FCC - TEST REPORT

Report Number	:	**68.950.23.0846.01**	Date of Issue:	**2023-11-06**
Model	:	**P53300-0111**		
Product Type	:	Persee 2		
Applicant	:	ORBBEC INC.		
Address	:	11-13/F, Union Tower Hi-tech Zone, No.63 Xuefu Rd., Nanshan Dist., Shenzhen, China		
Manufacturer	:	ORBBEC INC.		
Address	:	11-13/F, Union Tower Hi-tech Zone, No.63 Xuefu Rd., Nanshan Dist., Shenzhen, China		
Test Result	:	**n Positive** **o Negative**		
Total pages including Appendices	:	**76**		

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2 Details about the Test Laboratory

Details about the Test Laboratory
Test Site 1

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

3 Description of the Equipment Under Test

Product:	Persee 2
Model no.:	P53300-0111
FCC ID:	2A2CLP53300-0111
Options and accessories:	Adapter Model: TPQ-228F120200xW01 Input: 100-240VAC, 50/60Hz, 0.8A Output: 12V,2A Manufacturer: Shenzhen Tianyin Electronics CO., LTD.
Rating:	12.0VDC, 2.0A (powered by adapter)
RF Transmission Frequency:	2402MHz-2480MHz
No. of Operated Channel:	79
Modulation:	GFSK, π/4-DQPSK, 8DPSK
Antenna Type:	Internal antenna
Antenna Gain:	Gain: 2.8dBi
Description of the EUT:	EUT is a Persee 2 with Bluetooth Low Energy/Bluetooth BDR+EDR, 2.4GHz Wi-Fi and 5GHz Wi-Fi functions
Remark:	This report only for Bluetooth BR+EDR part.

NOTE 1: The above EUT's information is declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

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4 Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C 10-1-2021 Edition	PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02 Measurement Guidance and ANSI C63.10-2020.

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5 Summary of Test Results

Technical Requirements		
FCC Part 15 Subpart C		
Test Condition		Test Result
§15.207	Conducted emission AC power port	Pass
§15.247(b)(1)	Conducted peak output power	Pass
§15.247(e)	Power spectral density	N/A
§15.247(a)(2)	6dB bandwidth and 99% Occupied Bandwidth	N/A
§15.247(a)(1)	20dB bandwidth and 99% Occupied Bandwidth	Pass
§15.247(a)(1)	Min. of Hopping Channel Carrier Frequency Separation	Pass
§15.247(a)(1)(iii)	Min number of hopping frequencies	Pass
§15.247(a)(1)(iii)	Dwell Time - Average Time of Occupancy	Pass
§15.247(d)	Spurious RF conducted emissions	Pass
§15.247(d)	Band edge	Pass
§15.247(d) & §15.209 & §15.205	Spurious radiated emissions for transmitter	Pass
§15.203	Antenna requirement	Pass See note 2

Note 1: N/A=Not Applicable.
Note 2: The EUT uses an internal antenna, which gain is 2.8dBi. In accordance to §15.203, it is considered sufficiently to comply with the provisions of this section.

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6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: 2A2CLP53300-0111, complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules.

SUMMARY:

All tests according to the regulations cited on page 6 were

n - Performed

o - **Not** Performed

The Equipment Under Test

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

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

Sample Received Date:	2023-09-25
Testing Start Date:	2023-09-26
Testing End Date:	2023-10-27

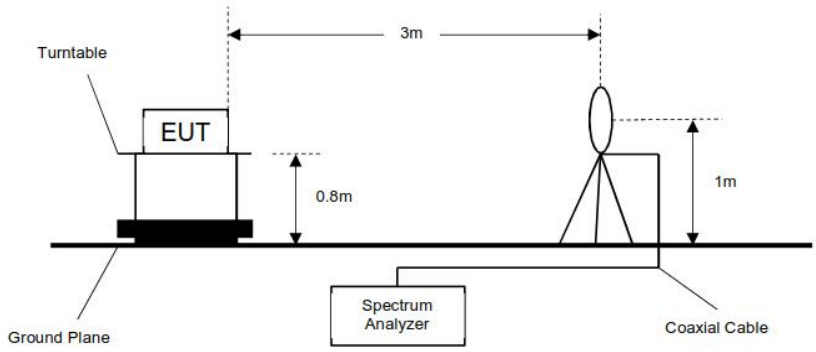
- TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch

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

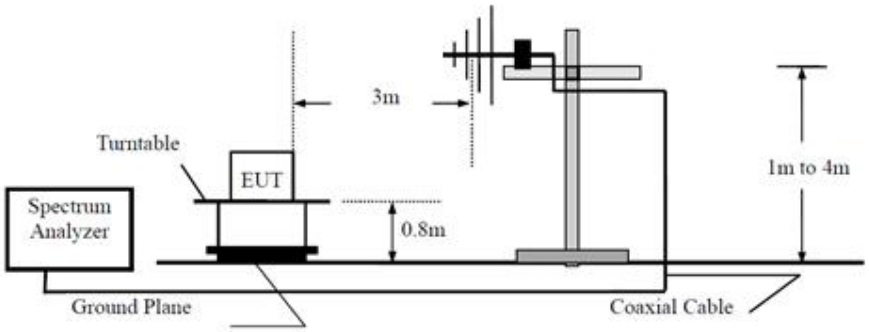
7 Test Setups

7.1 Radiated test setups

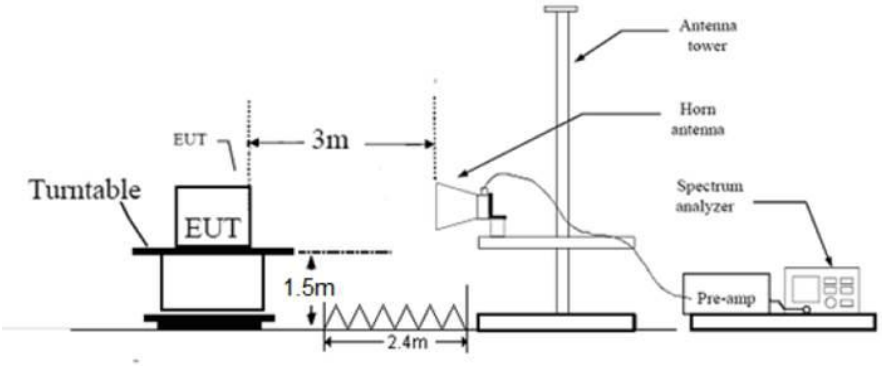
9KHz - 30MHz



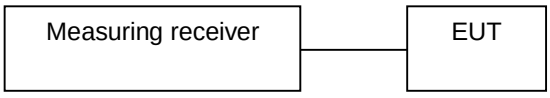
30MHz - 1GHz



Above 1GHz



7.2 Conducted RF test setups



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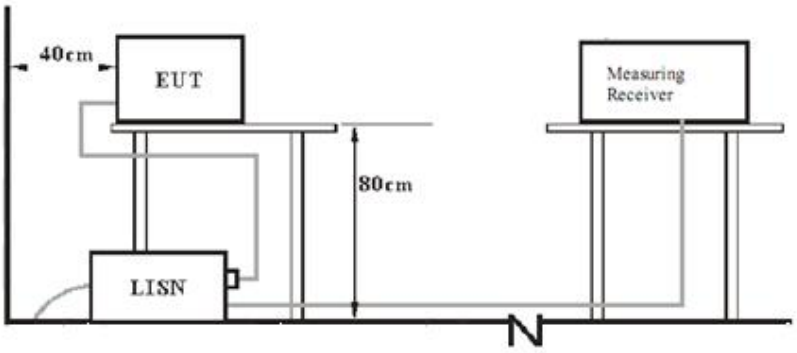
7.3 AC Power Line Conducted Emission test setups



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8 Systems test configuration

Auxiliary Equipment Used during Test:

Description	Manufacturer	Model NO.	S/N
Laptop	LENOVO	X200	--

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.

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9 Technical Requirement

9.1 Conducted Emission

Test Method

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

Limit

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

*Decreases with the logarithm of the frequency.

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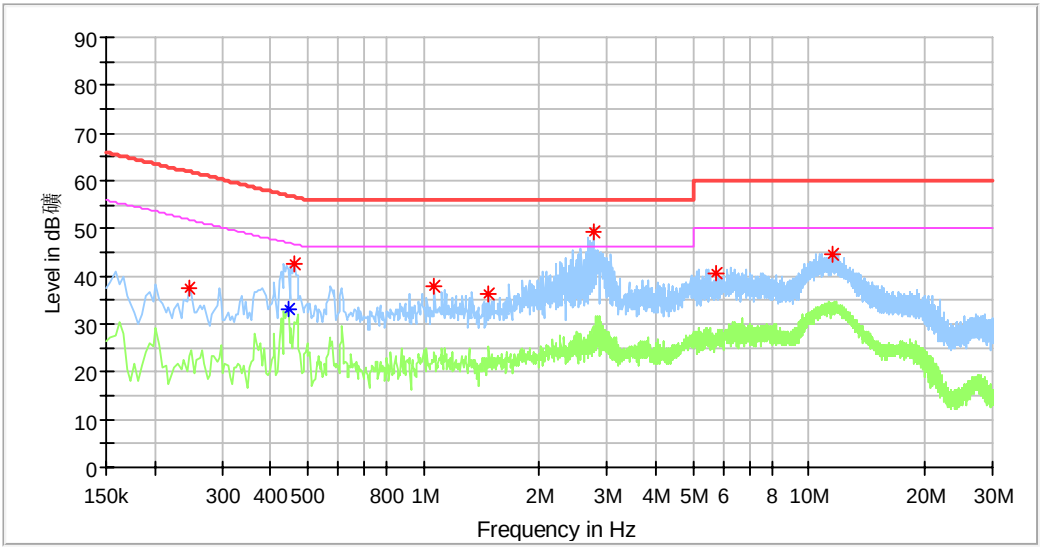
Conducted Emission

Product Type : Persee 2
M/N : P53300-0111
Operating Condition : Transmit
Test Specification : Line
Comment : AC 120V/60Hz (External adapter)



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.246000	37.46	---	61.89	24.43	L1	10.28
0.446000	---	33.25	46.95	13.70	L1	10.29
0.462000	42.76	---	56.66	13.90	L1	10.30
1.066000	37.77	---	56.00	18.23	L1	10.32
1.478000	36.36	---	56.00	19.64	L1	10.34
2.750000	49.46	---	56.00	6.54	L1	10.41
5.742000	40.57	---	60.00	19.43	L1	10.63
11.574000	44.79	---	60.00	15.21	L1	11.16

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
---	---	---	---	---		---

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

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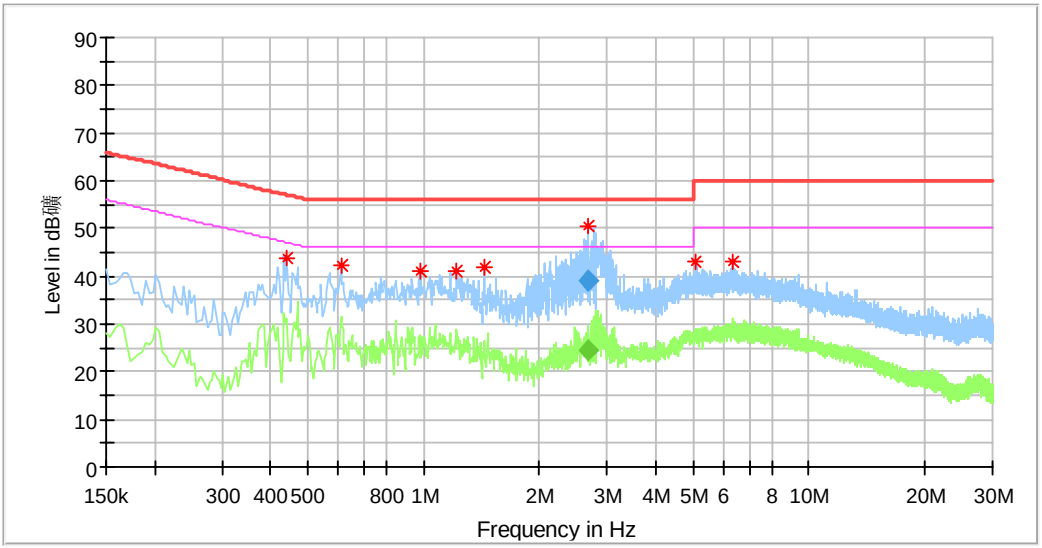
Conducted Emission

Product Type	:	Persee 2
M/N	:	P53300-0111
Operating Condition	:	Transmit
Test Specification	:	Neutral
Comment	:	AC 120V/60Hz (External adapter)



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.442000	43.90	---	57.02	13.12	N	10.20
0.610000	42.10	---	56.00	13.90	N	10.19
0.978000	41.06	---	56.00	14.94	N	10.20
1.222000	41.19	---	56.00	14.81	N	10.22
1.438000	41.65	---	56.00	14.35	N	10.23
2.685500	50.47	---	56.00	5.53	N	10.32
5.074000	42.91	---	60.00	17.09	N	10.53
6.382000	42.96	---	60.00	17.04	N	10.67

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
2.685500	---	24.50	46.00	21.50	N	10.32
2.685500	39.15	---	56.00	16.85	N	10.32

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

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9.2 Conducted peak output power

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 continuously
3. Use the following test receiver 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
4. 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 and record the results in the test report.
5. Repeat above procedures until all frequencies measured were complete.

Limits

According to §15.247 (b) (1), conducted peak output power limit as below:

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

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Conducted peak output power

Bluetooth Mode GFSK modulation Test Result

Frequency	Conducted Peak Output Power	Result
MHz	dBm	
Low channel 2402MHz	3.02	Pass
Middle channel 2441MHz	4.35	Pass
High channel 2480MHz	3.77	Pass

Bluetooth Mode π/4-DQPSK modulation Test Result

Frequency	Conducted Peak Output Power	Result
MHz	dBm	
Low channel 2402MHz	3.23	Pass
Middle channel 2441MHz	4.58	Pass
High channel 2480MHz	4	Pass

Bluetooth Mode 8DPSK modulation Test Result

Frequency	Conducted Peak Output Power	Result
MHz	dBm	
Low channel 2402MHz	3.34	Pass
Middle channel 2441MHz	4.77	Pass
High channel 2480MHz	4.16	Pass

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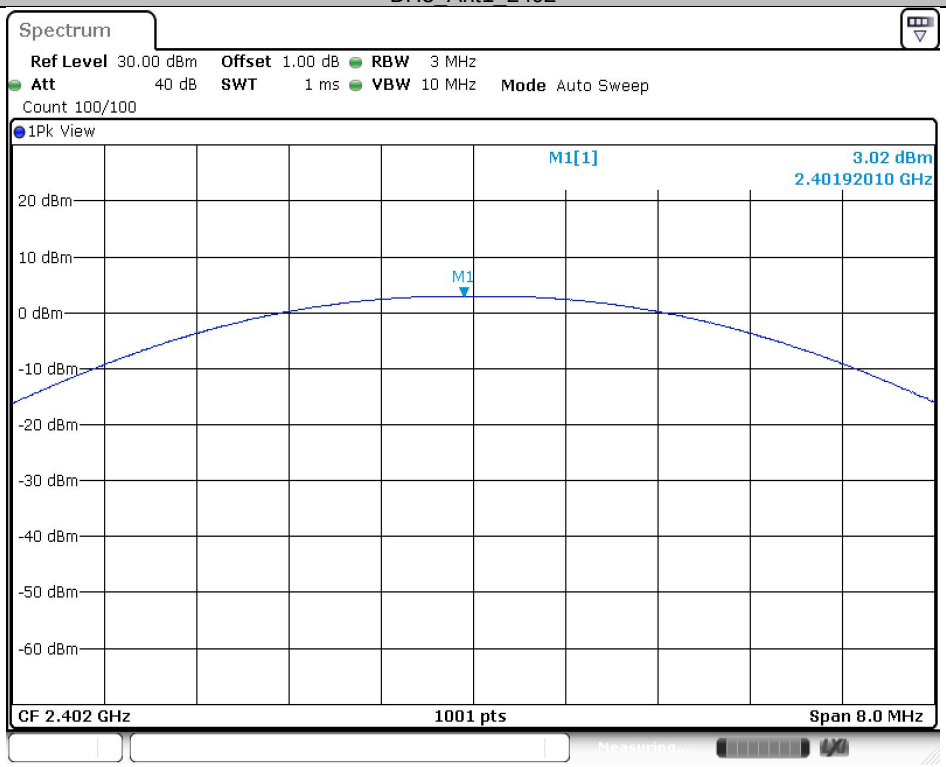

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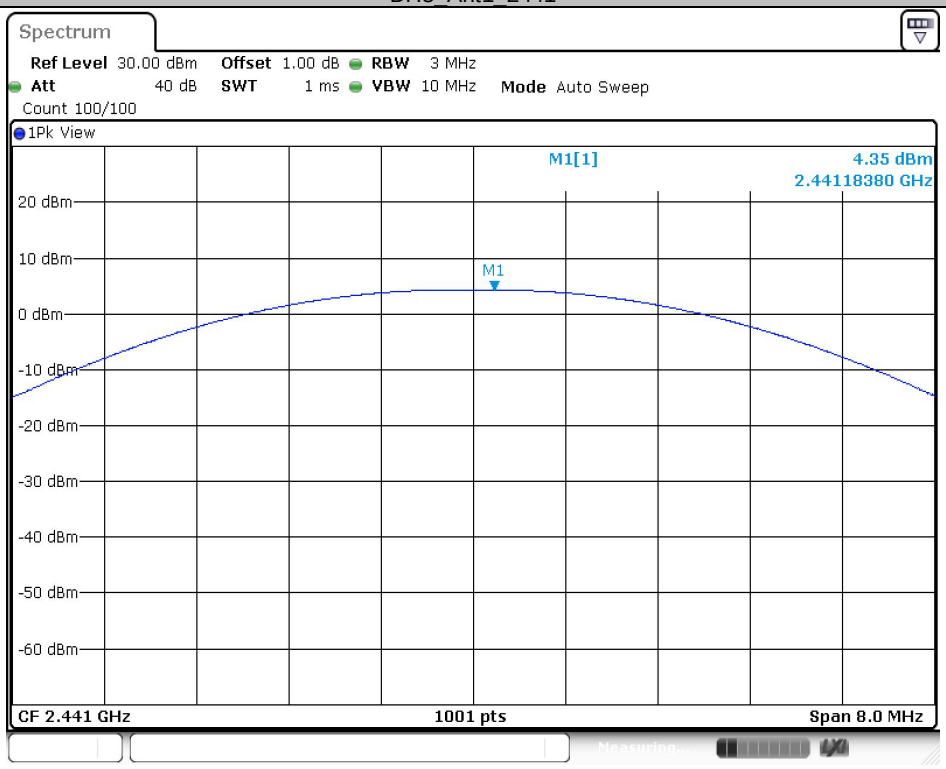

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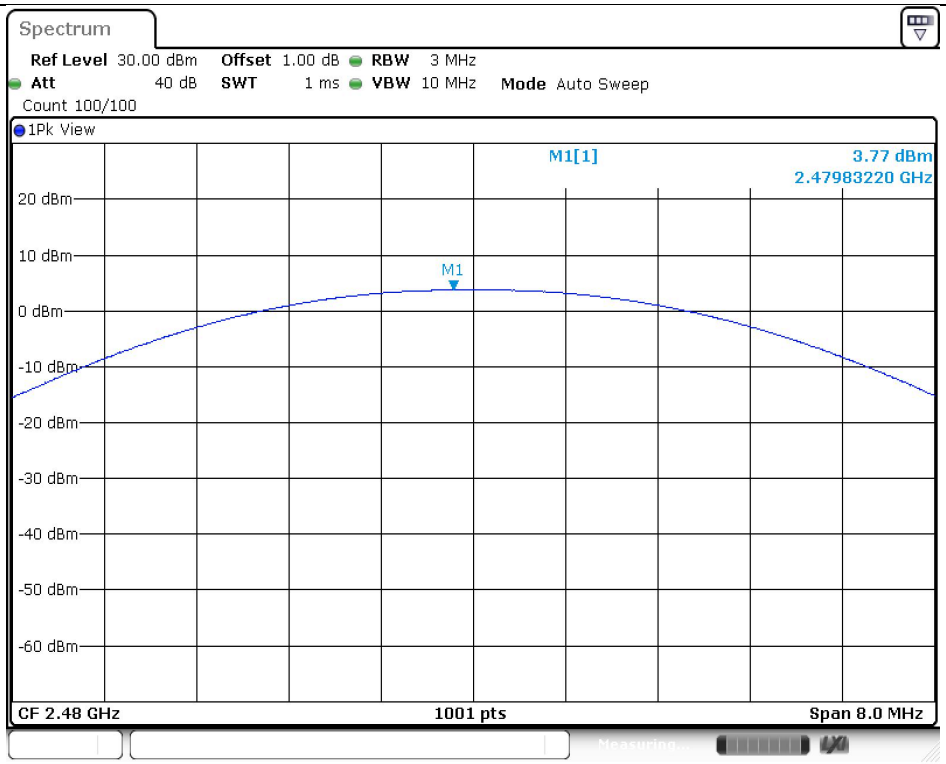

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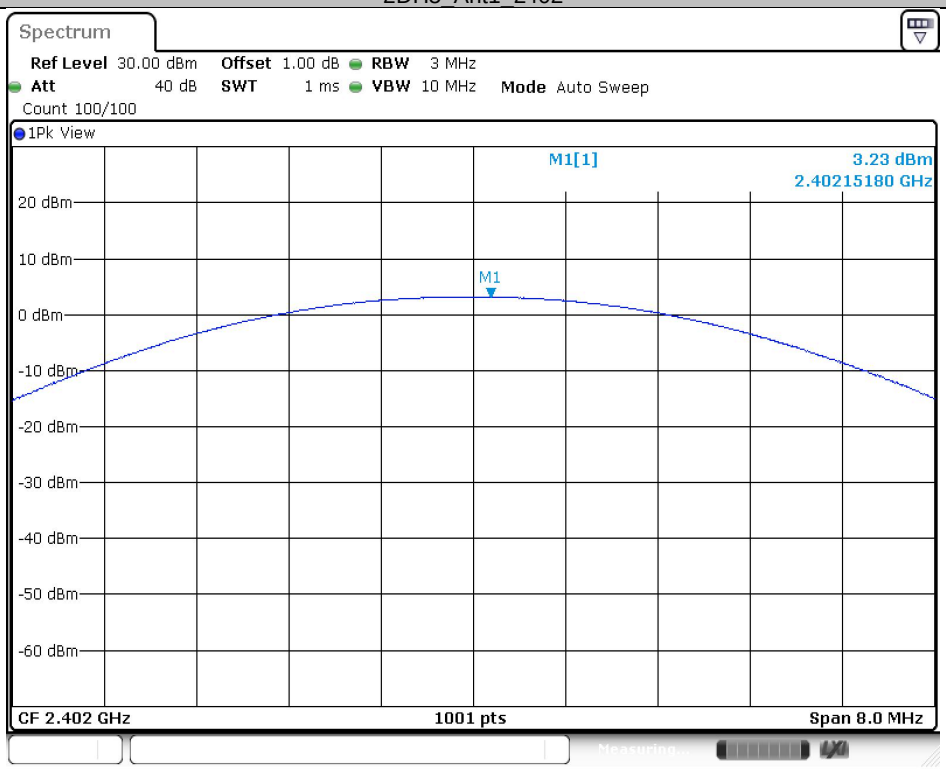

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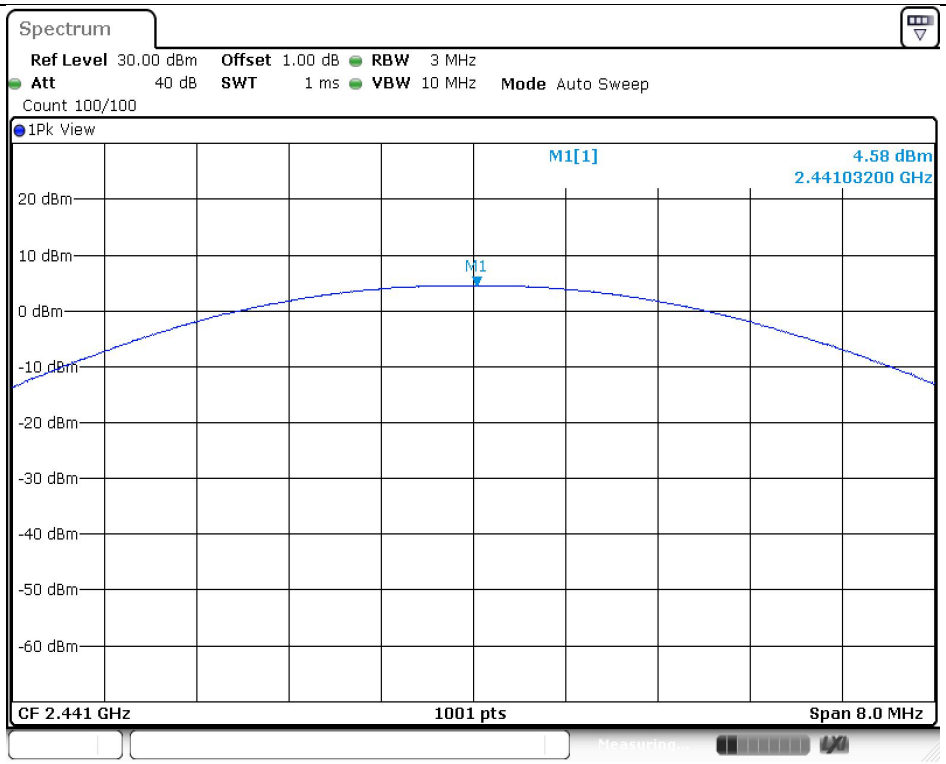

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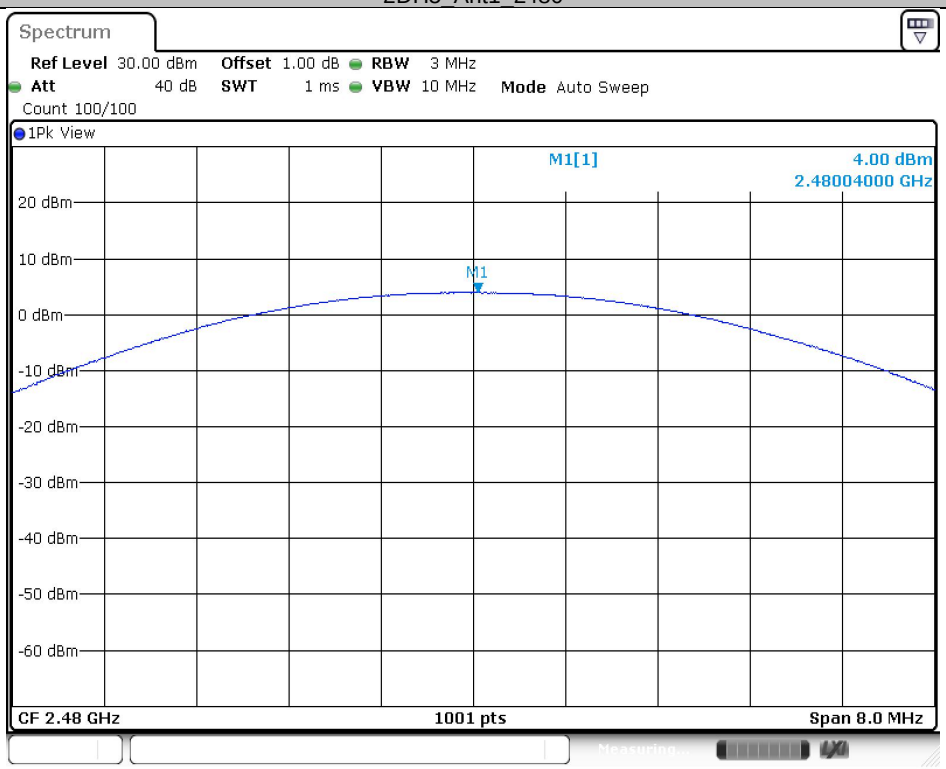

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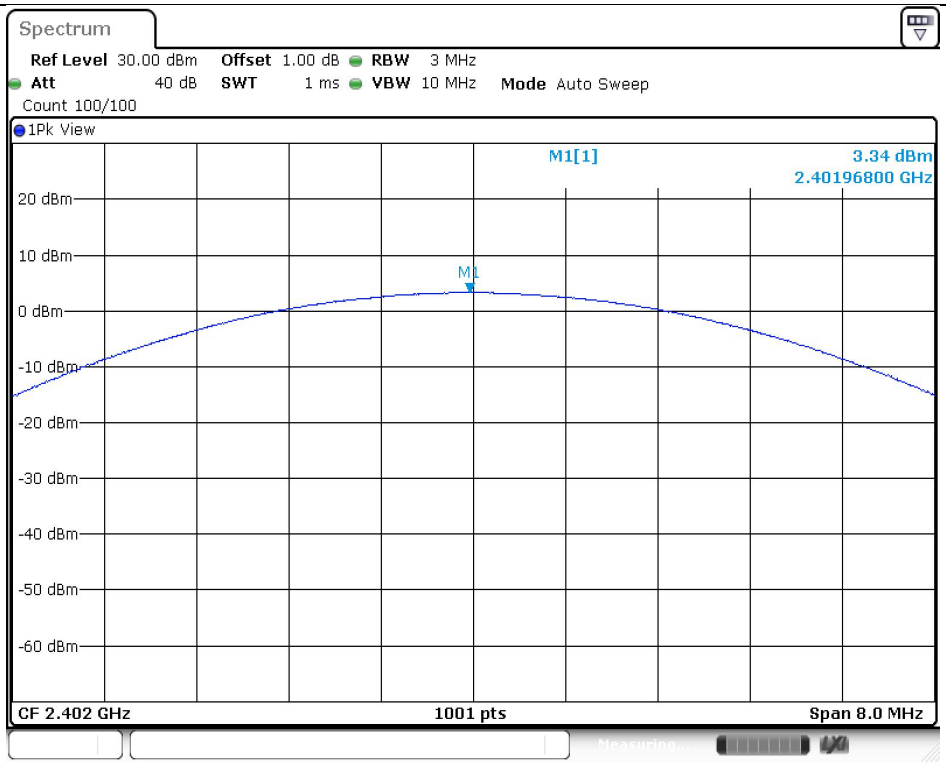

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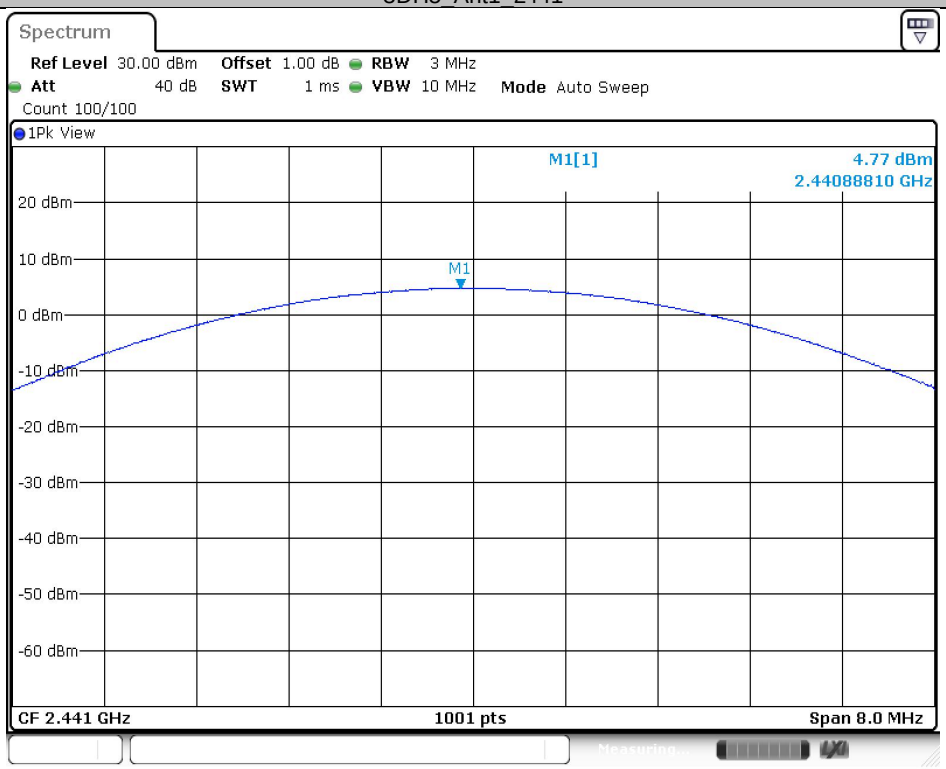

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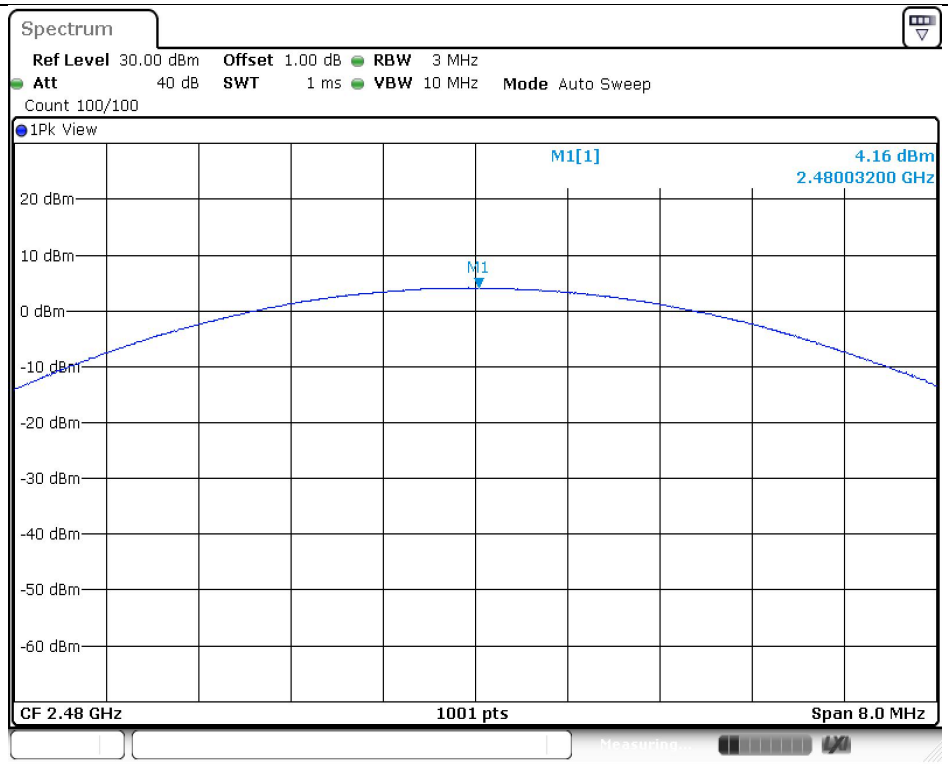

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9.3 20 dB bandwidth and 99% Occupied Bandwidth

Test Method

1. The RF output of EUT was connected to the spectrum analyzer 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 continuously.
3. Use the following test receiver settings:
   Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
   RBW ≥ 1% to 5% of the 20 dB bandwidth/99% OBW, VBW≥3RBW,
   Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Measure the frequency difference of two frequencies that were attenuated 20 dB/99% OBW from the reference level. Record the frequency difference as the emission bandwidth. Record the results.
5. Repeat above procedures until all frequencies measured were complete.

Limit

Limit [kHz]
N/A

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20 dB bandwidth and 99% Occupied Bandwidth

Bluetooth Mode GFSK Modulation test result

Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result
MHz	kHz	kHz	kHz	
2402	1149	908	--	Pass
2441	1149	908	--	Pass
2480	1152	911	--	Pass

Bluetooth Mode π/4-DQPSK Modulation test result

Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result
MHz	kHz	kHz	kHz	
2402	1440	1229	--	Pass
2441	1449	1247	--	Pass
2480	1452	1259	--	Pass

Bluetooth Mode 8DPSK Modulation test result

Frequency	20 dB Bandwidth	99% Bandwidth	Limit	Result
MHz	kHz	kHz	kHz	
2402	1428	1223	--	Pass
2441	1431	1238	--	Pass
2480	1440	1247	--	Pass

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20 dB Bandwidth

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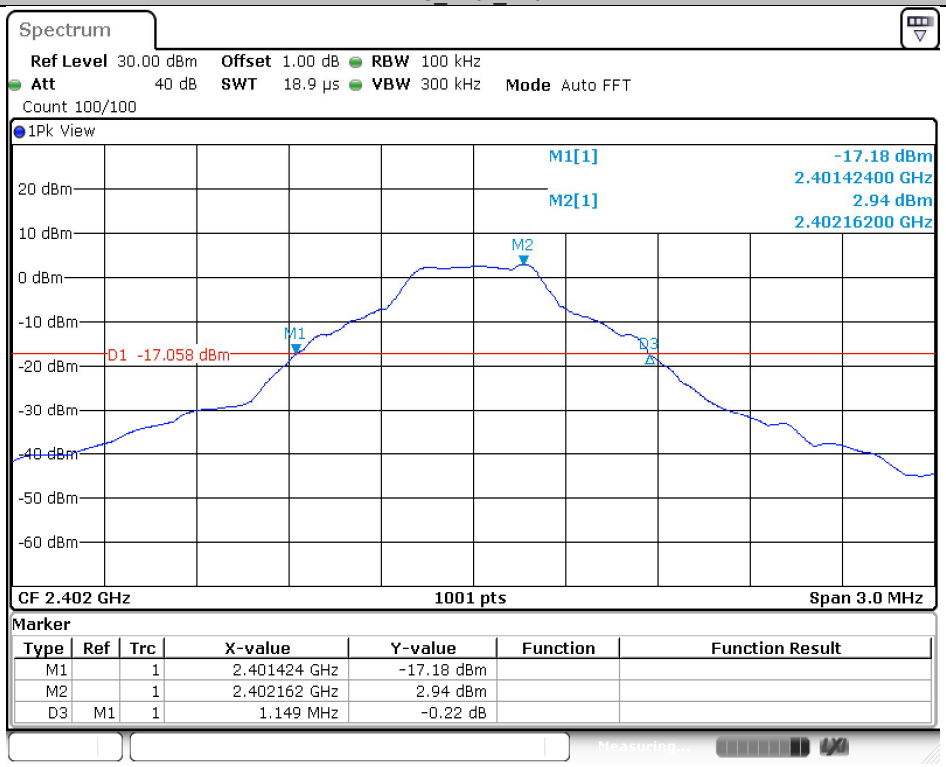

DH5_Ant1_2441

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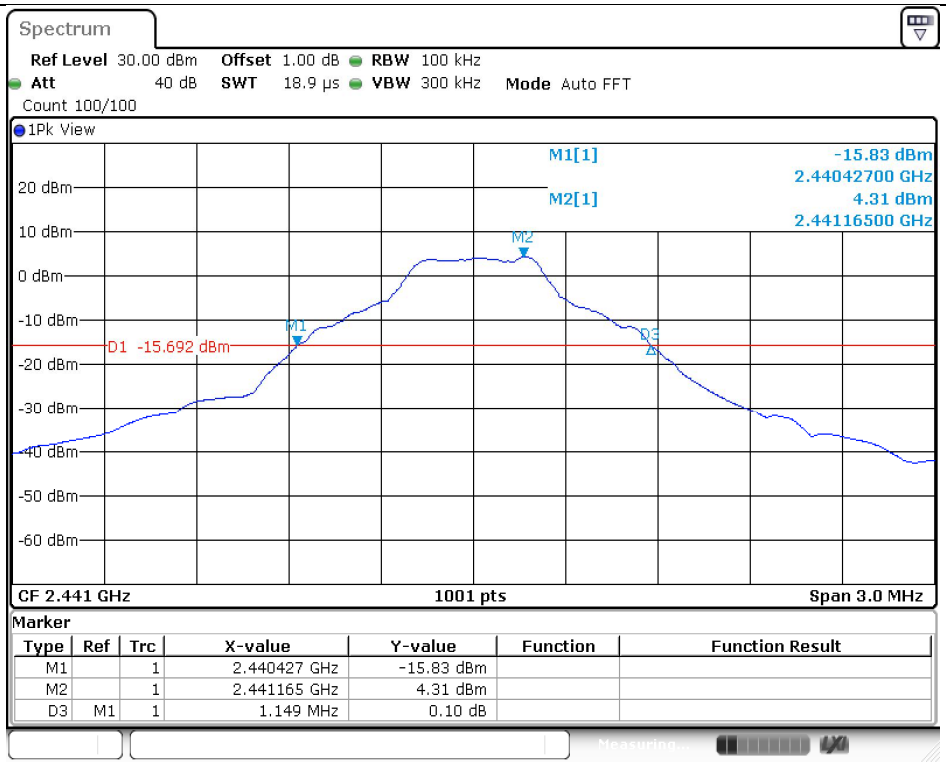

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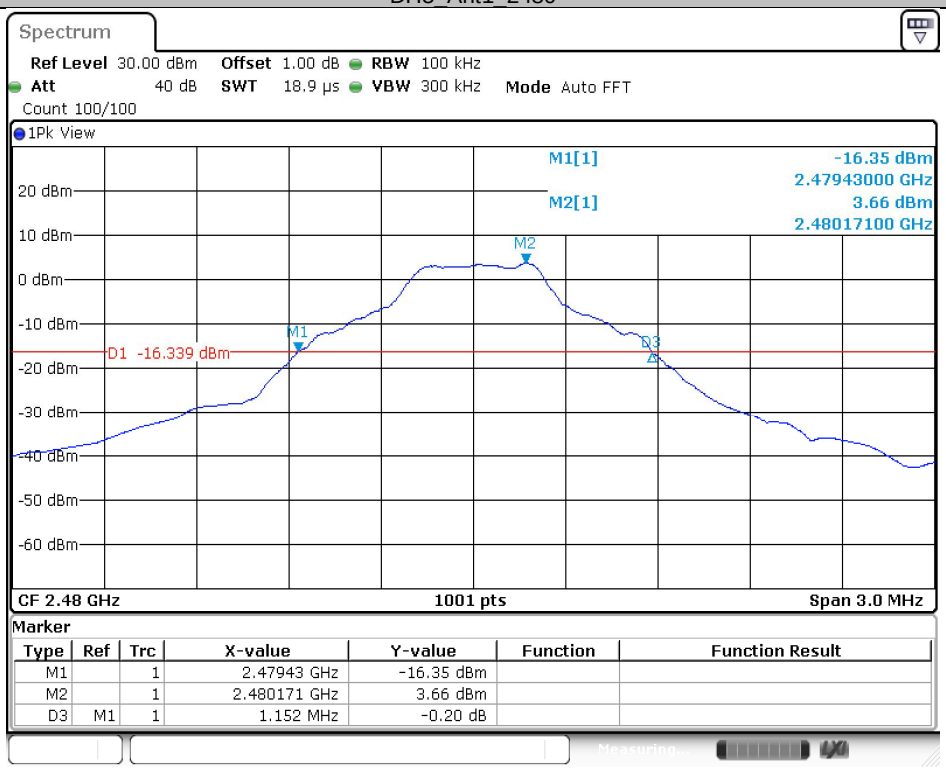

Date: 18.OCT.2023 12:23:23

2DH5_Ant1_2402

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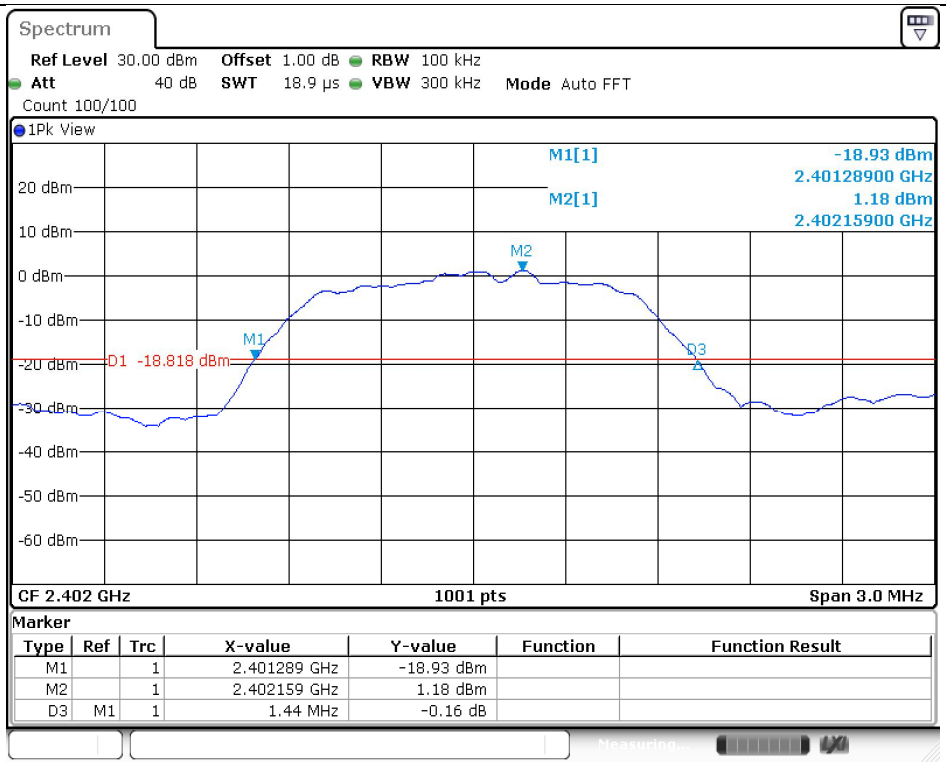

Date: 18.OCT.2023 12:25:46

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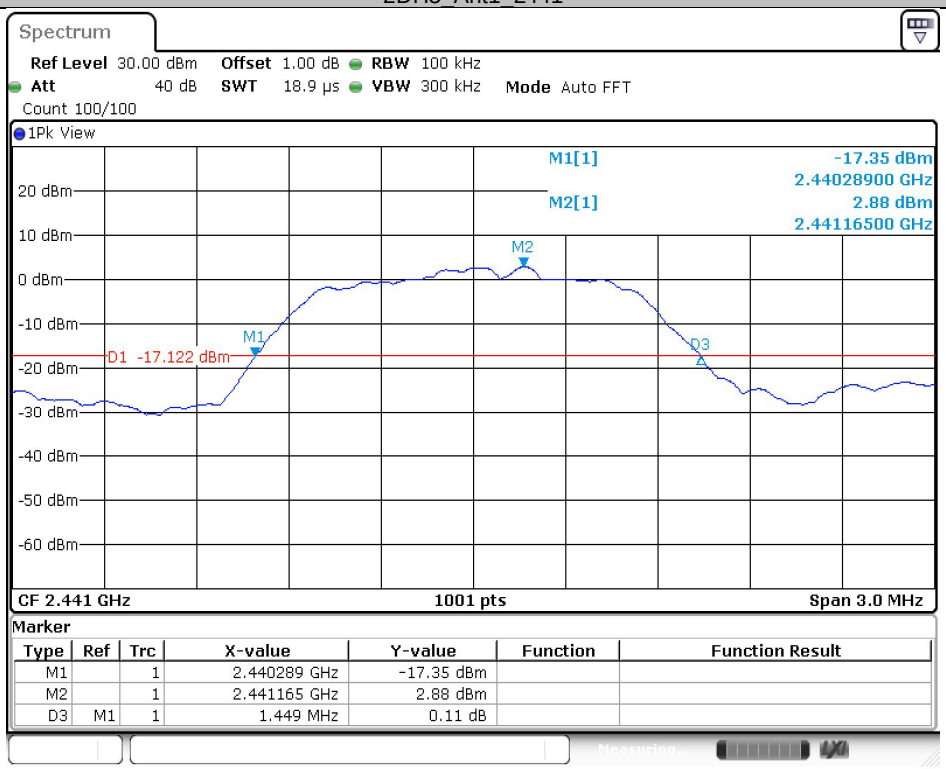

Date: 18.OCT.2023 12:27:02

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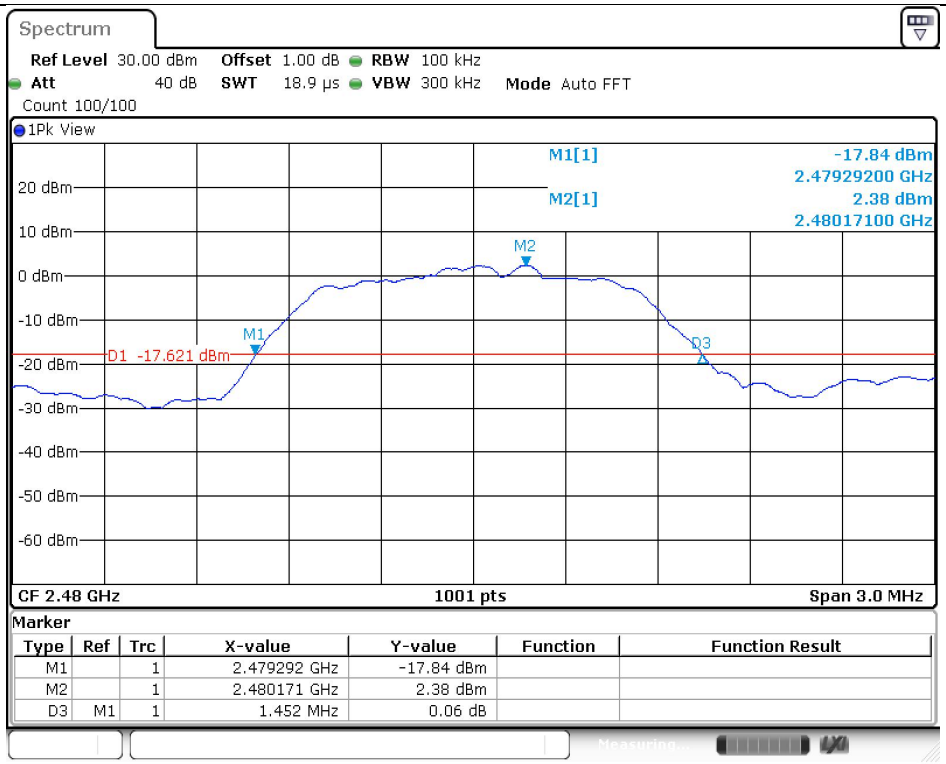
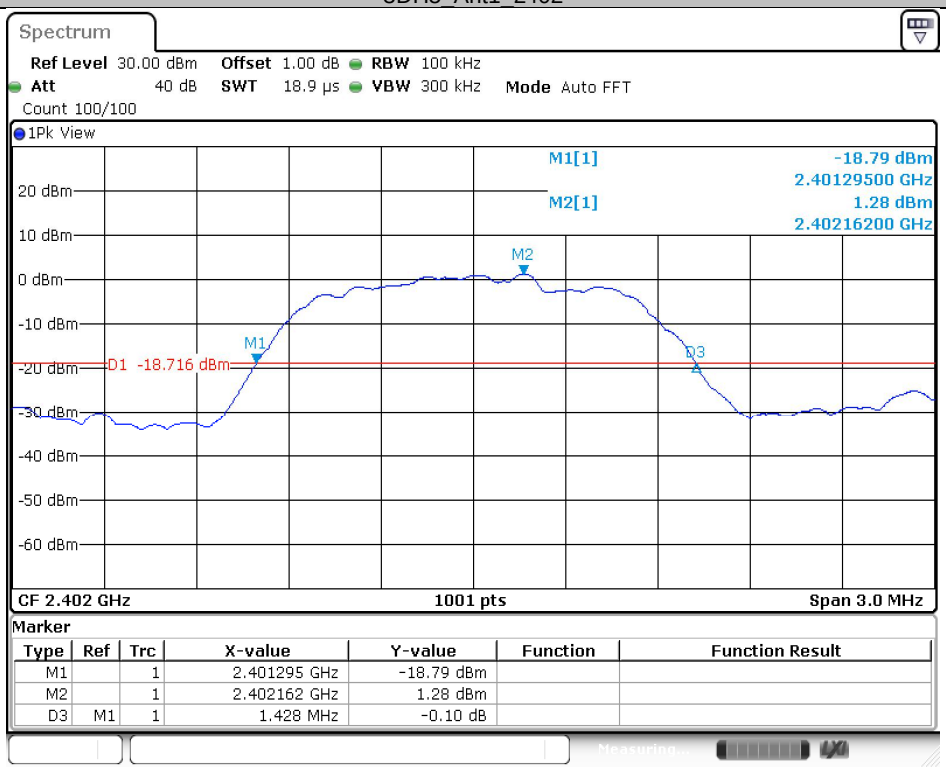


Date: 18.OCT.2023 12:28:08

3DH5_Ant1_2402



Date: 18.OCT.2023 12:32:11

3DH5_Ant1_2441

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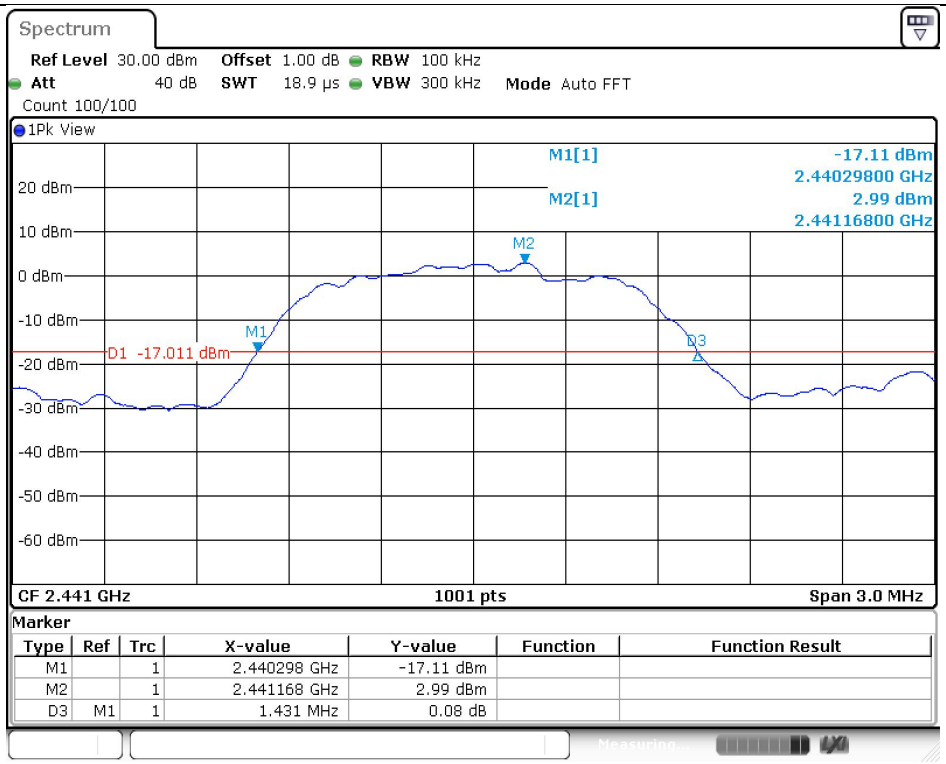

Date: 18.OCT.2023 12:35:04

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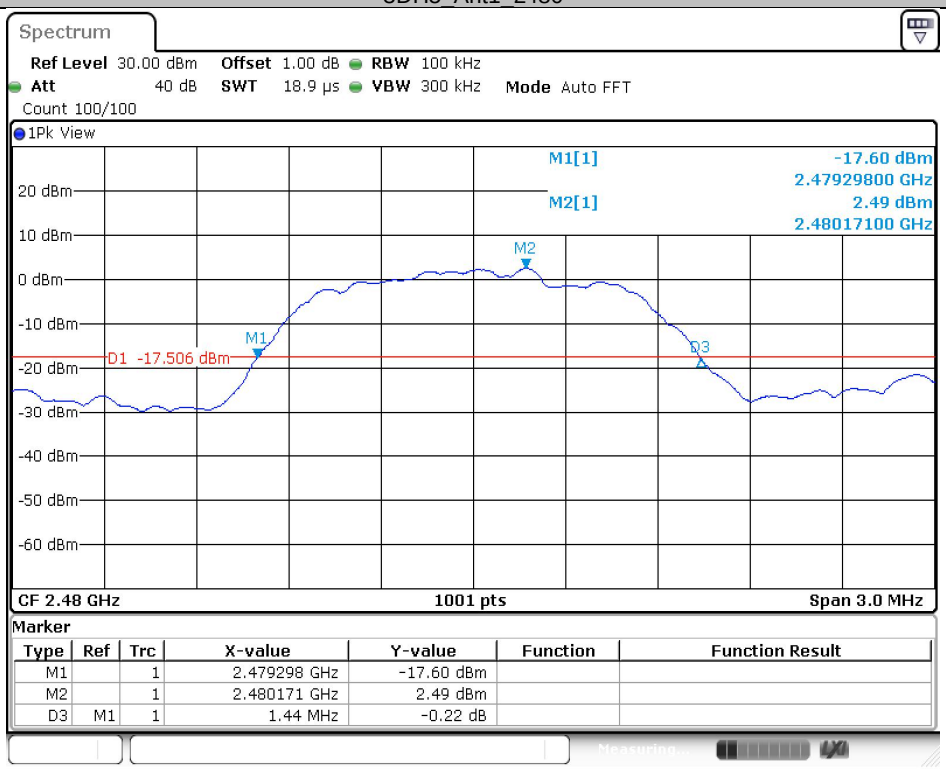

Date: 18.OCT.2023 12:39:44

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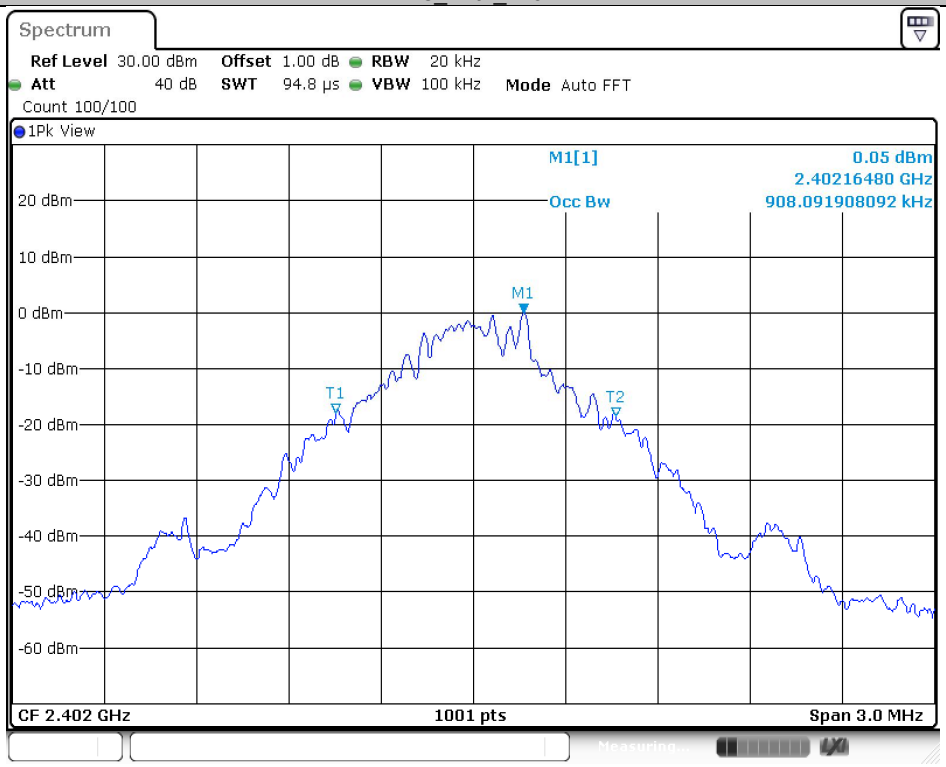
99% Occupied Bandwidth

DH5_Ant1_2402



DH5_Ant1_2441

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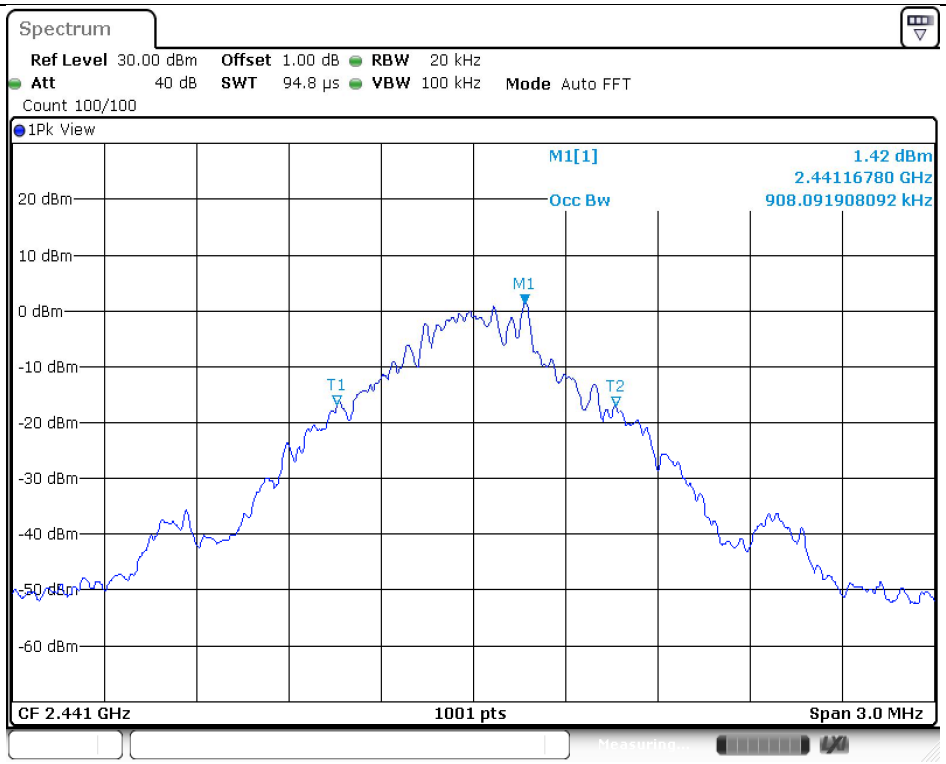
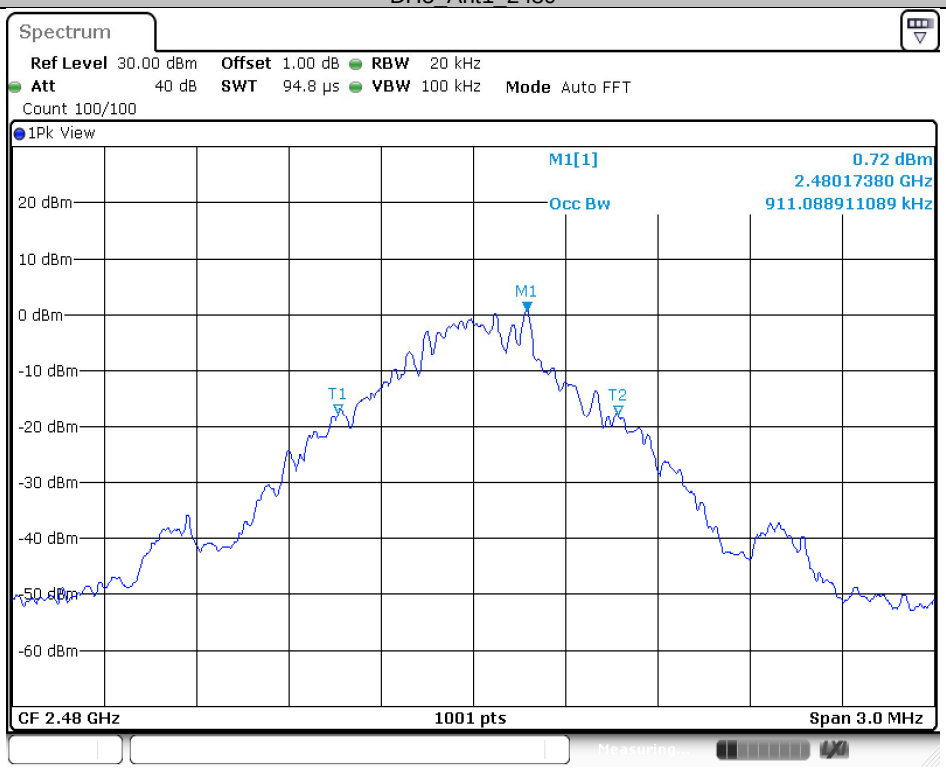


DH5_Ant1_2480



2DH5_Ant1_2402

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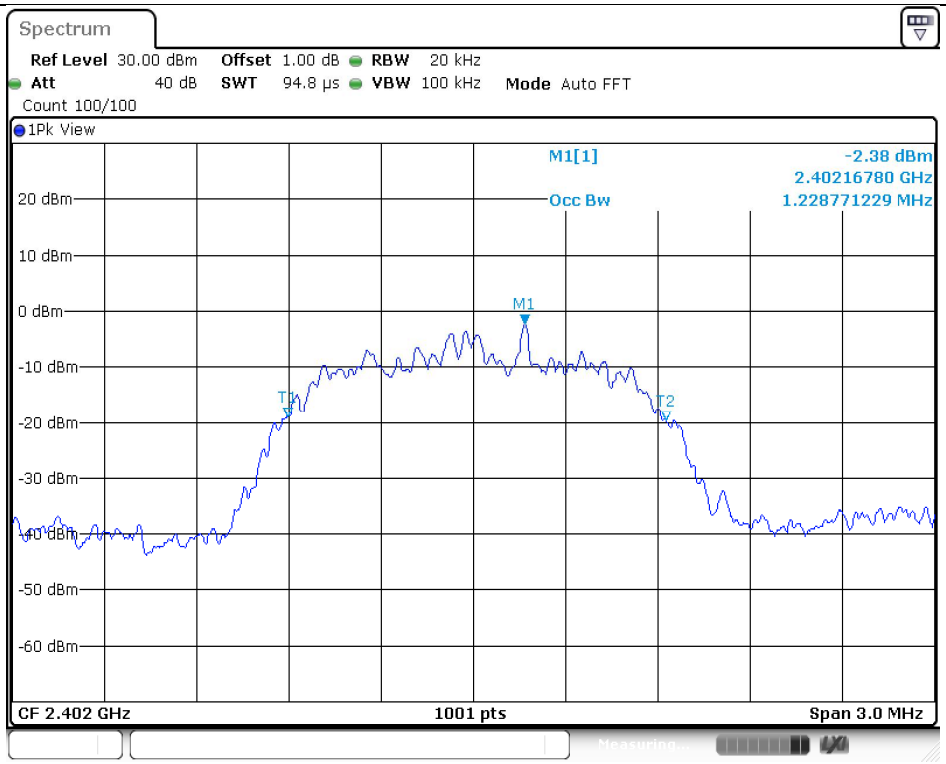

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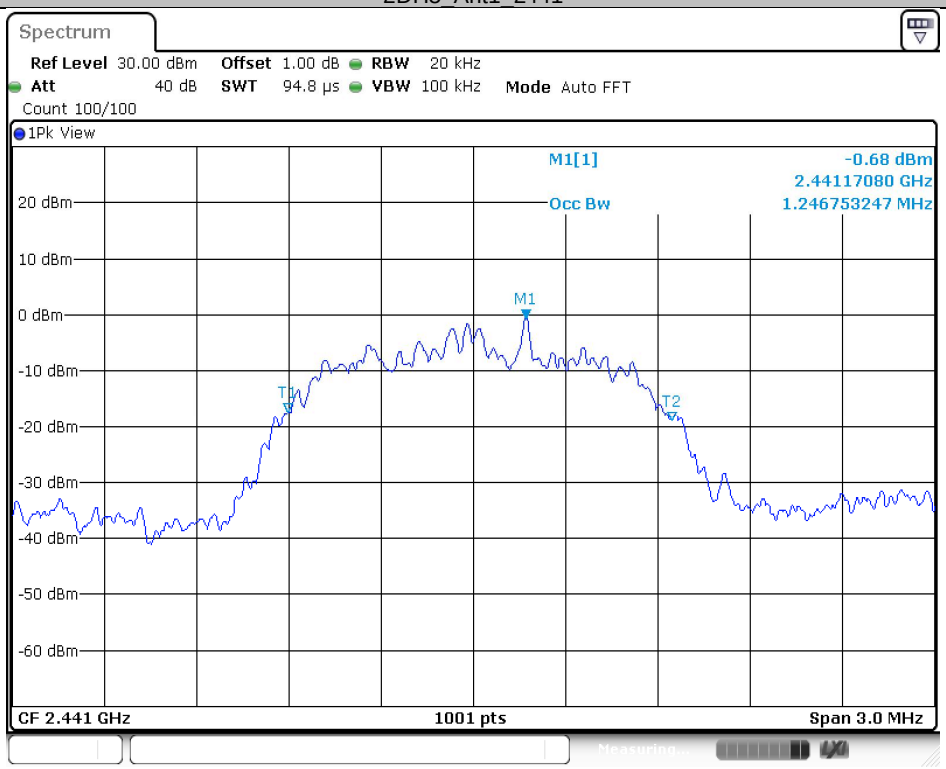

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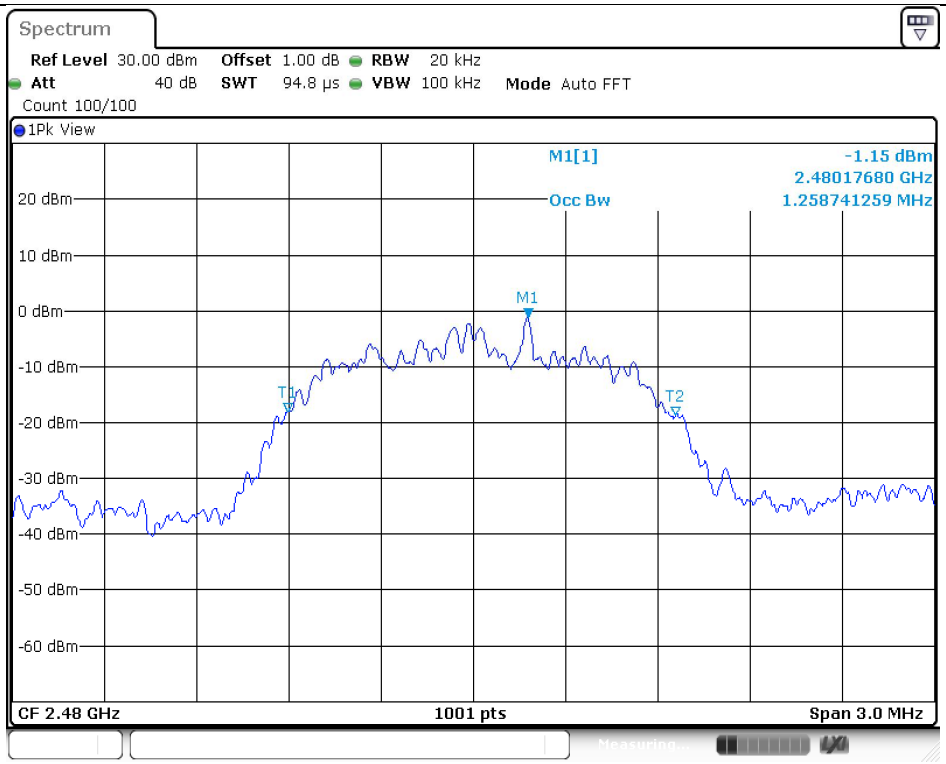
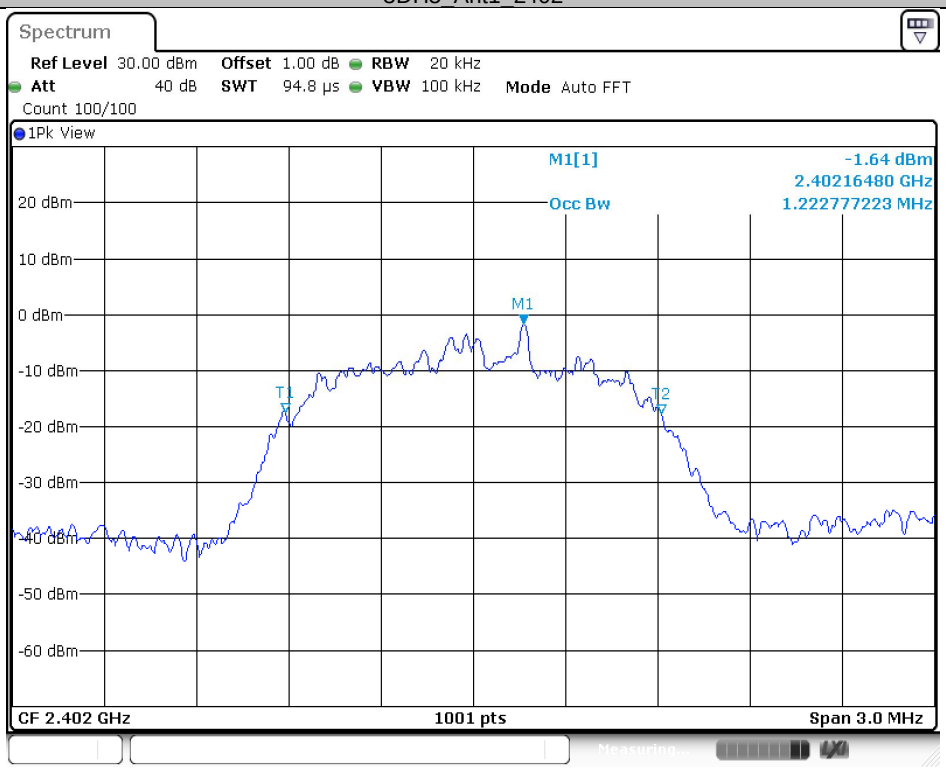


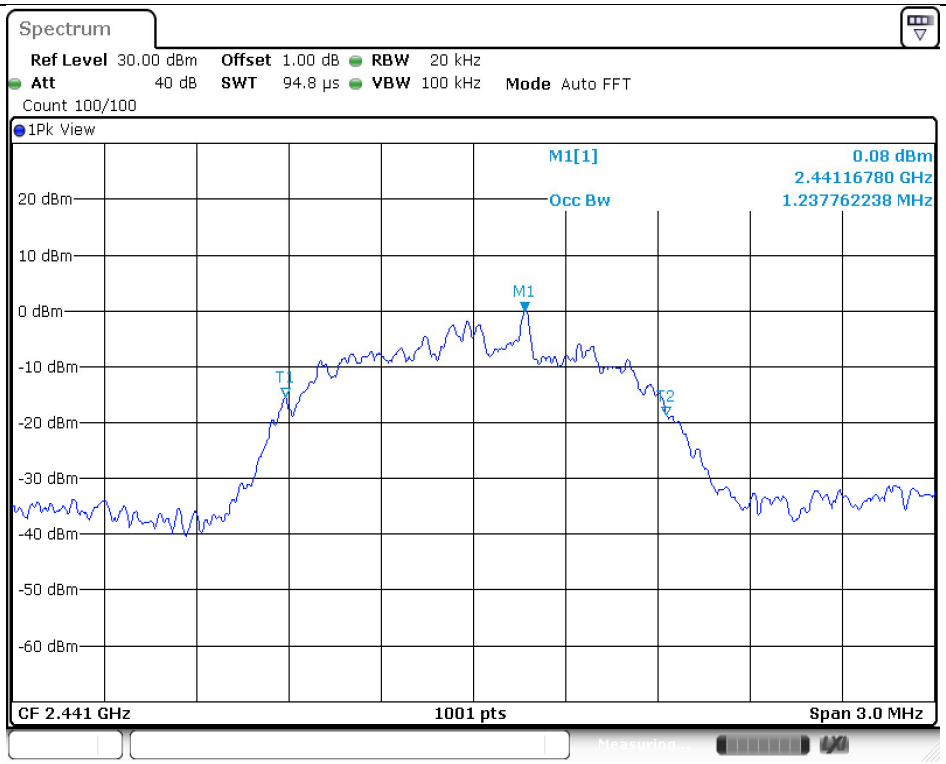
Date: 18.OCT.2023 12:28:19

3DH5_Ant1_2402



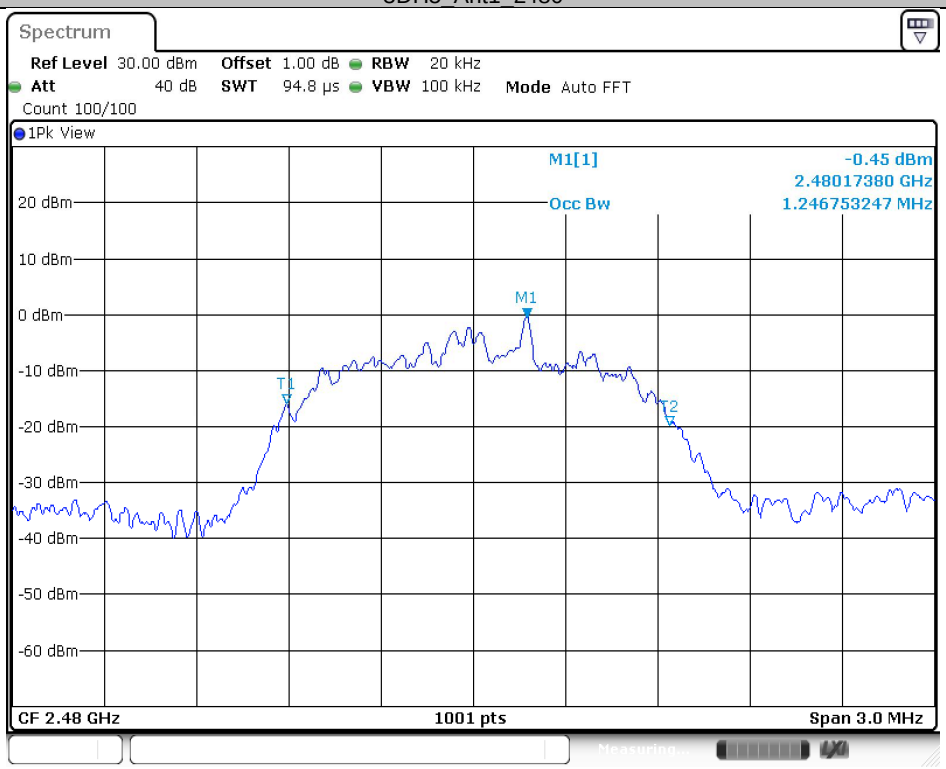
Date: 18.OCT.2023 12:32:22

3DH5_Ant1_2441



Date: 18.OCT.2023 12:35:15

3DH5_Ant1_2480



Date: 18.OCT.2023 12:39:54

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9.4 Carrier Frequency Separation

Test Method

1. The RF output of EUT was connected to the spectrum analyzer 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:
   Span = wide enough to capture the peaks of two adjacent channels, RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel. VBW ≥RBW, Sweep = auto, Detector function = peak.
4. By using the Max-Hold function record the separation of two adjacent channels.
5. Measure the frequency difference of these two adjacent channels by spectrum analyzer marker function. Record the results.
6. Repeat above procedures until all frequencies measured were complete.

Limit

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

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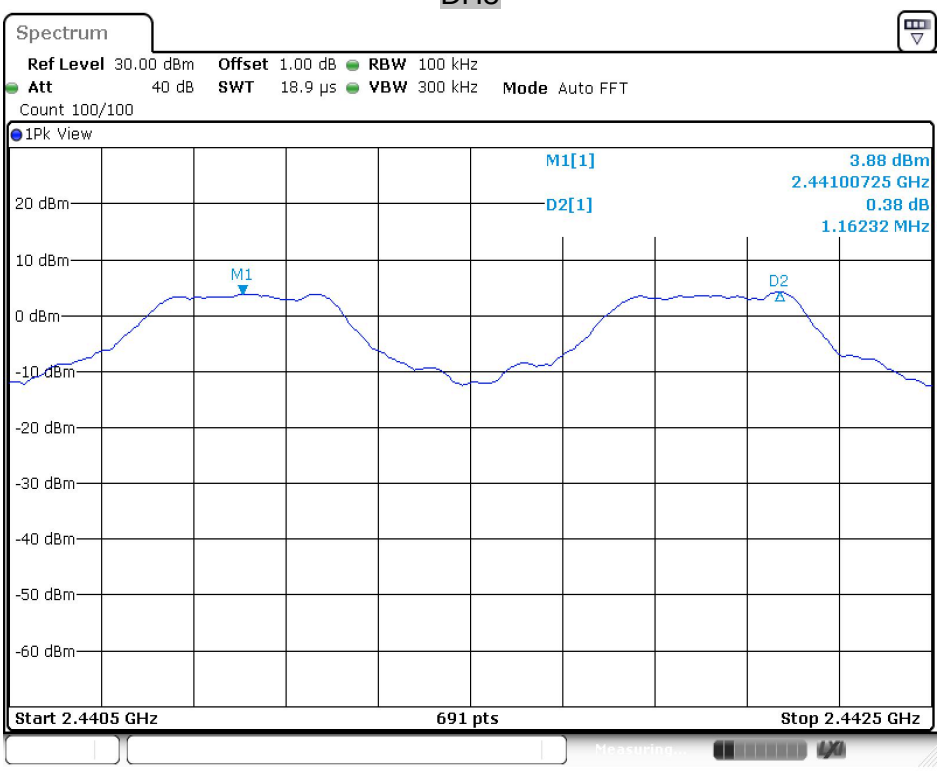
Carrier Frequency Separation

TestMode	Mode	Result[MHz]	Limit[MHz]	Verdict
DH5	Hop	1.162	>=1.152	PASS
2DH5	Hop	0.98	>=0.968	PASS
3DH5	Hop	1	>=0.960	PASS

DH5



Date: 18.OCT.2023 13:17:35

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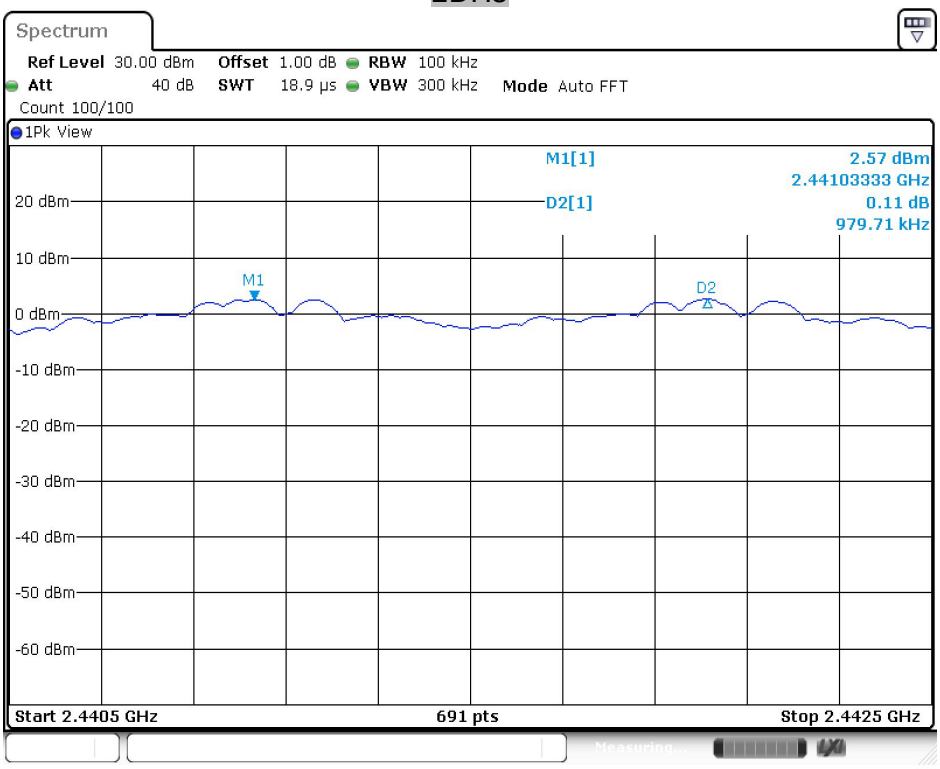
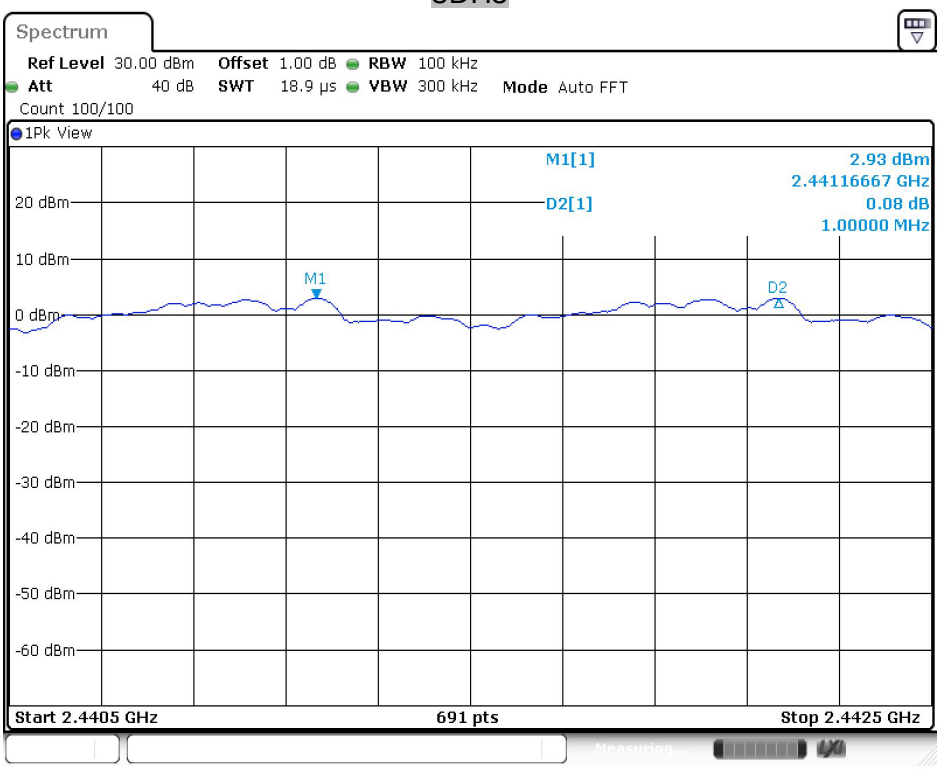
2DH5



Date: 18.OCT.2023 13:26:55

3DH5



Date: 18.OCT.2023 13:23:47

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9.5 Number of hopping frequencies

Test Method

1. The RF output of EUT was connected to the spectrum analyzer 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:
   Span = the frequency band of operation, RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller, VBW ≥RBW, Sweep = auto, Detector function = peak, Trace=Max hold.
4. Allow the trace to stabilize. It may prove necessary to break the span up to sections, in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

Limit

Limit number
⩾15

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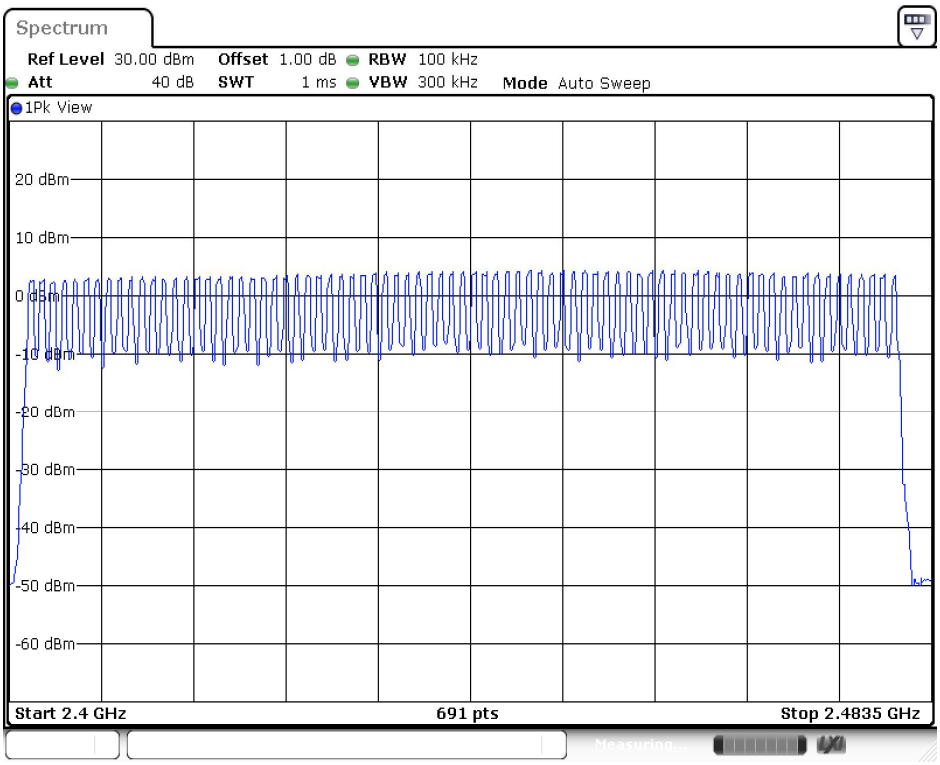
Number of hopping frequencies

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

Number of hopping frequencies	Result
79	Pass

GFSK Mode



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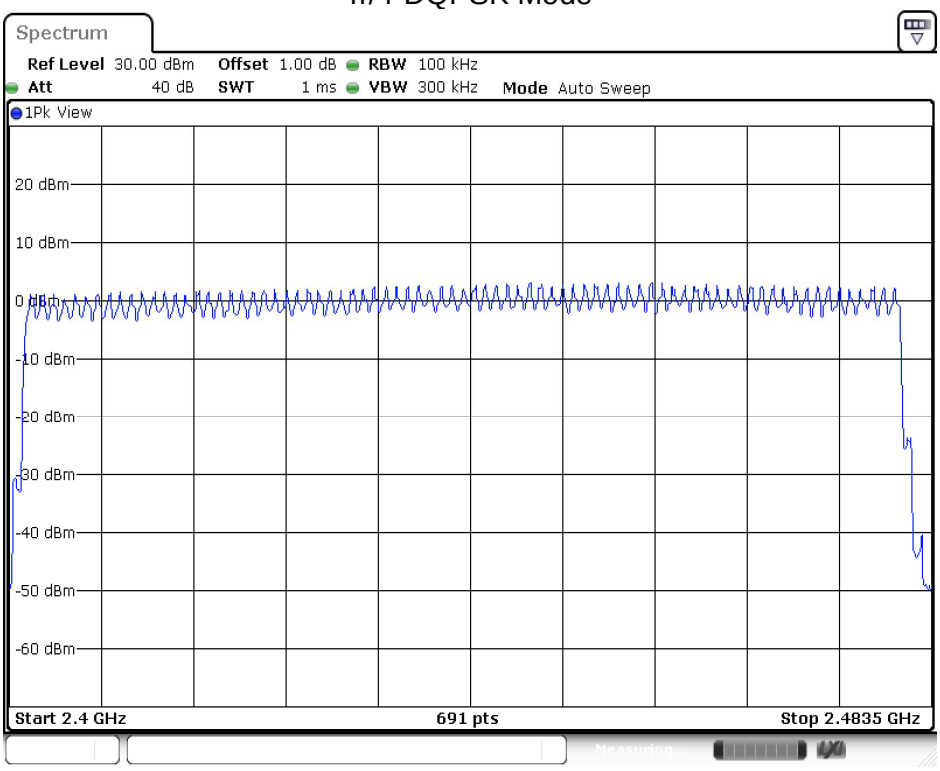
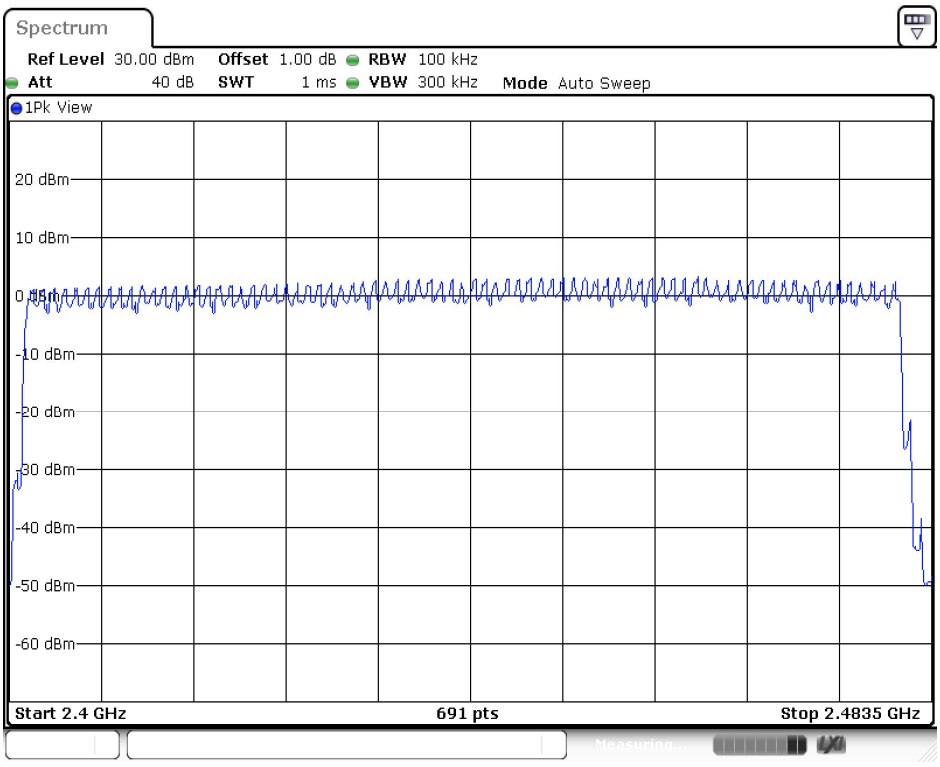
π/4-DQPSK Mode



Date: 18.OCT.2023 13:21:20

8DPSK Mode



Date: 18.OCT.2023 13:24:52

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9.6 Dwell Time

Test Method

1. The RF output of EUT was connected to the spectrum analyzer 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. Span: Zero span, centered on a hopping channel.
4. RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
5. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
6. Detector function: Peak.
7. Trace: Max hold. Use the marker-delta function to determine the transmit time per hop. If this value varies with different modes of operation (data rate, modulation format, number of hopping channels, etc.), then repeat this test for each variation in transmit time.

Limit

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

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Dwell Time

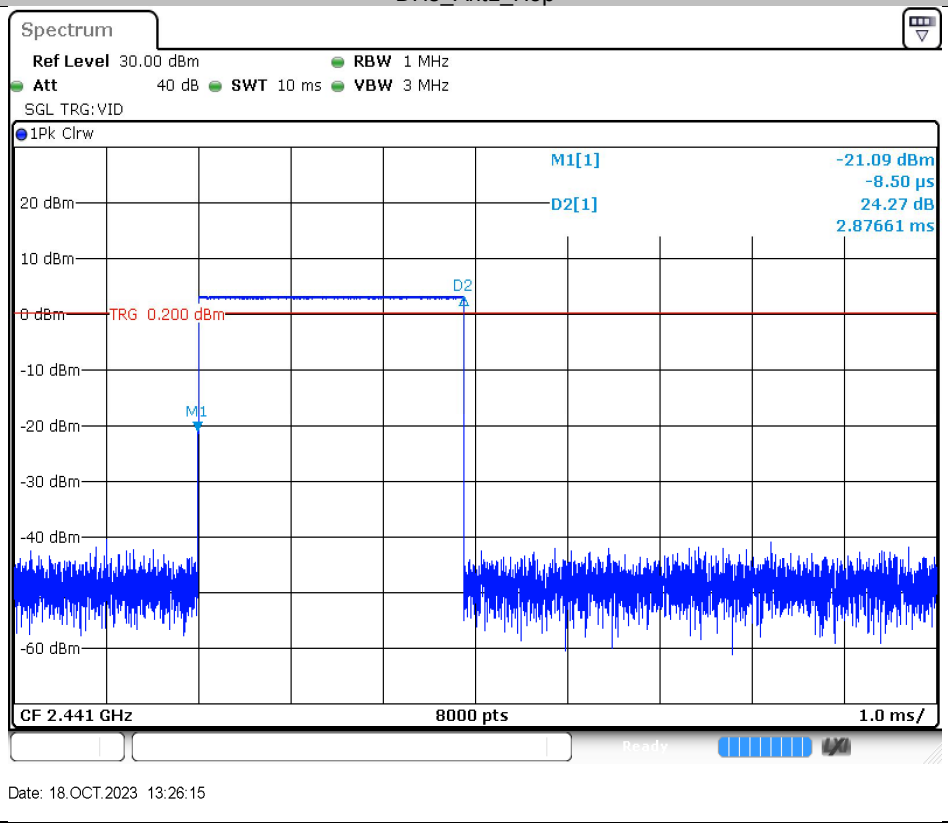
Dwell time

The maximum dwell time shall be 0.4 s.
According to the Bluetooth Core Specification, the worse result (DH5, 2DH5, 3DH5 mode) was reported to show compliance.
The duration for dwell time calculation: 0.4 [s] * hopping number = 0.4 [s] * 79 [ch] = 31.6 [s]
The Dwell Time = Burst Width * Total Hops.

Test Result

TestMode	Channel	BurstWidth (ms)	TotalHops	Result(s)	Limit(s)	Verdict
DH5	Hop	2.88	90	0.259	<=0.4	PASS
2DH5	Hop	2.87	110	0.316	<=0.4	PASS
3DH5	Hop	2.87	100	0.287	<=0.4	PASS

DH5_Ant1_Hop



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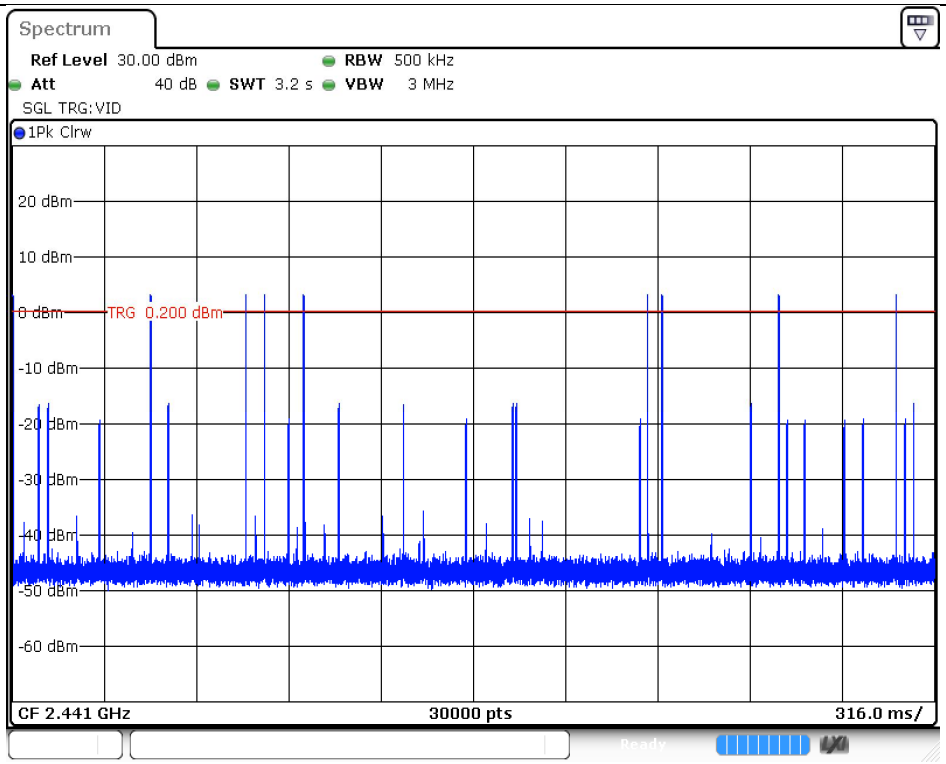
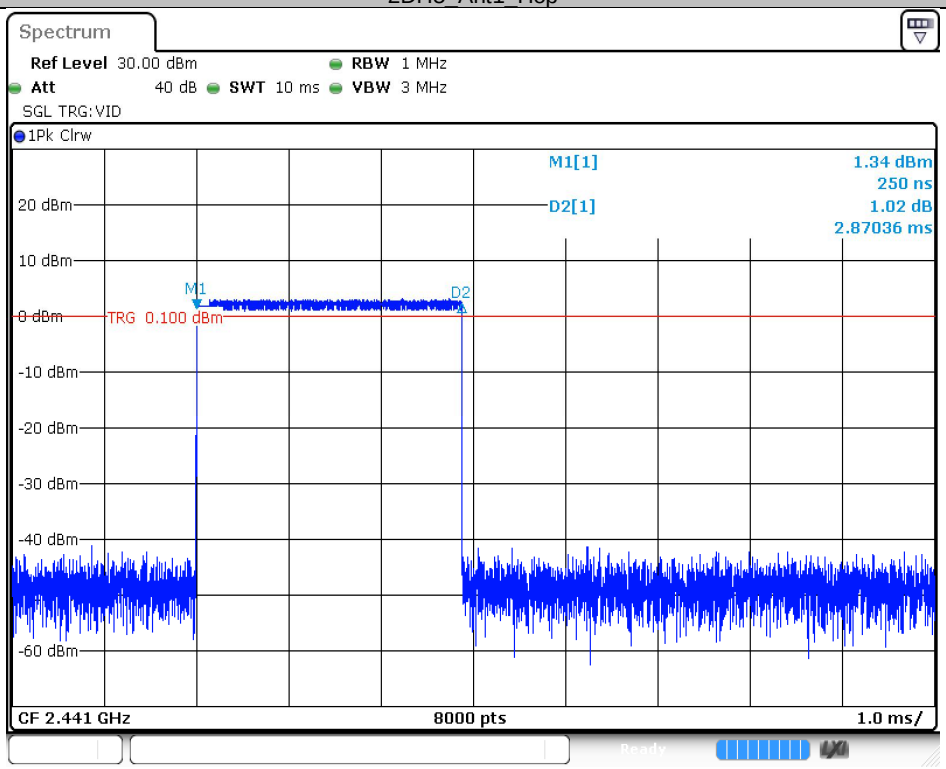


Date: 18.OCT.2023 13:26:20

2DH5_Ant1_Hop



Date: 18.OCT.2023 13:21:32

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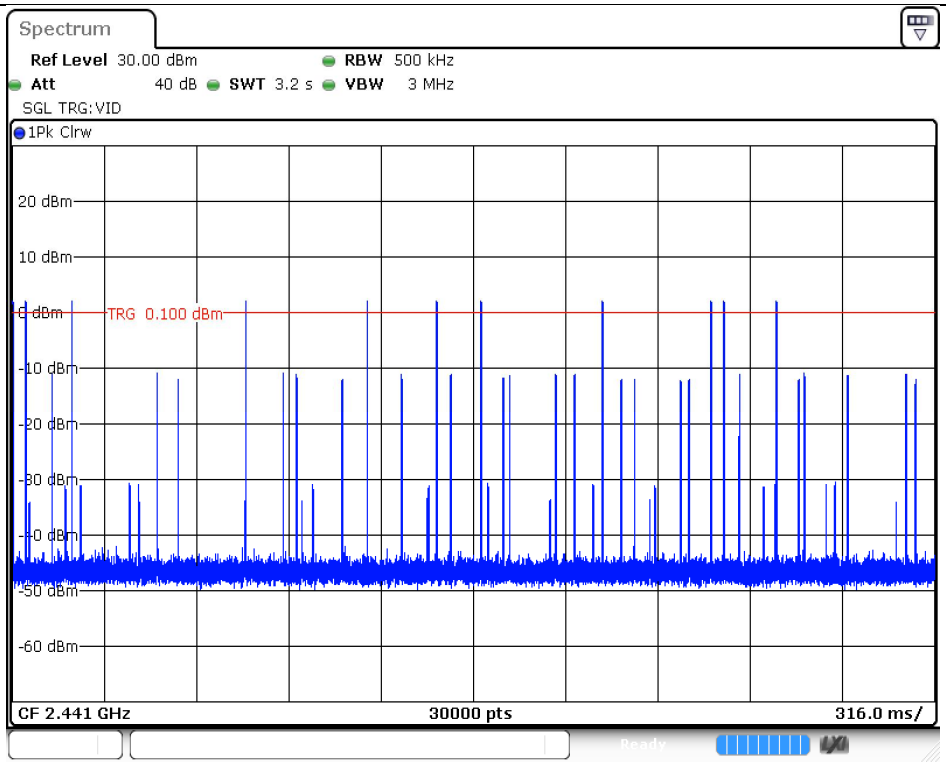
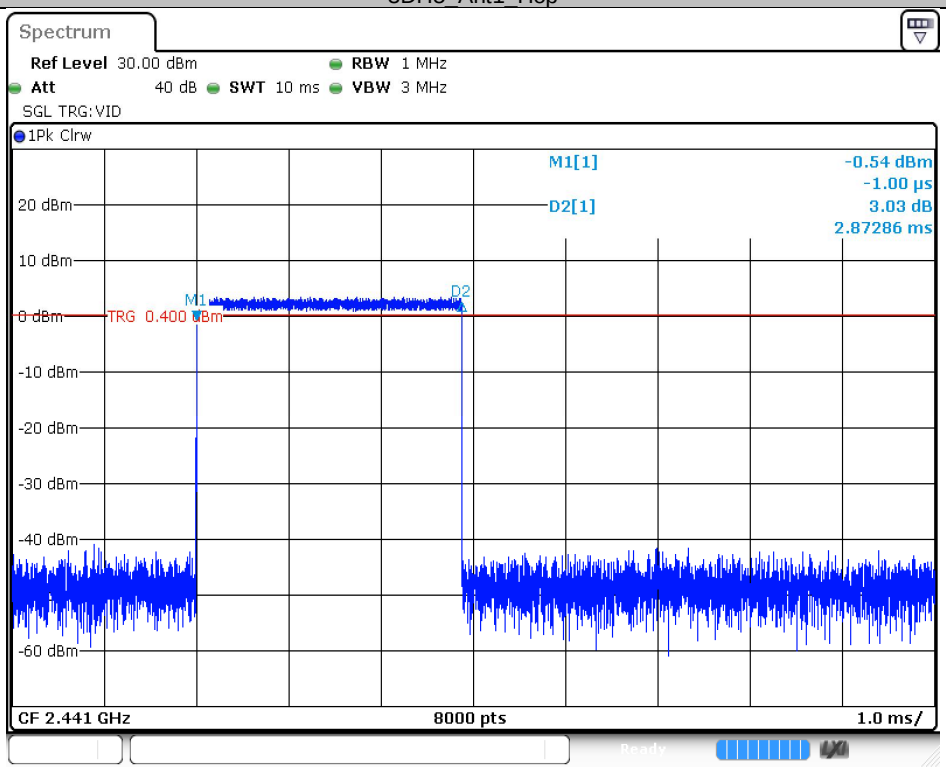


Date: 18.OCT.2023 13:21:37

3DH5_Ant1_Hop



Date: 18.OCT.2023 13:25:04

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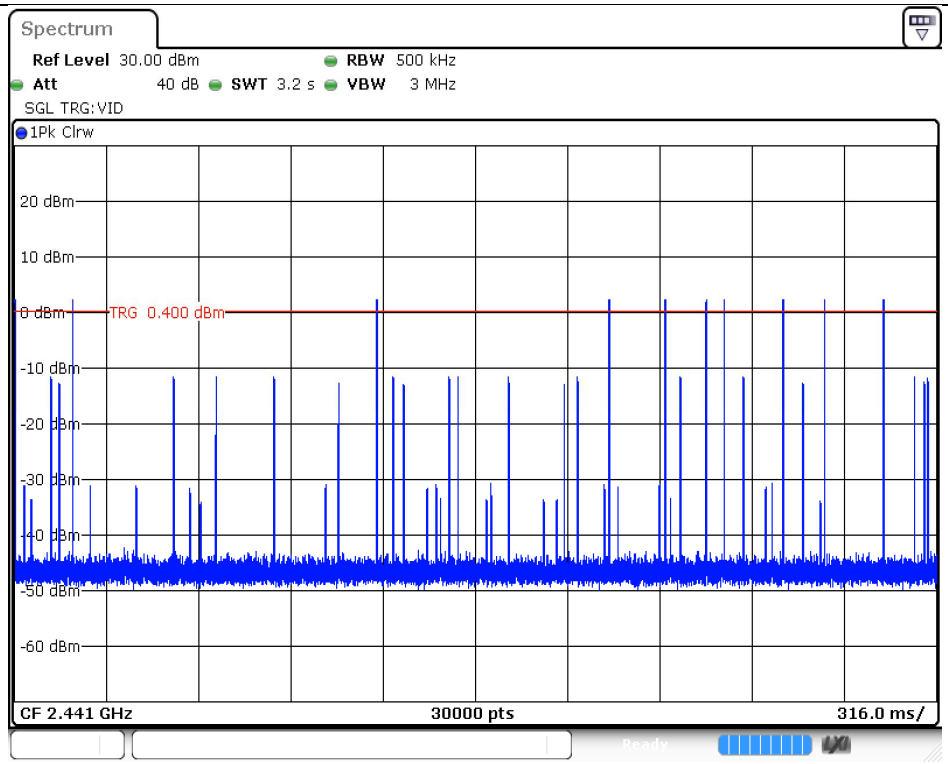

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9.7 Spurious RF conducted emissions

Test Method

1. The RF output of EUT was connected to the spectrum analyzer 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 continuously.
3. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector, Sweep = auto, Span = wide enough to capture the peak level of the in-band emission and all spurious emissions, Trace = max hold. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. The level displayed must comply with the limit specified in this Section.
4. Measure and record the results in the test report.
5. The RF fundamental frequency should be excluded against the limit line in the operating frequency

Limit

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

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Spurious RF conducted emissions

TestMode	Antenna	Channel(MHz)	FreqRange(MHz)	RefLevel	Result(dBm)	Limit(dBm)	Verdict
DH5	Ant1	2402	Reference	2.99	2.99	---	PASS
			30~1000	30~1000	-67.79	<=-17.01	PASS
			1000~26500	1000~26500	-51.46	<=-17.01	PASS
		2441	Reference	4.30	4.30	---	PASS
			30~1000	30~1000	-67.73	<=-15.7	PASS
			1000~26500	1000~26500	-52.55	<=-15.7	PASS
		2480	Reference	3.63	3.63	---	PASS
			30~1000	30~1000	-68.6	<=-16.37	PASS
			1000~26500	1000~26500	-52.5	<=-16.37	PASS
2DH5	Ant1	2402	Reference	1.20	1.20	---	PASS
			30~1000	30~1000	-68.24	<=-18.8	PASS
			1000~26500	1000~26500	-38.38	<=-18.8	PASS
		2441	Reference	2.84	2.84	---	PASS
			30~1000	30~1000	-68.27	<=-17.16	PASS
			1000~26500	1000~26500	-51.19	<=-17.16	PASS
		2480	Reference	2.34	2.34	---	PASS
			30~1000	30~1000	-68.14	<=-17.66	PASS
			1000~26500	1000~26500	-52.72	<=-17.66	PASS
3DH5	Ant1	2402	Reference	1.31	1.31	---	PASS
			30~1000	30~1000	-67.33	<=-18.69	PASS
			1000~26500	1000~26500	-32.64	<=-18.69	PASS
		2441	Reference	2.98	2.98	---	PASS
			30~1000	30~1000	-68.32	<=-17.02	PASS
			1000~26500	1000~26500	-52.18	<=-17.02	PASS
		2480	Reference	2.47	2.47	---	PASS
			30~1000	30~1000	-68.63	<=-17.53	PASS
			1000~26500	1000~26500	-51.9	<=-17.53	PASS

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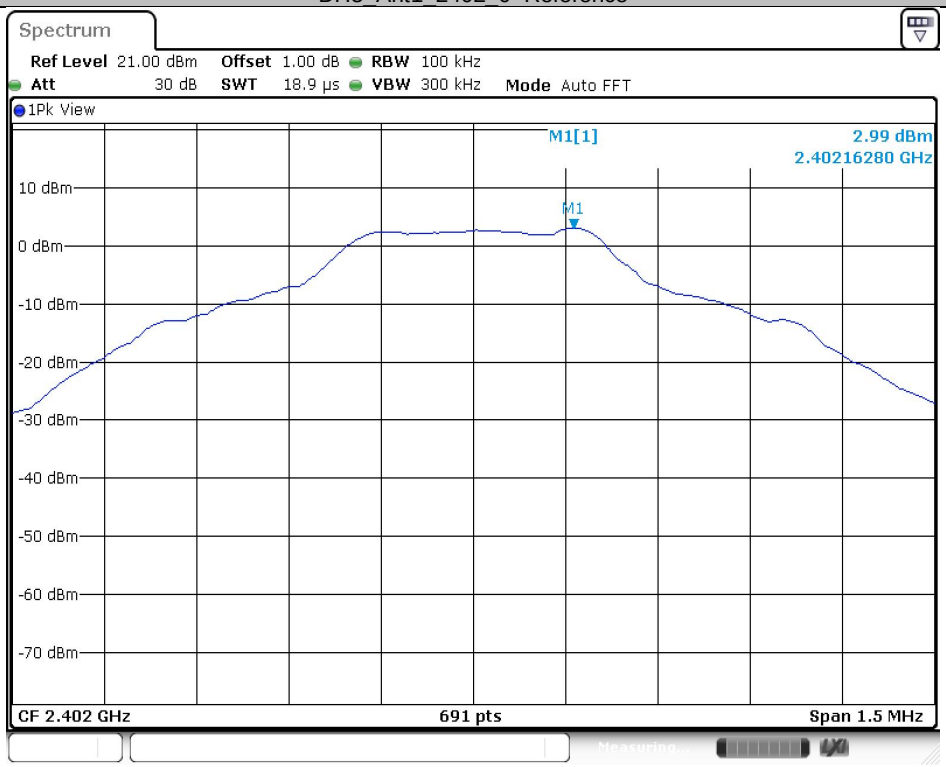
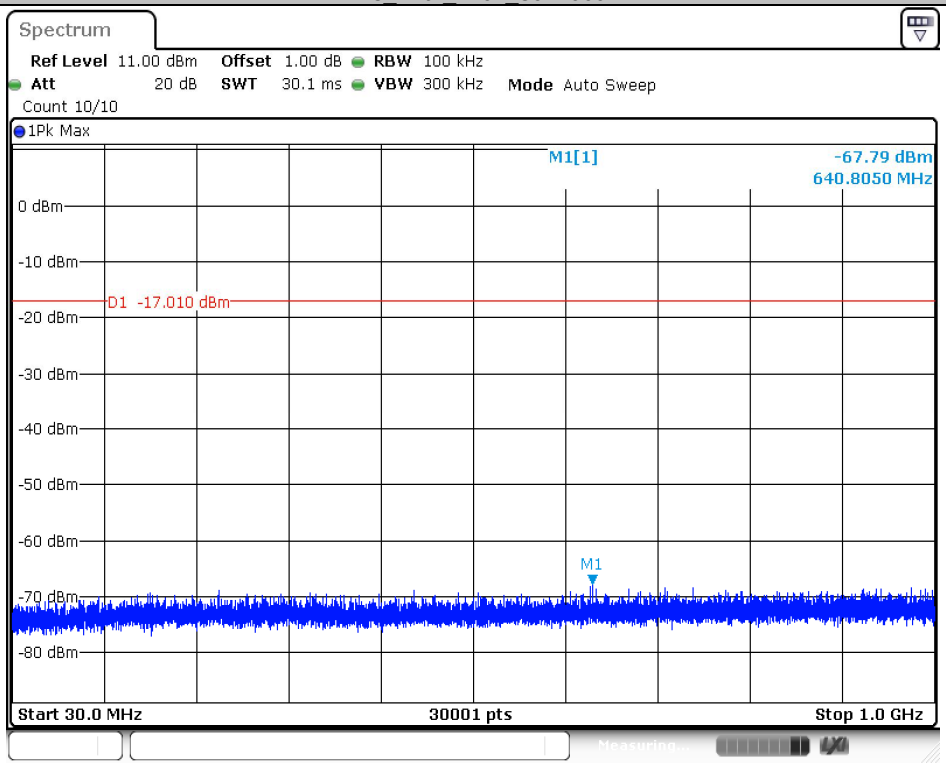
DH5_Ant1_2402_0~Reference



DH5_Ant1_2402_30~1000



DH5_Ant1_2402_1000~26500

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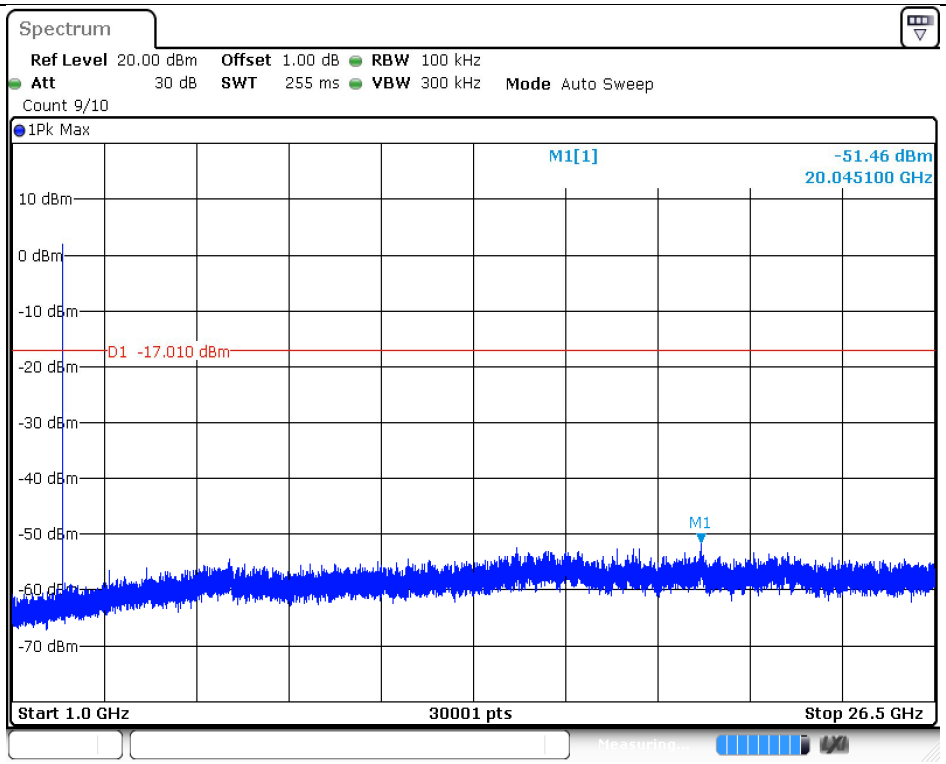

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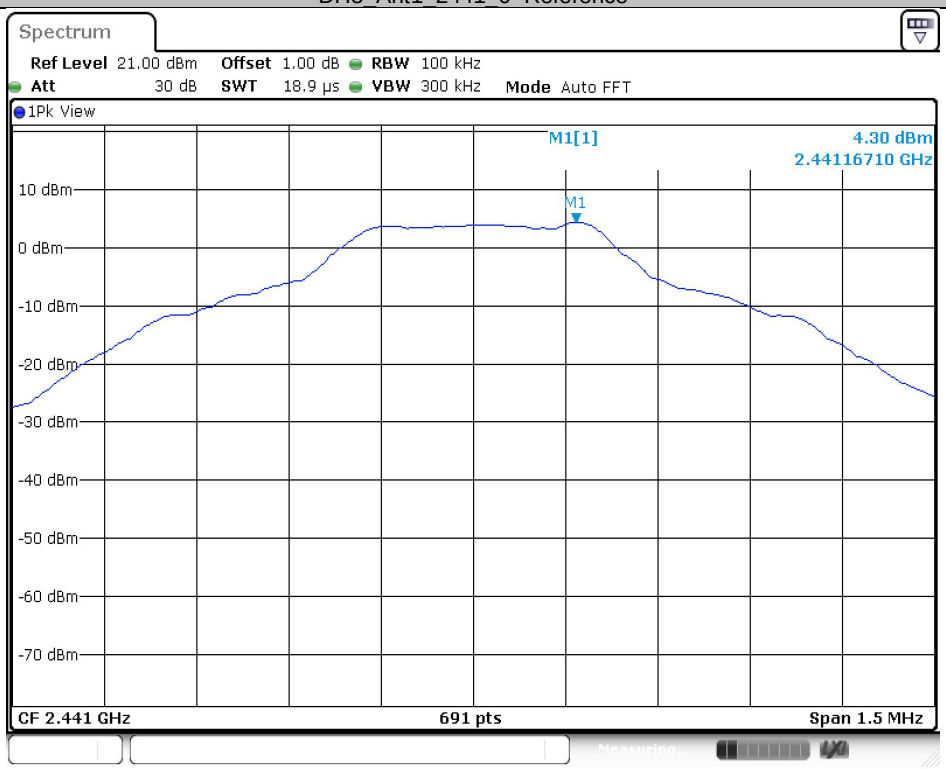

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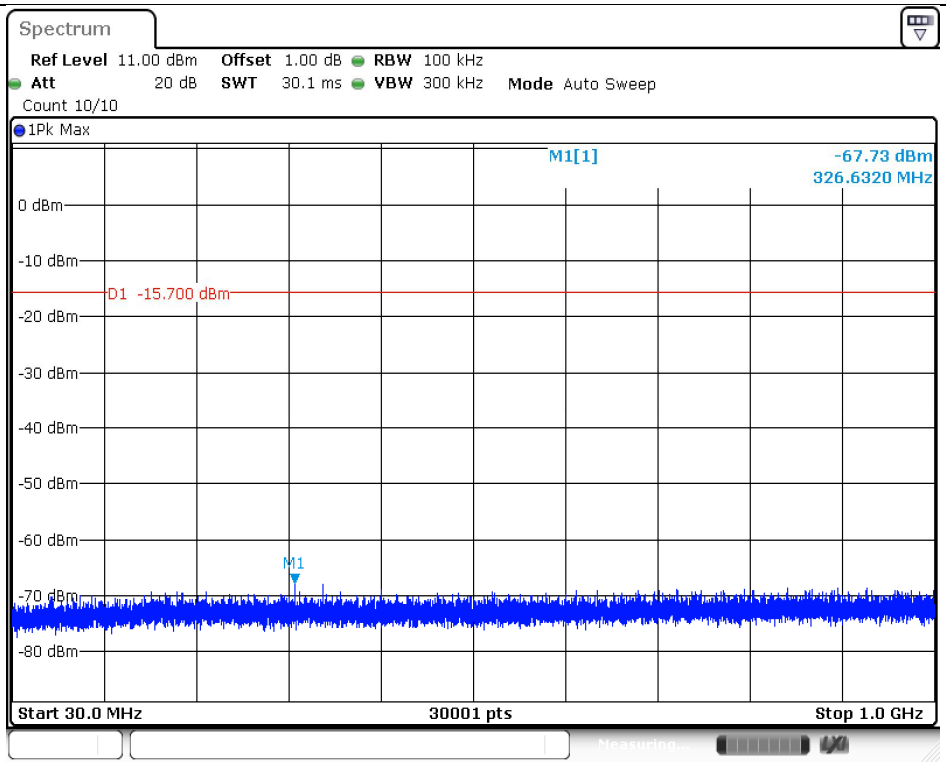

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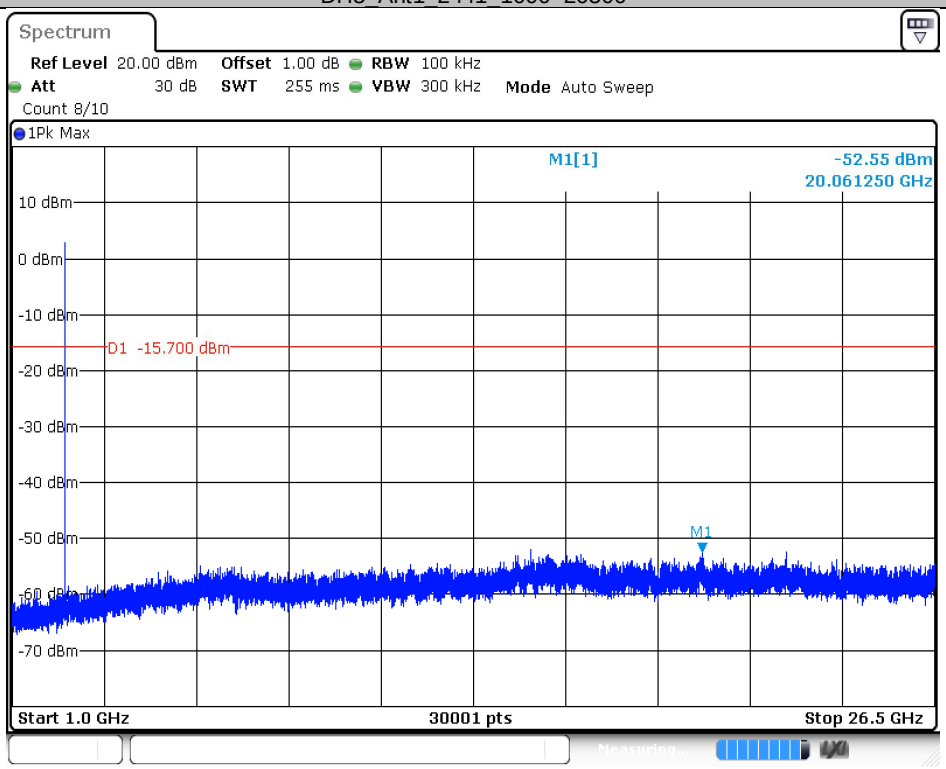

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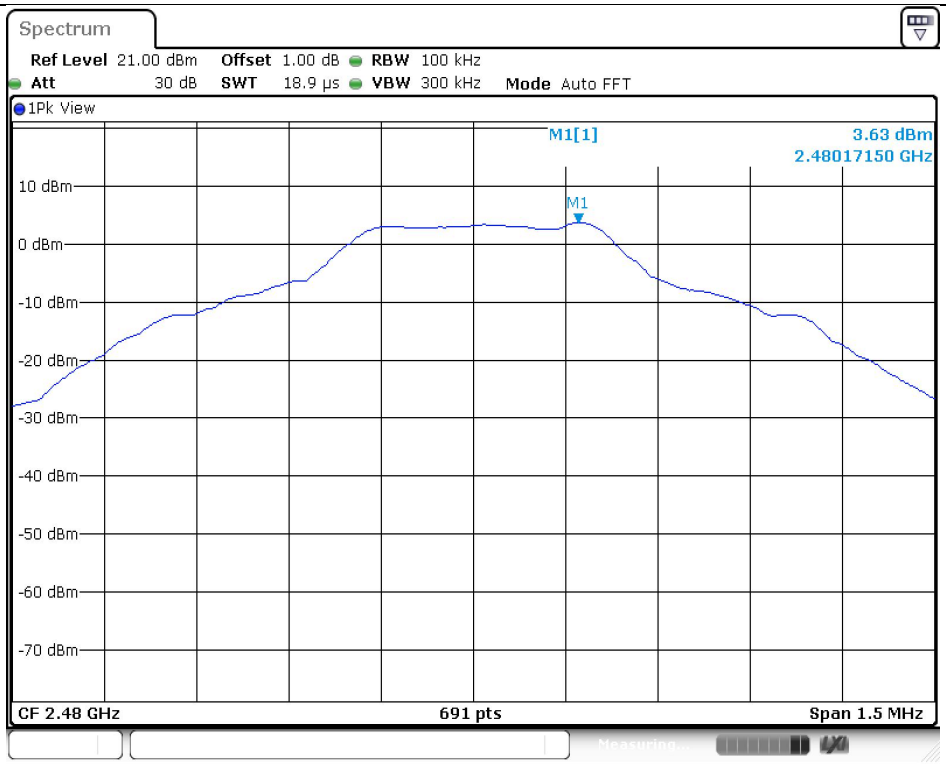

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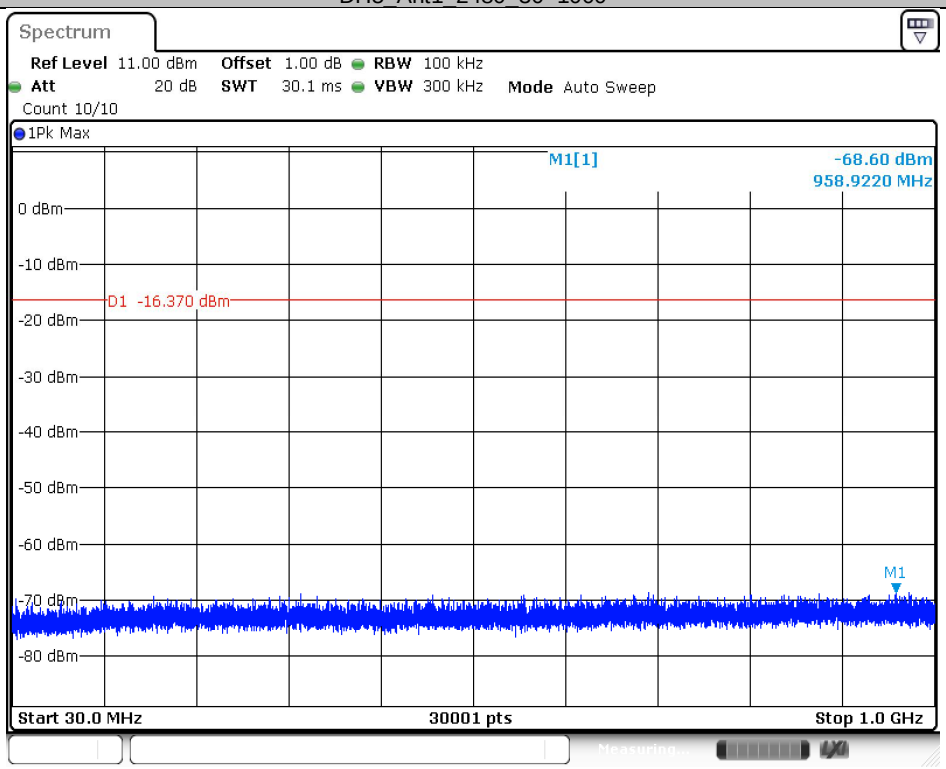

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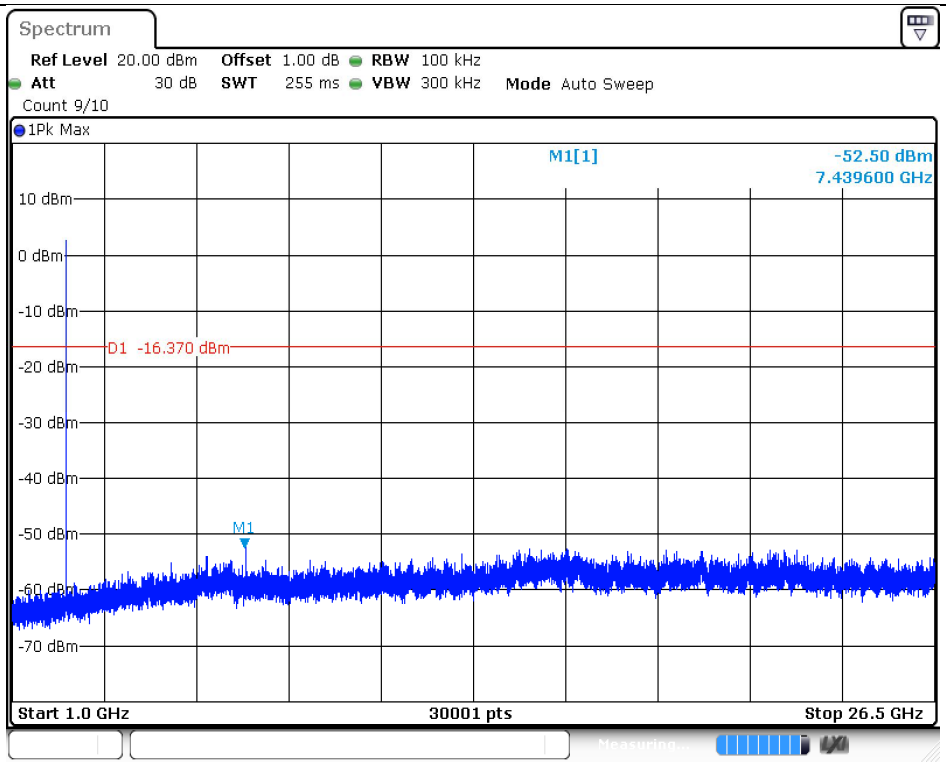

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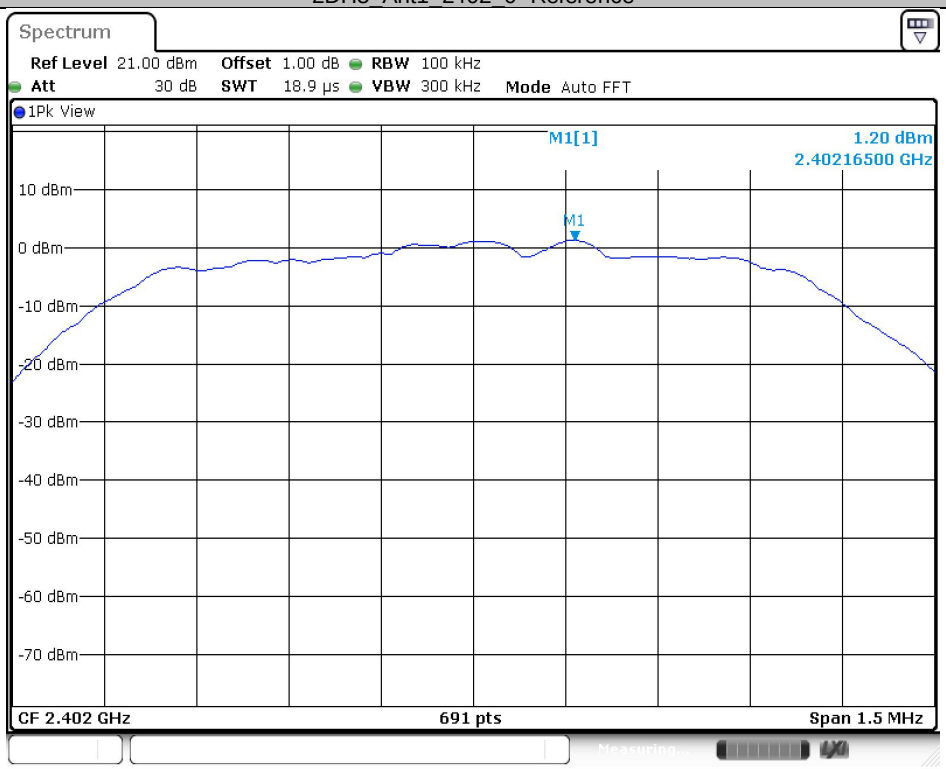

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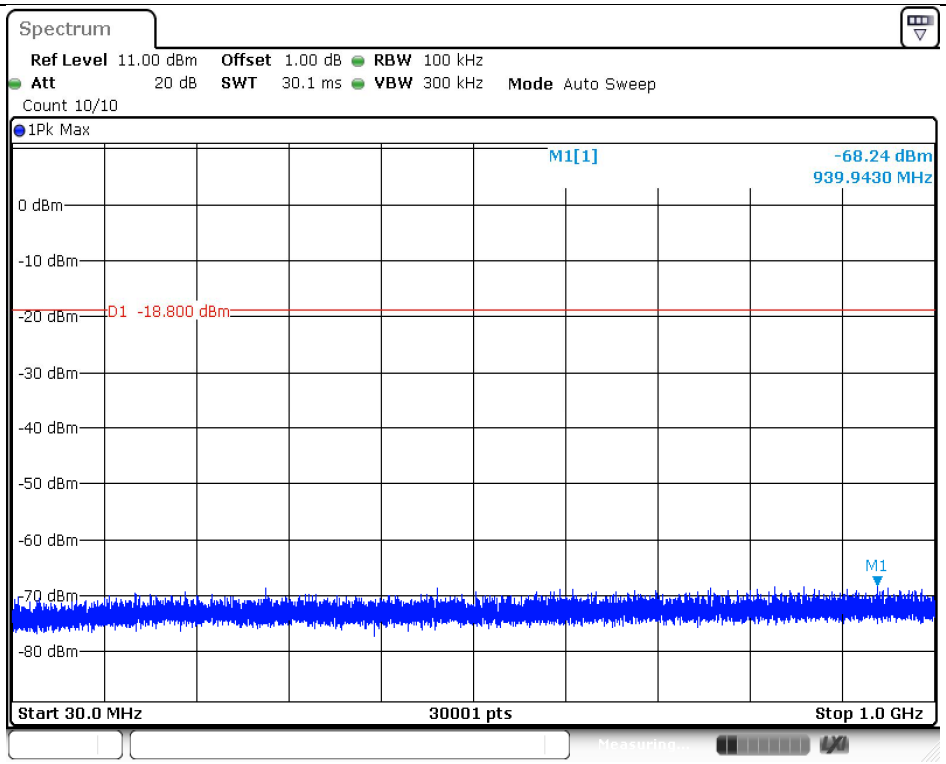

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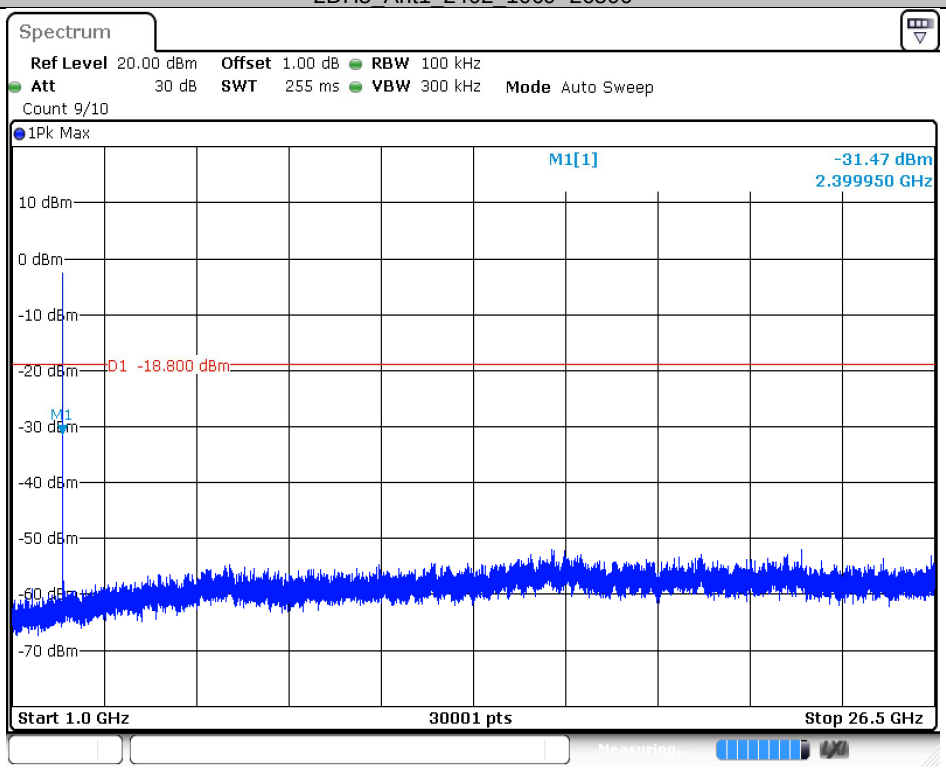

2DH5_Ant1_2441_0~Reference

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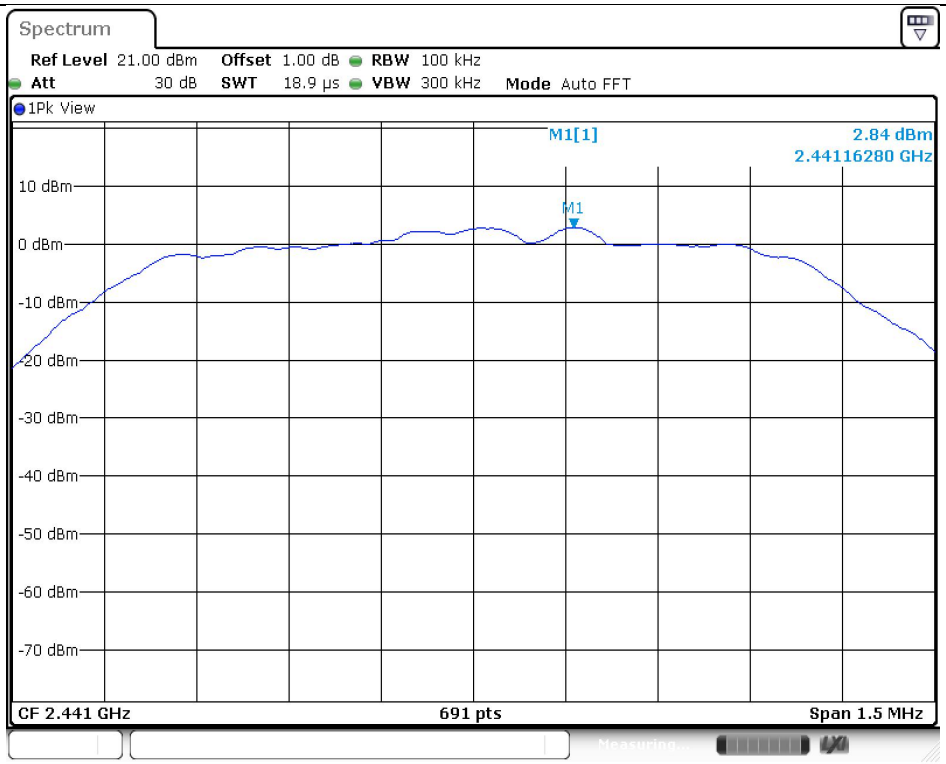

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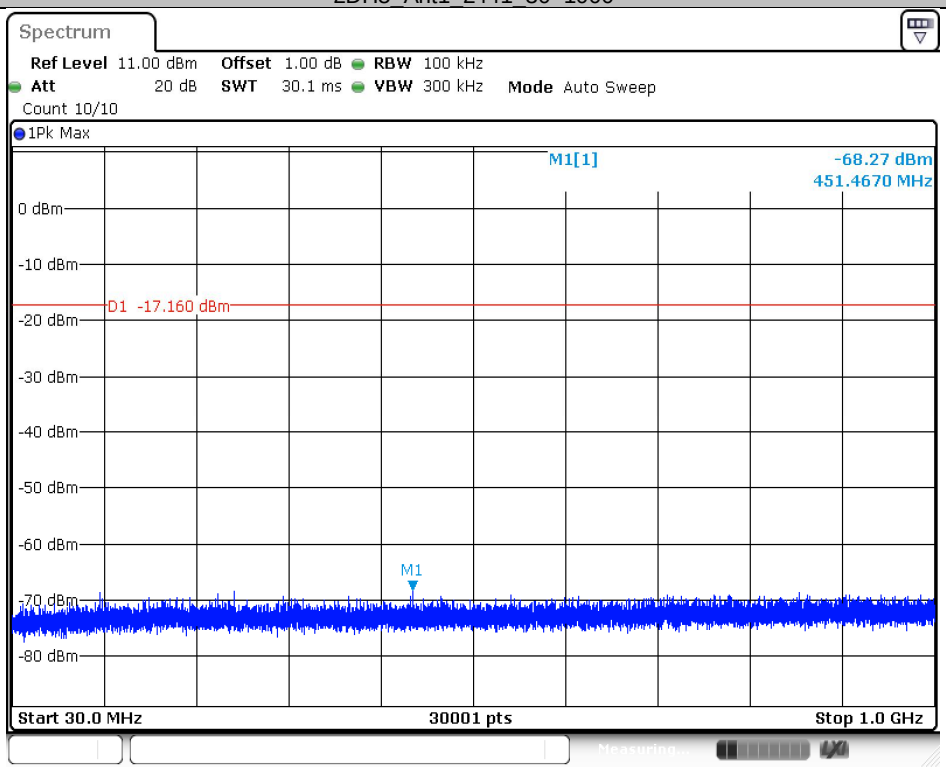

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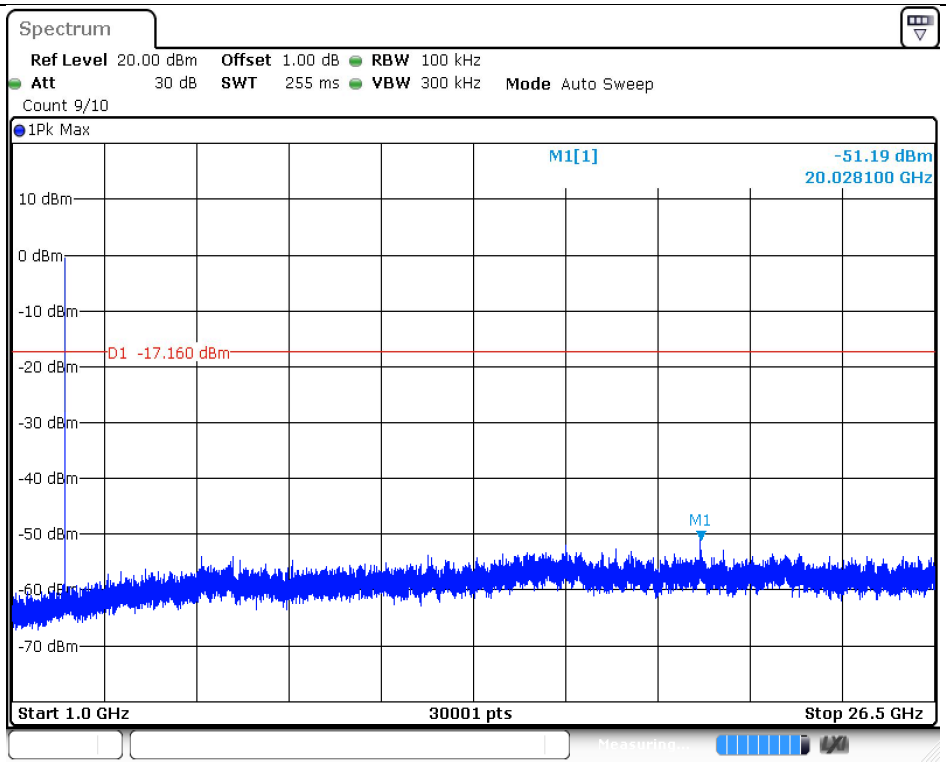

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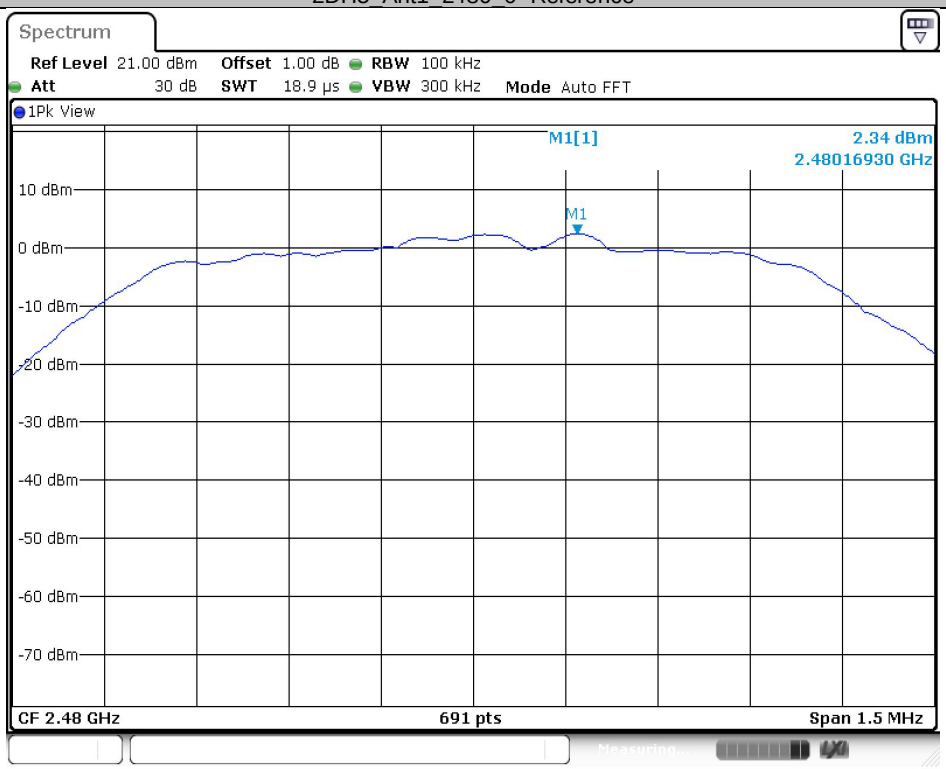

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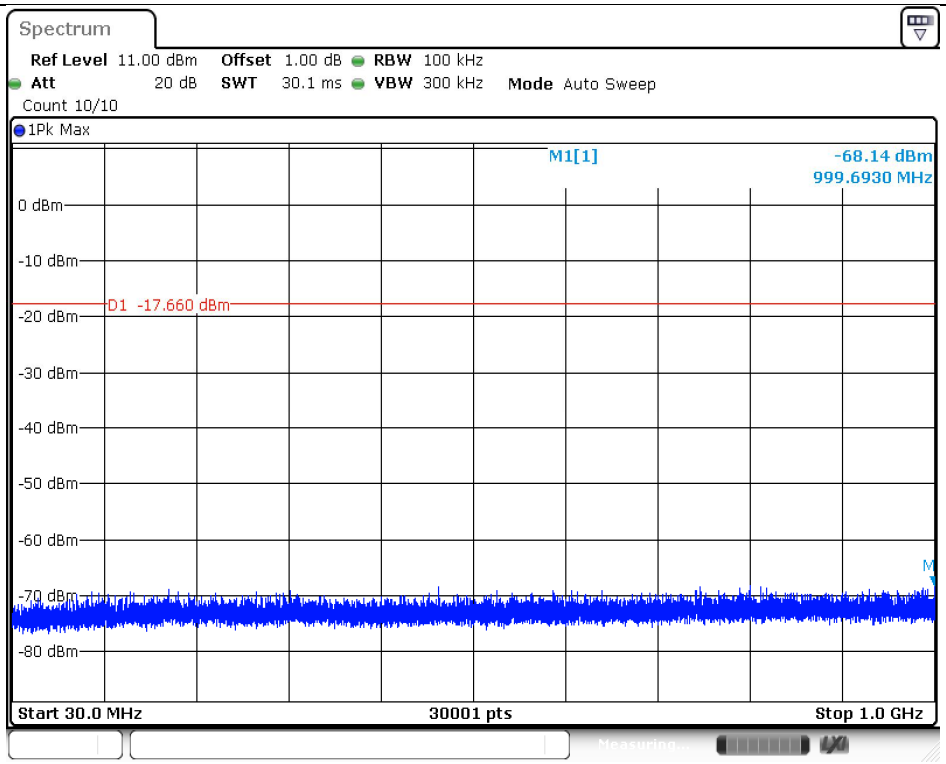

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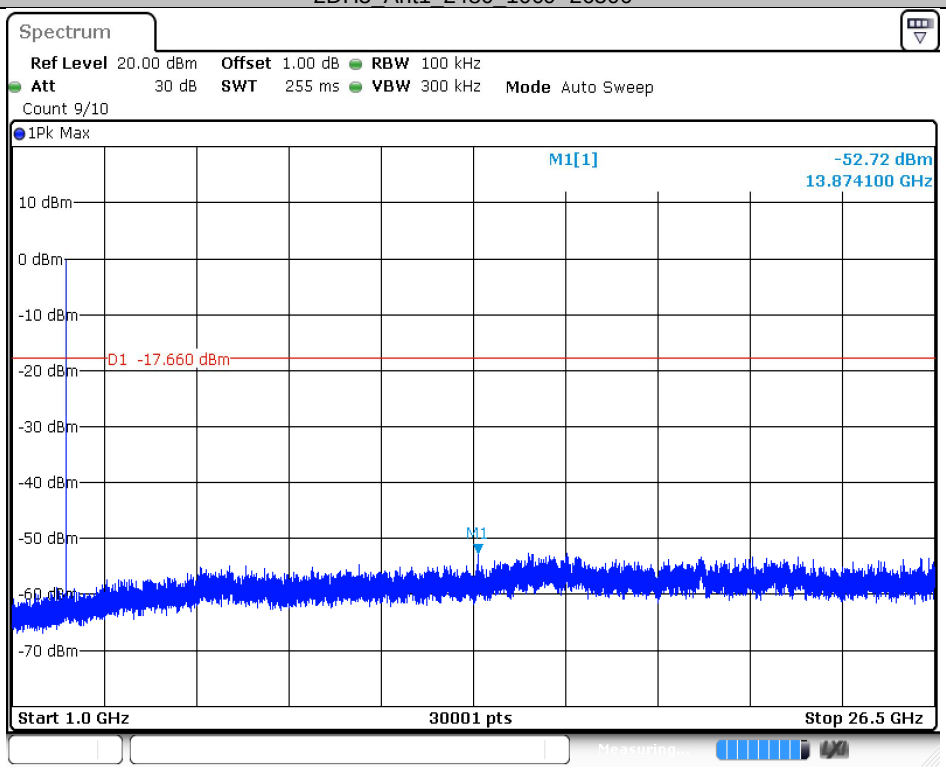

3DH5_Ant1_2402_0~Reference

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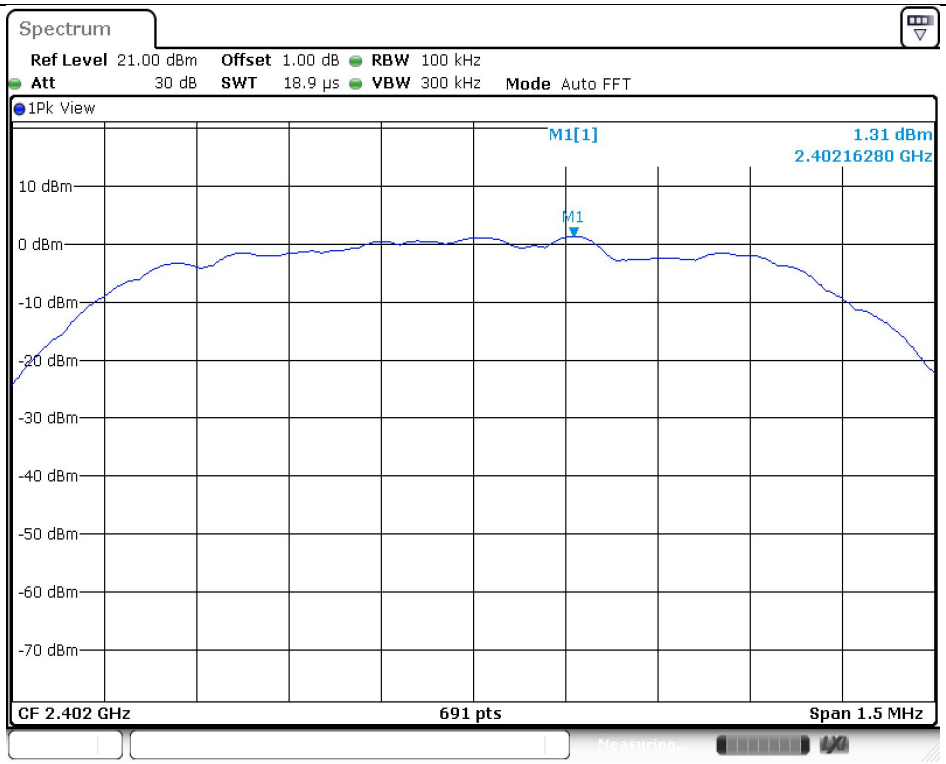

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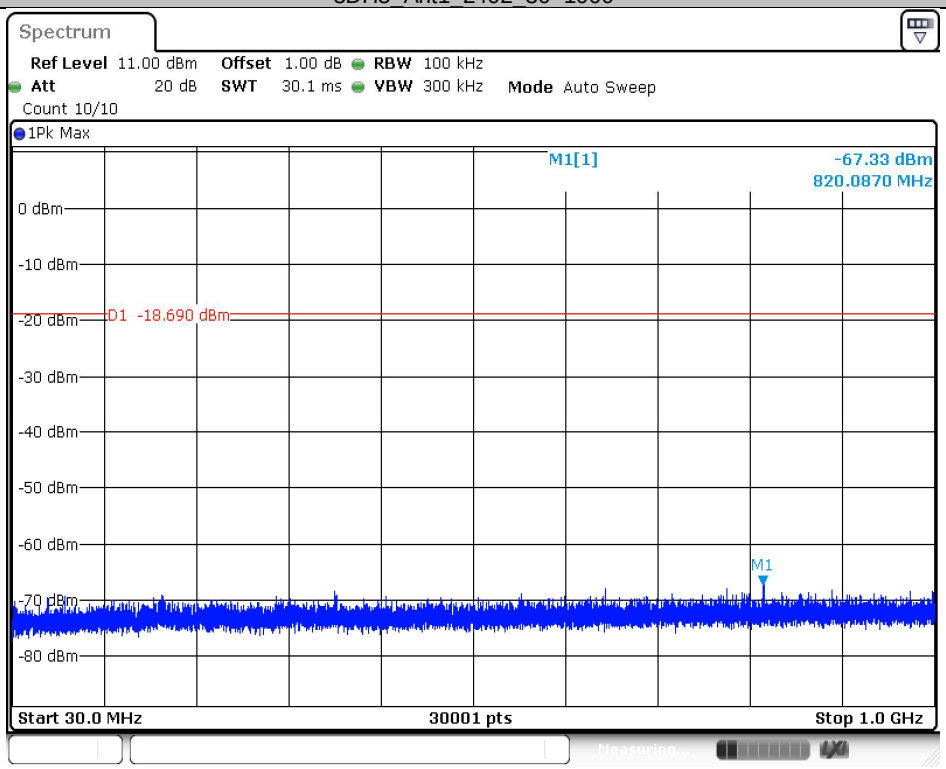

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TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
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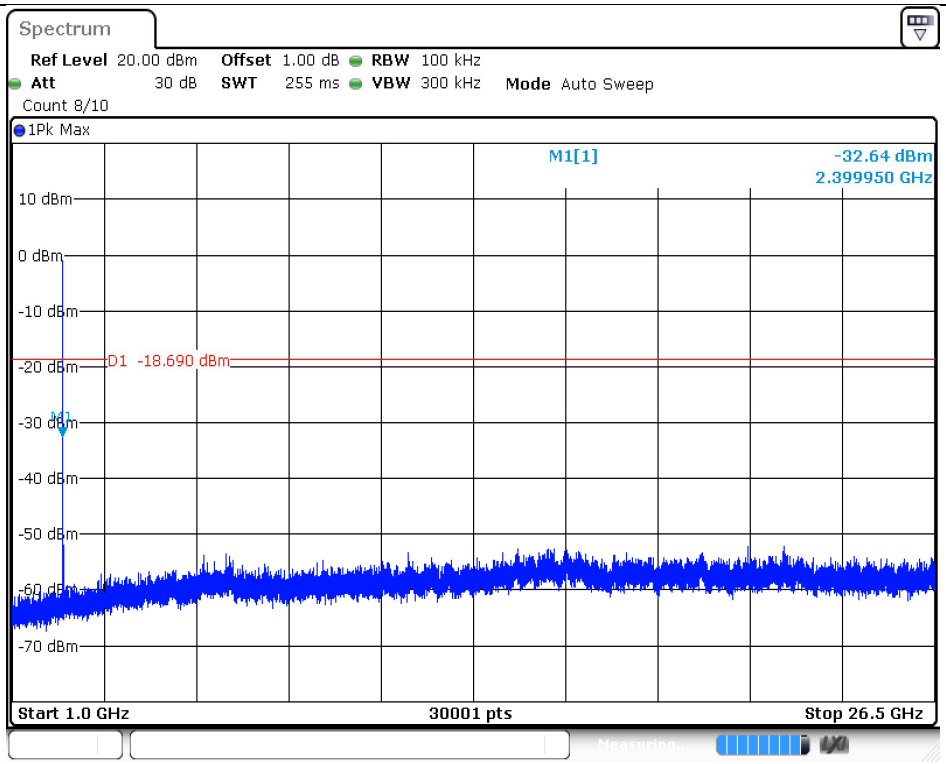

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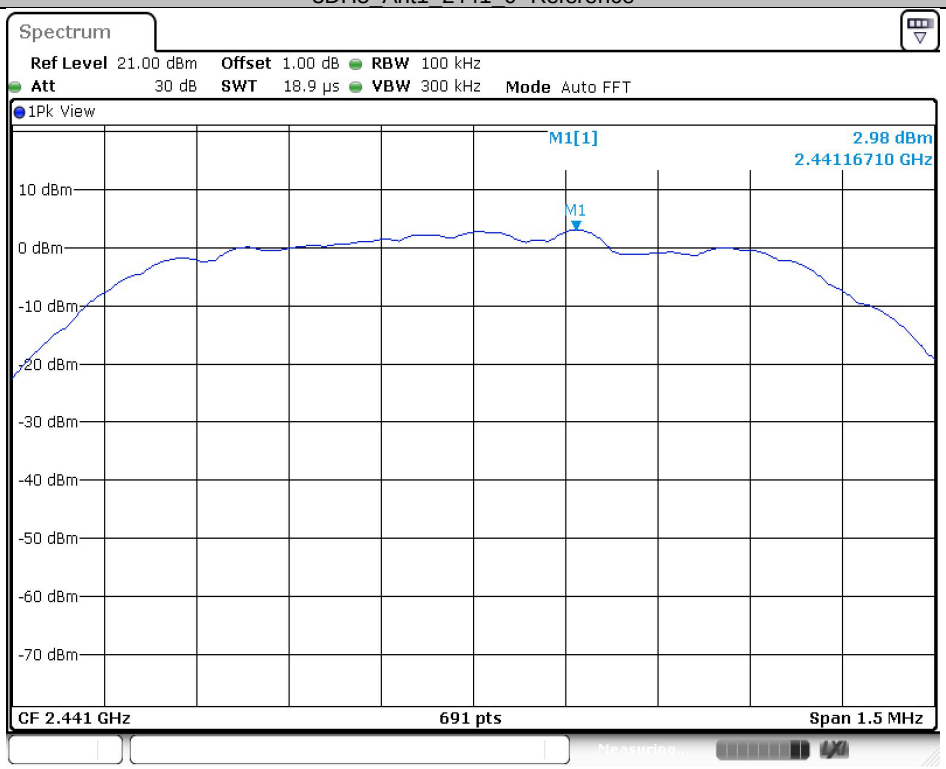

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TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
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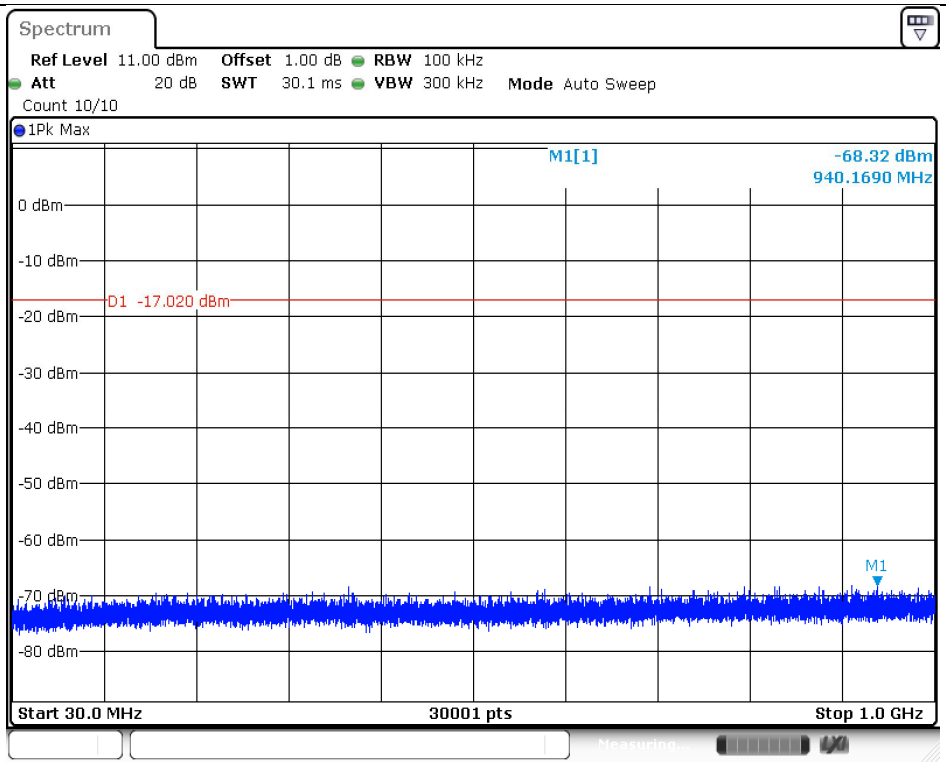

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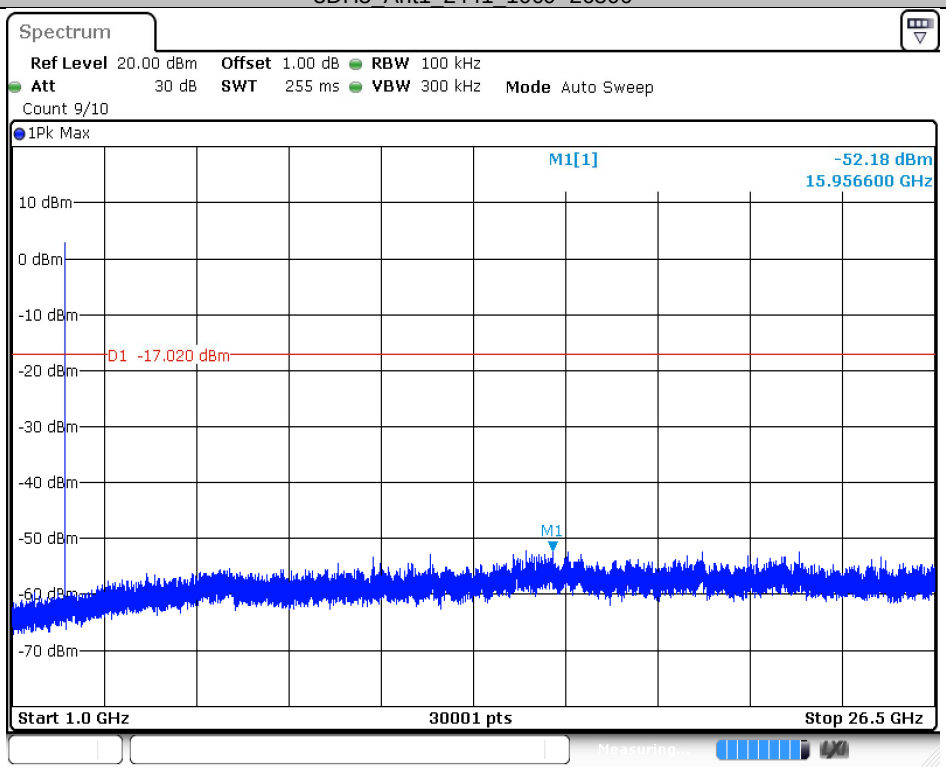

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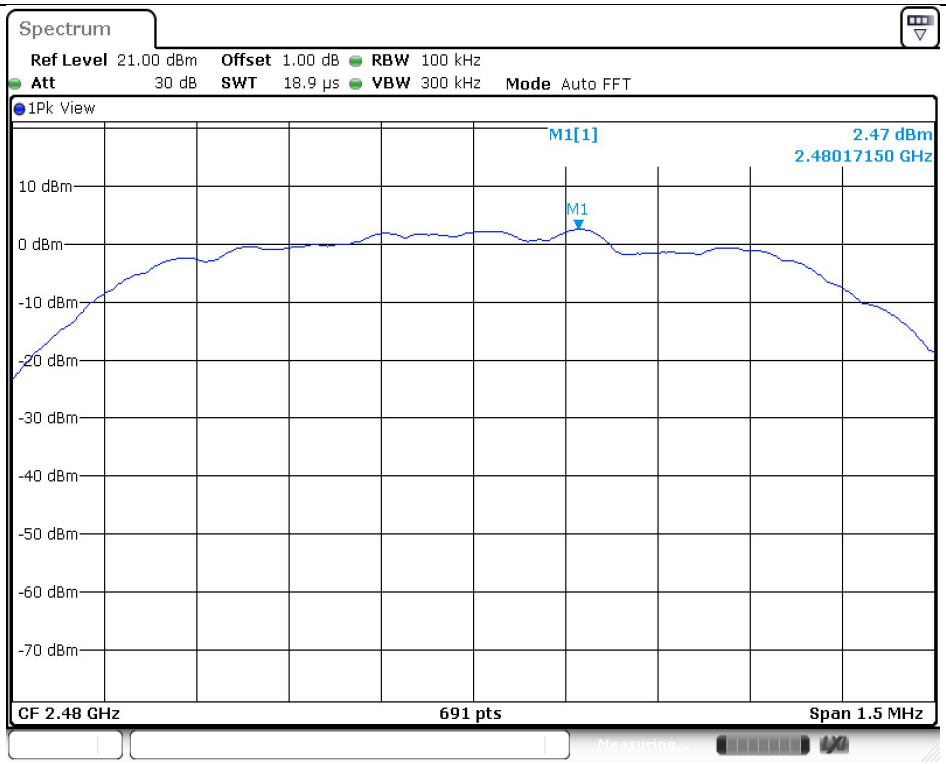

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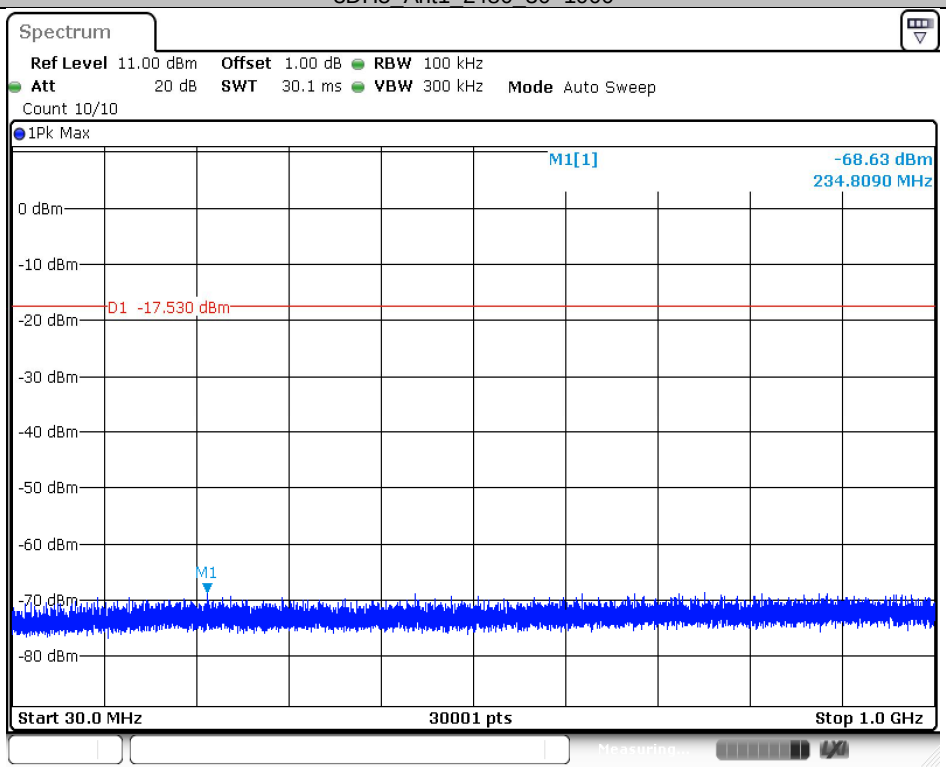

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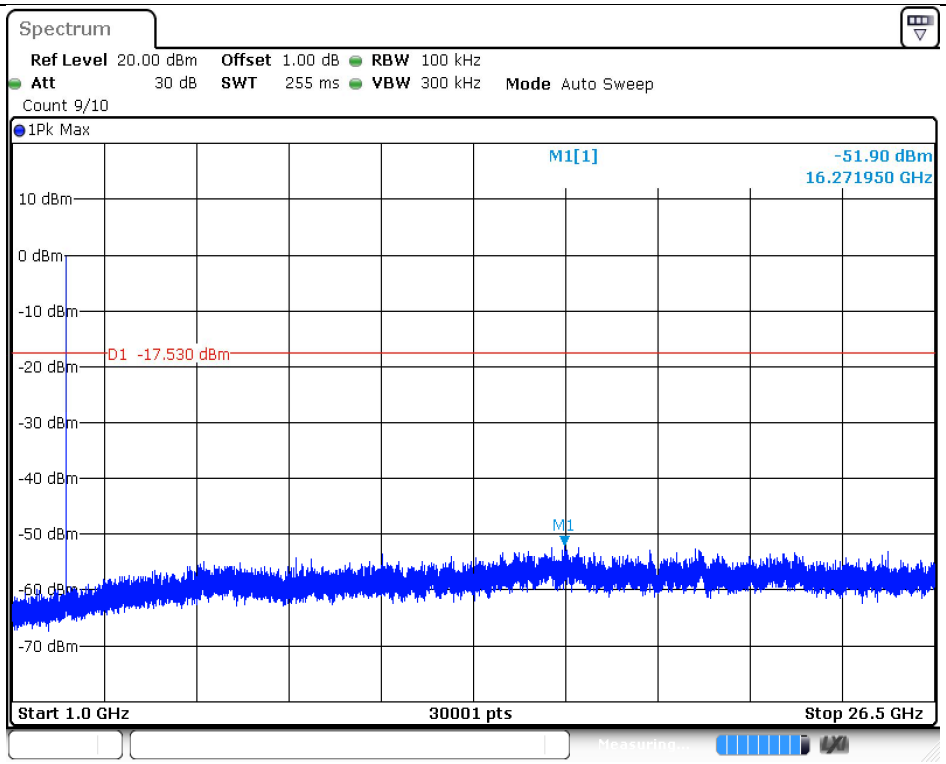

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9.8 Band edge testing

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 continuously. Set the EUT to the lowest frequency channel.
3. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector, Trace: Max hold, Sweep time: Coupled, Span: Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation. Allow the trace to stabilize.
4. Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.
5. Set the EUT to the highest frequency channel and repeat step 2) to 4)
6. Enable the EUT hopping mode, repeat the test.

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.

Result

TestMode	Antenna	ChName	Channel (MHz)	Reference Level (dBm)	Result (dBm)	Limit (dBm)	Verdict
DH5	Ant1	Low	2402	3.00	-29.46	<=-17	PASS
		High	2480	3.66	-43.09	<=-16.34	PASS
		Low	Hop_2402	3.04	-48.54	-16.96	PASS
		High	Hop_2480	3.94	-48.34	-16.06	PASS
2DH5	Ant1	Low	2402	2.90	-24.75	<=-17.1	PASS
		High	2480	3.72	-42.23	<=-16.28	PASS
		Low	Hop_2402	2.88	-48.75	-17.12	PASS
		High	Hop_2480	3.93	-47.18	-16.07	PASS
3DH5	Ant1	Low	2402	3.00	-24.79	<=-17	PASS
		High	2480	3.85	-42.11	<=-16.15	PASS
		Low	Hop_2402	2.77	-48.32	-17.23	PASS
		High	Hop_2480	4.08	-48.14	-15.92	PASS

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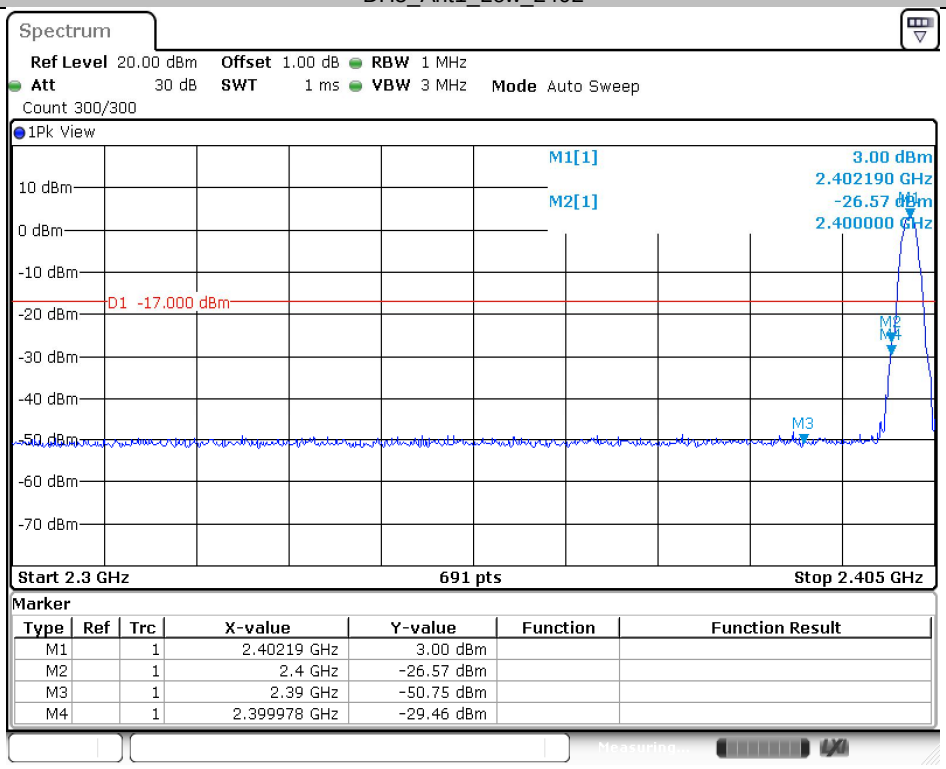
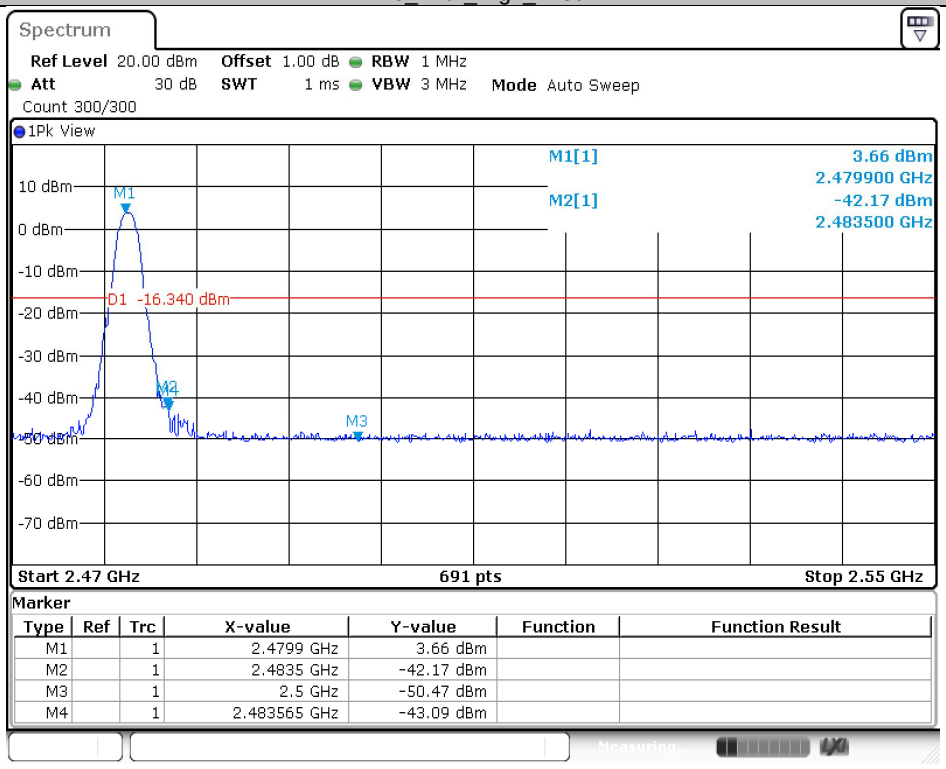
DH5_Ant1_Low_2402



Date: 18.OCT.2023 12:20:34

DH5_Ant1_High_2480



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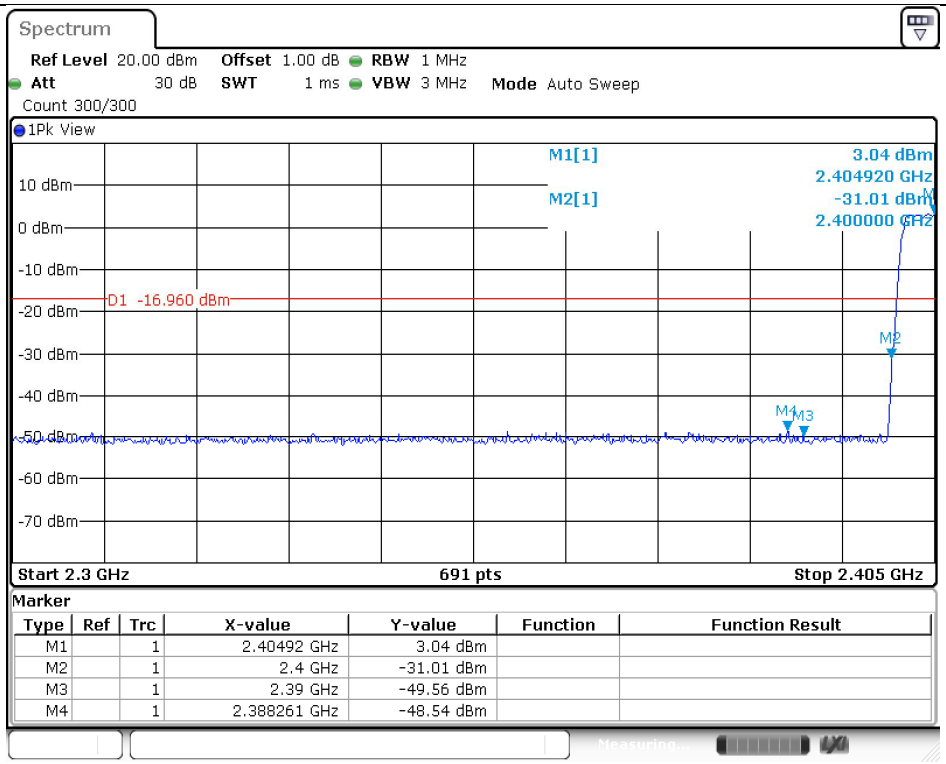
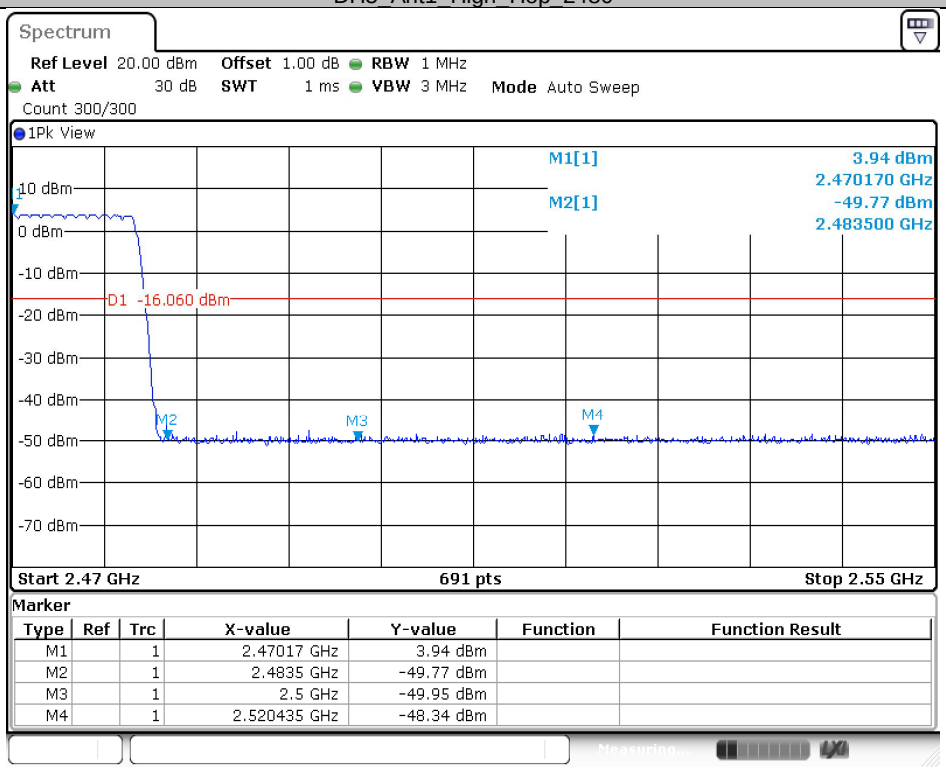
DH5_Ant1_Low_Hop_2402



DH5_Ant1_High_Hop_2480



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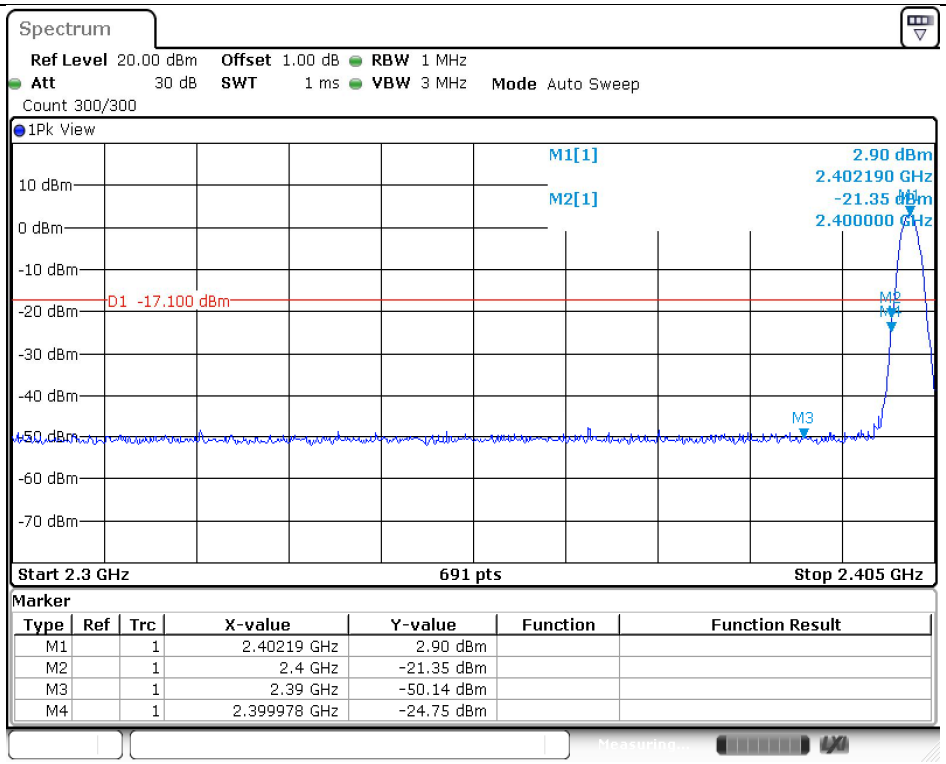

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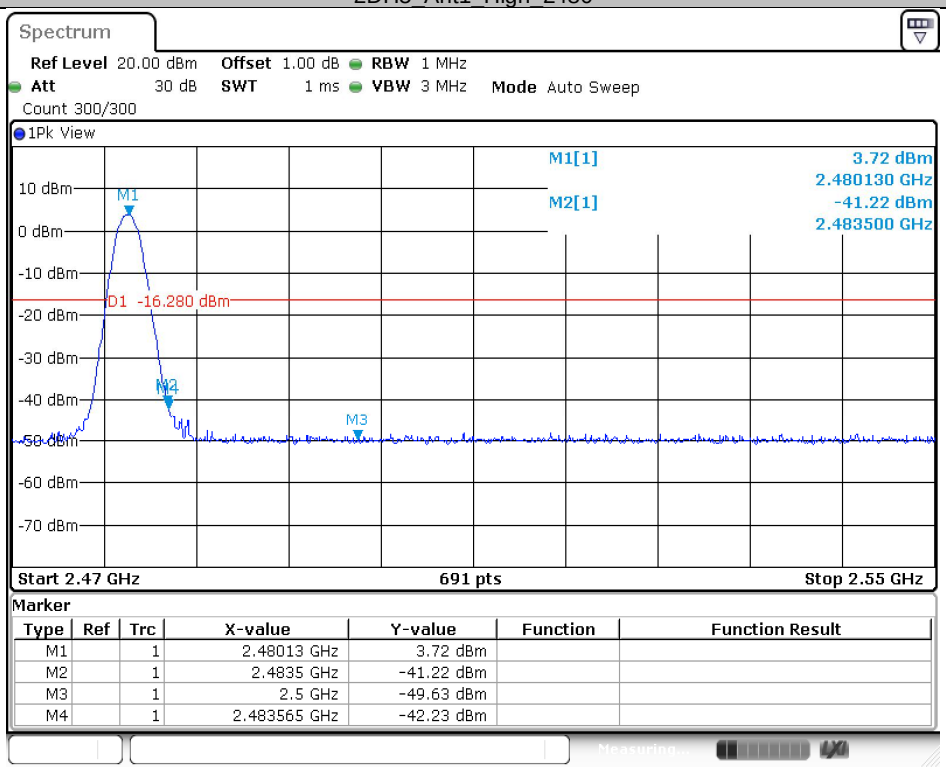

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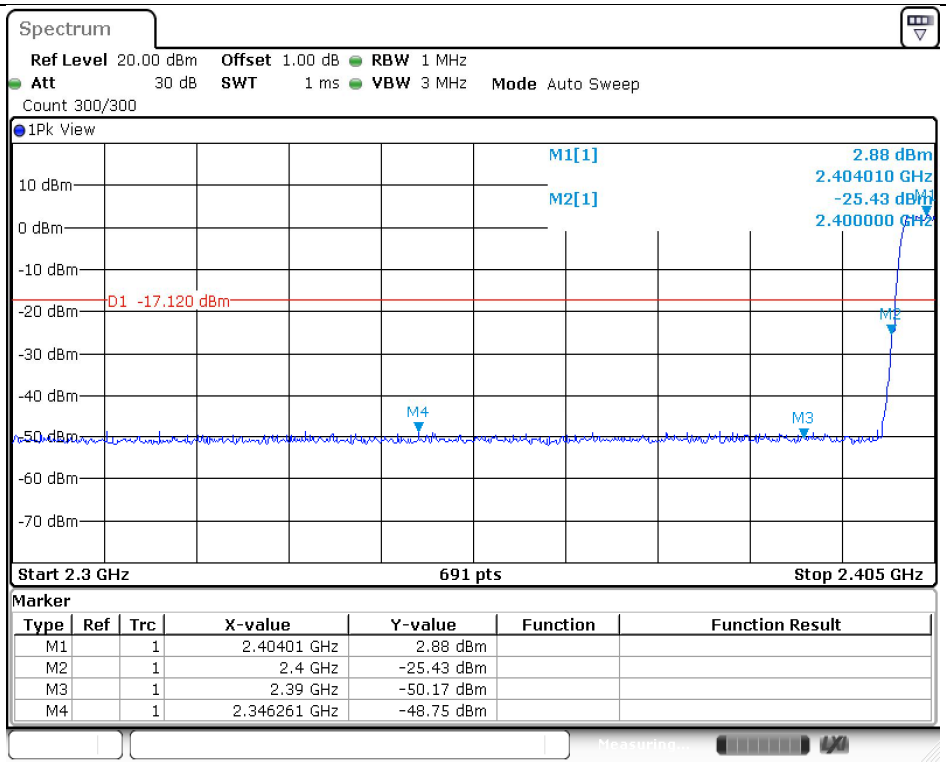

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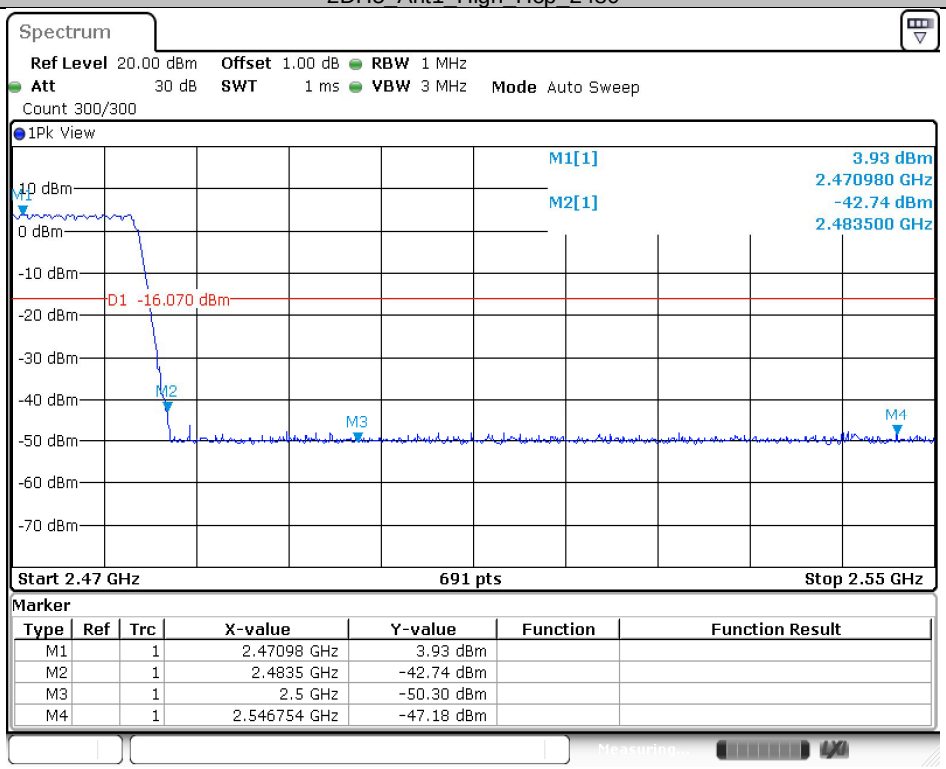

3DH5_Ant1_Low_2402

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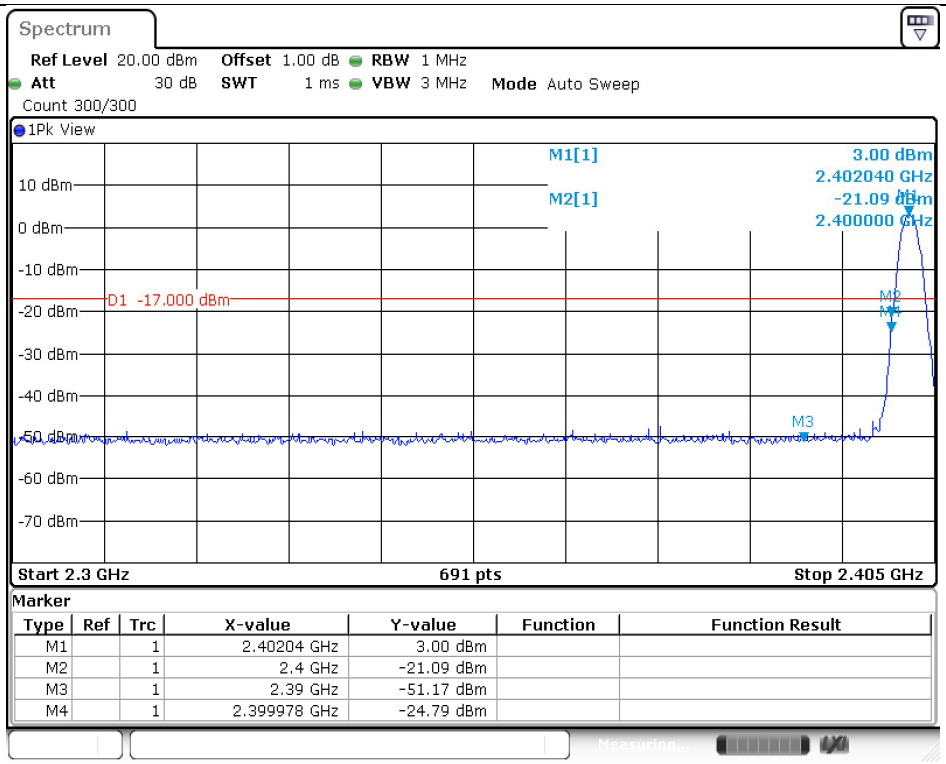

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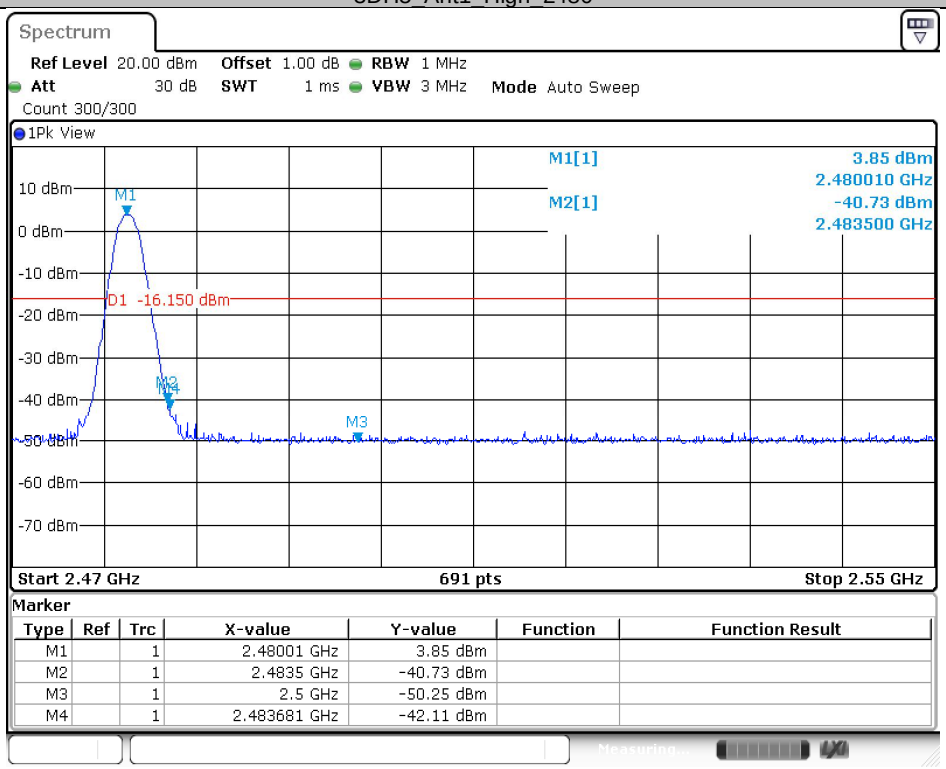

3DH5_Ant1_Low_Hop_2402

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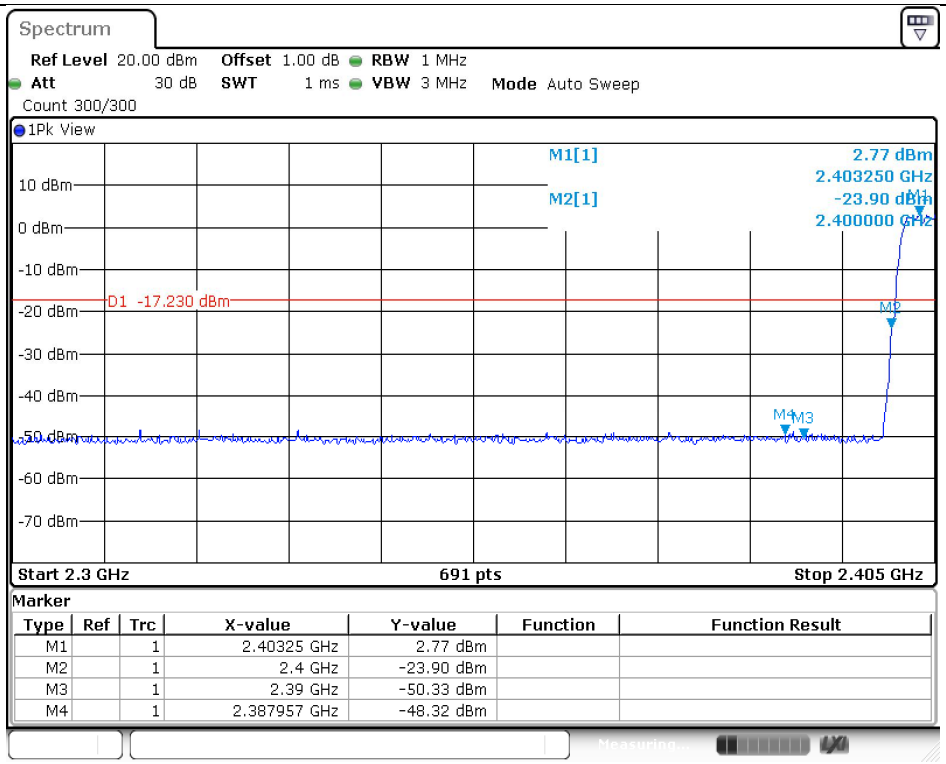

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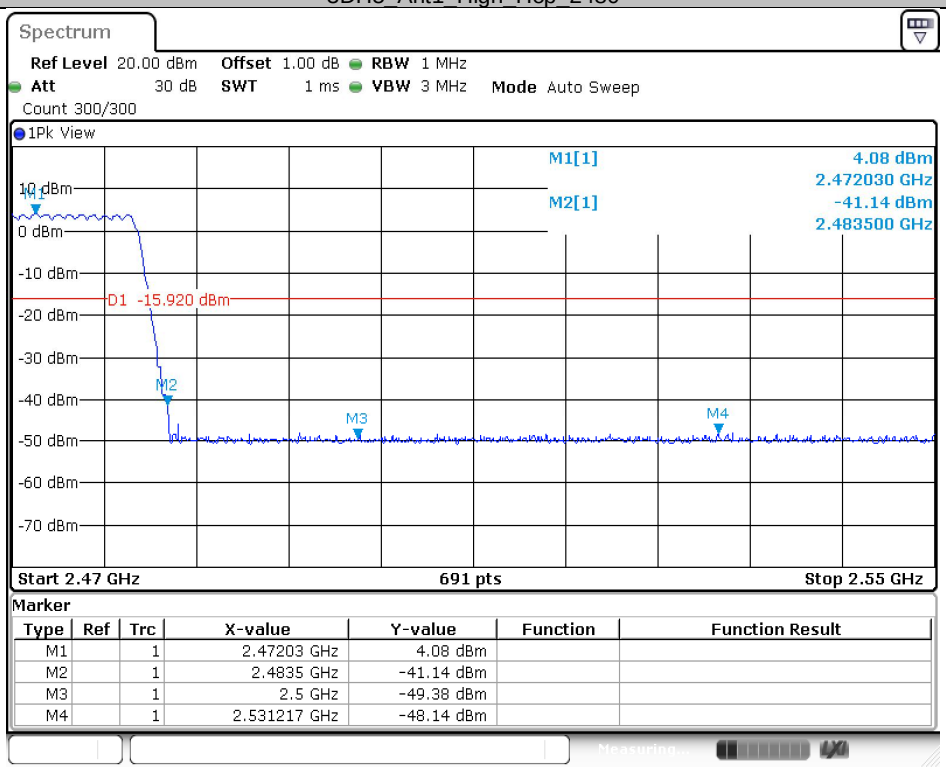

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9.9 Spurious radiated emissions for transmitter

Test Method

1. The EUT was place on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meters chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
4. 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.
5. 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.
6. Use the following test receiver settings According to C63.10:
   (1) Span shall wide enough to fully capture the emission being measured;
   (2) Set RBW=100 kHz to 120KHz for f < 1 GHz; VBW≥ RBW; Sweep = auto; Detector function = QP; Trace = max hold;
   (3) Set RBW = 1 MHz, VBW= 3MHz for f ≥1 GHz for peak measurement.
   For average measurement:
   The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle)).
   The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
7. Repeat above procedures until all frequencies measured were complete.

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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.

Frequency MHz	Field Strength μV/m	Field Strength dBμV/m	Detector	Measurement distance meters
0.009-0.490	2400/F(kHz)	48.5-13.8	AV	300
0.490-1.705	24000/F(kHz)	33.8-23.0	QP	30
1.705-30	30	29.5	QP	30
30-88	100	40	QP	3
88-216	150	43.5	QP	3
216-960	200	46	QP	3
960-1000	500	54	QP	3
Above 1000	500	54	AV	3
Above 1000	5000	74	PK	3

Note 1: Limit 3m(dBμV/m)=Limit 300m(dBμV/m)+40Log(300m/3m) (Below 30MHz)
Note 2: Limit 3m(dBμV/m)=Limit 30m(dBμV/m)+40Log(30m/3m) (Below 30MHz)

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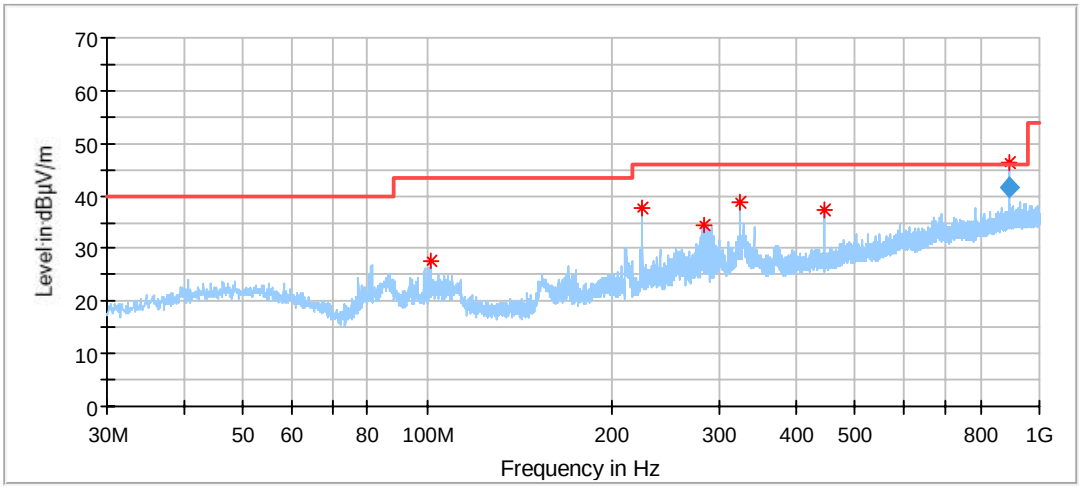
Spurious radiated emissions for transmitter

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

Transmitting spurious emission test result as below:

Below 1G:



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
101.672222	27.47	43.50	16.03	100.0	H	179.0	16.09
224.970000	37.84	46.00	8.16	100.0	H	260.0	16.45
283.385556	34.48	46.00	11.52	100.0	H	179.0	18.13
324.987778	38.72	46.00	7.28	100.0	H	260.0	19.36
445.052222	37.46	46.00	8.54	100.0	H	66.0	22.06
890.120556	46.18	46.00	-0.18	200.0	H	8.0	29.26

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
890.120556	41.80	46.00	4.20	200.0	H	8.0	29.26

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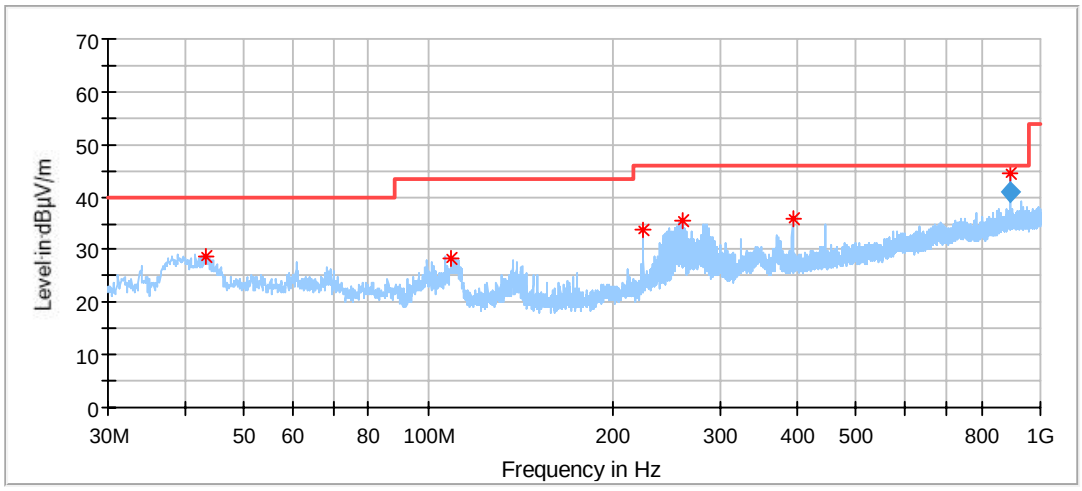


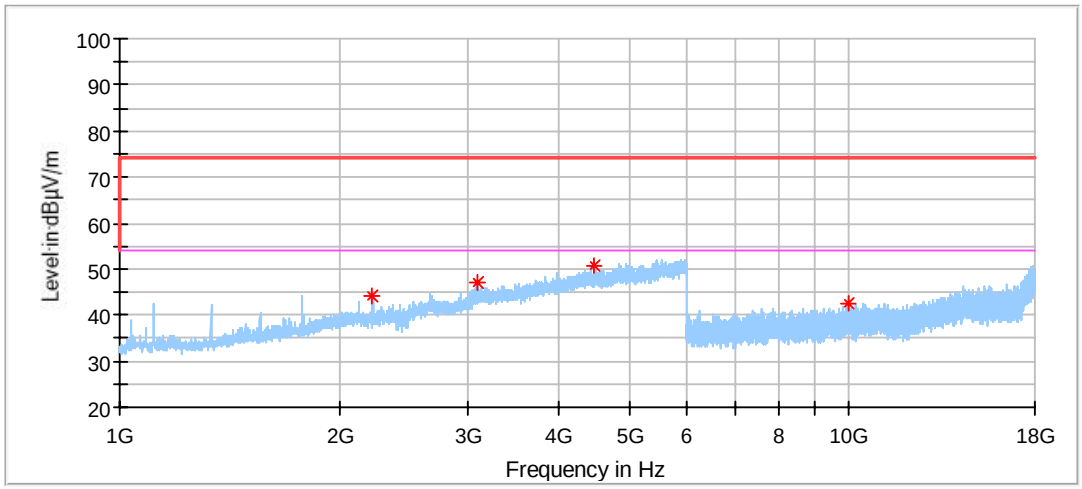
Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
43.364444	28.89	40.00	11.11	100.0	V	0.0	17.86
109.055000	28.52	43.50	14.98	100.0	V	261.0	15.63
224.970000	33.87	46.00	12.13	100.0	V	0.0	16.45
260.536667	35.51	46.00	10.49	200.0	V	164.0	18.04
393.965556	35.79	46.00	10.21	100.0	V	5.0	21.19
890.120556	44.34	46.00	1.66	200.0	V	0.0	29.26

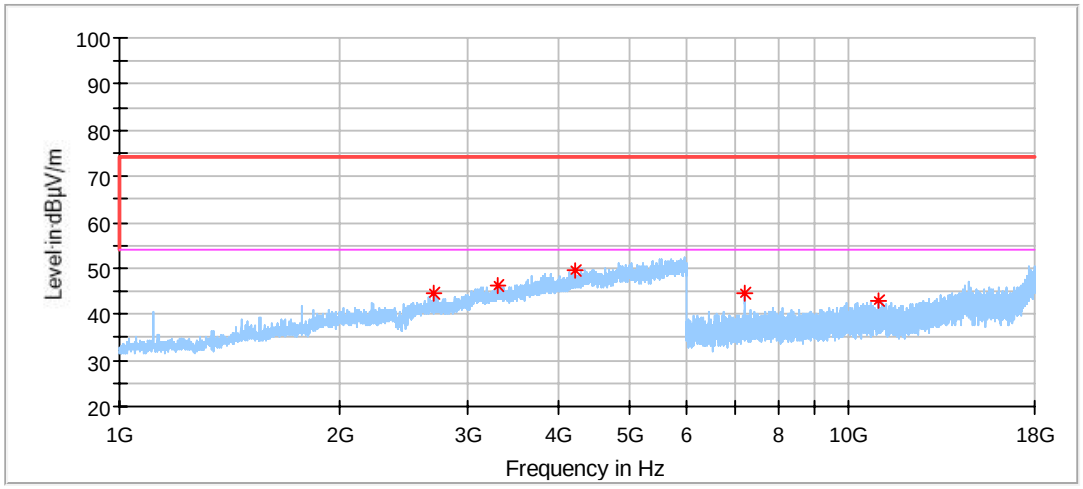
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
890.120556	41.10	46.00	4.90	200.0	V	0.0	29.26

Low channel 2402MHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2225.000000*	44.28	74.00	29.72	150.0	H	23.0	-5.63
3103.000000	46.93	74.00	27.07	150.0	H	34.0	-0.35
4466.500000	50.81	74.00	23.19	150.0	H	116.0	4.36
10010.500000	42.67	74.00	31.33	150.0	H	204.0	11.41



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2692.500000*	44.65	74.00	29.35	150.0	V	344.0	-3.07
3296.000000	46.45	74.00	27.55	150.0	V	251.0	-0.13
4209.000000	49.56	74.00	24.44	150.0	V	105.0	3.57
7206.500000	44.41	74.00	29.59	150.0	V	96.0	7.97
10959.500000*	42.84	74.00	31.16	150.0	V	332.0	12.10

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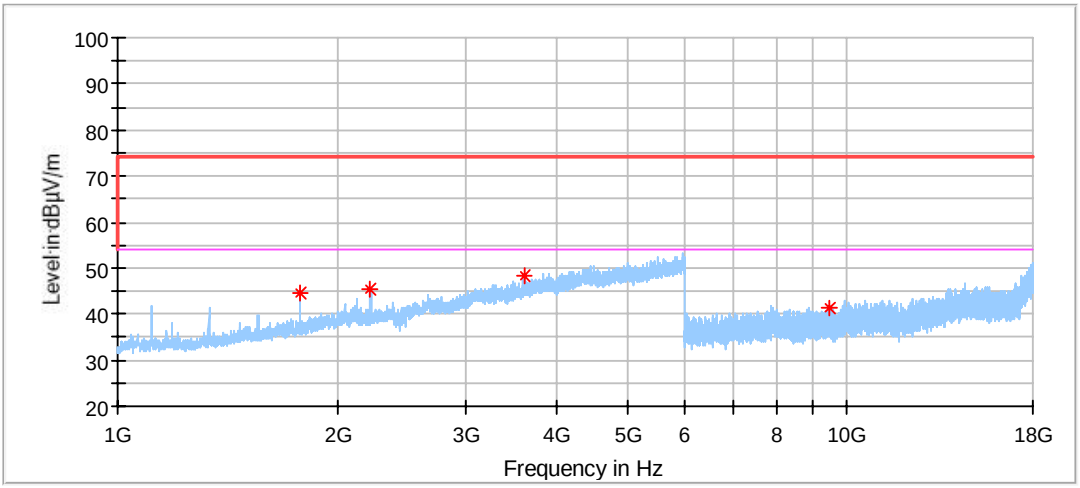
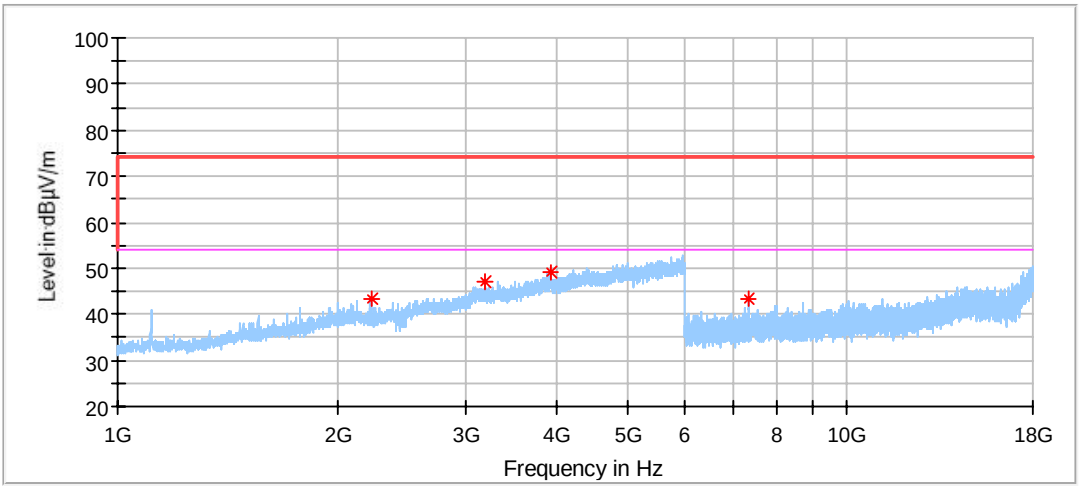
Middle channel 2441MHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1780.000000	44.50	74.00	29.50	150.0	H	321.0	-8.02
2225.000000*	45.50	74.00	28.50	150.0	H	280.0	-5.63
3607.500000*	48.19	74.00	25.81	150.0	H	136.0	1.16
9475.500000*	41.25	74.00	32.75	150.0	H	120.0	10.97



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2225.500000*	43.47	74.00	30.53	150.0	V	358.0	-5.63
3198.000000	47.22	74.00	26.78	150.0	V	353.0	-0.42
3916.500000	49.19	74.00	24.81	150.0	V	220.0	2.95
7320.500000*	43.56	74.00	30.44	150.0	V	96.0	7.96

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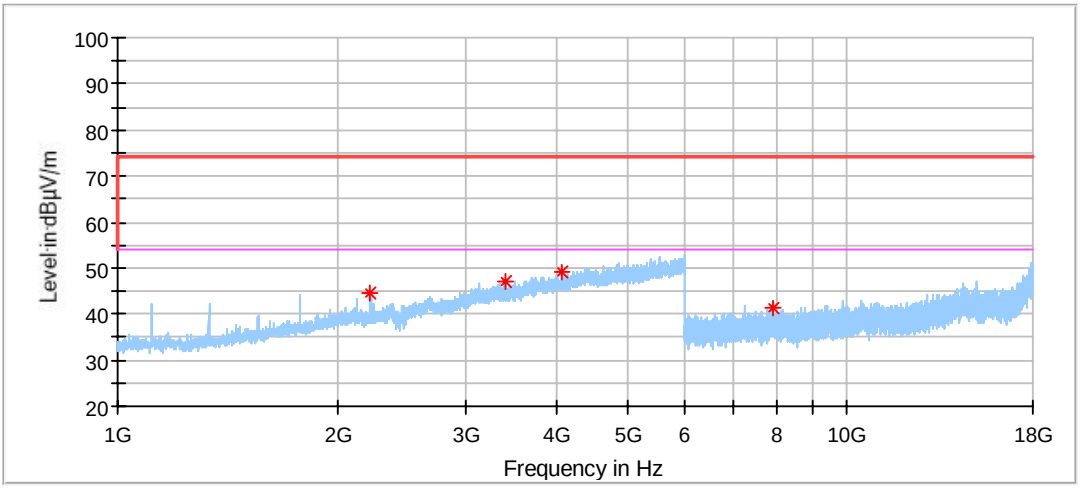
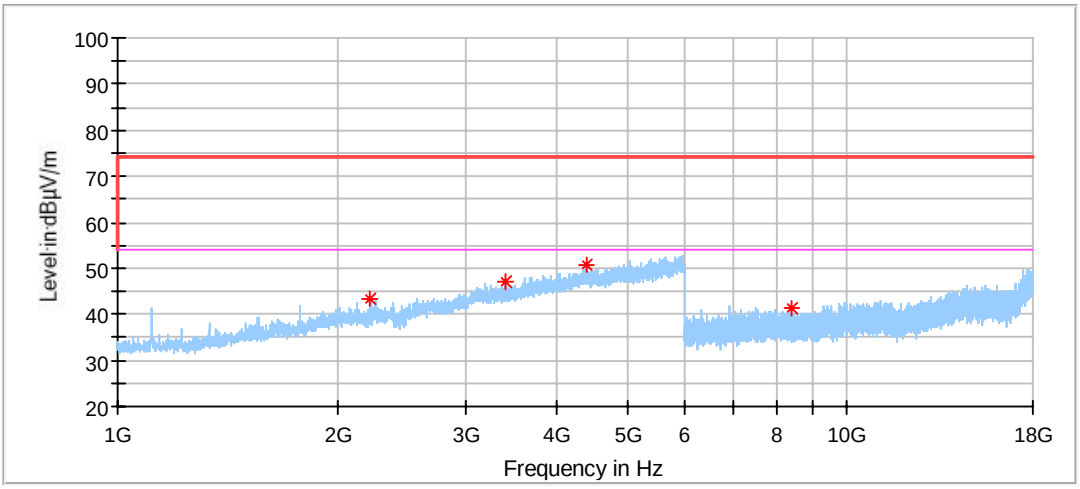
High channel 2480MHz



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2225.000000*	44.75	74.00	29.25	150.0	H	64.0	-5.63
3401.000000	47.10	74.00	26.90	150.0	H	4.0	0.16
4062.000000*	49.14	74.00	24.86	150.0	H	358.0	2.87
7900.000000	41.28	74.00	32.72	150.0	H	57.0	8.98



Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2225.000000*	43.27	74.00	30.73	150.0	V	0.0	-5.63
3396.000000	47.23	74.00	26.77	150.0	V	231.0	0.17
4407.000000	50.97	74.00	23.03	150.0	V	128.0	4.42
8386.500000*	41.40	74.00	32.60	150.0	V	183.0	9.46

Remark:
(1) "*" means the emission(s) appear within the restrict bands shall follow the requirement 15.205.
(2) Data of measurement within frequency range 9kHz-30MHz, 18-26GHz 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.
(3) The report only shows the worst test data.
(4) Corrected Amplitude = Read level + Corrector factor
Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain
Below 1GHz: Corrector factor = Antenna Factor + Cable Loss
(The Reading Level is recorded by software which is not shown in the sheet)

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10 Test Equipment List

Radiated Emission Test(9K – 30MHz)

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	2024-5-20
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9163	68-4-80-14-002	707	1	2024-7-18
Loop Antenna	Rohde & Schwarz	HFH2-Z2	68-4-80-14-006	100398	1	2024-5-28
Pre-amplifier	Rohde & Schwarz	SCU 18	68-4-29-14-001	102230	1	2024-8-7
Attenuator	Mini-circuits	UNAT-6+	68-4-81-21-002	15542	1	2024-5-19
3m Semi-anechoic chamber	TDK	SAC-3 #2	68-4-90-19-006	----	2	2024-5-19
Test software	Rohde & Schwarz	EMC32	68-4-90-19-006-A01	Version10.35.02	N/A	N/A

Radiated Emission 2# Test(30MHz – 40GHz)

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	2024-5-20
Wave Guide Antenna	ETS	3117	68-4-80-19-001	00218954	1	2024-3-5
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-001	100745	1	2024-4-26
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-002	100746	1	2024-5-19
Sideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	68-4-80-14-008	12827	1	2024-5-19
Pre-amplifier	Rohde & Schwarz	SCU 40A	68-4-29-14-002	100432	1	2024-7-11
Attenuator	Mini-circuits	UNAT-6+	68-4-81-21-002	15542	1	2024-8-1
3m Semi-anechoic chamber	TDK	SAC-3 #2	68-4-90-19-006	----	2	2024-5-19
Test software	Rohde & Schwarz	EMC32	68-4-90-19-006-A01	Version10.35.02	N/A	N/A

Conducted Emission 2# 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	2024-5-19
LISN	Rohde & Schwarz	ENV216	68-4-87-19-001	102472	1	2024-5-20
Attenuator	Shanghai Huaxiang	TS2-26-3	68-4-81-16-003	080928189	1	2024-5-19
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	----	3	2025-10-15

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Conducted RF Test System

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	2024-5-19
Test software	Tonscend	System for BT/WIFI	68-4-74-14-006-A13	Version 2.6.77.0518	N/A	N/A
Shielding Room	TDK	TS8997	68-4-90-19-003	----	3	2025-10-15

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11 System Measurement Uncertainty

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

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Conducted Emission 150kHz-30MHz (for test using AMN ENV432)	3.15dB
Uncertainty for Radiated Spurious Emission 9kHz-30MHz	4.70dB
Uncertainty for Radiated Spurious Emission 30MHz-1000MHz	Horizontal: 4.79dB; Vertical: 4.79dB;
Uncertainty for Radiated Spurious Emission 1000MHz-18000MHz	5.11dB;
Uncertainty for Radiated Spurious Emission 18000MHz-40000MHz	5.10dB;
Uncertainty for Conducted RF test with TS 8997	RF Power Conducted: 1.31dB Frequency test involved: 0.6×10^{-8} or 1%

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2021, clause 4.4.3 and 4.5.1.

---THE END OF REPORT---

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