

TEST REPORT

Product : 7" Tablet PC
Trade mark : KINGPAD, Dragon Touch
Model/Type reference : K77, K77X, K77 PLUS, K77 PRO,
K77X PLUS, K77X PRO
Serial Number : N/A
Report Number : EED32H000943-1
FCC ID : S5V-D107K2
Date of Issue : Aug. 24, 2015
Test Standards : 47 CFR Part 15 Subpart C (2014)
Test result : PASS

Prepared for:

Proexpress Distributor LLC

11011 GREENWOOD AVE.N APT 5, SEATTLE, WA 98103, United States

Prepared by:

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Aug. 24, 2015

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Check No.: 2212824360



2 Version

Version No.	Date	Description
00	Aug. 24, 2015	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

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

Remark:

All models are same except model name and brand name. Model K77 was selected for test.

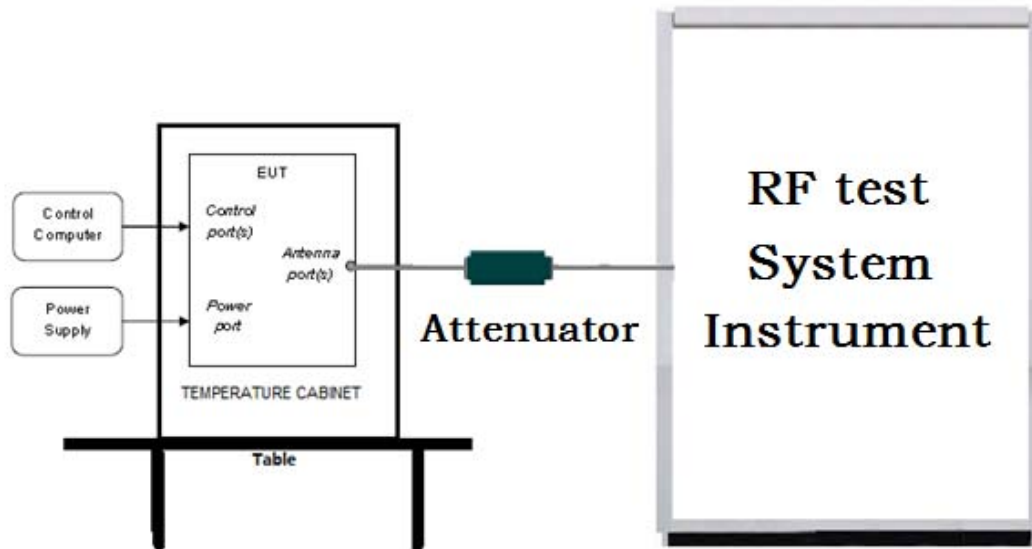
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5 Test Requirement

5.1 Test setup

5.1.1 For Conducted test setup



5.1.2 For Radiated Emissions test setup

Radiated Emissions setup:

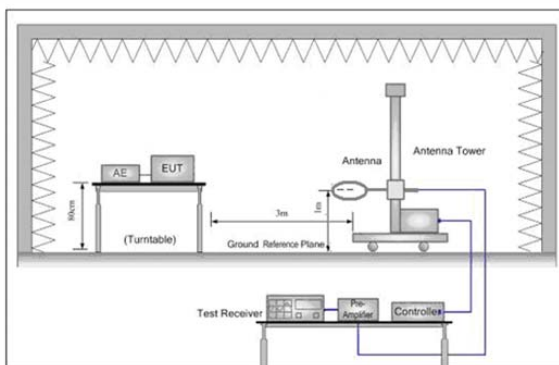


Figure 1. Below 30MHz

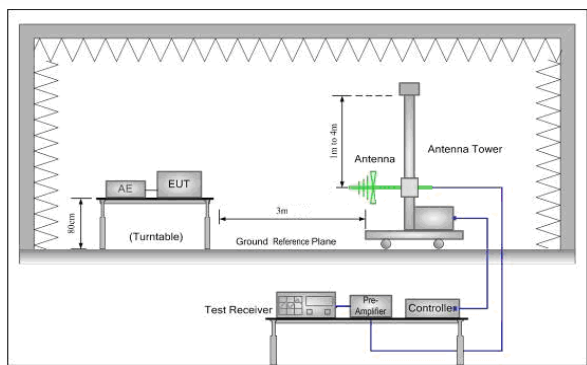


Figure 2. 30MHz to 1GHz

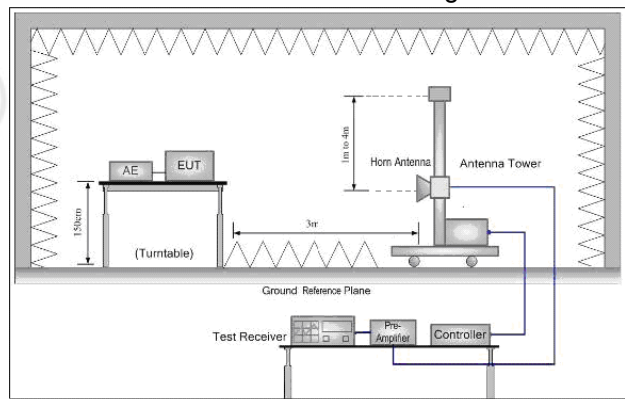
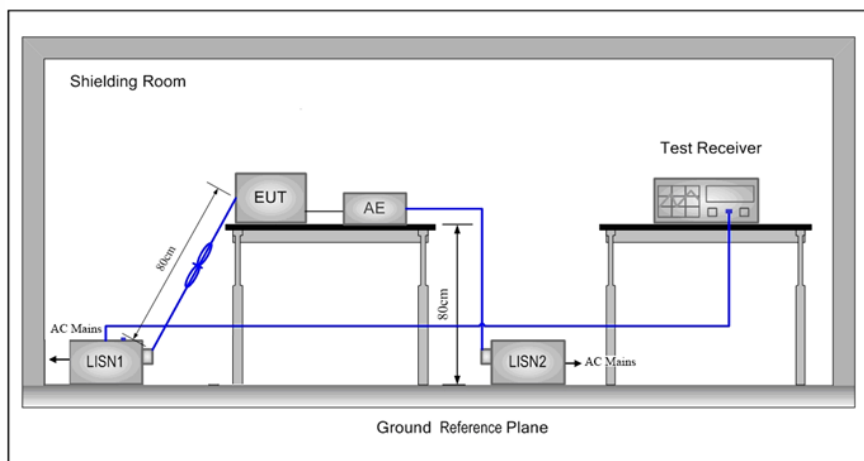


Figure 3. Above 1GHz

5.1.3 For Conducted Emissions test setup

Conducted Emissions setup



5.2 Test Environment

Operating Environment:	
Temperature:	24 °C
Humidity:	53 % RH
Atmospheric Pressure:	1010mbar

5.3 Test Condition

Test Mode	Tx/Rx	RF Channel		
		Low(L)	Middle(M)	High(H)
		Channel 1	Channel 40	Channel79
GFSK/π/4DQPSK/ 8DPSK(DH1,DH3,DH5)	2402MHz ~2480 MHz	2402MHz	2441MHz	2480MHz

6 General Information

6.1 Client Information

Applicant:	Proexpress Distributor LLC
Address of Applicant:	11011 GREENWOOD AVE.N APT 5, SEATTLE, WA 98103, United States
Manufacturer:	Proexpress Distributor LLC
Address of Manufacturer:	11011 GREENWOOD AVE.N APT 5, SEATTLE, WA 98103, United States

6.2 General Description of EUT

Product Name:	7" Tablet PC
Model No.(EUT):	K77, K77X, K77 PLUS, K77 PRO, K77X PLUS, K77X PRO
Trade mark:	KINGPAD, Dragon Touch
EUT Supports Radios application:	Bluetooth V3.0+EDR
Power Supply:	Input: 5V  2A
Sample Received Date:	Jun. 29, 2015
Sample tested Date:	Jun. 29, 2015 to Aug. 24, 2015

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						
Sample Type:	Portable production						
Antenna Type:	Integral						
Antenna Gain:	0dBi						
Test Voltage:	DC 3.7V						
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 with associated equipment below:

Device Type	Brand	Model	Data Cable	Remark
--	--	--	--	--
--	--	--	--	--

6.5 Test Location

All tests were performed at:

Centre Testing International (Shenzhen) Corporation

Building C, Scientific Innovation Park, Tiegang Reservoir, Xixiang, Baoan District, Shenzhen, China

Telephone: +86 (0) 755 3368 3668 Fax: +86 (0) 755 3368 3385

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.: 565659

Centre Testing International (Shenzhen) Corporation 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 565659.

IC-Registration No.: 7408A

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 .

IC-Registration No.: 7408B

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.

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	04-14-2015	04-13-2016
Communication test set test set	Agilent	N4010A	MY47230124	04-02-2015	04-01-2016
Spectrum Analyzer	Keysight	N9010A	MY54510339	04-01-2015	03-31-2016
Attenuator	HuaXiang	SHX370	15040701	04-01-2015	03-31-2016
Signal Generator	Keysight	N5182B	MY53051549	03-31-2015	03-30-2016
High-pass filter(3-18GHz)	Sinoscite	FL3CX03WG18 NM12-0398-002	---	01-13-2015	01-12-2016
High-pass filter(5-18GHz)	MICRO-TRONICS	SPA-F-63029-4	---	01-13-2015	01-12-2016
band rejection filter (GSM900)	Sinoscite	FL5CX01CA09C L12-0395-001	---	01-13-2015	01-12-2016
band rejection filter (GSM850)	Sinoscite	FL5CX01CA08C L12-0393-001	---	01-13-2015	01-12-2016
band rejection filter (GSM1800)	Sinoscite	FL5CX02CA04C L12-0396-002	---	01-13-2015	01-12-2016
band rejection filter (GSM1900)	Sinoscite	FL5CX02CA03C L12-0394-001	---	01-13-2015	01-12-2016
DC Power	Keysight	E3642A	MY54436035	03-31-2015	03-30-2016
PC-1	Lenovo	R4960d	---	04-01-2015	03-31-2016
BT&WI-FI Automatic control	R&S	OSPB157	101374	04-01-2015	03-31-2016
RF control unit	JS Tonscend	JS0806-2	2015860006	04-01-2015	03-31-2016
BT&WI-FI Automatic test software	JS Tonscend	JSTS1120-2	---	04-01-2015	03-31-2016

Shielding Room No. 1 – Conduction Emission Test					
Equipment	Manufacturer	Mode No.	Serial Number	Cal. date (mm-dd-yyyy)	Cal. Due date (mm-dd-yyyy)
Receiver	R&S	ESCI	100009	07-09-2014	07-08-2015
Receiver	R&S	ESCI	100009	07-09-2015	07-08-2016
LISN	R&S	ENV216	100098	11-12-2014	11-13-2015

3M Semi/full-anechoic Chamber					
Equipment	Manufacturer	Mode No.	Serial Number	Cal. date (mm-dd-yyyy)	Cal. Due date (mm-dd-yyyy)
3M Chamber	TDK	SAC-3	---	06-02-2015	06-01-2016
TRILOG Broadband Antenna	schwarzbeck	VULB9163	9163-617	07-14-2014	07-13-2015
TRILOG Broadband Antenna	schwarzbeck	VULB9163	9163-617	07-14-2015	07-13-2016
Microwave Preamplifier	Agilent	8449B	3008A02425	02-05-2015	02-04-2016
Horn Antenna	ETS-LINDGREN	3117	00057410	07-08-2014	07-07-2015
Horn Antenna	ETS-LINDGREN	3117	00057410	07-08-2015	07-07-2016
Loop Antenna	ETS	6502	00071730	07-23-2014	07-22-2015
Loop Antenna	ETS	6502	00071730	07-23-2015	07-22-2016
Spectrum Analyzer	R&S	FSP40	100416	07-09-2014	07-08-2015
Spectrum Analyzer	R&S	FSP40	100416	07-09-2015	07-08-2016
Receiver	R&S	ESCI	100435	07-09-2014	07-08-2015
Receiver	R&S	ESCI	100435	07-09-2015	07-08-2016
Multi device Controller	matur	NCD/070/10711112	---	01-13-2015	01-12-2016
LISN	schwarzbeck	NNBM8125	81251547	07-09-2014	07-08-2015
LISN	schwarzbeck	NNBM8125	81251547	07-09-2015	07-08-2016
LISN	schwarzbeck	NNBM8125	81251546	07-09-2014	07-08-2015
LISN	schwarzbeck	NNBM8125	81251546	07-09-2015	07-08-2016
Signal Generator	Agilent	E4438C	MY45095744	04-19-2015	04-18-2016
Signal Generator	Keysight	E8257D	MY53401106	04-14-2015	04-13-2016
Temperature/Humidity Indicator	TAYLOR	1451	5190	07-10-2014	07-09-2015
Temperature/Humidity Indicator	TAYLOR	1451	5190	07-10-2015	07-09-2016
Communication test set	Agilent	E5515C	GB47050533	01-13-2015	01-12-2016
Cable line	Fulai(7M)	SF106	5219/6A	01-13-2015	01-12-2016
Cable line	Fulai(6M)	SF106	5220/6A	01-13-2015	01-12-2016
Cable line	Fulai(3M)	SF106	5216/6A	01-13-2015	01-12-2016
Cable line	Fulai(3M)	SF106	5217/6A	01-13-2015	01-12-2016
Communication test set	R&S	CMW500	152394	04-19-2015	04-18-2016
High-pass filter(3-18GHz)	Sinoscite	FL3CX03WG18NM 12-0398-002	---	01-13-2015	01-12-2016
High-pass filter(5-18GHz)	MICRO-TRONICS	SPA-F-63029-4	---	01-13-2015	01-12-2016
band rejection filter	Sinoscite	FL5CX01CA09CL1 2-0395-001	---	01-13-2015	01-12-2016
band rejection filter	Sinoscite	FL5CX01CA08CL1 2-0393-001	---	01-13-2015	01-12-2016
band rejection filter	Sinoscite	FL5CX02CA04CL1 2-0396-002	---	01-13-2015	01-12-2016
band rejection filter	Sinoscite	FL5CX02CA03CL1 2-0394-001	---	01-13-2015	01-12-2016

8 Radio Technical Requirements Specification

Reference documents for testing:

No.	Identity	Document Title
1	FCC Part15C (2014)	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	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 K)

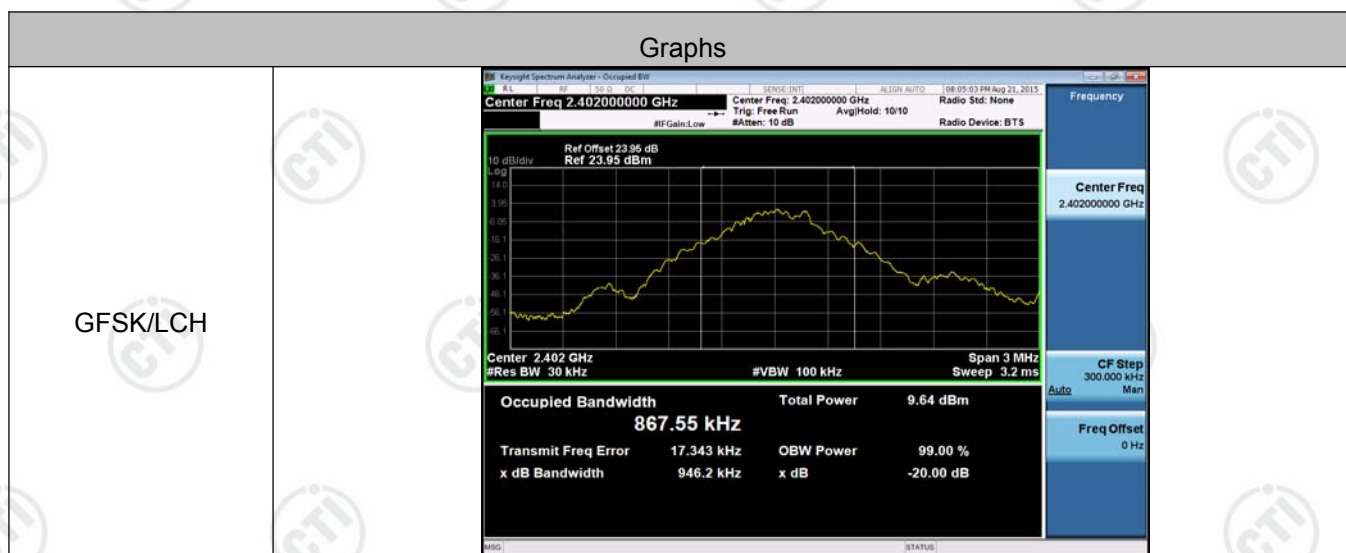
Appendix A): 20dB Occupied Bandwidth

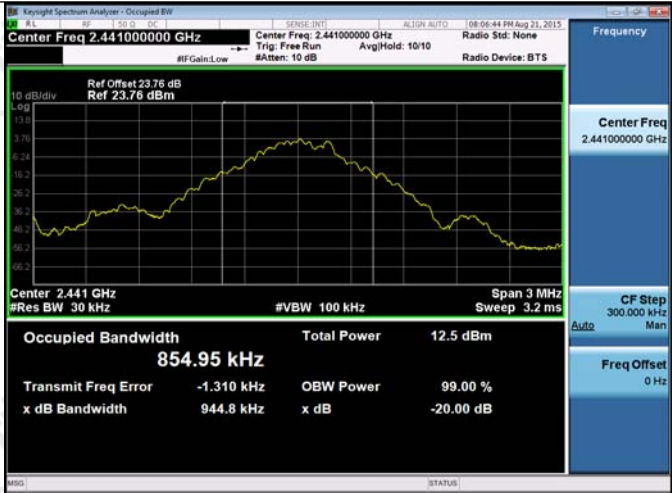
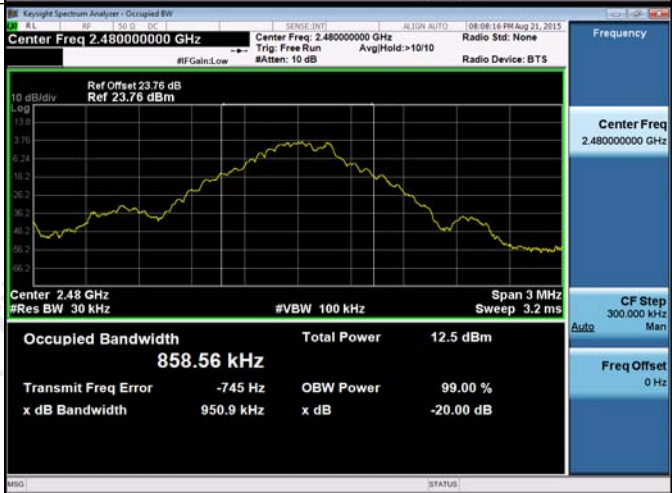
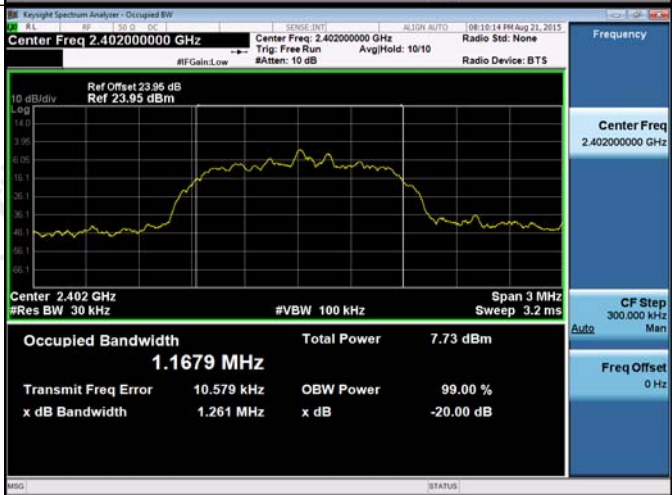
Test Result

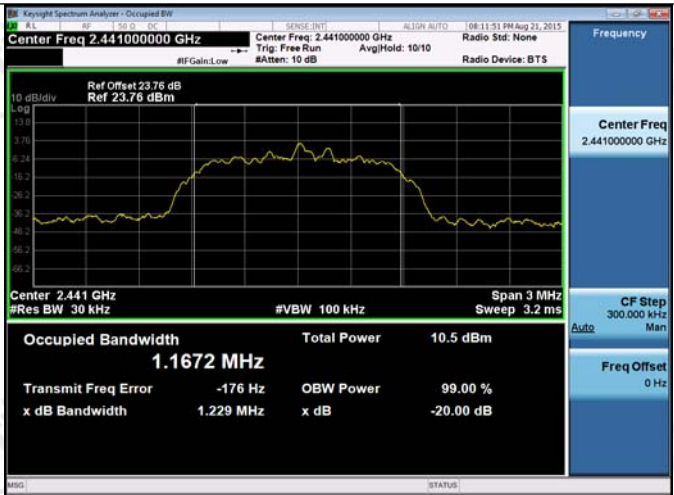
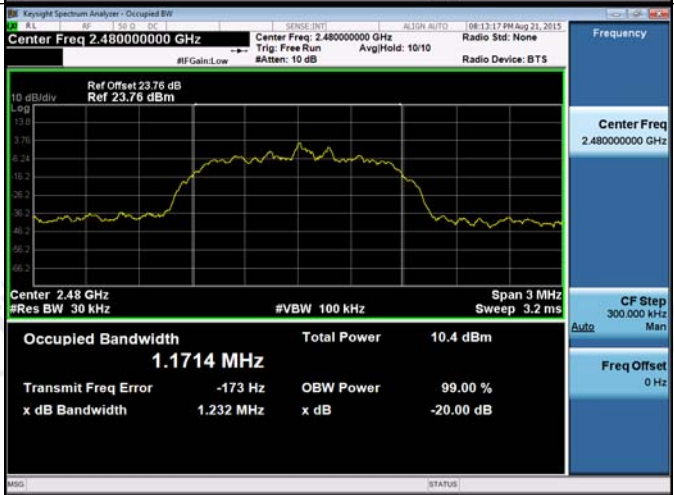
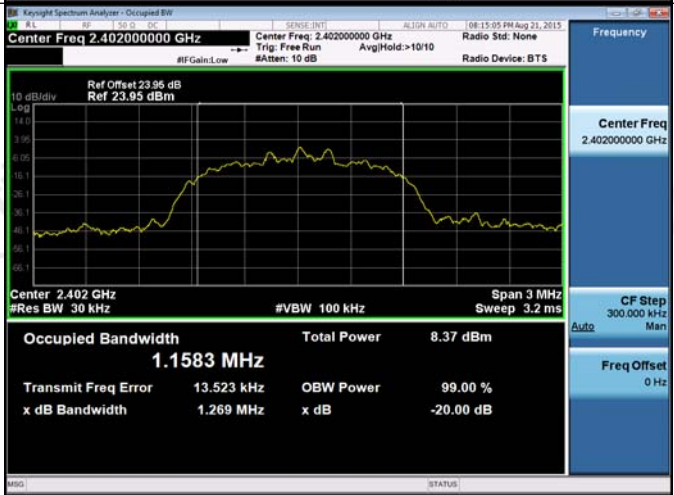
Mode	Channel.	20dB Bandwidth [MHz]	99% OBW [MHz]	Verdict
GFSK	LCH	0.9462	0.86755	PASS
GFSK	MCH	0.9448	0.85495	PASS
GFSK	HCH	0.9509	0.85856	PASS
$\pi/4$ DQPSK	LCH	1.261	1.1679	PASS
$\pi/4$ DQPSK	MCH	1.229	1.1672	PASS
$\pi/4$ DQPSK	HCH	1.232	1.1714	PASS
8DPSK	LCH	1.269	1.1583	PASS
8DPSK	MCH	1.260	1.1616	PASS
8DPSK	HCH	1.262	1.1631	PASS

Remark: Peak detector is used.

Test Graph



GFSK/MCH	 Keynote Spectrum Analyzer - Occupied BW Center Freq 2.441000000 GHz Ref Offset 23.76 dB Ref 23.76 dBm Center 2.441 GHz #Res BW 30 kHz Occupied Bandwidth 854.95 kHz Total Power 12.5 dBm Transmit Freq Error -1.310 kHz OBW Power 99.00 % x dB Bandwidth 944.8 kHz x dB -20.00 dB
GFSK/HCH	 Keynote Spectrum Analyzer - Occupied BW Center Freq 2.480000000 GHz Ref Offset 23.76 dB Ref 23.76 dBm Center 2.48 GHz #Res BW 30 kHz Occupied Bandwidth 858.56 kHz Total Power 12.5 dBm Transmit Freq Error -745 Hz OBW Power 99.00 % x dB Bandwidth 950.9 kHz x dB -20.00 dB
$\pi/4$ DQPSK/LCH	 Keynote Spectrum Analyzer - Occupied BW Center Freq 2.402000000 GHz Ref Offset 23.96 dB Ref 23.96 dBm Center 2.402 GHz #Res BW 30 kHz Occupied Bandwidth 1.1679 MHz Total Power 7.73 dBm Transmit Freq Error 10.579 kHz OBW Power 99.00 % x dB Bandwidth 1.261 MHz x dB -20.00 dB

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

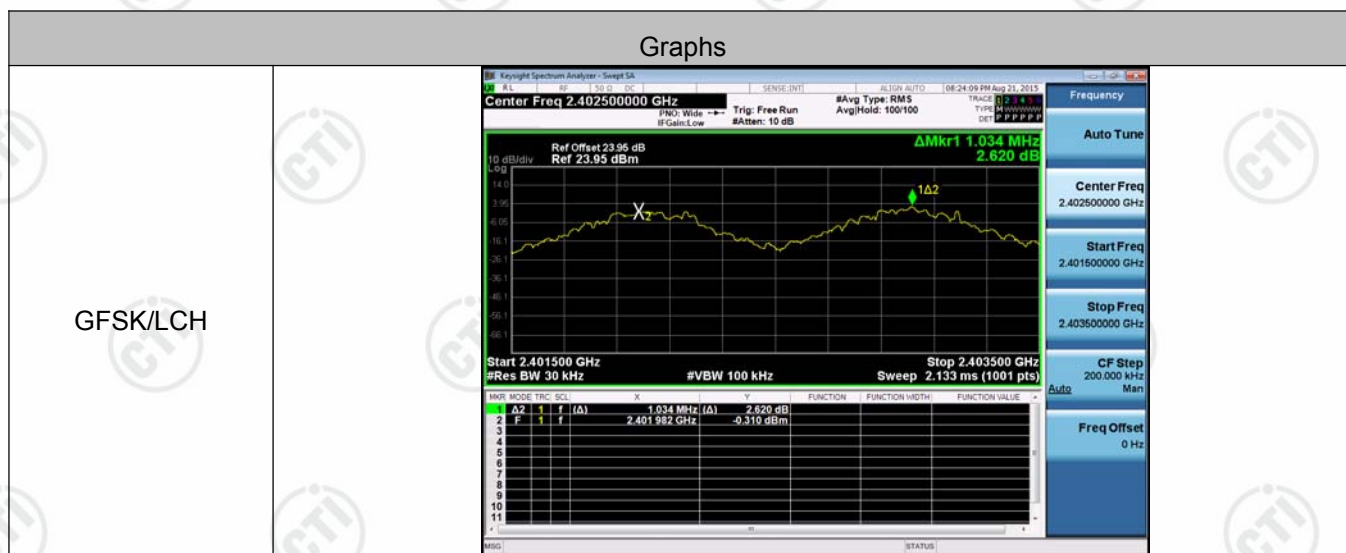


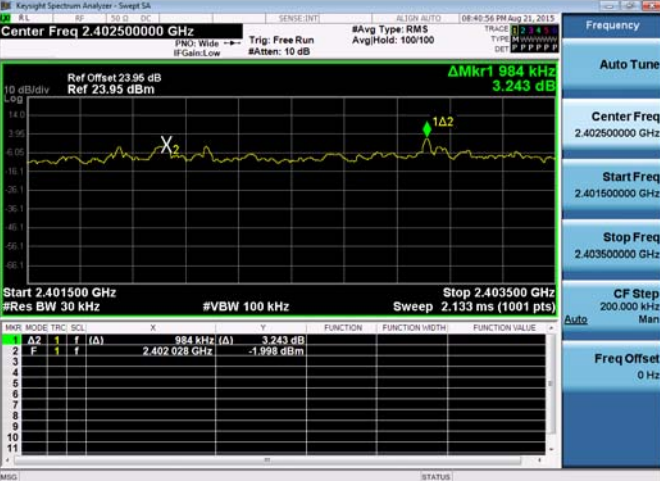
Appendix B): Carrier Frequency Separation

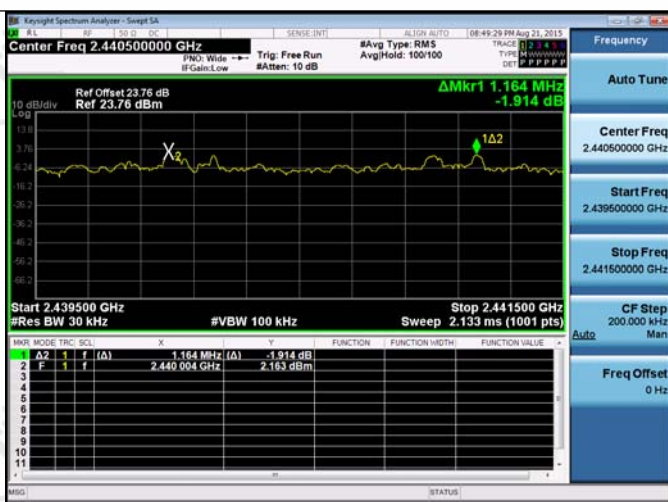
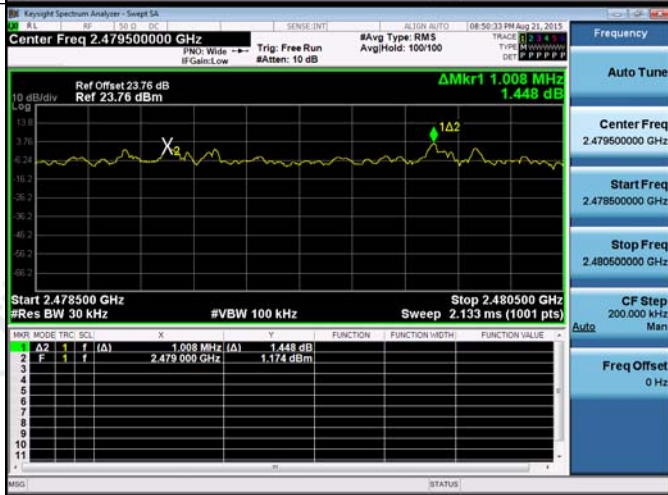
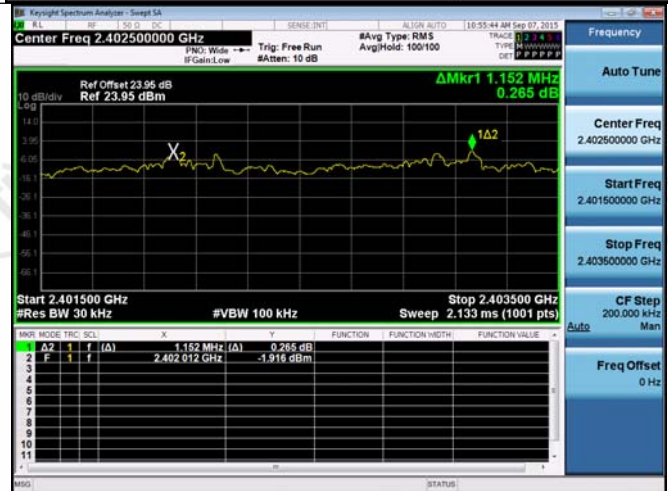
Result Table

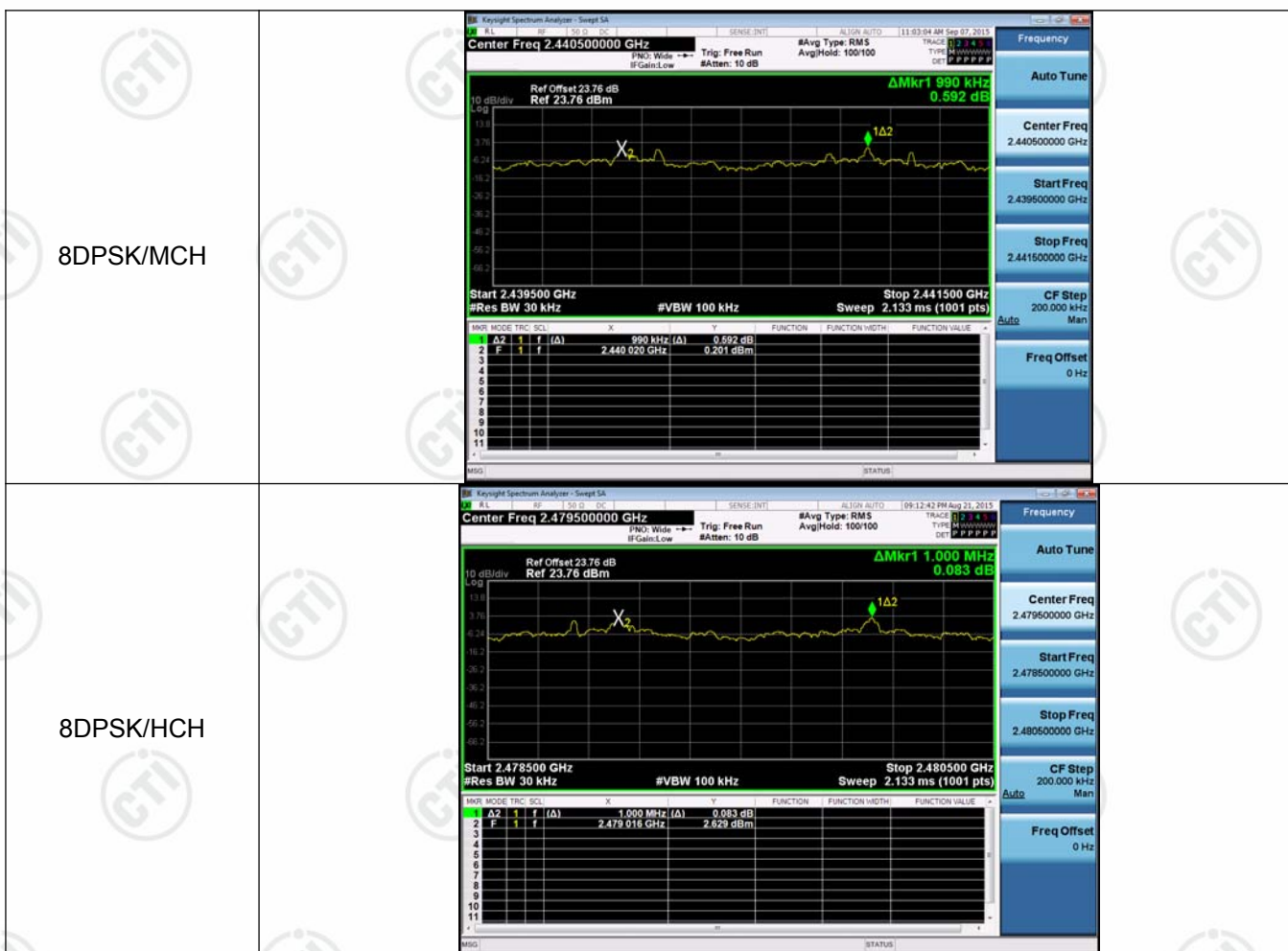
Mode	Channel.	Carrier Frequency Separation [MHz]	Verdict
GFSK	LCH	1.034	PASS
GFSK	MCH	1.032	PASS
GFSK	HCH	0.990	PASS
$\pi/4$ DQPSK	LCH	0.984	PASS
$\pi/4$ DQPSK	MCH	1.164	PASS
$\pi/4$ DQPSK	HCH	1.008	PASS
8DPSK	LCH	1.152	PASS
8DPSK	MCH	0.990	PASS
8DPSK	HCH	1.000	PASS

Test Graph



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

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



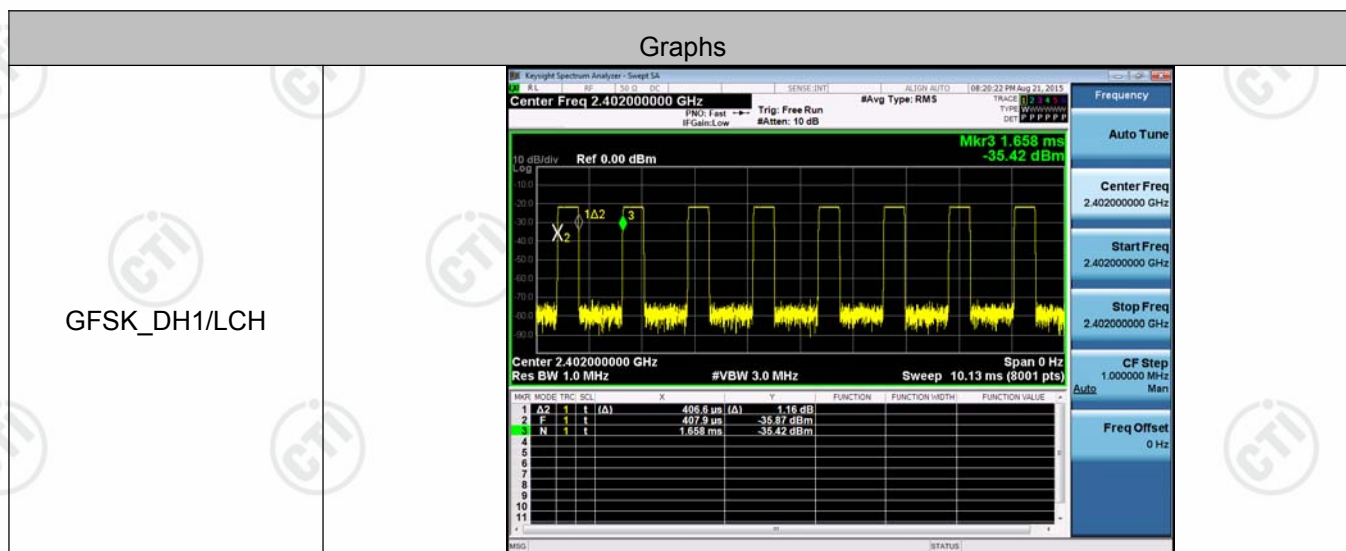
Appendix C): Dwell Time

Result Table

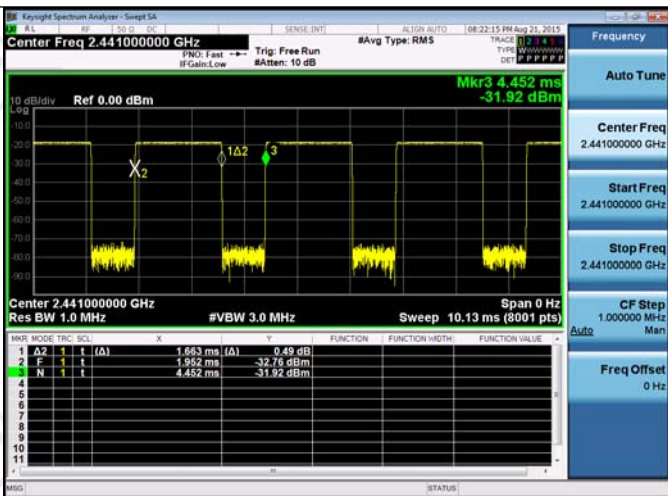
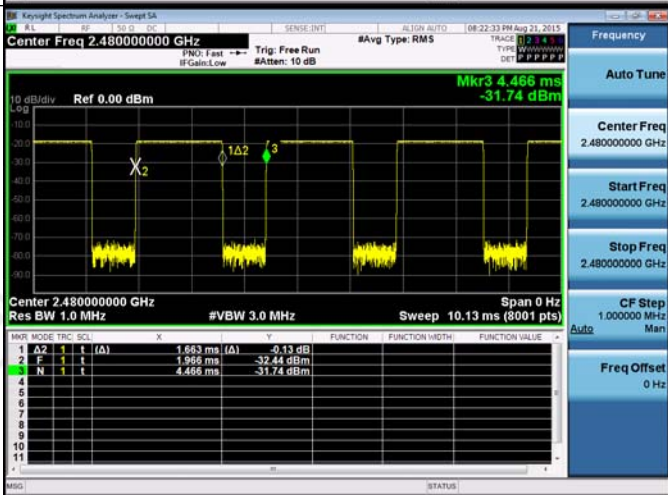
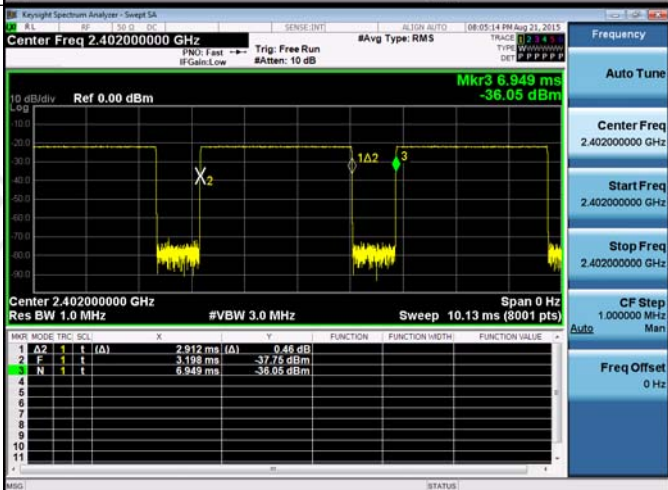
Mode	Packet	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Verdict
GFSK	DH1	LCH	0.407	320	0.13	PASS
GFSK	DH1	MCH	0.407	320	0.13	PASS
GFSK	DH1	HCH	0.408	320	0.131	PASS
GFSK	DH3	LCH	1.663	160	0.266	PASS
GFSK	DH3	MCH	1.663	160	0.266	PASS
GFSK	DH3	HCH	1.663	160	0.266	PASS
GFSK	DH5	LCH	2.912	106.7	0.311	PASS
GFSK	DH5	MCH	2.912	106.7	0.311	PASS
GFSK	DH5	HCH	2.912	106.7	0.311	PASS

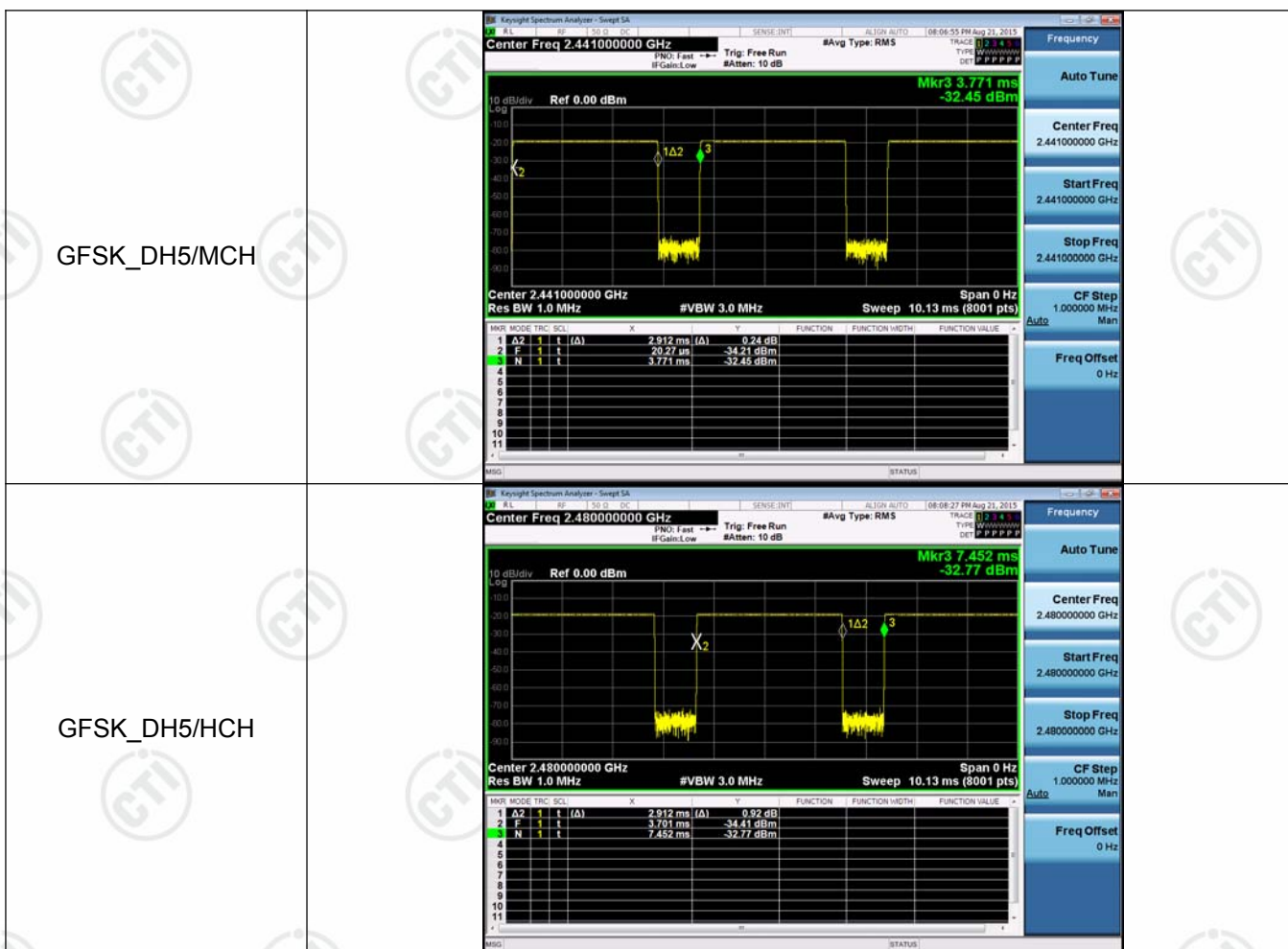
Remark: Only worse case GFSK is reported.

Test Graph





GFSK_DH3/MCH	 Keysight Spectrum Analyzer - Sweep SA Center Freq 2.441000000 GHz #Avg Type: RMS Ref 0.00 dBm Mkr3 4.452 ms -31.92 dBm Center 2.441000000 GHz #VBW 3.0 MHz Sweep 10.13 ms (8001 pts) Res BW 1.0 MHz <table><tr><th>MNR</th><th>MODE</th><th>TRIG</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>A2</td><td>1</td><td>t</td><td>(A)</td><td>1.663 ms</td><td>(A)</td><td></td><td>0.49 dB</td></tr><tr><td>2</td><td>F</td><td>1</td><td>t</td><td></td><td>1.952 ms</td><td></td><td></td><td>-32.76 dBm</td></tr><tr><td>3</td><td>N</td><td>1</td><td>t</td><td></td><td>4.452 ms</td><td></td><td></td><td>-31.92 dBm</td></tr></table>	MNR	MODE	TRIG	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	A2	1	t	(A)	1.663 ms	(A)		0.49 dB	2	F	1	t		1.952 ms			-32.76 dBm	3	N	1	t		4.452 ms			-31.92 dBm
MNR	MODE	TRIG	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																													
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2	F	1	t		1.952 ms			-32.76 dBm																													
3	N	1	t		4.452 ms			-31.92 dBm																													
GFSK_DH3/HCH	 Keysight Spectrum Analyzer - Sweep SA Center Freq 2.480000000 GHz #Avg Type: RMS Ref 0.00 dBm Mkr3 4.466 ms -31.74 dBm Center 2.480000000 GHz #VBW 3.0 MHz Sweep 10.13 ms (8001 pts) Res BW 1.0 MHz <table><tr><th>MNR</th><th>MODE</th><th>TRIG</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>A2</td><td>1</td><td>t</td><td>(A)</td><td>1.663 ms</td><td>(A)</td><td></td><td>-0.13 dB</td></tr><tr><td>2</td><td>F</td><td>1</td><td>t</td><td></td><td>1.952 ms</td><td></td><td></td><td>-32.44 dBm</td></tr><tr><td>3</td><td>N</td><td>1</td><td>t</td><td></td><td>4.466 ms</td><td></td><td></td><td>-31.74 dBm</td></tr></table>	MNR	MODE	TRIG	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	A2	1	t	(A)	1.663 ms	(A)		-0.13 dB	2	F	1	t		1.952 ms			-32.44 dBm	3	N	1	t		4.466 ms			-31.74 dBm
MNR	MODE	TRIG	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																													
1	A2	1	t	(A)	1.663 ms	(A)		-0.13 dB																													
2	F	1	t		1.952 ms			-32.44 dBm																													
3	N	1	t		4.466 ms			-31.74 dBm																													
GFSK_DH5/LCH	 Keysight Spectrum Analyzer - Sweep SA Center Freq 2.402000000 GHz #Avg Type: RMS Ref 0.00 dBm Mkr3 6.949 ms -36.05 dBm Center 2.402000000 GHz #VBW 3.0 MHz Sweep 10.13 ms (8001 pts) Res BW 1.0 MHz <table><tr><th>MNR</th><th>MODE</th><th>TRIG</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>A2</td><td>1</td><td>t</td><td>(A)</td><td>2.912 ms</td><td>(A)</td><td></td><td>0.46 dB</td></tr><tr><td>2</td><td>F</td><td>1</td><td>t</td><td></td><td>3.198 ms</td><td></td><td></td><td>-37.76 dBm</td></tr><tr><td>3</td><td>N</td><td>1</td><td>t</td><td></td><td>6.949 ms</td><td></td><td></td><td>-36.05 dBm</td></tr></table>	MNR	MODE	TRIG	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	A2	1	t	(A)	2.912 ms	(A)		0.46 dB	2	F	1	t		3.198 ms			-37.76 dBm	3	N	1	t		6.949 ms			-36.05 dBm
MNR	MODE	TRIG	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																													
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2	F	1	t		3.198 ms			-37.76 dBm																													
3	N	1	t		6.949 ms			-36.05 dBm																													

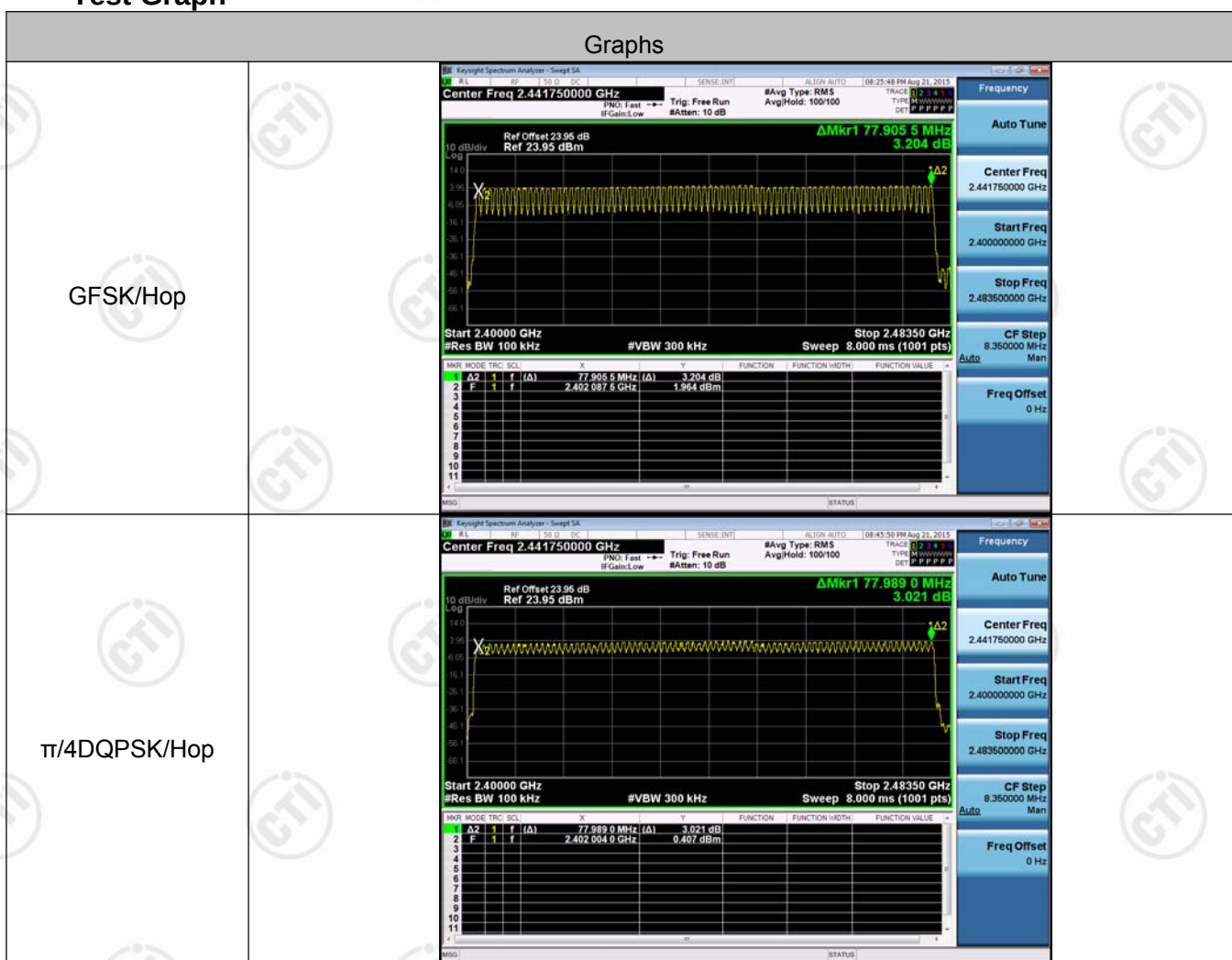


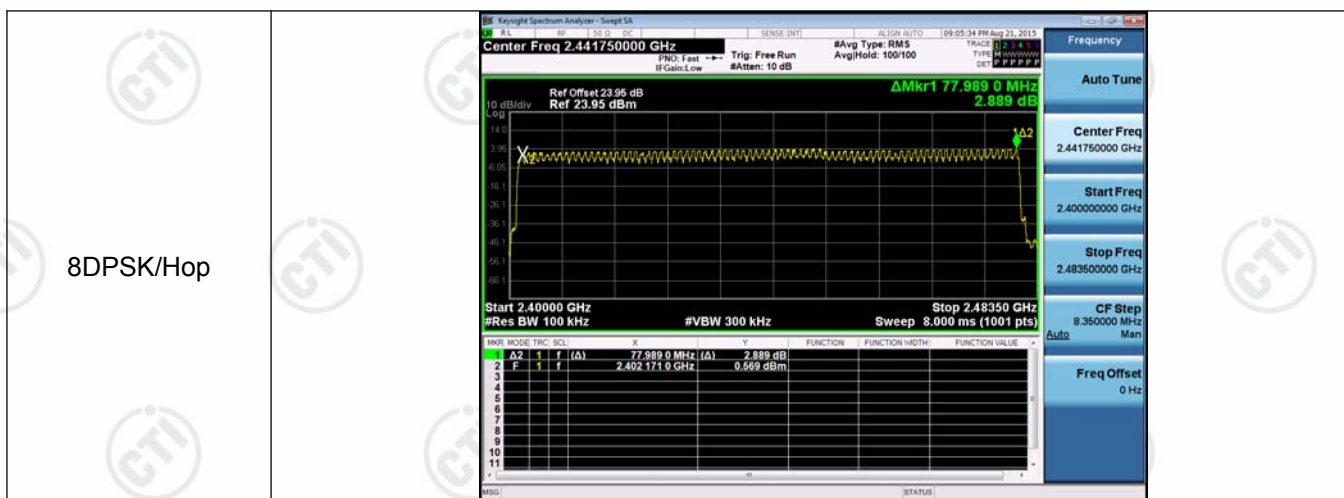
Appendix D): Hopping Channel Number

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



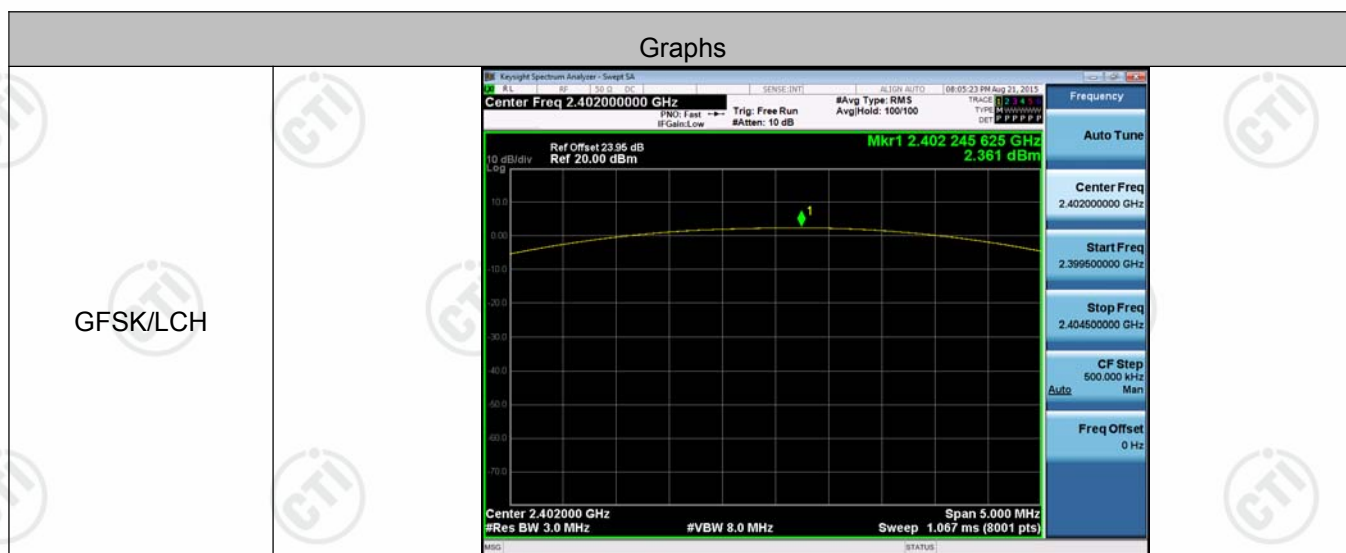


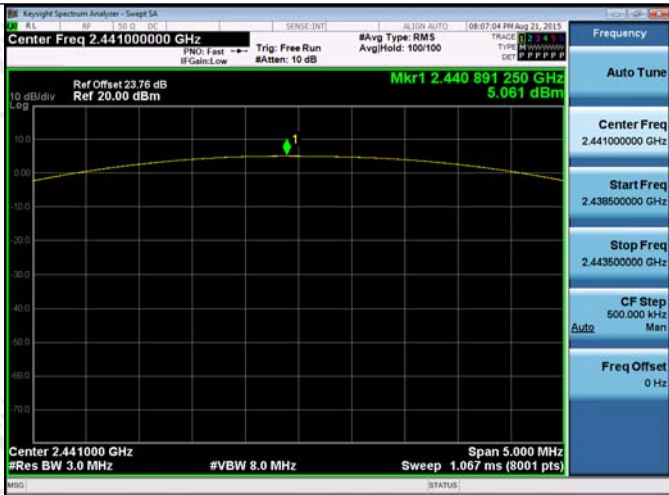
Appendix E): Conducted Peak Output Power

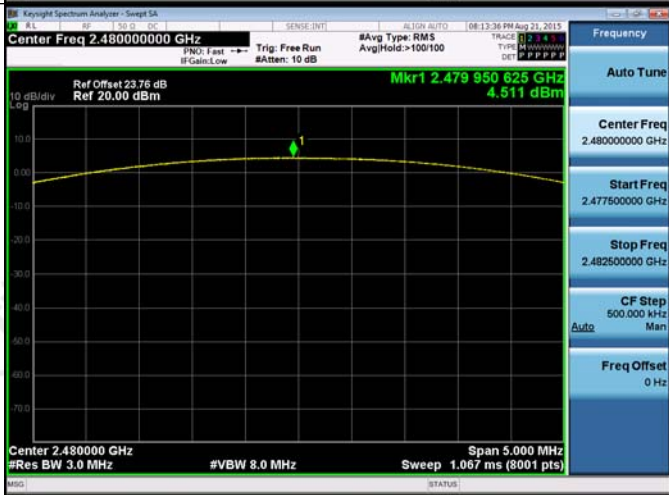
Result Table

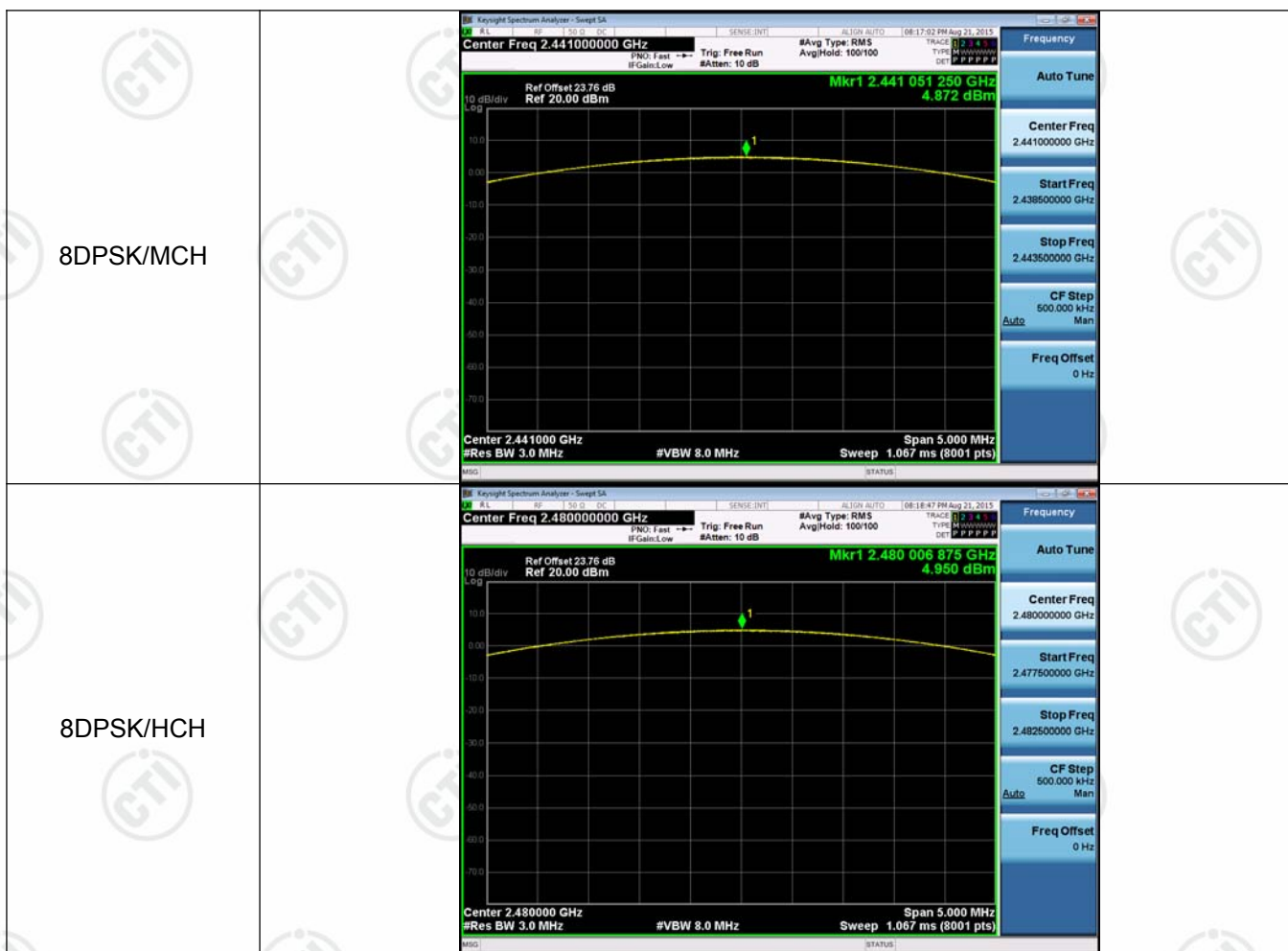
Mode	Channel.	Maximum Peak Output Power [dBm]	Verdict
GFSK	LCH	2.361	PASS
GFSK	MCH	5.061	PASS
GFSK	HCH	5.134	PASS
$\pi/4$ DQPSK	LCH	1.743	PASS
$\pi/4$ DQPSK	MCH	4.453	PASS
$\pi/4$ DQPSK	HCH	4.511	PASS
8DPSK	LCH	2.244	PASS
8DPSK	MCH	4.872	PASS
8DPSK	HCH	4.950	PASS

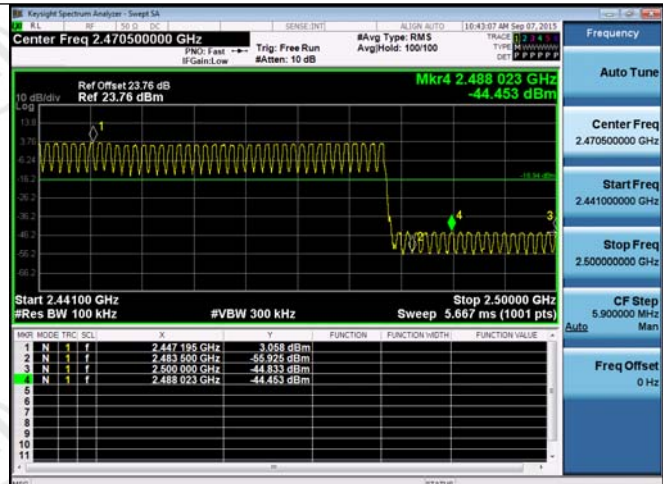
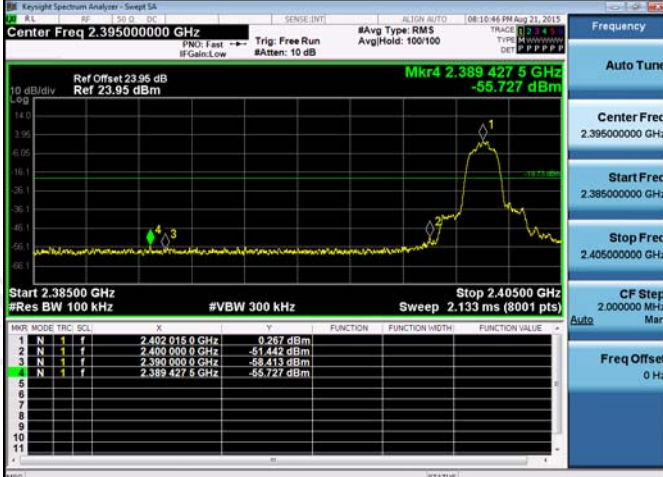
Test Graph

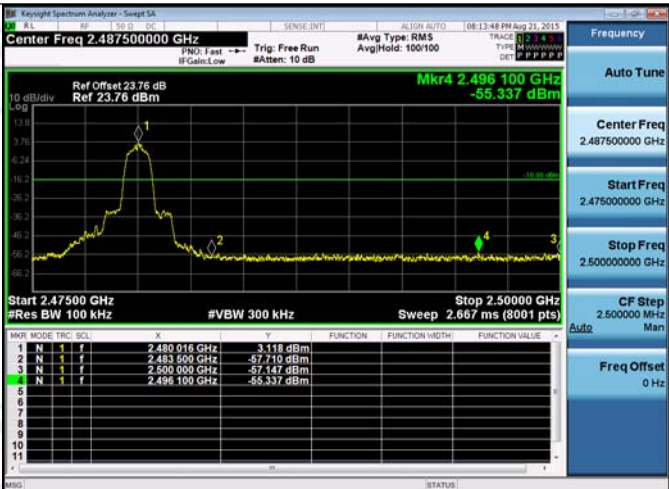
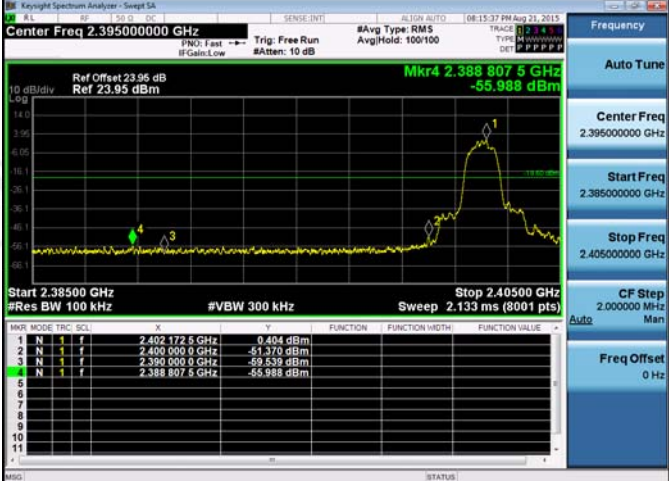


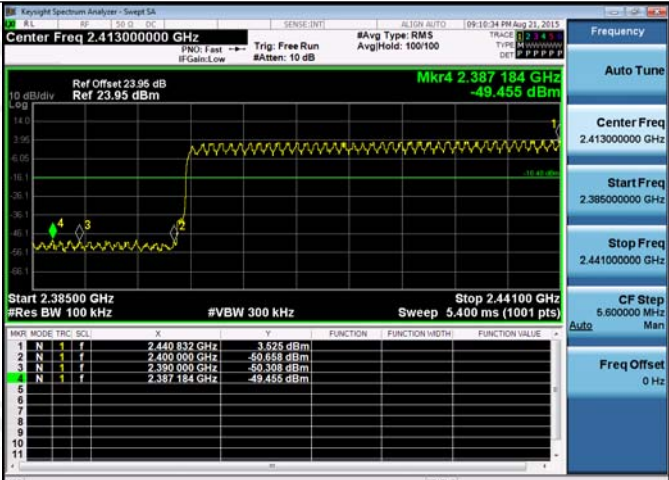
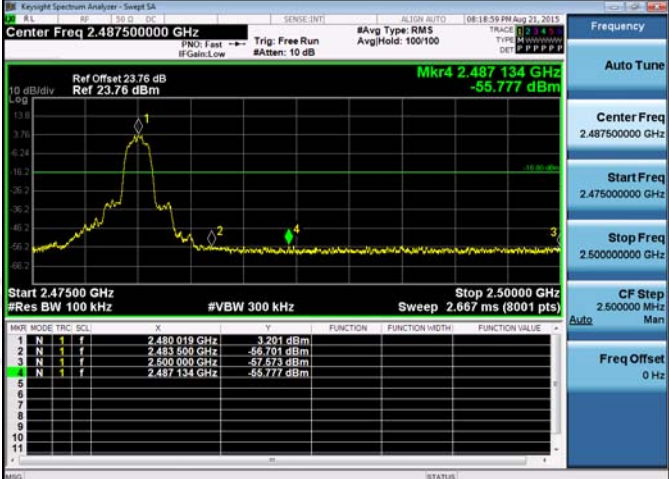
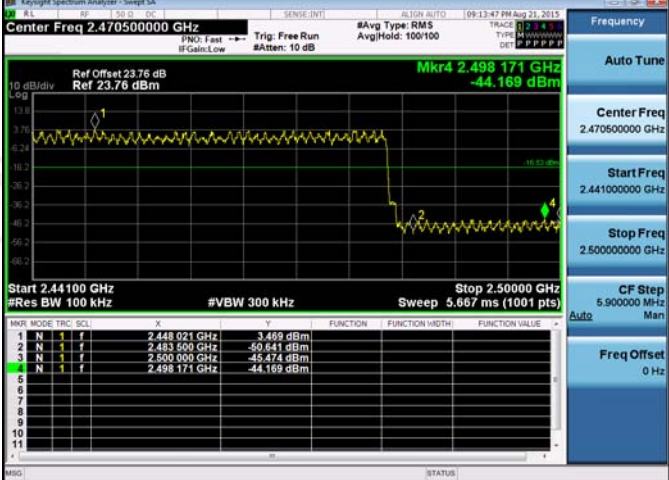
GFSK/MCH	
GFSK/HCH	
$\pi/4$ DQPSK/LCH	

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



GFSK/HCH/Hop	 <table><tr><th>NR</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>f</td><td>2.447195 GHz</td><td>3.058 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>f</td><td>2.483500 GHz</td><td>-55.925 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>f</td><td>2.500000 GHz</td><td>-44.833 dBm</td><td></td><td></td><td></td></tr><tr><td>4</td><td>N</td><td>1</td><td>f</td><td>2.488023 GHz</td><td>-44.453 dBm</td><td></td><td></td><td></td></tr></table>	NR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	f	2.447195 GHz	3.058 dBm				2	N	1	f	2.483500 GHz	-55.925 dBm				3	N	1	f	2.500000 GHz	-44.833 dBm				4	N	1	f	2.488023 GHz	-44.453 dBm			
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$\pi/4$ DQPSK/LCH/No Hop	 <table><tr><th>NR</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>f</td><td>2.4020150 GHz</td><td>3.267 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>f</td><td>2.4000000 GHz</td><td>-51.442 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>f</td><td>2.3900000 GHz</td><td>-58.413 dBm</td><td></td><td></td><td></td></tr><tr><td>4</td><td>N</td><td>1</td><td>f</td><td>2.3894275 GHz</td><td>-55.727 dBm</td><td></td><td></td><td></td></tr></table>	NR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	f	2.4020150 GHz	3.267 dBm				2	N	1	f	2.4000000 GHz	-51.442 dBm				3	N	1	f	2.3900000 GHz	-58.413 dBm				4	N	1	f	2.3894275 GHz	-55.727 dBm			
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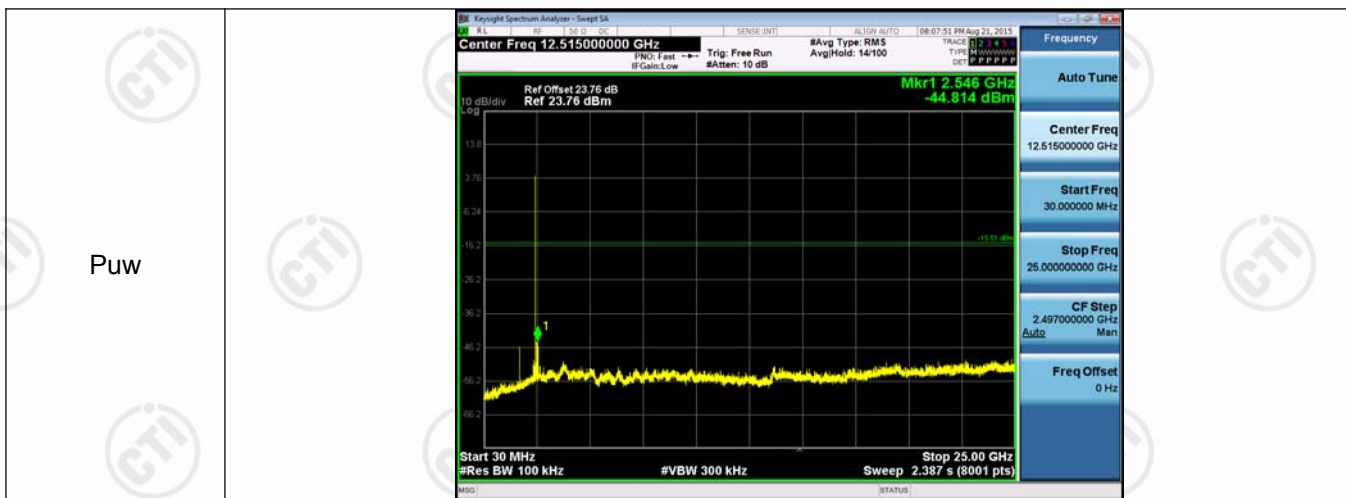
$\pi/4$DQPSK/HCH/No Hop	
$\pi/4$DQPSK/HCH/Hop	
8DPSK/LCH/No Hop	

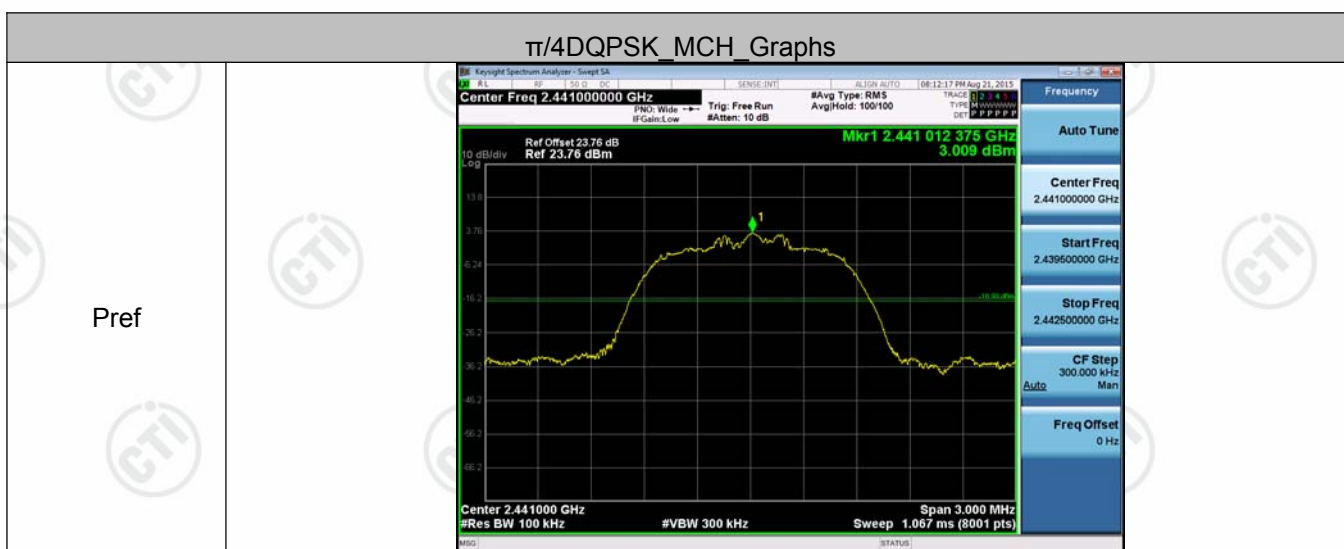
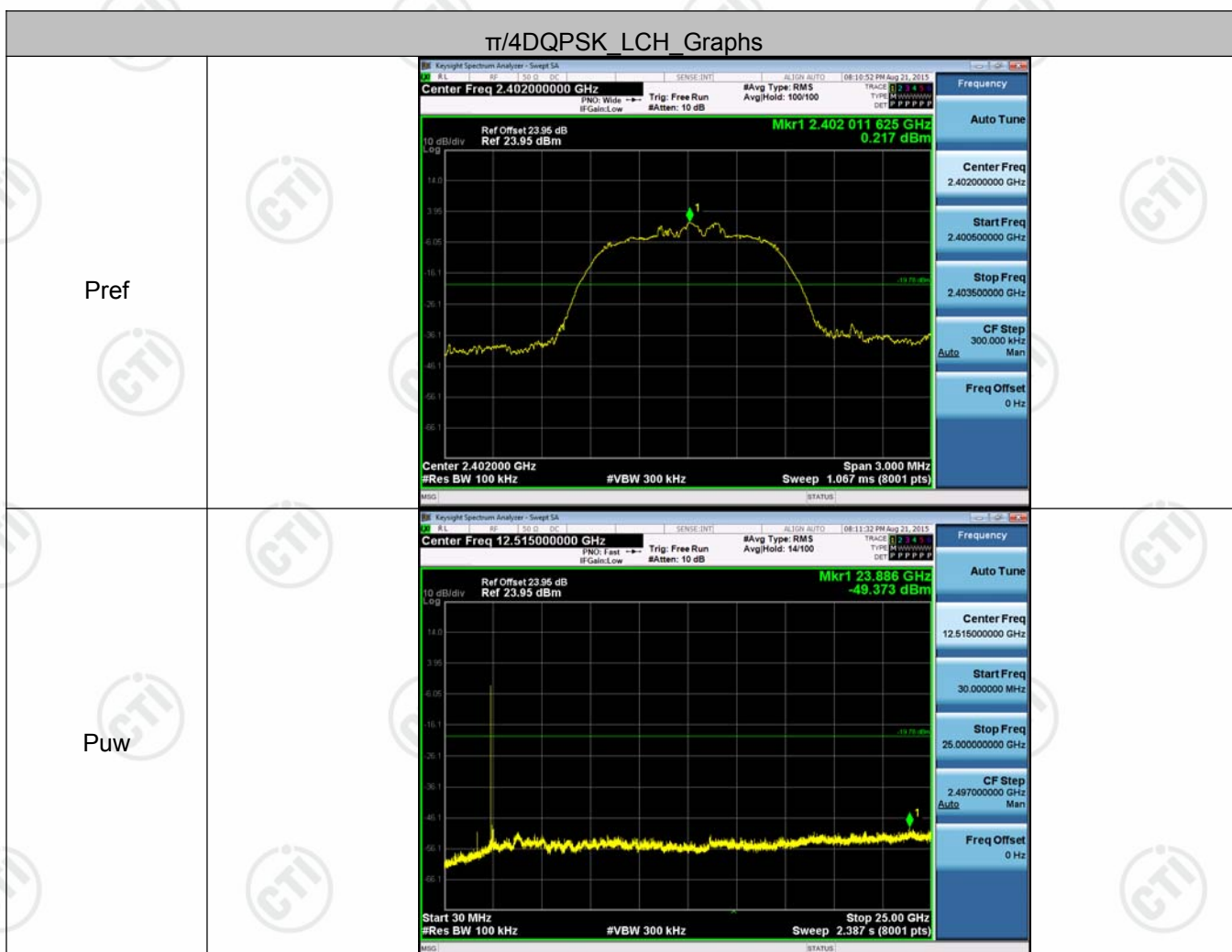
8DPSK/LCH/Hop	
8DPSK/HCH/No Hop	
8DPSK/HCH/Hop	

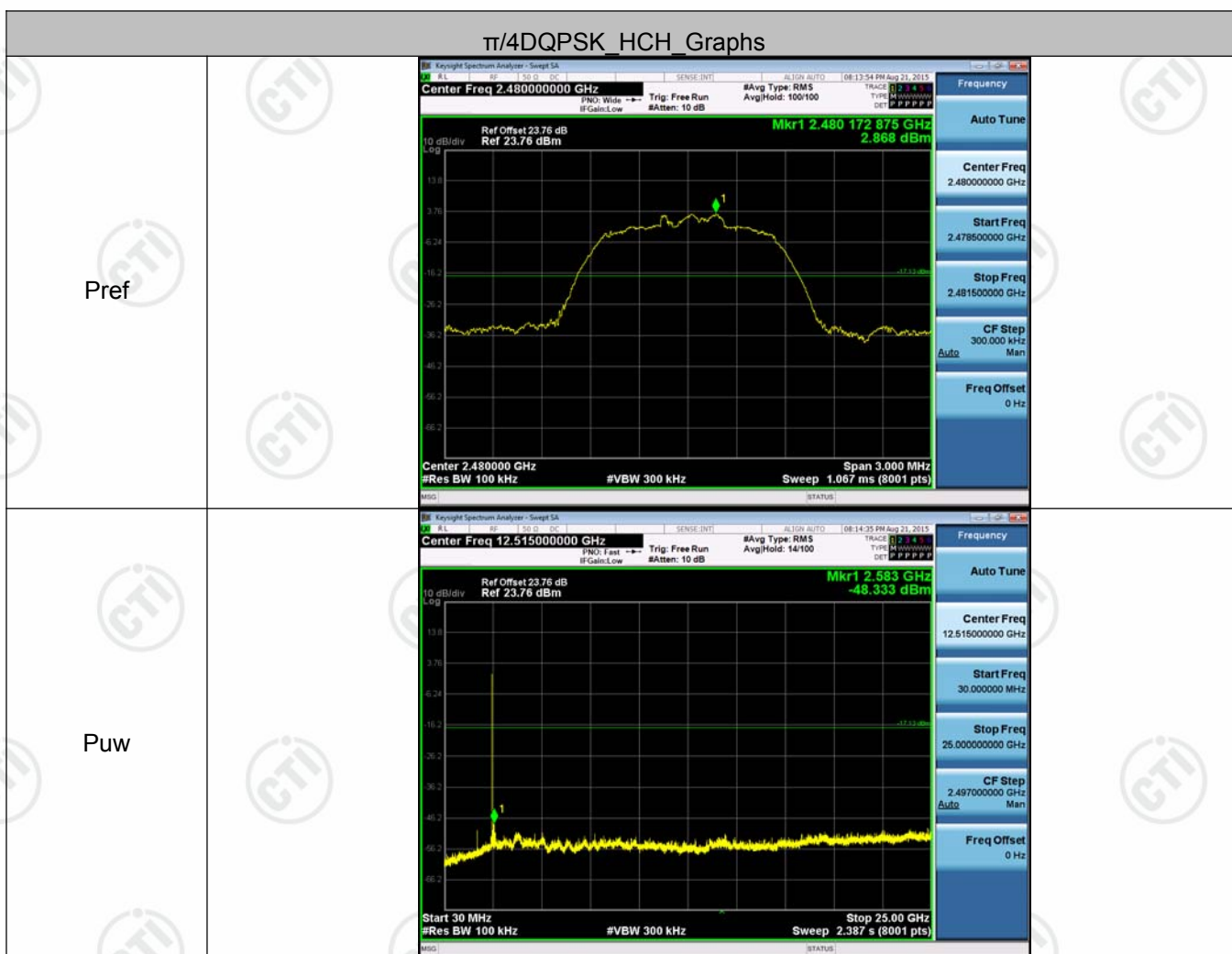
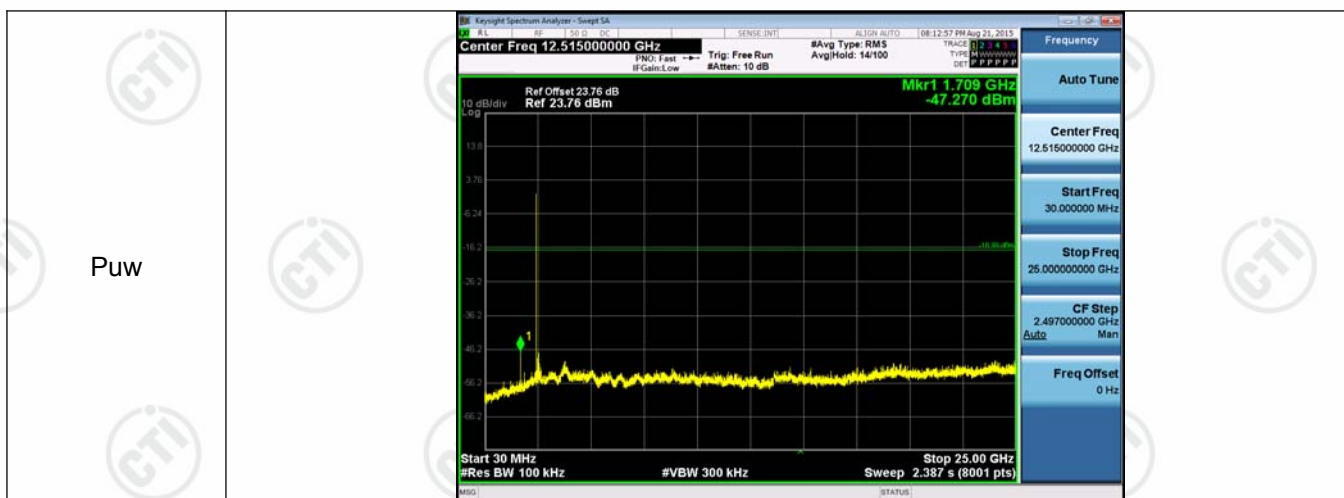
Appendix G): RF Conducted Spurious Emissions

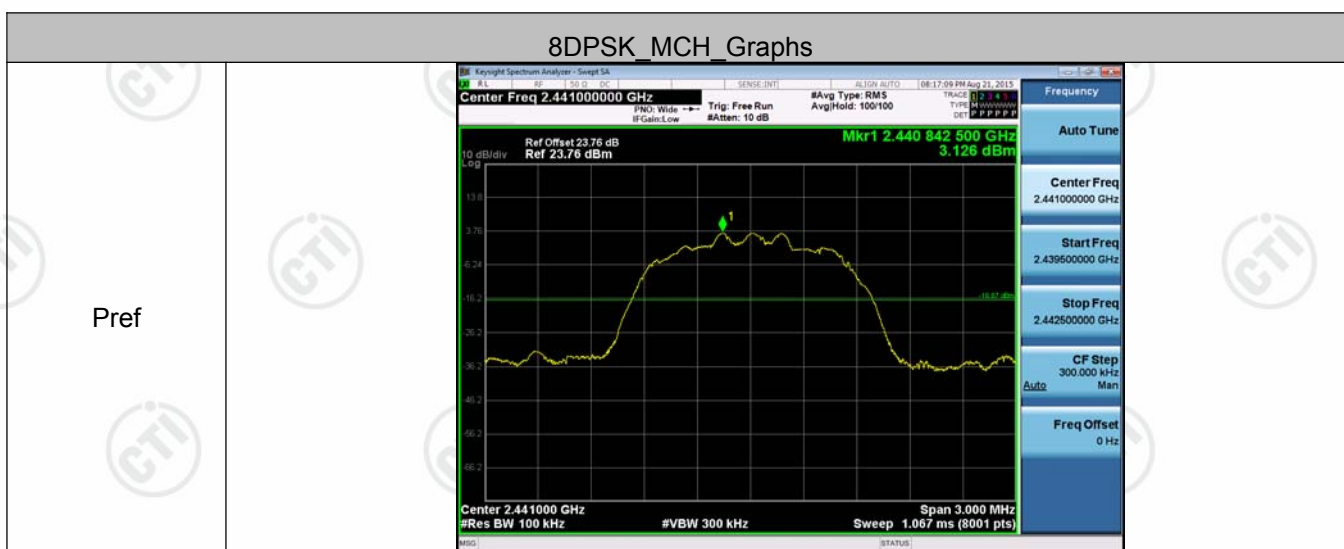
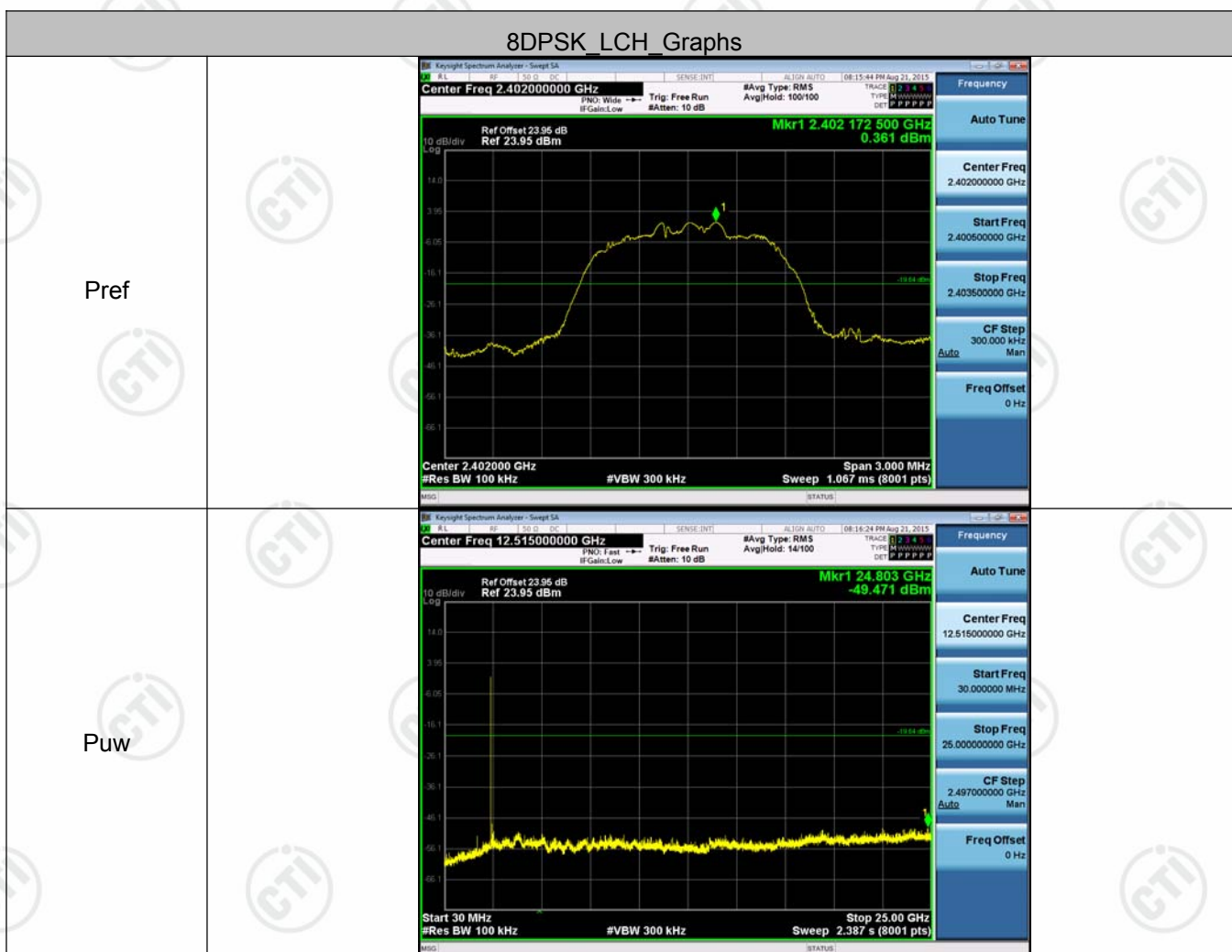
Test Graph

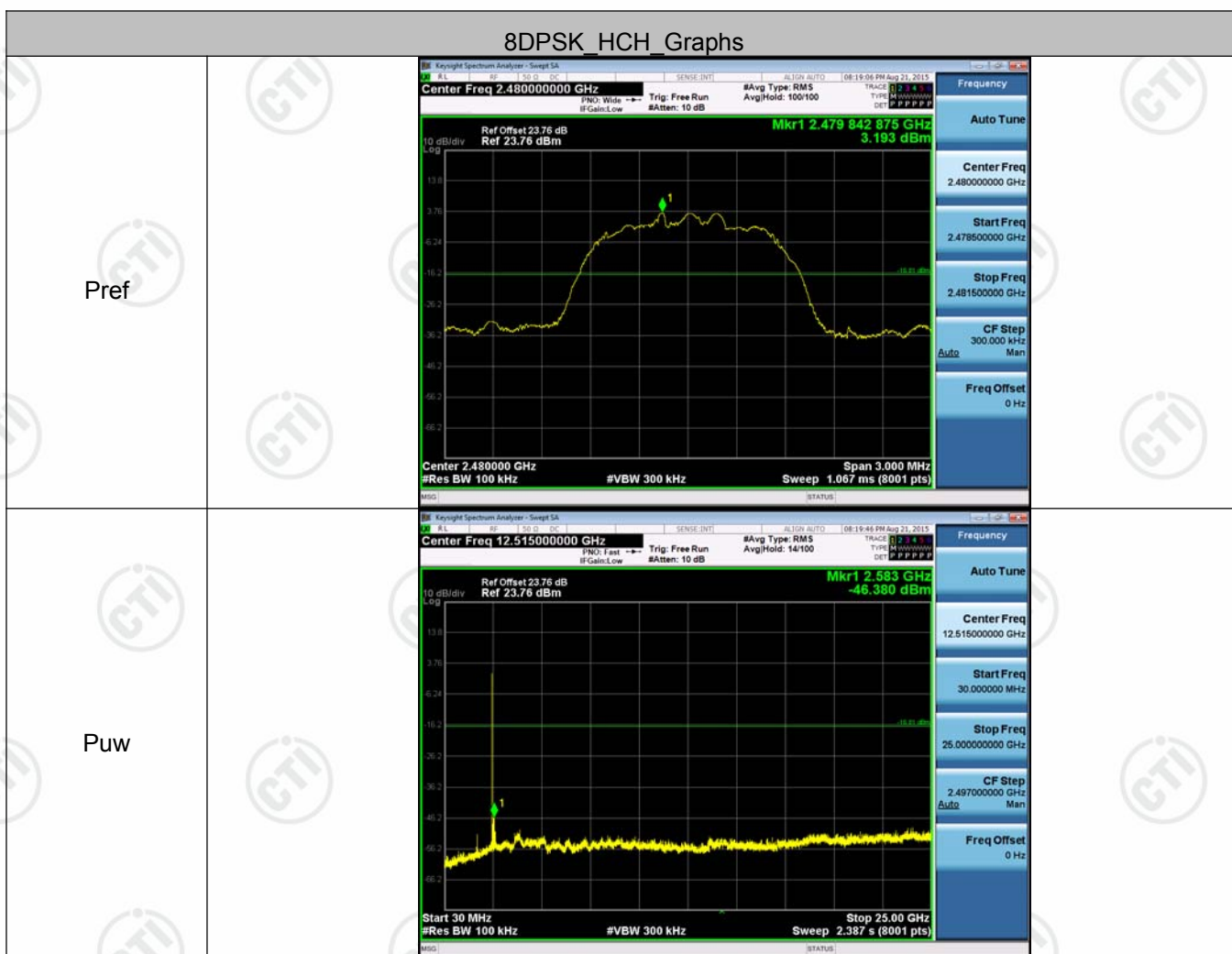
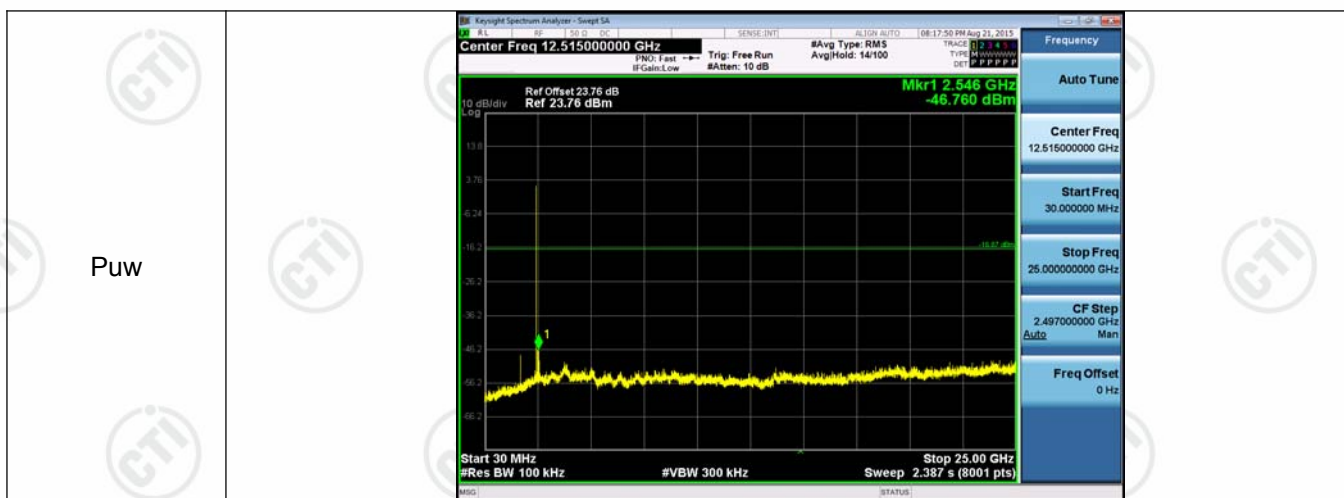




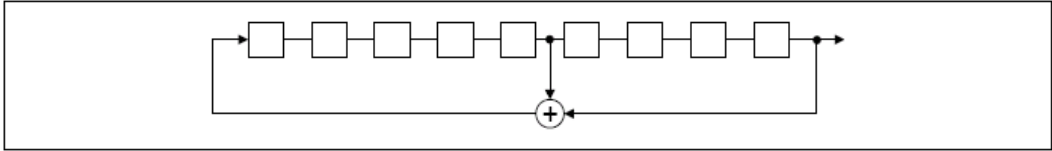








Appendix H) Pseudorandom Frequency Hopping Sequence

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 integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 0dBi.	

Appendix J) AC Power Line Conducted Emission

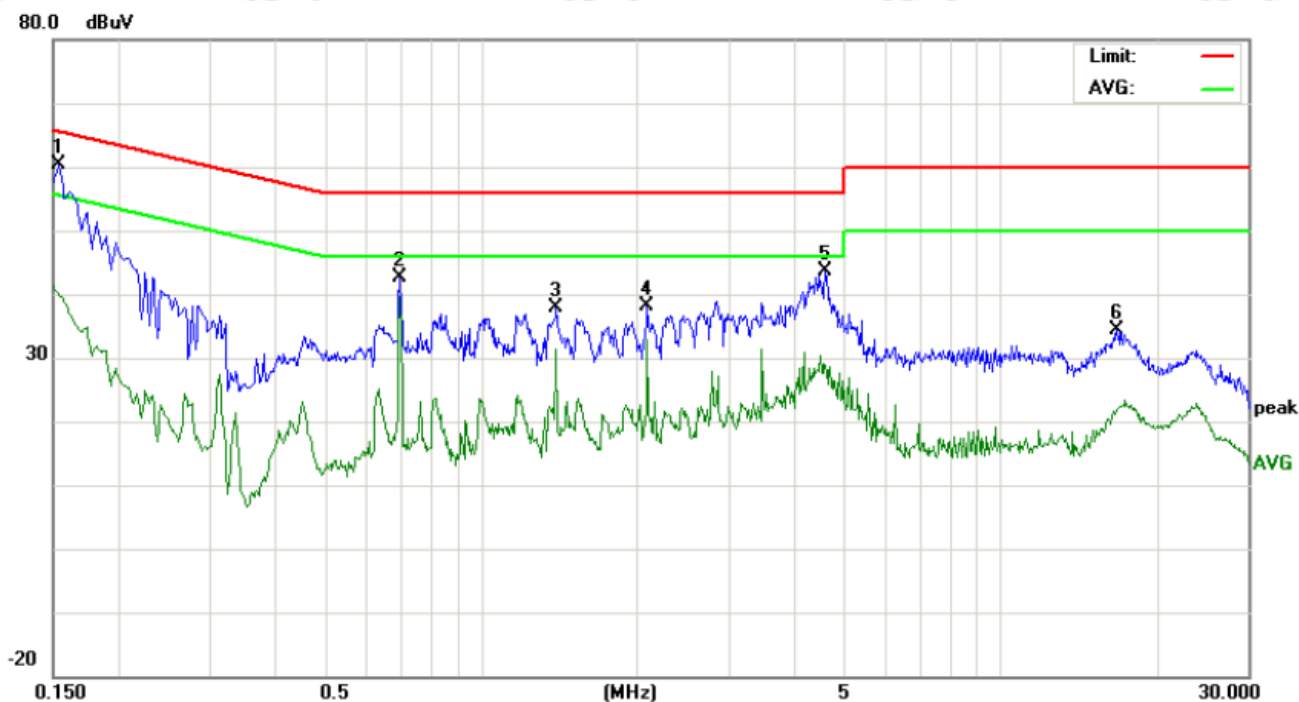
Test Procedure:	Test frequency range :150KHz-30MHz 1) The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a $50\Omega/50\mu\text{H} + 5\Omega$ linear impedance. 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:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
* 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			

Measurement Data

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

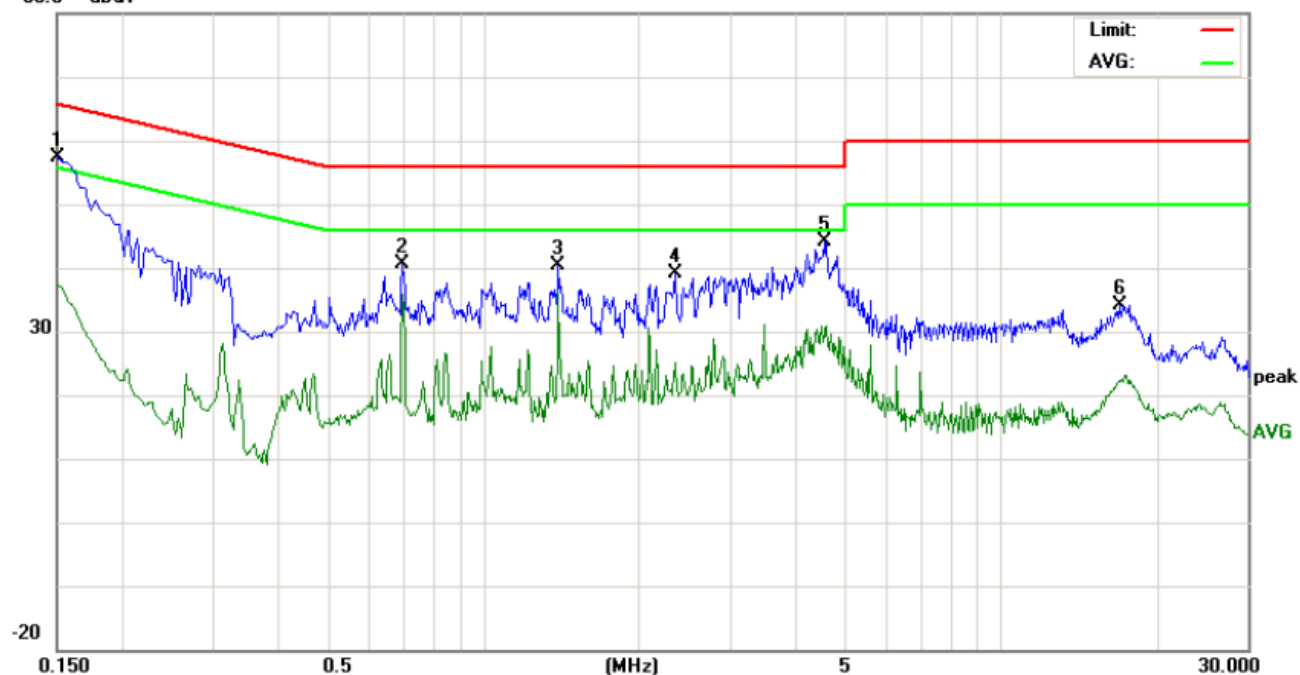
Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

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	0.1539	50.46		30.01	9.90	60.36	39.91	65.78	55.78	-5.42	-15.87		P	
2	0.6980	32.67		29.72	9.90	42.57	39.62	56.00	46.00	-13.43	-6.38		P	
3	1.3980	28.03		21.49	9.90	37.93	31.39	56.00	46.00	-18.07	-14.61		P	
4	2.0940	28.20		23.00	9.90	38.10	32.90	56.00	46.00	-17.90	-13.10		P	
5	4.6180	33.80		18.89	9.90	43.70	28.79	56.00	46.00	-12.30	-17.21		P	
6	16.7620	24.19		11.81	10.08	34.27	21.89	60.00	50.00	-25.73	-28.11		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	0.1500	47.43		27.50	9.90	57.33		37.40	65.99	55.99	-8.66	-18.59	P	
2	0.6980	30.78		25.89	9.90	40.68		35.79	56.00	46.00	-15.32	-10.21	P	
3	1.3980	30.57		26.38	9.90	40.47		36.28	56.00	46.00	-15.53	-9.72	P	
4	2.3500	29.33		15.21	9.90	39.23		25.11	56.00	46.00	-16.77	-20.89	P	
5	4.5580	34.14		19.54	9.90	44.04		29.44	56.00	46.00	-11.96	-16.56	P	
6	17.0180	24.03		12.17	10.10	34.13		22.27	60.00	50.00	-25.87	-27.73	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)/Radiated Spurious Emissions

Receiver Setup:	Frequency	Detector	RBW	VBW	Remark
	0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
	0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
	0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
	0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
	0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	120 kHz	300kHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
Test Procedure:		Peak	1MHz	10Hz	Average
	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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) 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. - If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. Above 1GHz test procedure as below: - Test the EUT in the lowest channel ,the middle 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	Field strength (microvolt/meter)	Limit (dBμV/m)	Remark	Measurement distance (m)
	0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz-88MHz	100	40.0	Quasi-peak	3
	88MHz-216MHz	150	43.5	Quasi-peak	3
	216MHz-960MHz	200	46.0	Quasi-peak	3
	960MHz-1GHz	500	54.0	Quasi-peak	3
	Above 1GHz	500	54.0	Average	3
Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.					

Radiated Spurious Emissions test Data:

All the modes of operation (X, Y, Z) were investigated and the worst-case emissions are reported.

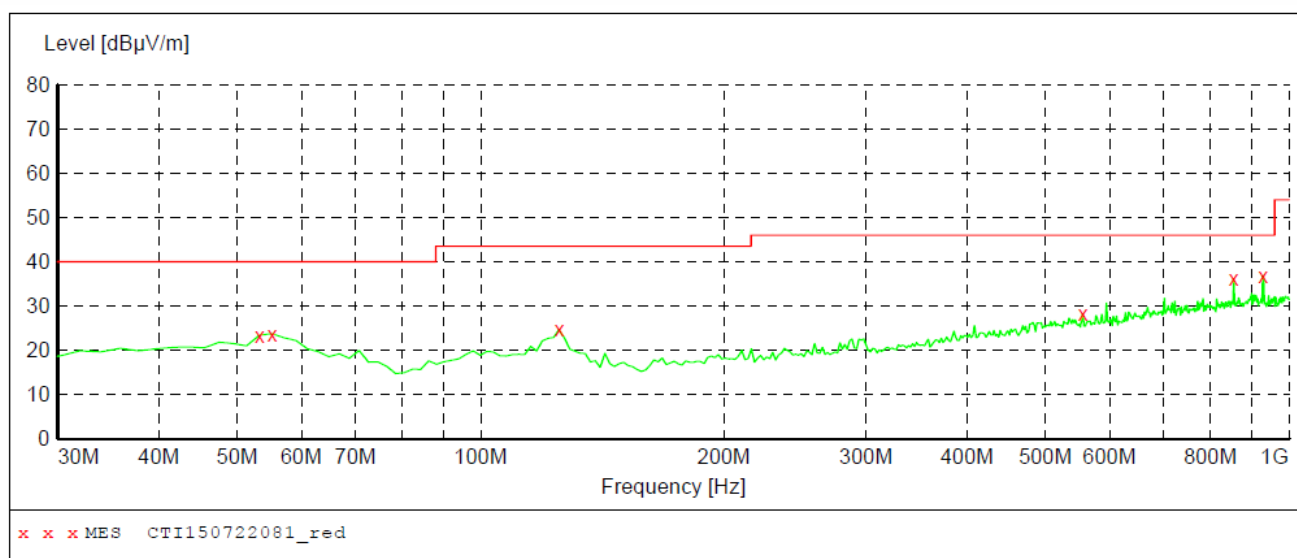
A. Below 30MHz:

No emissions were found higher than the background below 30MHz and background is lower than the limit, so it deems to compliance with the limit without recorded.

B. 30MHz ~ 1GHz:

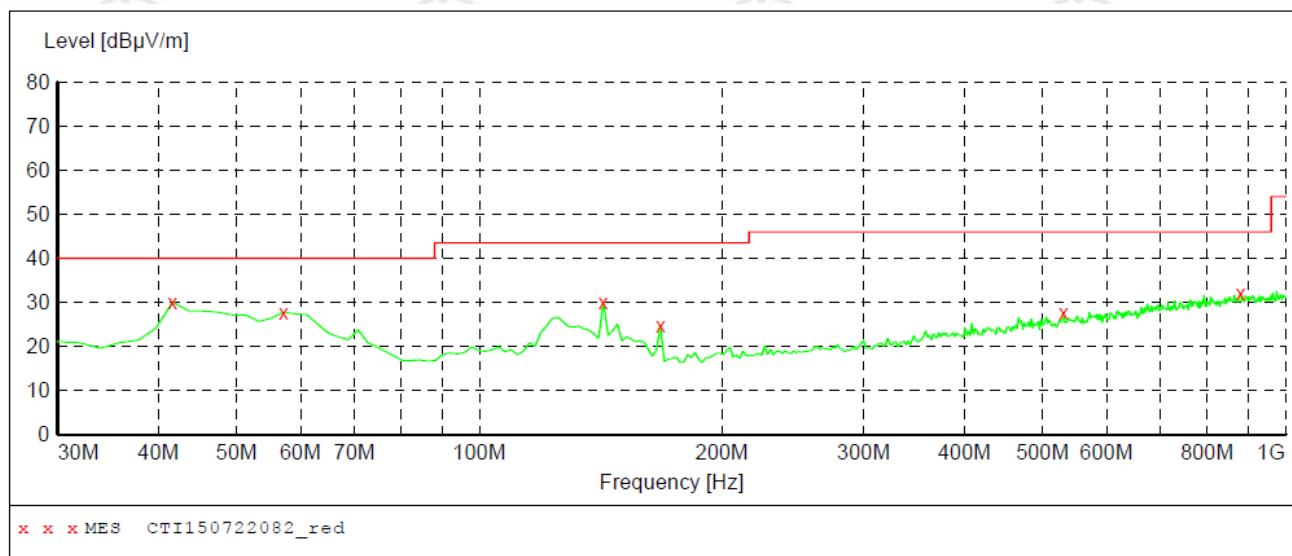
The test data of low channel, middle channel and high channel are almost same in frequency bands 30MHz to 1GHz, and the data of middle channel (GFSK mode) are chosen as representative in below:

H:



Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
53.280000	23.40	16.1	40.0	16.6	---	100.0	10.00	HORIZONTAL
55.220000	23.70	15.8	40.0	16.3	---	100.0	347.00	HORIZONTAL
125.060000	24.70	12.8	43.5	18.8	---	100.0	17.00	HORIZONTAL
555.740000	28.20	21.9	46.0	17.8	---	100.0	10.00	HORIZONTAL
854.500000	36.10	26.1	46.0	9.9	---	100.0	107.00	HORIZONTAL
928.220000	36.90	26.7	46.0	9.1	---	100.0	94.00	HORIZONTAL

V:



Frequency MHz	Level dBμV/m	Transd dB	Limit dBμV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
41.640000	30.00	15.9	40.0	10.0	---	100.0	335.00	VERTICAL
57.160000	27.80	15.6	40.0	12.2	---	100.0	242.00	VERTICAL
142.520000	30.10	11.7	43.5	13.4	---	100.0	29.00	VERTICAL
167.740000	24.60	12.3	43.5	18.9	---	100.0	282.00	VERTICAL
530.520000	27.70	21.7	46.0	18.3	---	100.0	10.00	VERTICAL
879.720000	32.10	26.5	46.0	13.9	---	100.0	335.00	VERTICAL

C. Above 1GHz:
Test Results-(Measurement Distance: 3m) Channel low 2402MHz_GFSK mode:

Frequency (MHz)	Measurement (dBuV/m)	Limit (dBuV/m)	Detector Type	Antenna (H/V)	Result (P/F)
2390.0	36.23	74	PK	H	P
2400.0	45.31	74	PK	H	P
2402.0*	84.24	---	PK	H	P
4804.0	41.65	74	PK	H	P
2390.0	36.31	74	PK	V	P
2400.0	43.54	74	PK	V	P
2402.0*	85.81	---	PK	V	P
4804.0	43.25	74	PK	V	P

*: fundamental frequency

Test Results-(Measurement Distance: 3m) Channel middle 2441MHz_GFSK mode:

Frequency (MHz)	Measurement (dBuV/m)	Limit (dBuV/m)	Detector Type	Antenna (H/V)	Result (P/F)
2441.0*	86.81	---	PK	H	P
4882.0	44.26	74	PK	H	P
2441.0*	87.64	---	PK	V	P
4882.0	44.85	74	PK	V	P

*: fundamental frequency

Test Results-(Measurement Distance: 3m) Channel high 2480MHz_GFSK mode:

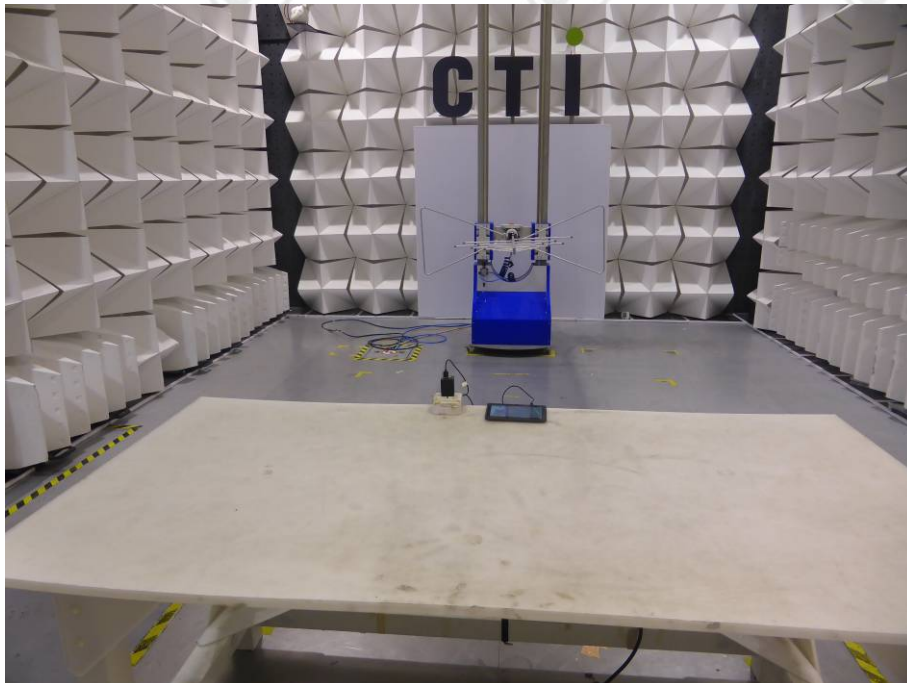
Frequency (MHz)	Measurement (dBuV/m)	Limit (dBuV/m)	Detector Type	Antenna (H/V)	Result (P/F)
2480.0*	86.01	---	PK	H	P
2483.5	42.85	74	PK	H	P
4960.0	41.43	74	PK	H	P
2480.0*	87.63	---	PK	V	P
2483.5	42.38	74	PK	V	P
4960.0	43.58	74	PK	V	P

*: fundamental frequency

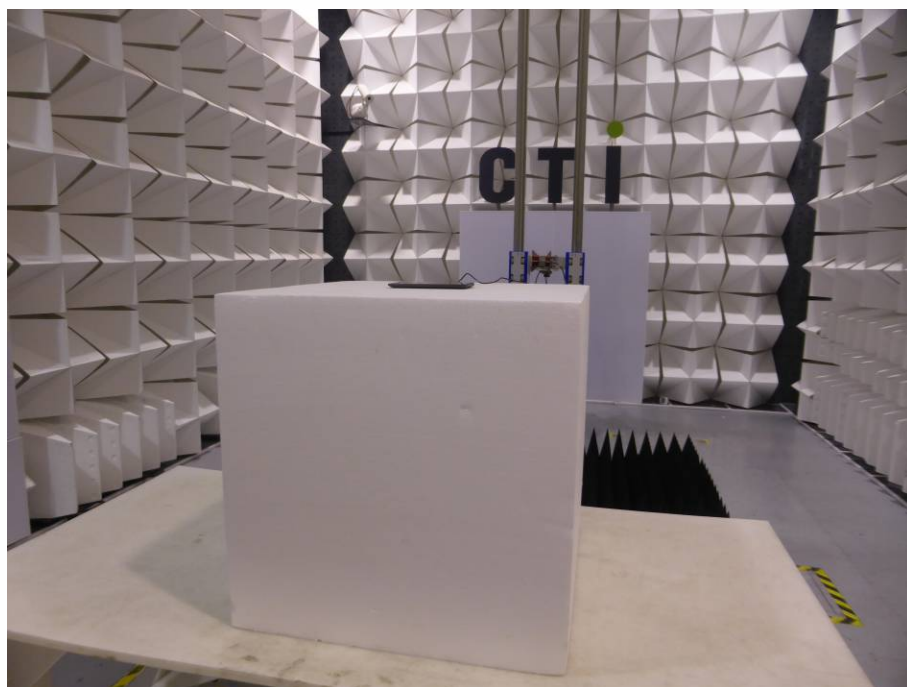
Remark:

- The above tables show that the frequencies peak data are all below the average limit, so the average data of these frequencies are deemed to fulfill the average limits and not reported.
- All the modes of GFSK, $\pi/4$ -DQPSK and 8DPSK have been tested. The worst case is GFSK mode, and the worst data of GFSK mode are chosen as above.
- No emission found from 18GHz to 25GHz.
- All outside of operating frequency band and restricted band specified are below 15.209.

PHOTOGRAPHS OF TEST SETUP



Radiated spurious emission Test Setup-1(Below 1GHz)



Radiated spurious emission Test Setup-2(Above 1GHz)



Conducted emission Test Setup

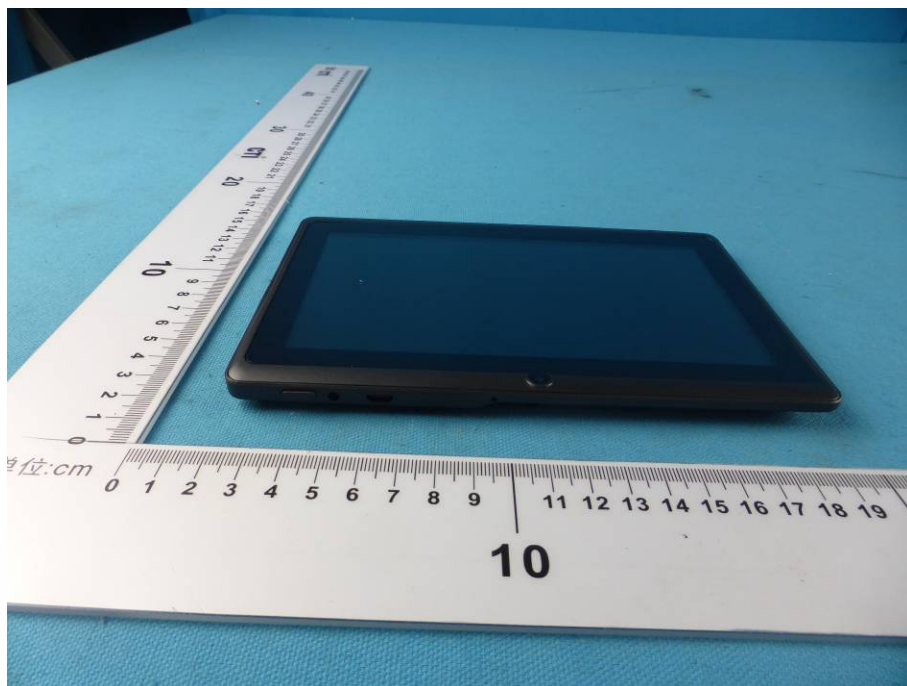
PHOTOGRAPHS OF EUT Constructional Details



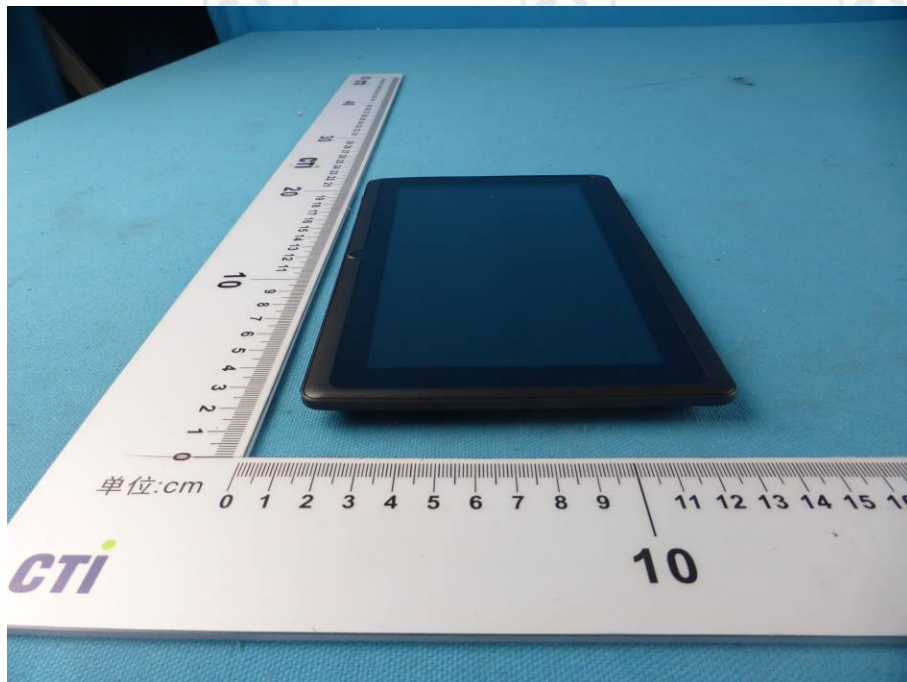
View of General Product-1



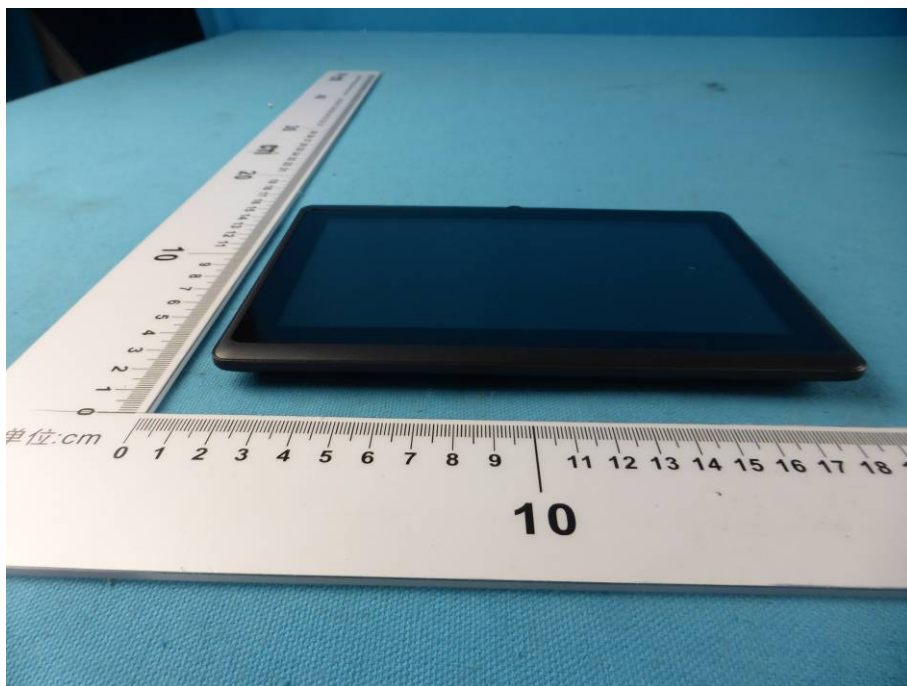
View of External Product-1



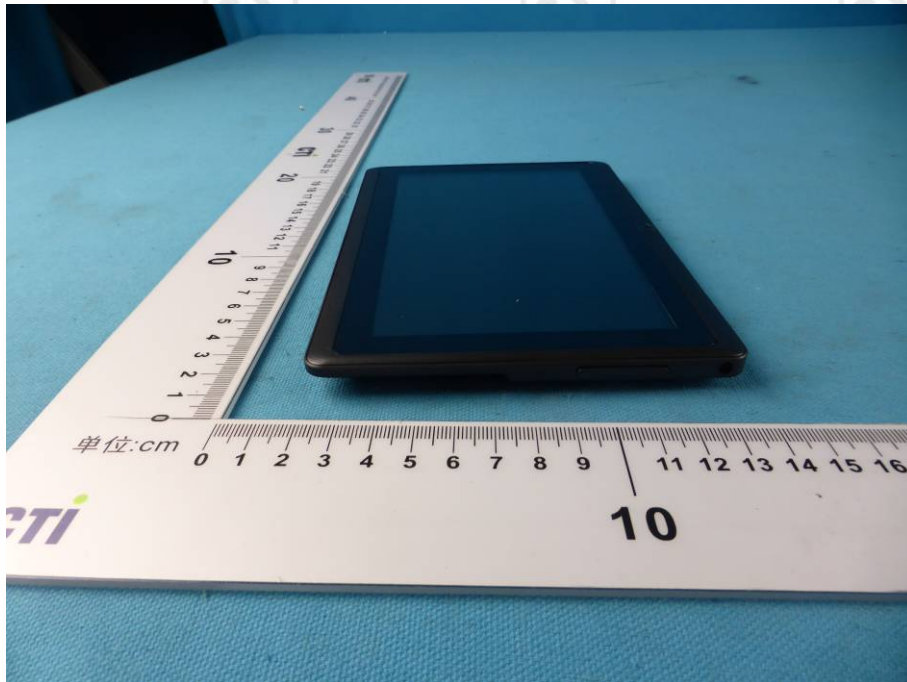
View of External Product-2



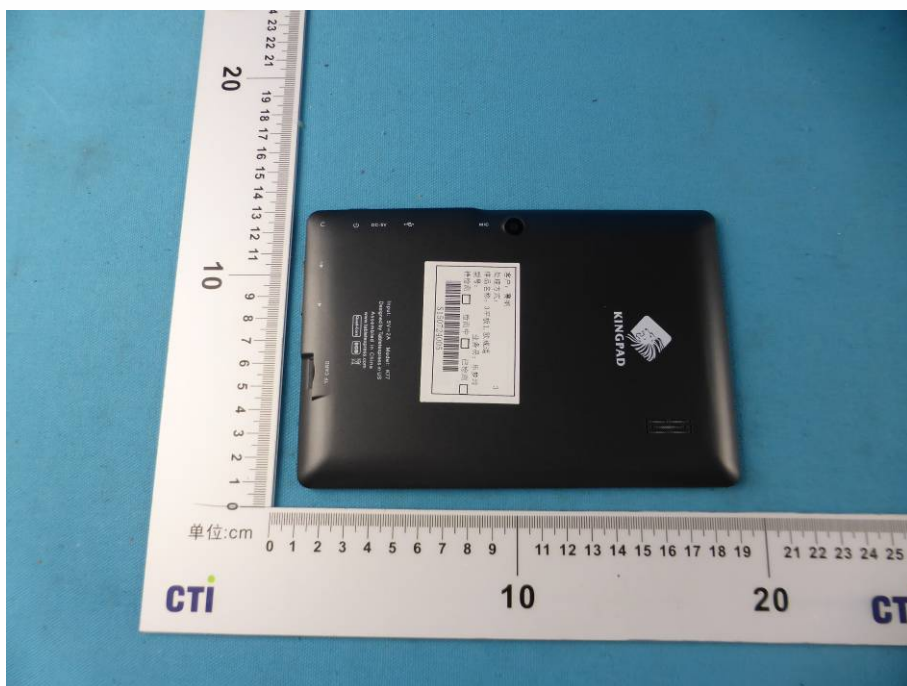
View of External Product-3



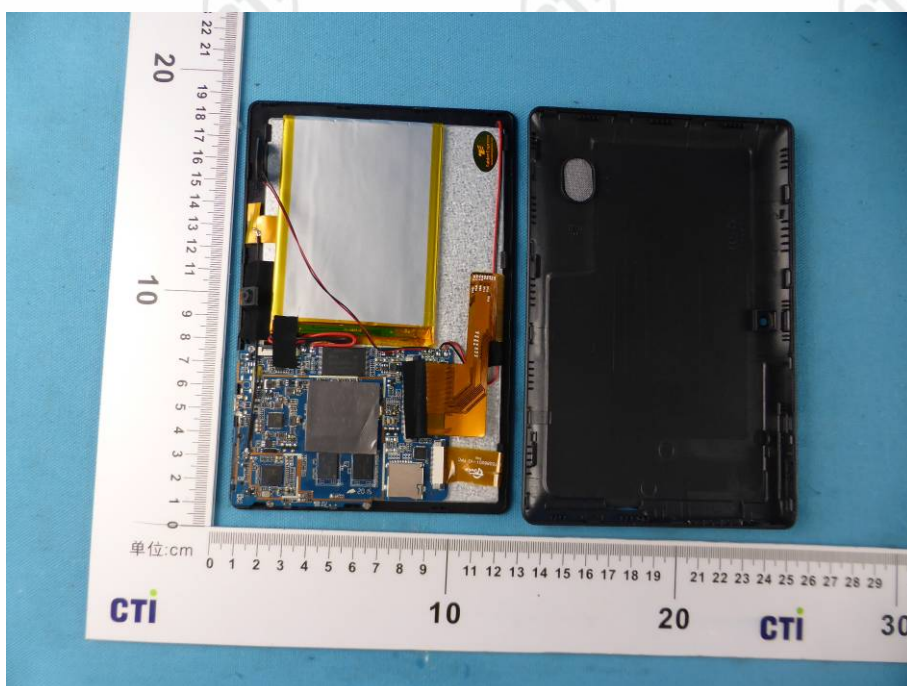
View of External Product-4



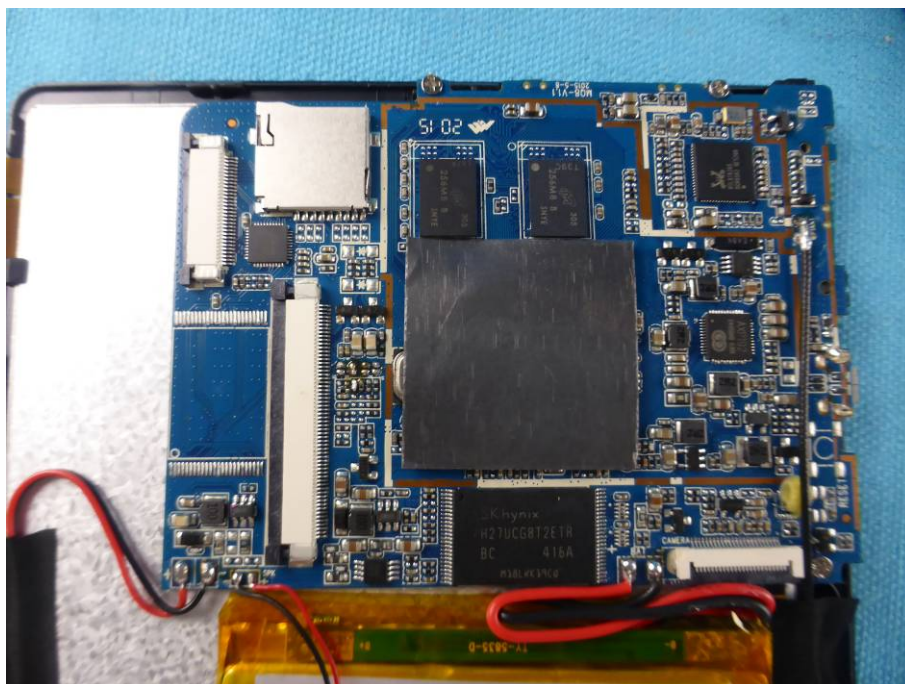
View of External Product-5



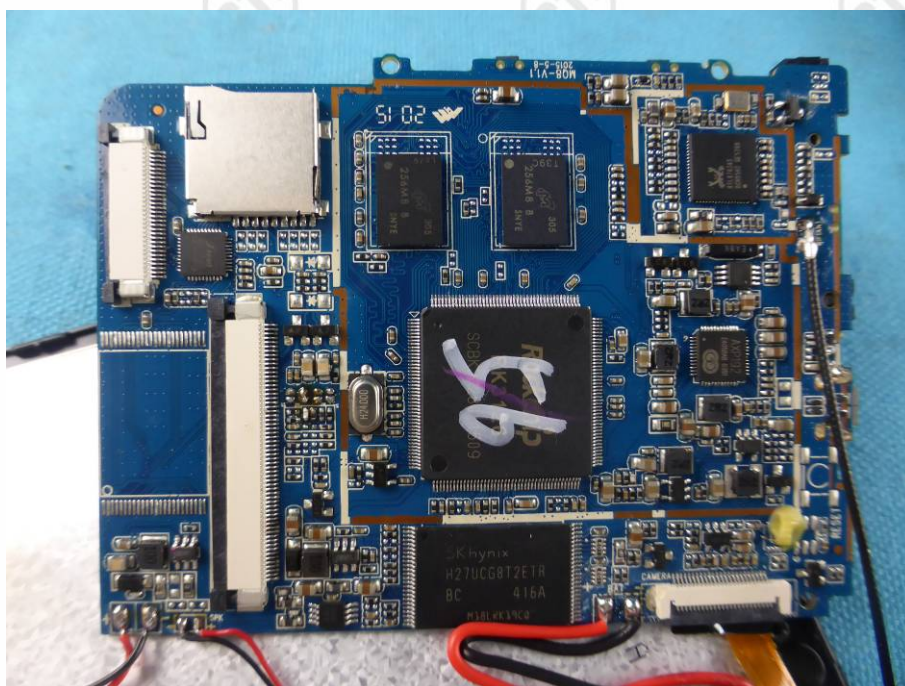
View of External Product-6



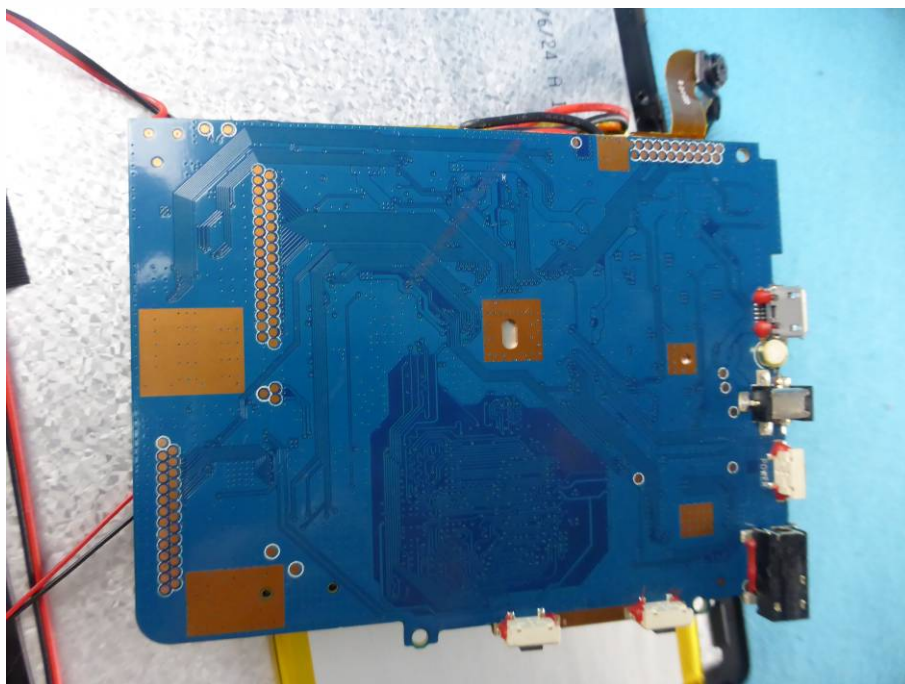
View of Internal Product-1



View of Internal Product-2



View of Internal Product-3



View of Internal Product-4



View of Internal Product-5

*** End of Report ***

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