



TEST REPORT

Report Reference No. : **TRE1708022101** R/C : 68383

FCC ID : **2ANLRHV316T**

Applicant's name : **Shenzhen Shenghesai Jishu Co.Ltd.**

Address : Room 203, A2 Building, Haoyuan Shangwu Center Baoshan Industrial Park, Mingzhi, Longhua District, Shenzhen, Guangdong, China 518000

Manufacturer : Shenzhen Shenghesai Jishu Co.Ltd.

Address : Room 203, A2 Building, Haoyuan Shangwu Center Baoshan Industrial Park, Mingzhi, Longhua District, Shenzhen, Guangdong, China 518000

Test item description : **Bluetooth headset**

Trade Mark : -

Model/Type reference : HV-316T

Listed Model(s) : RN116T, HV-316TS, HV-316, HV-358, HV-870, HV-980, Mango, RN117, EL201T, EL202, CL120T

Standard : **FCC CFR Title 47 Part 15 Subpart C Section 15.247**

Date of receipt of test sample : Aug. 30, 2017

Date of testing : Aug. 31, 2017 - Sept. 17, 2017

Date of issue : Sept. 18, 2017

Result : **PASS**

Compiled by
(Position+Printed name+Signature): File administrators Becky Liang

Becky Liang

Supervised by
(Position+Printed name+Signature): Project Engineer Jeff Sun

Jeff Sun

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

Shenzhen Huatongwei International Inspection Co., Ltd. All rights reserved.

This publication may be reproduced in whole or in part for non-commercial purposes as long as the Shenzhen Huatongwei International Inspection Co., Ltd. is acknowledged as copyright owner and source of the material. Shenzhen Huatongwei International Inspection Co., Ltd. takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context.

The test report merely correspond to the test sample.

Contents

<u>1.</u>	<u>TEST STANDARDS AND REPORT VERSION</u>	<u>3</u>
1.1.	Test Standards	3
1.2.	Report Version	3
<u>2.</u>	<u>TEST DESCRIPTION</u>	<u>4</u>
<u>3.</u>	<u>SUMMARY</u>	<u>5</u>
3.1.	Client Information	5
3.2.	Product Description	5
3.3.	Operation State	6
3.4.	EUT configuration	6
3.5.	Modifications	6
<u>4.</u>	<u>TEST ENVIRONMENT</u>	<u>7</u>
4.1.	Address of the test laboratory	7
4.2.	Test Facility	7
4.3.	Environmental conditions	8
4.4.	Statement of the measurement uncertainty	8
4.5.	Equipments Used during the Test	9
<u>5.</u>	<u>TEST CONDITIONS AND RESULTS</u>	<u>10</u>
5.1.	Antenna requirement	10
5.2.	Conducted Emissions (AC Main)	11
5.3.	Conducted Peak Output Power	14
5.4.	20 dB Bandwidth	18
5.5.	Carrier Frequencies Separation	22
5.6.	Hopping Channel Number	24
5.7.	Dwell Time	26
5.8.	Pseudorandom Frequency Hopping Sequence	30
5.9.	Restricted band (radiated)	31
5.10.	Band edge and Spurious Emissions (conducted)	33
5.11.	Spurious Emissions (radiated)	53
<u>6.</u>	<u>TEST SETUP PHOTOS</u>	<u>57</u>
<u>7.</u>	<u>EXTERANAL AND INTERNAL PHOTOS</u>	<u>59</u>

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 for Testing Unlicensed Wireless Devices

1.2. Report Version

Version No.	Date of issue	Description
00	Sept. 18, 2017	Original

2. TEST DESCRIPTION

Test Item	Section in CFR 47	Result	Test Engineer
Antenna Requirement	15.203/15.247 (c)	Pass	Baozhu Hu
AC Power Line Conducted Emissions	15.207	Pass	Jack Wang
Conducted Peak Output Power	15.247 (b)(1)	Pass	Baozhu Hu
20 dB Bandwidth	15.247 (a)(1)	Pass	Baozhu Hu
Carrier Frequencies Separation	15.247 (a)(1)	Pass	Baozhu Hu
Hopping Channel Number	15.247 (a)(1)	Pass	Baozhu Hu
Dwell Time	15.247 (a)(1)	Pass	Baozhu Hu
Pseudorandom Frequency Hopping Sequence	15.247(b)(4)&TCB Exclusion List (7 July 2002)	Pass	Baozhu Hu
Restricted band	15.247(d)/15.205	Pass	Hongquan Li
Radiated Emissions	15.247(d)/15.209	Pass	Michael Jie

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

3. SUMMARY

3.1. Client Information

Applicant:	Shenzhen Shenghesai Jishu Co.Ltd.
Address:	Room 203, A2 Building, Haoyuan Shangwu Center Baoshan Industrial Park, Mingzhi, Longhua District, Shenzhen, Guangdong, China 518000
Manufacturer:	Shenzhen Shenghesai Jishu Co.Ltd.
Address:	Room 203, A2 Building, Haoyuan Shangwu Center Baoshan Industrial Park, Mingzhi, Longhua District, Shenzhen, Guangdong, China 518000

3.2. Product Description

Name of EUT:	Bluetooth headset
Trade Mark:	-
Model No.:	HV-316T
Listed Model(s):	RN116T, HV-316TS, HV-316, HV-358, HV-870, HV-980, Mango, RN117, EL201T, EL202, CL120T
Power supply:	DC 3.7V From internal battery
Adapter information:	-
Hardware version:	v1.1
Software version:	v1.1
Bluetooth	
Version:	Supported BT4.1+EDR
Modulation:	GFSK, $\pi/4$ DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	Integral Antenna
Antenna gain:	5.22 dBi

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 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.

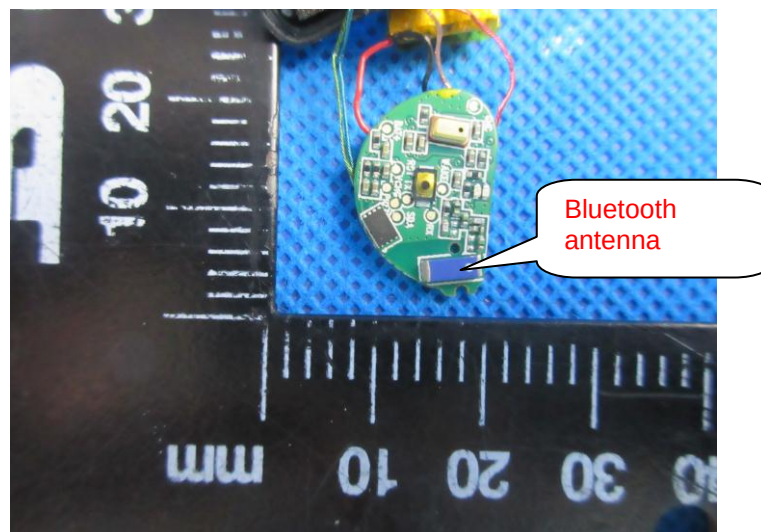
FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(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)

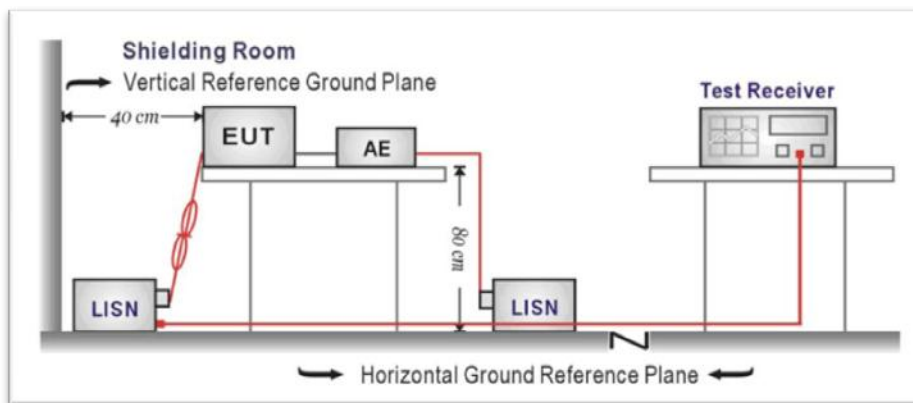
LIMIT

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

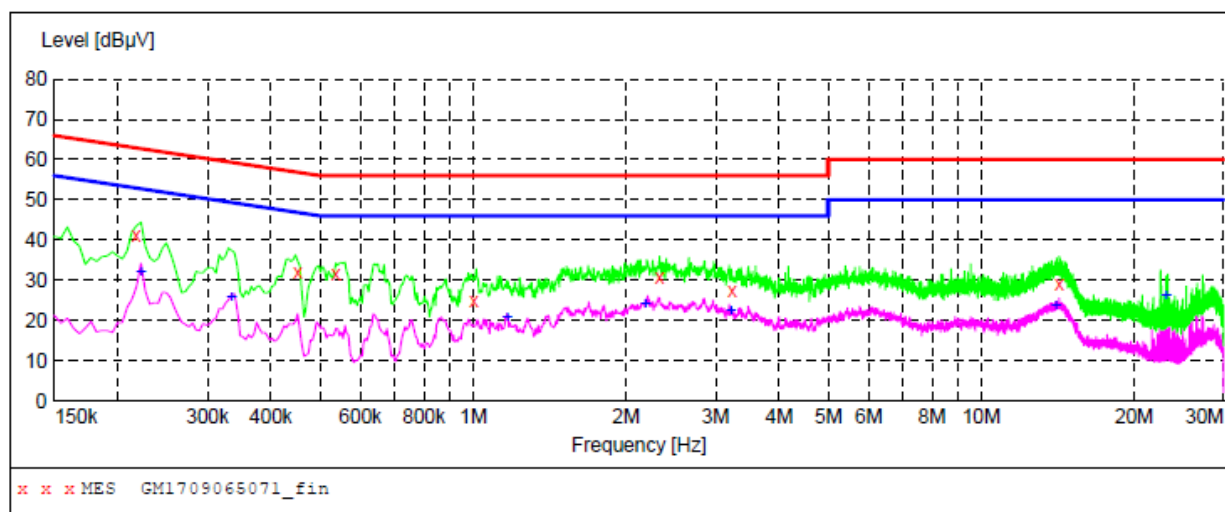
☒ Passed ☐ Not Applicable

Note:

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

Test Line:

L

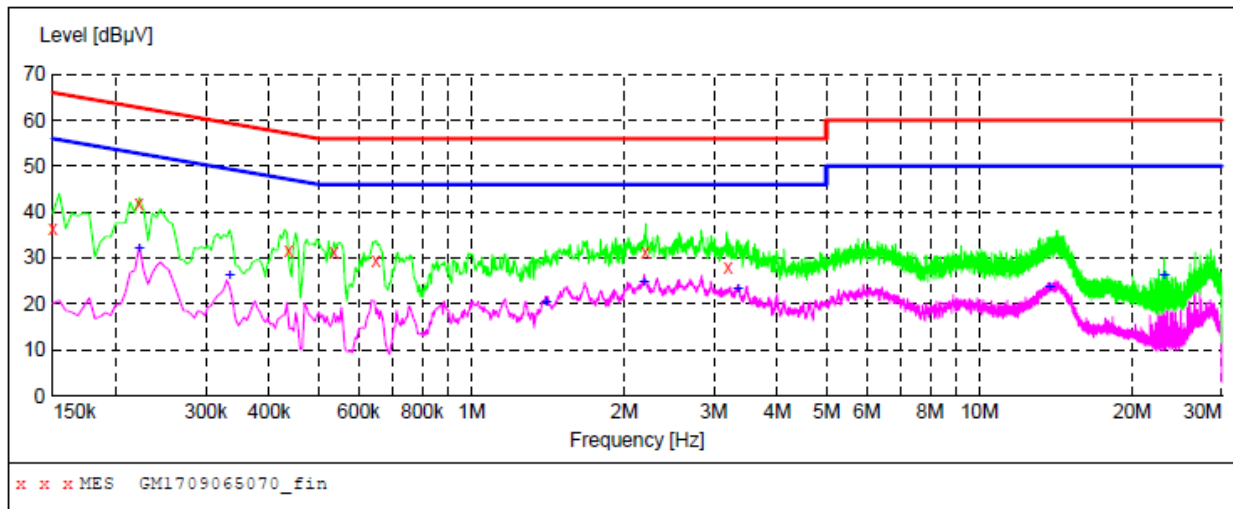


Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.217500	41.10	10.3	63	21.8	QP	L1	GND
0.451500	31.80	10.2	57	25.0	QP	L1	GND
0.537000	31.50	10.2	56	24.5	QP	L1	GND
1.005000	24.90	10.2	56	31.1	QP	L1	GND
2.328000	30.80	10.2	56	25.2	QP	L1	GND
3.237000	27.40	10.3	56	28.6	QP	L1	GND
14.262000	28.90	10.5	60	31.1	QP	L1	GND

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.222000	31.80	10.3	53	20.9	AV	L1	GND
0.334500	25.70	10.2	49	23.6	AV	L1	GND
1.167000	20.80	10.2	46	25.2	AV	L1	GND
2.179500	24.20	10.2	46	21.8	AV	L1	GND
3.219000	22.40	10.2	46	23.6	AV	L1	GND
14.014500	23.60	10.5	50	26.4	AV	L1	GND
23.127000	26.20	10.7	50	23.8	AV	L1	GND

Test Line:

N



Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.150000	36.60	10.4	66	29.4	QP	N	GND
0.222000	41.90	10.3	63	20.8	QP	N	GND
0.438000	31.60	10.2	57	25.5	QP	N	GND
0.537000	31.20	10.2	56	24.8	QP	N	GND
0.649500	29.60	10.2	56	26.4	QP	N	GND
2.202000	31.20	10.2	56	24.8	QP	N	GND
3.205500	27.90	10.2	56	28.1	QP	N	GND

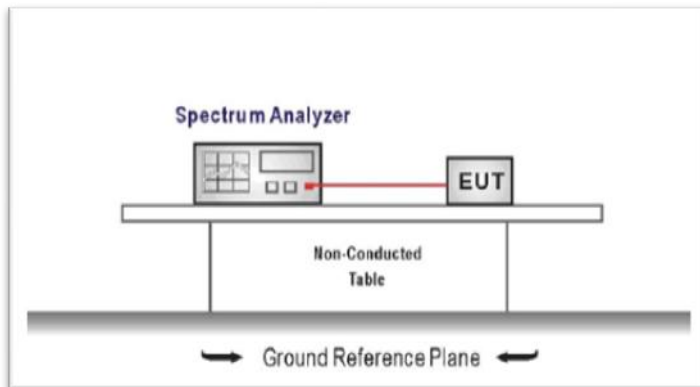
Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector	Line	PE
0.222000	31.90	10.3	53	20.8	AV	N	GND
0.334500	26.10	10.2	49	23.2	AV	N	GND
1.405500	20.40	10.2	46	25.6	AV	N	GND
2.184000	24.90	10.2	46	21.1	AV	N	GND
3.349500	23.10	10.3	46	22.9	AV	N	GND
13.749000	23.50	10.5	50	26.5	AV	N	GND
23.127000	26.10	10.7	50	23.9	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 $\geq$ the 20 dB bandwidth of the emission being measured, VBW $\geq$ RBW
 Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

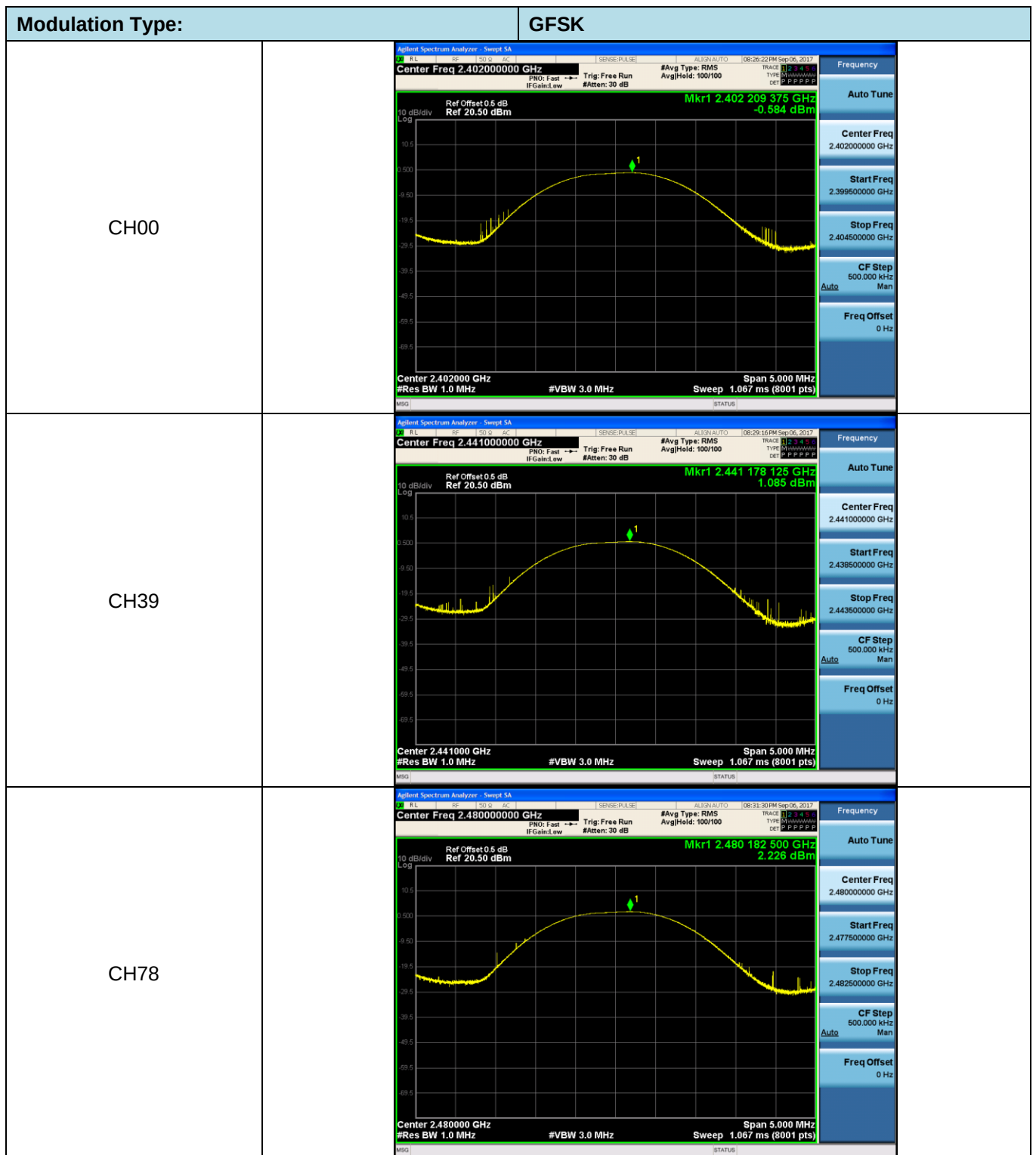
TEST MODE:

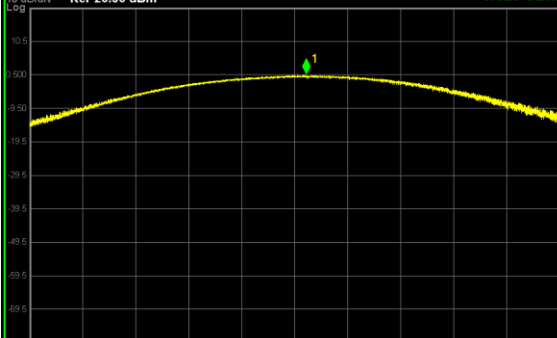
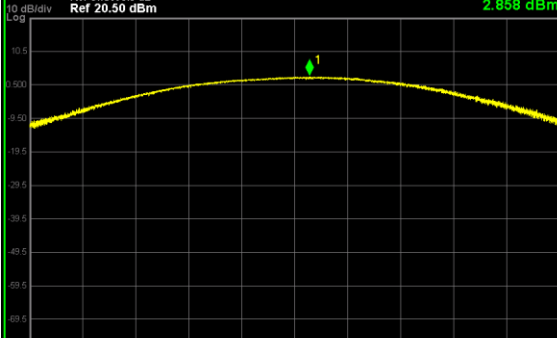
Please refer to the clause 3.3

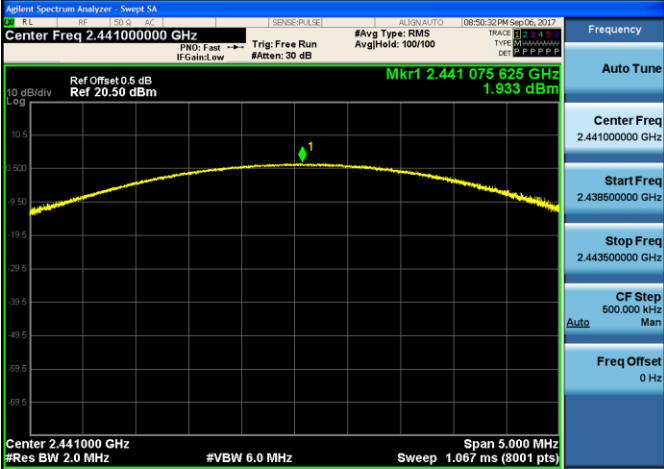
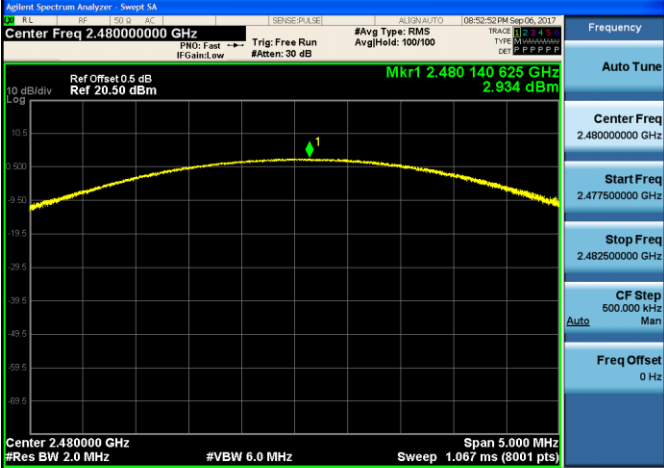
TEST RESULTS

☒ Passed ☐ Not Applicable

Modulation type	Channel	Output power (dBm)	Limit (dBm)	Result
GFSK	00	-0.584	≤ 30.00	Pass
	39	1.085		
	78	2.226		
$\pi/4$ DQPSK	00	0.320	≤ 21.00	Pass
	39	1.881		
	78	2.858		
8DPSK	00	0.389	≤ 21.00	Pass
	39	1.933		
	78	2.934		



Modulation Type:		$\pi/4$ DQPSK	
CH00		Agilent Spectrum Analyzer - Sweep SA RL SENSE: PULSE ALPHA: AUTO 08:39:51 PM Sep 06, 2017 Center Freq 2.402000000 GHz IF Gain: Low Trig: Free Run Avg Type: RMS Avg Hold: 100/100 Ref Offset: 0.5 dB Ref 20.50 dBm Mkr1 2.402 110 625 GHz 0.320 dBm 10 dB/div Log  Center 2.402000 GHz #Res BW 2.0 MHz #VBW 6.0 MHz Sweep 1.067 ms (8001 pts) Span 5.000 MHz MSG STATUS Frequency Auto Tune Center Freq 2.402000000 GHz Start Freq 2.399500000 GHz Stop Freq 2.404500000 GHz CF Step 500.000 kHz Auto Man Freq Offset 0 Hz	
CH39		Agilent Spectrum Analyzer - Sweep SA RL SENSE: PULSE ALPHA: AUTO 08:39:59 PM Sep 06, 2017 Center Freq 2.441000000 GHz IF Gain: Low Trig: Free Run Avg Type: RMS Avg Hold: 100/100 Ref Offset: 0.5 dB Ref 20.50 dBm Mkr1 2.441 123 750 GHz 1.881 dBm 10 dB/div Log  Center 2.441000 GHz #Res BW 2.0 MHz #VBW 6.0 MHz Sweep 1.067 ms (8001 pts) Span 5.000 MHz MSG STATUS Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.438500000 GHz Stop Freq 2.443500000 GHz CF Step 500.000 kHz Auto Man Freq Offset 0 Hz	
CH78		Agilent Spectrum Analyzer - Sweep SA RL SENSE: PULSE ALPHA: AUTO 08:42:01 PM Sep 06, 2017 Center Freq 2.480000000 GHz IF Gain: Low Trig: Free Run Avg Type: RMS Avg Hold: 100/100 Ref Offset: 0.5 dB Ref 20.50 dBm Mkr1 2.480 140 000 GHz 2.858 dBm 10 dB/div Log  Center 2.480000 GHz #Res BW 2.0 MHz #VBW 6.0 MHz Sweep 1.067 ms (8001 pts) Span 5.000 MHz MSG STATUS Frequency Auto Tune Center Freq 2.480000000 GHz Start Freq 2.477500000 GHz Stop Freq 2.482500000 GHz CF Step 500.000 kHz Auto Man Freq Offset 0 Hz	

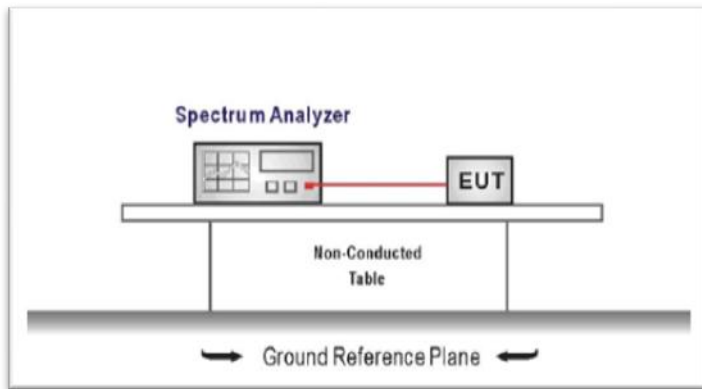
Modulation Type:		8DPSK
CH00		
CH39		
CH78		

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 $\geq$ 1% of the 20 dB bandwidth, VBW $\geq$ RBW
 Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

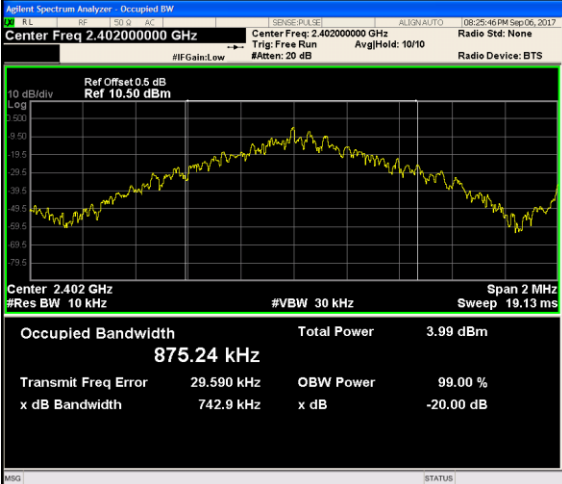
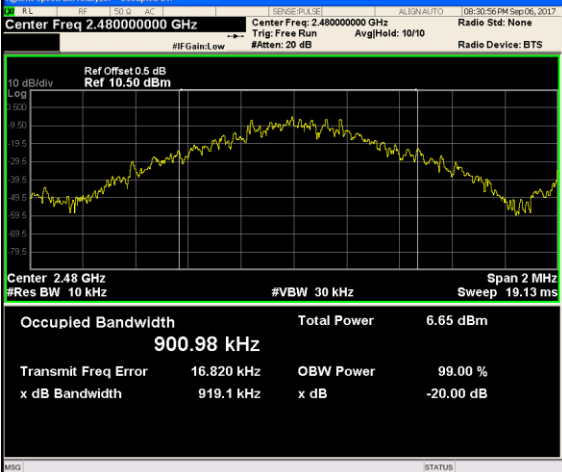
TEST MODE:

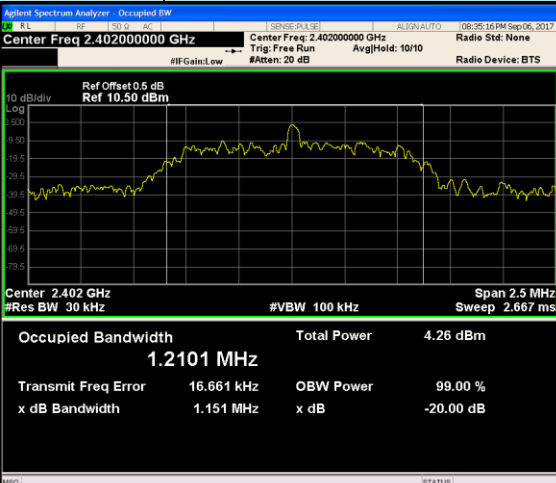
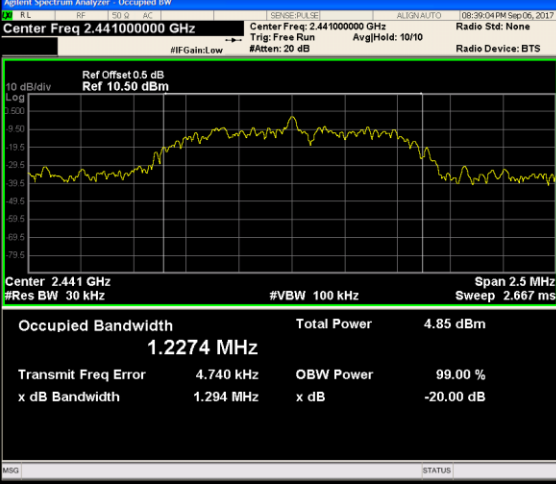
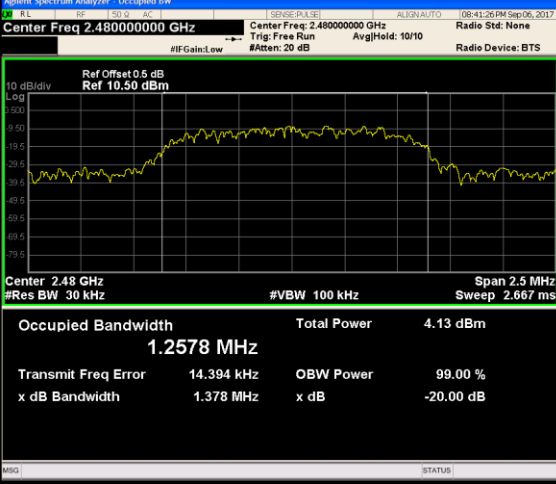
Please refer to the clause 3.3

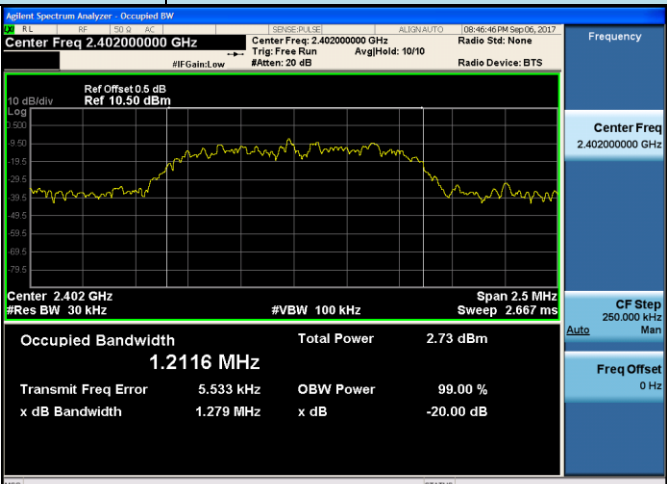
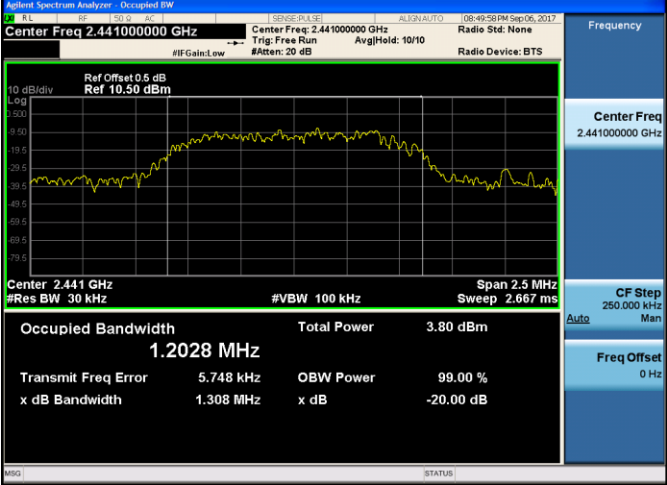
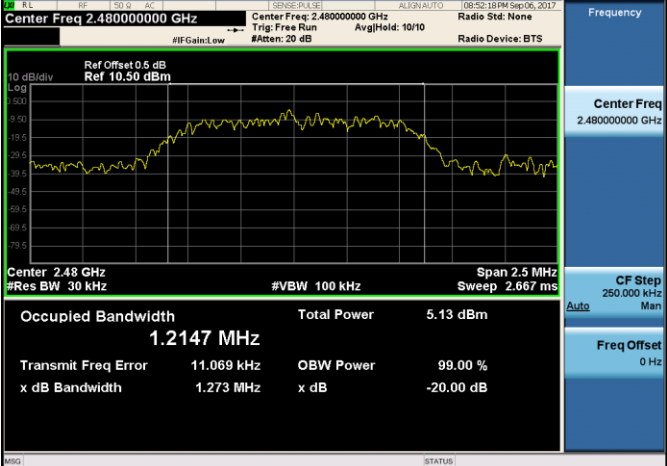
TEST RESULTS

☒ Passed ☐ Not Applicable

Modulation type	Channel	20 dB Bandwidth (MHz)	Limit (MHz)	Result
GFSK	00	0.743	-	Pass
	39	0.792		
	78	0.919		
$\pi/4$ DQPSK	00	1.151	-	Pass
	39	1.294		
	78	1.378		
8DPSK	00	1.279	-	Pass
	39	1.308		
	78	1.273		

Modulation Type:		GFSK																	
CH00	 <table><tr><td>Center Freq</td><td>2.402000000 GHz</td></tr><tr><td>CF Step</td><td>200.000 kHz</td></tr><tr><td>Freq Offset</td><td>0 Hz</td></tr><tr><td>Occupied Bandwidth</td><td>875.24 kHz</td></tr><tr><td>Total Power</td><td>3.99 dBm</td></tr><tr><td>Transmit Freq Error</td><td>29.590 kHz</td></tr><tr><td>OBW Power</td><td>99.00 %</td></tr><tr><td>x dB Bandwidth</td><td>742.9 kHz</td></tr><tr><td>x dB</td><td>-20.00 dB</td></tr></table>	Center Freq	2.402000000 GHz	CF Step	200.000 kHz	Freq Offset	0 Hz	Occupied Bandwidth	875.24 kHz	Total Power	3.99 dBm	Transmit Freq Error	29.590 kHz	OBW Power	99.00 %	x dB Bandwidth	742.9 kHz	x dB	-20.00 dB
Center Freq	2.402000000 GHz																		
CF Step	200.000 kHz																		
Freq Offset	0 Hz																		
Occupied Bandwidth	875.24 kHz																		
Total Power	3.99 dBm																		
Transmit Freq Error	29.590 kHz																		
OBW Power	99.00 %																		
x dB Bandwidth	742.9 kHz																		
x dB	-20.00 dB																		
CH39	 <table><tr><td>Center Freq</td><td>2.441000000 GHz</td></tr><tr><td>CF Step</td><td>200.000 kHz</td></tr><tr><td>Freq Offset</td><td>0 Hz</td></tr><tr><td>Occupied Bandwidth</td><td>895.65 kHz</td></tr><tr><td>Total Power</td><td>5.52 dBm</td></tr><tr><td>Transmit Freq Error</td><td>7.590 kHz</td></tr><tr><td>OBW Power</td><td>99.00 %</td></tr><tr><td>x dB Bandwidth</td><td>791.9 kHz</td></tr><tr><td>x dB</td><td>-20.00 dB</td></tr></table>	Center Freq	2.441000000 GHz	CF Step	200.000 kHz	Freq Offset	0 Hz	Occupied Bandwidth	895.65 kHz	Total Power	5.52 dBm	Transmit Freq Error	7.590 kHz	OBW Power	99.00 %	x dB Bandwidth	791.9 kHz	x dB	-20.00 dB
Center Freq	2.441000000 GHz																		
CF Step	200.000 kHz																		
Freq Offset	0 Hz																		
Occupied Bandwidth	895.65 kHz																		
Total Power	5.52 dBm																		
Transmit Freq Error	7.590 kHz																		
OBW Power	99.00 %																		
x dB Bandwidth	791.9 kHz																		
x dB	-20.00 dB																		
CH78	 <table><tr><td>Center Freq</td><td>2.480000000 GHz</td></tr><tr><td>CF Step</td><td>200.000 kHz</td></tr><tr><td>Freq Offset</td><td>0 Hz</td></tr><tr><td>Occupied Bandwidth</td><td>900.98 kHz</td></tr><tr><td>Total Power</td><td>6.65 dBm</td></tr><tr><td>Transmit Freq Error</td><td>16.820 kHz</td></tr><tr><td>OBW Power</td><td>99.00 %</td></tr><tr><td>x dB Bandwidth</td><td>919.1 kHz</td></tr><tr><td>x dB</td><td>-20.00 dB</td></tr></table>	Center Freq	2.480000000 GHz	CF Step	200.000 kHz	Freq Offset	0 Hz	Occupied Bandwidth	900.98 kHz	Total Power	6.65 dBm	Transmit Freq Error	16.820 kHz	OBW Power	99.00 %	x dB Bandwidth	919.1 kHz	x dB	-20.00 dB
Center Freq	2.480000000 GHz																		
CF Step	200.000 kHz																		
Freq Offset	0 Hz																		
Occupied Bandwidth	900.98 kHz																		
Total Power	6.65 dBm																		
Transmit Freq Error	16.820 kHz																		
OBW Power	99.00 %																		
x dB Bandwidth	919.1 kHz																		
x dB	-20.00 dB																		

Modulation Type:		$\pi/4$ DQPSK
CH00		Frequency Center Freq 2.40200000 GHz CF Step 250.000 kHz Auto Man Freq Offset 0 Hz
CH39		Frequency Center Freq 2.44100000 GHz CF Step 250.000 kHz Auto Man Freq Offset 0 Hz
CH78		Frequency Center Freq 2.48000000 GHz CF Step 250.000 kHz Auto Man Freq Offset 0 Hz

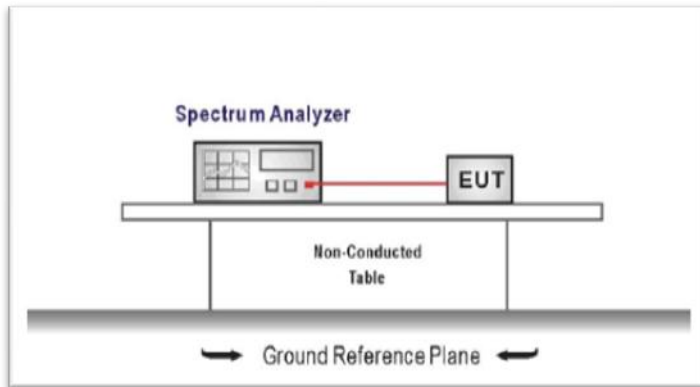
Modulation Type:		8DPSK
CH00		
CH39		
CH78		

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 $2/3 \times 20$ 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 $\geq 1\%$ of the span, VBW $\geq$ 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

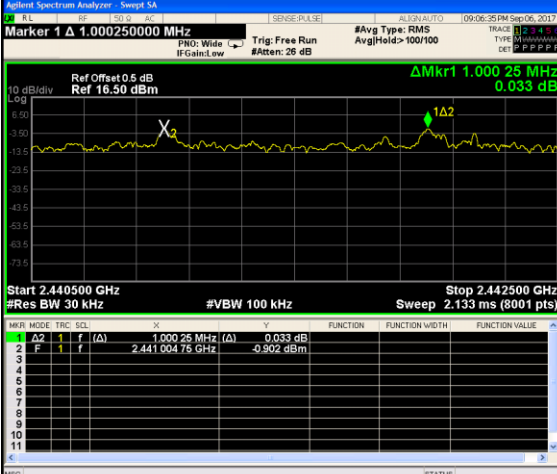
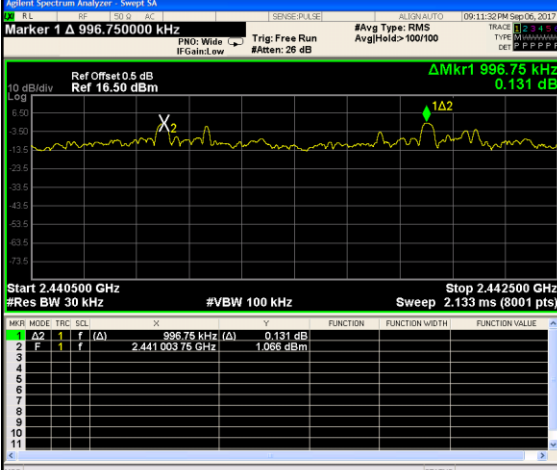
Modulation type	Channel	Carrier Frequencies Separation (MHz)	Limit (MHz) *	Result
GFSK	39	0.916	≥ 0.792	Pass
$\pi/4$ DQPSK	39	1.000	≥ 0.863	Pass
8DPSK	39	0.997	≥ 0.872	Pass

Note:

*: GFSK limit = The maximum 20 dB Bandwidth for GFSK modulation on the section 5.4.

$\pi/4$ DQPSK limit = $2/3 \times$ The maximum 20 dB Bandwidth for $\pi/4$ DQPSK modulation on the section 5.4.

8DPSK limit = $2/3 \times$ The maximum 20 dB Bandwidth for 8DPSK modulation on the section 5.4

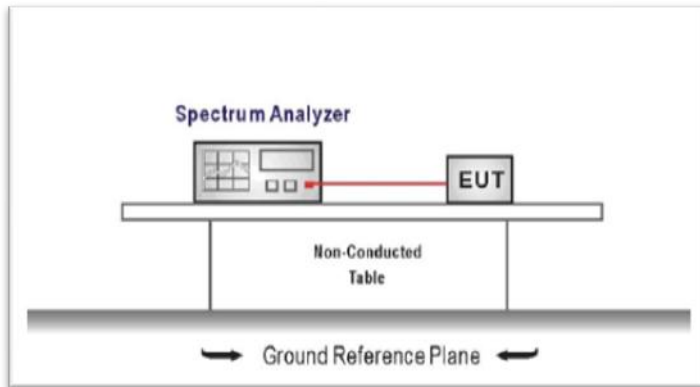
GFSK	 Agilent Spectrum Analyzer - Sweep SA Marker 1 Δ 916.250000 kHz Ref Offset 0.5 dB Ref 16.50 dBm ΔMkr1 916.25 kHz -0.710 dB Start 2.440500 GHz #Res BW 30 kHz #VBW 100 kHz Stop 2.442500 GHz Sweep 2.133 ms (8001 pts) <table><tr><th>Marker</th><th>Mode</th><th>Trig</th><th>SCL</th><th>X</th><th>Y</th><th>Function</th><th>Function Width</th><th>Function Value</th></tr><tr><td>1</td><td>Δ2</td><td>1</td><td>f</td><td>(Δ)</td><td>916.25 kHz (Δ)</td><td>-0.710 dB</td><td></td><td></td></tr><tr><td>2</td><td>F</td><td>1</td><td>f</td><td></td><td>2.441 064 00 GHz</td><td>-1.884 dBm</td><td></td><td></td></tr></table>	Marker	Mode	Trig	SCL	X	Y	Function	Function Width	Function Value	1	Δ 2	1	f	(Δ)	916.25 kHz (Δ)	-0.710 dB			2	F	1	f		2.441 064 00 GHz	-1.884 dBm			Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr--CF Mkr--Ref Lvl More 1 of 2
Marker	Mode	Trig	SCL	X	Y	Function	Function Width	Function Value																					
1	Δ 2	1	f	(Δ)	916.25 kHz (Δ)	-0.710 dB																							
2	F	1	f		2.441 064 00 GHz	-1.884 dBm																							
π /4DQPSK	 Agilent Spectrum Analyzer - Sweep SA Marker 1 Δ 1.000250000 MHz Ref Offset 0.5 dB Ref 16.50 dBm ΔMkr1 1.000 25 MHz 0.033 dB Start 2.440500 GHz #Res BW 30 kHz #VBW 100 kHz Stop 2.442500 GHz Sweep 2.133 ms (8001 pts) <table><tr><th>Marker</th><th>Mode</th><th>Trig</th><th>SCL</th><th>X</th><th>Y</th><th>Function</th><th>Function Width</th><th>Function Value</th></tr><tr><td>1</td><td>Δ2</td><td>1</td><td>f</td><td>(Δ)</td><td>1.000 25 MHz (Δ)</td><td>0.033 dB</td><td></td><td></td></tr><tr><td>2</td><td>F</td><td>1</td><td>f</td><td></td><td>2.441 064 75 GHz</td><td>-0.902 dBm</td><td></td><td></td></tr></table>	Marker	Mode	Trig	SCL	X	Y	Function	Function Width	Function Value	1	Δ 2	1	f	(Δ)	1.000 25 MHz (Δ)	0.033 dB			2	F	1	f		2.441 064 75 GHz	-0.902 dBm			Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr--CF Mkr--Ref Lvl More 1 of 2
Marker	Mode	Trig	SCL	X	Y	Function	Function Width	Function Value																					
1	Δ 2	1	f	(Δ)	1.000 25 MHz (Δ)	0.033 dB																							
2	F	1	f		2.441 064 75 GHz	-0.902 dBm																							
8DPSK	 Agilent Spectrum Analyzer - Sweep SA Marker 1 Δ 996.750000 kHz Ref Offset 0.5 dB Ref 16.50 dBm ΔMkr1 996.75 kHz 0.131 dB Start 2.440500 GHz #Res BW 30 kHz #VBW 100 kHz Stop 2.442500 GHz Sweep 2.133 ms (8001 pts) <table><tr><th>Marker</th><th>Mode</th><th>Trig</th><th>SCL</th><th>X</th><th>Y</th><th>Function</th><th>Function Width</th><th>Function Value</th></tr><tr><td>1</td><td>Δ2</td><td>1</td><td>f</td><td>(Δ)</td><td>996.75 kHz (Δ)</td><td>0.131 dB</td><td></td><td></td></tr><tr><td>2</td><td>F</td><td>1</td><td>f</td><td></td><td>2.441 063 75 GHz</td><td>1.068 dBm</td><td></td><td></td></tr></table>	Marker	Mode	Trig	SCL	X	Y	Function	Function Width	Function Value	1	Δ 2	1	f	(Δ)	996.75 kHz (Δ)	0.131 dB			2	F	1	f		2.441 063 75 GHz	1.068 dBm			Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr--CF Mkr--Ref Lvl More 1 of 2
Marker	Mode	Trig	SCL	X	Y	Function	Function Width	Function Value																					
1	Δ 2	1	f	(Δ)	996.75 kHz (Δ)	0.131 dB																							
2	F	1	f		2.441 063 75 GHz	1.068 dBm																							

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 $\geq$ 1% of the span, VBW $\geq$ RBW
Sweep = auto, Detector function = peak, Trace = max hold
4. Measure and record the results in the test report.

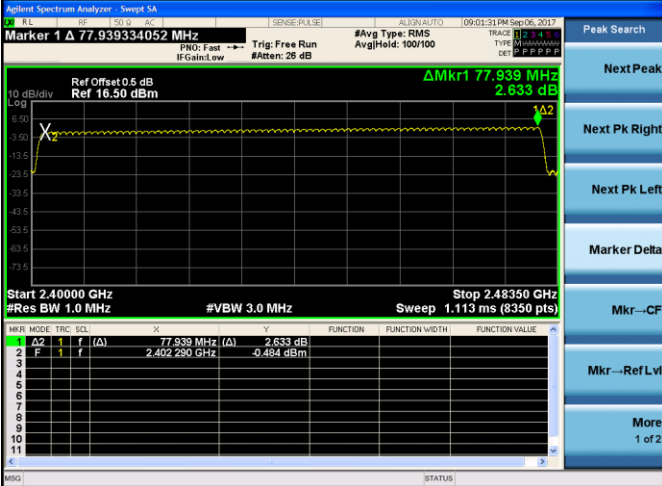
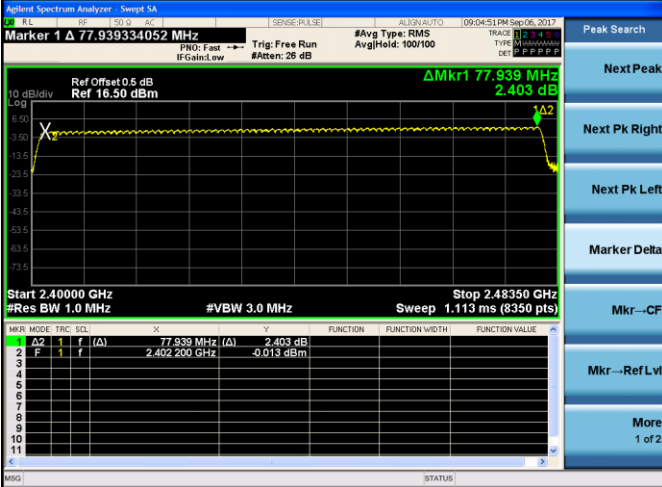
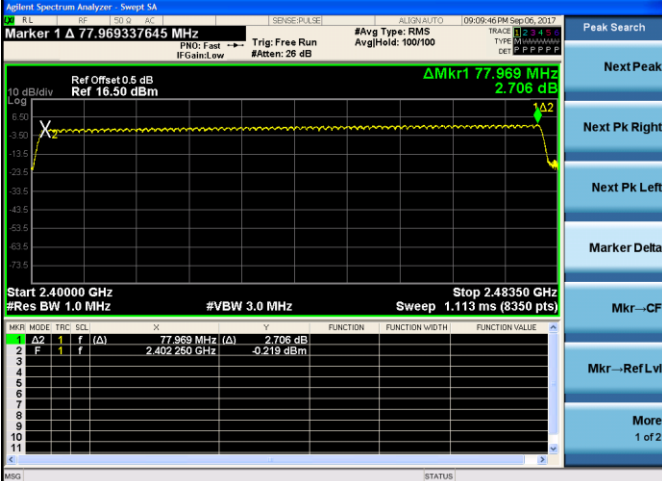
TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

☒ Passed ☐ Not Applicable

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

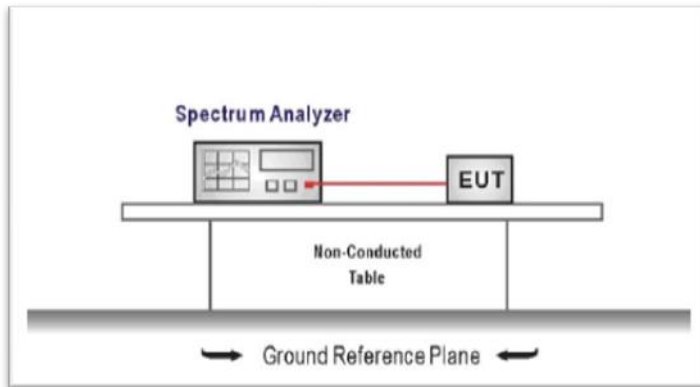
GFSK	 Agilent Spectrum Analyzer - Sweep SA Marker 1 Δ 77.939334052 MHz Ref Offset 0.5 dB Ref 16.50 dBm ΔMkr1 77.939 MHz 2.633 dB Start 2.40000 GHz #Res BW 1.0 MHz #VBW 3.0 MHz Sweep 1.113 ms (8350 pts) <table><tr><th>PKR</th><th>MODE</th><th>TRC</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>Δ2</td><td>1</td><td>f</td><td>(Δ)</td><td>77.939 MHz</td><td>(Δ)</td><td></td><td>2.633 dB</td></tr><tr><td>2</td><td>F</td><td>1</td><td>f</td><td></td><td>2.402 290 GHz</td><td></td><td></td><td>-0.484 dBm</td></tr></table>	PKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	Δ 2	1	f	(Δ)	77.939 MHz	(Δ)		2.633 dB	2	F	1	f		2.402 290 GHz			-0.484 dBm	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr--CF Mkr--Ref Lvl More 1 of 2
PKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																					
1	Δ 2	1	f	(Δ)	77.939 MHz	(Δ)		2.633 dB																					
2	F	1	f		2.402 290 GHz			-0.484 dBm																					
π /4DQPSK	 Agilent Spectrum Analyzer - Sweep SA Marker 1 Δ 77.939334052 MHz Ref Offset 0.5 dB Ref 16.50 dBm ΔMkr1 77.939 MHz 2.403 dB Start 2.40000 GHz #Res BW 1.0 MHz #VBW 3.0 MHz Sweep 1.113 ms (8350 pts) <table><tr><th>PKR</th><th>MODE</th><th>TRC</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>Δ2</td><td>1</td><td>f</td><td>(Δ)</td><td>77.939 MHz</td><td>(Δ)</td><td></td><td>2.403 dB</td></tr><tr><td>2</td><td>F</td><td>1</td><td>f</td><td></td><td>2.402 290 GHz</td><td></td><td></td><td>-0.013 dBm</td></tr></table>	PKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	Δ 2	1	f	(Δ)	77.939 MHz	(Δ)		2.403 dB	2	F	1	f		2.402 290 GHz			-0.013 dBm	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr--CF Mkr--Ref Lvl More 1 of 2
PKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																					
1	Δ 2	1	f	(Δ)	77.939 MHz	(Δ)		2.403 dB																					
2	F	1	f		2.402 290 GHz			-0.013 dBm																					
8DPSK	 Agilent Spectrum Analyzer - Sweep SA Marker 1 Δ 77.969337645 MHz Ref Offset 0.5 dB Ref 16.50 dBm ΔMkr1 77.969 MHz 2.706 dB Start 2.40000 GHz #Res BW 1.0 MHz #VBW 3.0 MHz Sweep 1.113 ms (8350 pts) <table><tr><th>PKR</th><th>MODE</th><th>TRC</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr><tr><td>1</td><td>Δ2</td><td>1</td><td>f</td><td>(Δ)</td><td>77.969 MHz</td><td>(Δ)</td><td></td><td>2.706 dB</td></tr><tr><td>2</td><td>F</td><td>1</td><td>f</td><td></td><td>2.402 290 GHz</td><td></td><td></td><td>-0.219 dBm</td></tr></table>	PKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	Δ 2	1	f	(Δ)	77.969 MHz	(Δ)		2.706 dB	2	F	1	f		2.402 290 GHz			-0.219 dBm	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr--CF Mkr--Ref Lvl More 1 of 2
PKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																					
1	Δ 2	1	f	(Δ)	77.969 MHz	(Δ)		2.706 dB																					
2	F	1	f		2.402 290 GHz			-0.219 dBm																					

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

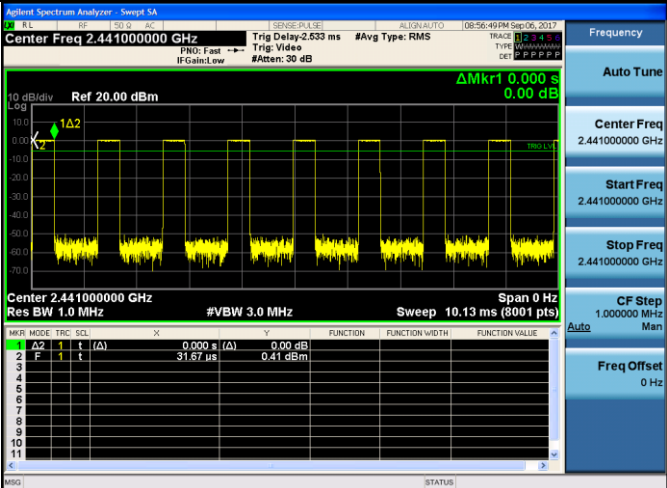
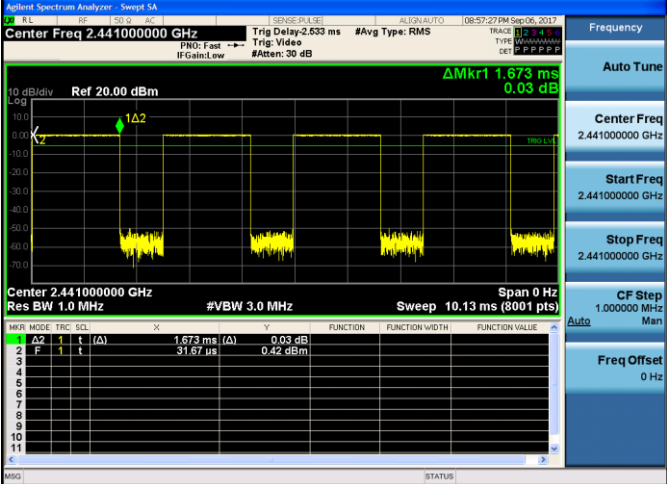
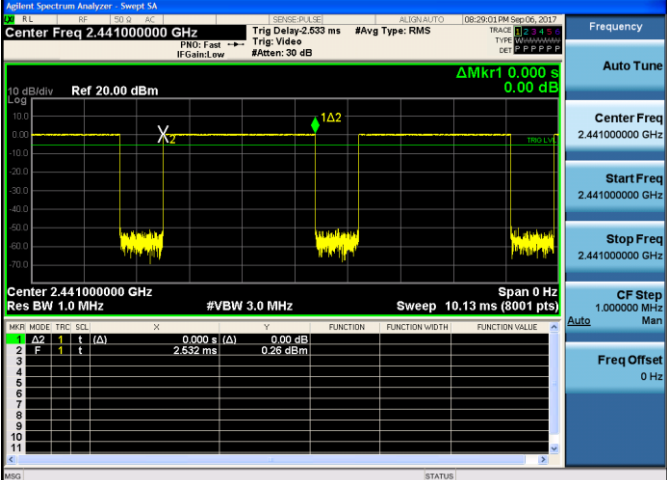
TEST RESULTS

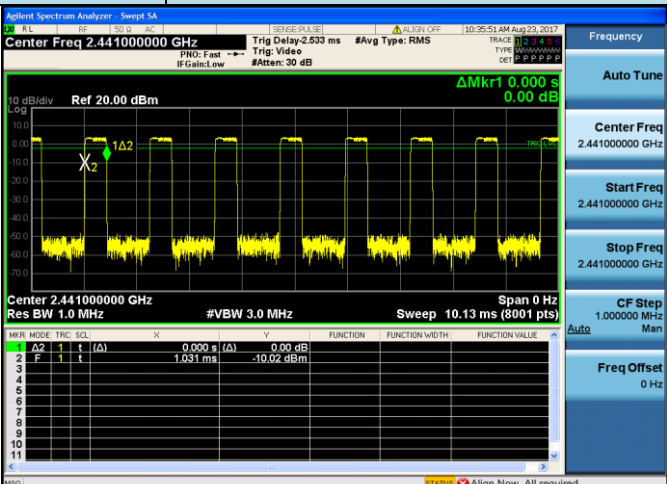
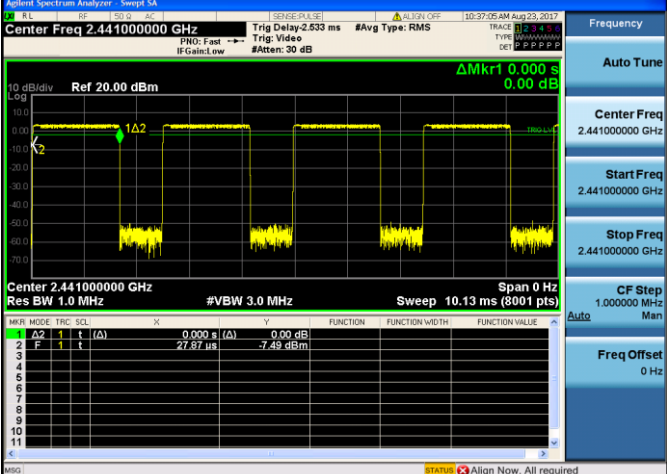
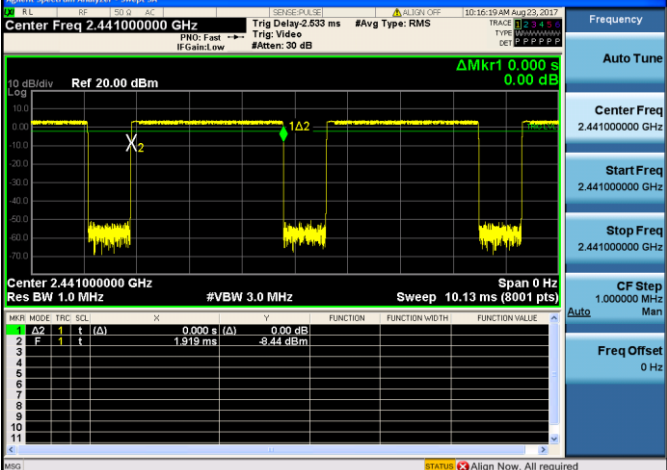
☒ Passed ☐ Not Applicable

Modulation type	Channel	Dwell time (Second)	Limit (Second)	Result
GFSK	DH1	0.134	≤ 0.40	Pass
	DH3	0.267		
	DH5	0.312		
π/4DQPSK	2DH1	0.134	≤ 0.40	Pass
	2DH3	0.267		
	2DH5	0.312		
8DPSK	3DH1	0.134	≤ 0.40	Pass
	3DH3	0.267		
	3DH5	0.312		

Note:

1. We have tested all mode at high,middle and low channel,and recoreded worst case at middle channel.
2. Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second for DH1, 2DH1, 3DH1
Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second for DH3, 2DH3, 3DH3
Dwell time=Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second for DH5, 2DH5, 3DH5

Modulation Type:		GFSK
DH1		
DH3		
DH5		

Modulation Type:		$\pi/4$ DQPSK																											
2DH1	 <table><tr><th>Marker</th><th>Mode</th><th>Trig</th><th>SCL</th><th>X</th><th>Y</th><th>Function</th><th>Function Width</th><th>Function Value</th></tr><tr><td>1</td><td>A2</td><td>1</td><td>t</td><td>(Δ)</td><td>0.000 s</td><td>(Δ)</td><td>0.00 dB</td><td></td></tr><tr><td>2</td><td>F</td><td>1</td><td>t</td><td>(Δ)</td><td>1.031 ms</td><td>(Δ)</td><td>-10.02 dBm</td><td></td></tr></table>	Marker	Mode	Trig	SCL	X	Y	Function	Function Width	Function Value	1	A2	1	t	(Δ)	0.000 s	(Δ)	0.00 dB		2	F	1	t	(Δ)	1.031 ms	(Δ)	-10.02 dBm		Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz CF Step 1.000000 MHz Man Freq Offset 0 Hz
Marker	Mode	Trig	SCL	X	Y	Function	Function Width	Function Value																					
1	A2	1	t	(Δ)	0.000 s	(Δ)	0.00 dB																						
2	F	1	t	(Δ)	1.031 ms	(Δ)	-10.02 dBm																						
2DH3	 <table><tr><th>Marker</th><th>Mode</th><th>Trig</th><th>SCL</th><th>X</th><th>Y</th><th>Function</th><th>Function Width</th><th>Function Value</th></tr><tr><td>1</td><td>A2</td><td>1</td><td>t</td><td>(Δ)</td><td>0.000 s</td><td>(Δ)</td><td>0.00 dB</td><td></td></tr><tr><td>2</td><td>F</td><td>1</td><td>t</td><td>(Δ)</td><td>27.87 μs</td><td>(Δ)</td><td>-7.49 dBm</td><td></td></tr></table>	Marker	Mode	Trig	SCL	X	Y	Function	Function Width	Function Value	1	A2	1	t	(Δ)	0.000 s	(Δ)	0.00 dB		2	F	1	t	(Δ)	27.87 μs	(Δ)	-7.49 dBm		Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz CF Step 1.000000 MHz Man Freq Offset 0 Hz
Marker	Mode	Trig	SCL	X	Y	Function	Function Width	Function Value																					
1	A2	1	t	(Δ)	0.000 s	(Δ)	0.00 dB																						
2	F	1	t	(Δ)	27.87 μs	(Δ)	-7.49 dBm																						
2DH5	 <table><tr><th>Marker</th><th>Mode</th><th>Trig</th><th>SCL</th><th>X</th><th>Y</th><th>Function</th><th>Function Width</th><th>Function Value</th></tr><tr><td>1</td><td>A2</td><td>1</td><td>t</td><td>(Δ)</td><td>0.000 s</td><td>(Δ)</td><td>0.00 dB</td><td></td></tr><tr><td>2</td><td>F</td><td>1</td><td>t</td><td>(Δ)</td><td>1.919 ms</td><td>(Δ)</td><td>-9.44 dBm</td><td></td></tr></table>	Marker	Mode	Trig	SCL	X	Y	Function	Function Width	Function Value	1	A2	1	t	(Δ)	0.000 s	(Δ)	0.00 dB		2	F	1	t	(Δ)	1.919 ms	(Δ)	-9.44 dBm		Frequency Auto Tune Center Freq 2.441000000 GHz Start Freq 2.441000000 GHz Stop Freq 2.441000000 GHz CF Step 1.000000 MHz Man Freq Offset 0 Hz
Marker	Mode	Trig	SCL	X	Y	Function	Function Width	Function Value																					
1	A2	1	t	(Δ)	0.000 s	(Δ)	0.00 dB																						
2	F	1	t	(Δ)	1.919 ms	(Δ)	-9.44 dBm																						

