



시험 성적서

TEST REPORT

페이지(page) : (1) / (총(Total) 40)

성적서 번호 Report No.		ICRT-TR-E223261-0A	
신청자 Client	기관명 Name	HANMI MICRONICS INC.	
	주 소 Address	72, Samdo-ro 48beon-gil, Yangchon-eup, Gimpo-si, Gyeonggi-do, Korea.	
시험대상품목 Sample description		RECEIVER	
모델명 Type designation		RECEIVERW85	
정 격 Ratings		DC 5.0 V	
시험장소 Place of test		☒ 고정시험(Inside test) ☐ 현장시험(Field test) 주소지(Address): 112, Hwanggeum 3-ro 7beon-gil, Hagun-ri, Yangchon-eup, Gimpo-si, Gyeonggi-do, Korea	
시험기간 Date of test		8. Nov. 2022 ~ 13. Dec. 2022	
시험방법/항목 Test Method/Item		FCC Part 15 Subpart C §15.247	
시험결과 Test Results		Refer to 3. Test Summary	
확 인 Affirmation	작성자 Tested by	기술책임자 Technical Manager	
	성 명 Name Seong-Hun, Jeong (서명)	성 명 Name Tae-Yang, Yoon (서명)	

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The above test report is certified that the above mentioned products have been tested for the sample.

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2022. 12. 13

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Revision History

Issued Report No.	Issued Date	Revisions	Effect Section
ICRT-TR-E223261-0A	2022.12.13	Initial Issue	All



1. Applicant & Manufacturer & Test Laboratory Information

1.1 Applicant information

Applicant	HANMI MICRONICS INC.
Address	72, Samdo-ro 48beon-gil, Yangchon-eup, Gimpo-si, Gyeonggi-do, Korea.
Contact Person	Jay Maeng
Telephone No.	82-01-3301-8347
Fax No.	82-07-3273-2420
E-mail	mjh@micronics.co.kr

1.2 Manufacturer Information

Manufacturer	HANMI MICRONICS INC.
Address	72, Samdo-ro 48beon-gil, Yangchon-eup, Gimpo-si, Gyeonggi-do, Korea.

1.3 Test Laboratory Information

Conducted tests were performed at	
Laboratory	ICR Co., Ltd.
Address	112, Hwanggeum 3-ro 7beon-gil, Hagun-ri, Yangchon-eup, Gimpo-si, Gyeonggi-do, Korea
Telephone No.	+82-2-6351-9002
Fax No.	+82-2-6351-9007
RRA No.	KR0165
KOLAS No.	KT652



2. Equipment under Test(EUT) Information

2.1 General Information

Product Name	RECEIVER
Brand Name	-
Model Name	RECEIVERW85
Additional Model Name	-
FCC ID	2A3QW-RECEIVERW85
Hardware Version	1.0
Software Version	1.0
Power Supply	DC 5.0 V

2.2 Additional Information

Equipment Class	DSS - Frequency Hopping Spread Spectrum system
Device Type	Stand-alone
Operating Frequency	2 402 MHz ~ 2 479 MHz
RF Output Power	3.97 dBm
Number of Channel	78
Modulation Type	GFSK
Antenna Type	PCB Antenna
Antenna Gain	-20.55 dBi
Antenna Operating Mode	Single Antenna Equipment with only one antenna

2.3 Mode of operation during the test

- The EUT is continuous transmission mode during the test with set at Low Channel, Middle Channel, and High Channel. To get a maximum radiated emission levels from the EUT, the EUT was moved throughout the XY, YZ, XZ planes.

2.4 Modifications of EUT

- None



3. Test Summary

3.1 Test standards and results

FCC Part 15 Subpart C			
Clause	Test items	Applied	Results
§15.247 (a)(1)(i)	20 dB Bandwidth & 99 % Bandwidth	☒	PASS
§15.247 (a)(1)	Carrier Frequency Separation	☒	PASS
§15.247 (a)(1) (iii)	Number of Hopping Frequencies	☒	PASS
§15.247 (a)(1) (iii)	Time of Occupancy (dwell Time)	☒	PASS
§15.247 (a)(1)	Maximum Conducted Output Power	☒	PASS
§15.247 (d)	Conducted Spurious Emission & Band edge (Non-Restricted band)	☒	PASS
§15.209 §15.205	Radiated Spurious Emission(Restricted band)	☒	PASS
§15.207	Power Line Conducted Emission	☒	PASS

3.2 Purpose of the test

- To determine whether the equipment under test fulfills the requirements of the standards stated in FCC Part 15 Subpart C Section 15.247.

3.3 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10: 2013.

Radiated testing was performed at a distance of 3 m from EUT to the antenna.

3.4 Configuration of Test System

3.4.1 Radiated emission test

Preliminary radiated emissions test were conducted using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions. Final radiated emission tests were conducted at 3 m Semi Anechoic Chamber. The turntable was rotated through 360 degrees and the EUT was tested by positioned three orthogonal planes to obtain the highest reading on the field strength meter. Once maximum reading was determined, the search antenna was raised and lowered in both vertical and horizontal polarization.

3.4.2 AC power line conducted emission test

The EUT was connected to LISN. All supporting equipment were connected to another LISN. Preliminary Power line Conducted Emission test was performed by using the procedure in ANSI C63.10: 2013 to determine the worse operating conditions



3.5 Antenna requirement

According to §15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section.

The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to §15.247(b)(4), the conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.

Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

3.5.1 Result: Pass

The transmitter has a **PCB Antenna**. The directional gain of the antenna is **-20.55 dBi**



4. Used equipment on test

	Description	Model Name	Manufacturer	Serial Number	Next Cal. (cycle)
☒	Spectrum analyzer	FSW85	R&S	101306	2023-03-02 (1Y)
☒	Signal Generator	SMB100A	R&S	180607	2023-03-03 (1Y)
☒	DC Power Supply	XDL 35-5P	Sorensen	J00385373	2023-03-03 (1Y)
☒	10 dB Attenuator	WA54-10-11	Weinschel	-	2023-03-07 (1Y)
☒	Loop Antenna	HFH2-Z2	Rohde & Schwarz	100506	2023-07-05 (2Y)
☒	TRILOG BROADBAND ANTENNA	VULB9162	SCHWARZBECK	142	2023-02-03 (2Y)
☒	RF Pre Amplifier	SCU08	Rohde & Schwarz	100747	2023-04-13 (1Y)
☒	EMI Test Receiver	ESR7	Rohde & Schwarz	102034	2023-04-13 (1Y)
☒	Horn Antenna	HF907	Rohde & Schwarz	102556	2023-08-18 (1Y)
☒	RF Pre Amplifier	SCU18	Rohde & Schwarz	102342	2023-04-13 (1Y)
☒	EMI Test Receiver	ESR26	Rohde & Schwarz	101462	2023-04-13 (1Y)
☒	Horn Antenna	LB-42-10-C-KF	AIBFO Inc.	J202024625	2023-03-10 (1Y)
☒	PreAmplifier	AMF-4F-18265-35-8P-1	MITEQ	771846	2023-03-07 (1Y)
☒	LISN	ENV216	Rohde & Schwarz	102193	2023-05-20 (1Y)

※ All test equipment used is calibration on a regular basis.



5. 20 dB Bandwidth & 99 % Bandwidth

5.1 Operating environment

Temperature : 23 °C

Relative humidity : 47 %

5.2 Measurement method

Standard : ANSI 63.10 (6.9.2)

5.3 Limit

Standard : §15.247 (a)(1)(i)

5.4 Test data

Operating mode : Transmit mode

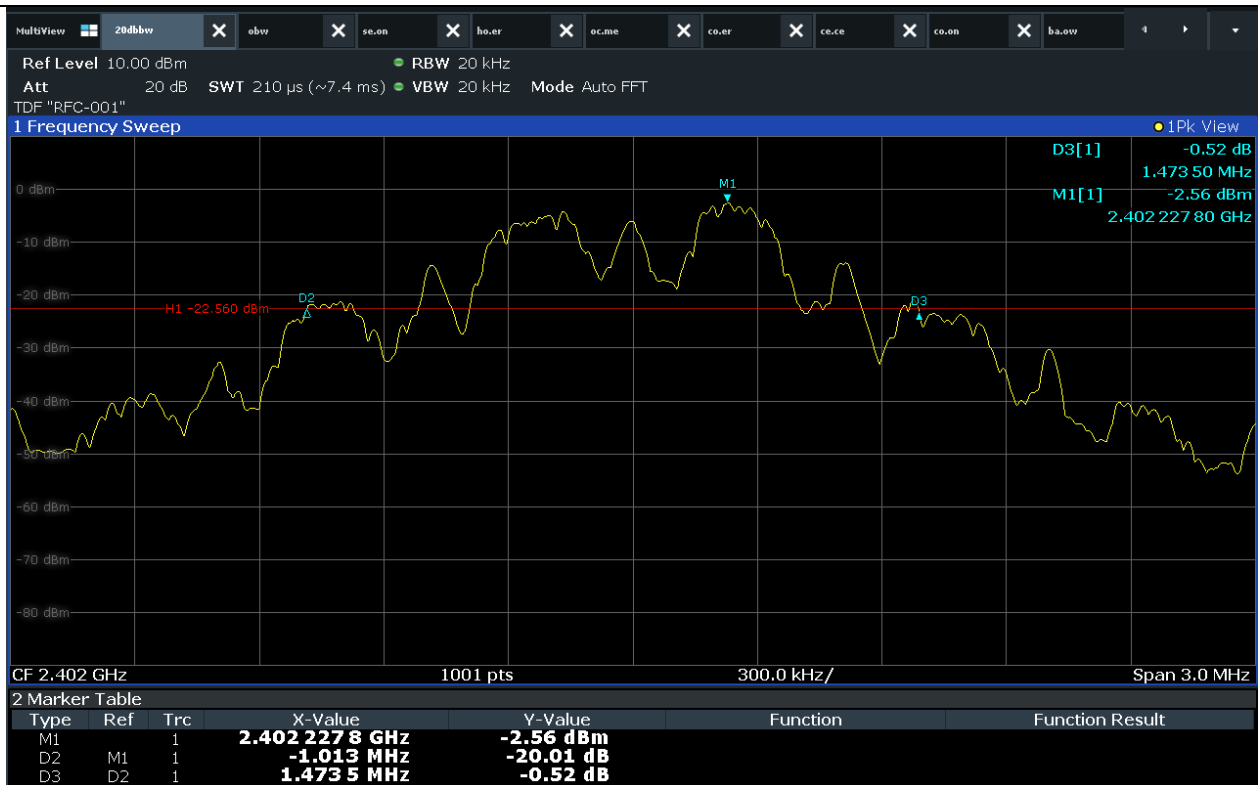
Test Result : Pass

5.4.1 Measured Results

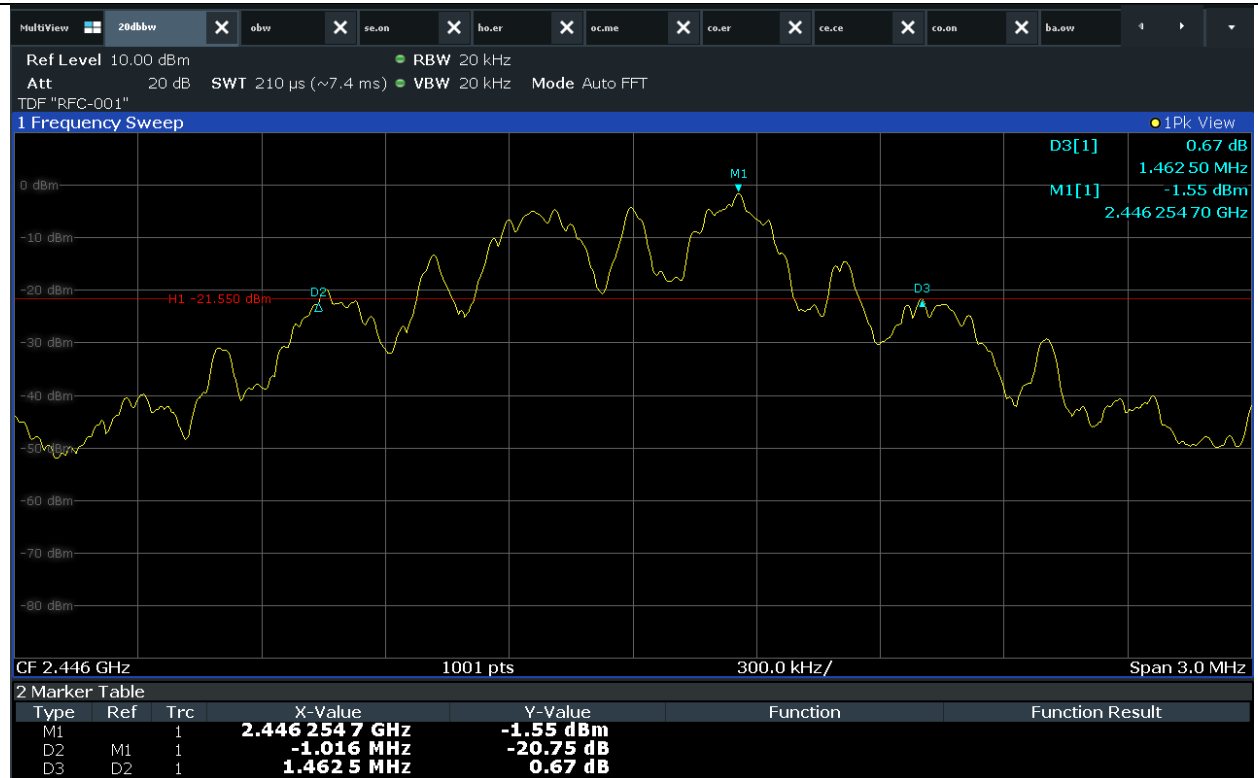
Modulation Type	Channel (Frequency)	20 dB Bandwidth (kHz)	99 % Occupied Bandwidth (kHz)
FHSS	1 (2 402 MHz)	1 473.50	1 385.72
	45 (2 446 MHz)	1 462.50	1 408.55
	78 (2 479 MHz)	1 474.50	1 409.36



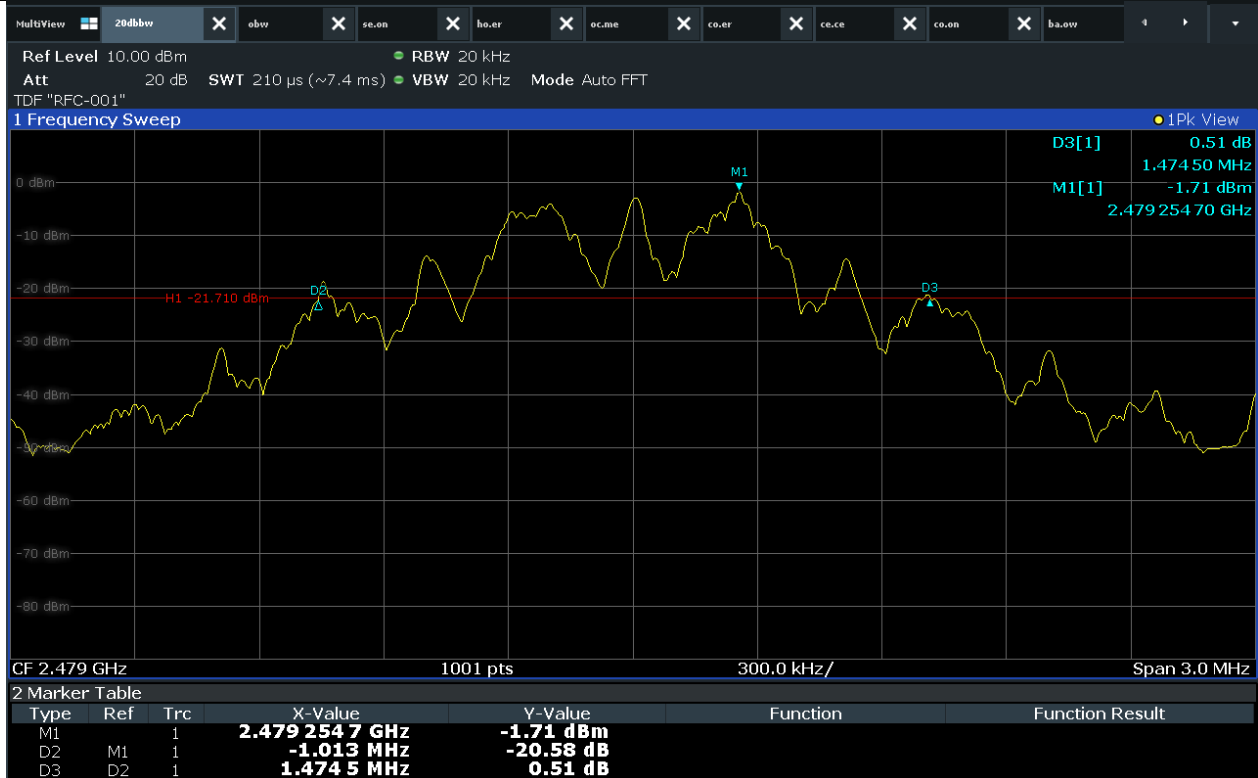
5.4.2 Measured Graph (20 dB Bandwidth)



Low CH

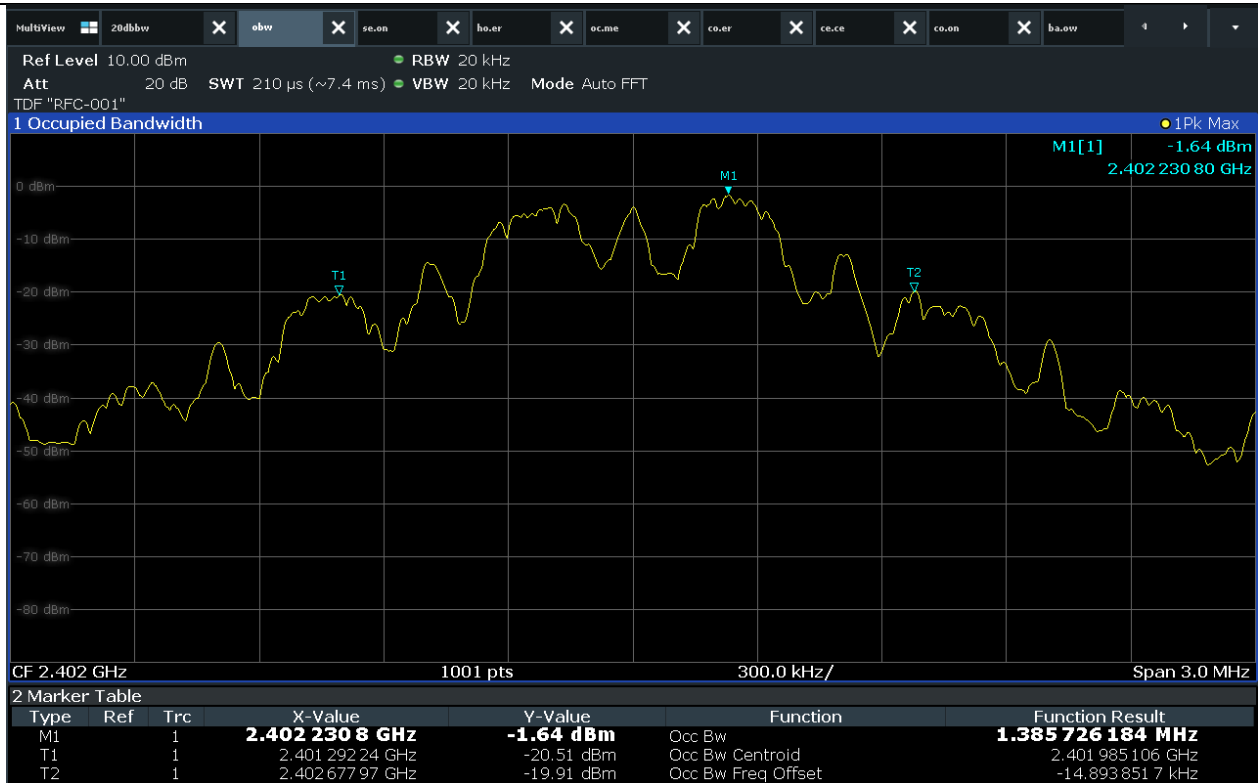


Mid CH



High CH

5.4.3 Measured Graph (99 % Bandwidth)



Low CH



6. Carrier Frequency Separation

6.1 Operating environment

Temperature : 23 °C

Relative humidity : 47 %

6.2 Measurement method

Standard : ANSI 63.10 (7.8.2)

6.3 Limit

Standard : 15.247 (a)(1)

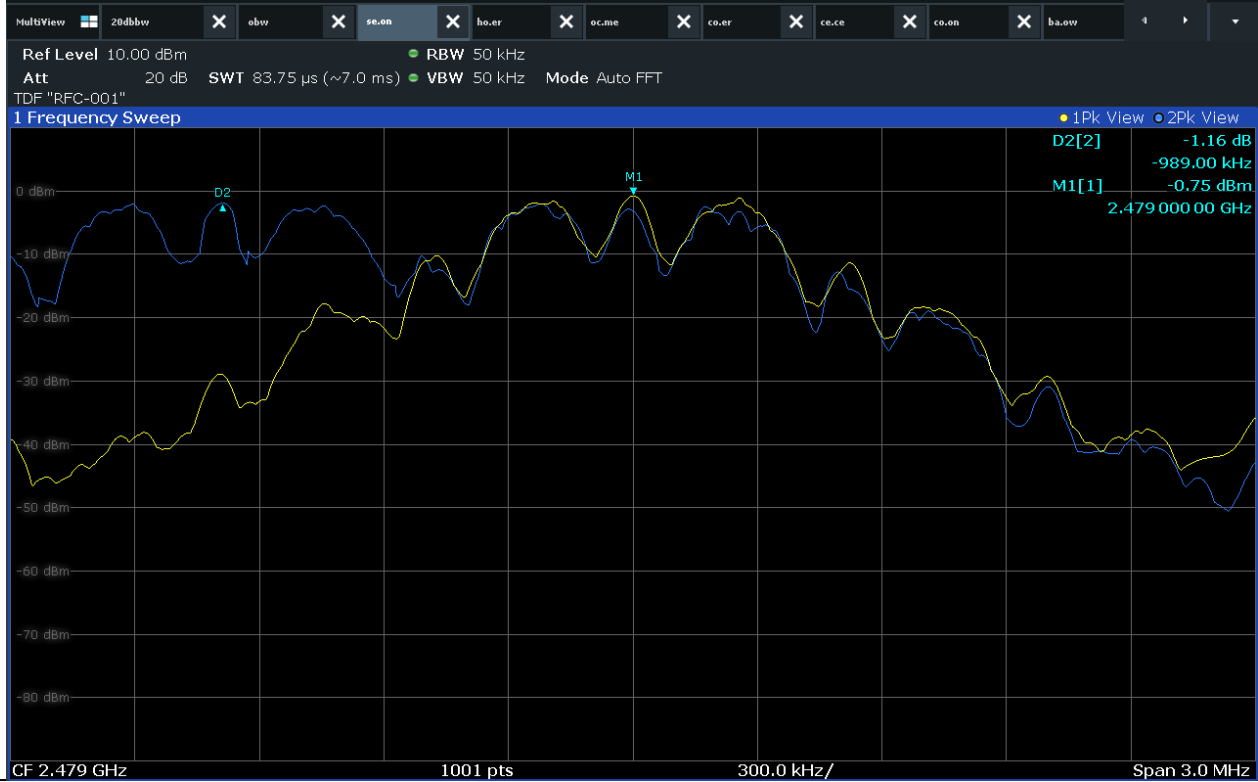
6.4 Test data

Operating mode : Transmit mode

Test Result : Pass

6.4.1 Measured Results

Modulation type	Channel (Frequency)	Separation (kHz)	Two-third 20 dB bandwidth of the hopping channel (kHz)	Limit
FHSS	0 (2 402 MHz)	1 001.00	982.33	25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater
	45 (2 446 MHz)	998.00	975.00	
	78 (2 479 MHz)	989.00	983.00	



High CH



7. Number of Hopping Frequency

7.1 Operating environment

Temperature : 23 °C

Relative humidity : 47 %

7.2 Measurement method

Standard : ANSI 63.10 (7.8.3)

7.3 Limit

Standard : 15.247 (a)(1)(iii)

7.4 Test data

Operating mode : Hopping mode

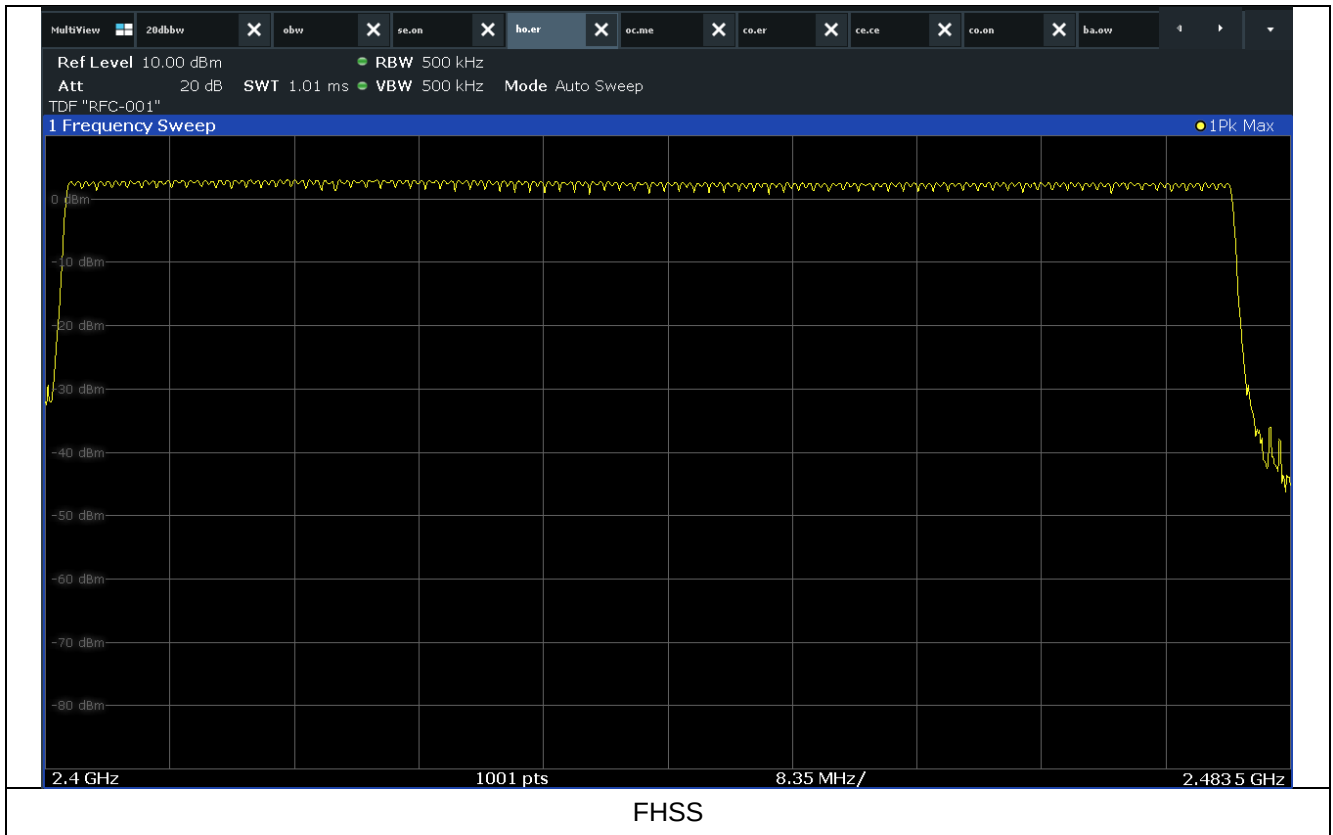
Test Result : Pass

7.4.1 Measured Results

Modulation type	Hopping Channel Number	Limit
FHSS	78	> 15



7.4.2 Measured Graph





8. Time of Occupancy (dwell Time)

8.1 Operating environment

Temperature : 23 °C

Relative humidity : 47 %

8.2 Measurement method

Standard : ANSI 63.10 (7.8.4)

8.3 Limit

Standard : §15.247 (a)(1)(iii)

8.4 Test data

Test Result : Pass

8.4.1 Measured Results

Operating Mode	Mode	Hops Over Occupancy Time (hops/s)	On Time (ms)	Occupancy Time (s)	Limit (s)
Hopping	FHSS	24	0.483	0.012	0.4

※ Hops Over Occupancy Time (hops/s) = $((6 / 0.1) \times 78) \times (0.4 / 78)$

※ Occupancy Time (s) = Hops Over Occupancy Time (hops/s) $\times$ On Time (ms) $((6 / 0.1) \times 0.4) \times 0.000483$ (On Time)



9. Maximum Conducted Output Power

9.1 Operating environment

Temperature : 23 °C

Relative humidity : 47 %

9.2 Measurement method

Standard : ANSI 63.10 (7.8.5)

9.3 Limit

Standard : §15.247 (a)(1)

9.4 Test data

Operating mode : Transmit mode

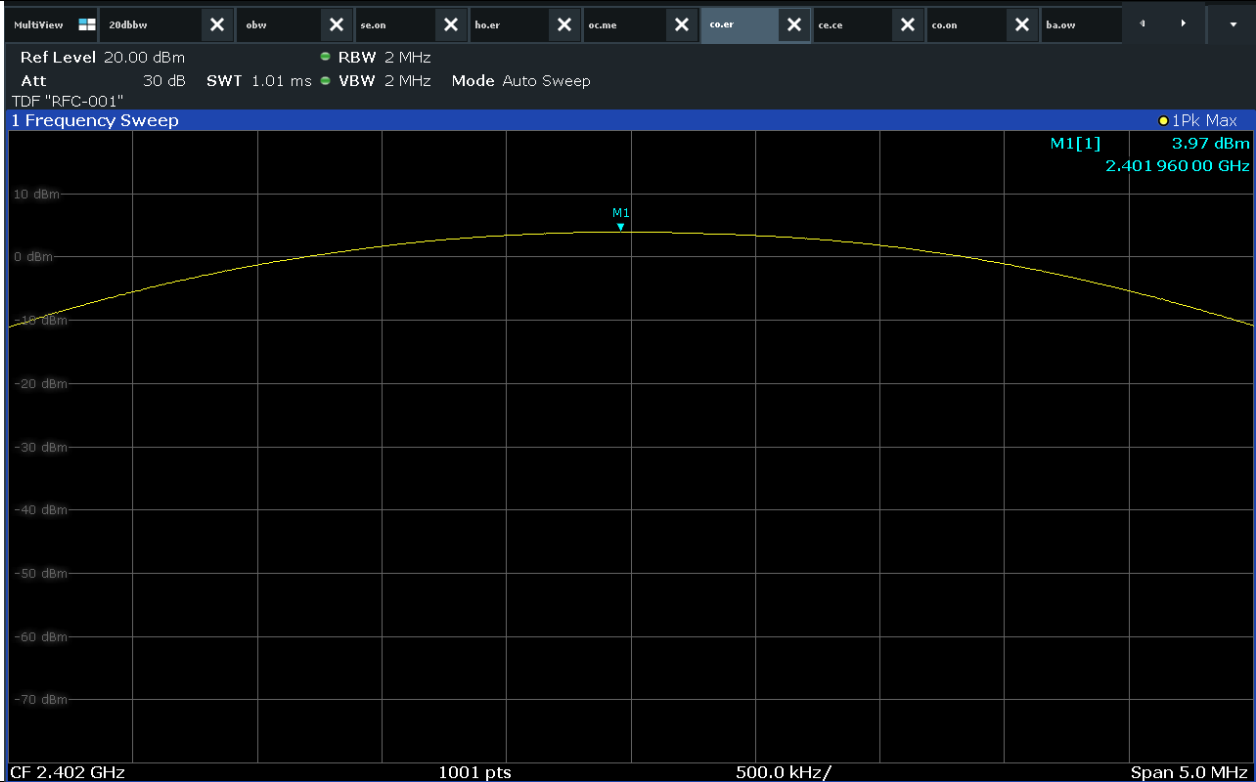
Test Result : Pass

9.4.1 Measured Results

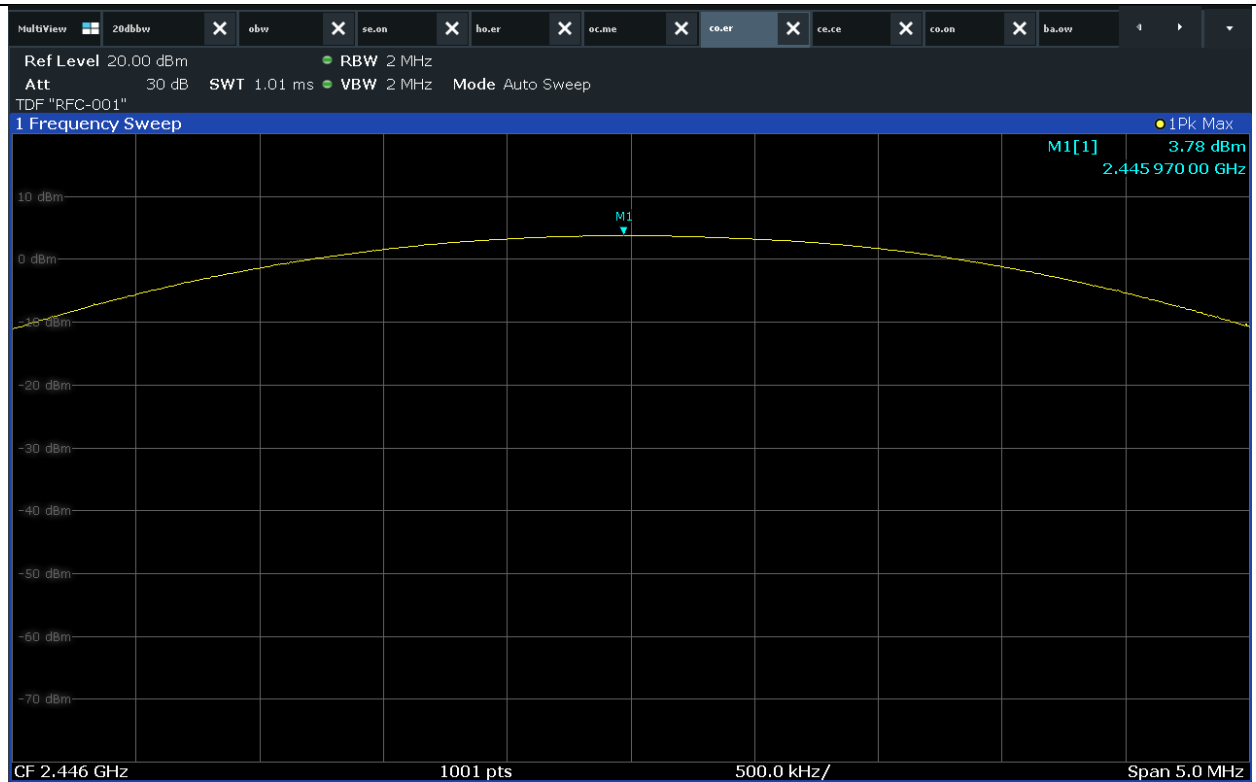
Modulation Type	Channel (Frequency)	Highest signal level (dBm)	Limit (dBm)
FHSS	0 (2 402 MHz)	3.97	30 (1 Watt)
	45 (2 446 MHz)	3.78	
	78 (2 479 MHz)	3.63	



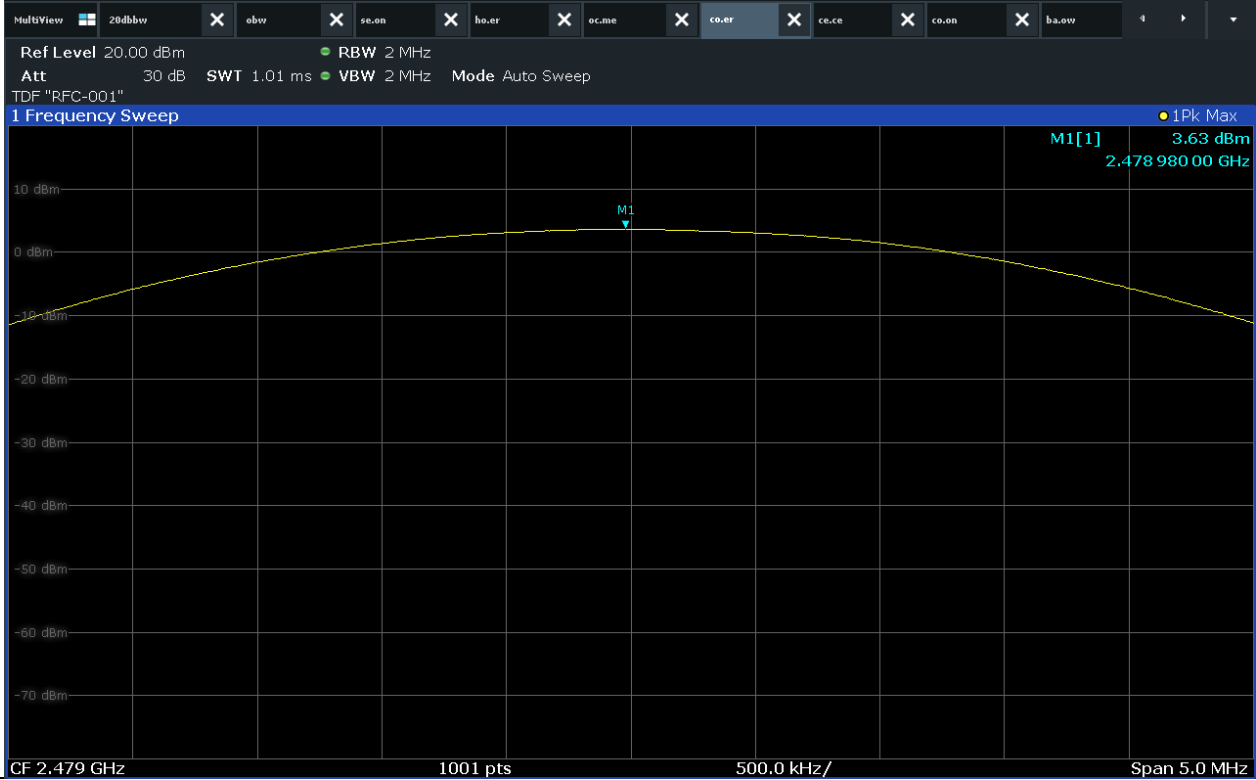
9.4.2 Measurement Graph



Low CH



Mid CH



High CH



10. Conducted Spurious Emission

10.1 Operating environment

Temperature : 23 °C

Relative humidity : 47 %

10.2 Measurement method

Standard : ANSI 63.10 (7.8.8) / ANSI 63.10 6.10.4)

10.3 Limit

Standard : §15.247 (d)

10.4 Test data

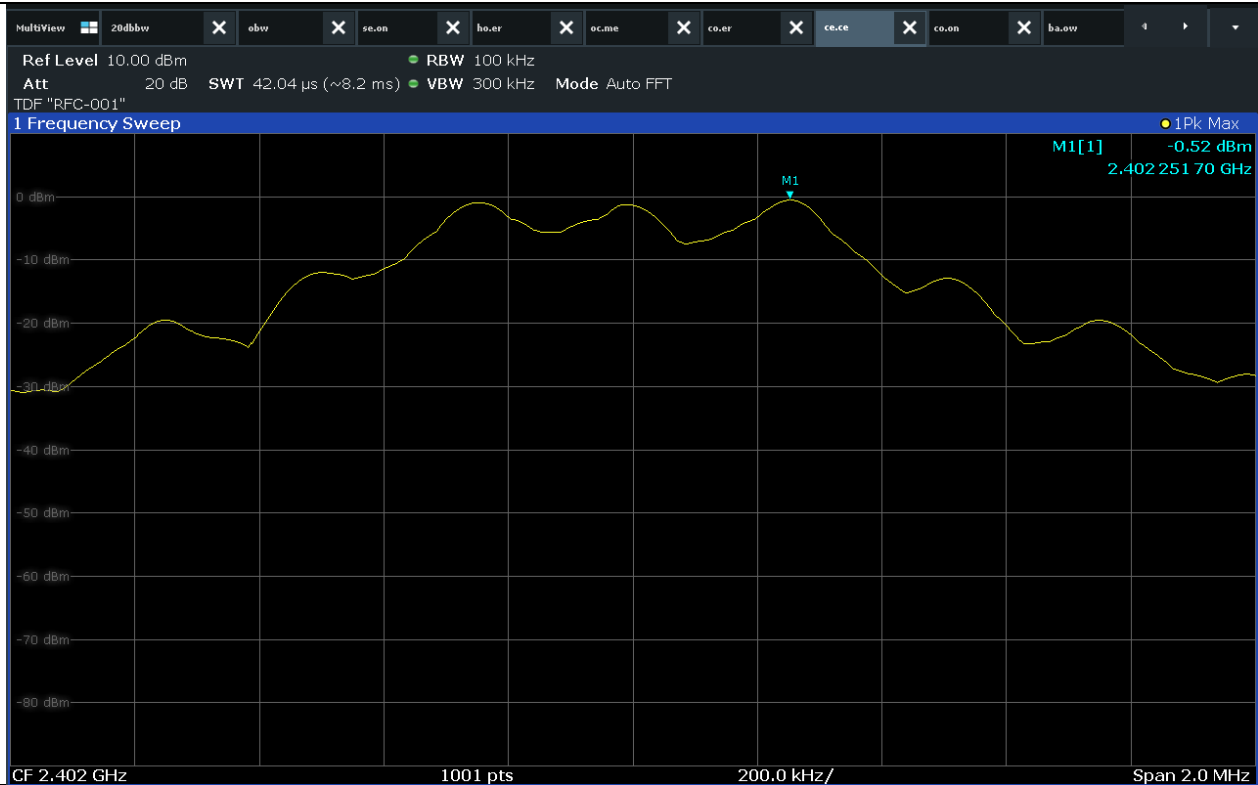
Operating mode : Transmit mode

Test Result : Pass

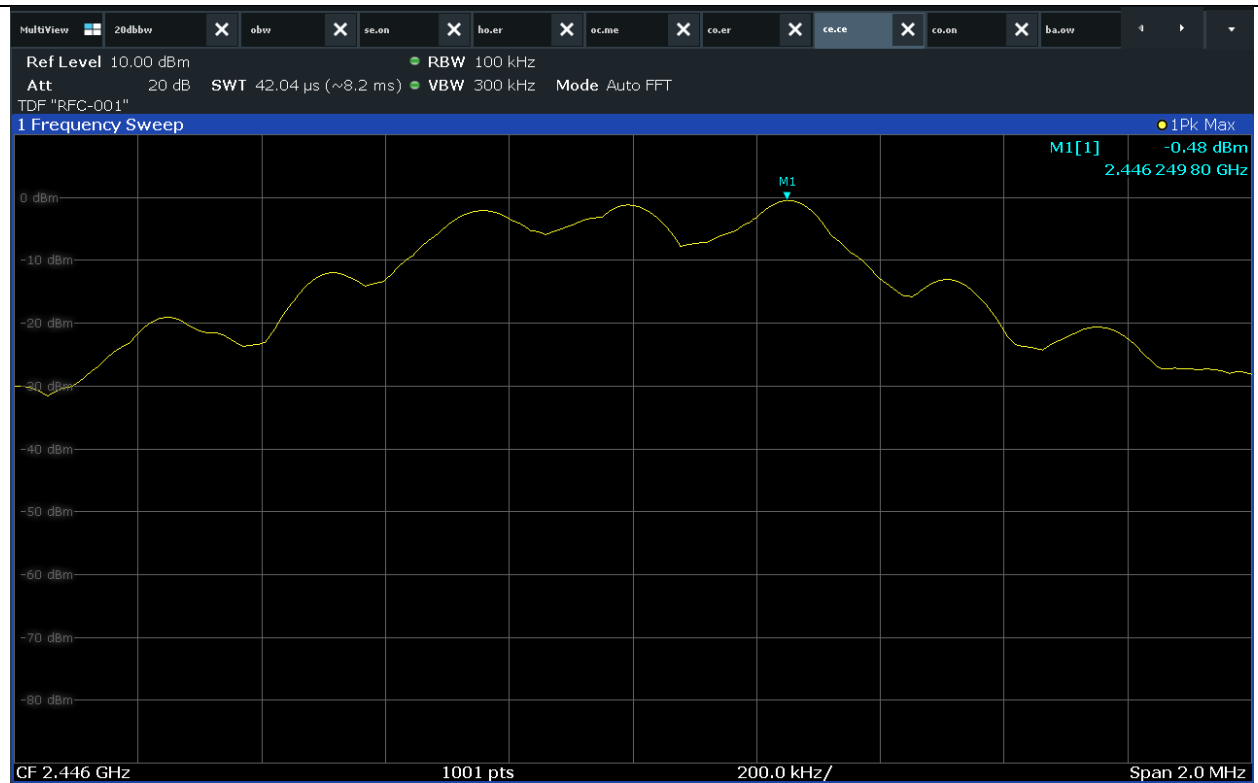
10.4.1 Measured Results



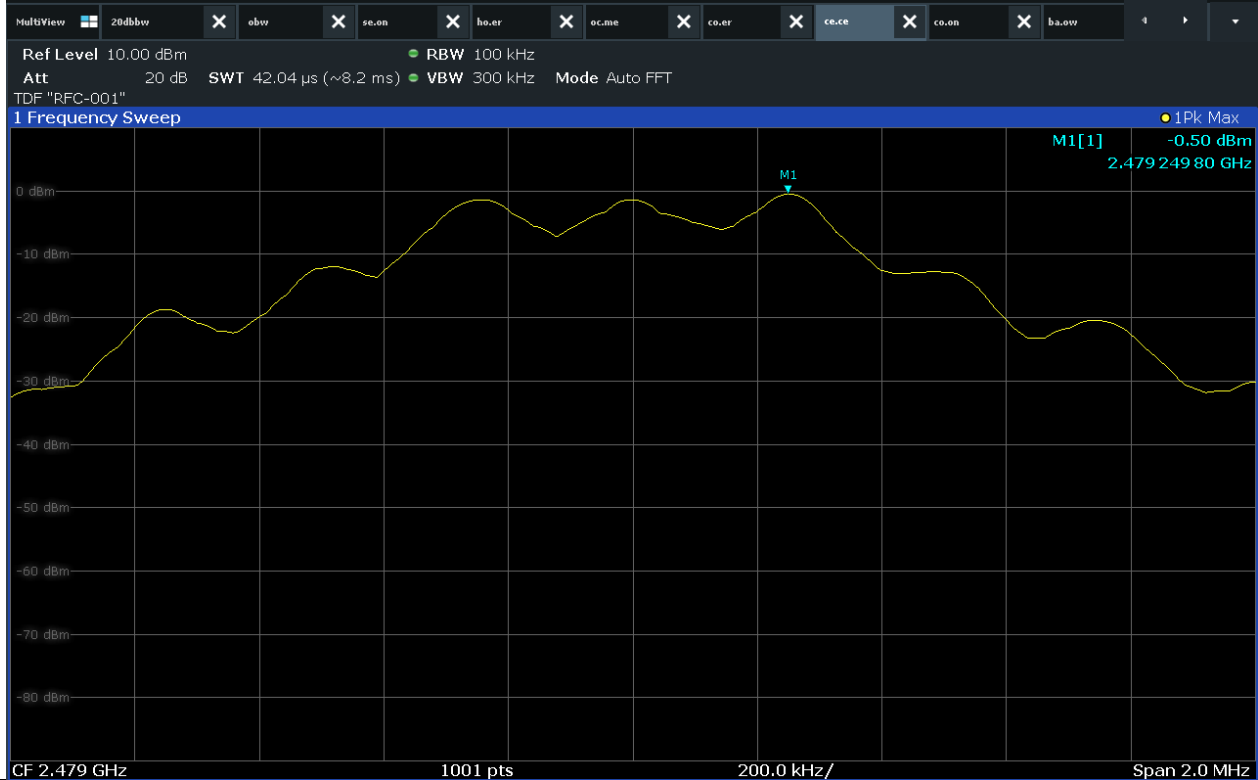
10.4.1.1 Signal level (dB m)



Low CH

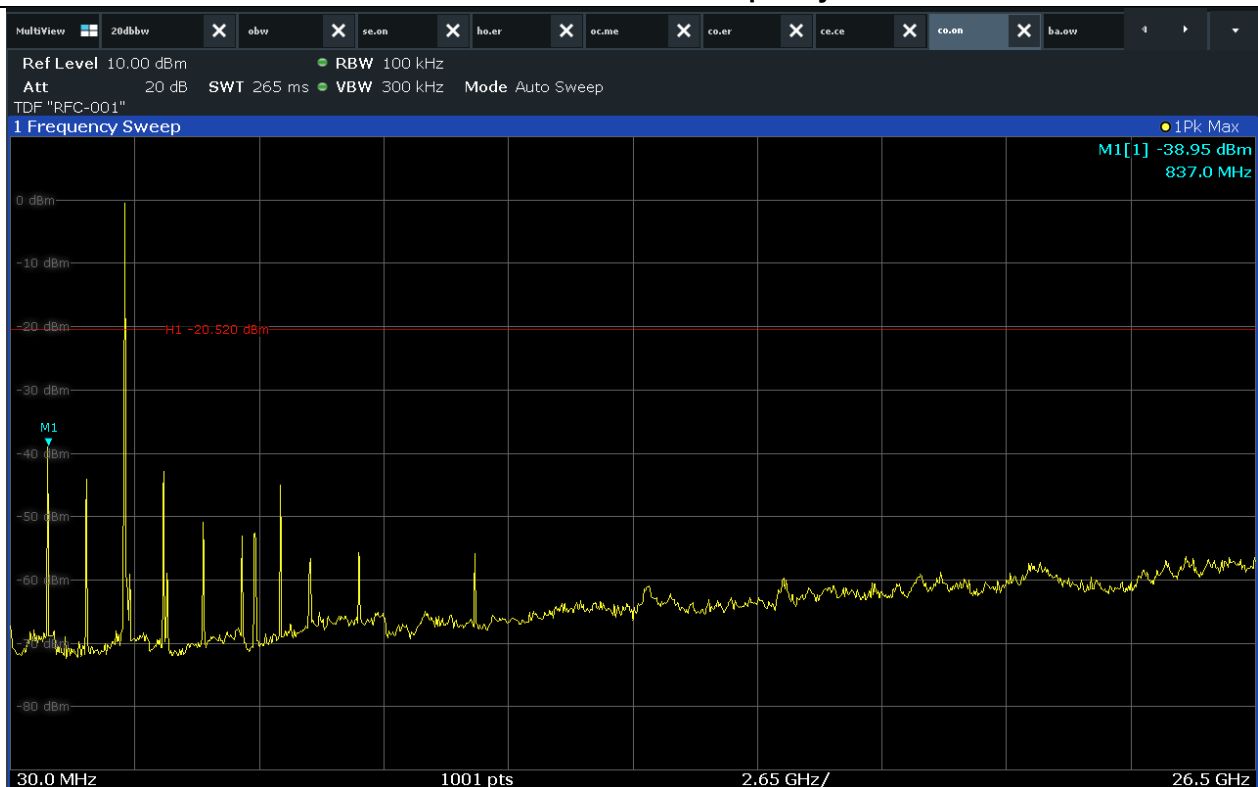


Mid CH

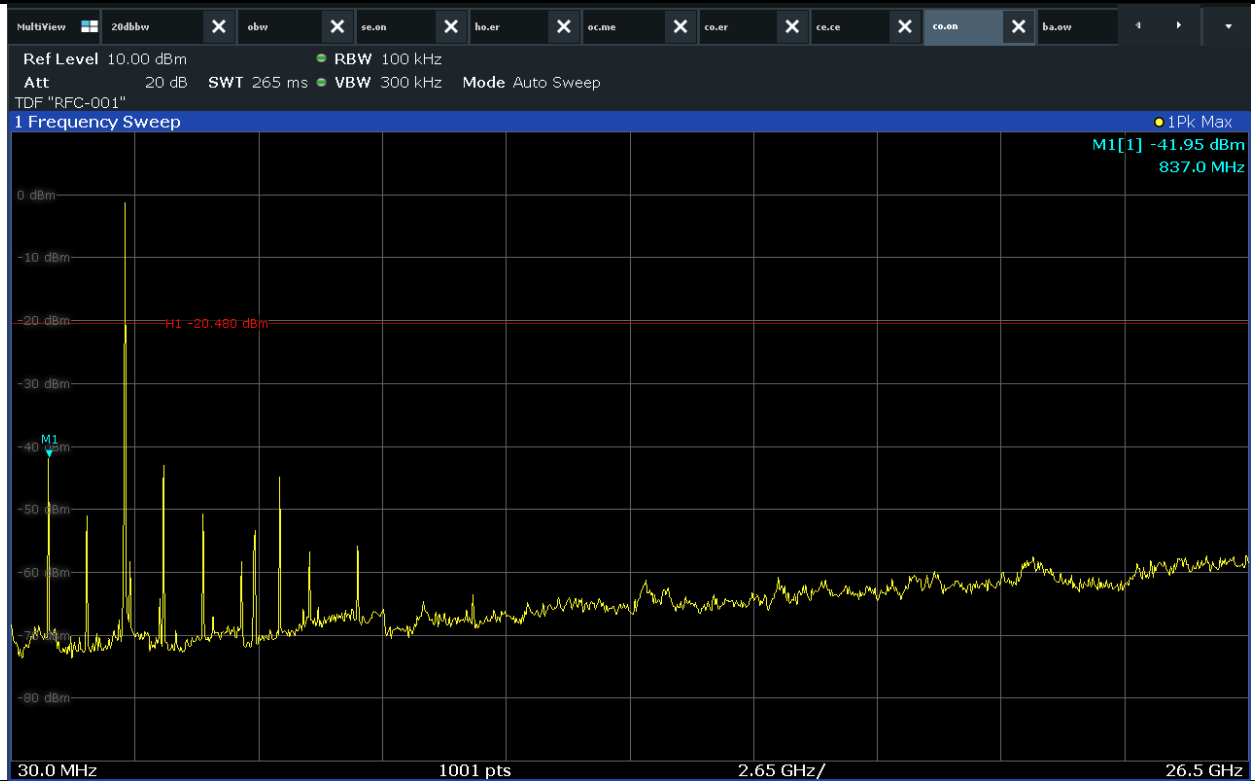


High CH

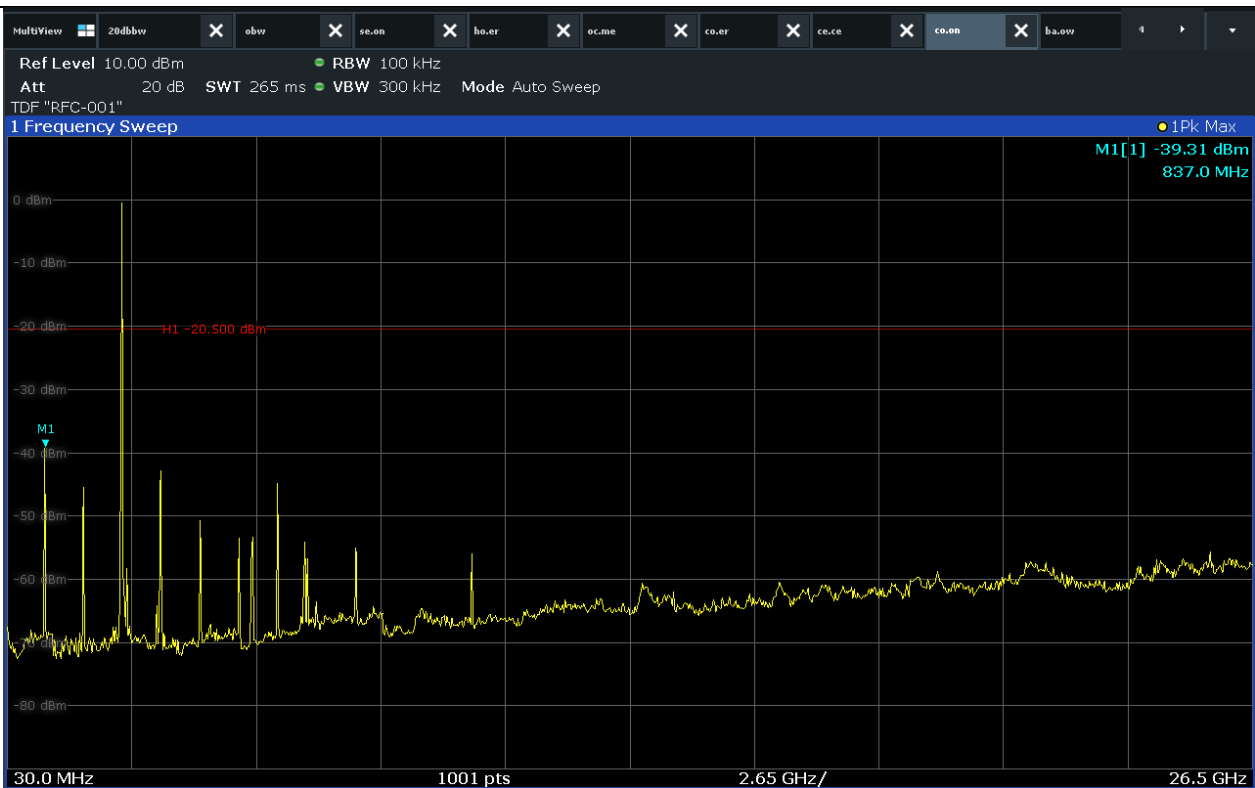
10.4.1.2 Unwanted Emissions In Non-Restricted Frequency Bands



Low CH



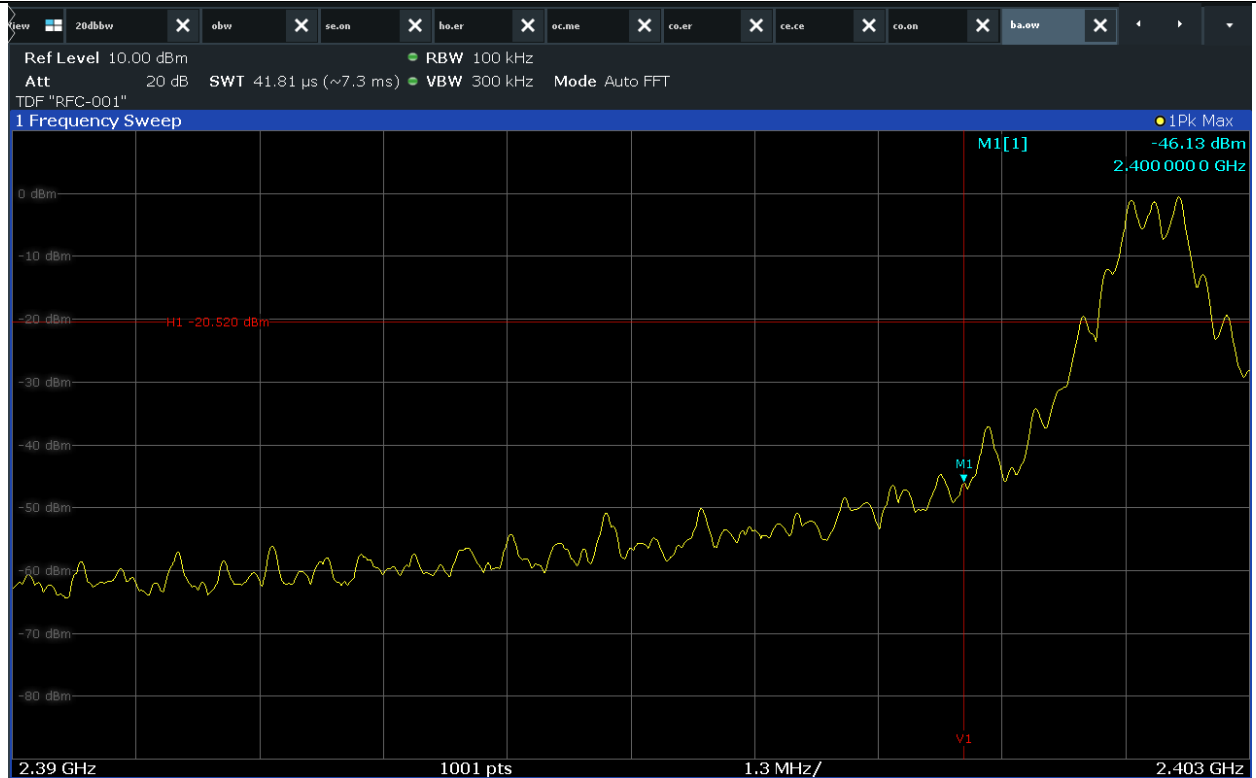
Mid CH



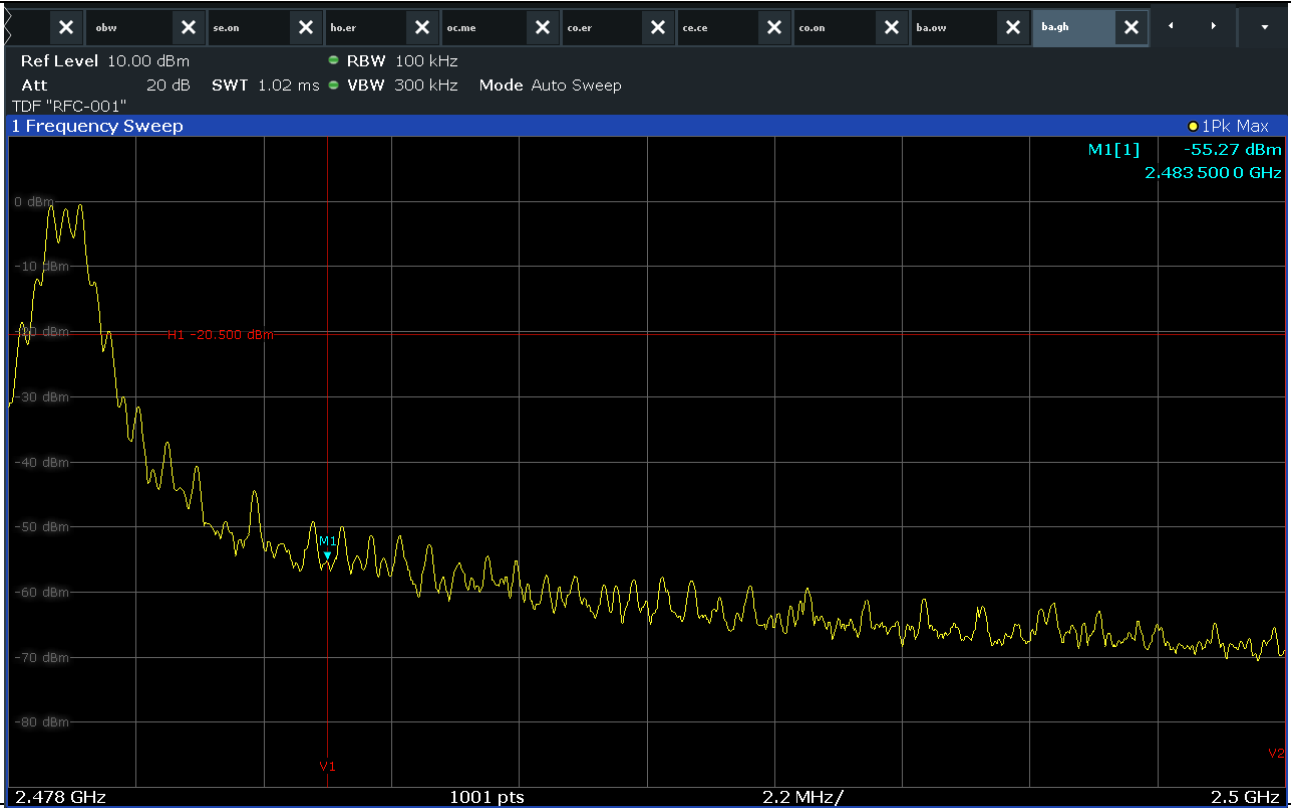
High CH



10.4.1.3 Band Edge (single channels)



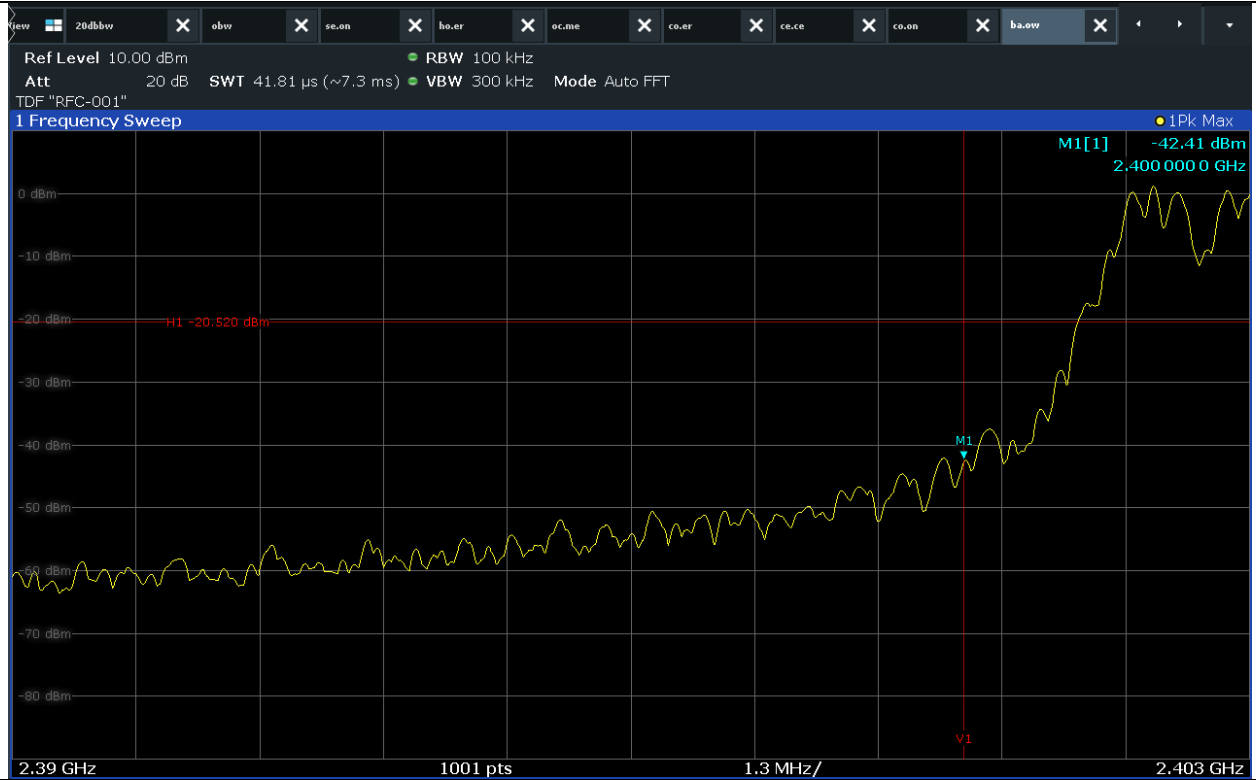
Low CH



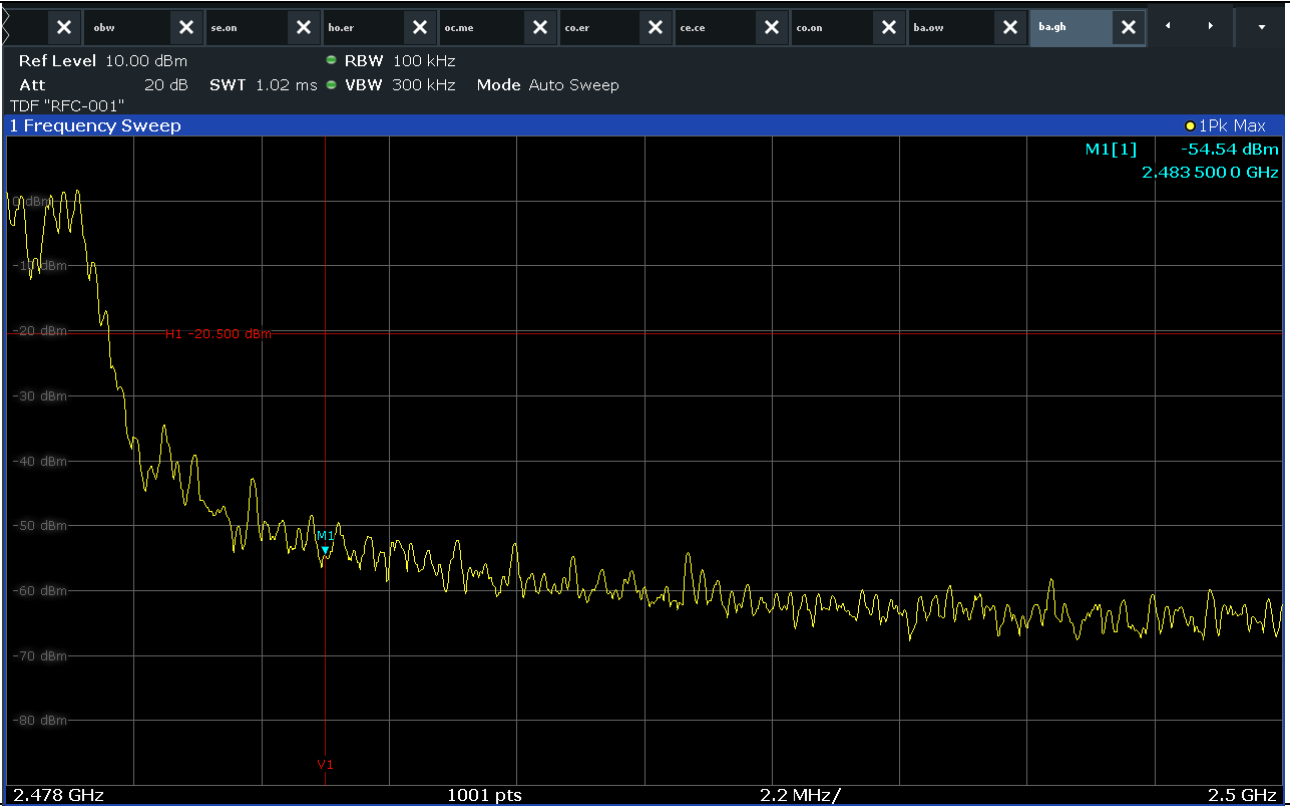
High CH



10.4.1.4 Band Edge (hopping)



Low CH



High CH

11. Radiated Spurious Emission

11.1 Operating environment

Temperature : 24 °C

Relative humidity : 48 %

11.2 Measurement method

Standard : ANSI 63.10 (6.4/6.5/6.6)

11.3 Limit

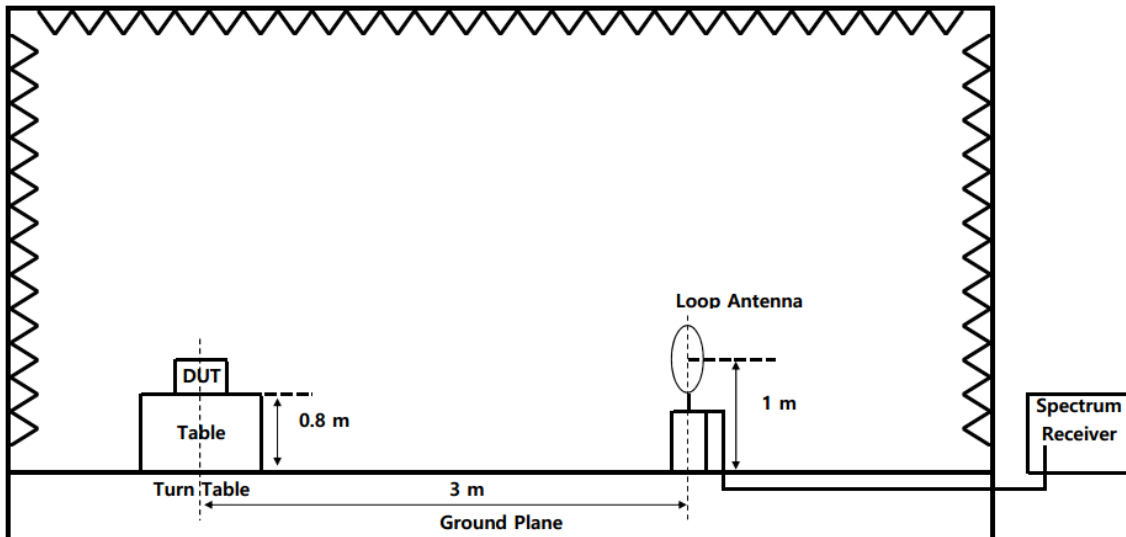
Standard : §15.205, §15.209

11.4 Test setup

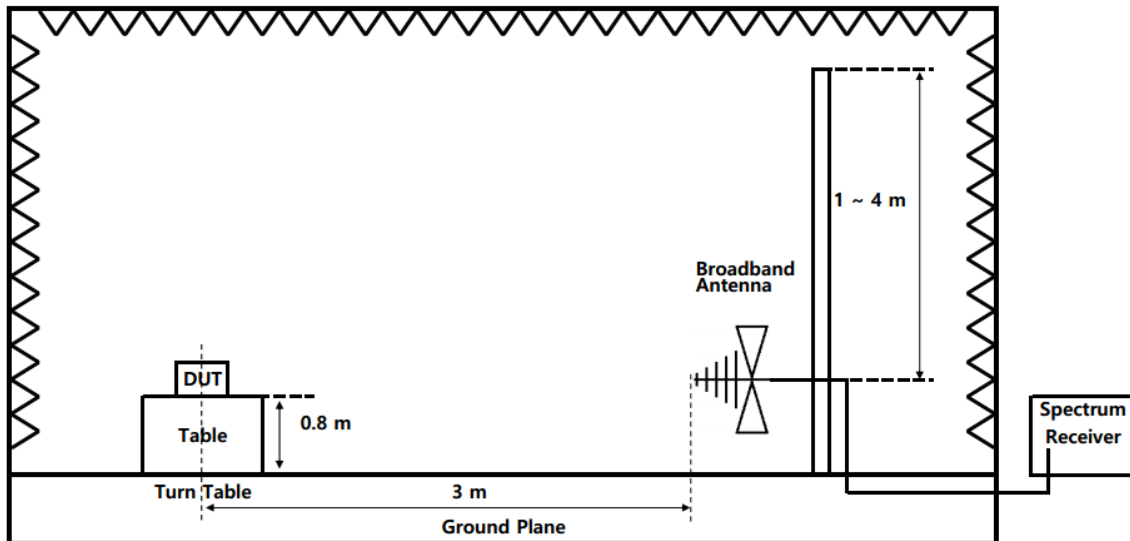
The radiated emissions measurements were performed on the 3 m, Semi-Anechoic Chamber. The EUT was placed on a non-conductive turntable above the ground plane.

The frequency spectrum from 9 kHz to 26.5 GHz was scanned and maximum emission levels at each frequency recorded. The system was rotated 360°, and the antenna was varied in the height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for horizontal and vertical polarization of the receiving antenna.

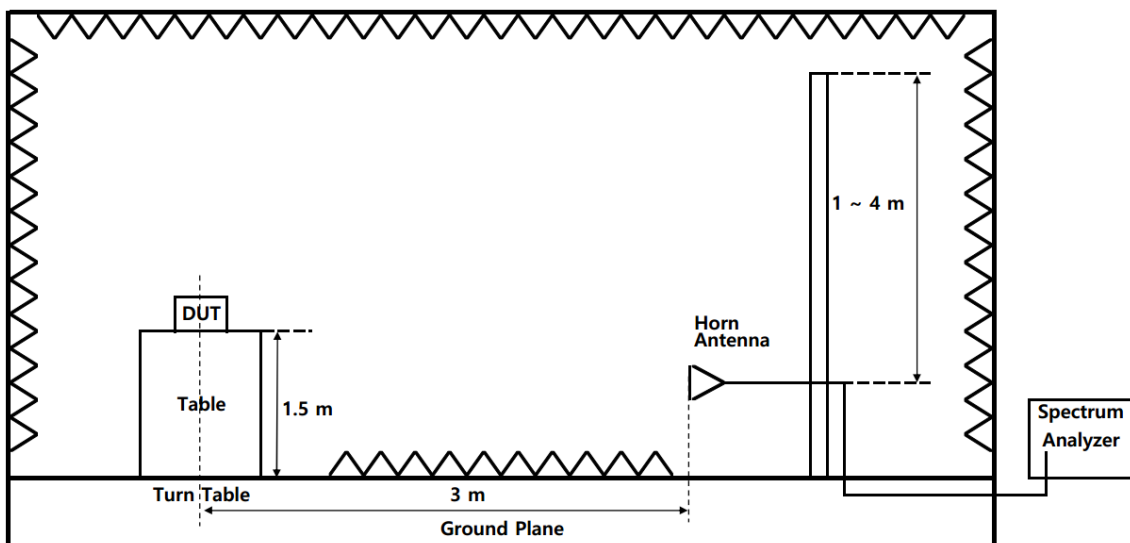
11.4.1 Below 30 MHz



11.4.2 30 MHz to 1 GHz



11.4.3 Above 1 GHz





11.5 Test data

Operating mode : Transmit mode

Test Result : Pass

11.5.1 Test data for Restricted band

11.5.1.1 Measure Results for FHSS

Frequency (MHz)	Reading (dBμV)	Detector	Ant. Pol. (H/V)	Corr. Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low CH							
2 388.82	66.85	Peak	V	-14.50	52.35	74	21.65
	33.06	Average	V		18.56	54	35.44
High CH							
2 484.26	68.05	Peak	V	-14.10	53.95	74	20.05
	40.29	Average	V		26.19	54	27.81

※ Ant. Pol. : Antenna Polarization

※ Corr. Factor. : Antenna Factor + Cable Loss - Amplifier Gain

※ Result = Reading + Corr. Factor

※ Margin = Limit – Result



11.5.2 Test data for Spurious & Harmonic

11.5.2.1 Measurement Results for FHSS

below 30 MHz

Frequency (MHz)	Reading (dBμV)	Detector	Ant. Pol. (H/V)	Corr. Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low CH							
It was not found any emissions peaks found from the EUT.							
Mid CH							
It was not found any emissions peaks found from the EUT.							
High CH							
It was not found any emissions peaks found from the EUT.							

※ Ant. Pol. : Antenna Polarization

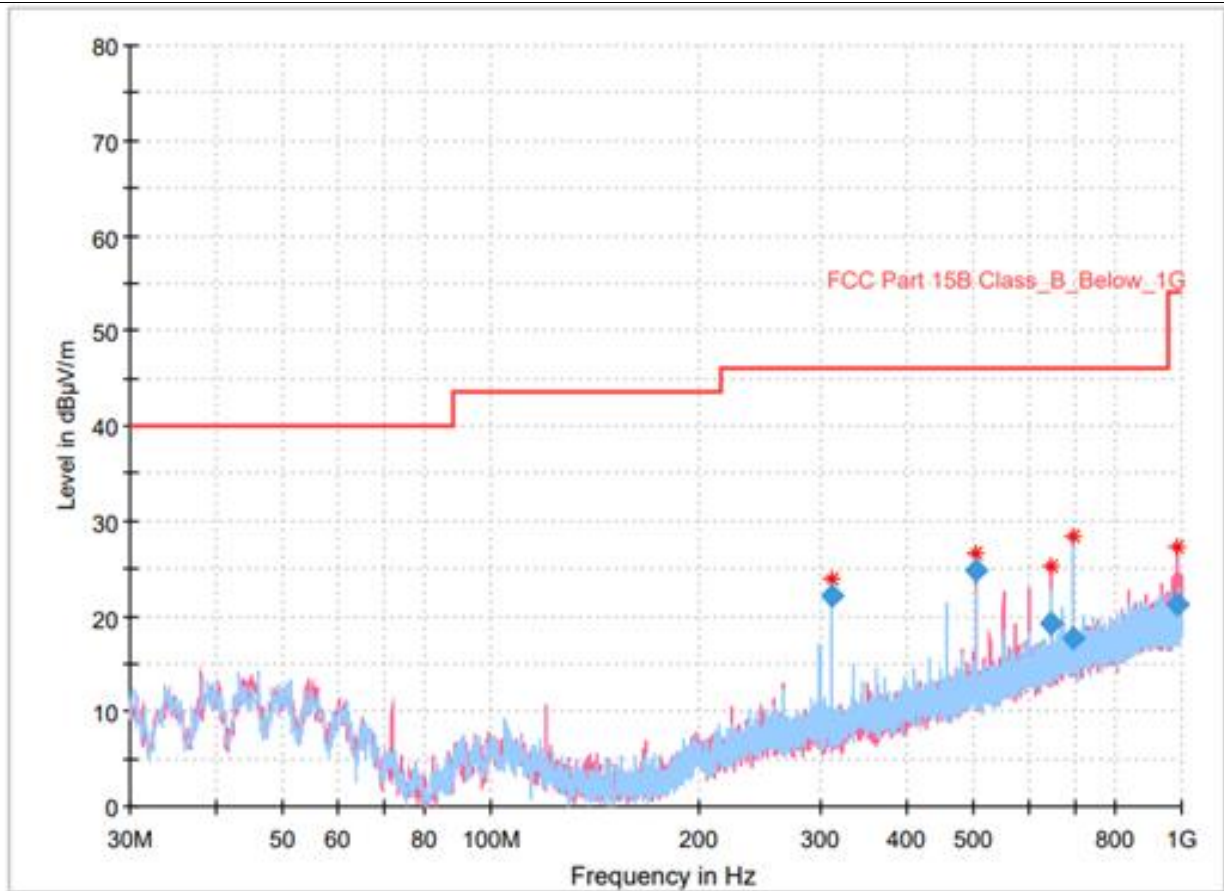
※ Corr. Factor. : Antenna Factor + Cable Loss - Amplifier Gain

※ Result = Reading + Corr. Factor

※ Margin = Limit – Result



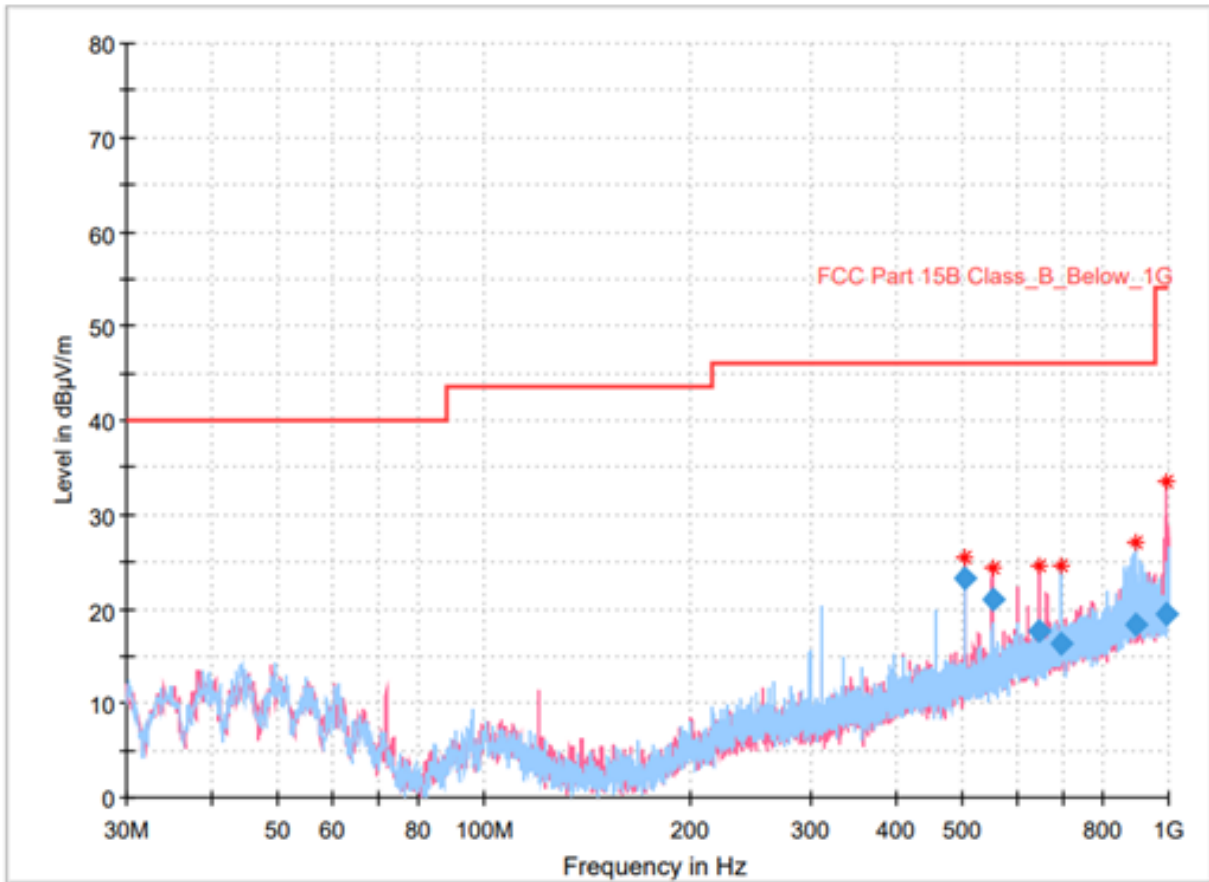
Measurement Results for below 1 GHz



Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
311.979000	22.20	46.00	23.80	1000.0	120.000	100.1	H	108.0	-20.6
504.039000	24.85	46.00	21.15	1000.0	120.000	100.1	V	0.0	-15.7
648.084000	19.25	46.00	26.75	1000.0	120.000	100.1	V	51.0	-13.1
696.099000	17.68	46.00	28.32	1000.0	120.000	100.1	H	27.0	-12.1
987.002000	21.25	54.00	32.75	1000.0	120.000	100.1	V	0.0	-8.7

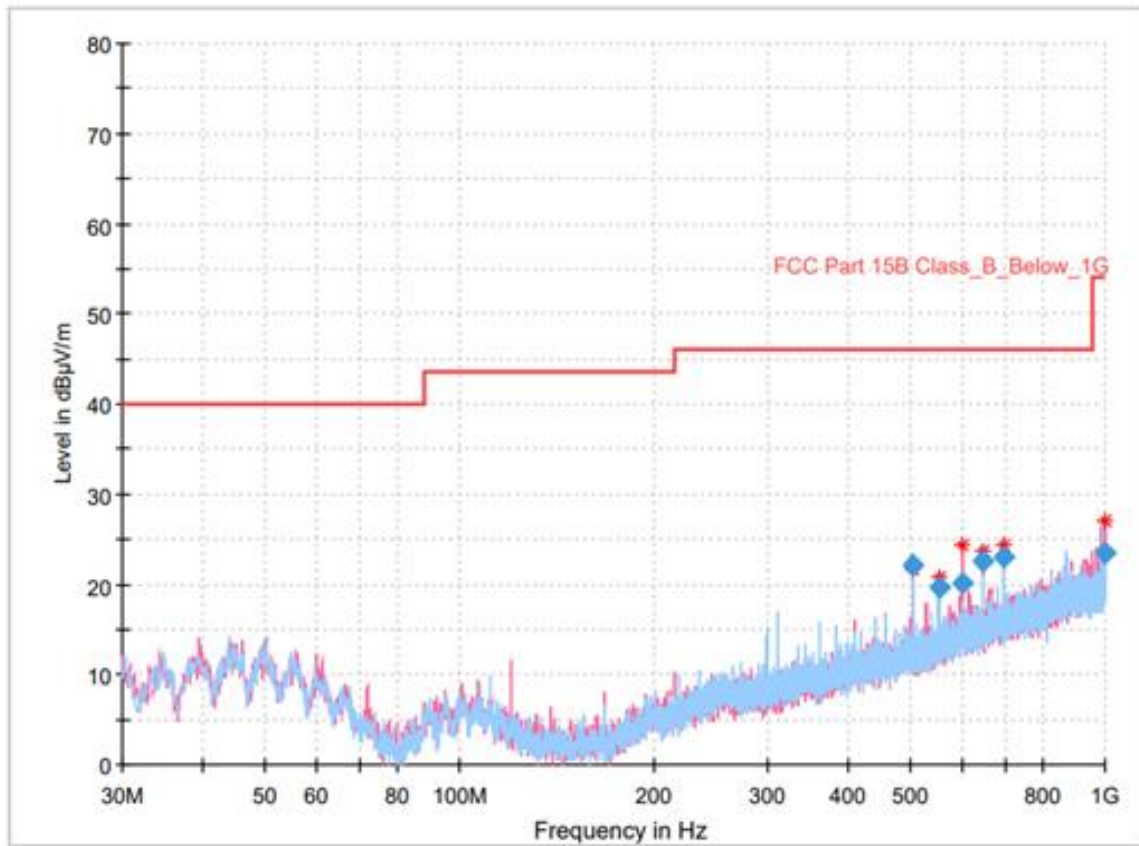
Low CH



Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
504.039000	23.16	46.00	22.84	1000.0	120.000	99.9	V	346.0	-15.7
552.054000	20.94	46.00	25.06	1000.0	120.000	99.9	V	356.0	-14.8
648.084000	17.70	46.00	28.30	1000.0	120.000	99.9	V	141.0	-13.1
696.099000	16.25	46.00	29.75	1000.0	120.000	99.9	H	296.0	-12.1
893.203000	18.37	46.00	27.63	1000.0	120.000	99.9	H	77.0	-9.3
995.247000	19.47	54.00	34.53	1000.0	120.000	99.9	V	319.0	-8.6

Mid CH



Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
504.039000	22.09	46.00	23.91	1000.0	120.000	100.0	V	224.0	-15.7
552.054000	19.77	46.00	26.23	1000.0	120.000	100.0	V	0.0	-14.8
600.069000	20.01	46.00	25.99	1000.0	120.000	100.0	V	153.0	-13.5
647.987000	22.58	46.00	23.42	1000.0	120.000	100.0	V	125.0	-13.1
696.002000	23.07	46.00	22.93	1000.0	120.000	100.0	H	295.0	-12.1
998.448000	23.51	54.00	30.49	1000.0	120.000	100.0	V	6.0	-8.5

High CH



Measurement Results for Above 1 GHz

Frequency (MHz)	Reading (dBμV)	Detector	Ant. Pol. (H/V)	Corr. Factor (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Low CH							
4 804.60	58.48	Peak	V	-3.90	54.58	74.00	19.42
	42.81	Average	V		38.91	54.00	15.09
7 205.00	59.13	Peak	V	0.70	59.83	74.00	14.17
	39.87	Average	V		40.57	54.00	13.43
9 608.80	50.36	Peak	V	3.60	53.96	74.00	20.04
	34.55	Average	V		38.15	54.00	15.85
Mid CH							
4 891.30	60.52	Peak	V	-3.40	57.12	74.00	16.88
	43.20	Average	V		39.80	54.00	14.20
7 337.60	55.10	Peak	V	0.70	55.80	74.00	18.20
	38.34	Average	V		39.04	54.00	14.96
9 783.90	58.02	Peak	V	3.90	61.92	74.00	12.08
	29.34	Average	V		33.24	54.00	20.76
High CH							
4 957.60	63.66	Peak	V	-3.20	60.46	74.00	13.54
	47.01	Average	V		43.81	54.00	10.19
7 436.20	59.85	Peak	V	1.00	60.85	74.00	13.15
	42.42	Average	V		43.42	54.00	10.58
9 914.80	48.59	Peak	V	4.20	52.79	74.00	21.21
	31.82	Average	V		36.02	54.00	17.98
12 395.10	47.08	Peak	V	6.30	53.38	74.00	20.62
	29.55	Average	V		35.85	54.00	18.15

※ Ant. Pol. : Antenna Polarization

※ Corr. Factor. : Antenna Factor + Cable Loss - Amplifier Gain

※ Result = Reading + Corr. Factor

※ Margin = Limit – Result



12. Power Line Conducted Emission

12.1 Operating environment

Temperature : 24 °C

Relative humidity : 48 %

12.2 Measurement method

Standard : §15.207

12.3 Limit

Standard : §15.207

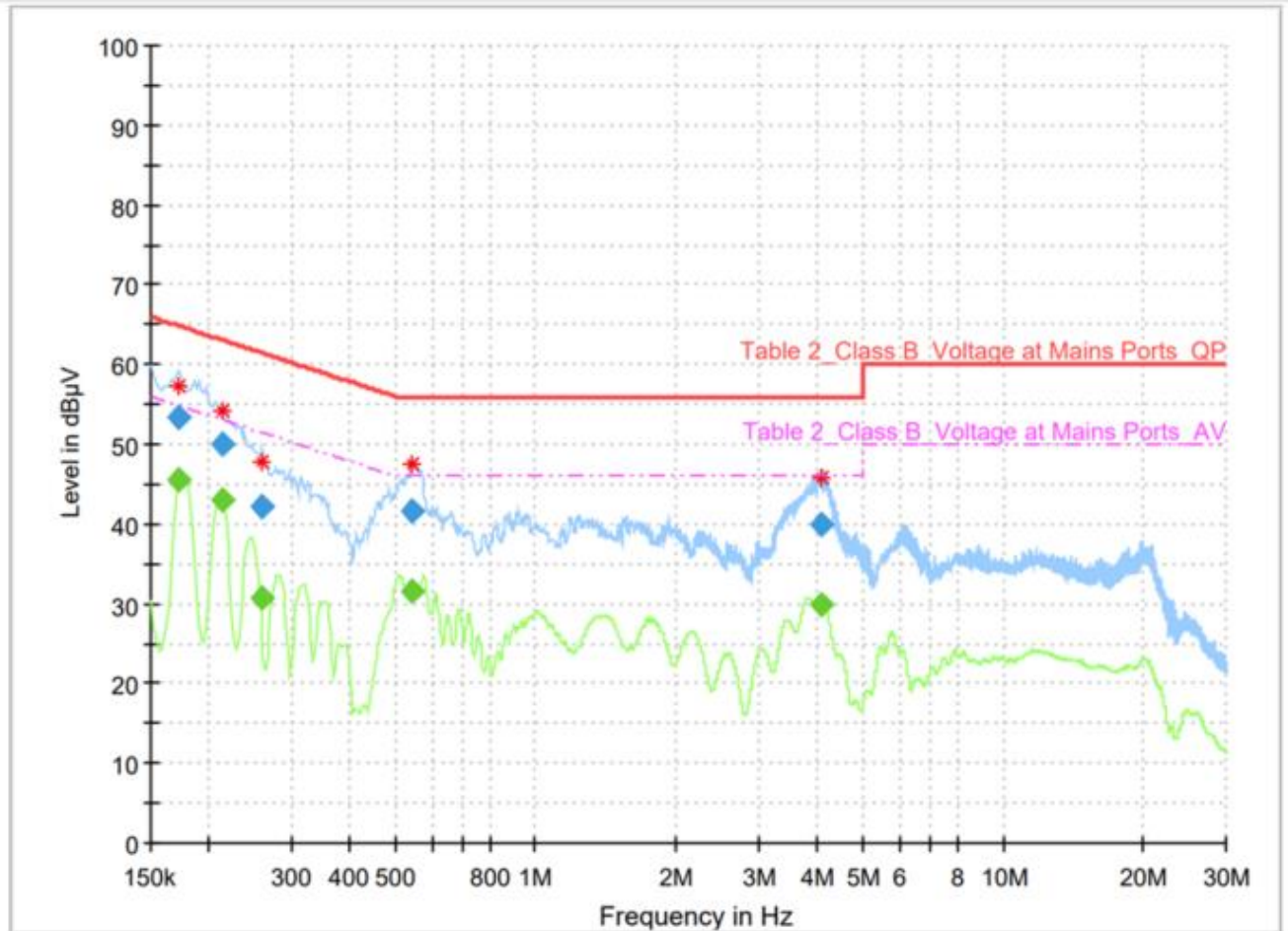
12.4 Test data

Operating mode : Transmit mode

Test Result : Pass

12.4.1 Measured Results & Graph

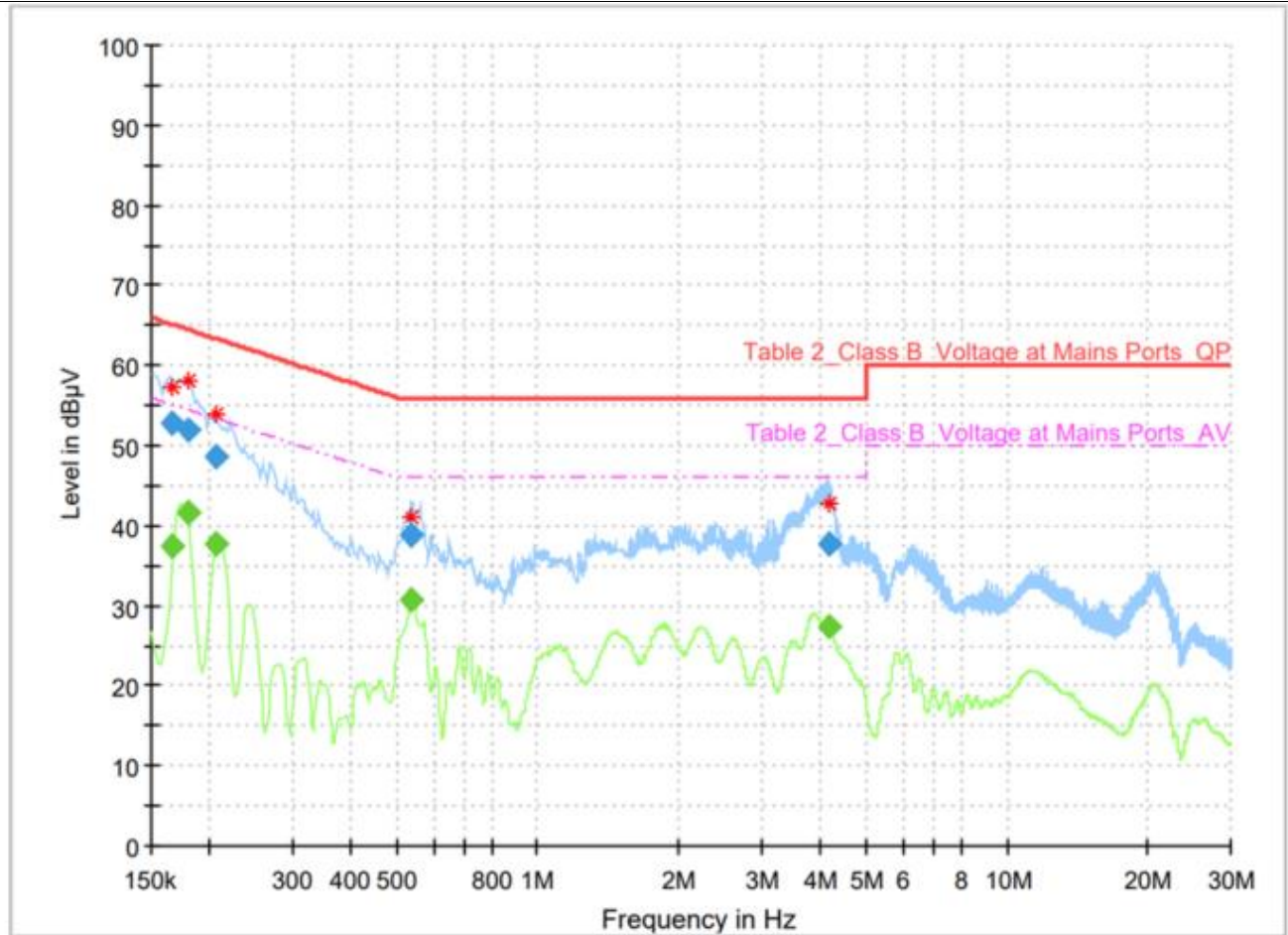
Live line



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.172500	---	45.62	54.84	9.22	5000.0	9.000	L1	10.1
0.172500	53.37	---	64.84	11.47	5000.0	9.000	L1	10.1
0.213000	---	42.95	53.09	10.14	5000.0	9.000	L1	9.9
0.213000	50.10	---	63.09	12.99	5000.0	9.000	L1	9.9
0.260250	---	30.65	51.42	20.77	5000.0	9.000	L1	9.7
0.260250	42.12	---	61.42	19.30	5000.0	9.000	L1	9.7
0.543750	---	31.46	46.00	14.54	5000.0	9.000	L1	10.0
0.543750	41.72	---	56.00	14.28	5000.0	9.000	L1	10.0
4.089750	---	30.02	46.00	15.98	5000.0	9.000	L1	9.9
4.089750	39.90	---	56.00	16.10	5000.0	9.000	L1	9.9

Neutral line



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	CAverage (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.165750	---	37.50	55.17	17.67	5000.0	9.000	N	10.1
0.165750	52.88	---	65.17	12.29	5000.0	9.000	N	10.1
0.179250	---	41.56	54.52	12.96	5000.0	9.000	N	10.1
0.179250	52.07	---	64.52	12.45	5000.0	9.000	N	10.1
0.206250	---	37.73	53.36	15.63	5000.0	9.000	N	9.9
0.206250	48.67	---	63.36	14.68	5000.0	9.000	N	9.9
0.537000	---	30.64	46.00	15.36	5000.0	9.000	N	10.0
0.537000	38.84	---	56.00	17.16	5000.0	9.000	N	10.0
4.200000	---	27.34	46.00	18.66	5000.0	9.000	N	9.9
4.200000	37.65	---	56.00	18.35	5000.0	9.000	N	9.9

- END -