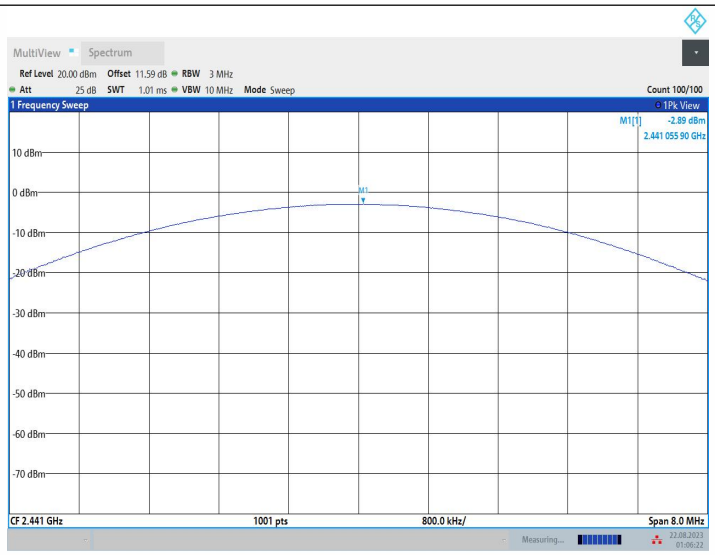
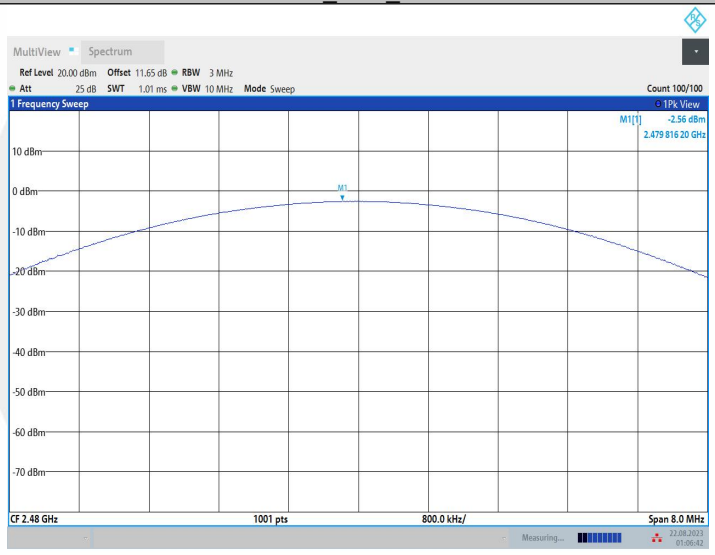


01:06:22 22.08.2023

3DH5_Ant1_2480



01:06:42 22.08.2023

9.6 CONDUCTED SUPRIOUS EMISSION

9.6.1 Applicable Standard

According to FCC Part 15.247(d) and KDB 558074 D01 15.247 MEAS GUIDANCE v05r02
According to IC RSS-247.5.5

9.6.2 Conformance Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is 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, based on either an RF conducted, provided the transmitter demonstrates compliance with the peak conducted power limits.

9.6.3 Test Configuration

Test according to clause 7.1 radio frequency test setup 1

9.6.4 Test Procedure

The transmitter output (antenna port) was connected to the spectrum analyzer

- **Reference level measurement**

Establish a reference level by using the following procedure:
Set instrument center frequency to DSS channel center frequency.
Set Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel.
Set the RBW = 100 kHz. Set the VBW ≥ 3 x RBW.
Set Detector = peak. Set Sweep time = auto couple.
Set Trace mode = max hold. Allow trace to fully stabilize.
Use the peak marker function to determine the maximum Maximumconducetedlevel.
Note that the channel found to contain the maximum conduceted level can be used to establish the reference level.

- **Band-edge measurement**

Use the following spectrum analyzer settings:
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 which fall outside of the authorized band of operation
Set RBW ≥ 1% of the span=100kHzSet VBW ≥3 x RBW
Set Sweep = autoSet Detector function = peakSet Trace = max hold
Allow the trace to stabilize. Set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. The marker-delta value now displayed must comply with the limit specified in this Section.
Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

- **Emission level measurement**

Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic.(30MHz to 25GHz).Set RBW = 100 kHzSet VBW ≥ RBW
Set Sweep = autoSet Detector function = peakSet 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.

9.6.5 Test Results

Temperature:	25˚C
Relative Humidity:	45%
ATM Pressure:	1011 mbar

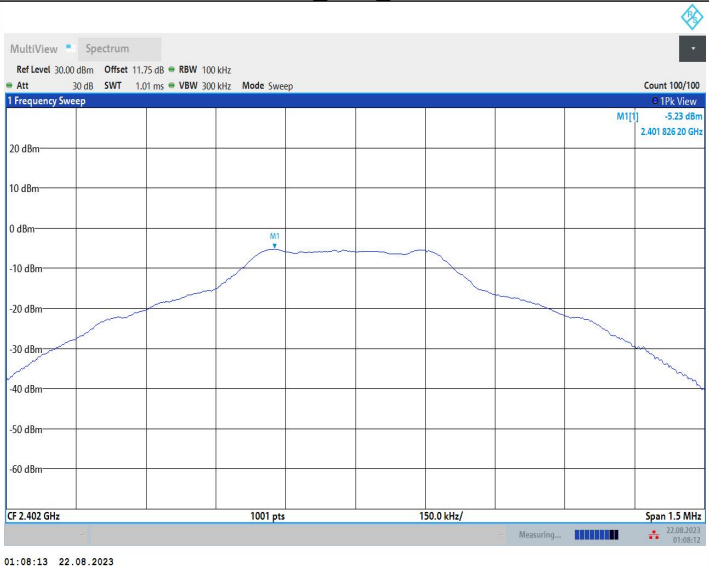
Note: N/A

All the antenna(Antenna 1) and modes(GFSK, π/4-DQPSK, 8DPSK, Hopping) mode have been tested, and the worst(Antenna 1,GFSK, Hopping) resultrecorded was report as below:

Reference level measurement

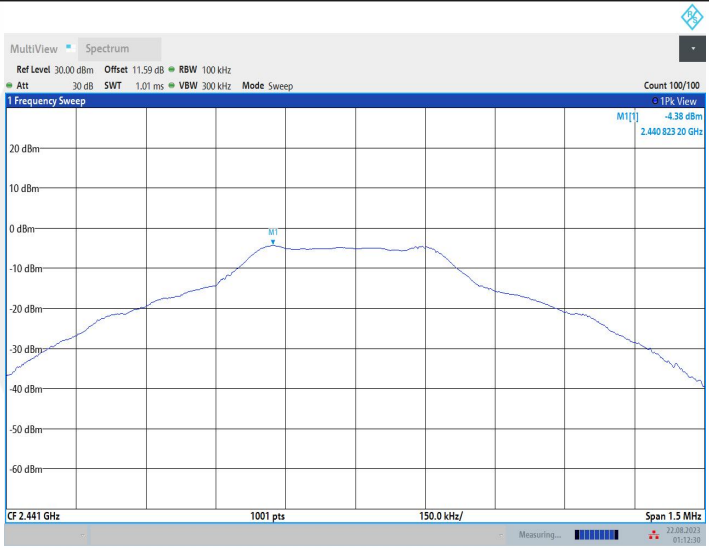
TestMode	Antenna	Freq(MHz)	Max.Point[MHz]	Result[dBm]
DH5	Ant1	2402	2401.83	-5.23
		2441	2440.82	-4.38
		2480	2479.82	-3.93
2DH5	Ant1	2402	2402.15	-5.29
		2441	2441.14	-4.40
		2480	2480.14	-3.96
3DH5	Ant1	2402	2401.82	-5.29
		2441	2440.82	-4.40
		2480	2479.82	-3.92

DH5_Ant1_2402



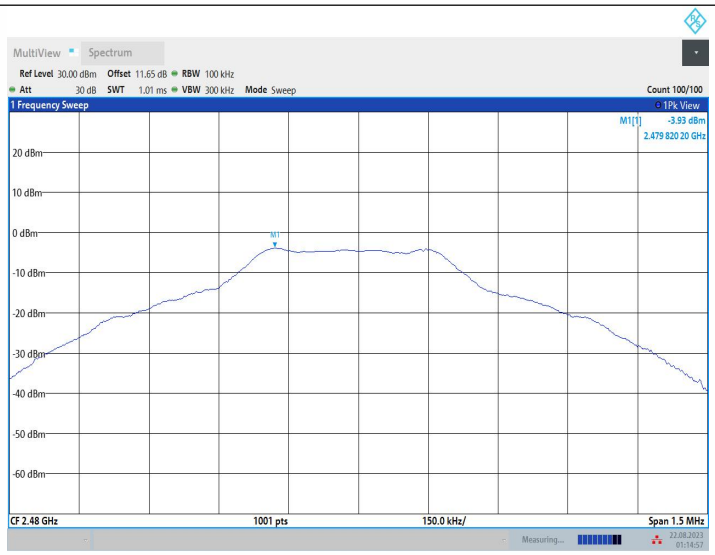
01:08:13 22.08.2023

DH5_Ant1_2441



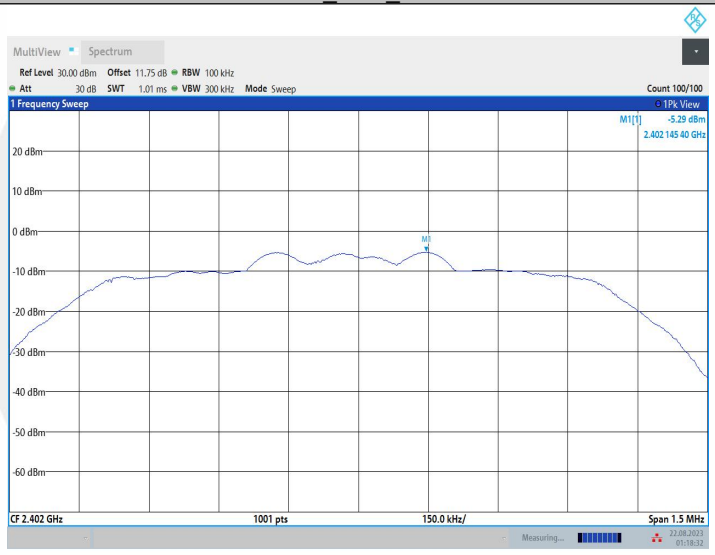
01:12:30 22.08.2023

DH5_Ant1_2480



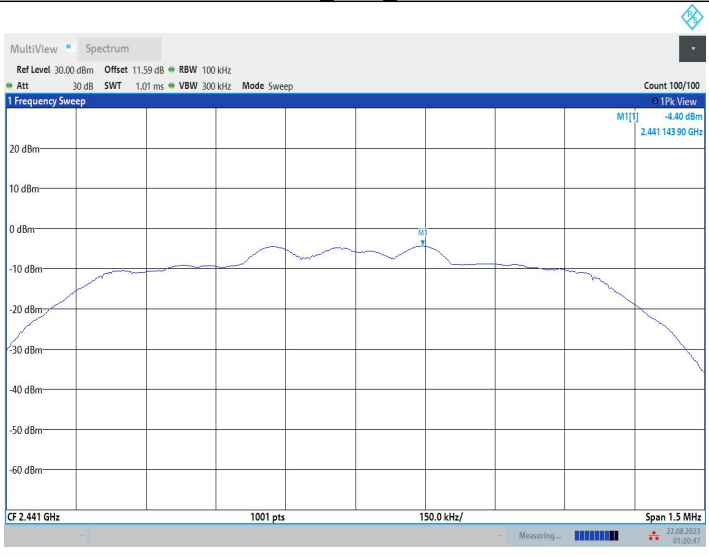
01:14:58 22.08.2023

2DH5_Ant1_2402



01:18:33 22.08.2023

2DH5_Ant1_2441



01:20:48 22.08.2023

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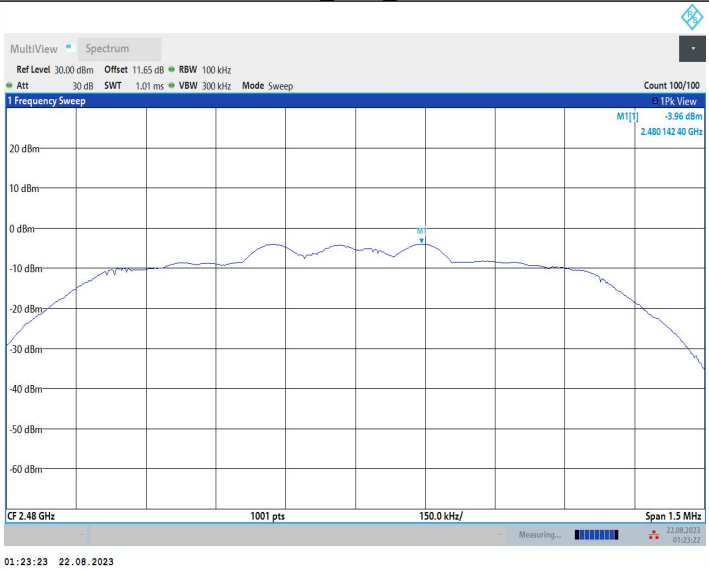
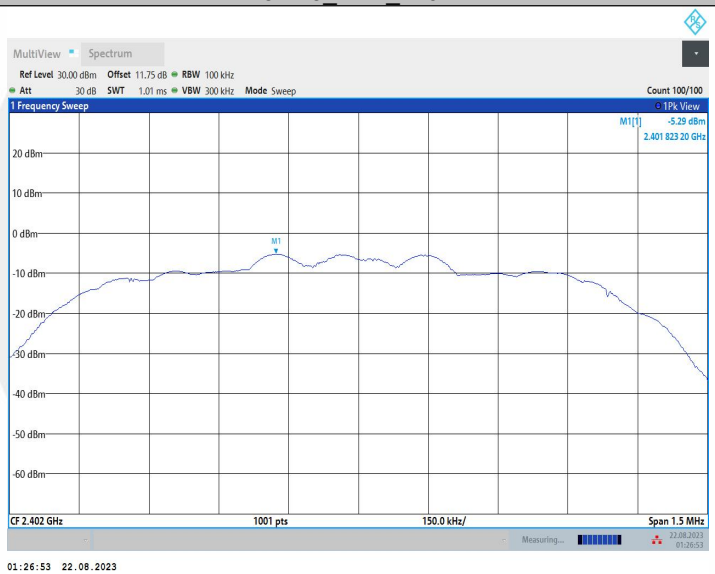
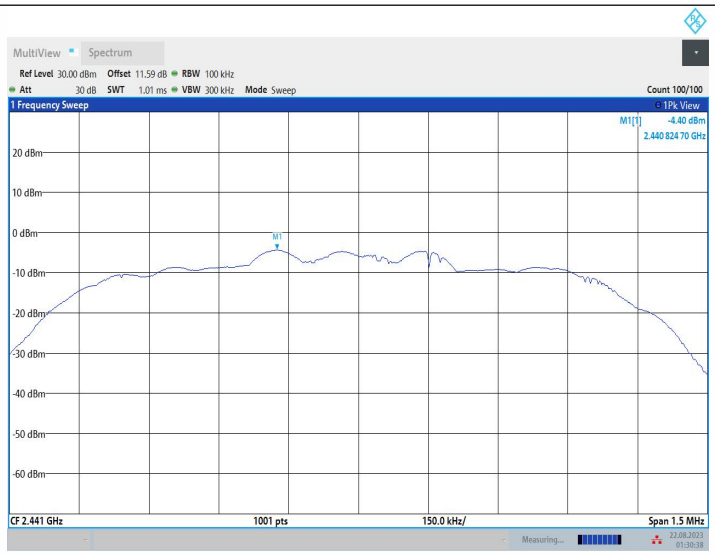
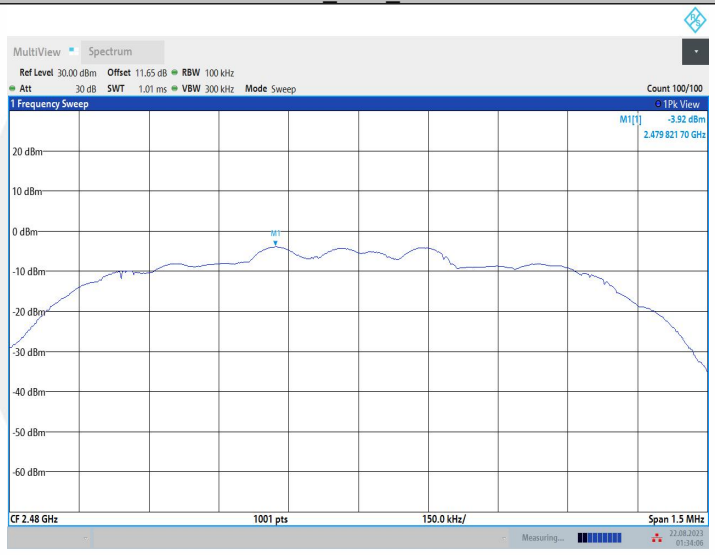

3DH5_Ant1_2402

3DH5_Ant1_2441



01:30:38 22.08.2023

3DH5_Ant1_2480

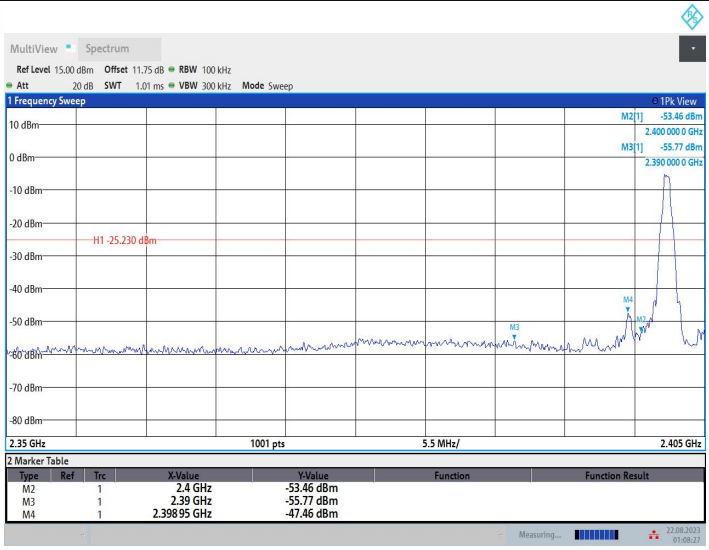


01:34:06 22.08.2023

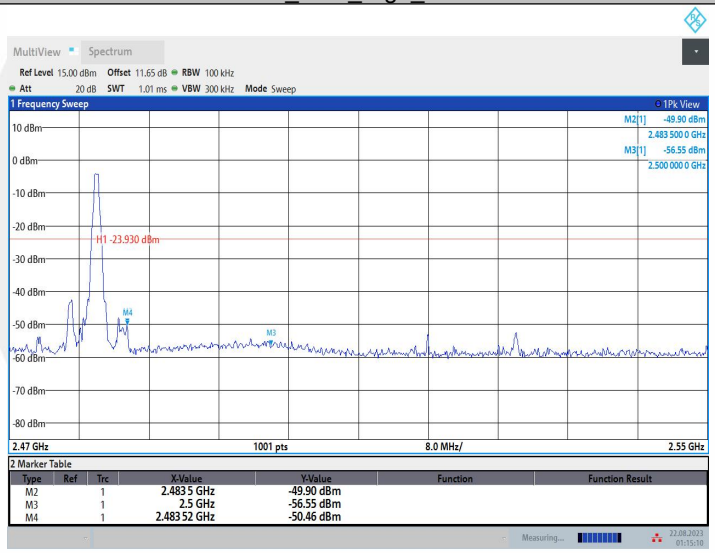
Band edge measurements

TestMode	Antenna	ChName	Frequency[MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	Low	2402	-5.23	-47.46	≤-25.23	PASS
		High	2480	-3.93	-50.46	≤-23.93	PASS
		Low	Hop_2402	-5.97	-53.54	≤-25.97	PASS
		High	Hop_2480	-4.06	-51.82	≤-24.06	PASS
2DH5	Ant1	Low	2402	-5.29	-48.75	≤-25.29	PASS
		High	2480	-3.96	-49.94	≤-23.96	PASS
		Low	Hop_2402	-5.64	-53.92	≤-25.64	PASS
		High	Hop_2480	-4.06	-51.89	≤-24.06	PASS
3DH5	Ant1	Low	2402	-5.29	-48.76	≤-25.29	PASS
		High	2480	-3.92	-48.76	≤-23.92	PASS
		Low	Hop_2402	-8.64	-54.65	≤-28.64	PASS
		High	Hop_2480	-5.36	-51.59	≤-25.36	PASS

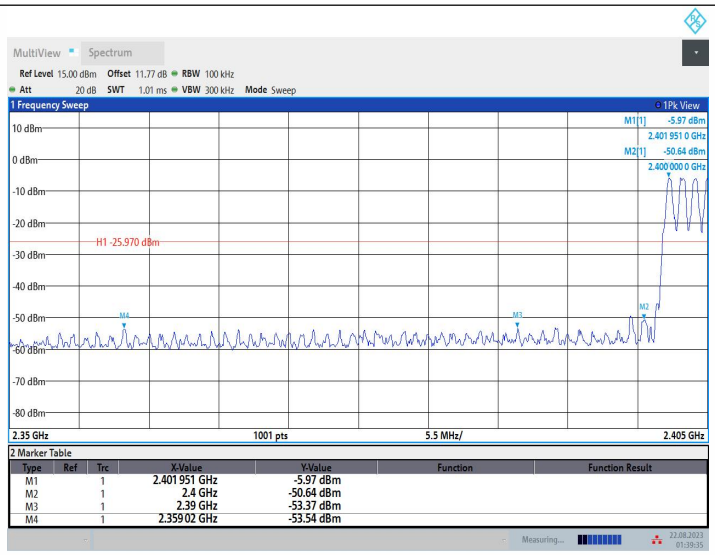
DH5_Ant1_Low_2402



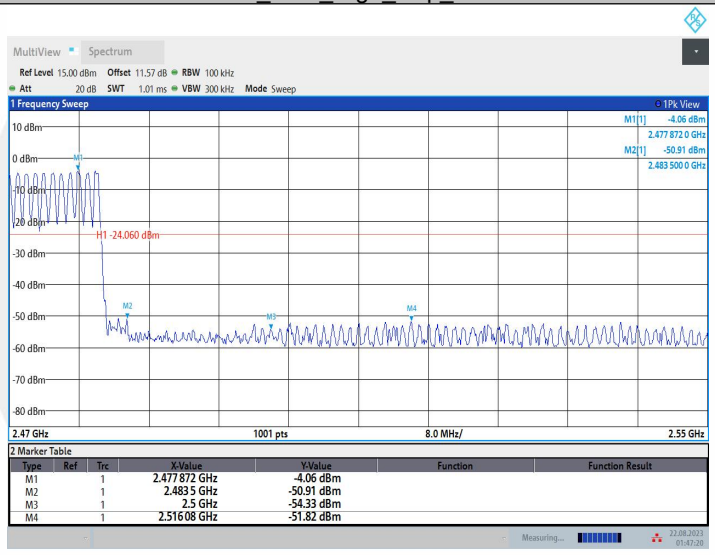
DH5_Ant1_High_2480



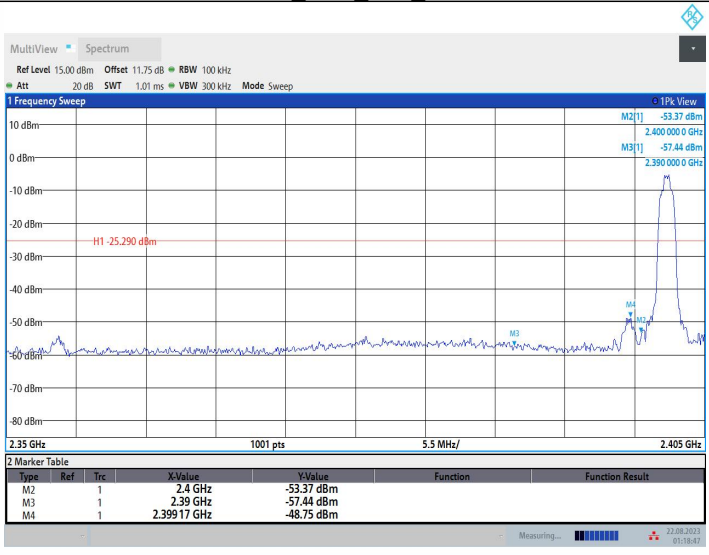
DH5_Ant1_Low_Hop_2402



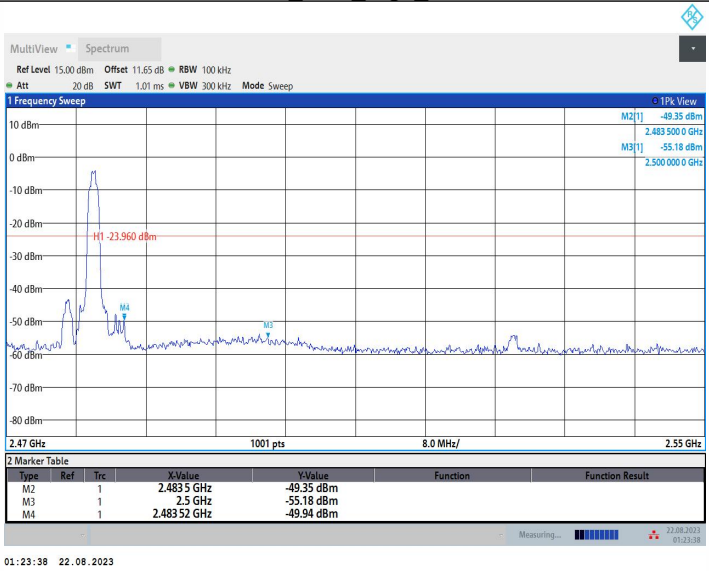
DH5_Ant1_High_Hop_2480



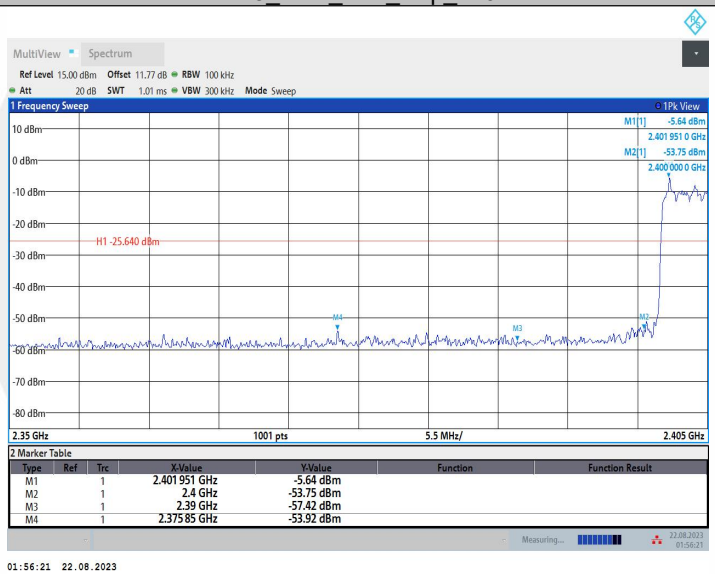
2DH5_Ant1_Low_2402



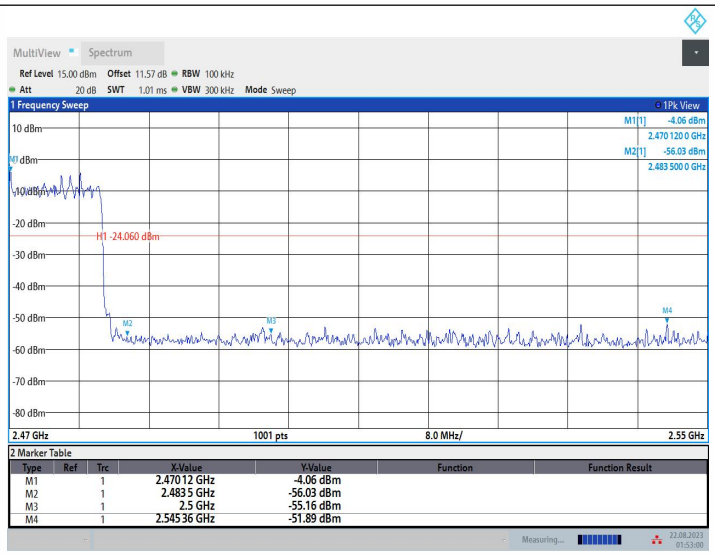
2DH5_Ant1_High_2480



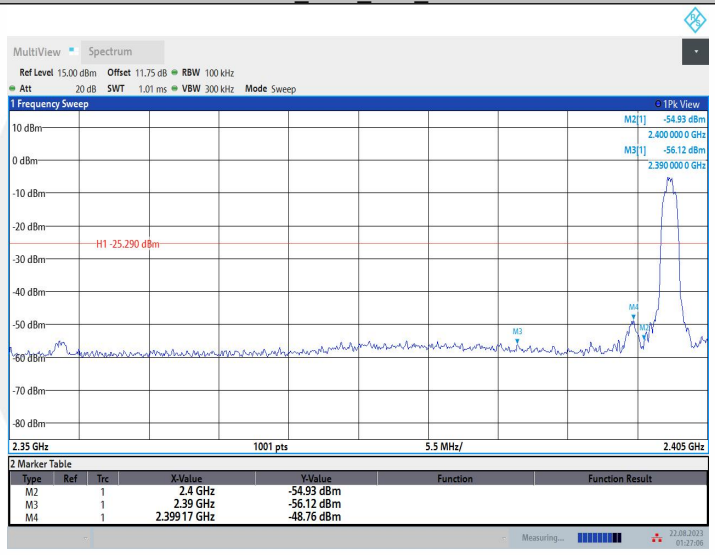
2DH5_Ant1_Low_Hop_2402



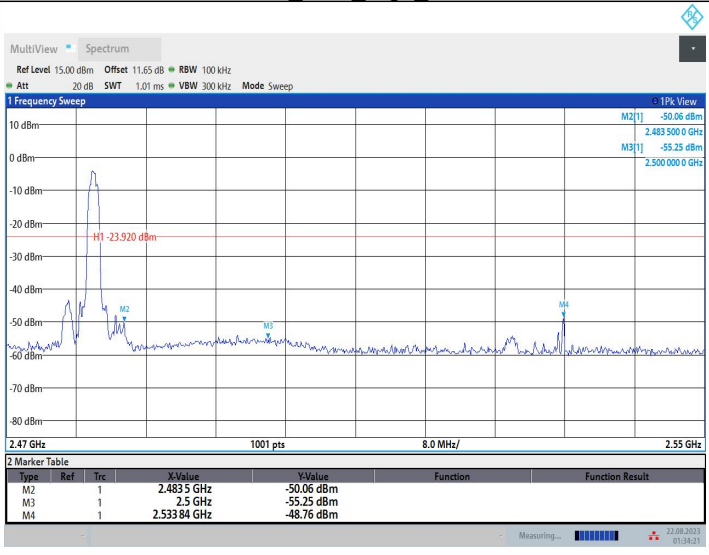
2DH5_Ant1_High_Hop_2480



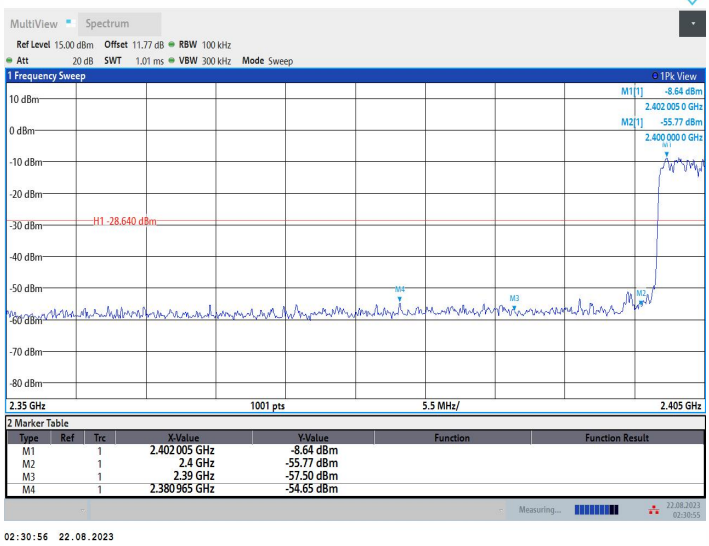
3DH5_Ant1_Low_2402



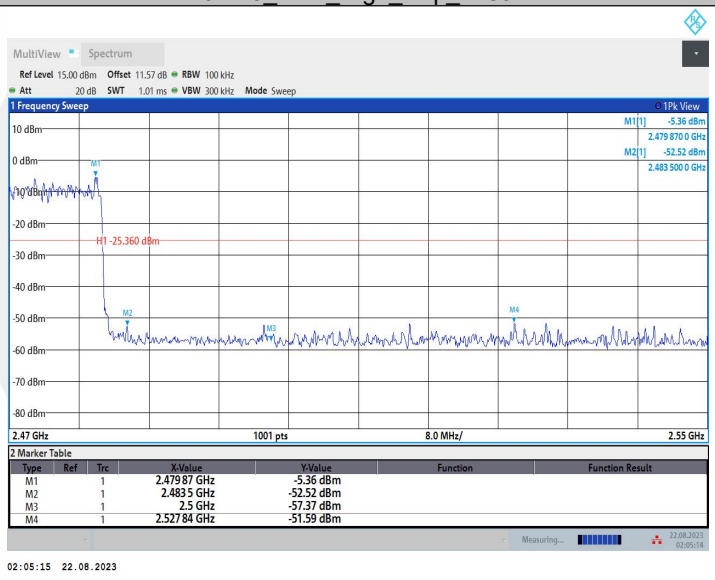
3DH5_Ant1_High_2480



3DH5_Ant1_Low_Hop_2402



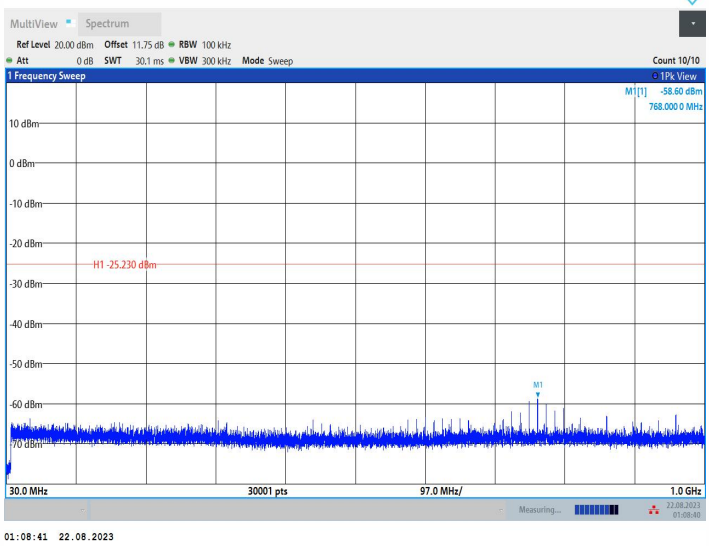
3DH5_Ant1_High_Hop_2480



Conducted Spurious Emission

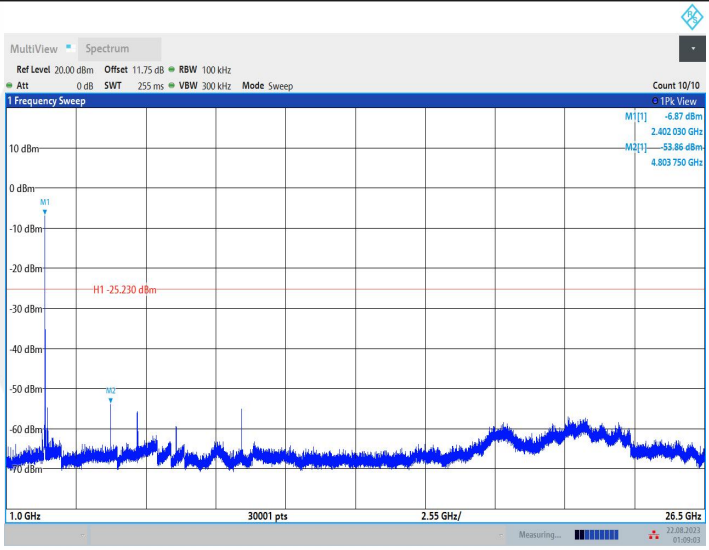
TestMode	Antenna	Frequency[MHz]	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	2402	30~1000	-5.23	-58.6	≤-25.23	PASS
			1000~26500	-5.23	-53.86	≤-25.23	PASS
		2441	30~1000	-4.38	-58.49	≤-24.38	PASS
			1000~26500	-4.38	-51.21	≤-24.38	PASS
		2480	30~1000	-3.93	-58.57	≤-23.93	PASS
			1000~26500	-3.93	-51.6	≤-23.93	PASS
2DH5	Ant1	2402	30~1000	-5.29	-58.28	≤-25.29	PASS
			1000~26500	-5.29	-52.8	≤-25.29	PASS
		2441	30~1000	-4.40	-57.83	≤-24.4	PASS
			1000~26500	-4.40	-51.54	≤-24.4	PASS
		2480	30~1000	-3.96	-58.39	≤-23.96	PASS
			1000~26500	-3.96	-54.6	≤-23.96	PASS
3DH5	Ant1	2402	30~1000	-5.29	-58.12	≤-25.29	PASS
			1000~26500	-5.29	-54.6	≤-25.29	PASS
		2441	30~1000	-4.40	-58.55	≤-24.4	PASS
			1000~26500	-4.40	-55.08	≤-24.4	PASS
		2480	30~1000	-3.92	-57.84	≤-23.92	PASS
			1000~26500	-3.92	-52.41	≤-23.92	PASS

DH5_Ant1_2402_30~1000



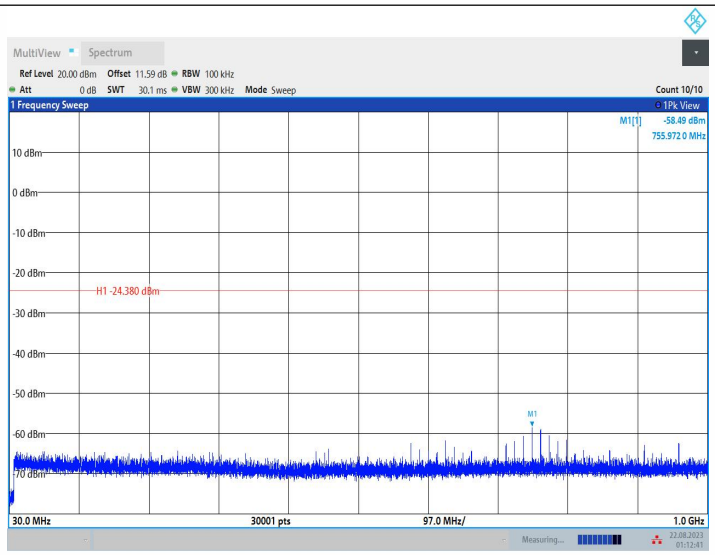
01:08:41 22.08.2023

DH5_Ant1_2402_1000~26500

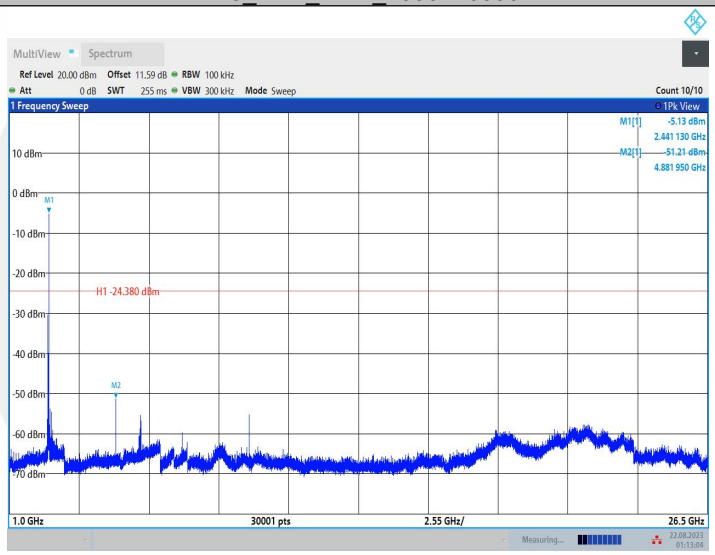


01:09:03 22.08.2023

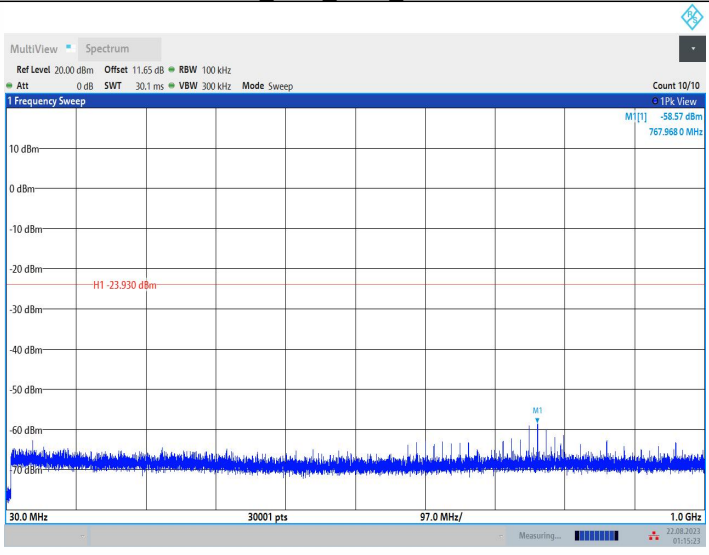
DH5_Ant1_2441_30~1000



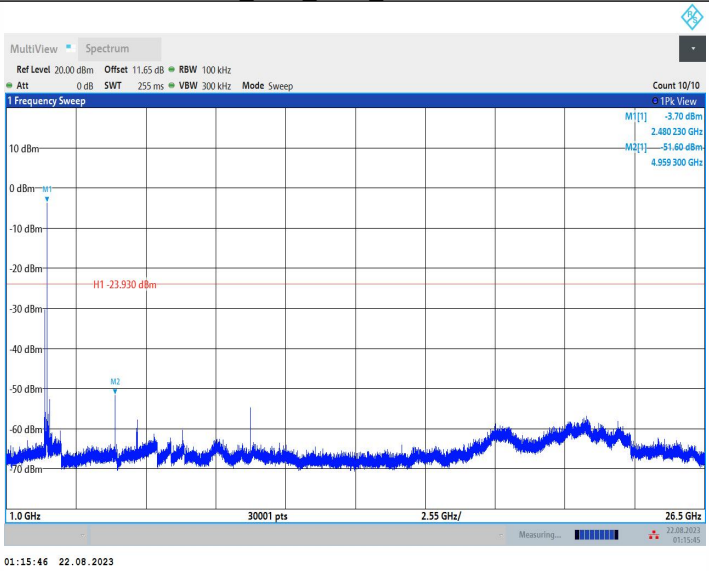
DH5_Ant1_2441_1000~26500



DH5_Ant1_2480_30~1000

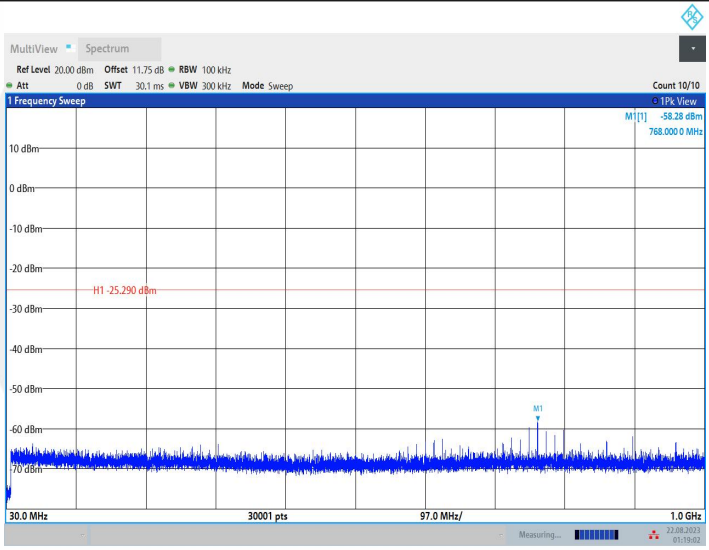


DH5_Ant1_2480_1000~26500



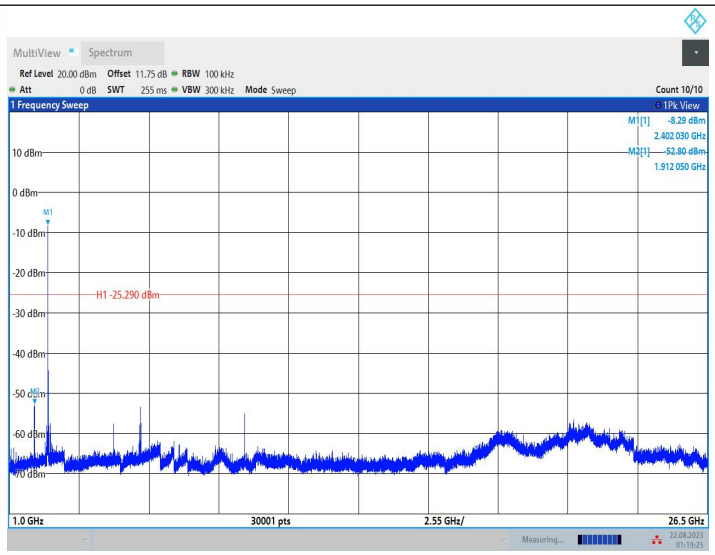
01:15:46 22.08.2023

2DH5_Ant1_2402_30~1000

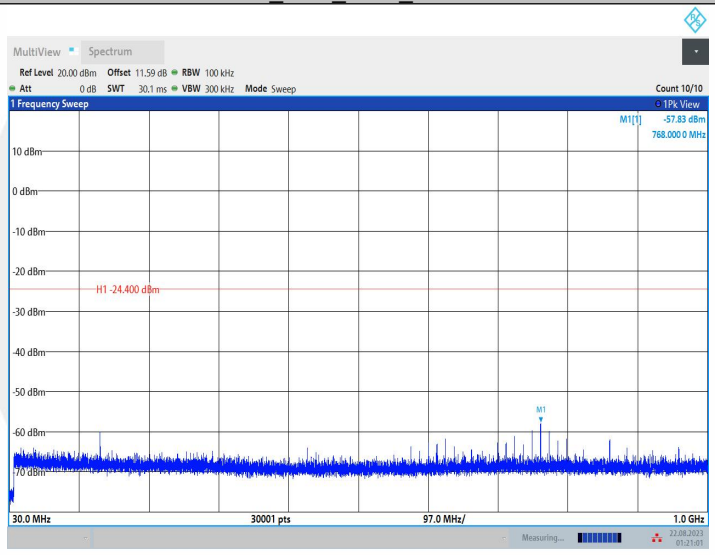


01:19:03 22.08.2023

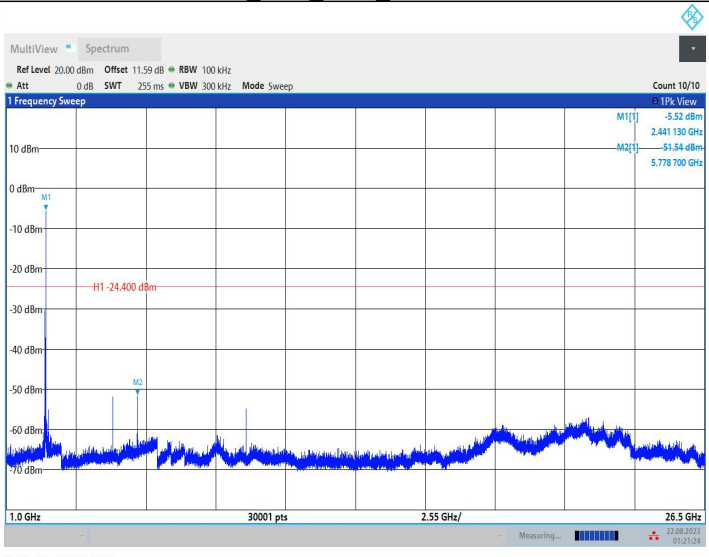
2DH5_Ant1_2402_1000~26500

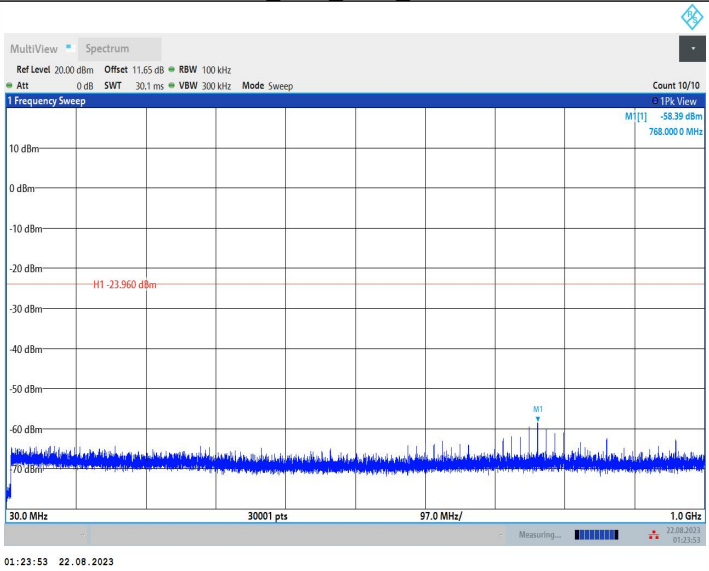


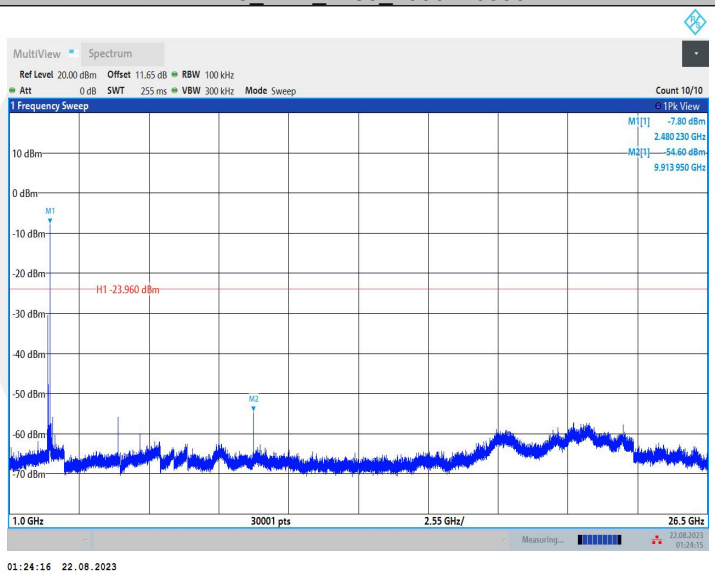
2DH5_Ant1_2441_30~1000



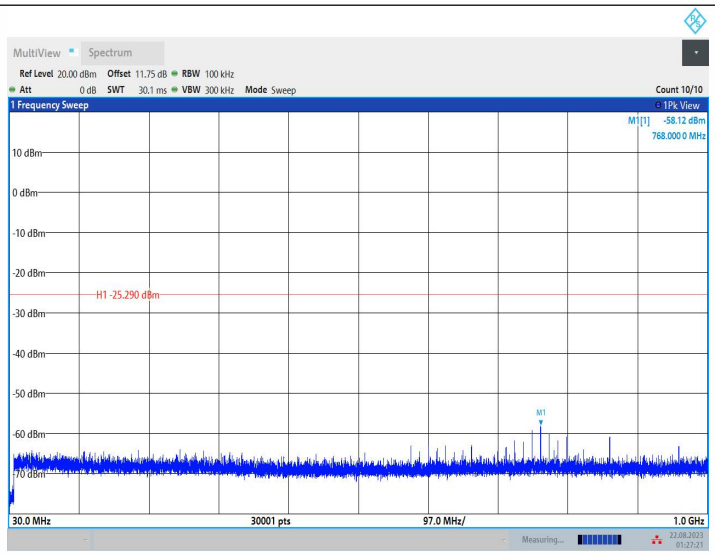
2DH5_Ant1_2441_1000~26500



2DH5_Ant1_2480_30~1000


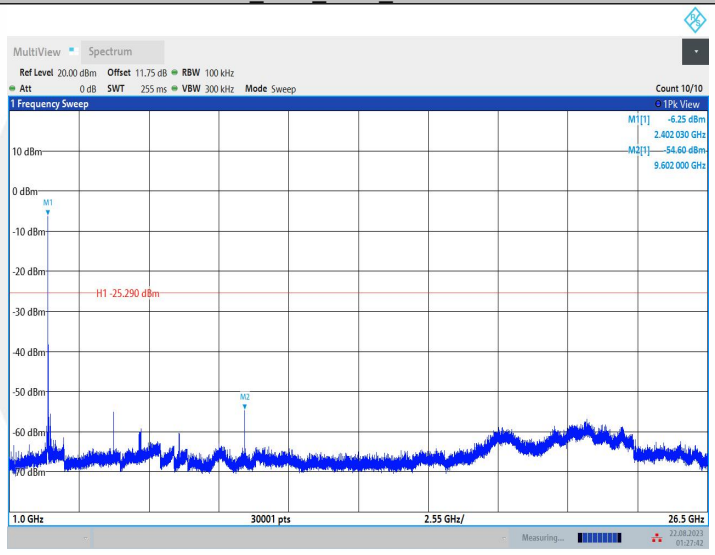
2DH5_Ant1_2480_1000~26500


3DH5_Ant1_2402_30~1000



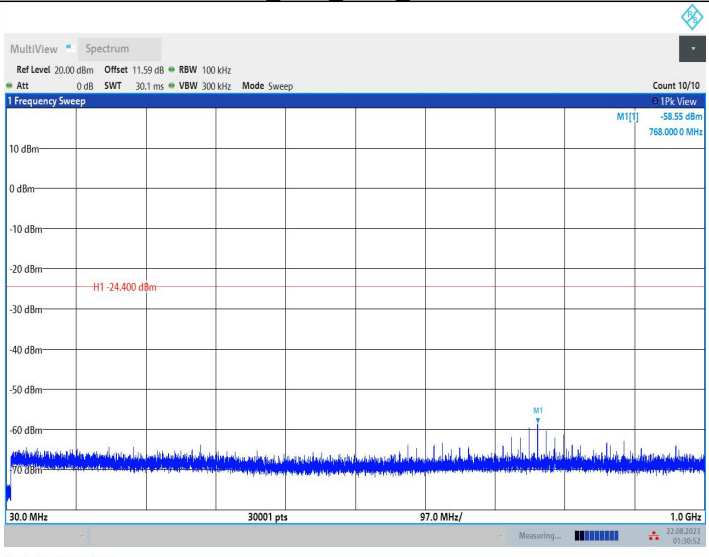
01:27:21 22.08.2023

3DH5_Ant1_2402_1000~26500

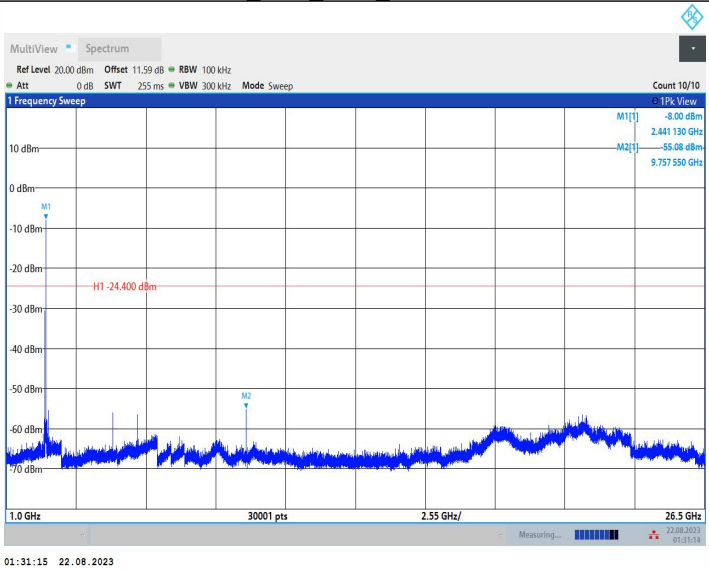


01:27:43 22.08.2023

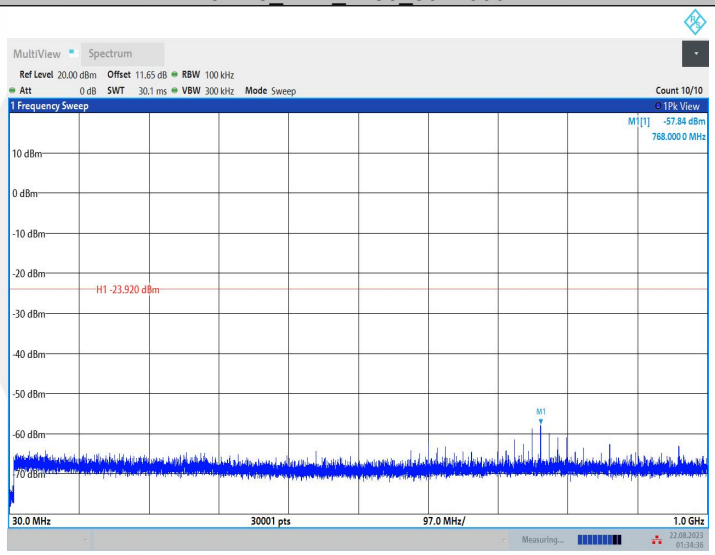
3DH5_Ant1_2441_30~1000



01:30:52 22.08.2023

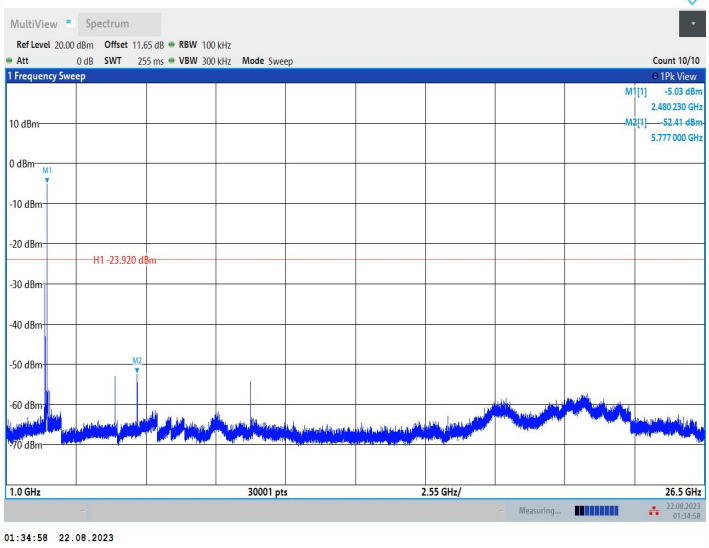
3DH5_Ant1_2441_1000~26500


01:31:15 22.08.2023

3DH5_Ant1_2480_30~1000


01:34:36 22.08.2023

3DH5_Ant1_2480_1000~26500


MultiView
Spectrum
Ref Level 20.00 dBm Offset 11.65 dB RBW 100 kHz
Att 0 dB SWT 255 ms VBW 300 kHz Mode Sweep
Count 10/10
1 Frequency Sweep
1Pk View
M1[1] -5.03 dBm
2.480 230 GHz
M2[1] -52.41 dBm
5.777 000 GHz
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
M2
H1 -23.920 dBm
1.0 GHz
30001 pts
2.55 GHz/
26.5 GHz
Measuring...
22.08.2023
01:34:58
01:34:58 22.08.2023

9.7 RADIATED SPURIOUS EMISSION

9.7.1 Applicable Standard

According to FCC Part 15.247(d), 15.205, 15.209 and KDB 558074 D01 15.247 MEAS GUIDANCE v05r02
According to IC RSS-Gen and RSS-247

9.7.2 Conformance Limit

According to FCC Part 15.247(d): 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)).
According to FCC Part15.205, Restricted bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(2)
13.36-13.41			

According to FCC Part15.205,the level of any transmitter spurious emission in Restricted bands shall not exceed the level of the emission specified in the following table

Restricted Frequency(MHz)	Field Strength (μV/m)	Field Strength (dBμV/m)	Measurement Distance
0.009-0.490	2400/F(KHz)	20 log (uV/m)	300
0.490-1.705	24000/F(KHz)	20 log (uV/m)	30
1.705-30	30	29.5	30
30-88	100	40	3
88-216	150	43.5	3
216-960	200	46	3
Above 960	500	54	3

9.7.3 Test Configuration

Test according to clause 7.2 radio frequency test setup 2

9.7.4 Test Procedure

This test is required for any spurious emission that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:
For Above 1GHz:
The EUT was placed on a turn table which is 1.5m above ground plane.
Maximum procedure was performed on the highest emissions to ensure EUT compliance.
Span = wide enough to fully capture the emission being measured
RBW = 1 MHz
VBW ≥ RBW
Sweep = auto
Detector function = peak

Trace = max hold
For Below 1GHz:
The EUT was placed on a turn table which is 0.8m above ground plane.
Maximum procedure was performed on the highest emissions to ensure EUT compliance.
Span = wide enough to fully capture the emission being measured
RBW = 100 kHz for
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
For Below 30MHz:
The EUT was placed on a turn table which is 0.8m above ground plane.
Maximum procedure was performed on the highest emissions to ensure EUT compliance.
Span = wide enough to fully capture the emission being measured
RBW = 9kHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
For Below 150KHz:
The EUT was placed on a turn table which is 0.8m above ground plane.
Maximum procedure was performed on the highest emissions to ensure EUT compliance.
Span = wide enough to fully capture the emission being measured
RBW = 200Hz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Follow the guidelines in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b). Submit this data.
Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from 20log(dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.
Repeat above procedures until all frequency measured was complete.

9.7.5 Test Results

- Spurious Emission below 30MHz(9KHz to 30MHz)

Temperature:	22˚ C
Relative Humidity:	45%
ATM Pressure:	1011 mbar

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV/m) PK	AV	Limit 3m(dBuV/m) PK	AV	Over(dB) PK	AV
--	--	--	--	--	--	--	--

Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
Limit line=Specific limits(dBuV) + distance extrapolation factor

- Spurious Emission Above 1GHz(1GHz to 25GHz)

All the antenna(Antenna 1) and modes(GFSK, π/4-DQPSK, 8DPSK) mode have been tested, and the worst(Antenna 1,GFSK) resultrecorded was report as below:

Test mode: GFSK Frequency: Channel 0: 2402MHz

Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
	H/V	PK	AV	PK	AV	PK	AV
11495.62	V	60.58	47.83	74.00	54.00	13.42	6.17
14647.5	V	64.09	47.31	74.00	54.00	9.91	6.69
17593.12	V	71.18	50.37	74.00	54.00	2.82	3.63
11527.5	H	60.04	47.35	74.00	54.00	13.96	6.65
14746.87	H	64.14	45.91	74.00	54.00	9.86	8.09
17608.12	H	70.92	50.21	74.00	54.00	3.08	3.79

Test mode: GFSK Frequency: Channel 39: 2441MHz

Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
	H/V	PK	AV	PK	AV	PK	AV
11495.62	V	61.08	48.13	74.00	54.00	13.42	5.87
14647.5	V	64.59	47.32	74.00	54.00	9.91	6.68
17593.12	V	71.68	50.04	74.00	54.00	2.82	3.96
11527.5	H	60.54	47.35	74.00	54.00	13.96	6.65
14746.87	H	64.64	45.98	74.00	54.00	9.86	8.02
17608.12	H	71.42	50.23	74.00	54.00	3.08	3.77

Test mode: GFSK Frequency: Channel 78: 2480MHz

Freq. (MHz)	Ant.Pol.	Emission Level(dBuV/m)		Limit 3m(dBuV/m)		Over(dB)	
	H/V	PK	AV	PK	AV	PK	AV
11495.62	V	60.08	48.62	74.00	54.00	13.42	5.38
14647.5	V	63.59	47.43	74.00	54.00	9.91	6.57
17593.12	V	70.68	50.33	74.00	54.00	2.82	3.67
11527.5	H	59.54	39.12	74.00	54.00	13.96	14.88
14746.87	H	63.64	46.32	74.00	54.00	9.86	7.68
17608.12	H	70.42	50.04	74.00	54.00	3.08	3.96

Note: (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
(2) Emission Level= Reading Level+Correct Factor.
(3) Correct Factor= Ant_F + Cab_L - Preamp
(4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

■ Spurious Emission in Restricted Band 2310-2390MHz and 2483.5-2500MHz

All the antenna(Antenna 1) and modes(GFSK, π/4-DQPSK, 8DPSK, Hopping) mode have been tested, and the worst(Antenna 1,GFSK, Hopping) resultrecorded was report as below:

Test mode:	GFSK	Frequency:	Channel 0: 2402MHz		
Frequency (MHz)	Polarity H/V	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2389.4	H	52.85	74.00	43.00	54.00
2389.93	V	50.01	74.00	43.20	54.00

Test mode:	GFSK	Frequency:	Channel 78: 2480MHz		
Frequency (MHz)	Polarity H/V	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2483.52	H	48.75	74.00	42.83	54.00
2483.71	V	47.79	74.00	43.19	54.00

Test mode:	GFSK	Frequency:	Hopping		
Frequency (MHz)	Polarity H/V	PK(dBuV/m) (VBW=3MHz)	Limit 3m (dBuV/m)	AV(dBuV/m) (VBW=10Hz)	Limit 3m (dBuV/m)
2393.36	H	55.92	74.00	45.52	54.00
2482.28	H	48.57	74.00	42.19	54.00
2397.13	V	54.74	74.00	46.21	54.00
2483.23	V	45.76	74.00	42.20	54.00

Note: (1) All Readings are Peak Value (VBW=3MHz) and Average Value (VBW=10Hz).
(2) Emission Level= Reading Level+Correct Factor.
(3) Correct Factor= Ant_F + Cab_L - Preamp
(4) The reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.