



RF TEST REPORT

Applicant Huawei Technologies Co., Ltd.
FCC ID QISELE-L04
Product Smart Phone
Model ELE-L04
Report No. R2004H0074-R1V1
Issue Date May 13, 2020

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15C (2019)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Performed by: Peng Tao

Approved by: Kai Xu

TA Technology (Shanghai) Co., Ltd.

No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China

TEL: +86-021-50791141/2/3

FAX: +86-021-50791141/2/3-8000

TABLE OF CONTENT

1	Test Laboratory	4
1.1	Notes of the Test Report	4
1.2	Testing Location	4
2	General Description of Equipment under Test	5
3	Applied Standards	7
4	Information about the FHSS characteristics	8
4.1	Frequency Hopping System Requirement	8
4.2	Pseudorandom Frequency Hopping Sequence	9
4.3	Equal Hopping Frequency Use	10
4.4	System Receiver Input Bandwidth	10
4.5	Test Configuration	11
5	Test Case Results	12
5.1	Peak Power Output –Conducted	12
5.2	Occupied Bandwidth (20dB)	15
5.3	Frequency Separation	24
5.4	Time of Occupancy (Dwell Time)	33
5.5	Band Edge Compliance	44
5.6	Number of hopping Frequency	53
5.7	Spurious RF Conducted Emissions	57
5.8	Unwanted Emission	65
5.9	Conducted Emission	105
6	Main Test Instruments	108

Summary of Measurement Results

Number	Test Case	Clause in FCC rules	Verdict
1	Frequency Hopping System	15.247 (g), (h)	Pass
2	Peak Power Output -Conducted	15.247(b)(1)	Pass
3	Occupied Bandwidth (20dB)	15.247(a)(1)	Pass
4	Frequency Separation	15.247(a)(1)	Pass
5	Time of Occupancy (Dwell Time)	15.247(a)(1)(iii)	Pass
6	Band Edge Compliance	15.247(d)	Pass
7	Number of Hopping Frequency	15.247(a)(1)(iii)	Pass
8	Spurious RF Conducted Emissions	15.247(d)	Pass
9	Unwanted Emissions	15.247(d),15.205,15.209	Pass
10	Conducted Emissions	15.207	Pass
Date of Testing: April 5, 2020~ April 20, 2020			

Note: This revised report (Report No.: R2004H0074-R1V1) supersedes and replaces the previously issued report (Report No.: R2004H0074-R1). Please discard or destroy the previously issued report and dispose of it accordingly.

1 Test Laboratory

1.1 Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2. Test facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

1.3 Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
Address: No.145, Jintang Rd, Tangzhen Industry Park, Pudong Shanghai, China
City: Shanghai
Post code: 201201
Country: P. R. China
Contact: Xu Kai
Telephone: +86-021-50791141/2/3
Fax: +86-021-50791141/2/3-8000
Website: <http://www.ta-shanghai.com>
E-mail: xukai@ta-shanghai.com

2 General Description of Equipment under Test

Client Information

Applicant	Huawei Technologies Co., Ltd.
Applicant address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C
Manufacturer	Huawei Technologies Co., Ltd.
Manufacturer address	Administration Building, Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, Shenzhen, 518129, P.R.C

General information

General Information					
EUT Description					
Model	ELE-L04				
SN:	9FK5T19109000056				
Hardware Version	HL1ELLEM				
Software Version	10.1.0.190(C792E9R1P3)				
Power Supply	Battery/AC adapter				
Antenna Type	Internal Antenna				
Antenna Connector	A permanently attached antenna (meet with the standard FCC Part 15.203 requirement)				
Antenna Gain	-2.56dBi				
Test Mode(s)	Basic Rate		Enhanced Data Rate(EDR)		
Modulation Type	Frequency Hopping Spread Spectrum (FHSS)				
	π/4-DQPSK	8DPSK	π/4-DQPSK	GFSK	GFSK
Packet Type (Maximum Payload)	BT UHD 2M	BT UHD 2M	BT UHD 4M	BLE 1M	BLE 2M
Max. Conducted Power	16.37dBm				
Operating Frequency Range(s)	2404-2478MHz				
EUT Accessory					
Adapter 1	Manufacturer: HuaweiTechnologies Co., Ltd. Model: HW-050450B00				
Adapter 2	Manufacturer: HuaweiTechnologies Co., Ltd. Model: HW-050450E00				
Adapter 3	Manufacturer: HuaweiTechnologies Co., Ltd. Model: HW-050450U00				
Adapter 4	Manufacturer: HuaweiTechnologies Co., Ltd. Model: HW-050450A00				
Adapter 5	Manufacturer: HuaweiTechnologies Co., Ltd. Model: HW-050450E01				



Adapter 6	Manufacturer: HuaweiTechnologies Co., Ltd. Model: HW-050450A01
Adapter 7	Manufacturer: HuaweiTechnologies Co., Ltd. Model: HW-050450B01
Adapter 8	Manufacturer: HuaweiTechnologies Co., Ltd. Model: HW-050450U01
Battery 1	Manufacturer: HuaweiTechnologies Co., Ltd. (Sunwoda Electronic Co., Ltd.) Model: HB436380ECW
Battery 2	Manufacturer: HuaweiTechnologies Co., Ltd. (Huizhou Desay Battery Co., Ltd.) Model: HB436380ECW
Earphone 1	Manufacturer: Jiangxi Lianchuang Hongsheng Electronic Co. ,LTD Model: MEMD1632B580C00
Earphone 2	Manufacturer: MERRY ELECTRONICS (SHENZHEN) CO., LTD. Model: EMC309-001
Earphone 3	Manufacturer: Boluo County Quancheng Electronic Co.,Ltd Model: 1311-3291-3.5mm-229
USB Cable 1	Manufacturer: Ningbo Broad Telecommunication Co., Ltd
USB Cable 2	Manufacturer: LUXSHARE Precision Industry Co., Ltd.
USB Cable 3	Manufacturer: HUIZHOU DEHONG TECHNOLOGY CO.,LTD.
Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant. 2. There is more than one USB cable, one Adapter/ Battery/ Earphone and USB Cable, each one should be applied throughout the compliance test respectively, and however, only the worst case (Adapter 2/ Battery 1/ Earphone 1 and USB Cable 2) will be recorded in this report.	

3 Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standards:

FCC CFR47 Part 15C (2019) Radio Frequency Devices

ANSI C63.10 (2013)

Reference standard:

KDB 558074 D01 15.247 Meas Guidance v05r02

4 Information about the FHSS characteristics

4.1 Frequency Hopping System Requirement

Standard requirement:

(g) Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

(h) The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Compliance for section 15.247(g):

According to Bluetooth Core Specification, the Bluetooth system transmits the packets with the pseudorandom hopping frequency with a continuous data and short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

Compliance for section 15.247(h):

According to Bluetooth Core Specification, the Bluetooth system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

According to Bluetooth Core Specification, the Bluetooth system is designed not have the ability to coordinate with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

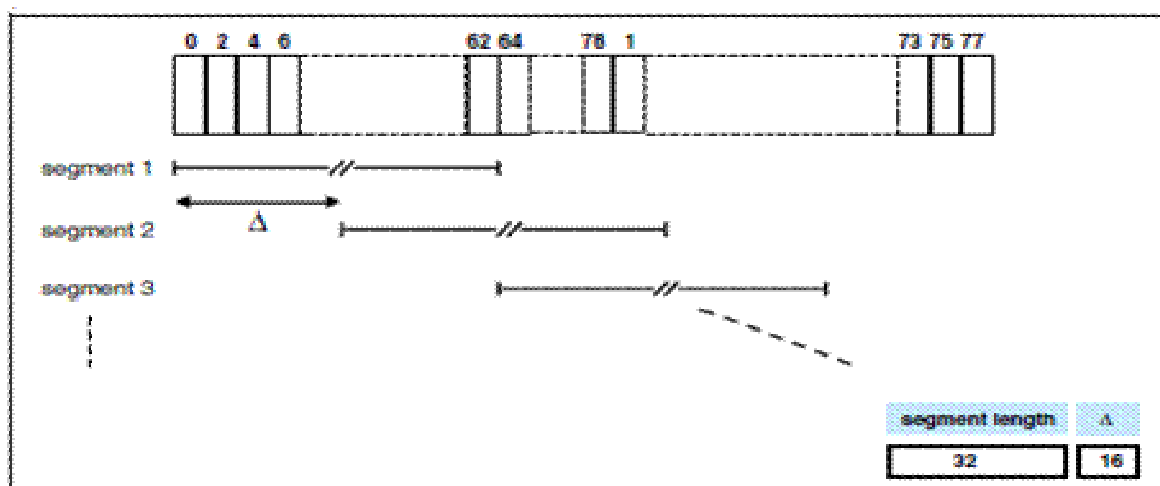
4.2 Pseudorandom Frequency Hopping Sequence

Frequency Hopping Systems. A spread spectrum system in which the carrier is modulated with the coded information in a conventional manner causing a conventional spreading of the RF energy about the frequency carrier. The frequency of the carrier is not fixed but changes at fixed intervals under the direction of a coded sequence. The wide RF bandwidth needed by such a system is not required by spreading of the RF energy about the carrier but rather to accommodate the range of frequencies to which the carrier frequency can hop. The test of a frequency hopping system is that the near term distribution of hops appears random, the long term distribution appears evenly distributed over the hop set, and sequential hops are randomly distributed in both direction and magnitude of change in the hop set.

Adaptive Frequency Hopping (AFH) was introduced in the Bluetooth specification to provide an effective way for a Bluetooth radio to counteract normal interference. AFH identifies "bad" channels, where either other wireless devices are interfering with the Bluetooth signal or the Bluetooth signal is interfering with another device. The AFH-enabled Bluetooth device will then communicate with other devices within its pioneer to share details of any identified bad channels. The devices will then switch to alternative available "good" channels, away from the areas of interference, thus having no impact on the bandwidth used.

The selection scheme chooses a segment of 32 hop frequencies spanning about 64 MHz and visits these hops in a pseudo-random order. Next, a different 32-hop segment is chosen, etc. In the page, master page response, slave page response, page scan, inquiry, inquiry response and inquiry scan hopping sequences, the same 32-hop segment is used all the time (the segment is selected by the address; different devices will have different paging segments).

When the basic channel hopping sequence is selected, the output constitutes a pseudo-random sequence that slides through the 37 hops. The principle is depicted in the figure below.



Hop selection scheme in CONNECTION state.

The smallest number of Hopping channel is 15. Pseudorandom Frequency Hopping Sequence Table as below: Channel: 3, 6, 7, 9, 12, 14, 18, 22, 25, 26, 28, 30, 33, 36, 37, etc.

Each frequency used equally on the average by each transmitter.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

4.3 Equal Hopping Frequency Use

All Bluetooth units participating in the Pico net are time and hop-synchronized to the channel. Each new transmission event begins on the next channel in the hopping sequence after the final channel used in the previous transmission event.

4.4 System Receiver Input Bandwidth

Each channel bandwidth is 1MHz. The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

4.5 Test Configuration

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the worst case was recorded.

Test Cases	Test Modes
Peak Power Output -Conducted	2M $\pi/4$ -DQPSK / 2M 8DPSK / 4M $\pi/4$ -DQPSK / 1M GFSK / 2M GFSK
Occupied Bandwidth (20dB)	2M $\pi/4$ -DQPSK / 2M 8DPSK / 4M $\pi/4$ -DQPSK / 1M GFSK / 2M GFSK
Frequency Separation	2M $\pi/4$ -DQPSK / 2M 8DPSK / 4M $\pi/4$ -DQPSK / 1M GFSK / 2M GFSK
Time of Occupancy (Dwell Time)	2M $\pi/4$ -DQPSK / 2M 8DPSK / 4M $\pi/4$ -DQPSK / 1M GFSK / 2M GFSK
Band Edge Compliance	2M $\pi/4$ -DQPSK / 2M 8DPSK / 4M $\pi/4$ -DQPSK / 1M GFSK / 2M GFSK
Number of Hopping Frequency	2M $\pi/4$ -DQPSK / 2M 8DPSK / 4M $\pi/4$ -DQPSK / 1M GFSK / 2M GFSK
Spurious RF Conducted Emissions	2M $\pi/4$ -DQPSK / 2M 8DPSK / 4M $\pi/4$ -DQPSK / 1M GFSK / 2M GFSK
Unwanted Emission	2M $\pi/4$ -DQPSK / 2M 8DPSK / 4M $\pi/4$ -DQPSK / 1M GFSK / 2M GFSK
Conducted Emission	2M $\pi/4$ -DQPSK / 2M 8DPSK / 4M $\pi/4$ -DQPSK / 1M GFSK / 2M GFSK

5 Test Case Results

5.1 Peak Power Output –Conducted

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

During the process of the testing, The EUT was connected to the spectrum analyzer .The EUT is controlled by the PC set to ensure max power transmission. The peak detector is used. These measurements have been tested at following channels: 0, 39, and 78.

Test Setup



Limits

Rule Part 15.247 (b) (1) specifies that " 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."

Peak Output Power	$\leq 0.125\text{W}$ (21dBm)
-------------------	------------------------------

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U=0.44$ dB.

Test Results
BT UHD Normal Mode

Mode	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	Conclusion
BT UHD 2M $\pi/4$-DQPSK	2404	8.69	21	PASS
	2440	9.80	21	PASS
	2478	8.86	21	PASS
BT UHD 2M 8DPSK	2404	9.09	21	PASS
	2440	10.20	21	PASS
	2478	9.27	21	PASS
BT UHD 4M $\pi/4$-DQPSK	2404	8.26	21	PASS
	2440	9.56	21	PASS
	2476	8.83	21	PASS
BLE 1M GFSK	2404	6.58	21	PASS
	2440	7.34	21	PASS
	2478	6.11	21	PASS
BLE 2M GFSK	2404	6.04	21	PASS
	2440	7.05	21	PASS
	2478	6.35	21	PASS

BT UHD High Power Mode

Mode	Frequency (MHz)	Peak Output Power (dBm)	Limit (dBm)	Conclusion
BT UHD 2M $\pi/4$ -DQPSK	2404	15.11	21	PASS
	2440	15.99	21	PASS
	2478	13.63	21	PASS
BT UHD 2M 8DPSK	2404	15.57	21	PASS
	2440	16.37	21	PASS
	2478	14.00	21	PASS
BT UHD 4M $\pi/4$ -DQPSK	2404	14.68	21	PASS
	2440	15.55	21	PASS
	2476	14.32	21	PASS
BLE 1M GFSK	2404	12.97	21	PASS
	2440	14.00	21	PASS
	2478	11.53	21	PASS
BLE 2M GFSK	2404	12.94	21	PASS
	2440	13.93	21	PASS
	2478	11.63	21	PASS

Note: The measured power density (dBm) has the offset with cable loss already.

Note: For AFH mode using 20 hopping channels, the maximum output power limit is 21dBm.

5.2 Occupied Bandwidth (20dB)

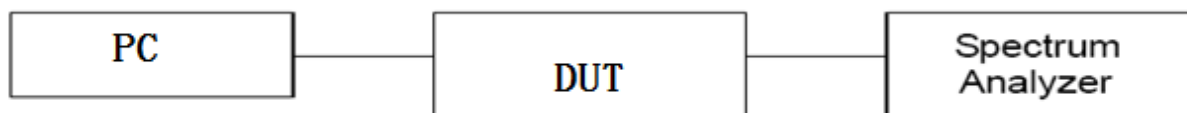
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to the spectrum analyzer through a known loss cable. The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value.

Test Setup



Limits

No specific occupied bandwidth requirements in part 15.247(a) (1).

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U=936$ Hz.

Test Results
BT UHD Normal Mode

Mode		Frequency (MHz)	99% bandwidth(kHz)	20dB Bandwidth(kHz)
BT UHD	BT UHD 2M $\pi/4$ -DQPSK	2404	2358.6	2512.0
		2440	2361.8	2510.0
		2478	2348.7	2517.0
	BT UHD 2M 8DPSK	2404	2351.8	2525.0
		2440	2358.2	2524.0
		2478	2358.3	2508.0
	BT UHD 4M $\pi/4$ -DQPSK	2404	4437.8	4478.0
		2440	4404.1	4424.0
		2476	4410.5	4448.0
	BLE 1M GFSK	2404	1026.9	1168.0
		2440	1026.2	1167.0
		2478	1026.4	1164.0
	BLE 2M GFSK	2404	2044.8	2201.0
		2440	2043.0	2200.0
		2478	2046.2	2214.0

BT UHD High Power Mode

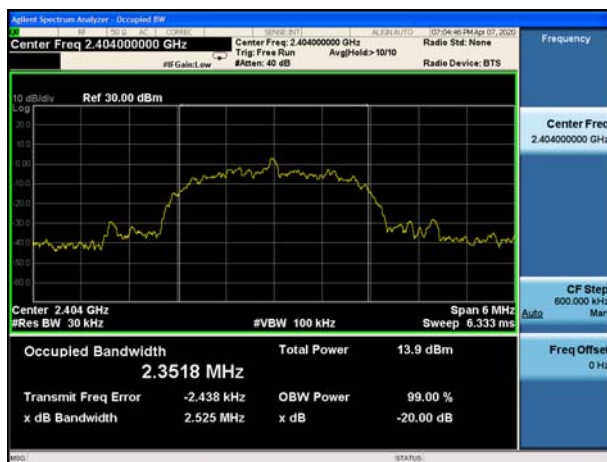
Mode		Frequency (MHz)	99% bandwidth(kHz)	20dB Bandwidth(kHz)
BT UHD	BT UHD 2M $\pi/4$ -DQPSK	2404	2348.8	2530.0
		2440	2346.4	2526.0
		2478	2341.6	2554.0
	BT UHD 2M 8DPSK	2404	2349.7	2530.0
		2440	2348.7	2532.0
		2478	2359.4	2528.0
	BT UHD 4M $\pi/4$ -DQPSK	2404	4601.3	4728.0
		2440	4596.6	4722.0
		2476	4590.7	4718.0
	BLE 1M GFSK	2404	1031.3	1174.0
		2440	1034.7	1178.0
		2478	1034.8	1178.0
	BLE 2M GFSK	2404	2045.7	2214.0
		2440	2053.1	2218.0
		2478	2050.5	2256.0

BT UHD Normal Mode

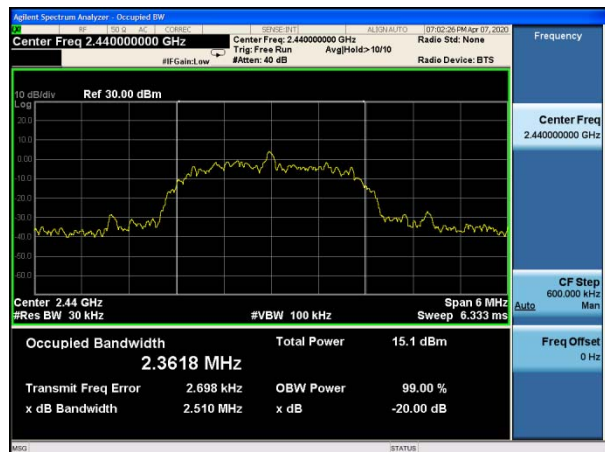
BT UHD 2M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2404



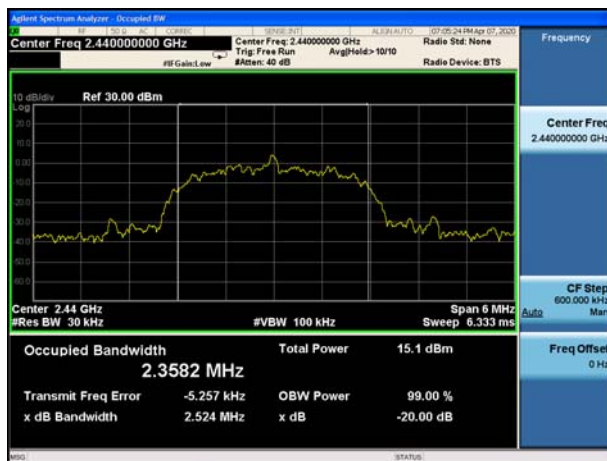
BT UHD 2M 8DPSK, Carrier frequency (MHz): 2404



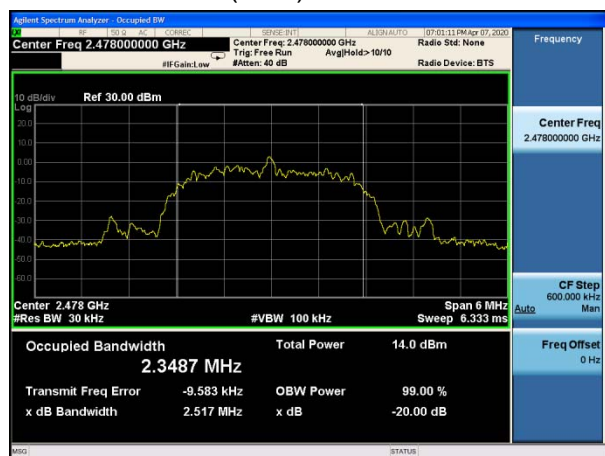
BT UHD 2M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2440



BT UHD 2M 8DPSK, Carrier frequency (MHz): 2440



BT UHD 2M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2478



BT UHD 2M 8DPSK, Carrier frequency (MHz): 2478



BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2404

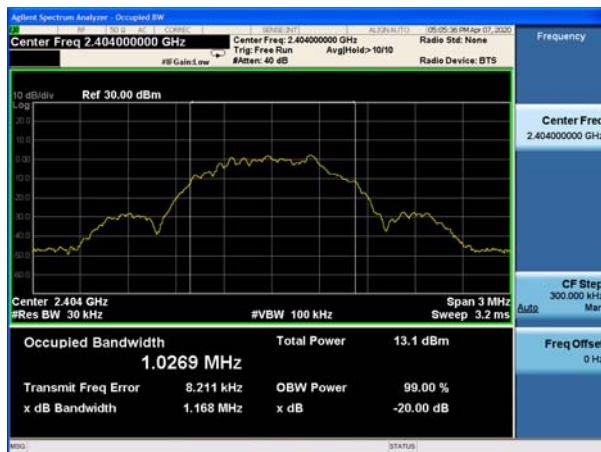
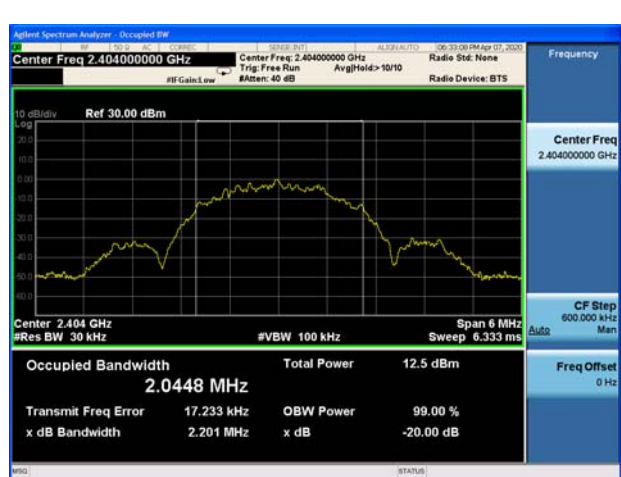
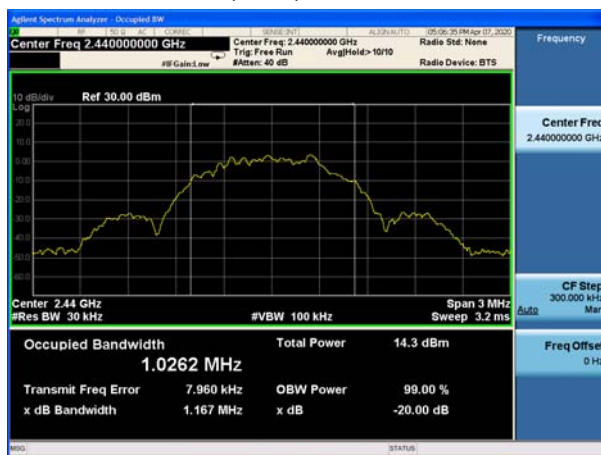
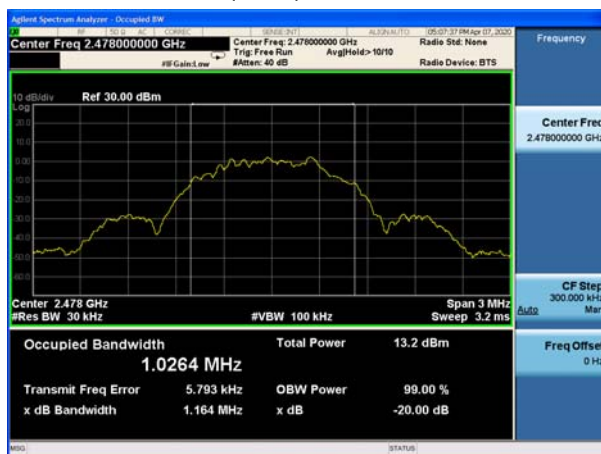


BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2440



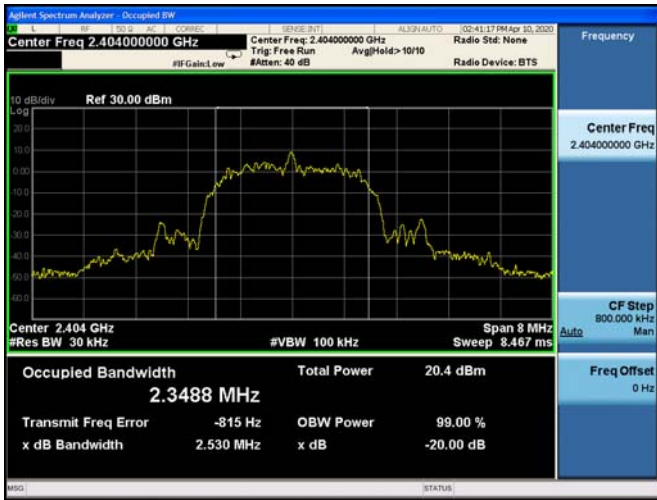
BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2476



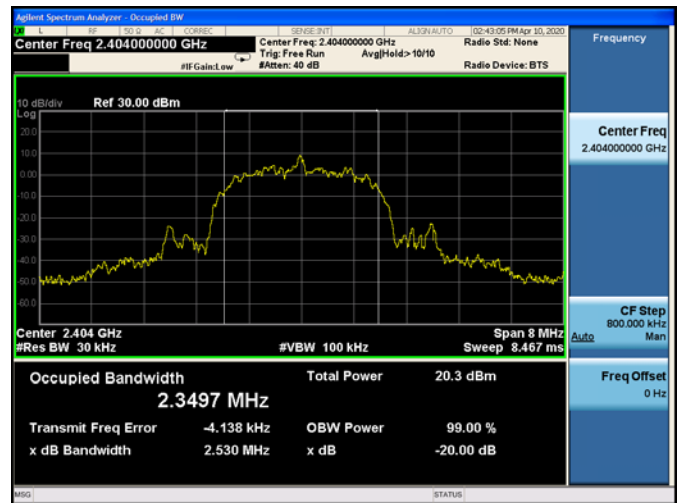
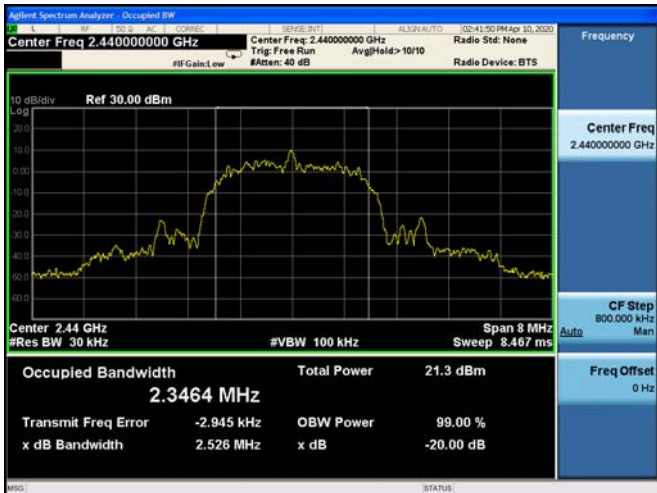
BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2404BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2404BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2440BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2440BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2478BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2478



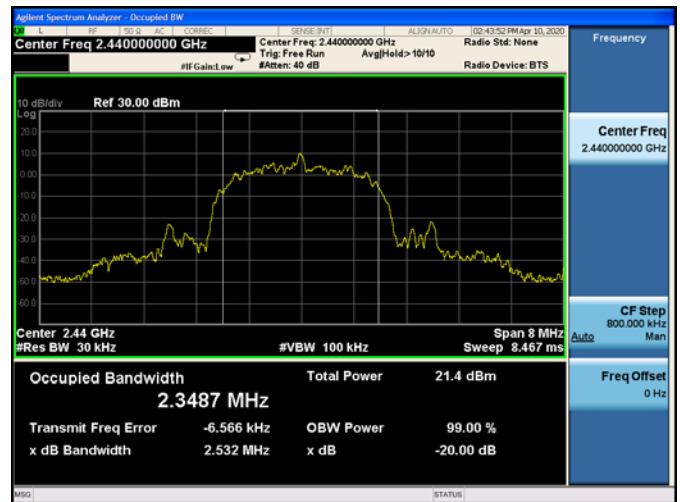
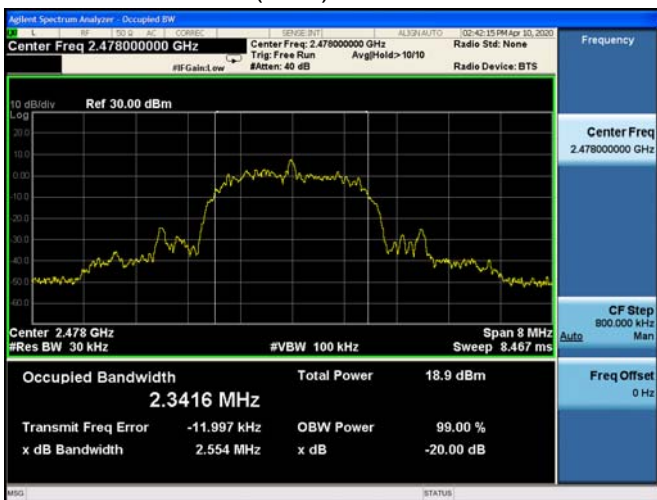
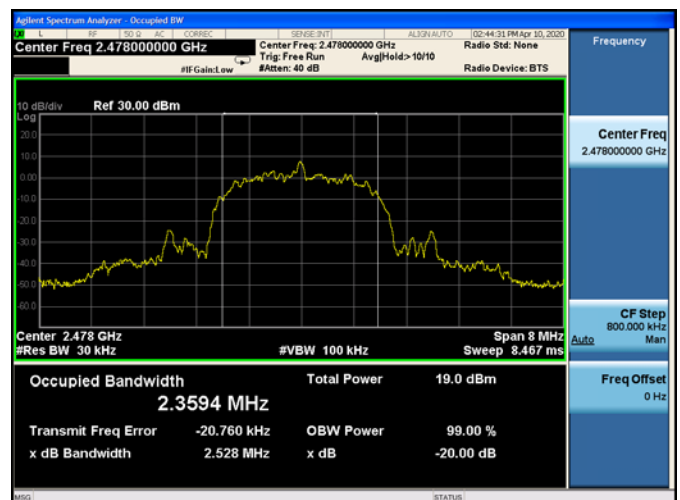
BT UHD High Power Mode

BT UHD 2M $\pi/4$ -DQPSK , Carrier frequency (MHz):
2404

BT UHD 2M 8DPSK, Carrier frequency (MHz): 2404

BT UHD 2M $\pi/4$ -DQPSK, Carrier frequency (MHz):
2440

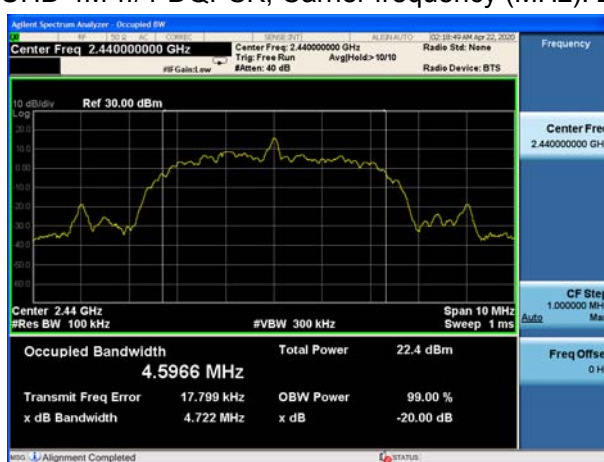
BT UHD 2M 8DPSK, Carrier frequency (MHz): 2440

BT UHD 2M $\pi/4$ -DQPSK CH37, Carrier frequency
(MHz): 2478BT UHD 2M 8DPSK CH37, Carrier frequency (MHz):
2478

BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2404

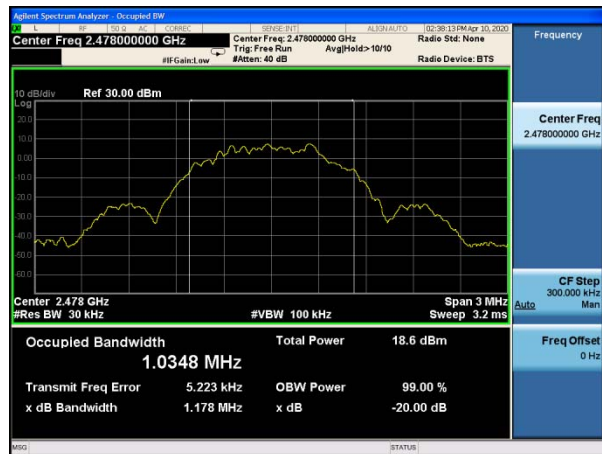
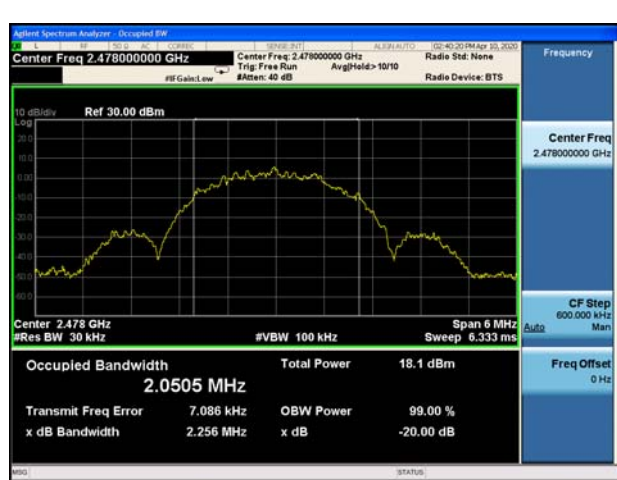


BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2440



BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2476



BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2404BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2404BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2440BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2440BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2478BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2478

5.3 Frequency Separation

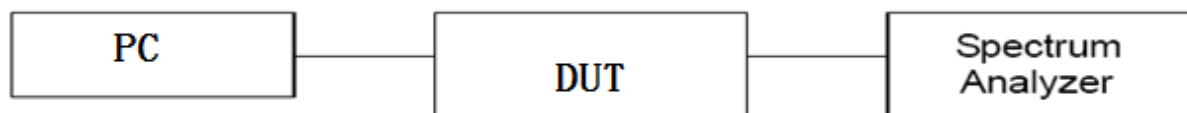
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

During the process of the testing, The EUT was connected to the spectrum analyzer .The EUT is controlled by the PC set to ensure max power transmission. RBW is set to 30 kHz and VBW is set to 100 kHz on spectrum analyzer. Set EUT on Hopping on mode.

Test setup



Limits

Rule Part 15.247(a)(1) specifies that “Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. ”

Note: The value of two-thirds of 20 dB bandwidth is always greater than 25 kHz.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U=936$ Hz.

Test Results:
BT UHD Normal Mode

Packet type	Carrier frequency (MHz)	Carrier frequency separation(kHz)	20dB Bandwidth(kHz)	Limit (kHz)	Conclusion
BT UHD 2M $\pi/4$ -DQPSK	2404	1998	2512.0	1674.67	PASS
	2440	2004	2510.0	1673.33	PASS
	2478	2004	2517.0	1678.00	PASS
BT UHD 2M 8DPSK	2404	2016	2525.0	1683.33	PASS
	2440	1986	2524.0	1682.67	PASS
	2478	1998	2508.0	1672.00	PASS
BT UHD 4M $\pi/4$ -DQPSK	2404	4010	4478.0	2985.33	PASS
	2440	4000	4424.0	2949.33	PASS
	2476	3990	4448.0	2965.33	PASS
BLE 1M GFSK	2404	1998	1168.0	778.67	PASS
	2440	1998	1167.0	778.00	PASS
	2478	1998	1164.0	776.00	PASS
BLE 2M GFSK	2404	2010	2201.0	1467.33	PASS
	2440	2016	2200.0	1466.67	PASS
	2478	2010	2214.0	1476.00	PASS
Note: The limit is two-thirds of 20 dB bandwidth.					

**BT UHD High Power Mode**

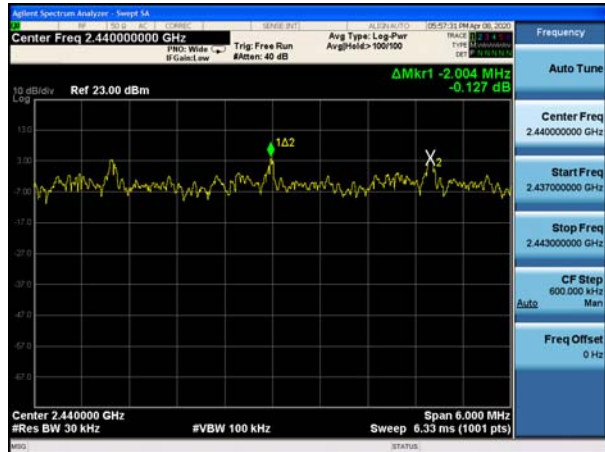
Packet type	Carrier frequency (MHz)	Carrier frequency separation(kHz)	20dB Bandwidth(kHz)	Limit (kHz)	Conclusion
BT UHD 2M $\pi/4$ -DQPSK	2404	1998	2530.0	1686.67	PASS
	2440	1998	2526.0	1684.00	PASS
	2478	1998	2554.0	1702.67	PASS
BT UHD 2M 8DPSK	2404	1998	2530.0	1686.67	PASS
	2440	1998	2532.0	1688.00	PASS
	2478	1998	2528.0	1685.33	PASS
BT UHD 4M $\pi/4$ -DQPSK	2404	4000	4728.0	3152.00	PASS
	2440	3990	4722.0	3148.00	PASS
	2476	4000	4718.0	3145.33	PASS
BLE 1M GFSK	2404	2004	1174.0	782.67	PASS
	2440	1998	1178.0	785.33	PASS
	2478	2004	1178.0	785.33	PASS
BLE 2M GFSK	2404	2022	2214.0	1476.00	PASS
	2440	1980	2218.0	1478.67	PASS
	2478	1992	2256.0	1504.00	PASS
Note: The limit is two-thirds of 20 dB bandwidth.					



BT UHD Normal Mode

BT UHD 2M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2404

BT UHD 2M 8DPSK, Carrier frequency (MHz): 2404

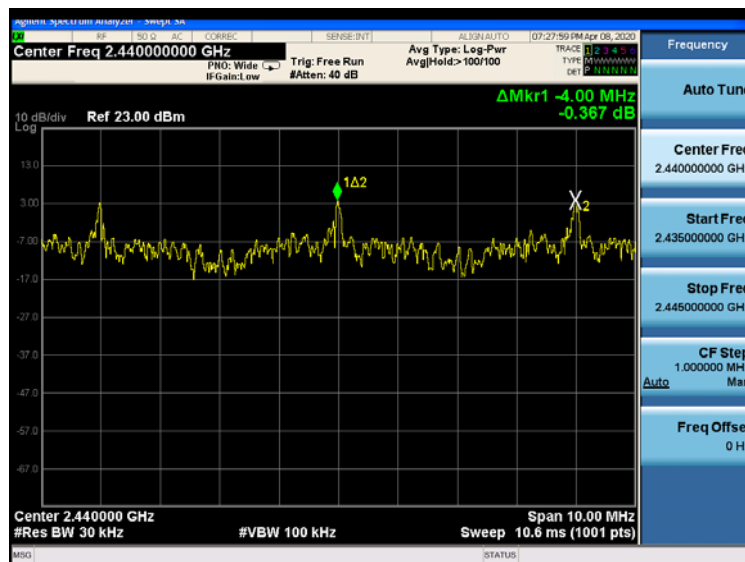
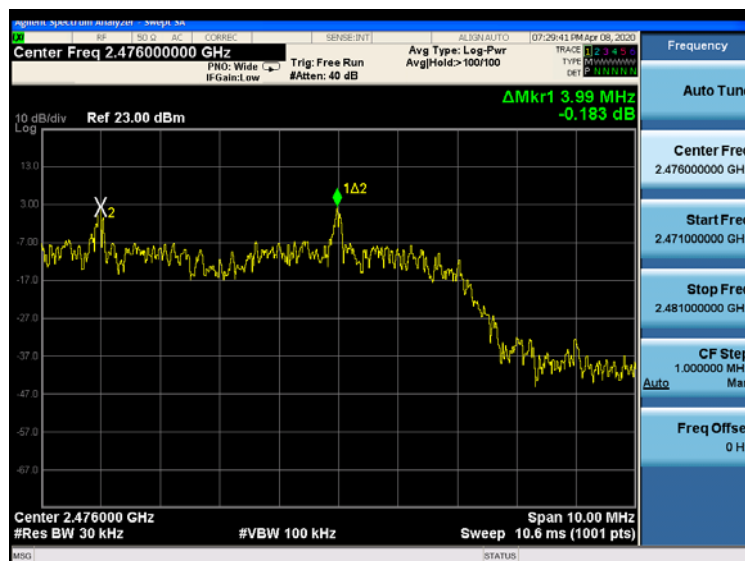
BT UHD 2M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2440

BT UHD 2M 8DPSK, Carrier frequency (MHz): 2440

BT UHD 2M $\pi/4$ -DQPSK CH37, Carrier frequency (MHz): 2478

BT UHD 2M 8DPSK CH37, Carrier frequency (MHz): 2478



BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2404BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2440BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2476

BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2404



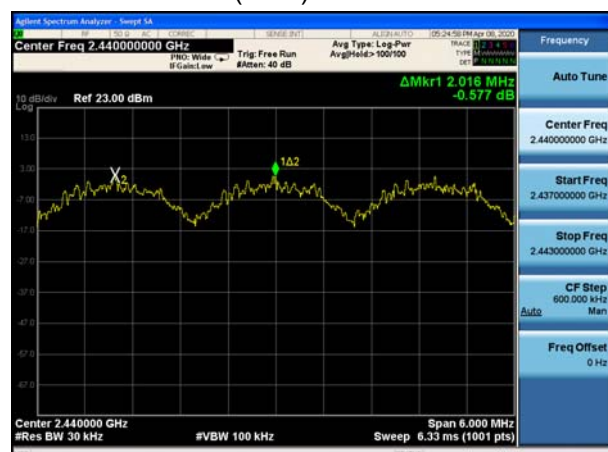
BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2404



BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2440



BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2440



BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2478



BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2478



BT UHD High Power Mode

BT UHD 2M $\pi/4$ -DQPSK, Carrier frequency
(MHz): 2404



BT UHD 2M 8DPSK, Carrier frequency (MHz):
2404



BT UHD 2M $\pi/4$ -DQPSK, Carrier frequency
(MHz): 2440



BT UHD 2M 8DPSK, Carrier frequency (MHz):
2440

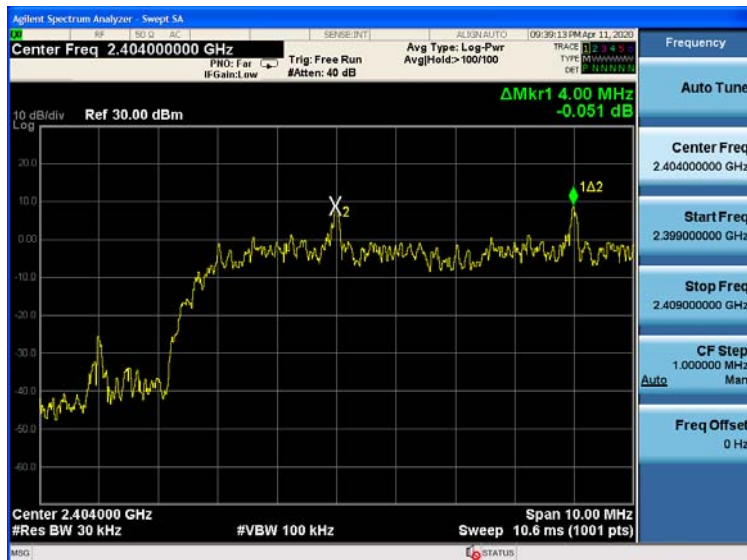
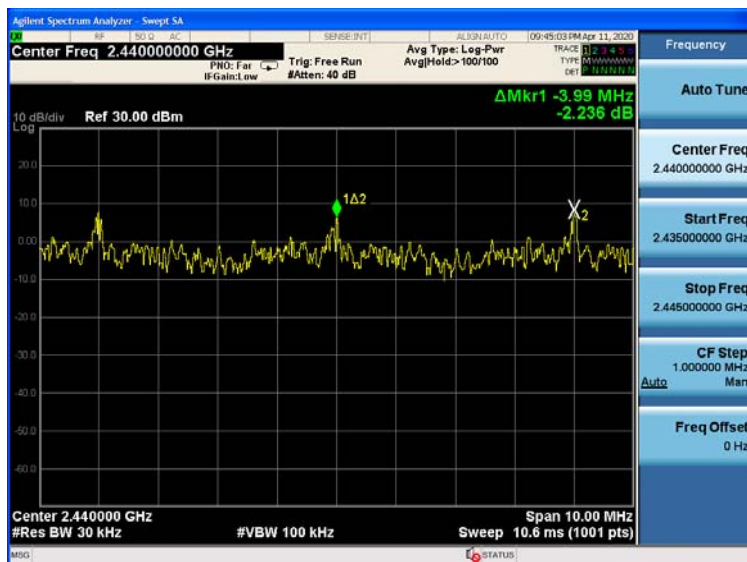


BT UHD 2M $\pi/4$ -DQPSK CH37, Carrier
frequency (MHz): 2478



BT UHD 2M 8DPSK CH37, Carrier frequency
(MHz): 2478



BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2404BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2440BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2476

BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2404



BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2404



BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2440



BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2440



BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2478



BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2478



5.4 Time of Occupancy (Dwell Time)

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

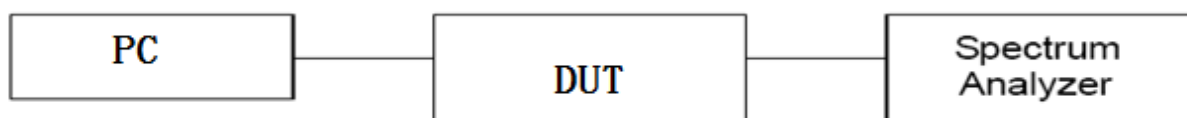
During the process of the testing, The EUT was connected to the spectrum analyzer .The EUT is controlled by the PC set to ensure max power transmission. RBW is set to 1MHz and VBW is set to 1MHz on spectrum analyzer. The dwell time is calculated by:

Dwell time = time slot length * hop rate * 0.4s with:

In normal mode, The selected EUT Packet type uses a slot type of DH5 packet and a hopping rate of 1600(ch*hop/s) for all channels. So the final hopping rate for all channel is 1600/5=320(ch*hop/s)

In AFH mode, The selected EUT Packet type uses a slot type of DH5 packet and a hopping rate of 800(ch*hop/s) for all channels. So the final hopping rate for all channel is 800/5=160(ch*hop/s)

Test Setup



Limits

Rule Part15.247(a) specifies that " Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed."

Dwell time	≤ 400ms
------------	---------

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$.

Requirements	Uncertainty	
Dwell Time	BT UHD 2M $\pi/4$ -DQPSK	$U=0.70\text{ms}$
	BT UHD 2M 8DPSK	$U=0.70\text{ms}$
	BT UHD 4M $\pi/4$ -DQPSK	$U=0.70\text{ms}$
	BLE 1M GFSK	$U=0.70\text{ms}$
	BLE 2M GFSK	$U=0.70\text{ms}$

Test Results:
BT UHD Normal Mode

In normal mode:

Packet type	Carrier frequency (MHz)	hop rate (1/s)	Time slot length(ms)	Dwell time (ms)	Limit (ms)	Conclusion
BT UHD 2M $\pi/4$ -DQPSK	2404	320	0.570	72.96	400	PASS
	2440	320	0.560	71.68	400	PASS
	2478	320	0.560	71.68	400	PASS
BT UHD 2M 8DPSK	2404	320	0.380	48.64	400	PASS
	2440	320	0.390	49.92	400	PASS
	2478	320	0.380	48.64	400	PASS
BT UHD 4M $\pi/4$ -DQPSK	2404	320	0.280	35.84	400	PASS
	2440	320	0.280	35.84	400	PASS
	2476	320	0.280	35.84	400	PASS
BLE 1M GFSK	2404	320	2.120	271.36	400	PASS
	2440	320	2.120	271.36	400	PASS
	2478	320	2.130	272.64	400	PASS
BLE 2M GFSK	2404	320	0.380	48.64	400	PASS
	2440	320	0.390	49.92	400	PASS
	2478	320	0.380	48.64	400	PASS
Note: Dwell time = time slot length * hop rate * 0.4s						

In AFH mode:

Packet type	Carrier frequency (MHz)	hop rate (1/s)	Time slot length(ms)	Dwell time (ms)	Limit (ms)	Conclusion
BT UHD 2M $\pi/4$ -DQPSK	2404	160	0.570	36.48	400	PASS
	2440	160	0.560	35.84	400	PASS
	2478	160	0.560	35.84	400	PASS
BT UHD 2M 8DPSK	2404	160	0.380	24.32	400	PASS
	2440	160	0.390	24.96	400	PASS
	2478	160	0.380	24.32	400	PASS
BT UHD 4M $\pi/4$ -DQPSK	2404	160	0.280	17.92	400	PASS
	2440	160	0.280	17.92	400	PASS
	2476	160	0.280	17.92	400	PASS
BLE 1M GFSK	2404	160	2.120	135.68	400	PASS
	2440	160	2.120	135.68	400	PASS
	2478	160	2.130	136.32	400	PASS
BLE 2M GFSK	2404	160	0.380	24.32	400	PASS
	2440	160	0.390	24.96	400	PASS
	2478	160	0.380	24.32	400	PASS
Note: Dwell time = time slot length * hop rate * 0.4s						

BT UHD High Power Mode

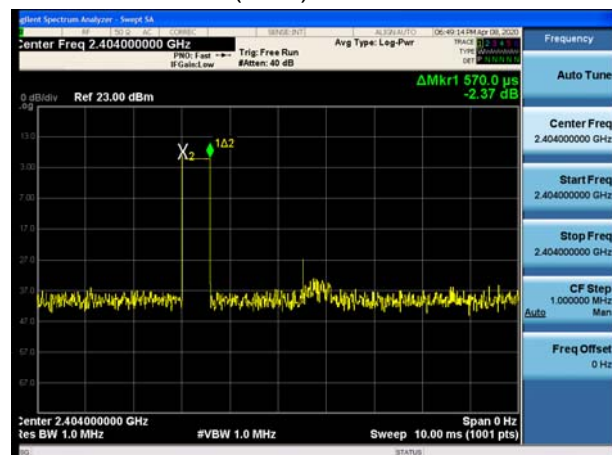
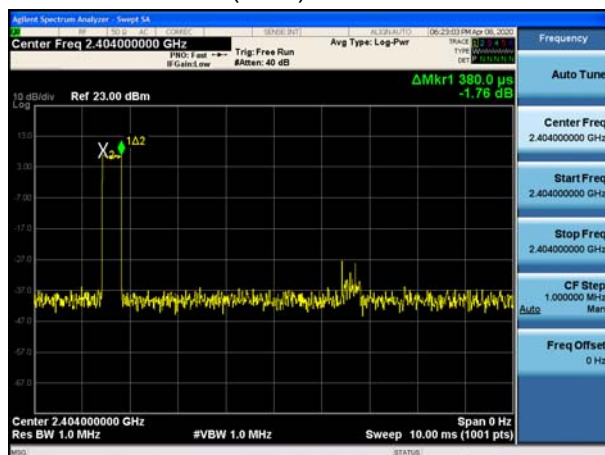
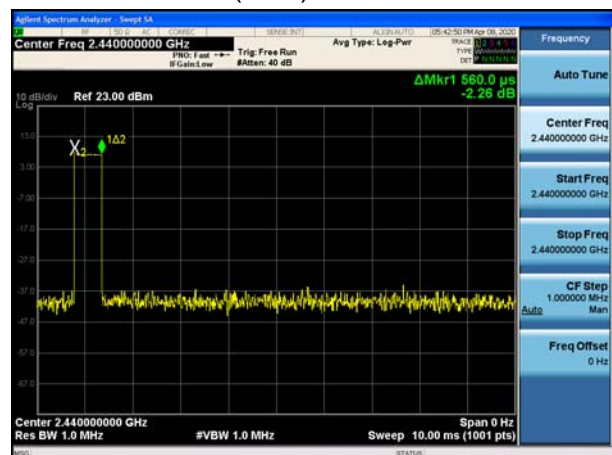
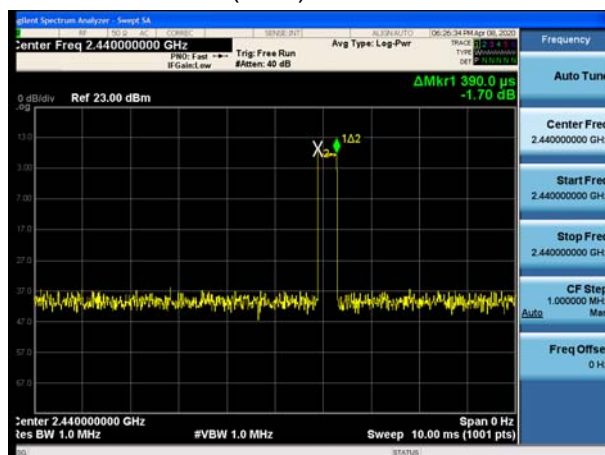
In normal mode:

Packet type	Carrier frequency (MHz)	hop rate (1/s)	Time slot length(ms)	Dwell time (ms)	Limit (ms)	Conclusion
BT UHD 2M $\pi/4$ -DQPSK	2404	320	0.570	72.96	400	PASS
	2440	320	0.560	71.68	400	PASS
	2478	320	0.570	72.96	400	PASS
BT UHD 2M 8DPSK	2404	320	0.390	49.92	400	PASS
	2440	320	0.400	51.20	400	PASS
	2478	320	0.400	51.20	400	PASS
BT UHD 4M $\pi/4$ -DQPSK	2404	320	0.280	35.84	400	PASS
	2440	320	0.260	33.28	400	PASS
	2476	320	0.260	33.28	400	PASS
BLE 1M GFSK	2404	320	2.130	272.64	400	PASS
	2440	320	2.130	272.64	400	PASS
	2478	320	2.120	271.36	400	PASS
BLE 2M GFSK	2404	320	1.070	136.96	400	PASS
	2440	320	1.070	136.96	400	PASS
	2478	320	1.070	136.96	400	PASS
Note: Dwell time = time slot length * hop rate * 0.4s						

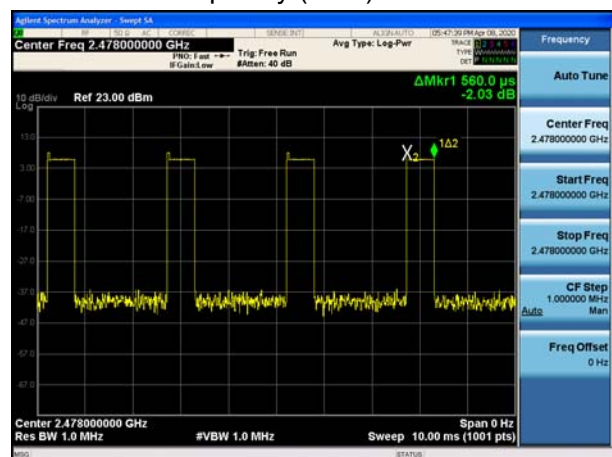
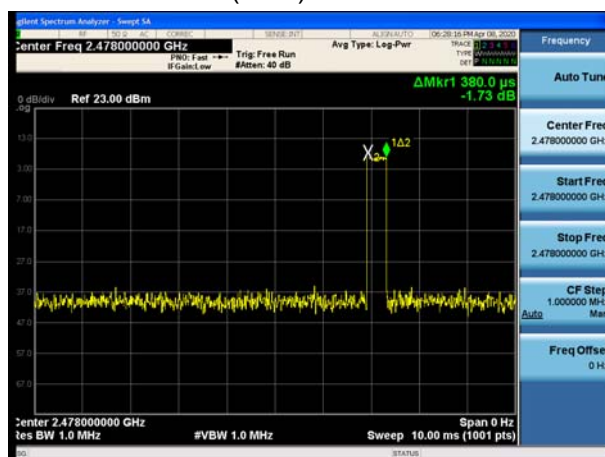
In AFH mode:

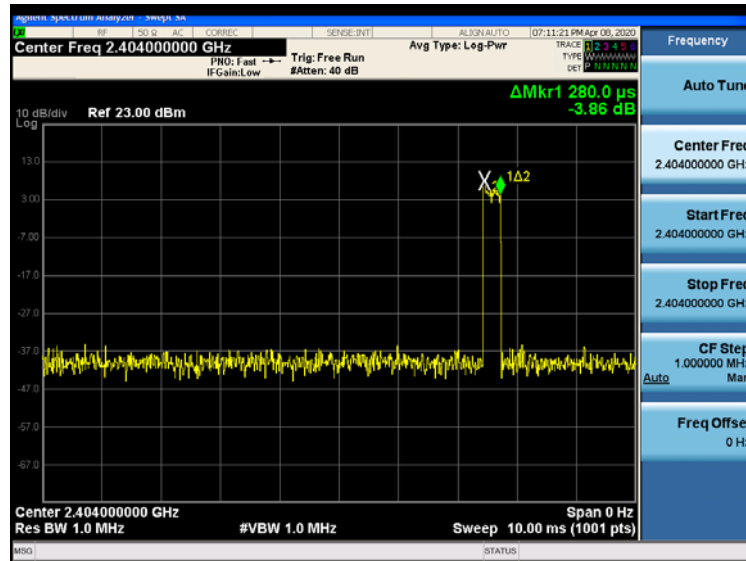
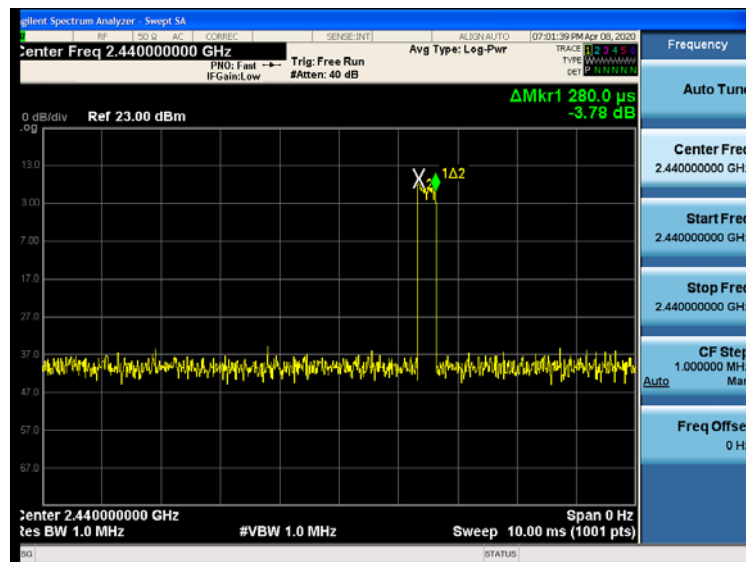
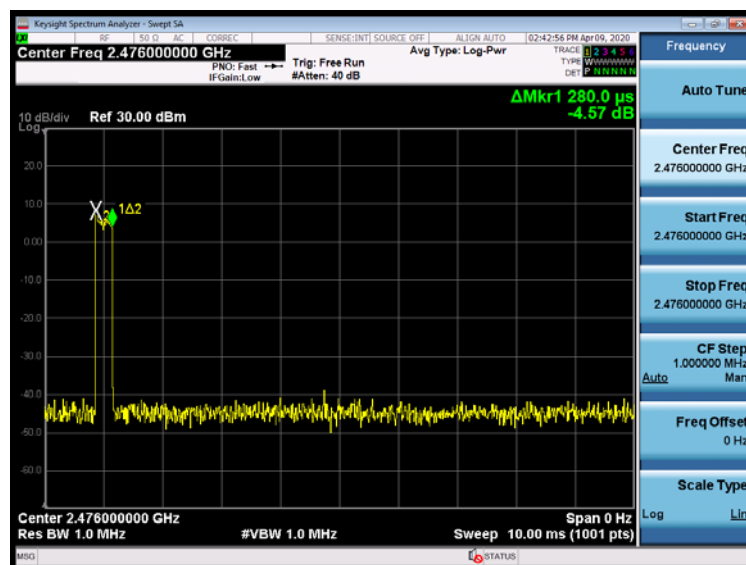
Packet type	Carrier frequency (MHz)	hop rate (1/s)	Time slot length(ms)	Dwell time (ms)	Limit (ms)	Conclusion
BT UHD 2M $\pi/4$ -DQPSK	2404	160	0.570	36.48	400	PASS
	2440	160	0.560	35.84	400	PASS
	2478	160	0.570	36.48	400	PASS
BT UHD 2M 8DPSK	2404	160	0.390	24.96	400	PASS
	2440	160	0.400	25.60	400	PASS
	2478	160	0.400	25.60	400	PASS
BT UHD 4M $\pi/4$ -DQPSK	2404	160	0.280	17.92	400	PASS
	2440	160	0.260	16.64	400	PASS
	2476	160	0.260	16.64	400	PASS
BLE 1M GFSK	2404	160	2.130	136.32	400	PASS
	2440	160	2.130	136.32	400	PASS
	2478	160	2.120	135.68	400	PASS
BLE 2M GFSK	2404	160	1.070	68.48	400	PASS
	2440	160	1.070	68.48	400	PASS
	2478	160	1.070	68.48	400	PASS
Note: Dwell time = time slot length * hop rate * 0.4s						

BT UHD Normal Mode

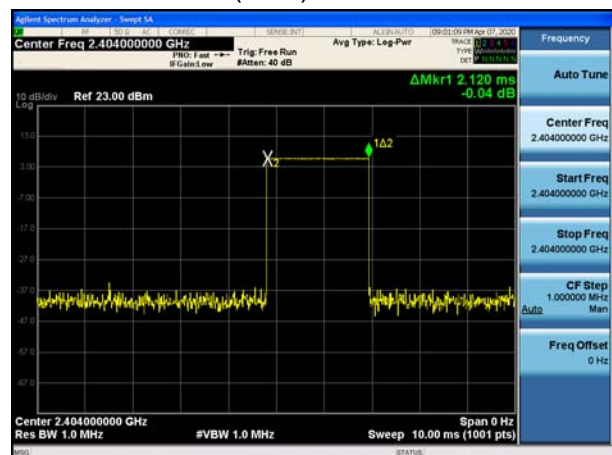
BT UHD 2M $\pi/4$ -DQPSK, Carrier frequency
(MHz): 2404BT UHD 2M 8DPSK, Carrier frequency
(MHz): 2404BT UHD 2M $\pi/4$ -DQPSK, Carrier frequency
(MHz): 2440BT UHD 2M 8DPSK, Carrier frequency
(MHz): 2440

BT UHD 2M $\pi/4$ -DQPSK CH37, Carrier
frequency (MHz): 2478

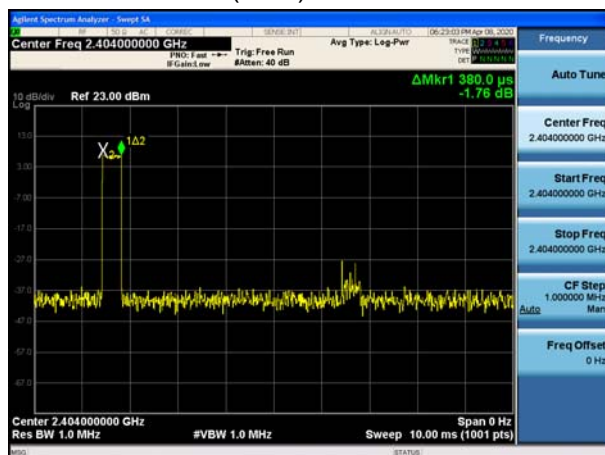
BT UHD 2M 8DPSK CH37, Carrier frequency
(MHz): 2478

BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2404BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2440BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2476

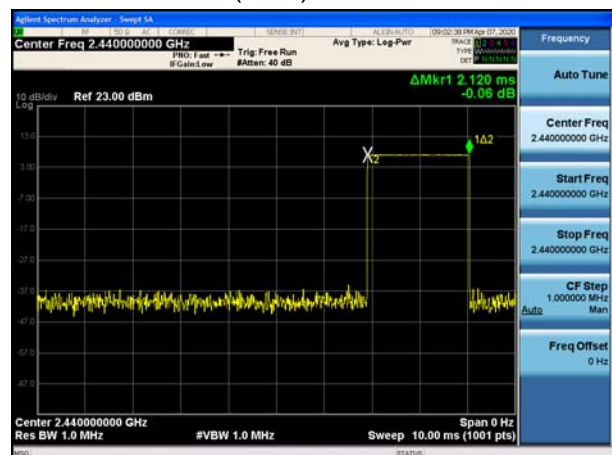
BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2404



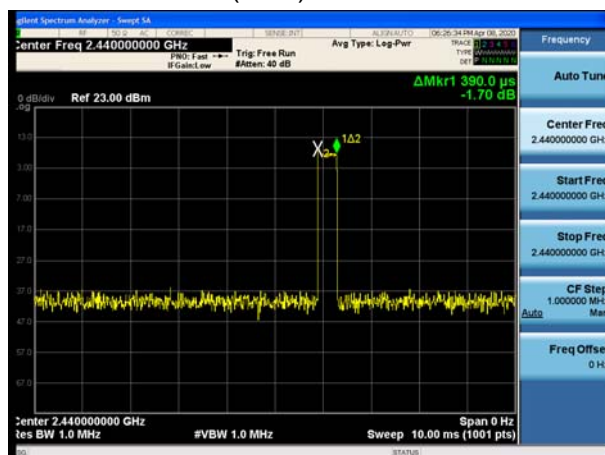
BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2404



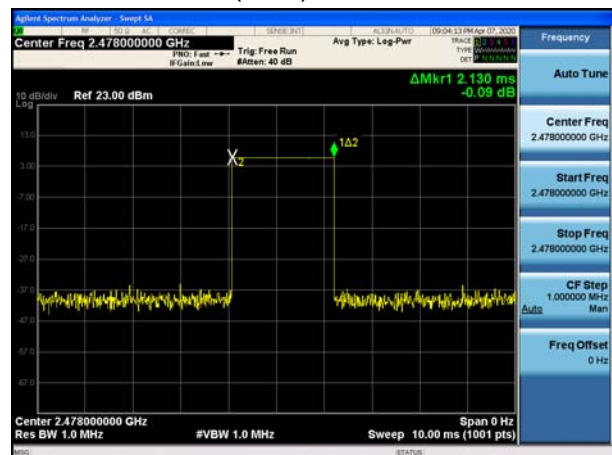
BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2440



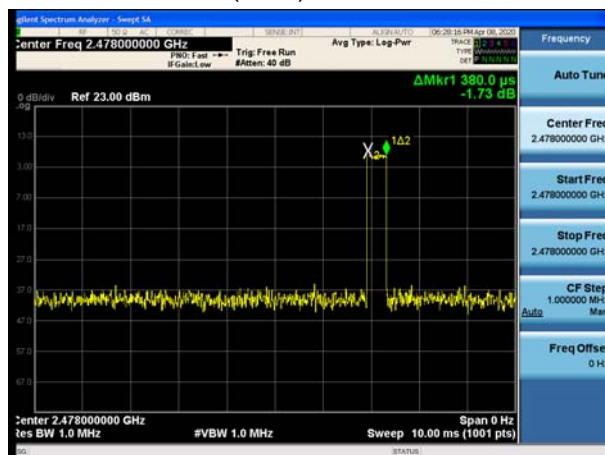
BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2440



BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2478

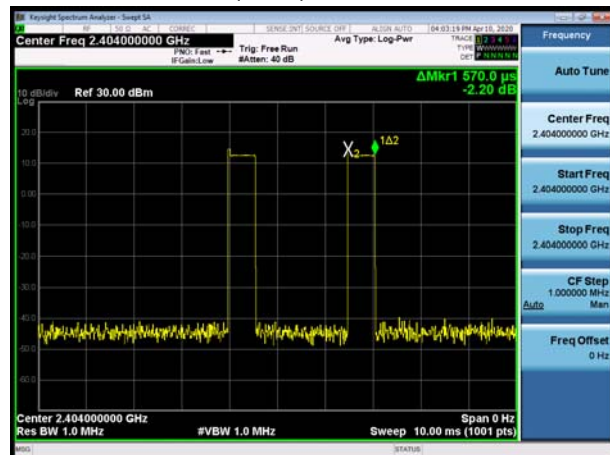
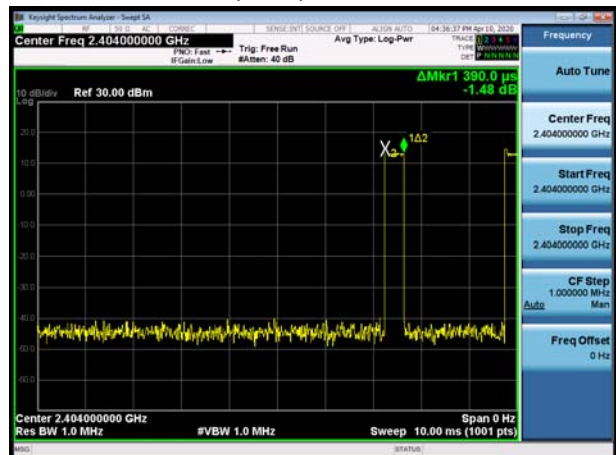
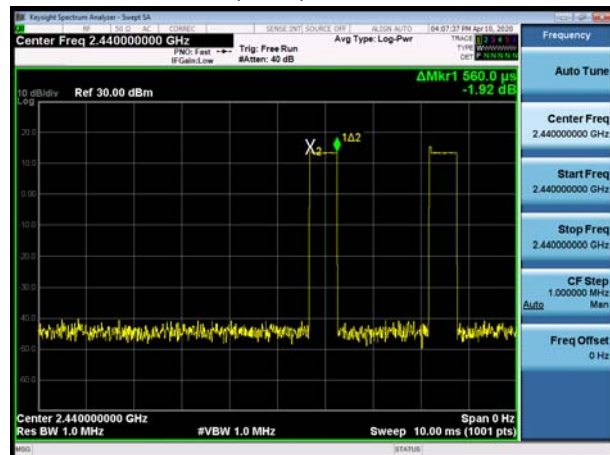
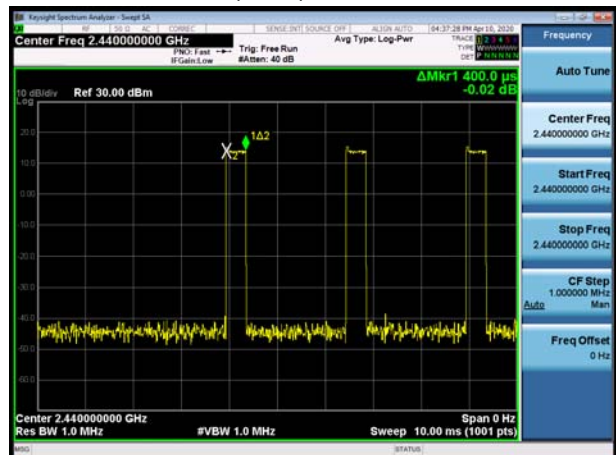
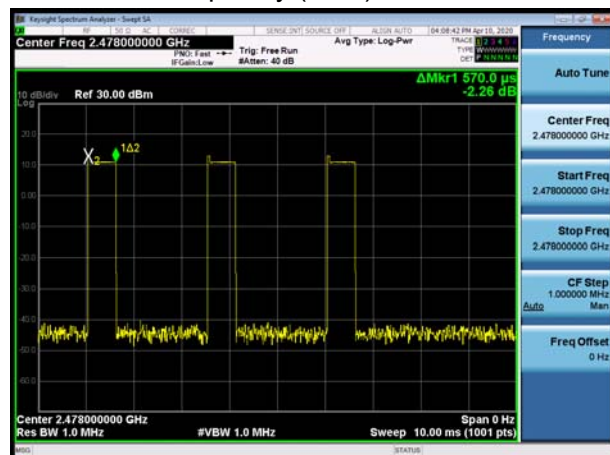
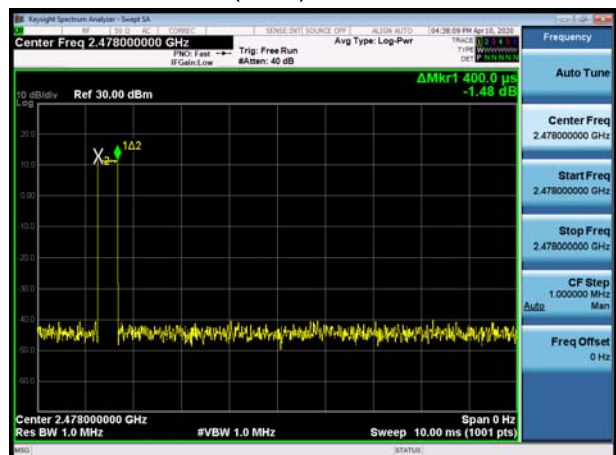


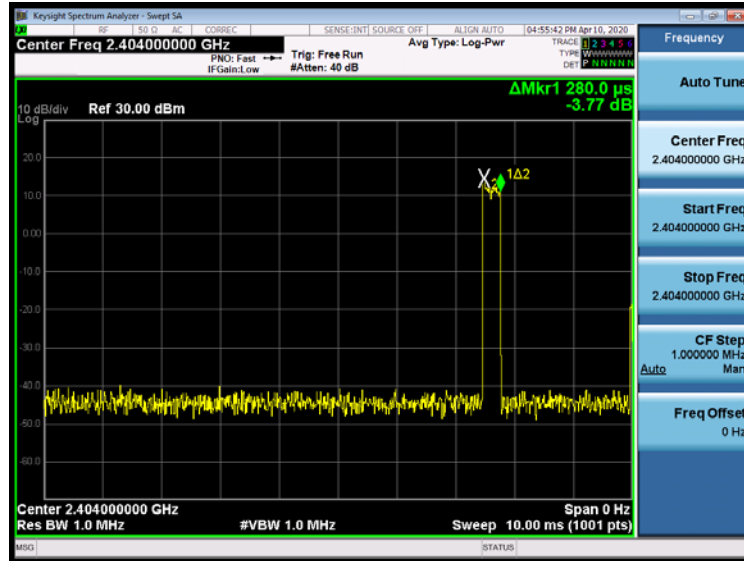
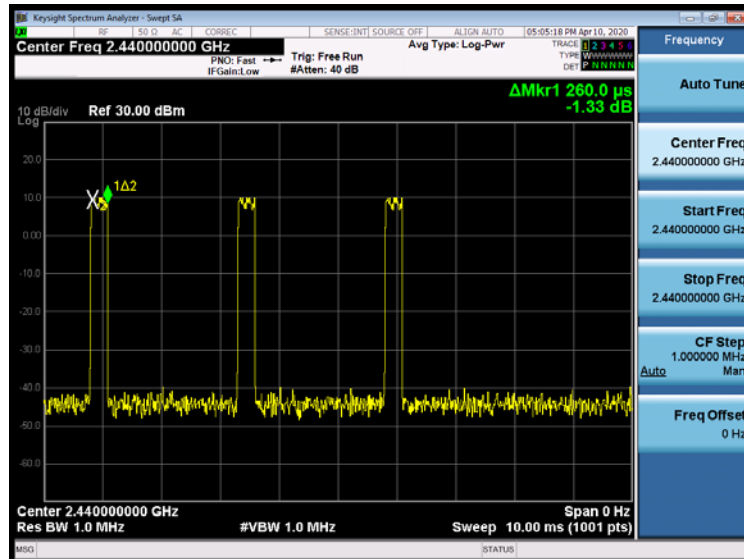
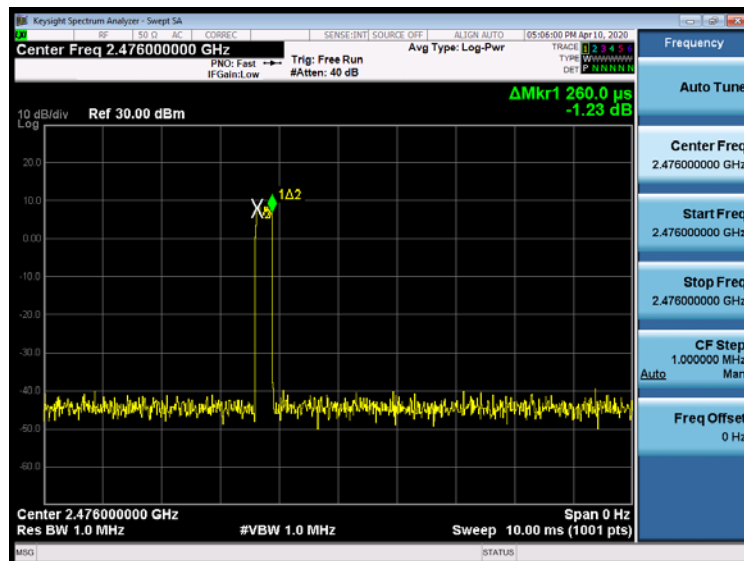
BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2478



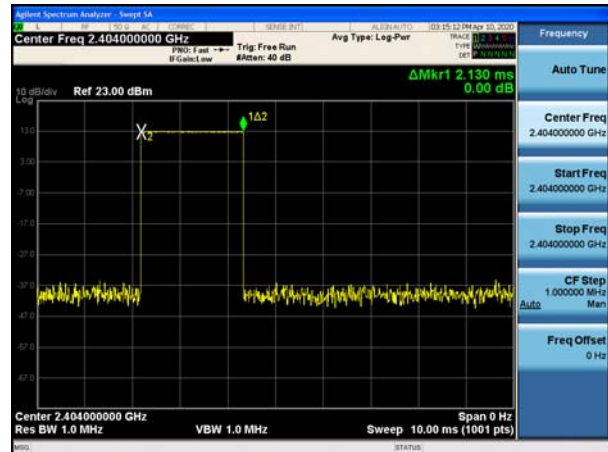


BT UHD High Power Mode

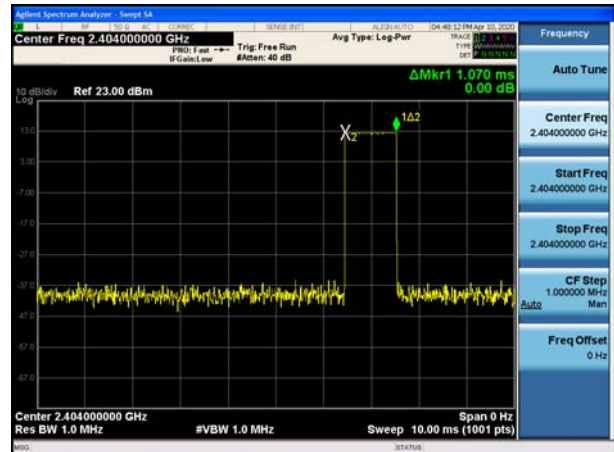
BT UHD 2M $\pi/4$ -DQPSK, Carrier frequency
(MHz): 2404BT UHD 2M 8DPSK, Carrier frequency
(MHz): 2404BT UHD 2M $\pi/4$ -DQPSK, Carrier frequency
(MHz): 2440BT UHD 2M 8DPSK, Carrier frequency
(MHz): 2440BT UHD 2M $\pi/4$ -DQPSK CH37, Carrier
frequency (MHz): 2478BT UHD 2M 8DPSK CH37, Carrier frequency
(MHz): 2478

BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2404BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2440BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2476

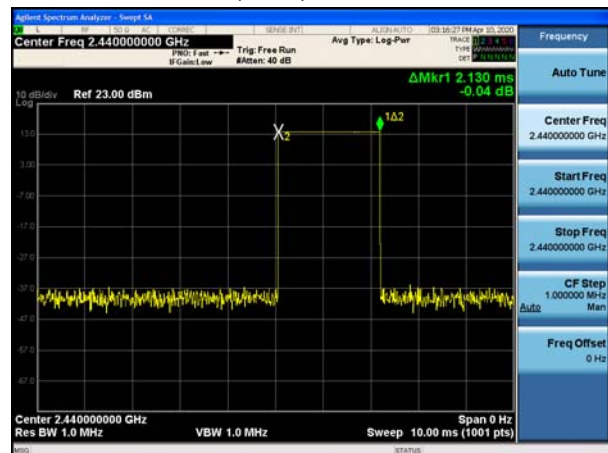
BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2404



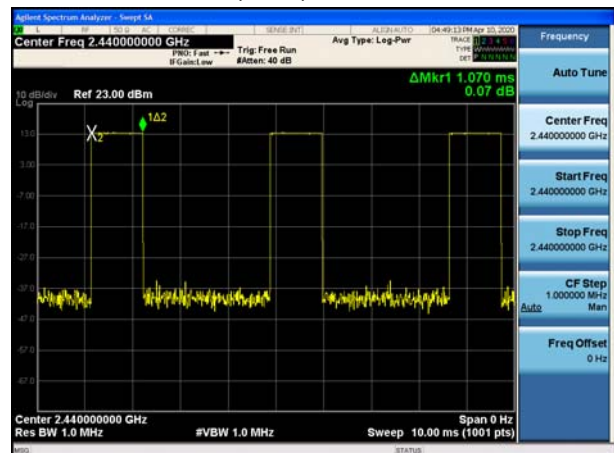
BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2404



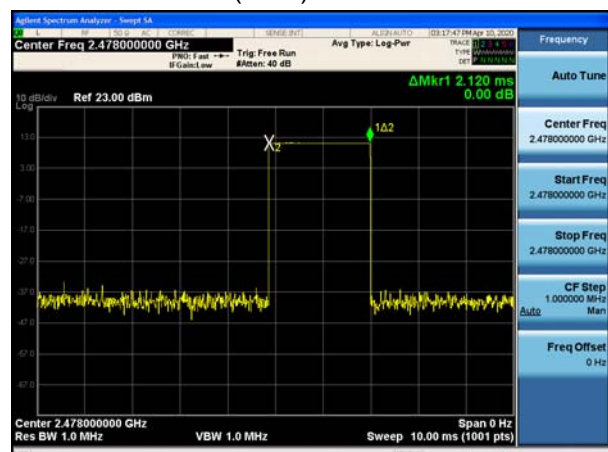
BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2440



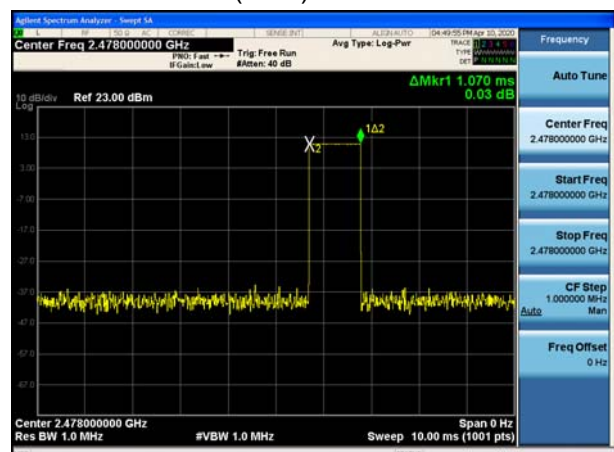
BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2440



BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2478



BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2478



5.5 Band Edge Compliance

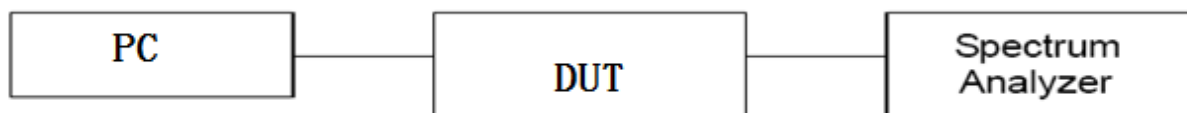
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

During the process of the testing, The EUT was connected to the spectrum analyzer .The EUT is controlled by the PC set to ensure max power transmission. The lowest and highest channels were measured. The peak detector is used. RBW is set to 100 kHz and VBW is set to 300 kHz on spectrum analyzer. EUT test for Hopping On mode and Hopping Off mode.

Test Setup



Limits

Rule Part 15.247(d) specifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.”

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

Frequency	Uncertainty
2GHz-3GHz	1.407 dB

Test Results
BT UHD Normal Mode
Hopping On

BT UHD 2M $\pi/4$ -DQPSK, Carrier frequency
(MHz): 2404



UHD 2M $\pi/4$ -DQPSK CH37, Carrier frequency
(MHz): 2478



BT UHD 2M 8DPSK, Carrier frequency
(MHz): 2404



BT UHD 2M 8DPSK CH37, Carrier frequency
(MHz): 2478

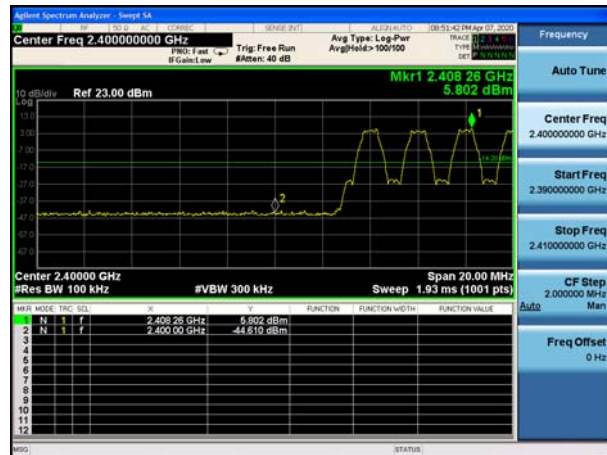
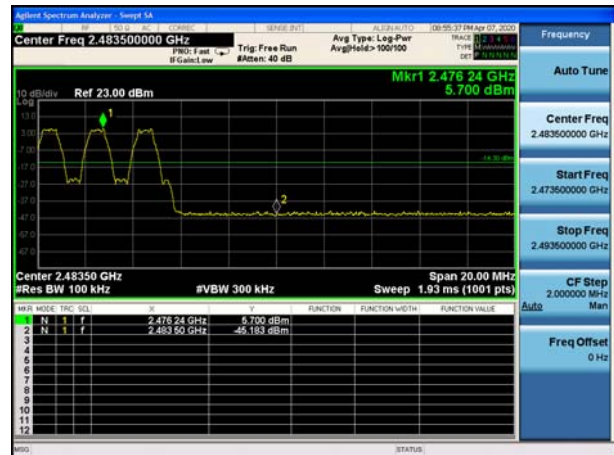
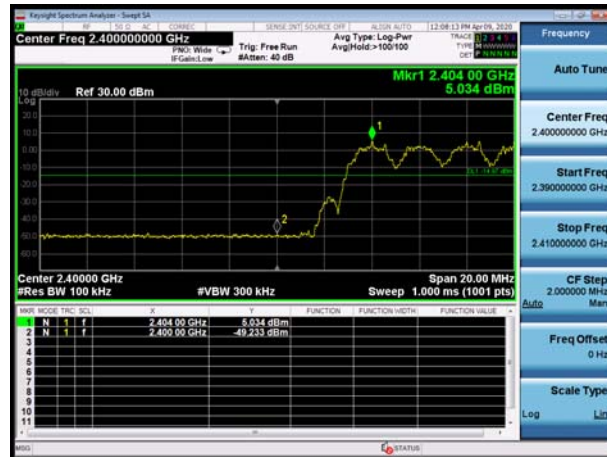
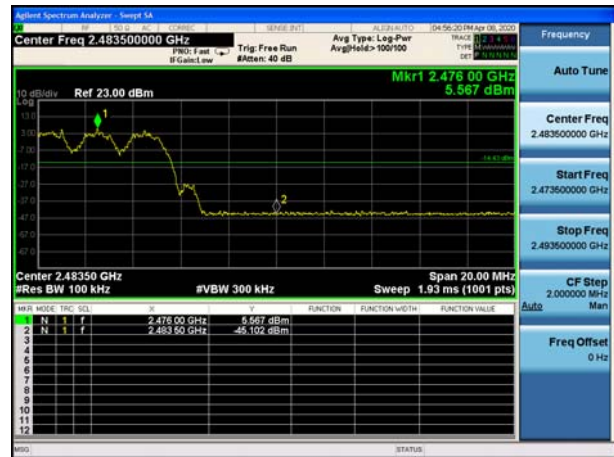


BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency
(MHz): 2404



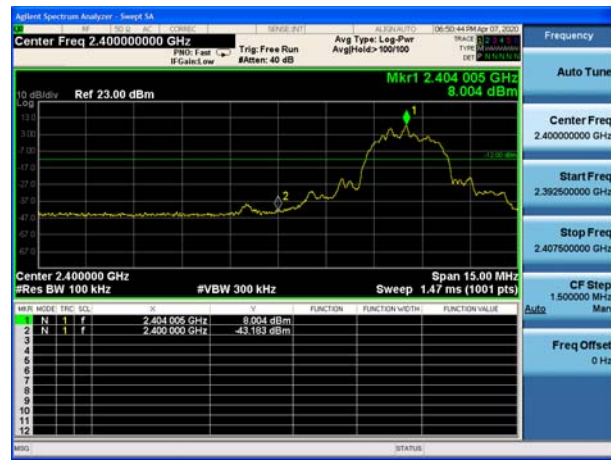
BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency
(MHz): 2476



BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2404BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2478BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2404BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2478

Hopping Off

BT UHD 2M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2404



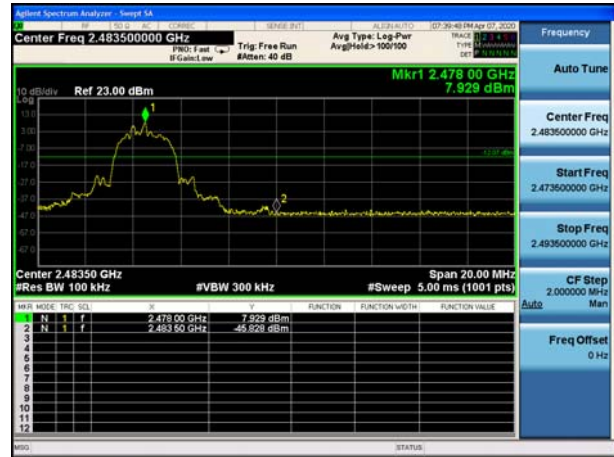
BT UHD 2M $\pi/4$ -DQPSK CH37, Carrier frequency (MHz): 2478



BT UHD 2M 8DPSK, Carrier frequency (MHz): 2404



BT UHD 2M 8DPSK CH37, Carrier frequency (MHz): 2478

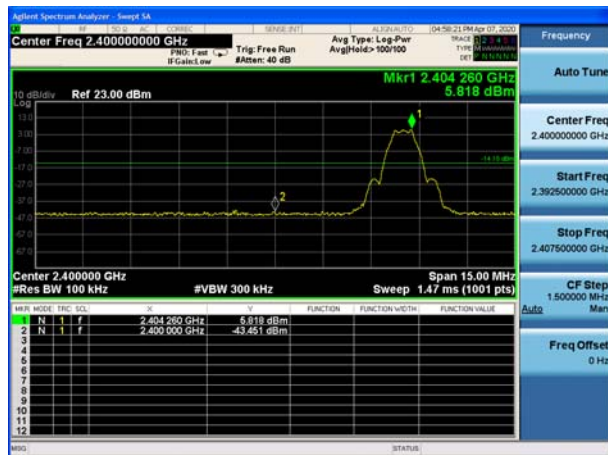
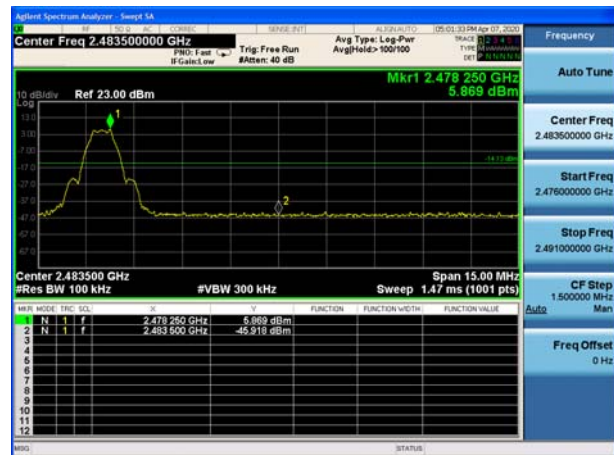
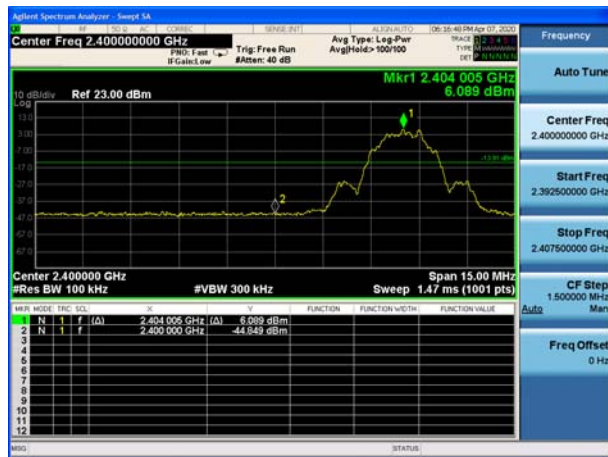
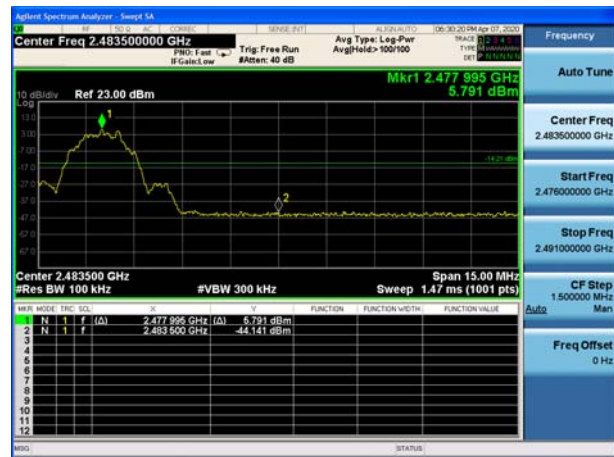


BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2404



BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency (MHz): 2476



BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2404BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2478BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2404BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2478

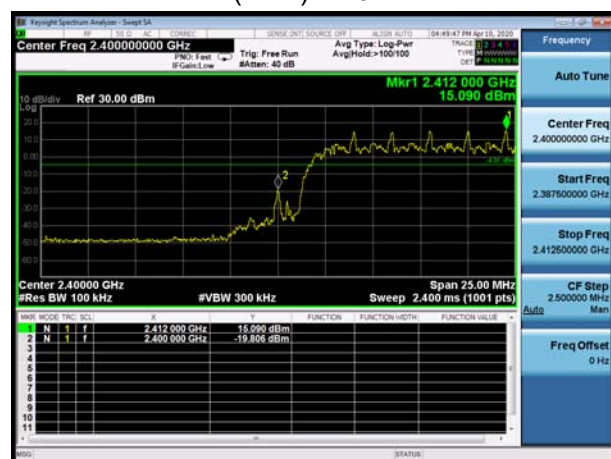
**BT UHD High Power Mode
Hopping On**

BT UHD 2M $\pi/4$ -DQPSK, Carrier frequency
(MHz): 2404

BT UHD 2M $\pi/4$ -DQPSK CH37, Carrier
frequency (MHz): 2478

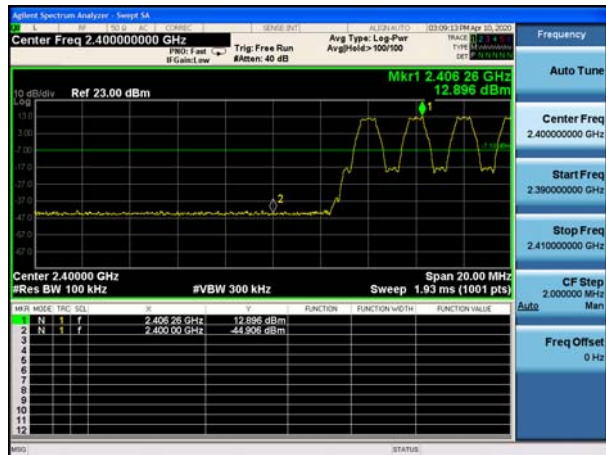
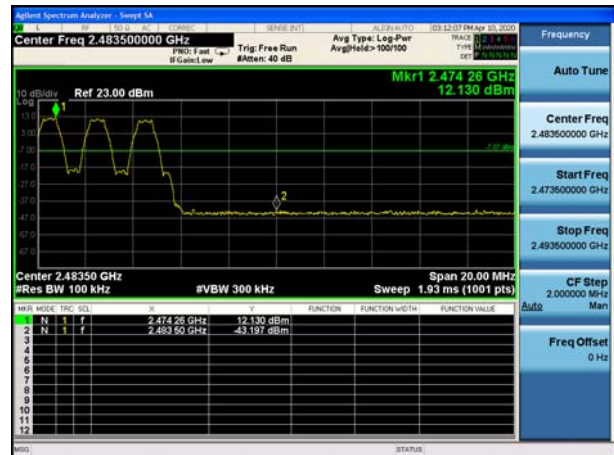
BT UHD 2M 8DPSK, Carrier frequency
(MHz): 2404BT UHD 2M 8DPSK CH37, Carrier frequency
(MHz): 2478

BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency
(MHz): 2404



BT UHD 4M $\pi/4$ -DQPSK, Carrier frequency
(MHz): 2476



BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2404BT UHD BLE 1M GFSK, Carrier frequency
(MHz): 2478BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2404BT UHD BLE 2M GFSK, Carrier frequency
(MHz): 2478