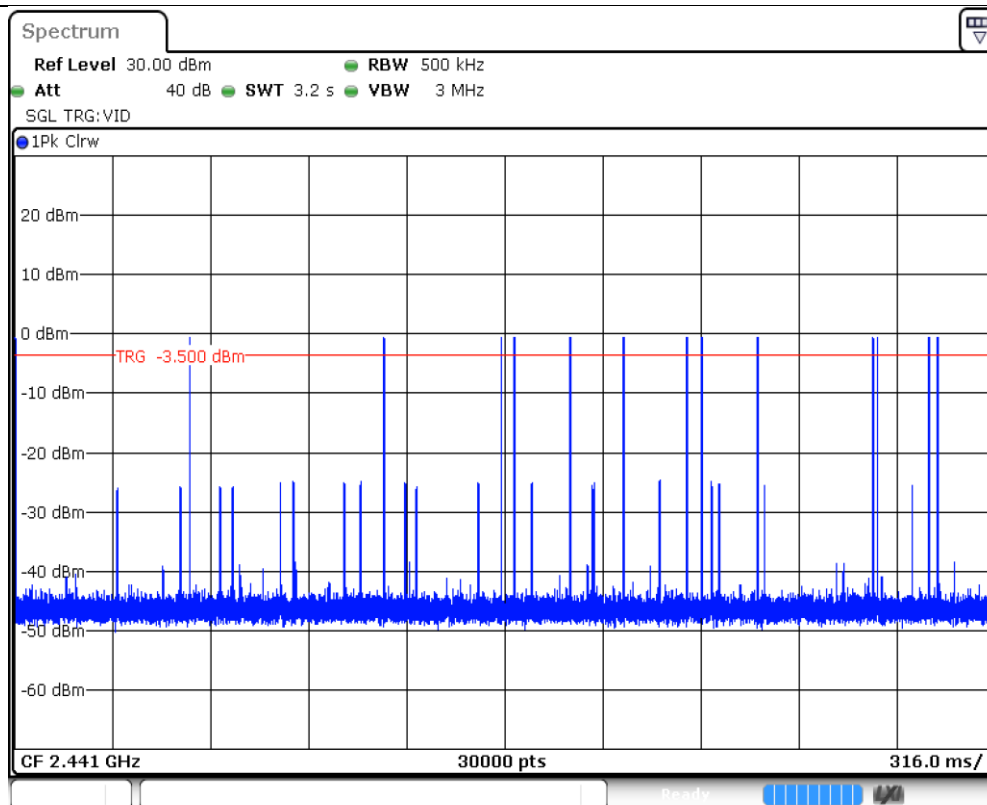




Date: 29.MAR.2023 15:55:03

9.6 Spurious RF conducted emissions

Test Method

1. Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
RBW = 100 kHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
3. The level displayed must comply with the limit specified in this Section. Submit these plots.
4. Repeat above procedures until all frequencies measured were complete.

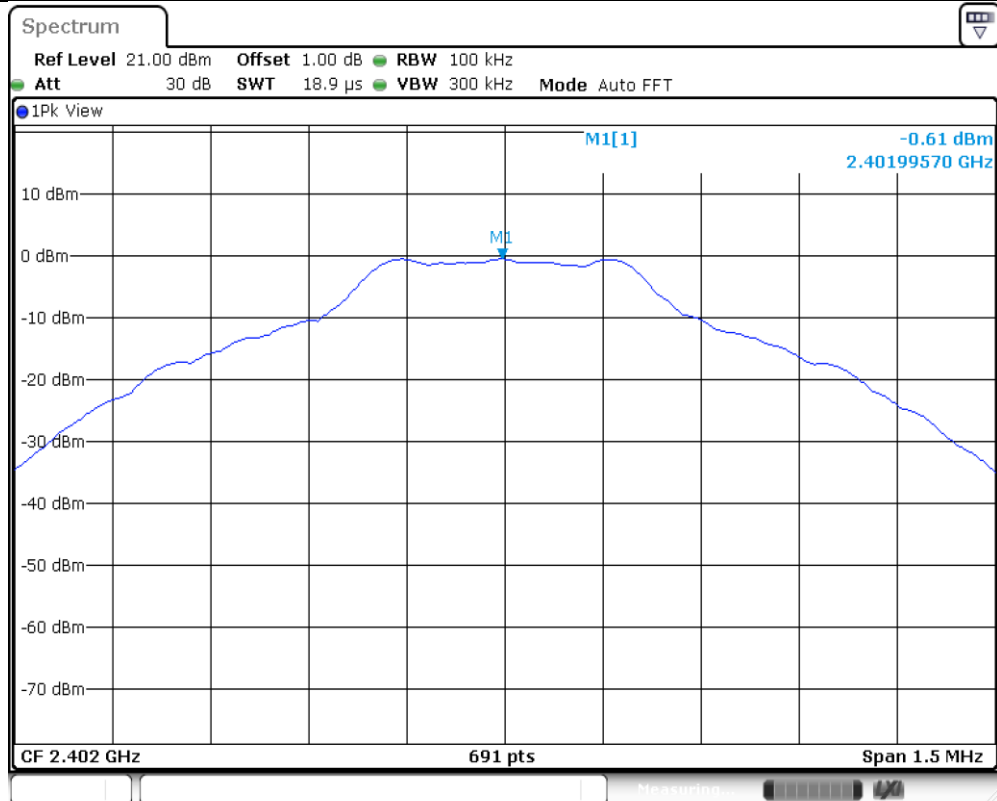
Limit

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

Spurious RF conducted emissions

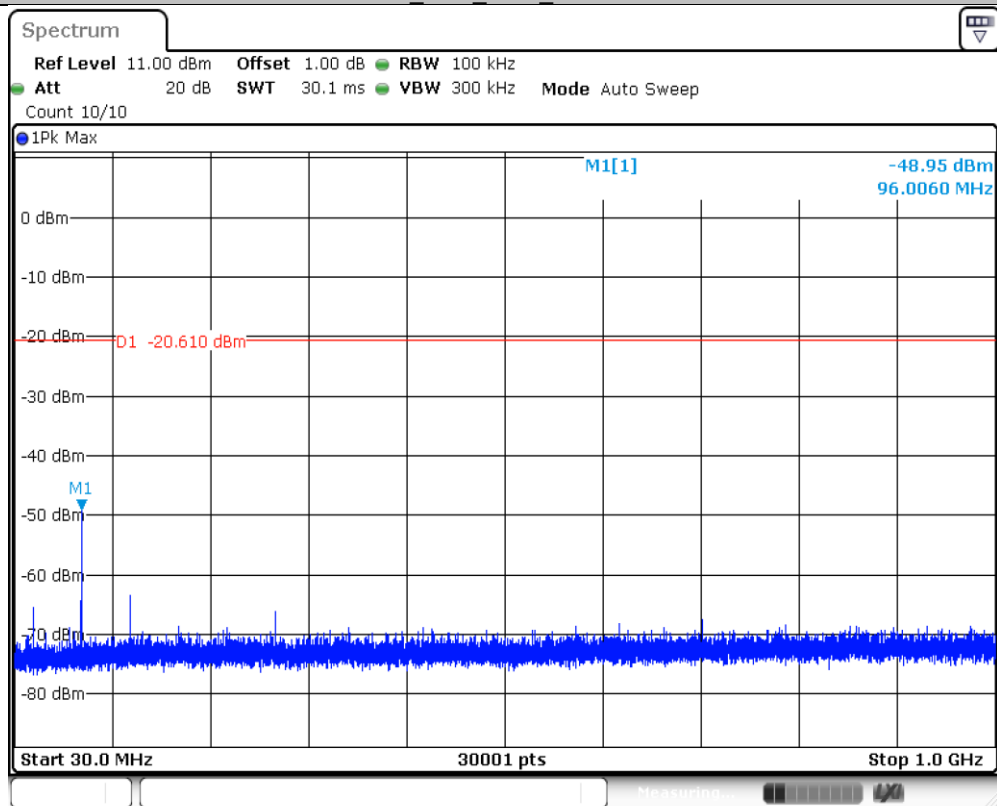
TestMode	Antenna	Channel(MHz)	FreqRange(MHz)	RefLevel	Result(dBm)	Limit(dBm)	Verdict
DH5	Ant1	2402	Reference	-0.61	-0.61	---	PASS
			30~1000	30~1000	-48.95	<=-20.61	PASS
			1000~26500	1000~26500	-44.48	<=-20.61	PASS
		2441	Reference	0.32	0.32	---	PASS
			30~1000	30~1000	-48.89	<=-19.68	PASS
			1000~26500	1000~26500	-46.84	<=-19.68	PASS
		2480	Reference	1.19	1.19	---	PASS
			30~1000	30~1000	-48.82	<=-18.81	PASS
			1000~26500	1000~26500	-46.11	<=-18.81	PASS
2DH5	Ant1	2402	Reference	-0.45	-0.45	---	PASS
			30~1000	30~1000	-48.94	<=-20.45	PASS
			1000~26500	1000~26500	-46.09	<=-20.45	PASS
		2441	Reference	0.49	0.49	---	PASS
			30~1000	30~1000	-45.3	<=-19.51	PASS
			1000~26500	1000~26500	-46.23	<=-19.51	PASS
		2480	Reference	1.24	1.24	---	PASS
			30~1000	30~1000	-48.87	<=-18.76	PASS
			1000~26500	1000~26500	-46.38	<=-18.76	PASS
3DH5	Ant1	2402	Reference	-0.59	-0.59	---	PASS
			30~1000	30~1000	-48.86	<=-20.59	PASS
			1000~26500	1000~26500	-43.39	<=-20.59	PASS
		2441	Reference	0.42	0.42	---	PASS
			30~1000	30~1000	-48.93	<=-19.58	PASS
			1000~26500	1000~26500	-46.71	<=-19.58	PASS
		2480	Reference	1.30	1.30	---	PASS
			30~1000	30~1000	-48.89	<=-18.7	PASS
			1000~26500	1000~26500	-45.74	<=-18.7	PASS

DH5_Ant1_2402_0~Reference



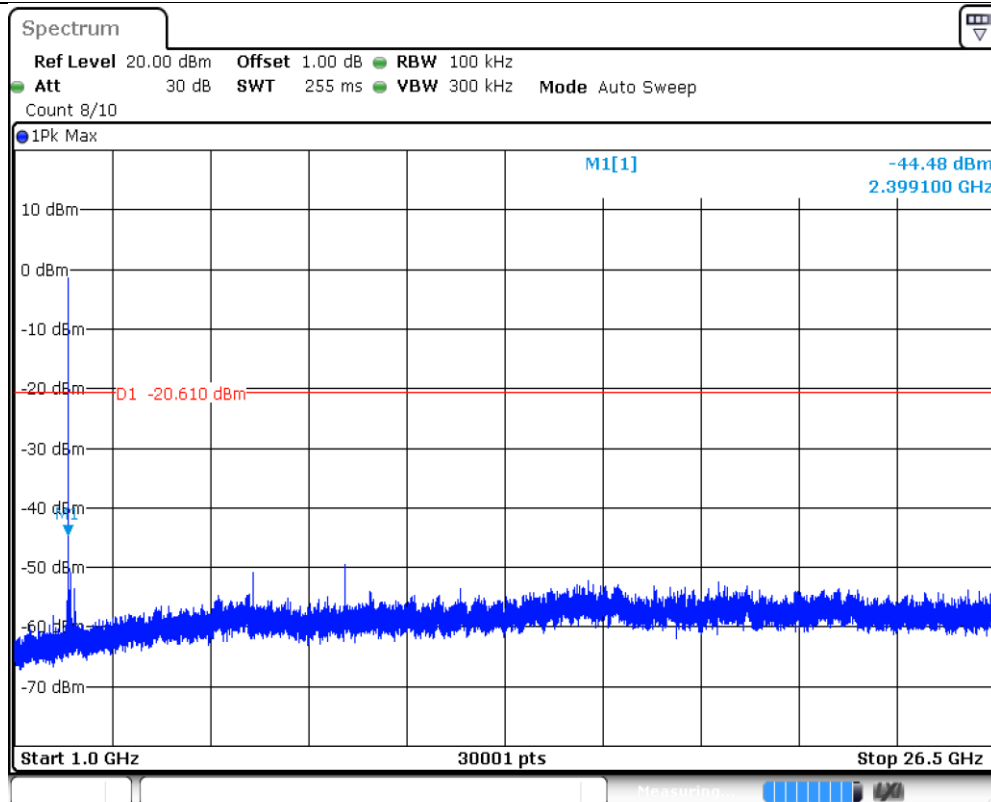
Date: 29.MAR.2023 15:30:37

DH5_Ant1_2402_30~1000



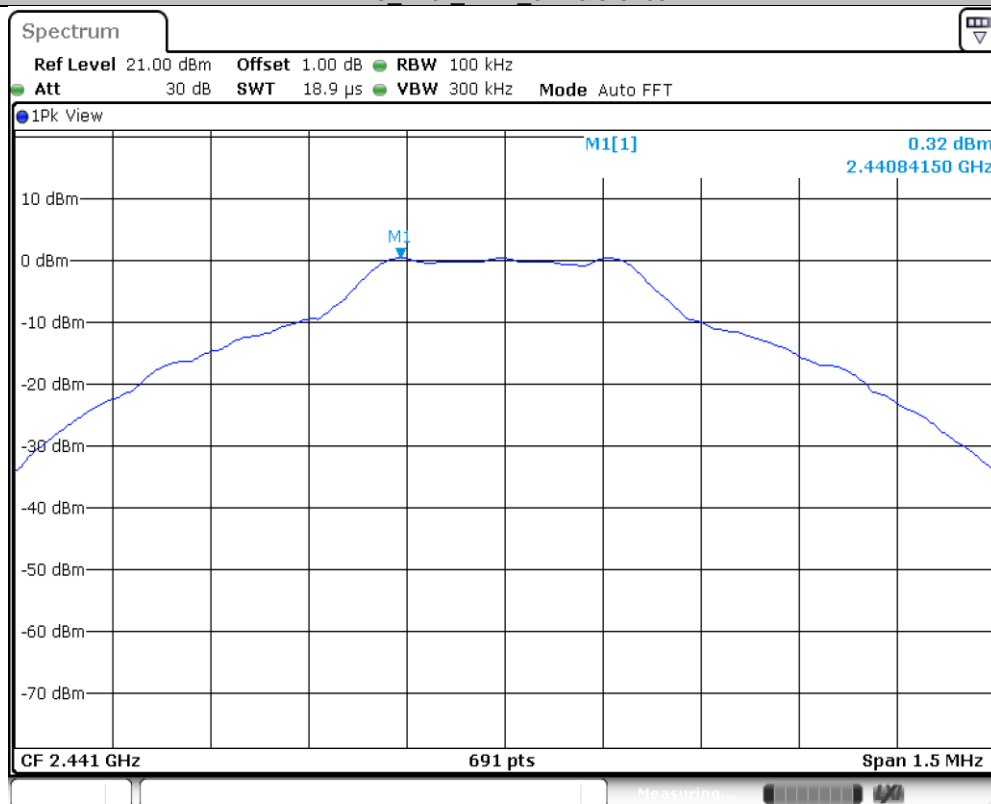
Date: 29.MAR.2023 15:30:43

DH5_Ant1_2402_1000~26500



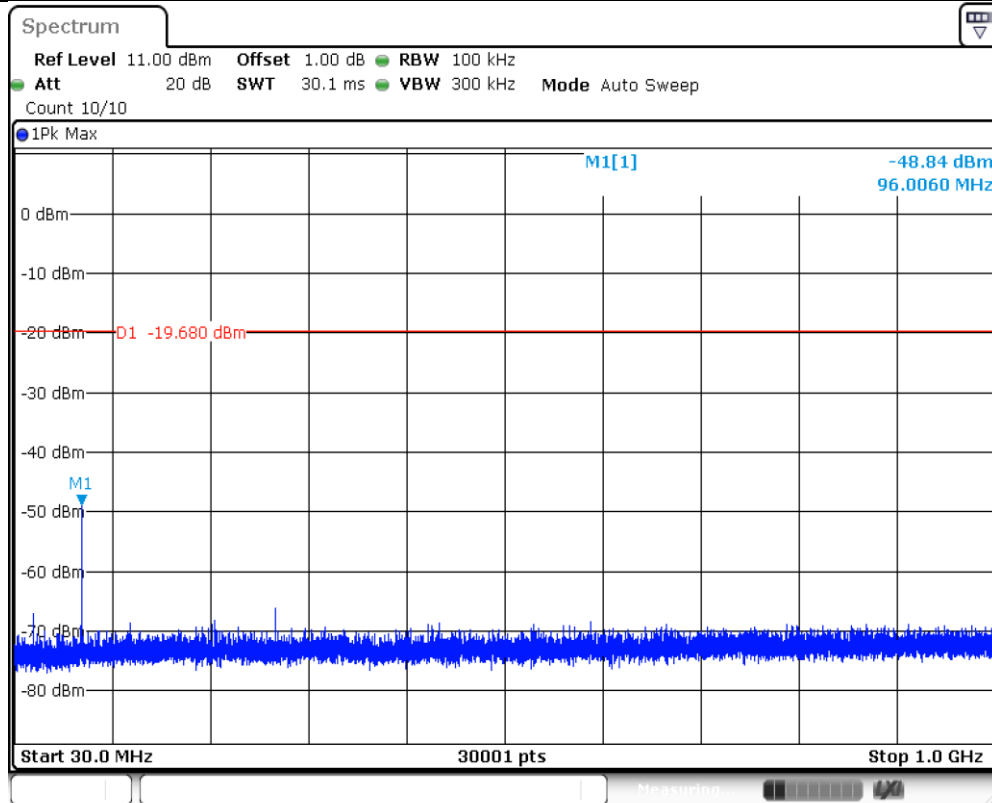
Date: 29.MAR.2023 15:30:51

DH5_Ant1_2441_0~Reference



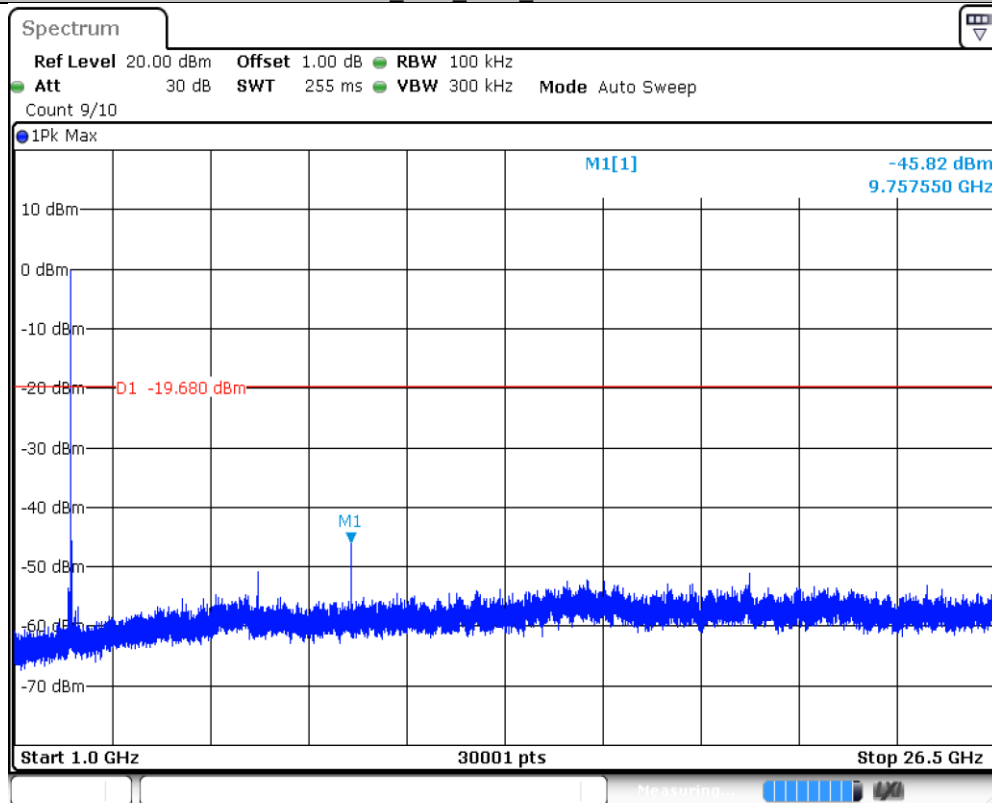
Date: 29.MAR.2023 15:32:32

DH5_Ant1_2441_30~1000



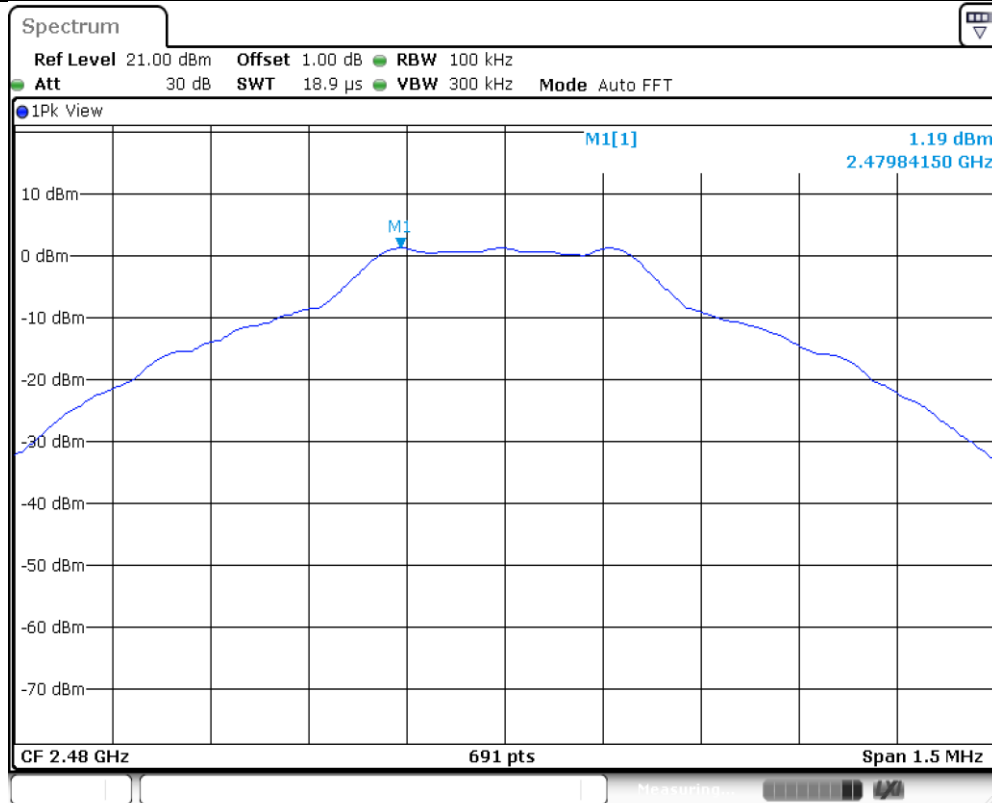
Date: 29.MAR.2023 15:32:39

DH5_Ant1_2441_1000~26500



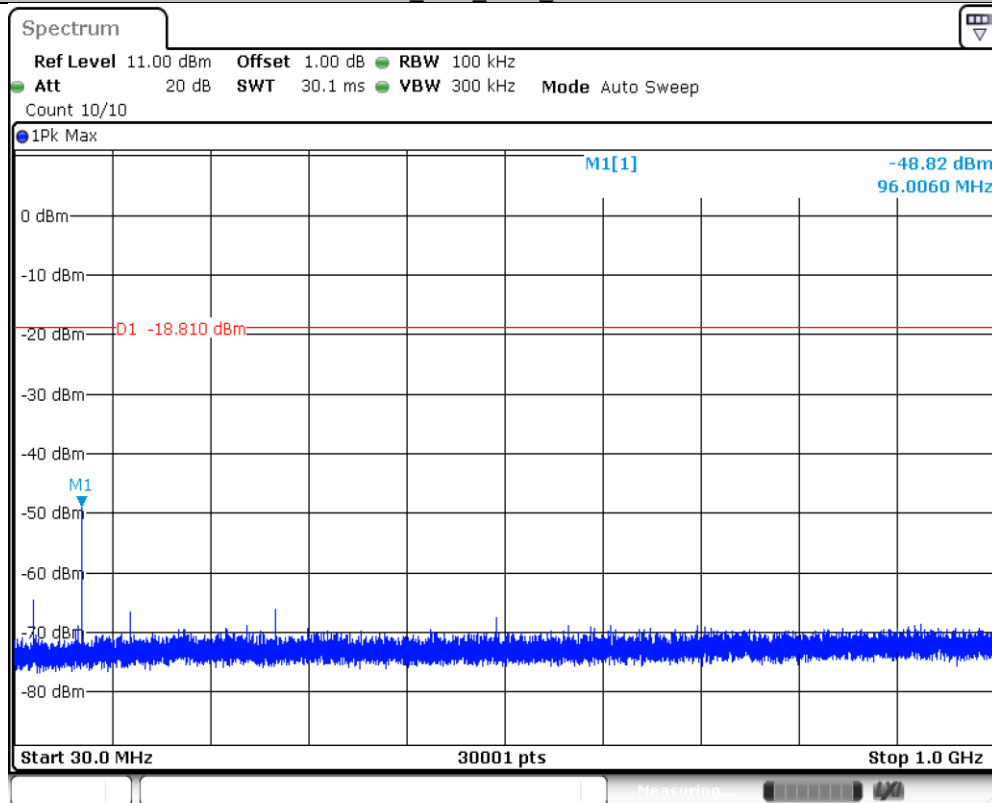
Date: 29.MAR.2023 15:32:46

DH5_Ant1_2480_0~Reference



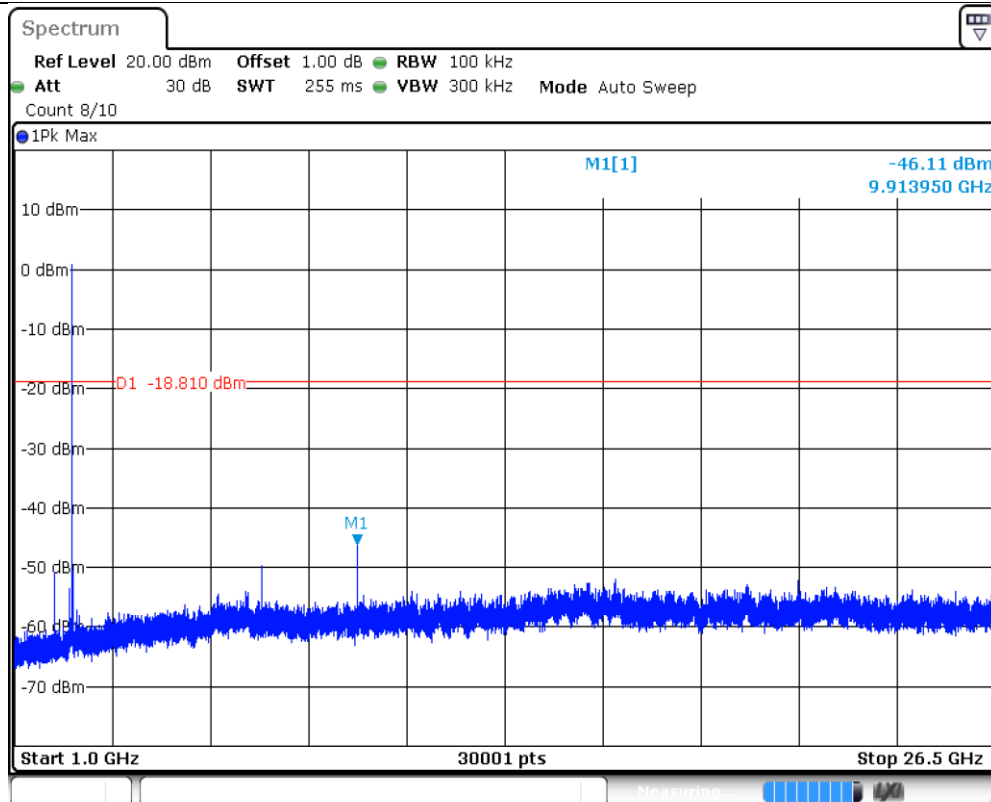
Date: 29.MAR.2023 15:34:04

DH5_Ant1_2480_30~1000



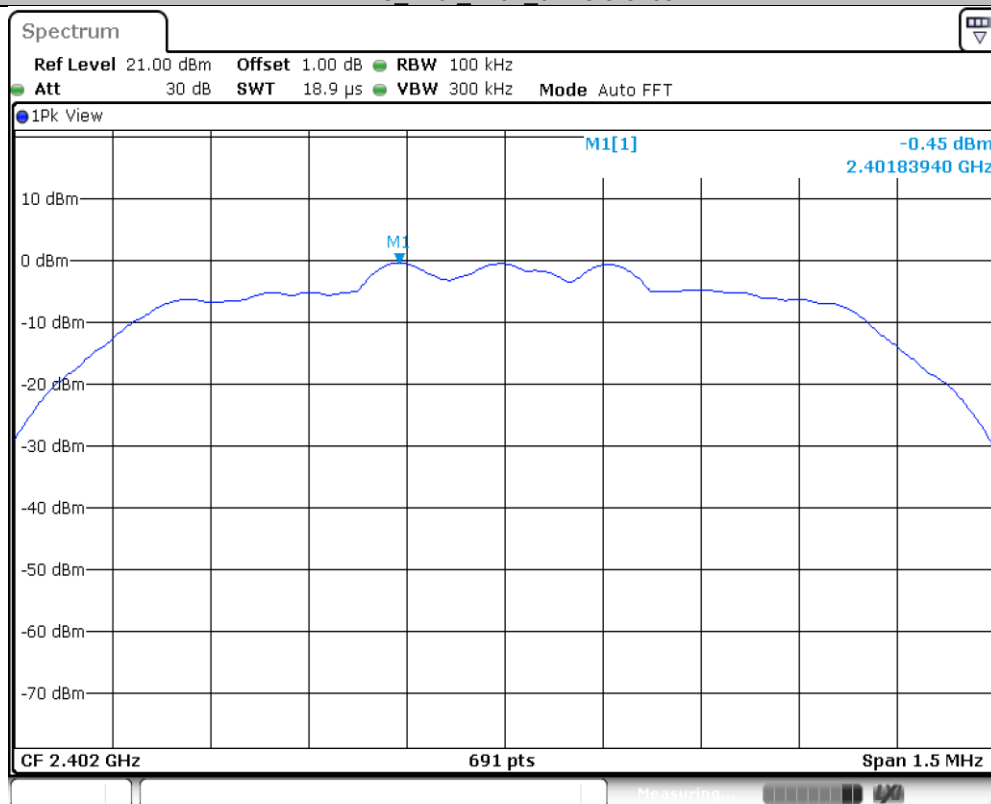
Date: 29.MAR.2023 15:34:10

DH5_Ant1_2480_1000~26500



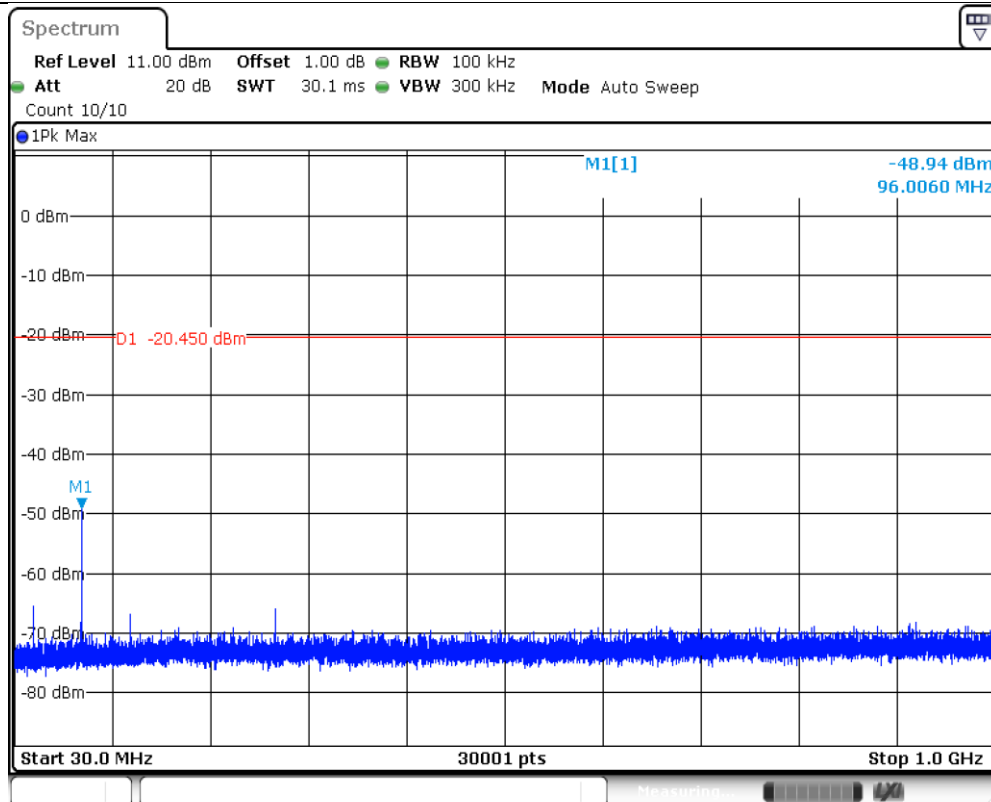
Date: 29.MAR.2023 15:34:18

2DH5_Ant1_2402_0~Reference



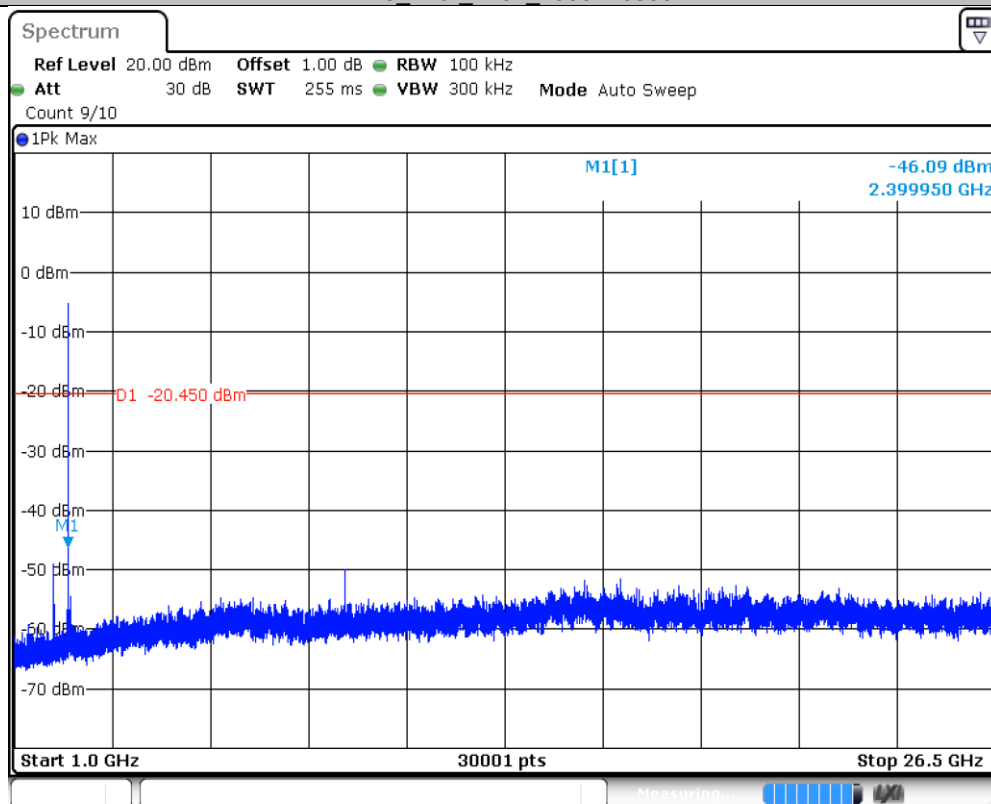
Date: 29.MAR.2023 15:35:40

2DH5_Ant1_2402_30~1000



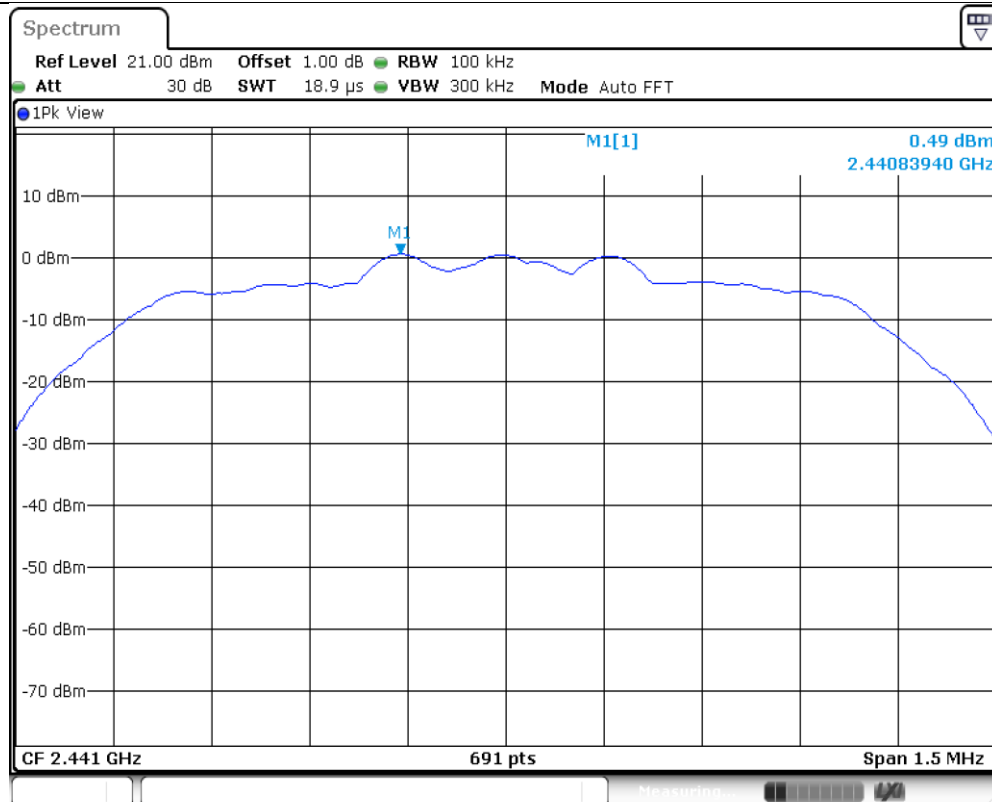
Date: 29.MAR.2023 15:35:46

2DH5_Ant1_2402_1000~26500



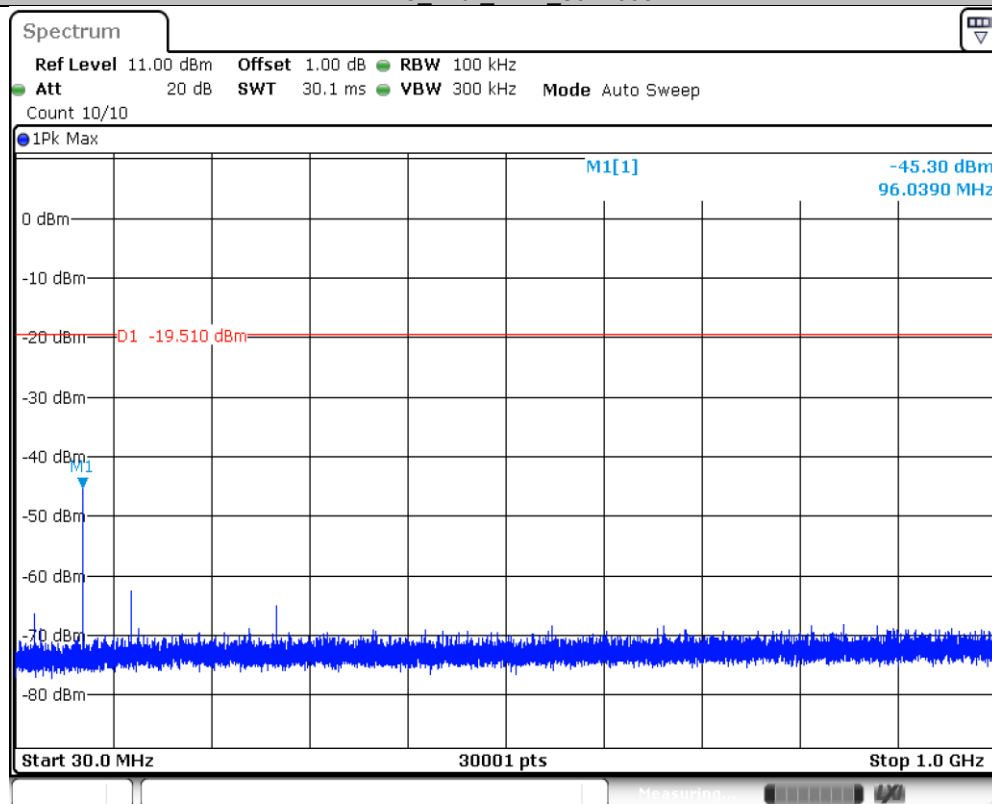
Date: 29.MAR.2023 15:35:54

2DH5_Ant1_2441_0~Reference



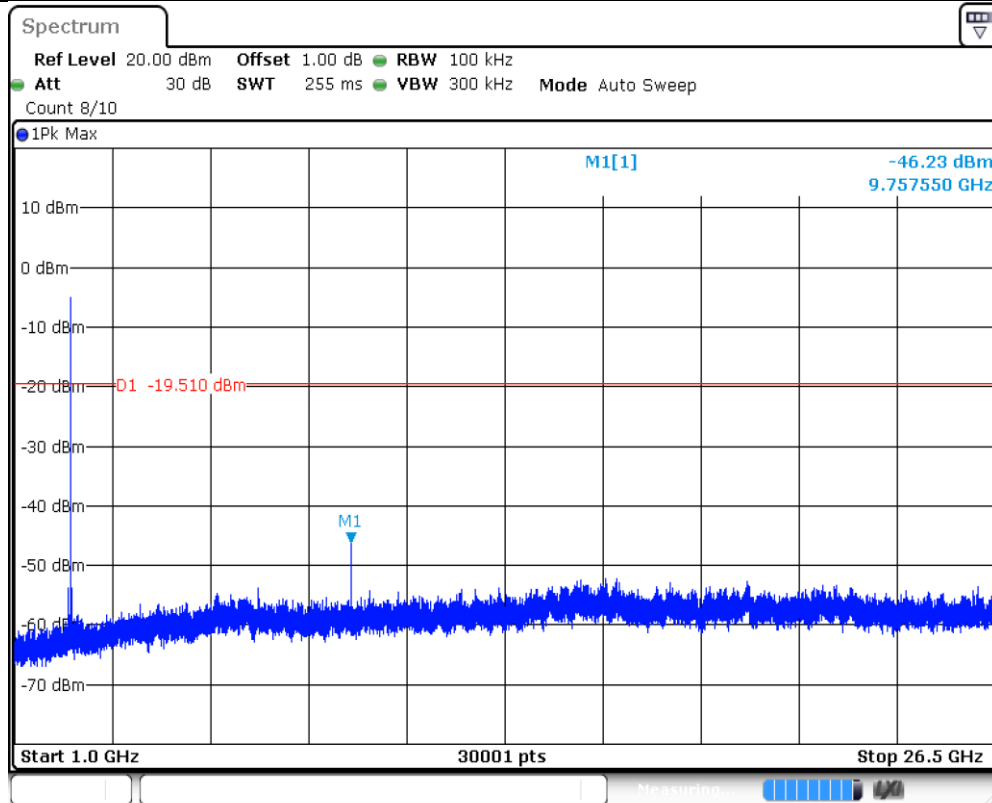
Date: 29.MAR.2023 15:37:11

2DH5_Ant1_2441_30~1000



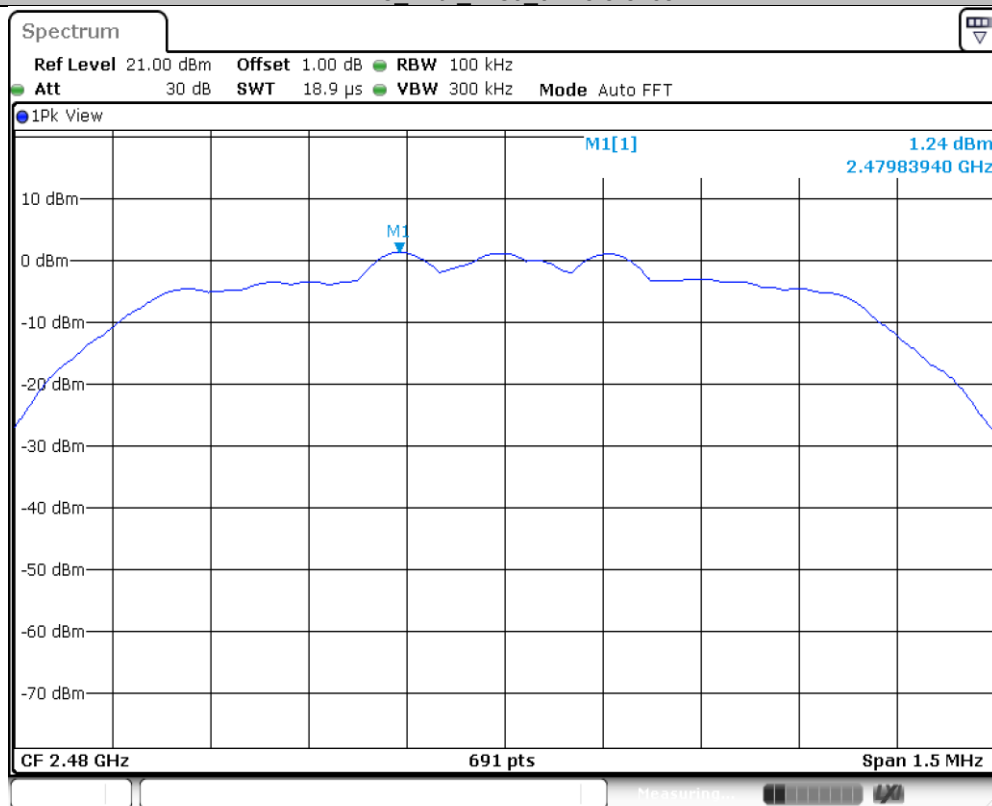
Date: 29.MAR.2023 15:37:17

2DH5_Ant1_2441_1000~26500



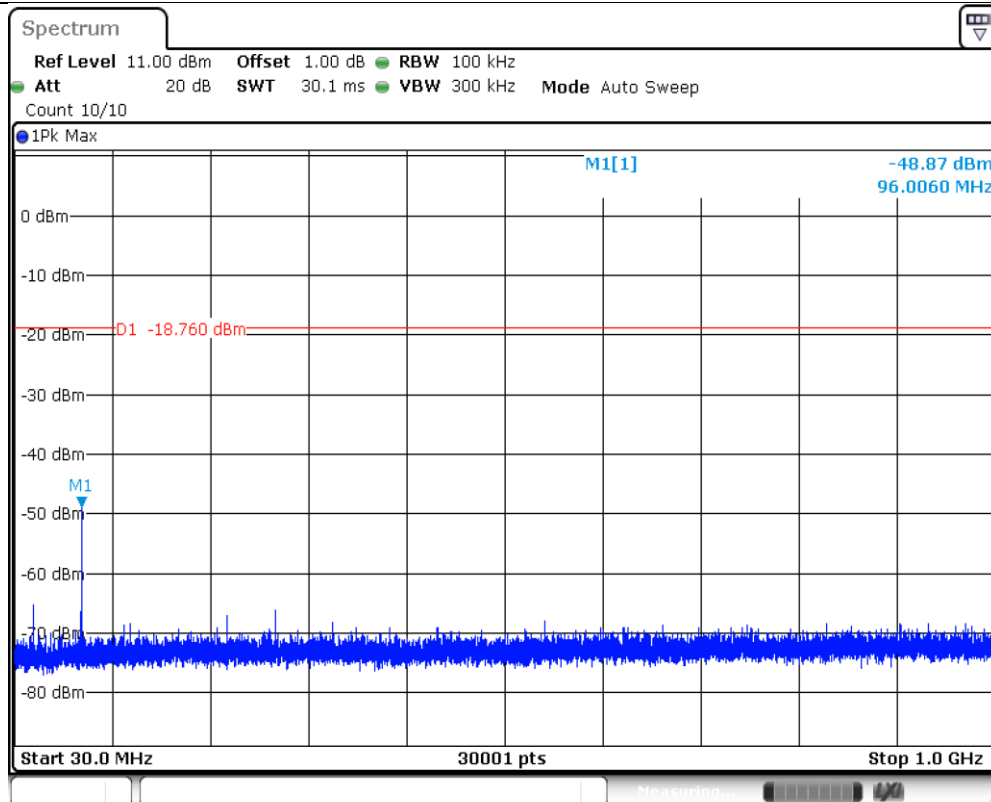
Date: 29.MAR.2023 15:37:25

2DH5_Ant1_2480_0~Reference



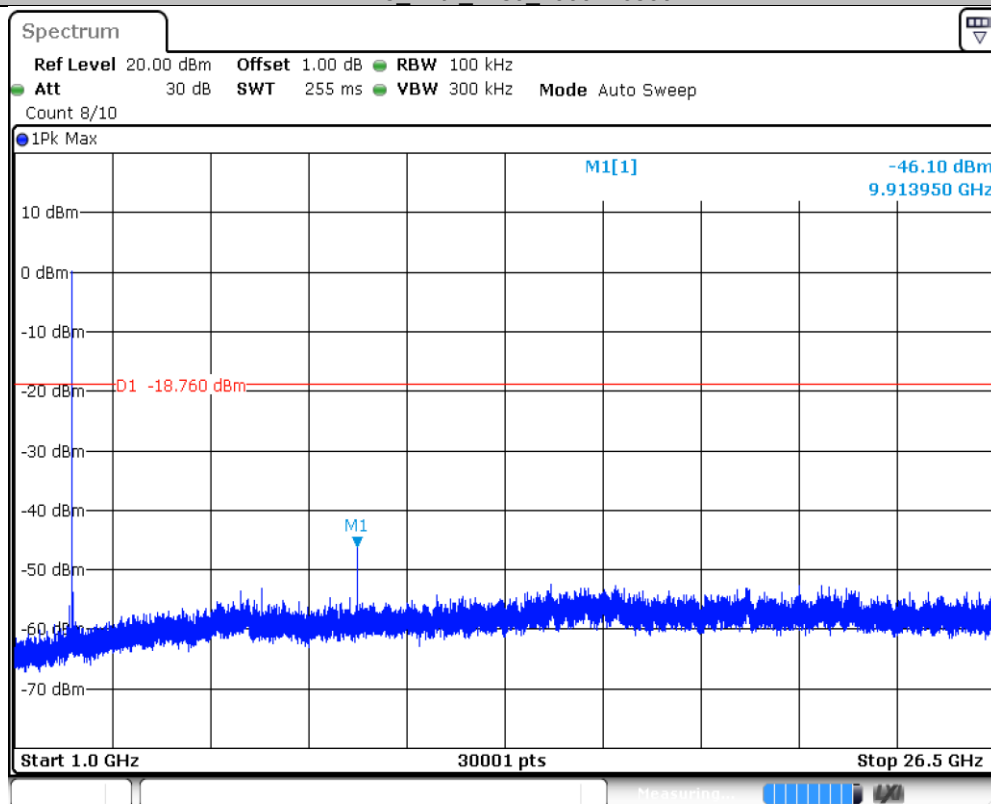
Date: 29.MAR.2023 15:38:48

2DH5_Ant1_2480_30~1000



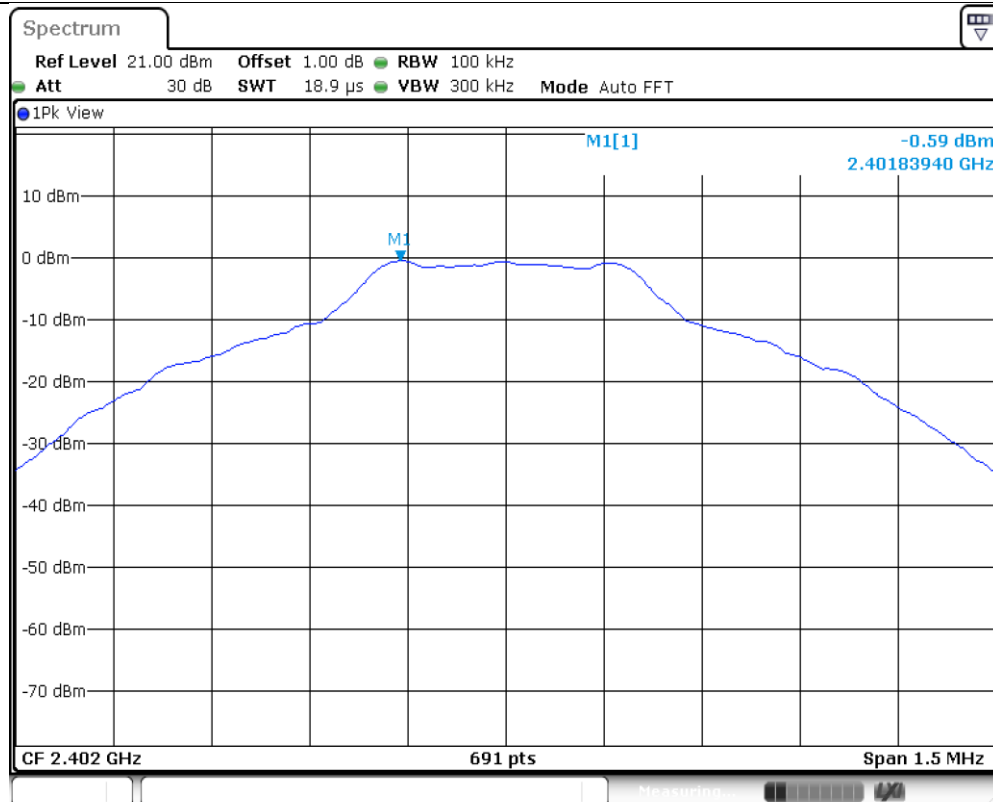
Date: 29.MAR.2023 15:38:54

2DH5_Ant1_2480_1000~26500



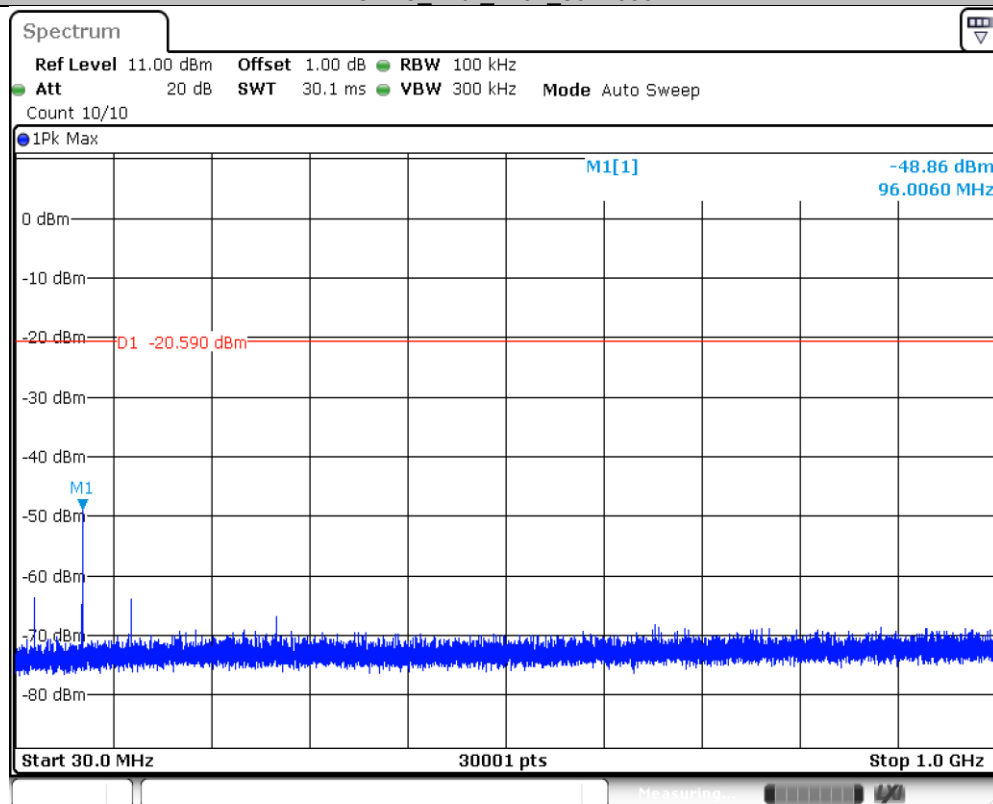
Date: 29.MAR.2023 15:39:02

3DH5_Ant1_2402_0~Reference



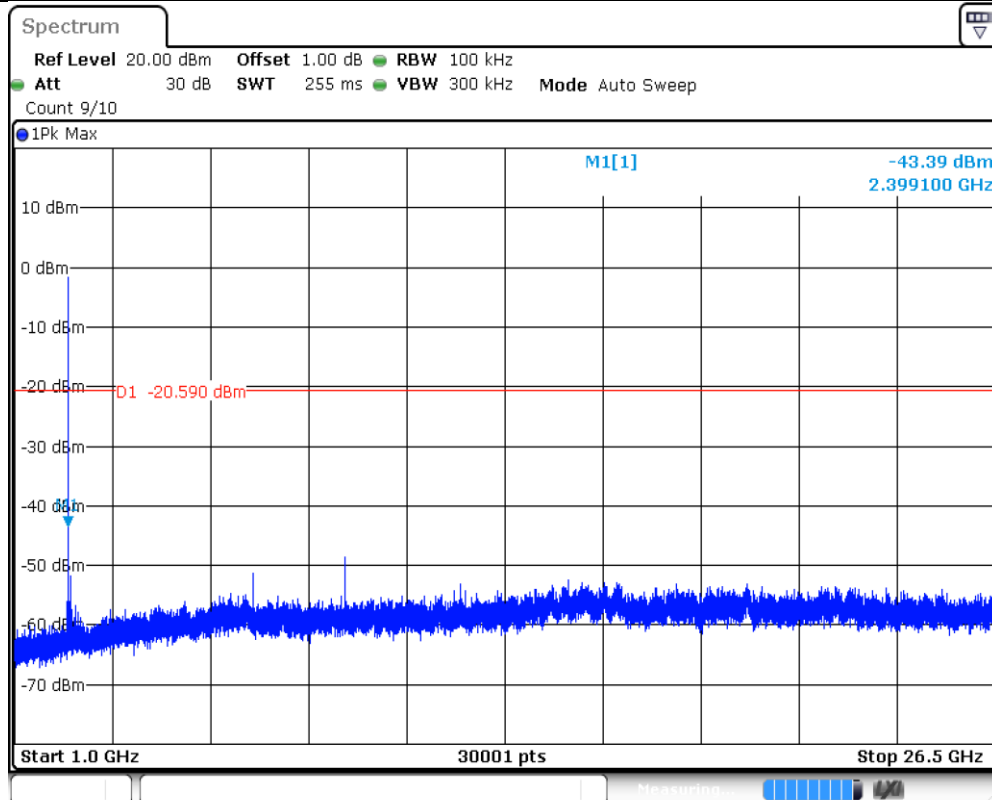
Date: 29.MAR.2023 15:40:36

3DH5_Ant1_2402_30~1000



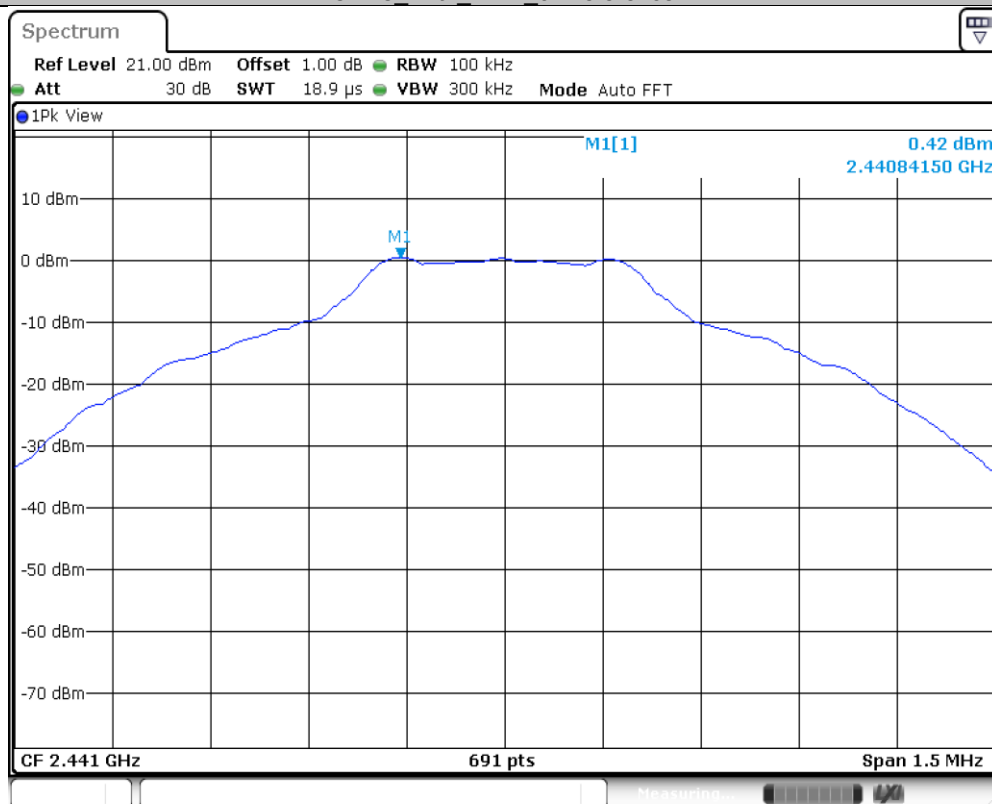
Date: 29.MAR.2023 15:40:42

3DH5_Ant1_2402_1000~26500



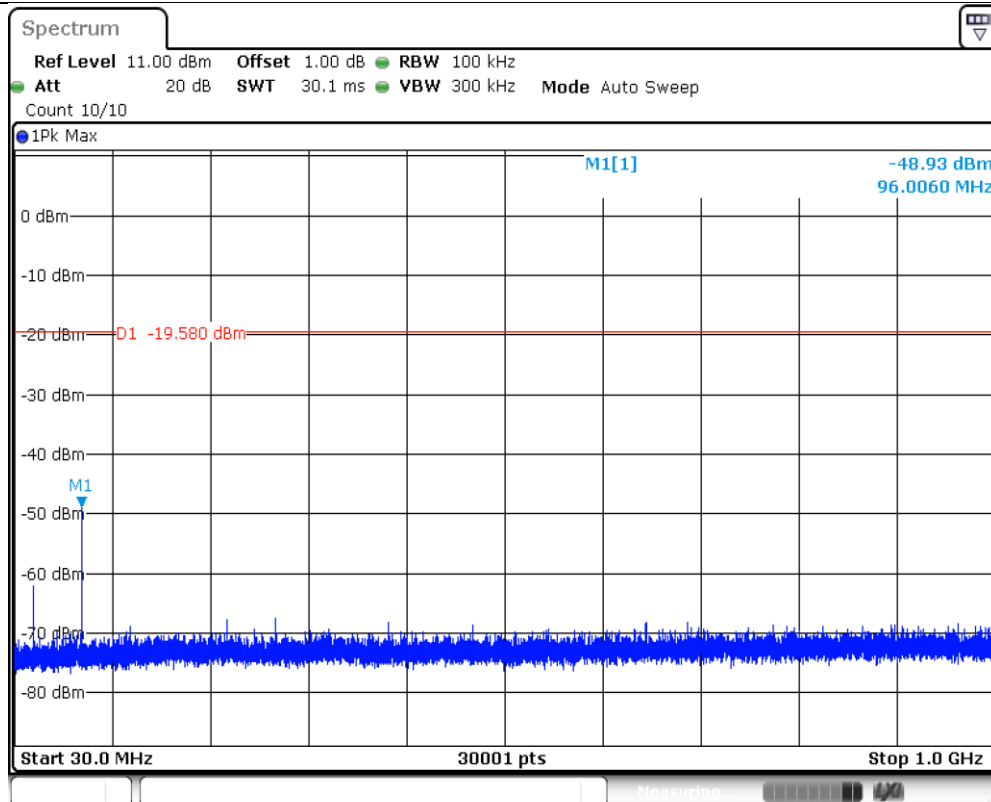
Date: 29.MAR.2023 15:40:50

3DH5_Ant1_2441_0~Reference



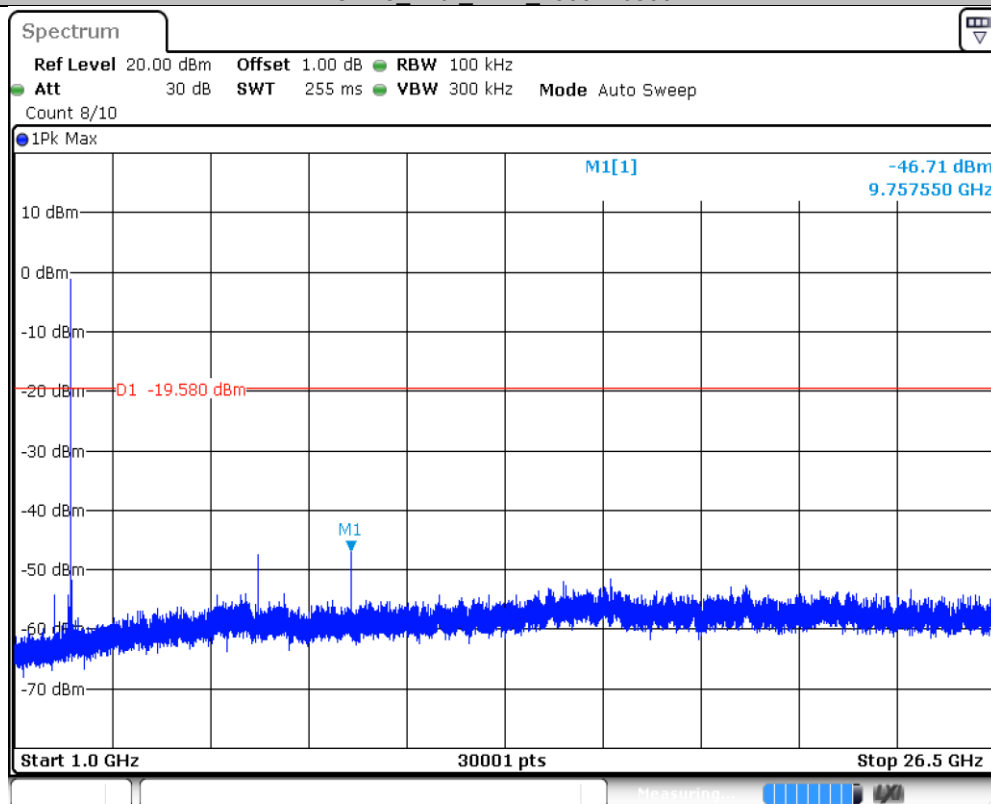
Date: 29.MAR.2023 15:42:06

3DH5_Ant1_2441_30~1000



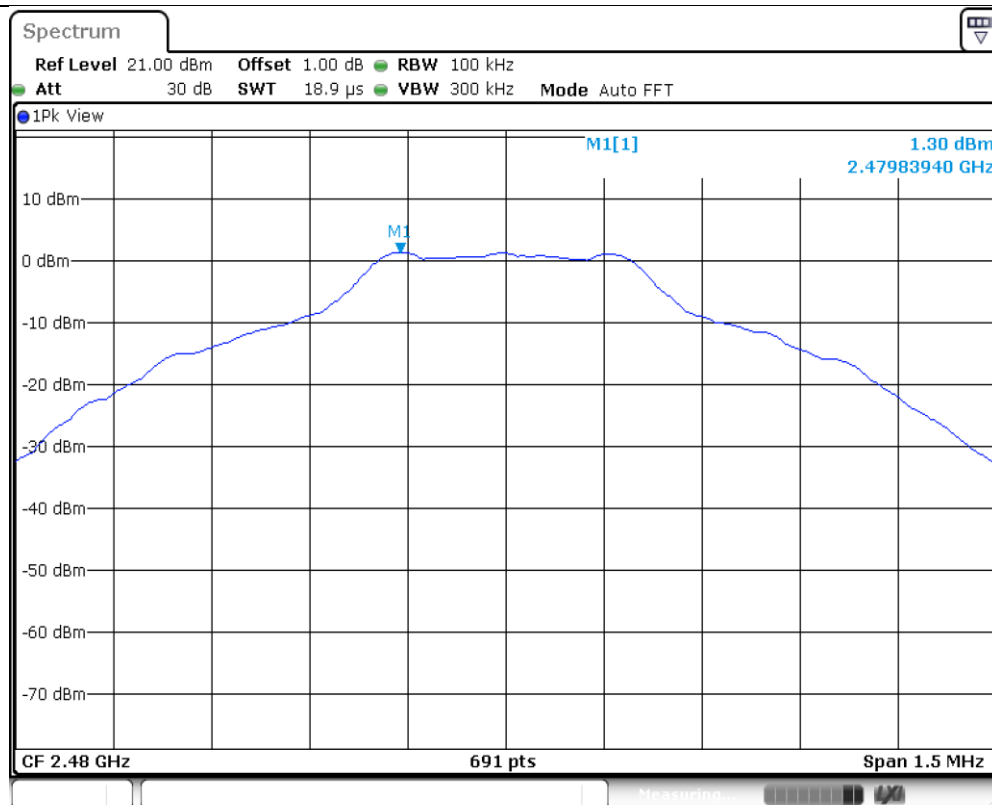
Date: 29.MAR.2023 15:42:12

3DH5_Ant1_2441_1000~26500

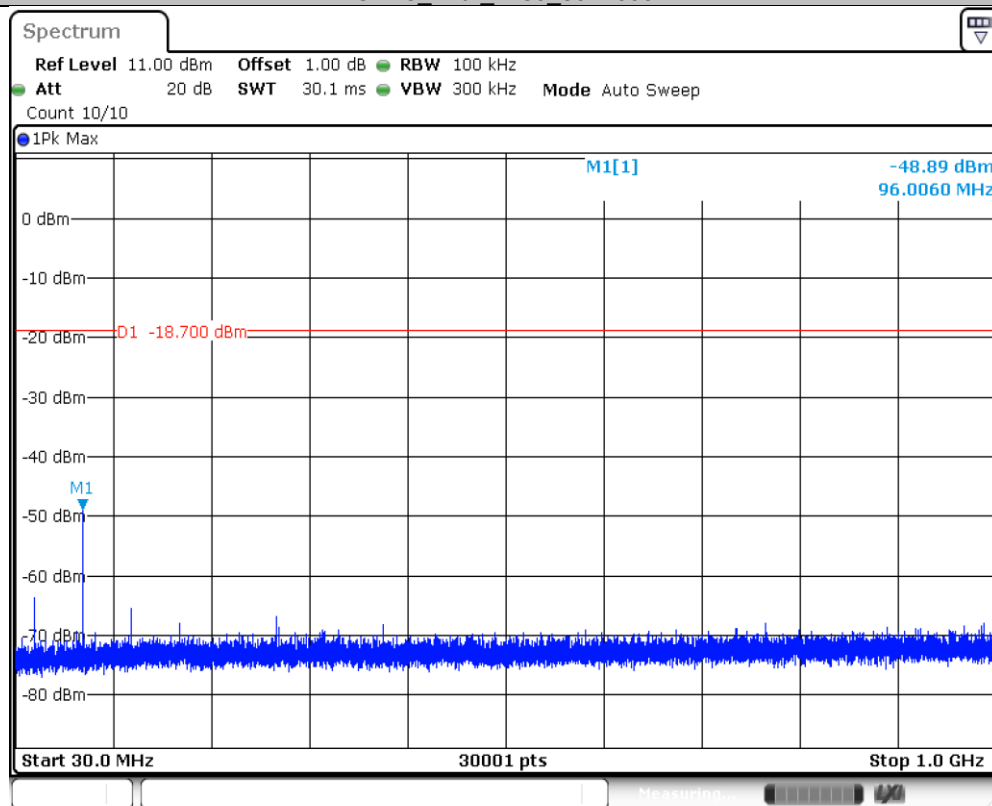


Date: 29.MAR.2023 15:42:20

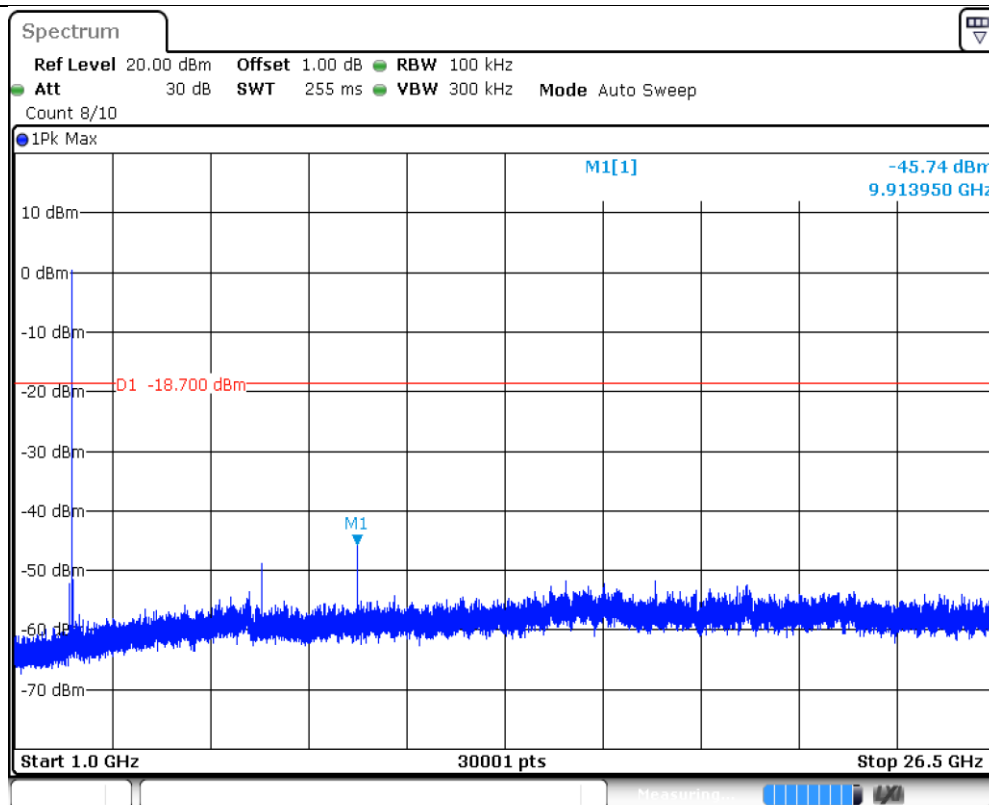
3DH5_Ant1_2480_0~Reference



3DH5_Ant1_2480_30~1000



3DH5_Ant1_2480_1000~26500



Date: 29.MAR.2023 15:44:02

9.7 Band edge testing

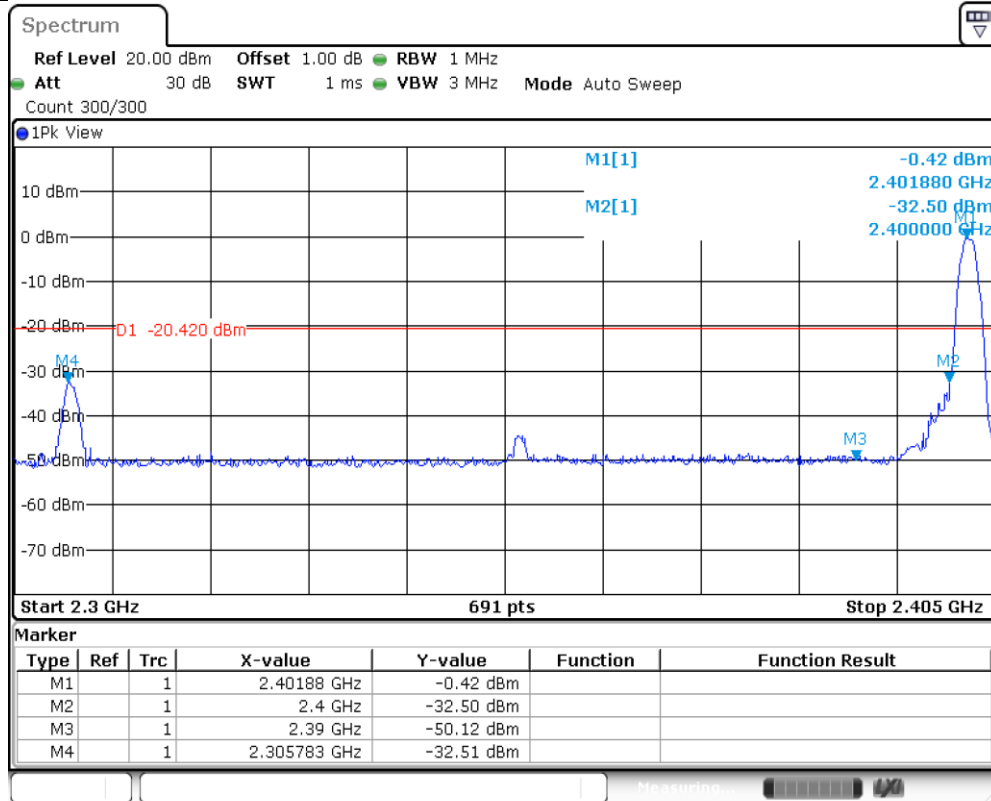
Test Method

- 1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW $\geq$ RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section. .
- 4 Repeat the test at the hopping off and hopping on mode, submit all the plots.

Limit:

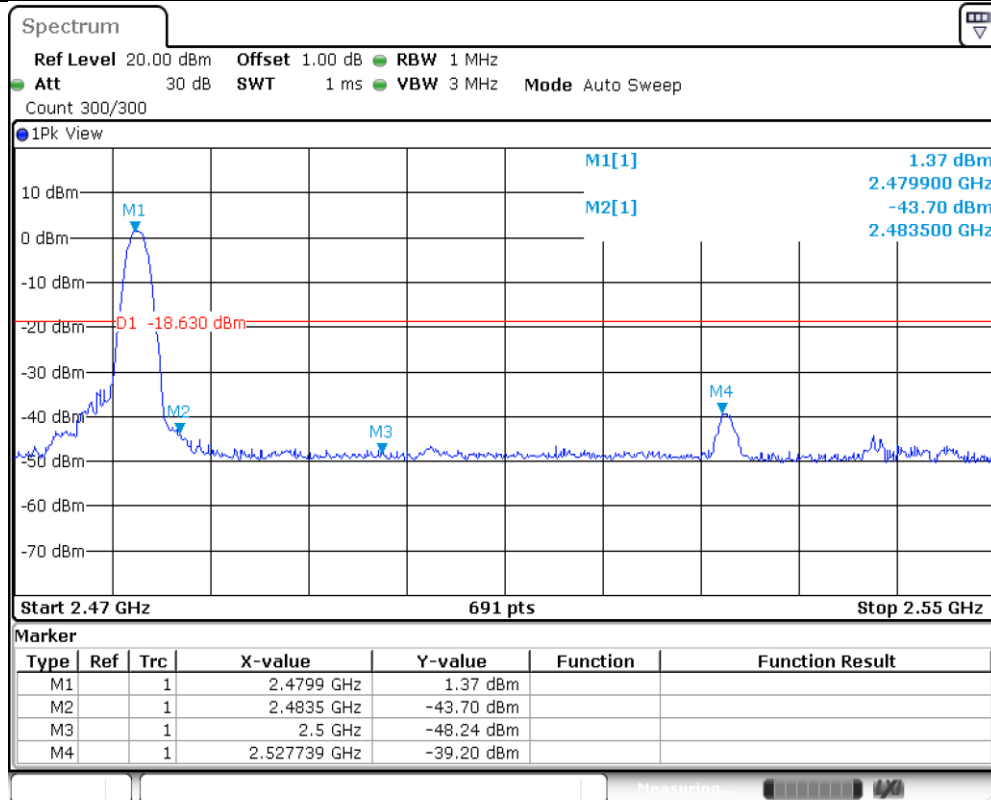
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either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

DH5_Ant1_Low_2402



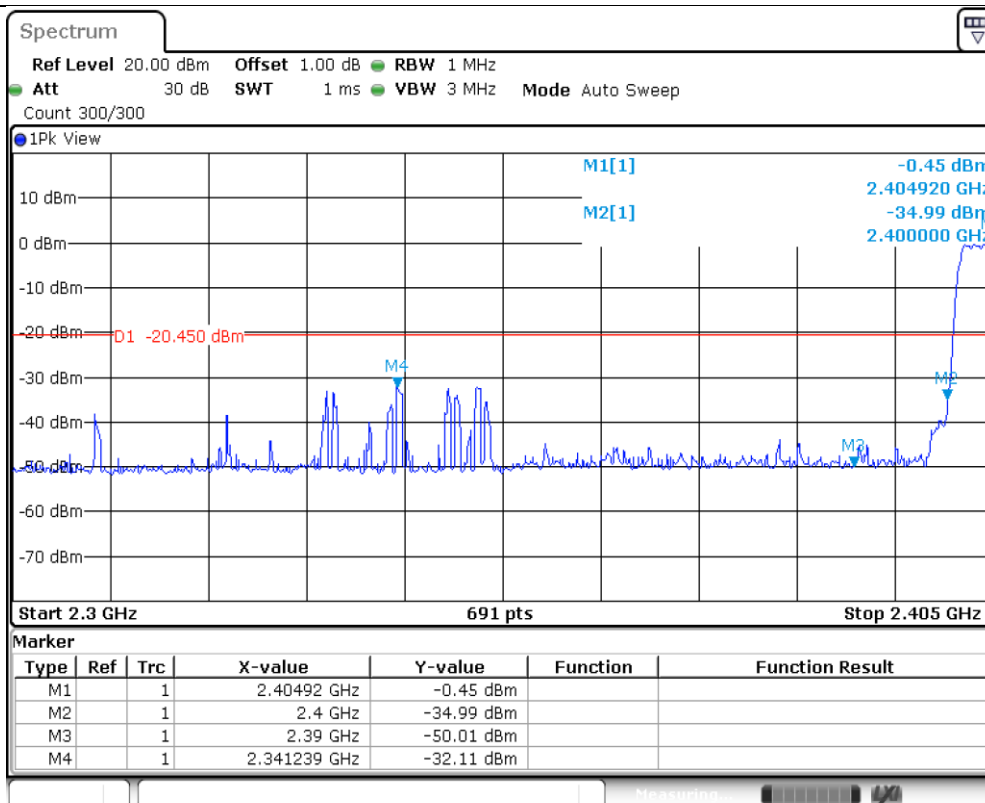
Date: 29.MAR.2023 15:30:31

DH5_Ant1_High_2480



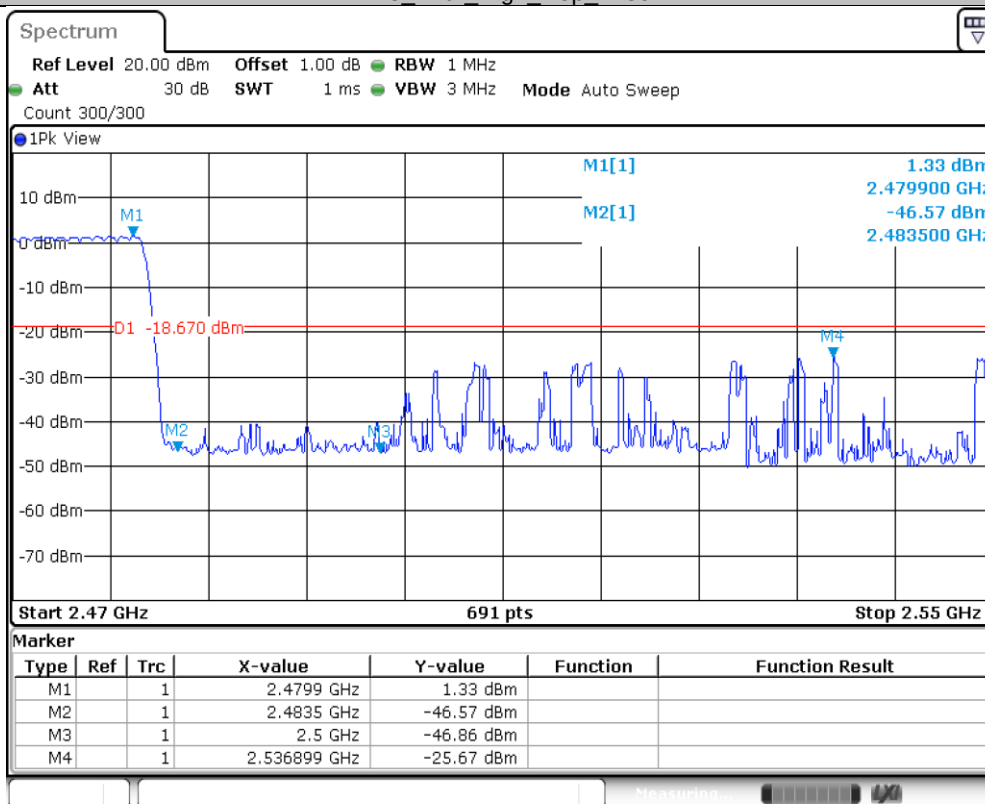
Date: 29.MAR.2023 15:33:58

DH5_Ant1_Low_Hop_2402



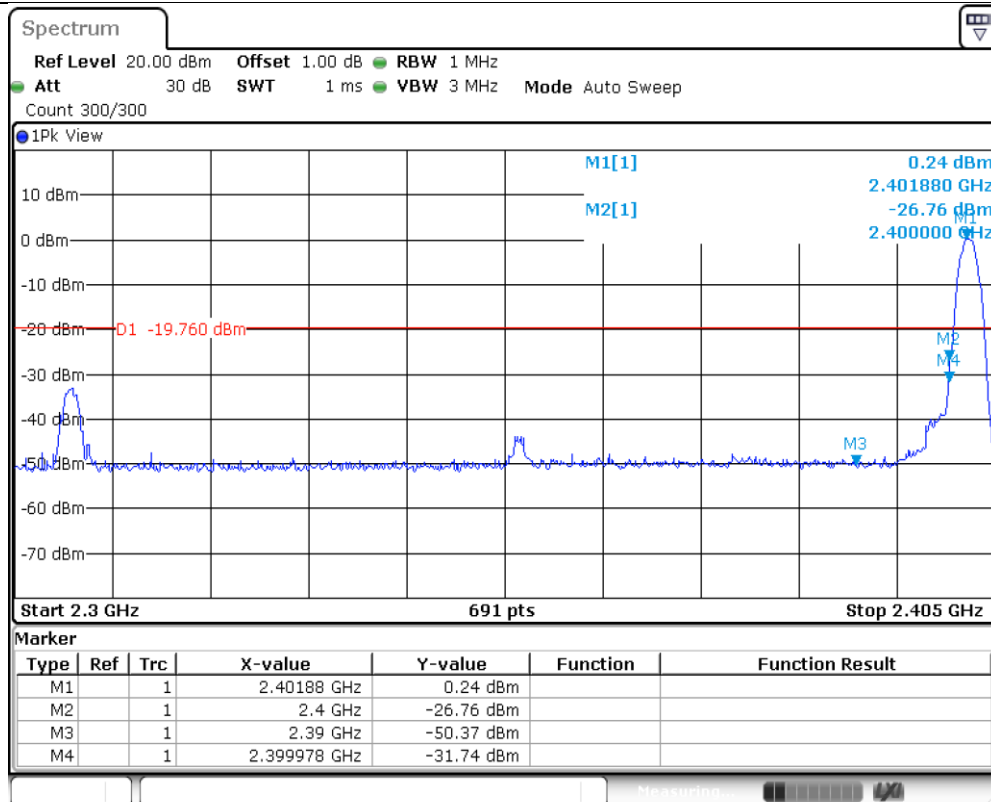
Date: 29.MAR.2023 15:44:43

DH5_Ant1_High_Hop_2480



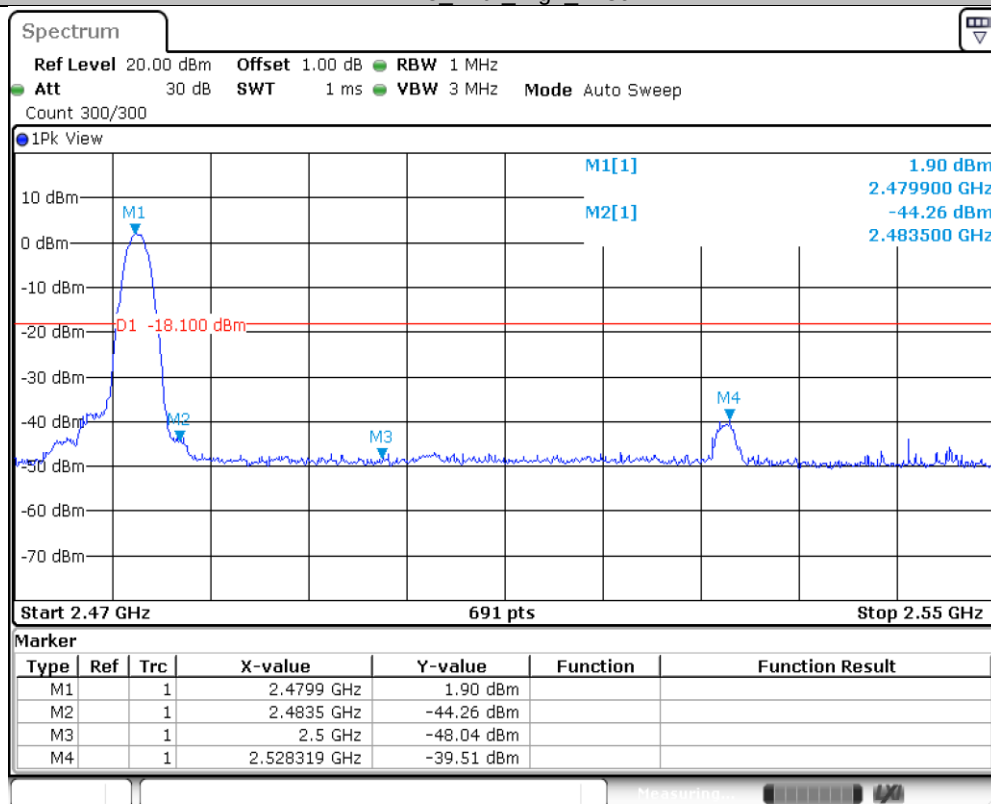
Date: 29.MAR.2023 15:45:03

2DH5_Ant1_Low_2402



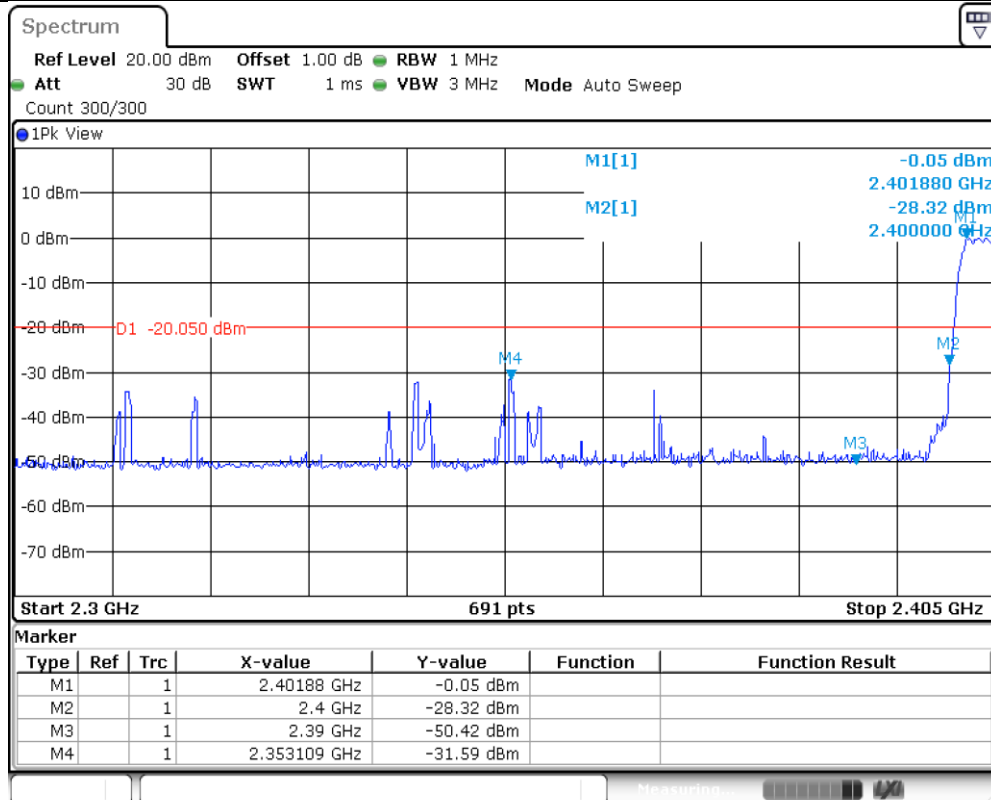
Date: 29.MAR.2023 15:35:35

2DH5_Ant1_High_2480



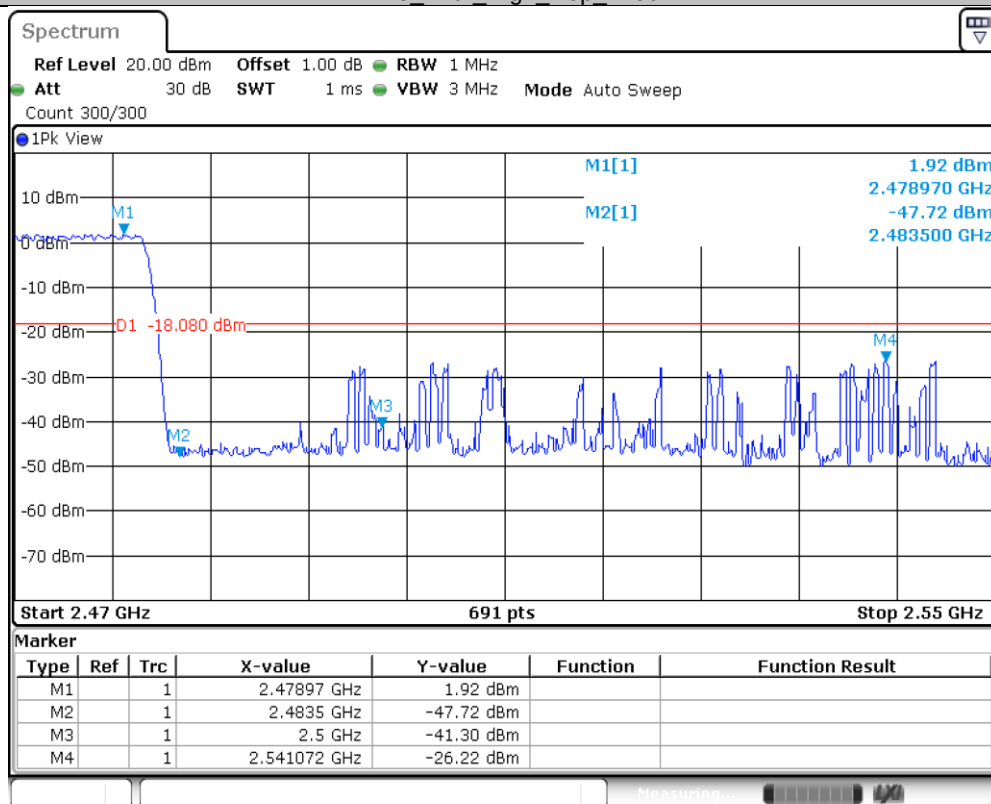
Date: 29.MAR.2023 15:38:42

2DH5_Ant1_Low_Hop_2402



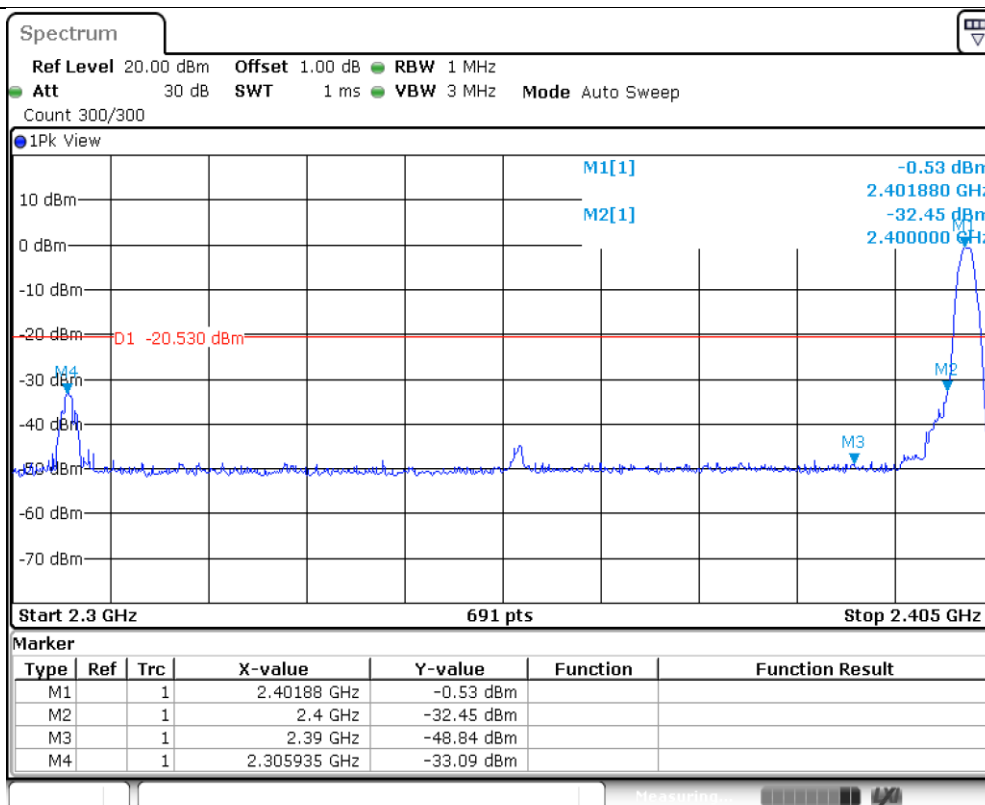
Date: 29.MAR.2023 15:45:25

2DH5_Ant1_High_Hop_2480



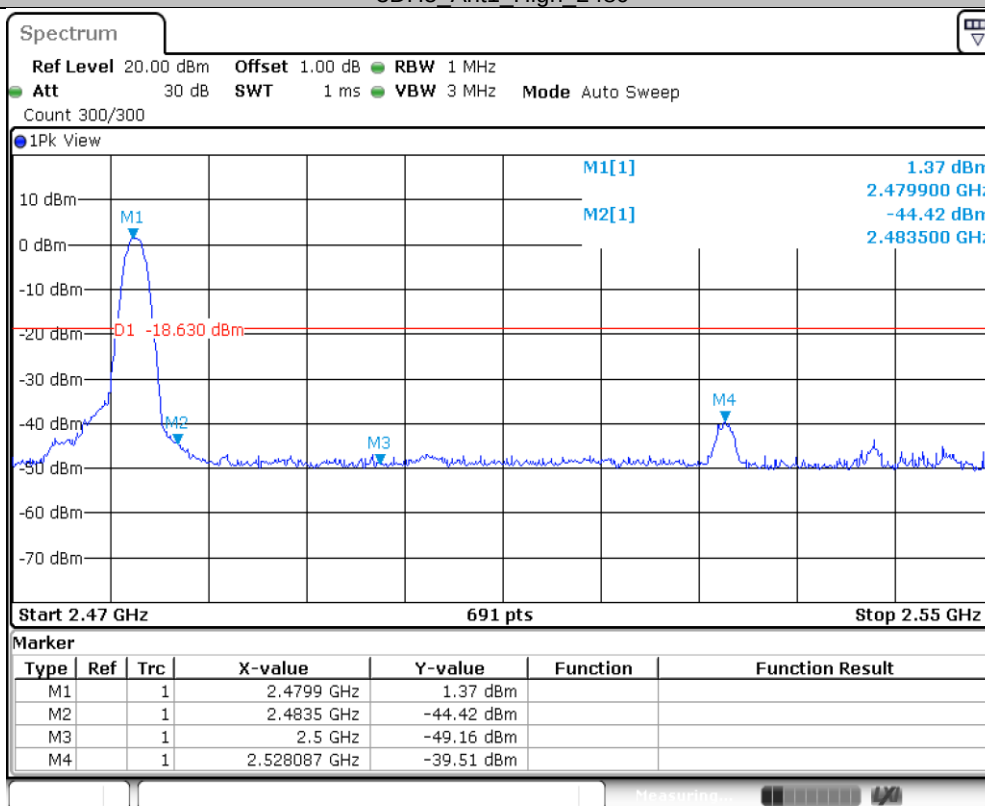
Date: 29.MAR.2023 15:45:36

3DH5_Ant1_Low_2402



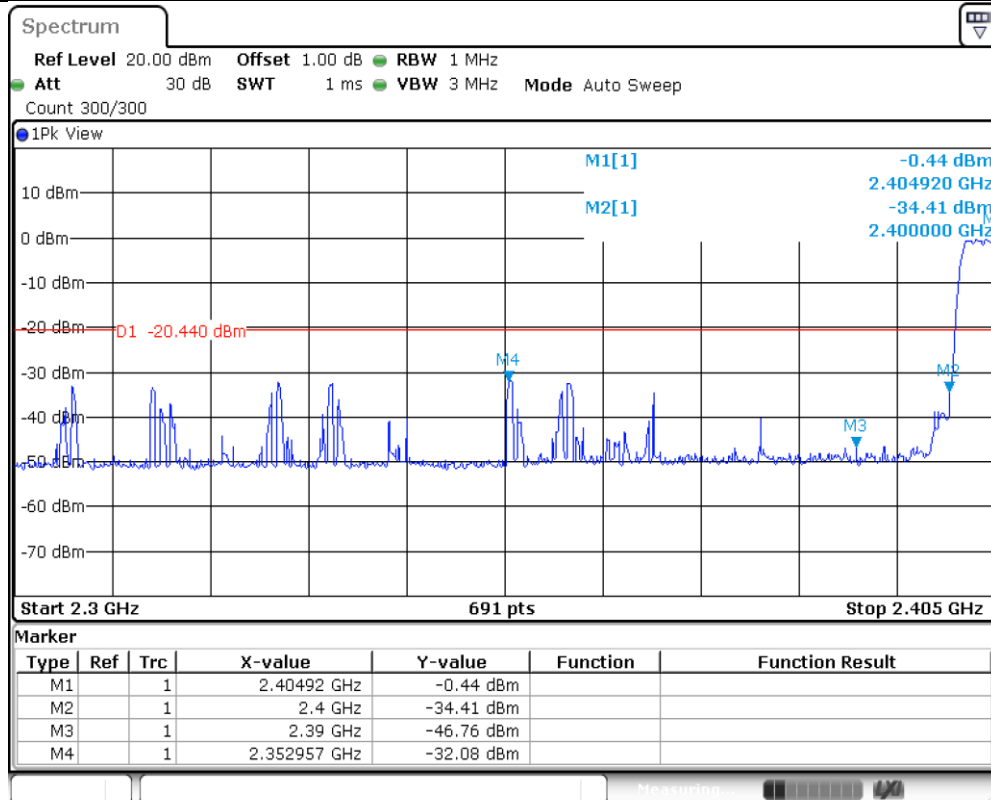
Date: 29.MAR.2023 15:40:30

3DH5_Ant1_High_2480



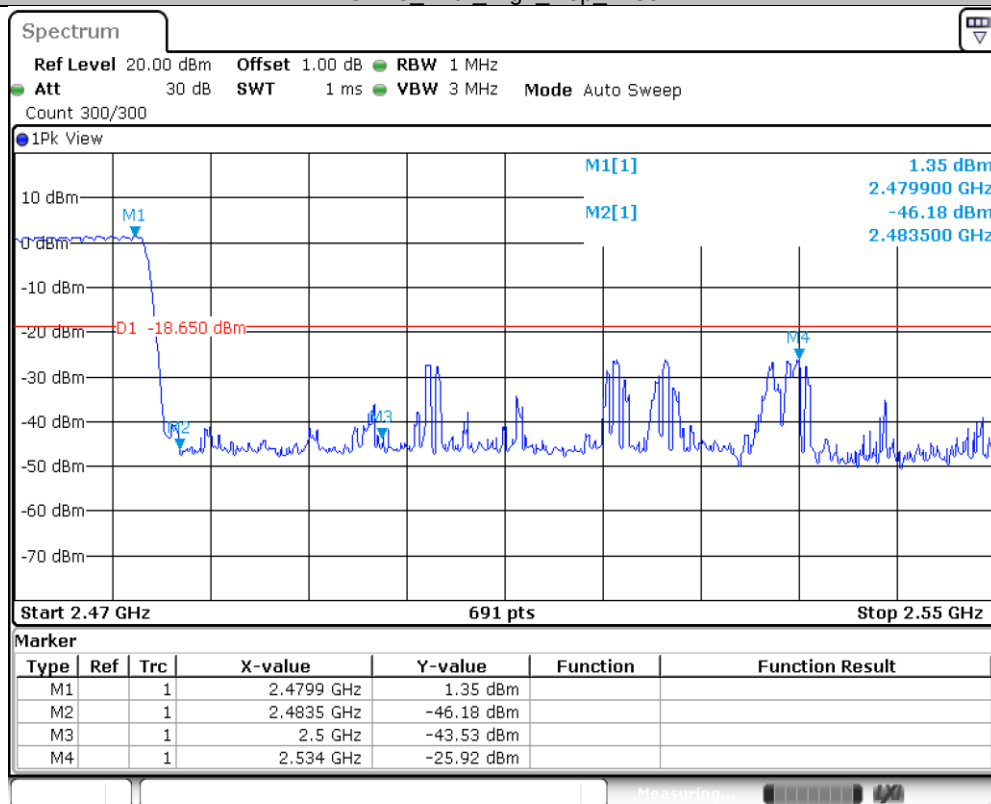
Date: 29.MAR.2023 15:43:43

3DH5_Ant1_Low_Hop_2402



Date: 29.MAR.2023 15:45:55

3DH5_Ant1_High_Hop_2480



Date: 29.MAR.2023 15:46:06

9.8 Spurious radiated emissions for transmitter

Test Method

- 1: The EUT was placed on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2: The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
- 3: The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- 4: For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- 5: Use the following spectrum analyzer settings According to C63.10:

For Below 1GHz

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 KHz to 120KHz, VBW $\geq$ RBW for peak measurement, Sweep = auto,
Detector function = peak, Trace = max hold.

For Peak unwanted emissions Above 1GHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW $\geq$ RBW for peak measurement, Sweep = auto,
Detector function = peak, Trace = max hold.

Procedures for average unwanted emissions measurements above 1000 MHz:

Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW=10Hz, Sweep = auto, Detector function = peak, Trace = max hold.
If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from $20\log(\text{dwell time}/100 \text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit.

If the emission is pulsed, modify the unit for continuous operation; use the settings shown above, then correct the reading by subtracting the peak-average correction factor, derived from the appropriate duty cycle calculation.

The setting method can refer to DA00-705.

Limit

The radio emission outside the operating frequency band shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. Radiated emissions which fall in the restricted bands, as defined in section 15.205, must comply with the radiated emission limits specified in section 15.209.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under section 5.4(d), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

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

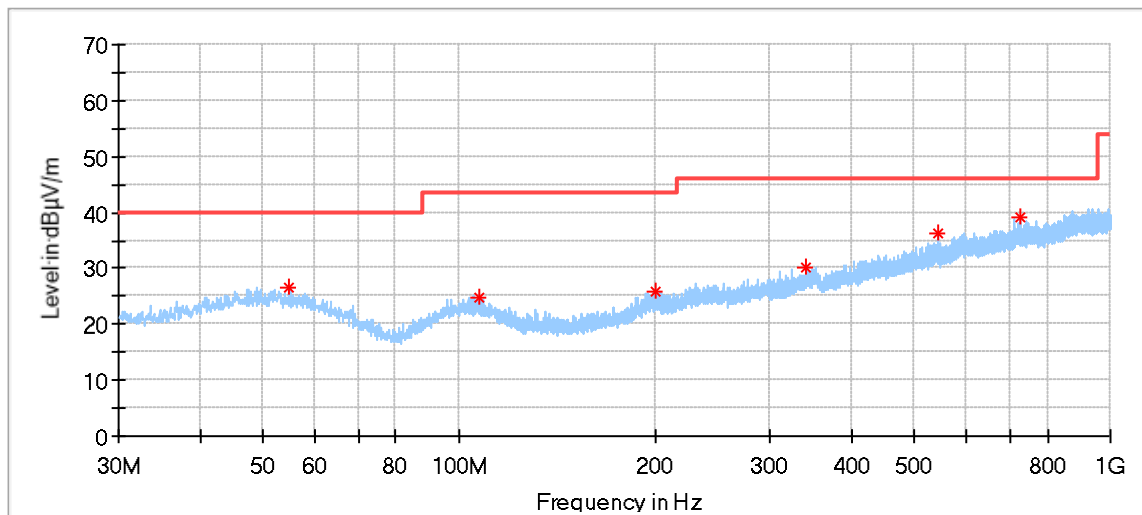
Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

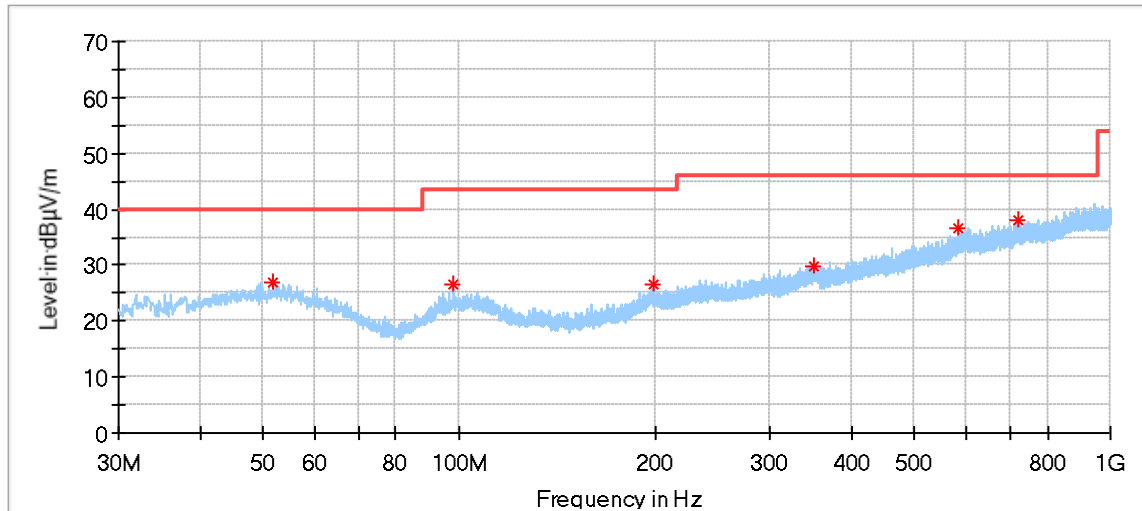
The only worse case (8DPSK mode) test result is listed in the report.

Transmitting spurious emission test result as below:

Below 1G:

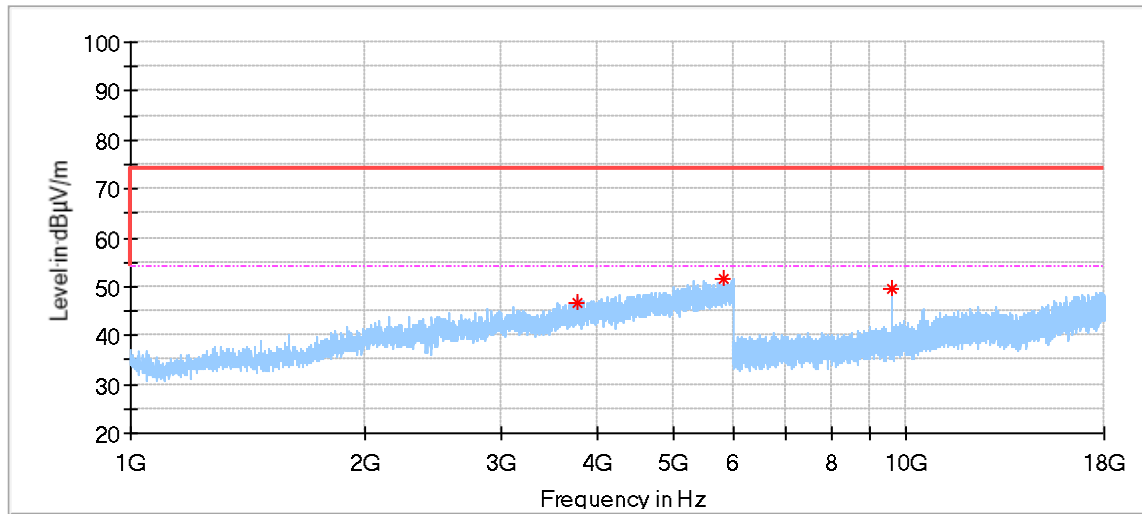


Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
54.950556	26.56	40.00	13.44	200.0	H	83.0	20.34
107.707778	24.82	43.50	18.68	100.0	H	45.0	18.58
199.965556	25.85	43.50	17.65	200.0	H	56.0	18.86
341.855000	30.26	46.00	15.74	200.0	H	355.0	22.58
545.393333	36.11	46.00	9.89	200.0	H	355.0	26.08
727.699444	39.07	46.00	6.93	100.0	H	45.0	29.00

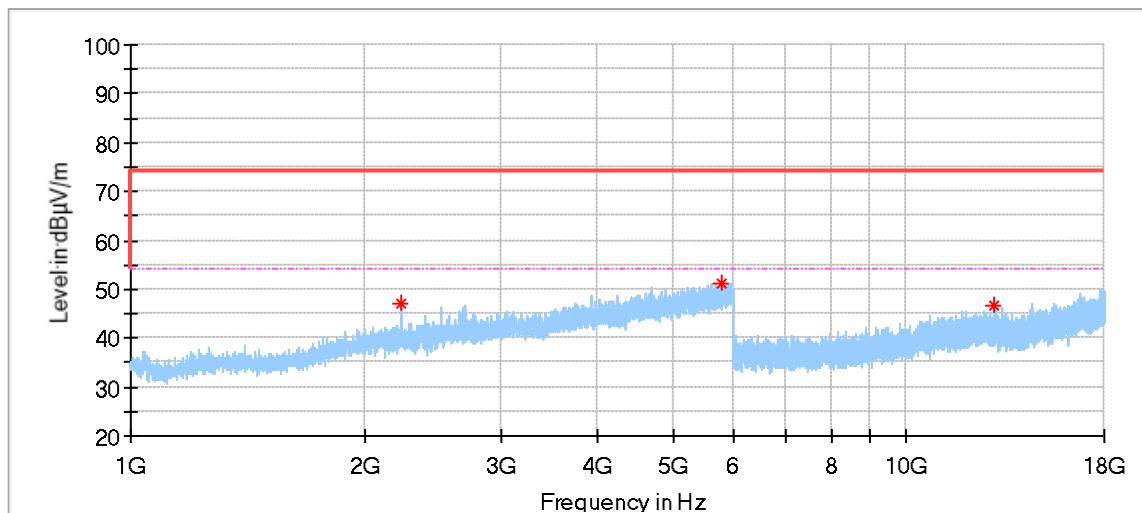


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
51.932778	26.91	40.00	13.09	100.0	V	195.0	20.63
98.169444	26.43	43.50	17.07	100.0	V	231.0	18.50
198.348889	26.73	43.50	16.77	200.0	V	298.0	19.05
349.291667	29.89	46.00	16.11	200.0	V	65.0	23.05
585.378889	36.55	46.00	9.45	100.0	V	258.0	27.32
723.065000	38.00	46.00	8.00	200.0	V	194.0	28.89

Low channel 2402MHz

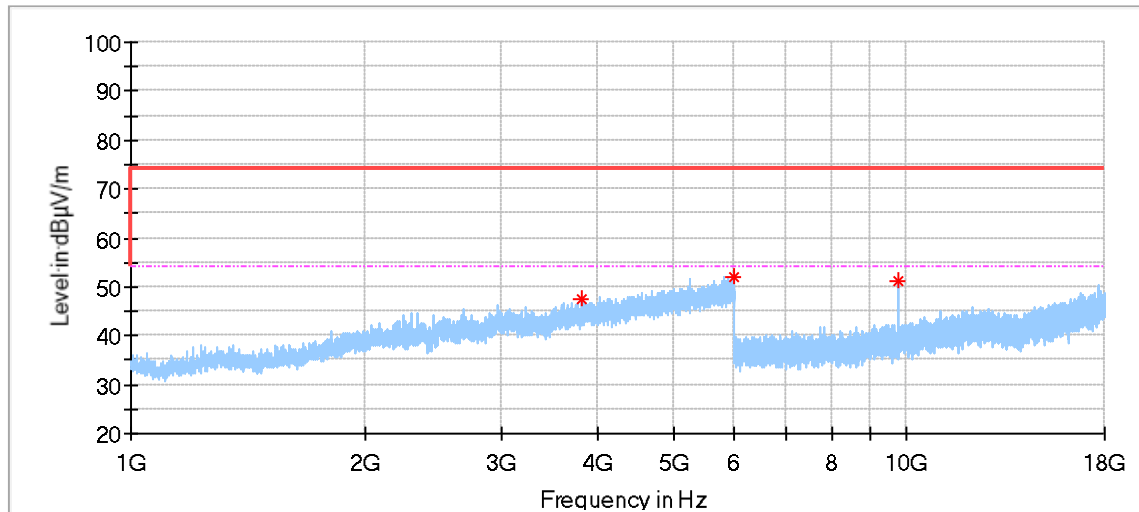


Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3763.500000*	46.65	74.00	27.35	150.0	H	245.0	2.97
5825.000000	51.66	74.00	22.34	150.0	H	71.0	8.47
9602.000000	49.59	74.00	24.41	150.0	H	316.0	11.83

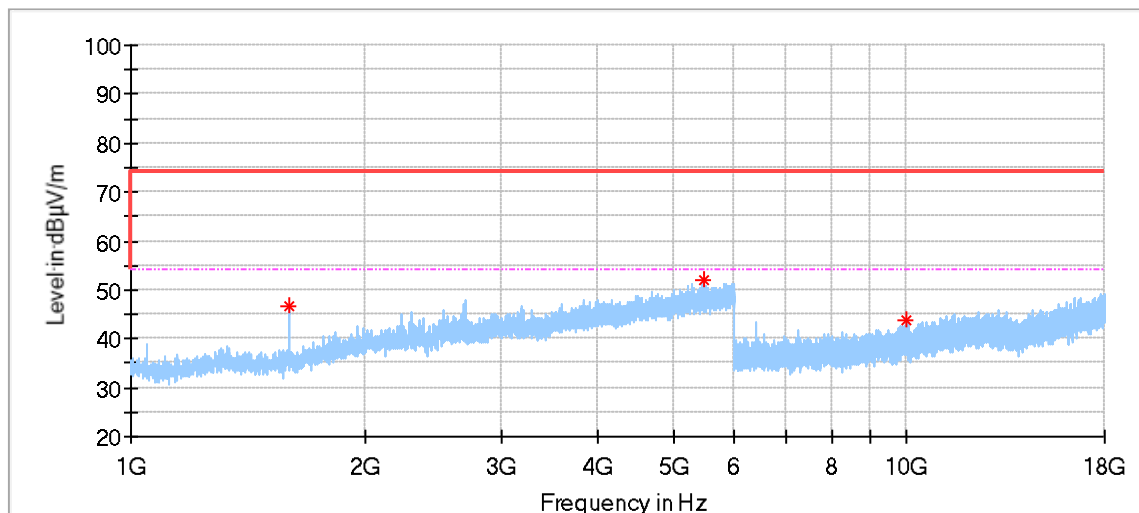


Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2233.000000*	46.89	74.00	27.11	150.0	V	292.0	-2.65
5791.000000	51.35	74.00	22.65	150.0	V	149.0	8.33
13002.500000	46.66	74.00	27.34	150.0	V	49.0	15.97

Middle channel 2441MHz

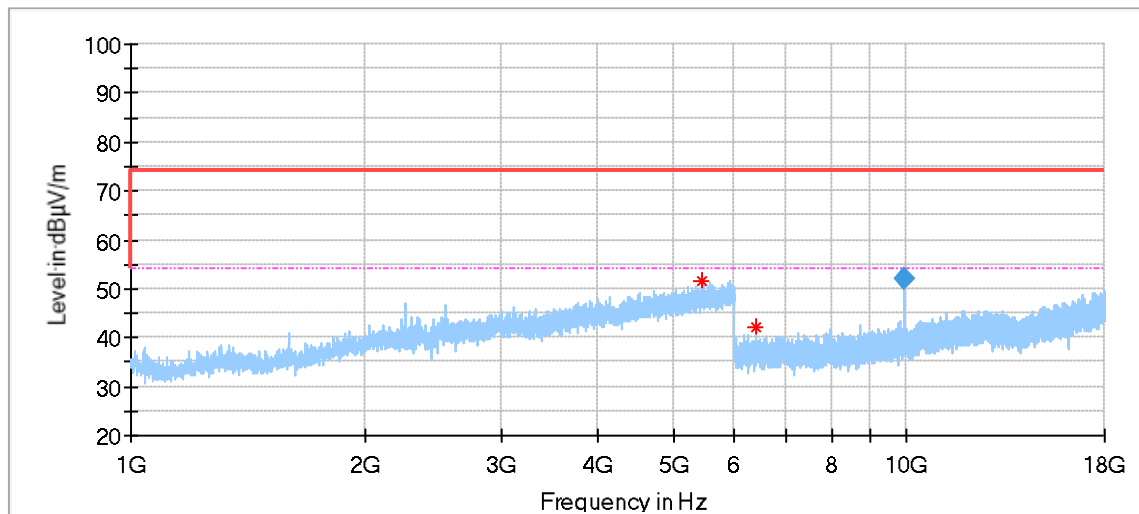


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3815.500000*	47.61	74.00	26.39	150.0	H	91.0	2.97
6000.000000	52.01	74.00	21.99	150.0	H	285.0	8.86
9758.000000	51.08	74.00	22.92	150.0	H	312.0	12.16

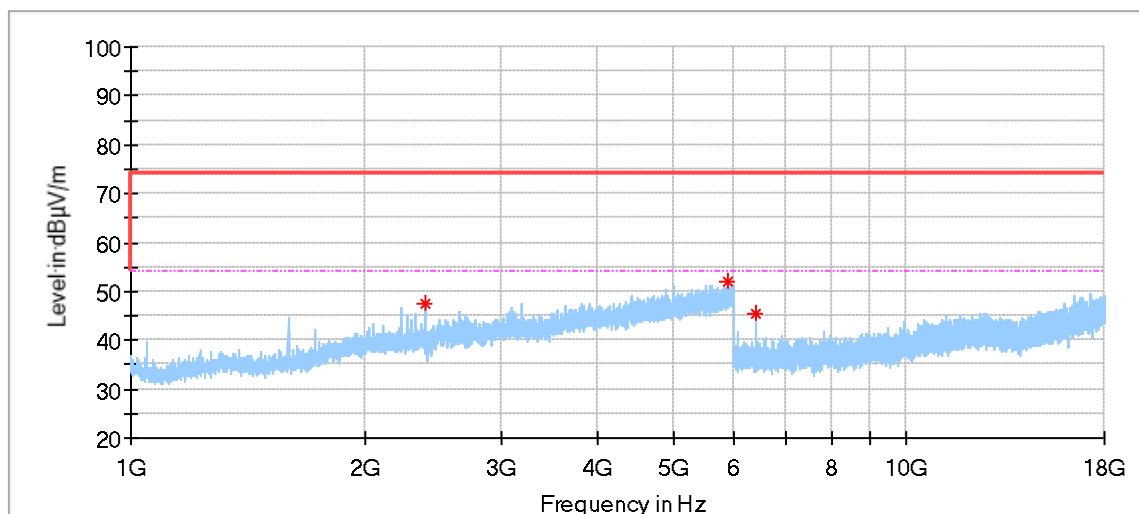


Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1597.500000*	46.83	74.00	27.17	150.0	V	338.0	-7.03
5470.000000	51.85	74.00	22.15	150.0	V	216.0	7.83
9964.000000	43.67	74.00	30.33	150.0	V	334.0	12.10

High channel 2480MHz



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
5458.500000	51.59	74.00	22.41	150.0	H	298.0	7.90
6397.500000	42.36	74.00	31.64	150.0	H	27.0	7.83
9914.000000	52.06	74.00	21.94	150.0	H	316.0	12.21
Frequency (MHz)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
9914.000000	52.02	54.00	1.98	150.0	H	316.0	12.21



Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2393.000000	47.43	74.00	26.57	150.0	V	37.0	-1.67
5874.000000	51.92	74.00	22.08	150.0	V	71.0	8.67
6389.500000	45.51	74.00	28.49	150.0	V	91.0	7.84

Remark:

- (1) “*” means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- (2) Data of measurement within frequency range 9kHz-30MHz, 18-26GHz are the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured, so test data does not present in this report.
- (3) The report only shows the worst test data.
- (4) Level= Reading Level + Correction Factor
- (5) Above 1GHz: Corrector factor = Antenna Factor + Cable Loss- Amplifier Gain

Below 1GHz: Corrector factor = Antenna Factor + Cable Loss
(The Reading Level is recorded by software which is not shown in the sheet)

10 Test Equipment List

Radiated Emission Test

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL INTERVAL (YEAR)	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	68-4-74-14-002	101269	1	2023-5-28
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9162	68-4-80-19-003	284	1	2023-7-12
Wave Guide Antenna	ETS	3117	68-4-80-19-001	00218954	1	2023-5-9
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-001	100745	1	2023-5-28
Pre-amplifier	Rohde & Schwarz	SCU 18F	68-4-29-19-002	100746	1	2023-5-28
Sideband Horn Antenna	Q-PAR	QWH-SL-18-40-K-SG	68-4-80-14-008	12827	1	2023-7-12
Pre-amplifier	Rohde & Schwarz	SCU 40A	68-4-29-14-002	100432	1	2023-7-27
Attenuator	Mini-circuits	UNAT-6+	68-4-81-21-002	15542	1	2023-5-27
3m Semi-anechoic chamber	TDK	SAC-3 #2	68-4-90-19-006	----	2	2023-5-28
Test software	Rohde & Schwarz	EMC32	68-4-90-19-006-A01	Version10.3 5.02	N/A	N/A

Conducted Emission Test

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL INTERVAL (YEAR)	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 3	68-4-74-19-002	102590	1	2023-5-27
LISN	Rohde & Schwarz	ENV216	68-4-87-19-001	102472	1	2023-5-27
Attenuator	Shanghai Huaxiang	TS2-26-3	68-4-81-16-003	080928189	1	2023-5-27
Test software	Rohde & Schwarz	EMC32	68-4-90-19-005-A01	Version10.35. 02	N/A	N/A
Shielding Room	TDK	CSR #2	68-4-90-19-005	----	3	2025-10-15

Conducted RF Test System

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL INTERVAL (YEAR)	CAL. DUE DATE
Signal Analyzer	Rohde & Schwarz	FSV40	68-4-74-14-004	101030	1	2023-5-27
Test software	Tonscend	System for BT/WIFI	68-4-74-14-006-A13	Version 2.6.77.0518	N/A	N/A
Shielding Room	TDK	TS8997	68-4-90-19-003	----	3	2025-10-15

11 System Measurement Uncertainty

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

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Conducted Emission 150kHz-30MHz (for test using AMN ENV432 or ENV4200)	3.57dB
Uncertainty for Radiated Emission in new 3m chamber (68-4-90-19-006) 30MHz-1000MHz	Horizontal: 4.59dB; Vertical: 4.75dB
Uncertainty for Radiated Emission in new 3m chamber (68-4-90-19-006) 1000MHz-18000MHz	Horizontal: 5.08dB; Vertical: 5.09dB;
Uncertainty for Radiated Emission 18000MHz-40000MHz	Horizontal: 4.52dB; Vertical: 4.51dB
Uncertainty for Conducted RF test	RF Power Conducted: 1.31dB Frequency test involved: 0.6×10 ⁻⁸ or 1%

Measurement Uncertainty Decision Rule

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

---THE END OF REPORT---