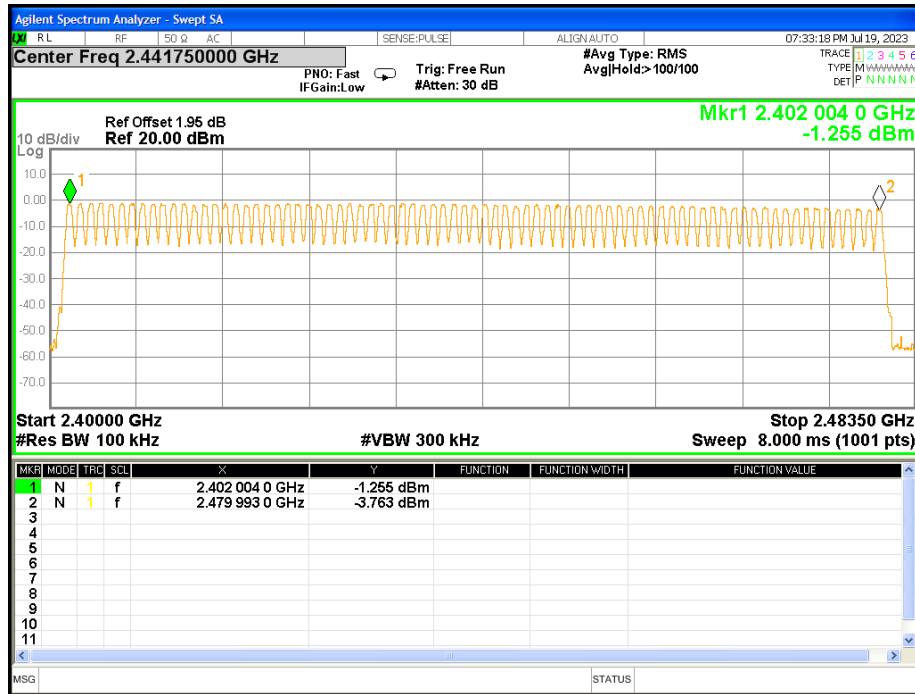
8. Hopping Channel Number

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak
Limit:	15 channels
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.
Test Instruments:	Refer to section 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

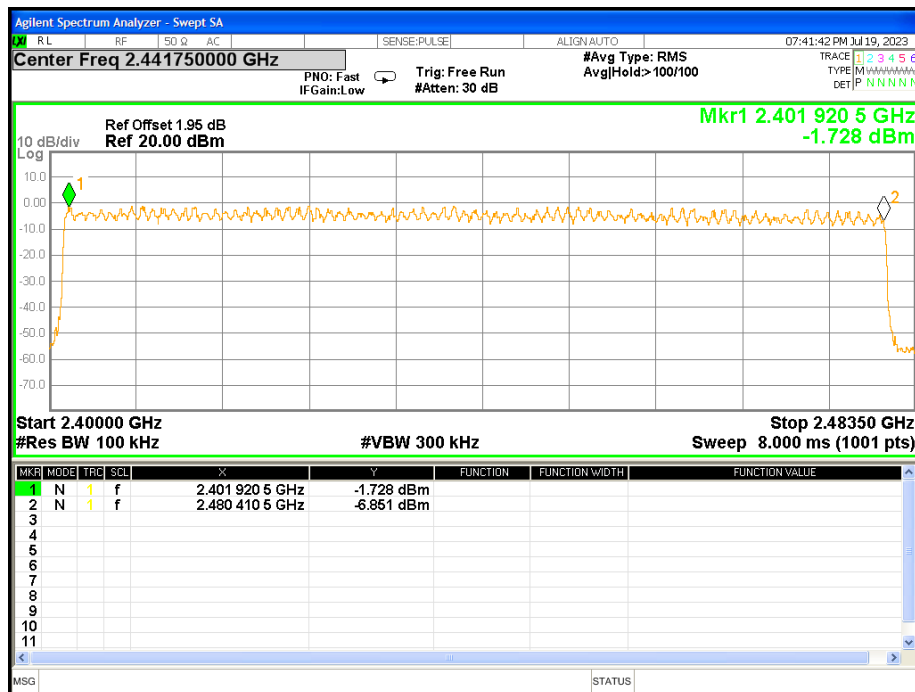
Measurement Data:

Mode	Hopping channel numbers	Limit	Result
GFSK	79	15	Pass
Pi/4QPSK	79	15	Pass
8DPSK	79	15	Pass

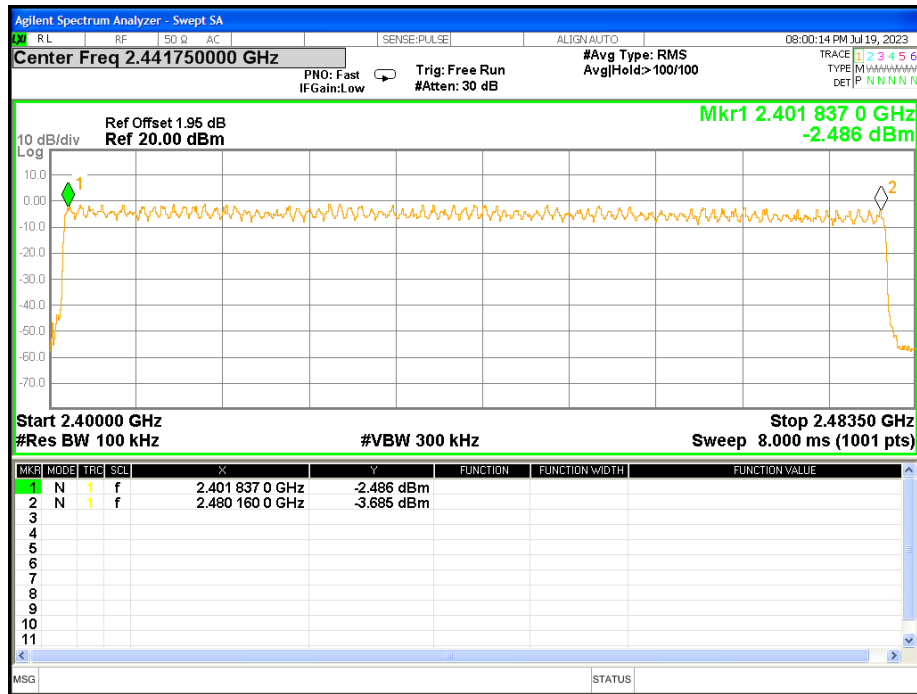
GFSK



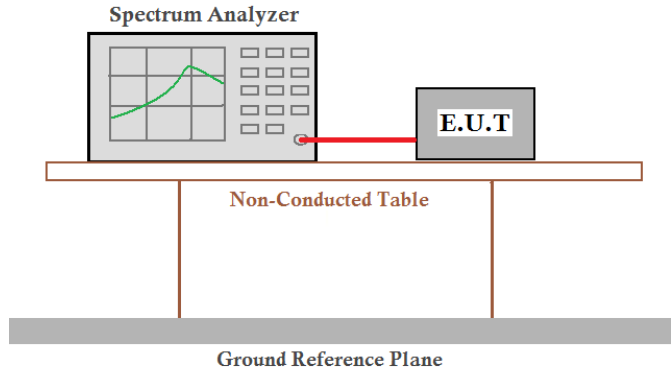
Pi/4QPSK



8DPSK



9. Dwell Time

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=1MHz, VBW=1MHz, Span=0Hz, Detector=Peak
Limit:	0.4 Second
Test setup:	 The diagram illustrates the test setup. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.
Test Instruments:	Refer to section 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

Measurement Data:

Mode	Frequency (MHz)	Burst Type	Pulse Width (ms)	Dwell Time (ms)	Limit (ms)	Verdict
GFSK	2441	DH1	2.905	302.12	400	PASS
		DH3	2.905	322.455		
		DH5	2.906	261.54		
π/4-DQPSK	2441	DH1	2.891	306.446	400	PASS
		DH3	2.909	325.808		
		DH5	2.91	308.46		
8DPSK	2441	DH1	2.892	300.768	400	PASS
		DH3	2.892	312.336		
		DH5	2.91	291		

The test period: $T = 0.4 \text{ Second/Channel} \times 79 \text{ Channel} = 31.6 \text{ s}$

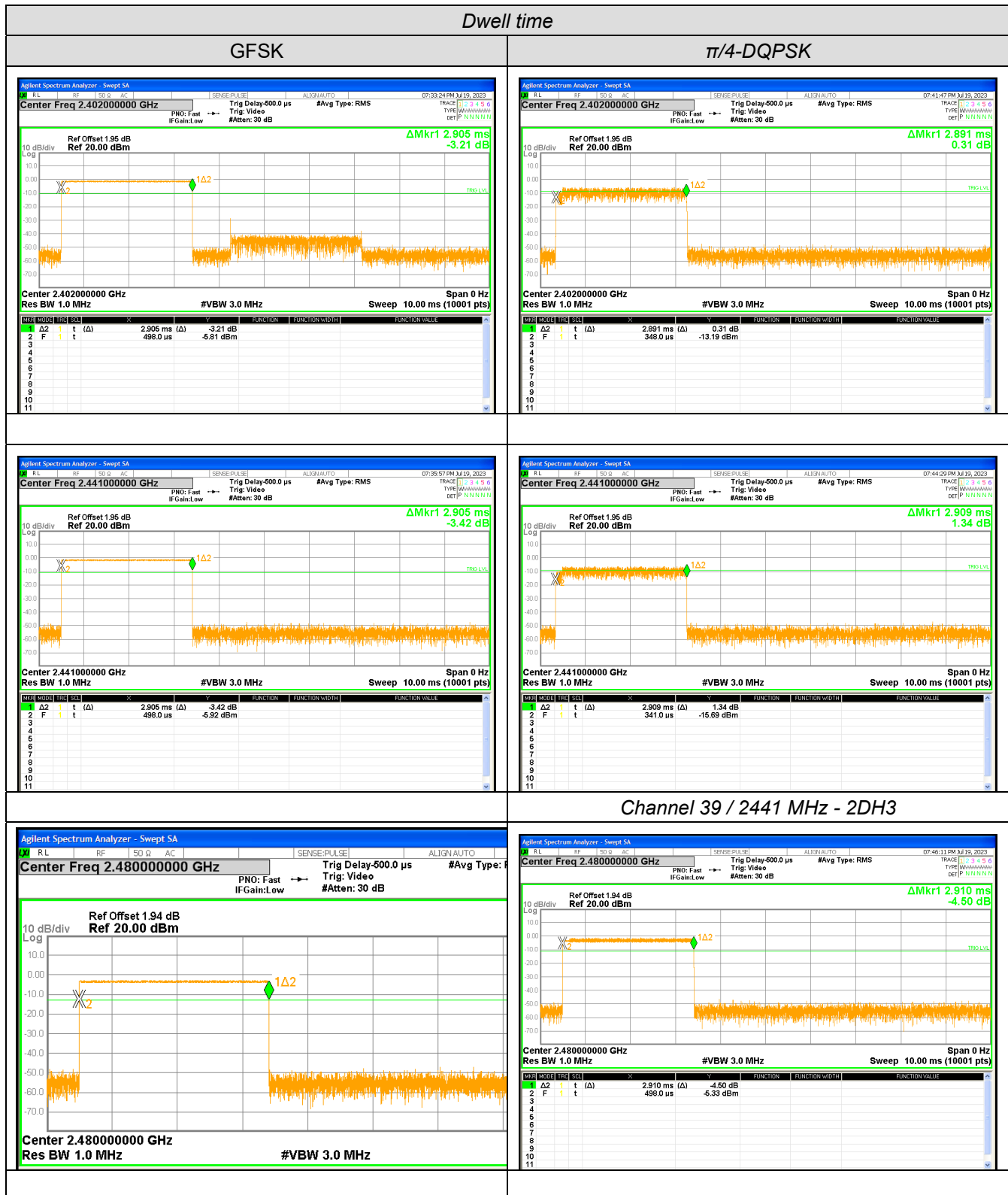
Test channel: 2402MHz/2441MHz/2480MHz as blow

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

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

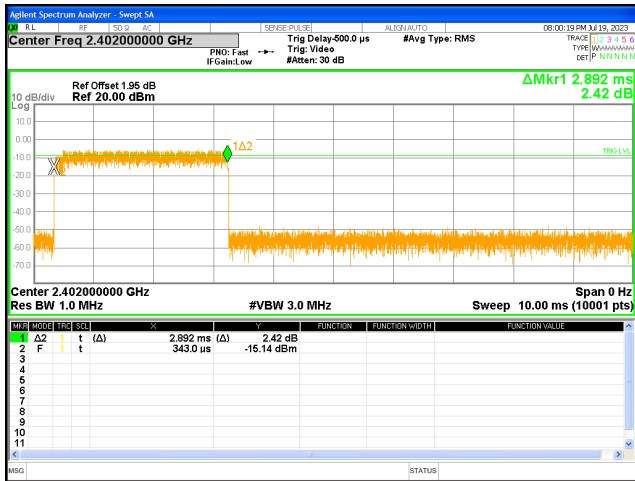
DH5 time slot= Pulse time (ms)*(1600/ (6*79))*31.6

Test plot as follows:



Dwell time

8DPSK

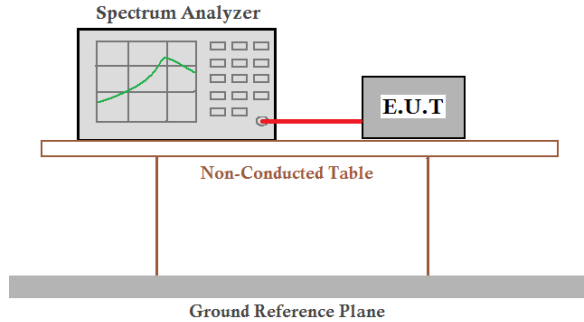


10. Pseudorandom Frequency Hopping Sequence

Test Requirement:	FCC Part15 C Section 15.247 (a)(1) requirement:
<i>Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.</i> <i>Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.</i>	
EUT Pseudorandom Frequency Hopping Sequence	
<i>The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized with nine ones.</i> • Number of shift register stages: 9 • Length of pseudo-random sequence: $2^9 - 1 = 511$ bits • Longest sequence of zeros: 8 (non-inverted signal) <i>Linear Feedback Shift Register for Generation of the PRBS sequence</i> <i>An example of Pseudorandom Frequency Hopping Sequence as follow:</i> <i>Each frequency used equally on the average by each transmitter.</i> <i>The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.</i>	

11. Band Edge

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 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

Marker-Delta Method

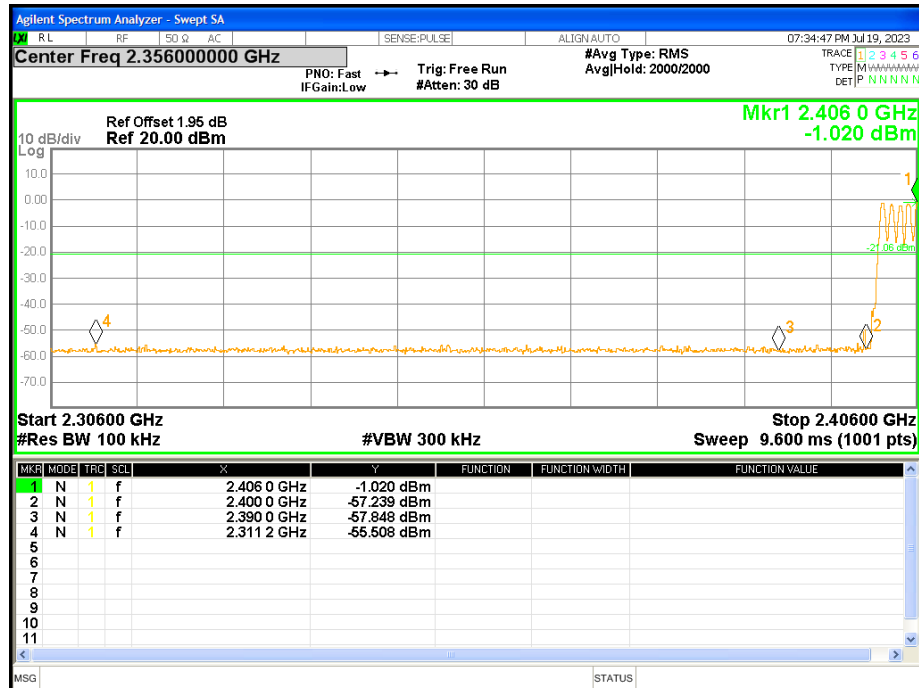
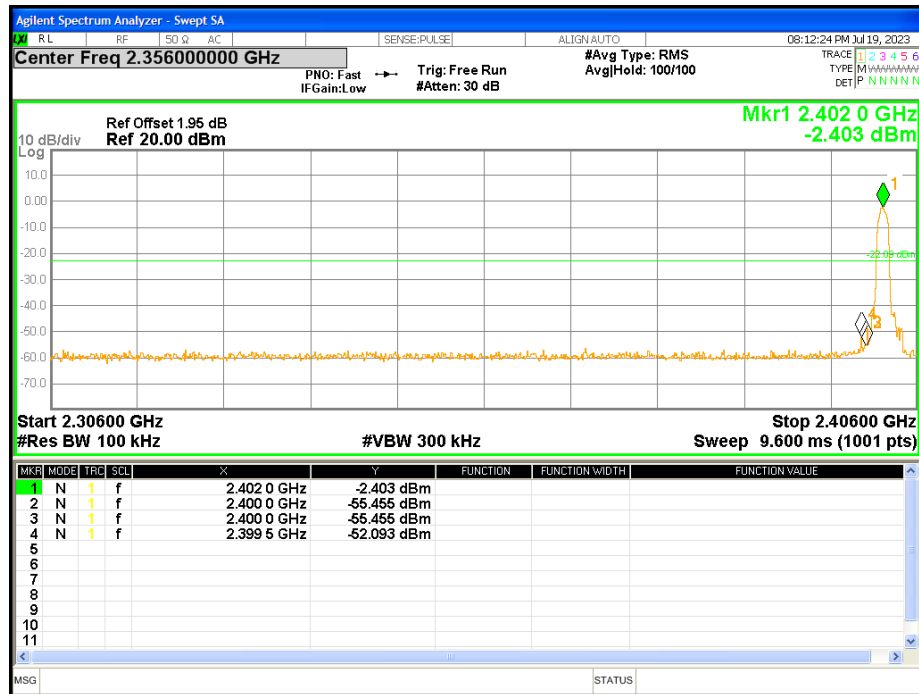
Test Requirement:	FCC Part15 C Section 15.209 and 15.205			
Test Method:	ANSI C63.10:2013 section 6.10.6			
Test Frequency Range:	All restriction band have been tested.			
Limit:	Frequency	Limit (dBuV/m @3m)	Remark	
	Above 1GHz	54.00	Average Value	
		74.00	Peak Value	

Test plot as follows:

GFSK Mode:

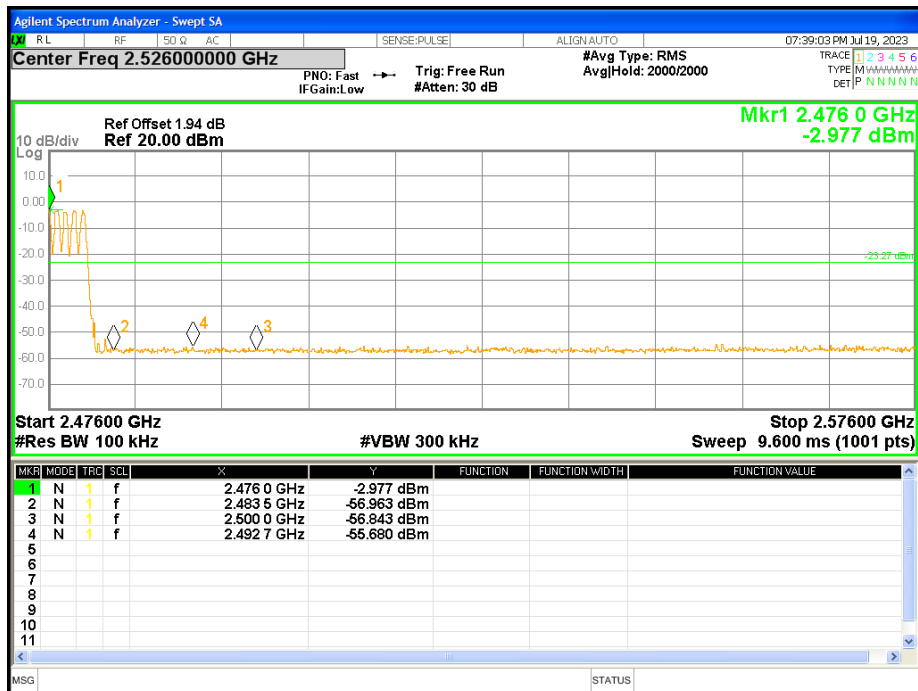
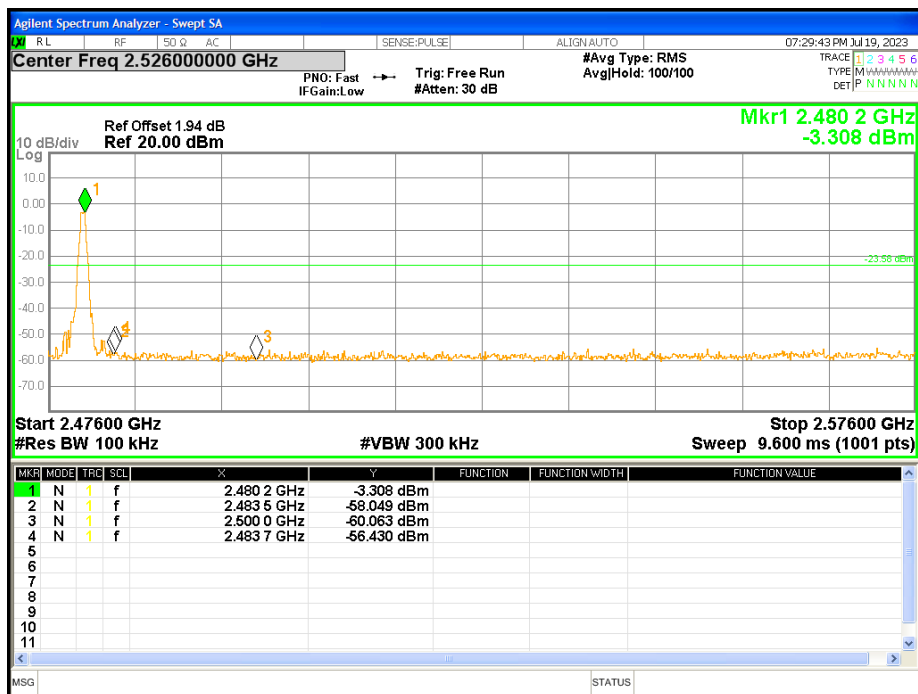
Test channel:

Lowest channel



Test channel:

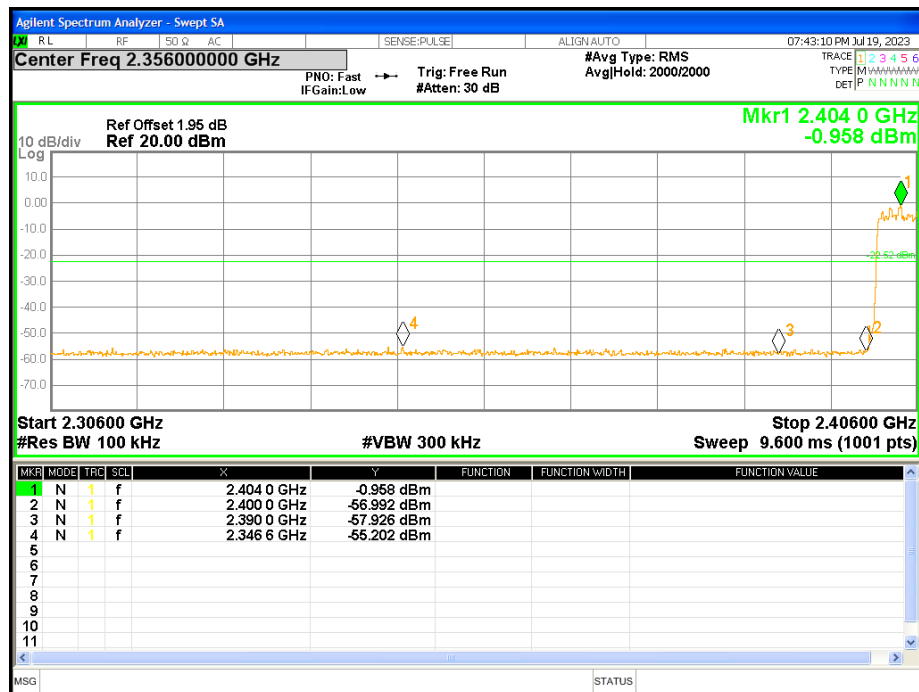
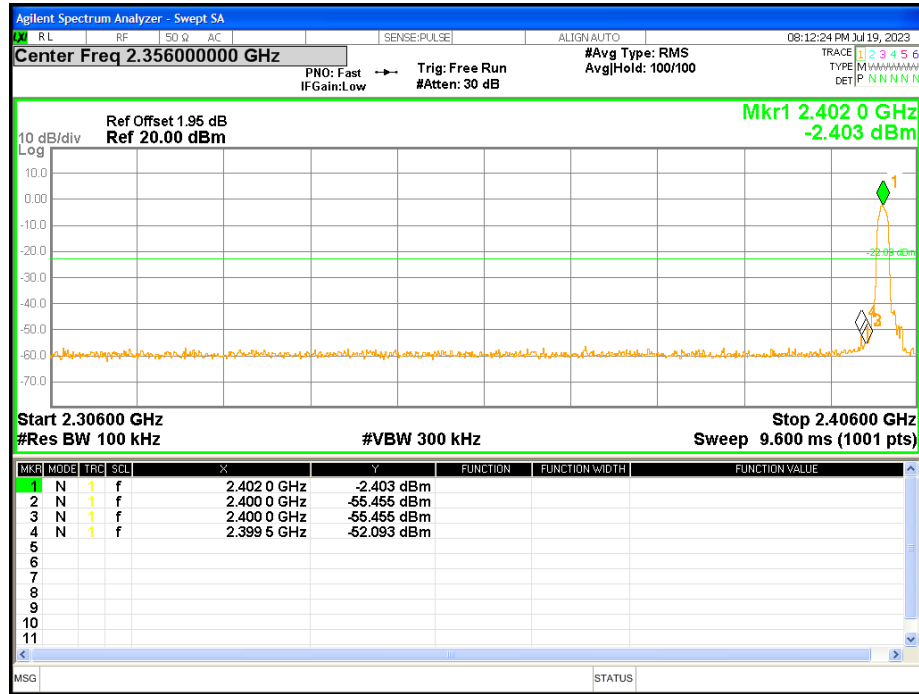
Highest channel



Pi/4QPSK Mode:

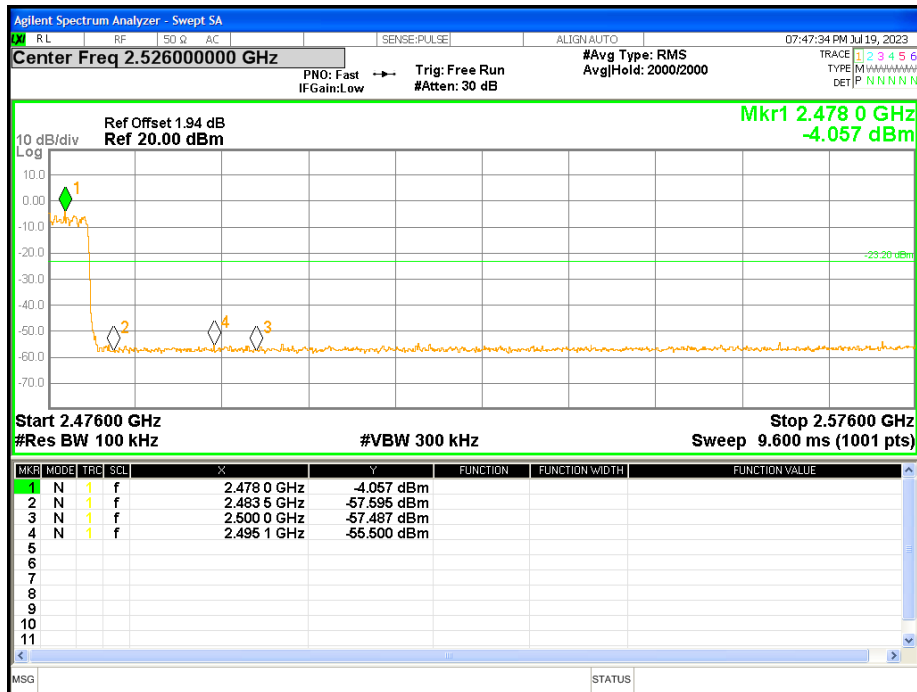
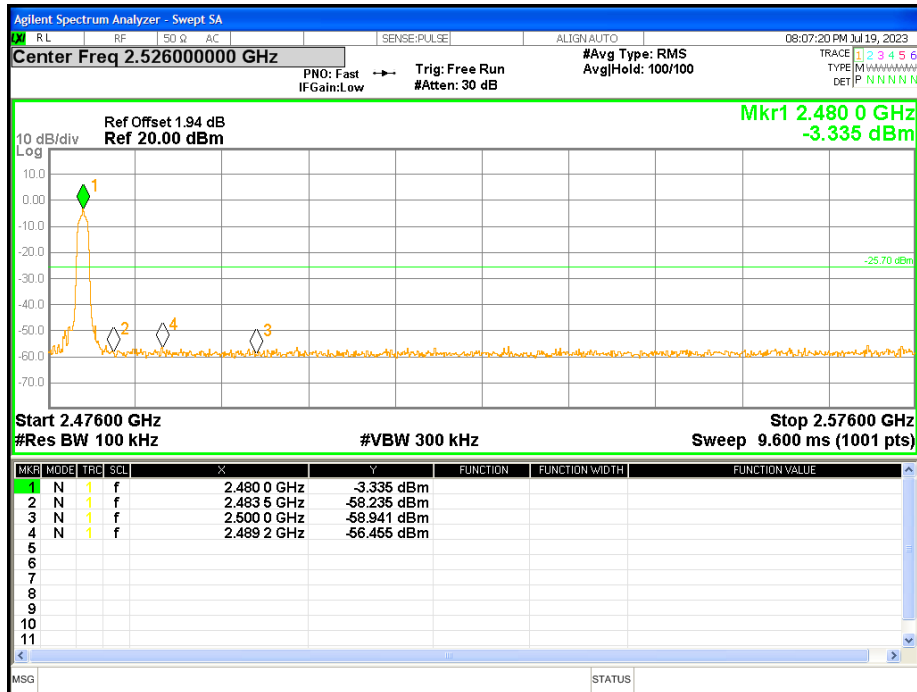
Test channel:

Lowest channel



Test channel:

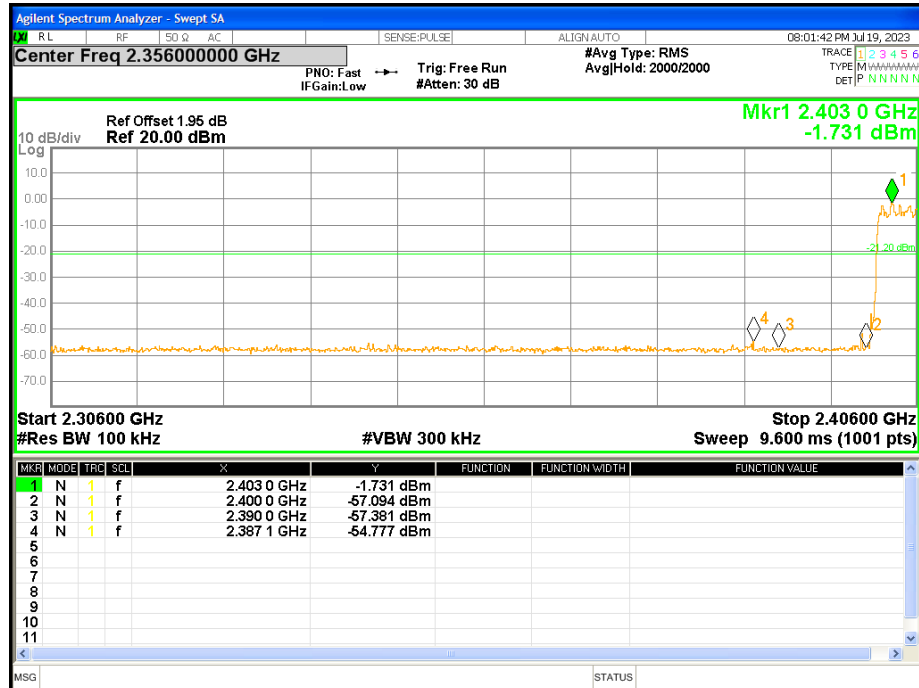
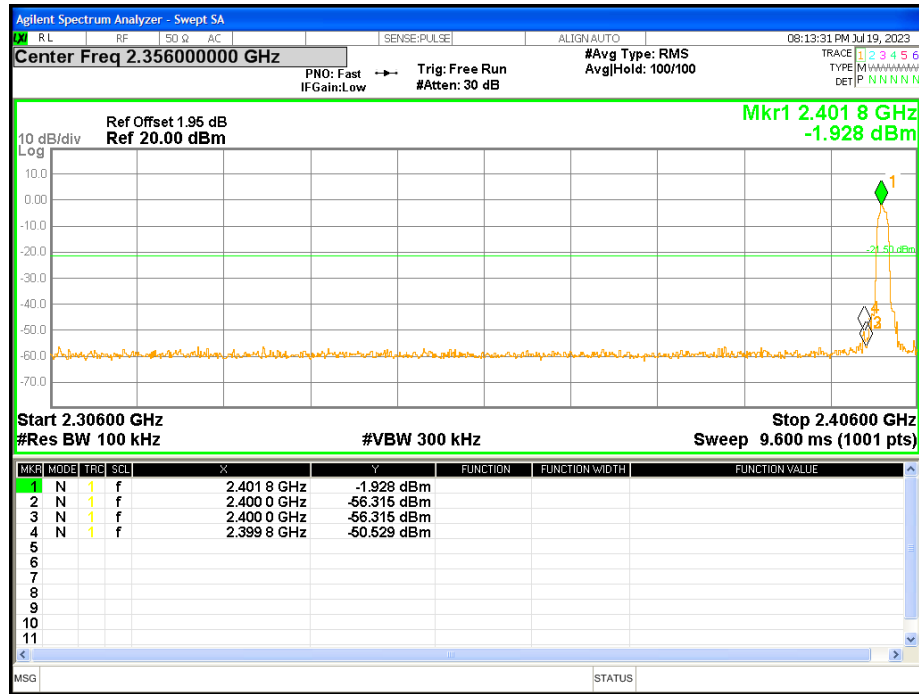
Highest channel



8DPSK Mode:

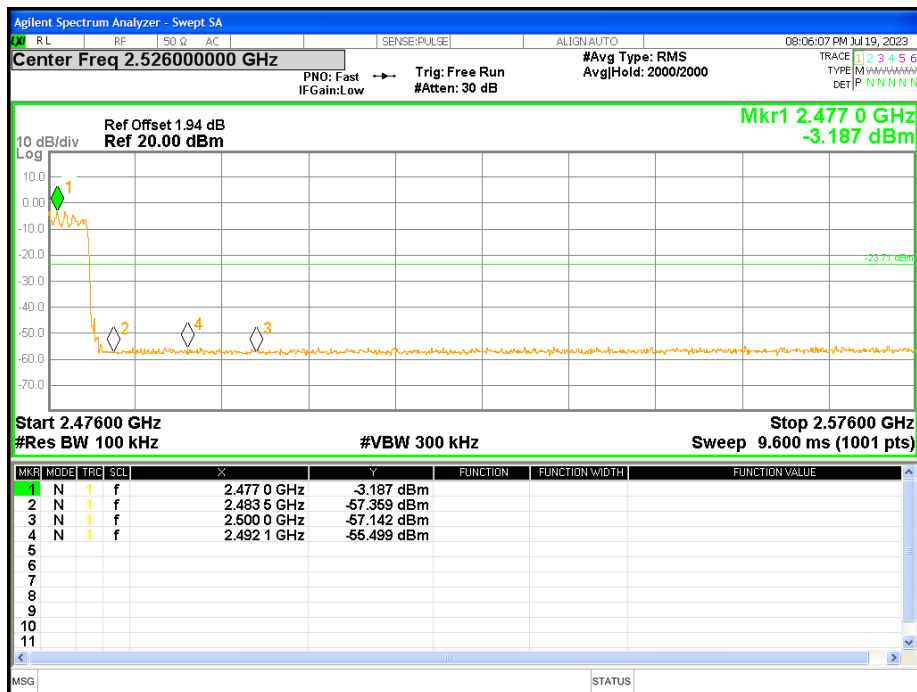
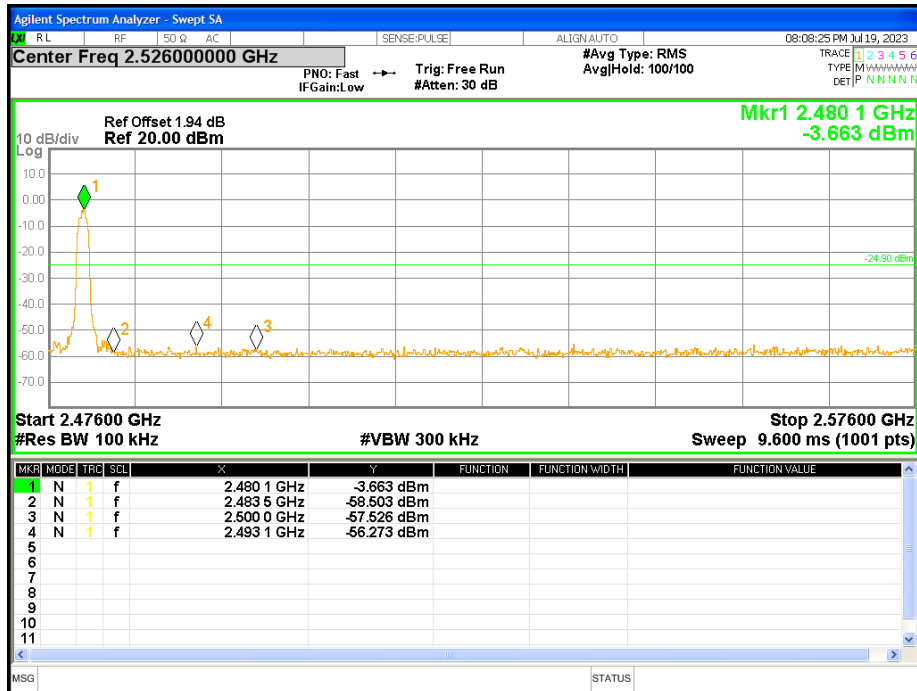
Test channel:

Lowest channel



Test channel:

Highest channel



Test channel:

Lowest

Peak value:

Frequency (MHz)	Fundamental (dBuV/m)	Delta (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2400.00	78.62	53.052	25.57	74.00	-48.43	Horizontal
2400.00	82.13	53.052	29.08	74.00	-44.92	Vertical

Test channel:

Highest

Peak value:

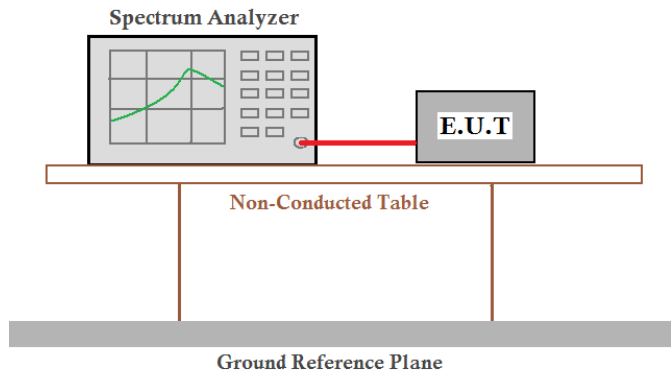
Frequency (MHz)	Fundamental (dBuV/m)	Delta (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2400.00	76.69	54.387	22.30	74.00	-51.70	Horizontal
2400.00	79.35	54.387	24.96	74.00	-49.04	Vertical

Remark:

1. Final Level = Filed Strength of Fundamental – Delta
2. During the test, pre-scan the GFSK, Pi/4QPSK, 8DPSK modulation, and found the GFSK modulation which it is worse case.
3. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

12. Spurious Emission

Conducted Emission Method

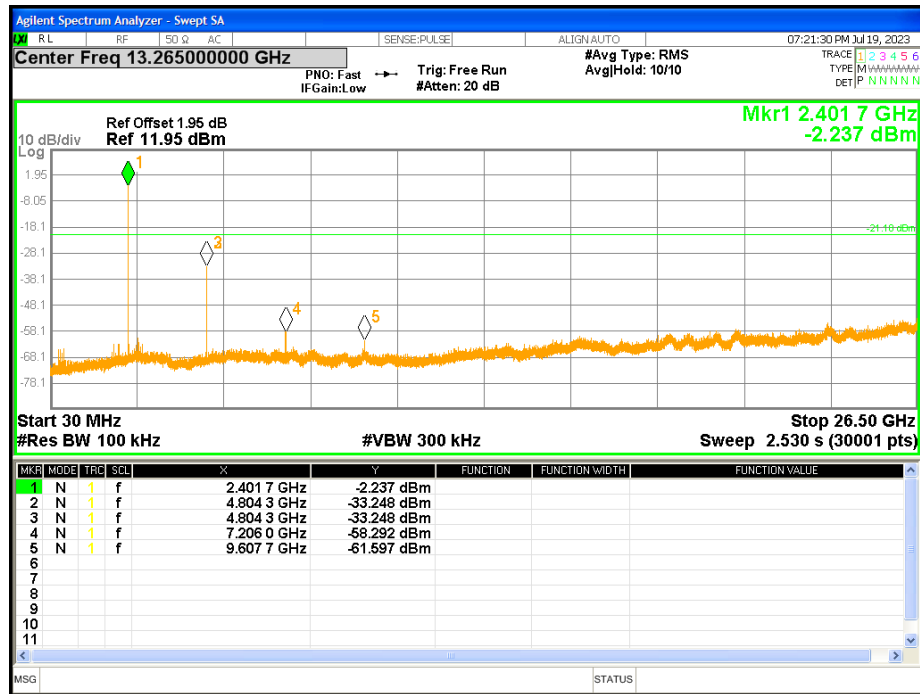
Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below 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:	 The diagram illustrates the test setup for conducted emission measurement. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table, which is supported by two vertical legs. Below the table is a Ground Reference Plane, represented by a thick grey bar.
Test Instruments:	Refer to section 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

Remark:

During the test, pre-scan the GFSK, Pi/4QPSK, 8DPSK modulation, and found the GFSK modulation which it is worse case.

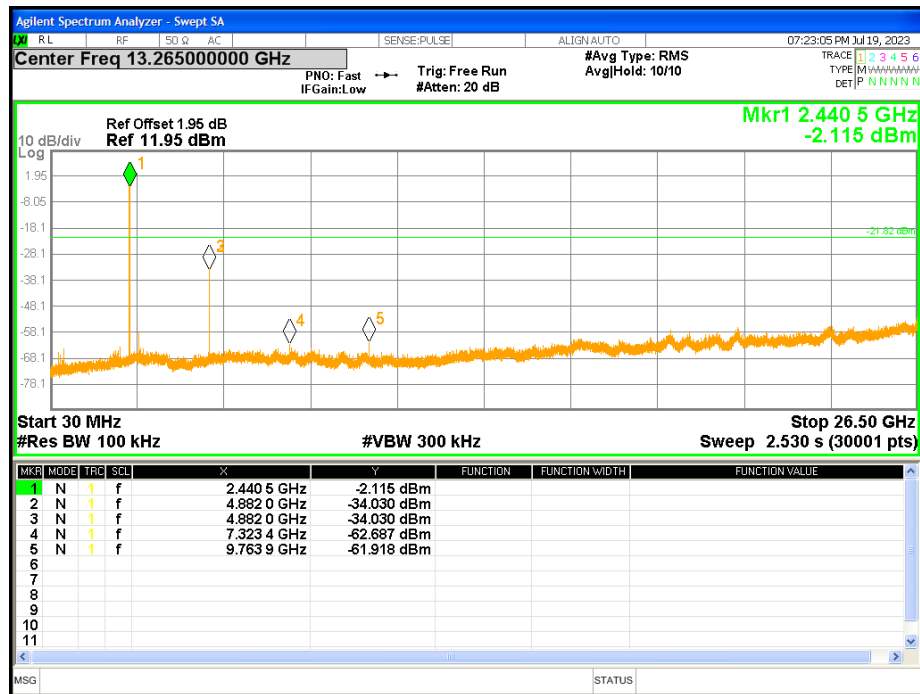
Test channel:

GFSK



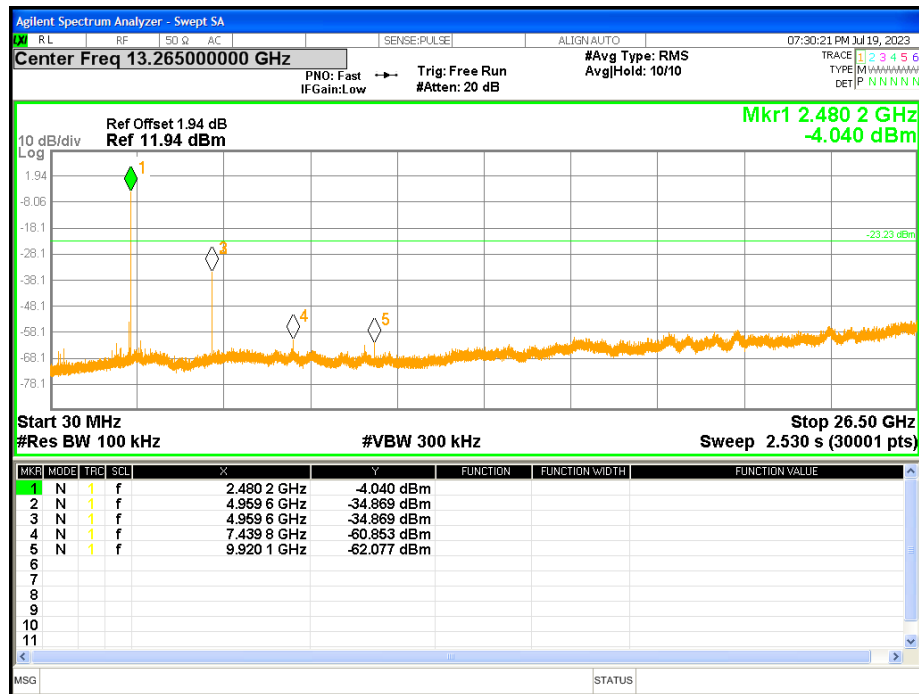
Test channel:

4QPSK

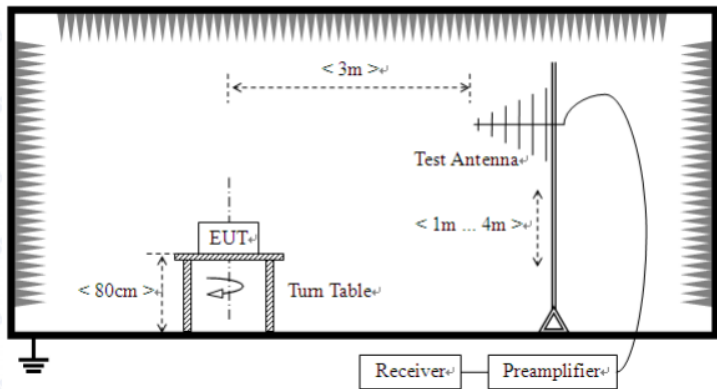


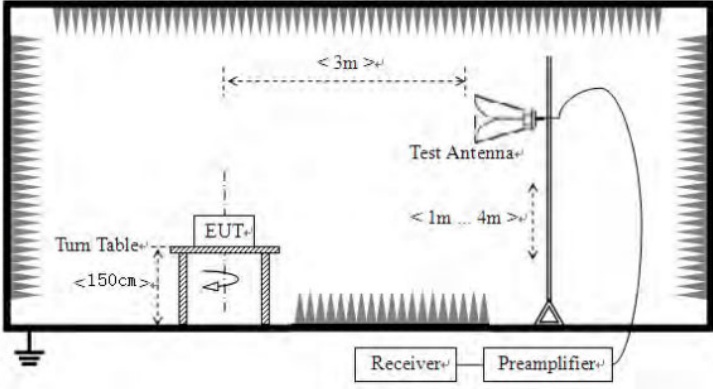
Test channel:

8DPSK



Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	30MHz to 25GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value
	Above 1GHz	Peak	1MHz	3MHz	Peak Value
		Average	1MHz	3MHz	Average Value
Limit:	Frequency		Limit (dBuV/m @3m)		Remark
	30MHz-88MHz		40.0		Quasi-peak Value
	88MHz-216MHz		43.5		Quasi-peak Value
	216MHz-960MHz		46.0		Quasi-peak Value
	960MHz-1GHz		54.0		Quasi-peak Value
	Above 1GHz		54.0		Average Value
			74.0		Peak Value
Test setup:	Below 1GHz				
					
	Above 1GHz				

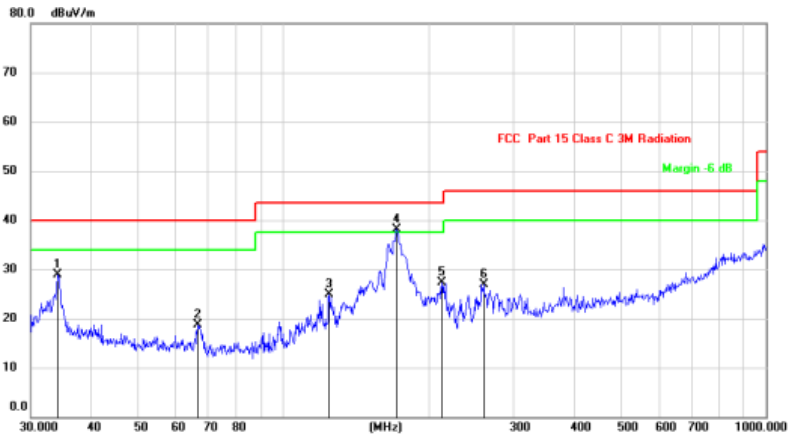
	
Test Procedure:	1. The EUT was placed on the top of a rotating table (0.8 meters below 1G and 1.5 meters above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving 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 1.7 for details
Test mode:	Refer to section 1.2 for details
Test results:	Pass

Remark:

1. During the test, pre-scan the GFSK, Pi/4QPSK, 8DPSK modulation, and found the GFSK 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.
- 3.

Measurement data: The result is a test of the left earbuds

Vertical:



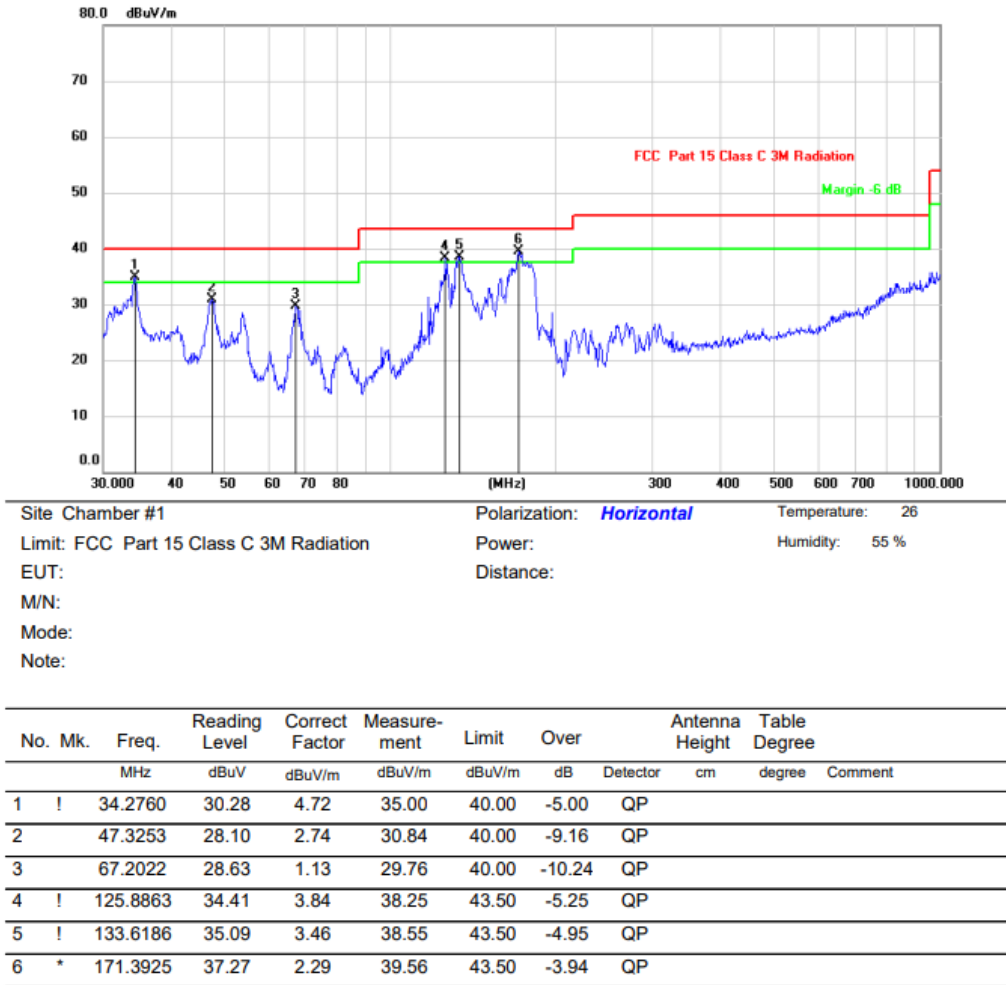
Site: Chamber #1
Limit: FCC Part 15 Class C 3M Radiation
EUT:
M/N:
Mode:
Note:

Polarization: **Vertical**
Power:
Distance:

Temperature: 26
Humidity: 55 %

No.	Mk.	Freq.	Reading	Correct	Measure-	Limit	Over	Antenna	Table	
		MHz	Level	Factor	ment			Height	Degree	
			dBuV	dBuV/m	dBuV/m	dBuV/m	dB	Detector	cm	degree
1		34.0363	23.98	4.88	28.86	40.00	-11.14	QP		
2		66.4989	17.37	1.24	18.61	40.00	-21.39	QP		
3		124.5690	21.10	3.88	24.98	43.50	-18.52	QP		
4	*	171.9944	35.75	2.44	38.19	43.50	-5.31	QP		
5		213.0149	23.76	3.63	27.39	43.50	-16.11	QP		
6		260.1444	21.85	5.09	26.94	46.00	-19.06	QP		

*:Maximum data x:Over limit !:over margin

Horizontal:

*:Maximum data x:Over limit !:over margin

■ Above 1GHz

Test channel:

Lowest

Peak value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2402	82.13	-	-	Vertical
4804	43.21	74.00	-30.79	Vertical
7206	38.14	74.00	-35.86	Vertical
9608	33.10	74.00	-40.90	Vertical
2402	78.62	-	-	Horizontal
4804	41.25	74.00	-32.75	Horizontal
7206	39.14	74.00	-34.86	Horizontal
9608	33.20	74.00	-40.80	Horizontal

Average value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2402	78.34	-	-	Vertical
4804	38.27	54.00	-15.73	Vertical
7206	34.63	54.00	-19.37	Vertical
9608	30.25	54.00	-23.75	Vertical
2402	75.31	-	-	Horizontal
4804	33.69	54.00	-20.31	Horizontal
7206	32.61	54.00	-21.39	Horizontal
9608	29.58	54.00	-24.42	Horizontal

Remark:

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 from 9 kHz to 30MHz was pre tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.
4. In frequency ranges 18 ~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.

Test channel:

Middle

Peak value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2442	76.95	-	-	Vertical
4882	41.36	74.00	-32.64	Vertical
7323	37.65	74.00	-36.35	Vertical
9764	32.58	74.00	-41.42	Vertical
2442	78.36	-	-	Horizontal
4882	38.68	74.00	-35.32	Horizontal
7323	37.26	74.00	-36.74	Horizontal
9764	31.02	74.00	-42.98	Horizontal

Average value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2442	75.31	-	-	Vertical
4882	37.38	54.00	-16.62	Vertical
7323	33.64	54.00	-20.36	Vertical
9764	29.51	54.00	-24.49	Vertical
2442	75.64	-	-	Horizontal
4882	34.68	54.00	-19.32	Horizontal
7323	33.75	54.00	-20.25	Horizontal
9764	29.01	54.00	-24.99	Horizontal

Remark:

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 from 9 kHz to 30MHz was pre tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.*
4. *In frequency ranges 18 ~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.*

Test channel:

Highest

Peak value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2480	79.35	-	-	Vertical
4960	41.20	74.00	-32.80	Vertical
7440	38.34	74.00	-35.66	Vertical
9920	32.25	74.00	-41.75	Vertical
2480	76.69	-	-	Horizontal
4960	39.68	74.00	-34.32	Horizontal
7440	35.63	74.00	-38.37	Horizontal
9920	30.28	74.00	-43.72	Horizontal

Average value:

Frequency (MHz)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2480	76.85	-	-	Vertical
4960	37.62	54.00	-16.38	Vertical
7440	35.41	54.00	-18.59	Vertical
9920	29.39	54.00	-24.61	Vertical
2480	74.61	-	-	Horizontal
4960	36.51	54.00	-17.49	Horizontal
7440	32.68	54.00	-21.32	Horizontal
9920	29.62	54.00	-24.38	Horizontal

Remark:

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 from 9 kHz to 30MHz was pre tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.
4. In frequency ranges 18 ~25GHz no any other harmonic emissions detected which are tested to compliance with the limit. No recording in the test report. No any other emissions level which are attenuated less than 20dB below the limit. No recording in the test report.

-----End-----