TEST REPORT

Product	:	Razor XV BT
Trade mark	:	Walker's
Model/Type reference	:	GWP-NHE-BT
Serial Number	:	N/A
Report Number	:	EED32L00066601
FCC ID	:	MV3-GWPNHE
Date of Issue	:	May 14, 2019
Test Standards	:	47 CFR Part 15 Subpart C
Test result	:	PASS

Prepared for:

Country Mate Technology Ltd
5/F, Blk E, Hing Yip Center. 31 Hing Yip Street, Kwun Tong, Kln, Hong Kong

Prepared by:

Centre Testing International Group Co., Ltd.
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Tested By:	Jay	Compiled by:	Kevin Ian
Reviewed by:	Ware xin	Approved by:	Kevin yang
Date:	May 14, 2019		

Check No.: 3096378380

2 Version

Version No.	Date	Description
00	May 14, 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

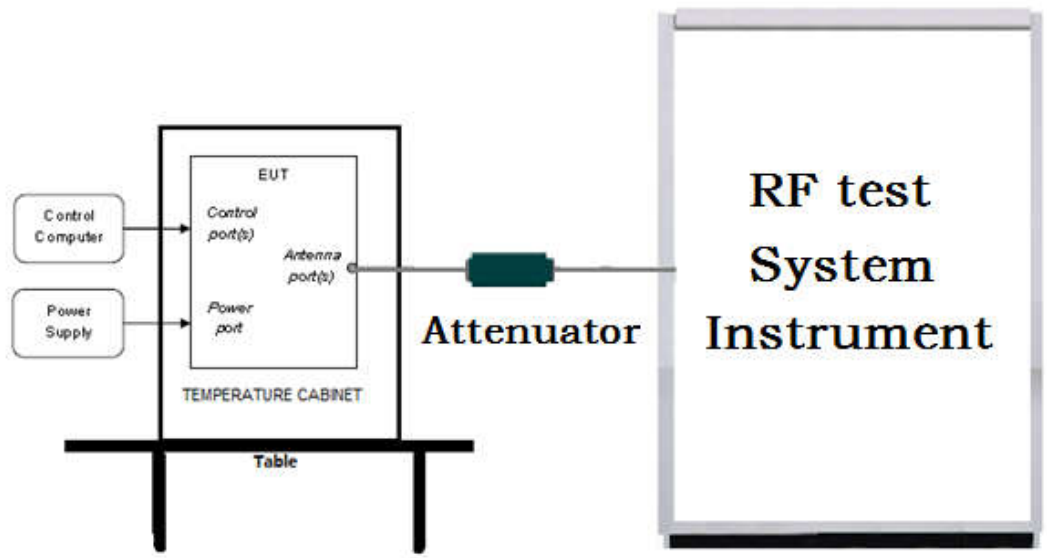
Remark:
Test according to ANSI C63.4-2014 & ANSI C63.10-2013.
The tested samples and the sample information are provided by the client.

4 Content

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:

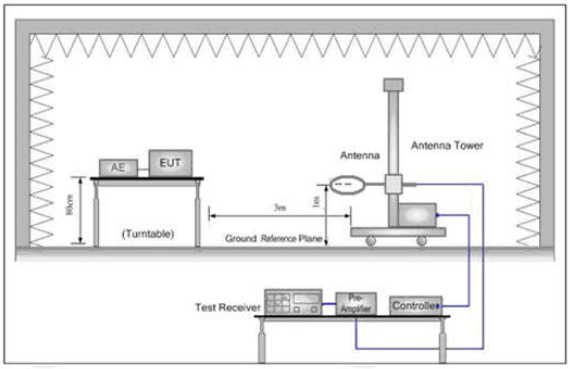


Figure 1. Below 30MHz

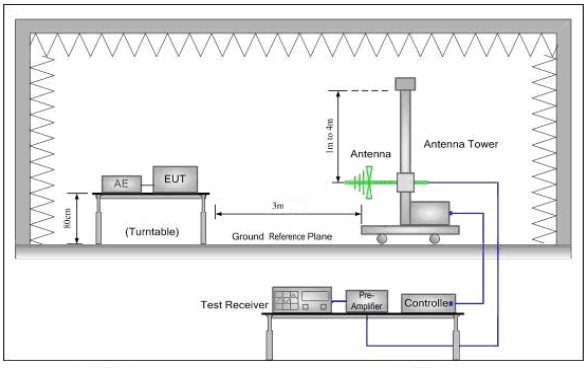


Figure 2. 30MHz to 1GHz

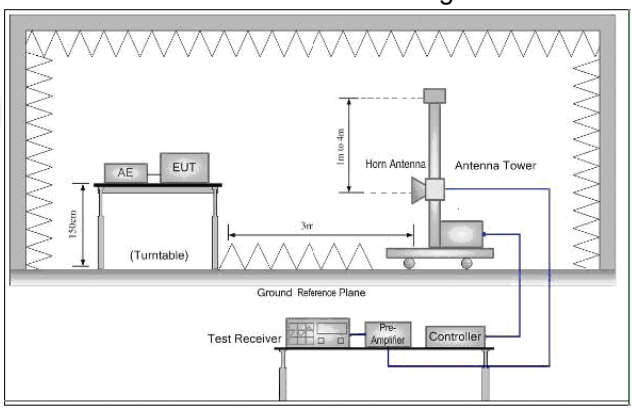
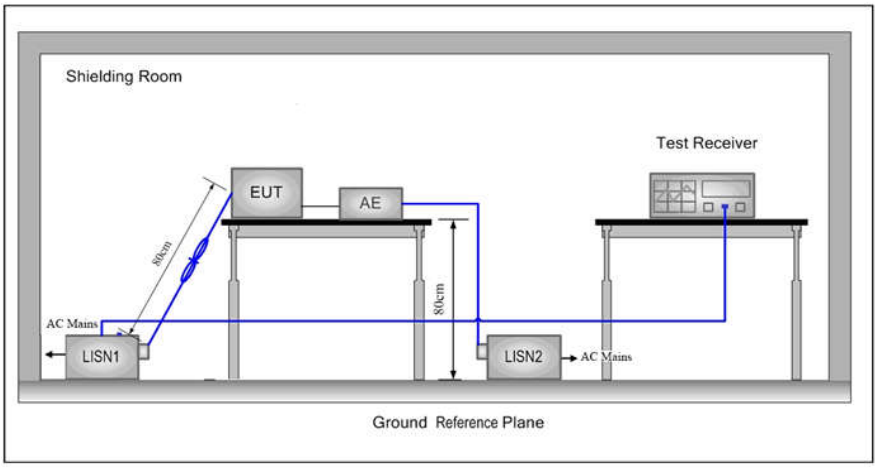


Figure 3. Above 1GHz

5.1.3 For Conducted Emissions test setup

Conducted Emissions setup



5.2 Test Environment

Operating Environment for RF conducted test:	
Temperature:	25°C
Humidity:	52% RH
Atmospheric Pressure:	101kPa

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 signal at the specific channel(s).				

Test mode:

Pre-scan under all rate at Lowest channel 1

Mode	**GFSK**		
packets	**1-DH1**	**1-DH3**	**1-DH5**
Power(dBm)	5.441	5.448	5.457

Mode	π/4DQPSK		
packets	**2-DH1**	**2-DH3**	**2-DH5**
Power(dBm)	5.699	5.705	5.718
Mode	8DPSK		
packets	**3-DH1**	**3-DH3**	**3-DH5**
Power(dBm)	5.509	5.512	5.531

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

6.2 General Description of EUT

Product Name:	Razor XV BT
Model No.(EUT):	GWP-NHE-BT
Trade mark:	Walker's
EUT Supports Radios application:	BT: 2402-2480MHz
Power Supply:	Battery: 3.7V,120mAh
Sample Received Date:	Mar. 29, 2019
Sample tested Date:	Mar. 29, 2019 to Apr. 15, 2019

6.3 Product Specification subjective to this standard

Operation Frequency:	2402MHz~2480MHz
Bluetooth Version:	5.0
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Modulation Type:	GFSK, π/4DQPSK, 8DPSK
Number of Channel:	79
Hopping Channel Type:	Adaptive Frequency Hopping systems
Hardware Version:	V02
Software Version:	V03
Test Power Grade:	N/A
Test Software of EUT:	AB153x_Airoha_Tool_Kit(ATK)_V1.1.16(manufacturer declare)
Antenna Type:	Chip Antenna
Antenna Gain:	-1.18dBi
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.

Associated equipment name		Manufacture	model	Serial number	Supplied by	Certification
AE1	adapter	TEKA	TEKA006-051000CHU	N/A	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)**
Signal Generator	Keysight	E8257D	MY53401106	03-01-2019	02-28-2020
Spectrum Analyzer	Keysight	N9010A	MY54510339	03-01-2019	02-28-2020
Signal Generator	Keysight	N5182B	MY53051549	03-01-2019	02-28-2020
High-pass filter	Sinoscite	FL3CX03WG18NM12-0398-002	---	01-09-2019	01-08-2020
High-pass filter	MICRO-TRONICS	SPA-F-63029-4	---	01-09-2019	01-08-2020
DC Power	Keysight	E3642A	MY54426035	03-01-2019	02-28-2020
PC-1	Lenovo	R4960d	---	03-01-2019	02-28-2020
BT&WI-FI Automatic control	R&S	OSP120	101374	03-01-2019	02-28-2020
RF control unit	JS Tonscend	JS0806-2	15860006	03-01-2019	02-28-2020
RF control unit	JS Tonscend	JS0806-1	15860004	03-01-2019	02-28-2020
RF control unit	JS Tonscend	JS0806-4	158060007	03-01-2019	02-28-2020
BT&WI-FI Automatic test software	JS Tonscend	JS1120-2	---	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
Communication test set	Agilent	E5515C	GB47050 534	03-01-2019	02-28-2020
Communication test set	R&S	CMW500	102898	01-18-2019	01-17-2020
LISN	R&S	ENV216	100098	05-10-2018	05-10-2019
LISN	schwarzbeck	NNLK8121	8121-529	05-10-2018	05-10-2019
Voltage Probe	R&S	ESH2-Z3 0299.7810.5 6	100042	06-13-2017	06-11-2020
Current Probe	R&S	EZ-17 816.2063.03	100106	05-30-2018	05-29-2019
ISN	TESEQ	ISN T800	30297	01-06-2019	01-15-2020

3M Semi/full-anechoic Chamber					
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
3M Chamber & Accessory Equipment	TDK	SAC-3	---	06-04-2016	06-03-2019
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-401	12-21-2018	12-20-2019
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-618	07-30-2018	07-29-2019
Microwave Preamplifier	Agilent	8449B	3008A02425	08-21-2018	08-20-2019
Microwave Preamplifier	Tonscend	EMC051845SE	980380	01-16-2019	01-15-2020
Horn Antenna	Schwarzbeck	BBHA 9120D	9120D-1869	04-25-2018	04-23-2021
Horn Antenna	ETS-LINDGREN	3117	00057410	06-05-2018	06-03-2021
Double ridge horn antenna	A.H.SYSTEMS	SAS-574	374	06-05-2018	06-04-2021
Pre-amplifier	A.H.SYSTEMS	PAP-1840-60	6041.6041	08-08-2018	08-07-2019
Loop Antenna	ETS	6502	00071730	06-22-2017	06-21-2019
Spectrum Analyzer	R&S	FSP40	100416	05-11-2018	05-10-2019
Receiver	R&S	ESCI	100435	05-25-2018	05-24-2019
Receiver	R&S	ESCI7	100938-003	11-23-2018	11-22-2019
Multi device Controller	maturo	NCD/070/10711112	---	01-09-2019	01-08-2020
LISN	schwarzbeck	NNBM8125	81251547	05-11-2018	05-10-2019
LISN	schwarzbeck	NNBM8125	81251548	05-11-2018	05-10-2019
Signal Generator	Agilent	E4438C	MY45095744	03-01-2019	02-28-2020
Signal Generator	Keysight	E8257D	MY53401106	03-01-2019	02-28-2020
Temperature/ Humidity Indicator	Shanghai qixiang	HM10	1804298	10-12-2018	10-11-2019
Communication test set	Agilent	E5515C	GB47050534	03-01-2019	02-28-2020
Cable line	Fulai(7M)	SF106	5219/6A	01-09-2019	01-08-2020
Cable line	Fulai(6M)	SF106	5220/6A	01-09-2019	01-08-2020
Cable line	Fulai(3M)	SF106	5216/6A	01-09-2019	01-08-2020
Cable line	Fulai(3M)	SF106	5217/6A	01-09-2019	01-08-2020
Communication test set	R&S	CMW500	104466	01-18-2019	01-17-2020
High-pass filter	Sinoscite	FL3CX03WG18NM12-0398-002	---	01-09-2019	01-08-2020
High-pass filter	MICRO-TRONICS	SPA-F-63029-4	---	01-09-2019	01-08-2020
band rejection filter	Sinoscite	FL5CX01CA09CL12-0395-001	---	01-09-2019	01-08-2020
band rejection filter	Sinoscite	FL5CX01CA08CL12-0393-001	---	01-09-2019	01-08-2020
band rejection filter	Sinoscite	FL5CX02CA04CL12-0396-002	---	01-09-2019	01-08-2020
band rejection filter	Sinoscite	FL5CX02CA03CL12-0394-001	---	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)

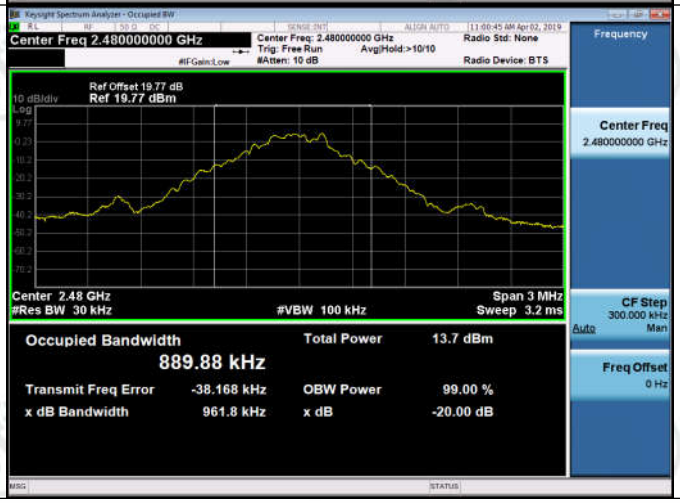
Appendix A): 20dB Occupied Bandwidth

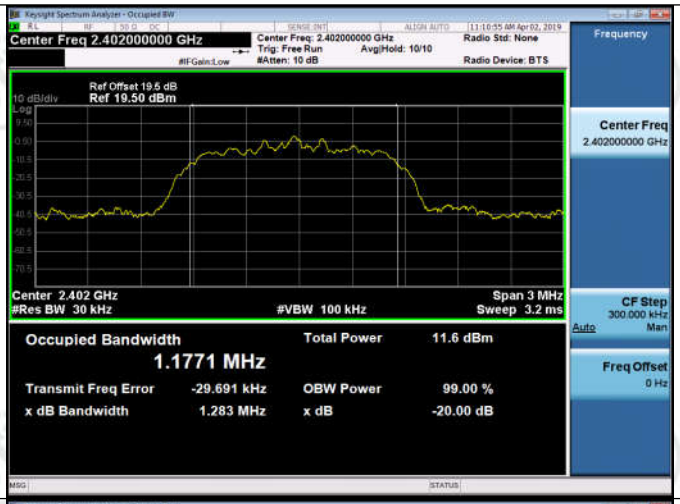
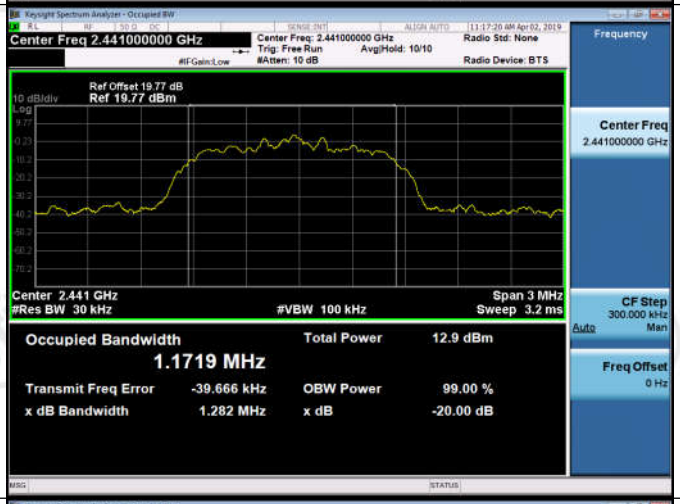
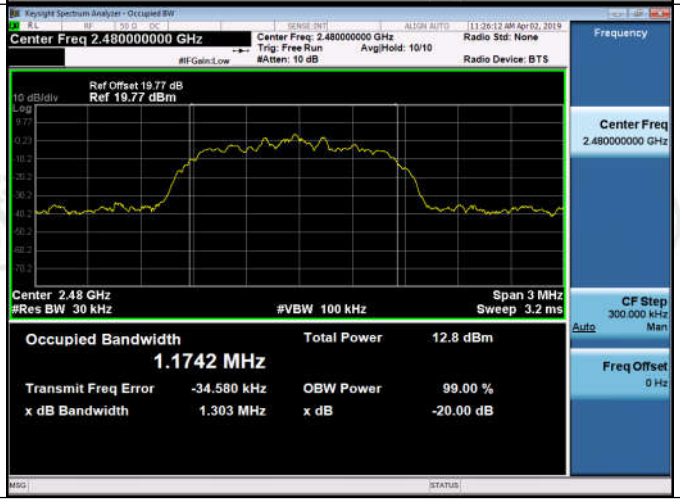
Spectrum Setup:	Span	RBW	VBW	Trace
	3MHz	30kHz	100kHz	Max Hold
Test procedure as below: a. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode. b. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilized for 20 dB bandwidth measurement. c. Use the 99% power bandwidth function of the instrument and report the measured bandwidth.				
Test Ambient:	Temp.: 25°C	Humid.: 52%	Press.: 101kPa	

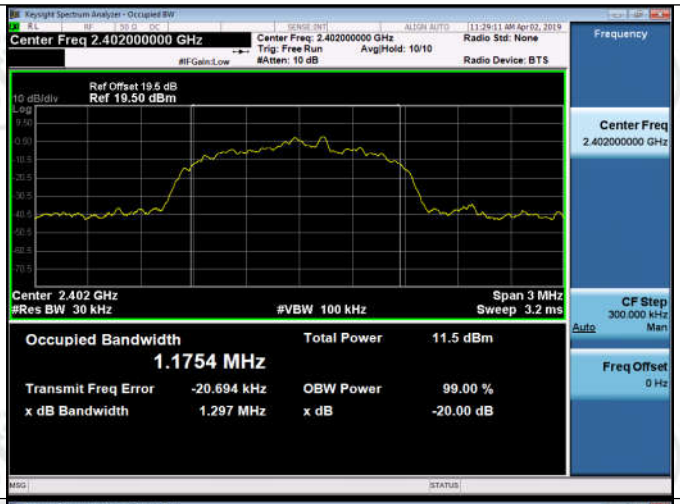
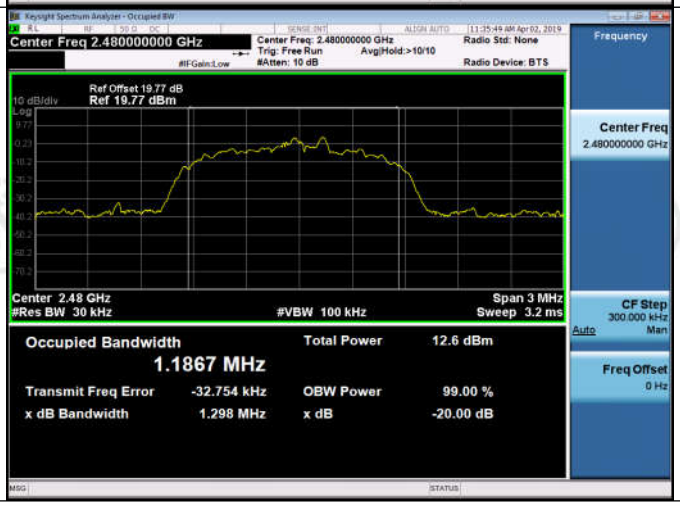
Test Result

Mode	Channel.	20dB Bandwidth [MHz]	99% OBW [MHz]	Verdict
GFSK	LCH	0.9595	0.89256	PASS
GFSK	MCH	0.9621	0.88853	PASS
GFSK	HCH	0.9618	0.88988	PASS
π/4DQPSK	LCH	1.283	1.1771	PASS
π/4DQPSK	MCH	1.282	1.1719	PASS
π/4DQPSK	HCH	1.303	1.1742	PASS
8DPSK	LCH	1.297	1.1754	PASS
8DPSK	MCH	1.296	1.1807	PASS
8DPSK	HCH	1.298	1.1867	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

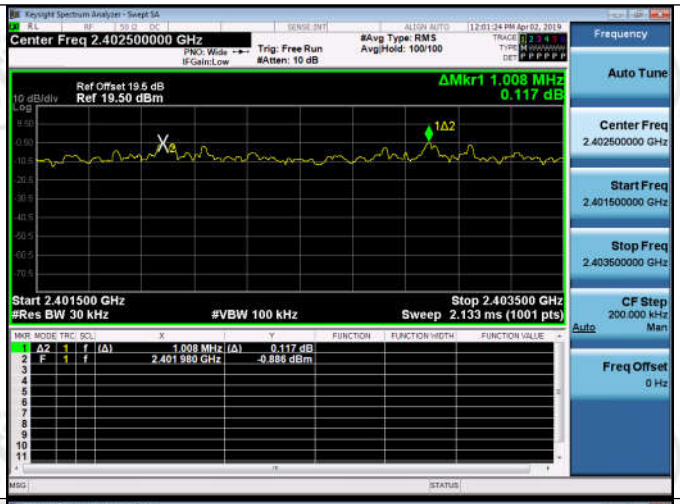
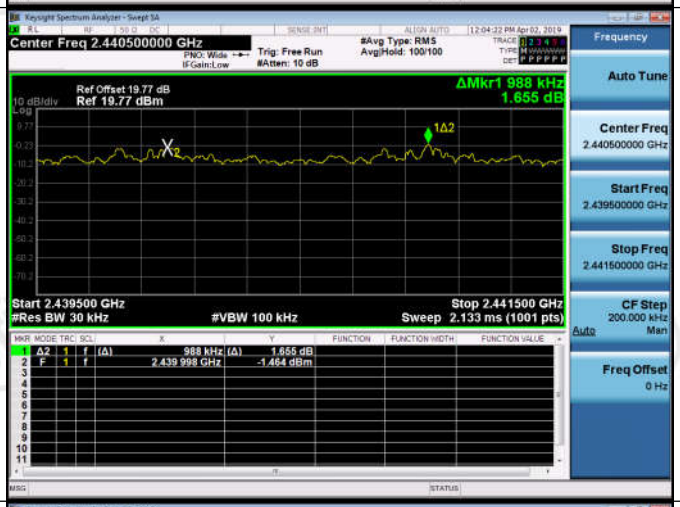
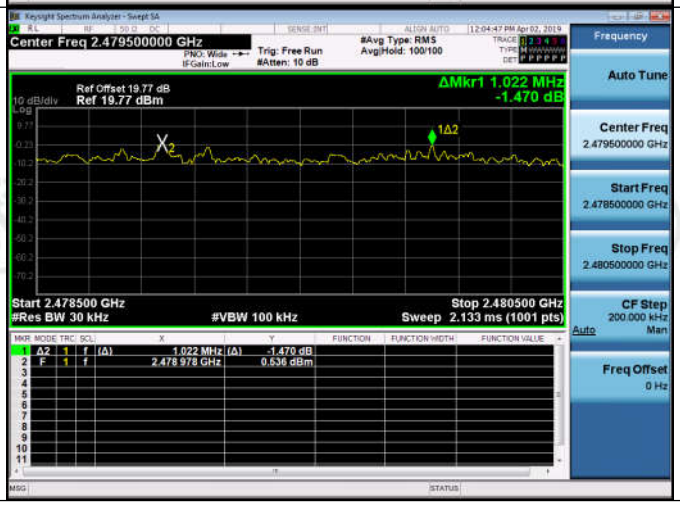
Spectrum Setup:			
	Span	RBW	VBW	Trace
	2MHz	30kHz	100kHz	Max Hold
Test procedure as below: a. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode. b. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilized for channel separation measurement.			
Limit:	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.		
Test Ambient:	Temp.: 25°C	Humid.: 52%	Press.: 101kPa

Result Table

Mode	Channel.	Carrier Frequency Separation [MHz]	Verdict
GFSK	LCH	1.148	PASS
GFSK	MCH	1.158	PASS
GFSK	HCH	1.156	PASS
π/4DQPSK	LCH	1.008	PASS
π/4DQPSK	MCH	0.988	PASS
π/4DQPSK	HCH	1.022	PASS
8DPSK	LCH	0.996	PASS
8DPSK	MCH	0.998	PASS
8DPSK	HCH	1.016	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

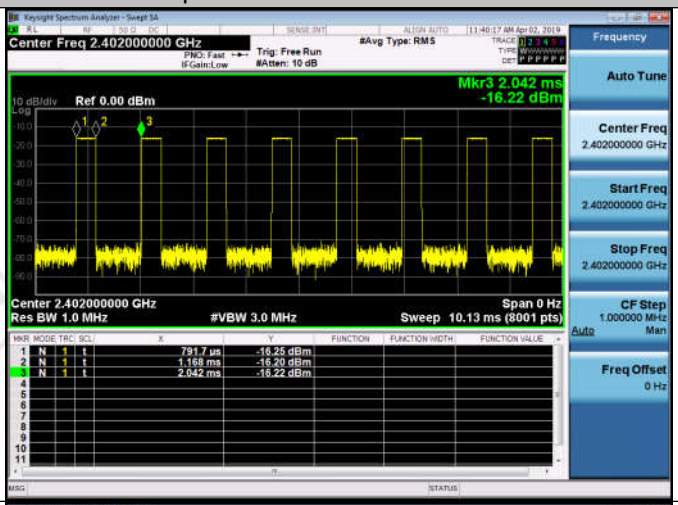
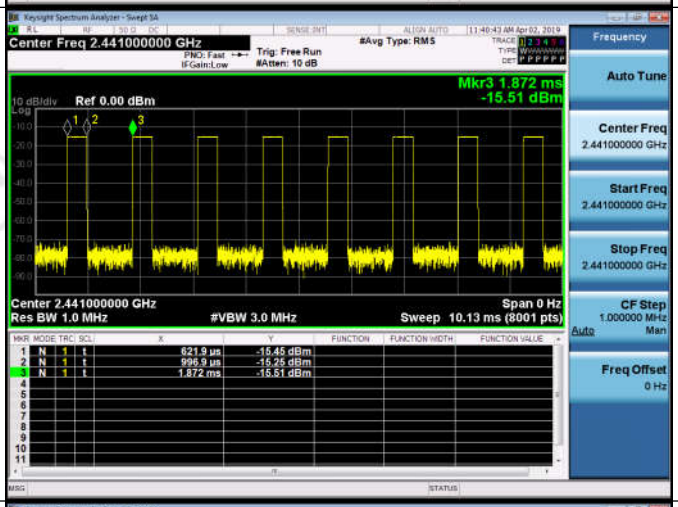
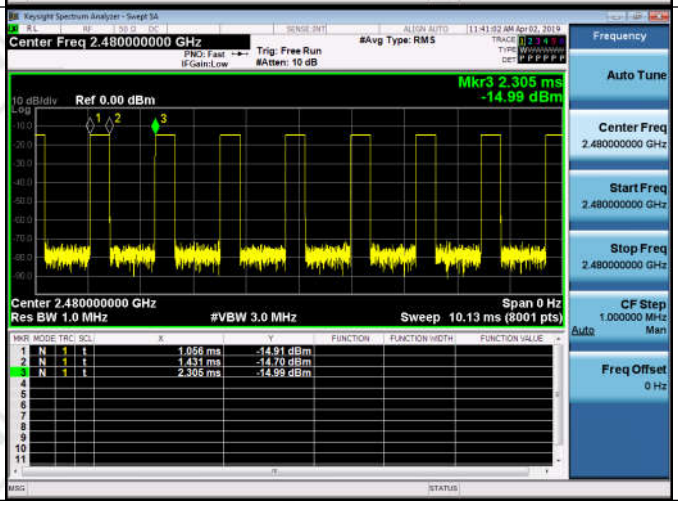
Spectrum Setup:			
	Span	RBW	VBW
	0MHz	1MHz	3MHz
Test procedure as below: a. The transmitter output (antenna port) was connected to the spectrum analyzer. b. Set RBW of spectrum analyzer to 1MHz and VBW to 3MHz. c. Sweep Time is more than once pulse time. d. Set the center frequency on any frequency would be measure and set the frequency span to zero span. e. Measure the maximum time duration of one single pulse.			
Limit:	Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.		
Test Ambient:	Temp.: 25°C	Humid.: 52%	Press.: 101kPa

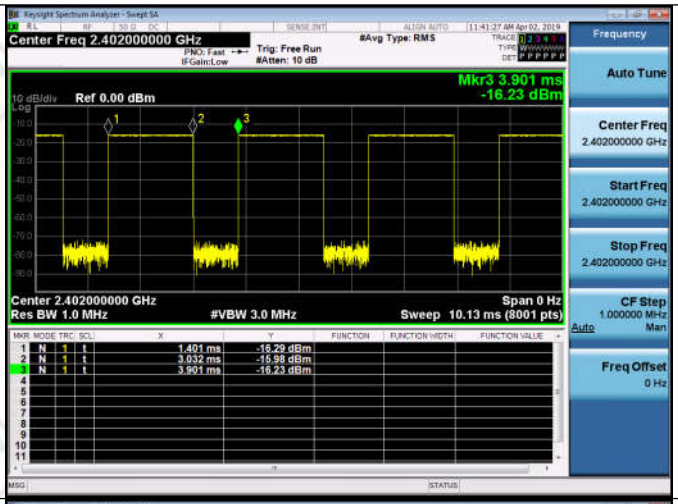
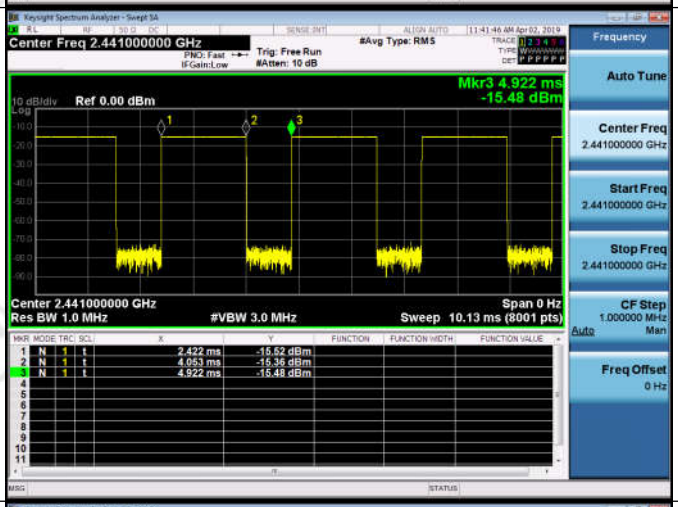
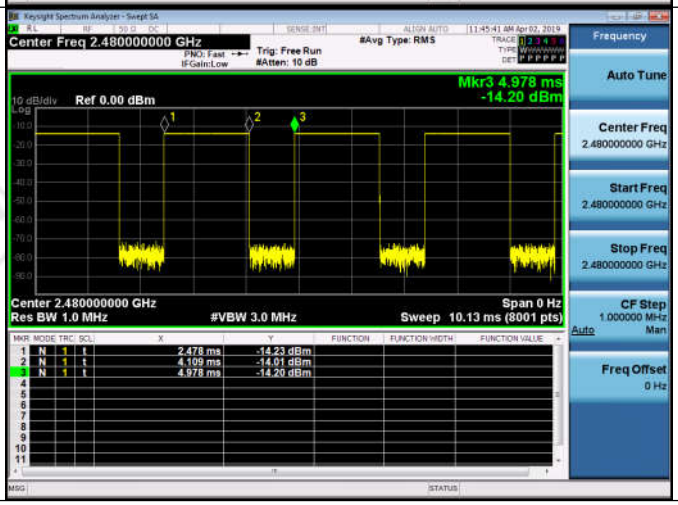
Result Table

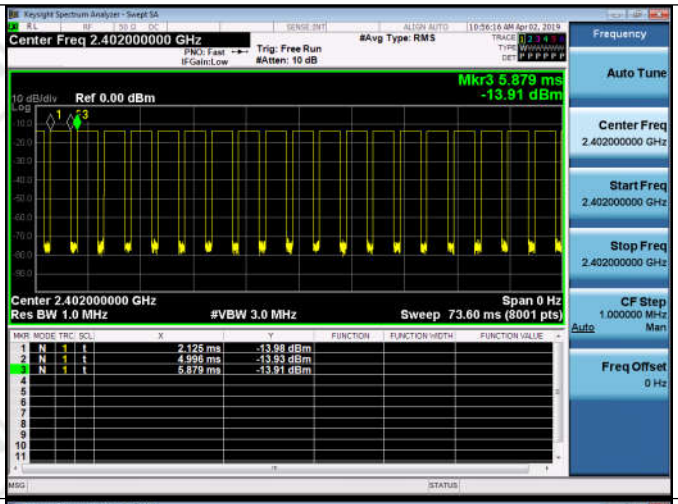
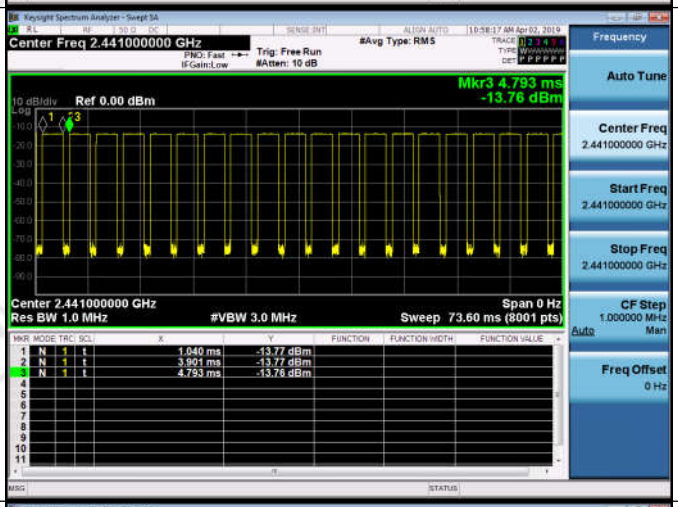
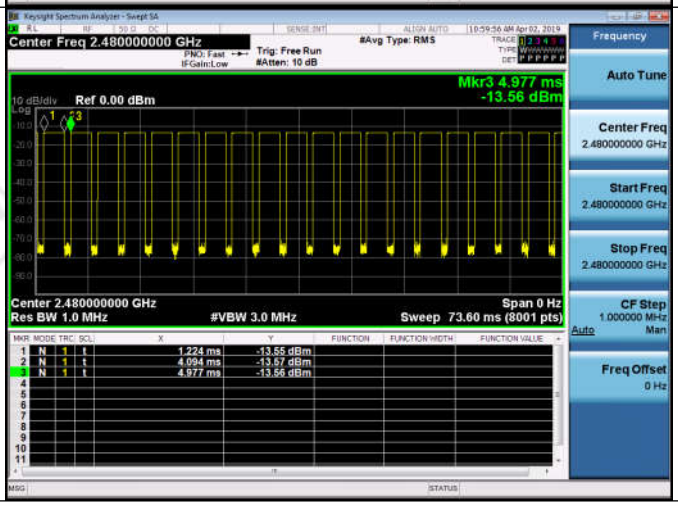
Mode	Packet	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Duty Cycle [%]	Verdict
GFSK	DH1	LCH	0.376203	320	0.12	0.30	PASS
GFSK	DH1	MCH	0.374934	320	0.12	0.30	PASS
GFSK	DH1	HCH	0.37493	320	0.12	0.30	PASS
GFSK	DH3	LCH	1.63147	160	0.261	0.65	PASS
GFSK	DH3	MCH	1.63146	160	0.261	0.65	PASS
GFSK	DH3	HCH	1.63147	160	0.261	0.65	PASS
GFSK	DH5	LCH	2.8704	106.7	0.306	0.76	PASS
GFSK	DH5	MCH	2.8612	106.7	0.305	0.76	PASS
GFSK	DH5	HCH	2.8704	106.7	0.306	0.76	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			

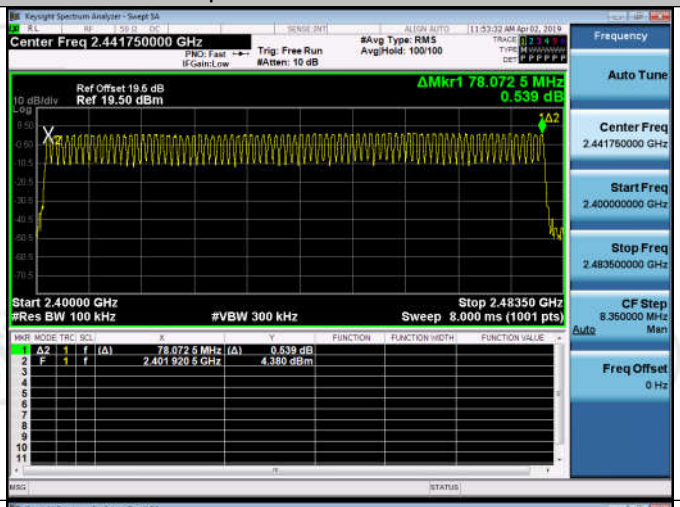
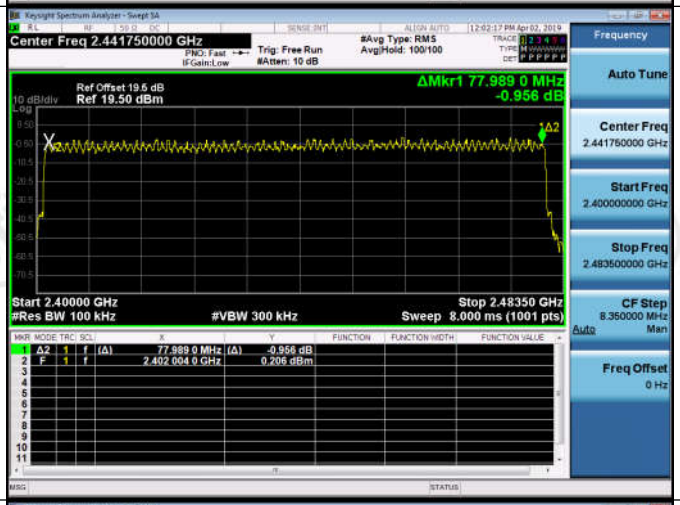
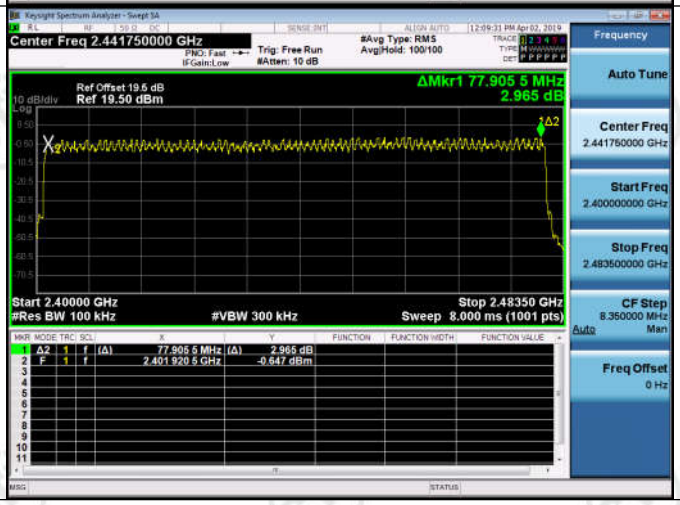
Appendix D): Hopping Channel Number

Spectrum Setup:			
	Span	RBW	VBW
	Operating Frequency Range	100kHz	300kHz
Test procedure as below: a. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode. b. The resolution bandwidth of 100 kHz and the video bandwidth of 300 kHz were utilized. c. Observe frequency hopping in 2400MHz~2483.5MHz, there are at least 75 non-overlapping channels.			
Limit:	At least 15 hopping frequencies, and should be equally spaced.		
Test Ambient:	Temp.: 25°C	Humid.: 52%	Press.: 101kPa

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			

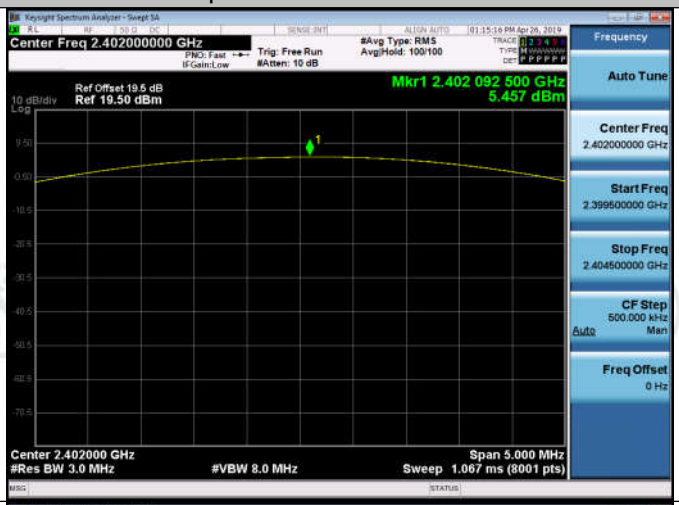
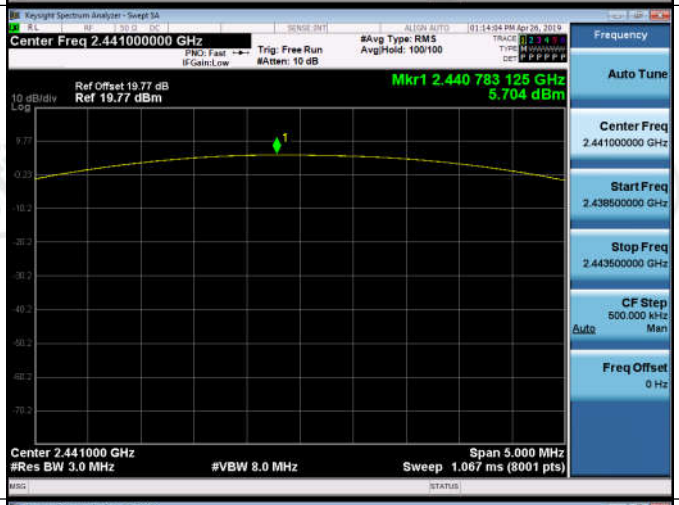
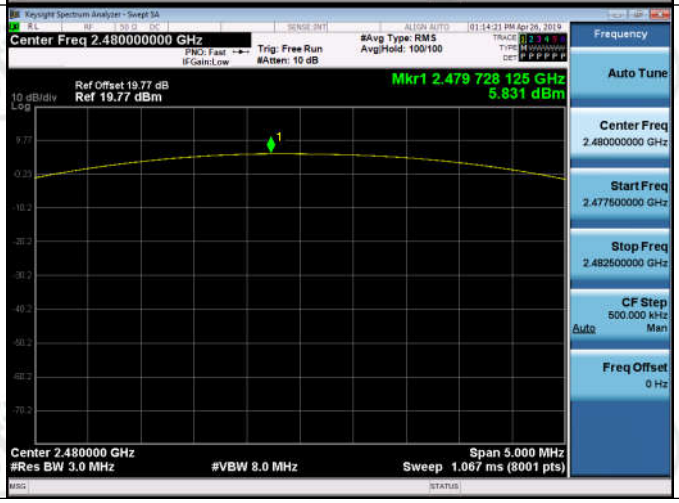
Appendix E): Conducted Peak Output Power

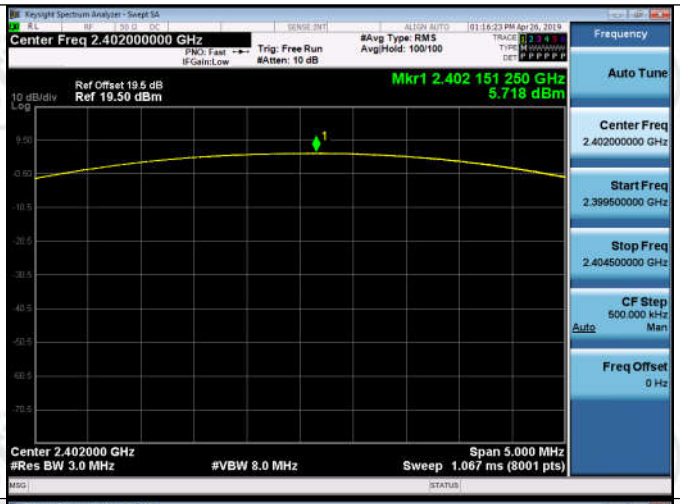
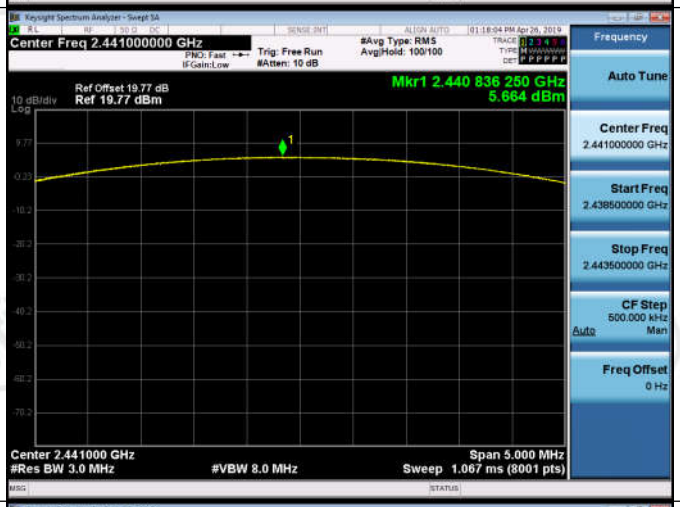
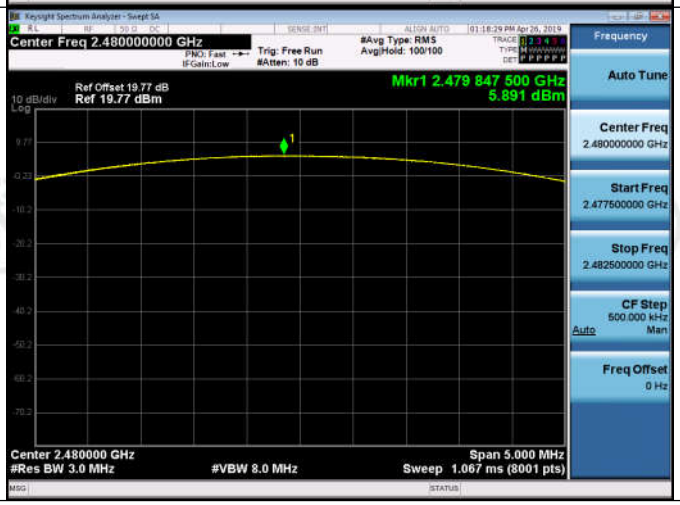
Test procedure as below: a. The transmitter output (antenna port) was connected to the spectrum analyzer. b. Set RBW of spectrum analyzer to 3MHz and VBW to 8MHz. c. Use peak marker function to determine the peak amplitude level.			
Limit:	For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, the limit for peak output power is 1Watt (30dBm). For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts (21dBm).		
Test Ambient:	Temp.: 25°C	Humid.: 52%	Press.: 101kPa

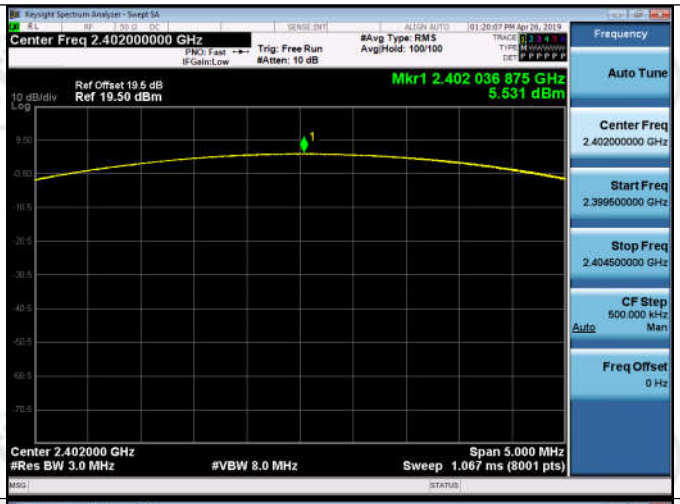
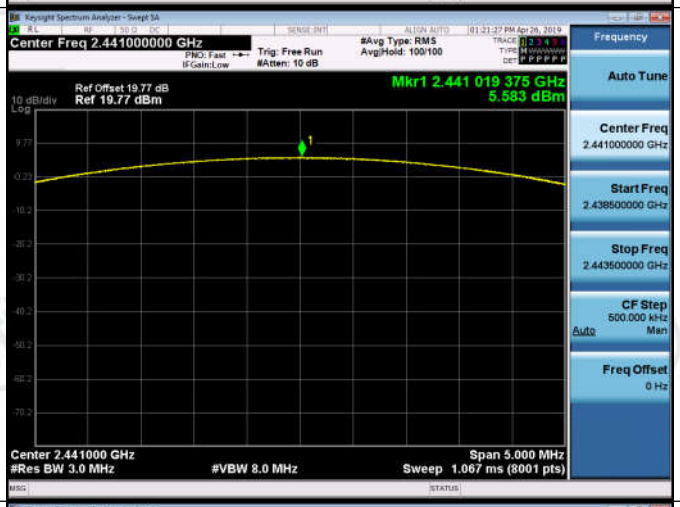
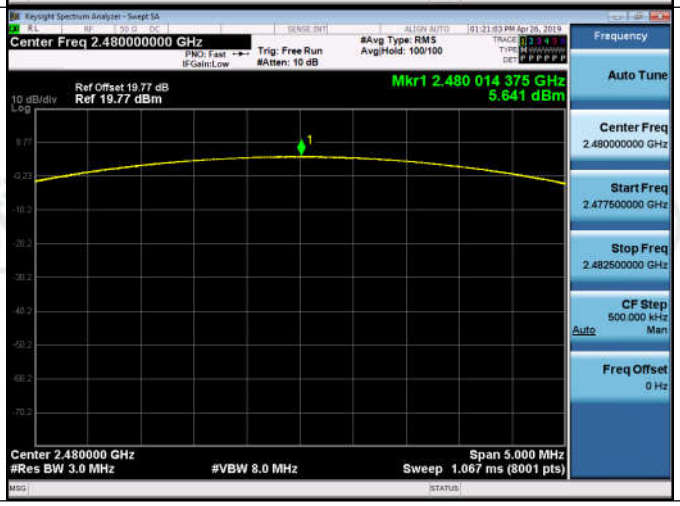
Result Table

Mode	Channel.	Maximum Peak Output Power [dBm]	Verdict
GFSK	LCH	5.457	PASS
GFSK	MCH	5.704	PASS
GFSK	HCH	5.831	PASS
π/4DQPSK	LCH	5.718	PASS
π/4DQPSK	MCH	5.664	PASS
π/4DQPSK	HCH	5.891	PASS
8DPSK	LCH	5.531	PASS
8DPSK	MCH	5.583	PASS
8DPSK	HCH	5.641	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		

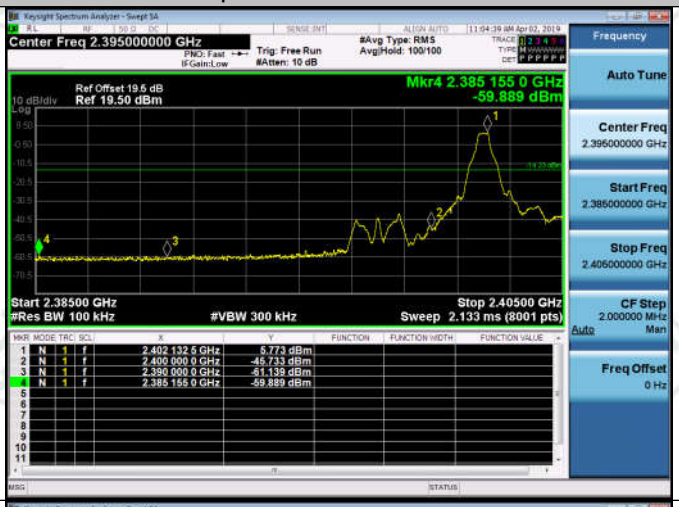
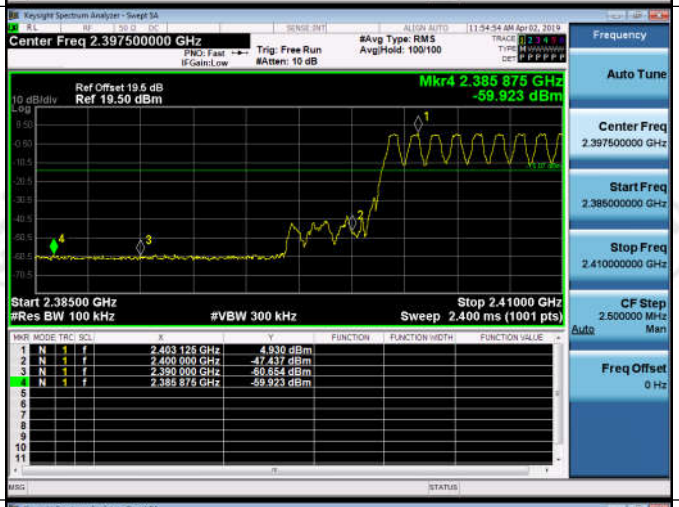
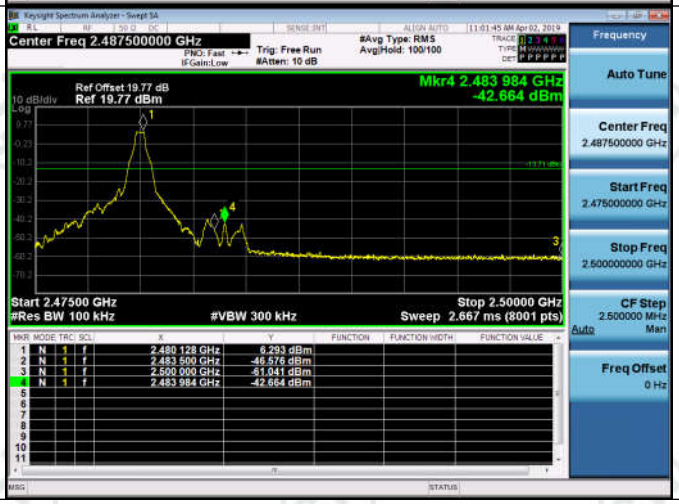
Appendix F): Band-edge for RF Conducted Emissions

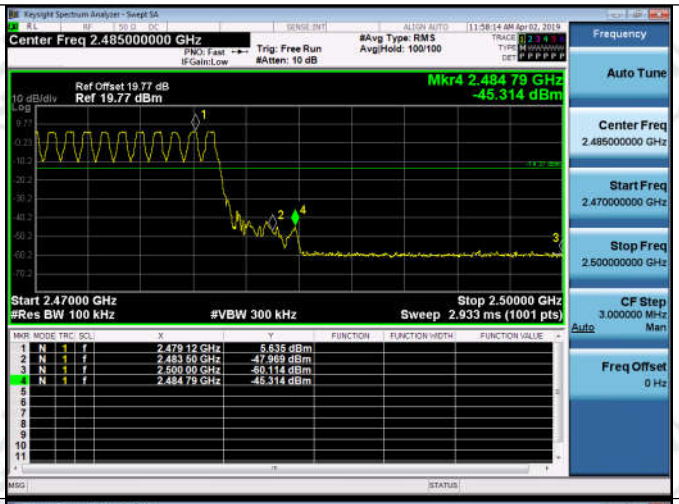
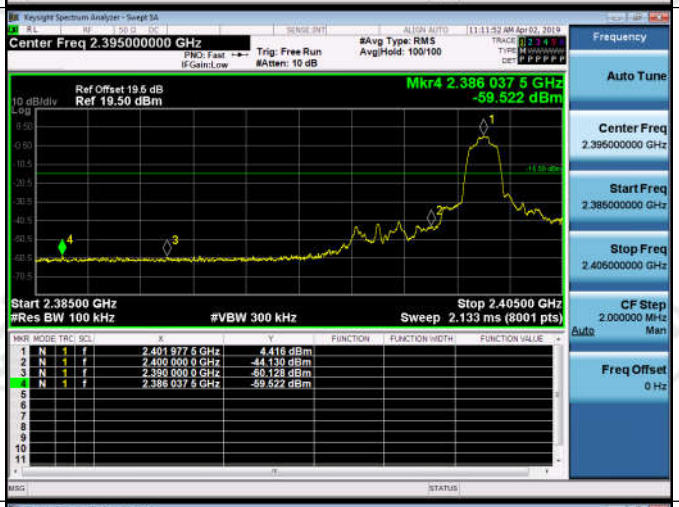
Test procedure as below: ANSI C63.10 (2013) Section 7.8.8			
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.		
Test Ambient:	Temp.: 25°C	Humid.: 52%	Press.: 101kPa

Result Table

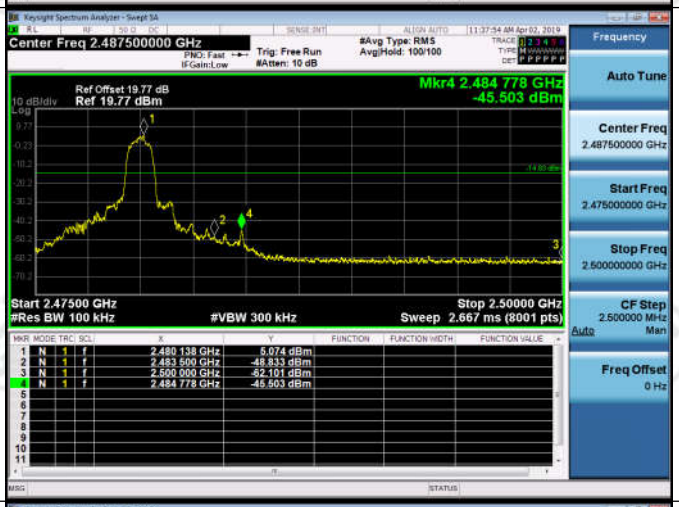
Mode	Channel	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max Spurious Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	2402	5.773	Off	-59.889	-14.23	PASS
			4.930	On	-59.923	-15.07	PASS
GFSK	HCH	2480	6.293	Off	-42.664	-13.71	PASS
			5.635	On	-45.314	-14.37	PASS
π/4DQPSK	LCH	2402	4.416	Off	-59.522	-15.58	PASS
			1.439	On	-59.289	-18.56	PASS
π/4DQPSK	HCH	2480	5.474	Off	-45.698	-14.53	PASS
			2.730	On	-55.111	-17.27	PASS
8DPSK	LCH	2402	4.074	Off	-58.366	-15.93	PASS
			1.606	On	-59.849	-18.39	PASS
8DPSK	HCH	2480	5.074	Off	-45.503	-14.93	PASS
			2.786	On	-53.071	-17.21	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			

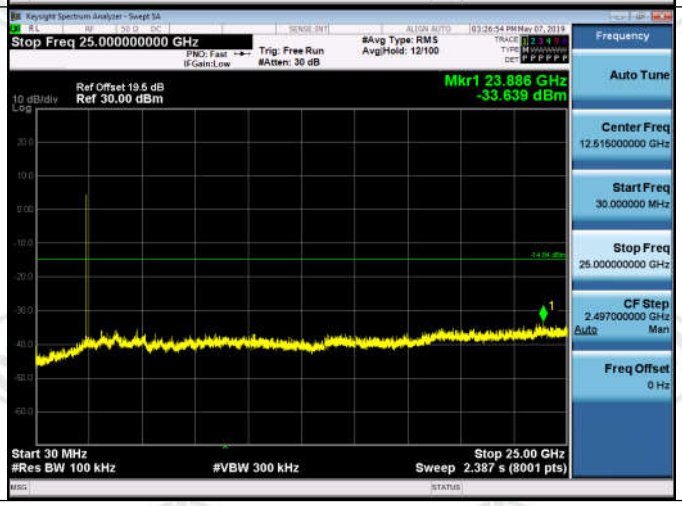
Appendix G): RF Conducted Spurious Emissions

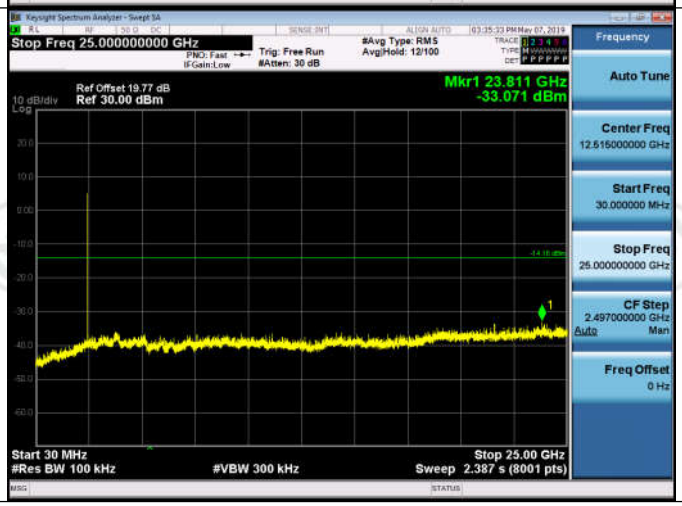
Test procedure as below: a. The transmitter output (antenna port) was connected to the spectrum analyzer. b. Set RBW of spectrum analyzer to 100kHz and VBW to 300kHz. c. Measurements are made over the 30MHz to 25GHz range with the transmitter set to the lowest, middle, and highest channels.			
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.		
Test Ambient:	Temp.: 25°C	Humid.: 52%	Press.: 101kPa

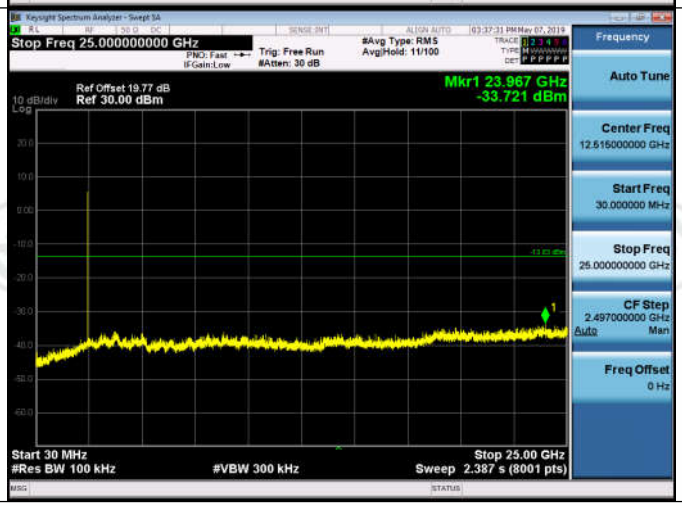
Result Table

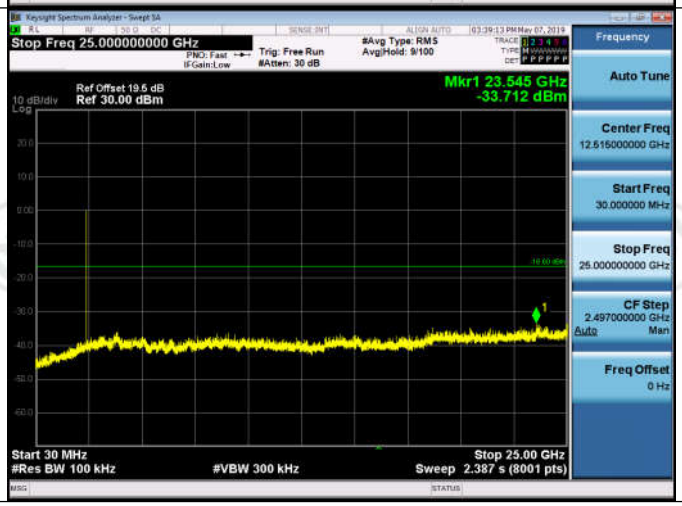
Mode	Channel	Pref [dBm]	Puw[dBm]	Verdict
GFSK	LCH	5.159	<Limit	PASS
GFSK	MCH	5.843	<Limit	PASS
GFSK	HCH	6.17	<Limit	PASS
π/4DQPSK	LCH	3.401	<Limit	PASS
π/4DQPSK	MCH	4.397	<Limit	PASS
π/4DQPSK	HCH	5.072	<Limit	PASS
8DPSK	LCH	3.618	<Limit	PASS
8DPSK	MCH	4.403	<Limit	PASS
8DPSK	HCH	5.097	<Limit	PASS

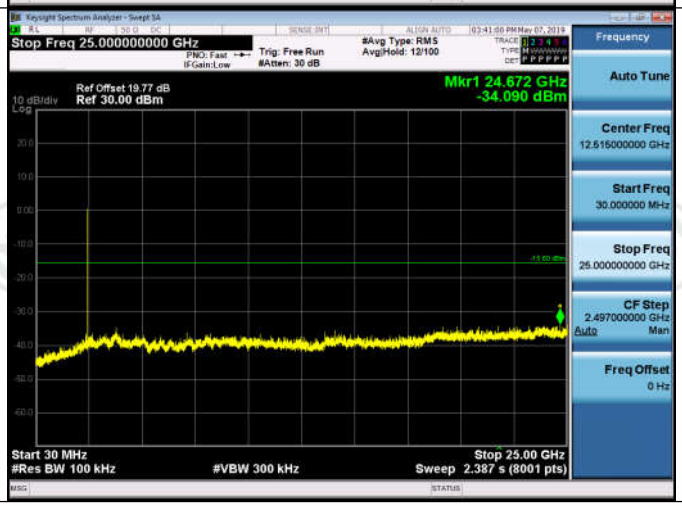
Test Graph

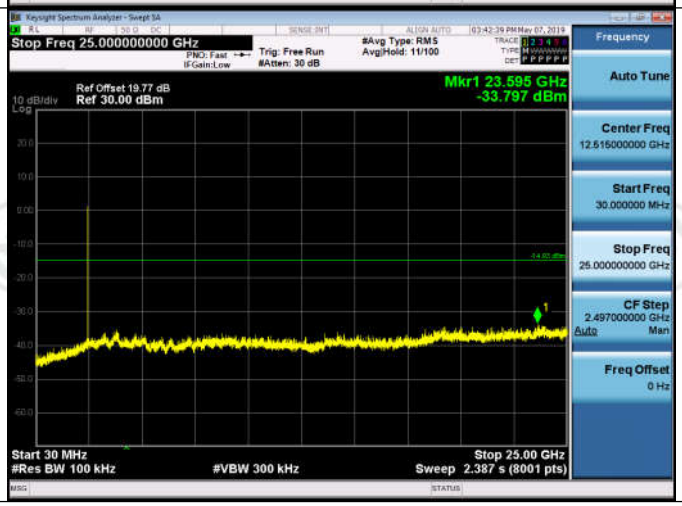
GFSK_LCH_Graphs		
Pref		
Puw		

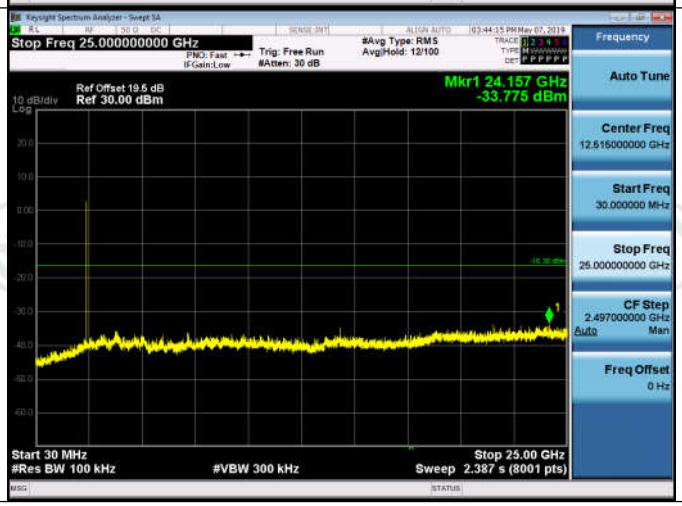
GFSK_MCH_Graphs			
Pref			
Puw			

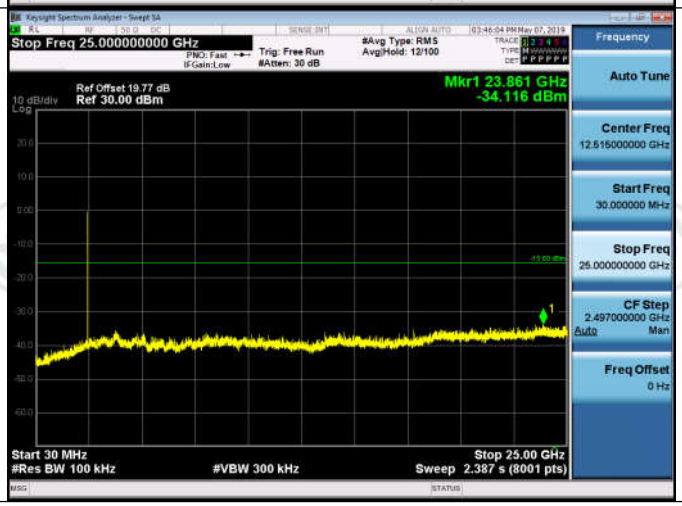
GFSK_HCH_Graphs			
Pref			
Puw			

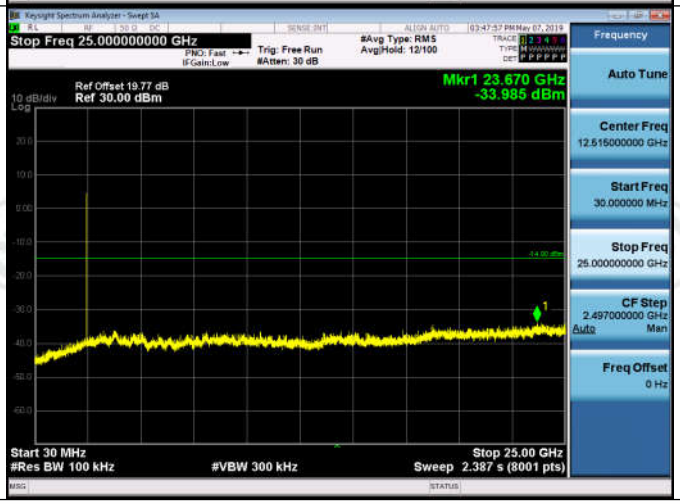
π/4DQPSK_LCH_Graphs			
Pref			
Puw			

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:**

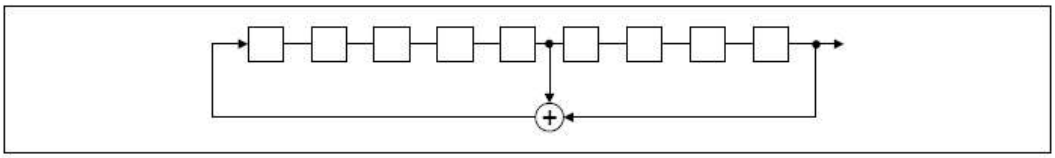
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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

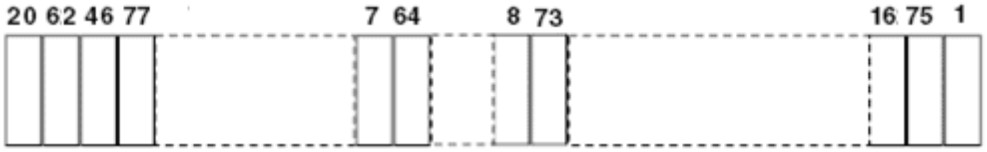
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized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

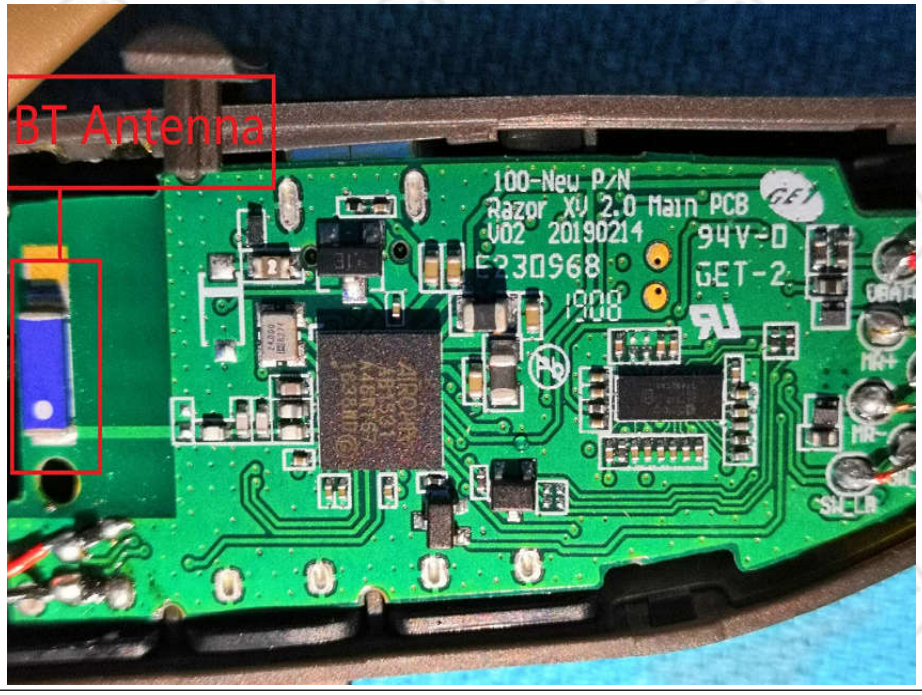
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit 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 Chip Antenna and no consideration of replacement. The best case gain of the antenna is -1.18dBi.



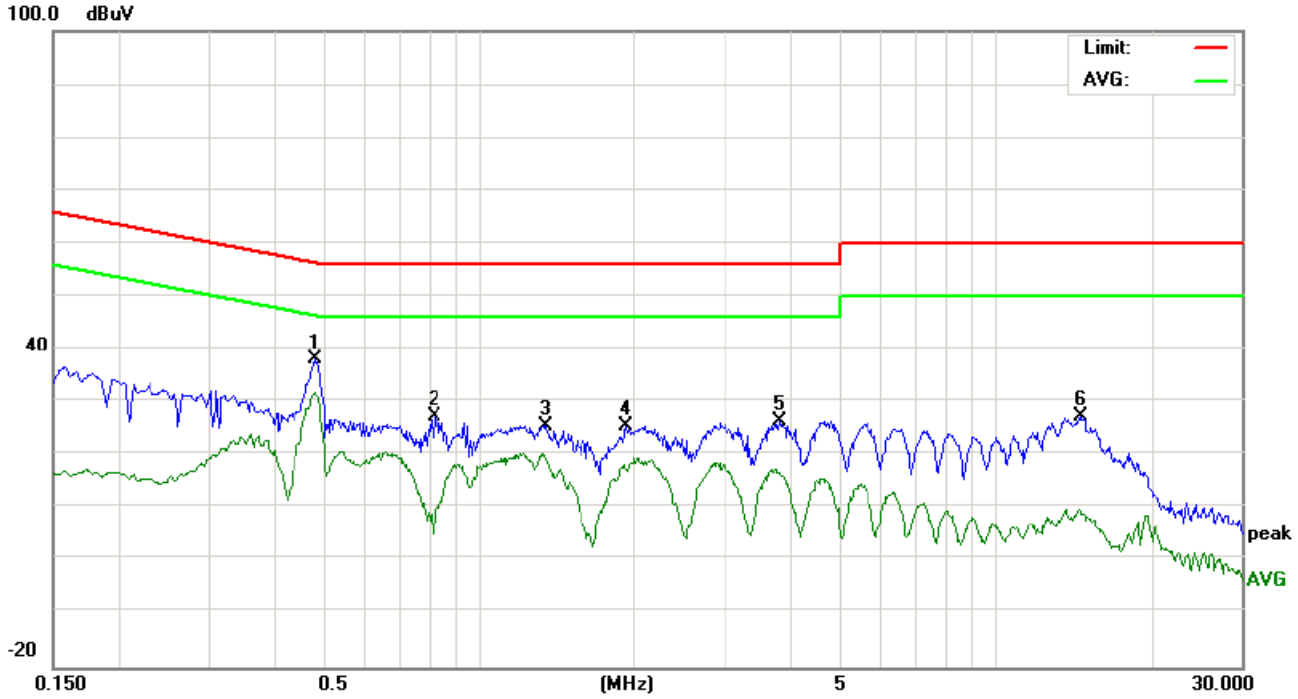
Appendix J): AC Power Line Conducted Emission

<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><td rowspan="2">Frequency range (MHz)</td><td colspan="2">Limit (dBμV)</td></tr>
<tr><td>Quasi-peak</td><td>Average</td></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>Test Ambient:</td><td>Temp.: 22°C</td><td>Humid.: 53%</td><td>Press.: 101kPa</td></tr>
</table>

Measurement Data

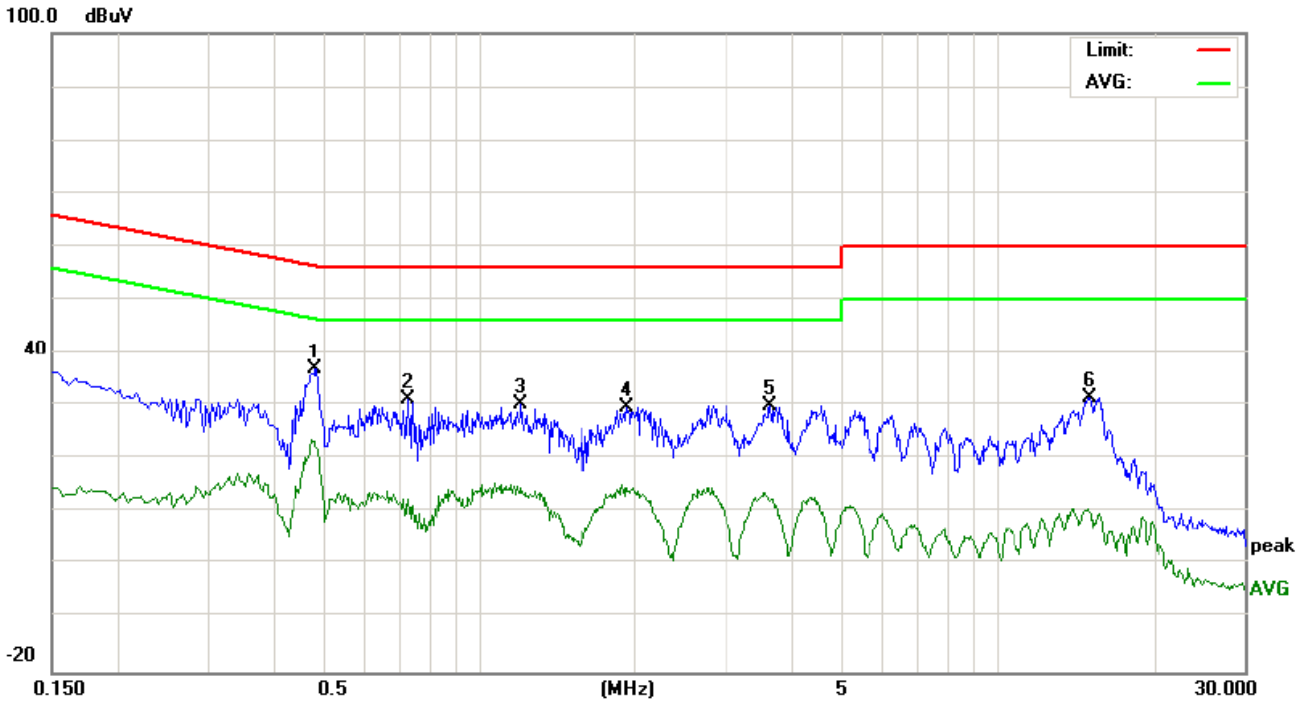
An initial pre-scan was performed on the live and neutral lines with peak detector.
Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

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	0.4820	28.26	25.86	21.72	9.89	38.15	35.75	31.61	56.30	46.30	-20.55	-14.69	P	
2	0.8180	17.57	10.10	-2.83	9.80	27.37	19.90	6.97	56.00	46.00	-36.10	-39.03	P	
3	1.3460	15.77	13.76	10.01	9.78	25.55	23.54	19.79	56.00	46.00	-32.46	-26.21	P	
4	1.9380	15.77	10.65	6.54	9.73	25.50	20.38	16.27	56.00	46.00	-35.62	-29.73	P	
5	3.8220	16.61	11.53	6.57	9.73	26.34	21.26	16.30	56.00	46.00	-34.74	-29.70	P	
6	14.6380	17.24	11.03	-3.75	9.97	27.21	21.00	6.22	60.00	50.00	-39.00	-43.78	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	0.4860	27.08	21.90	12.60	9.89	36.97	31.79	22.49	56.24	46.24	-24.45	-23.75	P	
2	0.7300	21.49	12.93	1.28	9.81	31.30	22.74	11.09	56.00	46.00	-33.26	-34.91	P	
3	1.2059	20.57	13.58	4.06	9.79	30.36	23.37	13.85	56.00	46.00	-32.63	-32.15	P	
4	1.9380	19.80	12.09	2.96	9.73	29.53	21.82	12.69	56.00	46.00	-34.18	-33.31	P	
5	3.6460	20.09	12.30	2.19	9.73	29.82	22.03	11.92	56.00	46.00	-33.97	-34.08	P	
6	15.1100	21.60	15.00	-1.88	9.98	31.58	24.98	8.10	60.00	50.00	-35.02	-41.90	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:

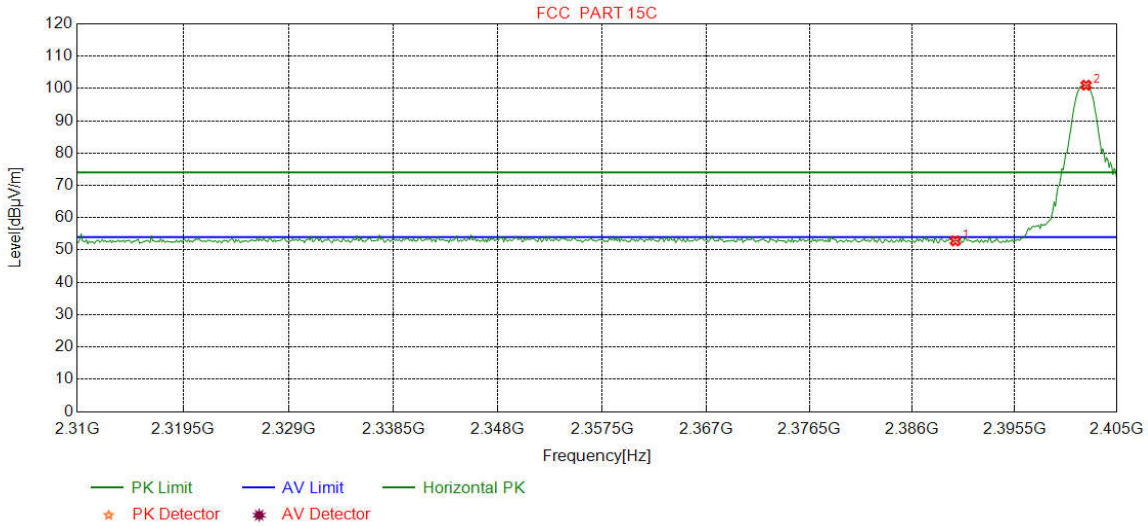
Frequency	Limit (dBμV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
	74.0	Peak Value

Test Ambient:	Temp.: 25°C	Humid.: 55%	Press.: 101kPa

Test plot as follows:

Mode:	GFSK Transmitting	Channel:	2402
Remark:	Peak		

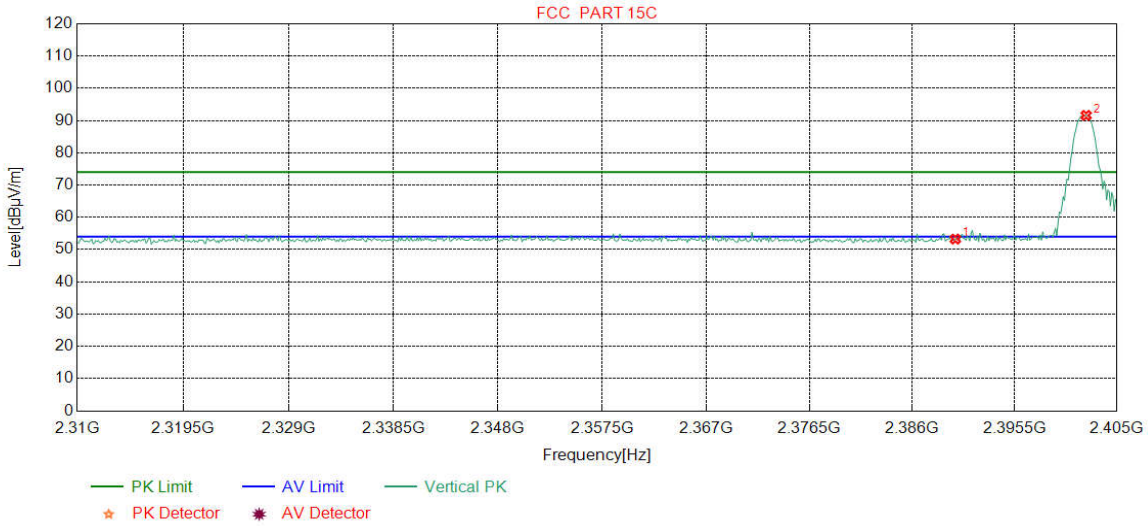
Test Graph



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	49.66	52.84	74.00	21.16	Pass	Horizontal
2	2402.1464	32.26	13.31	-42.43	97.86	101.00	74.00	-27.00	Pass	Horizontal

Mode:	GFSK Transmitting	Channel:	2402
Remark:	Peak		

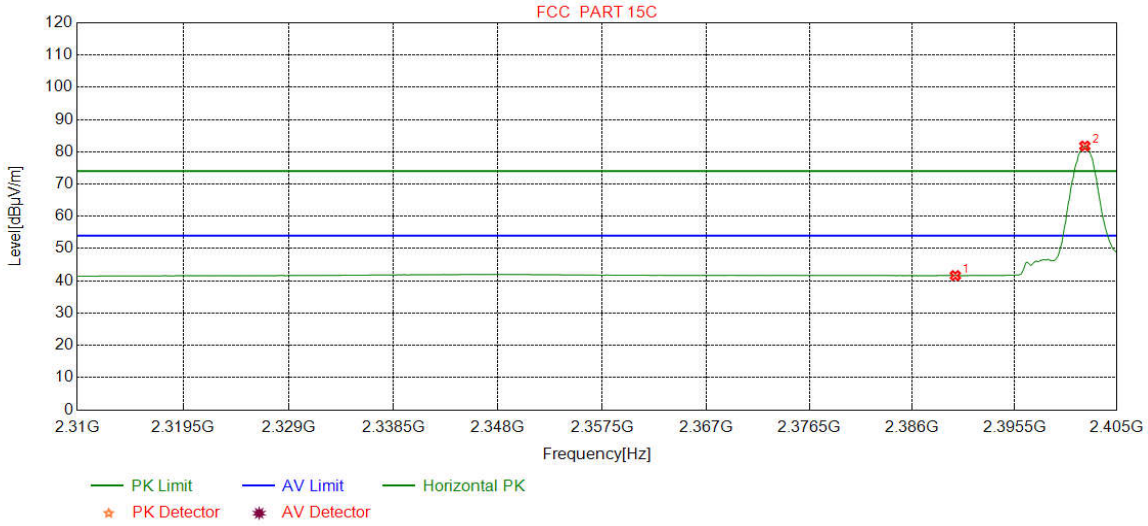
Test Graph



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	50.08	53.26	74.00	20.74	Pass	Vertical
2	2402.1464	32.26	13.31	-42.43	88.47	91.61	74.00	-17.61	Pass	Vertical

Mode:	GFSK Transmitting	Channel:	2402
Remark:	AV		

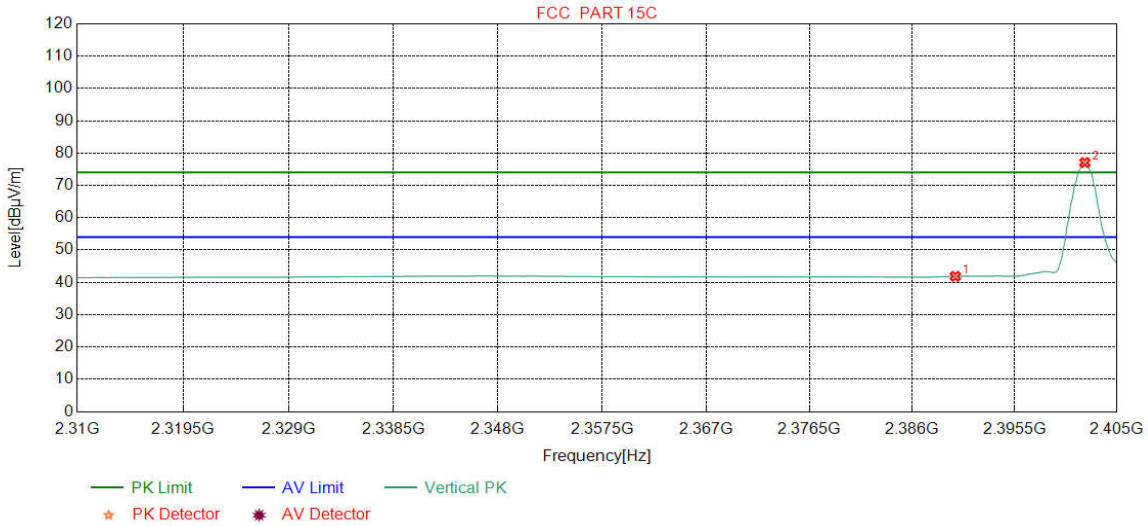
Test Graph



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	38.46	41.64	54.00	12.36	Pass	Horizontal
2	2402.0275	32.26	13.31	-42.43	78.66	81.80	54.00	-27.80	Pass	Horizontal

Mode:	GFSK Transmitting	Channel:	2402
Remark:	AV		

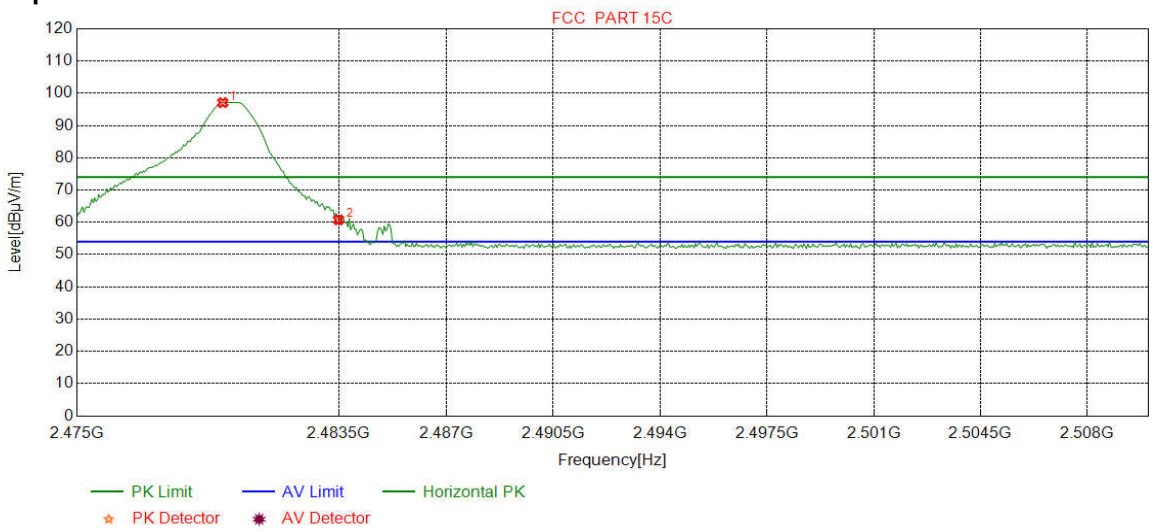
Test Graph



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	38.69	41.87	54.00	12.13	Pass	Vertical
2	2402.0275	32.26	13.31	-42.43	73.95	77.09	54.00	-23.09	Pass	Vertical

Mode:	GFSK Transmitting	Channel:	2480
Remark:	Peak		

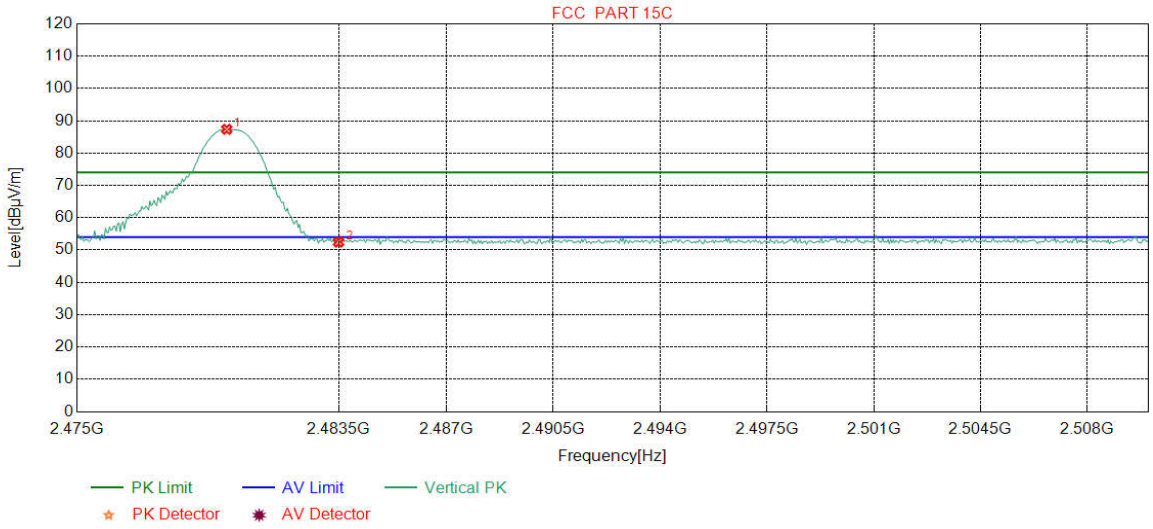
Test Graph



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	2479.7309	32.37	13.39	-42.39	93.73	97.10	74.00	-23.10	Pass	Horizontal
2	2483.5000	32.38	13.38	-42.40	57.41	60.77	74.00	13.23	Pass	Horizontal

Mode:	GFSK Transmitting	Channel:	2480
Remark:	Peak		

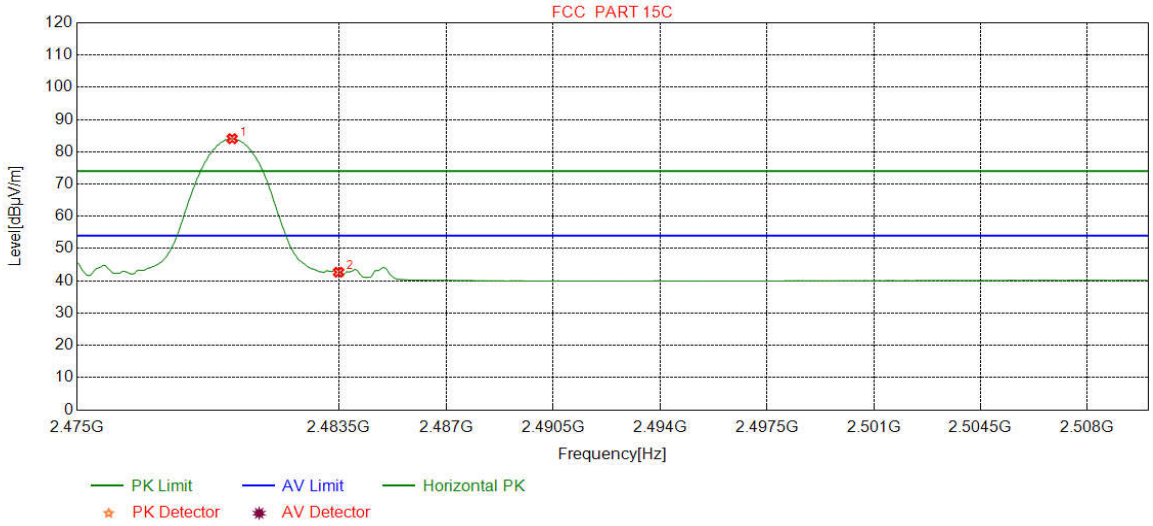
Test Graph



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	2479.8623	32.37	13.39	-42.39	84.00	87.37	74.00	-13.37	Pass	Vertical
2	2483.5000	32.38	13.38	-42.40	49.10	52.46	74.00	21.54	Pass	Vertical

Mode:	GFSK Transmitting	Channel:	2480
Remark:	AV		

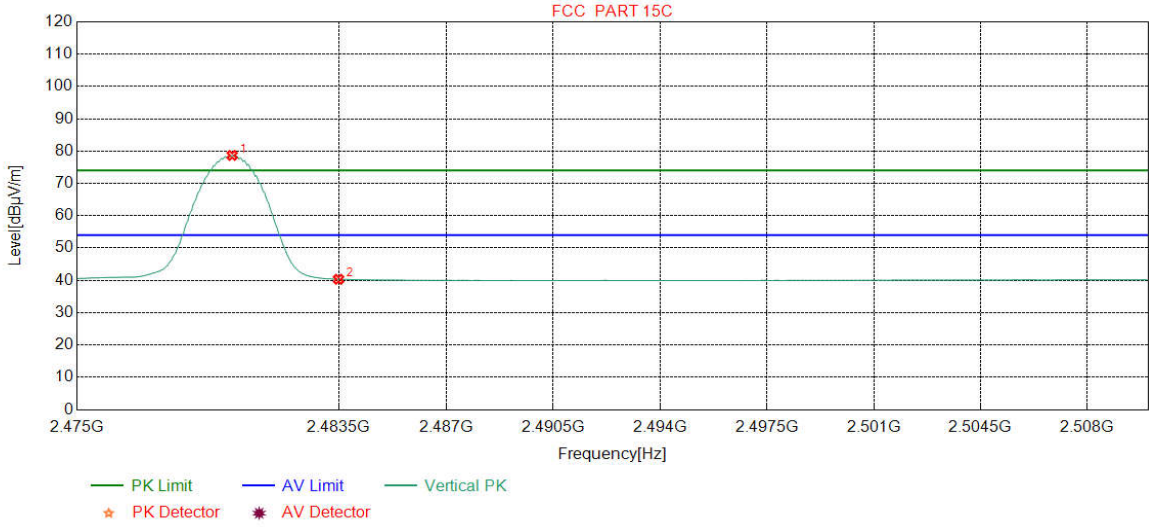
Test Graph



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	80.70	84.07	54.00	-30.07	Pass	Horizontal
2	2483.5000	32.38	13.38	-42.40	39.32	42.68	54.00	11.32	Pass	Horizontal

Mode:	GFSK Transmitting	Channel:	2480
Remark:	AV		

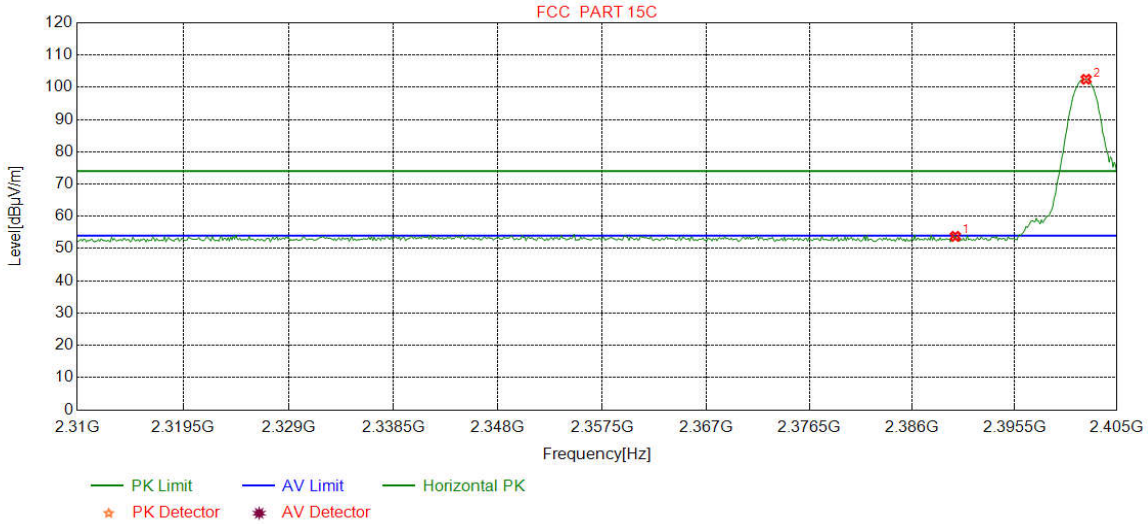
Test Graph



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	75.31	78.68	54.00	-24.68	Pass	Vertical
2	2483.5000	32.38	13.38	-42.40	36.97	40.33	54.00	13.67	Pass	Vertical

Mode:	π/4DQPSK Transmitting	Channel:	2402
Remark:	Peak		

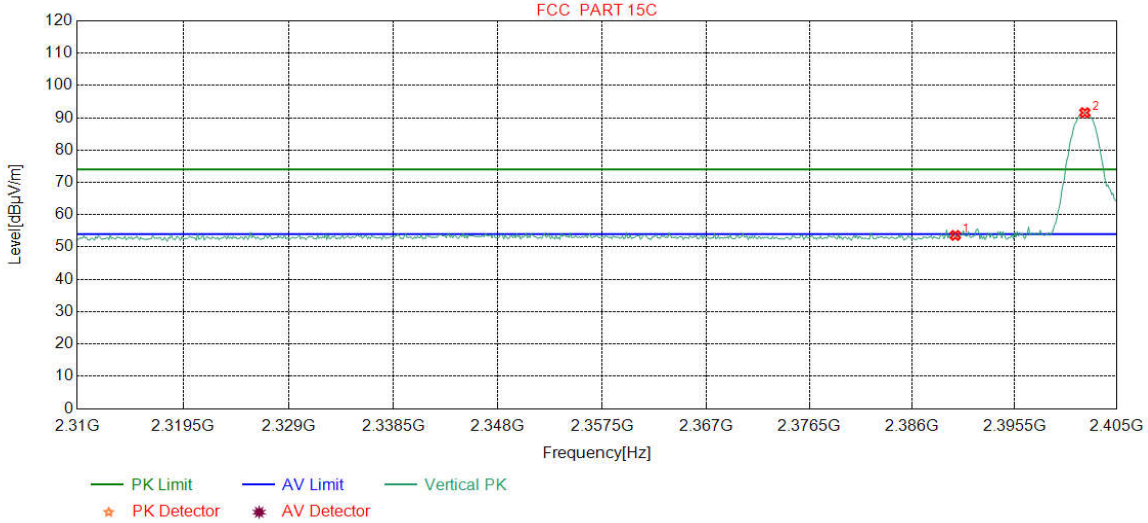
Test Graph



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	50.61	53.79	74.00	20.21	Pass	Horizontal
2	2402.1464	32.26	13.31	-42.43	99.35	102.49	74.00	-28.49	Pass	Horizontal

Mode:	π/4DQPSK Transmitting	Channel:	2402
Remark:	Peak		

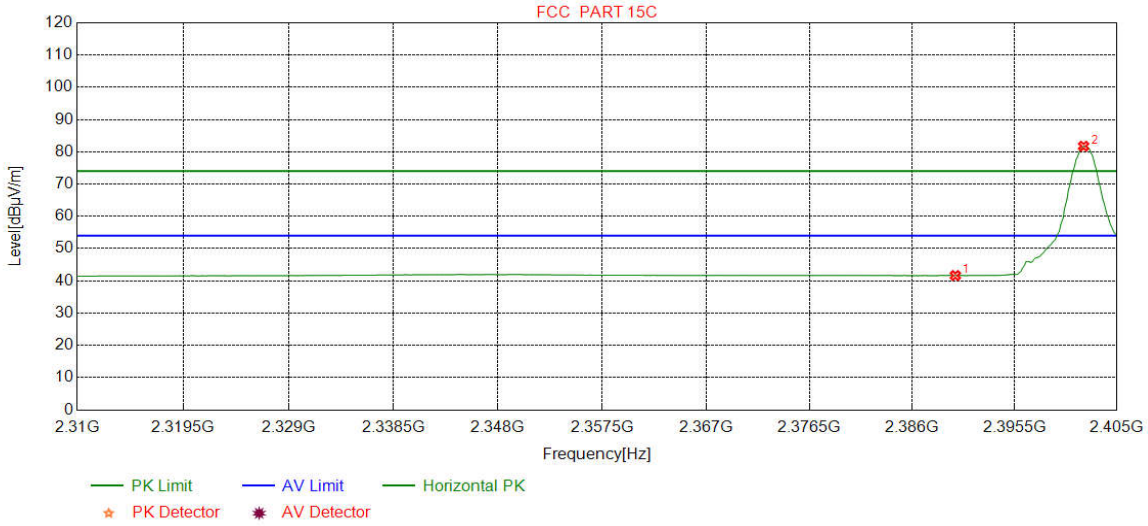
Test Graph



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	50.42	53.60	74.00	20.40	Pass	Vertical
2	2402.0275	32.26	13.31	-42.43	88.44	91.58	74.00	-17.58	Pass	Vertical

Mode:	π/4DQPSK Transmitting	Channel:	2402
Remark:	AV		

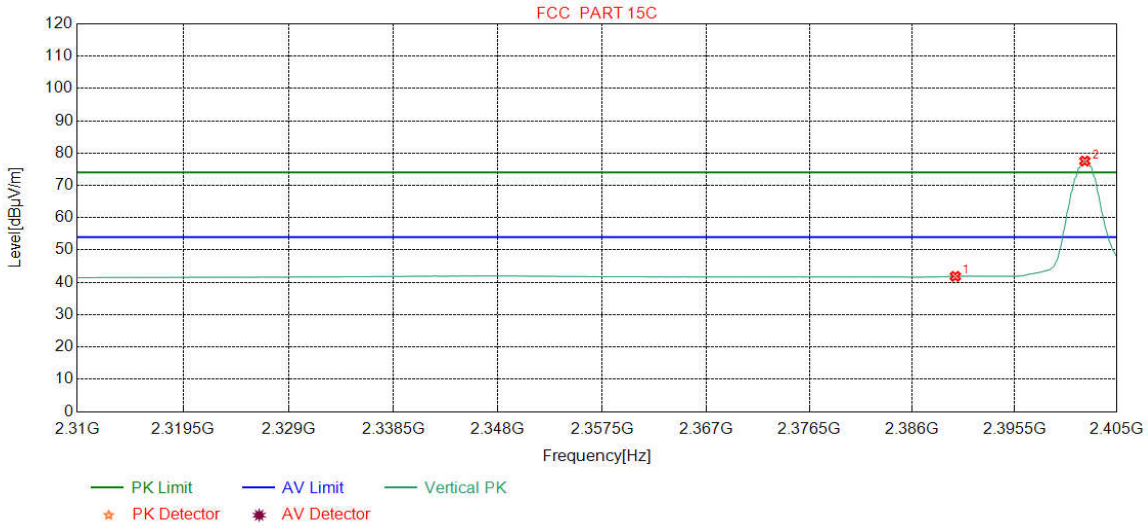
Test Graph



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	2401.9086	32.26	13.31	-42.43	78.62	81.76	54.00	-27.76	Pass	Horizontal

Mode:	π/4DQPSK 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	38.68	41.86	54.00	12.14	Pass	Vertical
2	2402.0275	32.26	13.31	-42.43	74.40	77.54	54.00	-23.54	Pass	Vertical