FCC Test Report

Report No.: AGC00806200103FE03

FCC ID	:	2AVTOTWS80
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	TWS Earbud
BRAND NAME	:	N/A
MODEL NAME	:	TWS80, EB5543
APPLICANT	:	Star Technology Industrial Co., Limited
DATE OF ISSUE	:	Mar. 09, 2020
STANDARD(S)	:	FCC Part 15.247
REPORT VERSION	:	V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd

CAUTION:
This report shall not be reproduced except in full without the written permission of the test laboratory and shall not be quoted out of context.

REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Mar. 09, 2020	Valid	Initial Release

TABLE OF CONTENTS

1. VERIFICATION OF CONFORMITY 5

2. GENERAL INFORMATION 6

2.1. PRODUCT DESCRIPTION 6
2.2. TABLE OF CARRIER FREQUENCYS 6
2.3. RECEIVER INPUT BANDWIDTH 7
2.4. EXAMPLE OF A HOPPING SEQUENCY IN DATA MODE 7
2.5. EQUALLY AVERAGE USE OF FREQUENCIES AND BEHAVIOUR 7
2.6. RELATED SUBMITTAL(S) / GRANT (S) 8
2.7. TEST METHODOLOGY 8
2.8. SPECIAL ACCESSORIES 8
2.9. EQUIPMENT MODIFICATIONS 8

3. MEASUREMENT UNCERTAINTY 9

4. DESCRIPTION OF TEST MODES 10

5. SYSTEM TEST CONFIGURATION 11

5.1. CONFIGURATION OF EUT SYSTEM 11
5.2 EQUIPMENT USED IN TESTED SYSTEM 11
5.3. SUMMARY OF TEST RESULTS 11

6. TEST FACILITY 12

7. PEAK OUTPUT POWER 13

7.1. MEASUREMENT PROCEDURE 13
7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 13
7.3. LIMITS AND MEASUREMENT RESULT 14

8. 20DB BANDWIDTH 18

8.1. MEASUREMENT PROCEDURE 18
8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 18
8.3. LIMITS AND MEASUREMENT RESULTS 18

9. CONDUCTED SPURIOUS EMISSION 23

9.1. MEASUREMENT PROCEDURE 23
9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 23
9.3. MEASUREMENT EQUIPMENT USED 23

9.4. LIMITS AND MEASUREMENT RESULT 23

10. RADIATED EMISSION 31

10.1. MEASUREMENT PROCEDURE 31
10.2. TEST SETUP 33
10.3. LIMITS AND MEASUREMENT RESULT 34
10.4. TEST RESULT 34

11. NUMBER OF HOPPING FREQUENCY 44

11.1. MEASUREMENT PROCEDURE 44
11.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION) 44
11.3. MEASUREMENT EQUIPMENT USED 44
11.4. LIMITS AND MEASUREMENT RESULT 44

12. TIME OF OCCUPANCY (DWELL TIME) 45

12.1. MEASUREMENT PROCEDURE 45
12.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION) 45
12.3. MEASUREMENT EQUIPMENT USED 45
12.4. LIMITS AND MEASUREMENT RESULT 45

13. FREQUENCY SEPARATION 49

13.1. MEASUREMENT PROCEDURE 49
13.2. TEST SETUP (BLOCK DIAGRAM OF CONFIGURATION) 49
13.3. MEASUREMENT EQUIPMENT USED 49
13.4. LIMITS AND MEASUREMENT RESULT 49

APPENDIX A: PHOTOGRAPHS OF TEST SETUP 50

APPENDIX B: PHOTOGRAPHS OF EUT 52

1. VERIFICATION OF CONFORMITY

Applicant	Star Technology Industrial Co., Limited
Address	ROOM 1102, BLOCK 1 ST, YI LUAN BUILDING, XIXIANG ROAD 230, BAOAN DISTRICT, SHENZHEN CHINA
Manufacturer	Star Technology Industrial Co., Limited
Address	ROOM 1102, BLOCK 1 ST, YI LUAN BUILDING, XIXIANG ROAD 230, BAOAN DISTRICT, SHENZHEN CHINA
Factory	Star Technology Industrial Co., Limited
Address	ROOM 1102, BLOCK 1 ST, YI LUAN BUILDING, XIXIANG ROAD 230, BAOAN DISTRICT, SHENZHEN CHINA
Product Designation	TWS Earbud
Brand Name	N/A
Test Model	TWS80
Series Model	EB5543
Difference Description	All the same except for the model name
Date of test	Jan. 16, 2020 to Jan. 19, 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	Thea Huang (Project Engineer)	Jan. 19, 2020
Reviewed By	Max Zhang (Reviewer)	Mar. 09, 2020
Approved By	Forrest Lei (Authorized Officer)	Mar. 09, 2020

2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as “TWS Earbud”. 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	-0.946dBm(Max)
Bluetooth Version	V 5.0
Modulation	BR ☒GFSK, EDR ☒π /4-DQPSK, ☐8DPSK BLE ☐GFSK 1Mbps ☐GFSK 2Mbps
Number of channels	79
Hardware Version	V1.2
Software Version	V1.0
Antenna Designation	Integral Antenna(Comply with requirements of the FCC part 15.203)
Antenna Gain	0dBi
Power Supply	DC 3.7V by battery

Note: The left earphone and right earphone are the same. Both of them had been tested and only the right earphone was the worst case recorded in the 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: 2AVTOTWS80** 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_1.0.1.2 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 Specification	Remark
1	TWS Earbud	TWS80	2AVTOTWS80	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. 11, 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	Sep. 09, 2019	Sep. 08, 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

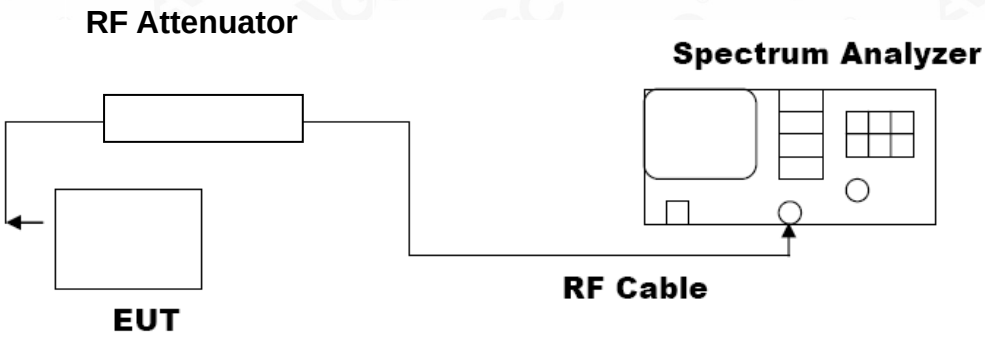
For peak power test:

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

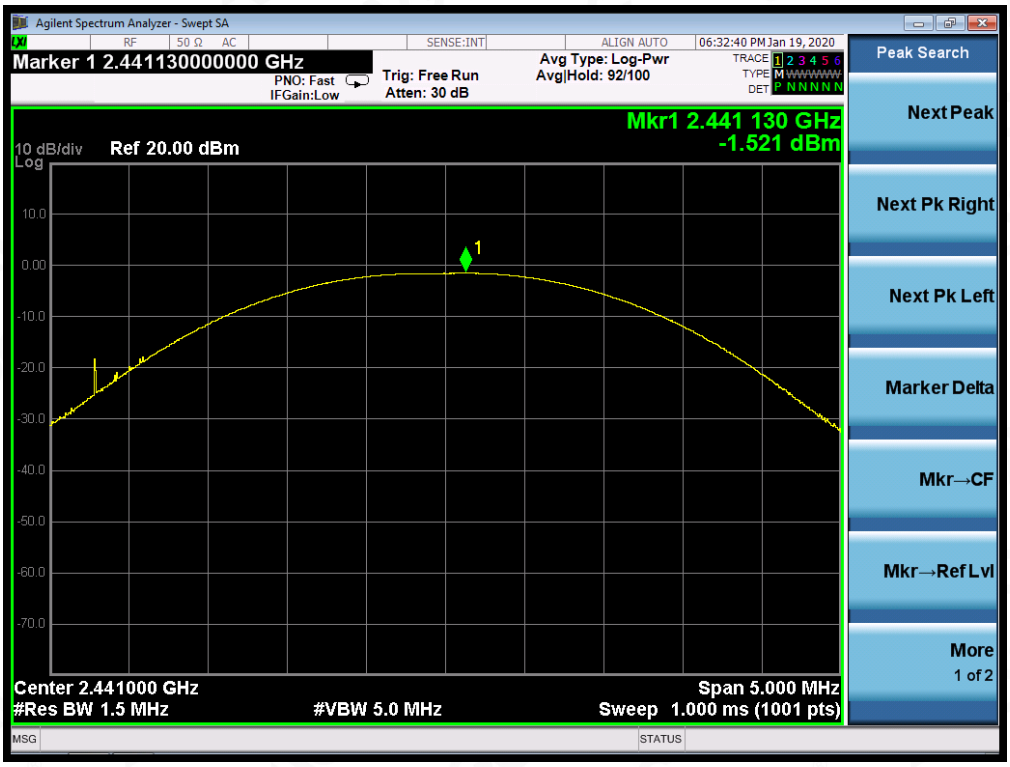


7.3. LIMITS AND MEASUREMENT RESULT

PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION			
Frequency (GHz)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.402	-1.829	30	Pass
2.441	-1.521	30	Pass
2.480	-1.754	30	Pass

CH0

CH39

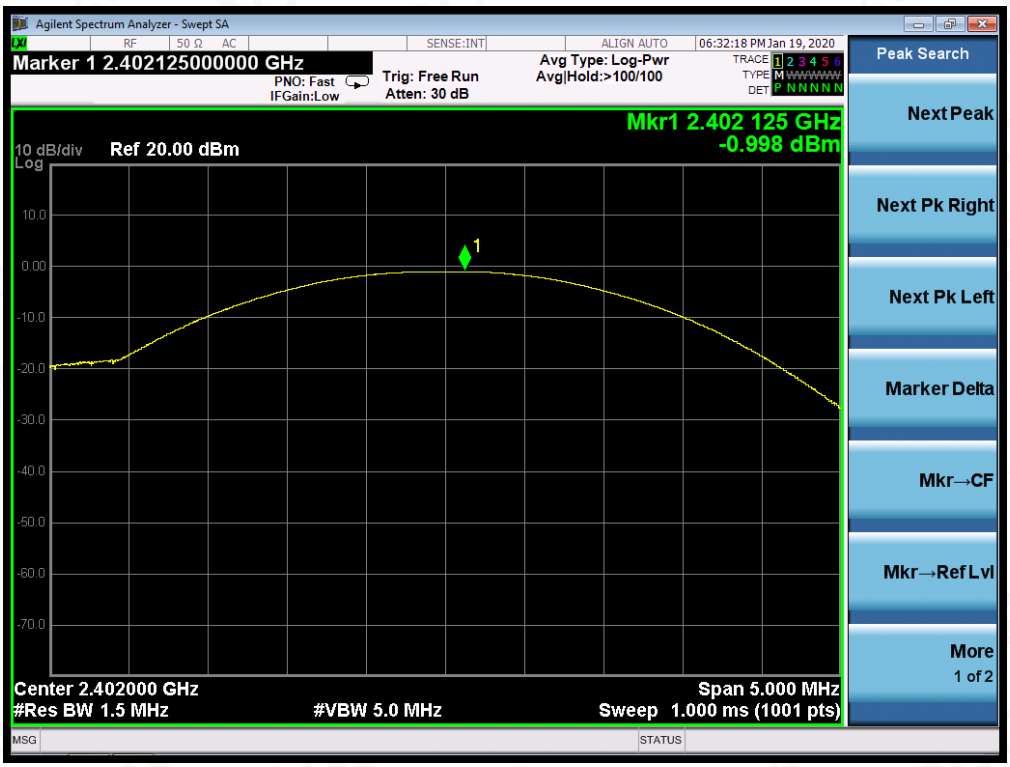

Agilent Spectrum Analyzer - Swept SA
Marker 1 2.441130000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 92/100
06:32:40 PM Jan 19, 2020
Mkr1 2.441 130 GHz
-1.521 dBm
10 dB/div
Ref 20.00 dBm
Log
Center 2.441000 GHz
#Res BW 1.5 MHz
#VBW 5.0 MHz
Span 5.000 MHz
Sweep 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

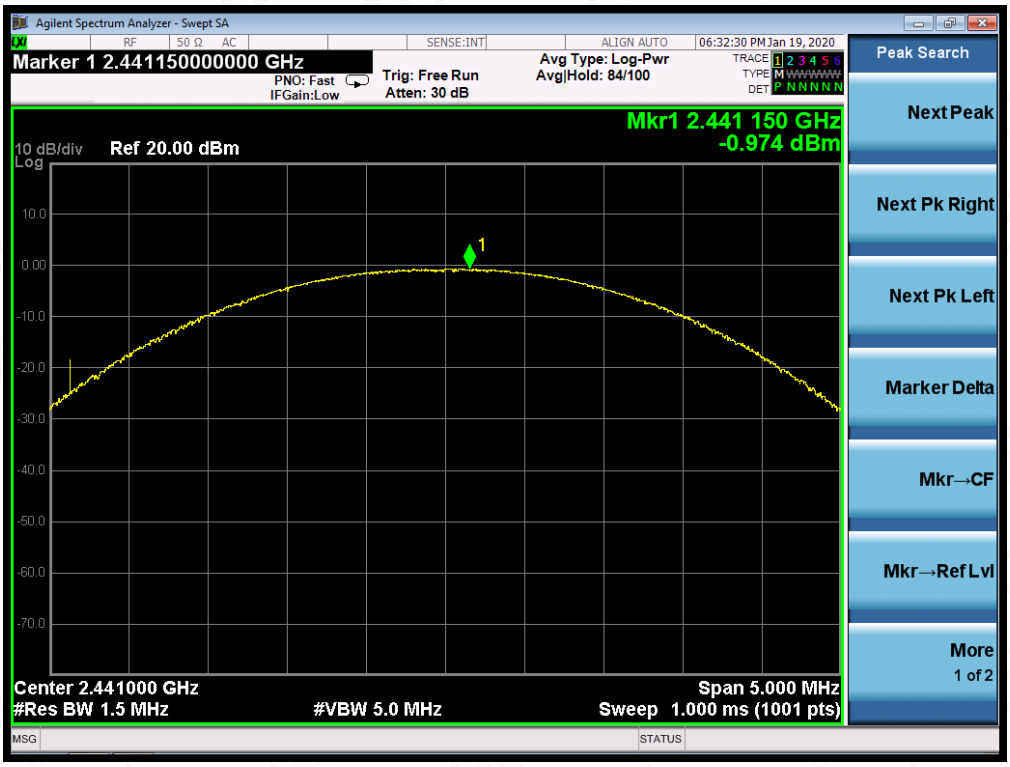
Agilent Spectrum Analyzer - Swept SA
Marker 1 2.480110000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
06:34:43 PM Jan 19, 2020
Mkr1 2.480 110 GHz
-1.754 dBm
10 dB/div
Ref 20.00 dBm
Log
Center 2.480000 GHz
#Res BW 1.5 MHz
#VBW 5.0 MHz
Span 5.000 MHz
Sweep 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	-0.998	30	Pass
2.441	-0.974	30	Pass
2.480	-0.946	30	Pass

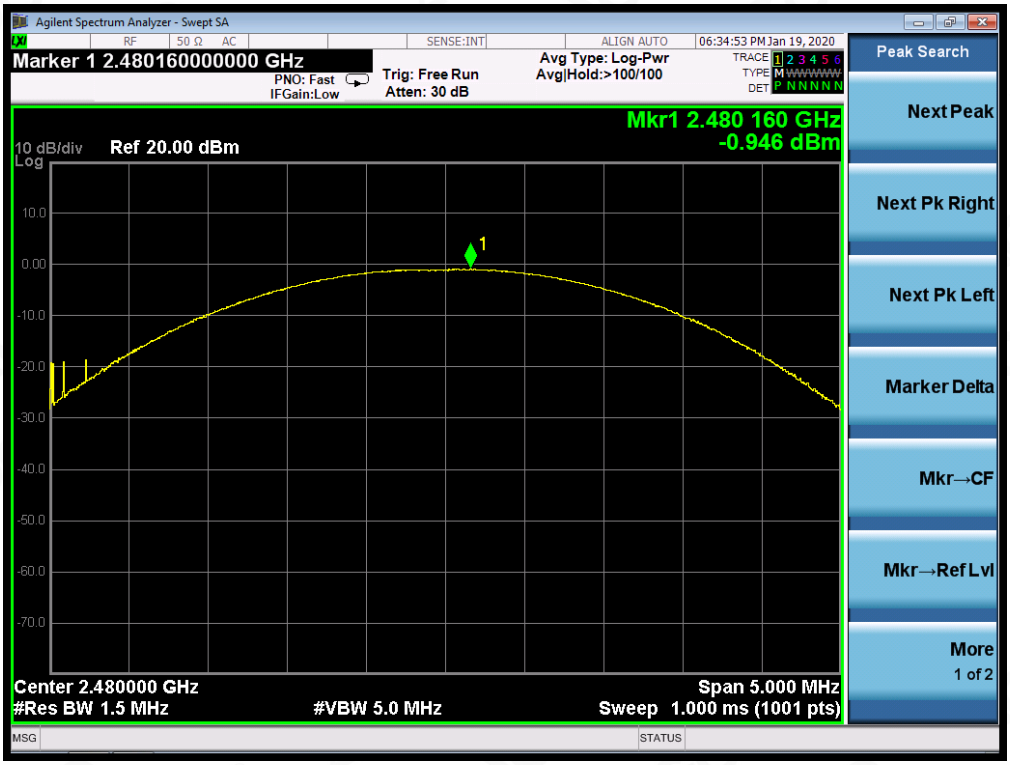
CH0



CH39


Agilent Spectrum Analyzer - Swept SA
Marker 1 2.441150000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold: 84/100
06:32:30 PM Jan 19, 2020
Mkr1 2.441 150 GHz
-0.974 dBm
10 dB/div
Ref 20.00 dBm
Log
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

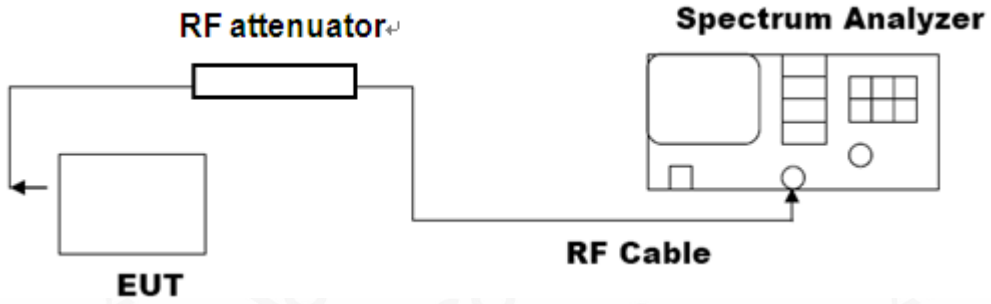

Agilent Spectrum Analyzer - Swept SA
Marker 1 2.480160000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
06:34:53 PM Jan 19, 2020
Mkr1 2.480 160 GHz
-0.946 dBm
10 dB/div
Ref 20.00 dBm
Log
Center 2.480000 GHz
#Res BW 1.5 MHz
#VBW 5.0 MHz
Span 5.000 MHz
Sweep 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.

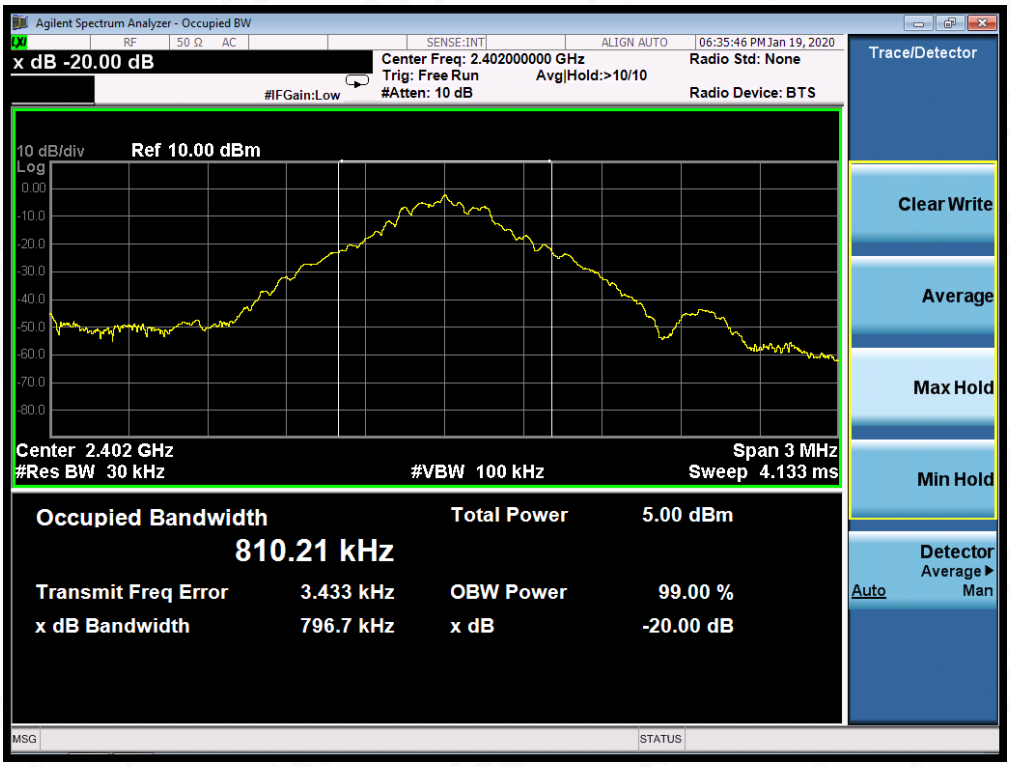
8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



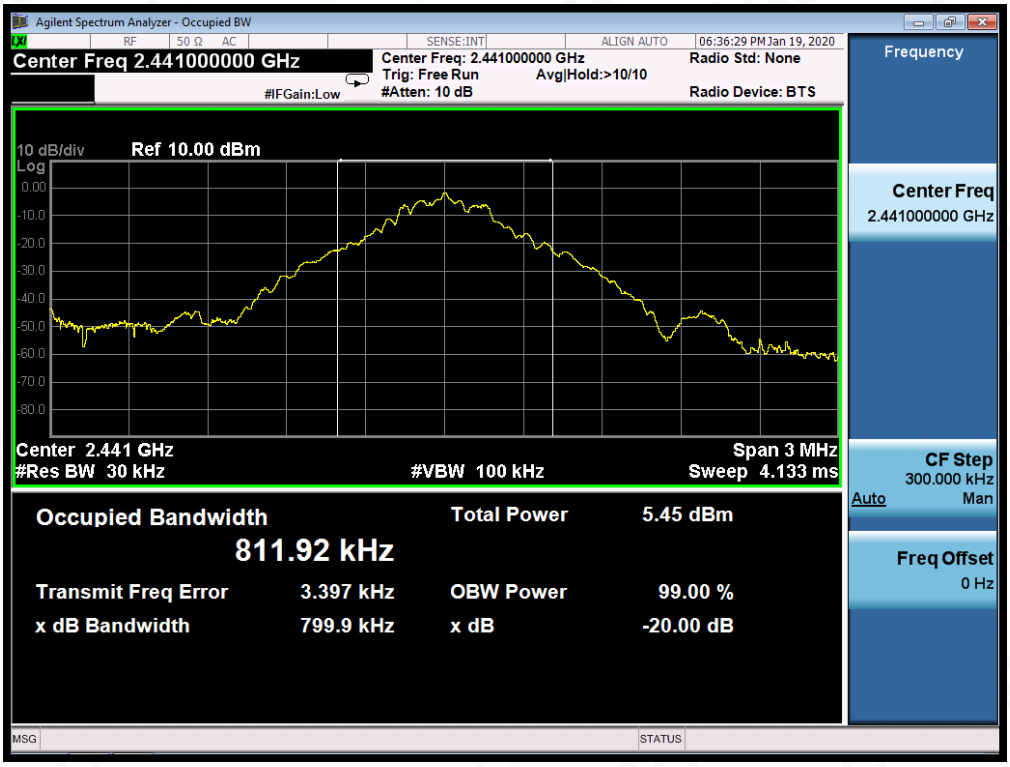
8.3. LIMITS AND MEASUREMENT RESULTS

MEASUREMENT RESULT FOR GFSK MOUDULATION			
Applicable Limits	Measurement Result		
	Test Data (MHz)		Criteria
N/A	Low Channel	0.7967	PASS
	Middle Channel	0.7999	PASS
	High Channel	0.7988	PASS

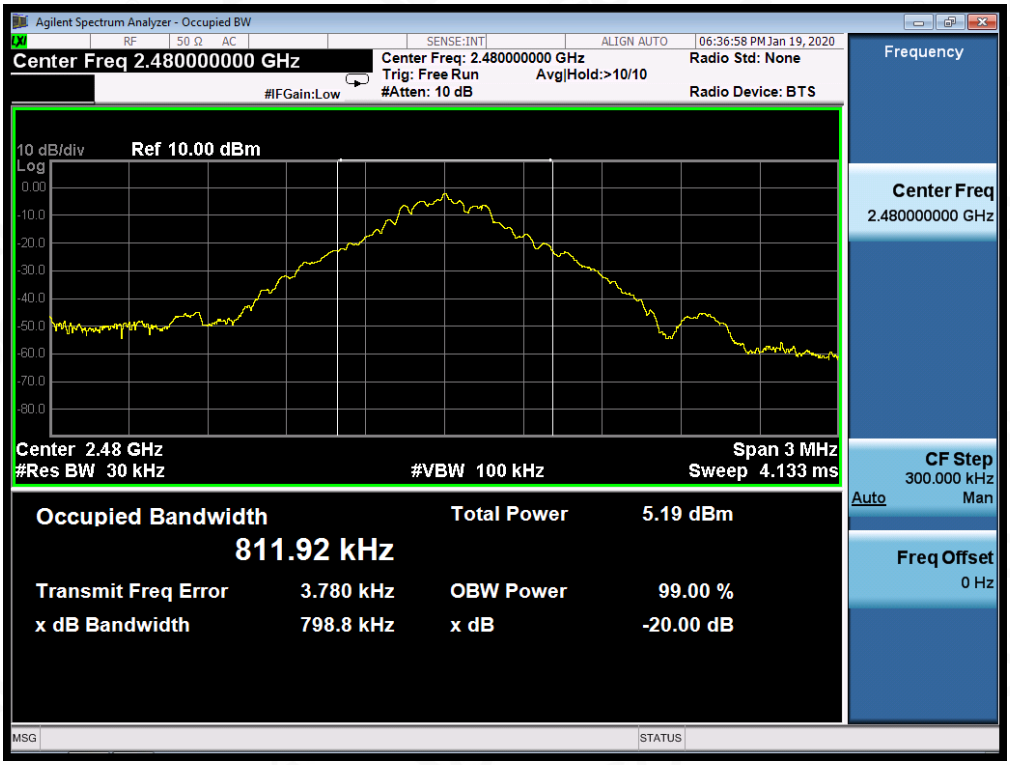
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

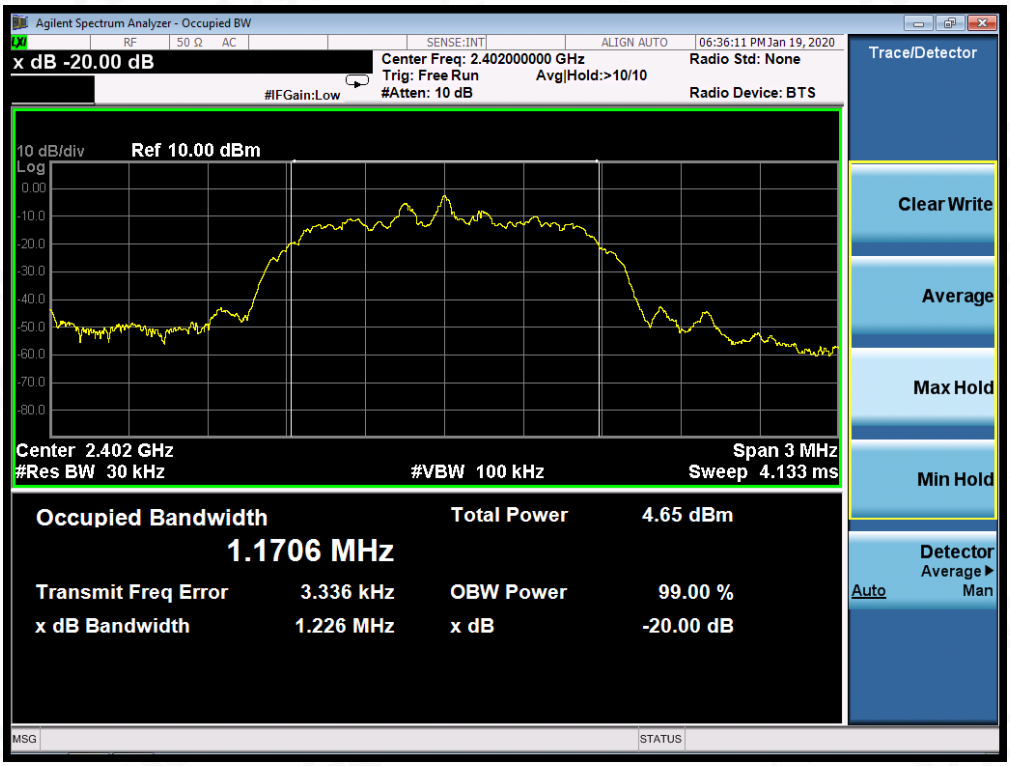


TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL

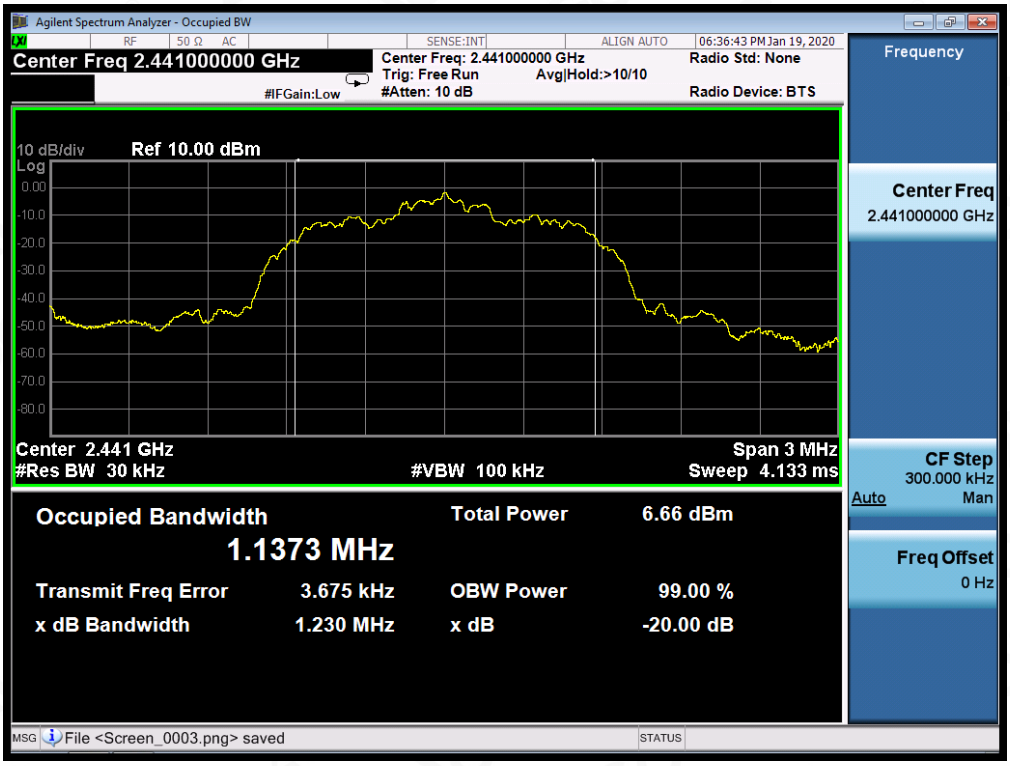


MEASUREMENT RESULT FOR Π /4-DQPSK MODULATION			
Applicable Limits	Measurement Result		
	Test Data (MHz)		Criteria
N/A	Low Channel	1.226	PASS
	Middle Channel	1.230	PASS
	High Channel	1.226	PASS

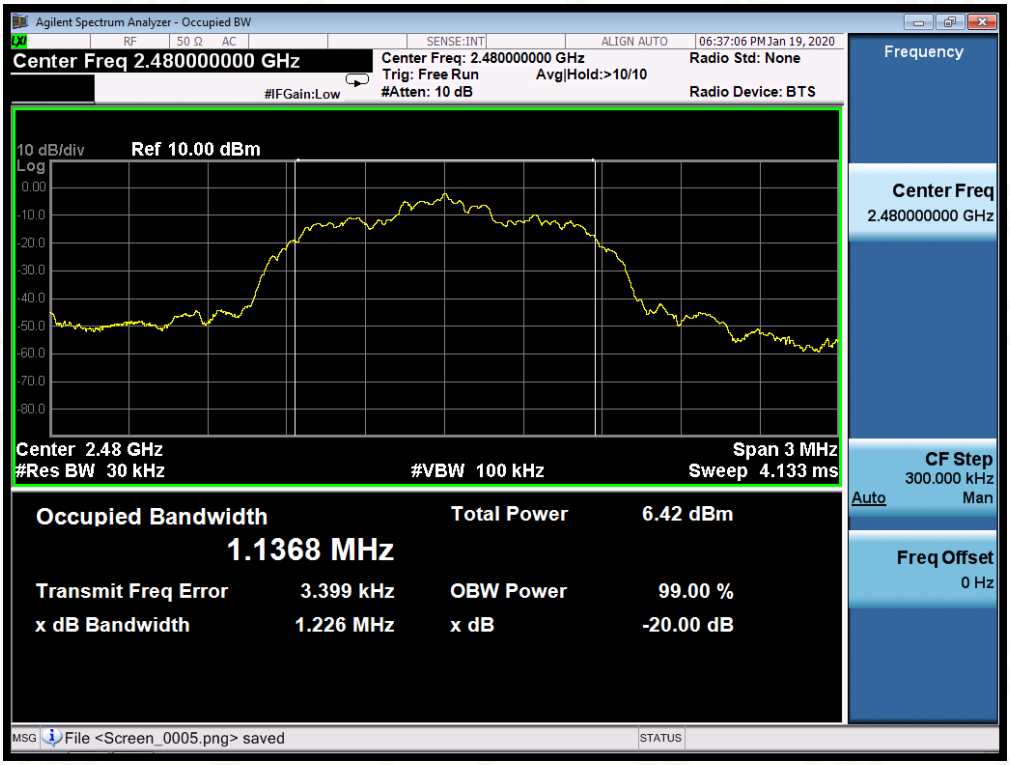
TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



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

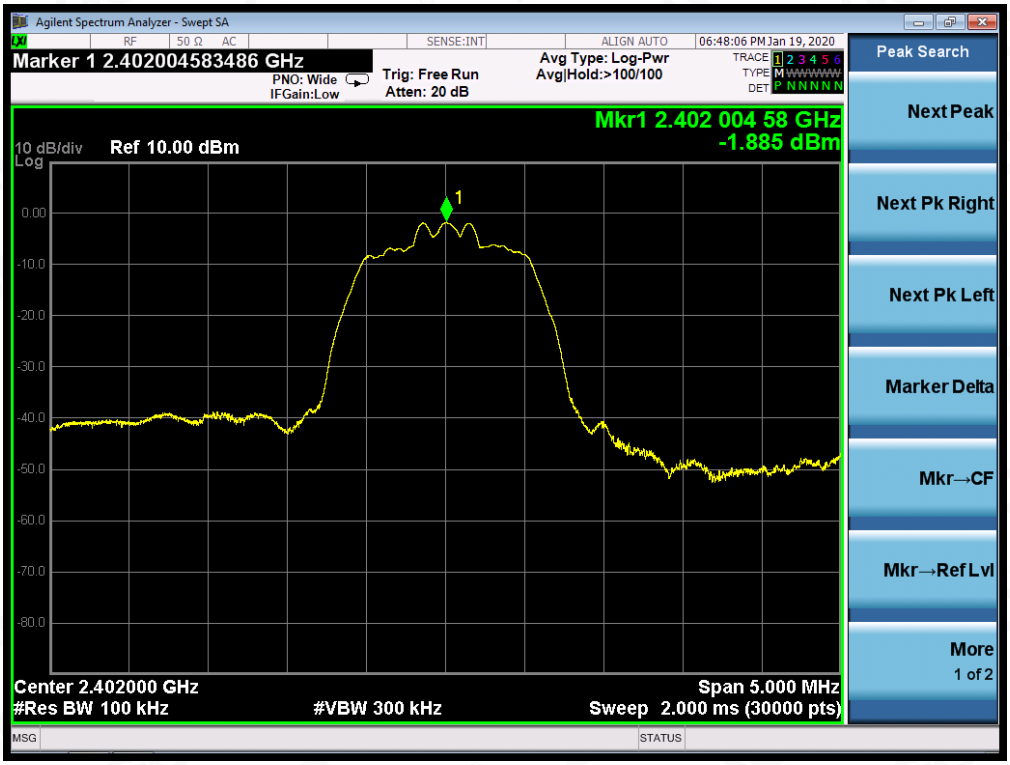
The same as described in section 6

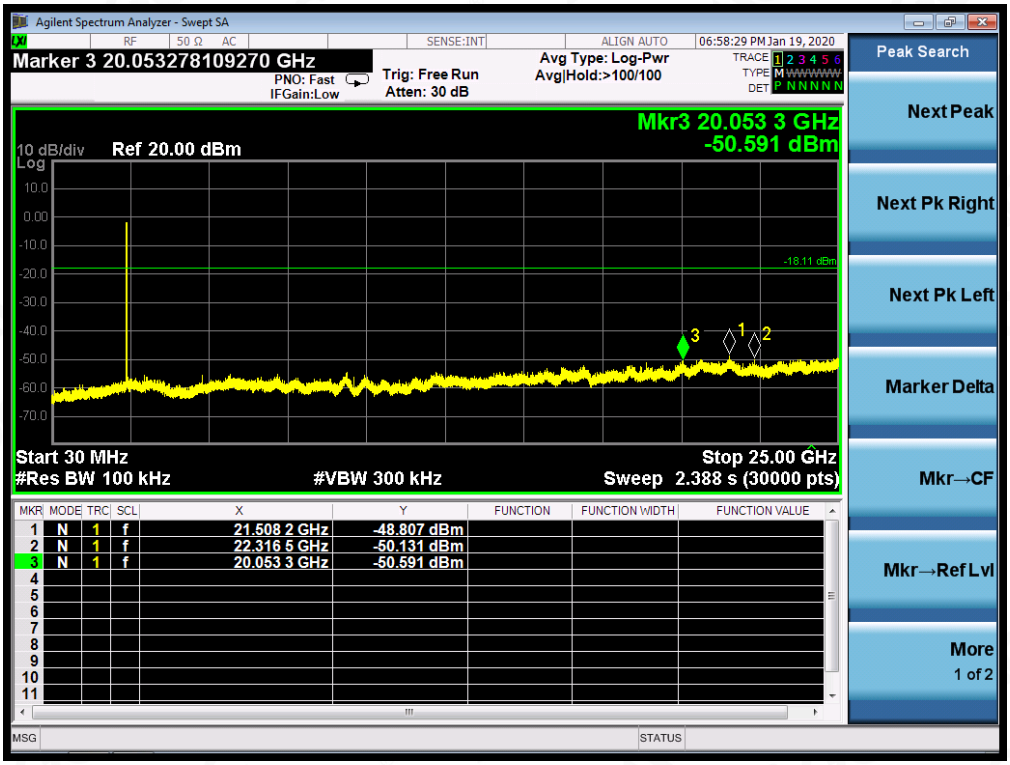
9.4. LIMITS AND MEASUREMENT RESULT

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. 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

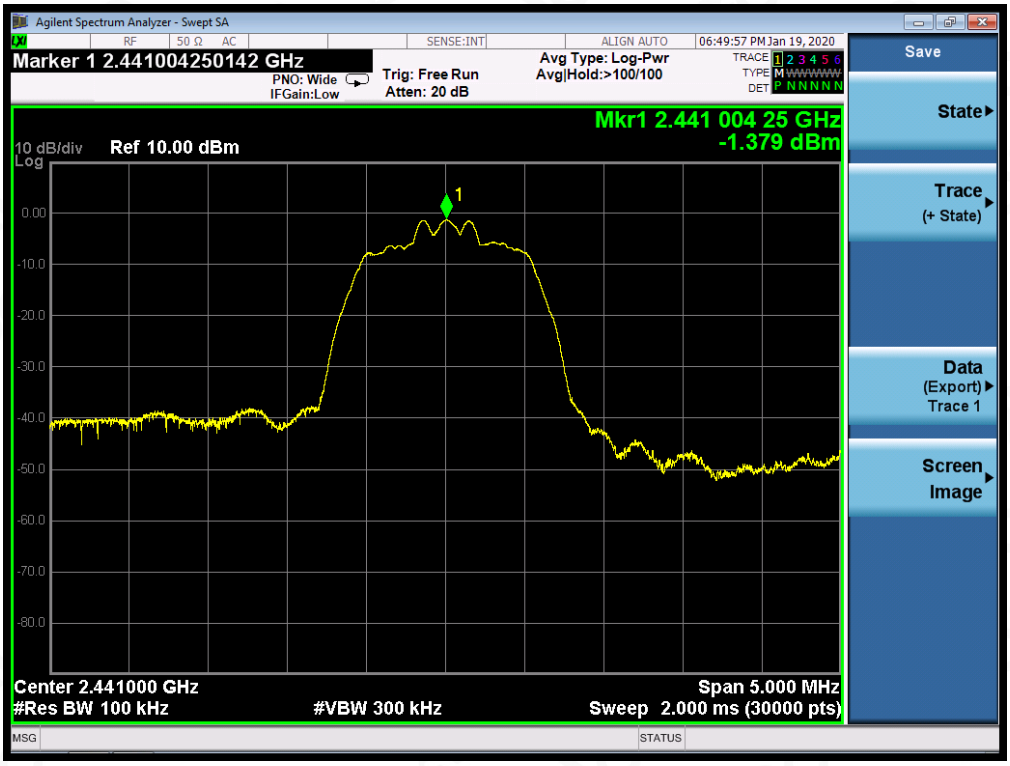
TEST RESULT FOR ENTIRE FREQUENCY RANGE

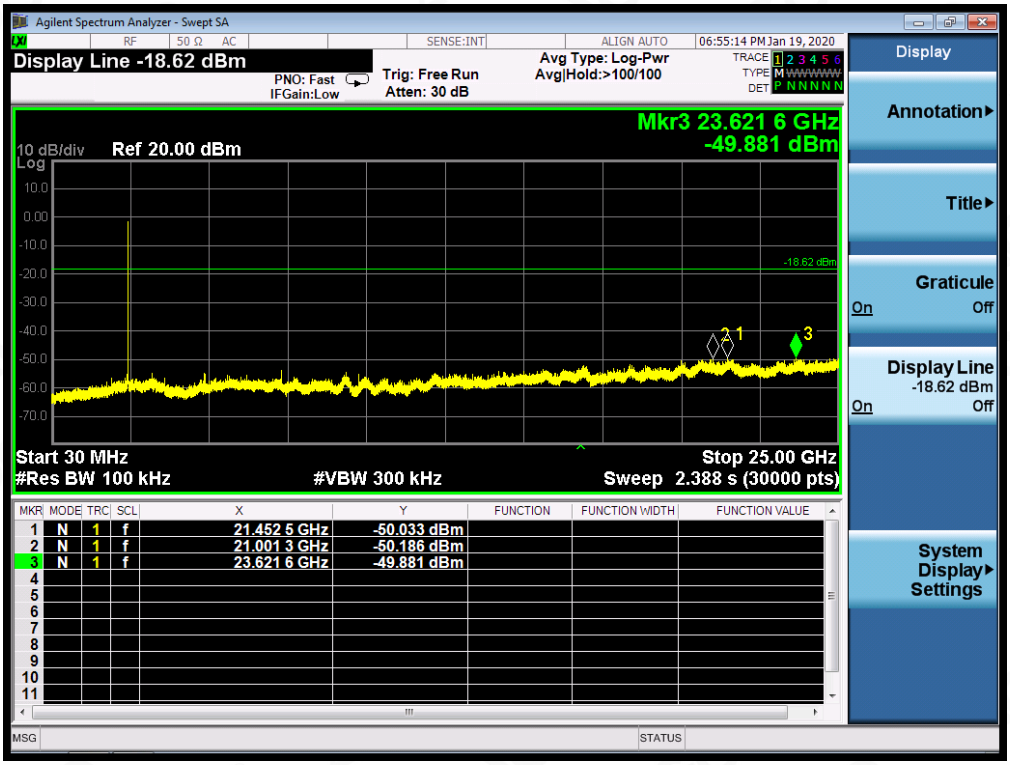
TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF π/4-DQPSK MODULATION IN LOW CHANNEL



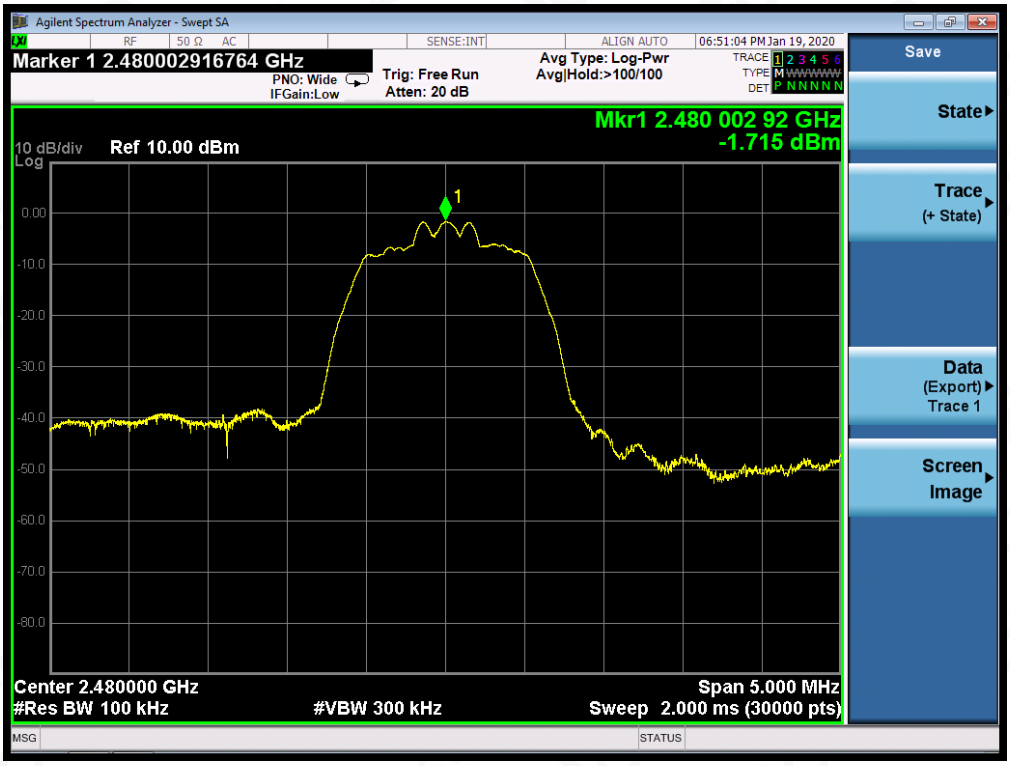


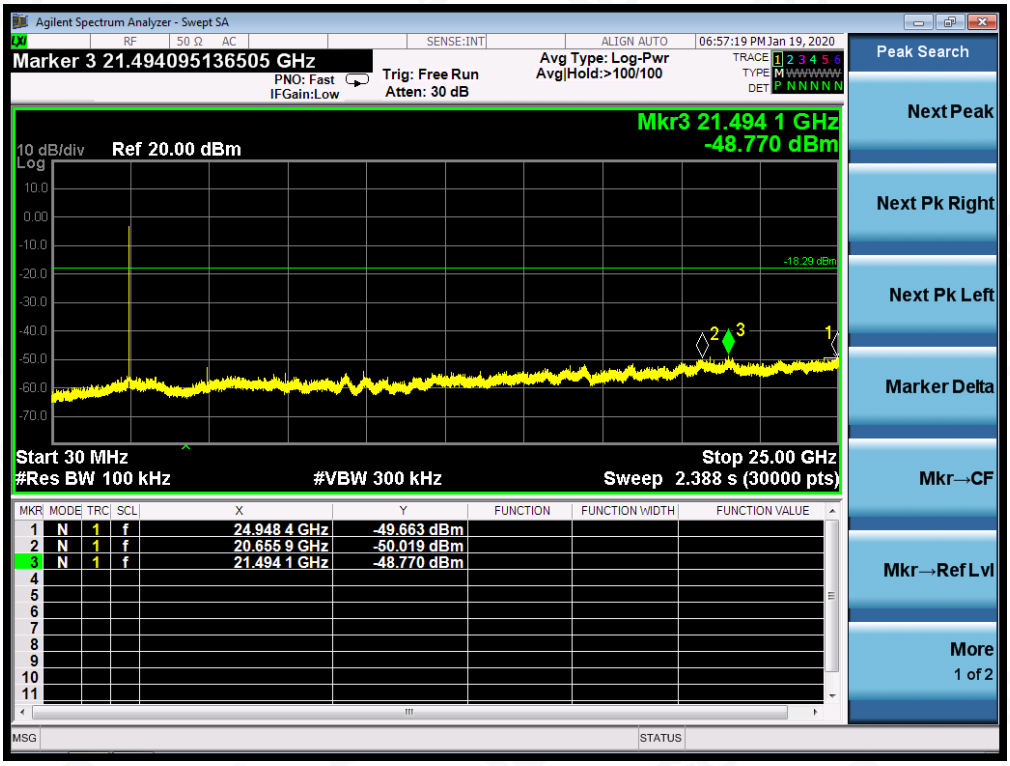
TEST PLOT OF OUT OF BAND EMISSIONS
OF π/4-DQPSK MODULATION IN MIDDLE CHANNEL





TEST PLOT OF OUT OF BAND EMISSIONS
OF π/4-DQPSK MODULATION IN HIGH CHANNEL





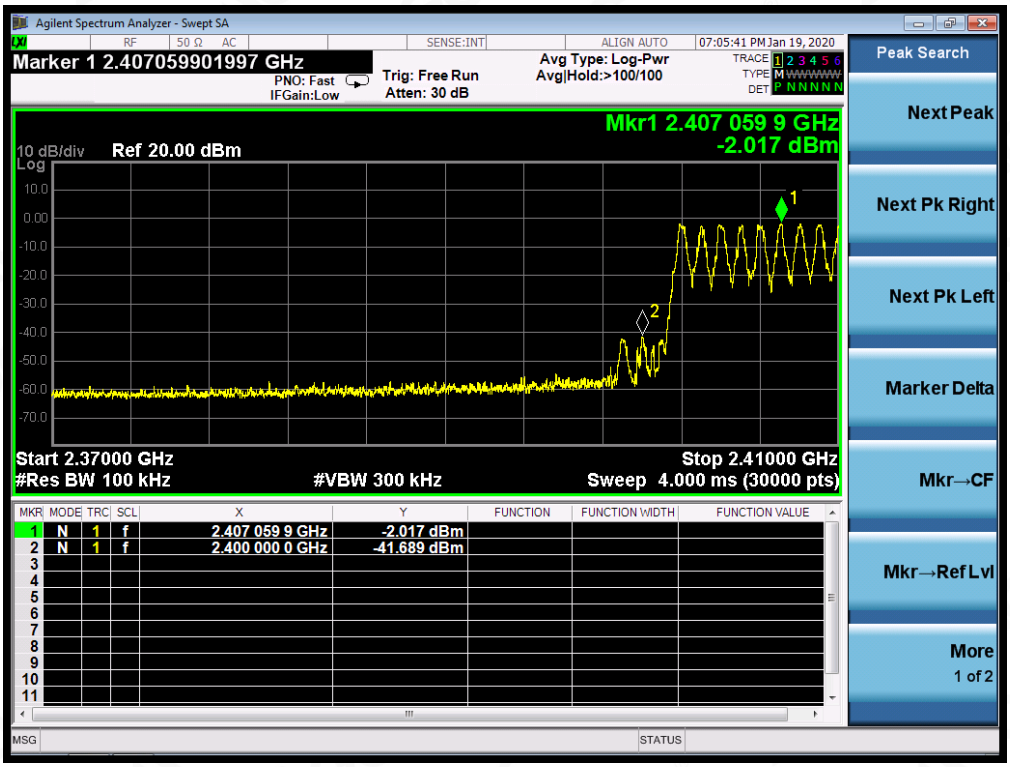
Note: The peak emissions without marker on the above plots are fundamental wave and need not to compare with the limit. The π/4-DQPSK modulation is the worst case and only those data recorded in the report.

TEST RESULT FOR BAND EDGE

GFSK MODULATION IN LOW CHANNEL

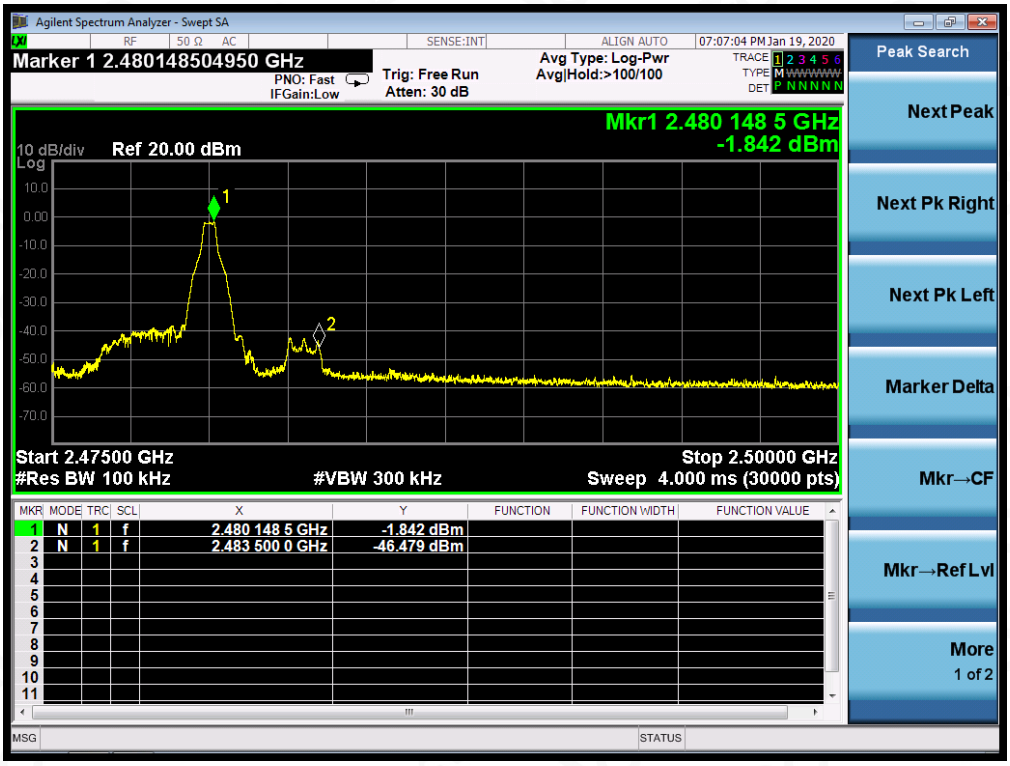
Hopping off

Hopping on

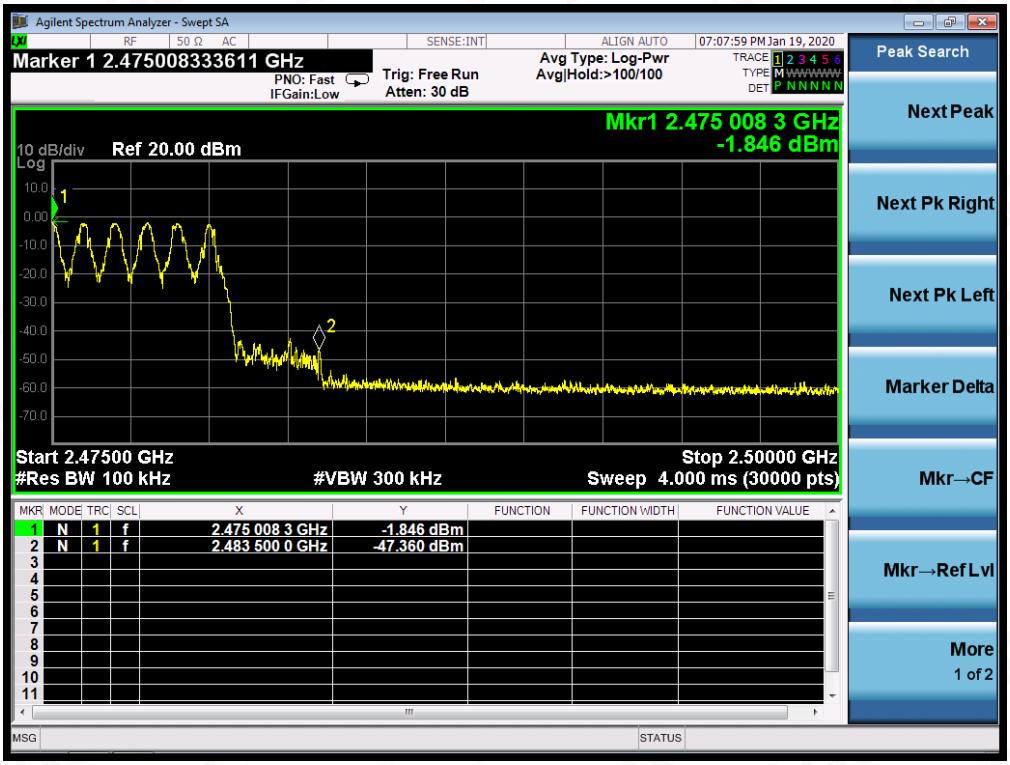


GFSK MODULATION IN HIGH CHANNEL

Hopping off

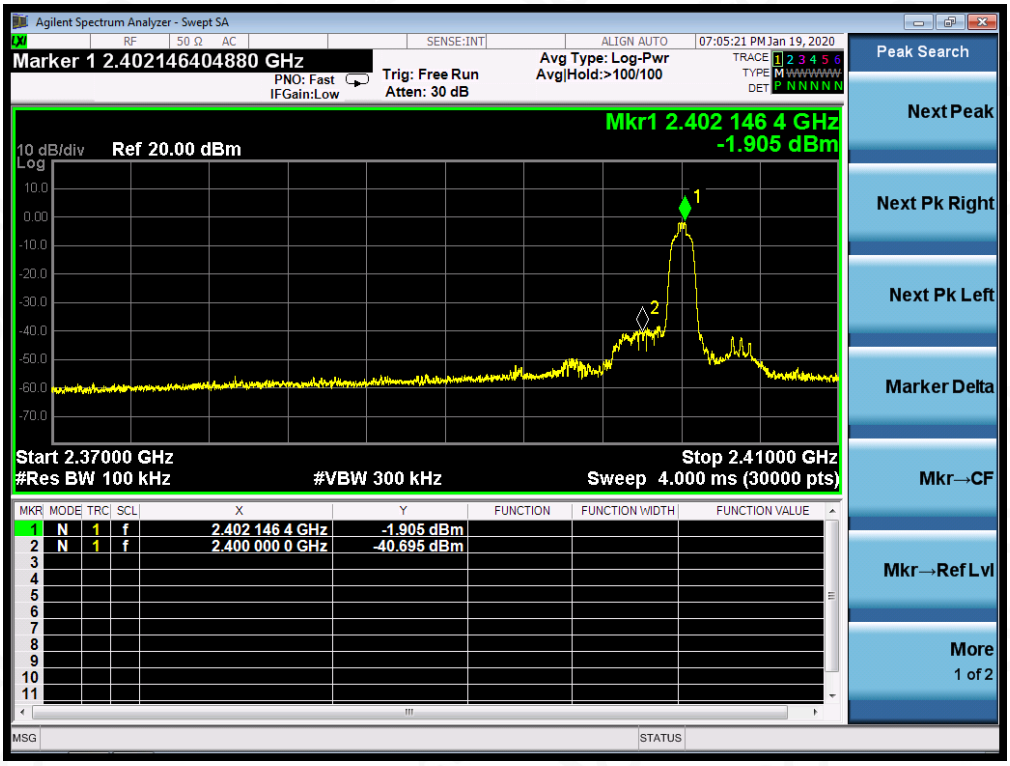


Hopping on

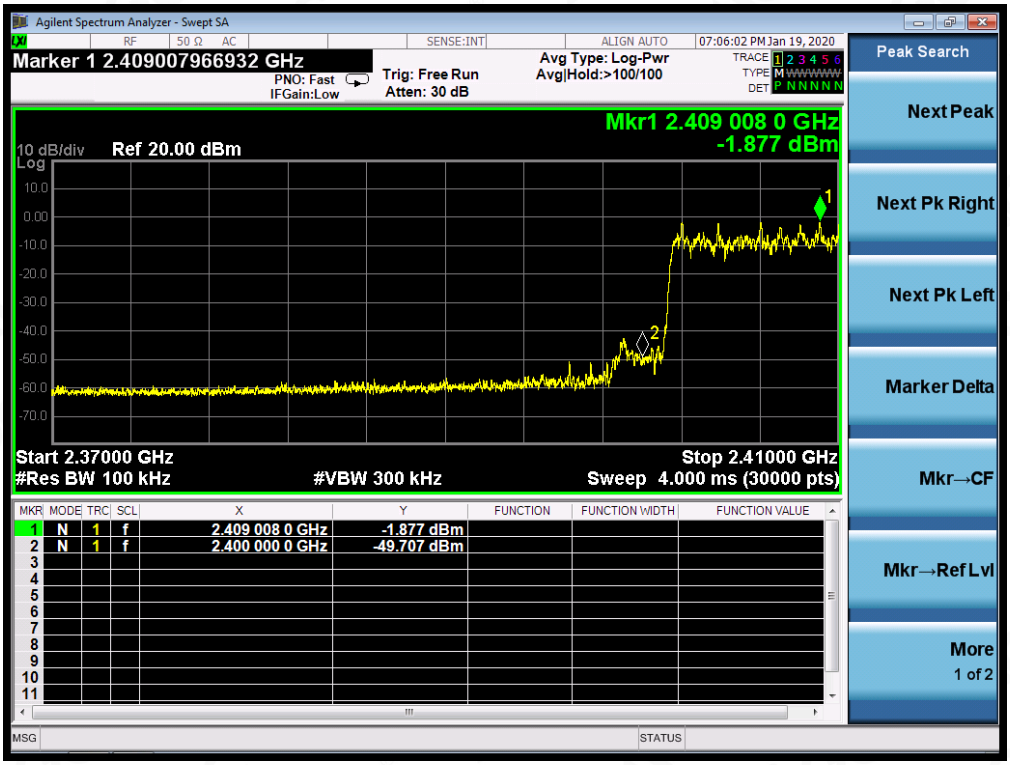


π /4-DQPSK MODULATION IN LOW CHANNEL

Hopping off

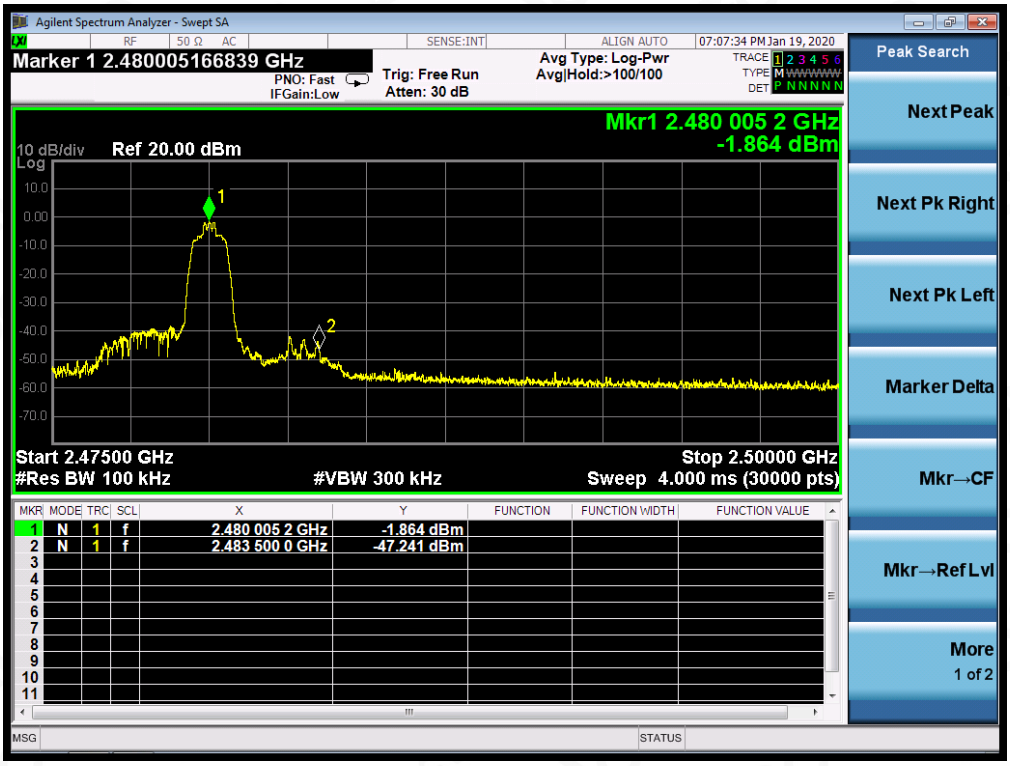


Hopping on

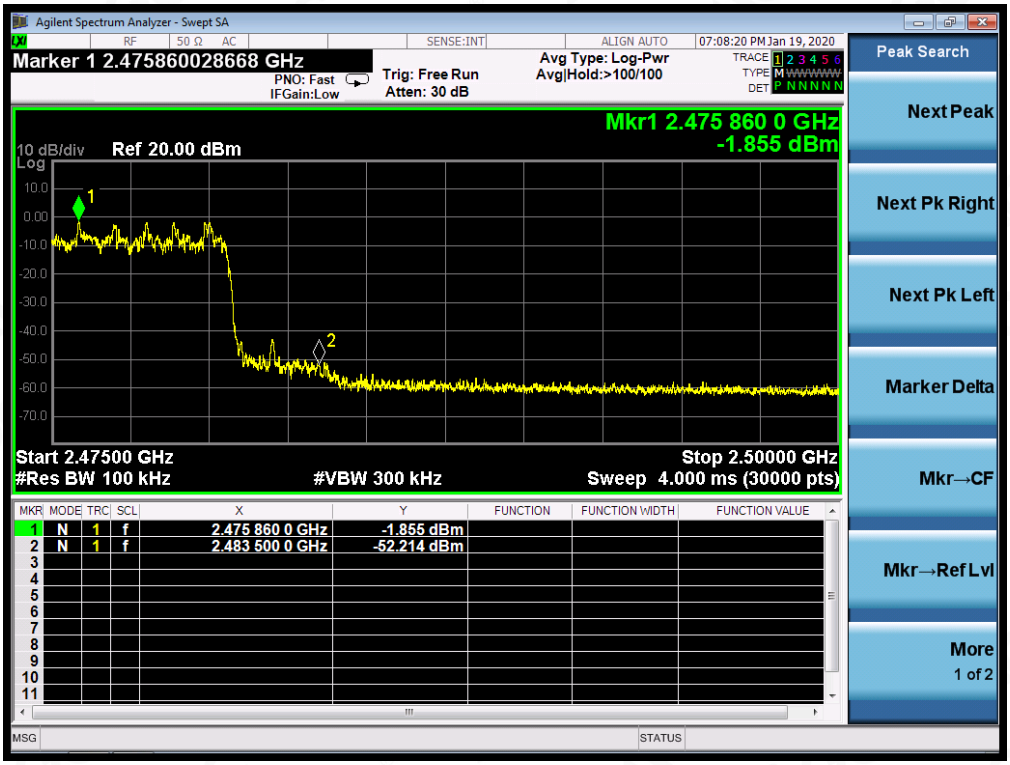


π /4-DQPSK MODULATION IN HIGH CHANNEL

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.

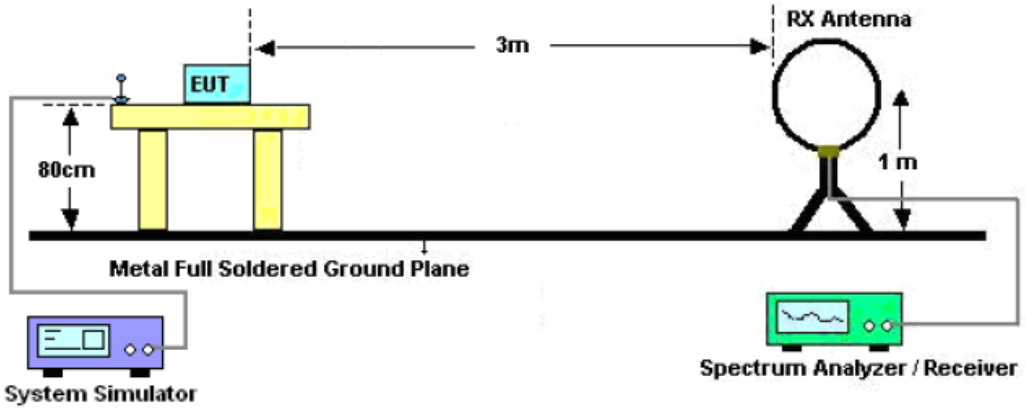
The following table is the setting of spectrum analyzer and receiver.

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 1MHz/3MHz for Peak, 1MHz/3MHz for Average

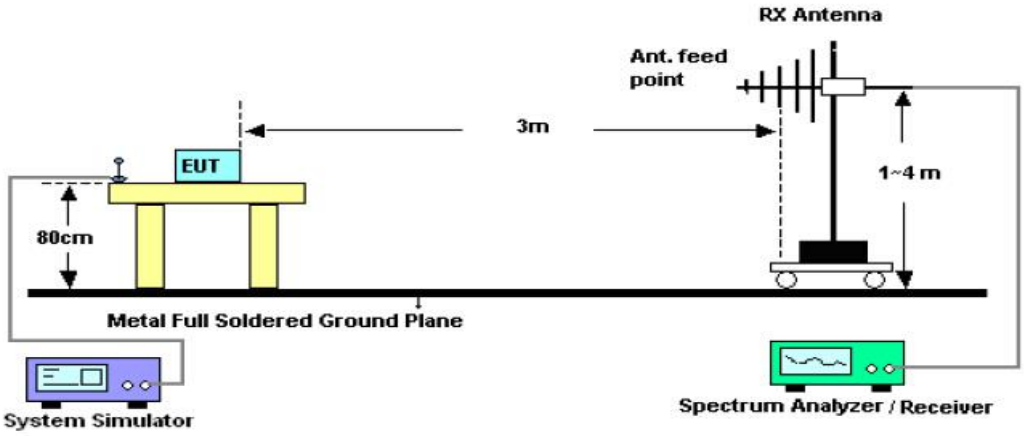
Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

10.2. TEST SETUP

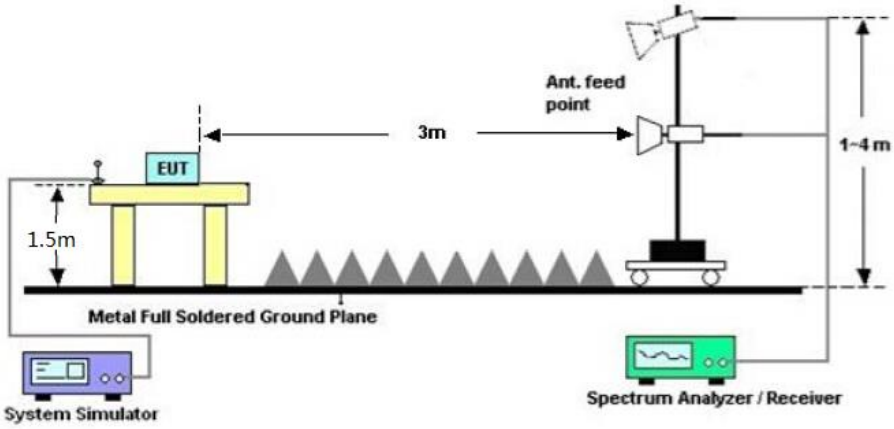
Radiated Emission Test-Setup Frequency Below 30MHz



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.

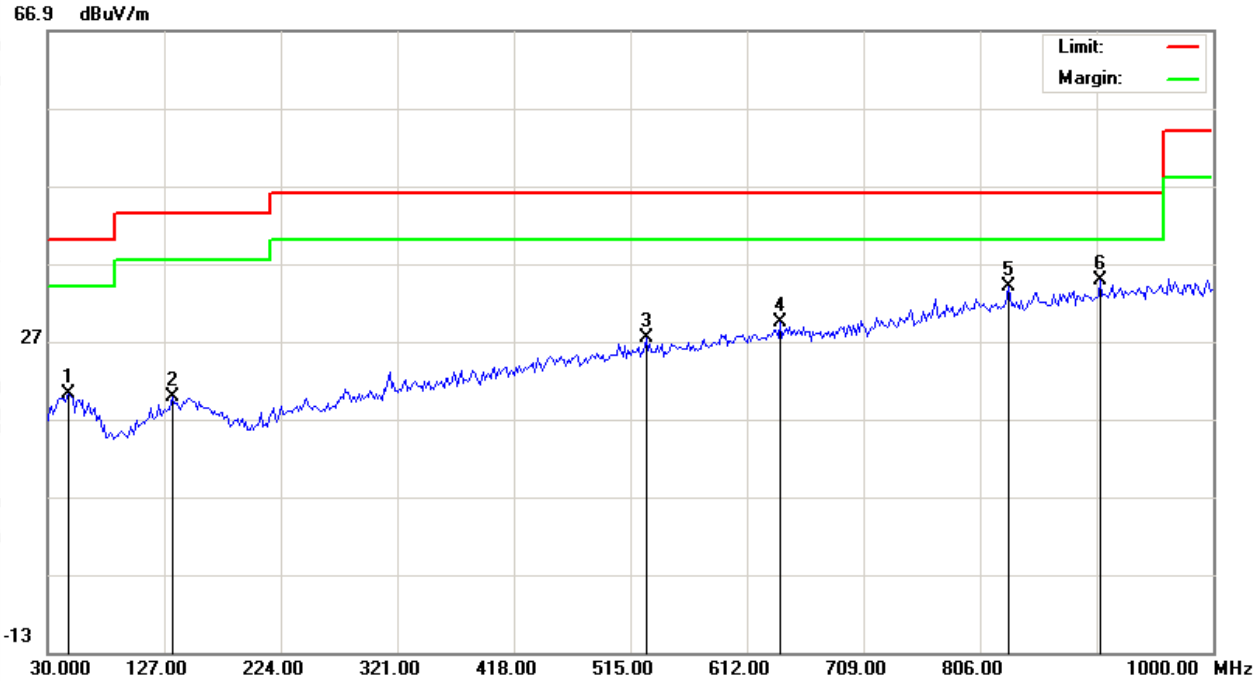
10.4. TEST RESULT

RADIATED EMISSION BELOW 30MHZ

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

RADIATED EMISSION BELOW 1GHZ

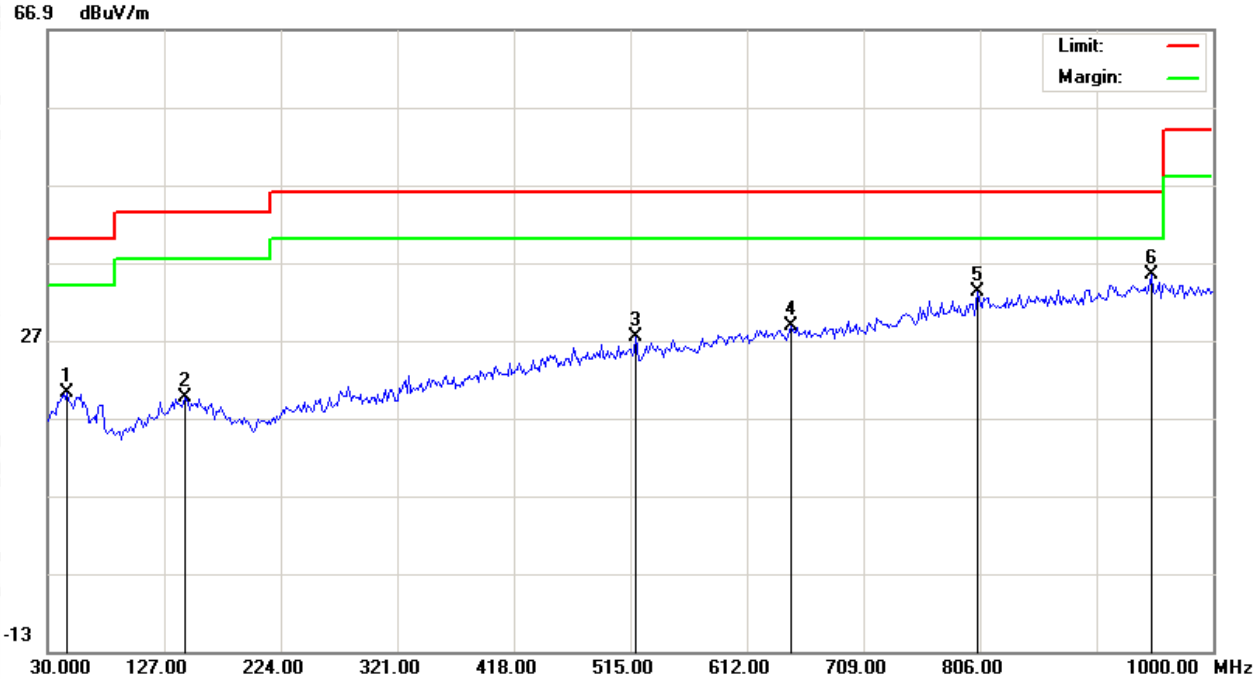
EUT	TWS Earbud	**Model Name**	TWS80
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	Mode 4	**Antenna**	Horizontal



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		47.7833	0.45	19.81	20.26	40.00	-19.74	peak			
2		133.4667	0.92	18.82	19.74	43.50	-23.76	peak			
3		527.9333	1.81	25.54	27.35	46.00	-18.65	peak			
4		639.4833	1.97	27.42	29.39	46.00	-16.61	peak			
5		830.2500	3.11	30.80	33.91	46.00	-12.09	peak			
6	*	906.2333	3.14	31.75	34.89	46.00	-11.11	peak			

RESULT: PASS

EUT	TWS Earbud	Model Name	TWS80
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		46.1667	0.38	19.87	20.25	40.00	-19.75	peak			
2		144.7833	0.44	19.22	19.66	43.50	-23.84	peak			
3		519.8500	1.96	25.38	27.34	46.00	-18.66	peak			
4		649.1833	1.20	27.54	28.74	46.00	-17.26	peak			
5		804.3832	2.76	30.47	33.23	46.00	-12.77	peak			
6	*	948.2667	3.26	32.12	35.38	46.00	-10.62	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 Earbud	**Model Name**	TWS80
Temperature	25°C	**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
4804.022	45.12	0.08	45.20	74.00	-28.80	peak
4804.022	41.26	0.08	41.34	54.00	-12.66	AVG
7206.033	43.75	2.21	45.96	74.00	-28.04	peak
7206.033	39.83	2.21	42.04	54.00	-11.96	AVG

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

EUT	TWS Earbud	**Model Name**	TWS80
Temperature	25°C	**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
4804.022	44.25	0.08	44.33	74.00	-29.67	peak
4804.022	39.87	0.08	39.95	54.00	-14.05	AVG
7206.033	40.26	2.21	42.47	74.00	-31.53	peak
7206.033	38.41	2.21	40.62	54.00	-13.38	AVG

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

EUT	TWS Earbud	**Model Name**	TWS80
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
4882.022	44.29	0.14	44.43	74.00	-29.57	peak
4882.022	41.13	0.14	41.27	54.00	-12.73	AVG
7323.033	42.07	2.36	44.43	74.00	-29.57	peak
7323.033	38.72	2.36	41.08	54.00	-12.92	AVG

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

EUT	TWS Earbud	**Model Name**	TWS80
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
4882.022	42.14	0.14	42.28	74.00	-31.72	peak
4882.022	39.25	0.14	39.39	54.00	-14.61	AVG
7323.033	40.83	2.36	43.19	74.00	-30.81	peak
7323.033	37.17	2.36	39.53	54.00	-14.47	AVG

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