FCC CERTIFICATION TEST REPORT

Applicant	:	Velodyne Acoustics GmbH
Address of Applicant	:	Alsterkrugchaussee 435 22335 Hamburg GERMAN
Manufacturer	:	Integrity Electronic Co. Ltd.
Address of Manufacturer	:	No. 68, Huang He Road, Feng Huang Gang, Tang Xia Town, Dong Guan City, Guangdong Province
Equipment under Test	:	subwoofer
Model No.	:	MiniVee X, VASUB8.2
FCC ID	:	2BESN-MINIVEEX
Test Standard(s)	:	FCC Rules and Regulations Part 15 Subpart C, ANSI C63.10:2013
Report No.	:	DDT-RE23121117-3E01
Issue Date	:	2024/03/15
Issue By	:	Guangdong Dongdian Testing Service Co., Ltd.
Address of Laboratory	:	Unit 2, Building 1, No. 17, Zongbu 2nd Road, Songshan Lake Park, Dongguan, Guangdong, China, 523808

REPORT

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Test Report Declare

Applicant	:	Velodyne Acoustics GmbH
Address of Applicant	:	Alsterkrugchaussee 435 22335 Hamburg GERMAN
Equipment under Test	:	subwoofer
Model No.	:	MiniVee X, VASUB8.2
Manufacturer	:	Integrity Electronic Co. Ltd.
Address of Manufacturer	:	No. 68, Huang He Road, Feng Huang Gang, Tang Xia Town, Dong Guan City, Guangdong Province

Test Standard Used:
FCC Rules and Regulations Part 15 Subpart C

Test Procedure Used:
ANSI C63.10:2013

We Declare:
The equipment described above is tested by Guangdong Dongdian Testing Service Co., Ltd. and in the configuration tested the equipment complied with the standards specified above. The test results are contained in this test report and Guangdong Dongdian Testing Service Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

After test and evaluation, our opinion is that the equipment provided for test compliance with the requirement of the above standards.

Report No.:	DDT-RE23121117-3E01		
Date of Receipt:	2023/12/29	**Date of Test:**	2023/12/29-2024/03/15

Prepared By: ***Approved By:***

Johnson Huang Damon Hu

Johnson Huang/Engineer ***Damon Hu/EMC Manager***

Note: This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Guangdong Dongdian Testing Service Co., Ltd.

Revision History

Rev.	Revisions	Issue Date	Revised By
---	Initial issue	2024/03/15	

1. Summary of Test Results

Description of Test Item	Standard	Result
Maximum Peak Output Power	FCC Part 15: 15.247(b)(1)	Pass
20 dB Bandwidth	FCC Part 15: 15.247(a)(1)	Pass
Carrier Frequency Separation	FCC Part 15: 15.247(a)(1)	Pass
Number of Hopping Channel	FCC Part 15: 15.247(a)(1)(iii)	Pass
Dwell Time	FCC Part 15: 15.247(a)(1)(iii)	Pass
RF Conducted Spurious Emissions	FCC Part 15: 15.247(d)	Pass
Radiated Emission	FCC Part 15: 15.205 FCC Part 15: 15.209 FCC Part 15: 15.247(d)	Pass
Band Edge Compliance	FCC Part 15: 15.205 FCC Part 15: 15.209 FCC Part 15: 15.247(d)	Pass
Power Line Conducted Emissions	FCC Part 15: 15.207(a)	Pass
Antenna Requirement	FCC Part 15: 15.203	Pass

2. General Test Information

2.1. Description of EUT

EUT Name	:	subwoofer
Model Number	:	MiniVee X, VASUB8.2
EUT Function Description	:	Please reference user manual of this device
Difference of models	:	Above models are identical in schematic and structure, only the appearance is different, therefore the test performed on the model VASUB8.2.
Power Supply	:	AC 100-240V, 50/60Hz
Radio Specification	:	Bluetooth (BR/EDR/LE)
Operation Frequency	:	Bluetooth (BR/EDR/LE): 2402 MHz-2480 MHz
Modulation	:	Bluetooth BR/EDR: GFSK, π/4-DQPSK, 8DPSK Bluetooth LE: GFSK

Note 1: "⊠" means to be chosen or applicable; "□" means don't to be chosen or not applicable; This note applies to entire report.

Note 2: This report only for Bluetooth BR/EDR.

Note 3: Antenna information:

Bluetooth Antenna information		
Antenna Type	:	PCB
Antenna Gain(dBi)	:	2.81

Note 4: Channel information:

Bluetooth BR/EDR Channel information					
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	27	2429	54	2456
1	2403	28	2430	55	2457
2	2404	29	2431	56	2458
3	2405	30	2432	57	2459
4	2406	31	2433	58	2460
5	2407	32	2434	59	2461
6	2408	33	2435	60	2462
7	2409	34	2436	61	2463
8	2410	35	2437	62	2464
9	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470

15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454		
26	2428	53	2455		

Note 5: The above EUT information is declared by manufacturer and for more detailed features description please refer to the manufacturer's specifications or User's Manual. The above Antenna information is declared by manufacturer and for more detailed features description please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

2.2. Accessories of EUT

Description of Accessories	Manufacturer	Model number	Description	Remark
N/A	N/A	N/A	N/A	N/A

2.3. Assistant equipment used for test

Assistant equipment	Manufacturer	Model number	EMC Compliance	SN
NoteBook	Lenovo	i5-3230M	N/A	MM-202201270935

2.4. Block diagram of EUT configuration for test

AC mains —— [EUT]

Test software: FrequencyTool_v0.3.2

The test software was used to control EUT work in Continuous Tx mode, and select test channel, wireless mode as below table.

The pathloss of external cable: 0.5 dB (According to the manufacturer's claims)

Tested mode, channel, information			
Mode	Setting Tx Power	Channel	Frequency (MHz)
GFSK hopping on Tx mode	-4	CH0 to CH78	2402 to 2480
π/4-DQPSK hopping on Tx mode	-4	CH0 to CH78	2402 to 2480
8DPSK hopping on Tx mode	-4	CH0 to CH78	2402 to 2480
GFSK hopping off Tx mode	-4	CH0	2402
	-4	CH39	2441
	-4	CH78	2480
π/4-DQPSK hopping off Tx mode	-4	CH0	2402
	-4	CH39	2441
	-4	CH78	2480
8DPSK hopping off Tx mode	-4	CH0	2402
	-4	CH39	2441
	-4	CH78	2480
Worst-case data rates were: GFSK mode: DH5, π/4-DQPSK mode: 2DH5, 8DPSK mode: 3DH5			

2.5. Deviations of test standard

No deviation.

2.6. Test environment conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature range:	+15℃ to +35 ℃
Humidity range:	20% to 75%
Pressure range:	86 kPa to106 kPa

Note: The specific temperature and humidity information of each test item refers to the temperature and humidity record in the corresponding test data.

2.7. Test laboratory

Guangdong Dongdian Testing Service Co., Ltd.

Add.: Unit 2, Building 1, No. 17, Zongbu 2nd Road, Songshan Lake Park, Dongguan, Guangdong, China, 523808

Tel.: +86-0769-38826678, http://www.dgddt.com, Email: ddt@dgddt.com.

CNAS Accreditation No. L6451; A2LA Accreditation Number: 3870.01

FCC Designation Number: CN1182, Test Firm Registration Number: 540522

Innovation, Science and Economic Development Canada Site Registration Number: 10288A

Conformity Assessment Body identifier: CN0048

VCCI facility registration number: C-20087, T-20088, R-20123, R-20155, G-20118

2.8. Measurement uncertainty

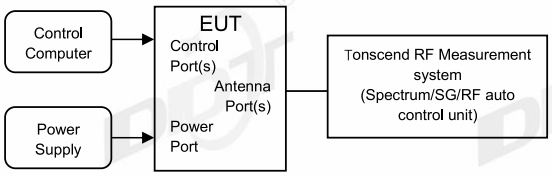
Test Item	Uncertainty
Bandwidth	1.1%
Peak Output Power (Conducted) (Spectrum analyzer)	0.86 dB (10 MHz ≤ f < 3.6 GHz);
	1.38 dB (3.6 GHz ≤ f < 8 GHz)
Peak Output Power (Conducted) (Power Sensor)	0.74 dB
Power Spectral Density	0.74 dB (10 MHz ≤ f < 3.6 GHz);
	1.38 dB (3.6 GHz ≤ f < 8 GHz)
Frequencies Stability	6.7 x 10^{-8} (Antenna couple method)
	5.5 x 10^{-8} (Conducted method)
Conducted spurious emissions	0.86 dB (10 MHz ≤ f < 3.6 GHz);
	1.40 dB (3.6 GHz ≤ f < 8 GHz)
	1.66 dB (8 GHz ≤ f < 26.5 GHz)
Uncertainty for radio frequency (RBW < 20 kHz)	3×10^{-8}
Temperature	0.4 ℃
Humidity	2 %
Uncertainty for Radiation Emission test (9 kHz – 30 MHz)	3.44 dB
Uncertainty for Radiation Emission test (30 MHz - 1 GHz)	4.70 dB (Antenna Polarize: V)
	4.84 dB (Antenna Polarize: H)
Uncertainty for Radiation Emission test (1 GHz - 40 GHz)	4.10 dB (1 - 6 GHz)
	4.40 dB (6 GHz - 18 GHz)
	3.54 dB (18 GHz - 26 GHz)
	4.30 dB (26 GHz - 40 GHz)
Uncertainty for Power line conduction emission test	3.34dB (150KHz-30MHz)
	3.72dB (9KHz-150KHz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

3. Equipment Used During Conductive Test

Equipment	Manufacturer	Model No.	Serial Number	Due Date
☒RF Connected Test (RF Measurement System 3#)				
SIGNAL ANALYZER	R&S	FSV40	101407	2024/07/11
Wideband Radio Communication Tester	R&S	CMW500	117491	2024/04/26
EXG Analog Signal Generator	KEYSIGHT	N5173B	MY62153058	2024/07/11
MXG Vector Signal Generator	Agilent	N5182A	MY48180912	2024/04/22
RF Control Unit	Tonscend	JS0806-2	20C8060230	2024/04/26
TEMP&HUMI Programmable Chamber	ZHIXIANG	ZXGDJS-150L	ZX170110-A	2024/05/14
Test Software	Tonscend	JS1120-3	Ver.3.2.22	N/A

4. 20 dB Bandwidth

4.1. Block diagram of test setup



4.2. Limits

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in § 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

4.3. Test procedure

(1) The test according to ANSI C63.10-2013 clause 6.9.2.
(2) Connect EUT's antenna output to spectrum analyzer by RF cable, the path loss was compensated to the results
(3) Set the EUT as maximum power setting and enable the EUT transmit continuously
(4) Use the following spectrum analyzer settings for the 20 dB bandwidth measurement:

RBW:	1% to 5% of the OBW
VBW:	approximately three times RBW
Span:	between 2 times and 5 times the OBW
Detector Mode:	Peak
Sweep time:	Auto
Trace mode:	Max hold

(5) Measure and record the results in the report.

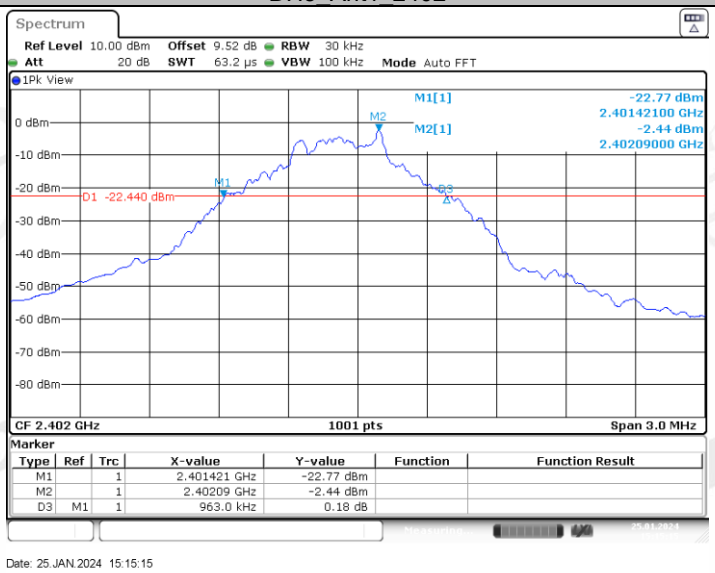
4.4. Test result

Test Engineer:	Haofeng	Test Site:	RF Measurement System 3#
Ambient Condition:	23.5℃,31.2%RH	Test Date:	2024.01.25
Test Power Supply:	AC240V/50Hz	EUT:	Subwoofer
Sample Number:	S23121117-02	Model No.:	VASUB8.2

Test Mode	Antenna	Frequency [MHz]	20dB EBW[MHz]
DH5	Ant1	2402	0.96
		2441	0.96
		2480	0.98
2DH5	Ant1	2402	1.31
		2441	1.31
		2480	1.31
3DH5	Ant1	2402	1.30
		2441	1.30
		2480	1.30

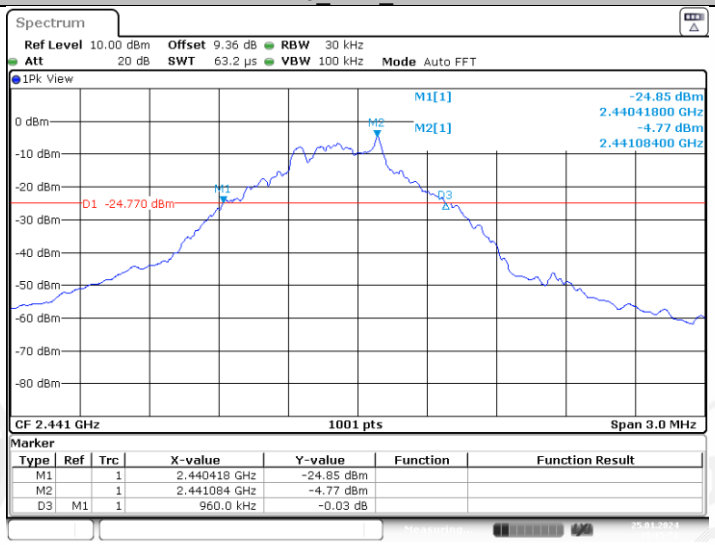
4.5. Test graphs

DH5_Ant1_2402



Date: 25.JAN.2024 15:15:15

DH5_Ant1_2441



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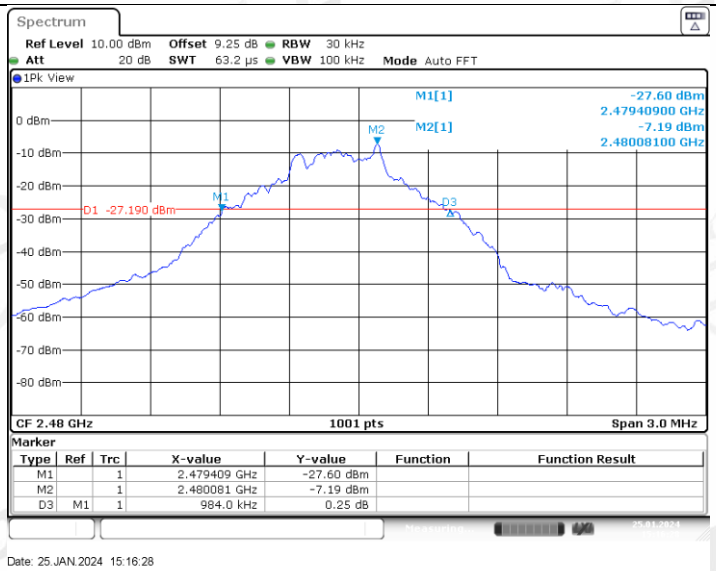
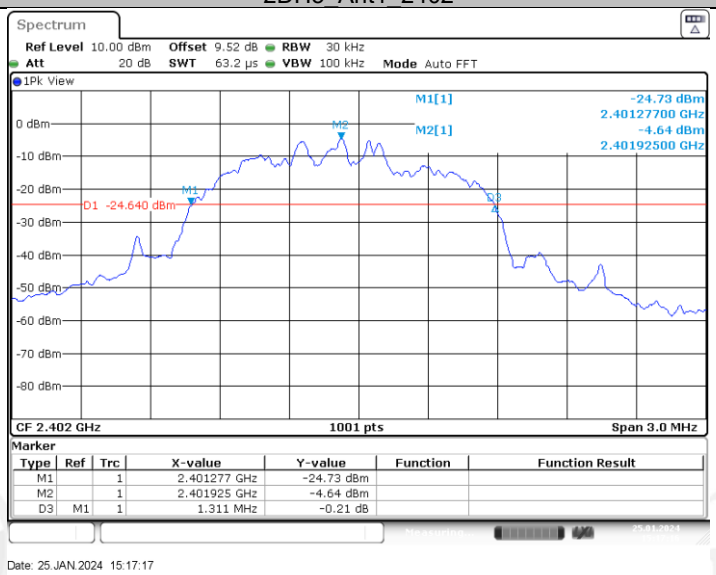


2DH5_Ant1_2402



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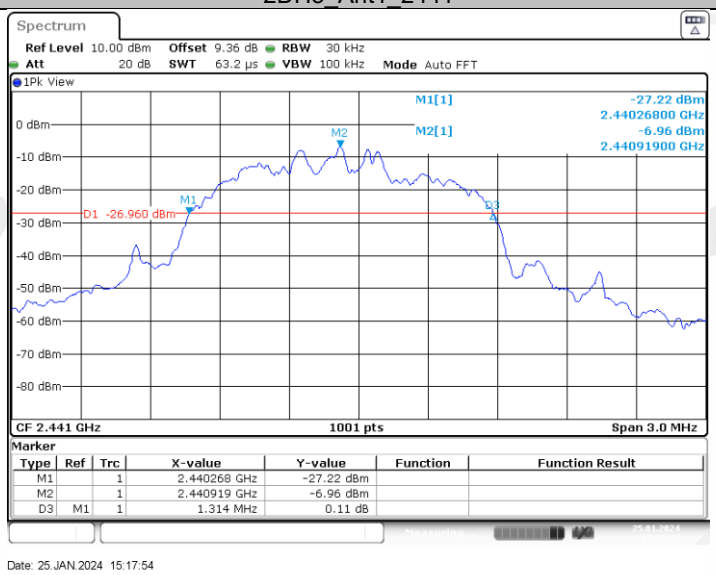

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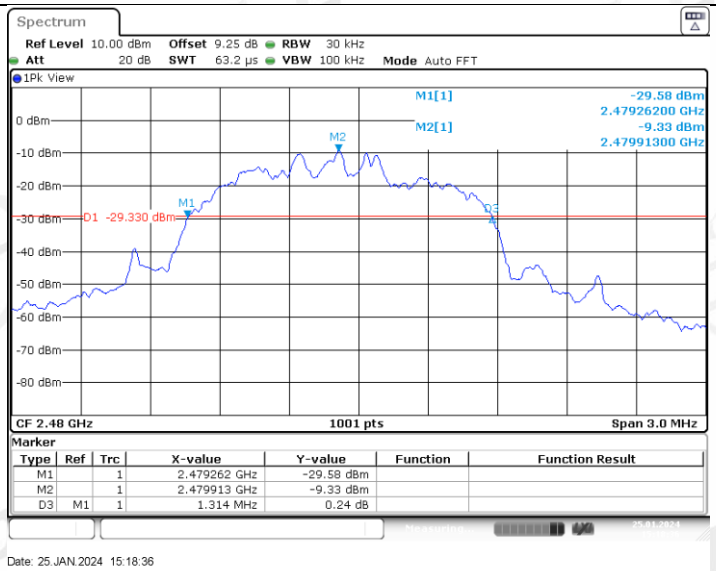

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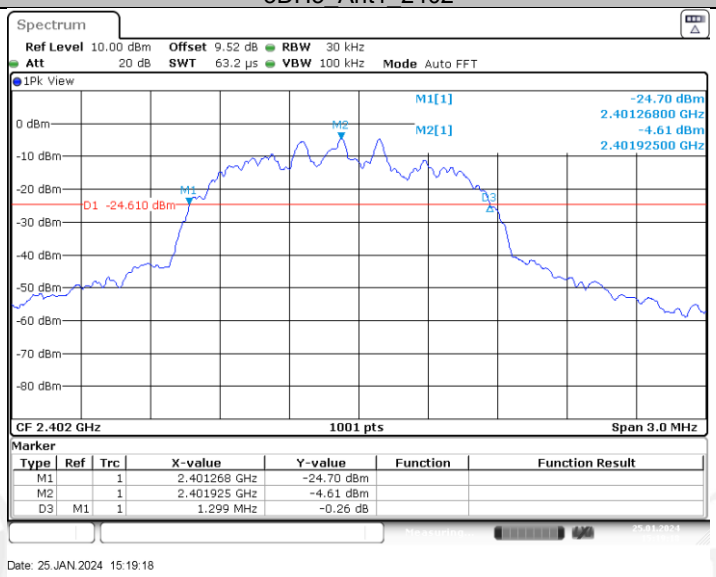

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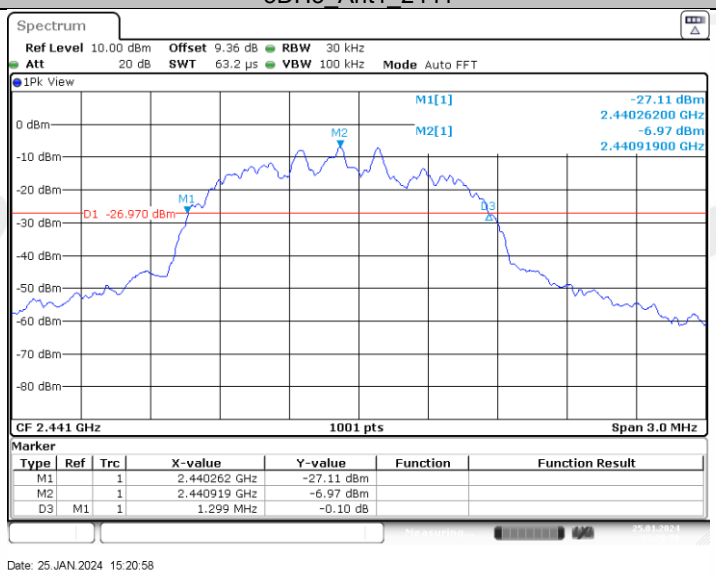

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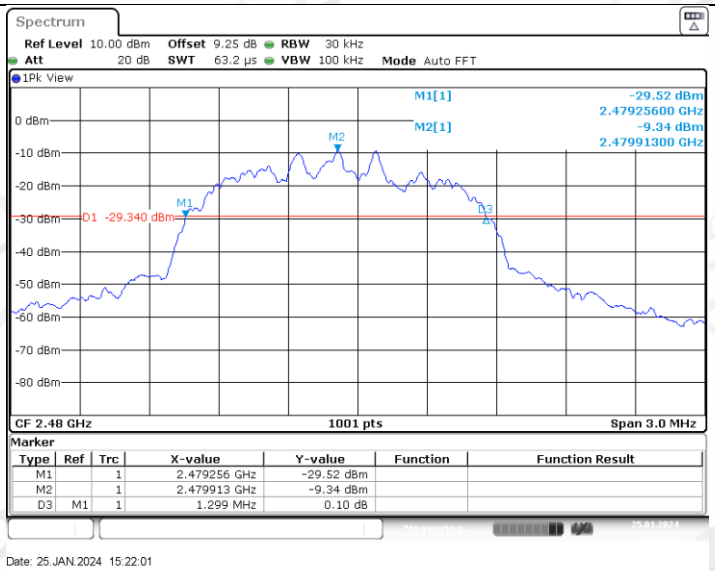
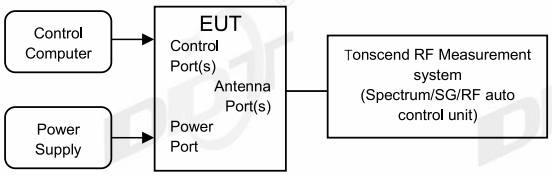

Spectrum
Ref Level 10.00 dBm Offset 9.25 dB RBW 30 kHz
Att 20 dB SWT 63.2 µs VBW 100 kHz Mode Auto FFT
1Pk View
M1[1] -29.52 dBm
2.47925600 GHz
M2[1] -9.34 dBm
2.47991300 GHz
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
D1 -29.340 dBm
M1
M2
D3
CF 2.48 GHz
1001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.479256 GHz -29.52 dBm
M2 1 2.479913 GHz -9.34 dBm
D3 M1 1 1.299 MHz 0.10 dB
Date: 25.JAN.2024 15:22:01

5. Maximum Peak Output Power

5.1. Block diagram of test setup



5.2. Limits

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts, the e.i.r.p shall not exceed 4W.

5.3. Test procedure

(1) The test according to ANSI C63.10-2013 clause 7.8.5.
(2) Connect EUT's antenna output to spectrum analyzer by RF cable, the path loss was compensated to the results.
(3) Set the EUT as maximum power setting and enable the EUT transmit continuously.
(4) Use the following spectrum analyzer settings for the maximum peak output power measurement:

RBW:	> 20 dB bandwidth of the emission being measured.
VBW:	VBW ≥ RBW.
Span:	Approximately five times the 20 dB bandwidth, centered on a hopping channel.
Detector Mode:	Peak
Sweep time:	Auto
Trace mode:	Max hold

(5) Use the marker-to-peak function to set the marker to the peak of the emission and record the results in the report.

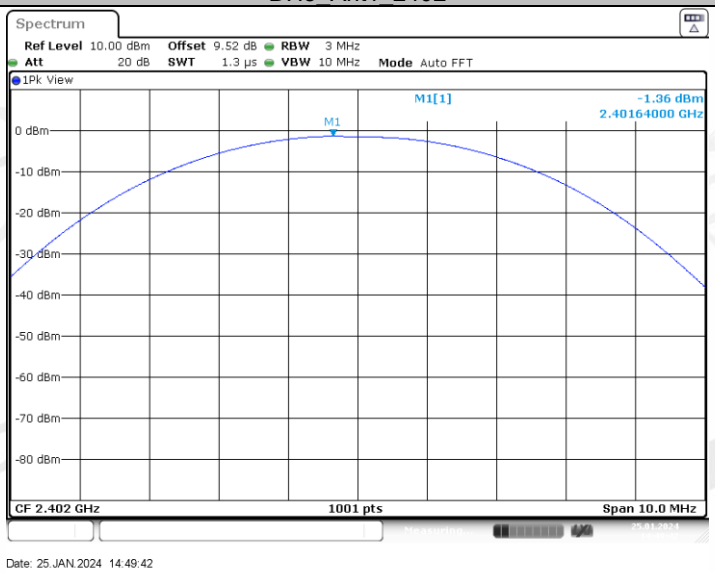
5.4. Test result

Test Engineer:	Haofeng	Test Site:	RF Measurement System 3#
Ambient Condition:	23.5℃,31.2%RH	Test Date:	2024.01.25
Test Power Supply:	AC240V/50Hz	EUT:	Subwoofer
Sample Number:	S23121117-02	Model No.:	VASUB8.2

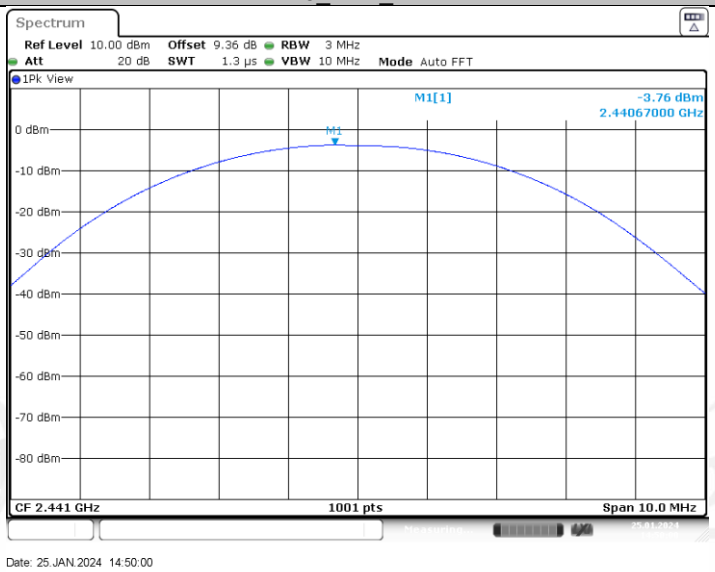
Test Mode	Antenna	Frequency [MHz]	Conducted Peak Power[dBm]	Conducted Limit[dBm]	EIRP[dBm]	EIRP Limit[dBm]	Verdict
DH5	Ant1	2402	-1.36	≤20.97	1.45	≤30	PASS
		2441	-3.76	≤20.97	-0.95	≤30	PASS
		2480	-6.21	≤20.97	-3.40	≤30	PASS
2DH5	Ant1	2402	-1.45	≤20.97	1.36	≤30	PASS
		2441	-3.87	≤20.97	-1.06	≤30	PASS
		2480	-6.21	≤20.97	-3.40	≤30	PASS
3DH5	Ant1	2402	-1.46	≤20.97	1.35	≤30	PASS
		2441	-3.82	≤20.97	-1.01	≤30	PASS
		2480	-6.33	≤20.97	-3.52	≤30	PASS

5.5. Test graphs

DH5_Ant1_2402



DH5_Ant1_2441



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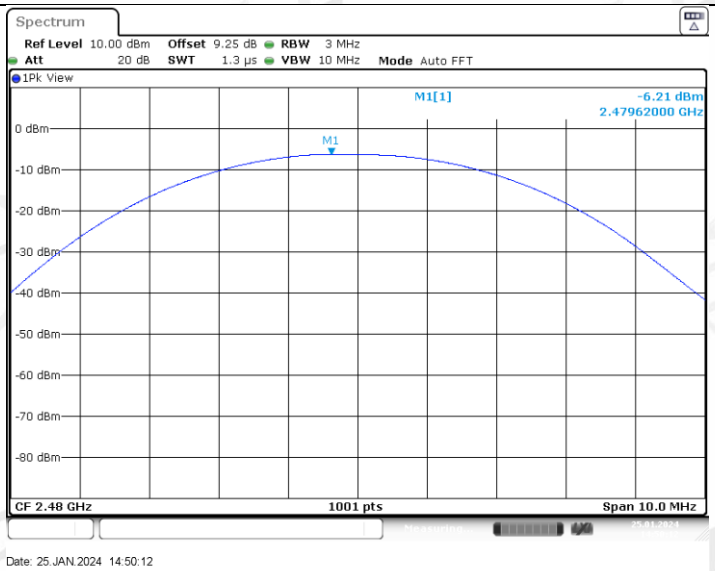

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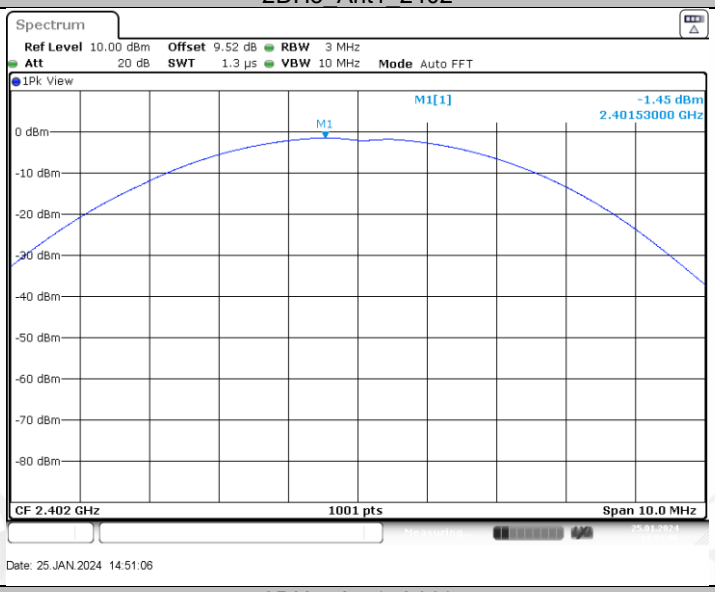

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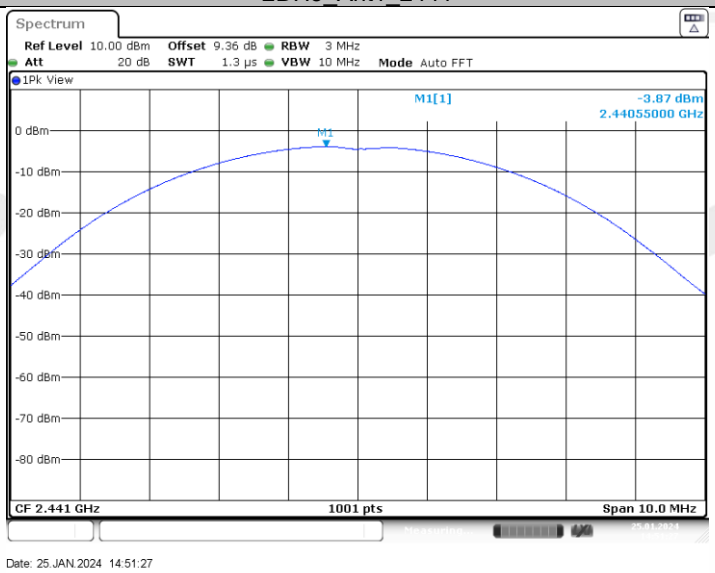
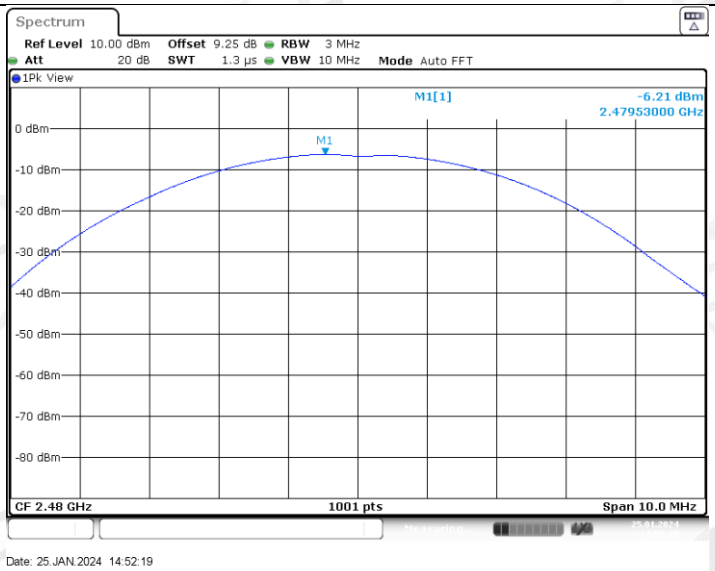
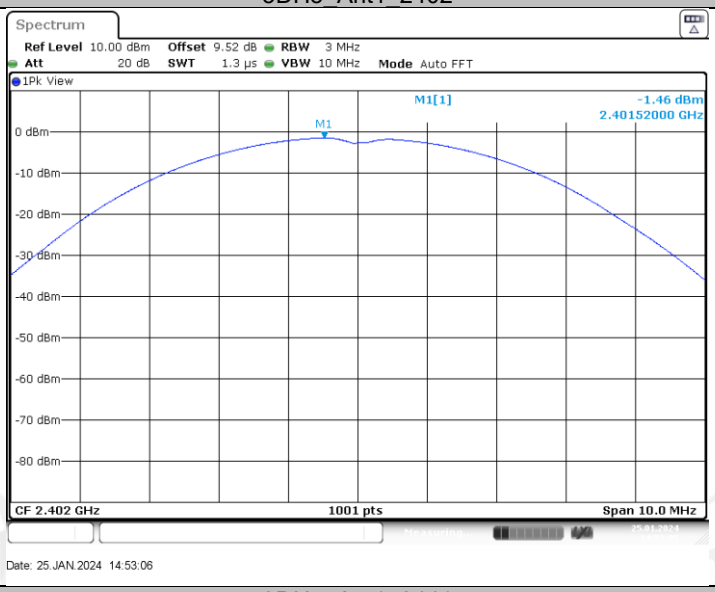


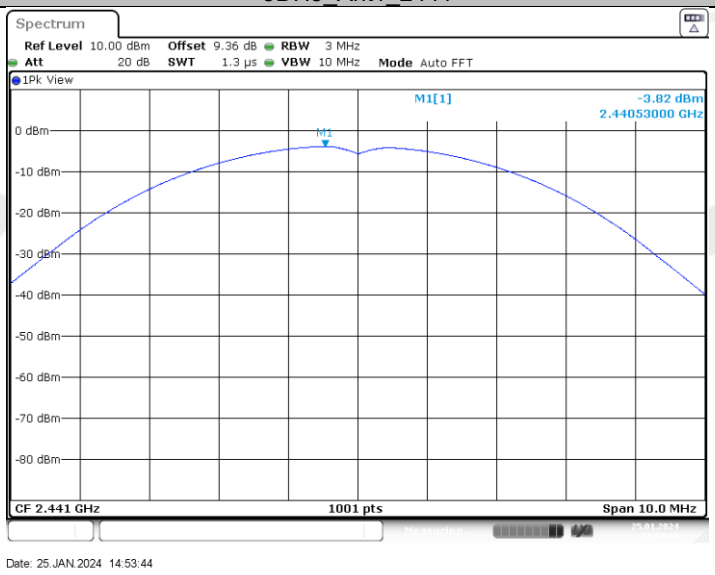
2DH5_Ant1_2480



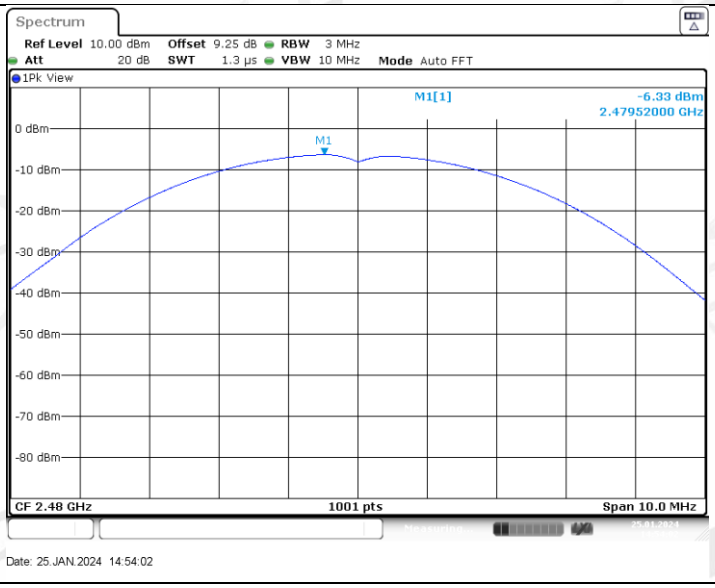
3DH5_Ant1_2402



3DH5_Ant1_2441

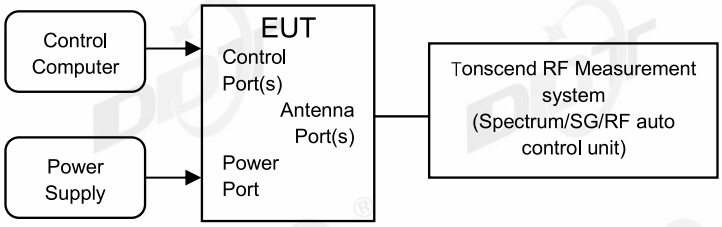


3DH5_Ant1_2480


Spectrum
Ref Level 10.00 dBm Offset 9.25 dB RBW 3 MHz
Att 20 dB SWT 1.3 µs VBW 10 MHz Mode Auto FFT
1Pk View
M1[1] -6.33 dBm
2.47952000 GHz
M1
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
CF 2.48 GHz
1001 pts
Span 10.0 MHz
Date: 25.JAN.2024 14:54:02

6. Carrier Frequency Separation

6.1. Block diagram of test setup



6.2. Limits

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

6.3. Test procedure

(1) The test according to ANSI C63.10-2013 clause 7.8.2.
(2) Connect EUT's antenna output to spectrum analyzer by RF cable, the path loss was compensated to the results.
(3) Set the EUT as maximum power setting and enable the EUT transmit continuously.
(4) Use the following spectrum analyzer settings for the maximum peak output power measurement:

RBW:	approximately 30% of the channel spacing
VBW:	VBW ≥ RBW.
Span:	Wide enough to capture the peaks of two adjacent channels.
Detector Mode:	Peak
Sweep time:	Auto
Trace mode:	Max hold

(5) Use the marker-delta function to determine the separation between the peaks of the adjacent channels and record the results in the report.

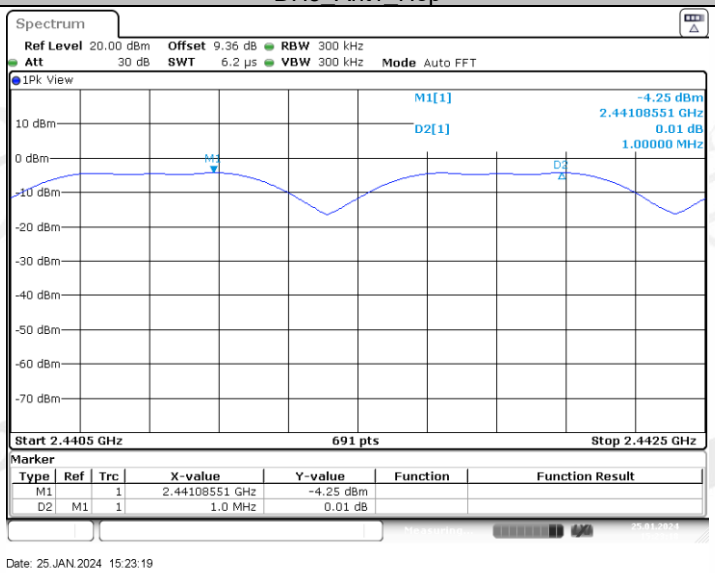
6.4. Test result

Test Engineer:	Haofeng	Test Site:	RF Measurement System 3#
Ambient Condition:	23.5℃,31.2%RH	Test Date:	2024.01.25
Test Power Supply:	AC240V/50Hz	EUT:	Subwoofer
Sample Number:	S23121117-02	Model No.:	VASUB8.2

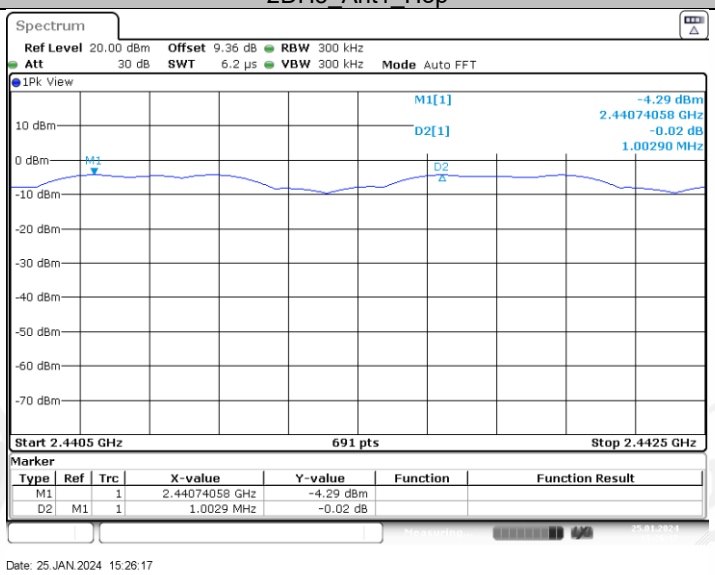
Test Mode	Antenna	Frequency [MHz]	Result [MHz]	Limit [MHz]	Verdict
DH5	Ant1	Hop	1	≥0.980	PASS
2DH5	Ant1	Hop	1.003	≥0.873	PASS
3DH5	Ant1	Hop	1.003	≥0.867	PASS

6.5. Test graphs

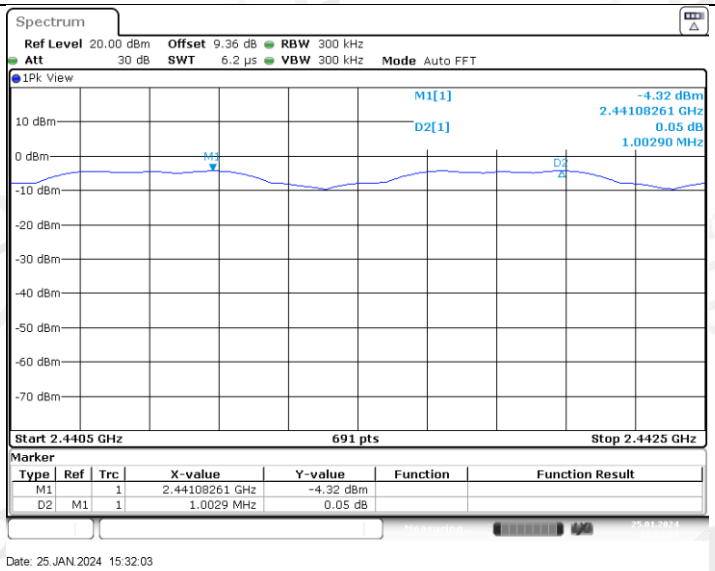
DH5_Ant1_Hop



2DH5_Ant1_Hop

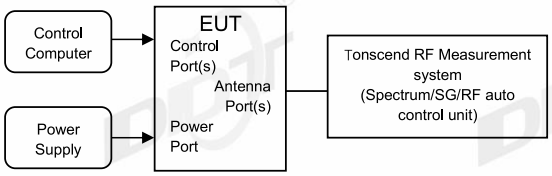


3DH5_Ant1_Hop


Spectrum
Ref Level 20.00 dBm Offset 9.36 dB RBW 300 kHz
Att 30 dB SWT 6.2 µs VBW 300 kHz Mode Auto FFT
1Pk View
M1[1] -4.32 dBm
2.44108261 GHz
D2[1] 0.05 dB
1.00290 MHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
Start 2.4405 GHz 691 pts Stop 2.4425 GHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.44108261 GHz -4.32 dBm
D2 M1 1 1.0029 MHz 0.05 dB
Date: 25.JAN.2024 15:32:03

7. Dwell Time

7.1. Block diagram of test setup



7.2. Limits

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

7.3. Test procedure

(1) The test according to ANSI C63.10-2013 clause 7.8.4.
(2) Connect EUT's antenna output to spectrum analyzer by RF cable, the path loss was compensated to the results.
(3) Set the EUT as maximum power setting and enable the EUT transmit continuously.
(4) Use the following spectrum analyzer settings for the maximum peak output power measurement:

RBW:	≤ channel spacing and where possible RBW should be set >>1 / T
VBW:	VBW ≥ RBW.
Span:	Zero span, centered on a hopping channel.
Detector Mode:	Peak
Sweep time:	Auto
Trace mode:	Clear Write.

(5) The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s
(6) Measure the hopping number and on time of each pulse with spectrum analyzer in zero span set, and calculate dwell time with formula Dwell time = total hops *pulse's on time.
(7) Measure and record the results in the report.

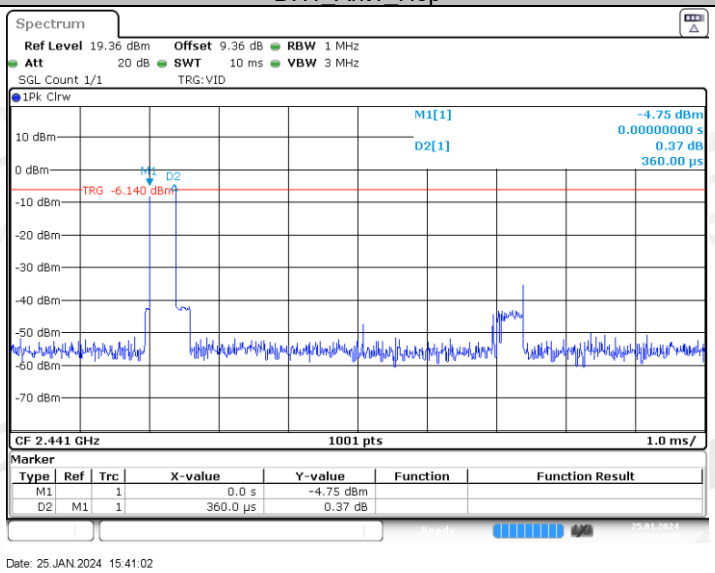
7.4. Test result

Test Engineer:	Haofeng	Test Site:	RF Measurement System 3#
Ambient Condition:	23.5℃,31.2%RH	Test Date:	2024.01.25
Test Power Supply:	AC240V/50Hz	EUT:	Subwoofer
Sample Number:	S23121117-02	Model No.:	VASUB8.2

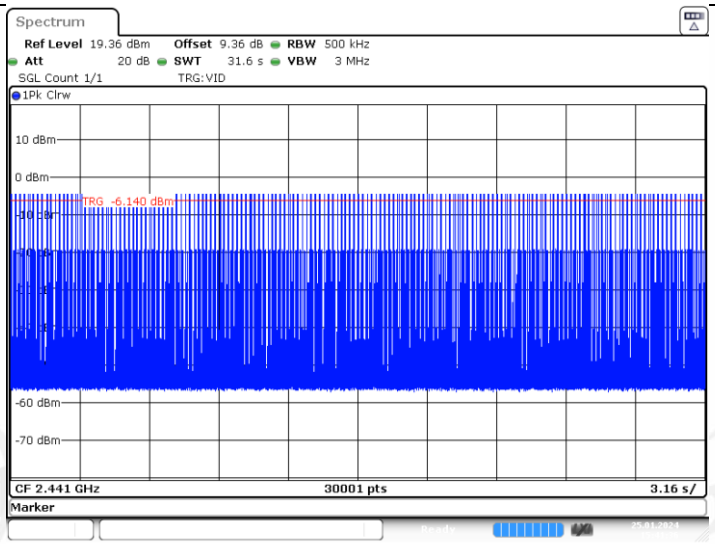
Test Mode	Antenna	Frequency [MHz]	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Hop	0.360	311	0.112	≤0.4	PASS
DH3	Ant1	Hop	1.630	174	0.284	≤0.4	PASS
DH5	Ant1	Hop	2.870	107	0.307	≤0.4	PASS
2DH1	Ant1	Hop	0.370	311	0.115	≤0.4	PASS
2DH3	Ant1	Hop	1.620	172	0.279	≤0.4	PASS
2DH5	Ant1	Hop	2.870	103	0.296	≤0.4	PASS
3DH1	Ant1	Hop	0.370	311	0.115	≤0.4	PASS
3DH3	Ant1	Hop	1.620	173	0.28	≤0.4	PASS
3DH5	Ant1	Hop	2.870	103	0.296	≤0.4	PASS

7.5. Test graphs

DH1_Ant1_Hop

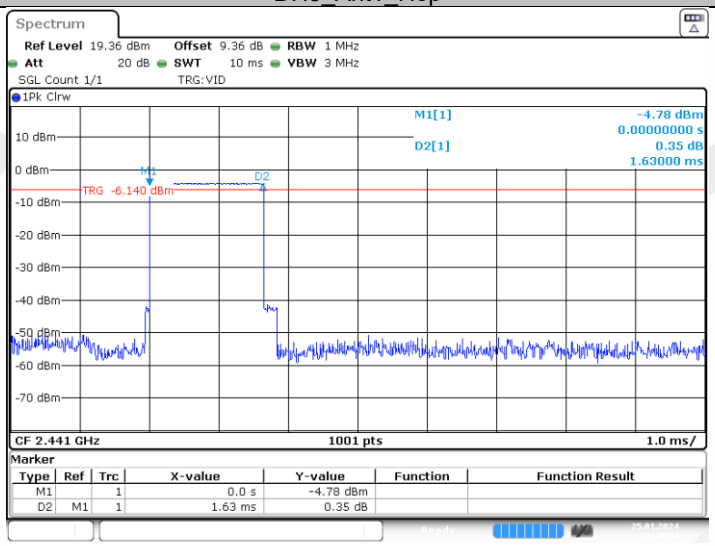


Date: 25.JAN.2024 15:41:02

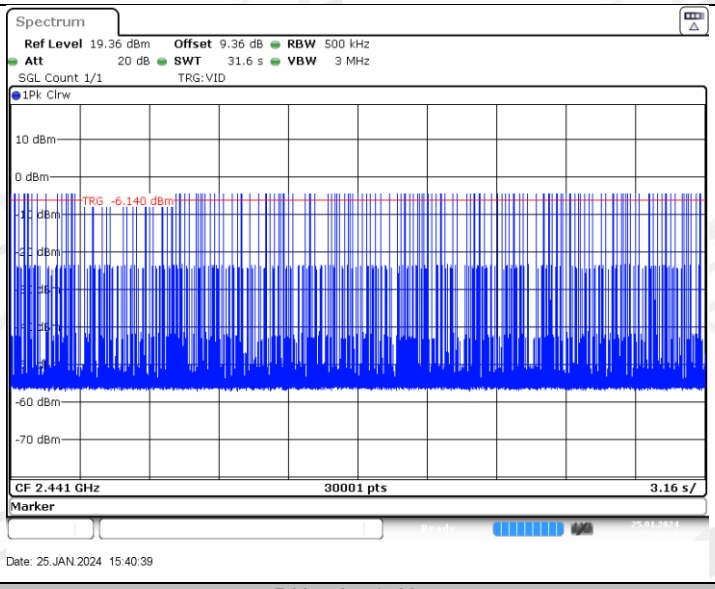


Date: 25.JAN.2024 15:41:36

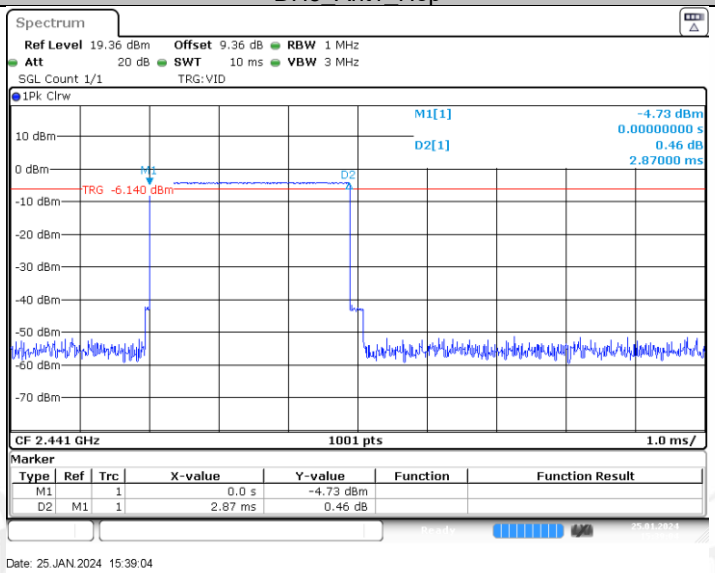
DH3_Ant1_Hop

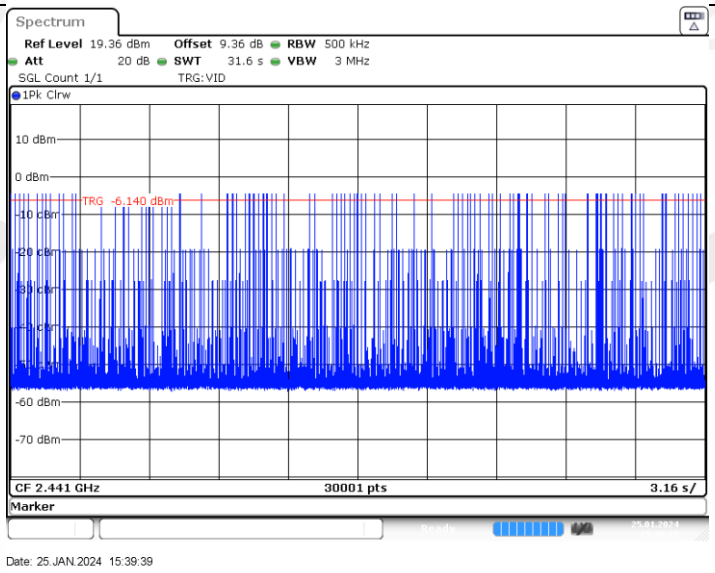


Date: 25.JAN.2024 15:40:05

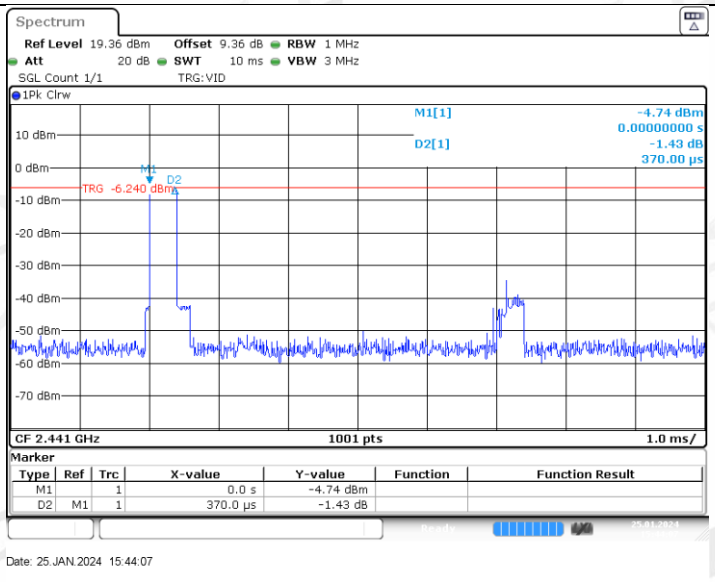


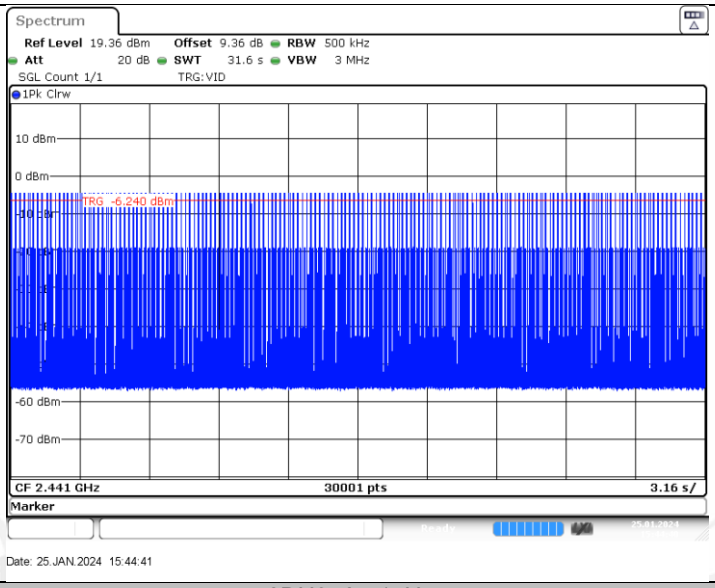
DH5_Ant1_Hop



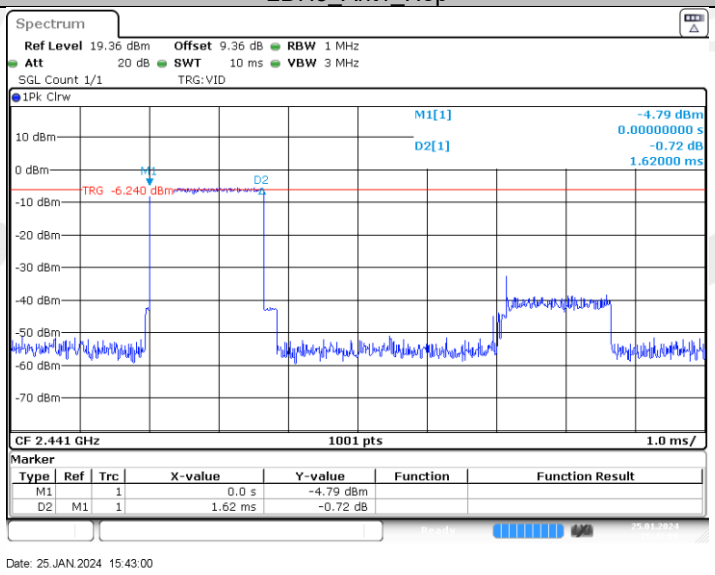


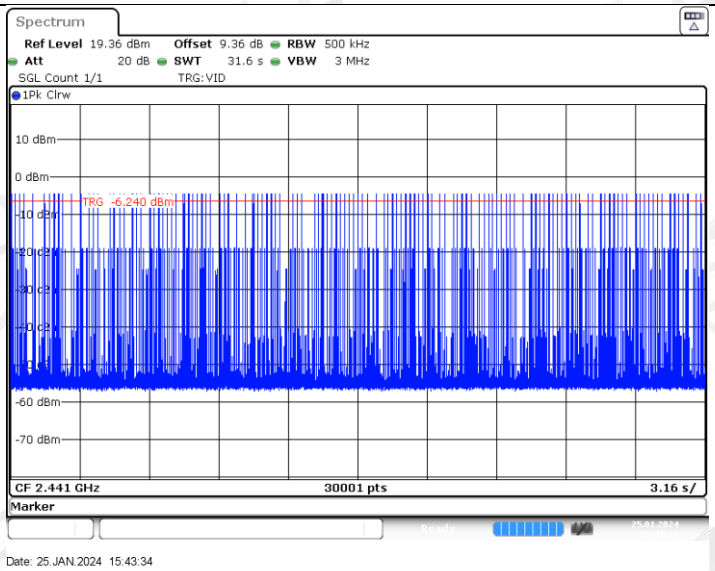
2DH1_Ant1_Hop



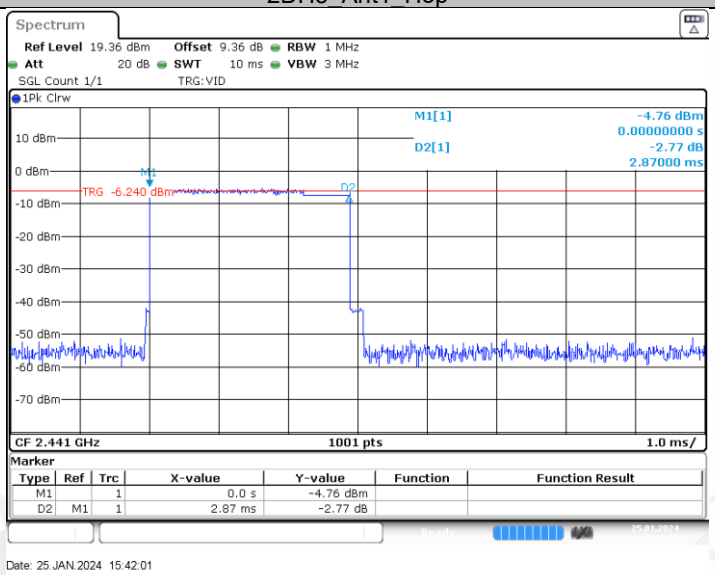


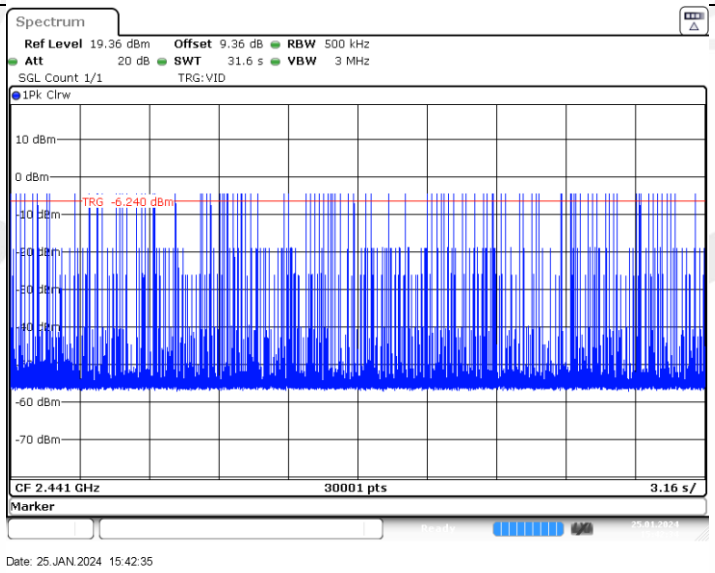
2DH3_Ant1_Hop



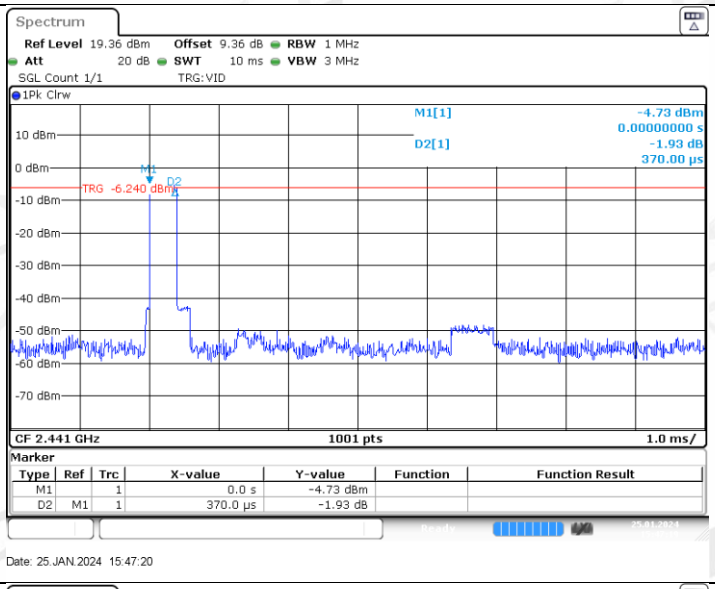


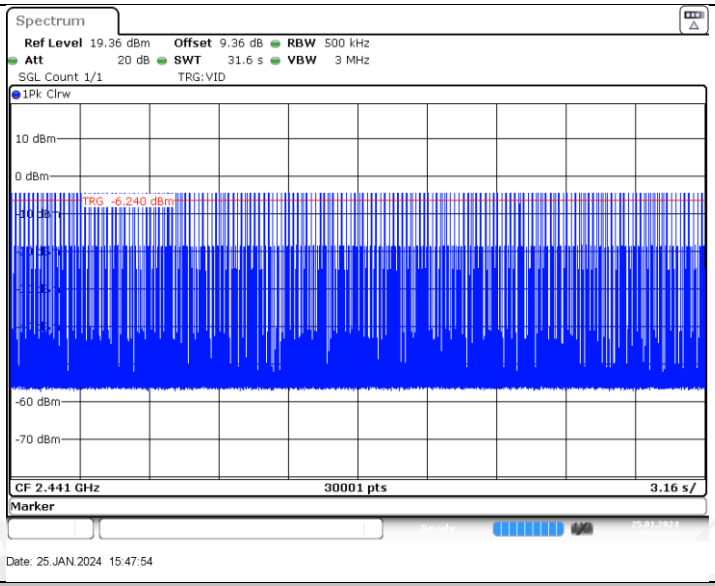
2DH5_Ant1_Hop



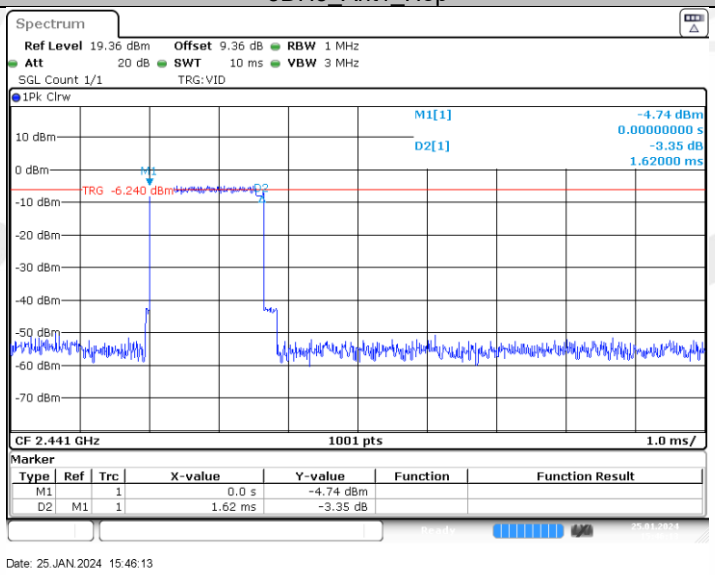


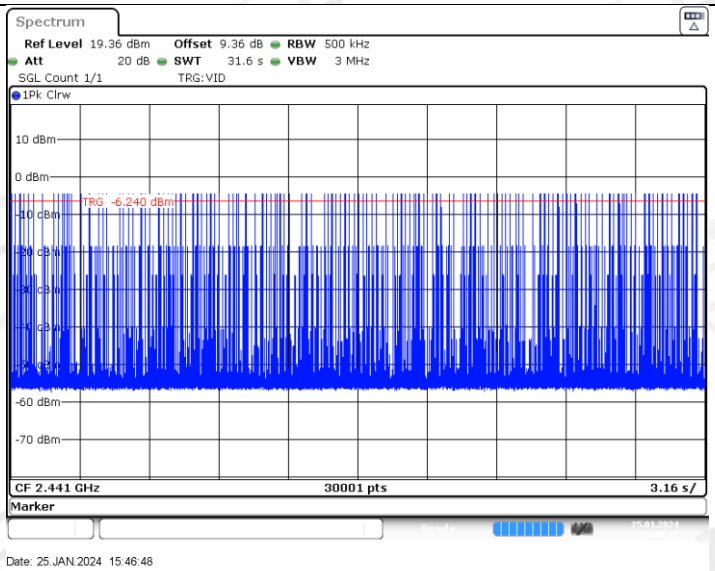
3DH1_Ant1_Hop



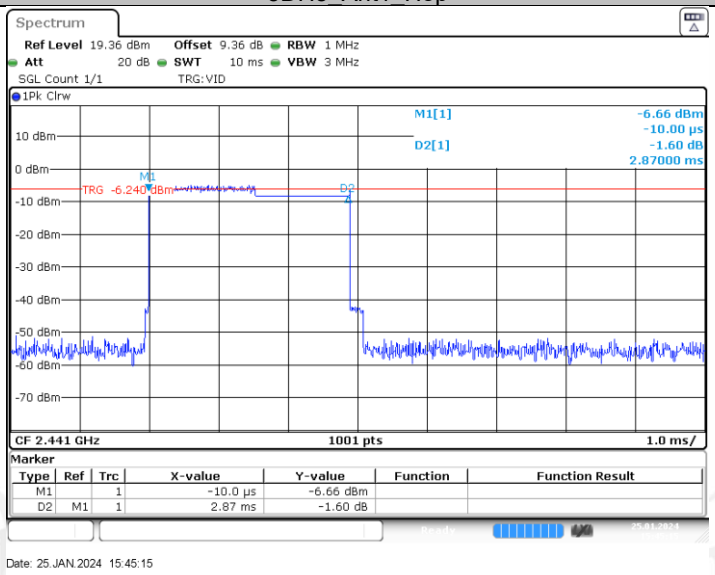


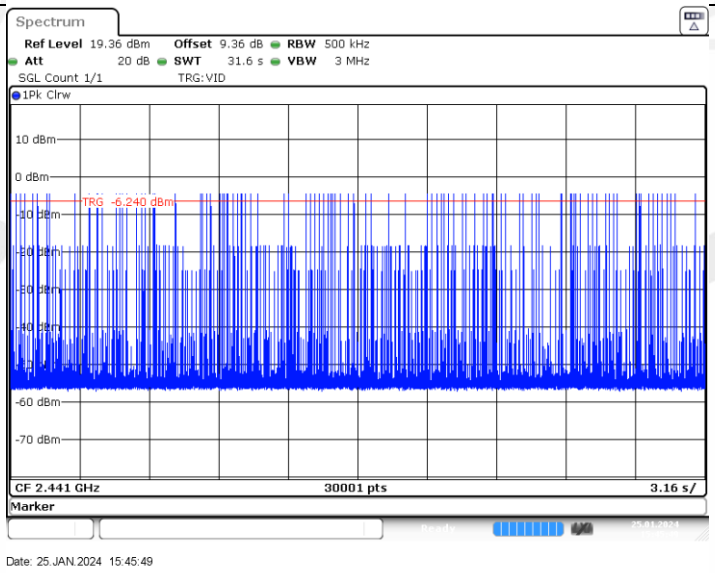
3DH3_Ant1_Hop





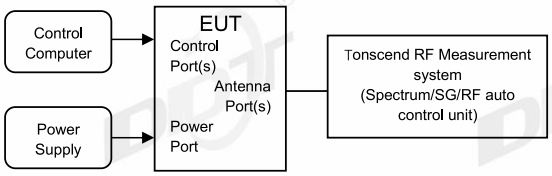
3DH5_Ant1_Hop





8. Number of Hopping Channel

8.1. Block diagram of test setup



8.2. Limits

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

8.3. Test procedure

(1) The test according to ANSI C63.10-2013 clause 7.8.3.
(2) Connect EUT's antenna output to spectrum analyzer by RF cable, the path loss was compensated to the results.
(3) Set the EUT as maximum power setting and enable the EUT transmit continuously.
(4) Use the following spectrum analyzer settings for the maximum peak output power measurement:

RBW:	RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
VBW:	VBW ≥ RBW.
Span:	The frequency band of operation
Detector Mode:	Peak
Sweep time:	Auto
Trace mode:	Max hold

(5) Measure the hopping number and record the results in the report.
(6) Measure and record the results in the report.

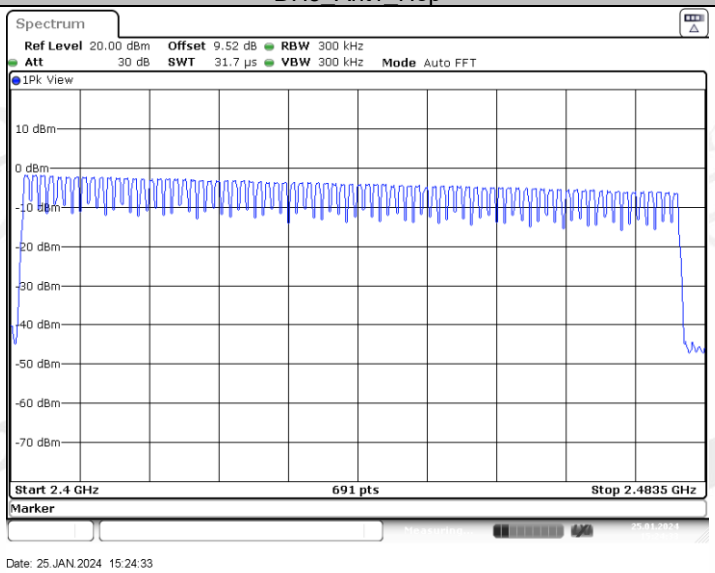
8.4. Test result

Test Engineer:	Haofeng	Test Site:	RF Measurement System 3#
Ambient Condition:	23.5℃,31.2%RH	Test Date:	2024.01.25
Test Power Supply:	AC240V/50Hz	EUT:	Subwoofer
Sample Number:	S23121117-02	Model No.:	VASUB8.2

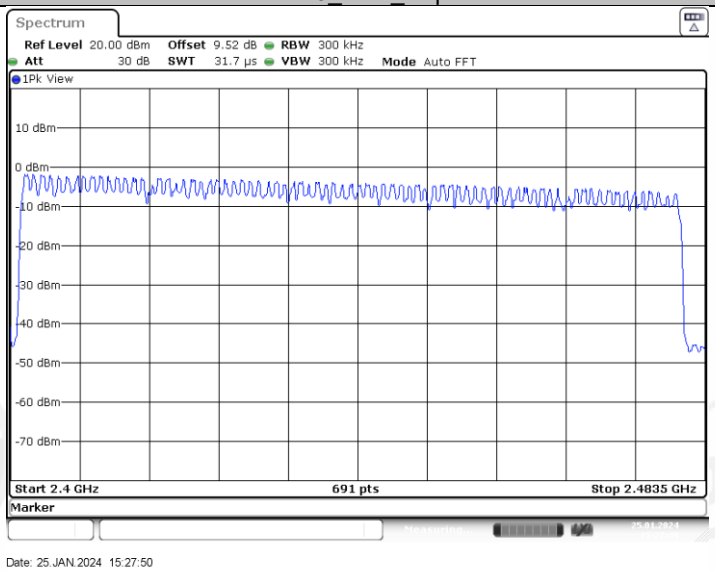
Test Mode	Antenna	Frequency [MHz]	Result [Num]	Limit [Num]	Verdict
DH5	Ant1	Hop	79	≥15	PASS
2DH5	Ant1	Hop	79	≥15	PASS
3DH5	Ant1	Hop	79	≥15	PASS

8.5. Test graphs

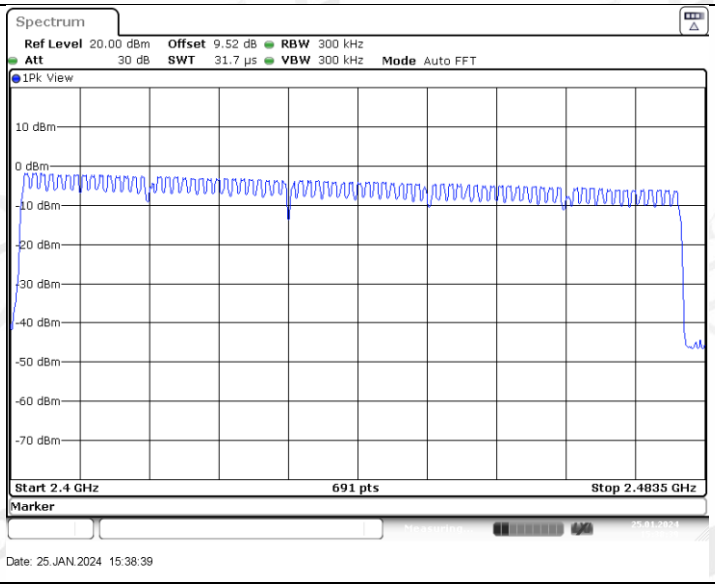
DH5_Ant1_Hop



2DH5_Ant1_Hop

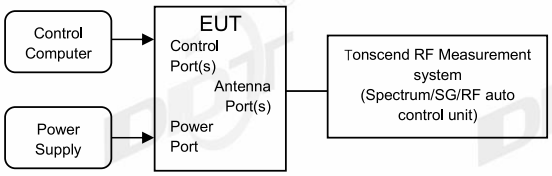


3DH5_Ant1_Hop


Spectrum
Ref Level 20.00 dBm Offset 9.52 dB RBW 300 kHz
Att 30 dB SWT 31.7 µs VBW 300 kHz Mode Auto FFT
1Pk View
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
Start 2.4 GHz
691 pts
Stop 2.4835 GHz
Marker
Date: 25.JAN.2024 15:38:39

9. Band Edge Compliance (Conducted Method)

9.1. Block diagram of test setup



9.2. Limit

All restriction band should comply with 15.209, other emission should be at least 20dB below the fundamental.

9.3. Test procedure

(1) Connect EUT's antenna output to spectrum analyzer by RF cable.
(2) Establish a reference level by using the following procedure:

RBW:	100 kHz
VBW:	300 kHz
Span	Encompass frequency range to be measured
Detector Mode:	Peak
Sweep time:	Auto
Trace mode	Max hold

(3) Allow the trace to stabilize, use the peak marker function to determine the maximum peak power level to establish the reference level.
(4) Then mark the maximum amplitude of all unwanted emissions outside of the authorized frequency band.

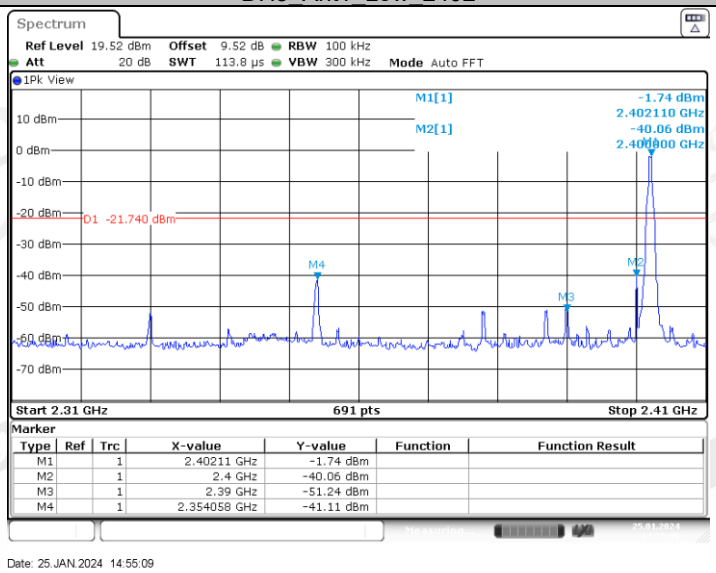
9.4. Test result

Test Engineer:	Haofeng	Test Site:	RF Measurement System 3#
Ambient Condition:	23.5℃,31.2%RH	Test Date:	2024.01.25
Test Power Supply:	AC240V/50Hz	EUT:	Subwoofer
Sample Number:	S23121117-02	Model No.:	VASUB8.2

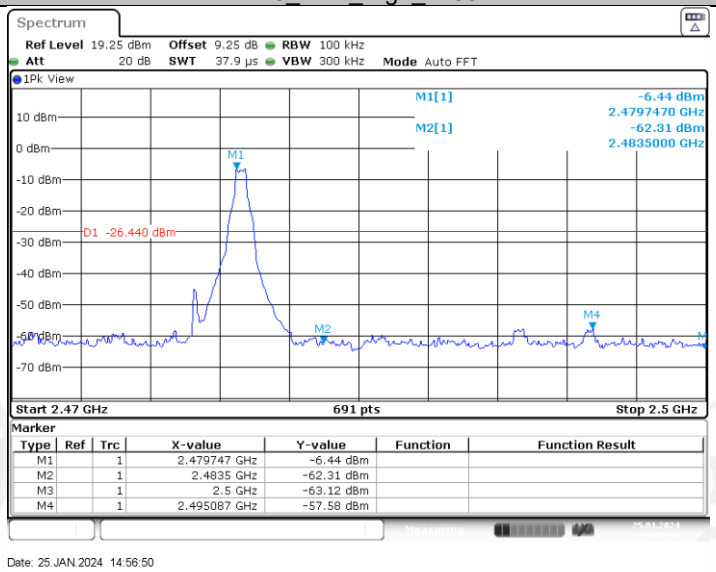
Mode	Freq. (MHz)	Verdict
GFSK	Hopping off 2402	Pass
	Hopping off 2480	Pass
	Hopping on	Pass
π/4-DQPSK	Hopping off 2402	Pass
	Hopping off 2480	Pass
	Hopping on	Pass
8DPSK	Hopping off 2402	Pass
	Hopping off 2480	Pass
	Hopping on	Pass

9.5. Test graphs

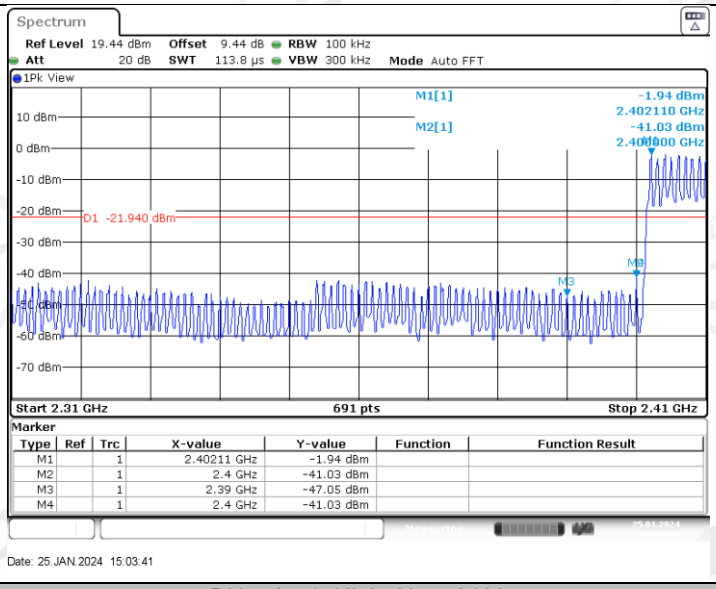
DH5_Ant1_Low_2402



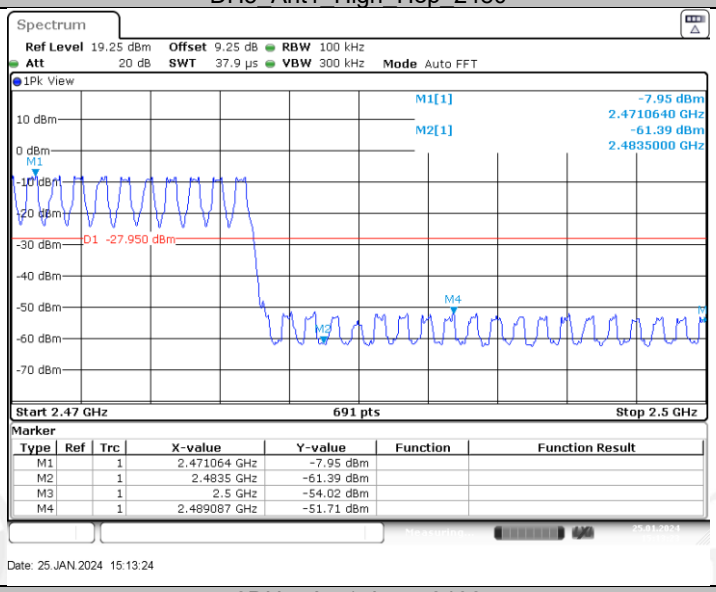
DH5_Ant1_High_2480



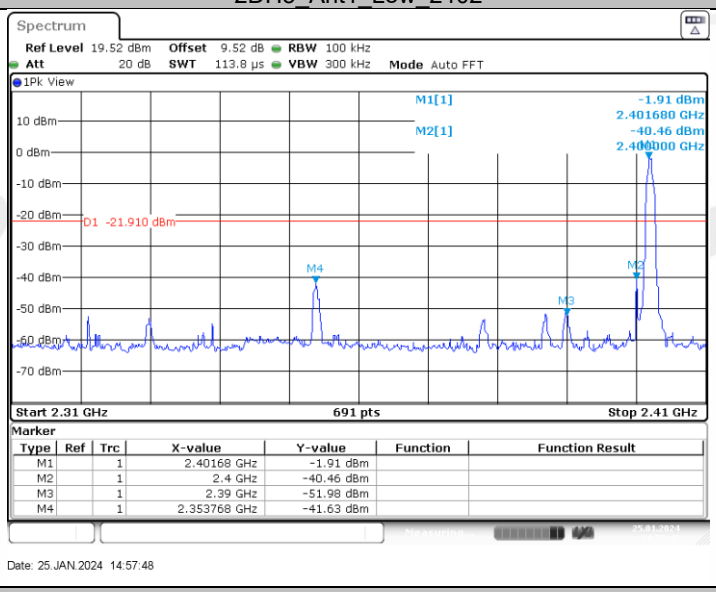
DH5_Ant1_Low_Hop_2402



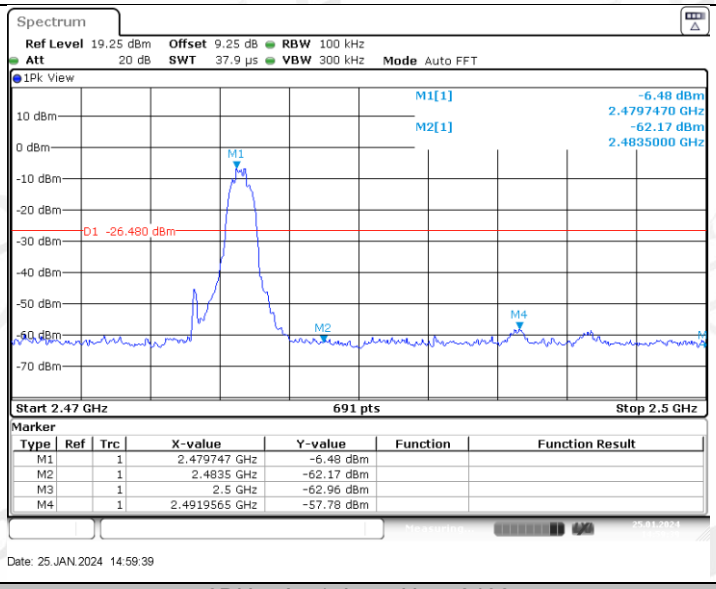
DH5_Ant1_High_Hop_2480



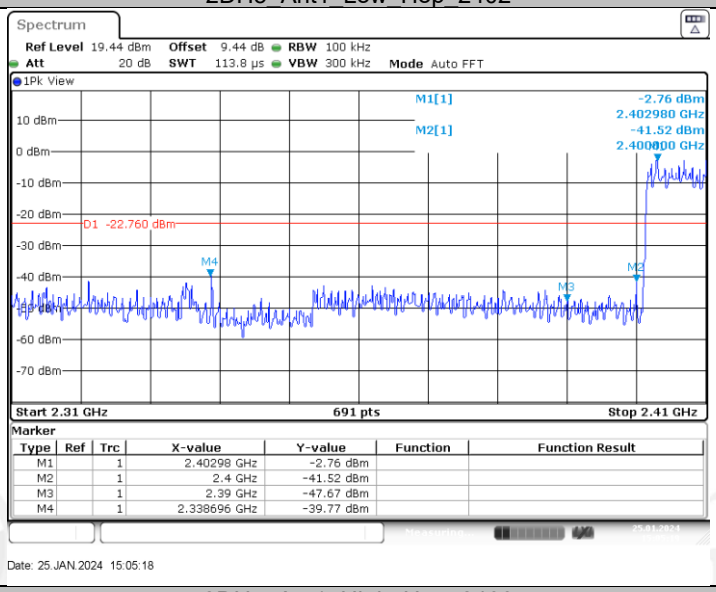
2DH5_Ant1_Low_2402



2DH5_Ant1_High_2480



2DH5_Ant1_Low_Hop_2402



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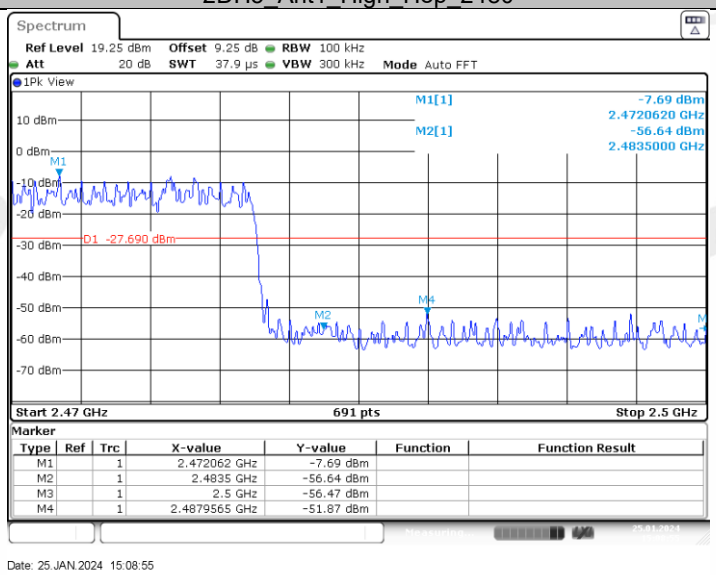

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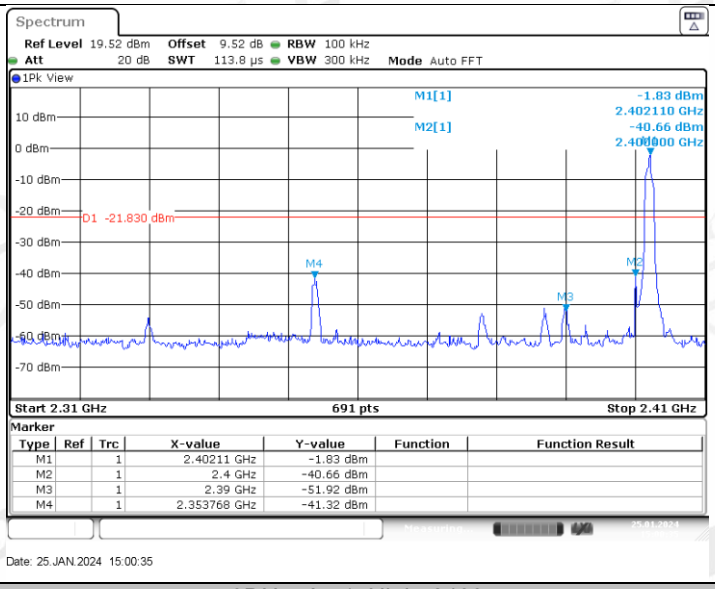

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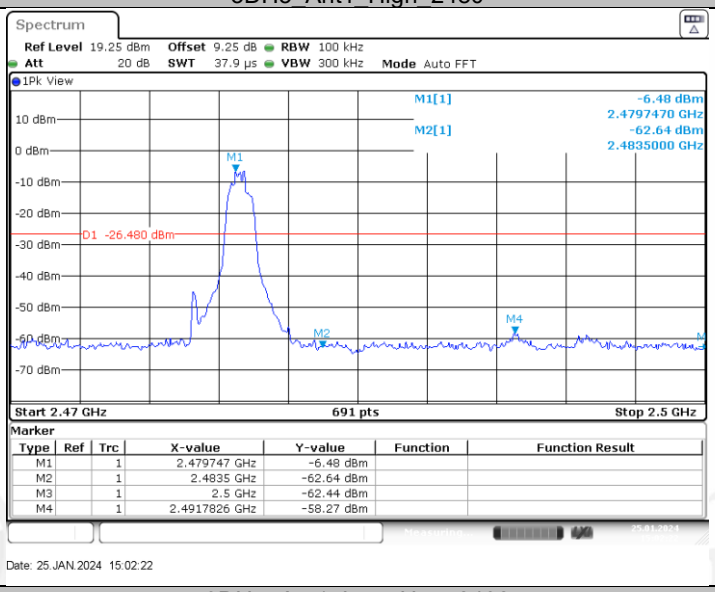

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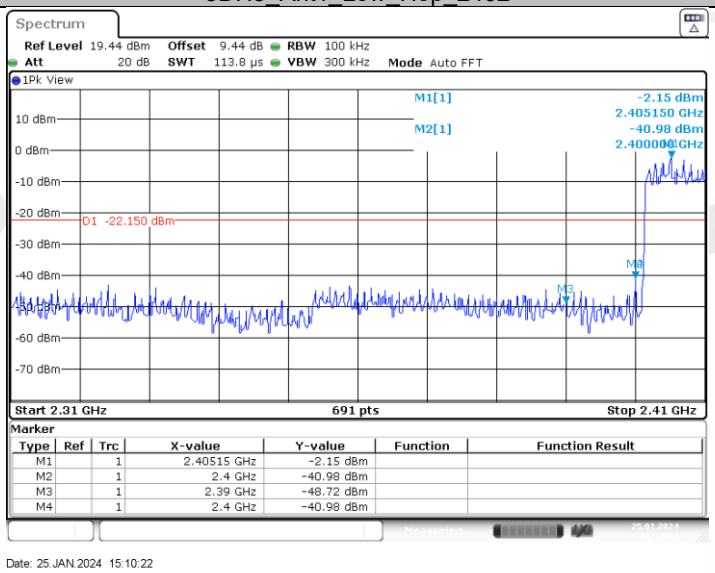
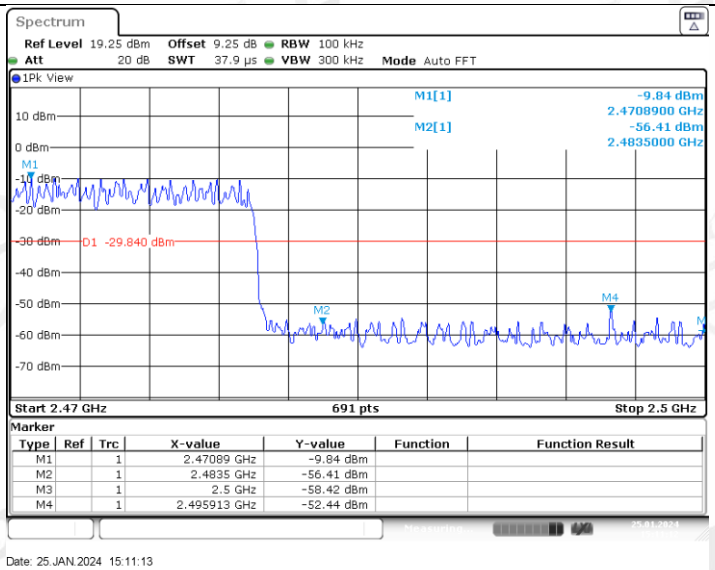
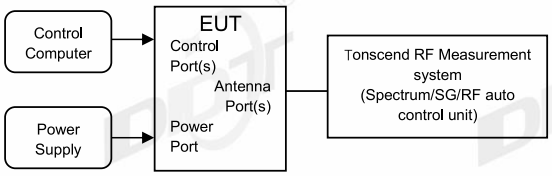


3DH5_Ant1_High_Hop_2480


Spectrum
Ref Level 19.25 dBm Offset 9.25 dB RBW 100 kHz
Att 20 dB SWT 37.9 µs VBW 300 kHz Mode Auto FFT
1Pk View
M1[1] -9.84 dBm 2.4708900 GHz
M2[1] -56.41 dBm 2.4835000 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
D1 -29.840 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
M2
M4
Start 2.47 GHz 691 pts Stop 2.5 GHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.47089 GHz -9.84 dBm
M2 1 2.4835 GHz -56.41 dBm
M3 1 2.5 GHz -58.42 dBm
M4 1 2.495913 GHz -52.44 dBm
Date: 25.JAN.2024 15:11:13

10. RF Conducted Spurious Emissions

10.1. Block diagram of test setup



10.2. Limits

In any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator 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.

10.3. Test procedure

(1) Connect EUT's antenna output to spectrum analyzer by RF cable.
(2) Establish a reference level by using the following procedure:

Center frequency	Test frequency
RBW:	100 kHz
VBW:	300 kHz
Span	Wide enough to capture the peak level of the in-band emission
Detector Mode:	Peak
Sweep time:	Auto
Trace mode	Max hold

(3) Allow the trace to stabilize, use the peak marker function to determine the maximum peak power level to establish the reference level.
(4) Set the spectrum analyzer as follows:

RBW:	100 kHz
VBW:	300 kHz
Span	Encompass frequency range to be measured
Number of measurement points	≥Span/RBW
Detector Mode:	Peak
Sweep time:	Auto
Trace mode	Max hold

Allow the trace to stabilize, use the peak marker function to determine the maximum amplitude of all unwanted emissions outside of the authorized frequency band

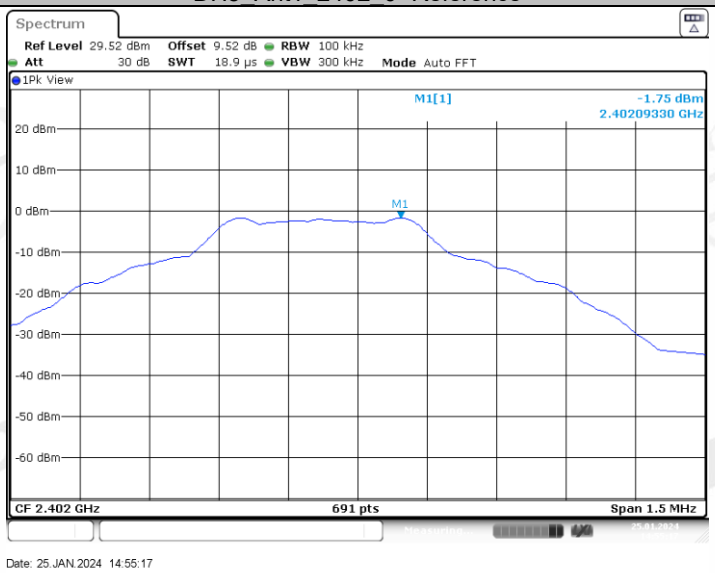
10.4. Test result

Test Engineer:	Haofeng	Test Site:	RF Measurement System 3#
Ambient Condition:	23.5℃,31.2%RH	Test Date:	2024.01.25
Test Power Supply:	AC240V/50Hz	EUT:	Subwoofer
Sample Number:	S23121117-02	Model No.:	VASUB8.2

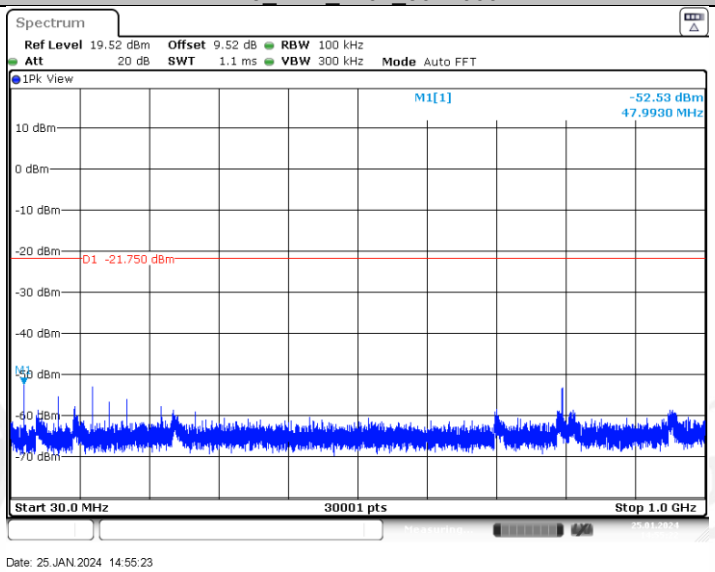
Mode	Freq. (MHz)	Verdict
GFSK	Hopping off 2402	Pass
	Hopping off 2441	Pass
	Hopping off 2480	Pass
π/4-DQPSK	Hopping off 2402	Pass
	Hopping off 2441	Pass
	Hopping off 2480	Pass
8DPSK	Hopping off 2402	Pass
	Hopping off 2441	Pass
	Hopping off 2480	Pass

10.5. Test graphs

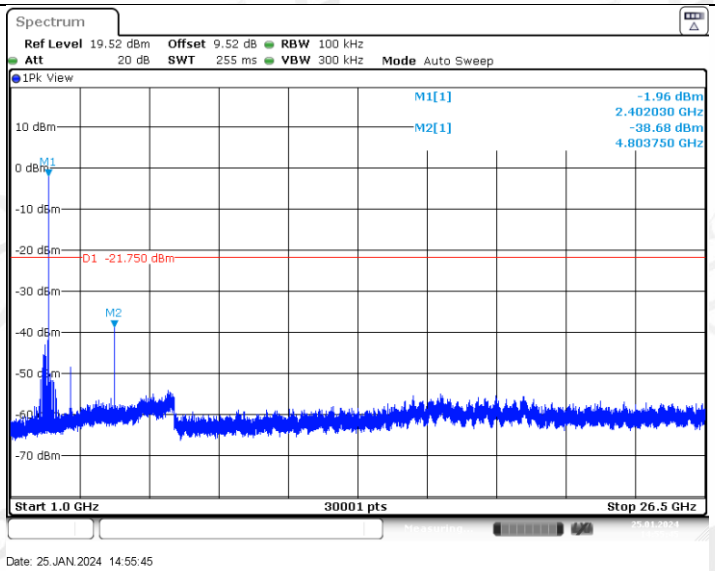
DH5_Ant1_2402_0~Reference



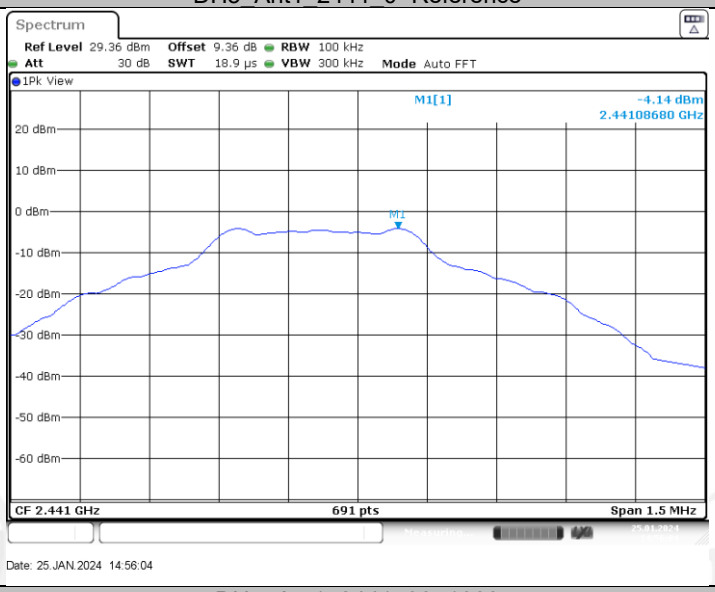
DH5_Ant1_2402_30~1000



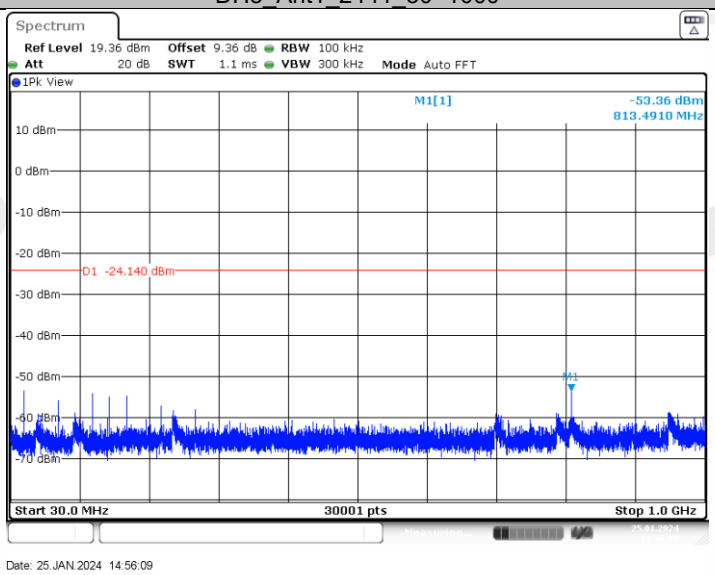
DH5_Ant1_2402_1000~26500



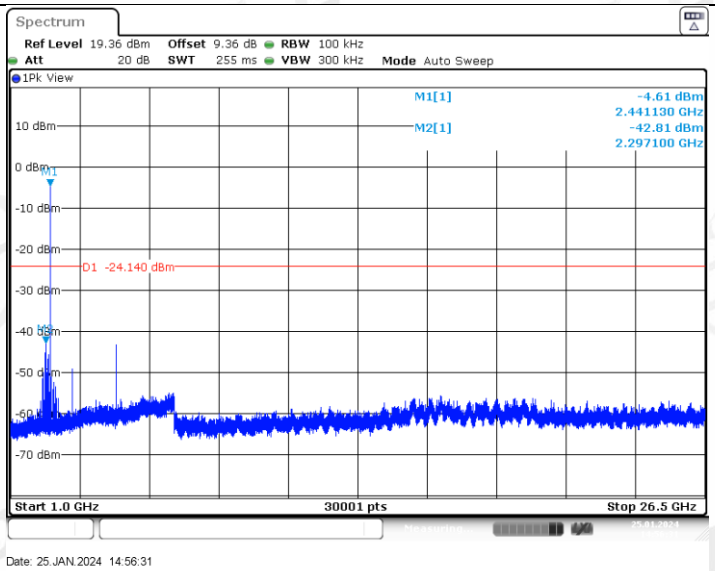
DH5_Ant1_2441_0~Reference



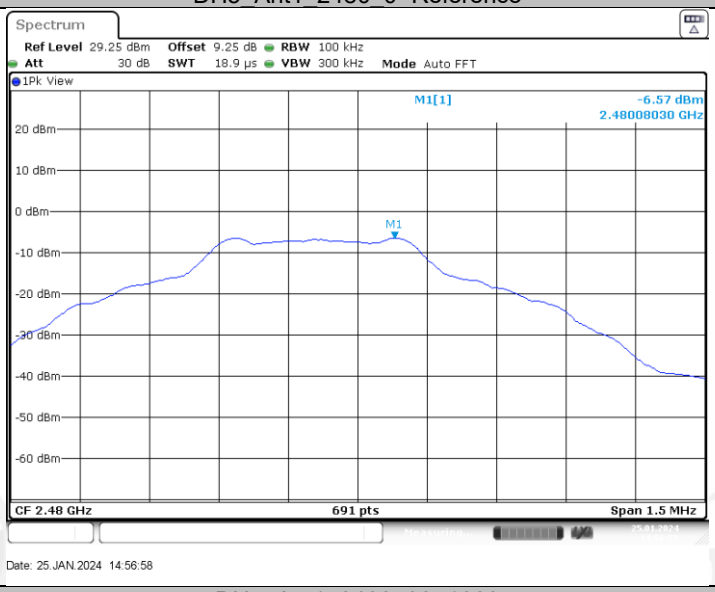
DH5_Ant1_2441_30~1000



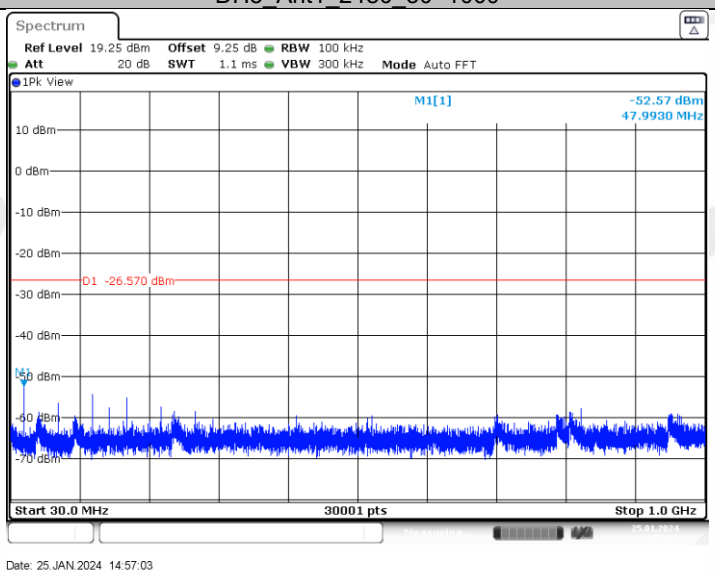
DH5_Ant1_2441_1000~26500



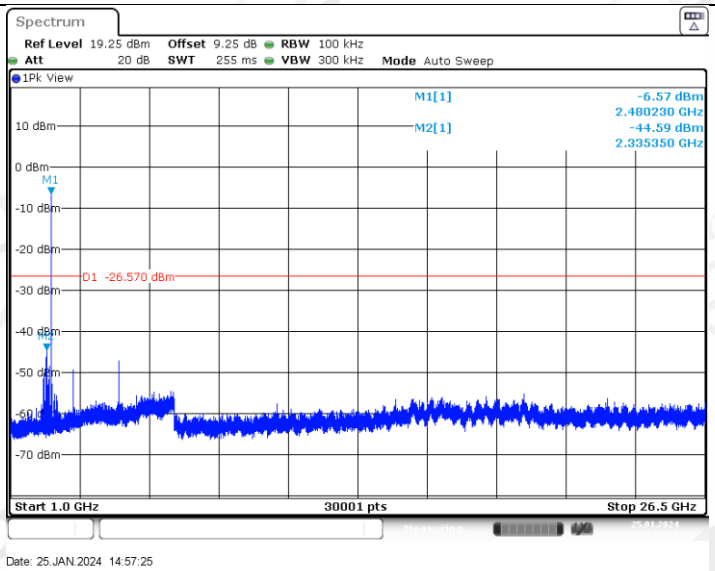
DH5_Ant1_2480_0~Reference



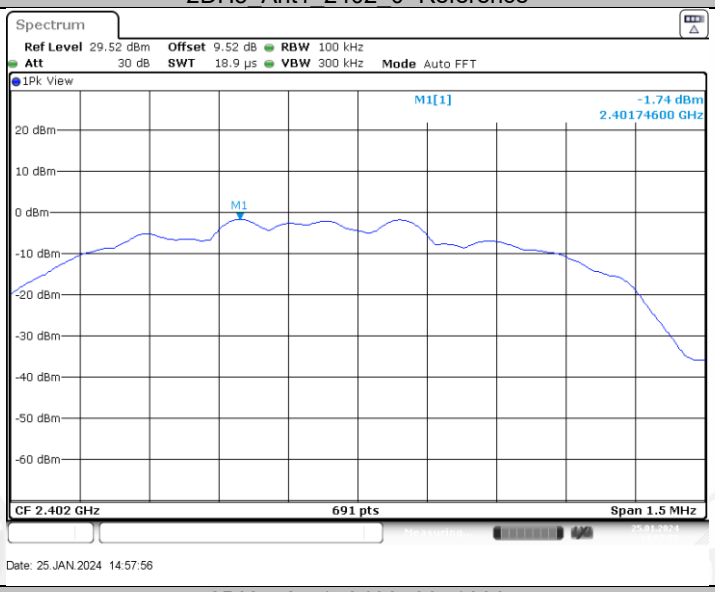
DH5_Ant1_2480_30~1000



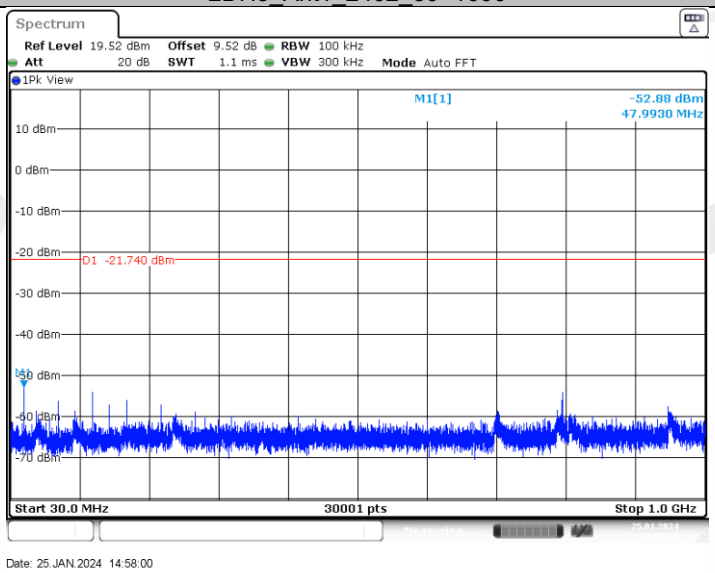
DH5_Ant1_2480_1000~26500



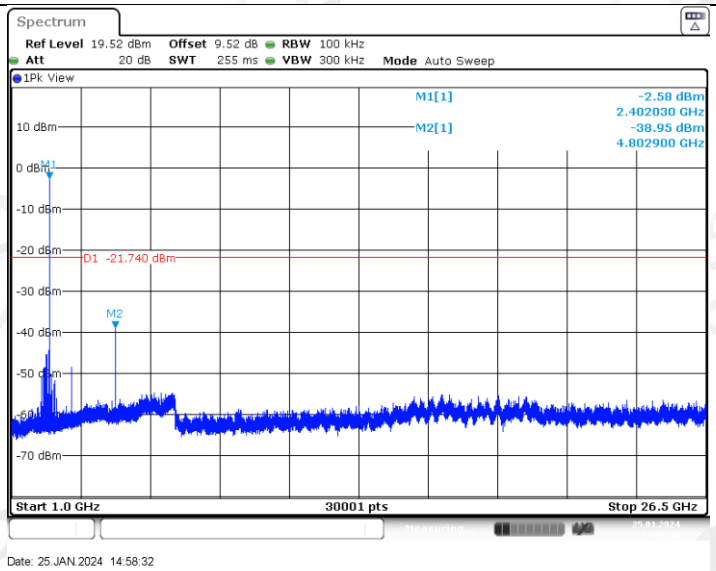
2DH5_Ant1_2402_0~Reference



2DH5_Ant1_2402_30~1000



2DH5_Ant1_2402_1000~26500



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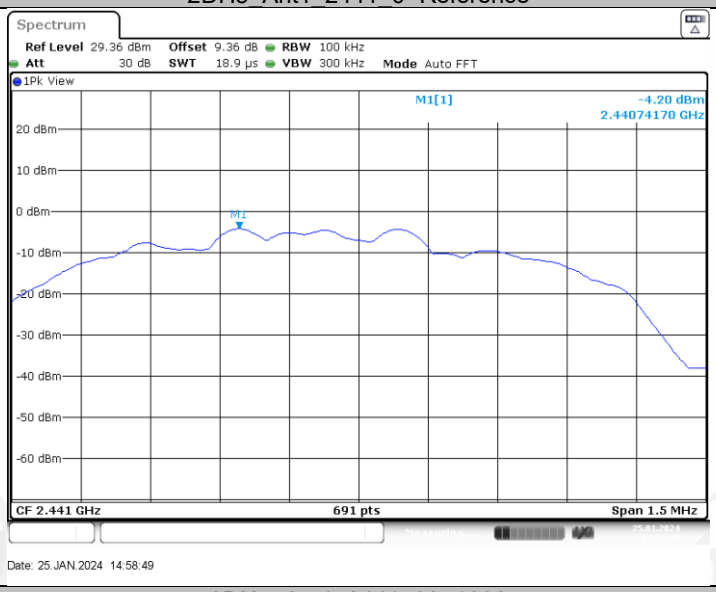
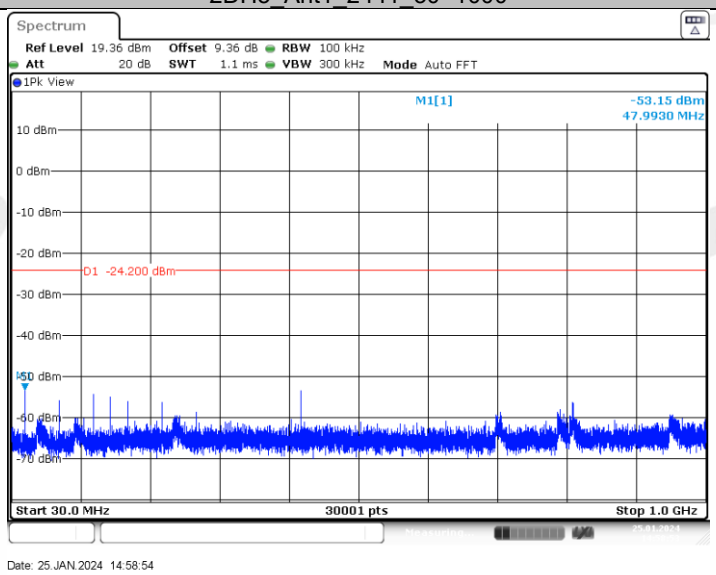
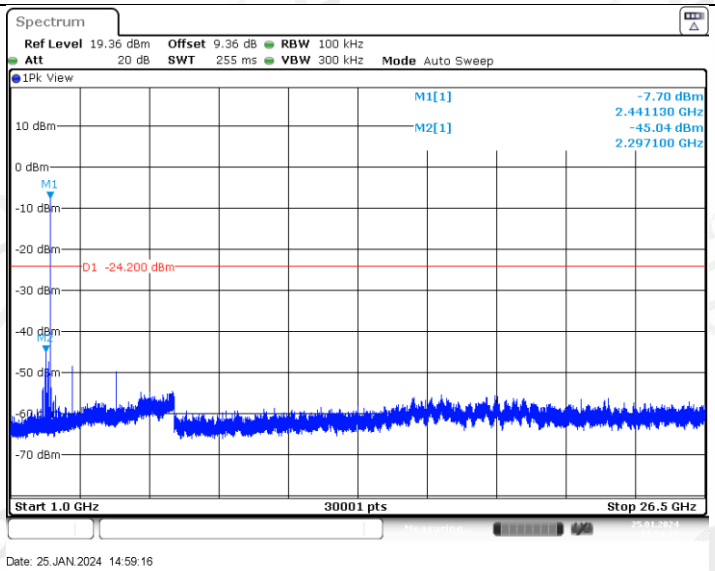


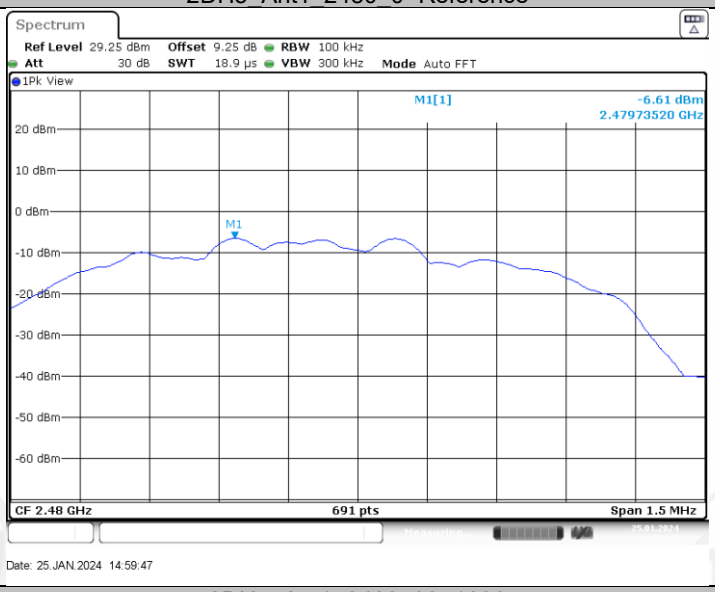
2DH5_Ant1_2441_30~1000



2DH5_Ant1_2441_1000~26500



2DH5_Ant1_2480_0~Reference



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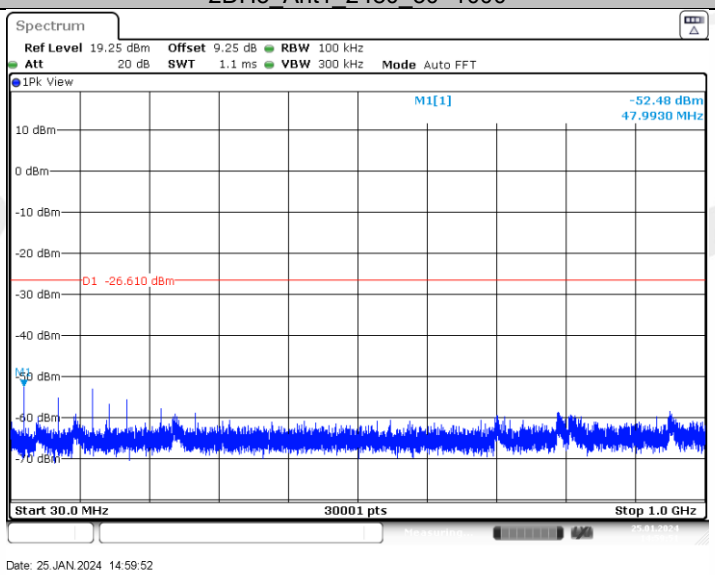

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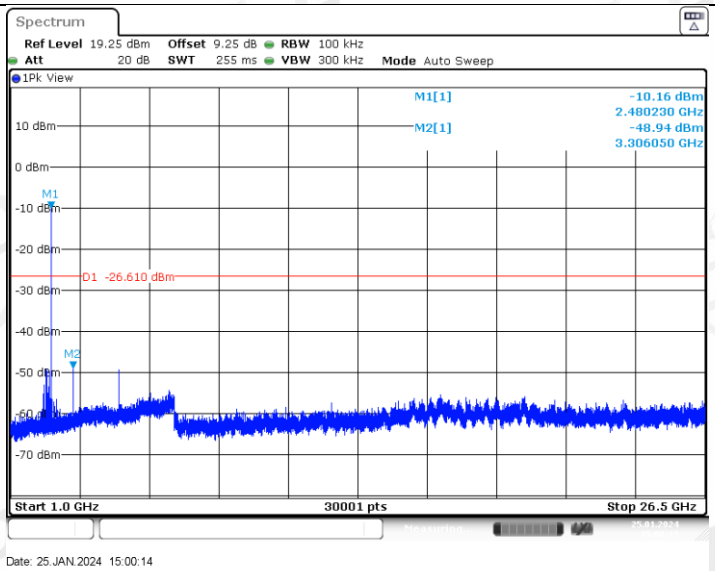
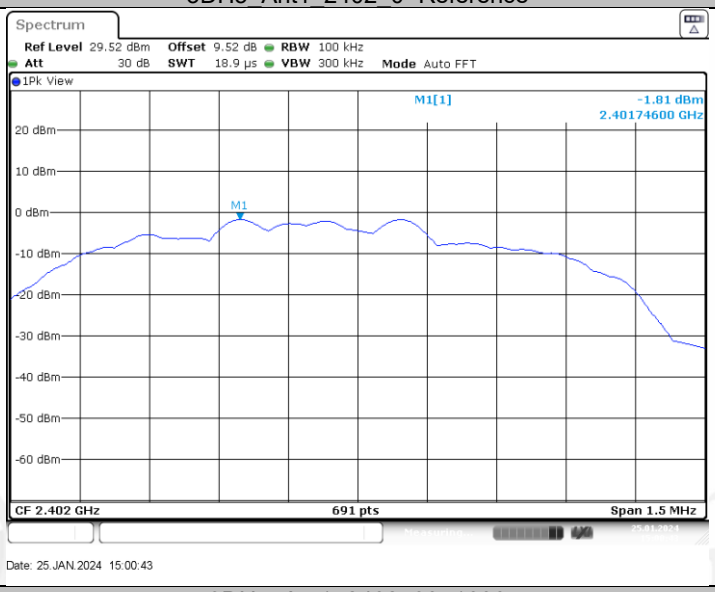


3DH5_Ant1_2402_0~Reference



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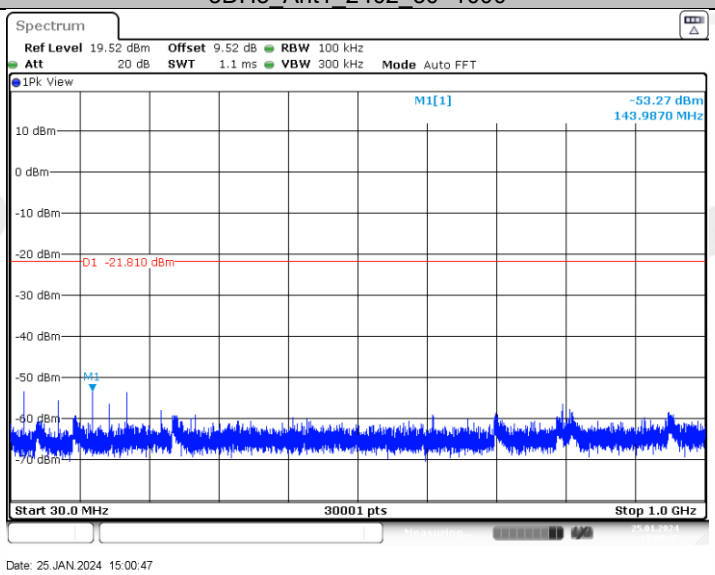
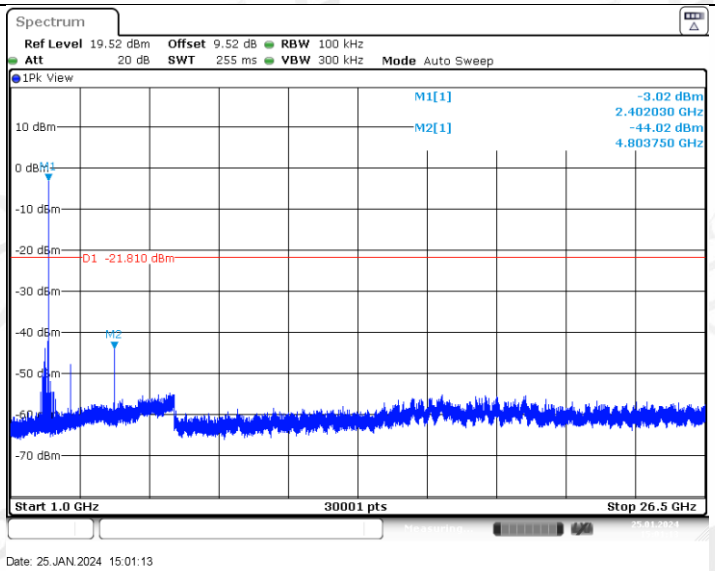


3DH5_Ant1_2402_1000~26500



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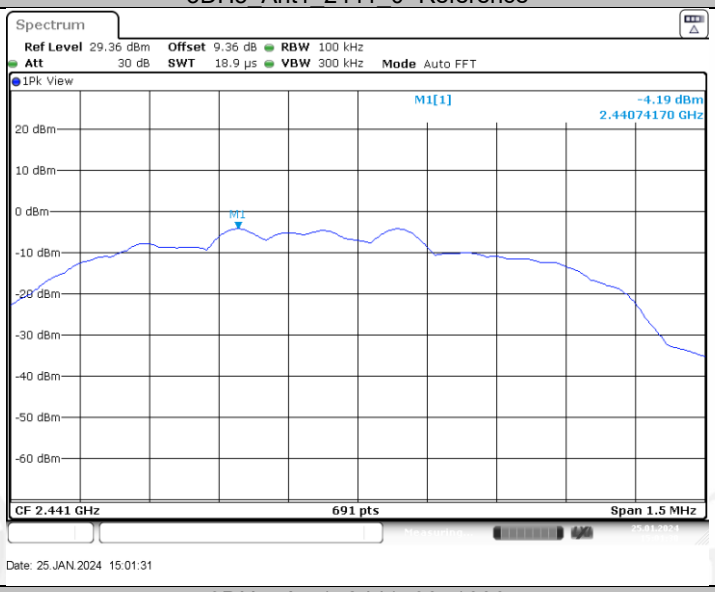

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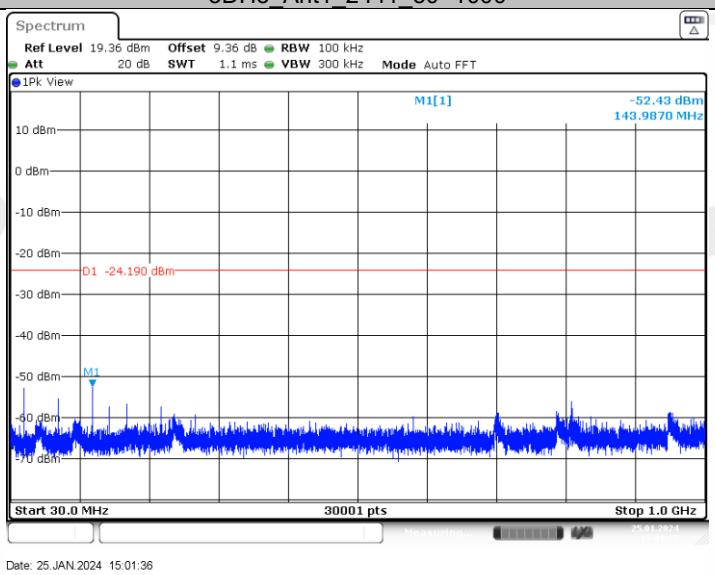
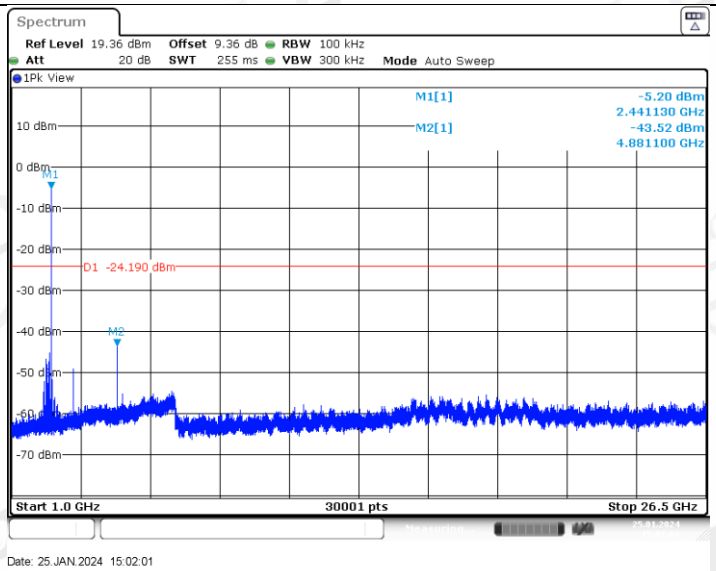
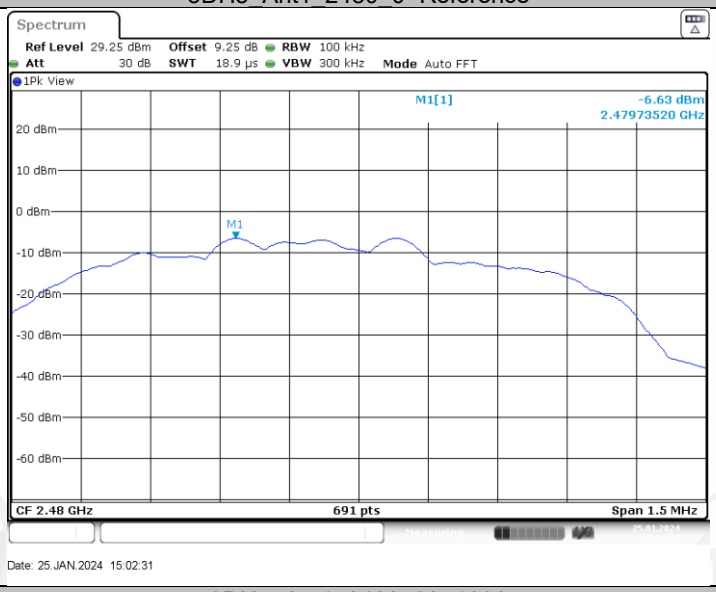


3DH5_Ant1_2441_1000~26500



3DH5_Ant1_2480_0~Reference



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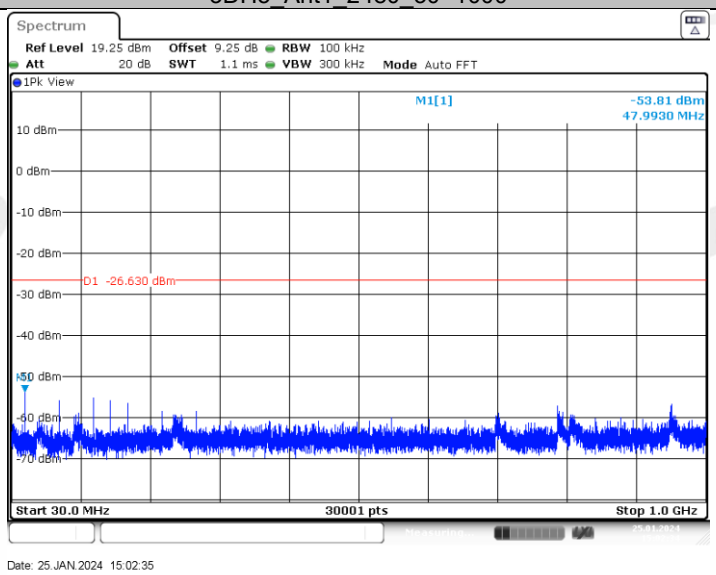
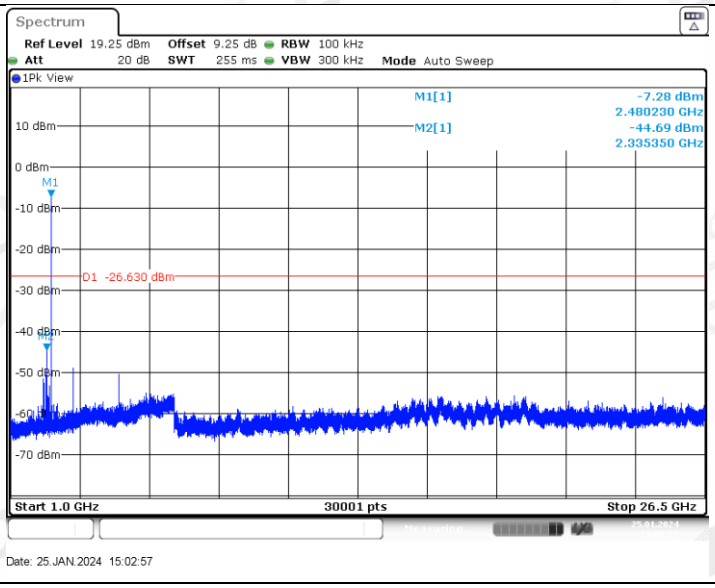
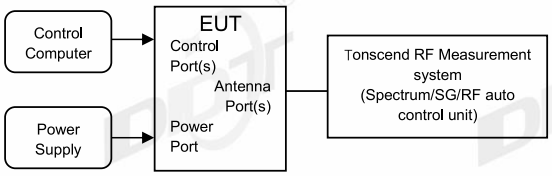


3DH5_Ant1_2480_1000~26500


Spectrum
Ref Level 19.25 dBm Offset 9.25 dB RBW 100 kHz
Att 20 dB SWT 255 ms VBW 300 kHz Mode Auto Sweep
1Pk View
M1[1] -7.28 dBm
2.480230 GHz
M2[1] -44.69 dBm
2.335350 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
D1 -26.630 dBm
Start 1.0 GHz
30001 pts
Stop 26.5 GHz
Date: 25.JAN.2024 15:02:57

11. Duty cycle

11.1. Block diagram of test setup



11.2. Limit

Just for Report.

11.3. Test procedure

(1) Connected the EUT's antenna port to the Spectrum Analyzer by suitable attenuator, The cable loss and attenuator loss have been put into spectrum analyzer as amplitude offset.
set the Spectrum Analyzer as below:
Centre Frequency: The centre frequency of the middle hopping channel.
Resolution BW: 10 MHz.
Video BW: 10 MHz.
Span: Zero span.
Detector: Peak.
Trace Mode: Clear Write.
Sweep: Video Trigger

(2) When the trace is complete, measure the sending time of 1 burst and the duty cycle of 1 burst cycle.

(3) Calculate dwell time follow below formula:
Duty cycle= Pulse's on time / Burst cycle

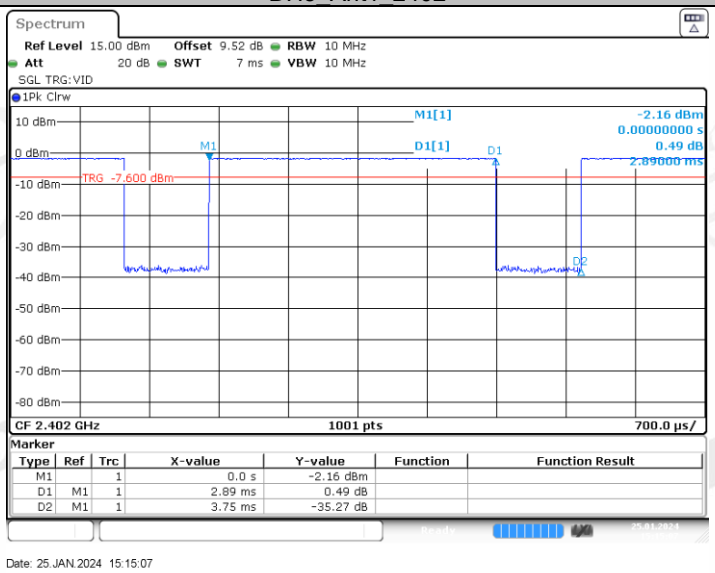
11.4. Test result

Test Engineer:	Haofeng	Test Site:	RF Measurement System 3#
Ambient Condition:	23.5℃,31.2%RH	Test Date:	2024.01.25
Test Power Supply:	AC240V/50Hz	EUT:	Subwoofer
Sample Number:	S23121117-02	Model No.:	VASUB8.2

Test Mode	Antenna	Frequency [MHz]	ON Time [ms]	Period [ms]	Duty Cycle [%]	Duty Cycle Factor[dB]
DH5	Ant1	2402	2.89	3.75	77.07	1.13
		2441	2.89	3.75	77.07	1.13
		2480	2.89	3.75	77.07	1.13
2DH5	Ant1	2402	2.89	3.75	77.07	1.13
		2441	2.89	3.75	77.07	1.13
		2480	2.89	3.75	77.07	1.13
3DH5	Ant1	2402	2.89	3.76	76.86	1.14
		2441	2.89	3.76	76.86	1.14
		2480	2.89	3.75	77.07	1.13

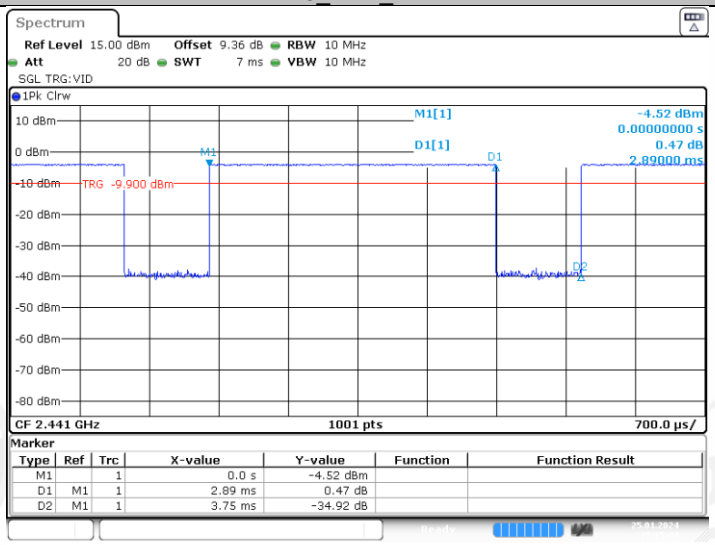
11.5. Test graphs

DH5_Ant1_2402



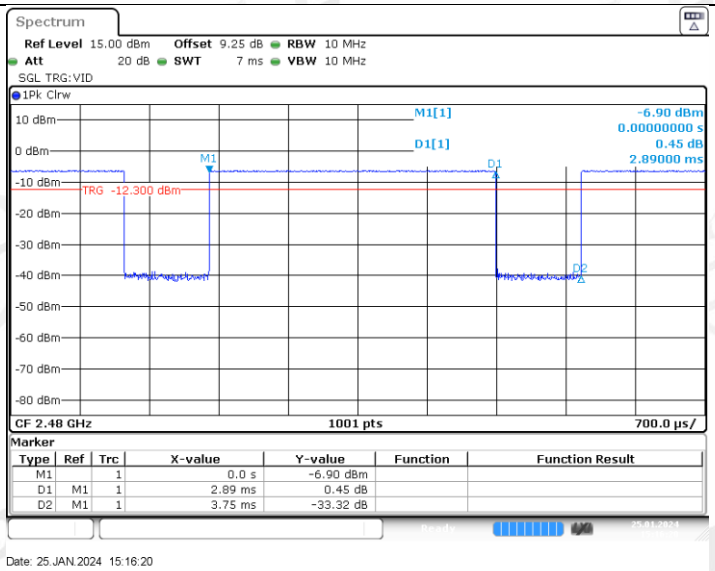
Date: 25.JAN.2024 15:15:07

DH5_Ant1_2441

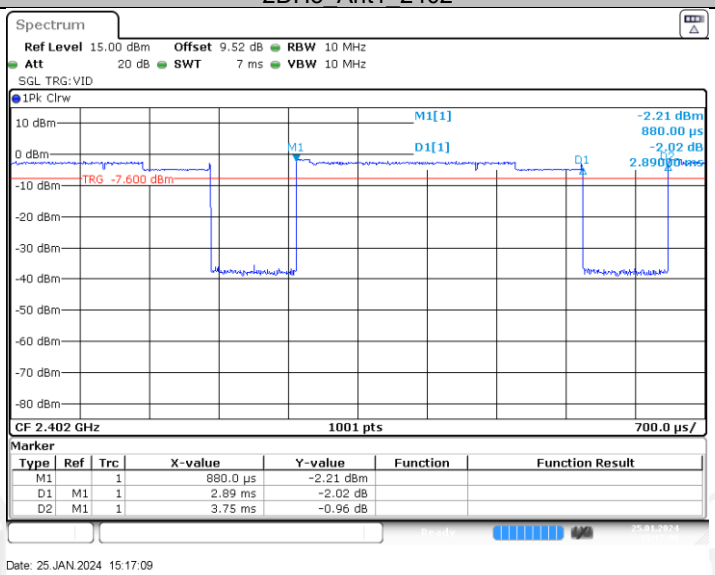


Date: 25.JAN.2024 15:15:44

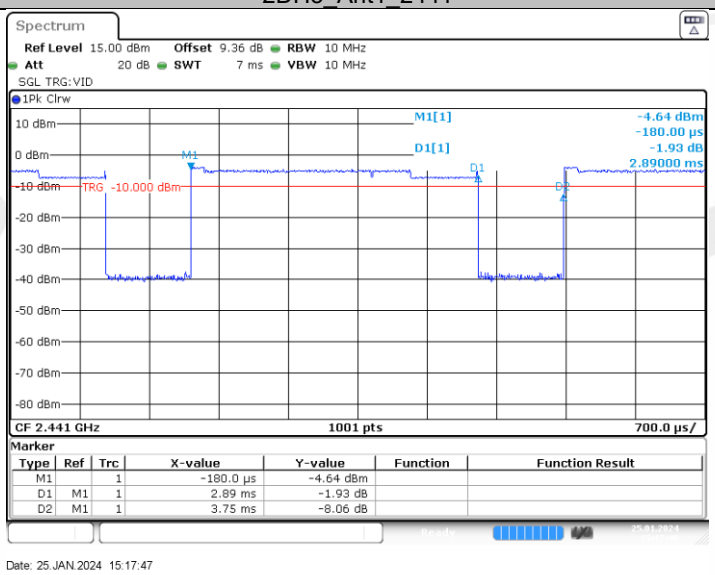
DH5_Ant1_2480



2DH5_Ant1_2402



2DH5_Ant1_2441



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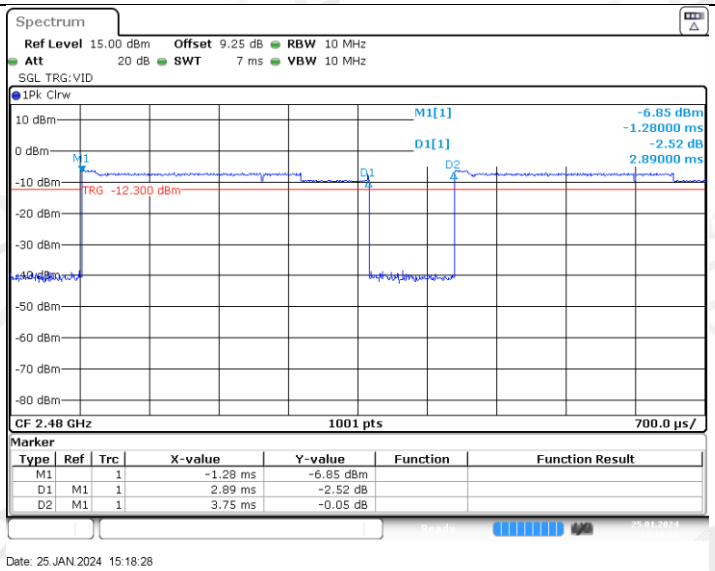

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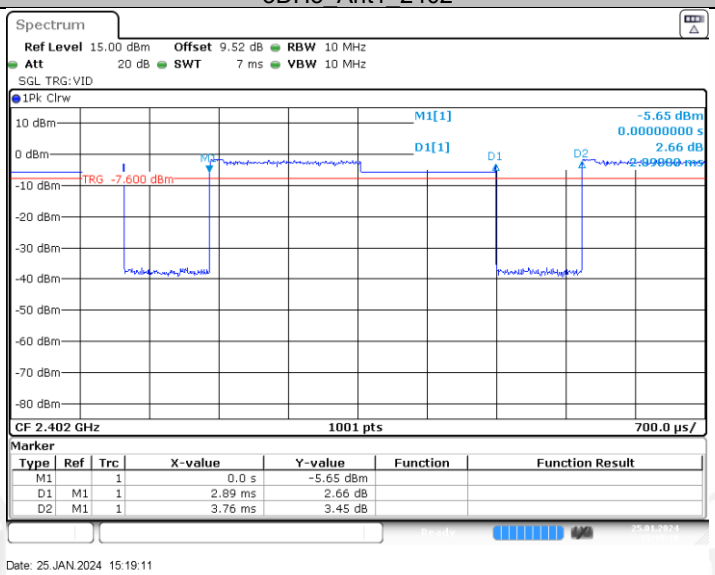

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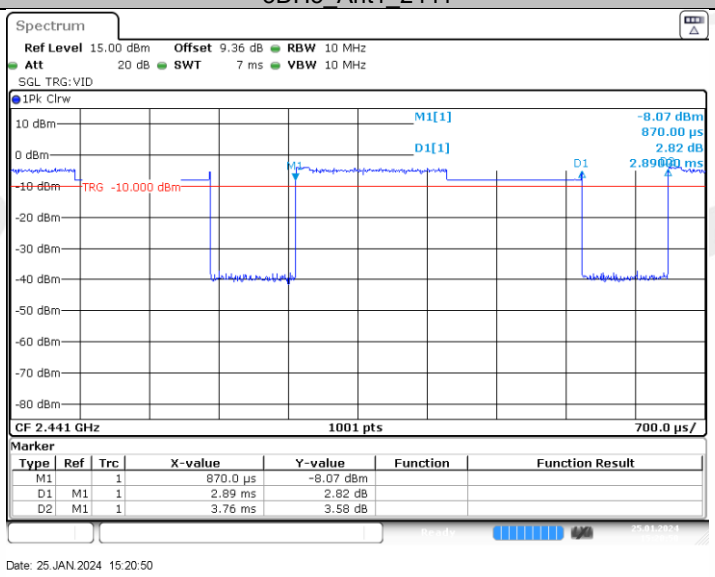

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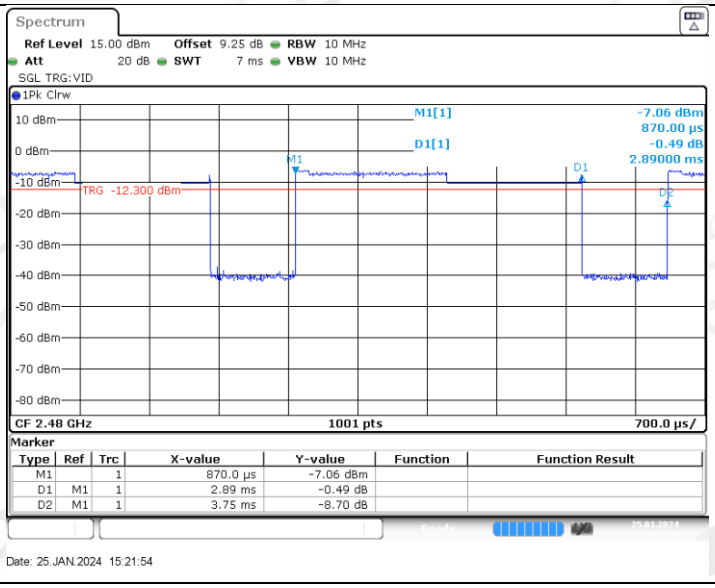
Spectrum
Ref Level 15.00 dBm Offset 9.25 dB RBW 10 MHz
Att 20 dB SWT 7 ms VBW 10 MHz
SGL TRG:VID
1Pk Clrw
M1[1] -7.06 dBm
870.00 µs
D1[1] -0.49 dB
2.89000 ms
TRG -12.300 dBm
CF 2.48 GHz
1001 pts
700.0 µs/
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 870.0 µs -7.06 dBm
D1 M1 1 2.89 ms -0.49 dB
D2 M1 1 3.75 ms -8.70 dB
Date: 25.JAN.2024 15:21:54