

TEST REPORT

Product : WIRELESS BATTERY DIAGNOSTICS
SYSTEM
Trade mark : AUTEL
Model/Type reference : MaxiBAS BT609
Serial Number : N/A
Report Number : EED32M00253901
FCC ID : WQ8MAXIBASBT609
Date of Issue: : Jan. 04, 2021
Test Standards : 47 CFR Part 15 Subpart C
Test result : PASS

Prepared for:

Autel Intelligent Tech. Corp., Ltd.
7th-8th, 10th Floor, Bldg. B1, Zhiyuan,
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Prepared by:

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Date:

Jan. 04, 2021

Check No.: 4762102967

2 Version

Version No.	Date	Description
00	Jan. 04, 2021	Original

3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15, Subpart C Section 15.203/15.247 (c)	ANSI C63.10-2013	PASS
AC Power Line Conducted Emission	47 CFR Part 15, Subpart C Section 15.207	ANSI C63.10-2013	PASS
Conducted Peak Output Power	47 CFR Part 15, Subpart C Section 15.247 (b)(1)	ANSI C63.10-2013	PASS
20dB Occupied Bandwidth	47 CFR Part 15, Subpart C Section 15.247 (a)(1)	ANSI C63.10-2013	PASS
Carrier Frequencies Separation	47 CFR Part 15, Subpart C Section 15.247 (a)(1)	ANSI C63.10-2013	PASS
Hopping Channel Number	47 CFR Part 15, Subpart C Section 15.247 (b)	ANSI C63.10-2013	PASS
Dwell Time	47 CFR Part 15, Subpart C Section 15.247 (a)(1)	ANSI C63.10-2013	PASS
Pseudorandom Frequency Hopping Sequence	47 CFR Part 15, Subpart C Section 15.247(b)(4)&TCB Exclusion List (7 July 2002)	ANSI C63.10-2013	PASS
RF Conducted Spurious Emissions	47 CFR Part 15, Subpart C Section 15.247(d)	ANSI C63.10-2013	PASS
Radiated Spurious emissions	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10-2013	PASS
Restricted bands around fundamental frequency (Radiated Emission)	47 CFR Part 15 Subpart C Section 15.205/15.209	ANSI C63.10-2013	PASS

Remark:

Test according to ANSI C63.4-2014 & ANSI C63.10-2013.

Company Name and Address shown on Report, the sample(s) and sample Information was/ were provided by the applicant who should be responsible for the authenticity which CTI hasn't verified.

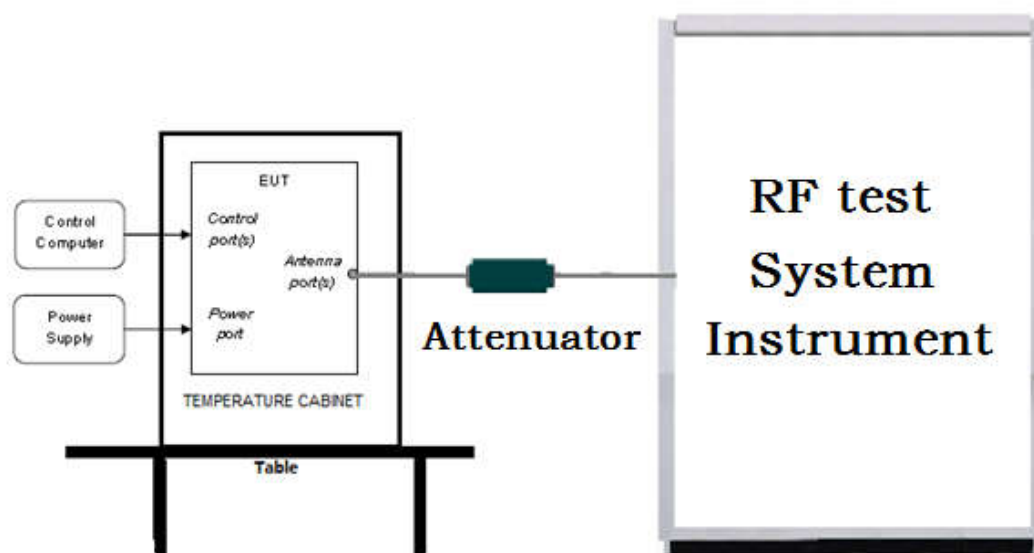
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5 Test Requirement

5.1 Test setup

5.1.1 For Conducted test setup



5.1.2 For Radiated Emissions test setup

Radiated Emissions setup:

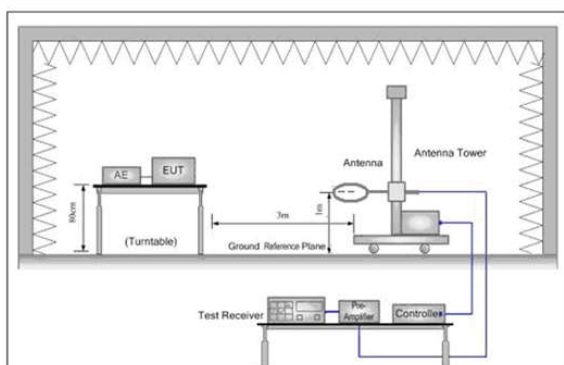


Figure 1. Below 30MHz

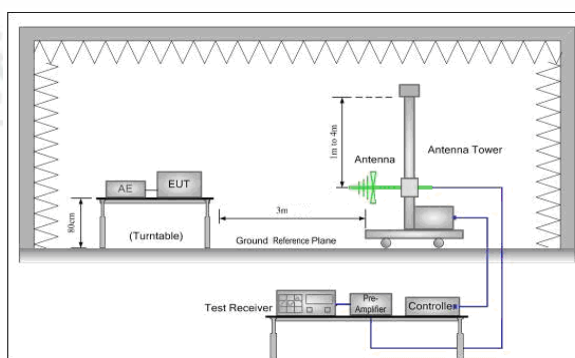


Figure 2. 30MHz to 1GHz

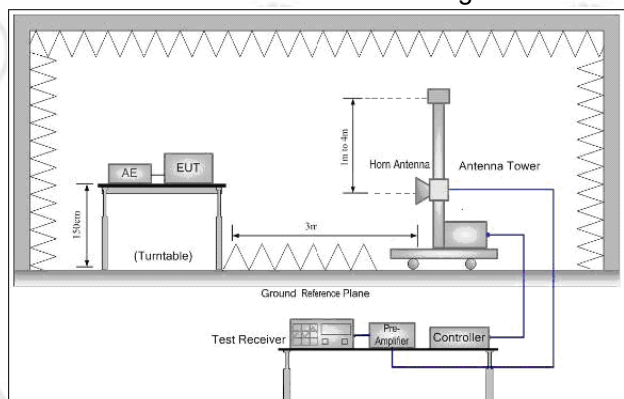
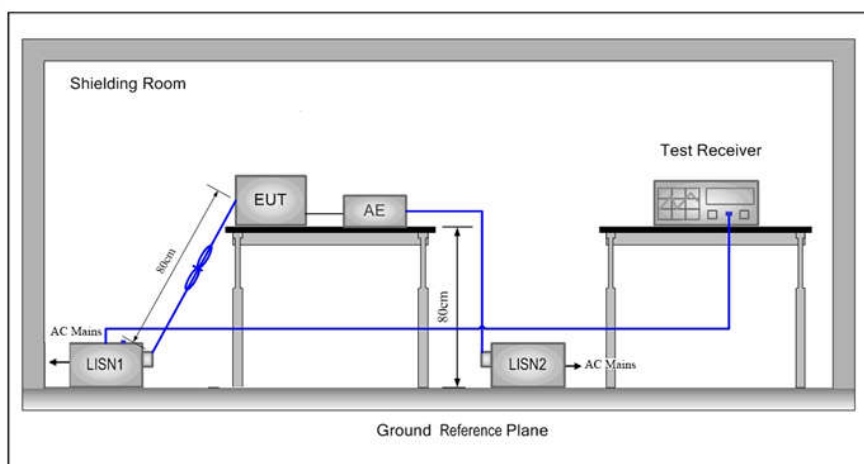


Figure 3. Above 1GHz

5.1.3 For Conducted Emissions test setup

Conducted Emissions setup



5.2 Test Environment

Operating Environment:	
Temperature:	24°C
Humidity:	54 % RH
Atmospheric Pressure:	1010mbar

5.3 Test Condition

Test Mode	Tx/Rx	RF Channel		
		Low(L)	Middle(M)	High(H)
GFSK/π/4DQPSK/ 8DPSK(DH1,DH3,DH5)	2402MHz ~2480 MHz	Channel 0	Channel 39	Channel78
		2402MHz	2441MHz	2480MHz

6 General Information

6.1 Client Information

Applicant:	Autel Intelligent Tech. Corp., Ltd.
Address of Applicant:	7th-8th, 10th Floor, Bldg. B1, Zhiyuan, Xueyuan Rd. Xili, Nanshan, Shenzhen, 518055, China
Manufacturer:	Autel Intelligent Tech. Corp., Ltd.
Address of Manufacturer:	7th-8th, 10th Floor, Bldg. B1, Zhiyuan, Xueyuan Rd. Xili, Nanshan, Shenzhen, 518055, China
Factory1:	Autel Intelligent Technology Corp., Ltd. Guangming Branch
Address of Factory1:	7F&6F, East Wing, Building 2, and 6F of Electronical Building, Yanxiang Industrial Zone, Gaoxin Rd, Dongzhou Community of Guangming New District, Shenzhen
Factory2:	AUTEL VIETNAM COMPANY LIMITED
Address of Factory2:	4th Floor, Factory#6, Land#CN1, An Duong Industrial Zone, Hong Phong Township, An Duong County, Hai Phong, VietNam

6.2 General Description of EUT

Product Name:	WIRELESS BATTERY DIAGNOSTICS SYSTEM	
Model No.(EUT):	MaxiBAS BT609	
Trade mark:	AUTEL	
Power Supply:	SWITCHING AC/DC Power Adapter	MODEL: GME10C-050200FUu INPUT: 100-240V~, 50/60Hz, 0.28A OUTPUT: 5V --- 2A
	Battery	Model: TB2021 Capacity: 5800mAh/22.33Wh Nominal Voltage: 3.85V
Operation Frequency:	2402MHz~2480MHz	
Bluetooth Version:	4.2	
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)	
Modulation Type:	GFSK, $\pi/4$ DQPSK, 8DPSK	
Number of Channel:	79	
Hopping Channel Type:	Adaptive Frequency Hopping systems	
Test Power Grade:	default	
Test Software of EUT:	Blue Tool	
Antenna Type:	FPC antenna	
Antenna Gain:	4.21dBi	
Test Voltage:	Battery 3.85V	
Sample Received Date:	Aug. 20, 2020	
Sample tested Date:	Aug. 20, 2020 to Nov. 6, 2020	

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
2	2404MHz	22	2424MHz	42	2444MHz	62	2464MHz
3	2405MHz	23	2425MHz	43	2445MHz	63	2465MHz
4	2406MHz	24	2426MHz	44	2446MHz	64	2466MHz
5	2407MHz	25	2427MHz	45	2447MHz	65	2467MHz
6	2408MHz	26	2428MHz	46	2448MHz	66	2468MHz
7	2409MHz	27	2429MHz	47	2449MHz	67	2469MHz
8	2410MHz	28	2430MHz	48	2450MHz	68	2470MHz
9	2411MHz	29	2431MHz	49	2451MHz	69	2471MHz
10	2412MHz	30	2432MHz	50	2452MHz	70	2472MHz
11	2413MHz	31	2433MHz	51	2453MHz	71	2473MHz
12	2414MHz	32	2434MHz	52	2454MHz	72	2474MHz
13	2415MHz	33	2435MHz	53	2455MHz	73	2475MHz
14	2416MHz	34	2436MHz	54	2456MHz	74	2476MHz
15	2417MHz	35	2437MHz	55	2457MHz	75	2477MHz
16	2418MHz	36	2438MHz	56	2458MHz	76	2478MHz
17	2419MHz	37	2439MHz	57	2459MHz	77	2479MHz
18	2420MHz	38	2440MHz	58	2460MHz	78	2480MHz
19	2421MHz	39	2441MHz	59	2461MHz		

6.3 Description of Support Units

The EUT has been tested with associated equipment below

Associated equipment name		Manufacture	model	S/N serial number	Supplied by	Certification
AE	Notebook	DELL	DELL 3490	D245DX2	DELL	CE&FCC

6.4 Test Location

All tests were performed at:

Centre Testing International Group Co., Ltd.

Building C, Hongwei Industrial Park Block 70, Bao'an District, Shenzhen, China

Telephone: +86 (0) 755 33683668 Fax: +86 (0) 755 33683385

No tests were sub-contracted.

FCC Designation No.: CN1164

6.5 Deviation from Standards

None.

6.6 Abnormalities from Standard Conditions

None.

6.7 Other Information Requested by the Customer

None.

6.8 Measurement Uncertainty(95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.9×10^{-8}
2	RF power, conducted	0.46dB (30MHz-1GHz)
		0.55dB (1GHz-18GHz)
3	Radiated Spurious emission test	4.3dB (30MHz-1GHz)
		4.5dB (1GHz-12.75GHz)
4	Conduction emission	3.5dB (9kHz to 150kHz)
		3.1dB (150kHz to 30MHz)
5	Temperature test	0.64°C
6	Humidity test	3.8%
7	DC power voltages	0.026%

7 Equipment List

RF test system					
Equipment	Manufacturer	Mode No.	Serial Number	Cal. Date (mm-dd-yyyy)	Cal. Due date (mm-dd-yyyy)
Spectrum Analyzer	Keysight	N9010A	MY54510339	02-17-2020	02-16-2021
Signal Generator	Keysight	N5182B	MY53051549	02-17-2020	02-16-2021
Temperature/ Humidity Indicator	biaozhi	HM10	1804186	06-29-2020	06-28-2021
High-pass filter	Sinoscite	FL3CX03WG18NM 12-0398-002	---	---	---
High-pass filter	MICRO- TRONICS	SPA-F-63029-4	---	---	---
DC Power	Keysight	E3642A	MY56376072	02-17-2020	02-16-2021
PC-1	Lenovo	R4960d	---	---	---
BT&WI-FI Automatic control	R&S	OSP120	101374	02-17-2020	02-16-2021
RF control unit	JS Tonscend	JS0806-2	158060006	02-17-2020	02-16-2021
BT&WI-FI Automatic test software	JS Tonscend	JS1120-3	---	---	---

Conducted disturbance Test					
Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm-dd-yyyy)	Cal. Due date (mm-dd-yyyy)
Receiver	R&S	ESCI	100435	04-28-2020	04-27-2021
Temperature/ Humidity Indicator	Defu	TH128	/	---	---
LISN	R&S	ENV216	100098	03-05-2020	03-04-2021
Barometer	changchun	DYM3	1188	---	---

3M full-anechoic Chamber					
Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm-dd-yyyy)	Cal. Due date (mm-dd-yyyy)
RSE Automatic test software	JS Tonscend	JS36-RSE	10166	---	---
Receiver	Keysight	N9038A	MY57290136	03-05-2020	03-04-2021
Spectrum Analyzer	Keysight	N9020B	MY57111112	03-05-2020	03-04-2021
Spectrum Analyzer	Keysight	N9030B	MY57140871	03-05-2020	03-04-2021
TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	9163-1148	04-25-2018	04-24-2021
Horn Antenna	Schwarzbeck	BBHA 9170	9170-832	04-25-2018	04-24-2021
Horn Antenna	ETS-LINDGREN	3117	00057407	07-10-2018	07-09-2021
Preamplifier	EMCI	EMC184055SE	980596	05-20-2020	05-19-2021
Preamplifier	EMCI	EMC001330	980563	04-22-2020	04-21-2021
Preamplifier	JS Tonscend	980380	EMC051845SE	01-09-2020	01-08-2021
Temperature/Humidity Indicator	biaozhi	GM1360	EE1186631	04-27-2020	04-26-2021
Fully Anechoic Chamber	TDK	FAC-3	---	01-17-2018	01-16-2021
Filter bank	JS Tonscend	JS0806-F	188060094	04-10-2018	04-09-2021
Cable line	Times	SFT205-NMSM-2.50M	394812-0001	---	---
Cable line	Times	SFT205-NMSM-2.50M	394812-0002	---	---
Cable line	Times	SFT205-NMSM-2.50M	394812-0003	---	---
Cable line	Times	SFT205-NMSM-2.50M	393495-0001	---	---
Cable line	Times	EMC104-NMNM-1000	SN160710	---	---
Cable line	Times	SFT205-NMSM-3.00M	394813-0001	---	---
Cable line	Times	SFT205-NMNM-1.50M	381964-0001	---	---
Cable line	Times	SFT205-NMSM-7.00M	394815-0001	---	---
Cable line	Times	HF160-KMKM-3.00M	393493-0001	---	---

3M Semi/full-anechoic Chamber					
Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm-dd-yyyy)	Cal. Due date (mm-dd-yyyy)
3M Chamber & Accessory Equipment	TDK	SAC-3	---	05-24-2019	05-23-2022
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-618	05-16-2020	05-15-2021
Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-076	04-25-2018	04-24-2021
Receiver	R&S	ESCI7	100938-003	10-21-2019	10-20-2020
Multi device Controller	maturo	NCD/070/10711 112	---	---	---
Temperature/ Humidity Indicator	Shanghai qixiang	HM10	1804298	06-29-2020	06-28-2021
Cable line	Fulai(7M)	SF106	5219/6A	---	---
Cable line	Fulai(6M)	SF106	5220/6A	---	---
Cable line	Fulai(3M)	SF106	5216/6A	---	---
Cable line	Fulai(3M)	SF106	5217/6A	---	---

8 Radio Technical Requirements Specification

Reference documents for testing:

No.	Identity	Document Title
1	FCC Part15C	Subpart C-Intentional Radiators
2	ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

Test Results List:

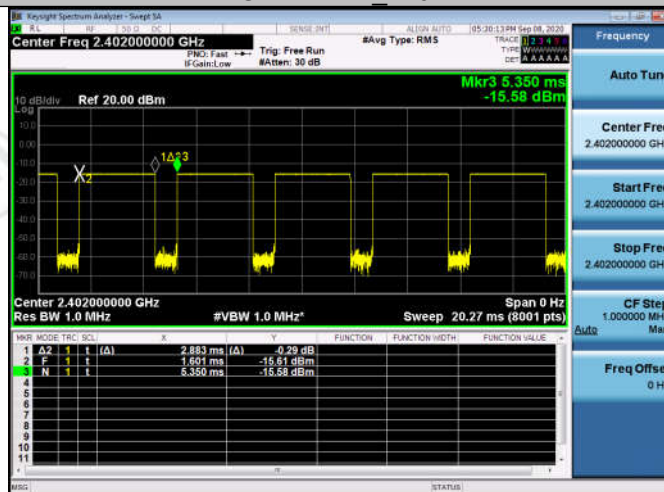
Test requirement	Test method	Test item	Verdict	Note
Part15C Section 15.247 (a)(1)	ANSI 63.10	20dB Occupied Bandwidth	PASS	Appendix A)
Part15C Section 15.247 (a)(1)	ANSI 63.10	Carrier Frequencies Separation	PASS	Appendix B)
Part15C Section 15.247 (a)(1)	ANSI 63.10	Dwell Time	PASS	Appendix C)
Part15C Section 15.247(d)	ANSI 63.10	Band-edge for RF Conducted Emissions	PASS	Appendix D)
Part15C Section 15.247(d)	ANSI 63.10	RF Conducted Spurious Emissions	PASS	Appendix E)
Part15C Section 15.247 (a)(1)	ANSI 63.10	Pseudorandom Frequency Hopping Sequence	PASS	Appendix F)
Part15C Section 15.203/15.247 (c)	ANSI 63.10	Antenna Requirement	PASS	Appendix G)
Part15C Section 15.207	ANSI 63.10	AC Power Line Conducted Emission	PASS	Appendix H)
Part15C Section 15.205/15.209	ANSI 63.10	Restricted bands around fundamental frequency (Radiated) Emission)	PASS	Appendix I)
Part15C Section 15.205/15.209	ANSI 63.10	Radiated Spurious Emissions	PASS	Appendix J)

**Duty Cycle
Result Table**

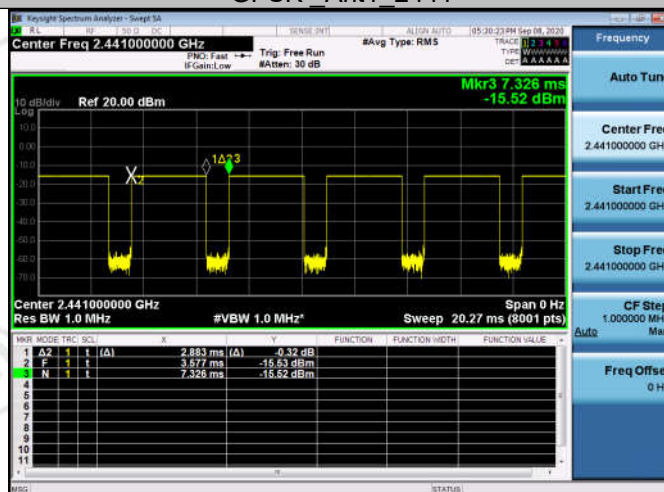
Test Mode	Antenna	Channel	Duty Cycle [%]	Limit	Verdict
GFSK	Ant1	LCH	76.89	---	PASS
	Ant1	MCH	76.89	---	PASS
	Ant1	HCH	76.82	---	PASS
$\pi/4$ DQPSK	Ant1	LCH	76.91	---	PASS
	Ant1	MCH	76.91	---	PASS
	Ant1	HCH	76.96	---	PASS
8DPSK	Ant1	LCH	76.96	---	PASS
	Ant1	MCH	76.96	---	PASS
	Ant1	HCH	76.96	---	PASS

Test Graph

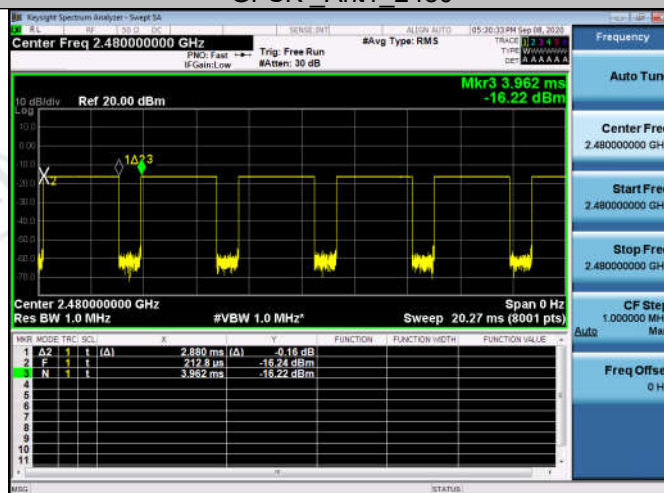
GFSK Ant1_2402



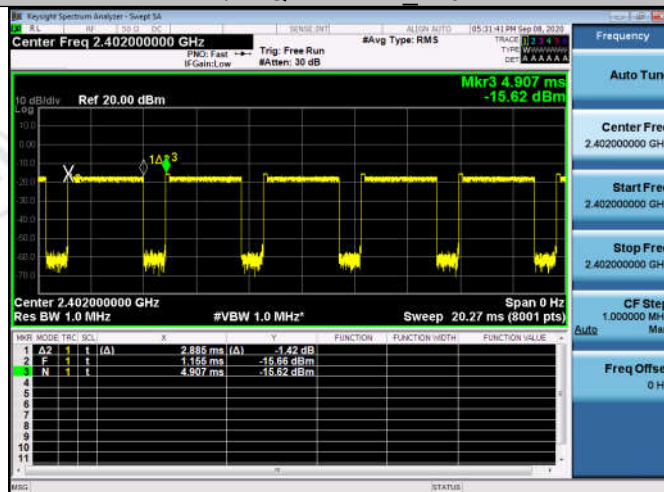
GFSK Ant1_2441



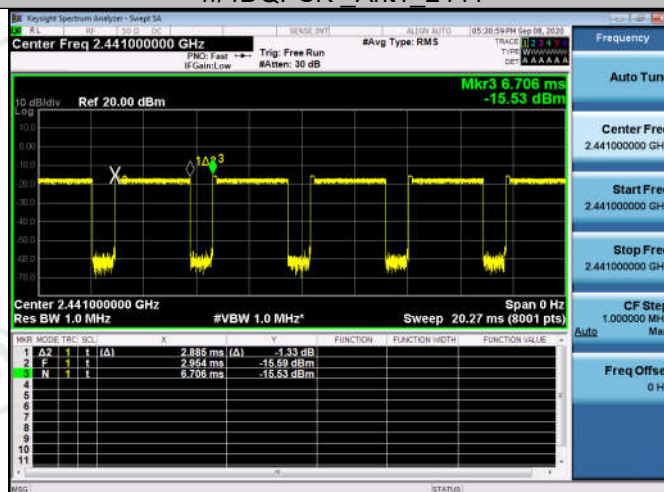
GFSK Ant1_2480



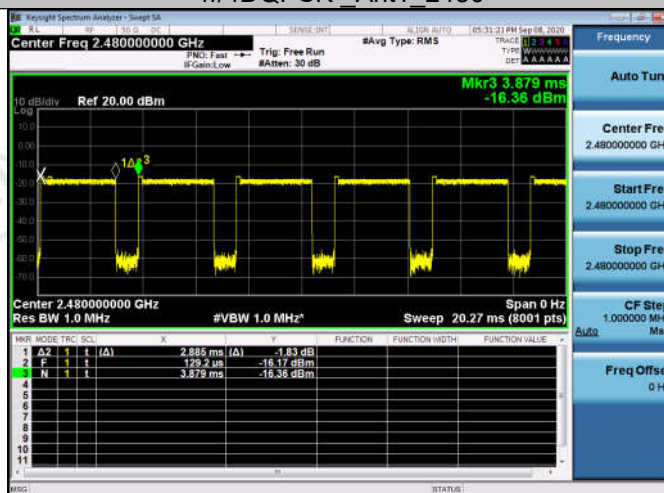
$\pi/4$ DQPSK Ant1_2402



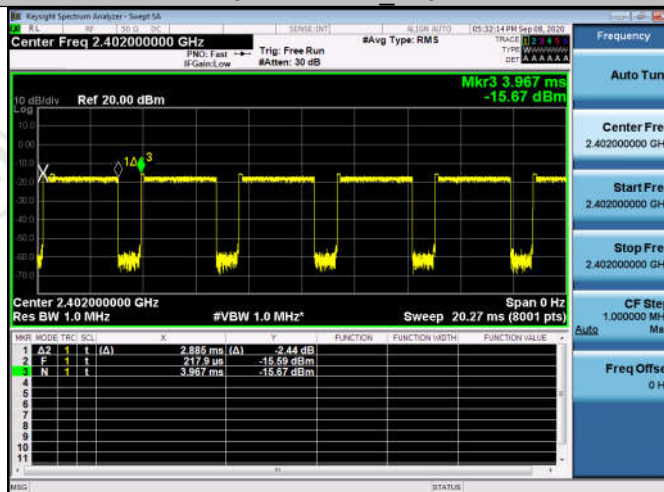
$\pi/4$ DQPSK Ant1_2441



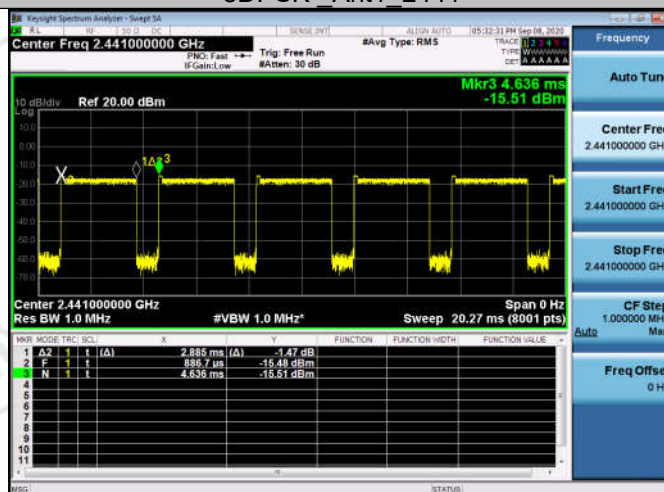
$\pi/4$ DQPSK Ant1_2480



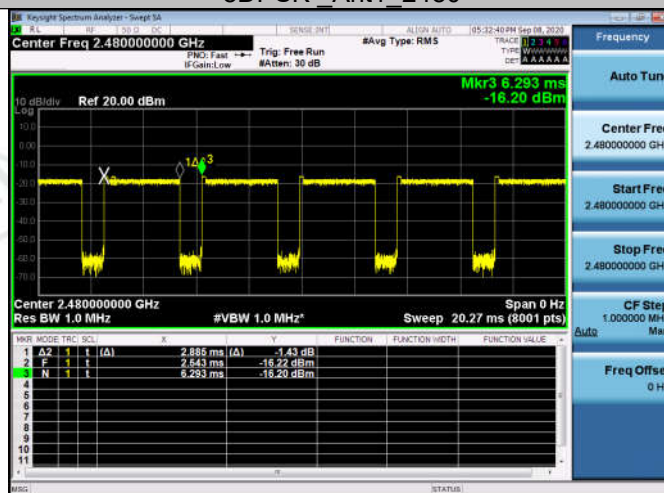
8DPSK Ant1_2402



8DPSK_Ant1_2441



8DPSK_Ant1_2480



Appendix A): 20dB Occupied Bandwidth

Test Limit

According to §15.247(a) (1),

20 dB Bandwidth : For reporting purposes only.

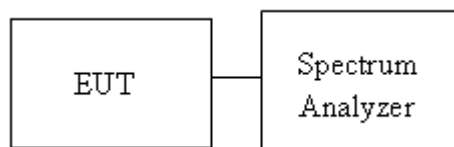
Occupied Bandwidth(99%) : For reporting purposes only.

Test Procedure

Test method Refer as Section 8.1 and ANSI C63.10: 2013 clause 7.8.7,

1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT
3. SA set RBW =30kHz, VBW = 100kHz and Detector = Peak, to measurement 20dB Bandwidth.
4. SA set RBW = 1% ~ 5% OBW, VBW = three times the RBW and Detector = Peak, to measurement 99% Bandwidth.
5. Measure and record the result of 20 dB Bandwidth and 99% Bandwidth. in the test report.

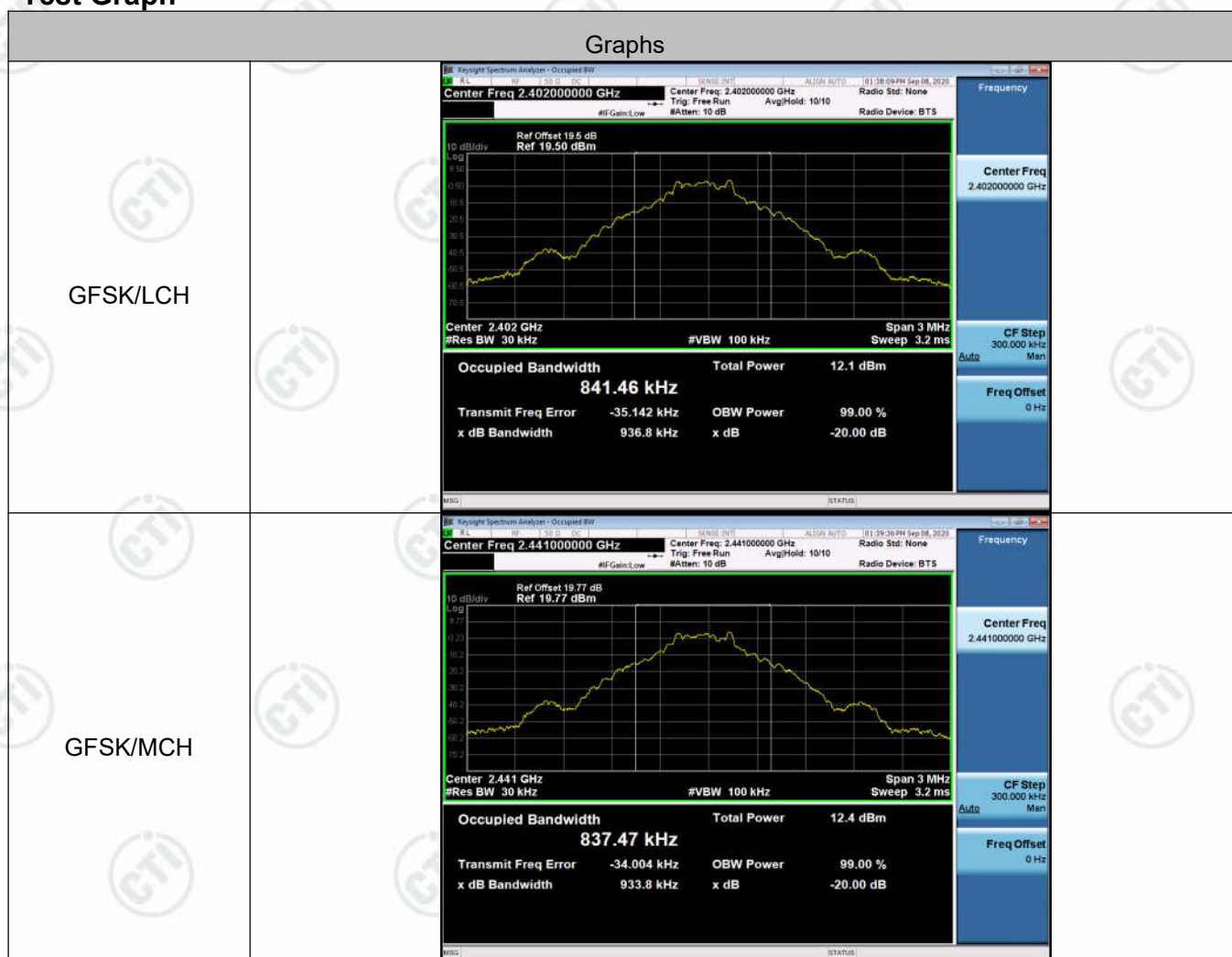
Test Setup

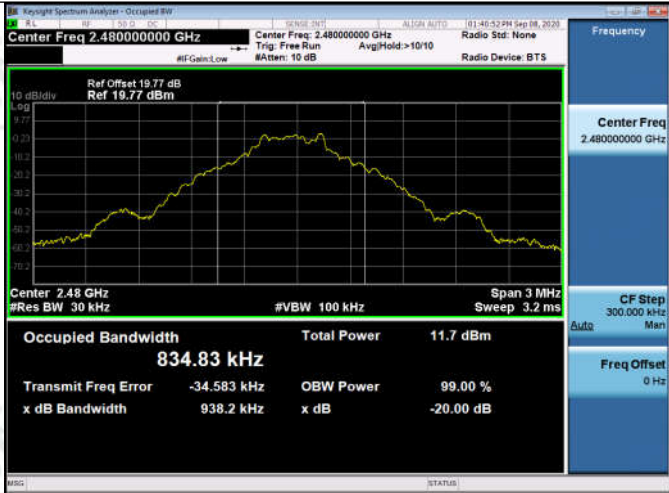
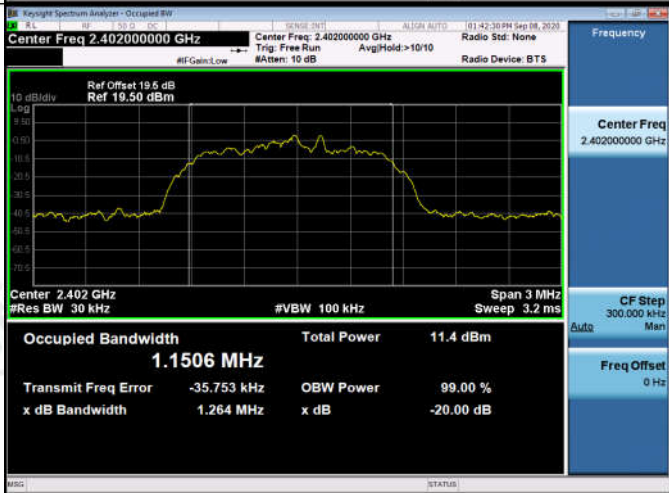
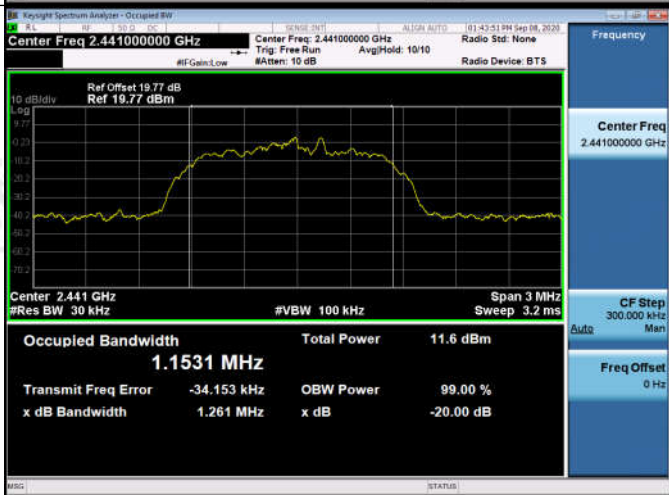


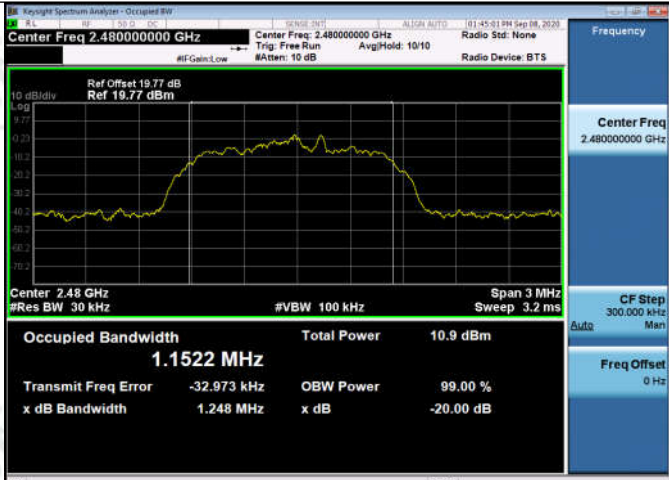
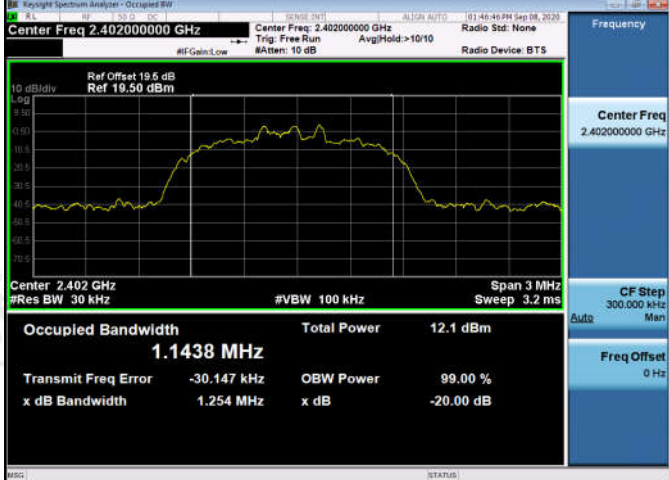
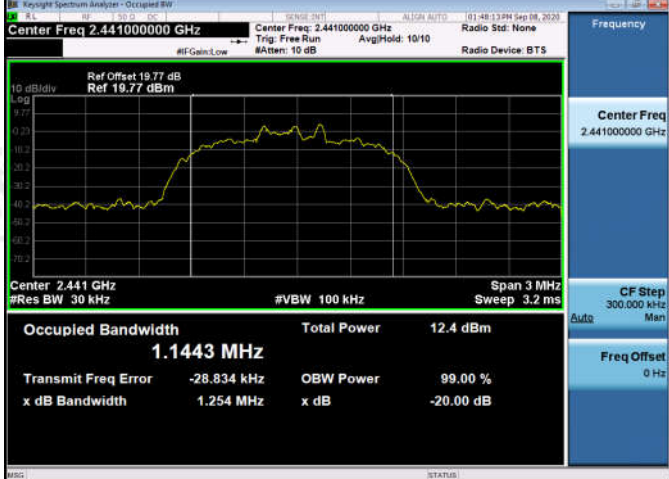
Test Result

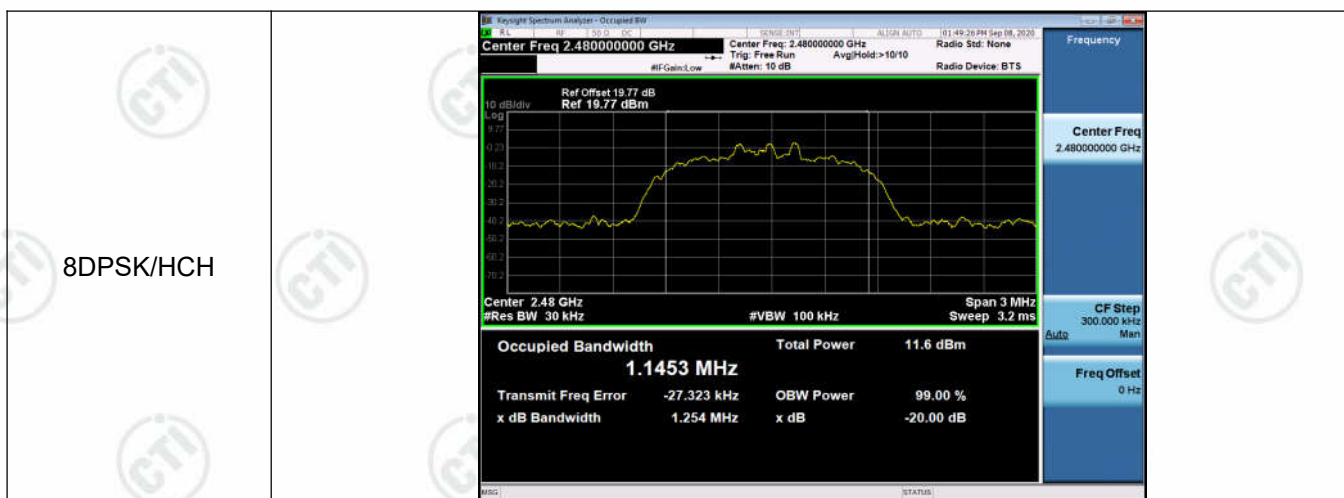
Mode	Channel.	20dB Bandwidth [MHz]	99% OBW [MHz]	Verdict
GFSK	LCH	0.9368	0.84146	PASS
GFSK	MCH	0.9338	0.83747	PASS
GFSK	HCH	0.9382	0.83483	PASS
$\pi/4$ DQPSK	LCH	1.264	1.1506	PASS
$\pi/4$ DQPSK	MCH	1.261	1.1531	PASS
$\pi/4$ DQPSK	HCH	1.248	1.1522	PASS
8DPSK	LCH	1.254	1.1438	PASS
8DPSK	MCH	1.254	1.1443	PASS
8DPSK	HCH	1.254	1.1453	PASS

Test Graph



GFSK/HCH	
π/4DQPSK/LCH	
π/4DQPSK/MCH	

$\pi/4$DQPSK/HCH	
8DPSK/LCH	
8DPSK/MCH	



Appendix B): Carrier Frequency Separation

Test Limit

According to §15.247(a)(1),

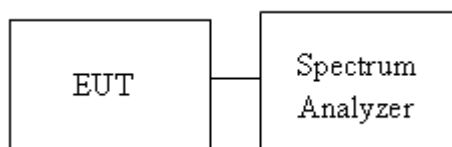
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Limit	> two-thirds of the 20 dB bandwidth
-------	-------------------------------------

Test Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. EUT RF output port connected to the SA by RF cable.
3. Set the spectrum analyzer as RBW = 100kHz, VBW = 300kHz, Sweep = auto.
Max hold, mark 3 peaks of hopping channel and record the 3 peaks frequency

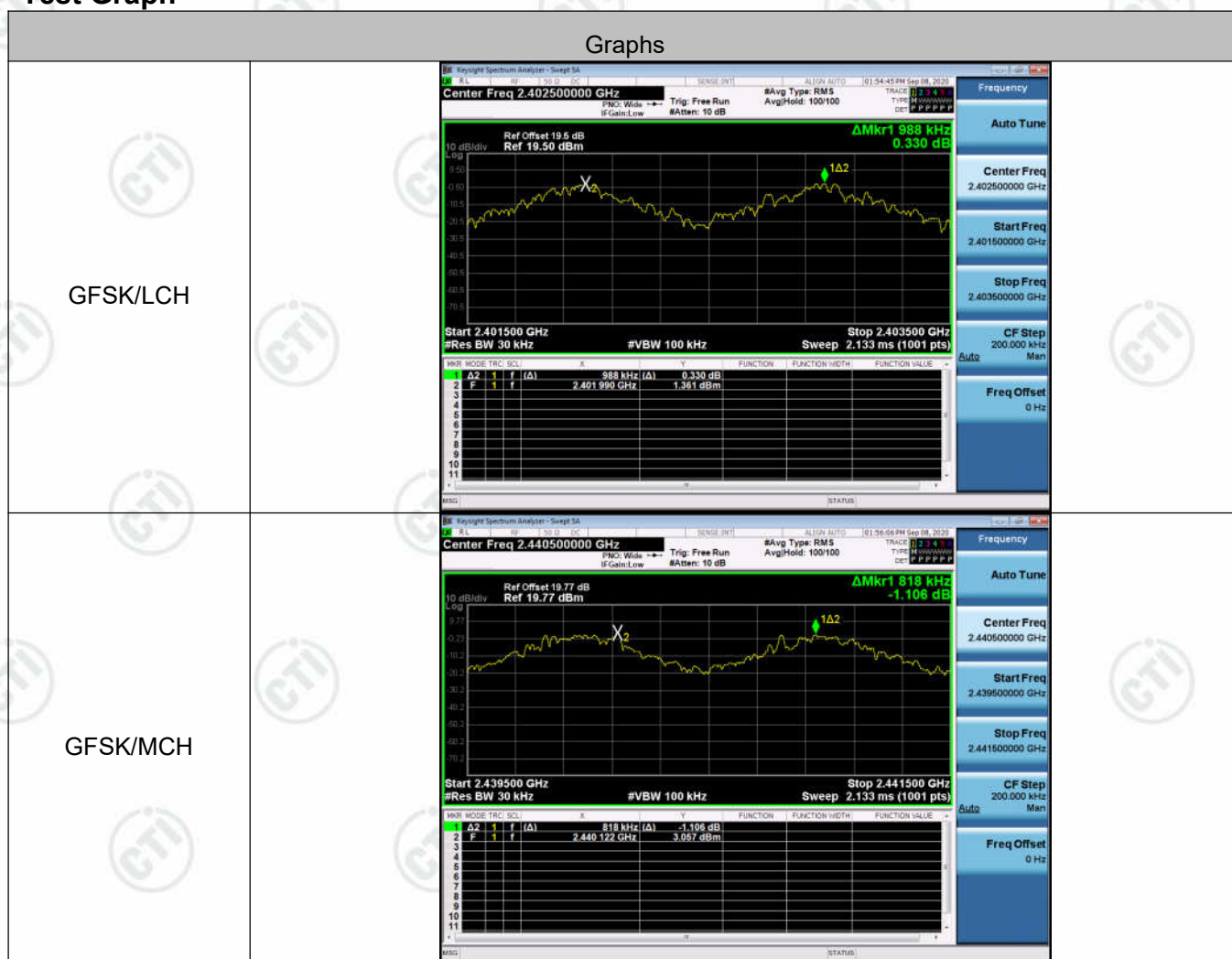
Test Setup



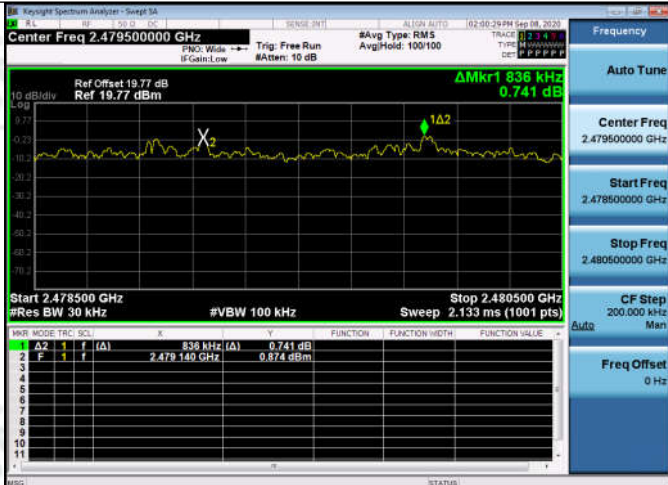
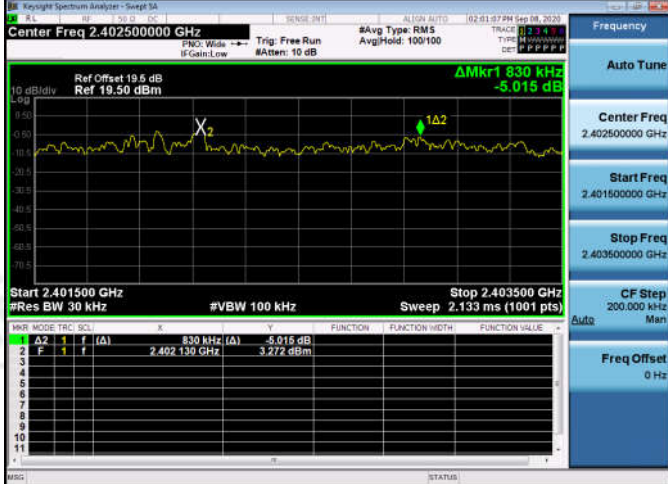
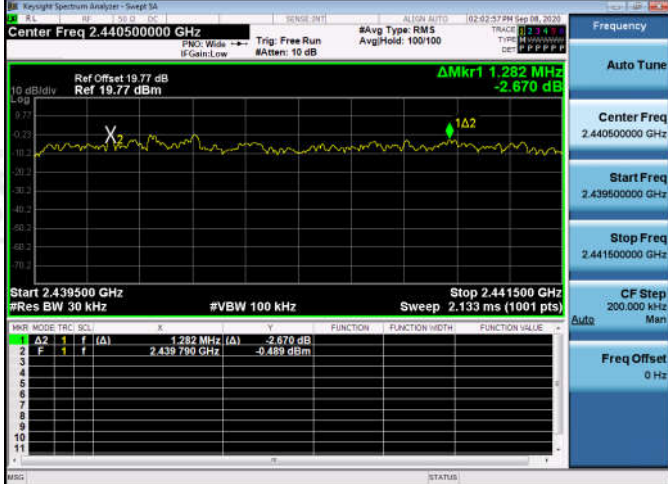
Result Table

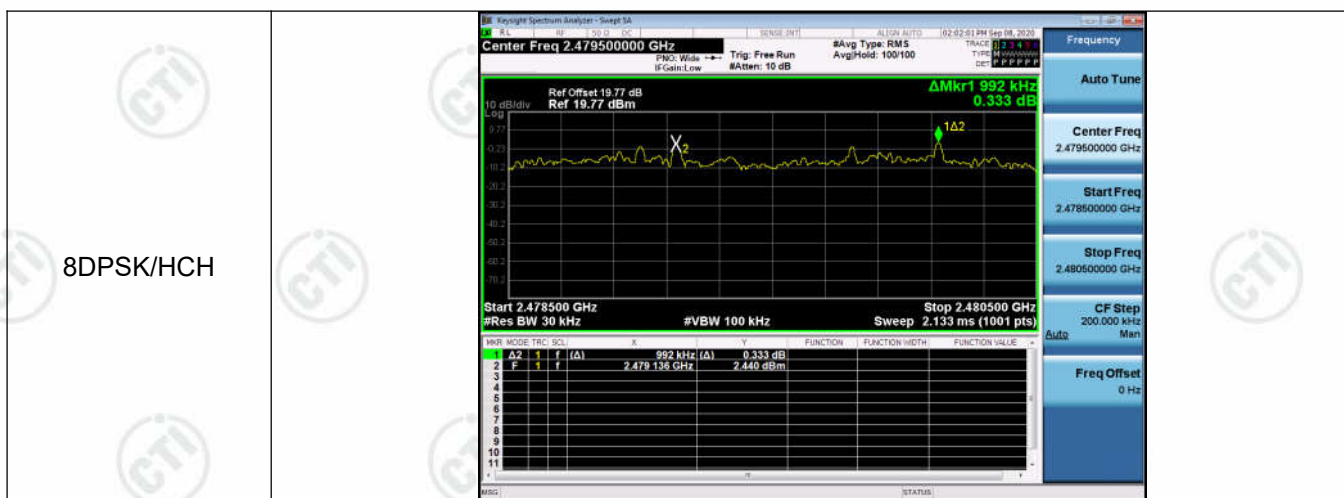
Mode	Channel.	Carrier Frequency Separation [MHz]	Verdict
GFSK	LCH	0.988	PASS
GFSK	MCH	0.818	PASS
GFSK	HCH	1.026	PASS
$\pi/4$ DQPSK	LCH	1.018	PASS
$\pi/4$ DQPSK	MCH	1.094	PASS
$\pi/4$ DQPSK	HCH	0.836	PASS
8DPSK	LCH	0.830	PASS
8DPSK	MCH	1.282	PASS
8DPSK	HCH	0.992	PASS

Test Graph



GFSK/HCH	Keynote Spectrum Analyzer - Sweep SA Center Freq 2.479500000 GHz Ref Offset 19.77 dB Ref 19.77 dBm Delta Mk1 1.026 MHz 0.774 dB Start 2.478500 GHz #Res BW 30 kHz #VBW 100 kHz Sweep 2.133 ms (1001 pts) <table><tr><th>NR</th><th>MODE</th><th>TRC</th><th>SCN</th><th>F</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>A2</td><td>1</td><td>f</td><td>(A)</td><td>1.026 MHz (A)</td><td>0.774 dB</td><td></td></tr><tr><td>2</td><td>F</td><td>1</td><td>f</td><td>(A)</td><td>2.478 974 GHz</td><td>0.142 dBm</td><td></td></tr></table>	NR	MODE	TRC	SCN	F	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	A2	1	f	(A)	1.026 MHz (A)	0.774 dB		2	F	1	f	(A)	2.478 974 GHz	0.142 dBm	
NR	MODE	TRC	SCN	F	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																		
1	A2	1	f	(A)	1.026 MHz (A)	0.774 dB																			
2	F	1	f	(A)	2.478 974 GHz	0.142 dBm																			
π /4DQPSK/LCH	Keynote Spectrum Analyzer - Sweep SA Center Freq 2.402500000 GHz Ref Offset 19.5 dB Ref 19.50 dBm Delta Mk1 1.018 MHz -5.591 dB Start 2.401500 GHz #Res BW 30 kHz #VBW 100 kHz Sweep 2.133 ms (1001 pts) <table><tr><th>NR</th><th>MODE</th><th>TRC</th><th>SCN</th><th>F</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>A2</td><td>1</td><td>f</td><td>(A)</td><td>1.018 MHz (A)</td><td>-5.591 dB</td><td></td></tr><tr><td>2</td><td>F</td><td>1</td><td>f</td><td>(A)</td><td>2.402 130 GHz</td><td>2.106 dBm</td><td></td></tr></table>	NR	MODE	TRC	SCN	F	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	A2	1	f	(A)	1.018 MHz (A)	-5.591 dB		2	F	1	f	(A)	2.402 130 GHz	2.106 dBm	
NR	MODE	TRC	SCN	F	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																		
1	A2	1	f	(A)	1.018 MHz (A)	-5.591 dB																			
2	F	1	f	(A)	2.402 130 GHz	2.106 dBm																			
π /4DQPSK/MCH	Keynote Spectrum Analyzer - Sweep SA Center Freq 2.440500000 GHz Ref Offset 19.77 dB Ref 19.77 dBm Delta Mk1 1.094 MHz -0.317 dB Start 2.439500 GHz #Res BW 30 kHz #VBW 100 kHz Sweep 2.133 ms (1001 pts) <table><tr><th>NR</th><th>MODE</th><th>TRC</th><th>SCN</th><th>F</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>A2</td><td>1</td><td>f</td><td>(A)</td><td>1.094 MHz (A)</td><td>-0.317 dB</td><td></td></tr><tr><td>2</td><td>F</td><td>1</td><td>f</td><td>(A)</td><td>2.439 860 GHz</td><td>-0.882 dBm</td><td></td></tr></table>	NR	MODE	TRC	SCN	F	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	A2	1	f	(A)	1.094 MHz (A)	-0.317 dB		2	F	1	f	(A)	2.439 860 GHz	-0.882 dBm	
NR	MODE	TRC	SCN	F	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																		
1	A2	1	f	(A)	1.094 MHz (A)	-0.317 dB																			
2	F	1	f	(A)	2.439 860 GHz	-0.882 dBm																			

$\pi/4$DQPSK/HCH	
8DPSK/LCH	
8DPSK/MCH	



Appendix C): Dwell Time

Test Limit

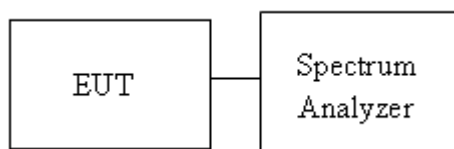
According to §15.247(a)(1)(iii)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Test Procedure

1. EUT RF output port connected to the SA by RF cable.
2. Set center frequency of spectrum analyzer = operating frequency.
3. Set the spectrum analyzer as RBW, VBW=1MHz, Sweep = 1 ms

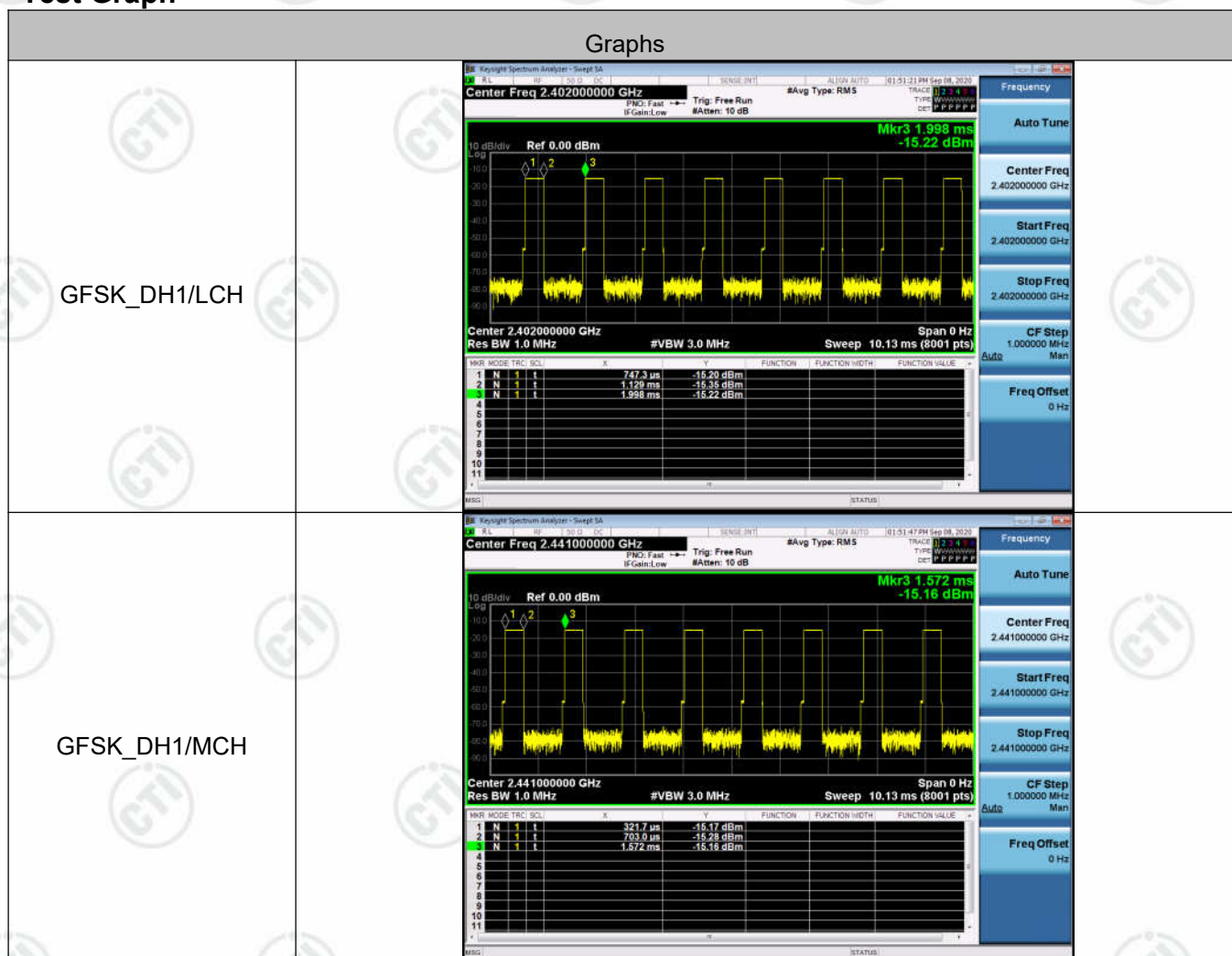
Test Setup

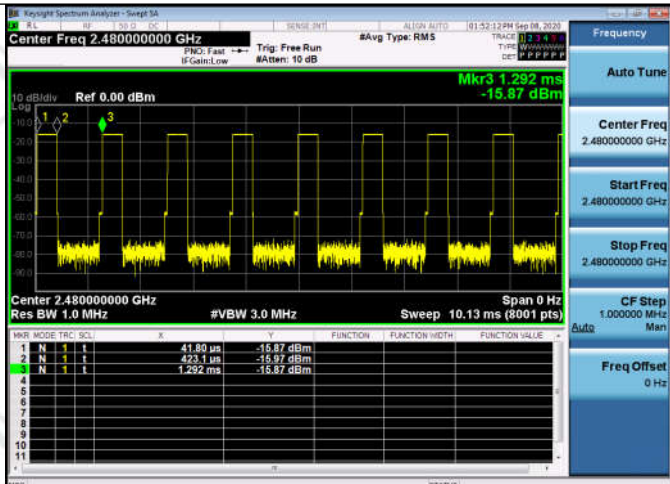
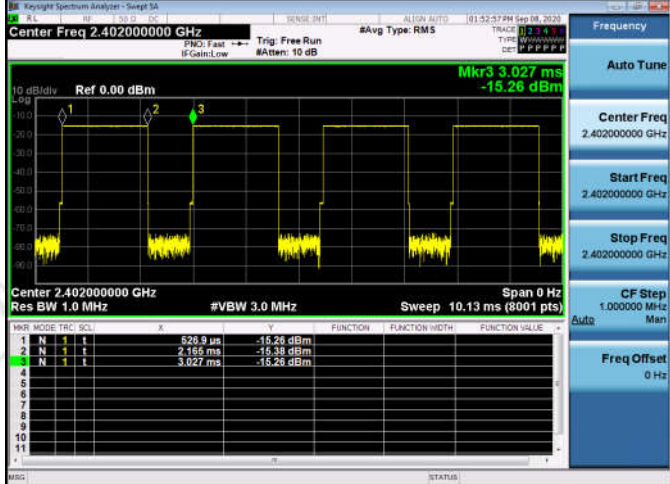
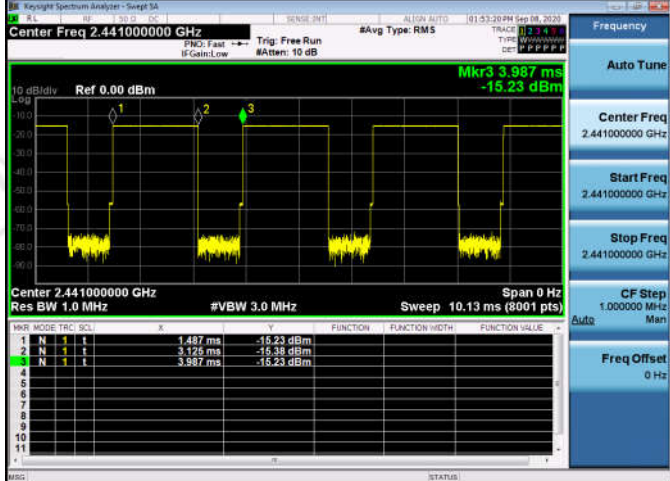


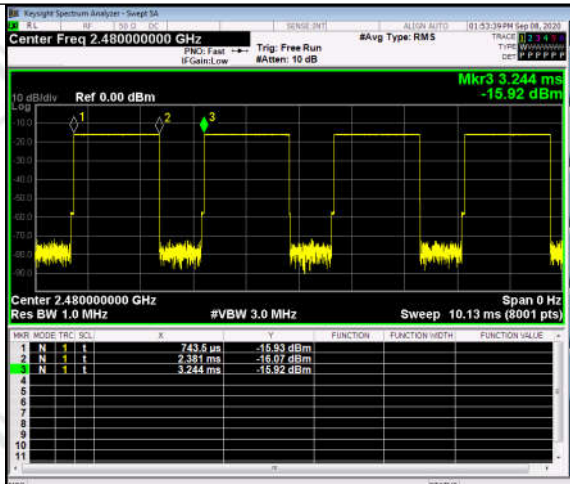
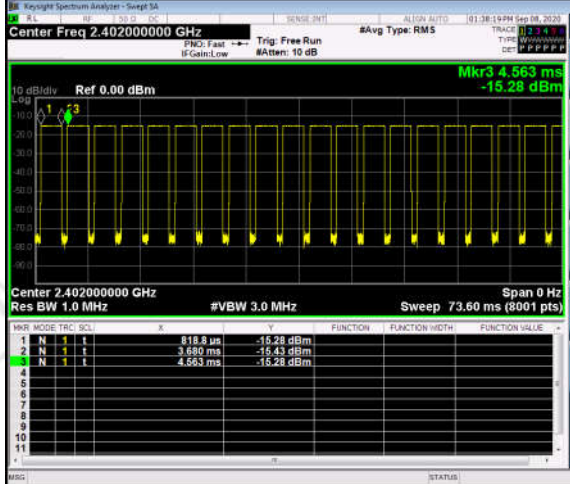
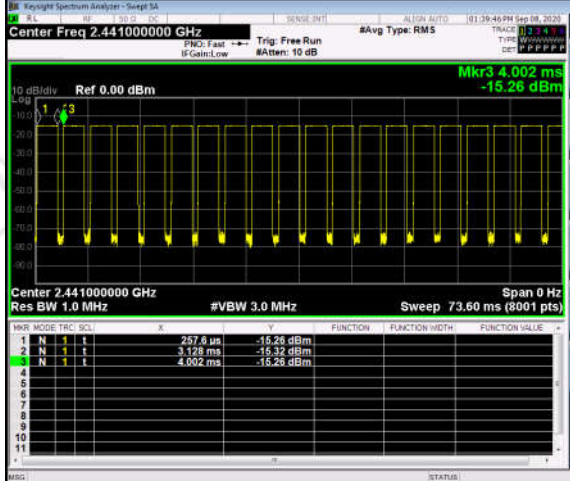
Result Table

Mode	Packet	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Duty Cycle [%]	Verdict
GFSK	DH1	LCH	0.381267	320	0.122	0.30	PASS
GFSK	DH1	MCH	0.381267	320	0.122	0.30	PASS
GFSK	DH1	HCH	0.381267	320	0.122	0.30	PASS
GFSK	DH3	LCH	1.637797	160	0.262	0.66	PASS
GFSK	DH3	MCH	1.6378	160	0.262	0.66	PASS
GFSK	DH3	HCH	1.637797	160	0.262	0.66	PASS
GFSK	DH5	LCH	2.8612	106.7	0.305	0.76	PASS
GFSK	DH5	MCH	2.8704	106.7	0.306	0.77	PASS
GFSK	DH5	HCH	2.8704	106.7	0.306	0.77	PASS

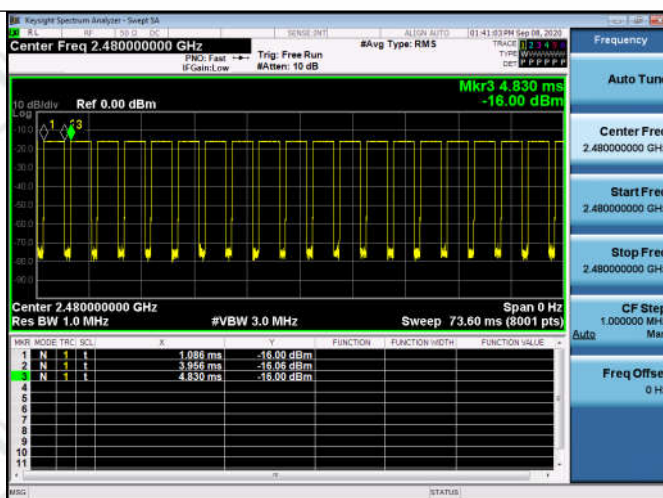
Test Graph



GFSK_DH1/HCH	 <table><tr><th>MNR</th><th>MODE</th><th>TRC</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>N</td><td>1</td><td>1</td><td>41.80 μs</td><td>-15.87 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>1</td><td>423.1 μs</td><td>-15.97 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>1</td><td>1.292 ms</td><td>-15.87 dBm</td><td></td><td></td><td></td></tr></table>	MNR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	1	41.80 μ s	-15.87 dBm				2	N	1	1	423.1 μ s	-15.97 dBm				3	N	1	1	1.292 ms	-15.87 dBm			
MNR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																													
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GFSK_DH3/LCH	 <table><tr><th>MNR</th><th>MODE</th><th>TRC</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>N</td><td>1</td><td>1</td><td>529.9 μs</td><td>-15.26 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>1</td><td>2.166 ms</td><td>-15.38 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>1</td><td>3.027 ms</td><td>-15.25 dBm</td><td></td><td></td><td></td></tr></table>	MNR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	1	529.9 μ s	-15.26 dBm				2	N	1	1	2.166 ms	-15.38 dBm				3	N	1	1	3.027 ms	-15.25 dBm			
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GFSK_DH3/MCH	 <table><tr><th>MNR</th><th>MODE</th><th>TRC</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>N</td><td>1</td><td>1</td><td>1.487 ms</td><td>-15.23 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>1</td><td>3.126 ms</td><td>-15.38 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>1</td><td>3.987 ms</td><td>-15.23 dBm</td><td></td><td></td><td></td></tr></table>	MNR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	1	1.487 ms	-15.23 dBm				2	N	1	1	3.126 ms	-15.38 dBm				3	N	1	1	3.987 ms	-15.23 dBm			
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GFSK_DH3/HCH	 <table><tr><th>MNR</th><th>MODE</th><th>TRC</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>N</td><td>1</td><td>1</td><td>743.6 μs</td><td>-15.93 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>1</td><td>2.381 ms</td><td>-16.07 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>1</td><td>3.244 ms</td><td>-15.92 dBm</td><td></td><td></td><td></td></tr></table>	MNR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	1	743.6 μ s	-15.93 dBm				2	N	1	1	2.381 ms	-16.07 dBm				3	N	1	1	3.244 ms	-15.92 dBm				Frequency Auto Tune Center Freq 2.480000000 GHz Start Freq 2.480000000 GHz Stop Freq 2.480000000 GHz CF Step 1.000000 MHz Freq Offset 0 Hz
MNR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																														
1	N	1	1	743.6 μ s	-15.93 dBm																																	
2	N	1	1	2.381 ms	-16.07 dBm																																	
3	N	1	1	3.244 ms	-15.92 dBm																																	
GFSK_DH5/LCH	 <table><tr><th>MNR</th><th>MODE</th><th>TRC</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>N</td><td>1</td><td>1</td><td>618.8 μs</td><td>-15.28 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>1</td><td>3.680 ms</td><td>-16.43 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>1</td><td>4.563 ms</td><td>-15.28 dBm</td><td></td><td></td><td></td></tr></table>	MNR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	1	618.8 μ s	-15.28 dBm				2	N	1	1	3.680 ms	-16.43 dBm				3	N	1	1	4.563 ms	-15.28 dBm				Frequency Auto Tune Center Freq 2.402000000 GHz Start Freq 2.402000000 GHz Stop Freq 2.402000000 GHz CF Step 1.000000 MHz Freq Offset 0 Hz
MNR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																														
1	N	1	1	618.8 μ s	-15.28 dBm																																	
2	N	1	1	3.680 ms	-16.43 dBm																																	
3	N	1	1	4.563 ms	-15.28 dBm																																	
GFSK_DH5/MCH	 <table><tr><th>MNR</th><th>MODE</th><th>TRC</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>N</td><td>1</td><td>1</td><td>257.6 μs</td><td>-16.26 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>1</td><td>3.128 ms</td><td>-16.32 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>1</td><td>4.002 ms</td><td>-15.26 dBm</td><td></td><td></td><td></td></tr></table>	MNR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	1	257.6 μ s	-16.26 dBm				2	N	1	1	3.128 ms	-16.32 dBm				3	N	1	1	4.002 ms	-15.26 dBm				Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz CF Step 1.000000 MHz Freq Offset 0 Hz
MNR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																														
1	N	1	1	257.6 μ s	-16.26 dBm																																	
2	N	1	1	3.128 ms	-16.32 dBm																																	
3	N	1	1	4.002 ms	-15.26 dBm																																	

GFSK_DH5/HCH



Appendix D): Hopping Channel Number Test Limit

According to §15.247(a)(1)(iii)

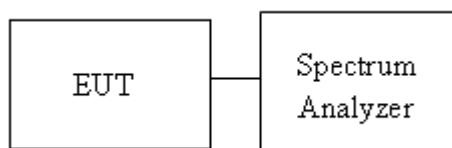
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

Test Procedure

Test method Refer as ANSI C63.10: 2013 clause 7.8.3

1. Place the EUT on the table and set it in transmitting mode.
2. EUT RF output port connected to the SA by RF cable.
3. Set spectrum analyzer Start Freq. = 2400 MHz, Stop Freq. = 2483.5 MHz,
RBW = 100KHz, VBW = 300KHz.
4. Max hold, view and count how many channel in the band.

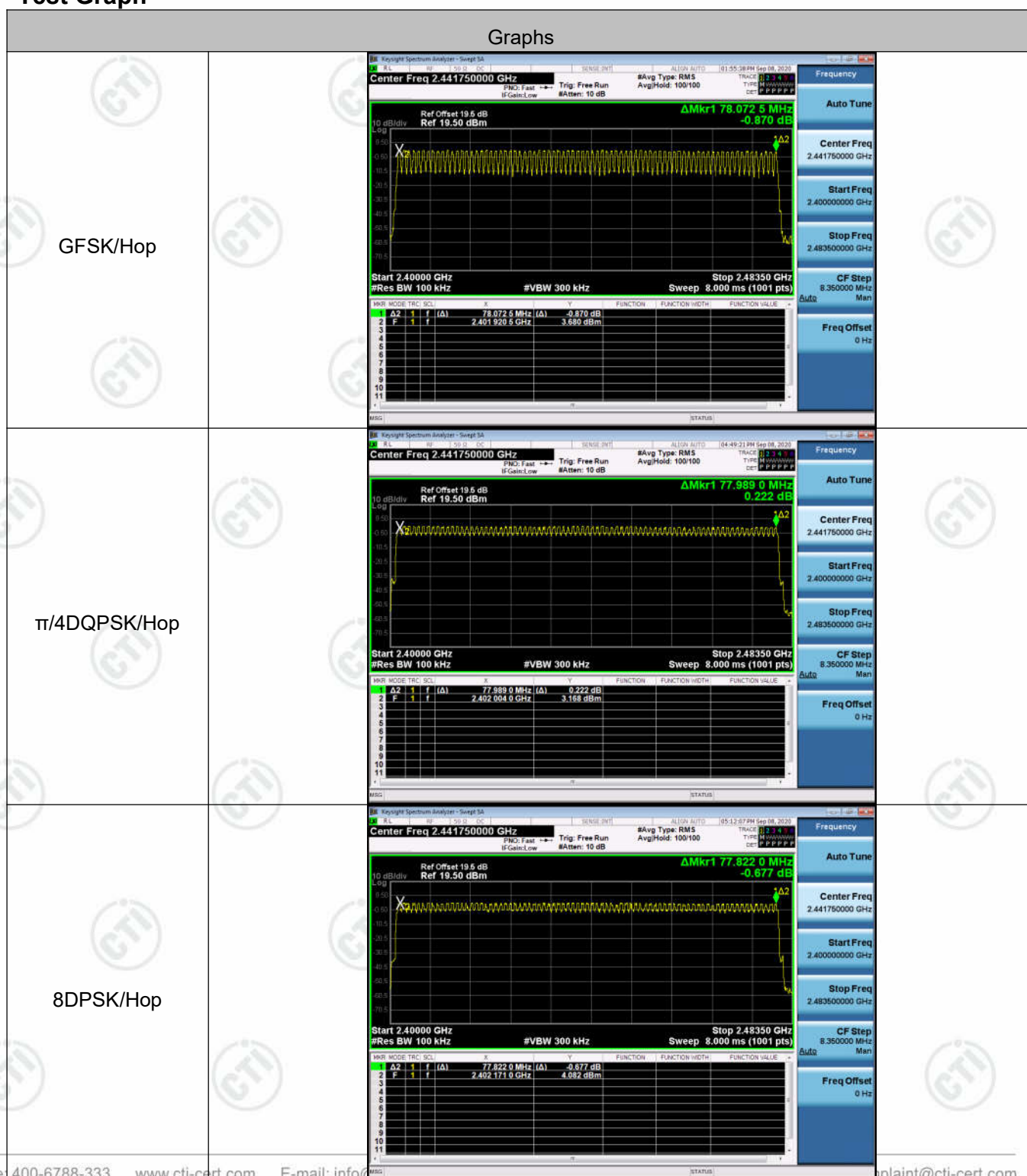
Test Setup



Result Table

Mode	Channel.	Number of Hopping Channel	Verdict
GFSK	Hop	79	PASS
$\pi/4$ DQPSK	Hop	79	PASS
8DPSK	Hop	79	PASS

Test Graph



Appendix E): Conducted Peak Output Power

Test Limit

According to §15.247(b)(1).

Peak output power:

FCC

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.

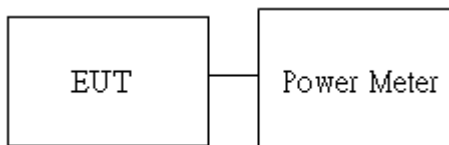
Limit	☒ Antenna not exceed 6 dBi: 21dBm ☐ Antenna with DG greater than 6 dBi: 21dBm [Limit = 30 – (DG – 6)]
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Average output power: For reporting purposes only.

Test Procedure

1. The EUT RF output connected to the power meter by RF cable.
2. Setting maximum power transmit of EUT.
3. The path loss was compensated to the results for each measurement.
4. Measure and record the result of Peak output power and Average output power. in the test report.

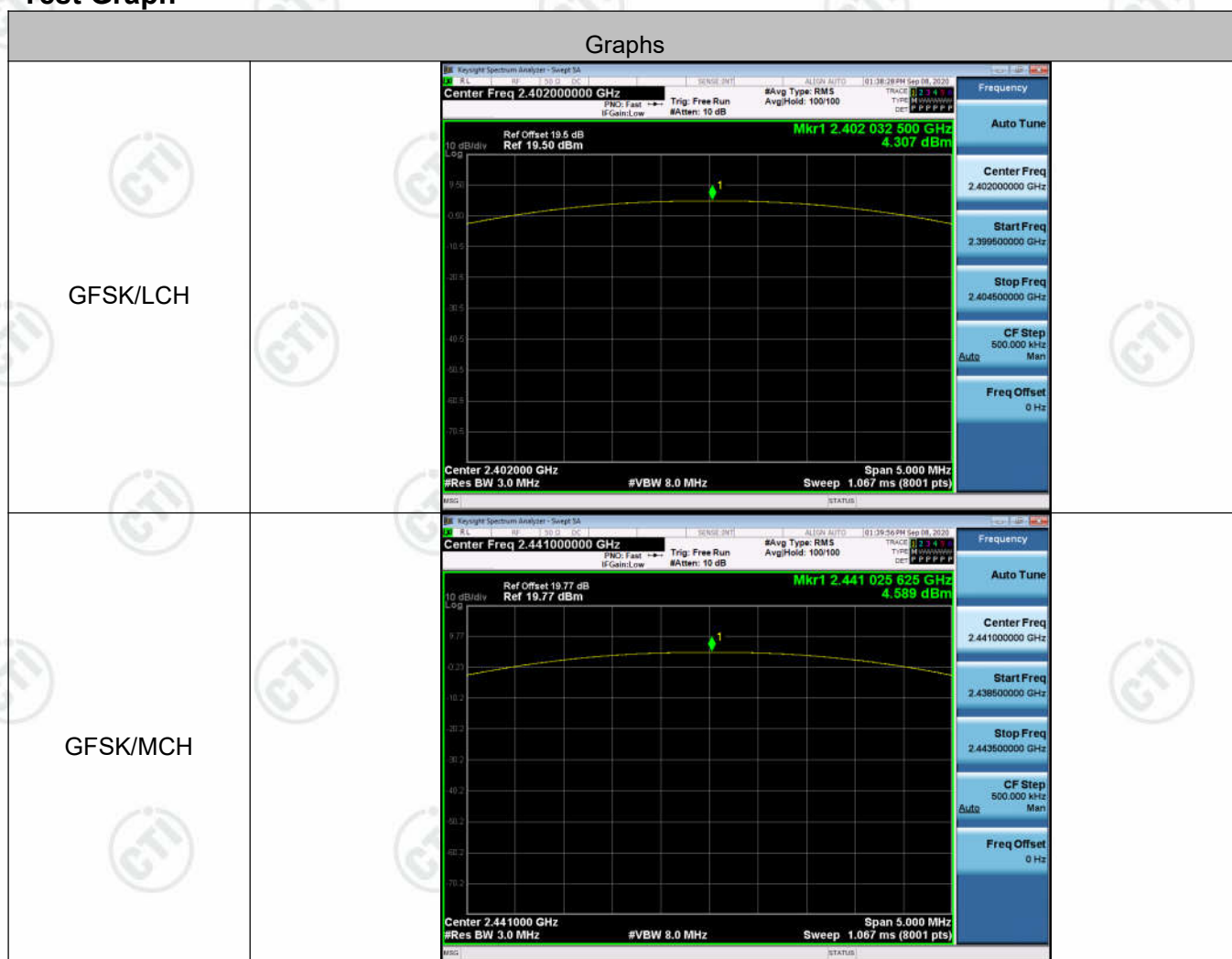
Test Setup



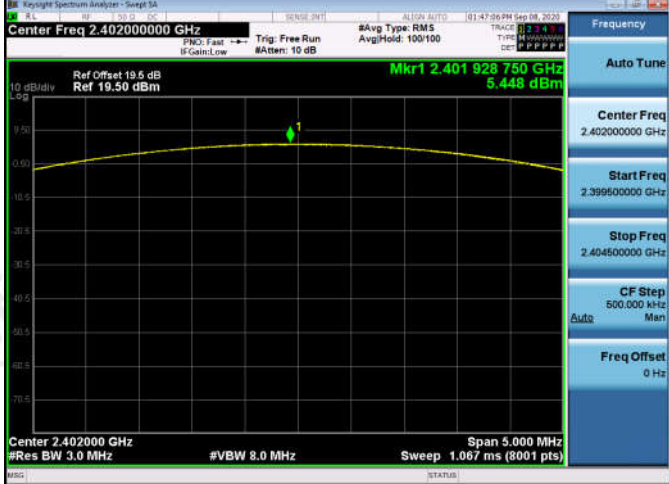
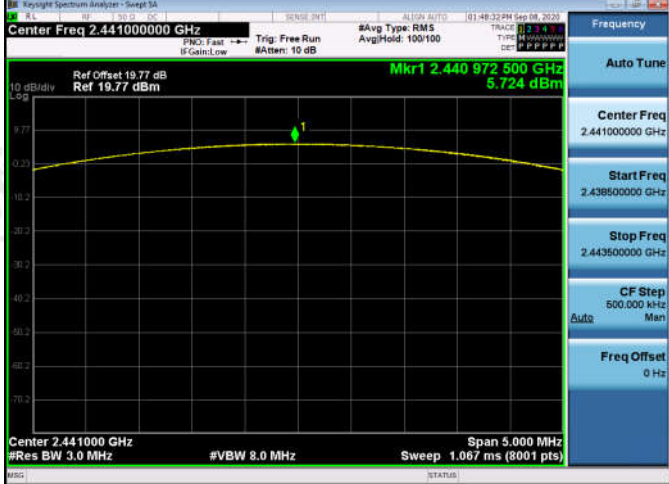
Result Table

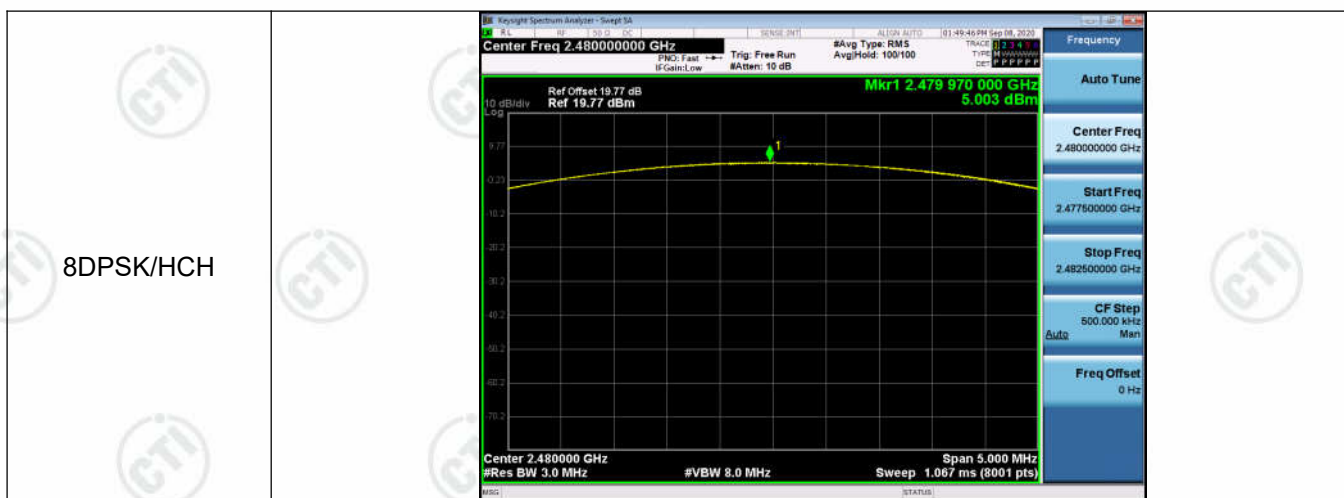
Mode	Channel.	Maximum Peak Output Power [dBm]	Verdict
GFSK	LCH	4.307	PASS
GFSK	MCH	4.589	PASS
GFSK	HCH	3.859	PASS
$\pi/4$ DQPSK	LCH	5.039	PASS
$\pi/4$ DQPSK	MCH	5.325	PASS
$\pi/4$ DQPSK	HCH	4.636	PASS
8DPSK	LCH	5.448	PASS
8DPSK	MCH	5.724	PASS
8DPSK	HCH	5.003	PASS

Test Graph



GFSK/HCH	
$\pi/4$ DQPSK/LCH	
$\pi/4$ DQPSK/MCH	

π/4DQPSK/HCH	
8DPSK/LCH	
8DPSK/MCH	



Appendix D): Band-edge for RF Conducted Emissions

Test Limit

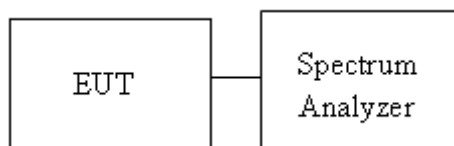
According to §15.247(d),

Limit	-20 dBc
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Test Procedure

1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.
2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.
3. The Band Edge at 2.4GHz and 2.4835GHz are investigated with normal hopping mode.

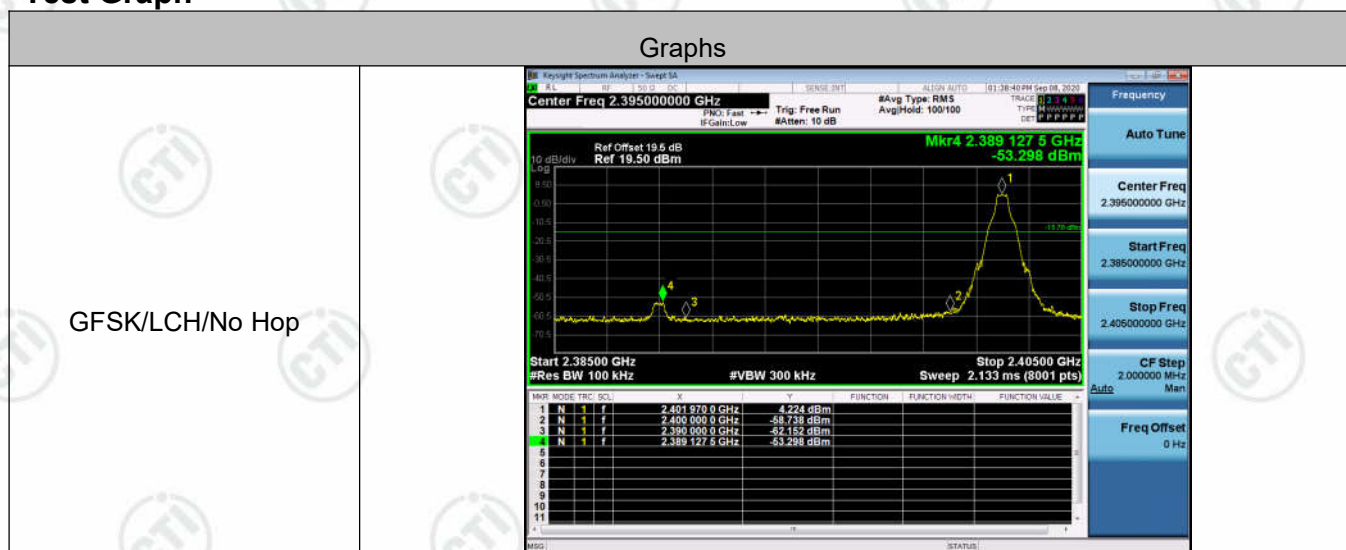
Test Setup

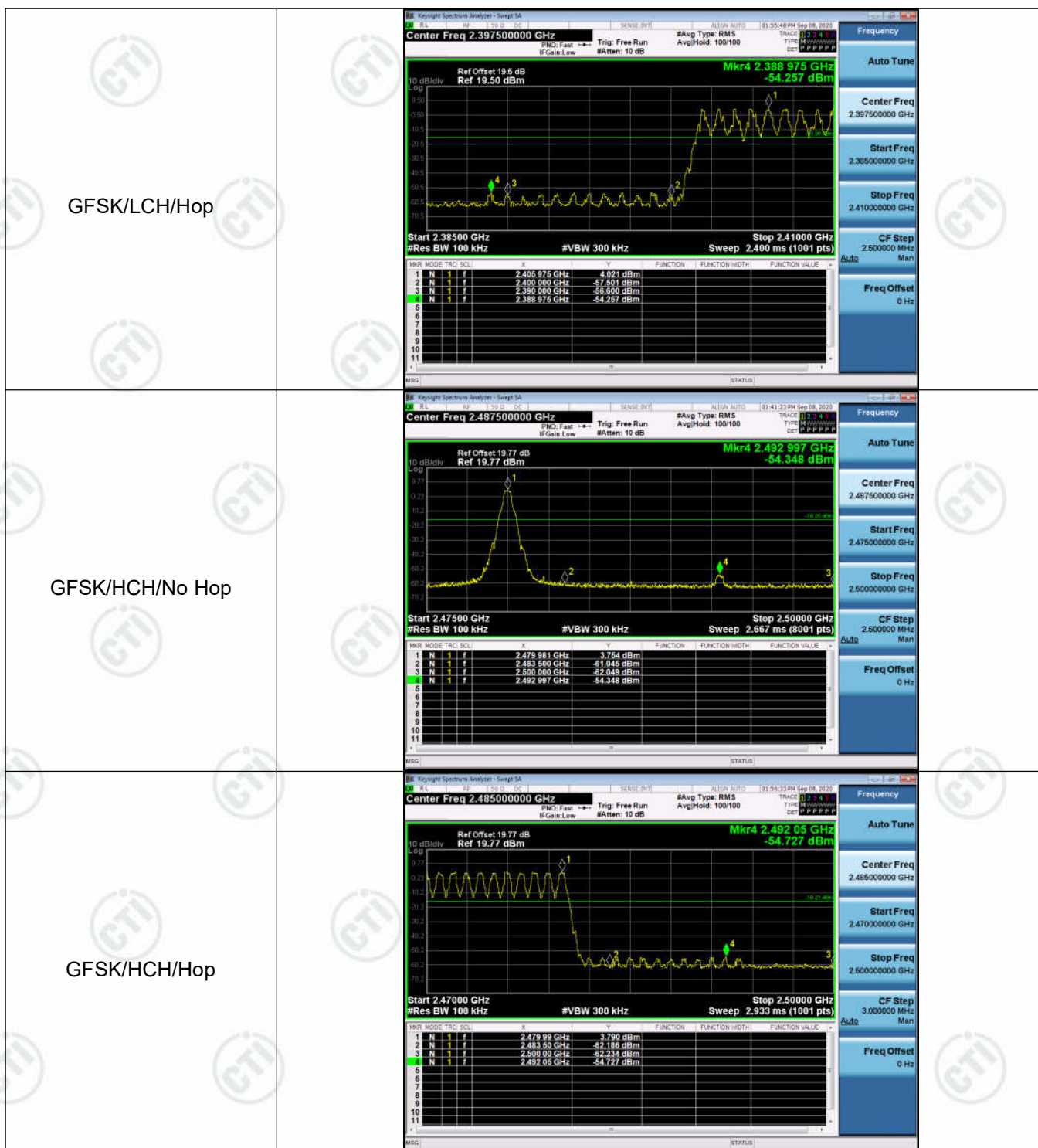


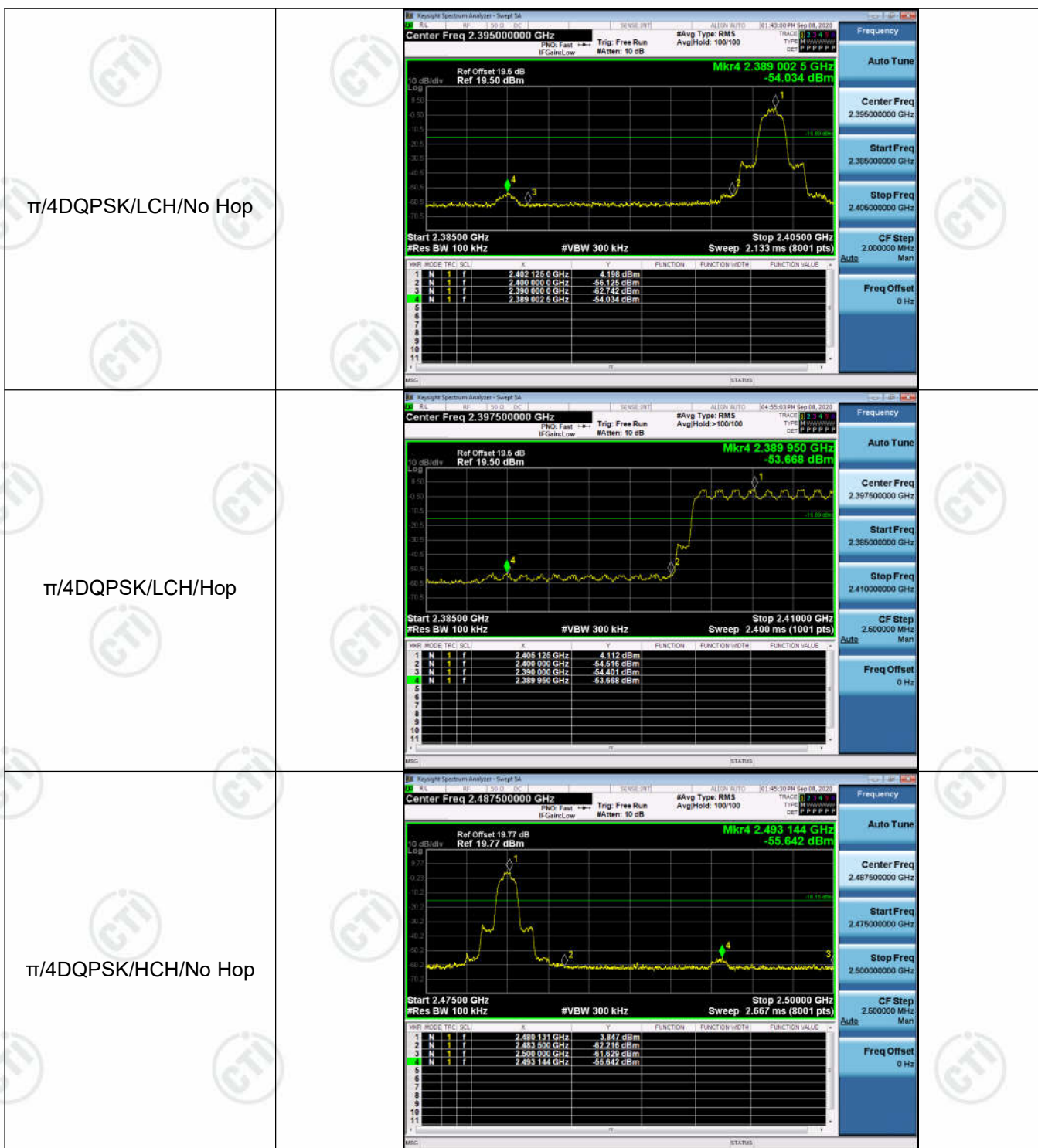
Result Table

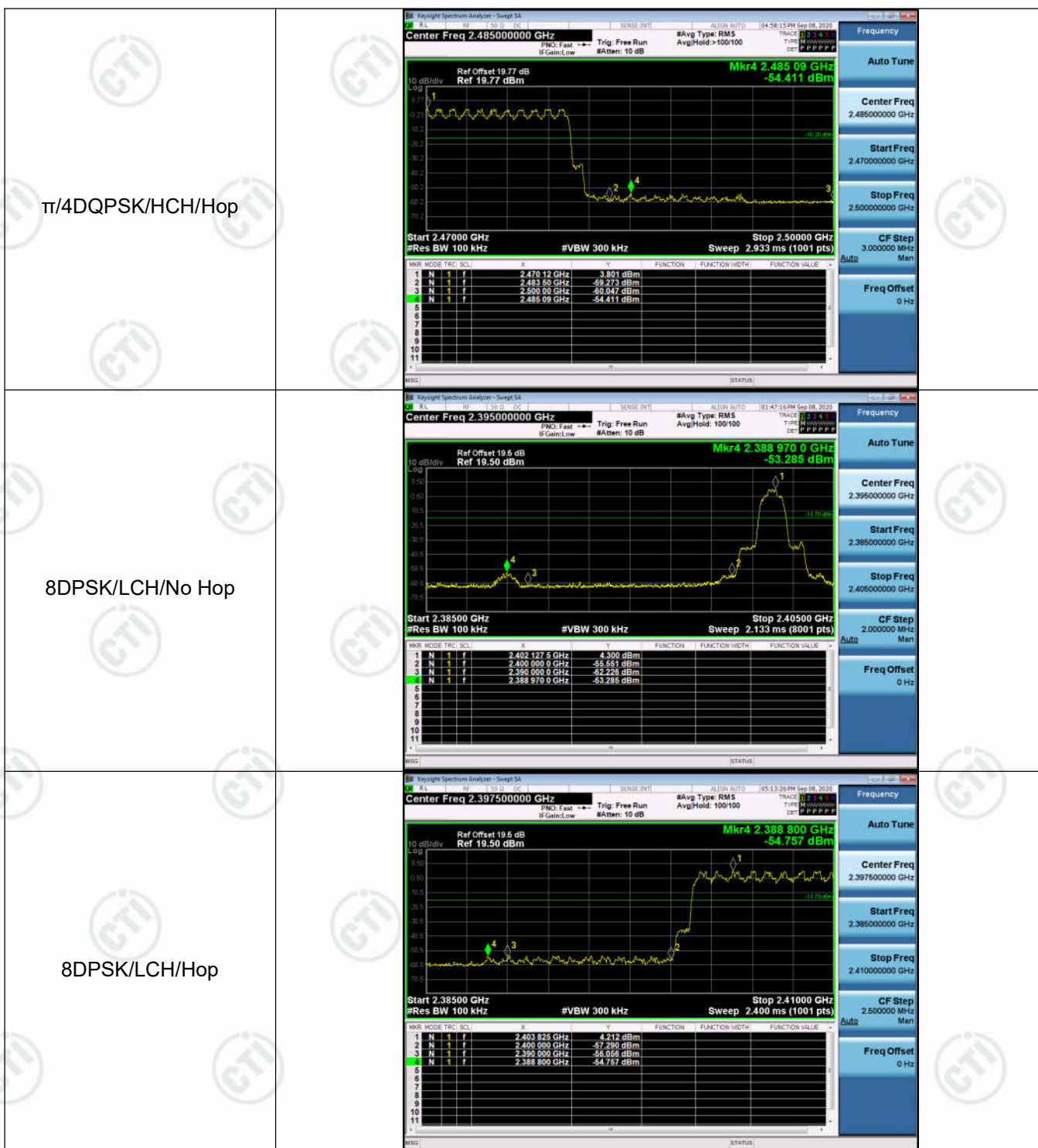
Mode	Channel	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max Spurious Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	2402	4.224	Off	-53.298	-15.78	PASS
			4.021	On	-54.257	-15.98	PASS
GFSK	HCH	2480	3.754	Off	-54.348	-16.25	PASS
			3.790	On	-54.727	-16.21	PASS
$\pi/4$ DQPSK	LCH	2402	4.198	Off	-54.034	-15.8	PASS
			4.112	On	-53.668	-15.89	PASS
$\pi/4$ DQPSK	HCH	2480	3.847	Off	-55.642	-16.15	PASS
			3.801	On	-54.411	-16.2	PASS
8DPSK	LCH	2402	4.300	Off	-53.285	-15.7	PASS
			4.212	On	-54.757	-15.79	PASS
8DPSK	HCH	2480	3.875	Off	-54.859	-16.13	PASS
			3.871	On	-54.407	-16.13	PASS

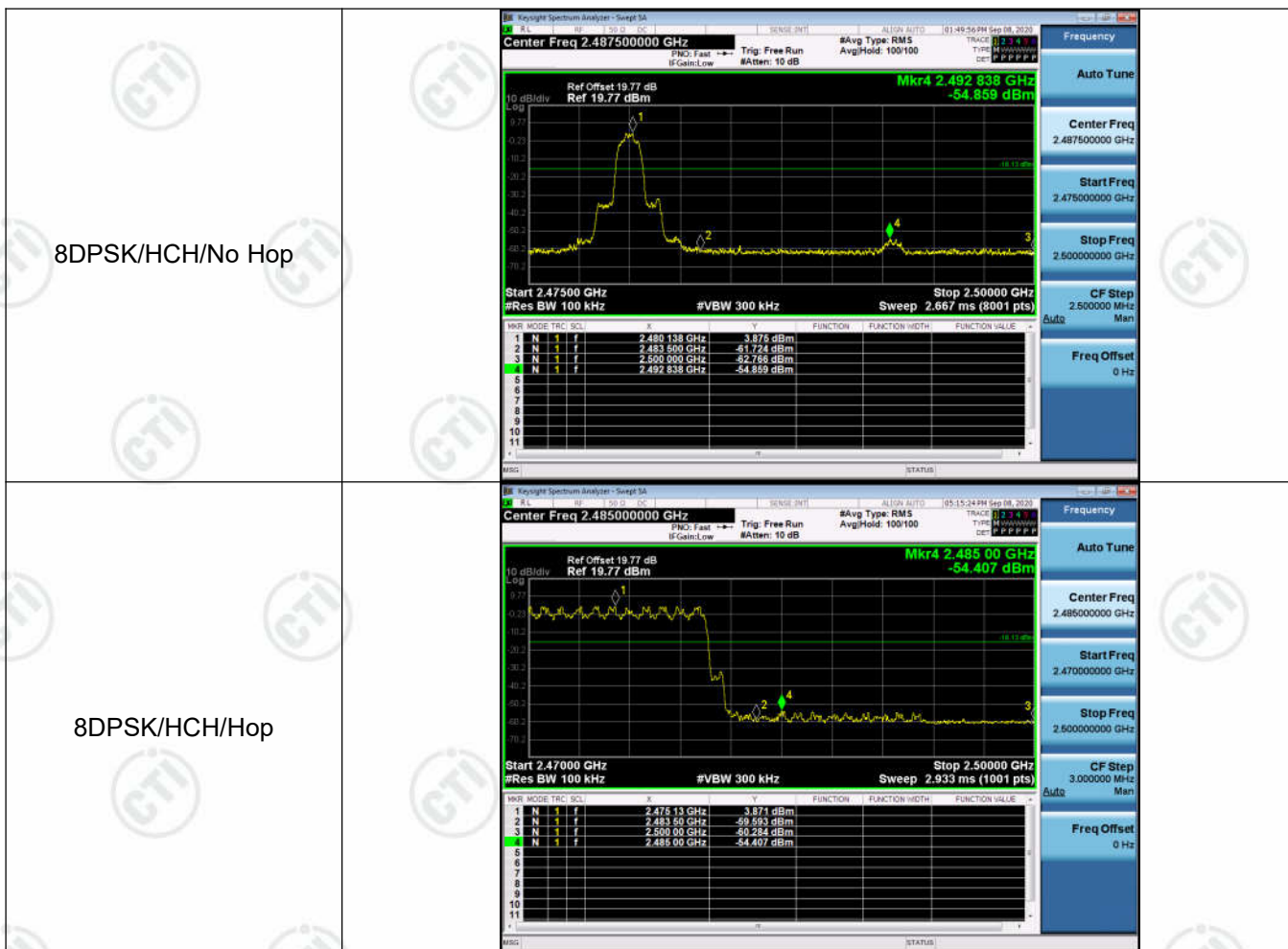
Test Graph











Appendix E): RF Conducted Spurious Emissions

Test Limit

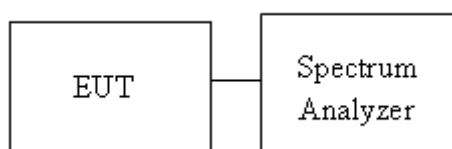
According to §15.247(d)

Limit	-20 dBc
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Test Procedure

1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.
2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.

Test Setup



Result Table

Mode	Channel	Pref [dBm]	Puw[dBm]	Verdict
GFSK	LCH	4.126	<Limit	PASS
GFSK	MCH	4.412	<Limit	PASS
GFSK	HCH	3.685	<Limit	PASS
$\pi/4$ DQPSK	LCH	4.049	<Limit	PASS
$\pi/4$ DQPSK	MCH	4.35	<Limit	PASS
$\pi/4$ DQPSK	HCH	3.64	<Limit	PASS
8DPSK	LCH	4.248	<Limit	PASS
8DPSK	MCH	4.562	<Limit	PASS
8DPSK	HCH	3.833	<Limit	PASS

Test Graph







