

Test Report

Report No. : CQASZ20190800040EX-03

Applicant: VTIN TECHNOLOGY Co.,Limited

Address of Applicant: UNIT D 16/F ONE CAPITAL PLACE 21 LUARD ROAD WAN CHAI, Hong Kong

Manufacturer: VTIN TECHNOLOGY Co.,Limited

Address of Manufacturer: UNIT D 16/F ONE CAPITAL PLACE 21 LUARD ROAD WAN CHAI, Hong Kong

Equipment Under Test (EUT):

Product: wireless mouse

Test Model No.: PC254A

Brand Name: VICTSING

FCC ID: 2AIL4-PC254A

Standards: 47 CFR Part 15, Subpart C Section 15.247

Date of Test: 2019-07-30 to 2019-08-28

Date of Issue: 2019-08-28

Test Result : PASS*

Tested By:

Tom Chen

(Tom Chen)

Reviewed By:

Aaron Ma

(Aaron Ma)

Approved By:

Jack Ai

(Jack Ai)



* In the configuration tested, the EUT complied with the standards specified above.

The test report is effective only with both signature and specialized stamp, The result(s) shown in this report refer only to the sample(s) tested. Without written approval of CQA, this report can't be reproduced except in full.

2. Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20190800040EX-03	Rev.01	Initial report	2019-08-28

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)	N/A
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 (a)(1)	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
Band-edge for RF Conducted Emissions	47 CFR Part 15, Subpart C Section 15.247(d)	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
Restricted bands around fundamental frequency (Radiated Emission)	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10 (2013)	PASS

N/A: Not Applicable

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5. General Information

4.1 Client Information

Applicant:	VTIN TECHNOLOGY Co.,Limited
Address of Applicant:	UNIT D 16/F ONE CAPITAL PLACE 21 LUARD ROAD WAN CHAI, Hong Kong
Manufacturer:	VTIN TECHNOLOGY Co.,Limited
Address of Manufacturer:	UNIT D 16/F ONE CAPITAL PLACE 21 LUARD ROAD WAN CHAI, Hong Kong

4.2 General Description of EUT

Product Name:	wireless mouse
Test Model No.:	PC254A
Trade Mark:	VICTSING
EUT Supports Radios application:	Bluetooth V5.0(BLE)+Bluetooth V3.0+2.4G

4.3 Product Specification subjective to this standard

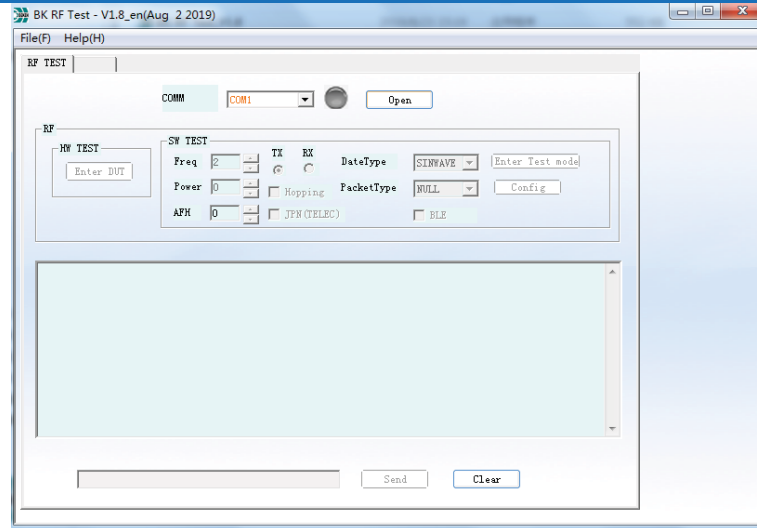
Radio function:	Bluetooth V3.0
Operation Frequency:	2402-2480MHz
Hardware Version:	V2.0
Software Version:	V1.8
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Modulation Type:	GFSK, $\pi/4$ DQPSK, 8DPSK
Transfer Rate:	1Mbps/2Mbps/3Mbps
Number of Channel:	79
Hopping Channel Type:	Adaptive Frequency Hopping systems
Test Power Grade:	Power level: 2
Test Software of EUT:	V1.8 (For details, refer to the software interface on page 7.)
Product Type:	<input type="checkbox"/> Mobile <input checked="" type="checkbox"/> Portable <input type="checkbox"/> Fix Location
Antenna Type:	PCB antenna
Antenna Gain:	0dBi
EUT Power Supply:	battery: 1.5V

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
0	2402MHz	20	2422MHz	40	2442MHz	60	2462MHz
1	2403MHz	21	2423MHz	41	2443MHz	61	2463MHz
2	2404MHz	22	2424MHz	42	2444MHz	62	2464MHz
3	2405MHz	23	2425MHz	43	2445MHz	63	2465MHz
4	2406MHz	24	2426MHz	44	2446MHz	64	2466MHz
5	2407MHz	25	2427MHz	45	2447MHz	65	2467MHz
6	2408MHz	26	2428MHz	46	2448MHz	66	2468MHz
7	2409MHz	27	2429MHz	47	2449MHz	67	2469MHz
8	2410MHz	28	2430MHz	48	2450MHz	68	2470MHz
9	2411MHz	29	2431MHz	49	2451MHz	69	2471MHz
10	2412MHz	30	2432MHz	50	2452MHz	70	2472MHz
11	2413MHz	31	2433MHz	51	2453MHz	71	2473MHz
12	2414MHz	32	2434MHz	52	2454MHz	72	2474MHz
13	2415MHz	33	2435MHz	53	2455MHz	73	2475MHz
14	2416MHz	34	2436MHz	54	2456MHz	74	2476MHz
15	2417MHz	35	2437MHz	55	2457MHz	75	2477MHz
16	2418MHz	36	2438MHz	56	2458MHz	76	2478MHz
17	2419MHz	37	2439MHz	57	2459MHz	77	2479MHz
18	2420MHz	38	2440MHz	58	2460MHz	78	2480MHz
19	2421MHz	39	2441MHz	59	2461MHz		

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The Lowest channel	2402MHz
The Middle channel	2441MHz
The Highest channel	2480MHz



4.4 Test Environment

Operating Environment:	
Radiated Emission	
Temperature:	25.4 °C
Humidity:	52 % RH
Atmospheric Pressure:	992mbar
RF item test (RF test room)	
Temperature:	26.7.5 °C
Humidity:	57 % RH
Atmospheric Pressure:	992mbar
Test Mode:	Use test software to set the lowest frequency, the middle frequency and the highest frequency keep transmitting of the EUT. Note: In the process of transmitting of EUT, the duty cycle >98%.

4.5 Description of Support Units

The EUT has been tested with associated equipment below.

Description	Manufacturer	Model No.	Remark	FCC certification
PC	Lenovo	ThinkPad E450C	Provide by lab	FCC ID
AC/DC Adapter	Lenovo	ADLX65NLC3A	Provide by lab	FCC SDOC

4.6 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 within the calibration limits of the equipment and facilities.

The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the **Shenzhen Huaxia Testing Technology Co., Ltd.** quality system acc. to DIN EN 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.

Hereafter the best measurement capability for CQA laboratory is reported:

No.	Item	Uncertainty	Notes
1	Radiated Emission (Below 1GHz)	5.12dB	(1)
2	Radiated Emission (Above 1GHz)	4.60dB	(1)
3	Conducted Disturbance (0.15~30MHz)	3.34dB	(1)
4	Radio Frequency	3×10^{-8}	(1)
5	Duty cycle	0.6 %.	(1)
6	Occupied Bandwidth	1.1%	(1)
7	RF conducted power	0.86dB	(1)
8	RF power density	0.74	(1)
9	Conducted Spurious emissions	0.86dB	(1)
10	Temperature test	0.8°C	(1)
11	Humidity test	2.0%	(1)
12	Supply voltages	0.5 %.	(1)
13	Frequency Error	5.5 Hz	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

4.7 Test Facility

Shenzhen Huaxia Testing Technology Co., Ltd,

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua District, Shenzhen, China

The test facility is recognized, certified, or accredited by the following organizations:

- **IC Registration No.: 22984-1**

The 3m Semi-anechoic chamber of Shenzhen Huaxia Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

The test facility is recognized, certified, or accredited by the following organizations:

- **CNAS (No. CNAS L5785)**

CNAS has accredited Shenzhen Huaxia Testing Technology Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

- **A2LA (Certificate No. 4742.01)**

Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4742.01.

- **FCC Registration No.: 522263**

Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.:522263

4.9 Deviation from Standards

None.

4.10 Other Information Requested by the Customer

None.

4.11 Equipment List

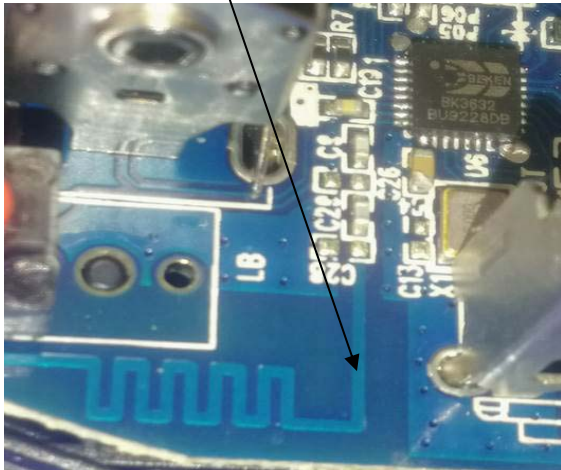
Test Equipment	Manufacturer	Model No.	Instrument No.	Calibration Date	Calibration Due Date
EMI Test Receiver	R&S	ESR7	CQA-005	2018/9/26	2019/9/25
Spectrum analyzer	R&S	FSU26	CQA-038	2018/10/28	2018/10/27
Spectrum analyzer	keysight	N9020A	CQA-105	2018/10/28	2019/10/27
Preamplifier	MITEQ	AFS4-00010300-18-10P-4	CQA-035	2018/9/26	2019/9/25
Preamplifier	MITEQ	AMF-6D-02001800-29-20P	CQA-036	2018/11/2	2019/11/1
Loop antenna	Schwarzbeck	FMZB1516	CQA-087	2018/10/28	2020/10/27
Bilog Antenna	R&S	HL562	CQA-011	2018/9/26	2020/9/25
Horn Antenna	R&S	HF906	CQA-012	2018/9/26	2020/9/25
Horn Antenna	Schwarzbeck	BBHA 9170	CQA-088	2018/9/26	2020/9/25
Coaxial Cable (Above 1GHz)	CQA	N/A	C019	2018/9/26	2019/9/25
Coaxial Cable (Below 1GHz)	CQA	N/A	C020	2018/9/26	2019/9/25
Antenna Connector	CQA	RFC-01	CQA-080	2018/9/26	2019/9/25
RF cable(9KHz~40GHz)	CQA	RF-01	CQA-079	2018/9/26	2019/9/25
Power divider	MIDWEST	PWD-2533-02-SMA-79	CQA-067	2018/9/26	2019/9/25
EMI Test Receiver	R&S	ESPI3	CQA-013	2018/9/26	2019/9/25
LISN	R&S	ENV216	CQA-003	2018/11/5	2019/11/4
Coaxial cable	CQA	N/A	CQA-C009	2018/9/26	2019/9/25

Note:

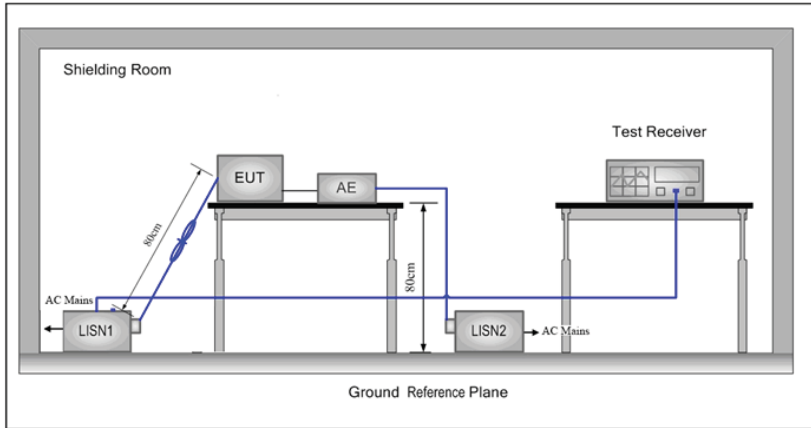
The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

6. Test results and Measurement Data

5.1. Antenna Requirement

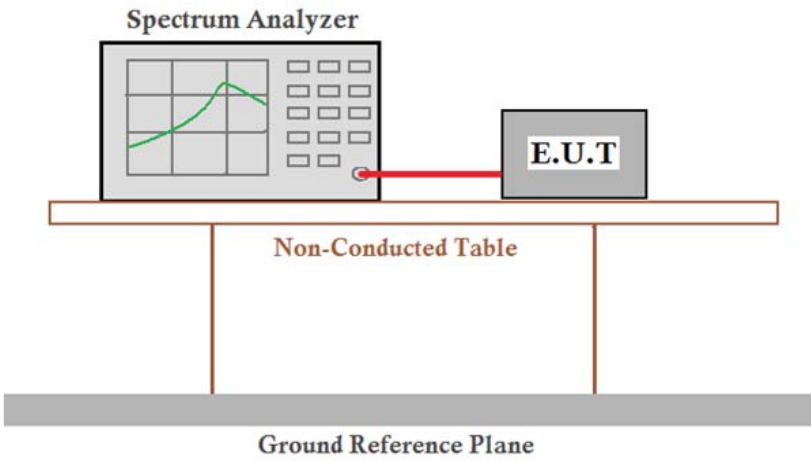
Standard requirement:	47 CFR Part 15C Section 15.203 /247(c)
<p>15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses 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.</p> <p>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.</p>	
EUT Antenna:	<p>PCB ANTENNA</p> 
The antenna is integral antenna. The best case gain of the antenna is 0dBi.	

5.2. Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.207		
Test Method:	ANSI C63.10: 2013		
Test Frequency Range:	150kHz to 30MHz		
Limit:	Frequency range (MHz)	Limit (dBuV)	
		Quasi-peak	Average
	0.15-0.5	66 to 56*	56 to 46*
	0.5-5	56	46
	5-30	60	50
* Decreases with the logarithm of the frequency.			
Test Procedure:	<ol style="list-style-type: none"> 1) The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a $50\Omega/50\mu\text{H} + 5\Omega$ linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement. 		
Test Setup:			
Test Mode:	N/A		
Test Results:	N/A		

Not application to this device

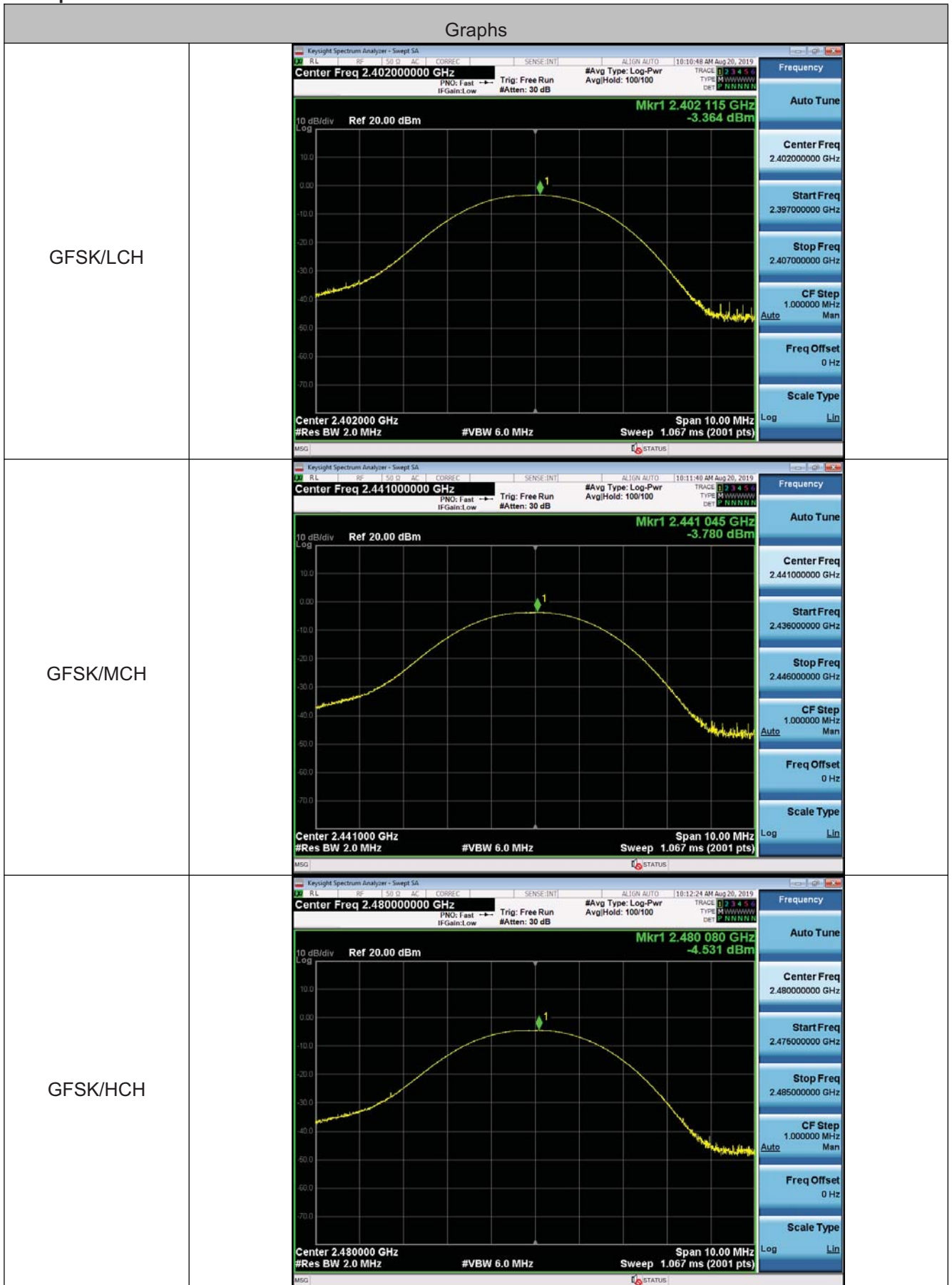
5.3. Conducted Peak Output Power


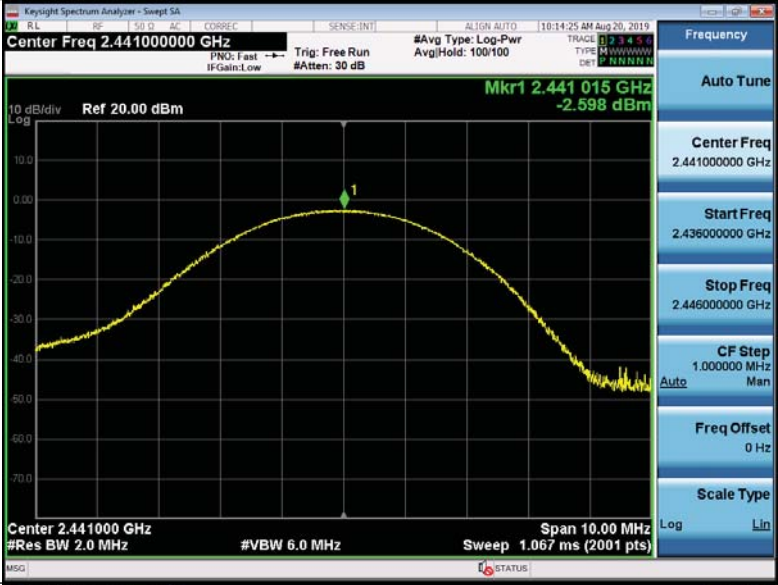

Test Requirement:	47 CFR Part 15C Section 15.247 (b)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	 <p>Remark: Offset=Cable loss+ attenuation factor.</p>
Limit:	21dBm
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type. Only the worst case is recorded in the report.
Test Results:	Pass




Measurement Data

GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-3.364	21dBm	Pass
Middle	-3.780	21dBm	Pass
Highest	-4.531	21dBm	Pass
$\pi/4$ DQPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-2.259	21dBm	Pass
Middle	-2.598	21dBm	Pass
Highest	-3.363	21dBm	Pass
8DPSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	-2.240	21dBm	Pass
Middle	-2.578	21dBm	Pass
Highest	-3.392	21dBm	Pass

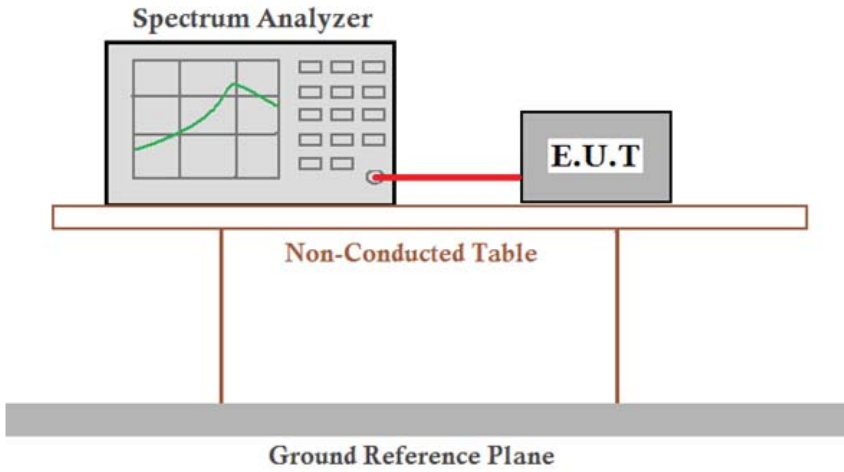
Test plot as follows:



<p>$\pi/4$DQPSK/LCH</p>	 <p>KeySight Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.402000000 GHz</p> <p>Ref 20.00 dBm</p> <p>Mkr1 2.401990 GHz -2.259 dBm</p> <p>Center 2.402000 GHz</p> <p>#Res BW 2.0 MHz</p> <p>#VBW 6.0 MHz</p> <p>Span 10.00 MHz</p> <p>Sweep 1.067 ms (2001 pts)</p>	
<p>$\pi/4$DQPSK/MCH</p>	 <p>KeySight Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.441000000 GHz</p> <p>Ref 20.00 dBm</p> <p>Mkr1 2.441015 GHz -2.598 dBm</p> <p>Center 2.441000 GHz</p> <p>#Res BW 2.0 MHz</p> <p>#VBW 6.0 MHz</p> <p>Span 10.00 MHz</p> <p>Sweep 1.067 ms (2001 pts)</p>	
<p>$\pi/4$DQPSK/HCH</p>	 <p>KeySight Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.480000000 GHz</p> <p>Ref 20.00 dBm</p> <p>Mkr1 2.480150 GHz -3.363 dBm</p> <p>Center 2.480000 GHz</p> <p>#Res BW 2.0 MHz</p> <p>#VBW 6.0 MHz</p> <p>Span 10.00 MHz</p> <p>Sweep 1.067 ms (2001 pts)</p>	

8DPSK/LCH	 <p>KeySight Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.402000000 GHz</p> <p>Ref 20.00 dBm</p> <p>Mkr1 2.402 075 GHz -2.240 dBm</p> <p>Center 2.402000 GHz</p> <p>#Res BW 2.0 MHz</p> <p>#VBW 6.0 MHz</p> <p>Span 10.00 MHz</p> <p>Sweep 1.067 ms (2001 pts)</p>	
8DPSK /MCH	 <p>KeySight Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.441000000 GHz</p> <p>Ref 20.00 dBm</p> <p>Mkr1 2.441 045 GHz -2.578 dBm</p> <p>Center 2.441000 GHz</p> <p>#Res BW 2.0 MHz</p> <p>#VBW 6.0 MHz</p> <p>Span 10.00 MHz</p> <p>Sweep 1.067 ms (2001 pts)</p>	
8DPSK /HCH	 <p>KeySight Spectrum Analyzer - Swept SA</p> <p>Center Freq 2.480000000 GHz</p> <p>Ref 20.00 dBm</p> <p>Mkr1 2.480 215 GHz -3.392 dBm</p> <p>Center 2.480000 GHz</p> <p>#Res BW 2.0 MHz</p> <p>#VBW 6.0 MHz</p> <p>Span 10.00 MHz</p> <p>Sweep 1.067 ms (2001 pts)</p>	

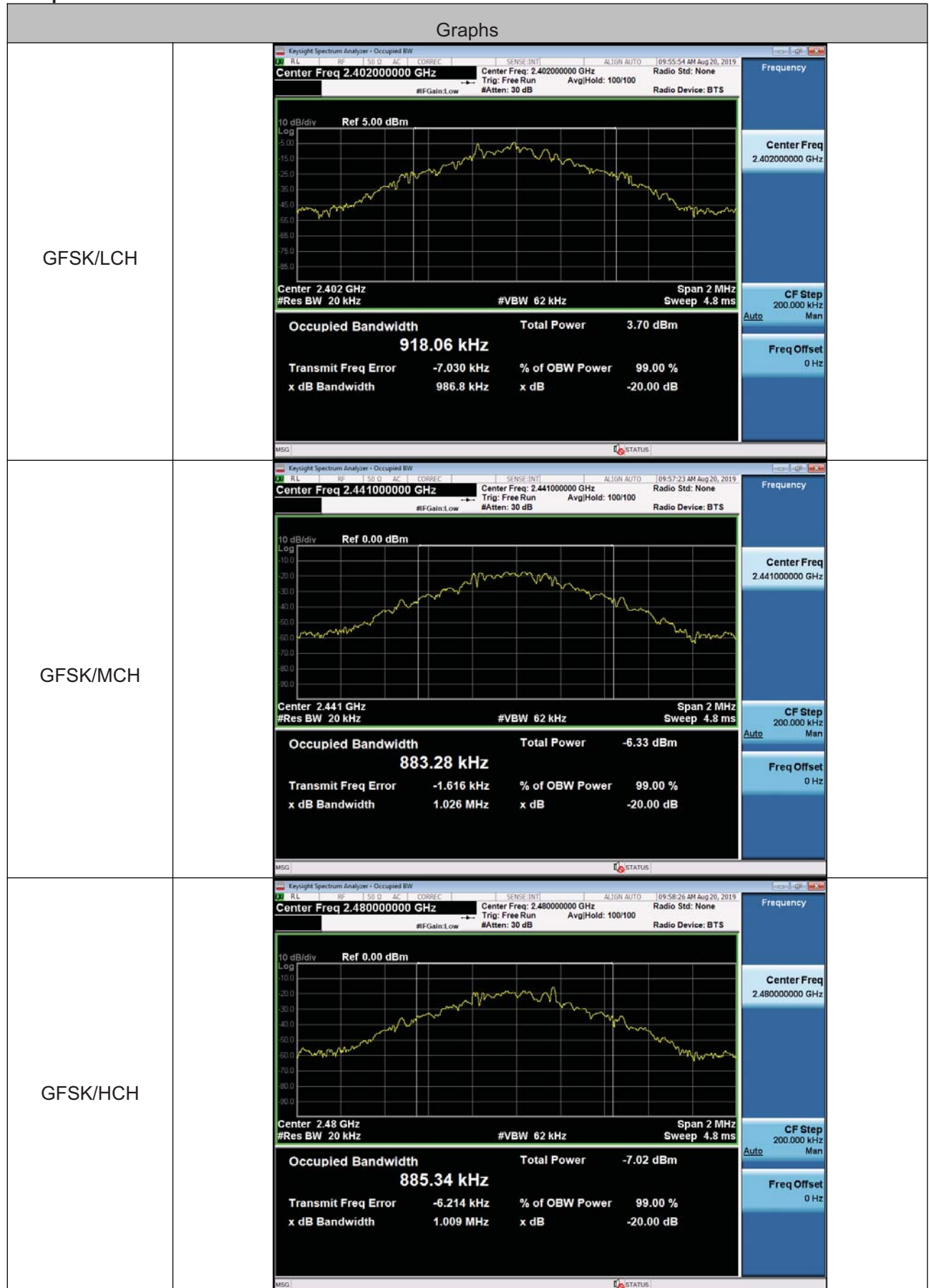
5.4. 20dB Occupy Bandwidth

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	 <p>Remark: Offset=Cable loss+ attenuation factor.</p>
Limit:	NA
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type. Only the worst case is recorded in the report.
Test Results:	Pass

Measurement Data

Test channel	20dB Occupy Bandwidth (MHz)		
	GFSK	$\pi/4$ DQPSK	8DPSK
Lowest	0.987	1.181	1.172
Middle	1.026	1.310	1.178
Highest	1.009	1.197	1.177

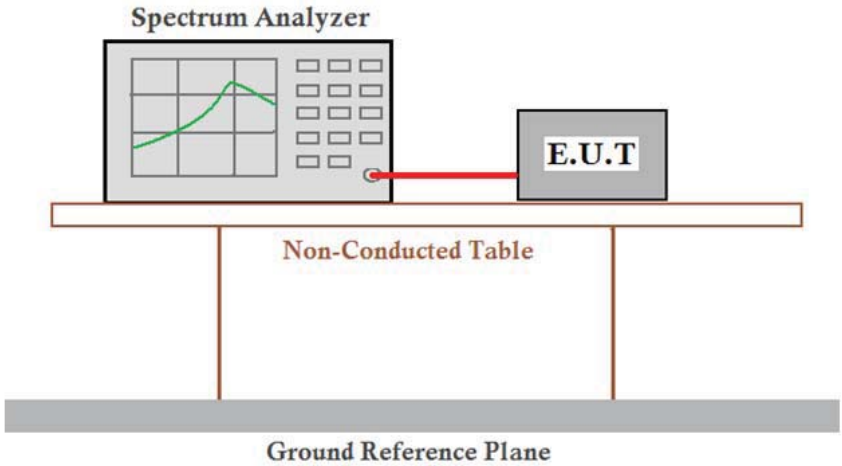
Test plot as follows:



<p>$\pi/4$DQPSK/LCH</p>	 <p>KeySight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.402000000 GHz</p> <p>Center Freq: 2.402000000 GHz</p> <p>Trig: Free Run</p> <p>Avg/Hold: 100/100</p> <p>Radio Std: None</p> <p>Radio Device: BTS</p> <p>Ref 5.00 dBm</p> <p>Center 2.402 GHz</p> <p>#Res BW 20 kHz</p> <p>#VBW 62 kHz</p> <p>Span 2 MHz</p> <p>Sweep 4.8 ms</p> <p>Occupied Bandwidth 1.1685 MHz</p> <p>Total Power 2.93 dBm</p> <p>Transmit Freq Error -27.283 kHz</p> <p>% of OBW Power 99.00 %</p> <p>x dB Bandwidth 1.181 MHz</p> <p>x dB -20.00 dB</p> <p>Frequency</p> <p>Center Freq 2.402000000 GHz</p> <p>CF Step 200.000 kHz</p> <p>Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>$\pi/4$DQPSK/MCH</p>	 <p>KeySight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.441000000 GHz</p> <p>Center Freq: 2.441000000 GHz</p> <p>Trig: Free Run</p> <p>Avg/Hold: 100/100</p> <p>Radio Std: None</p> <p>Radio Device: BTS</p> <p>Ref 10.00 dBm</p> <p>Center 2.441 GHz</p> <p>#Res BW 20 kHz</p> <p>#VBW 62 kHz</p> <p>Span 2 MHz</p> <p>Sweep 4.8 ms</p> <p>Occupied Bandwidth 1.1841 MHz</p> <p>Total Power 1.77 dBm</p> <p>Transmit Freq Error -23.766 kHz</p> <p>% of OBW Power 99.00 %</p> <p>x dB Bandwidth 1.310 MHz</p> <p>x dB -20.00 dB</p> <p>Frequency</p> <p>Center Freq 2.441000000 GHz</p> <p>CF Step 200.000 kHz</p> <p>Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>$\pi/4$DQPSK/HCH</p>	 <p>KeySight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.480000000 GHz</p> <p>Center Freq: 2.480000000 GHz</p> <p>Trig: Free Run</p> <p>Avg/Hold: 100/100</p> <p>Radio Std: None</p> <p>Radio Device: BTS</p> <p>Ref 10.00 dBm</p> <p>Center 2.48 GHz</p> <p>#Res BW 20 kHz</p> <p>#VBW 62 kHz</p> <p>Span 2 MHz</p> <p>Sweep 4.8 ms</p> <p>Occupied Bandwidth 1.1673 MHz</p> <p>Total Power 1.93 dBm</p> <p>Transmit Freq Error -27.845 kHz</p> <p>% of OBW Power 99.00 %</p> <p>x dB Bandwidth 1.197 MHz</p> <p>x dB -20.00 dB</p> <p>Frequency</p> <p>Center Freq 2.480000000 GHz</p> <p>CF Step 200.000 kHz</p> <p>Auto Man</p> <p>Freq Offset 0 Hz</p>

8DPSK/LCH	 <p>KeySight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.402000000 GHz</p> <p>Center Freq: 2.402000000 GHz</p> <p>Trig: Free Run</p> <p>Avg/Hold: 100/100</p> <p>Radio Std: None</p> <p>Radio Device: BTS</p> <p>#F Gain: Low</p> <p>#Atten: 30 dB</p> <p>10 dB/div</p> <p>Ref 0.00 dBm</p> <p>Center 2.402 GHz</p> <p>#Res BW 20 kHz</p> <p>#VBW 62 kHz</p> <p>Span 2 MHz</p> <p>Sweep 4.8 ms</p> <p>Occupied Bandwidth 1.1491 MHz</p> <p>Total Power 2.93 dBm</p> <p>Transmit Freq Error -34.114 kHz</p> <p>% of OBW Power 99.00 %</p> <p>x dB Bandwidth 1.172 MHz</p> <p>x dB -20.00 dB</p> <p>Frequency</p> <p>Center Freq 2.402000000 GHz</p> <p>CF Step 200.000 kHz</p> <p>Auto Man</p> <p>Freq Offset 0 Hz</p> <p>MSG STATUS</p>
8DPSK /MCH	 <p>KeySight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.441000000 GHz</p> <p>Center Freq: 2.441000000 GHz</p> <p>Trig: Free Run</p> <p>Avg/Hold: 100/100</p> <p>Radio Std: None</p> <p>Radio Device: BTS</p> <p>#F Gain: Low</p> <p>#Atten: 30 dB</p> <p>10 dB/div</p> <p>Ref 0.00 dBm</p> <p>Center 2.441 GHz</p> <p>#Res BW 20 kHz</p> <p>#VBW 62 kHz</p> <p>Span 2 MHz</p> <p>Sweep 4.8 ms</p> <p>Occupied Bandwidth 1.1539 MHz</p> <p>Total Power 2.44 dBm</p> <p>Transmit Freq Error -33.071 kHz</p> <p>% of OBW Power 99.00 %</p> <p>x dB Bandwidth 1.178 MHz</p> <p>x dB -20.00 dB</p> <p>Frequency</p> <p>Center Freq 2.441000000 GHz</p> <p>CF Step 200.000 kHz</p> <p>Auto Man</p> <p>Freq Offset 0 Hz</p> <p>MSG STATUS</p>
8DPSK /HCH	 <p>KeySight Spectrum Analyzer - Occupied BW</p> <p>Center Freq 2.480000000 GHz</p> <p>Center Freq: 2.480000000 GHz</p> <p>Trig: Free Run</p> <p>Avg/Hold: 100/100</p> <p>Radio Std: None</p> <p>Radio Device: BTS</p> <p>#F Gain: Low</p> <p>#Atten: 30 dB</p> <p>10 dB/div</p> <p>Ref 0.00 dBm</p> <p>Center 2.48 GHz</p> <p>#Res BW 20 kHz</p> <p>#VBW 62 kHz</p> <p>Span 2 MHz</p> <p>Sweep 4.8 ms</p> <p>Occupied Bandwidth 1.1556 MHz</p> <p>Total Power 1.67 dBm</p> <p>Transmit Freq Error -31.753 kHz</p> <p>% of OBW Power 99.00 %</p> <p>x dB Bandwidth 1.177 MHz</p> <p>x dB -20.00 dB</p> <p>Frequency</p> <p>Center Freq 2.480000000 GHz</p> <p>CF Step 200.000 kHz</p> <p>Auto Man</p> <p>Freq Offset 0 Hz</p> <p>MSG STATUS</p>

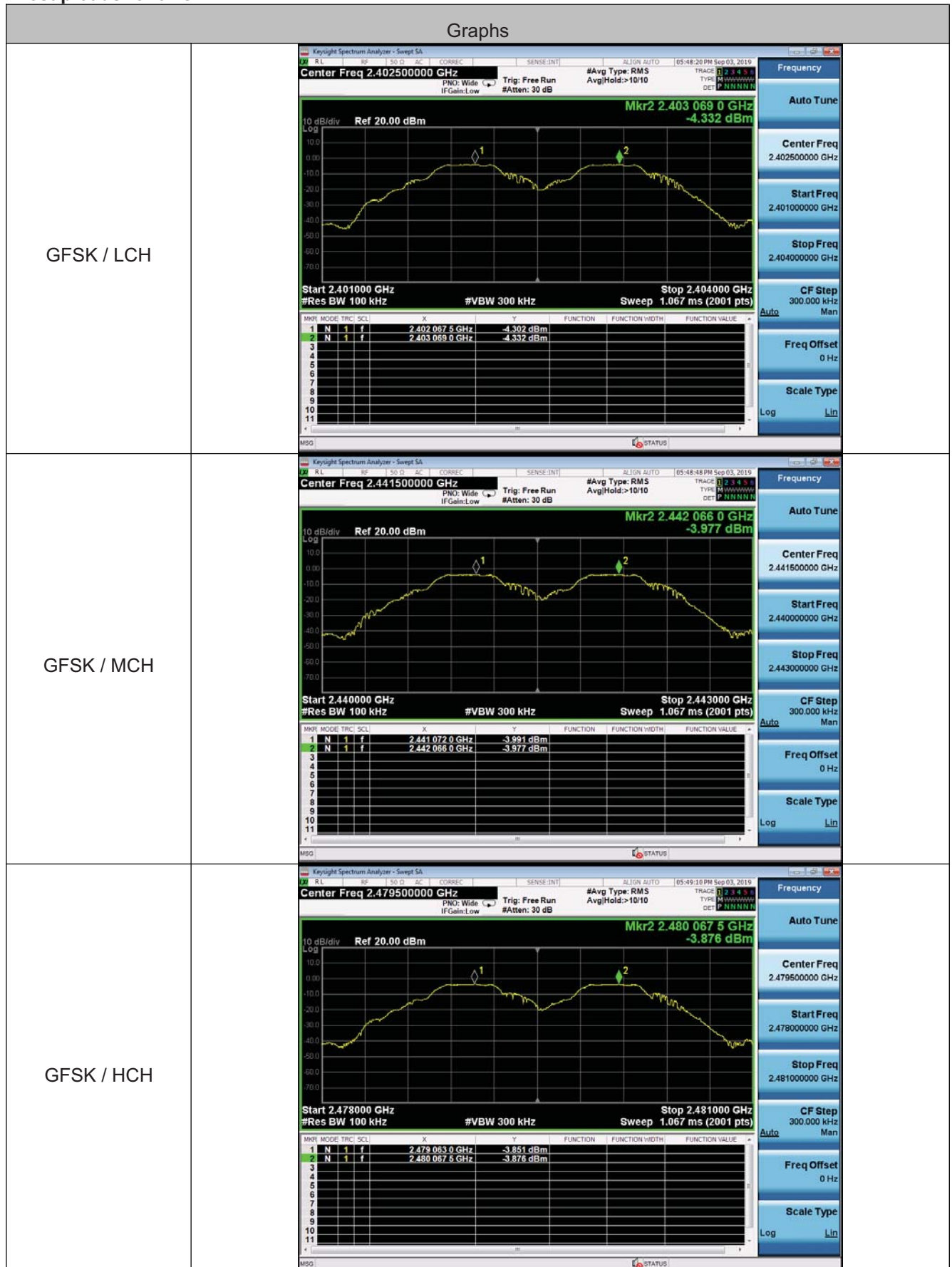
5.5. Frequencies Separation

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	 <p>Remark: Offset=Cable loss+ attenuation factor.</p>
Limit:	2/3 of the 20dB bandwidth
	Remark: the transmission power is less than 0.125W.
Exploratory Test Mode:	Hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type. Only the worst case is recorded in the report.
Test Results:	Pass

Modulation	Channel	Channel Separation (MHz)	Limit(MHz)	Result
GFSK	CH00	1.002	25KHz or 2/3*20dB bandwidth	Pass
	CH01			
	CH39	0.994		
	CH40			
	CH77	1.004		
	CH78			
pi/4DQPSK	CH00	1.322	25KHz or 2/3*20dB bandwidth	Pass
	CH01			
	CH39	1.148		

	CH40	1.006		
	CH77			
	CH78			
8DPSK	CH00	1.003	25KHz or 2/3*20dB bandwidth	Pass
	CH01			
	CH39	1.000		
	CH40			
	CH77	1.001		
	CH78			

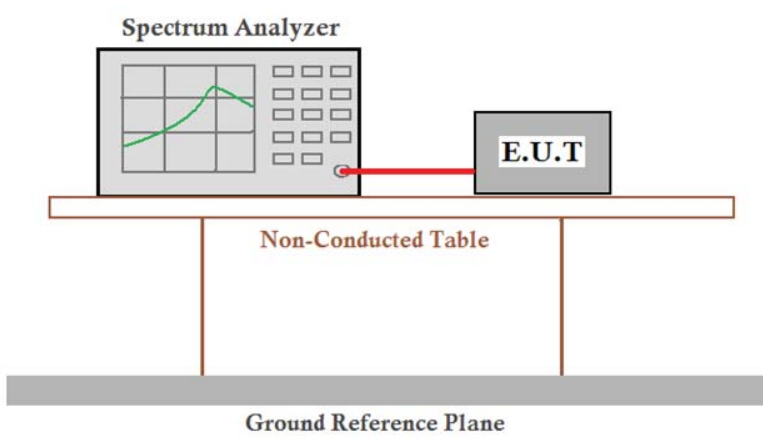
Test plot as follows:



<p>$\pi/4$DQPSK / LCH</p>	
<p>$\pi/4$DQPSK / MCH</p>	
<p>$\pi/4$DQPSK / HCH</p>	

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




5.6. Hopping Channel Number

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	 <p>Remark: Offset=Cable loss+ attenuation factor.</p>
Limit:	At least 15 channels
Exploratory Test Mode:	hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type. Only the worst case is recorded in the report.
Test Results:	Pass

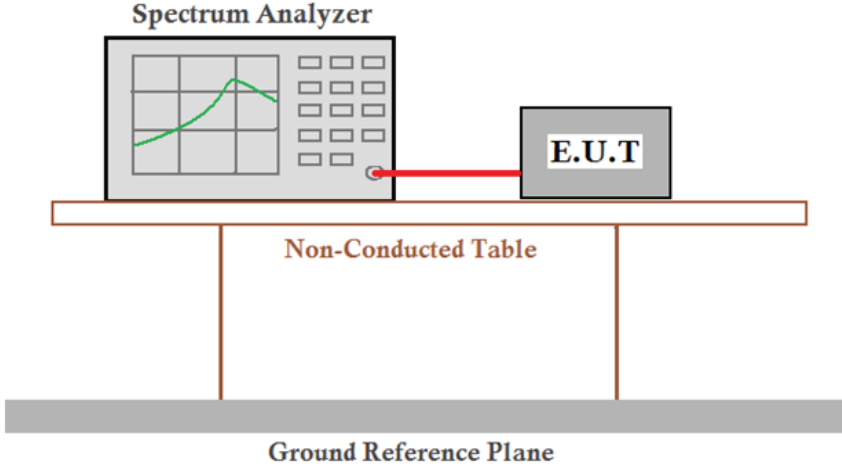
Measurement Data

Mode	Hopping channel numbers	Limit
GFSK	79	≥ 15
$\pi/4$ DQPSK	79	≥ 15
8DPSK	79	≥ 15

Test plot as follows:

Graphs	
GFSK/Hop	 <p>Key parameters for GFSK/Hop:</p> <ul style="list-style-type: none"> Center Freq: 2.441750000 GHz Start Freq: 2.400000000 GHz Stop Freq: 2.483500000 GHz CF Step: 8.350000 MHz Freq Offset: 0 Hz Scale Type: Log Ref: 20.00 dBm Mkr2: 2.480 00 GHz, -4.424 dBm Start: 2.40000 GHz, #Res BW 100 kHz #VBW 300 kHz Sweep: 8.000 ms (2001 pts)
$\pi/4$ DQPSK/Hop	 <p>Key parameters for $\pi/4$DQPSK/Hop:</p> <ul style="list-style-type: none"> Center Freq: 2.441750000 GHz Start Freq: 2.400000000 GHz Stop Freq: 2.483500000 GHz CF Step: 8.350000 MHz Freq Offset: 0 Hz Scale Type: Log Ref: 20.00 dBm Mkr2: 2.480 00 GHz, -9.812 dBm Start: 2.40000 GHz, #Res BW 100 kHz #VBW 300 kHz Sweep: 8.000 ms (2001 pts)
8DPSK/Hop	 <p>Key parameters for 8DPSK/Hop:</p> <ul style="list-style-type: none"> Center Freq: 2.441750000 GHz Start Freq: 2.400000000 GHz Stop Freq: 2.483500000 GHz CF Step: 8.350000 MHz Freq Offset: 0 Hz Scale Type: Log Ref: 20.00 dBm Mkr2: 2.480 00 GHz, -4.412 dBm Start: 2.40000 GHz, #Res BW 100 kHz #VBW 300 kHz Sweep: 8.000 ms (2001 pts)

5.7. Dwell Time

Test Requirement:	47 CFR Part 15C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Test Setup:	 <p>Remark: Offset=Cable loss+ attenuation factor.</p>
Test Mode:	Hopping transmitting with all kind of modulation and all kind of data type.
Limit:	0.4 Second
Test Results:	Pass

Measurement Data

Mode	Packet	Channel	Burst Width [ms/hop/ch]	Dwell Time[ms]	Limit (ms)
GFSK	DH1	LCH	0.404	129.280	≤400
		MCH	0.406	129.920	≤400
		HCH	0.408	130.560	≤400
	DH3	LCH	1.656	264.960	≤400
		MCH	1.656	264.960	≤400
		HCH	1.660	265.600	≤400
	DH5	LCH	2.910	310.400	≤400
		MCH	2.905	309.867	≤400
		HCH	2.905	309.867	≤400
π/4DQPSK	2DH1	LCH	0.419	134.080	≤400
		MCH	0.419	134.080	≤400
		HCH	0.419	134.080	≤400
	2DH3	LCH	1.663	266.080	≤400
		MCH	1.671	267.360	≤400
		HCH	1.603	266.080	≤400
	2DH5	LCH	2.923	311.787	≤400

8DPSK		MCH	2.913	310.720	≤400
		HCH	2.923	311.787	≤400
	3DH1	LCH	0.419	134.080	≤400
		MCH	0.419	134.080	≤400
		HCH	0.415	132.800	≤400
	3DH3	LCH	1.663	266.080	≤400
		MCH	1.663	266.080	≤400
		HCH	1.662	265.920	≤400
	3DH5	LCH	2.922	311.680	≤400
		MCH	2.922	311.680	≤400
		HCH	2.927	312.213	≤400

Remark:

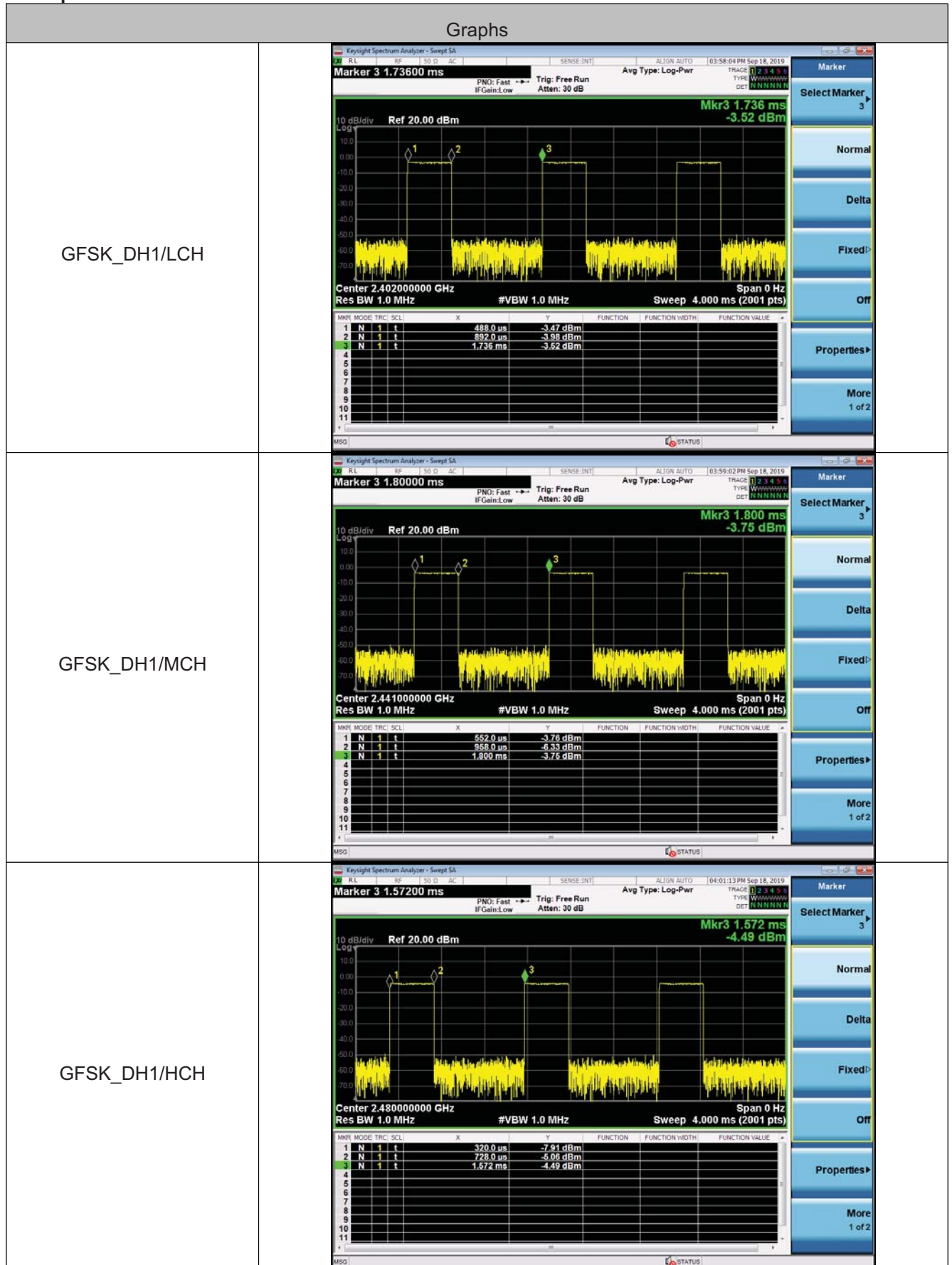
The test period: $T = 0.4 \text{ Second/Channel} \times 79 \text{ Channel} = 31.6 \text{ s}$

DH1/2DH1/3DH1 Dwell time = $\text{Burst Width}(\text{ms}) \times (1600 / (2 \times 79)) \times 31.6$

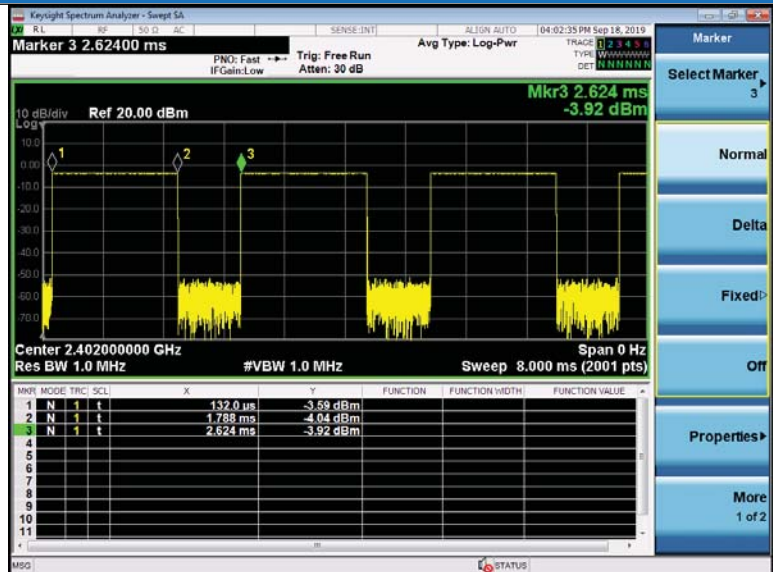
DH3/2DH3/3DH3 Dwell time = $\text{Burst Width}(\text{ms}) \times (1600 / (4 \times 79)) \times 31.6$

DH5/2DH5/3DH5 Dwell time = $\text{Burst Width}(\text{ms}) \times (1600 / (6 \times 79)) \times 31.6$

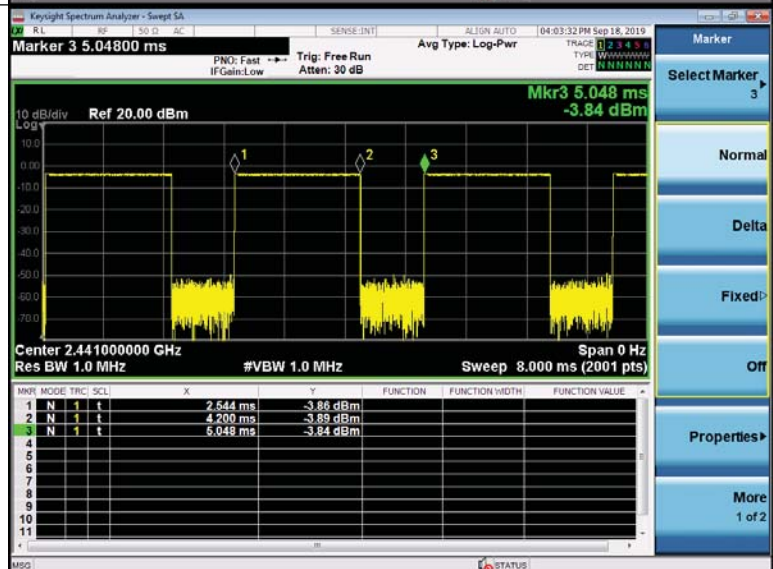
Test plot as follows:



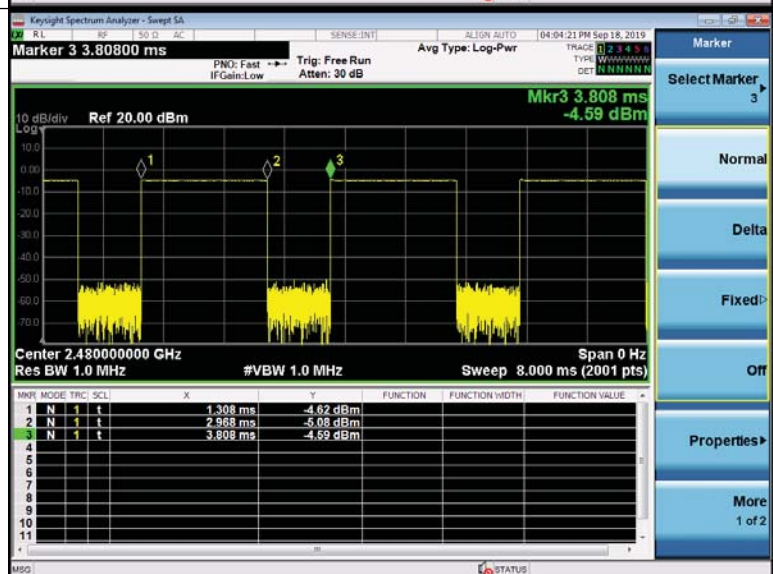
GFSK_DH3/LCH



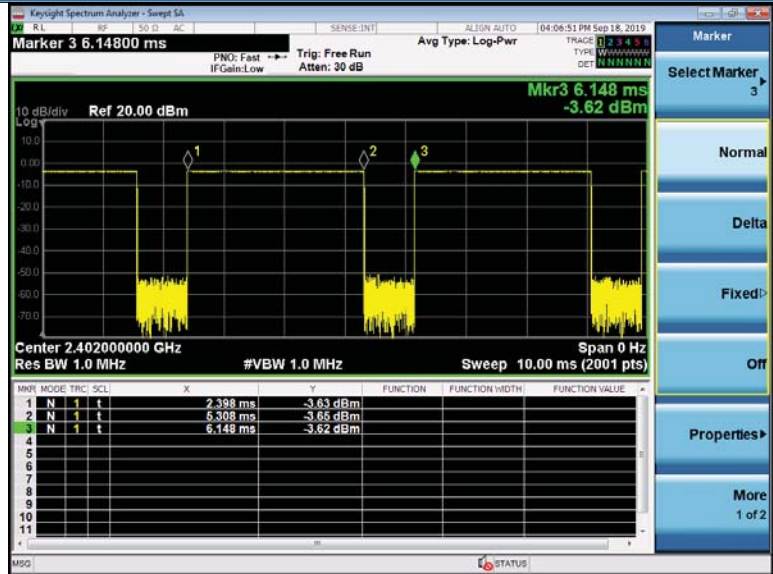
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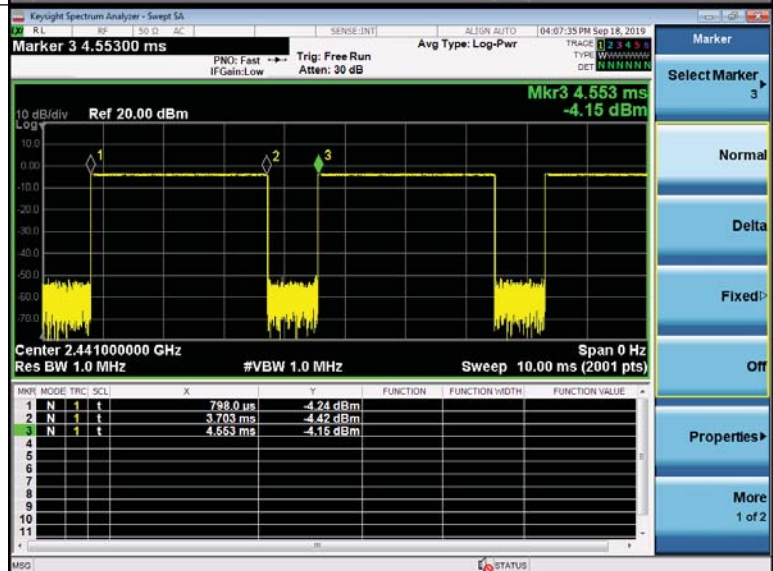
GFSK_DH3/HCH



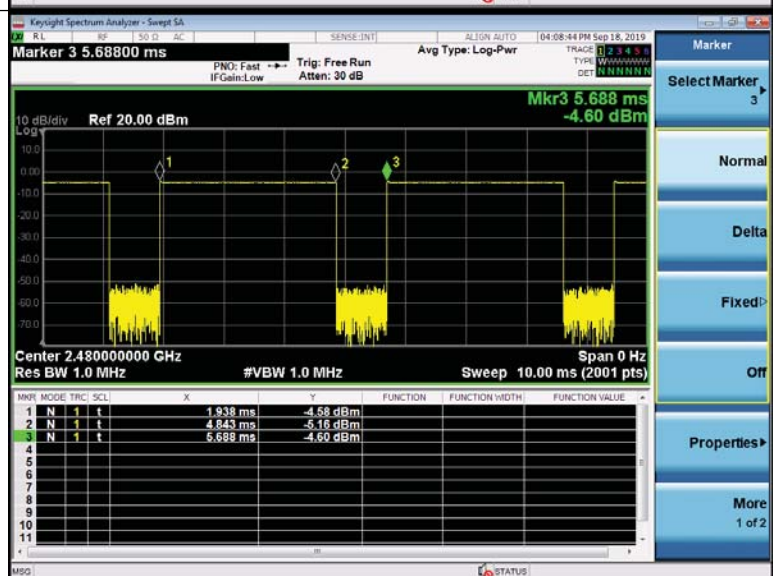
GFSK_DH5/LCH



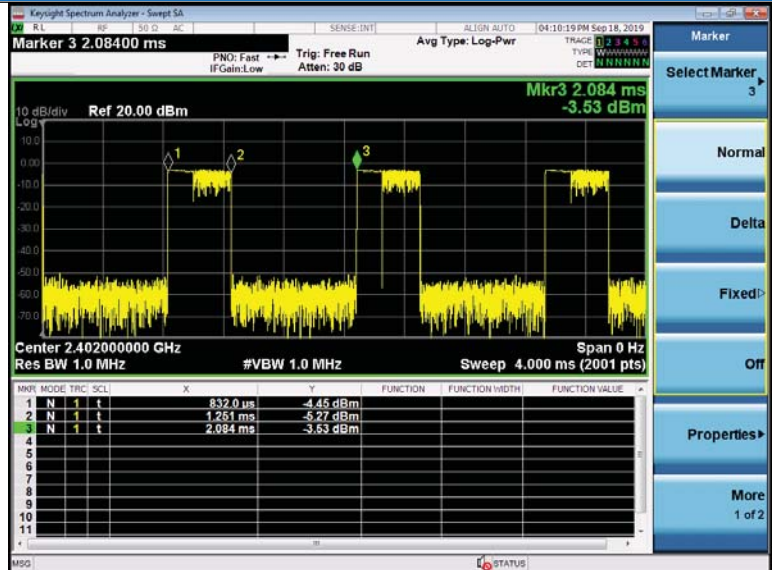
GFSK_DH5/MCH



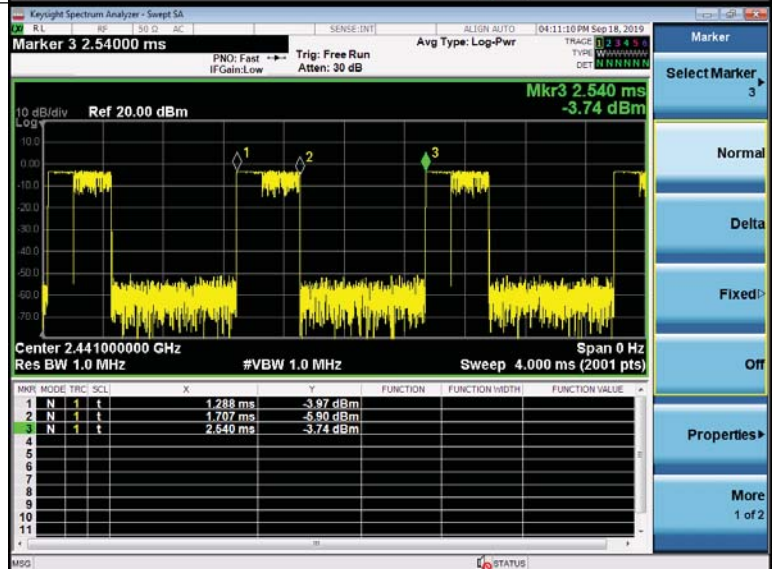
GFSK_DH5/HCH



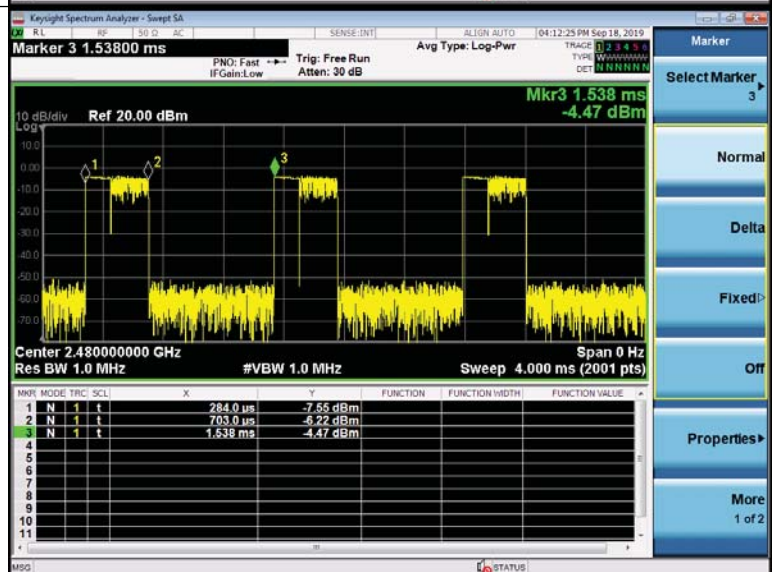
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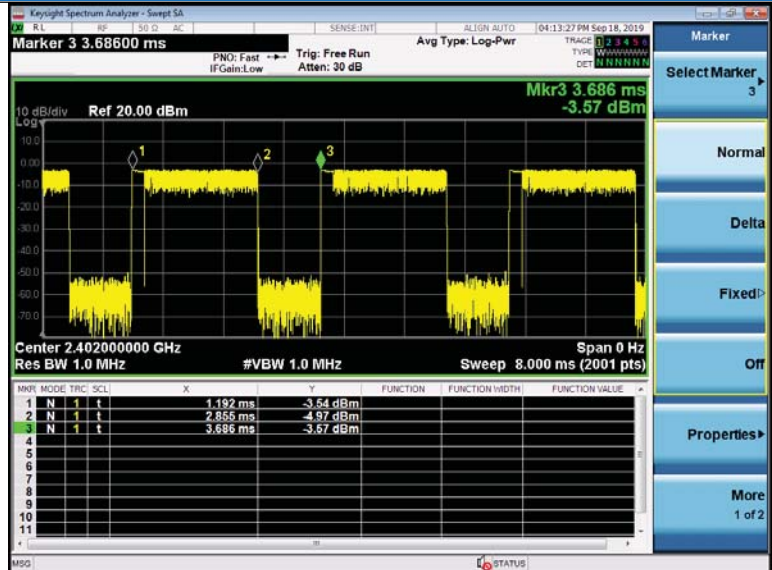
$\pi/4$ DQPSK_2DH1/MCH



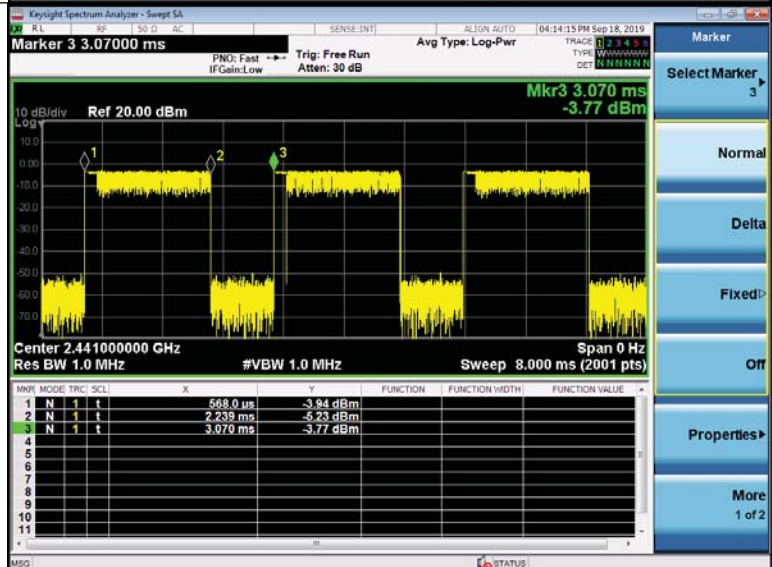
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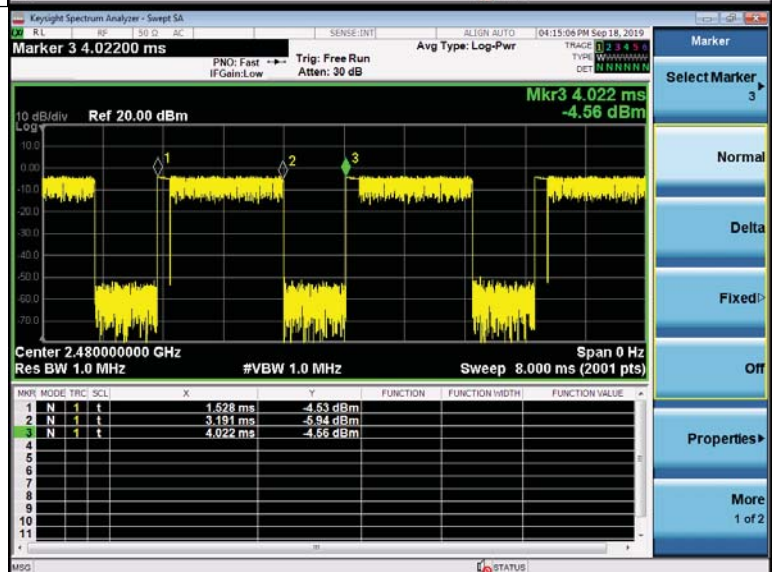
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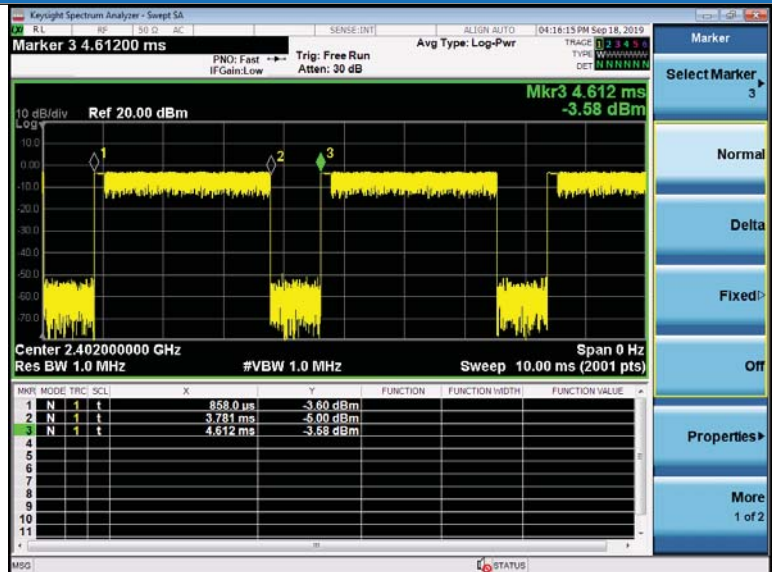
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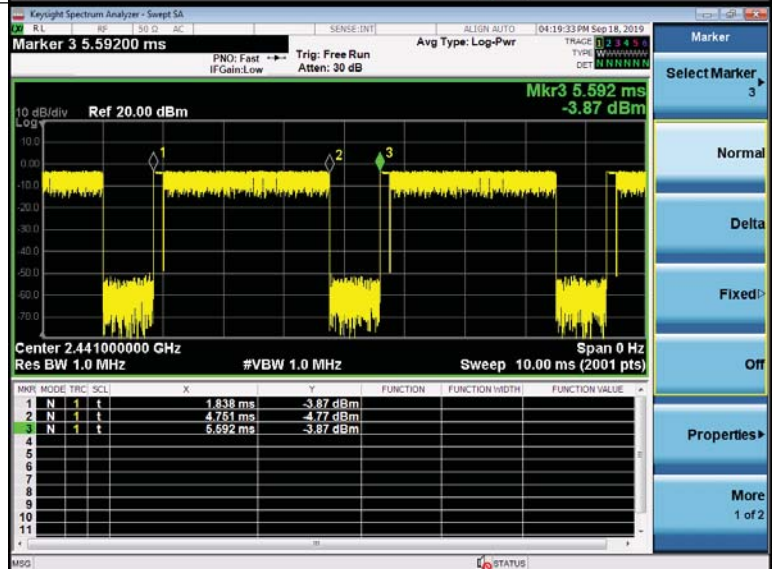
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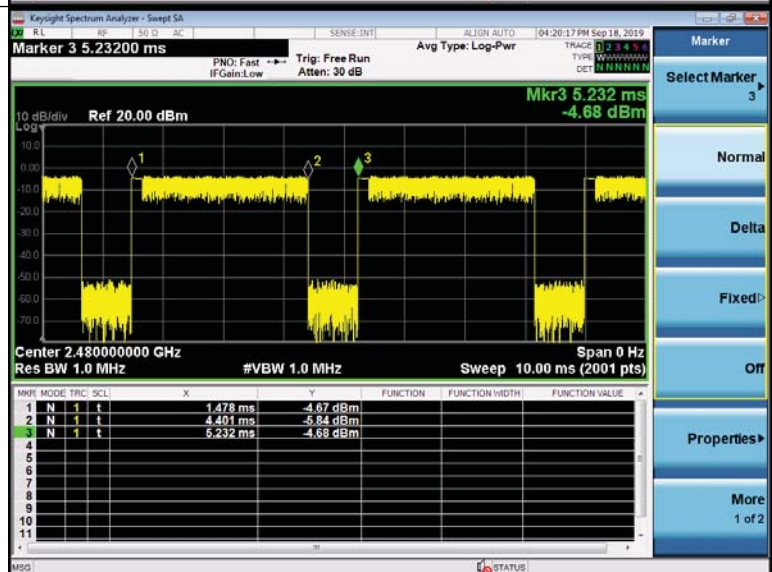
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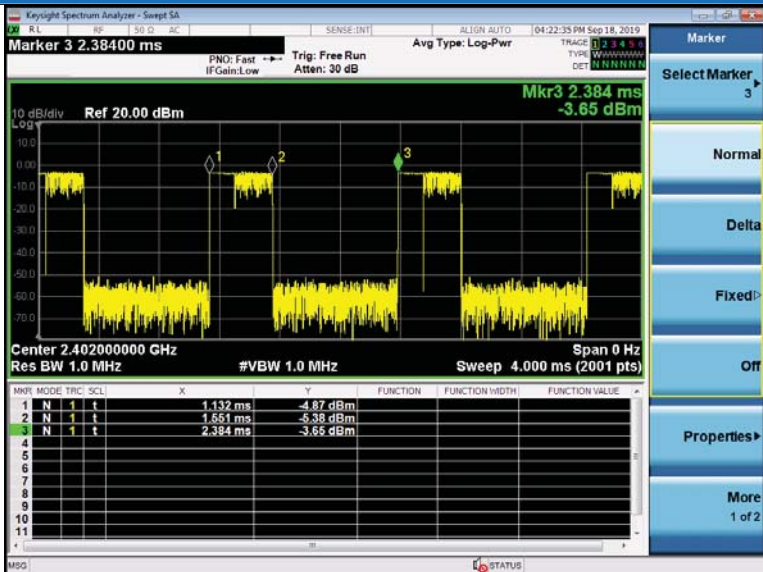



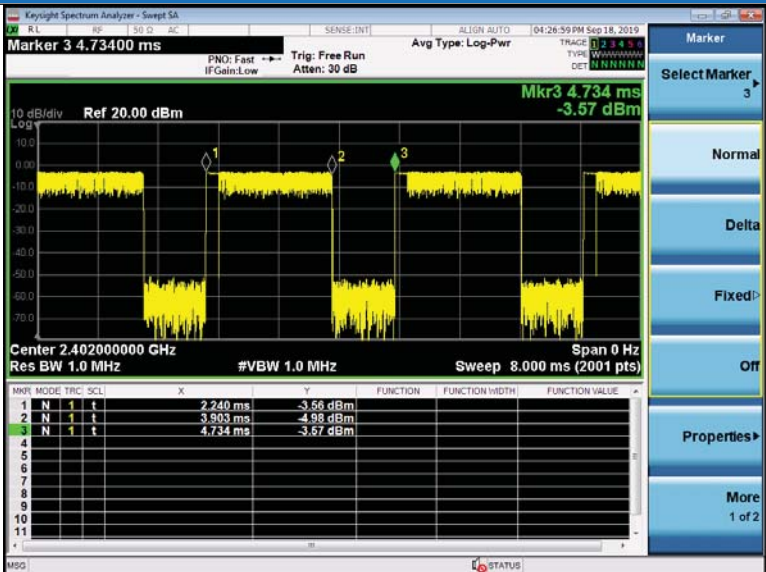
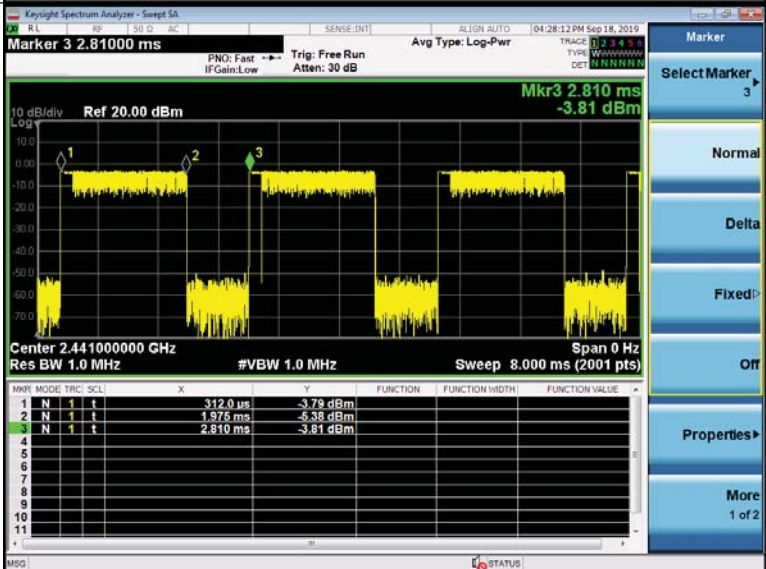
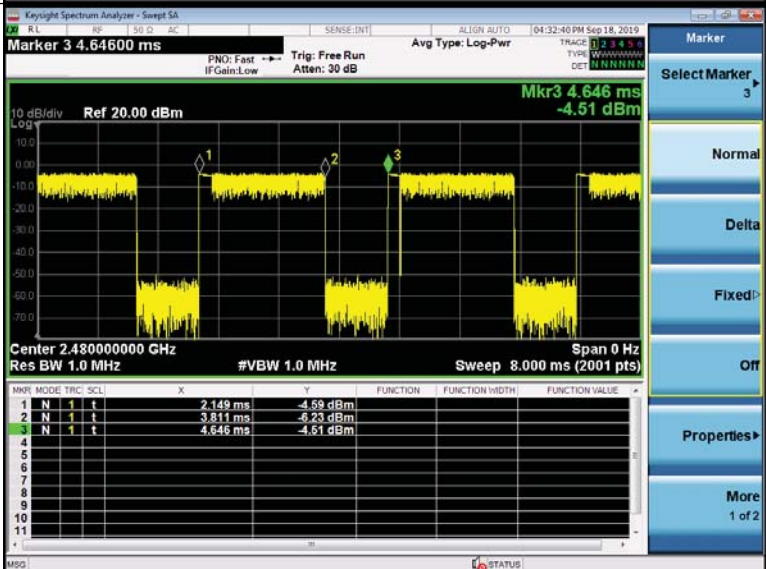
$\pi/4$ DQPSK_2DH5/MCH



$\pi/4$ DQPSK_2DH5/HCH

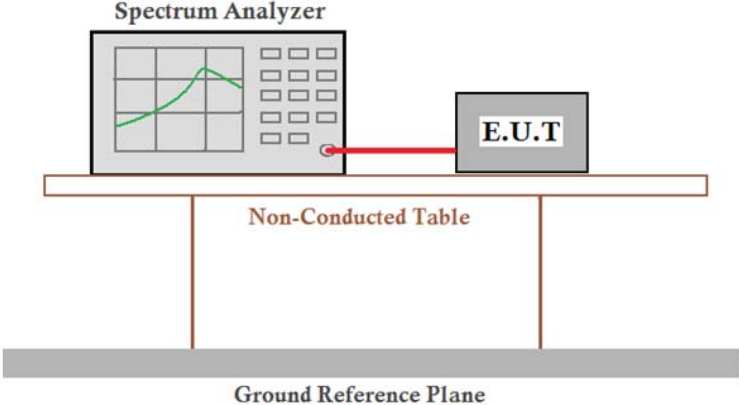


8DPSK_3DH1/LCH	 <p>Marker 3 2.38400 ms</p> <p>Ref 20.00 dBm</p> <p>Mkr3 2.384 ms -3.65 dBm</p> <p>Center 2.402000000 GHz Res BW 1.0 MHz #VBW 1.0 MHz Sweep 4.000 ms (2001 pts)</p> <table><thead><tr><th>MNPT</th><th>MODE</th><th>TRIG</th><th>SCL</th><th>X</th><th>Y</th><th>FUNCTION</th><th>FUNCTION WIDTH</th><th>FUNCTION VALUE</th></tr></thead><tbody><tr><td>1</td><td>N</td><td>1</td><td>t</td><td>1.132 ms</td><td>-4.87 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>t</td><td>1.651 ms</td><td>-5.38 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>t</td><td>2.384 ms</td><td>-3.65 dBm</td><td></td><td></td><td></td></tr></tbody></table>	MNPT	MODE	TRIG	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	t	1.132 ms	-4.87 dBm				2	N	1	t	1.651 ms	-5.38 dBm				3	N	1	t	2.384 ms	-3.65 dBm			
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8DPSK_3DH3/LCH	 <p>Marker 3 4.73400 ms</p> <p>Ref 20.00 dBm</p> <p>Mkr3 4.734 ms -3.57 dBm</p> <p>Center 2.402000000 GHz Res BW 1.0 MHz #VBW 1.0 MHz Sweep 8.000 ms (2001 pts)</p> <table><tr><th>MNPR</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>N</td><td>1</td><td>t</td><td>2.240 ms</td><td>-3.56 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>t</td><td>3.803 ms</td><td>-4.98 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td>N</td><td>1</td><td>t</td><td>4.734 ms</td><td>-3.57 dBm</td><td></td><td></td><td></td></tr></table>	MNPR	MODE	TRIG	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	t	2.240 ms	-3.56 dBm				2	N	1	t	3.803 ms	-4.98 dBm				3	N	1	t	4.734 ms	-3.57 dBm			
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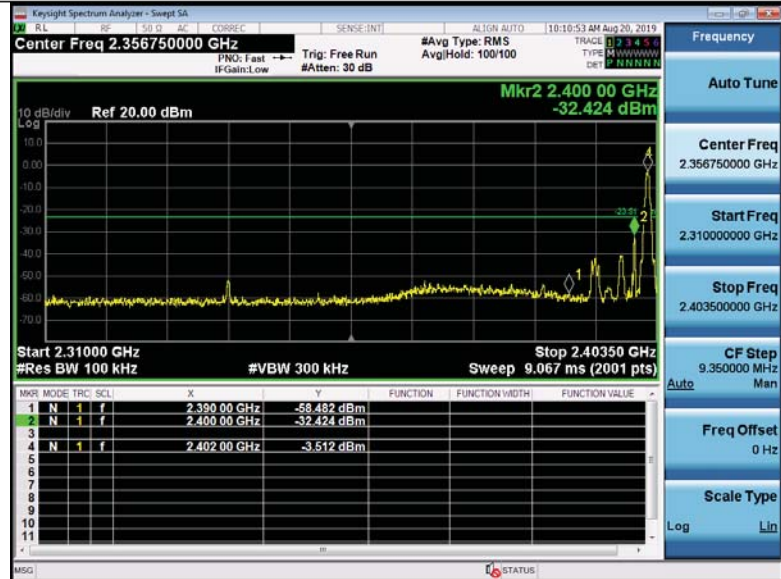
5.8. Band-edge for RF Conducted Emissions

Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Test Setup:	 <p>Remark: $Offset = \text{cable loss} + \text{attenuation factor}$.</p>
Limit:	In any 100kHz 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.
Exploratory Test Mode:	Hopping and Non-hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type. Only the worst case is recorded in the report.
Test Results:	Pass

Test plot as follows:

Graphs

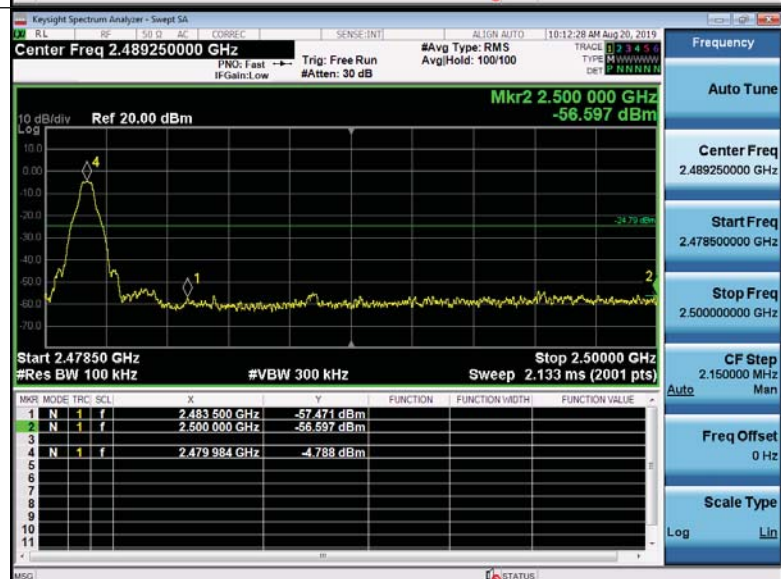
GFSK/LCH/No Hop



GFSK/LCH/Hop



GFSK/HCH/No Hop

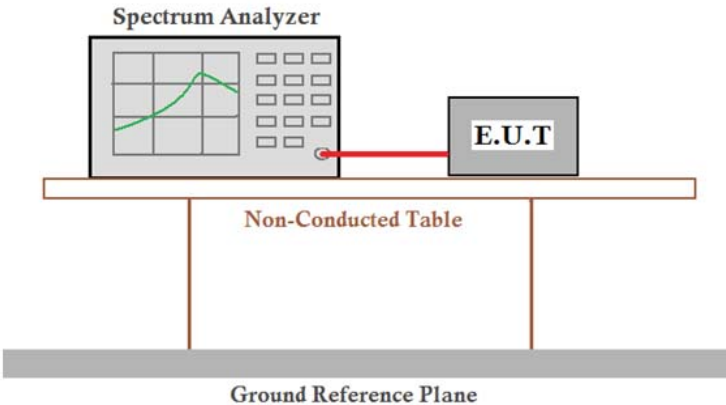


GFSK/HCH/Hop	<div><div><div>KeySight Spectrum Analyzer - Swept SA</div><div>SL 10.0 dB 20.000000 GHz 10.000000 MHz</div></div></div>
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$\pi/4$ DQPSK/HCH/No Hop	<div><div><div>KeySight Spectrum Analyzer - Swept SA</div><div>Center Freq 2.489250000 GHz</div><div>10 dB/div Ref 20.00 dBm</div><div>Mkr2 2.500 000 GHz -59.266 dBm</div><div>Start 2.47850 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 2.133 ms (2001 pts)</div><table><thead><tr><th>MNR</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></thead><tbody><tr><td>1</td><td>N</td><td>1</td><td>f</td><td>2.483 500 GHz</td><td>-60.451 dBm</td><td></td><td></td><td></td></tr><tr><td>2</td><td>N</td><td>1</td><td>f</td><td>2.500 000 GHz</td><td>-59.266 dBm</td><td></td><td></td><td></td></tr><tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>4</td><td>N</td><td>1</td><td>f</td><td>2.479 973 GHz</td><td>-4.798 dBm</td><td></td><td></td><td></td></tr><tr><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>6</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>7</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>8</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>9</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>10</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>11</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></tbody></table></div><div><div>Frequency</div><div>Auto Tune</div><div>Center Freq 2.489250000 GHz</div><div>StartFreq 2.478500000 GHz</div><div>Stop Freq 2.500000000 GHz</div><div>CF Step 2.150000 MHz Man</div><div>Freq Offset 0 Hz</div><div>Scale Type Log Lin</div></div></div>	MNR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	f	2.483 500 GHz	-60.451 dBm				2	N	1	f	2.500 000 GHz	-59.266 dBm				3									4	N	1	f	2.479 973 GHz	-4.798 dBm				5									6									7									8									9									10									11									
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5.9. Spurious RF Conducted Emissions

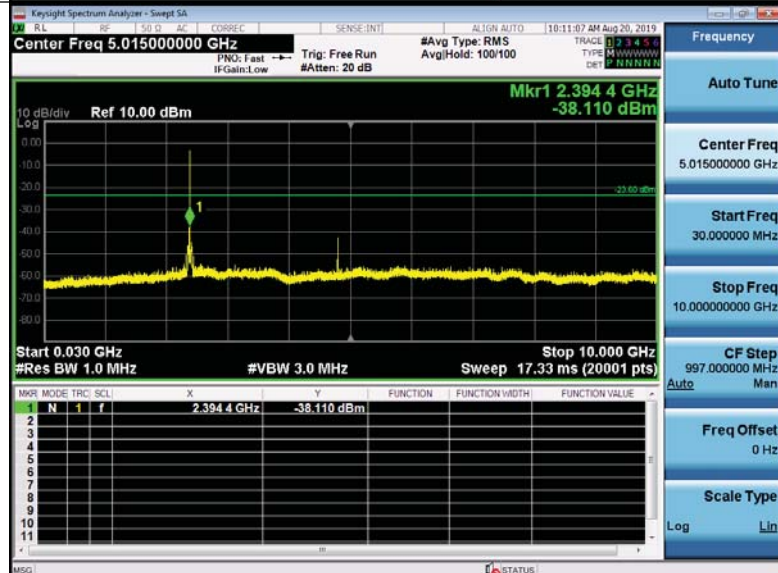
Test Requirement:	47 CFR Part 15C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Test Setup:	 <p>Remark: Offset=cable loss+ attenuation factor.</p>
Limit:	In any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that 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.
Exploratory Test Mode:	Non-hopping transmitting with all kind of modulation and all kind of data type
Final Test Mode:	Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.
Test Results:	Pass

GFSK LCH_Graphs

Reference



30MHz-10GHz



10GHz-26.5GHz

