

TEST REPORT

Product : 7.85"Tablet PC
Trade mark : DragonTouch, KINGPAD, KINGSLIM, AKASO
Model/Type reference : X80, X8, X80 PLUS, X80 PRO, X8 PLUS,
X8 PRO, X8 KIDS, X80 KIDS
Serial Number : N/A
Report Number : EED32I00298701
FCC ID : S5V-D08X80
Date of Issue : Feb. 08, 2017
Test Standards : 47 CFR Part 15 Subpart C (2015)
Test result : PASS

Prepared for:

Proexpress Distributor LLC

**11011 Greenwood Ave N 11011 Greenwood Ave N, Seattle Washington
United States**

Prepared by:

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Feb. 08, 2017



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Check No.: 2496574422

2 Version

Version No.	Date	Description
00	Feb. 08, 2017	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

Remark:

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

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

Model No.: X80, X8, X80 PLUS, X80 PRO, X8 PLUS, X8 PRO, X8 KIDS, X80 KIDS

Only the model X80 was tested, since the PCB, Schematic, Hardware etc were identical for the above models, X80, X8, X80 PLUS, X80 PRO, X8 PLUS, X8 PRO, X8 KIDS, X80 KIDS are named differently due to difference agent and marketing purposes.

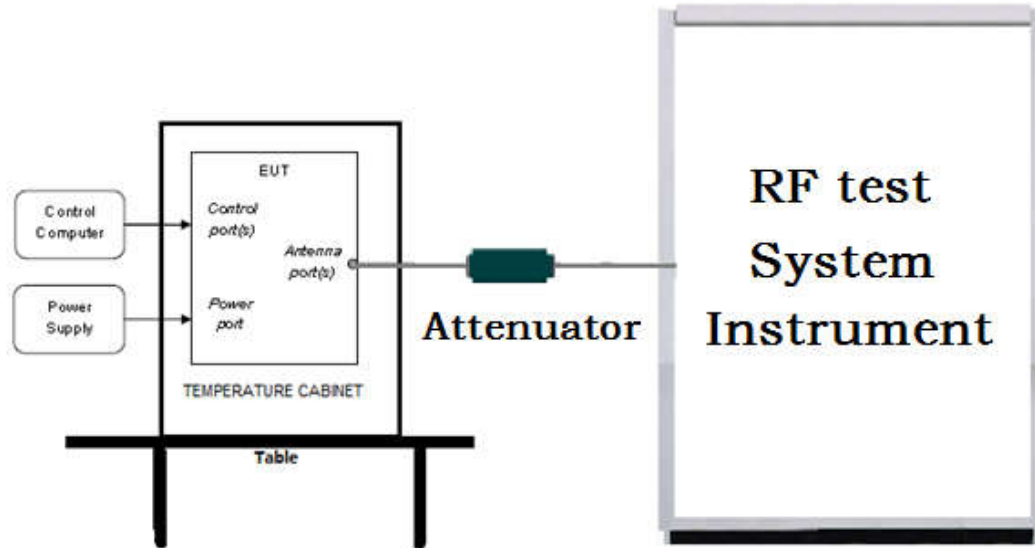
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5 Test Requirement

5.1 Test setup

5.1.1 For Conducted test setup



5.1.2 For Radiated Emissions test setup

Radiated Emissions setup:

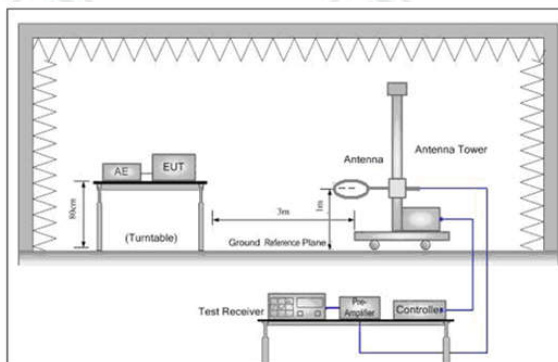


Figure 1. Below 30MHz

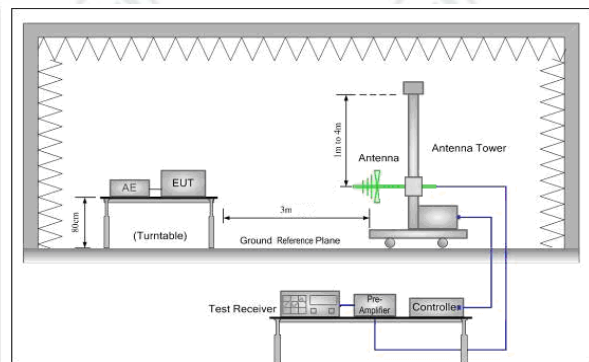


Figure 2. 30MHz to 1GHz

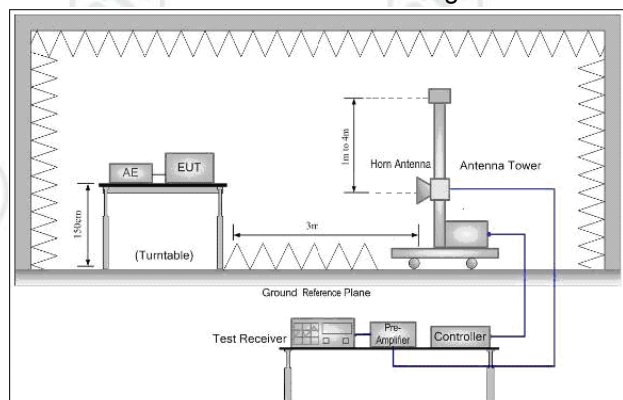
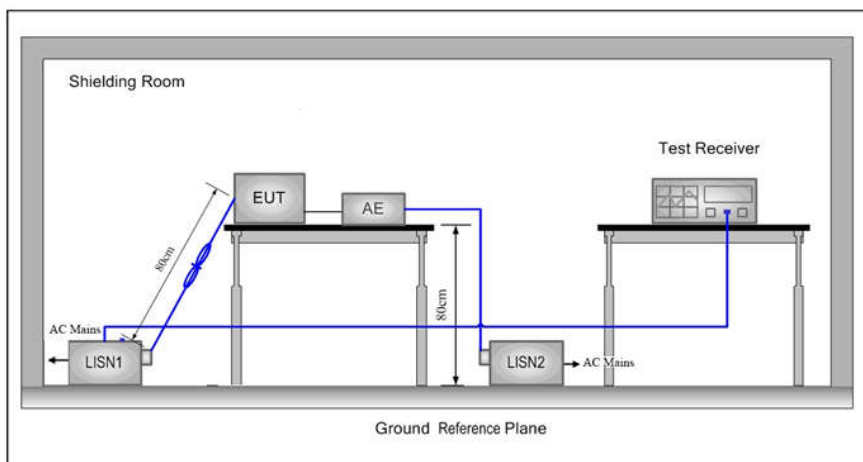


Figure 3. Above 1GHz

5.1.3 For Conducted Emissions test setup

Conducted Emissions setup



5.2 Test Environment

Operating Environment:	
Temperature:	23 °C
Humidity:	54% RH
Atmospheric Pressure:	1010mbar

5.3 Test Condition

Test Mode	Tx	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
TX mode:	The EUT transmitted the continuous modulation test signal at the specific channel(s).			

Test mode:

Pre-scan under all rate at Highest channel 79

Mode	GFSK		
packets	1-DH1	1-DH3	1-DH5
Power(dBm)	1.691	2.213	2.829

Mode	π /4DQPSK		
packets	2-DH1	2-DH3	2-DH5
Power(dBm)	2.918	3.505	4.157
Mode	8DPSK		
packets	3-DH1	3-DH3	3-DH5
Power(dBm)	3.317	3.875	4.536

Through Pre-scan, 1-DH5 packet the power is the worst case of GFSK, 2-DH5 packet the power is the worst case of π /4DQPSK, 3-DH5 packet the power is the worst case of 8DPSK.

6 General Information

6.1 Client Information

Applicant:	Proexpress Distributor LLC
Address of Applicant:	11011 Greenwood Ave N 11011 Greenwood Ave N, Seattle Washington United States
Manufacturer:	Proexpress Distributor LLC
Address of Manufacturer:	11011 Greenwood Ave N 11011 Greenwood Ave N, Seattle Washington United States
Factory:	Proexpress Distributor LLC
Address of Factory:	11011 Greenwood Ave N 11011 Greenwood Ave N, Seattle Washington United States

6.2 General Description of EUT

Product Name:	7.85"Tablet PC
Model No.:	X80, X8, X80 PLUS, X80 PRO, X8 PLUS, X8 PRO, X8 KIDS, X80 KIDS
Test Model No.:	X80
Trade Mark:	DragonTouch, KINGPAD, KINGSLIM, AKASO
EUT Supports Radios application:	Wlan 2.4GHz 802.11b/g/n(HT20and HT40), Bluetooth V3.0+EDR
AC adapter:	Model: GS-0500200A Input: 100-240VAC 50/60Hz Output: DC5V $\overline{\sim}$ 2000mA
Sample Received Date:	Nov.18, 2016
Sample tested Date:	Nov.18, 2016 to Jan. 24, 2017

6.3 Product Specification subjective to this standard

Operation Frequency:	2402MHz~2480MHz						
Bluetooth Version:	3.0+EDR						
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						
Sample Type:	Portable production						
Test power grade:	BT3.0: 3 (manufacturer declare)						
Test software of EUT:	SoFia RFTestTool V1.1(manufacturer declare)						
Antenna Type:	PIFA antenna						
Antenna Gain:	0dBi						
Test Voltage:	AC 120V/60Hz						
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, China 518101

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

No tests were sub-contracted.

6.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L1910

Centre Testing International Group Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories..

A2LA-Lab Cert. No. 3061.01

Centre Testing International Group Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 886427

Centre Testing International Group Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 886427.

IC-Registration No.: 7408A-2

The 3m Alternate Test Site of Centre Testing International Group Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 7408A-2 .

IC-Registration No.: 7408B-1

The 10m Alternate Test Site of Centre Testing International Group Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 7408B-1.

NEMKO-Aut. No.: ELA503

Centre Testing International Group Co., Ltd. has been assessed the quality assurance system, the testing facilities, qualifications and testing practices of the relevant parts of the organization. The quality assurance system of the Laboratory has been validated against ISO/IEC 17025 or equivalent. The laboratory also fulfils the conditions described in Nemko Document NLA-10.

VCCI

The Radiation 3 &10 meters site of Centre Testing International Group Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-4096.

Main Ports Conducted Interference Measurement of Centre Testing International Group Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: C-4563.

Telecommunication Ports Conducted Disturbance Measurement of Centre Testing International Group Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: T-2146.

The Radiation 3 meters site of Centre Testing International Group Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-758

6.7 Deviation from Standards

None.

6.8 Abnormalities from Standard Conditions

None.

6.9 Other Information Requested by the Customer

None.

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

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.9×10^{-8}
2	RF power, conducted	0.31dB (30MHz-1GHz)
		0.57dB (1GHz-18GHz)
3	Radiated Spurious emission test	4.5dB (30MHz-1GHz)
		4.8dB (1GHz-12.75GHz)
4	Conduction emission	3.6dB (9kHz to 150kHz)
		3.2dB (150kHz to 30MHz)
5	Temperature test	0.64°C
6	Humidity test	2.8%
7	DC power voltages	0.025%

7 Equipment List

RF test system					
Equipment	Manufacturer	Mode No.	Serial Number	Cal. Date (mm-dd-yyyy)	Cal. Due date (mm-dd-yyyy)
Signal Generator	Keysight	E8257D	MY53401106	04-01-2016	03-31-2017
Spectrum Analyzer	Keysight	N9010A	MY54510339	04-01-2016	03-31-2017
Signal Generator	Keysight	N5182B	MY53051549	04-01-2016	03-31-2017
DC Power	Keysight	E3642A	MY54436035	04-01-2016	03-31-2017
PC-1	Lenovo	R4960d	---	04-01-2016	03-31-2017
power meter & power sensor	R&S	OSP120	101374	04-01-2016	03-31-2017
RF control unit	JS Tonscend	JS0806-2	158060006	04-01-2016	03-31-2017
BT&WI-FI Automatic test software	JS Tonscend	JS1120-2	---	04-01-2016	03-31-2017

Conducted disturbance Test					
Equipment	Manufacturer	Mode No.	Serial Number	Cal. date (mm-dd-yyyy)	Cal. Due date (mm-dd-yyyy)
Receiver	R&S	ESCI	100009	06-16-2016	06-15-2017
Temperature/ Humidity Indicator	TAYLOR	1451	1905	04-27-2016	04-26-2017
LISN	R&S	ENV216	100098	06-16-2016	06-15-2017
LISN	schwarzbeck	NNLK8121	8121-529	06-16-2016	06-15-2017
Voltage Probe	R&S	ESH2-Z3	--	07-09-2014	07-07-2017
Current Probe	R&S	EZ17	100106	06-16-2016	06-15-2017
ISN	TESEQ GmbH	ISN T800	30297	01-29-2015	01-27-2017

3M Semi/full-anechoic Chamber					
Equipment	Manufacturer	Mode No.	Serial Number	Cal. date (mm-dd-yyyy)	Cal. Due date (mm-dd-yyyy)
3M Chamber & Accessory Equipment	TDK	SAC-3	---	06-05-2016	06-05-2019
TRILOG Broadband Antenna	SCHWARZBECK	VULB9163	9163-484	05-23-2016	05-22-2017
Microwave Preamplifier	Agilent	8449B	3008A02425	02-04-2016	02-03-2017
Horn Antenna	ETS-LINDGREN	3117	00057407	07-20-2015	07-18-2018
Loop Antenna	ETS	6502	00071730	07-30-2015	07-28-2017
Spectrum Analyzer	R&S	FSP40	100416	06-16-2016	06-15-2017
Receiver	R&S	ESCI	100435	06-16-2016	06-15-2017
Multi device Controller	maturo	NCD/070/10711 112	---	01-10-2017	01-09-2018
LISN	schwarzbeck	NNBM8125	81251547	06-16-2016	06-15-2017
LISN	schwarzbeck	NNBM8125	81251548	06-16-2016	06-15-2017
Signal Generator	Agilent	E4438C	MY45095744	04-01-2016	03-31-2017
Signal Generator	Keysight	E8257D	MY53401106	04-01-2016	03-31-2017
Temperature/ Humidity Indicator	TAYLOR	1451	1905	04-27-2016	04-26-2017
Cable line	Fulai(7M)	SF106	5219/6A	01-10-2017	01-09-2018
Cable line	Fulai(6M)	SF106	5220/6A	01-10-2017	01-09-2018
Cable line	Fulai(3M)	SF106	5216/6A	01-10-2017	01-09-2018
Cable line	Fulai(3M)	SF106	5217/6A	01-10-2017	01-09-2018
High-pass filter	Sinoscite	FL3CX03WG18 NM12-0398-002	---	01-10-2017	01-09-2018
High-pass filter	MICRO-TRONICS	SPA-F-63029-4	---	01-10-2017	01-09-2018
band rejection filter	Sinoscite	FL5CX01CA09 CL12-0395-001	---	01-10-2017	01-09-2018
band rejection filter	Sinoscite	FL5CX01CA08 CL12-0393-001	---	01-10-2017	01-09-2018
band rejection filter	Sinoscite	FL5CX02CA04 CL12-0396-002	---	01-10-2017	01-09-2018
band rejection filter	Sinoscite	FL5CX02CA03 CL12-0394-001	---	01-10-2017	01-09-2018

8 Radio Technical Requirements Specification

Reference documents for testing:

No.	Identity	Document Title
1	FCC Part15C (2015)	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 Section15.247 (a)(1)	ANSI 63.10	20dB Occupied Bandwidth	PASS	Appendix A)
Part15C Section15.247 (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 Section15.247 (b)	ANSI 63.10	Hopping Channel Number	PASS	Appendix D)
Part15C Section15.247 (b)(1)	ANSI 63.10	Conducted Peak Output Power	PASS	Appendix E)
Part15C Section15.247(d)	ANSI 63.10	Band-edge for RF Conducted Emissions	PASS	Appendix F)
Part15C Section15.247(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 Section15.207	ANSI 63.10	AC Power Line Conducted Emission	PASS	Appendix J)
Part15C Section 15.205/15.209	ANSI 63.10	Restricted bands around fundamental frequency (Radiated) Emission	PASS	Appendix K)
Part15C Section 15.205/15.209	ANSI 63.10	Radiated Spurious Emissions	PASS	Appendix L)

Appendix A): 20dB Occupied Bandwidth

Test Result

Mode	Channel.	20dB Bandwidth [MHz]	99% OBW [MHz]	Verdict
GFSK	LCH	1.028	0.92073	PASS
GFSK	MCH	0.9847	0.91637	PASS
GFSK	HCH	0.9804	0.91697	PASS
$\pi/4$ DQPSK	LCH	1.288	1.1813	PASS
$\pi/4$ DQPSK	MCH	1.289	1.1813	PASS
$\pi/4$ DQPSK	HCH	1.291	1.1818	PASS
8DPSK	LCH	1.286	1.1797	PASS
8DPSK	MCH	1.291	1.1760	PASS
8DPSK	HCH	1.286	1.1777	PASS

Test Graph

Graphs

GFSK/LCH



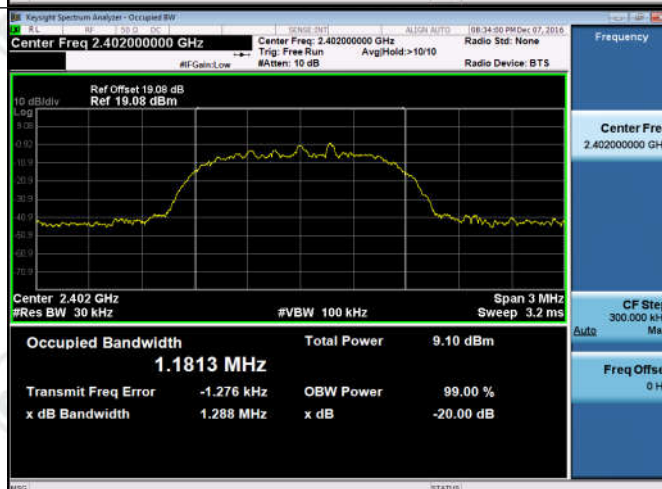
GFSK/MCH



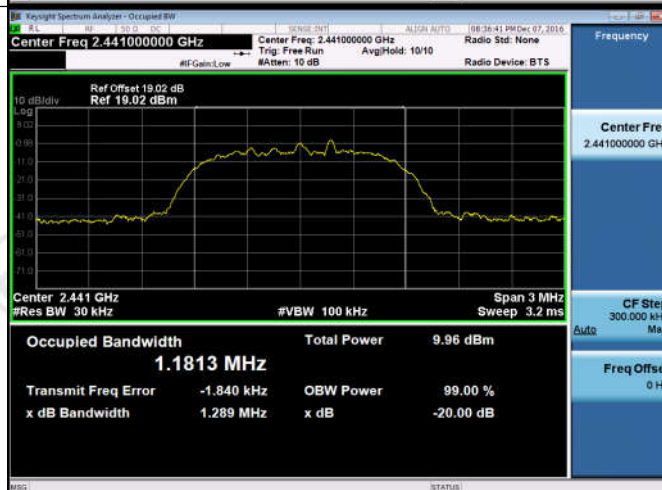
GFSK/HCH



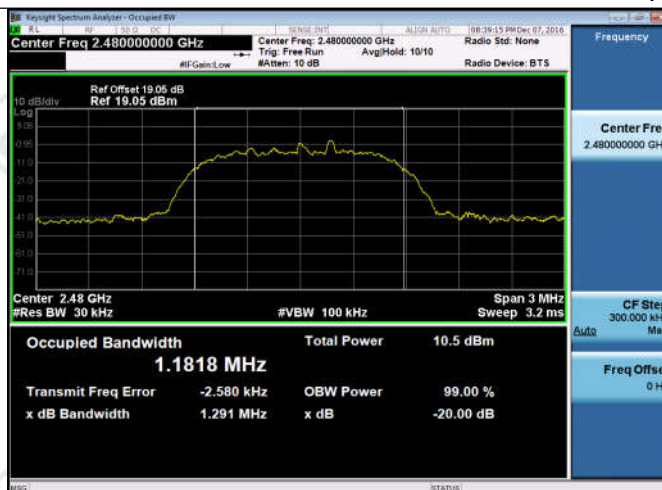
$\pi/4$ DQPSK/LCH



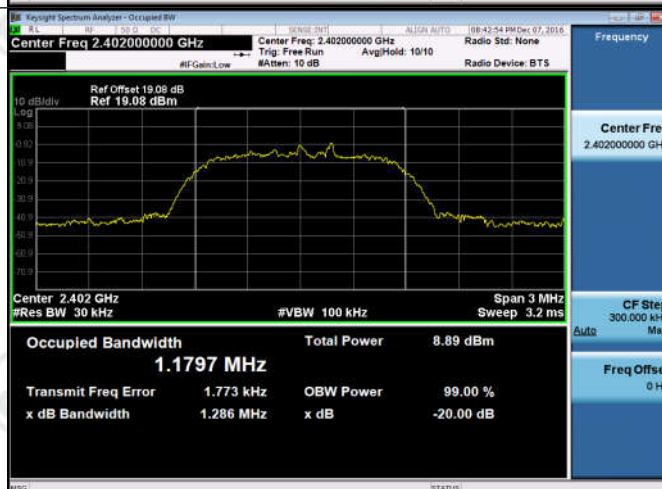
$\pi/4$ DQPSK/MCH



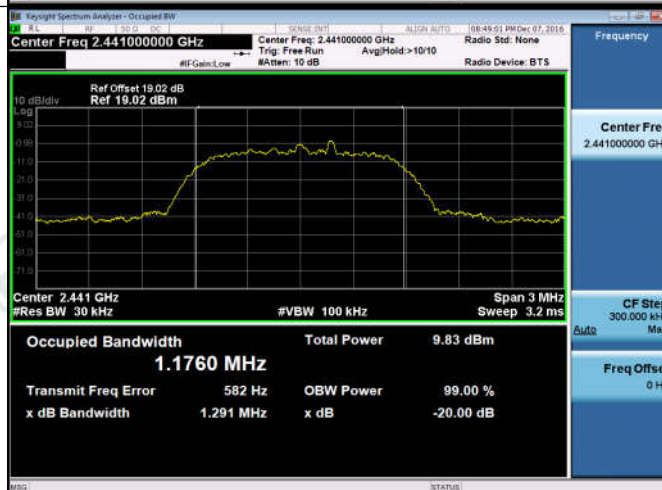
$\pi/4$ DQPSK/HCH



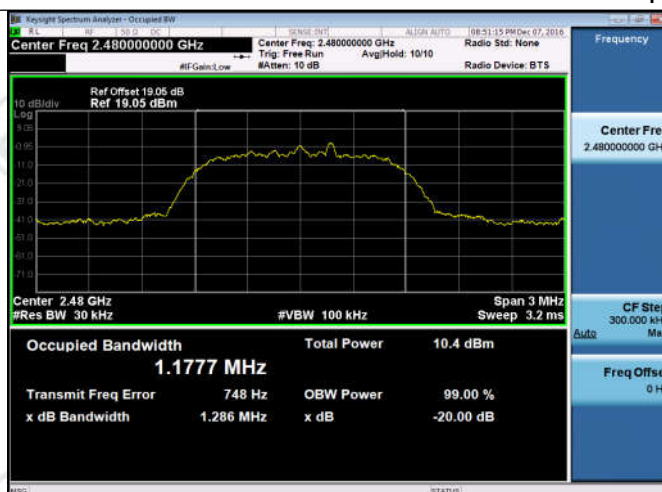
8DPSK/LCH



8DPSK/MCH



8DPSK/HCH



Appendix B): Carrier Frequency Separation

Result Table

Mode	Channel.	Carrier Frequency Separation [MHz]	Verdict
GFSK	LCH	1.180	PASS
GFSK	MCH	1.000	PASS
GFSK	HCH	1.000	PASS
$\pi/4$ DQPSK	LCH	1.118	PASS
$\pi/4$ DQPSK	MCH	0.920	PASS
$\pi/4$ DQPSK	HCH	0.972	PASS
8DPSK	LCH	1.146	PASS
8DPSK	MCH	1.118	PASS
8DPSK	HCH	1.022	PASS

Test Graph

Graphs

GFSK/LCH



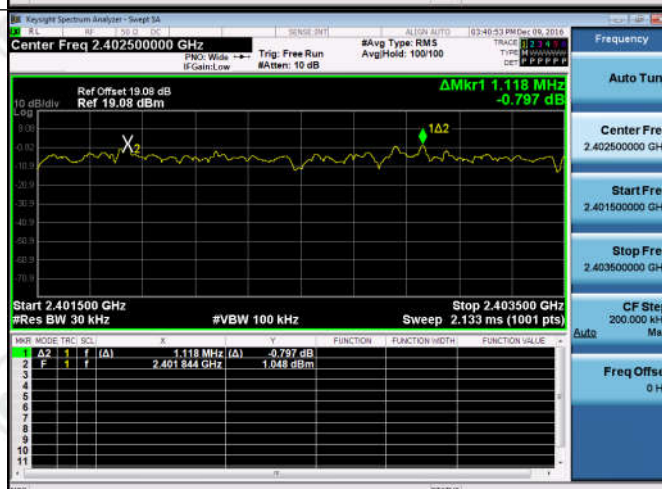
GFSK/MCH



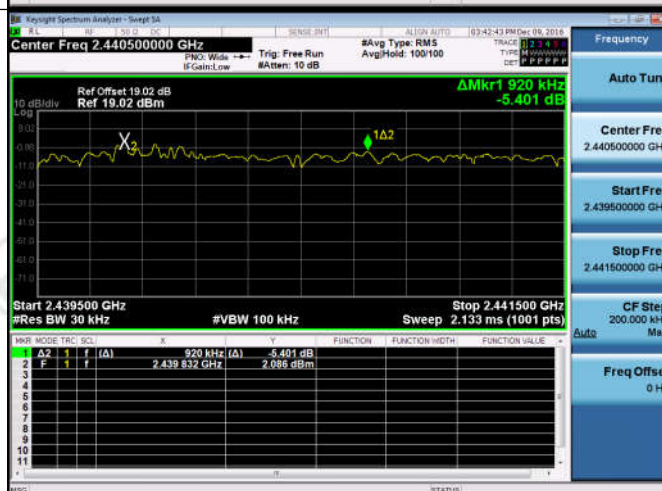
GFSK/HCH

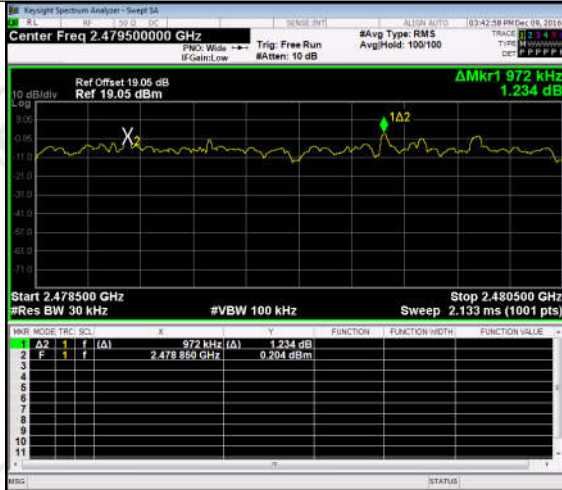
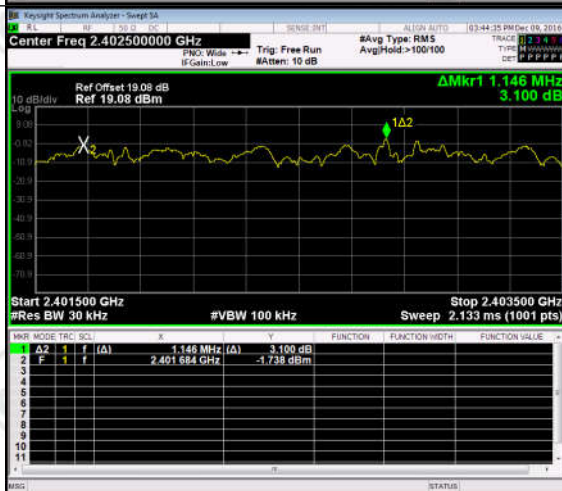
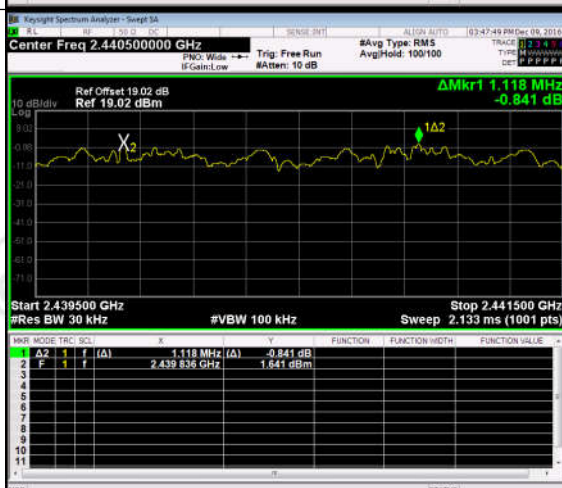


π /4DQPSK/LCH

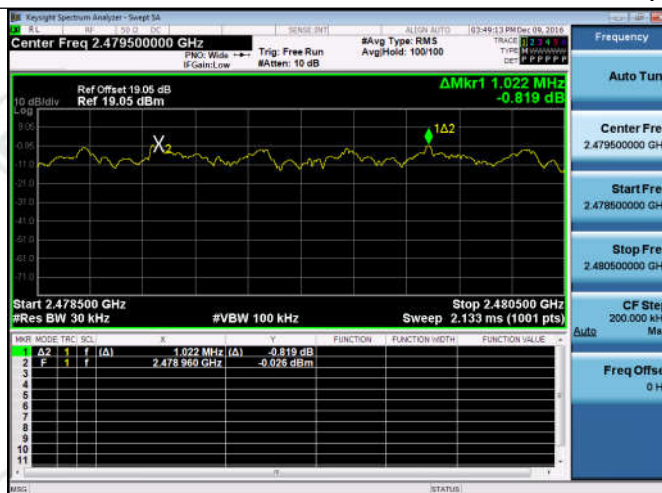


π /4DQPSK/MCH



$\pi/4$ DQPSK/HCH	 Center Freq 2.479500000 GHz Ref Offset 19.05 dB Ref 19.05 dBm ΔMkr1 972 kHz 1.234 dB Start 2.478500 GHz #VBW 100 kHz Stop 2.480500 GHz #Res BW 30 kHz Sweep 2.133 ms (1001 pts) <table><tr><th>NR</th><th>MODE</th><th>TRC</th><th>SCN</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION METH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>Δ2</td><td>1</td><td>f</td><td>(Δ)</td><td>972 kHz</td><td>(Δ)</td><td>1.234 dB</td><td></td></tr><tr><td>2</td><td>F</td><td>1</td><td>f</td><td>(Δ)</td><td>2.478 860 GHz</td><td></td><td>-0.204 dBm</td><td></td></tr></table>	NR	MODE	TRC	SCN	X	Y	FUNCTION	FUNCTION METH	FUNCTION VALUE	1	Δ2	1	f	(Δ)	972 kHz	(Δ)	1.234 dB		2	F	1	f	(Δ)	2.478 860 GHz		-0.204 dBm	
NR	MODE	TRC	SCN	X	Y	FUNCTION	FUNCTION METH	FUNCTION VALUE																				
1	Δ2	1	f	(Δ)	972 kHz	(Δ)	1.234 dB																					
2	F	1	f	(Δ)	2.478 860 GHz		-0.204 dBm																					
8DPSK/LCH	 Center Freq 2.402500000 GHz Ref Offset 19.08 dB Ref 19.08 dBm ΔMkr1 1.146 MHz 3.100 dB Start 2.401500 GHz #VBW 100 kHz Stop 2.403500 GHz #Res BW 30 kHz Sweep 2.133 ms (1001 pts) <table><tr><th>NR</th><th>MODE</th><th>TRC</th><th>SCN</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION METH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>Δ2</td><td>1</td><td>f</td><td>(Δ)</td><td>1.146 MHz</td><td>(Δ)</td><td>3.100 dB</td><td></td></tr><tr><td>2</td><td>F</td><td>1</td><td>f</td><td>(Δ)</td><td>2.401 684 GHz</td><td></td><td>-1.739 dBm</td><td></td></tr></table>	NR	MODE	TRC	SCN	X	Y	FUNCTION	FUNCTION METH	FUNCTION VALUE	1	Δ2	1	f	(Δ)	1.146 MHz	(Δ)	3.100 dB		2	F	1	f	(Δ)	2.401 684 GHz		-1.739 dBm	
NR	MODE	TRC	SCN	X	Y	FUNCTION	FUNCTION METH	FUNCTION VALUE																				
1	Δ2	1	f	(Δ)	1.146 MHz	(Δ)	3.100 dB																					
2	F	1	f	(Δ)	2.401 684 GHz		-1.739 dBm																					
8DPSK/MCH	 Center Freq 2.440500000 GHz Ref Offset 19.02 dB Ref 19.02 dBm ΔMkr1 1.118 MHz -0.841 dB Start 2.439500 GHz #VBW 100 kHz Stop 2.441500 GHz #Res BW 30 kHz Sweep 2.133 ms (1001 pts) <table><tr><th>NR</th><th>MODE</th><th>TRC</th><th>SCN</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION METH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>Δ2</td><td>1</td><td>f</td><td>(Δ)</td><td>1.118 MHz</td><td>(Δ)</td><td>-0.841 dB</td><td></td></tr><tr><td>2</td><td>F</td><td>1</td><td>f</td><td>(Δ)</td><td>2.439 839 GHz</td><td></td><td>-1.641 dBm</td><td></td></tr></table>	NR	MODE	TRC	SCN	X	Y	FUNCTION	FUNCTION METH	FUNCTION VALUE	1	Δ2	1	f	(Δ)	1.118 MHz	(Δ)	-0.841 dB		2	F	1	f	(Δ)	2.439 839 GHz		-1.641 dBm	
NR	MODE	TRC	SCN	X	Y	FUNCTION	FUNCTION METH	FUNCTION VALUE																				
1	Δ2	1	f	(Δ)	1.118 MHz	(Δ)	-0.841 dB																					
2	F	1	f	(Δ)	2.439 839 GHz		-1.641 dBm																					

8DPSK/HCH

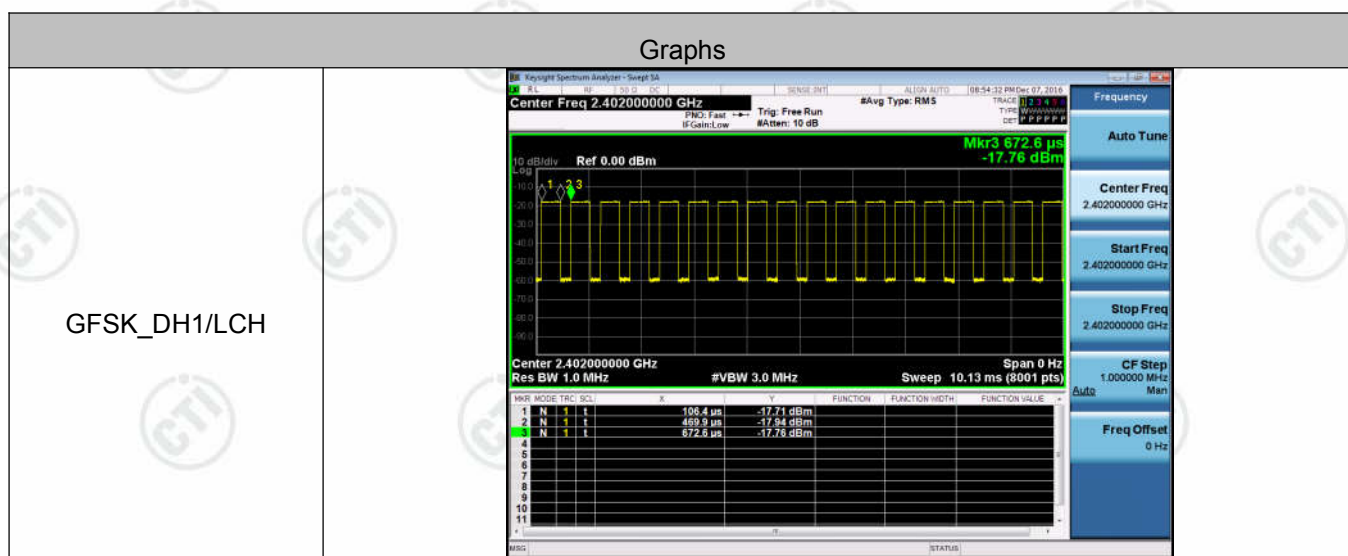


Appendix C): Dwell Time

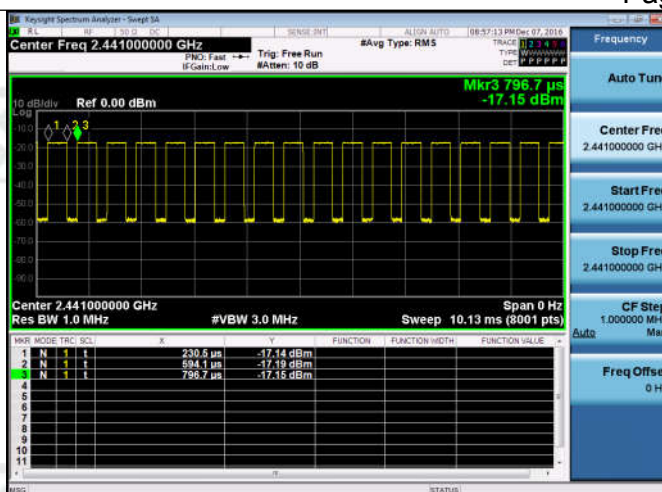
Result Table

Mode	Packet	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Duty Cycle [%]	Verdict
GFSK	DH1	LCH	0.363533	320	0.116	0.64	PASS
GFSK	DH1	MCH	0.363534	320	0.116	0.64	PASS
GFSK	DH1	HCH	0.3635333	320	0.116	0.64	PASS
GFSK	DH3	LCH	1.620063	160	0.259	0.89	PASS
GFSK	DH3	MCH	1.620063	160	0.259	0.89	PASS
GFSK	DH3	HCH	1.618803	160	0.259	0.89	PASS
GFSK	DH5	LCH	2.86773	106.7	0.306	0.93	PASS
GFSK	DH5	MCH	2.866467	106.7	0.306	0.93	PASS
GFSK	DH5	HCH	2.866467	106.7	0.306	0.93	PASS

Test Graph



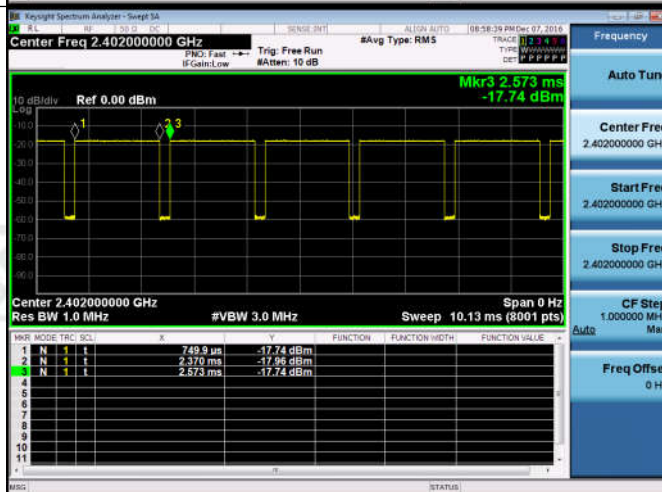
GFSK_DH1/MCH



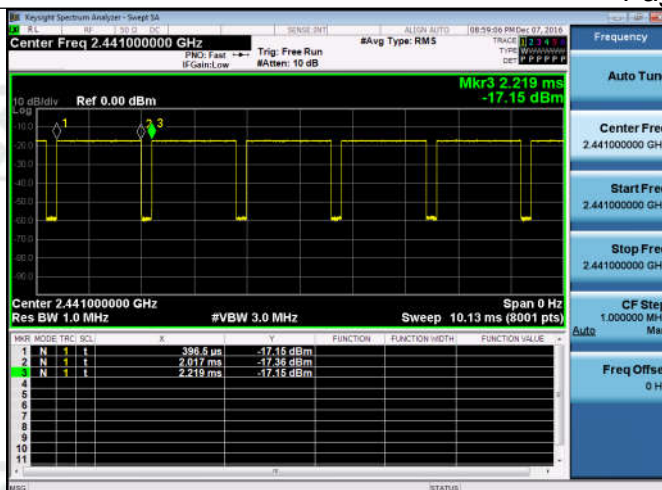
GFSK_DH1/HCH



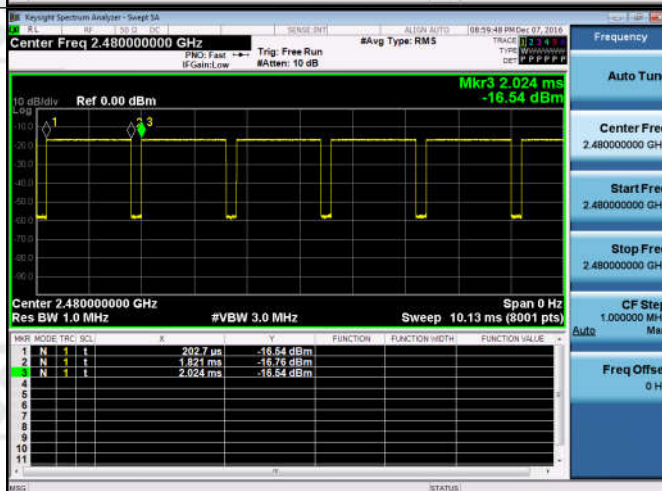
GFSK_DH3/LCH



GFSK_DH3/MCH



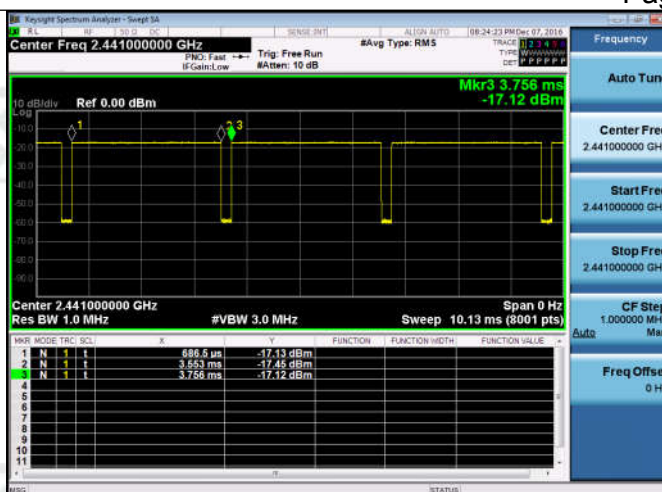
GFSK_DH3/HCH



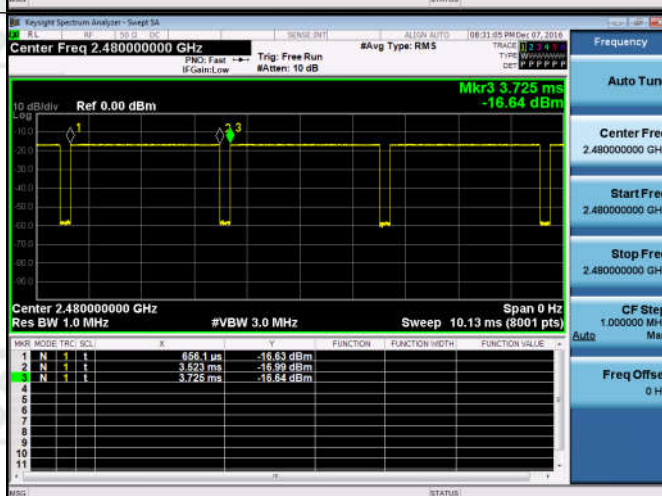
GFSK_DH5/LCH



GFSK_DH5/MCH



GFSK_DH5/HCH

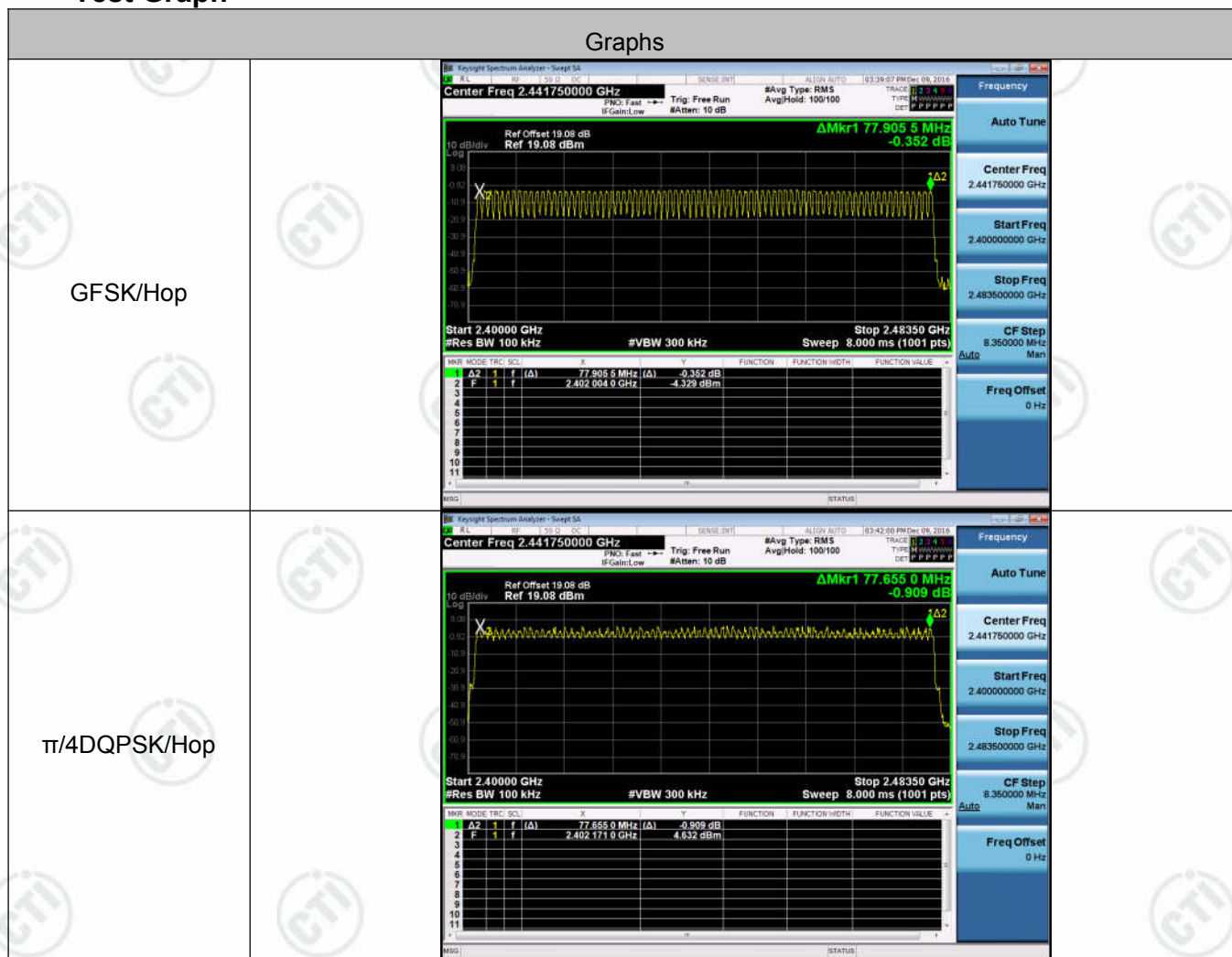


Appendix D): Hopping Channel Number

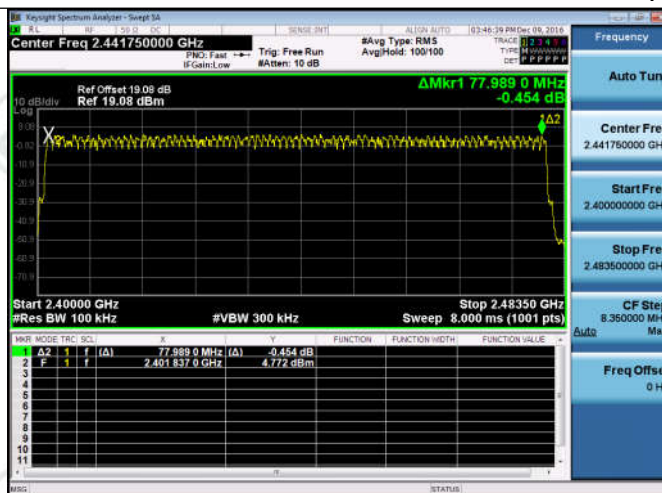
Result Table

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

Test Graph



8DPSK/Hop

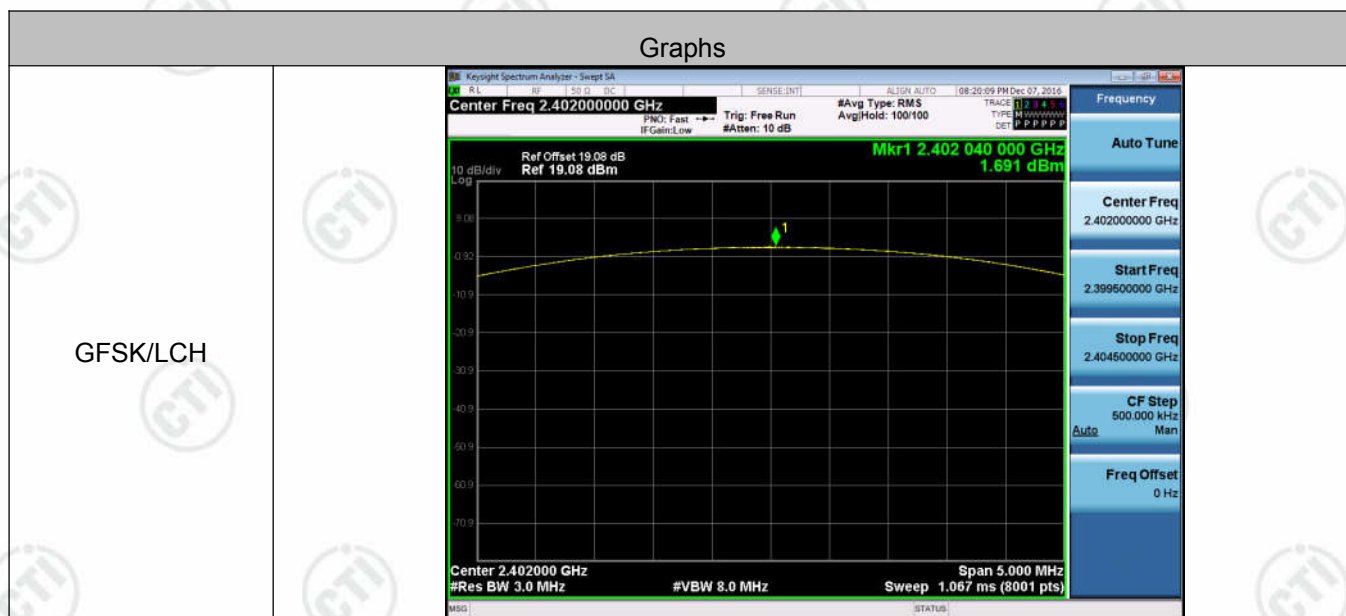


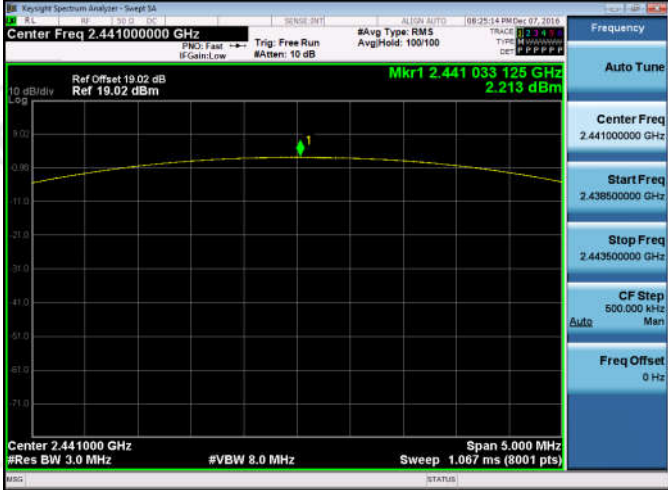
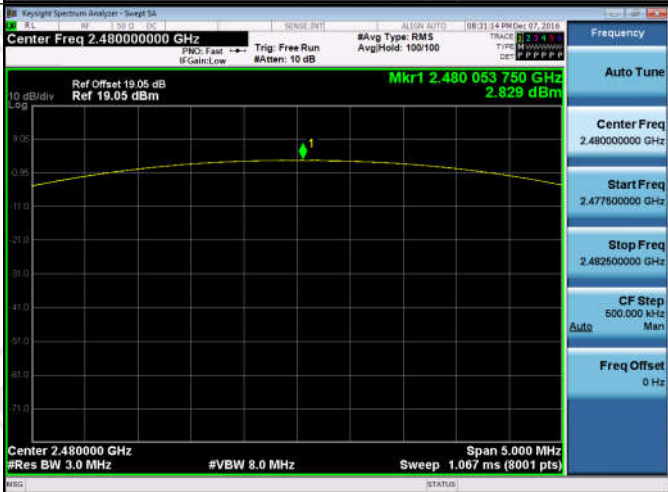
Appendix E): Conducted Peak Output Power

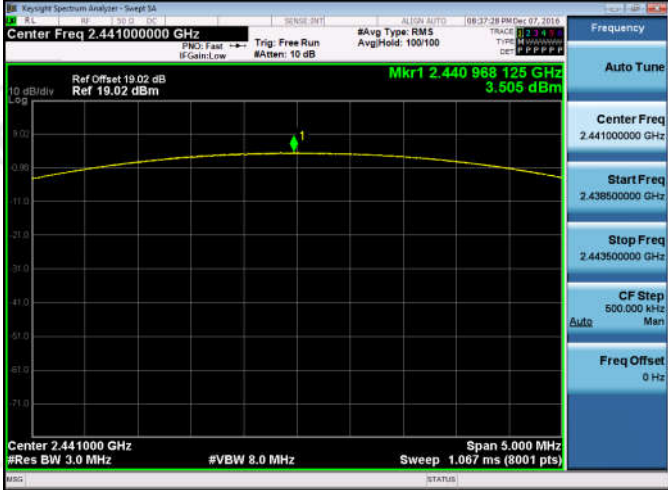
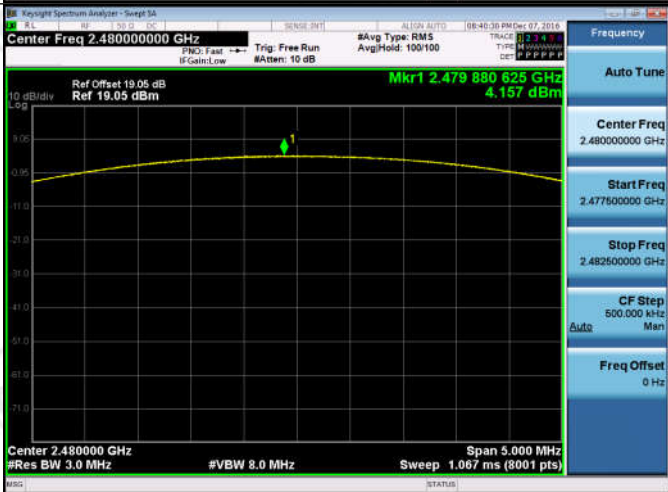
Result Table

Mode	Channel.	Maximum Peak Output Power [dBm]	Verdict
GFSK	LCH	1.691	PASS
GFSK	MCH	2.213	PASS
GFSK	HCH	2.829	PASS
$\pi/4$ DQPSK	LCH	2.918	PASS
$\pi/4$ DQPSK	MCH	3.505	PASS
$\pi/4$ DQPSK	HCH	4.157	PASS
8DPSK	LCH	3.317	PASS
8DPSK	MCH	3.875	PASS
8DPSK	HCH	4.536	PASS

Test Graph



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

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



Appendix F): Band-edge for RF Conducted Emissions

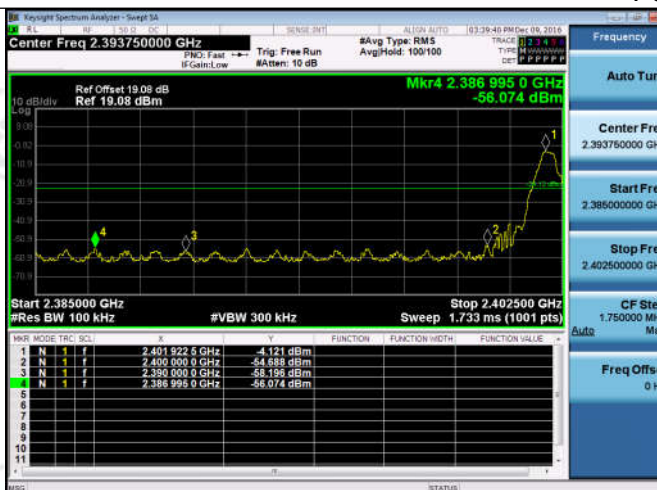
Result Table

Mode	Channel	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max Spurious Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	2402	1.152	Off	-60.988	-18.85	PASS
			-4.121	On	-56.074	-24.12	PASS
GFSK	HCH	2480	2.216	Off	-58.456	-17.78	PASS
			-4.172	On	-55.841	-24.17	PASS
$\pi/4$ DQPSK	LCH	2402	0.834	Off	-61.015	-19.17	PASS
			2.777	On	-50.724	-17.22	PASS
$\pi/4$ DQPSK	HCH	2480	2.228	Off	-58.926	-17.77	PASS
			1.174	On	-50.044	-18.83	PASS
8DPSK	LCH	2402	1.057	Off	-60.976	-18.94	PASS
			3.800	On	-49.606	-16.2	PASS
8DPSK	HCH	2480	2.217	Off	-58.038	-17.78	PASS
			3.891	On	-49.332	-16.11	PASS

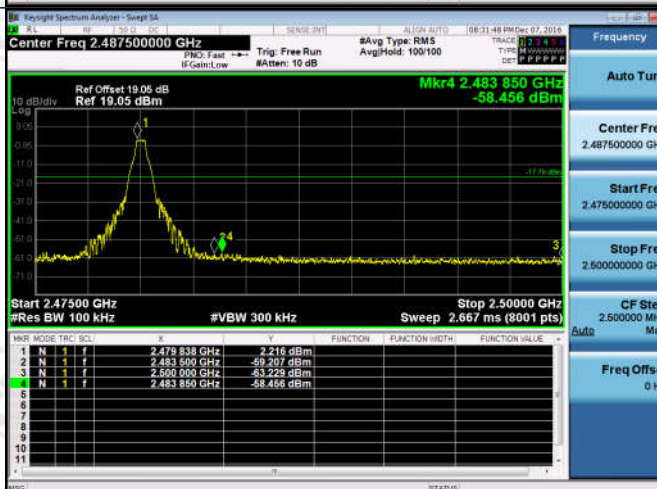
Test Graph



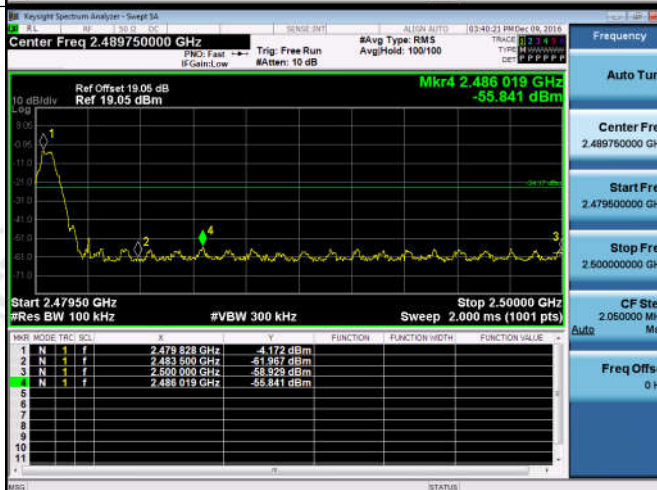
GFSK/LCH/Hop

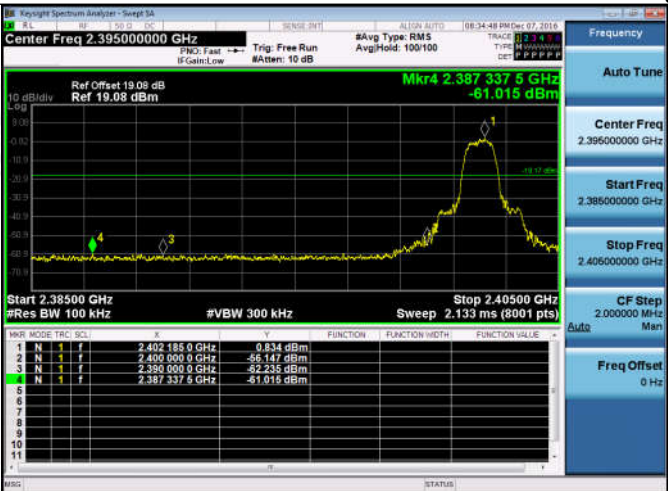
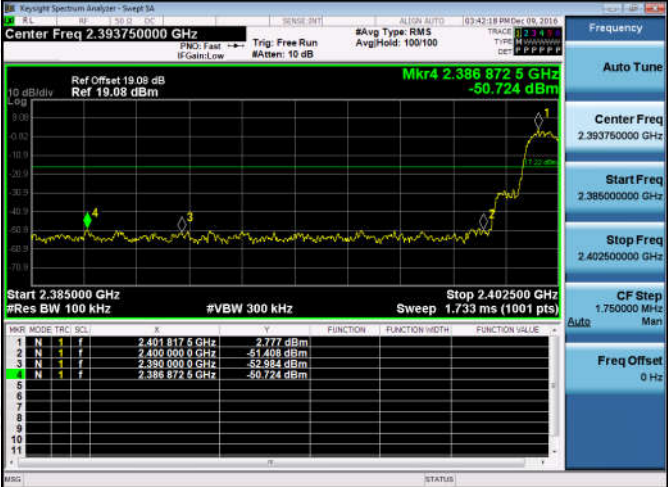
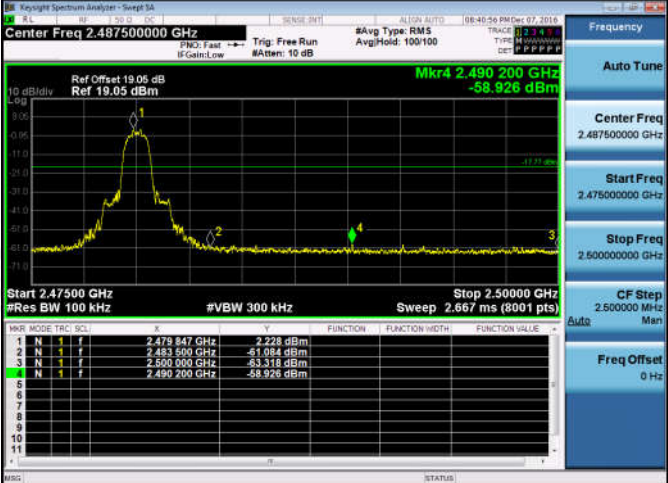


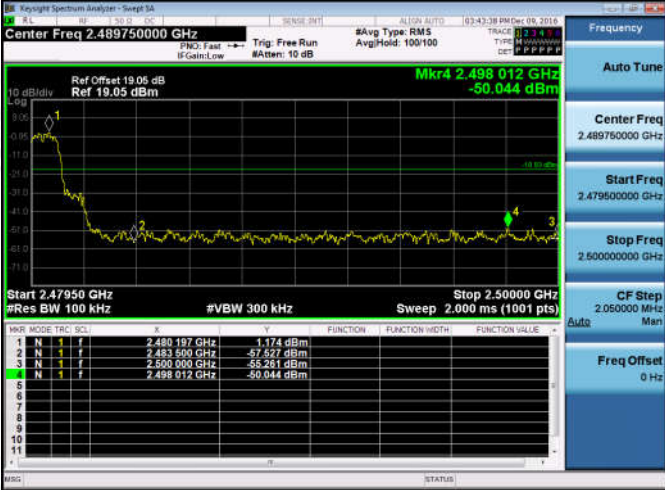
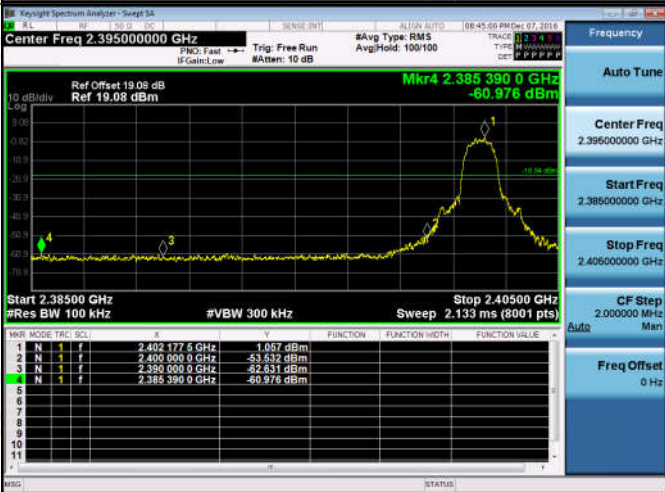
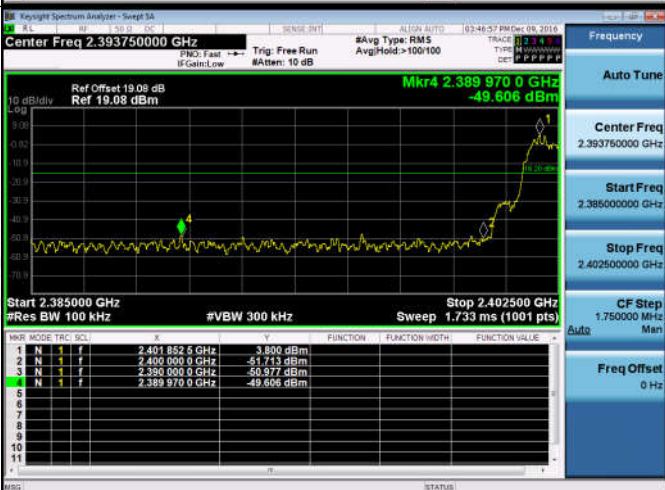
GFSK/HCH/No Hop



GFSK/HCH/Hop



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

$\pi/4$DQPSK/HCH/Hop	
8DPSK/LCH/No Hop	
8DPSK/LCH/Hop	

Keylight Spectrum Analyzer - Sweep 3A

Center Freq 2.487500000 GHz

PN0: Fast Trig: Free Run #Avg Type: RMS

IF Gain: Low #Attain: 10 dB Avg/Hold: 1000

Trace 01: 2.483 791 GHz

Ref Offset 19.05 dB Ref 19.05 dBm

Mkr4 2.483 791 GHz -58.038 dBm

Start 2.475000 GHz Stop 2.500000 GHz

#Res BW 100 kHz #VBW 300 kHz Sweep 2.667 ms (8001 pts)

Marker	Frequency (GHz)	Power (dBm)
1	2.478 841 GHz	-2.217 dBm
2	2.483 500 GHz	-60.374 dBm
3	2.500 000 GHz	-82.696 dBm
4	2.483 791 GHz	-58.038 dBm

File Edit View Window Help

VB: Keylight Spectrum Analyzer - Sweep 34

SENSE [INT] ALIAS AUTO 193.4935 PM Per (06, 2016)

Center Freq 2.489750000 GHz #Avg Type: RMS Traces: 3 3 3 3 3
PNO: Fast Trig: Free Run Avg/100 TYP: M Modulation
If Gain: Low MATtem: 10 dB DET: P P P P P

Auto Tune

Center Freq
2.489750000 GHz

Start Freq
2.479600000 GHz

Stop Freq
2.500000000 GHz

CF Stop
2.050000000 MHz

Auto

Freq Offset 19.05 dBm
Ref 19.05 dBm

Mkr4 2.484 010 GHz
-49.332 dBm

10 dB/Div
Log

Start 2.47950 GHz
#Res BW 100 kHz

#VBW 300 kHz

Stop 2.500000 GHz
Sweep 2.000 ms (1001 pts)

VBW Mode TRC: SC

	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.479 828 GHz	3.891 dBm
2	N	1	f	2.483 500 GHz	-56.040 dBm
3	N	1	f	2.486 000 GHz	-54.221 dBm
4	N	1	f	2.484 010 GHz	-49.332 dBm
5					
6					
7					
8					
9					
10					
11					

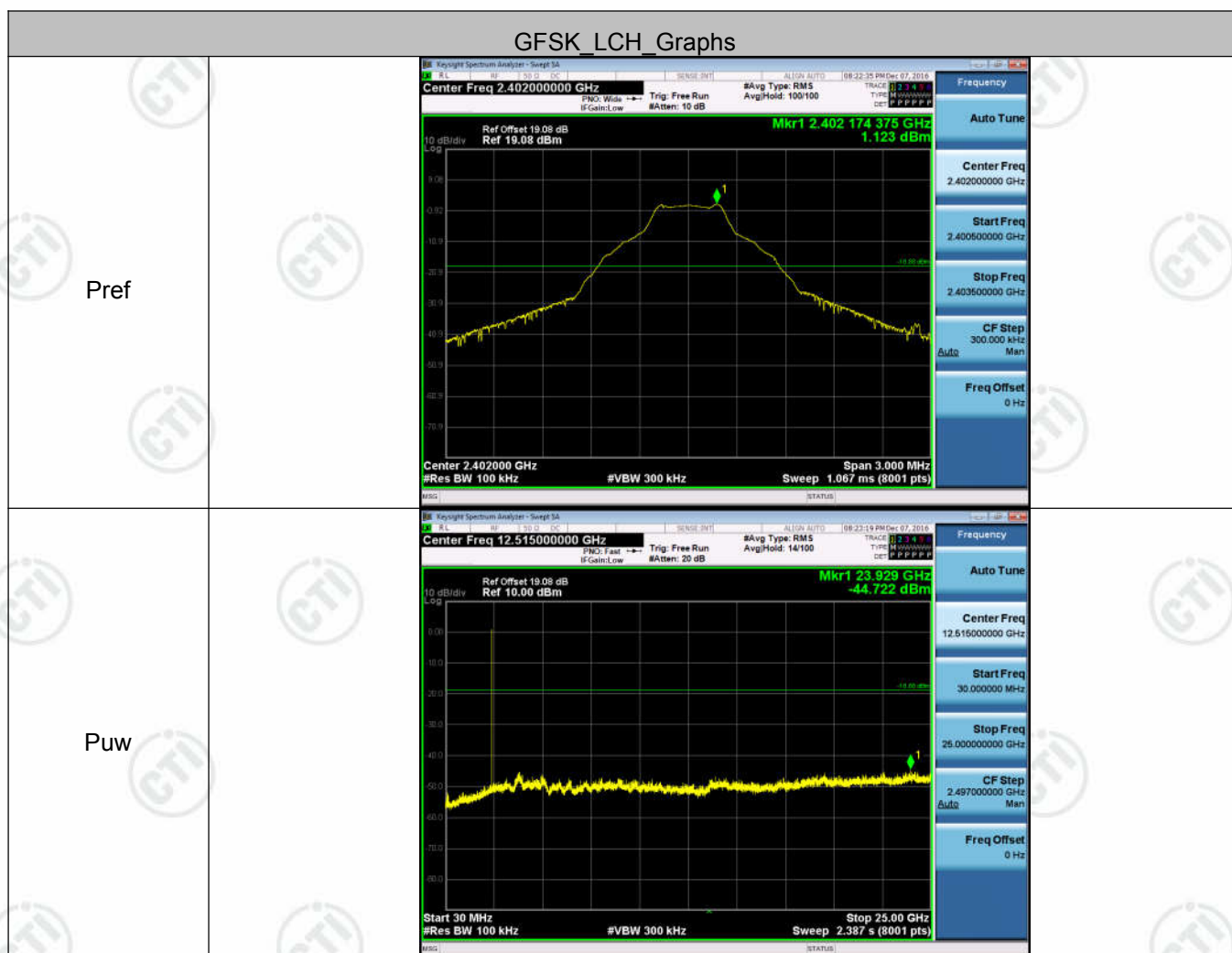
MSG (STATUS)

Appendix G): RF Conducted Spurious Emissions

Result Table

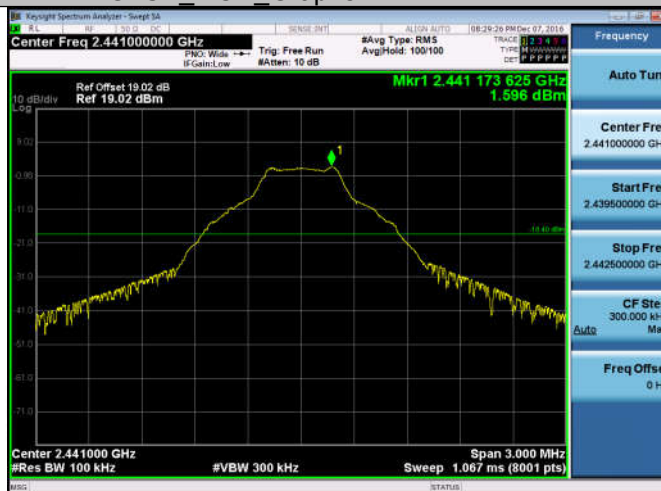
Mode	Channel	Pref [dBm]	Puw[dBm]	Verdict
GFSK	LCH	1.123	<Limit	PASS
GFSK	MCH	1.596	<Limit	PASS
GFSK	HCH	2.168	<Limit	PASS
$\pi/4$ DQPSK	LCH	1.113	<Limit	PASS
$\pi/4$ DQPSK	MCH	1.636	<Limit	PASS
$\pi/4$ DQPSK	HCH	2.166	<Limit	PASS
8DPSK	LCH	1.105	<Limit	PASS
8DPSK	MCH	1.634	<Limit	PASS
8DPSK	HCH	2.189	<Limit	PASS

Test Graph

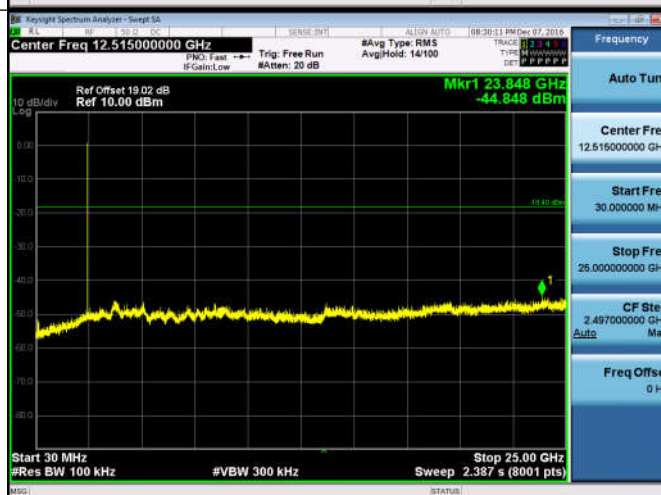


GFSK_MCH_Graphs

Pref



Puw



GFSK_HCH_Graphs

Pref



Puw

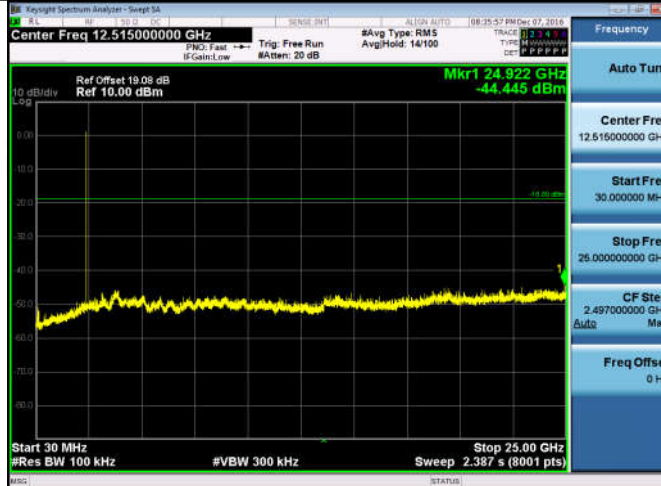


$\pi/4$ DQPSK_LCH_Graphs

Pref

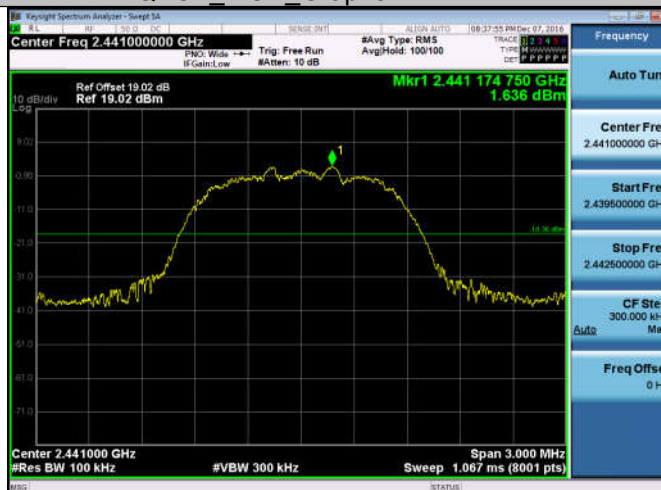


Puw

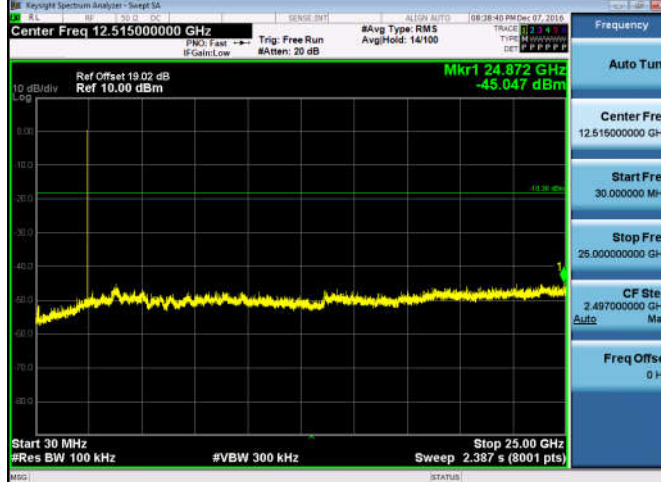


$\pi/4$ DQPSK_MCH_Graphs

Pref

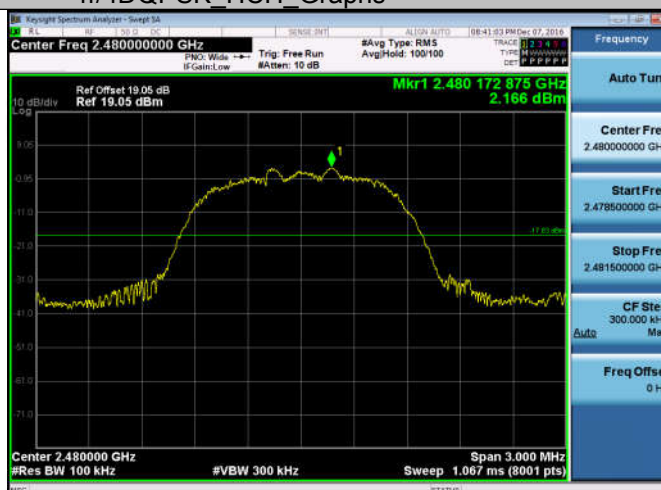


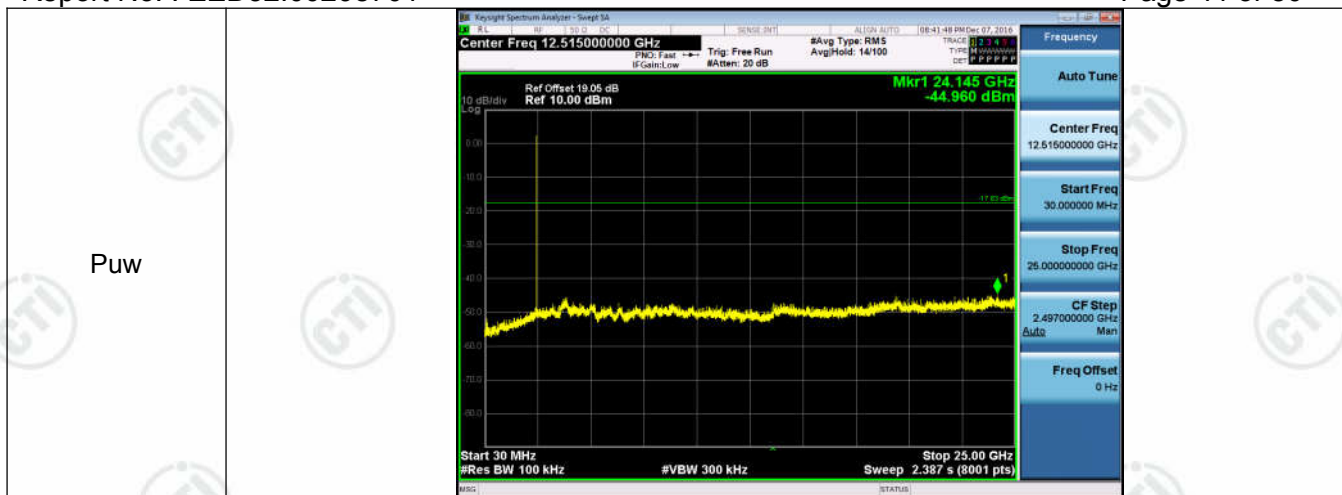
Puw



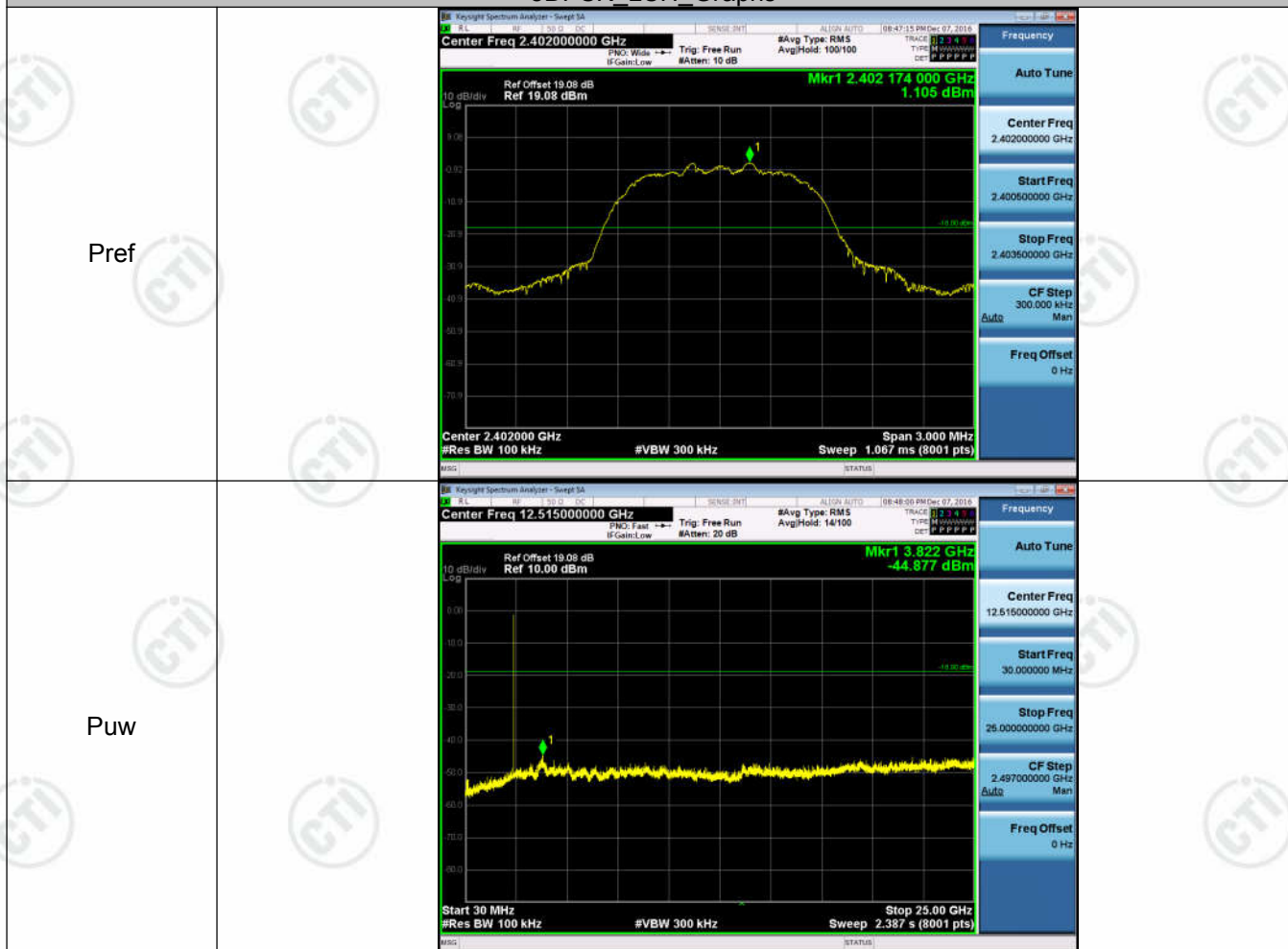
$\pi/4$ DQPSK_HCH_Graphs

Pref





8DPSK_LCH_Graphs

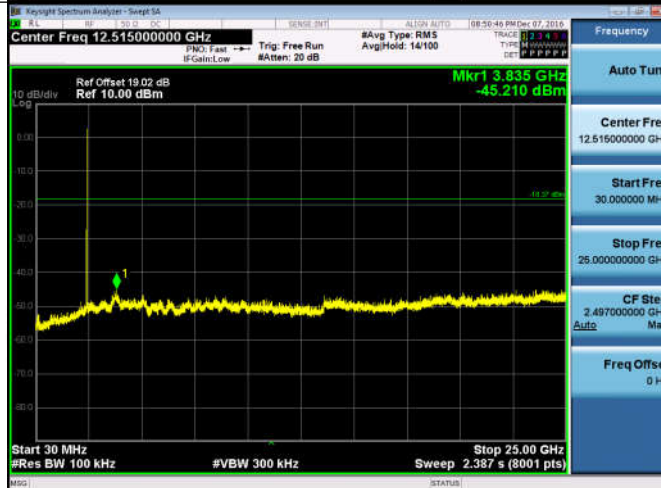


8DPSK_MCH_Graphs

Pref



Puw

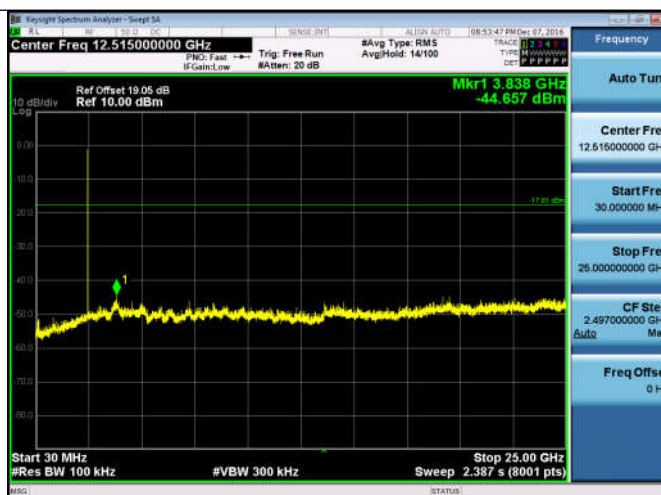


8DPSK_HCH_Graphs

Pref



P_{uw}



Appendix H): Pseudorandom Frequency Hopping Sequence

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1) requirement:
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. 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.	
EUT Pseudorandom Frequency Hopping Sequence 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. • 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> An example of Pseudorandom Frequency Hopping Sequence as follow: Each frequency used equally on the average by each transmitter. 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. The device does not have the ability to be coordinated with other FHSS systems in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters.	

Appendix I): Antenna Requirement

15.203 requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna:

The antenna is PIFA antenna and no consideration of replacement. The best case gain of the antenna is 0dBi.



Appendix J): AC Power Line Conducted Emission

Test Procedure:	Test frequency range :150KHz-30MHz 1)The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 3)The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. 5) 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 on conducted measurement.														
Limit:	<table><tr><th rowspan="2">Frequency range (MHz)</th><th colspan="2">Limit (dBμV)</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> * The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz. NOTE : The lower limit is applicable at the transition frequency	Frequency range (MHz)	Limit (dBμV)		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 (dBμV)														
	Quasi-peak	Average													
0.15-0.5	66 to 56*	56 to 46*													
0.5-5	56	46													
5-30	60	50													

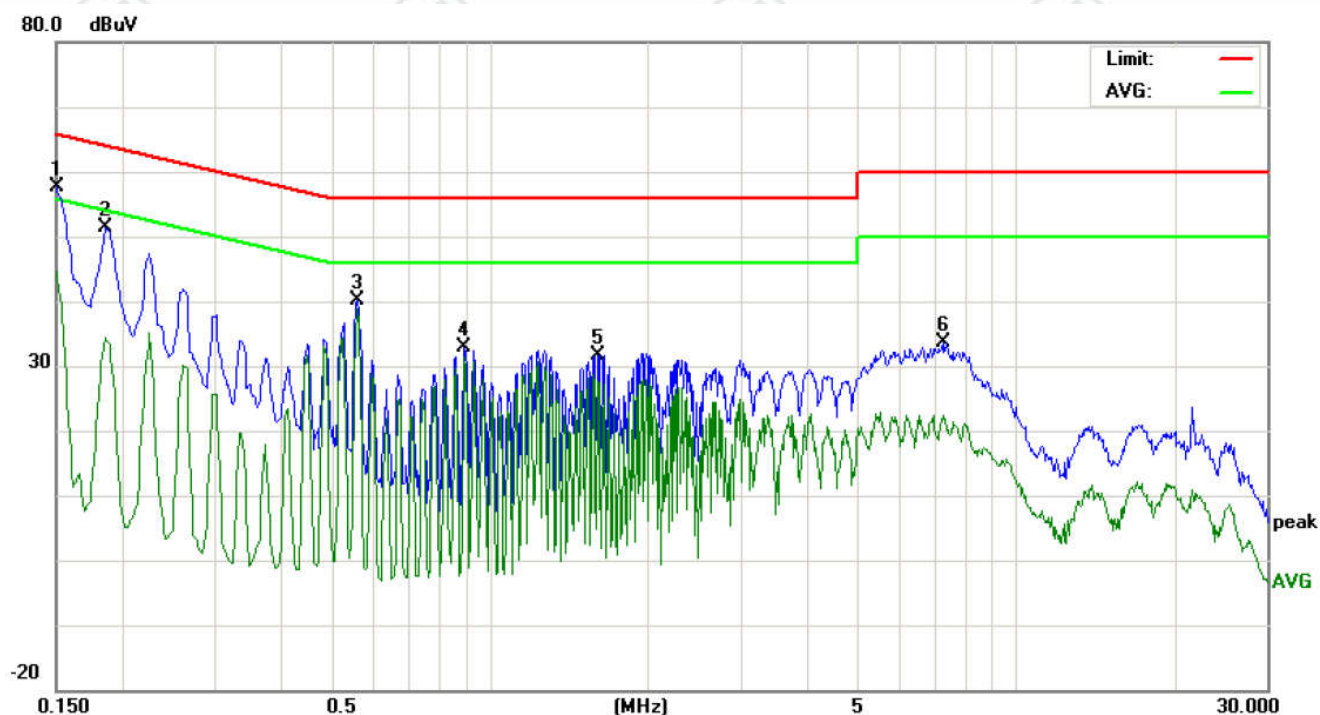
Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

AC 120V/60Hz

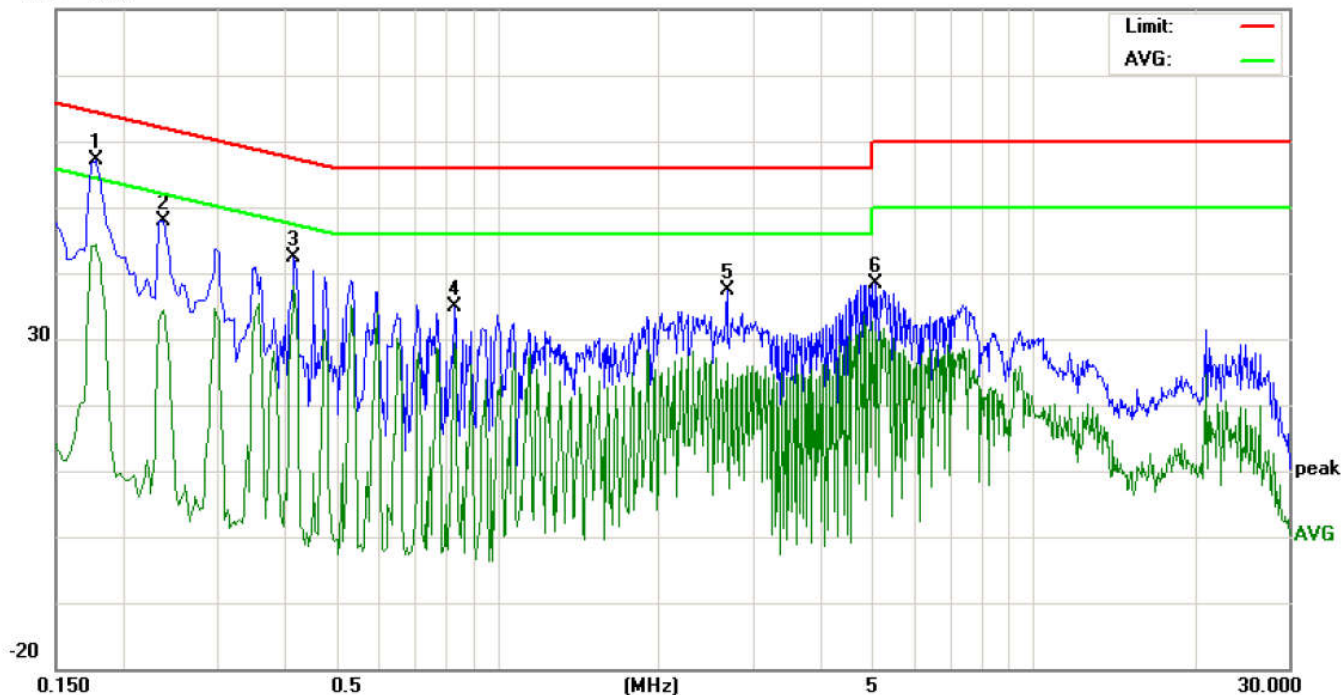
Live line:



No.	Freq. MHz	Reading_Level (dBuV)			Correct Factor dB	Measurement (dBuV)			Limit (dBuV)		Margin (dB)		P/F	Comment
		Peak	QP	AVG		peak	QP	AVG	QP	AVG	QP	AVG		
1	0.1500	47.81		34.83	9.80	57.61		44.63	65.99	55.99	-8.38	-11.36	P	
2	0.1860	41.62		24.62	9.80	51.42		34.42	64.21	54.21	-12.79	-19.79	P	
3	0.5620	30.20		28.93	9.90	40.10		38.83	56.00	46.00	-15.90	-7.17	P	
4	0.8980	23.25		21.66	9.70	32.95		31.36	56.00	46.00	-23.05	-14.64	P	
5	1.6100	21.85		17.85	9.88	31.73		27.73	56.00	46.00	-24.27	-18.27	P	
6	7.2780	23.62		12.30	10.00	33.62		22.30	60.00	50.00	-26.38	-27.70	P	

Neutral line:

80.0 dBuV



No.	Freq. MHz	Reading_Level (dBuV)			Correct Factor dB	Measurement (dBuV)			Limit (dBuV)		Margin (dB)		P/F	Comment
		Peak	QP	AVG		peak	QP	AVG	QP	AVG	QP	AVG		
1	0.1780	47.44		34.48	9.80	57.24	44.28		64.57	54.57	-7.33	-10.29	P	
2	0.2380	38.02		24.47	9.80	47.82	34.27		62.16	52.16	-14.34	-17.89	P	
3	0.4180	32.39		28.14	9.90	42.29	38.04		57.49	47.49	-15.20	-9.45	P	
4	0.8340	25.14		19.53	9.83	34.97	29.36		56.00	46.00	-21.03	-16.64	P	
5	2.6820	27.46		16.31	10.00	37.46	26.31		56.00	46.00	-18.54	-19.69	P	
6	5.0700	28.26		21.01	10.00	38.26	31.01		60.00	50.00	-21.74	-18.99	P	

Notes:

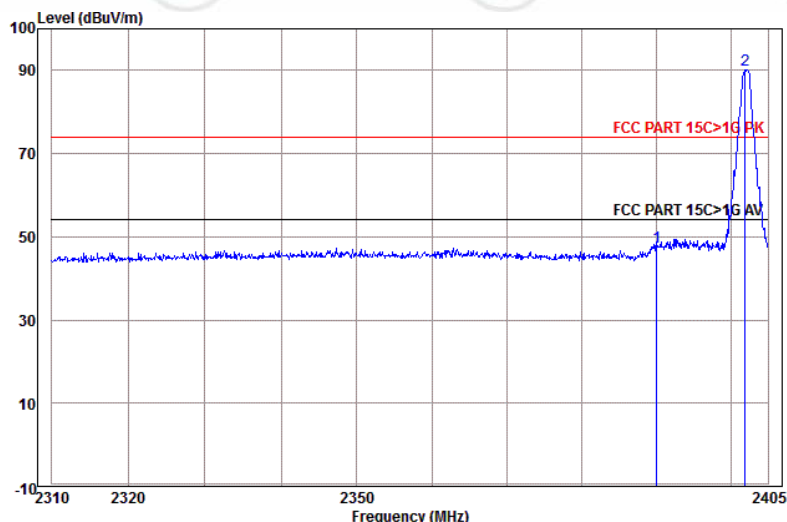
1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level = Receiver Reading + LISN Factor + Cable Loss.

Appendix K): Restricted bands around fundamental frequency (Radiated)

Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	30MHz-1GHz	Quasi-peak	120kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Test Procedure:	Below 1GHz test procedure as below: - The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. - The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. - 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. - 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 rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. - The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. - Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel Above 1GHz test procedure as below: - Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter). b. Test the EUT in the lowest channel , the Highest channel - The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case. - Repeat above procedures until all frequencies measured was complete.				
Limit:	Frequency	Limit (dBμV/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	

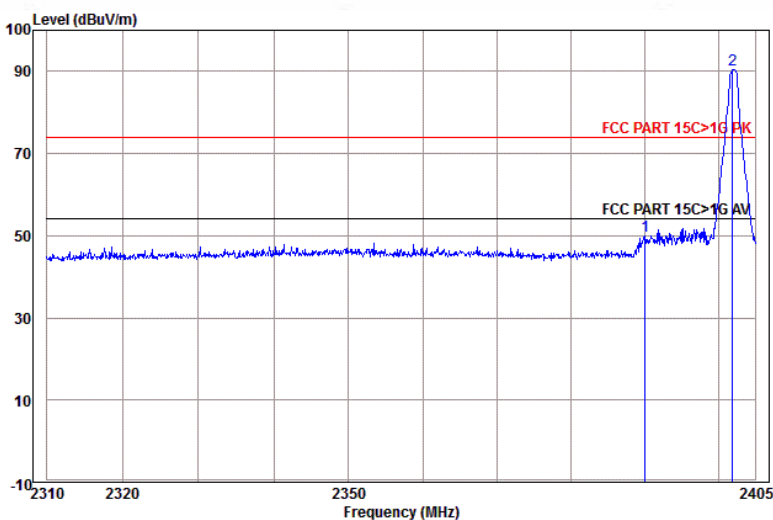
Test plot as follows:

Worse case mode:	GFSK(1-DH5)		
Frequency: 2390.0MHz	Test channel: Lowest	Polarization: Horizontal	Remark: Peak



	Ant Freq	Cable Factor	Preamp Loss	Read Level	Read Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2390.000	32.53	4.28	34.39	45.13	47.55	74.00	-26.45	Horizontal
2 pp	2401.900	32.56	4.31	34.39	87.59	90.07	74.00	16.07	Horizontal

Worse case mode:	GFSK(1-DH5)		
Frequency: 2390.0MHz	Test channel: Lowest	Polarization: Vertical	Remark: Peak



	Ant Freq	Cable Factor	Preamp Loss	Read Level	Read Level	Limit Line	Over Limit	Pol/Phase	Remark
	MHz	dB/m	dB	dB	dBuV	dBuV/m	dBuV/m	dB	
1	2390.000	32.53	4.28	34.39	47.43	49.85	74.00	-24.15	Vertical
2 pp	2401.900	32.56	4.31	34.39	87.94	90.42	74.00	16.42	Vertical