

TEST REPORT

Report Number.....	90966-22-72-22-PP003			
Date of issue	2022-12-02			
Tested by (+signature)	Duke			
Approved by (+signature)....	Jason			
Testing Laboratory name.....	SLG-CPC Testlaboratory Co., Ltd.			
Address	No. 11, Wu Song Road, Dongcheng District, Dongguan, Guangdong Province, China 523117			
Applicant's name	JUNHUAWEIYEKEJIYOUXIANGONGSI			
Address	shenzhenshilongguanquyuanshanjiedaoxikenshequbaotongnanlu64#			
Manufacturer's name	JUNHUAWEIYEKEJIYOUXIANGONGSI			
Address	shenzhenshilongguanquyuanshanjiedaoxikenshequbaotongnanlu64#			
Factory's name	JUNHUAWEIYEKEJIYOUXIANGONGSI			
Address	shenzhenshilongguanquyuanshanjiedaoxikenshequbaotongnanlu64#			
Standard(s).....	FCC 47 CFR Part 15, Subpart C			
Test item description.....	Wireless Bluetooth projector			
Trade Mark.....	N/A			
Model/Type reference.....	LX5501, WNI-M6, A4, K10, M525, J5, K99, LX5601			
FCC ID	2A9CO-LX5501			
Date of receipt of test item ..	2022-10-19			
Date (s) of performance of test.....	2022-10-20 to 2022-12-01			
Summary of Test Results.....	Pass			
The Summary of Test Results based on a technical opinion belongs to the standard(s).				
General disclaimer: This report shall not be reproduced except in full, without the written approval of SLG-CPC Testlaboratory Co., Ltd. The test results in the report only apply to the tested sample.				

TABLE OF CONTENTS

1	EUT TECHNICAL DESCRIPTION	4
2	SUMMARY OF TEST RESULT	5
3	TEST METHODOLOGY	6
3.1	GENERAL DESCRIPTION OF APPLIED STANDARDS	6
3.2	MEASUREMENT EQUIPMENT USED	6
3.3	DESCRIPTION OF TEST MODES	7
4	FACILITIES AND ACCREDITATIONS	8
4.1	FACILITIES	8
4.2	LABORATORY ACCREDITATIONS AND LISTINGS	8
5	TEST SYSTEM UNCERTAINTY	9
6	SETUP OF EQUIPMENT UNDER TEST	10
6.1	RADIO FREQUENCY TEST SETUP 1	10
6.2	RADIO FREQUENCY TEST SETUP 2	10
6.3	CONDUCTED EMISSION TEST SETUP	12
6.4	BLOCK DIAGRAM CONFIGURATION OF TEST SYSTEM	13
6.5	SUPPORT EQUIPMENT	13
7	TEST REQUIREMENTS	14
7.1	20DB BANDWIDTH	14
7.2	CARRIER FREQUENCY SEPARATION	20
7.3	NUMBER OF HOPPING FREQUENCIES	26
7.4	AVERAGE TIME OF OCCUPANCY (DWELL TIME)	29
7.5	MAXIMUM PEAK CONDUCTED OUTPUT POWER	32
7.6	CONDUCTED SPURIOUS EMISSION	38
7.7	RADIATED SPURIOUS EMISSION	45
7.8	CONDUCTED EMISSION TEST	59
7.9	ANTENNA APPLICATION	62

Modified Information

Report No.	Revision Data	Summary
90535-22-72-22-PP003	2022-12-02	Original Version

1 EUT TECHNICAL DESCRIPTION

Characteristics	Description
Product	Wireless Bluetooth projector
Model Number	LX5501, WNI-M6, A4, K10, M525, J5, K99, LX5601 All models have the same wireless module PCB, RF chip structure circuit diagram. All tests were performed on model K10
Device Type	Bluetooth V5.1
Data Rate	1Mbps for BT V5.1 GFSK modulation 2Mbps for BT V5.1 pi/4-DQPSK modulation 3Mbps for BT V5.1 8DPSK modulation
Modulation:	GFSK modulation for BT V5.1 (1Mbps) pi/4-DQPSK modulation for BT V5.1 (2Mbps) 8DPSK modulation for BT V5.1 (3Mbps)
Operating Frequency Range(s):	2402-2480MHz
Number of Channels:	79 channels
Transmit Power Max:	-0.06 dBm
Antenna Type	PCB Antenna
Antenna Gain	-0.58 dBi
Power supply	AC 100-240V 50/60Hz
Temperature Range:	-20°C ~ +55°C

Note: for more details, please refer to the User's manual of the EUT.

2 SUMMARY OF TEST RESULT

FCC Part Clause	Test Parameter	Verdict	Remark
15.247(a)(1)	20 dB Bandwidth	PASS	
15.247(a)(1)	Carrier Frequency Separation	PASS	
15.247(a)(1)	Number of Hopping Frequencies	PASS	
15.247(a)(1)	Average Time of Occupancy (Dwell Time)	PASS	
15.247(b)(1)	Maximum Peak Conducted Output Power	PASS	
15.247(c)	Conducted Spurious Emissions	PASS	
15.247(d) 15.209	Radiated Spurious Emissions	PASS	
15.207	Conducted Emission	PASS	
15.203	Antenna Application	PASS	
15.247 (a) (1)/g/h	Frequency Hopping System	PASS	
NOTE1: N/A (Not Applicable) NOTE2: According to FCC KDB 558074 D01 15.247 Meas Guidance v05r02, the report use radiated measurements in the restricted frequency bands. In addition, the radiated test is also performed to ensure the emissions emanating from the device cabinet also comply with the applicable limits.			

RELATED SUBMITTAL(S) / GRANT(S):

This submittal(s) (test report) is intended for FCC ID: 2A9CO-LX5501 filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

3 TEST METHODOLOGY

3.1 GENERAL DESCRIPTION OF APPLIED STANDARDS

According to its specifications, the EUT must comply with the requirements of the following standards:

FCC 47 CFR Part 15, Subpart C

FCC KDB 558074 D01 15.247 Meas Guidance v05r02

3.2 MEASUREMENT EQUIPMENT USED

Equipment	Model	Manufacturer	S/N	Last Cal.	Due Cal.
RF Connected Test					
Vector Signal Generator	Rohde & Schwarz	SMBV100B(6G)	101166	2022/06/29	1 year
Analog Signal Generator	Rohde & Schwarz	SMB100A(40G)	181333	2022/06/29	1 year
Signal Analyzer	Rohde & Schwarz	FSV40	101527	2022/04/19	1 year
Power Analyzer	Rohde & Schwarz	OSP-B157W8	N/A	2022/06/29	1 year
Wideband Radio Communication Tester	R&S	CMW270	101985	2022/07/05	1 year
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	166898	2022/07/14	1 year
Temperature&Humidity test chamber	ESPEC	VC 4018	/	2022/03/23	1 year
Radiated Emission Test					
EMI Test Receiver	KEYSIGHT	N9010A	MY56070465	2021/12/10	1 year
EMI Test Receiver	Rohde & Schwarz	FSV40	101511	2022/04/19	1 year
Bilog Antenna	Schwarzbeck	VULB 9163	01335	2020/04/28	3 year
Power Amplifier	EMEC	EM330	060676	2021/12/10	3 year
Cable	Tuyue	F4309	L-400-NmNm-12000	2021/12/10	1 year
Horn Antenna	Schwarzbeck	BBHA9120D	1779	2022/04/21	3 year
Horn Antenna	Schwarzbeck	BBHA9170	00954	2022/09/13	3 year
Power Amplifier	Rohde & Schwarz	SCU-18F	180118	2022/04/21	3 year
Active Loop Antenna	ETS LINDGREN	6512	41623	2022/04/23	3 year
Test Software	Farad	EZ-EMC	Ver.CPC-3A1	/	/
Conducted Emission Test					
LISN	Schwarzbeck	NSLK 8127	8127-892	2022/03/19	1 year
LISN	Schwarzbeck	NSLK 8127	8127-437	2022/08/26	1 year
EMI Test Receiver	R&S	ESR3	102124	2021/12/10	1 year
Pulse Limiter	R&S	ESH3-Z2	357.8810.52	2021/12/10	1 year
Test Software	Farad	EZ-EMC	Ver.CPC-3A1	/	/

3.3 DESCRIPTION OF TEST MODES

The EUT has been tested under its typical operating condition.

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

Test of channel included the lowest and middle and highest frequency to perform the test, then record on this report.

Those data rates (1Mbps for Bluetooth V5.1 GFSK modulation; 2Mbps for Bluetooth V5.1 pi/4-DQPSK modulation; 3Mbps for Bluetooth V5.1 8DPSK modulation) were used for all test.

Pre-defined engineering program for regulatory testing used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Frequency and Channel list for Bluetooth V5.1

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	39	2441
1	2403	40	2442	76	2478
2	2404	41	2443	77	2479
...	78	2480

Note: $fc=2402MHz+(k-1)\times1MHz$ k=1 to 79

Test Frequency and channel for Bluetooth V5.1

Lowest Frequency		Middle Frequency		Highest Frequency	
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	39	2441	78	2480

4 FACILITIES AND ACCREDITATIONS

4.1 FACILITIES

All measurement facilities used to collect the measurement data are located at No. 11, Wu Song Road, Dongcheng District, Dongguan, Guangdong Province, China 523117. The sites are constructed in conformance with the requirements of ANSI C63.4, ANSI C63.10 and CISPR Publication 32.

4.2 LABORATORY ACCREDITATIONS AND LISTINGS

Site Description	
EMC Lab.	: Accredited by ISED, October 04 2021 CAB identifier: CN0126 Company Number: 27767 Accredited by A2LA, October 04 2021 The Certificate Registration Number is 6325.01
Name of Firm	: SLG-CPC Testlaboratory Co., Ltd.
Site Location	: No. 11, Wu Song Road, Dongcheng District, Dongguan, Guangdong Province, China 523117

5 TEST SYSTEM UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

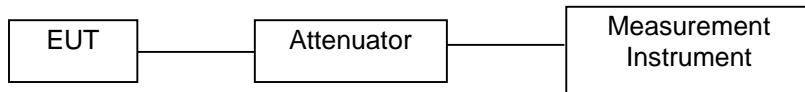
Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-5}$
Maximum Peak Output Power Test	$\pm 1.0\%$
Conducted Emissions Test	$\pm 3.08\text{dB}$
Radiated Emission Test	$\pm 4.60\text{dB}$
Power Density	$\pm 0.9\%$
Occupied Bandwidth Test	$\pm 2.3\%$
Band Edge Test	$\pm 1.2\%$
Antenna Port Emission	$\pm 3\text{dB}$
Temperature	$\pm 3.2\%$
Humidity	$\pm 2.5\%$

Measurement Uncertainty for a level of Confidence of 95%

6 SETUP OF EQUIPMENT UNDER TEST

6.1 RADIO FREQUENCY TEST SETUP 1

The Bluetooth V5.1 component's antenna port(s) of the EUT are connected to the measurement instrument per an appropriate attenuator. The EUT is controlled by PC/software to emit the specified signals for the purpose of measurements.



6.2 RADIO FREQUENCY TEST SETUP 2

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4 dB according to the standards: ANSI C63.10. The test distance is 3m. The setup is according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 and CAN/CSA-CEI/IEC CISPR 32.

Below 30MHz:

The EUT is placed on a turntable 0.8meters above the ground in the chamber, 3 meter away from the antenna (loop antenna). The Antenna should be positioned with its plane vertical at the specified distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The center of the loop shall be 1 m above the ground. For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT.

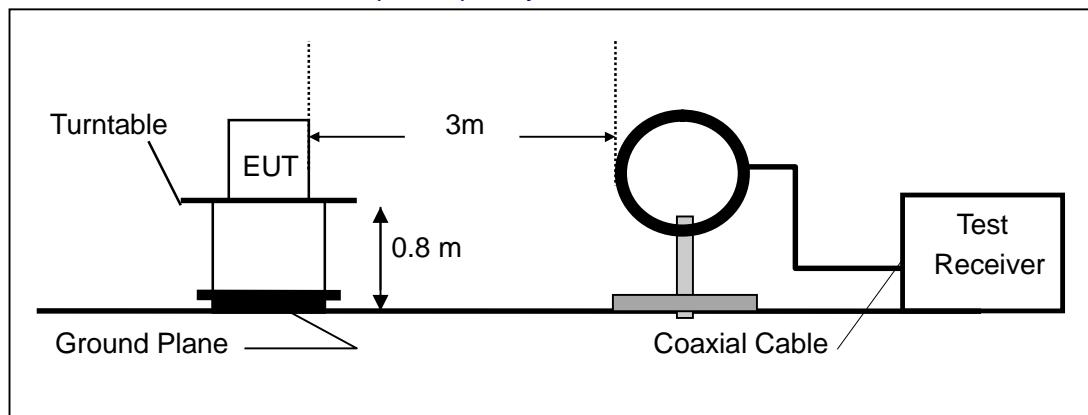
Above 30MHz:

The EUT is placed on a turntable 0.8meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

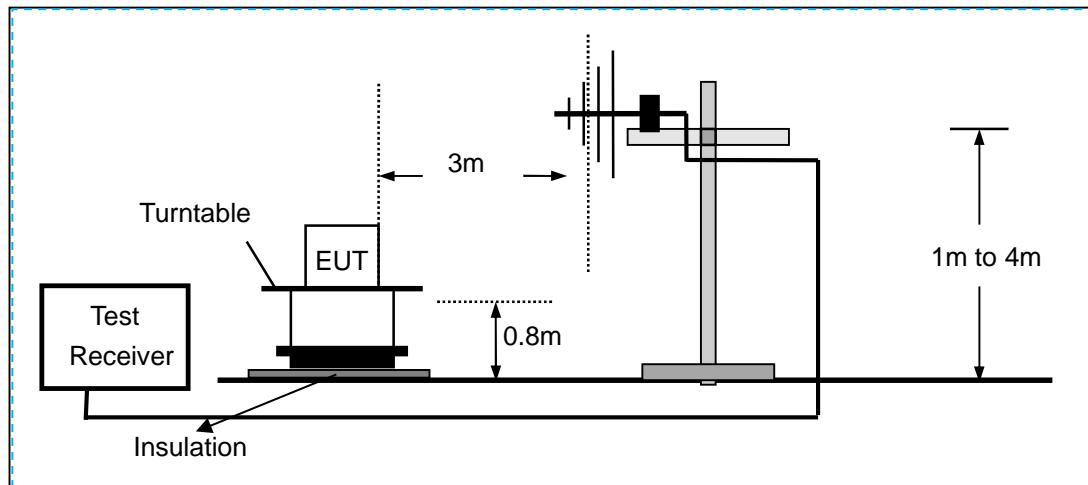
Above 1GHz:

(Note: the FCC's permission to use 1.5m as an alternative per TCBC Conf call of Dec. 2, 2014.) The EUT is placed on a turntable 1.5 meters above the ground in the chamber, 3 meter away from the antenna. The maximal emission value is acquired by adjusting the antenna height, polarisation and turntable azimuth. Normally, the height range of antenna is 1 m to 4 m, the azimuth range of turntable is 0° to 360°, and the receive antenna has two polarizations Vertical (V) and Horizontal (H).

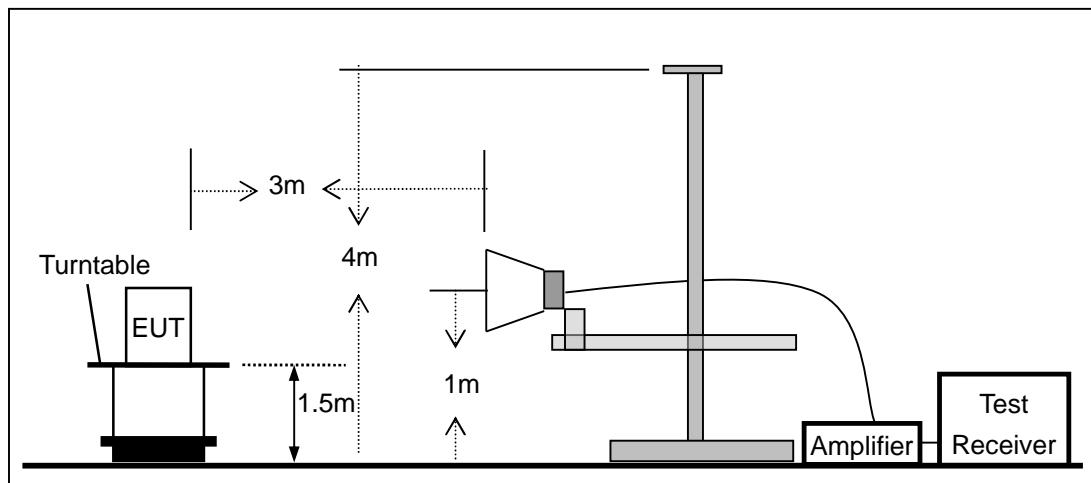
(a) Radiated Emission Test Set-Up, Frequency Below 30MHz



(b) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(c) Radiated Emission Test Set-Up, Frequency above 1000MHz

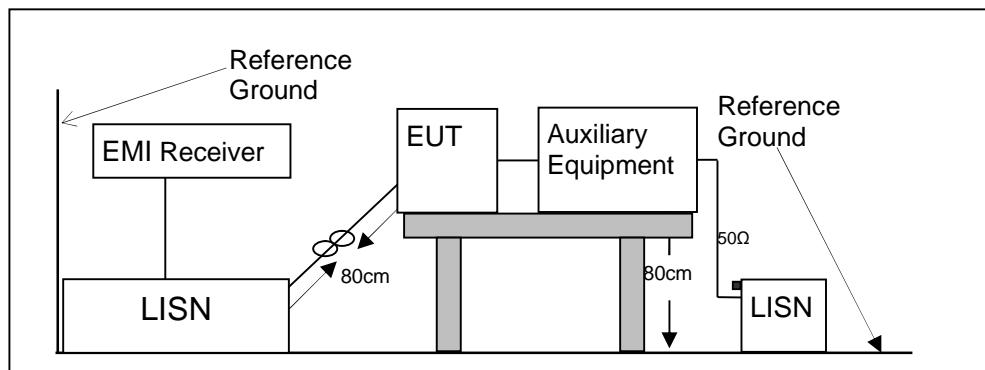


6.3 CONDUCTED EMISSION TEST SETUP

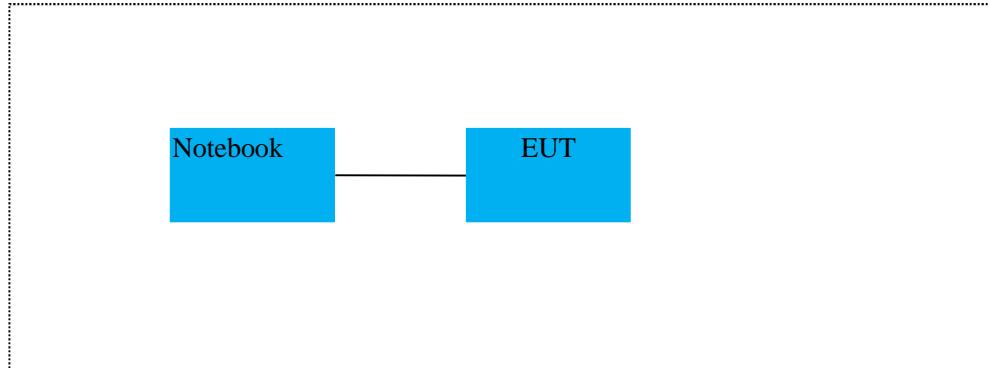
The mains cable of the EUT (Perfect Share Mini) must be connected to LISN. The LISN shall be placed 0.8m from the boundary of EUT and bonded to a ground reference plane for LISN mounted on top of the ground reference plane. This distance is between the closest points of the LISN and the EUT. All other units of the EUT and associated equipment shall be at least 0.8m from the LISN.

Ground connections, where required for safety purposes, shall be connected to the reference ground point of the LISN and, where not otherwise provided or specified by the manufacturer, shall be of same length as the mains cable and run parallel to the mains connection at a separation distance of not more than 0.8m.

According to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.



6.4 BLOCK DIAGRAM CONFIGURATION OF TEST SYSTEM



6.5 SUPPORT EQUIPMENT

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite

Auxiliary Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
Notebook	Lenovo	MPNXB1505007	MP1XHYV7

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

7 TEST REQUIREMENTS

7.1 20DB BANDWIDTH

7.1.1 Applicable Standard

According to FCC Part 15.247(a)(1) and KDB 558074 D01 15.247 MEAS GUIDANCE v05r02

7.1.2 Conformance Limit

No limit requirement.

7.1.3 Test Configuration

Test according to clause 6.1 radio frequency test setup 1

7.1.4 Test Procedure

The EUT was operating in Bluetooth V5.1 mode and controlled its channel. Printed out the test result from the spectrum by hard copy function.

The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.

Set to the maximum power setting and enable the EUT transmit continuously

Set RBW = 30 kHz.

Set the video bandwidth (VBW) =100 kHz.

Set Span= approximately 2 to 3 times the 20 dB bandwidth

Set Detector = Peak.

Set Trace mode = max hold.

Set Sweep = auto couple.

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the markerdelta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.

Measure and record the results in the test report.

Test Results

Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

Modulation Mode	Channel Number	Channel Frequency (MHz)	Measurement Bandwidth (MHz)	Limit (MHz)	Verdict
GFSK	00	2402	0.949	N/A	PASS
	39	2441	1.014	N/A	PASS
	78	2480	0.962	N/A	PASS
pi/4-DQPSK	00	2402	1.278	N/A	PASS
	39	2441	1.277	N/A	PASS
	78	2480	1.276	N/A	PASS
8DPSK	00	2402	1.299	N/A	PASS
	39	2441	1.330	N/A	PASS
	78	2480	1.303	N/A	PASS

Note: N/A (Not Applicable)











7.2 CARRIER FREQUENCY SEPARATION

7.2.1 Applicable Standard

According to FCC Part 15.247(a)(1) and KDB 558074 D01 15.247 MEAS GUIDANCE v05r02

7.2.2 Conformance Limit

Frequency hopping systems operating in the 2400-2483.5MHz band shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

In case of an output power less than 125mW, the frequency hopping system may have channels separated by a minimum of 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater.

7.2.3 Test Configuration

Test according to clause 6.1 radio frequency test setup 1

7.2.4 Test Procedure

■ According to FCC Part15.247(a)(1)

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
Set the RBW =30kHz. Set VBW =100kHz.

Set the span = wide enough to capture the peaks of two adjacent channels

Set Sweep time = auto couple.

Set Detector = peak. Set Trace mode = max hold.

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

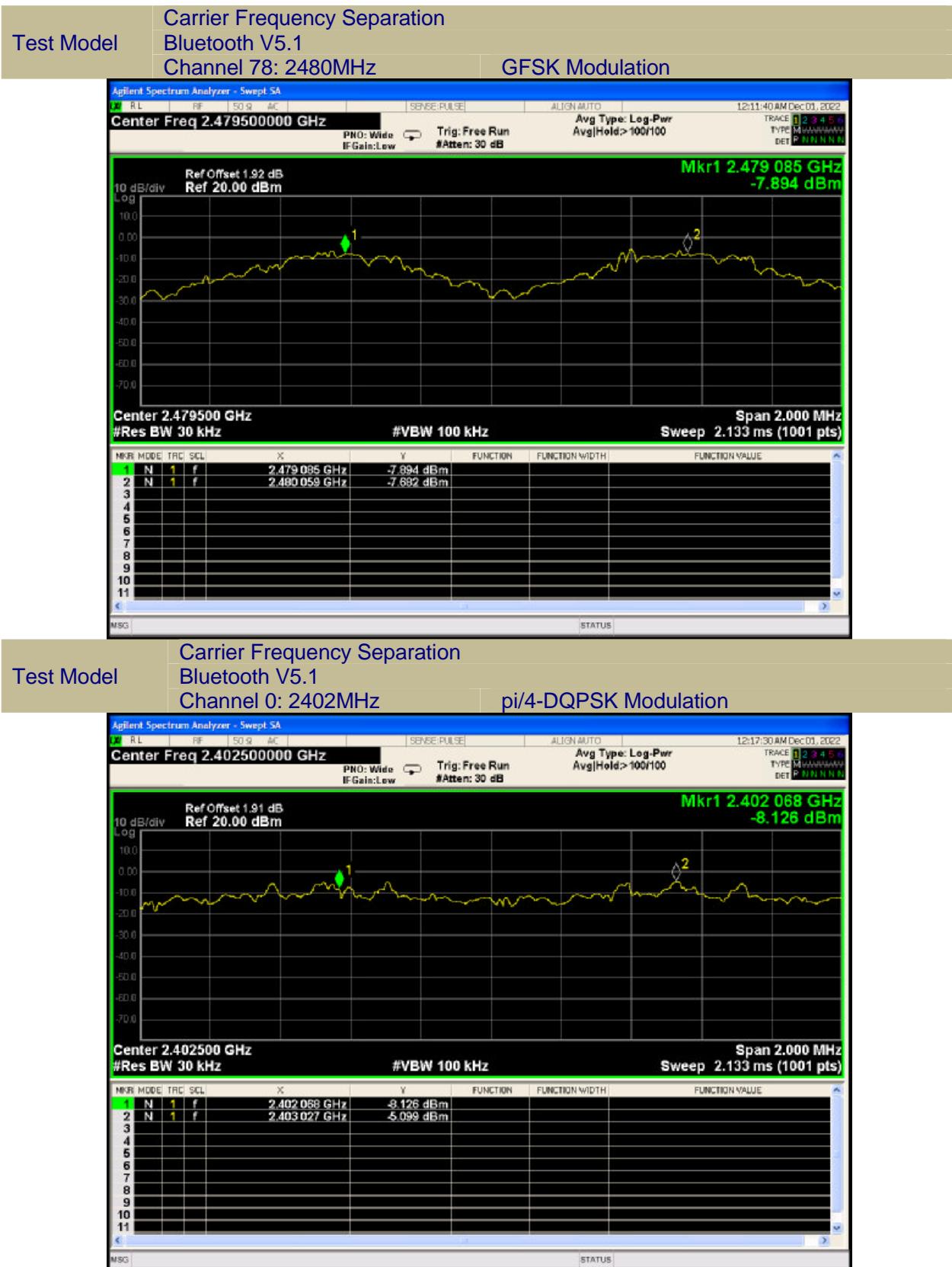
Test Results

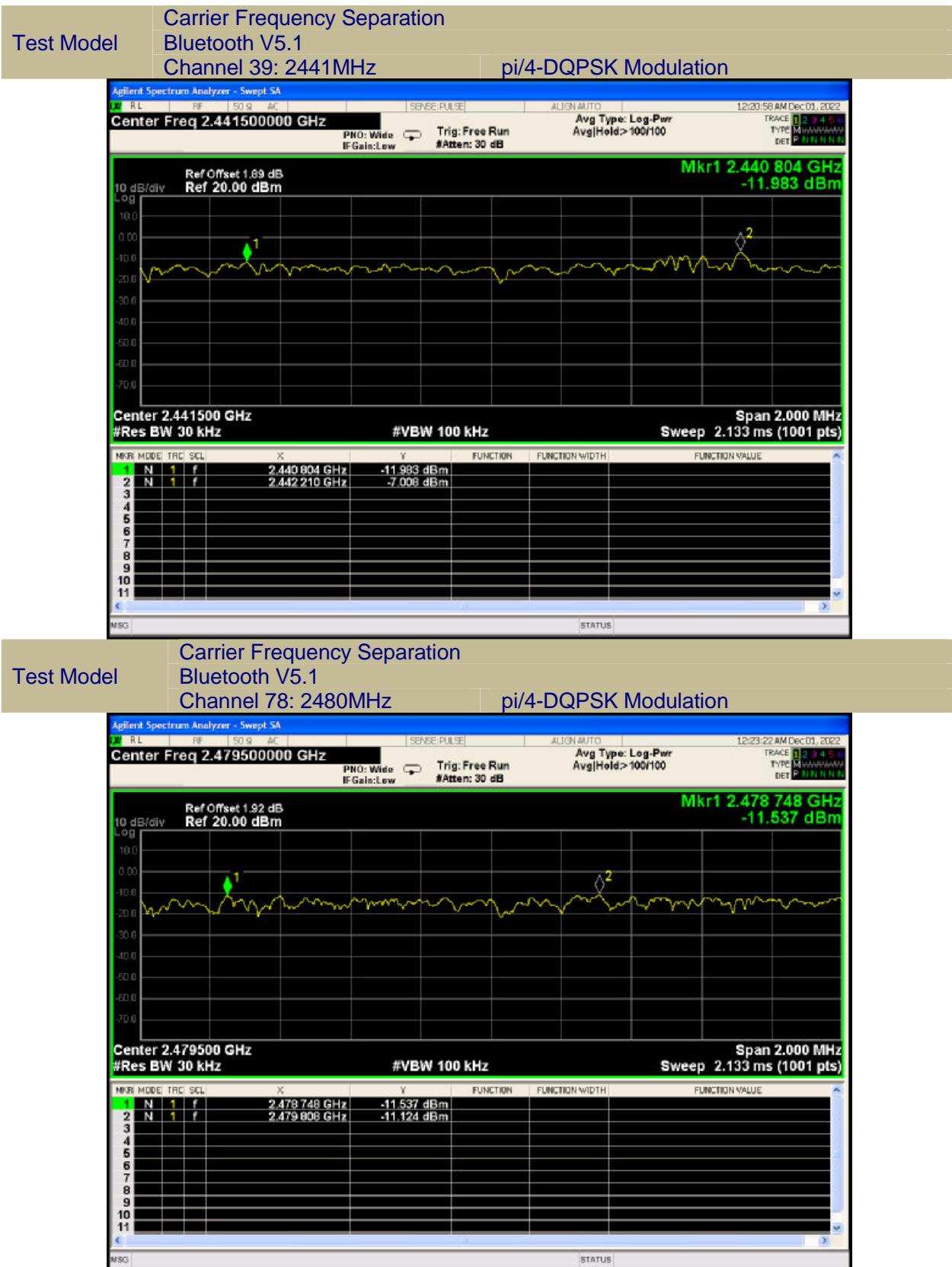
Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

Modulation Mode	Channel Number	Channel Frequency (MHz)	Measurement Bandwidth (kHz)	Limit (kHz)	Verdict
GFSK	0	2402	1022	>632	PASS
	39	2441	971	>676	PASS
	78	2480	974	>641	PASS
pi/4-DQPSK	0	2402	959	>852	PASS
	39	2441	1406	>851	PASS
	78	2480	1060	>850	PASS
8DPSK	0	2402	1173	>866	PASS
	39	2441	1313	>886	PASS
	78	2480	1303	>868	PASS

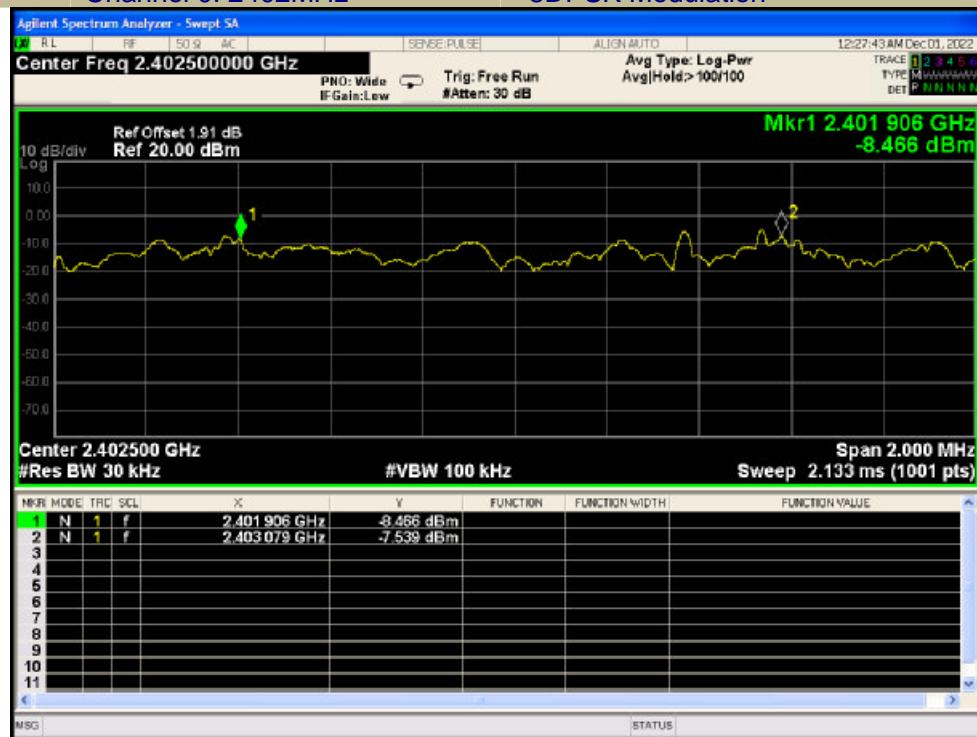
Note: Limit = 20dB bandwidth * 2/3



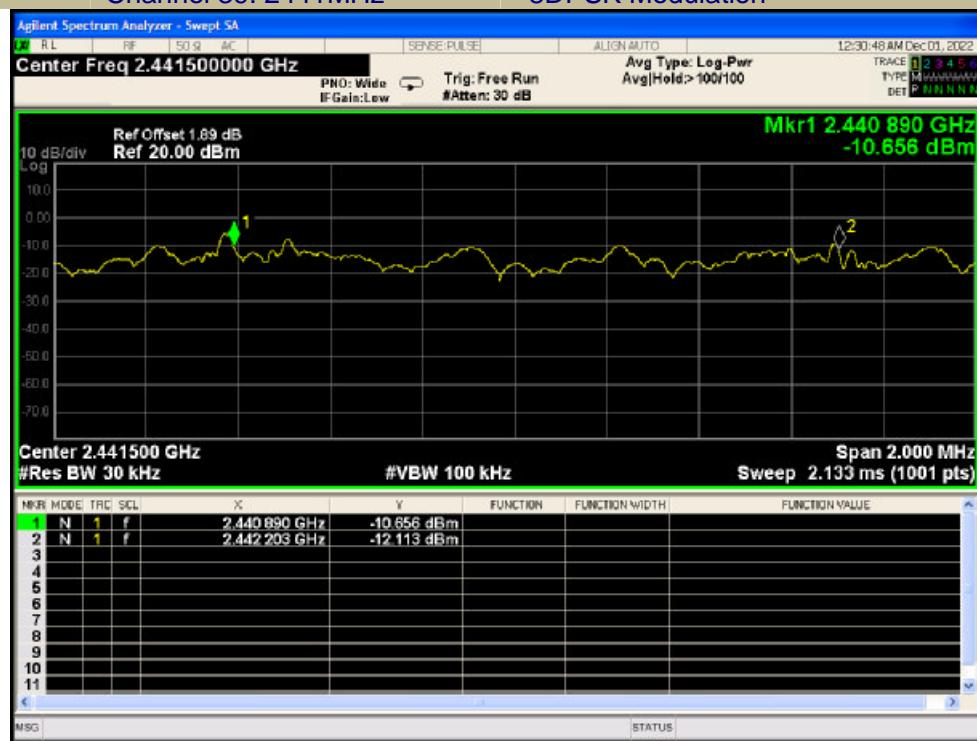


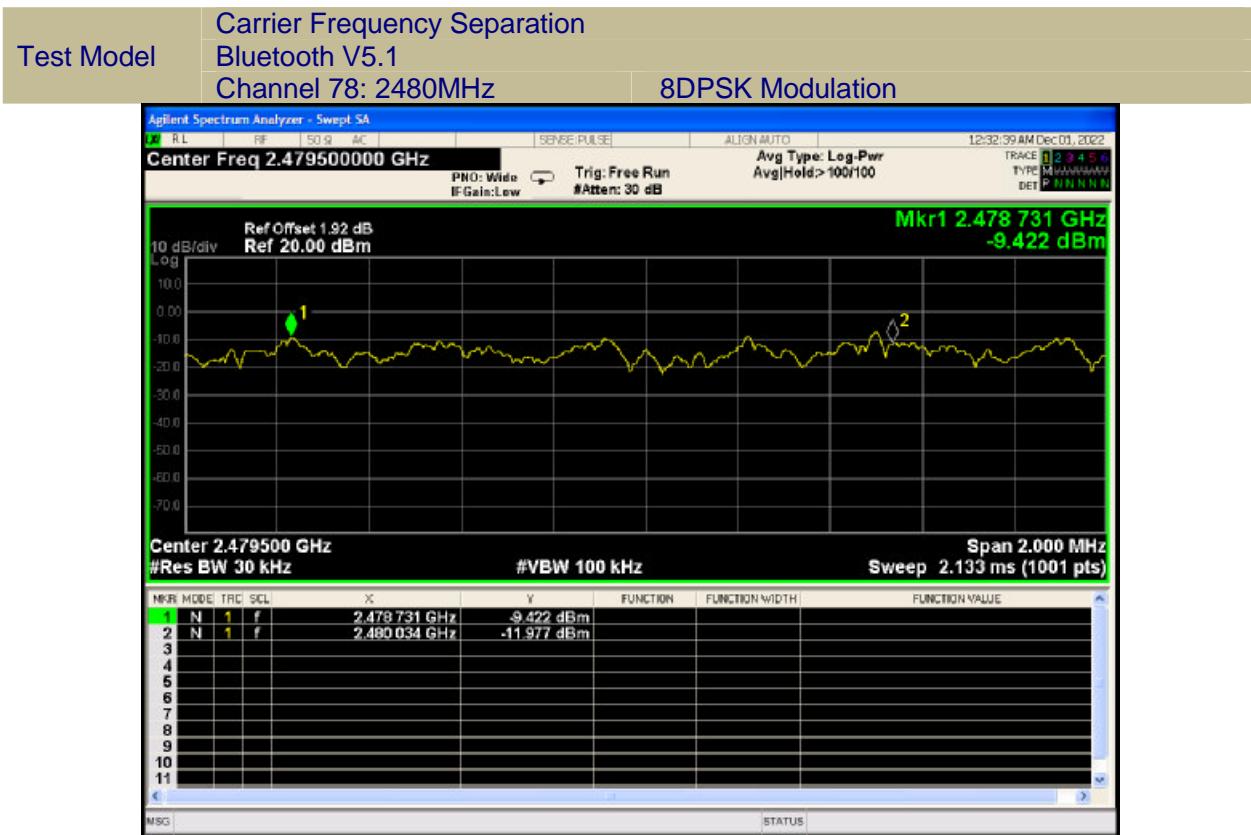


Test Model	Carrier Frequency Separation
	Bluetooth V5.1
	Channel 0: 2402MHz



Test Model	Carrier Frequency Separation
	Bluetooth V5.1
	Channel 39: 2441MHz





7.3 NUMBER OF HOPPING FREQUENCIES

7.3.1 Applicable Standard

According to FCC Part 15.247(a)(1) (iii) and KDB 558074 D01 15.247 MEAS GUIDANCE v05r02

7.3.2 Conformance Limit

Frequency hopping systems operating in the 2400-2483.5MHz band shall use at least 15 channels.

7.3.3 Test Configuration

Test according to clause 6.1 radio frequency test setup 1

7.3.4 Test Procedure

■ According to FCC Part 15.247(a)(1)(iii)

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = the frequency band of operation (2400-2483.5MHz)

RBW \geq 100KHz

VBW \geq RBW

Sweep = auto

Detector function = peak

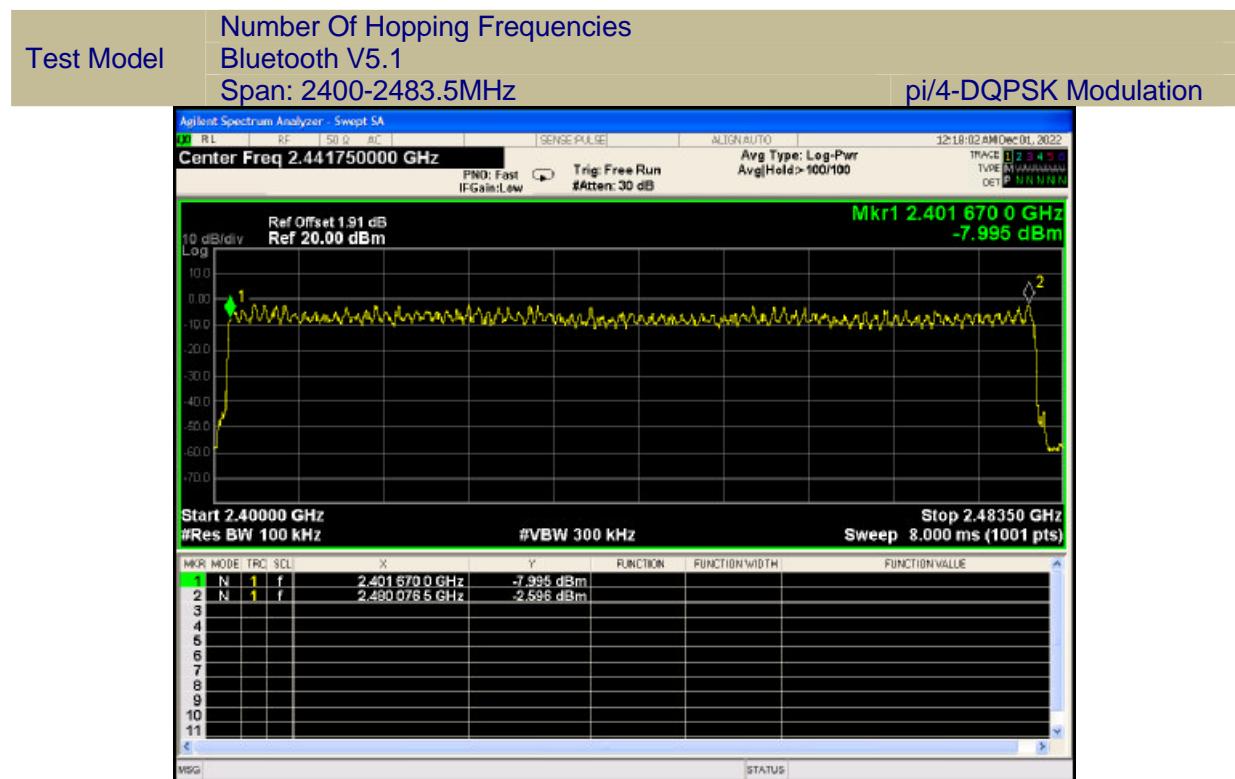
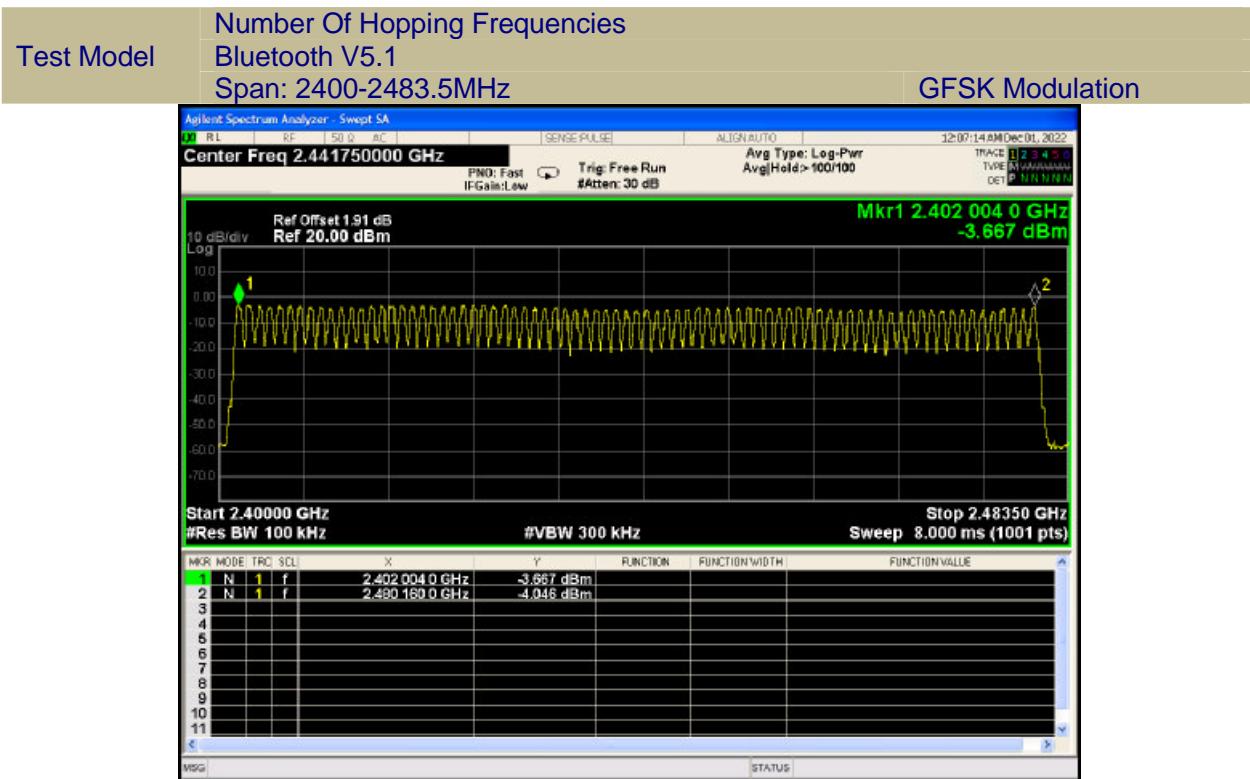
Trace = max hold

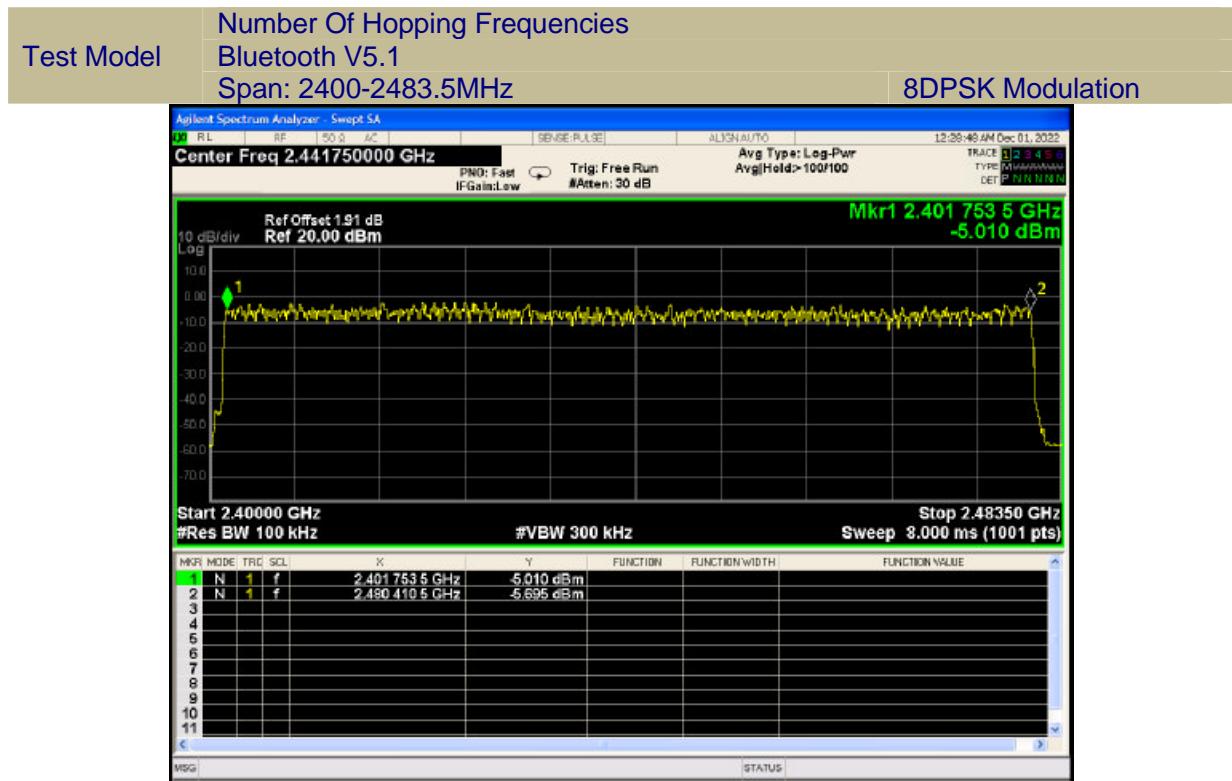
Allow the trace to stabilize. It may prove necessary to break the span up to sections, in order to clearly show all of the hopping frequencies.

Test Results

Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

Modulation Mode	Hopping Channel Frequency Range	Quantity of Hopping Channel	Quantity of Hopping Channel limit
GFSK	2402-2480	79	>15
pi/4-DQPSK	2402-2480	79	>15
8DPSK	2402-2480	79	>15





7.4 AVERAGE TIME OF OCCUPANCY (DWELL TIME)

7.4.1 Applicable Standard

According to FCC Part 15.247(a)(1)(iii) and KDB 558074 D01 15.247 MEAS GUIDANCE v05r02

7.4.2 Conformance Limit

For frequency hopping systems operating in the 2400-2483.5MHz band, the average time of occupancy on any channel shall not be greater than 0.4s within a period of 0.4s multiplied by the number of hopping channels employed.

7.4.3 Test Configuration

Test according to clause 6.1 radio frequency test setup 1

7.4.4 Test Procedure

- According to FCC Part15.247(a)(1)(iii)

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:
 Span = zero span, centered on a hopping channel

RBW = 1 MHz

VBW \geq RBW

Sweep = as necessary to capture the entire dwell time per hopping channel

Detector function = peak

Trace = max hold

If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section.

7.4.5 Test Results

Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

Bluetooth (GFSK, pi/4-DQPSK, 8DPSK) mode have been tested, and the worst result(GFSK) was report as below:

Modulation Mode	Channel Number	Packet type	Pluse width (ms)	Dwell Time (ms)	Limit (ms)	Verdict
GFSK	0	DH1	0.383	122.560	<400	PASS
	0	DH3	1.638	262.080	<400	PASS
	0	DH5	2.887	307.946	<400	PASS
Note: Dwell Time(DH1)=PW*(1600/2/79)*31.6 Dwell Time(DH3)=PW*(1600/4/79)*31.6 Dwell Time(DH5)=PW*(1600/6/79)*31.6						

Test Model	Average Time Of Occupancy (Dwell Time) Bluetooth V5.1 CH 0: 2480MHz	GFSK DH1
------------	---	----------

