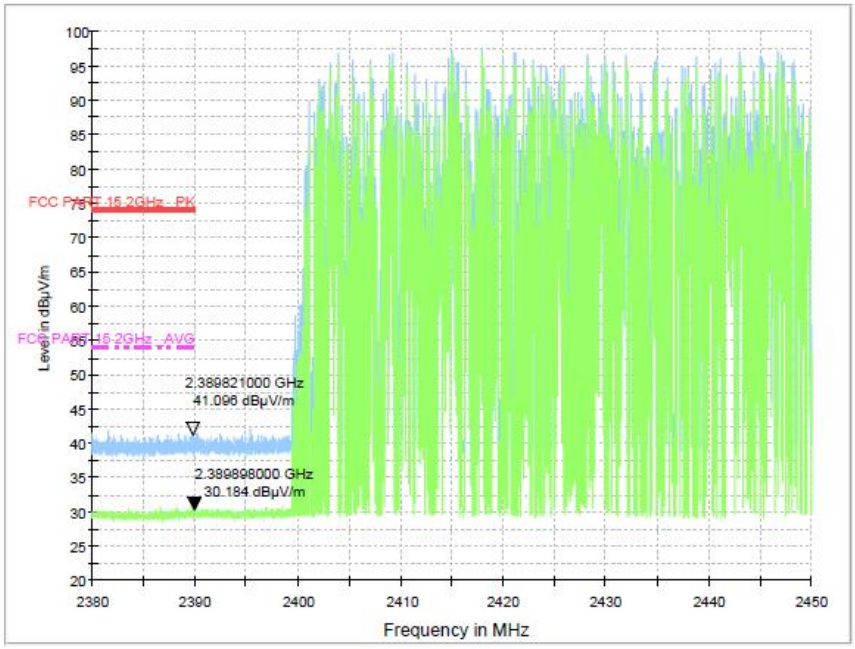
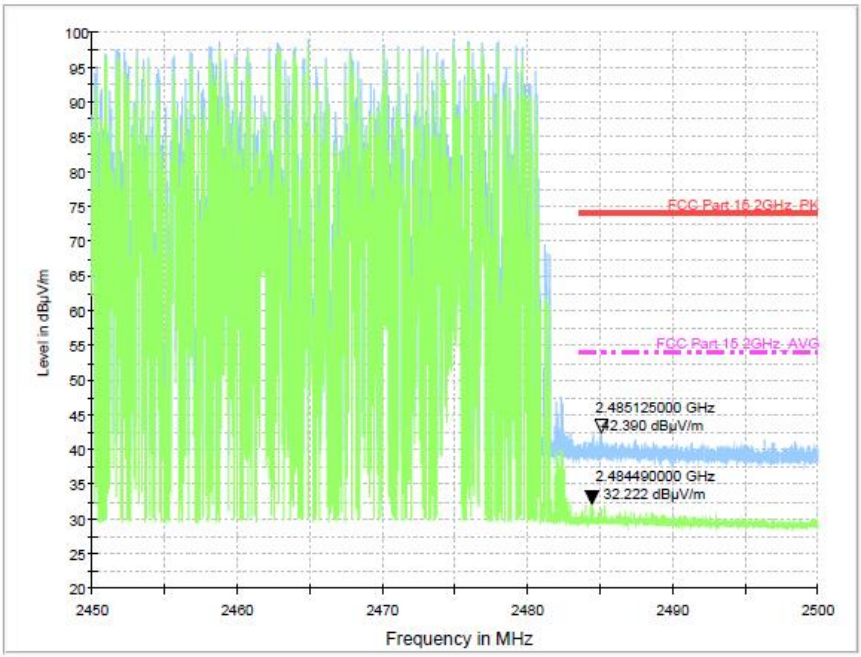
TM6 / Band: 2.4G / BW: 1 / CH: L



TM6 / Band: 2.4G / BW: 1 / CH: H



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6.9 Emissions in restricted frequency bands (below 1GHz)

Test Requirement:	In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`
Test Method:	Radiated emissions tests
Test Limit:	Frequency (MHz) / Field strength (microvolts/meter) / Measurement distance (meters) 0.009-0.490 / 2400/F(kHz) / 300 0.490-1.705 / 24000/F(kHz) / 30 1.705-30.0 / 30 / 30 30-88 / 100 ** / 3 88-216 / 150 ** / 3 216-960 / 200 ** / 3 Above 960 / 500 / 3 ** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.
Procedure:	ANSI C63.10-2013 section 6.6.4

6.9.1 E.U.T. Operation:

Operating Environment:	
Temperature:	24.9 °C
Humidity:	49.4 %
Atmospheric Pressure:	1010 mbar

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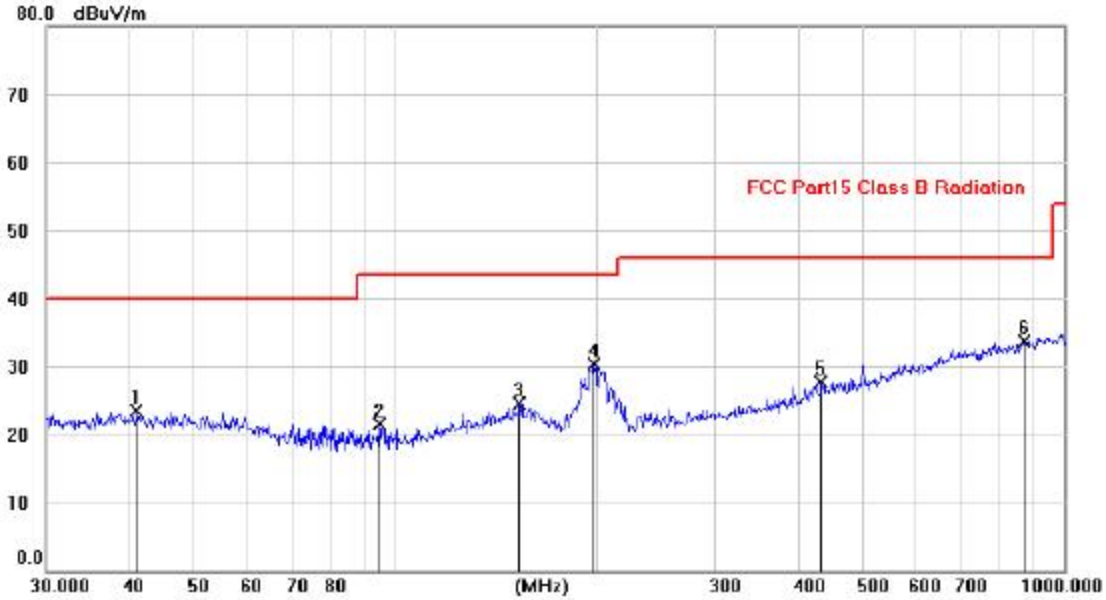
6.9.2 Test Data:

Note: All the mode have been tested, and only the worst case of GFSK mode are in the report
TM1 / Polarization: Horizontal / Band: 2.4G / BW: 1 / CH: H



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		41.0407	9.12	14.34	23.46	40.00	-16.54	peak			
2		94.7158	10.94	10.48	21.42	43.50	-22.08	peak			
3		153.6127	9.46	15.05	24.51	43.50	-18.99	peak			
4		198.3326	19.28	11.00	30.28	43.50	-13.22	peak			
5		433.8620	10.55	17.17	27.72	46.00	-18.28	peak			
6	*	874.2245	9.93	23.71	33.64	46.00	-12.36	peak			

Note:1. *:Maximum data; x:Over limit; !:over margin.
2.Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

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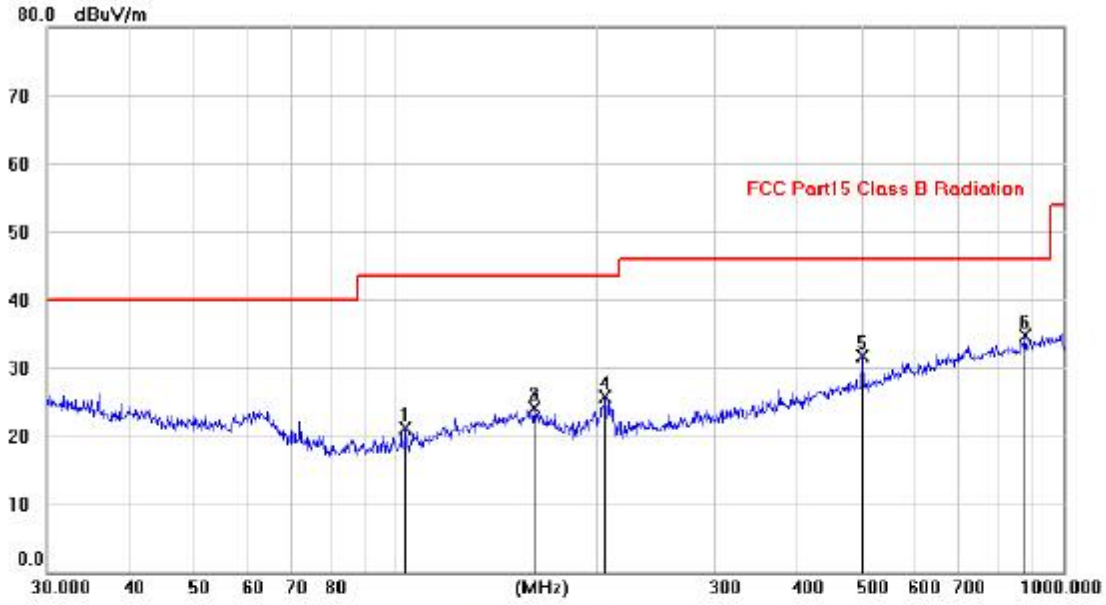
TM1 / Polarization: Vertical / Band: 2.4G / BW: 1 / CH: H



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector	cm	degree	Comment
1		103.5994	9.88	11.20	21.08	43.50	-22.42	peak			
2		161.4173	9.11	14.90	24.01	43.50	-19.49	peak			
3		161.4173	9.11	14.90	24.01	43.50	-19.49	peak			
4		206.1563	14.61	11.00	25.61	43.50	-17.89	peak			
5		500.0086	13.45	18.21	31.66	46.00	-14.34	peak			
6	*	876.6802	10.88	23.73	34.61	46.00	-11.39	peak			

Note:1. *:Maximum data; x:Over limit; !:over margin.
2.Measurement=Reading Level+Correct Factor; Correct Factor=Antenna Factor+Cable Loss.

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6.10 Emissions in restricted frequency bands (above 1GHz)

Test Requirement:	In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)(see § 15.205(c)).`
Test Method:	Radiated emissions tests
Test Limit:	Frequency (MHz) / Field strength (microvolts/meter) / Measurement distance (meters) 0.009-0.490 / 2400/F(kHz) / 300 0.490-1.705 / 24000/F(kHz) / 30 1.705-30.0 / 30 / 30 30-88 / 100 ** / 3 88-216 / 150 ** / 3 216-960 / 200 ** / 3 Above 960 / 500 / 3 ** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.
Procedure:	ANSI C63.10-2013 section 6.6.4

6.10.1 E.U.T. Operation:

Operating Environment:	
Temperature:	24.9 °C
Humidity:	49.4 %
Atmospheric Pressure:	1010 mbar

6.10.2 Test Data:

From 1G-25GHz

Test Mode: GFSK TX Low									
Freq (MHz)	Read Level (dBuV/m)	Polar (H/V)	Antenna Factor (dB/m)	Cable loss(dB)	Amp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4804	48.42	V	33.93	10.18	34.26	58.27	74	-15.73	PK
4804	36.30	V	33.93	10.18	34.26	46.15	54	-7.85	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
4804	47.63	H	33.93	10.18	34.26	57.48	74	-16.52	PK
4804	35.86	H	33.93	10.18	34.26	45.71	54	-8.29	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
Test Mode: GFSK TX Mid									
4882	49.87	V	33.95	10.20	34.26	59.76	74	-14.24	PK
4882	35.17	V	33.95	10.20	34.26	45.06	54	-8.94	AV
7323	/	/	/	/	/	/	/	/	/
9764	/	/	/	/	/	/	/	/	/
4882	48.68	H	33.95	10.20	34.26	58.57	74	-15.43	PK
4882	34.23	H	33.95	10.20	34.26	44.12	54	-9.88	AV
7323	/	/	/	/	/	/	/	/	/
9764	/	/	/	/	/	/	/	/	/
Test Mode: GFSK TX High									
4960	47.89	V	33.98	10.22	34.25	57.84	74	-16.16	PK
4960	33.16	V	33.98	10.22	34.25	43.11	54	-10.89	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/
4960	46.83	H	33.98	10.22	34.25	56.78	74	-17.22	PK
4960	32.88	H	33.98	10.22	34.25	42.83	54	-11.17	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/

Note:

1, Result = Read level + Antenna factor + cable loss-Amp factor

2, All the other emissions not reported were too low to read and deemed to comply with FCC limit.

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Test Mode: π/4 DQPSK TX Low									
Freq (MHz)	Read Level (dBuV/m)	Polar (H/V)	Antenna Factor (dB/m)	Cable loss(dB)	Amp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4804	48.57	V	33.93	10.18	34.26	58.42	74	-15.58	PK
4804	36.08	V	33.93	10.18	34.26	45.93	54	-8.07	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
4804	47.60	H	33.93	10.18	34.26	57.45	74	-16.55	PK
4804	35.97	H	33.93	10.18	34.26	45.82	54	-8.18	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
Test Mode: π/4 DQPSK TX Mid									
4882	49.51	V	33.95	10.20	34.26	59.40	74	-14.60	PK
4882	35.99	V	33.95	10.20	34.26	45.88	54	-8.12	AV
7323	/	/	/	/	/	/	/	/	/
9764	/	/	/	/	/	/	/	/	/
4882	48.93	H	33.95	10.20	34.26	58.82	74	-15.18	PK
4882	34.22	H	33.95	10.20	34.26	44.11	54	-9.89	AV
7323	/	/	/	/	/	/	/	/	/
9764	/	/	/	/	/	/	/	/	/
Test Mode: π/4 DQPSK TX High									
4960	47.69	V	33.98	10.22	34.25	57.64	74	-16.36	PK
4960	33.25	V	33.98	10.22	34.25	43.20	54	-10.80	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/
4960	46.45	H	33.98	10.22	34.25	56.40	74	-17.60	PK
4960	32.35	H	33.98	10.22	34.25	42.30	54	-11.70	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/

Note:

1, Result = Read level + Antenna factor + cable loss-Amp factor

2, All the other emissions not reported were too low to read and deemed to comply with FCC limit.

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Test Mode: 8DPSK TX Low									
Freq (MHz)	Read Level (dBuV/m)	Polar (H/V)	Antenna Factor (dB/m)	Cable loss(dB)	Amp Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
4804	48.69	V	33.93	10.18	34.26	58.54	74	-15.46	PK
4804	36.80	V	33.93	10.18	34.26	46.65	54	-7.35	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
4804	47.61	H	33.93	10.18	34.26	57.46	74	-16.54	PK
4804	35.62	H	33.93	10.18	34.26	45.47	54	-8.53	AV
7206	/	/	/	/	/	/	/	/	/
9608	/	/	/	/	/	/	/	/	/
Test Mode: 8DPSK TX Mid									
4882	49.01	V	33.95	10.20	34.26	58.90	74	-15.10	PK
4882	35.19	V	33.95	10.20	34.26	45.08	54	-8.92	AV
7323	/	/	/	/	/	/	/	/	/
9764	/	/	/	/	/	/	/	/	/
4882	48.63	H	33.95	10.20	34.26	58.52	74	-15.48	PK
4882	34.72	H	33.95	10.20	34.26	44.61	54	-9.39	AV
7323	/	/	/	/	/	/	/	/	/
9764	/	/	/	/	/	/	/	/	/
Test Mode: 8DPSK TX High									
4960	47.57	V	33.98	10.22	34.25	57.52	74	-16.48	PK
4960	33.78	V	33.98	10.22	34.25	43.73	54	-10.27	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/
4960	46.09	H	33.98	10.22	34.25	56.04	74	-17.96	PK
4960	32.42	H	33.98	10.22	34.25	42.37	54	-11.63	AV
7440	/	/	/	/	/	/	/	/	/
9920	/	/	/	/	/	/	/	/	/

Note:

1, Result = Read level + Antenna factor + cable loss-Amp factor

2, All the other emissions not reported were too low to read and deemed to comply with FCC limit.

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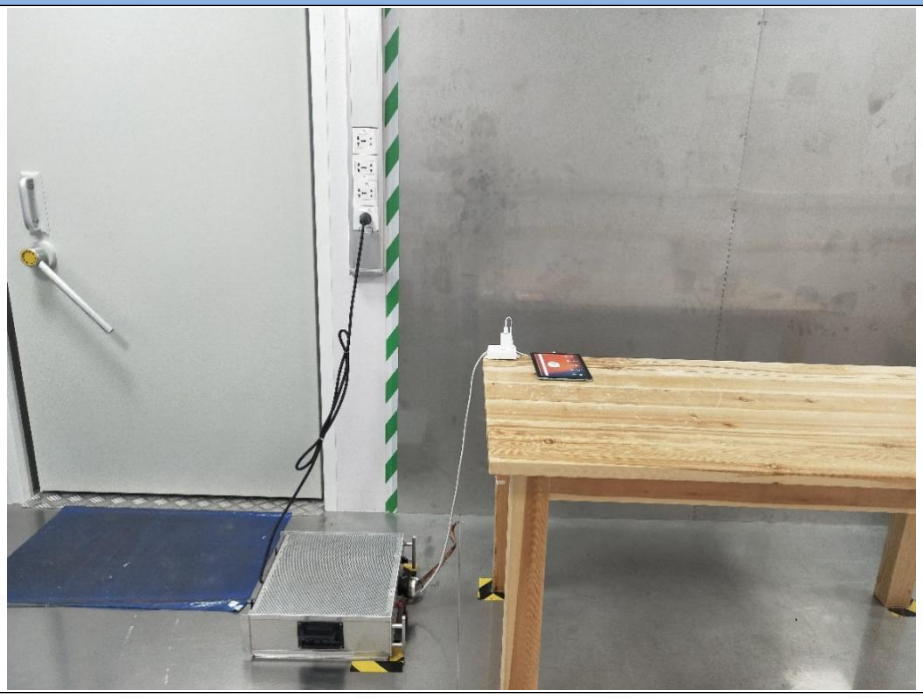
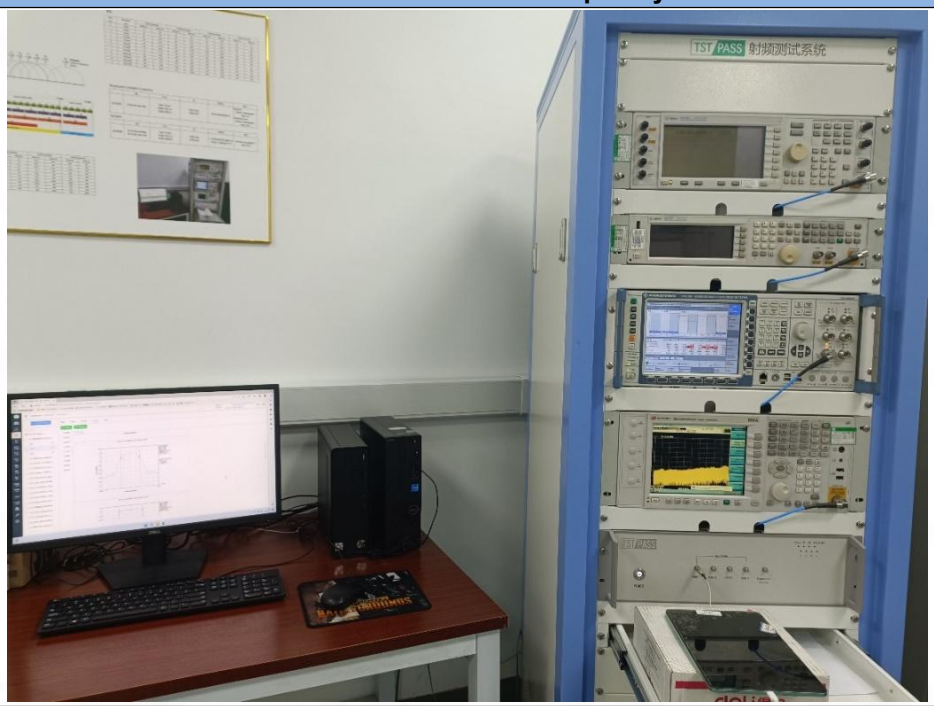
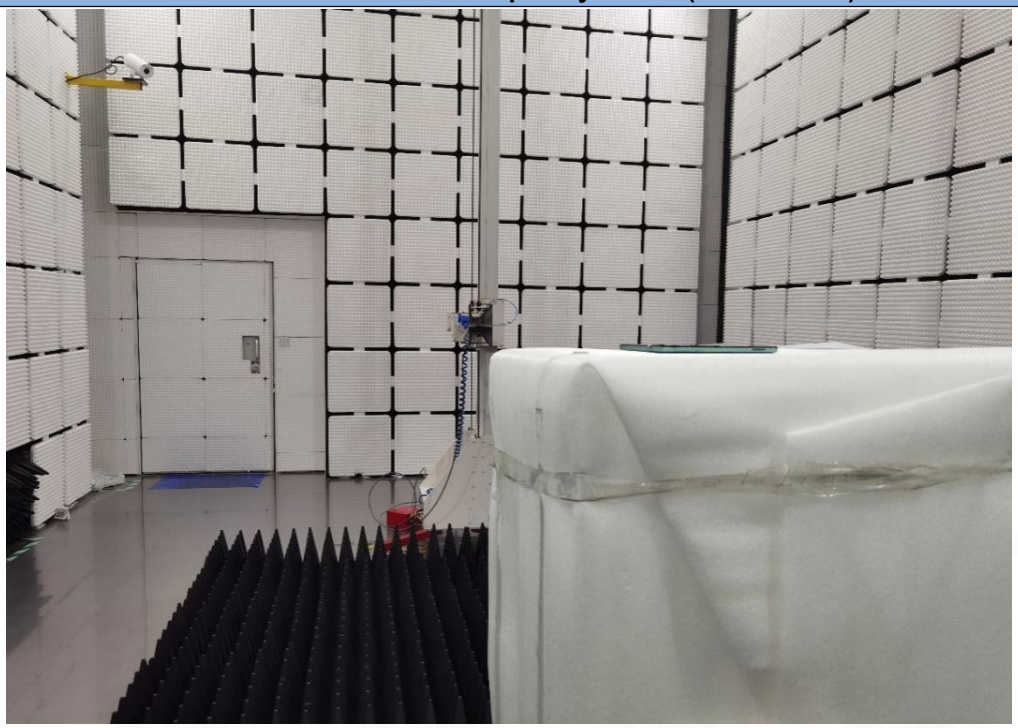
7 Test Setup Photos

Conducted Emission at AC power line


Occupied Bandwidth
Maximum Conducted Output Power
Channel Separation
Number of Hopping Frequencies
Dwell Time
Emissions in non-restricted frequency bands



Band edge emissions (Radiated)
Emissions in restricted frequency bands (above 1GHz)



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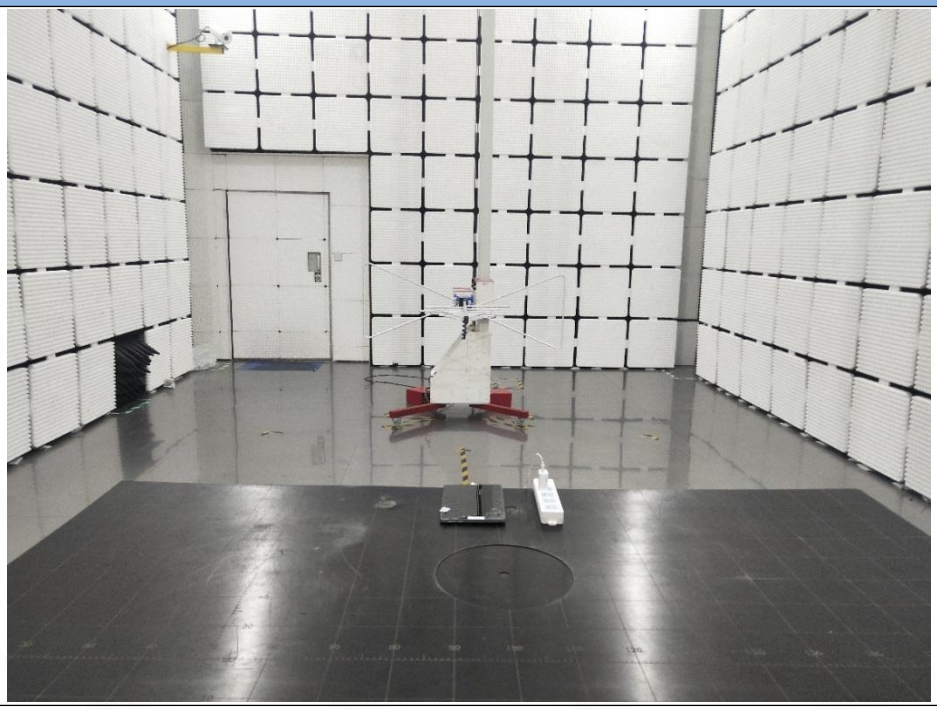
Emissions in restricted frequency bands (below 1GHz)


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8 EUT Constructional Details (EUT Photos)

Please refer to the report No. BTF230710R00301

Appendix

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1. Bandwidth

1.1 OBW

1.1.1 Test Result

TestMode	Antenna	Freq(MHz)	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.752	2401.6254	2402.3776	---	---
		2441	0.761	2440.6224	2441.3836	---	---
		2480	0.761	2479.6134	2480.3746	---	---
2DH5	Ant1	2402	1.142	2401.4246	2402.5664	---	---
		2441	1.151	2440.4186	2441.5694	---	---
		2480	1.151	2479.4126	2480.5634	---	---
3DH5	Ant1	2402	1.151	2401.4246	2402.5754	---	---
		2441	1.151	2440.4246	2441.5754	---	---
		2480	1.148	2479.4186	2480.5664	---	---

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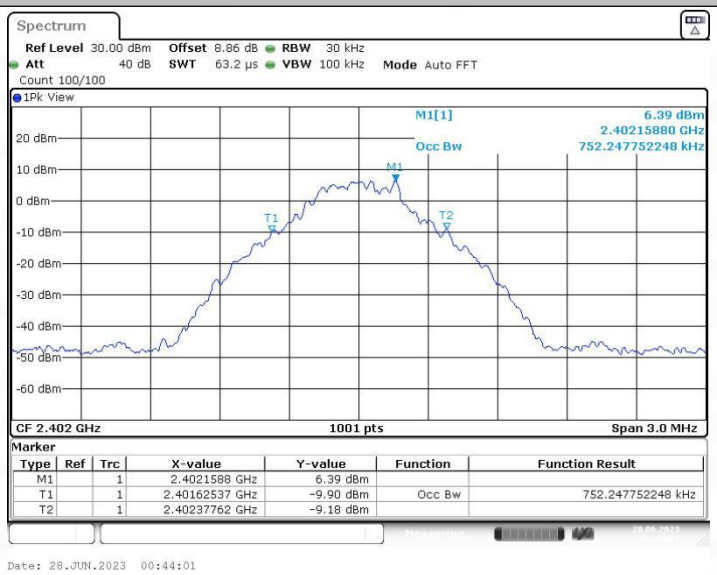
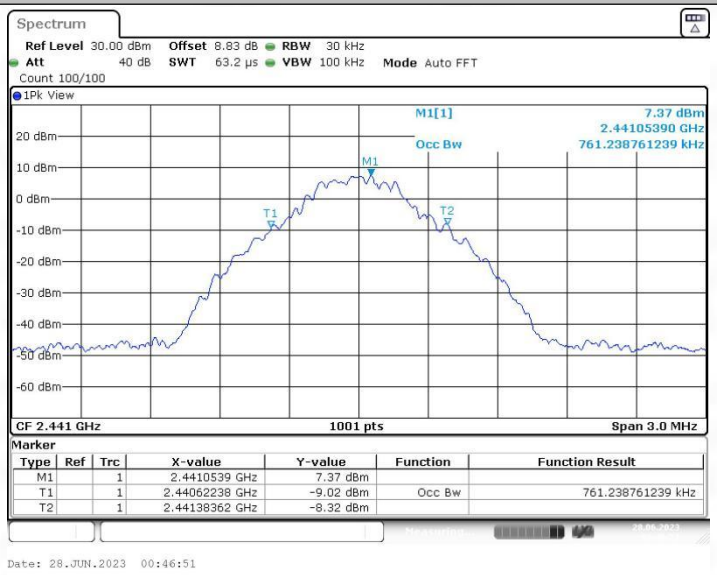
1.1.2 Test Graph

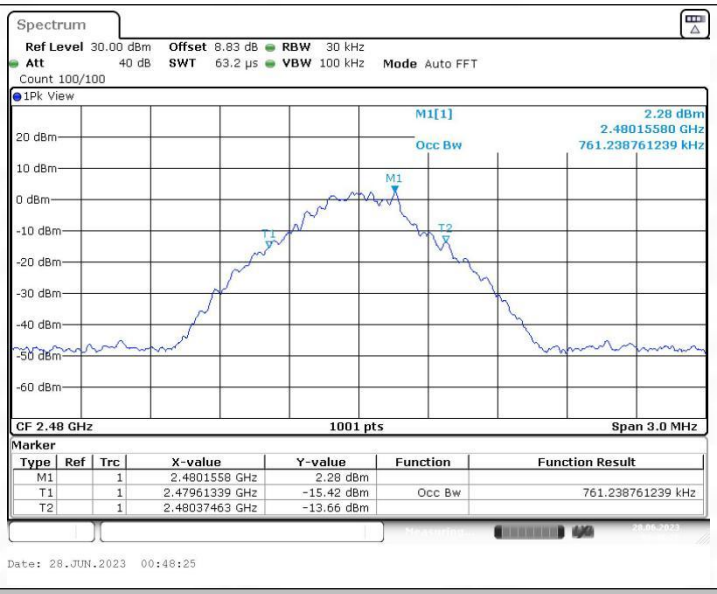
DH5_Ant1_2402



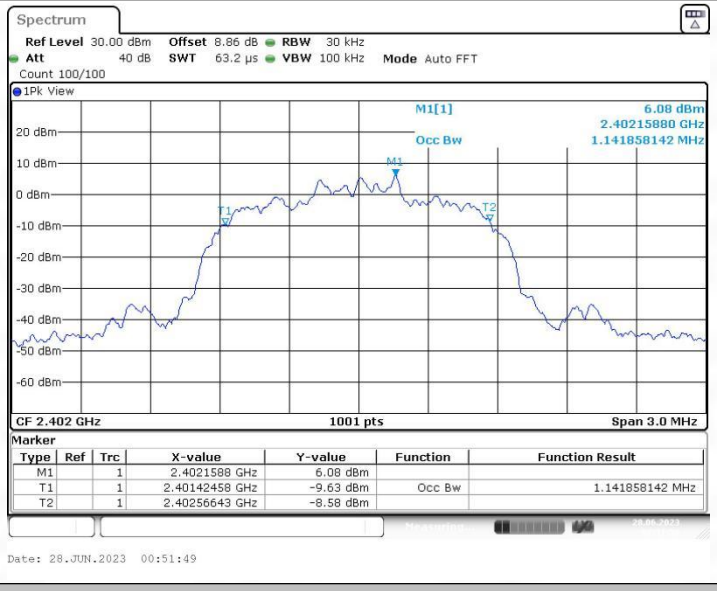
DH5_Ant1_2441



DH5_Ant1_2480



2DH5_Ant1_2402



2DH5_Ant1_2441

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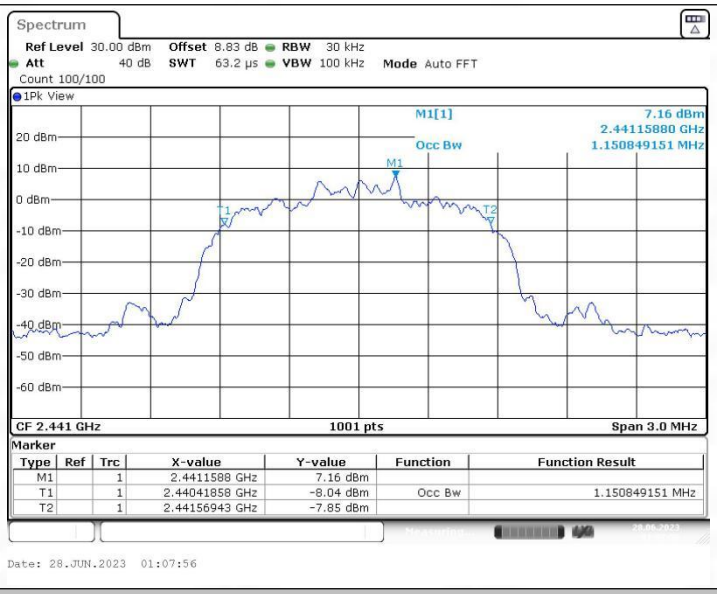
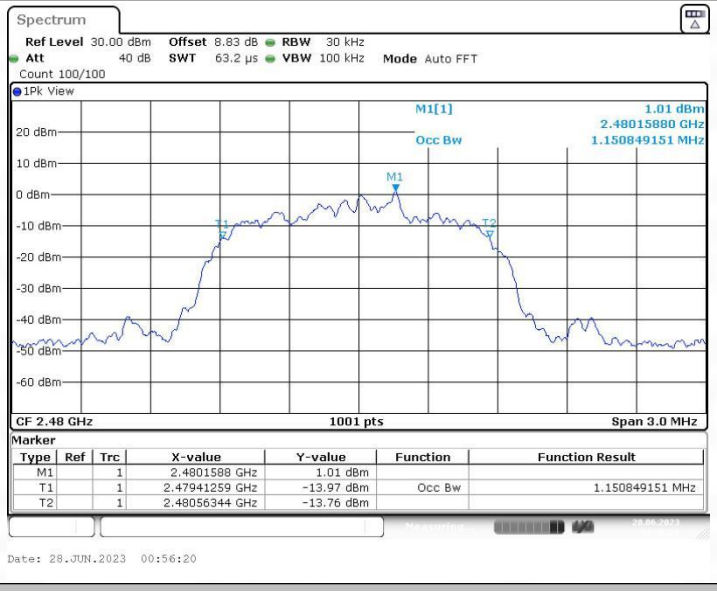


2DH5_Ant1_2480



3DH5_Ant1_2402

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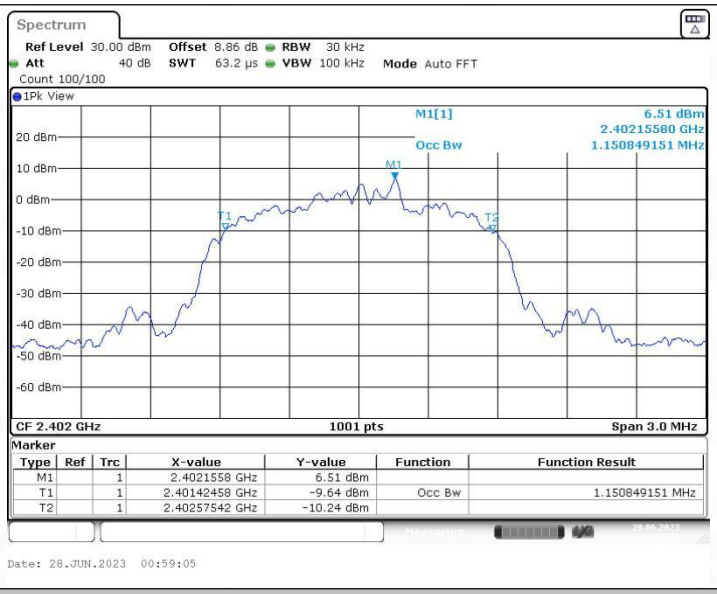
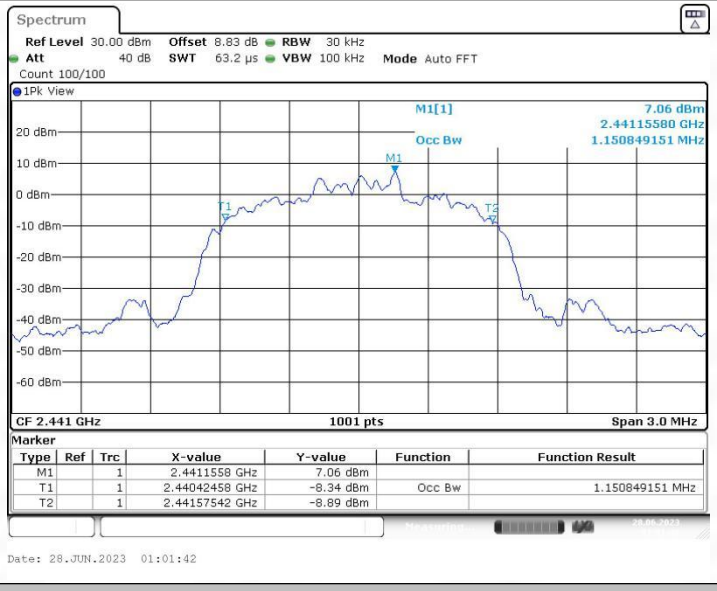


3DH5_Ant1_2441



3DH5_Ant1_2480

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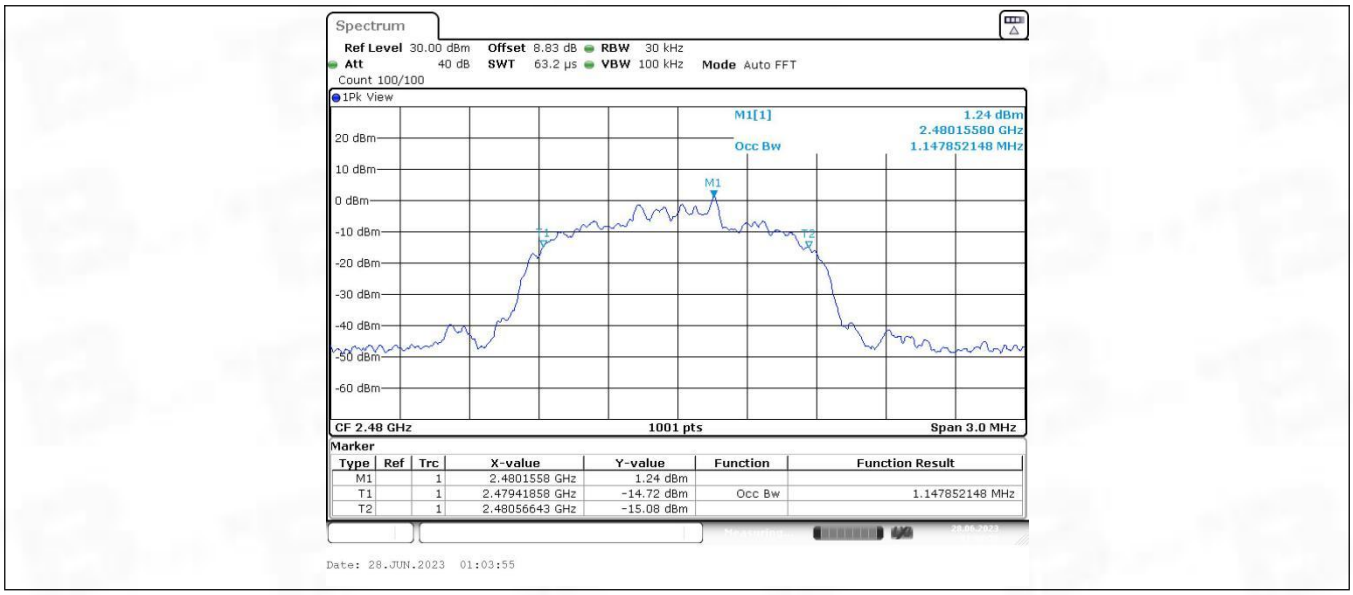
Spectrum
Ref Level 30.00 dBm Offset 8.83 dB RBW 30 kHz
Att 40 dB SWT 63.2 µs VBW 100 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] 1.24 dBm
2.48015580 GHz
Occ Bw 1.147852148 MHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
CF 2.48 GHz
1001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.4801558 GHz 1.24 dBm
T1 1 2.47941858 GHz -14.72 dBm Occ Bw 1.147852148 MHz
T2 1 2.48056643 GHz -15.08 dBm
Date: 28.JUN.2023 01:03:55

1.2 20dB BW

1.2.1 Test Result

TestMode	Antenna	Freq(MHz)	20dB EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.84	2401.57	2402.41	---	---
		2441	0.85	2440.56	2441.41	---	---
		2480	0.86	2479.54	2480.41	---	---
2DH5	Ant1	2402	1.27	2401.37	2402.64	---	---
		2441	1.28	2440.36	2441.64	---	---
		2480	1.26	2479.36	2480.62	---	---
3DH5	Ant1	2402	1.26	2401.36	2402.62	---	---
		2441	1.28	2440.35	2441.64	---	---
		2480	1.27	2479.35	2480.62	---	---

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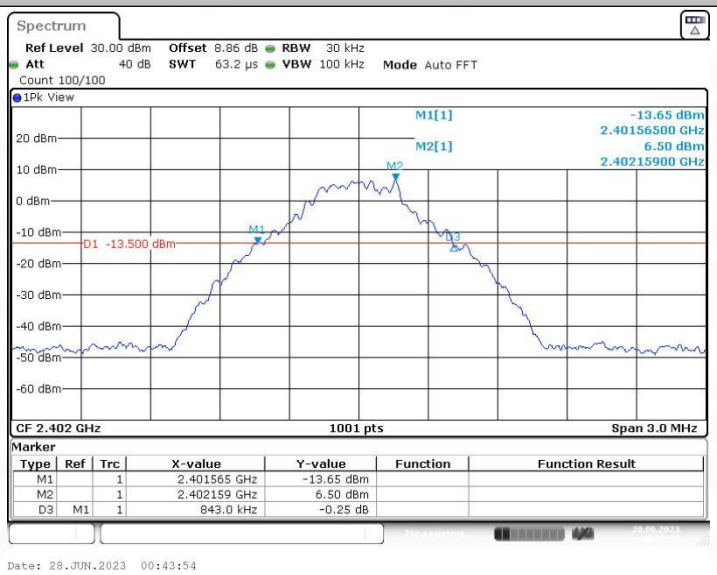
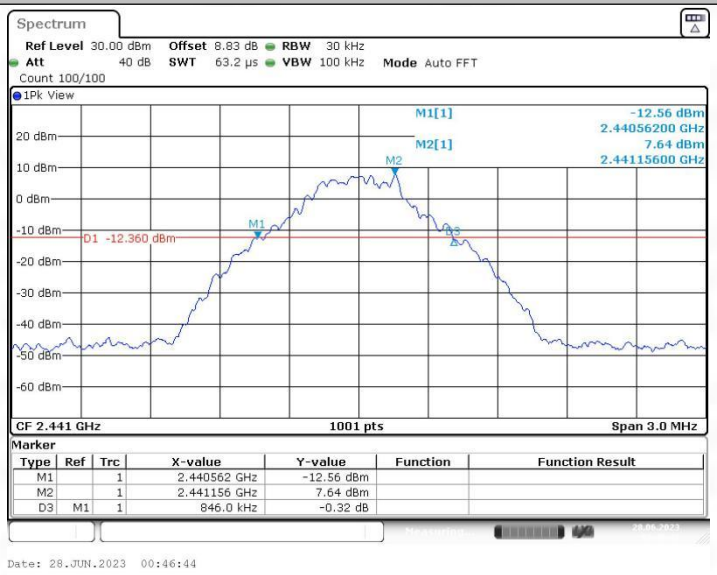
1.2.2 Test Graph

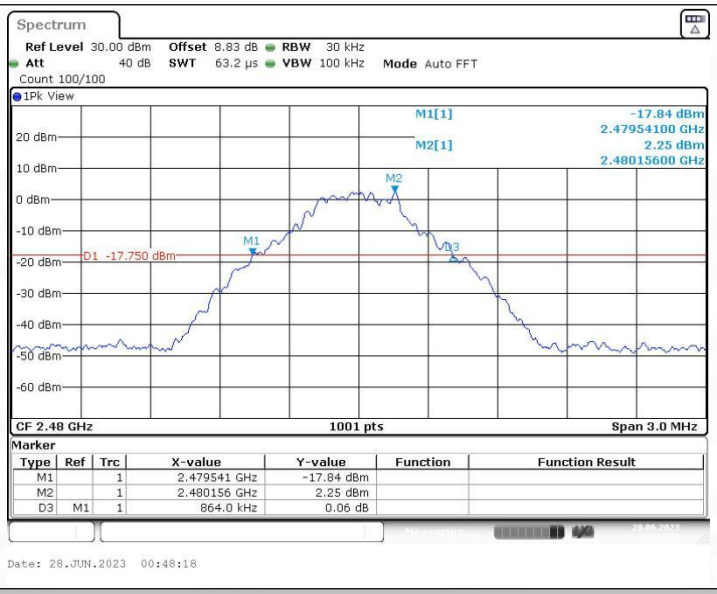
DH5_Ant1_2402



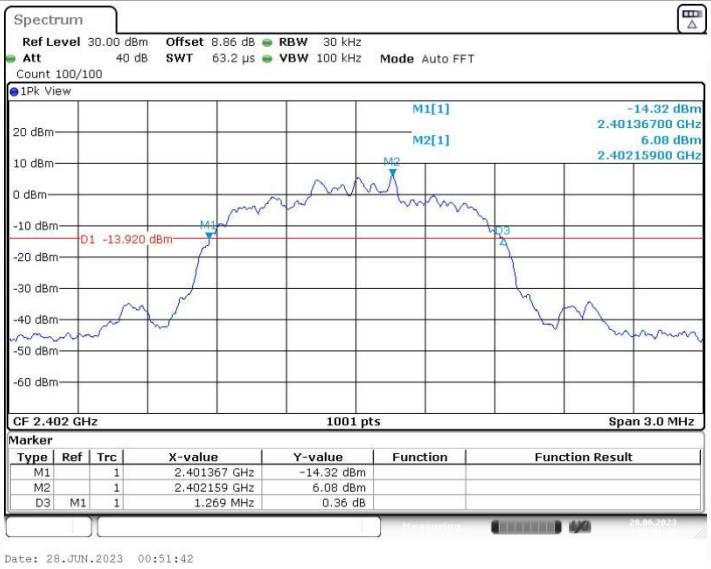
DH5_Ant1_2441



DH5_Ant1_2480



2DH5_Ant1_2402



2DH5_Ant1_2441

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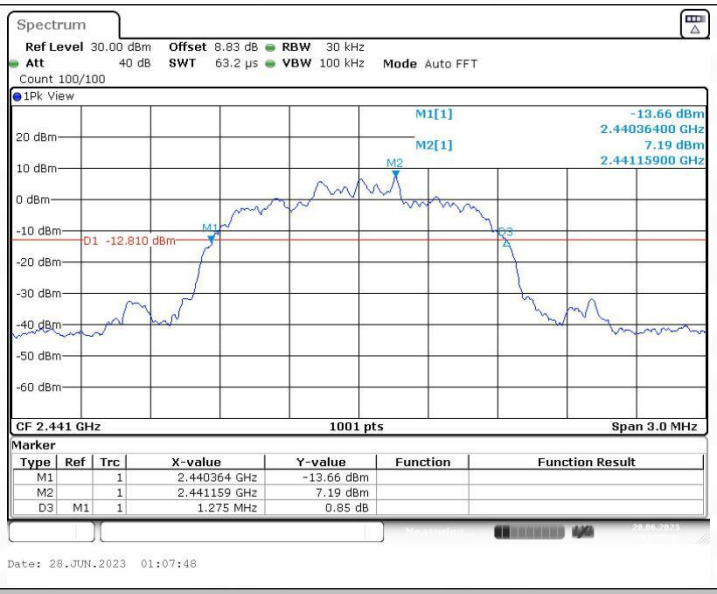
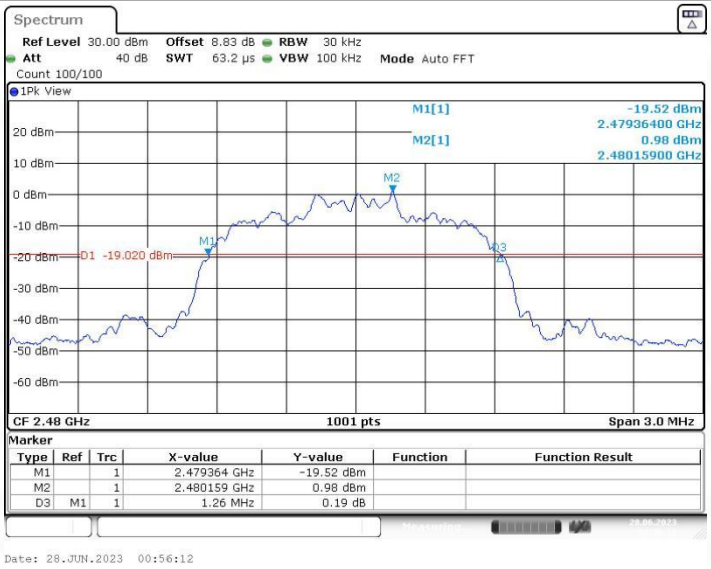


2DH5_Ant1_2480



3DH5_Ant1_2402

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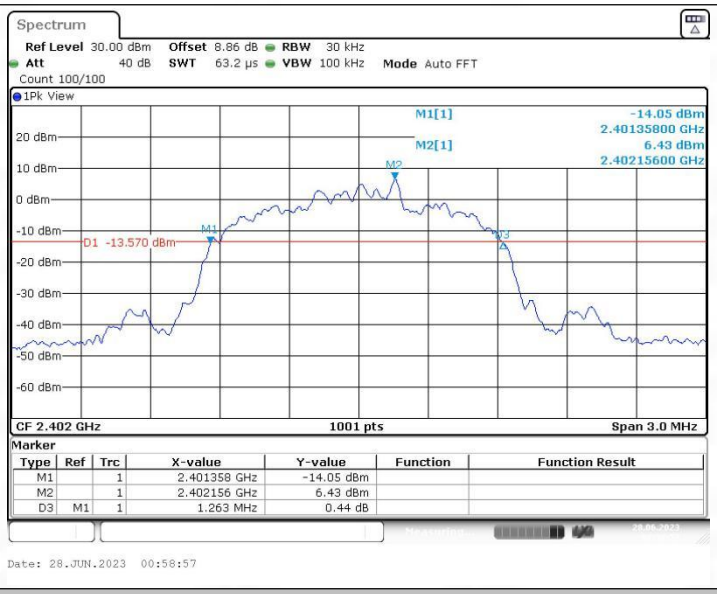
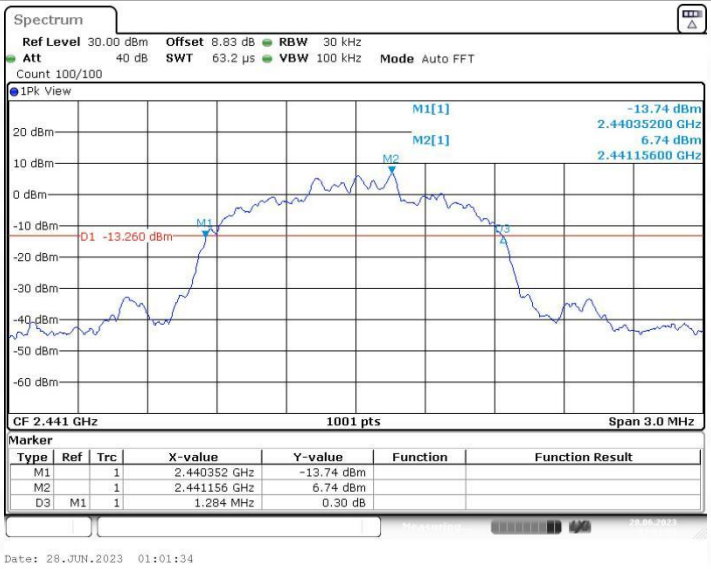


3DH5_Ant1_2441



3DH5_Ant1_2480

BTF Testing Lab (Shenzhen) Co., Ltd.
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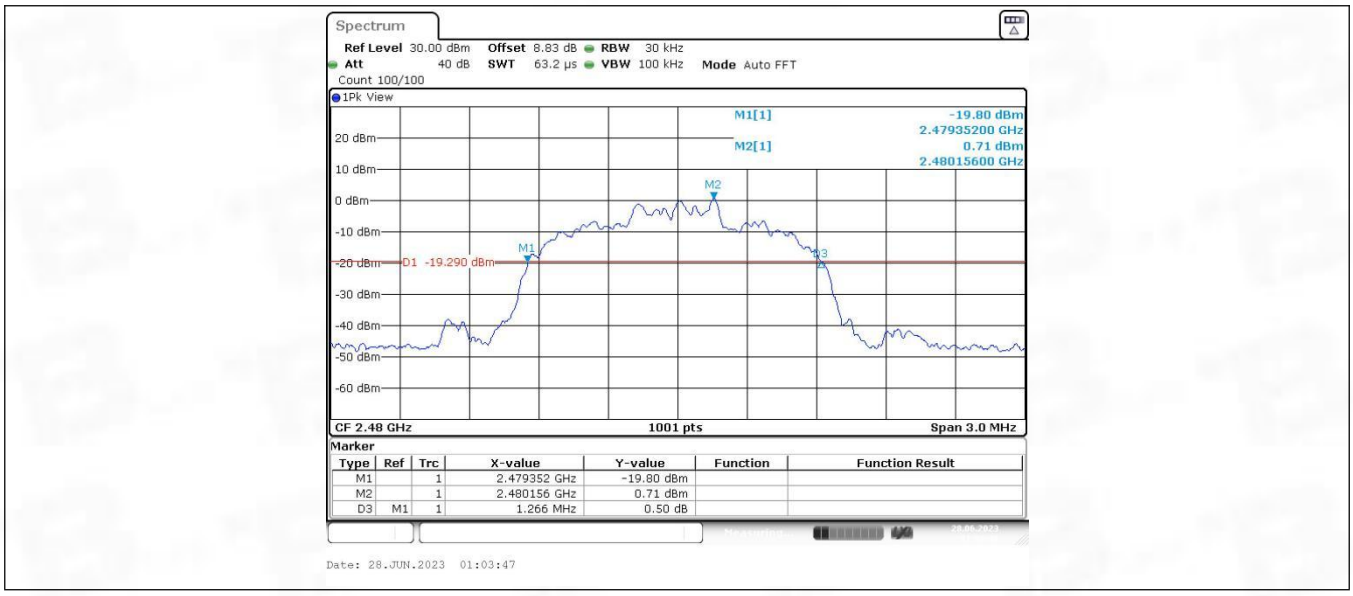
Spectrum
Ref Level 30.00 dBm Offset 8.83 dB RBW 30 kHz
Att 40 dB SWT 63.2 µs VBW 100 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] -19.80 dBm
2.47935200 GHz
M2[1] 0.71 dBm
2.48015600 GHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
D1 -19.290 dBm
M1
M2
D3
CF 2.48 GHz
1001 pts
Span 3.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 2.479352 GHz -19.80 dBm
M2 1 2.480156 GHz 0.71 dBm
D3 M1 1 1.266 MHz 0.50 dB
Date: 28.JUN.2023 01:03:47

2. Maximum Conducted Output Power

2.1 Power

2.1.1 Test Result

Test Mode	Antenna	Freq(MHz)	Conducted Peak Powert[dBm]	Conducted Limit[dBm]	Verdict
DH5	Ant1	2402	9.42	≤30	PASS
		2441	10.48	≤30	PASS
		2480	5.38	≤30	PASS
2DH5	Ant1	2402	9.44	≤20.97	PASS
		2441	10.33	≤20.97	PASS
		2480	4.33	≤20.97	PASS
3DH5	Ant1	2402	9.13	≤20.97	PASS
		2441	10.19	≤20.97	PASS
		2480	4.24	≤20.97	PASS

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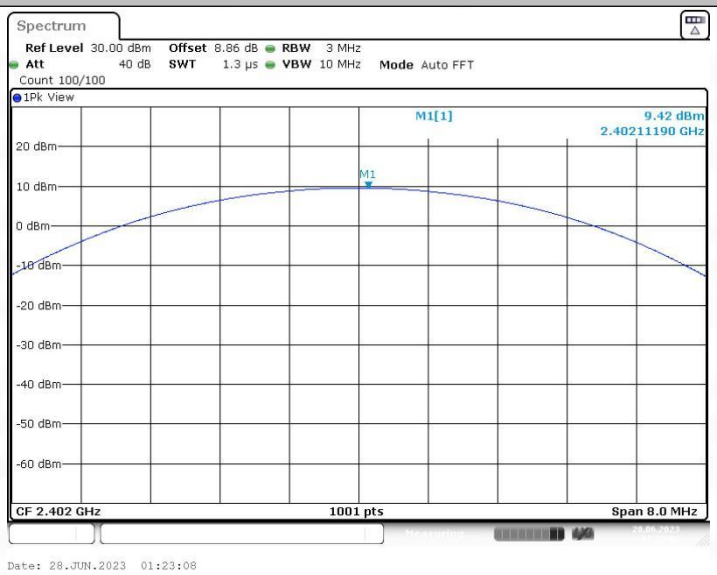
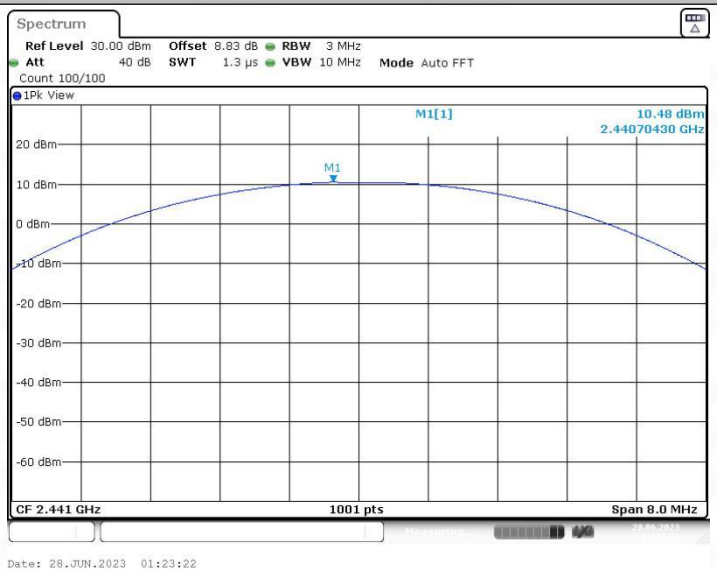
2.1.2 Test Graph

DH5_Ant1_2402



DH5_Ant1_2441



DH5_Ant1_2480

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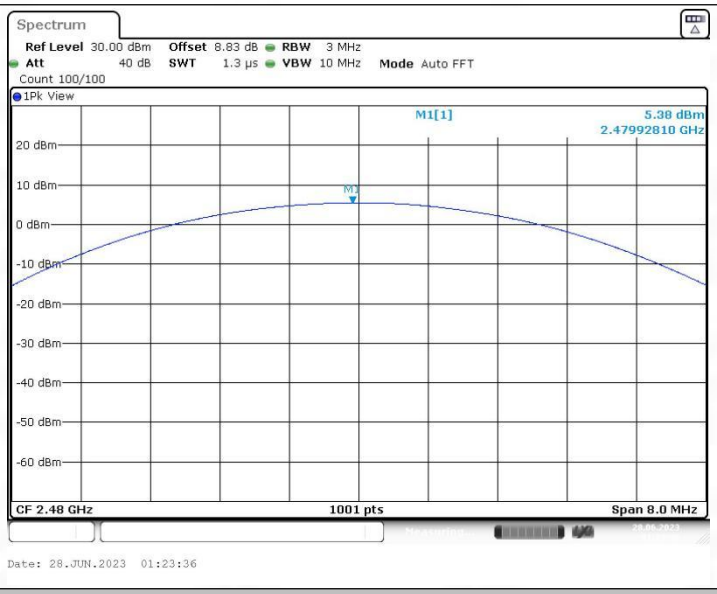
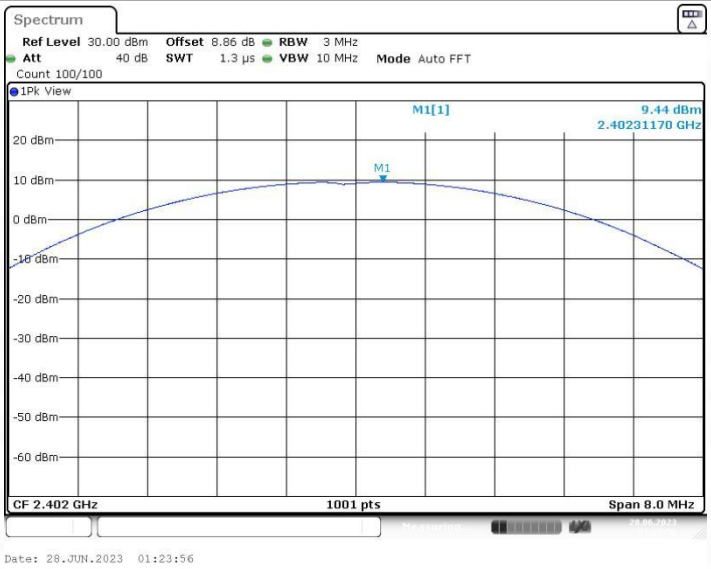


2DH5_Ant1_2402



2DH5_Ant1_2441

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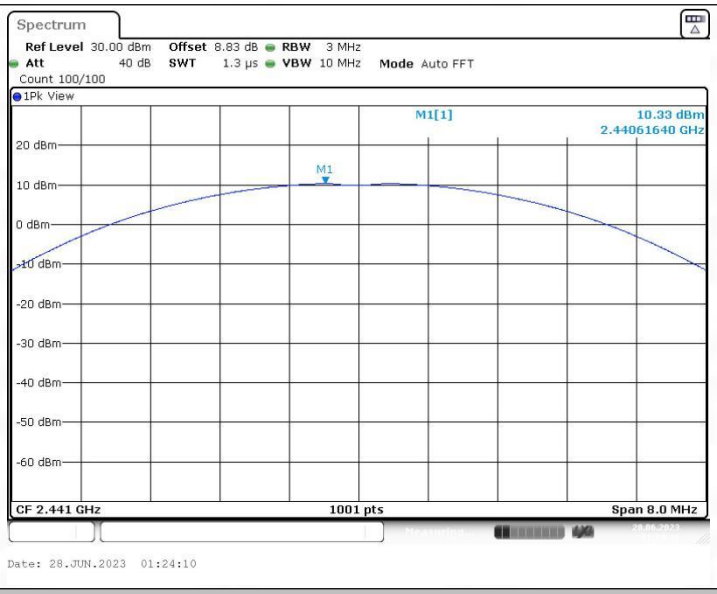
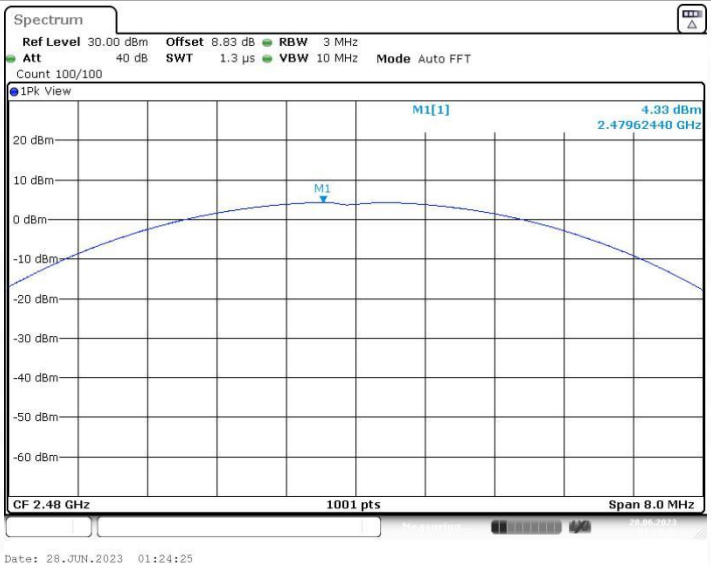


2DH5_Ant1_2480



3DH5_Ant1_2402

BTF Testing Lab (Shenzhen) Co., Ltd.
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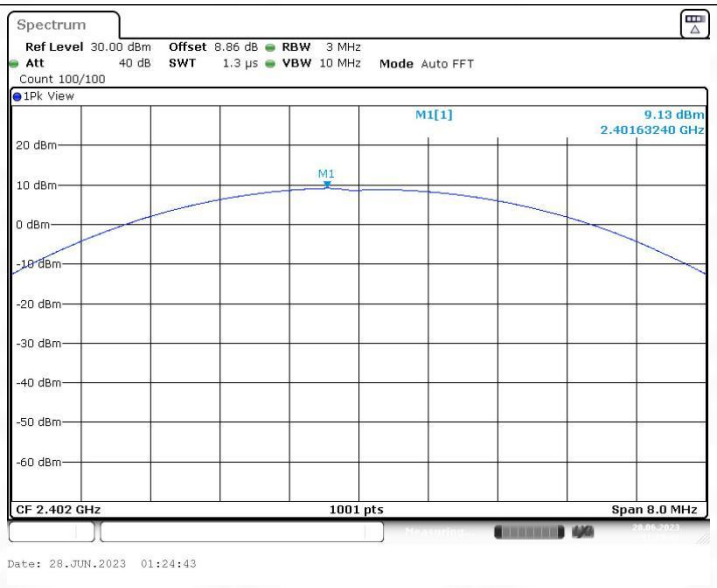
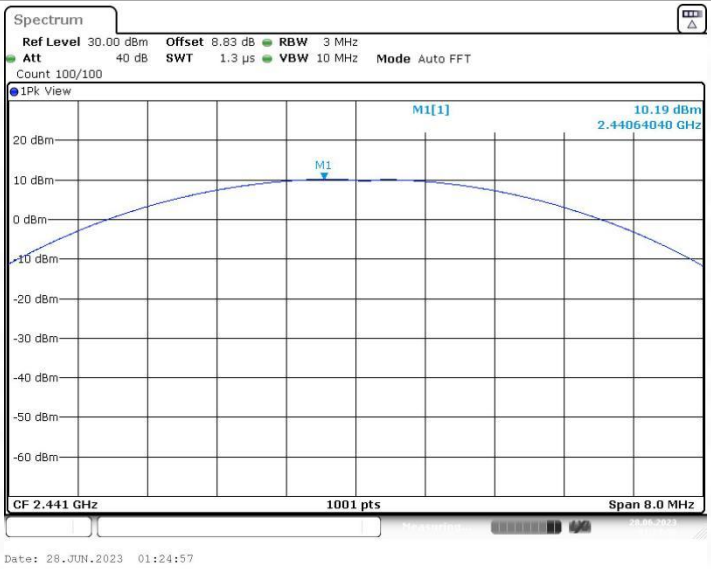


3DH5_Ant1_2441



3DH5_Ant1_2480

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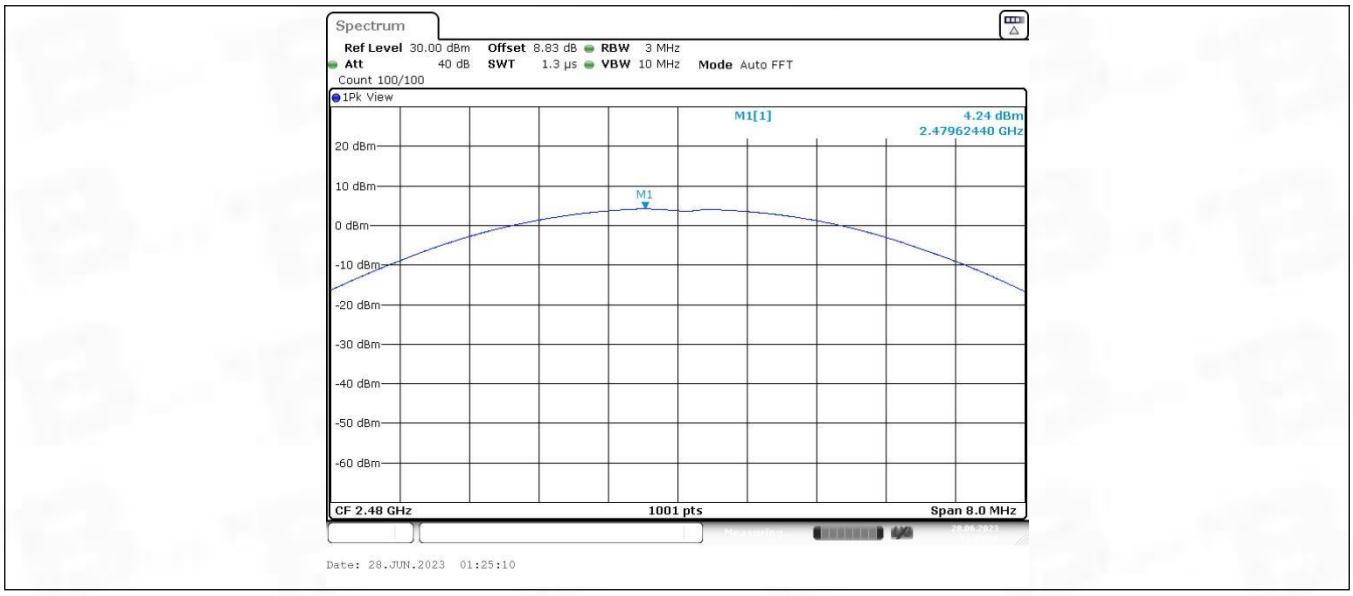

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3. Carrier Frequency Separation

3.1 Ant1

3.1.1 Test Result

TestMode	Antenna	Freq(MHz)	Result[MHz]	Limit[MHz]	Verdict
DH5	Ant1	Hop	1.003	≥0.860	PASS
2DH5	Ant1	Hop	1.012	≥0.853	PASS
3DH5	Ant1	Hop	0.991	≥0.853	PASS

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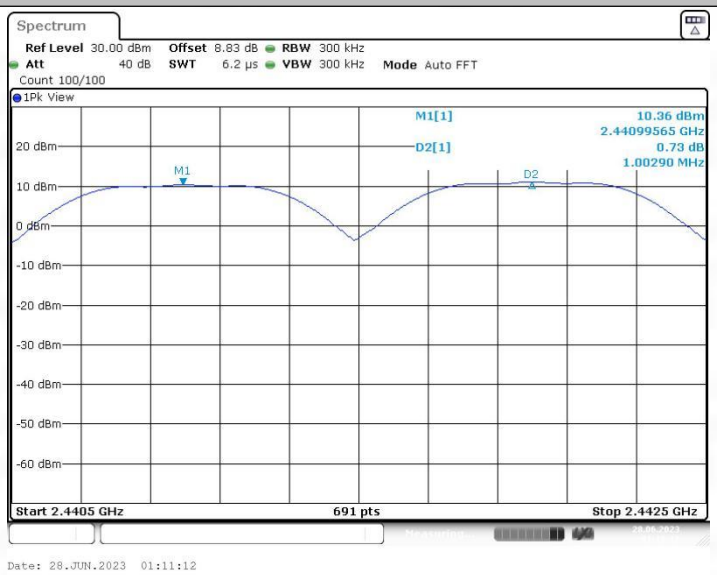
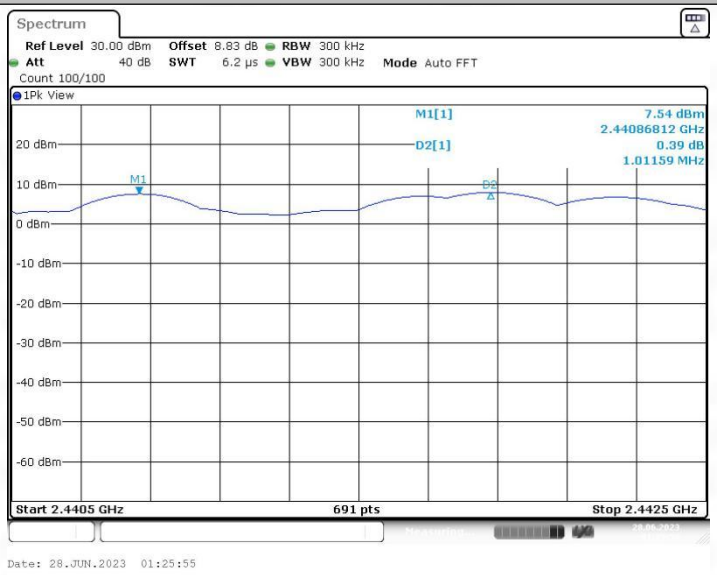
3.1.2 Test Graph

DH5_Ant1_Hop



2DH5_Ant1_Hop



3DH5_Ant1_Hop

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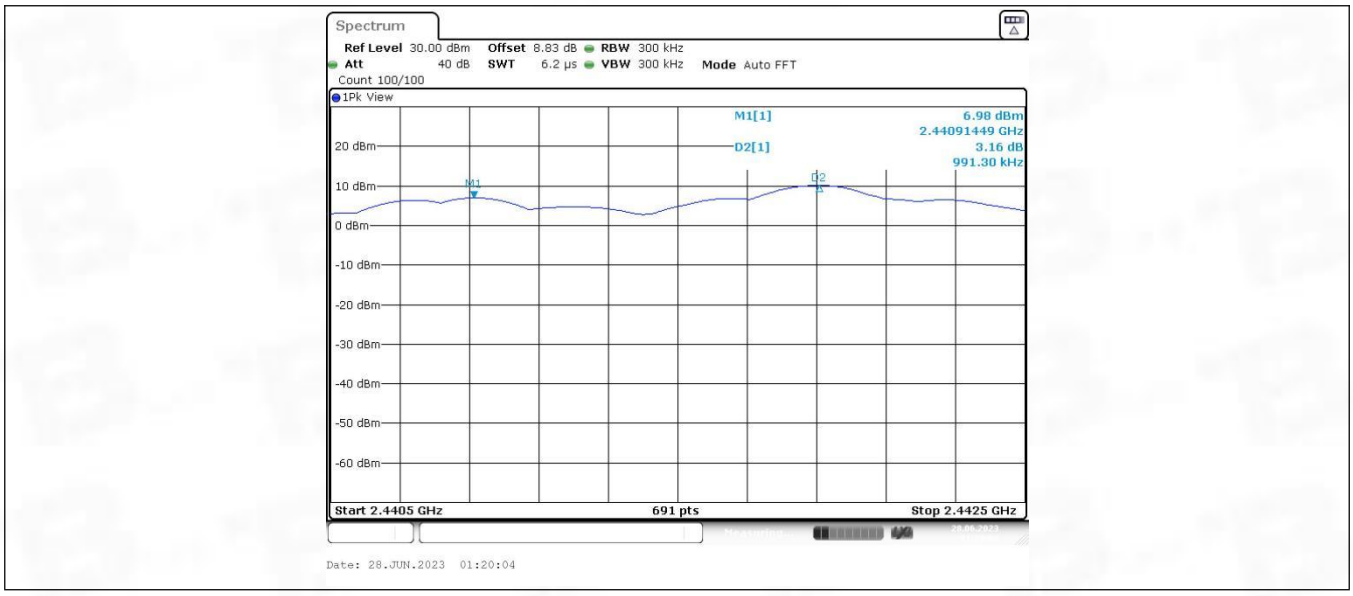
Spectrum
Ref Level 30.00 dBm Offset 8.83 dB RBW 300 kHz
Att 40 dB SWT 6.2 µs VBW 300 kHz Mode Auto FFT
Count 100/100
1Pk View
M1[1] 6.98 dBm
2.44091449 GHz
D2[1] 3.16 dB
991.30 kHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
Start 2.4405 GHz
691 pts
Stop 2.4425 GHz
Date: 28.JUN.2023 01:20:04

4. Number of Hopping Frequencies

4.1 HoppNum

4.1.1 Test Result

Mode	Frequency (MHz)	Packet Type	Num of Hopping Frequencies		Verdict
			ANT1	Limit	
GFSK	HOPP	DH5	79	>=15	Pass
Pi/4DQPSK	HOPP	2DH5	79	>=15	Pass
8DPSK	HOPP	3DH5	79	>=15	Pass

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