# FCC Test Report

Report No.: AGC08188191201FE03

| | | |
|---|---|---|
| **FCC ID** | : | 2AQ39-T100 |
| **APPLICATION PURPOSE** | : | Original Equipment |
| **PRODUCT DESIGNATION** | : | TWS Earphones |
| **BRAND NAME** | : | Tuddrom |
| **MODEL NAME** | : | T100 |
| **APPLICANT** | : | Dongguan Tuddrom Electronics Co., Ltd |
| **DATE OF ISSUE** | : | Jan. 17, 2020 |
| **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 | / | Jan. 17, 2020 | Valid | Initial Release |

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## 1. VERIFICATION OF CONFORMITY

| | |
|---|---|
| **Applicant** | Dongguan Tuddrom Electronics Co., Ltd |
| **Address** | No.8 ,Hengxing Road, Hengkeng industrial Park, Liaobu Town, Dongguan City, Guangdong Province, China |
| **Manufacturer** | Dongguan Tuddrom Electronics Co., Ltd |
| **Address** | No.8 ,Hengxing Road, Hengkeng industrial Park, Liaobu Town, Dongguan City, Guangdong Province, China |
| **Factory** | Dongguan Tuddrom Electronics Co., Ltd |
| **Address** | No.8 ,Hengxing Road, Hengkeng industrial Park, Liaobu Town, Dongguan City, Guangdong Province, China |
| **Product Designation** | TWS Earphones |
| **Brand Name** | Tuddrom |
| **Test Model** | T100 |
| **Date of test** | Jan. 07, 2020 to Jan. 17, 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 | Nini Guo<br>(Project Engineer) | Jan. 17, 2020 |
| Reviewed By | Max Zhang<br>(Reviewer) | Jan. 17, 2020 |
| Approved By | Forrest Lei<br>(Authorized Officer) | Jan. 17, 2020 |

# 2. GENERAL INFORMATION

## 2.1. PRODUCT DESCRIPTION

The EUT is designed as “TWS Earphones”. It is designed by way of utilizing the GFSK and Pi/4 DQPSK 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** | -2.055dBm(Max) |
| **Bluetooth Version** | V 5.0 |
| **Modulation** | BR ☒GFSK, EDR ☒π /4-DQPSK, ☐8DPSK<br>BLE ☐GFSK 1Mbps ☐GFSK 2Mbps |
| **Number of channels** | 79 |
| **Hardware Version** | T100-L-V0_3-20191029 |
| **Software Version** | V1.1.1 |
| **Antenna Designation** | Integral Antenna(Comply with requirements of the FCC part 15.203) |
| **Antenna Gain** | 2dBi |
| **Power Supply** | DC 3.7V by battery |

Note: The EUT comprises left and right channel headsets, both are the same in SCH but different in the PCB Layout. Both of them have been tested. Only the test worst data of left headset recorded in this report.

## 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 |

## 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 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 SEQUENCY 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 ehavior 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 ehavior:

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.

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

This submittal(s) (test report) is intended for **FCC ID: 2AQ39-T100** 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.

## 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 = ±3.2 dB
- Uncertainty of Radiated Emission below 1GHz, Uc = ±3.9 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 %

## 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 | Hopping mode GFSK |
| 8 | Hopping mode π/4-DQPSK |

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.
4. The test software is the FCC Assist 1.0.2 which can set the EUT into the individual test modes.

# 5. SYSTEM TEST CONFIGURATION

## 5.1. CONFIGURATION OF EUT SYSTEM

Radiated Emission Configure :

EUT

## 5.2 EQUIPMENT USED IN TESTED SYSTEM

| Item | Equipment | Model No. | ID or | Remark |
|---|---|---|---|---|
| 1 | TWS Earphones | T100 | 2AQ39-T100 | 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 can not use the BT function with charging

## 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, 2019 | Jun. 26, 2020 |
| EXA Signal Analyzer | Aglient | N9010A | MY53470504 | Dec. 12, 2019 | Dec. 11, 2020 |
| 2.4GHz Fliter | EM Electronics | 2400-2500MHz | N/A | Feb. 27, 2019 | Feb. 26, 2020 |
| Attenuator | ZHINAN | E-002 | N/A | Aug. 26, 2019 | Aug. 25, 2020 |
| Horn antenna | SCHWARZBECK | BBHA 9170 | #768 | Sep. 09, 2019 | Sep. 08, 2021 |
| 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. 15, 2019 | Oct. 16, 2020 |
| ANTENNA | SCHWARZBECK | VULB9168 | 494 | Jan. 09, 2019 | Jan. 08, 2021 |
| Test software | FARA | EZ-EMC (Ver RA-03A) | N/A | N/A | N/A |

# 7. PEAK OUTPUT POWER

## 7.1. MEASUREMENT PROCEDURE

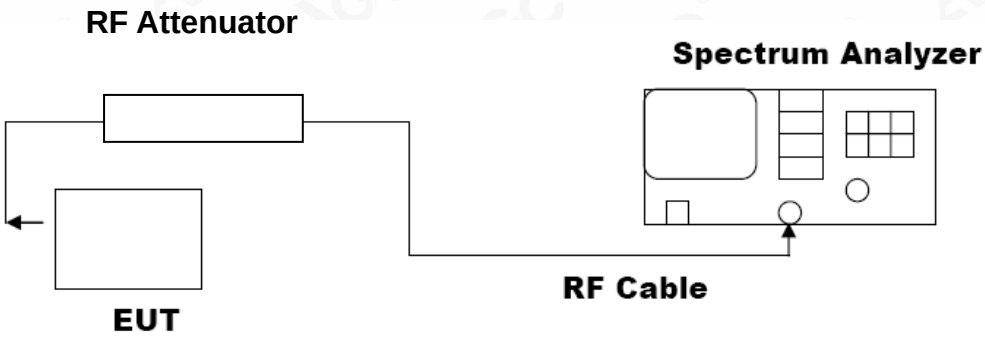
For peak power test:

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**

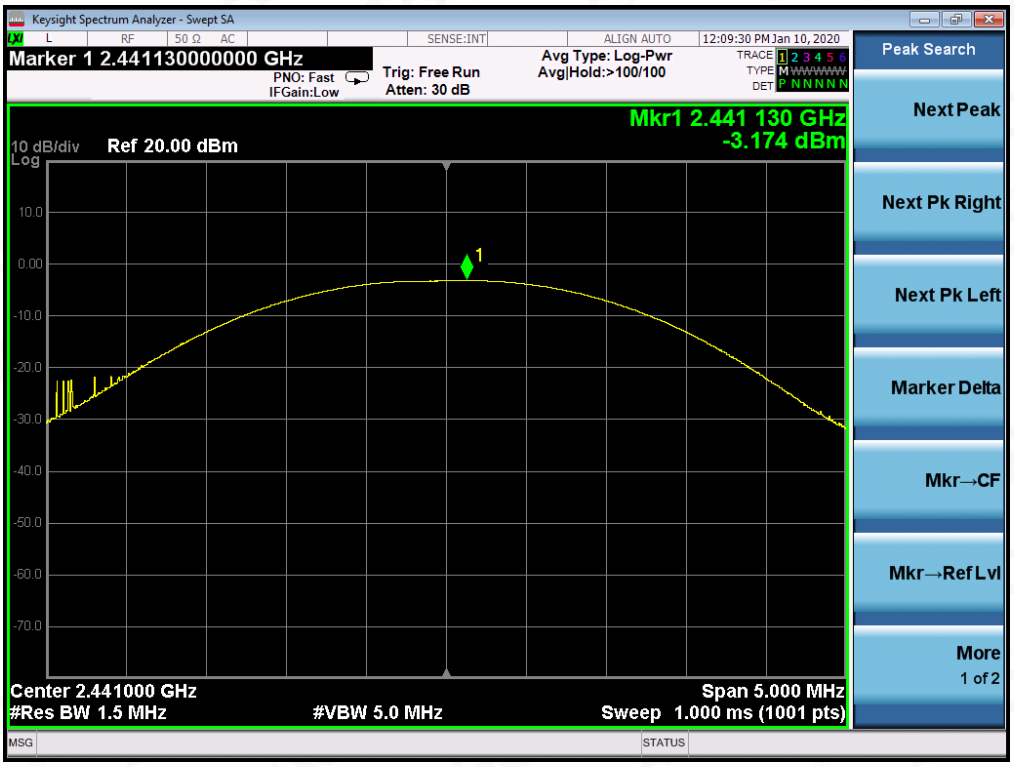


## 7.3. LIMITS AND MEASUREMENT RESULT

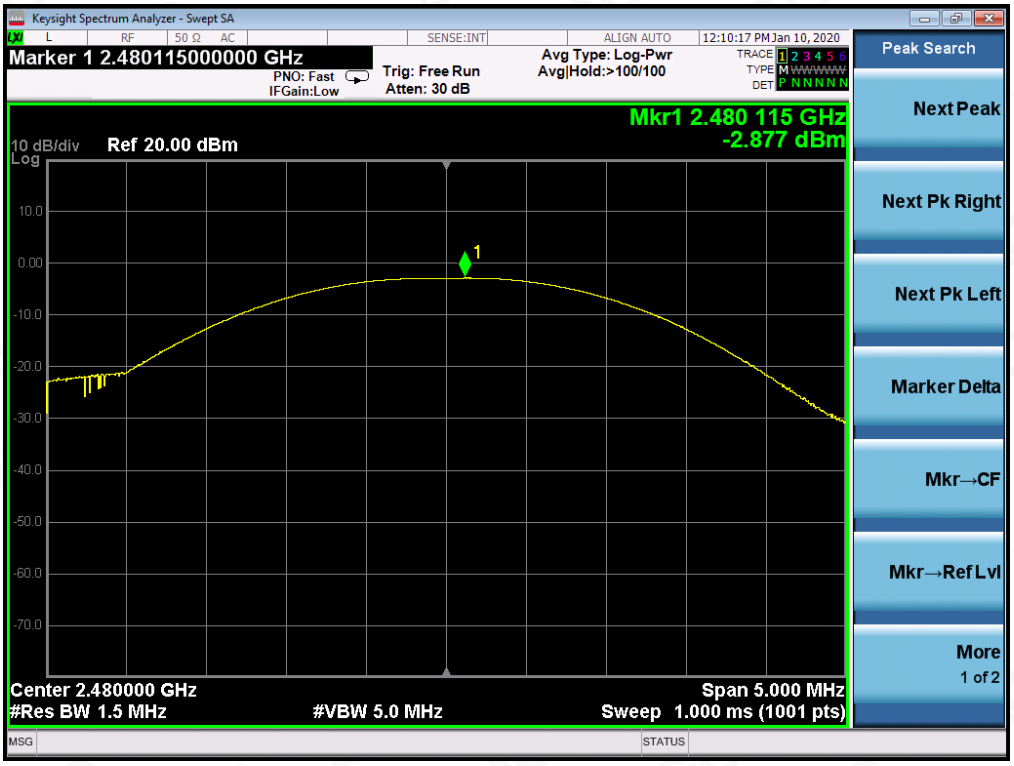
| PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION | | | |
|---|---|---|---|
| Frequency (GHz) | Peak Power (dBm) | Applicable Limits (dBm) | Pass or Fail |
| 2.402 | -4.119 | 30 | Pass |
| 2.441 | -3.174 | 30 | Pass |
| 2.480 | -2.877 | 30 | Pass |

CH0

CH39

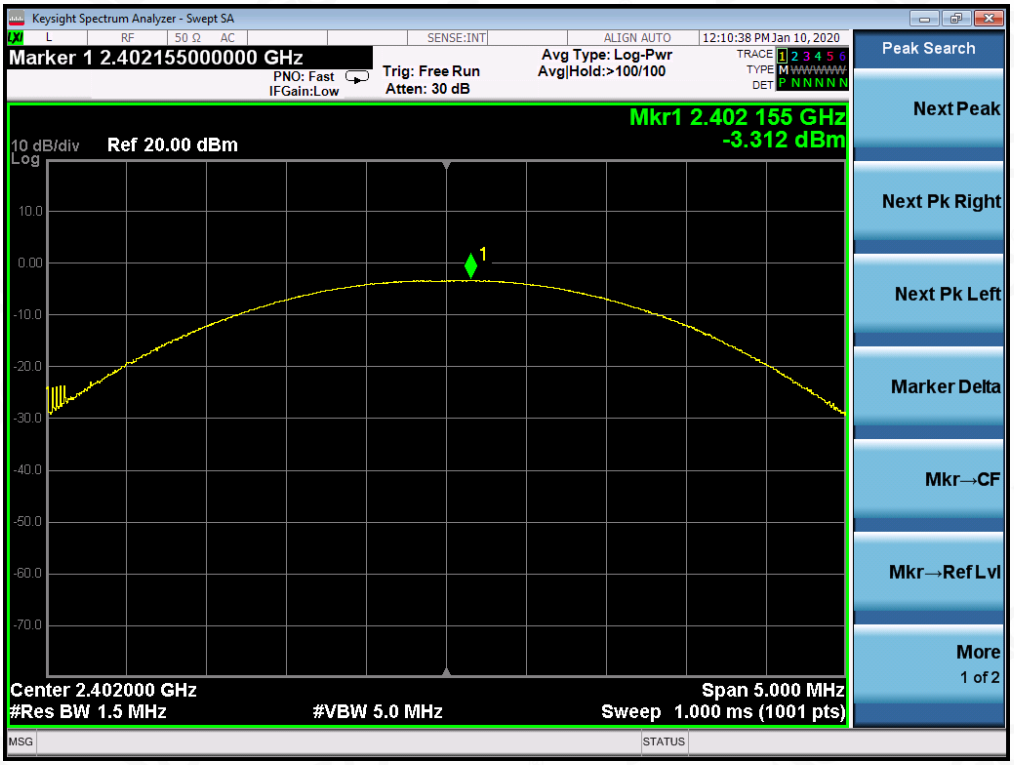

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.441130000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:09:30 PM Jan 10, 2020
Mkr1 2.441 130 GHz
-3.174 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.441000 GHz
#Res BW 1.5 MHz
#VBW 5.0 MHz
Span 5.000 MHz
Sweep 1.000 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

CH78

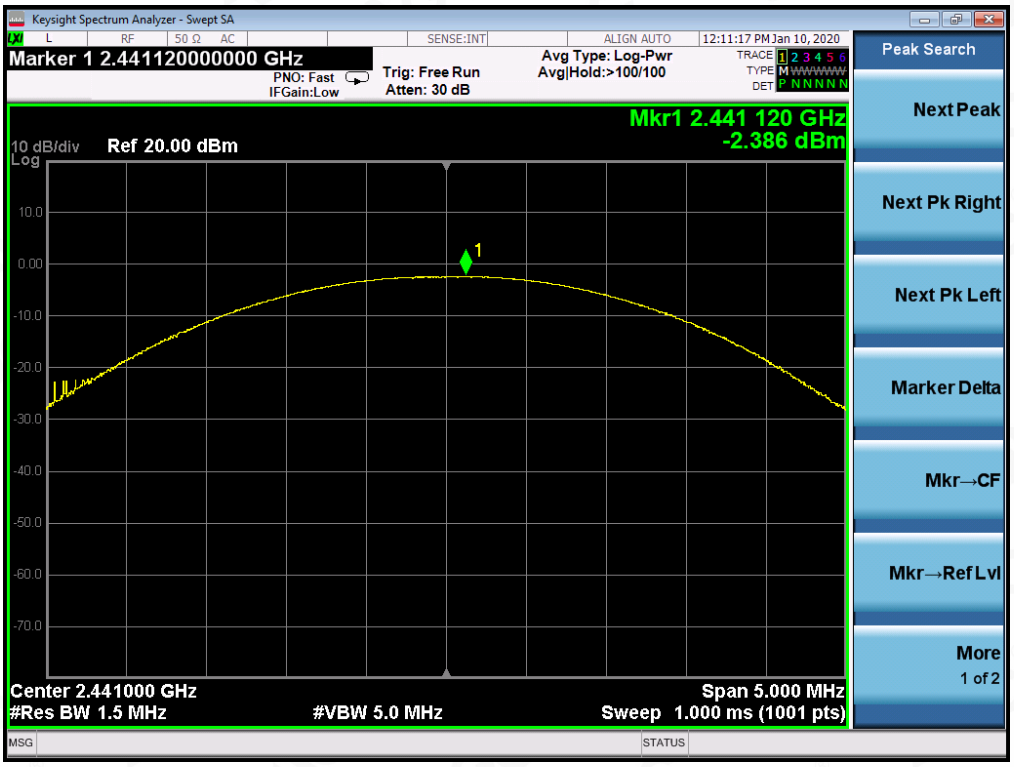

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.480115000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:10:17 PM Jan 10, 2020
Mkr1 2.480 115 GHz
-2.877 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.480000 GHz
#Res BW 1.5 MHz
#VBW 5.0 MHz
Span 5.000 MHz
Sweep 1.000 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

| PEAK OUTPUT POWER MEASUREMENT RESULT FOR Ⅱ /4-DQPSK MODULATION | | | |
|---|---|---|---|
| Frequency (GHz) | Peak Power (dBm) | Applicable Limits (dBm) | Pass or Fail |
| 2.402 | -3.312 | 30 | Pass |
| 2.441 | -2.386 | 30 | Pass |
| 2.480 | -2.055 | 30 | Pass |

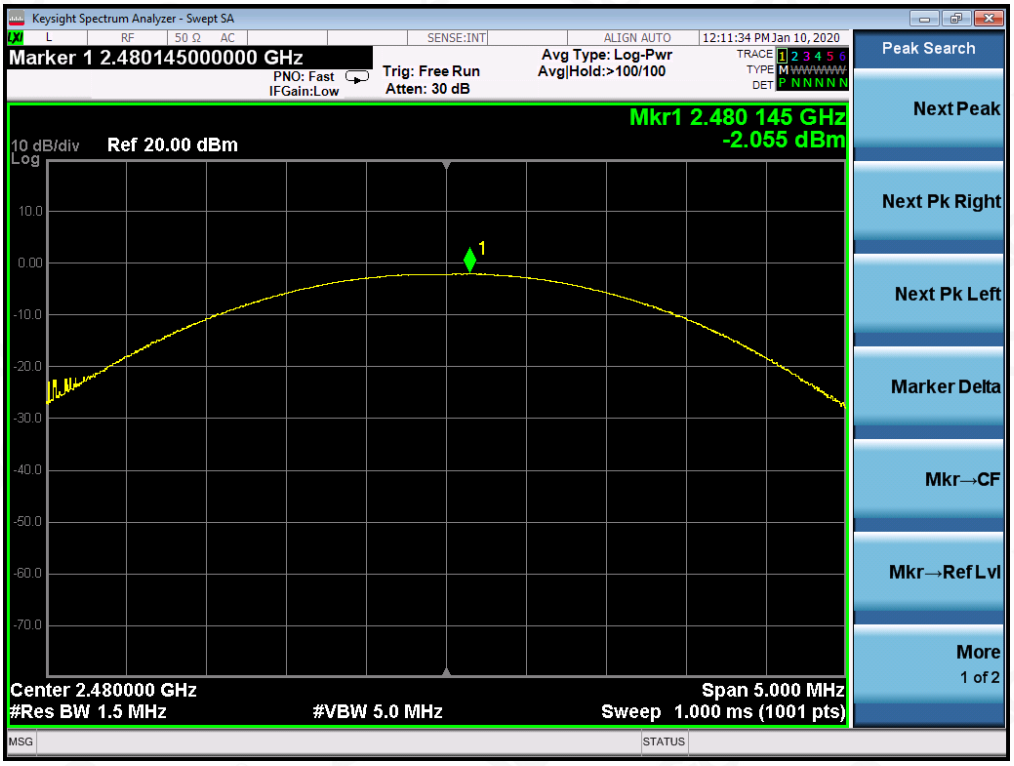
CH0



CH39


Keysight Spectrum Analyzer - Swept SA
Marker 1 2.441120000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:11:17 PM Jan 10, 2020
Mkr1 2.441 120 GHz
-2.386 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.441000 GHz
#Res BW 1.5 MHz
#VBW 5.0 MHz
Span 5.000 MHz
Sweep 1.000 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

CH78

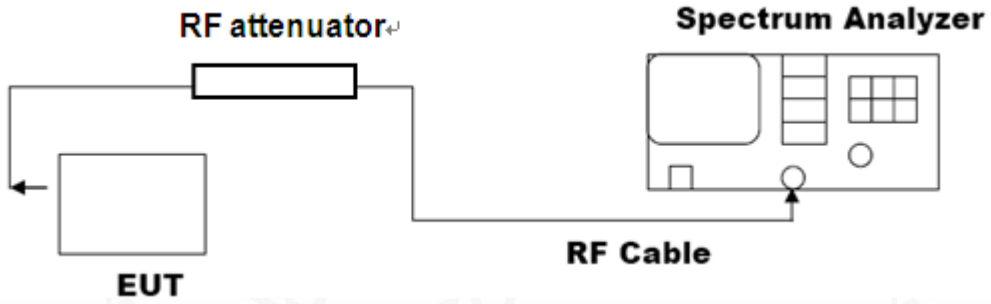

Keysight Spectrum Analyzer - Swept SA
Marker 1 2.480145000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
12:11:34 PM Jan 10, 2020
Mkr1 2.480 145 GHz
-2.055 dBm
10 dB/div
Log
Ref 20.00 dBm
Center 2.480000 GHz
#Res BW 1.5 MHz
#VBW 5.0 MHz
Span 5.000 MHz
Sweep 1.000 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2

# 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.

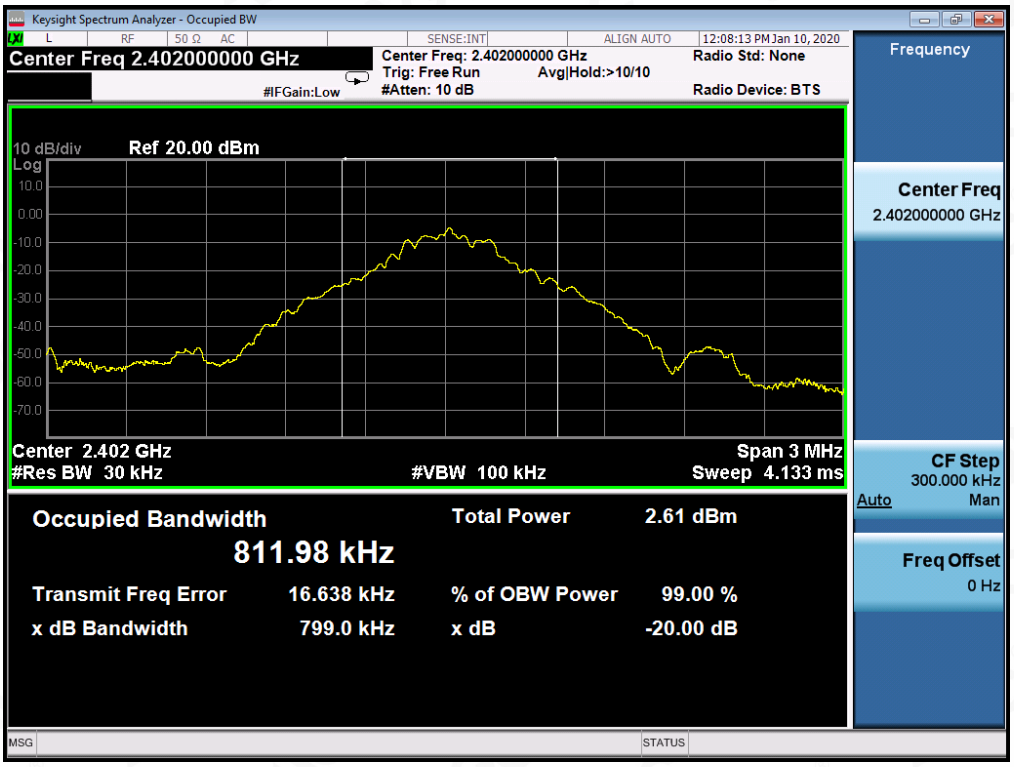
## 8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



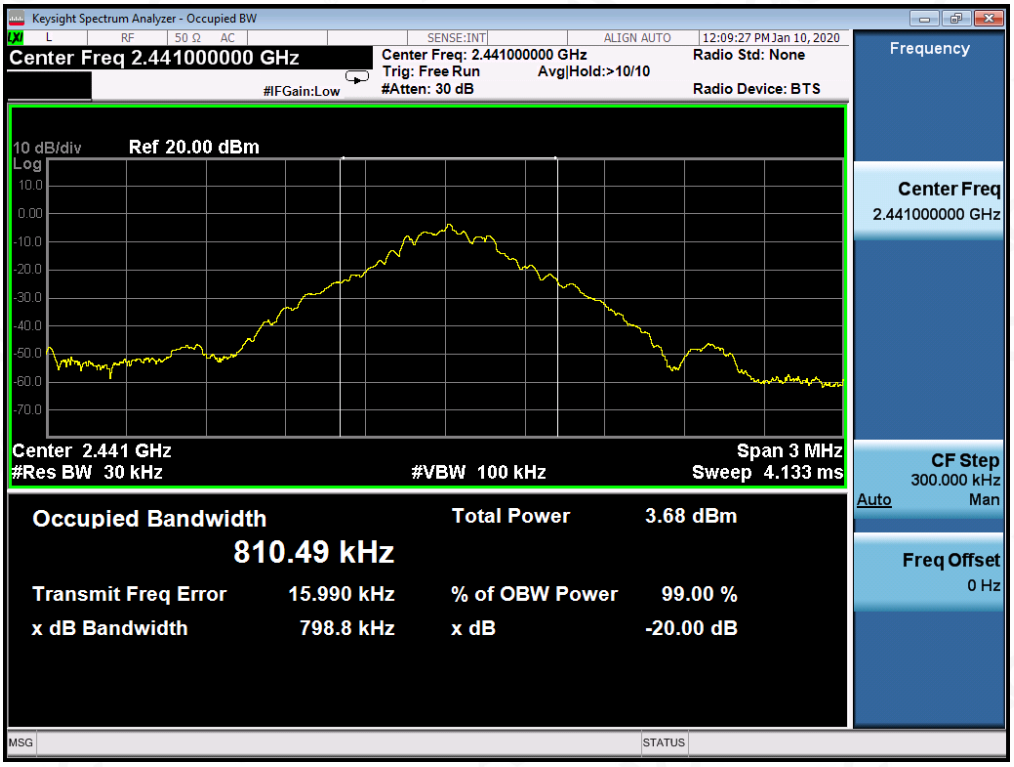

## 8.3. LIMITS AND MEASUREMENT RESULTS

| MEASUREMENT RESULT FOR GFSK MOUDULATION | | | |
|---|---|---|---|
| Applicable Limits | Measurement Result | | |
| | Test Data (MHz) | | Criteria |
| N/A | Low Channel | 0.7990 | PASS |
| | Middle Channel | 0.7988 | PASS |
| | High Channel | 0.7984 | PASS |

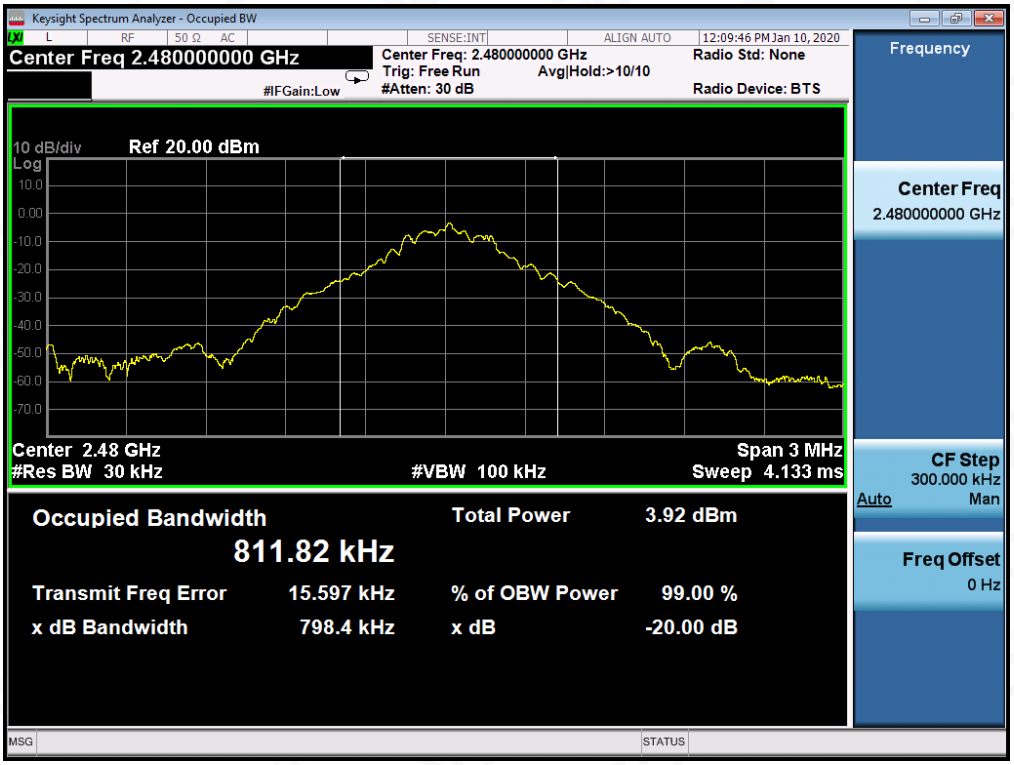
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL




TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

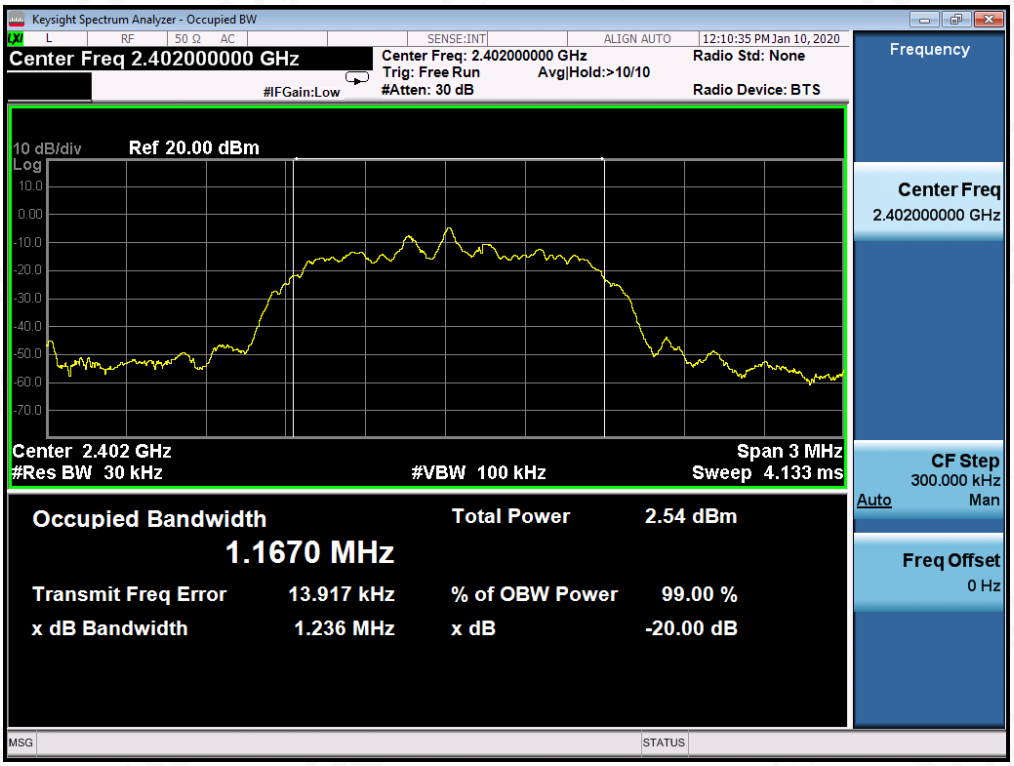


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

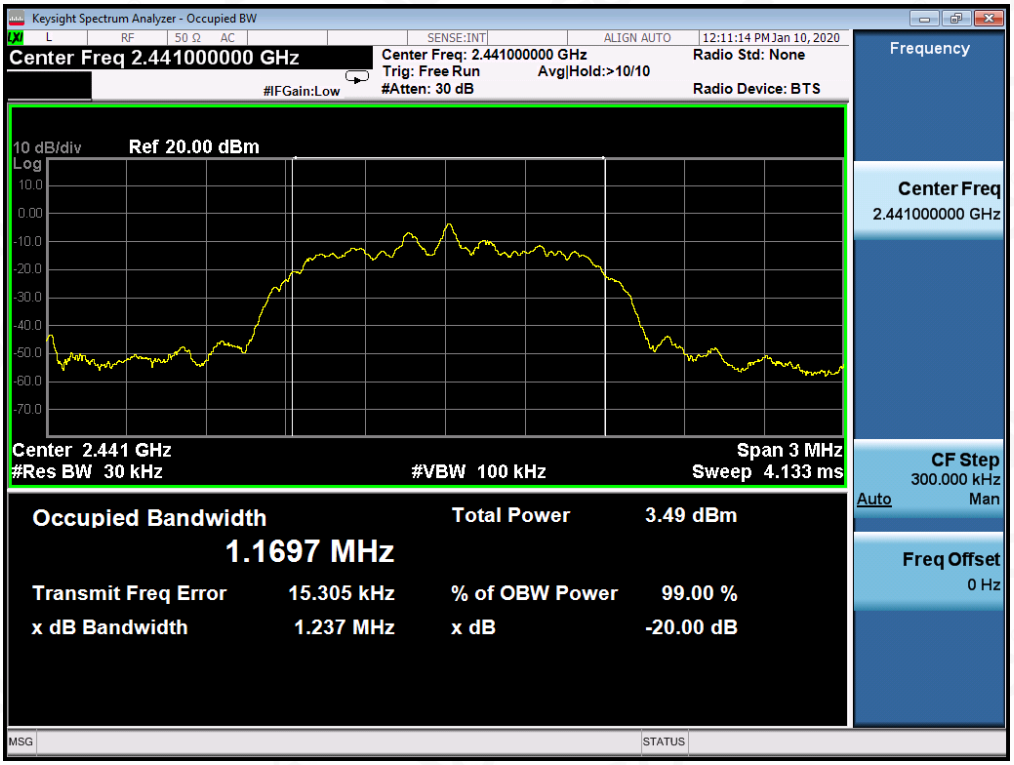


| MEASUREMENT RESULT FOR Π /4-DQPSK MODULATION | | | |
|---|---|---|---|
| Applicable Limits | Measurement Result | | |
| | Test Data (MHz) | | Criteria |
| N/A | Low Channel | 1.236 | PASS |
| | Middle Channel | 1.237 | PASS |
| | High Channel | 1.229 | PASS |

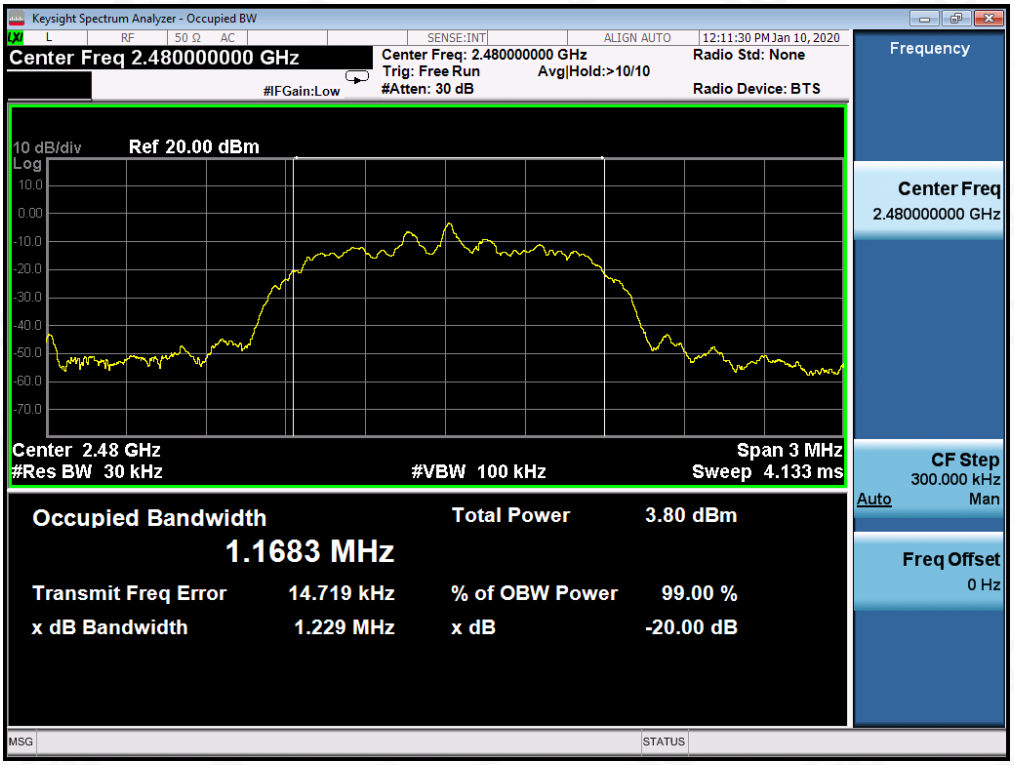
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL




TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



# 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

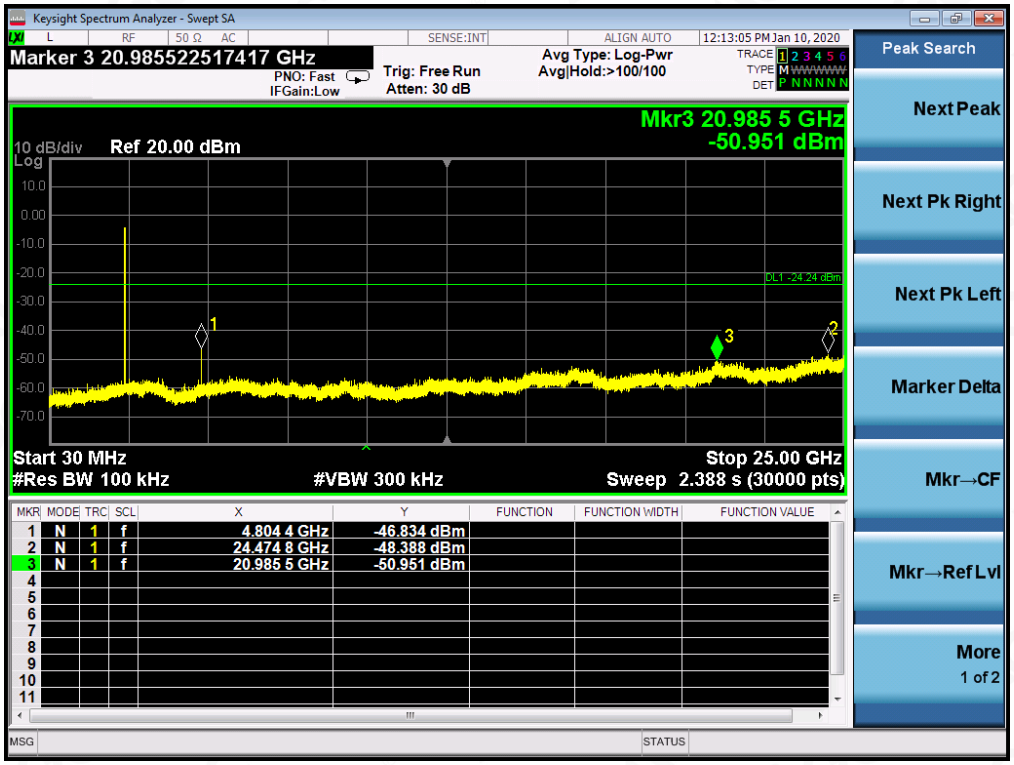
The same as described in section 6

## 9.4. LIMITS AND MEASUREMENT RESULT

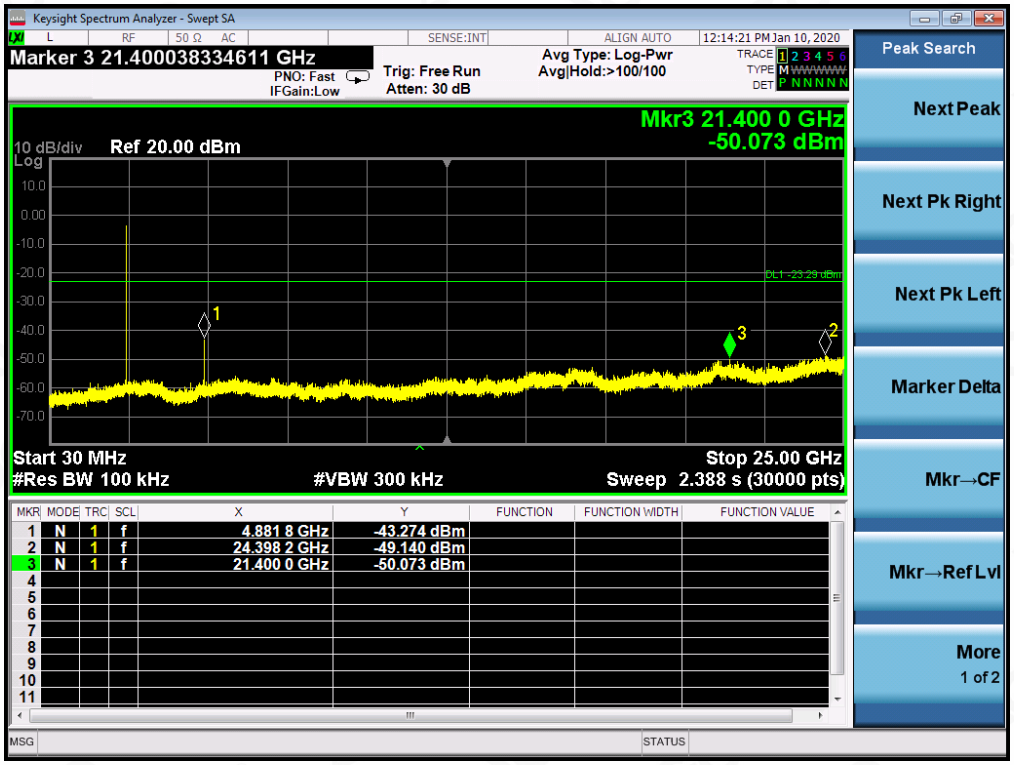
| LIMITS AND MEASUREMENT RESULT | | |
|---|---|---|
| Applicable Limits | Measurement Result | |
| | Test Data | Criteria |
| In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power.<br>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 |

## TEST RESULT FOR ENTIRE FREQUENCY RANGE

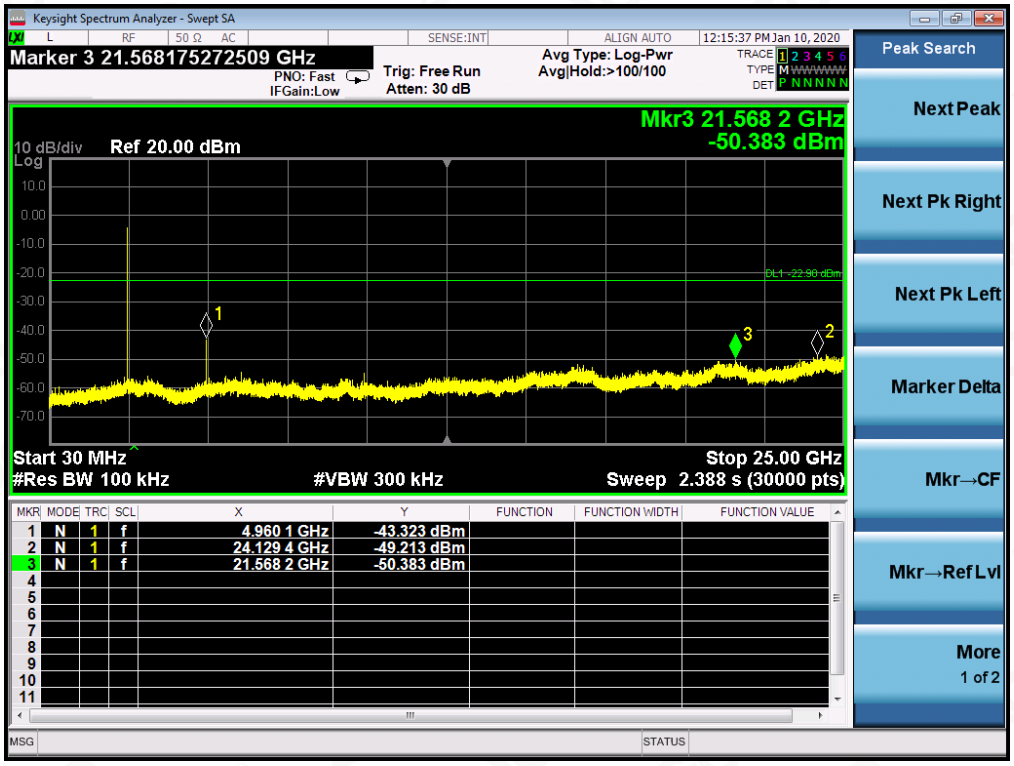
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF GFSK MODULATION IN LOW CHANNEL



TEST PLOT OF OUT OF BAND EMISSIONS
OF GFSK MODULATION IN MIDDLE CHANNEL



TEST PLOT OF OUT OF BAND EMISSIONS
OF GFSK MODULATION IN HIGH CHANNEL

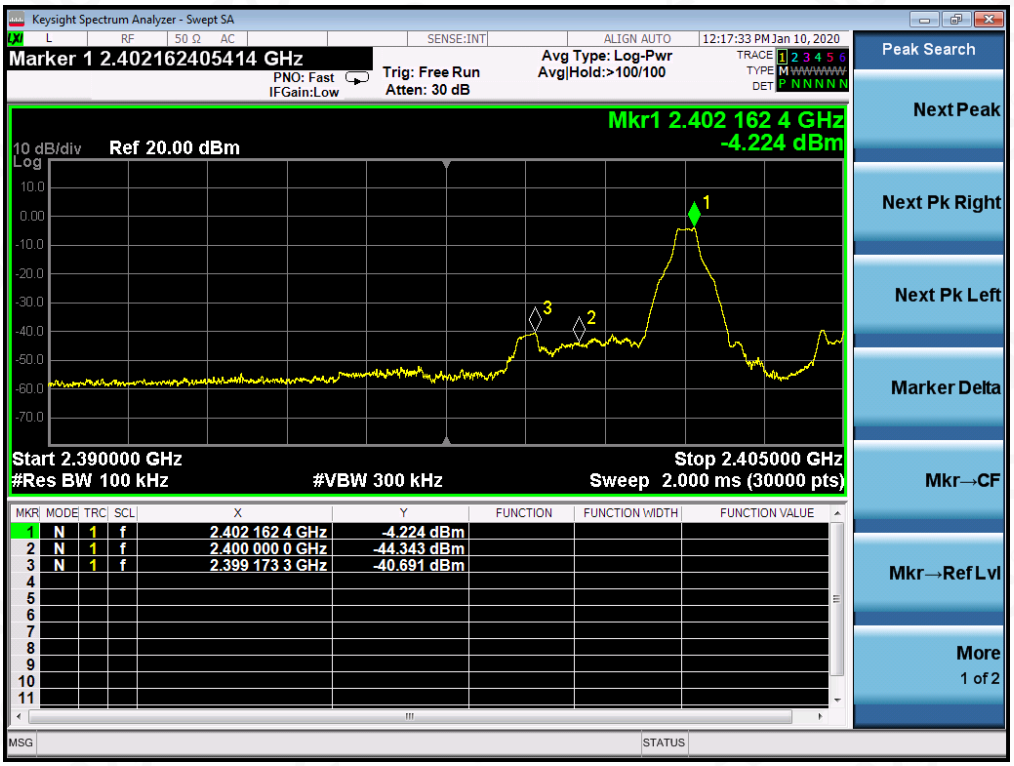



Note: The peak emissions without marker on the above plots are fundamental wave and need not to compare with the limit. The GFSK modulation is the worst case and only those data recorded in the report.

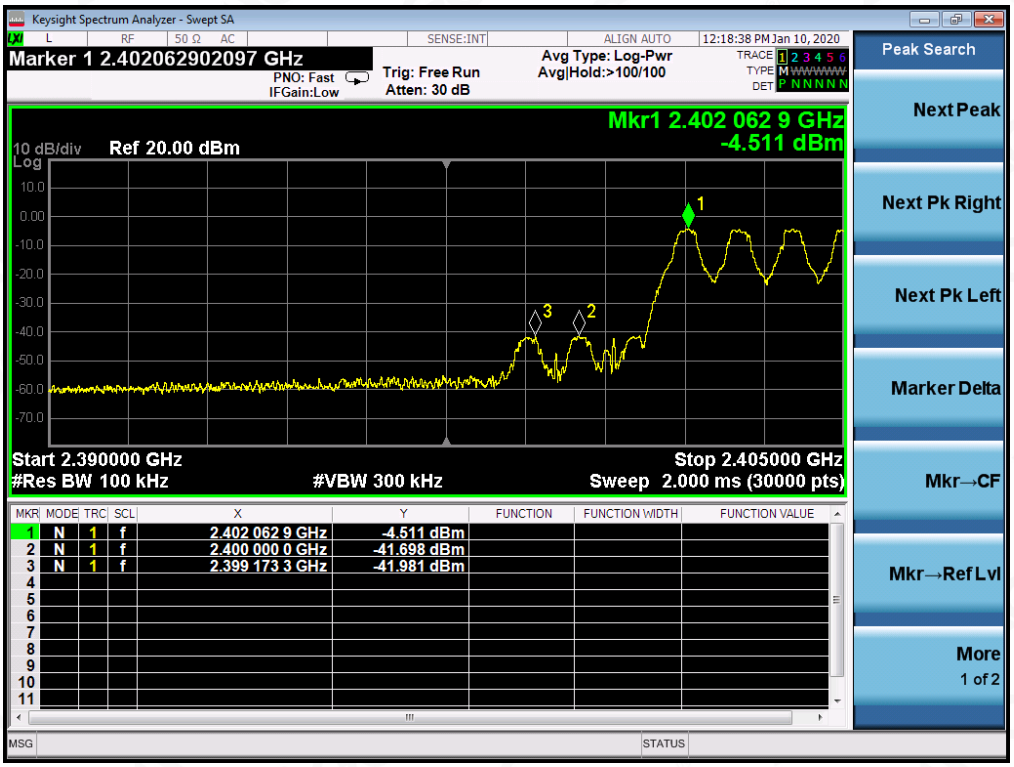
## TEST RESULT FOR BAND EDGE

GFSK MODULATION IN LOW CHANNEL

Hopping off

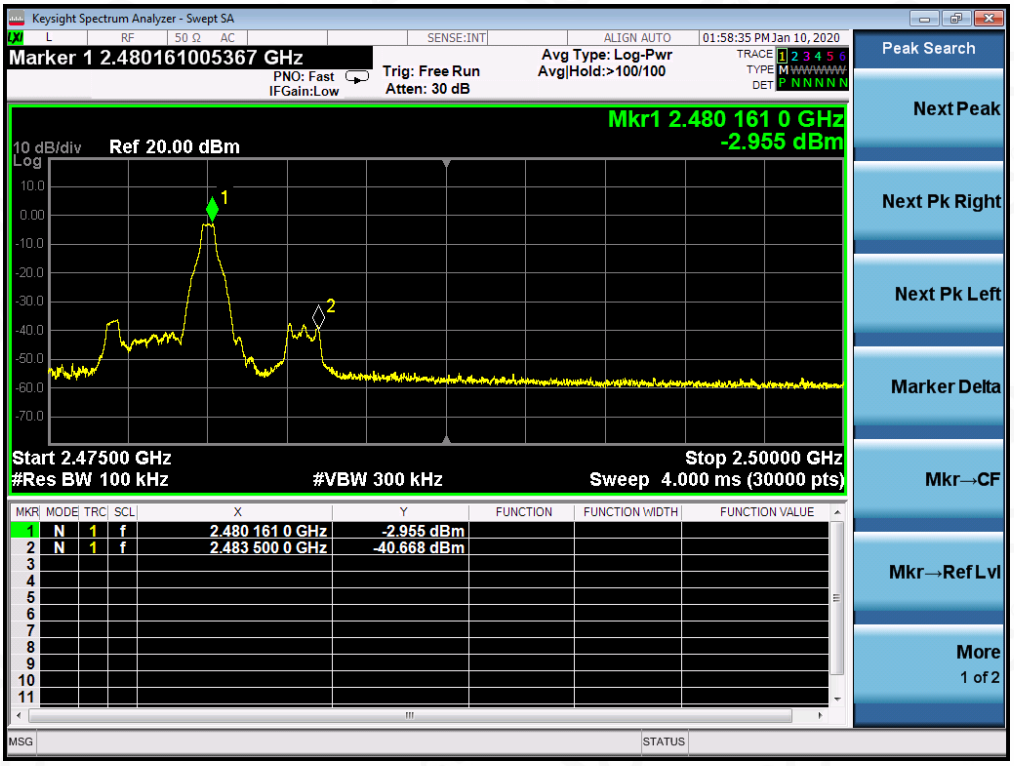



Hopping on

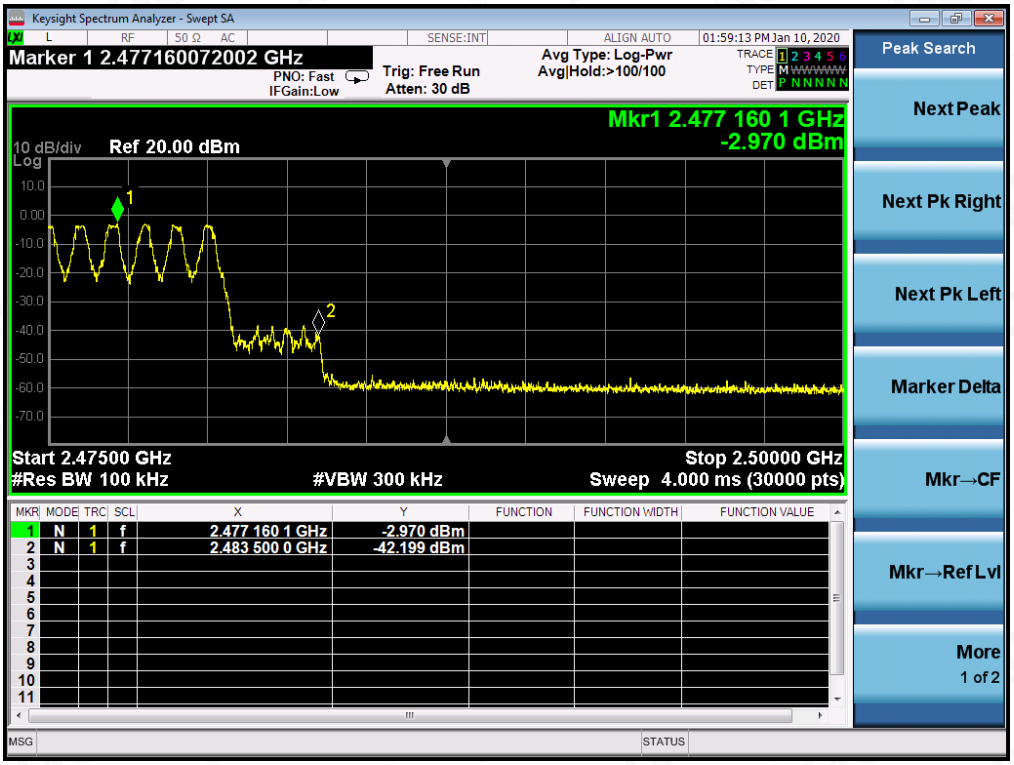


GFSK MODULATION IN HIGH CHANNEL

Hopping off

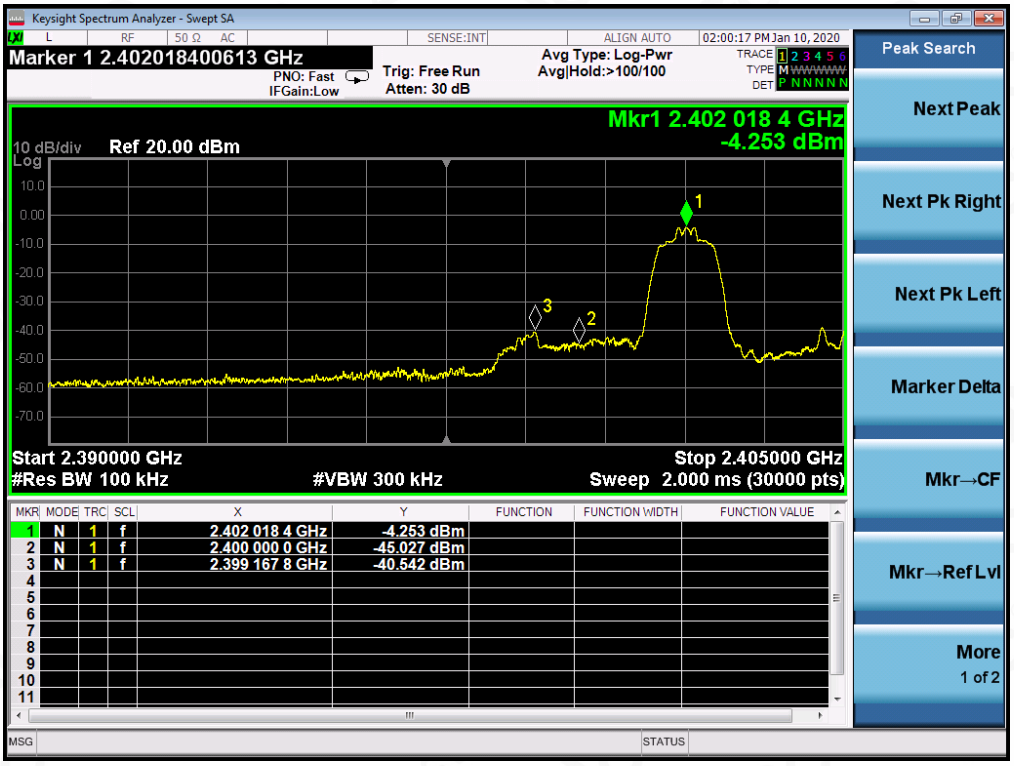



Hopping on

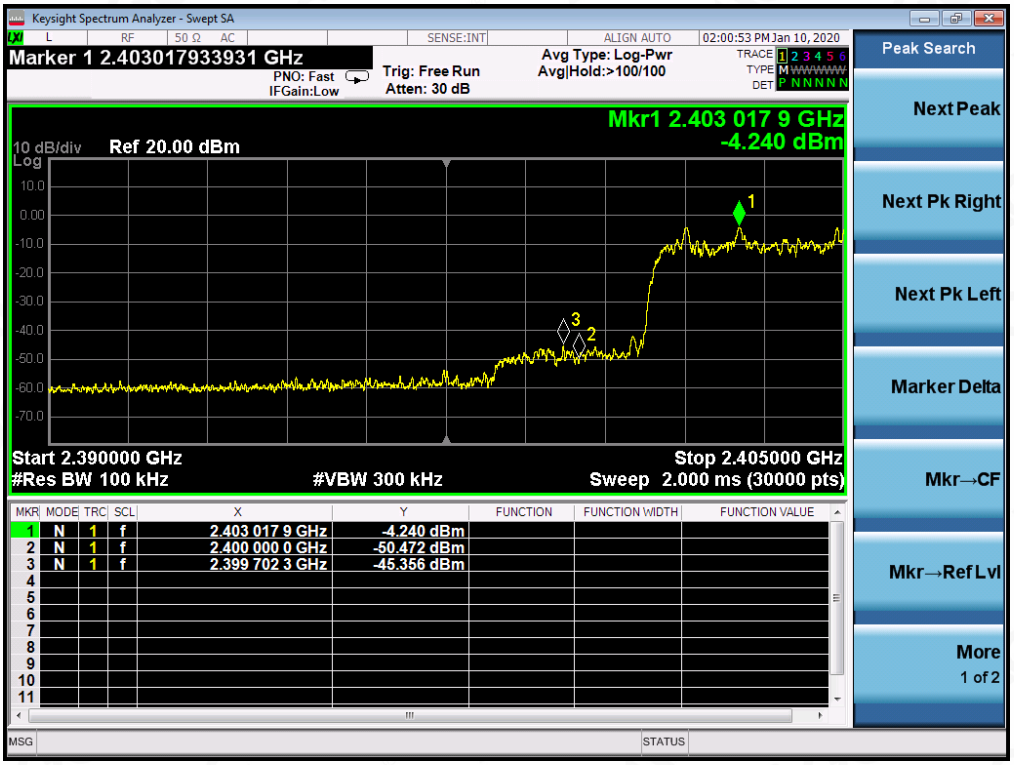


## $\pi$ /4-DQPSK MODULATION IN LOW CHANNEL

Hopping off

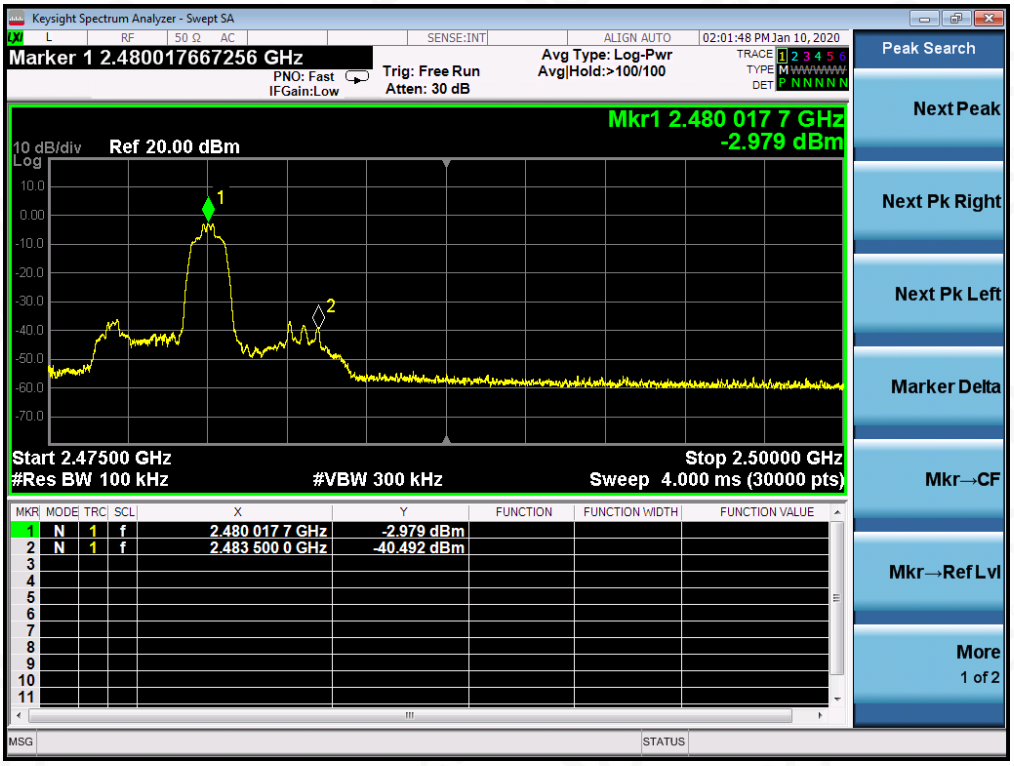



Hopping on

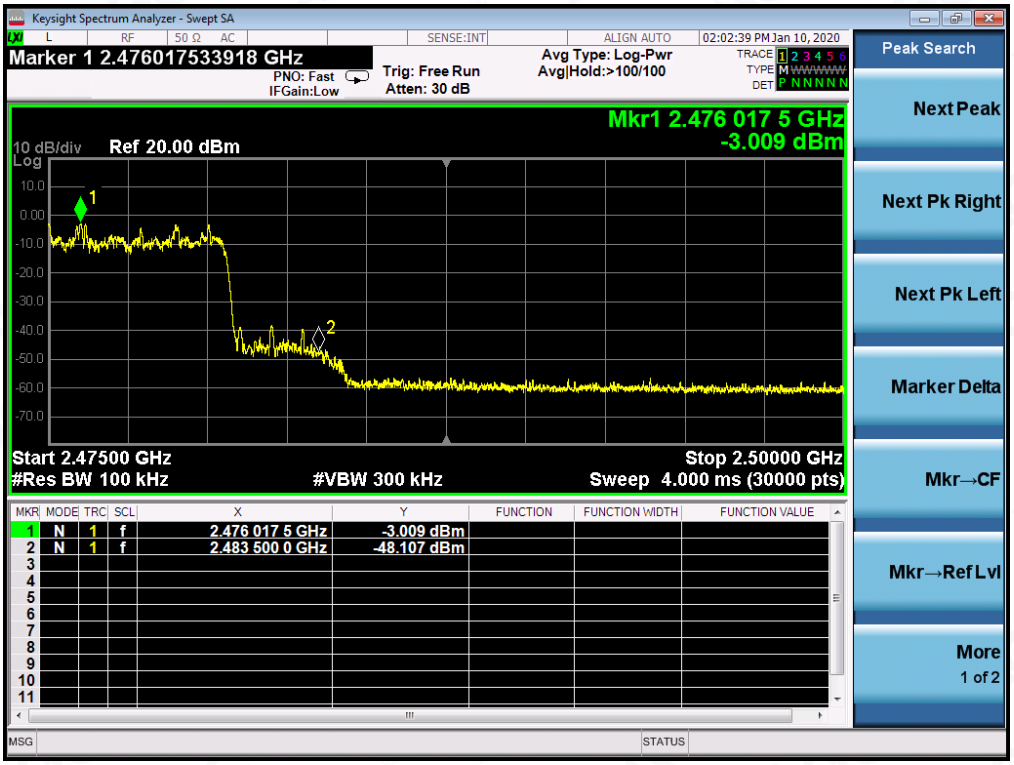


## π /4-DQPSK MODULATION IN HIGH CHANNEL

Hopping off




Hopping on



# 10. RADIATED EMISSION

## 10.1. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

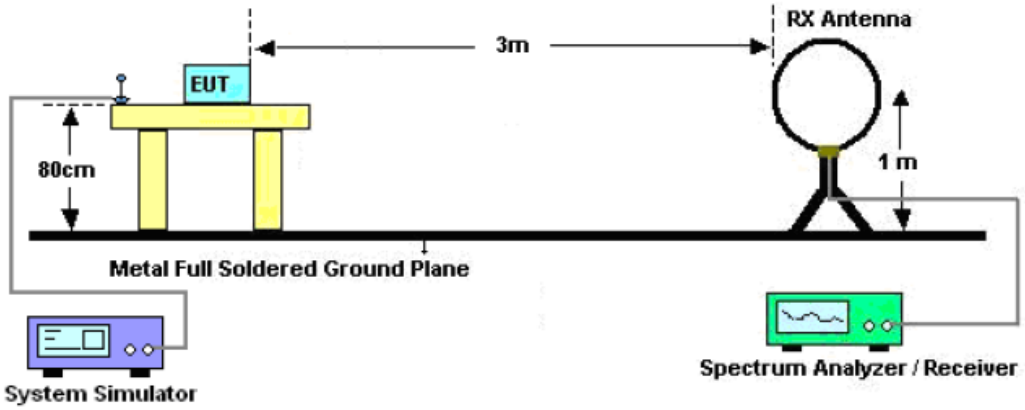
The following table is the setting of spectrum analyzer and receiver.

| Spectrum Parameter | Setting |
|---|---|
| Start ~Stop Frequency | 9KHz~150KHz/RB 200Hz for QP |
| Start ~Stop Frequency | 150KHz~30MHz/RB 9KHz for QP |
| Start ~Stop Frequency | 30MHz~1000MHz/RB 120KHz for QP |
| Start ~Stop Frequency | 1GHz~26.5GHz<br>1MHz/3MHz for Peak, 1MHz/3MHz for Average |

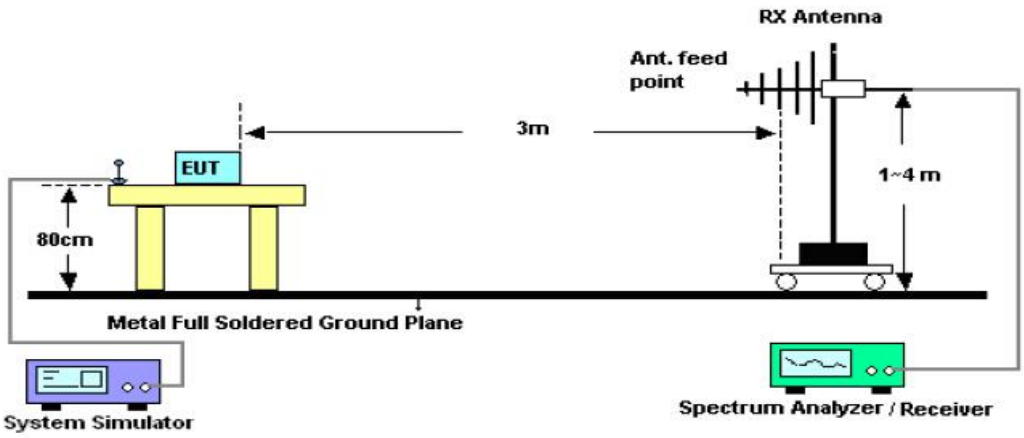
| Receiver Parameter | Setting |
|---|---|
| Start ~Stop Frequency | 9KHz~150KHz/RB 200Hz for QP |
| Start ~Stop Frequency | 150KHz~30MHz/RB 9KHz for QP |
| Start ~Stop Frequency | 30MHz~1000MHz/RB 120KHz for QP |

## 10.2. TEST SETUP

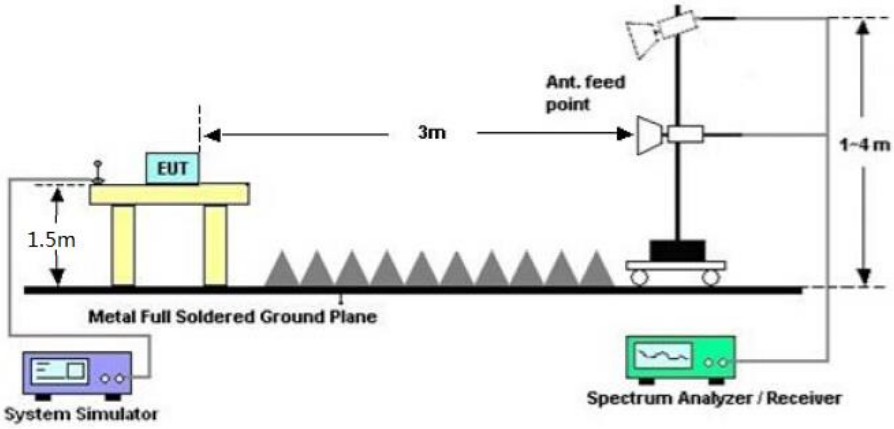
Radiated Emission Test-Setup Frequency Below 30MHz




RADIATED EMISSION TEST SETUP 30MHz-1000MHz




RADIATED EMISSION TEST SETUP ABOVE 1000MHz



## 10.3. LIMITS AND MEASUREMENT RESULT

15.209 Limit in the below table has to be followed

| Frequencies (MHz) | Field Strength (micorvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009~0.490 | 2400/F(KHz) | 300 |
| 0.490~1.705 | 24000/F(KHz) | 30 |
| 1.705~30.0 | 30 | 30 |
| 30~88 | 100 | 3 |
| 88~216 | 150 | 3 |
| 216~960 | 200 | 3 |
| Above 960 | 500 | 3 |

Note: All modes were tested For restricted band radiated emission,
the test records reported below are the worst result compared to other modes.

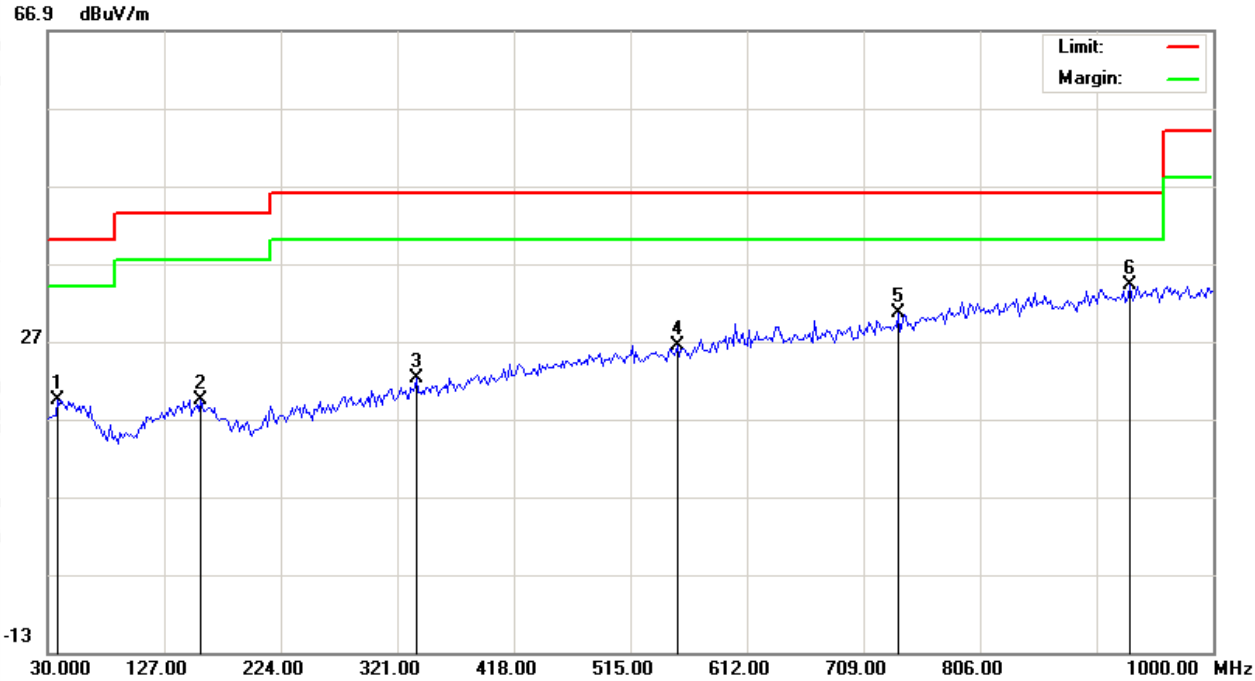
## 10.4. TEST RESULT

**RADIATED EMISSION BELOW 30MHZ**

No emission found between lowest internal used/generated frequencies to 30MHz.

## RADIATED EMISSION BELOW 1GHZ

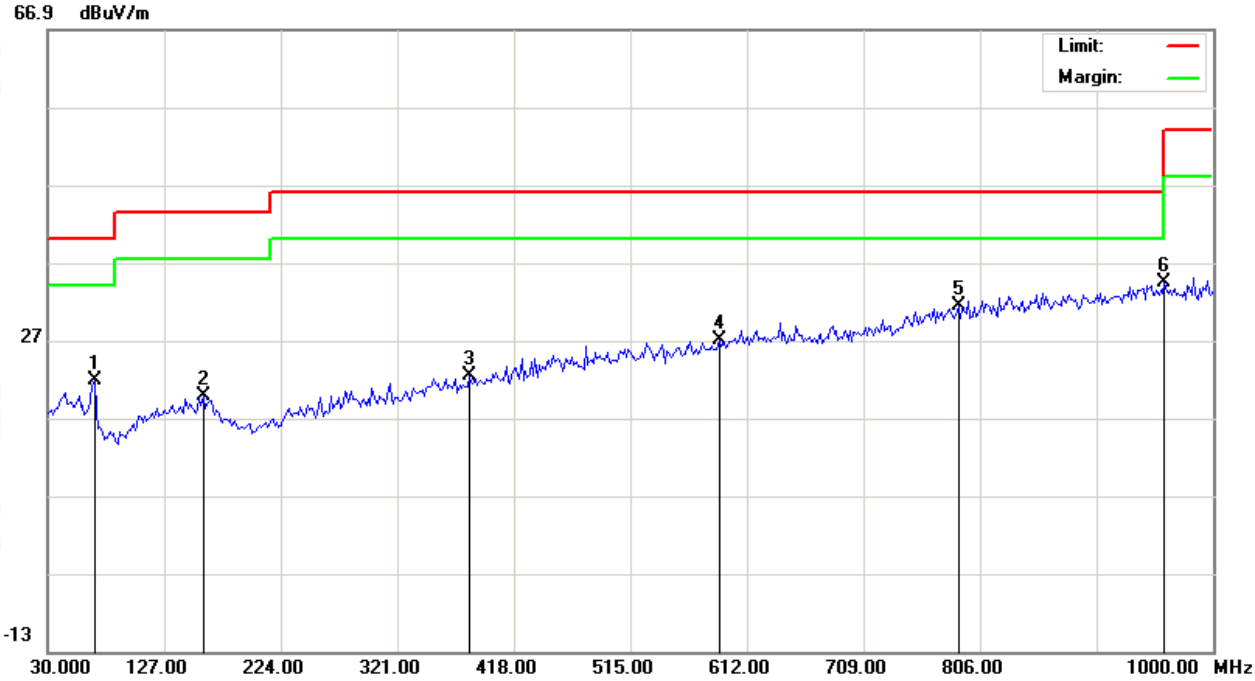
| | | | |
|---|---|---|---|
| **EUT** | TWS Earphones | **Model Name** | T100 |
| **Temperature** | 25°C | **Relative Humidity** | 55.4% |
| **Pressure** | 960hPa | **Test Voltage** | Normal Voltage |
| **Test Mode** | Mode 4 | **Antenna** | Horizontal |




| No. | Mk. | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 38.0833 | 0.02 | 19.41 | 19.43 | 40.00 | -20.57 | peak | | | |
| 2 | | 157.7167 | 0.19 | 19.19 | 19.38 | 43.50 | -24.12 | peak | | | |
| 3 | | 337.1666 | 1.50 | 20.77 | 22.27 | 46.00 | -23.73 | peak | | | |
| 4 | | 553.8000 | 0.43 | 26.04 | 26.47 | 46.00 | -19.53 | peak | | | |
| 5 | | 738.1000 | 1.51 | 29.01 | 30.52 | 46.00 | -15.48 | peak | | | |
| 6 | * | 930.4833 | 2.21 | 31.96 | 34.17 | 46.00 | -11.83 | peak | | | |

**RESULT: PASS**

| EUT | TWS Earphones | Model Name | T100 |
|---|---|---|---|
| Temperature | 25°C | Relative Humidity | 55.4% |
| Pressure | 960hPa | Test Voltage | Normal Voltage |
| Test Mode | Mode 4 | Antenna | Vertical |




| No. | Mk | Freq. | Reading | Factor | Measurement | Limit | Over | Detector | Antenna Height | Table Degree | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | . | MHz | dBuV | dB/m | dBuV/m | dBuV/m | dB | | cm | degree | |
| 1 | | 68.8000 | 4.45 | 17.32 | 21.77 | 40.00 | -18.23 | peak | | | |
| 2 | | 159.3333 | 0.61 | 19.19 | 19.80 | 43.50 | -23.70 | peak | | | |
| 3 | | 380.8167 | 0.16 | 22.31 | 22.47 | 46.00 | -23.53 | peak | | | |
| 4 | | 589.3667 | 0.32 | 26.74 | 27.06 | 46.00 | -18.94 | peak | | | |
| 5 | | 788.2167 | 1.22 | 30.14 | 31.36 | 46.00 | -14.64 | peak | | | |
| 6 | * | 959.5833 | 2.17 | 32.21 | 34.38 | 46.00 | -11.62 | peak | | | |

**RESULT: PASS**

**Note:** 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. All test modes had been pre-tested. The mode 4 is the worst case and recorded in the report.

## RADIATED EMISSION ABOVE 1GHZ

| | | | |
|---|---|---|---|
| **EUT** | TWS Earphones | **Model Name** | T100 |
| **Temperature** | 25℃ | **Relative Humidity** | 55.4% |
| **Pressure** | 960hPa | **Test Voltage** | Normal Voltage |
| **Test Mode** | Mode 1 | **Antenna** | Horizontal |

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Value Type |
|---|---|---|---|---|---|---|
| 4804.000 | 46.67 | 0.08 | 46.75 | 74 | -27.25 | peak |
| 4804.000 | 41.58 | 0.08 | 41.66 | 54 | -12.34 | AVG |
| 7206.000 | 42.34 | 2.21 | 44.55 | 74 | -29.45 | peak |
| 7206.000 | 39.45 | 2.21 | 41.66 | 54 | -12.34 | AVG |
| | | | | | | |
| | | | | | | |

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

| | | | |
|---|---|---|---|
| **EUT** | TWS Earphones | **Model Name** | T100 |
| **Temperature** | 25℃ | **Relative Humidity** | 55.4% |
| **Pressure** | 960hPa | **Test Voltage** | Normal Voltage |
| **Test Mode** | Mode 1 | **Antenna** | Vertical |

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Value Type |
|---|---|---|---|---|---|---|
| 4804.000 | 44.13 | 0.08 | 44.21 | 74 | -29.79 | peak |
| 4804.000 | 39.78 | 0.08 | 39.86 | 54 | -14.14 | AVG |
| 7206.000 | 41.25 | 2.21 | 43.46 | 74 | -30.54 | peak |
| 7206.000 | 37.66 | 2.21 | 39.87 | 54 | -14.13 | AVG |
| | | | | | | |
| | | | | | | |

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

| | | | |
|---|---|---|---|
| **EUT** | TWS Earphones | **Model Name** | T100 |
| **Temperature** | 25°C | **Relative Humidity** | 55.4% |
| **Pressure** | 960hPa | **Test Voltage** | Normal Voltage |
| **Test Mode** | Mode 2 | **Antenna** | Horizontal |

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Value Type |
|---|---|---|---|---|---|---|
| 4882.000 | 45.87 | 0.14 | 46.01 | 74 | -27.99 | peak |
| 4882.000 | 41.34 | 0.14 | 41.48 | 54 | -12.52 | AVG |
| 7323.000 | 42.96 | 2.36 | 45.32 | 74 | -28.68 | peak |
| 7323.000 | 38.12 | 2.36 | 40.48 | 54 | -13.52 | AVG |
| | | | | | | |
| | | | | | | |

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

| | | | |
|---|---|---|---|
| **EUT** | TWS Earphones | **Model Name** | T100 |
| **Temperature** | 25°C | **Relative Humidity** | 55.4% |
| **Pressure** | 960hPa | **Test Voltage** | Normal Voltage |
| **Test Mode** | Mode 2 | **Antenna** | Vertical |

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Value Type |
|---|---|---|---|---|---|---|
| 4882.000 | 45.97 | 0.14 | 46.11 | 74 | -27.89 | peak |
| 4882.000 | 40.23 | 0.14 | 40.37 | 54 | -13.63 | AVG |
| 7323.000 | 41.84 | 2.36 | 44.2 | 74 | -29.8 | peak |
| 7323.000 | 37.65 | 2.36 | 40.01 | 54 | -13.99 | AVG |
| | | | | | | |
| | | | | | | |

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

| | | | |
|---|---|---|---|
| **EUT** | TWS Earphones | **Model Name** | T100 |
| **Temperature** | 25°C | **Relative Humidity** | 55.4% |
| **Pressure** | 960hPa | **Test Voltage** | Normal Voltage |
| **Test Mode** | Mode 3 | **Antenna** | Horizontal |

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Value Type |
|---|---|---|---|---|---|---|
| 4960.000 | 45.91 | 0.22 | 46.13 | 74 | -27.87 | peak |
| 4960.000 | 40.25 | 0.22 | 40.47 | 54 | -13.53 | AVG |
| 7440.000 | 42.59 | 2.64 | 45.23 | 74 | -28.77 | peak |
| 7440.000 | 38.76 | 2.64 | 41.4 | 54 | -12.6 | AVG |
| | | | | | | |
| | | | | | | |
| Remark: | | | | | | |
| Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

| | | | |
|---|---|---|---|
| **EUT** | TWS Earphones | **Model Name** | T100 |
| **Temperature** | 25°C | **Relative Humidity** | 55.4% |
| **Pressure** | 960hPa | **Test Voltage** | Normal Voltage |
| **Test Mode** | Mode 3 | **Antenna** | Vertical |

| Frequency (MHz) | Meter Reading (dBμV) | Factor (dB) | Emission Level (dBμV/m) | Limits (dBμV/m) | Margin (dB) | Value Type |
|---|---|---|---|---|---|---|
| 4960.000 | 46.39 | 0.22 | 46.61 | 74 | -27.39 | peak |
| 4960.000 | 42.56 | 0.22 | 42.78 | 54 | -11.22 | AVG |
| 7440.000 | 43.07 | 2.64 | 45.71 | 74 | -28.29 | peak |
| 7440.000 | 38.23 | 2.64 | 40.87 | 54 | -13.13 | AVG |
| | | | | | | |
| | | | | | | |
| Remark: | | | | | | |
| Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

**RESULT: PASS**

**Note:**

Other emissions from 1G to 25 GHz are considered as ambient noise. No recording in the test report.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The “Factor” value can be calculated automatically by software of measurement system.

All test modes had been tested. The GFSK modulation is the worst case and recorded in the report.

## TEST RESULT FOR RESTRICTED BANDS REQUIREMENTS

| | | | |
|---|---|---|---|
| **EUT** | TWS Earphones | **Model Name** | T100 |
| **Temperature** | 25˚C | **Relative Humidity** | 55.4% |
| **Pressure** | 960hPa | **Test Voltage** | Normal Voltage |
| **Test Mode** | Mode 1 | **Antenna** | Horizontal |

PK

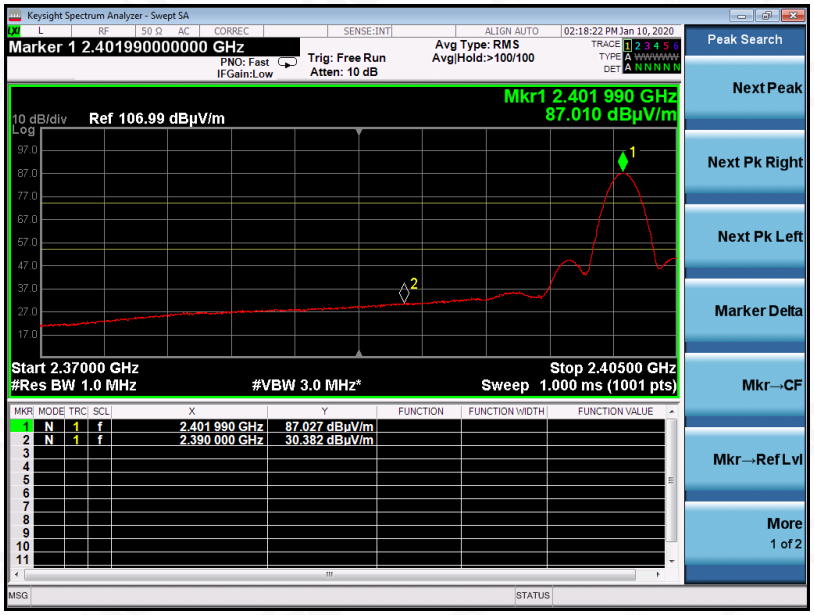
AV

**RESULT: PASS**

| | | | |
|---|---|---|---|
| **EUT** | TWS Earphones | **Model Name** | T100 |
| **Temperature** | 25℃ | **Relative Humidity** | 55.4% |
| **Pressure** | 960hPa | **Test Voltage** | Normal Voltage |
| **Test Mode** | Mode 1 | **Antenna** | Vertical |

PK

AV

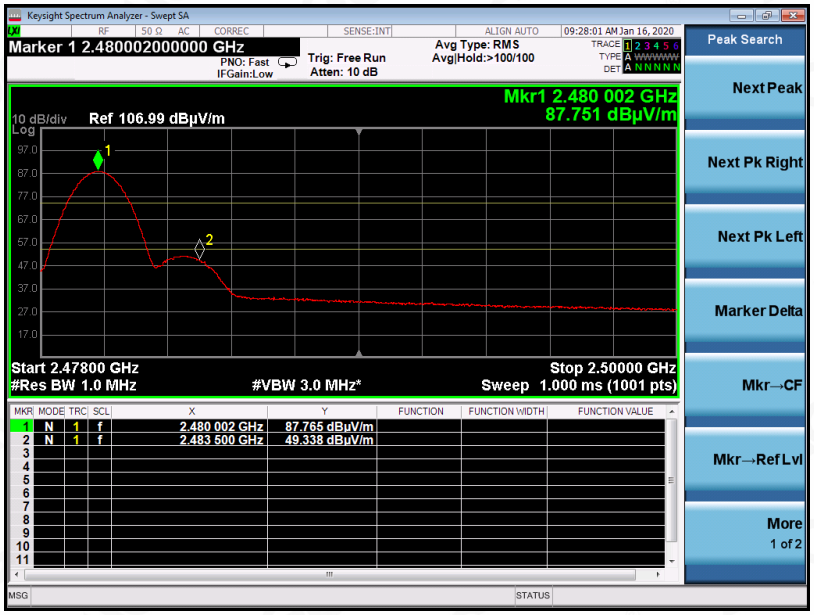



**RESULT: PASS**

| | | | |
|---|---|---|---|
| **EUT** | TWS Earphones | **Model Name** | T100 |
| **Temperature** | 25℃ | **Relative Humidity** | 55.4% |
| **Pressure** | 960hPa | **Test Voltage** | Normal Voltage |
| **Test Mode** | Mode 3 | **Antenna** | Horizontal |

PK

AV

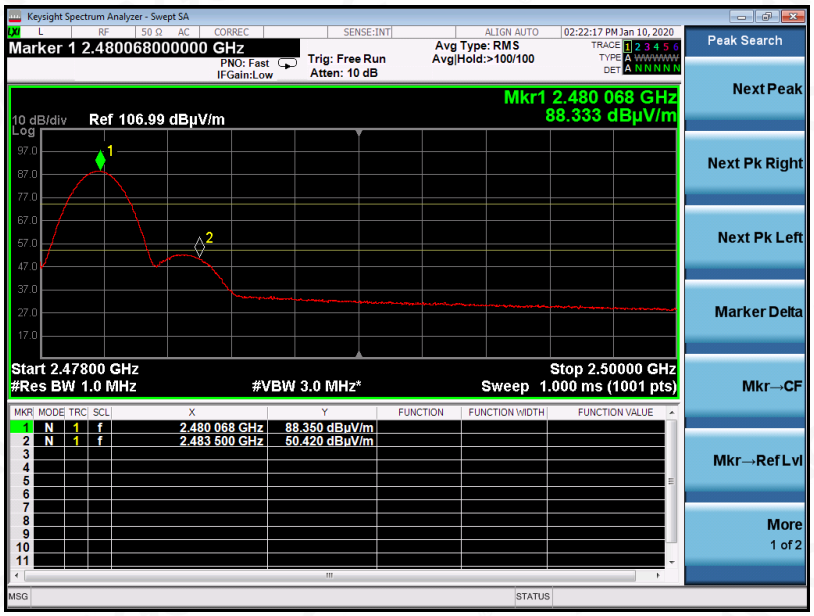



**RESULT: PASS**

| | | | |
|---|---|---|---|
| **EUT** | TWS Earphones | **Model Name** | T100 |
| **Temperature** | 25°C | **Relative Humidity** | 55.4% |
| **Pressure** | 960hPa | **Test Voltage** | Normal Voltage |
| **Test Mode** | Mode 3 | **Antenna** | Vertical |

PK

AV




**RESULT: PASS**

**Note**: The factor had been edited in the "Input Correction" of the Spectrum Analyzer. So the Amplitude of test plots is equal to Reading level plus the Factor in dB. Use the A dB(µV) to represent the Amplitude. Use the F dB(µV/m) to represent the Field Strength. So A=F. All test modes had been pre-tested. The GFSK modulation is the worst case and recorded in the report.

# 11. NUMBER OF HOPPING FREQUENCY

## 11.1. MEASUREMENT PROCEDURE

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

1. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
2. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
3. VBW ≥ RBW. Sweep: Auto. Detector function: Peak. Trace: Max hold.
4. Allow the trace to stabilize.

## 11.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

Same as described in section 8.2

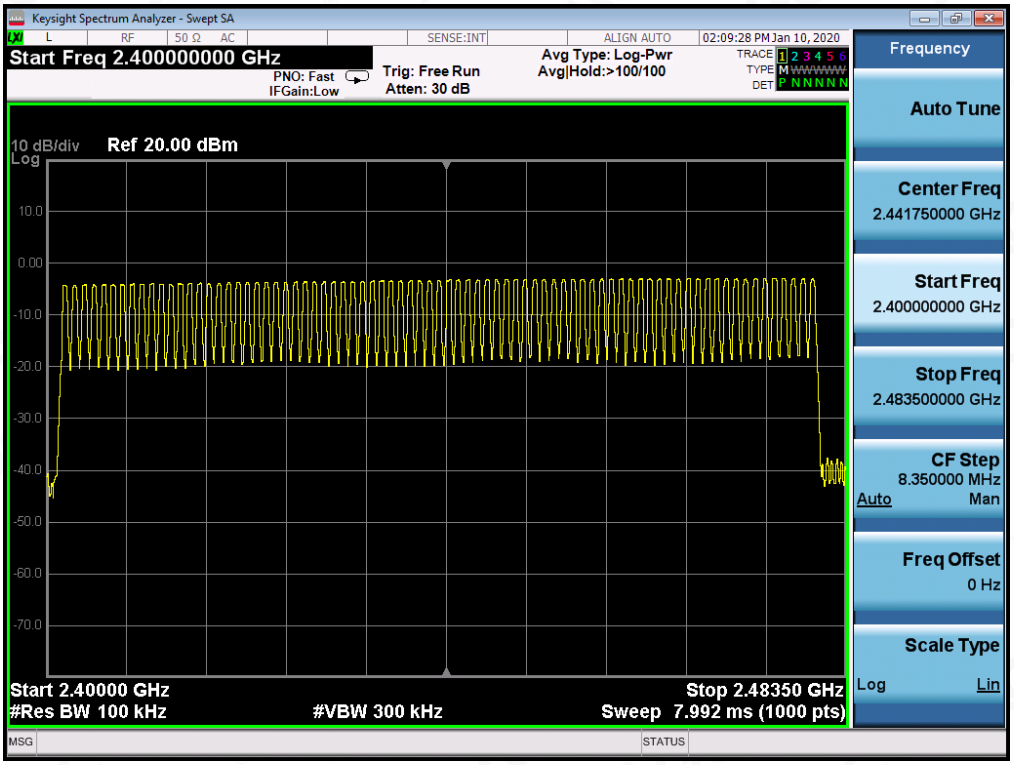
## 11.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

## 11.4. LIMITS AND MEASUREMENT RESULT

| TOTAL NO. OF HOPPING CHANNEL | LIMIT (NO. OF CH) | MEASUREMENT (NO. OF CH) | RESULT |
|---|---|---|---|
| | >=15 | 79 | PASS |

TEST PLOT FOR NO. OF TOTAL CHANNELS




Note: The GFSK modulation is the worst case and recorded in the report.

# 12. TIME OF OCCUPANCY (DWELL TIME)

## 12.1. MEASUREMENT PROCEDURE

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

1. Span: Zero span, centered on a hopping channel.
2. RBW shall be≤channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
3. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
4. Detector function: Peak. Trace: Max hold.
5. Use the marker-delta function to determine the transmit time per hop.
6. Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:
   (Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer) × (period specified in the requirements / analyzer sweep time)
7. The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements.

## 12.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION)

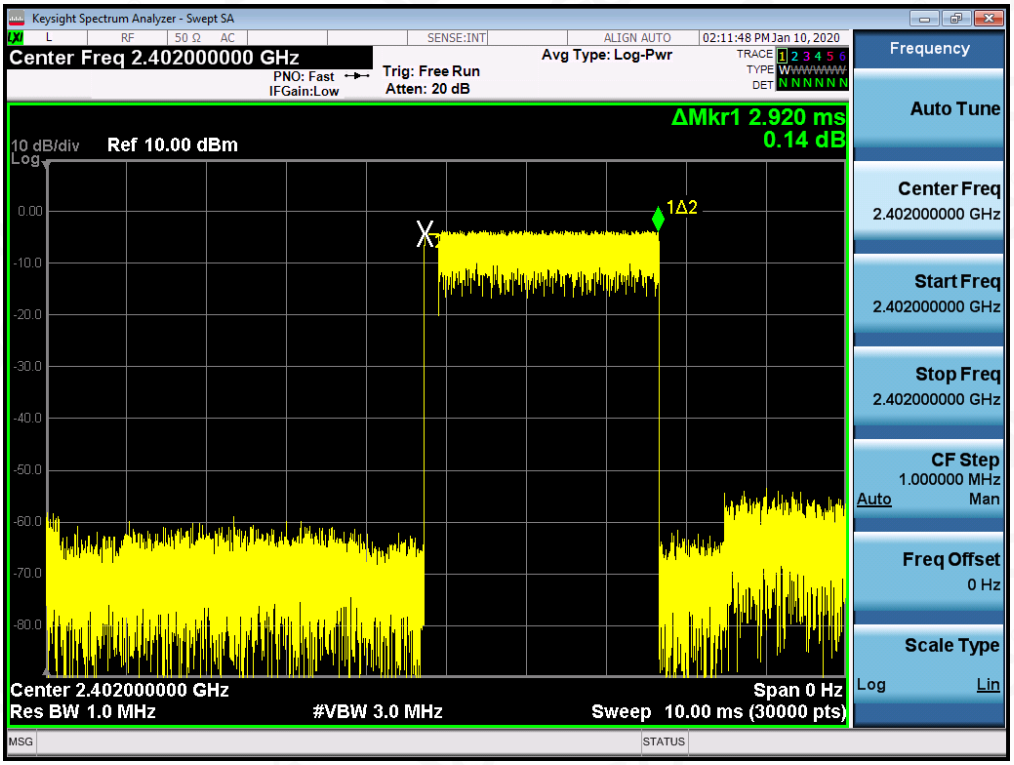
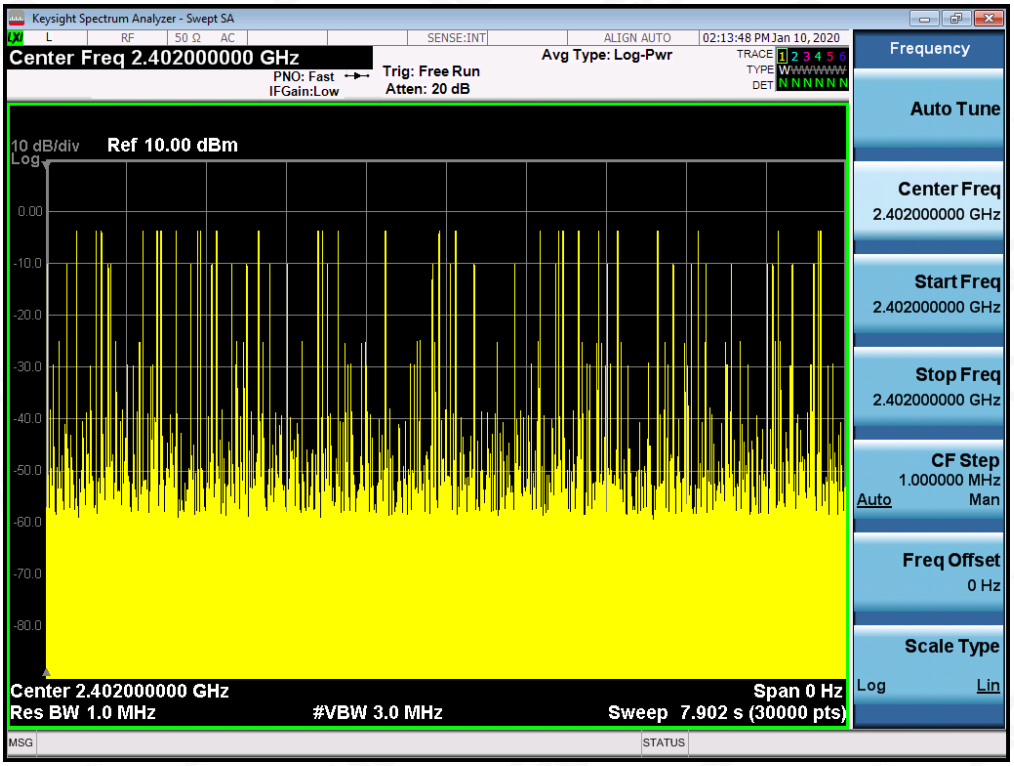
Same as described in section 8.2

## 12.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

## 12.4. LIMITS AND MEASUREMENT RESULT

| Channel | Time of Pulse for DH5 (ms) | Number of hops in the period specified in the requirements | Sweep Time (ms) | Limit (ms) |
|---|---|---|---|---|
| Low | 2.920 | 27*4 | 315.36 | 400 |
| Middle | 2.917 | 26*4 | 303.37 | 400 |
| High | 2.923 | 30*4 | 350.76 | 400 |

Note: The 8-DPSK modulation is the worst case and recorded in the report.

TEST PLOT OF LOW CHANNEL