TEST REPORT

Product	:	Multi-Functional Wireless Speaker
Trade mark	:	WOW!dea
Model/Type reference	:	SKOIN, M5, M5A, M5B, M5C, M5D, M5E, M5F, M5T, M5S, M5y (y=Refer to Different Color and Package Set Code)
Serial Number	:	N/A
Report Number	:	EED32K00293601
FCC ID	:	2AJIX-M5
Date of Issue	:	May 13, 2019
Test Standards	:	47 CFR Part 15 Subpart C
Test result	:	PASS

Prepared for:

Shenzhen Hongyi Science & Technology Development Co., Ltd.
Unit 601-602, Building No. A4, East Industrial Park of OCT,
Nanshan District, Shenzhen, China

Prepared by:

Centre Testing International Group Co., Ltd.
Hongwei Industrial Zone, Bao'an 70 District,
Shenzhen, Guangdong, China
TEL: +86-755-3368 3668
FAX: +86-755-3368 3385

Tested By: Tay Zheng Compiled by: Kevin Lan

Reviewed by: Vore Xin Approved by: Kevin Yang

Kevin yang

Date: May 13, 2019

Check No.: 3757538892

2 Version

Version No.	Date	Description
00	May 13, 2019	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 samples and the sample information are provided by the client.
Model No.: SKOIN, M5, M5A, M5B, M5C, M5D, M5E, M5F, M5T, M5S, M5y (y=Refer to Different Color and Package Set Code)
Only the model M5 was tested, since the electrical circuit design, layout, components used and internal wiring were identical for the above models, with difference being outer decoration.

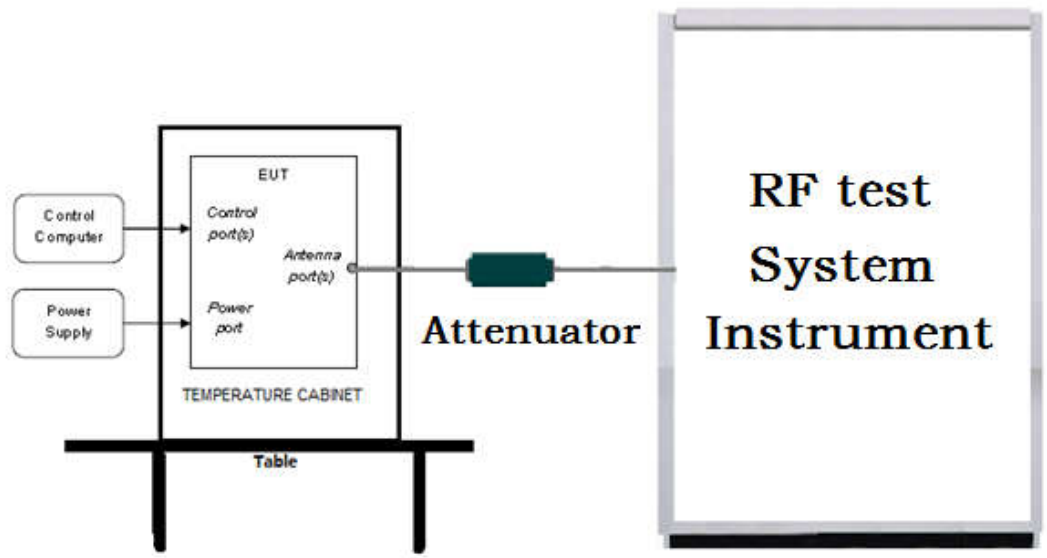
4 Content

1 COVER PAGE **1**
2 VERSION **2**
3 TEST SUMMARY **3**
4 CONTENT **4**
5 TEST REQUIREMENT **5**
5.1 TEST SETUP 5
5.1.1 For Conducted test setup 5
5.1.2 For Radiated Emissions test setup 5
5.1.3 For Conducted Emissions test setup 6
5.2 TEST ENVIRONMENT 6
5.3 TEST CONDITION 6
6 GENERAL INFORMATION **7**
6.1 CLIENT INFORMATION 7
6.2 GENERAL DESCRIPTION OF EUT 7
6.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD 7
6.4 DESCRIPTION OF SUPPORT UNITS 8
6.5 TEST LOCATION 8
6.6 DEVIATION FROM STANDARDS 8
6.7 ABNORMALITIES FROM STANDARD CONDITIONS 8
6.8 OTHER INFORMATION REQUESTED BY THE CUSTOMER 8
6.9 MEASUREMENT UNCERTAINTY (95% CONFIDENCE LEVELS, K=2) 9
7 EQUIPMENT LIST **10**
8 RADIO TECHNICAL REQUIREMENTS SPECIFICATION **12**
Appendix A): 20dB Occupied Bandwidth 13
Appendix B): Carrier Frequency Separation 17
Appendix C): Dwell Time 21
Appendix D): Hopping Channel Number 25
Appendix E): Conducted Peak Output Power 27
Appendix F): Band-edge for RF Conducted Emissions 31
Appendix G): RF Conducted Spurious Emissions 36
Appendix H): Pseudorandom Frequency Hopping Sequence 43
Appendix I): Antenna Requirement 44
Appendix J): AC Power Line Conducted Emission 45
Appendix K): Restricted bands around fundamental frequency (Radiated) 48
Appendix L): Radiated Spurious Emissions 62
PHOTOGRAPHS OF TEST SETUP **70**
PHOTOGRAPHS OF EUT CONSTRUCTIONAL DETAILS **72**

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:

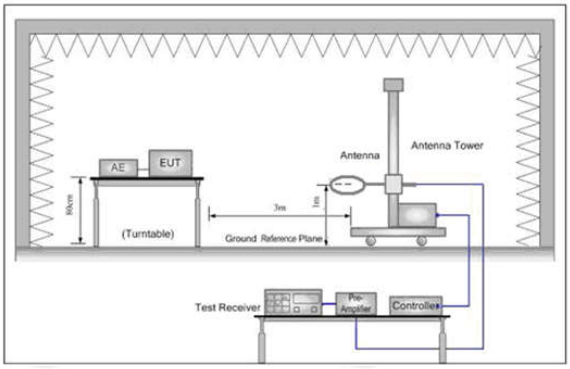


Figure 1. Below 30MHz

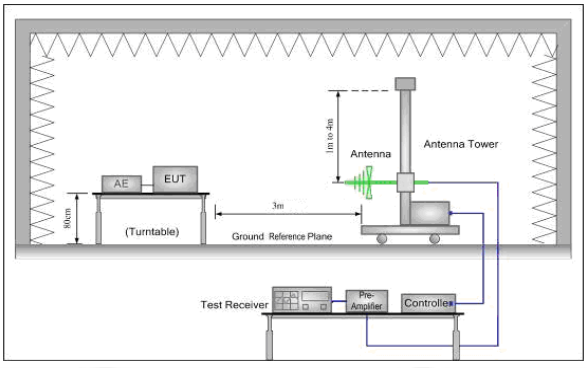


Figure 2. 30MHz to 1GHz

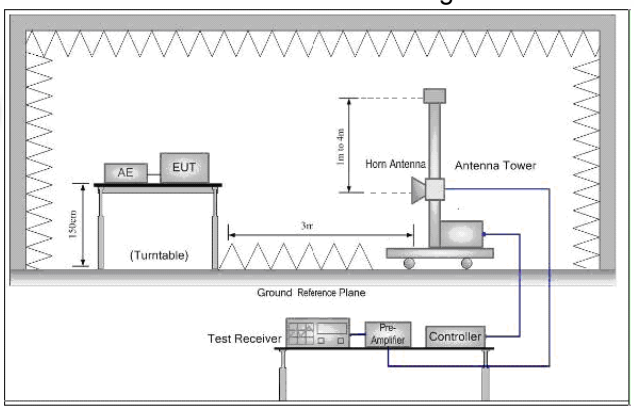
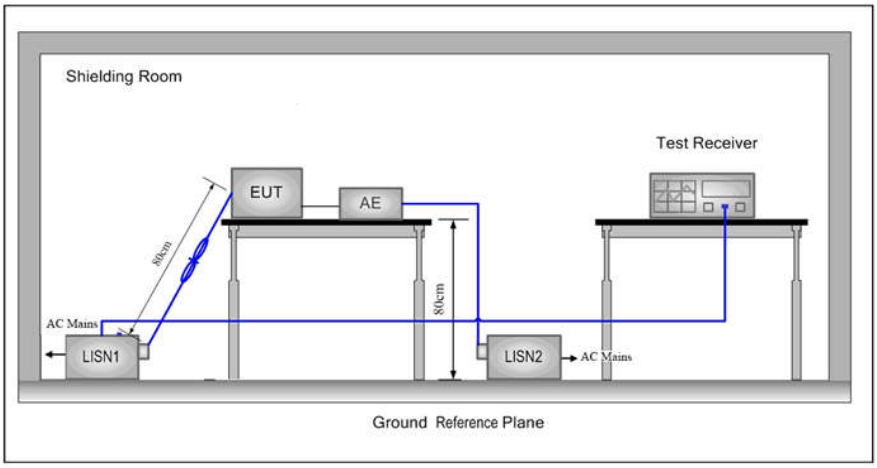


Figure 3. Above 1GHz

5.1.3 For Conducted Emissions test setup

Conducted Emissions setup



5.2 Test Environment

Operating Environment:	
Temperature:	24°C
Humidity:	55 % 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 1

Mode	**GFSK**		
packets	**1-DH1**	**1-DH3**	**1-DH5**
Power(dBm)	0.918	0.899	0.860

Mode	π/4DQPSK		
packets	**2-DH1**	**2-DH3**	**2-DH5**
Power(dBm)	2.280	2.179	2.122
Mode	8DPSK		
packets	**3-DH1**	**3-DH3**	**3-DH5**
Power(dBm)	2.744	2.638	2.510

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:	Shenzhen Hongyi Science & Technology Development Co., Ltd.
Address of Applicant:	Unit 601-602, Building No. A4, East Industrial Park of OCT, Nanshan District, Shenzhen, China
Manufacturer:	Shenzhen Hongyi Science & Technology Development Co., Ltd.
Address of Manufacturer:	Unit 601-602, Building No. A4, East Industrial Park of OCT, Nanshan District, Shenzhen, China
Factory:	Shenzhen Hongyi Science & Technology Development Co., Ltd.
Address of Factory:	Unit 601-602, Building No. A4, East Industrial Park of OCT, Nanshan District, Shenzhen, China

6.2 General Description of EUT

Product Name:	Multi-Functional Wireless Speaker
Model No.(EUT):	SKOIN, M5, M5A, M5B, M5C, M5D, M5E, M5F, M5T, M5S, M5y (y=Refer to Different Color and Package Set Code)
Test model No.(EUT):	M5
Trade mark:	WOW!dea
EUT Supports Radios application:	BT: 4.2 BT Dual mode: 2402MHz to 2480MHz
Power Supply:	DC 12V, Battery 7.4V
Sample Received Date:	Oct. 30, 2018
Sample tested Date:	Jan. 31, 2019 to Apr. 20, 2019

6.3 Product Specification subjective to this standard

Operation Frequency:	2402MHz~2480MHz
Bluetooth Version:	4.2
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Modulation Type:	GFSK, π/4DQPSK, 8DPSK
Number of Channel:	79
Hopping Channel Type:	Adaptive Frequency Hopping systems
Hardware Version:	V4.0(manufacturer declare)
Firmware Version:	V4.0(manufacturer declare)
Test Power Grade:	N/A
Test Software of EUT:	N/A
Antenna Type:	PCB Antenna
Antenna Gain:	-0.58 dBi
Test Voltage:	AC 120V 60Hz, Battery 7.4V

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.

Associated equipment name		Manufacture	model	S/N	Supplied by	Certification
AE1	DC Source	TRADEX	LPS 202A	10209898	CTI	FCC

6.5 Test Location

All tests were performed at:

Centre Testing International Group Co., Ltd

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

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

No tests were sub-contracted.

FCC Designation No.: CN1164

6.6 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**	**Model No.**	**Serial Number**	**Cal. Date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
Spectrum Analyzer	Keysight	N9010A	MY54510339	03-02-2018 03-01-2019	03-01-2019 02-28-2020
High-pass filter	Sinoscite	FL3CX03WG18 NM12-0398-002	---	01-09-2019	01-08-2020
DC Power	Keysight	E3642A	MY54426035	03-02-2018 03-01-2019	03-01-2019 02-28-2020
PC-1	Lenovo	R4960d	---	03-02-2018 03-01-2019	03-01-2019 02-28-2020
BT&WI-FI Automatic control	R&S	OSP120	101374	03-02-2018 03-01-2019	03-01-2019 02-28-2020
RF control unit	JS Tonscend	JS0806-2	15860006	03-02-2018 03-01-2019	03-01-2019 02-28-2020
BT&WI-FI Automatic test software	JS Tonscend	JS1120-2	---	03-02-2018 03-01-2019	03-01-2019 02-28-2020
Temperature/ Humidity Indicator	biaozhi	HM10	1804186	10-12-2018	10-11-2019

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	05-25-2018	05-24-2019
Temperature/ Humidity Indicator	Defu	TH128	/	07-02-2018	07-01-2019
LISN	R&S	ENV216	100098	05-10-2018	05-10-2019

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	---	06-04-2016	06-03-2019
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-618	07-30-2018	07-29-2019
Preamplifier	EMCI	EMC001330	980563	06-20-2018	06-19-2019
Loop Antenna	ETS	6502	00071730	06-22-2017	06-21-2019
Receiver	R&S	ESCI	100435	05-25-2018	05-24-2019
Multi device Controller	maturo	NCD/070/1071 1112	---	01-09-2019	01-08-2020
Temperature/ Humidity Indicator	Shanghai qixiang	HM10	1804298	10-12-2018	10-11-2019
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	06-20-2018	06-19-2019
Spectrum Analyzer	Keysight	N9020B	MY57111112	03-28-2018 03-27-2019	03-27-2019 03-25-2020
Spectrum Analyzer	Keysight	N9030B	MY57140871	03-28-2018 03-27-2019	03-27-2019 03-25-2020
Horn Antenna	Schwarzbeck	BBHA 9170	9170-832	04-25-2018	04-23-2021
Horn Antenna	ETS-LINDGREN	3117	00057407	07-10-2018	07-08-2021
Preamplifier	EMCI	EMC184055SE	980596	06-20-2018	06-19-2019
Preamplifier	Agilent	8449B	3008A02425	08-21-2018	08-20-2019
Temperature/ Humidity Indicator	biaozhi	GM1360	EE1186631	05-02-2018	05-01-2019
Fully Anechoic Chamber	TDK	FAC-3	---	01-17-2018	01-15-2021
Filter bank	JS Tonscend	JS0806-F	188060094	04-10-2018	04-08-2021
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 Unlicesed 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 L)

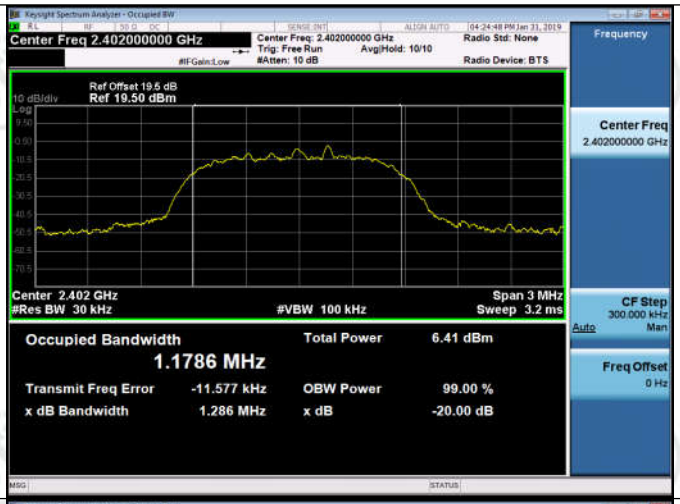
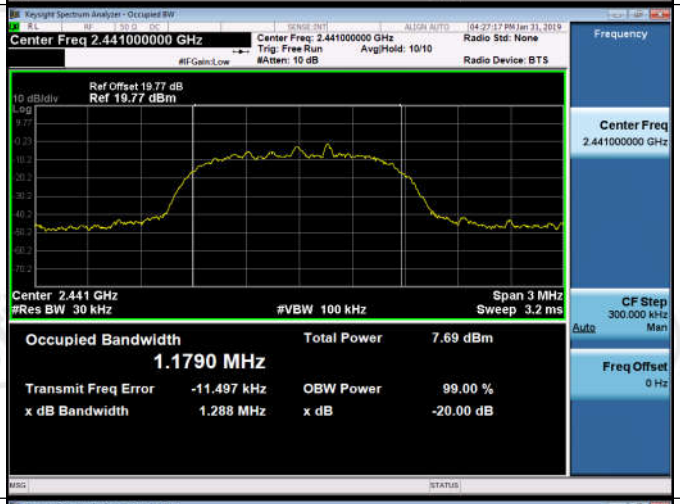
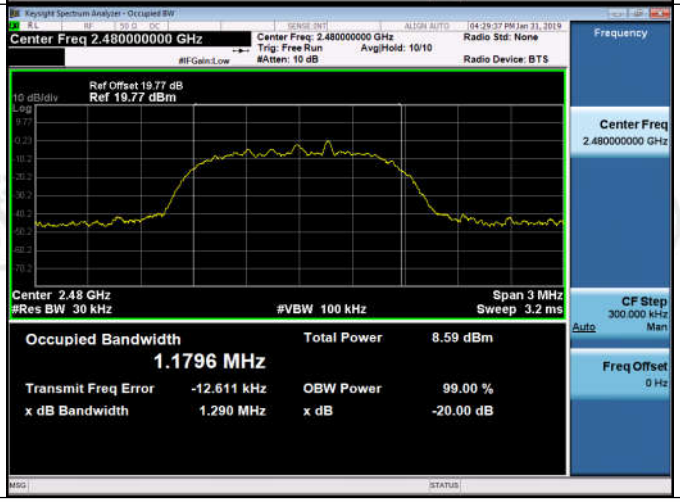
Appendix A): 20dB Occupied Bandwidth

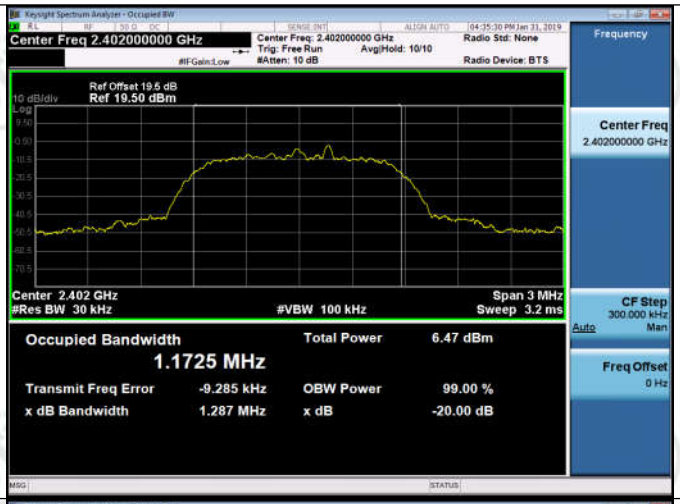
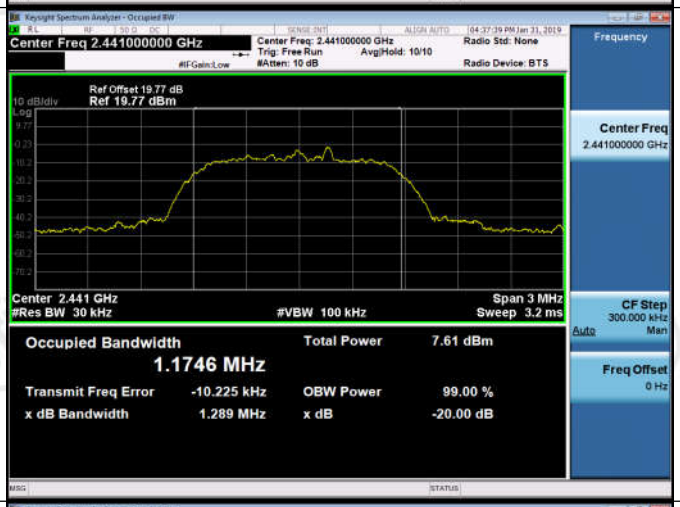
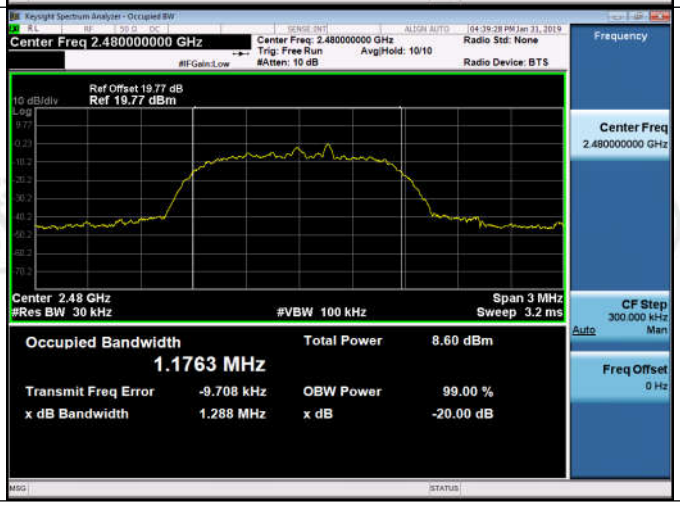
Test Result

Mode	Channel.	20dB Bandwidth [MHz]	99% OBW [MHz]	Verdict	Remark
GFSK	LCH	0.9874	0.91686	PASS	Peak detector
GFSK	MCH	0.9876	0.91618	PASS	
GFSK	HCH	0.9908	0.91901	PASS	
π/4DQPSK	LCH	1.286	1.1786	PASS	
π/4DQPSK	MCH	1.288	1.1790	PASS	
π/4DQPSK	HCH	1.290	1.1796	PASS	
8DPSK	LCH	1.287	1.1725	PASS	
8DPSK	MCH	1.289	1.1746	PASS	
8DPSK	HCH	1.288	1.1763	PASS	

Test Graph

Graphs			
GFSK/LCH			
GFSK/MCH			
GFSK/HCH			

π/4DQPSK/LCH		
π/4DQPSK/MCH		
π/4DQPSK/HCH		

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

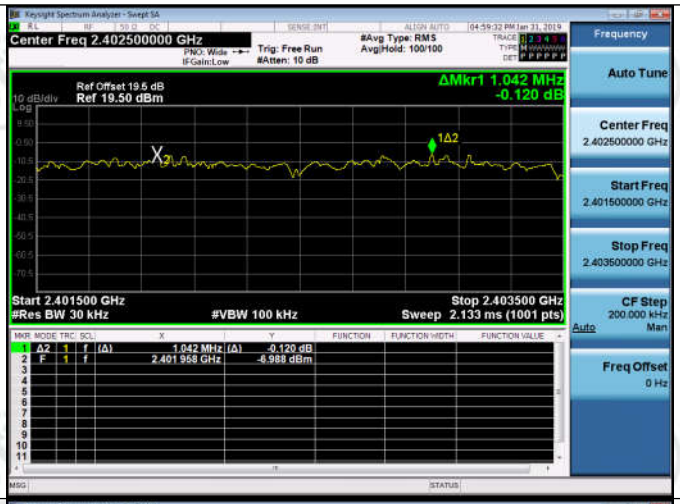
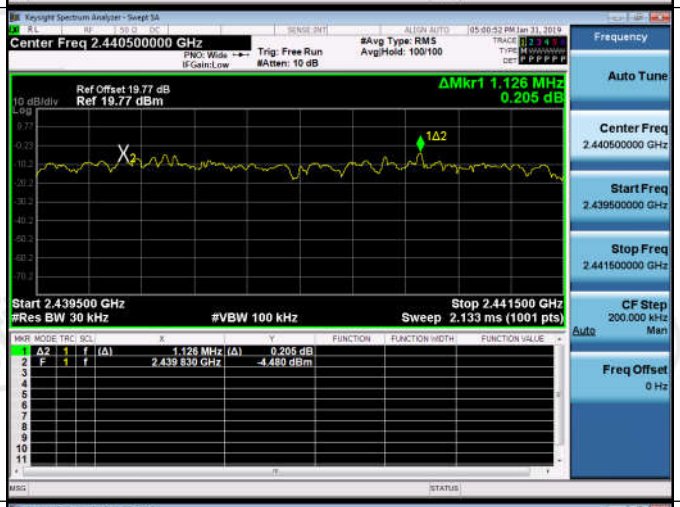
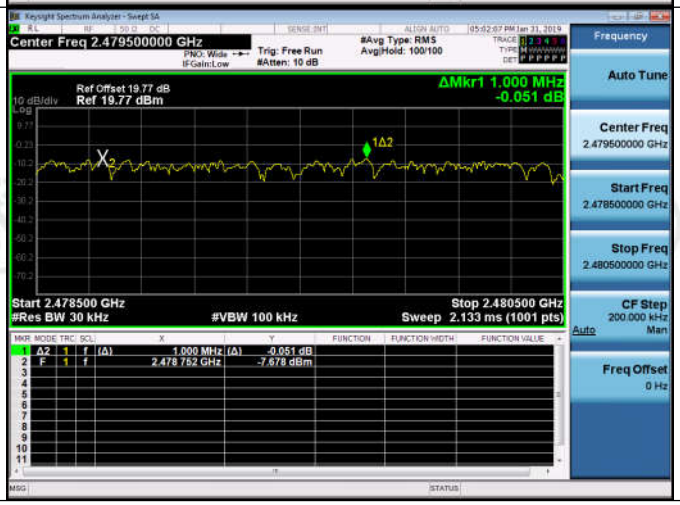
Appendix B): Carrier Frequency Separation

Result Table

Mode	Channel.	Carrier Frequency Separation [MHz]	Verdict
GFSK	LCH	1.024	PASS
GFSK	MCH	0.900	PASS
GFSK	HCH	1.094	PASS
π/4DQPSK	LCH	1.042	PASS
π/4DQPSK	MCH	1.126	PASS
π/4DQPSK	HCH	1.000	PASS
8DPSK	LCH	0.966	PASS
8DPSK	MCH	0.994	PASS
8DPSK	HCH	0.994	PASS

Test Graph

Graphs			
GFSK/LCH			
GFSK/MCH			
GFSK/HCH			

π/4DQPSK/LCH		
π/4DQPSK/MCH		
π/4DQPSK/HCH		

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

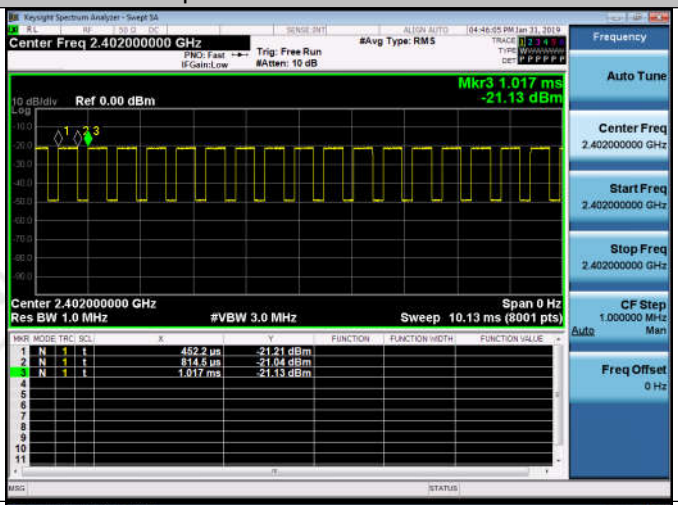
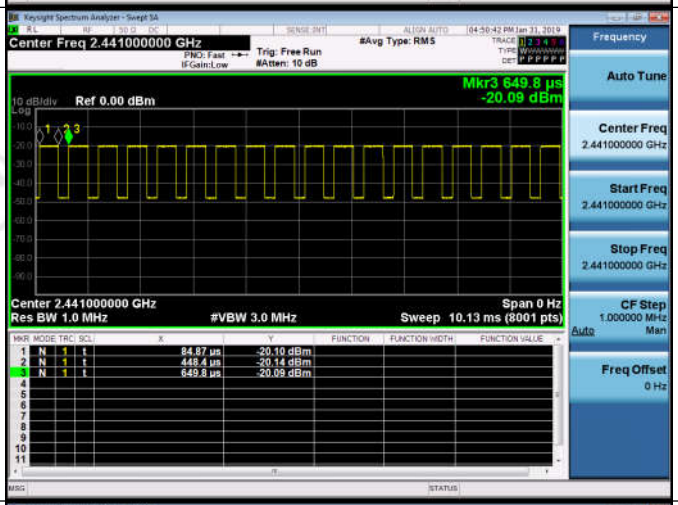
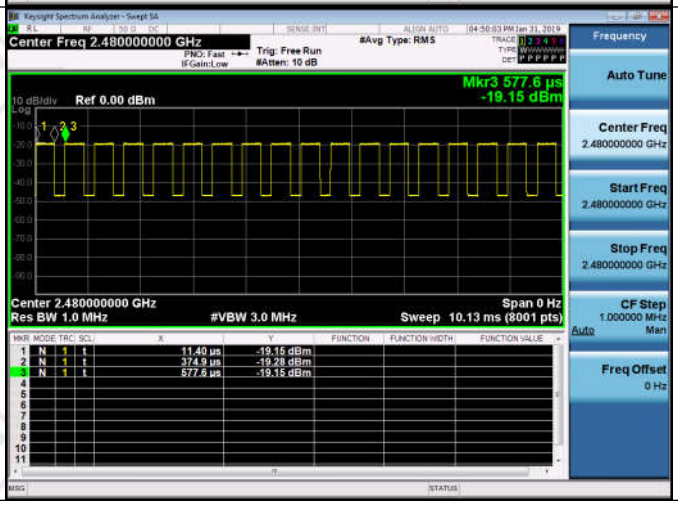
Appendix C): Dwell Time

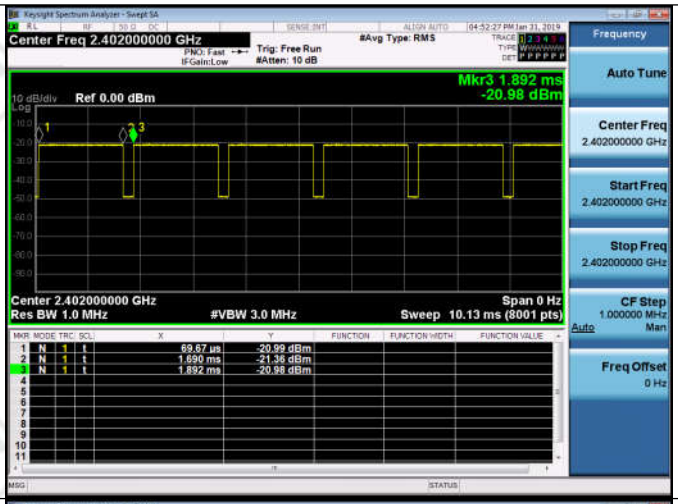
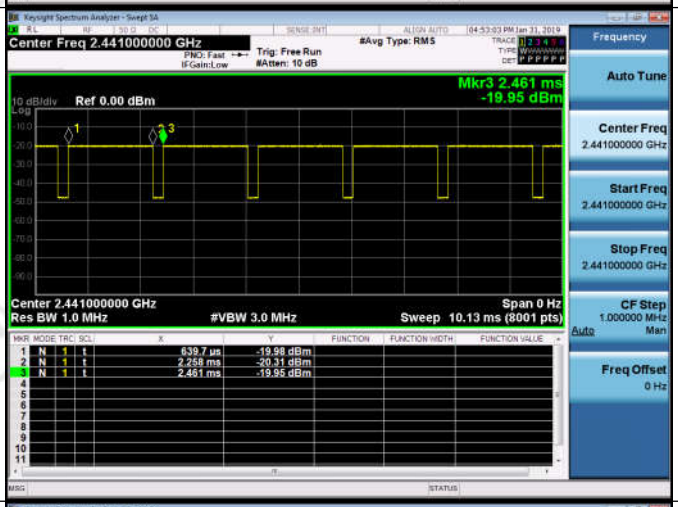
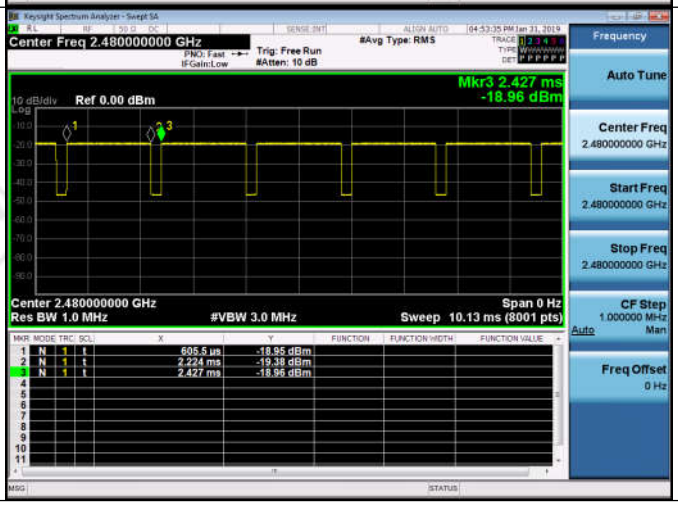
Result Table

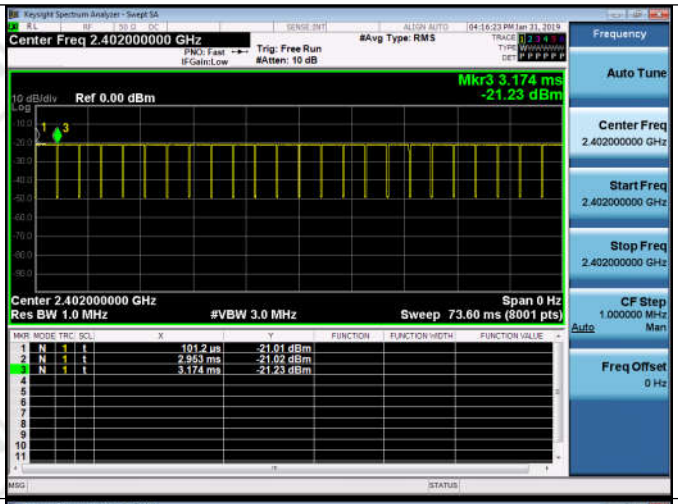
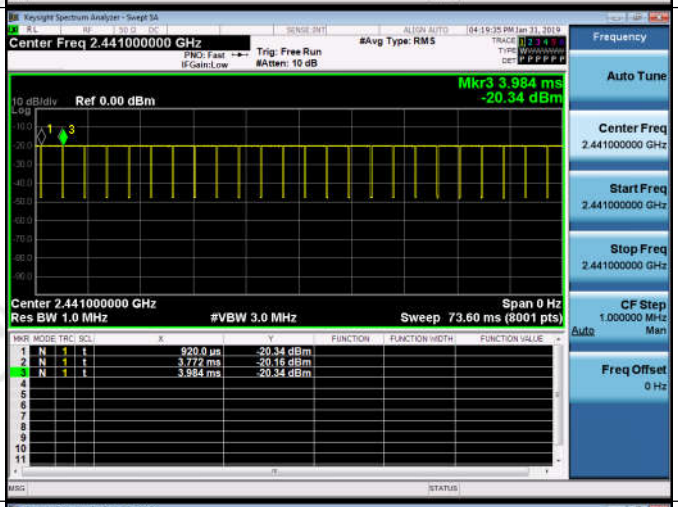
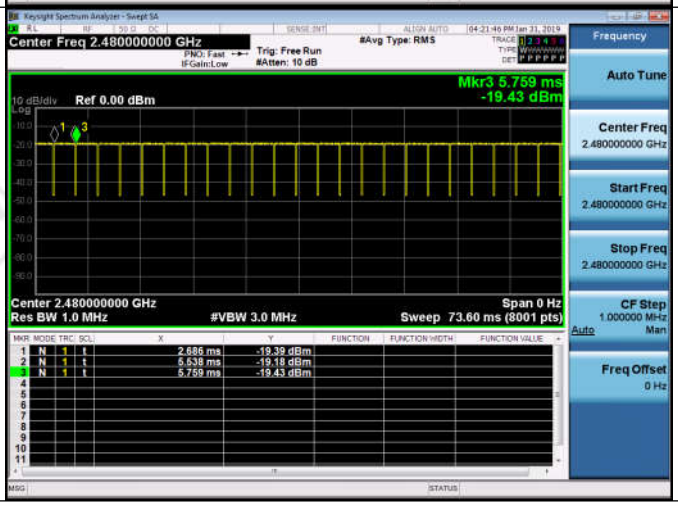
Mode	Packet	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Verdict
GFSK	DH1	LCH	0.362267	320	0.116	PASS
GFSK	DH1	MCH	0.3635333	320	0.116	PASS
GFSK	DH1	HCH	0.363533	320	0.116	PASS
GFSK	DH3	LCH	1.6200633	160	0.259	PASS
GFSK	DH3	MCH	1.618803	160	0.259	PASS
GFSK	DH3	HCH	1.618803	160	0.259	PASS
GFSK	DH5	LCH	2.852	106.7	0.304	PASS
GFSK	DH5	MCH	2.852	106.7	0.304	PASS
GFSK	DH5	HCH	2.852	106.7	0.304	PASS

Remark : All modes are tested, only the worst mode GFSK is reported.

Test Graph

Graphs			
GFSK_DH1/LCH			
GFSK_DH1/MCH			
GFSK_DH1/HCH			

GFSK_DH3/LCH			
GFSK_DH3/MCH			
GFSK_DH3/HCH			

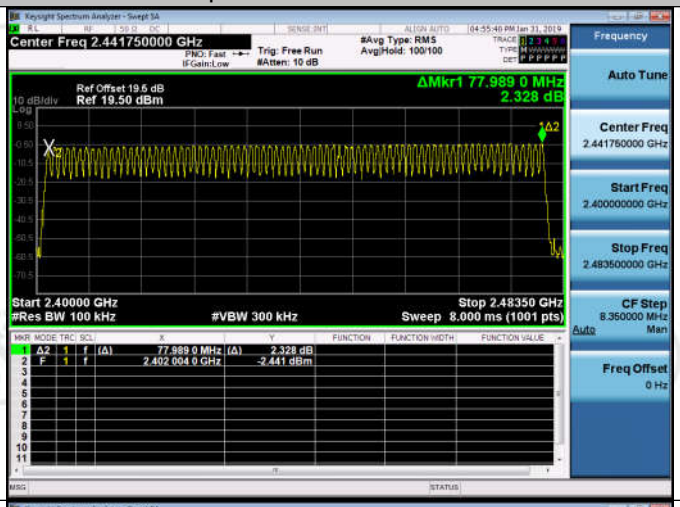
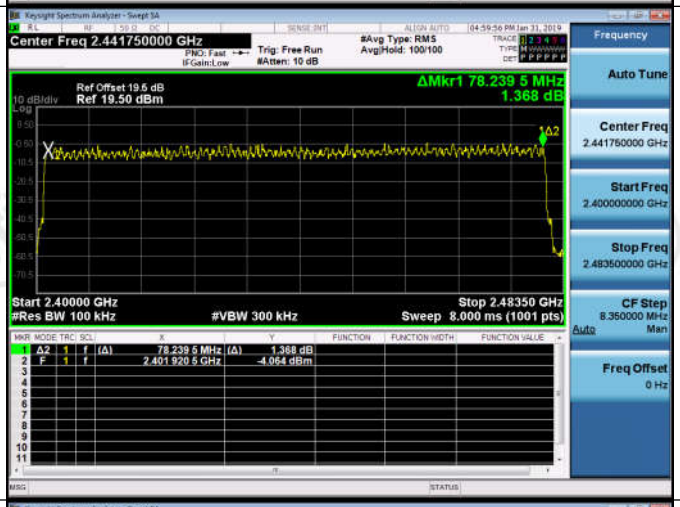
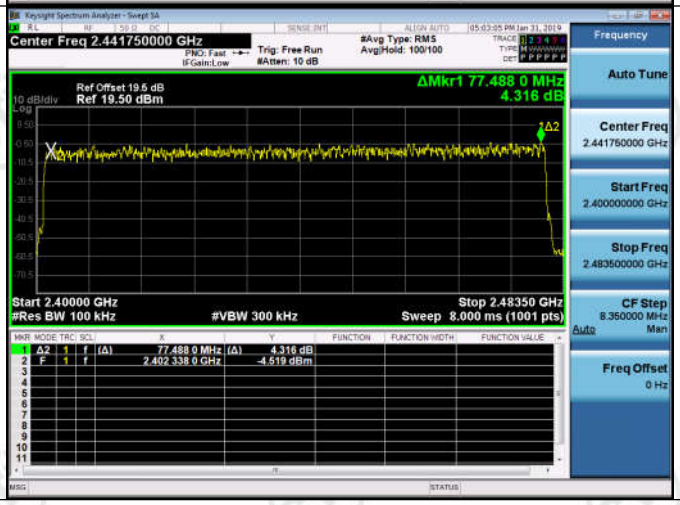
GFSK_DH5/LCH			
GFSK_DH5/MCH			
GFSK_DH5/HCH			

Appendix D): Hopping Channel Number

Result Table

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

Test Graph

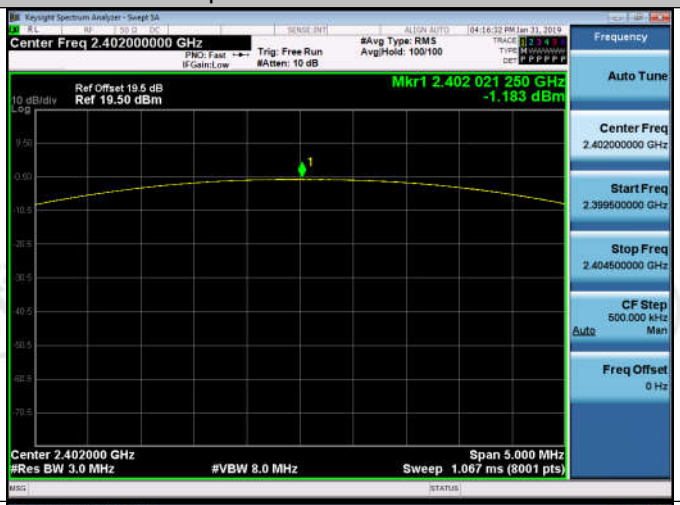
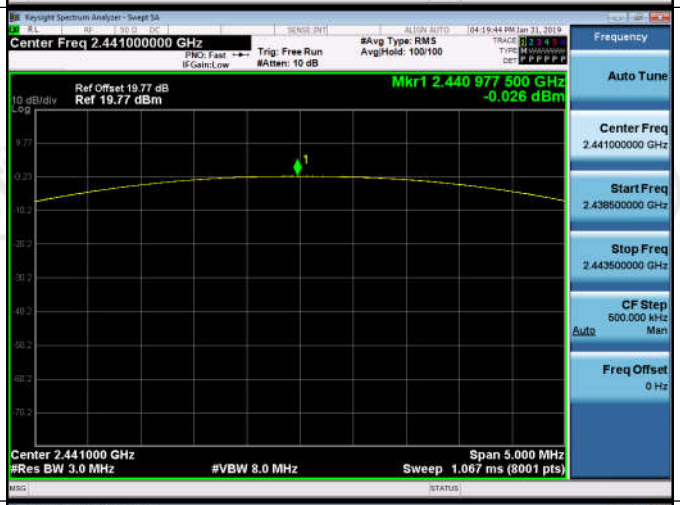
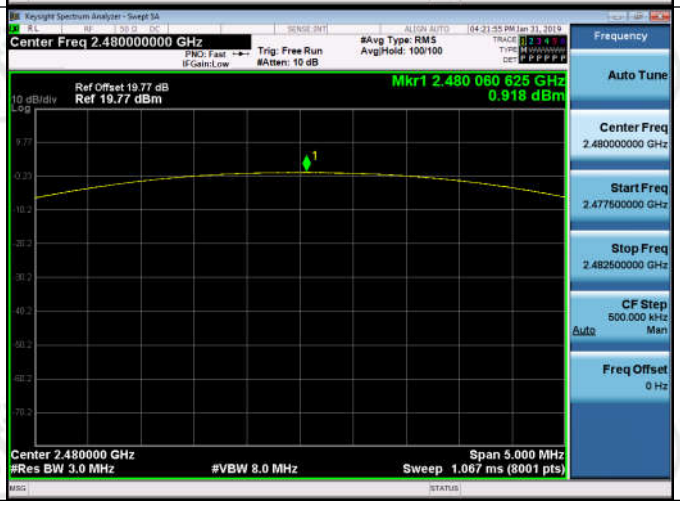
Graphs			
GFSK/Hop			
π/4DQPSK/Hop			
8DPSK/Hop			

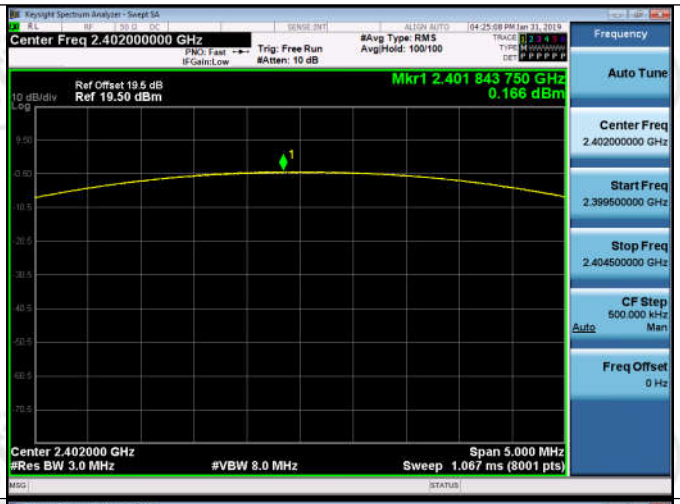
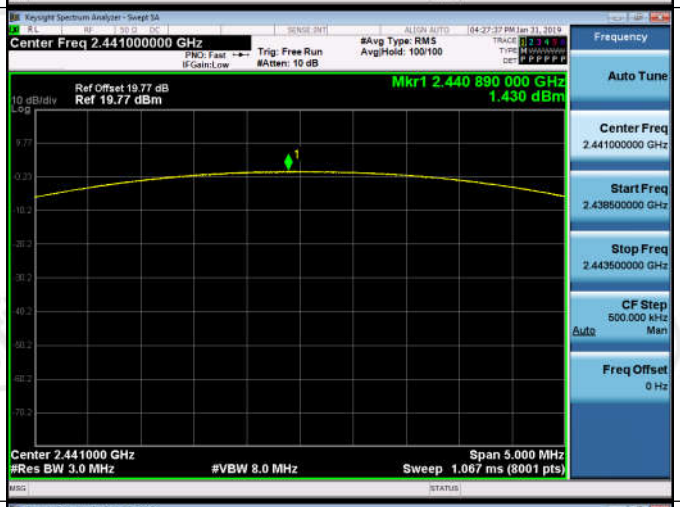
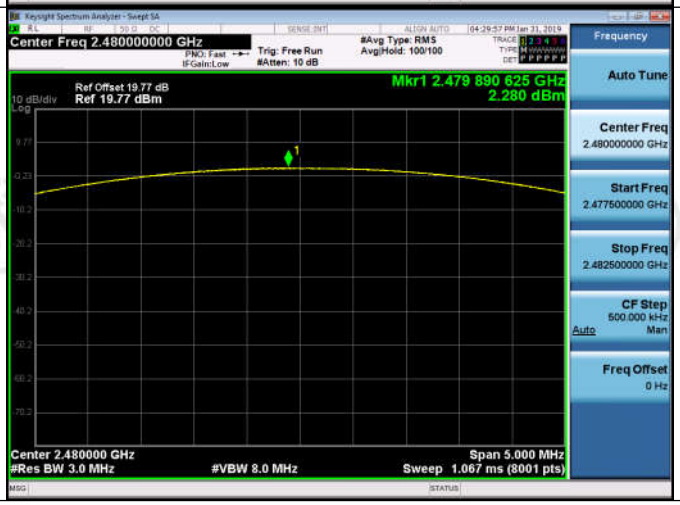
Appendix E): Conducted Peak Output Power

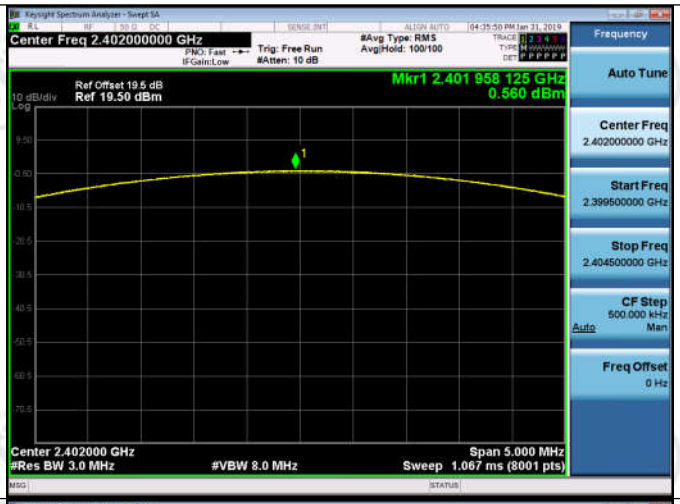
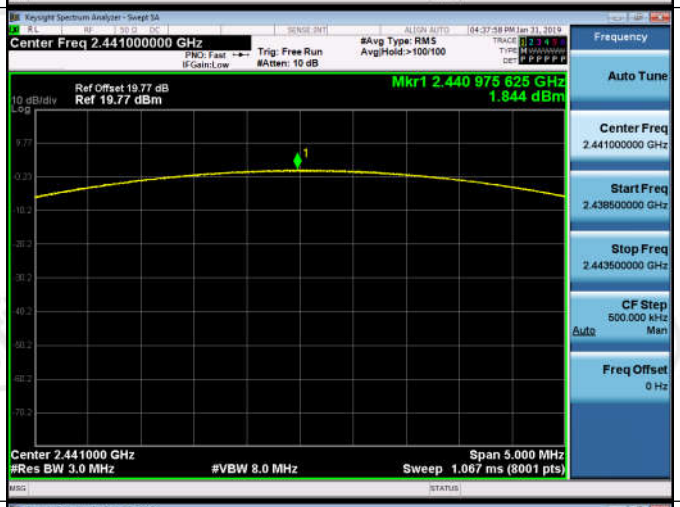
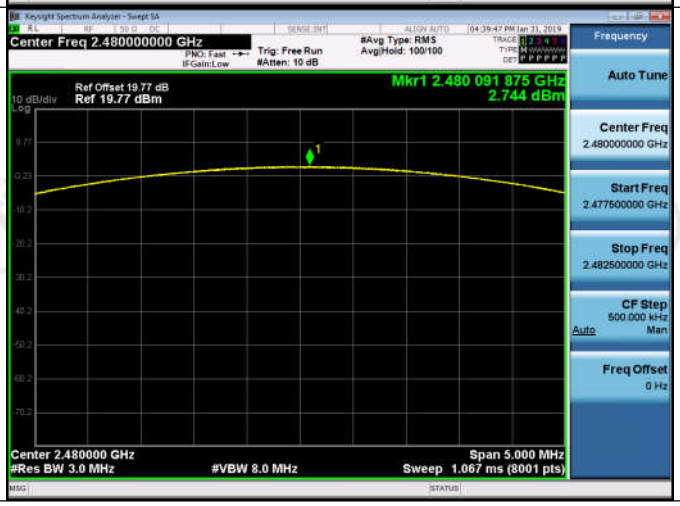
Result Table

Mode	Channel.	Maximum Peak Output Power [dBm]	Verdict
GFSK	LCH	-1.183	PASS
GFSK	MCH	-0.026	PASS
GFSK	HCH	0.918	PASS
π/4DQPSK	LCH	0.166	PASS
π/4DQPSK	MCH	1.430	PASS
π/4DQPSK	HCH	2.280	PASS
8DPSK	LCH	0.560	PASS
8DPSK	MCH	1.844	PASS
8DPSK	HCH	2.744	PASS

Test Graph

Graphs			
GFSK/LCH			
GFSK/MCH			
GFSK/HCH			

π/4DQPSK/LCH		
π/4DQPSK/MCH		
π/4DQPSK/HCH		

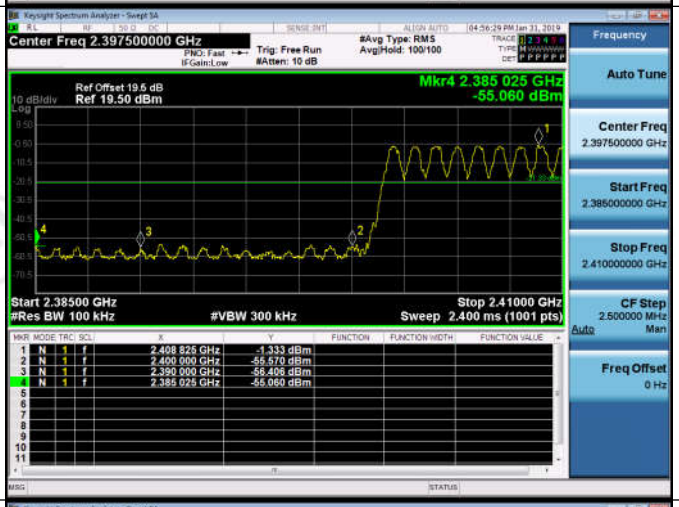
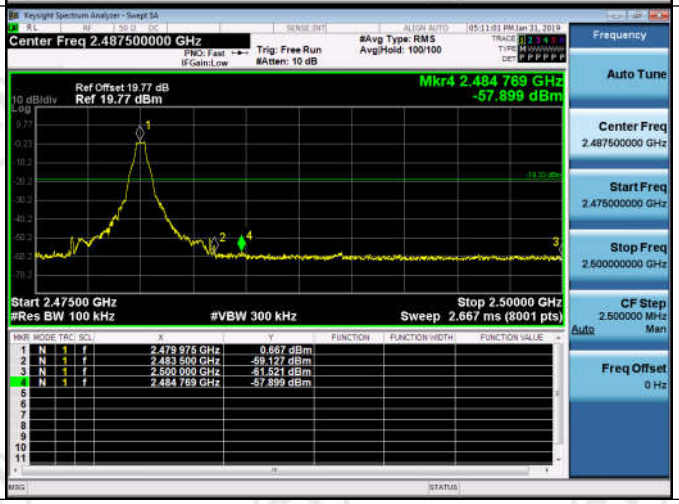
8DPSK/LCH		
8DPSK/MCH		
8DPSK/HCH		

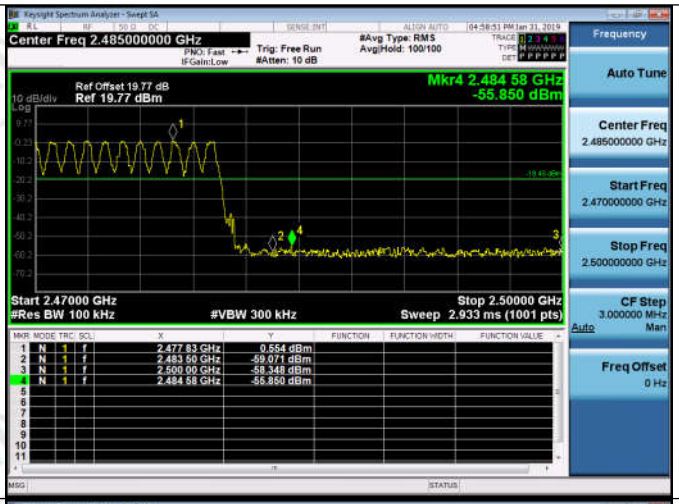
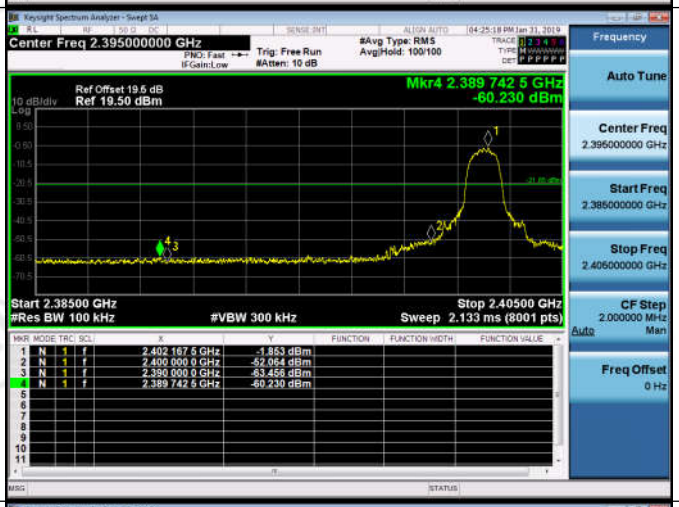
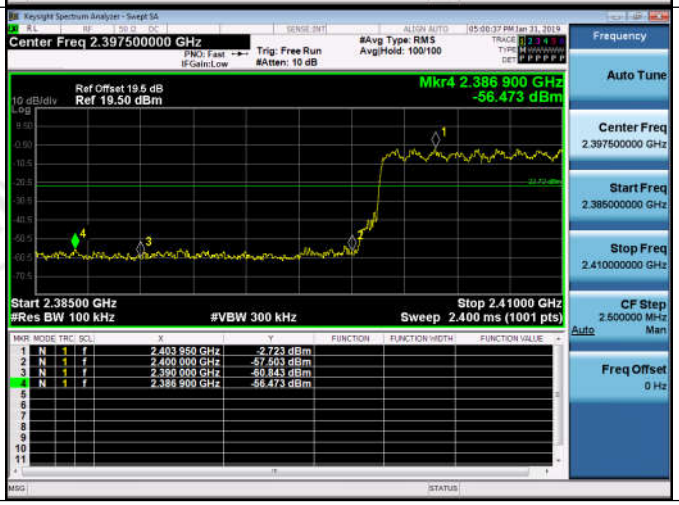
Appendix F): Band-edge for RF Conducted Emissions

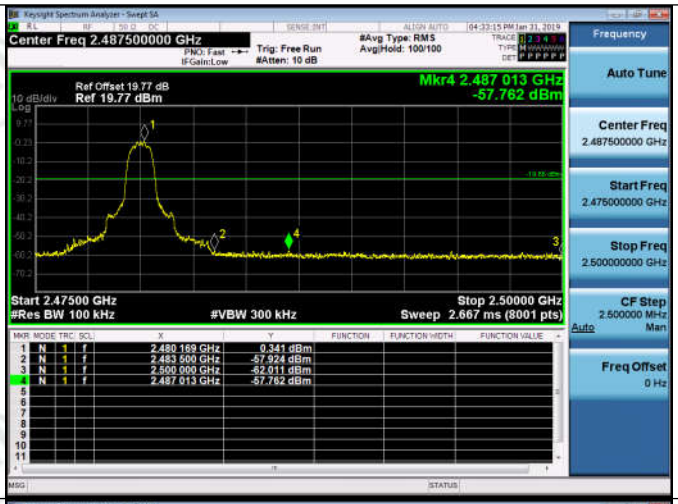
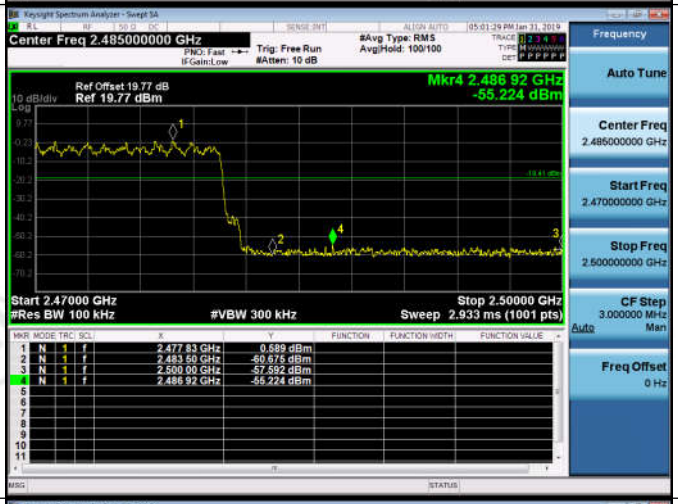
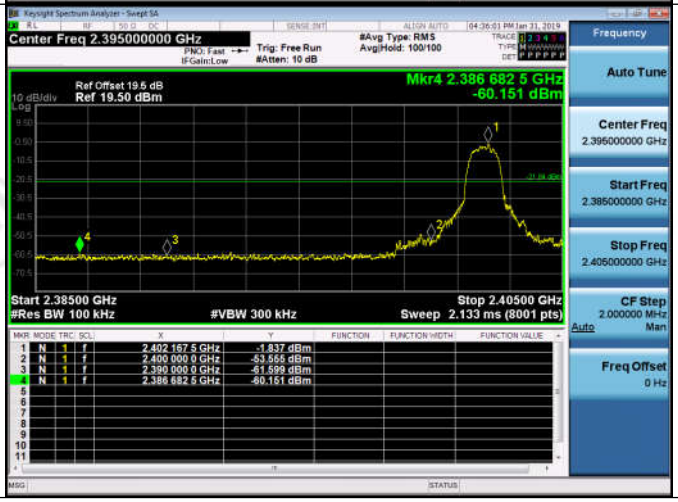
Result Table

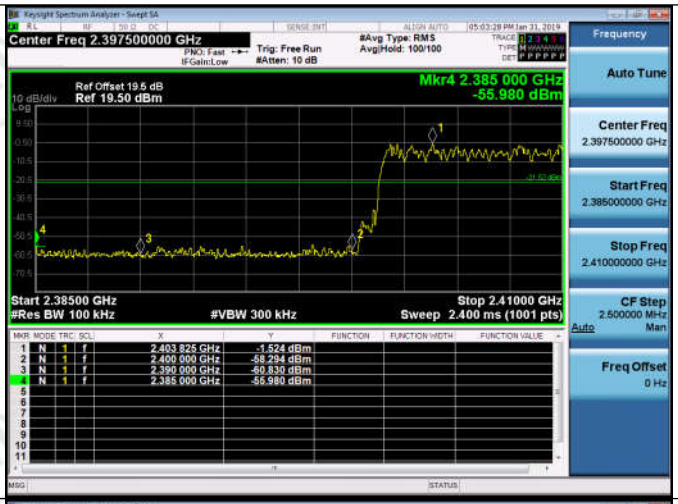
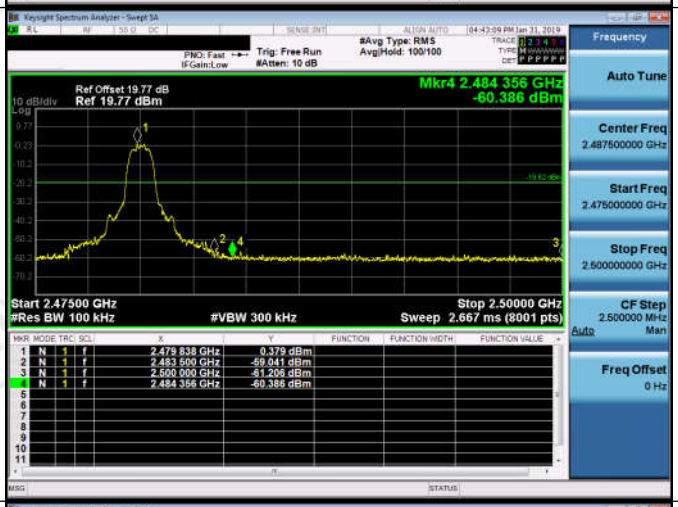
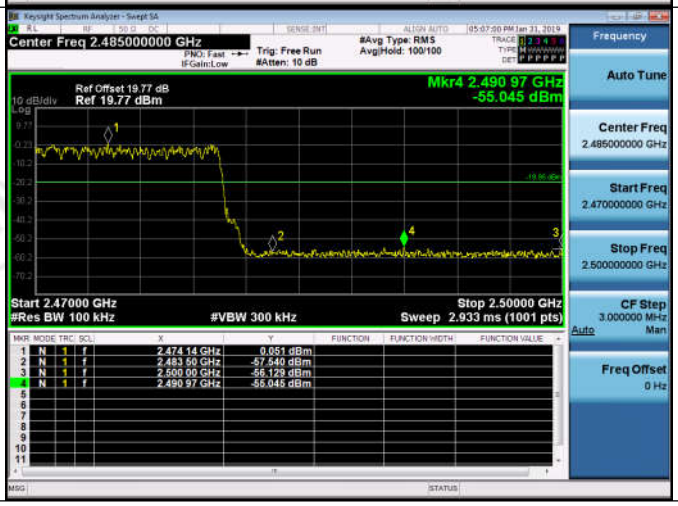
Mode	Channel	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max Spurious Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	2402	-1.749	Off	-60.111	-21.75	PASS
			-1.333	On	-55.060	-21.33	PASS
GFSK	HCH	2480	0.667	Off	-57.899	-19.33	PASS
			0.554	On	-55.850	-19.45	PASS
π/4DQPSK	LCH	2402	-1.853	Off	-60.230	-21.85	PASS
			-2.723	On	-56.473	-22.72	PASS
π/4DQPSK	HCH	2480	0.341	Off	-57.762	-19.66	PASS
			0.589	On	-55.224	-19.41	PASS
8DPSK	LCH	2402	-1.837	Off	-60.151	-21.84	PASS
			-1.524	On	-55.980	-21.52	PASS
8DPSK	HCH	2480	0.379	Off	-55.126	-19.62	PASS
			0.051	On	-55.045	-19.95	PASS

Test Graph

Graphs		
GFSK/LCH/No Hop		
GFSK/LCH/Hop		
GFSK/HCH/No Hop		

GFSK/HCH/Hop			
π/4DQPSK/LCH/No Hop			
π/4DQPSK/LCH/Hop			

π/4DQPSK/HCH/No Hop			
π/4DQPSK/HCH/Hop			
8DPSK/LCH/No Hop			

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

Appendix G): RF Conducted Spurious Emissions

Result Table

Mode	Channel	Pref [dBm]	Puw[dBm]	Verdict
GFSK	LCH	-1.815	<Limit	PASS
GFSK	MCH	-0.576	<Limit	PASS
GFSK	HCH	0.312	<Limit	PASS
π/4DQPSK	LCH	-1.874	<Limit	PASS
π/4DQPSK	MCH	-0.568	<Limit	PASS
π/4DQPSK	HCH	0.313	<Limit	PASS
8DPSK	LCH	-1.894	<Limit	PASS
8DPSK	MCH	-0.603	<Limit	PASS
8DPSK	HCH	0.338	<Limit	PASS

Remark: Scan from 9kHz to 25GHz, the disturbance below 30MHz was very low, more than 10dB below the limit, and the below emissions were the highest point could be found when testing, so only the below emissions had been displayed. The amplitude of spurious emissions from the conducted which are attenuated more than 10dB below the limit need not be reported.

Test Graph

GFSK_LCH_Graphs		
Pref		
Puw		

GFSK_MCH_Graphs		
Pref		

Puw	

GFSK_HCH_Graphs	
Pref	
Puw	

π/4DQPSK_LCH_Graphs			
Pref		
Puw		

π/4DQPSK_MCH_Graphs			
Pref		

Puw	

π/4DQPSK_HCH_Graphs	
Pref	
Puw	

8DPSK_LCH_Graphs		
Pref		
Puw		

8DPSK_MCH_Graphs		
Pref		

Puw	

8DPSK_HCH_Graphs	
Pref	
Puw	

Appendix H): Pseudorandom Frequency Hopping Sequence

Test Requirement:	47 CFR Part 15**C Section 15.247 (a)(1) requirement:**

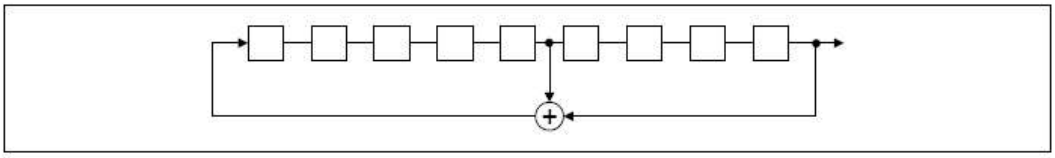
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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

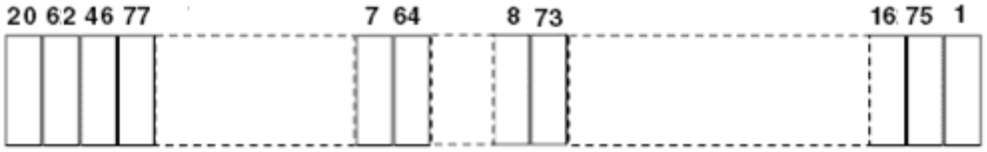
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized 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)



Linear Feedback Shift Register for Generation of the PRBS sequence

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:

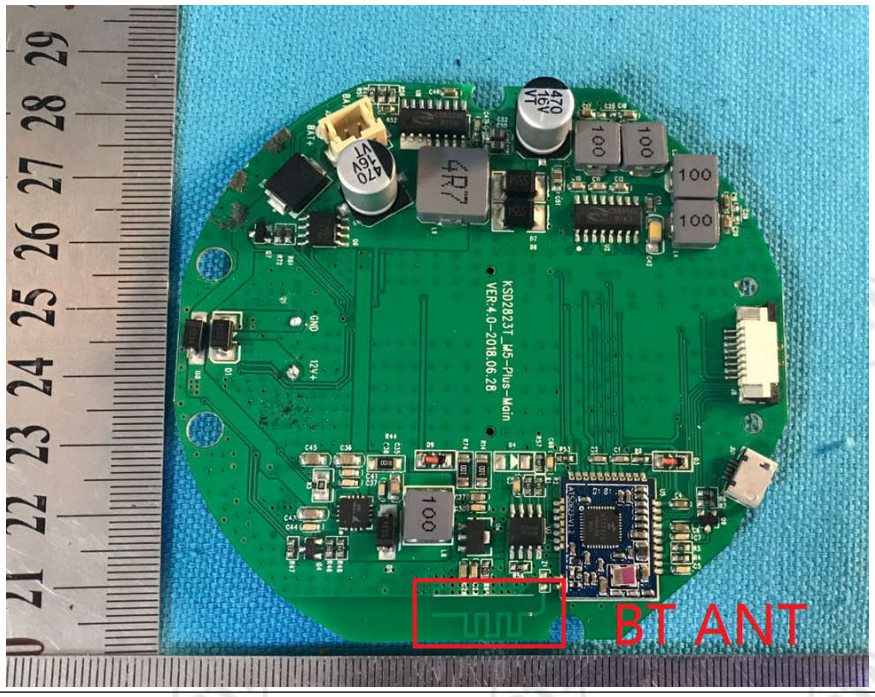
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit 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 PCB Antenna and no consideration of replacement. The best case gain of the antenna is -0.58 dBi.



Appendix J): AC Power Line Conducted Emission

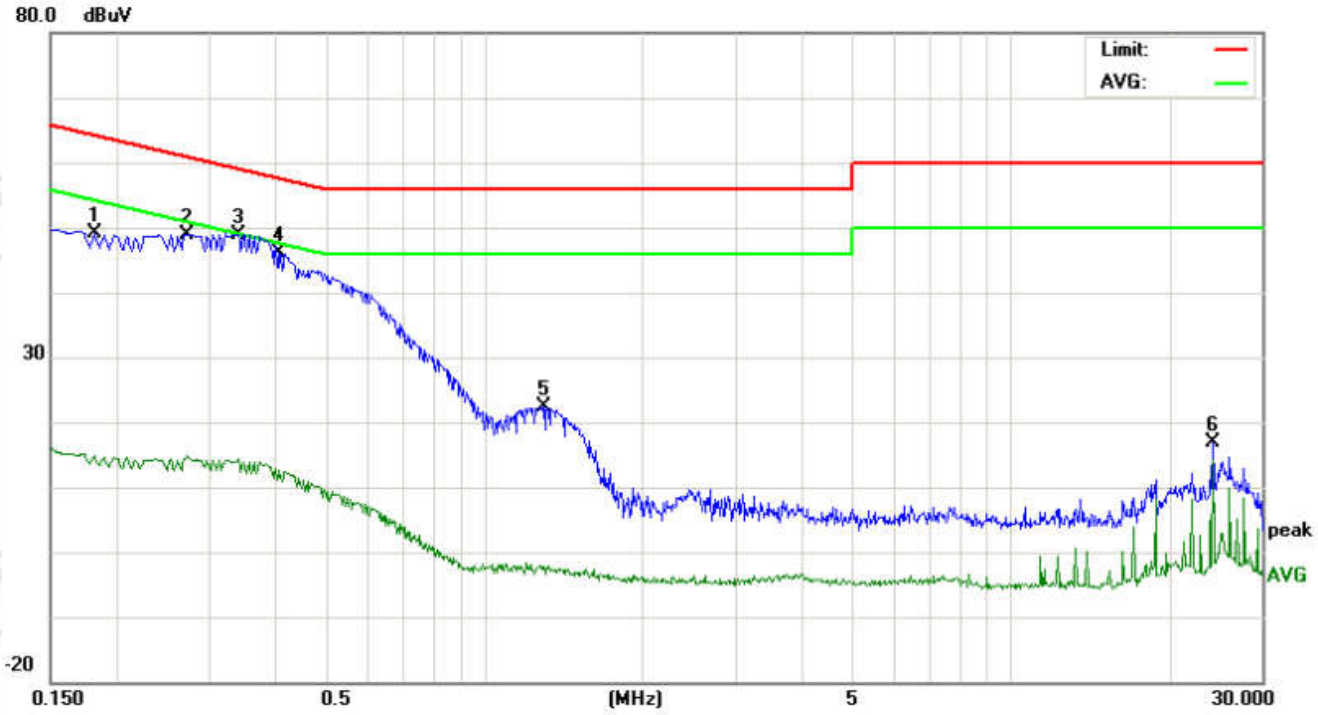
<table>
<tr><td>Test Procedure:</td><td>Test frequency range :150KHz-30MHz
1)The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. 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.</td></tr>
<tr><td>Limit:</td><td>
<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</td></tr>
<tr><td>Temperature:</td><td>22°C</td><td>Humidity:</td><td>53%</td></tr>
</table>

Measurement Data

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

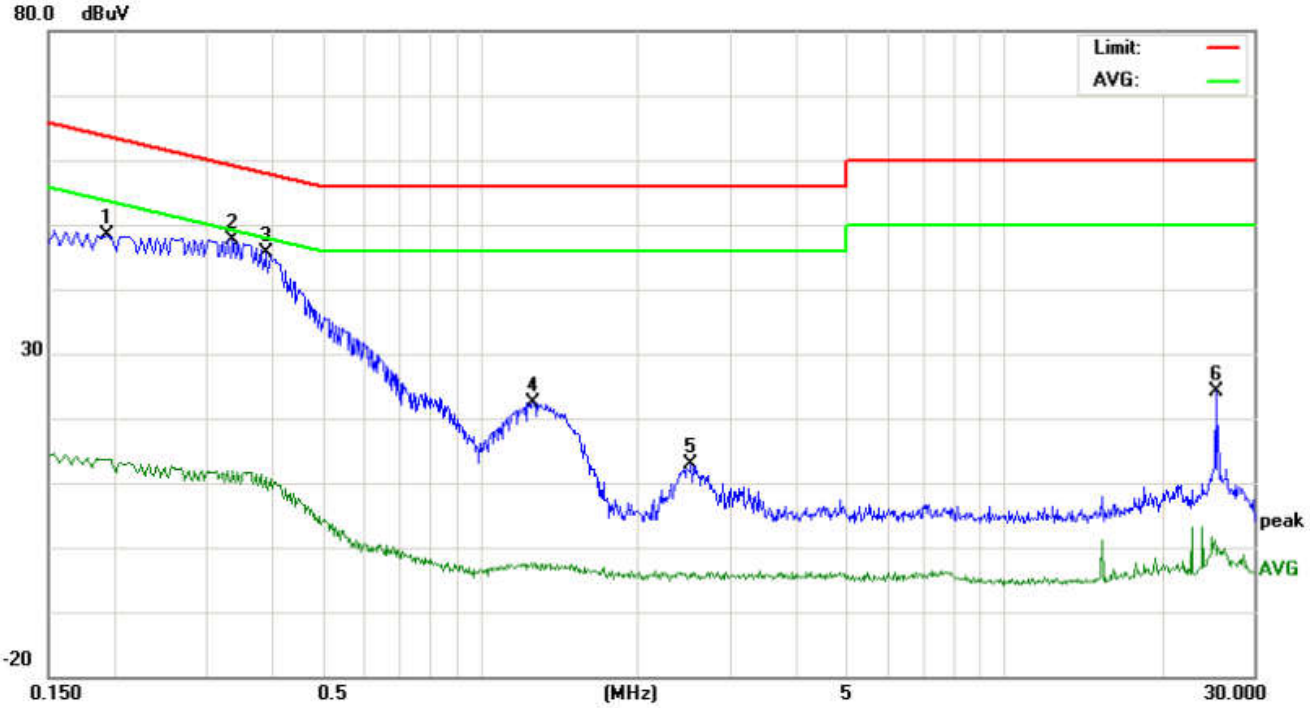
Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Live line:



No.	Freq.	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)			
	MHz	Peak	QP	AVG	dB	peak	QP	AVG	QP	AVG	QP	AVG	P/F	Comment
1	0.1819	39.14	33.40	4.91	9.91	49.05	43.31	14.82	64.39	54.39	-21.08	-39.57	P	
2	0.2740	39.00	32.50	4.78	9.98	48.98	42.48	14.76	60.99	50.99	-18.51	-36.23	P	
3	0.3420	38.96	31.10	4.46	9.95	48.91	41.05	14.41	59.15	49.15	-18.10	-34.74	P	
4	0.4100	39.64	29.10	6.25	9.89	49.53	38.99	16.14	57.65	47.65	-18.66	-31.51	P	
5	1.3020	12.48	4.80	-11.9	9.78	22.26	14.58	-2.21	56.00	46.00	-41.42	-48.21	P	
6	24.1700	6.85	3.50	4.16	9.93	16.78	13.43	14.09	60.00	50.00	-46.57	-35.91	P	

Neutral line:



No.	Freq.	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)			
	MHz	Peak	QP	AVG	dB	peak	QP	AVG	QP	AVG	QP	AVG	P/F	Comment
1	0.1940	38.37	32.10	3.81	9.91	48.28	42.01	13.72	63.86	53.86	-21.85	-40.14	P	
2	0.3379	37.65	30.80	1.86	9.96	47.61	40.76	11.82	59.25	49.25	-18.49	-37.43	P	
3	0.3899	35.65	28.50	0.92	9.90	45.55	38.40	10.82	58.06	48.06	-19.66	-37.24	P	
4	1.2660	12.63	4.90	-12.7	9.79	22.42	14.69	-3.00	56.00	46.00	-41.31	-49.00	P	
5	2.5300	3.16	-5.90	-14.2	9.72	12.88	3.82	-4.51	56.00	46.00	-52.18	-50.51	P	
6	25.4300	14.17	-4.50	-10.0	9.94	24.11	5.44	-0.06	60.00	50.00	-54.56	-50.06	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:

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. 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.
d. 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.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. 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:

g. 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).
h. b. Test the EUT in the lowest channel , the Highest channel
i. 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.
j. Repeat above procedures until all frequencies measured was complete.

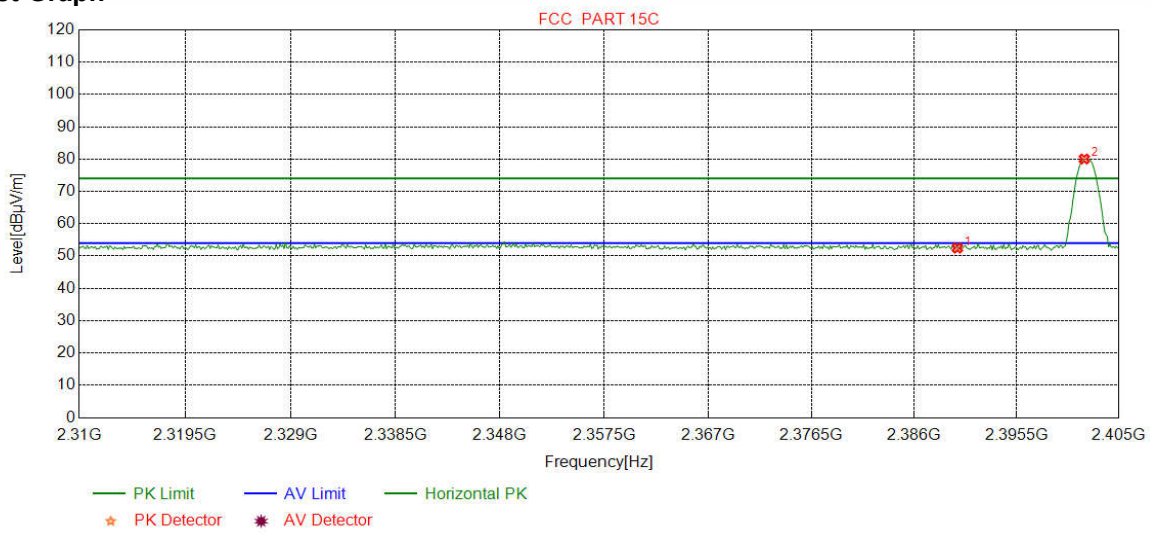
Limit:

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:

Mode:	GFSK Transmitting	Channel:	2402
Remark:	Peak		

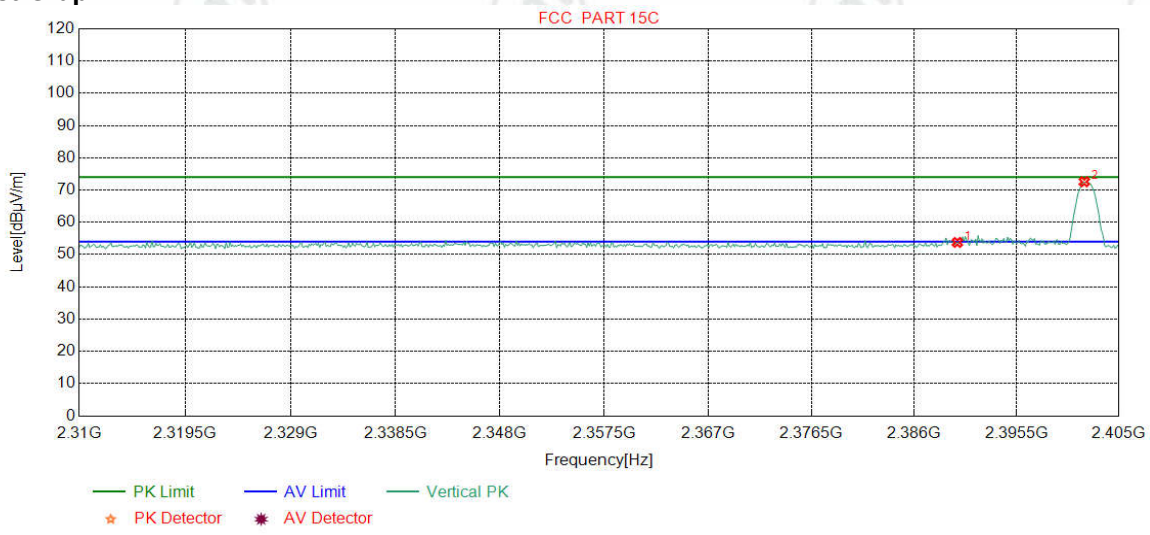
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBµV]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-42.44	49.28	52.46	74.00	21.54	Pass	Horizontal
2	2401.7897	32.26	13.31	-42.43	76.89	80.03	74.00	-6.03	Pass	Horizontal

Mode:	GFSK Transmitting	Channel:	2402
Remark:	Peak		

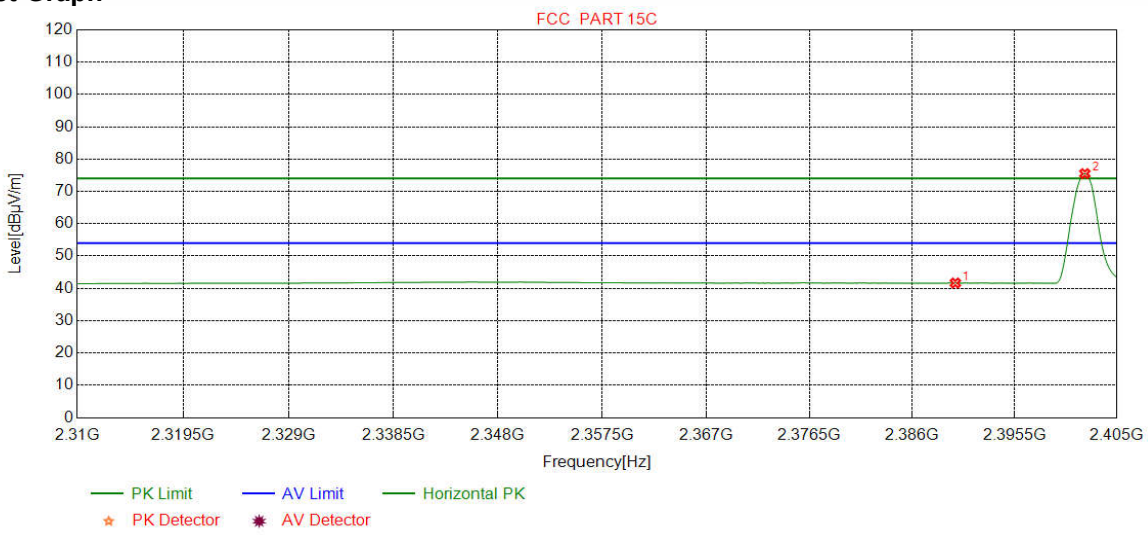
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBµV]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-42.44	50.60	53.78	74.00	20.22	Pass	Vertical
2	2401.7897	32.26	13.31	-42.43	69.43	72.57	74.00	1.43	Pass	Vertical

Mode:	GFSK Transmitting	Channel:	2402
Remark:	AV		

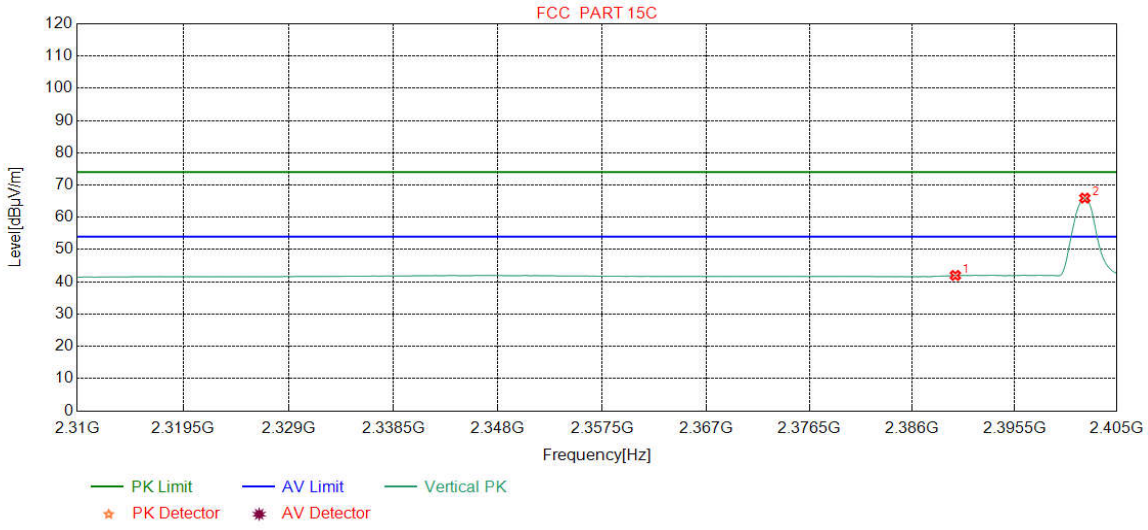
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBµV]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-42.44	38.48	41.66	54.00	12.34	Pass	Horizontal
2	2402.0275	32.26	13.31	-42.43	72.37	75.51	54.00	-21.51	Pass	Horizontal

Mode:	GFSK Transmitting	Channel:	2402
Remark:	AV		

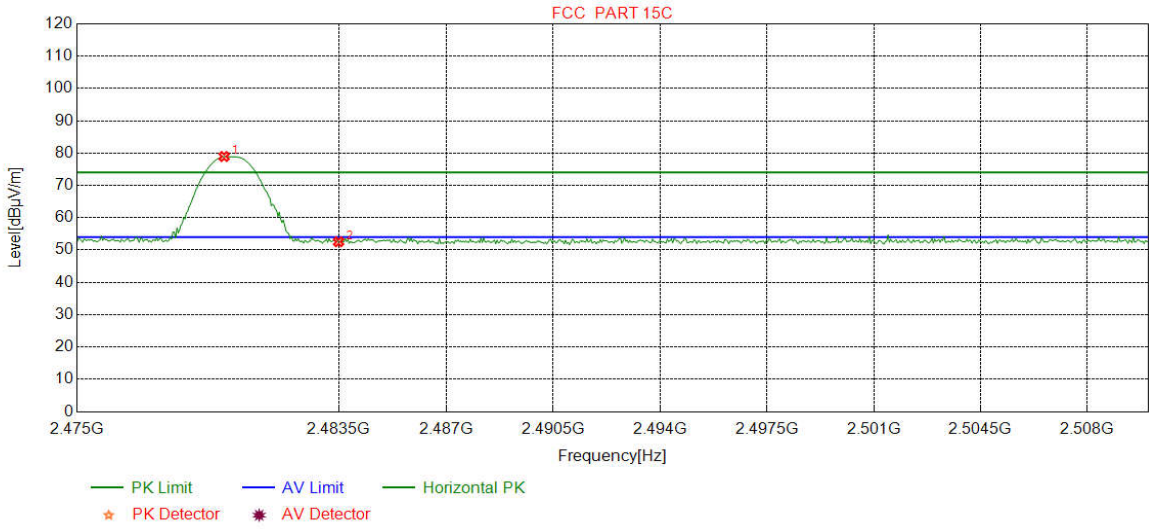
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBµV]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Result	Polarity
1	2390.0000	32.25	13.37	-42.44	38.82	42.00	54.00	12.00	Pass	Vertical
2	2402.0275	32.26	13.31	-42.43	62.82	65.96	54.00	-11.96	Pass	Vertical

Mode:	GFSK Transmitting	Channel:	2480
Remark:	Peak		

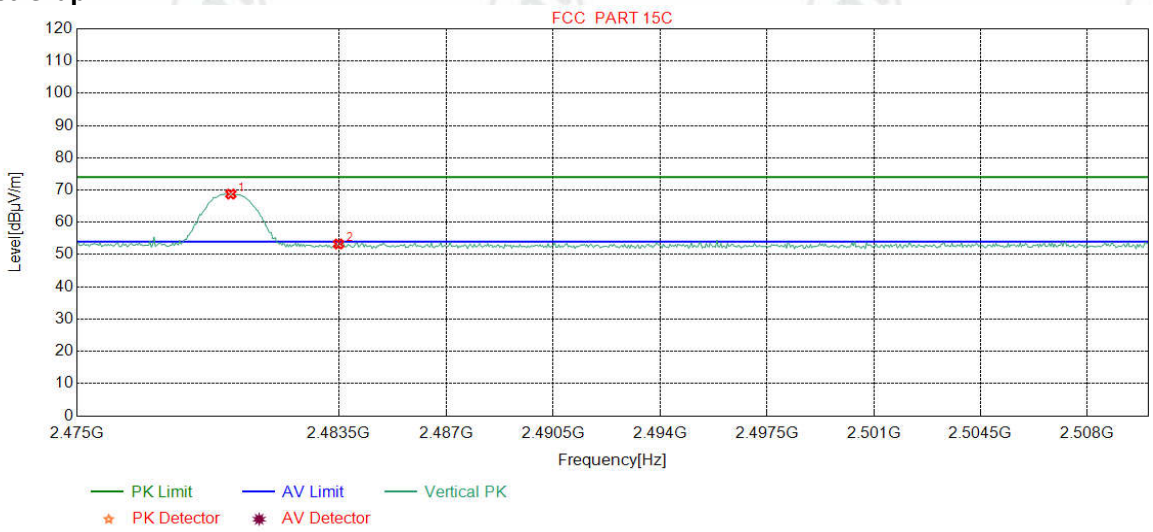
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBµV]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Result	Polarity
1	2479.7747	32.37	13.39	-42.39	75.58	78.95	74.00	-4.95	Pass	Horizontal
2	2483.5000	32.38	13.38	-42.40	49.21	52.57	74.00	21.43	Pass	Horizontal

Mode:	GFSK Transmitting	Channel:	2480
Remark:	Peak		

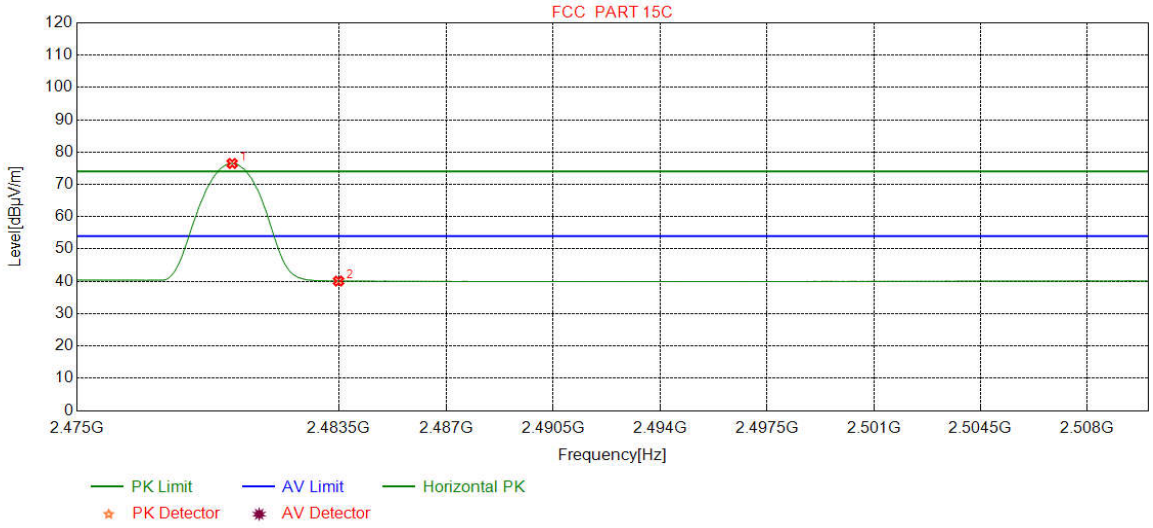
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBµV]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Result	Polarity
1	2479.9937	32.37	13.39	-42.39	65.38	68.75	74.00	5.25	Pass	Vertical
2	2483.5000	32.38	13.38	-42.40	49.93	53.29	74.00	20.71	Pass	Vertical

Mode:	GFSK Transmitting	Channel:	2480
Remark:	AV		

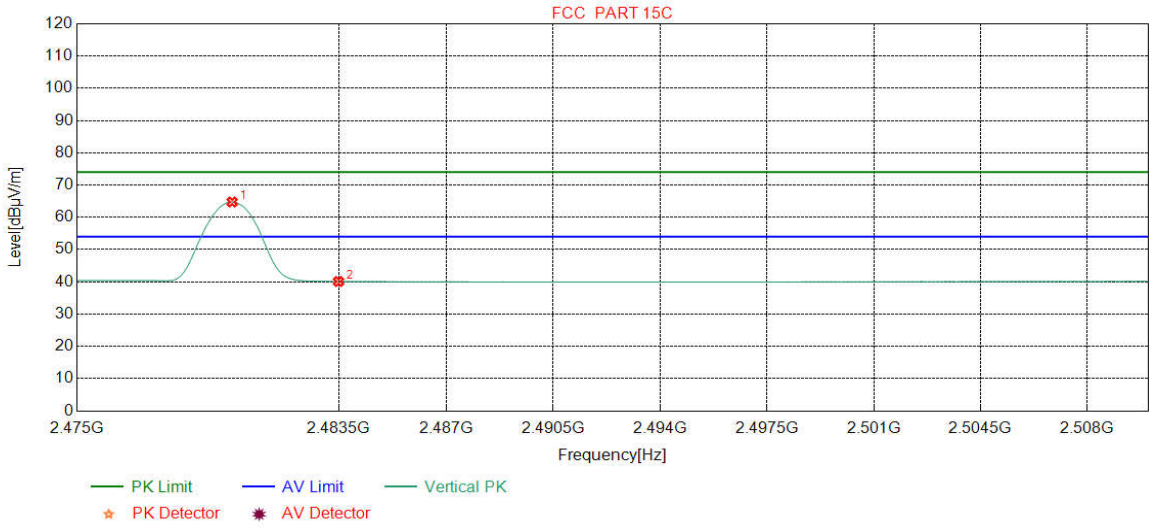
Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBµV]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Result	Polarity
1	2480.0375	32.37	13.39	-42.39	73.12	76.49	54.00	-22.49	Pass	Horizontal
2	2483.5000	32.38	13.38	-42.40	36.73	40.09	54.00	13.91	Pass	Horizontal

Mode:	GFSK Transmitting	Channel:	2480
Remark:	AV		

Test Graph



NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBµV]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Result	Polarity
1	2480.0375	32.37	13.39	-42.39	61.39	64.76	54.00	-10.76	Pass	Vertical
2	2483.5000	32.38	13.38	-42.40	36.74	40.10	54.00	13.90	Pass	Vertical