FCC/ISED - TEST REPORT

Report Number	:	**68.950.22.0169.01**	Date of Issue:	**2022-03-16**
Model	:	**STMD1**		
Product Type	:	WiFi/BT Module		
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	:	64		

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1 Table of Contents

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, Nantou Checkpoint Road 2, Nanshan District, Shenzhen City, 518052, P. R. China
FCC Designation Number:	CN5009
FCC Registration No.:	514049
IC Registration Number:	10320A
Telephone: Fax:	86 755 8828 6998 86 755 8828 5299

3 Description of the Equipment Under Test

Product:	WiFi/BT Module
Model no.:	STMD1
FCC ID:	CNFSTMD1
IC:	10193A-STMD1
PMN:	STMD1
HVIN:	STMD1
Rating:	3.6VDC
RF Transmission Frequency:	2402MHz-2480MHz
No. of Operated Channel:	79
Modulation:	GFSK, π/4-DQPSK, 8DPSK
Antenna Type:	PIFA
Antenna Gain:	1.64dBi max for 2.4GHz
Description of the EUT:	The Equipment Under Test (EUT) is a WiFi/BT Module supports 2.4GHz Bluetooth/WIFI, 5GHz WIFI functions.

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.

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 a PIFA antenna, which gain is 1.64dBi. In accordance to §15.203 and RSS-Gen 6.8, it is considered sufficiently to comply with the provisions of this section.

6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: CNFSTMD1, 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-STMD1, complies with RSS-247, RSS-GEN.

The Model: STMD1 supports Bluetooth Low Energy/Bluetooth BR+EDR /WIFI functions

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:	2022-02-10
Testing Start Date:	2022-02-10
Testing End Date:	2022-03-08

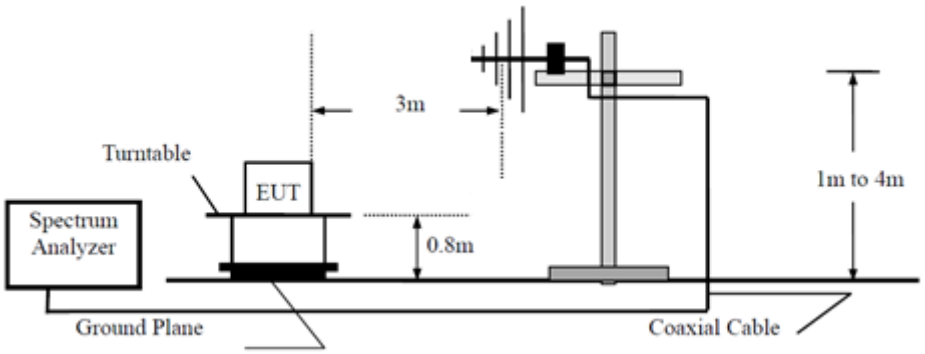
- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch

Reviewed by:	Prepared by:	Tested by:
John Zhi	Joe Gu	Carry Cai
Project Manager	Project Engineer	Test Engineer

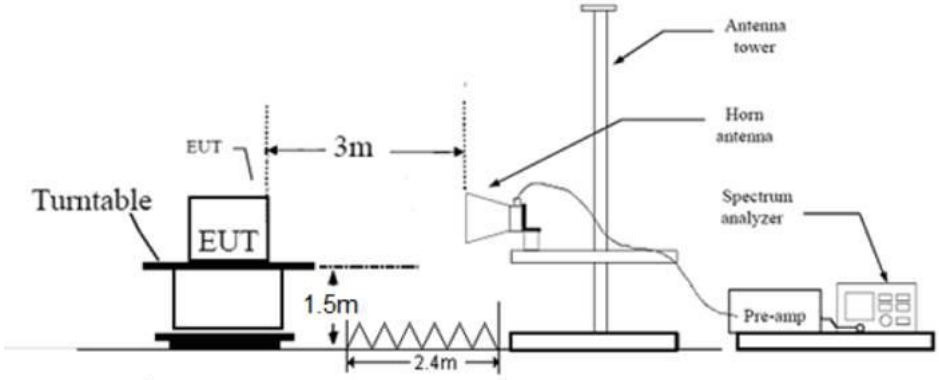
7 Test Setups

7.1 Radiated test setups

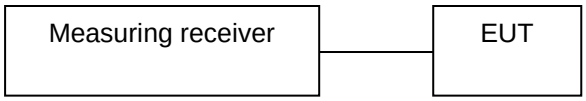
Below 1GHz



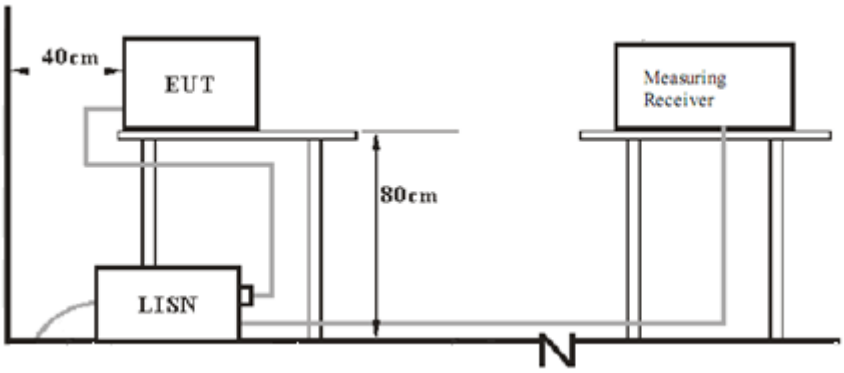
Above 1GHz



7.2 Conducted RF test setups



7.3 AC Power Line Conducted Emission test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

DESCRIPTION	MANUFACTURER	MODEL NO.	S/N
NOTEBOOK	LENOVO	X220	--

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. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.

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

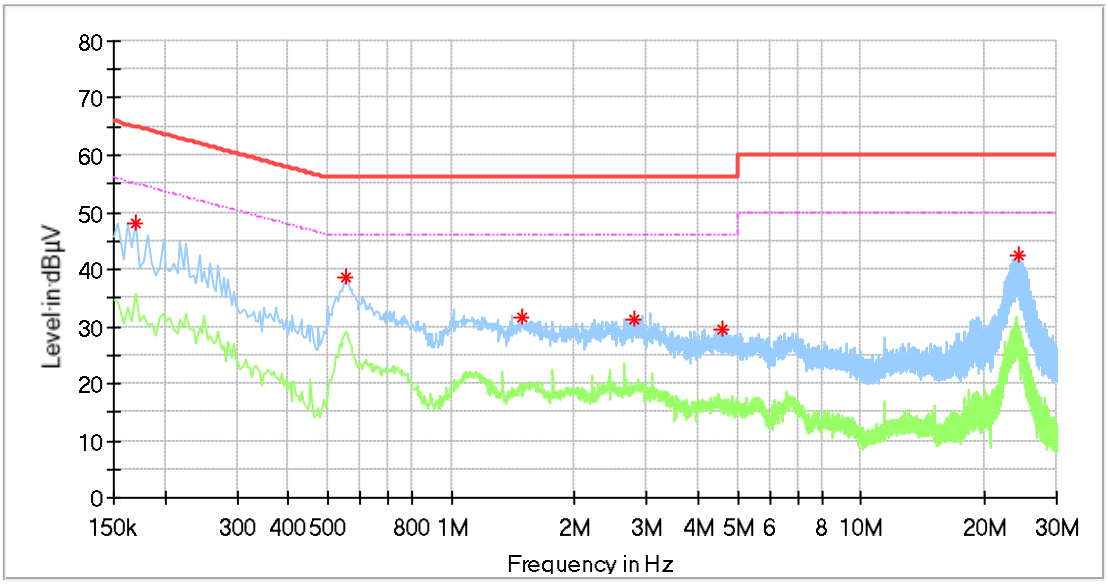
According to §15.207 & RSS-GEN 8.8, conducted emissions limit as below:

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

Conducted Emission

Product Type : WiFi/BT Module
M/N : STMD1
Operating Condition : Charging + TX
Test Specification : Power Line, Live
Comment : AC 120V/60Hz (Notebook)

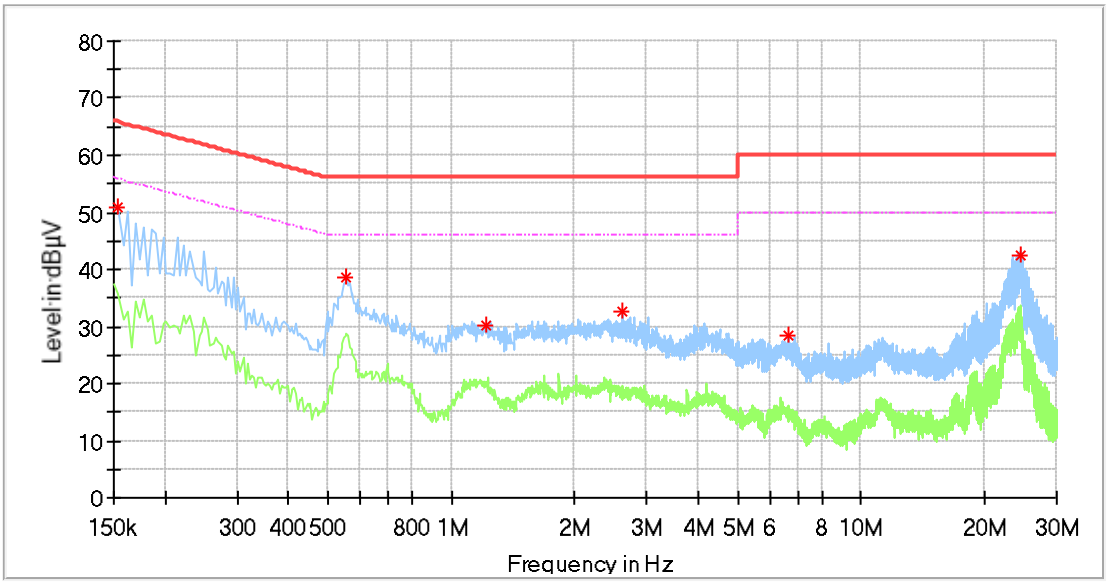


Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.170000	47.95	---	64.96	17.01	L1	9.72
0.554000	38.60	---	56.00	17.40	L1	9.65
1.486000	31.48	---	56.00	24.52	L1	9.68
2.786000	31.22	---	56.00	24.78	L1	9.72
4.578000	29.58	---	56.00	26.42	L1	9.80
24.210000	42.52	---	60.00	17.48	L1	10.42

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)

Conducted Emission

Product Type	:	WiFi/BT Module
M/N	:	STMD1
Operating Condition	:	Charging + TX
Test Specification	:	Power Line, Neutral
Comment	:	AC 120V/60Hz (Notebook)



Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.154000	50.82	---	65.78	14.96	N	9.78
0.554000	38.71	---	56.00	17.29	N	9.68
1.214000	30.12	---	56.00	25.88	N	9.70
2.610000	32.56	---	56.00	23.44	N	9.76
6.650000	28.46	---	60.00	31.54	N	9.96
24.434000	42.58	---	60.00	17.42	N	10.80

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)

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:

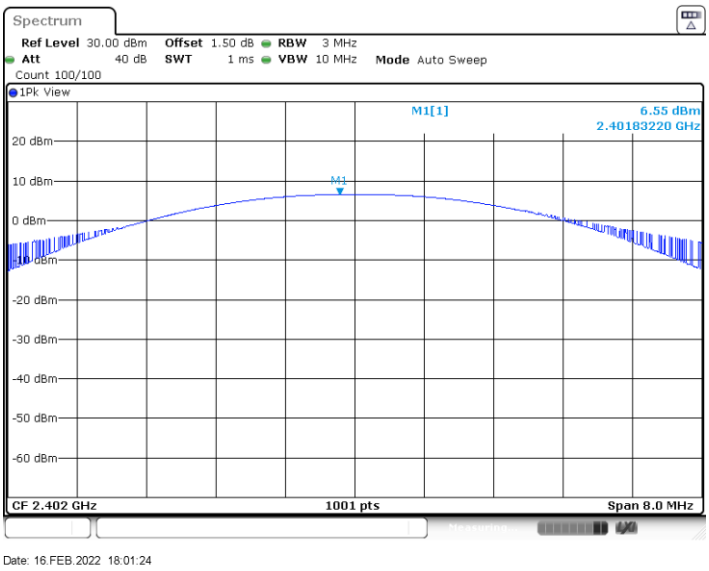
Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤4	≤36.2

Conducted output power

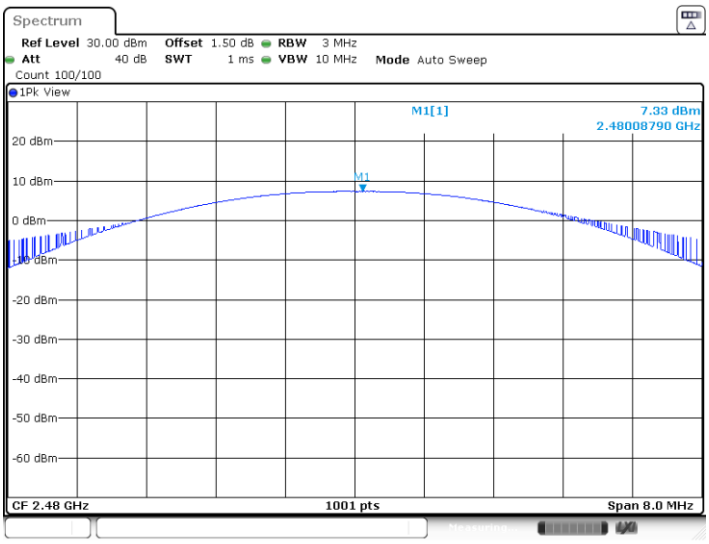
Bluetooth Mode GFSK modulation Test Result

Frequency	Conducted Output Power	Antenna Gain	EIRP	Result
MHz	dBm	dBi	dBm	
Low channel 2402MHz	6.55	1.64	8.19	Pass
Middle channel 2441MHz	7.51	1.64	9.15	Pass
High channel 2480MHz	7.33	1.64	8.97	Pass

Low channel 2402MHz



Middle channel 2441MHz



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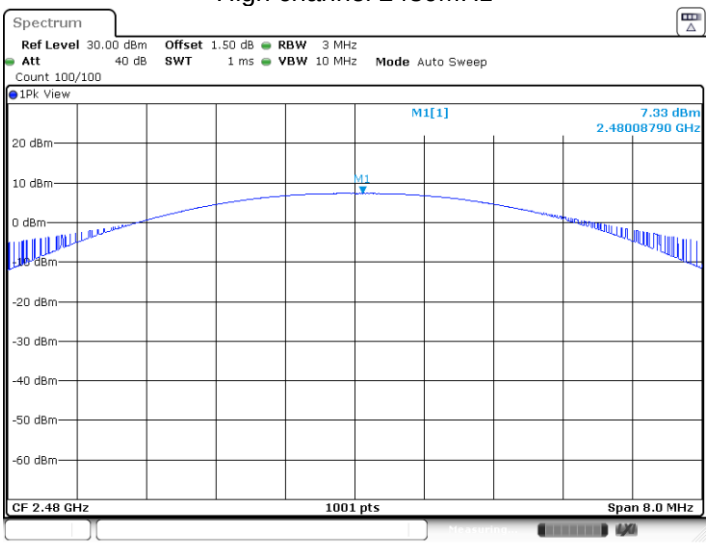
High channel 2480MHz



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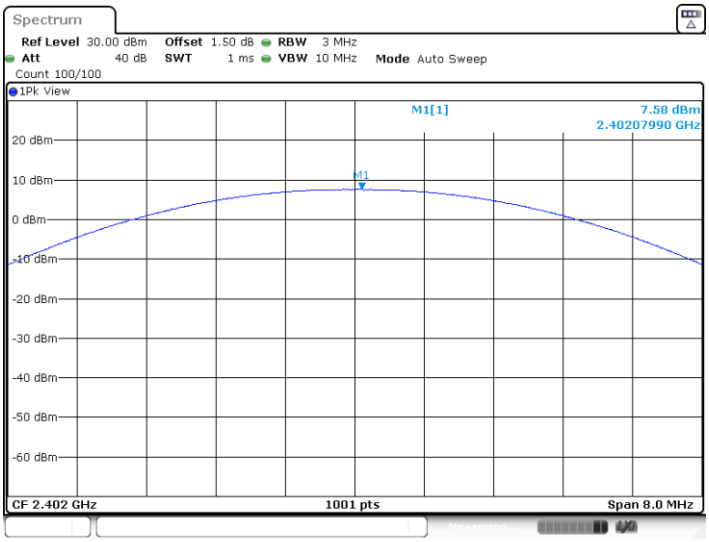
Bluetooth Mode π/4-DQPSK modulation Test Result

Frequency	Conducted Output Power	Antenna Gain	EIRP	Result
MHz	dBm	dBi	dBm	
Low channel 2402MHz	7.58	1.64	9.22	Pass
Middle channel 2441MHz	7.67	1.64	9.31	Pass
High channel 2480MHz	7.16	1.64	8.80	Pass

Low channel 2402MHz



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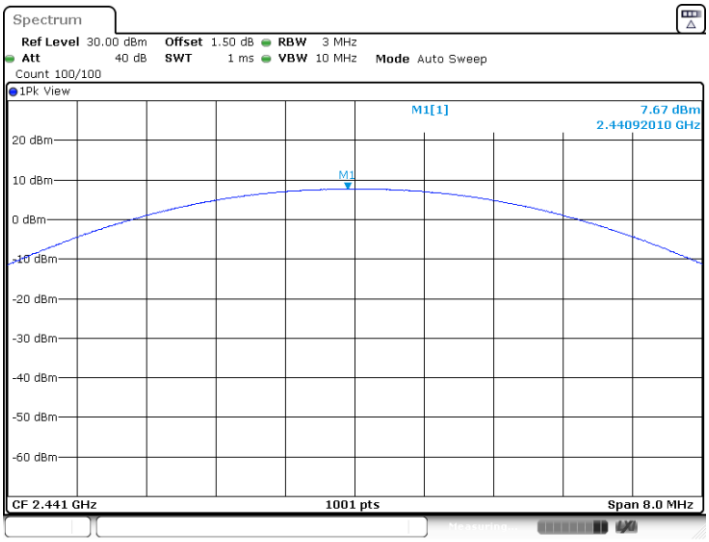
Middle channel 2441MHz



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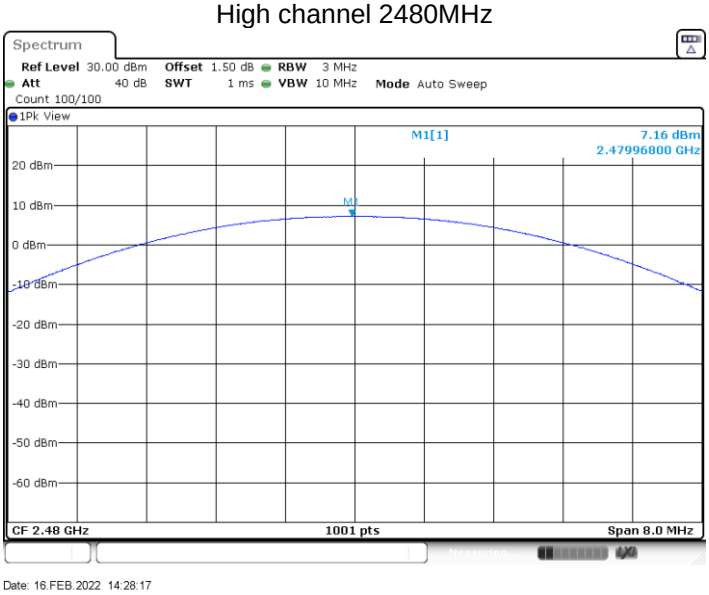
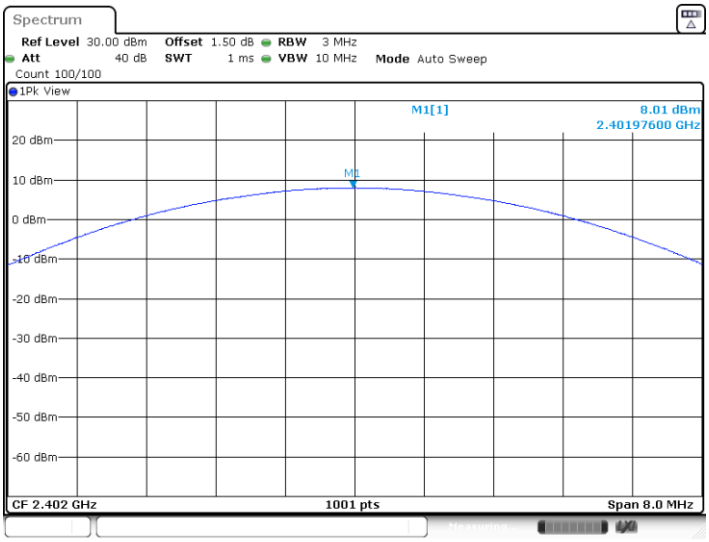
High channel 2480MHz



Bluetooth Mode 8DPSK modulation Test Result

Frequency	Conducted Output Power	Antenna Gain	EIRP	Result
MHz	dBm	dBi	dBm	
Low channel 2402MHz	8.01	1.64	9.65	Pass
Middle channel 2441MHz	8.06	1.64	9.70	Pass
High channel 2480MHz	7.59	1.64	9.23	Pass

Low channel 2402MHz



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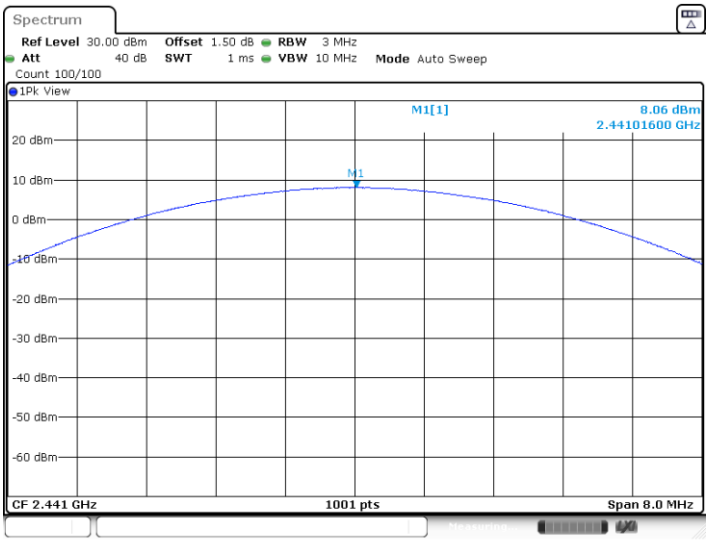
Middle channel 2441MHz



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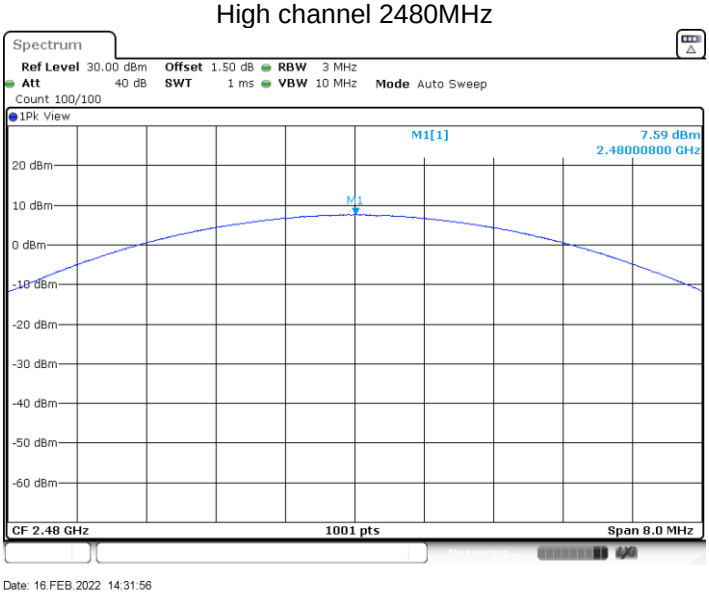
High channel 2480MHz



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

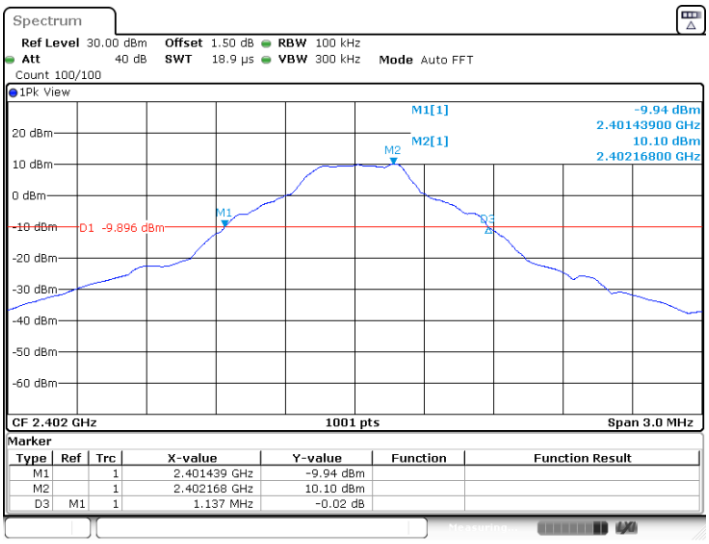
Limit [kHz]
N/A

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	1137	896	--	Pass
2441	1140	899	--	Pass
2480	1146	896	--	Pass

Low channel 2402MHz



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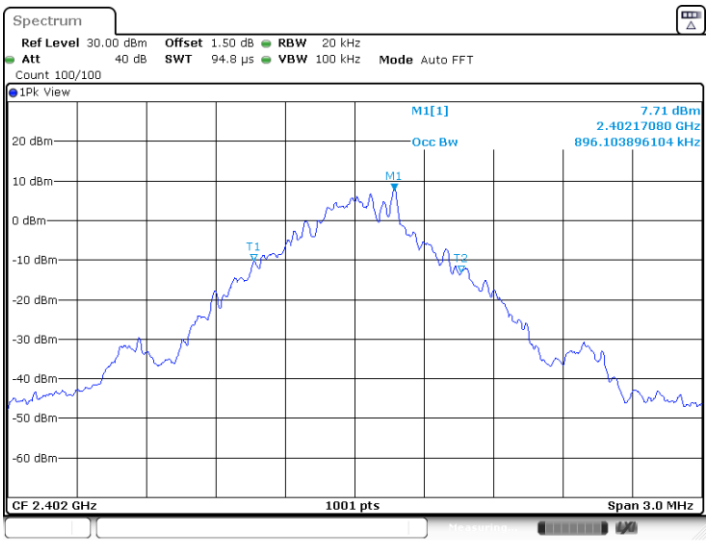

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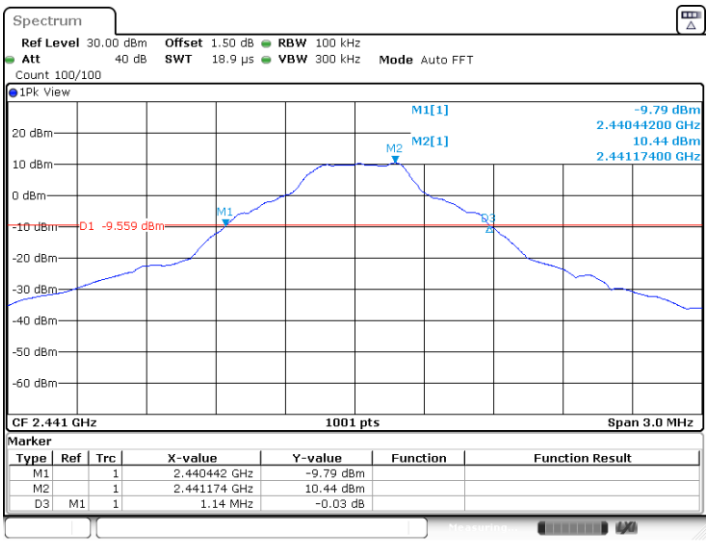
Middle channel 2441MHz



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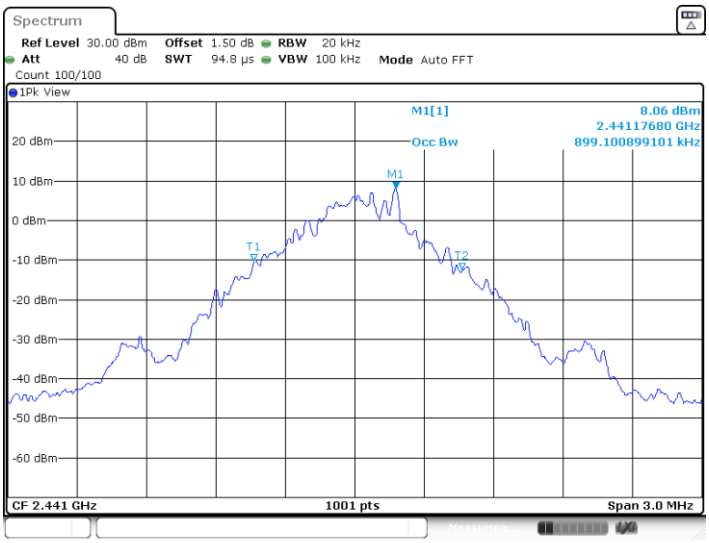

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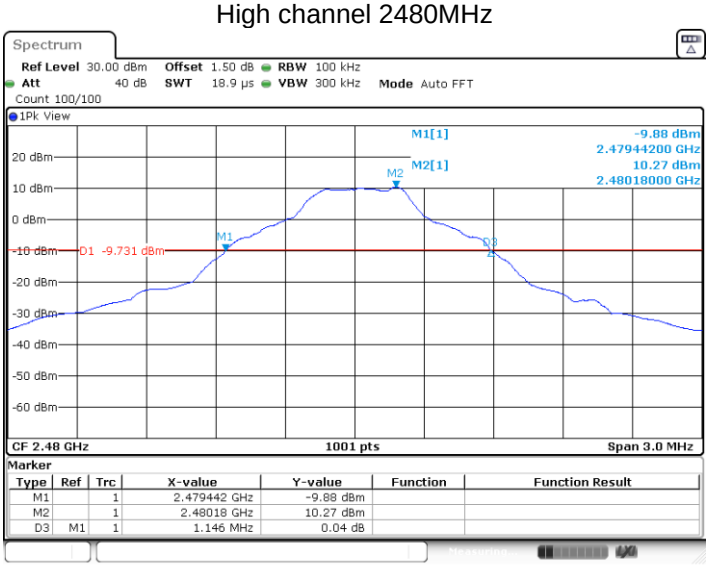
High channel 2480MHz



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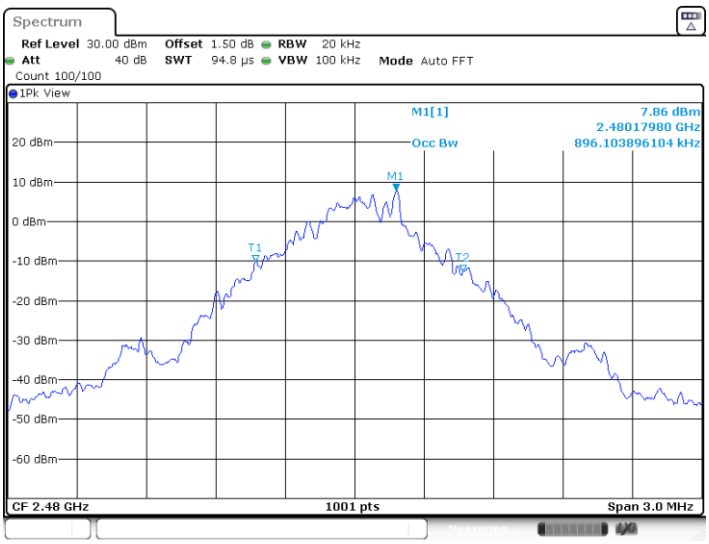

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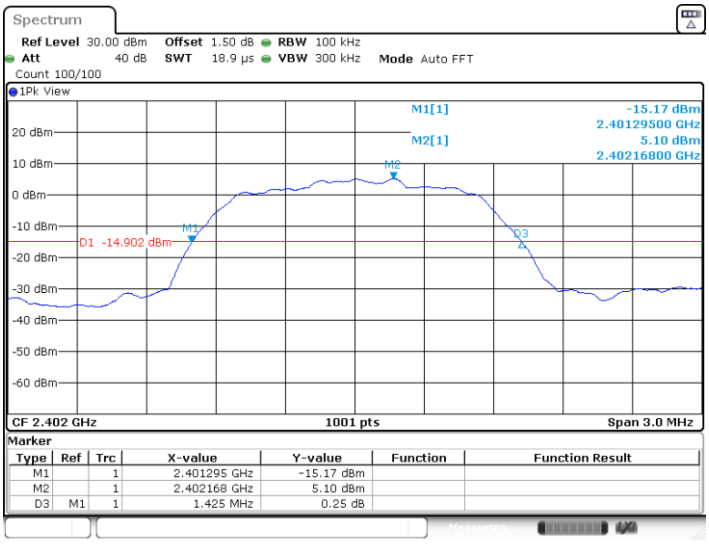
20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode π/4-DQPSK Modulation test result

Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result
MHz	kHz	kHz	kHz	
2402	1425	1214	--	Pass
2441	1428	1214	--	Pass
2480	1431	1217	--	Pass

Low channel 2402MHz



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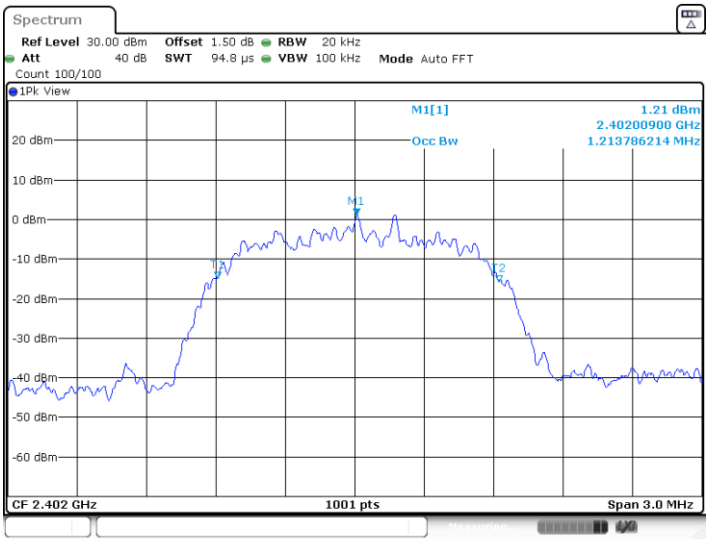

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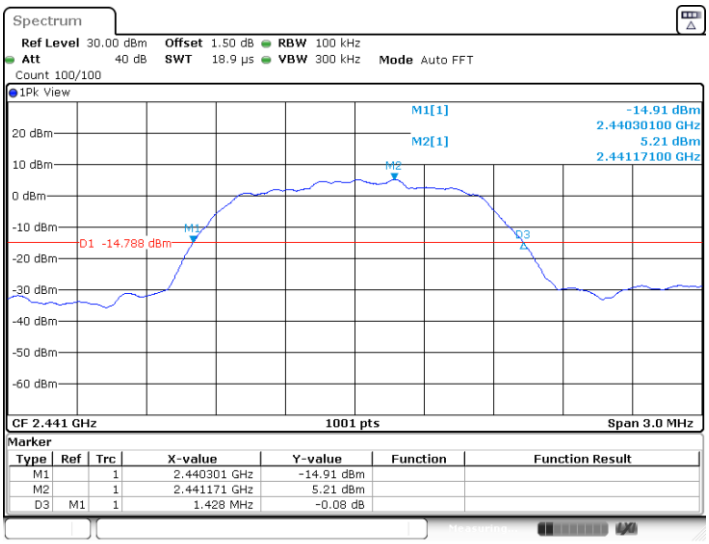
Middle channel 2441MHz



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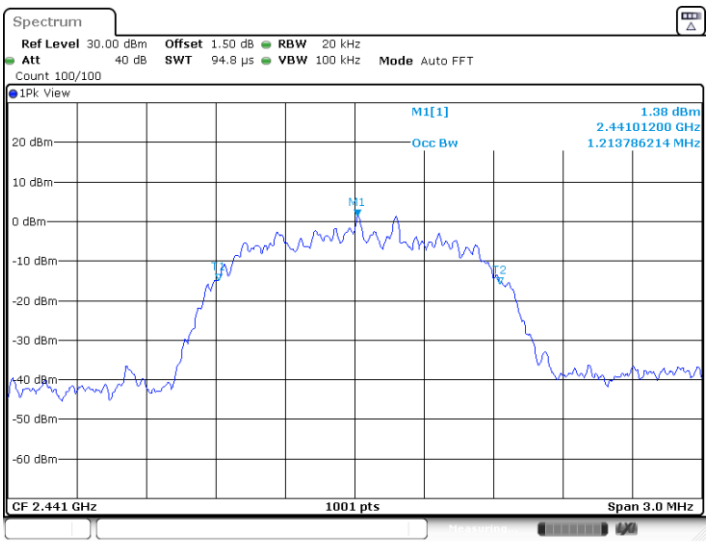

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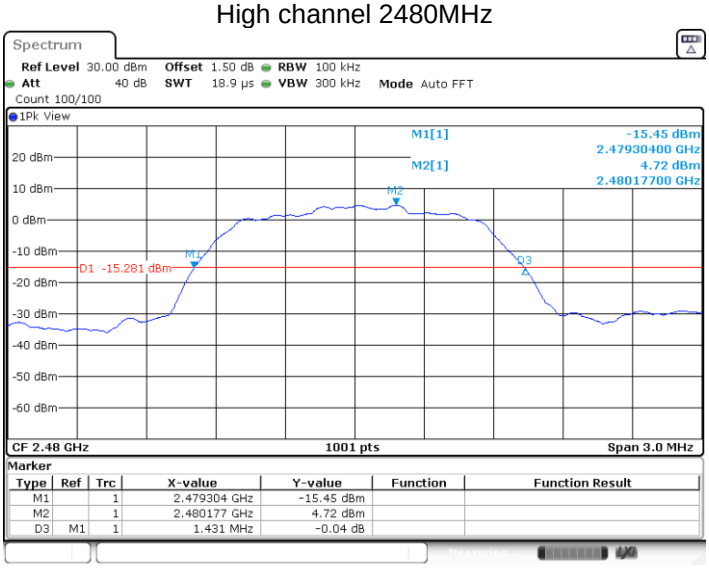
High channel 2480MHz



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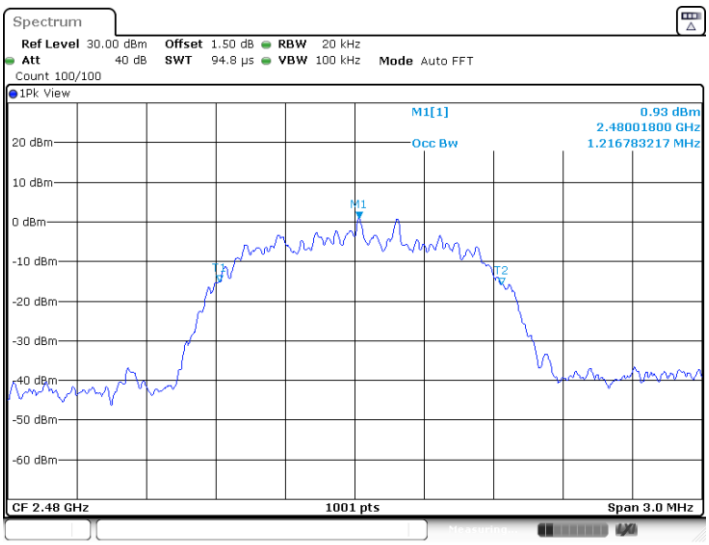

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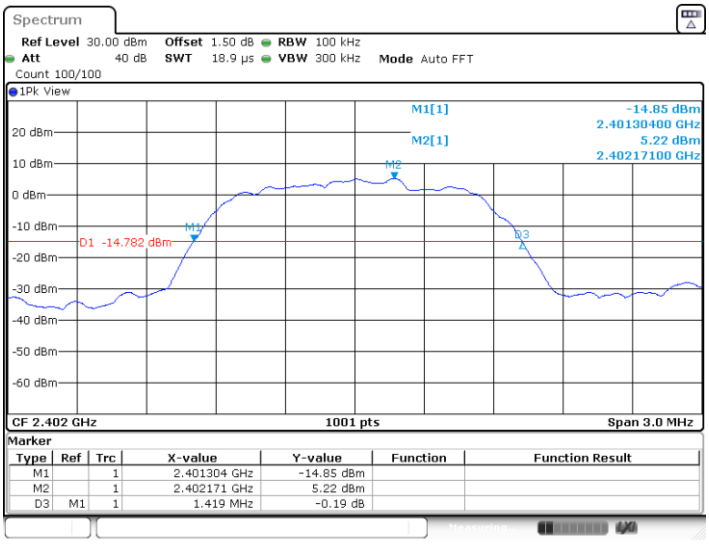
20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode 8DPSK Modulation test result

Frequency MHz	20 dB Bandwidth kHz	99% Bandwidth kHz	Limit kHz	Result
2402	1419	1214	--	Pass
2441	1422	1214	--	Pass
2480	1422	1214	--	Pass

Low channel 2402MHz



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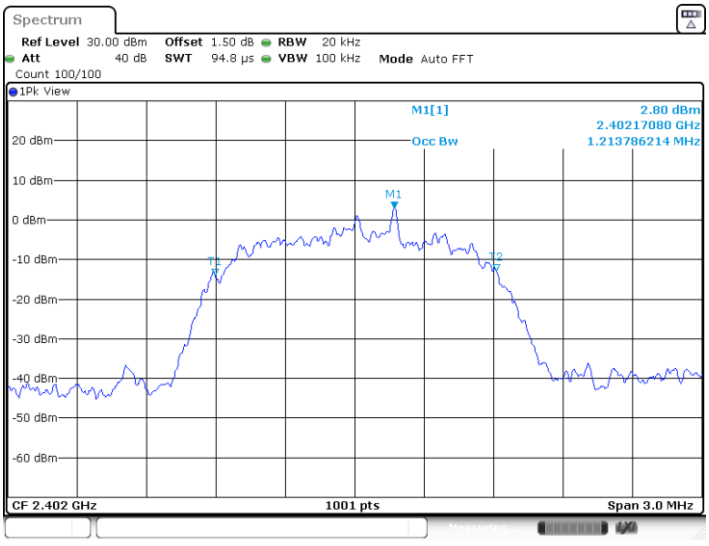

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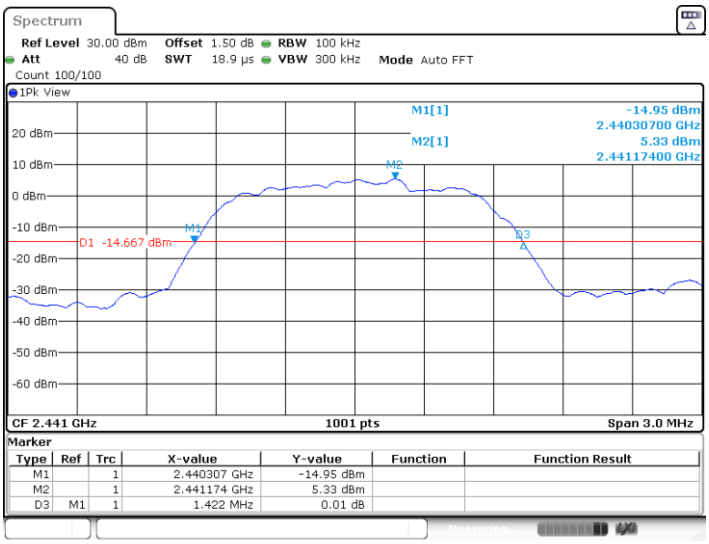
Middle channel 2441MHz



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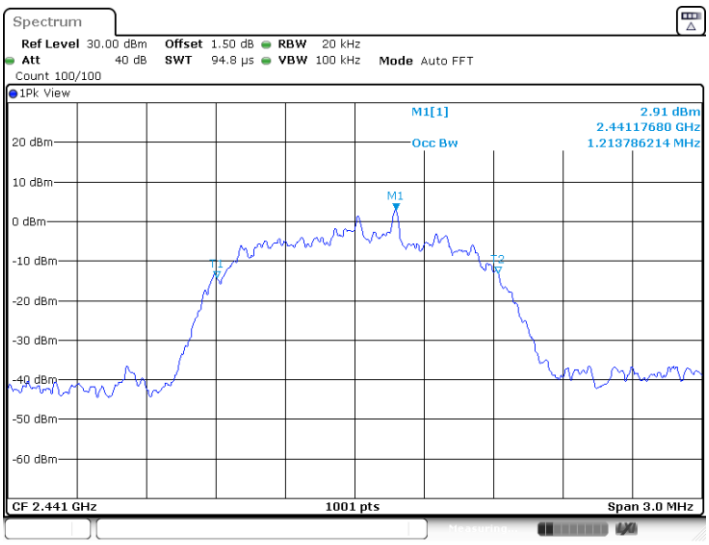
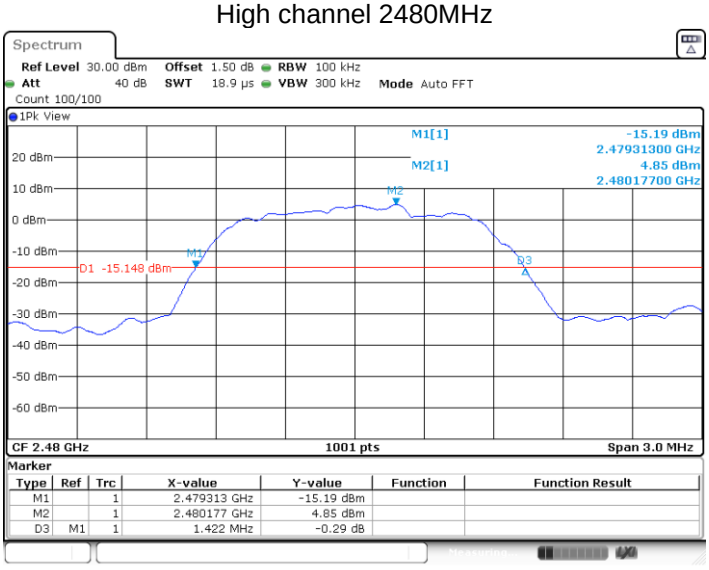
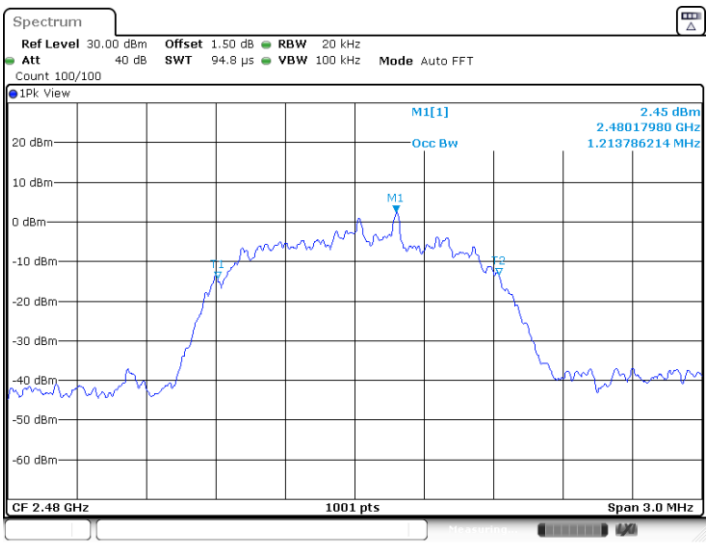


Date: 16.FEB.2022 14:11:14

High channel 2480MHz



Date: 16.FEB.2022 14:13:27



Date: 16.FEB.2022 14:13:38

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

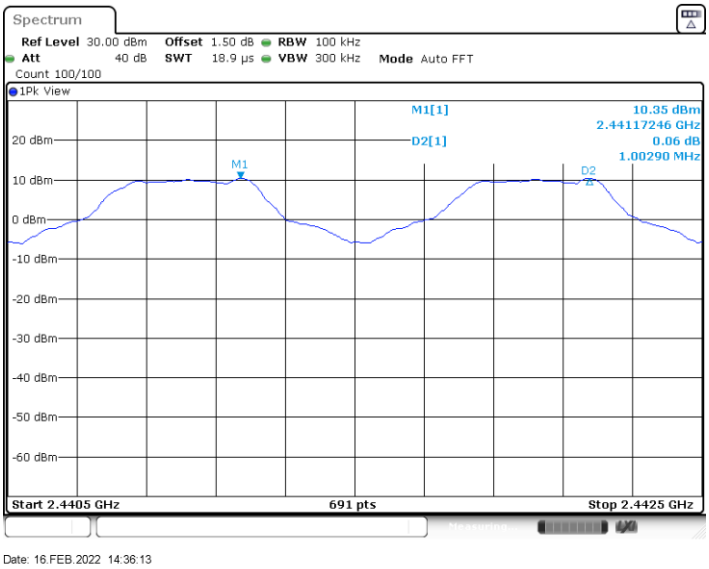
Limit kHz
⩾25KHz or 2/3 of the 20 dB bandwidth which is greater

Frequency MHz	2/3 of 20 dB Bandwidth kHz
GFSK	764
π/4-DQPSK	954
8DPSK	948

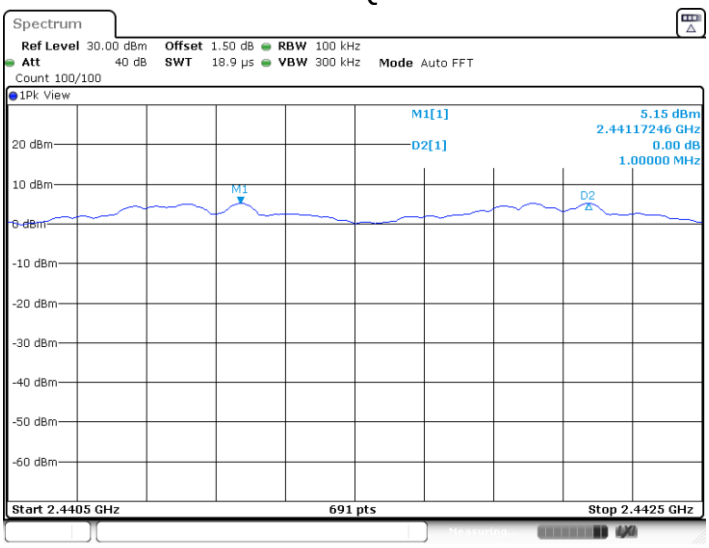
Carrier Frequency Separation

TestMode	Channel	Result[MHz]	Limit[MHz]	Verdict
GFSK	Hop	1.003	>=0.764	PASS
π/4-DQPSK	Hop	1.000	>=0.954	PASS
8DPSK	Hop	0.997	>=0.948	PASS

GFSK

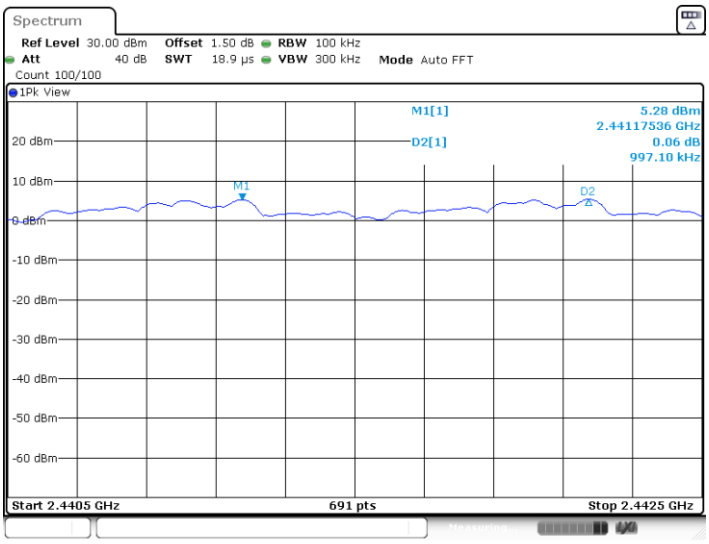


π /4-DQPSK



Date: 16.FEB.2022 14:42:44

8DPSK



Date: 16.FEB.2022 14:44:53

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

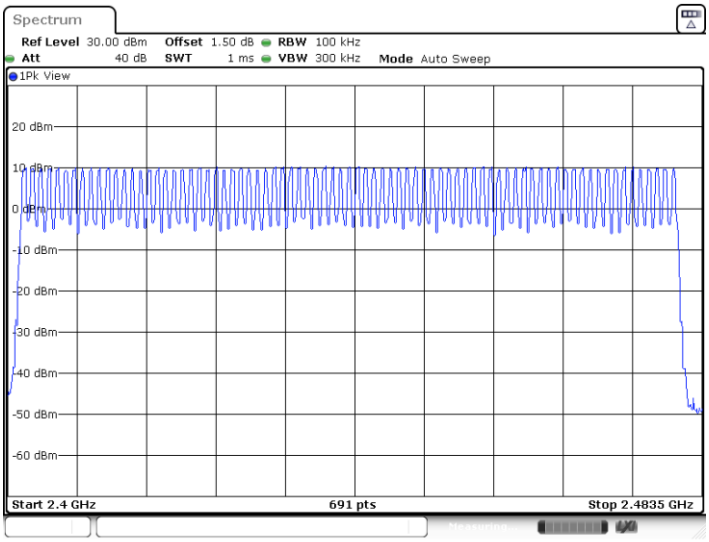
Limit number
⩾15

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.

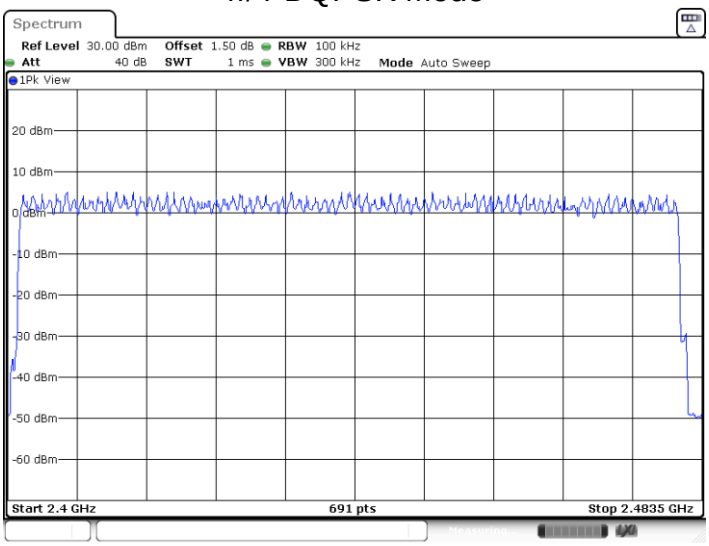
Number of hopping frequencies	Result
79	Pass

GFSK Mode



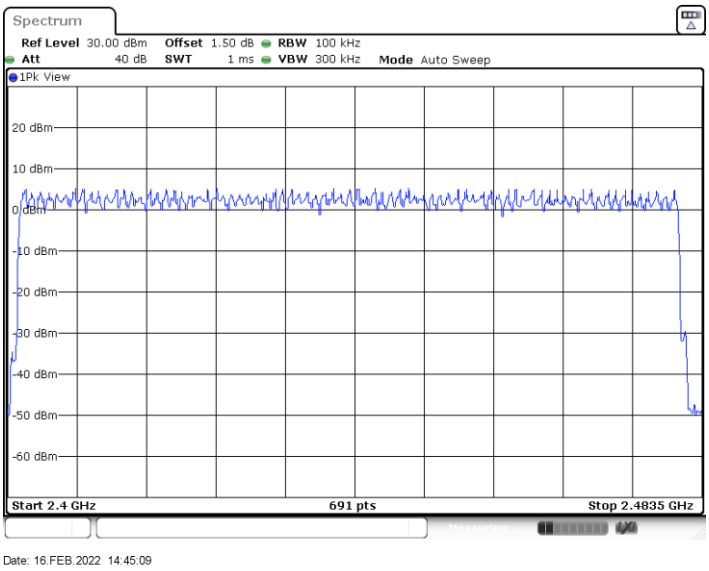
Date: 16.FEB.2022 14:36:30

π/4-DQPSK Mode



Date: 16.FEB.2022 14:39:49

8DPSK Mode


Spectrum
Ref Level 30.00 dBm Offset 1.50 dB RBW 100 kHz
Att 40 dB SWT 1 ms VBW 300 kHz Mode Auto Sweep
1Pk View
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
Start 2.4 GHz
691 pts
Stop 2.4835 GHz
Date: 16.FEB.2022 14:45:09

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.

Dwell Time

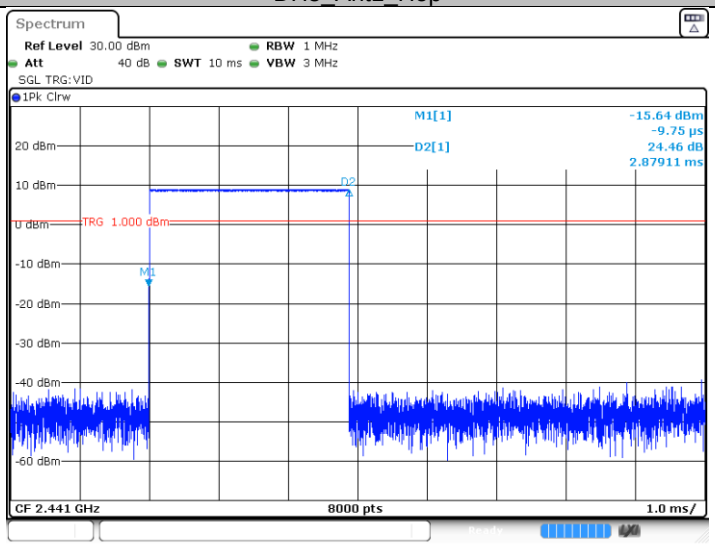
Dwell time

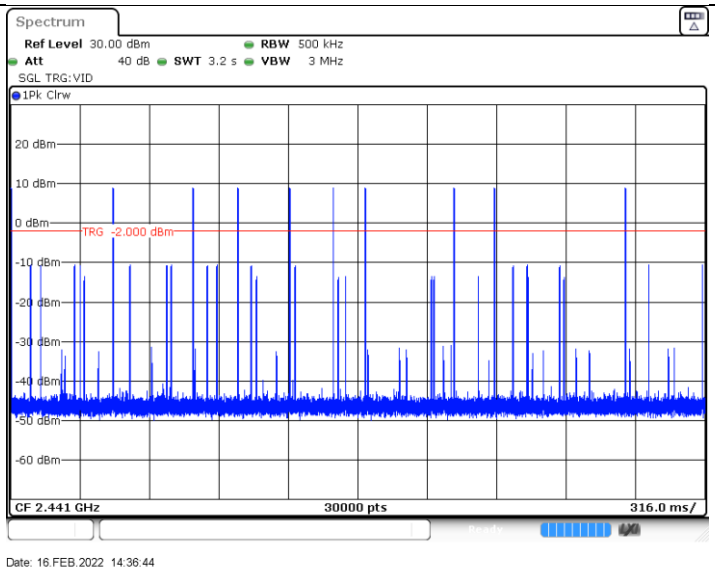
The maximum dwell time shall be 0.4 s.
The Dwell Time = Burst Width * Total Hops. The detailed calculations are showed as follows:
The duration for dwell time calculation: 0.4 [s] * hopping number = 0.4 [s] * 79 [ch] = 31.6 [s*ch];

Test Result

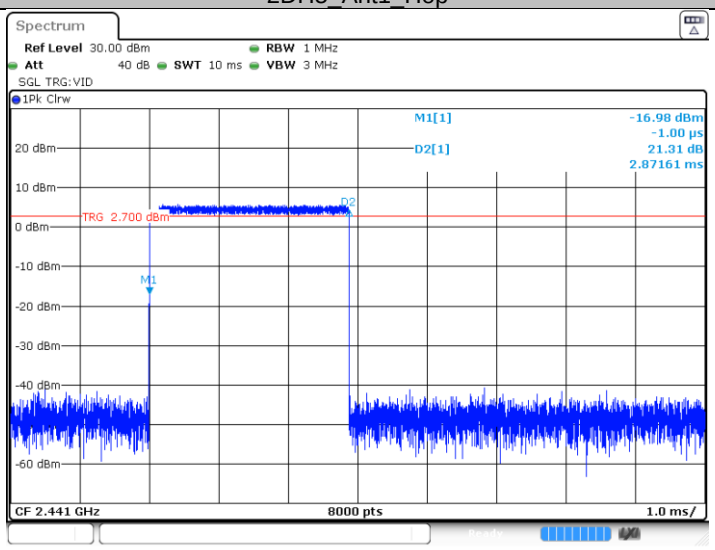
Modulation	TestMode	Channel	BurstWidth (ms)	TotalHops	Result(s)	Limit(s)	Verdict
GFSK	DH5	Hop	2.88	100	0.288	<=0.4	PASS
π/4-DQPSK	2DH5	Hop	2.87	110	0.316	<=0.4	PASS
8-DPSK	3DH5	Hop	2.87	100	0.287	<=0.4	PASS

DH5_Ant1_Hop

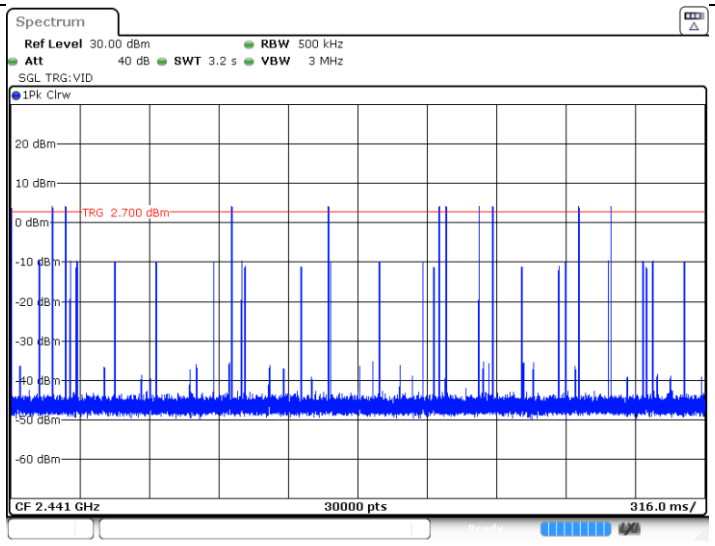




2DH5_Ant1_Hop

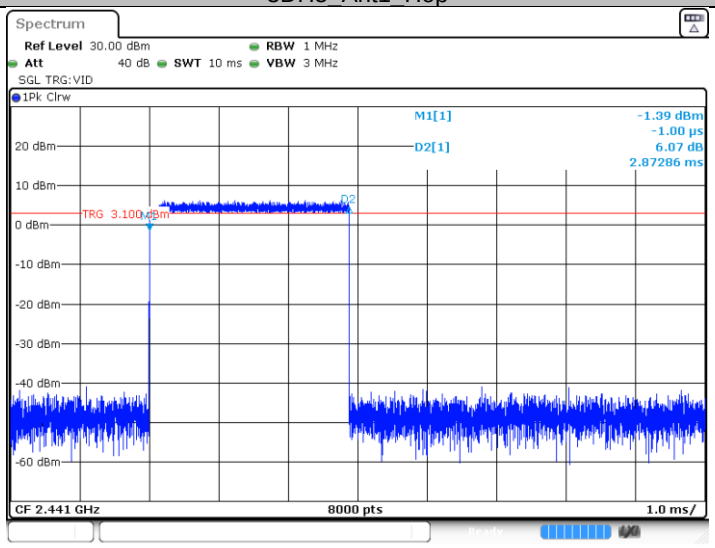


Date: 2.MAR.2022 16:58:45

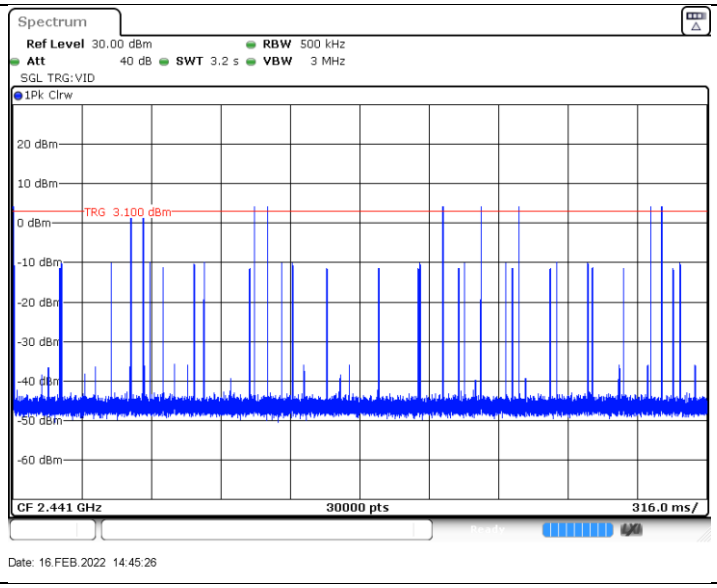


Date: 2.MAR.2022 16:58:50

3DH5_Ant1_Hop



Date: 16.FEB.2022 14:45:21


Spectrum
Ref Level 30.00 dBm
RBW 500 kHz
Att 40 dB SWT 3.2 s VBW 3 MHz
SGL TRG:VID
1Pk Clrw
20 dBm
10 dBm
TRG 3.100 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
CF 2.441 GHz
30000 pts
316.0 ms/
Date: 16.FEB.2022 14:45:26

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.

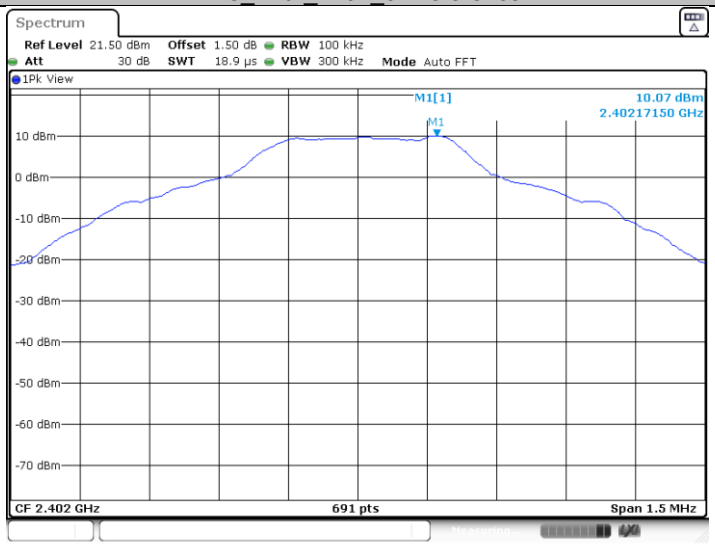
Limit

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

Spurious RF conducted emissions

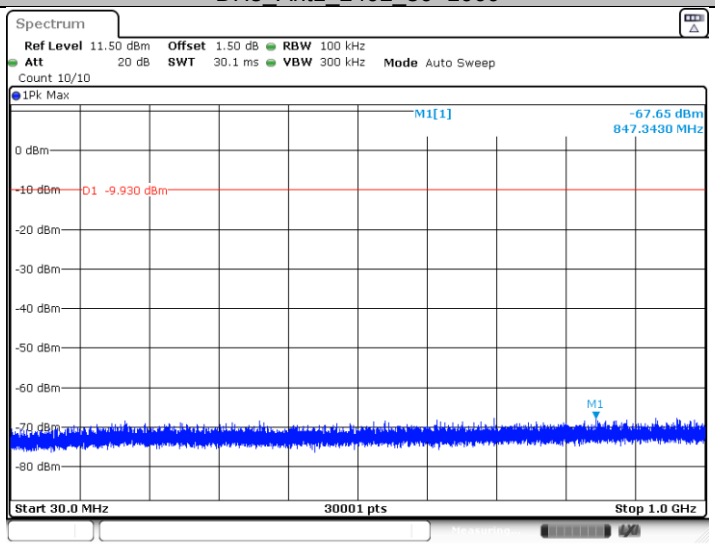
Remark: The emissions exceed limit is fundamental signal.

DH5_Ant1_2402_0~Reference



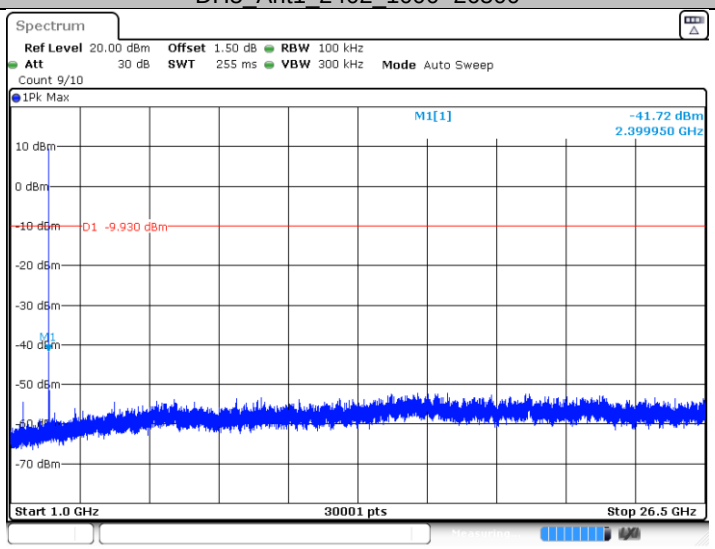
Date: 16.FEB.2022 13:50:55

DH5_Ant1_2402_30~1000



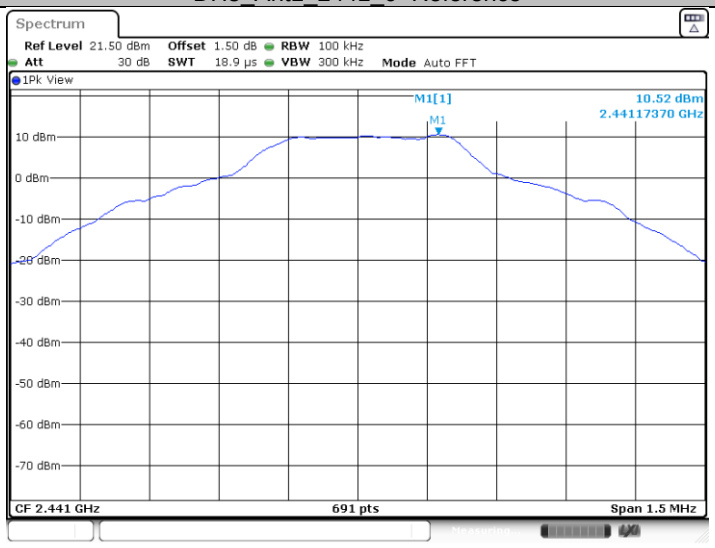
Date: 16.FEB.2022 13:51:02

DH5_Ant1_2402_1000~26500



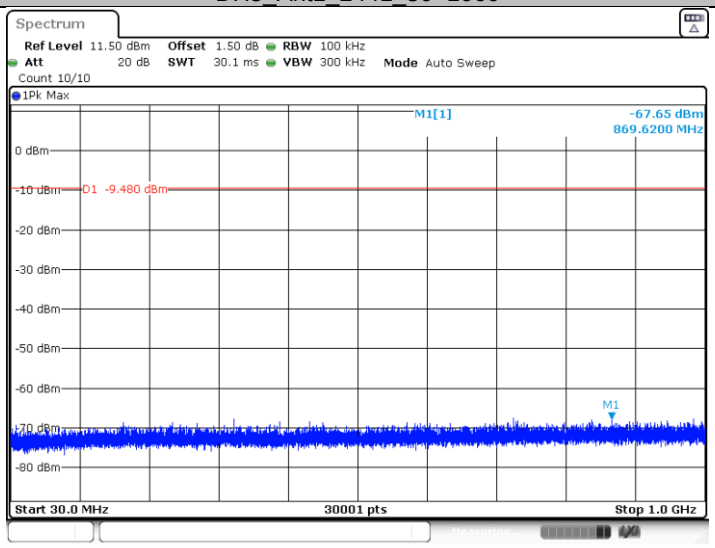
Date: 16.FEB.2022 13:51:09

DH5_Ant1_2441_0~Reference



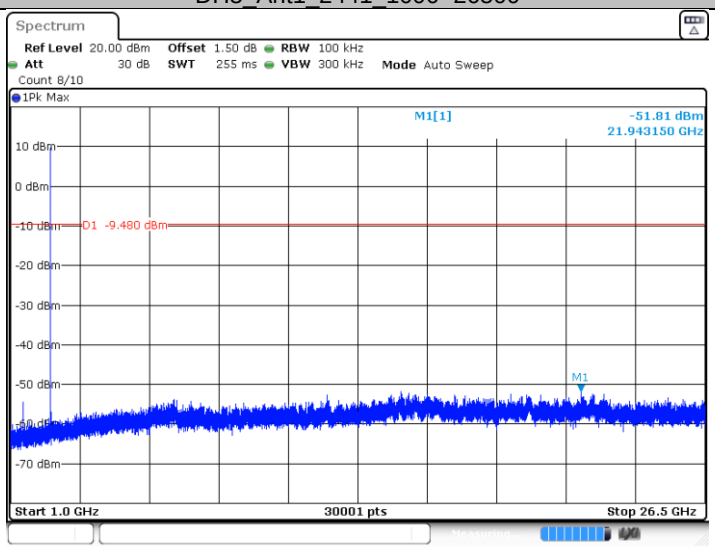
Date: 16.FEB.2022 13:55:45

DH5_Ant1_2441_30~1000



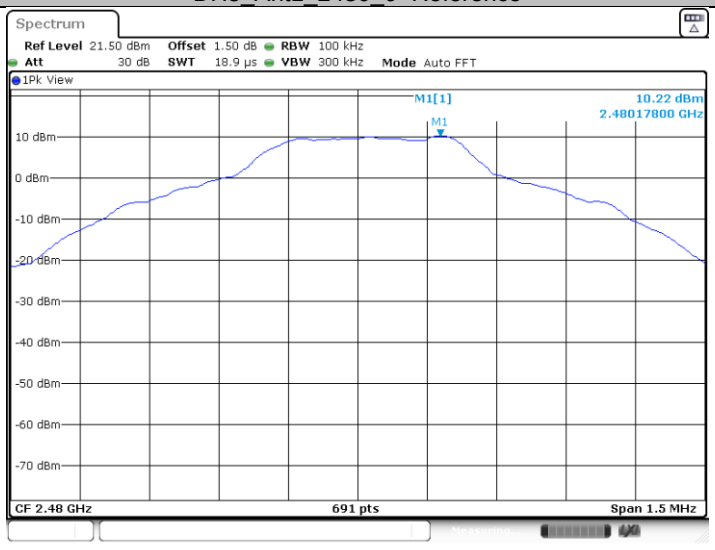
Date: 16.FEB.2022 13:55:51

DH5_Ant1_2441_1000~26500



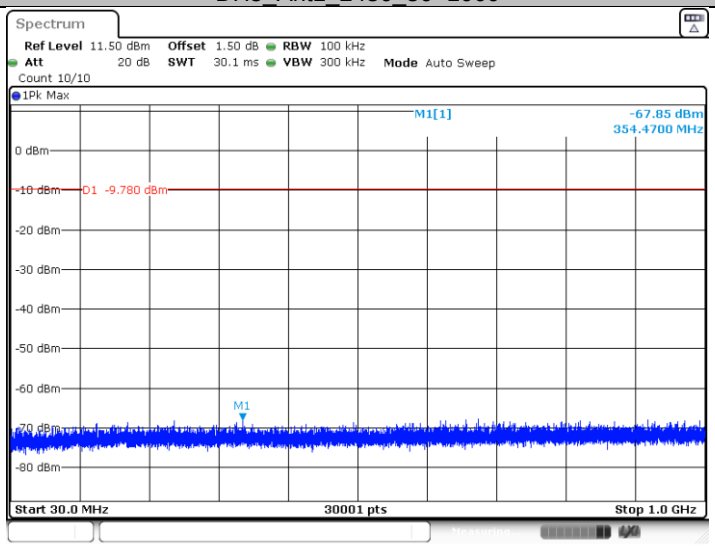
Date: 16.FEB.2022 13:55:59

DH5_Ant1_2480_0~Reference



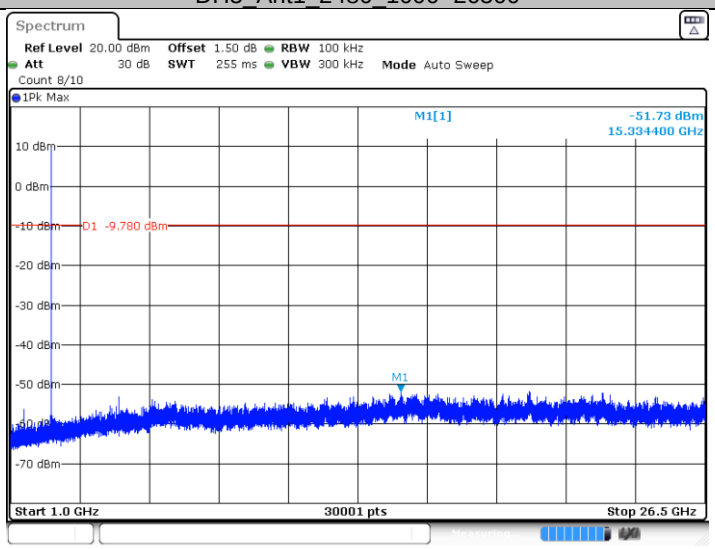
Date: 16.FEB.2022 13:58:44

DH5_Ant1_2480_30~1000



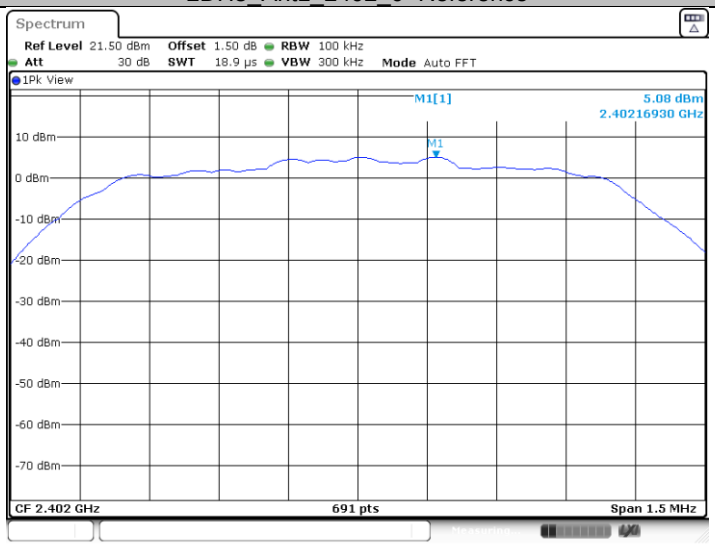
Date: 16.FEB.2022 13:58:50

DH5_Ant1_2480_1000~26500



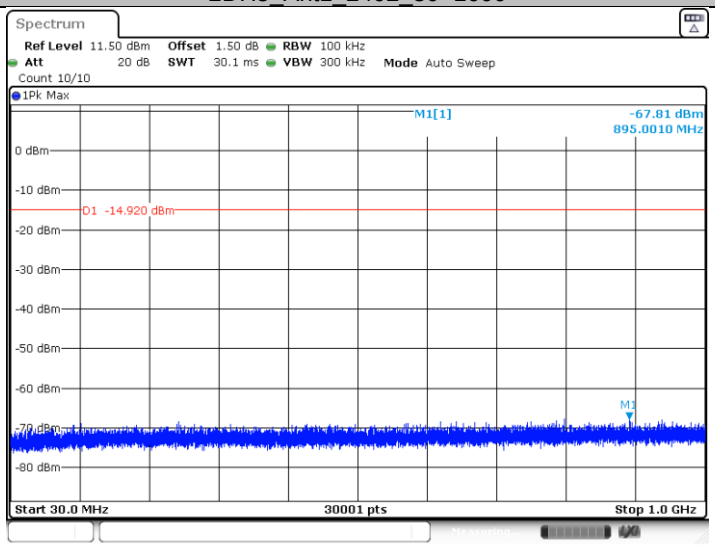
Date: 16.FEB.2022 13:58:58

2DH5_Ant1_2402_0~Reference



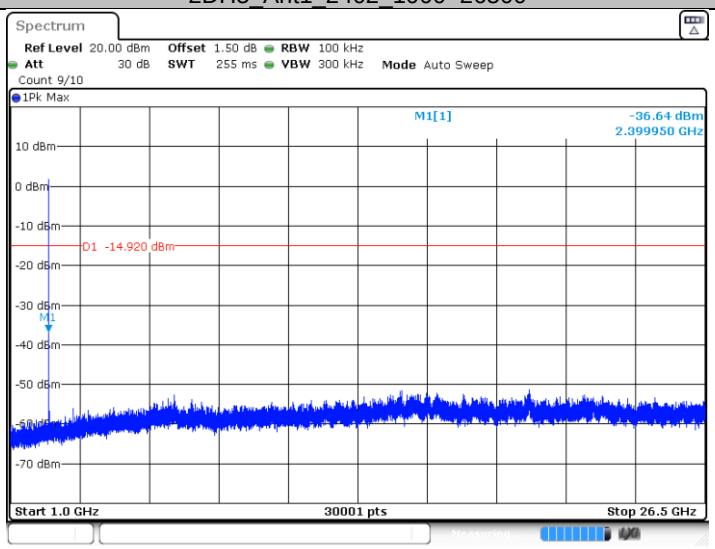
Date: 16.FEB.2022 14:01:33

2DH5_Ant1_2402_30~1000



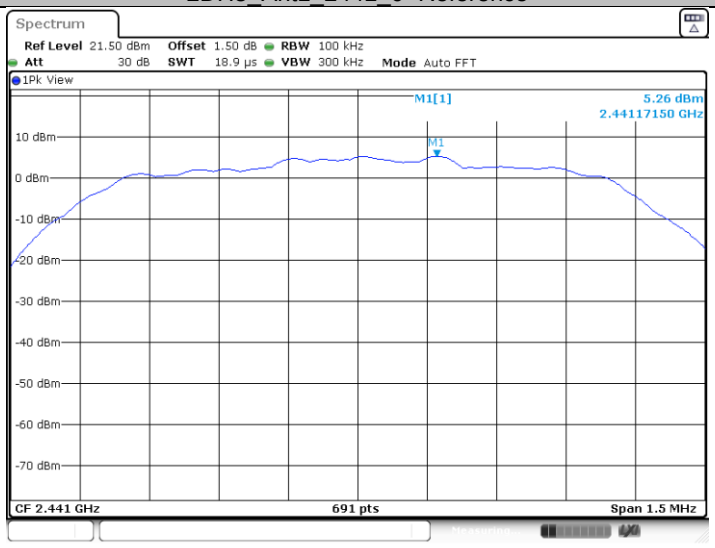
Date: 16.FEB.2022 14:01:39

2DH5_Ant1_2402_1000~26500



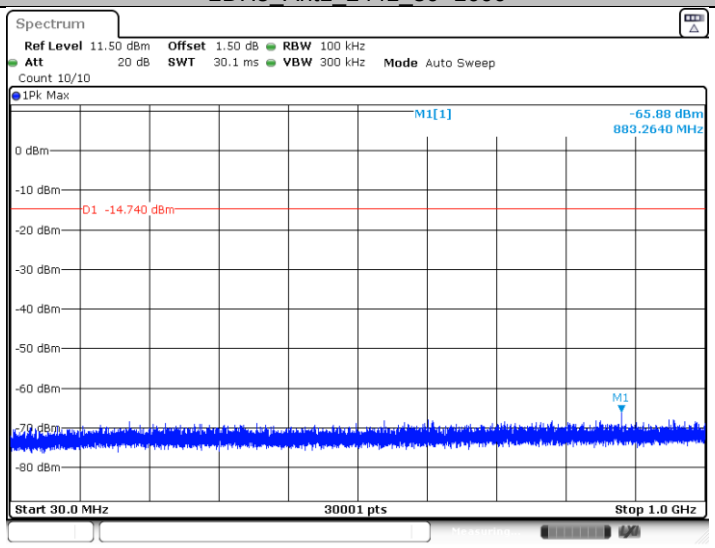
Date: 16.FEB.2022 14:01:47

2DH5_Ant1_2441_0~Reference



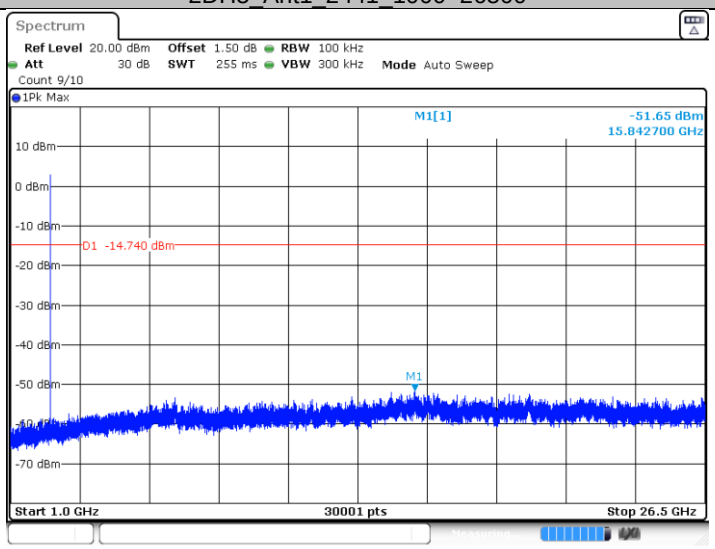
Date: 16.FEB.2022 14:04:04

2DH5_Ant1_2441_30~1000



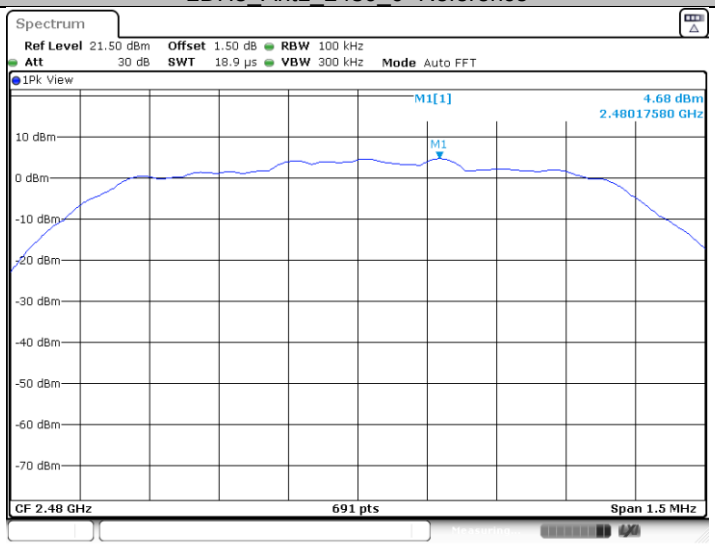
Date: 16.FEB.2022 14:04:10

2DH5_Ant1_2441_1000~26500



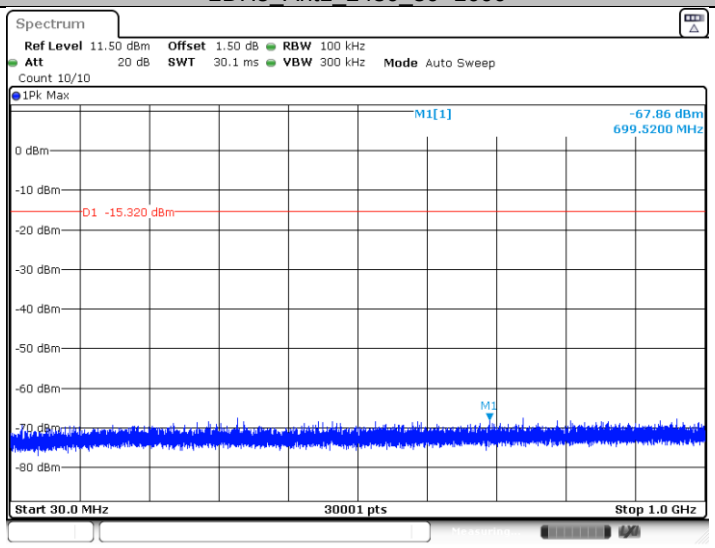
Date: 16.FEB.2022 14:04:18

2DH5_Ant1_2480_0~Reference



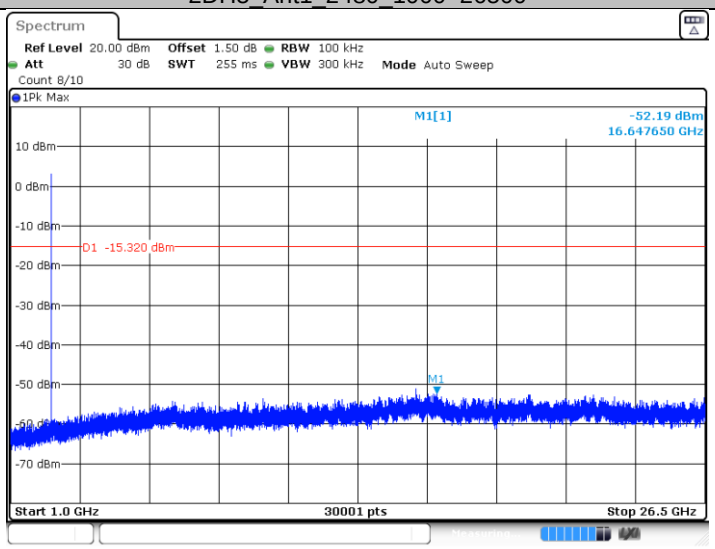
Date: 16.FEB.2022 14:06:39

2DH5_Ant1_2480_30~1000



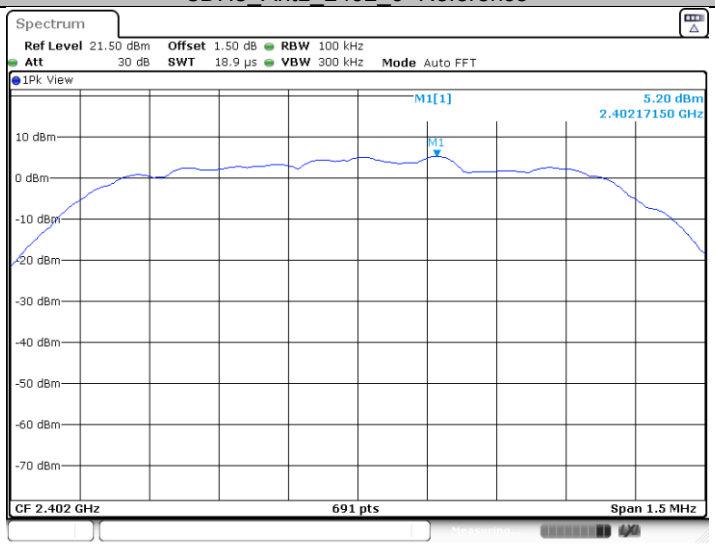
Date: 16.FEB.2022 14:06:45

2DH5_Ant1_2480_1000~26500



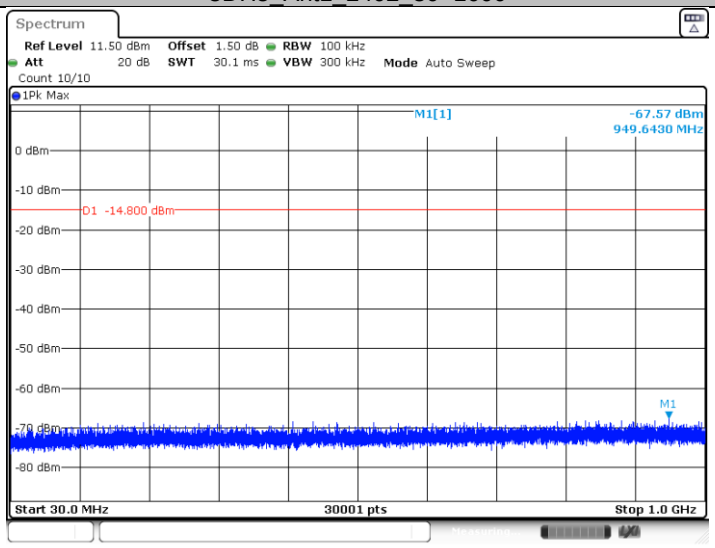
Date: 16.FEB.2022 14:06:53

3DH5_Ant1_2402_0~Reference



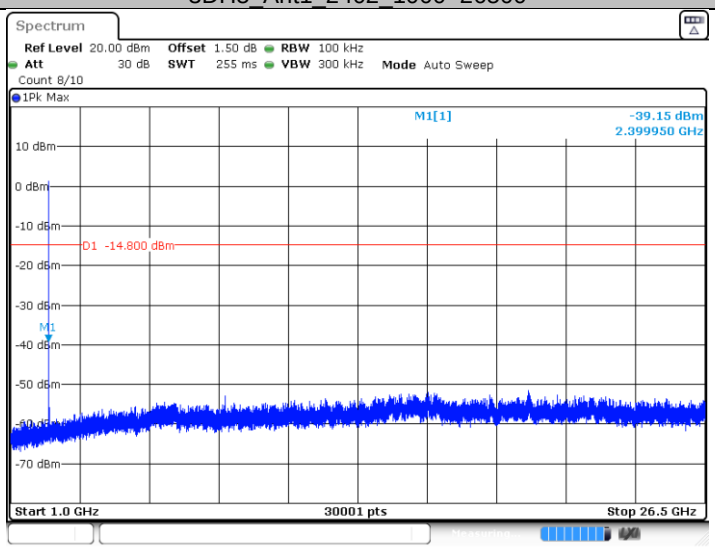
Date: 16.FEB.2022 14:09:05

3DH5_Ant1_2402_30~1000



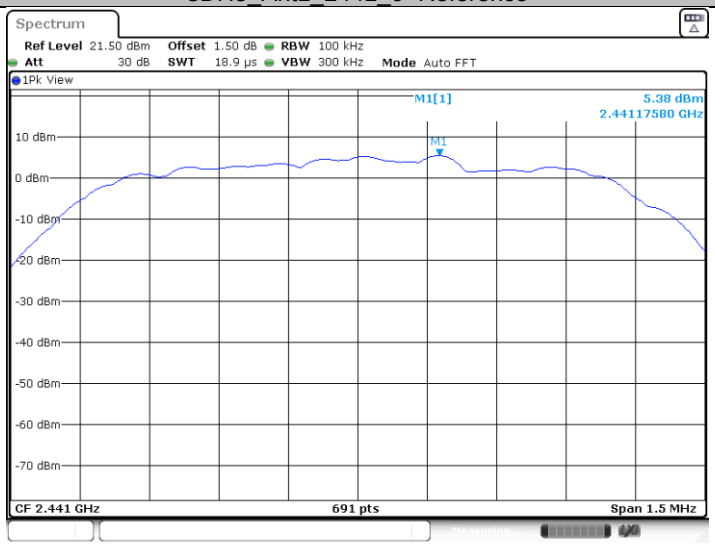
Date: 16.FEB.2022 14:09:11

3DH5_Ant1_2402_1000~26500



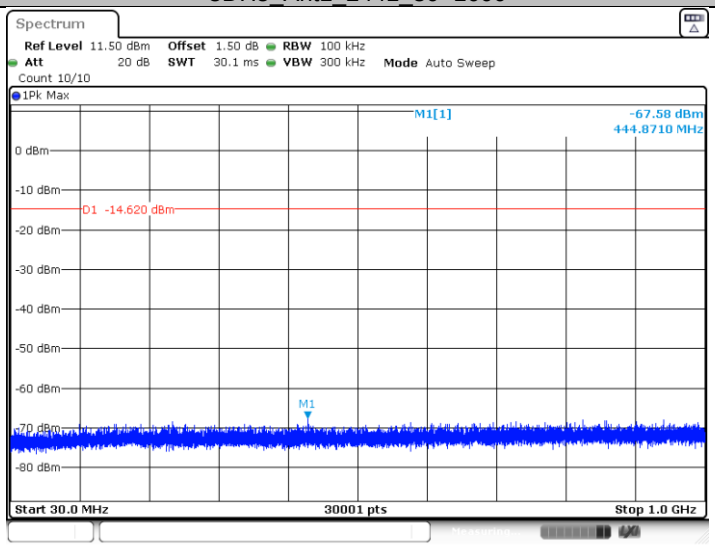
Date: 16.FEB.2022 14:09:19

3DH5_Ant1_2441_0~Reference



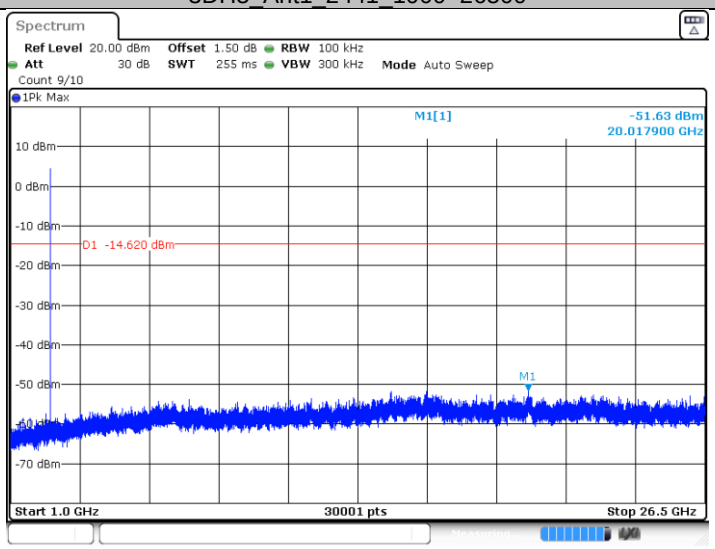
Date: 16.FEB.2022 14:11:20

3DH5_Ant1_2441_30~1000



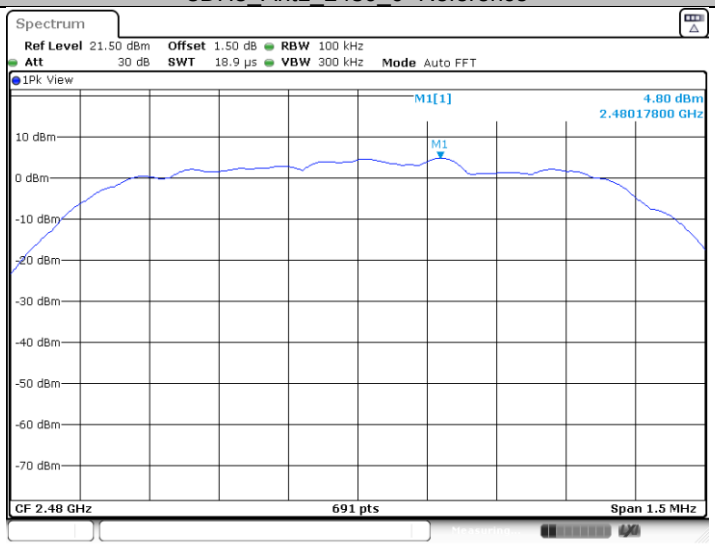
Date: 16.FEB.2022 14:11:26

3DH5_Ant1_2441_1000~26500



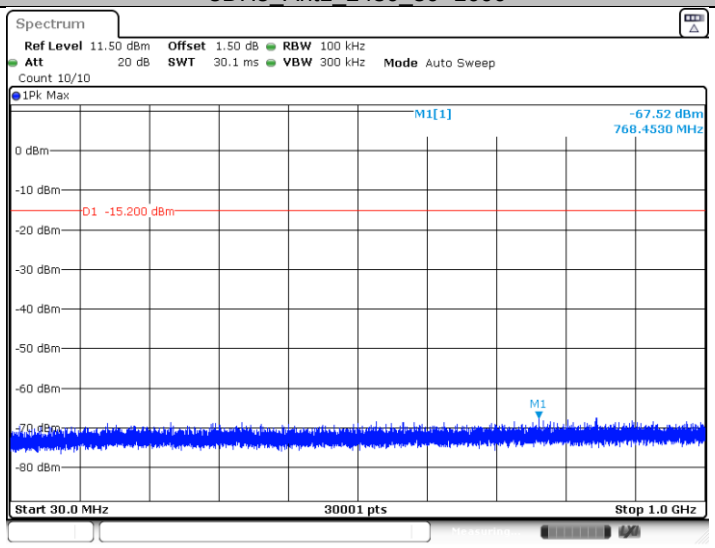
Date: 16.FEB.2022 14:11:34

3DH5_Ant1_2480_0~Reference

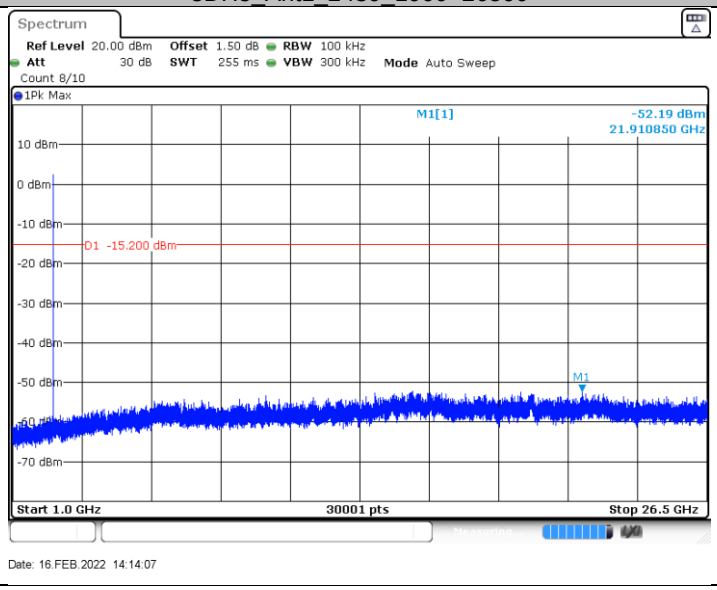


Date: 16.FEB.2022 14:13:53

3DH5_Ant1_2480_30~1000



Date: 16.FEB.2022 14:13:59

3DH5_Ant1_2480_1000~26500


9.8 Band edge testing

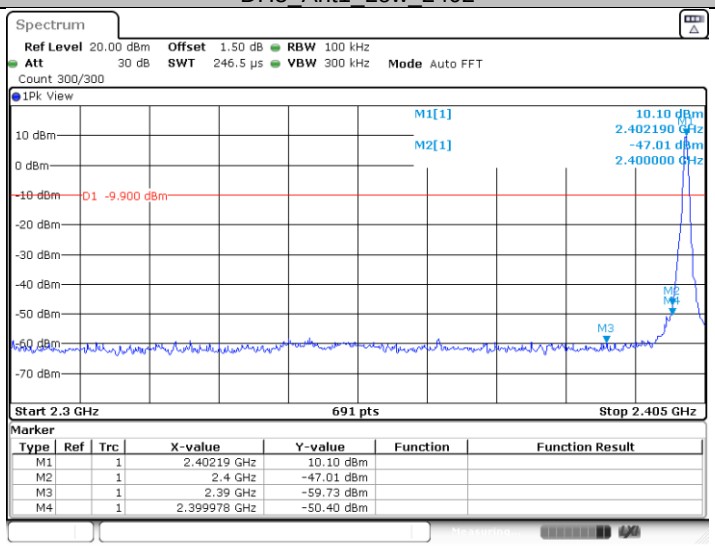
Test Method

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:

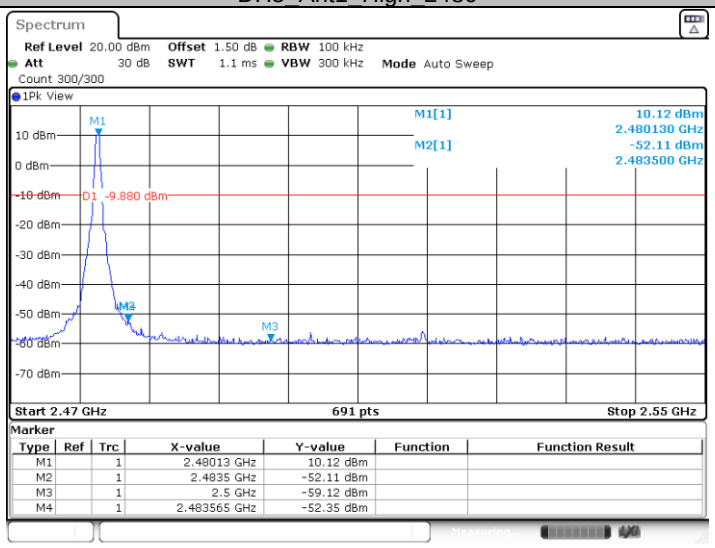
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an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

DH5_Ant1_Low_2402



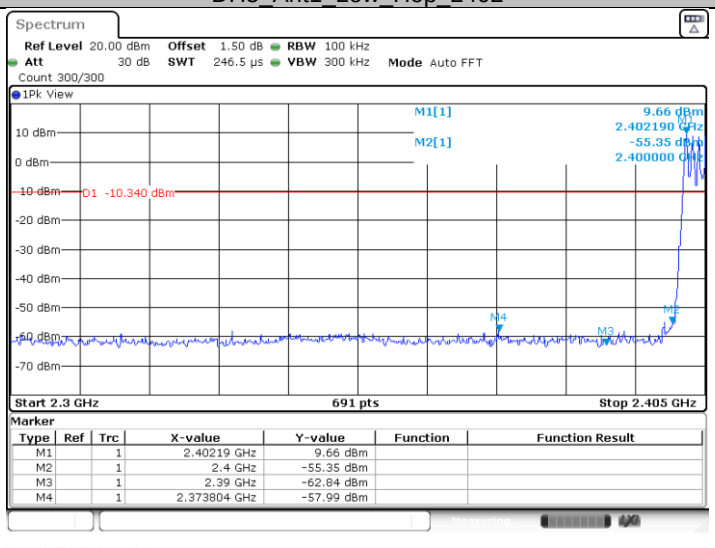
Date: 16.FEB.2022 13:47:13

DH5_Ant1_High_2480



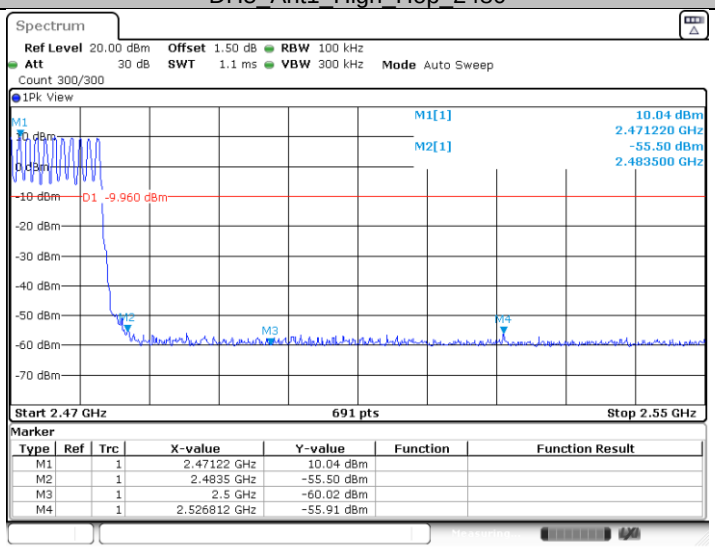
Date: 16.FEB.2022 13:58:39

DH5_Ant1_Low_Hop_2402



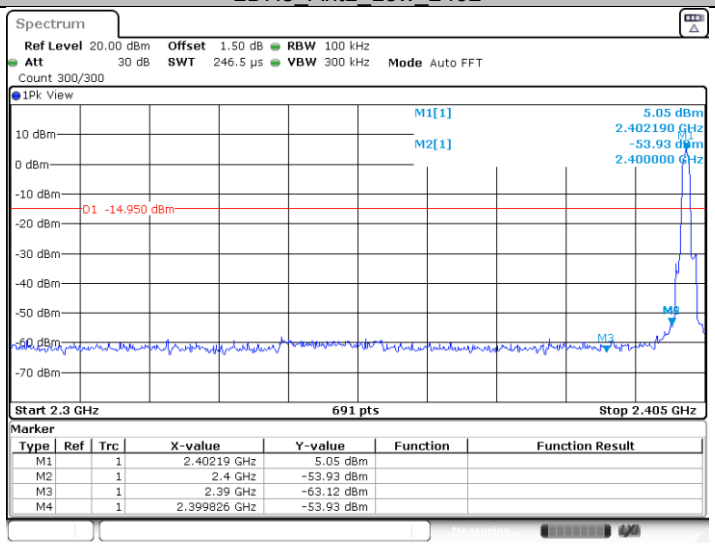
Date: 16.FEB.2022 14:35:29

DH5_Ant1_High_Hop_2480



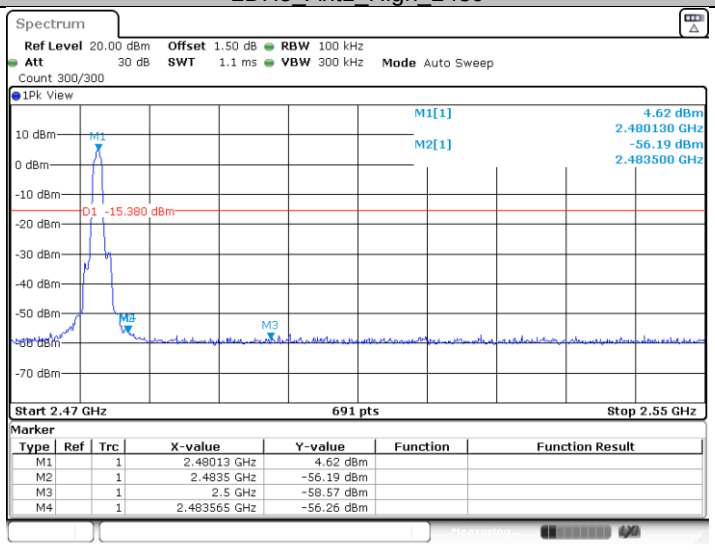
Date: 16.FEB.2022 14:37:04

2DH5_Ant1_Low_2402



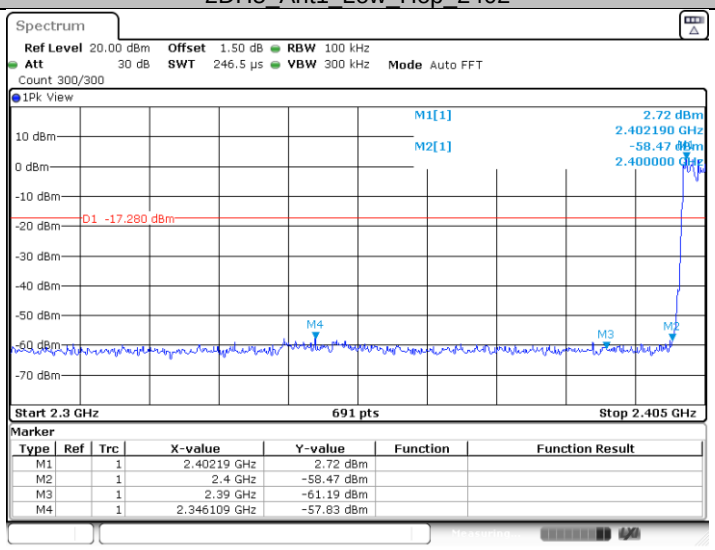
Date: 16.FEB.2022 14:01:27

2DH5_Ant1_High_2480



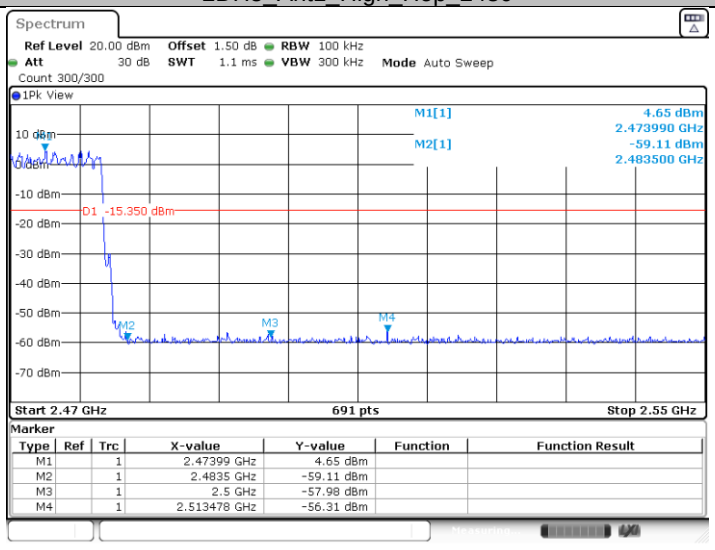
Date: 16.FEB.2022 14:06:33

2DH5_Ant1_Low_Hop_2402



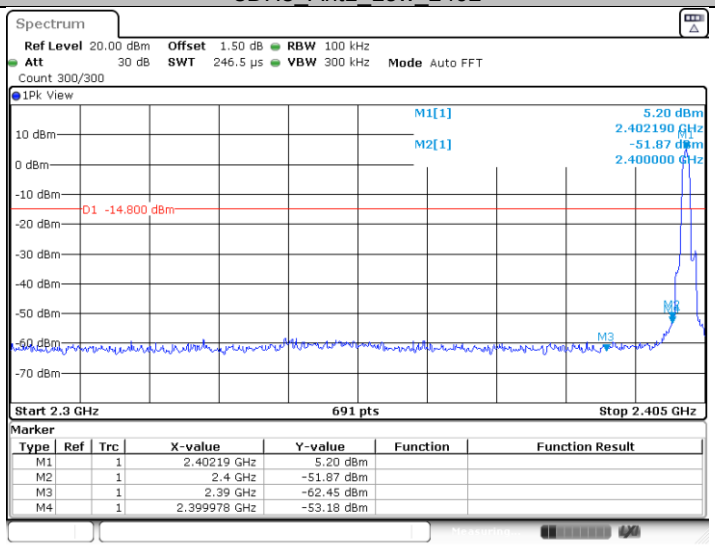
Date: 16.FEB.2022 14:38:19

2DH5_Ant1_High_Hop_2480



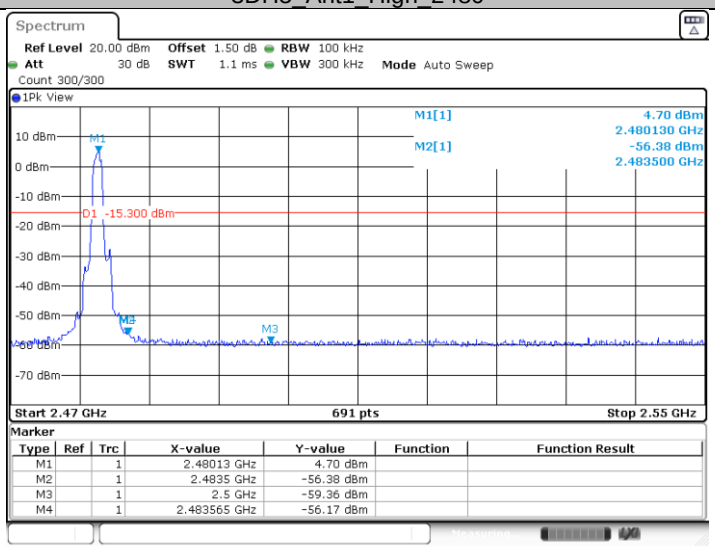
Date: 16.FEB.2022 14:40:18

3DH5_Ant1_Low_2402



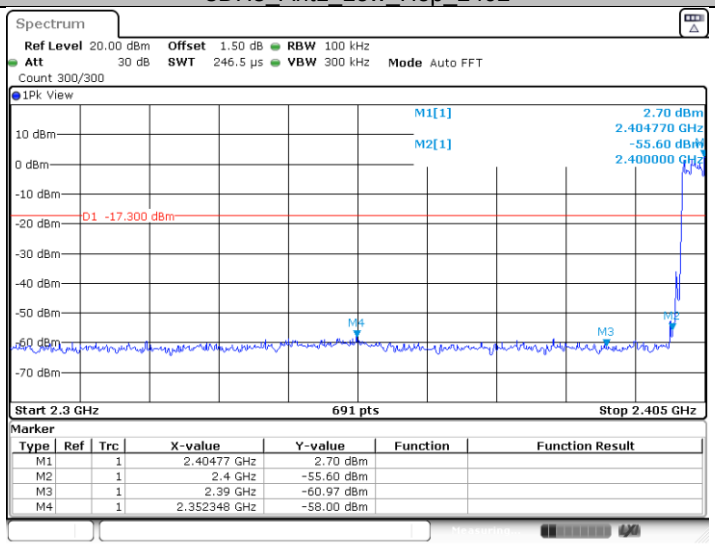
Date: 16.FEB.2022 14:08:59

3DH5_Ant1_High_2480



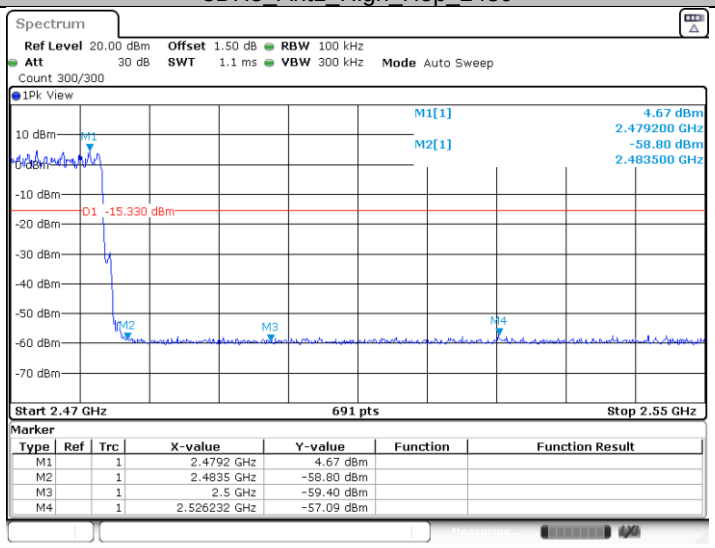
Date: 16.FEB.2022 14:13:47

3DH5_Ant1_Low_Hop_2402



Date: 16.FEB.2022 14:43:49

3DH5_Ant1_High_Hop_2480



Date: 16.FEB.2022 14:45:38

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:

Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW=10Hz, Sweep = auto, Detector function = peak, Trace = max hold.
If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from 20log(dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit.

If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correct factor, derived from the appropriate the duty cycle calculation.

The setting method can refer to DA00-705.

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, must comply with the radiated emission limits specified in section 15.209.
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 the 100 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. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

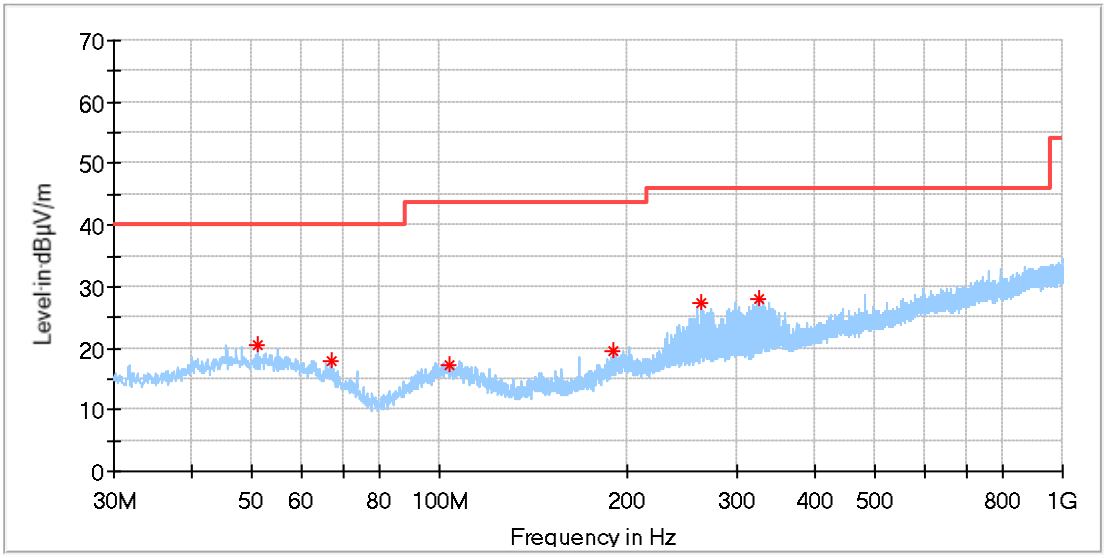
Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

Spurious radiated emissions for transmitter

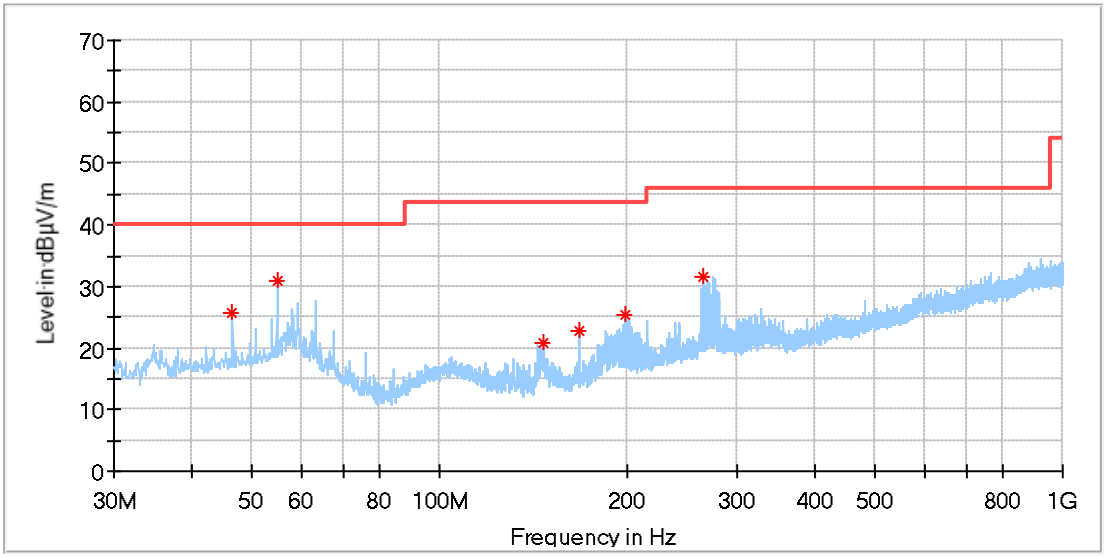
According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.
The only worse case (8DPSK mode) test result is listed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

Transmitting spurious emission test result as below:

Below 1G:

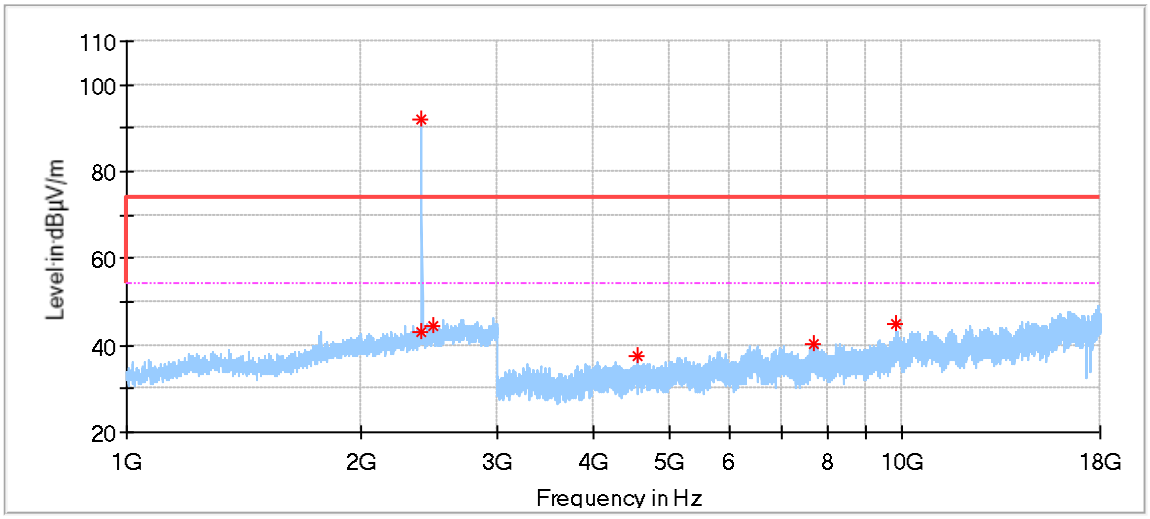


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
51.158125	20.39	40.00	19.61	100.0	H	339.0	20.93
66.860000	17.97	40.00	22.03	100.0	H	274.0	18.40
103.841250	17.12	43.50	26.38	200.0	H	0.0	19.37
190.474375	19.60	43.50	23.90	100.0	H	198.0	18.37
263.285000	27.20	46.00	18.80	100.0	H	138.0	20.81
326.153125	27.85	46.00	18.15	100.0	H	189.0	22.25

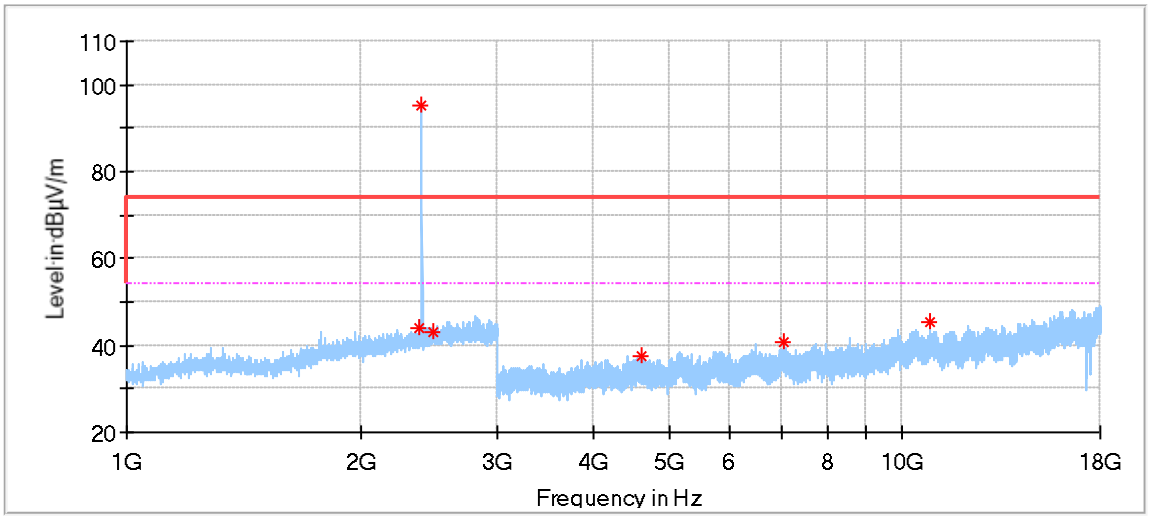


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
46.490000	25.65	40.00	14.35	100.0	V	163.0	20.85
54.856250	30.78	40.00	9.22	100.0	V	209.0	20.80
146.521250	21.00	43.50	22.50	100.0	V	0.0	15.49
167.921875	22.67	43.50	20.83	100.0	V	0.0	16.49
198.052500	25.34	43.50	18.16	100.0	V	0.0	19.63
265.649375	31.74	46.00	14.26	200.0	V	277.0	20.87

Low channel 2402MHz

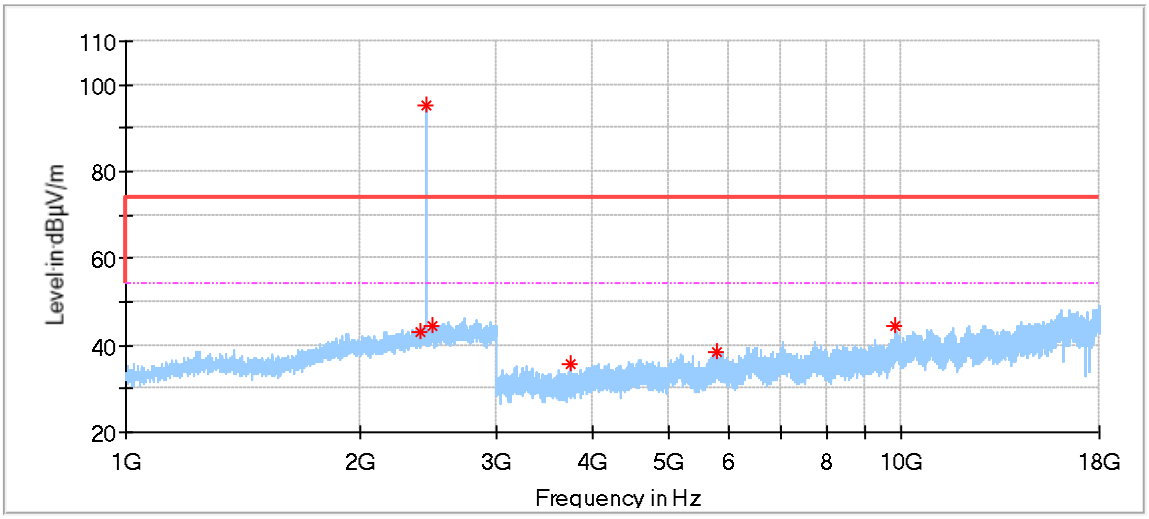


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2390.000000	43.20	74.00	30.80	100.0	H	278.0	-3.12
2402.380952	91.82	74.00	-17.82	100.0	H	308.0	-3.14
2483.857143	44.29	74.00	29.71	100.0	H	183.0	-2.76
4566.000000	37.71	74.00	36.29	100.0	H	207.0	2.83
7679.000000	40.24	74.00	33.76	100.0	H	92.0	8.24
9826.500000	44.77	74.00	29.23	100.0	H	92.0	11.24

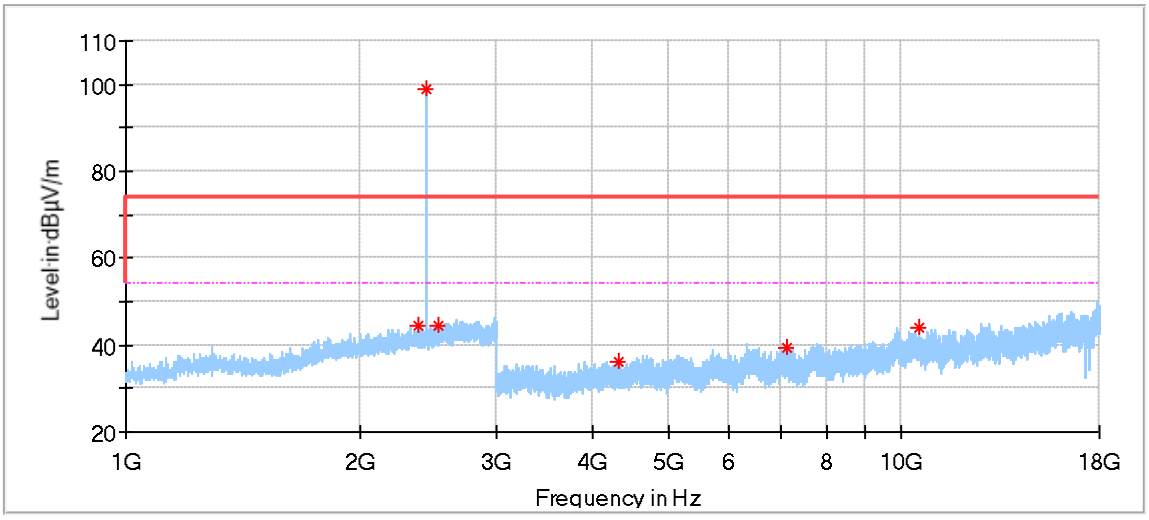


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2389.047619	44.06	74.00	29.94	100.0	V	121.0	-3.11
2402.380952	95.21	74.00	-21.21	100.0	V	275.0	-3.14
2483.095238	42.95	74.00	31.05	100.0	V	334.0	-2.75
4608.000000	37.71	74.00	36.29	100.0	V	208.0	3.09
7031.500000	40.57	74.00	33.43	100.0	V	12.0	7.40
10887.500000	45.60	74.00	28.40	100.0	V	0.0	10.82

Middle channel 2441MHz

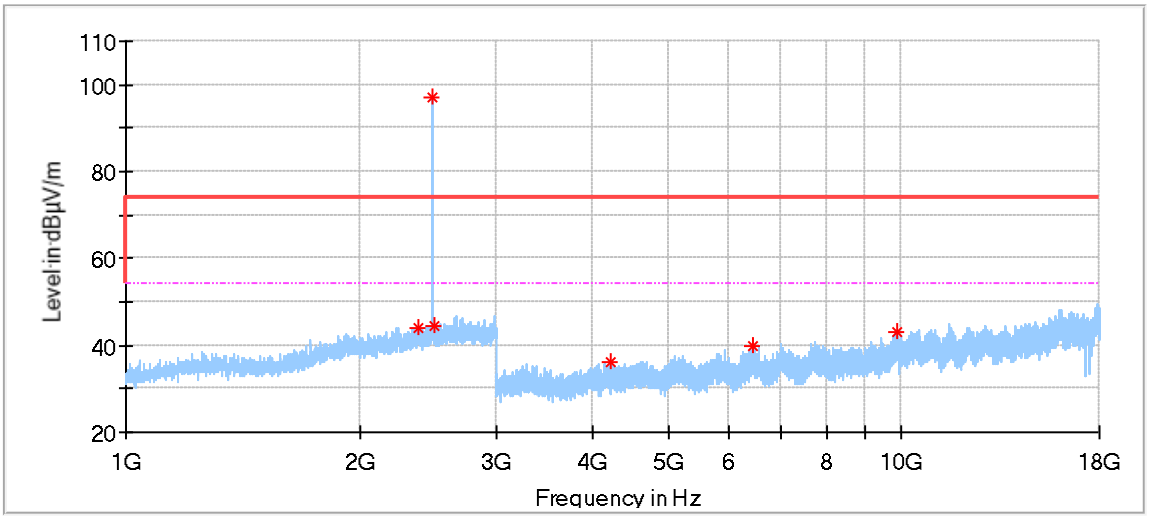


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2390.666667	43.07	74.00	30.93	100.0	H	131.0	-3.13
2441.428571	95.32	74.00	-21.32	100.0	H	337.0	-3.01
2483.095238	44.42	74.00	29.58	100.0	H	139.0	-2.75
3751.500000	35.50	74.00	38.50	100.0	H	179.0	0.41
5785.000000	38.50	74.00	35.50	100.0	H	238.0	5.28
9812.000000	44.32	74.00	29.68	100.0	H	63.0	10.99

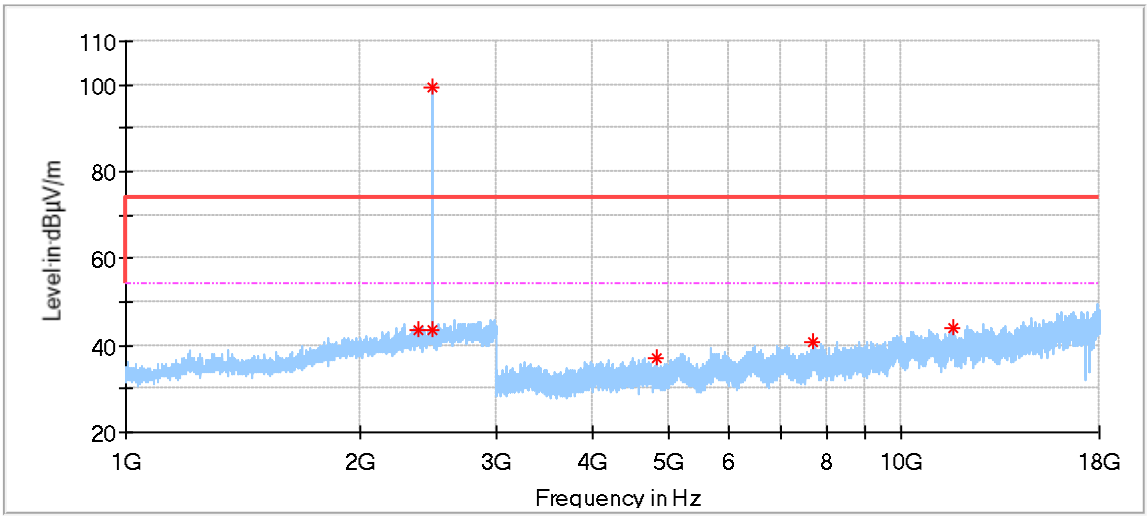


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2390.000000	44.39	74.00	29.61	100.0	V	190.0	-3.09
2441.428571	98.78	74.00	-24.78	100.0	V	278.0	-3.01
2487.619048	44.46	74.00	29.54	100.0	V	315.0	-2.64
4327.000000	36.34	74.00	37.66	100.0	V	295.0	2.21
7108.500000	39.29	74.00	34.71	100.0	V	11.0	7.29
10558.000000	43.80	74.00	30.20	100.0	V	120.0	10.74

High channel 2480MHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2388.571429	44.05	74.00	29.95	100.0	H	62.0	-3.11
2480.476191	96.94	74.00	-22.94	100.0	H	337.0	-2.76
2495.714286	44.30	74.00	29.70	100.0	H	224.0	-2.75
4227.500000	36.13	74.00	37.87	100.0	H	0.0	1.67
6415.500000	39.88	74.00	34.12	100.0	H	327.0	6.67
9862.500000	43.16	74.00	30.84	100.0	H	356.0	11.81



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2390.571429	44.05	74.00	29.95	100.0	H	62.0	-3.11
2480.476191	96.94	74.00	-22.94	100.0	H	337.0	-2.76
2485.714286	44.30	74.00	29.70	100.0	H	224.0	-2.75
4227.500000	36.13	74.00	37.87	100.0	H	0.0	1.67
6415.500000	39.88	74.00	34.12	100.0	H	327.0	6.67
9862.500000	43.16	74.00	30.84	100.0	H	356.0	11.81

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)

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	68-4-74-19-002	102590	1	2022-6-4
LISN	Rohde & Schwarz	ENV216	68-4-87-19-001	102472	1	2022-6-5
Attenuator	Shanghai Huaxiang	TS2-26-3	68-4-81-16-003	080928189	1	2022-6-3
Test software	Rohde & Schwarz	EMC32	68-4-90-19-005-A01	Version10.35.02	N/A	N/A
Shielding Room	TDK	CSR #2	68-4-90-19-005	----	1	2022-11-07

Radiated Emission Test

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	2022-6-4
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9162	68-4-80-19-003	284	1	2022-2-2
Wave Guide Antenna	ETS	3117	68-4-80-19-001	00218954	1	2022-5-24
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-001	100745	1	2022-10-10
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-002	100746	1	2022-10-10
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	2022-8-23
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	Version10.35.02	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	2022-6-3

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 or ENV4200)	3.62dB
Uncertainty for Radiated Spurious Emission 25MHz-3000MHz	Horizontal: 4.67dB; Vertical: 4.65dB;
Uncertainty for Radiated Spurious Emission 3000MHz-18000MHz	Horizontal: 4.77dB; Vertical: 4.75dB;
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	Horizontal: 3.12dB; Vertical: 3.10dB;
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.27dB Frequency test involved: 0.6×10^{-7} or 1%

---THE END OF REPORT---