Shenzhen Huatongwei International Inspection Co., Ltd.
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TEST REPORT

Report Reference No. ..... :	**TRE1710005801**	R/C…….: 62161
FCC ID ..... :	**2AKBO-4312**	
Applicant's name ..... :	**Great American Merchandise & Events (GAME)**	
Address.....:	16444 N 91ST STREET, SCOTTSDALE, Arizona, United States	
Manufacturer.....:	Great American Merchandise & Events (GAME)	
Address.....:	16444 N 91ST STREET, SCOTTSDALE, Arizona, United States	
Test item description ..... :	**Wireless speaker and Light Show**	
Trade Mark .....:	-	
Model/Type reference.....:	4312	
Listed Model(s) .....:	-	
Standard ..... :	**FCC CFR Title 47 Part 15 Subpart C Section 15.247**	
Date of receipt of test sample…….....:	Oct. 16, 2017	
Date of testing……..:	Oct. 17, 2017 - Oct. 26, 2017	
Date of issue……....:	Oct. 26, 2017	
**Result.....……..: **	**PASS**	

Compiled by (Position+Printed name+Signature):	File administrators Shayne Zhu	Shayne Zhu
Supervised by (Position+Printed name+Signature):	Project Engineer Jerry Wang	Jerry Wang
Approved by (Position+Printed name+Signature):	RF Manager Hans Hu	Hans Hu

Testing Laboratory Name ..... :	**Shenzhen Huatongwei International Inspection Co., Ltd.**
Address.....:	1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

Contents

1. TEST STANDARDS AND REPORT VERSION

1.1. Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

ANSI C63.10-2013: American National Standard forTesting Unlicensed Wireless Devicese

1.2. Report version

Version No.	Date of issue	Description
00	Oct. 26, 2017	Original

2. TEST DESCRIPTION

Test Item	Section in CFR 47	Result	Test Engineer
Antenna Requirement	15.203/15.247 (c)	Pass	William Wang
AC Power Line Conducted Emissions	15.207	Pass	William Wang
Conducted Peak Output Power	15.247 (b)(1)	Pass	William Wang
20 dB Bandwidth	15.247 (a)(1)	Pass	William Wang
Carrier Frequencies Separation	15.247 (a)(1)	Pass	William Wang
Hopping Channel Number	15.247 (a)(1)	Pass	William Wang
Dwell Time	15.247 (a)(1)	Pass	William Wang
Pseudorandom Frequency Hopping Sequence	15.247(b)(4)	Pass	William Wang
Restricted band	15.247(d)/15.205	Pass	William Wang
Radiated Emissions	15.247(d)/15.209	Pass	William Wang

Note: The measurement uncertainty is not included in the test result.

3. SUMMARY

3.1. Client Information

Applicant:	Great American Merchandise & Events (GAME)
Address:	16444 N 91ST STREET, SCOTTSDALE, Arizona, United States
Manufacturer:	Great American Merchandise & Events (GAME)
Address:	16444 N 91ST STREET, SCOTTSDALE, Arizona, United States

3.2. Product Description

Name of EUT:	Wireless speaker and Light Show
Trade Mark:	-
Model No.:	4312
Listed Model(s):	-
Power supply:	DC 5V for USB port & DC 3.7V for internal battery
Adapter information:	-
Hardware version:	-
Software version:	-
Bluetooth	
Version:	Supported BT4.0+EDR
Modulation:	GFSK, π/4DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	Integral antenna
Antenna gain:	0.5dBi

3.3. Operation state

➢ **Test frequency list**

According to section 15.31(m), regards to the operating frequency range over 10 MHz, must select three channel which were tested. the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the above gray bottom.

Channel	Frequency (MHz)
00	2402
01	2403
⋮	⋮
39	2441
⋮	⋮
77	2479
78	2480

➢ **TEST MODE**

For RF test items:
The engineering test program was provided and enabled to make EUT continuous transmit
For AC power line conducted emissions:
The EUT was set to connect with the Bluetooth instrument under large package sizes transmission.
For Radiated suprious emissions test item:
The EUT in each of three orthogonal axis emissions had been tested ,but only the worst case (X axis) data recorded in the report.

3.4. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- ● - supplied by the manufacturer
- ○ - supplied by the lab

	/	Manufacturer:	/
		Model No.:	/
	/	Manufacturer:	/
		Model No.:	/

3.5. Modifications

No modifications were implemented to meet testing criteria.

4. TEST ENVIRONMENT

4.1. Address of the test laboratory

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.
Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

4.2. Test Facility

CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 3902.01

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

FCC-Registration No.: 762235

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

IC-Registration No.:5377B-1

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No.: 5377B-1.

ACA

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

4.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15~35°C
Relative Humidity:	30~60 %
Air Pressure:	950~1050mba

4.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors in calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to TR-100028-01 “Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1” and TR-100028-02 “Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2” and is documented in the Shenzhen Huatongwei International Inspection Co., Ltd. quality system according to ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Here after the best measurement capability for Shenzhen Huatongwei International Inspection Co., Ltd. is reported:

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Conducted spurious emissions 9kHz~40GHz	1.60 dB	(1)
Radiated spurious emissions 9kHz~40GHz	2.20 dB	(1)
Conducted Emissions 9kHz~30MHz	3.39 dB	(1)
Radiated Emissions 30~1000MHz	4.24 dB	(1)
Radiated Emissions 1~18GHz	5.16 dB	(1)
Radiated Emissions 18~40GHz	5.54 dB	(1)
Occupied Bandwidth	---------	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

4.5. Equipments Used during the Test

Conducted Emissions					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Artificial Mains	Rohde&Schwarz	ESH2-Z5	100028	2016/11/13
2	EMI Test Receiver	Rohde&Schwarz	ESCI3	100038	2016/11/13
3	Pulse Limiter	Rohde&Schwarz	ESHSZ2	100044	2016/11/13
4	EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	-	-

Radiated Emissions					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	EMI test receiver	Rohde&Schwarz	ESI 26	100009	2016/11/13
2	Loop Antenna	Rohde&Schwarz	HFH2-Z2	100020	2016/11/13
3	Ultra-Broadband Antenna	ShwarzBeck	VULB9163	538	2016/11/13
4	Horn antenna	ShwarzBeck	9120D	1011	2016/11/13
5	Horn Antenna	SCHWARZBECK	BBHA9170	25841	2016/11/13
6	Amplifier	Sonoma	310N	E009-13	2016/11/13
7	JS Amplifier	Rohde&Schwarz	JS4-00101800-28-5A	F201504	2016/11/13
8	Amplifier	Compliance Direction systems	PAP1-4060	120	2016/11/13
9	High pass filter	Compliance Direction systems	BSU-6	34202	2016/11/13
10	EMI test Software	Rohde&Schwarz	ESK1	-	-
11	EMI test Software	Audix	E3	-	-
12	TURNTABLE	MATURO	TT2.0	-	-
13	ANTENNA MAST	MATURO	TAM-4.0-P	-	-

RF Conducted methods					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Spectrum Analyzer	Rohde&Schwarz	FSP	1164.4391.40	2016/11/13
2	MXA Signal Analyzer	Agilent Technologies	N9020A	MY5050187	2016/11/13

The Cal.Interval was one year.

5. TEST CONDITIONS AND RESULTS

5.1. Antenna requirement

Requirement

FCC CFR Title 47 Part 15 Subpart C Section 15.203:

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 anantenna 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.

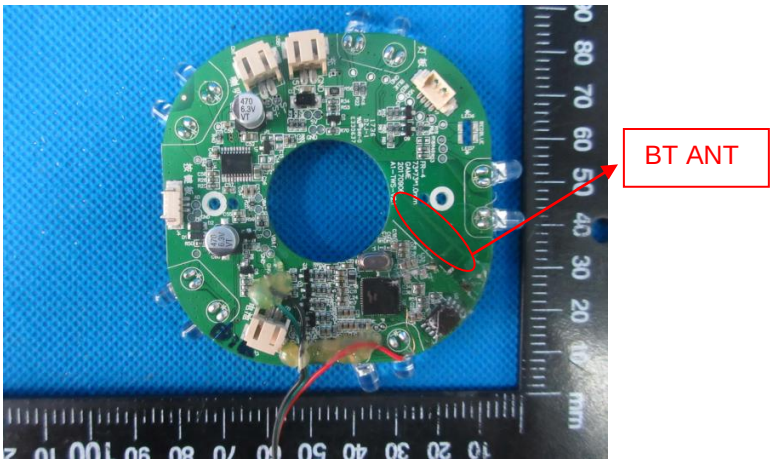
FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

Test Result:

☒ **Passed** ☐ **Not Applicable**

The directional gain of the antenna less than 6 dBi, please refer to the below antenna photo.



5.2. Conducted Emissions (AC Main)

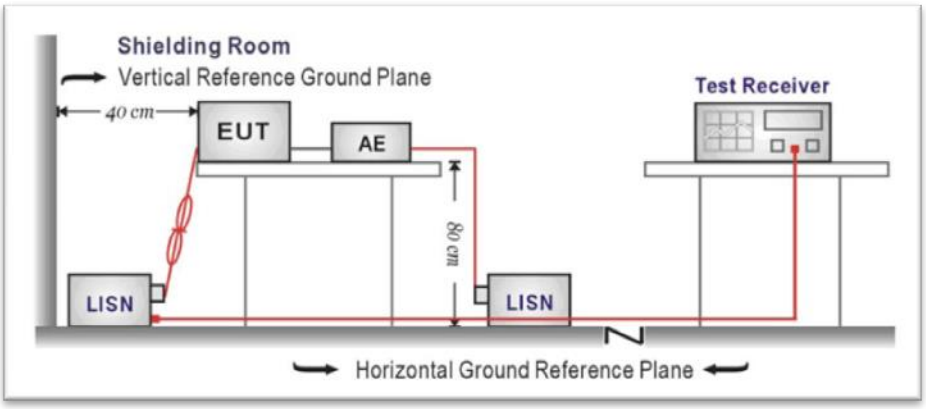
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor,was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

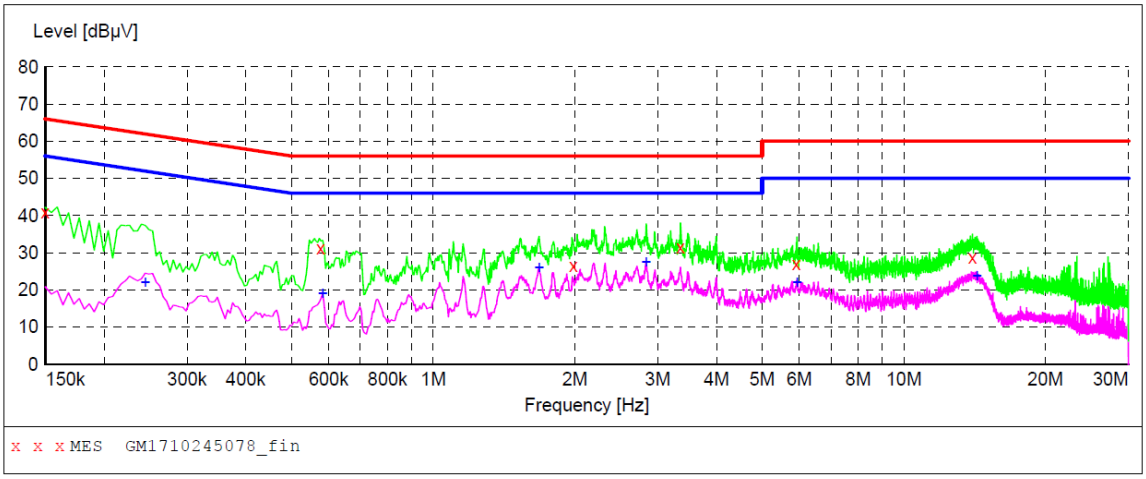
TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Note:
1) Transd= Cable lose + Pulse Limiter Factor + Artificial Mains Factor
2) Margin= Limit - Level

Test Voltage @ 120V

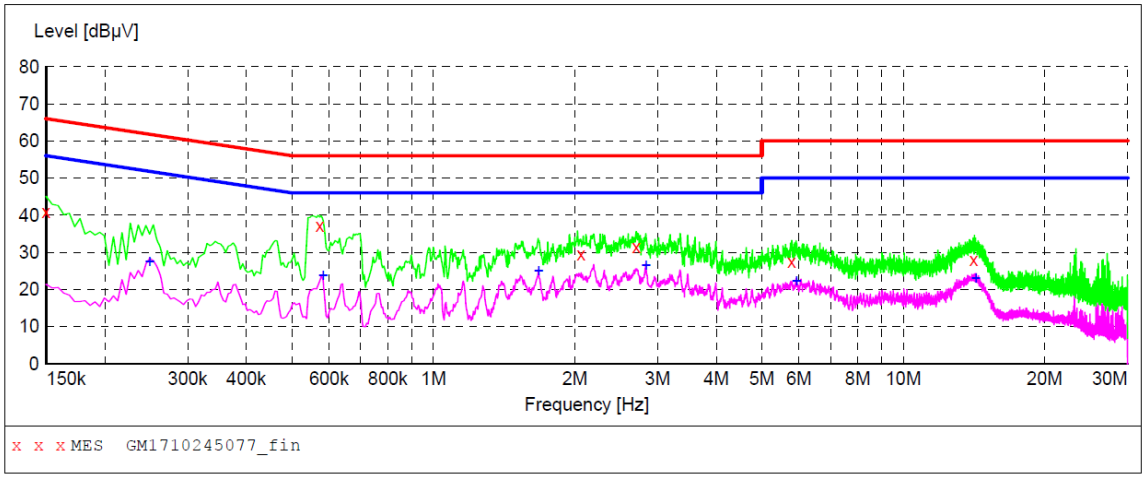
Test Line:	L



Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.150000	40.90	10.4	66	25.1	QP	L1	GND
0.577500	31.20	10.2	56	24.8	QP	L1	GND
1.986000	26.50	10.2	56	29.5	QP	L1	GND
3.354000	31.50	10.3	56	24.5	QP	L1	GND
5.910000	26.90	10.3	60	33.1	QP	L1	GND
13.996500	28.70	10.5	60	31.3	QP	L1	GND

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.244500	22.10	10.3	52	29.8	AV	L1	GND
0.582000	19.10	10.2	46	26.9	AV	L1	GND
1.680000	25.90	10.2	46	20.1	AV	L1	GND
2.832000	27.40	10.2	46	18.6	AV	L1	GND
5.932500	22.10	10.3	50	27.9	AV	L1	GND
14.298000	23.70	10.5	50	26.3	AV	L1	GND

Test Line:	N

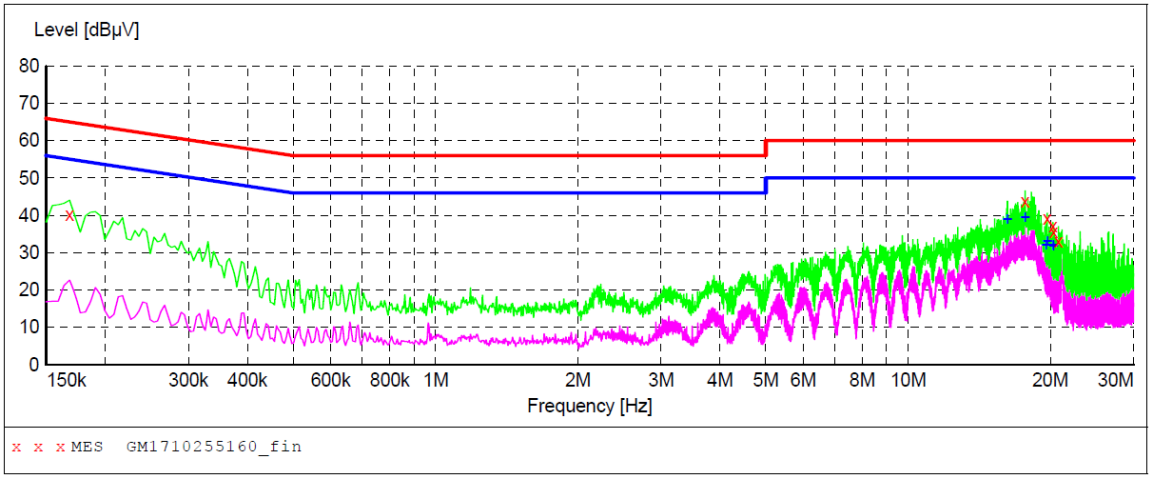


Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.150000	40.80	10.4	66	25.2	QP	N	GND
0.573000	37.30	10.2	56	18.7	QP	N	GND
2.062500	29.60	10.2	56	26.4	QP	N	GND
2.706000	31.50	10.2	56	24.5	QP	N	GND
5.788500	27.50	10.3	60	32.5	QP	N	GND
14.131500	28.10	10.5	60	31.9	QP	N	GND

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.249000	27.60	10.3	52	24.2	AV	N	GND
0.582000	23.80	10.2	46	22.2	AV	N	GND
1.675500	24.90	10.2	46	21.1	AV	N	GND
2.836500	26.40	10.2	46	19.6	AV	N	GND
5.923500	22.30	10.3	50	27.7	AV	N	GND
14.257500	22.90	10.5	50	27.1	AV	N	GND

Test Voltage @ 240V

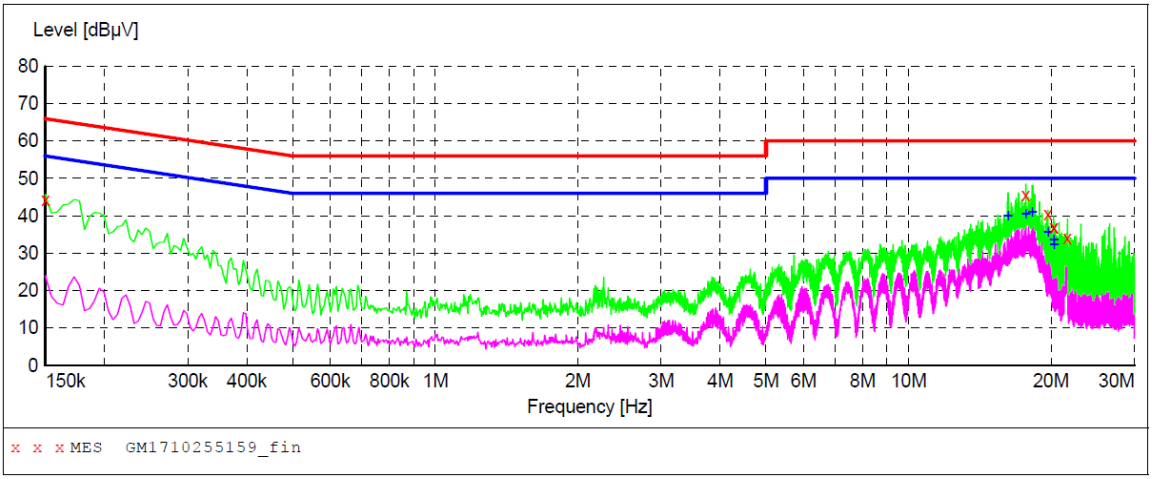
Test Line:	L



Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.168000	40.10	10.4	65	25.0	QP	L1	GND
17.695500	43.70	10.5	60	16.3	QP	L1	GND
19.707000	39.30	10.5	60	20.7	QP	L1	GND
20.256000	37.20	10.6	60	22.8	QP	L1	GND
20.319000	35.60	10.6	60	24.4	QP	L1	GND
20.809500	33.20	10.6	60	26.8	QP	L1	GND

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
16.228500	38.90	10.5	50	11.1	AV	L1	GND
17.695500	39.50	10.5	50	10.5	AV	L1	GND
19.585500	32.10	10.5	50	17.9	AV	L1	GND
19.711500	33.00	10.5	50	17.0	AV	L1	GND
20.260500	32.10	10.6	50	17.9	AV	L1	GND
20.319000	31.70	10.6	50	18.3	AV	L1	GND

Test Line:	N



Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.150000	44.40	10.4	66	21.6	QP	N	GND
17.691000	45.50	10.5	60	14.5	QP	N	GND
19.707000	40.40	10.5	60	19.6	QP	N	GND
20.260500	36.80	10.6	60	23.2	QP	N	GND
20.319000	36.80	10.6	60	23.2	QP	N	GND
21.664500	34.20	10.6	60	25.8	QP	N	GND

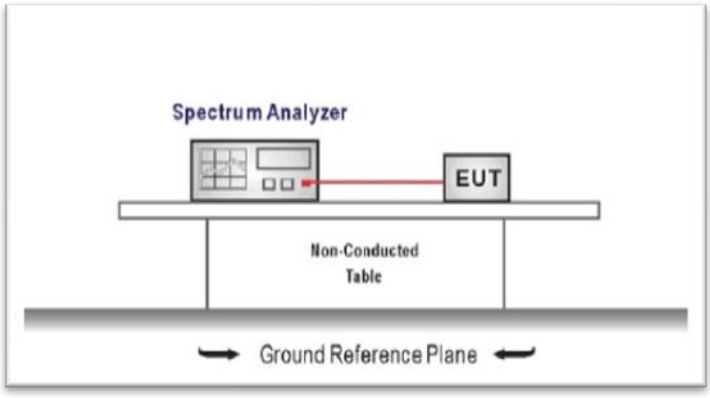
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
16.228500	40.00	10.5	50	10.0	AV	N	GND
17.695500	40.50	10.5	50	9.5	AV	N	GND
18.244500	41.00	10.5	50	9.0	AV	N	GND
19.707000	35.70	10.5	50	14.3	AV	N	GND
20.256000	33.60	10.6	50	16.4	AV	N	GND
20.319000	32.30	10.6	50	17.7	AV	N	GND

5.3. Conducted Peak Output Power

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(1): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the pathloss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
   RBW≥ the 20 dB bandwidth of the emission being measured, VBW≥RBW
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

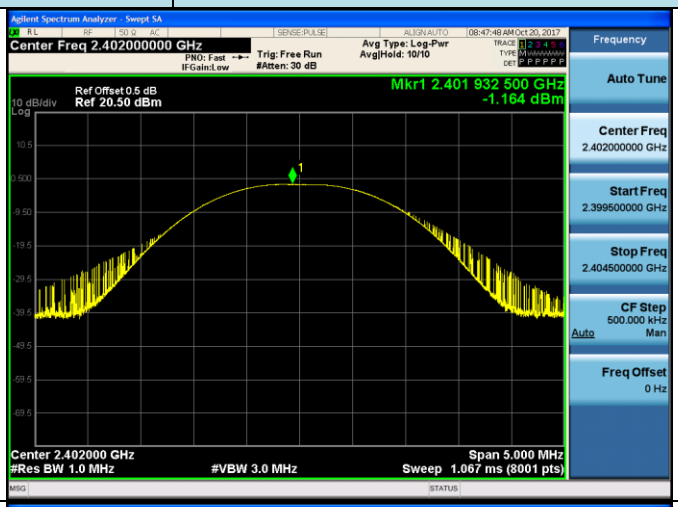
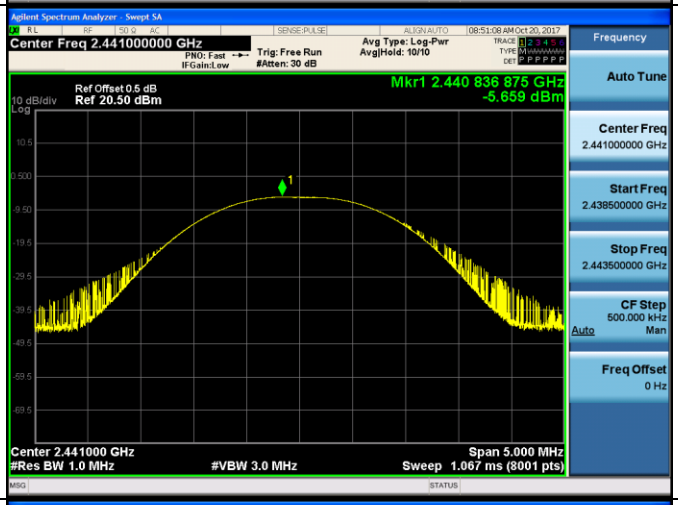
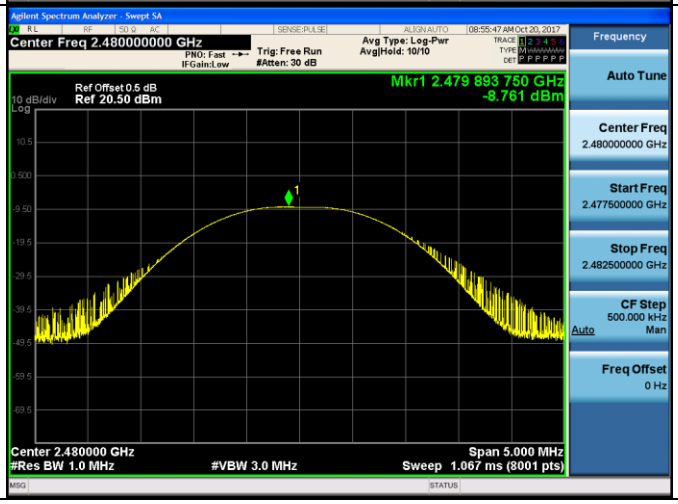
TEST MODE:

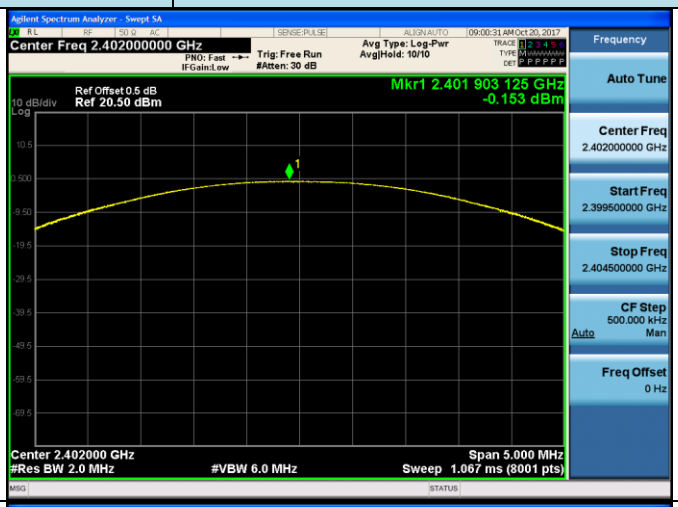
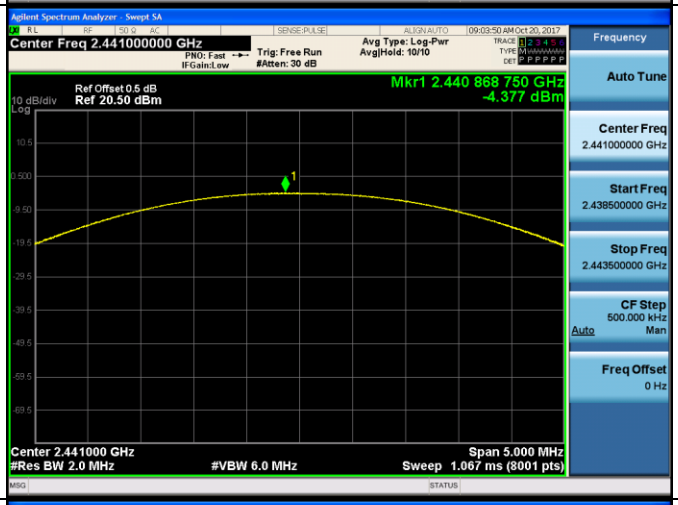
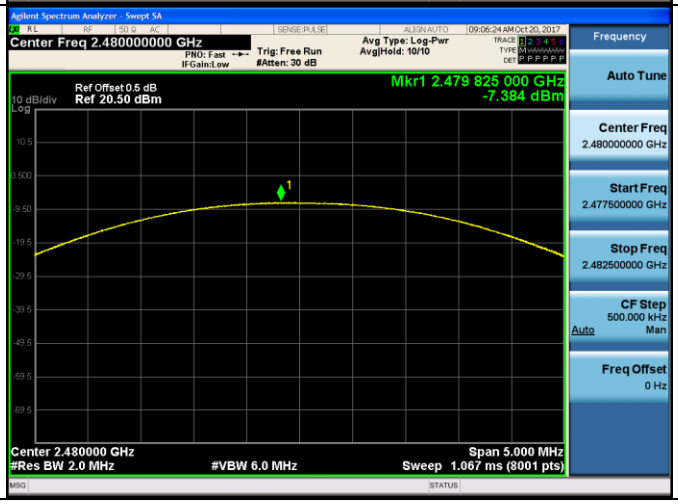
Please refer to the clause 3.3

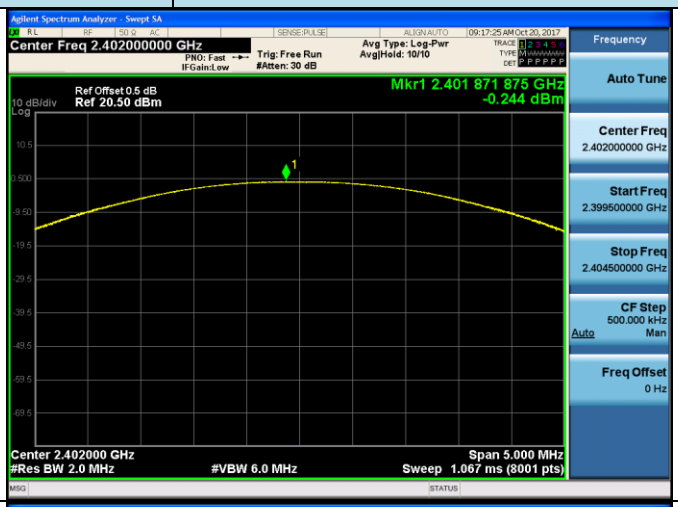
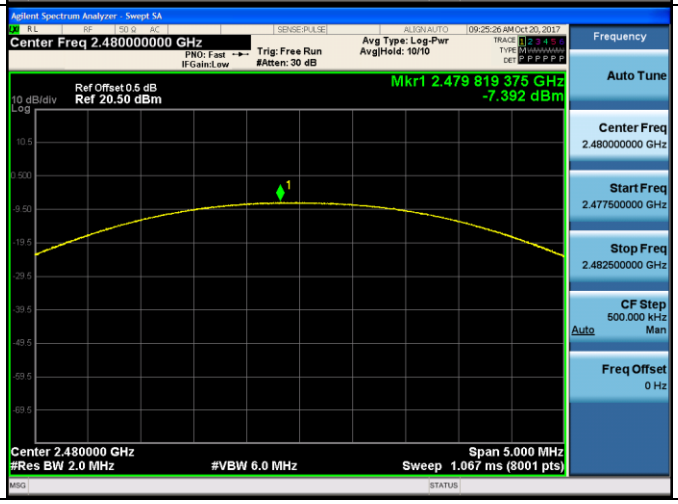
TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Modulation type	Channel	Output power (dBm)	Limit (dBm)	Result
GFSK	00	-1.164	≤ 30.00	Pass
	39	-5.659		
	78	-8.761		
π/4DQPSK	00	-0.153	≤ 21.00	Pass
	39	-4.377		
	78	-7.384		
8DPSK	00	-0.244	≤ 21.00	Pass
	39	-4.496		
	78	-7.392		

Modulation Type:		GFSK	
CH00			
CH39			
CH78			

Modulation Type:		π/4DQPSK	
CH00			
CH39			
CH78			

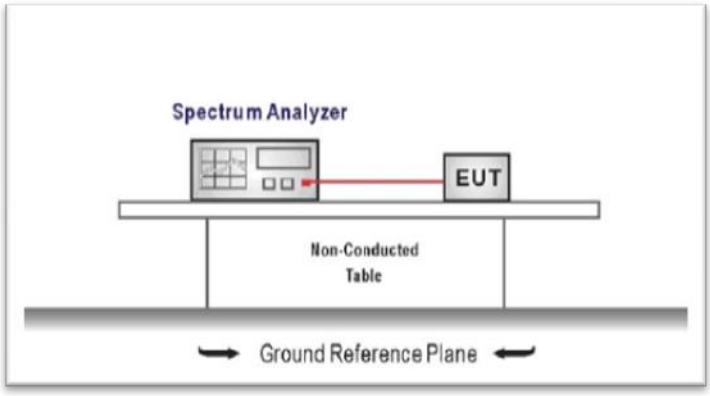
Modulation Type:		8DPSK	
CH00			
CH39			
CH78			

5.4. 20 dB Bandwidth

LIMIT

N/A

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
   RBW ≥ 1% of the 20 dB bandwidth, VBW ≥ RBW
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

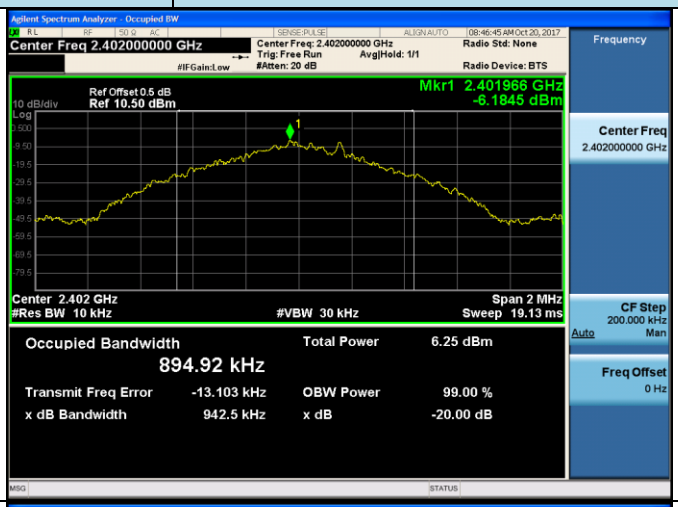
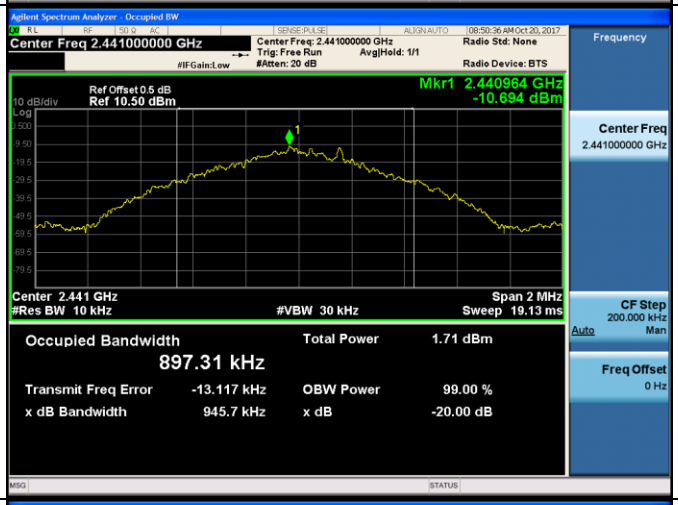
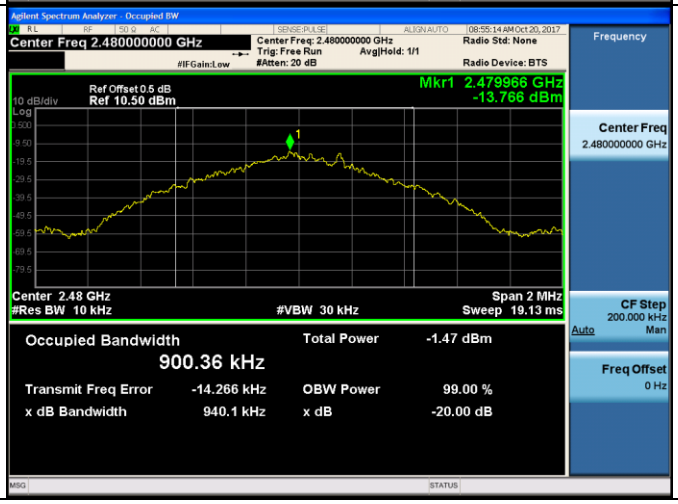
TEST MODE:

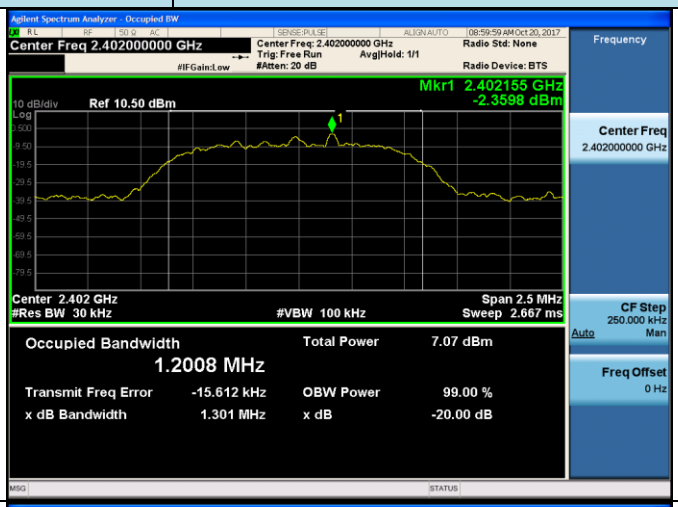
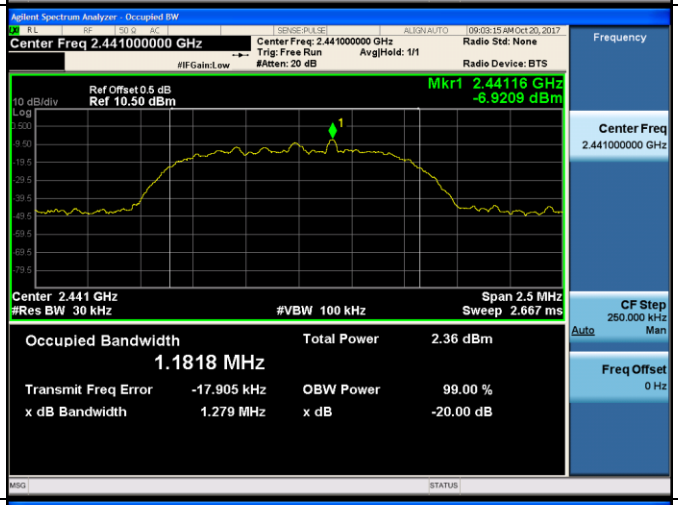
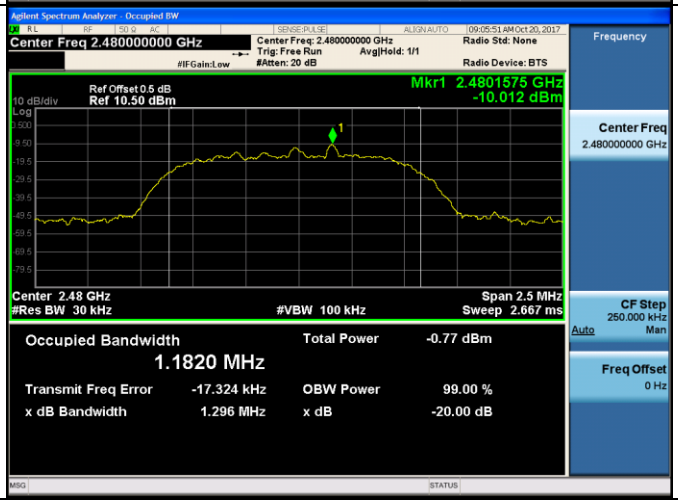
Please refer to the clause 3.3

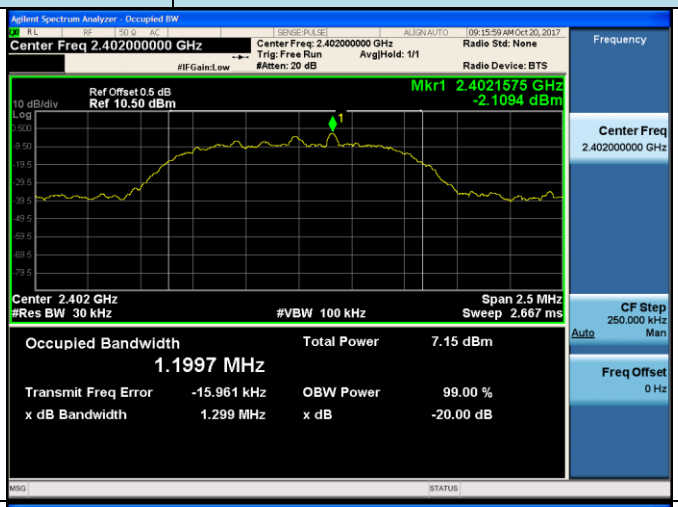
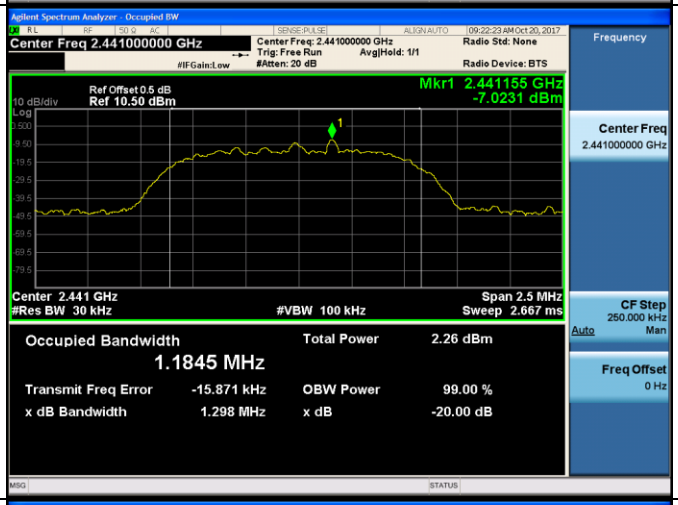
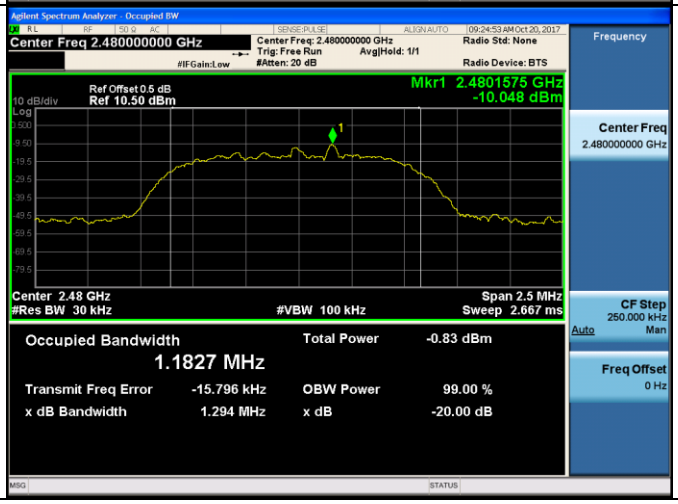
TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Modulation type	Channel	20 dB Bandwidth (MHz)	Limit (MHz)	Result
GFSK	00	0.9425	-	Pass
	39	0.9457		
	78	0.9401		
π/4DQPSK	00	1.301	-	Pass
	39	1.279		
	78	1.296		
8DPSK	00	1.299	-	Pass
	39	1.298		
	78	1.294		

Modulation Type:		GFSK	
CH00			
CH39			
CH78			

Modulation Type:		π/4DQPSK	
CH00			
CH39			
CH78			

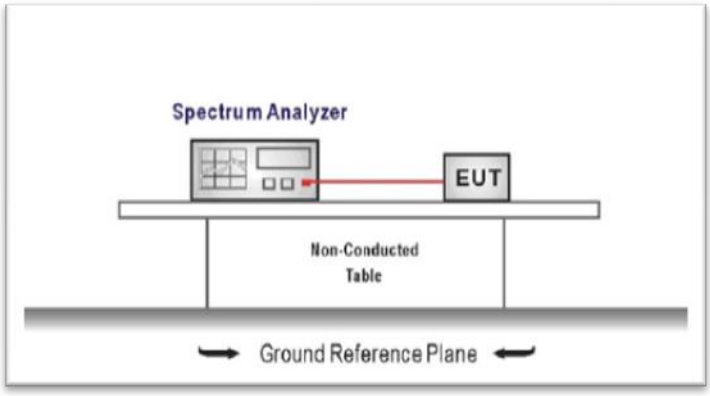
Modulation Type:		8DPSK	
CH00			
CH39			
CH78			

5.5. Carrier Frequencies Separation

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25 kHz or the 2/3*20 dB bandwidth of the hopping channel, whichever is greater.

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels
   RBW ≥ 1% of the span, VBW ≥ RBW
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

TEST MODE:

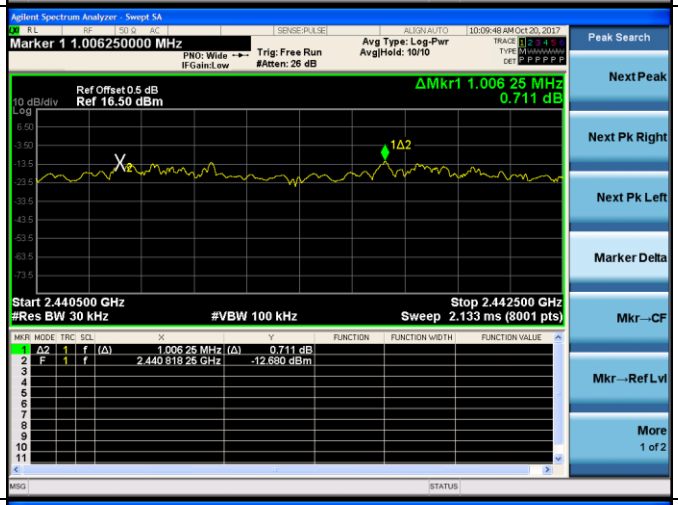
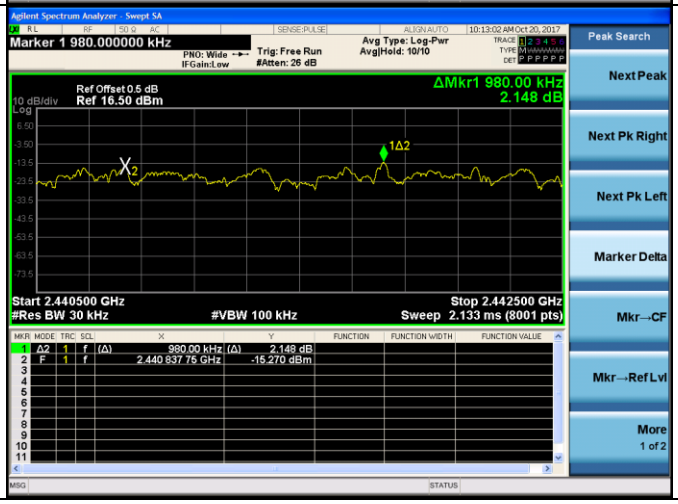
Please refer to the clause 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Modulation type	Channel	Carrier Frequencies Separation (MHz)	Limit (MHz) *	Result
GFSK	39	1.010	≥0.946	Pass
π/4DQPSK	39	1.006	≥0.867	Pass
8DPSK	39	0.980	≥0.866	Pass

Note:
*: GFSK limit = The maximum 20 dB Bandwidth for GFSK modulation on the section 5.4.
π/4DQPSK limit = 2/3 * The maximum 20 dB Bandwidth for π/4DQPSK modulation on the section 5.4.
8DPSK limit = 2/3 * The maximum 20 dB Bandwidth for 8DPSK modulation on the section 5.4

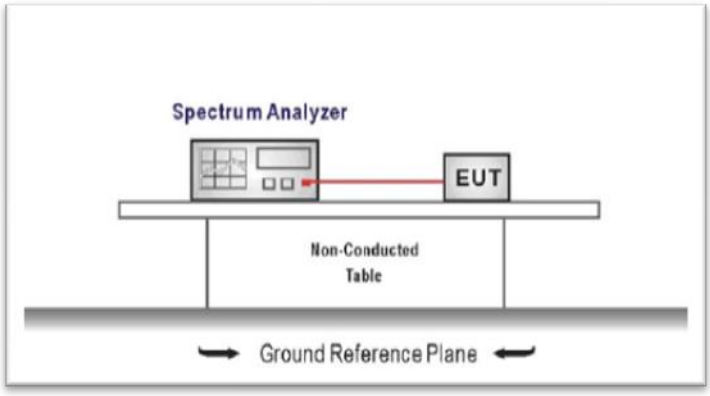
GFSK			
π/4DQPSK			
8DPSK			

5.6. Hopping Channel Number

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):Frequency hopping systems in the 2400–2483.5 MHz band shall use at least **15** channels.

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span = the frequency band of operation
   RBW ≥ 1% of the span, VBW ≥ RBW
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Modulation type	Channel number	Limit	Result
GFSK	79	≥15.00	Pass
π/4DQPSK	79		
8DPSK	79		

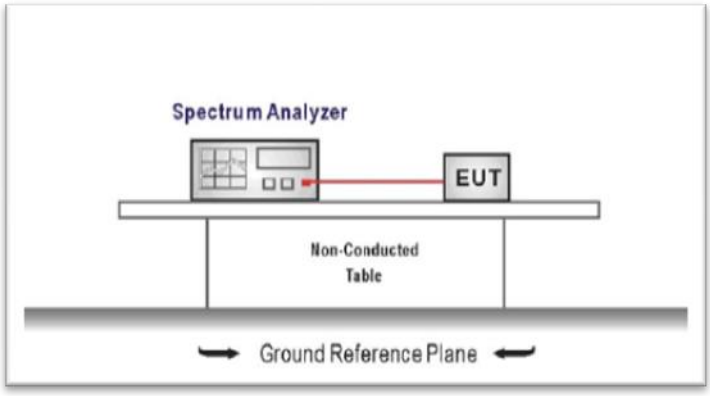
GFSK			
π/4DQPSK			
8DPSK			

5.7. Dwell Time

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):The average time of occupancy on any channel shall not be greater than 0.4 seconds within a pe-riod of 0.4 seconds multiplied by the number of hopping channels employed.

TEST CONFIGURATION



TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span = zero span, centered on a hopping channel, RBW= 1 MHz, VBW ≥ RBW
   Sweep = as necessary to capture the entire dwell time per hopping channel,
   Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

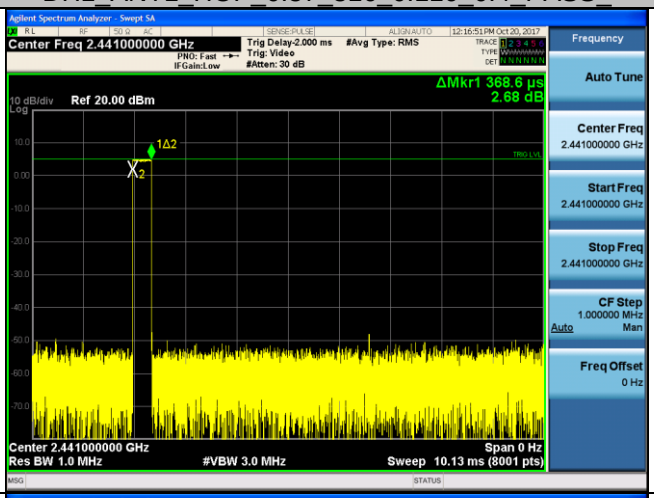
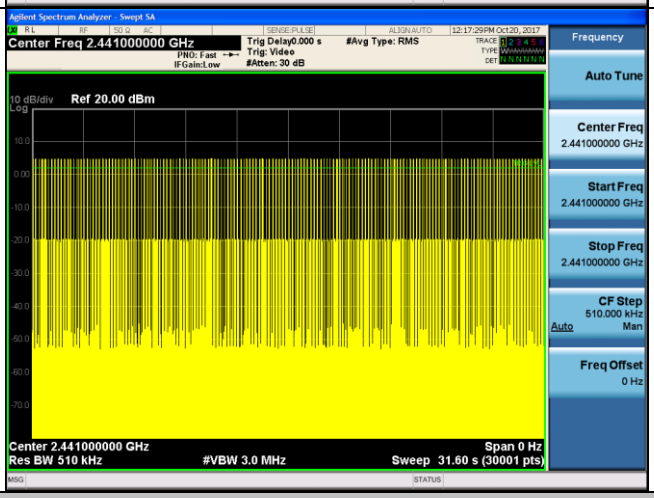
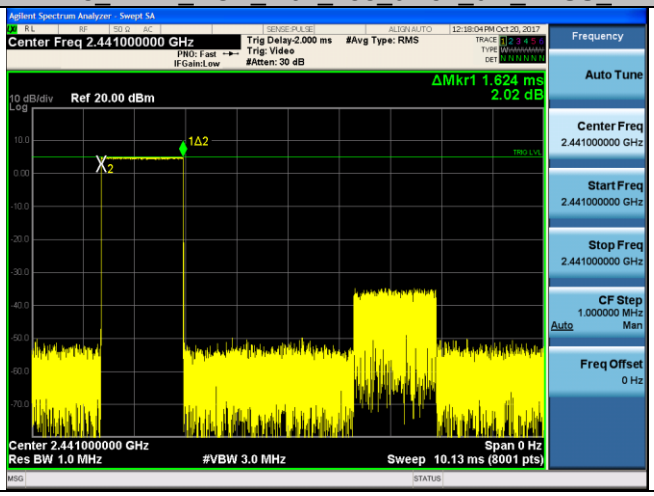
TEST MODE:

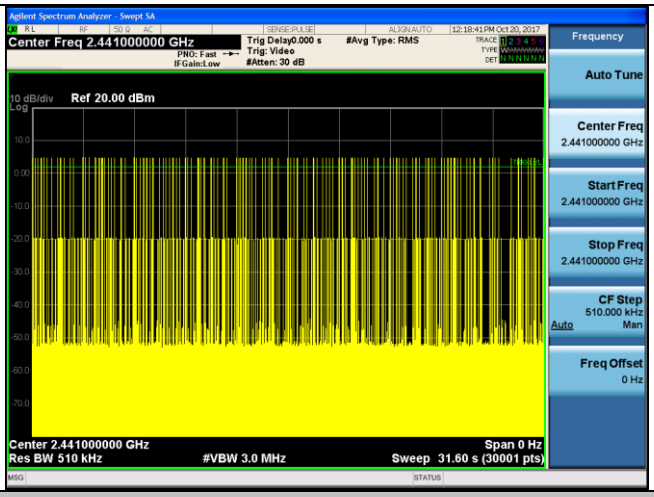
Please refer to the clause 3.3

TEST RESULTS

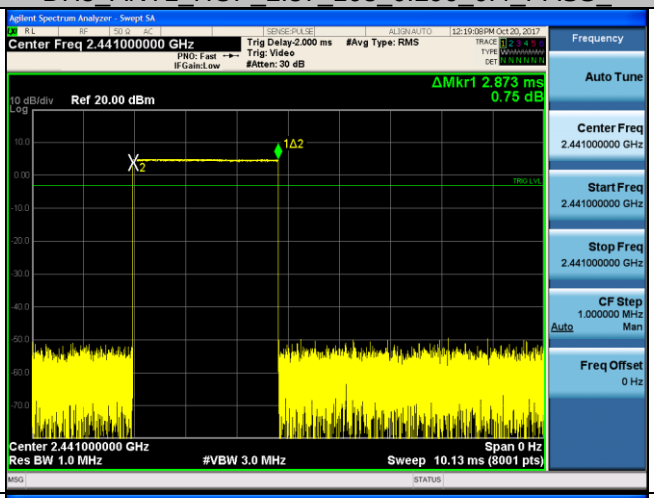
☒ **Passed** ☐ **Not Applicable**

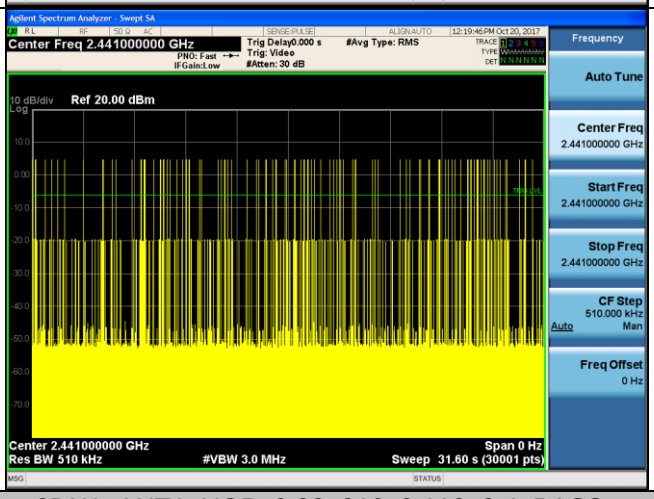
TestMode	Antenna	Channel	BurstWidth(ms)	TotalHops	Result(s)	Limit(s)	Verdict
DH1	ANT1	HOP	0.37	316	0.116	0.4	PASS
DH3	ANT1	HOP	1.62	158	0.257	0.4	PASS
DH5	ANT1	HOP	2.87	103	0.296	0.4	PASS
2DH1	ANT1	HOP	0.38	316	0.119	0.4	PASS
2DH3	ANT1	HOP	1.63	157	0.256	0.4	PASS
2DH5	ANT1	HOP	2.88	104	0.299	0.4	PASS
3DH1	ANT1	HOP	0.38	316	0.119	0.4	PASS
3DH3	ANT1	HOP	1.63	157	0.255	0.4	PASS
3DH5	ANT1	HOP	2.88	104	0.299	0.4	PASS

DH1_ANT1_HOP_0.37_316_0.116_0.4_PASS_


DH3_ANT1_HOP_1.62_158_0.257_0.4_PASS_


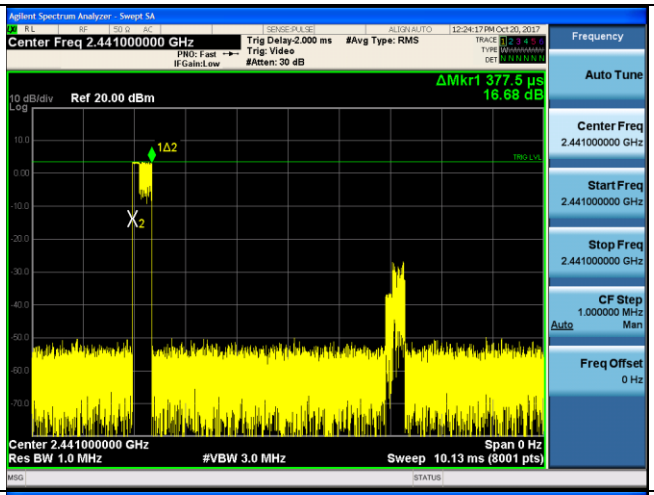


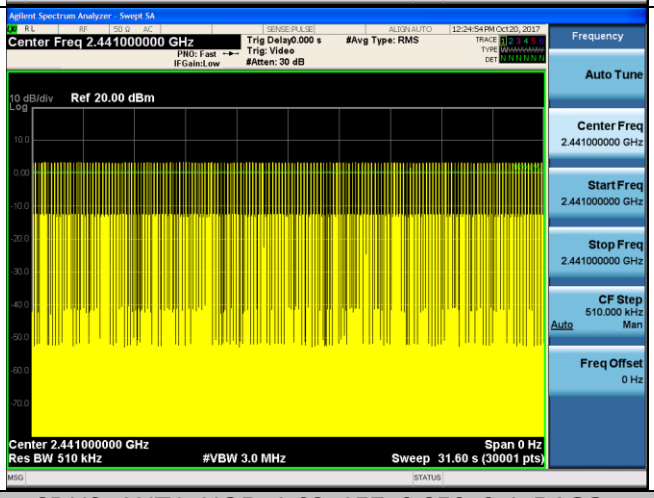
DH5_ANT1_HOP_2.87_103_0.296_0.4_PASS_



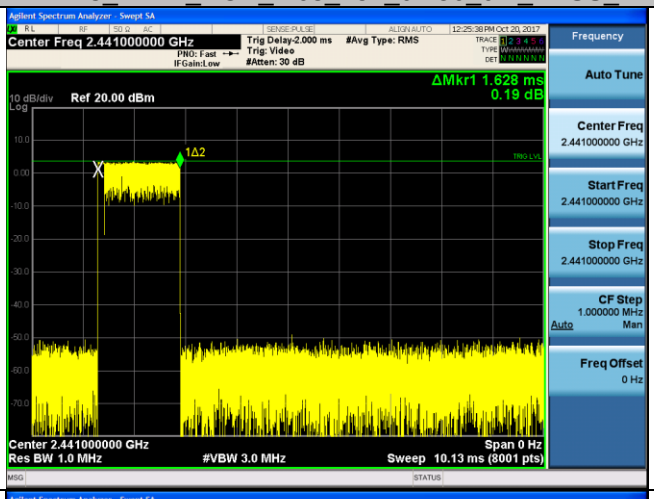


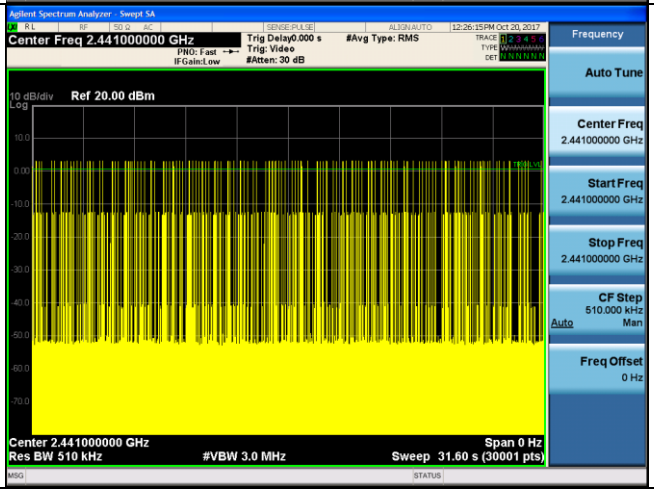
2DH1_ANT1_HOP_0.38_316_0.119_0.4_PASS_

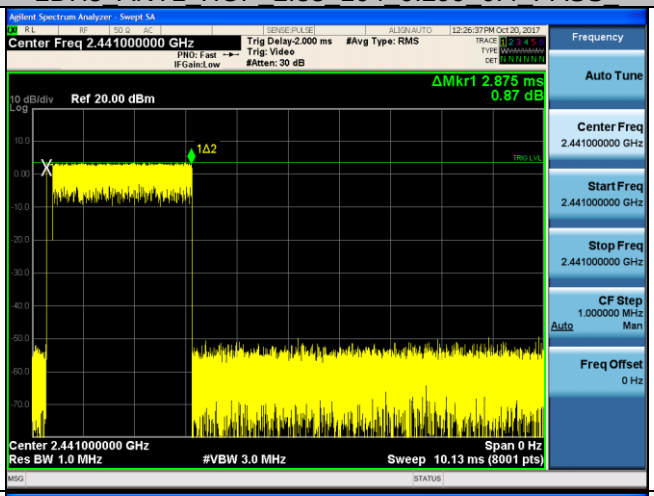
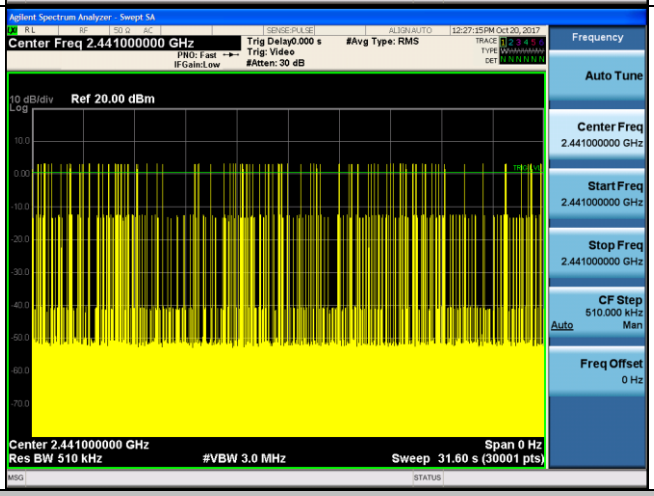
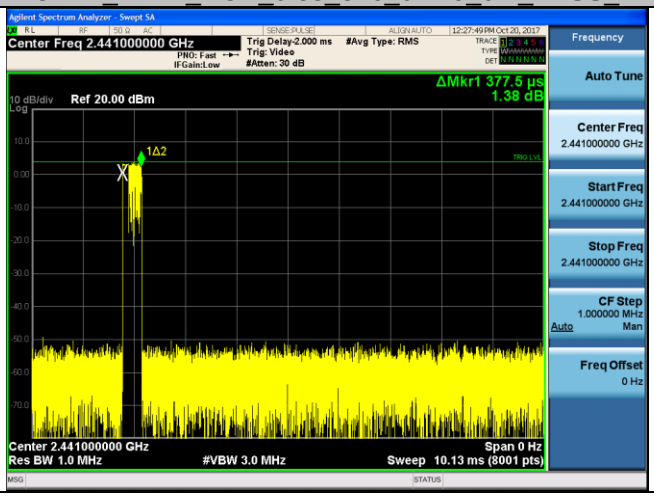


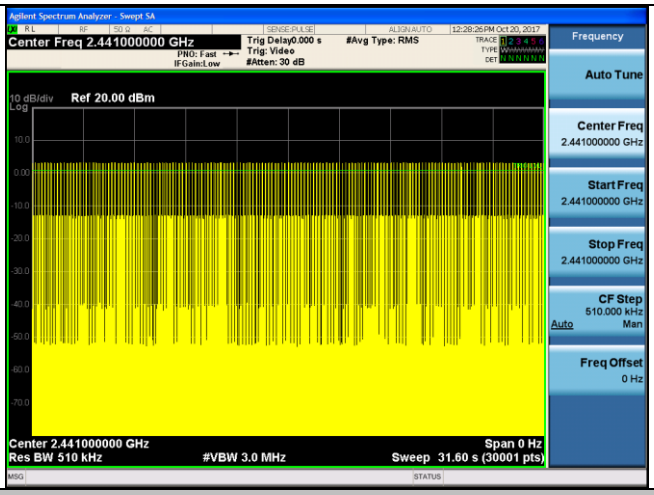


2DH3_ANT1_HOP_1.63_157_0.256_0.4_PASS_

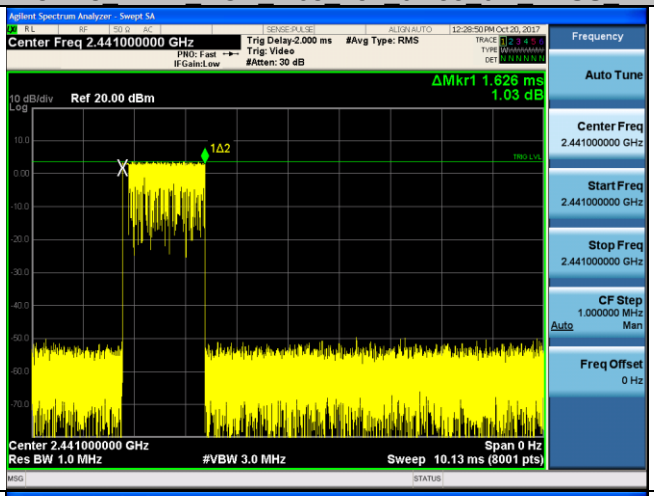


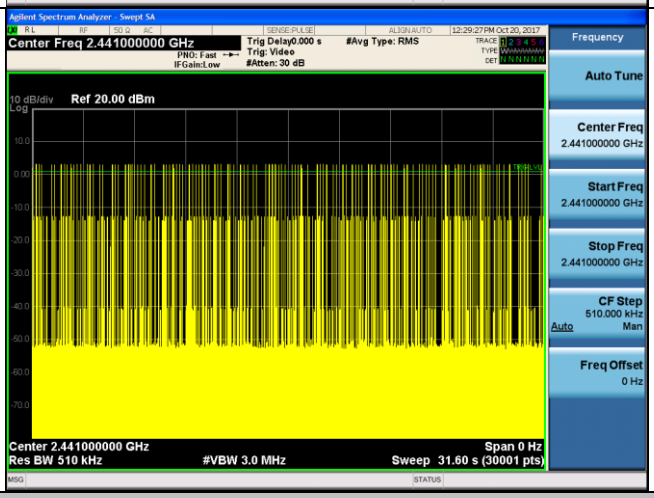


2DH5_ANT1_HOP_2.88_104_0.299_0.4_PASS_


3DH1_ANT1_HOP_0.38_316_0.119_0.4_PASS_


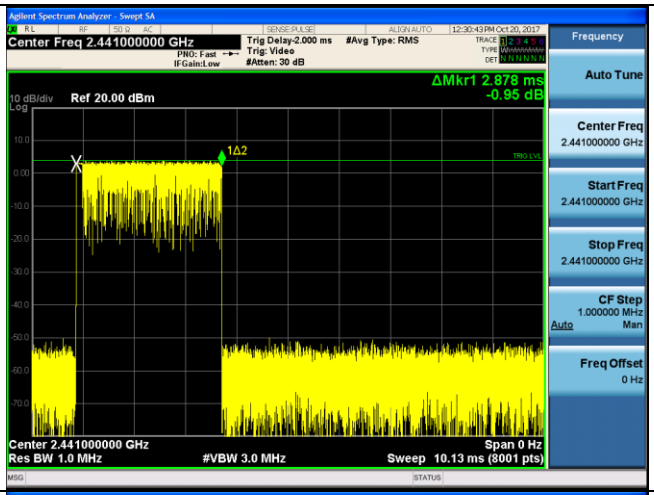


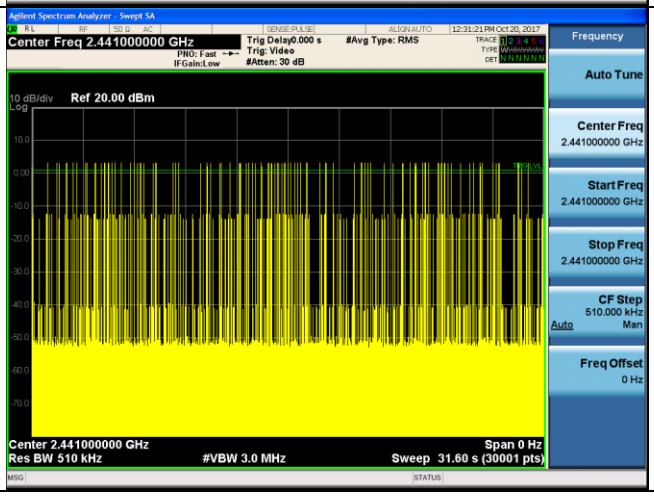
3DH3_ANT1_HOP_1.63_157_0.255_0.4_PASS_





3DH5_ANT1_HOP_2.88_104_0.299_0.4_PASS_


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
PNO: Fast
IFGain:Low
Trig Delay-2.000 ms
Trig: Video
#Avg Type: RMS
#Atten: 30 dB
12:30:43 PM Oct 20, 2017
ΔMkr1 2.878 ms
-0.95 dB
10 dB/div
Log
Ref 20.00 dBm
1Δ2
Center 2.441000000 GHz
Res BW 1.0 MHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 10.13 ms (8001 pts)
Frequency
Auto Tune
Center Freq
2.441000000 GHz
Start Freq
2.441000000 GHz
Stop Freq
2.441000000 GHz
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.441000000 GHz
PNO: Fast
IFGain:Low
Trig Delay0.000 s
Trig: Video
#Avg Type: RMS
#Atten: 30 dB
12:31:21 PM Oct 20, 2017
10 dB/div
Log
Ref 20.00 dBm
Center 2.441000000 GHz
Res BW 510 kHz
#VBW 3.0 MHz
Span 0 Hz
Sweep 31.60 s (30001 pts)
Frequency
Auto Tune
Center Freq
2.441000000 GHz
Start Freq
2.441000000 GHz
Stop Freq
2.441000000 GHz
CF Step
510.000 kHz
Auto
Man
Freq Offset
0 Hz

5.8. Pseudorandom Frequency Hopping Sequence

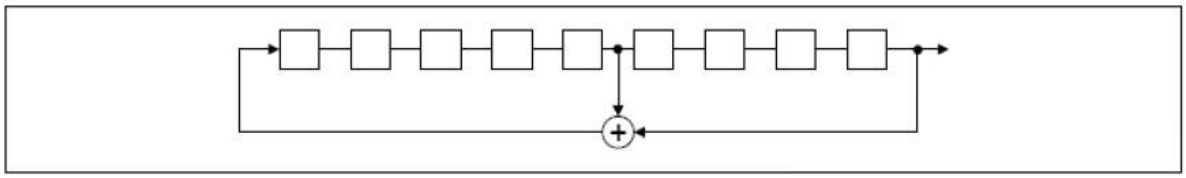
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):Frequency hopping systems shall have hopping channel carrier fre-quencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Al-ternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier fre-quencies 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 chan-nel frequencies that are selected at the system hopping rate from a pseudo ran-domly ordered list of hopping fre-quencies. Each frequency must be used equally on the average by each trans-mitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their cor-responding transmitters and shall shift frequencies in synchronization with the transmitted signals.

TEST RESULTS

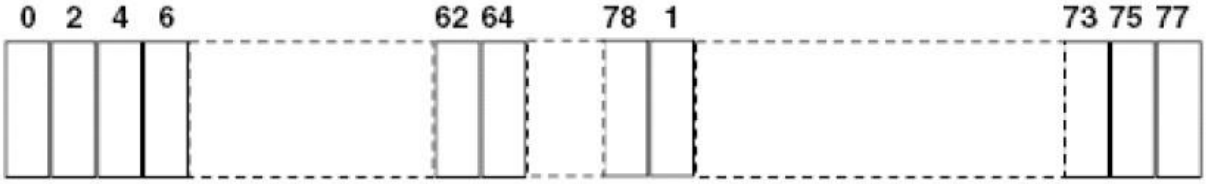
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage.And the result is fed back to the input of the friststage.The sequence begins with the frist one of 9 consecutive ones,forexample:the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An explame of pseudorandom frequency hopping sequence as follows:



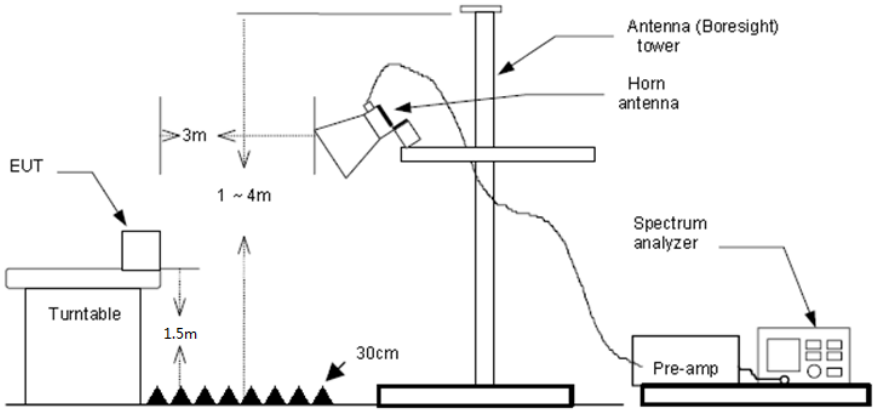
Each frequency used equally one the average by each transmitter.
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

5.9. Restricted band (radiated)

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, Radiated Emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the Radiated Emissions limits specified in §15.209(a) (see §15.205(c)).

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10:2013 for compliance to FCC 47CFR 15.247 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT waspositioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. Thisis repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:
   RBW=1 MHz, VBW=3 MHz Peak detector for Peak value
   RBW=1 MHz, VBW=10 Hz Peak detector for Average value.

TEST MODE:
Please refer to the clause 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Note:
1) Final level= Read level + Antenna Factor+ Cable Loss- Preamp Factor
2) Have pre-scan all modulation mode, found the GFSK modulation which it was worst case, so only the worst case's data on the test report.
3) The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.

CH00									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2310.00	36.88	28.05	6.62	37.65	33.90	74.00	-40.10	Horizontal	Peak
2390.03	35.29	27.65	6.75	37.87	31.82	74.00	-42.18	Horizontal	Peak
2310.00	38.73	28.05	6.62	37.65	35.75	74.00	-38.25	Vertical	Peak
2390.03	38.99	27.65	6.75	37.87	35.52	74.00	-38.48	Vertical	Peak
2310.00	21.81	28.05	6.62	37.65	18.83	54.00	-35.17	Horizontal	Average
2390.03	21.03	27.65	6.75	37.87	17.56	54.00	-36.44	Horizontal	Average
2310.00	21.17	28.05	6.62	37.65	18.19	54.00	-35.81	Vertical	Average
2390.03	22.65	27.65	6.75	37.87	19.18	54.00	-34.82	Vertical	Average

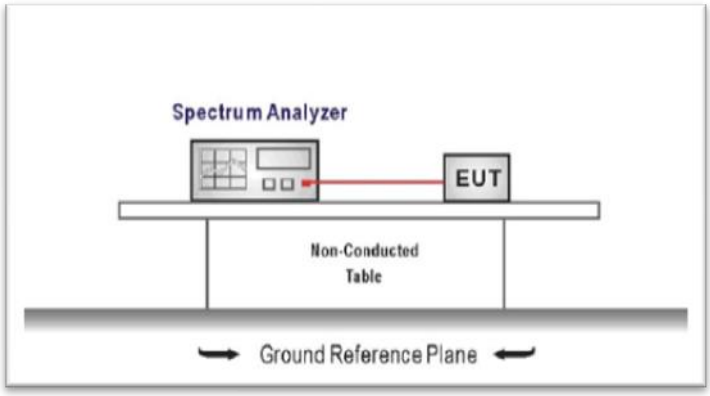
CH78									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2483.55	47.99	27.26	6.83	37.87	44.21	74.00	-29.79	Horizontal	Peak
2500.00	58.70	27.20	6.84	37.87	54.87	74.00	-19.13	Horizontal	Peak
2483.50	53.66	27.26	6.83	37.87	49.88	74.00	-24.12	Vertical	Peak
2500.00	35.45	27.20	6.84	37.87	31.62	74.00	-42.38	Vertical	Peak
2483.50	42.56	27.26	6.83	37.87	38.78	54.00	-15.22	Horizontal	Average
2500.00	21.83	27.20	6.84	37.87	18.00	54.00	-36.00	Horizontal	Average
2483.50	36.39	27.26	6.83	37.87	32.61	54.00	-21.39	Vertical	Average
2500.00	21.91	27.20	6.84	37.87	18.08	54.00	-35.92	Vertical	Average

5.10. Band edge and Spurious Emissions (conducted)

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

TEST CONFIGURATION



TEST PROCEDURE

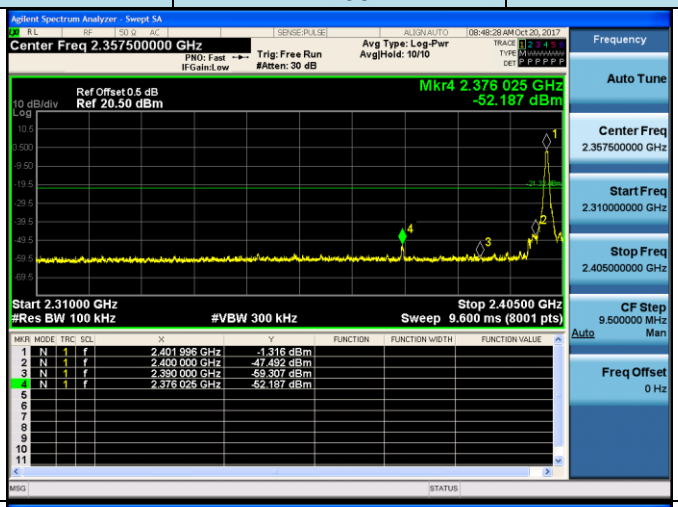
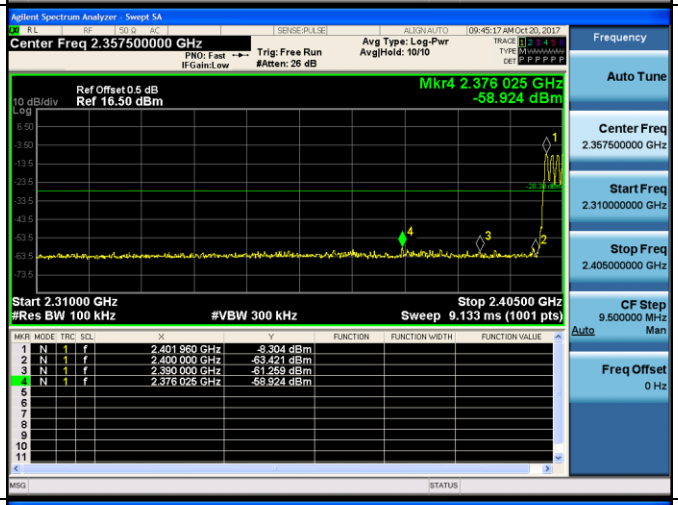
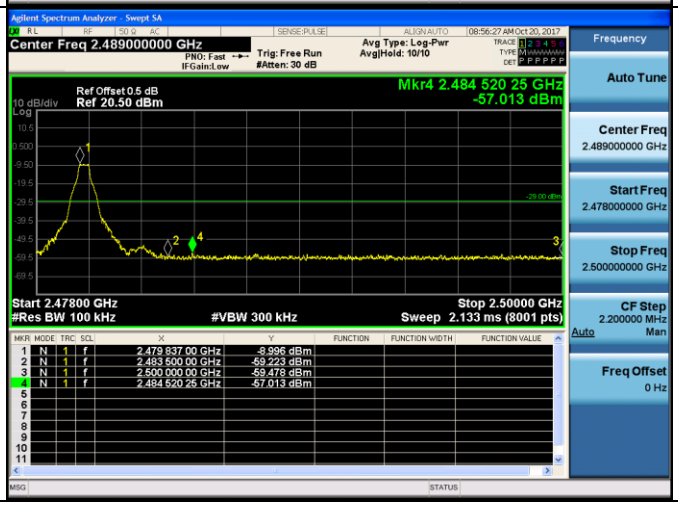
1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   RBW = 100 kHz, VBW ≥ RBW
   Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

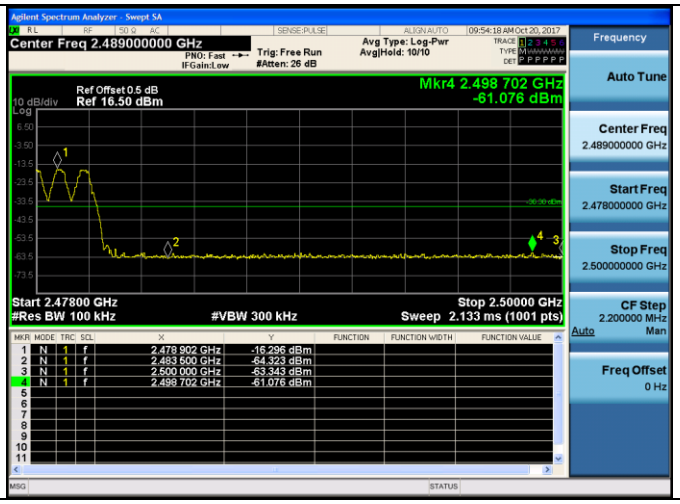
TEST MODE:

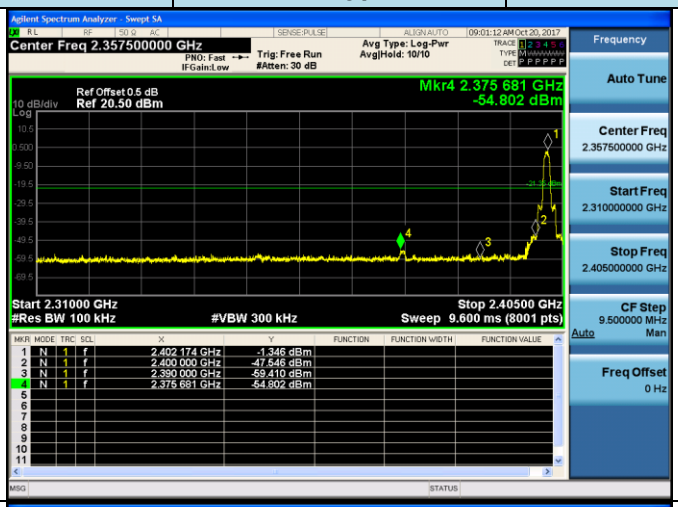
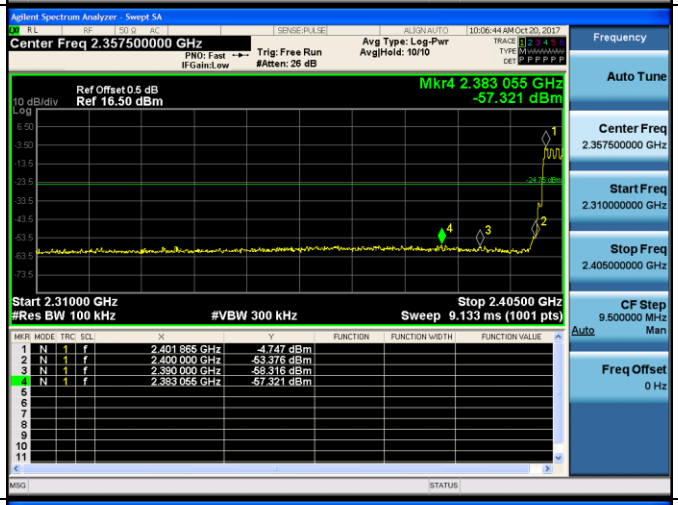
Please refer to the clause 3.3

TEST RESULTS

☒ **Passed** ☐ **Not Applicable**

Test Item:	Band edge	Modulation type:	GFSK
CH00 No hopping mode	
CH00 Hopping mode	
CH78 No hopping mode	

CH78 Hopping mode			

Test Item:	Band edge	Modulation type:	π/4DQPSK
CH00 No hopping mode	
CH00 Hopping mode	
CH78 No hopping mode