FCC/ISED - TEST REPORT

Report Number	:	**68.760.22.0420.01**	Date of Issue:	**2022-06-10**
Model	:	**CPPM1**		
Product Type	:	Camera		
Applicant	:	GoPro, Inc.		
Address	:	3025 Clearview Way, San Mateo, CA 94402, USA		
Manufacturer	:	GoPro, Inc.		
Address	:	3025 Clearview Way, San Mateo, CA 94402, USA		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages including Appendices	:	61		

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Building 12 & 13, Zhiheng Wisdomland Business Park, Guankou Erlu, Nantou, Nanshan District,
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1 Table of Contents

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2 Details about the Test Laboratory

Details about the Test Laboratory
Test Site 1

Company name:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch Building 12&13, Zhiheng Wisdomland Business Park, Guankou Erlu, Nantou, Nanshan District, Shenzhen, 518052 China
FCC Designation Number:	CN5009
FCC Registration No.:	514049
IC Registration Number:	10320A
Telephone:	86 755 8828 6998
Fax:	86 755 8828 5299

3 Description of the Equipment Under Test

Product:	Camera
Model no.:	CPPM1
FCC ID:	CNFCPPM1
IC:	10193A-CPPM1
PMN:	CPPM1
HVIN:	CPPM1
Rating:	3.85VDC
RF Transmission Frequency:	2402MHz-2480MHz
No. of Operated Channel:	79
Modulation:	GFSK, π/4-DQPSK, 8DPSK
Antenna Type:	Internal Integrated Metal Antenna
Antenna Gain:	-2.1dBi max for 2.4GHz
Description of the EUT:	The Equipment Under Test (EUT) is a Camera supports 2.4GHz Bluetooth/WIFI, 5GHz WIFI functions.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2020 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators
RSS-Gen Issue 5, Amendment 2, February 2021	General Requirements and Information for the Certification of Radio Apparatus
RSS-247 Issue 2 February 2017	Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices

All the test methods were according to Public Notice DA 00-705 -Frequency Hopper Spread Spectrum Test Procedure, KDB558074 D01 v05r02 and ANSI C63.10-2013.

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5 Summary of Test Results

Technical Requirements			
FCC Part 15 Subpart C/RSS-247 Issue 2/RSS-Gen Issue 5			
Test Condition		Test Result	Test Site
§15.207 RSS-GEN 8.8	Conducted emission AC power port	Pass	Site 1
§15.247 (b) (3) & RSS-247 5.4(d)	Conducted output power	Pass	Site 1
RSS-247 5.4(d)	Equivalent Isotropic Radiated Power	Pass	Site 1
§15.247(e) RSS-247 5.2(b)	Power spectral density	N/A	--
§15.247(a)(2) RSS-247 5.2(a) & RSS-GEN 6.7	6dB bandwidth	N/A	--
§15.247(a)(1) RSS-247 5.1(b)	20dB Occupied bandwidth	Pass	Site 1
RSS-GEN 6.7	99% Occupied Bandwidth	Pass	Site 1
§15.247(a)(1) RSS-247 5.1(b)	Carrier frequency separation	Pass	Site 1
§15.247(a)(1)(iii) RSS-247 5.1(d)	Number of hopping frequencies	Pass	Site 1
§15.247(a)(1)(iii) RSS-247 5.1(d)	Dwell Time	Pass	Site 1
§15.247(d) RSS-247 5.5	Spurious RF conducted emissions	Pass	Site 1
§15.247(d) RSS-247 5.5	Band edge	Pass	Site 1
§15.247(d) & §15.209 & §15.205 RSS-247 5.5 & RSS-Gen 6.13	Spurious radiated emissions for transmitter	Pass	Site 1
§15.203 RSS-Gen 6.8	Antenna requirement	Pass See note 1	--

Remark 1: N/A – Not Applicable.
Note 1: The EUT uses an Internal Integrated Metal Antenna, which gain is -2.10dBi. In accordance to §15.203 and RSS-Gen 6.8, it is considered sufficiently to comply with the provisions of this section.

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: CNFCPPM1, complies with Section 15.207, 15.209, 15.205, 15.247 of the FCC Part 15, Subpart C.

This submittal(s) (test report) is intended for IC: 10193A-CPPM1, complies with RSS-247, RSS-GEN.

The Model: CPPM1 supports Bluetooth Low Energy/Bluetooth BDR+EDR /WIFI functions, power by 3.85VDC, 1506mAh supplied by a rechargeable Lithium Ion Battery or 5VDC supplied by USB type C port.
The TX and RX range is 2402MHz-2480MHz for Bluetooth, 2412MHz – 2462MHz for 2.4GHzWIFI, 5180MHz – 5320MHz, 5500MHz – 5720MHz, 5745MHz – 5825MHz for 5GHzWIFI.

Note: The report is for BDR+EDR only.

SUMMARY:

All tests according to the regulations cited on page 6 were

■ - Performed

☐ - **Not** Performed

The Equipment Under Test

■ - **Fulfills** the general approval requirements.

☐ - **Does not** fulfill the general approval requirements.

Sample Received Date:	2022-05-25
Testing Start Date:	2022-05-30
Testing End Date:	2022-06-08

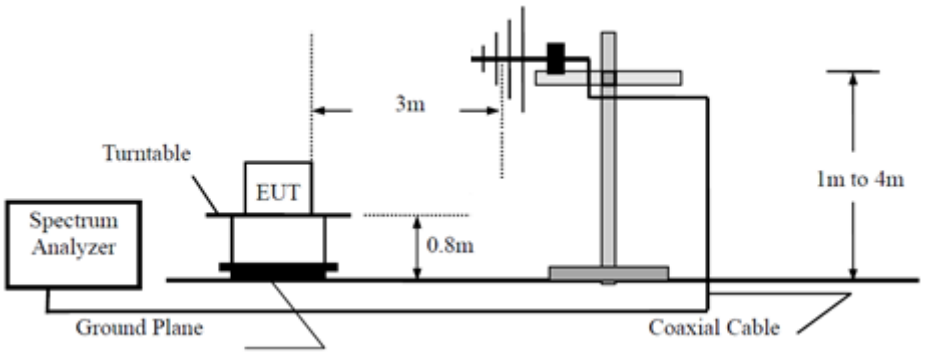
- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch

Reviewed by:	Prepared by:	Tested by:
John Zhi	Myron Yu	Carry Cai
Project Manager	Project Engineer	Test Engineer

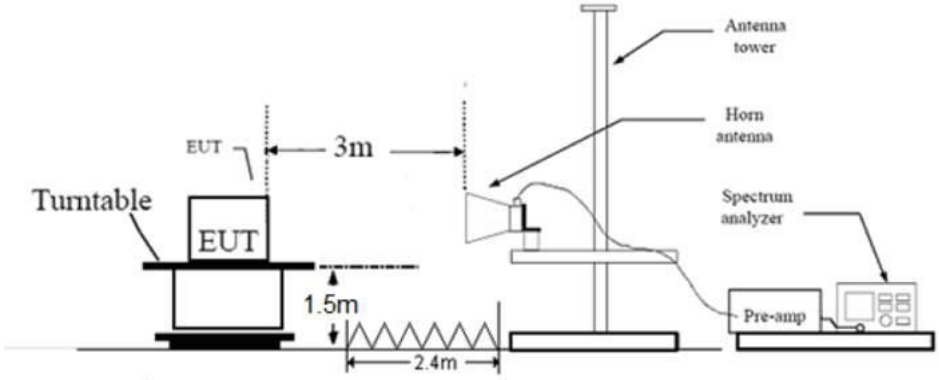
7 Test Setups

7.1 Radiated test setups

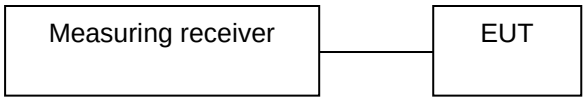
Below 1GHz



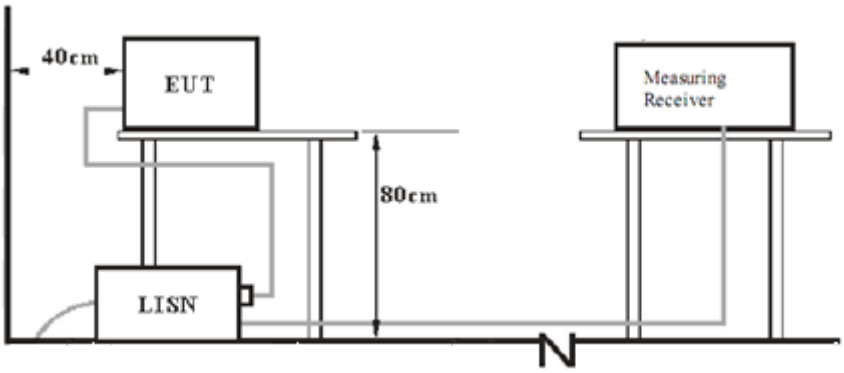
Above 1GHz



7.2 Conducted RF test setups



7.3 AC Power Line Conducted Emission test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.	S/N
LAPTOP	LENOVO	T460S	--
USB TYPE C CABLE	GOPRO	0.46M (LENGTH)	--
AC ADAPTER	APPLE	A1401	--

The system was configured to hopping mode and non-hopping mode.

Hopping mode: typical working mode (normal hopping status)

Non-hopping mode: The system was configured to operate at a signal channel transmitting.

Test Software Information:

Test Software Version	QRCT (V3.0-186.0) from QUALCOMM
Modulation	Setting TX Power
GFSK	8
π/4-DQPSK	9
8-DPSK	9

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9 Technical Requirement

9.1 Conducted Emission

Test Method

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. Both sides of AC line were checked for maximum conducted interference.
6. The frequency range from 150 kHz to 30 MHz was searched.
7. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

Limit

According to §15.207 & RSS-GEN 8.8, conducted emissions limit as below:

Frequency MHz	QP Limit dBµV	AV Limit dBµV
0.150-0.500	66-56*	56-46*
0.500-5	56	46
5-30	60	50

*Decreasing linearly with logarithm of the frequency

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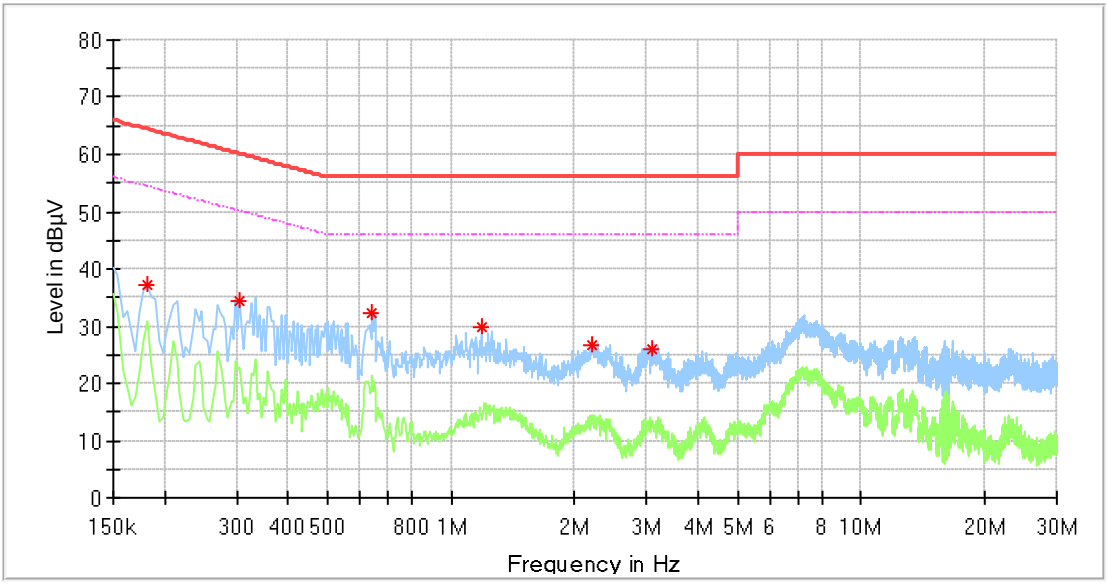
Conducted Emission

Product Type : Camera
M/N : CPPM1
Operating Condition : Charging + TX
Test Specification : Power Line, Live
Comment : AC 120V/60Hz (External adapter)



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.182000	37.32	---	64.39	27.07	L1	9.71
0.306000	34.40	---	60.08	25.68	L1	9.66
0.642000	32.41	---	56.00	23.59	L1	9.65
1.190000	29.76	---	56.00	26.24	L1	9.66
2.206000	26.77	---	56.00	29.23	L1	9.70
3.098000	25.83	---	56.00	30.17	L1	9.74

Remark:
Level=Reading Level + Correction Factor
Correction Factor=Cable Loss + LISN Factor
(The Reading Level is recorded by software which is not shown in the sheet)

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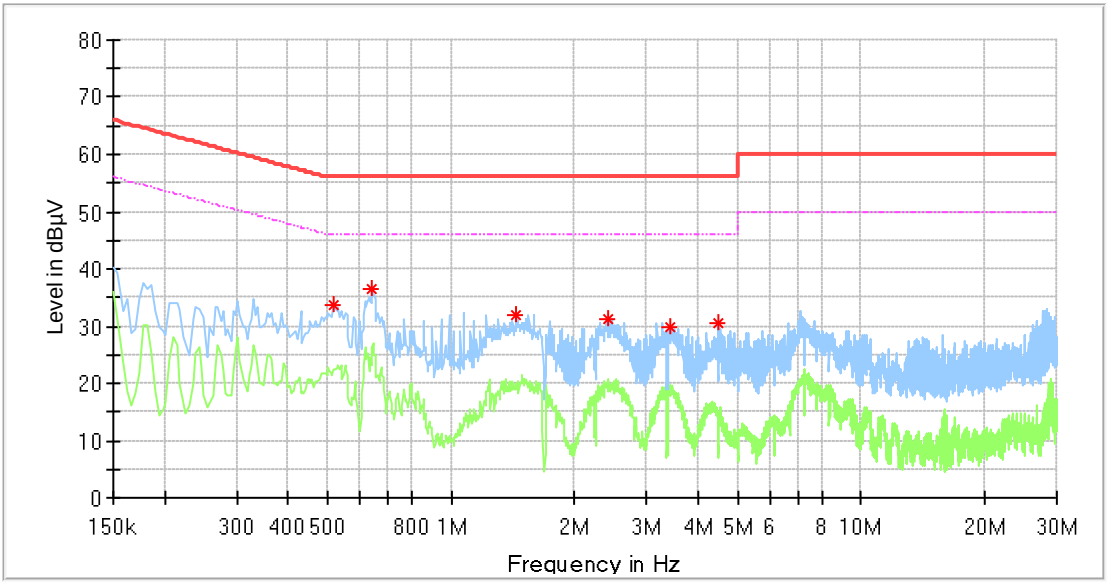
Conducted Emission

Product Type	:	Camera
M/N	:	CPPM1
Operating Condition	:	Charging + TX
Test Specification	:	Power Line, Neutral
Comment	:	AC 120V/60Hz (External adapter)



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.518000	33.75	---	56.00	22.25	N	9.68
0.642000	36.56	---	56.00	19.44	N	9.68
1.438000	32.03	---	56.00	23.97	N	9.71
2.402000	31.19	---	56.00	24.81	N	9.75
3.406000	29.92	---	56.00	26.08	N	9.79
4.498000	30.53	---	56.00	25.47	N	9.85

Remark:
Level=Reading Level + Correction Factor
Correction Factor=Cable Loss + LISN Factor
(The Reading Level is recorded by software which is not shown in the sheet)

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9.2 Conducted output power

Test Method

1. The EUT was placed on 0.8m height table, the RF output of EUT was connected to the test receiver by RF cable. The path loss was compensated to the results for each measurement.
2. Use the following spectrum analyzer settings:
   Span = approximately 5 times the 20dB bandwidth, centered on a hopping channel
   RBW > the 20dB bandwidth of the emission being measured, VBW≥RBW,
   Sweep = auto, Detector function = peak, Trace = max hold
3. Allow the 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

Limits

According to §15.247 (b) (3) & RSS-247 5.4(d), conducted output power limit as below:

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤1	≤30

According to & RSS-247 5.4(d), EIRP limit as below:

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤4	≤36.2

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Conducted output power

Bluetooth Mode GFSK modulation Test Result

Frequency	Conducted Output Power	Antenna Gain	EIRP	Result
MHz	dBm	dBi	dBm	
Low channel 2402MHz	7.22	-2.10	5.12	Pass
Middle channel 2441MHz	7.86	-2.10	5.76	Pass
High channel 2480MHz	7.84	-2.10	5.74	Pass

Bluetooth Mode π/4-DQPSK modulation Test Result

Frequency	Conducted Output Power	Antenna Gain	EIRP	Result
MHz	dBm	dBi	dBm	
Low channel 2402MHz	8.71	-2.10	6.61	Pass
Middle channel 2441MHz	8.91	-2.10	6.81	Pass
High channel 2480MHz	8.53	-2.10	6.43	Pass

Bluetooth Mode 8DPSK modulation Test Result

Frequency	Conducted Output Power	Antenna Gain	EIRP	Result
MHz	dBm	dBi	dBm	
Low channel 2402MHz	8.50	-2.10	6.40	Pass
Middle channel 2441MHz	8.72	-2.10	6.62	Pass
High channel 2480MHz	8.35	-2.10	6.25	Pass

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9.3 20 dB bandwidth and 99% Occupied Bandwidth

Test Method

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Limit

Limit [kHz]
N/A

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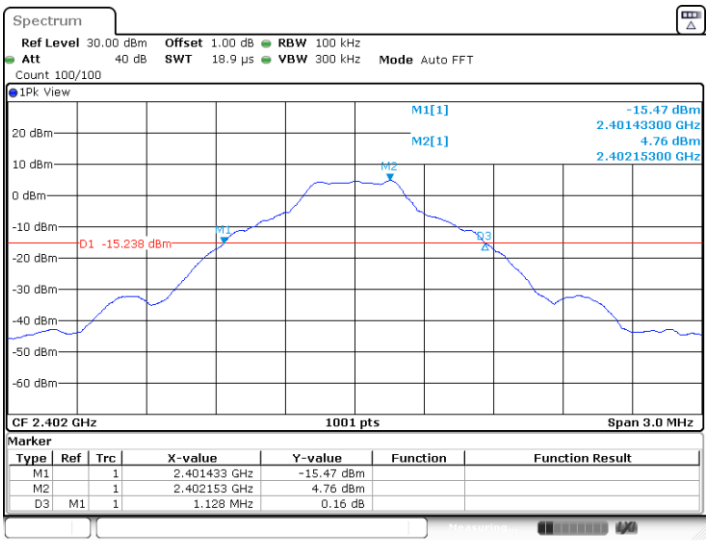
20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode GFSK Modulation test result

Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result
MHz	kHz	kHz	kHz	
2402	1128	893	--	Pass
2441	1128	893	--	Pass
2480	1128	890	--	Pass

Low channel 2402MHz



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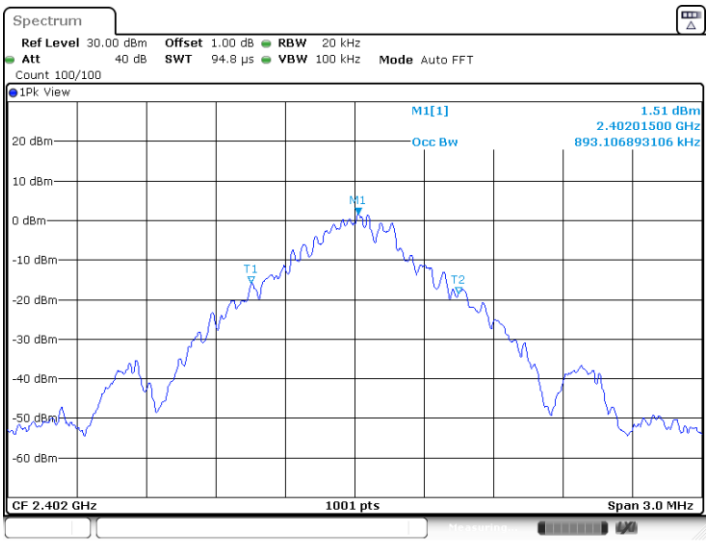

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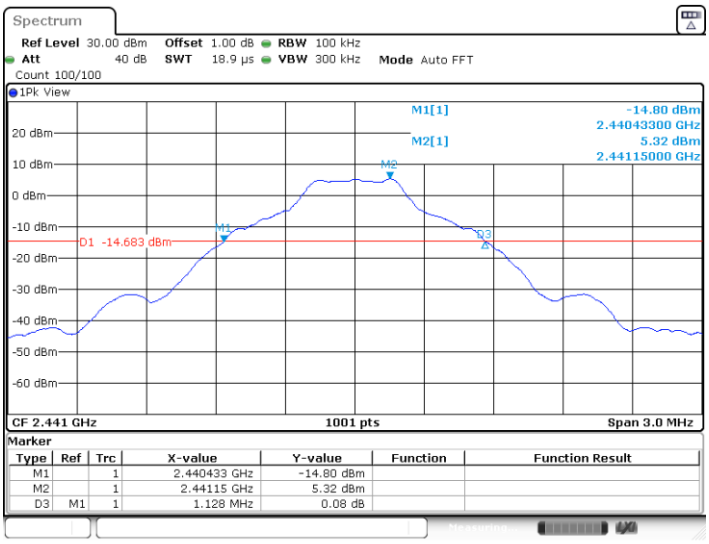
Middle channel 2441MHz



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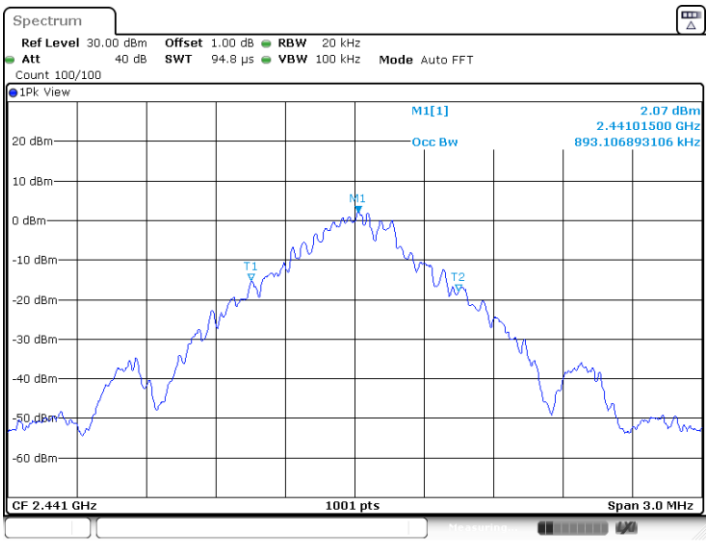

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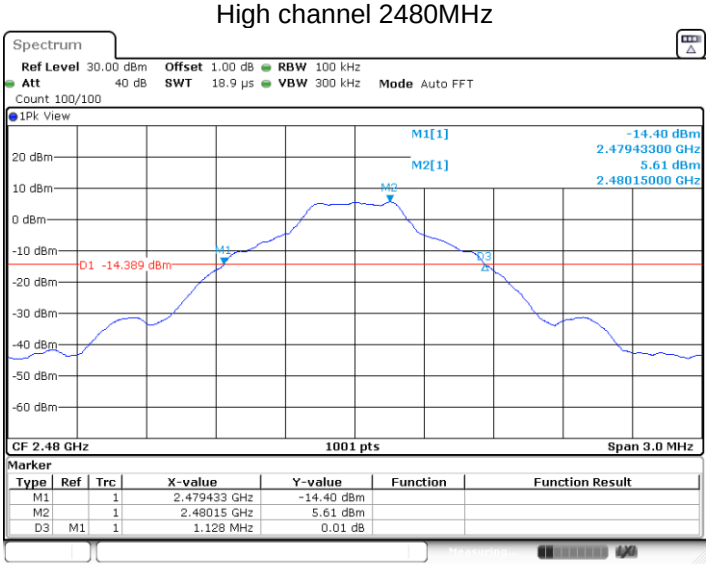
High channel 2480MHz



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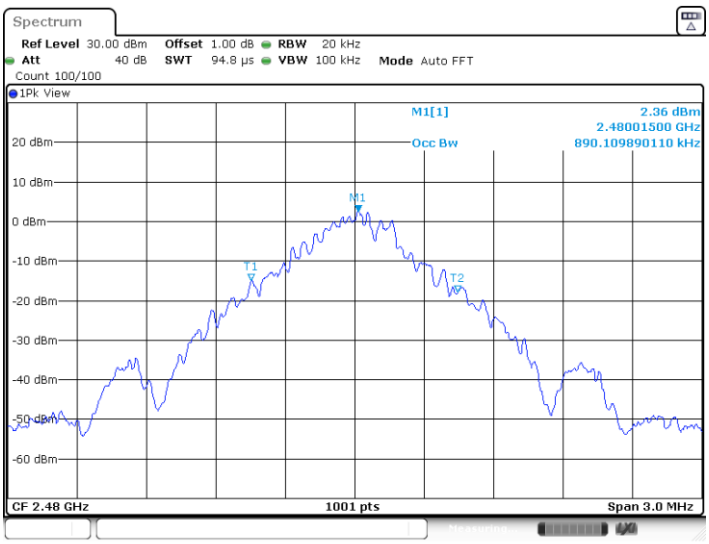

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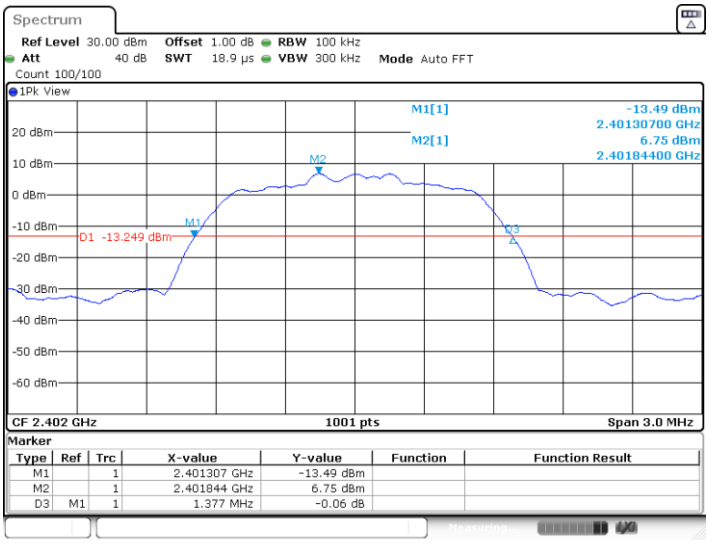
20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode π/4-DQPSK Modulation test result

Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result
MHz	kHz	kHz	kHz	
2402	1377	1181	--	Pass
2441	1377	1181	--	Pass
2480	1374	1181	--	Pass

Low channel 2402MHz



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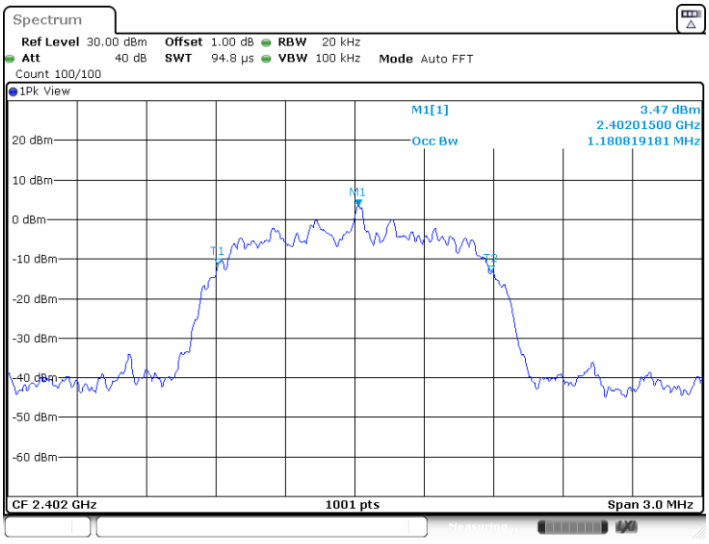

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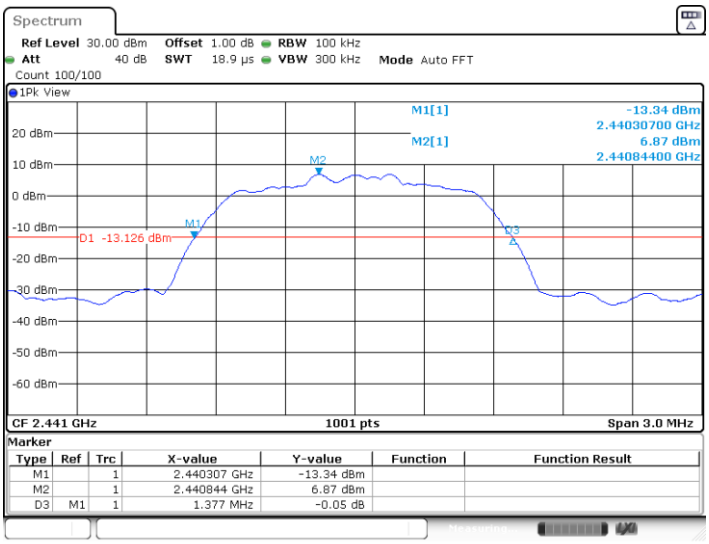
Middle channel 2441MHz



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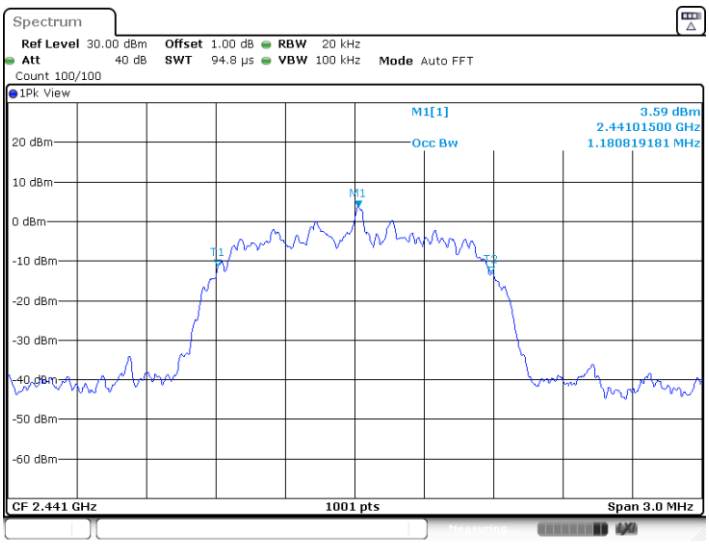

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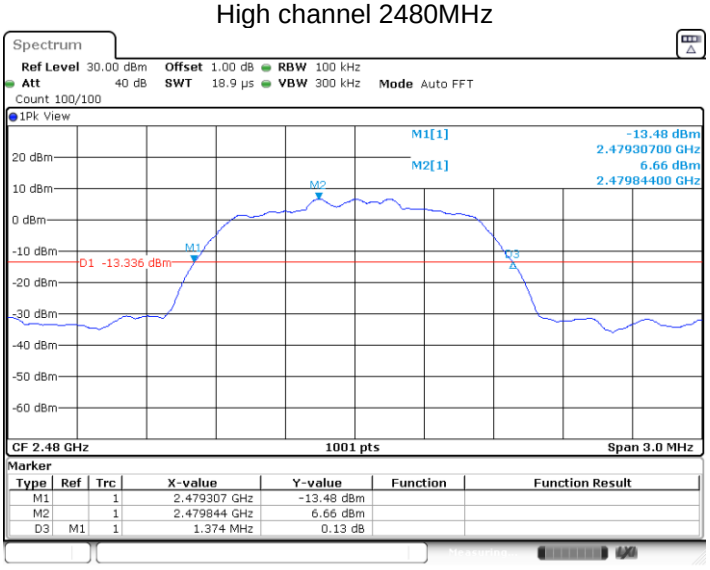
High channel 2480MHz



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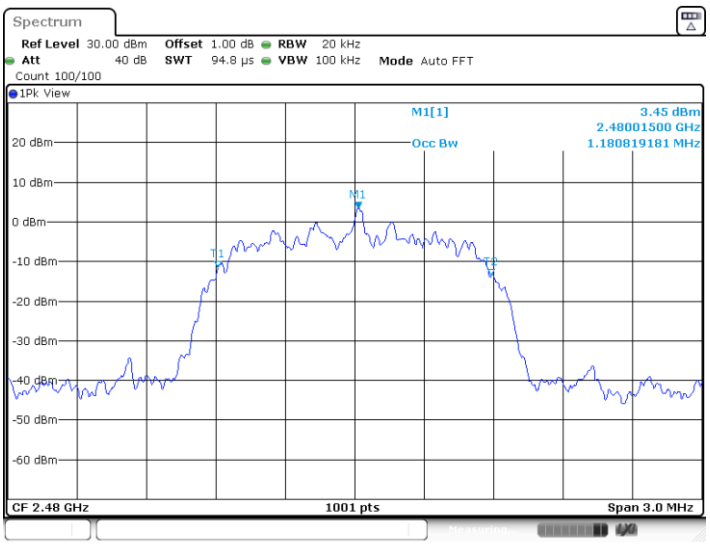

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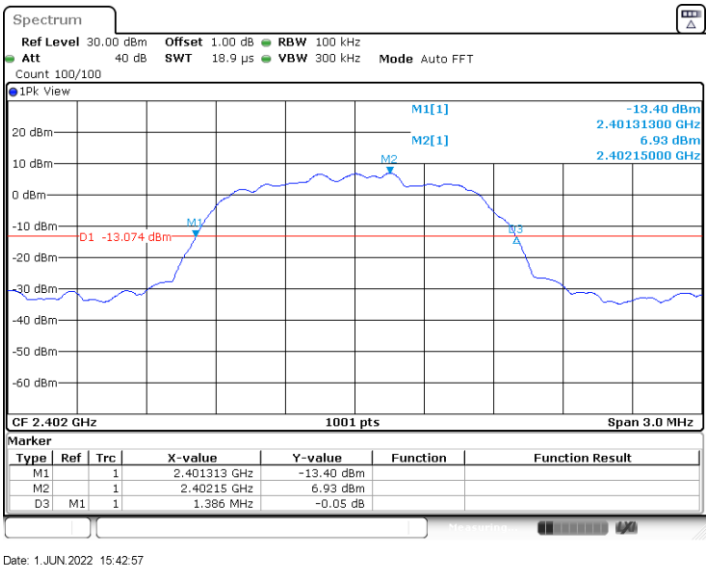
20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode 8DPSK Modulation test result

Frequency MHz	20 dB Bandwidth kHz	99% Bandwidth kHz	Limit kHz	Result
2402	1386	1184	--	Pass
2441	1386	1184	--	Pass
2480	1386	1184	--	Pass

Low channel 2402MHz



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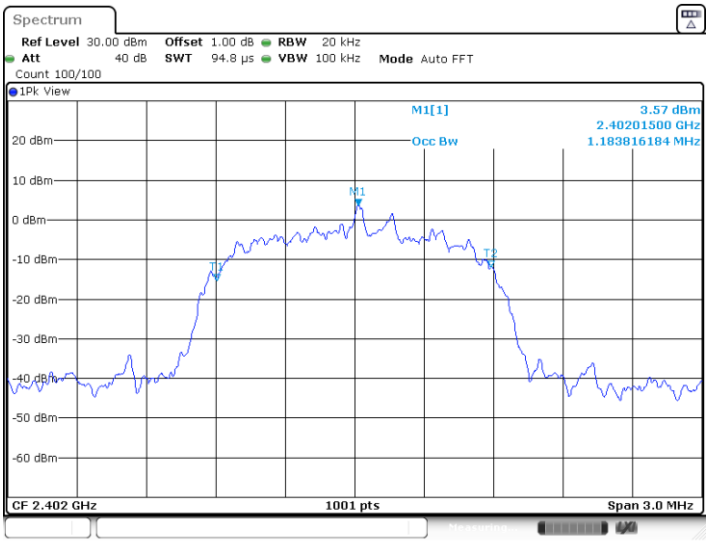

Date: 1.JUN.2022 15:43:07

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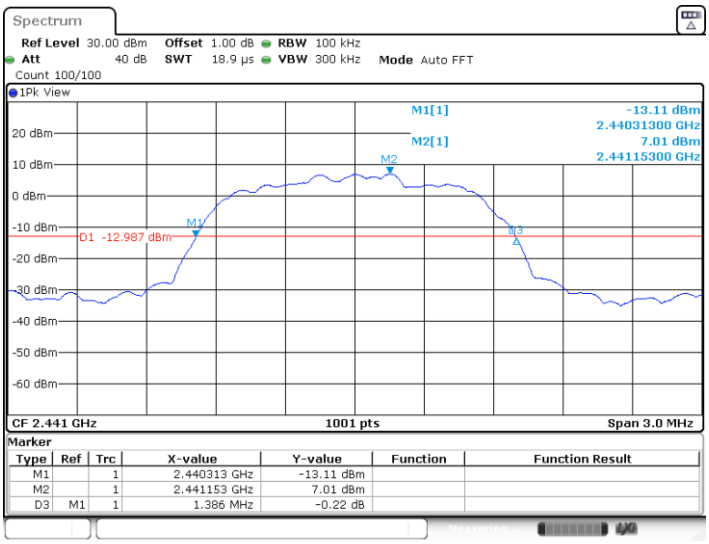
Middle channel 2441MHz



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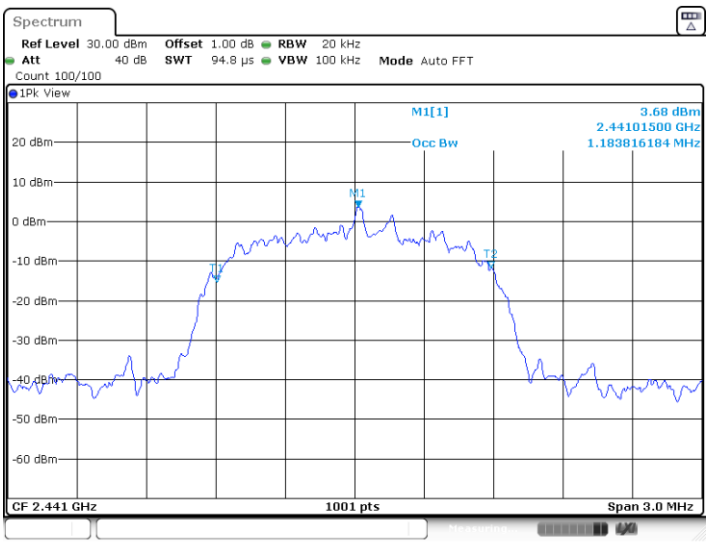

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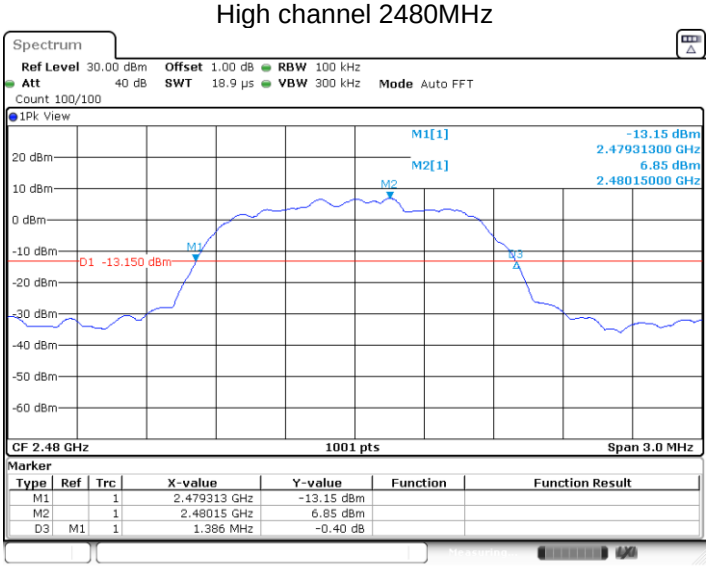
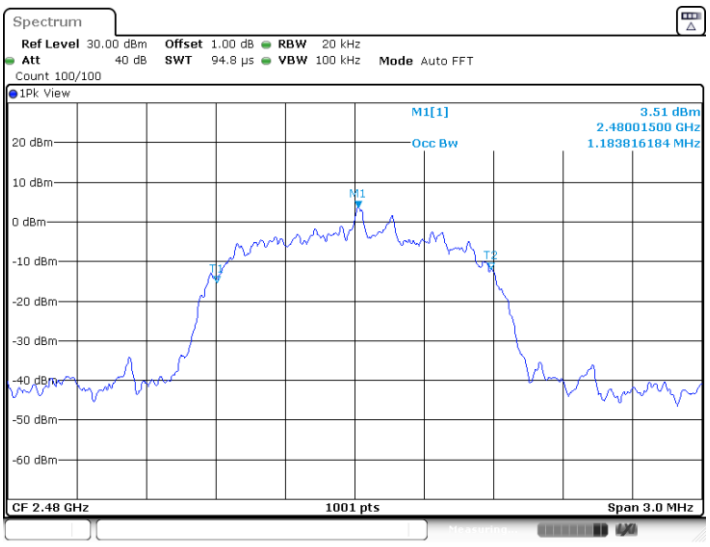
High channel 2480MHz



Date: 1.JUN.2022 15:47:34



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9.4 Carrier Frequency Separation

Test Method

1. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW) ≥RBW, Sweep = auto, Detector function = peak
2. By using the Max-Hold function record the separation of two adjacent channels.
3. Measure the frequency difference of these two adjacent channels by spectrum analyzer marker function.
4. Repeat above procedures until all frequencies measured were complete.

Limit

Limit kHz
⩾25KHz or 2/3 of the 20 dB bandwidth which is greater

Frequency MHz	2/3 of 20 dB Bandwidth kHz
GFSK	1003
π/4-DQPSK	991
8DPSK	1154

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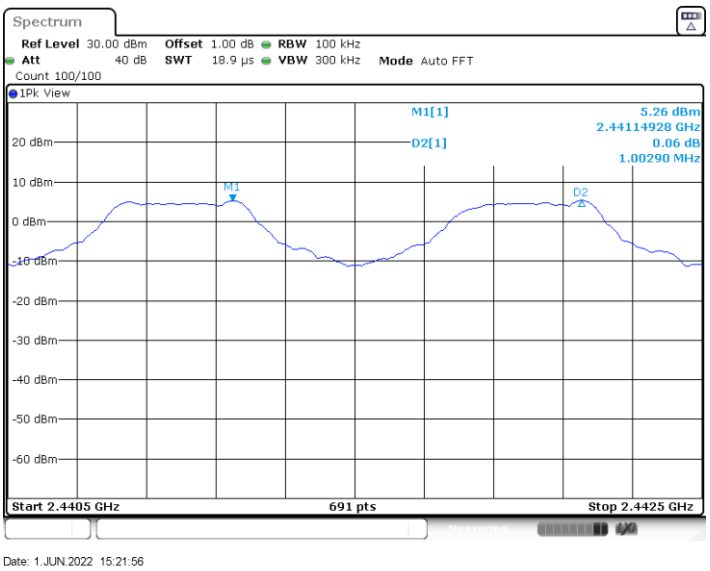
Carrier Frequency Separation

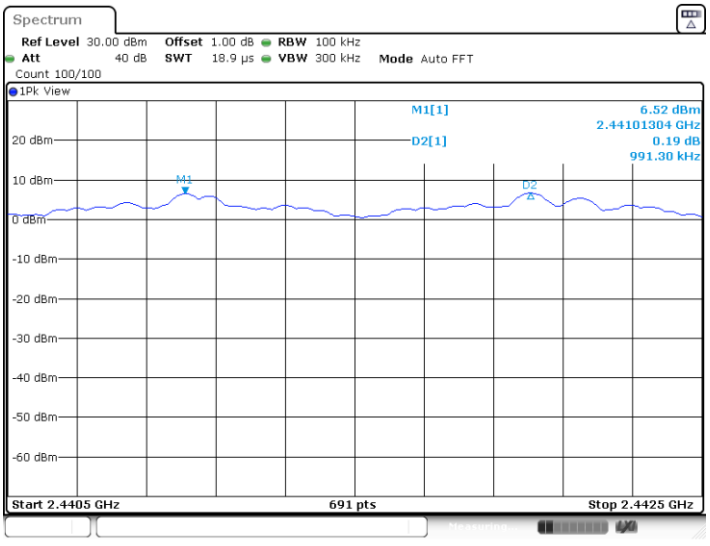
Test Mode	Antenna	Channel	Result [MHz]	Limit [MHz]	Verdict
GFSK	Ant1	Hop	1.003	>=0.752	PASS
π/4-DQPSK	Ant1	Hop	0.991	>=0.918	PASS
8DPSK	Ant1	Hop	1.154	>=0.025	PASS

GFSK



Date: 1.JUN.2022 15:21:56

π /4-DQPSK



Date: 1.JUN.2022 15:36:28

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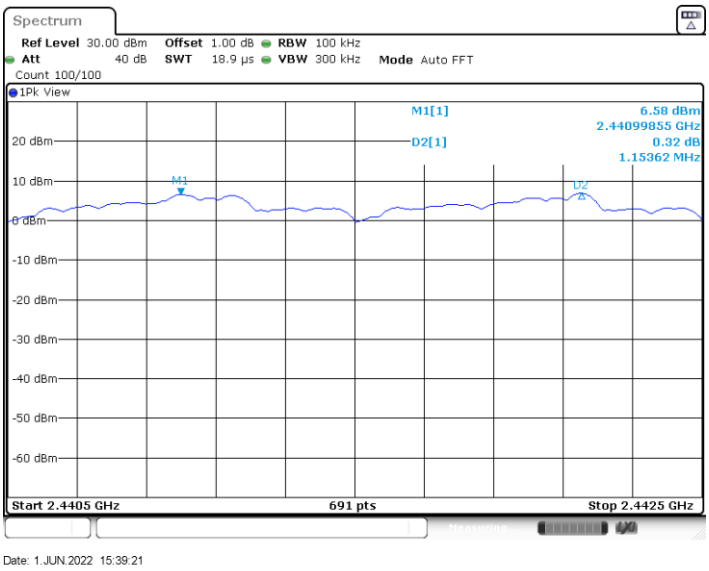
8DPSK



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9.5 Number of hopping frequencies

Test Method

1. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peaks of two adjacent channels, RBW ≥ 1% of the span, VBW) ≥RBW, Sweep = auto, Detector function = peak
2. Set the spectrum analyzer on Max-Hold Mode, and then keep the EUT in hopping mode.
3. Record all the signals from each channel until each one has been recorded.
4. Repeat above procedures until all frequencies measured were complete.

Limit

Limit number
⩾15

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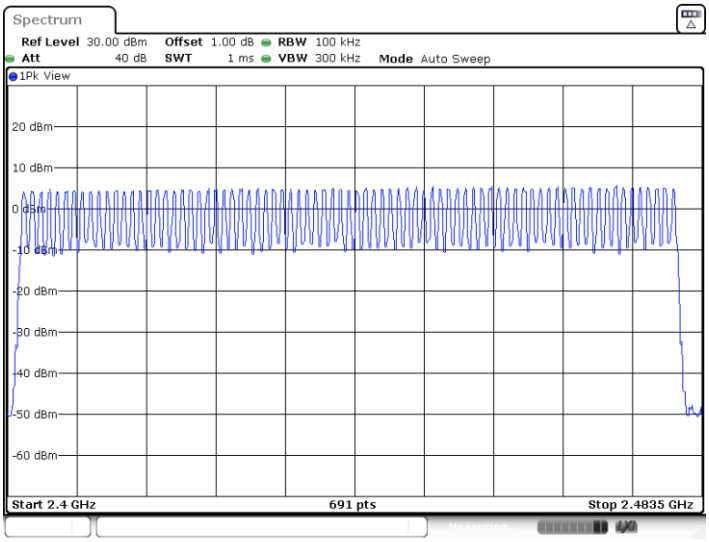
Number of hopping frequencies

Test result: The measurement was performed with the typical configuration (normal hopping status), and the total hopping channels is constant for the all modulation mode according with the Bluetooth Core Specification. Here GFSK modulation mode was used to show compliance.

Number of hopping frequencies	Result
79	Pass

GFSK Mode



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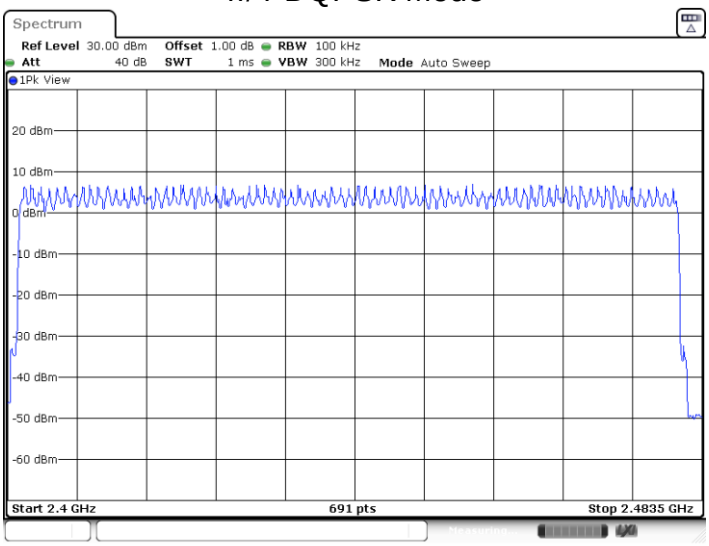
π/4-DQPSK Mode



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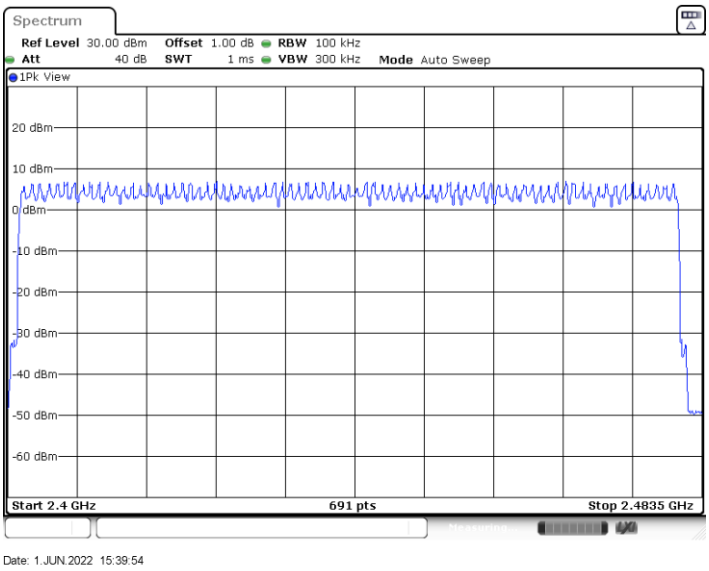
8DPSK Mode



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9.6 Dwell Time

Test Method

1. The RF output of EUT was connected to the test receiver by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit to hopping mode.
3. Use the following spectrum analyzer settings:
   RBW: 1MHz; VBW: 1MHz; SPAN: Zero Span
   Set the spectrum analyzer on Max-Hold Mode,
4. Adjust the center frequency of spectrum analyzer on any frequency be measured.
5. Measure the Dwell Time by spectrum analyzer Marker function. Record the results.
   Dwell Time = Burst Width * Total Hops
6. Repeat above procedures until all frequencies measured were complete.

Limit

The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

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Dwell Time

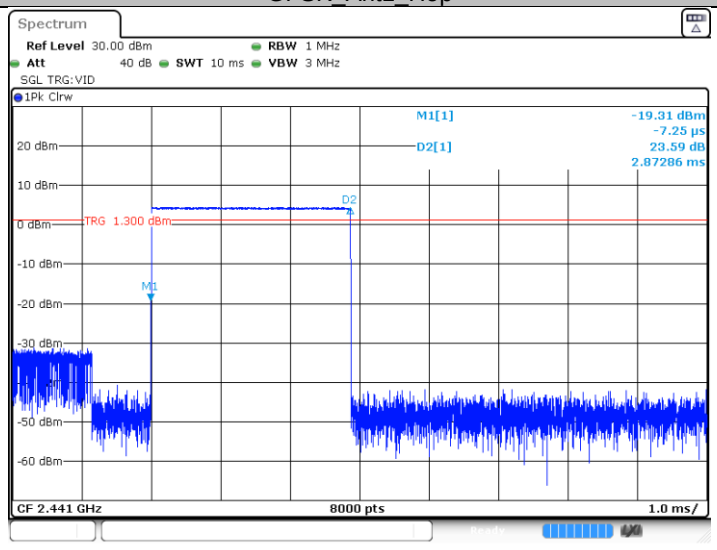
Dwell time

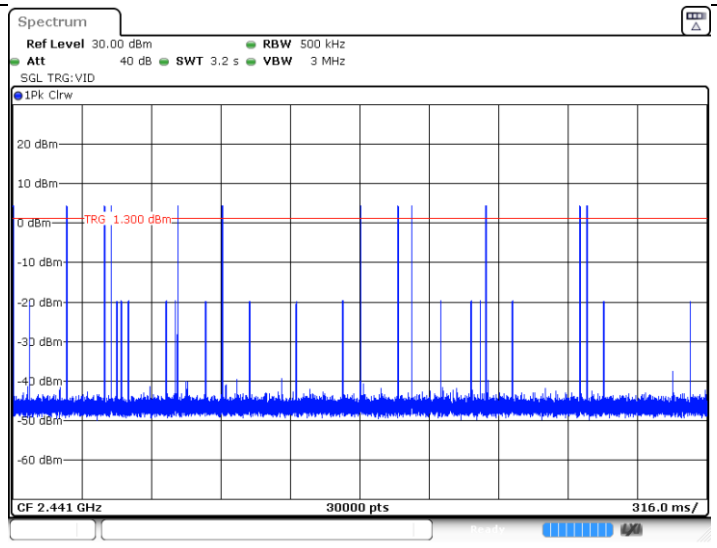
The maximum dwell time shall be 0.4 s.
The Dwell Time = Burst Width * Total Hops. The detailed calculations are showed as follows:
The duration for dwell time calculation: 0.4 [s] * hopping number = 0.4 [s] * 79 [ch] = 31.6 [s*ch];

Test Result

Test Mode	Antenna	Channel	Burst Width [ms]	Total Hops	Result [s]	Limit [s]	Verdict
GFSK	Ant1	Hop	2.87	120	0.345	<=0.4	PASS
π/4-DQPSK	Ant1	Hop	2.88	80	0.23	<=0.4	PASS
8DPSK	Ant1	Hop	2.88	110	0.316	<=0.4	PASS

GFSK_Ant1_Hop





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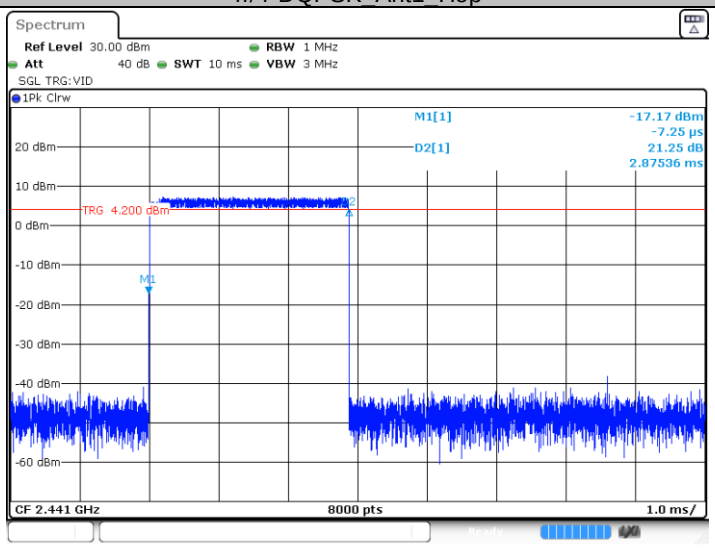
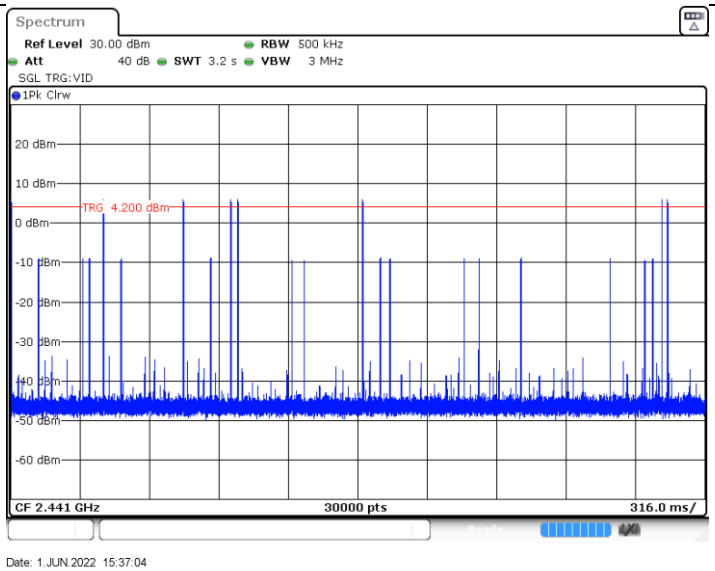
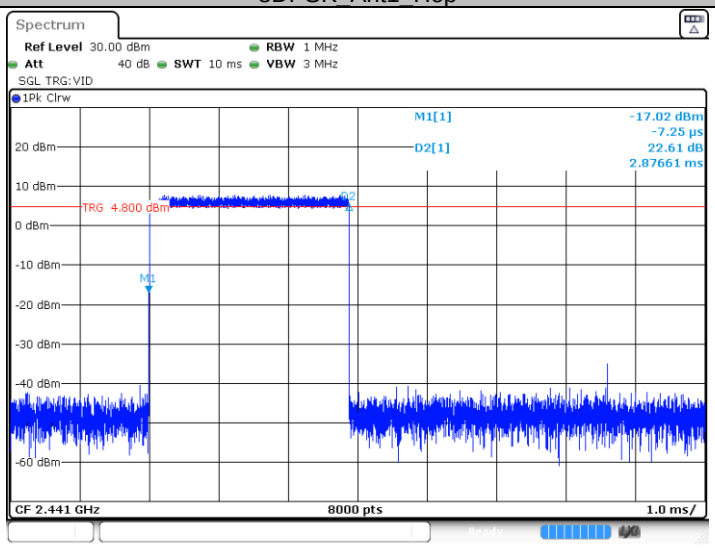
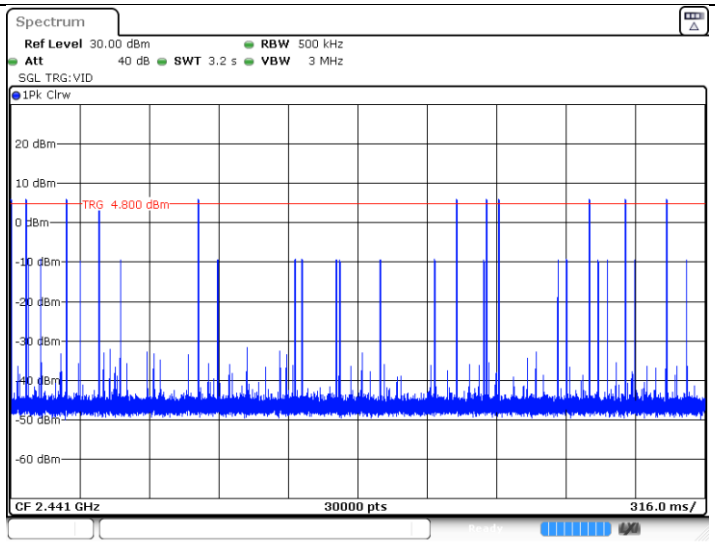
π/4-DQPSK_Ant1_Hop



8DPSK_Ant1_Hop



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9.7 Spurious RF conducted emissions

Test Method

1. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
   RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
3. The level displayed must comply with the limit specified in this Section. Submit these plots.
4. Repeat above procedures until all frequencies measured were complete.

Limit

Frequency Range MHz	Limit (dBc)
30-25000	-20

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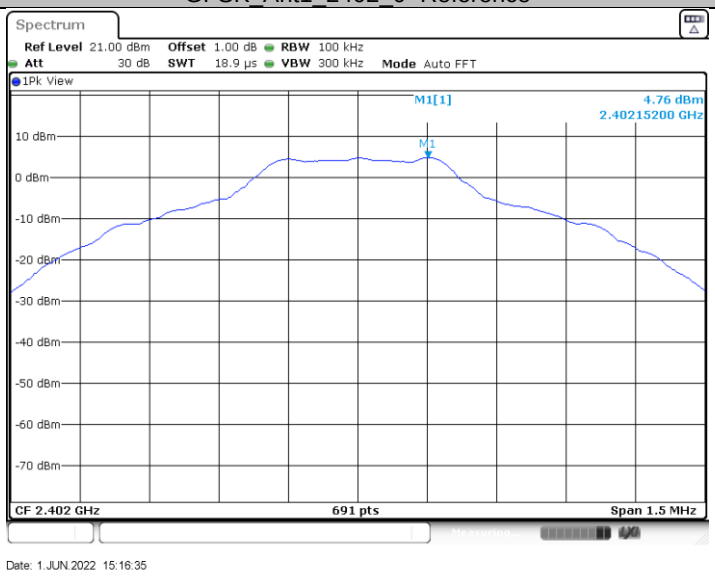
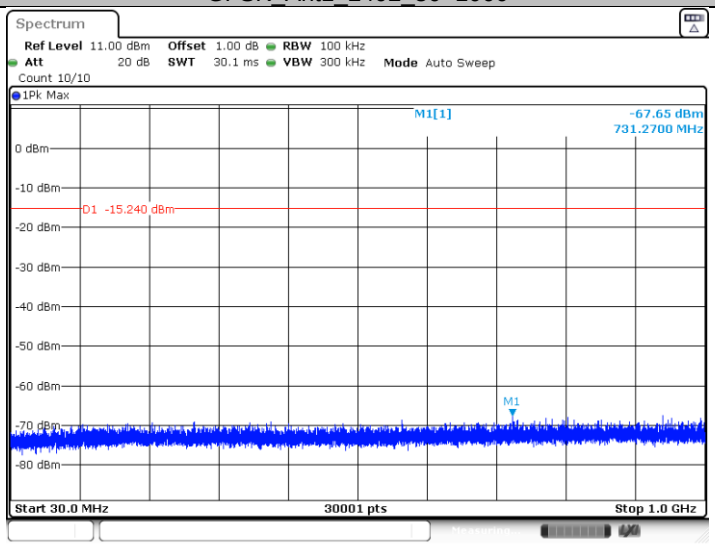
Spurious RF conducted emissions

Remark: The emissions exceed limit is fundamental signal.

GFSK_Ant1_2402_0~Reference

GFSK_Ant1_2402_30~1000


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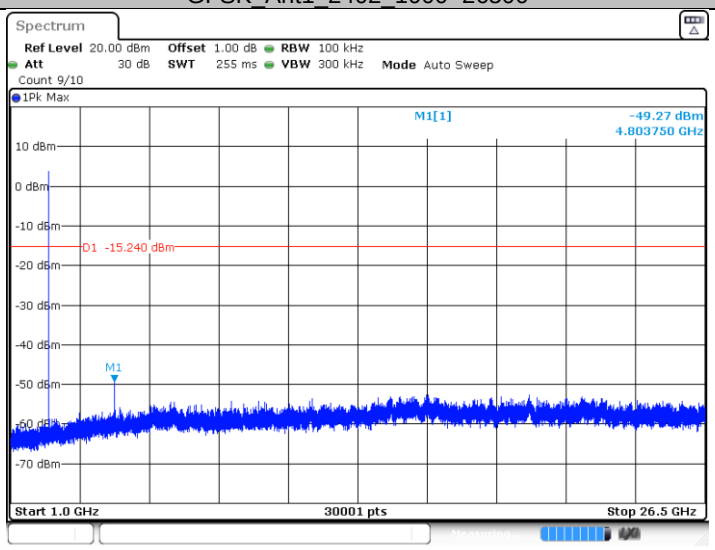
GFSK_Ant1_2402_1000~26500



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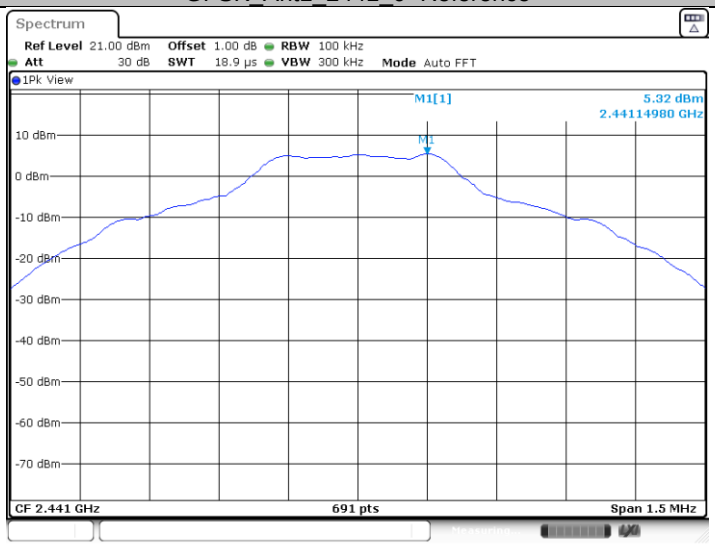

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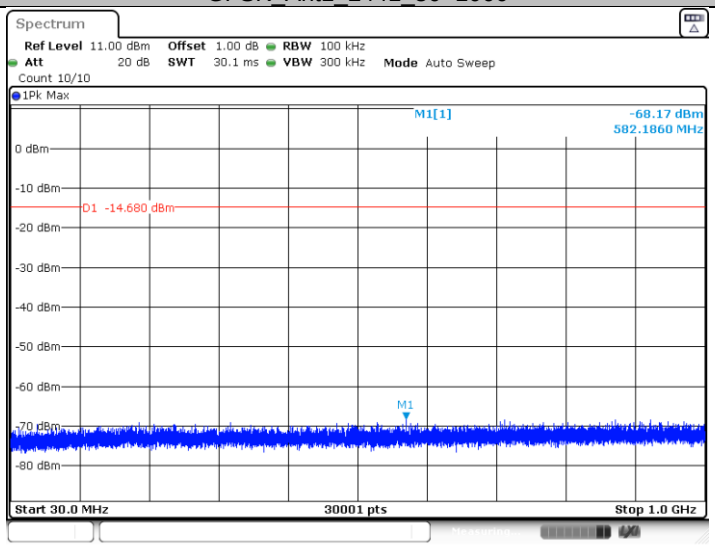

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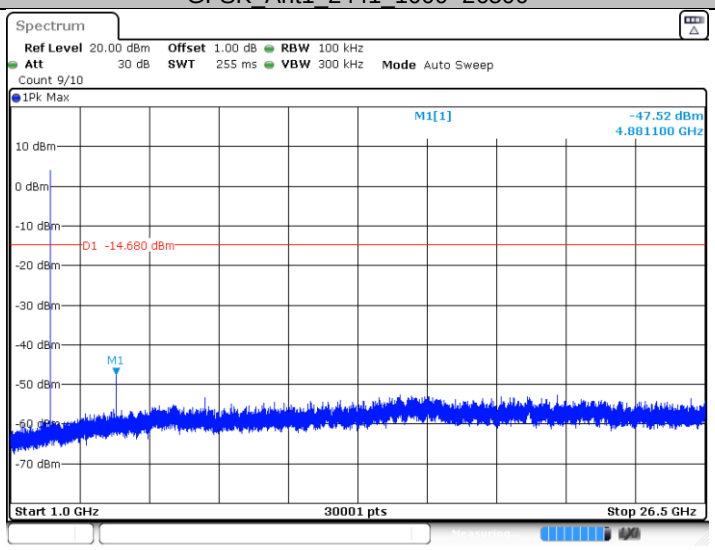
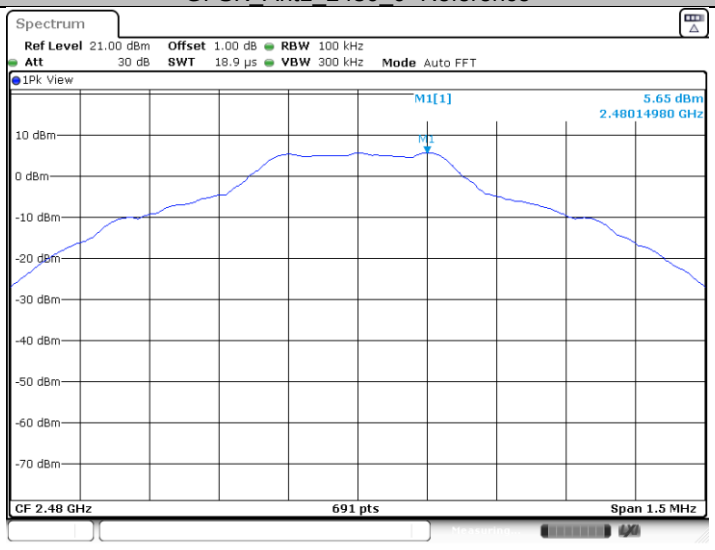
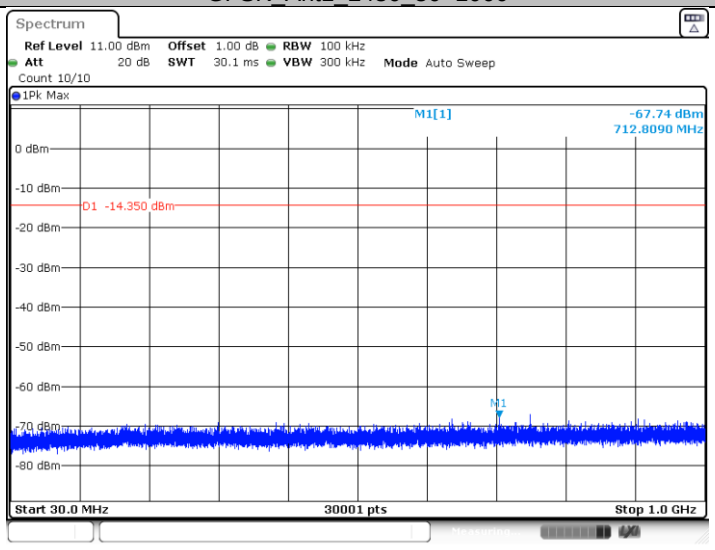
GFSK_Ant1_2441_1000~26500



GFSK_Ant1_2480_0~Reference



GFSK_Ant1_2480_30~1000



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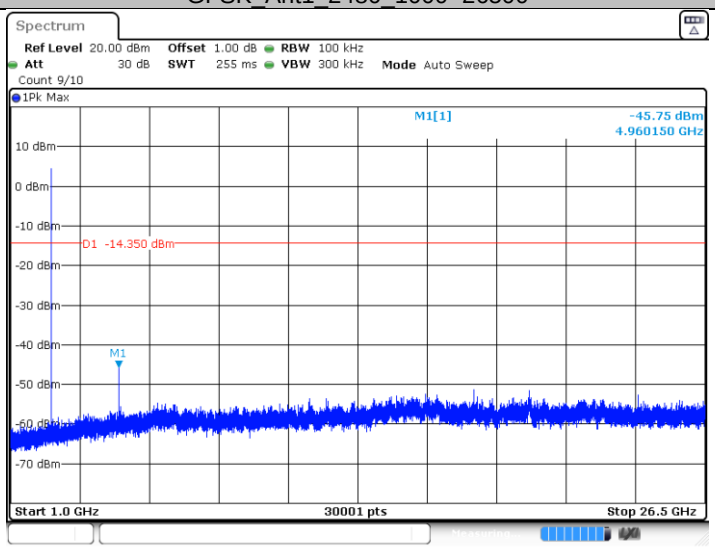
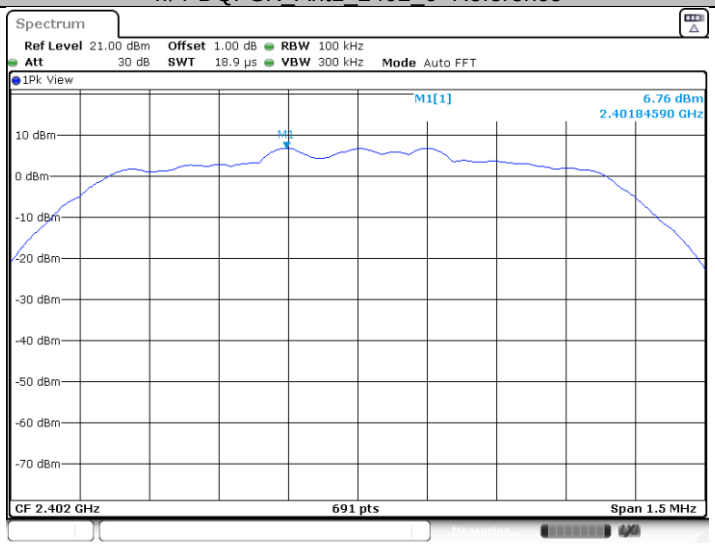
GFSK_Ant1_2480_1000~26500



π/4-DQPSK_Ant1_2402_0~Reference



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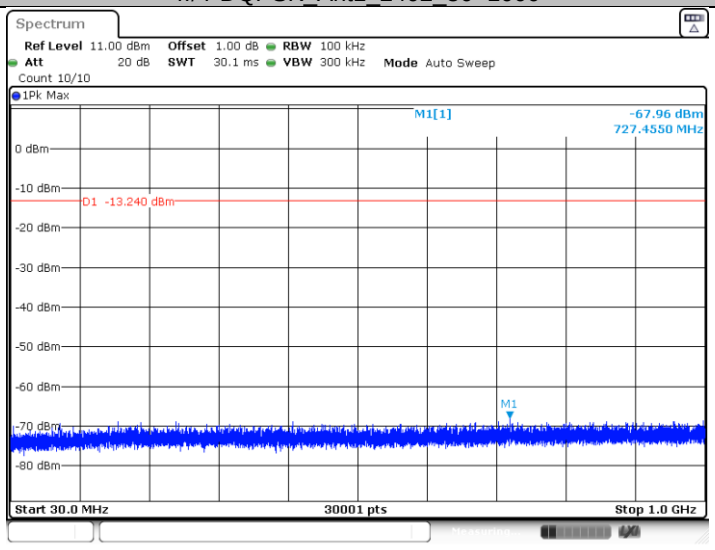

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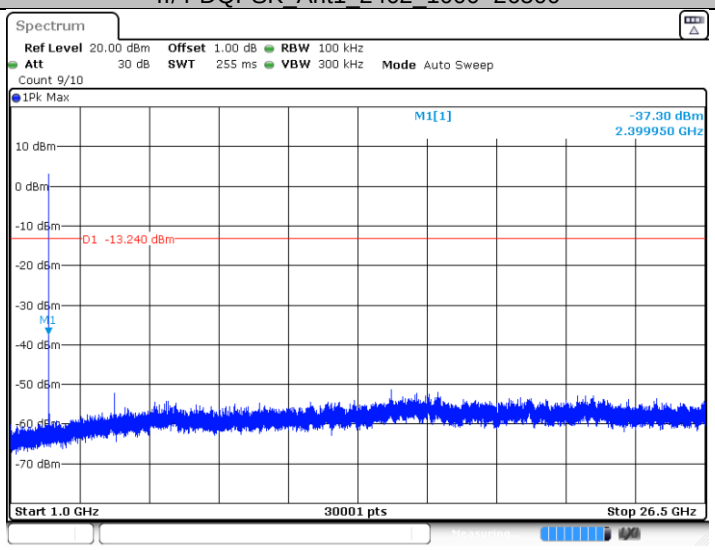
π/4-DQPSK_Ant1_2402_1000~26500



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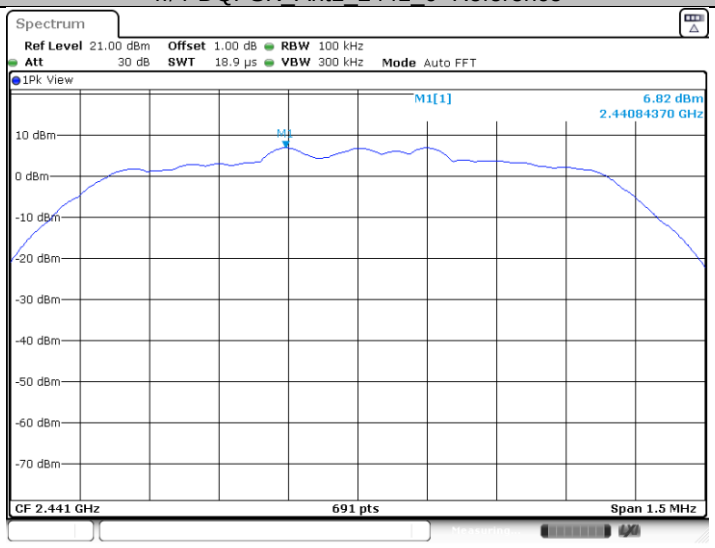
π/4-DQPSK_Ant1_2441_0~Reference



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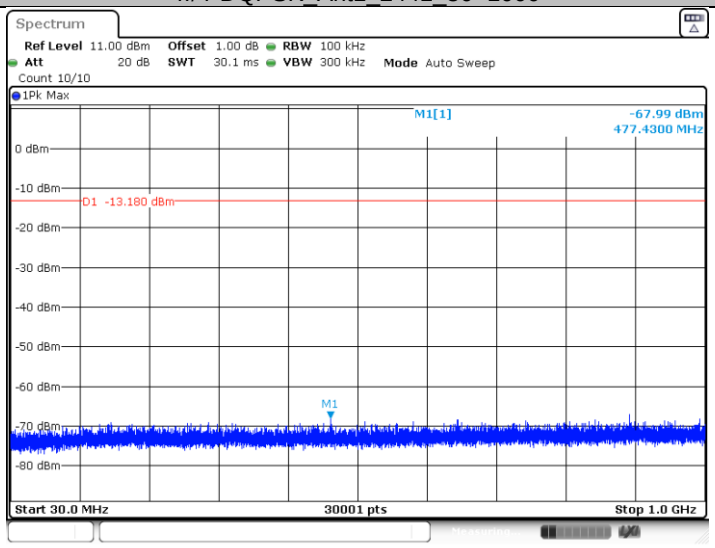
π/4-DQPSK_Ant1_2441_30~1000



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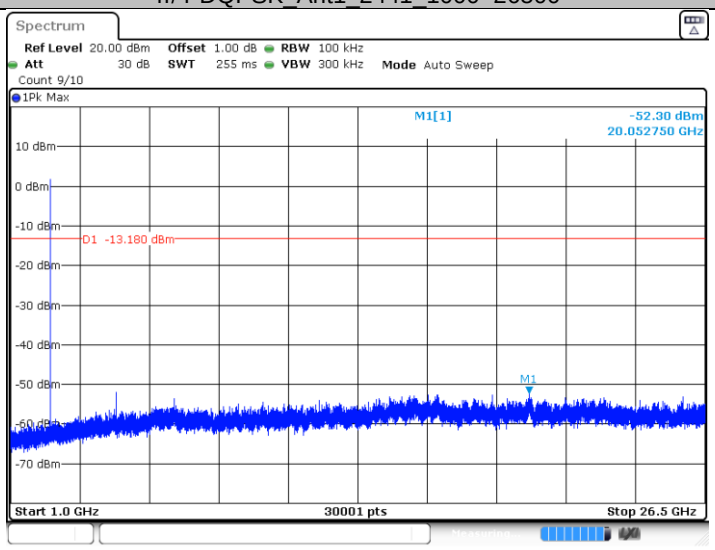
π/4-DQPSK_Ant1_2441_1000~26500



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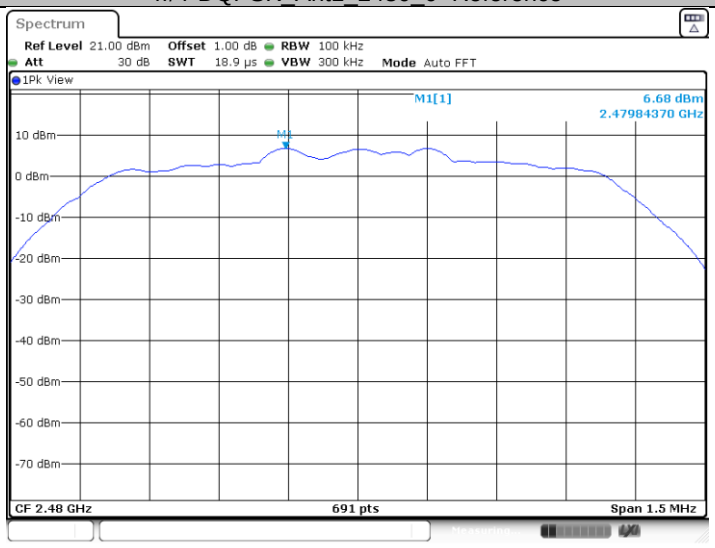

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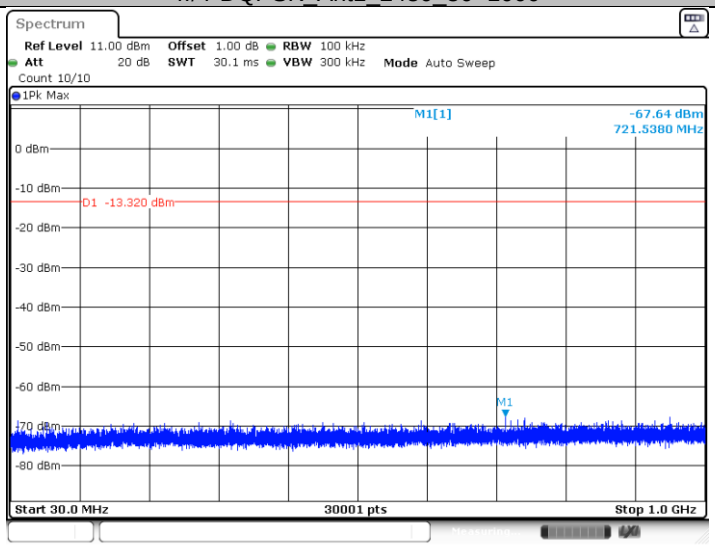
π/4-DQPSK_Ant1_2480_30~1000



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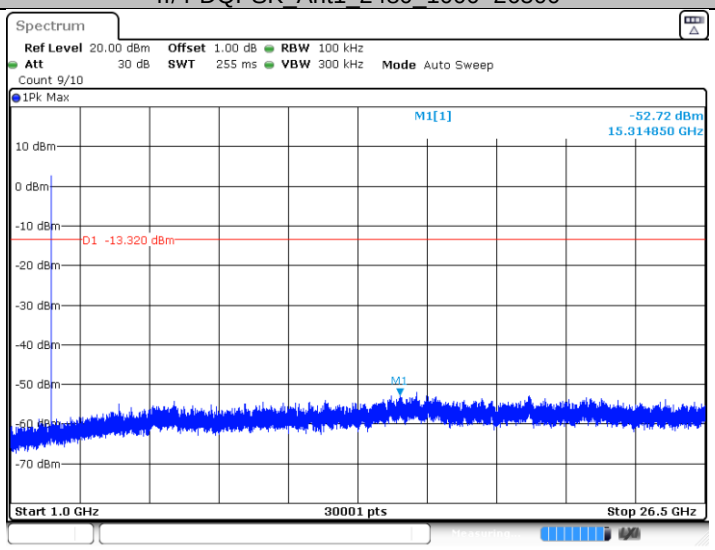
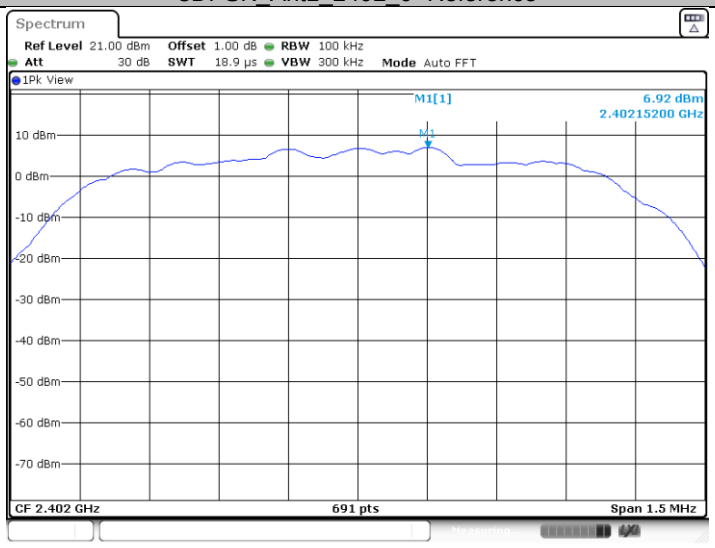
π/4-DQPSK_Ant1_2480_1000~26500



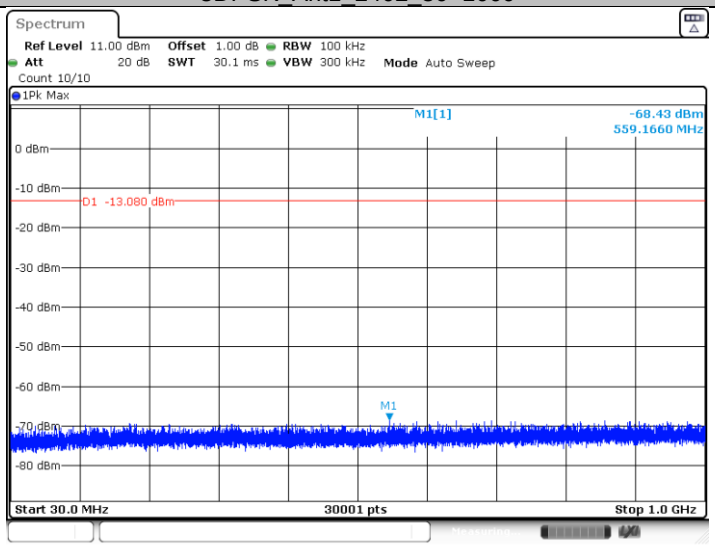
Date: 1.JUN.2022 15:34:16

8DPSK_Ant1_2402_0~Reference



Date: 1.JUN.2022 15:43:22

8DPSK_Ant1_2402_30~1000



Date: 1.JUN.2022 15:43:28

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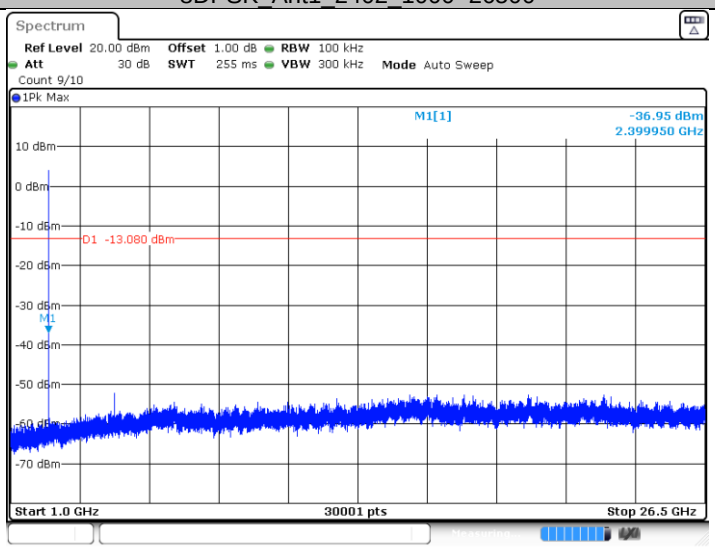
8DPSK_Ant1_2402_1000~26500



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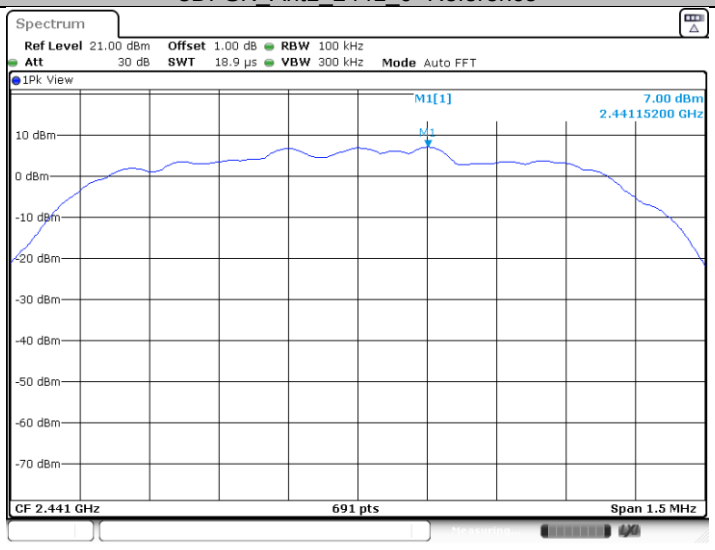

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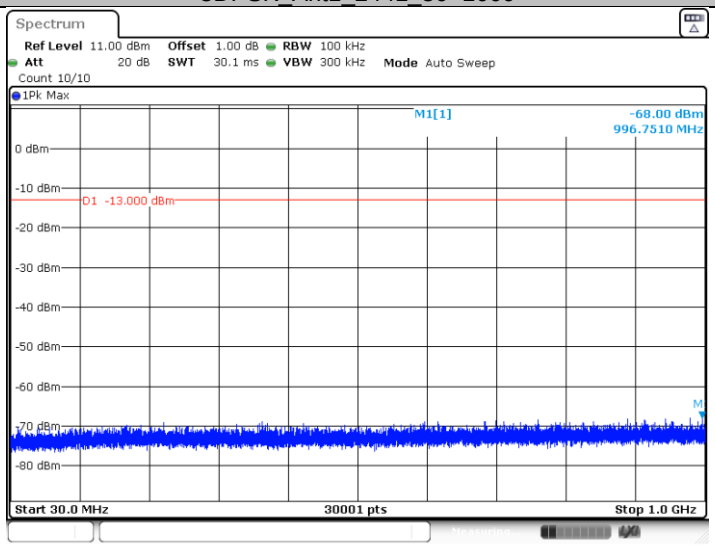

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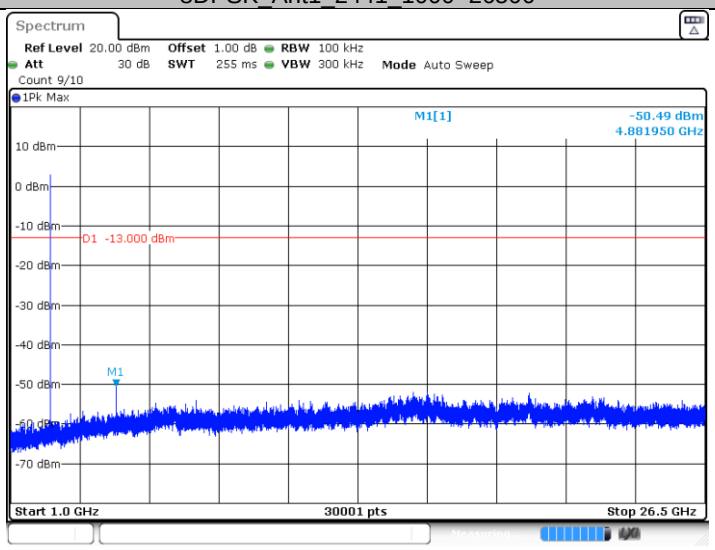
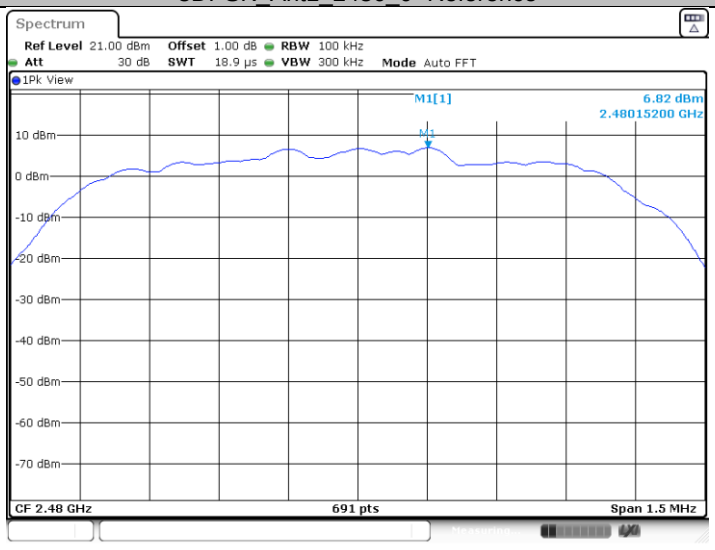
8DPSK_Ant1_2441_1000~26500



8DPSK_Ant1_2480_0~Reference



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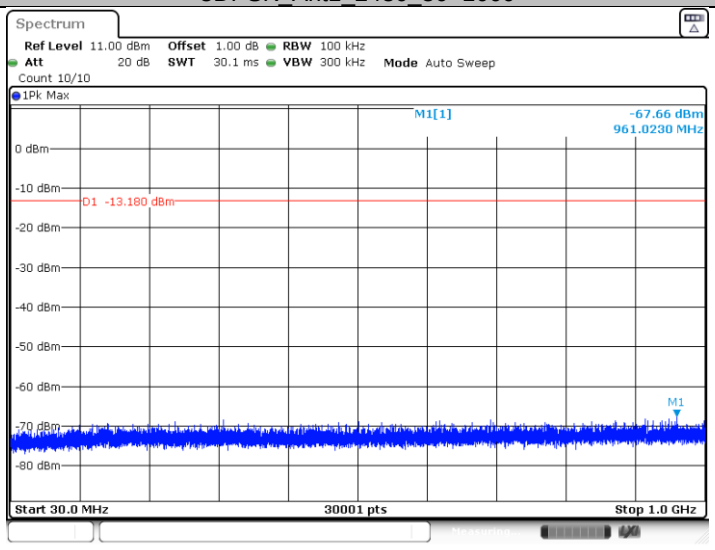

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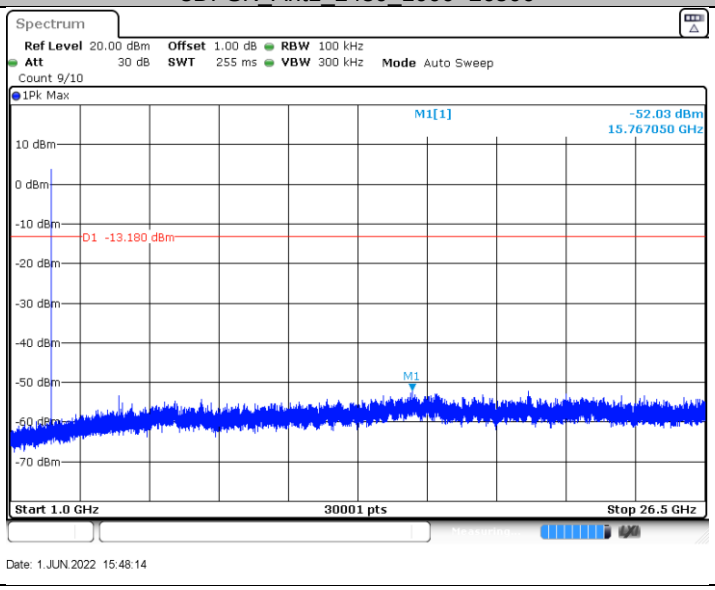
8DPSK_Ant1_2480_1000~26500


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9.8 Band edge testing

Test Method

1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW≥RBW, Sweep = auto, Detector function = peak, Trace = max hold
2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
3 The level displayed must comply with the limit specified in this Section.
4 Repeat the test at the hopping off and hopping on mode, submit all the plots.

Limit:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits.

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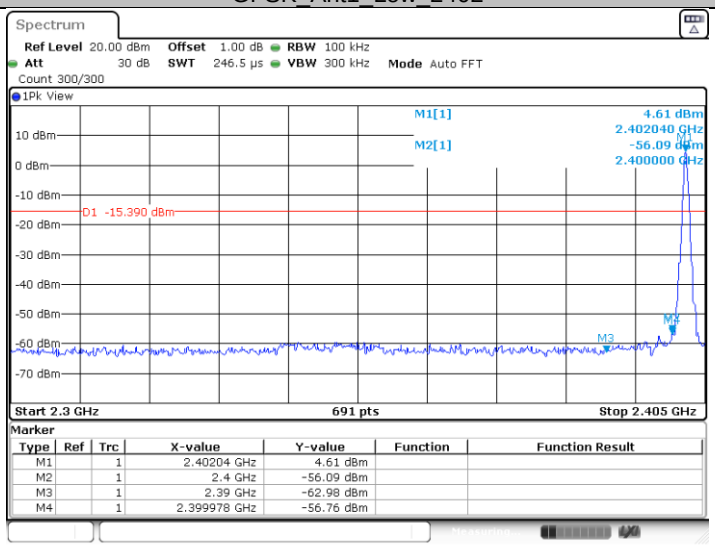
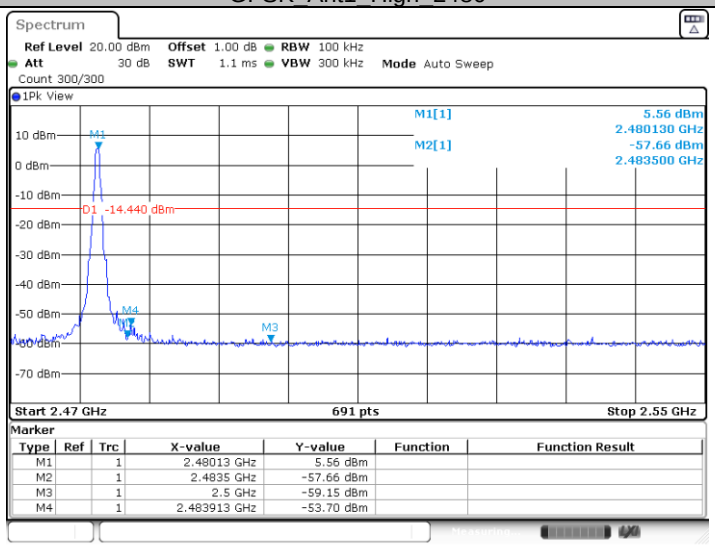
GFSK_Ant1_Low_2402



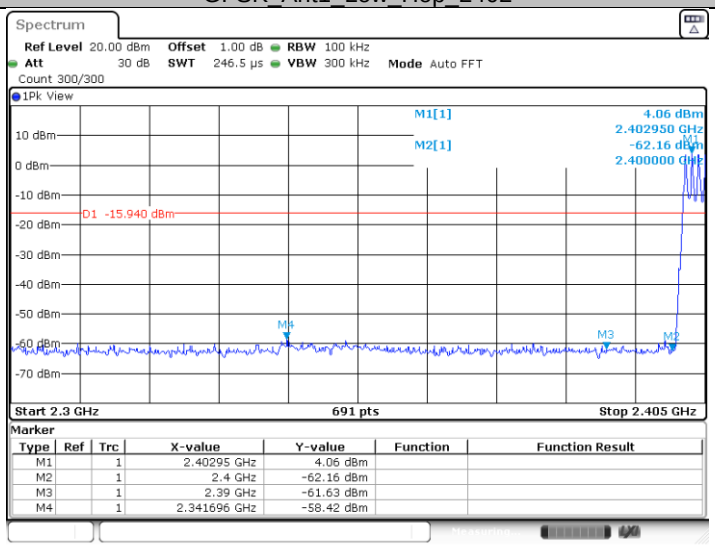
Date: 1.JUN.2022 15:16:29

GFSK_Ant1_High_2480



Date: 1.JUN.2022 15:26:31

GFSK_Ant1_Low_Hop_2402



Date: 1.JUN.2022 15:20:44

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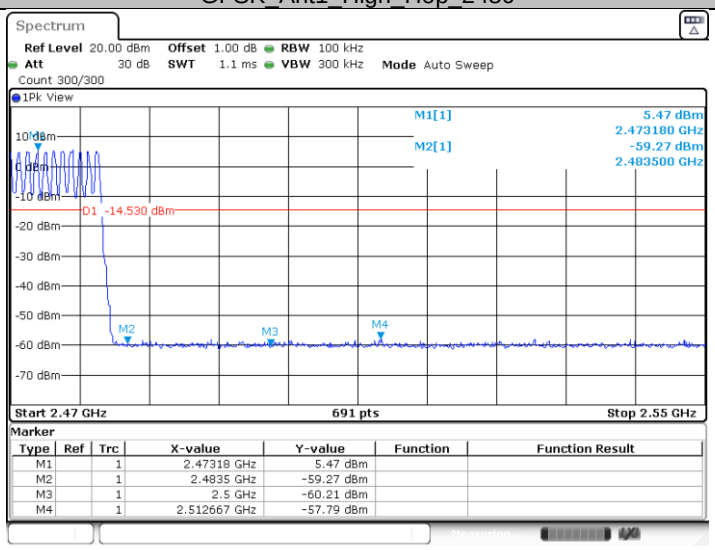
GFSK_Ant1_High_Hop_2480

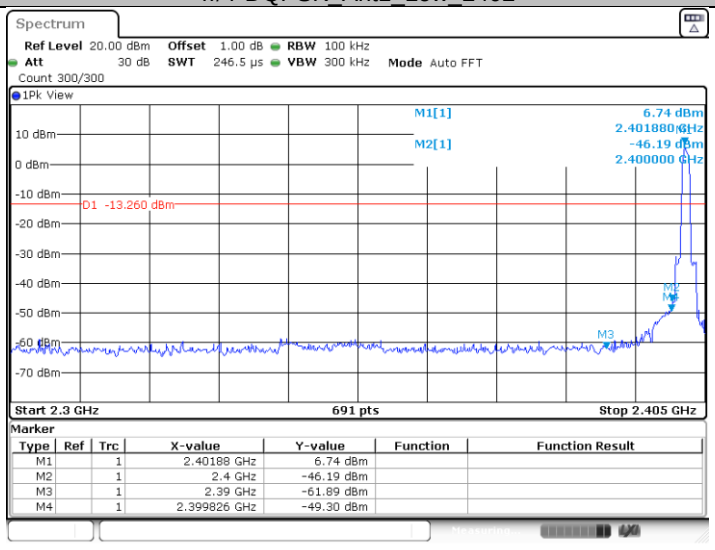


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.47318 GHz	5.47 dBm		
M2		1	2.4835 GHz	-59.27 dBm		
M3		1	2.5 GHz	-60.21 dBm		
M4		1	2.512667 GHz	-57.79 dBm		

Date: 1.JUN.2022 15:22:35

π/4-DQPSK_Ant1_Low_2402

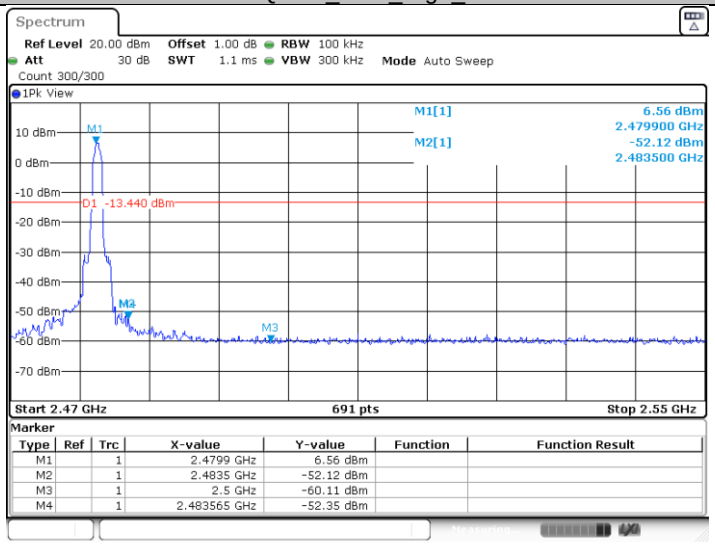


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40188 GHz	6.74 dBm		
M2		1	2.4 GHz	-46.19 dBm		
M3		1	2.39 GHz	-61.89 dBm		
M4		1	2.399826 GHz	-49.30 dBm		

Date: 1.JUN.2022 15:28:51

π/4-DQPSK_Ant1_High_2480



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4799 GHz	6.56 dBm		
M2		1	2.4835 GHz	-52.12 dBm		
M3		1	2.5 GHz	-60.11 dBm		
M4		1	2.483565 GHz	-52.35 dBm		

Date: 1.JUN.2022 15:33:57

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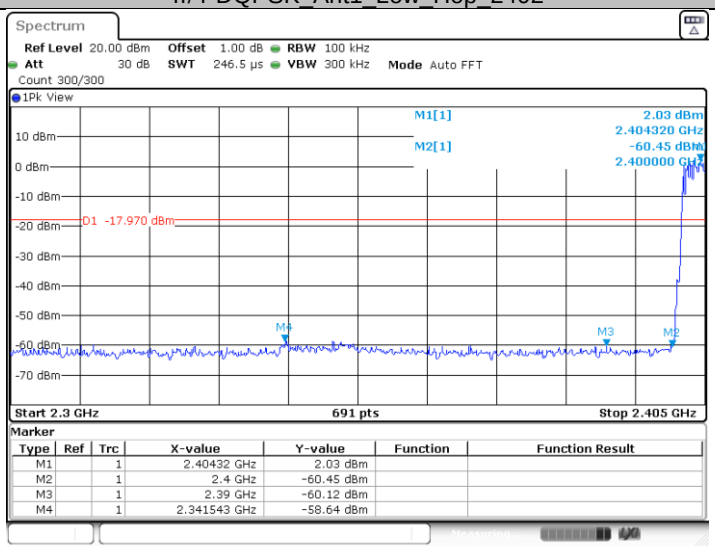
π/4-DQPSK_Ant1_Low_Hop_2402



Date: 1.JUN.2022 15:35:52

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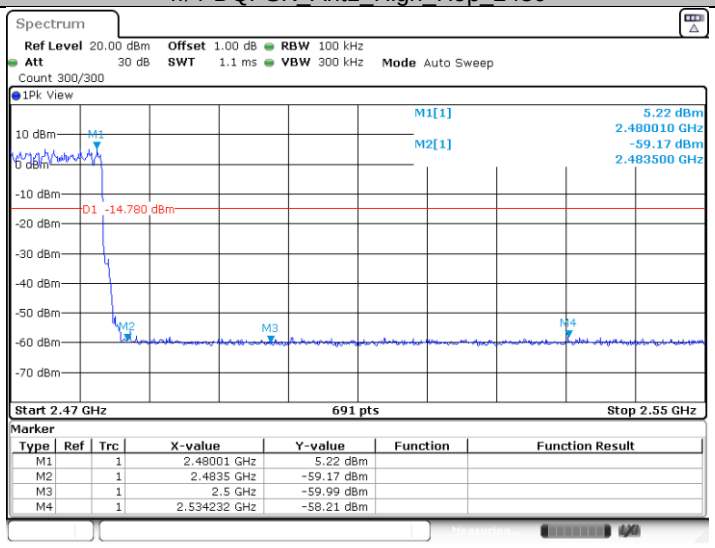

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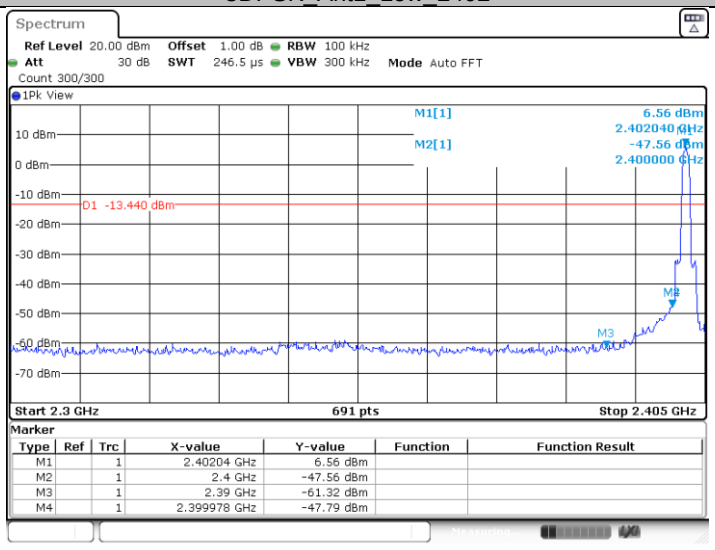
8DPSK_Ant1_Low_2402



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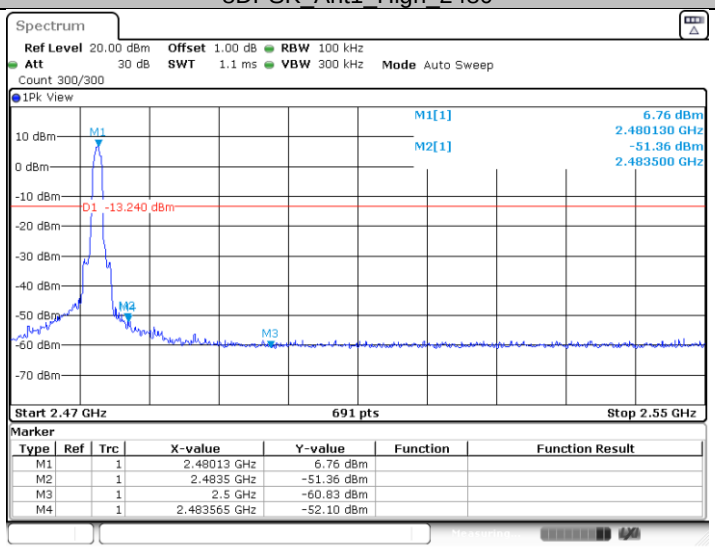
8DPSK_Ant1_High_2480



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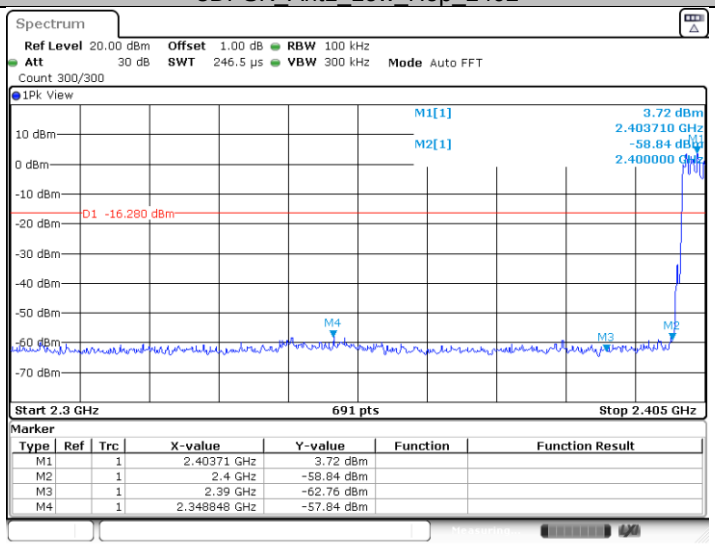
8DPSK_Ant1_Low_Hop_2402



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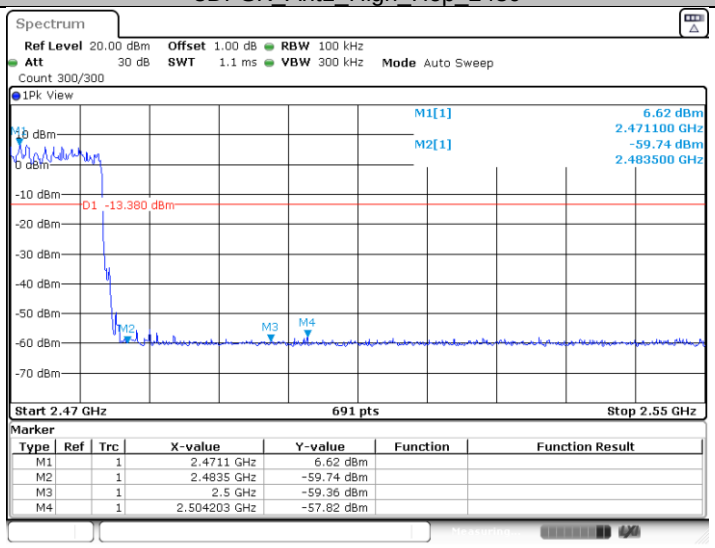
8DPSK_Ant1_High_Hop_2480



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9.9 Spurious radiated emissions for transmitter

Test Method

1: The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3: The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5: Use the following spectrum analyzer settings According to C63.10:
For Below 1GHz
Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 KHz to 120KHz, VBW≥RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW≥RBW for peak measurement ,Sweep = auto, Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz

a) RBW = 1 MHz.
b) VBW ≥[3 × RBW].
c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \ RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
e) Sweep time = auto.
f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of 1 / D,where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is [10 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

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2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is [20 log (1 / D)], where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.
3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

Limit

The radio emission outside the operating frequency band shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Radiated emissions which fall in the restricted bands, as defined in section15.205 and RSS-GEN 8.10, must comply with the radiated emission limits specified in section 15.209.

Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

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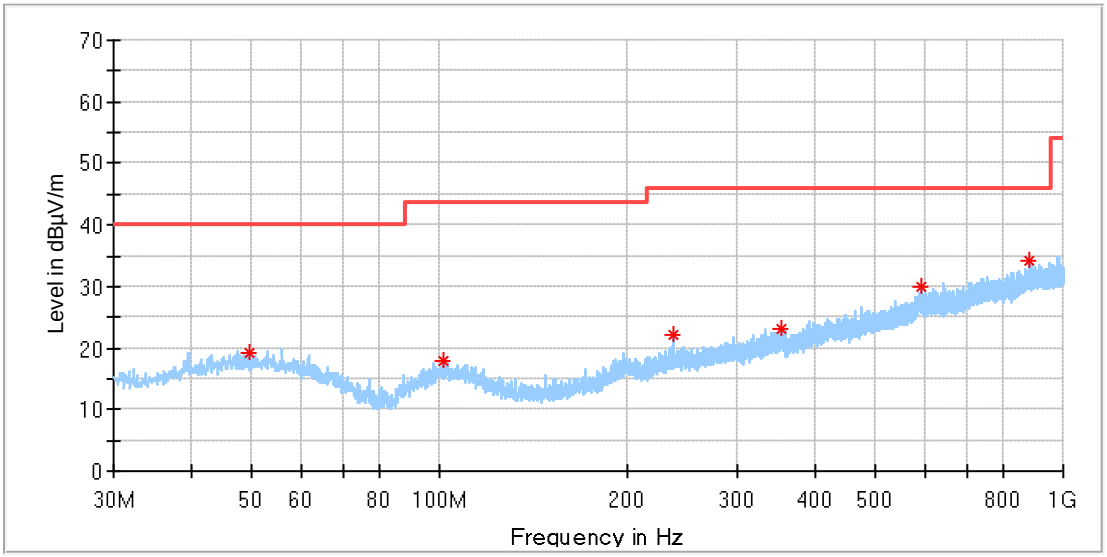
Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.
The only worse case (8DPSK mode) test result is listed in the report.

Transmitting spurious emission test result as below:

Below 1G:



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
49.642500	19.20	40.00	20.80	200.0	H	0.0	21.00
101.052500	17.92	43.50	25.58	200.0	H	162.0	19.22
237.095000	22.07	46.00	23.93	200.0	H	0.0	20.24
352.646250	23.21	46.00	22.79	200.0	H	0.0	23.60
590.235625	29.99	46.00	16.01	200.0	H	21.0	28.29
882.326875	34.08	46.00	11.92	200.0	H	262.0	32.15

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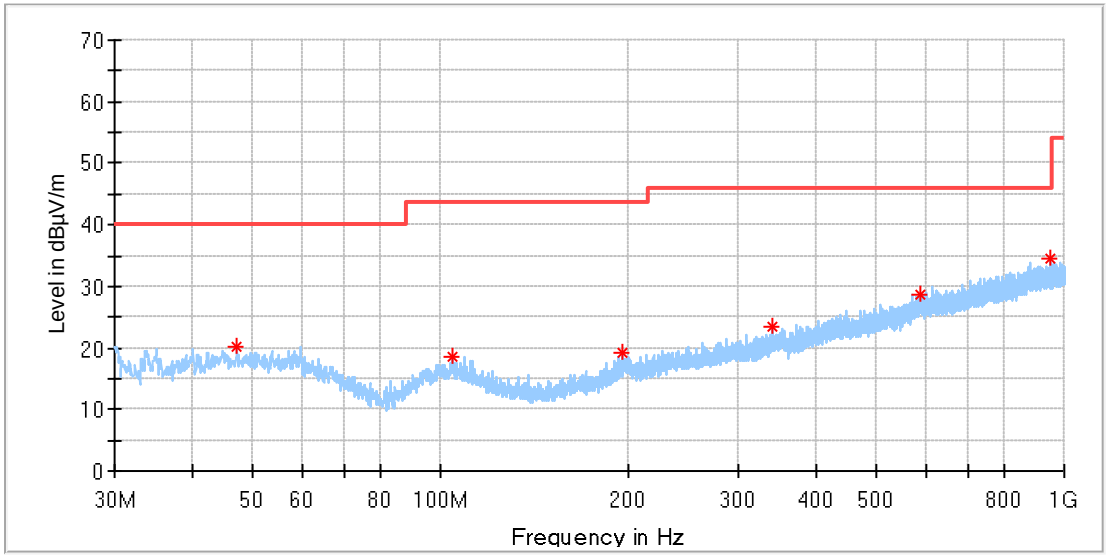

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
47.217500	20.25	40.00	19.75	100.0	V	162.0	20.78
104.386875	18.63	43.50	24.87	100.0	V	0.0	19.31
195.445625	19.22	43.50	24.28	100.0	V	267.0	19.17
341.248750	23.40	46.00	22.60	100.0	V	78.0	23.13
587.204375	28.78	46.00	17.22	100.0	V	68.0	28.21
951.439375	34.64	46.00	11.36	100.0	V	330.0	32.66

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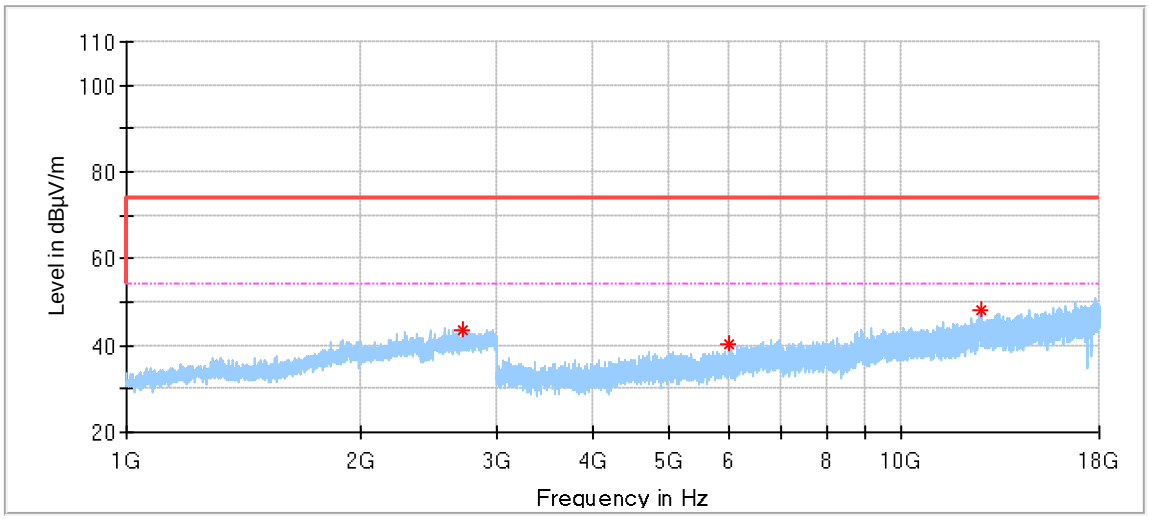
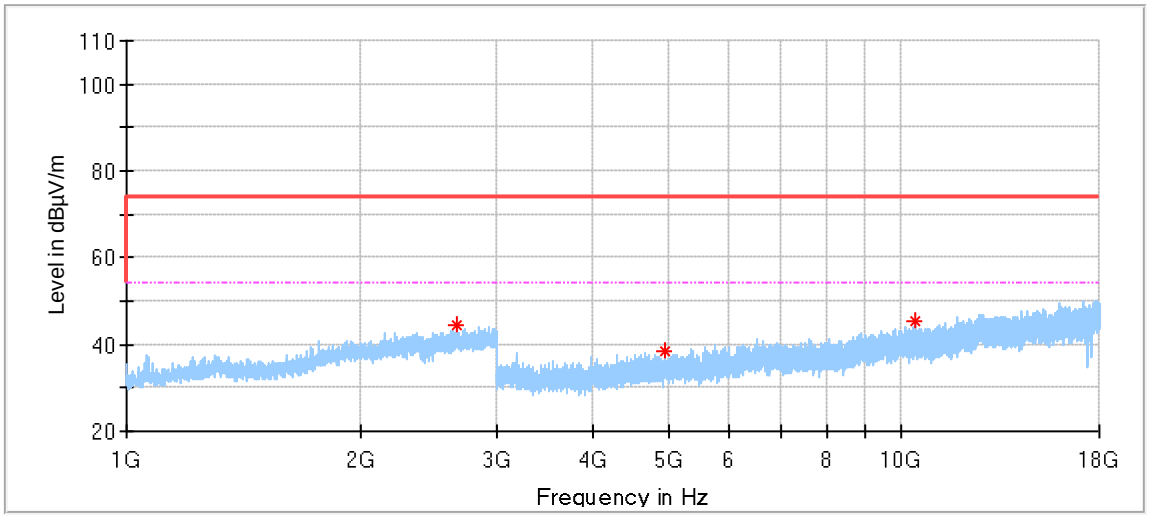
Low channel 2402MHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2722.380952	43.54	74.00	30.46	150.0	H	319.0	-1.29
5995.500000	40.48	74.00	33.52	150.0	H	327.0	7.98
12642.000000	48.00	74.00	26.00	150.0	H	295.0	16.72



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2660.476191	44.44	74.00	29.56	150.0	V	13.0	-1.36
4959.000000	38.60	74.00	35.40	150.0	V	356.0	5.31
10416.500000	45.52	74.00	28.48	150.0	V	327.0	12.62

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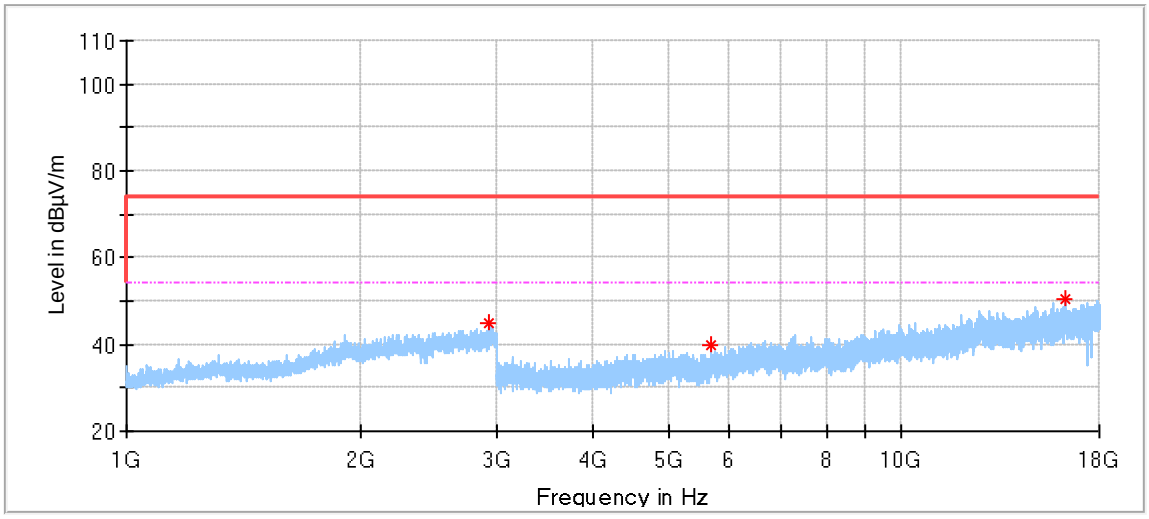
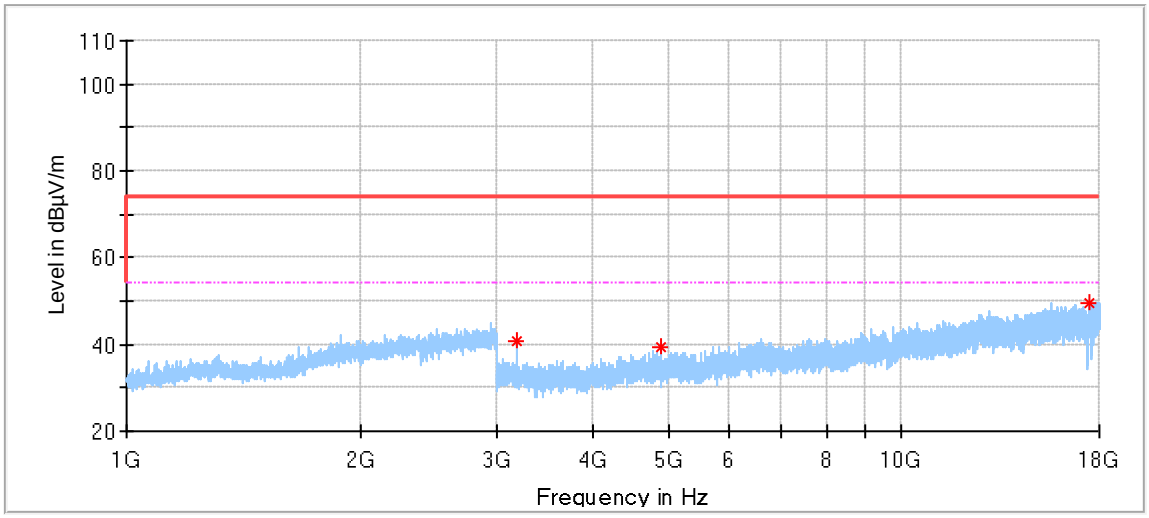
Middle channel 2441MHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2931.428571	44.92	74.00	29.08	150.0	H	268.0	-0.66
5684.500000	39.96	74.00	34.04	150.0	H	120.0	6.76
16290.500000	50.31	74.00	23.69	150.0	H	264.0	20.14



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3195.000000	40.64	74.00	33.36	150.0	V	35.0	0.36
4882.000000	39.34	74.00	34.66	150.0	V	146.0	4.94
17451.000000	49.73	74.00	24.27	150.0	V	233.0	21.85

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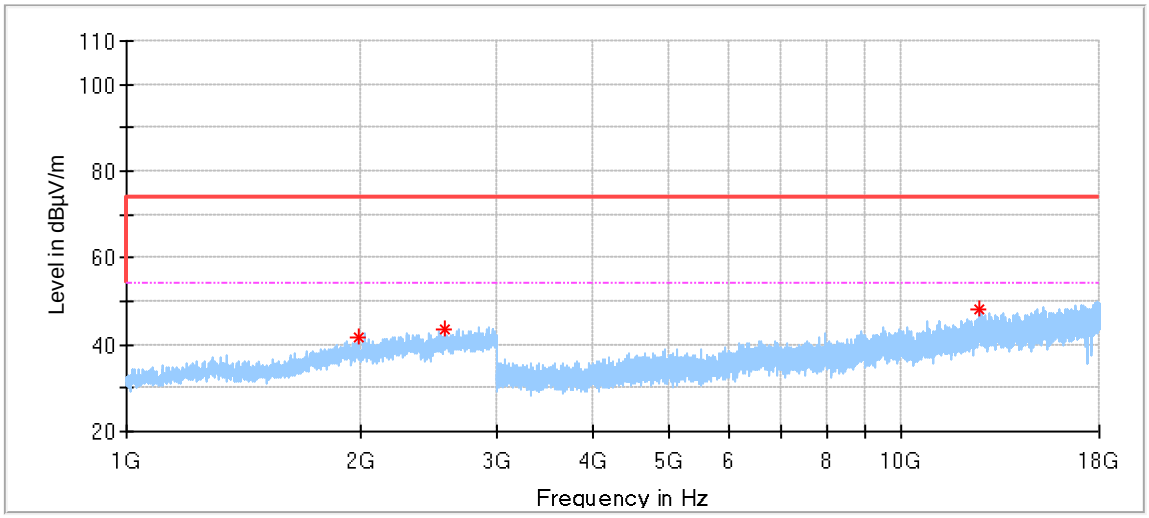
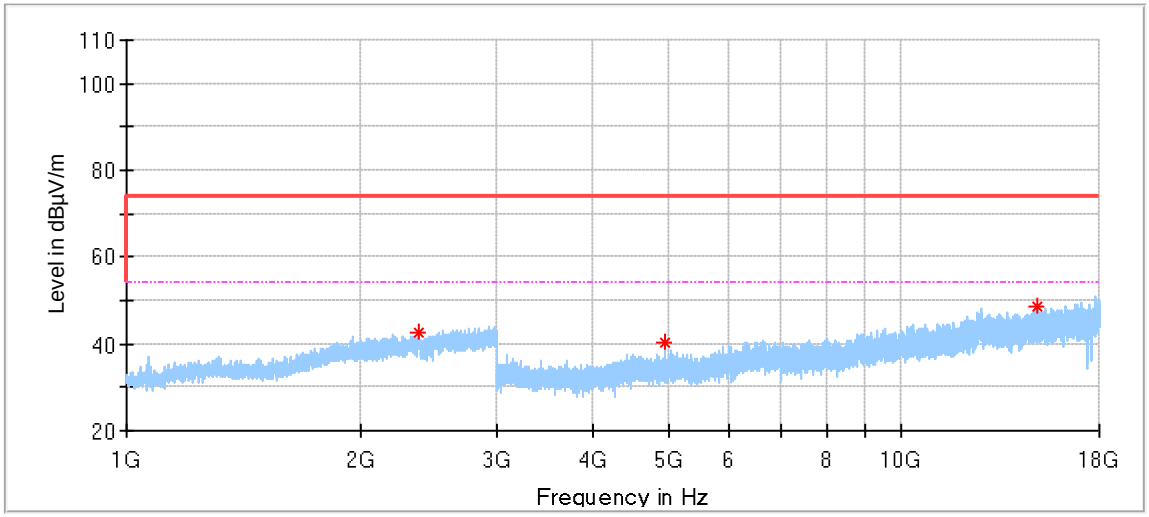
Shenzhen, Guangdong 518052, China Tel. +86 755 8828 6998, Fax: +86 755 8828 5299

High channel 2480MHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1998.095238	41.74	74.00	32.26	150.0	H	0.0	-3.76
2570.000000	43.49	74.00	30.51	150.0	H	4.0	-1.55
12602.500000	47.99	74.00	26.01	150.0	H	151.0	16.28



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2377.142857	42.58	74.00	31.42	150.0	V	0.0	-2.28
4960.000000	40.30	74.00	33.70	150.0	V	297.0	5.32
14956.000000	48.76	74.00	25.24	150.0	V	67.0	17.34

Remark:

(1) Data of measurement within frequency range18-26GHz are the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured, so test data does not present in this report,

(2) Level= Reading Level + Correction Factor

(3) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss
(The Reading Level is recorded by software which is not shown in the sheet)

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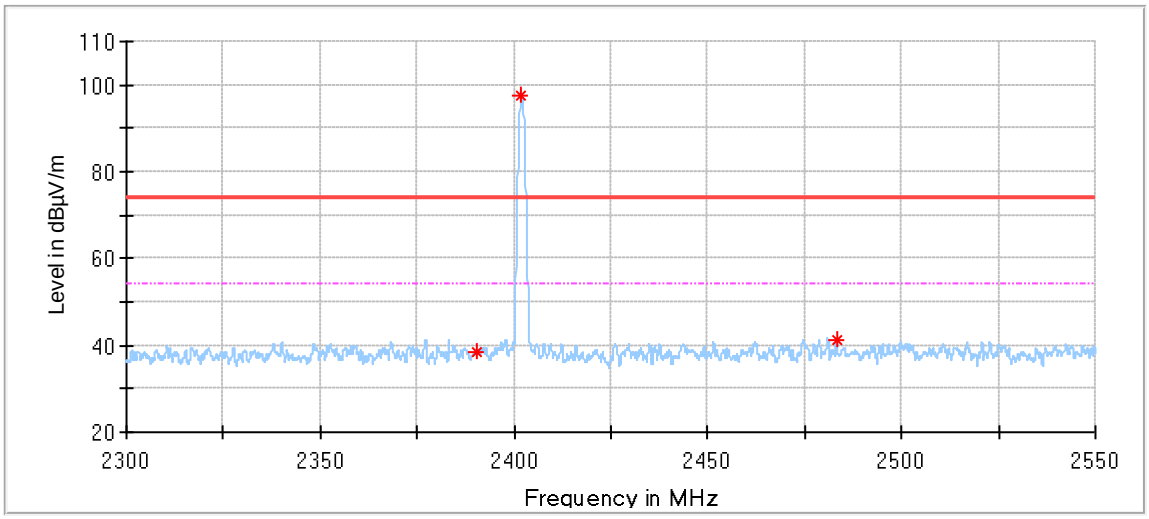
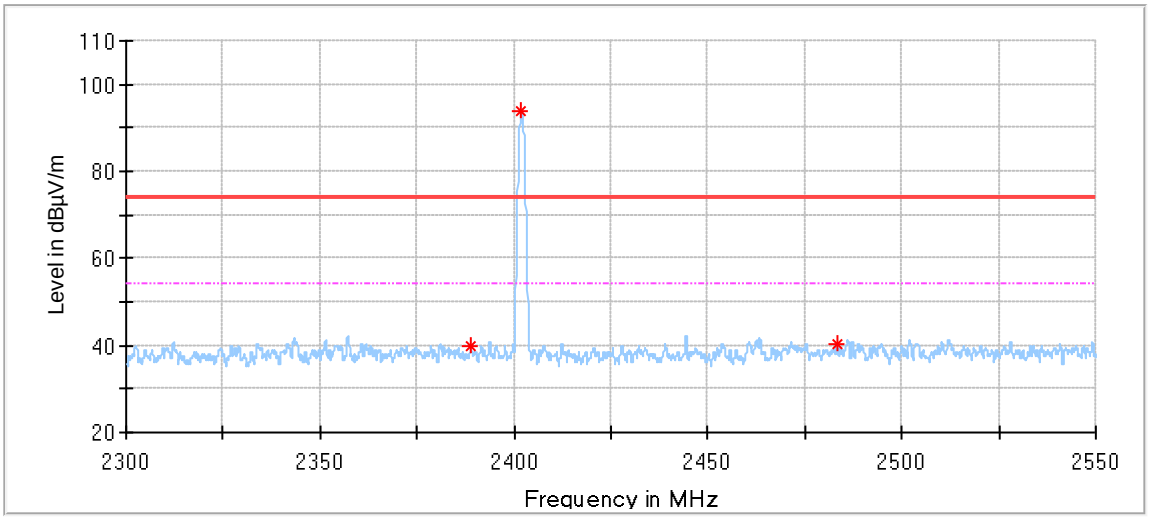
Restricted bands of operation test result as below:

Low channel 2402MHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2390.238095	38.38	74.00	35.62	150.0	H	129.0	-2.93
2401.904762	97.36	74.00	-23.36	150.0	H	269.0	-2.92
2483.214286	41.01	74.00	32.99	150.0	H	245.0	-2.60



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2388.869048	39.67	74.00	34.33	150.0	V	182.0	-2.93
2401.904762	93.70	74.00	-19.70	150.0	V	261.0	-2.92
2483.214286	40.14	74.00	33.86	150.0	V	37.0	-2.60

Remark:
Level=Reading Level + Correction Factor
Correction Factor=Antenna Factor + Cable Loss – Pre-amplifier
(The Reading Level is recorded by software which is not shown in the sheet)

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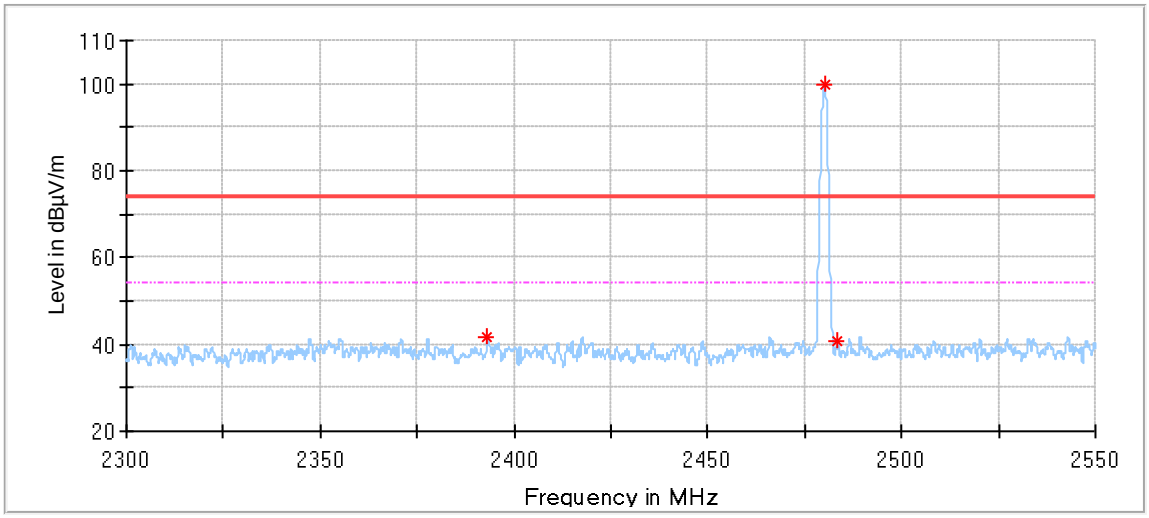
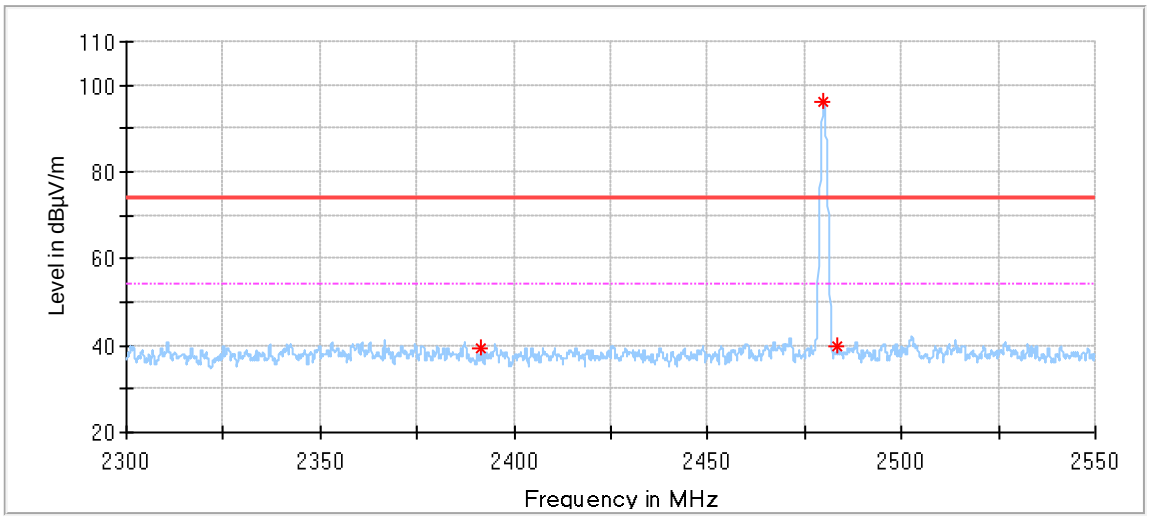
High channel 2480MHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2393.214286	41.85	74.00	32.15	150.0	H	163.0	-2.93
2480.119048	99.75	74.00	-25.75	150.0	H	270.0	-2.62
2483.392857	40.93	74.00	33.07	150.0	H	264.0	-2.60



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2391.488095	39.42	74.00	34.58	150.0	V	295.0	-2.93
2479.940476	96.23	74.00	-22.23	150.0	V	259.0	-2.62
2483.392857	39.75	74.00	34.25	150.0	V	206.0	-2.60

Remark:
Level=Reading Level + Correction Factor
Correction Factor=Antenna Factor + Cable Loss – Pre-amplifier
(The Reading Level is recorded by software which is not shown in the sheet)

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10 Test Equipment List

Conducted Emission Test

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Cal interval (year)	Cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 3	68-4-74-14-001	101782	1	2023-5-27
LISN	Rohde & Schwarz	ENV432	68-4-87-16-001	101318	1	2023-5-27
Attenuator	Shanghai Huaxiang	TS2-26-3	68-4-81-16-003	080928189	1	2023-5-27
Test software	Rohde & Schwarz	EMC32	68-4-90-14-003-A10	Version 9.15.00	N/A	N/A
Shielding Room	TDK	CSR #1	68-4-90-19-004	----	1	2022-11-07

Radiated Emission Test 1#

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Cal interval (year)	Cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 7	68-4-74-19-001	102176	1	2023-5-27
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	68-4-80-14-002	707	1	2022-7-23
Pre-amplifier	Rohde & Schwarz	SCU 18	68-4-29-14-001	102230	1	2023-5-28
Attenuator	Mini-circuits	UNAT-6+	68-4-81-21-001	15542	1	2023-5-27
3m Semi-anechoic chamber	TDK	SAC-3 #1	68-4-90-14-001	----	2	2023-5-28
Test software	Rohde & Schwarz	EMC32	68-4-90-14-001-A10	Version 10.35.02	N/A	N/A

Radiated Emission Test 2#

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Cal interval (year)	Cal. due date
EMI Test Receiver	Rohde & Schwarz	ESR 26	68-4-74-14-002	101269	1	2023-5-28
Wave Guide Antenna	ETS	3117	68-4-80-19-001	00218954	1	2023-5-9
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-001	100745	1	2023-5-28
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-002	100746	1	2023-5-28
Sideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	68-4-80-14-008	12827	1	2022-7-21
Pre-amplifier	Rohde & Schwarz	SCU 40A	68-4-29-14-002	100432	1	2022-7-27
Attenuator	Mini-circuits	UNAT-6+	68-4-81-21-002	15542	1	2023-5-27
3m Semi-anechoic chamber	TDK	SAC-3 #2	68-4-90-19-006	----	2	2023-5-28
Test software	Rohde & Schwarz	EMC32	68-4-90-19-006-A01	Version 10.35.02	N/A	N/A

RF Conducted Test

Description	Manufacturer	Model no.	Equipment ID	Serial no.	Cal interval (year)	Cal. due date
Signal Analyzer	Rohde & Schwarz	FSV40	68-4-74-14-004	101030	1	2023-5-27

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11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Conducted Emission 150kHz-30MHz (for test using AMN ENV432)	3.71dB
Uncertainty for Radiated Emission in 3m chamber (68-4-90-14-001)30MHz-1000MHz	Horizontal: 4.68dB; Vertical: 4.65dB;
Uncertainty for Radiated Emission in new 3m chamber (68-4-90-19-006) 1000MHz-18000MHz	Horizontal: 4.76dB; Vertical: 4.75dB;
Uncertainty for Radiated Emission 18000MHz-40000MHz	Horizontal: 4.51dB; Vertical: 4.50dB
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.27dB Frequency test involved: 0.6×10^{-7} or 1%

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.

---THE END OF REPORT---

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