Annex 1: Measurement diagrams 20-1-0167901T02a-A1-C1

Number of pages:	55	**Date of Report:**	2021-Oct-08
Testing company:	CETECOM GmbH Im Teelbruch 116 45219 Essen Germany Tel. + 49 (0) 20 54 / 95 19-0 Fax: + 49 (0) 20 54 / 95 19-150	**Applicant:**	Geolux d.o.o.
Product: **Model:**	**Water Level Sensor** **LX80**		
FCC ID:	2AN9XLX801	**IC:**	26475-LX801
Testing has been carried out in accordance with:	**Title 47 CFR, Chapter I** **FCC Regulations, Subchapter A** Part 15, Subpart C: §15.256 **ISED Regulations** RSS-Gen, Issue 5 + Amendment 2 RSS-211, Issue 1 Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method and limit".		

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1 Measurement diagrams

1.1 Fundamental bandwidth

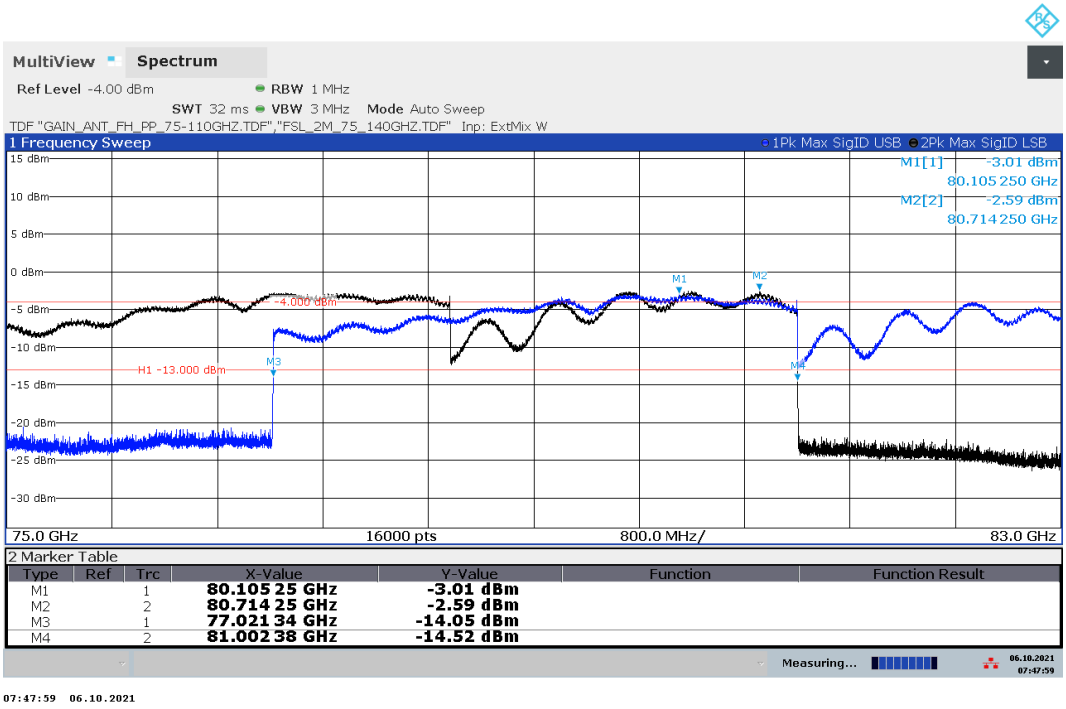

Diagram 1. 10 dB bandwidth under nominal condition TnomVnom

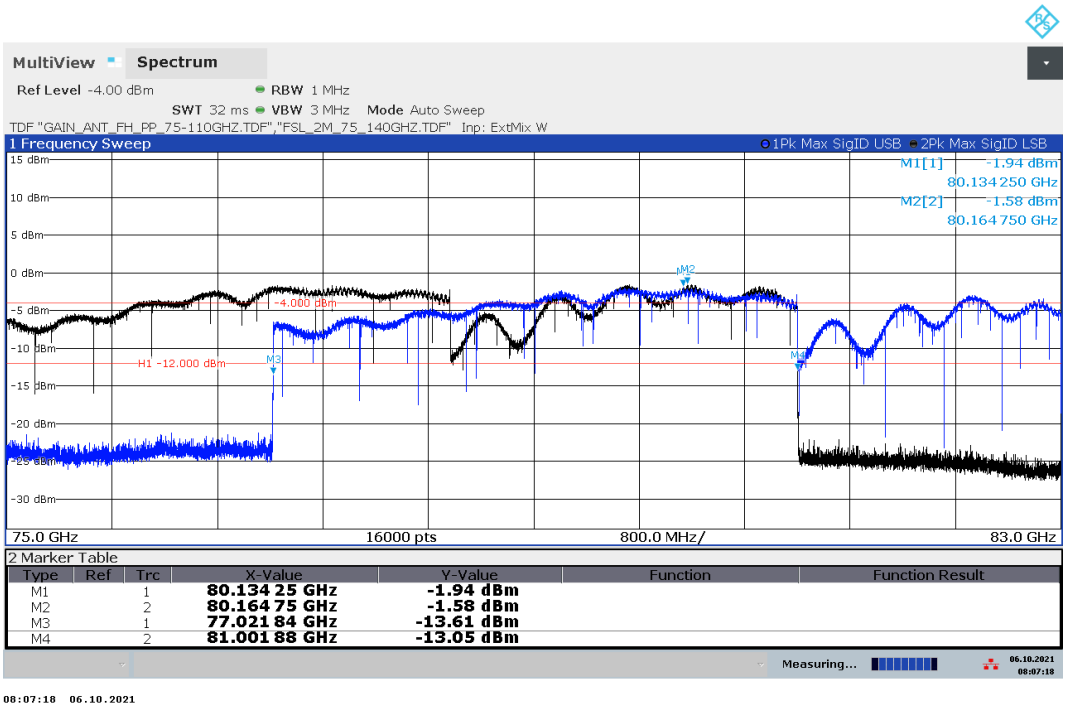

Diagram 2. 10 dB bandwidth under extreme condition TnomVmin

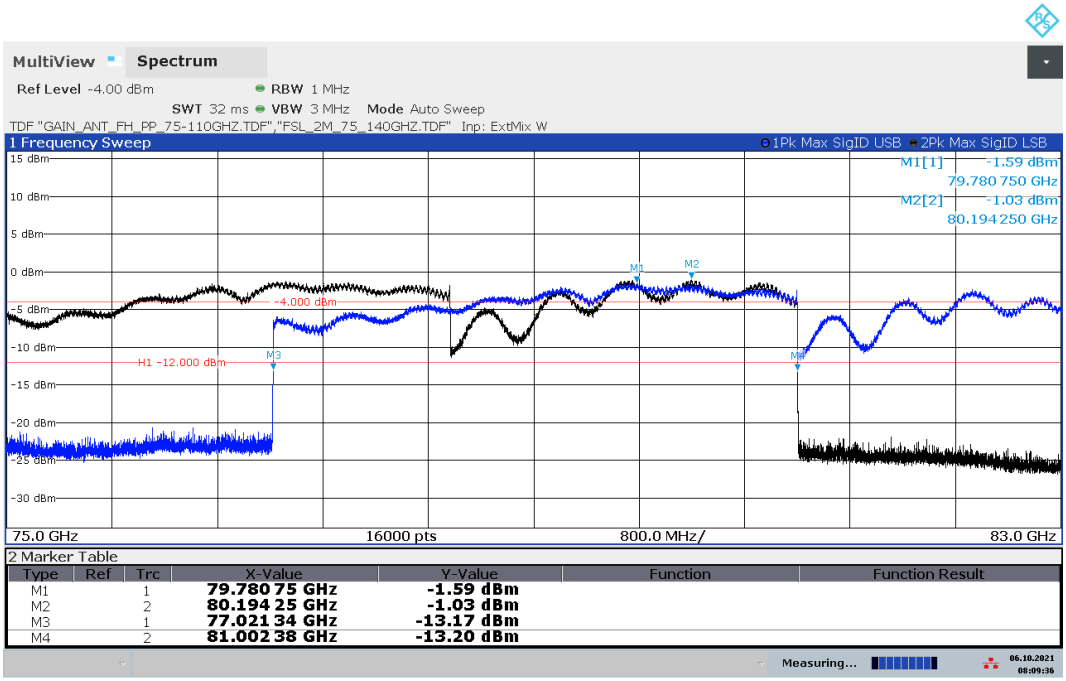

Diagram 3. 10 dB bandwidth under extreme condition TnomVmax

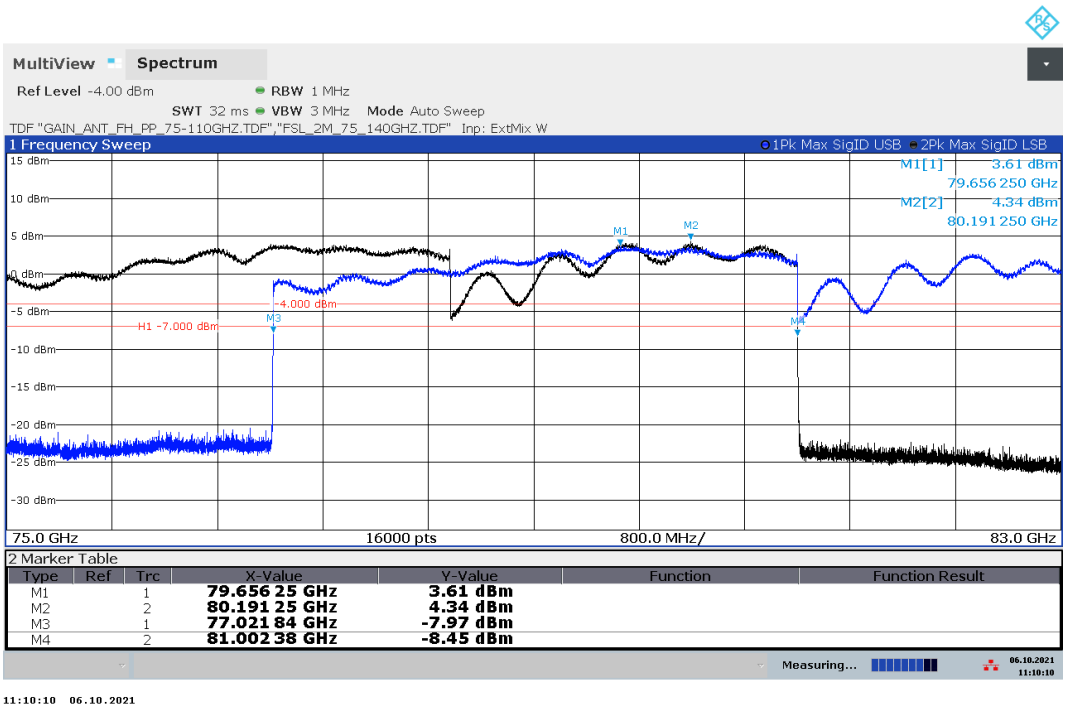

Diagram 4. 10 dB bandwidth under extreme condition TminVnom

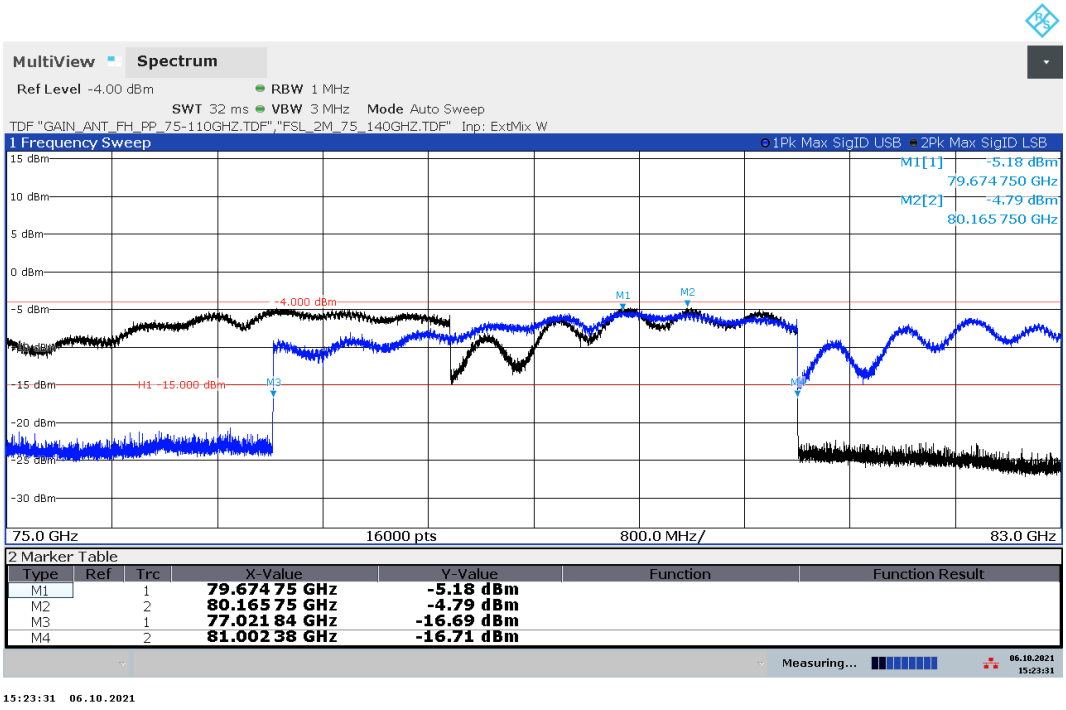

Diagram 5. 10 dB bandwidth under extreme condition TmaxVnom

1.2 Fundamental emission EIRP

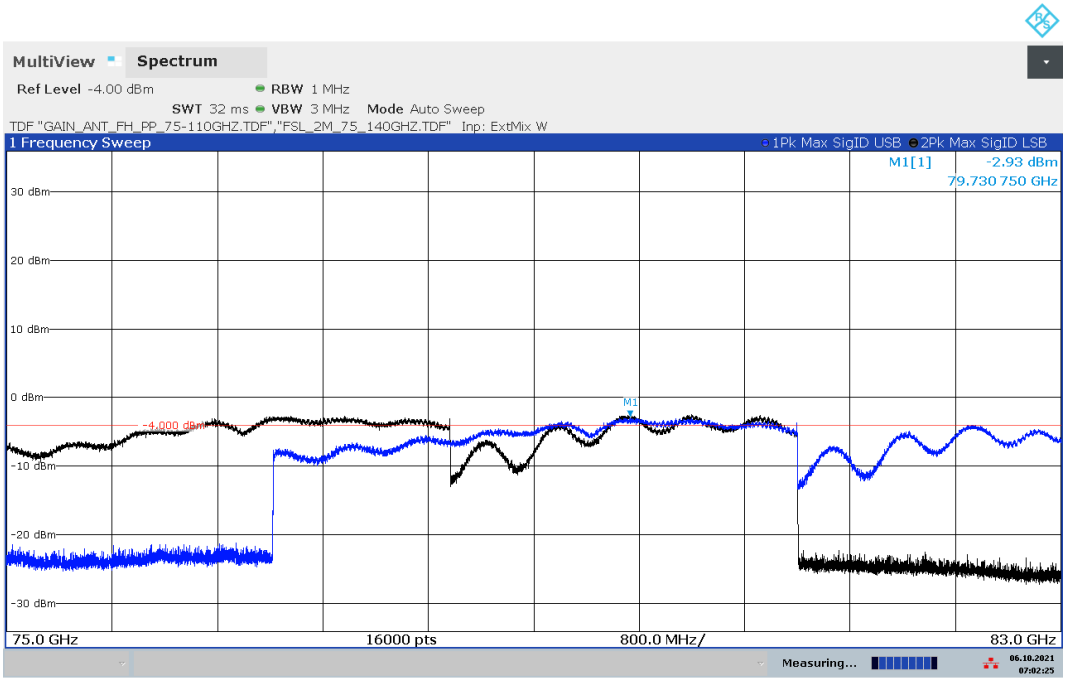

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Diagram 6. radiated emission power measured with RBW = 1 MHz

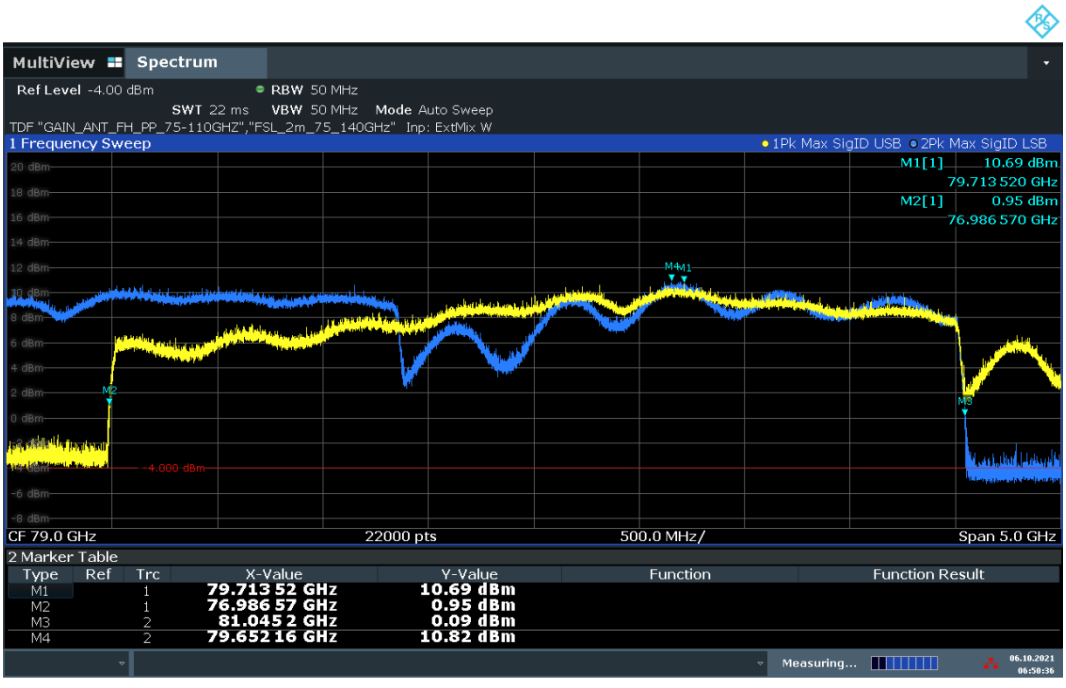

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Diagram 7. radiated emission power measured with RBW = 50 MHz

1.3 Duty cycle (for information only)

Diagram 8. FMCW signal in time domain. The frequency sweep time (pulse width) 16 µs. The retrace time 131 µs. Thus the total cycle time is 147 µs.

1.4 Unwanted emissions

Remark: The unwanted emissions are measured with the EUT operating under **test mode 1: frequency modulation continuous wave (FMCW) mode** and **test mode 2: continuous wave at fixed frequencies (f_low/middle/high)**. For test under 60 GHz, test mode 1 is used due to following reason: The test mode 2 does not represent the real using scenario, but only for testing. The test mode 2 causes the EUT power supply unit to overload and radiates excessive emissions in the lower frequency range. For the test above 60 GHz, test mode 2 is used due to following reasons: Measuring in higher frequency range with external mixers can cause mixing products such as ghost signals. If the EUT operates at fixed frequencies, so do the ghost signals as well, so that the ghost signals can be identified clearly. Measuring in higher frequency range also require better measuring dynamic. Appling a smaller resolution bandwidth can achieve a better measuring dynamic, if the EUT operates in CW mode at fixed frequency.

1.4.1 Frequency range 9 kHz – 30 MHz. EUT in FMCW mode.

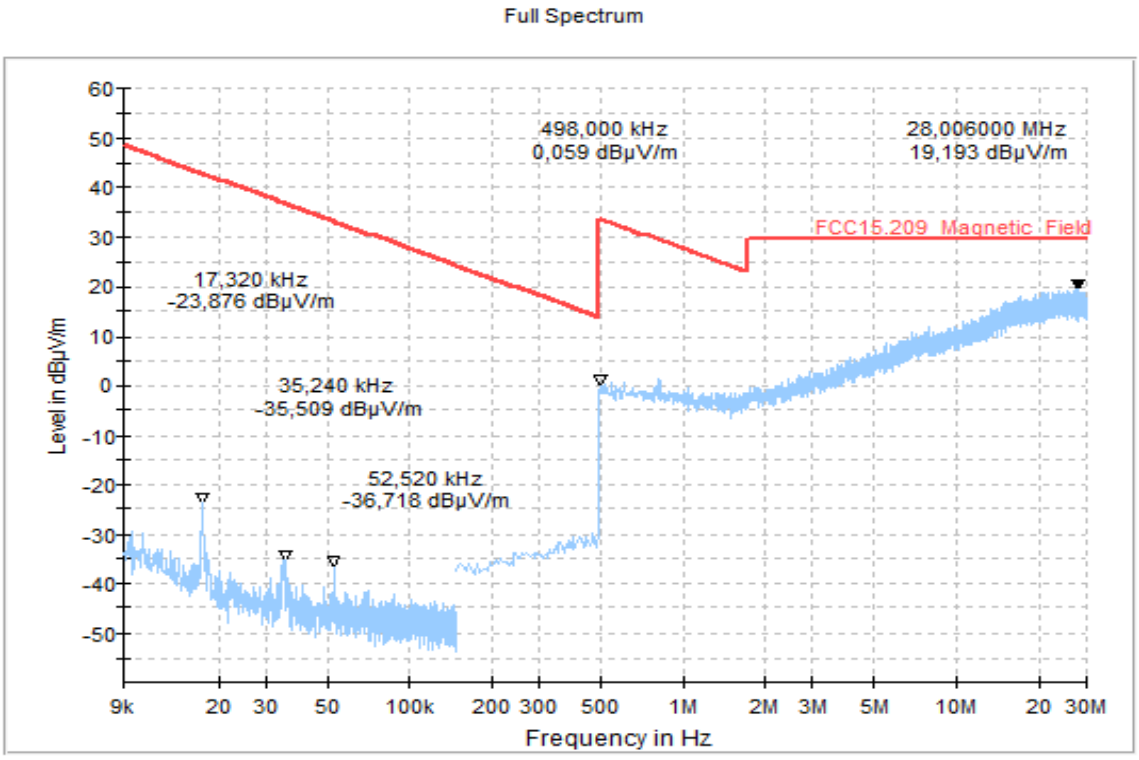

Diagram 9. Unwanted emission measured in the semi-anechoic chamber. EUT at standing position.

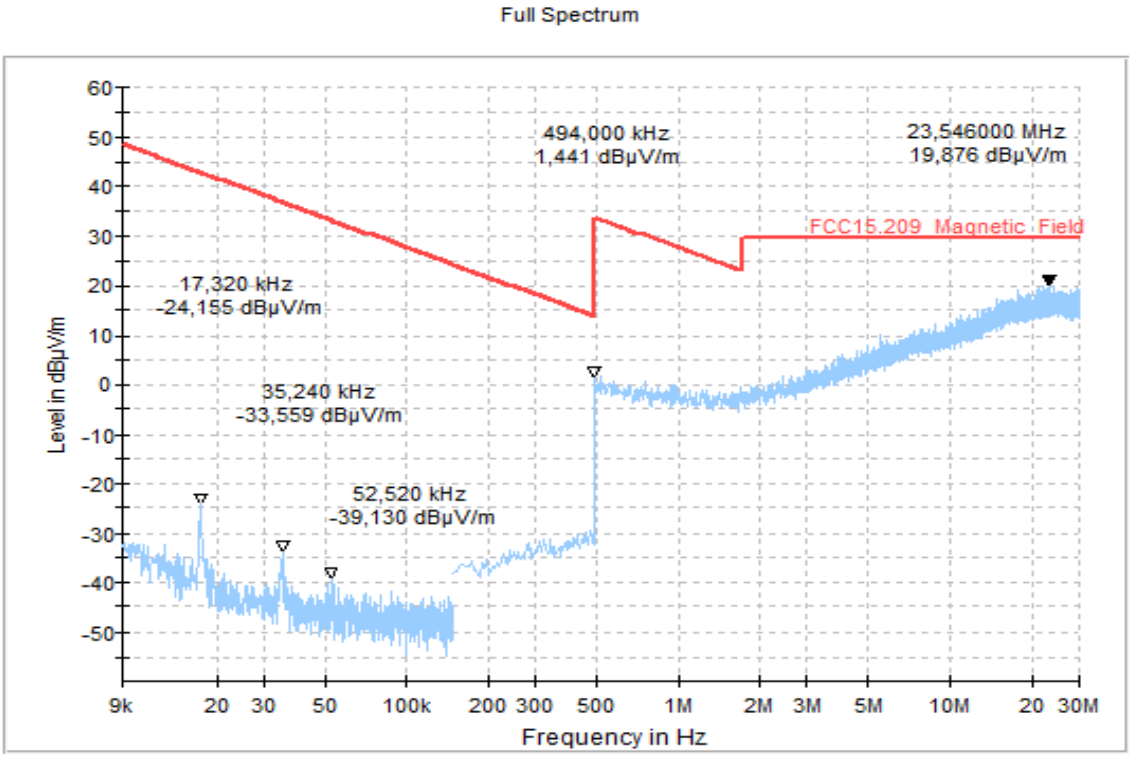

Diagram 10. Unwanted emission measured in the semi-anechoic chamber. EUT at lying position.

1.4.2 Frequency range 30 MHz – 1 GHz. EUT in FMCW mode.

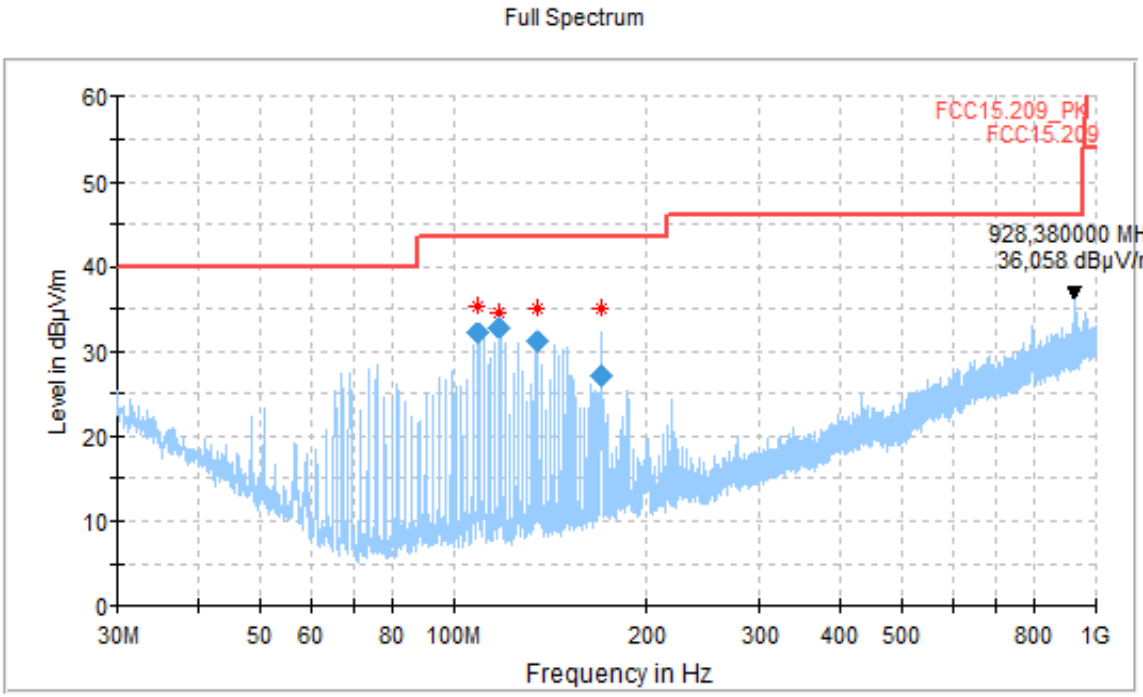

Diagram 11. Unwanted emission measured in the semi-anechoic chamber. EUT at standing position.

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
109.525	32.19	43.50	11.31	120.000	136.0	V	316.0	8.2	0.0	1.2	7.0	24.0
117.985	32.73	43.50	10.77	120.000	105.0	V	239.0	7.9	0.0	1.0	6.9	24.8
134.793	31.06	43.50	12.44	120.000	129.0	V	270.0	9.8	0.0	1.1	8.7	21.2
169.495	27.08	43.50	16.42	120.000	105.0	V	172.0	10.2	0.0	1.4	8.8	16.9

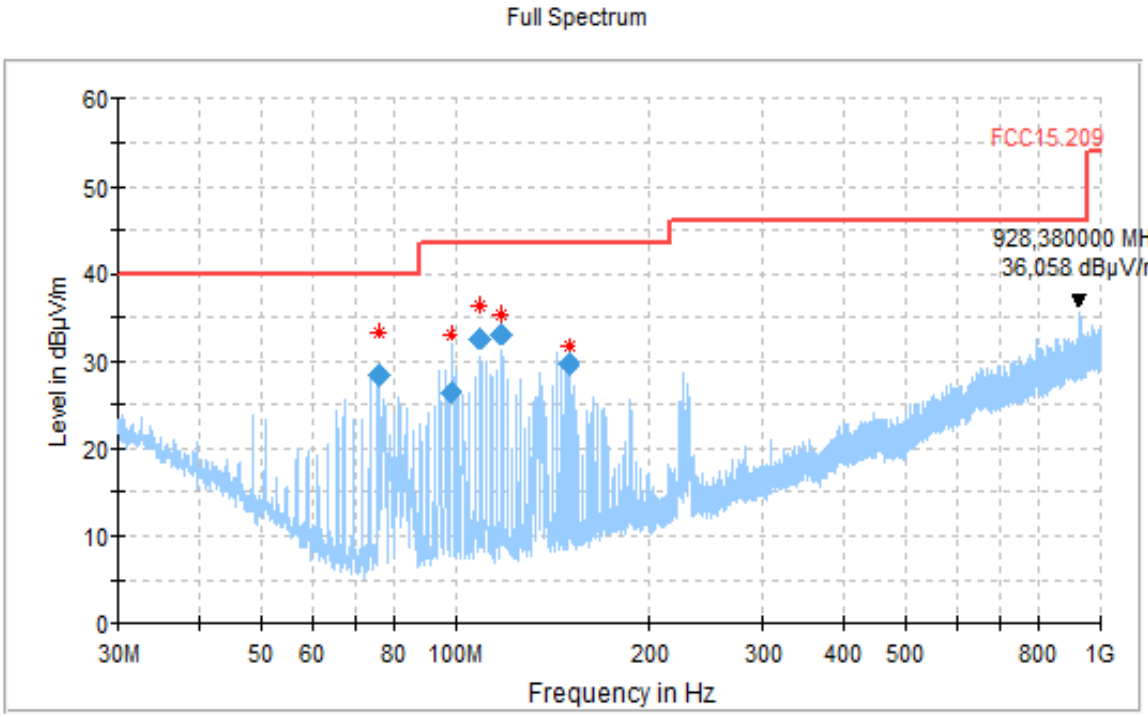

Diagram 12. Unwanted emission measured in the semi-anechoic chamber. EUT at lying position.

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)	Sig Path (dB)	Preamp (dB)	Trd Corr. (dB/m)	Raw Rec (dBµV)
75.813	28.40	40.00	11.60	120.000	162.0	V	214.0	6.7	0.0	0.9	5.8	21.7
98.195	26.32	43.50	17.18	120.000	133.0	V	268.0	8.1	0.0	0.9	7.2	18.2
109.529	32.60	43.50	10.90	120.000	153.0	V	295.0	8.2	0.0	1.2	7.0	24.4
117.929	33.07	43.50	10.43	120.000	133.0	V	264.0	7.9	0.0	1.0	6.9	25.2
149.493	29.51	43.50	13.99	120.000	109.0	V	81.0	8.6	0.0	1.1	7.5	20.9

1.4.3 Frequency range 1 GHz – 17 GHz. EUT in FMCW mode.

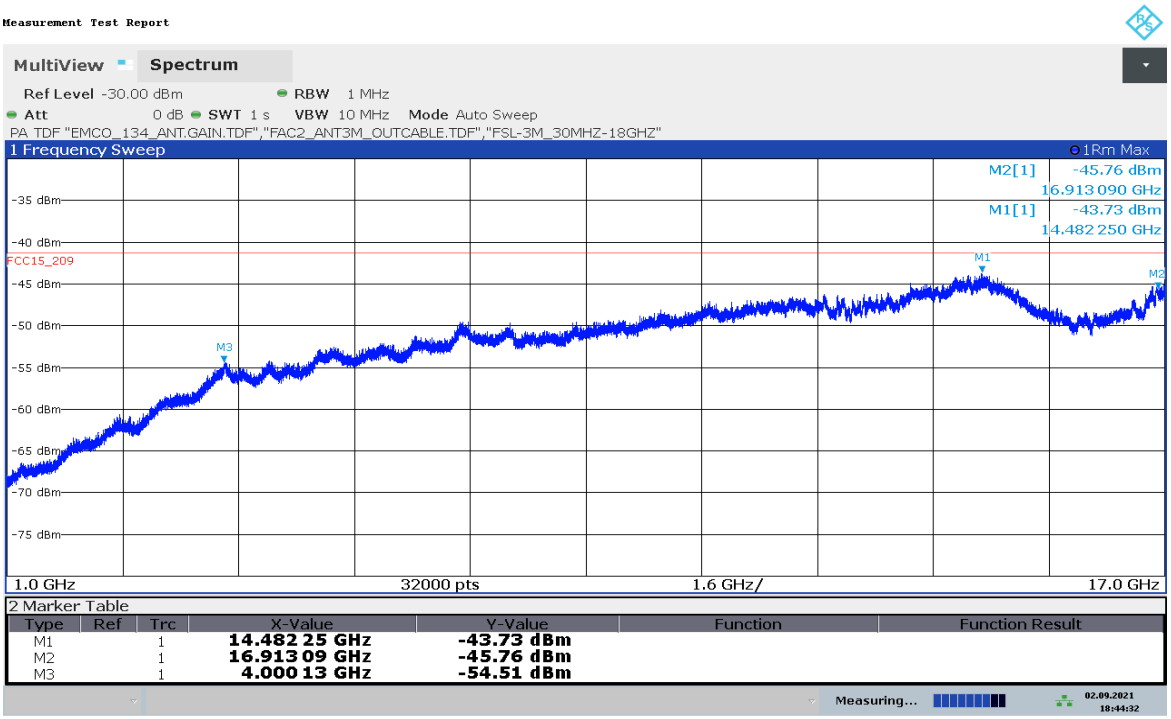

Diagram 13. Tested in the FAC2. EUT is turned and tilt and measured with both horizontal and vertical polarization.

1.4.4 Frequency range 17 GHz – 33 GHz. EUT in FMCW mode.

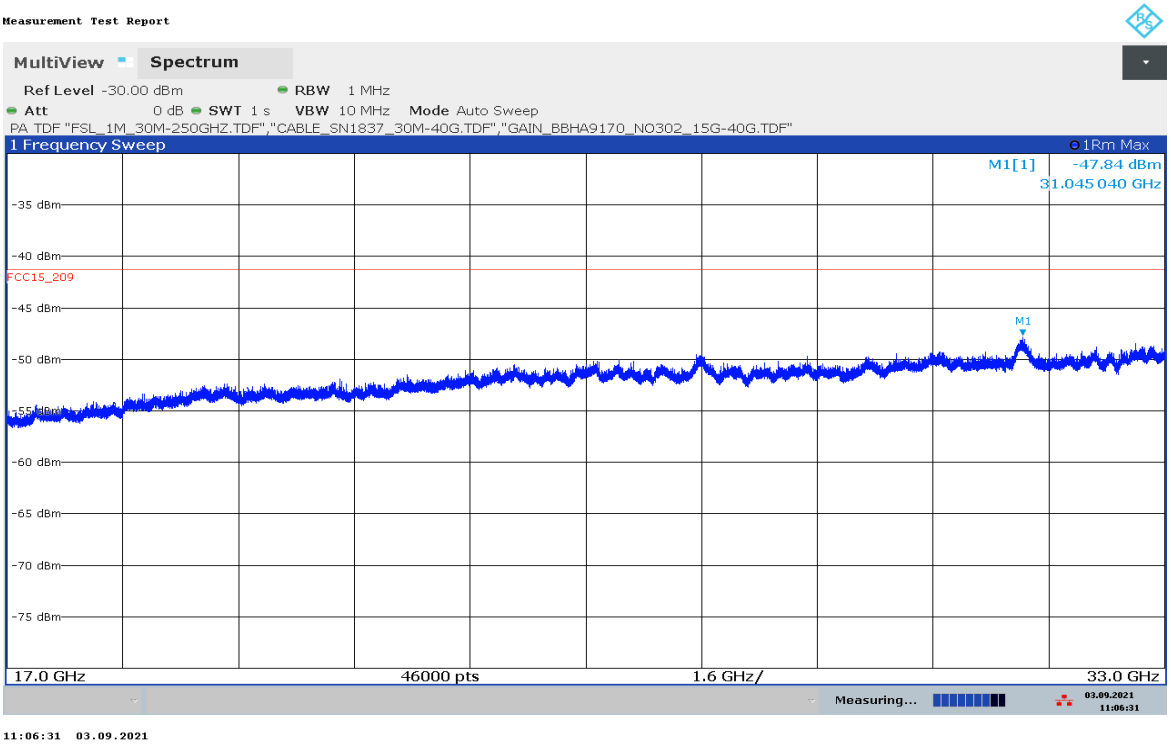

Diagram 14. Tested in the FAC2. EUT is turned and tilt and measured with both horizontal and vertical polarization.

1.4.5 Frequency range 33 GHz – 50 GHz. EUT in FMCW mode.

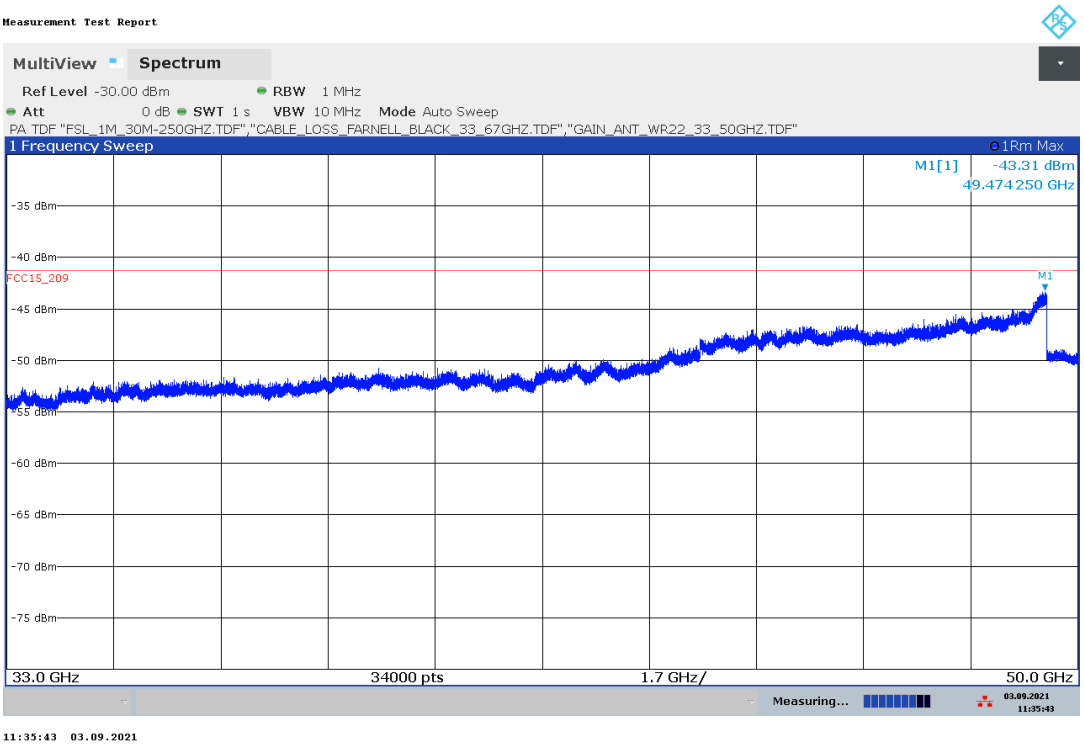

Diagram 15. Tested in the FAC2. EUT is turned and tilt and measured with both horizontal and vertical polarization.

1.4.6 Frequency range 50 GHz – 60 GHz. EUT in FMCW mode.

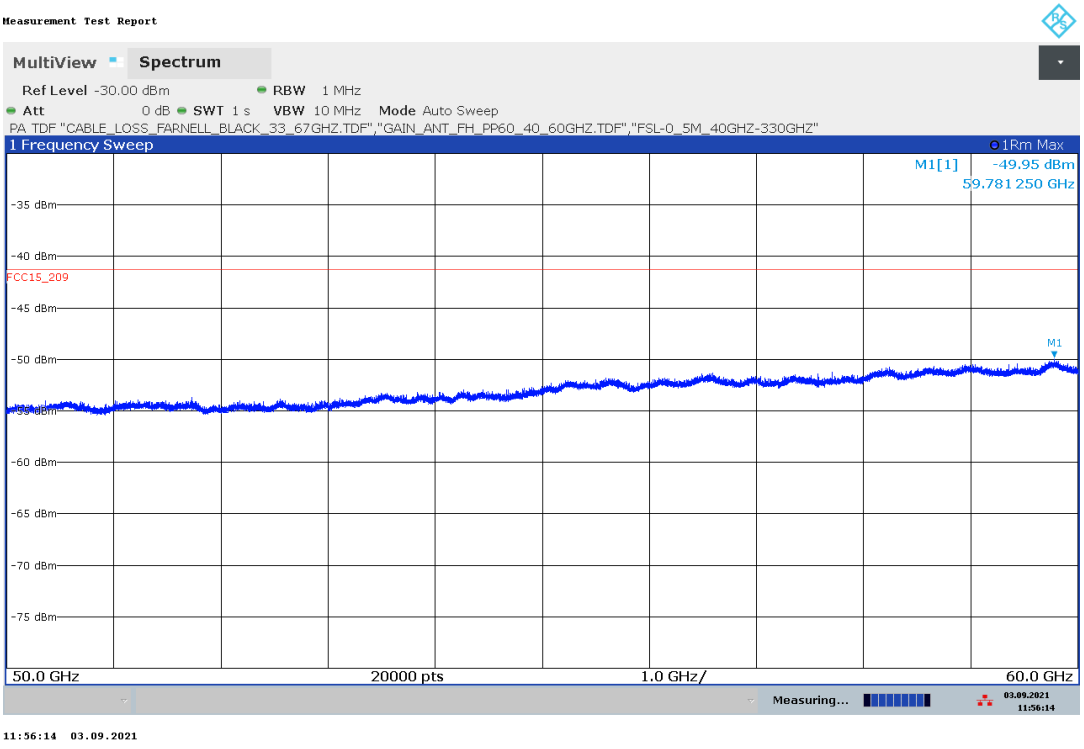

Diagram 16. Tested in the FAC2. EUT is turned and tilt and measured with both horizontal and vertical polarization.

Remark: Above 60 GHz, the external mixer is applied. The signal ID function is activated in order to identify the mixing products. Thus 2 traces “SigID USB” and “SigID LSB” are displayed in the following diagrams. The emission peak is a mixing product, if the 2 traces do not completely overlap. The trace 1 “SigID USB” is displayed in front and the trace 2 “SigID LSB” in behind.

1.4.7 Frequency range 60 GHz – 75 GHz. EUT in CW mode: f_high

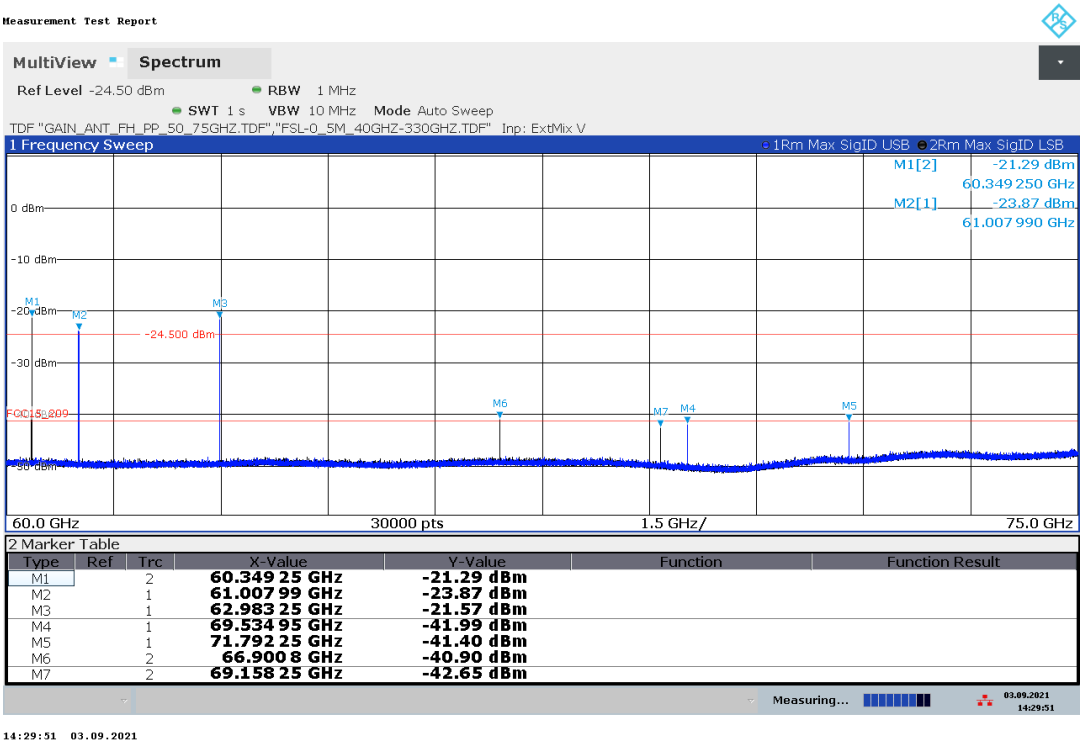

Diagram 17. The emission peaks marked by M1/6/7 are clearly mixing products. M2/3/4/5 are investigated in the following measurements.

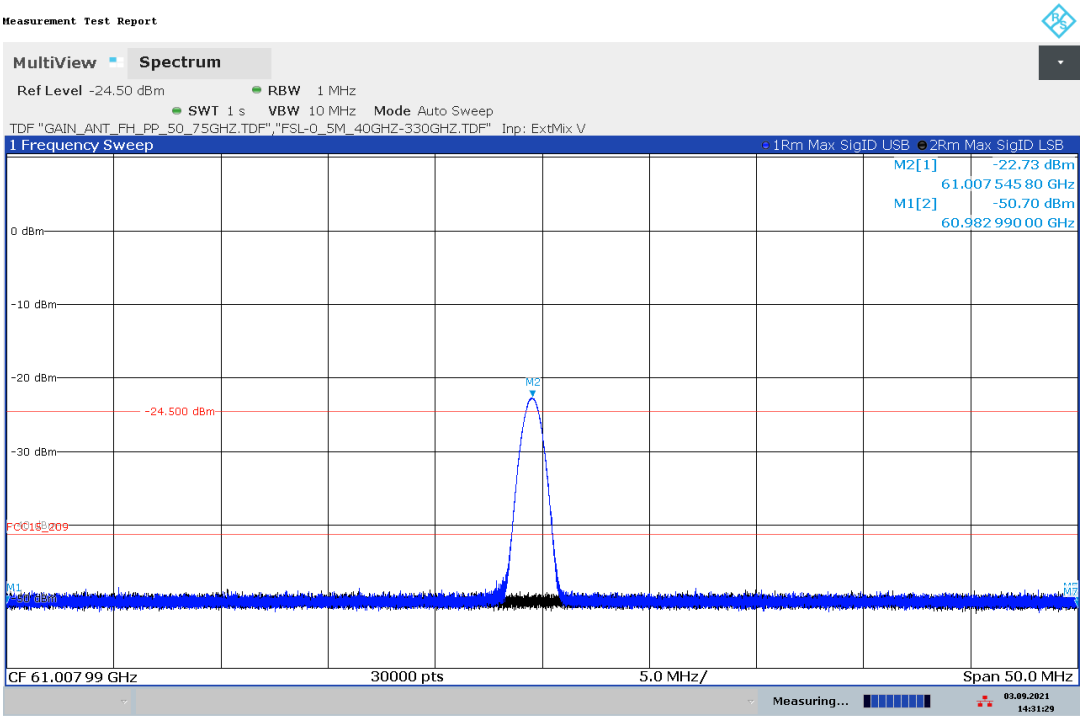

Diagram 18. The emission peak marked by M2 is investigated in narrow span. Trace 1/2 do not overlap. Thus mixing product.

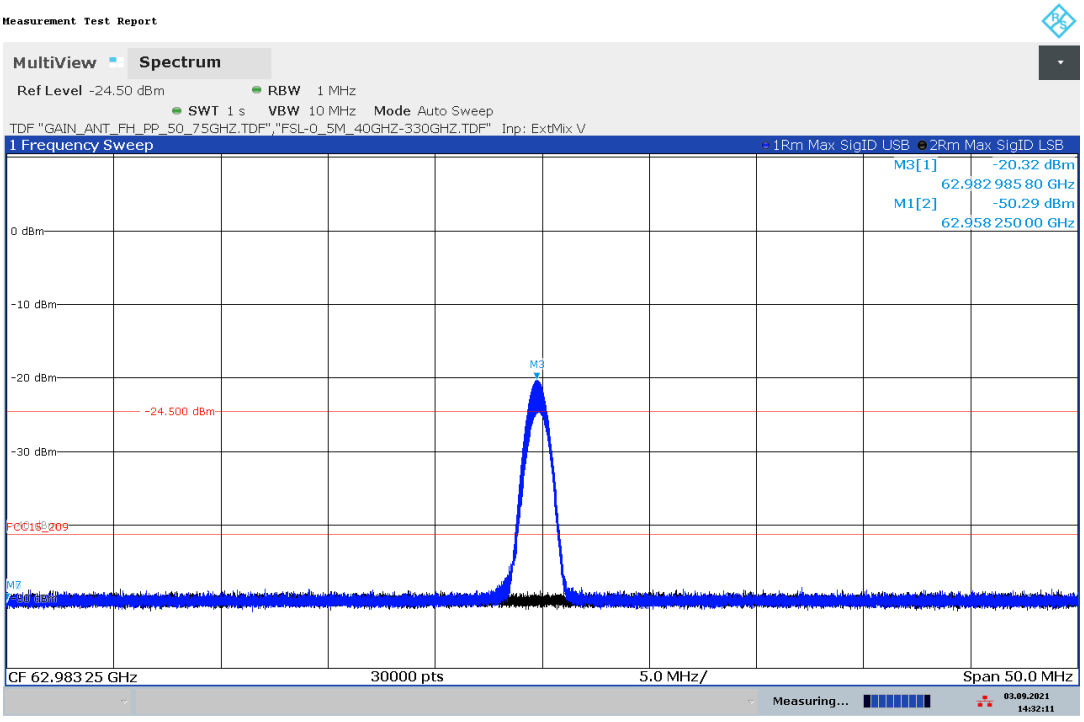

Diagram 19. The emission peak marked by M3 is investigated in narrow span. Trace 1/2 do not overlap. Thus mixing product.

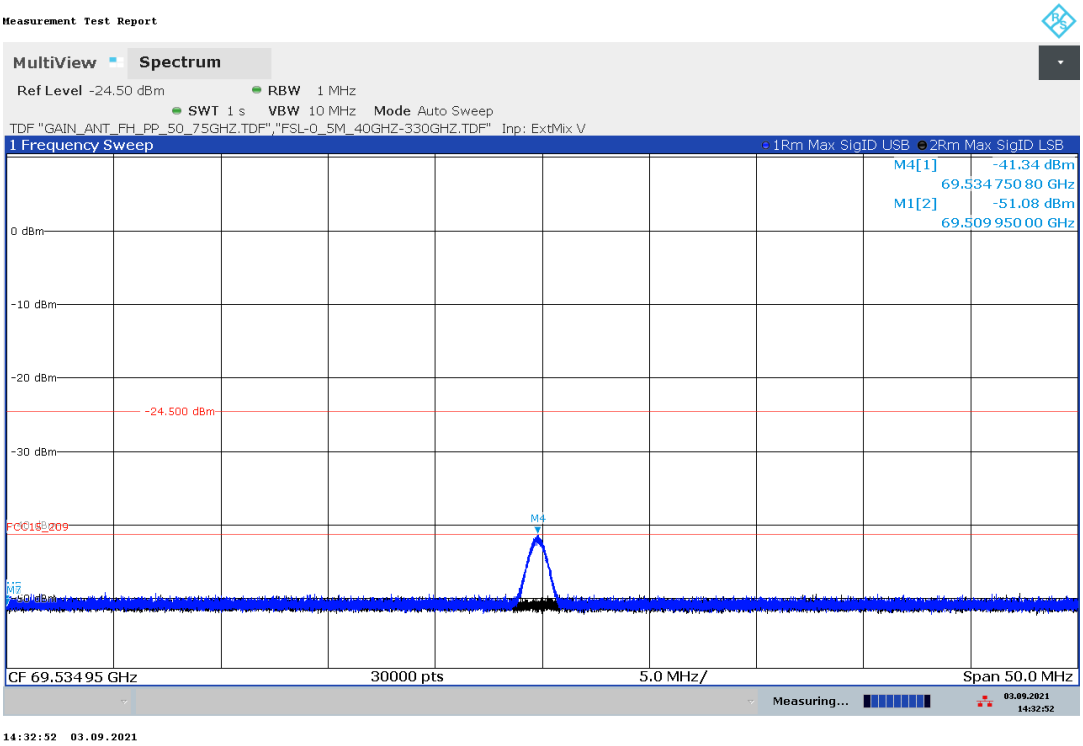

Diagram 20. The emission peak marked by M4 is investigated in narrow span. Trace 1/2 do not overlap. Thus mixing product.

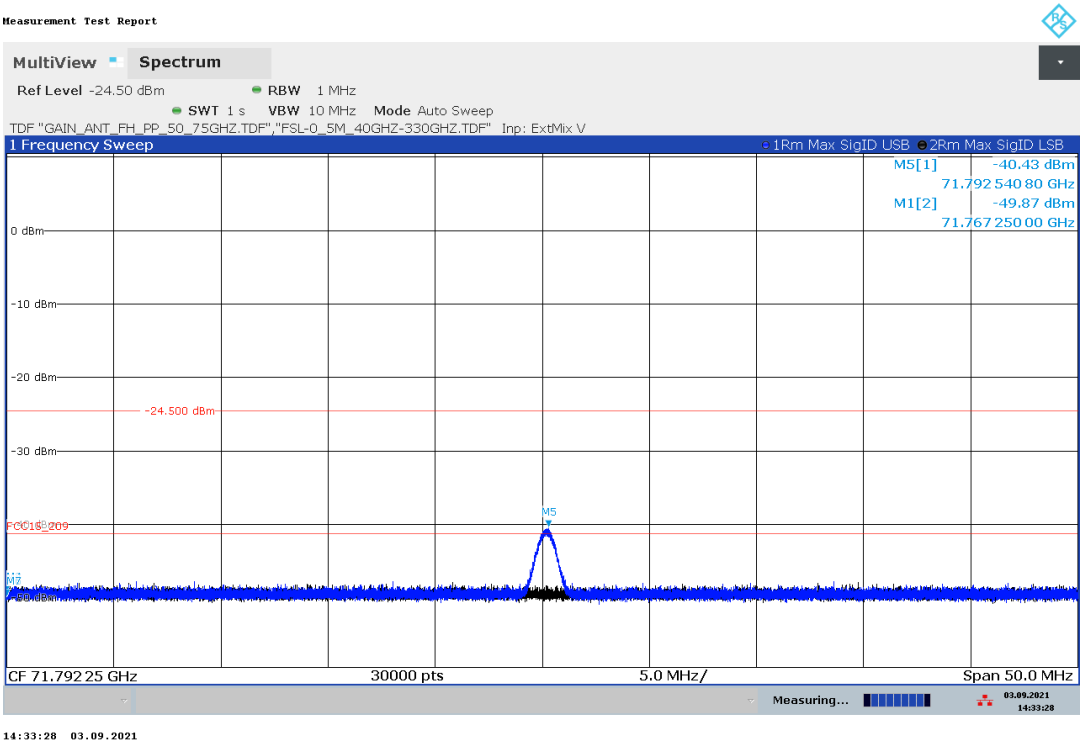

Diagram 21. The emission peak marked by M5 is investigated in narrow span. Trace 1/2 do not overlap. Thus mixing product.

1.4.8 Frequency range 60 GHz – 75 GHz. EUT in CW mode: f_middle

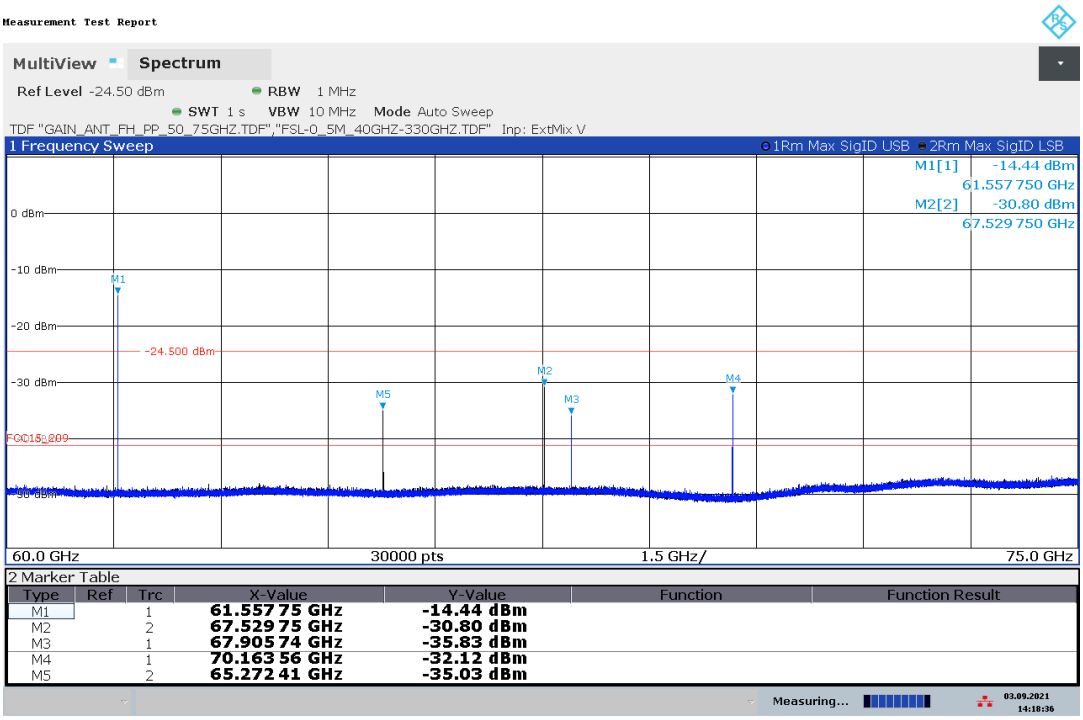

Diagram 22. The emission peaks marked by M2/5 are clearly mixing products. M1/3/4 are investigated in the following measurements.

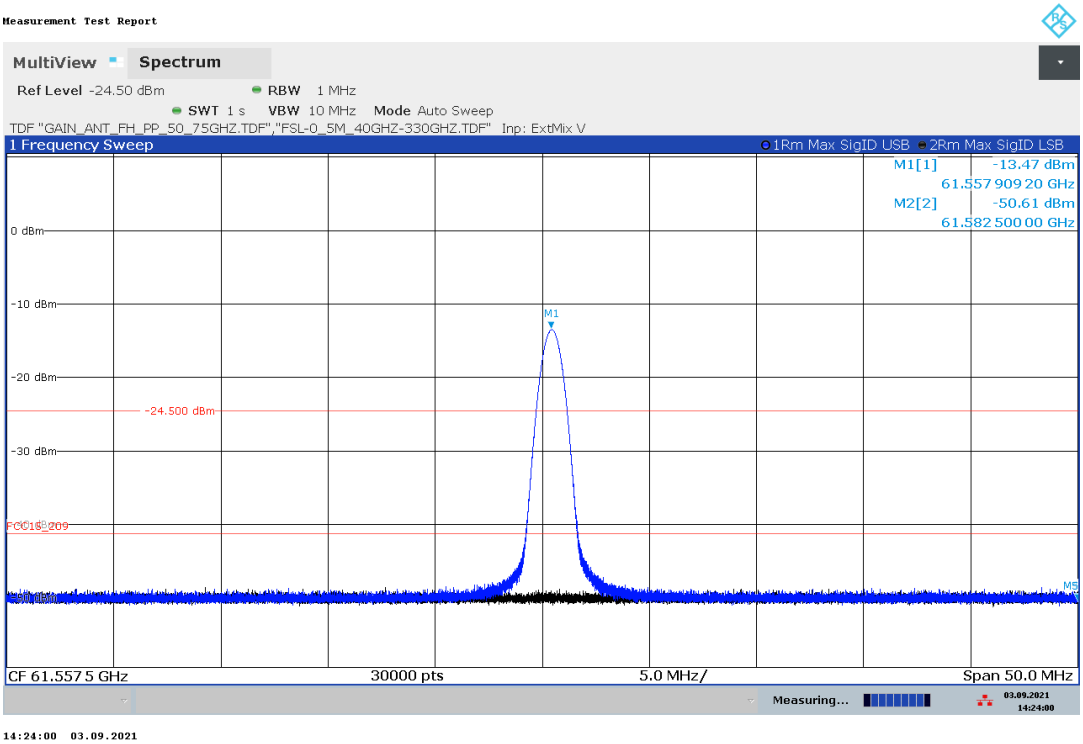

Diagram 23. The emission peak marked by M1 is investigated in narrow span. Trace 1/2 do not overlap. Thus mixing product.

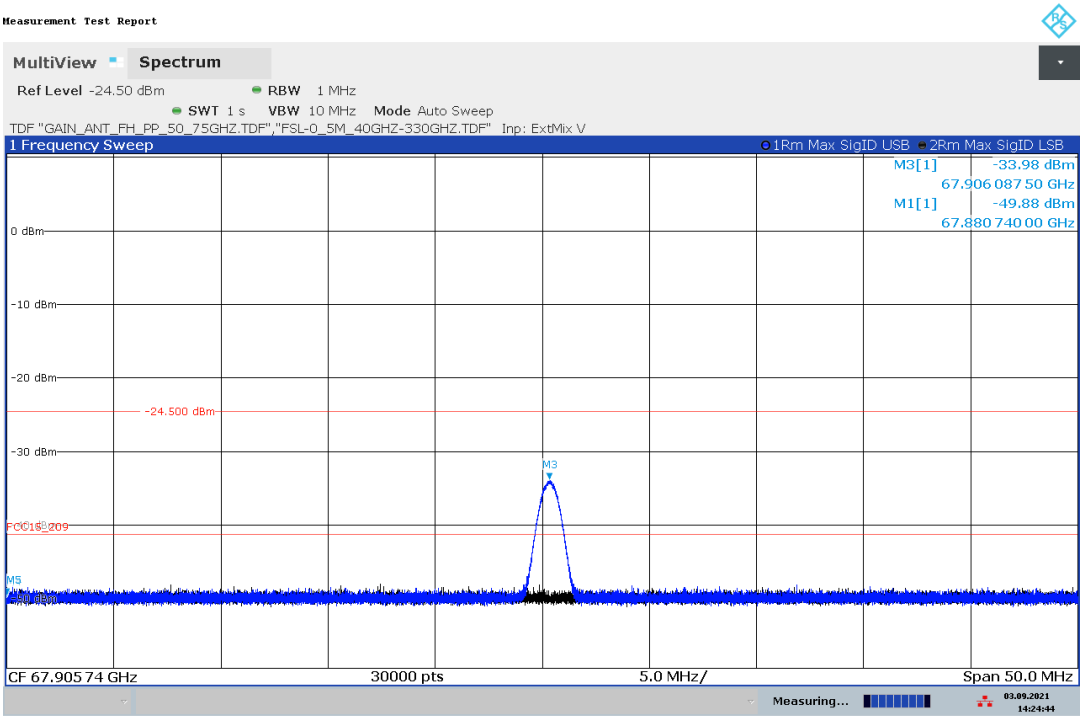

Diagram 24. The emission peak marked by M3 is investigated in narrow span. Trace 1/2 do not overlap. Thus mixing product.

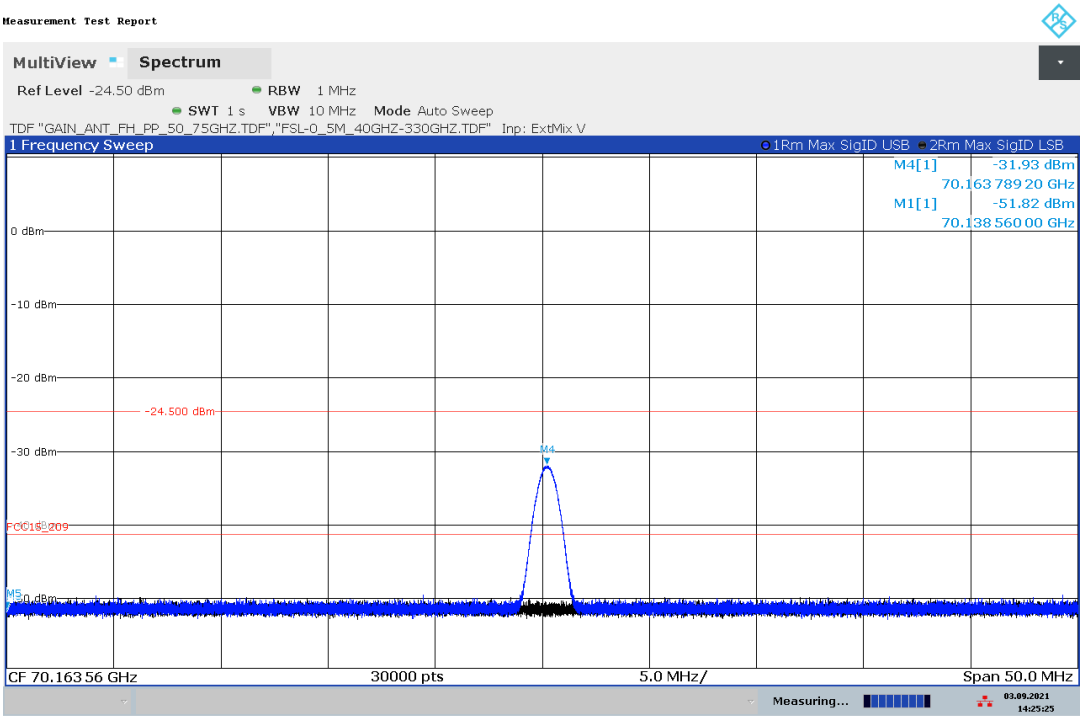

Diagram 25. The emission peak marked by M4 is investigated in narrow span. Trace 1/2 do not overlap. Thus mixing product.

1.4.9 Frequency range 60 GHz – 75 GHz. EUT in CW mode: f_low

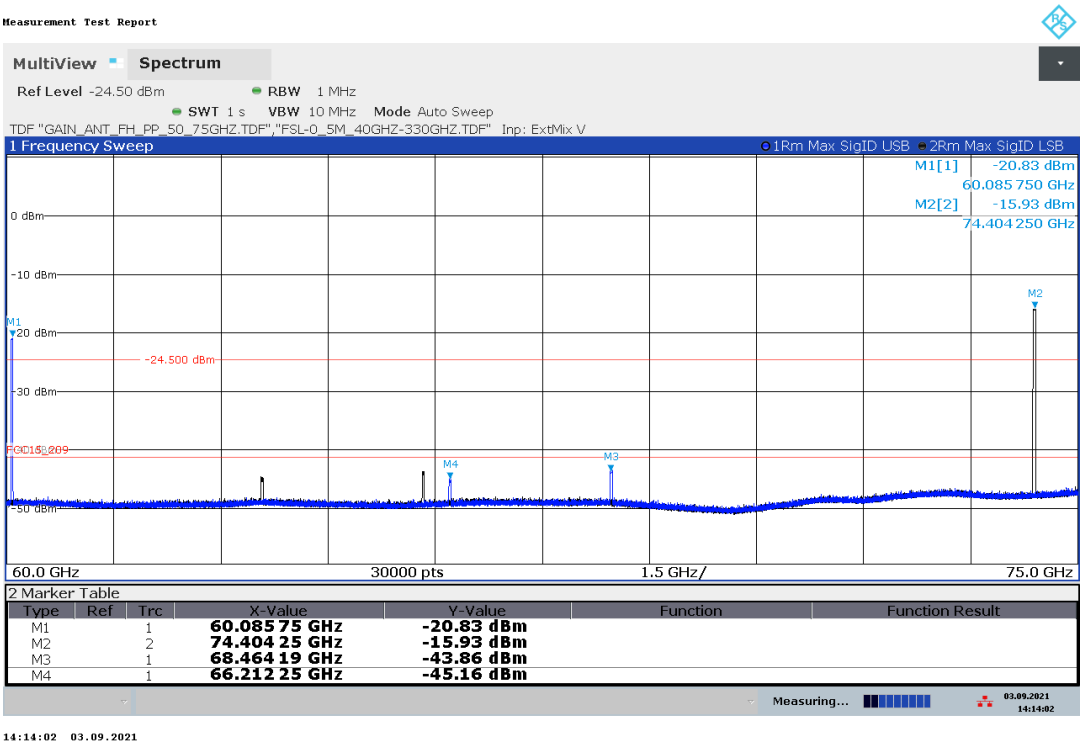

Diagram 26. The emission peaks marked by M1/2/3/4 are mixing products, because the trace 1/2 don't overlap.

1.4.10 Frequency range 75 GHz – 90 GHz. EUT in CW mode: f_high

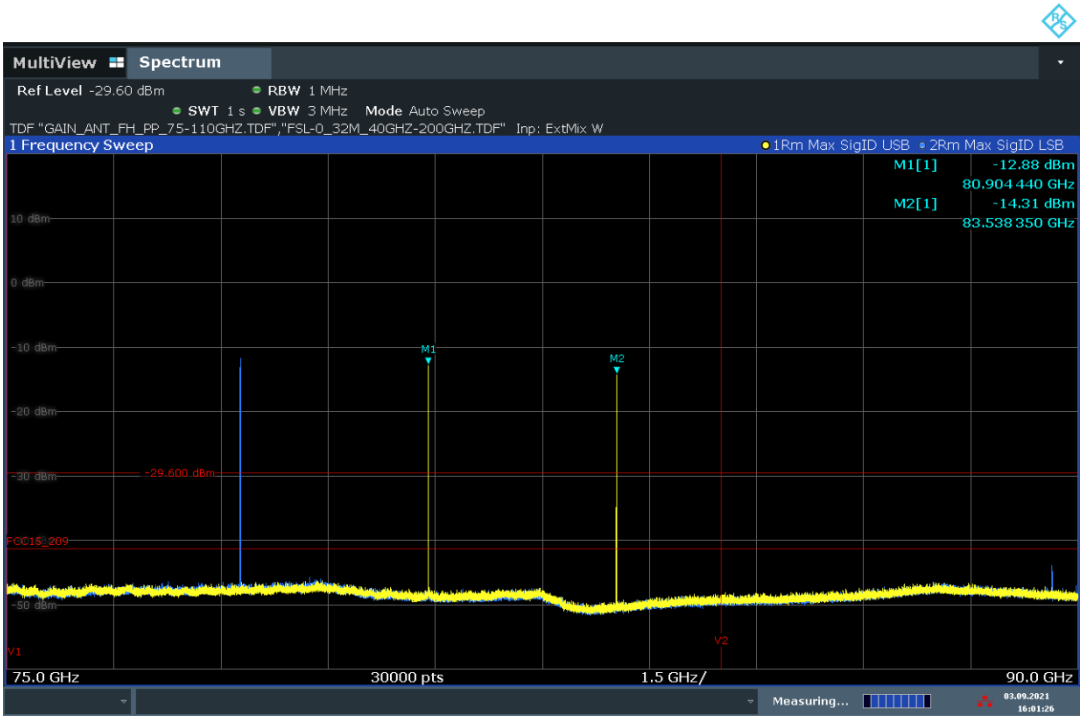

Diagram 27. The emission peak marked by M1 is the wanted signal (f_high = 80.9 GHz). The peak to the left is clearly a mixing product, because the traces 1/2 do not overlap. M2 is investigated in the following measurement.

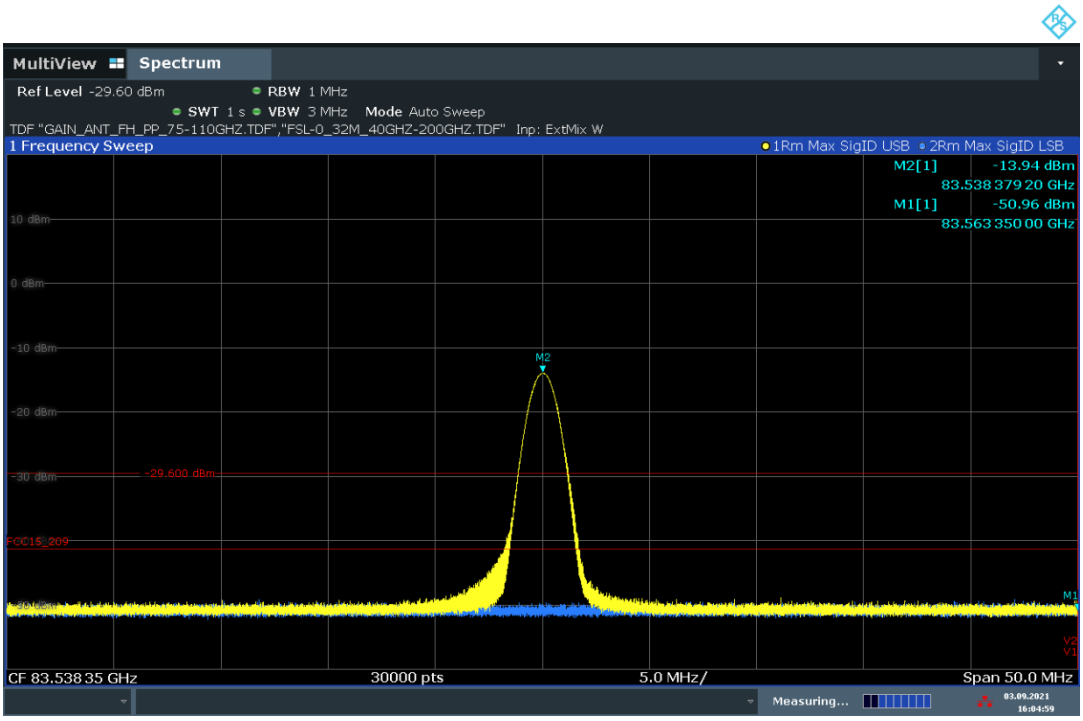

Diagram 28. The emission peak marked by M2 is investigated in narrow span. Trace 1/2 do not overlap. Thus mixing product.

1.4.11 Frequency range 75 GHz – 90 GHz. EUT in CW mode: f_middle

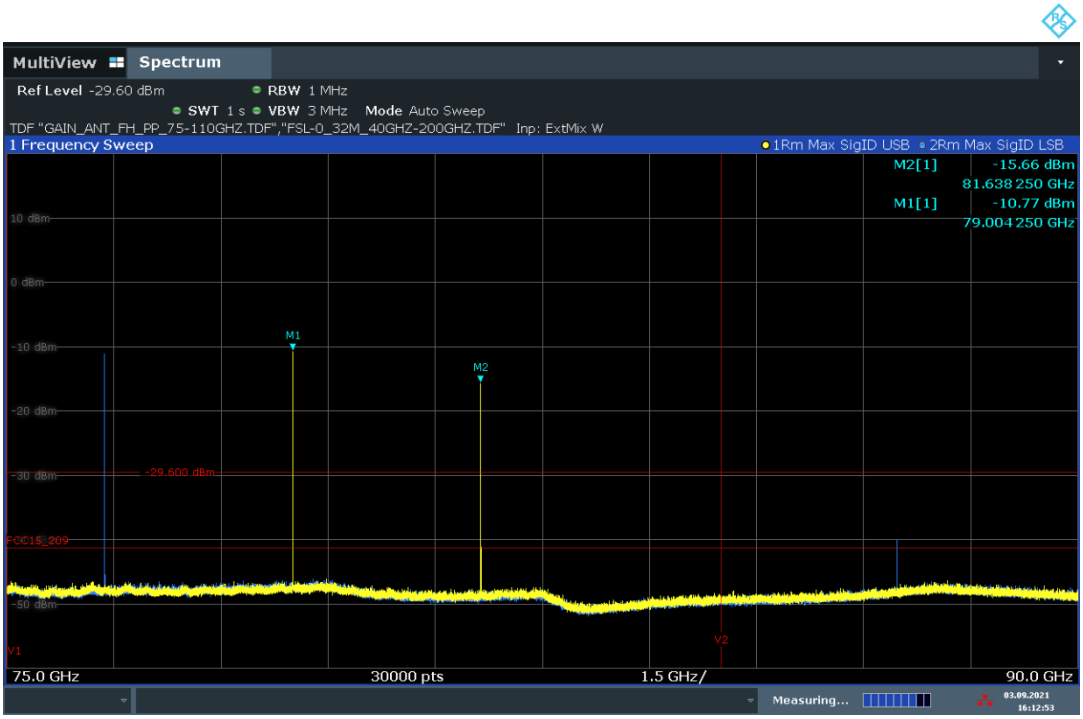

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Diagram 29. The emission peak marked by M1 is the wanted signal (f_middle = 79 GHz). The peak to the left is clearly a mixing product, because the traces 1/2 do not overlap. M2 is investigated in the following measurement.

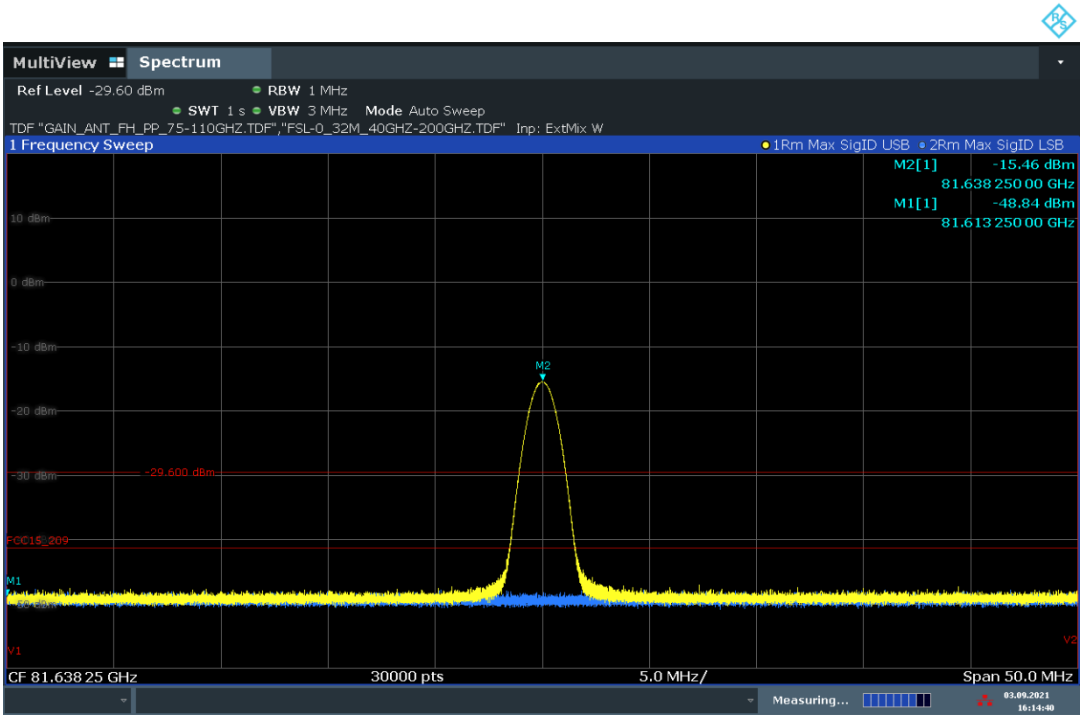

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Diagram 30. The emission peak marked by M2 is investigated in narrow span. Trace 1/2 do not overlap. Thus mixing product.

1.4.12 Frequency range 75 GHz – 90 GHz. EUT in CW mode: f_low

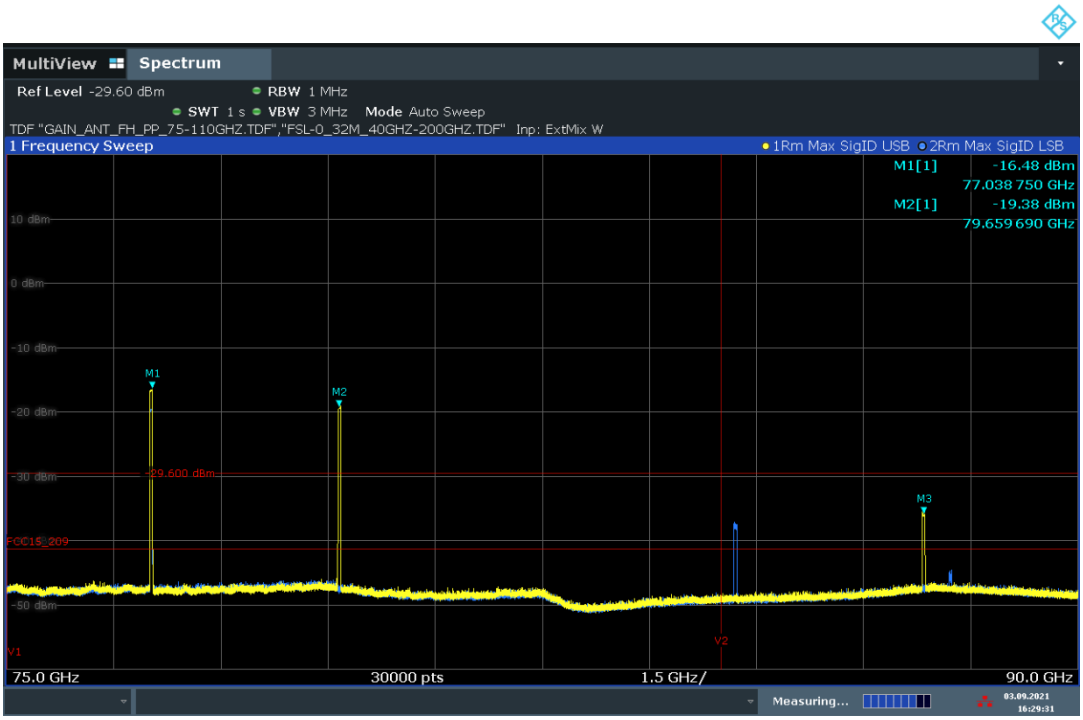

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Diagram 31. The emission peak marked by M1 is the wanted signal (f_high = 77 GHz). The peaks M2/3 and the unmarked peak between M2/3 are mixing products, because the traces 1/2 do not overlap.

1.4.13 Frequency range 90 GHz – 110 GHz. EUT in CW mode: f_high

Remark: The EUT operates under CW mode at fixed frequency. By applying small resolution bandwidth in certain frequency range, the required dynamic is achieved to show compliance. The same method is applied testing CW mode f_middle/low. See following section.

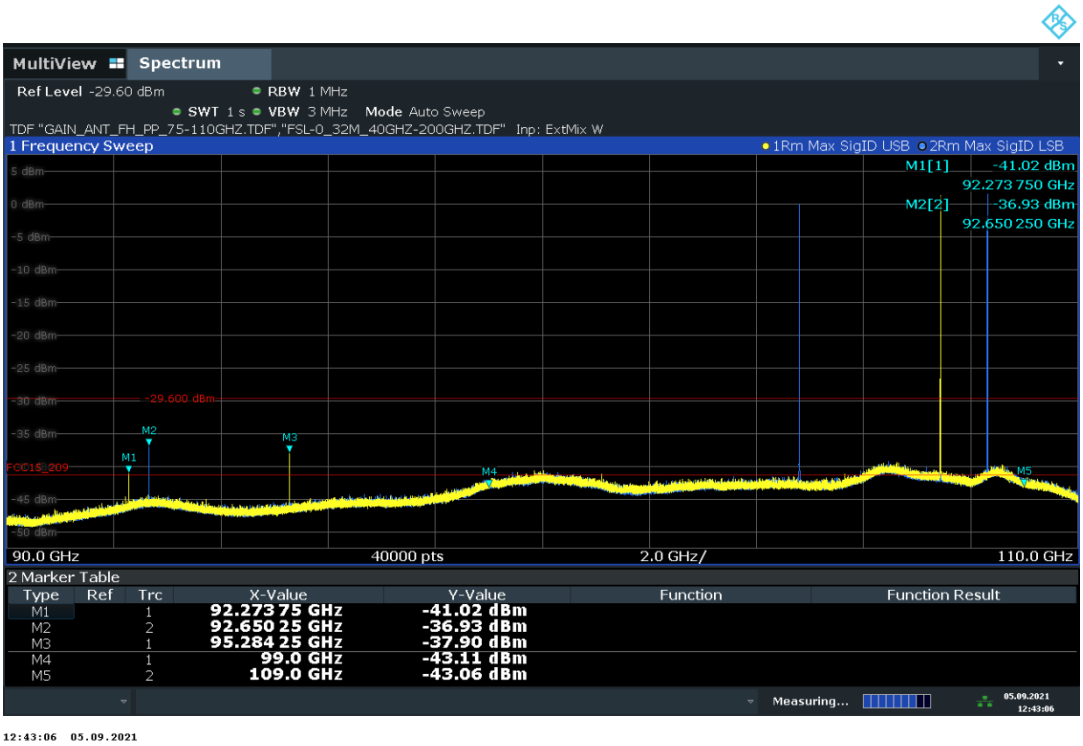

Diagram 32. The peak M2 and the other two peaks in blue (trace 2 displayed in front) are mixing product, because the traces 1/2 do not overlap. The peaks M1/3 are investigated in the following measurements. In frequency range marked from M4 to M5, it does not show required dynamic, thus small bandwidth is applied in the following measurements. These diagrams are divided into several due to limitation on the maximum number of measuring points.

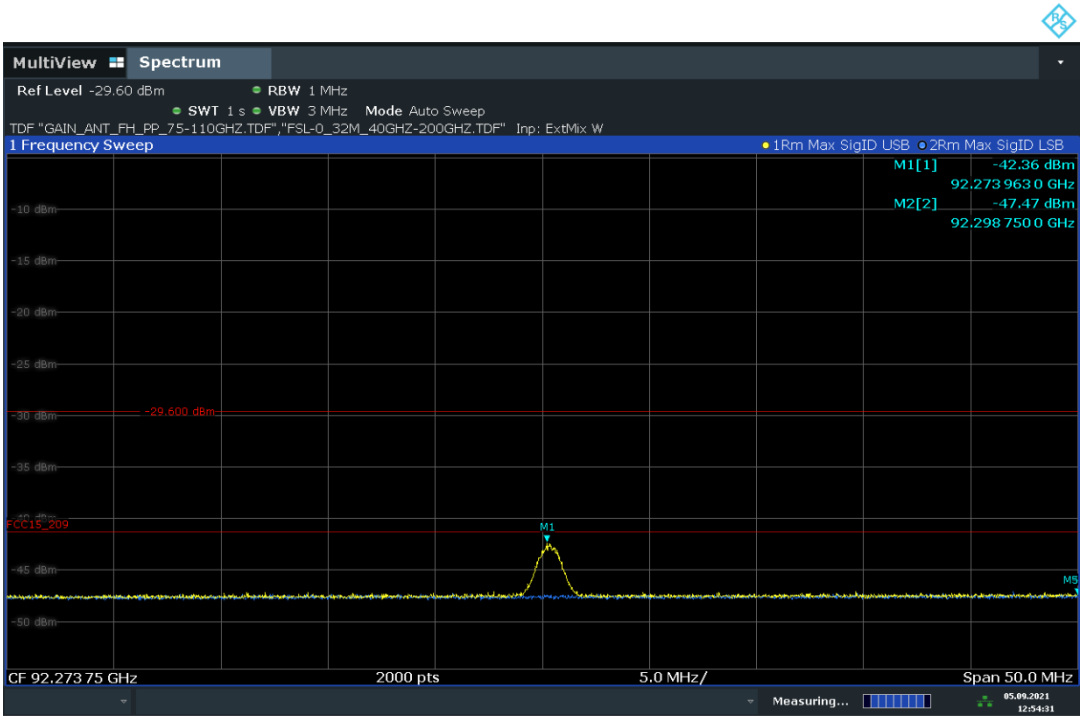

Diagram 33. The emission peak marked by M1 is investigated in narrow span. Trace 1/2 do not overlap. Thus mixing product.

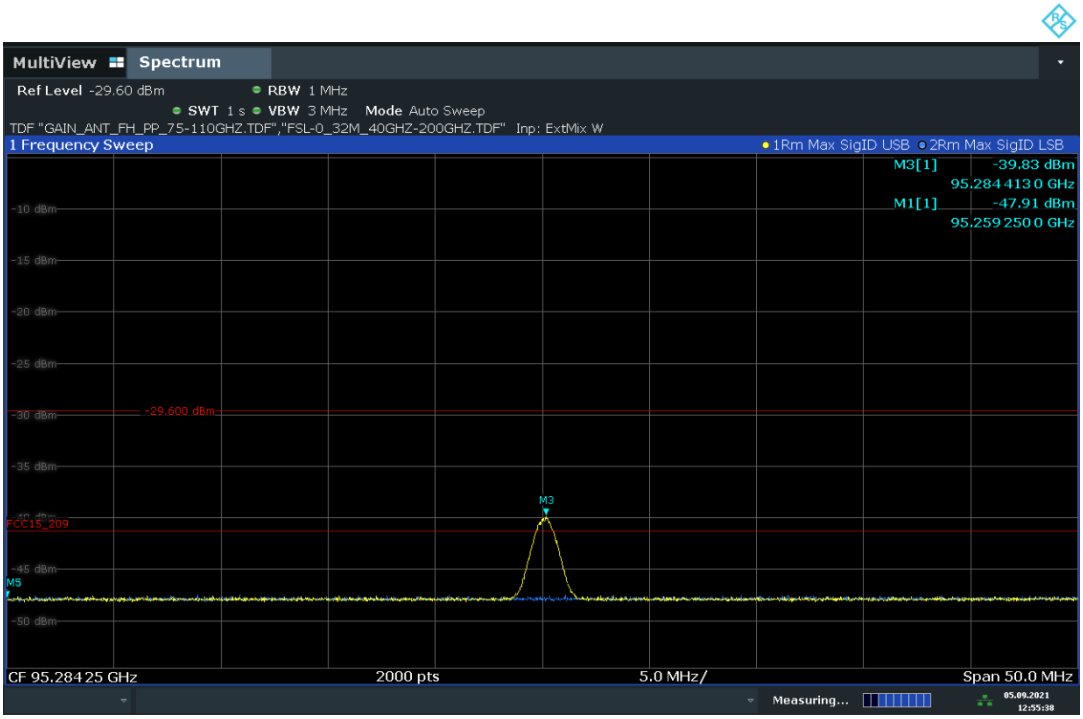

Diagram 34. The emission peak marked by M3 is investigated in narrow span. Trace 1/2 do not overlap. Thus mixing product.

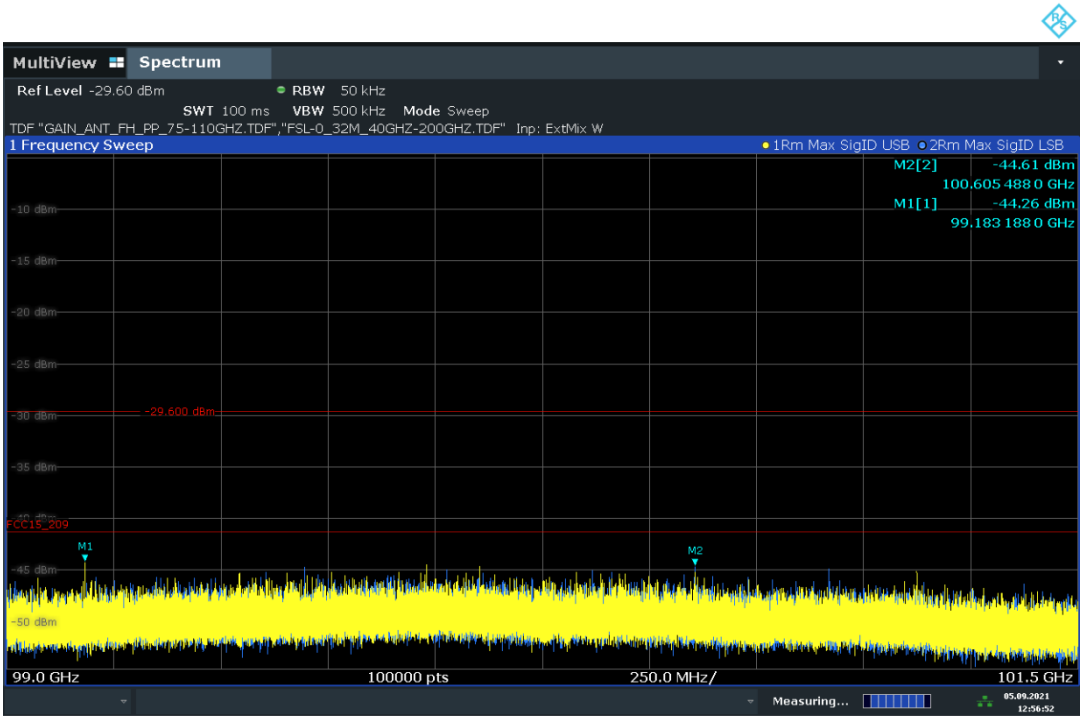

Diagram 35. Small bandwidth is applied in this frequency range in order to show compliance.

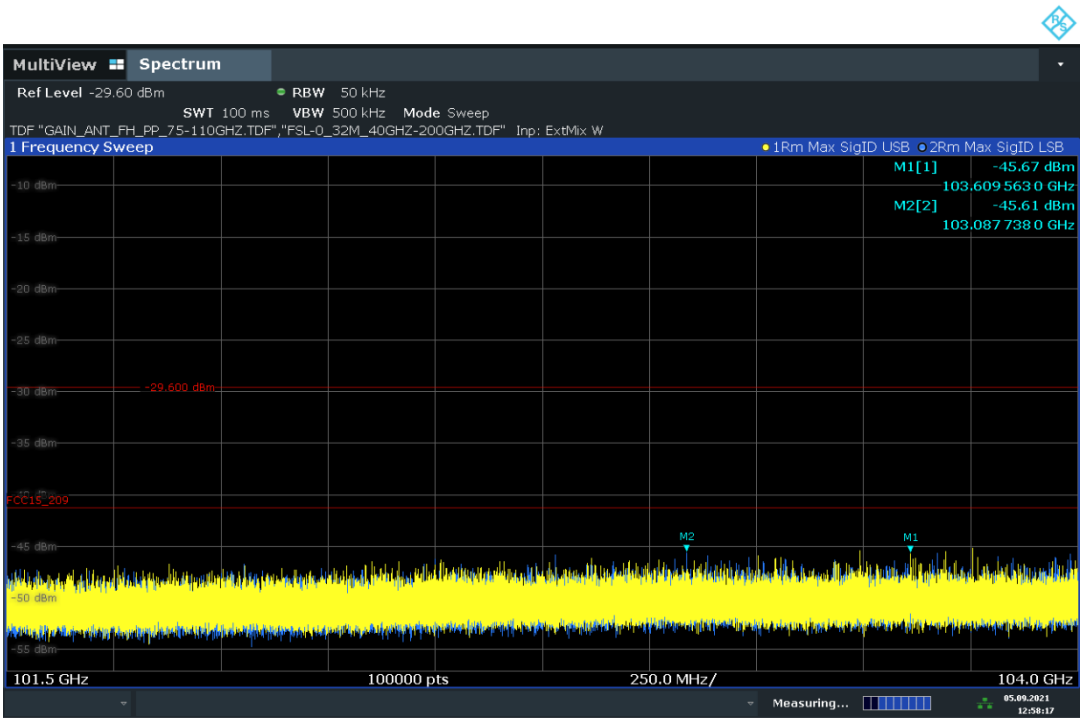

Diagram 36. Small bandwidth is applied in this frequency range in order to show compliance.

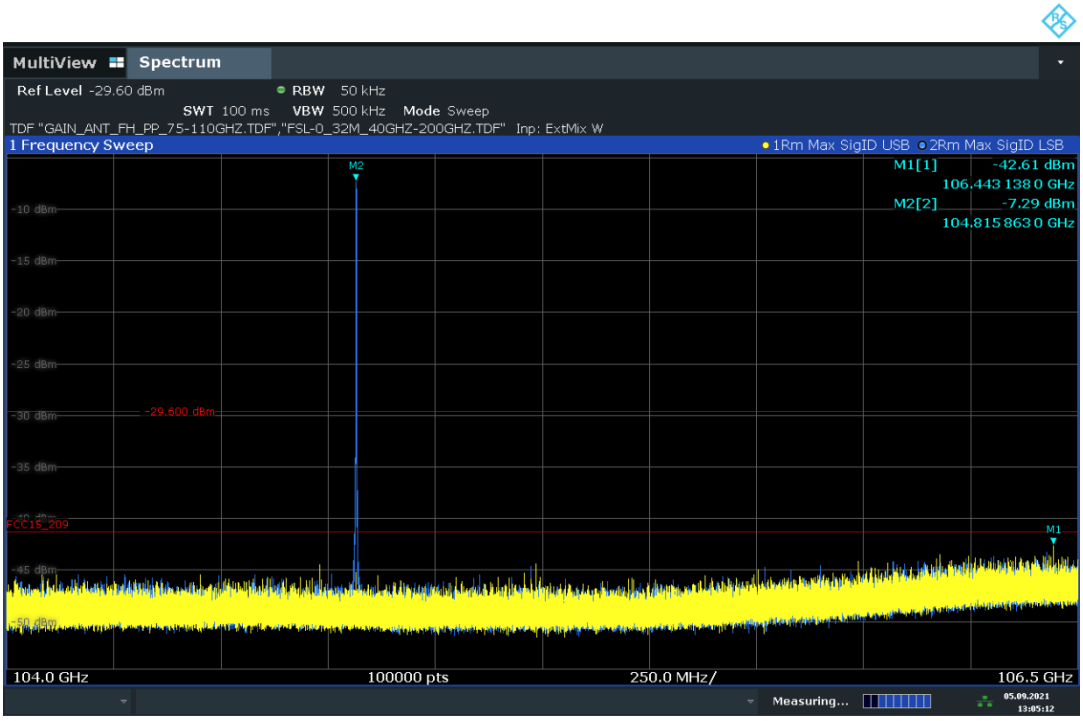

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Diagram 37. Small bandwidth is applied in this frequency range in order to show compliance. The peak M2 is a mixing product, because the traces 1/2 do not overlap.

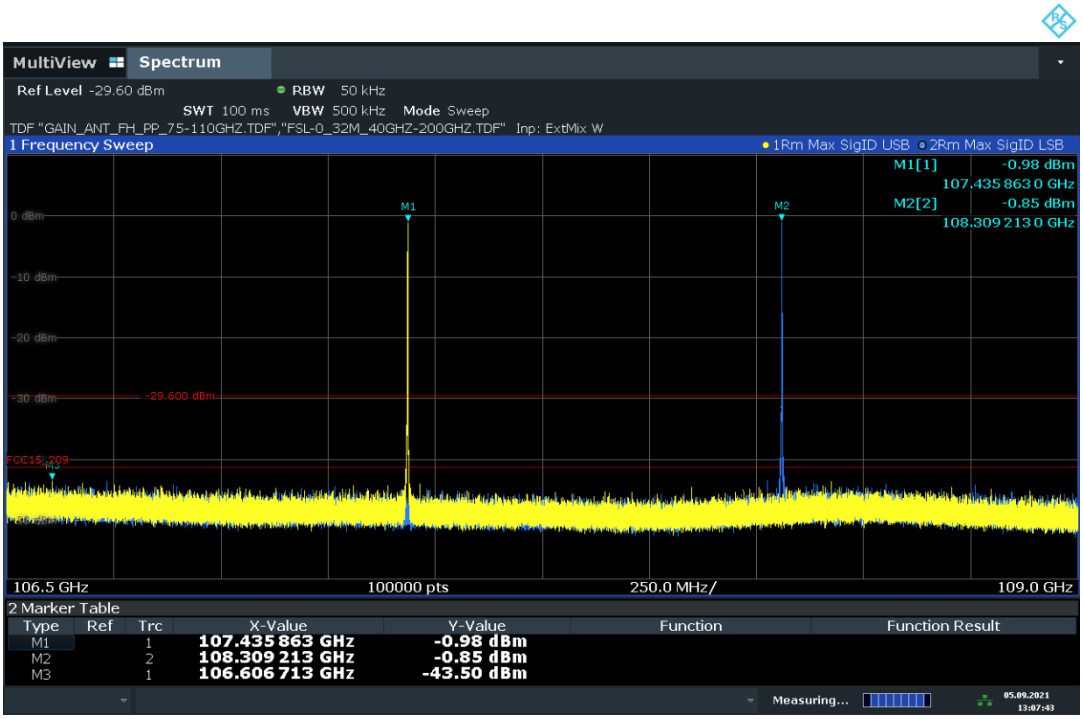

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Diagram 38. Small bandwidth is applied in this frequency range in order to show compliance. The peak M2 is a mixing product, because the traces 1/2 do not overlap. The peak M1 is investigated in the following measurement.

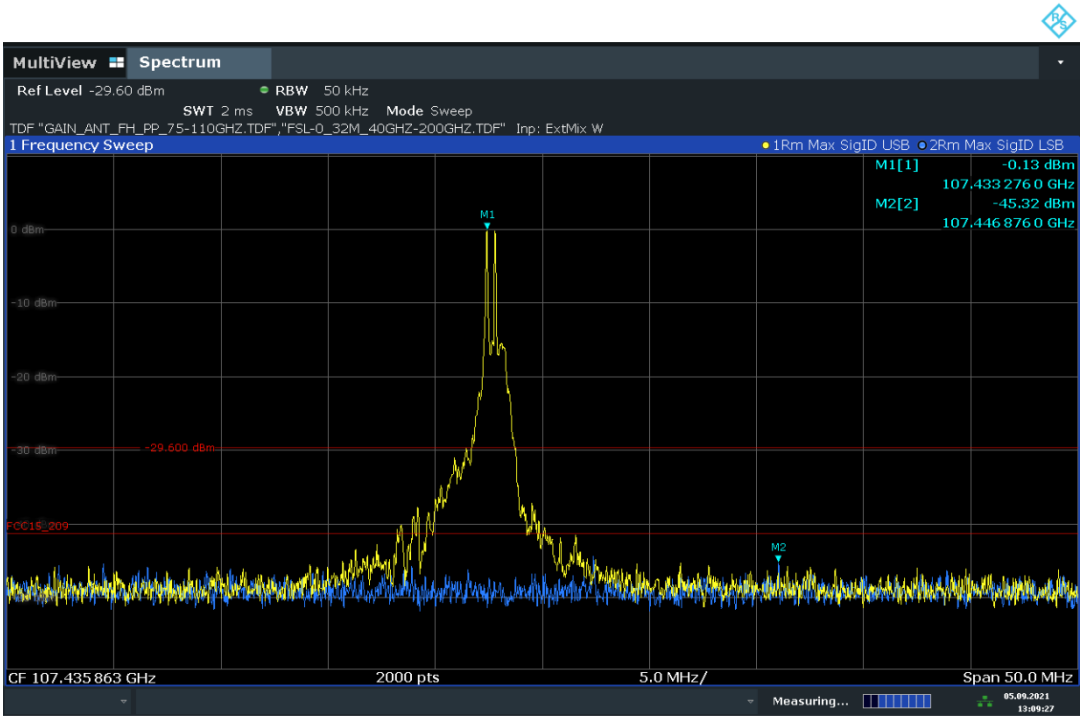

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Diagram 39. The emission peak marked by M1 is investigated in narrow span. Trace 1/2 do not overlap. Thus mixing product.

1.4.14 Frequency range 90 GHz – 110 GHz. EUT in CW mode: f_middle

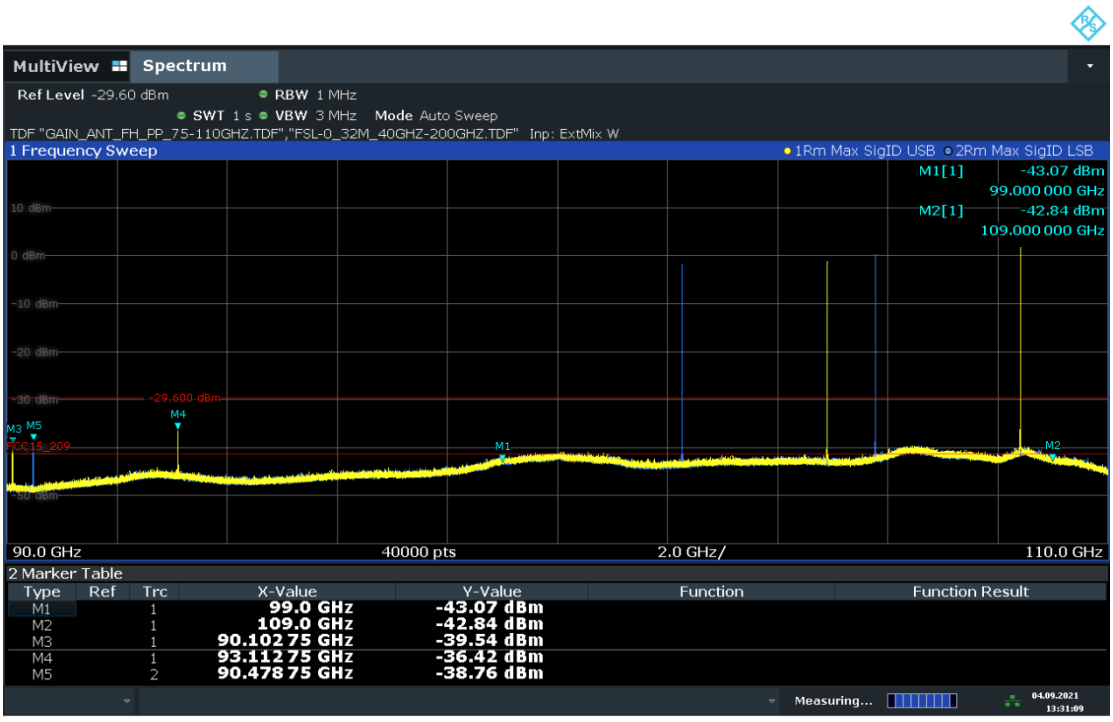

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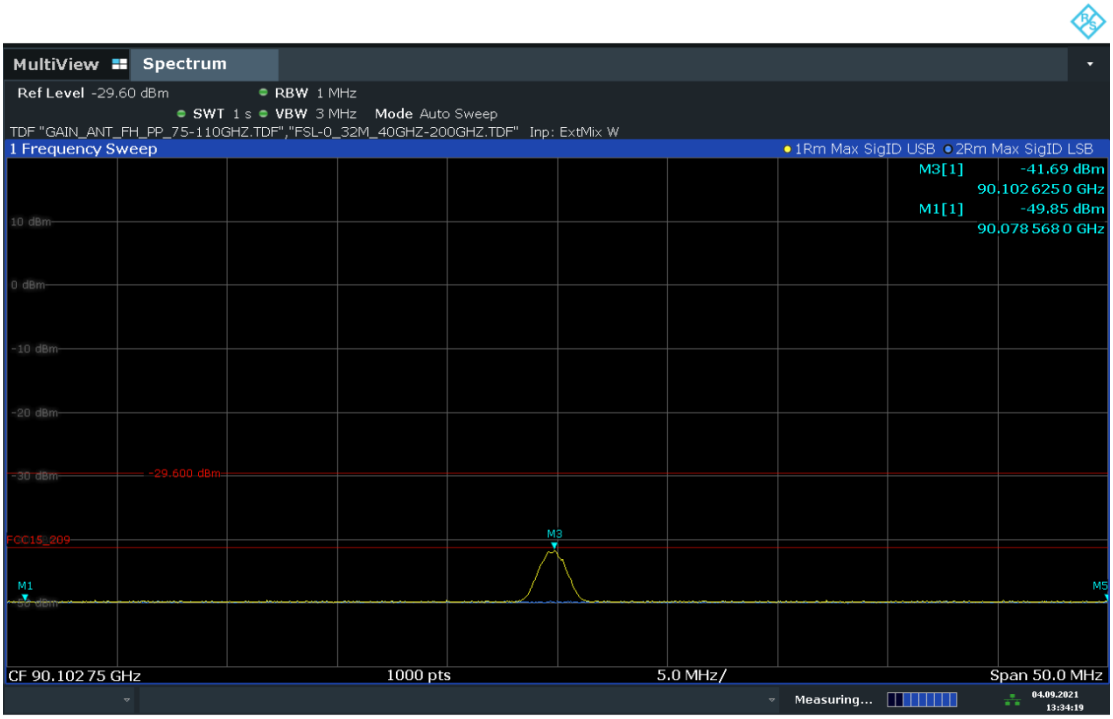
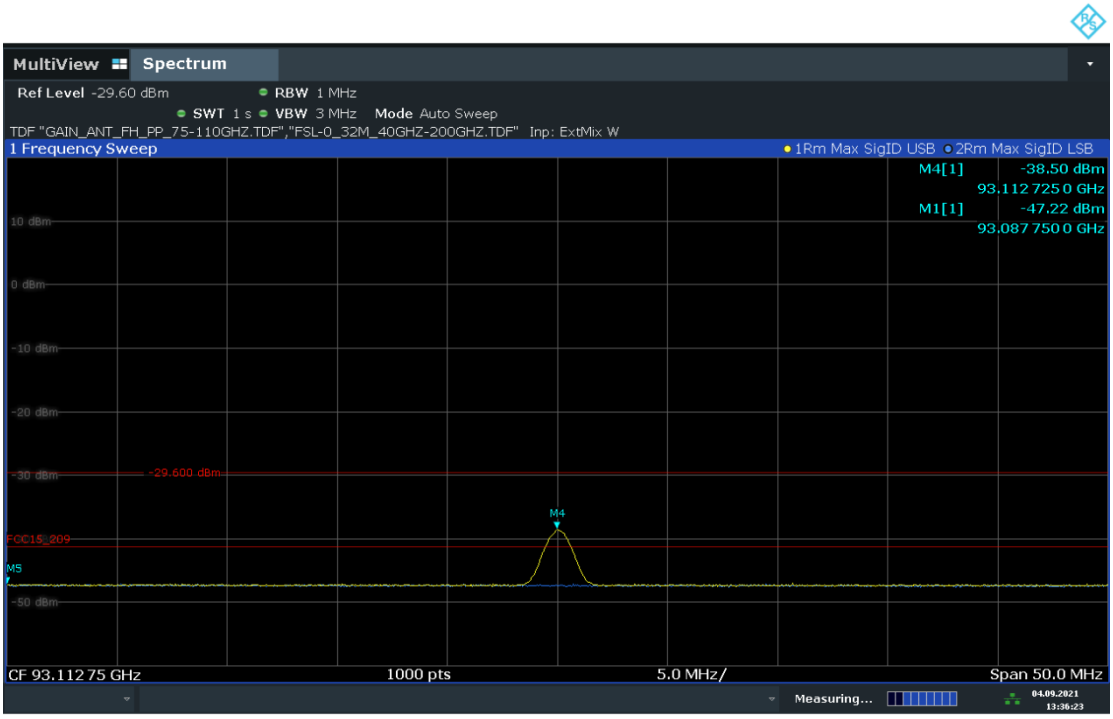
Diagram 40. The peaks M3/4/5 are investigated in the following measurements. In frequency range marked from M1 to M2, it does not show required dynamic, thus small bandwidth is applied in the following measurements. These diagrams are divided into several due to limitation on the maximum number of measuring points.



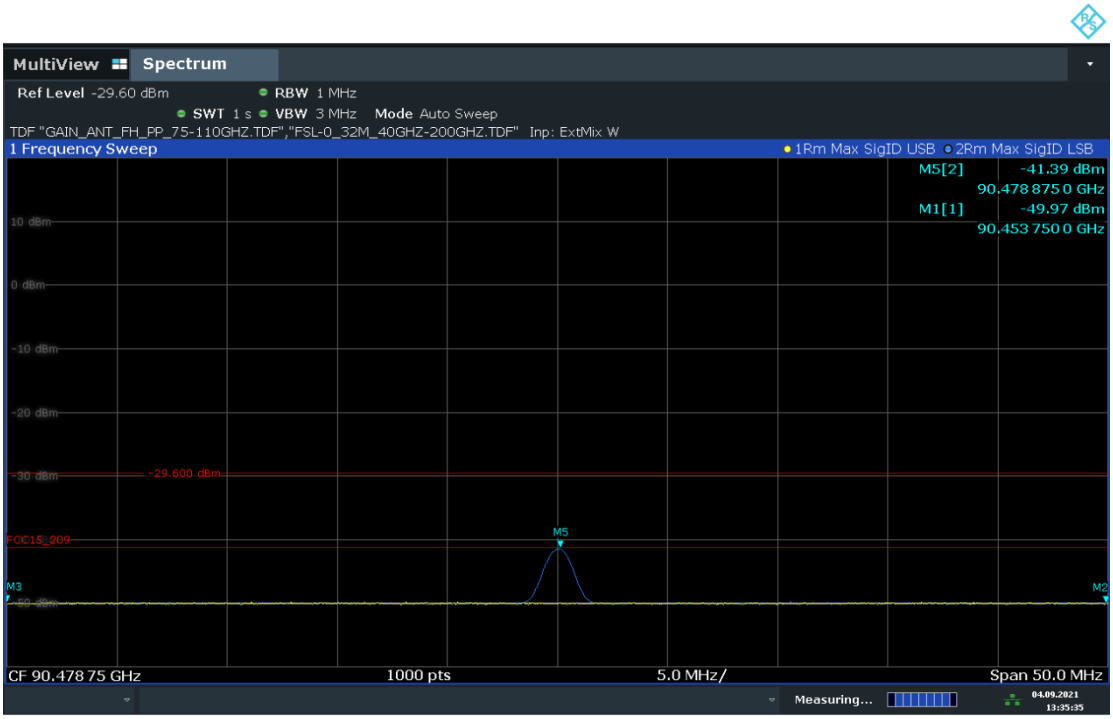
13:34:20 04.09.2021

Diagram 41. The emission peak marked by M3 is investigated in narrow span. Trace 1/2 do not overlap. Thus mixing product.



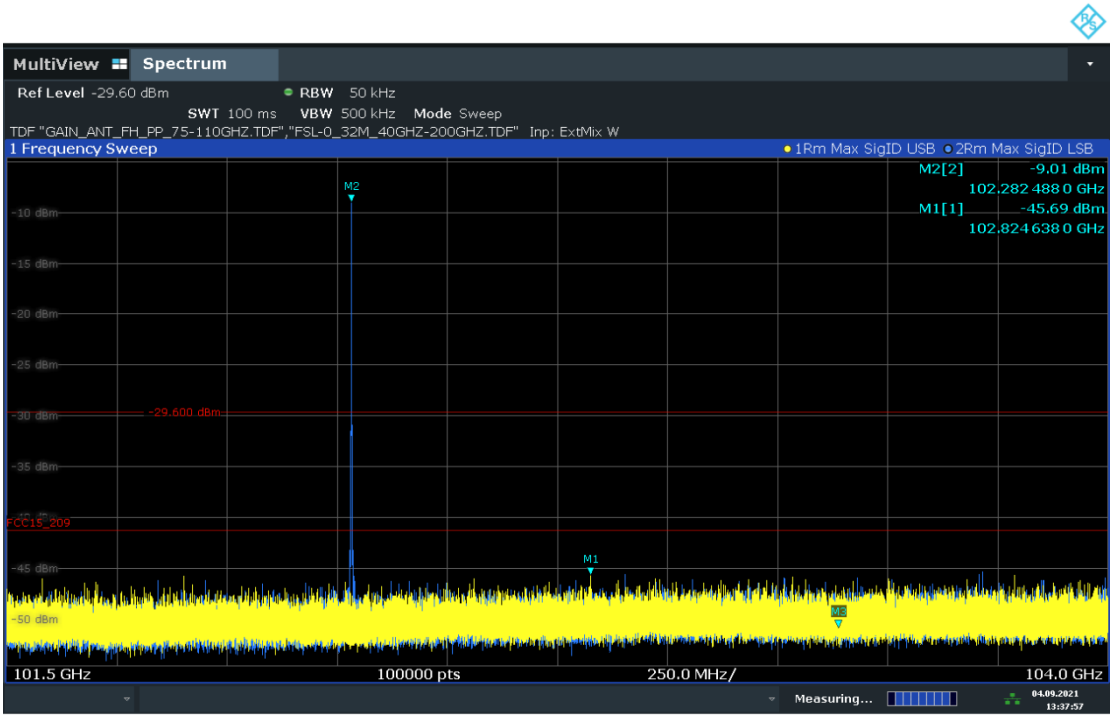
13:36:23 04.09.2021

Diagram 42. The emission peak marked by M4 is investigated in narrow span. Trace 1/2 do not overlap. Thus mixing product.



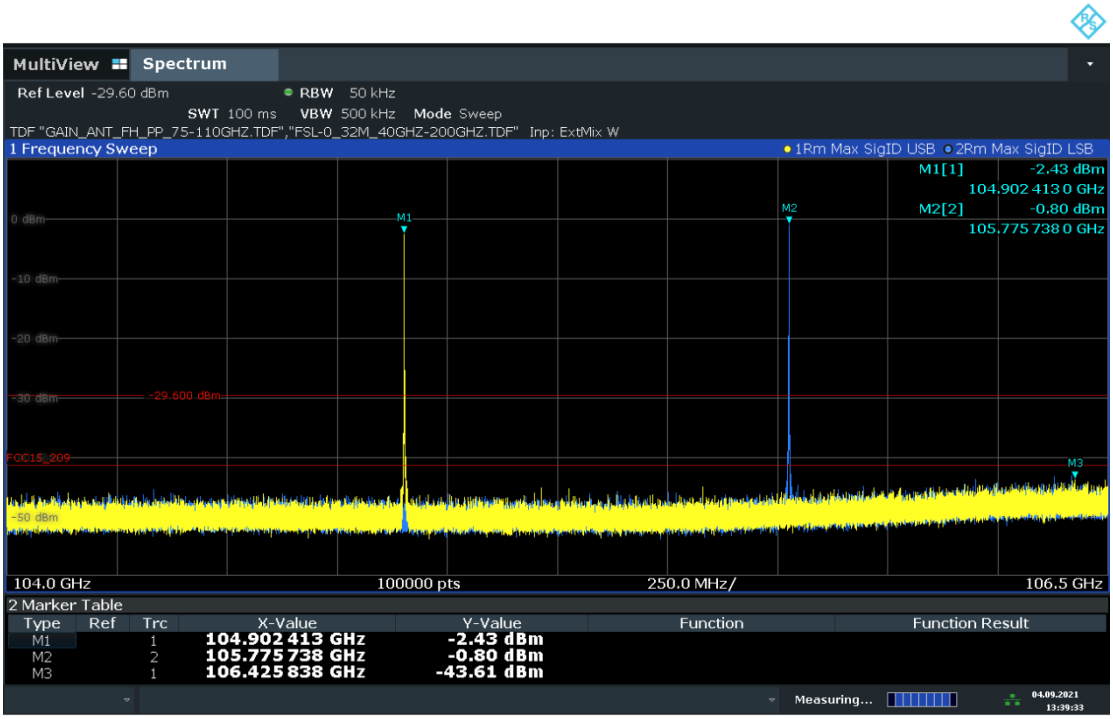
13:35:35 04.09.2021

Diagram 43. The emission peak marked by M5 is investigated in narrow span. Trace 1/2 do not overlap. Thus mixing product.



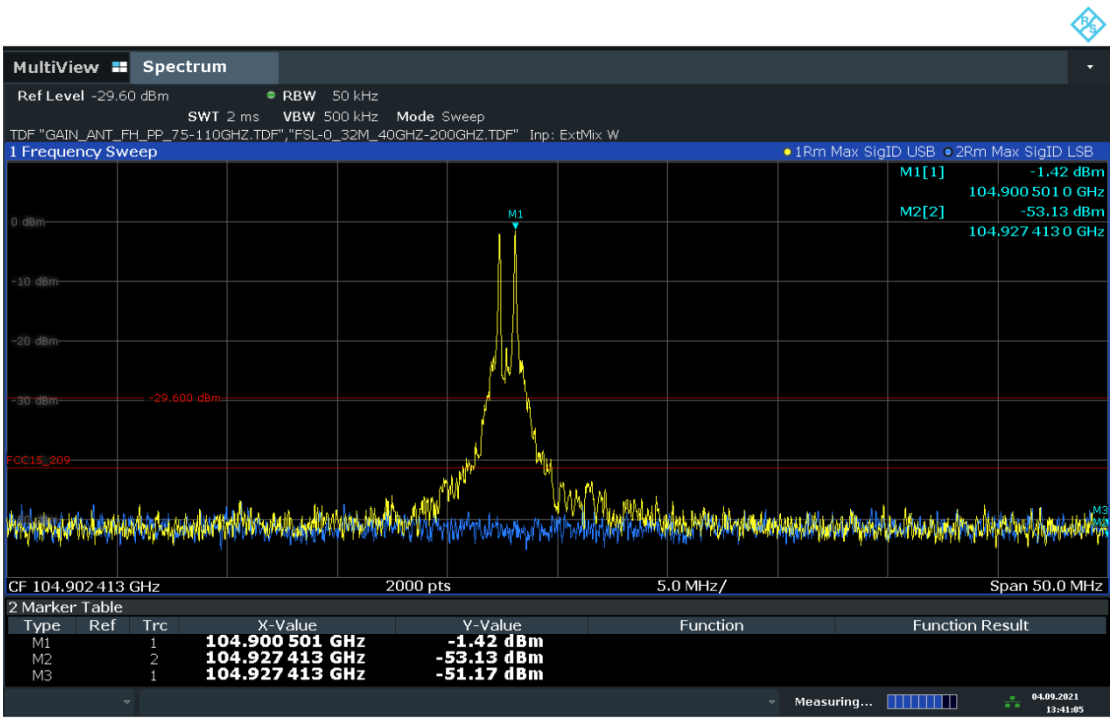
13:37:57 04.09.2021

Diagram 44. Small bandwidth is applied in this frequency range in order to show compliance. The peak M2 is a mixing product, because the traces 1/2 do not overlap.



13:39:33 04.09.2021

Diagram 45. Small bandwidth is applied in this frequency range in order to show compliance. The peak M2 is a mixing product, because the traces 1/2 do not overlap. The peak M1 is investigated in the following measurement.



13:41:05 04.09.2021

Diagram 46. The emission peak marked by M1 is investigated in narrow span. Trace 1/2 do not overlap. Thus mixing product.