FCC 47 CFR PART 15 SUBPART C AND ANSI C63.10: 2013 TEST REPORT

For

JBL Bluetooth Turntable

Model: JBL SPINNER BT

Data Applies To: N/A

Brand Name: JBL

Issued for

Harman International Industries, Incorporated
8500 Balboa Blvd, Northridge, CA 91329, UNITED STATES.

Issued By

Compliance Certification Services Inc.

Tainan Lab.
No. 168, Ln. 523, Sec. 3, Zhongzheng Rd.,
Rende Dist., Tainan City, 717017, Taiwan
Issued Date: August 24, 2023

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REVISION HISTORY

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	August 11, 2023	Initial Issue	ALL	Polly Wang
01	August 22, 2023	See the following note rev.01	P.76.77	Polly Wang
02	August 24, 2023	See the following note rev.02	ALL	Polly Wang

Note:

※ Rev.00 Issue Date: August 11, 2023
Original report.

※ Rev.01 Issue Date: August 22, 2023
Add 9kHz to 30MHz data for RADIATED EMISSIONS.

※ Rev.02 Issue Date: August 24, 2023
Update Product Name.

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TITLE PAGE NO.

1. TEST REPORT CERTIFICATION

Applicant	:	**Harman International Industries, Incorporated** 8500 Balboa Blvd, Northridge, CA 91329, UNITED STATES.
Manufacturer	:	**1.Ya Horng Electronic Co., Ltd** No. 35, Shalun, Jon Sha Village, Anding Dist., Tainan City 745, Taiwan **2. Ya Horng（Dongguan）Electronic Co.,Ltd.** Room 201, Building #9, No.84 Gaoyu South Road, Tangxia Town,Dong Guan, Guangdong, China
Equipment Under Test	:	JBL Bluetooth Turntable
Model Number	:	JBL SPINNER BT
Data Applies To	:	N/A
Brand Name	:	JBL
Date of Test	:	June 07, 2023 ~ August 21, 2023

APPLICABLE STANDARD	
STANDARD	**TEST RESULT**
FCC Part 15 Subpart C AND ANSI C63.10: 2013	PASS
Statements of Conformity	
Determining compliance shall be based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.	

We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in **ANSI C63.10: 2013** and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:

Ted Huang

Ted Huang
Sr. Engineer

2. TEST RESULT SUMMARY

FCC Standard Section	Report Section	Test Item	Result
15.203	3	ANTENNA REQUIREMENT	Pass
15.247(a)(1)	8.1	20dB BANDWIDTH	Pass
15.247(b)(1)	8.2	MAXIMUM PEAK OUTPUT POWER	Pass
15.247(a)(1)	8.3	HOPPING CHANNEL SEPARATION	Pass
15.247(a)(1)(iii)	8.4	NUMBER OF HOPPING FREQUENCY USED	Pass
15.247(a)(1)(iii)	8.5	DWELL TIME	Pass
-	8.6	DUTY CYCLE	-
15.247(d)	8.7	CONDUCTED SPURIOUS EMISSION	Pass
15.247(d)	8.8	RADIATED EMISSIONS	Pass
15.207(a)	8.9	POWERLINE CONDUCTED EMISSIONS	Pass

3. EUT DESCRIPTION

3.1 DESCRIPTION OF EUT & POWER

Product	JBL Bluetooth Turntable
Model Number	JBL SPINNER BT
Data Applies To	N/A
Brand Name	JBL
Received Date	May 31, 2023
Reported Date	July 06, 2023
Frequency Range	2402MHz ~ 2480MHz
Transmit Peak Power	GFSK : -1.436dBm / 0.718mW 8DPSK: 1.775dBm / 1.505mW
Channel Spacing	1MHz
Transmit Data Rate	GFSK Mode：1 Mbps 4/πDQPSK Mode : 2Mbps 8DPSK Mode : 3Mbps
Modulation Type	GFSK、π/4DQPSK、8DPSK
Number of Channels	79 Channels
EUT Power Supply	AC 100-240V
Antenna Type	Manufacturer: Birto Type: PCB Antenna Model: WF-EM-1510-0067-A(WF0EM12-I080) Gain: 2.31 dBi
Firmware Version	DL4351_ICYH111P01_STM32F030F4P6_Y0-4
Software Version	N/A

Power Adapter :

Manufacturer	Model No.	Power Input	Power Output
GPE	GPE012T-120100-Z	100-240V~ 50/60Hz 0.5A	12Vdc 1.0A 12.0W MAX

Remark:
1. The sample selected for test was production product and was provided by manufacturer.
2. This submittal(s) (test report) is intended for **FCC ID: API-SPINNERBT** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.
3. For more details, please refer to the User's manual of the EUT.

4. DESCRIPTION OF TEST MODES

The EUT had been tested under operating condition.

There are three channels have been tested as following :

Channel	Frequency (MHz)
Low	2402
Middle	2441
High	2480

Radiated Emission Test (Below 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

Normal Operation

Radiated Emission Test (Above 1 GHz):

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

Tested Channel	Modulation Technology	Modulation Type	Packet Type
Low, Mid, High	FHSS	GFSK	DH5
Low, Mid, High	FHSS	8-DPSK	3-DH5

Bandedge Measurement :

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

Tested Channel	Modulation Technology	Modulation Type	Packet Type
Low, High	FHSS	GFSK	DH5
Low, High	FHSS	8-DPSK	3-DH5

Antenna Port Conducted Measurement :

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

Tested Channel	Modulation Technology	Modulation Type	Packet Type
Low, Mid, High	FHSS	GFSK	DH5
Low, Mid, High	FHSS	8-DPSK	3-DH5

5. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10 : 2013 and FCC CFR 47 15.207, 15.209 and 15.247.

6. FACILITIES AND ACCREDITATIONS

6.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

☐ No.8, Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

☒ No. 168, Ln. 523, Sec. 3, Zhongzheng Rd., Rende Dist., Tainan City 717, Taiwan

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 22.

6.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.
Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.
Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.
All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

6.3 LABORATORY ACCREDITATIONS LISTINGS

The test facilities used to perform radiated and conducted emissions tests are accredited by Taiwan Accreditation Foundation for the specific scope of accreditation under Lab Code: 1109 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by TAF or any agency of the Government. In addition, the test facilities are listed with Federal Communications Commission (registration no: TW1109).

6.4 TABLE OF ACCREDITATIONS AND LISTINGS

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

Taiwan	TAF

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	Industry Canada (ISED#: 2324H)
Germany	TUV NORD
Taiwan	BSMI
USA	FCC

6.5 MEASUREMENT EQUIPMENT USED

For §8.8.2~8.8.3

Chamber 1166 Room (Radiation Test)					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Active Loop Antenna	ETS-LINDREN	6502	8905-2356	08/29/2022	08/28/2023
Attenuator	MCL	BW-S15W5	0535	01/19/2023	01/18/2024
Bilog Antenna With 6dB Attenuator	SUNOL SCIENCES & EMCI	JB1 & N-6-06	A021306 & AT-N0682	10/11/2022	10/10/2023
Cable	EMCI	EM102-KMKM	CB1166-01	06/17/2023	06/16/2024
Double Ridged Guide Horn Antenna	ETS-LINDGREN	3116	00078900	03/25/2023	03/24/2024
EMI Test Receiver	R&S	ESCI 7	100856	06/15/2023	06/14/2024
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	08/11/2022	08/10/2023
Double Ridged Guide Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-788(98006)	04/18/2023	04/17/2024
Notch Filter	MICRO-TRONICS	BRM50702-01	018	01/19/2023	01/18/2024
Pre-Amplifier	EMCI	EMC012645	980098	01/19/2023	01/18/2024
Pre-Amplifier	Com-Power	PAM-840A	461378	06/07/2023	06/06/2024
Software	Excel(ccs-o6-2020 v1.1)，e3(v6.101222)				

For §8.1~8.7 8.8.4

Chamber 1166 Room (Conducted Test)					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	08/11/2022	08/10/2023
SMA Cable+10dB Attenuator	CCS	SMA+10dB ATT	SMA/10dB	01/19/2023	01/18/2024
Software	Excel(ccs-o6-2020 v1.1)				

For §8.9

Conducted Emission room #1					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
BNC Coaxial Cable	CCS	BNC50	11	01/19/2023	01/18/2024
EMI Test Receiver	R&S	ESCI	100960	01/11/2023	01/10/2024
LISN	FCC	FCC-LISN-50-32-2	08009	07/15/2022	07/14/2023
LISN	SCHWARZBECK	NNLK8130	8130124	01/18/2023	01/17/2024
Pulse Limiter	SCHWARZBECK	VTSD 9561-F	797	01/19/2023	01/18/2024
Test S/W	e3(v6.101222)				

6.6 MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

6.7 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

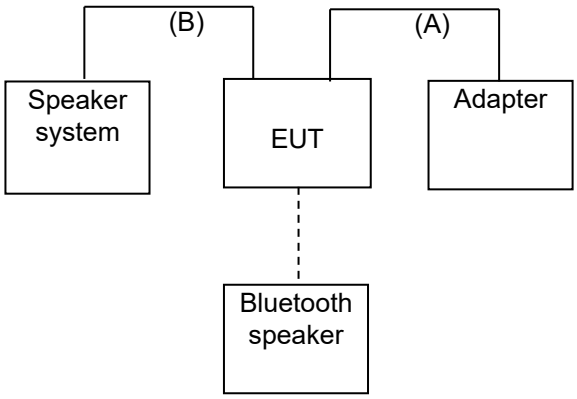
PARAMETER	UNCERTAINTY
Radiated Emission, 9kHz~30MHz Test Site : CB1166	±2.7dB
Radiated Emission, 30 MHz ~1GHz Test Site : CB1166	±3.76dB
Radiated Emission, 1GHz ~18GHz Test Site : CB1166	±4.43dB
Radiated Emission, 18GH~26.5GHz Test Site : CB1166	±4.79dB
Radiated Emission, 26.5GH~40GHz Test Site : CB1166	±4.72dB
Power Line Conducted Emission, 9kHz~30MHz	±1.83dB
Band Width	0.025%
Peak Output Power MU	±1.9dB
Band Edge MU	±0.264dBuV
Channel Separation MU	±361.69Hz
Duty Cycle MU	±0.2%
Frequency Stability MU	±0.493Hz
Temperature	±0.5
Humidity	±3%

This measurement uncertainty is confidence of approximately 95%, k=2

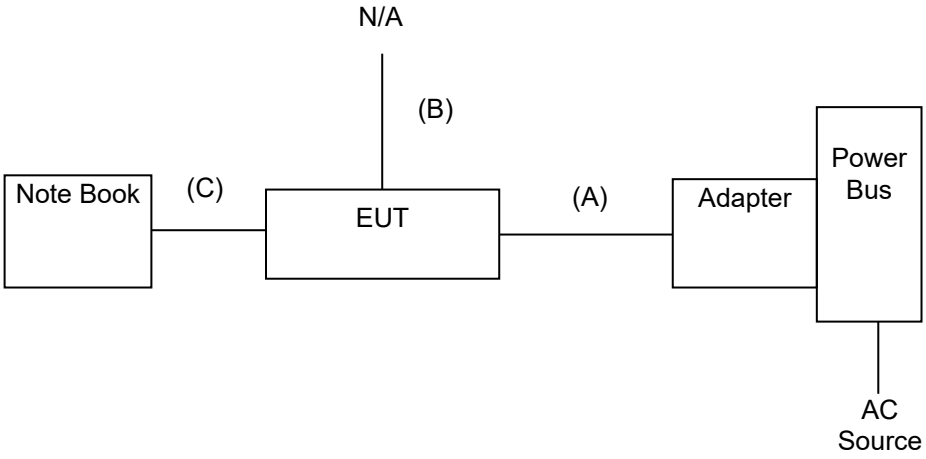
7. SETUP OF EQUIPMENT UNDER TEST

7.1 SETUP CONFIGURATION OF EUT

EMI



RF



7.2 SUPPORT EQUIPMENT

For EMI test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1	Speaker System	T.C.SATR	TCS2285	DOC	N/A
2	Bluetooth Speaker	KINYO	BTS-672	N/A	N/A

No.	Signal cable description	
A	DC Cable Power	Unshielded, 1.6m 1 pcs.
B	Audio	Shielded, 1.0m 1 pcs.

For RF test

No.	Product	Manufacturer	Model No.	Certify No.	Power cable
1	Note Book	Acer	Z5WE1	N/A	Unshielded, 1.8m with 1 core.

No.	Signal cable description	
A	DC Power	Unshielded, 1.5m 1 pcs.
B	Audio	Shielded, 1.0m 1 pcs.
C	USB	Shielded, 1.8m 1 pcs.

Note:

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.
3) shd. = shielded; unshd. = unshielded

EUT OPERATING CONDITION

RF Setup

1. Set up all computers like the setup diagram.
2. The “Blue Test 3 V3.3.9.1137” software was used for testing
3.Choose Transport “DEBUG” and Device “USB DBG(100)”

BT1.0、3.0

TX Mode:

PACKET TX
Channel 1~5: 0,39,78
GFSK(DH1):
Packet Type:DH1 > Packet Length 27
Power(0-9) : (5;6;6)
GFSK(DH3):
Packet Type:DH3 > Packet Length 183
Power(0-9) : (5;6;6)
GFSK(DH5):
Packet Type:DH5 > Packet Length 339
Power(0-9) : (5;6;6)
8-DPSK(3DH1):
Packet Type:3DH1 > Packet Length 83
Power(0-9) : 6
8-DPSK(3DH3):
Packet Type:3DH3 > Packet Length 552
Power(0-9) : 6
8-DPSK(3DH5):
Packet Type:3DH5 > Packet Length 1021
Power(0-9) : 6

RX Mode:

PACKET TX

BT4.0、5.0

TX Mode:

BLE TEST TX
Channel > 0,20,39 (0-39)
Length > 37
Bit pattern > Pseudo-rdm 9
PHY > 1M (2M)

RX Mode:

BLE TEST RX

Channel > 0 (0-39)

PHY > 1M (2M)

4. All of the function are under run.
5. Start test.

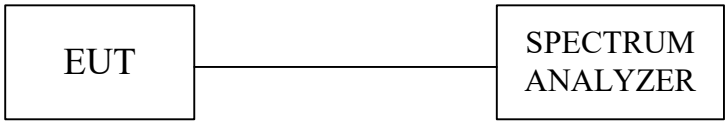
8. APPLICABLE LIMITS AND TEST RESULTS

8.1 20dB BANDWIDTH FOR HOPPING

LIMIT

None; for reporting purposes only.

TEST SETUP



TEST PROCEDURE

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 x RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.

TEST RESULTS

Model Name	JBL SPINNER BT	Test By	Peter Chu
Temp & Humidity	23.5°C, 48%	Test Date	2023/06/19

Modulation Type: GFSK / DH5

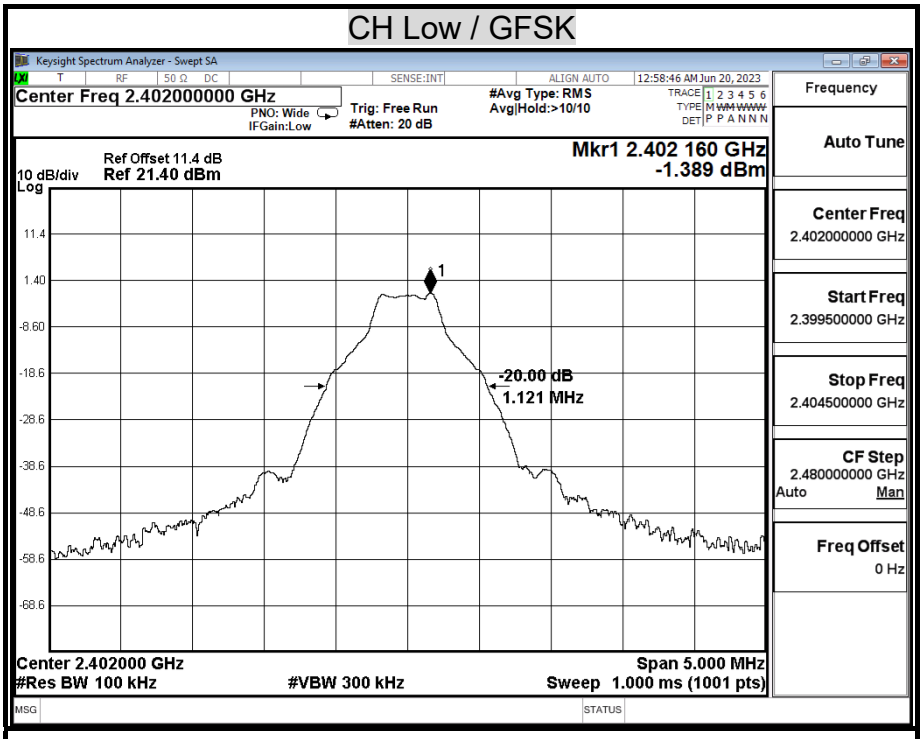
Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Two-third of 20dB Bandwidth (MHz)	Pass / Fail
Low	2402	1121.00	0.75	PASS
Middle	2441	1120.00	0.75	PASS
High	2480	1122.00	0.75	PASS

Modulation Type: 8-DPSK / 3-DH5

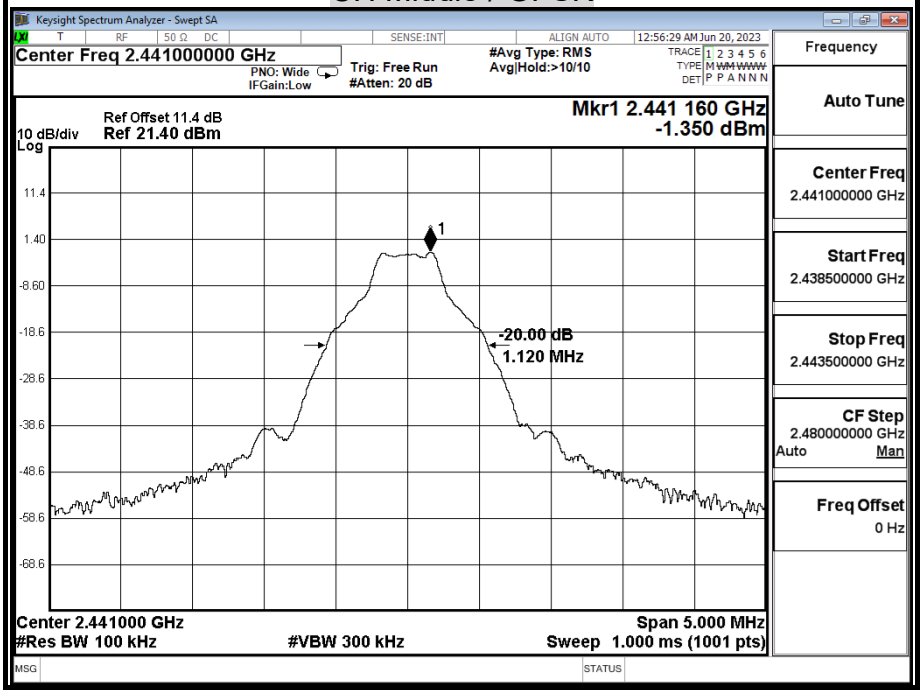
Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Two-third of 20dB Bandwidth (MHz)	Pass / Fail
Low	2402	1402.00	0.93	PASS
Middle	2441	1405.00	0.93	PASS
High	2480	1403.00	0.93	PASS

20dB BANDWIDTH

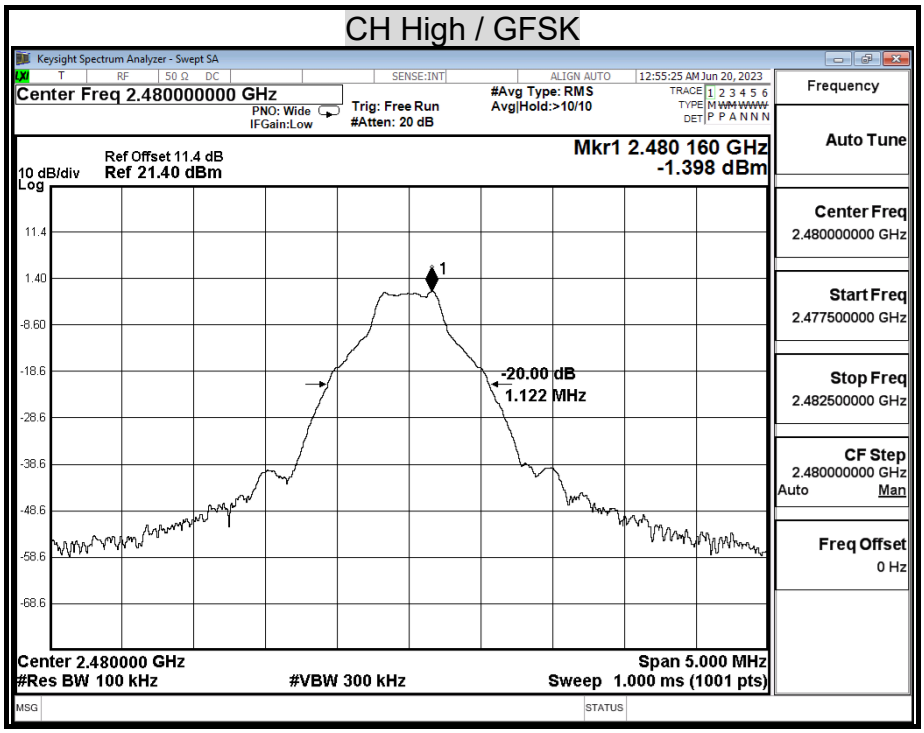
CH Low / GFSK



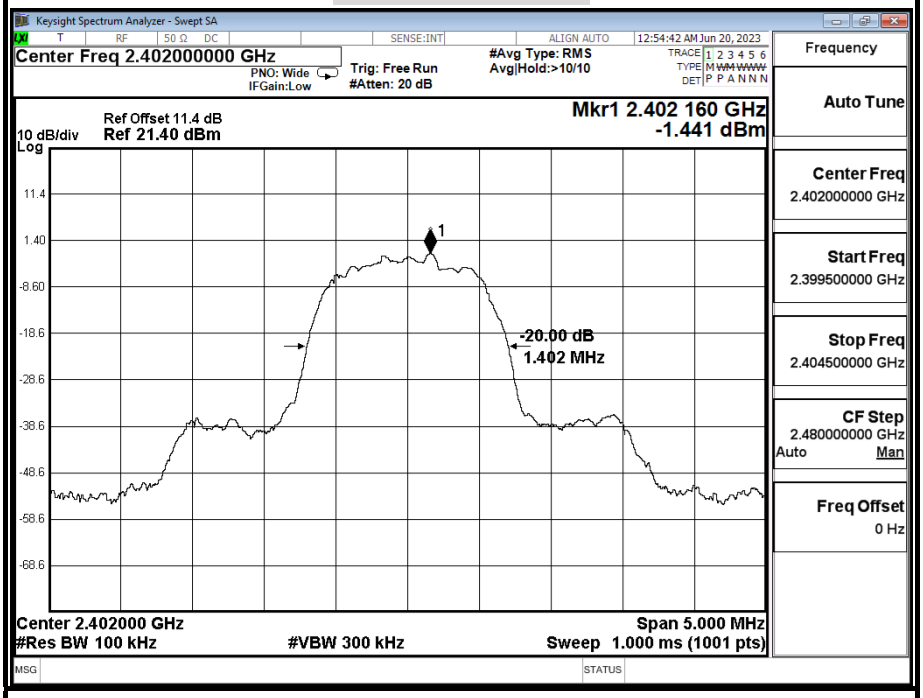
CH Middle / GFSK



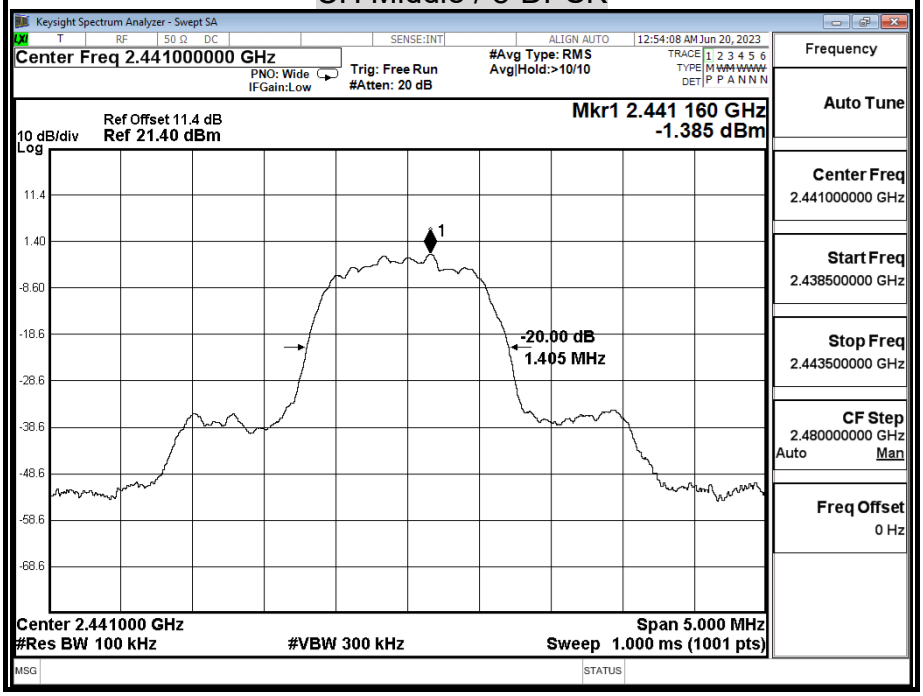
CH High / GFSK



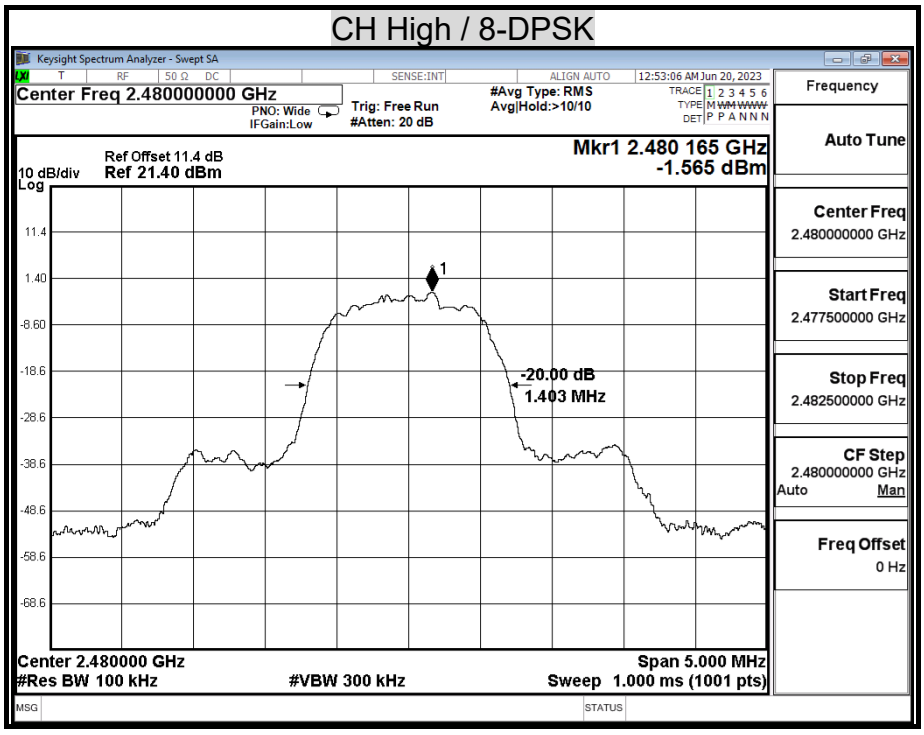
CH Low / 8-DPSK



CH Middle / 8-DPSK



CH High / 8-DPSK



8.2 MAXIMUM PEAK OUTPUT POWER

LIMIT

§15.247(b)(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

Test Configuration

TEST PROCEDURE

The RF power output was measured with a Spectrum Analyzer connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency.

Peak Power set:
1. Set the RBW = ≥ DTS bandwidth.
2. Set the VBW ≥ [3 × RBW].
3. Set the span ≥ [1.5 × DTS bandwidth].
4. Detector = peak.
5. Sweep time = auto couple.
6.Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the instrument's band/channel power measurement function with the band limits set equal to the DTS bandwidth edges (for some instruments, this may require a manual override to select the peak detector). If the instrument does not have a band power function, then sum the spectrum levels (in linear power units) at intervals equal to the RBW extending across the DTS channel bandwidth.

Average power set:

1. Measure the duty cycle D of the transmitter output signal
2. Set span to at least 1.5 times the OBW.
3. Set the RBW = ≥ DTS bandwidth
4. Set VBW ≥ [3 × RBW].
5. Number of points in sweep ≥ [2 × span / RBW]. (This gives bin-to-bin spacing ≤ RBW / 2, so that narrowband signals are not lost between frequency bins.)
6. Manually set sweep time ≥ [10 × (number of points in sweep) × (total ON/OFF period of the transmitted signal)].
7. Set detector = RMS (power averaging).
8. Perform a single sweep.
9. Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function with band limits set equal to the OBW band edges. If the instrument does not have a band power function, then sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW.
10. Add [10 log (1 / D)], where D is the duty cycle, to the measured power to compute the average power during the actual transmission times.

TEST RESULTS

Model Name	JBL SPINNER BT	Test By	Peter Chu
Temp & Humidity	23.5°C, 48%	Test Date	2023/06/19

Modulation Type: GFSK / DH5

Channel	Channel Frequency (MHz)	Peak Power Output (dBm)	Peak Power Output (mW)	Limit (mW)	Result
Low	2402	-1.64	0.68	125	PASS
Mid	2441	-1.44	0.71		PASS
High	2480	-1.60	0.69		PASS

Modulation Type: 8-DPSK / 3-DH5

Channel	Channel Frequency (MHz)	Peak Power Output (dBm)	Peak Power Output (mW)	Limit (mW)	Result
Low	2402	1.78	1.50	125	PASS
Mid	2441	1.77	1.50		PASS
High	2480	1.61	1.44		PASS

Average Power Data

Modulation Type: GFSK / DH5

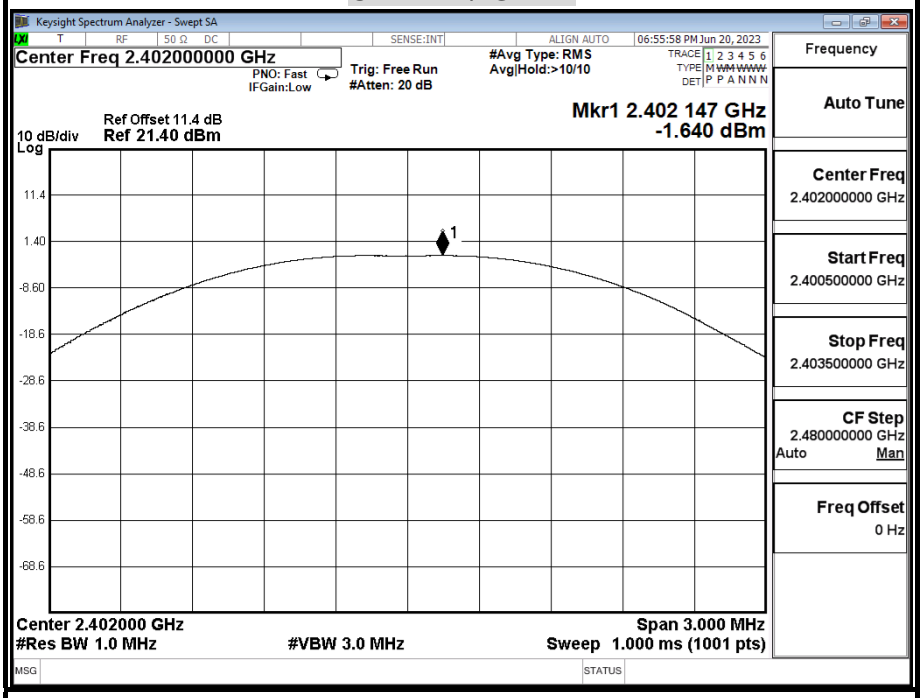
Channel	Channel Frequency (MHz)	Measure Power (dBm)	10 log (1 / D)	Average Power (dBm)
Low	2402	-2.925	1.10	-1.82
Middle	2441	-2.863	1.10	-1.76
High	2480	-2.959	1.10	-1.86

Modulation Type: 8-DPSK / 3-DH5

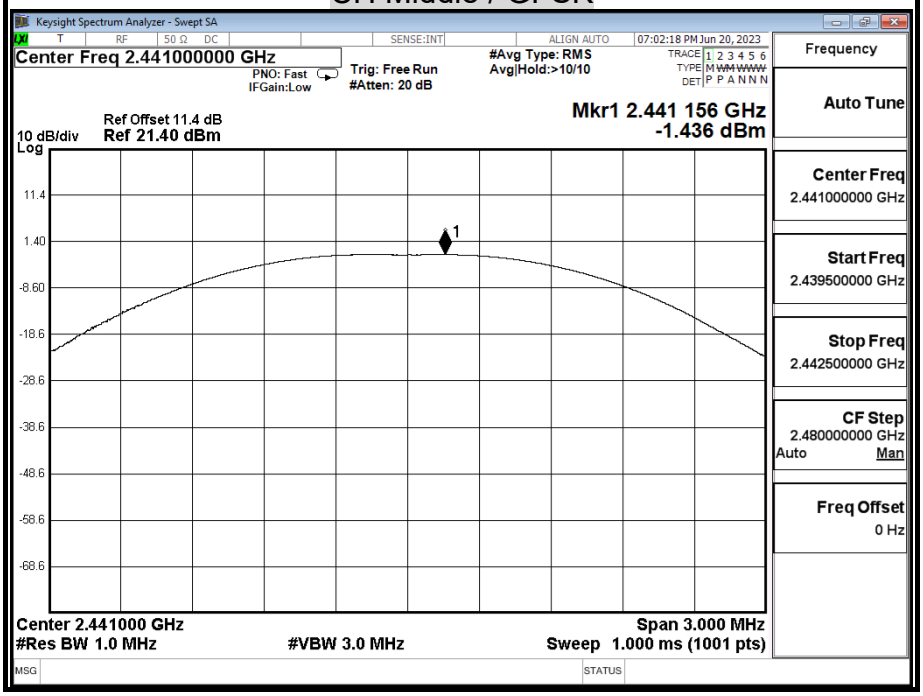
Channel	Channel Frequency (MHz)	Measure Power (dBm)	10 log (1 / D)	Average Power (dBm)
Low	2402	-2.759	1.10	-1.66
Middle	2441	-2.725	1.10	-1.62
High	2480	-2.943	1.10	-1.84

MAXIMUM PEAK OUTPUT POWER

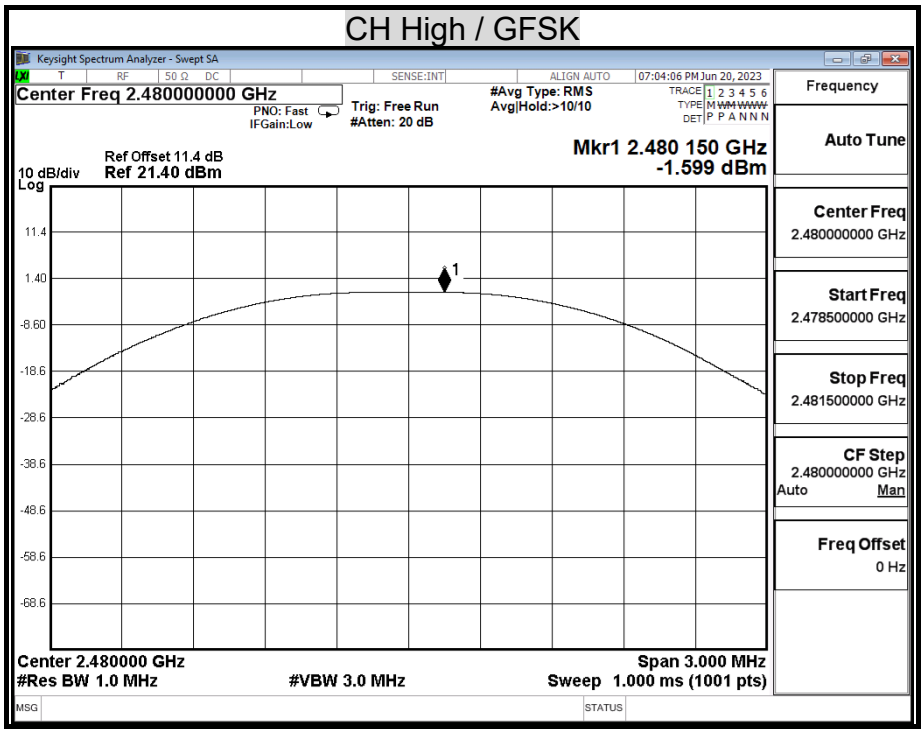
CH Low / GFSK



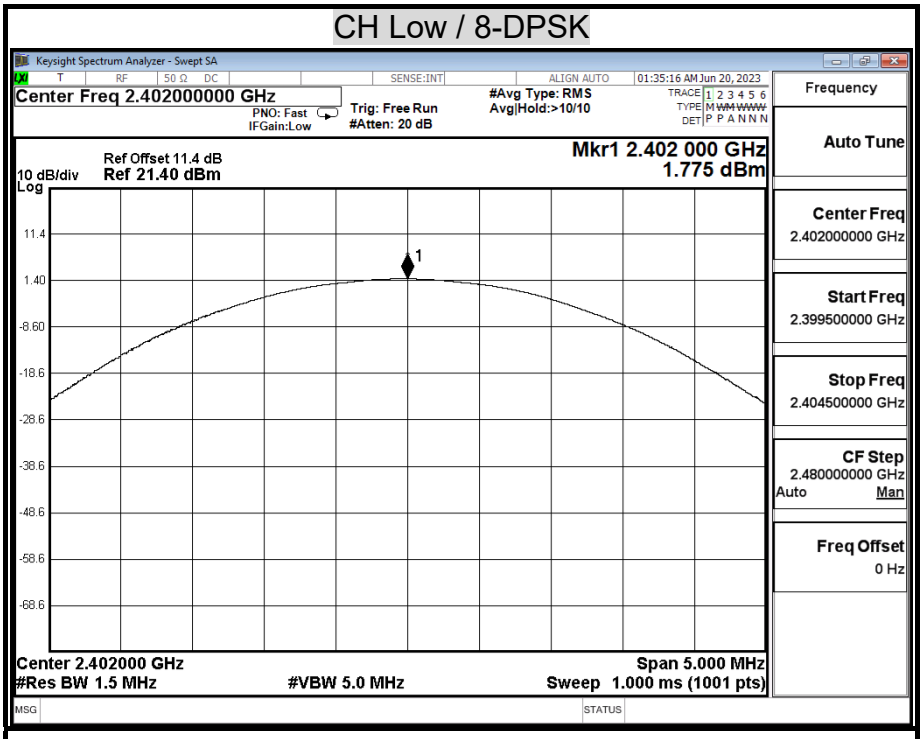
CH Middle / GFSK



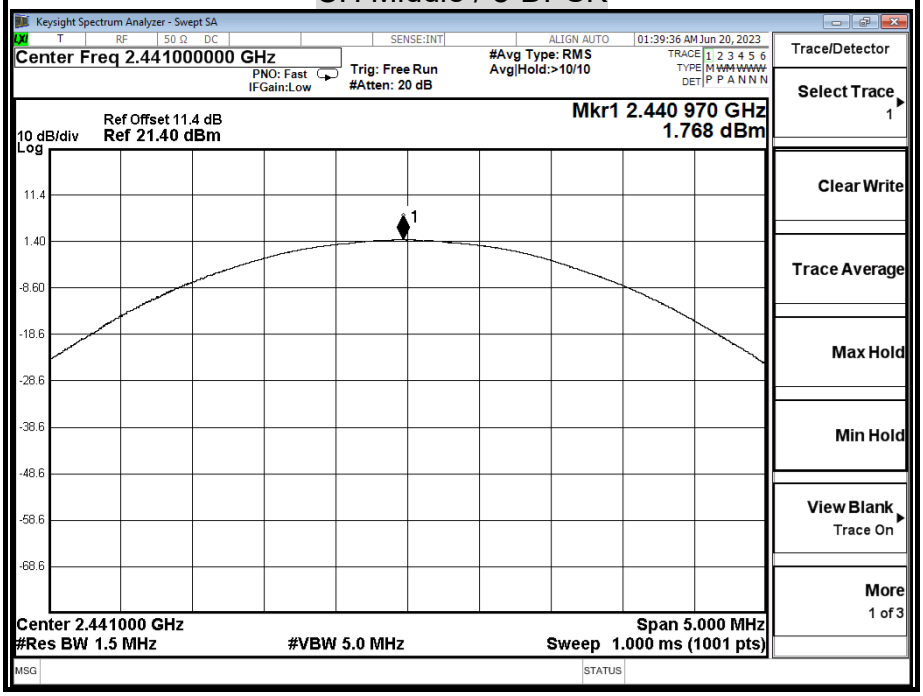
CH High / GFSK



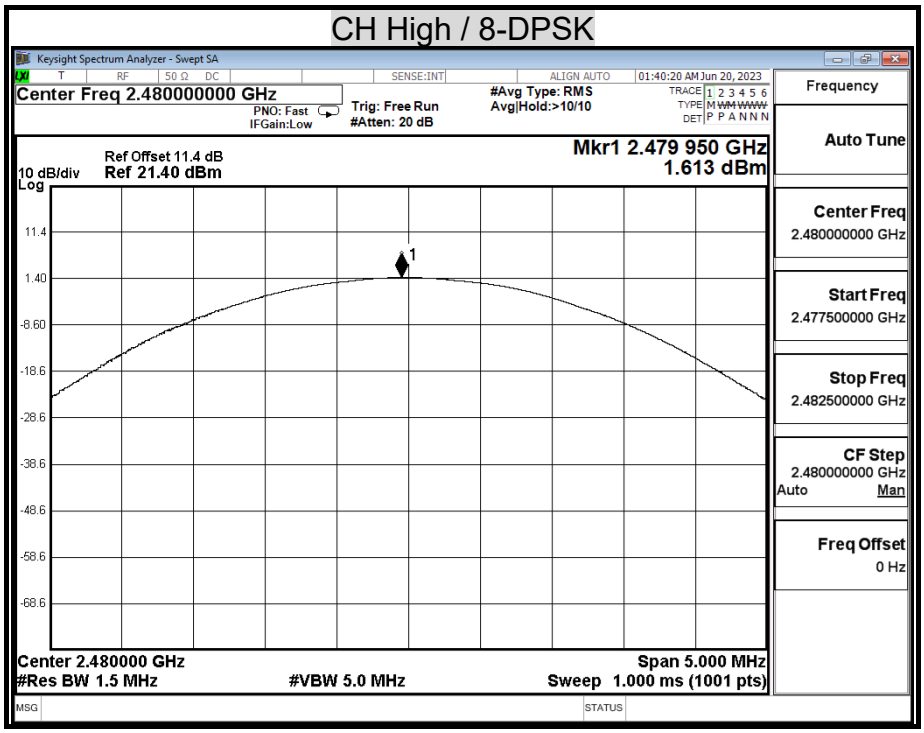
CH Low / 8-DPSK



CH Middle / 8-DPSK

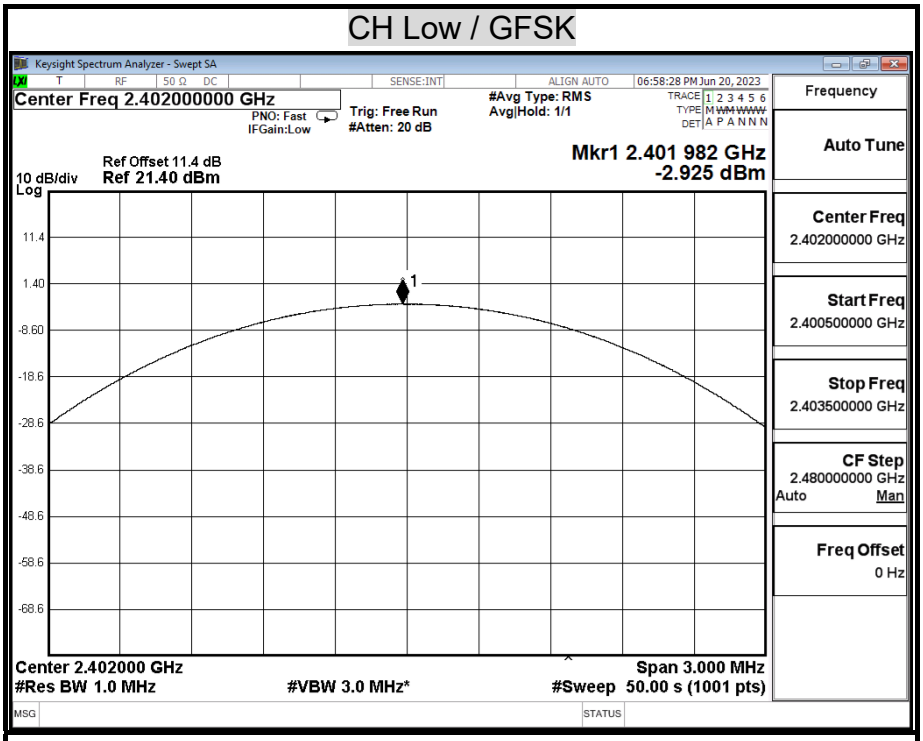


CH High / 8-DPSK

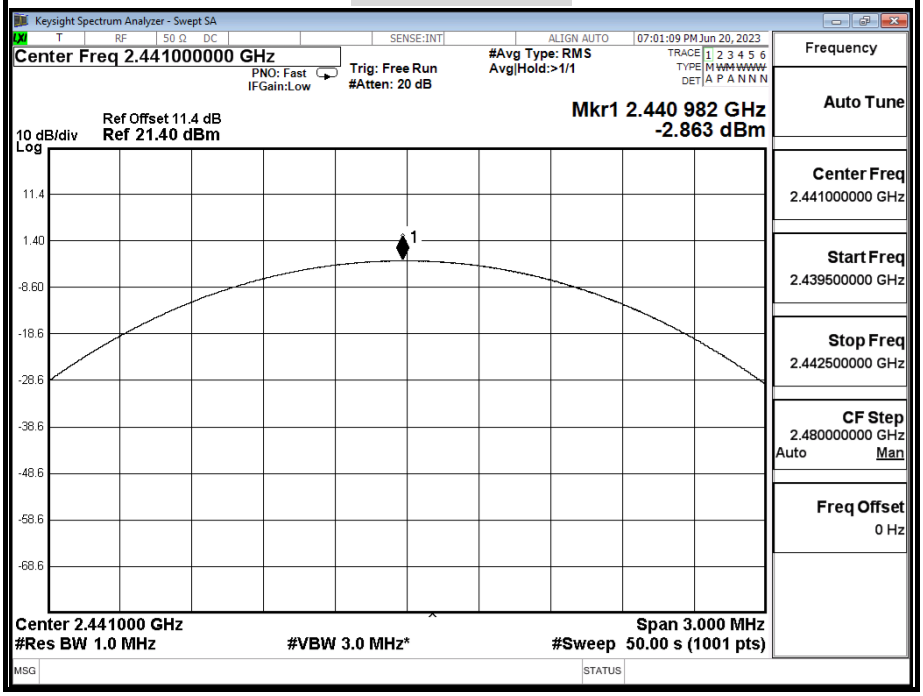


AVERAGE POWER

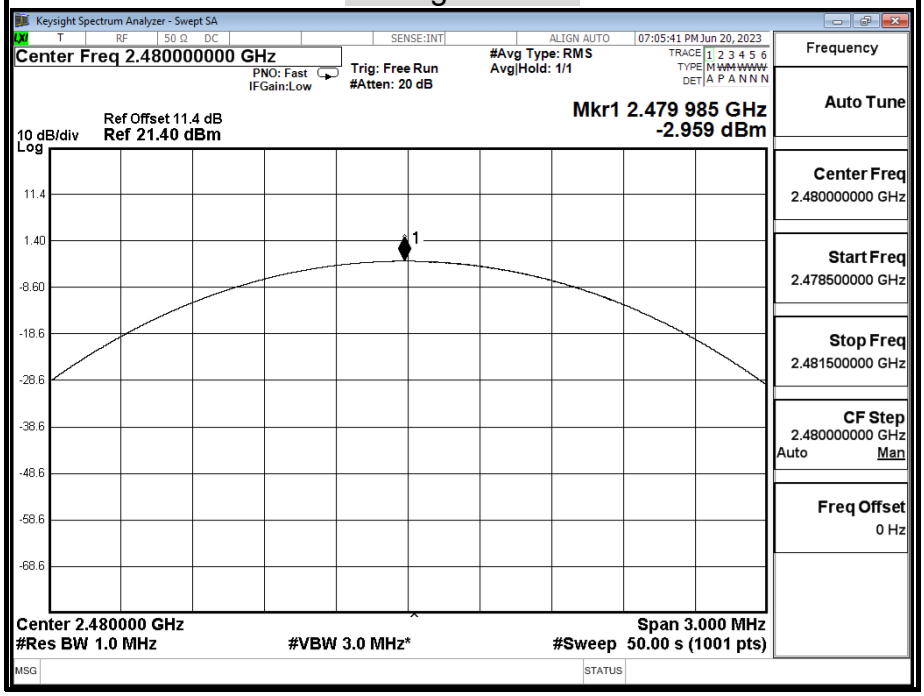
CH Low / GFSK



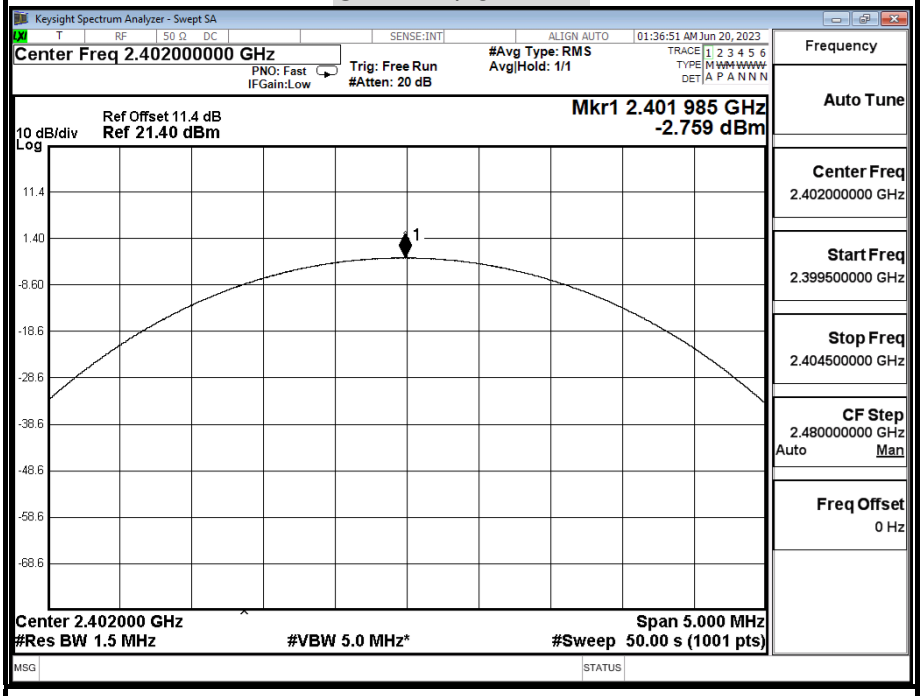
CH Mid / GFSK



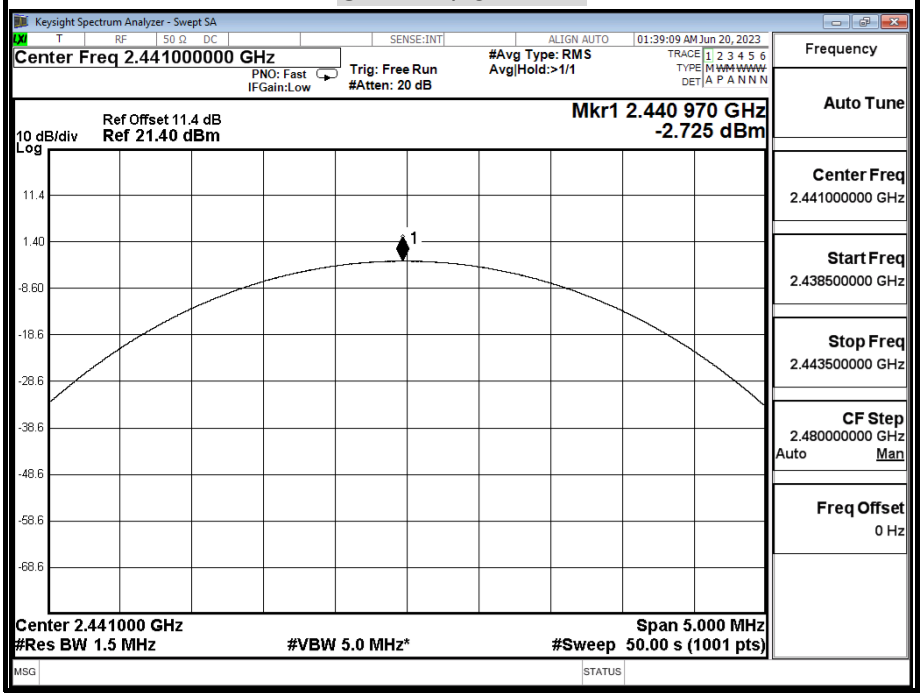
CH High / GFSK



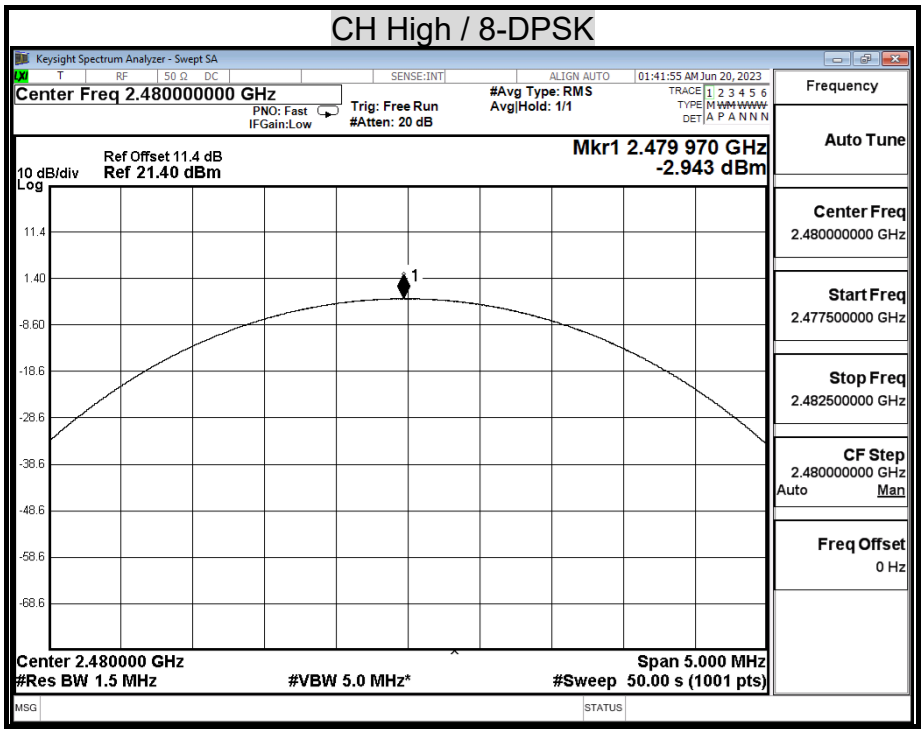
CH Low / 8-DPSK



CH Mid / 8-DPSK



CH High / 8-DPSK



8.3 HOPPING CHANNEL SEPARATION

LIMIT

§15.247(a)(1) 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. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

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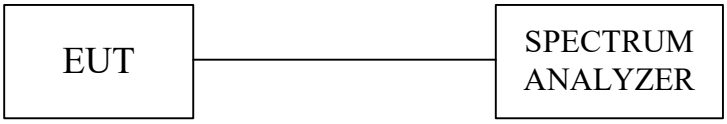
TEST SETUP



TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the MaxHold function record the separation of adjacent channels.
4. Measure the frequency difference of these two adjacent channels by spectrum analyzer MARK function. And then plot the result on spectrum analyzer screen.
5. Repeat above procedures until all frequencies measured were complete.

TEST RESULTS

Refer to section 8.1, 20dB bandwidth measurement, the measured channel separation should be greater than two-third of 20dB bandwidth or Minimum bandwidth.

Model Name	JBL SPINNER BT	Test By	Peter Chu
Temp & Humidity	23.5°C, 48%	Test Date	2023/06/19

Modulation Type: GFSK / DH5

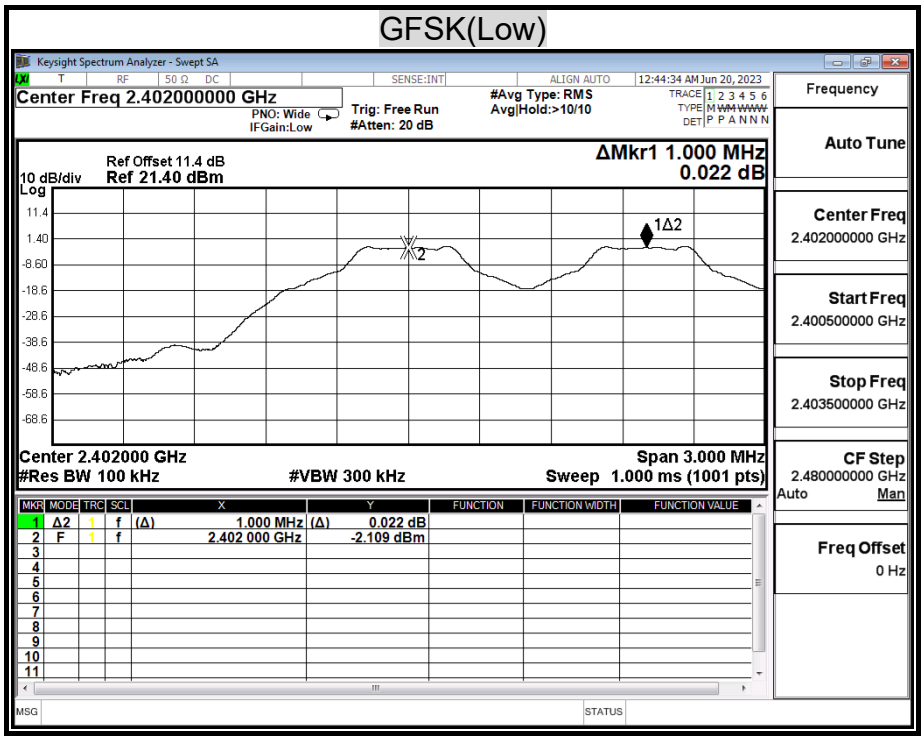
Channel	Adjacent Hopping Channel Separation (MHz)	Two –third of 20dB bandwidth (MHz)	Minimum Bandwidth (kHz)	Result
2402MHz	1.00	0.75	25	PASS
2441MHz	1.00	0.75	25	PASS
2480MHz	1.00	0.75	25	PASS

Modulation Type: 8-DPSK / 3-DH5

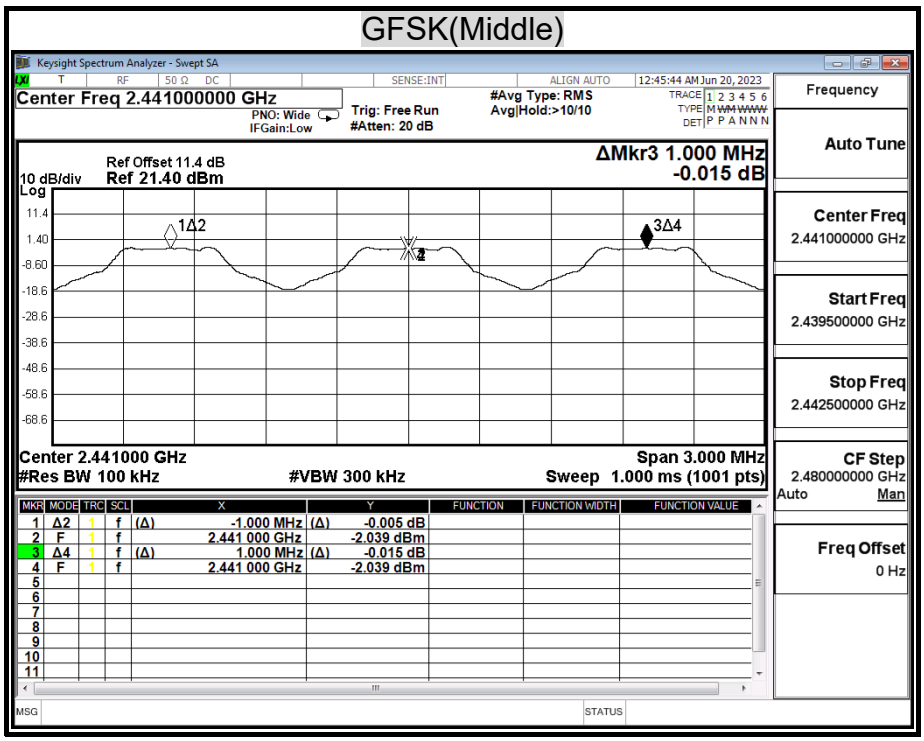
Channel	Adjacent Hopping Channel Separation (MHz)	Two –third of 20dB bandwidth (MHz)	Minimum Bandwidth (kHz)	Result
2402MHz	1.00	0.93	25	PASS
2441MHz	1.00	0.93	25	PASS
2480MHz	1.00	0.93	25	PASS

HOPPING CHANNEL SEPARATION

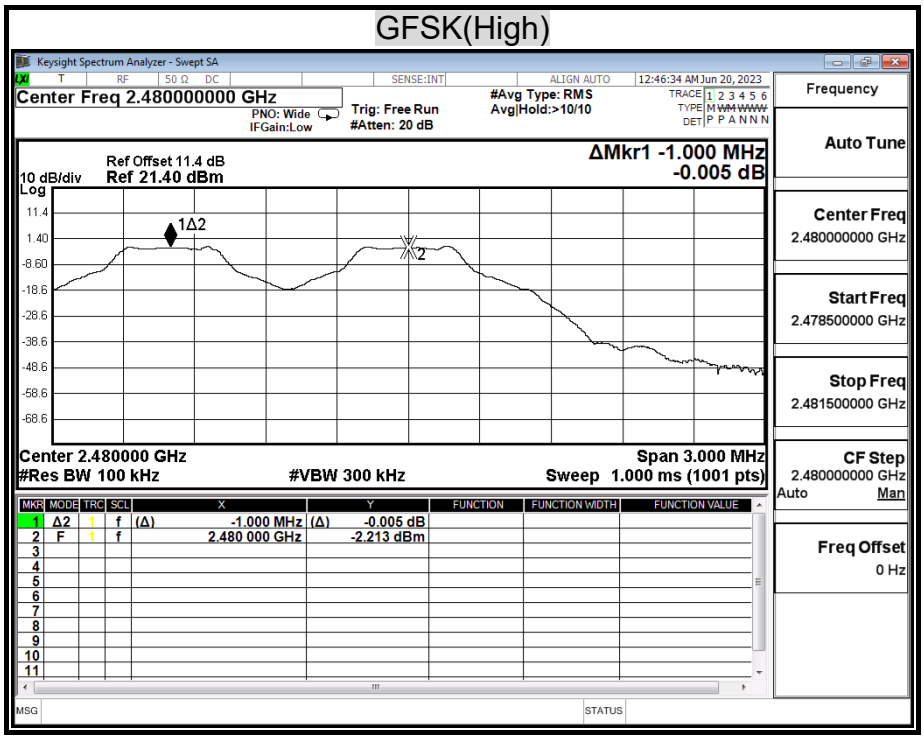
GFSK(Low)



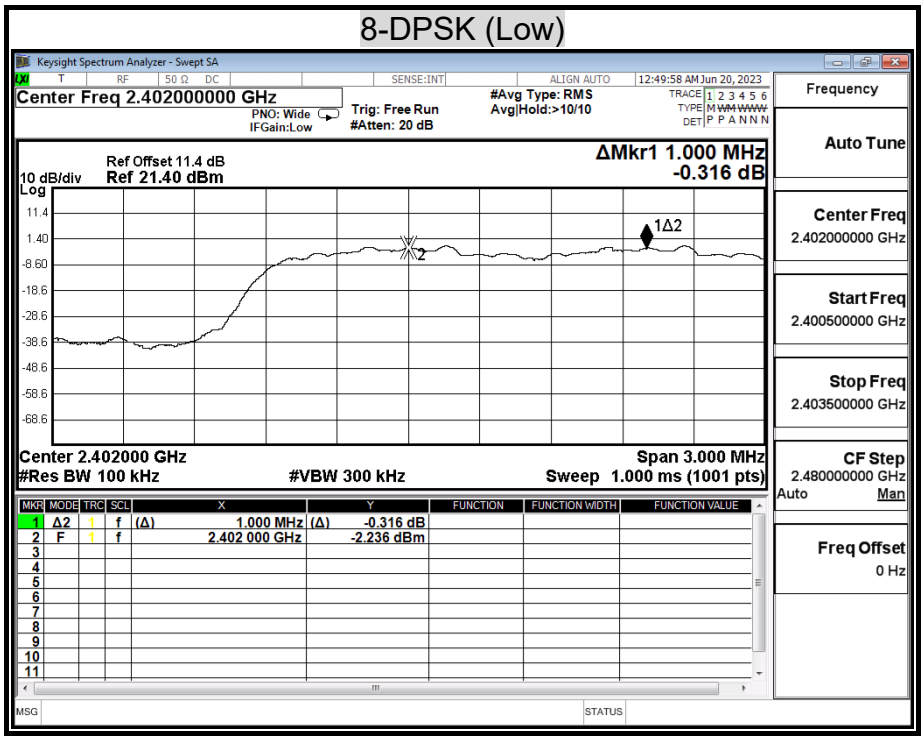
GFSK(Middle)



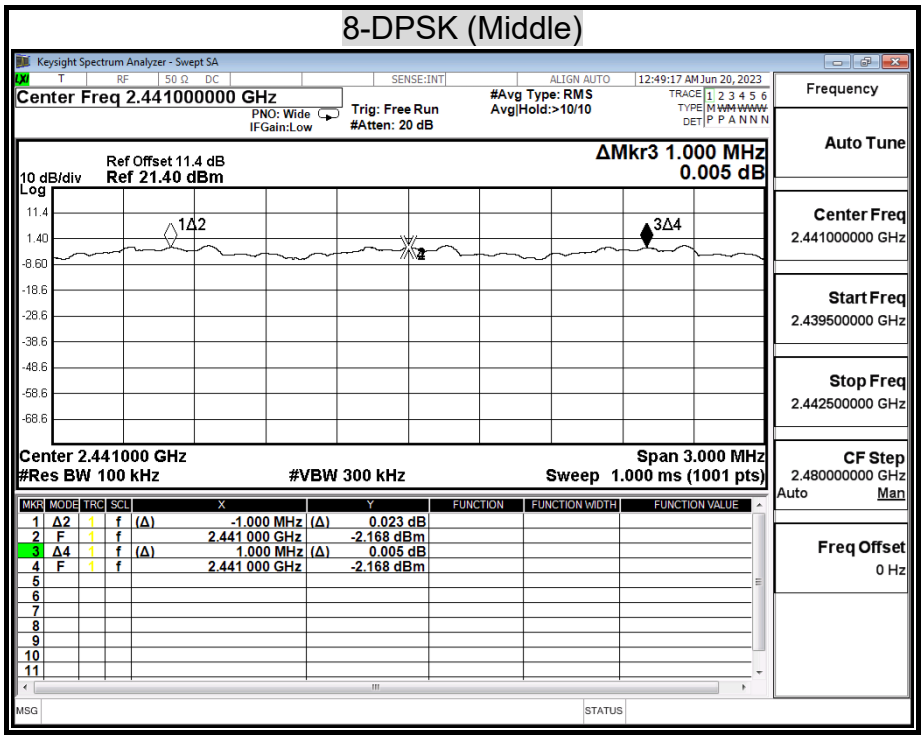
GFSK(High)



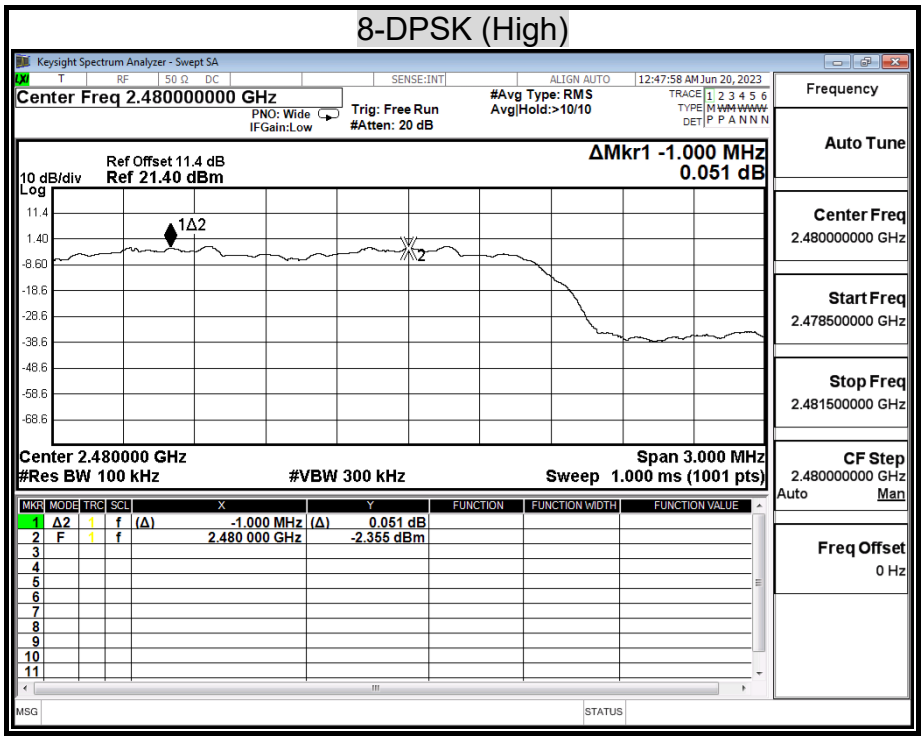
8-DPSK (Low)



8-DPSK (Middle)



8-DPSK (High)

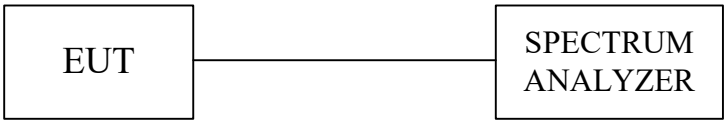


8.4 NUMBER OF HOPPING FREQUENCY USED

LIMIT

§15.247(a)(1)(iii) For frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

TEST SETUP



TEST PROCEDURE

1 Check the calibration of the measuring instrument (spectrum analyzer) using either an internal calibrator or a known signal from an external generator.
2 Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3 Set the spectrum analyzer on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
4 Set the spectrum analyzer on View mode and then plot the result on spectrum analyzer screen.
5 Repeat above procedures until all frequencies measured were complete.

TEST RESULTS

Model Name	JBL SPINNER BT	Test By	Peter Chu
Temp & Humidity	23.5°C, 48%	Test Date	2023/06/19

Modulation Type: GFSK / DH5

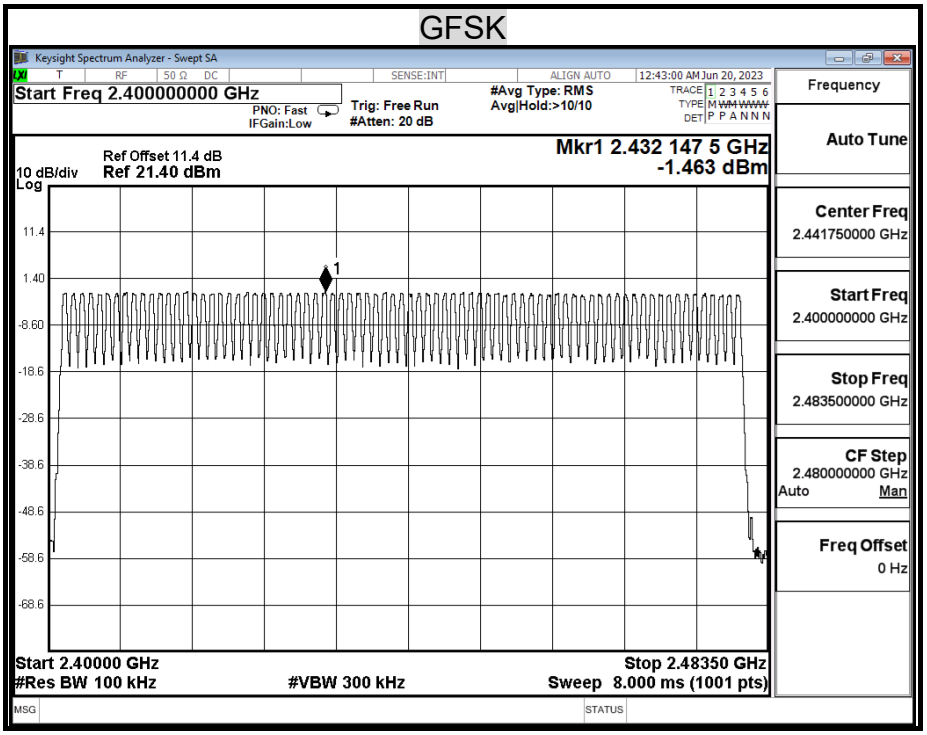
Result(No.of CH)	Limit(No.of CH)	Result
79	>15	PASS

Modulation Type: 8-DPSK / 3-DH5

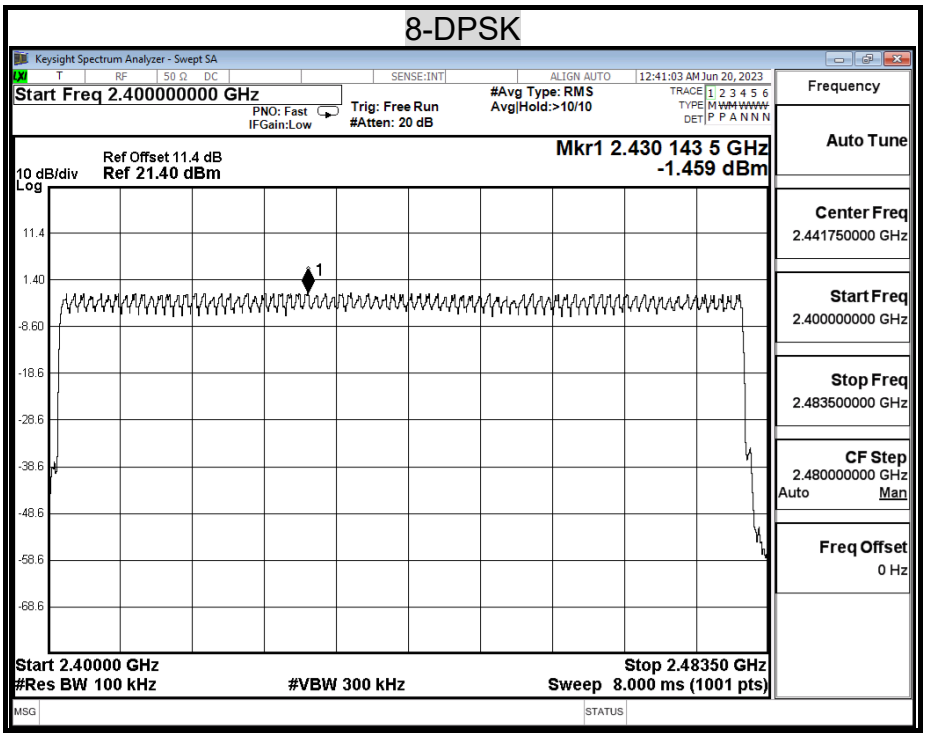
Result(No.of CH)	Limit(No.of CH)	Result
79	>15	PASS

NUMBER OF HOPPING FREQUENCY USED

GFSK



8-DPSK

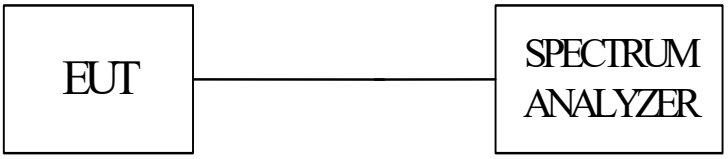


8.5 DWELL TIME ON EACH CHANNEL

LIMIT

§15.247(a)(1)(iii) For frequency hopping system operating in the 2400-2483.5MHz band, the average time of occupancy on any frequency shall not be greater than 0.4 second within a 31.6 second period.

TEST SETUP



TEST PROCEDURE

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Adjust the center frequency of spectrum analyzer on any frequency be measured and set spectrum analyzer to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
5. Repeat above procedures until all frequencies measured were complete.
6. The Bluetooth Headset has 3 type of payload, DH1, DH3, DH5. The hopping rate is 1600 per second. The longer the payload is, the slower the hopping rate is.

TEST RESULTS

Time of occupancy on the TX channel in 31.6sec = time domain slot length × hop rate ÷ number of hop per channel × 31.6
Refer to the attached graph.
The hopping rates of Bluetooth devices change with different types of payload. The longer the payload is, the slower the hopping rate. The hopping rate scenario is defined in Bluetooth core specification.

Model Name	JBL SPINNER BT	Test By	Peter Chu
Temp & Humidity	23.5°C, 48%	Test Date	2023/06/19

Modulation Type: GFSK / DH5

Transmitting Frequency	Packet type	Dwell time (ms)	Time of occupancy on the TX channel in 31.6sec (ms)	Limit for Time of occupancy on the TX channel in 31.6sec (ms)	Results
2441MHz	DH1	0.400	128.00	400.000	PASS
2441MHz	DH3	1.665	266.40	400.000	PASS
2441MHz	DH5	2.910	310.40	400.000	PASS
2441MHz	AFH	2.910	155.20	400.000	PASS

DH1 Dwell tine= 0.400 ms×(1600÷2)÷79×31.6= 128.00 (ms)
DH3 Dwell tine= 1.665 ms×(1600÷4)÷79×31.6= 266.40 (ms)
DH5 Dwell tine= 2.910 ms×(1600÷6)÷79×31.6= 310.40 (ms)
AFH Dwell tine= 2.910 ms×(800÷6)÷20×8= 155.20 (ms)

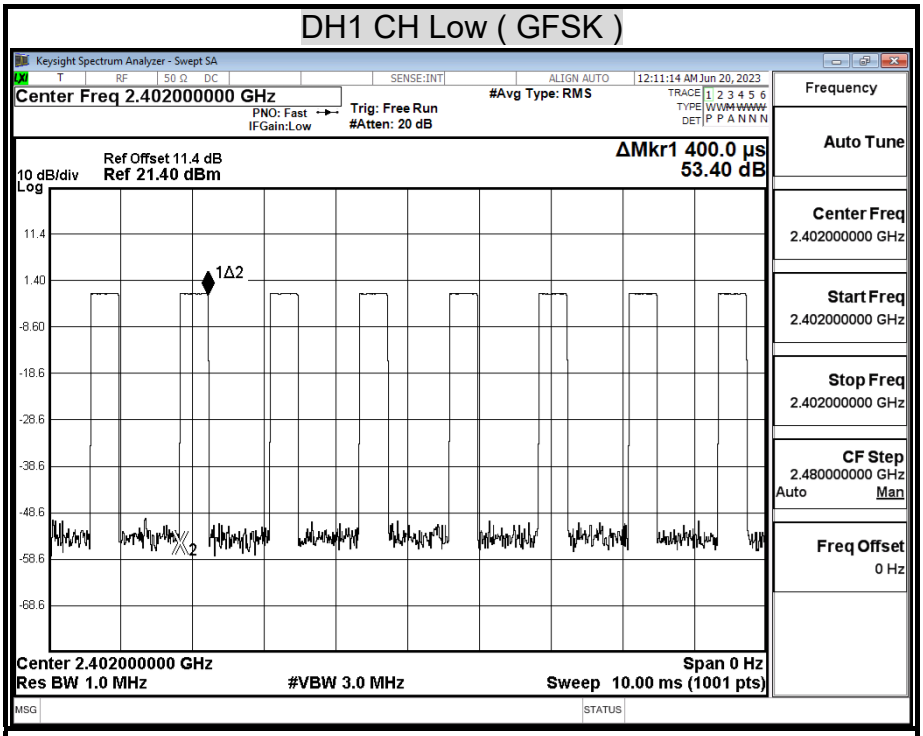
Modulation Type: 8-DPSK / 3-DH5

Transmitting Frequency	Packet type	Dwell time (ms)	Time of occupancy on the TX channel in 31.6sec (ms)	Limit for Time of occupancy on the TX channel in 31.6sec (ms)	Results
2441MHz	3DH1	0.400	128.00	400.000	PASS
2441MHz	3DH3	1.665	266.40	400.000	PASS
2441MHz	3DH5	2.910	310.40	400.000	PASS
2441MHz	AFH	2.910	155.20	400.000	PASS

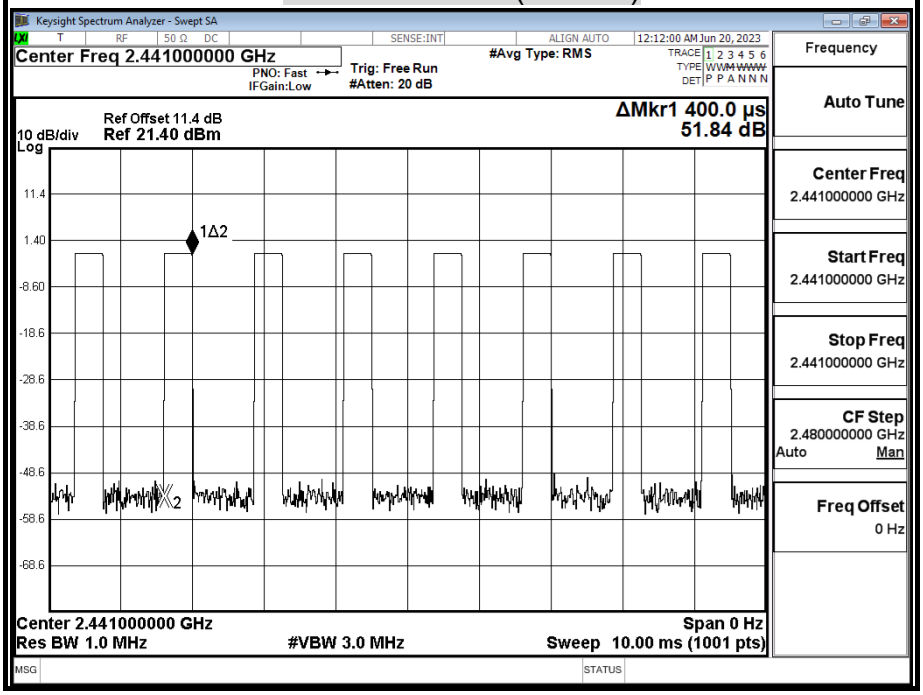
3DH1 Dwell tine= 0.400 ms×(1600÷2)÷79×31.6= 128.00 (ms)
3DH3 Dwell tine= 1.665 ms×(1600÷4)÷79×31.6= 266.40 (ms)
3DH5 Dwell tine= 2.910 ms×(1600÷6)÷79×31.6= 310.40 (ms)
AFH Dwell tine= 2.910 ms×(800÷6)÷20×8= 155.20 (ms)

DWELL TIME ON EACH PAYLOAD

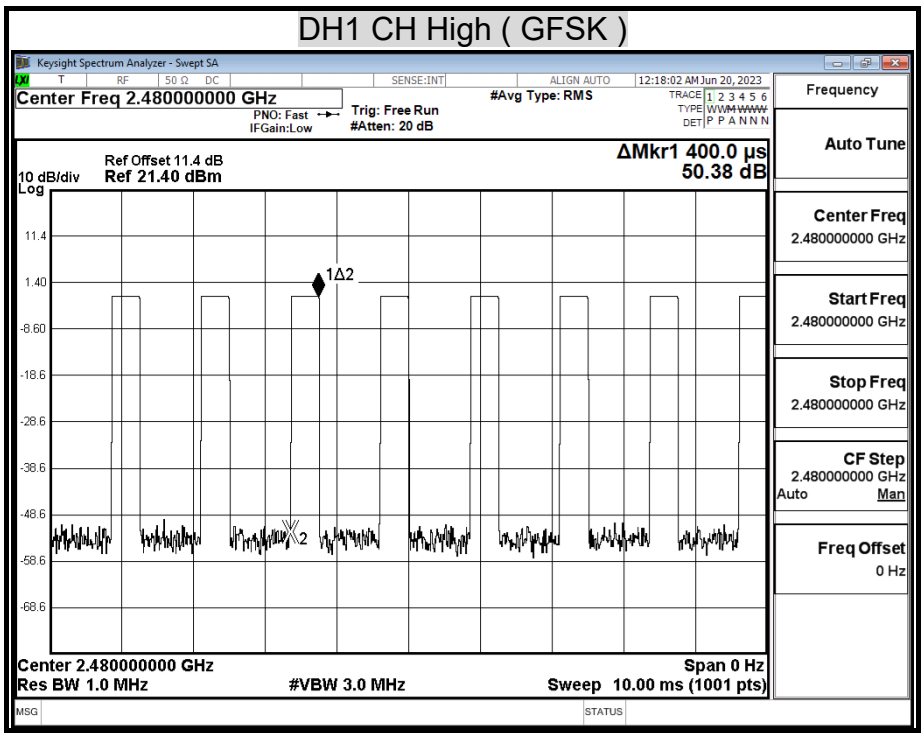
DH1 CH Low (GFSK)



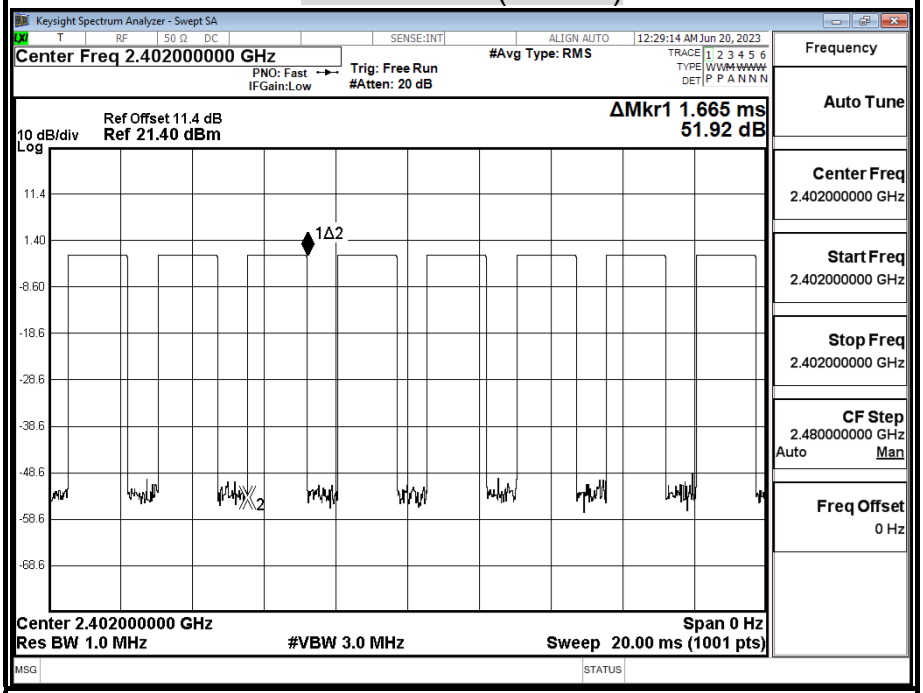
DH1 CH Middle (GFSK)



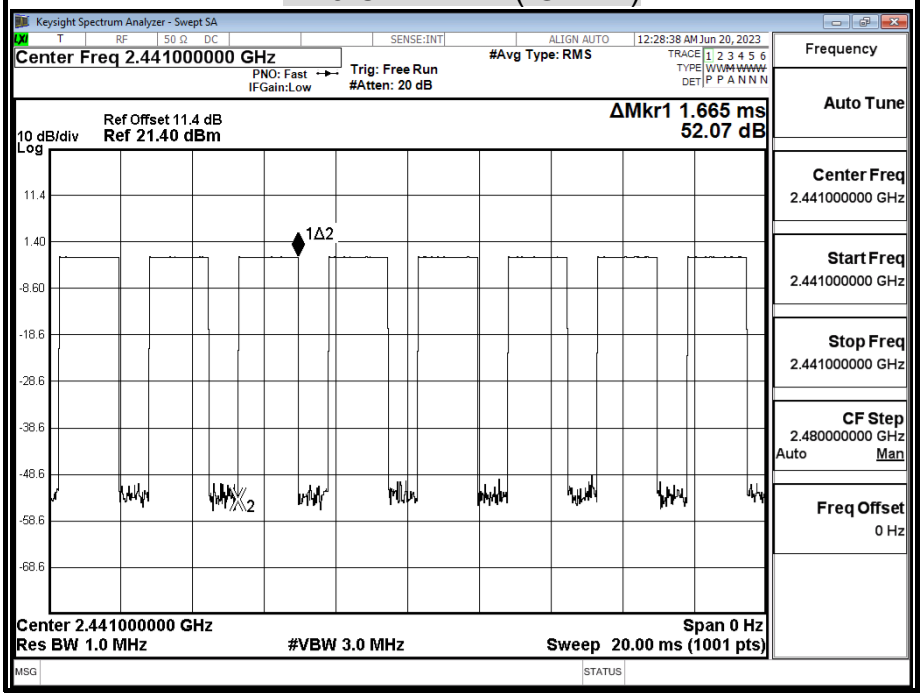
DH1 CH High (GFSK)



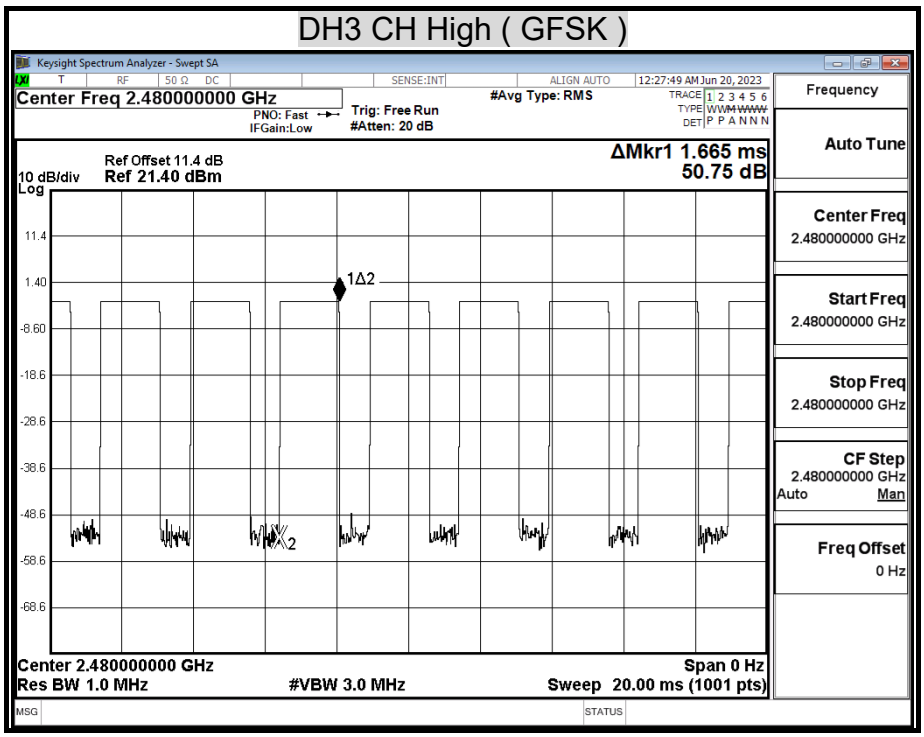
DH3 CH Low (GFSK)



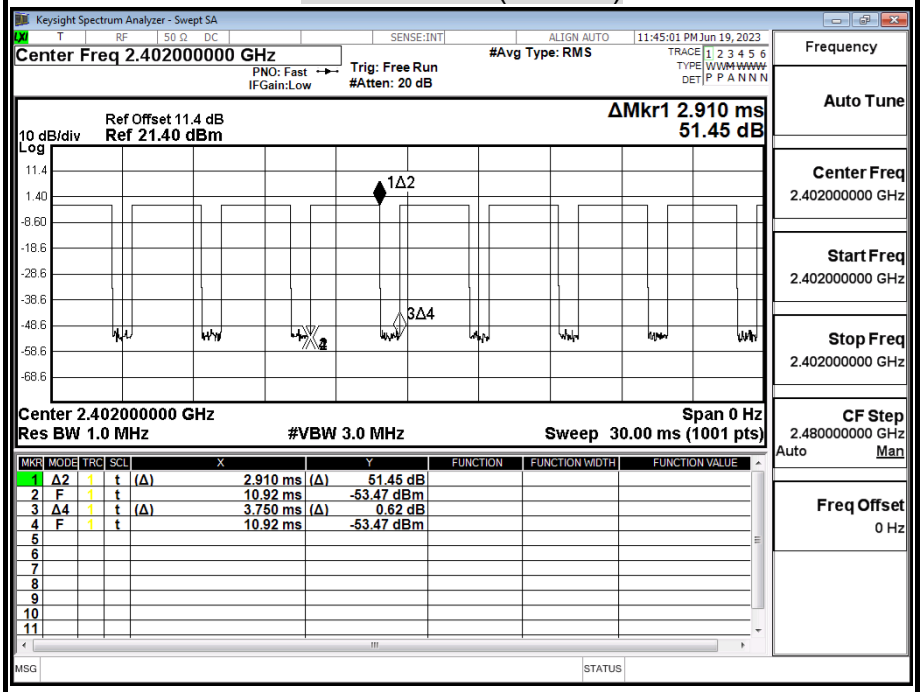
DH3 CH Middle (GFSK)



DH3 CH High (GFSK)



DH5 CH Low (GFSK)



DH5 CH Middle (GFSK)