

TEST REPORT

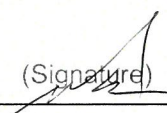
KOSTEC Co., Ltd. 28(175-20, Annyeong-dong) 406-gil sejaro, Hwaseong-si, Gyeonggi-do, Korea Tel:031-222-4251, Fax:031-222-4252	Report No.: KST-FCR-210014(1)	 KOSTEC Co., Ltd. http://www.kostec.org
1. Applicant • Name : Audio-Technica Corporation • Address : 2-46-1 Nishi-naruse, Machida, Tokyo, 194-8666, Japan 2. Test Item • Product Name: STEREO TRANSMITTER • Model Name: ATW-T3205DF2 • Brand:  audio-technica • FCC ID: JFZT3205DF2 3. Manufacturer • Name : Audio-Technica Corporation • Address : 2-46-1 Nishi-naruse, Machida, Tokyo, 194-8666, Japan 4. Date of Test : 2021. 05. 25. ~ 2021. 05. 27, 2021. 07.12. FCC CFR 47, Part 2 & 74 Subpart H-Low Power Auxiliary Stations 5. Test Method Used : ANSI/TIA-603-E-2016 ANSI C63.26-2015 ANSI C63.4-2014 6. Test Result : Compliance 7. Note: -		
Supplementary Information The device bearing the brand name and FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with measurement procedures specified in ANSI/TIA-603-E-2016 We attest to the accuracy of data and all measurements reported herein were performed by KOSTEC Co., Ltd. and were made under Chief Engineer's supervision. We assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report is not related to KOLAS accreditation.		
Affirmation	Tested by Name : Choo, Kwang-Yeol (Signature) 	Technical Manager Name : Park, Gyeong-Hyeon (Signature) 
2021. 07. 13. KOSTEC Co., Ltd.		

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1. GENERAL INFORMATION

1.1 Test Facility

Test laboratory and address

KOSTEC Co., Ltd.

28(175-20,Annyeong-dong)406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea

Telephone Number: 82-31-222-4251

Facsimile Number: 82-31-222-4252

Registration information

KOLAS No.: KT232

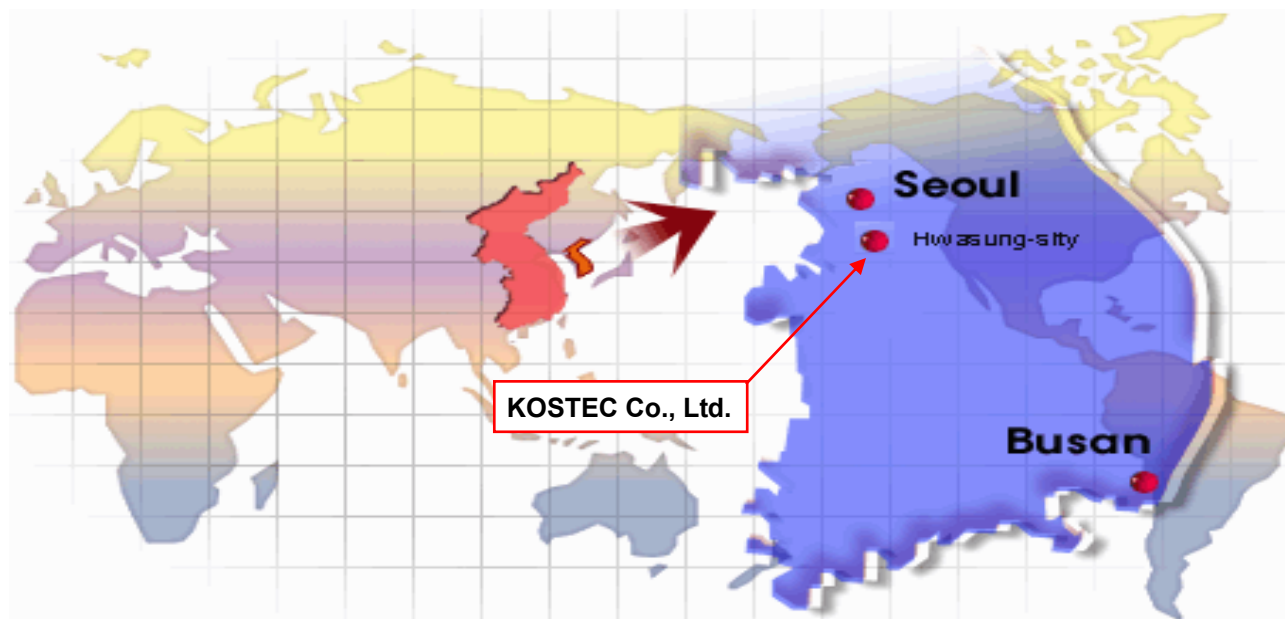
RRA (National Radio Research Agency): KR0041

FCC Designation No.: KR0041

IC Designation No.: KR0041

VCCI Membership No.: 2005

1.2 Location



1.3 Revision History of test report

Rev.	Revisions	Effect page	Reviewed	Date
-	Initial issue	All	Park, Gyeong-Hyeon	2021. 05. 27.
1	Revise equipment description and re-test emission mask	5 Page, 25~30 Page	Park, Gyeong-Hyeon	2021. 07. 13.

2. EQUIPMENT DESCRIPTION

The product specification described herein was declared by manufacturer. And refer to user's manual for the details.

Equipment Name	STEREO TRANSMITTER
Model No	ATW-T3205DF2
Type of Equipment	Licensed Broadcast Transmitter Fixed to Face (UHF Wireless Microphone)
Intended Operating Environment	General Population/Uncontrolled Exposure
Serial Number	Proto type
Primary User Functions of EUT	One-Way Wireless Voice Communication
RF Output Power Rating	50 mW (High) / 10 mW (Low)-Selectable
Operating Frequency Range	470 MHz ~ 608 MHz
RF Output Impedance	50 Ω
Channel Spacing	25 kHz
Modulation	FM for analog voice
Occupied Bandwidth (99%)	105 kHz
Emission Designation	105KF3E
Power Source	Adaptor: Input/100~240Vac, Output/12 Vdc 1 A
Hardware Version	TP2
Software Version	MCU:0.0.6 / FPGA : 0.2.0
Antenna Description	Whip Antenna, Max 1.298 dBi
FCC ID	JFZT3205DF2
Remark	The above DUT's information was declared by manufacturer. Please refer to the specifications or user manual for more detailed description.

3. SYSTEM CONFIGURATION FOR TEST

3.1 Characteristics of equipment

The Equipment Under Test (EUT) use for Fixed type UHF Wireless Microphone

3.2 Used peripherals list

Description	Model No.	Serial No.	Manufacture	Remark
AC ADAPTER AD-SC1210AO	KSAS0121200100VU	P#9277-01660B	Audio-technica	-

3.3 Product Modification

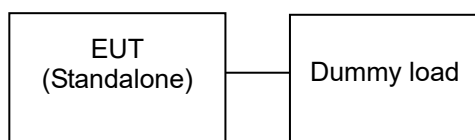
N/A

3.4 Operating Mode

Constantly transmitting with a modulated and unmodulated carrier at maximum power on the low, middle and high channels. Radiated emissions tests were performed with antenna ports terminated.

3.5 Test Setup of EUT

The measurements were taken in continuous transmit mode.





3.6 Table for Carrier Frequencies

Modulation Type	Tested Channel	Channel separation (kHz)	Test freq. (MHz)
Analog	Low	25	470.125
	Mid		539.000
	High		607.875

3.7 Used Test Equipment List

No.	Instrument	Model	S/N	Manufacturer	Next Cal Date	Cal interval	used
1	T & H Chamber	PL-3J	15003623	ESPEC CORP	2021.11.04	1 year	☐
2	T & H Chamber	SH-662	93000067	ESPEC CORP	2021.09.02	1 year	☒
3	T & H Chamber	SH-641	92006831	ESPEC CORP	2022.03.29	1 year	☐
4	Spectrum Analyzer	8563EC	3046A00527	Agilent Technology	2022.01.19	1 year	☐
5	Spectrum Analyzer	FSV30	104029	Rohde & Schwarz	2021.09.01	1 year	☐
6	Spectrum Analyzer	FSV30	20-353063	Rohde & Schwarz	2022.01.19	1 year	☐
7	Spectrum Analyzer	FSV40	101727	Rohde & Schwarz	2022.07.19	1 year	☐
8	Signal Analyzer	FSW43	101294	Rohde & Schwarz	2022.02.18	1 year	☒
9	Signal Analyzer	FSW85	101602	Rohde & Schwarz	2022.06.30	1 year	☐
10	EMI Test Receiver	ESCI7	100823	Rohde & Schwarz	2022.01.20	1 year	☒
11	EMI Test Receiver	ESI	837514/004	Rohde & Schwarz	2021.08.31	1 year	☐
12	Vector Signal Analyzer	89441A	3416A02620	Agilent Technology	2022.01.20	1 year	☐
13	Network Analyzer	8753ES	US39172348	AGILENT	2021.09.01	1 year	☐
14	EPM Series Power meter	E4418B	GB39512547	Agilent Technology	2022.01.19	1 year	☐
15	RF Power Sensor	E9300A	MY41496631	Agilent Technology	2022.01.19	1 year	☐
16	Microwave Frequency Counter	5352B	2908A00480	Agilent Technology	2022.01.19	1 year	☐
17	Audio Analyzer	8903B	3514A16919	Agilent Technology	2022.01.19	1 year	☒
18	Audio Telephone Analyzer	DD-5601CID	520010281	CREDIX	2022.01.18	1 year	☐
19	Modulation Analyzer	8901A	3041A05716	H.P	2022.01.18	1 year	☒
20	Digital storage Oscilloscope	TDS3052	B015962	Tektronix	2021.08.31	1 year	☐
21	ESG-D Series Signal Generator	E4436B	US39260458	Agilent Technology	2022.01.18	1 year	☒
22	Vector Signal Generator	SMBV100A	257557	Rohde & Schwarz	2022.01.18	1 year	☐
23	GNSS Signal Generator	TC-2800A	2800A000494	TESCOM CO., LTD.	2022.01.19	1 year	☐
24	Signal Generator	SMB100A	179628	Rohde & Schwarz	2022.05.04	1 year	☒
25	Signal Generator	N5173B	MY57280148	KEYSIGHT	2022.06.11	1 year	☐
26	SLIDAC	None	0207-4	Myoung sung Ele.	2022.01.20	1 year	☐
27	DC Power supply	DRP-5030	9028029	Digital Electronic Co.,Ltd	2022.01.20	1 year	☐
28	DC Power supply	E3610A	KR24104505	Agilent Technology	2022.01.19	1 year	☐
29	DC Power supply	UP-3005T	68	Unicon Co.,Ltd	2022.01.20	1 year	☐
30	DC Power Supply	SM 3004-D	114701000117	DELTAELEKTRONIKA	2022.01.19	1 year	☐
31	DC Power supply	6632B	MY43004005	Agilent Technology	2022.01.20	1 year	☐
32	DC Power Supply	6632B	MY43004137	Agilent Technology	2022.01.20	1 year	☒
33	Termination	1433-3	LM718	WEINSCHEL	2022.07.16	1 year	☐
34	Termination	1432-3	QR946	AEROFLEX/WEINSCHEL	2022.07.16	1 year	☐
35	Attenuator	24-30-34	BX5630	Aeroflex / Weinschel	2021.12.04	1 year	☐
36	Attenuator	8498A	3318A09485	HP	2022.01.19	1 year	☒
37	Step Attenuator	8494B	3308A32809	HP	2022.01.19	1 year	☐
38	RF Step Attenuator	RSP	100091	Rohde & Schwarz	2022.01.19	1 year	☐
39	Attenuator	18B50W-20F	64671	INMET	2022.01.19	1 year	☐
40	Attenuator	10 dB	1	Rohde & Schwarz	2022.05.04	1 year	☐
41	Attenuator	54A-10	74564	WEINSCHEL	2021.09.02	1 year	☐
42	Attenuator	56-10	66920	WEINSCHEL	2022.05.04	1 year	☐
43	Attenuator	48-30-33-LIM	BL5350	Weinschel Corp.	2022.07.16	1 year	☐
44	Power divider	11636B	51212	HP	2022.01.21	1 year	☐
45	3Way Power divider	KPDSU3W	00070365	KMW	2021.08.31	1 year	☐
46	4Way Power divider	70052651	173834	KRYTAR	2022.01.19	1 year	☐
47	3Way Power divider	1580	SQ361	WEINSCHEL	2022.05.04	1 year	☐
48	OSP	OSP120	101577	Rohde & Schwarz	2022.06.14	1 year	☐
49	White noise audio filter	ST31EQ	101902	SoundTech	2021.08.31	1 year	☐
50	Dual directional coupler	778D	17693	HEWLETT PACKARD	2022.01.19	1 year	☐

No.	Instrument	Model	S/N	Manufacturer	Next Cal Date	Cal interval	used
51	Dual directional coupler	772D	2839A00924	HEWLETT PACKARD	2022.01.19	1 year	☐
52	Band rejection filter	3TNF-0006	26	DOVER Tech	2022.01.19	1 year	☐
53	Band rejection filter	3TNF-0007	311	DOVER Tech	2022.01.19	1 year	☐
54	Band rejection filter	WTR-BRF2442-84NN	09020001	WAVE TECH Co.,LTD	2022.01.19	1 year	☐
55	Band rejection filter	WRCJV12-5695-5725-5825-5855-50SS	1	Wainwright Instruments GmbH	2022.05.04	1 year	☐
56	Band rejection filter	WRCJV12-5120-5150-5350-5380-40SS	4	Wainwright Instruments GmbH	2022.05.04	1 year	☐
57	Band rejection filter	WRCGV10-2360-2400-2500-2540-50SS	2	Wainwright Instruments GmbH	2022.05.04	1 year	☐
58	Band rejection filter	CTF-155M-S1	001	RF One Electronics	2021.08.31	1 year	☐
59	Band rejection filter	CTF-435M-S1	001	RF One Electronics	2021.08.31	1 year	☒
60	Band rejection filter	CTF-5890M-70MS1	1	RF One Electronics	2022.01.19	1 year	☐
61	Highpass Filter	WHJS1100-10EF	1	WAINWRIGHT	2022.01.19	1 year	☒
62	Highpass Filter	WHJS3000-10EF	1	WAINWRIGHT	2022.01.19	1 year	☐
63	Highpass Filter	WHNX6-5530-7000-26500-40CC	2	Wainwright Instruments GmbH	2022.05.04	1 year	☐
64	Highpass Filter	WHNX6-2370-3000-26500-40CC	4	Wainwright Instruments GmbH	2022.05.04	1 year	☐
65	WideBand Radio Communication Tester	CMW500	102276	Rohde & Schwarz	2022.01.19	1 year	☐
66	WideBand Radio Communication Tester	CMW500	117235	Rohde & Schwarz	2022.01.19	1 year	☐
67	WideBand Radio Communication Tester(with CMX500)	CMW500	167157	Rohde & Schwarz	2022.04.09	1 year	☐
68	Bluetooth Tester	TC-3000B	3000B6A0166	TESCOM CO., LTD.	2022.01.18	1 year	☐
69	Loop Antenna	6502	9203-0493	EMCO	2023.05.31	2 year	☒
70	BiconiLog Antenna	3142B	1745	EMCO	2022.04.24	2 year	☒
71	Trilog-Broadband Antenna _(R)	VULB 9168	9168-606	SCHWARZBECK	2022.09.21	2 year	☐
72	Biconical Antenna _(T)	VUBA9117	9117-342	Schwarz beck	2022.03.24	2 year	☐
73	Horn Antenna	3115	9605-4834	EMCO	2022.03.06	2 year	☒
74	Horn Antenna	QMS-00208	21909	STEATITE ANTENNA	2022.12.04	2 year	☐
75	Horn Antenna _(R)	3117	00135191	ETS-LINDGREN	2022.04.29	2 year	☐
76	Horn Antenna _(T)	3115	2996	EMCO	2022.02.14	2 year	☒
77	Horn Antenna _(R)	BBHA 9170	9170-722	SCHWARZBECK	2022.05.12	2 year	☐
78	Horn Antenna _(T)	BBHA 9170	743	SCHWARZBECK	2023.01.21	2 year	☐
79	AMPLIFIER(A_10)	TK-PA6S	120009	TESTEK	2022.01.19	1 year	☒
80	AMPLIFIER(C_3)	TK-PA01S	200141-L	TESTEK	2021.09.23	1 year	☐
81	PREAMPLIFIER(C_3)	8449B	3008A02577	Agilent	2022.01.19	1 year	☐
82	RF PRE AMPLIFIER	SCU08F2	100762	Rohde & Schwarz	2021.12.04	1 year	☐
83	AMPLIFIER	TK-PA18	150003	TESTEK	2022.01.21	1 year	☐
84	AMPLIFIER	TK-PA1840H	160010-L	TESTEK	2022.01.21	1 year	☐
85	Horn Antenna	M19RH	T01	OML, Inc.	2022.05.29	2 year	☐
86	Horn Antenna	M19RH	R01	OML, Inc.	2022.05.29	2 year	☐
87	Horn Antenna	M12RH	T02	OML, Inc.	2022.05.29	2 year	☐
88	Horn Antenna	M12RH	R02	OML, Inc.	2022.05.29	2 year	☐
89	Horn Antenna	M08RH	T03	OML, Inc.	2022.05.29	2 year	☐
90	Horn Antenna	M08RH	R03	OML, Inc.	2022.05.29	2 year	☐
91	Horn Antenna	M05RH	T04	OML, Inc.	2022.05.29	2 year	☐
92	Horn Antenna	M05RH	R04	OML, Inc.	2022.05.29	2 year	☐
93	Horn Antenna	M03RH	T05	OML, Inc.	2022.05.29	2 year	☐
94	Horn Antenna	M03RH	R05	OML, Inc.	2022.05.29	2 year	☐
95	Harmonic Mixer	M12HWD	200529-1	OML, Inc.	2022.07.12	1 year	☐
96	Harmonic Mixer	M08HWD	200529-1	OML, Inc.	2022.07.12	1 year	☐
97	Harmonic Mixer	M05HWD	200529-1	OML, Inc.	2022.07.12	1 year	☐
98	Harmonic Mixer	M03HWD	200529-1	OML, Inc.	2022.07.12	1 year	☐
99	Source Module	S19MS-A	200529-1	OML, Inc.	2022.07.02	1 year	☐
100	Source Module	S12MS-A	200529-1	OML, Inc.	2022.07.02	1 year	☐
101	Source Module	S08MS-A	200529-1	OML, Inc.	2022.07.02	1 year	☐
102	Source Module	S05MS-A	200529-1	OML, Inc.	2022.07.02	1 year	☐
103	Source Module	S03MS-A	200529-1	OML, Inc.	2022.07.02	1 year	☐

4. SUMMARY TEST RESULTS

Description of Test	FCC Rule	Test report Clause	Used	Test Result
RF Output Power	2.1046, 74.861(e)(1)(ii)	Clause 5.1	☒	Compliance
Modulation Characteristics	2.1047(a), 74.861(e)(3)	Clause 5.2	☒	Compliance
Occupied Bandwidth & Emission Mask	2.1049(c)(i), 74.861(e)(5)(6)(7)	Clause 5.3	☒	Compliance
Spurious Emission On Antenna Port	2.1051, 74.861(e)(6)(iii)	Clause 5.4	☒	Compliance
Radiated Spurious Emissions	2.1053, 74.861(e)(6)(iii)	Clause 5.5	☒	Compliance
Frequency Stability	2.1055, 74.861(e)(4)	Clause 5.6	☒	Compliance
Compliance/pass : The EUT complies with the essential requirements in the standard. Not Compliance : The EUT does not comply with the essential requirements in the standard. N/A : The test was not applicable in the standard.				

Procedure Reference

FCC CFR 47, Part 2 & 74 Subpart H-Low Power Auxiliary Stations

ANSI/TIA-603-E-2016

ANSI C63.26-2015

ANSI C63.4-2014

KDB 206256 D01

5. MEASUREMENT RESULTS

5.1 RF Output Power

5.1.1 Standard Applicable [FCC §74.861(e)(1)(ii) & §2.1046]

According to §74.861(e)(1)(ii) of the FCC Rules, for low power auxiliary station operating in the 470 MHz ~ 608 MHz, the power of the measured unmodulated carrier power and the output of the transmitter conducted power (antenna input power) may not exceed 250 mW.

5.1.2 Test Environment conditions

- Ambient temperature : (20 - 21) °C • Relative Humidity : (50 - 51) % R.H.

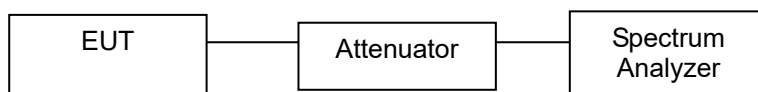
5.1.3 Measurement Procedure

The transmitter output was connected to the spectrum analyzer with an attenuator. The power output shall be monitored and recorded and no adjustment shall be made to the transmitter after the test has begun. If the power output is adjustable, measurements shall be made for the highest and lowest power levels.

The spectrum analyzer is set to the as follows :

- RBW : 1 MHz
- VBW : 3 MHz

5.1.4 Test setup



5.1.5 Measurement Result

Frequency [MHz]	Power Level	Conducted output Power [mW]	Limit [dBm]	Test Results
470.125	Low	8.68	250 mW	Compliance
539.000	Low	5.26		Compliance
607.875	Low	6.55		Compliance
470.125	High	46.25	250 mW	Compliance
539.000	High	26.01		Compliance
607.875	High	36.49		Compliance

5.2 Modulation Characteristics

5.2.1 Standard Applicable [FCC §Part 74.861(e)(3) §2.1047(a)]

According to §2.1047(a) of the FCC Rules, for Voice Modulated Communication Equipment, the frequency response of the audio modulating circuit over a range of 100 Hz to 5000 Hz shall be measured. For equipment required to have an audio low-pass filter, the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be measured.

According to §74.861(e)(3) of the FCC Rules, any form of modulation may be used. A maximum deviation of ± 75 kHz is permitted when frequency modulation is employed.

CH spacing	Frequency deviation
25 kHz	75 kHz

Part 2.1047(a) A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

Audio frequency	Minimum Attenuation Rel. to 1 kHz Attenuation
3 - 20 kHz	$60 \log_{10}(f/3)$ dB where f is in kHz
20 - 30 kHz	50 dB

5.2.2 Test Environment conditions

- Ambient temperature : (20 - 21) °C • Relative Humidity : (50 - 51) % R.H.

5.2.3 Measurement Procedure

- Audio frequency response

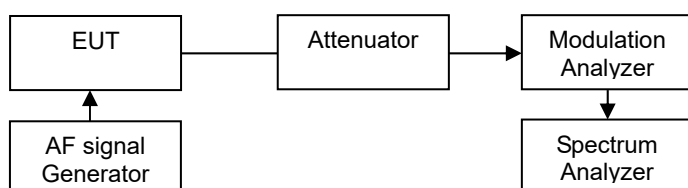
The audio input level needed for a particular percentage of modulation was measured in accordance with ANSI/TIA-603-E-2016. The audio input curves versus modulation are shown below. Curves are provided for audio input frequencies of 300, 1 000, 3 000 and 5 000 Hz.

- Test frequency: Mid

- Modulation Limit

The carrier frequency deviation was measured with the tone adjust the audio input for 60 % of rated system deviation at 1 kHz using this level as a reference (0 dB) and vary the input level from -20 to +20 dB. Record the frequency deviation obtained as a function of the input level at frequencies 0.1, 0.5, 1.0, 3.0 and 5.0 kHz. The maximum deviation was recorded at each test condition.

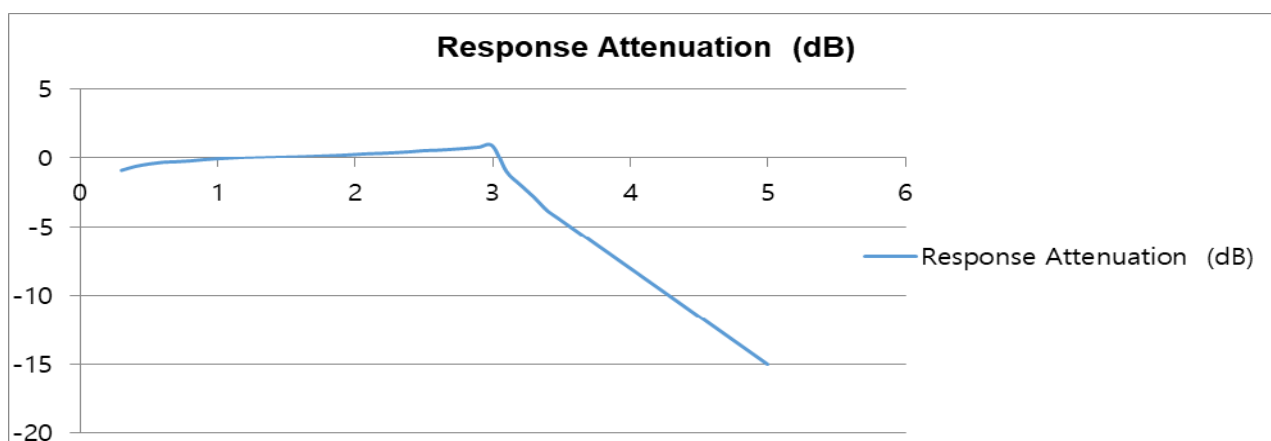
5.2.4 Test setup



5.2.5 Measurement Result

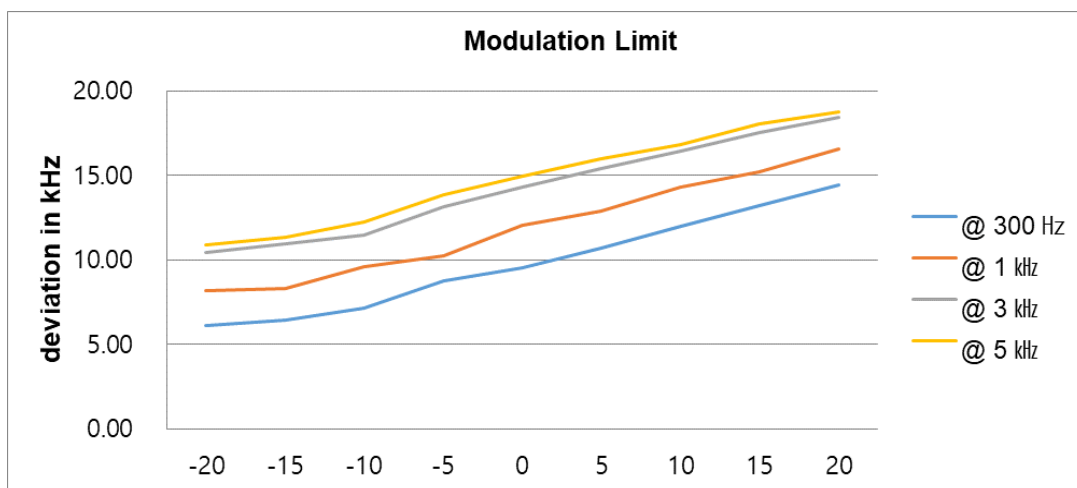
• Audio frequency response

Audio Frequency (Hz)	Response Attenuation (dB)	Audio Frequency (Hz)	Response Attenuation (dB)
300	-0.87	2 800	0.72
400	-0.59	2 900	0.79
500	-0.41	3 000	0.88
600	-0.29	3 100	-0.96
700	-0.25	3 200	-1.91
800	-0.19	3 300	-2.83
900	-0.11	3 400	-3.87
1 000	-0.03	3 500	-4.56
1 200	0.08	4 000	-8.17
1 400	0.13	5 000	-15.53
1 600	0.18	-	-
1 800	0.25	-	-
2 000	0.35	-	-
2 100	0.41	-	-
2 200	0.44	-	-
2 300	0.49	-	-
2 400	0.55	-	-
2 500	0.63	-	-
2 600	0.66	-	-
2 700	0.72	-	-



• Modulation Limit

Audio input Level (dB)	Frequency Deviation (kHz)				Limit (kHz)
	@ 300 Hz	@ 1 kHz	@ 3 kHz	@ 5 kHz	
-20	6.12	8.15	10.41	10.87	75
-15	4.45	8.32	10.92	11.32	75
-10	7.17	9.58	11.48	12.21	75
-5	8.76	10.20	13.17	13.84	75
0	9.51	12.06	14.30	14.97	75
5	10.70	12.89	15.38	16.01	75
10	12.01	14.30	16.40	16.80	75
15	13.20	15.20	17.50	18.20	75
20	14.40	16.56	18.40	18.73	75



5.3 Occupied Bandwidth & Emission Mask

5.3.1 Standard Applicable [FCC §74.861(e)(5)(6) & §2.1049(c)(1)]

With radiotelephone transmitters, according to §2.1049(c)(1) of the FCC Rules, "other than single sideband or independent sideband transmitter-when modulated by a 2500 Hz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation. The input level shall be established at the frequency of maximum response of the audio modulation circuit." According to §74.861(e)(5) & §74.861(e)(6) of FCC Rules,

(5) the operating bandwidth shall not exceed 200 kHz

(6) (i) On any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB;

(ii) On any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB;

(iii) On any frequency removed from the operating frequency by more than 250 percent of the authorized bandwidth: at least $43 + 10 \log_{10}$ (mean output power in watts) dB;

(7) Analog emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.1.2 of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; part 1: Technical characteristics and methods of measurement. Digital emissions within the band from one megahertz below to one megahertz above the carrier frequency shall comply with the emission mask in section 8.3.2.2 (Figure 4) of the European Telecommunications Institute Standard ETSI EN 300 422-1 v1.4.2 (2011-08), Electromagnetic compatibility and Radio spectrum Matters (ERM); Wireless microphones in the 25 MHz to 3 GHz frequency range; part 1: Technical characteristics and methods of measurement. Beyond one megahertz below and above the carrier frequency, emissions shall comply with the limits specified in section 8.4 of ETSI EN 300 422-1 v1.4.2 (2011-08). The requirements of this paragraph (e)(7) shall not apply to applications for certification of equipment in these bands until nine months after release of the Commission's Channel Reassignment Public Notice, as defined in §73.3700(a)(2) of this chapter.

5.3.2 Test Environment conditions

- Ambient temperature : (20 - 21) °C • Relative Humidity : (50 - 51) % R.H.

5.3.3 Measurement Procedure

• Occupied Bandwidth

The EUT was modulated by 2.5 kHz Sine wave audio signal, The level of the audio signal employed is 16 dB greater than that necessary to produce 50 % of rated system deviation. Rated system deviation is 75 kHz.

The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.

Measure the maximum width of the emission that is 26 dB down from the peak of the emission. The 99 % occupied bandwidth is the frequency bandwidth of the signal power at the 99 % channel power of occupied bandwidth.

The spectrum analyzer is set to the as follows :

- RBW : 1 kHz
- VBW : >3 x RBW
- Detector function : peak
- Trace : max hold

• Emission Mask

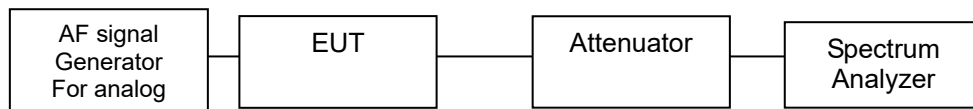
• Voice Modulation Through a Voice Input Port @ 2.1049(c)(1)

The transmitter was modulated by a 2.5 kHz tone signal at an input level 16 dB greater than that required to produce 50 % modulation (e.g.: ± 75 kHz peak deviation at 1 kHz modulating frequency). The input level was established at the frequency of maximum response of the audio modulating circuit.

The spectrum analyzer is set to the as follows

- RBW = 1 kHz
- VBW: >3 x RBW"

5.3.4 Test setup



5.3.5 Measurement Result

Frequency [MHz]	Power Level	99 % Bandwidth [kHz]	Limit [kHz]	Test Results
470.125	Low	101.99	≤200	Compliance
539.000	Low	101.99		Compliance
607.875	Low	101.88		Compliance
470.125	High	102.09	≤200	Compliance
539.000	High	102.24		Compliance
607.875	High	102.25		Compliance

* Emission Designator :

- Calculated Emission : $2M + 2D = (2 \times 2.5 \text{ kHz}) + (2 \times 50 \text{ kHz}) = 105\text{kF3E}$

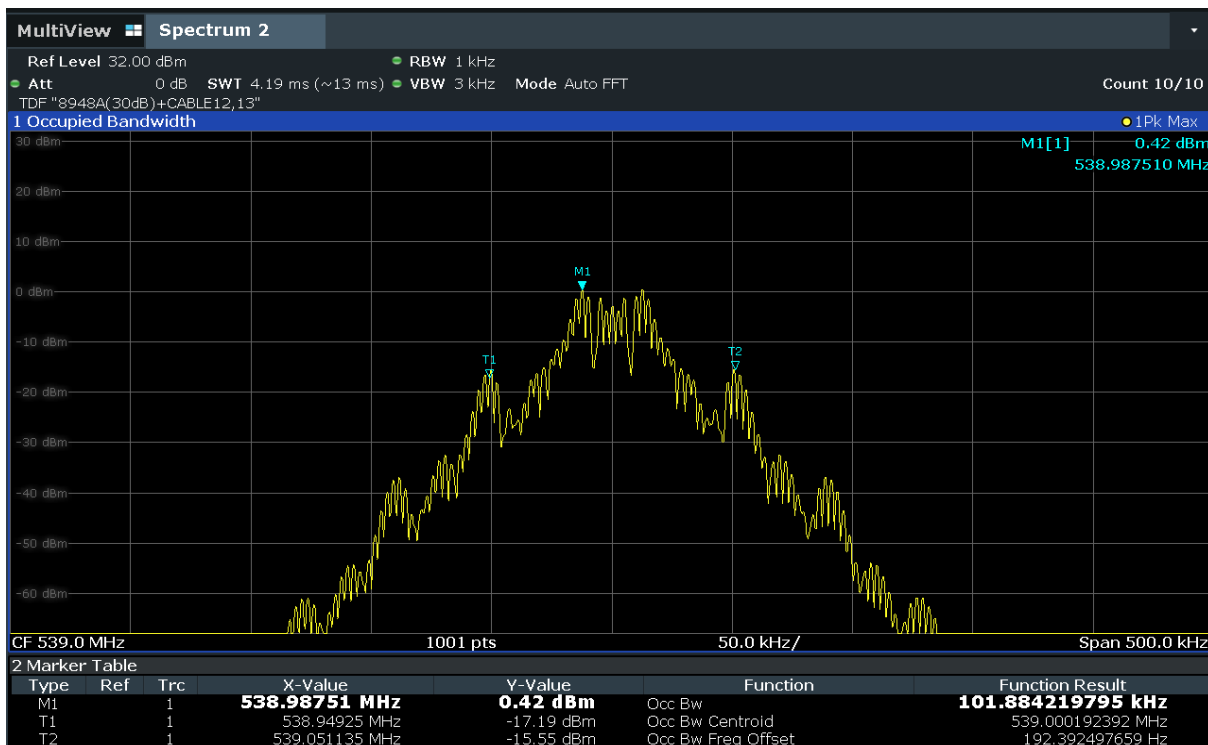
5.3.6 Test Plot

99 % band width / Power level: Low

CH Low : 470.125 MHz



CH Middle : 539.000 MHz



CH High : 607.875 MHz



99 % band width / Power level: High

CH Low : 470.125 MHz



CH Middle : 539.000 MHz

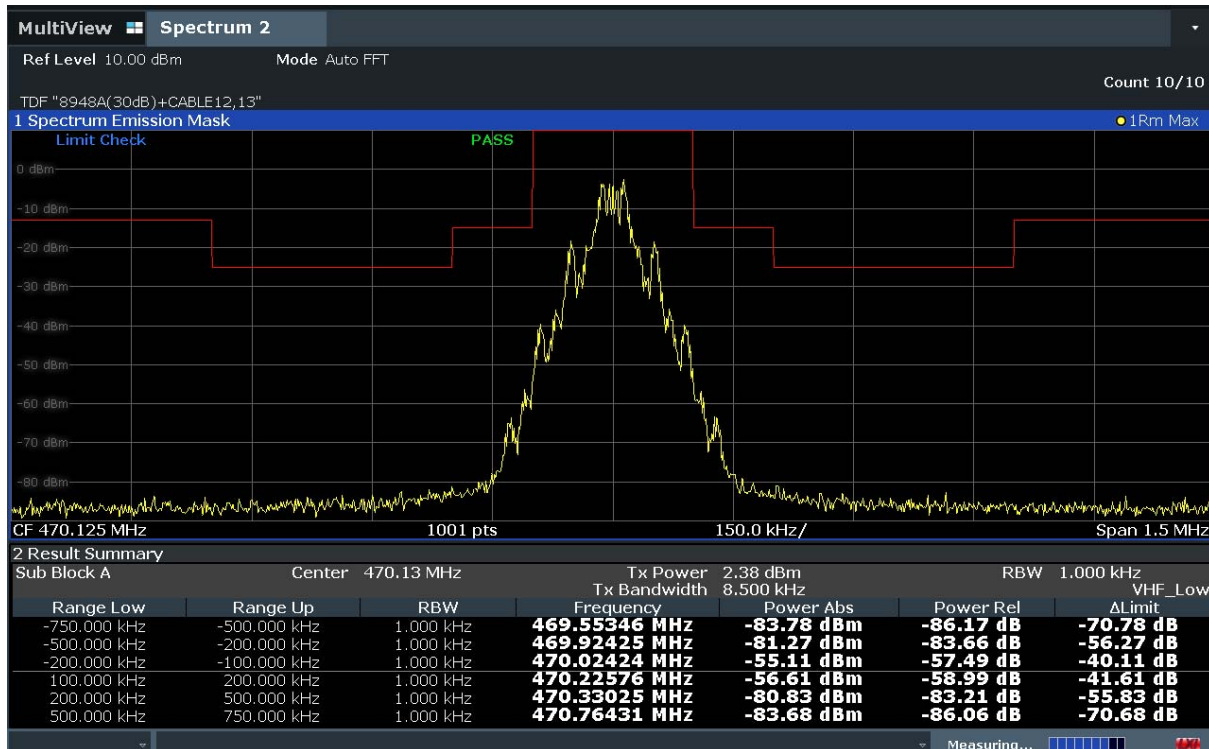


CH High : 607.875 MHz

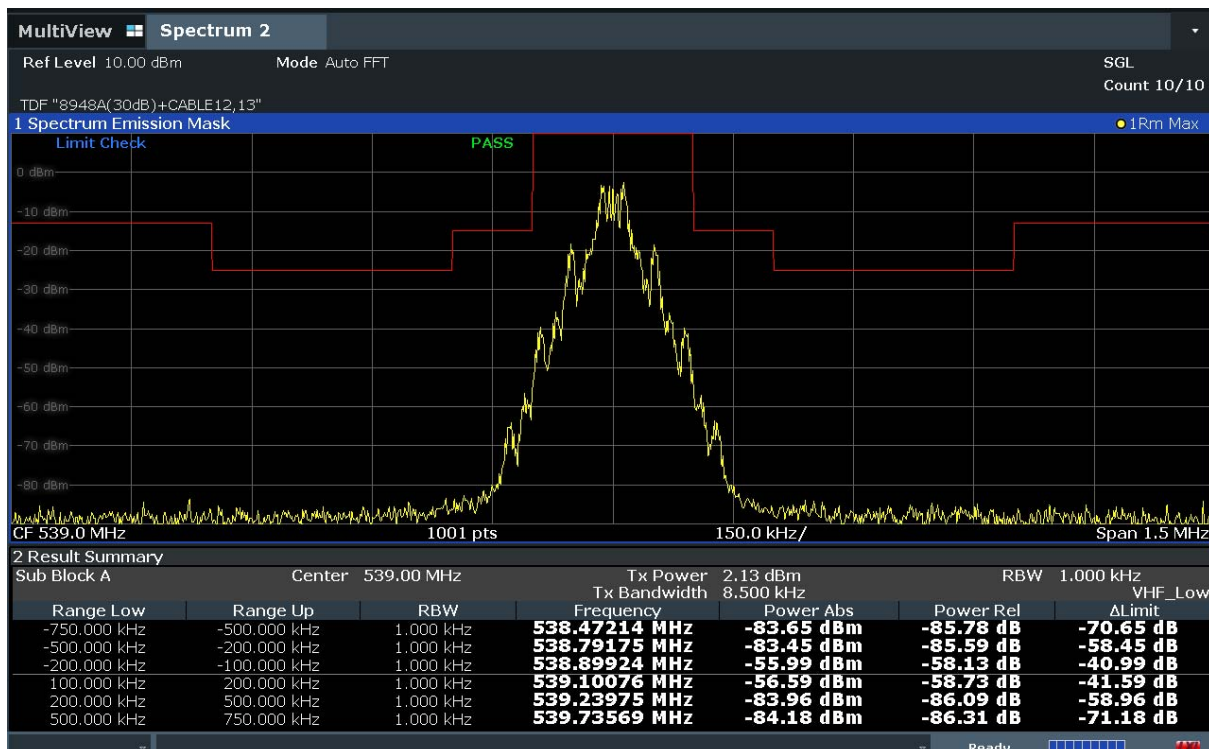


Emission Mask 1 / Power level: Low

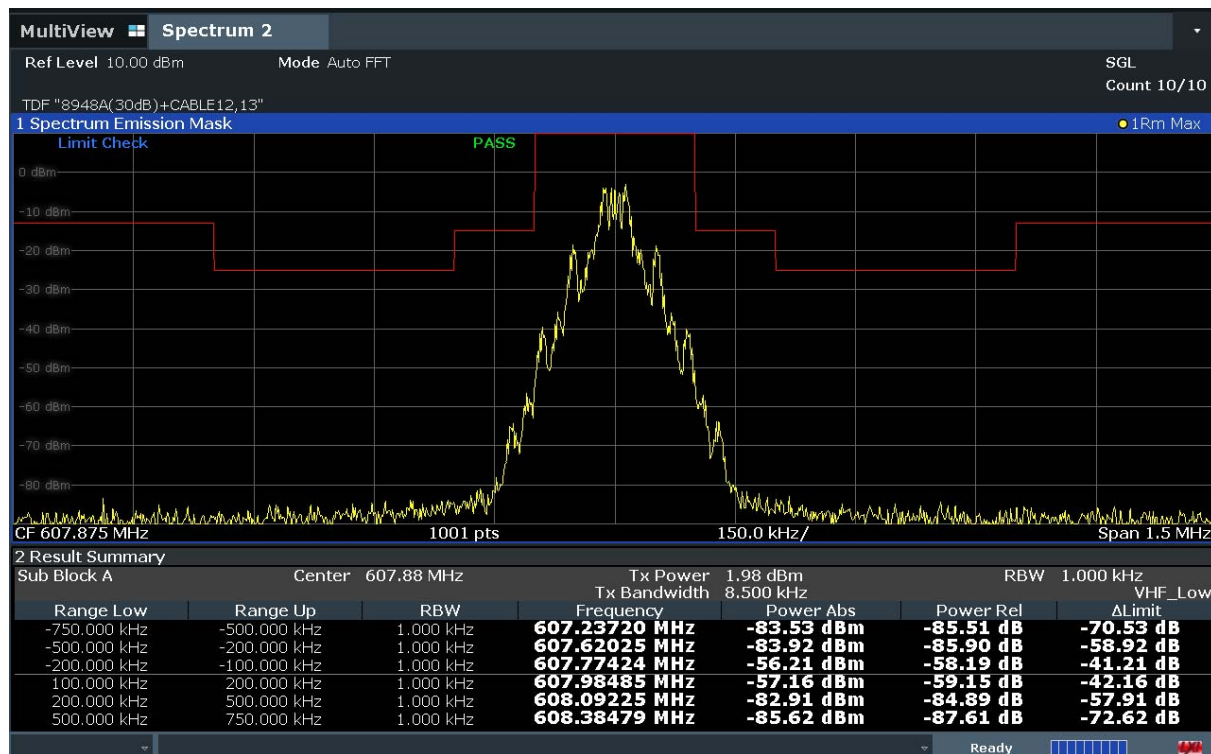
CH Low : 470.125 MHz



CH Middle : 539.000 MHz

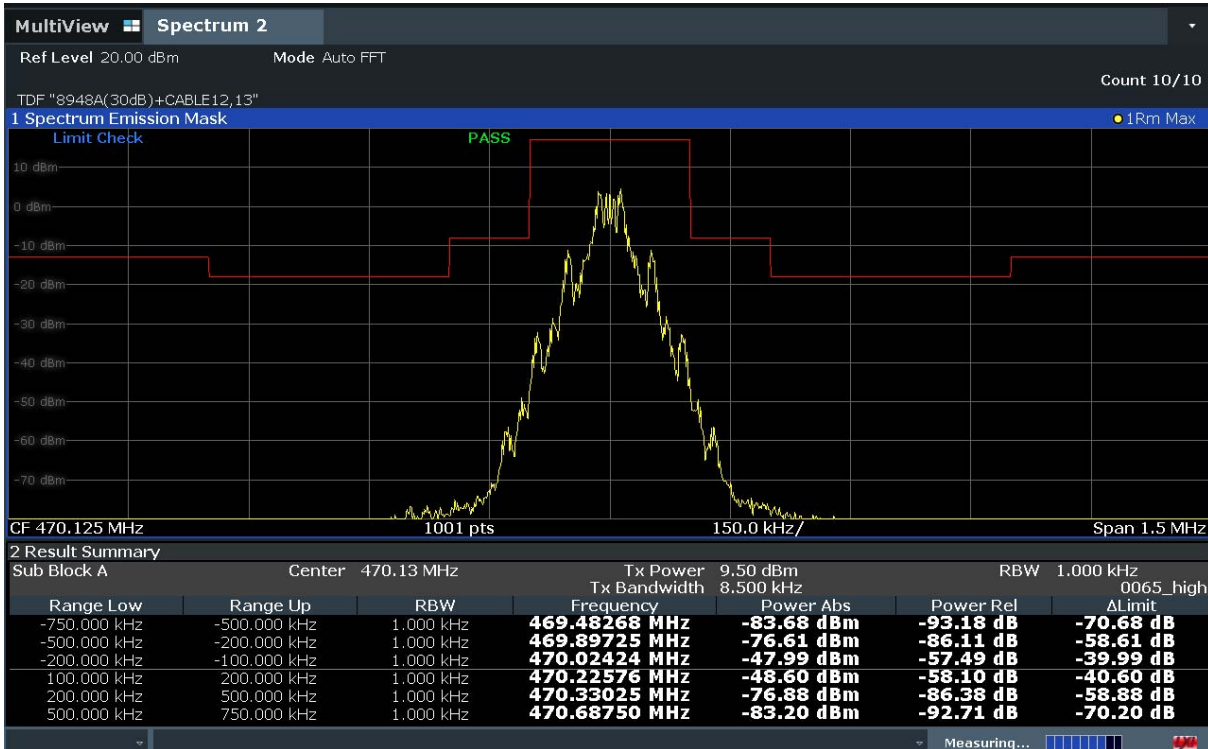


CH High : 607.875 MHz

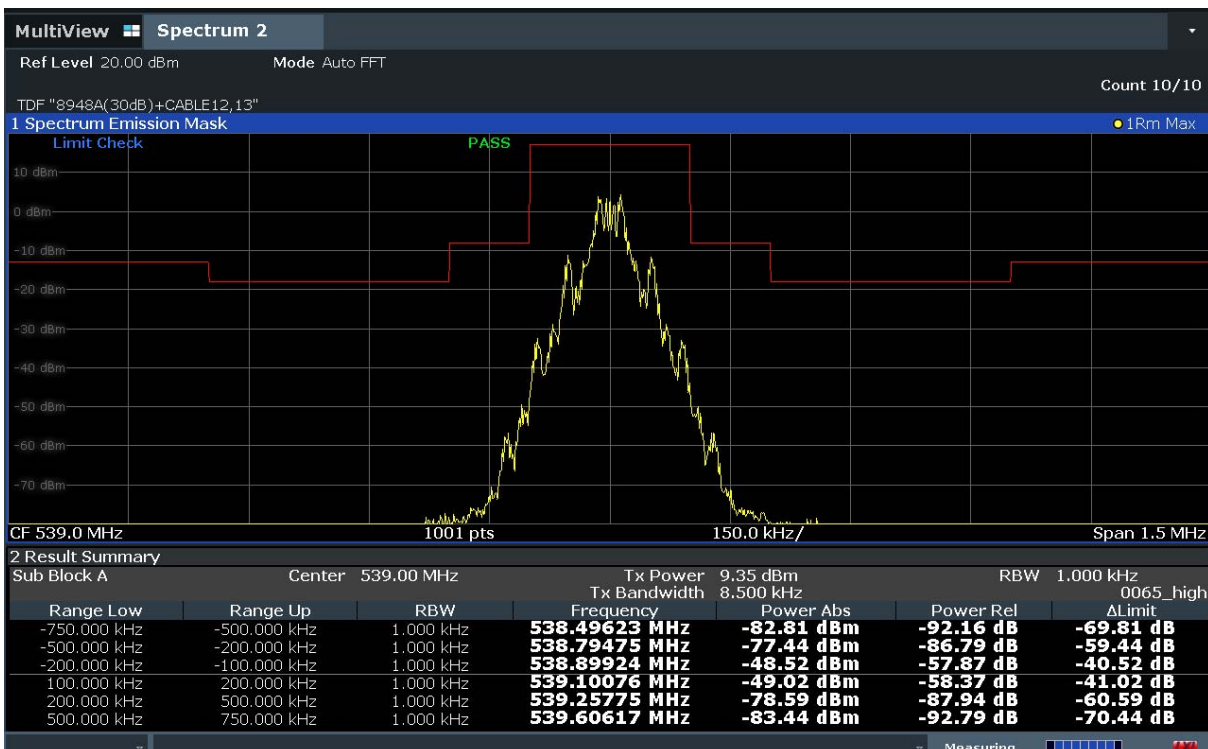


Emission Mask 1 / Power level: High

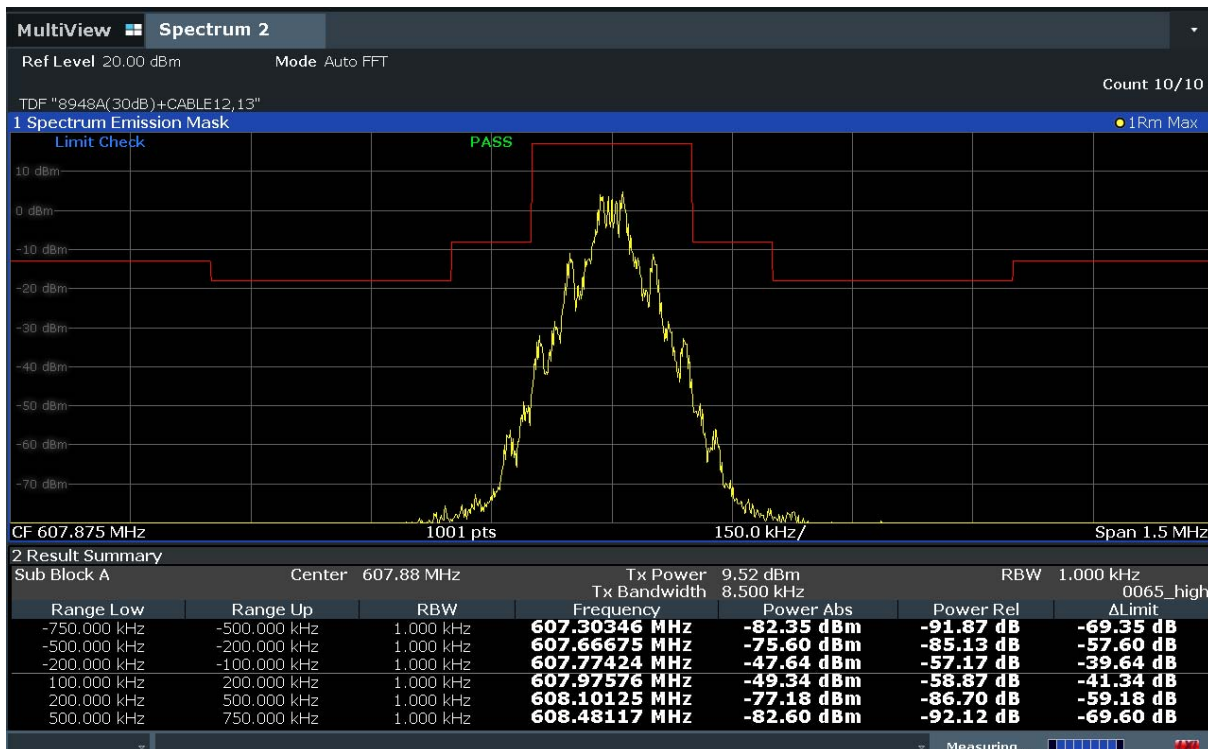
CH Low : 470.125 MHz



CH Middle : 539.000 MHz



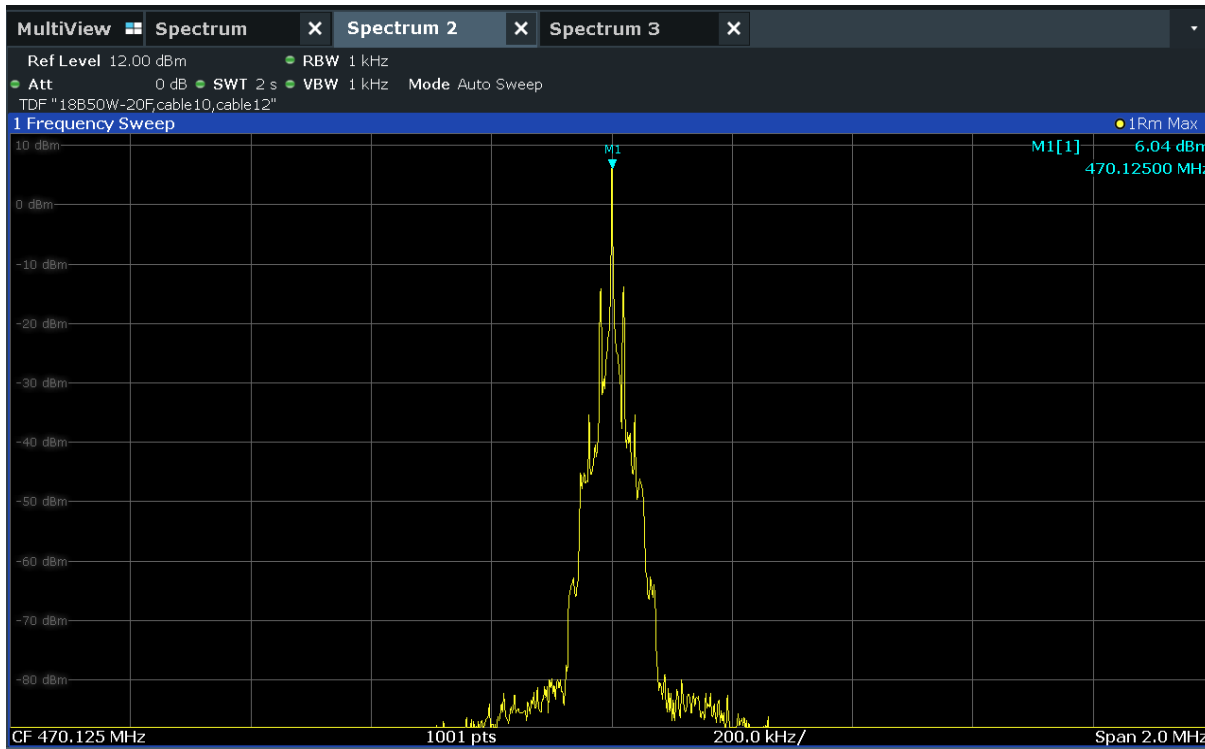
CH High : 607.875 MHz



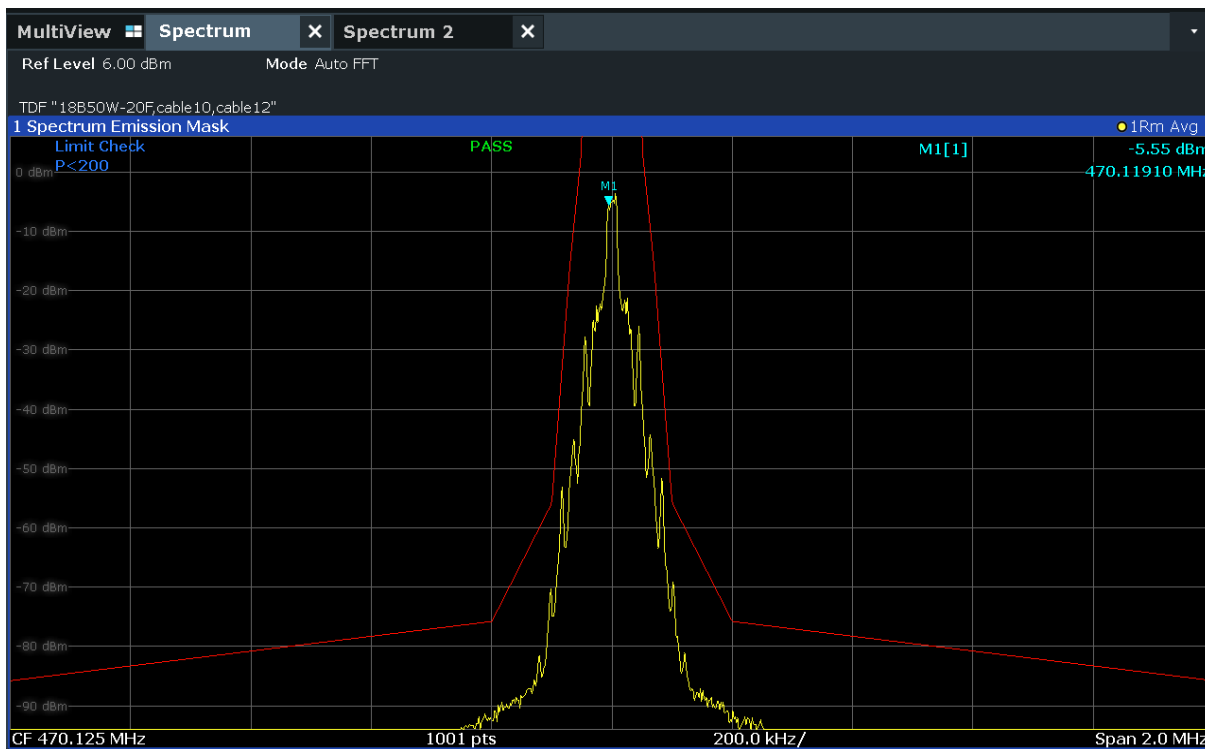
Emission Mask 2 / Power level: Low

CH Low : 470.125 MHz

Reference

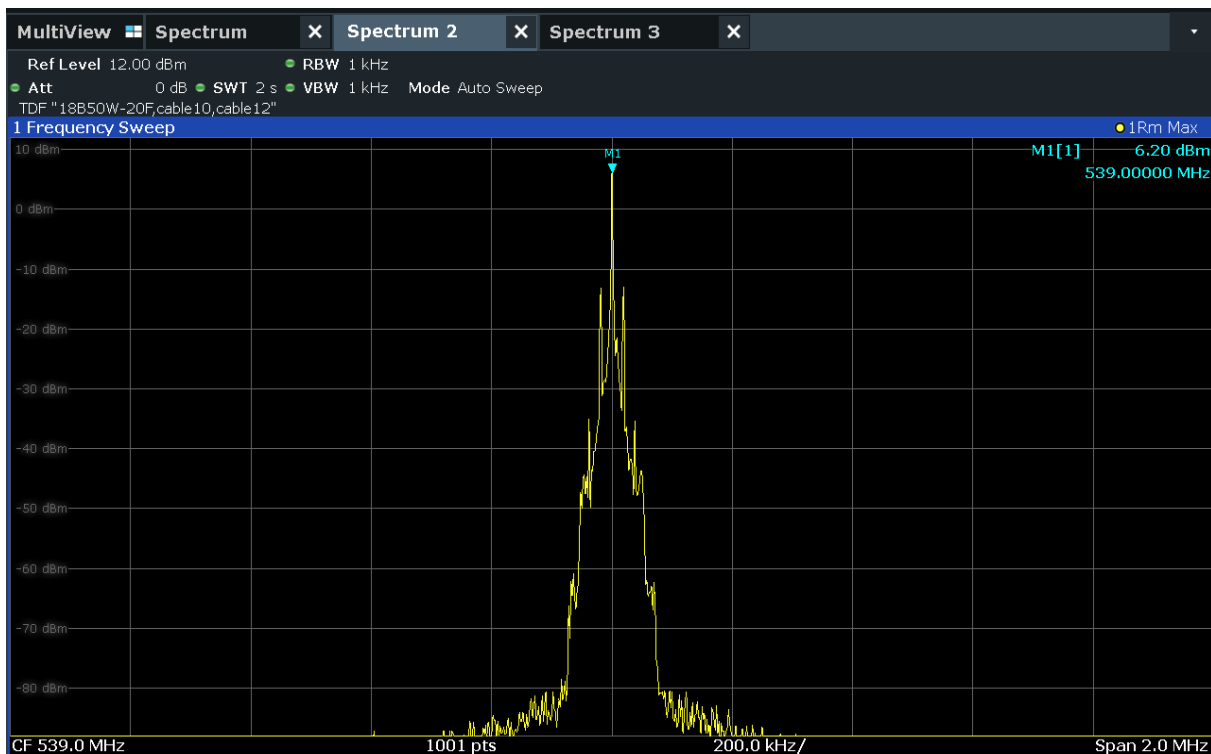


CH Low : 470.125 MHz

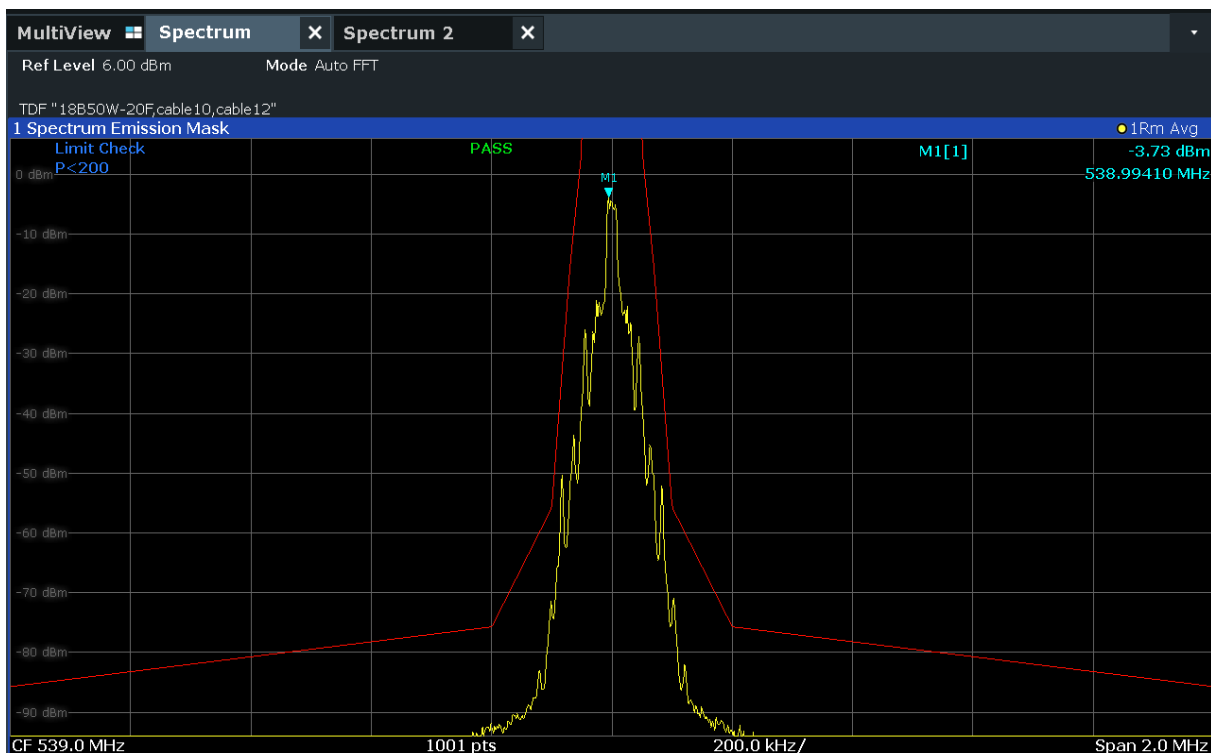


CH Middle : 539.000 MHz

Reference

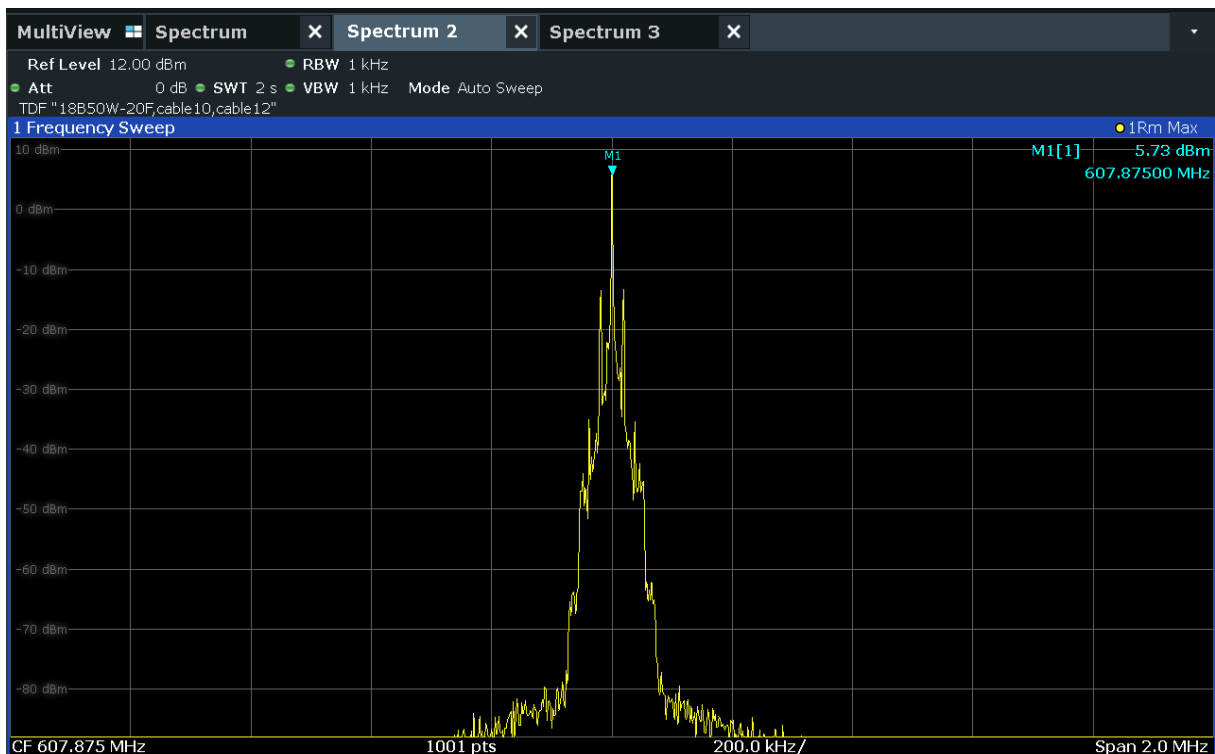


CH Middle : 539.000 MHz

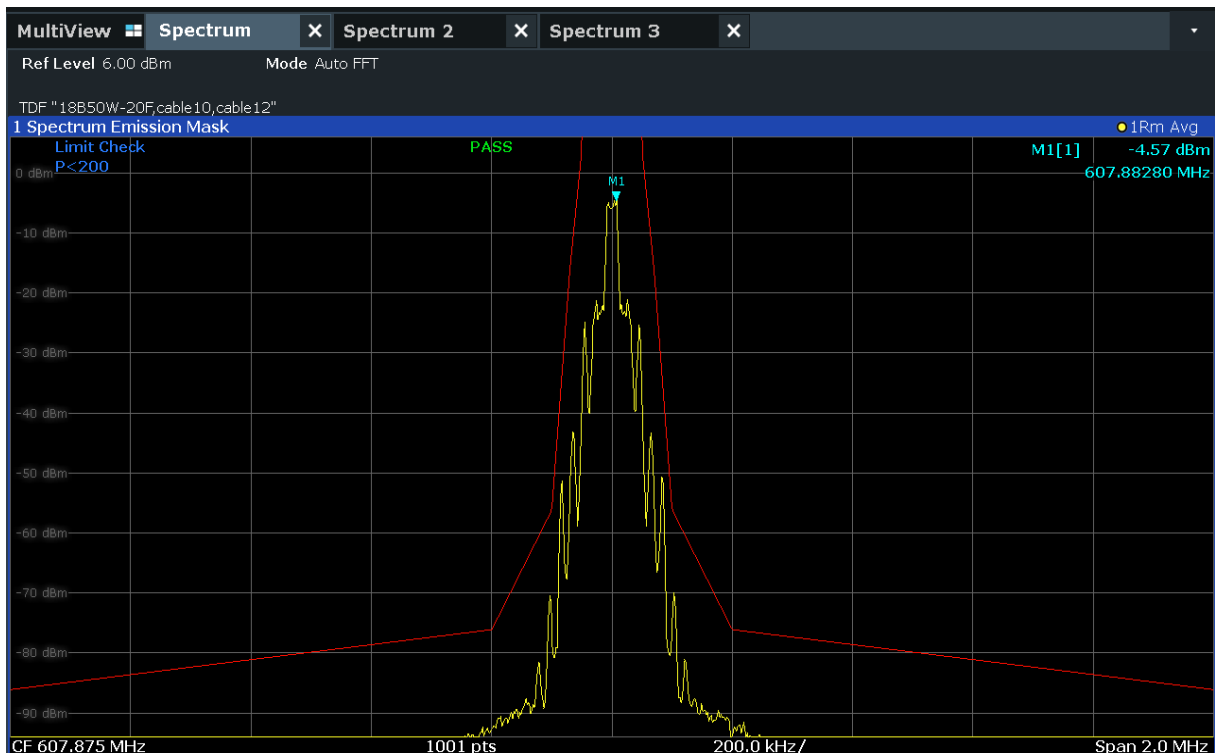


CH High : 607.875 MHz

Reference



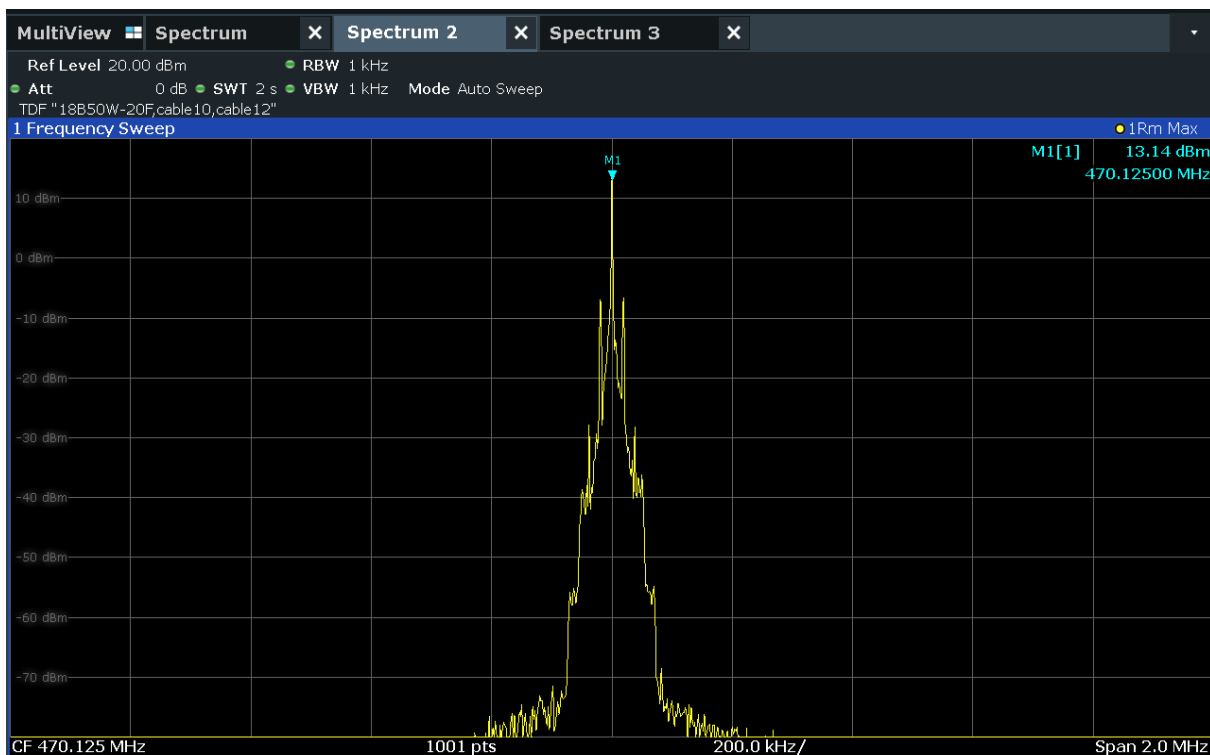
CH High : 607.875 MHz



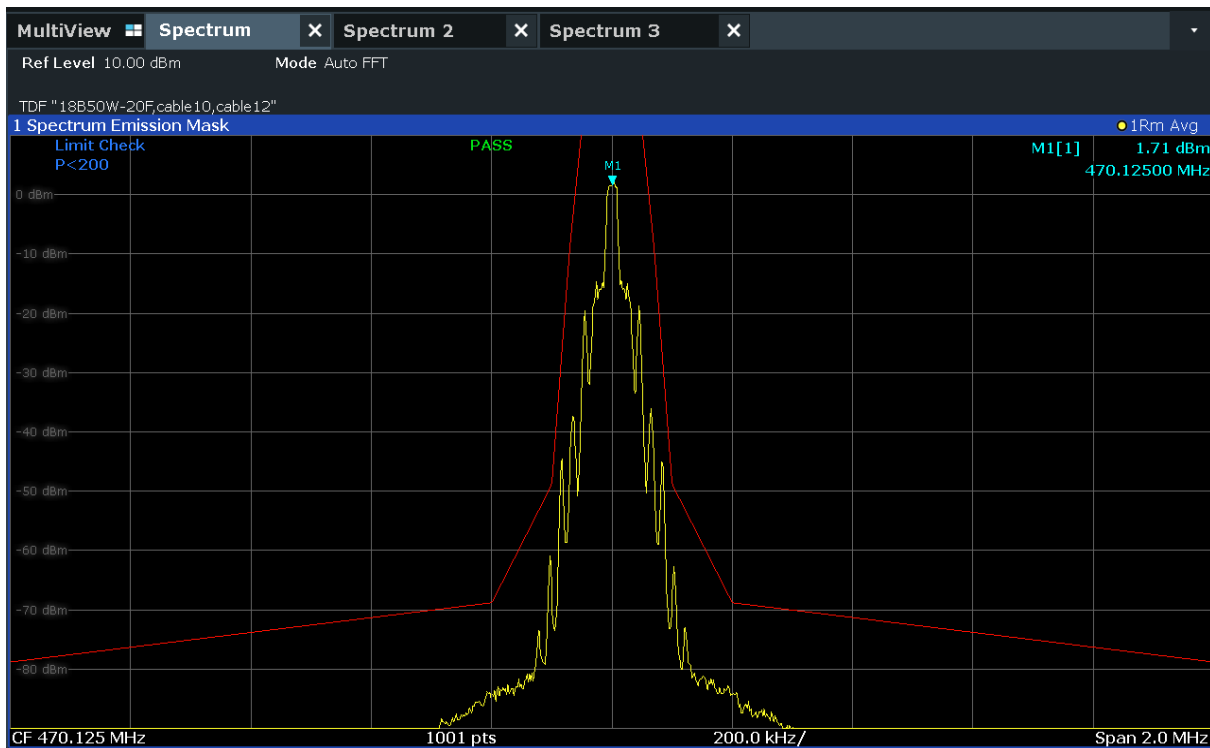
Emission Mask 2 / Power level: High

CH Low : 470.125 MHz

Reference

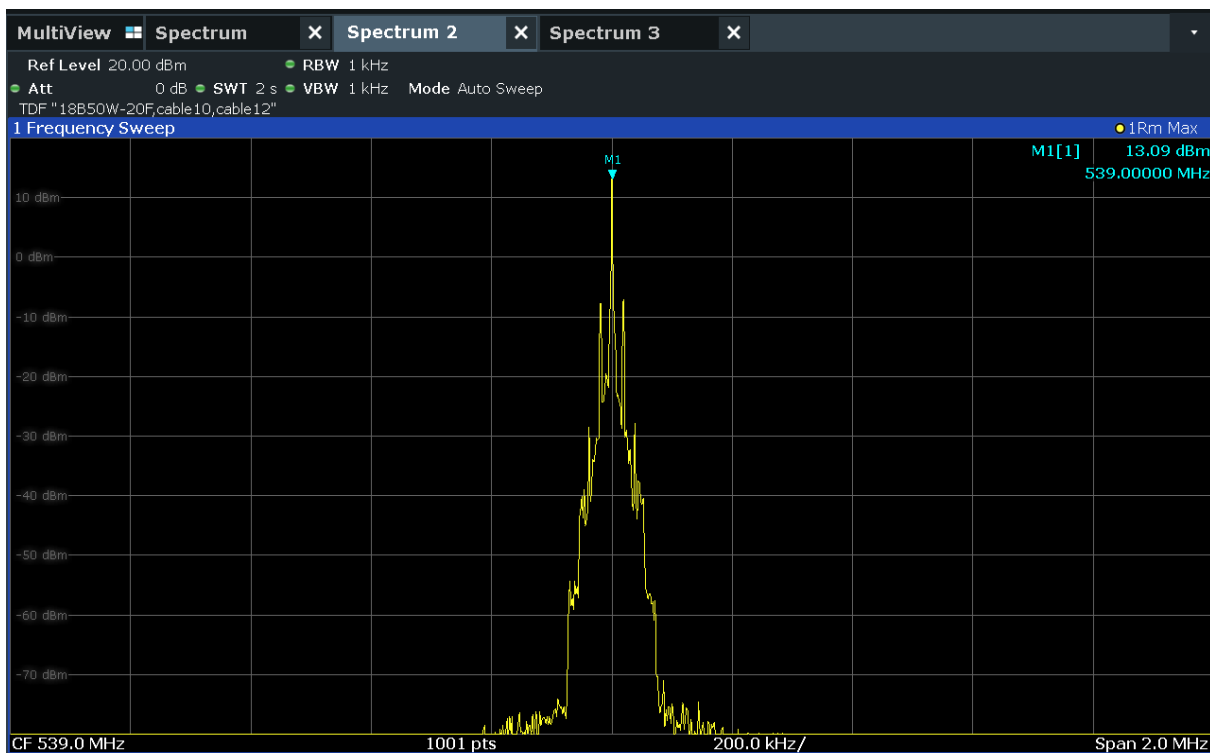


CH Low : 470.125 MHz



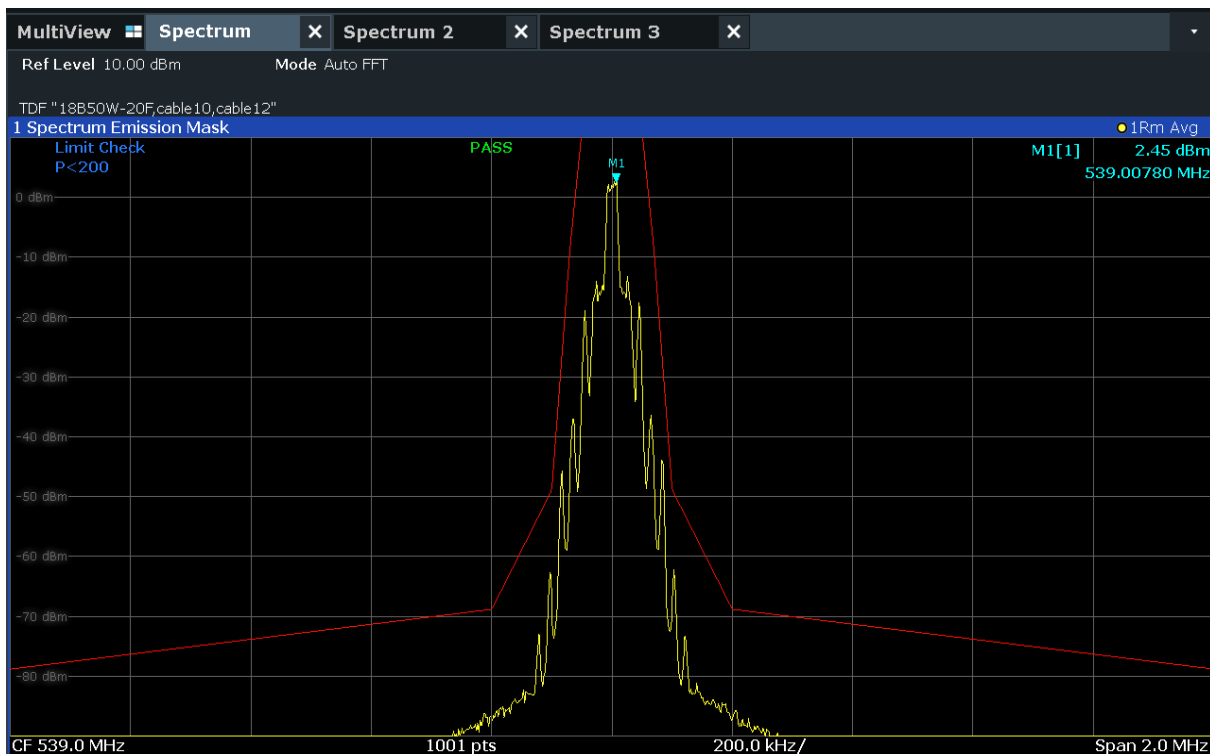
CH Middle : 539.000 MHz

Reference



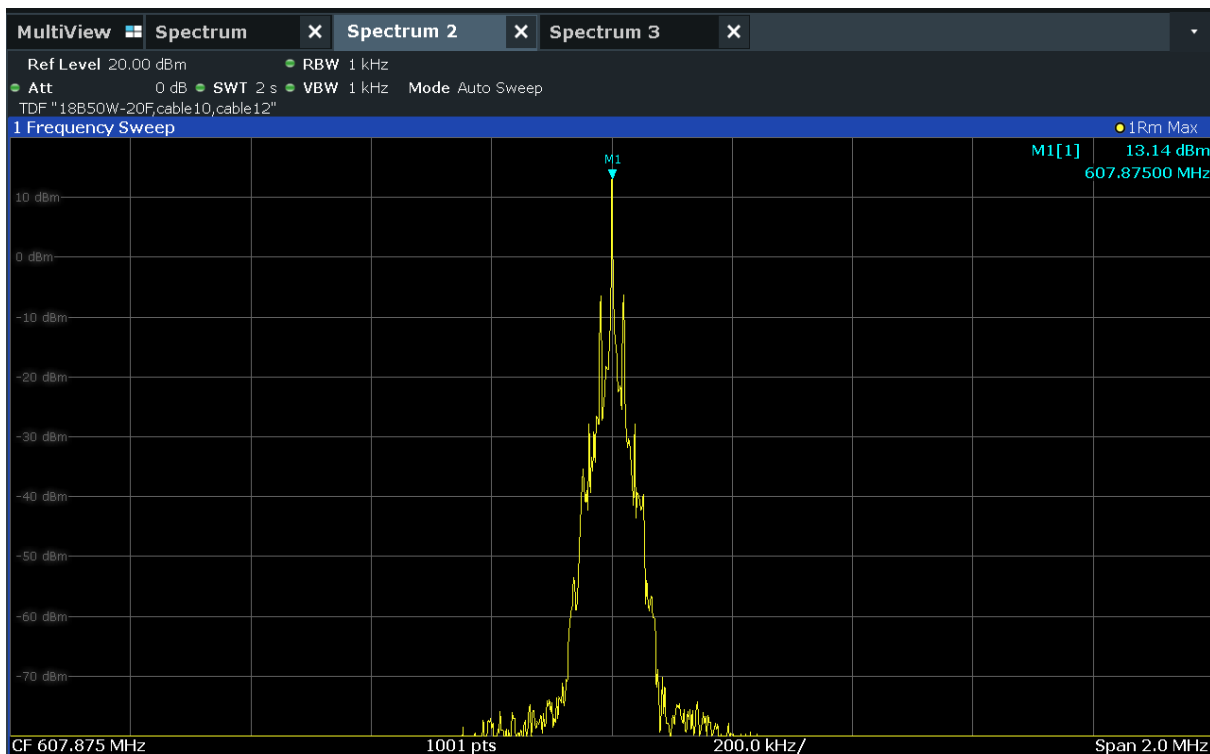
CH Middle : 539.000 MHz

Reference

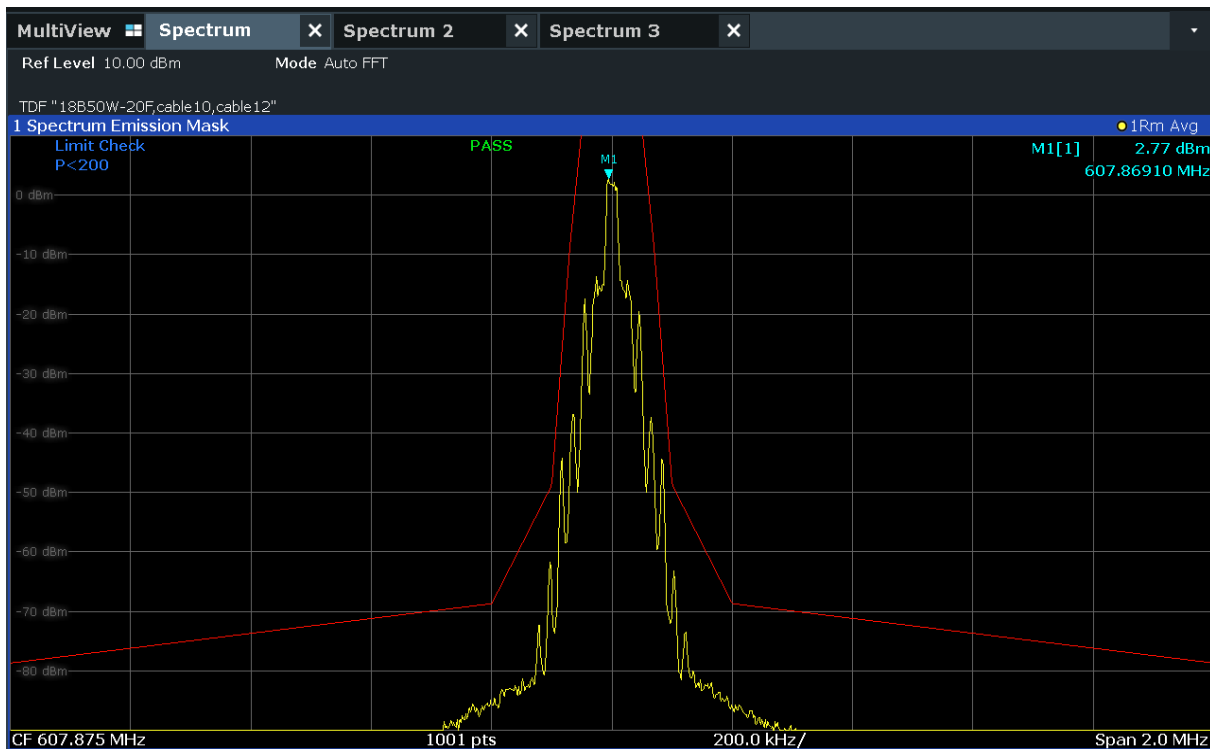


CH High : 607.875 MHz

Reference



CH High : 607.875 MHz



5.4 Spurious Emission On Antenna Port

5.4.1 Standard Applicable [FCC §74.861(e)(6)(iii), §2.1051]

According to §2.1051 of the FCC Rules, the radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions, which are attenuated more than 20 dB below the permissible value, need not be specified

According to §74.861(e)(6) of the FCC Rules, the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

(iii) On any frequency removed from the operating frequency by more than 250 percent up to and including 250 percent of the authorized bandwidth: at least 43 plus $10\log_{10}(\text{output power in watts})$ dB.

5.4.2 Test Environment conditions

- Ambient temperature : (20 - 21) °C • Relative Humidity : (50 - 51) % R.H.

5.4.3 Measurement Procedure

The carrier was modulated 100 % using a 2 500 Hz tone. The spectrum was scanned from the lowest frequency generated to at least the 10th harmonic of the fundamental. The measurements were made in accordance with standard ANSI/TIA-603-E-2016. The RBW = 100 kHz, VBW = 300 kHz and the span set to 10.0 MHz and the spectrum was scanned from 30 MHz to the 10th harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

5.4.4 Test setup

Refer 5.3.4

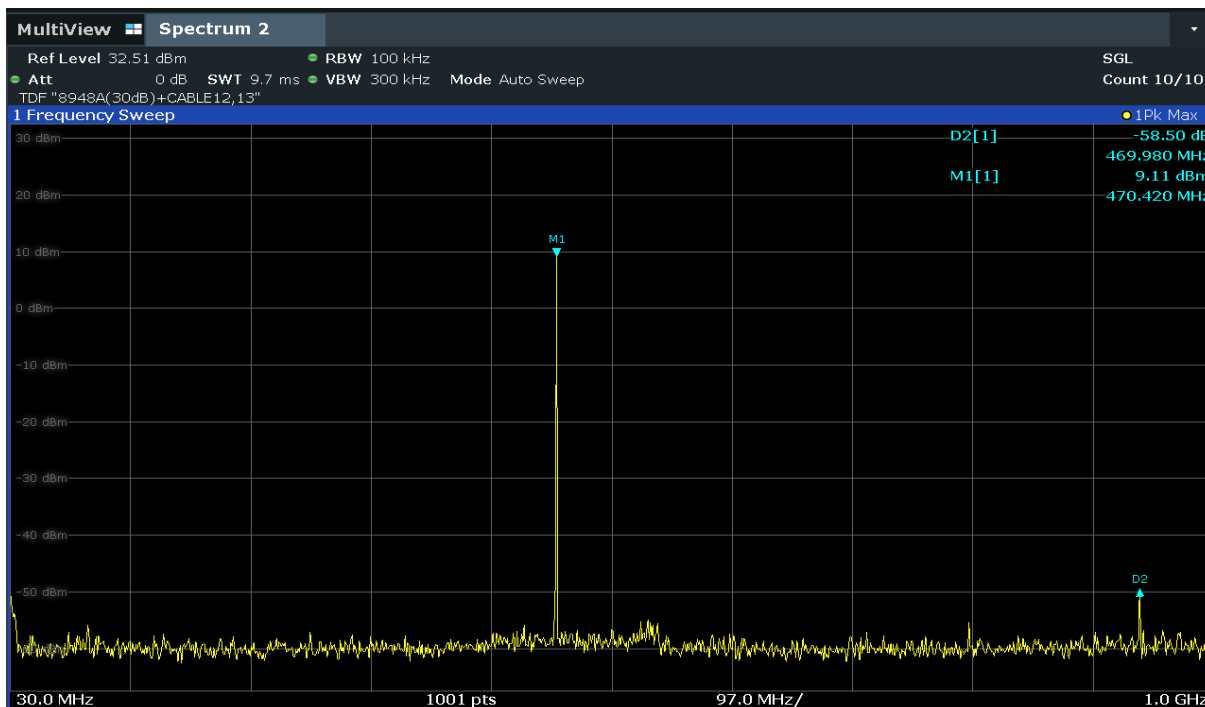
5.4.5 Measurement Result

See the 5.4.6 Test plots

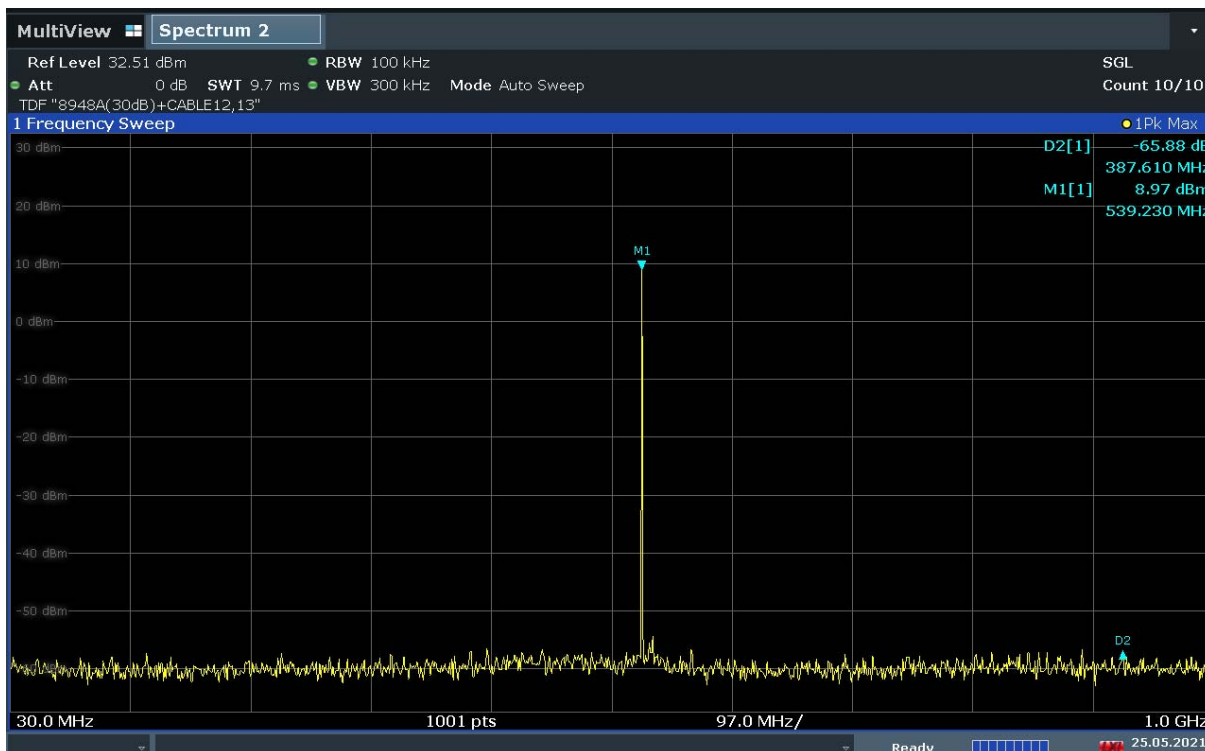
5.4.6 Test Plot

Below 1GHz / Power level: Low

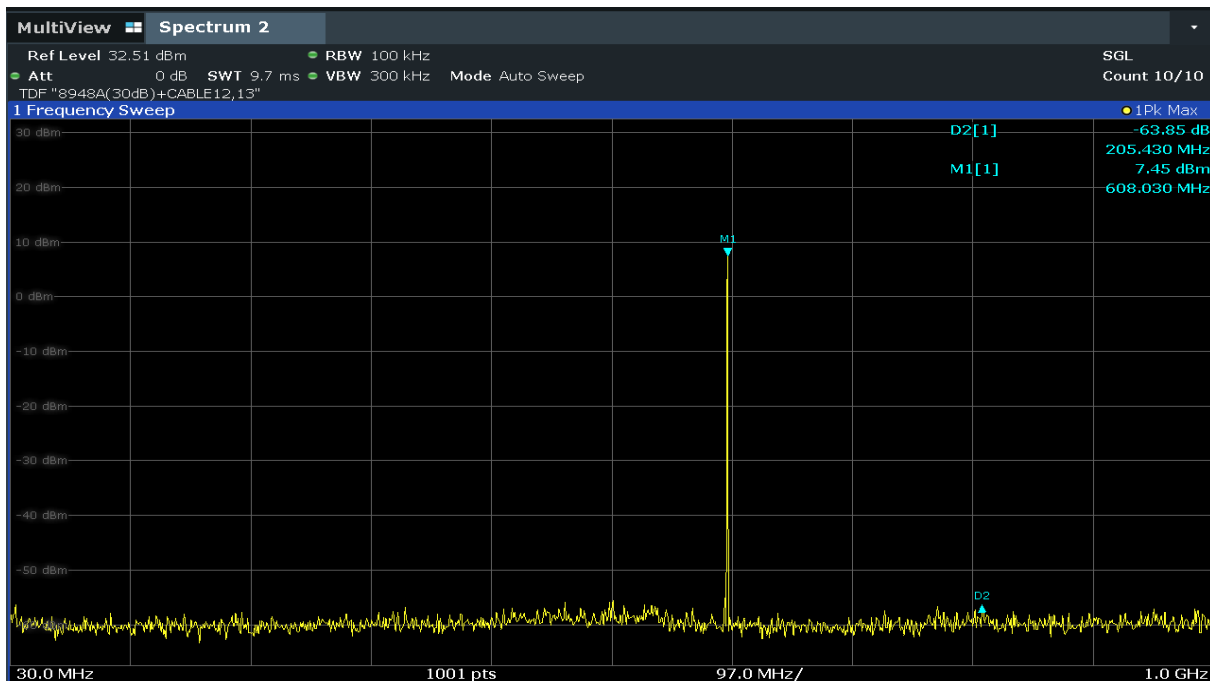
CH Low : 470.125 MHz



CH Middle : 539.000 MHz

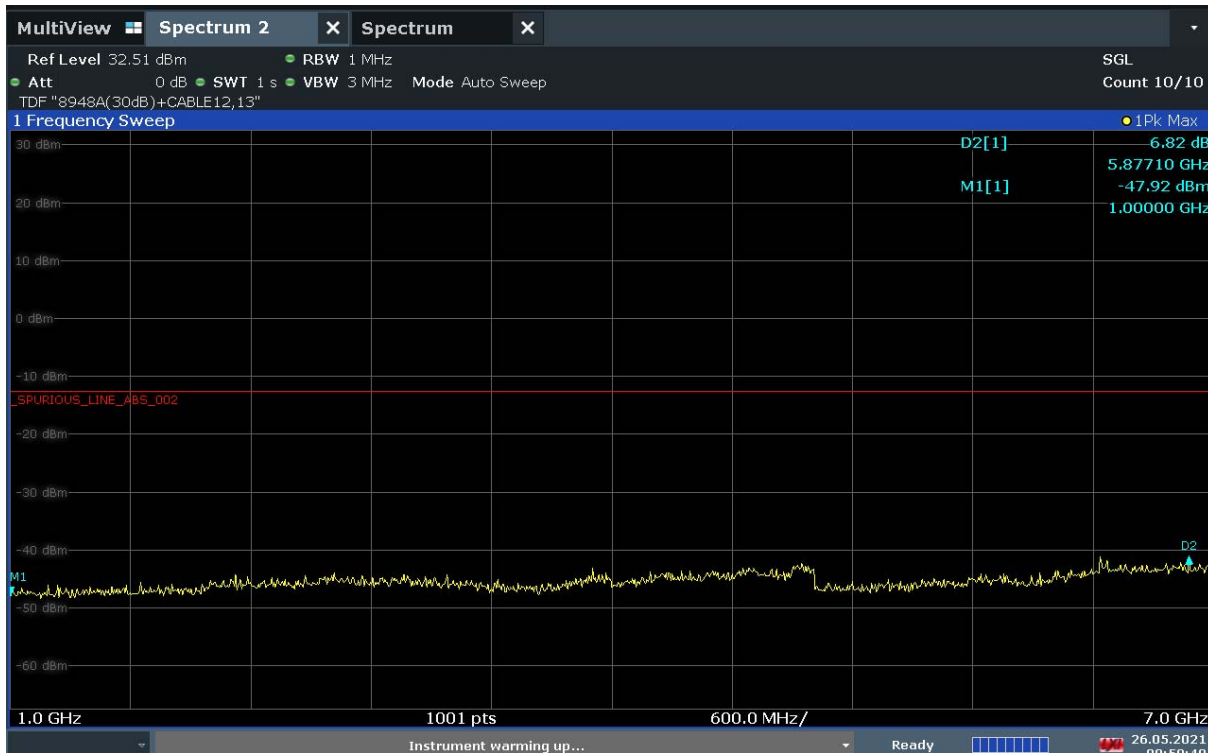


CH High : 607.875MHz

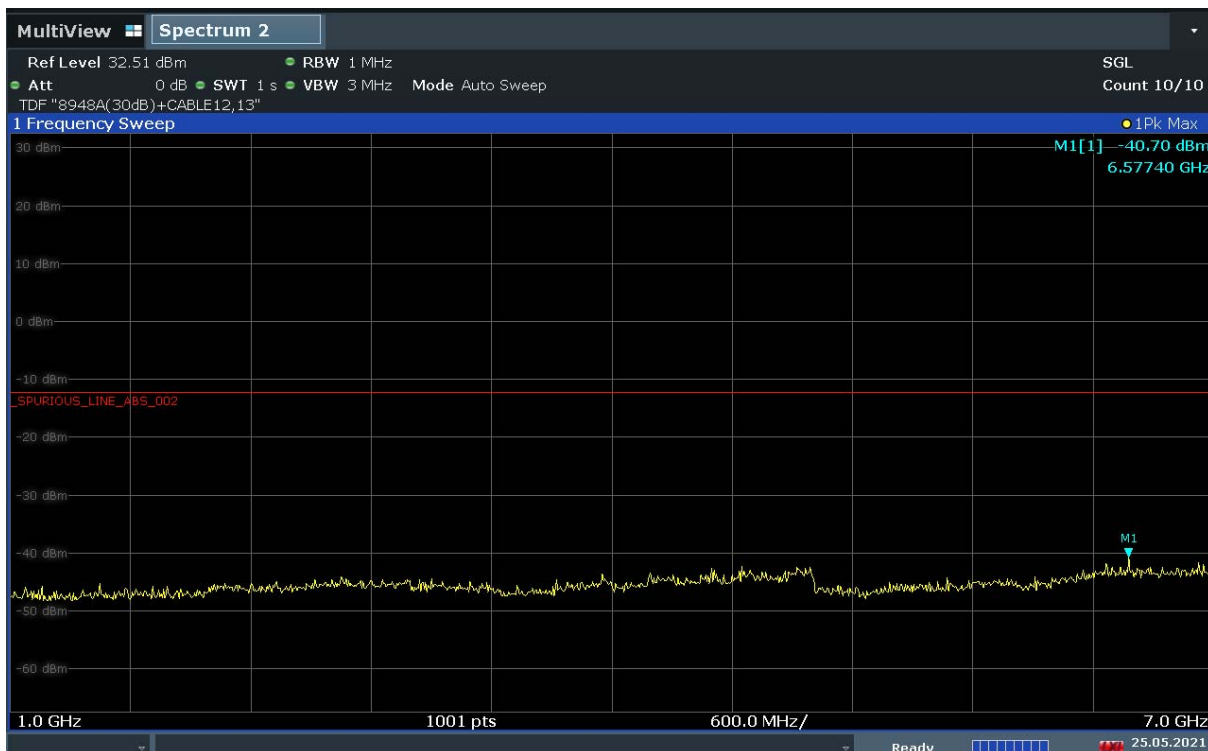


Above 1GHz / Power level: Low

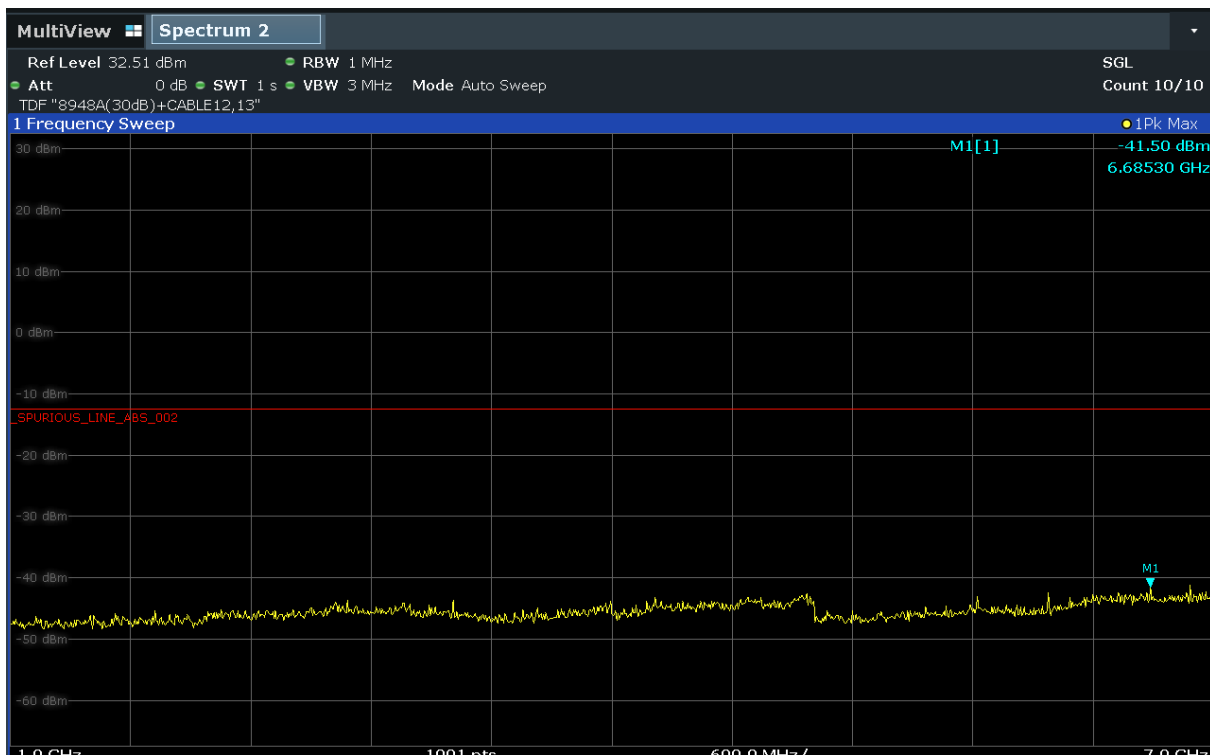
CH Low : 470.125 MHz



CH Middle : 539.000 MHz



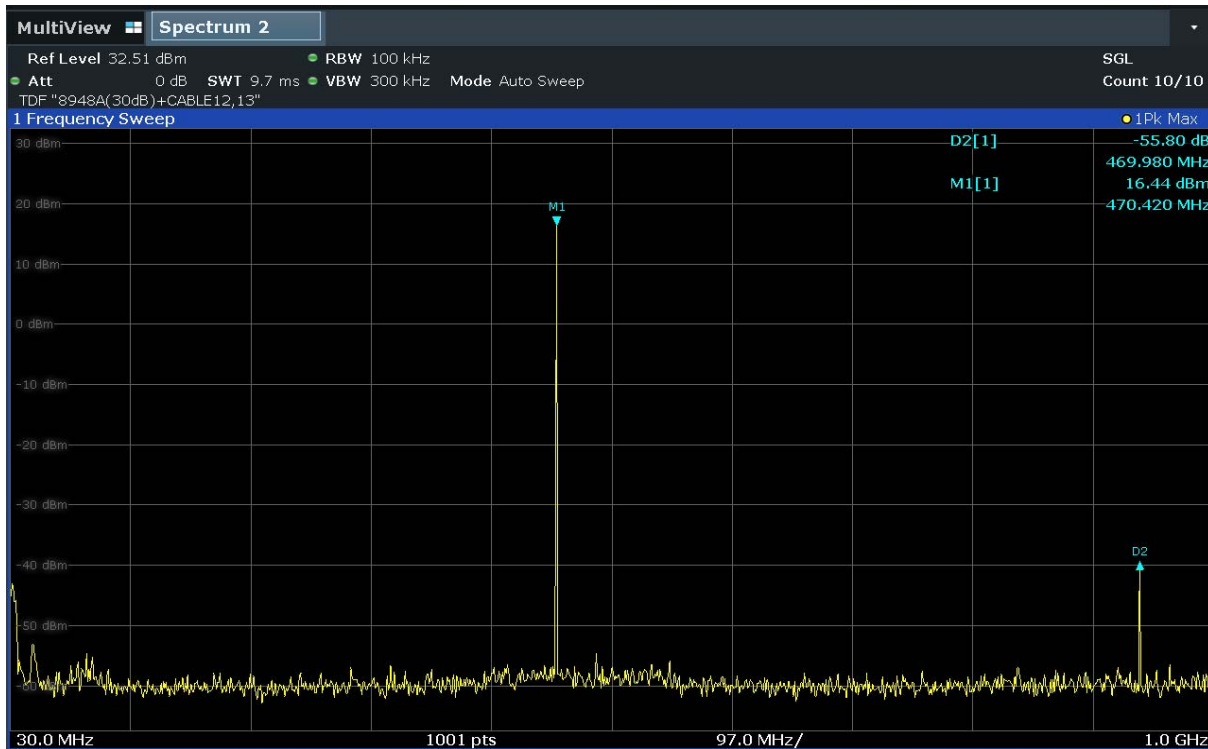
CH High : 607.875 MHz



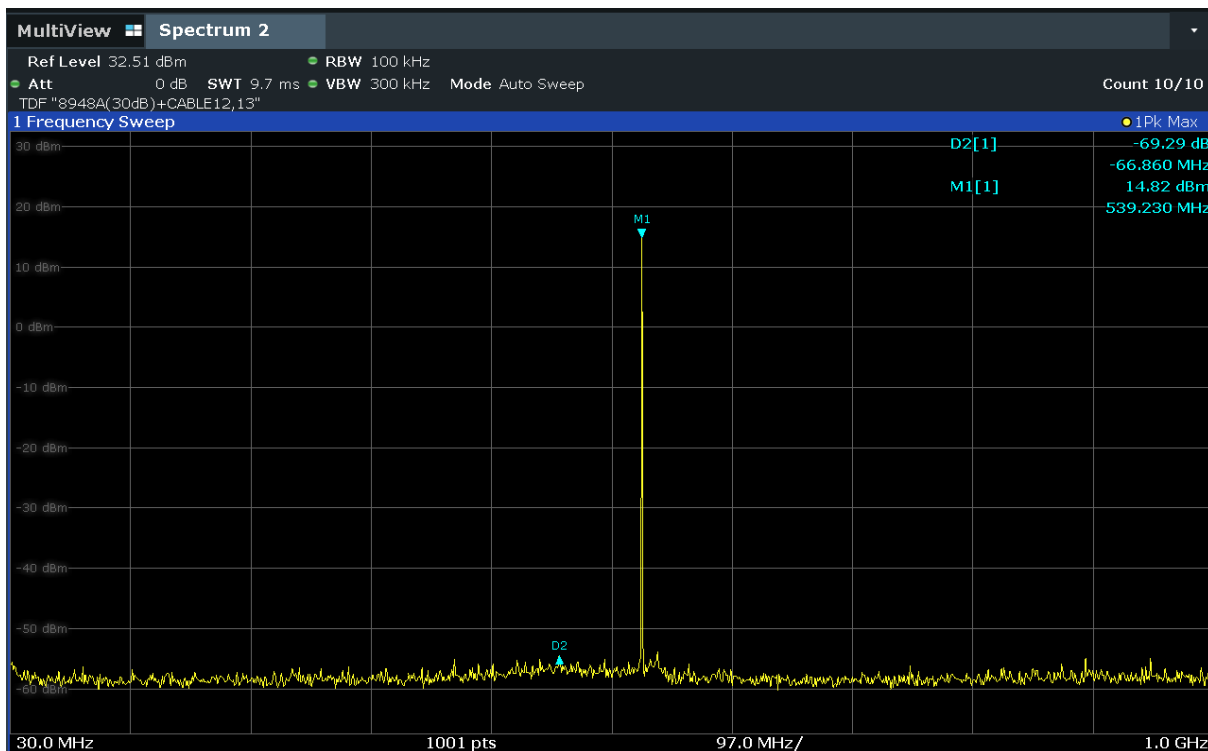
※ Above 1GHz, no radiated spurious signals were detected at less than 6 dB for operating channels.

Below 1GHz / Power level: High

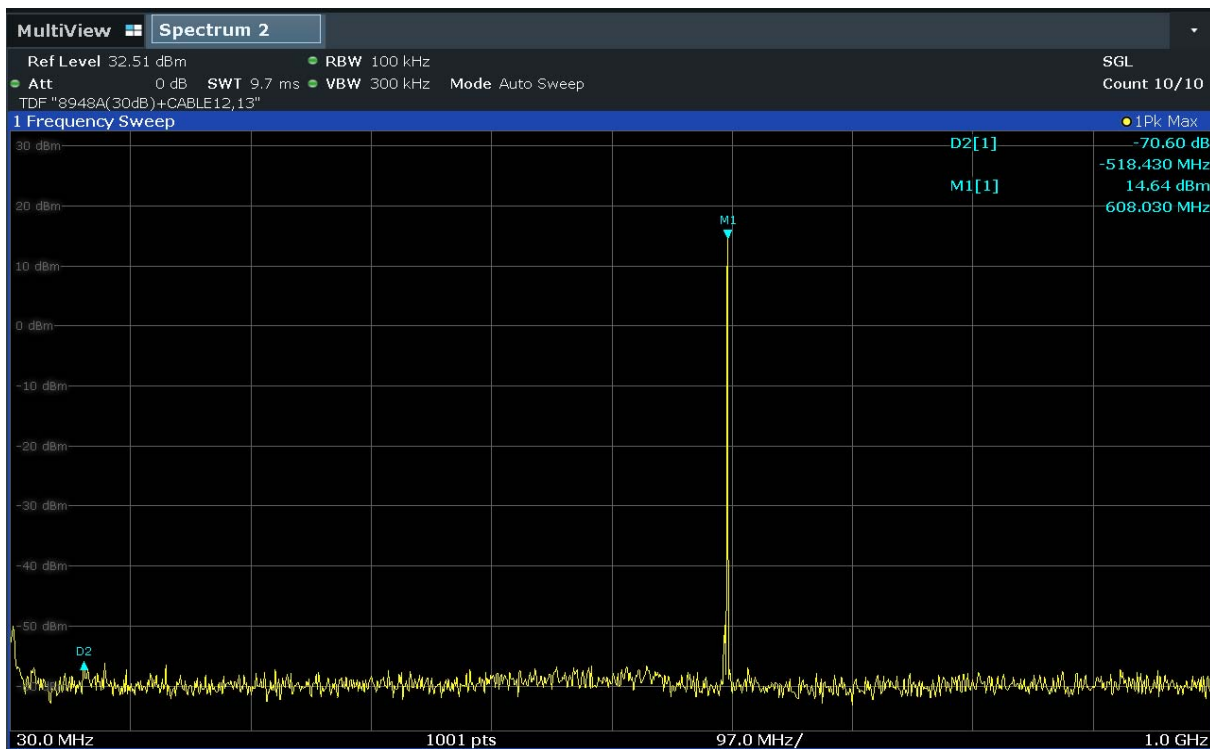
CH Low : 470.125 MHz



CH Middle : 539.000 MHz

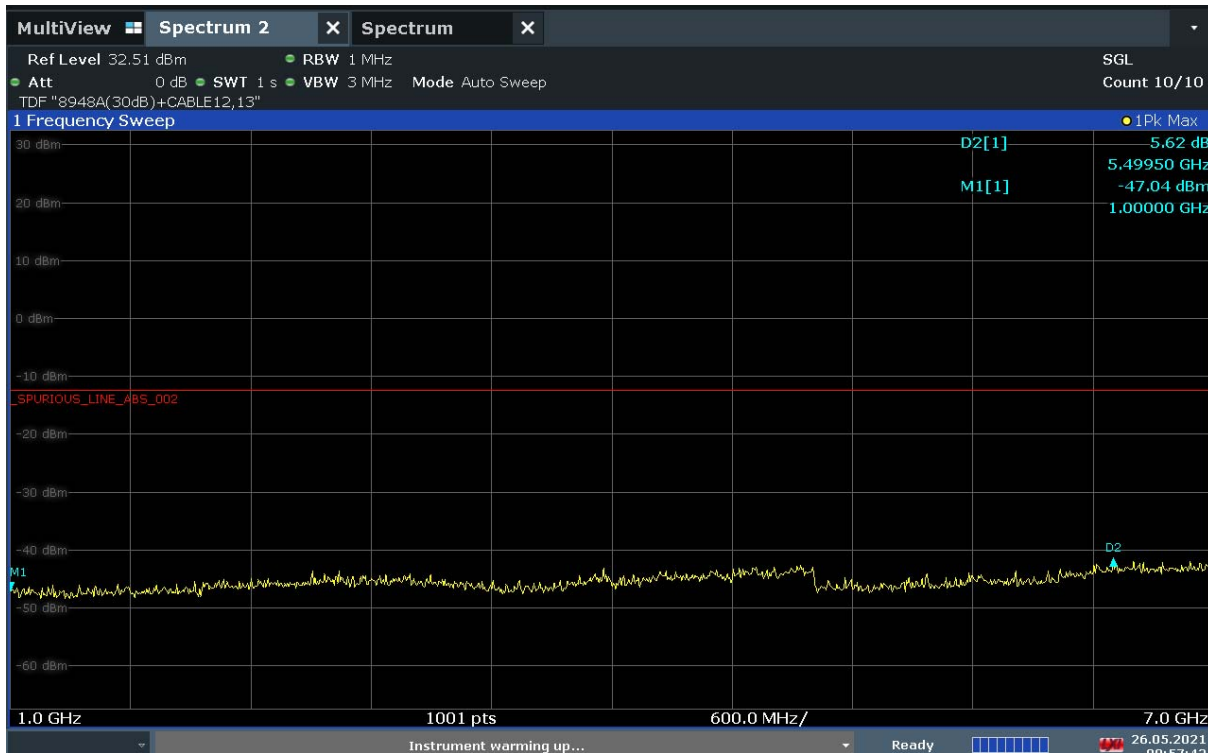


CH High : 607.875 MHz

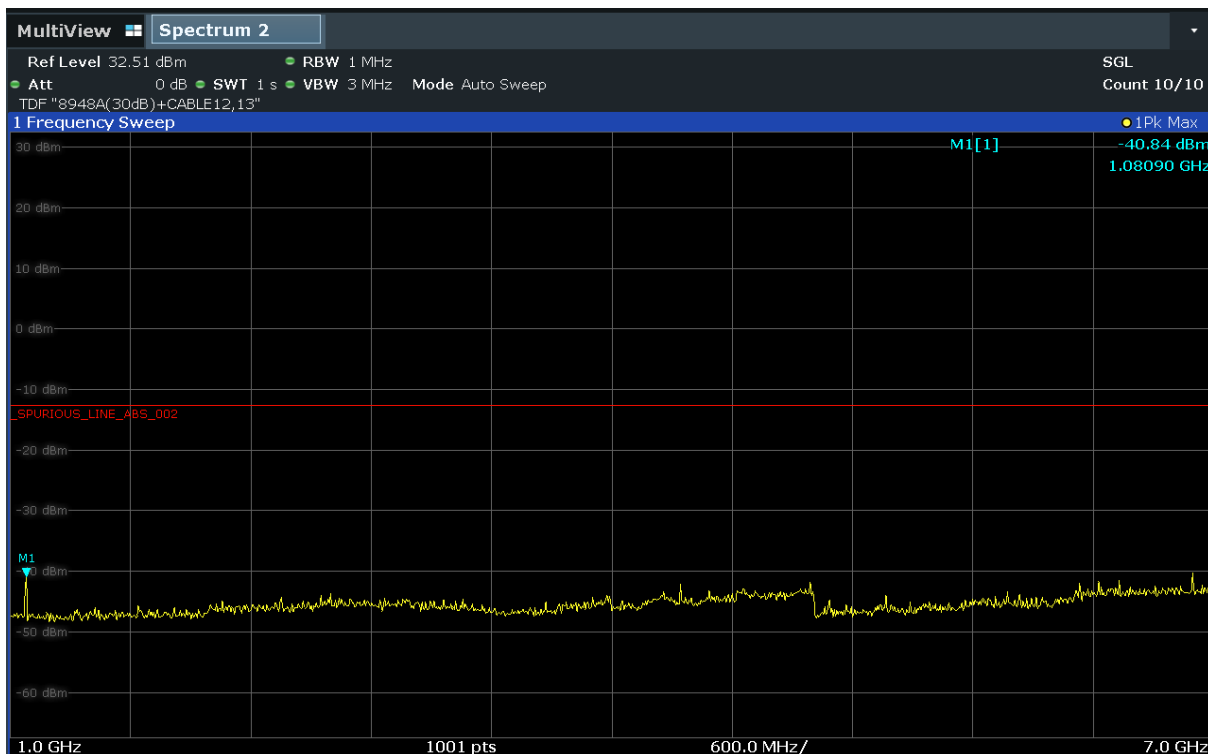


Above 1GHz / Power level: High

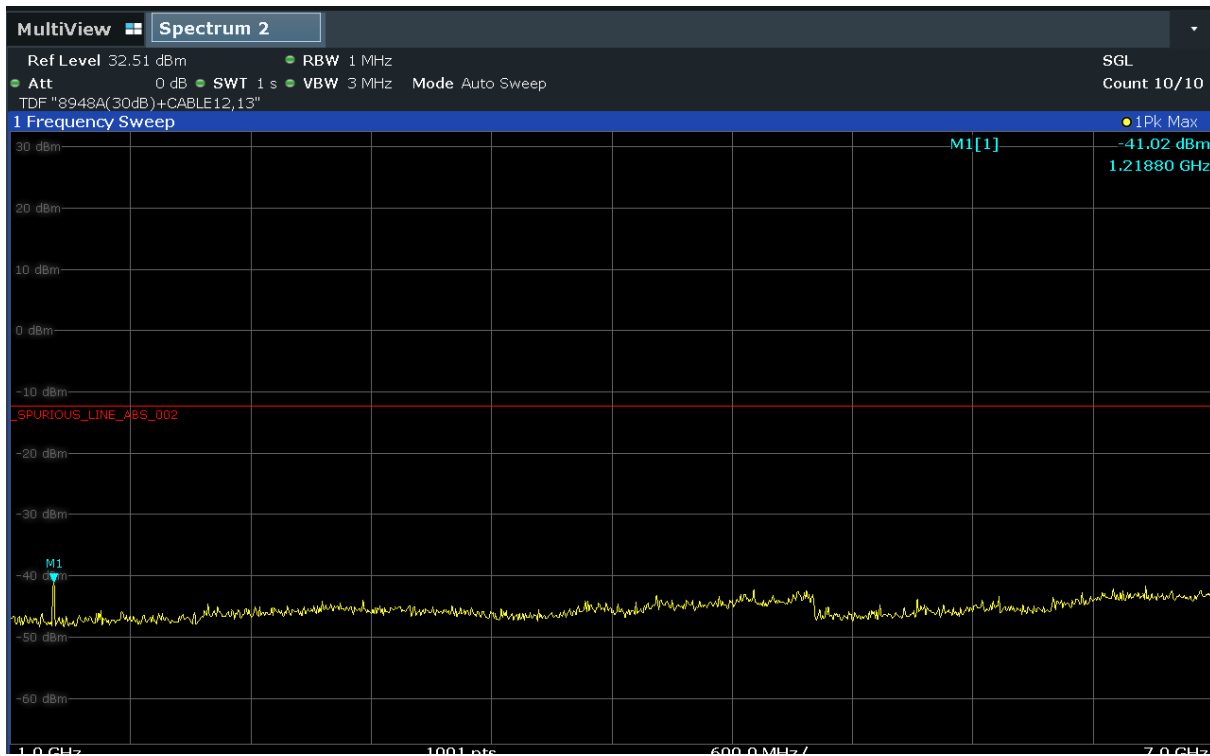
CH Low : 470.125 MHz



CH Middle : 539.000 MHz



CH High : 607.875 MHz



※ Above 1GHz, no radiated spurious signals were detected at less than 6 dB for operating channels.

5.5 Radiated Spurious Emissions

5.5.1 Standard Applicable [FCC §74.861(e)(6)(iii)& §2.1053]

According to §2.1053 of the FCC Rules, measurements shall be made to detect spurious emission that may be radiated directly from the cabinet, control circuits, power leads, or intermediated circuit elements under normal condition of installation and operation. Information submitted shall include the relative radiated power of spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from a half wave dipole antenna.

According to §74.861(e)(6) of the FCC Rules, the mean power of emissions shall be attenuated below the mean out power of the transmitter in accordance with the following schedule:

(iii) On any frequency removed from the operating frequency by more than 250 percent up to and including 250 percent of the authorized bandwidth: at least 43 plus $10\log_{10}(\text{output power in watts})$ dB.

5.5.2 Test Environment conditions

- Ambient temperature : (20 - 21) °C • Relative Humidity : (50 - 51) % R.H.

5.5.3 Measurement Procedure

The EUT was setup according to ANSI/TIA 603E-2016 for compliance to FCC 47CFR part 74 requirements.

As a below test procedure (①~⑬), The result value of measurement is performed to condition of the below; The EUT will operate in continuous transmission mode during the time necessary to perform the measured of the frequency. Substitution method was performed to determine the actual P_{erp} (or P_{eirp}) emission levels of the EUT.

The following test procedure as below;

The test is performed in a fully pyramidal chamber to determine the accurate frequencies, after maximum emissions level will be checked on a test chamber and measuring distance is 3 m from EUT to test antenna.

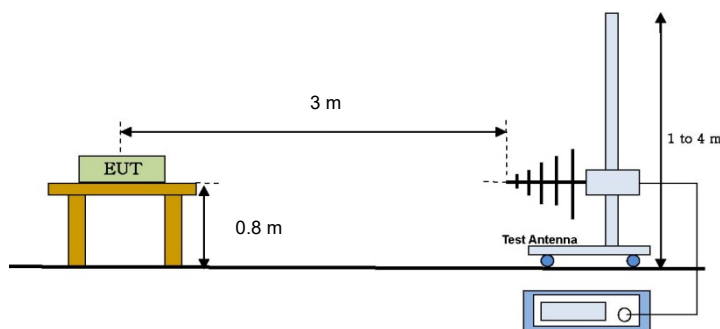
- ① The EUT was set on with continuous transmission mode and placed on a 0.8 meter high non-conductive table on the chamber.
- ② The test antenna is used on Bi-Log antenna at above 30 MHz, and used on Horn antenna at 1 GHz and then the measurements are repeated with the test antenna for vertical and horizontal polarization. The output of the test antenna will be connected to a measuring receiver, and it is set to tuned over the required standard measuring frequency range.
- ③ At each frequency at which a relevant spurious component is detected, the test antenna will be raised and lowered through the specified range of heights until an maximum signal level is detected on the measuring receiver.
- ④ The EUT is position x, y, z axis on rotating through 360 degrees in the horizontal plane, until the Max. signal level is detected by the measuring receiver.
- ⑤ The receiver is scanned from requested measuring frequency band and then the maximum meter reading is recorded. The radiated emissions were measured with requested standard specification (detector and resolution bandwidth etc.)
- ⑥ The EUT was then removed and replaced with substitution antenna .The center of the antenna was approximately at the same location as the center of the EUT, and calibrated for the frequency of the spurious component detected.
- ⑦ Signal generator output port connected with substitution antenna input port. If necessary, may use shield cable between signal generator and substitution antenna
- ⑧ The frequency of the calibrated signal generator is set to frequency of the spurious component detected, and the input attenuator setting of the measuring receiver was adjust in order to increase the sensitivity of

the measuring receiver, if necessary

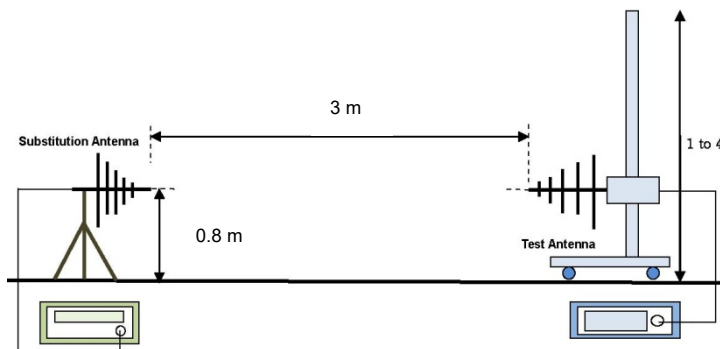
- ⑨ The test antenna was raised and lowered through the specified range of heights to ensure that maximum signal is received.
 - ⑩ The input signal to the substitution antenna was be adjusted until an equal or a known related level to that detected from the transmitter is obtained on the measuring receiver.
 - ⑪ The input signal to the substitution antenna was be recorded as a power level and corrected for any change of input attenuator setting of the measuring receiver
 - ⑫ The measure of P_{erp} (or P_{eirp}) the spurious components is the larger of the two power levels recorded for each spurious component at the input to the substitution antenna, corrected for the gain of the substitution antenna, if necessary.
 - ⑬ It is correction to signal generator's offset value. In this case of P_{erp} (or P_{eirp}) shall calculated as follow as formula ;
- P_{erp} (or P_{eirp}) = Signal generator level (dBm) – Cable loss(dB) + Standard Antenna gain

The measurement frequency range from 30 MHz - 10th Harmonic of fundamental was investigated.

5.5.4 Test Setup



[Radiated measurement setup_Below than 1 GHz]



[Effective Radiated Power measurement setup]

※ Above the test antenna is used on Horn antenna at above 1 GHz.

Measurement Uncertainty

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI C63.10-2013. All measurement uncertainty values are shown with a coverage factor of $k = 2$ to indicate a 95% level of confidence. The measurement uncertainty shown below meets or exceeds the UCISPR measurement uncertainty values specified in CISPR 16-4-2 and, thus, can be compared directly to specified limits to determine compliance.

Radiated Emission measurement: Below 1 GHz: 3.62 dB (CL: Approx 95 %, $k=2$)
Above 1 GHz: 4.18 dB (CL: Approx 95 %, $k=2$)

5.5.5 Measurement Result

The following frequencies were selected based on the antenna radiated results, the worst case are presented.

(30 MHz ~ 7 GHz)							
The worst test results high channel 607.875 MHz							
Frequency [MHz]	SG. Level [dBm]	ANT.Gain [dBd]	Cable Loss [dB]	P. Mea [dBm]	Limit [dBm]	Margin [dB]	Polarity
799.96	-39.73	-2.20	1.49	-43.42	-13.00	30.42	H
875.80	-42.80	-3.95	1.49	-48.24	-13.00	35.24	H
The worst test results high channel 607.875 MHz							
Frequency [MHz]	SG. Level [dBm]	ANT.Gain	Cable Loss [dB]	P. Mea [dBm]	Limit [dBm]	Margin [dBm]	Polarity
-	-	-	-	-	-13.00	-	-

※ Above 1GHz, no radiated spurious signals were detected at less than 6 dB for operating channels

5.6 Frequency Stability

5.6.1 Standard Applicable [FCC §74.861(e)(4) & §2.1055]

According to §2.1055 of the FCC Rules, the frequency stability shall be measure with variation of ambient temperature from -30° C to +50 ° C, and according to FCC 2.1055(d)(1), the frequency stability shall be measured with reducing primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

According to §74.861(e)(4) of the FCC Rules, the frequency tolerance of the transmitter shall be 0.005 percent.

5.6.2 Test Environment conditions

- Ambient temperature : (20 - 21) °C • Relative Humidity : (50 - 51) % R.H.

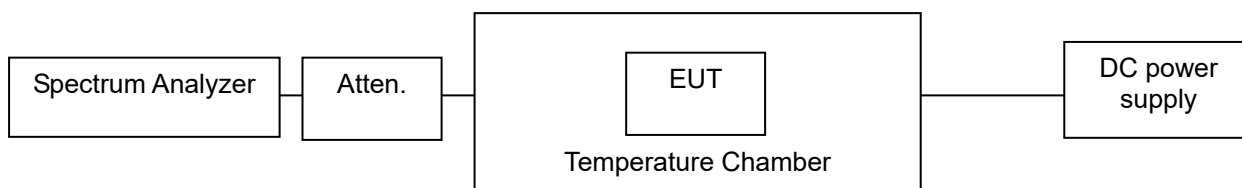
5.6.3 Measurement Procedure

EUT connect to Spectrum analyzer, test is performed in T&H chamber.

These measurements shall also be performed at normal and extreme test conditions.

- Test Method : ANSI/TIA-603-E-2016, clause 2.2.2 for frequency stability tests
 - Frequency stability with respect to ambient temperature
 - Frequency stability when varying supply voltage

5.6.4 Test setup



5.6.5 Measurement Result

- Operating frequency : 539.000 MHz
- Channel : mid

Temp(°C)	Power Supply	Measured Frequency (MHz)	Frequency error (Hz)	Frequency error (%)	Test Results
50	DC 12 (V _{nom})	539.000 152	152	0.000028	Compliance
40		538 999 938	-62	-0.000012	Compliance
30		538.999 864	-136	-0.000025	Compliance
20		539.000 168	168	0.000031	Compliance
10		539.000 171	171	0.000032	Compliance
0		538.999 952	-48	-0.000009	Compliance
-10		539.000 132	149	0.000024	Compliance
-20		539.000 103	103	0.000019	Compliance
-30		539.000 146	146	0.000027	Compliance
Nom Temperature	DC 10.2 (V _{min})	539.000 169	169	0.000031	Compliance
Nom Temperature	DC 13.8 (V _{max})	539.000 164	164	0.000030	Compliance
Limit	0.005%				