

TEST REPORT

Product : Razor XV 3.0
Trade mark : Walker's
Model/Type reference : GWP-BTN-BT, GWP-BTN-BT-XXX
(Where X=0 to 9 or A to Z)
Serial Number : N/A
Report Number : EED32L00342601
FCC ID : MV3-BTN
Date of Issue: : Mar. 02, 2020
Test Standards : 47 CFR Part 15 Subpart C
Test result : PASS

Prepared for:

Country Mate Technology Ltd.
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Prepared by:

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Date:

Mar. 02, 2020

Check No.:3096357367



2 Version

Version No.	Date	Description
00	Mar. 02, 2020	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 15Subpart C Section 15.205/15.209	ANSI C63.10-2013	PASS

Remark:

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

The tested samples and the sample information are provided by the client.

Model No.:GWP-BTN-BT, GWP-BTN-BT-XXX (Where X=0 to 9 or A to Z)

Only the model GWP-BTN-BT,was tested, Their electrical circuit design, layout, components used and internal wiring are identical, Only the Color or Package is different.

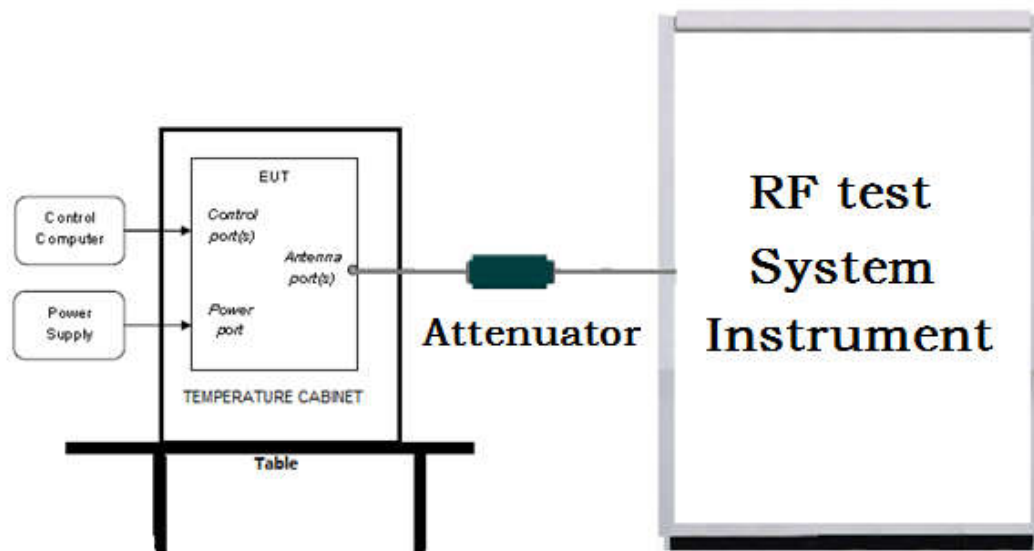
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5 Test Requirement

5.1 Test setup

5.1.1 For Conducted test setup



5.1.2 For Radiated Emissions test setup

Radiated Emissions setup:

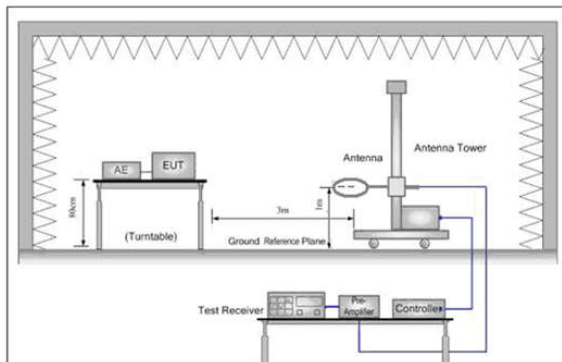


Figure 1. Below 30MHz

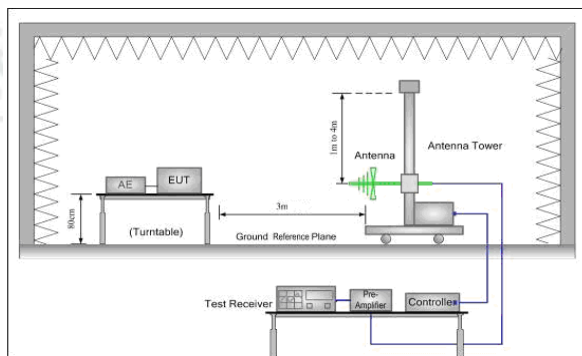


Figure 2. 30MHz to 1GHz

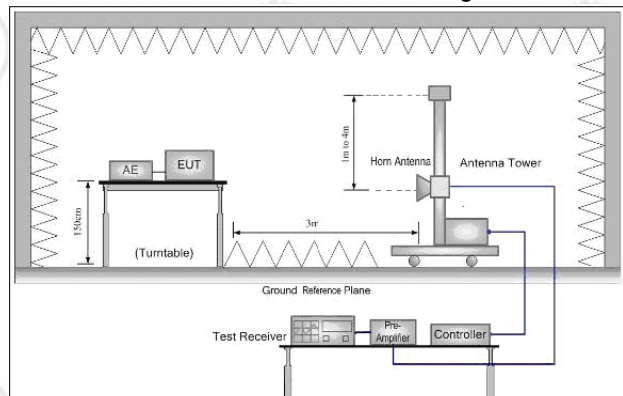
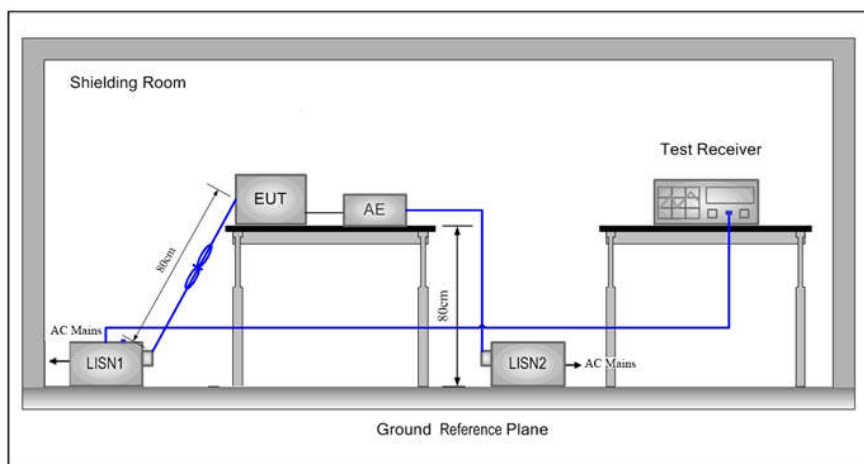


Figure 3. Above 1GHz

5.1.3 For Conducted Emissions test setup

Conducted Emissions setup



5.2 Test Environment

Operating Environment:	
Temperature:	24.0 °C
Humidity:	55 % RH
Atmospheric Pressure:	1010 mbar

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 1	Channel 40	Channel79
		2402MHz	2441MHz	2480MHz

6 General Information

6.1 Client Information

Applicant:	Country Mate Technology Ltd.
Address of Applicant:	5/F, Blk E, Hing Yip Center, 31 Hing Yip Street, Kwun Tong, Kln, Hong Kong
Manufacturer:	Country Mate Technology Ltd.
Address of Manufacturer:	5/F, Blk E, Hing Yip Center, 31 Hing Yip Street, Kwun Tong, Kln, Hong Kong
Factory:	Concord Electronic (Huizhou) Ltd.
Address of Factory:	21, Ping An Rd, Shuikou Street, Hui Cheng District, Huizhou City, Guangdong Province,

6.2 General Description of EUT

Product Name:	Razor XV 3.0	
Model No.(EUT):	GWP-BTN-BT, GWP-BTN-BT-XXX (Where X=0 to 9 or A to Z)	
Test Mode No.:	GWP-BTN-BT	
Tark mark:	Walker's	
EUT Supports Radios application	BT 5.0 Single mode, 2402MHz to 2480MHz	
Power Supply:	Battery	Li-ion Battery: DC 3.7V 120mAh, Charge: DC 5V
Sample Received Date:	Nov. 18, 2019	
Sample tested Date:	Nov. 18, 2019 to Dec. 05, 2019	

6.3 Product Specification subjective to this standard

Operation Frequency:	2402MHz~2480MHz						
Bluetooth Version:	5.0						
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:	DH5:0/0/0; 2DH5:-6/-6/-6; 3DH5:-4/-4/-4						
Test Software of EUT:	Bluetest3						
Antenna Type:	Chip Antenna						
Antenna Gain:	0.8dbi						
Test Voltage:	DC 5V						
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		

6.4 Description of Support Units

The EUT has been tested independently

6.5 Test Location

All tests were performed at:

Centre Testing International Group Co., Ltd.

Hongwei Industrial Zone, Bao'an 70 District, Shenzhen, Guangdong, China518101

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

No tests were sub-contracted.

FCC Designation No.: CN1164

6.6 Deviation from Standards

None.

6.7 Abnormalities from Standard Conditions

None.

6.8 Other Information Requested by the Customer

None.

6.9 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	03-01-2019	02-29-2020
Signal Generator	Keysight	N5182B	MY53051549	03-01-2019	02-29-2020
Temperature/ Humidity Indicator	biaozhi	HM10	1804186	07-26-2019	07-25-2020
High-pass filter	Sinoscite	FL3CX03WG18 NM12-0398-002	---	01-09-2019	01-08-2020
High-pass filter	MICRO-TRONICS	SPA-F-63029-4	---	01-09-2019	01-08-2020
DC Power	Keysight	E3642A	MY56376072	03-01-2019	02-29-2020
PC-1	Lenovo	R4960d	---	03-01-2019	02-29-2020
BT&WI-FI Automatic control	R&S	OSP120	101374	03-01-2019	02-29-2020
RF control unit	JS Tonscend	JS0806-2	158060006	03-01-2019	02-29-2020
BT&WI-FI Automatic test software	JS Tonscend	JS1120-3	---	03-01-2019	02-29-2020

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	05-20-2019	05-19-2020
Temperature/ Humidity Indicator	Defu	TH128	/	06-14-2019	06-13-2020
LISN	R&S	ENV216	100098	05-08-2019	05-07-2020
Barometer	changchun	DYM3	1188	06-20-2019	06-19-2020

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	07-26-2019	07-25-2020
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/070/107 11112	---	01-09-2019	01-08-2020
Temperature/ Humidity Indicator	Shanghai qixiang	HM10	1804298	07-26-2019	07-25-2020
Cable line	Fulai(7M)	SF106	5219/6A	01-09-2019	01-08-2020
Cable line	Fulai(6M)	SF106	5220/6A	01-09-2019	01-08-2020
Cable line	Fulai(3M)	SF106	5216/6A	01-09-2019	01-08-2020
Cable line	Fulai(3M)	SF106	5217/6A	01-09-2019	01-08-2020

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	06-19-2019	06-18-2020
Receiver	Keysight	N9038A	MY57290136	03-27-2019	03-26-2020
Spectrum Analyzer	Keysight	N9020B	MY57111112	03-27-2019	03-26-2020
Spectrum Analyzer	Keysight	N9030B	MY57140871	03-27-2019	03-26-2020
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	05-22-2019	5-21-2020
Preamplifier	EMCI	EMC001330	980563	05-08-2019	05-07-2020
Preamplifier	JS Tonscend	980380	EMC051845 SE	01-16-2019	01-15-2020
Temperature/ Humidity Indicator	biaozhi	GM1360	EE1186631	04-30-2019	04-29-2020
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	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMSM-2.50M	394812-0002	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMSM-2.50M	394812-0003	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMSM-2.50M	393495-0001	01-09-2019	01-08-2020
Cable line	Times	EMC104-NMNM-1000	SN160710	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMSM-3.00M	394813-0001	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMNM-1.50M	381964-0001	01-09-2019	01-08-2020
Cable line	Times	SFT205-NMSM-7.00M	394815-0001	01-09-2019	01-08-2020
Cable line	Times	HF160-KMKM-3.00M	393493-0001	01-09-2019	01-08-2020

8 Radio Technical Requirements Specification

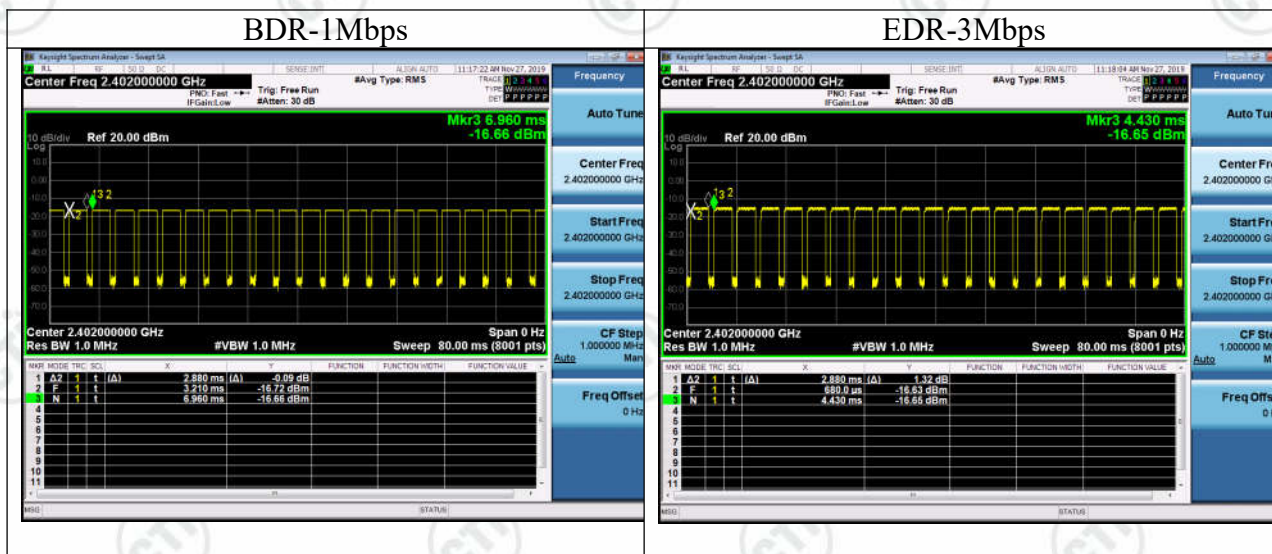
Reference documents for testing:

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 (b)	ANSI 63.10	Hopping Channel Number	PASS	Appendix D)
Part15C Section 15.247 (b)(1)	ANSI 63.10	Conducted Peak Output Power	PASS	Appendix E)
Part15C Section 15.247(d)	ANSI 63.10	Band-edge for RF Conducted Emissions	PASS	Appendix F)
Part15C Section 15.247(d)	ANSI 63.10	RF Conducted Spurious Emissions	PASS	Appendix G)
Part15C Section 15.247 (a)(1)	ANSI 63.10	Pseudorandom Frequency Hopping Sequence	PASS	Appendix H)
Part15C Section 15.203/15.247 (c)	ANSI 63.10	Antenna Requirement	PASS	Appendix I)
Part15C Section 15.207	ANSI 63.10	AC Power Line Conducted Emission	PASS	AppendixJ)
Part15C Section 15.205/15.209	ANSI 63.10	Restricted bands around fundamental frequency (Radiated) Emission)	PASS	AppendixK)
Part15C Section 15.205/15.209	ANSI 63.10	Radiated Spurious Emissions	PASS	AppendixL)

Duty Cycle			
Configuration	TX ON(ms)	TX ALL(ms)	Duty Cycle(%)
BDR-1Mbps	2.880	3.75	76.8%
EDR-3Mbps	2.880	3.75	76.8%



Appendix A): 20dB Occupied Bandwidth

Test Limit

According to §15.247(a) (1),

20 dB Bandwidth : For reporting purposes only.

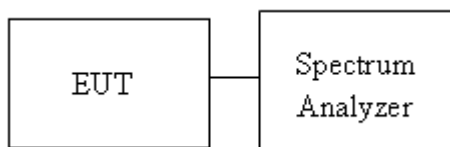
Occupied Bandwidth(99%) : For reporting purposes only.

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.
- 6.

Test Setup



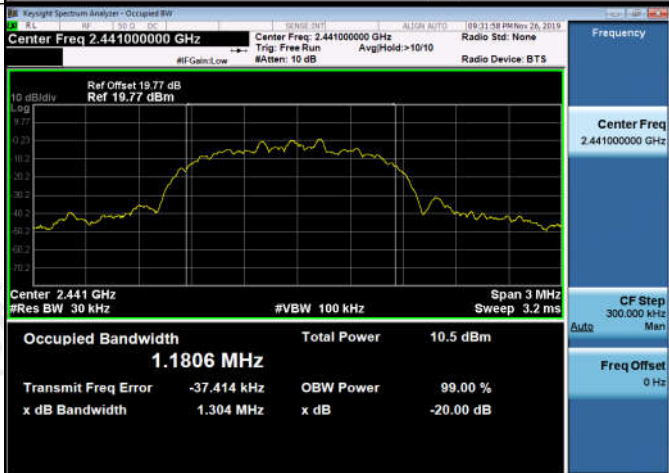
Test Result

Mode	Channel.	20dB Bandwidth [MHz]	99% OBW [MHz]	Verdict
GFSK	LCH	1.110	0.87010	PASS
GFSK	MCH	1.110	0.86828	PASS
GFSK	HCH	1.107	0.86111	PASS
π /4DQPSK	LCH	1.395	1.1891	PASS
π /4DQPSK	MCH	1.395	1.1867	PASS
π /4DQPSK	HCH	1.397	1.1878	PASS
8DPSK	LCH	1.384	1.1812	PASS
8DPSK	MCH	1.384	1.1806	PASS
8DPSK	HCH	1.384	1.1803	PASS

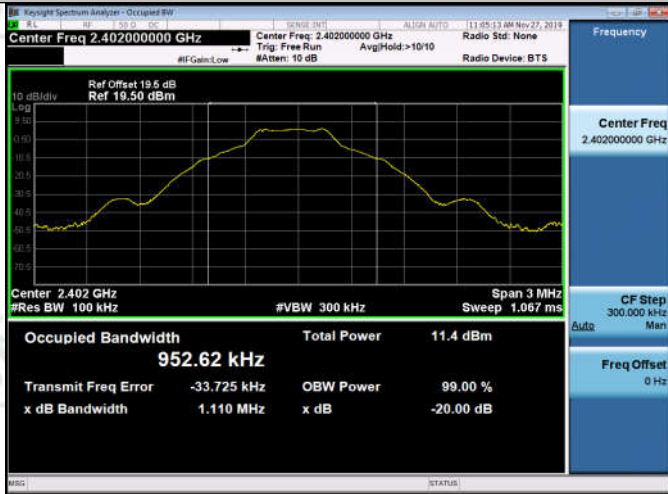
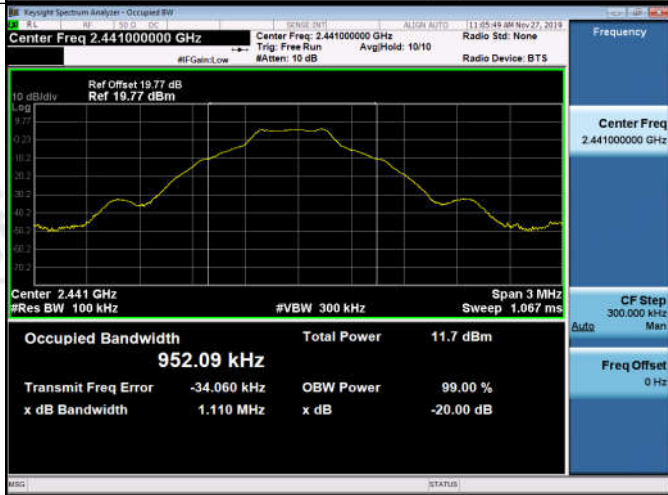
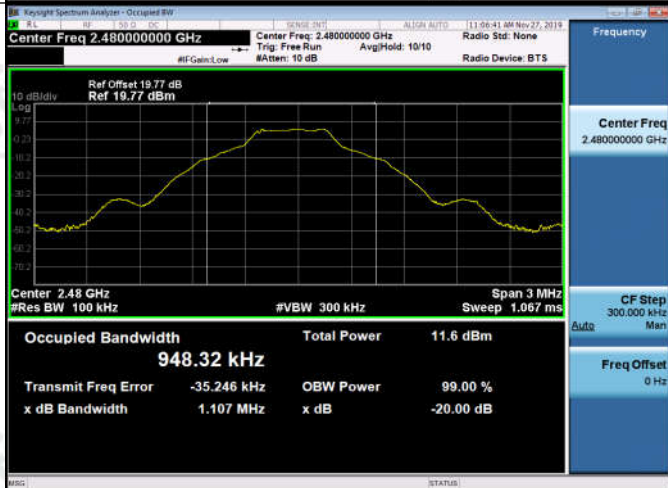
Test Graph

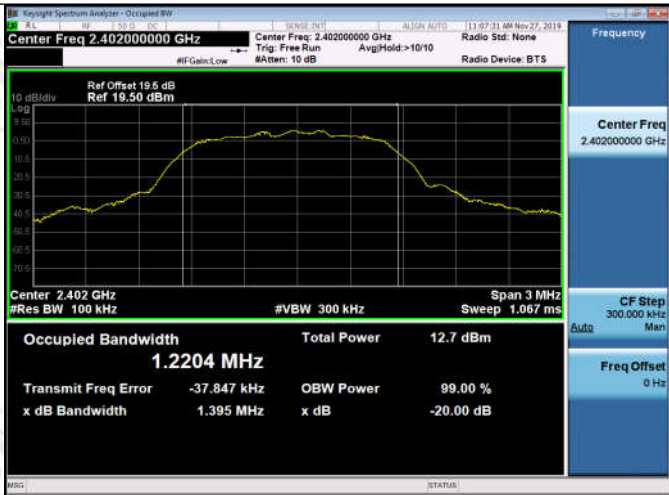
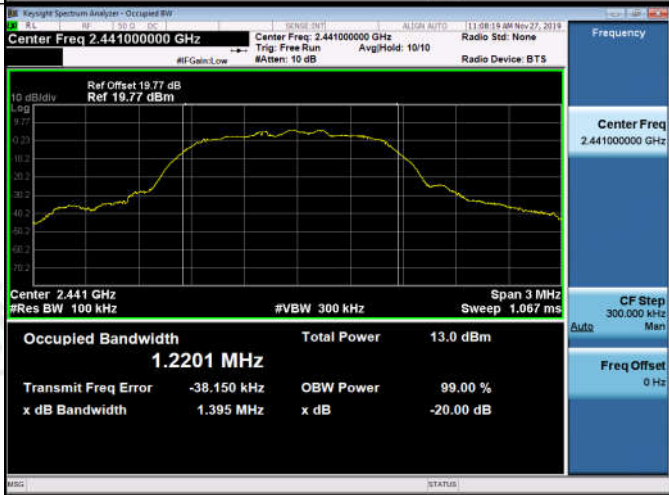
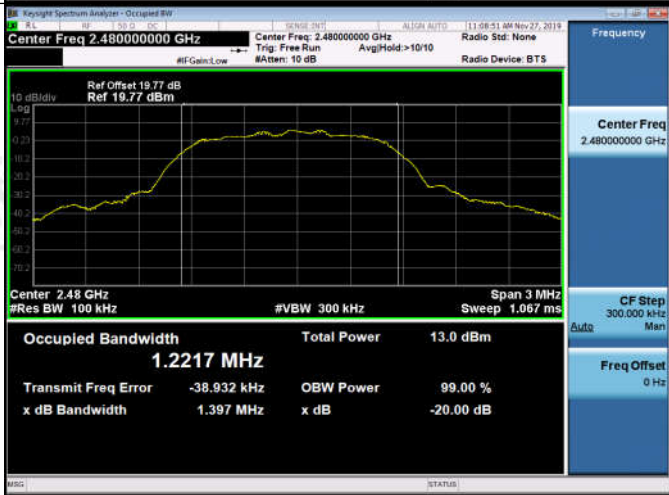


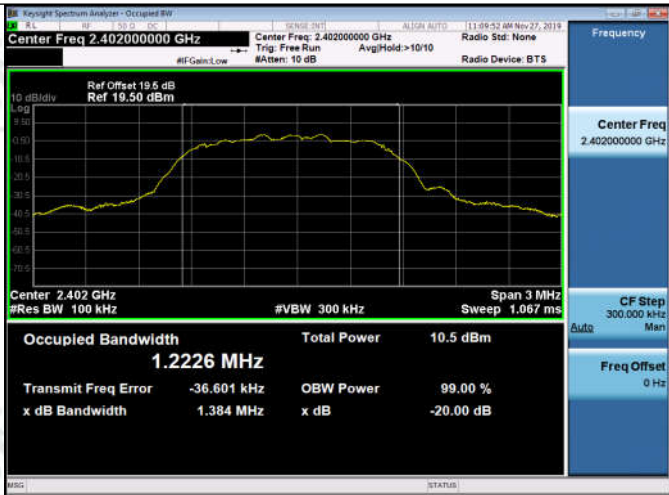
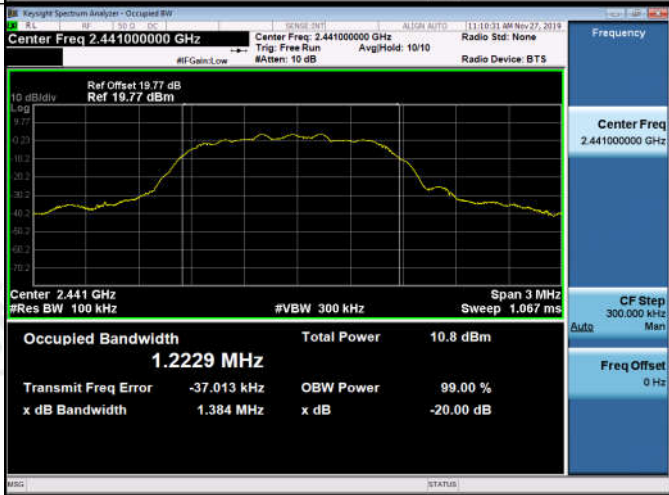
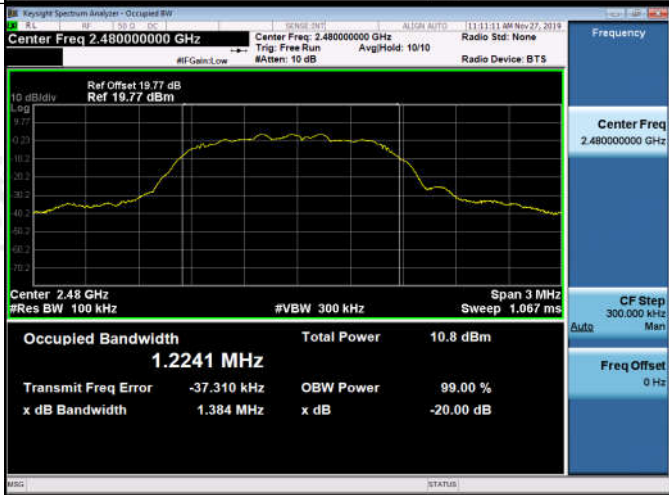
$\pi/4$DQPSK/LCH	 Keyight Spectrum Analyzer - Occupied BW Center Freq 2.40200000 GHz Ref Offset 19.5 dB Ref 19.50 dBm Center 2.402 GHz #Res BW 30 kHz Span 3 MHz Sweep 3.2 ms #VBW 100 kHz Occupied Bandwidth 1.1891 MHz Total Power 7.66 dBm Transmit Freq Error -37.487 kHz OBW Power 99.00 % x dB Bandwidth 1.334 MHz x dB -20.00 dB
$\pi/4$DQPSK/MCH	 Keyight Spectrum Analyzer - Occupied BW Center Freq 2.441000000 GHz Ref Offset 19.77 dB Ref 19.77 dBm Center 2.441 GHz #Res BW 30 kHz Span 3 MHz Sweep 3.2 ms #VBW 100 kHz Occupied Bandwidth 1.1867 MHz Total Power 8.25 dBm Transmit Freq Error -38.350 kHz OBW Power 99.00 % x dB Bandwidth 1.332 MHz x dB -20.00 dB
$\pi/4$DQPSK/HCH	 Keyight Spectrum Analyzer - Occupied BW Center Freq 2.480000000 GHz Ref Offset 19.77 dB Ref 19.77 dBm Center 2.48 GHz #Res BW 30 kHz Span 3 MHz Sweep 3.2 ms #VBW 100 kHz Occupied Bandwidth 1.1878 MHz Total Power 8.25 dBm Transmit Freq Error -38.402 kHz OBW Power 99.00 % x dB Bandwidth 1.334 MHz x dB -20.00 dB

8DPSK/LCH	
8DPSK/MCH	
8DPSK/HCH	

Graphs

GFSK/LCH	 KeySight Spectrum Analyzer - Occupied BW Center Freq 2.402000000 GHz Center Freq: 2.402000000 GHz Radio Std: None Ref Offset 19.5 dB Ref 19.50 dBm Center 2.402 GHz Span 3 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 1.067 ms Occupied Bandwidth 952.62 kHz Total Power 11.4 dBm Transmit Freq Error -33.725 kHz OBW Power 99.00 % x dB Bandwidth 1.110 MHz x dB -20.00 dB
GFSK/MCH	 KeySight Spectrum Analyzer - Occupied BW Center Freq 2.441000000 GHz Center Freq: 2.441000000 GHz Radio Std: None Ref Offset 19.77 dB Ref 19.77 dBm Center 2.441 GHz Span 3 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 1.067 ms Occupied Bandwidth 952.09 kHz Total Power 11.7 dBm Transmit Freq Error -34.060 kHz OBW Power 99.00 % x dB Bandwidth 1.110 MHz x dB -20.00 dB
GFSK/HCH	 KeySight Spectrum Analyzer - Occupied BW Center Freq 2.480000000 GHz Center Freq: 2.480000000 GHz Radio Std: None Ref Offset 19.77 dB Ref 19.77 dBm Center 2.48 GHz Span 3 MHz #Res BW 100 kHz #VBW 300 kHz Sweep 1.067 ms Occupied Bandwidth 948.32 kHz Total Power 11.6 dBm Transmit Freq Error -35.246 kHz OBW Power 99.00 % x dB Bandwidth 1.107 MHz x dB -20.00 dB

$\pi/4$DQPSK/LCH	 Center Freq 2.402000000 GHz Ref Offset 19.5 dB Ref 19.50 dBm Center 2.402 GHz #Res BW 100 kHz Span 3 MHz Sweep 1.067 ms Occupied Bandwidth 1.2204 MHz Total Power 12.7 dBm Transmit Freq Error -37.847 kHz OBW Power 99.00 % x dB Bandwidth 1.395 MHz x dB -20.00 dB
$\pi/4$DQPSK/MCH	 Center Freq 2.441000000 GHz Ref Offset 19.77 dB Ref 19.77 dBm Center 2.441 GHz #Res BW 100 kHz Span 3 MHz Sweep 1.067 ms Occupied Bandwidth 1.2201 MHz Total Power 13.0 dBm Transmit Freq Error -38.150 kHz OBW Power 99.00 % x dB Bandwidth 1.395 MHz x dB -20.00 dB
$\pi/4$DQPSK/HCH	 Center Freq 2.480000000 GHz Ref Offset 19.77 dB Ref 19.77 dBm Center 2.48 GHz #Res BW 100 kHz Span 3 MHz Sweep 1.067 ms Occupied Bandwidth 1.2217 MHz Total Power 13.0 dBm Transmit Freq Error -38.932 kHz OBW Power 99.00 % x dB Bandwidth 1.397 MHz x dB -20.00 dB

8DPSK/LCH	 Keyight Spectrum Analyzer - Occupied BW Center Freq 2.402000000 GHz Ref Offset 19.5 dB Ref 19.50 dBm Center 2.402 GHz #Res BW 100 kHz Span 3 MHz Sweep 1.067 ms #VBW 300 kHz Occupied Bandwidth 1.2226 MHz Total Power 10.5 dBm Transmit Freq Error -36.601 kHz OBW Power 99.00 % x dB Bandwidth 1.384 MHz x dB -20.00 dB
8DPSK/MCH	 Keyight Spectrum Analyzer - Occupied BW Center Freq 2.441000000 GHz Ref Offset 19.77 dB Ref 19.77 dBm Center 2.441 GHz #Res BW 100 kHz Span 3 MHz Sweep 1.067 ms #VBW 300 kHz Occupied Bandwidth 1.2229 MHz Total Power 10.8 dBm Transmit Freq Error -37.013 kHz OBW Power 99.00 % x dB Bandwidth 1.384 MHz x dB -20.00 dB
8DPSK/HCH	 Keyight Spectrum Analyzer - Occupied BW Center Freq 2.480000000 GHz Ref Offset 19.77 dB Ref 19.77 dBm Center 2.48 GHz #Res BW 100 kHz Span 3 MHz Sweep 1.067 ms #VBW 300 kHz Occupied Bandwidth 1.2241 MHz Total Power 10.8 dBm Transmit Freq Error -37.310 kHz OBW Power 99.00 % x dB Bandwidth 1.384 MHz x dB -20.00 dB

Appendix B): Carrier Frequency Separation

Test Limit

According to §15.247(a)(1),

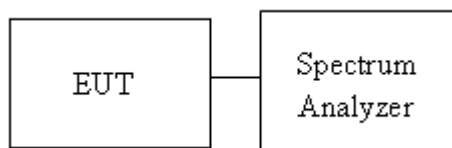
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 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 = 30kHz, VBW = 100kHz, Sweep = auto.
Max hold, mark 3 peaks of hopping channel and record the 3 peaks frequency

Test Setup

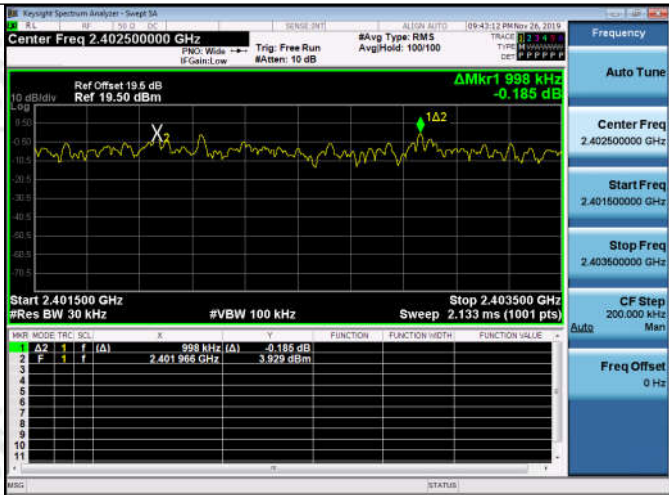
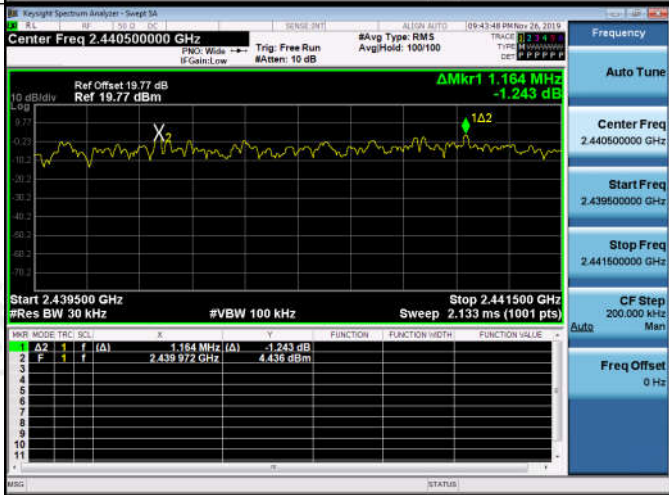
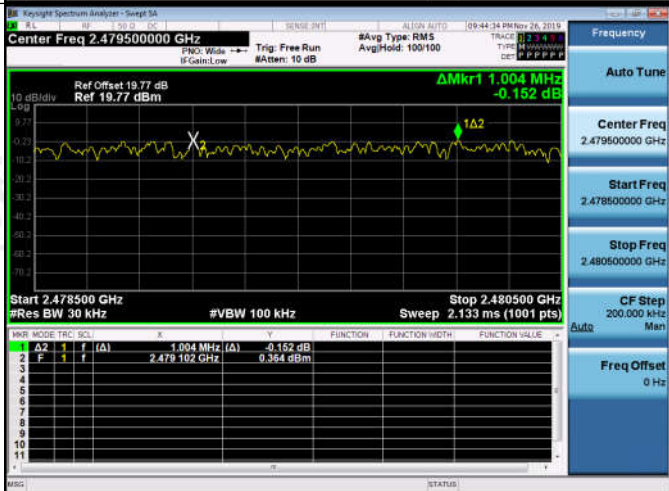


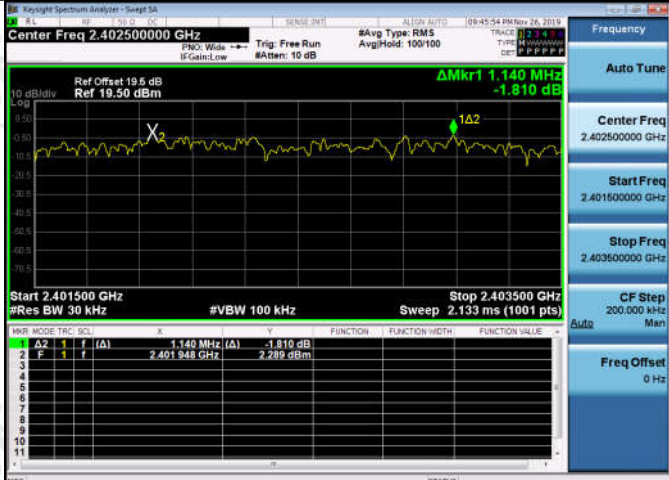
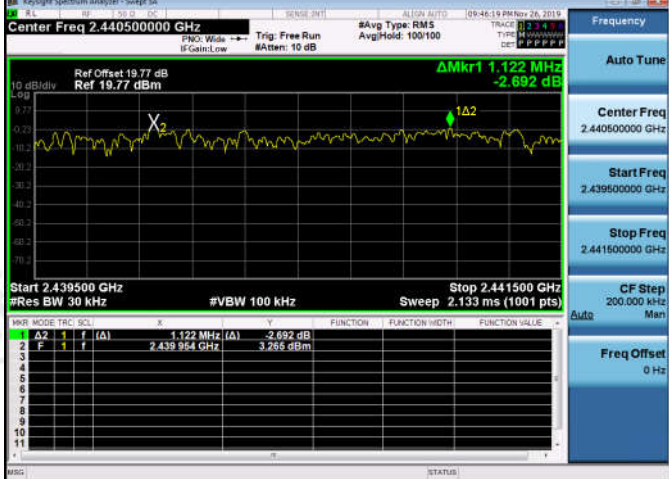
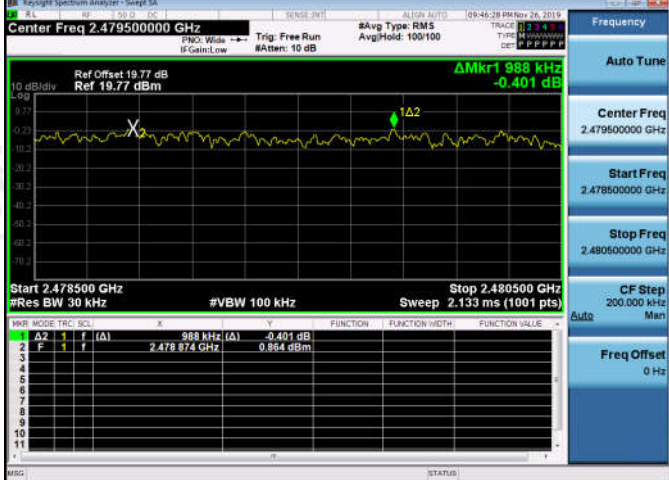
Result Table

Mode	Channel.	Carrier Frequency Separation [MHz]	Verdict
GFSK	LCH	1.054	PASS
GFSK	MCH	1.178	PASS
GFSK	HCH	0.904	PASS
$\pi/4$ DQPSK	LCH	0.998	PASS
$\pi/4$ DQPSK	MCH	1.164	PASS
$\pi/4$ DQPSK	HCH	1.004	PASS
8DPSK	LCH	1.140	PASS
8DPSK	MCH	1.122	PASS
8DPSK	HCH	0.988	PASS

Test Graph



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

8DPSK/LCH	
8DPSK/MCH	
8DPSK/HCH	

Appendix C): Dwell Time

Test Limit

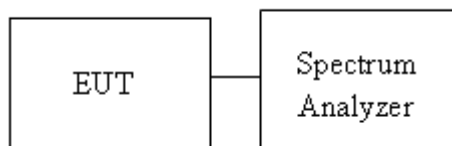
According to §15.247(a)(1)(iii),

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 = auto

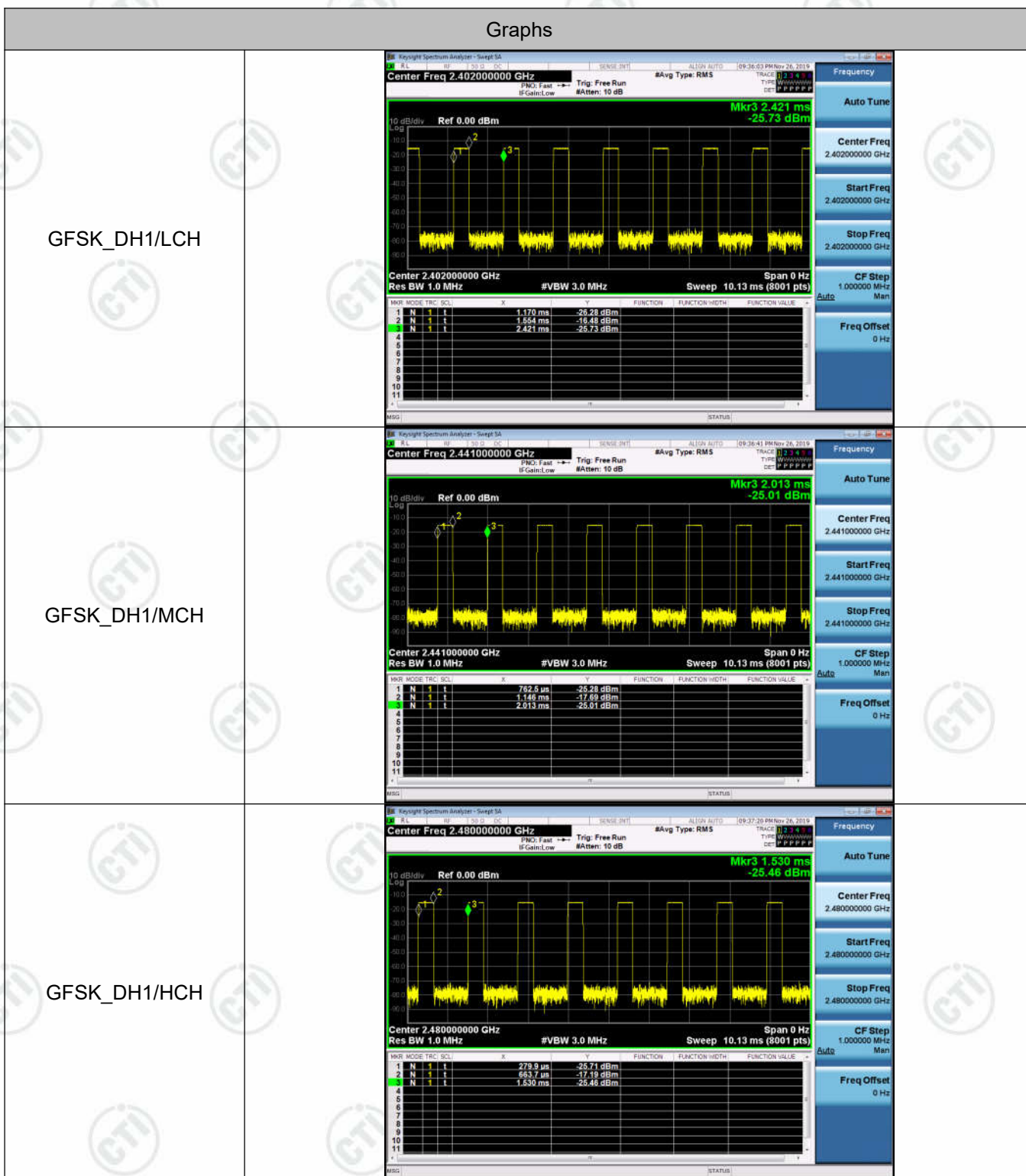
Test Setup

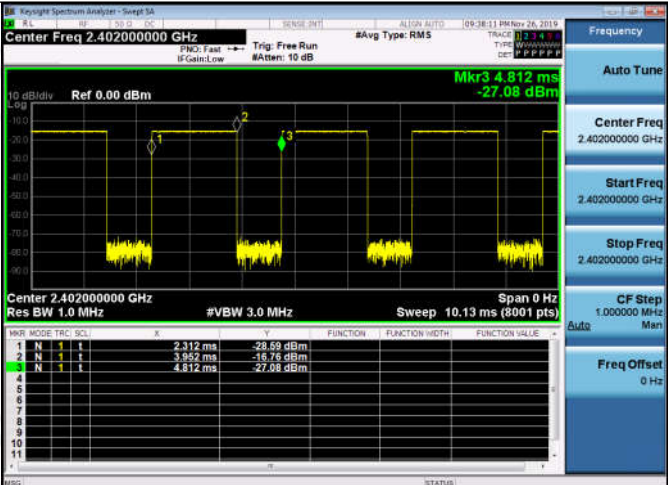
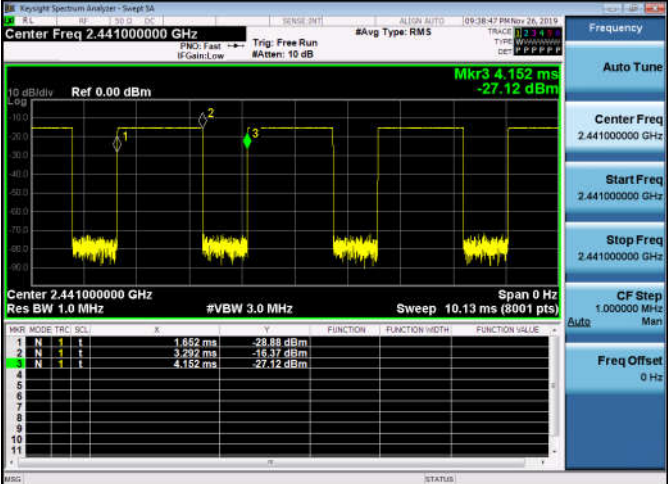
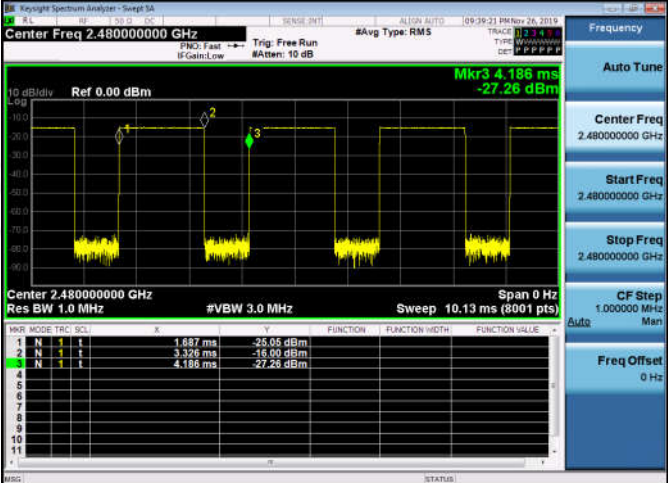


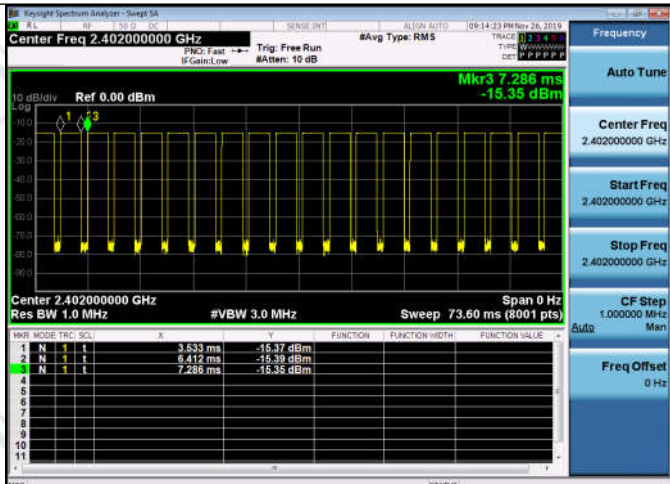
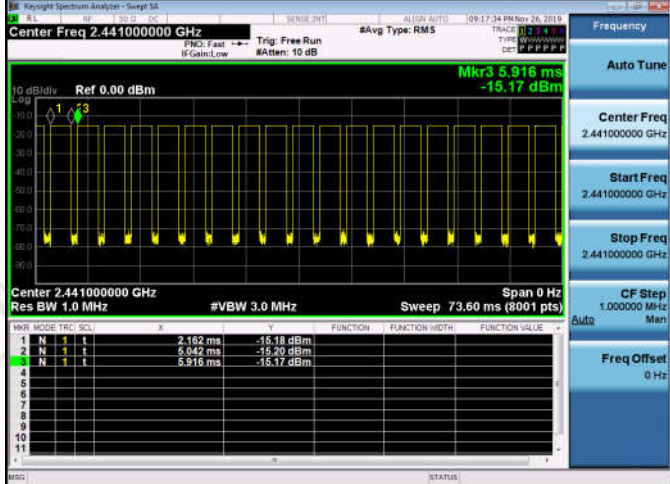
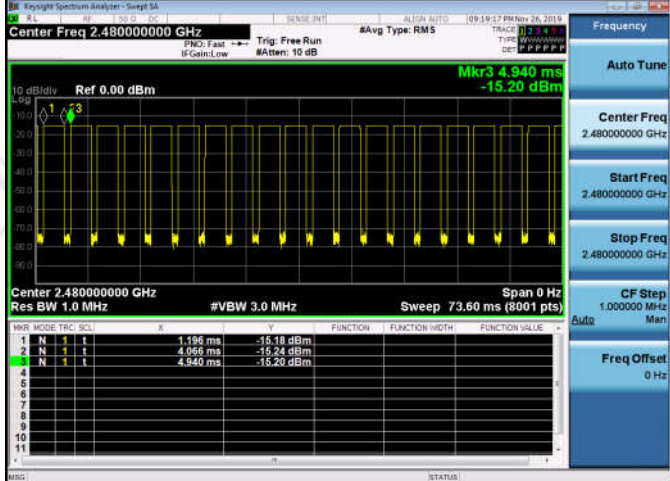
Result Table

Mode	Packet	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Duty Cycle [%]	Verdict
GFSK	DH1	LCH	0.3838	320	0.123	0.31	PASS
GFSK	DH1	MCH	0.383797	320	0.123	0.31	PASS
GFSK	DH1	HCH	0.3838	320	0.123	0.31	PASS
GFSK	DH3	LCH	1.64033	160	0.262	0.66	PASS
GFSK	DH3	MCH	1.64034	160	0.262	0.66	PASS
GFSK	DH3	HCH	1.63907	160	0.262	0.66	PASS
GFSK	DH5	LCH	2.8796	106.7	0.307	0.77	PASS
GFSK	DH5	MCH	2.8796	106.7	0.307	0.77	PASS
GFSK	DH5	HCH	2.8704	106.7	0.306	0.77	PASS

Test Graph



GFSK_DH3/LCH	
GFSK_DH3/MCH	
GFSK_DH3/HCH	

GFSK_DH5/LCH	 Center Freq 2.402000000 GHz Ref 0.00 dBm Mkr3 7.286 ms -15.35 dBm <table><thead><tr><th>Mkr</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></thead><tbody><tr><td>1</td><td>N</td><td>1</td><td>1</td><td>3.633 ms</td><td>-15.37 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>1</td><td>6.412 ms</td><td>-15.39 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>1</td><td>7.286 ms</td><td>-15.35 dBm</td><td></td><td></td><td></td></tr></tbody></table>	Mkr	Mode	Trc	Scl	X	Y	Function	Function Width	Function Value	1	N	1	1	3.633 ms	-15.37 dBm				2	N	1	1	6.412 ms	-15.39 dBm				3	N	1	1	7.286 ms	-15.35 dBm			
Mkr	Mode	Trc	Scl	X	Y	Function	Function Width	Function Value																													
1	N	1	1	3.633 ms	-15.37 dBm																																
2	N	1	1	6.412 ms	-15.39 dBm																																
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GFSK_DH5/MCH	 Center Freq 2.441000000 GHz Ref 0.00 dBm Mkr3 5.916 ms -15.17 dBm <table><thead><tr><th>Mkr</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></thead><tbody><tr><td>1</td><td>N</td><td>1</td><td>1</td><td>2.162 ms</td><td>-15.18 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>1</td><td>5.042 ms</td><td>-15.20 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>1</td><td>5.916 ms</td><td>-15.17 dBm</td><td></td><td></td><td></td></tr></tbody></table>	Mkr	Mode	Trc	Scl	X	Y	Function	Function Width	Function Value	1	N	1	1	2.162 ms	-15.18 dBm				2	N	1	1	5.042 ms	-15.20 dBm				3	N	1	1	5.916 ms	-15.17 dBm			
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3	N	1	1	5.916 ms	-15.17 dBm																																
GFSK_DH5/HCH	 Center Freq 2.480000000 GHz Ref 0.00 dBm Mkr3 4.940 ms -15.20 dBm <table><thead><tr><th>Mkr</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></thead><tbody><tr><td>1</td><td>N</td><td>1</td><td>1</td><td>1.196 ms</td><td>-15.18 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>1</td><td>4.066 ms</td><td>-15.24 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>1</td><td>4.940 ms</td><td>-15.20 dBm</td><td></td><td></td><td></td></tr></tbody></table>	Mkr	Mode	Trc	Scl	X	Y	Function	Function Width	Function Value	1	N	1	1	1.196 ms	-15.18 dBm				2	N	1	1	4.066 ms	-15.24 dBm				3	N	1	1	4.940 ms	-15.20 dBm			
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1	N	1	1	1.196 ms	-15.18 dBm																																
2	N	1	1	4.066 ms	-15.24 dBm																																
3	N	1	1	4.940 ms	-15.20 dBm																																

Appendix D): Hopping Channel Number

Test Limit

According to §15.247(a)(1)(iii)

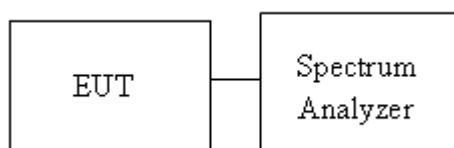
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

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.

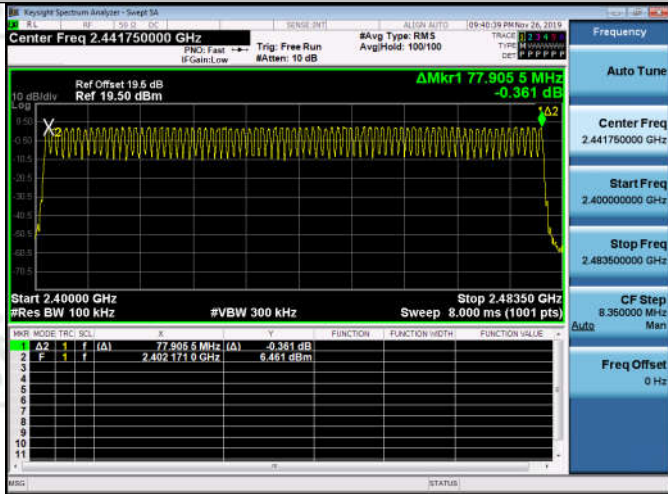
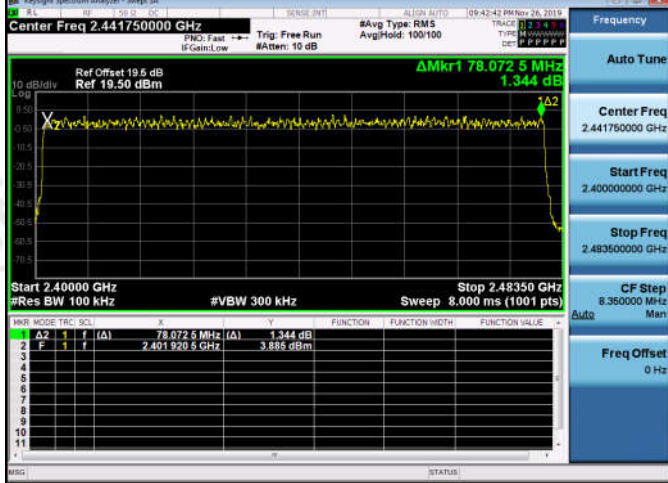
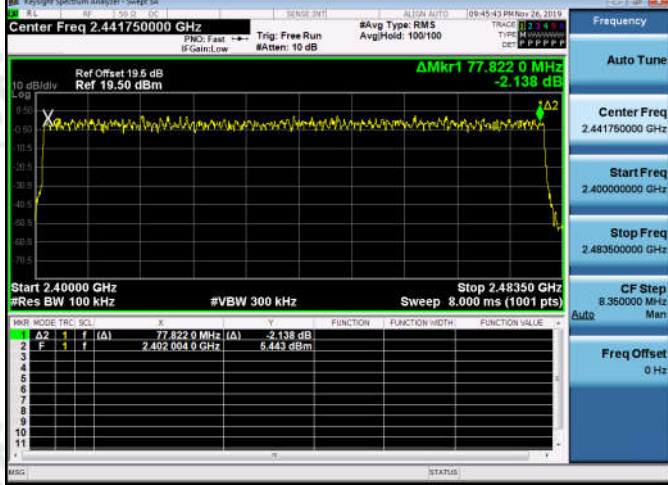
Test Setup



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

Graphs		
GFSK/Hop		
$\pi/4$ DQPSK/Hop		
8DPSK/Hop		

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.

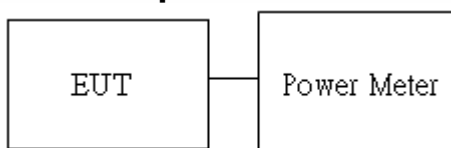
Limit	☒ Antenna not exceed 6 dBi : 21dBm ☐ Antenna with DG greater than 6 dBi : 21dBm [Limit = 30 – (DG – 6)]
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Average output power : For reporting purposes only.

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.

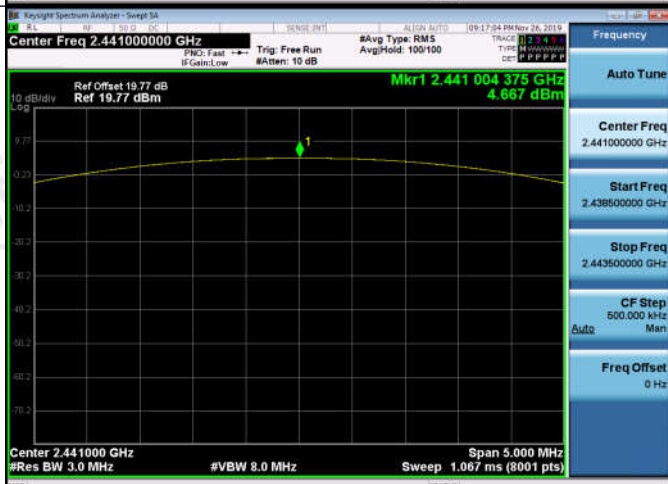
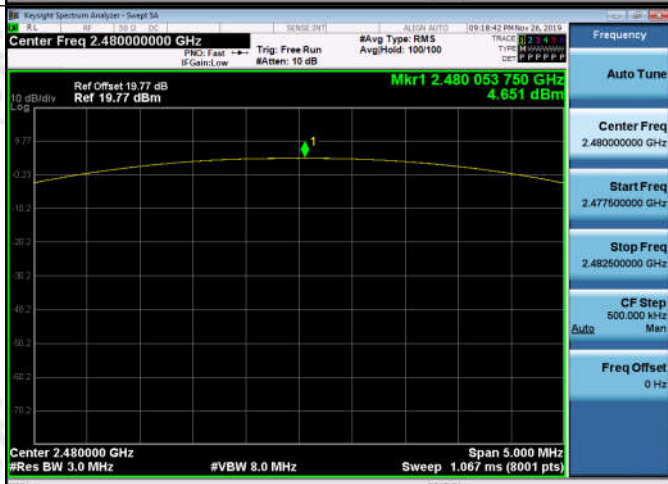
Test Setup

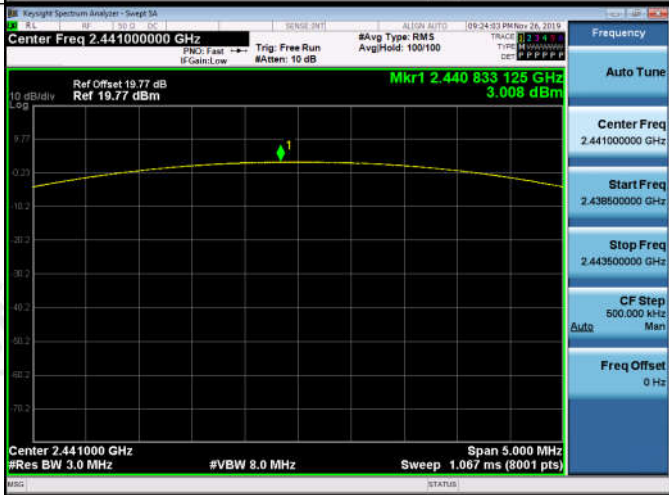
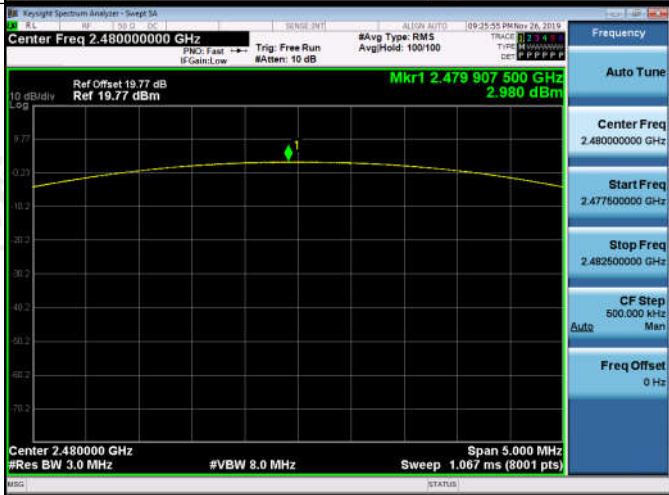


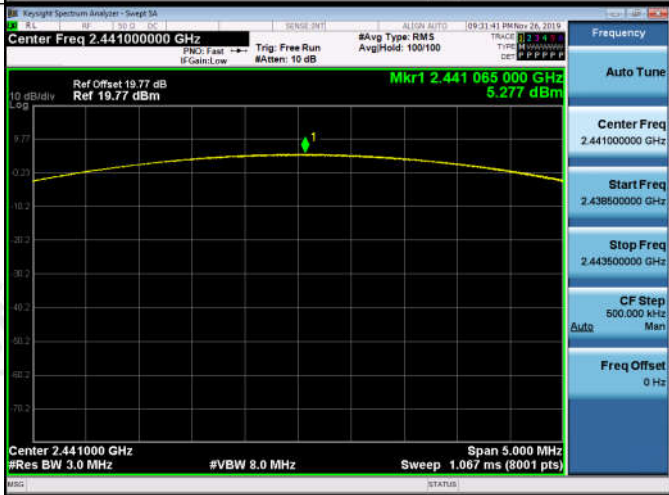
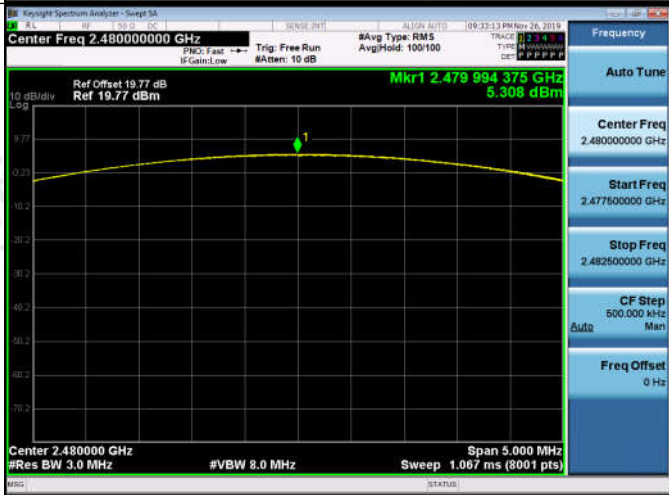
Result Table

Mode	Channel.	Maximum Peak Output Power [dBm]	Verdict
GFSK	LCH	4.209	PASS
GFSK	MCH	4.667	PASS
GFSK	HCH	4.651	PASS
$\pi/4$ DQPSK	LCH	2.522	PASS
$\pi/4$ DQPSK	MCH	3.008	PASS
$\pi/4$ DQPSK	HCH	2.980	PASS
8DPSK	LCH	4.828	PASS
8DPSK	MCH	5.277	PASS
8DPSK	HCH	5.308	PASS

Test Graph

Graphs	
GFSK/LCH	
GFSK/MCH	
GFSK/HCH	

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

8DPSK/LCH	
8DPSK/MCH	
8DPSK/HCH	

Appendix F): Band-edge for RF Conducted Emissions

Test Limit

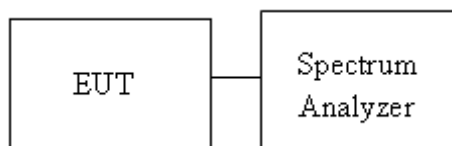
According to §15.247(d),

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

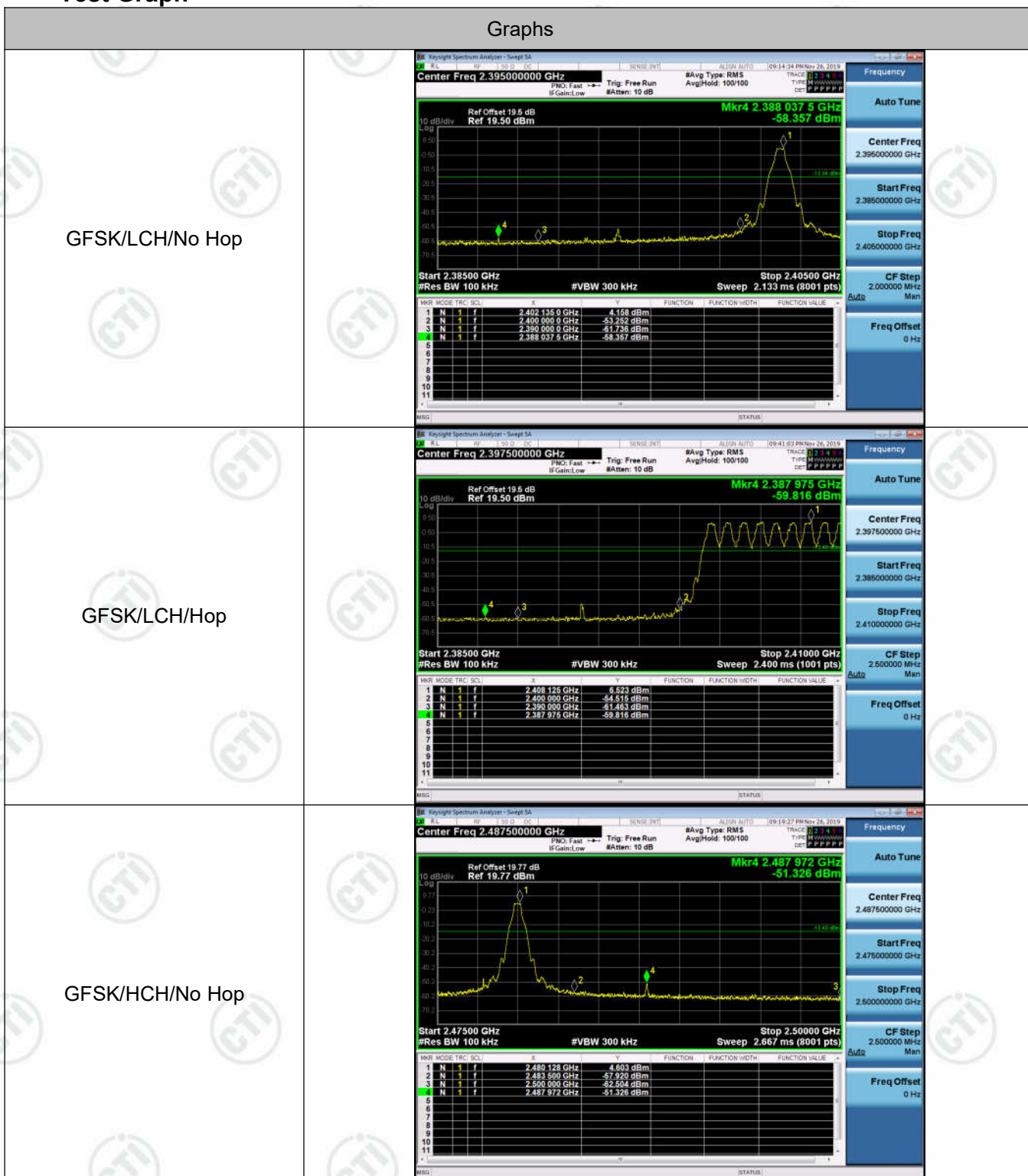


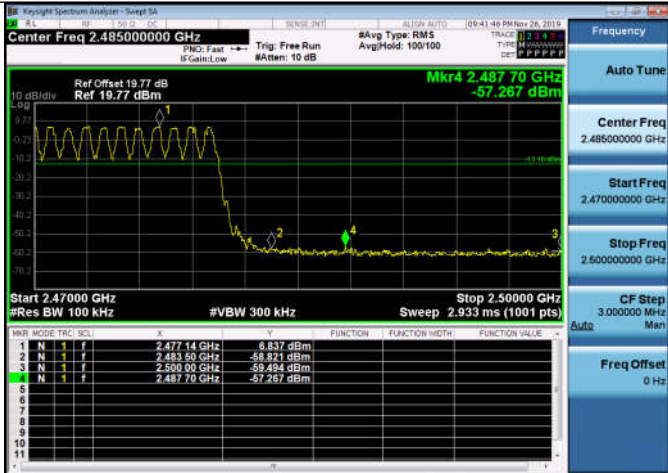
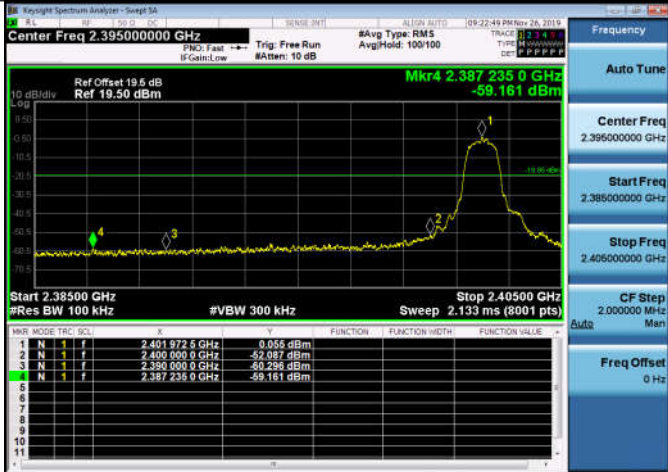
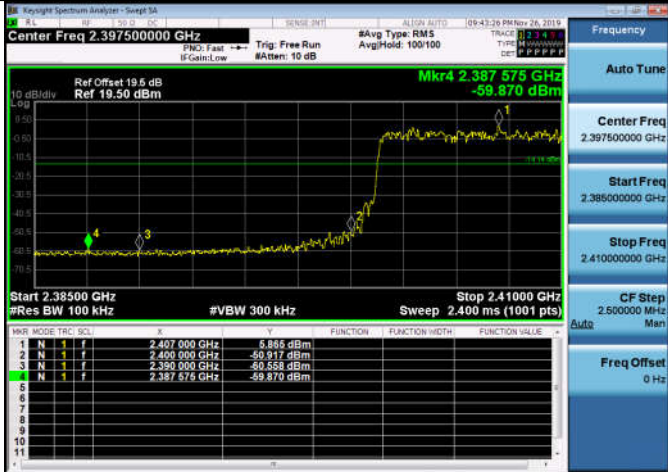
Result Table

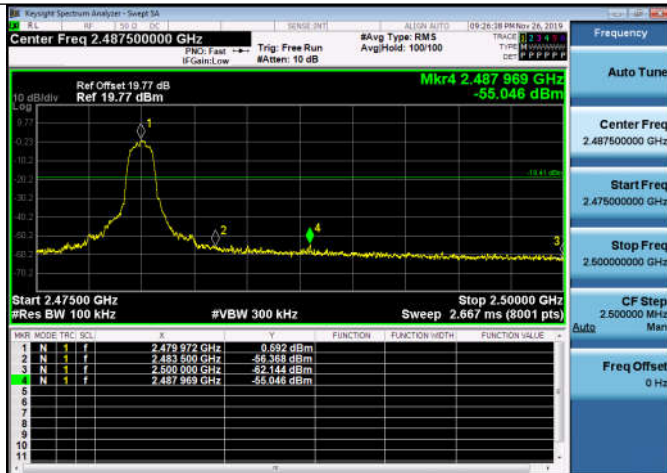
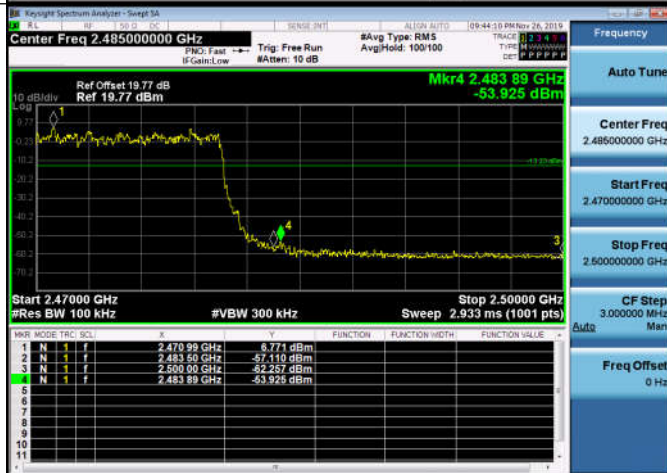
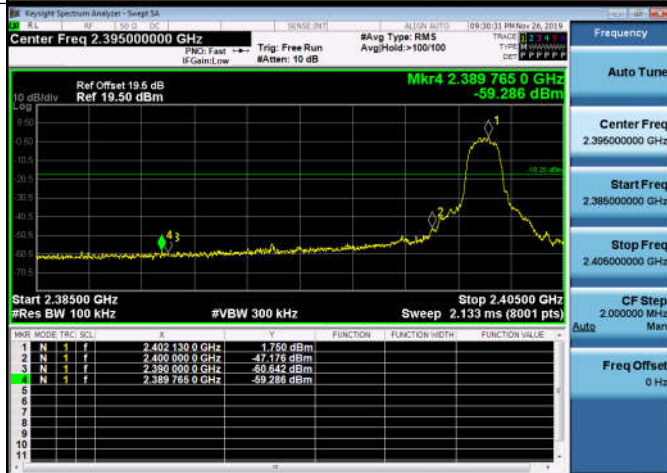
Mode	Channel	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max Spurious Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	2402	4.158	Off	-58.357	-15.84	PASS
			6.523	On	-59.816	-13.48	PASS
GFSK	HCH	2480	4.603	Off	-51.326	-15.4	PASS
			6.837	On	-57.267	-13.16	PASS
$\pi/4$ DQPSK	LCH	2402	0.055	Off	-59.161	-19.95	PASS
			5.865	On	-59.870	-14.14	PASS
$\pi/4$ DQPSK	HCH	2480	0.592	Off	-55.046	-19.41	PASS
			6.771	On	-53.925	-13.23	PASS
8DPSK	LCH	2402	1.750	Off	-59.286	-18.25	PASS
			6.247	On	-60.146	-13.75	PASS
8DPSK	HCH	2480	2.255	Off	-53.418	-17.75	PASS
			6.354	On	-49.779	-13.65	PASS

Test Graph

Graphs



GFSK/HCH/Hop	
$\pi/4$DQPSK/LCH/No Hop	
$\pi/4$DQPSK/LCH/Hop	

$\pi/4$ DQPSK/HCH/No Hop	 <table><tr><th>NR</th><th>MODE</th><th>TRC</th><th>SCL</th><th>F</th><th>F</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>N</td><td>1</td><td>f</td><td>2.479 972 GHz</td><td>-59.268 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>f</td><td>2.483 500 GHz</td><td>-52.144 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>f</td><td>2.487 969 GHz</td><td>-55.046 dBm</td><td></td><td></td><td></td></tr></table>	NR	MODE	TRC	SCL	F	F	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	f	2.479 972 GHz	-59.268 dBm				2	N	1	f	2.483 500 GHz	-52.144 dBm				3	N	1	f	2.487 969 GHz	-55.046 dBm			
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2	N	1	f	2.483 50 GHz	-52.257 dBm																																
3	N	1	f	2.485 89 GHz	-53.925 dBm																																
8DPSK/LCH/No Hop	 <table><tr><th>NR</th><th>MODE</th><th>TRC</th><th>SCL</th><th>F</th><th>F</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>N</td><td>1</td><td>f</td><td>2.402 130 GHz</td><td>-47.176 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>f</td><td>2.380 000 GHz</td><td>-60.842 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>f</td><td>2.389 765 GHz</td><td>-59.286 dBm</td><td></td><td></td><td></td></tr></table>	NR	MODE	TRC	SCL	F	F	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	f	2.402 130 GHz	-47.176 dBm				2	N	1	f	2.380 000 GHz	-60.842 dBm				3	N	1	f	2.389 765 GHz	-59.286 dBm			
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Appendix G): RF Conducted Spurious Emissions

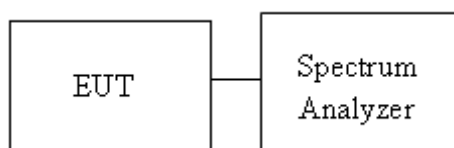
Test Limit
According to §15.247(d),

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	4.101	<Limit	PASS
GFSK	MCH	4.614	<Limit	PASS
GFSK	HCH	4.521	<Limit	PASS
$\pi/4$ DQPSK	LCH	-0.056	<Limit	PASS
$\pi/4$ DQPSK	MCH	0.48	<Limit	PASS
$\pi/4$ DQPSK	HCH	0.291	<Limit	PASS
8DPSK	LCH	1.642	<Limit	PASS
8DPSK	MCH	2.128	<Limit	PASS
8DPSK	HCH	2.211	<Limit	PASS

Test Graph

