

FCC Test Report

Report No.: AGC00275190503FE03

FCC ID : VLJ-SH035
APPLICATION PURPOSE : Original Equipment
PRODUCT DESIGNATION : Bluetooth Headset
BRAND NAME : motorola
MODEL NAME : SH035
CLIENT : Binatone Electronics International Ltd.
DATE OF ISSUE : May 22, 2019
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 | / | May 22, 2019 | Valid | Initial Release |



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1. VERIFICATION OF CONFORMITY

| | |
|---------------------------------|---|
| Applicant | Binatone Electronics International Ltd. |
| Address | Floor23A, 9 Des Voeux Road West, Sheung Wan, Hong Kong, China |
| Manufacturer | Binatone Electronics International Ltd. |
| Address | Floor 23A, 9 Des Voeux Road West, Sheung Wan, Hong Kong, China |
| Factory | Shen Zhen Jonter Digital Co., LTD |
| Address | Floor 3, Building 4, Jinbo Industrial Park, Hezhou Village Hangcheng Street, Bao'an District, Shenzhen, China |
| Product Designation | Bluetooth Headset |
| Brand Name | motorola |
| Test Model | SH035 |
| Date of test | May 13, 2019 to May 21, 2019 |
| Deviation | None |
| 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.

Tested By

John Zeng

John Zeng(Zeng Weiqiang)

May 21, 2019

Reviewed By

Max Zhang

Max Zhang(Zhang Yi)

May 22, 2019

Approved By

*Forrest Lei*Forrest Lei(Lei Yonggang)
Authorized Officer

May 22, 2019



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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as "Bluetooth Headset". It is designed by way of utilizing the GFSK, Pi/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 2.480GHz |
| RF Output Power | 4.417dBm(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 | BTE004C-MB-V04 |
| Software Version | BTE004C_MBF_V1.7 |
| Antenna Designation | PCB Antenna(Comply with requirements of the FCC part 15.203) |
| Antenna Gain | 0dBi |
| Power Supply | DC 3.7V by battery |
| Note: The EUT doesn't support BLE. | |

2.2. TABLE OF CARRIER FREQUENCYS

| Frequency Band | Channel Number | Frequency |
|----------------|----------------|-----------|
| 2402~2480MHZ | 0 | 2402MHZ |
| | 1 | 2403MHZ |
| | : | : |
| | 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 multislot 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 79 hopping sequence in data mode:

40,21,44,23,42,53,46,55,48,33,52,35,50,65,54,67
56,37,60,39,58,69,62,71,64,25,68,27,66,57,70,59
72,29,76,31,74,61,78,63,01,41,05,43,03,73,07,75
09,45,13,47,11,77,15,00,64,49,66,53,68,02,70,06
01, 51, 03, 55, 05, 04

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 zation with other units only offset are 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 bit 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 te 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.

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.



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

This submittal(s) (test report) is intended for **FCC ID: VLJ-SH035** 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.



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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: $U_c = \pm 2 \%$
- Uncertainty of Dwell Time: $U_c = \pm 2 \%$
- Uncertainty of Frequency: $U_c = \pm 2 \%$



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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 $\pi/4$ -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:
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.



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5. SYSTEM TEST CONFIGURATION**5.1. CONFIGURATION OF EUT SYSTEM**

Radiated Emission Configure :

**5.2. EQUIPMENT USED IN TESTED SYSTEM**

| Item | Equipment | Model No. | ID or Specification | Remark |
|------|-------------------|-----------|---------------------|--------|
| 1 | Bluetooth Headset | SH035 | VLJ-SH035 | EUT |

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 | N/A |

Note: The EUT not can 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 | Jun. 12, 2018 | Jun. 11, 2019 |
| EXA Signal Analyzer | Agilent | N9010A | MY53470504 | Dec. 20, 2018 | Dec. 19, 2019 |
| 2.4GHz Fliter | Micro-tronics | 087 | N/A | Jun. 12, 2018 | Jun. 11, 2019 |
| Attenuator | Weinachel Corp | 58-30-33 | N/A | Jun. 12, 2018 | Jun. 11, 2019 |
| Horn antenna | SCHWARZBECK | BBHA 9170 | #768 | Sep. 21, 2017 | Sep. 20, 2020 |
| Active loop antenna (9K-30MHz) | ZHINAN | ZN30900C | 18051 | Jun. 14, 2018 | Jun. 13, 2020 |
| Double-Ridged Waveguide Horn | ETS LINDGREN | 3117 | 00034609 | May. 26, 2018 | May. 25, 2020 |
| Broadband Preamplifier | ETS LINDGREN | 3117PA | 00225134 | Oct. 25, 2018 | Oct. 24, 2019 |
| ANTENNA | SCHWARZBECK | VULB9168 | D69250 | Sep. 28, 2017 | Sep. 27, 2019 |



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7. PEAK OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

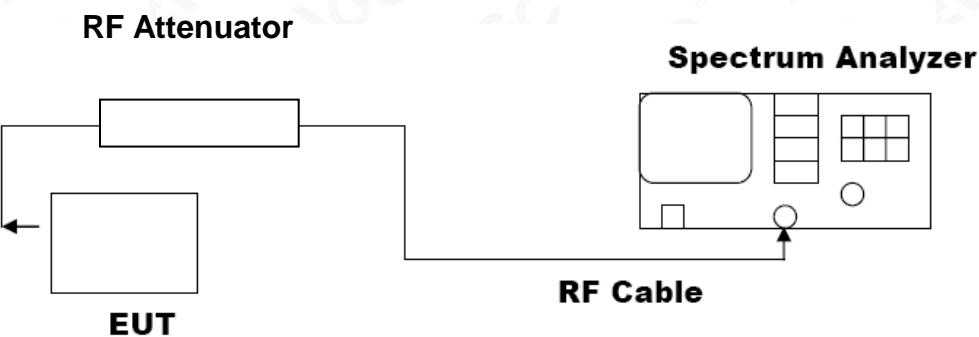
For peak power test:

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

| PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION | | | |
|--|---------------------|----------------------------|--------------|
| Frequency (GHz) | Peak Power (dBm) | Applicable Limits (dBm) | Pass or Fail |
| 2.402 | 2.325 | 30 | Pass |
| 2.441 | 1.814 | 30 | Pass |
| 2.480 | 1.401 | 30 | Pass |



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| PEAK OUTPUT POWER MEASUREMENT RESULT FOR II /4-DQPSK MODULATION | | | |
|--|---------------------|----------------------------|--------------|
| Frequency (GHz) | Peak Power (dBm) | Applicable Limits (dBm) | Pass or Fail |
| 2.402 | 4.166 | 30 | Pass |
| 2.441 | 3.771 | 30 | Pass |
| 2.480 | 3.415 | 30 | 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 | 4.417 | 30 | Pass |
| 2.441 | 4.007 | 30 | Pass |
| 2.480 | 4.414 | 30 | Pass |

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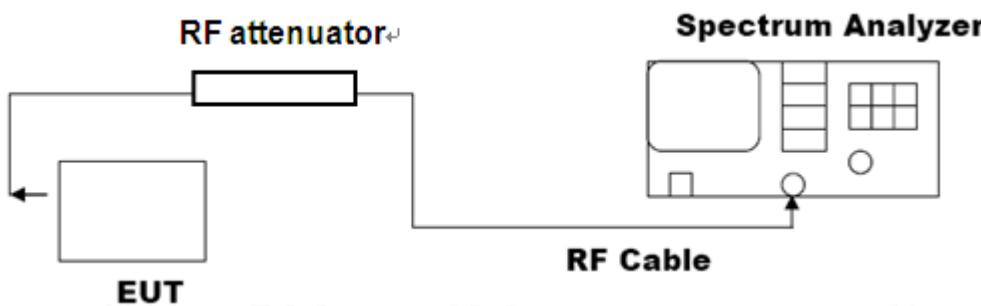
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8. 20DB BANDWIDTH

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)



8.3. LIMITS AND MEASUREMENT RESULTS

| MEASUREMENT RESULT FOR GFSK MOUDULATION | | | |
|---|--------------------|-------|----------|
| Applicable Limits | Measurement Result | | |
| | Test Data (MHz) | | Criteria |
| N/A | Low Channel | 1.026 | PASS |
| | Middle Channel | 1.021 | PASS |
| | High Channel | 1.026 | PASS |

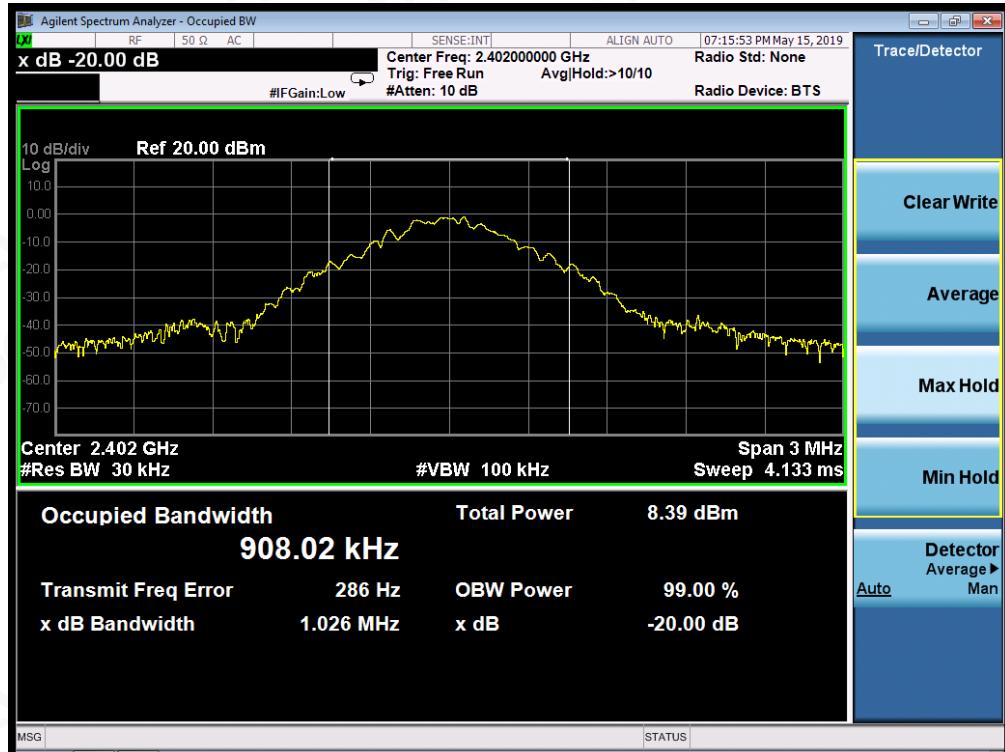


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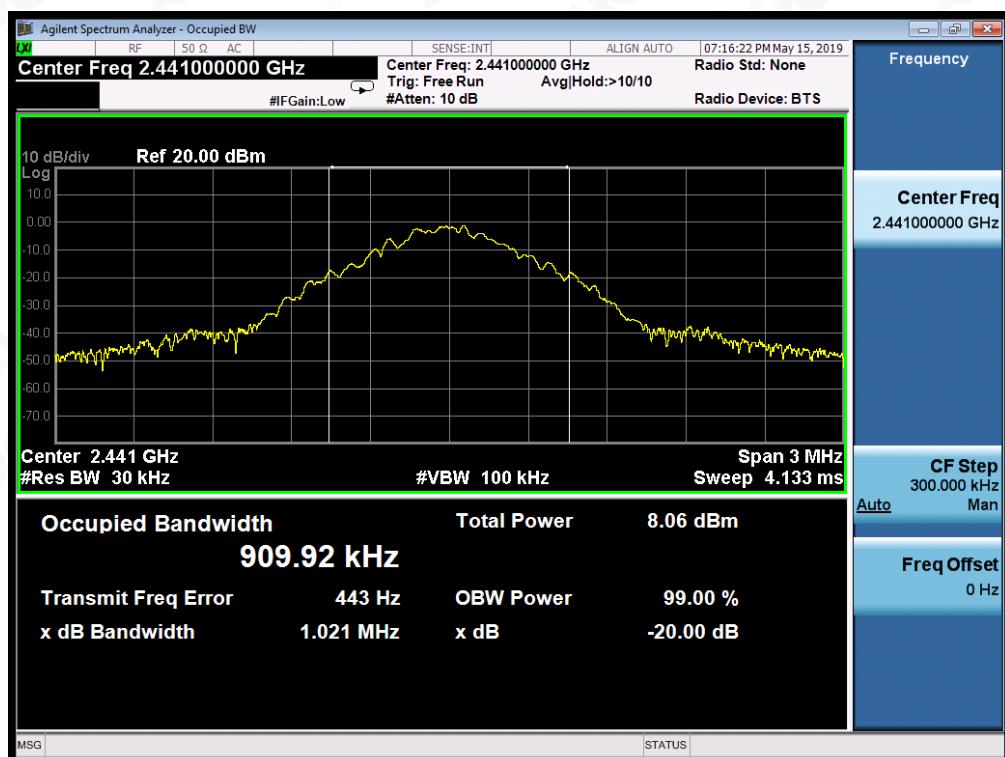
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TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

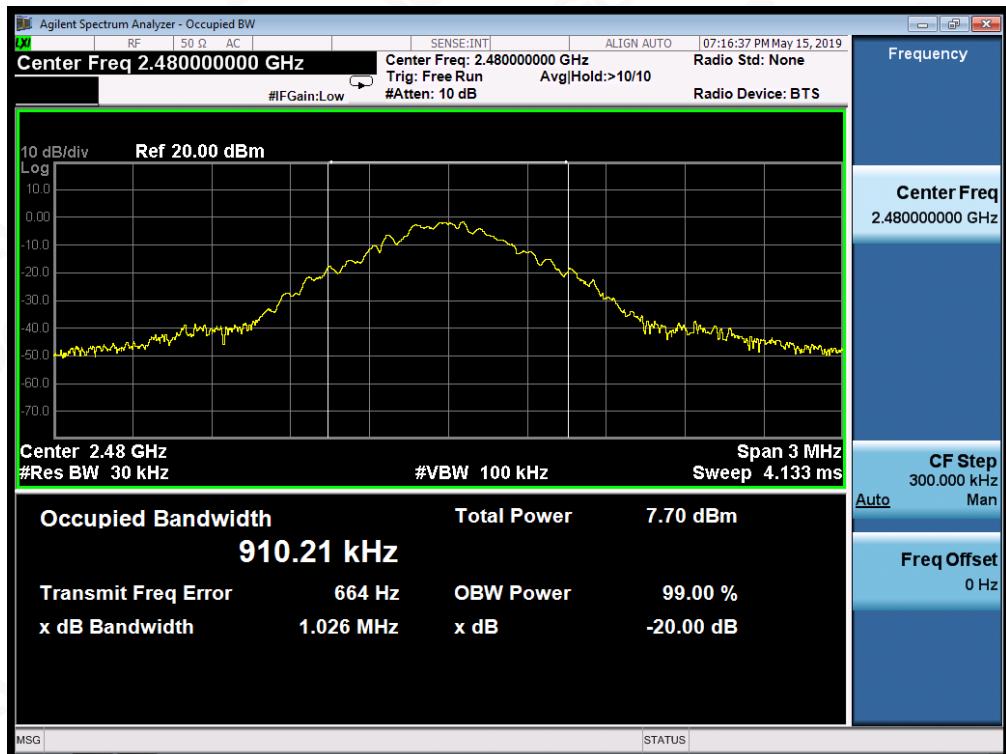


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TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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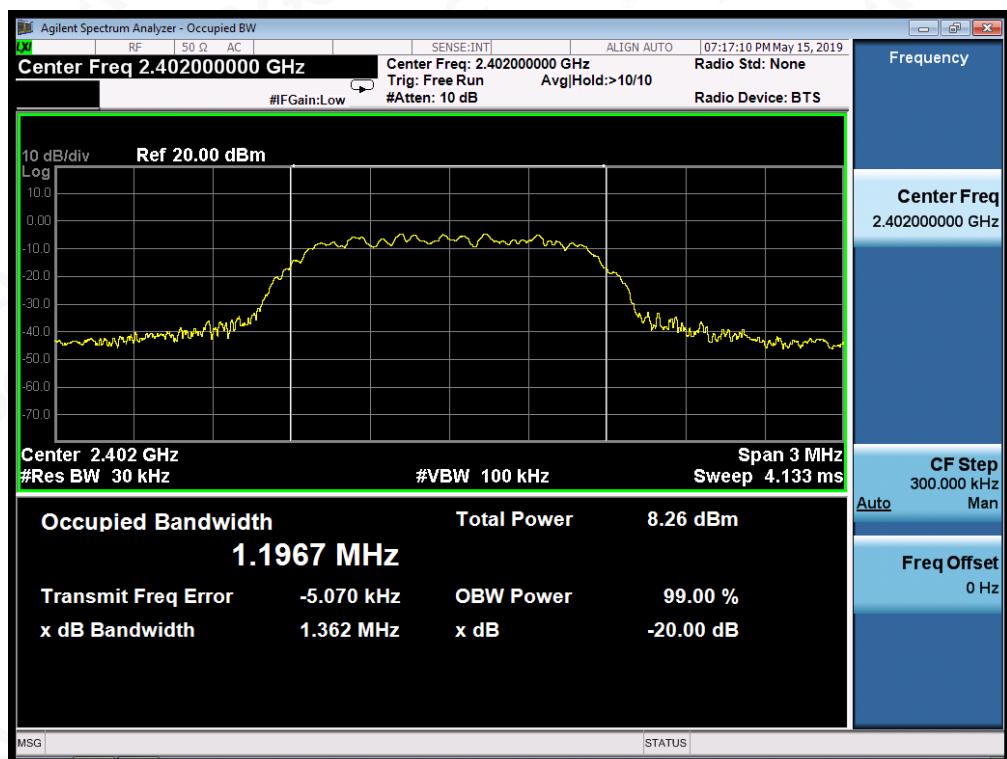
Add: 2/F., Building 2, No.1-4, Chaxi Sanwei Technial Industrial Park, Gushu,
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| MEASUREMENT RESULT FOR II /4-DQPSK MODULATION | | | |
|---|--------------------|-------|----------|
| Applicable Limits | Measurement Result | | |
| | Test Data (MHz) | | Criteria |
| N/A | Low Channel | 1.362 | PASS |
| | Middle Channel | 1.360 | PASS |
| | High Channel | 1.363 | PASS |

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

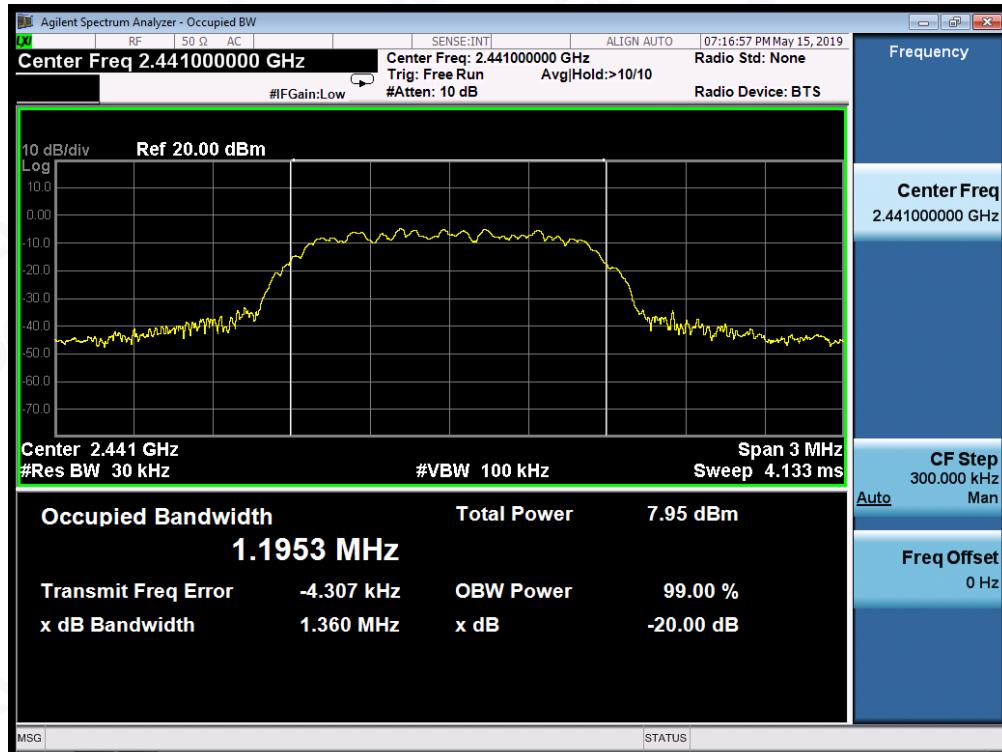


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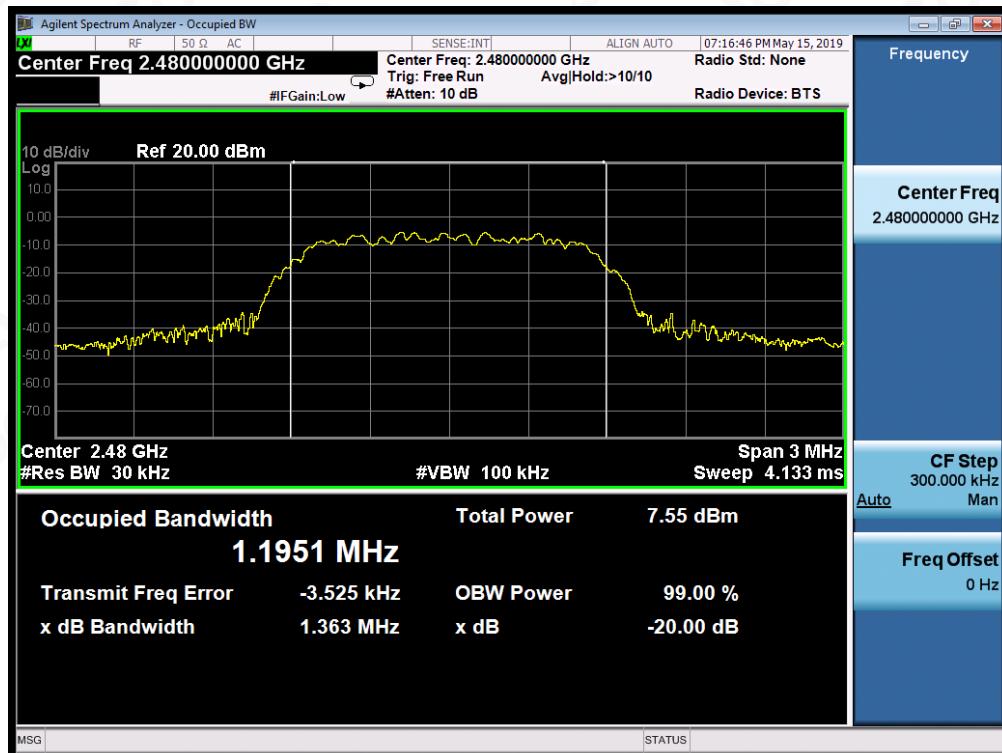
 Add: 2/F., Building 2, No.1–4, Chaxi Sanwei Technial Industrial Park, Gushu,
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TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



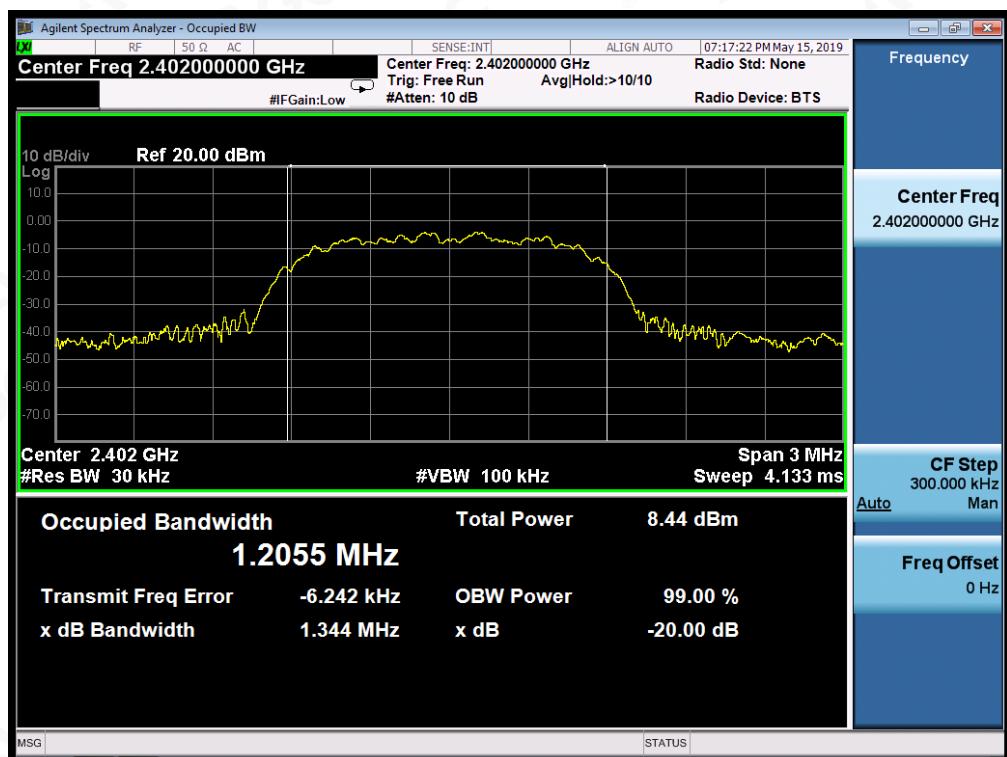
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 Add: 2/F., Building 2, No.1–4, Chaxi Sanwei Technial Industrial Park, Gushu,
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| MEASUREMENT RESULT FOR 8-DPSK MODULATION | | | |
|--|--------------------|-------|----------|
| Applicable Limits | Measurement Result | | |
| | Test Data (MHz) | | Criteria |
| N/A | Low Channel | 1.344 | PASS |
| | Middle Channel | 1.344 | PASS |
| | High Channel | 1.343 | PASS |

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

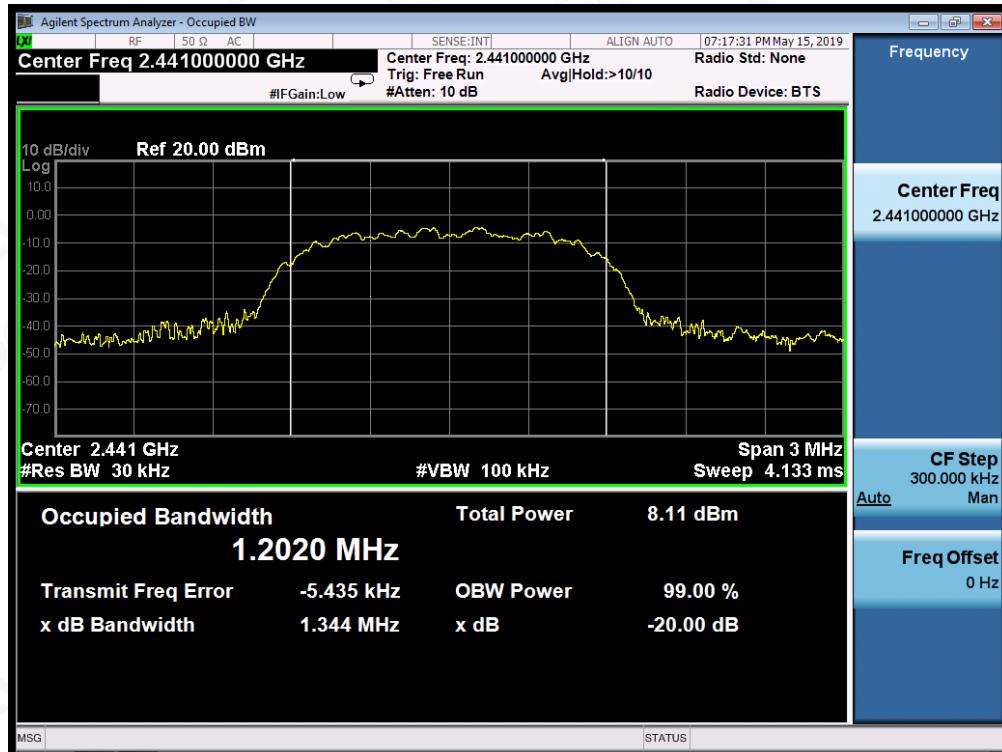


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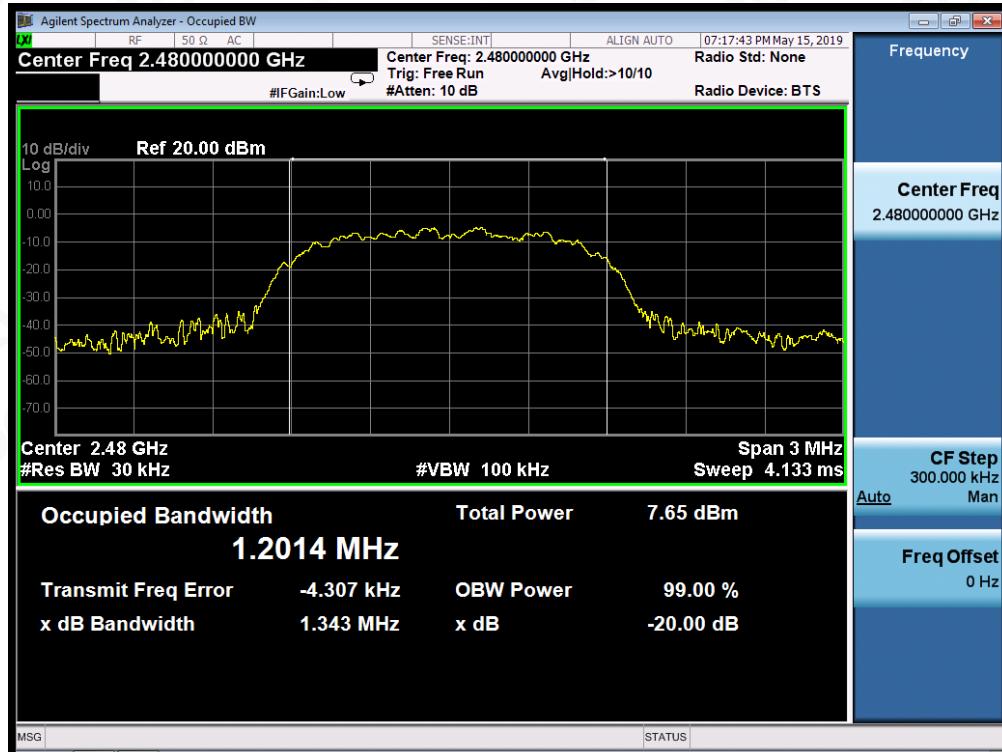
 Add: 2/F., Building 2, No.1–4, Chaxi Sanwei Technial Industrial Park, Gushu,
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TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



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 |

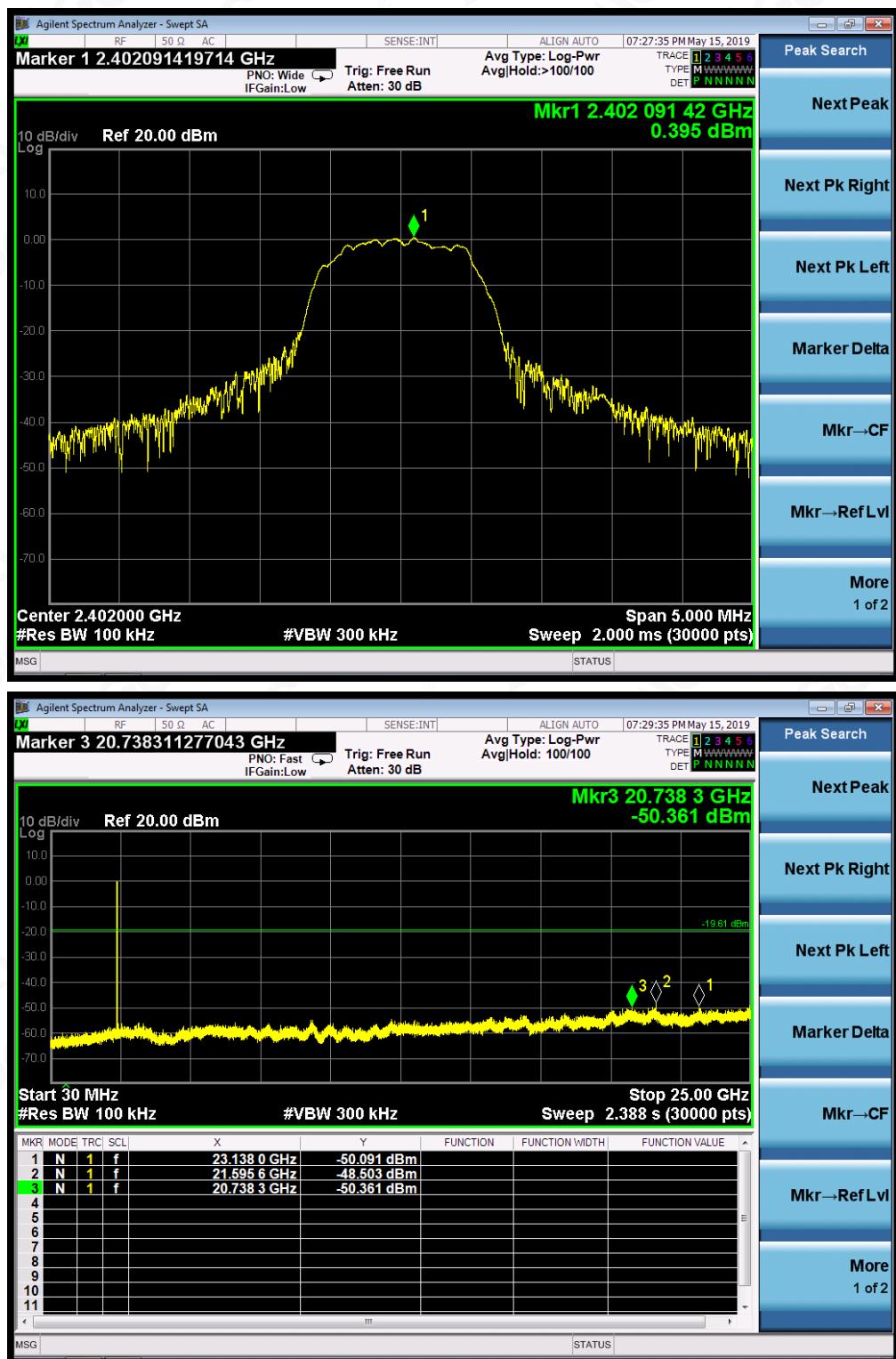


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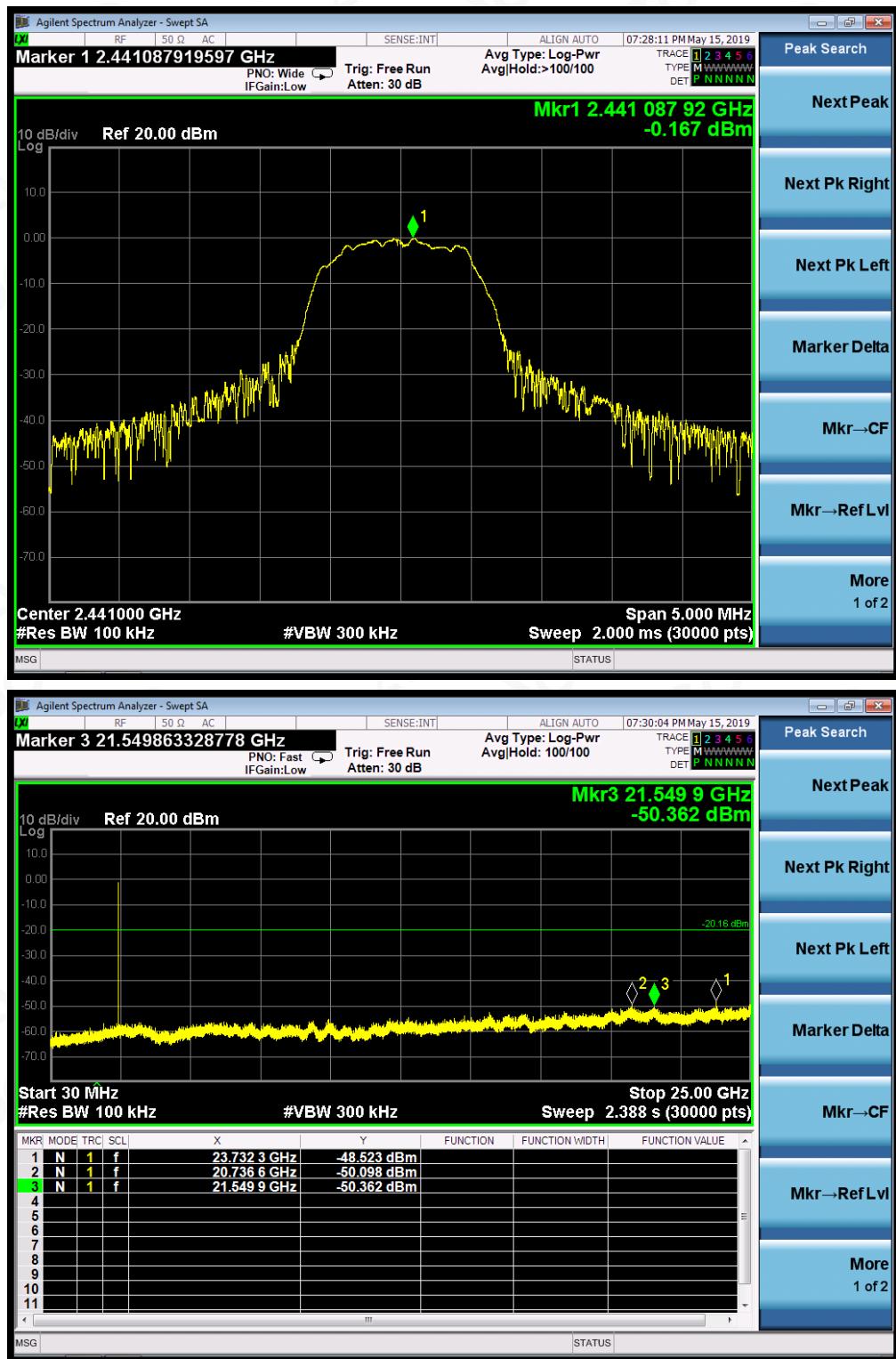
TEST RESULT FOR ENTIRE FREQUENCY RANGE
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE
OF 8DPSK MODULATION IN LOW CHANNEL



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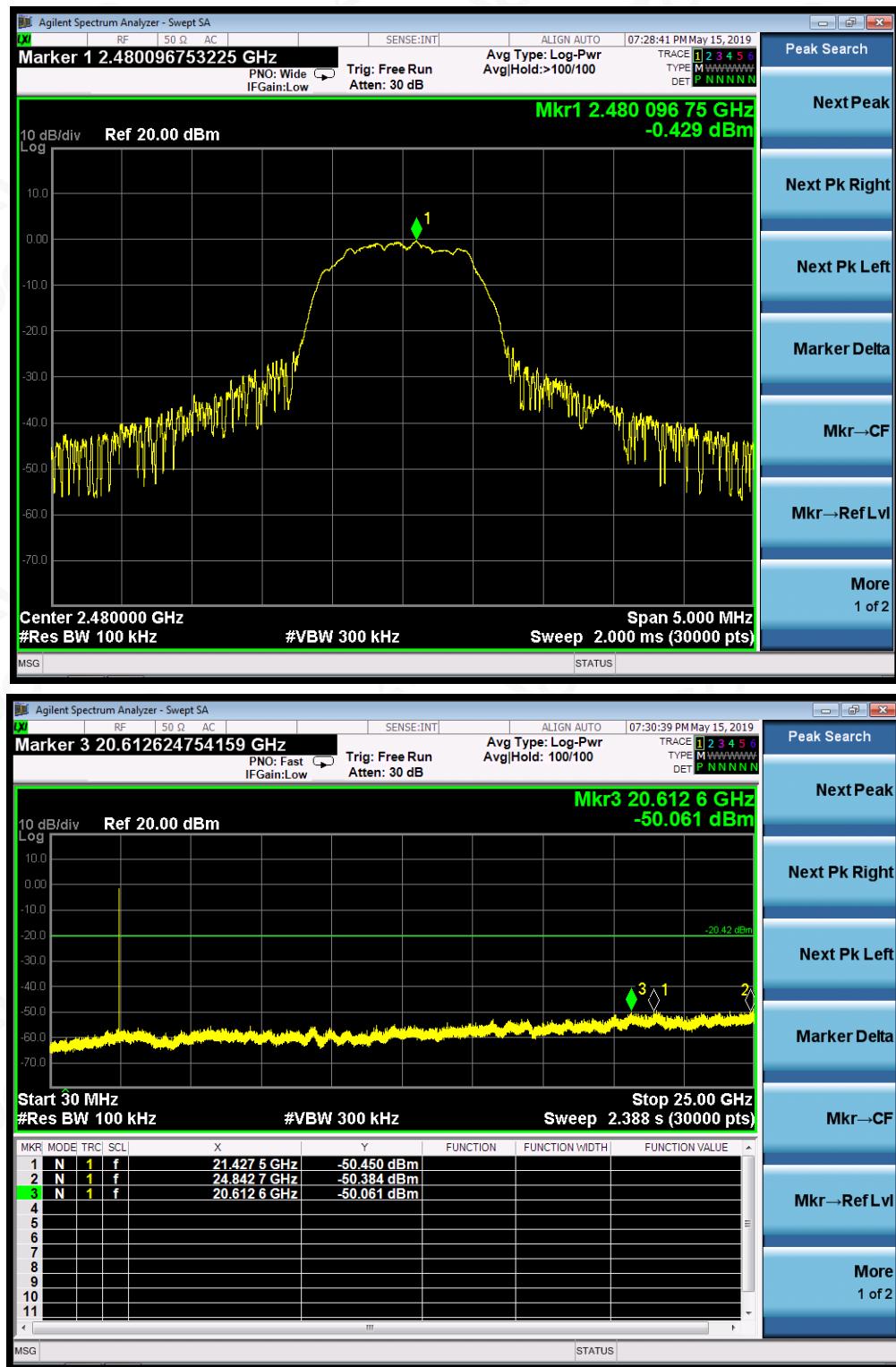
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TEST PLOT OF OUT OF BAND EMISSIONS
 OF 8DPSK MODULATION IN MIDDLE CHANNEL


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


Note: The peak emissions without marker on the above plots are fundamental wave and need not to compare with the limit. The 8DPSK modulation is the worst case and only those data recorded in the report.



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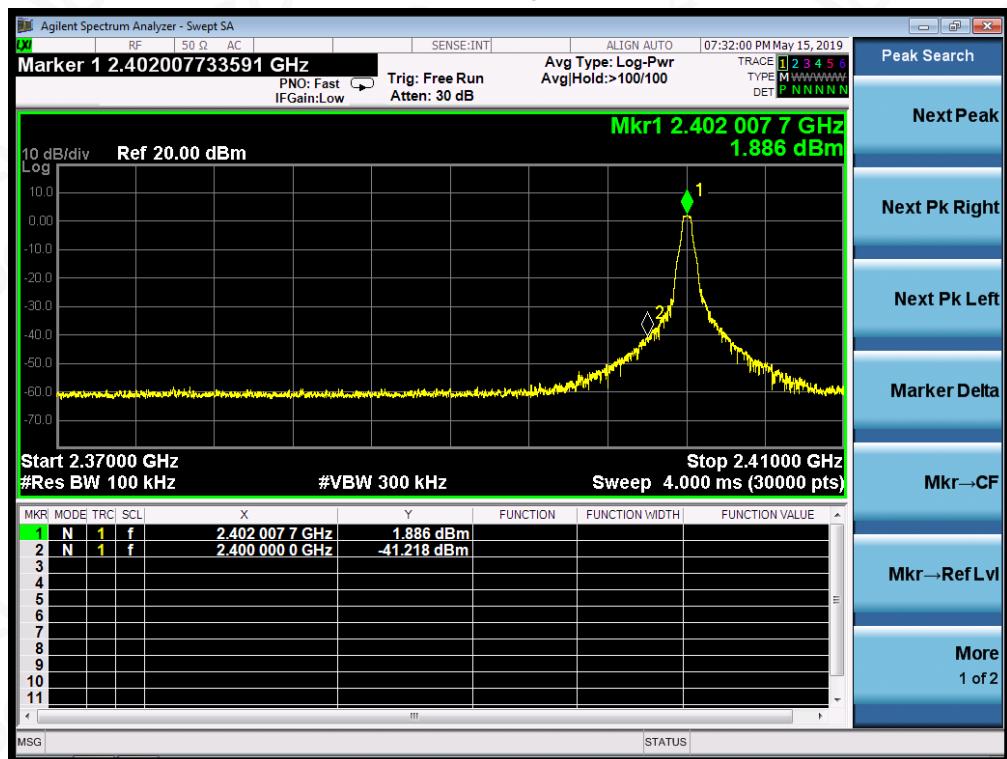
 Add: 2/F., Building 2, No.1–4, Chaxi Sanwei Technial Industrial Park, Gushu,
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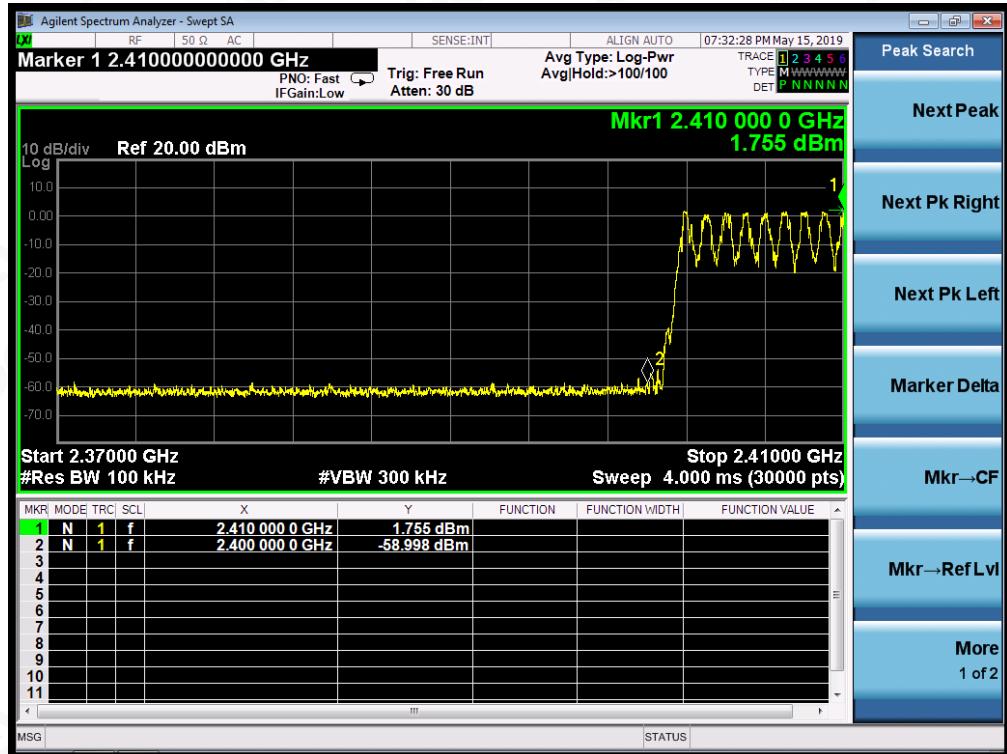
TEST RESULT FOR BAND EDGE

GFSK MODULATION IN LOW CHANNEL

Hopping off



Hopping on

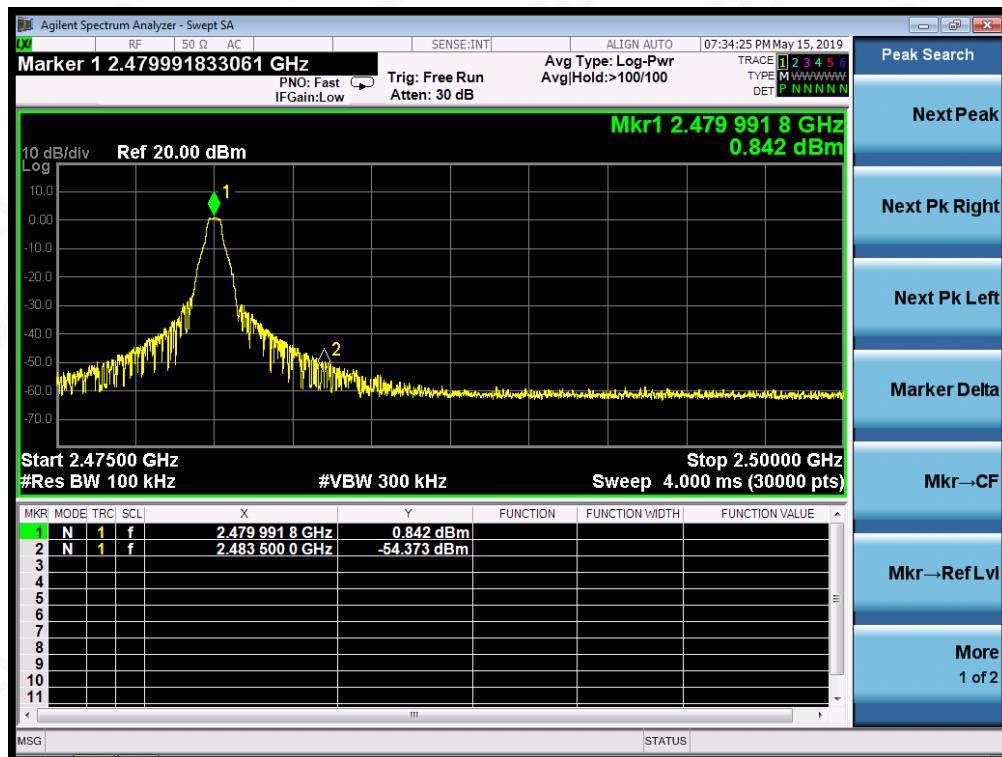


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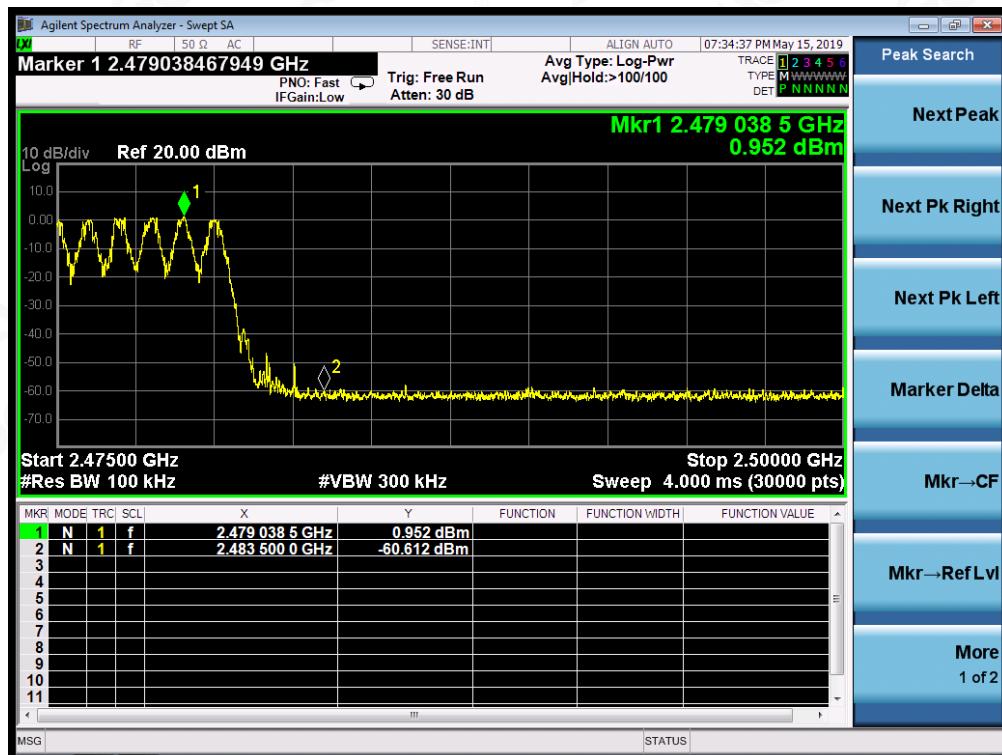
Add: 2/F., Building 2, No.1–4, Chaxi Sanwei Technial Industrial Park, Gushu, Xixiang, Bao'an District, Shenzhen, Guangdong, China

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GFSK MODULATION IN HIGH CHANNEL
 Hopping off


Hopping on

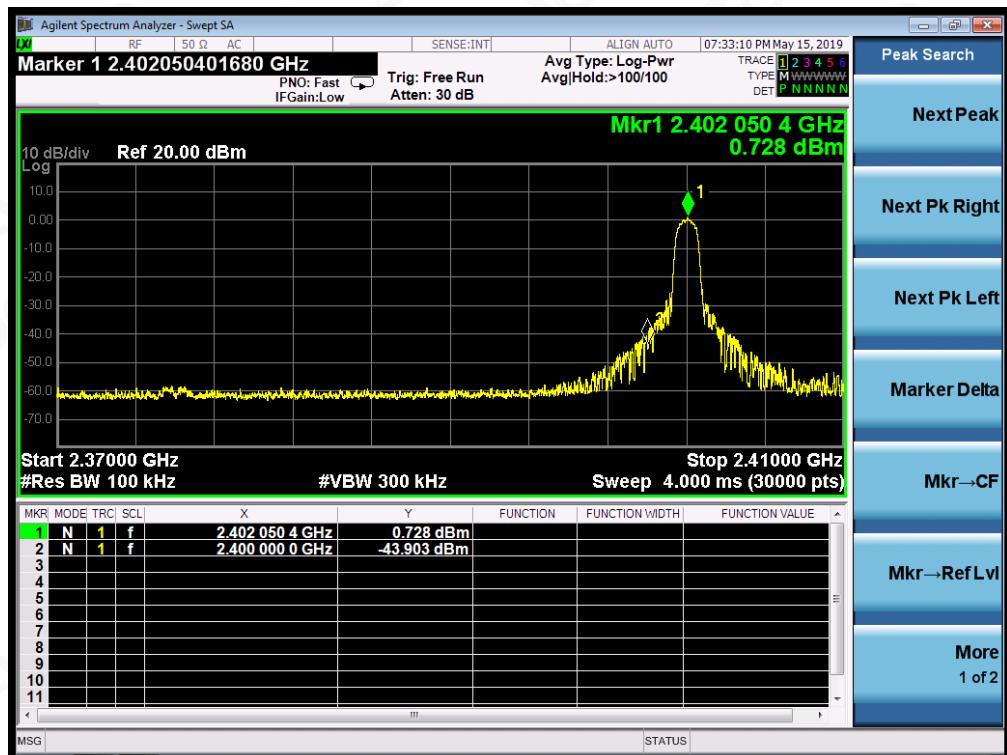


Attestation of Global Compliance(Shenzhen)Co.,Ltd.

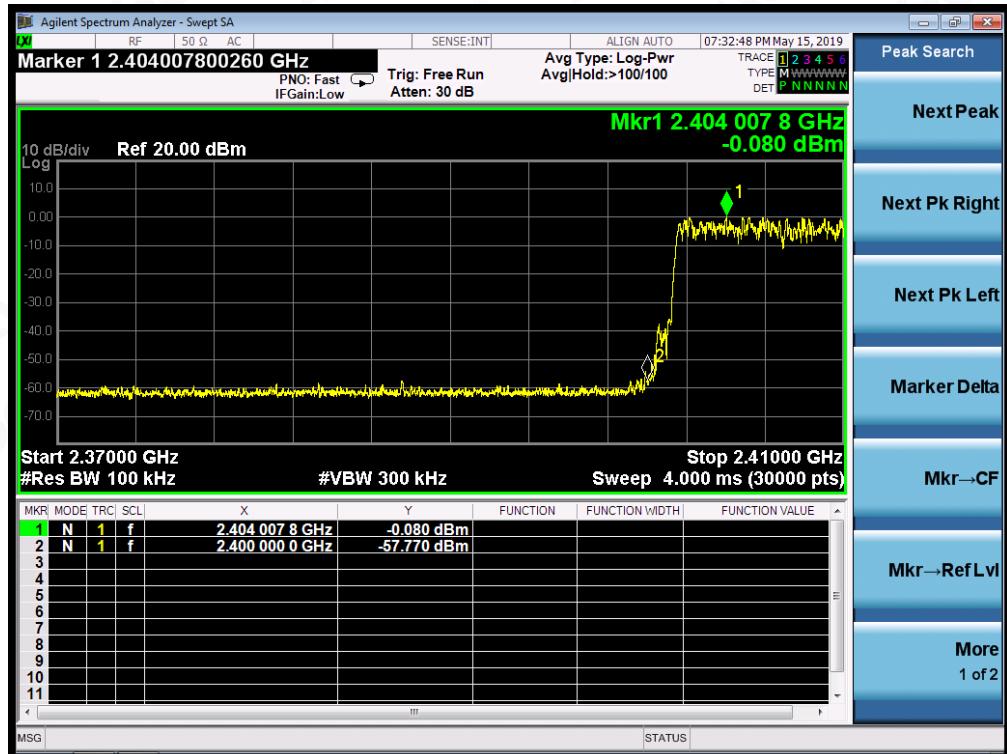
 Add: 2/F., Building 2, No.1–4, Chaxi Sanwei Technial Industrial Park, Gushu,
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π /4-DQPSK MODULATION IN LOW CHANNEL
Hopping off



Hopping on



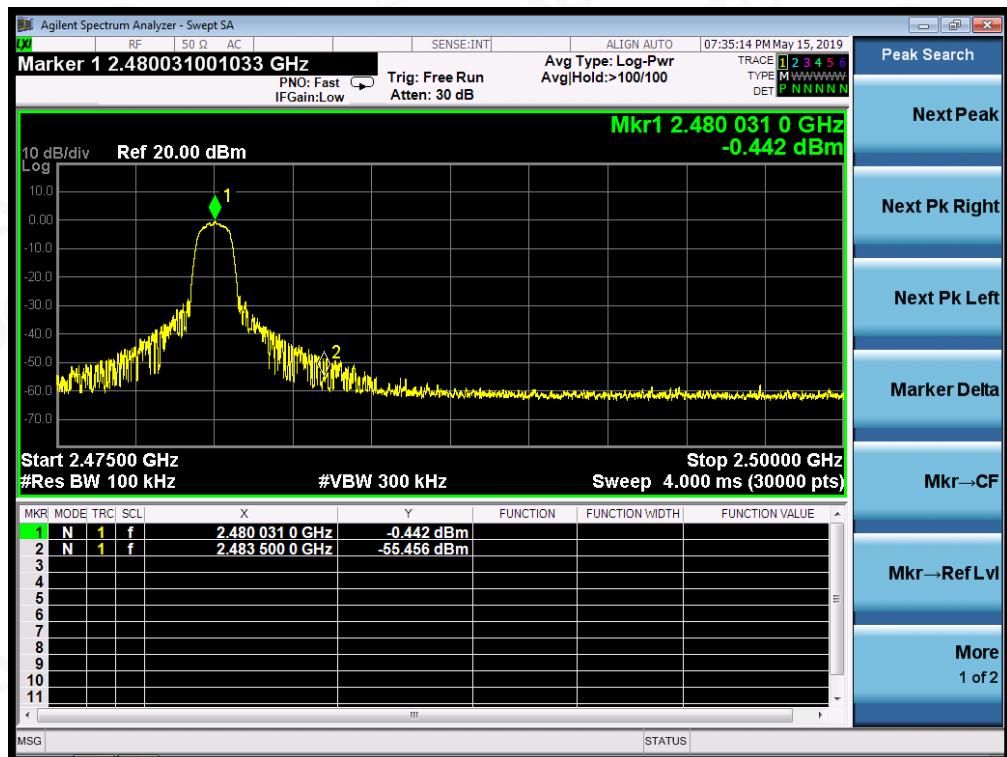
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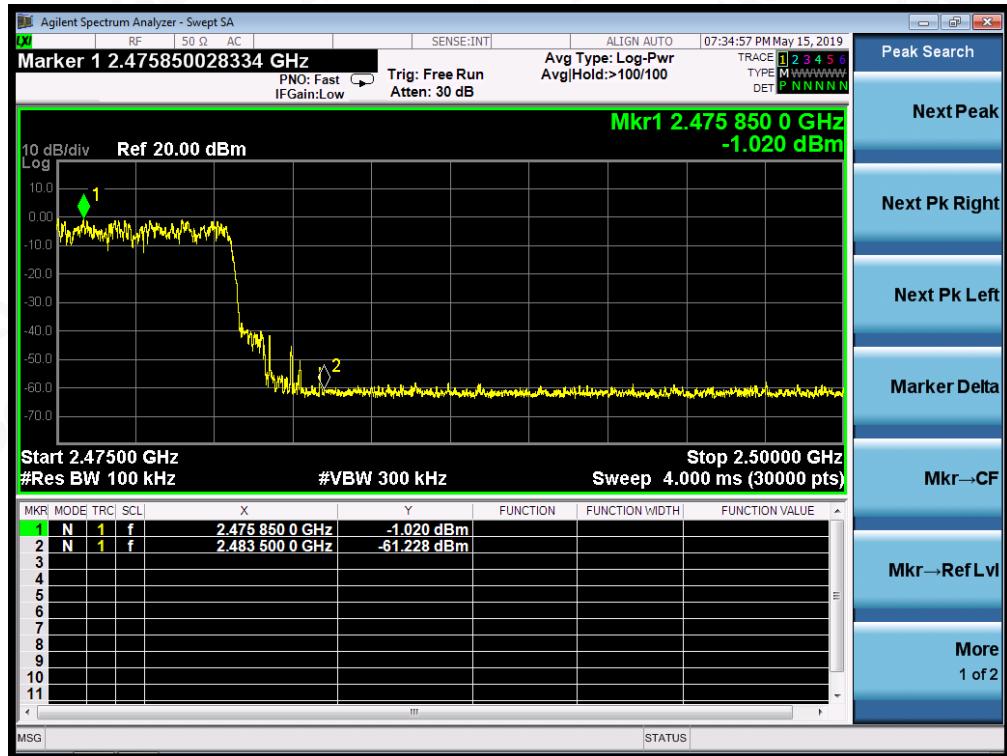
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π /4-DQPSK MODULATION IN HIGH CHANNEL
Hopping off



Hopping on



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