FCC/ISED - TEST REPORT

Report Number	:	**68.950.21.0676.01**	Date of Issue:	**2021-11-11**
Model	:	**GQGM1**		
FCC ID	:	SZGGQGM1		
IC	:	7702A-GQGM1		
Product Type	:	Wireless Device		
Applicant	:	Weifang Goertek Electronics Co., Ltd		
Address	:	Gaoxin 2 Road, Free Trade Zone, 261205 Weifang, Shandong, PEOPLE'S REPUBLIC OF CHINA		
Manufacturer	:	Weifang Goertek Electronics Co., Ltd		
Address	:	Gaoxin 2 Road, Free Trade Zone, 261205 Weifang, Shandong, PEOPLE'S REPUBLIC OF CHINA		
Test Result	:	■ **Positive** ☐ **Negative**		
Total pages including Appendices	:	60		

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TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District Shenzhen 518052, P.R. China

1 Table of Contents

TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan
District Shenzhen 518052, P.R. China

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: 86 755 8828 6998
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Report Version:

Revision	Release Date	History/Memo.
N/A	2021-11-11	Initial Release

3 Description of the Equipment Under Test

Product:	Wireless Device
Model no.:	GQGM1
FCC ID:	SZGGQGM1
IC:	7702A-GQGM1
PMN:	GQGM1
HVIN:	GQGM1
RF Transmission Frequency:	2402MHz-2480MHz
No. of Operated Channel:	79
Modulation:	GFSK, π/4-DQPSK, 8DPSK
Antenna Type:	Monopole
Antenna Gain:	-7.88dBi max for 2.4GHz
Description of the EUT:	The Equipment Under Test (EUT) is a Wireless Device with Bluetooth Low Energy/Bluetooth BDR+EDR 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 Site	Test Result
§15.207	RSS-GEN 8.8	Conducted emission AC power port	--	N/A
§15.247(b)(1)	RSS-247 Clause 5.4(b)	Conducted peak output power and e.i.r.p.	Site 1	PASS
§15.247(e)	RSS-247 Clause 5.2(b)	Power spectral density	--	N/A
§15.247(a)(2)	RSS-247 Clause 5.2(a)	6dB bandwidth	--	N/A
§15.247(a)(1)	RSS-247 Clause 5.1(a) & RSS-Gen 6.7	20dB bandwidth and 99% Occupied Bandwidth	Site 1	PASS
§15.247(a)(1)	RSS-247 Clause 5.1(b)	Carrier frequency separation	Site 1	PASS
§15.247(a)(1)(iii)	RSS-247 Clause 5.1(d)	Number of hopping frequencies	Site 1	PASS
§15.247(a)(1)(iii)	RSS-247 Clause 5.1(d)	Dwell Time	Site 1	PASS
§15.247(d)	RSS-247 Clause 5.5	Spurious RF conducted emissions	Site 1	PASS
§15.247(d)	RSS-247 Clause 5.5	Band edge	Site 1	PASS
§15.247(d) & §15.209 & §15.205	RSS-247 Clause 5.5 & RSS-GEN 6.13 RSS-GEN 8.9 RSS-GEN 8.10	Spurious radiated emissions for transmitter and receiver	Site 1	PASS
§15.203	RSS-GEN 6.8	Antenna requirement	See note 2	PASS

Note 1: N/A=Not Applicable.
Note 2: The EUT uses a monopole antenna, which gain is -7.88dBi. 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: SZGGQGM1, IC: 7702A-GQGM1, complies with Section 15.205, 15.209, 15.247 of the FCC Part 15, Subpart C and RSS-247 issue 2 and RSS-Gen issue 5 rules.

The Equipment Under Test (EUT) is a Wireless Device with Bluetooth Low Energy/Bluetooth BDR+EDR functions.

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:	2021-10-25
Testing Start Date:	2021-10-25
Testing End Date:	2021-11-10

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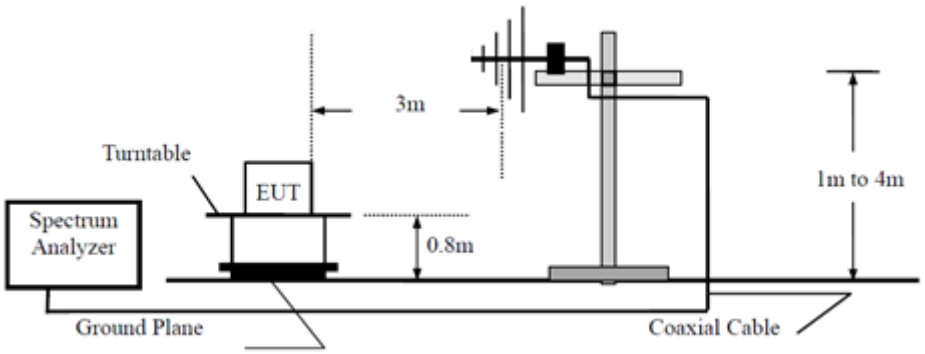
Reviewed by:	Prepared by:	Tested by:
John Zhi	Joe Gu	Gary Cai
Project Manager	Project Engineer	Test Engineer

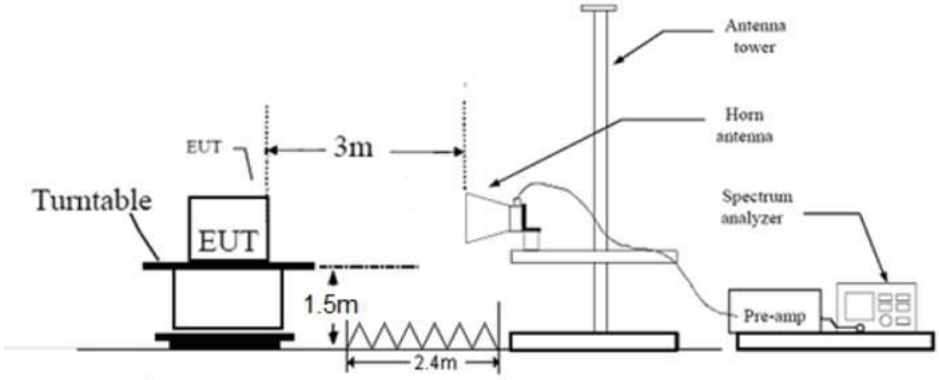
7 Test Setups

7.1 Radiated test setups

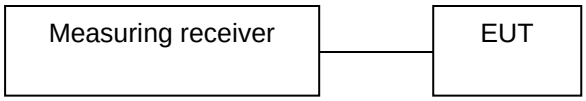
Below 1GHz



Above 1GHz



7.2 Conducted RF test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

Name	Model	Manufacturer	S/N	Cal Due Date
Notebook	X220	Lenovo	--	--

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 peak output power and e.i.r.p.

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

Conducted Peak Output Power:

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

For e.i.r.p.:

Frequency Range MHz	Limit W	Limit dBm
2400-2483.5	≤4	≤36

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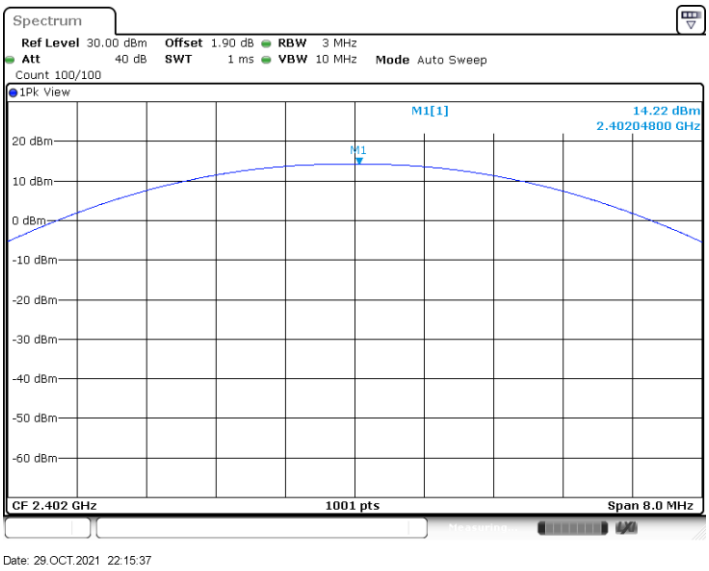
Conducted peak output power

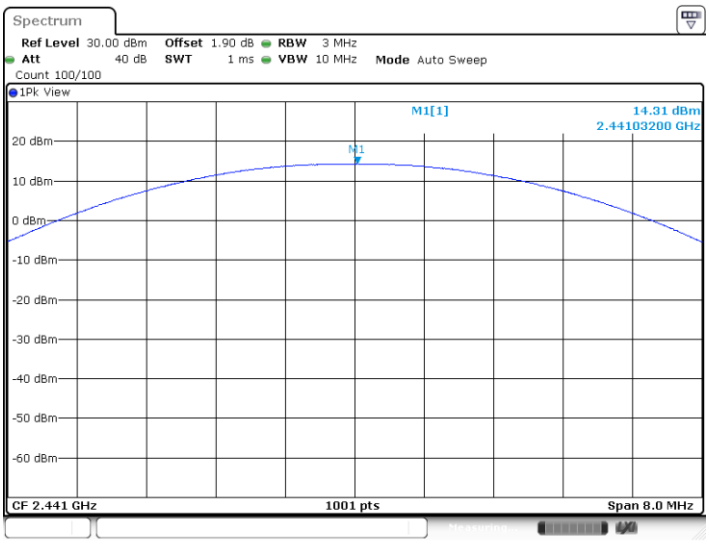
Bluetooth Mode GFSK modulation Test Result

Frequency	Conducted Peak Output Power	Antenna Gain	EIRP	Result
MHz	dBm	dBi	dBm	
Low channel 2402MHz	14.22	-7.88	6.34	Pass
Middle channel 2441MHz	14.31	-7.88	6.43	Pass
High channel 2480MHz	14.52	-7.88	6.64	Pass

Low channel 2402MHz



Middle channel 2441MHz



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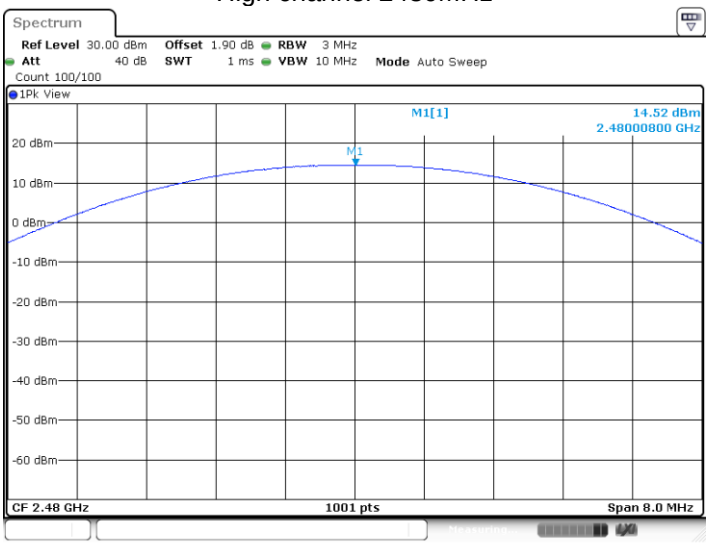
High channel 2480MHz



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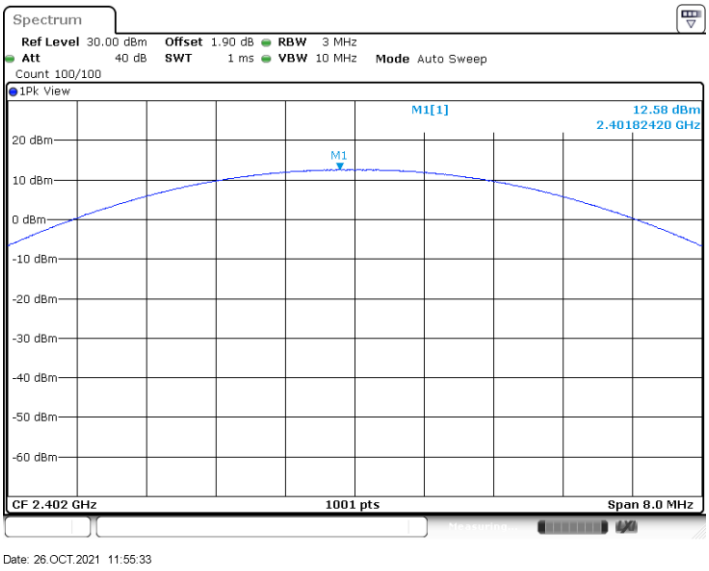
Bluetooth Mode π/4-DQPSK modulation Test Result

Frequency	Conducted Peak Output Power	Antenna Gain	EIRP	Result
MHz	dBm	dBi	dBm	
Low channel 2402MHz	12.58	-7.88	4.70	Pass
Middle channel 2441MHz	12.93	-7.88	5.05	Pass
High channel 2480MHz	13.43	-7.88	5.55	Pass

Low channel 2402MHz



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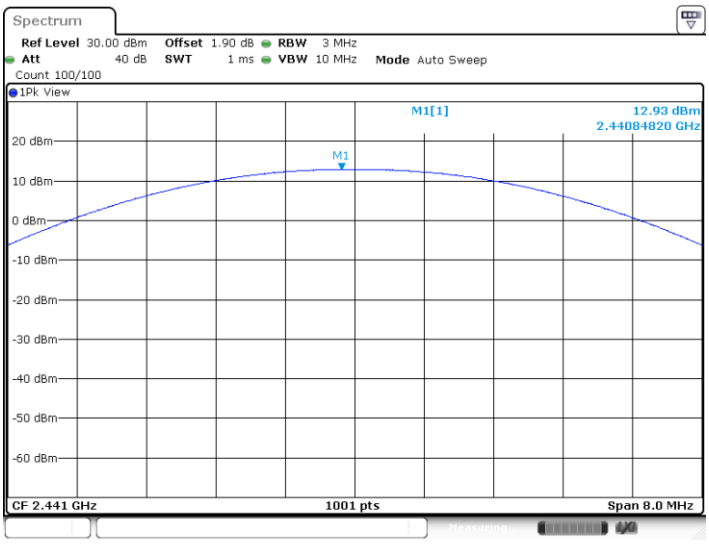
Middle channel 2441MHz



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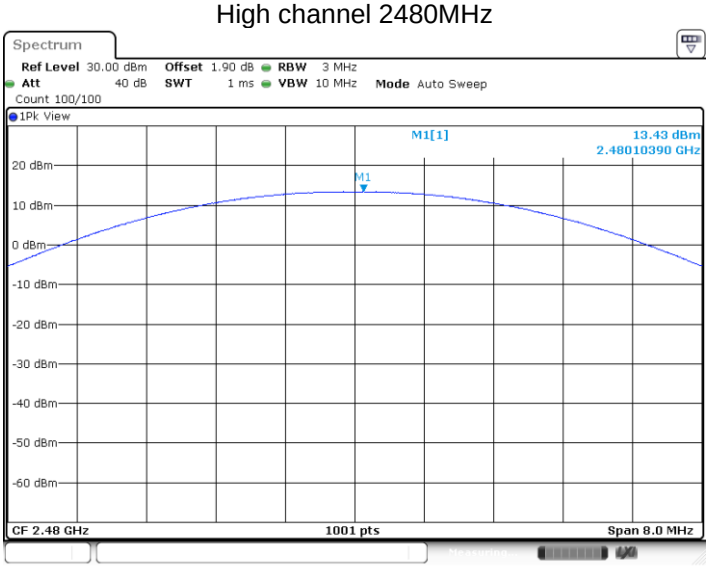
High channel 2480MHz



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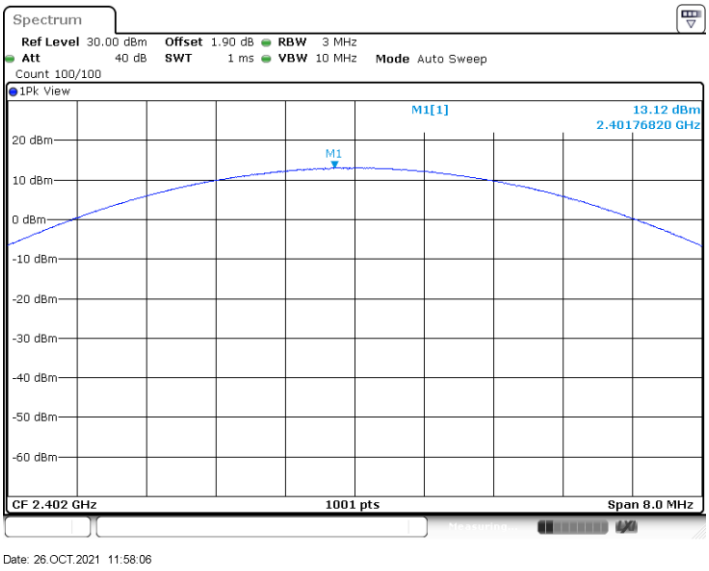
Bluetooth Mode 8DPSK modulation Test Result

Frequency	Conducted Peak Output Power	Antenna Gain	EIRP	Result
MHz	dBm	dBi	dBm	
Low channel 2402MHz	13.12	-7.88	5.24	Pass
Middle channel 2441MHz	13.29	-7.88	5.41	Pass
High channel 2480MHz	13.61	-7.88	5.73	Pass

Low channel 2402MHz



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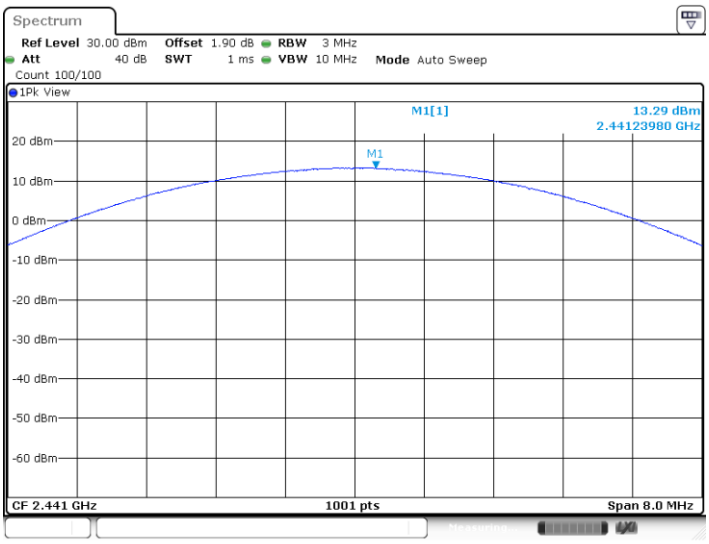
Middle channel 2441MHz



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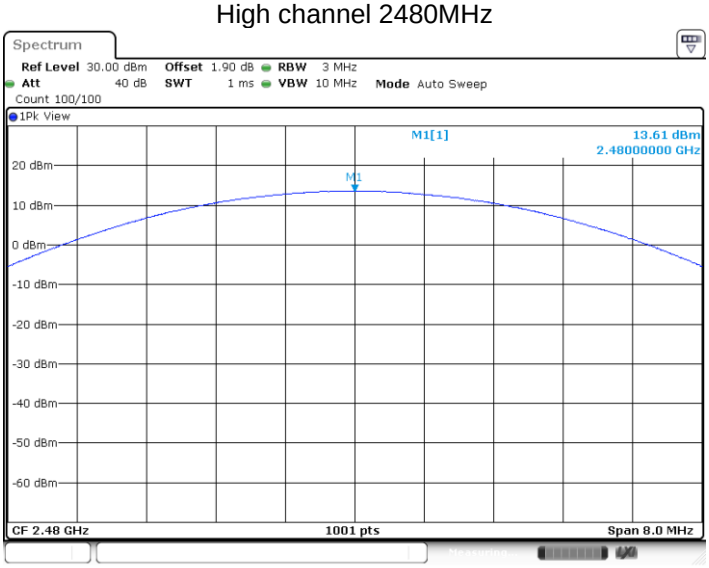
High channel 2480MHz



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9.2 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

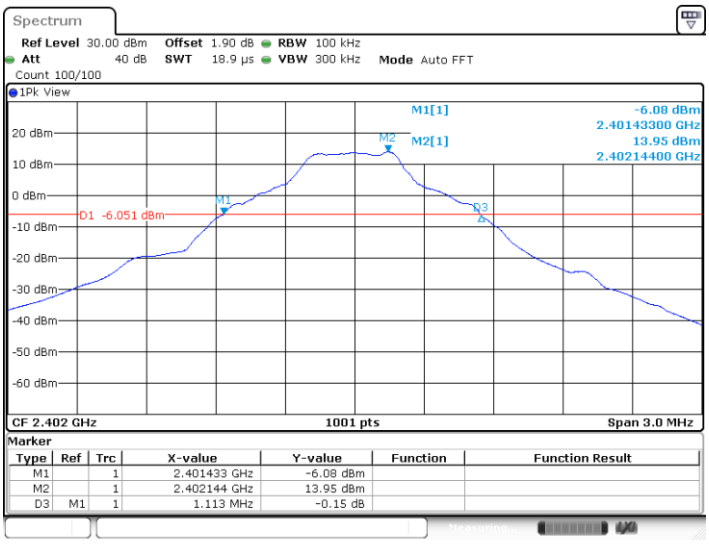
Limit [kHz]
N/A

20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode GFSK Modulation test result

Frequency MHz	20 dB Bandwidth kHz	99% Bandwidth kHz	Limit kHz	Result
2402	1113	884	--	Pass
2441	1113	884	--	Pass
2480	1119	884	--	Pass

Low channel 2402MHz



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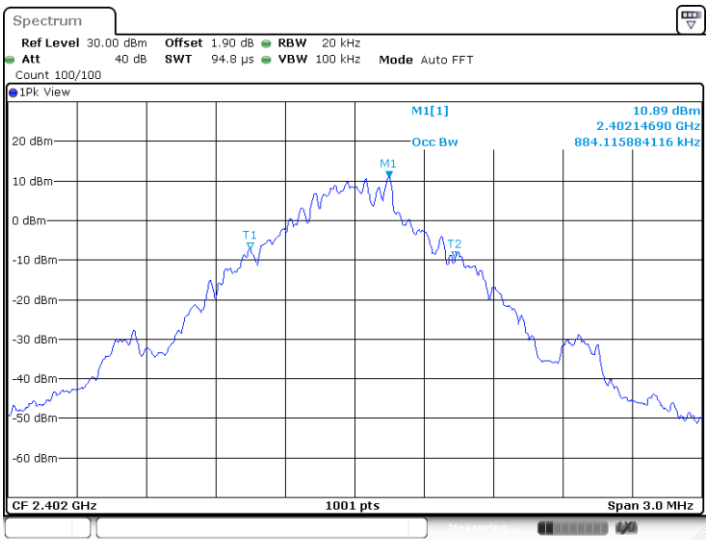

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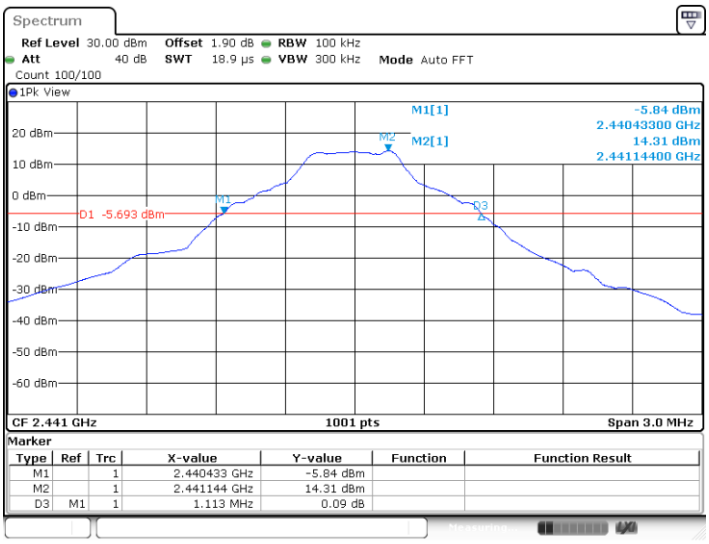
Middle channel 2441MHz



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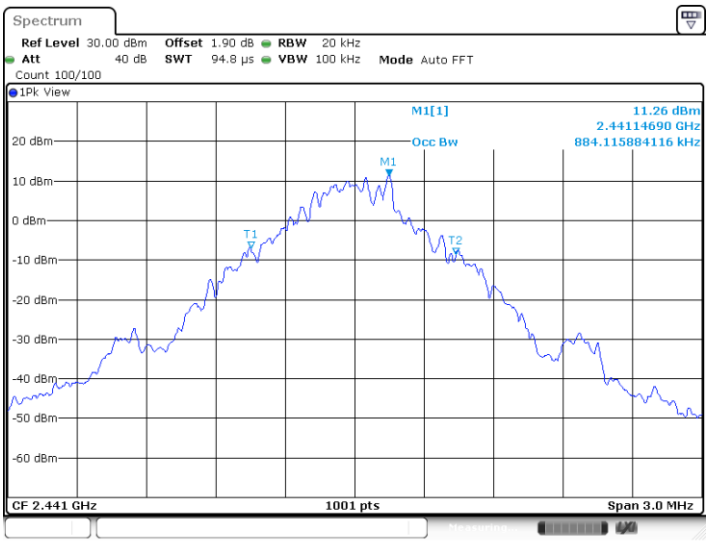

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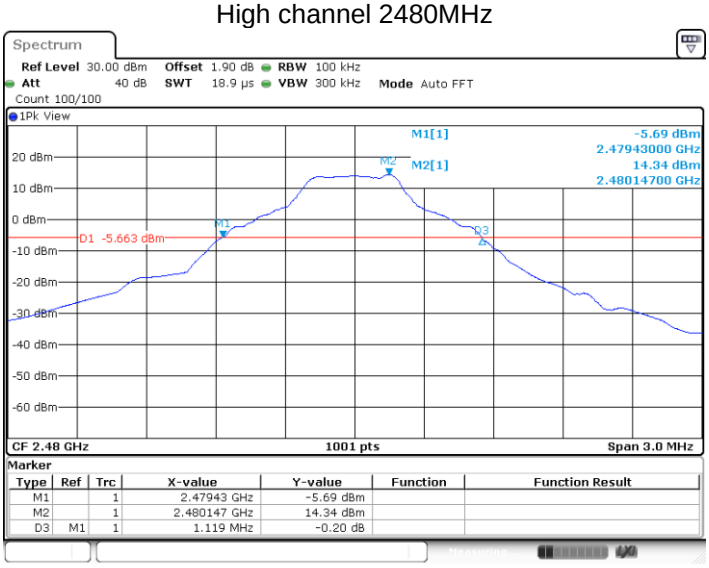
High channel 2480MHz



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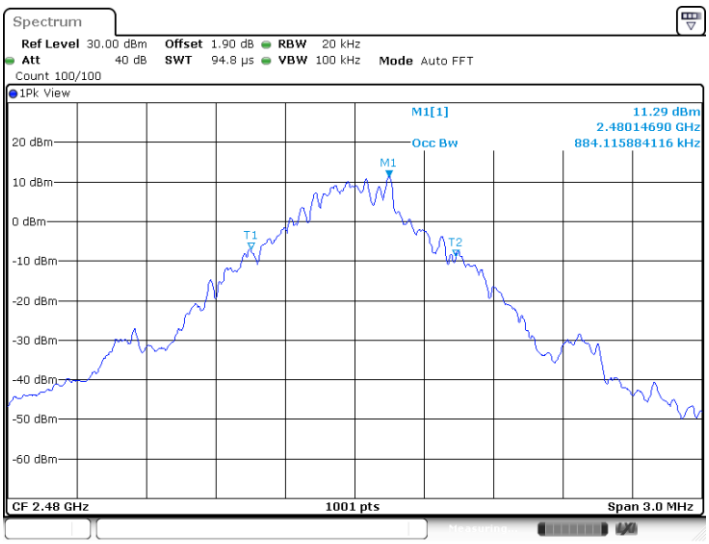

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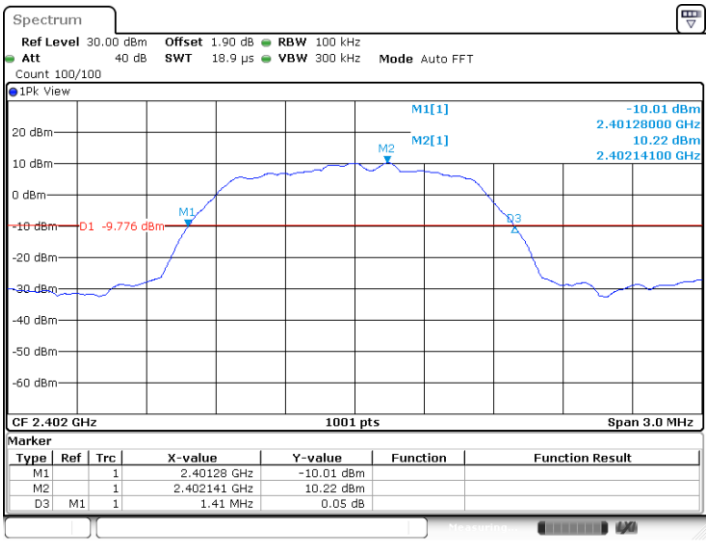
20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode π/4-DQPSK Modulation test result

Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result
MHz	kHz	kHz	kHz	
2402	1410	1190	--	Pass
2441	1407	1193	--	Pass
2480	1410	1199	--	Pass

Low channel 2402MHz



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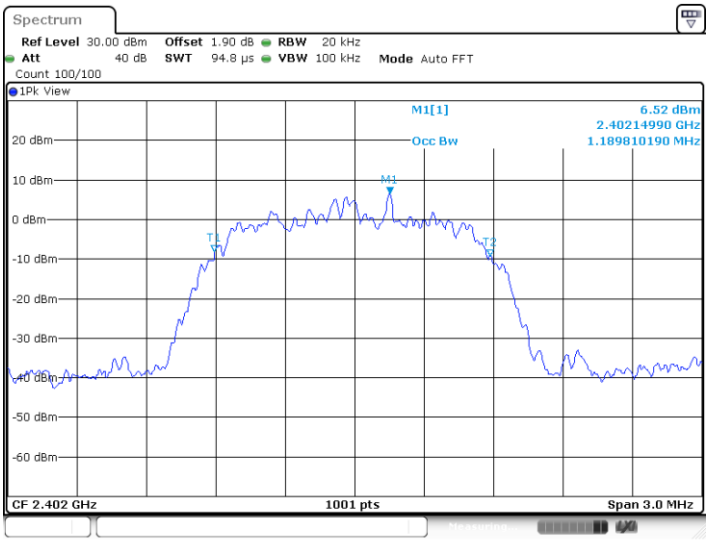

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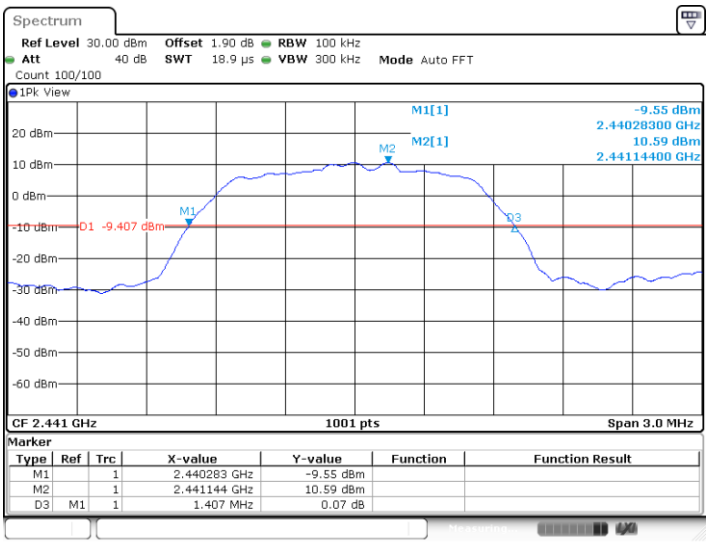
Middle channel 2441MHz



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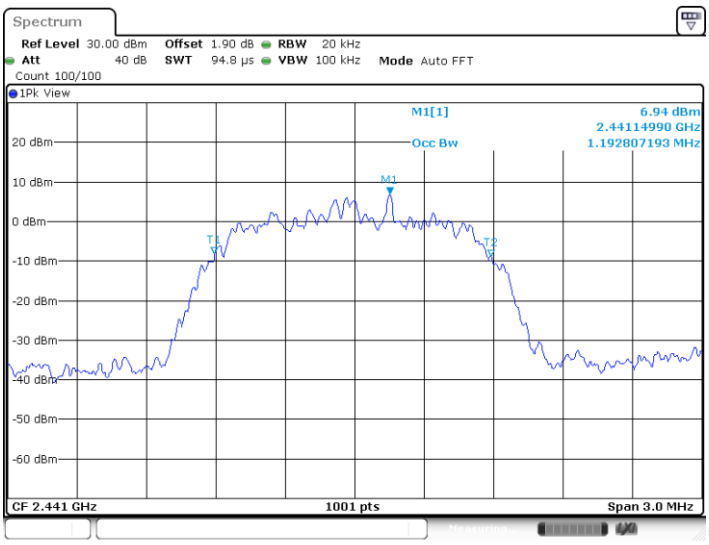

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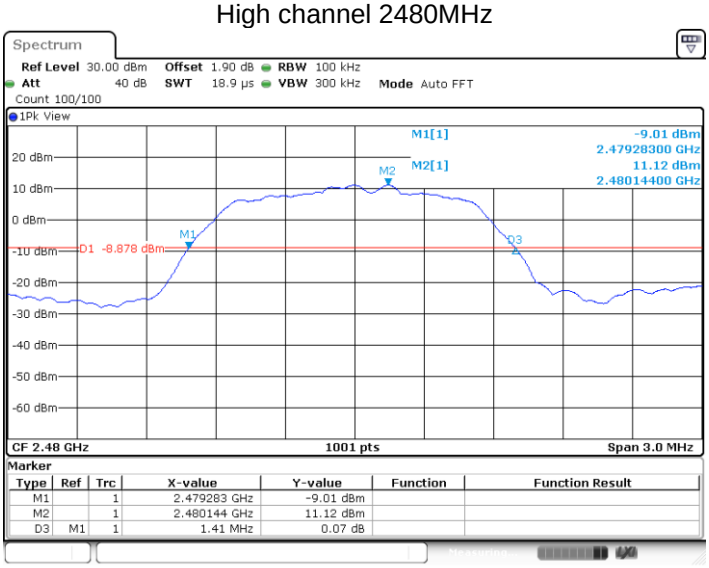
High channel 2480MHz



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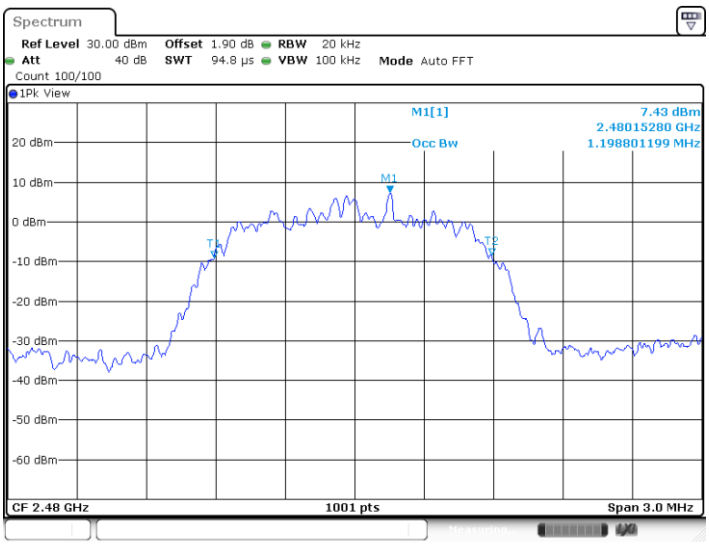

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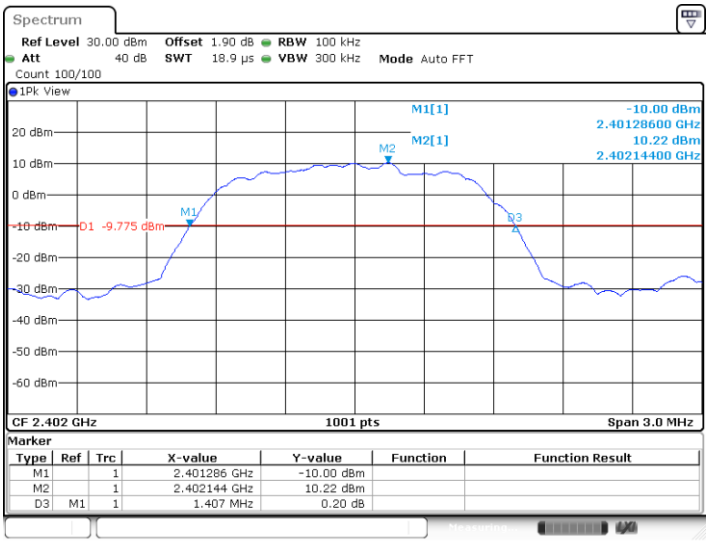
20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode 8DPSK Modulation test result

Frequency MHz	20 dB Bandwidth kHz	99% Bandwidth kHz	Limit kHz	Result
2402	1407	1196	--	Pass
2441	1407	1196	--	Pass
2480	1413	1202	--	Pass

Low channel 2402MHz



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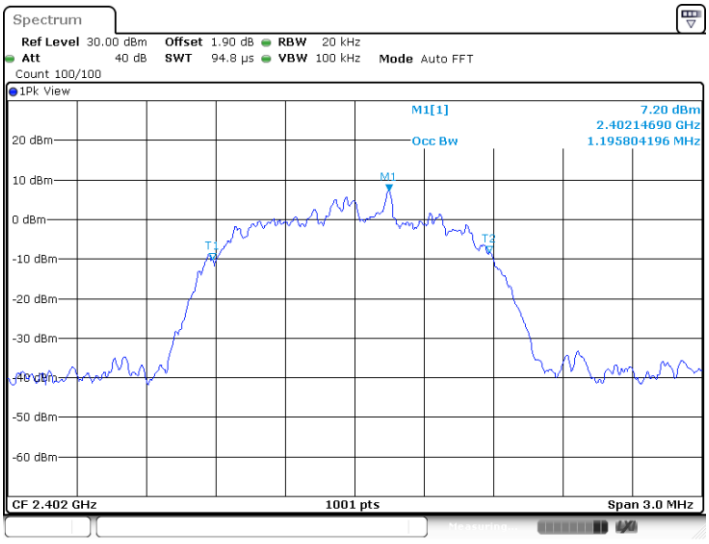

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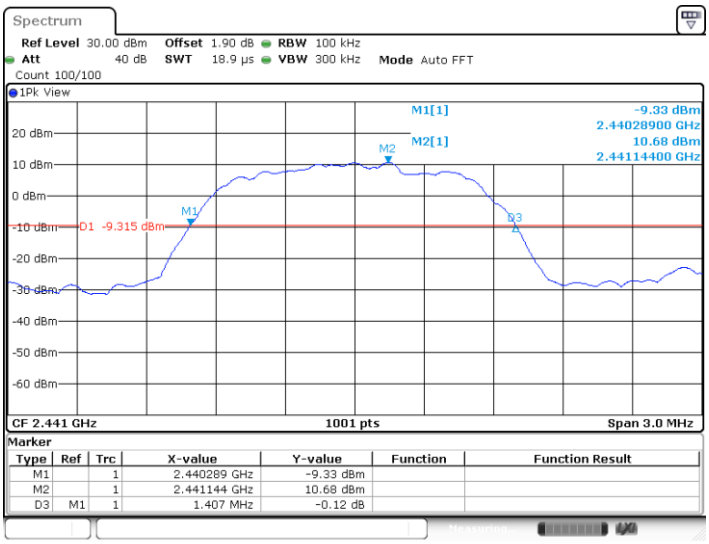
Middle channel 2441MHz



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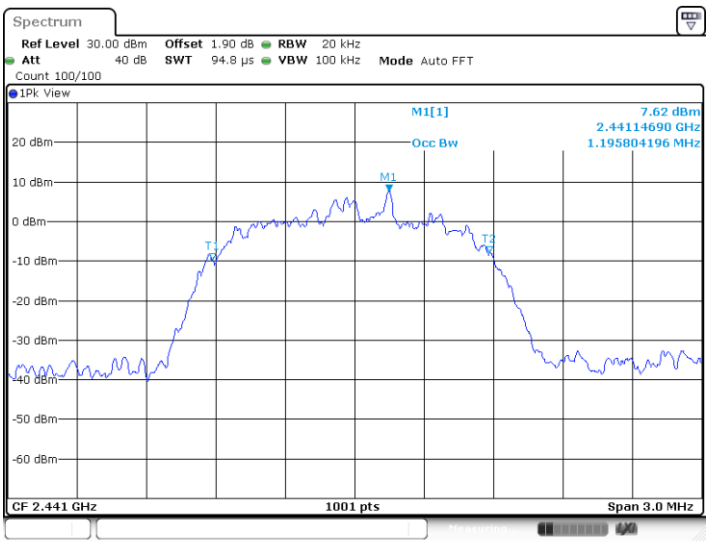

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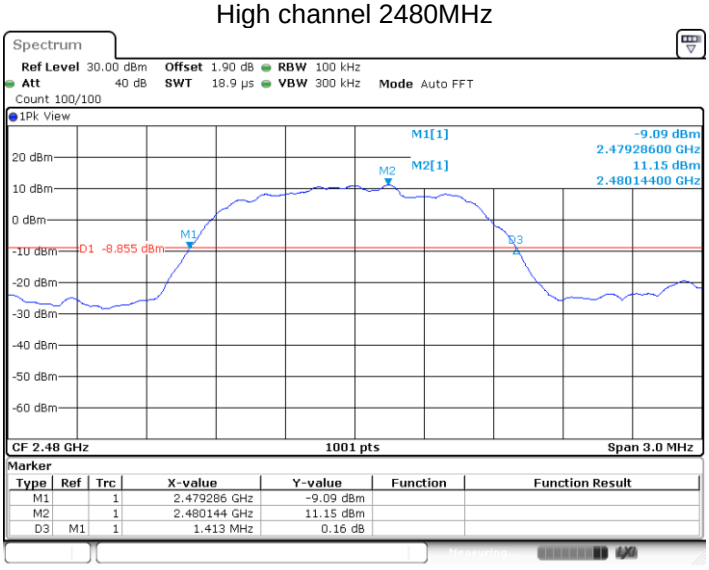
High channel 2480MHz



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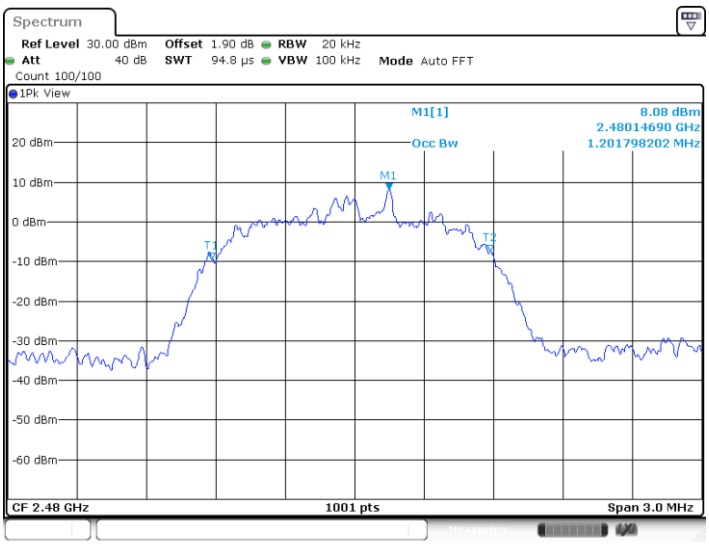

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9.3 Carrier Frequency Separation

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.

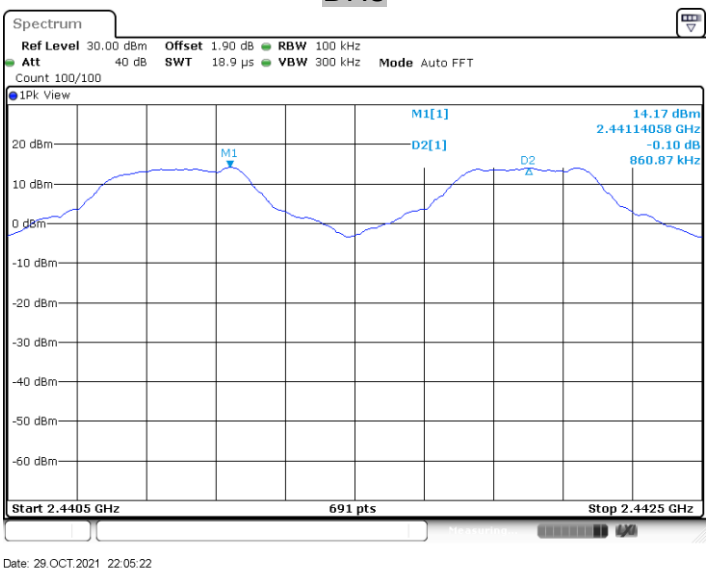
Limit

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

Carrier Frequency Separation

TestMode	Channel	Result[MHz]	Limit[MHz]	Verdict
DH5	Hop	0.861	>=0.746	PASS
2DH5	Hop	1.006	>=0.940	PASS
3DH5	Hop	1.000	>=0.942	PASS

DH5



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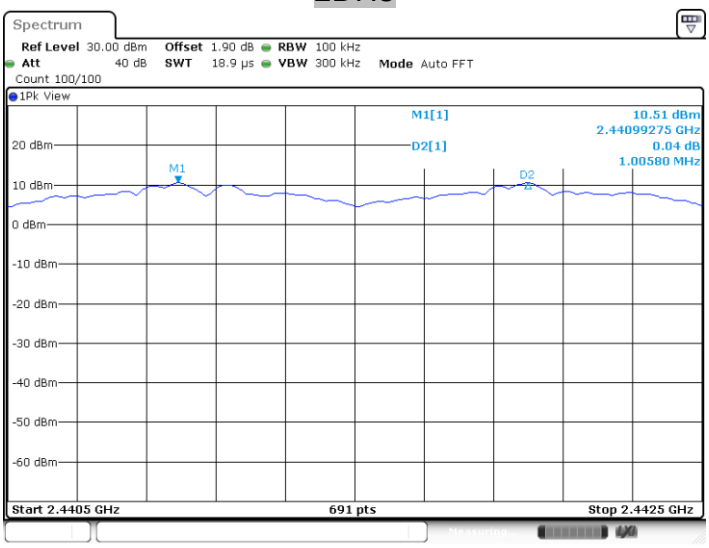
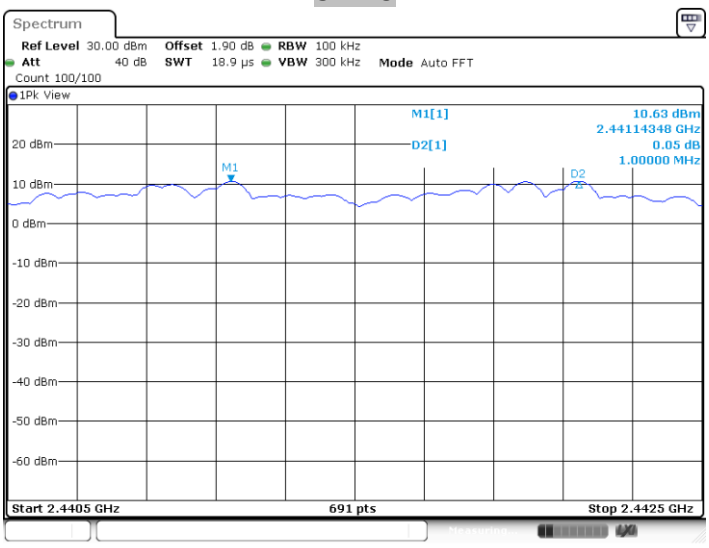
2DH5



Date: 29.OCT.2021 22:09:37

3DH5



Date: 29.OCT.2021 22:13:04

9.4 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.

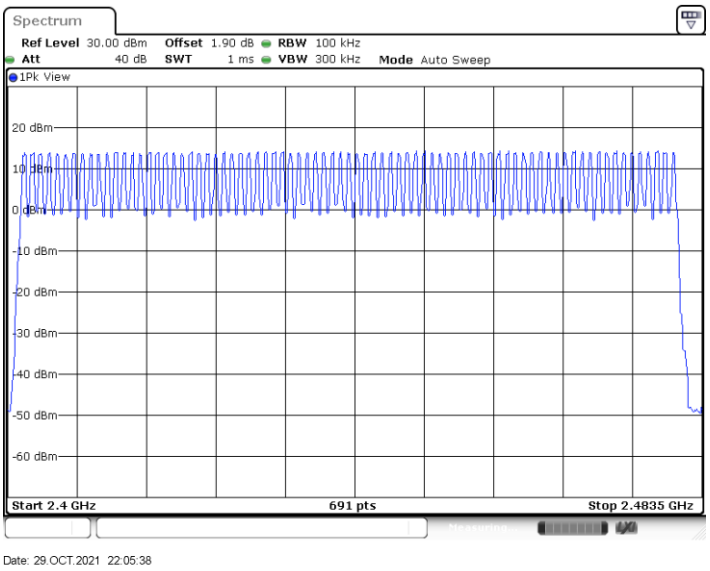
Limit

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



TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12 & 13, Zhiheng Wisdomland Business Park, Nantou Checkpoint Road 2, Nanshan District Shenzhen 518052, P.R. China

9.5 Dwell Time

Test Method

1. Connect EUT antenna terminal to the spectrum analyzer with a low loss cable. Equipment mode: Spectrum analyzer
2. RBW: 1MHz; VBW: 1MHz; SPAN: Zero Span
3. Adjust the center frequency of spectrum analyzer on any frequency be measured.
4. Measure the Dwell Time by spectrum analyzer Marker function.
5. 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

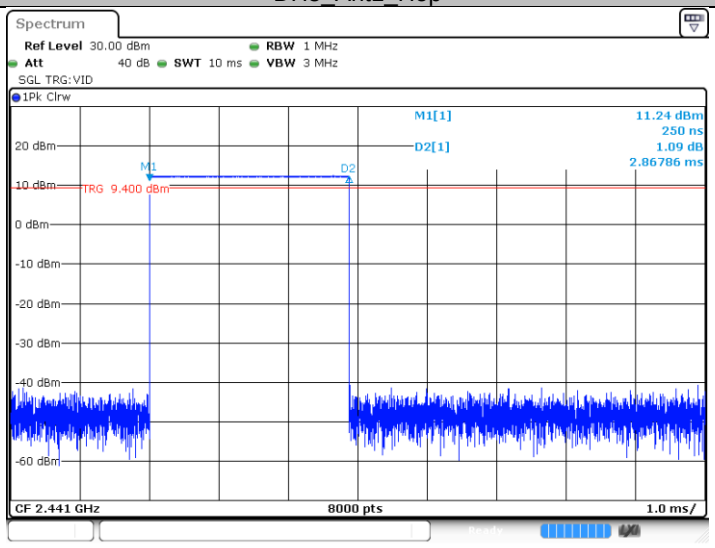
Dwell time
The maximum dwell time shall be 0.4 s.

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];

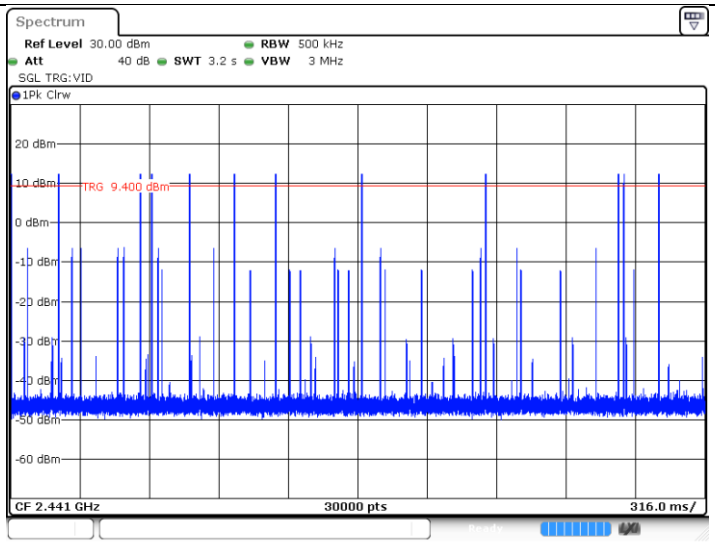
Test Result

TestMode	Channel	BurstWidth (ms)	TotalHops	Result(s)	Limit(s)	Verdict
DH5	Hop	2.87	120	0.344	<=0.4	PASS
2DH5	Hop	2.87	90	0.258	<=0.4	PASS
3DH5	Hop	2.88	100	0.288	<=0.4	PASS

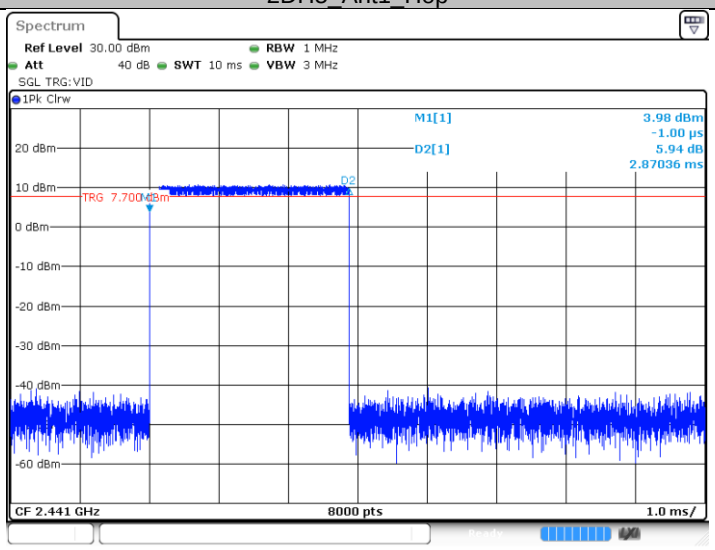
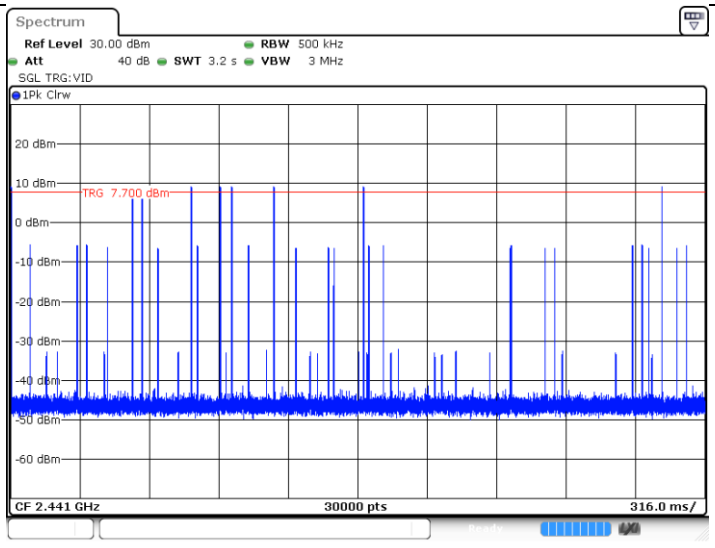
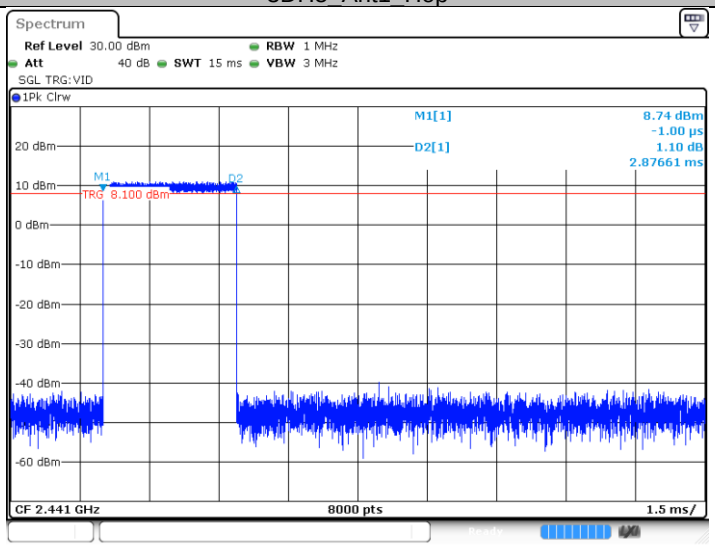
DH5_Ant1_Hop

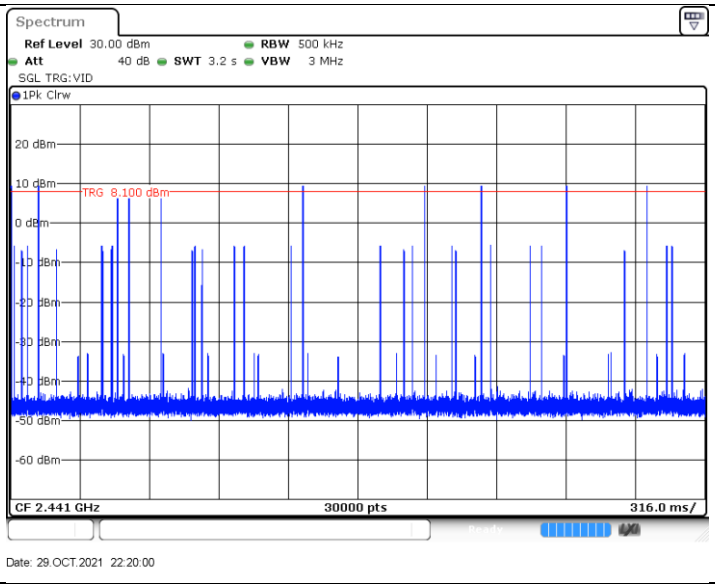


Date: 29.OCT.2021 22:05:50



Date: 29.OCT.2021 22:05:55

2DH5_Ant1_Hop
 Date: 29.OCT.2021 22:19:18
 Date: 29.OCT.2021 22:19:23
3DH5_Ant1_Hop
 Date: 29.OCT.2021 22:19:55


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 8.100 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: 29.OCT.2021 22:20:00

9.6 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.

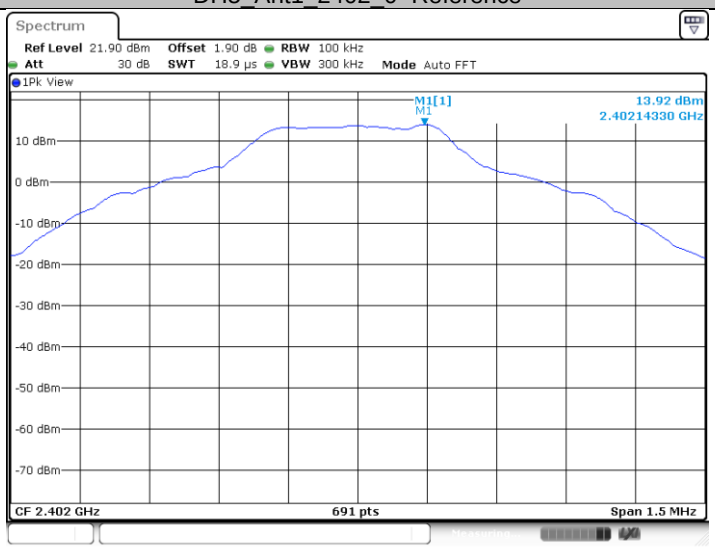
Limit

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

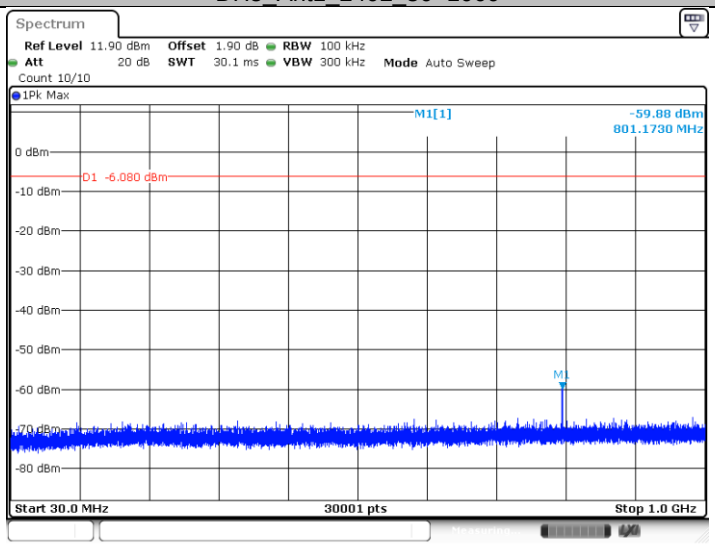
Spurious RF conducted emissions

TestMode	Antenna	Channel(MHz)	FreqRange(MHz)	RefLevel	Result(dBm)	Limit(dBm)	Verdict
DH5	Ant1	2402	Reference	13.92(dBm)	13.92	---	PASS
			30~1000	30~1000(MHz)	-59.88	<=-6.08	PASS
			1000~26500	1000~26500(MHz)	-42.27	<=-6.08	PASS
		2441	Reference	14.31(dBm) (MHz)	14.31	---	PASS
			30~1000	30~1000(MHz)	-54.11	<=-5.69	PASS
			1000~26500	1000~26500(MHz)	-46.33	<=-5.69	PASS
		2480	Reference	14.34(dBm)	14.34	---	PASS
			30~1000	30~1000(MHz)	-51.48	<=-5.66	PASS
			1000~26500	1000~26500(MHz)	-45.12	<=-5.66	PASS
2DH5	Ant1	2402	Reference	10.15(dBm)	10.15	---	PASS
			30~1000	30~1000(MHz)	-67.29	<=-9.85	PASS
			1000~26500	1000~26500(MHz)	-39.97	<=-9.85	PASS
		2441	Reference	10.64(dBm)	10.64	---	PASS
			30~1000	30~1000(MHz)	-65.51	<=-9.36	PASS
			1000~26500	1000~26500(MHz)	-47.45	<=-9.36	PASS
		2480	Reference	11.05(dBm)	11.05	---	PASS
			30~1000	30~1000(MHz)	-64.63	<=-8.95	PASS
			1000~26500	1000~26500(MHz)	-47.55	<=-8.95	PASS
3DH5	Ant1	2402	Reference	10.19(dBm)	10.19	---	PASS
			30~1000	30~1000(MHz)	-67.25	<=-9.81	PASS
			1000~26500	1000~26500(MHz)	-38.05	<=-9.81	PASS
		2441	Reference	10.71(dBm)	10.71	---	PASS
			30~1000	30~1000(MHz)	-65.42	<=-9.29	PASS
			1000~26500	1000~26500(MHz)	-46.96	<=-9.29	PASS
		2480	Reference	11.08(dBm)	11.08	---	PASS
			30~1000	30~1000(MHz)	-62.34	<=-8.92	PASS
			1000~26500	1000~26500(MHz)	-47.52	<=-8.92	PASS

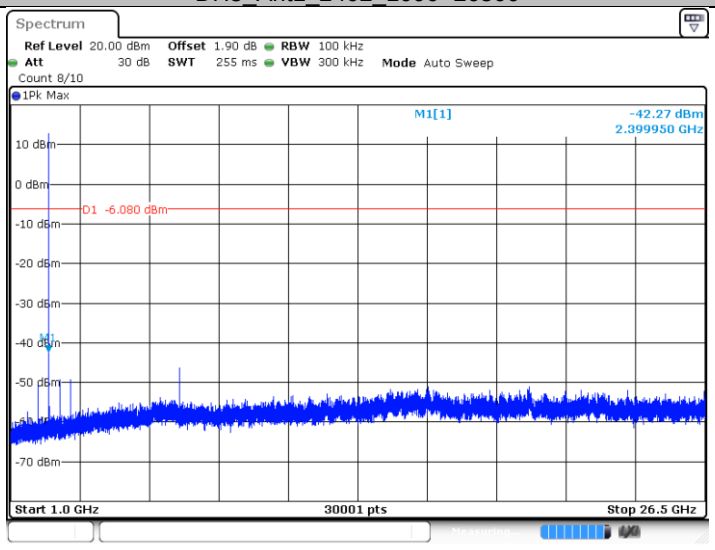
DH5_Ant1_2402_0~Reference



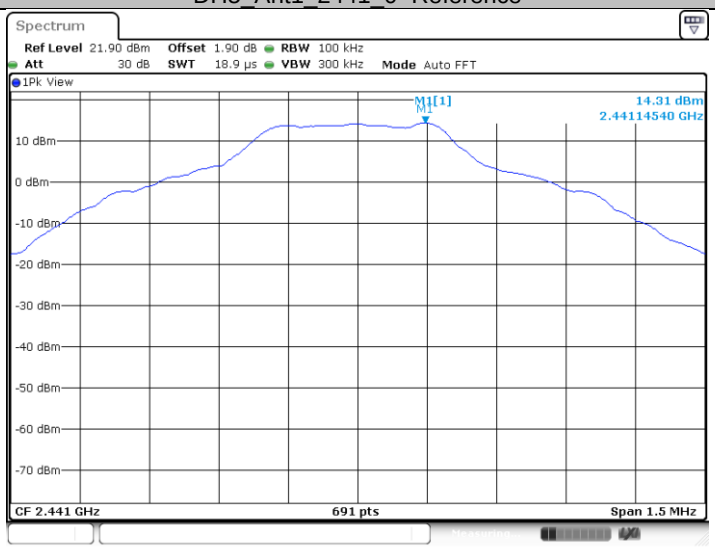
DH5_Ant1_2402_30~1000



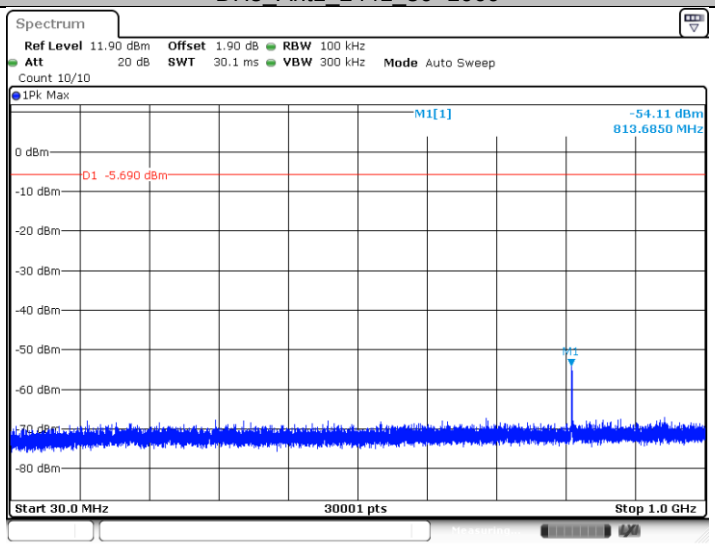
DH5_Ant1_2402_1000~26500



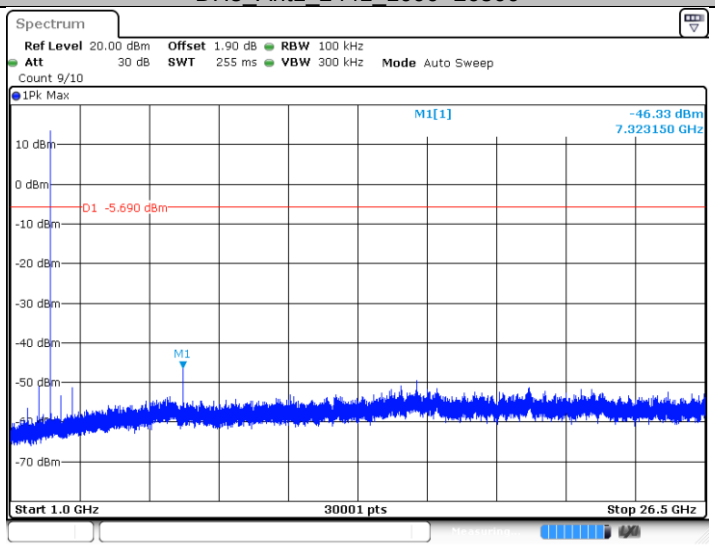
DH5_Ant1_2441_0~Reference



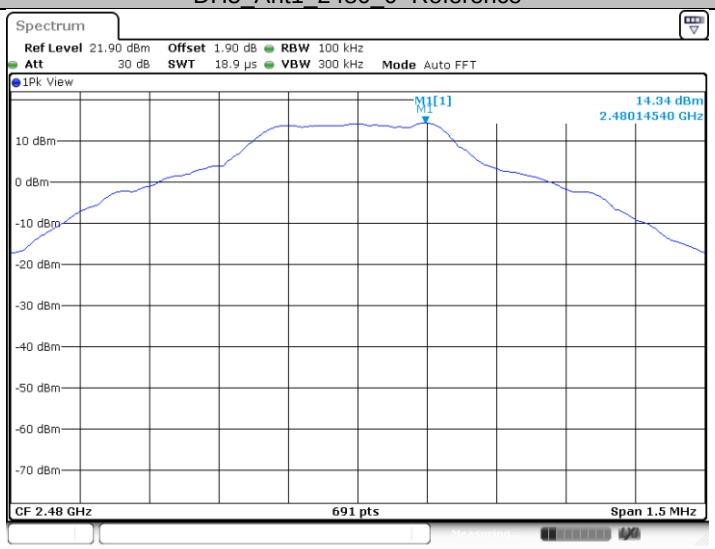
DH5_Ant1_2441_30~1000



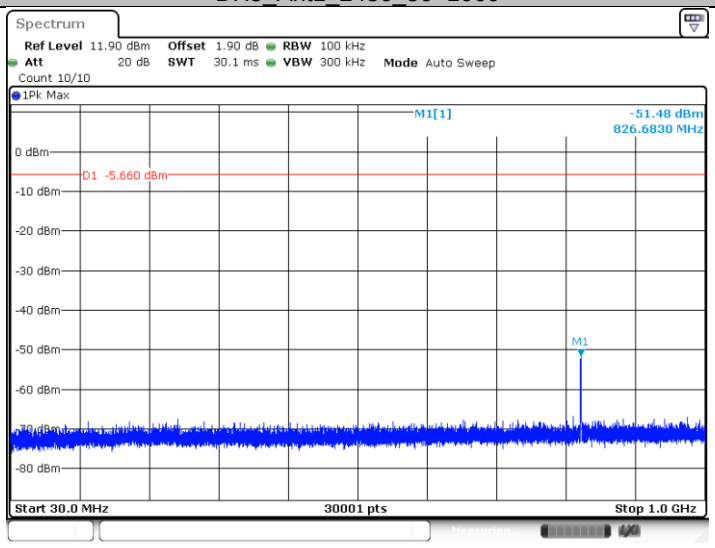
DH5_Ant1_2441_1000~26500



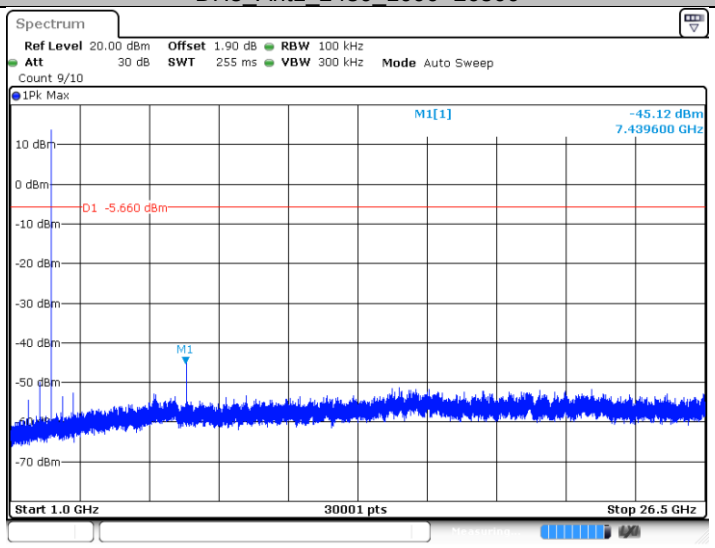
DH5_Ant1_2480_0~Reference



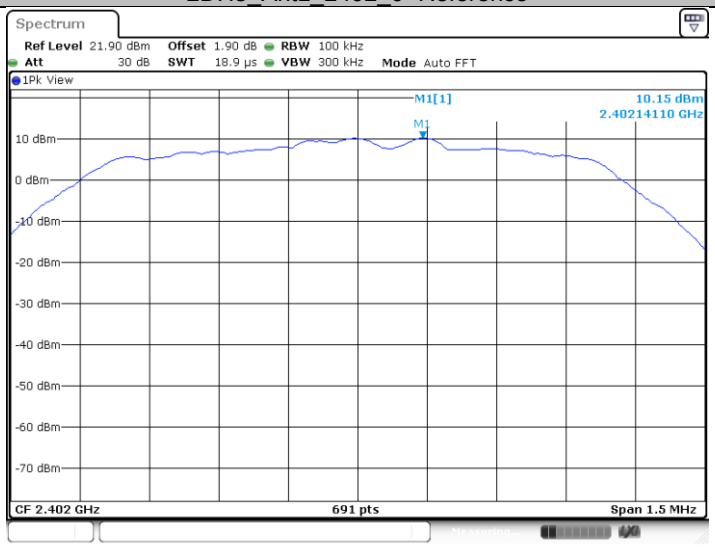
DH5_Ant1_2480_30~1000



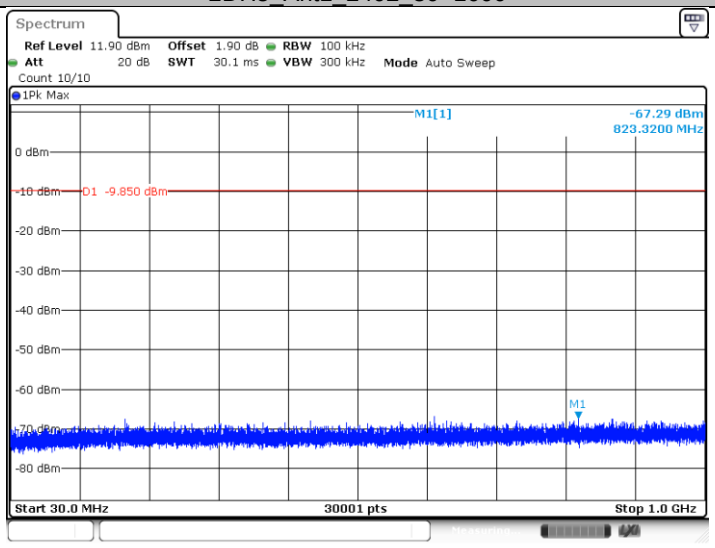
DH5_Ant1_2480_1000~26500



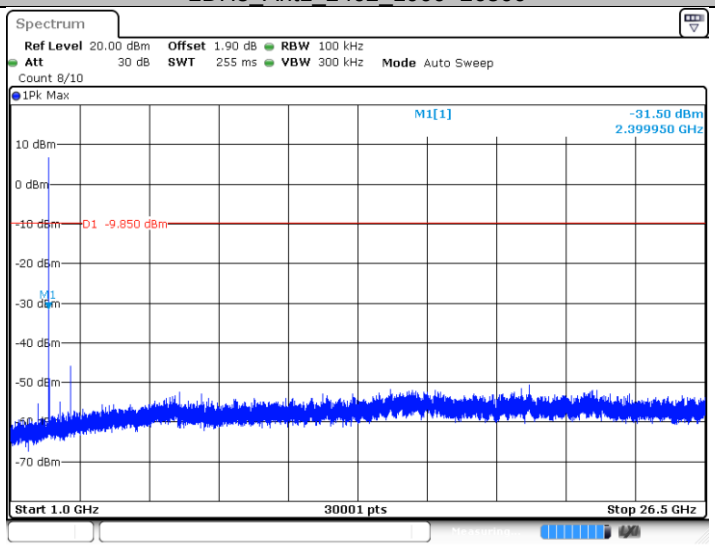
2DH5_Ant1_2402_0~Reference



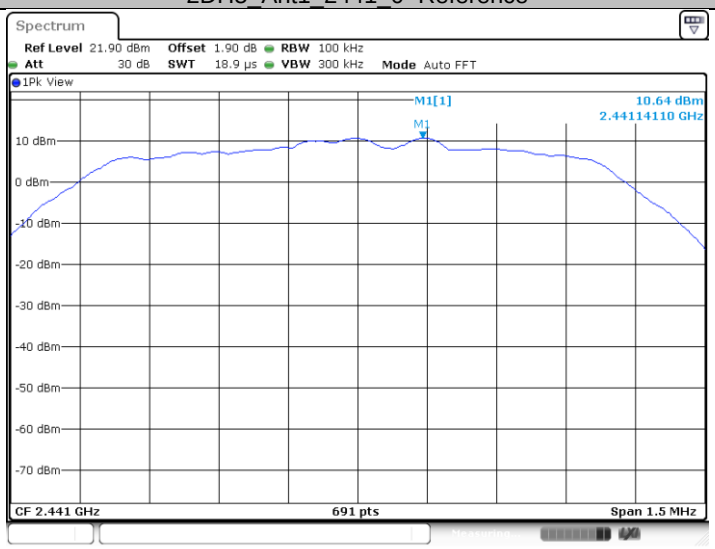
2DH5_Ant1_2402_30~1000



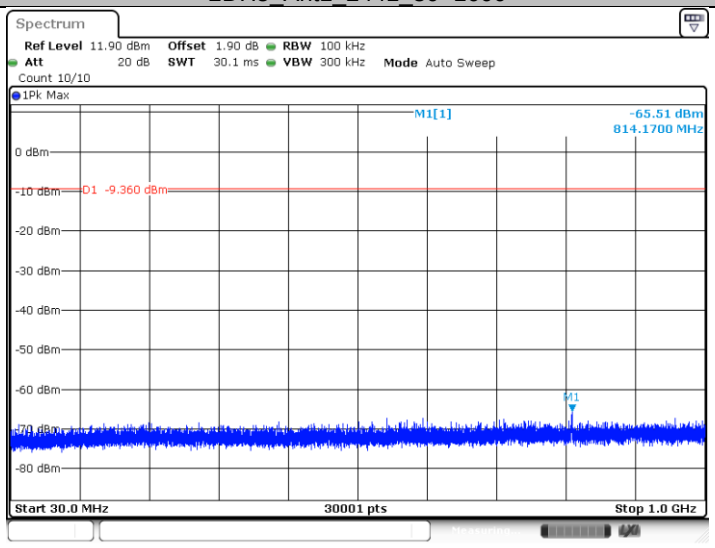
2DH5_Ant1_2402_1000~26500



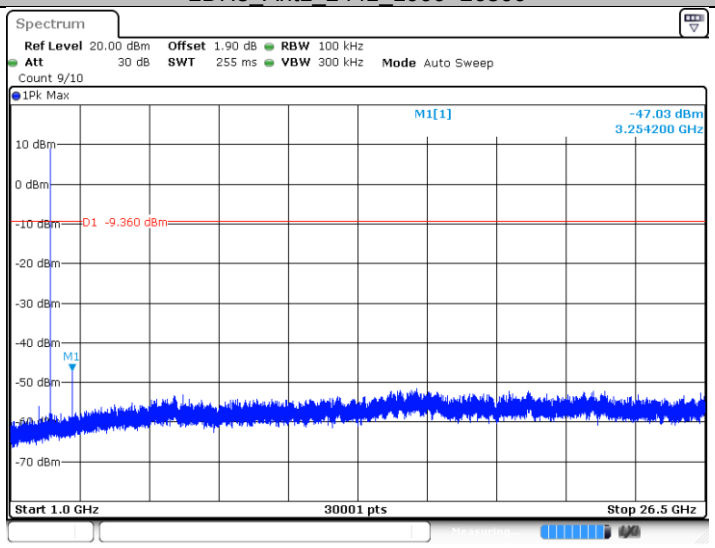
2DH5_Ant1_2441_0~Reference



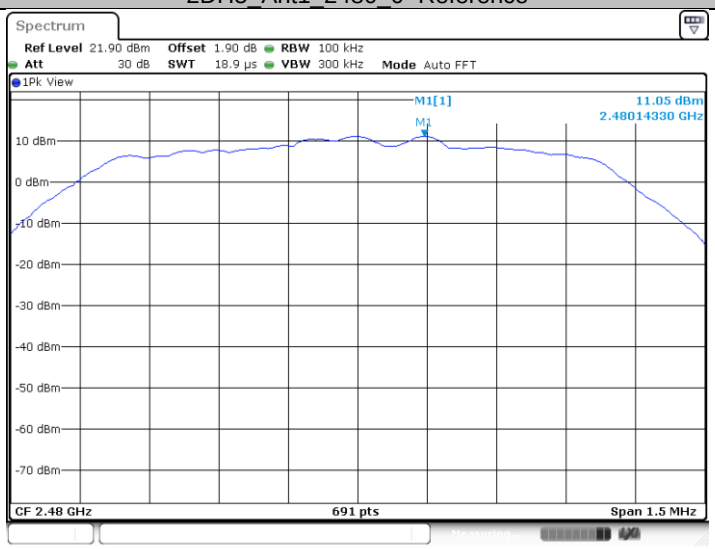
2DH5_Ant1_2441_30~1000



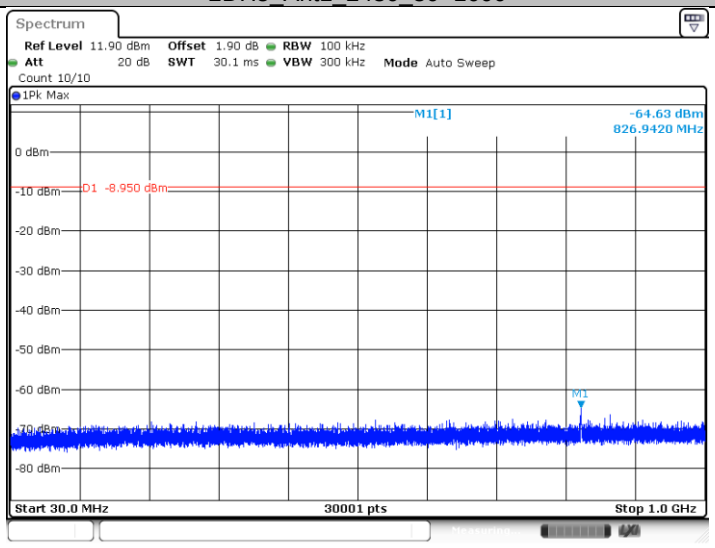
2DH5_Ant1_2441_1000~26500



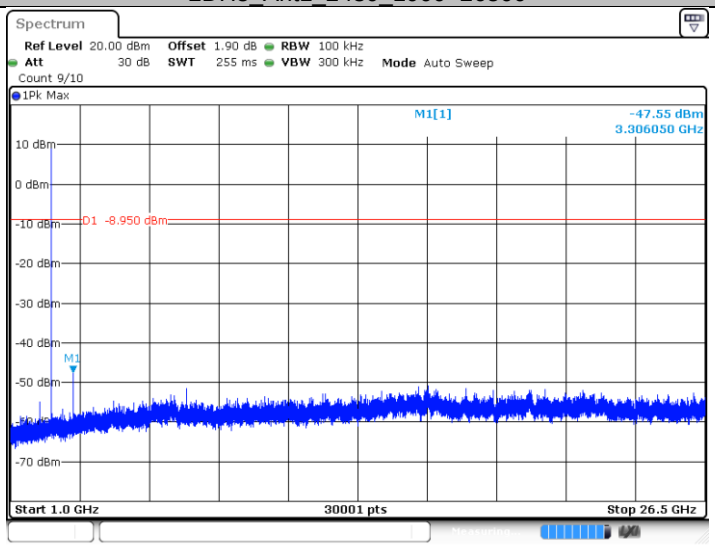
2DH5_Ant1_2480_0~Reference

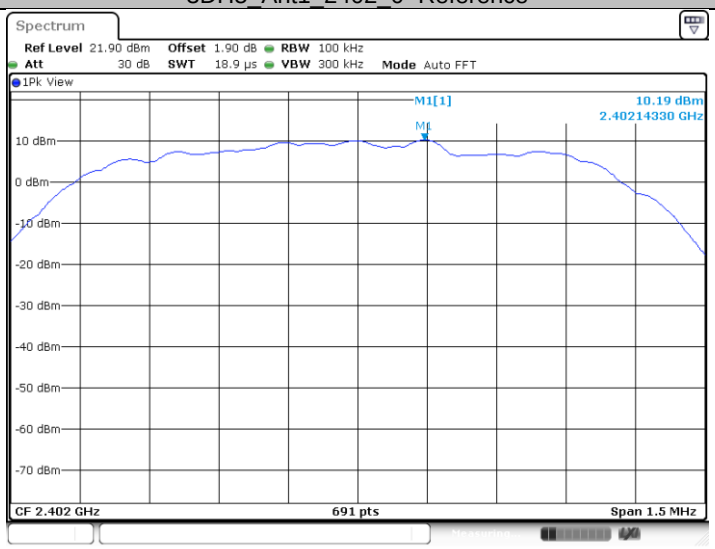
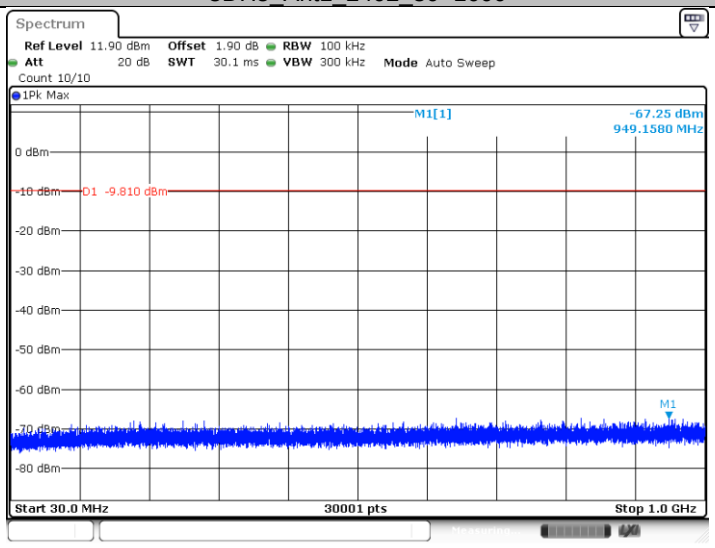
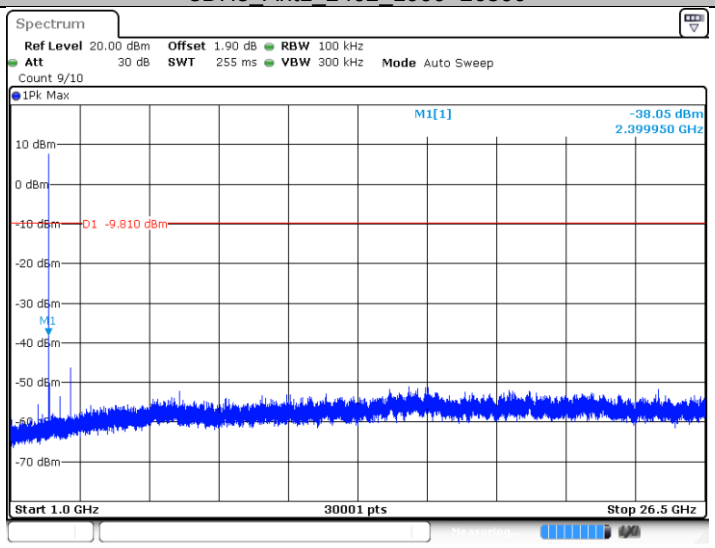


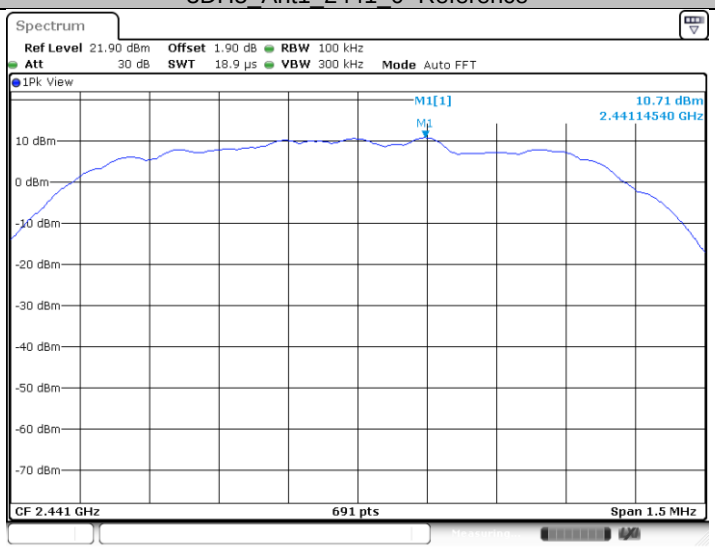
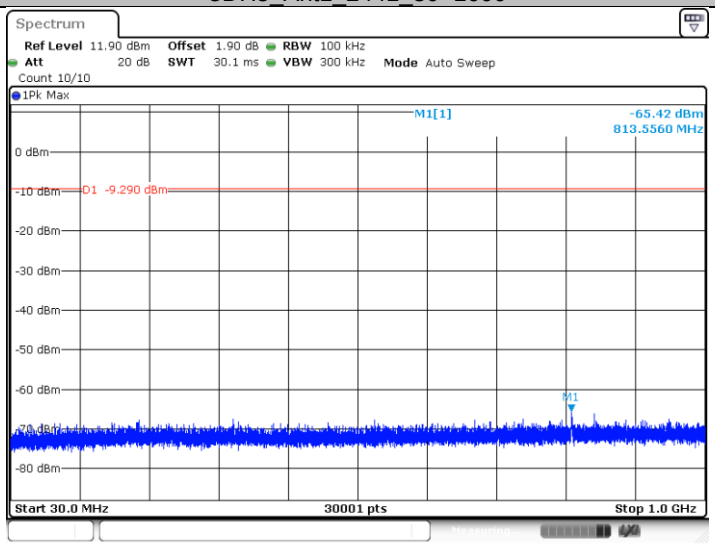
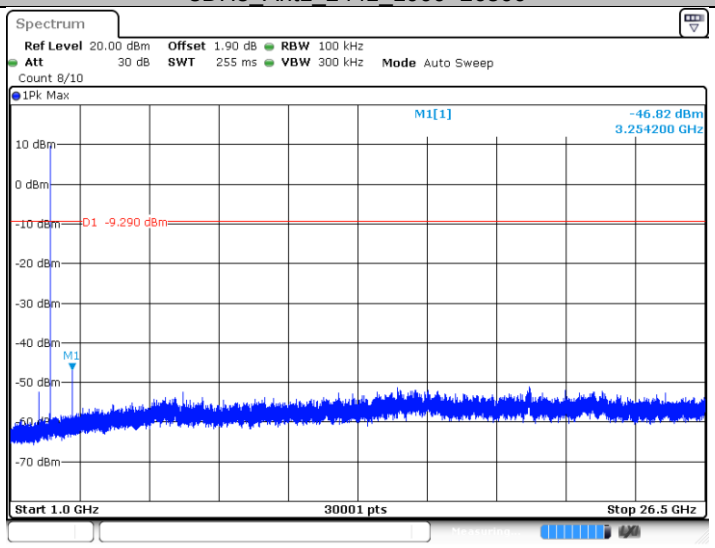
2DH5_Ant1_2480_30~1000



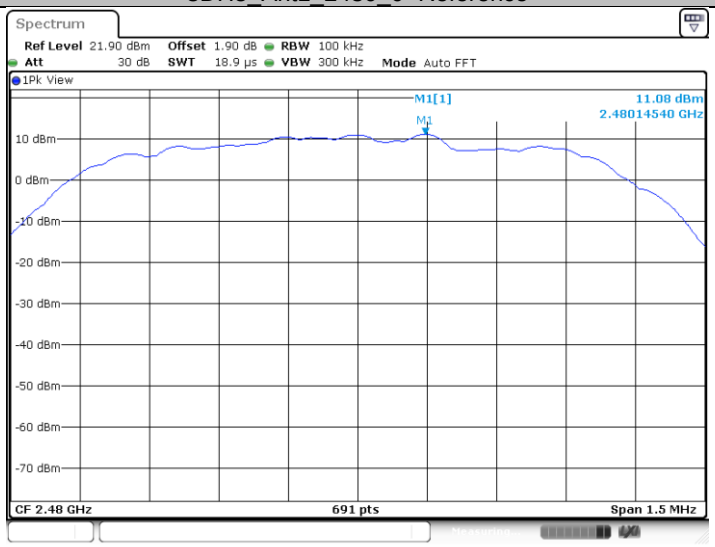
2DH5_Ant1_2480_1000~26500



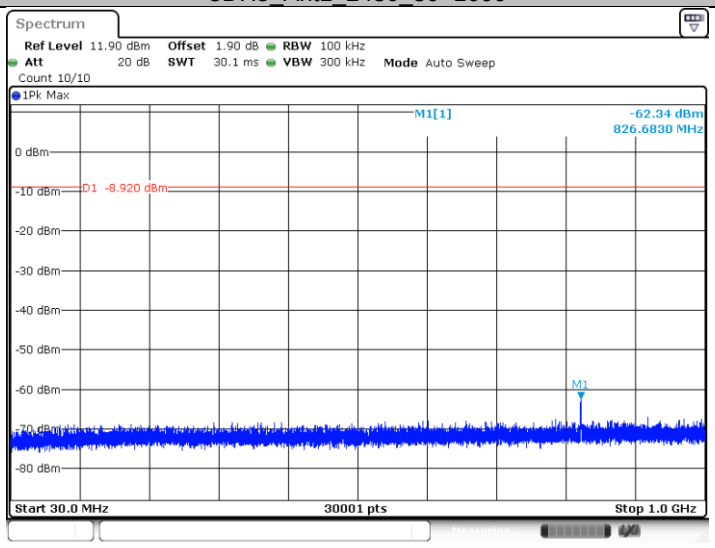
3DH5_Ant1_2402_0~Reference

3DH5_Ant1_2402_30~1000

3DH5_Ant1_2402_1000~26500


3DH5_Ant1_2441_0~Reference

3DH5_Ant1_2441_30~1000

3DH5_Ant1_2441_1000~26500


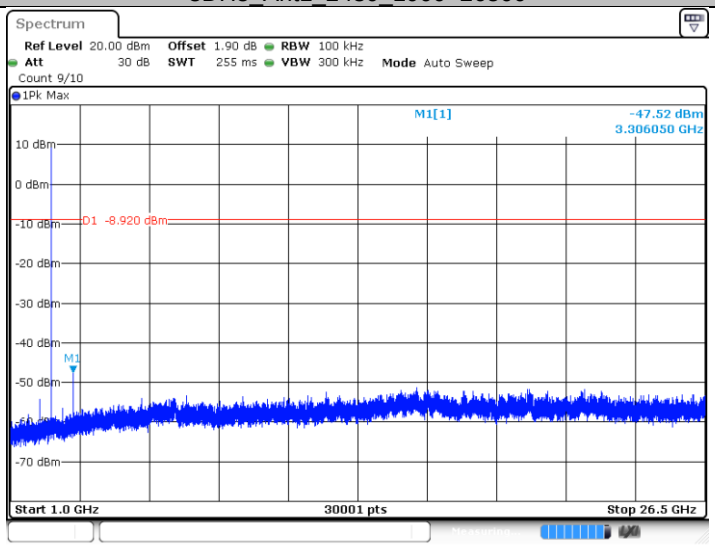
3DH5_Ant1_2480_0~Reference



3DH5_Ant1_2480_30~1000



3DH5_Ant1_2480_1000~26500



9.7 Band edge testing

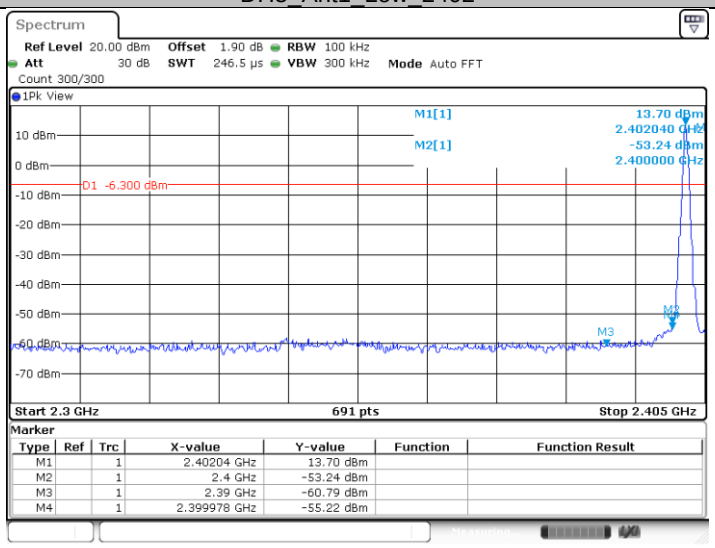
Test Method

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:

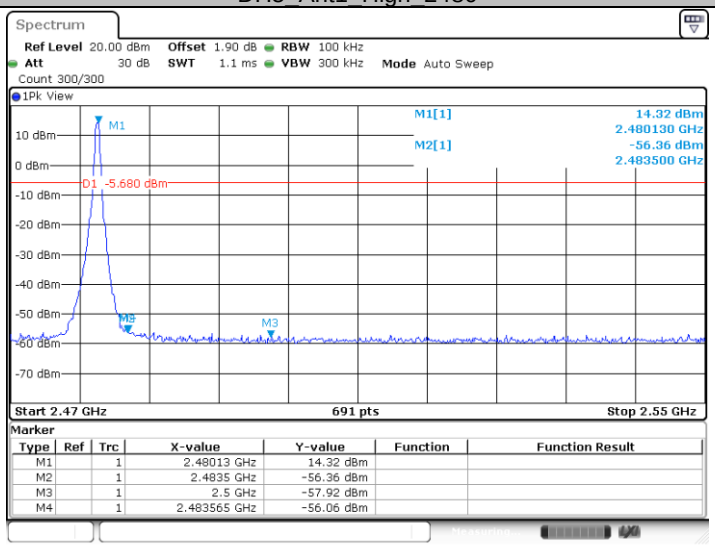
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an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

DH5_Ant1_Low_2402



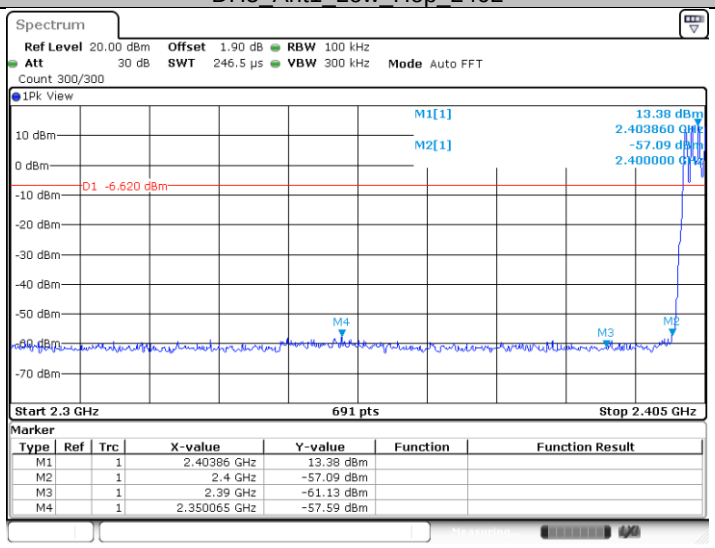
Date: 29.OCT.2021 21:46:17

DH5_Ant1_High_2480



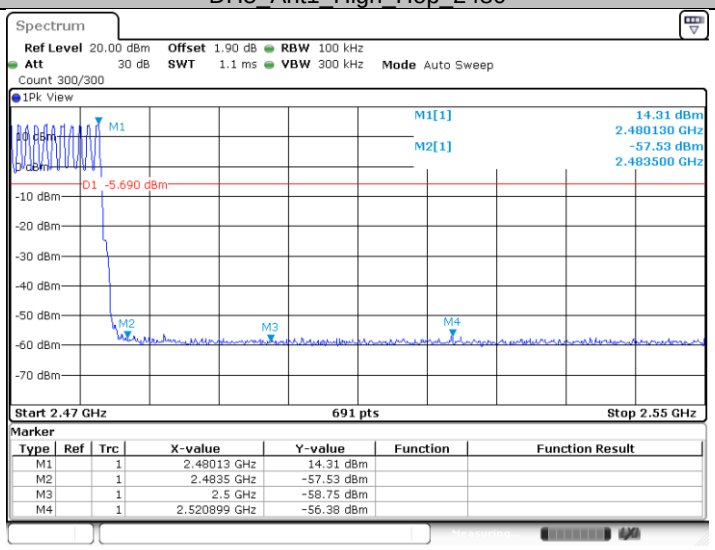
Date: 29.OCT.2021 21:52:04

DH5_Ant1_Low_Hop_2402



Date: 29.OCT.2021 22:04:21

DH5_Ant1_High_Hop_2480

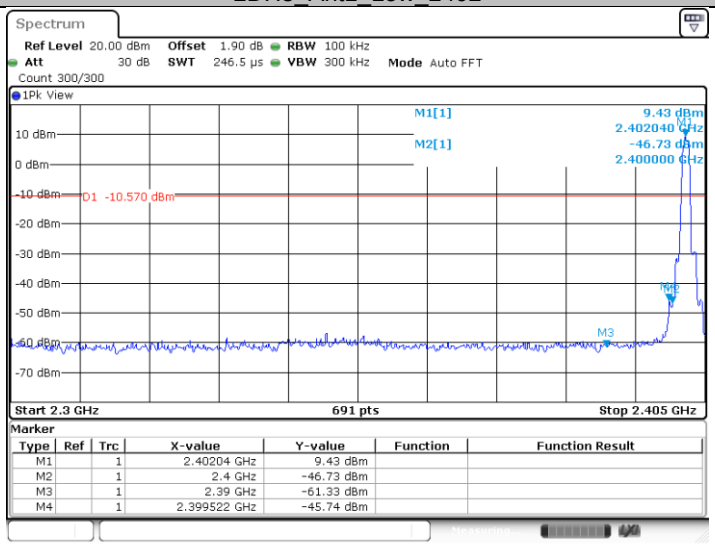


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.48013 GHz	14.31 dBm		
M2		1	2.4835 GHz	-57.53 dBm		
M3		1	2.5 GHz	-58.75 dBm		
M4		1	2.520899 GHz	-56.38 dBm		

Date: 29.OCT.2021 22:08:10

2DH5_Ant1_Low_2402

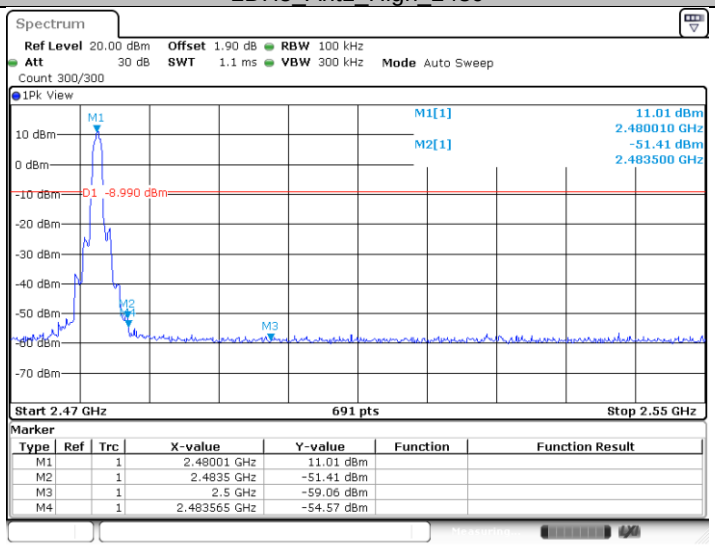


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.40204 GHz	9.43 dBm		
M2		1	2.4 GHz	-46.73 dBm		
M3		1	2.39 GHz	-61.33 dBm		
M4		1	2.399522 GHz	-45.74 dBm		

Date: 29.OCT.2021 21:54:02

2DH5_Ant1_High_2480

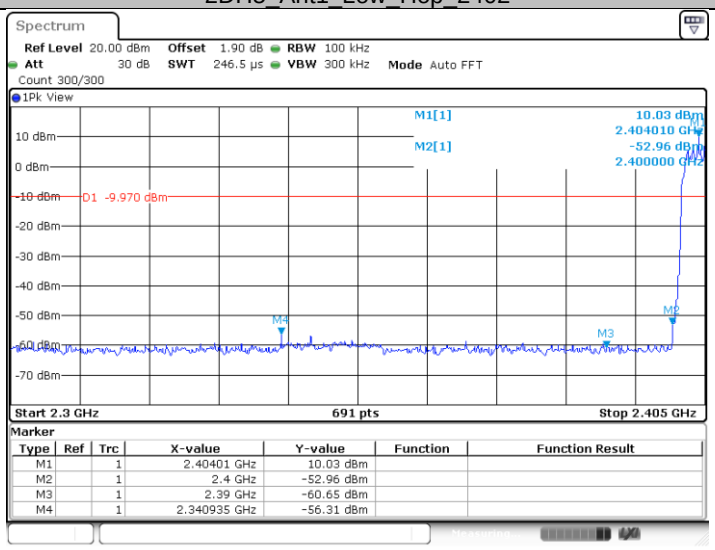


Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.48001 GHz	11.01 dBm		
M2		1	2.4835 GHz	-51.41 dBm		
M3		1	2.5 GHz	-59.06 dBm		
M4		1	2.483565 GHz	-54.57 dBm		

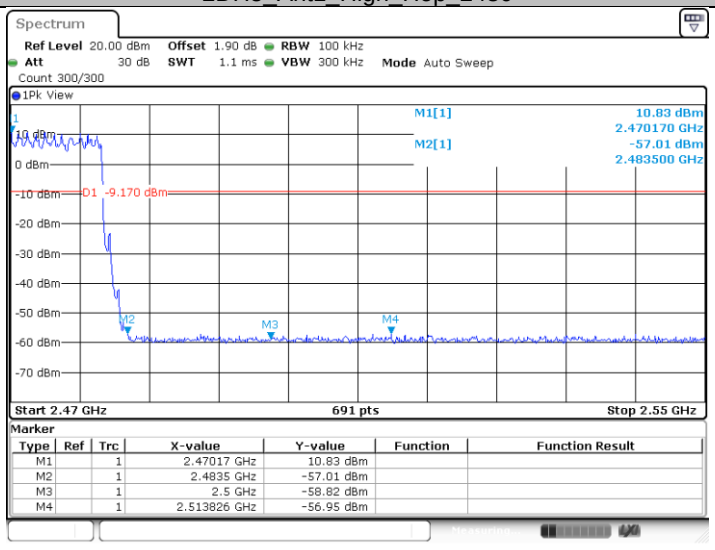
Date: 29.OCT.2021 21:58:12

2DH5_Ant1_Low_Hop_2402



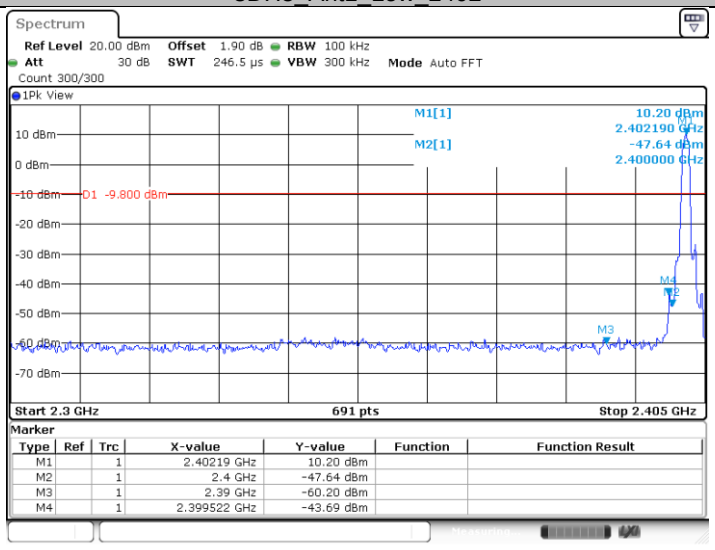
Date: 29.OCT.2021 22:09:12

2DH5_Ant1_High_Hop_2480



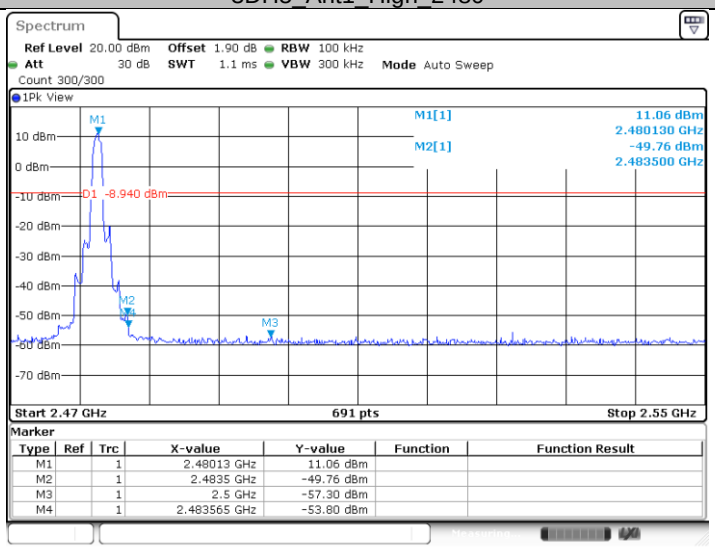
Date: 29.OCT.2021 22:12:13

3DH5_Ant1_Low_2402



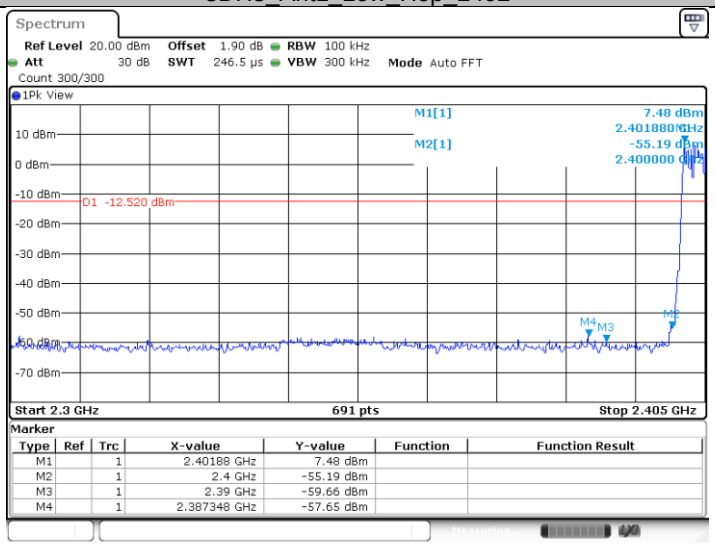
Date: 29.OCT.2021 22:00:34

3DH5_Ant1_High_2480



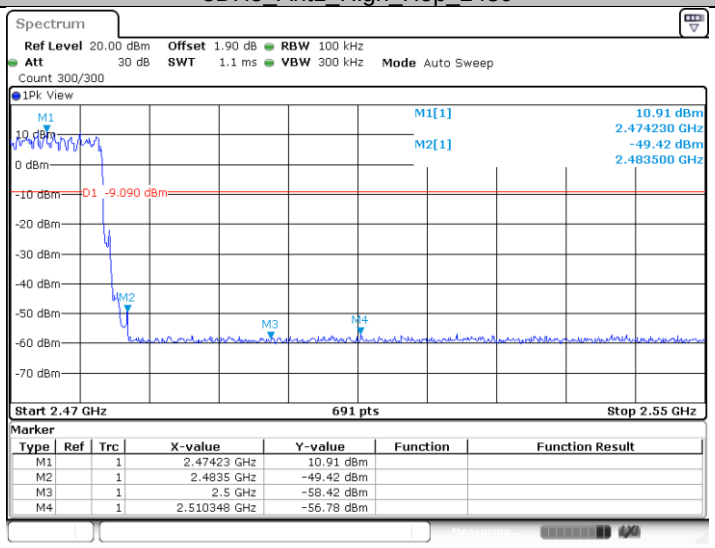
Date: 29.OCT.2021 22:03:26

3DH5_Ant1_Low_Hop_2402



Date: 29.OCT.2021 22:12:47

3DH5_Ant1_High_Hop_2480



Date: 29.OCT.2021 22:14:59

9.8 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.

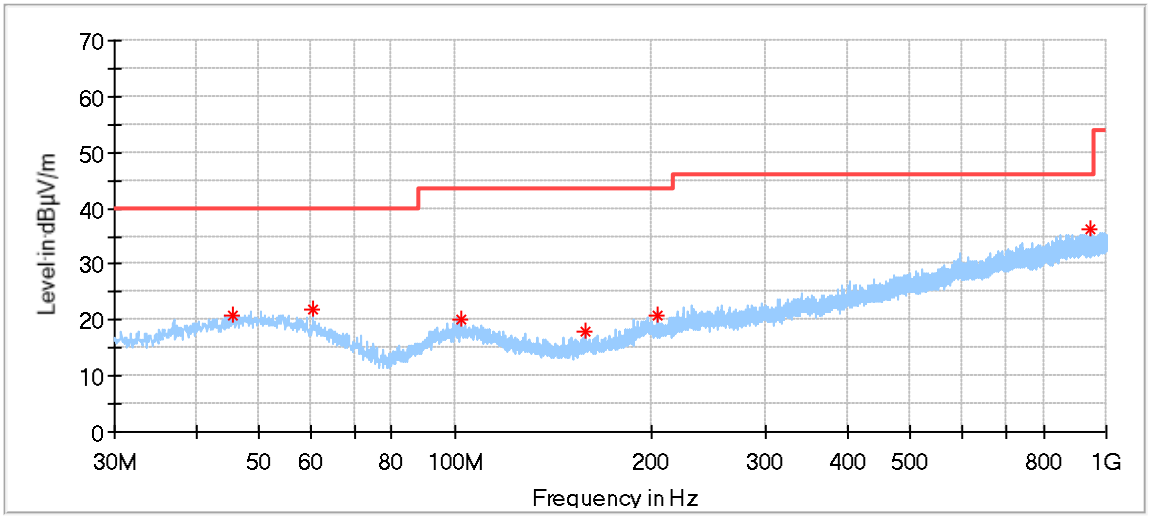
Frequency MHz	Field Strength uV/m	Field Strength dBµV/m	Detector
30-88	100	40	QP
88-216	150	43.5	QP
216-960	200	46	QP
960-1000	500	54	QP
Above 1000	500	54	AV
Above 1000	5000	74	PK

Spurious radiated emissions for transmitter

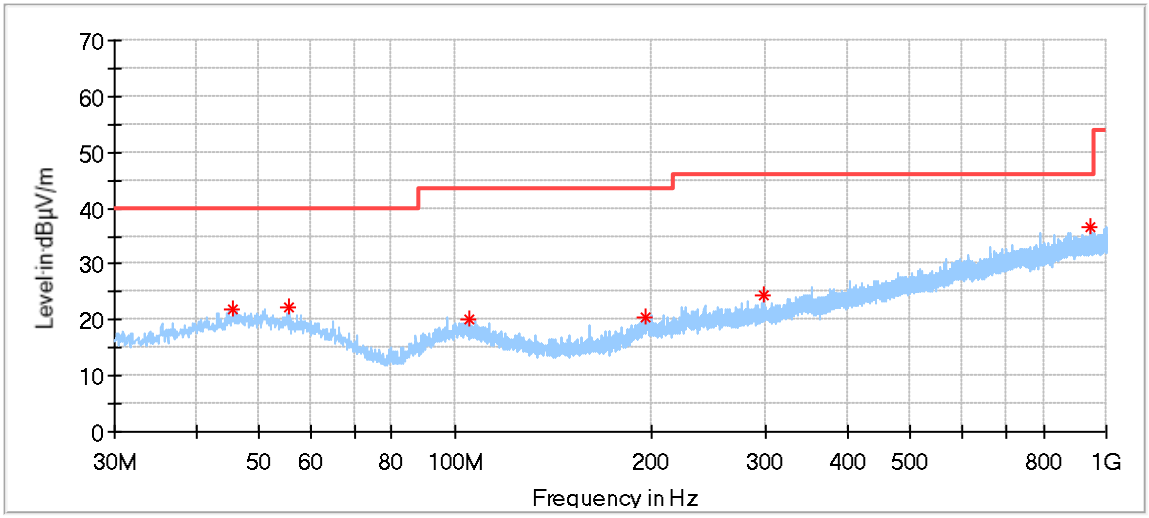
According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.
The only worse case (GFSK mode) test result is listed in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

Transmitting spurious emission test result as below:

Below 1G:

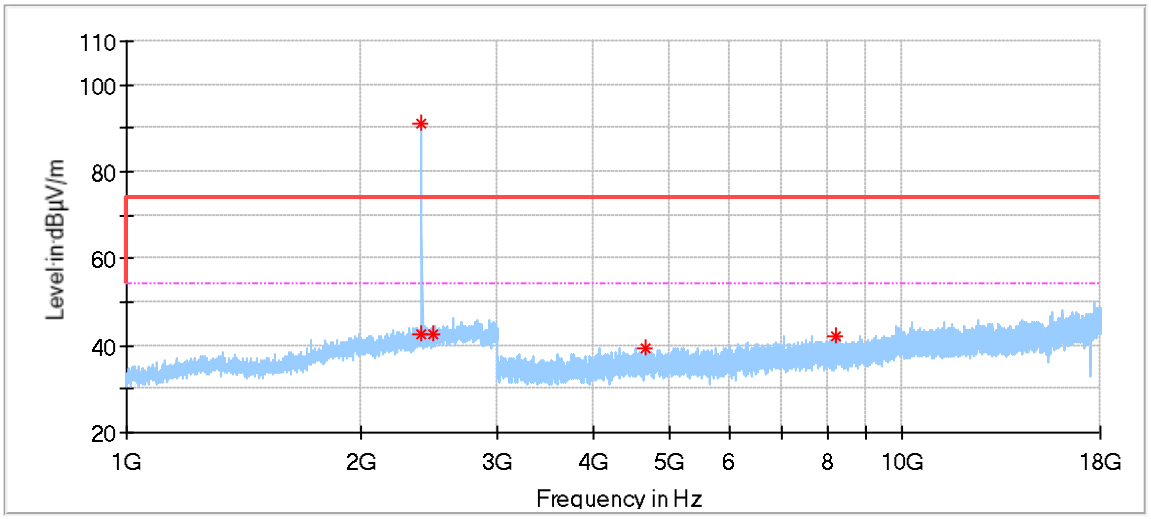


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
45.520000	20.79	40.00	19.21	100.0	H	205.0	20.86
60.501111	21.81	40.00	18.19	100.0	H	194.0	19.40
102.211111	20.20	43.50	23.30	200.0	H	0.0	18.64
158.093889	17.99	43.50	25.51	100.0	H	273.0	15.63
204.653889	20.84	43.50	22.66	100.0	H	11.0	17.92
945.572222	36.36	46.00	9.64	100.0	H	355.0	31.84

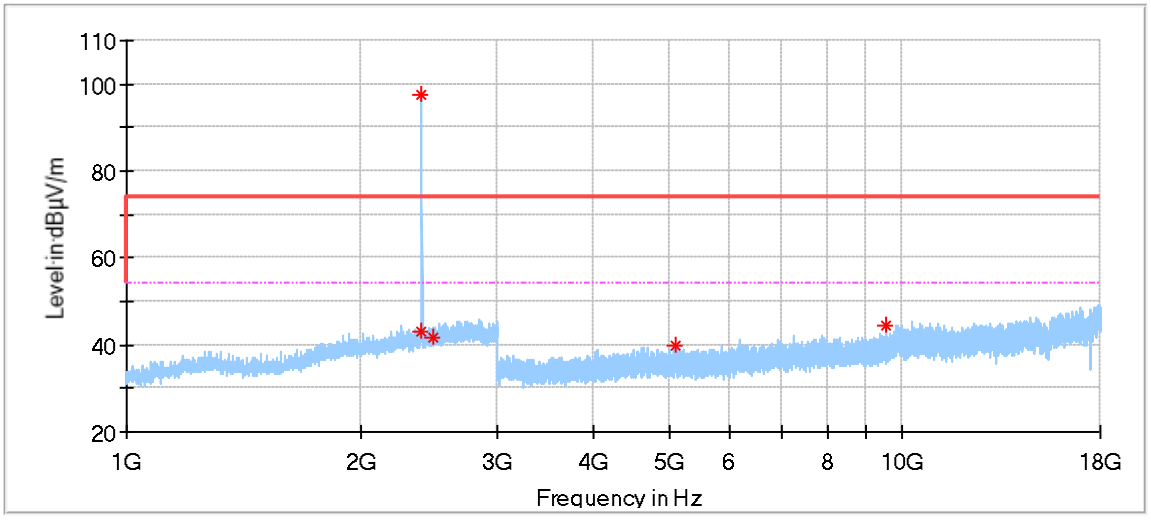


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
45.466111	21.77	40.00	18.23	200.0	V	6.0	20.85
55.705000	22.25	40.00	17.75	100.0	V	330.0	20.32
105.228889	20.20	43.50	23.30	200.0	V	0.0	18.51
196.355000	20.60	43.50	22.90	100.0	V	224.0	18.78
297.558333	24.47	46.00	21.53	100.0	V	40.0	20.75
945.572222	36.76	46.00	9.24	200.0	V	124.0	31.84

Low channel 2402MHz

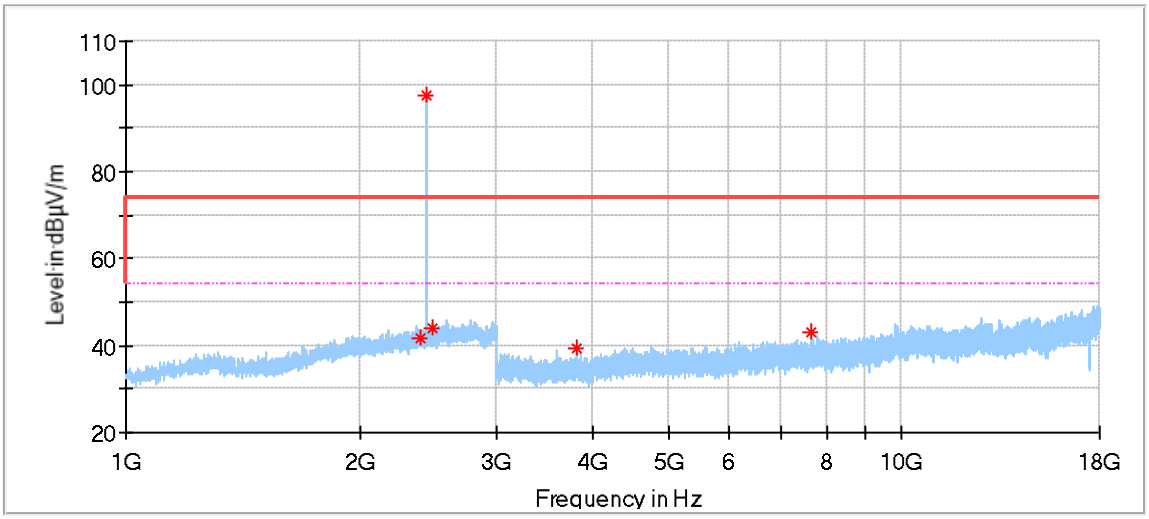


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2390.476191	42.52	74.00	31.48	150.0	H	89.0	-3.12
2402.380952	90.89	74.00	-16.89	150.0	H	83.0	-3.14
2484.285714	42.64	74.00	31.36	150.0	H	248.0	-2.76
4659.000000	39.61	74.00	34.39	150.0	H	352.0	3.24
8226.500000	42.03	74.00	31.97	150.0	H	332.0	8.32

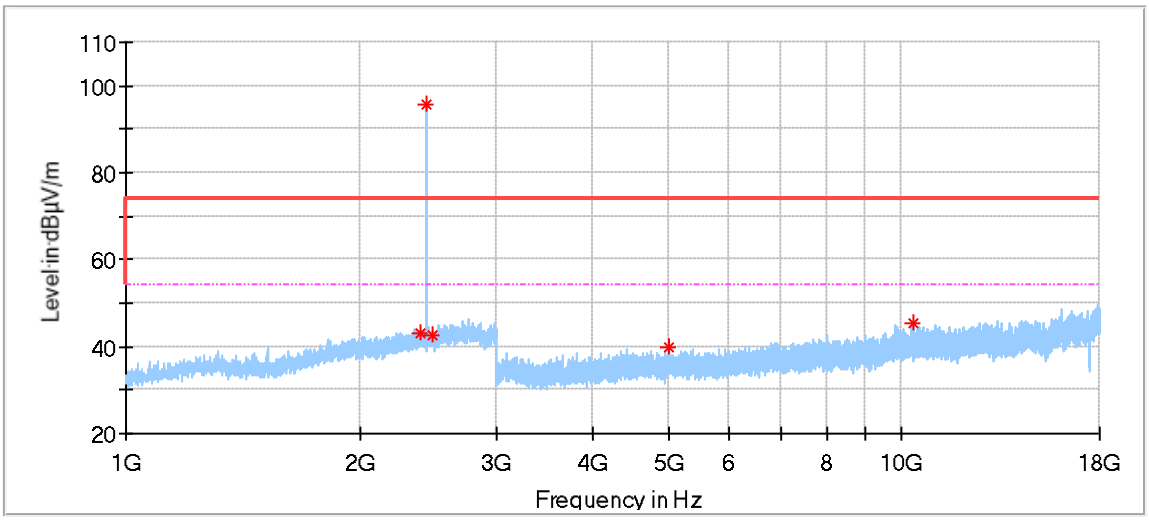


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2390.000000	43.29	74.00	30.71	150.0	V	70.0	-3.12
2402.380952	97.65	74.00	-23.65	150.0	V	232.0	-3.14
2484.761905	41.48	74.00	32.52	150.0	V	31.0	-2.76
5109.000000	39.87	74.00	34.13	150.0	V	355.0	4.07
9501.000000	44.45	74.00	29.55	150.0	V	228.0	10.14

Middle channel 2441MHz

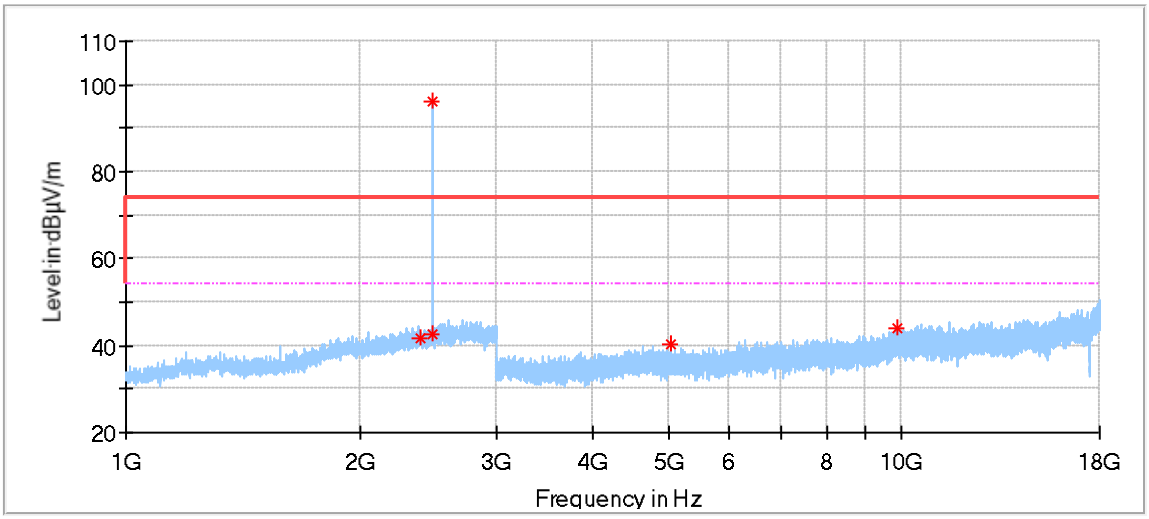


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2392.857143	41.89	74.00	32.11	150.0	H	314.0	-3.12
2441.428571	97.44	74.00	-23.44	150.0	H	226.0	-3.01
2483.333333	43.94	74.00	30.06	150.0	H	221.0	-2.76
3821.000000	39.30	74.00	34.70	150.0	H	119.0	0.53
7653.500000	43.04	74.00	30.96	150.0	H	229.0	8.05

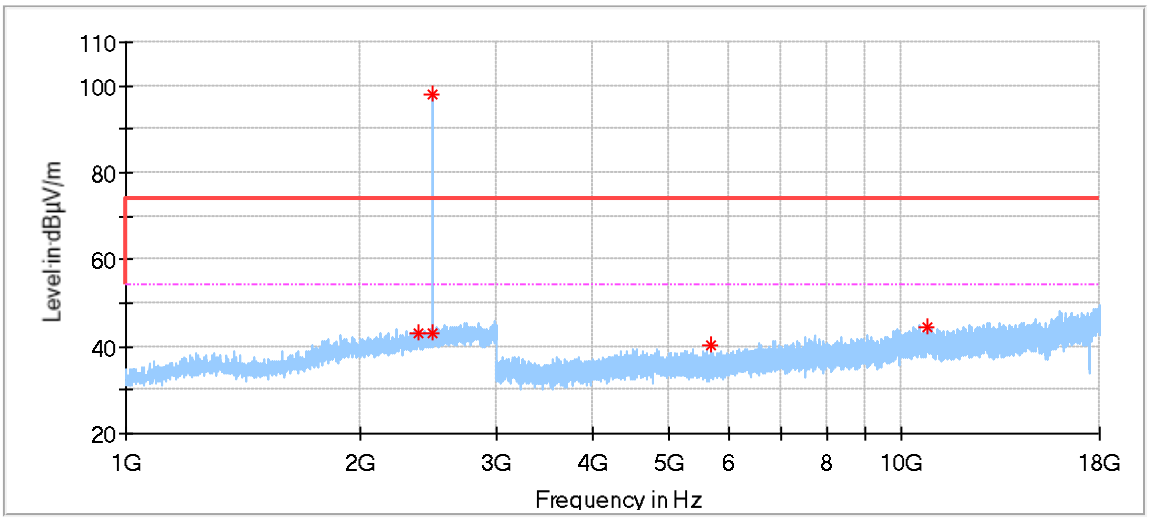


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2390.000000	42.99	74.00	31.01	150.0	V	254.0	-3.12
2441.428571	95.68	74.00	-21.68	150.0	V	171.0	-3.01
2485.238095	42.77	74.00	31.23	150.0	V	37.0	-2.76
5023.000000	39.80	74.00	34.20	150.0	V	315.0	3.85
10371.000000	45.59	74.00	28.41	150.0	V	355.0	10.81

High channel 2480MHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2390.000000	41.75	74.00	32.25	150.0	H	48.0	-3.12
2480.476191	96.21	74.00	-22.21	150.0	H	138.0	-2.76
2483.809524	42.84	74.00	31.16	150.0	H	149.0	-2.76
5035.000000	40.23	74.00	33.77	150.0	H	74.0	3.86
9890.500000	44.13	74.00	29.87	150.0	H	226.0	11.31



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2389.047619	43.09	74.00	30.91	150.0	V	144.0	-3.11
2480.476191	97.92	74.00	-23.92	150.0	V	182.0	-2.76
2483.809524	43.13	74.00	30.87	150.0	V	149.0	-2.76
5683.500000	40.29	74.00	33.71	150.0	V	144.0	5.05
10820.000000	44.54	74.00	29.46	150.0	V	52.0	10.69

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
Radiated Spurious Emission 30MHz-1000MHz	Horizontal: 4.70dB; Vertical: 4.67dB;
Radiated Spurious Emission 1000MHz-18000MHz	Horizontal: 4.65dB; Vertical: 4.63dB;
Conducted RF test with TS 8997	RF Power Conducted: 1.31dB Frequency test involved: 0.6×10^{-7} or 1%

---THE END OF REPORT---

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