

FCC Test Report

Report No.: AGC08328201201FE03

FCC ID : 2AG68-TWS-824A
APPLICATION PURPOSE : Original Equipment
PRODUCT DESIGNATION : TRUE WIRELESS EARBUDS
BRAND NAME : N/A
MODEL NAME : TWS-824A
APPLICANT : Dongguan Koppo Electronics Co., Ltd.
DATE OF ISSUE : Dec. 30, 2020
STANDARD(S) : FCC Part 15.247
REPORT VERSION : V1.0

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REPORT REVISE RECORD

| Report Version | Revise Time | Issued Date | Valid Version | Notes |
|----------------|-------------|---------------|---------------|-----------------|
| V1.0 | / | Dec. 30, 2020 | Valid | Initial Release |

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1. VERIFICATION OF CONFORMITY

| | |
|---------------------------------|--|
| Applicant | Dongguan Koppo Electronics Co., Ltd. |
| Address | No.2 Road 3, Buxinji Industrial Area, Guanjingtou Village, Fenggang Town, Dongguan City, Guangdong Province, China |
| Manufacturer | Dongguan Koppo Electronics Co., Ltd. |
| Address | No.2 Road 3, Buxinji Industrial Area, Guanjingtou Village, Fenggang Town, Dongguan City, Guangdong Province, China |
| Factory | Dongguan Koppo Electronics Co., Ltd. |
| Address | No.2 Road 3, Buxinji Industrial Area, Guanjingtou Village, Fenggang Town, Dongguan City, Guangdong Province, China |
| Product Designation | TRUE WIRELESS EARBUDS |
| Brand Name | N/A |
| Test Model | TWS-824A |
| Date of test | Dec. 04, 2020 to Dec. 30, 2020 |
| 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.

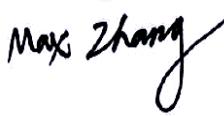
Prepared By



John Zeng
Project Engineer

Dec. 30, 2020

Reviewed By



Max Zhang
Reviewer

Dec. 30, 2020

Approved By



Forrest Lei
Authorized Officer

Dec. 30, 2020

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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as "TRUE WIRELESS EARBUDS". 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 | Left: -3.423dBm (Max); Right: -6.513dBm (Max); |
| Bluetooth Version | V 5.0 |
| Modulation | BR <input checked="" type="checkbox"/> GFSK, EDR <input checked="" type="checkbox"/> π /4-DQPSK, <input checked="" type="checkbox"/> 8DPSK BLE <input type="checkbox"/> GFSK 1Mbps <input type="checkbox"/> GFSK 2Mbps |
| Number of channels | 79 |
| Hardware Version | V0.2 |
| Software Version | V1 |
| Antenna Designation | FPC Antenna (Comply with requirements of the FCC part 15.203) |
| Antenna Gain | -1.65dBi |
| 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 left headset has been tested and recorded in this report, which is the worst case.

2.2. TABLE OF CARRIER FREQUENCIES

| 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 or 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 SEQUENCE 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: 2AG68-TWS-824A** 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 $y \pm U$, 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, $U_c = \pm 3.2 \text{ dB}$
- Uncertainty of Radiated Emission below 1GHz, $U_c = \pm 3.9 \text{ dB}$
- Uncertainty of Radiated Emission above 1GHz, $U_c = \pm 4.8 \text{ dB}$
- Uncertainty of total RF power, conducted, $U_c = \pm 0.8 \text{ dB}$
- Uncertainty of spurious emissions, conducted, $U_c = \pm 2.7 \text{ dB}$
- Uncertainty of Occupied Channel Bandwidth: $U_c = \pm 2 \text{ %}$
- Uncertainty of Dwell Time: $U_c = \pm 2 \text{ %}$
- Uncertainty of Frequency: $U_c = \pm 2 \text{ %}$

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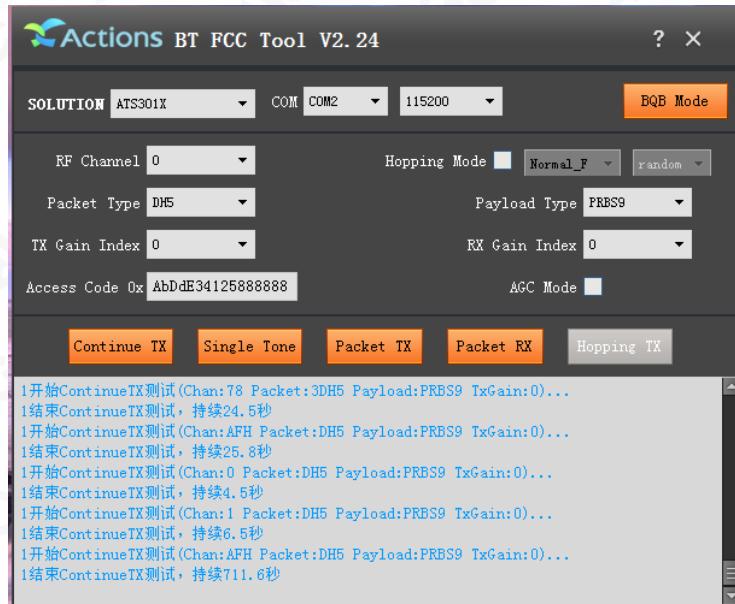
4. DESCRIPTION OF TEST MODES

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

Note:

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

Software Setting



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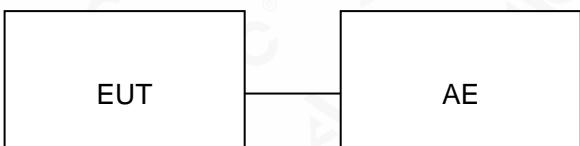
5. SYSTEM TEST CONFIGURATION

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 | TRUE WIRELESS EARBUDS | TWS-824A | 2AG68-TWS-824A | EUT |
| 2 | Control board | N/A | USB_TTL | 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 | Agilent | N9010A | MY53470504 | Dec. 12, 2019 | Dec. 11, 2020 |
| EXA Signal Analyzer | Agilent | 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 | N/A | N/A |
| Horn antenna | SCHWARZBECK | BBHA 9170 | #768 | Sep. 09, 2019 | Sep. 08, 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. 09, 2019 | Jan. 08, 2021 |
| 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

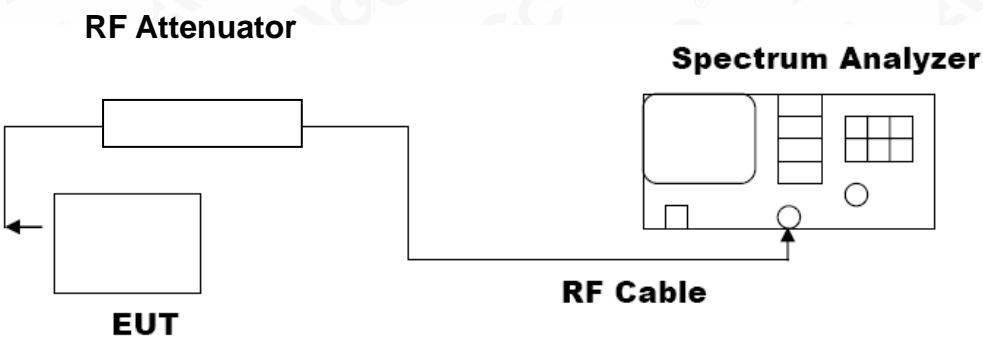
For peak power test:

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 \geq 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 left ear:

| PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION | | | |
|--|---------------------|----------------------------|--------------|
| Frequency (GHz) | Peak Power (dBm) | Applicable Limits (dBm) | Pass or Fail |
| 2.402 | -5.770 | 30 | Pass |
| 2.441 | -4.863 | 30 | Pass |
| 2.480 | -3.720 | 30 | Pass |



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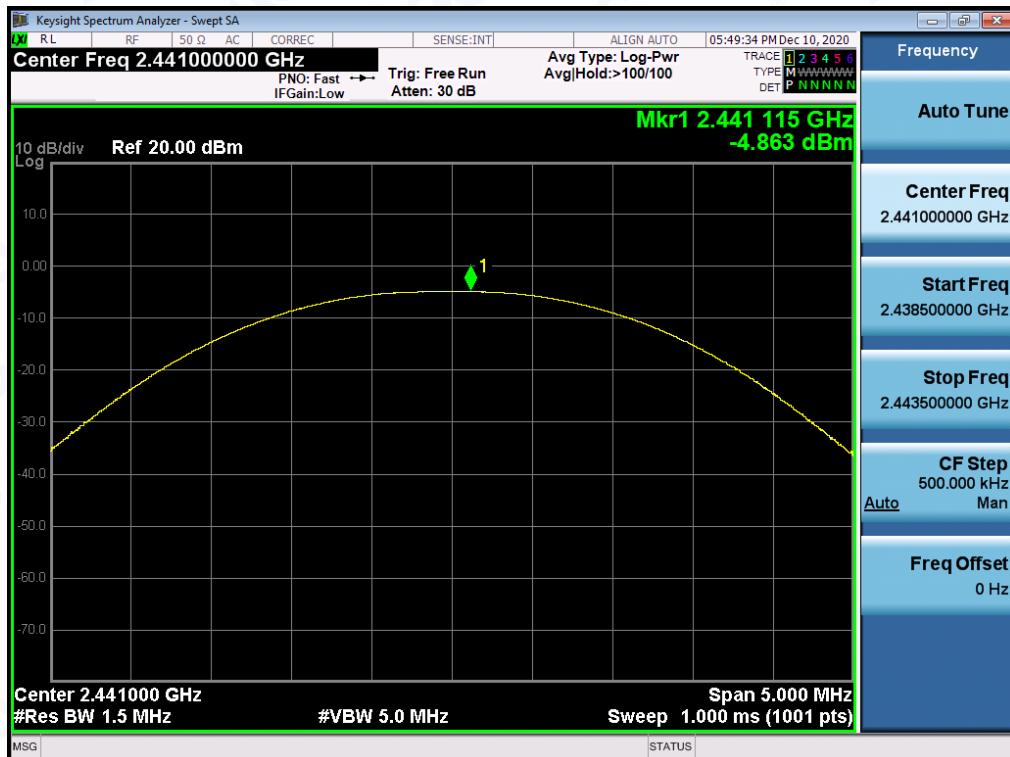
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| PEAK OUTPUT POWER MEASUREMENT RESULT FOR $\Pi/4$ -DQPSK MODULATION | | | |
|---|---------------------|----------------------------|--------------|
| Frequency (GHz) | Peak Power (dBm) | Applicable Limits (dBm) | Pass or Fail |
| 2.402 | -5.747 | 21 | Pass |
| 2.441 | -4.921 | 21 | Pass |
| 2.480 | -3.755 | 21 | Pass |



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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 | -5.609 | 21 | Pass |
| 2.441 | -4.521 | 21 | Pass |
| 2.480 | -3.423 | 21 | Pass |



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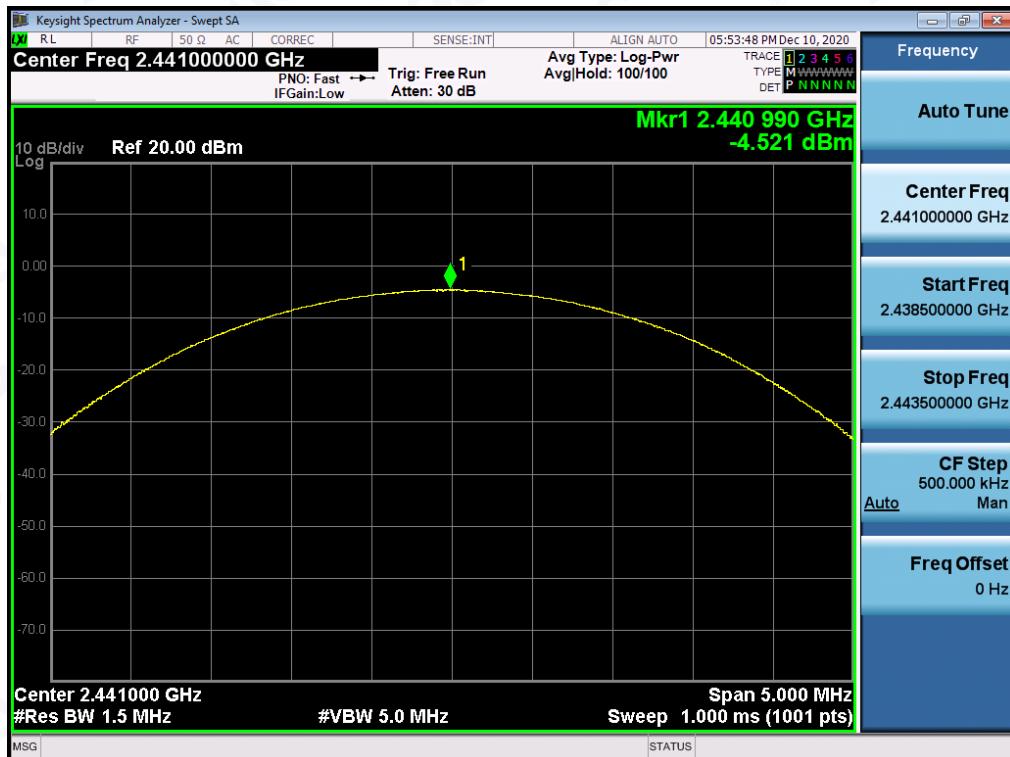
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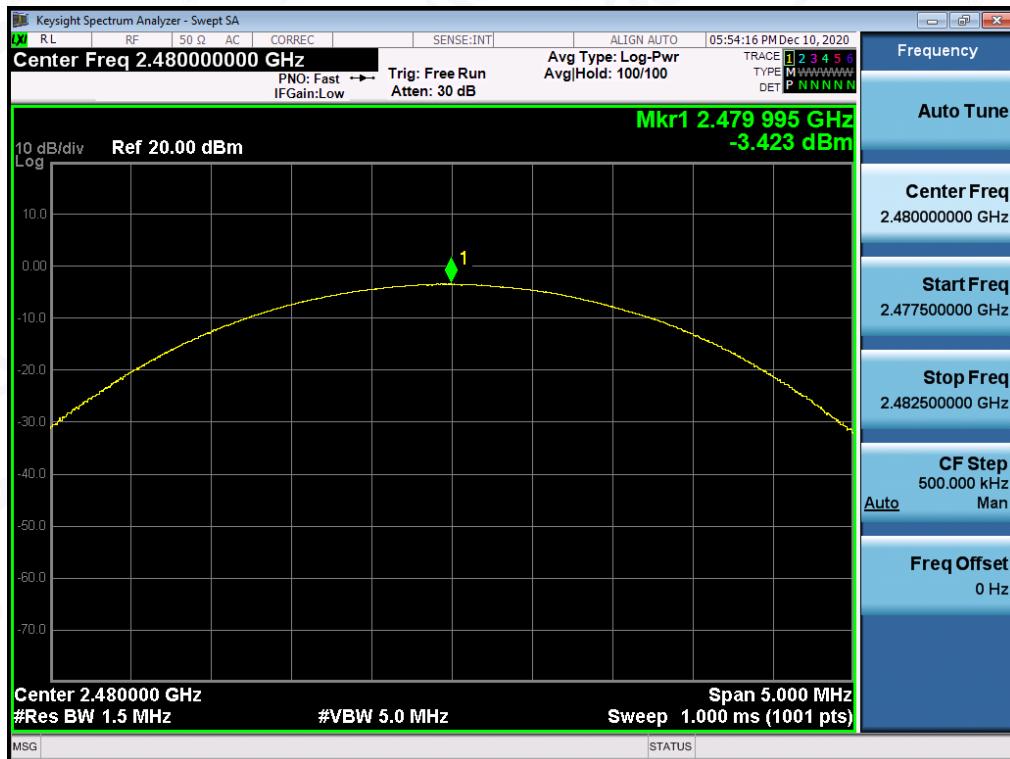
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The right ear:

| PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION | | | |
|--|---------------------|----------------------------|--------------|
| Frequency (GHz) | Peak Power (dBm) | Applicable Limits (dBm) | Pass or Fail |
| 2.402 | -8.440 | 21 | Pass |
| 2.441 | -7.486 | 21 | Pass |
| 2.480 | -6.513 | 21 | Pass |



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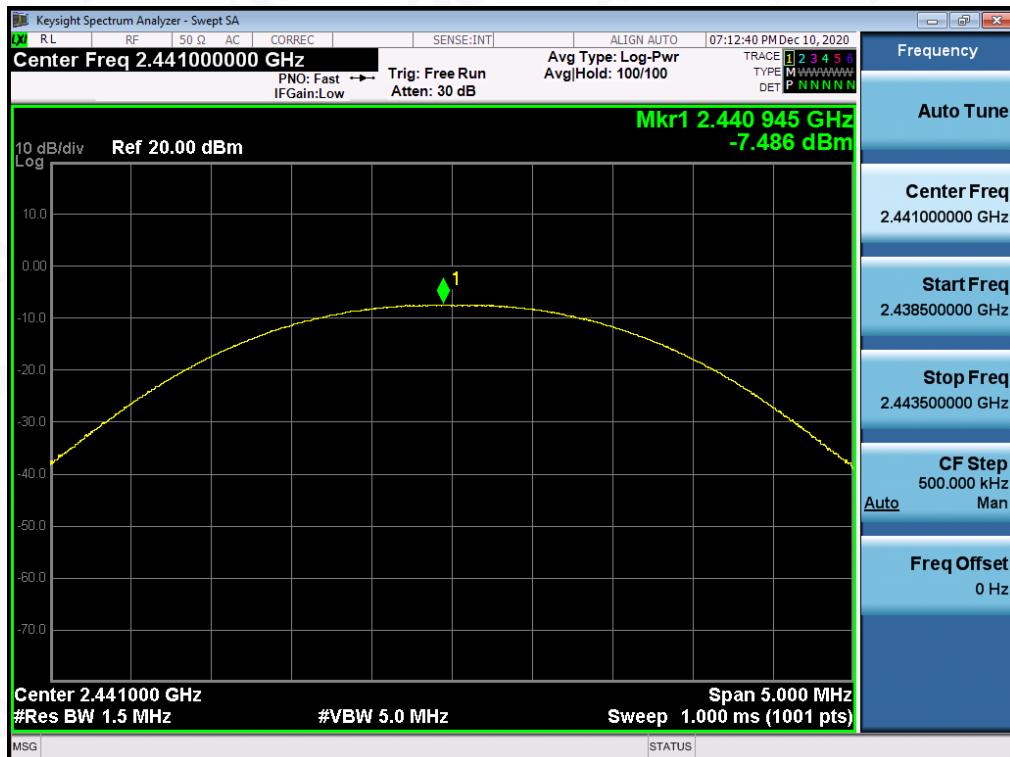
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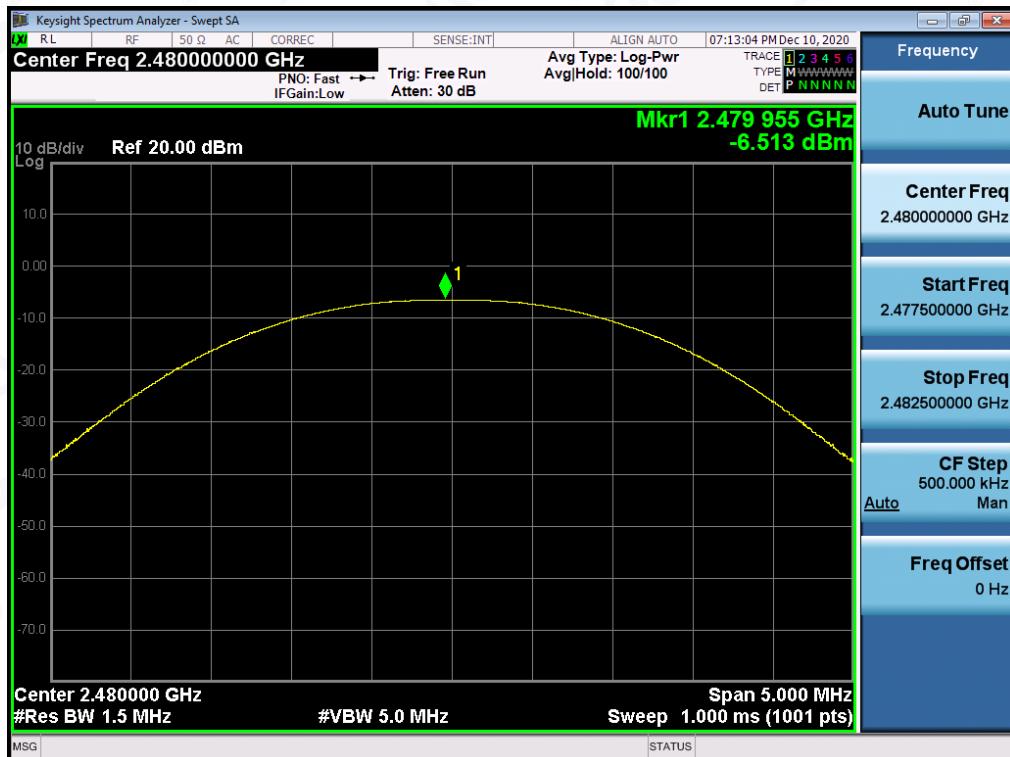
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| PEAK OUTPUT POWER MEASUREMENT RESULT FOR $\Pi/4$ -DQPSK MODULATION | | | |
|---|---------------------|----------------------------|--------------|
| Frequency (GHz) | Peak Power (dBm) | Applicable Limits (dBm) | Pass or Fail |
| 2.402 | -8.624 | 21 | Pass |
| 2.441 | -7.659 | 21 | Pass |
| 2.480 | -6.582 | 21 | Pass |



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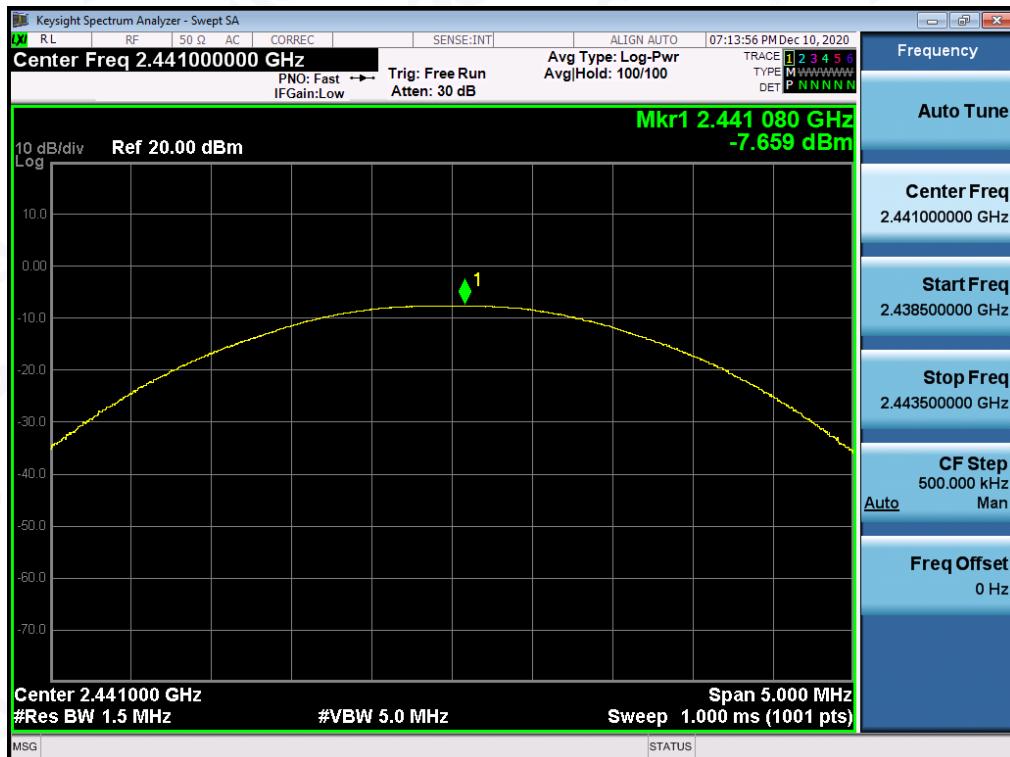
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| PEAK OUTPUT POWER MEASUREMENT RESULT FOR 8-DPSK MODULATION | | | |
|---|---------------------|----------------------------|--------------|
| Frequency (GHz) | Peak Power (dBm) | Applicable Limits (dBm) | Pass or Fail |
| 2.402 | -8.638 | 21 | Pass |
| 2.441 | -7.635 | 21 | Pass |
| 2.480 | -6.591 | 21 | Pass |



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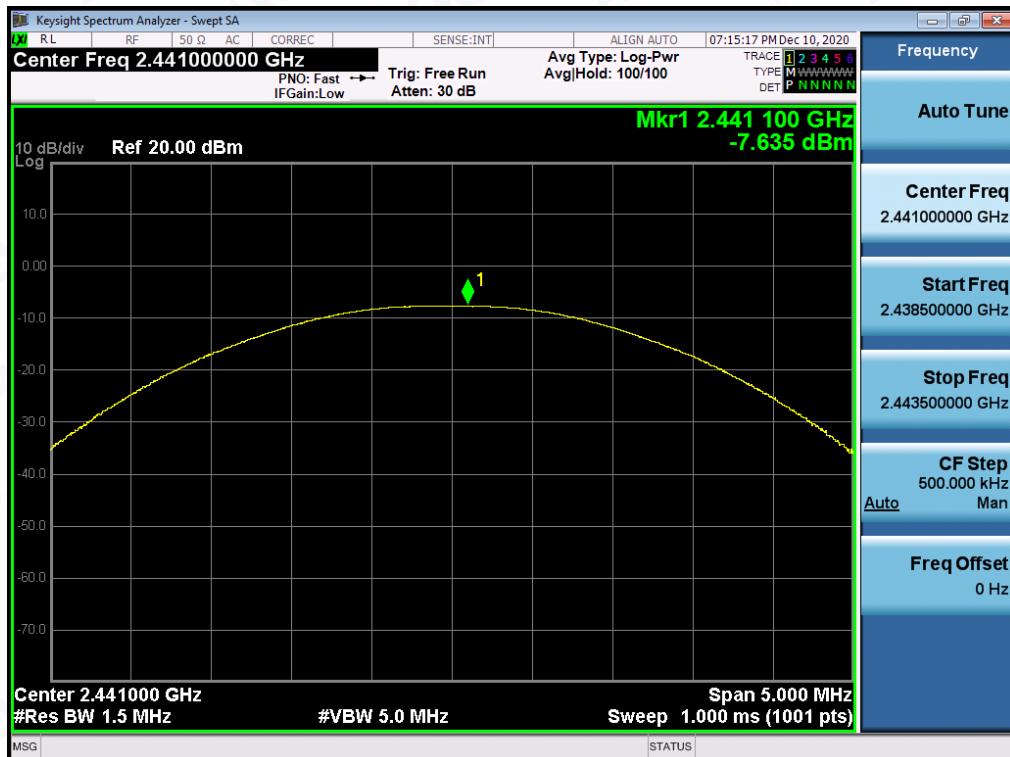
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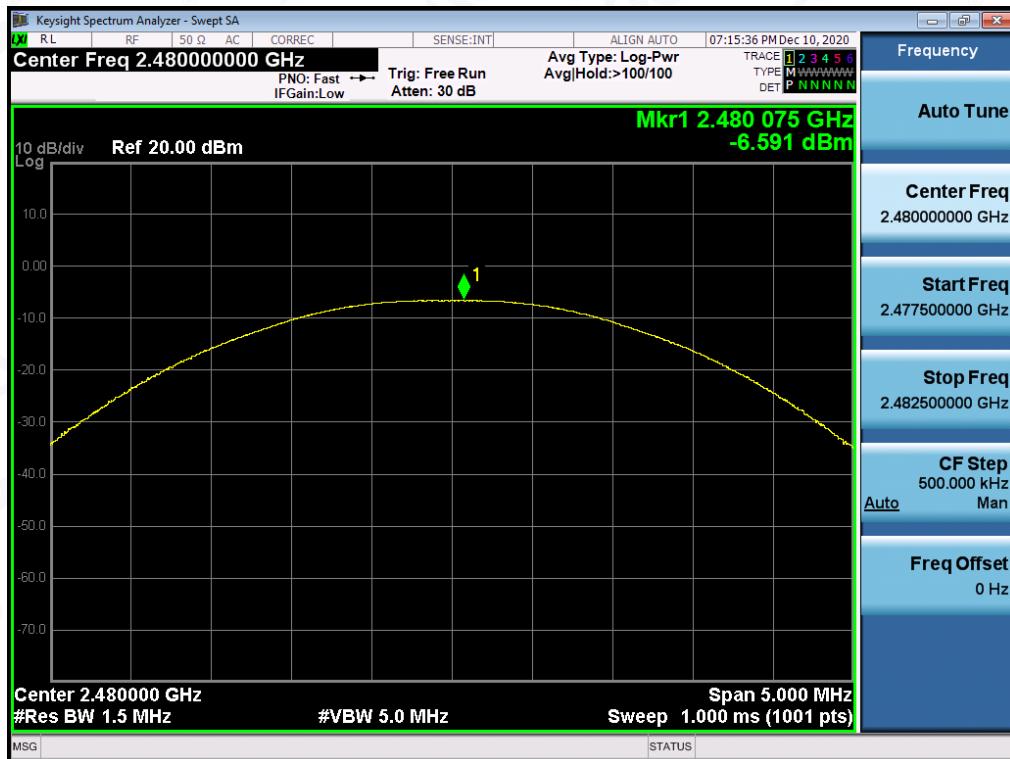
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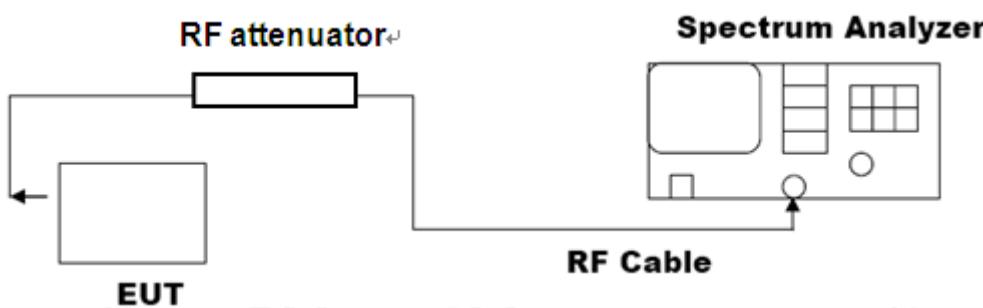


8. 20DB BANDWIDTH

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 hopping 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 | 0.928 | PASS |
| | Middle Channel | 0.925 | PASS |
| | High Channel | 0.926 | PASS |

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



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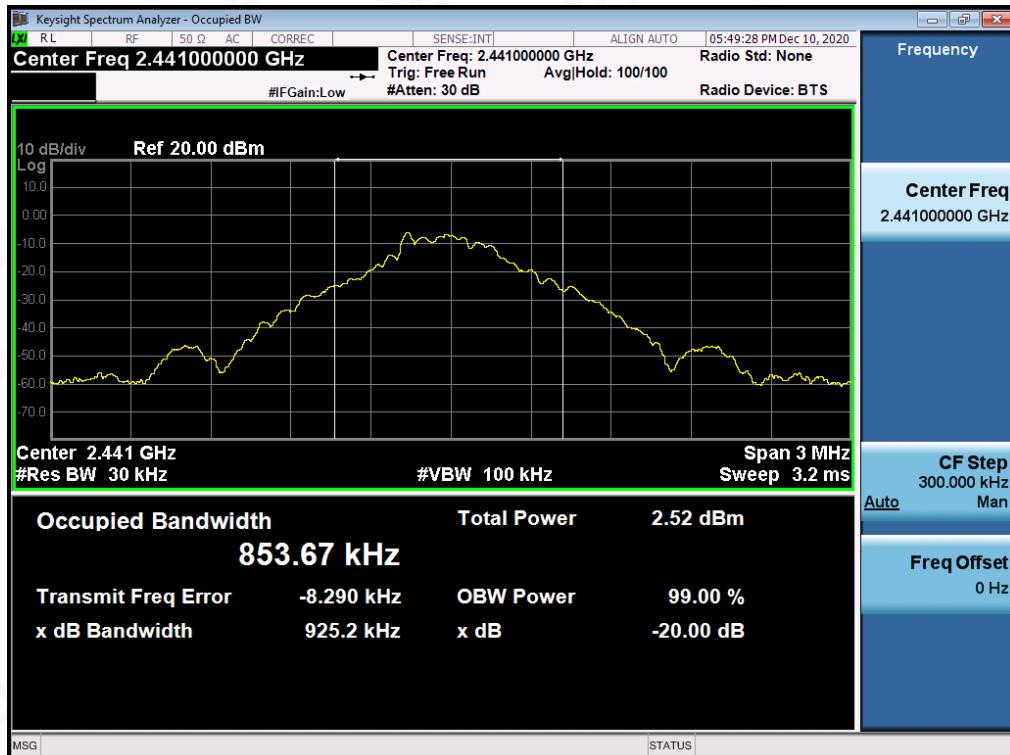
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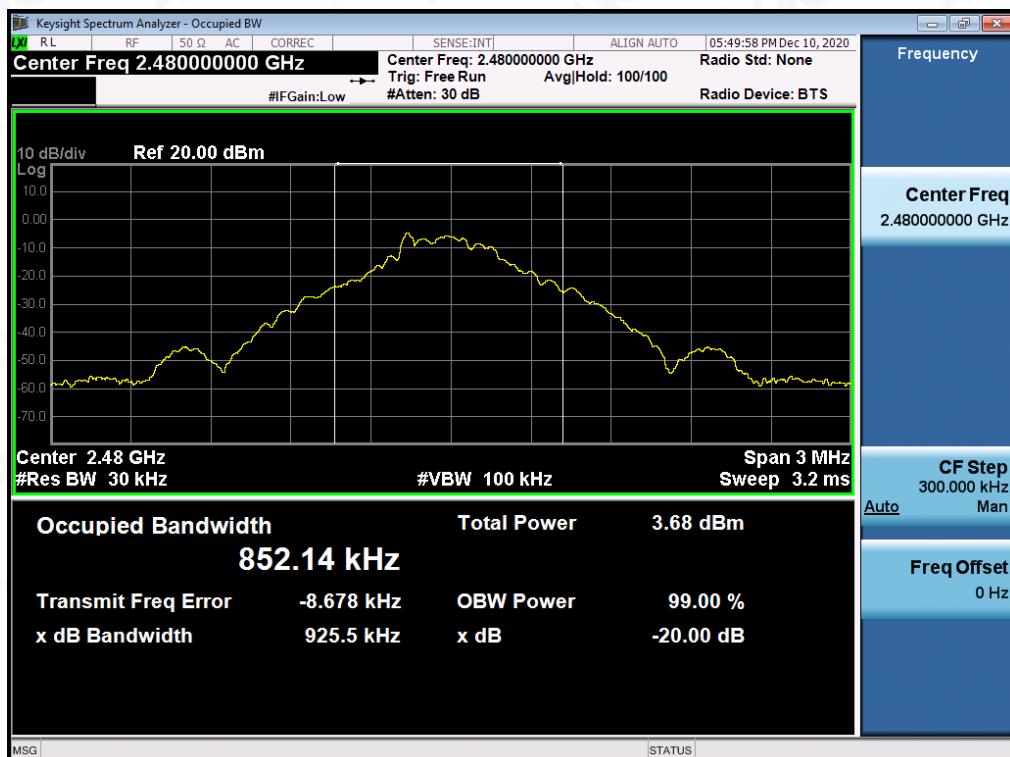
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TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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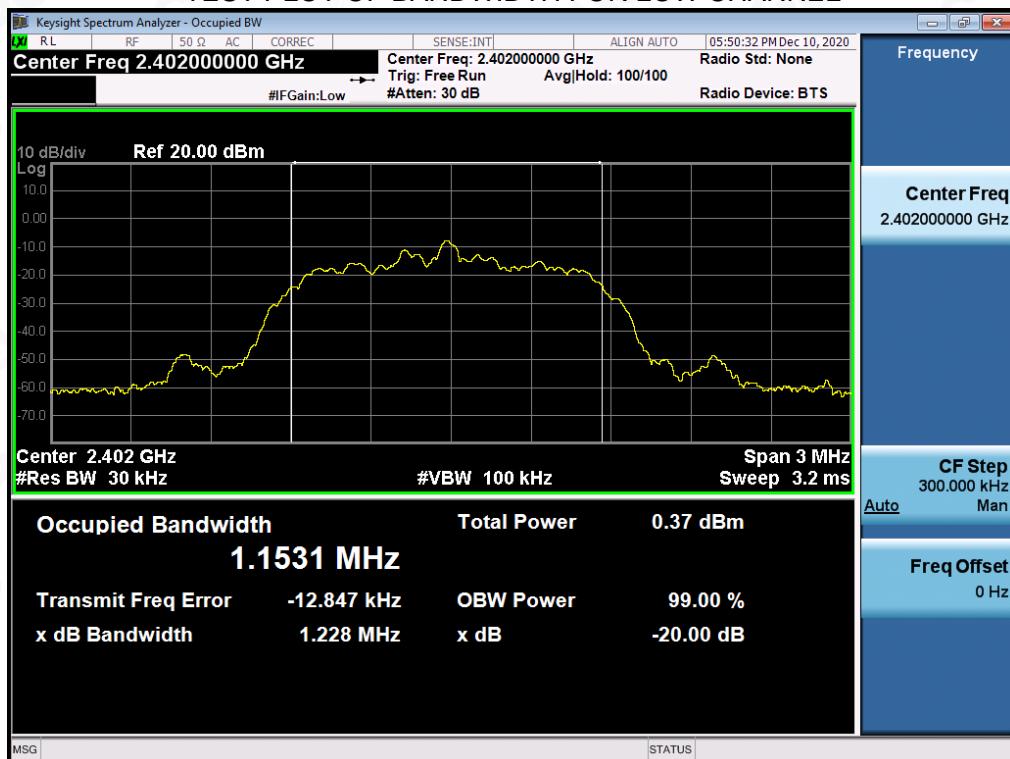
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| MEASUREMENT RESULT FOR II /4-DQPSK MODULATION | | | |
|---|--------------------|----------|------|
| Applicable Limits | Measurement Result | | |
| | Test Data (MHz) | Criteria | |
| N/A | Low Channel | 1.228 | PASS |
| | Middle Channel | 1.231 | PASS |
| | High Channel | 1.230 | PASS |

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



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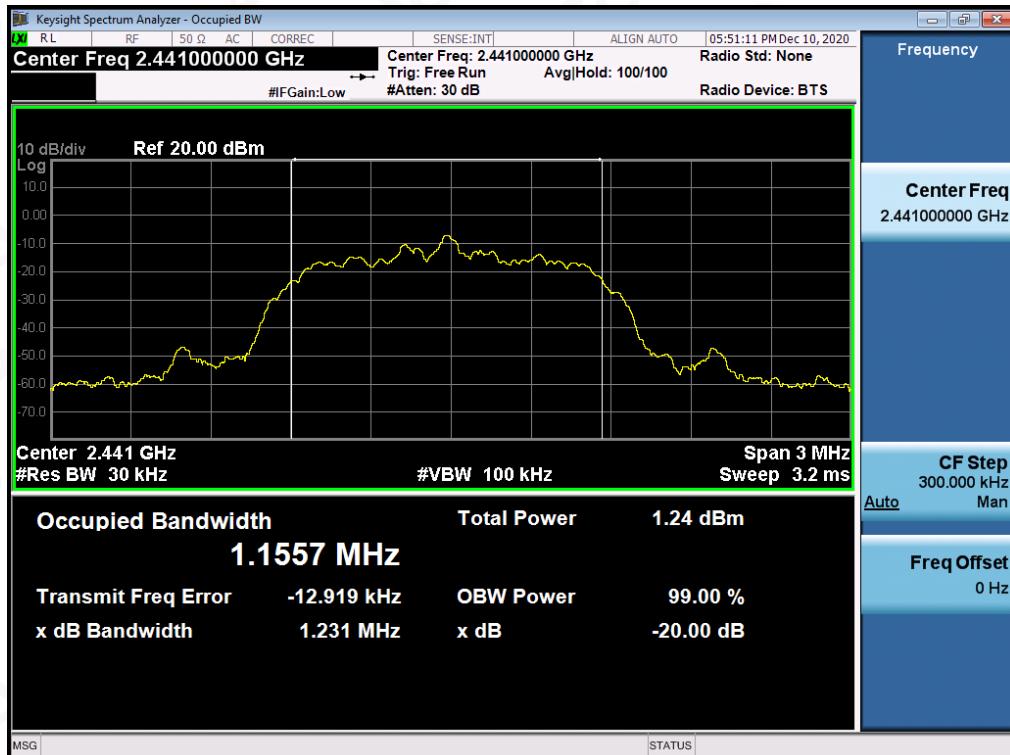
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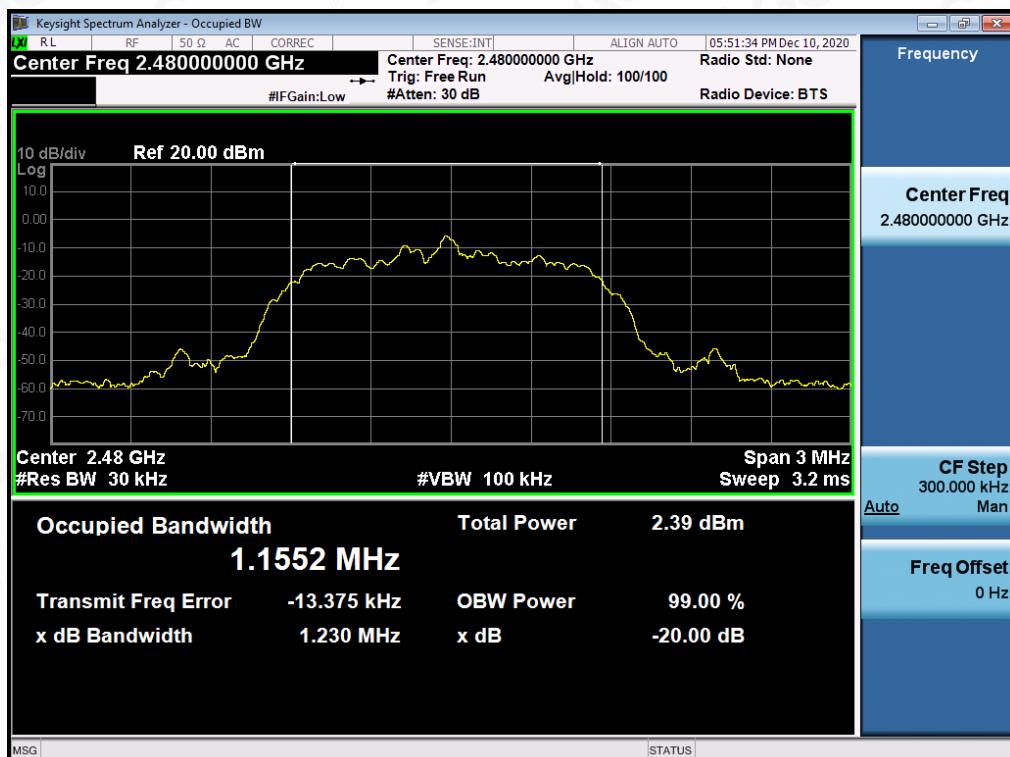
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TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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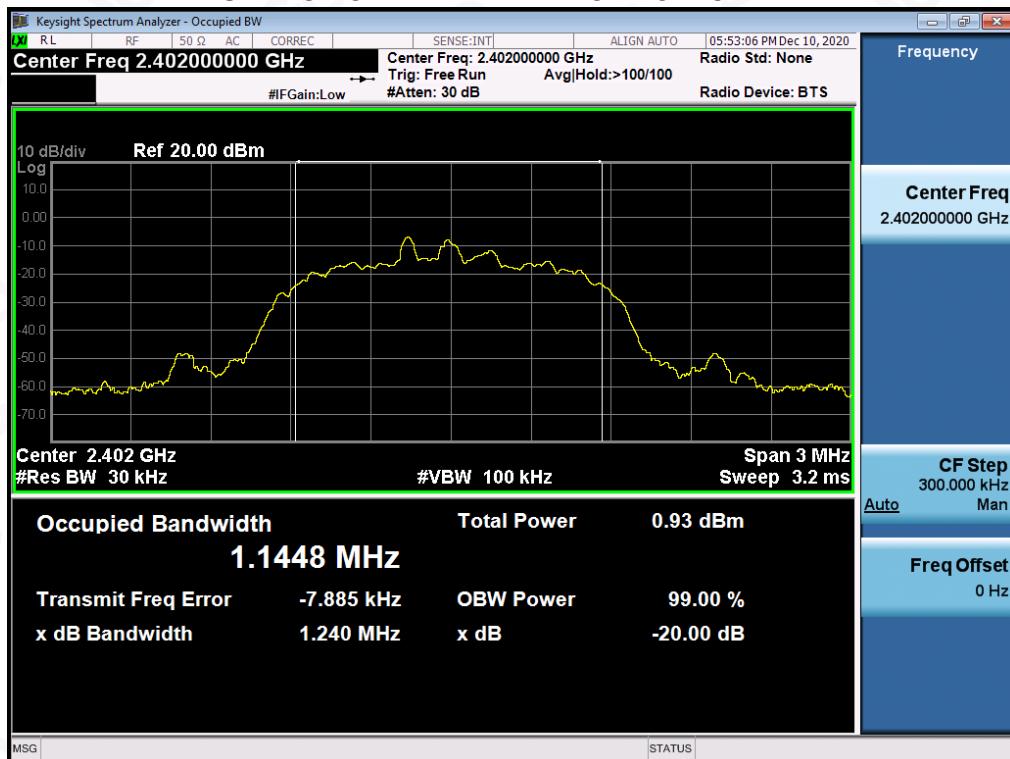
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| MEASUREMENT RESULT FOR 8-DPSK MODULATION | | | |
|--|--------------------|-------|----------|
| Applicable Limits | Measurement Result | | |
| | Test Data (MHz) | | Criteria |
| N/A | Low Channel | 1.240 | PASS |
| | Middle Channel | 1.254 | PASS |
| | High Channel | 1.246 | PASS |

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



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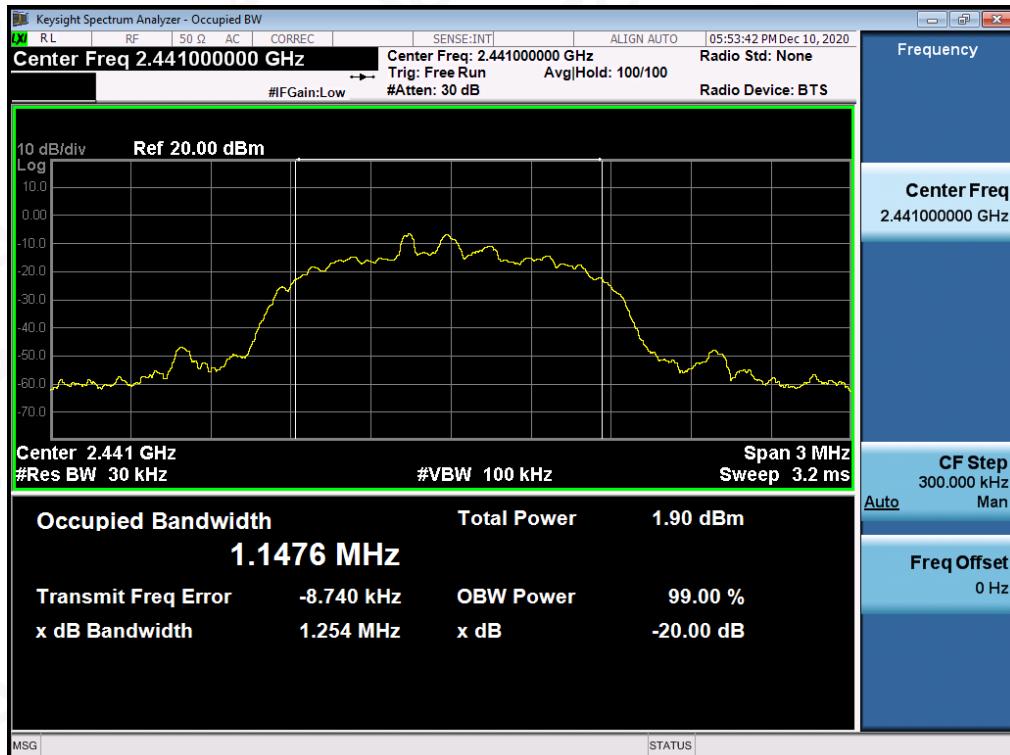
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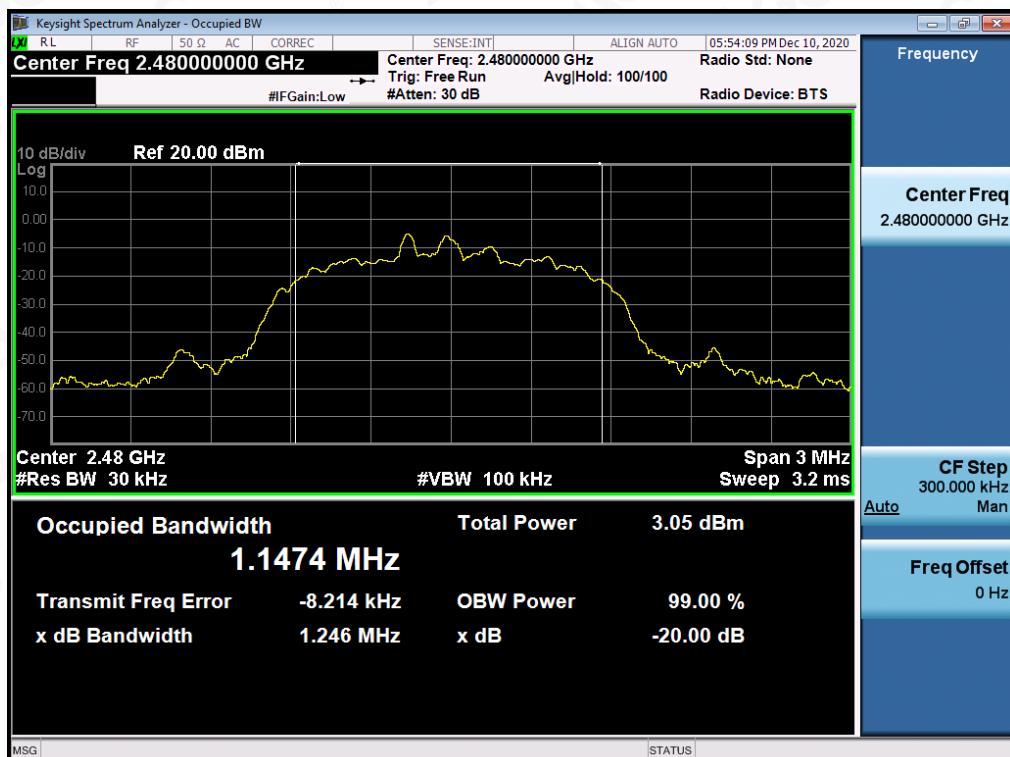
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TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



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. | At least -20dBc than the limit Specified on the BOTTOM Channel | PASS |
| 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 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



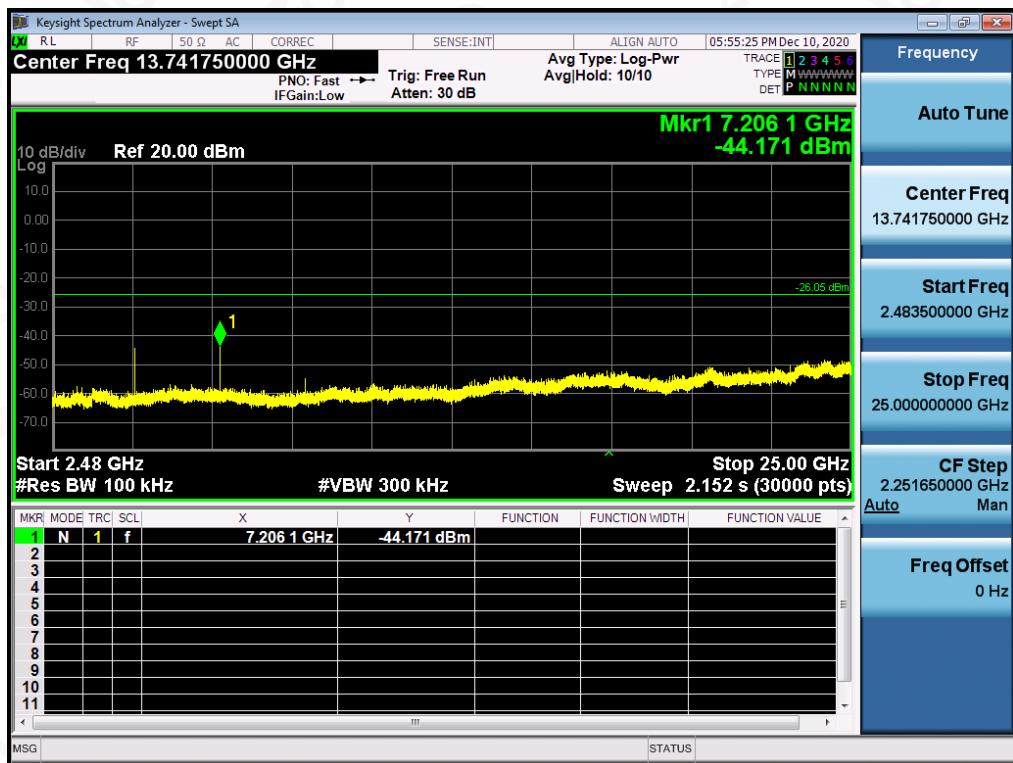
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TEST PLOT OF OUT OF BAND EMISSIONS
 OF 8DPSK MODULATION IN MIDDLE CHANNEL

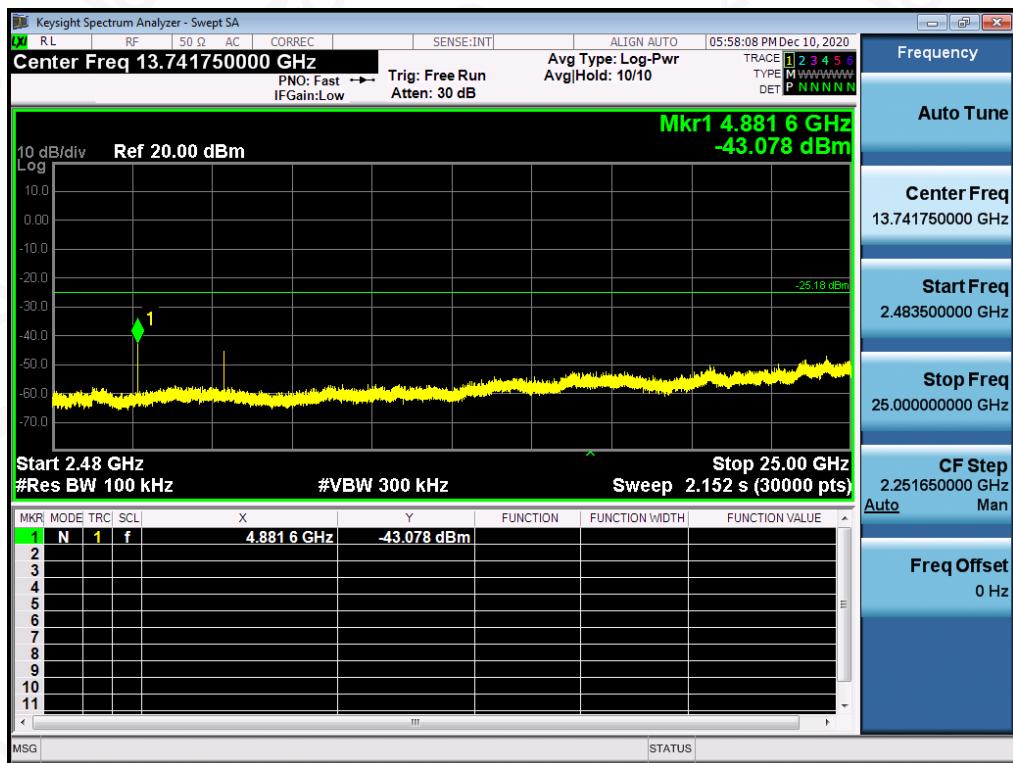

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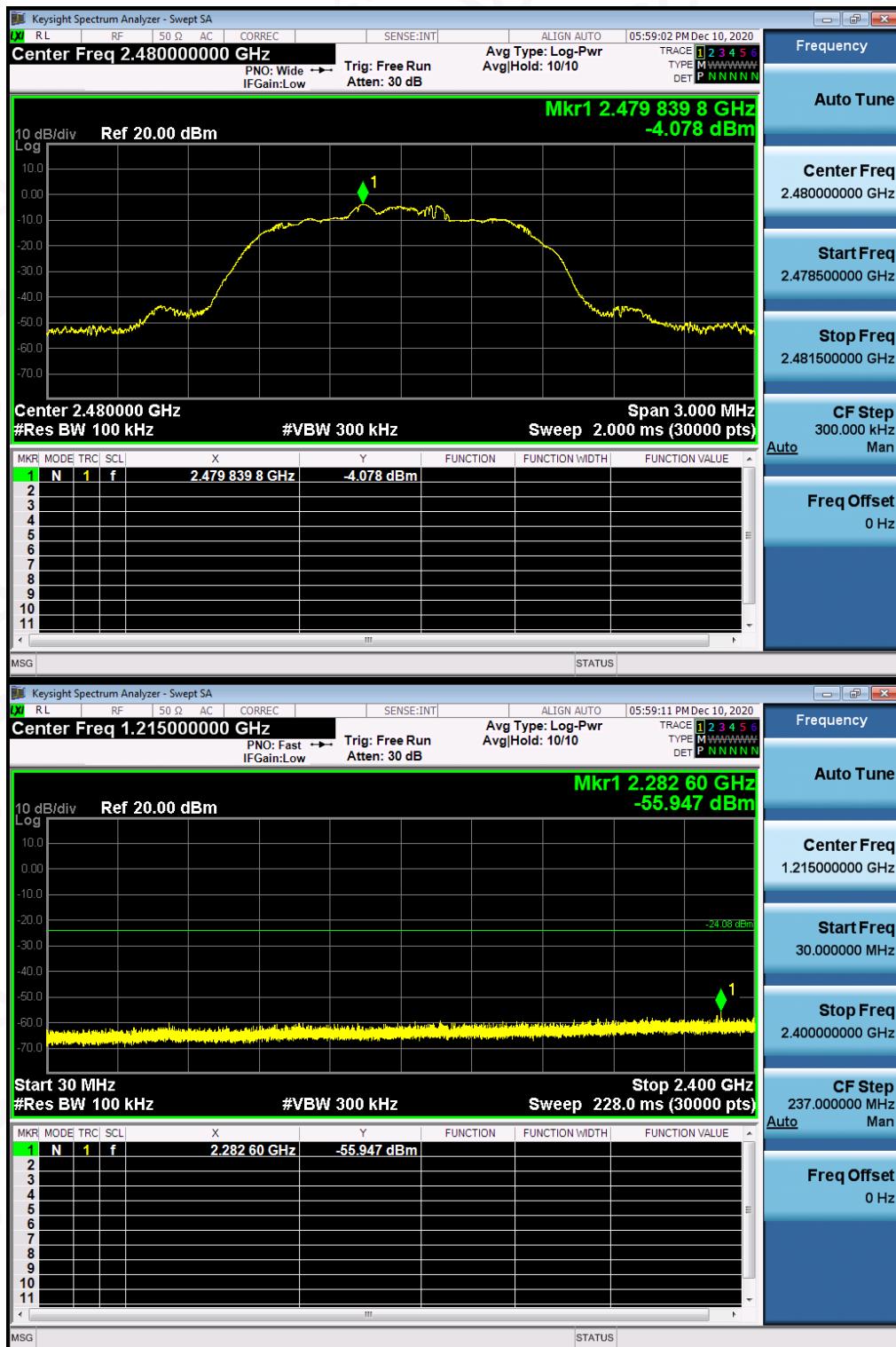
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TEST PLOT OF OUT OF BAND EMISSIONS
 OF 8DPSK MODULATION IN HIGH CHANNEL


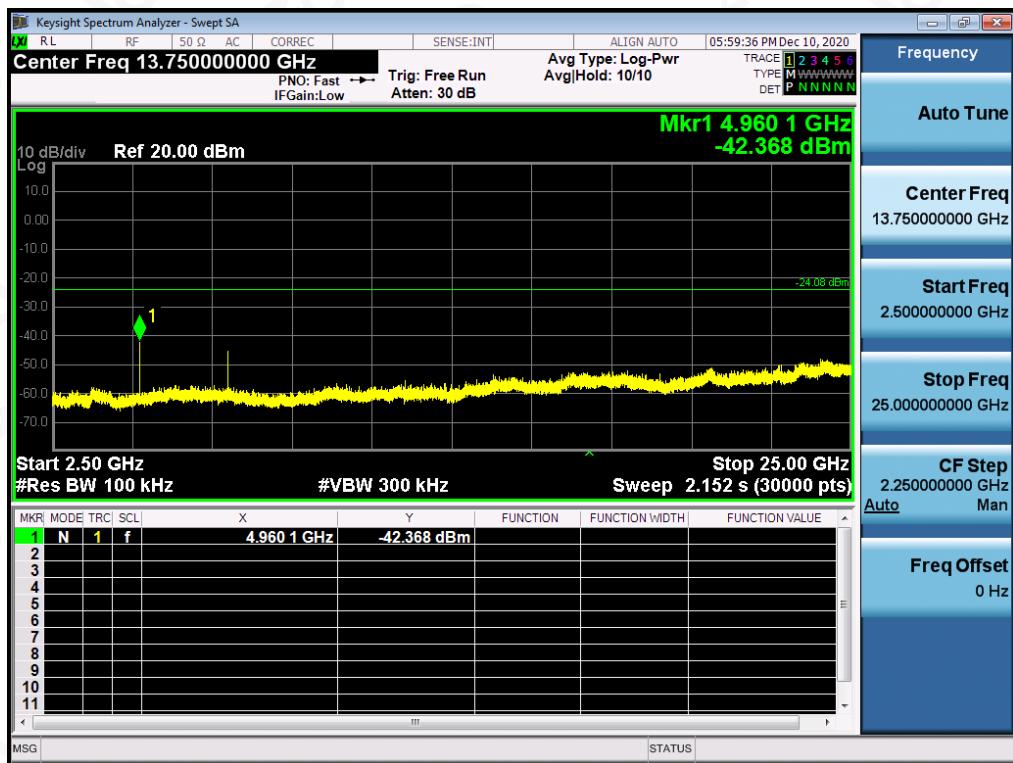
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Note: The 8DPSK modulation is the worst case and only those data recorded in the report.

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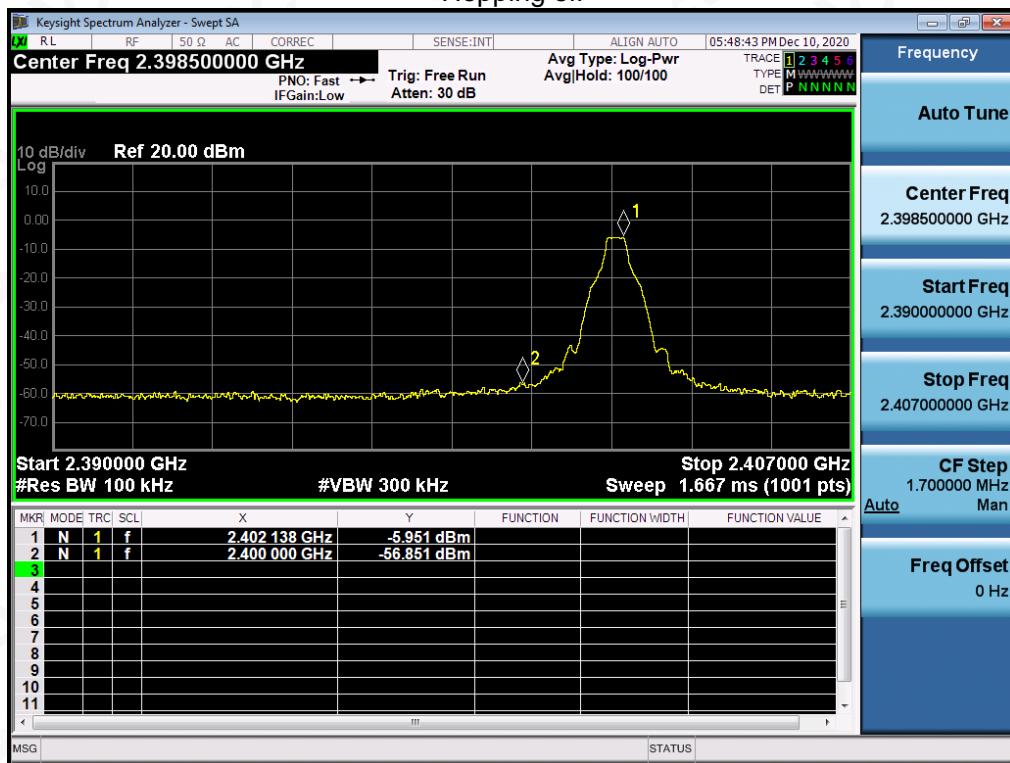
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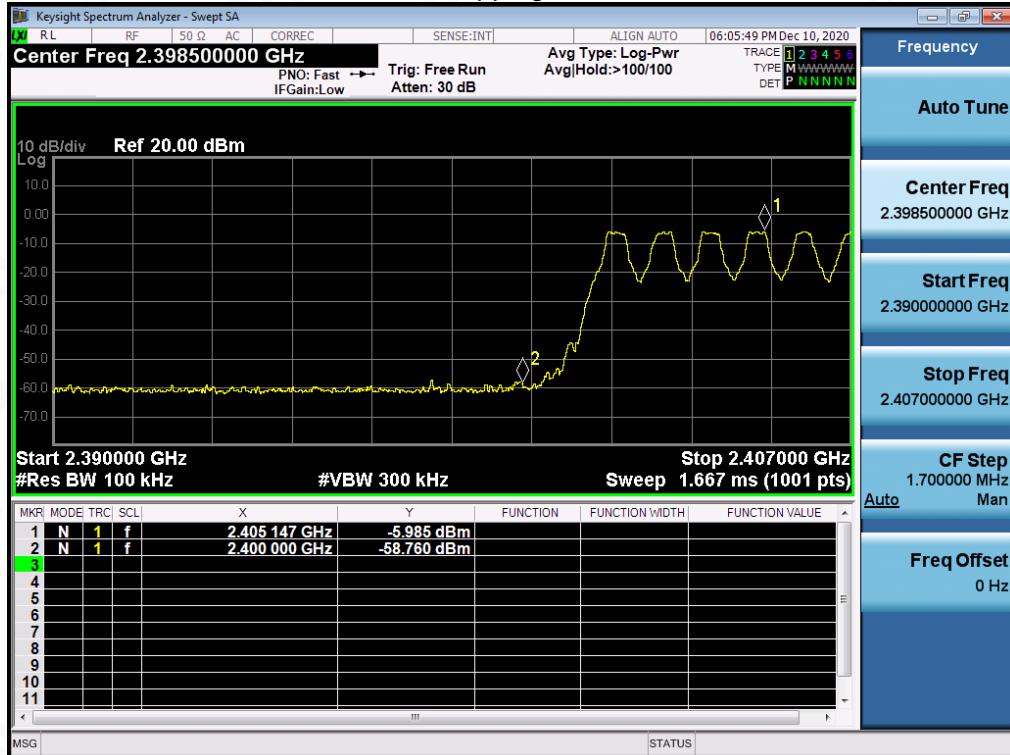
TEST RESULT FOR BAND EDGE

GFSK MODULATION IN LOW CHANNEL

Hopping off



Hopping on



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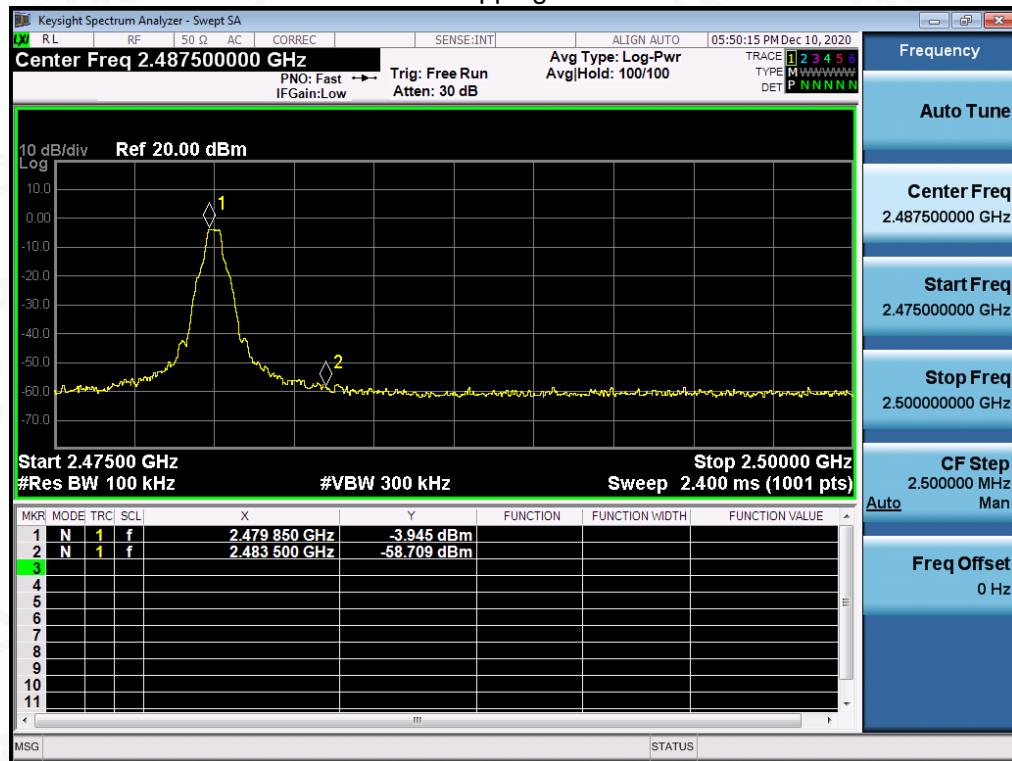
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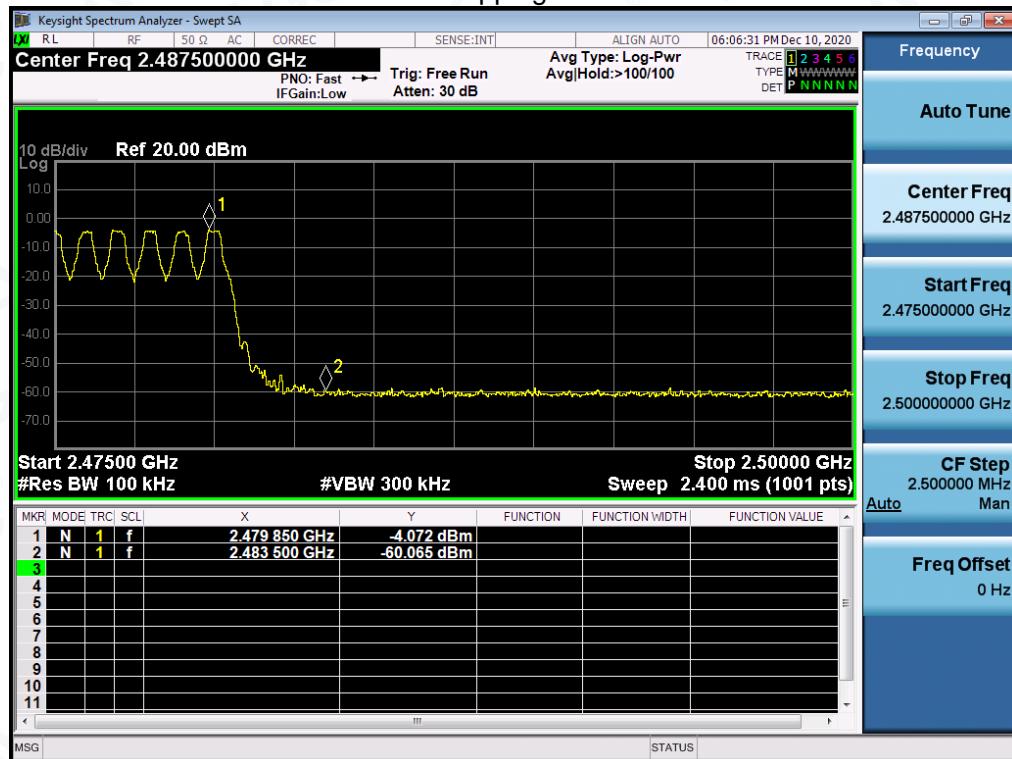


GFSK MODULATION IN HIGH CHANNEL

Hopping off



Hopping on



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