FCC Test Report

Report No.: AGC06023210201FE03

FCC ID	:	2AYZ9-KZTWS
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	TWS Bluetooth earphone
BRAND NAME	:	KZ
MODEL NAME	:	SA08, Z1, S2, Z1 PRO, SK1, SKS, Z3, VX10, S1A, S1 PRO
APPLICANT	:	Dongguan Yuan Ze Acoustics Technology., Ltd
DATE OF ISSUE	:	Feb. 25, 2021
STANDARD(S)	:	FCC Part 15.247
REPORT VERSION	:	V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd

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REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Feb. 25, 2021	Valid	Initial Release

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1. VERIFICATION OF CONFORMITY

Applicant	Dongguan Yuan Ze Acoustics Technology., Ltd
Address	2nd Floor, Building A, 26 Hantang Street, Qiantou Community Dongcheng Street, Dongguan City, Guangdong Province
Manufacturer	Dongguan Yuan Ze Acoustics Technology., Ltd
Address	2nd Floor, Building A, 26 Hantang Street, Qiantou Community Dongcheng Street, Dongguan City, Guangdong Province
Factory	Dongguan Yuan Ze Acoustics Technology., Ltd
Address	2nd Floor, Building A, 26 Hantang Street, Qiantou Community Dongcheng Street, Dongguan City, Guangdong Province
Product Designation	TWS Bluetooth earphone
Brand Name	KZ
Test Model	SA08
Series Model	Z1, S2, Z1 PRO, SK1, SKS, Z3, VX10, S1A, S1 PRO
Difference Description	All the same except for the model name.
Date of test	Feb. 20, 2021 to Feb. 25, 2021
Deviation	No any deviation from the test method
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BR/RF

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. 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 radiated emission limits of FCC PART 15.247.

Prepared By	Thea Huang Project Engineer	Feb. 25, 2021
Reviewed By	Max Zhang Reviewer	Feb. 25, 2021
Approved By	Forrest Lei Authorized Officer	Feb. 25, 2021

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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as “TWS Bluetooth earphone”. It is designed by way of utilizing the GFSK, π /4-DQPSK and 8DPSK technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	2.402 GHz to 2.480 GHz
RF Output Power	4.027dBm (Max)
Bluetooth Version	V5.0
Modulation	BR ☒GFSK, EDR ☒π /4-DQPSK, ☒8DPSK BLE ☐GFSK 1Mbps ☐GFSK 2Mbps
Number of channels	79
Hardware Version	V1.0
Software Version	V1.0
Antenna Designation	Ceramic Antenna (Comply with requirements of the FCC part 15.203)
Antenna Gain	3dBi
Power Supply	DC 3.7V by battery or DC 5V by adapter
Note: 1.The EUT doesn’t support BLE. 2. The EUT includes left and right channel earphones, the schematic diagram is the same, but the PCB Layout is different. The RF output power of each earphone has been tested and recorded in the report. For other test items, due to the higher power, the right headset has been tested and recorded in this report, which is the worst case.	

2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
2402~2480MHz	0	2402 MHz
	1	2403 MHz
	:	:
	38	2440 MHz
	39	2441 MHz
	40	2442 MHz
	:	:
	77	2479 MHz
	78	2480 MHz

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2.3. RECEIVER INPUT BANDWIDTH

The input bandwidth of the receiver is 1.3MHz, in every connection one Bluetooth device is the master and the other one is slave. The master determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally, the type of connection (e.g. single of multi slot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also, the slave of the connection will use these settings. Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

2.4. EXAMPLE OF A HOPPING SEQUENCY IN DATA MODE

Example of a hopping sequence in data mode:
40, 21, 44, 23, 04, 15, 66, 56, 19, 78, 07, 28, 69, 55,
36, 45, 05, 13, 43, 74, 57, 35, 67, 76, 02, 34, 54, 63,
42, 11, 30, 06, 64, 25, 75, 48, 17, 33, 58, 01, 29, 14,
51, 72, 03, 31, 50, 61, 77, 18, 10, 47, 12, 68, 08, 49,
20, 00, 73, 09, 16, 60, 71, 41, 24, 53, 38, 26, 46, 37,
65, 32, 70, 52, 27, 59, 22, 62, 39

2.5. EQUALLY AVERAGE USE OF FREQUENCIES AND BEHAVIOUR

The generation of the hopping sequence in connection mode depends essentially on two input values:

1. LAP/UAP of the master of the connection.
2. Internal master clock.

The LAP (lower address part) are the 24 LSB's of the 48 BD_ADDRESS. The BD_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP (upper address part) are the 24MSB's of the 48BD_ADDRESS

The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For behavior action with other units only offset is used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5us. The clock has a cycle of about one day(23h30).

In most case it is implemented as 28 bits counter. For the deriving of the hopping sequence the entire. LAP (24 bits),4LSB's(4bits) (Input 1) and the 27MSB's of the clock (Input 2) are used. With this input values different mathematical procedures (permutations, additions, XOR-operations) are performed to generate the Sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions the Bluetooth system has the following behavior:

The first connection between the two devices is established, a hopping sequence was generated. For Transmitting the wanted data the complete hopping sequence was not used. The connection ended.

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The second connection will be established. A new hopping sequence is generated. Due to the fact the Bluetooth clock has a different value, because the period between the two transmission is longer (and it Cannot be shorter) than the minimum resolution of the clock(312.5us). The hopping sequence will always differ from the first one.

2.6. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2AYZ9-KZTWS** filing to comply with the FCC PART 15.247 requirements.

2.7. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013). Radiated testing was performed at an antenna to EUT distance 3 meters.

2.8. SPECIAL ACCESSORIES

Refer to section 5.2.

2.9. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

2.10. ANTENNA REQUIREMENT

This intentional radiator is designed with a permanently attached antenna of an antenna to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

For more information of the antenna, please refer to the APPENDIX B: PHOTOGRAPHS OF EUT.

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3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y ±U, where expended uncertainty U is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

- Uncertainty of Conducted Emission, Uc = ±3.1 dB
- Uncertainty of Radiated Emission below 1GHz, Uc = ±4.0 dB
- Uncertainty of Radiated Emission above 1GHz, Uc = ±4.8 dB
- Uncertainty of total RF power, conducted, Uc = ±0.8dB
- Uncertainty of spurious emissions, conducted, Uc = ±2.7dB
- Uncertainty of Occupied Channel Bandwidth: Uc = ±2 %
- Uncertainty of Dwell Time: Uc = ±2 %
- Uncertainty of Frequency: Uc = ±2 %

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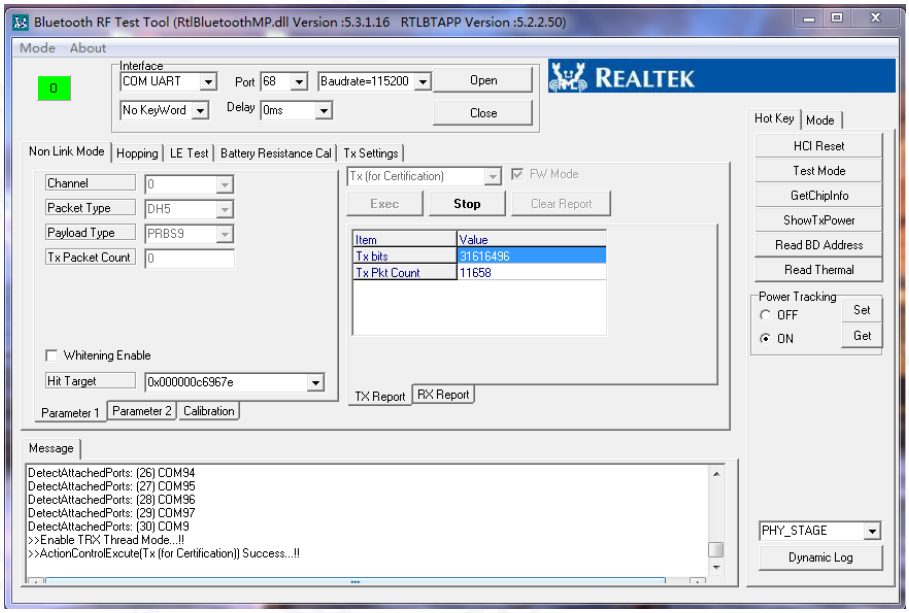
4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel GFSK
2	Middle channel GFSK
3	High channel GFSK
4	Low channel π/4-DQPSK
5	Middle channel π/4-DQPSK
6	High channel π/4-DQPSK
7	Low channel 8DPSK
8	Middle channel 8DPSK
9	High channel 8DPSK
10	Hopping mode GFSK
11	Hopping mode π/4-DQPSK
12	Hopping mode 8DPSK

Note:

1. Only the result of the worst case was recorded in the report, if no other cases.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.
3. For Conducted Test method, a temporary antenna connector is provided by the manufacture.

Software Setting



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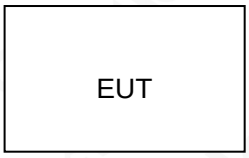
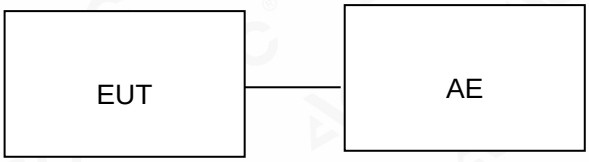
5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Radiated Emission Configure:



Conducted Emission Configure:



5.2. EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	TWS Bluetooth earphone	SA08	2AYZ9-KZTWS	EUT
2	Control Box	USB to TTL	N/A	AE

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
15.247 (b)(1)	Peak Output Power	Compliant
15.247 (a)(1)	20 dB Bandwidth	Compliant
15.247 (d)	Conducted Spurious Emission	Compliant
15.209	Radiated Emission	Compliant
15.247 (a)(1)(iii)	Number of Hopping Frequency	Compliant
15.247 (a)(1)(iii)	Time of Occupancy	Compliant
15.247 (a)(1)	Frequency Separation	Compliant
15.207	Conducted Emission	Not applicable

Note: The EUT is powered by battery. The EUT can not use the BT function with charging

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6. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance (Shenzhen) Co., Ltd is accredited by A2LA

TEST EQUIPMENT OF RADIATED EMISSION TEST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	May 15, 2020	May 14, 2021
EXA Signal Analyzer	Aglient	N9010A	MY53470504	Dec. 07, 2020	Dec.06, 2021
2.4GHz Filter	EM Electronics	2400-2500MHz	N/A	Mar. 23, 2020	Mar. 22, 2022
Attenuator	ZHINAN	E-002	N/A	Sep. 03, 2020	Sep. 02, 2022
Horn antenna	SCHWARZBECK	BBHA 9170	#768	Sep. 21, 2019	Sep. 20, 2021
Active loop antenna (9K-30MHz)	ZHINAN	ZN30900C	18051	May 22, 2020	May 21, 2022
Double-Ridged Waveguide Horn	ETS LINDGREN	3117	00034609	May 17, 2019	May 16, 2021
Broadband Preamplifier	ETS LINDGREN	3117PA	00225134	Sep. 03, 2020	Sep. 02, 2022
ANTENNA	SCHWARZBECK	VULB9168	494	Jan. 08,2021	Jan. 07,2023
Test software	Tonscend	JS32-RE (Ver.2.5)	N/A	N/A	N/A

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7. PEAK OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

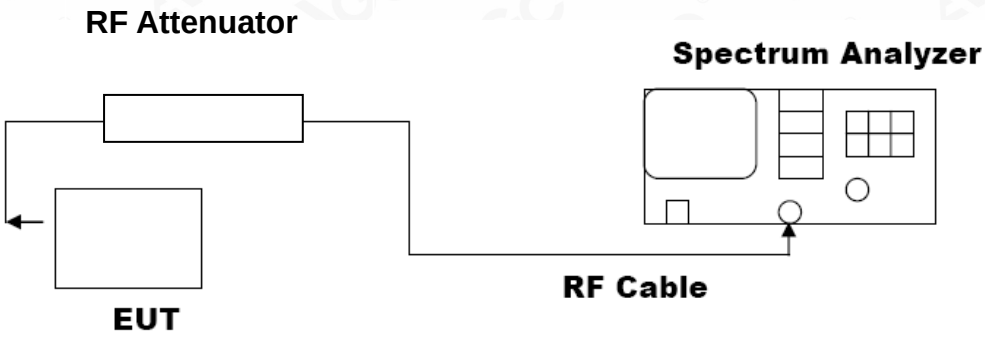
For peak power test:

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
3. RBW > 20 dB bandwidth of the emission being measured.
4. VBW ⩾RBW.
5. Sweep: Auto.
6. Detector function: Peak.
7. Trace: Max hold.

Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

PEAK POWER TEST SETUP



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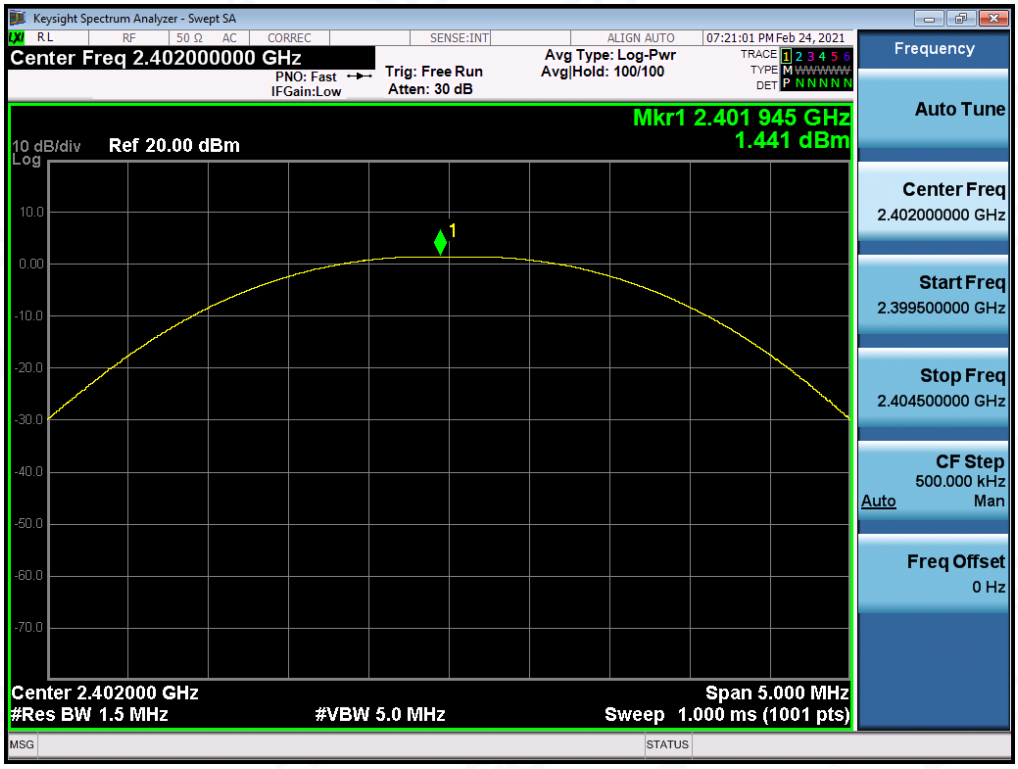
7.3. LIMITS AND MEASUREMENT RESULT

The right ear:

PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION			
Frequency (GHz)	**Peak Power (dBm)**	**Applicable Limits (dBm)**	**Pass or Fail**
2.402	1.441	21	Pass
2.441	1.459	21	Pass
2.480	1.058	21	Pass

CH0



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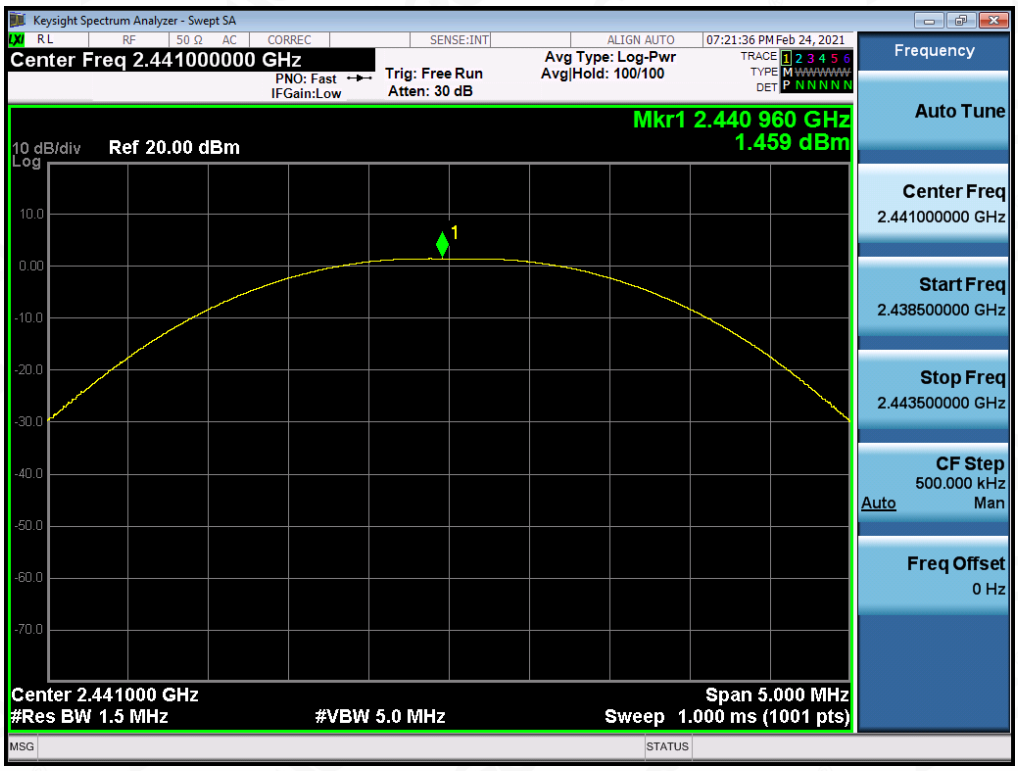
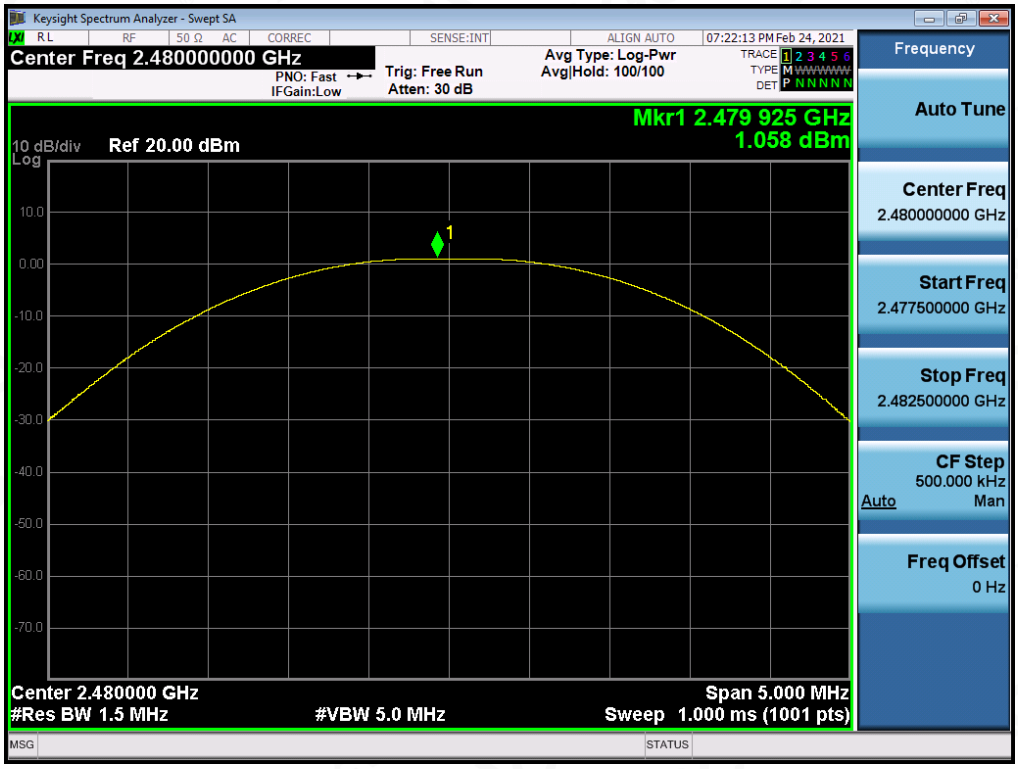
CH39



CH78



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PEAK OUTPUT POWER MEASUREMENT RESULT FOR Π/4-DQPSK MODULATION			
Frequency (GHz)	**Peak Power (dBm)**	**Applicable Limits (dBm)**	**Pass or Fail**
2.402	3.559	21	Pass
2.441	3.597	21	Pass
2.480	3.341	21	Pass

CH0

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PEAK OUTPUT POWER MEASUREMENT RESULT FOR 8-DPSK MODULATION			
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.402	4.027	21	Pass
2.441	3.561	21	Pass
2.480	3.837	21	Pass

CH0

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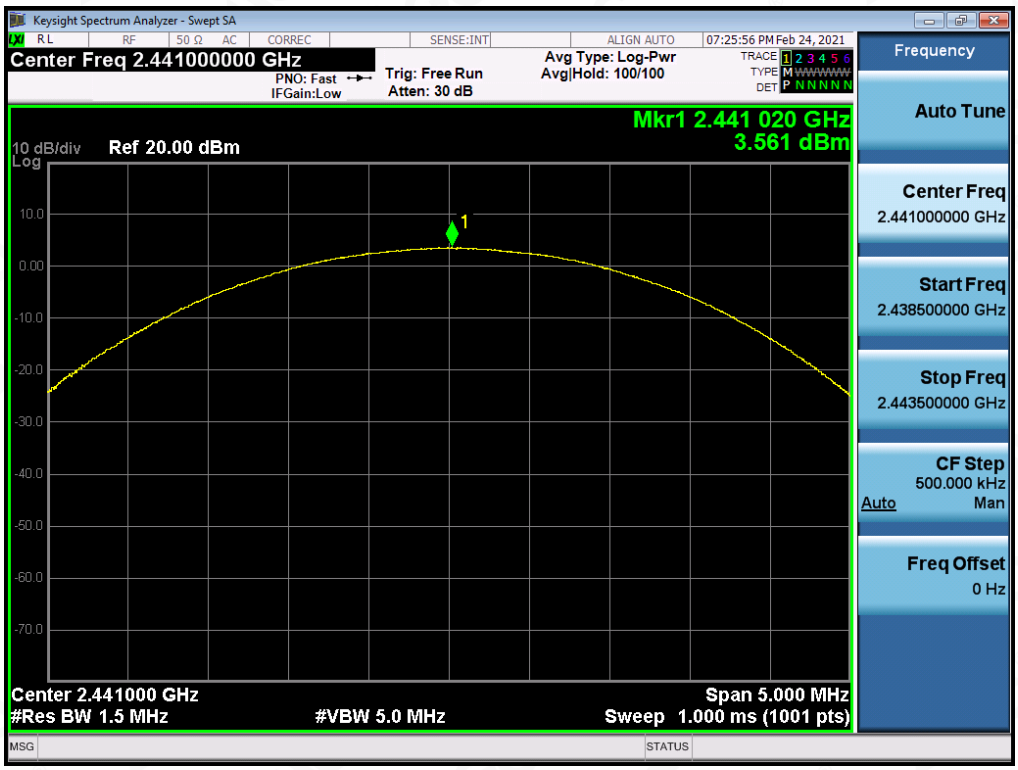
CH39



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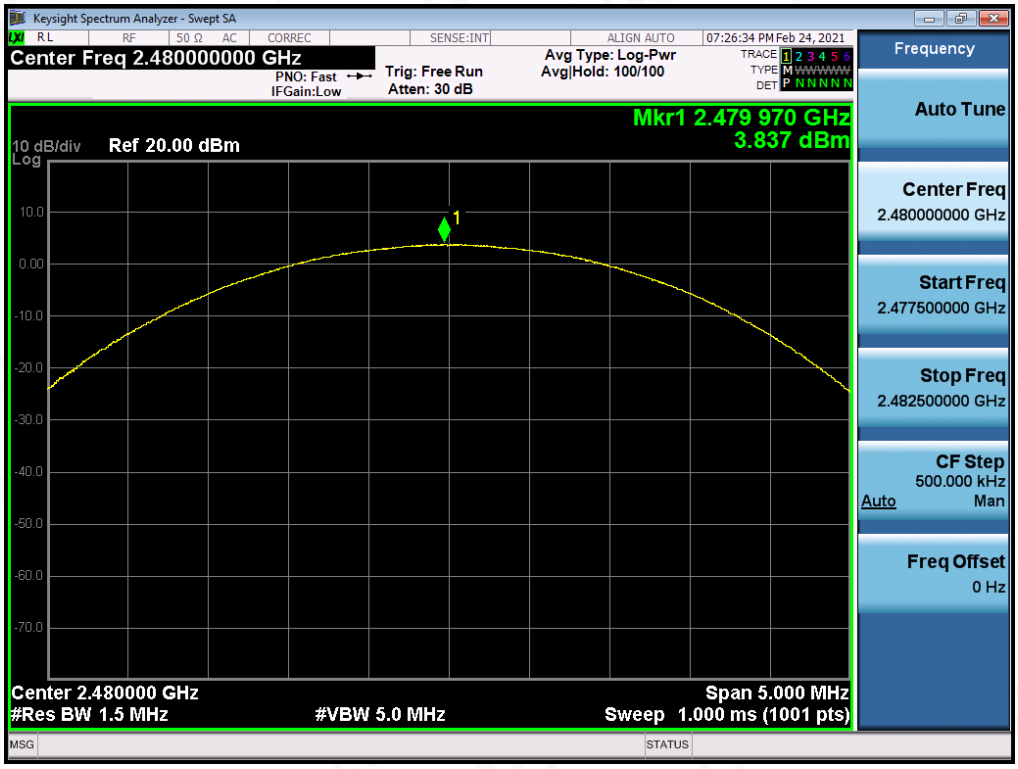

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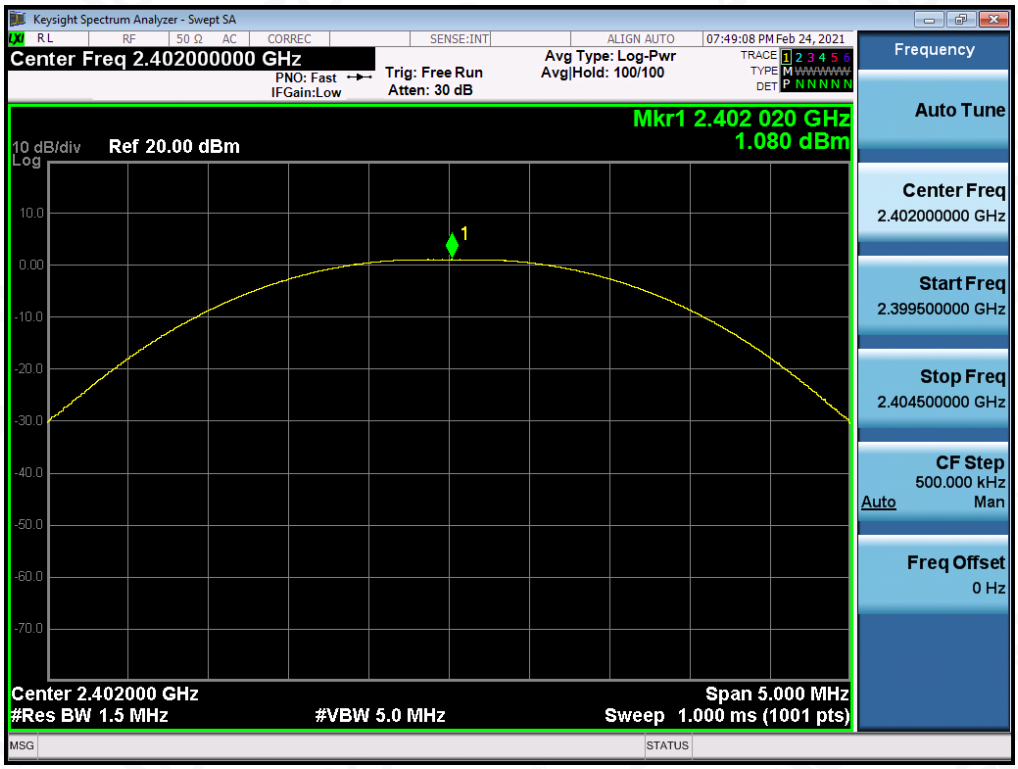
The left ear:

PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION			
Frequency (GHz)	**Peak Power (dBm)**	**Applicable Limits (dBm)**	**Pass or Fail**
2.402	1.080	21	Pass
2.441	0.894	21	Pass
2.480	0.458	21	Pass

CH0



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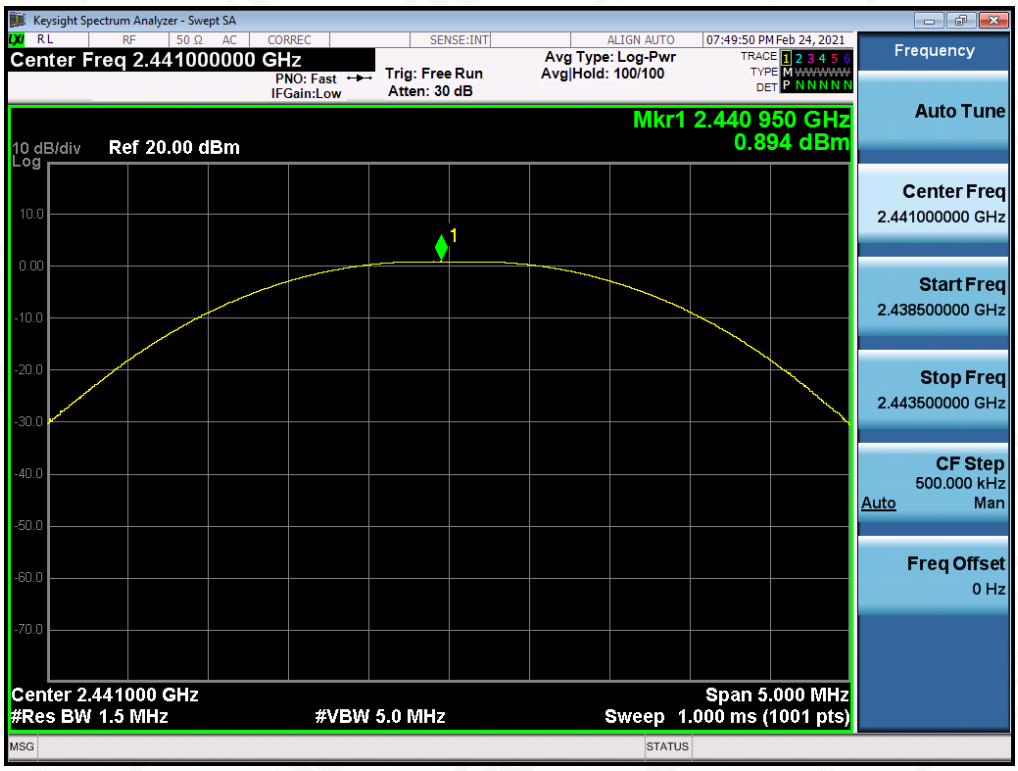

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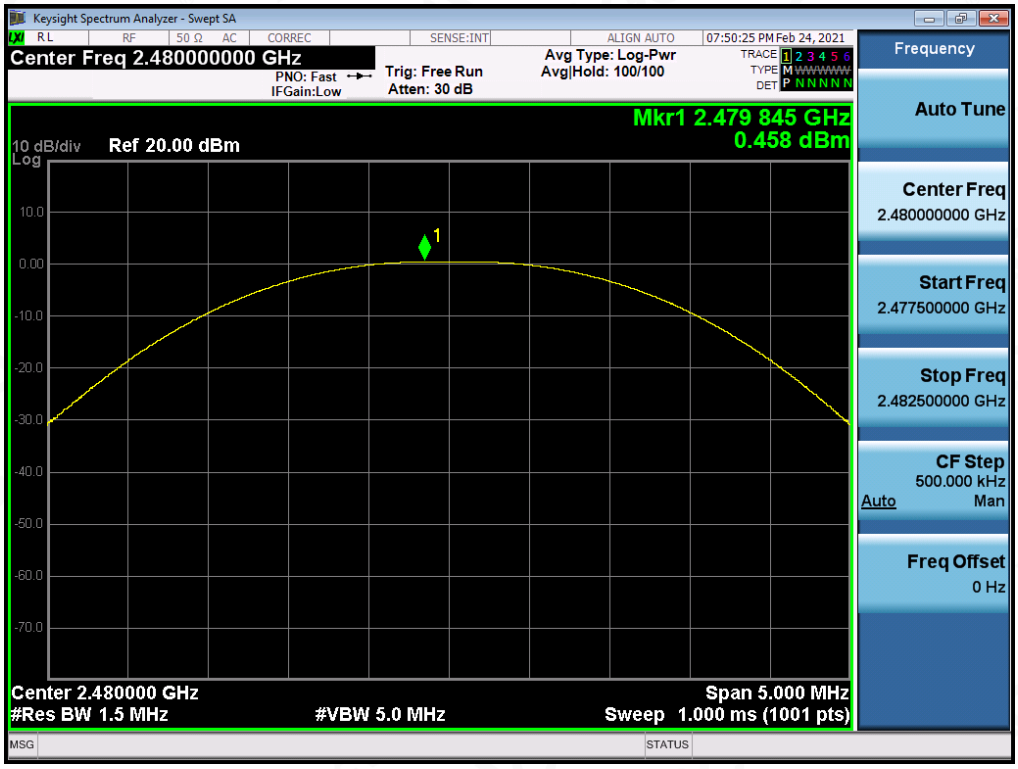

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PEAK OUTPUT POWER MEASUREMENT RESULT FOR Π/4-DQPSK MODULATION			
Frequency (GHz)	**Peak Power (dBm)**	**Applicable Limits (dBm)**	**Pass or Fail**
2.402	2.696	21	Pass
2.441	2.640	21	Pass
2.480	2.294	21	Pass

CH0

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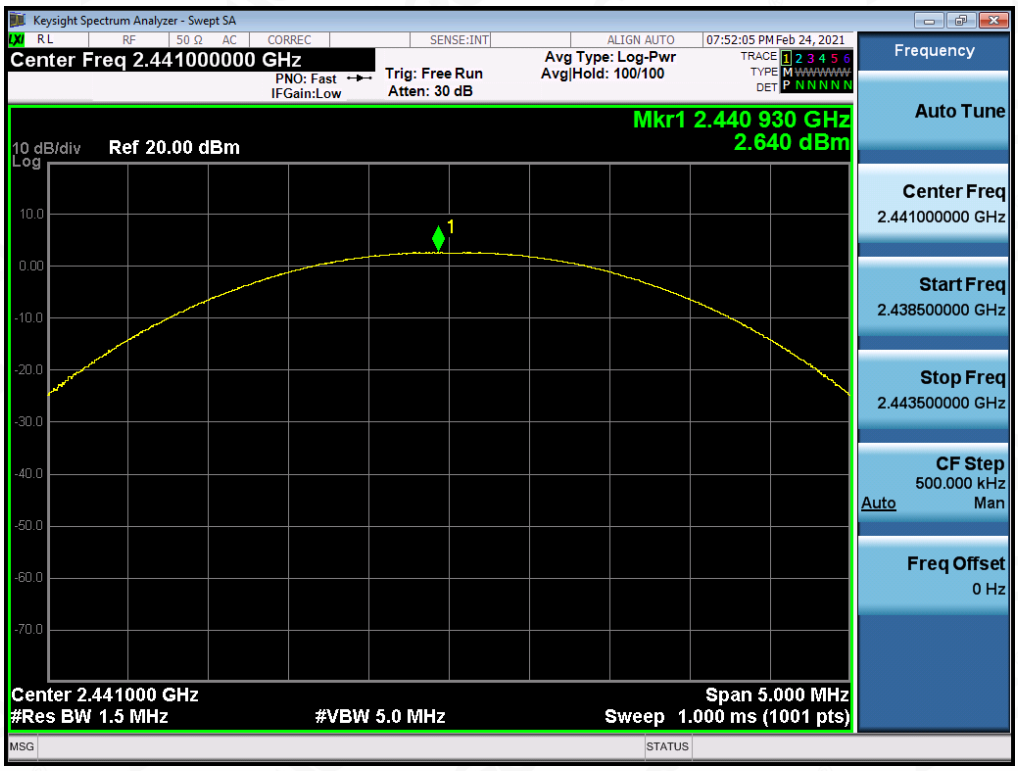

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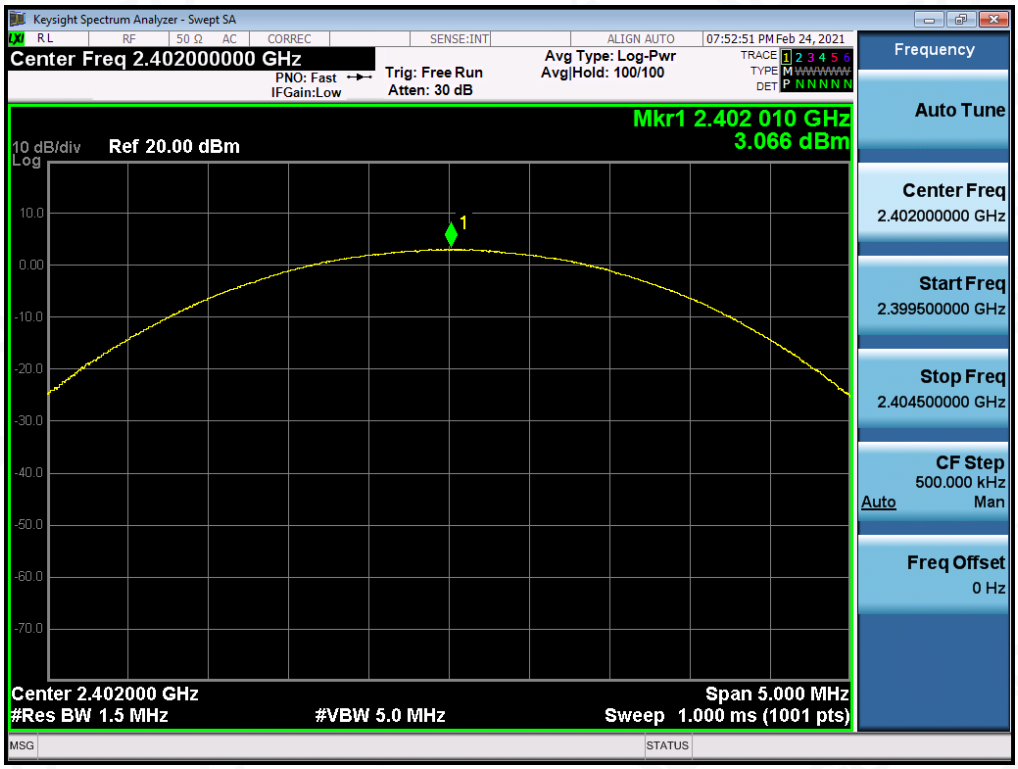
PEAK OUTPUT POWER MEASUREMENT RESULT FOR 8-DPSK MODULATION			
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.402	3.066	21	Pass
2.441	3.074	21	Pass
2.480	2.764	21	Pass

CH0



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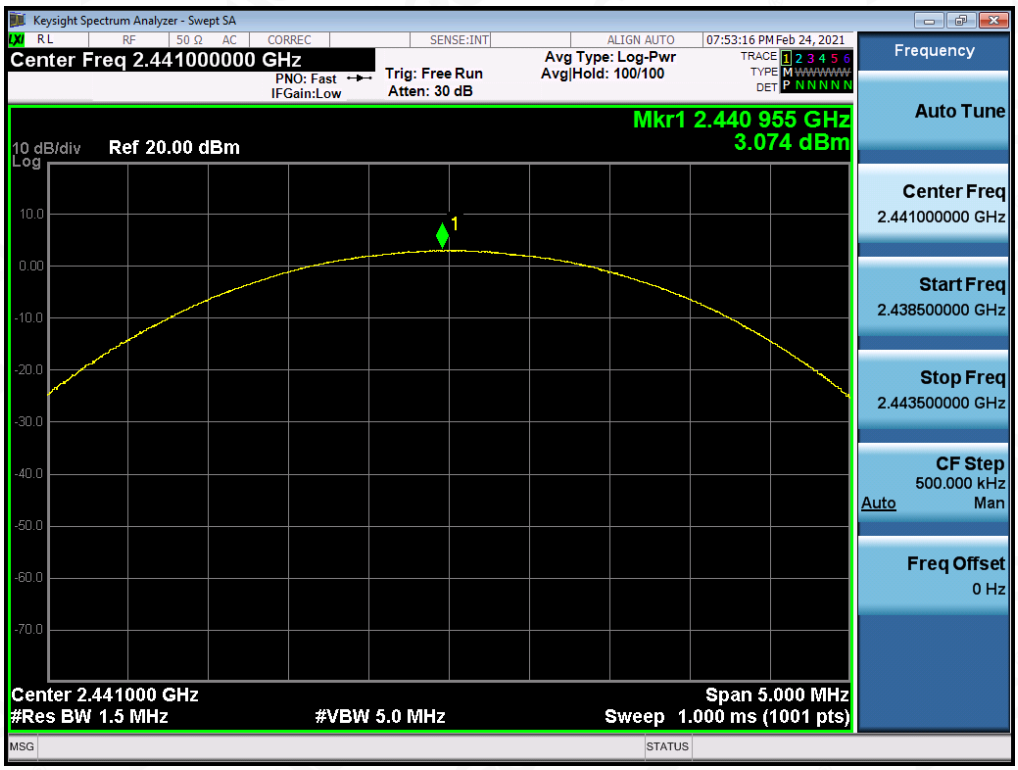

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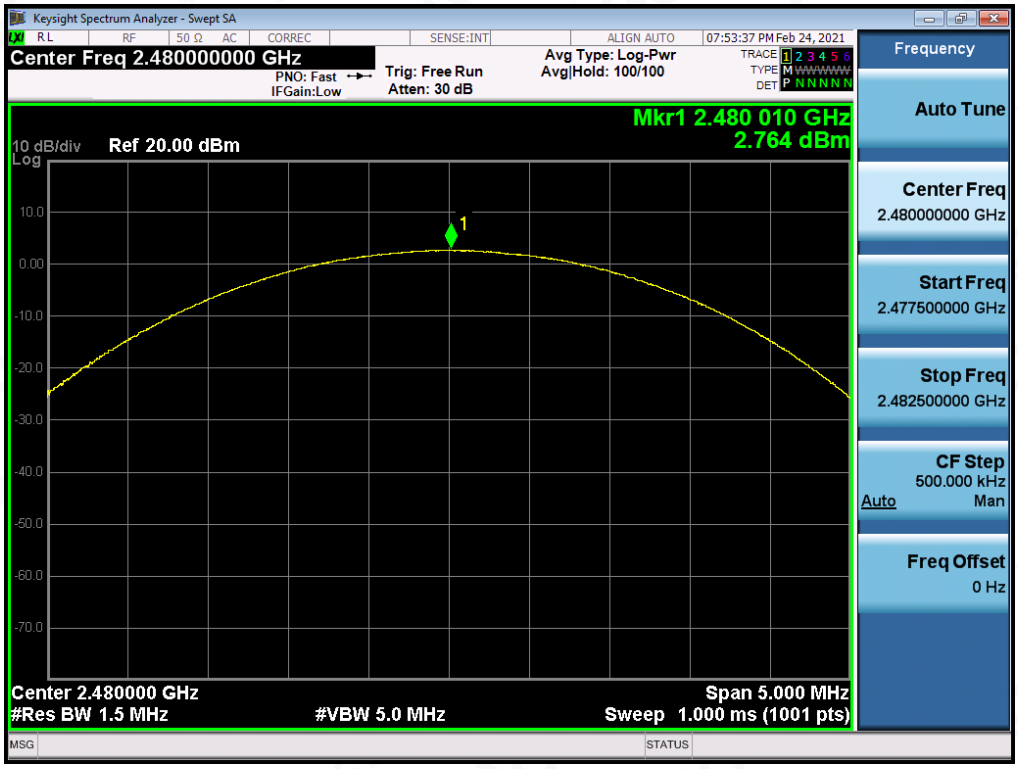

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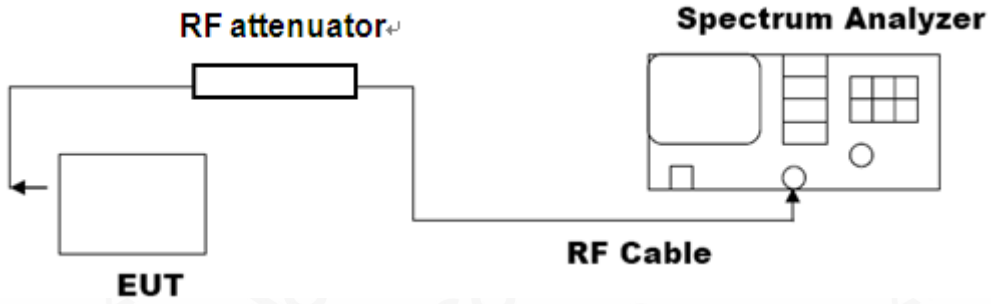
8. 20DB BANDWIDTH

8.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
3. Set Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hoping channel
   The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW; Sweep = auto; Detector function = peak
4. Set SPA Trace 1 Max hold, then View.

8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



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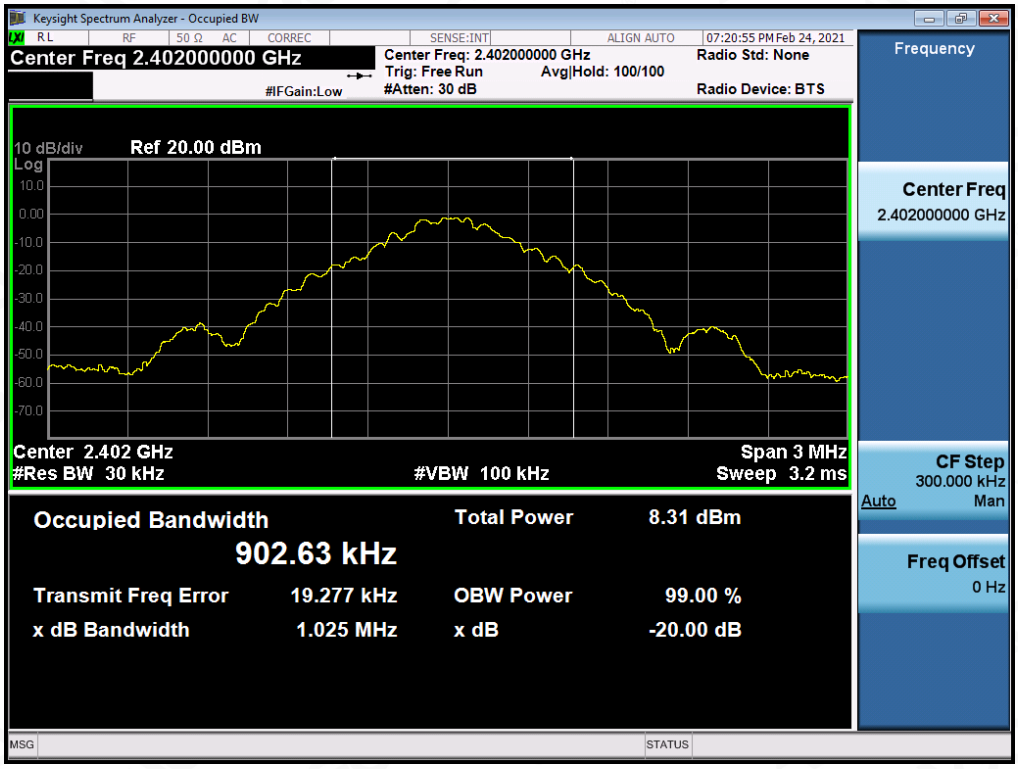
8.3. LIMITS AND MEASUREMENT RESULTS

MEASUREMENT RESULT FOR GFSK MOUDULATION			
Applicable Limits	Measurement Result		
	Test Data (MHz)		Criteria
N/A	Low Channel	1.025	PASS
	Middle Channel	1.030	PASS
	High Channel	1.025	PASS

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



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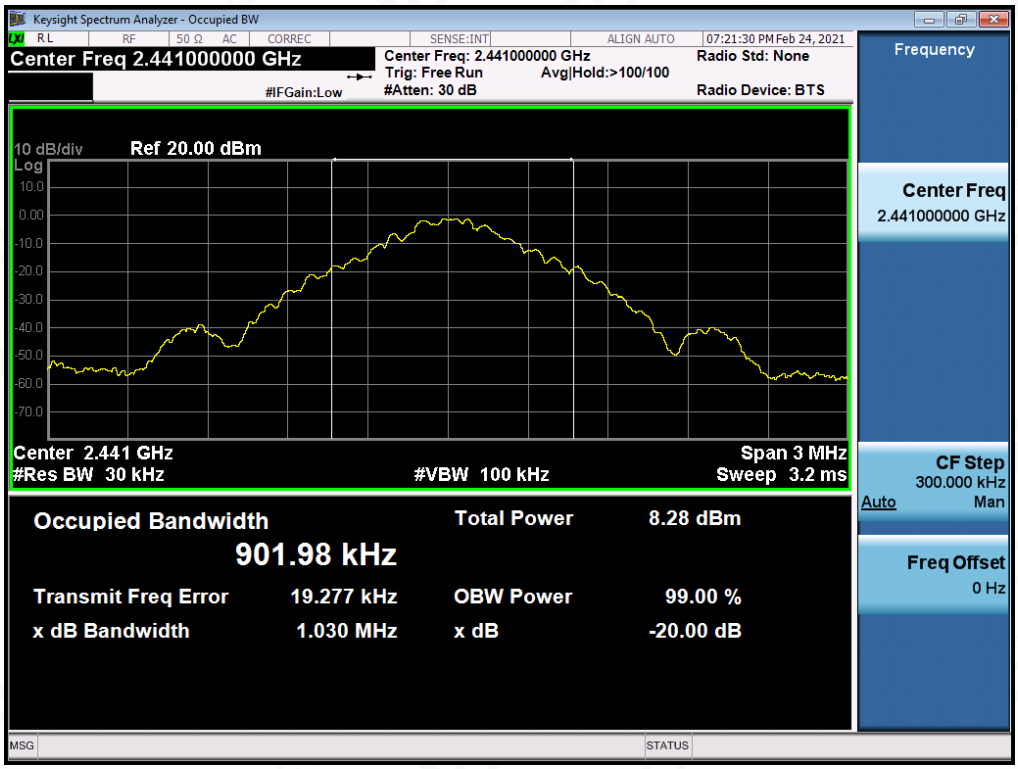
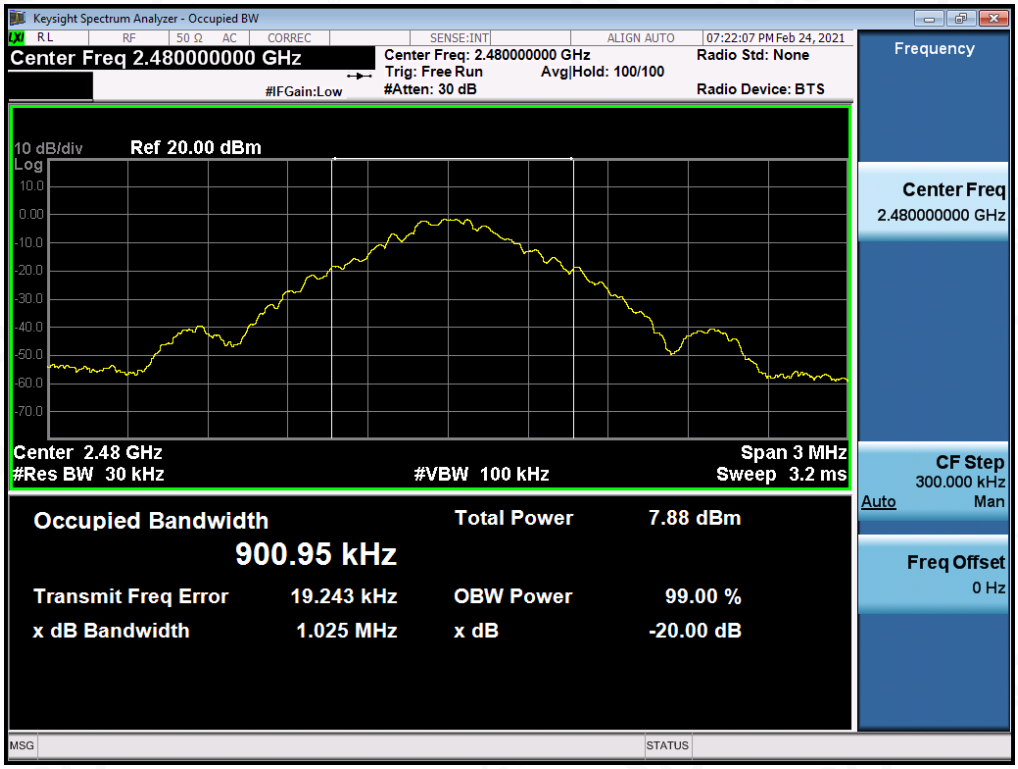
TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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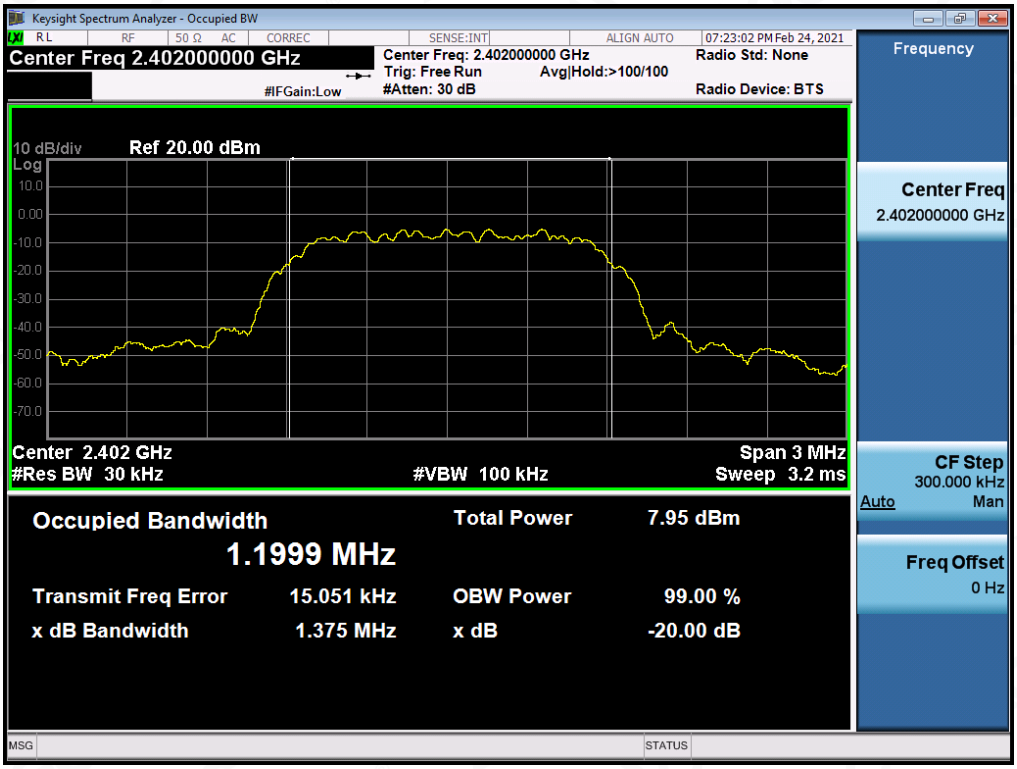
MEASUREMENT RESULT FOR Π /4-DQPSK MODULATION			
Applicable Limits	Measurement Result		
	Test Data (MHz)		Criteria
N/A	Low Channel	1.375	PASS
	Middle Channel	1.373	PASS
	High Channel	1.372	PASS

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



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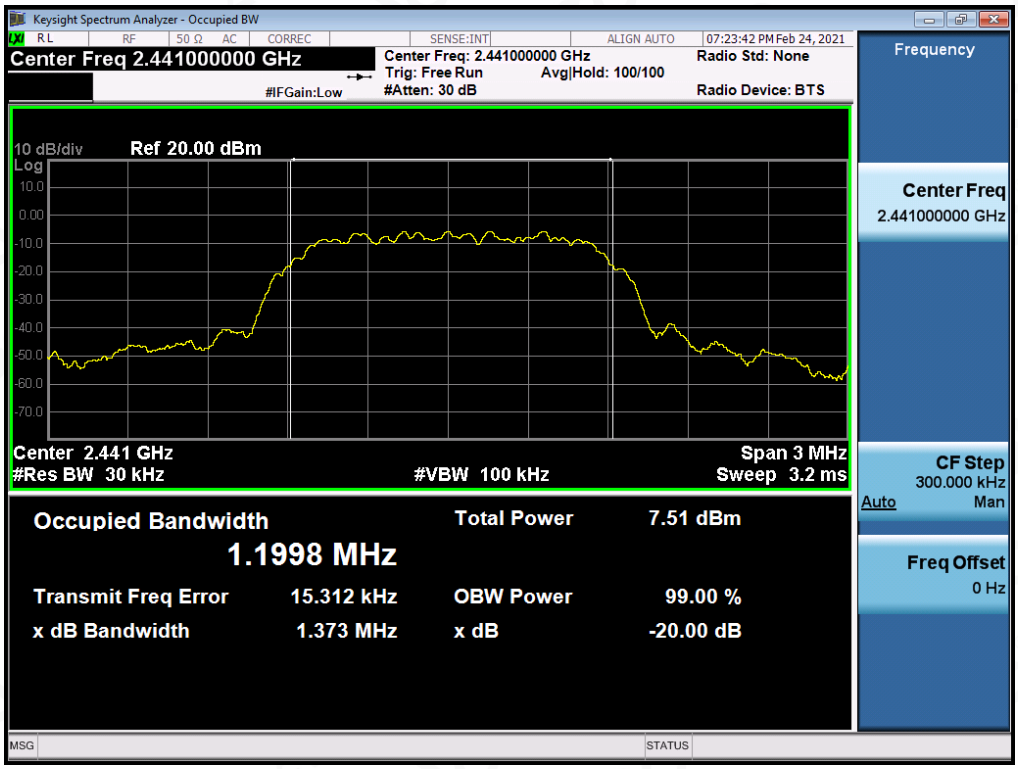
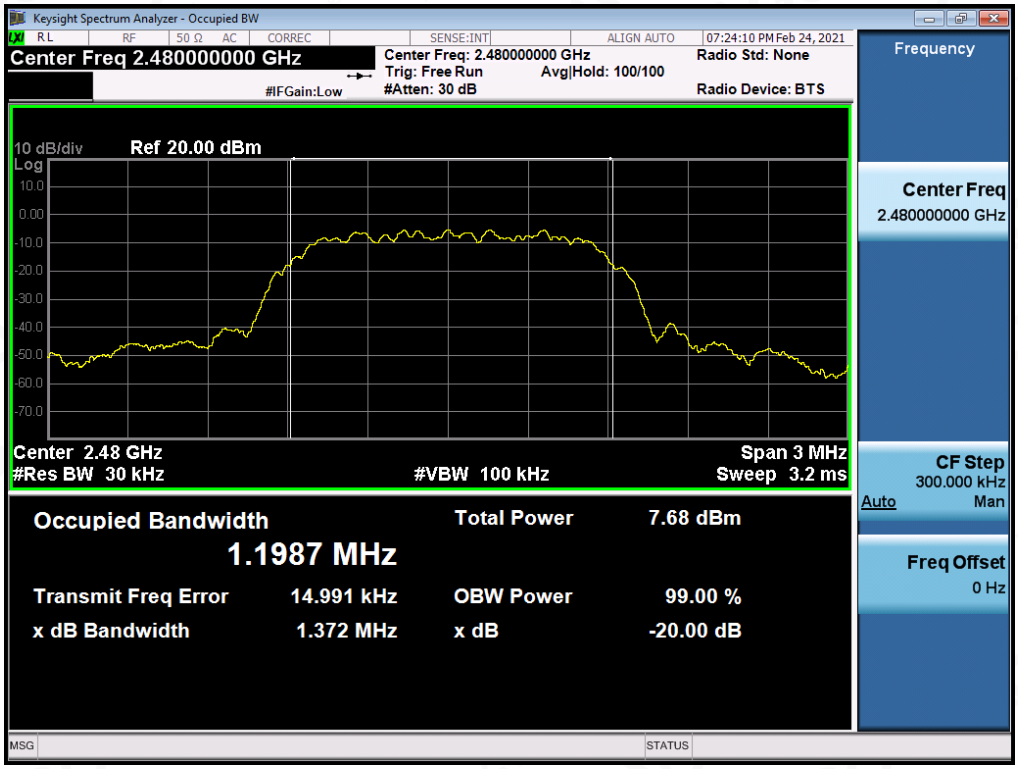
TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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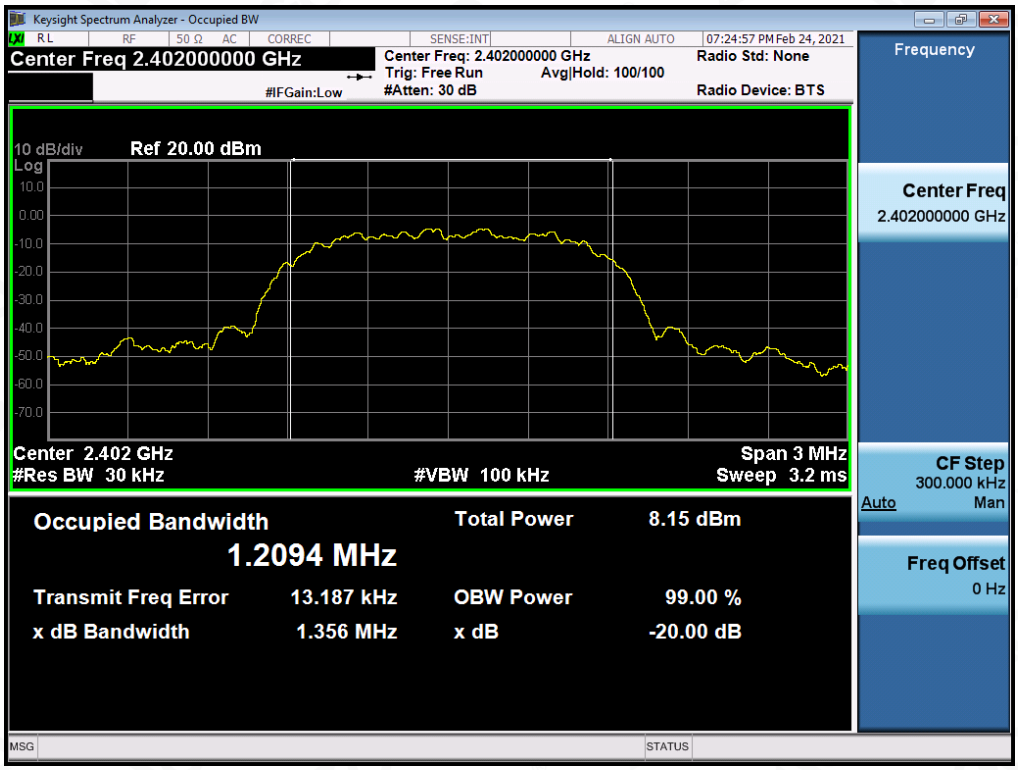
MEASUREMENT RESULT FOR 8-DPSK MODULATION			
Applicable Limits	Measurement Result		
	Test Data (MHz)		Criteria
N/A	Low Channel	1.356	PASS
	Middle Channel	1.356	PASS
	High Channel	1.354	PASS

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



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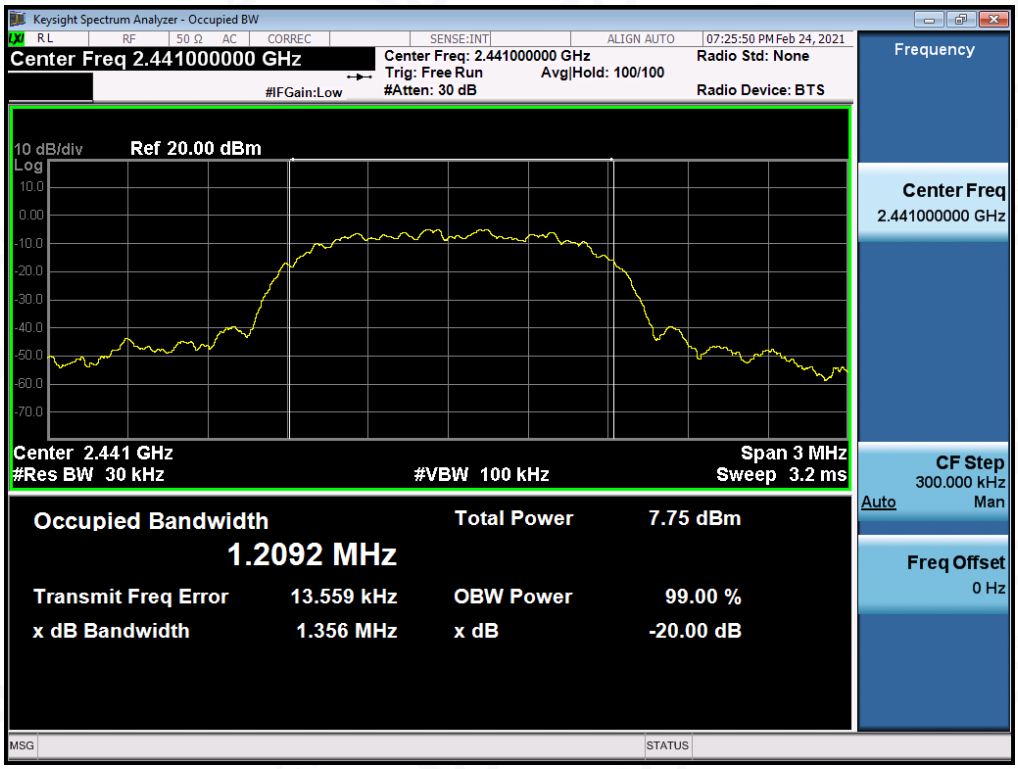
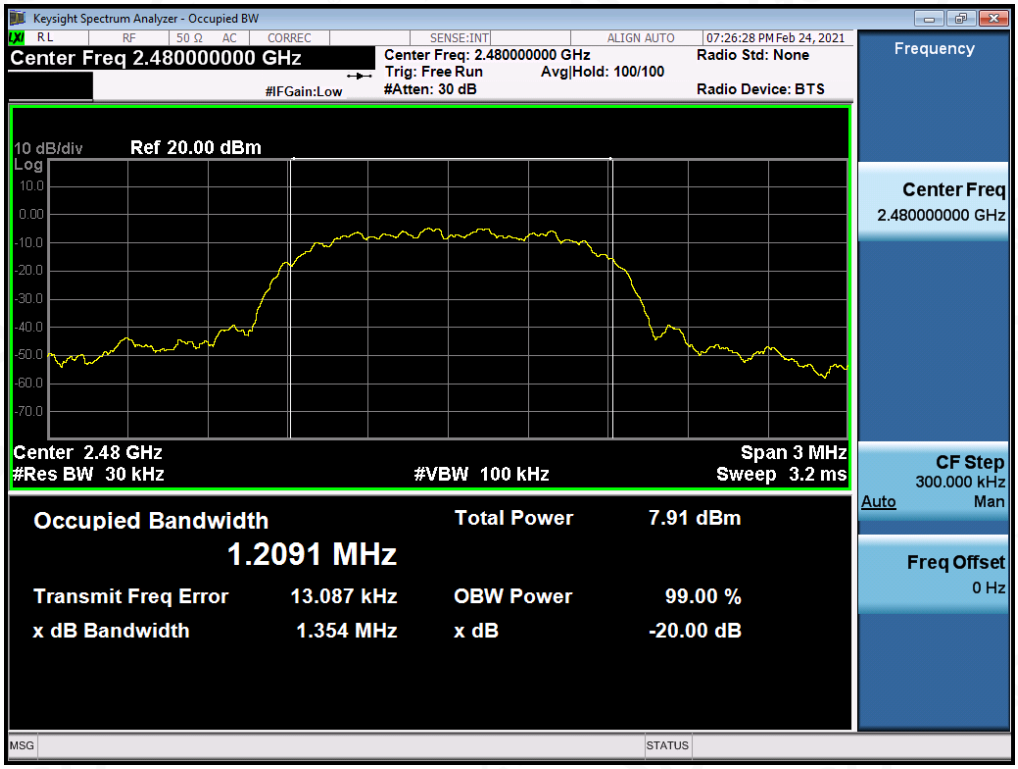
TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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9. CONDUCTED SPURIOUS EMISSION

9.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, the Middle and the bottom operation frequency individually.
3. Set the Span = wide enough to capture the peak level of the in-band emission and all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic.
   RBW = 100 kHz; VBW= 300 kHz; Sweep = auto; Detector function = peak.
4. Set SPA Trace 1 Max hold, then View.

9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 8.2

9.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

9.4. LIMITS AND MEASUREMENT RESULT

LIMITS AND MEASUREMENT RESULT		
Applicable Limits	**Measurement Result**	
	Test Data	**Criteria**
In any 100 kHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiation emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in§15.209(a))	At least -20dBc than the limit Specified on the BOTTOM Channel	PASS
	At least -20dBc than the limit Specified on the TOP Channel	PASS

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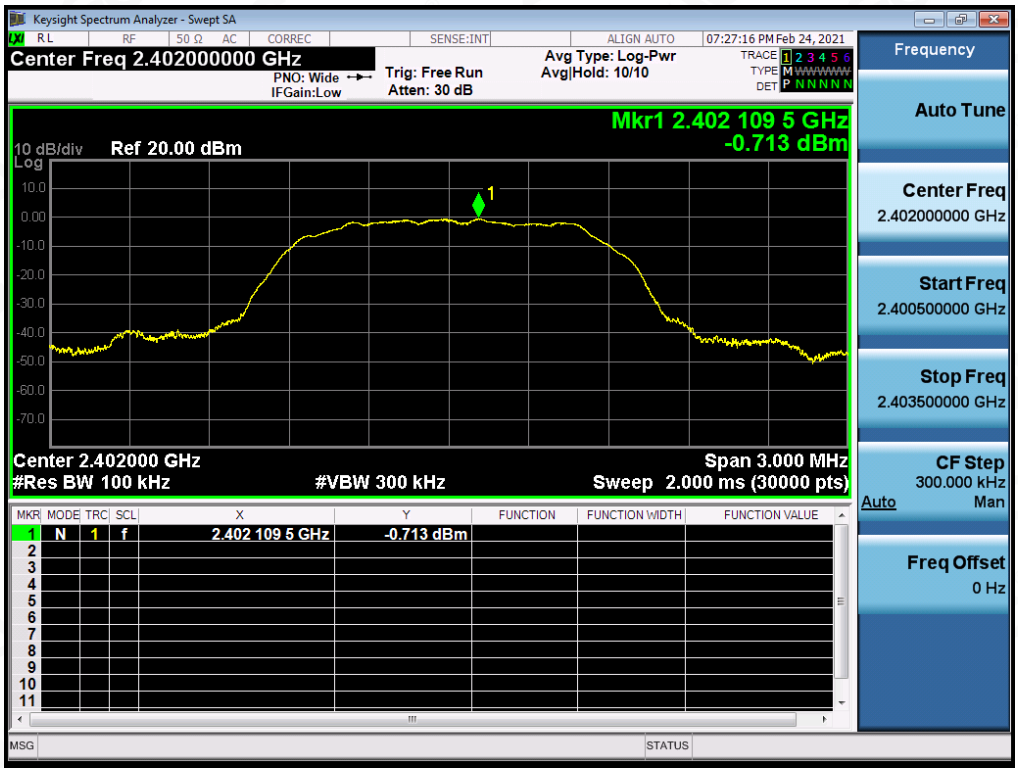
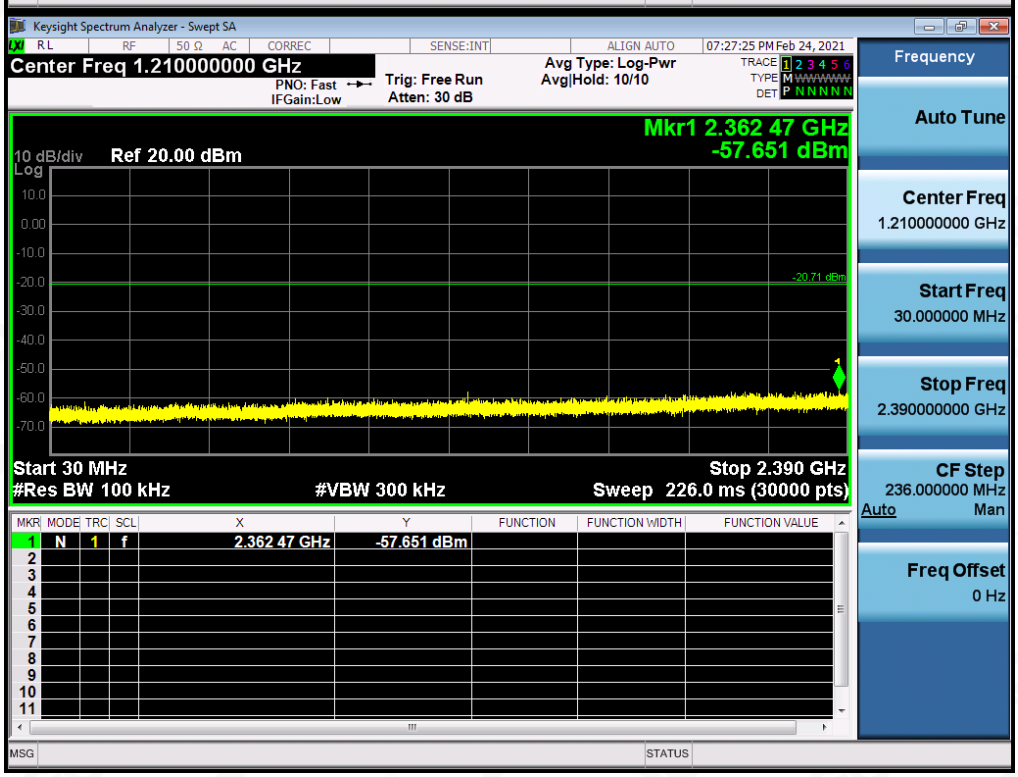
TEST RESULT FOR ENTIRE FREQUENCY RANGE

TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF 8DPSK MODULATION IN LOW CHANNEL





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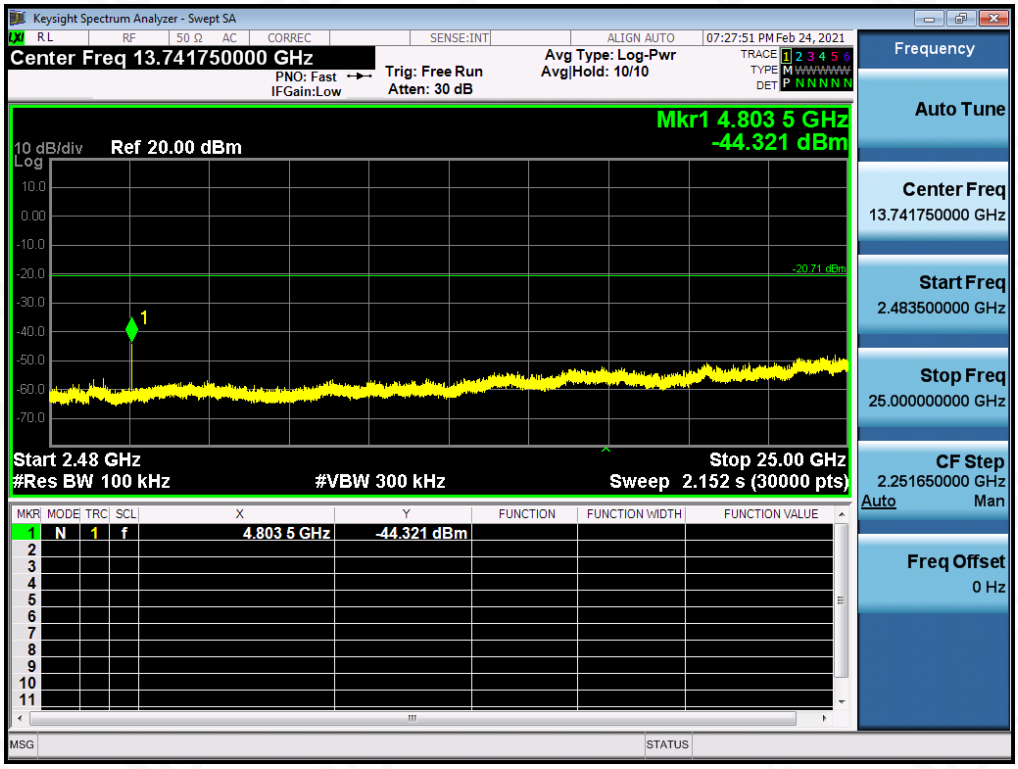

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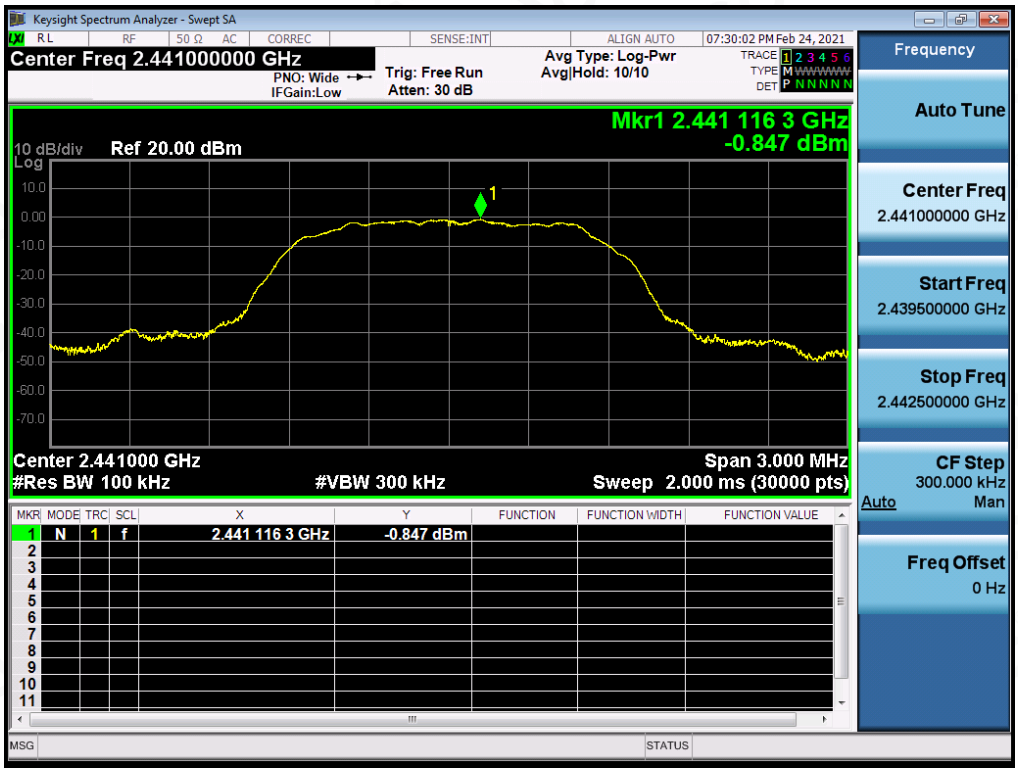
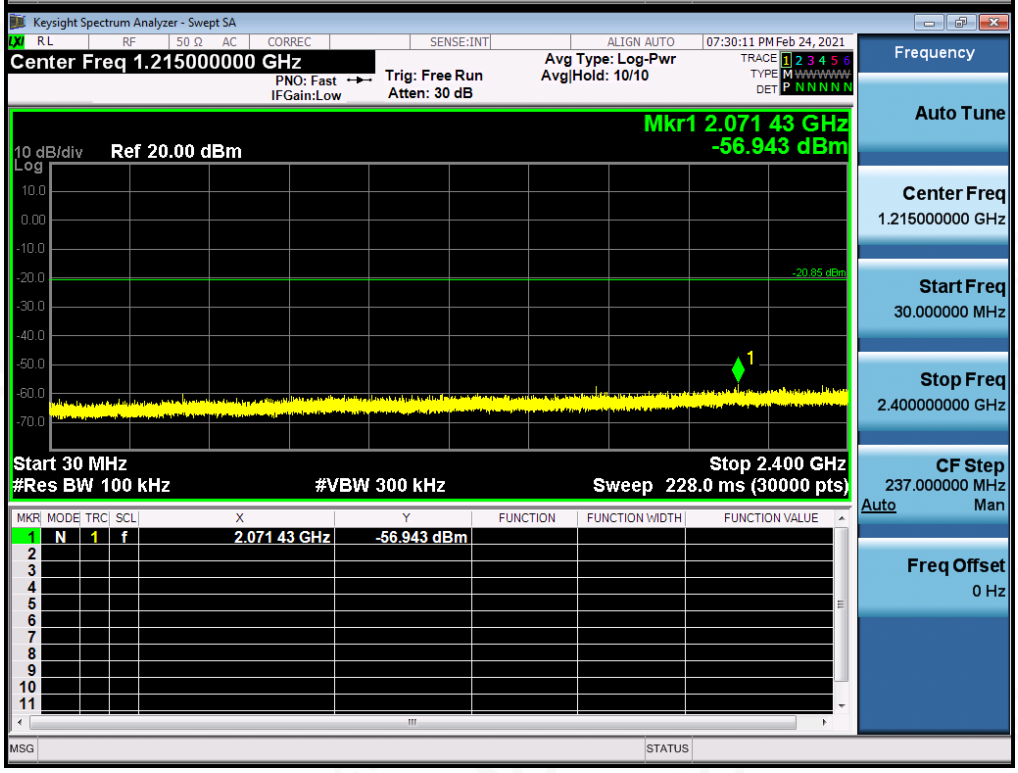
TEST PLOT OF OUT OF BAND EMISSIONS
OF 8DPSK MODULATION IN MIDDLE CHANNEL





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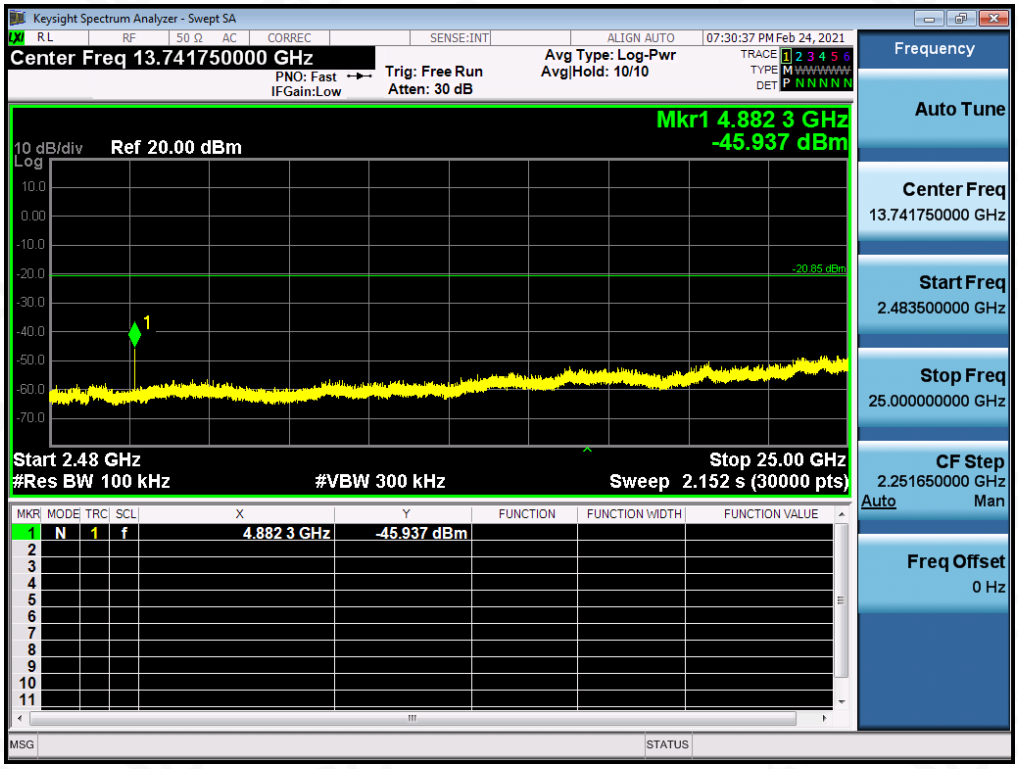

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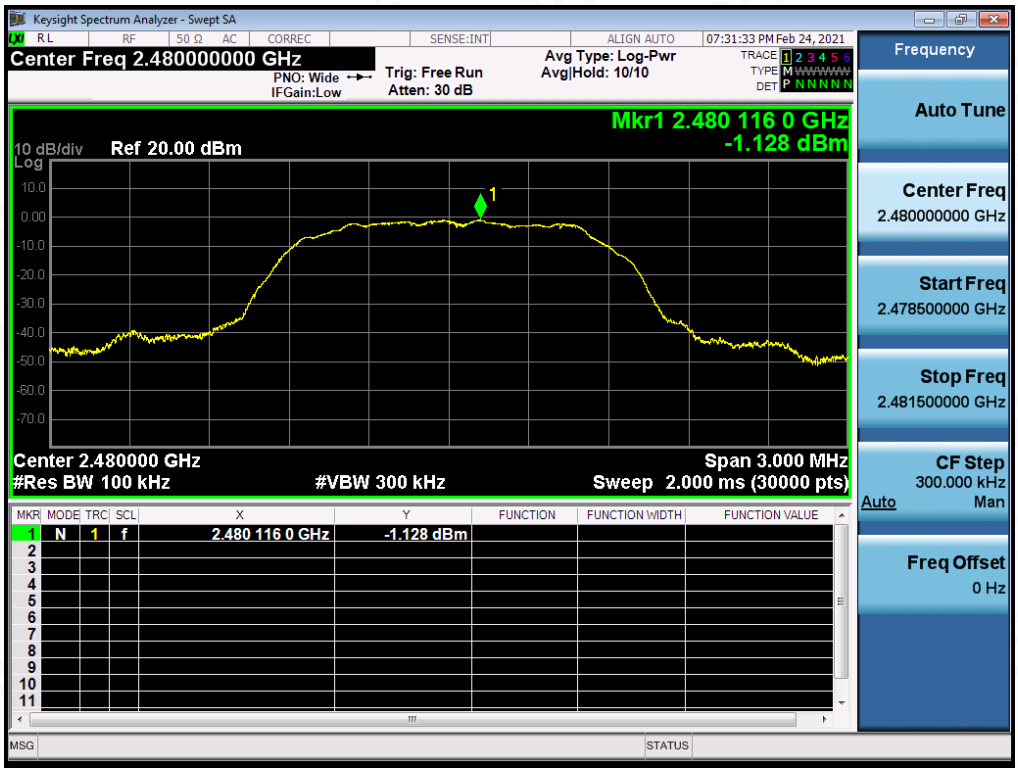
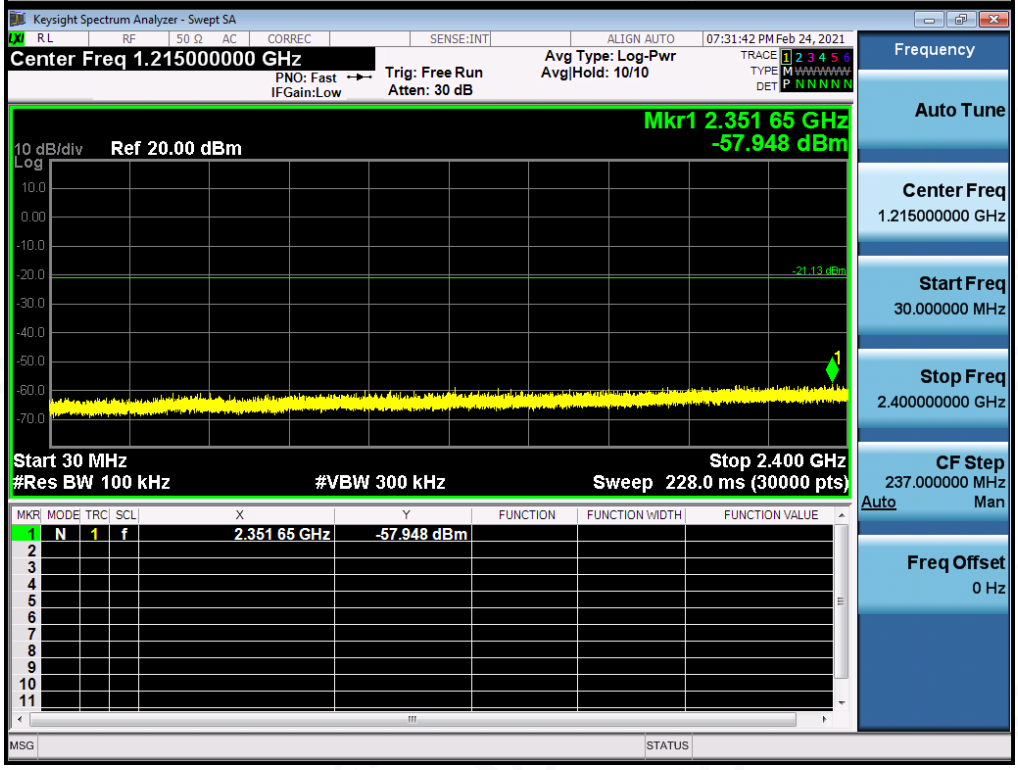
TEST PLOT OF OUT OF BAND EMISSIONS
OF 8DPSK MODULATION IN HIGH CHANNEL





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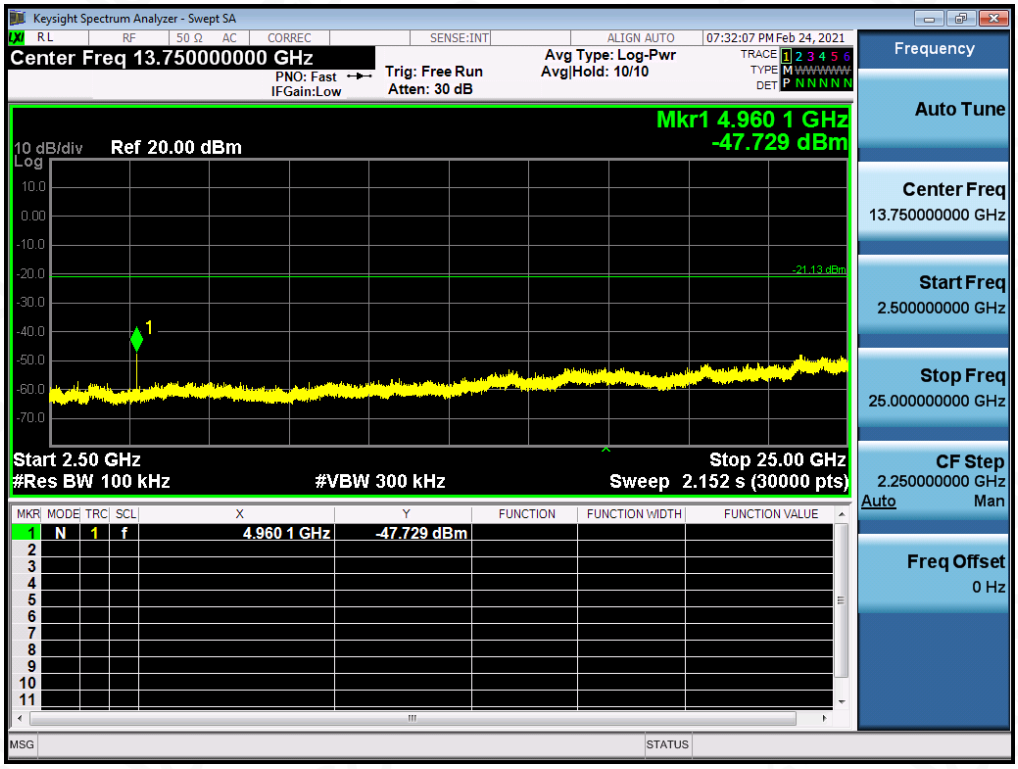

Note: The 8DPSK modulation is the worst case and only those data recorded in the report.

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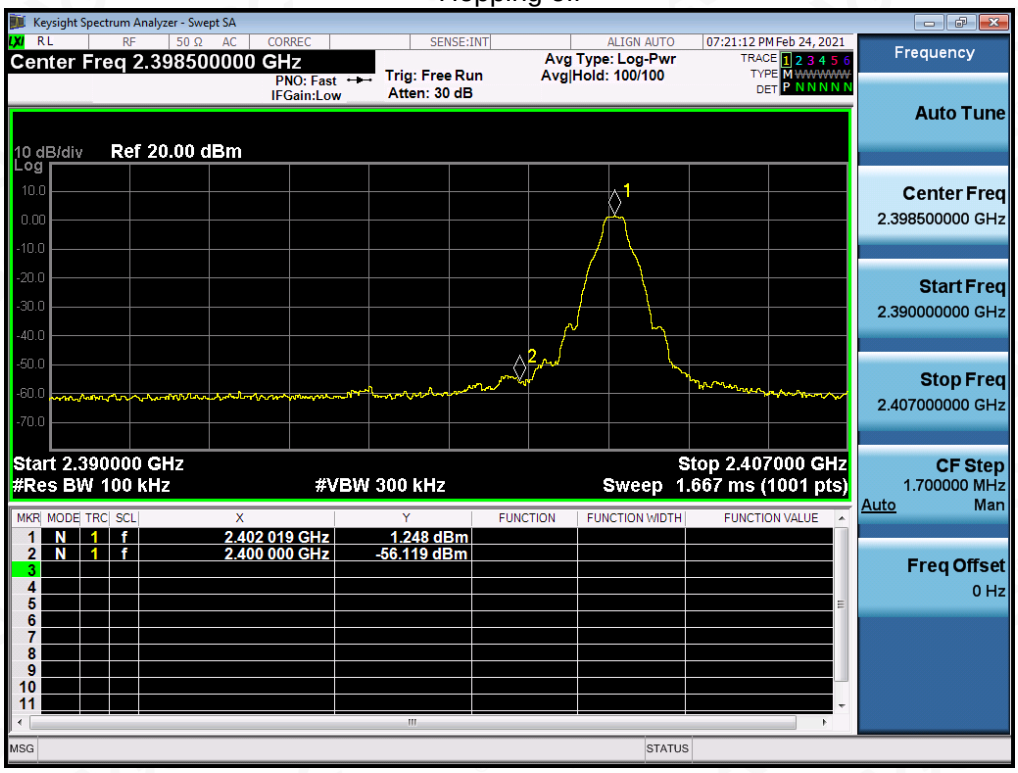
TEST RESULT FOR BAND EDGE

GFSK MODULATION IN LOW CHANNEL

Hopping off



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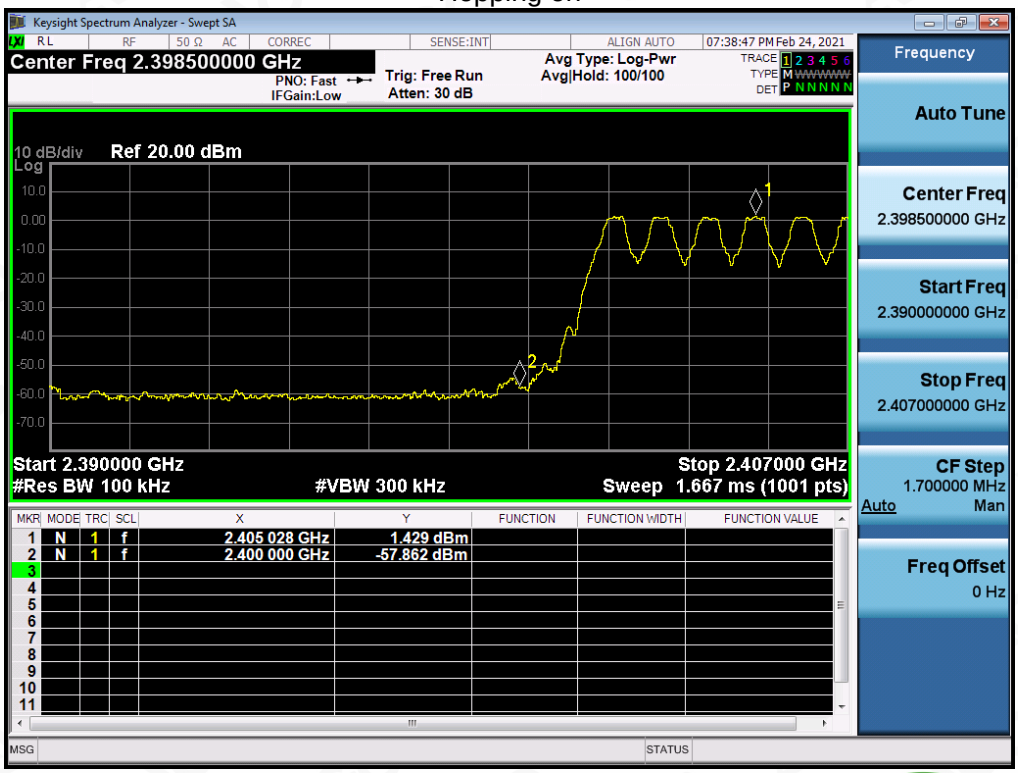

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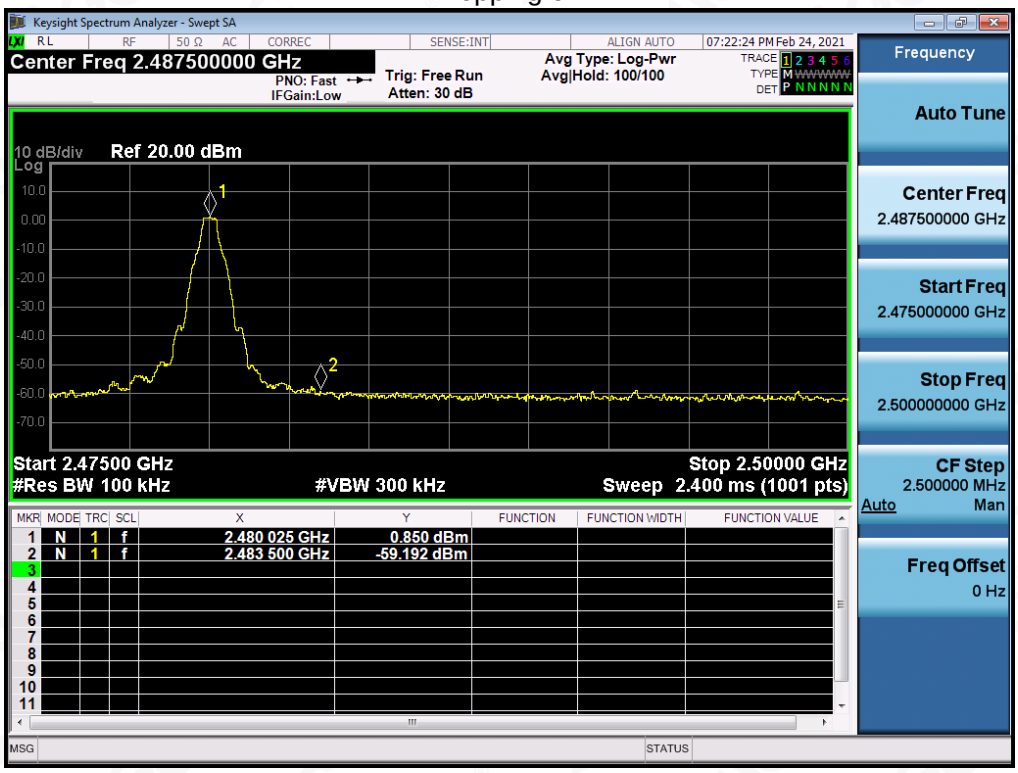
GFSK MODULATION IN HIGH CHANNEL

Hopping off



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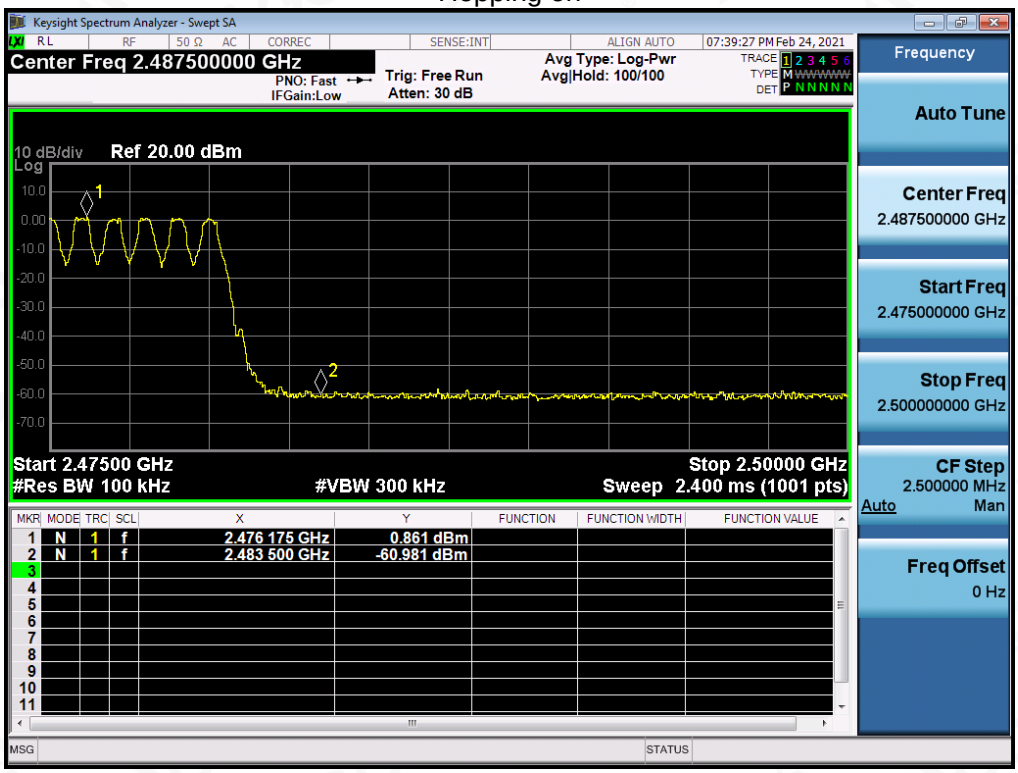

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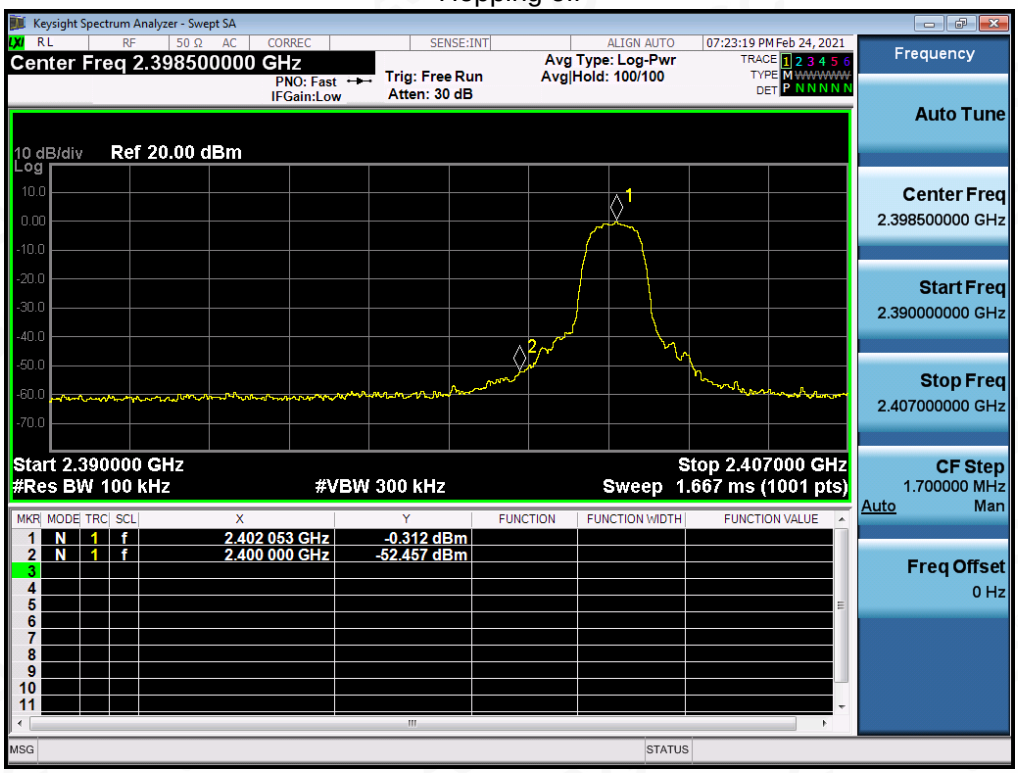
π /4-DQPSK MODULATION IN LOW CHANNEL

Hopping off



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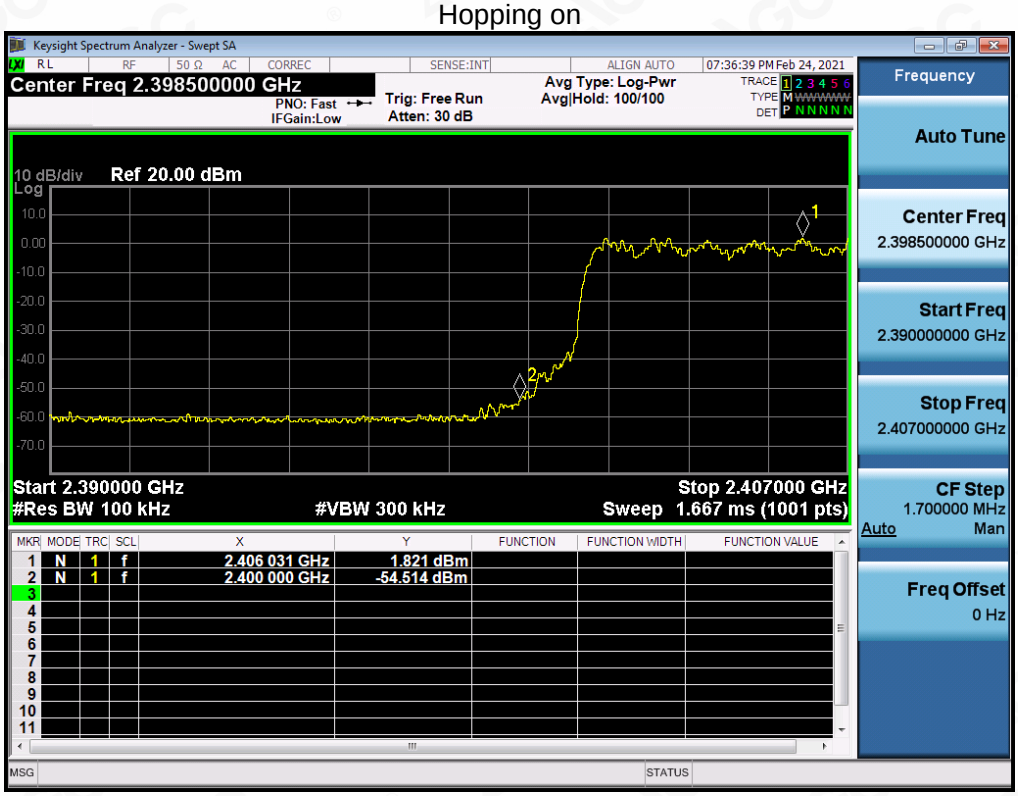

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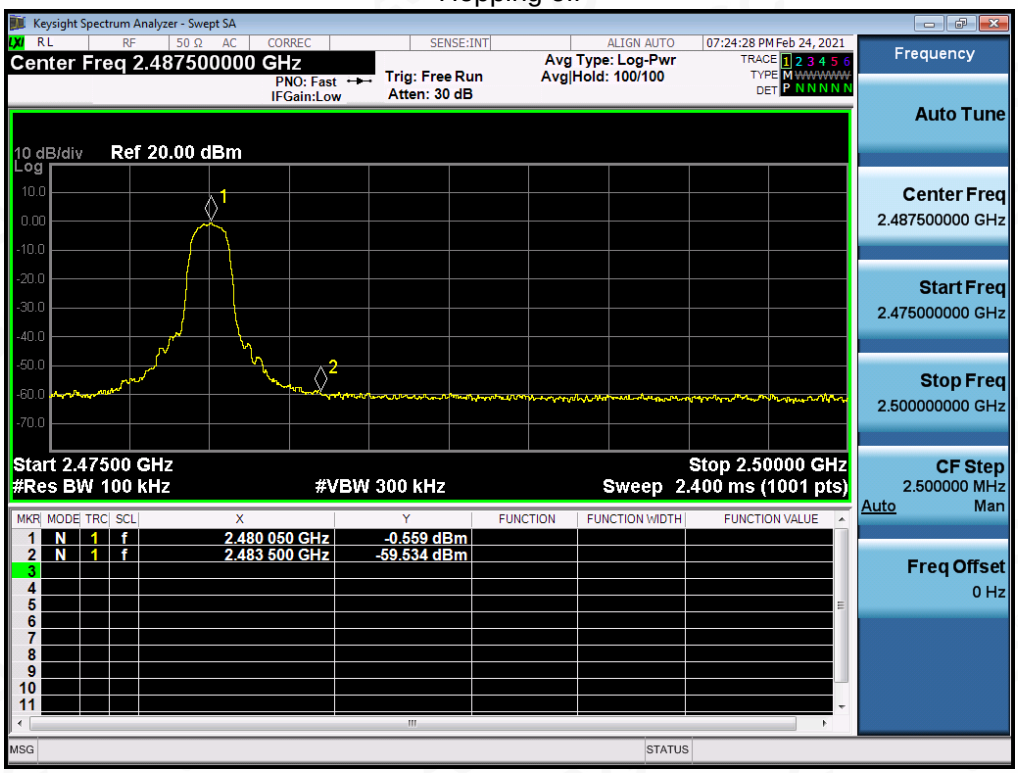
π /4-DQPSK MODULATION IN HIGH CHANNEL

Hopping off



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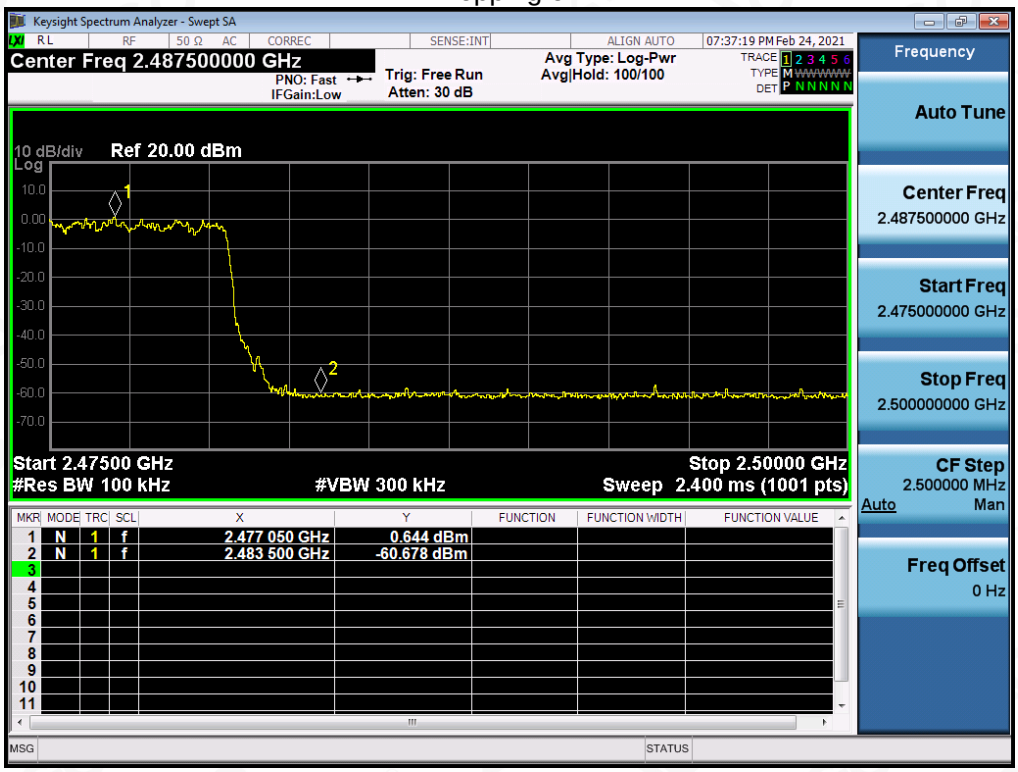

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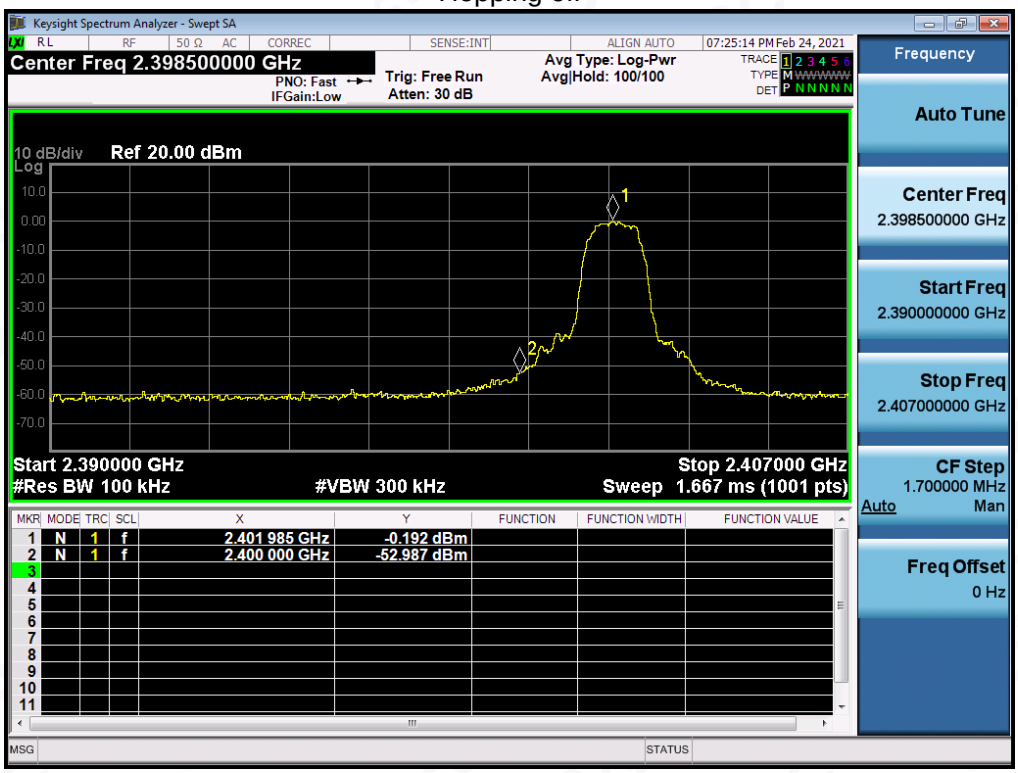
8-DPSK MODULATION IN LOW CHANNEL

Hopping off



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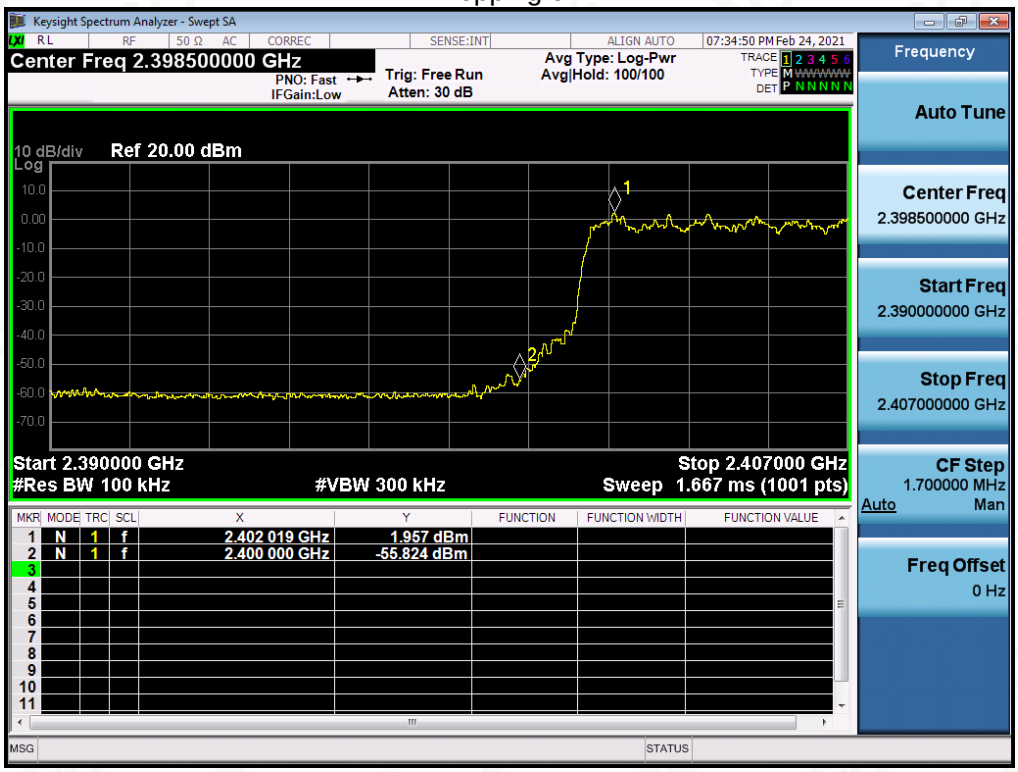

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