

Annex 202:

Measurement diagrams 23-1-0145601T010_TR1-A202-R01

Number of pages:	36	Date of Report:	2025-Feb-07
Testing company:	cetecom advanced GmbH Untertuerkheimer Str. 6-10 66117 Saarbruecken GERMANY	Applicant:	Brose Fahrzeugteile SE & Co. KG, Bamberg
Product: Model:	Periphery Monitoring Radar (PMR) PMRGEN2		
FCC ID:	2AHV8-G67498		
Testing has been carried out in accordance with:	FCC – Title 47, Chapter I, Subchapter D Part 95, Subpart M The 76-81GHz Band Radar Service		

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1 Measurement diagrams

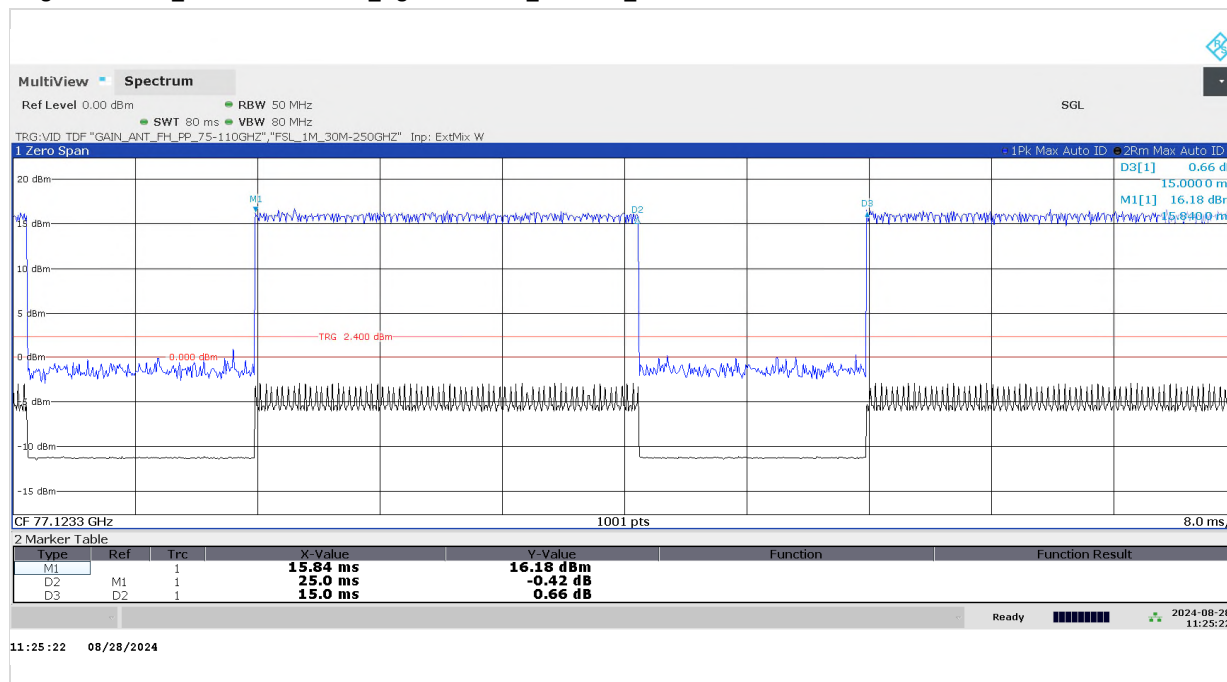
1.1 Timing of transmissions

Diagram: TID000_23-1-0145601T010_Cycle time_40ms_S19



Test Mode emissions, Cycle-Time=40ms

Diagram: TID001_23-1-0145601T010_Signal on 25ms_off 15ms_S19



TX-on, TX-off times

1.2 Peak power

Different measurements are taken to investigate the effect of desensitization.

Diagram no.: TID002_23-1-0145601T010_Peak_EIRP_AntH_RBW_1MHz_S19.PNG

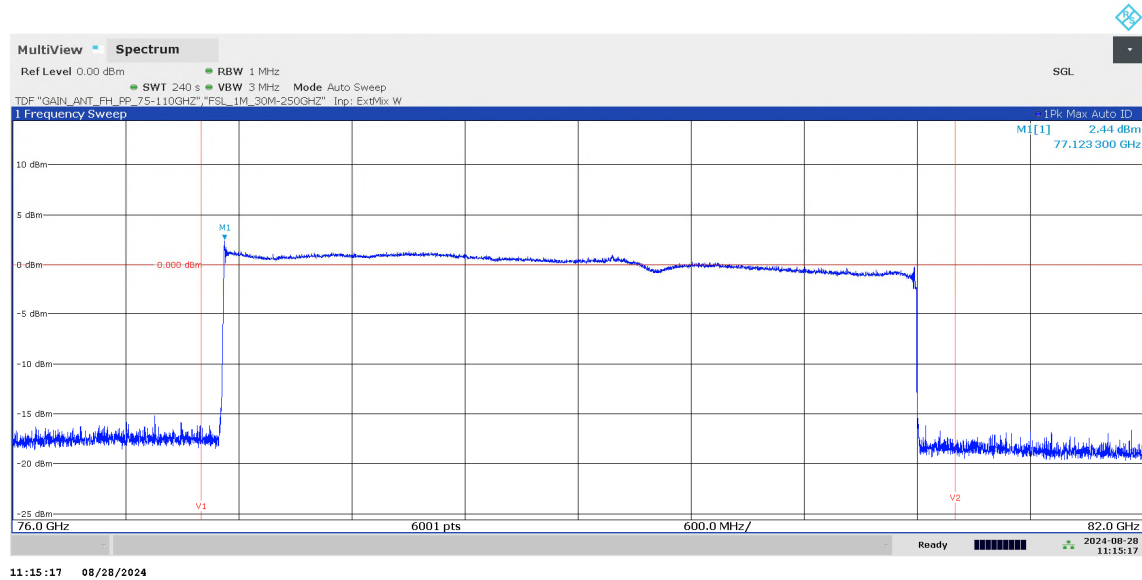


Diagram no.: TID003_23-1-0145601T010_Peak_EIRP_AntH_RBW_10MHz_S19.PNG

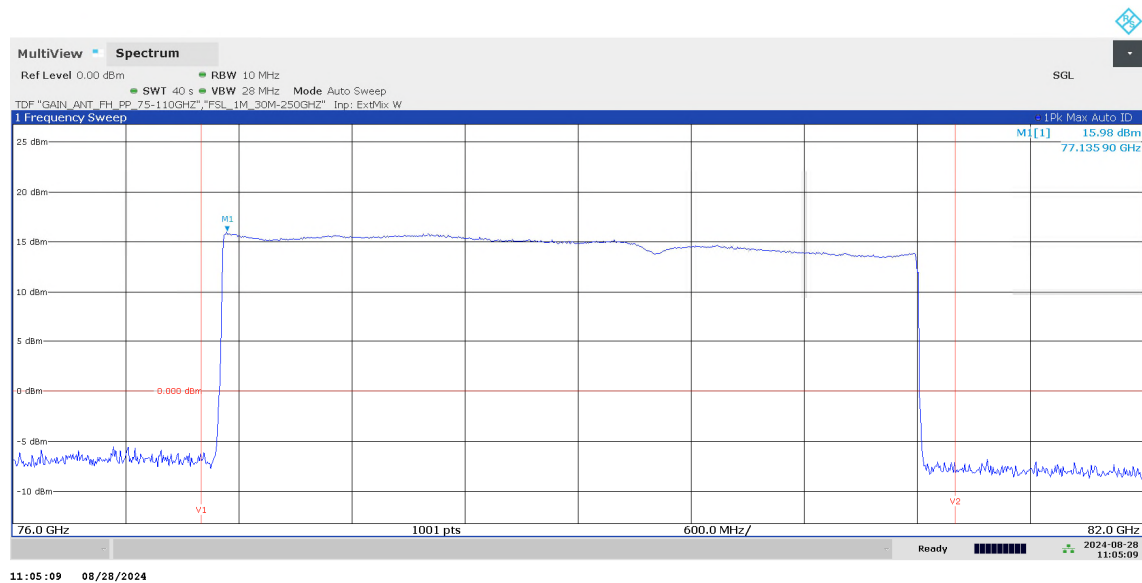


Diagram no.: TID004_23-1-0145601T010_Peak_EIRP_AntH_RBW_20MHz_S19.PNG

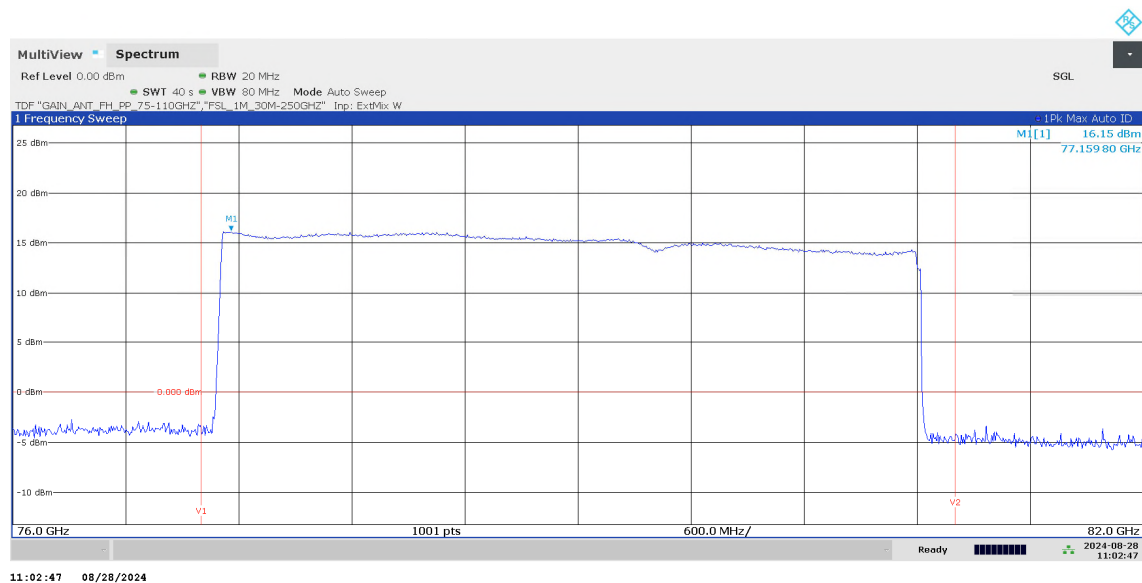


Diagram no.: TID005_23-1-0145601T010_Peak_EIRP_AntH_RBW_30MHz_S19.PNG

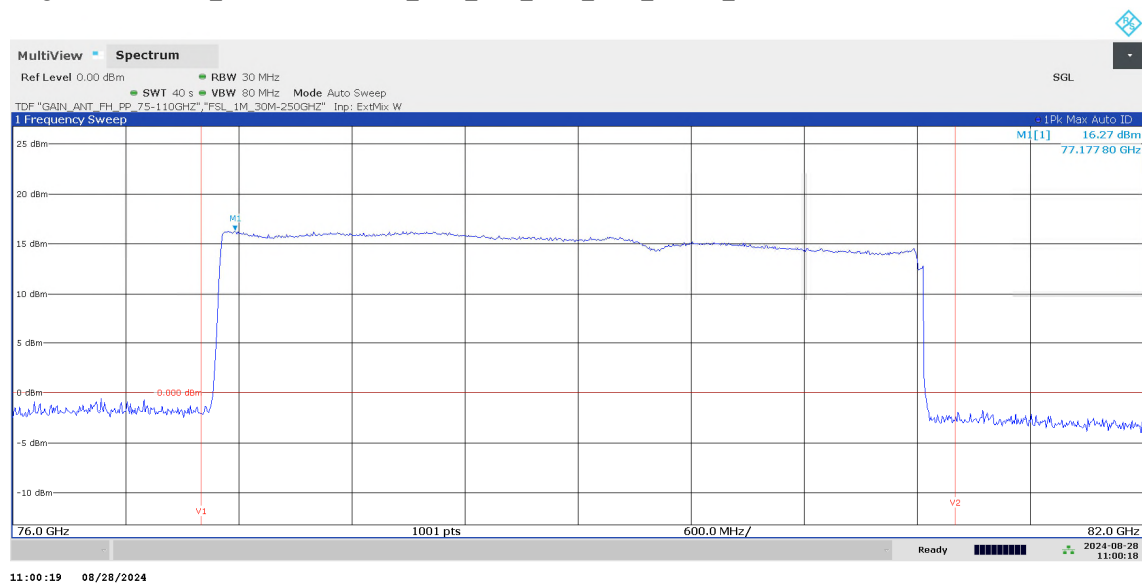
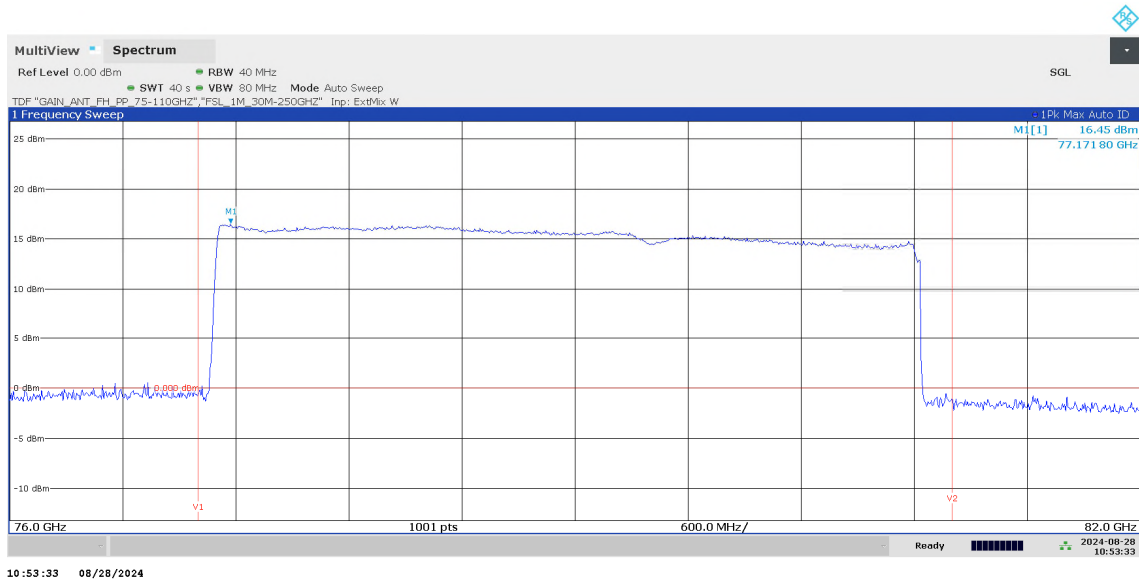
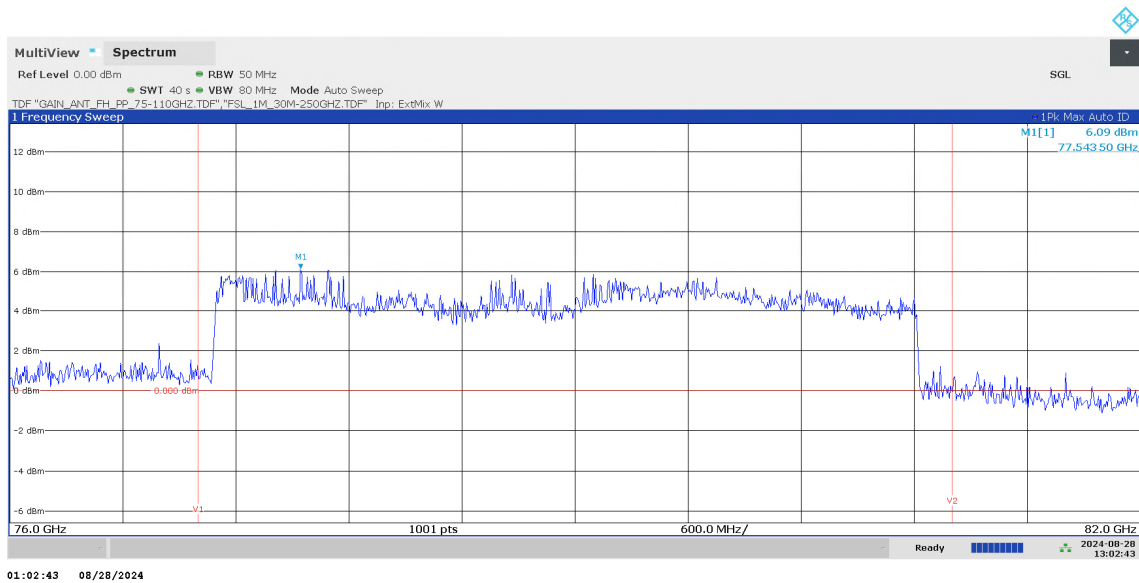


Diagram no.: TID006_23-1-0145601T010_Peak_EIRP_AntH_RBW_40MHz_S19.PNG



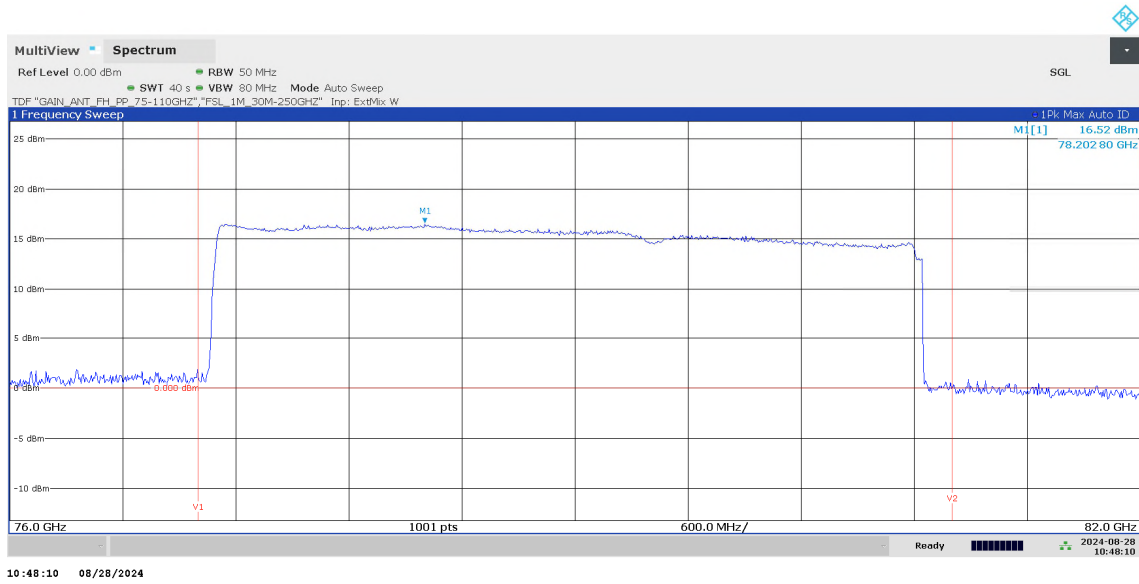
Final measurement result with RBW=50MHz: 16.45dBm (antenna horizontal polarisation)

Diagram no.: TID007_01_23-1-0145601T010_Peak_EIRP_AntV_RBW_50MHz_S19.PNG



Antenna vertical polarisation: not worst-case.

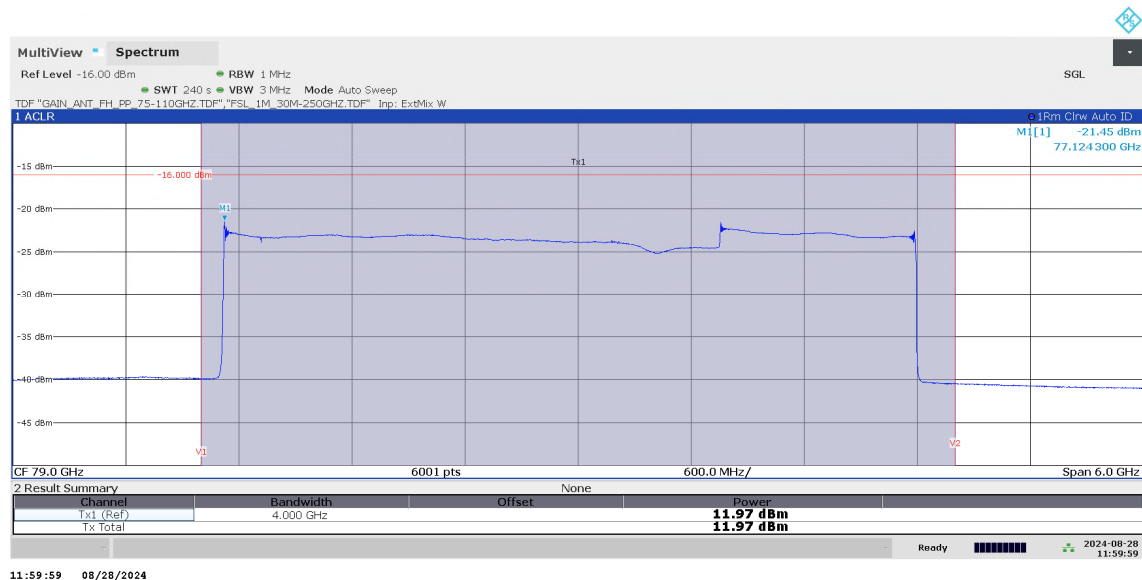
Diagram no.: TID007_23-1-0145601T010_Peak_EIRP_AntH_RBW_50MHz_S19.PNG



Final measurement result with RBW=50MHz: 16.52dBm (antenna horizontal polarisation)

1.3 Channel power

Diagram no.: TID010_23-1-0145601T010_Channel_Power_AntH_4 GHz_S19.PNG



1.4 Radiated emissions

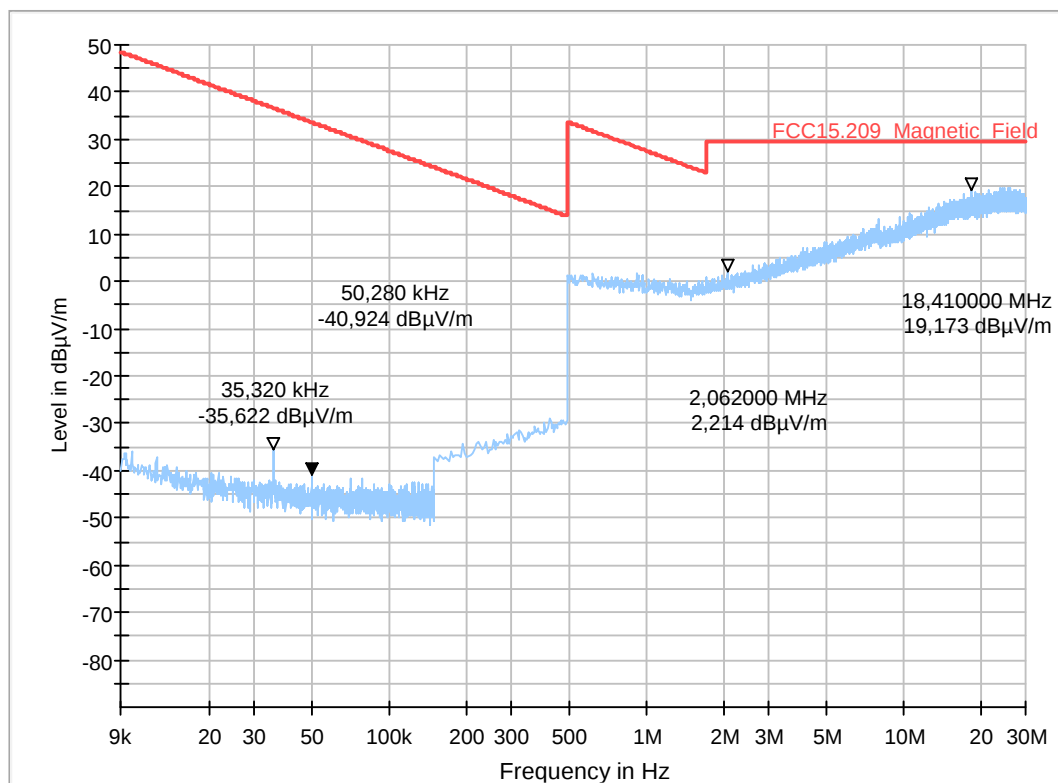
1.4.1 Radiated emissions (f<30MHz)

TID010a_23-1-0145601T010_Magnetic_Field_9kHz-30MHz_EUT_front_rear_left_right

Common Information

Test description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test Site Location:	Ref.-Nr. 441 Semi Anechoic Chamber (SAC1) with 3 m measurement distance
Version of Testsoftware:	EMC32 V10.60.20
Distance correction:	used accord. table, pls. see test report
Technical Data:	Please see page 2 for detailed data of measurement setup
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test Standard:	FCC 15.205 § 15.209; RSS-Gen: Issue 5
Operator:	AHo
Operating Mode:	TX-on, RADAR Active
Power during tests:	12V DC
Environmental Conditions:	Humidity: 52% rH; Temperature: 21 °C
EUT Setup:	EUT front, rear, right, left
Verdict:	Passed

Full Spectrum

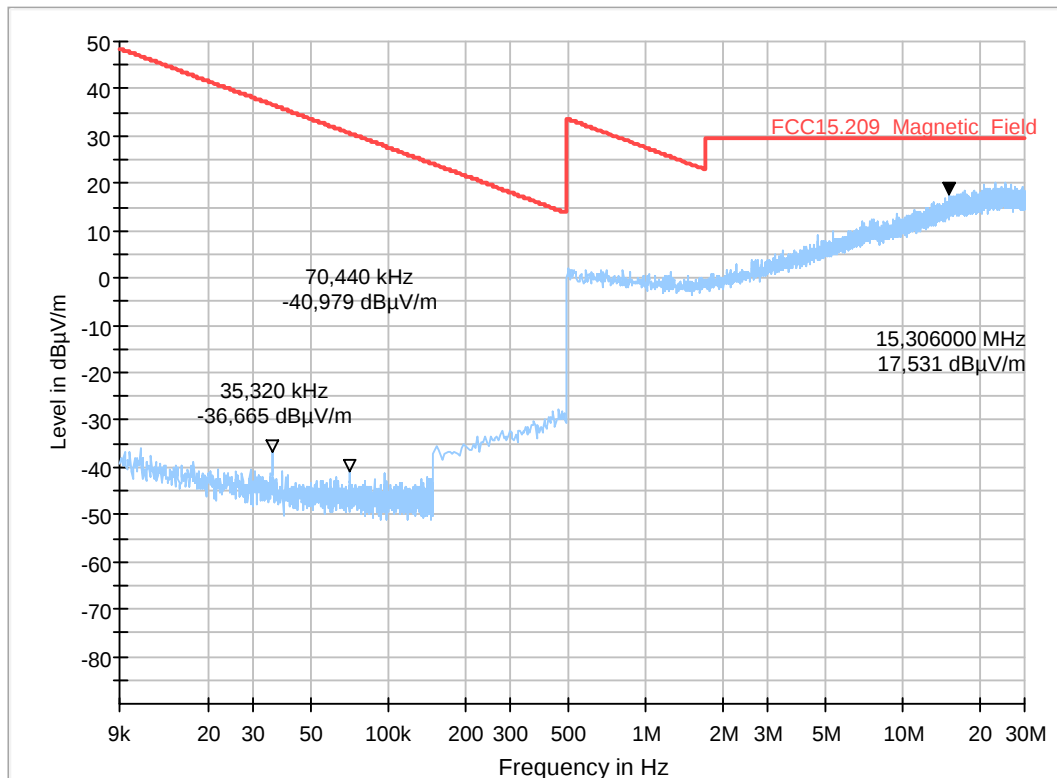


TID010b_23-1-0145601T010_Magnetic_Field_9kHz-30MHz_EUT_top_bottom_left_right

Common Information

Test description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test Site Location:	Ref.-Nr. 441 Semi Anechoic Chamber (SAC1) with 3 m measurement distance
Version of Testsoftware:	EMC32 V10.60.20
Distance correction:	used accord. table, pls. see test report
Technical Data:	Please see page 2 for detailed data of measurement setup
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test Standard:	FCC 15.205 § 15.209; RSS-Gen: Issue 5
Operator:	AHo
Operating Mode:	TX-on, RADAR Active
Power during tests:	12V DC
Environmental Conditions:	Humidity: 52% rH; Temperature: 21 °C
EUT Setup:	EUT top, bottom, right, left
Verdict:	Passed

Full Spectrum

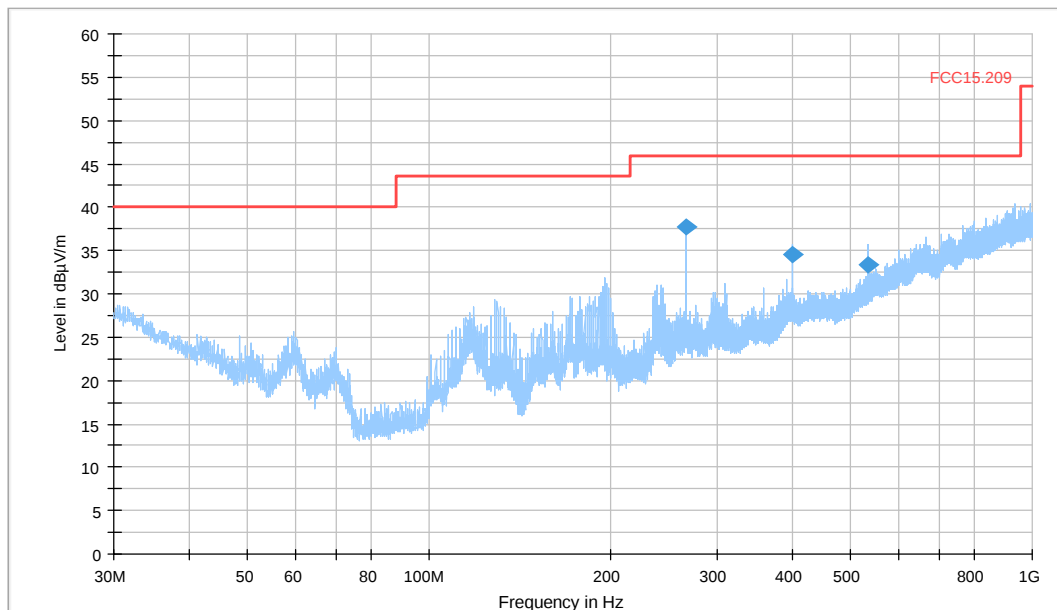


1.4.2 Radiated emissions (30MHz<f<1GHz)

TID011a_23-1-0145601T010_RSE_30MHz-1GHz_EUT_front_rear_left_right

Common Information

Test Description:	Radiated field strength emission
Test Site:	CETECOM GmbH Essen
Test Standard:	FCC 15.205&15.209 & RSS Gen. Issue 5
Antenna polarisation:	horizontal/vertical
Environmental Conditions:	Humidity: 54 %rH; Temperature: 23 °C
Operator Name:	Aho
EUT:	front, rear, left, right
Operating Mode:	TX mode, RADAR Active
Power supply:	12 V DC
Verdict:	Passed
EUT Sample no:	S19_C01



Final_Result

Frequency (MHz)	Quasi Peak (dBµV /m)	Limit (dBµV /m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)
266.679000	37.75	46.00	8.25	120.000	116.0	H	163.0	14.1	0.0
399.995000	34.55	46.00	11.45	120.000	105.0	V	184.0	19.3	0.0
533.319000	33.28	46.00	12.72	120.000	111.0	V	128.0	21.3	0.0

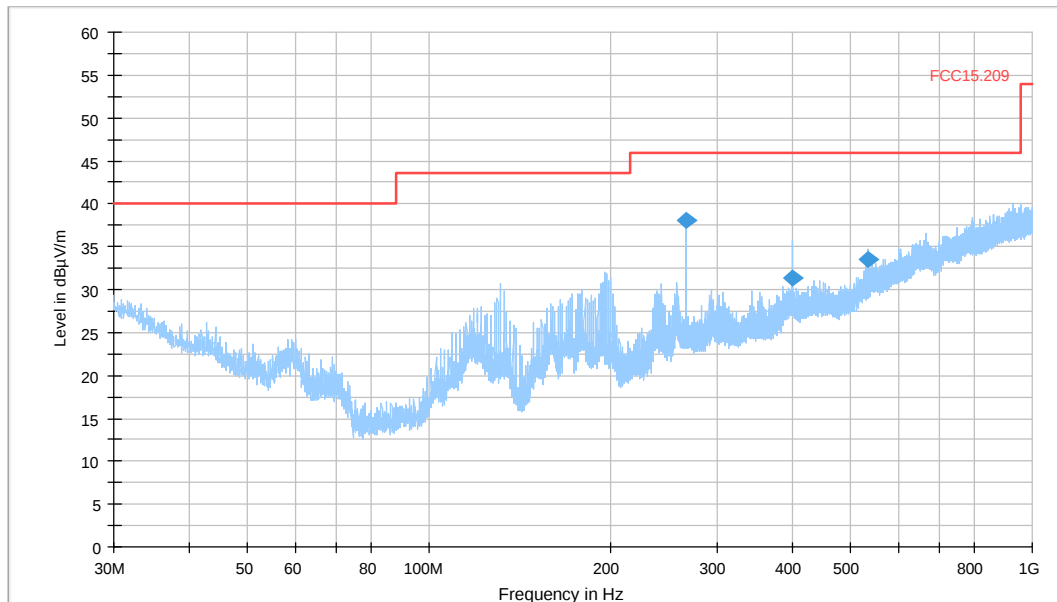
(continuation of the "Final_Result" table from column 17 ...)

Frequency (MHz)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
266.679000	1.6	12.5	23.6	20:47:58 - 10.09.2024
399.995000	2.0	17.3	15.2	20:57:28 - 10.09.2024
533.319000	2.4	18.9	12.0	20:52:48 - 10.09.2024

TID011b_23-1-0145601T010_RSE_30MHz-1GHz_EUT_top_bottom_left_right

Common Information

Test Description:	Radiated field strength emission
Test Site:	CETECOM GmbH Essen
Test Standard:	FCC 15.205&15.209 & RSS Gen. Issue 5
Antenna polarisation:	horizontal/vertical
Environmental Conditions:	Humidity: 54 %rH; Temperature: 23 °C
Operator Name:	Aho
EUT:	top, bottom, left, right
Operating Mode:	TX mode, RADAR Active
Power supply:	12 V DC
Verdict:	Passed
EUT Sample no:	S19_C01



Final_Result

Frequency (MHz)	Quasi Peak (dBµV /m)	Limit (dBµV /m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)
266.683000	37.96	46.00	8.04	120.000	114.0	H	157.0	14.1	0.0
400.039000	31.33	46.00	14.67	120.000	111.0	V	182.0	19.3	0.0
533.319000	33.50	46.00	12.50	120.000	105.0	V	140.0	21.3	0.0

(continuation of the "Final_Result" table from column 17 ...)

Frequency (MHz)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)	Comment
266.683000	1.6	12.5	23.8	21:44:54 - 10.09.2024
400.039000	2.0	17.3	12.0	21:54:10 - 10.09.2024
533.319000	2.4	18.9	12.2	21:49:41 - 10.09.2024

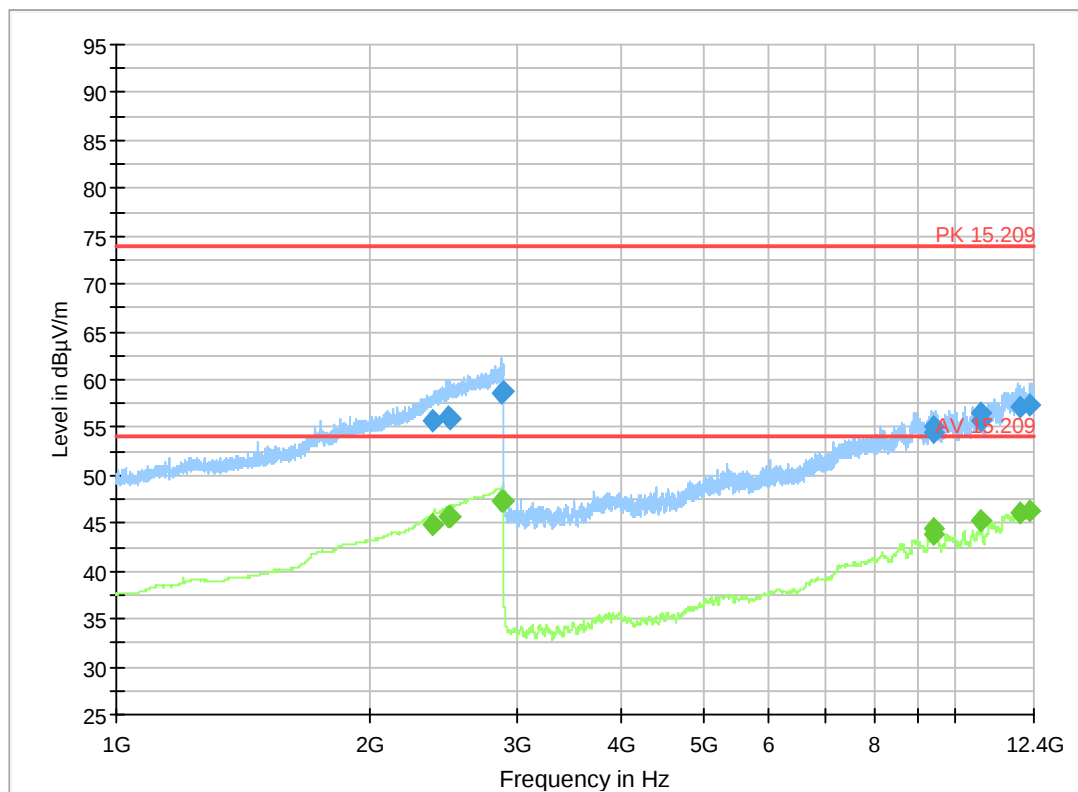
1.4.3 Radiated emissions (1GHz<f<12.4GHz)

TID012_23-1-0145601T010_RSE_1 - 12.4GHz_S19_FCC_ISED

Common Information

Test Description:	Radiated Field Strength Emission@3m distance
Test Site Location:	cetecom advanced gmbh / Essen
Test Site:	Fully Anechoic Room (FAR2)
Test Standard:	FCC 15.209 & RSS-Gen, Issue 5
Operating Mode:	Operator, please fill in the operating mode
Environmental Conditions:	Humidity: 60%rH; Temperature: 25°C
SW-Version:	EMC32 V10.60.20
Operator:	Aho
Set-up:	1
Verdict:	Passed
Sample No:	S19_C01

Full Spectrum



Final_Result_PK+

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2381.696667	55.71	74.00	18.29	100.0	1000.000	155.0	V	200.0
2381.750000	55.78	74.00	18.22	100.0	1000.000	155.0	H	15.0
2492.330000	56.21	74.00	17.79	100.0	1000.000	155.0	H	10.0
2497.773333	55.85	74.00	18.15	100.0	1000.000	155.0	H	-1.0
2883.367200	58.62	74.00	15.38	100.0	1000.000	155.0	H	-29.0
2891.288750	58.87	74.00	15.13	100.0	1000.000	155.0	V	-26.0
9395.556250	54.50	74.00	19.50	100.0	1000.000	155.0	H	-16.0
9438.515000	55.07	74.00	18.93	100.0	1000.000	155.0	V	30.0
10725.536250	55.70	74.00	18.30	100.0	1000.000	155.0	V	210.0
10730.703750	56.44	74.00	17.56	100.0	1000.000	155.0	H	-24.0
11947.193333	57.21	74.00	16.79	100.0	1000.000	155.0	H	6.0
12283.985833	57.31	74.00	16.69	100.0	1000.000	155.0	V	253.0

(continuation of the "Final_Result_PK+" table from column 9 ...)

Frequency (MHz)	Elevation (deg)	Corr. (dB/m)	Sig Path (dB)	Preamplifier (dB)	Trd Corr. (dB/m)	Raw Rec (dBμV)
2381.696667	90.0	33.3	4.6	0.0	28.6	22.5
2381.750000	0.0	33.3	4.6	0.0	28.6	22.5
2492.330000	0.0	33.5	4.8	0.0	28.7	22.7
2497.773333	90.0	33.6	4.8	0.0	28.7	22.3
2883.367200	90.0	34.6	5.1	0.0	29.5	24.1
2891.288750	90.0	34.6	5.1	0.0	29.5	24.3
9395.556250	0.0	9.2	-28.5	0.0	37.6	45.3
9438.515000	90.0	9.2	-28.4	0.0	37.6	45.8
10725.536250	0.0	9.0	-29.1	0.0	38.1	46.7
10730.703750	0.0	8.9	-29.1	0.0	38.1	47.5
11947.193333	0.0	10.6	-28.2	0.0	38.8	46.6
12283.985833	90.0	11.3	-27.1	0.0	38.4	46.0

(continuation of the "Final_Result_PK+" table from column 15 ...)

Frequency (MHz)	Comment
2381.696667	12:12:58 PM - 06-Sep-24
2381.750000	12:06:19 PM - 06-Sep-24
2492.330000	12:07:31 PM - 06-Sep-24
2497.773333	12:08:52 PM - 06-Sep-24
2883.367200	12:10:02 PM - 06-Sep-24
2891.288750	12:11:27 PM - 06-Sep-24
9395.556250	2:34:13 PM - 06-Sep-24
9438.515000	2:40:40 PM - 06-Sep-24
10725.536250	2:38:50 PM - 06-Sep-24
10730.703750	2:35:41 PM - 06-Sep-24
11947.193333	2:37:07 PM - 06-Sep-24
12283.985833	2:42:31 PM - 06-Sep-24

Final_Result_RMS

Frequency (MHz)	RMS (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
2381.696667	44.80	54.00	9.20	100.0	1000.000	155.0	V	200.0
2381.750000	44.85	54.00	9.15	100.0	1000.000	155.0	H	15.0
2492.330000	45.60	54.00	8.40	100.0	1000.000	155.0	H	10.0
2497.773333	45.68	54.00	8.32	100.0	1000.000	155.0	H	-1.0
2883.367200	47.21	54.00	6.79	100.0	1000.000	155.0	H	-29.0
2891.288750	47.28	54.00	6.72	100.0	1000.000	155.0	V	-26.0
9395.556250	43.75	54.00	10.25	100.0	1000.000	155.0	H	-16.0
9438.515000	44.52	54.00	9.48	100.0	1000.000	155.0	V	30.0
10725.536250	45.20	54.00	8.80	100.0	1000.000	155.0	V	210.0
10730.703750	45.20	54.00	8.80	100.0	1000.000	155.0	H	-24.0
11947.193333	46.04	54.00	7.96	100.0	1000.000	155.0	H	6.0
12283.985833	46.37	54.00	7.63	100.0	1000.000	155.0	V	253.0

(continuation of the "Final_Result_RMS" table from column 9 ...)

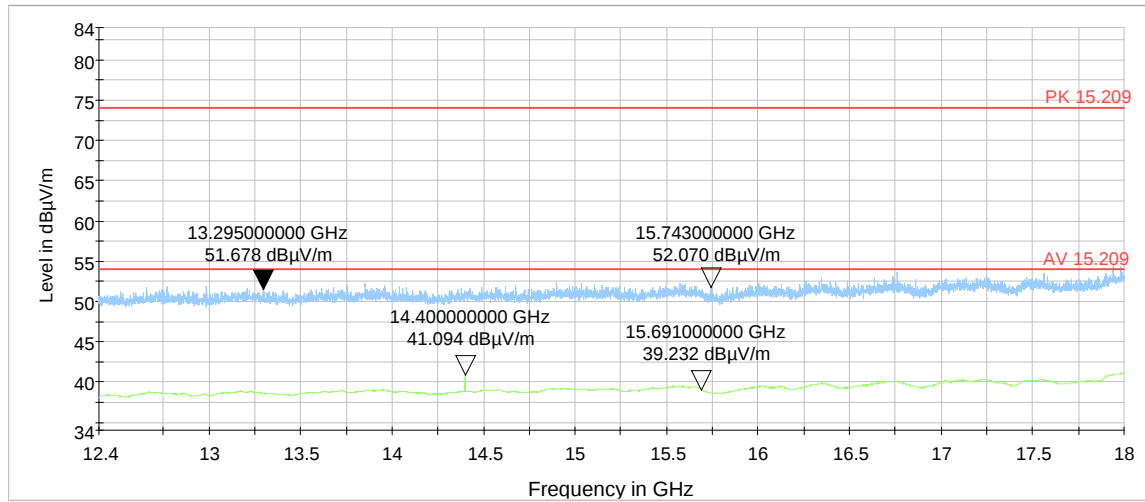
Frequency (MHz)	Elevation (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBμV)
2381.696667	90.0	33.3	4.6	0.0	28.6	11.5
2381.750000	0.0	33.3	4.6	0.0	28.6	11.6
2492.330000	0.0	33.5	4.8	0.0	28.7	12.1
2497.773333	90.0	33.6	4.8	0.0	28.7	12.1
2883.367200	90.0	34.6	5.1	0.0	29.5	12.6
2891.288750	90.0	34.6	5.1	0.0	29.5	12.7
9395.556250	0.0	9.2	-28.5	0.0	37.6	34.6
9438.515000	90.0	9.2	-28.4	0.0	37.6	35.3
10725.536250	0.0	9.0	-29.1	0.0	38.1	36.2
10730.703750	0.0	8.9	-29.1	0.0	38.1	36.3
11947.193333	0.0	10.6	-28.2	0.0	38.8	35.4
12283.985833	90.0	11.3	-27.1	0.0	38.4	35.0

(continuation of the "Final_Result_RMS" table from column 15 ...)

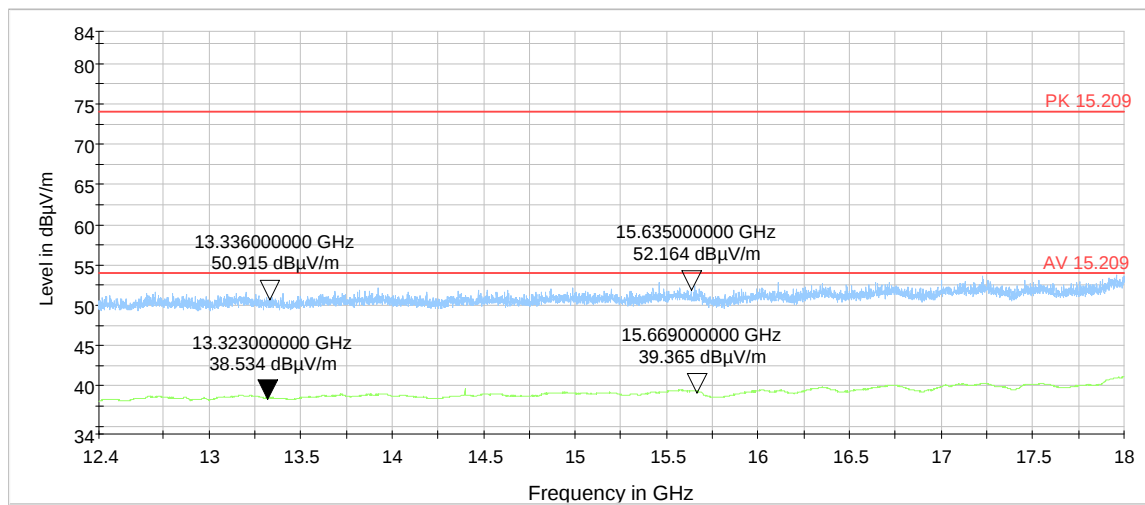
Frequency (MHz)	Comment
2381.696667	12:12:58 PM - 06-Sep-24
2381.750000	12:06:19 PM - 06-Sep-24
2492.330000	12:07:31 PM - 06-Sep-24
2497.773333	12:08:52 PM - 06-Sep-24
2883.367200	12:10:02 PM - 06-Sep-24
2891.288750	12:11:27 PM - 06-Sep-24
9395.556250	2:34:13 PM - 06-Sep-24
9438.515000	2:40:40 PM - 06-Sep-24
10725.536250	2:38:51 PM - 06-Sep-24
10730.703750	2:35:41 PM - 06-Sep-24
11947.193333	2:37:07 PM - 06-Sep-24
12283.985833	2:42:31 PM - 06-Sep-24

1.4.4 Radiated emissions (12.4GHz<f<18GHz)

TID013a



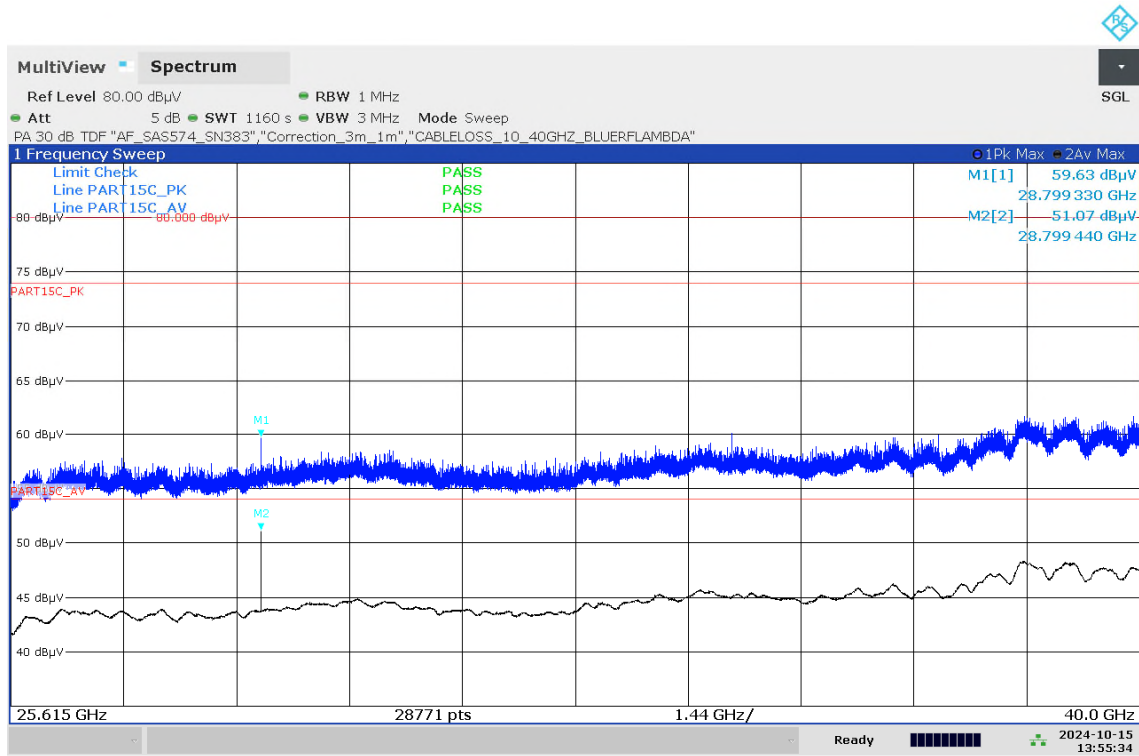
TID013b



1.4.5 Radiated emissions (18GHz<f<40GHz)

1.4.5.1 Antenna horizontal

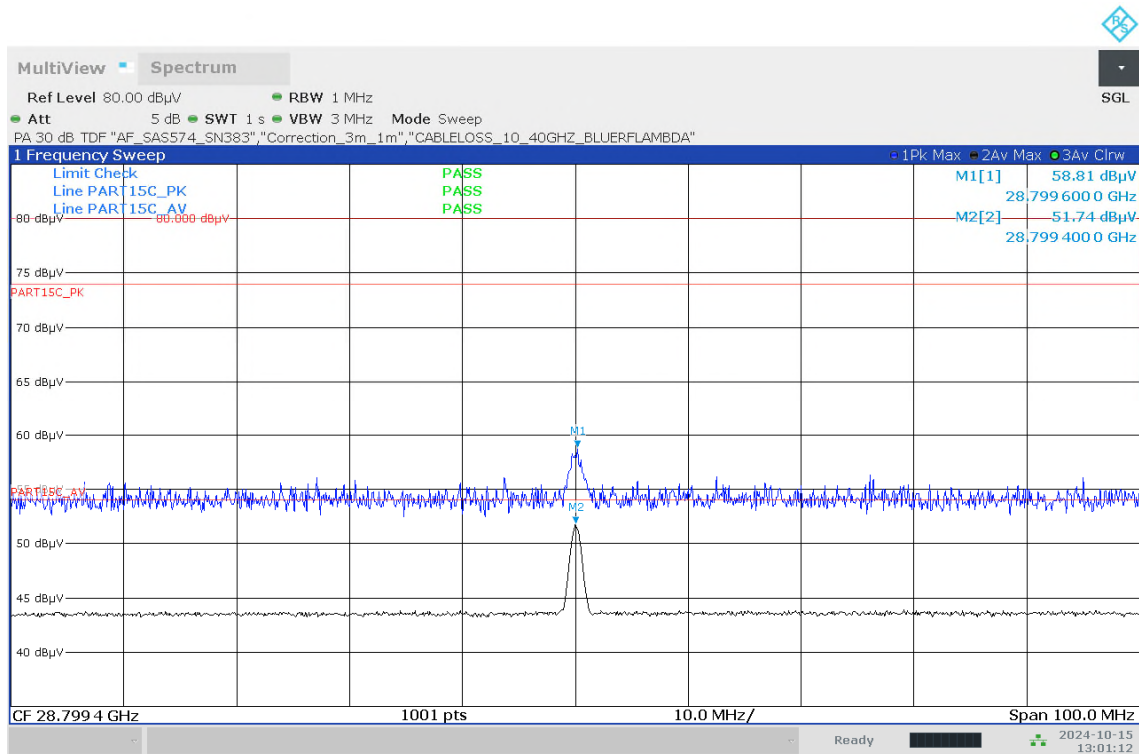
Diagram no.: TID202a_02_RSE_TX_S28_18-40GHz_A71_E92__Anth.PNG



01:55:34 10/15/2024

Final investigation necessary

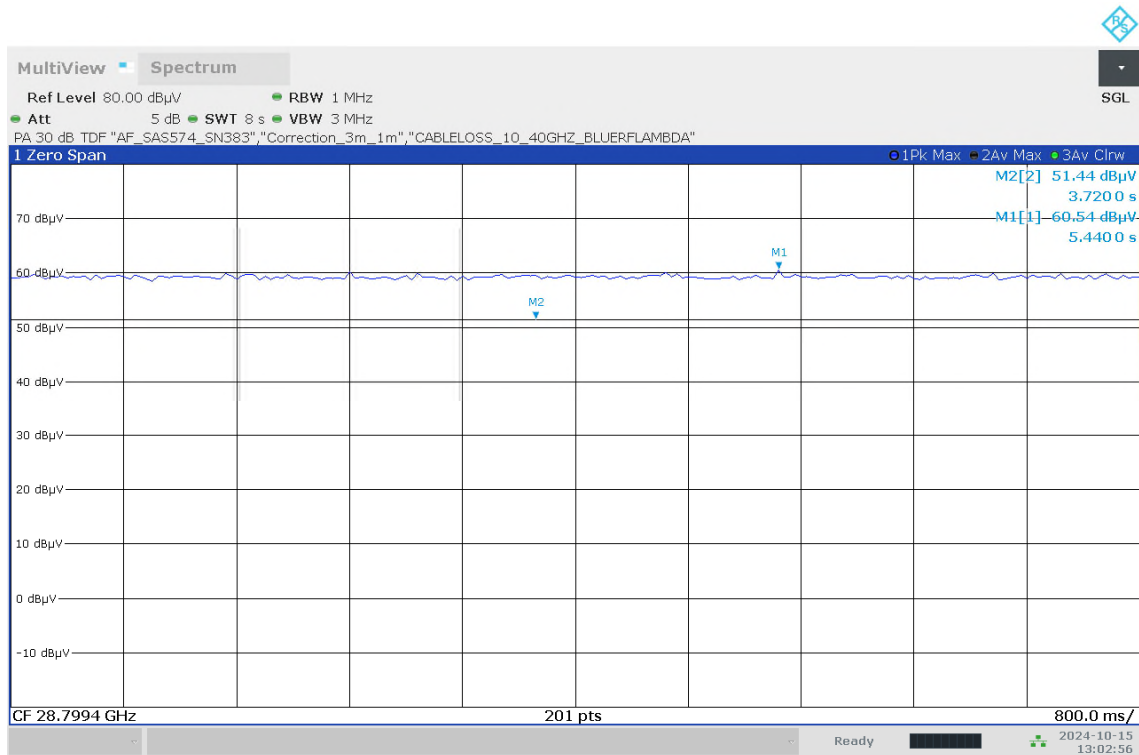
Diagram no.: TID201a_02_k1_krit_28_8GHz_A71_E92_Anth.PNG



01:01:13 10/15/2024

Maximization of emission

Diagram no.: TID201a_03_k1_krit_28_8GHz_ZeroSpan_A71_E92_Anth.PNG



01:02:57 10/15/2024

Final result with ZERO-Span, PK and AV detector

1.4.5.2 Antenna vertical

Diagram no.: TID202b_02_RSE_TX_S28_18-33_105GHz_AntV.PNG

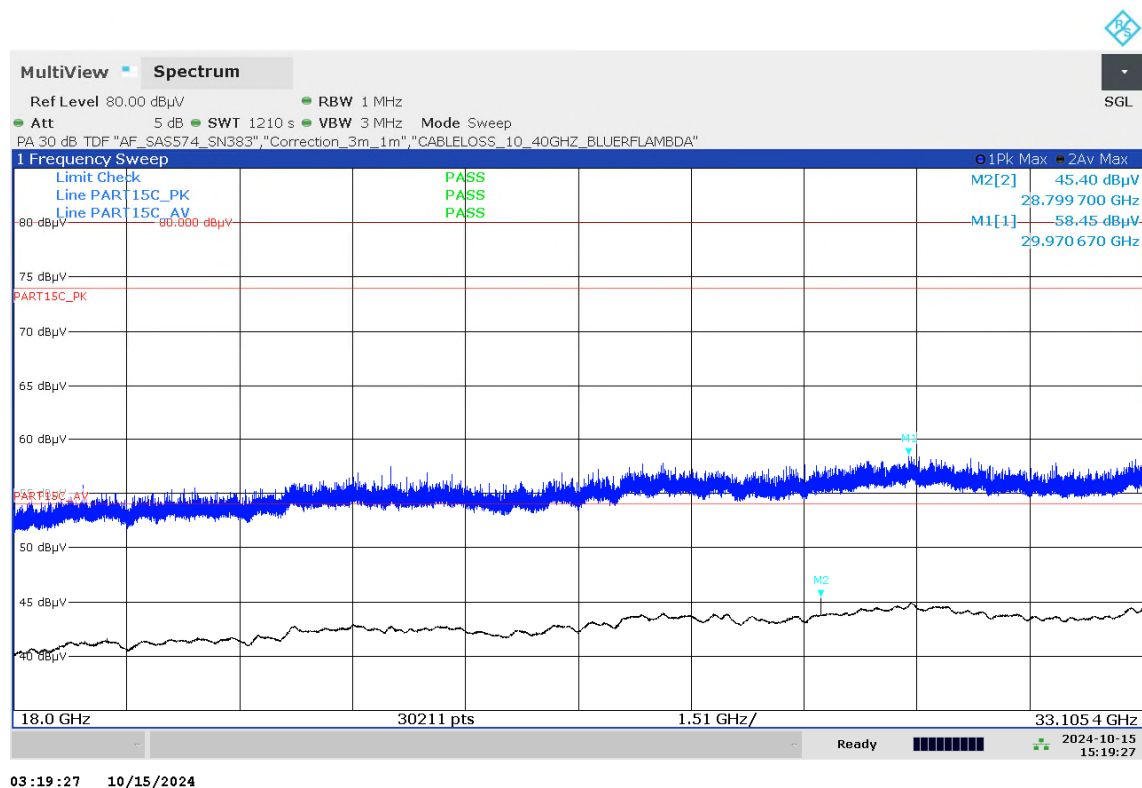


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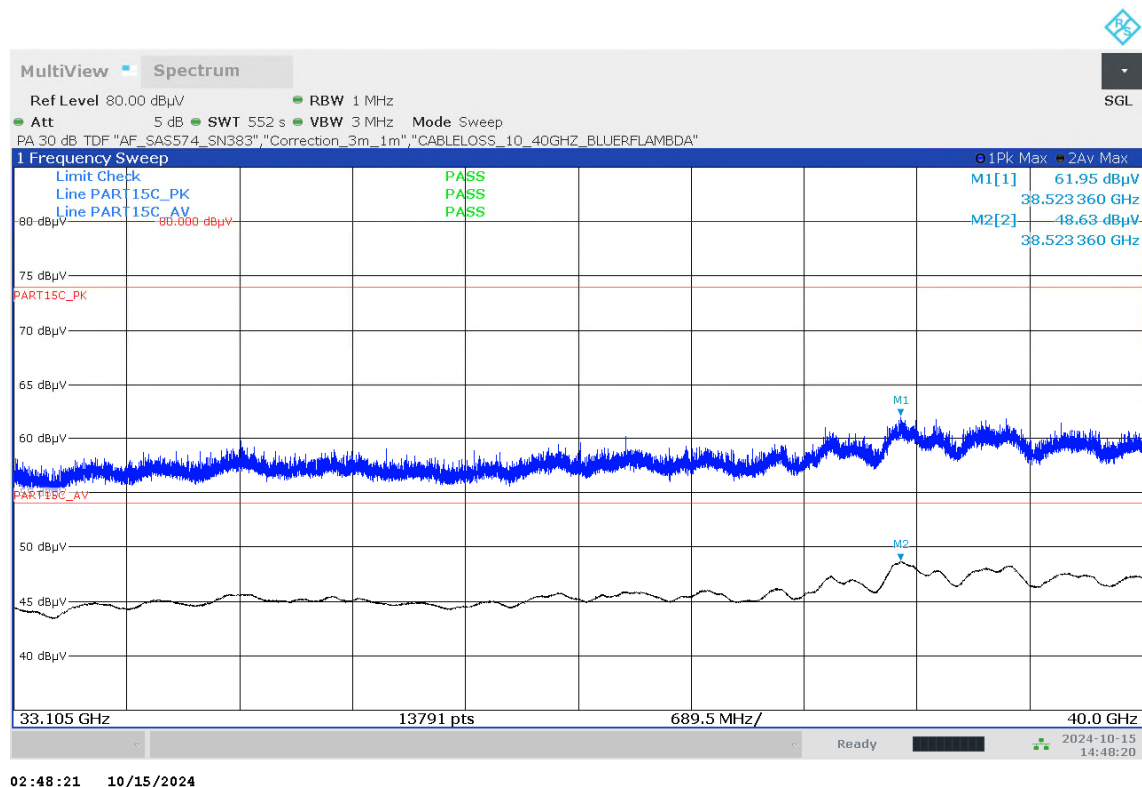
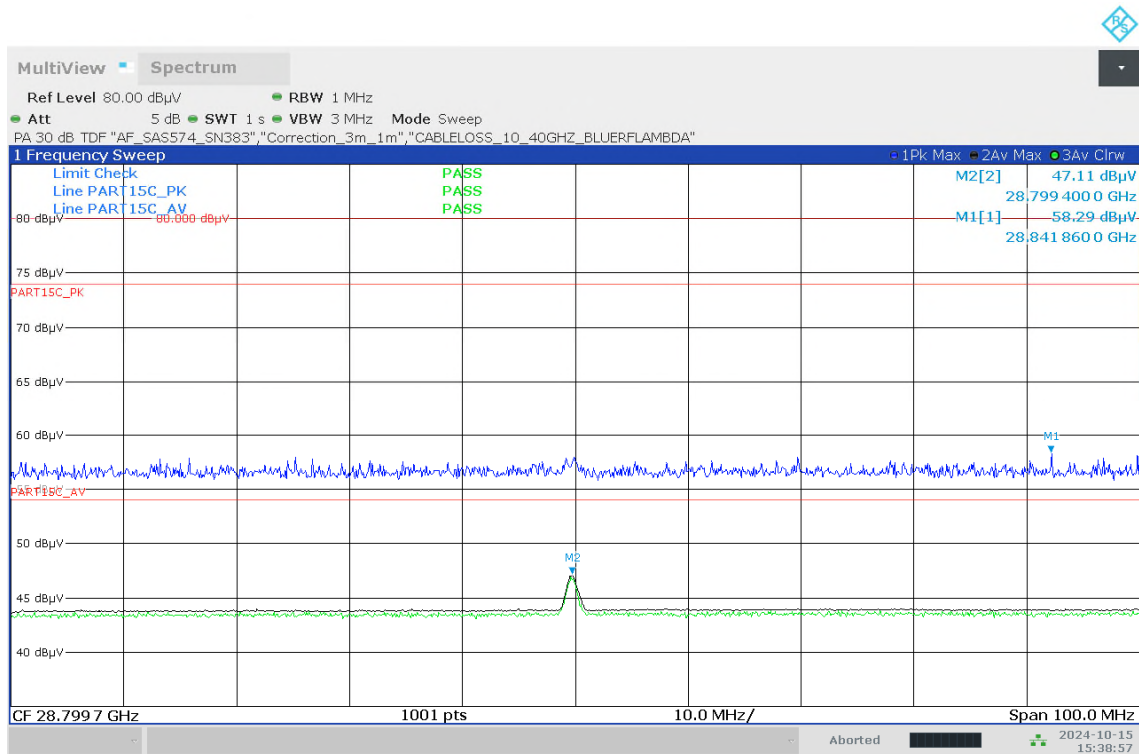


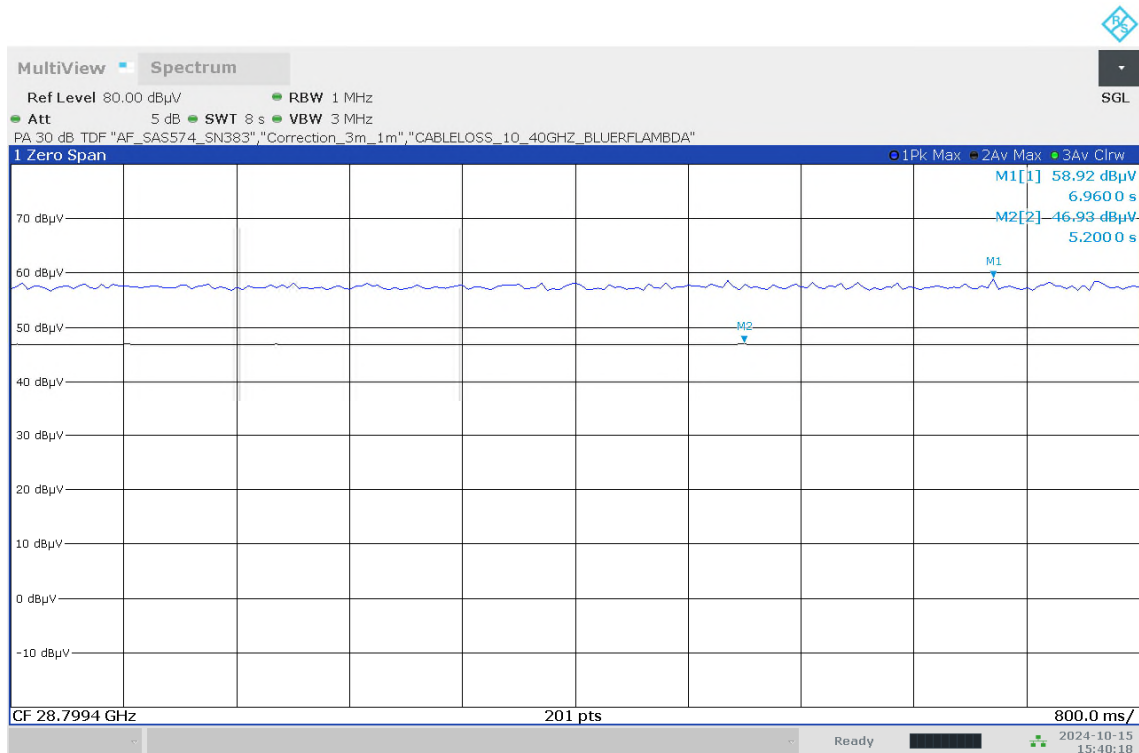
Diagram no.: TID202b_02_01_f1_krit_28.8GHz_A170_E93_AntV.PNG



03:38:57 10/15/2024

Maximization of emission

Diagram no.: TID202b_02_02_S28_f1_krit_28.8GHz_ZeroSpan_A170_E93_AntV.PNG



03:40:18 10/15/2024

Final result with ZERO-Span, Peak and Average detector measurement

1.4.6 Radiated emissions (40GHz<f<50GHz)

Diagram no.: TID015a_RSE_TX_S19_40G-50GHz_AntH.PNG

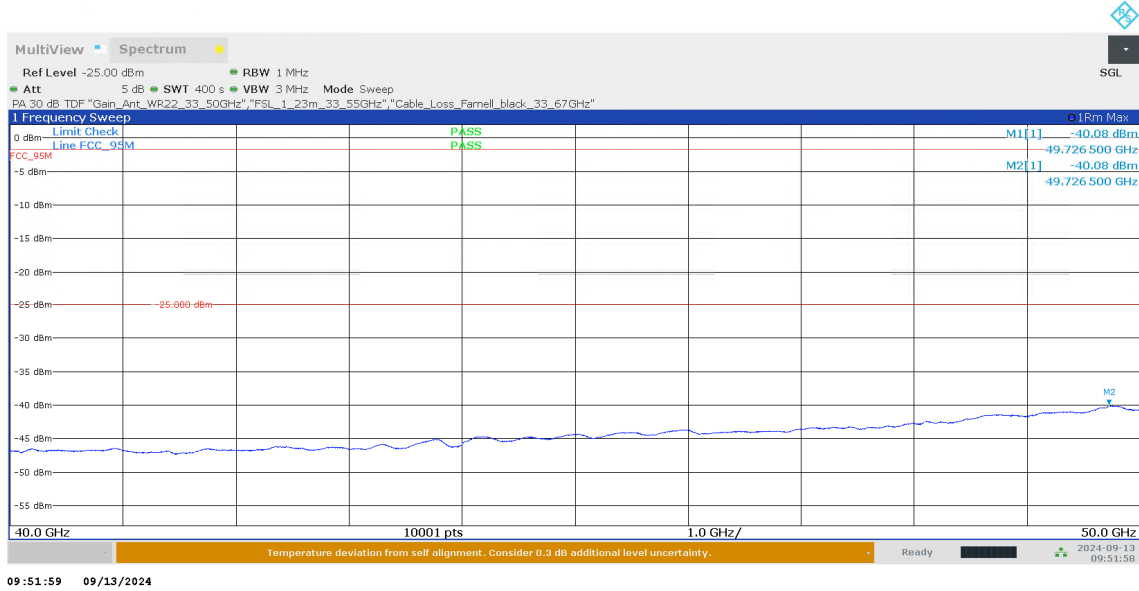
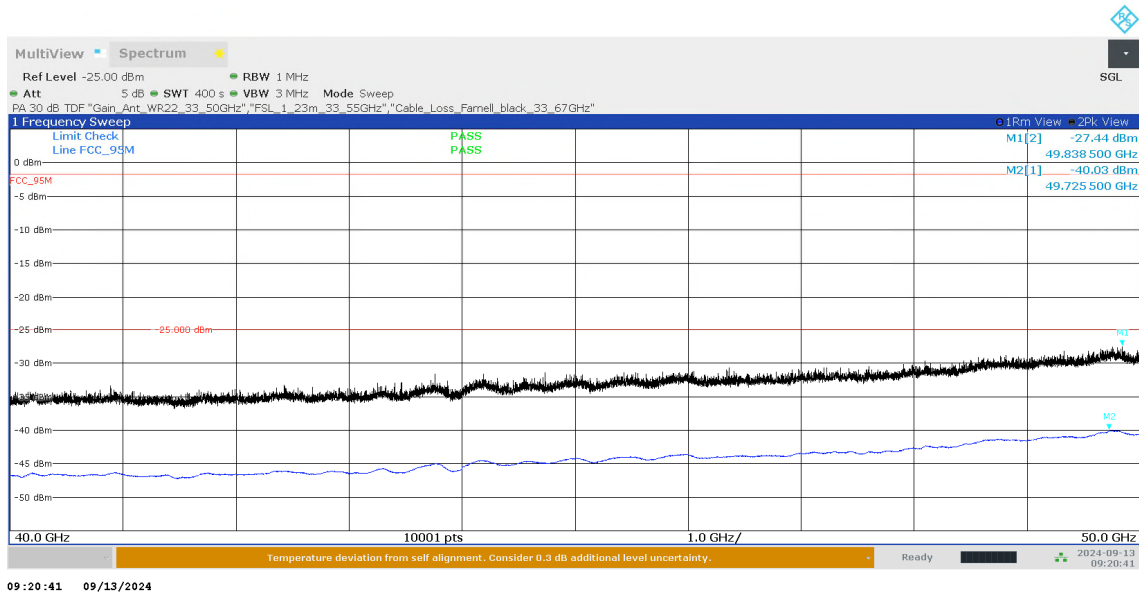
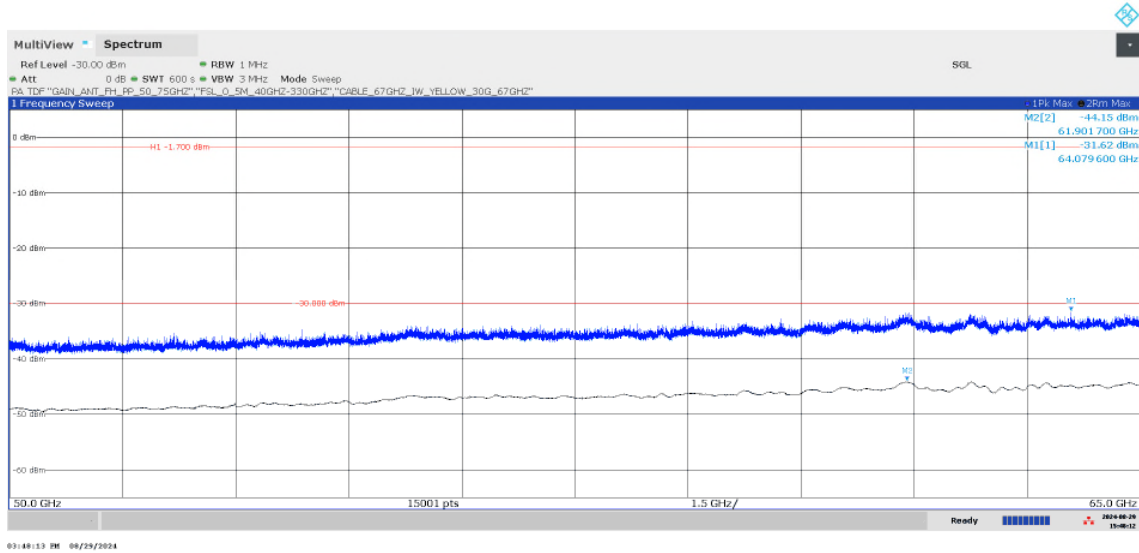


Diagram no.: TID015b_RSE_TX_S19_40G-50GHz_AntV.PNG



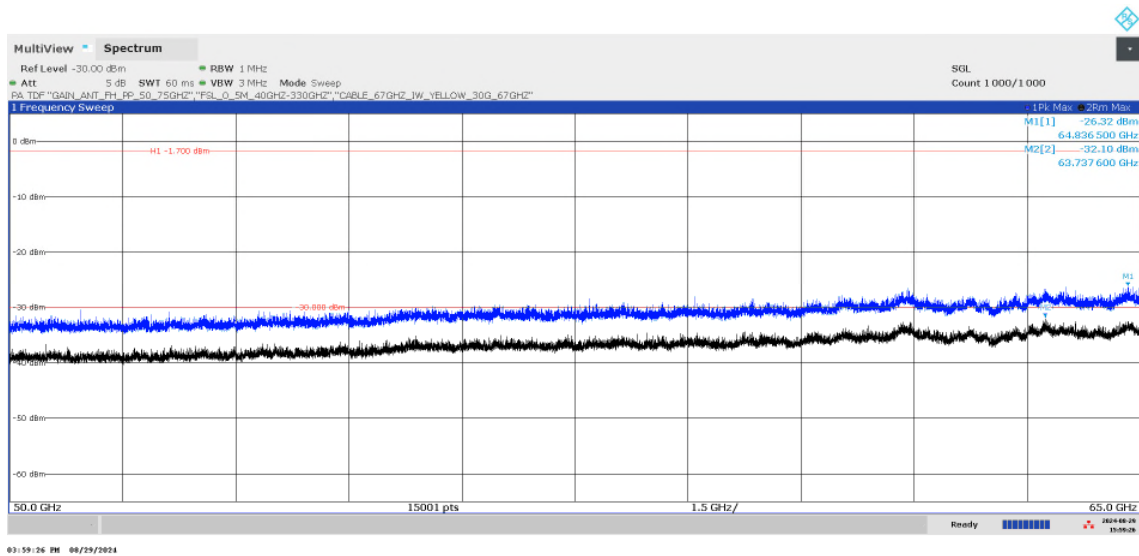
1.4.7 Radiated emissions (50GHz<f<65GHz)

Diagram no.: TID016a_01_23-1-0145601T010_RSE_50 - 65GHz_S19_FCC_AntH.PNG



Peak detector for monitoring purposes switched on

Diagram no.: TID016b_01_23-1-0145601T010_RSE_50 - 65GHz_S19_FCC_AntV_S19.PNG



Peak detector for monitoring purposes switched on

1.4.8 Radiated emissions (65GHz<f<75GHz)

Diagram no.: TID017a_23-1-0145601T010_RSE_65 - 75GHz_S19_FCC_AntH.PNG

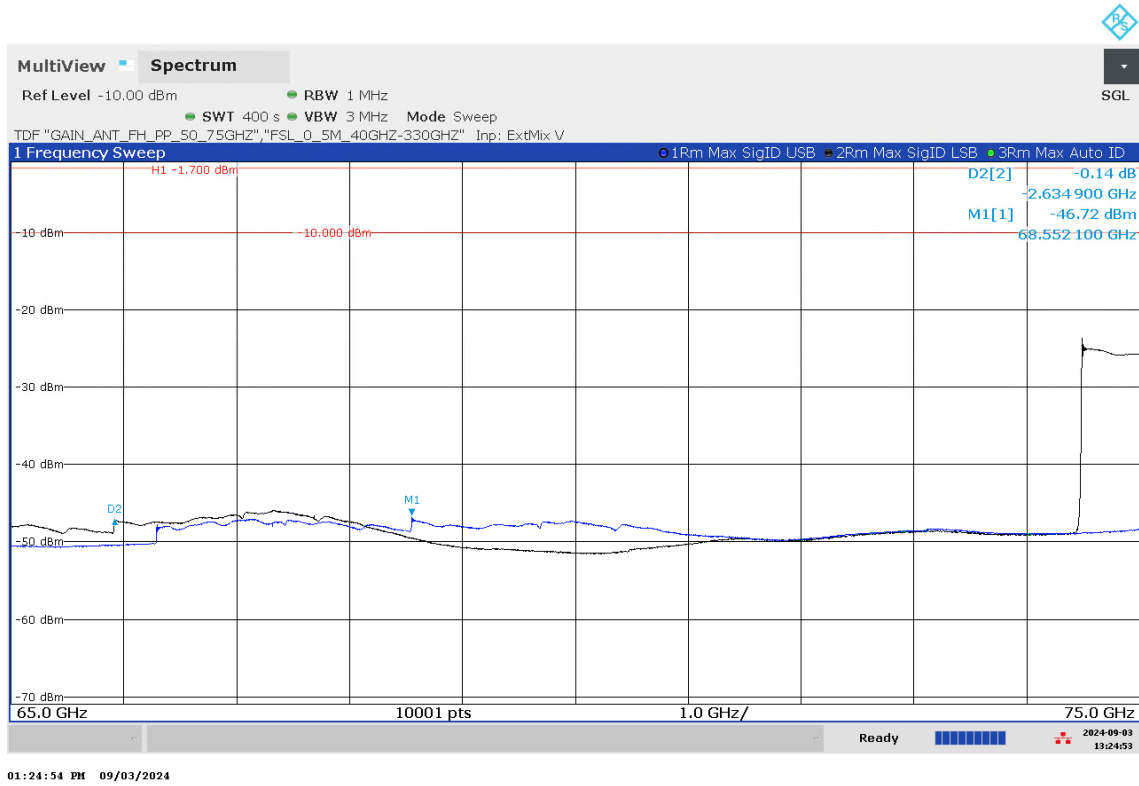
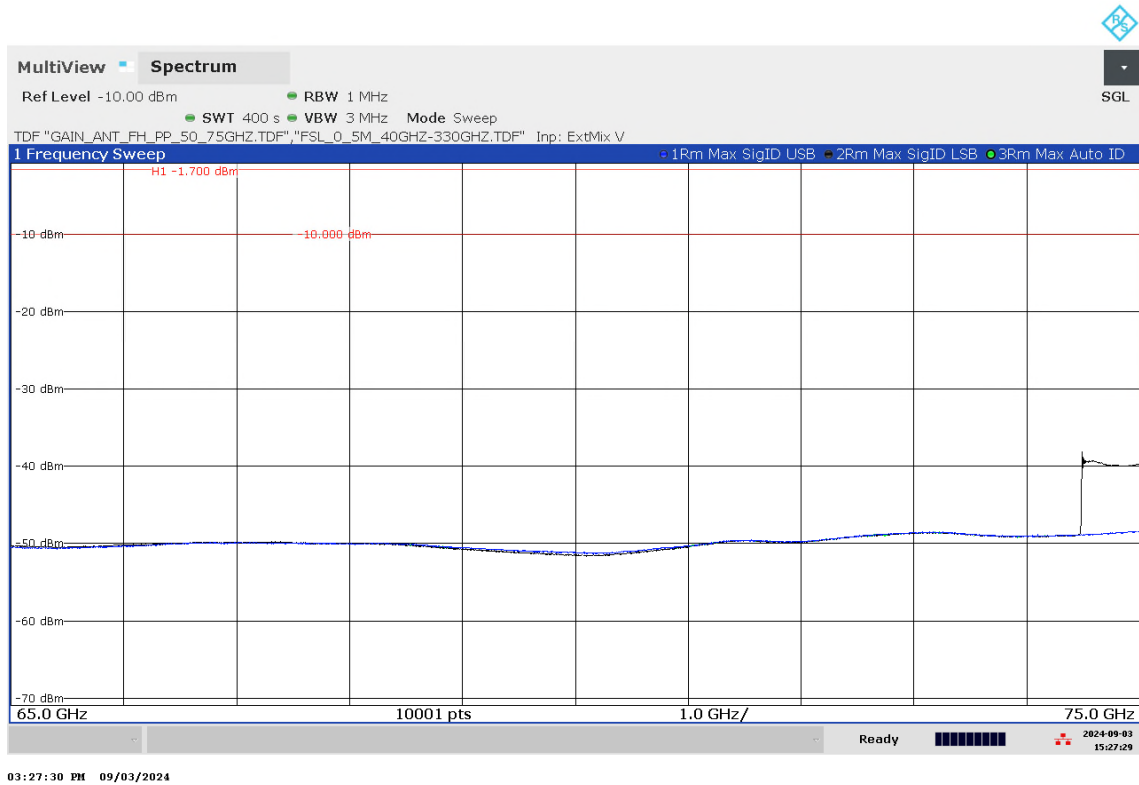


Diagram no.: TID017b_23-1-0145601T010_RSE_65 - 75GHz_S19_FCC_AntV.PNG



1.4.9 Radiated emissions (75GHz<f<90GHz)

Diagram no.: TID018_23-1-0145601T010_RSE_75 - 90GHz_S19_FCC_AntH.PNG

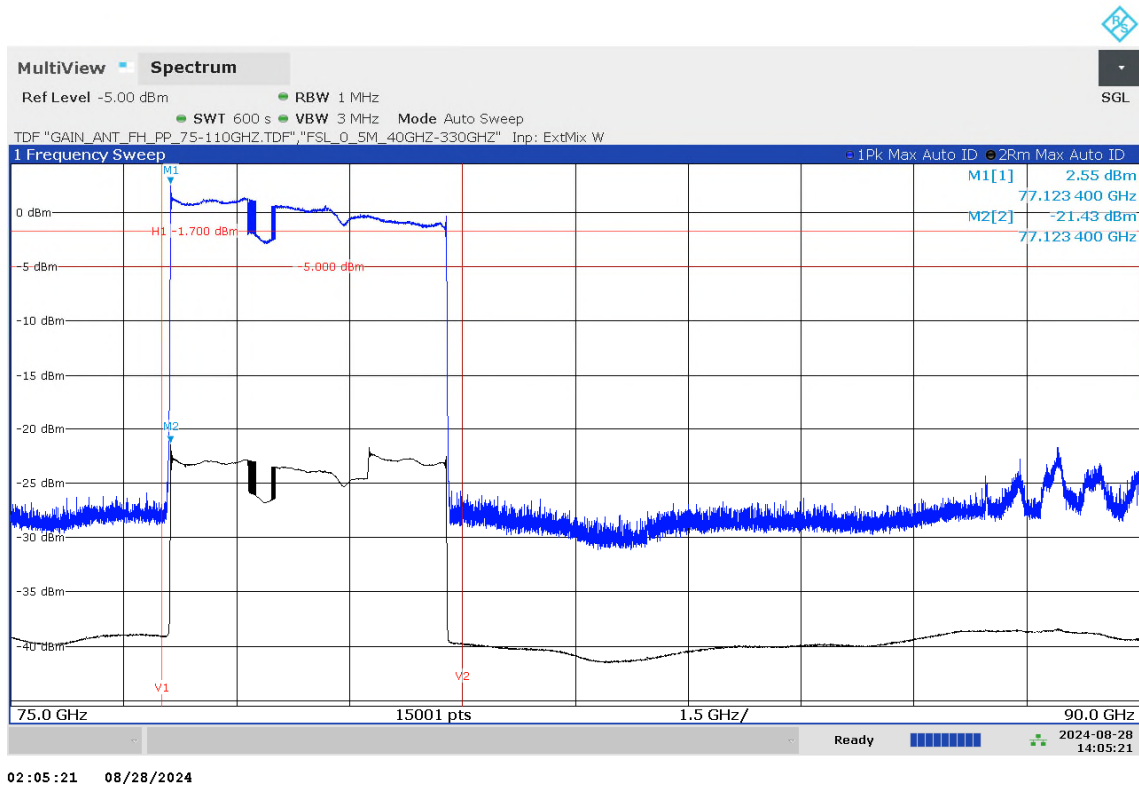
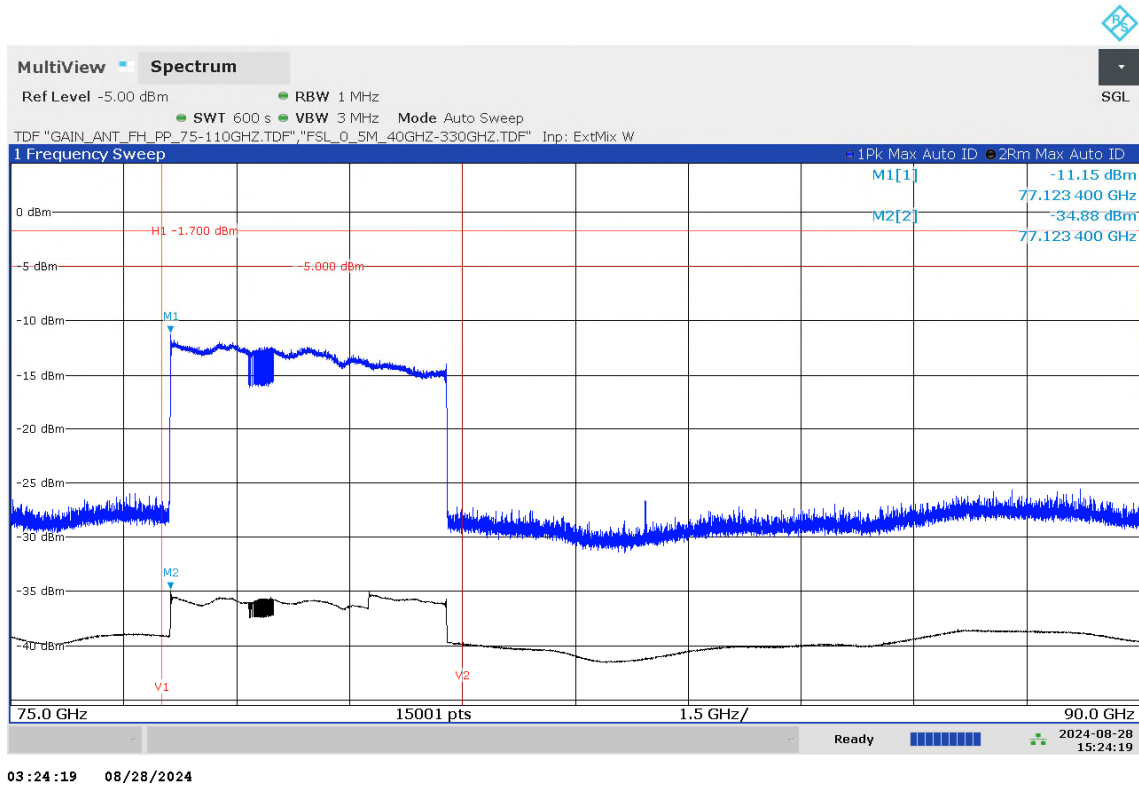


Diagram no.: TID019_23-1-0145601T010_RSE_75 - 90GHz_S19_FCC_AntV.PNG



1.4.10 Radiated emissions (90GHz<f<110GHz)

Diagram no.: TID021_23-1-0145601T010_RSE_90 - 110GHz_S19_FCC_AntH.PNG

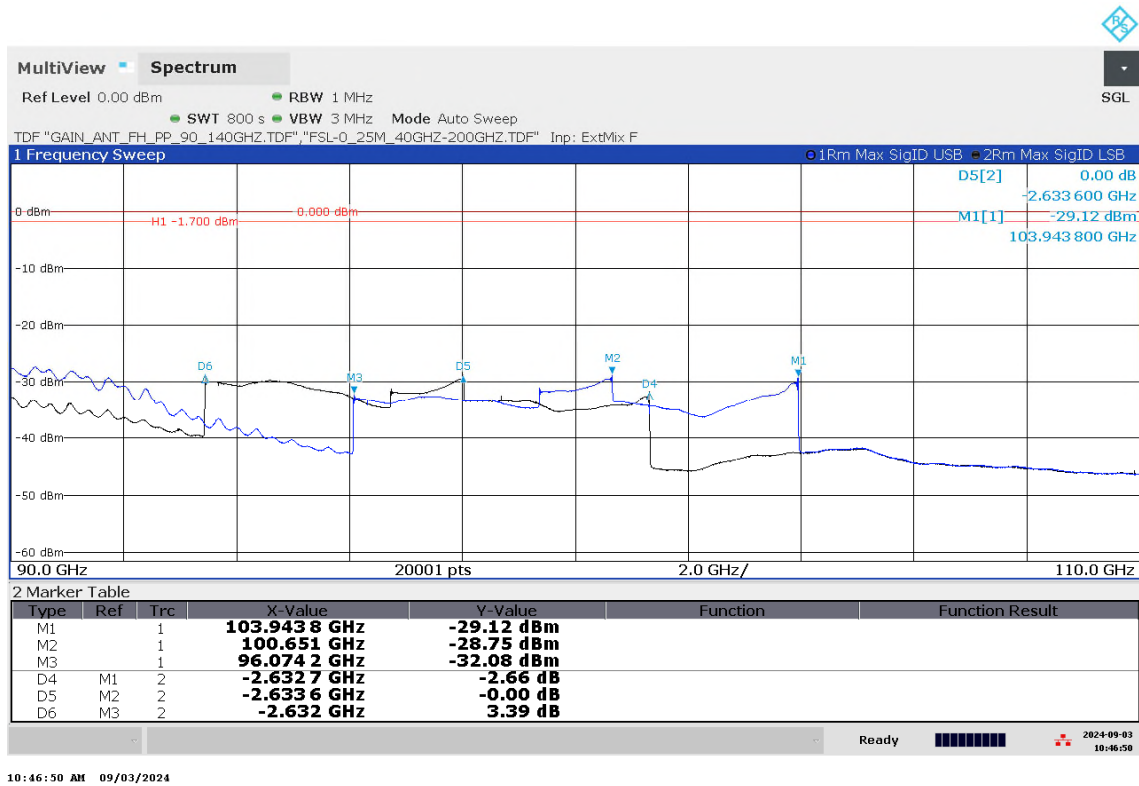


Diagram no.: TID022_23-1-0145601T010_RSE_90 - 110GHz_S19_FCC_AntV.PNG

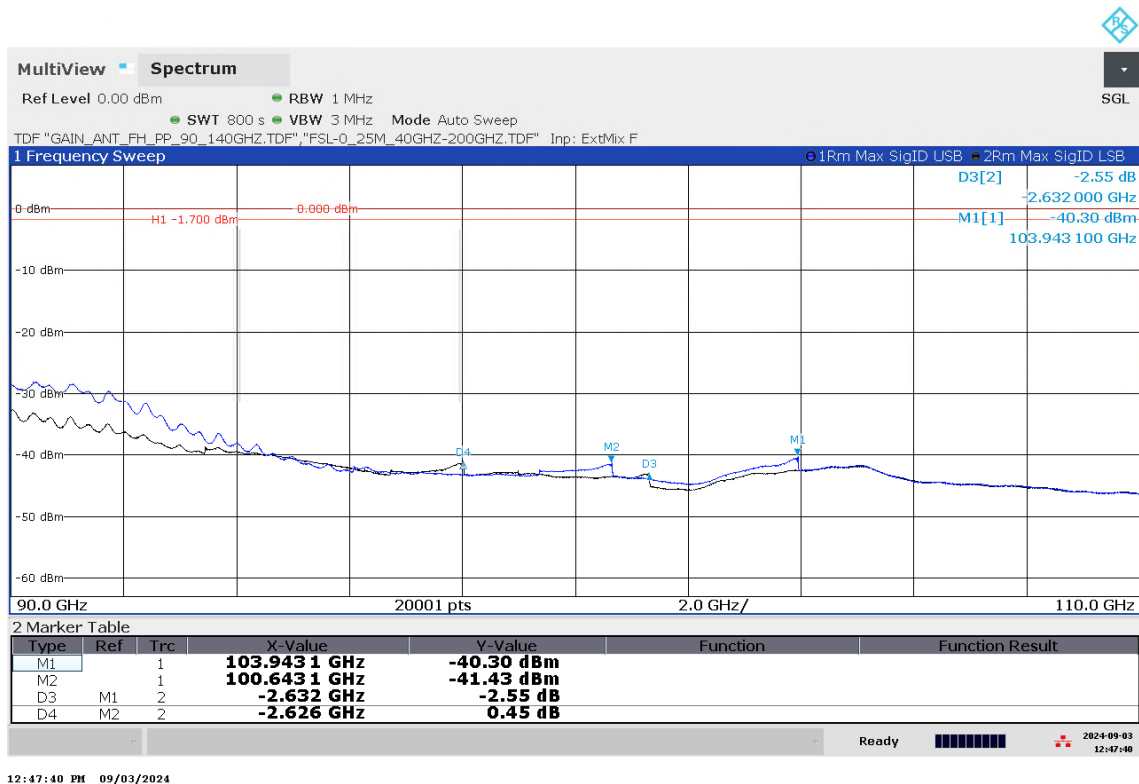
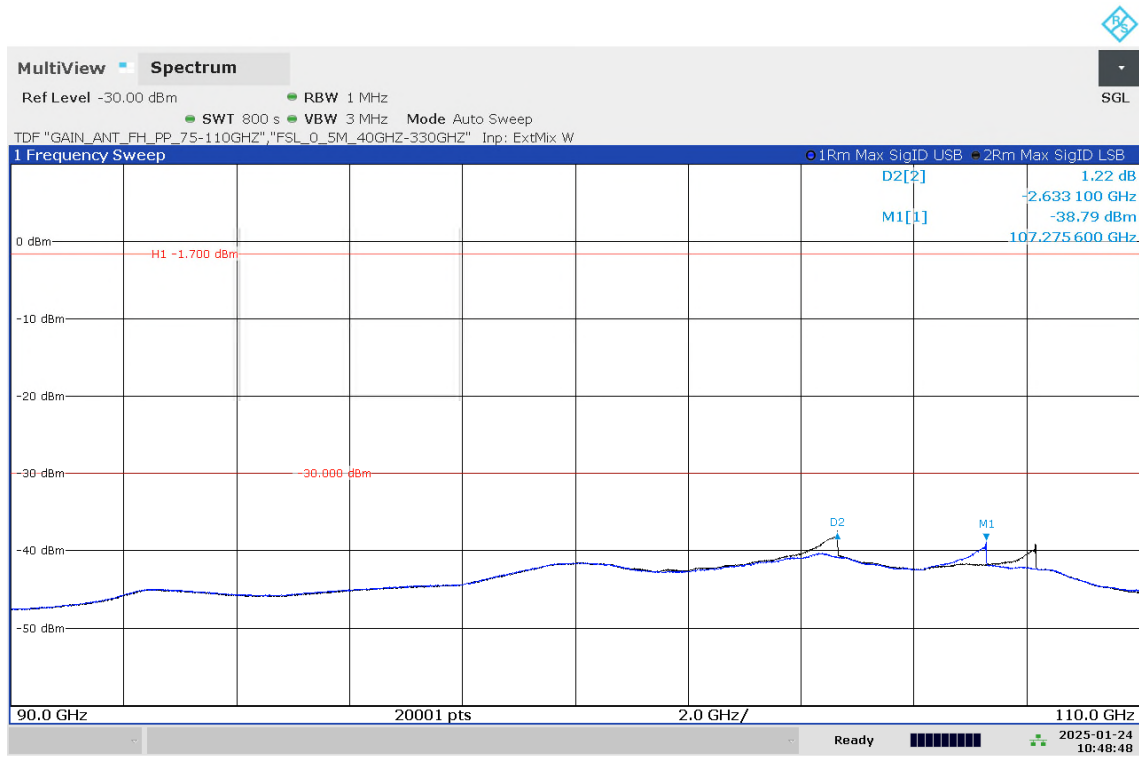


Diagram no.: TID022_02_23-1-0145601T010_RSE_90 - 110GHz_S31_FCC_AntV_with_HP_filter.PNG



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Use of W-Band high pass filter ($f_c=82\text{GHz}$)

1.4.11 Radiated emissions (110GHz<f<120GHz)

Diagram no.: TID023_23-1-0145601T010_RSE_110 - 120GHz_S19_FCC_AntH_FCC.PNG

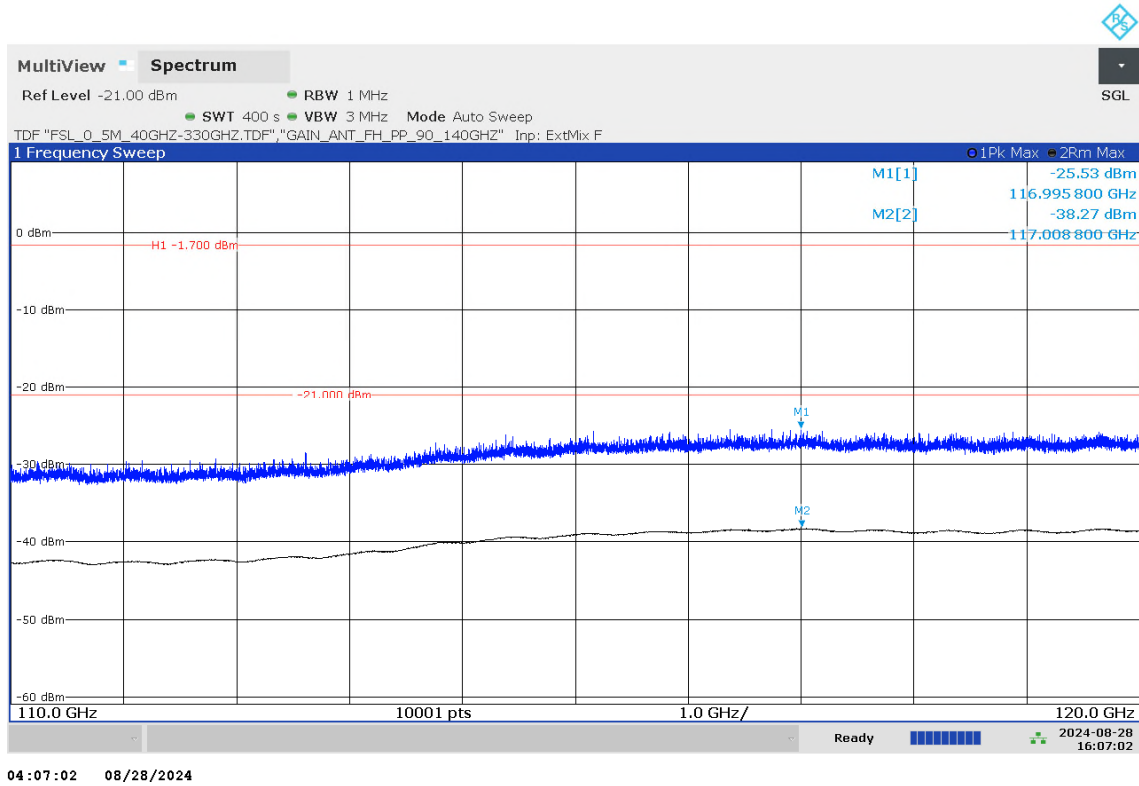
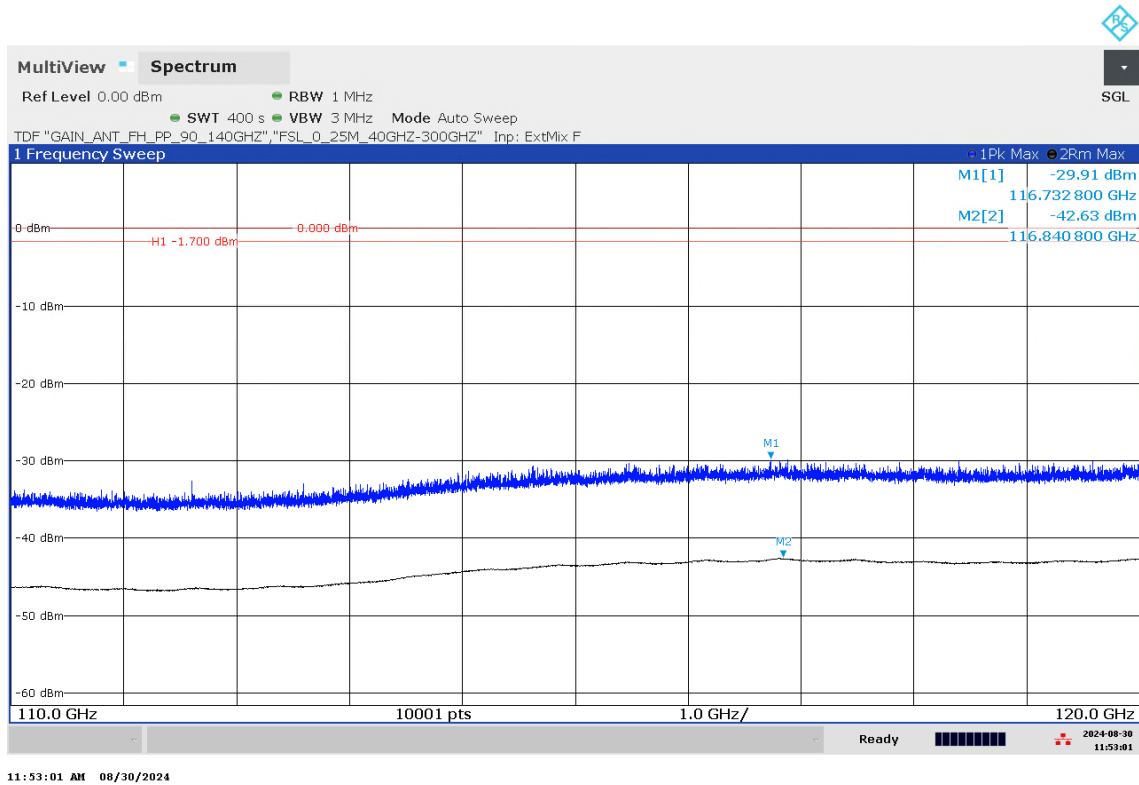
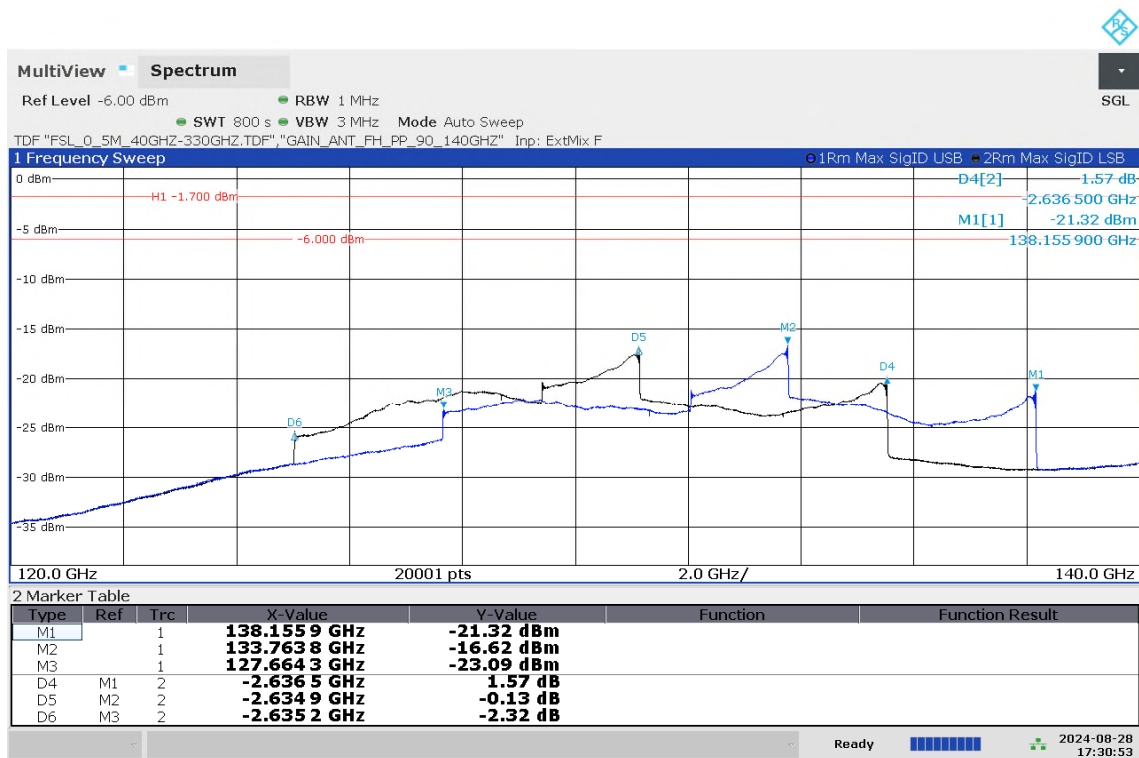


Diagram no.: TID024_23-1-0145601T010_RSE_110 - 120GHz_S19_FCC_AntV.PNG



1.4.12 Radiated emissions (120GHz<f<140GHz)

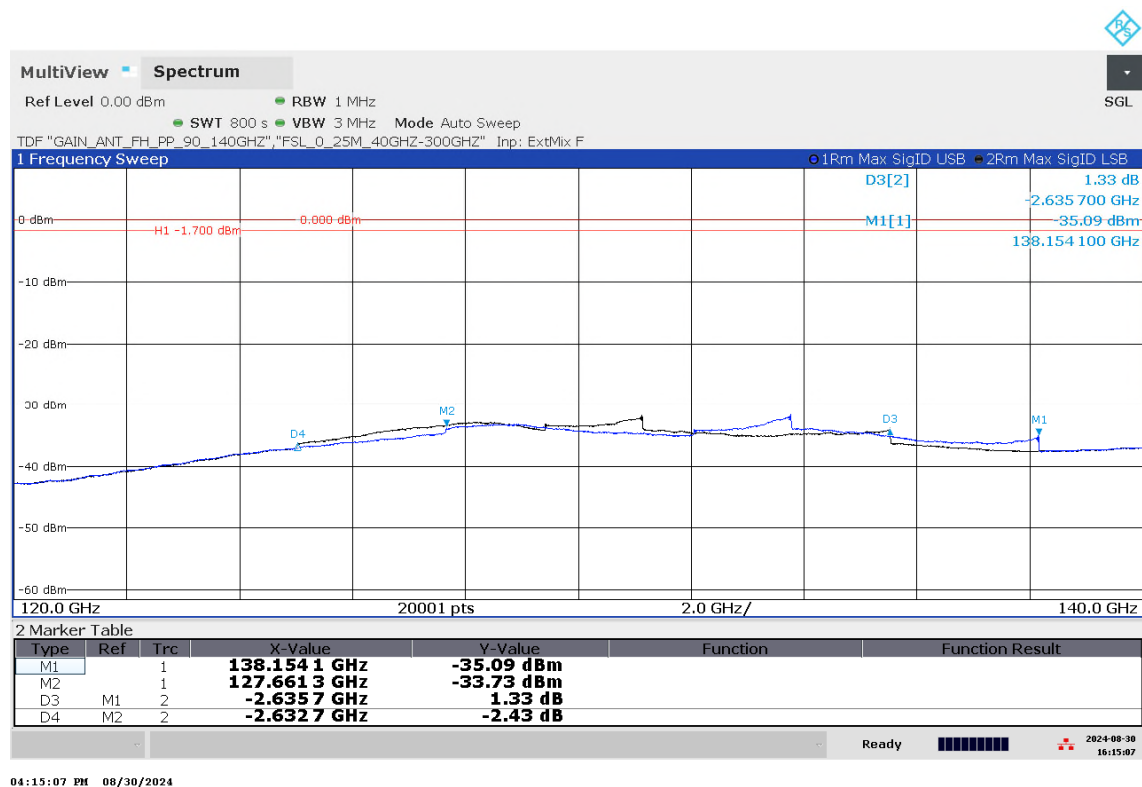
Diagram no.: TID025_23-1-0145601T010_RSE_120 - 140GHz_S19_FCC_Anth.PNG



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Intermodulation products 12*LO with carrier. Shift of intermodulation products with 2*IF (=2.63GHz)

Diagram no.: TID026_23-1-0145601T010_RSE_120 - 140GHz_S19_FCC_AntV.PNG



1.4.13 Radiated emissions (140GHz<f<150GHz)

Diagram no.: TID027_23-1-0145601T010_RSE_140 - 150GHz_S19_FCC_AntH.PNG

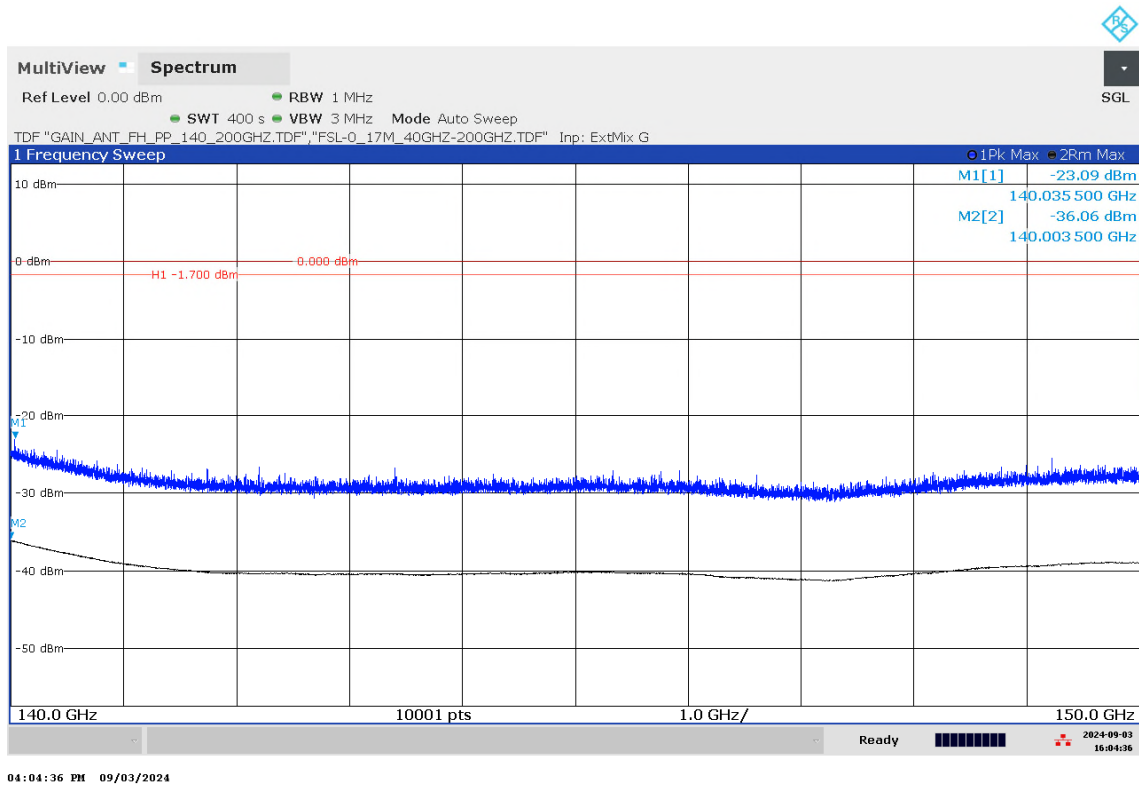
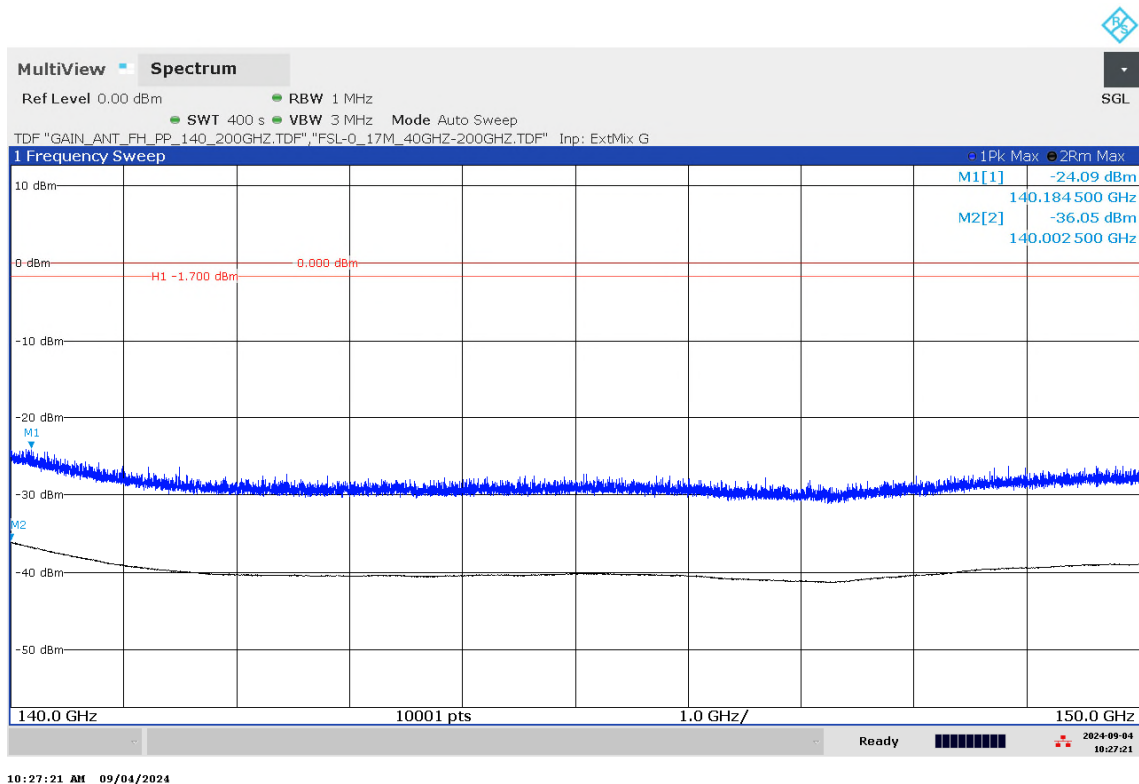


Diagram no.: TID028_23-1-0145601T010_RSE_140 - 150GHz_S19_FCC_AntV.PNG



1.4.14 Radiated emissions (150GHz<f<160GHz)

Diagram no.: TID029_23-1-0145601T010_RSE_150 - 160GHz_S19_FCC_AntH.PNG

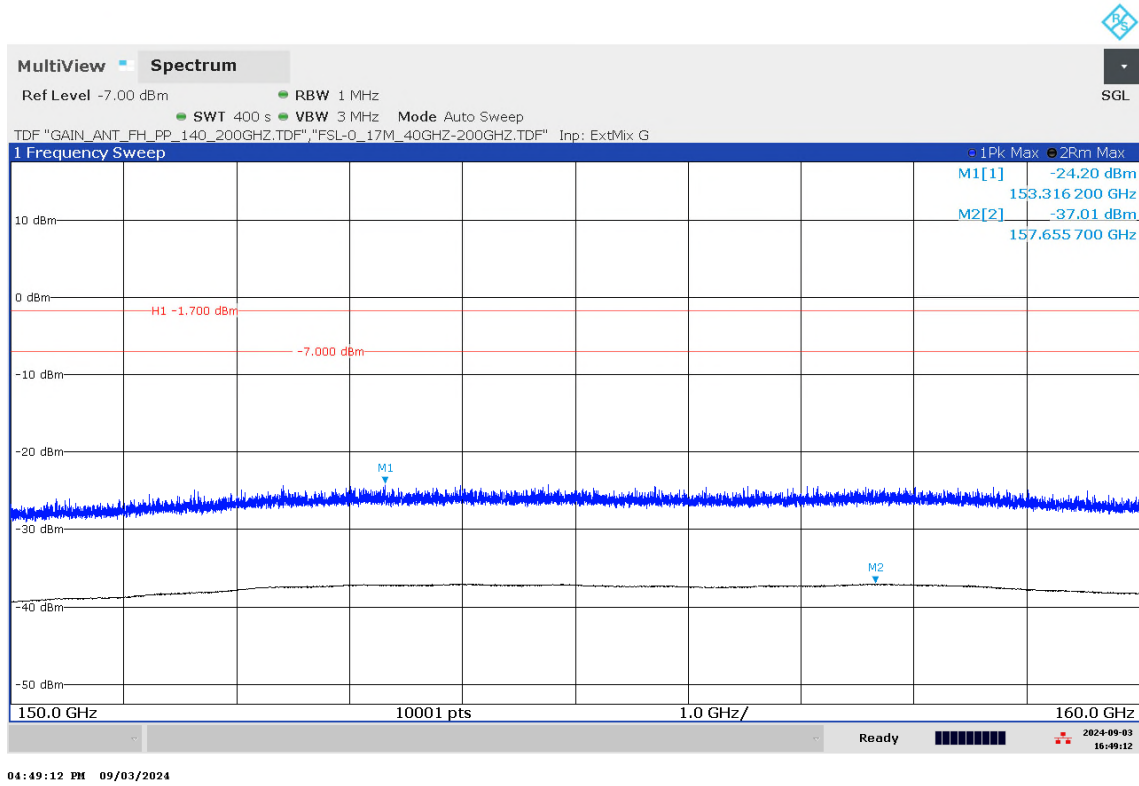
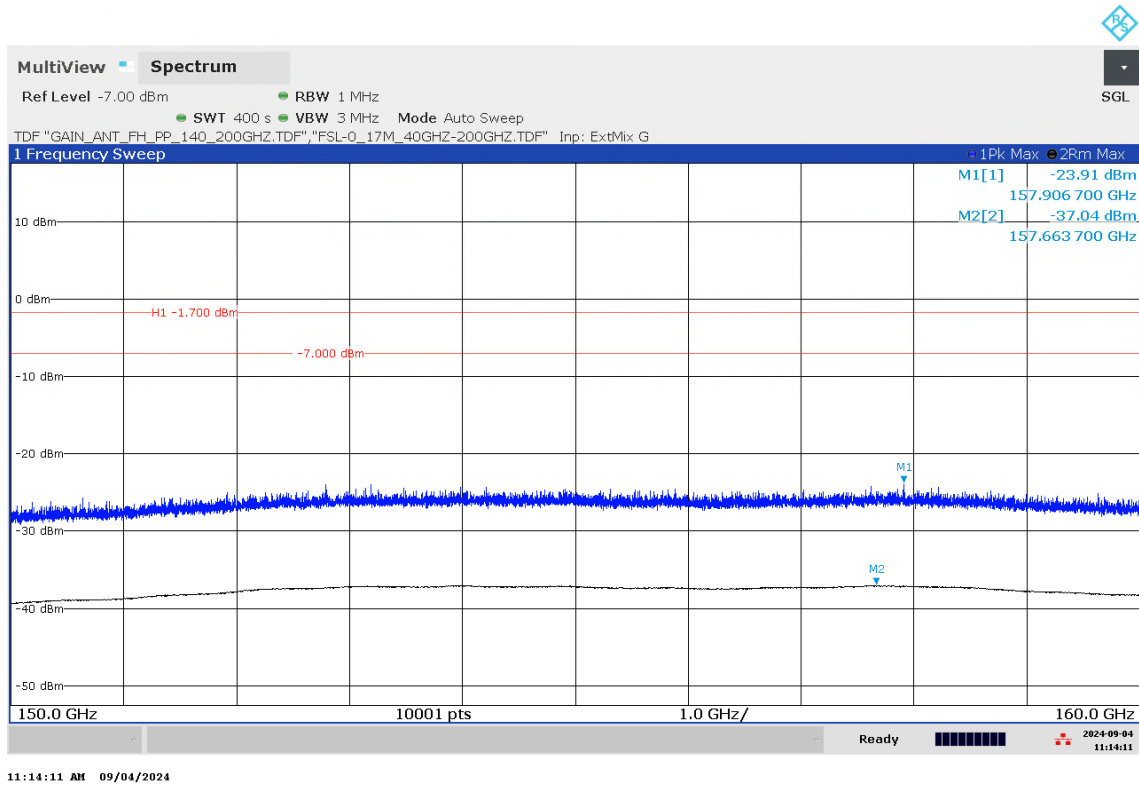


Diagram no.: TID030_23-1-0145601T010_RSE_150 - 160GHz_S19_FCC_AntV.PNG



1.4.15 Radiated emissions (160GHz<f<170GHz)

Diagram no.: TID031_23-1-0145601T010_RSE_160 - 170GHz_S19_FCC_AntH.PNG

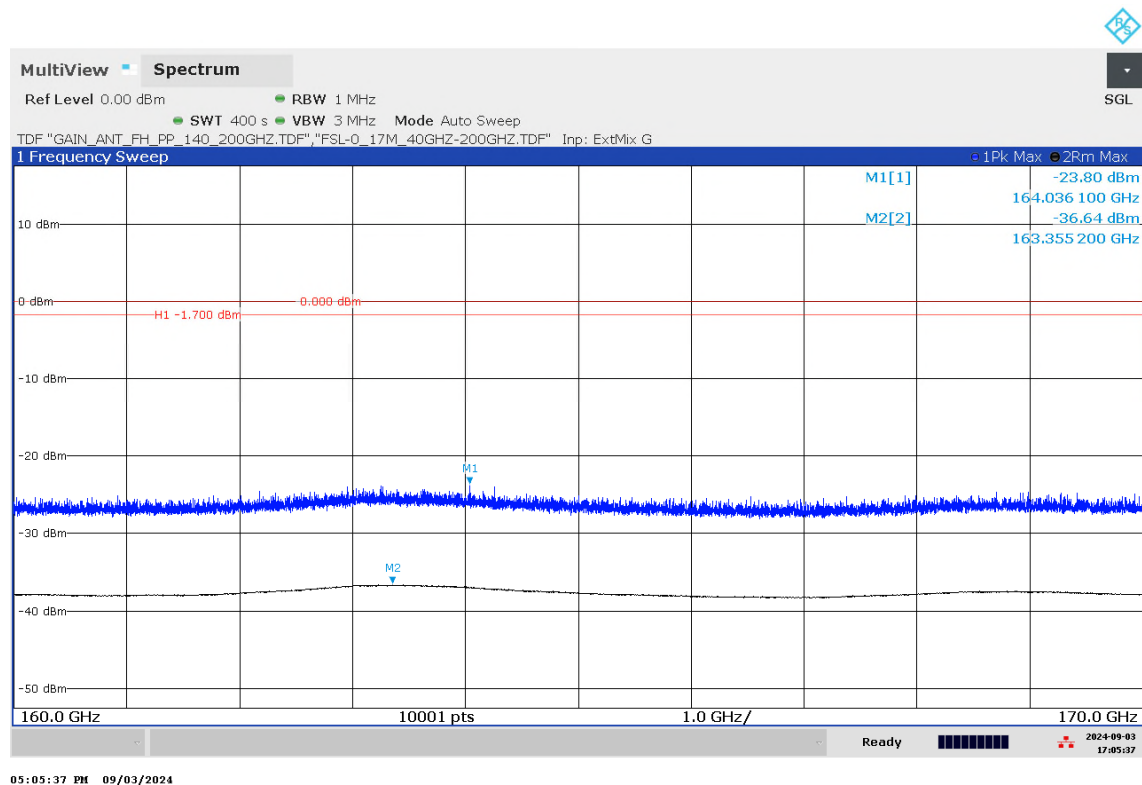
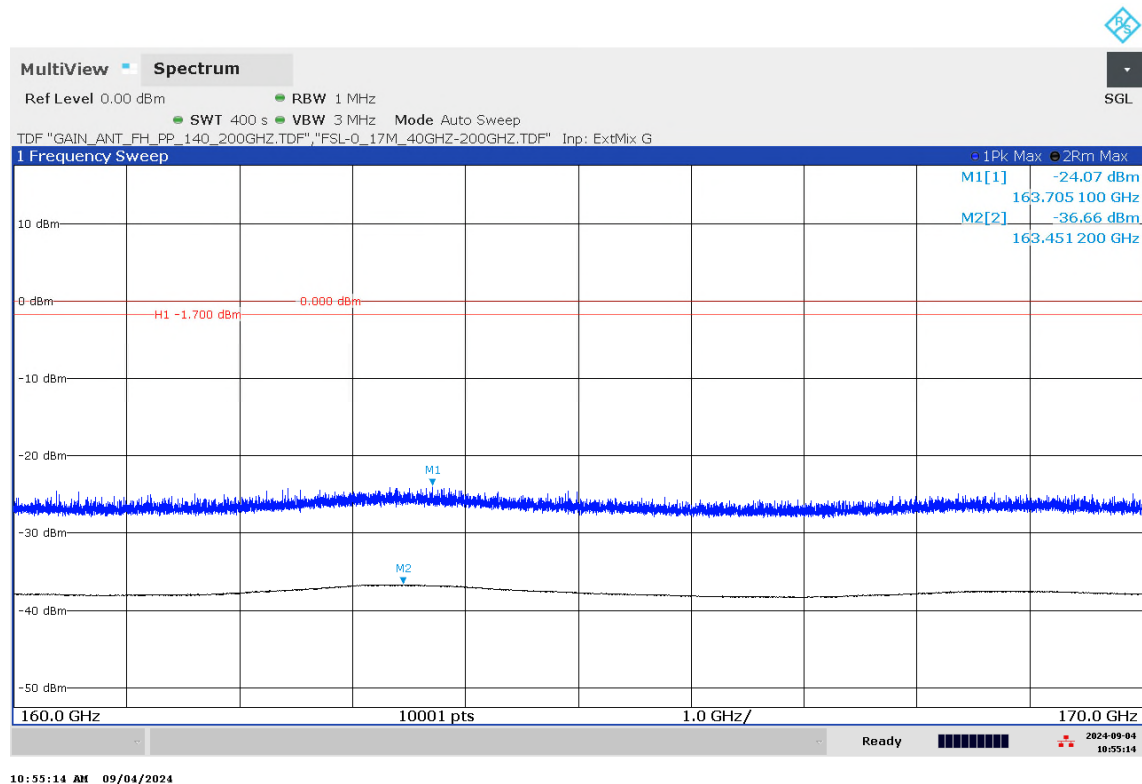


Diagram no.: TID032_23-1-0145601T010_RSE_160 - 170GHz_S19_FCC_AntV.PNG



1.4.16 Radiated emissions (170GHz<f<200GHz)

Diagram no.: TID033_23-1-0145601T010_RSE_170 - 200GHz_S19_FCC_AntH.PNG

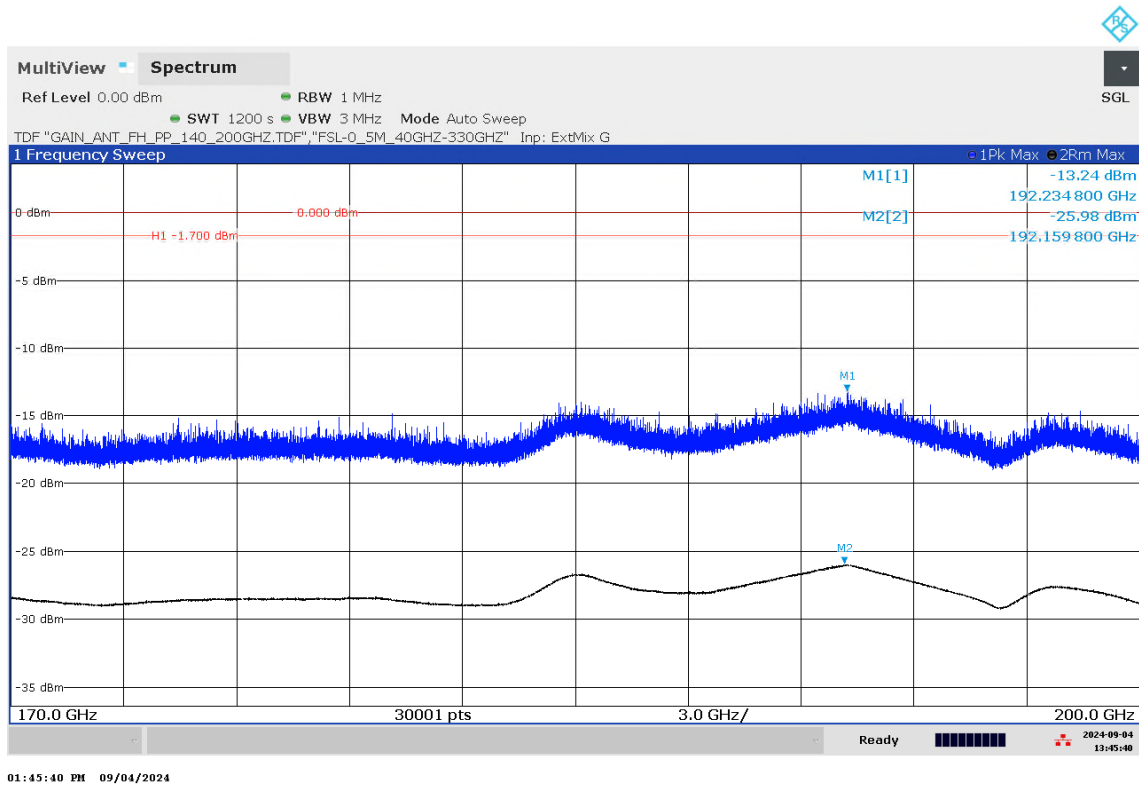
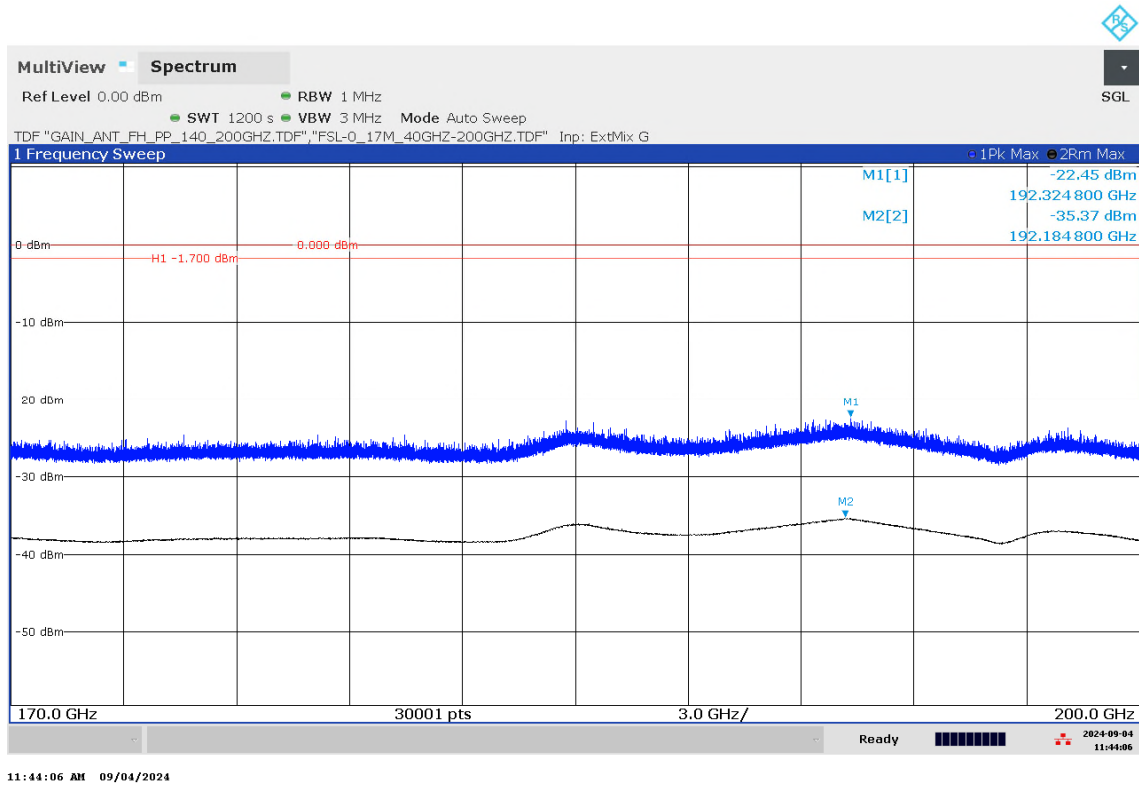


Diagram no.: TID034_23-1-0145601T010_RSE_170 - 200GHz_S19_FCC_AntV.PNG



1.4.17 Radiated emissions (200GHz<f<220GHz)

Diagram no.: TID035_23-1-0145601T010_RSE_200 - 220GHz_S19_FCC_AntH.PNG

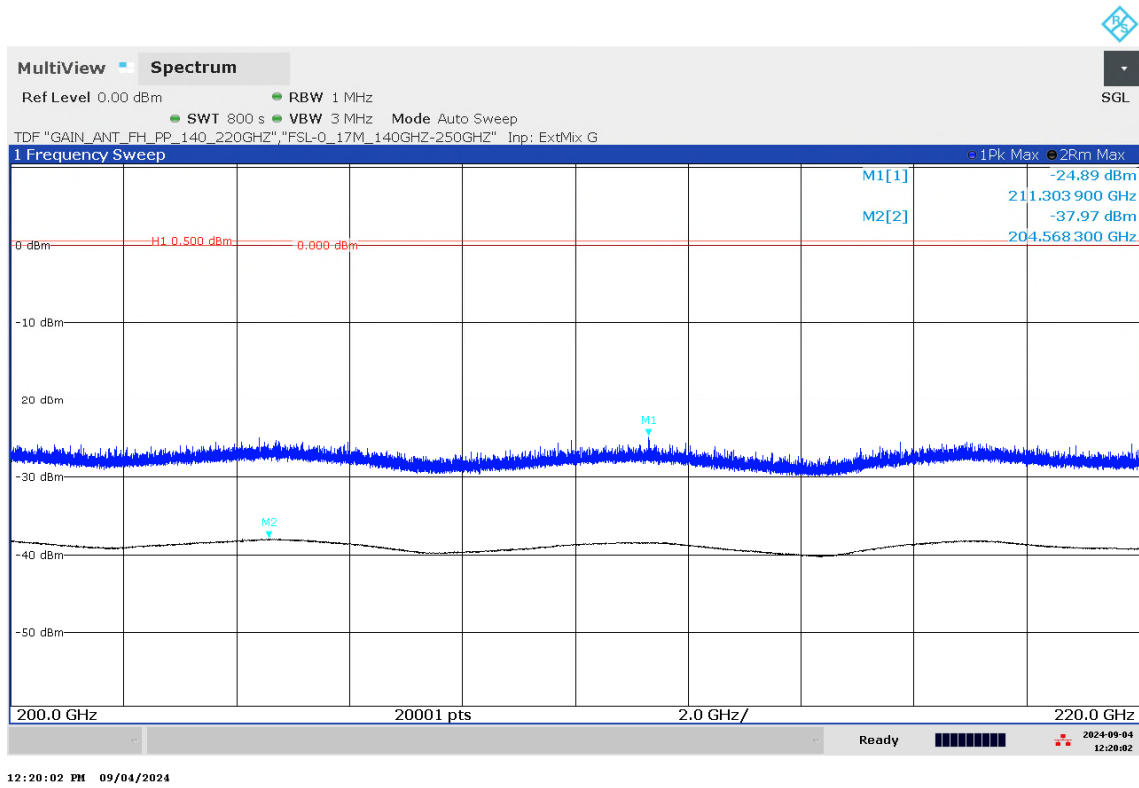
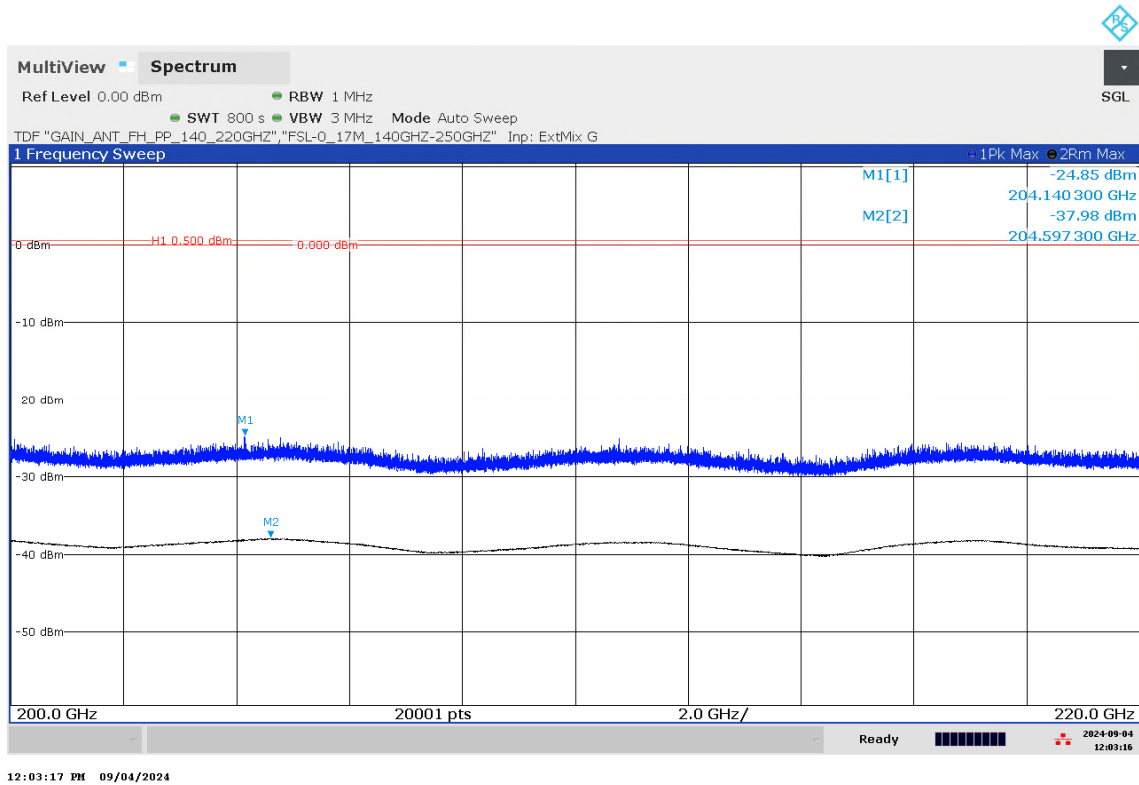


Diagram no.: TID036_23-1-0145601T010_RSE_200 - 220GHz_S19_FCC_AntV.PNG



1.4.18 Radiated emissions (220GHz<f<243GHz)

Diagram no.: TID037_23-1-0145601T010_RSE_220 - 243GHz_S19_FCC_AntH.PNG

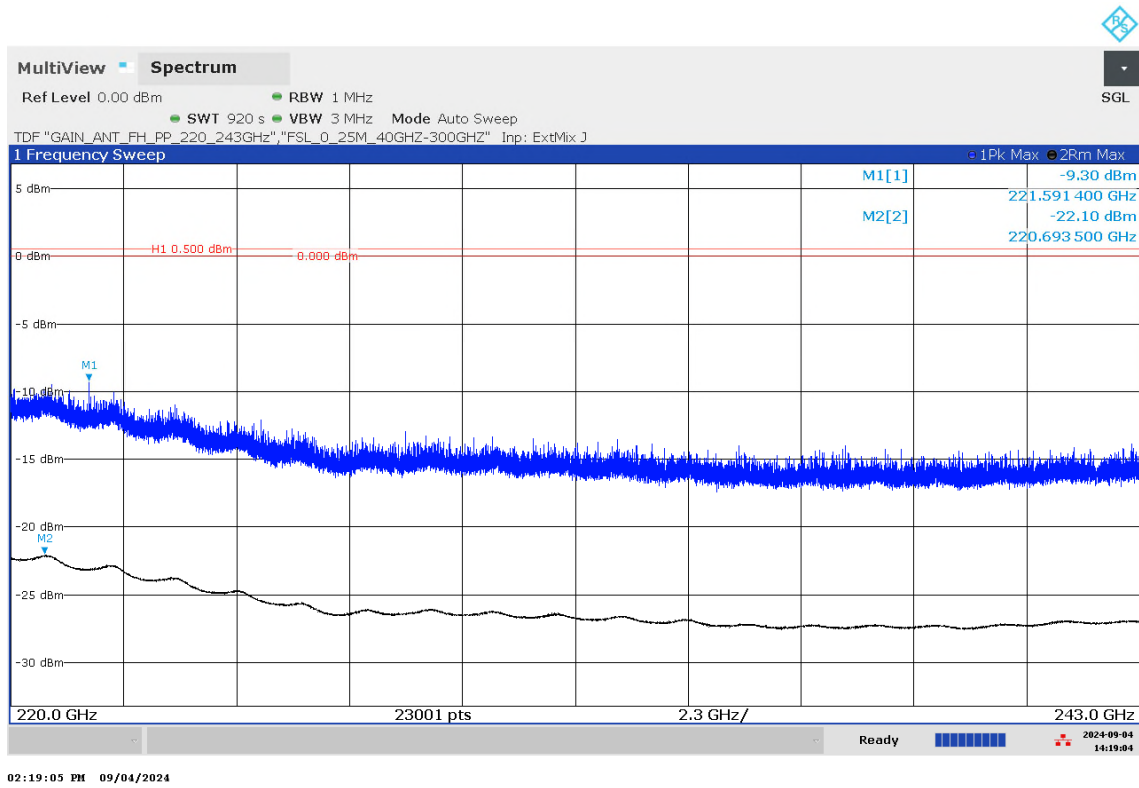
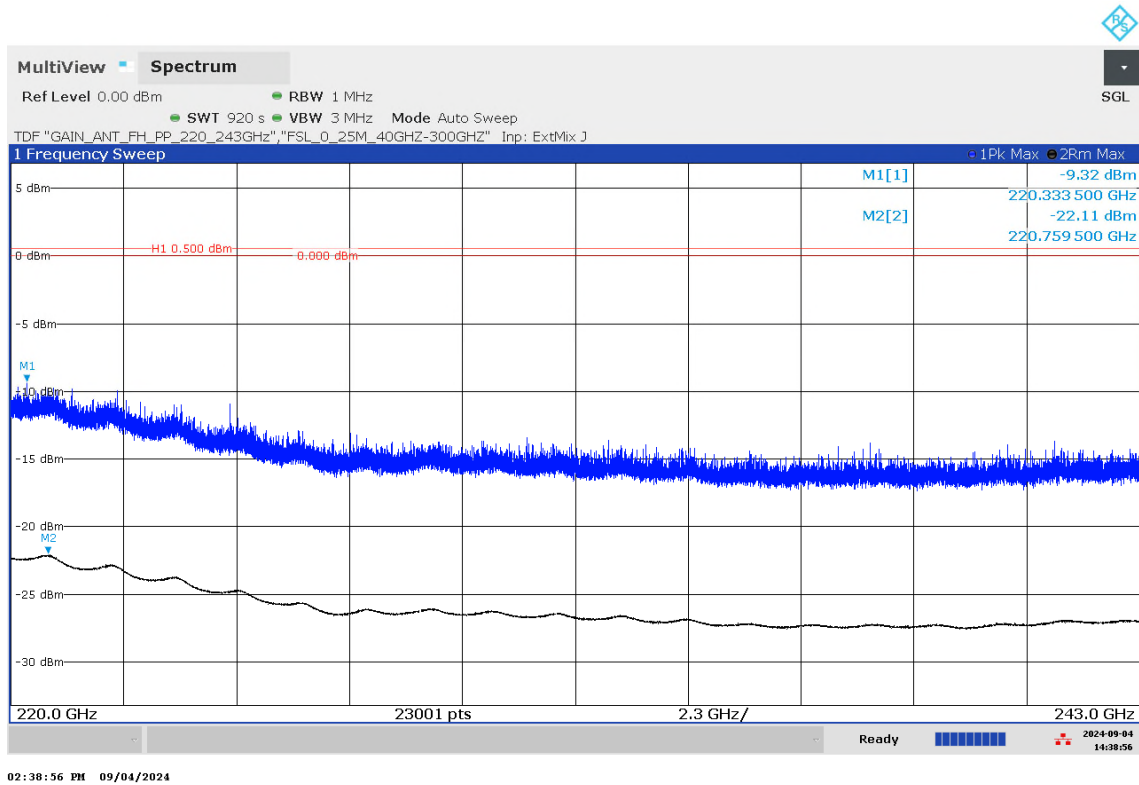


Diagram no.: TID038_23-1-0145601T010_RSE_220 - 243GHz_S19_FCC_AntV.PNG



End Of Annex 202