

APPENDIX C: Test results for 5.47 GHz – 5.725 GHz band

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TEST CONDITIONS

Power supply (V):

$$V_{\text{nominal}} = 3.3 \text{ Vdc}$$

Type of power supply = DC voltage from HMC/NGFC test board.

Type of antenna = External attachable PIFA antenna.

Declared Gain for antenna = 5 dBi

Operating frequencies in the sub-band 5.47-5.725 GHz.

-For IEEE 802.11a, the equipment uses channels 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140.

-For IEEE 802.11n, there are two bandwidths:

For 20 MHz bandwidth the equipment uses channels 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140.

For 40 MHz bandwidth the equipment uses channels 102, 110, 118, 126, 134.

-For IEEE 802.11ac, there are three bandwidths:

For 20 MHz bandwidth the equipment uses channels 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140, 144.

For 40 MHz bandwidth the equipment uses channels 102, 110, 118, 126, 134, 142.

For 80 MHz bandwidth the equipment uses channels 106, 122, 138.

TEST FREQUENCIES:

For WiFi a/n20/ac20:

Lowest channel (100): 5500 MHz

Middle channel (120): 5600 MHz

Highest channel (140) 5700 MHz for 802.11n20 and 5720 MHz (144) for 802.11ac20

For WiFi n40/ac40:

Lowest channel (102): 5510 MHz

Middle channel (118): 5590 MHz

Highest channel (134) 5670 MHz for 802.11n40 and 5710 MHz (142) for 802.11ac40

For WiFi ac80:

Lowest channel (106): 5530 MHz

Middle channel (122): 5610 MHz

Highest channel (138): 5690 MHz

The test set-up was made in accordance to the general provisions of FCC KDB 789033 D01 General UNII Test Procedures v01r02, FCC KDB 644545 D01 Guidance for IEEE 802.11ac and Pre-ac Device Emission Testing and FCC KDB 662911 D01 Multiple Transmitter Output v01r02.

For 802.11a mode the EUT can transmit at both CHAIN A and CHAIN B RF outputs individually but not simultaneously.

For 802.11n/ac modes 802.11n20/ac20 (20 MHz channel bandwidth), 802.11n40/ac40 (40MHz channel bandwidth) and 802.11ac80 (80MHz channel bandwidth) mode the EUT can transmit at both CHAIN A and CHAIN B RF outputs individually and simultaneously.

For radio testing purposes the card was installed in a test fixture. The test fixture is connected to a laptop computer and dc power supplied. The laptop computer was used to configure the EUT to continuously transmit at a specified output power with different modes and modulation schemes.

The data rates of 6Mb/s for 802.11a, HT4 (SISO)/HT8 (MIMO) for 802.11n20/ac20 and n40/ac40, and VHT6 (SISO)/(MIMO) for 802.11 ac80 were selected based on preliminary testing that identified those rates corresponding to the worst cases for output power and spurious levels at the band edges.

The field strength at the band edges was evaluated for each mode and on each chain individually on the lowest and highest channels at the rated power for the channel under test. Where the power at the edge channels was lower than the power at the center channels additional measurements were made at the adjacent channels. Single transmission at each chain and simultaneous transmission at both chains modes were fully evaluated.

The PC was using the Intel test utility DRTU Version "OEDRTU 558x86" DRTU 1.6.1.558.

During transmitter test the EUT was being controlled by the Intel DRTU tool to operate in a continuous transmit mode on the test channels as required and in each of the different modulation modes.

The conducted RF output power at each chain was adjusted according to the client's supplied Target values (see following table) using the Intel DRTU tool and measuring the power by using a calibrated average power meter. Measured values for adjustment were within -0.2 dB/+0.3 dB respect to the Target values.

RF conducted output power target values

	Mode	BW (MHz)	Channel / Freq.	SISO Chain A (dBm)	SISO Chain B (dBm)	MIMO at both ports A and B (dBm)
5.47–5.725 GHz Band						
	802.11a	20	100 / 5500	13,5	13	n/a
			104 / 5520	16,5	16,5	n/a
			120 / 5600	16,5	16,5	n/a
			136 / 5680	16,5	16,5	n/a
			140 / 5700	13	12,5	n/a
	802.11n	20	100 / 5500	13,5	13	11,00
			104 / 5520	16,5	16,5	13,50
			120 / 5600	16,5	16,5	13,50
			136 / 5680	16,5	16,5	13,50
			140 / 5700	13	12,5	10,50
	802.11n*	40	102 / 5510	10,5	10,5	8,00
			110 / 5550	16,5	16,5	13,50
			118 / 5590	16,5	16,5	13,50
			134 / 5670	15,5	15,5	13,00
	802.11ac	20	144 / 5720	16,5	16,5	13,50
	802.11ac	40	142 / 5710	16,5	16,5	13,50
	802.11ac	80	106 / 5530	9	9	6,50
			122 / 5610	14	14	13,50
			138 / 5690	14	14	13,50

CONDUCTED MEASUREMENTS

The equipment under test was set up in a shielded room and it is connected to the spectrum analyzer using low loss RF cables with sma type connectors. The reading in the spectrum analyzer is corrected taking into account the cable loss.

RADIATED MEASUREMENTS

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 1m for the frequency range 1 GHz-40 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-40 GHz horn antenna).

For radiated emissions in the range 1 GHz-40 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive (wooden) platform one meter above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360°.

Measurements were made in both horizontal and vertical planes of polarization.

99 % and 26 dB Bandwidth

RESULTS

1. 802.11a mode (see next plots).

CHAIN A

	Lowest frequency 5500 MHz	Middle frequency 5600 MHz	Highest frequency 5700 MHz
99% bandwidth (MHz)	18.109	22.756	18.109
26 dB bandwidth (MHz)	27.083	41.586	27.484
Measurement uncertainty (kHz)	±21.7		

CHAIN B

	Lowest frequency 5500 MHz	Middle frequency 5600 MHz	Highest frequency 5700 MHz
99% bandwidth (MHz)	18.029	19.070	18.029
26 dB bandwidth (MHz)	26.683	32.612	26.843
Measurement uncertainty (kHz)	±21.7		

2. 802.11 n20 MHz and 802.11 ac 20 MHz (except channel 144) modes. (see next plots).

CHAIN A

	Lowest frequency 5500 MHz	Middle frequency 5600 MHz	Highest frequency 5700 MHz
99% bandwidth (MHz)	18.590	20.352	18.750
26 dB bandwidth (MHz)	25.641	40.224	26.843
Measurement uncertainty (kHz)	±21.7		

CHAIN B

	Lowest frequency 5500 MHz	Middle frequency 5600 MHz	Highest frequency 5700 MHz
99% bandwidth (MHz)	18.590	18.990	18.590
26 dB bandwidth (MHz)	25.160	30.689	25.481
Measurement uncertainty (kHz)	±21.7		

Note: the test was performed with 802.11 n20 MHz mode which is the same modulation scheme as 802.11 ac 20 MHz.

802.11 ac 20MHz (channel 144):

CHAIN A

	Frequency 5720 MHz
99% bandwidth (MHz)	19.310
26 dB bandwidth (MHz)	21.859 in UNII_3, 10.385 in UNII_4 and 36.779 (Total)
Measurement uncertainty (kHz)	±21.7

CHAIN B

	Frequency 5720 MHz
99% bandwidth (MHz)	18.990
26 dB bandwidth (MHz)	20.385 in UNII_3, 8.077 in UNII_4 and 33.413 (Total)
Measurement uncertainty (kHz)	±21.7

3. 802.11 n40 MHz and 802.11 ac 40 MHz (except channel 142)modes. (see next plots).

CHAIN A

	Lowest frequency 5510 MHz	Middle frequency 5590 MHz	Highest frequency 5670 MHz
99% bandwidth (MHz)	36.378	37.660	37.179
26 dB bandwidth (MHz)	42.468	64.743	62.468
Measurement uncertainty (kHz)	±21.7		

CHAIN B

	Lowest frequency 5510 MHz	Middle frequency 5590 MHz	Highest frequency 5670 MHz
99% bandwidth (MHz)	36.378	36.859	36.700
26 dB bandwidth (MHz)	42.468	54.167	54.327
Measurement uncertainty (kHz)	±21.7		

Note: the test was performed with 802.11 n40 MHz mode which is the same modulation scheme as 802.11 ac 40 MHz.

802.11 ac 40MHz (channel 142):

CHAIN A

	Frequency 5710 MHz
99% bandwidth (MHz)	37.660
26 dB bandwidth (MHz)	50.160 in UNII_3, 18.429 in UNII_4 and 68.589 (Total)
Measurement uncertainty (kHz)	±21.7

CHAIN B

	Frequency 5710 MHz
99% bandwidth (MHz)	37.019
26 dB bandwidth (MHz)	48.397 in UNII_3, 11.218 in UNII_4 and 59.615 (Total)
Measurement uncertainty (kHz)	±21.7

4. 802.11 ac 80 MHz mode. (see next plots).

CHAIN A

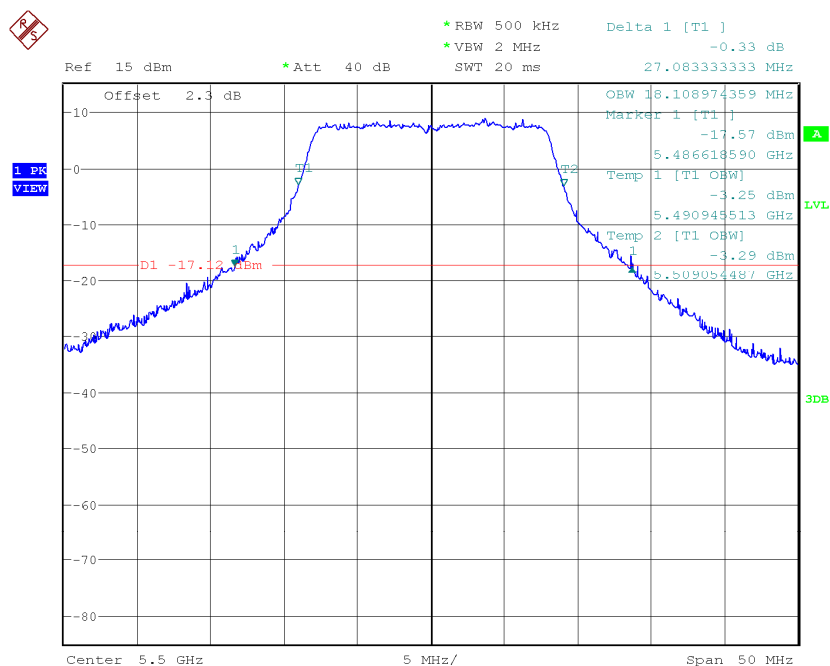
	Lowest frequency 5530 MHz	Highest frequency 5610 MHz	Highest frequency 5690 MHz
99% bandwidth (MHz)	75.160	75.721	75.000
26 dB bandwidth (MHz)	81.570	96.875	82.532 in UNII_3+5.609 in UNII_4 and 88.141 (Total)
Measurement uncertainty (kHz)	±21.7		

CHAIN B

	Lowest frequency 5530 MHz	Highest frequency 5610 MHz	Highest frequency 5690 MHz
99% bandwidth (MHz)	75.000	75.721	75.160
26 dB bandwidth (MHz)	81.570	83.461	82.692 in UNII_3, 5.769 in UNII_4) and 88.301 (Total)
Measurement uncertainty (kHz)	± 21.7		

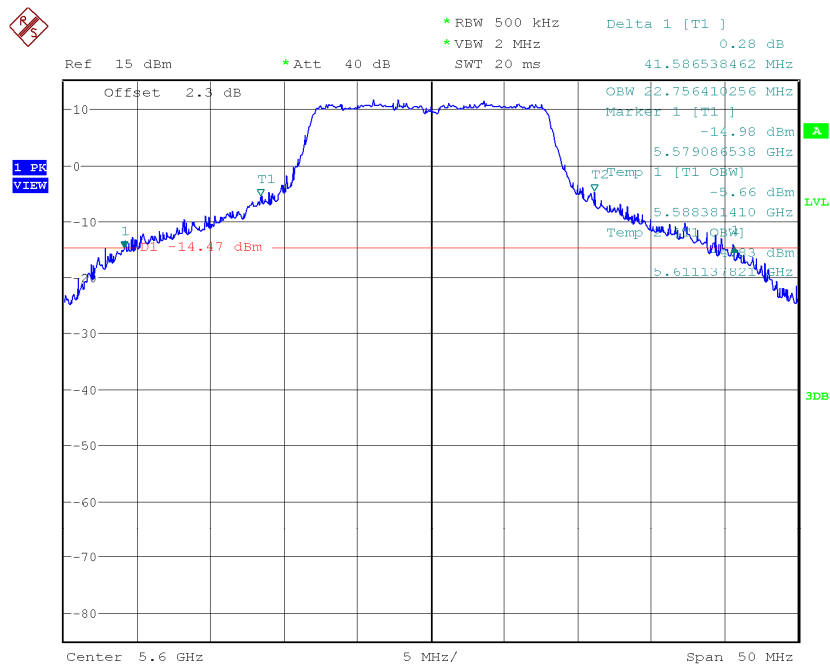
802.11a mode CHAIN A

Lowest Channel



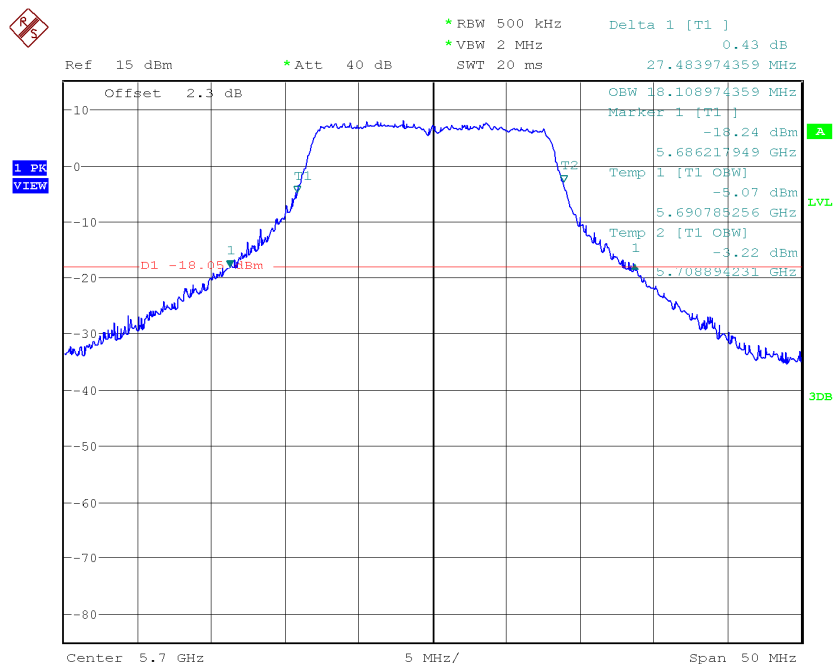
Date: 29.JAN.2013 09:08:46

Middle Channel



Date: 29.JAN.2013 09:12:54

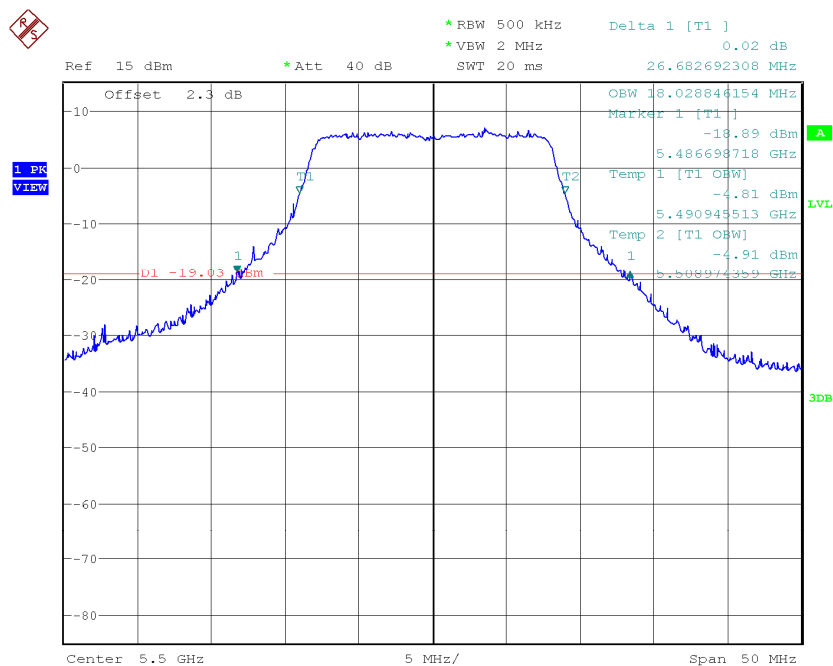
Highest Channel



Date: 29.JAN.2013 09:18:22

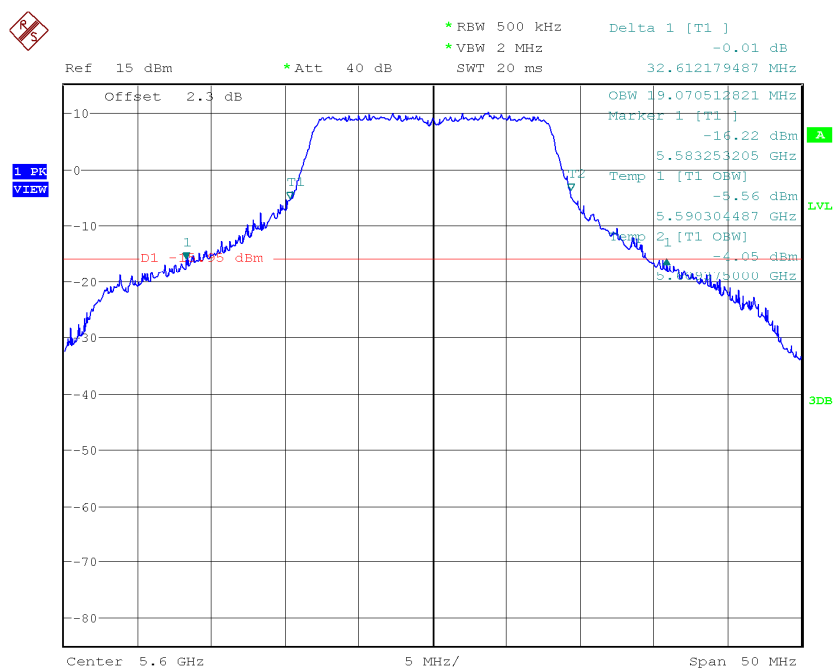
802.11a mode CHAIN B

Lowest Channel



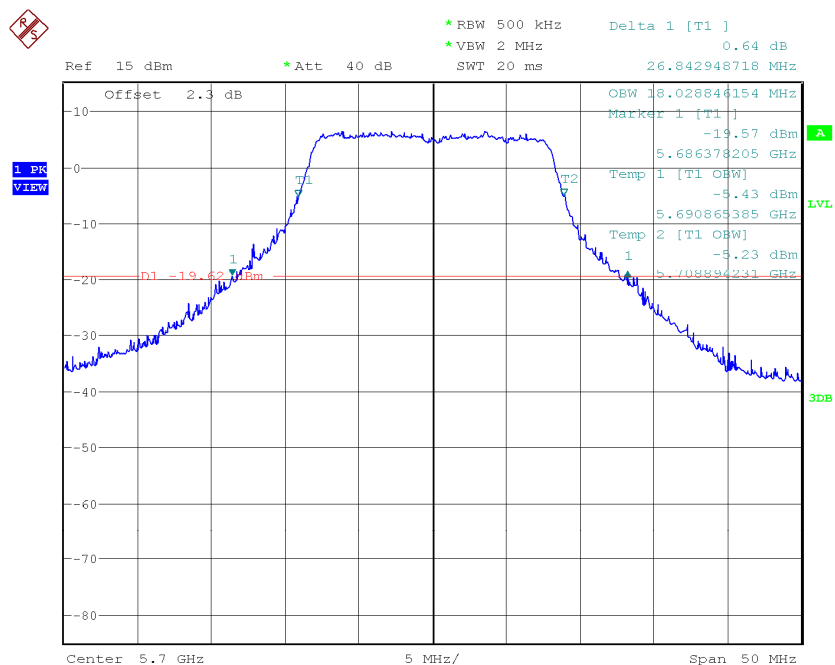
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Middle Channel



Date: 29.JAN.2013 09:25:52

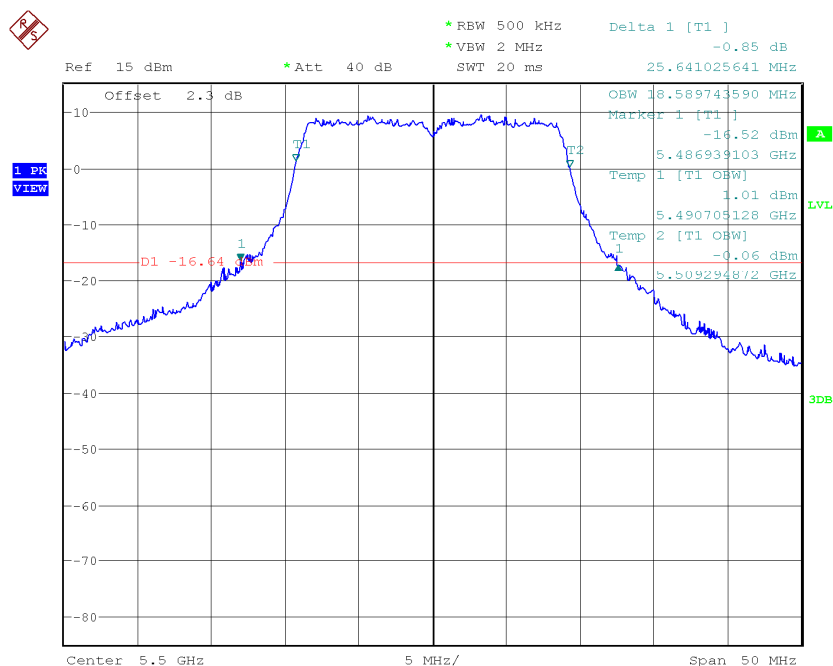
Highest Channel



Date: 29.JAN.2013 09:22:11

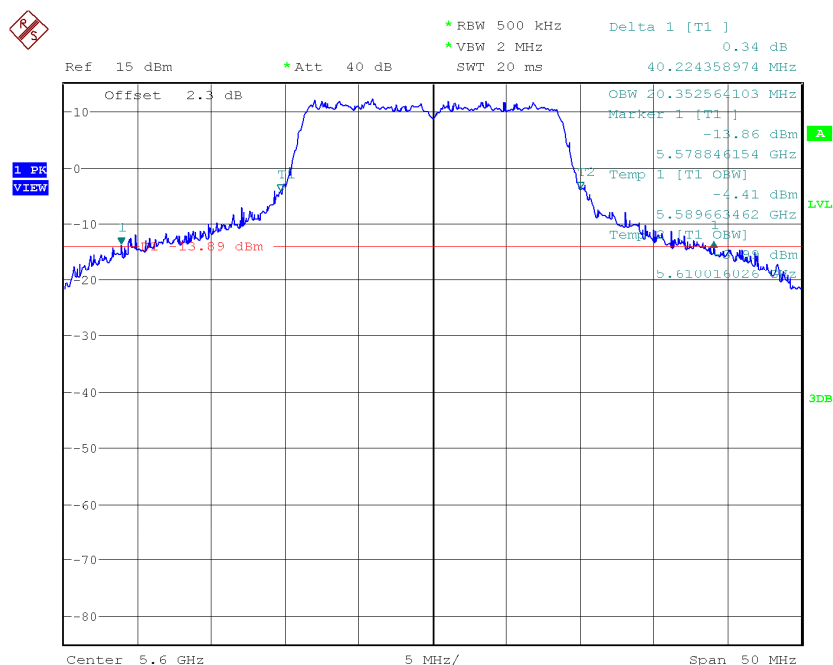
802.11 n20 MHz and 802.11 ac 20 MHz modes (except channel 144) CHAIN A

Lowest Channel



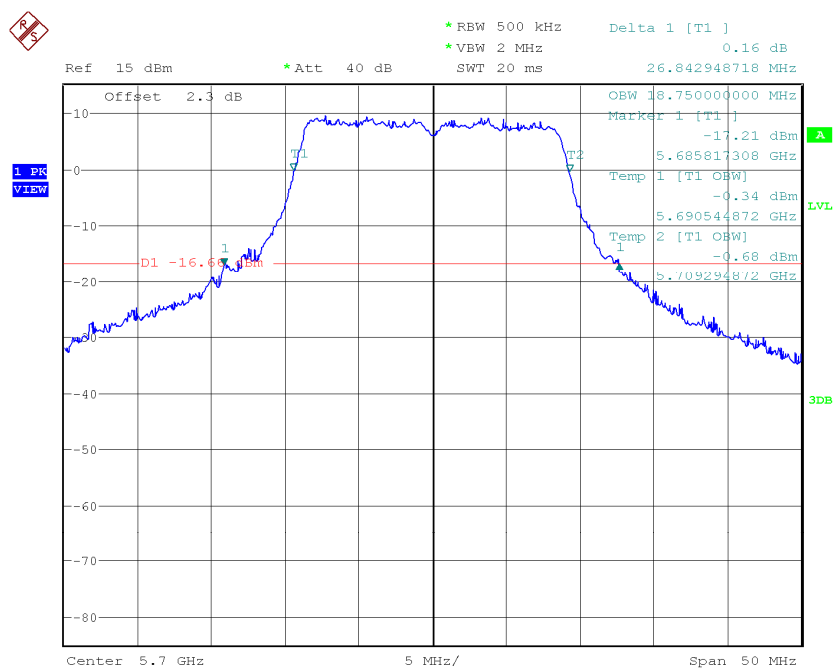
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Middle Channel



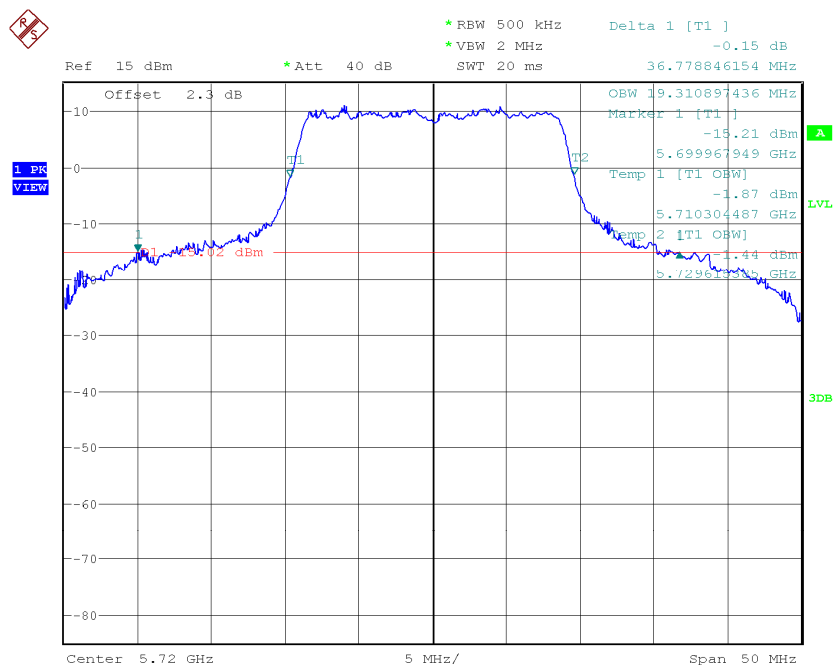
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Highest Channel



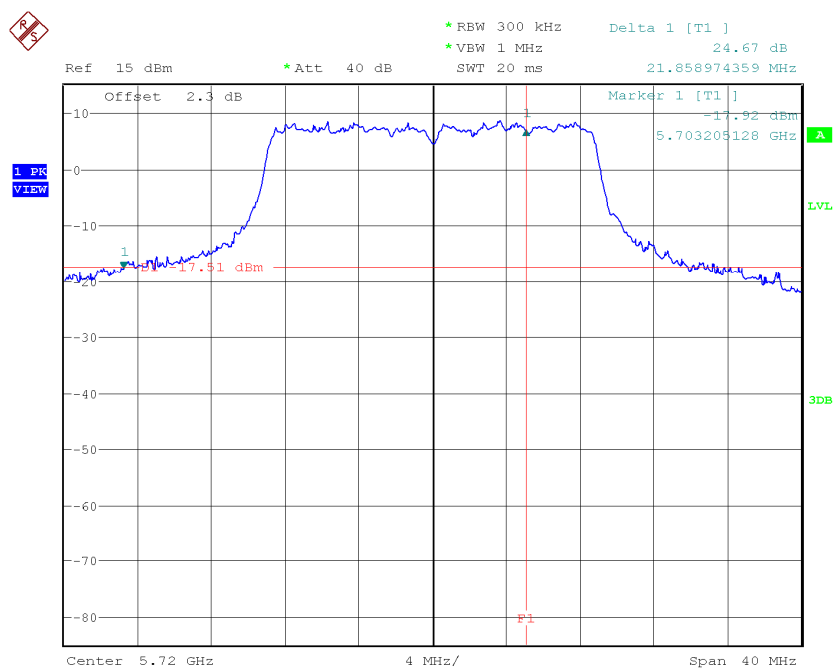
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802.11 ac 20MHz: Channel 144. Total Bandwidth



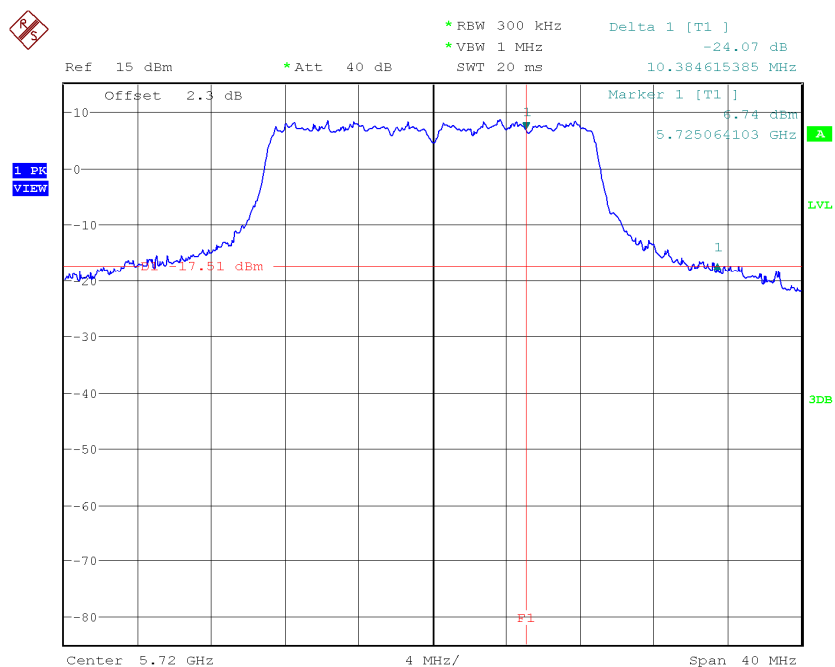
Date: 29.JAN.2013 10:05:24

26 dB BW inside UNII_3 sub-band:



Date: 29.JAN.2013 10:43:56

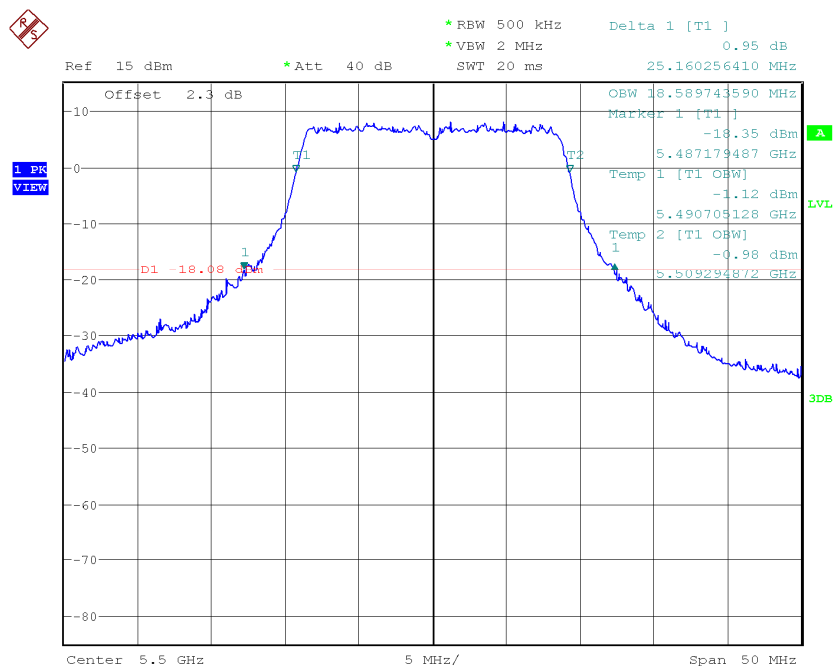
26 dB BW inside UNII_4 sub-band:



Date: 29.JAN.2013 10:45:00

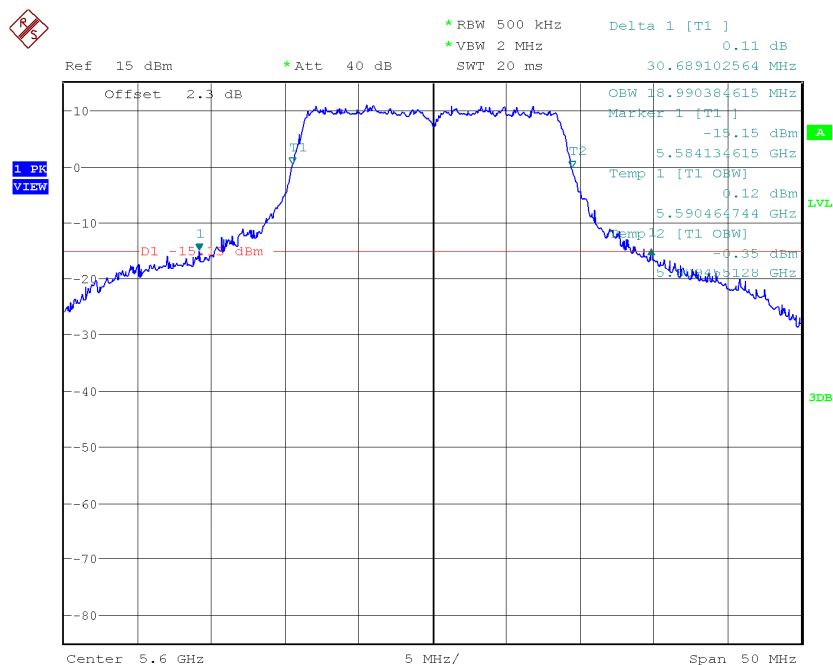
802.11 n20 MHz and 802.11 ac 20 MHz modes (except channel 144) CHAIN B

Lowest Channel



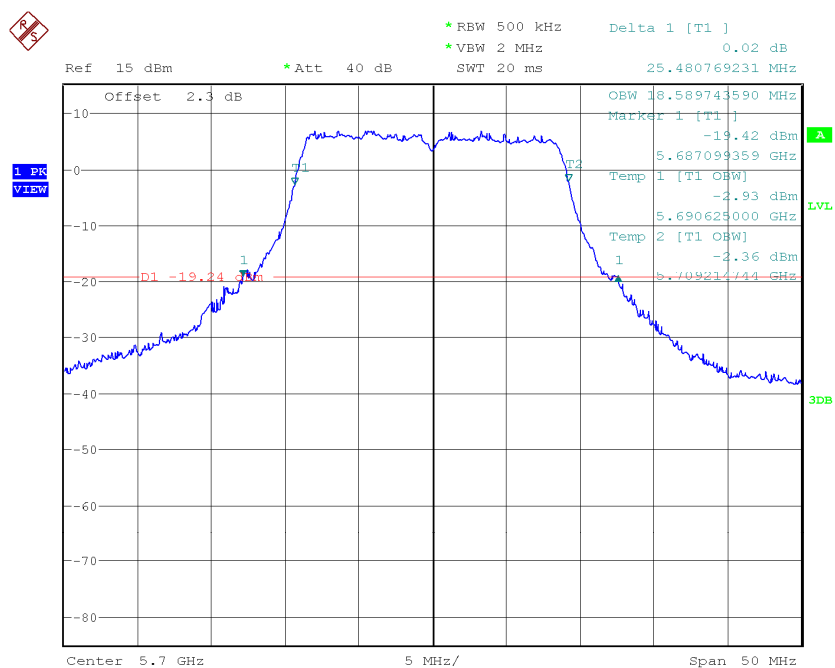
Date: 29.JAN.2013 09:33:24

Middle Channel



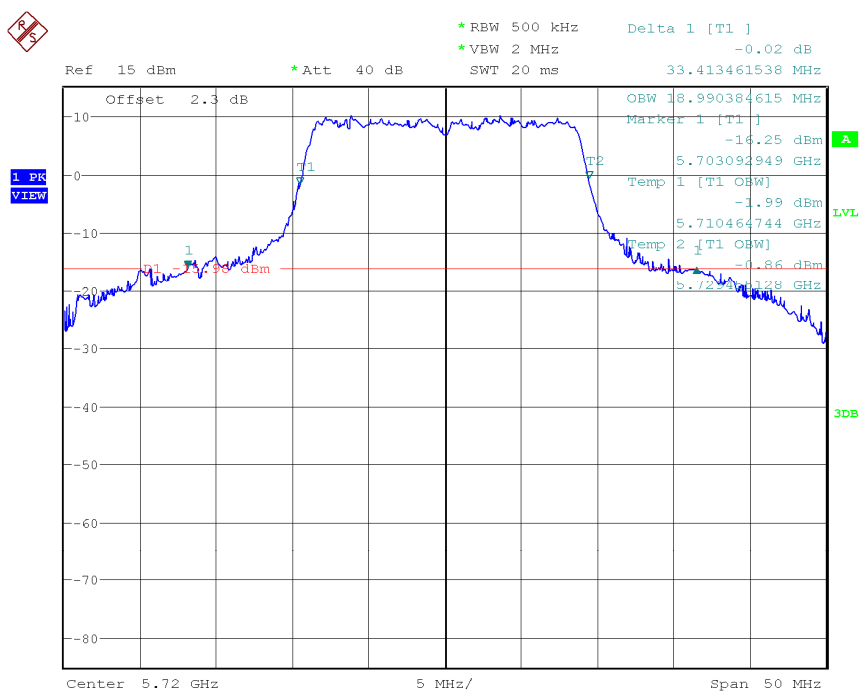
Date: 29.JAN.2013 09:37:17

Highest Channel



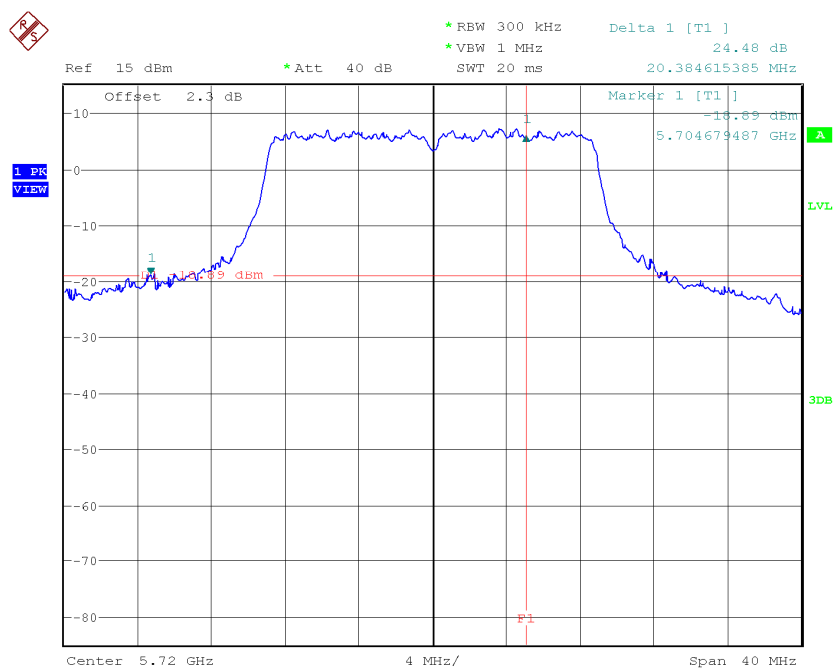
Date: 29.JAN.2013 09:41:59

802.11 ac 20MHz: Channel 144. Total Bandwidth.



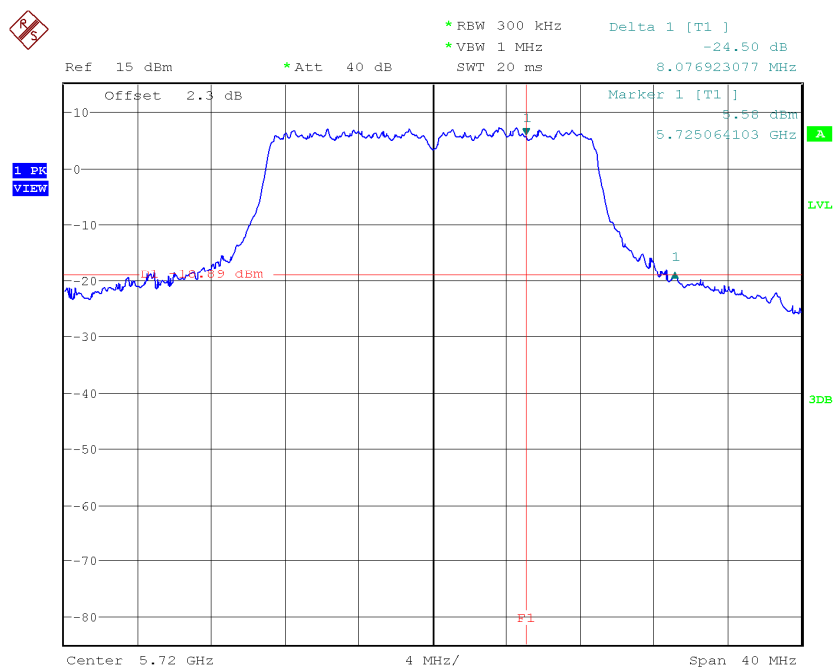
Date: 29.JAN.2013 10:08:36

26 dB BW inside UNII_3 sub-band:



Date: 29.JAN.2013 10:36:51

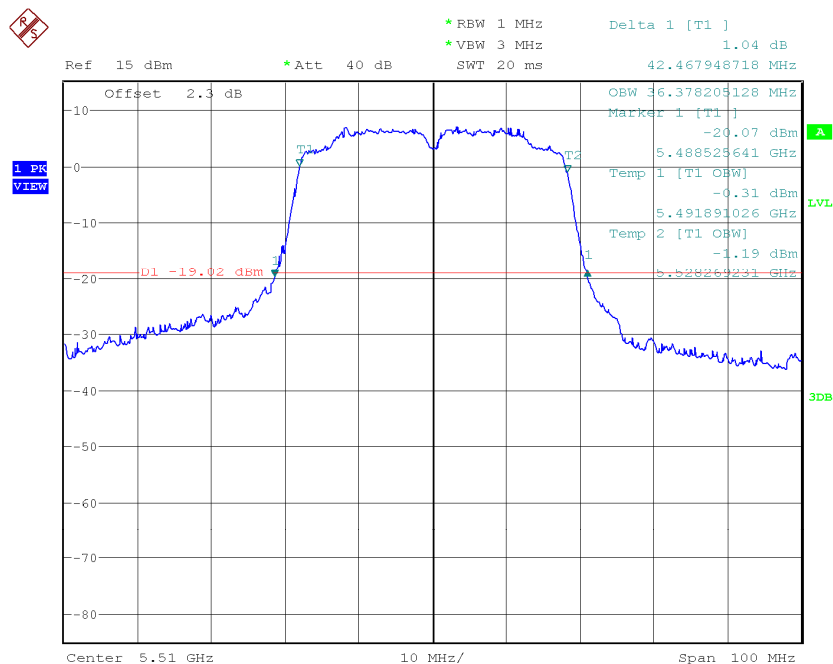
26 dB BW inside UNII_4 sub-band:



Date: 29.JAN.2013 10:37:44

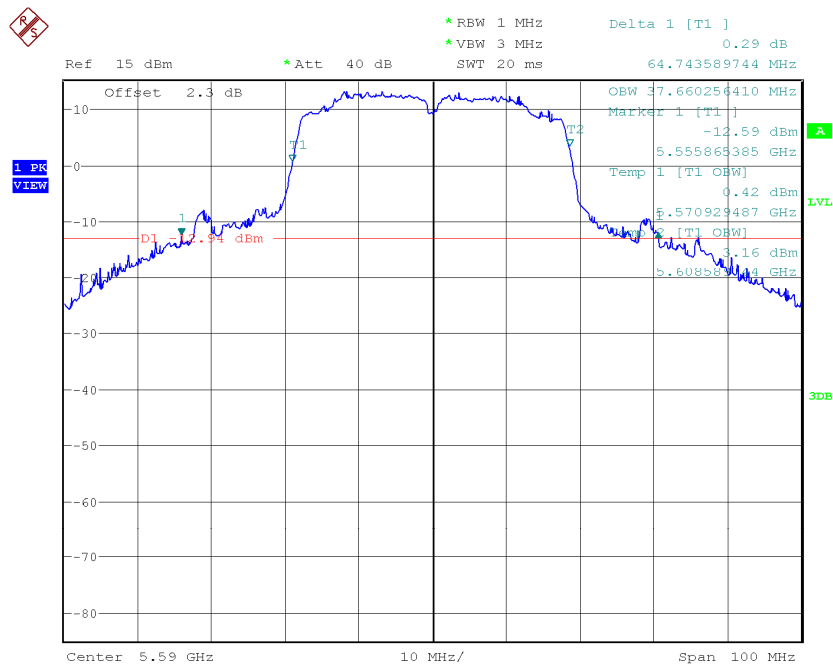
802.11 n40 MHz and 802.11 ac 40 MHz modes (except channel 142) CHAIN A

Lowest Channel



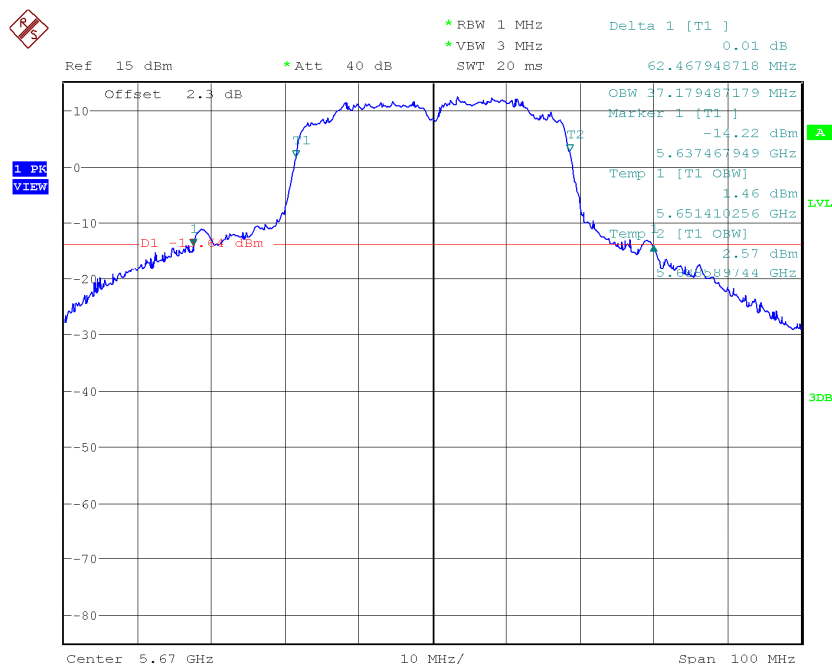
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Middle Channel



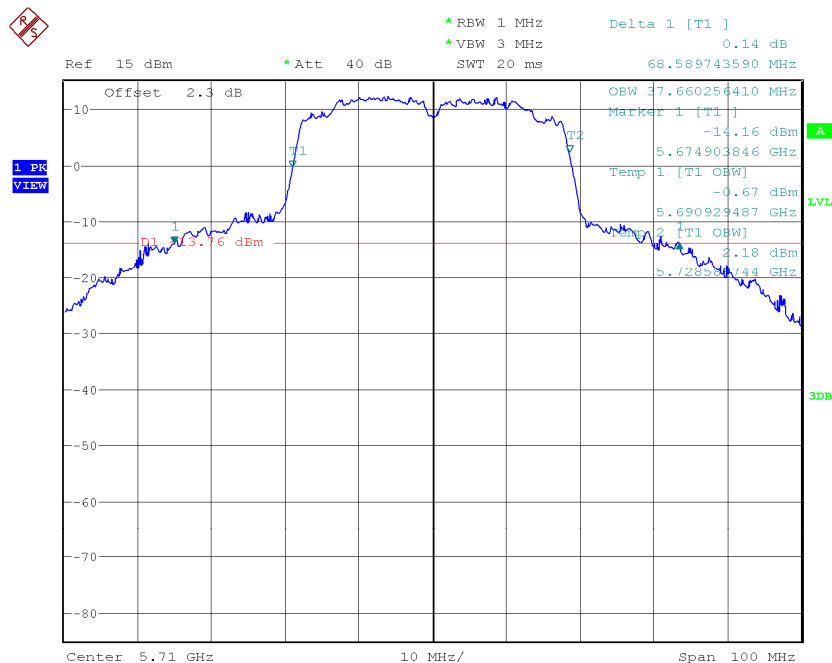
Date: 28.JAN.2013 17:16:20

Highest Channel



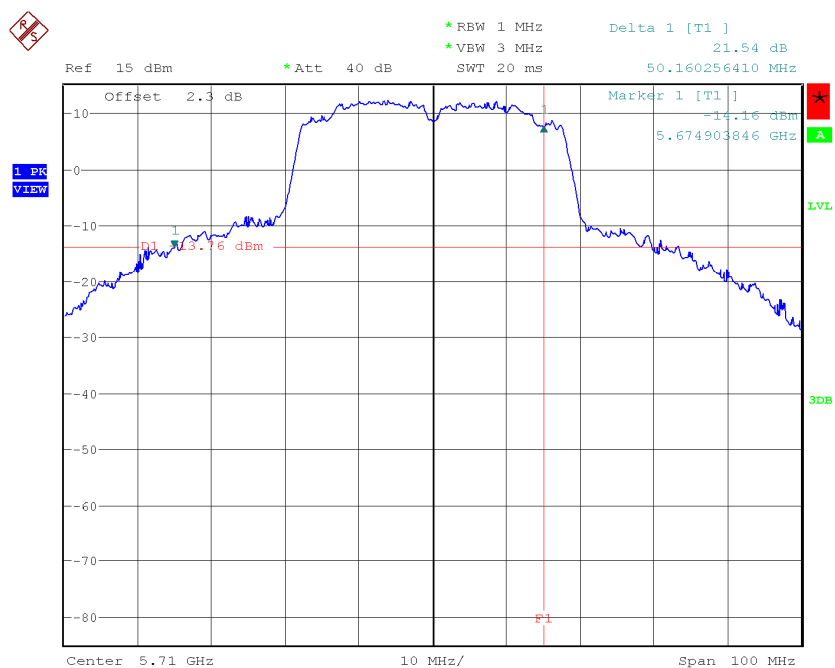
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802.11 ac 40MHz: Channel 142. Total Bandwidth



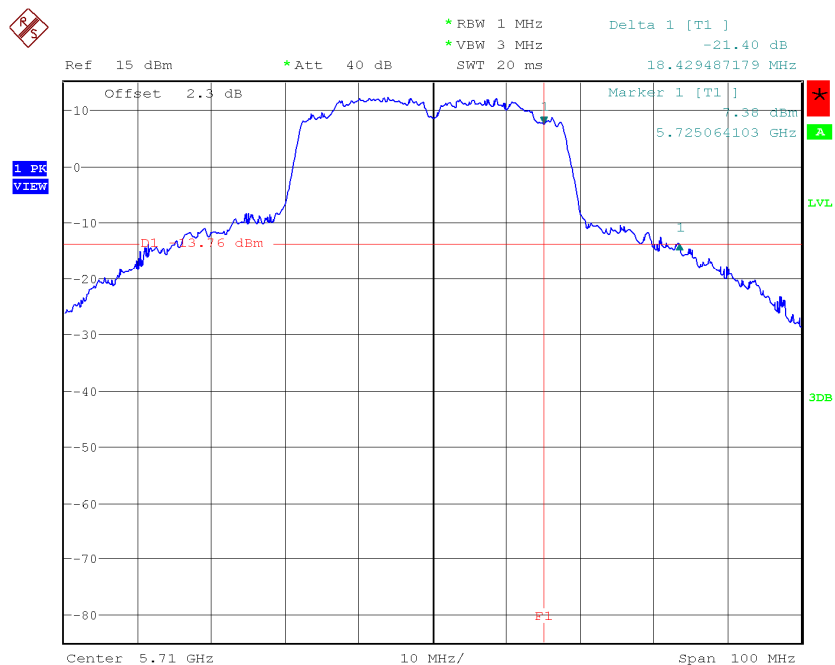
Date: 29.JAN.2013 10:52:10

26 dB BW inside UNII_3 sub-band:



Date: 29.JAN.2013 10:54:44

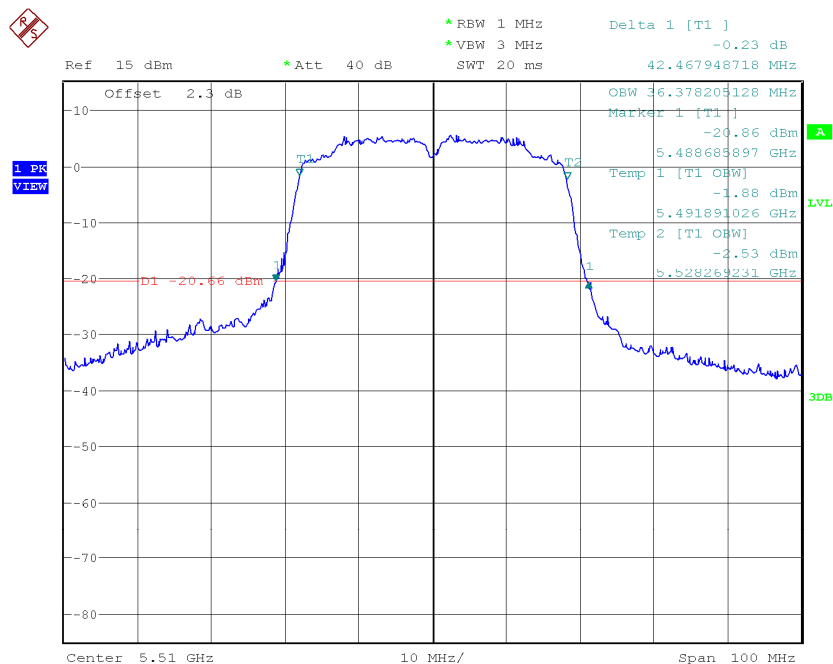
26 dB BW inside UNII_4 sub-band:



Date: 29.JAN.2013 10:55:39

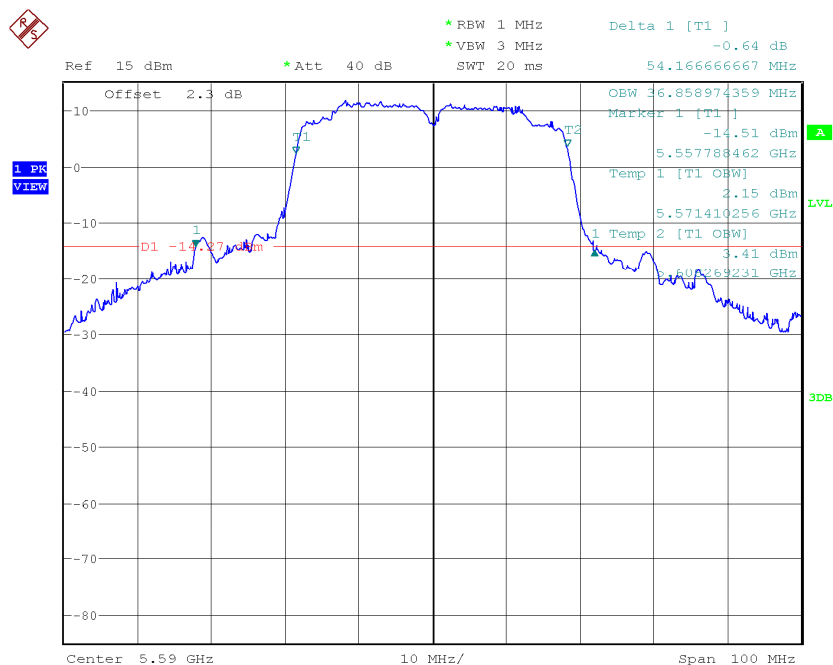
802.11 n40 MHz and 802.11 ac 40 MHz modes (except channel 142) CHAIN B

Lowest Channel



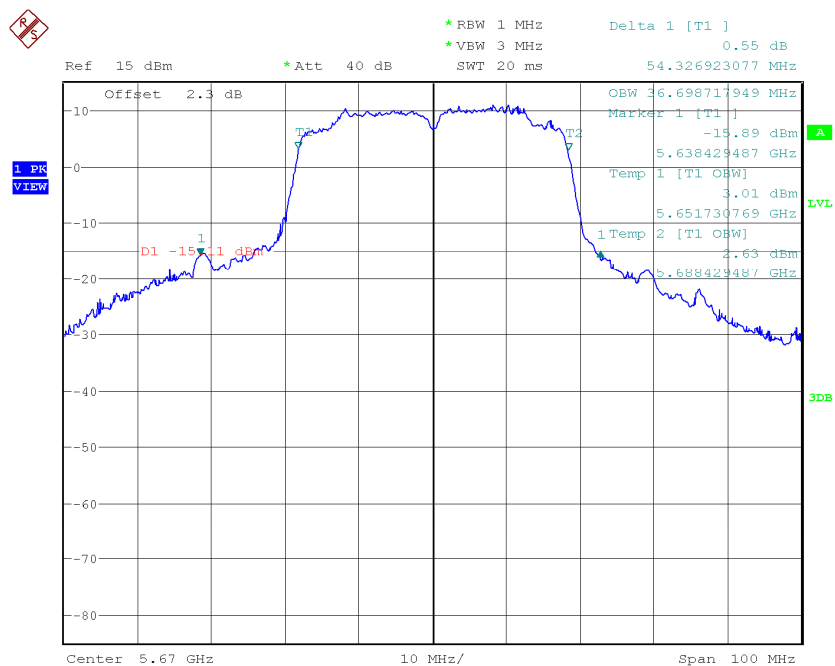
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Middle Channel



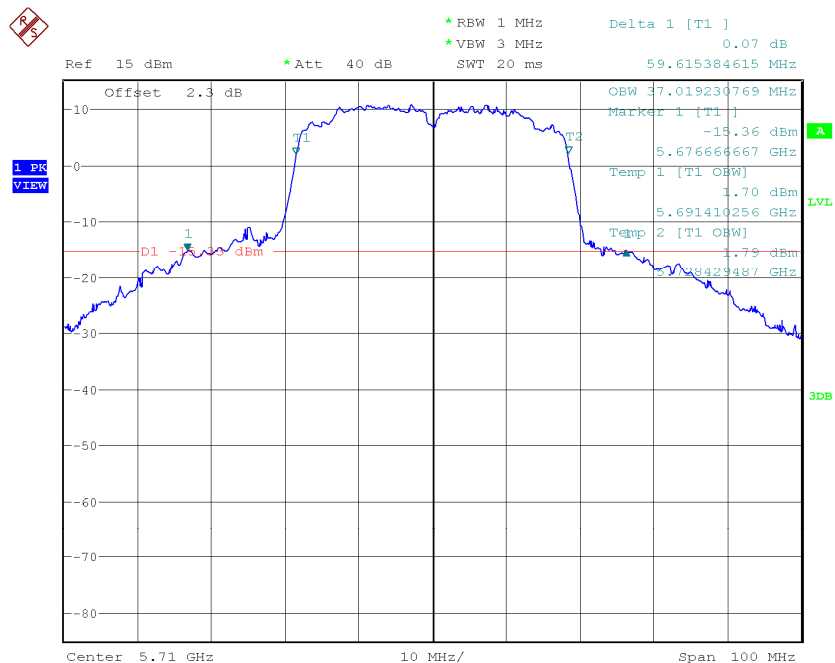
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Highest Channel



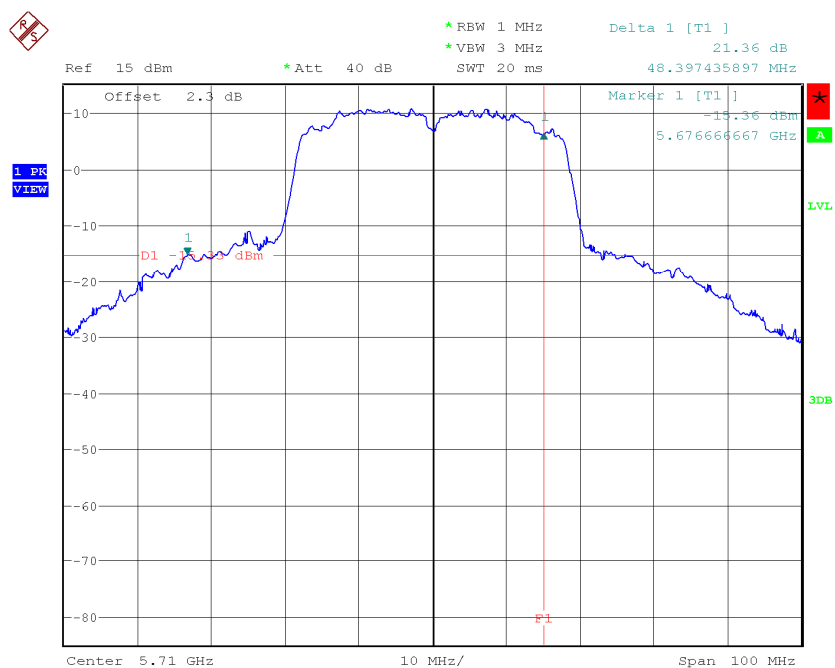
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802.11 ac 40MHz: Channel 142. Total Bandwidth.



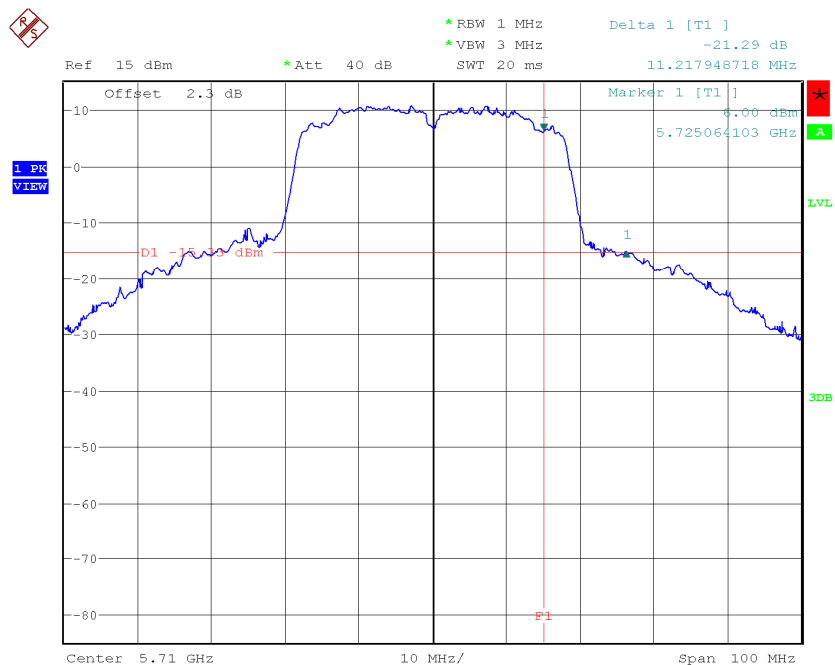
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26 dB BW inside UNII_3 sub-band:



Date: 29.JAN.2013 11:02:52

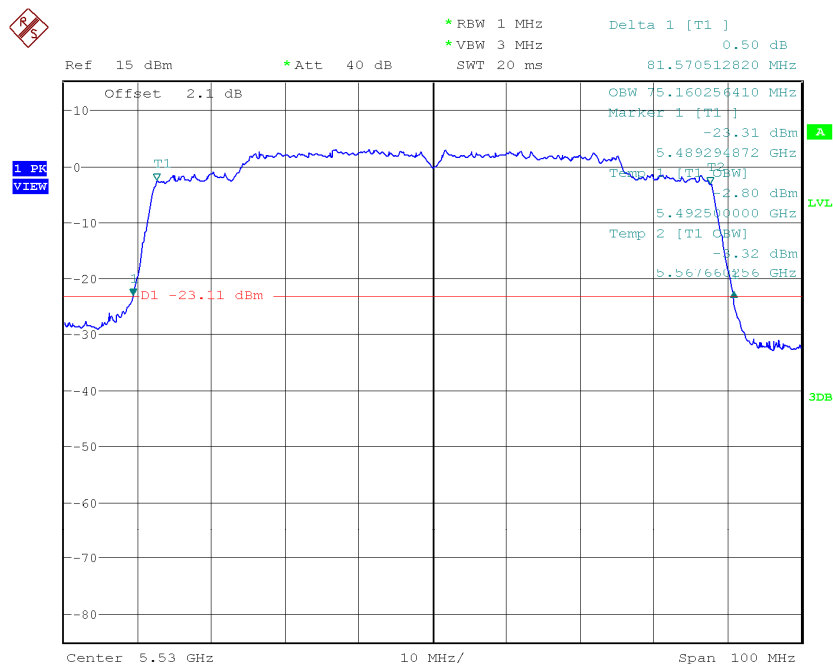
26 dB BW inside UNII_4 sub-band:



Date: 29.JAN.2013 11:03:56

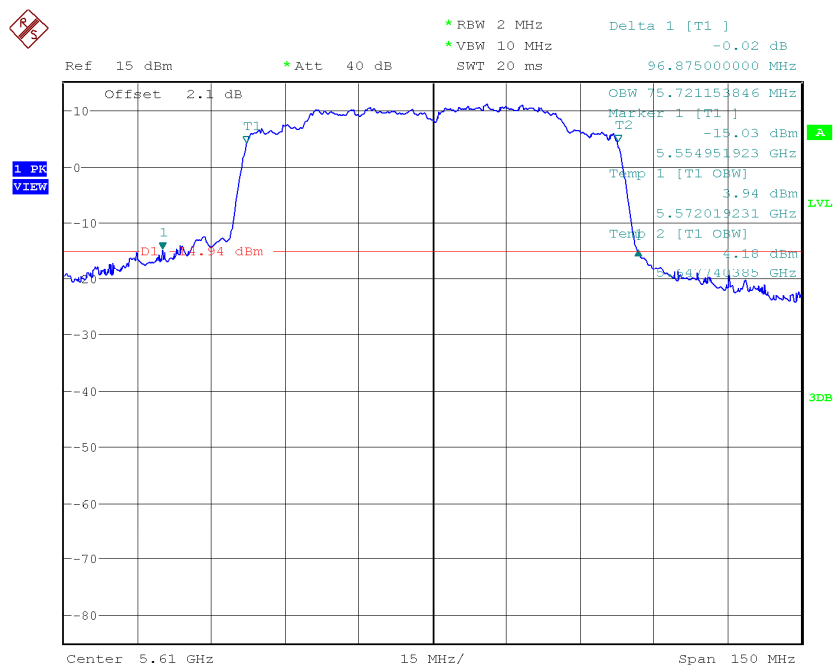
802.11 ac 80 MHz mode (except channel 138) CHAIN A

Lowest Channel



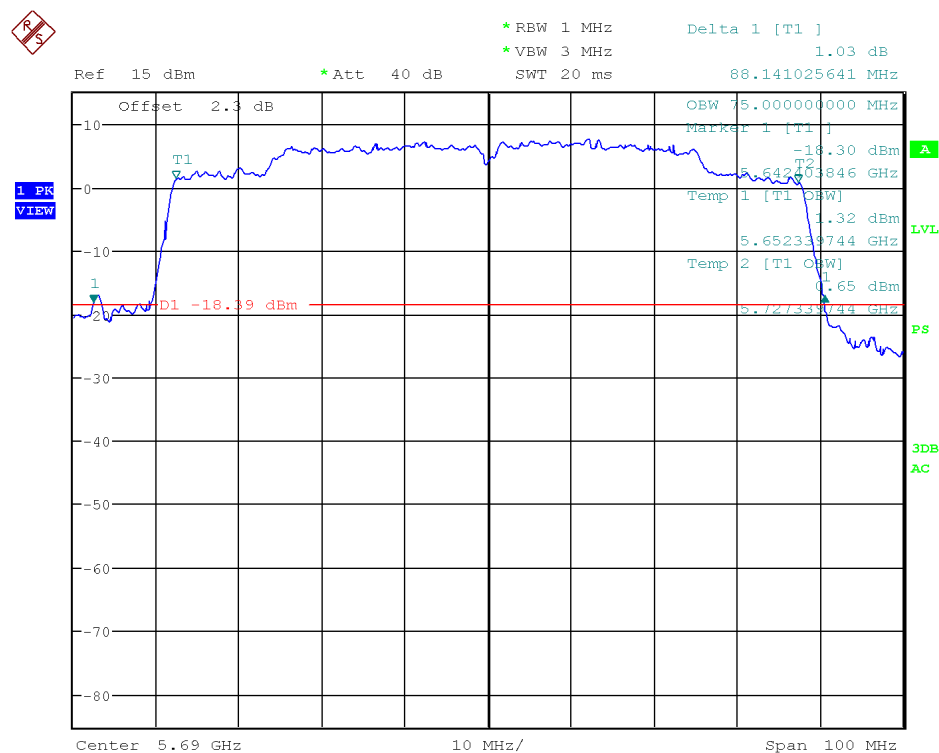
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Middle Channel

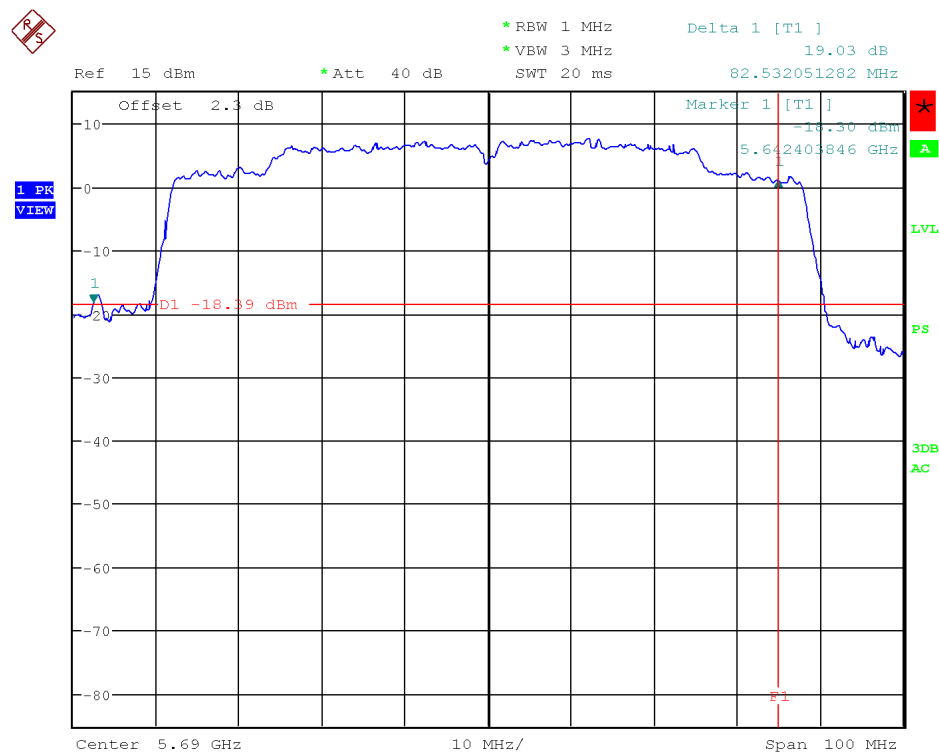


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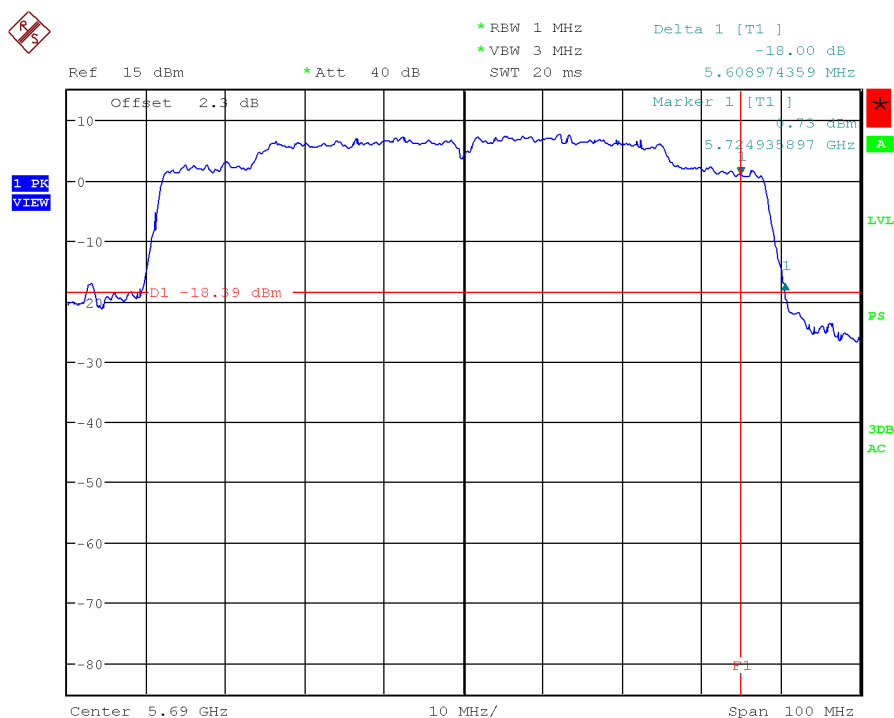
802.11 ac 80MHz: Channel 138. Total Bandwidth.



26 dB BW inside UNII_3 sub-band:

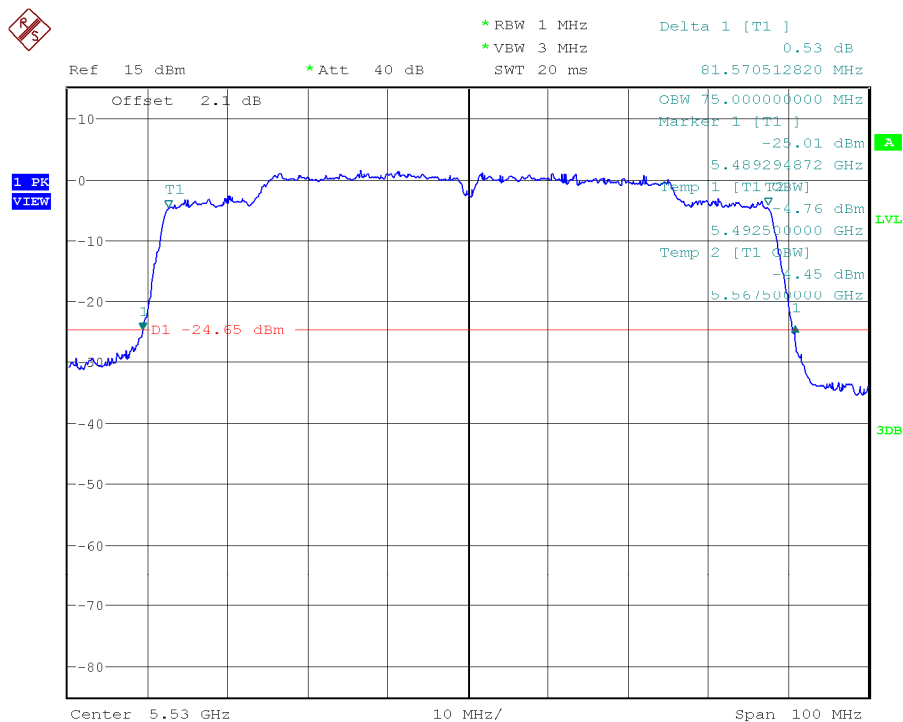


26 dB BW inside UNII_4 sub-band:



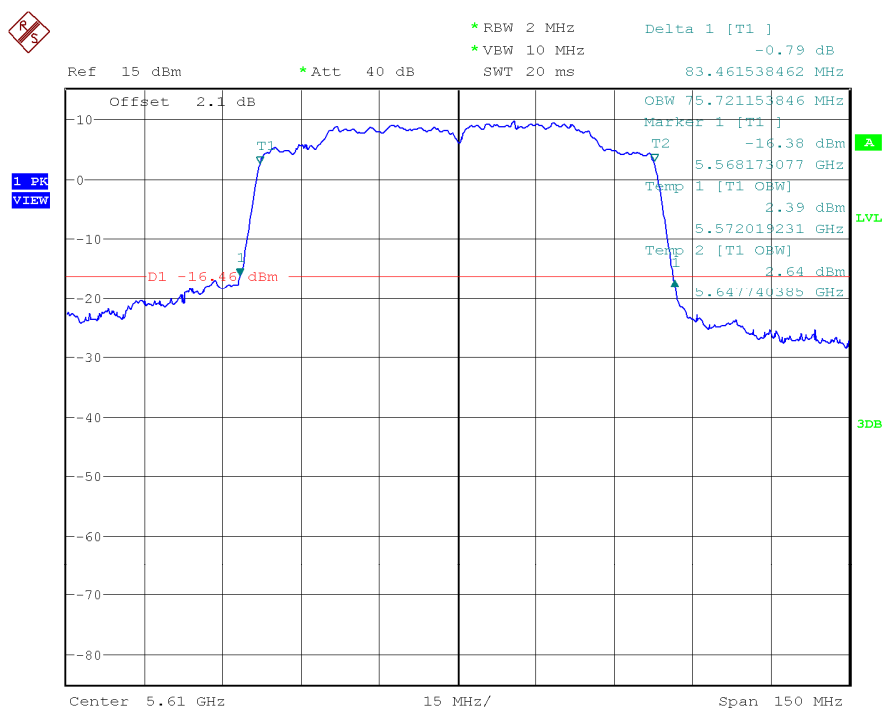
802.11 ac 80 MHz mode (except channel 138) CHAIN B

Lowest Channel



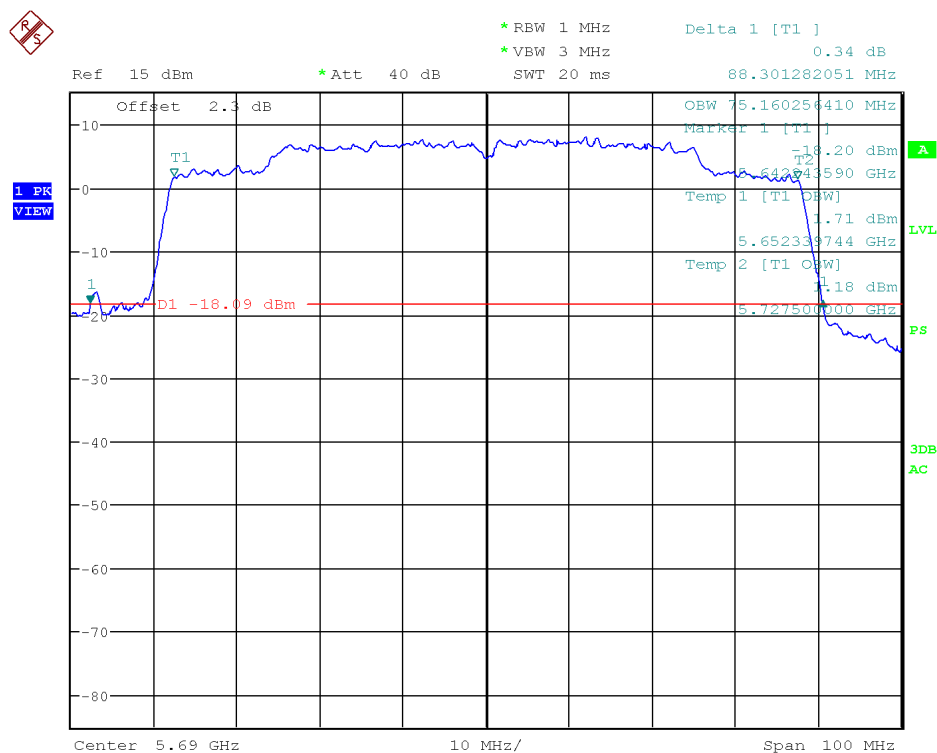
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Middle Channel

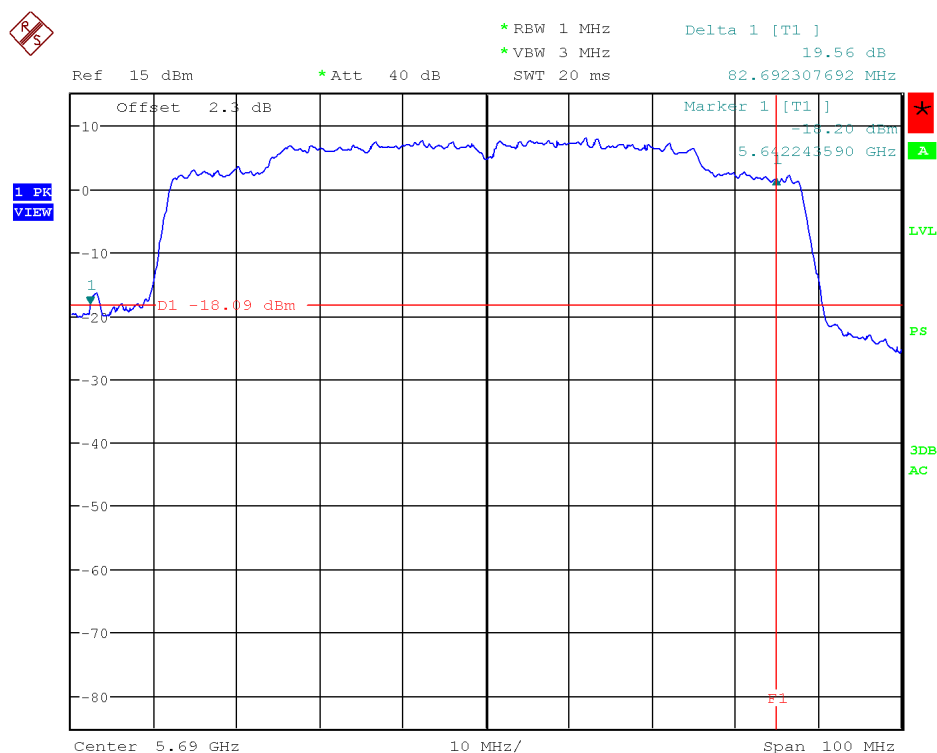


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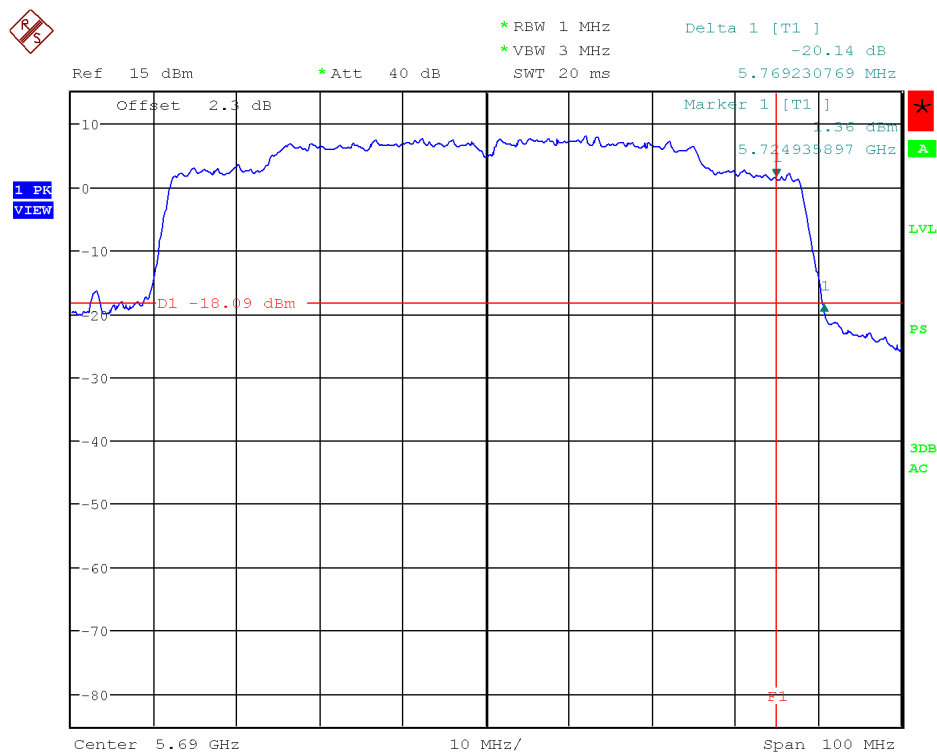
802.11 ac 80MHz: Channel 138. Total Bandwidth.



26 dB BW inside UNII_3 sub-band:



26 dB BW inside UNII_4 sub-band:



Section 15.407 Subclause (a) (2) / RSS-210 A9.2. (3). Maximum output power, Peak power spectral density and antenna gain

SPECIFICATION

FCC 15.407: For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW (23.97 dBm) or $11 \text{ dBm} + 10 \log B$, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725–5.825 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1 W (30 dBm) or $17 \text{ dBm} + 10 \log B$, where B is the 26-dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 17 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

RSS-210: For the band 5.47-5.725 GHz the maximum conducted output power shall not exceed 250 mW (23.97 dBm) or $10 + 10 \log_{10} B$, dBm, whichever power is less. The power spectral density shall not exceed 11dBm in any 1.0 MHz band. The maximum e.i.r.p. shall not exceed 1.0 W (30 dBm) or $17 + 10 \log B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.

For the band 5.725–5.825 GHz the maximum conducted output power shall not exceed 1.0 W (30 dBm) or $17 + 10 \log_{10} B$, dBm, whichever power is less. The power spectral density shall not exceed 17 dBm in any 1.0 MHz band. The maximum e.i.r.p. shall not exceed 4.0 W or $23 + 10 \log_{10} B$, dBm, whichever power is less. B is the 99% emission bandwidth in MHz.

Within the emission bandwidth, when the peak spectral density per MHz over any continuous transmission exceeds the average ($10 \log_{10} B$) value by more than 3 dB, the permissible power spectral density shall be reduced by the excess amount.

RESULTS

The maximum conducted output power was measured using the channel power integration method according to point C) 3) b) (Method SA-1) of Guidance 789033 D01.

For channel 144 ac20MHz, channel 142 ac40 MHz and channel 138 ac80MHz the maximum conducted output power was measured using the method according to point H) 2) b) (ii) (Integration across the entire U-NII band) of the Guidance for IEEE 802.11ac and Pre-ac Device Emissions Testing “Guidance 644545 V01 for IEEE802.11ac”.

Conducted output power within a U-NII band: Integrate over the band or integrate over a span including the 26-dB EBWs of transmission segments within the band or integrate over 26-dB EBW of each transmission segment in the band and sum.

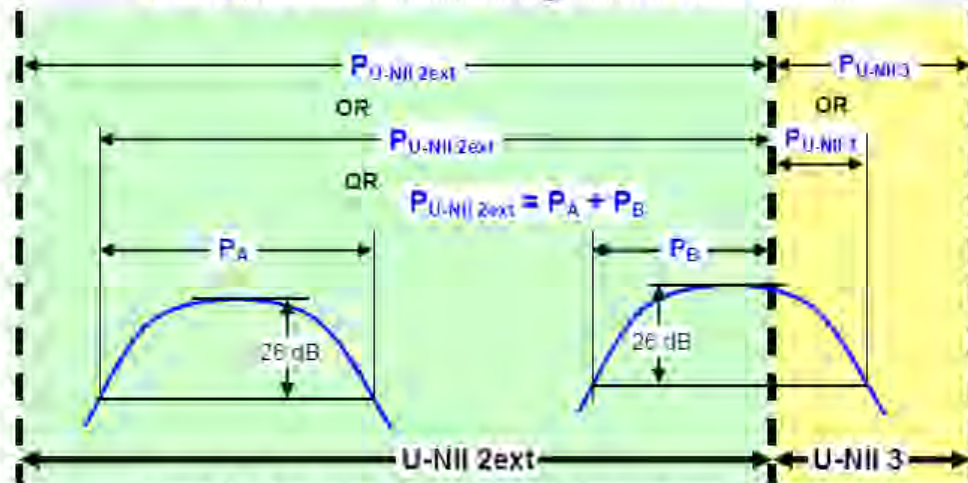


Figure 6. Conducted Output Power Measurement Examples

In the measure-and-sum approach for MIMO mode, the conducted emission level (*e.g.*, transmit power or power in specified bandwidth) is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in linear power units (mW—not dBm).

The peak power spectral density (PPSD) was measured using the method according to point E) (Method SA-1) of Guidance 789033 D01.

For MIMO mode, the Measure and add $10 \log (NANT)$ dB, (where NANT is the number of outputs) technique was used according to the Guidance for Emission Testing of Transmitters with Multiple Outputs in the Same Band 662911 D01 Multiple Transmitter Output v01r02 dated 9/26/2012.

With this technique, spectrum measurements are performed at each output of the device, and the quantity $10 \log (NANT)$ dB is added to each spectrum value before comparing to the emission limit. Number of outputs = 2.

The e.i.r.p. levels are calculated by adding the declared maximum antenna gain (dBi).

For MIMO mode, the Guidance on directional Gain calculations according to the Guidance for Emission Testing of Transmitters with Multiple Outputs in the Same Band 662911 D01 Multiple Transmitter Output v01r02 dated 9/26/2012 was used.

The number of transmit antennas (NANT) are 2 and the number of spatial streams (Nss) are 2 and therefore the Array Gain is 0 dB.

1. 802.11a mode (see next plots).

CHAIN A Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power (dBm)	Maximum output power e.i.r.p. (dBm)	PPSD/MHz (dBm)	PPSD/MHz e.i.r.p. (dBm)
5500 MHz	13.46	18.46	2.28	7.28
5600 MHz	17.21	22.21	6.05	11.05
5700 MHz	13.16	18.16	2.00	7.00

CHAIN B Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power (dBm)	Maximum output power e.i.r.p. (dBm)	PPSD/MHz (dBm)	PPSD/MHz e.i.r.p. (dBm)
5500 MHz	13.27	18.27	2.14	7.14
5600 MHz	17.01	22.01	5.81	10.81
5700 MHz	12.50	17.50	1.38	6.38

Measurement uncertainty = ± 1.5 dB

Verdict: Pass

2. 802.11 n20 MHz and 802.11 ac 20 MHz modes (except channel 144). (see next plots).

Note: the test was performed with 802.11 n20 MHz mode which is the same modulation scheme as 802.11 ac 20 MHz.

CHAIN A Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power (dBm)	Maximum output power e.i.r.p. (dBm)	PPSD/MHz (dBm)	PPSD/MHz e.i.r.p. (dBm)
5500 MHz	13.48	18.48	2.11	7.11
5600 MHz	17.13	22.13	5.67	10.67
5700 MHz	13.04	18.04	1.90	6.90

CHAIN B Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power (dBm)	Maximum output power e.i.r.p. (dBm)	PPSD/MHz (dBm)	PPSD/MHz e.i.r.p. (dBm)
5500 MHz	12.67	17.67	1.29	6.29
5600 MHz	16.23	21.23	4.83	9.83
5700 MHz	12.61	17.61	1.23	6.23

MIMO CHAIN A+B. MAXIMUM OUTPUT POWER

Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power Chain A (dBm)	Maximum conducted output power Chain B (dBm)	Total conducted output power (dBm) A+B	Total output power e.i.r.p. (dBm) A+B
5500 MHz	11.04	10.75	13.91	18.91
5600 MHz	14.54	13.79	17.20	22.20
5700 MHz	10.70	10.35	13.53	18.53

Measurement uncertainty = ± 1.5 dB

Verdict: Pass

MIMO CHAIN A+B. PPSD/MHz

Maximum declared antenna gain = 5 dBi

Frequency	PPSD/MHz Chain A (dBm)	PPSD/MHz Chain B (dBm)	Total PPSD/MHz Chain A (dBm) ¹	Total PPSD/MHz Chain B (dBm) ¹	Total PPSD/MHz Chain A e.i.r.p. (dBm)	Total PPSD/MHz Chain B e.i.r.p. (dBm)
5500 MHz	-0.26	-0.44	2.74	2.56	7.74	7.56
5600 MHz	3.19	2.47	6.19	5.47	11.19	10.47
5700 MHz	-0.63	-0.92	2.37	2.08	7.37	7.08

Note 1: The quantity $10 \cdot \log 2$ (two antennas) is added to the spectrum peak value according to document 662911 D01.

Measurement uncertainty = ± 1.5 dB

Verdict: Pass

802.11 ac 20MHz. Channel 144

CHAIN A

Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power (dBm) per sub-band		Maximum output power e.i.r.p. (dBm) per sub-band		PPSD/MHz (dBm) per sub-band		PPSD/MHz e.i.r.p. (dBm) per sub-band	
	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4
5720 MHz	14.72	9.82	19.72	14.82	4.39	4.61	9.39	9.61

CHAIN B

Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power (dBm) per sub-band		Maximum output power e.i.r.p. (dBm) per sub-band		PPSD/MHz (dBm) per sub-band		PPSD/MHz e.i.r.p. (dBm) per sub-band	
	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4
5720 MHz	15.54	9.38	20.54	14.38	5.22	4.31	10.22	9.31

MIMO CHAIN A+B. MAXIMUM OUTPUT POWER

Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power per sub-band Chain A (dBm)		Maximum conducted output power per sub-band Chain B (dBm)		Total conducted output power (dBm)		Total output power e.i.r.p. (dBm)	
	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4
5720 MHz	12.73	5.53	12.72	6.03	15.73	8.79	20.73	13.79

Measurement uncertainty = ± 1.5 dB

Verdict: Pass

MIMO CHAIN A+B. PPSD/MHz

Maximum declared antenna gain = 5 dBi

Freq.	PPSD/MHz per sub-band Chain A (dBm)		PPSD/MHz per sub-band Chain B (dBm)		Total PPSD/MHz per sub-band Chain A (dBm) ¹		Total PPSD/MHz per sub-band Chain B (dBm) ¹		Total PPSD/MHz per sub-band Chain A e.i.r.p. (dBm)		Total PPSD/MHz per sub-band Chain B e.i.r.p. (dBm)	
	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4
5720 MHz	2.46	0.65	2.40	1.07	5.46	3.65	5.40	4.07	10.46	8.65	10.40	9.07

Note 1: The quantity $10 \cdot \log 2$ (two antennas) is added to the spectrum peak value according to document 662911 D01

3. 802.11 n40 MHz and 802.11 ac 40 MHz modes (except channel 142). (see next plots).

Note: the test was performed with 802.11 n40 MHz mode which is the same modulation scheme as 802.11 ac 40 MHz.

CHAIN A

Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power (dBm)	Maximum output power e.i.r.p. (dBm)	PPSD/MHz (dBm)	PPSD/MHz e.i.r.p. (dBm)
5510 MHz	10.25	15.25	-3.31	1.69
5590 MHz	16.76	21.76	3.22	8.22
5670 MHz	15.66	20.66	1.58	6.58

CHAIN B

Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power (dBm)	Maximum output power e.i.r.p. (dBm)	PPSD/MHz (dBm)	PPSD/MHz e.i.r.p. (dBm)
5510 MHz	10.47	15.47	-3.07	1.93
5590 MHz	16.57	21.57	3.06	8.06
5670 MHz	15.66	20.66	2.30	7.30

MIMO CHAIN A+B. MAXIMUM OUTPUT POWER

Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power Chain A (dBm)	Maximum conducted output power Chain B (dBm)	Total conducted output power (dBm) A+B	Total output power e.i.r.p. (dBm) A+B
5510 MHz	8.00	7.77	10.89	15.89
5590 MHz	13.65	13.57	16.62	21.62
5670 MHz	13.22	12.97	15.98	20.98

Measurement uncertainty = ± 1.5 dB

Verdict: Pass

MIMO CHAIN A+B. PPSD/MHz

Maximum declared antenna gain = 5 dBi

Frequency	PPSD/MHz Chain A (dBm)	PPSD/MHz Chain B (dBm)	Total PPSD/MHz Chain A (dBm) ¹	Total PPSD/MHz Chain B (dBm) ¹	Total PPSD/MHz Chain A e.i.r.p. (dBm)	Total PPSD/MHz Chain B e.i.r.p. (dBm)
5510 MHz	-5.13	-5.39	-2.13	-2.39	2.87	2.61
5590 MHz	0.47	0.33	3.47	3.33	8.47	8.33
5670 MHz	-0.11	-0.28	2.89	2.72	7.89	7.72

Note 1: The quantity $10 \cdot \log 2$ (two antennas) is added to the spectrum peak value according to document 662911 D01.

Measurement uncertainty = ± 1.5 dB

Verdict: Pass

802.11 ac 40MHz. Channel 142.

CHAIN A

Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power (dBm) per sub-band		Maximum output power e.i.r.p. (dBm) per sub-band		PPSD/MHz (dBm) per sub-band		PPSD/MHz e.i.r.p. (dBm) per sub-band	
	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4
5710 MHz	15.25	2.81	20.25	7.81	1.91	-1.57	6.91	3.43

CHAIN B

Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power (dBm) per sub-band		Maximum output power e.i.r.p. (dBm) per sub-band		PPSD/MHz (dBm) per sub-band		PPSD/MHz e.i.r.p. (dBm) per sub-band	
	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4
5710 MHz	15.65	3.08	20.65	8.08	2.32	-1.22	7.32	3.78

MIMO CHAIN A+B. MAXIMUM OUTPUT POWER

Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power per sub-band Chain A (dBm)		Maximum conducted output power per sub-band Chain B (dBm)		Total conducted output power (dBm) per sub-band		Total output power e.i.r.p. (dBm) per sub-band	
	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4
5710 MHz	13.35	0.93	13.31	0.59	16.34	3.77	21.34	8.77

Measurement uncertainty = ± 1.5 dB

Verdict: Pass

MIMO CHAIN A+B. PPSD/MHz

Maximum declared antenna gain = 5 dBi

Freq.	PPSD/MHz per sub-band Chain A (dBm)		PPSD/MHz per sub-band Chain B (dBm)		Total PPSD/MHz per sub-band Chain A (dBm) ¹		Total PPSD/MHz per sub-band Chain B (dBm) ¹		Total PPSD/MHz per sub-band Chain A e.i.r.p. (dBm)		Total PPSD/MHz Chain B e.i.r.p. per sub-band (dBm)	
	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4
5710 MHz	0.32	-3.32	0.22	-3.68	3.32	-0.32	3.22	-0.68	8.32	4.68	8.22	4.32

Note 1: The quantity $10 \cdot \log 2$ (two antennas) is added to the spectrum peak value according to document 662911 D01.

Measurement uncertainty = ± 1.5 dB

Verdict: Pass

4. 802.11 ac 80 MHz mode (except channel 138). (see next plots).

CHAIN A

Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power (dBm)	Maximum output power e.i.r.p. (dBm)	PPSD/MHz (dBm)	PPSD/MHz e.i.r.p. (dBm)
5530 MHz	8.81	13.81	-7.19	-2.19
5610 MHz	14.23	19.23	-1.45	3.55

CHAIN B

Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power (dBm)	Maximum output power e.i.r.p. (dBm)	PPSD/MHz (dBm)	PPSD/MHz e.i.r.p. (dBm)
5530 MHz	9.19	14.19	-6.71	-1.71
5610 MHz	14.23	19.23	-1.42	3.58

MIMO CHAIN A+B. MAXIMUM OUTPUT POWER

Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power Chain A (dBm)	Maximum conducted output power Chain B (dBm)	Total conducted output power (dBm) A+B	Total output power e.i.r.p. (dBm) A+B
5530 MHz	6.42	6.60	9.52	14.52
5610 MHz	13.64	13.72	16.69	21.69

Measurement uncertainty = ± 1.5 dB

Verdict: Pass

MIMO CHAIN A+B. PPSD/MHz

Maximum declared antenna gain = 5 dBi

Frequency	PPSD/MHz Chain A (dBm)	PPSD/MHz Chain B (dBm)	Total PPSD/MHz Chain A (dBm) ¹	Total PPSD/MHz Chain B (dBm) ¹	Total PPSD/MHz Chain A e.i.r.p. (dBm)	Total PPSD/MHz Chain B e.i.r.p. (dBm)
5530 MHz	-9.34	-9.03	-6.34	-6.03	-1.34	-1.03
5610 MHz	-1.58	-1.44	1.42	1.56	6.42	6.56

Note 1: The quantity $10 \cdot \log 2$ (two antennas) is added to the spectrum peak value according to document 662911 D01.

Measurement uncertainty = ± 1.5 dB

Verdict: Pass

802.11 ac 80MHz. Channel 138.

CHAIN A

Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power (dBm) per sub-band		Maximum output power e.i.r.p. (dBm) per sub-band		PPSD/MHz (dBm) per sub-band		PPSD/MHz e.i.r.p. (dBm) per sub-band	
	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4
5690 MHz	13.10	-2.81	18.10	2.19	-2.78	-7.13	2.22	-2.13

CHAIN B

Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power (dBm) per sub-band		Maximum output power e.i.r.p. (dBm) per sub-band		PPSD/MHz (dBm) per sub-band		PPSD/MHz e.i.r.p. (dBm) per sub-band	
	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4
5690 MHz	13.45	-2.73	18.45	2.27	-2.41	-6.98	2.59	-1.98

MIMO CHAIN A+B. MAXIMUM OUTPUT POWER

Maximum declared antenna gain = 5 dBi

Frequency	Maximum conducted output power per sub-band Chain A (dBm)		Maximum conducted output power per sub-band Chain B (dBm)		Total conducted output power (dBm) per sub-band		Total output power e.i.r.p. (dBm) per sub-band	
	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4
5690 MHz	13.4	-3.18	13.35	-2.62	16.38	0.11	21.38	5.11

Measurement uncertainty = ± 1.5 dB

Verdict: Pass

MIMO CHAIN A+B. PPSD/MHz

Maximum declared antenna gain = 5 dBi

Freq.	PPSD/MHz per sub-band Chain A (dBm)		PPSD/MHz per sub-band Chain B (dBm)		Total PPSD/MHz per sub-band Chain A (dBm) ¹		Total PPSD/MHz per sub-band Chain B (dBm) ¹		Total PPSD/MHz per sub-band Chain A e.i.r.p. (dBm)		Total PPSD/MHz per sub-band Chain B e.i.r.p. (dBm)	
	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4	UNII_3	UNII_4
5690 MHz	-2.27	-6.90	-2.21	-6.66	0.73	-3.90	0.79	-3.66	5.73	1.10	5.79	1.34

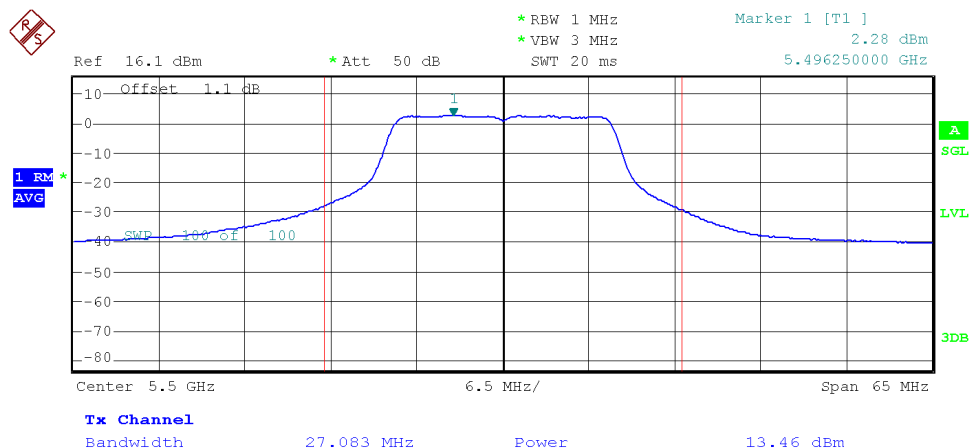
Note 1: The quantity $10 \cdot \log 2$ (two antennas) is added to the spectrum peak value according to document 662911 D01.

Measurement uncertainty = ± 1.5 dB

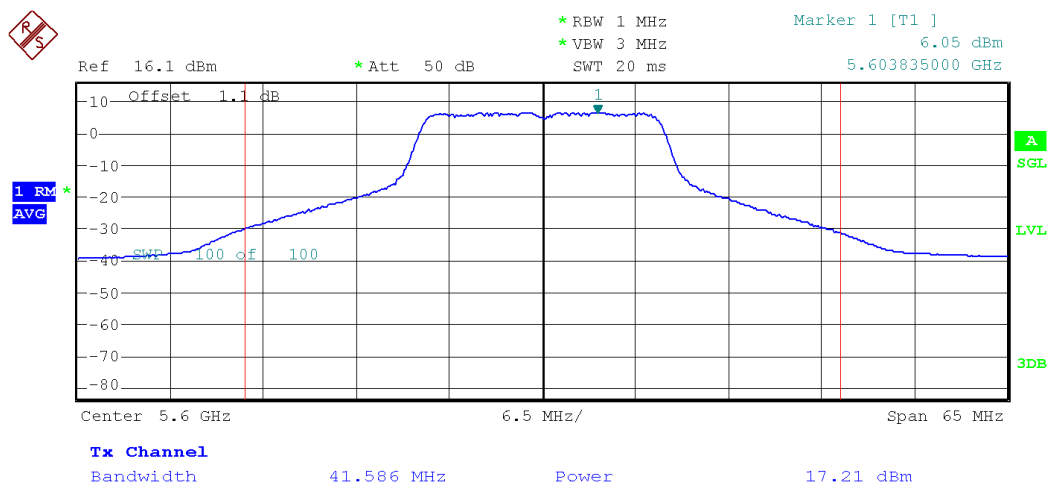
Verdict: Pass

802.11a mode CHAIN A

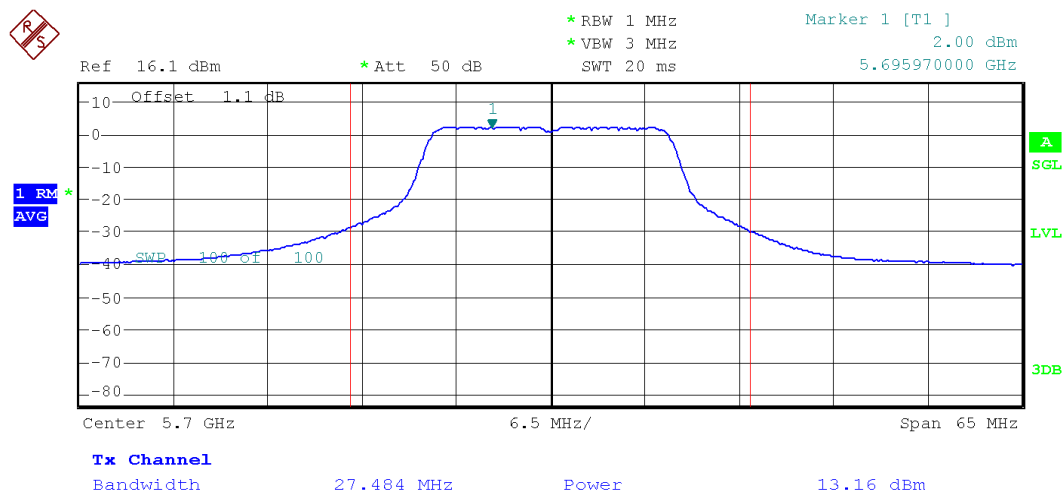
Lowest Channel



Middle Channel

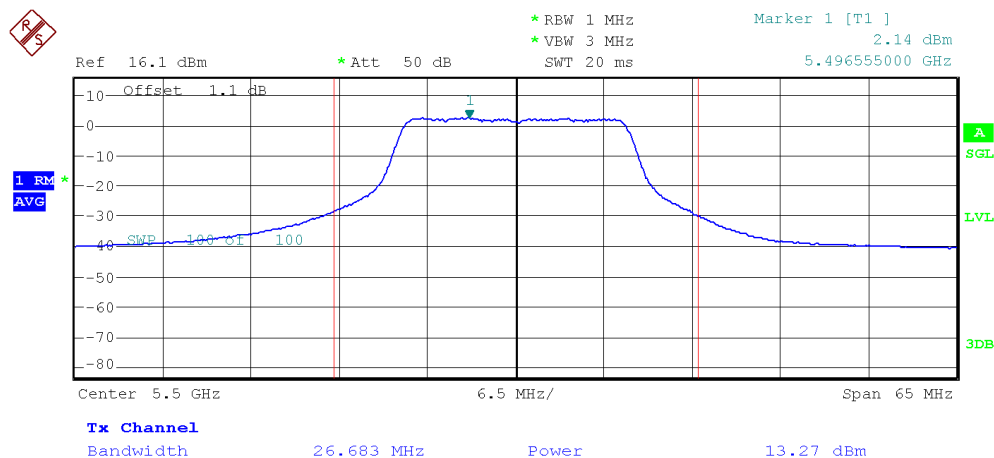


Highest Channel

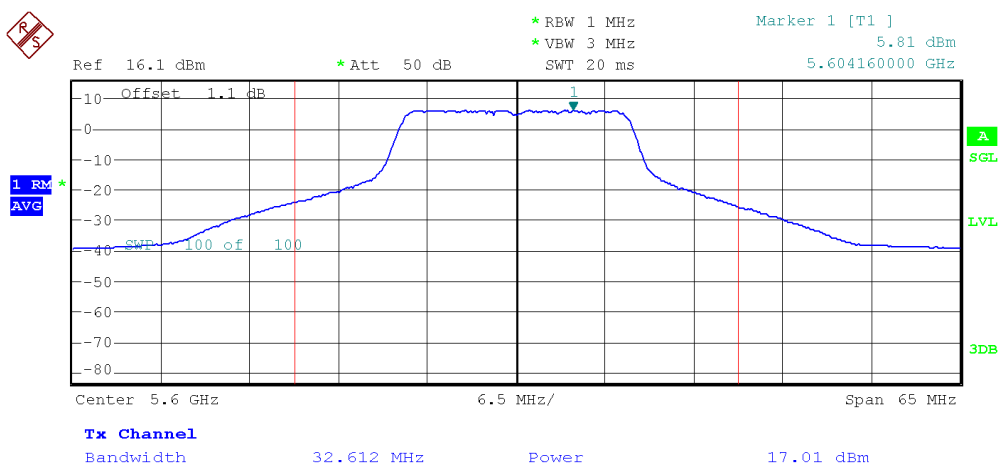


802.11a mode CHAIN B

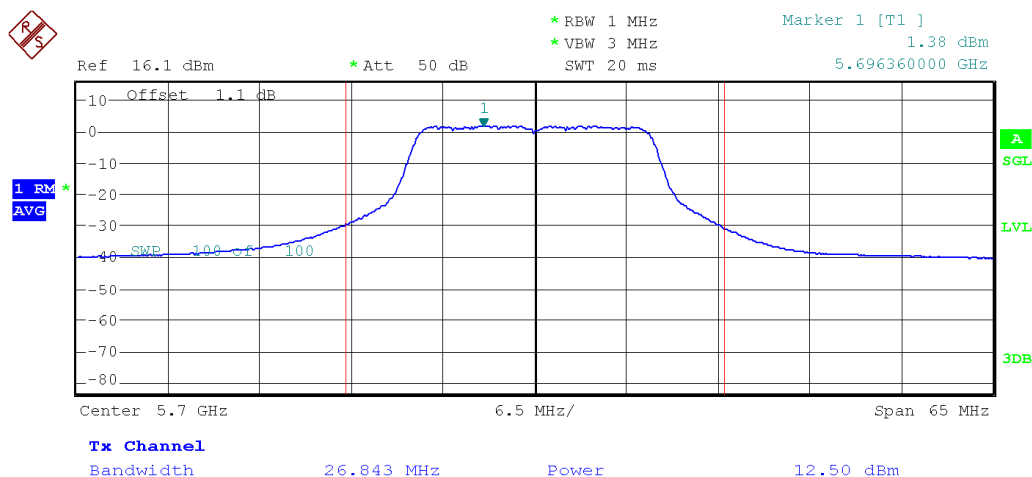
Lowest Channel



Middle Channel

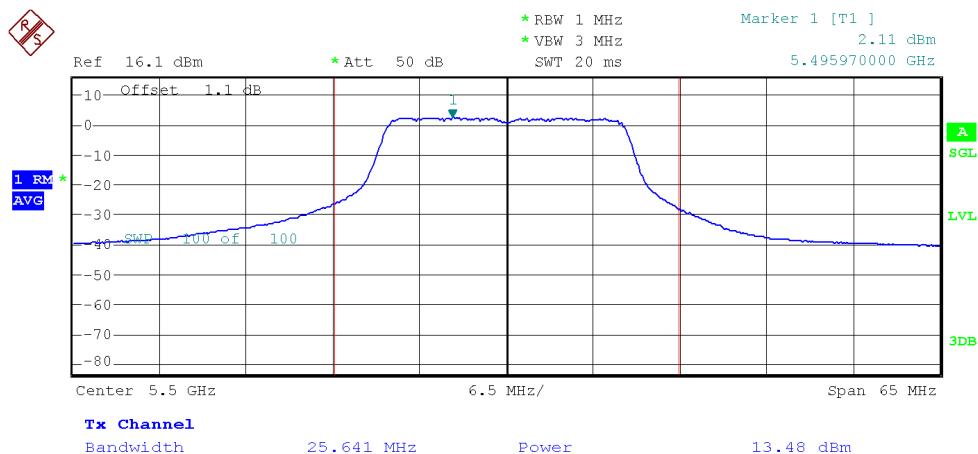


Highest Channel

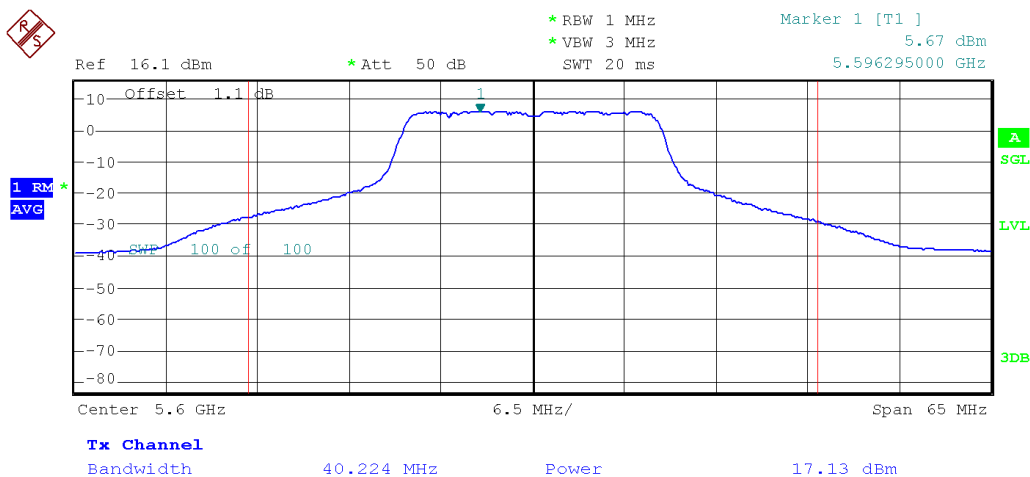


802.11 n20 MHz modes (except channel 144) CHAIN A

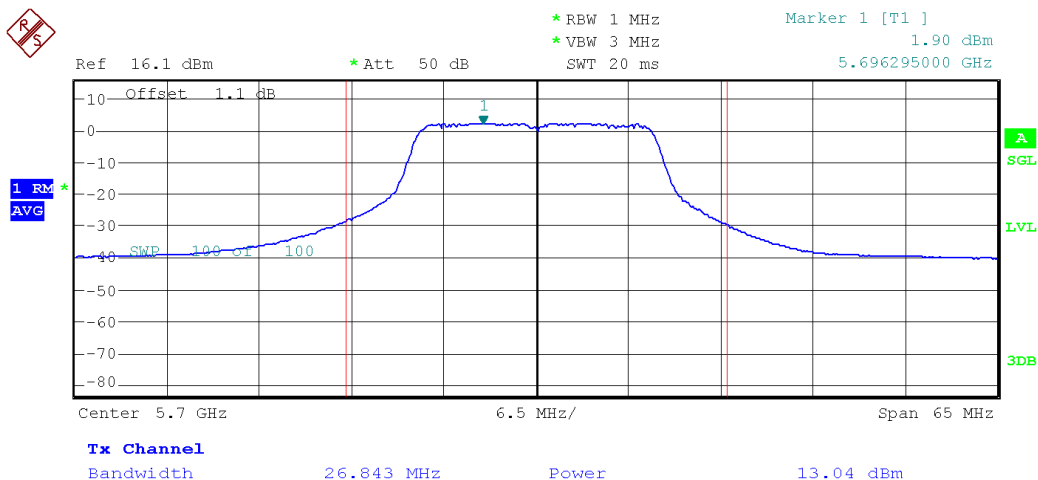
Lowest Channel



Middle Channel

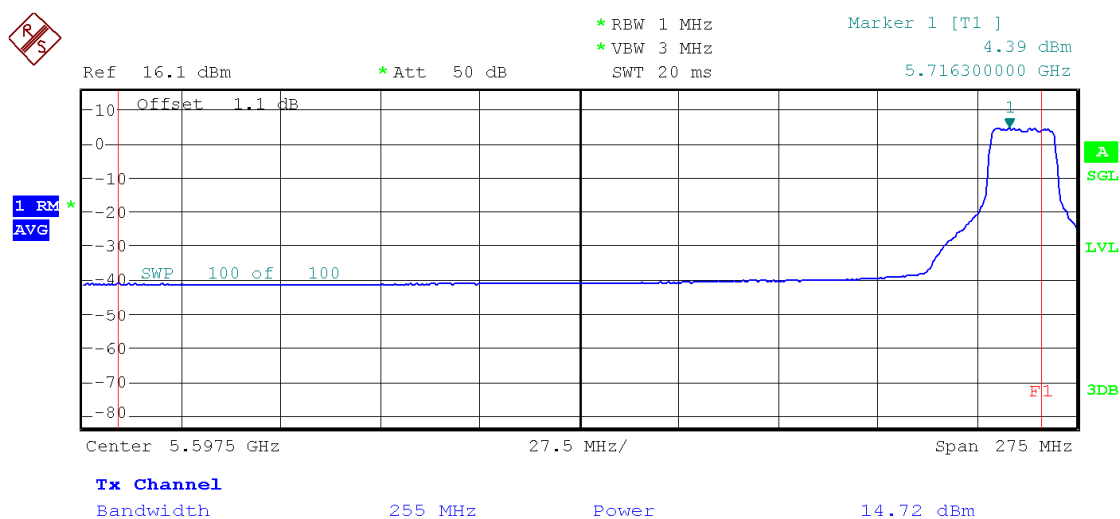


Highest Channel

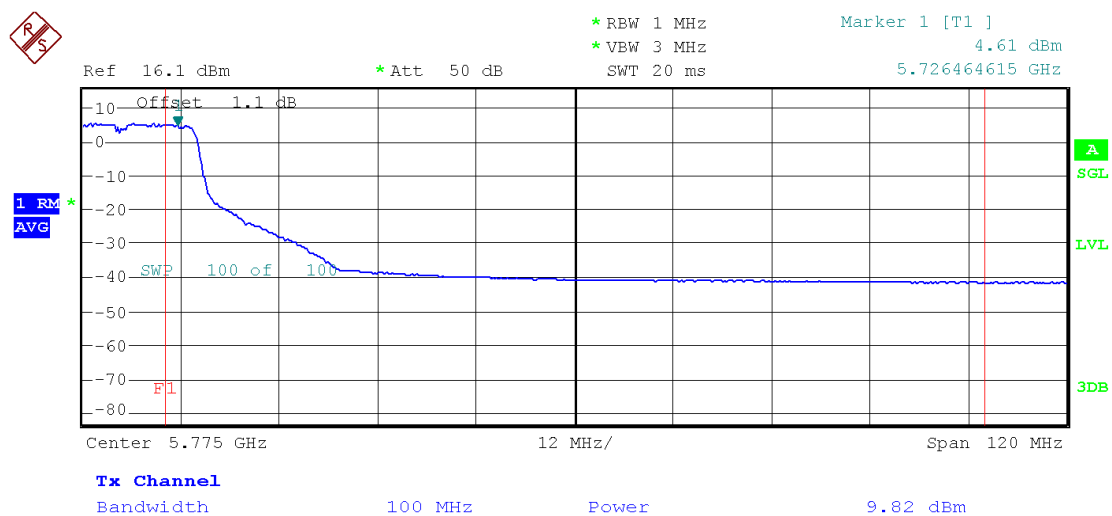


802.11 ac 20MHz : Channel 144

Power and PPSD in sub-band UNII_3:

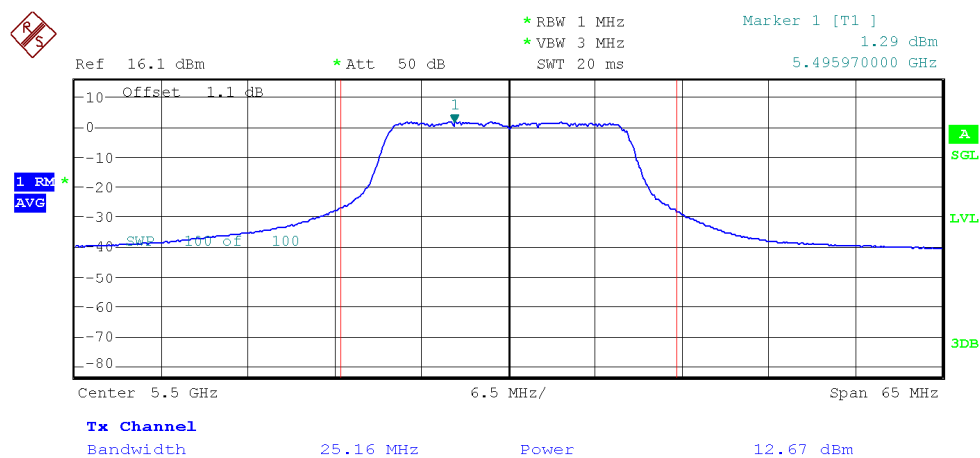


Power and PPSD in sub-band UNII_4:

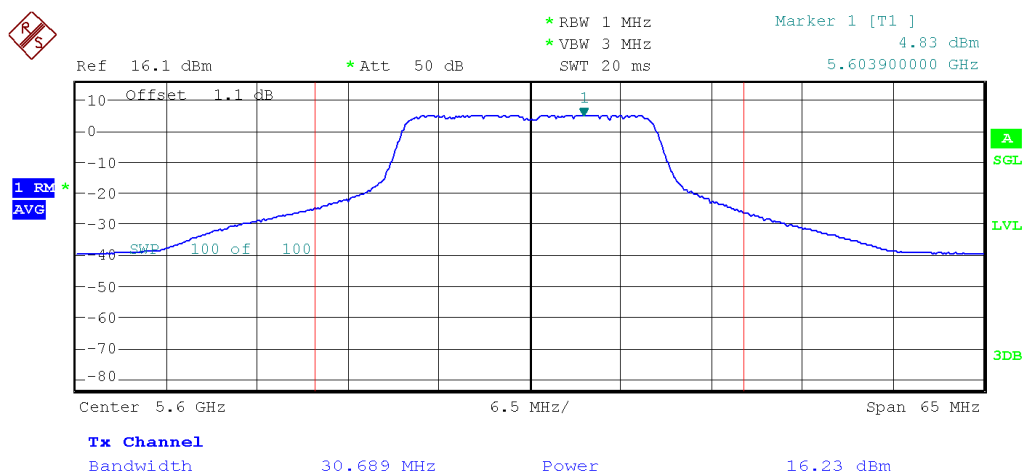


802.11 n20 MHz and 802.11 ac 20 MHz modes (except channel 144) CHAIN B

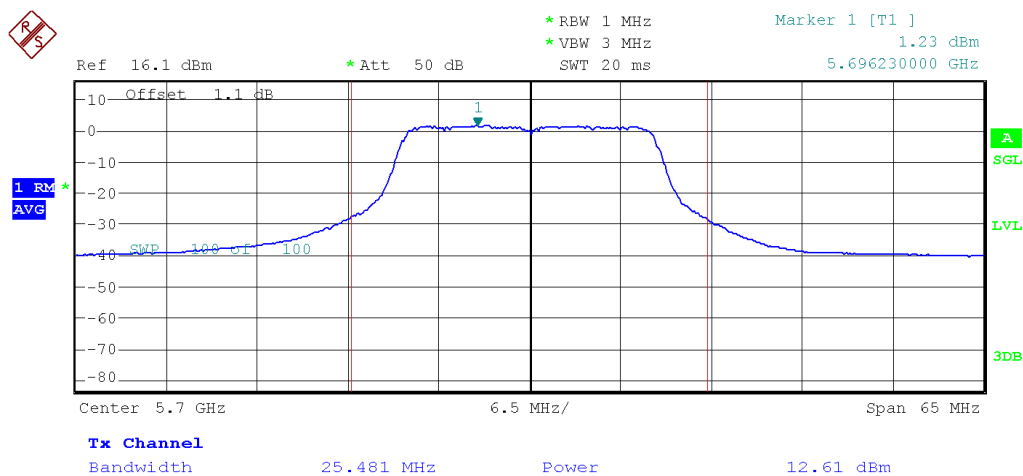
Lowest Channel



Middle Channel

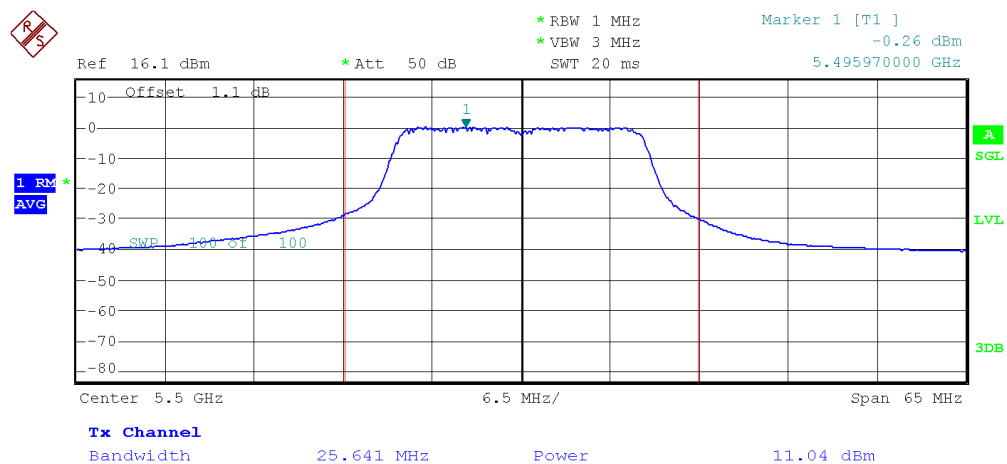


Highest Channel

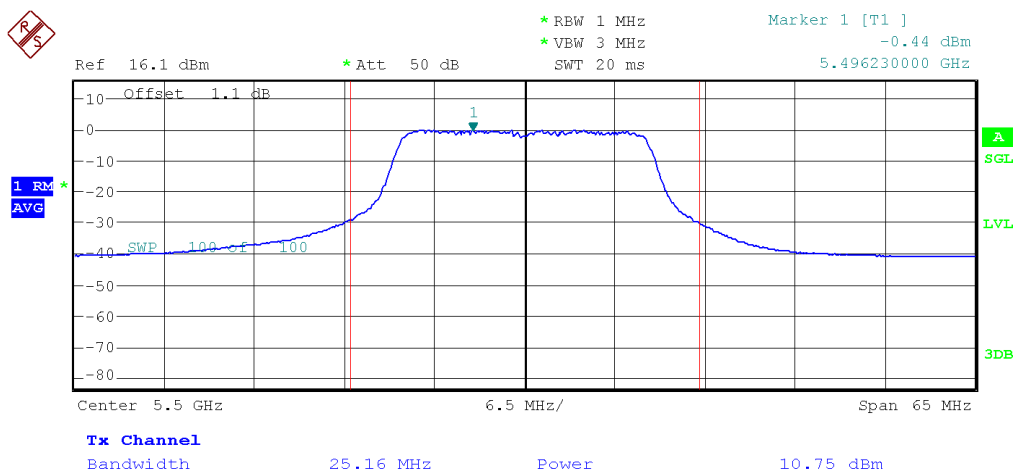


802.11 n20 MHz and 802.11 ac 20 MHz modes (except channel 144) MIMO CHAIN A+B

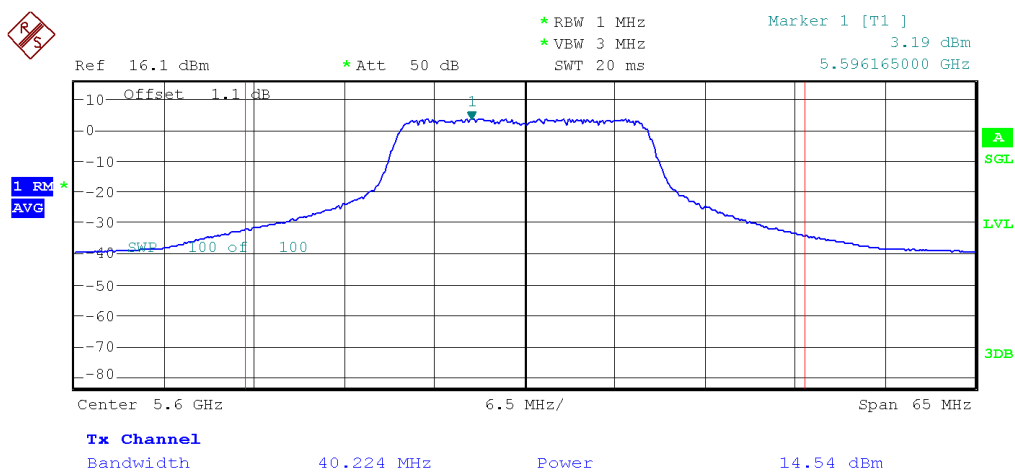
Lowest Channel. Port A



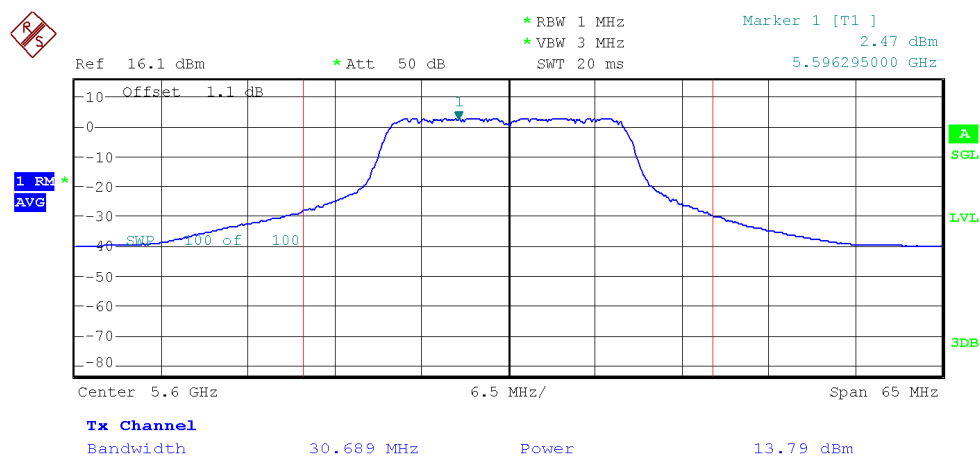
Lowest Channel. Port B



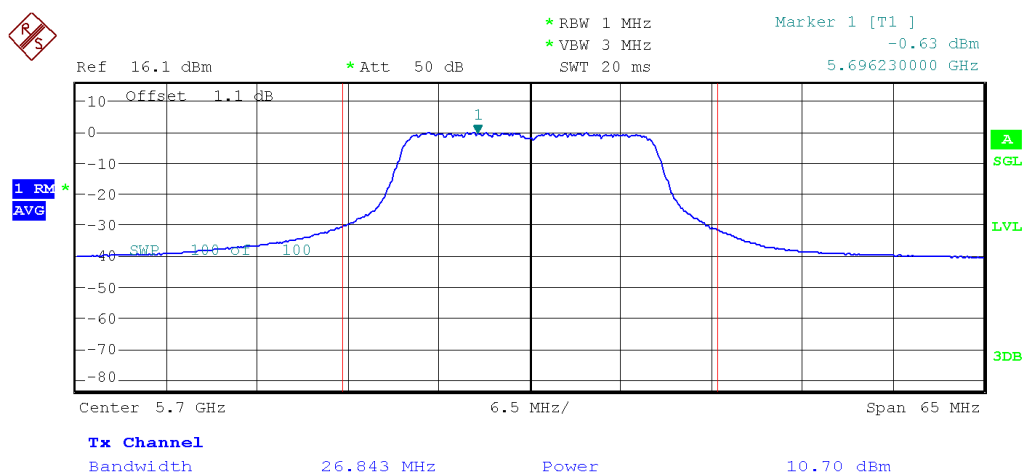
Middle Channel. Port A



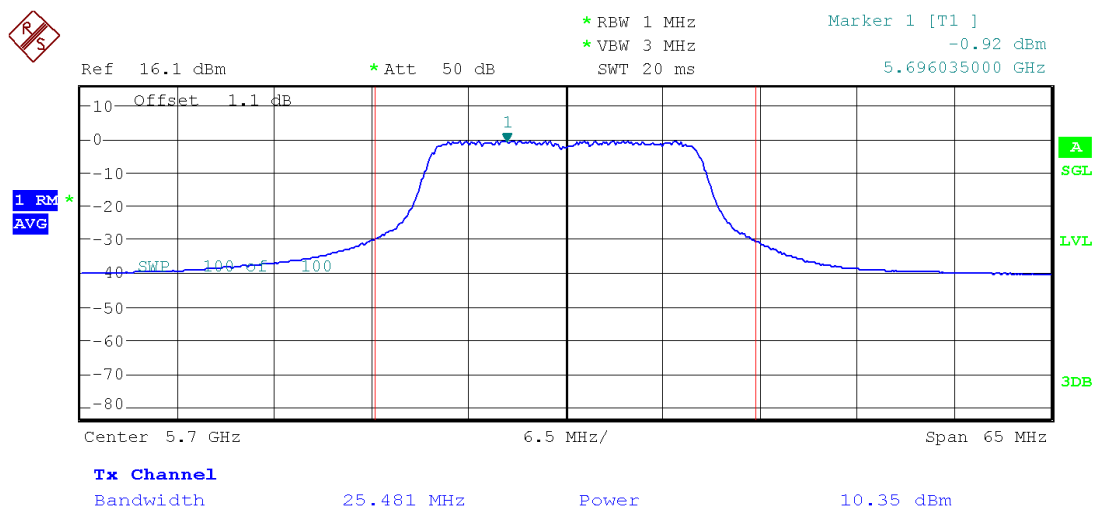
Middle Channel. Chain B



Highest Channel. Port A

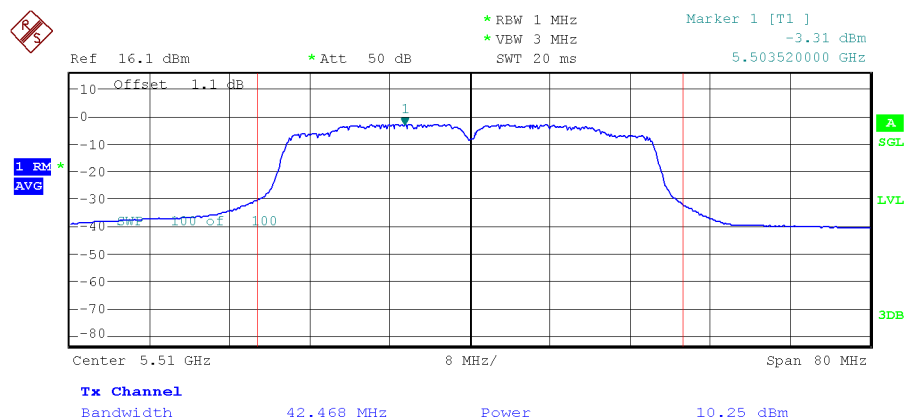


Highest Channel. Port B

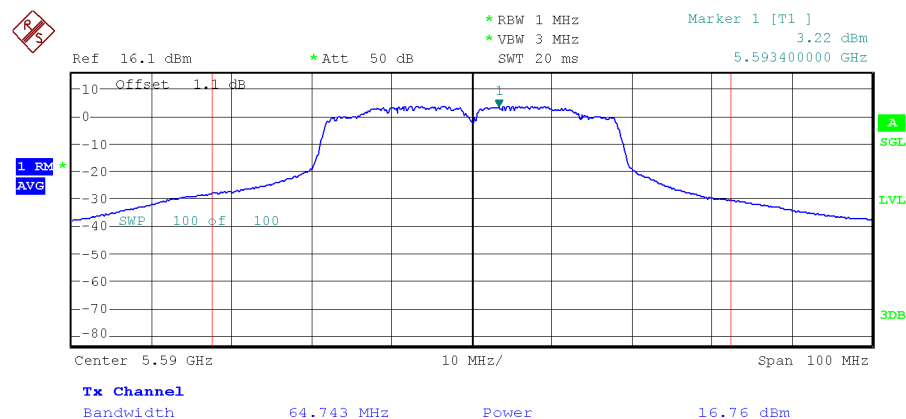


802.11 n40 MHz modes (except channel 142) CHAIN A

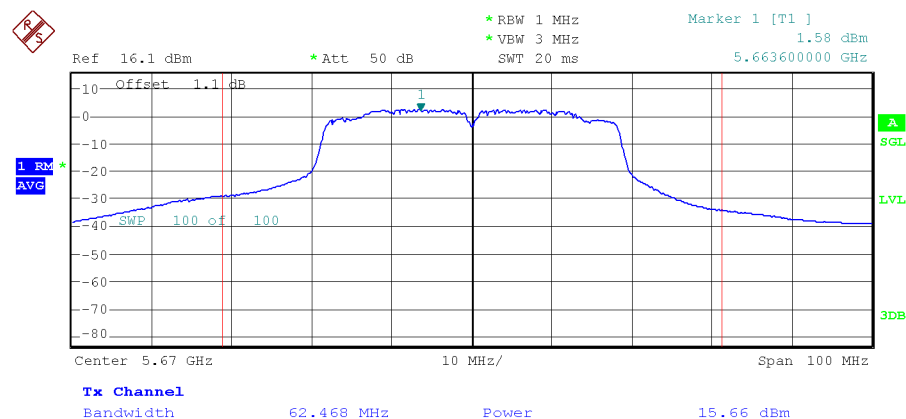
Lowest Channel



Middle Channel

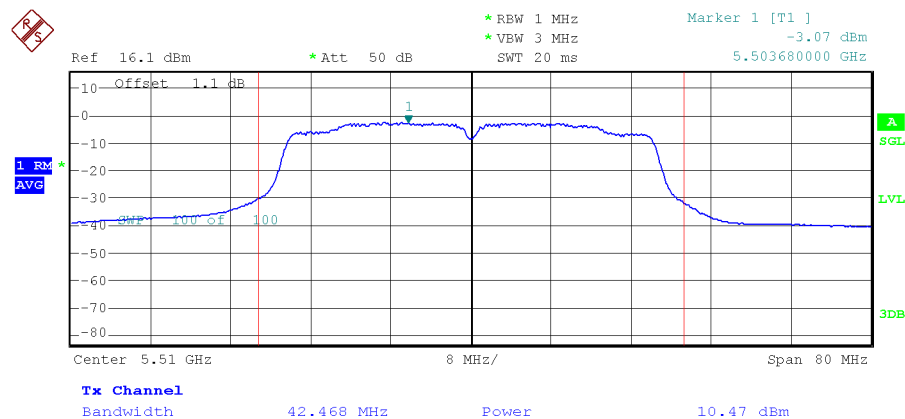


Highest Channel

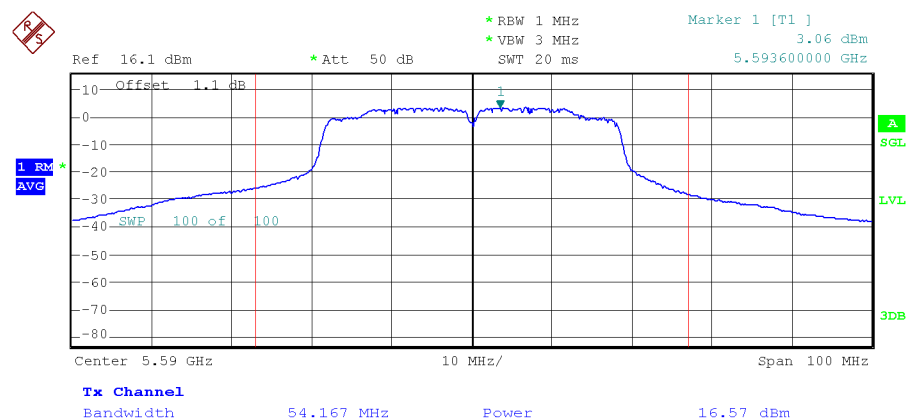


802.11 n40 MHz modes (except channel 142) CHAIN B

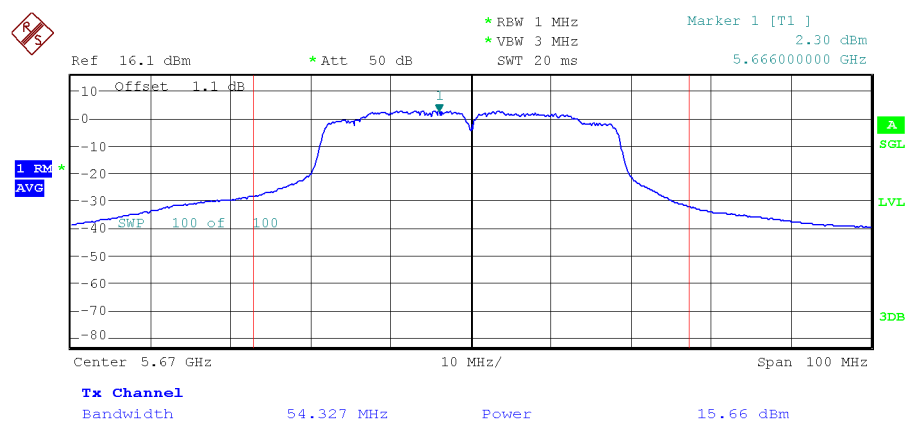
Lowest Channel



Middle Channel

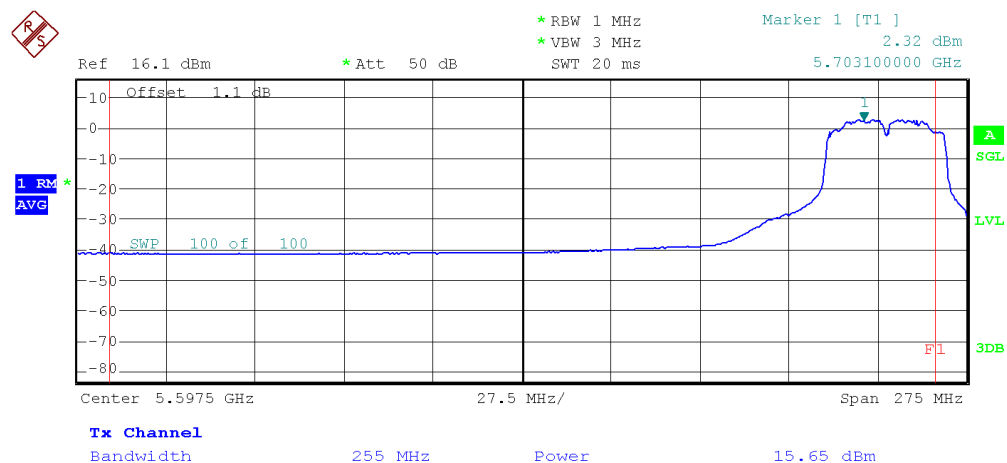


Highest Channel

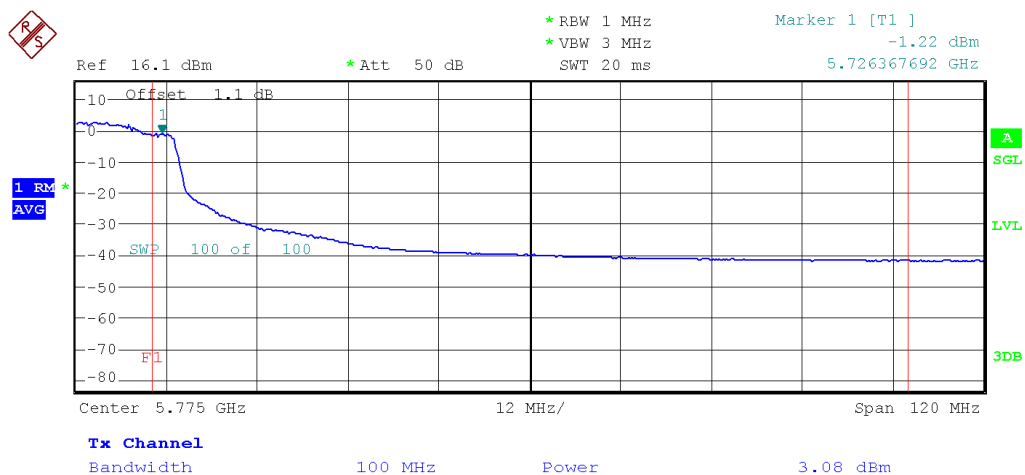


802.11 ac 40MHz : Channel 142

Power and PPSD in sub-band UNII_3:

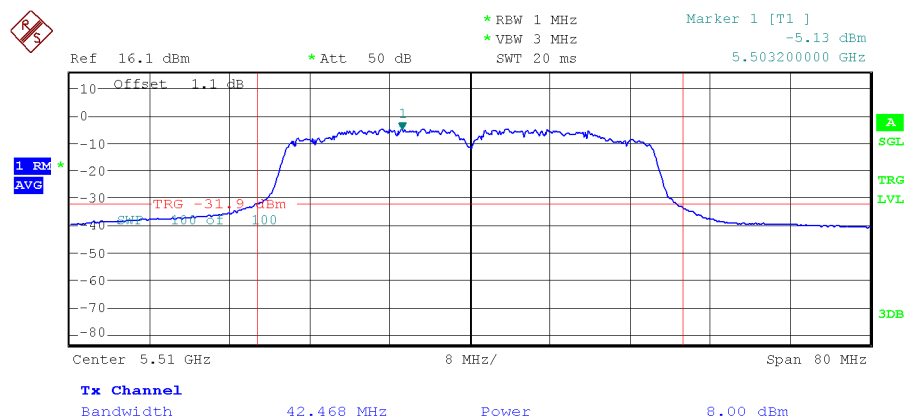


Power and PPSD in sub-band UNII_4:

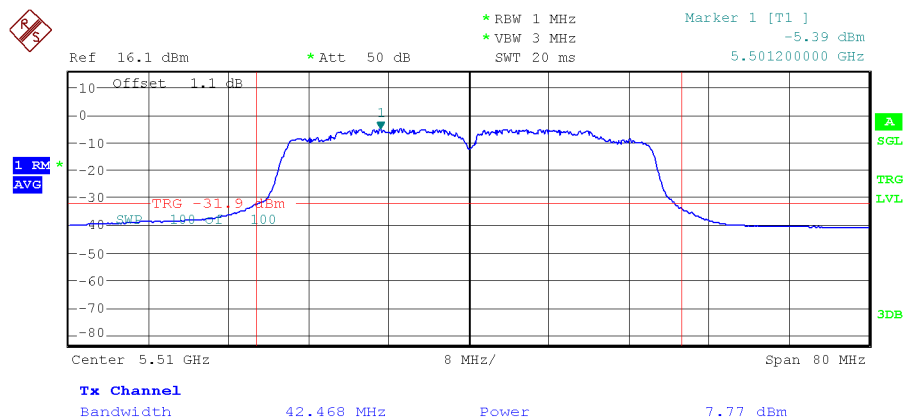


802.11 n40 MHz modes (except channel 142) MIMO CHAIN A+B

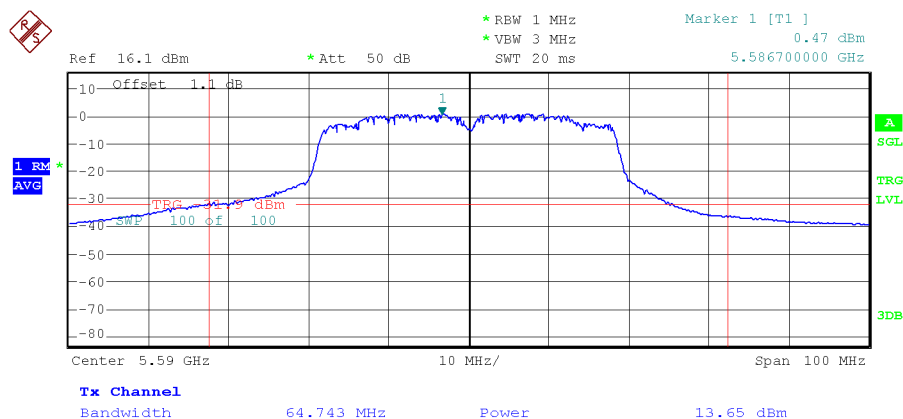
Lowest Channel. Port A



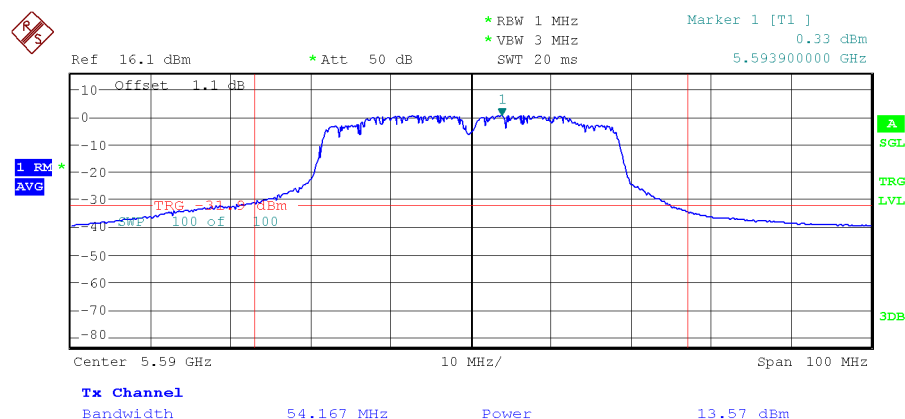
Lowest Channel. Port B



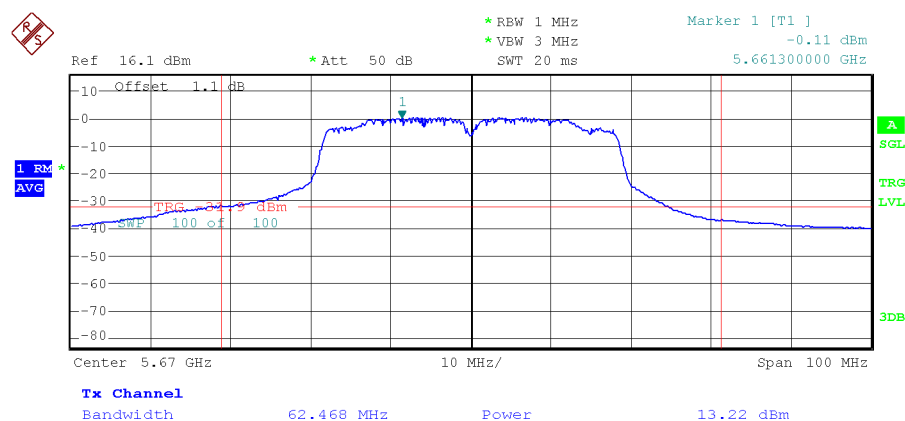
Middle Channel. Port A



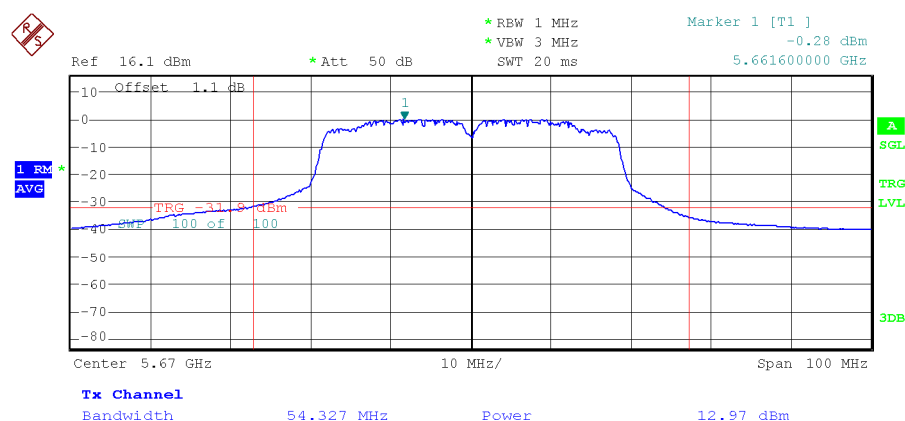
Middle Channel. Chain B



Highest Channel. Port A

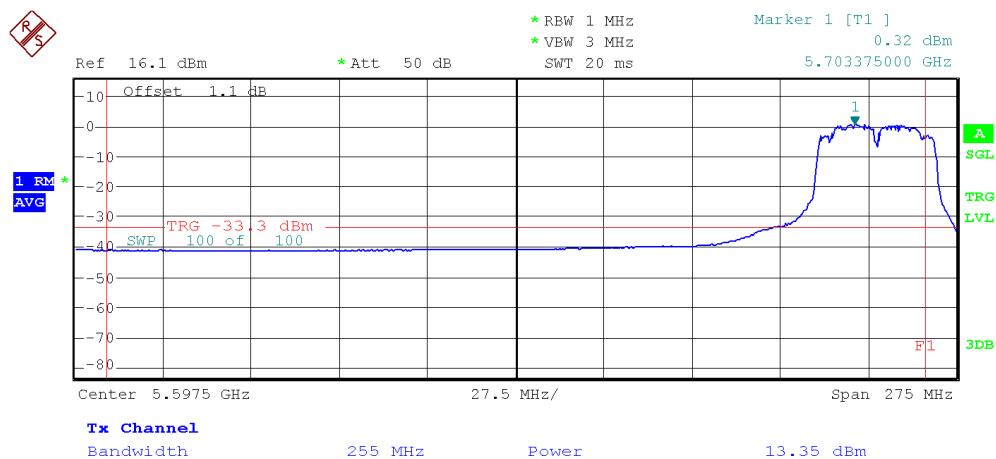


Highest Channel. Port B

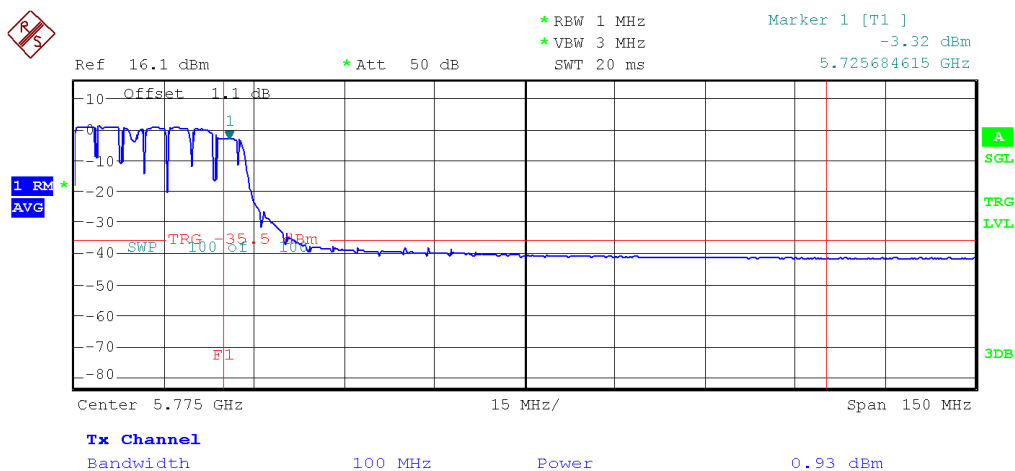


802.11 ac40MHz : Channel 142

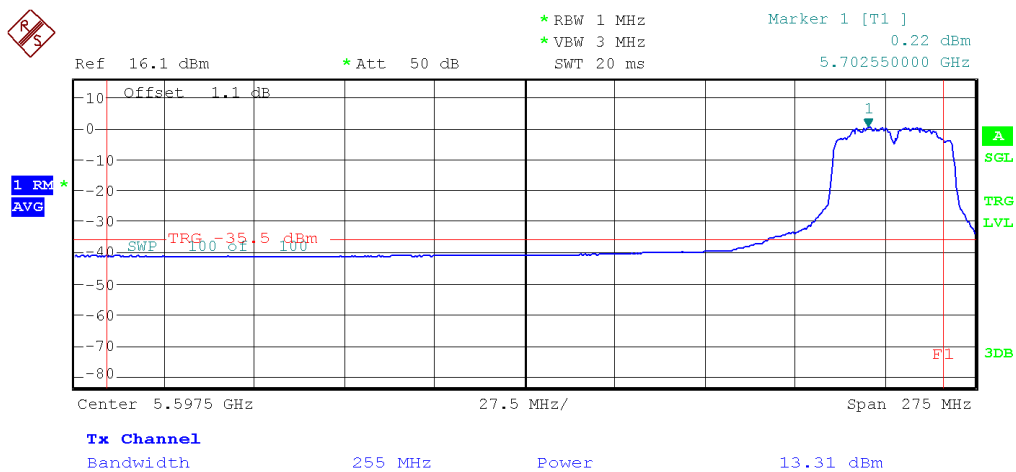
Power and PPSD in sub-band UNII_3: Port A



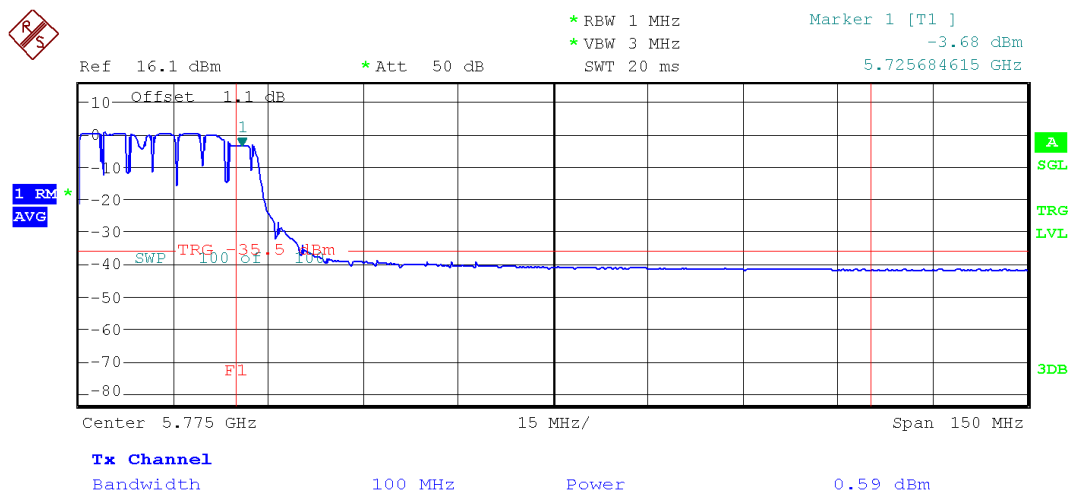
Power and PPSD in sub-band UNII_4: Port A



Power and PPSD in sub-band UNII_3: Port B

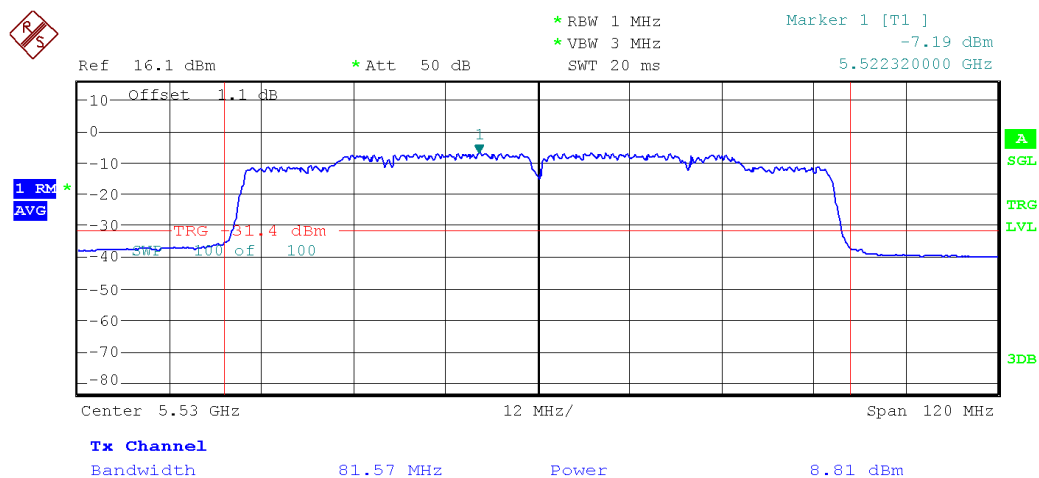


Power and PPSD in sub-band UNII_4: Port B

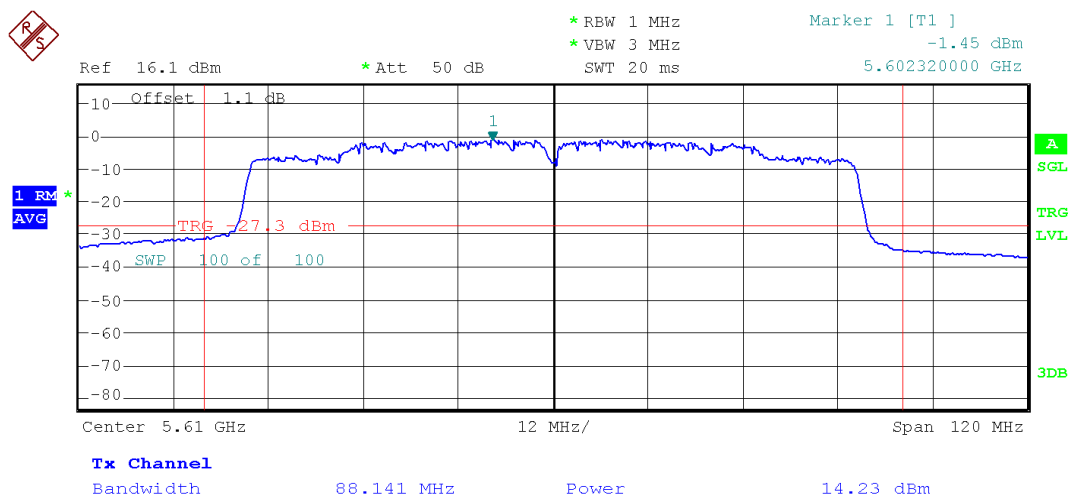


802.11 ac80 MHz modes (except channel 138) CHAIN A

Lowest Channel

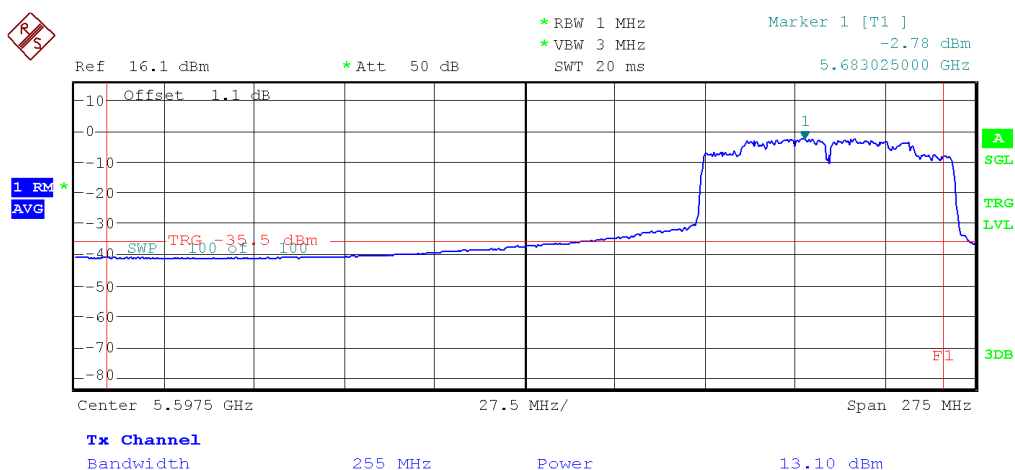


Highest Channel

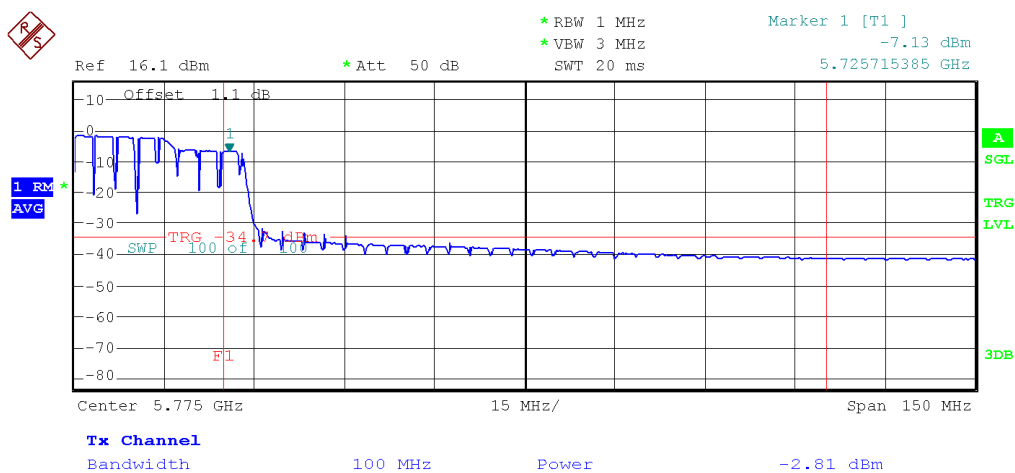


802.11 ac80MHz : Channel 138

Power and PPSD in sub-band UNII_3:

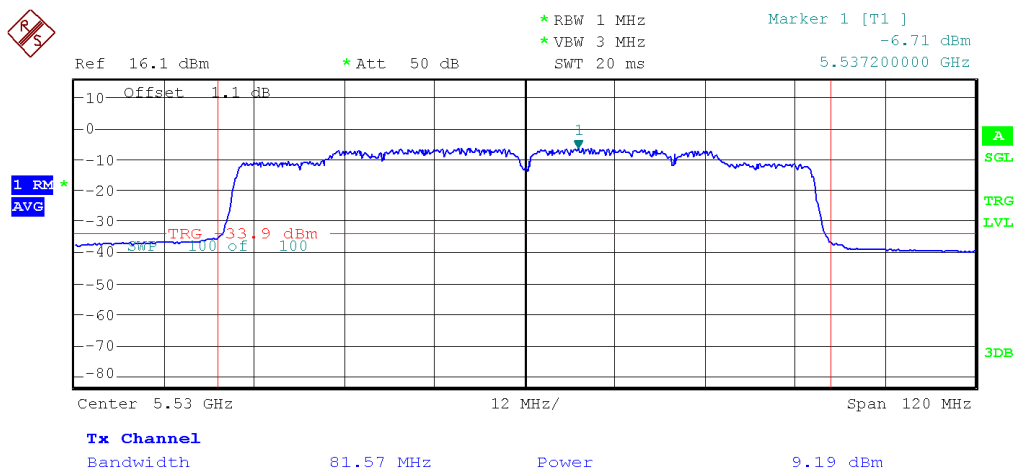


Power and PPSD in sub-band UNII_4:

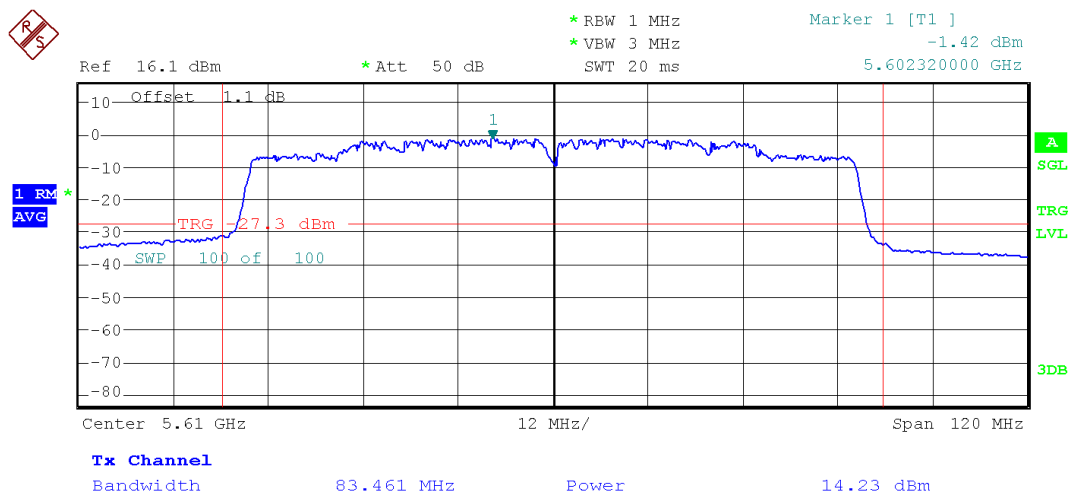


802.11 ac80 MHz modes (except channel 138) CHAIN B

Lowest Channel

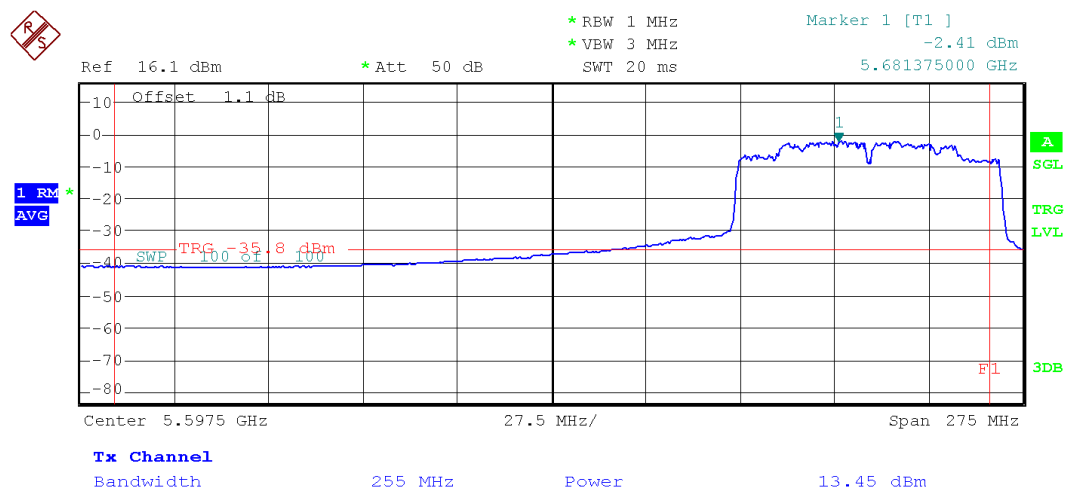


Middle Channel

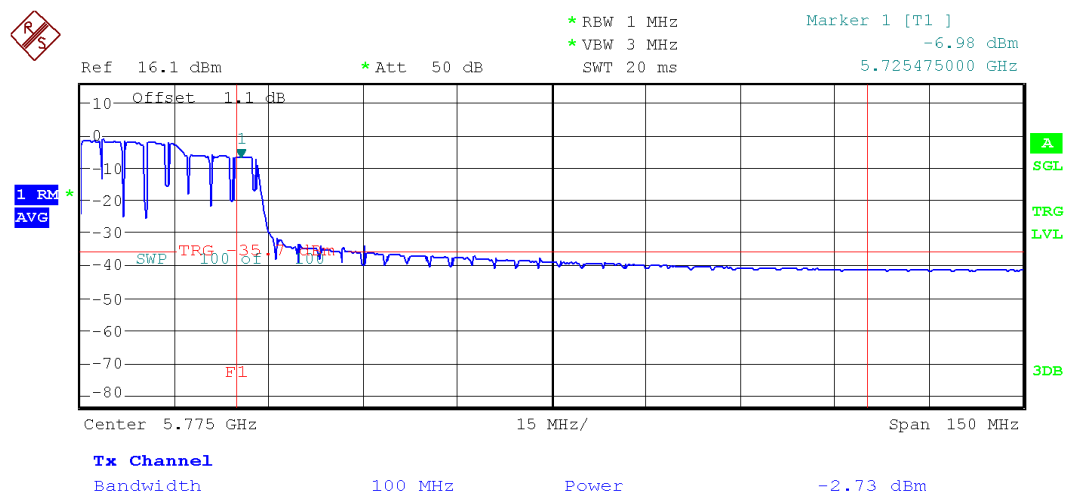


802.11 ac80MHz : Channel 138

Power and PPSD in sub-band UNII_3:

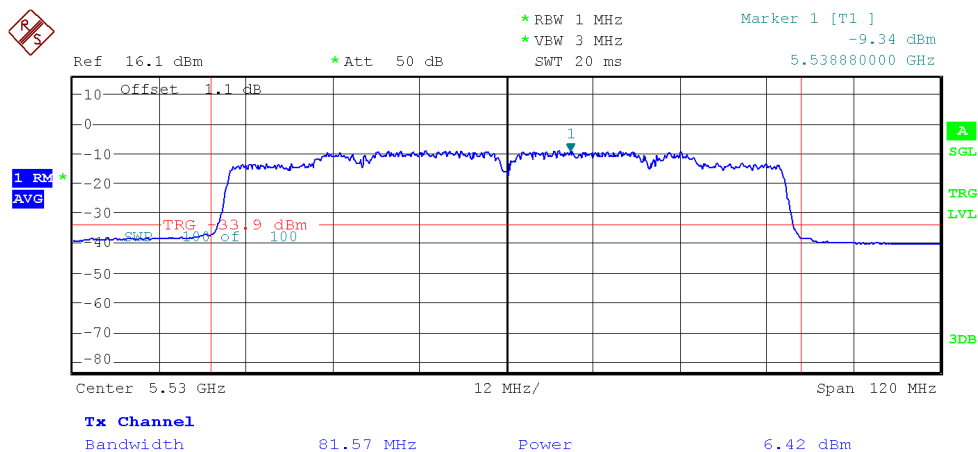


Power and PPSD in sub-band UNII_4:

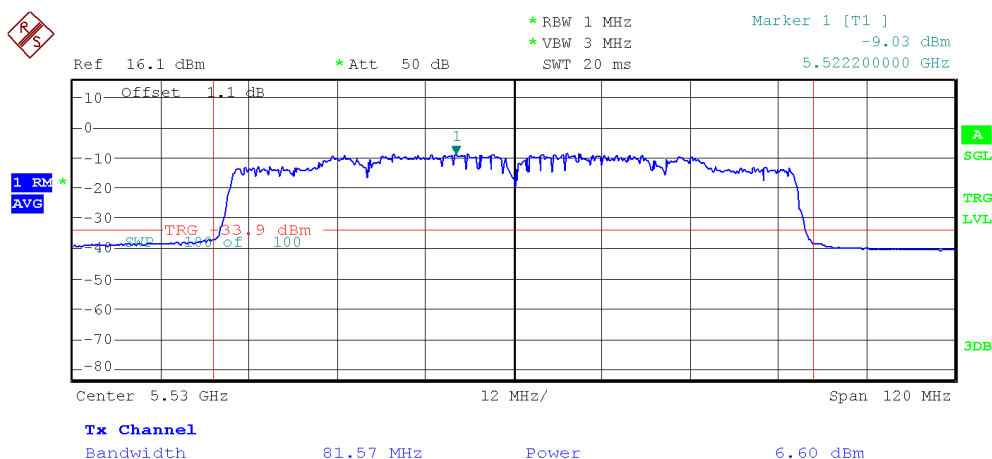


802.11 ac80 MHz modes (except channel 138) MIMO CHAIN A+B

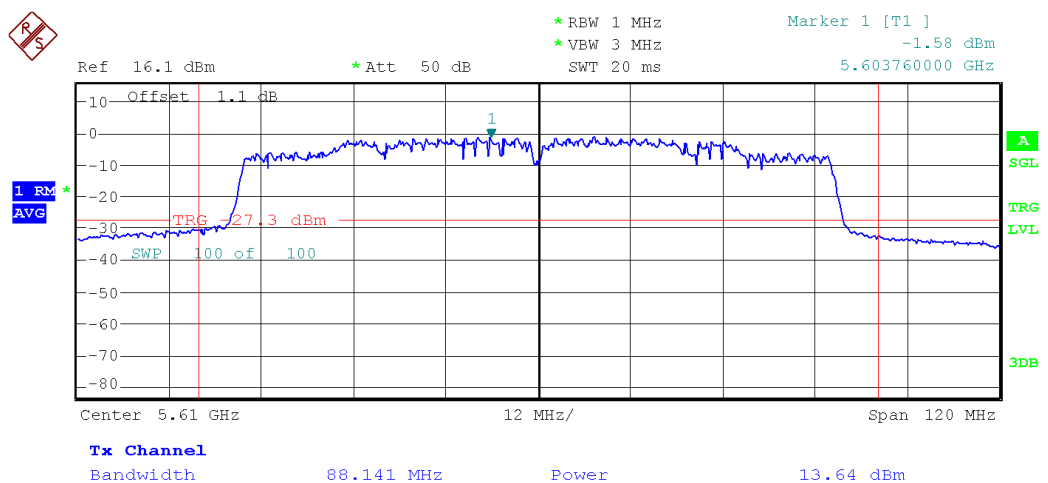
Lowest Channel. Port A



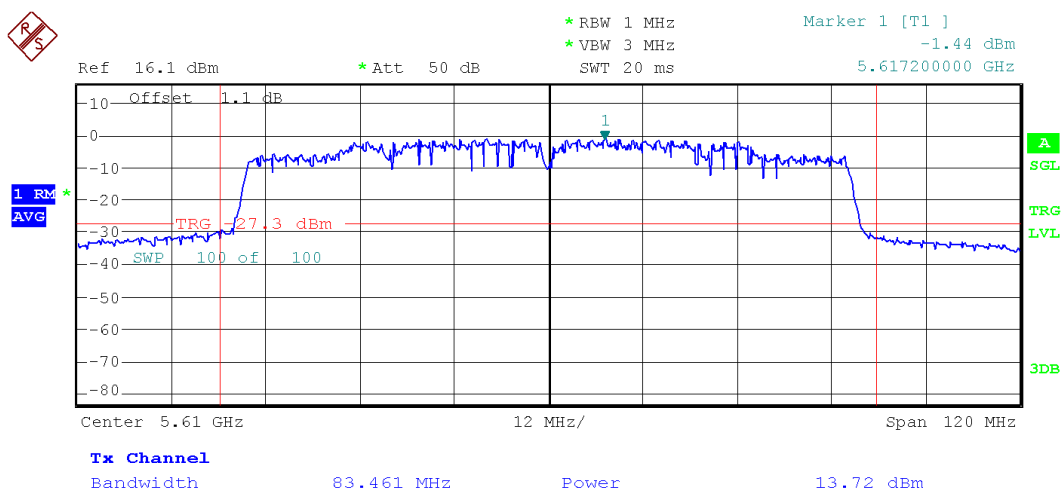
Lowest Channel. Port B



Highest Channel. Port A

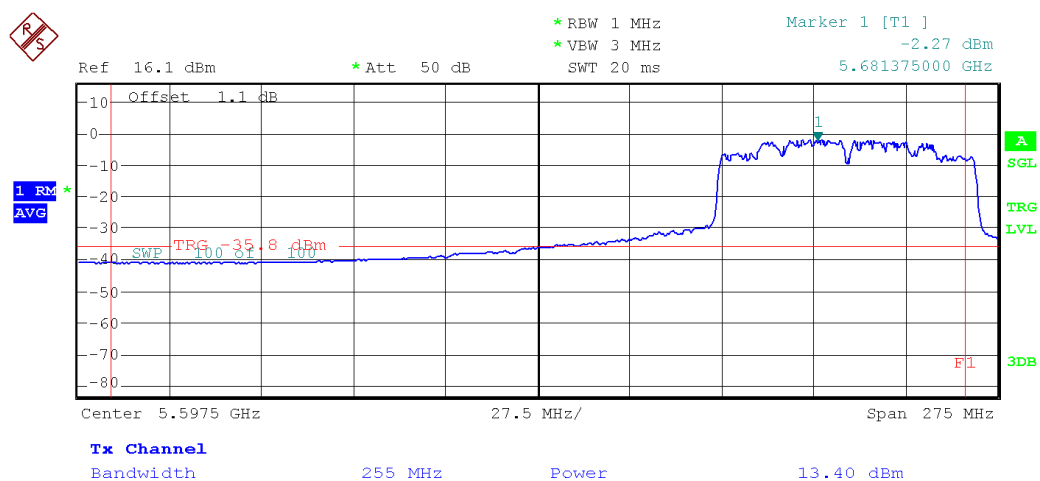


Highest Channel. Chain B

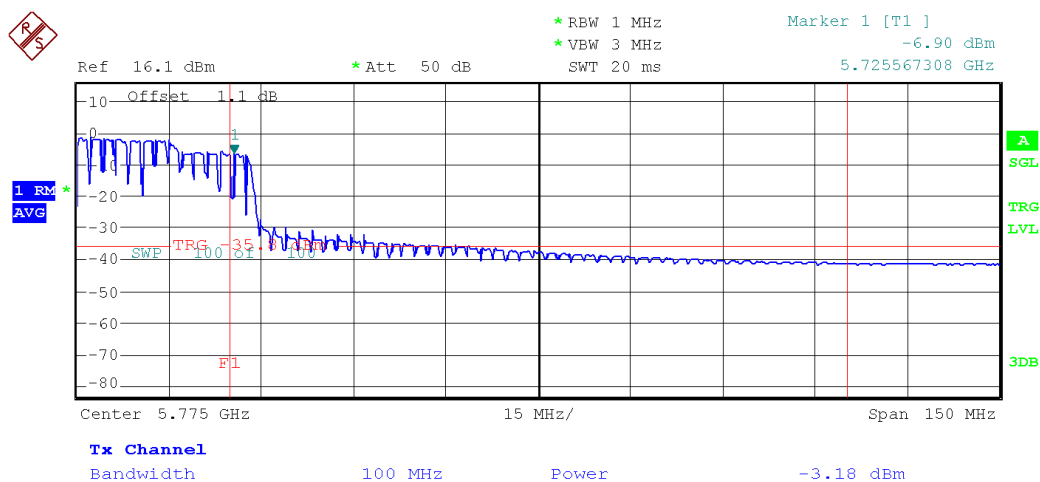


802.11 ac80MHz : Channel 138

Power and PPSD in sub-band UNII_3: Port A

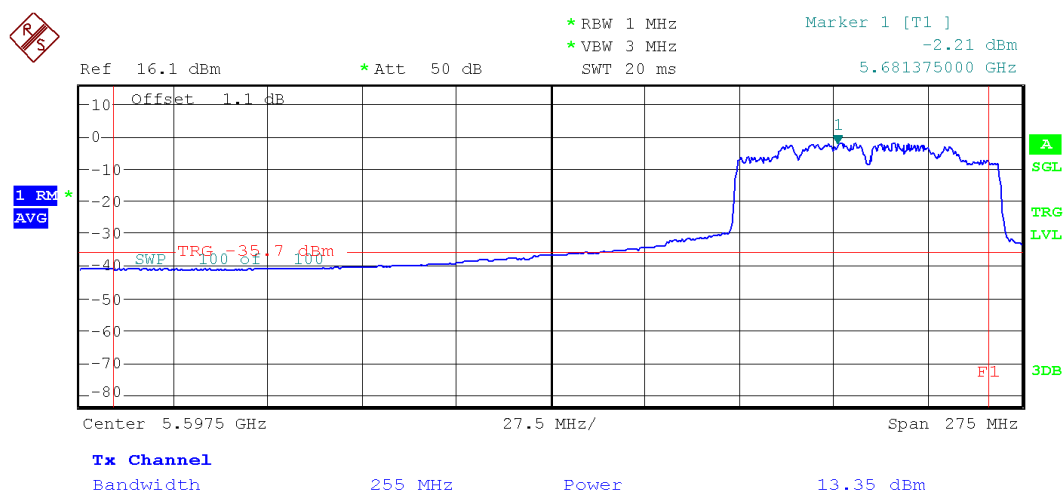


Power and PPSD in sub-band UNII_4: Port A

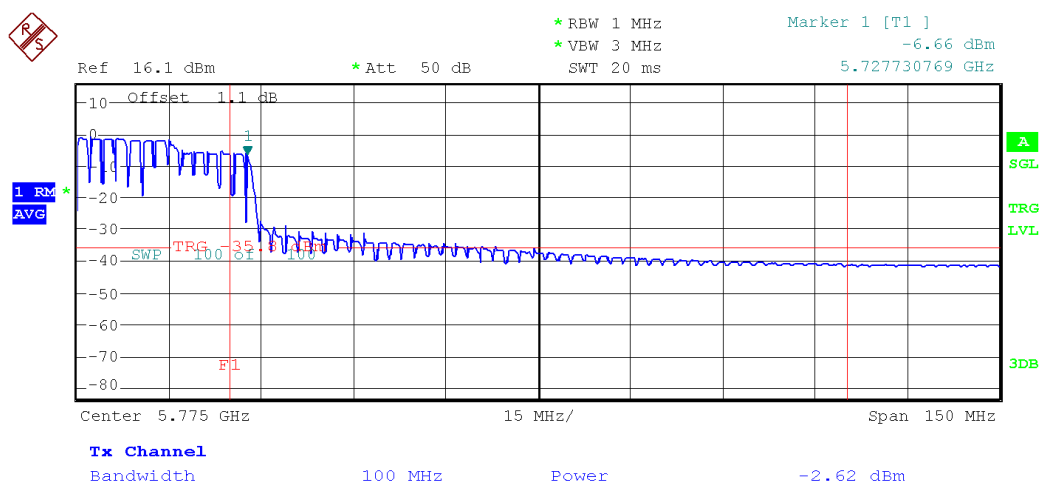


802.11 ac80MHz : Channel 138

Power and PPSD in sub-band UNII_3: Port B



Power and PPSD in sub-band UNII_4: Port B



**Section 15.407 Subclause (b) (3) / RSS-210 A9.2. (3). Undesirable radiated emissions (Transmitter)
1 to 40 GHz**

SPECIFICATION

For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz (68.23 dB μ V/m at 3 m distance).

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)):

Frequency Range (MHz)	Field strength (μ V/m)	Field strength (dB μ V/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	300
1.705 - 30.0	30	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 40000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 1m for the frequency range 1 GHz-40 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

The equipment transmits continuously in the selected channel so it is not necessary a duty cycle correction factor.

Frequency range 30 MHz-1 GHz

The spurious signals detected do not depend on either the operating channel or the modulation mode.

See test results in Appendix A for details.

Frequency range 1 GHz-40 GHz

The results in the next tables show the maximum measured levels in the 1-40 GHz range including the restricted band 5.35-5.46 GHz and adjacent bands 5.46-5.47 GHz and 5.725-5.825 GHz (see next plots).

For OFDM modulation modes (802.11g, 802.11n20, 802.11n40 and 802.11ac80), a preliminary measurement in the central channel in the range 1-18 GHz was performed to determine the worst case. The lowest channel was measured for out-of-band emissions for the worst case (802.11a). The highest channel was measured for out-of-band emissions for channel 144 (ac20 mode 5720 MHz) since the adjusted transmit power is higher than channel 140 (802.11a mode 5700 MHz) in both SISO and MIMO modes.

The field strength at the band edges was evaluated for each mode and on each chain individually on the lowest and highest channels at the rated power for the channel under test. Where the power at the edge channels was lower than the power at the center channels additional measurements were made at the adjacent channels. Single transmission at each chain and simultaneous transmission at both chains modes were fully evaluated.

Spurious signals with peak levels above the average limit (54 dB μ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

1. WiFi 5GHz 802.11 a mode.

Lowest frequency (100) 5500 MHz. Out-of-band spurious emissions inside restricted band 5.35-5.46 GHz and 5.46-5.47 adjacent band.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.4600	V	Peak	60.12	± 4.09
		Average	48.32	± 4.09
5.4676	V	Peak	62.31	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.4600	V	Peak	60.04	± 4.09
		Average	47.12	± 4.09
5.4671	V	Peak	60.83	± 4.09

Middle frequency (120) 5600 MHz. Out-of-band spurious emissions in the 1-40 GHz range.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
11.2019	V	Peak	47.05	± 4.09
16.8137	V	Peak	45.31	± 4.09
22.3974	V	Peak	51.08	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
11.2019	V	Peak	48.74	± 4.09
22.3974	V	Peak	53.83	± 4.09

Highest frequency (140) 5700 MHz. Out-of-band spurious emissions inside adjacent band 5.725-5.825 GHz.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.725	V	Peak	60.71	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.725	V	Peak	60.54	± 4.09

Channel 104 (5520 MHz): Out-of-band spurious emissions inside restricted band 5.35-5.46 GHz and 5.46-5.47 adjacent band.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.4198	V	Peak	60.78	± 4.09
		Average	47.60	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.3676	V	Peak	60.63	± 4.09
		Average	47.48	± 4.09

Channel 136 (5680 MHz). Out-of-band spurious emissions inside adjacent band 5.725-5.825 GHz.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.8169	V	Peak	61.16	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.8212	V	Peak	60.90	± 4.09

Verdict: PASS

2. WiFi 5GHz 802.11 n20 mode

Lowest frequency (100) 5500 MHz. Out-of-band spurious emissions inside restricted band 5.35-5.46 GHz and 5.46-5.47 adjacent band.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.4700	V	Peak	61.28	± 4.09
		Average	47.82	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.4700	V	Peak	60.83	± 4.09
		Average	47.51	± 4.09

Chain A+B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.46	V	Peak	60.35	± 4.09
		Average	47.35	± 4.09

Middle frequency (120) 5600MHz. Out-of-band spurious emissions in the 1-40 GHz range.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
16.7969	V	Peak	43.76	± 4.09
22.3974	V	Peak	51.06	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
11.2019	V	Peak	46.25	± 4.09
22.3974	V	Peak	52.90	± 4.09

Chain A+B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
11.20192	V	Peak	46.27	± 4.09
22.39743	V	Peak	51.93	± 4.09

Highest frequency (140) 5700 MHz. Out-of-band spurious emissions inside adjacent band 5.725-5.825 GHz.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.7260	V	Peak	62.33	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.7260	V	Peak	61.62	± 4.09

Chain A+B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.7250	V	Peak	61.06	± 4.09

Channel 104 (5520 MHz): Out-of-band spurious emissions inside restricted band 5.35-5.46 GHz and 5.46-5.47 adjacent band.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.4263	V	Peak	61.16	± 4.09
		Average	47.86	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.4200	V	Peak	61.33	± 4.09
		Average	47.52	± 4.09

Chain A+B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.4695	V	Peak	60.65	± 4.09
		Average	47.49	± 4.09

Channel 136 (5680 MHz). Out-of-band spurious emissions inside adjacent band 5.725-5.825 GHz.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.8070	V	Peak	60.97	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.7638	V	Peak	61.42	± 4.09

Chain A+B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.8225	V	Peak	61.32	± 4.09

802.11 ac 20MHz:

Channel 144 (5720 MHz). Out-of-band spurious emissions in the 1-40 GHz range.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
17.1600	V	Peak	45.46	± 4.09
22.8800	V	Peak	52.78	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
11.4371	V	Peak	46.63	± 4.09
22.8800	V	Peak	52.88	± 4.09

Chain A+B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
11.4371	V	Peak	46.59	± 4.09
22.8800	V	Peak	52.89	± 4.09

Verdict: PASS

3. WiFi 5GHz 802.11 n40 mode

Lowest frequency (102) 5510MHz. Out-of-band spurious emissions inside restricted band 5.35-5.46 GHz and 5.46-5.47 adjacent band. Highest levels in bands.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.4594	V	Peak	61.84	± 4.09
5.4600	V	Average	48.02	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.4644	V	Peak	60.77	± 4.09
5.4600	V	Average	47.72	± 4.09

Chain A+B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.4695	V	Peak	60.65	± 4.09
		Average	48.95	± 4.09

Middle frequency (118) 5590 MHz. Out-of-band spurious emissions in the 1-40 GHz range.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
22.3590	V	Peak	51.50	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
22.3590	V	Peak	53.14	± 4.09

Chain A+B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
22.3590	V	Peak	52.03	± 4.09

Highest frequency (134) 5670MHz. Out-of-band spurious emissions inside adjacent band 5.725-5.825 GHz.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.7256	V	Peak	62.38	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.7256	V	Peak	61.33	± 4.09

Chain A+B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.8206	V	Peak	60.79	± 4.09

Channel 110 (5550 MHz). 5510MHz. Out-of-band spurious emissions inside restricted band 5.35-5.46 GHz and 5.46-5.47 adjacent band. Highest spurious levels in bands.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.4646	V	Peak	61.13	± 4.09
5.4578	V	Average	48.17	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.3886	V	Peak	60.99	± 4.09
5.4586	V	Average	47.91	± 4.09

Chain A+B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.4536	V	Peak	60.51	± 4.09
5.4668	V	Average	48.53	± 4.09

Verdict: PASS

4. WiFi 5GHz 802.11 ac80 mode

Lowest frequency (106) 5530MHz. Out-of-band spurious emissions inside restricted band 5.35-5.46 GHz and 5.46-5.47 adjacent band. Highest spurious levels in bands.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBμV/m)	Measurement Uncertainty (dB)
5.4642	V	Peak	62.06	± 4.09
5.4700	V	Average	48.63	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBμV/m)	Measurement Uncertainty (dB)
5.4628	V	Peak	62.97	± 4.09
5.4470	V	Average	48.62	± 4.09

Chain A+B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBμV/m)	Measurement Uncertainty (dB)
5.4626	V	Peak	61.80	± 4.09
		Average	48.35	± 4.09

Middle frequency (122) 5610MHz. Out-of-band spurious emissions in the 1-40 GHz range and emissions inside restricted band 5.35-5.46 GHz and 5.46-5.47 GHz / 5.725-5.825 GHz adjacent bands.

Chain A

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBμV/m)	Measurement Uncertainty (dB)
5.4500	V	Peak	61.21	± 4.09
5.4600	V	Average	48.00	± 4.09
5.7644	V	Peak	61.36	± 4.09
22.4360	V	Peak	51.60	± 4.09

Chain B

Spurious frequency (GHz)	Polarization	Detector	Emission Level (dBμV/m)	Measurement Uncertainty (dB)
5.4315	V	Peak	60.96	± 4.09
5.4600	V	Average	47.63	± 4.09
5.7915	V	Peak	61.99	± 4.09
22.4360	V	Peak	51.88	± 4.09

Chain A+B

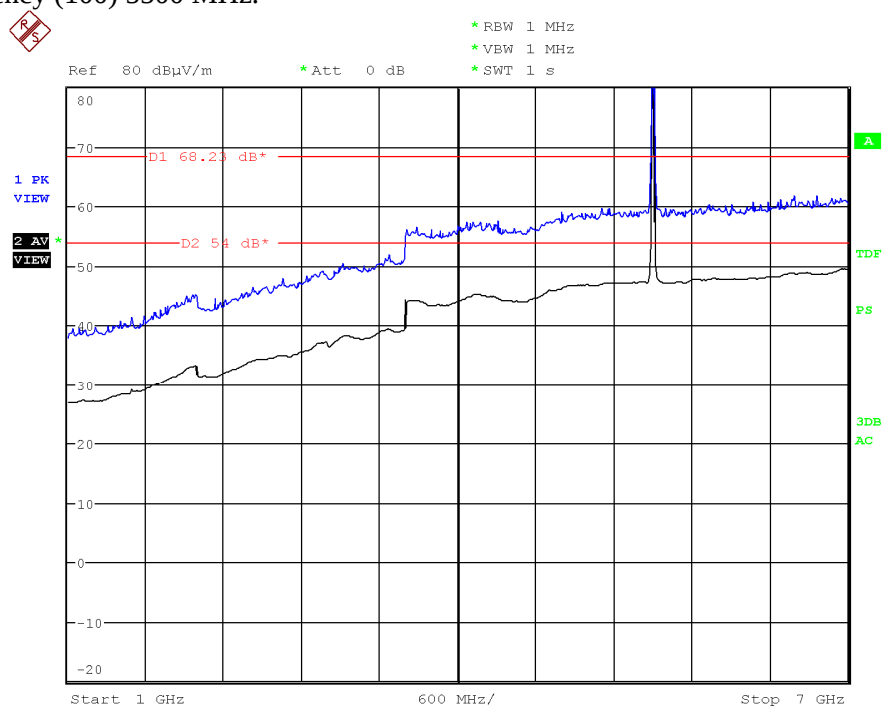
Spurious frequency (GHz)	Polarization	Detector	Emission Level (dB μ V/m)	Measurement Uncertainty (dB)
5.4654	V	Peak	62.85	± 4.09
		Average	49.20	± 4.09
5.79150	V	Peak	60.76	± 4.09
22.4360	V	Peak	52.78	± 4.09

Verdict: PASS

FREQUENCY RANGE 1 GHz to 7 GHz.

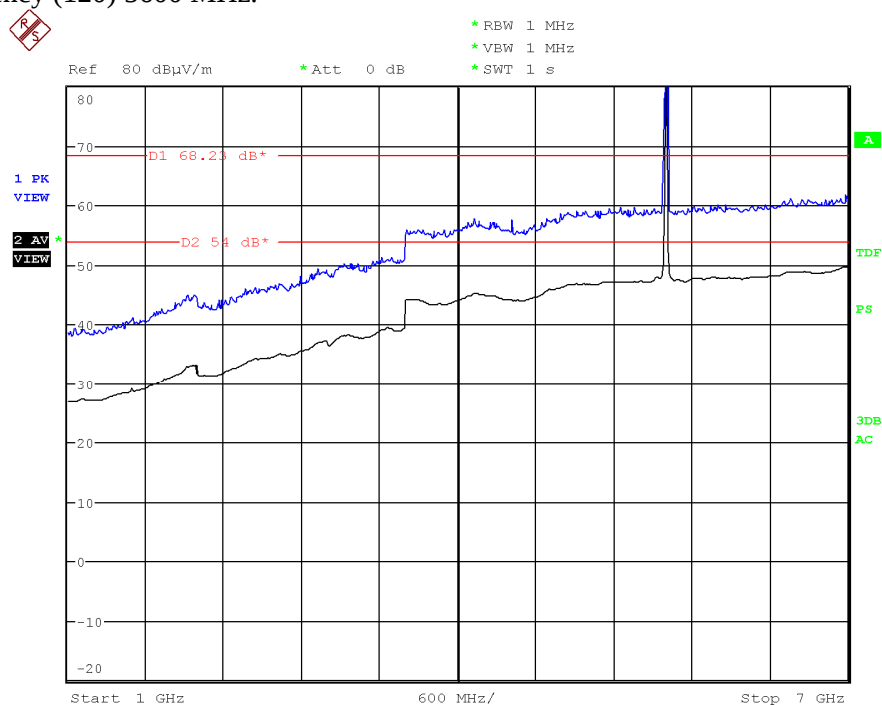
1. WiFi 5GHz 802.11 a mode

Lowest frequency (100) 5500 MHz.



Note: The peak above the limit is the carrier frequency. This plot is valid for both Chain A and Chain B.

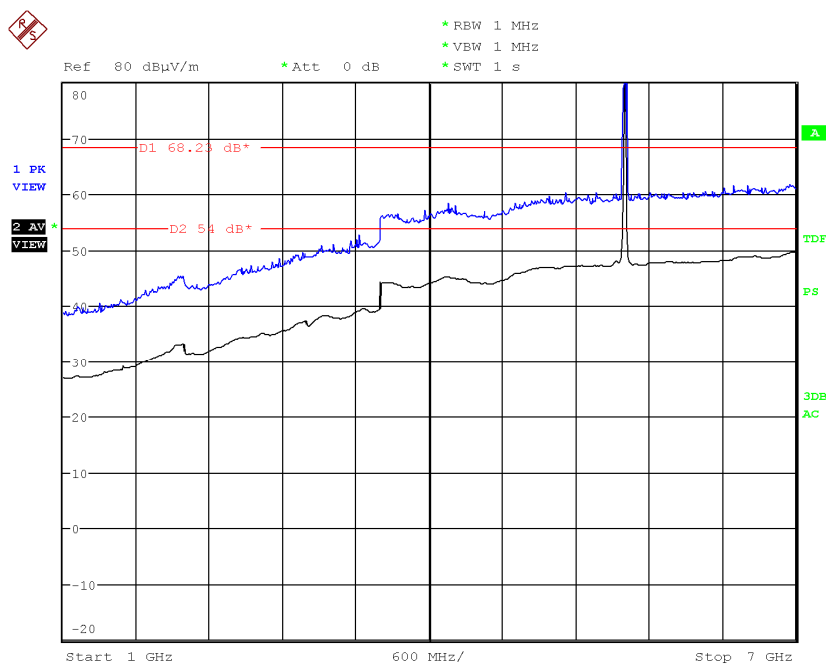
Middle frequency (120) 5600 MHz.



Note: The peak above the limit is the carrier frequency. This plot is valid for both Chain A and Chain B.

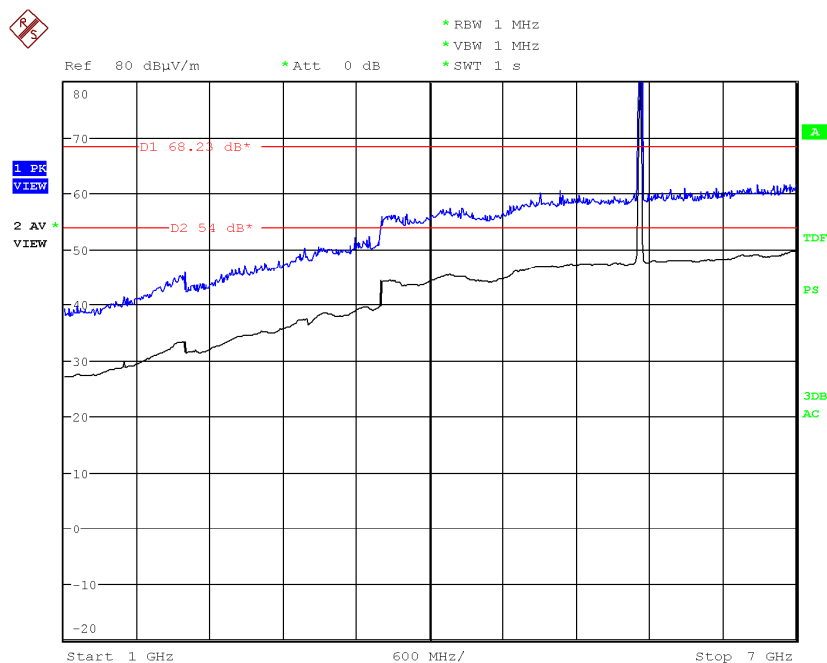
2. WiFi 5GHz 802.11 n20 mode

Middle frequency (120) 5600 MHz.



Note: The peak above the limit is the carrier frequency. This plot is valid for both Chain A, Chain B and Chain A+B.

802.11ac20 mode: CH 144 5720 MHz.

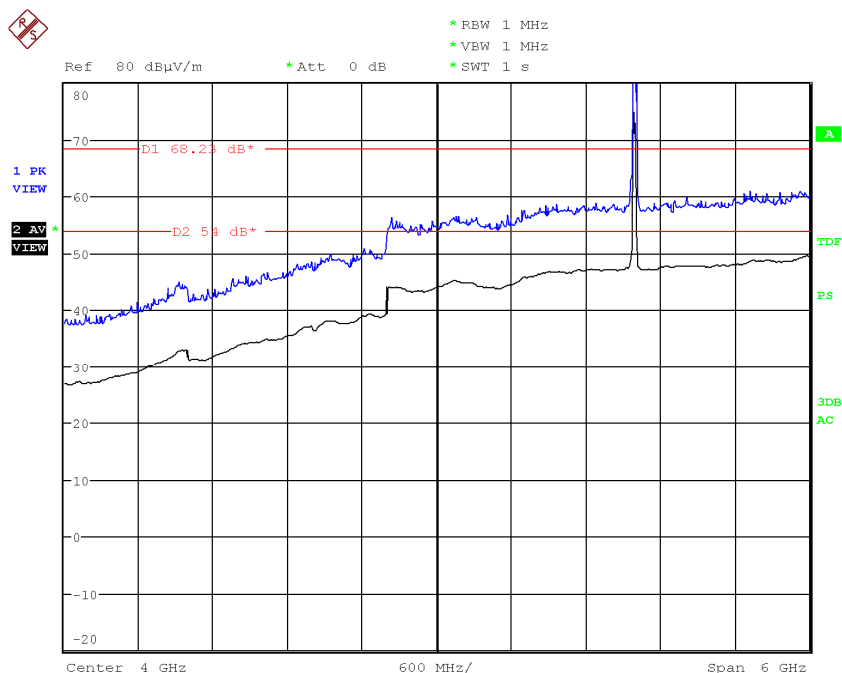


Date: 28.JAN.2013 09:38:26

Note: The peak above the limit is the carrier frequency. This plot is valid for both Chain A, Chain B and Chain A+B.

3. WiFi 5GHz 802.11 n40 mode

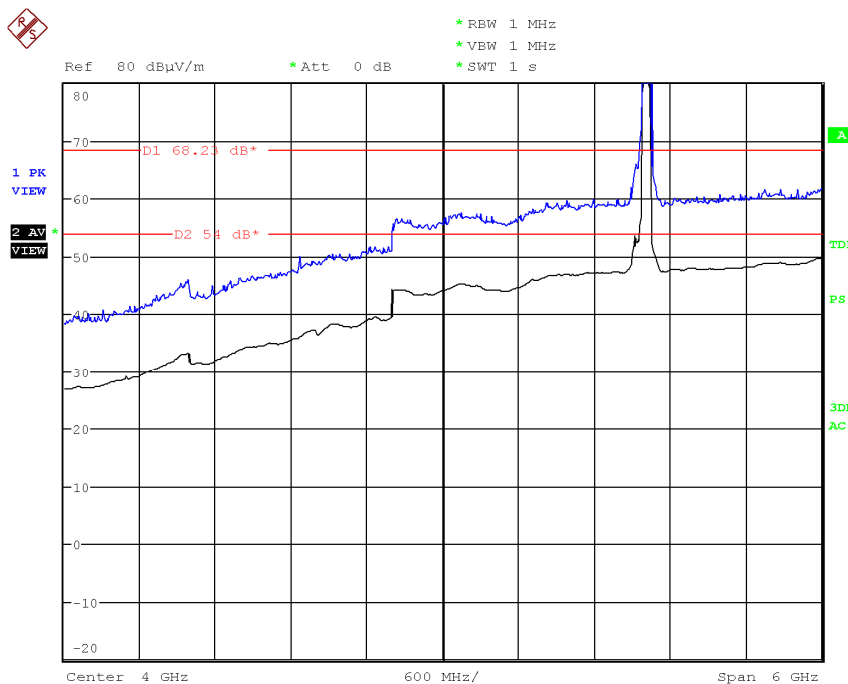
Middle frequency (118) 5590 MHz.



Note: The peak above the limit is the carrier frequency. This plot is valid for both Chain A, Chain B and Chain A+B.

4. WiFi 5GHz 802.11 ac80 mode

Middle frequency (122) 5610 MHz.



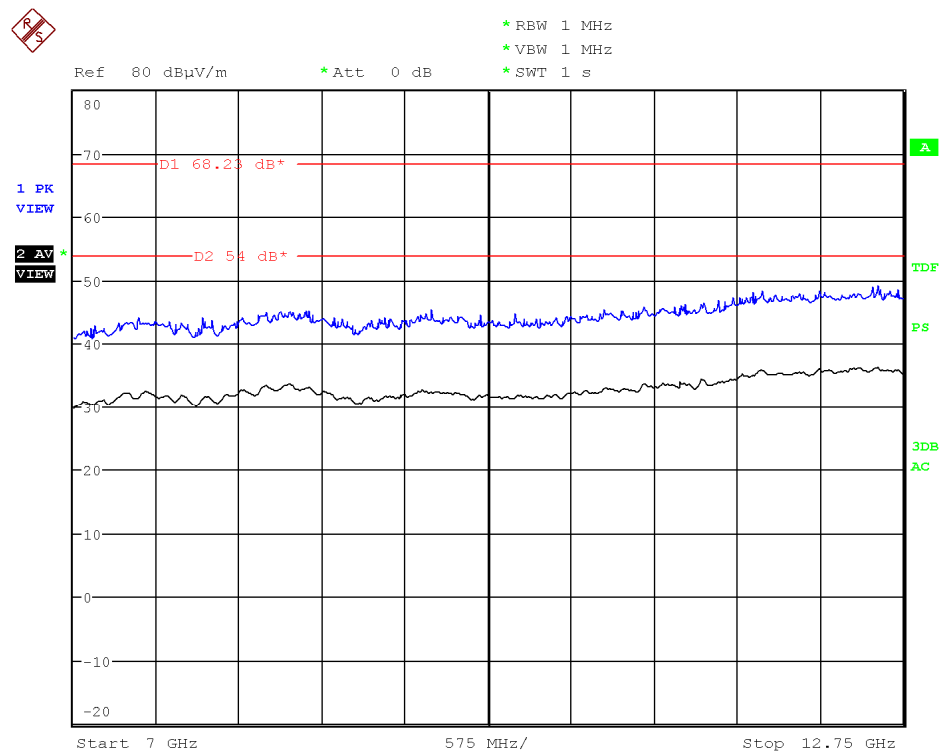
Note: The peak above the limit is the carrier frequency. This plot is valid for both Chain A, Chain B and Chain A+B.

FREQUENCY RANGE 7 GHz to 12.75 GHz.

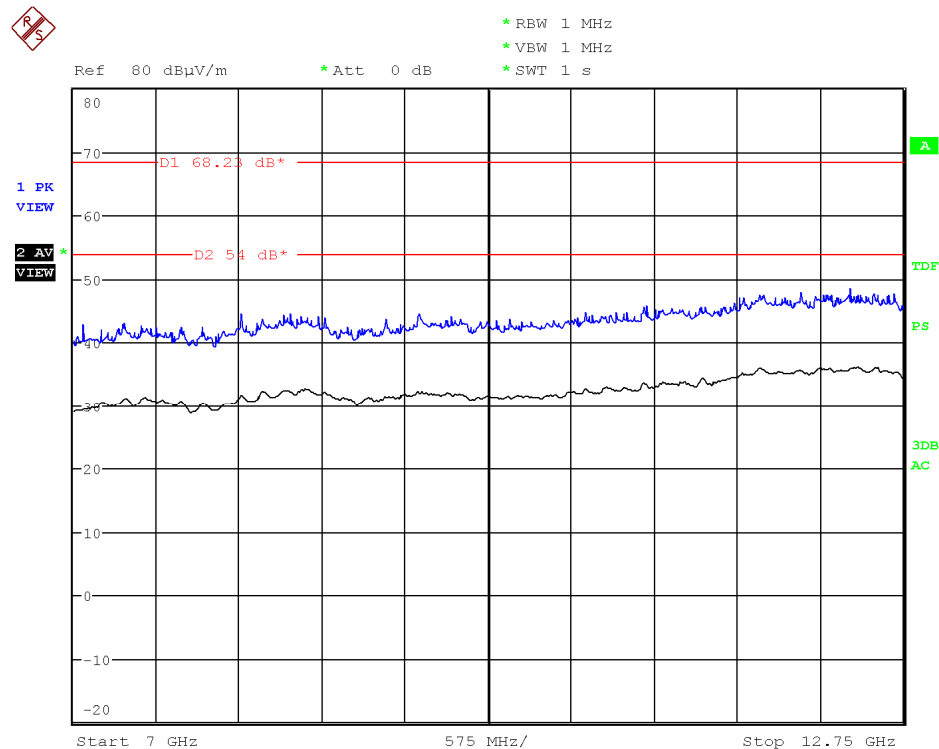
1. WiFi 5GHz 802.11 a mode

Lowest frequency (100) 5500 MHz.

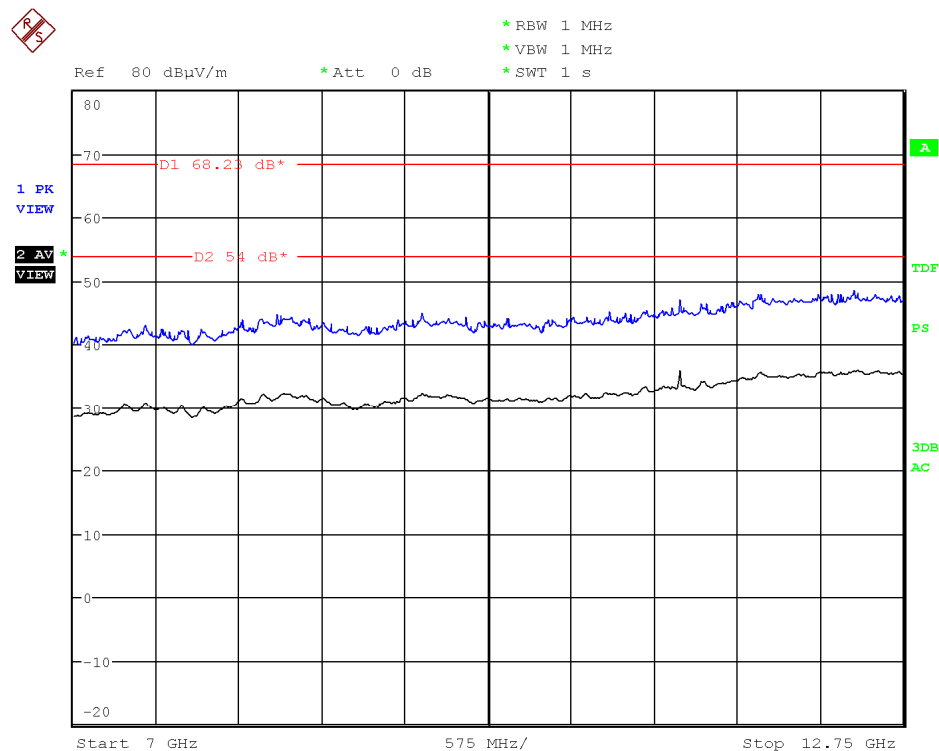
Chain A



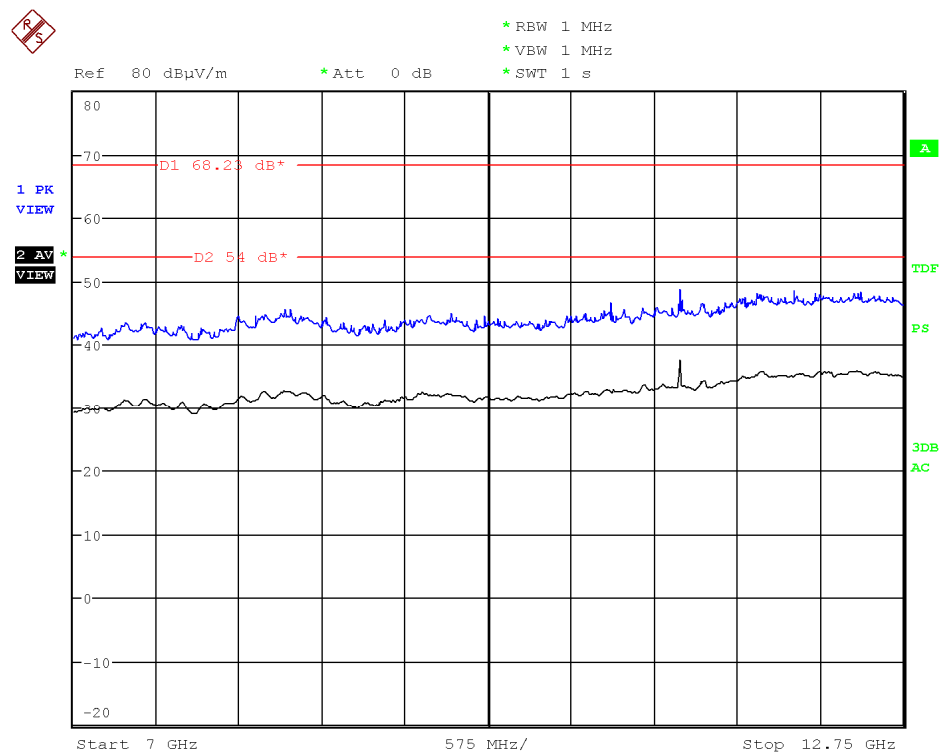
Chain B



Middle frequency (120) 5600 MHz.
Chain A



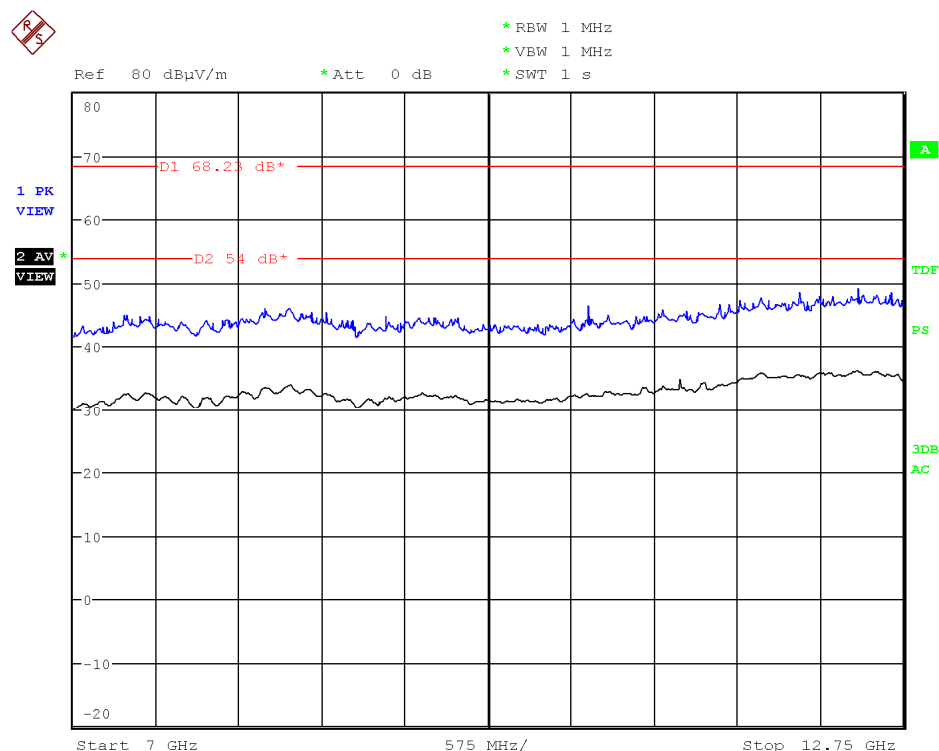
Chain B



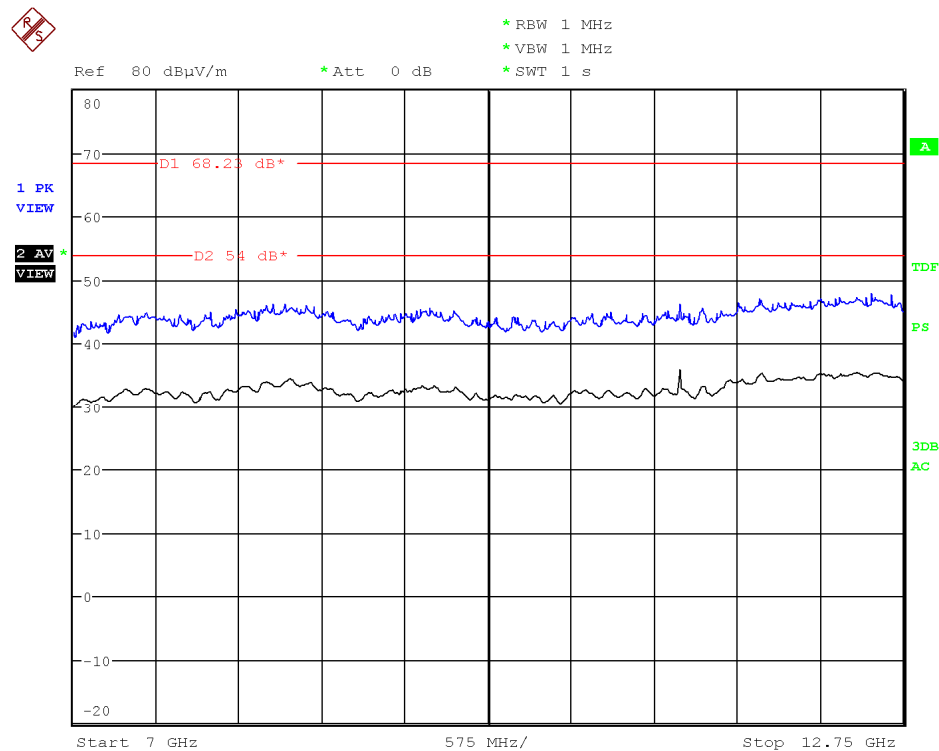
2. WiFi 5GHz 802.11 n20 mode

Middle frequency (120) 5600 MHz.

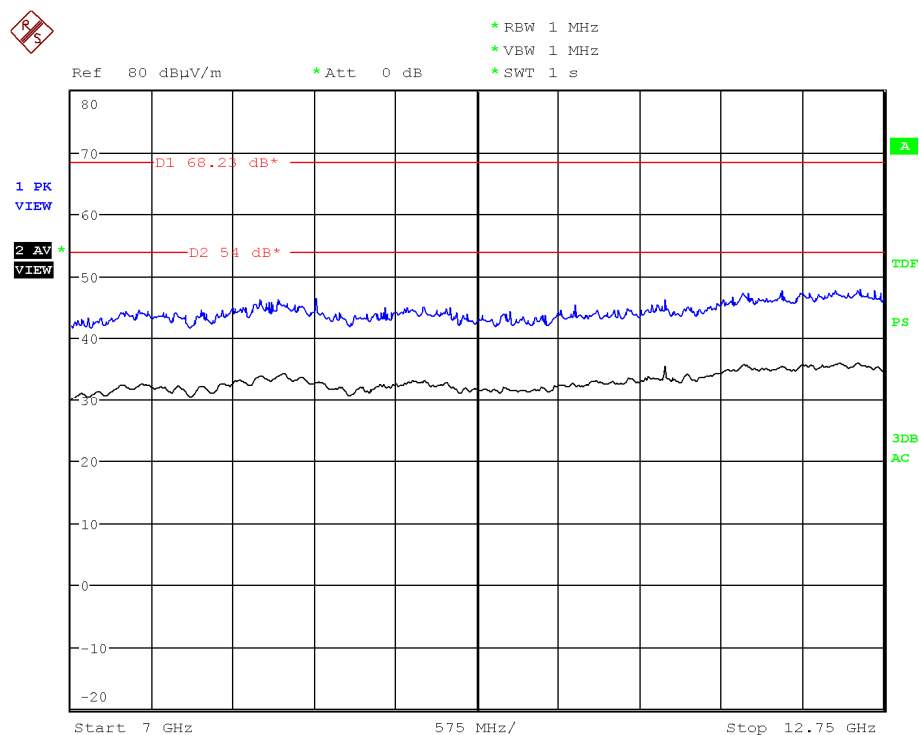
Chain A



Chain B

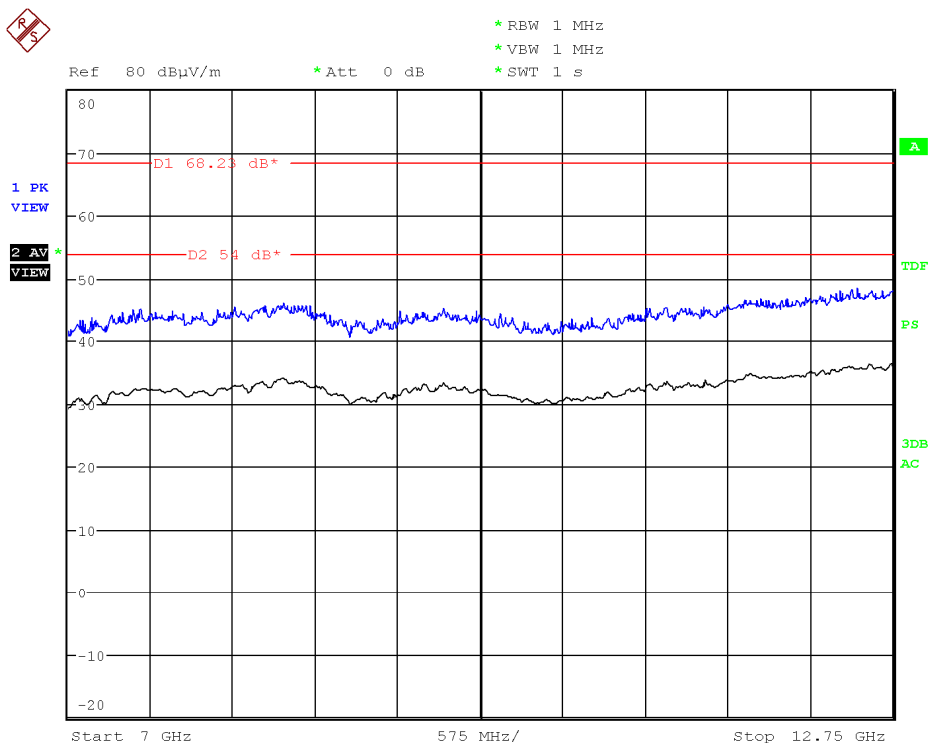


Chain A+B



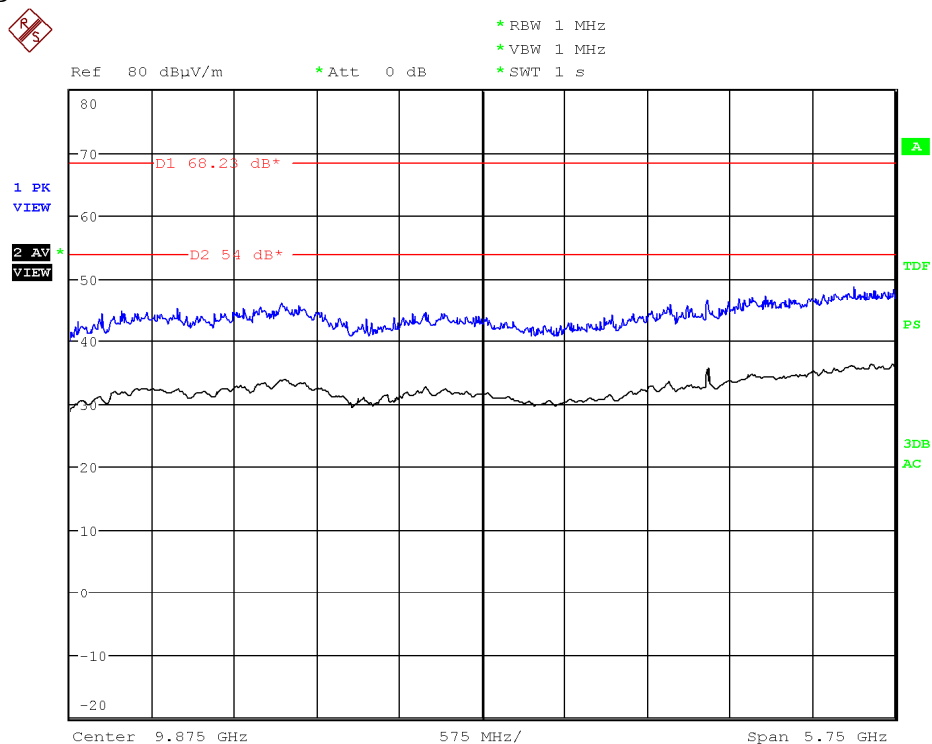
802.11ac20 mode: CH 144 (5720 MHz)

Chain A



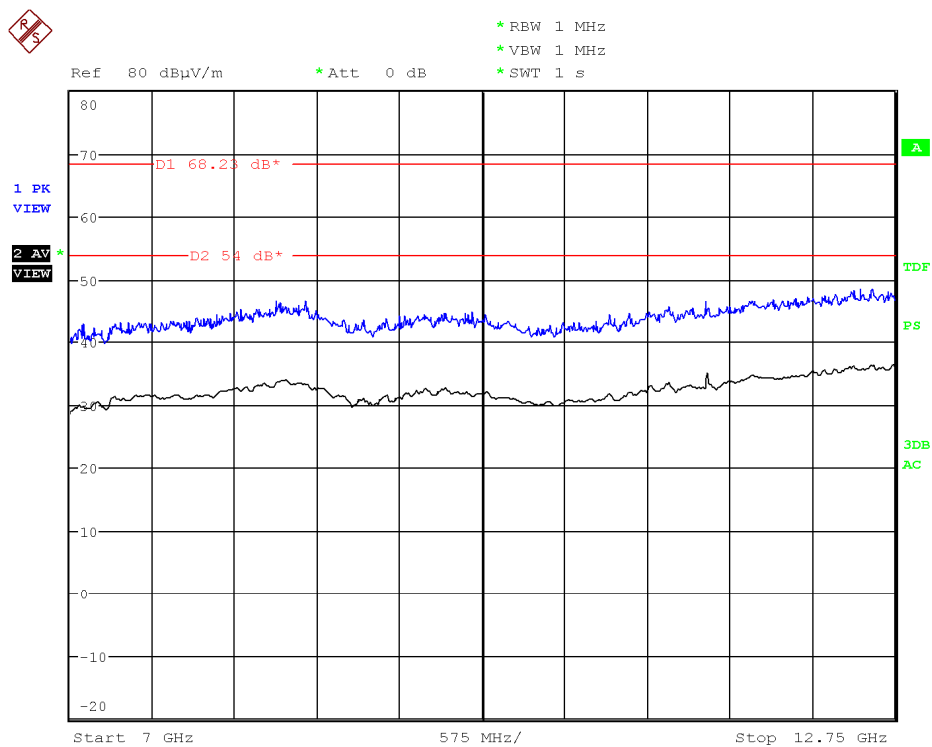
Date: 28.JAN.2013 09:42:24

Chain B



Date: 28.JAN.2013 09:51:17

Chain A+B

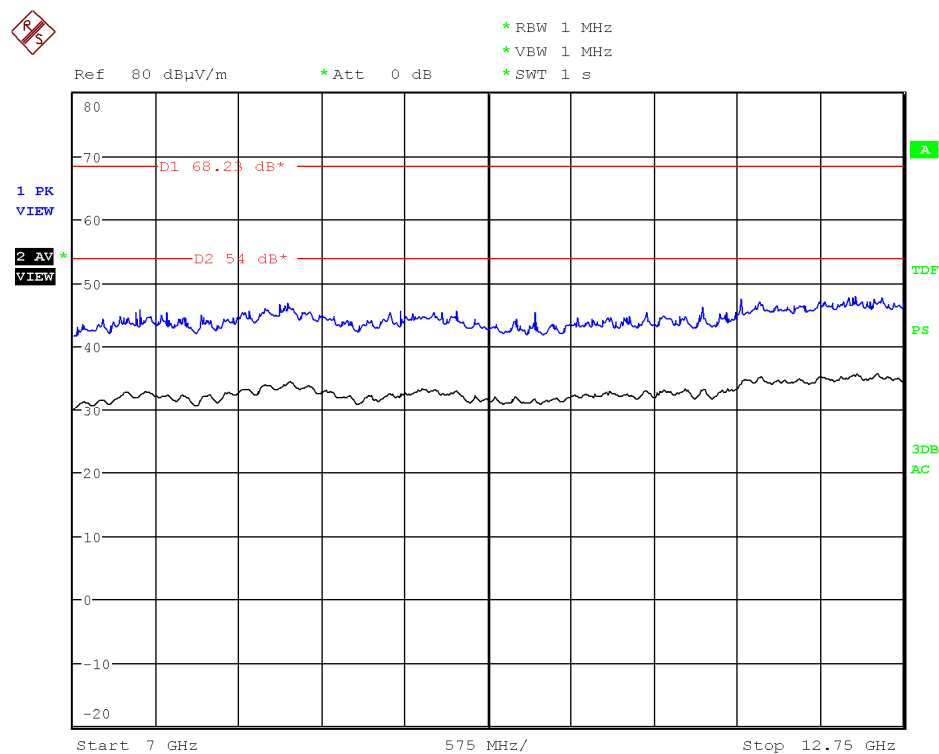


Date: 28.JAN.2013 09:54:54

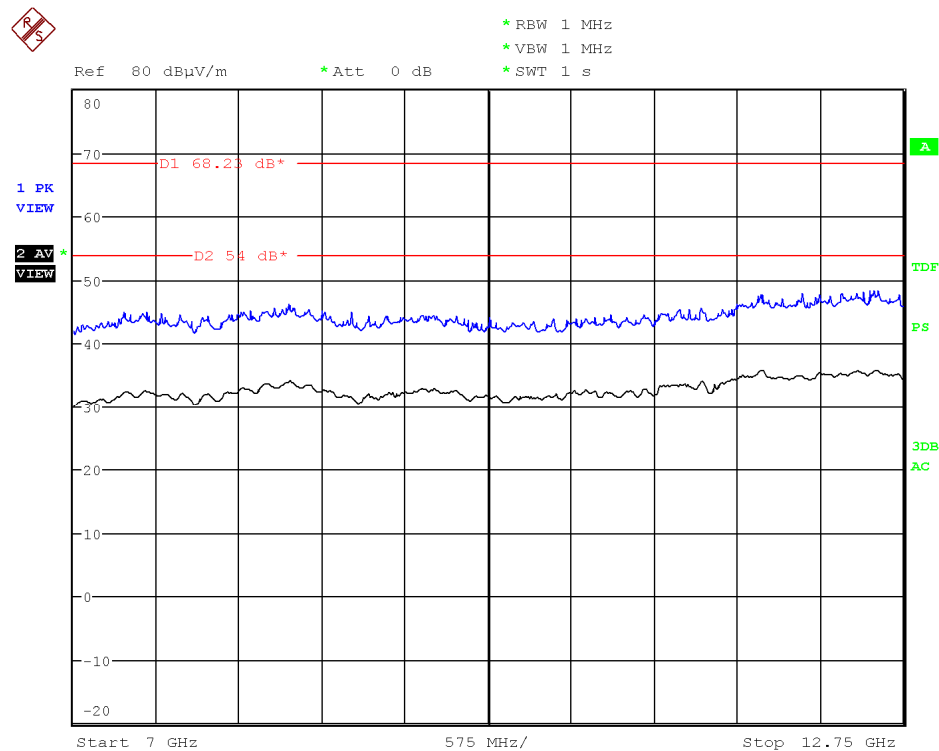
3. WiFi 5GHz 802.11 n40 mode

Middle frequency (118) 5590 MHz.

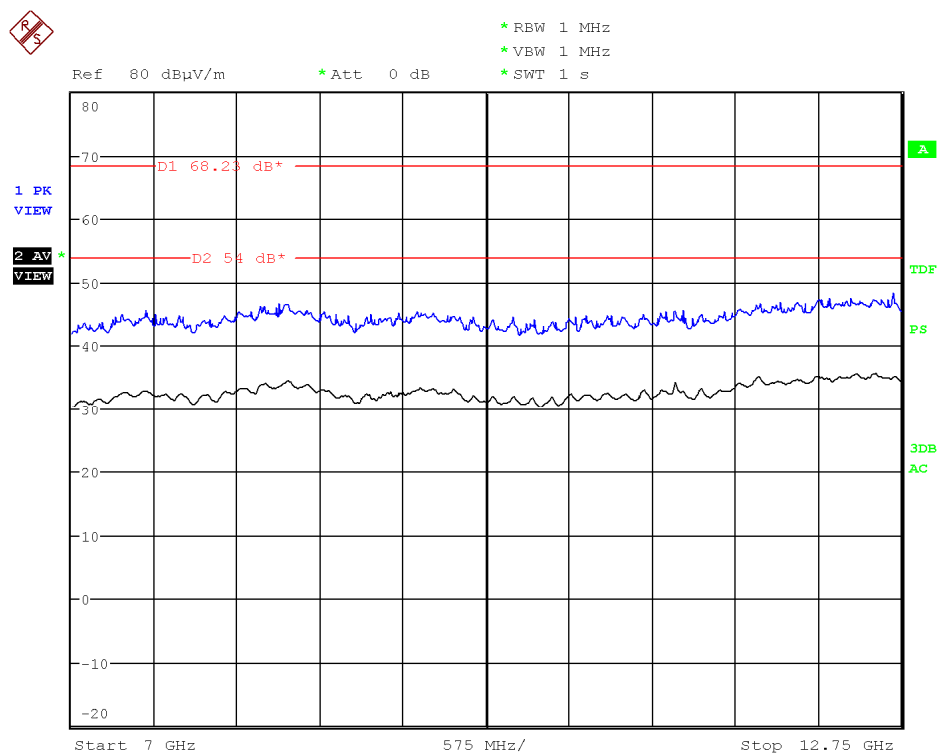
Chain A



Chain B



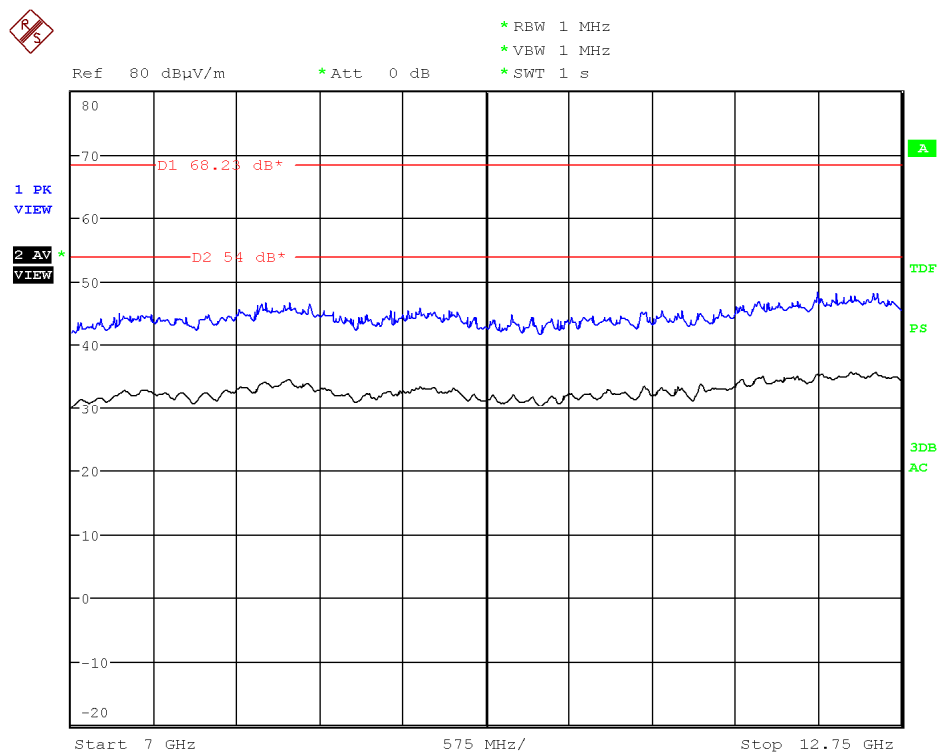
Chain A+B



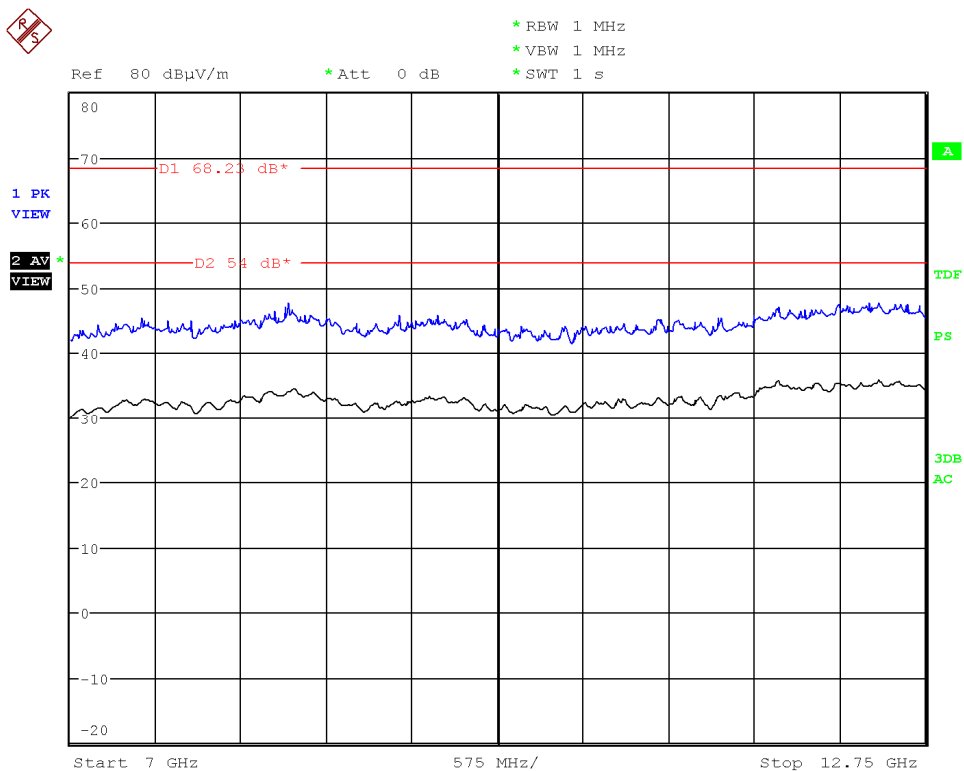
4. WiFi 5GHz 802.11 ac80 mode

Middle frequency (122) 5610 MHz.

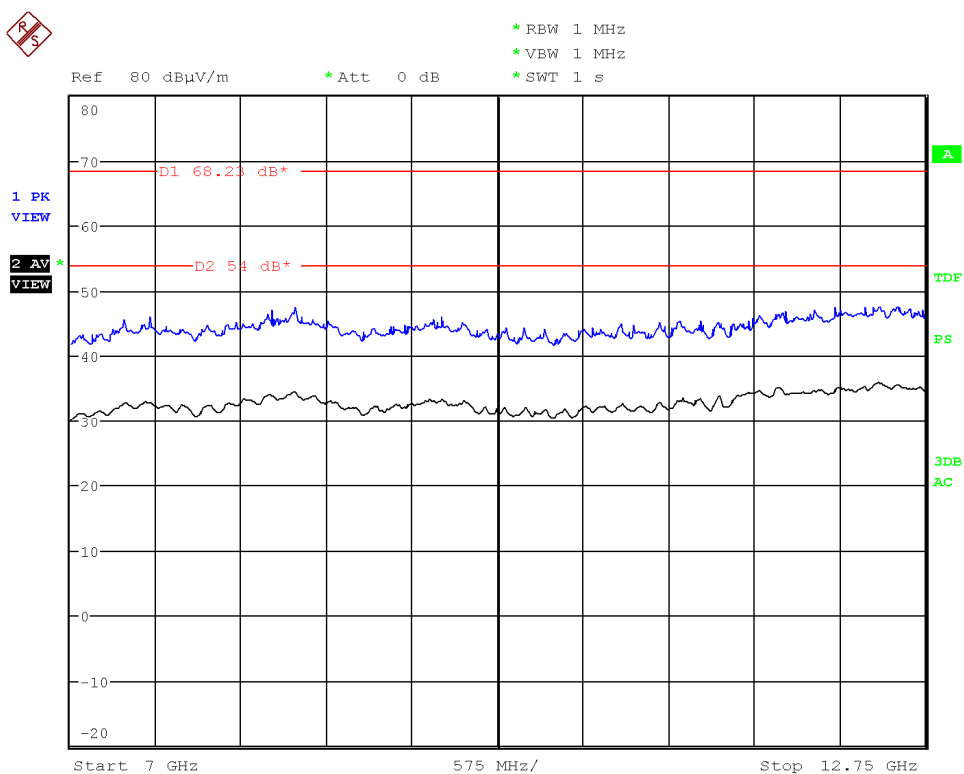
Chain A



Chain B



Chain A+B

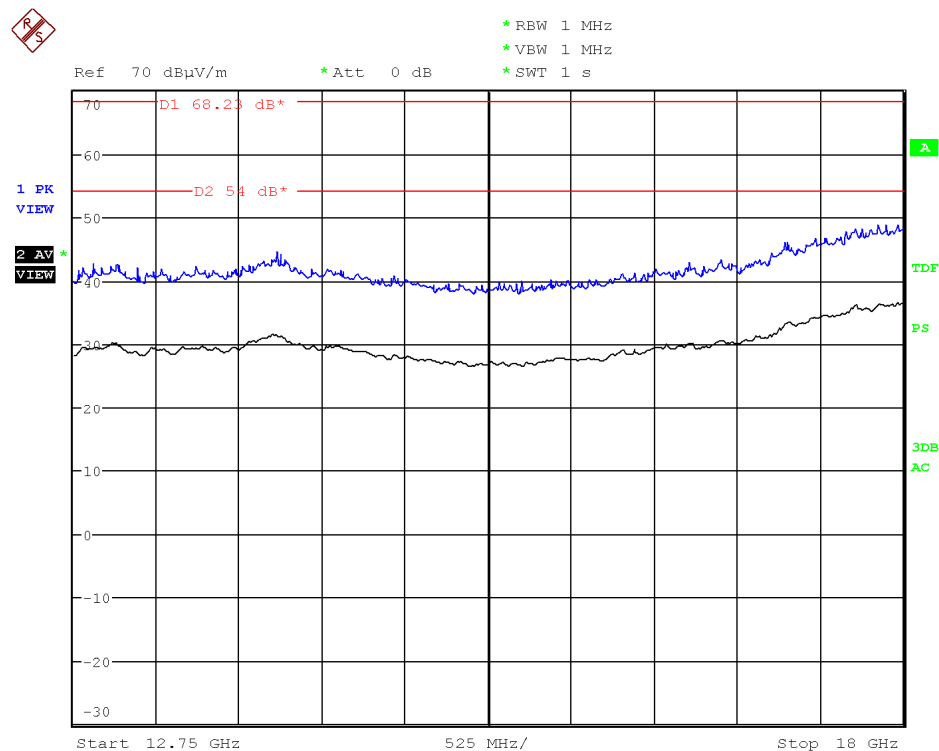


FREQUENCY RANGE 12.75 GHz to 18 GHz.

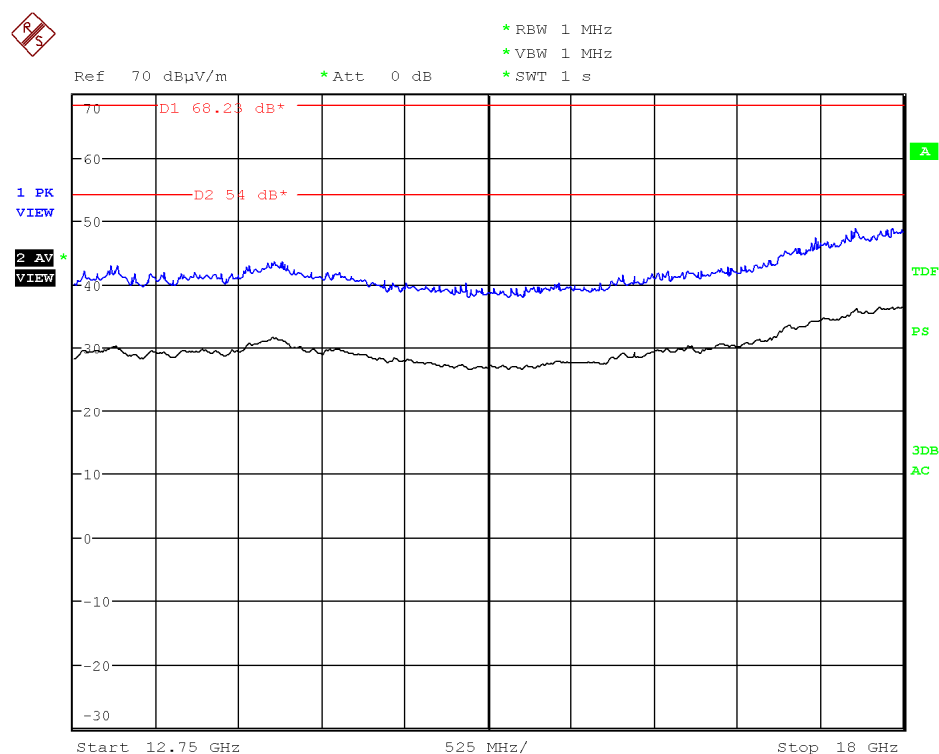
1. WiFi 5GHz 802.11 a mode

Lowest frequency (100) 5500 MHz.

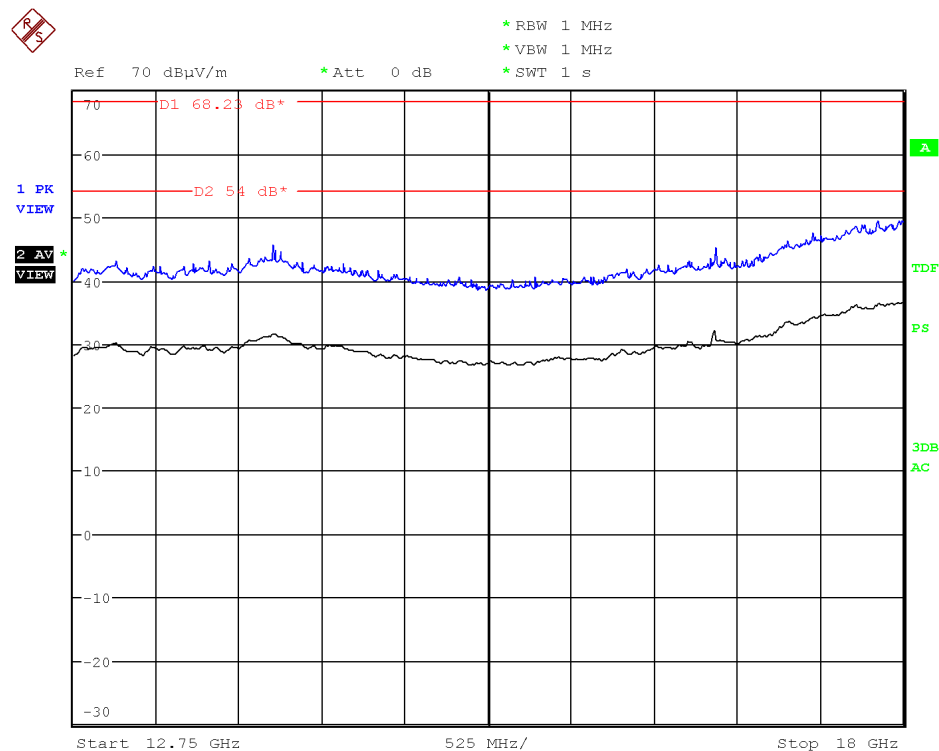
Chain A



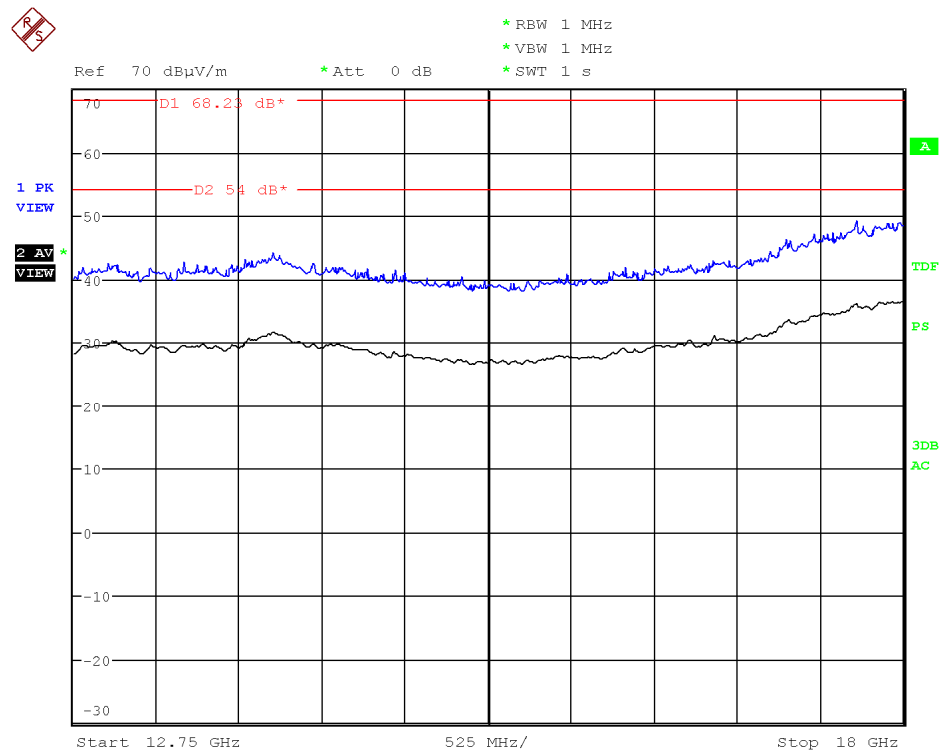
Chain B



Middle frequency (120) 5600 MHz.
Chain A



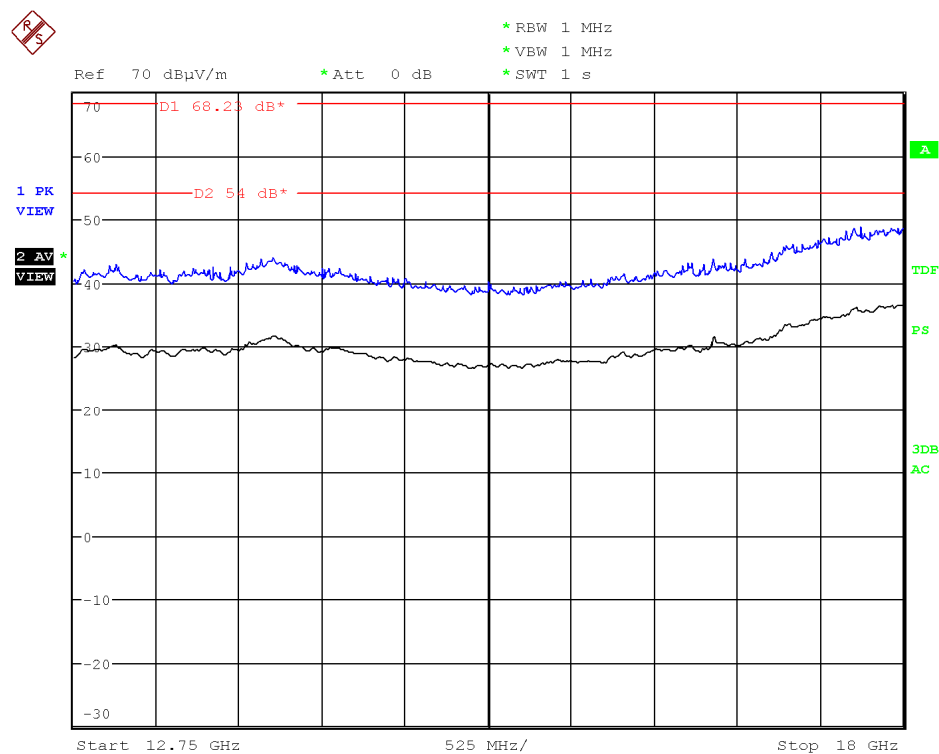
Chain B



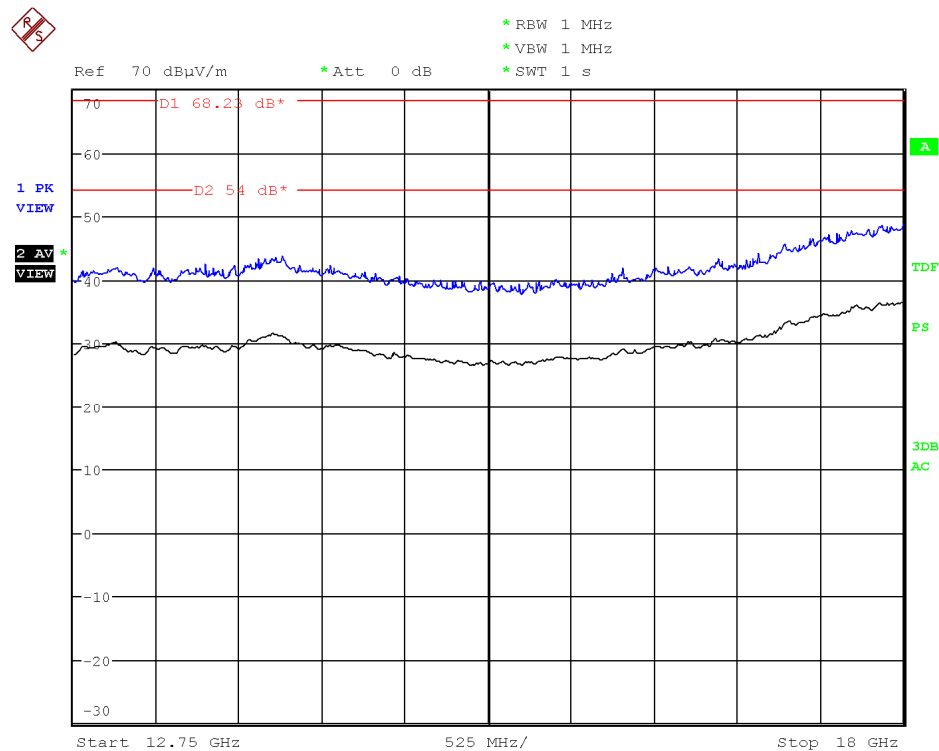
2. WiFi 5GHz 802.11 n20 mode

Middle frequency (120) 5600 MHz.

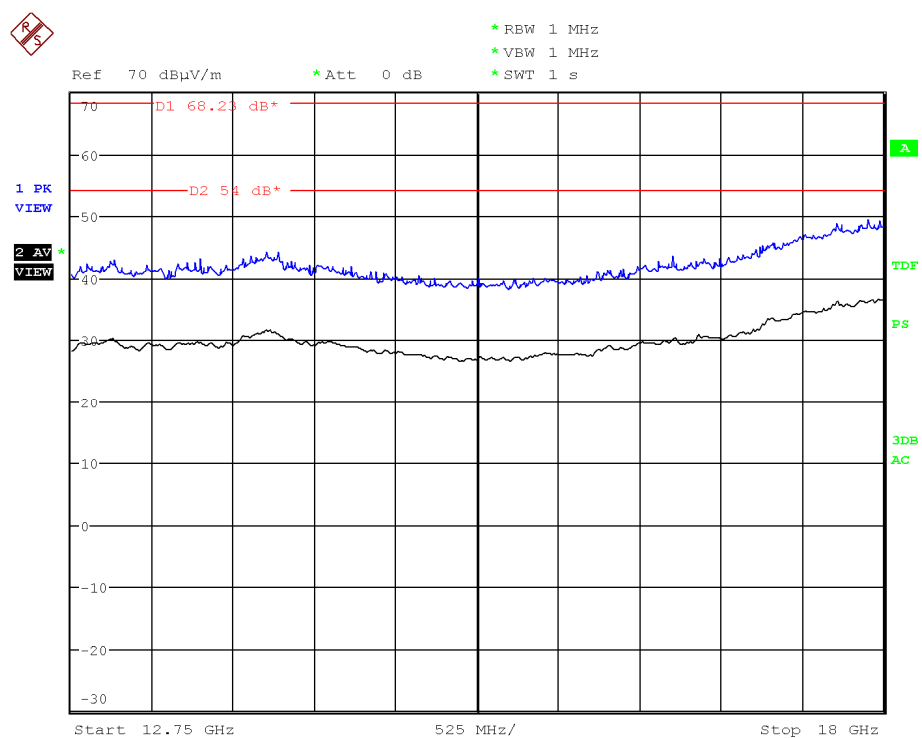
Chain A



Chain B

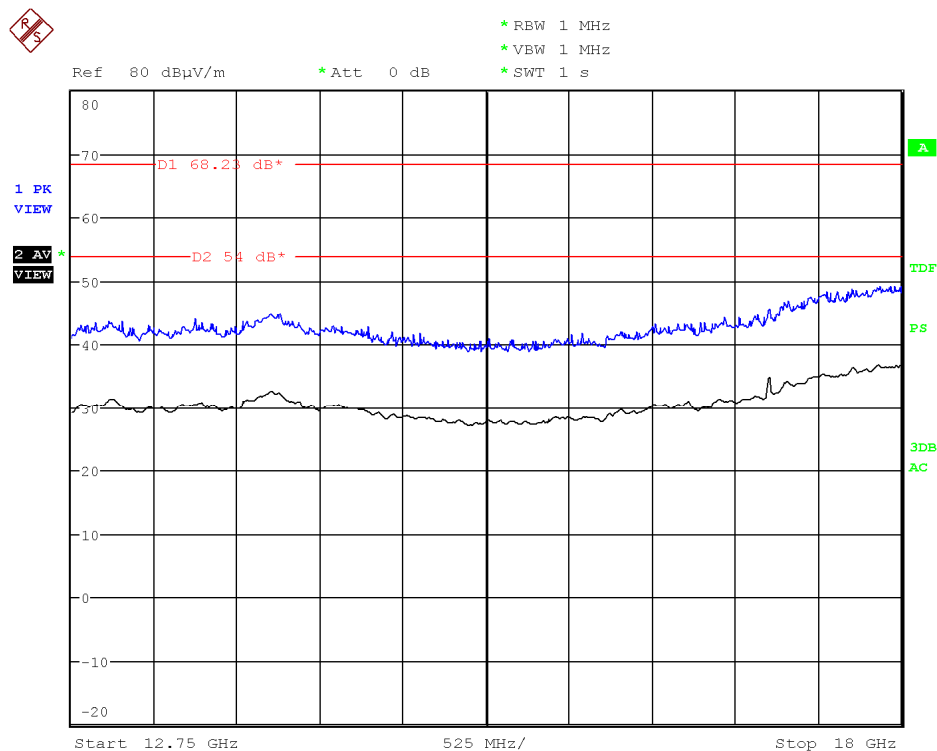


Chain A+B

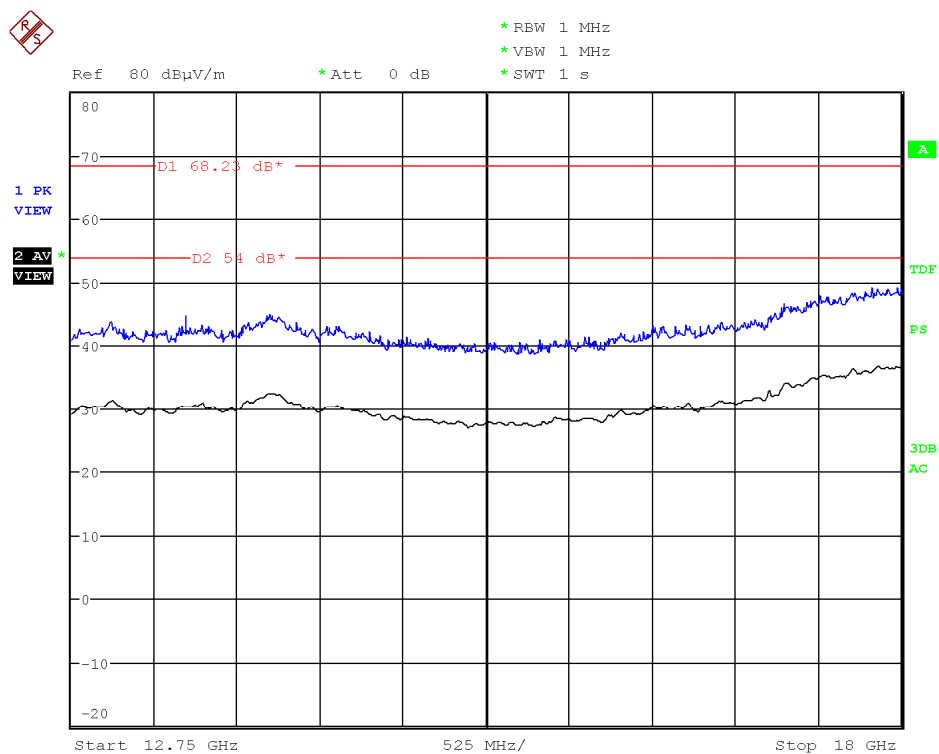


802.11ac20 mode: CH 144 (5720 MHz)

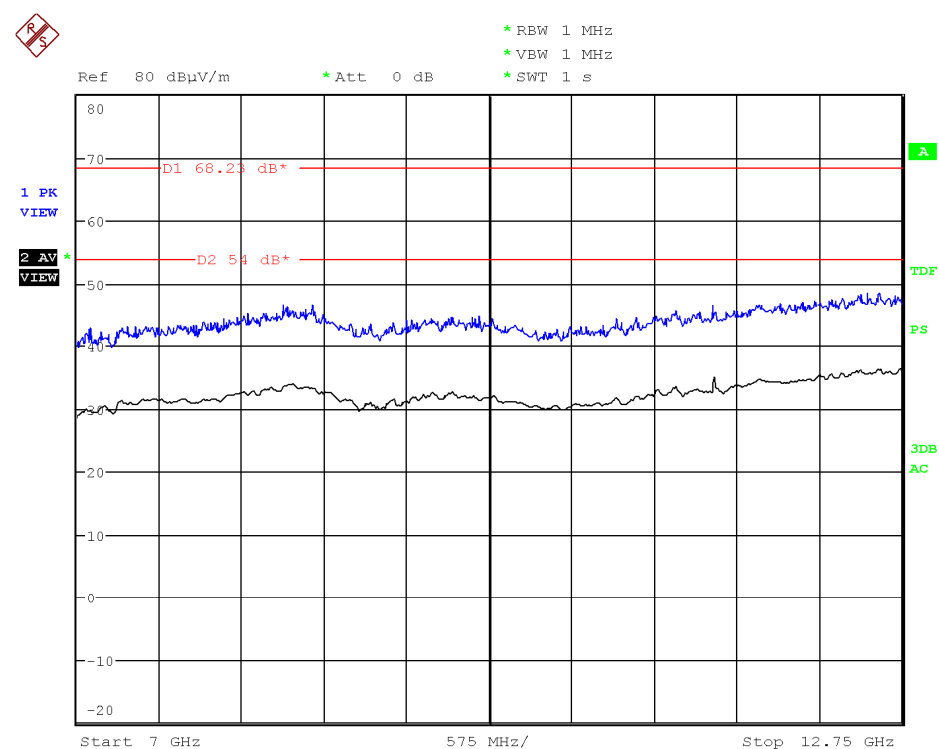
Chain A



Chain B



Chain A+B

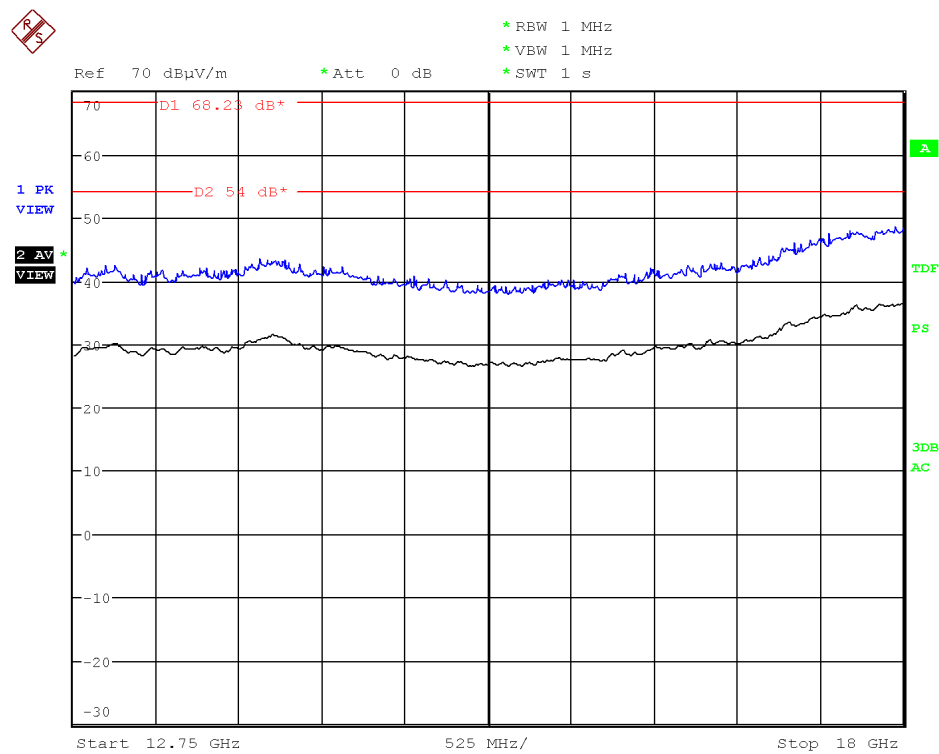


Date: 28.JAN.2013 09:54:54

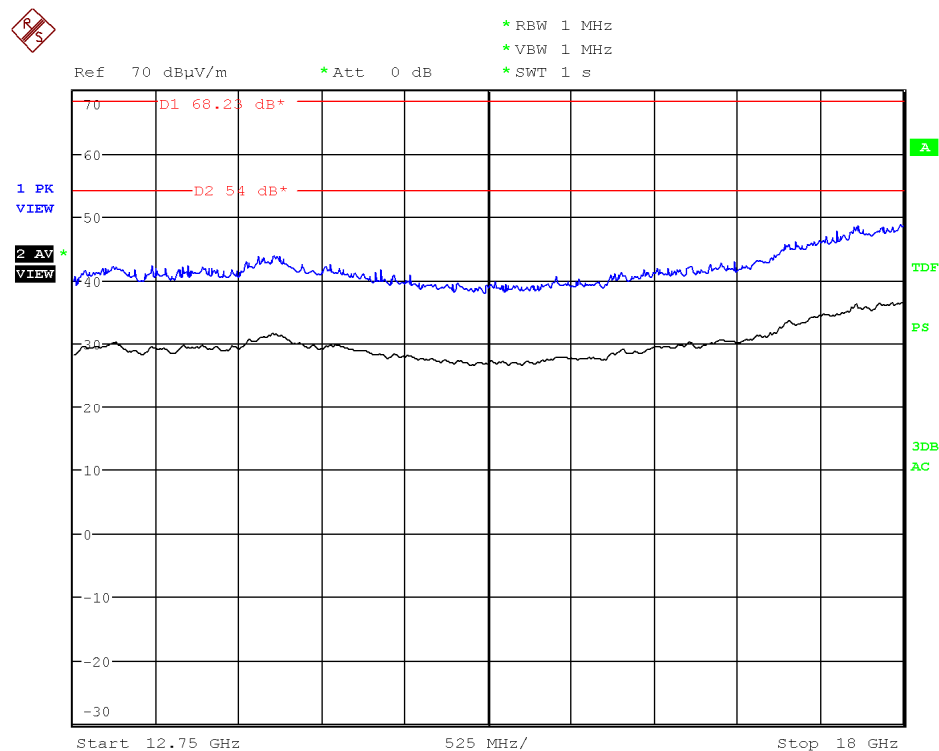
3. WiFi 5GHz 802.11 n40 mode

Middle frequency (118) 5590 MHz.

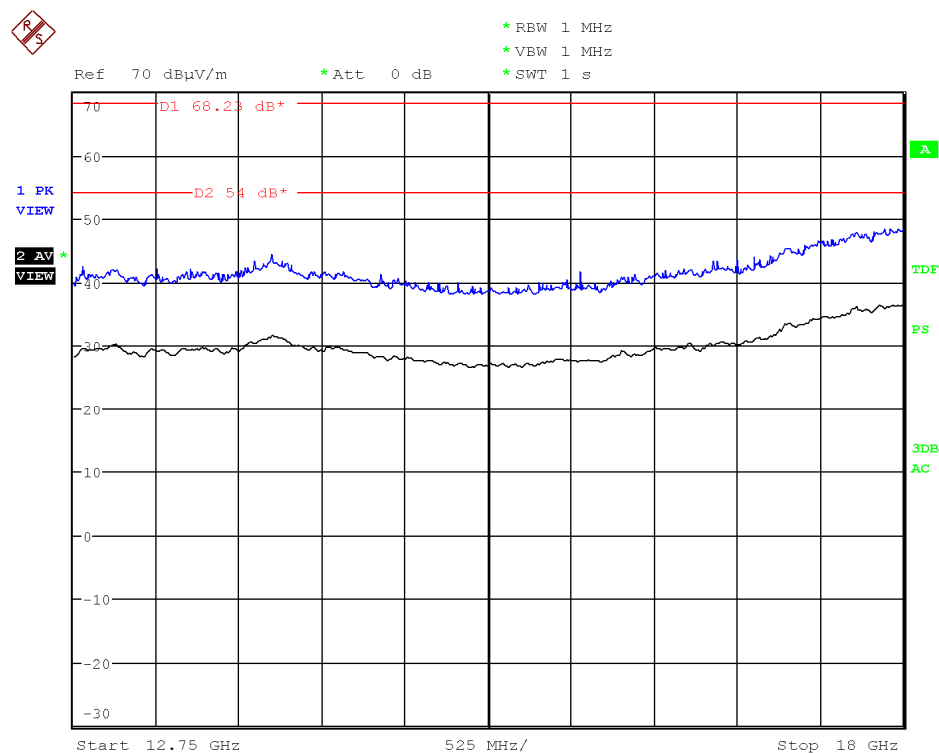
Chain A



Chain B



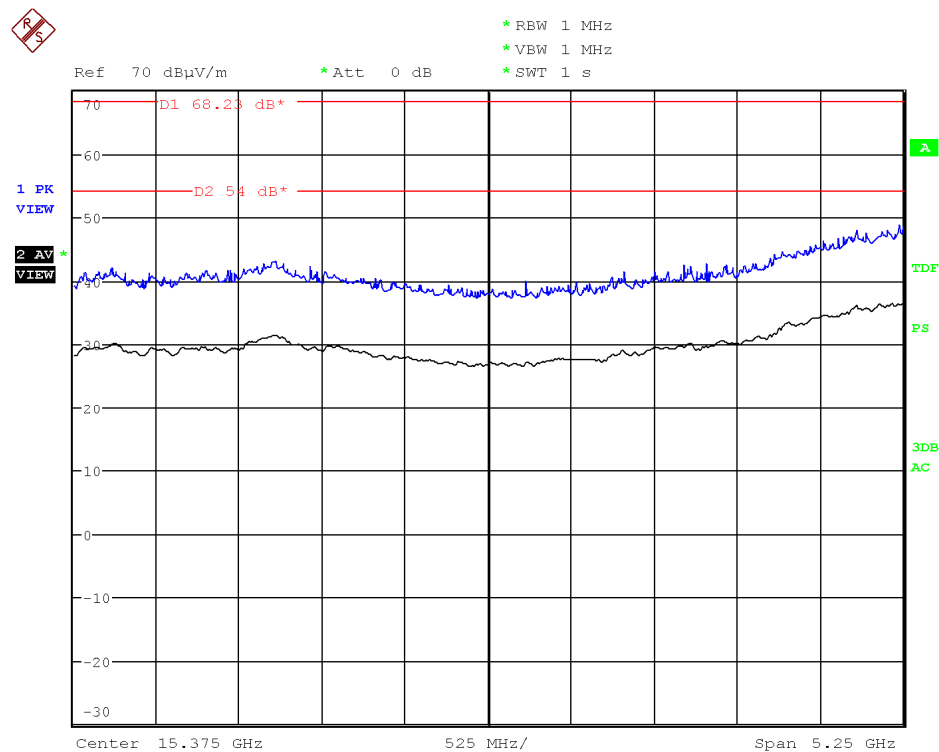
Chain A+B



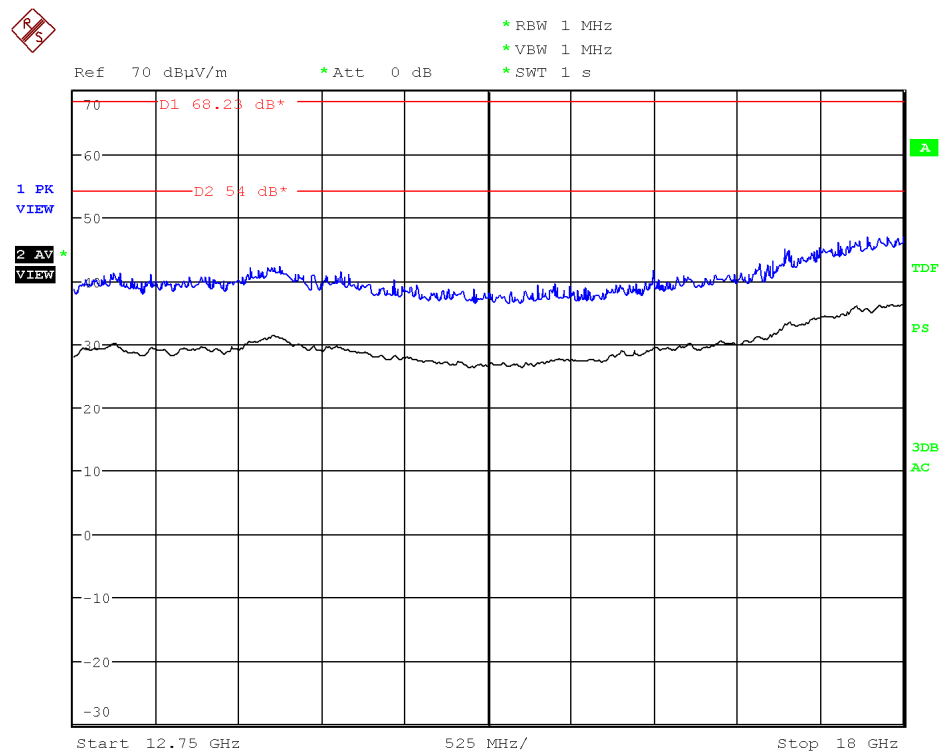
4. WiFi 5GHz 802.11 ac80 mode

Middle frequency (122) 5610 MHz.

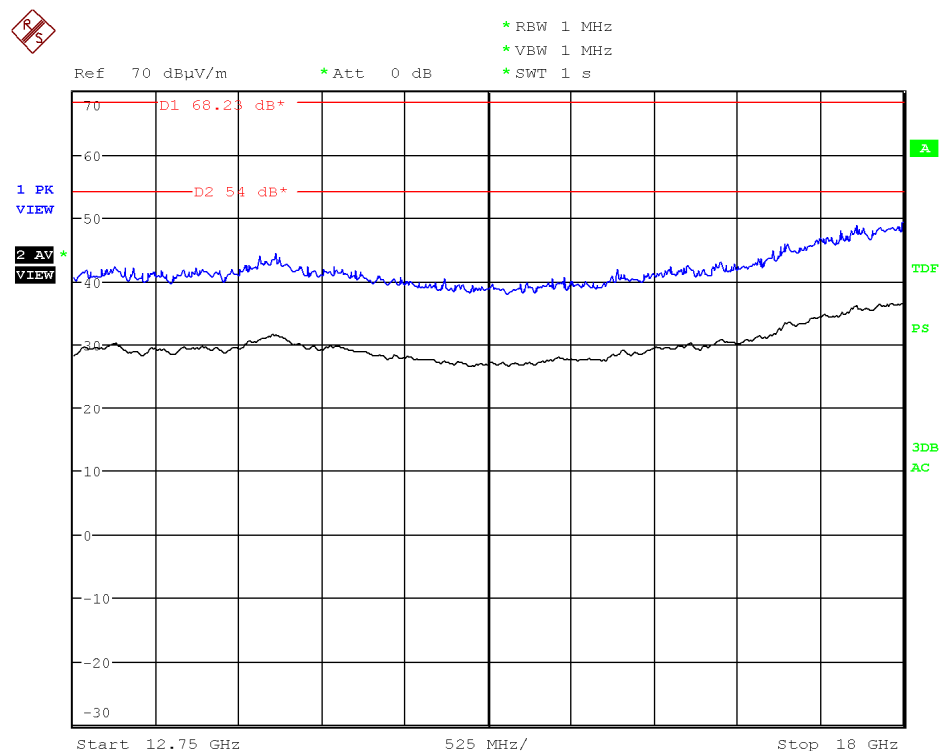
Chain A



Chain B



Chain A+B

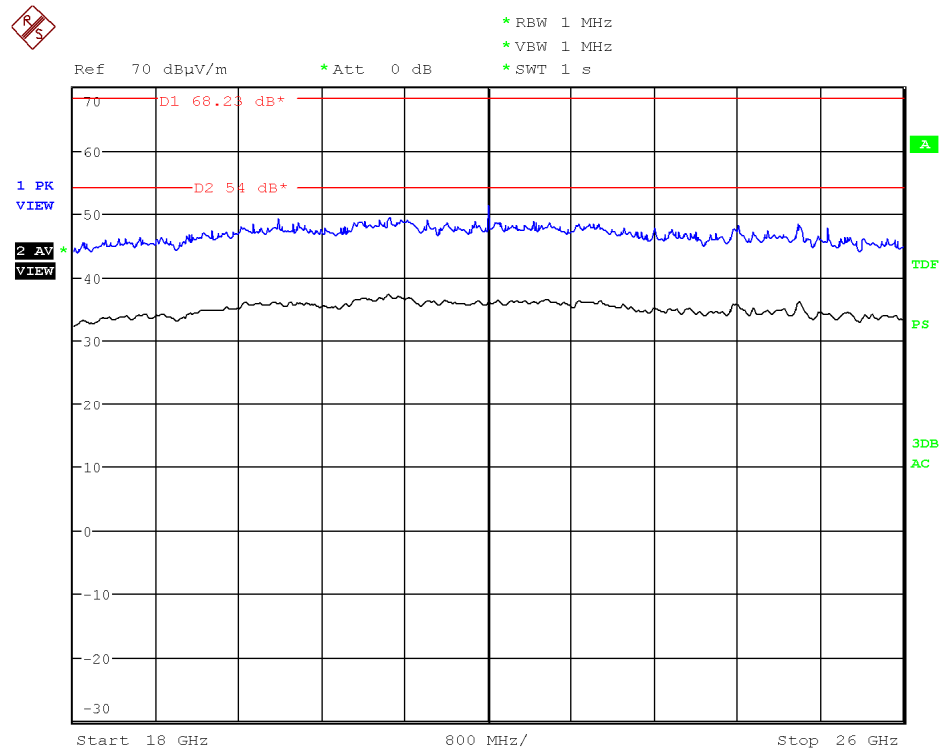


FREQUENCY RANGE 18 GHz to 26 GHz.

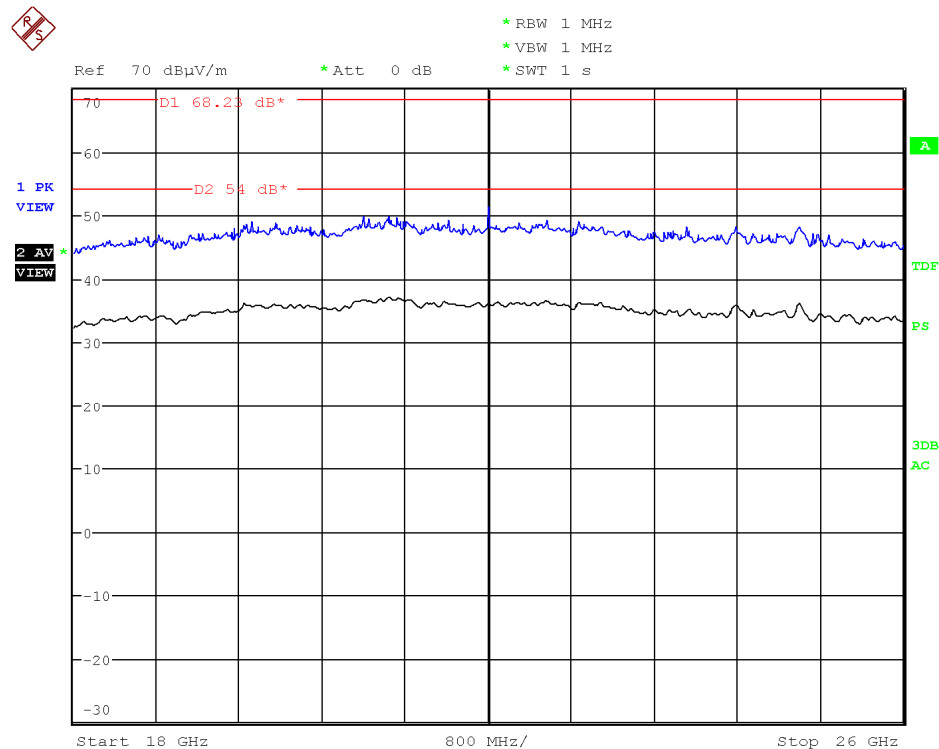
1. WiFi 5GHz 802.11 a mode

Lowest frequency (100) 5500 MHz.

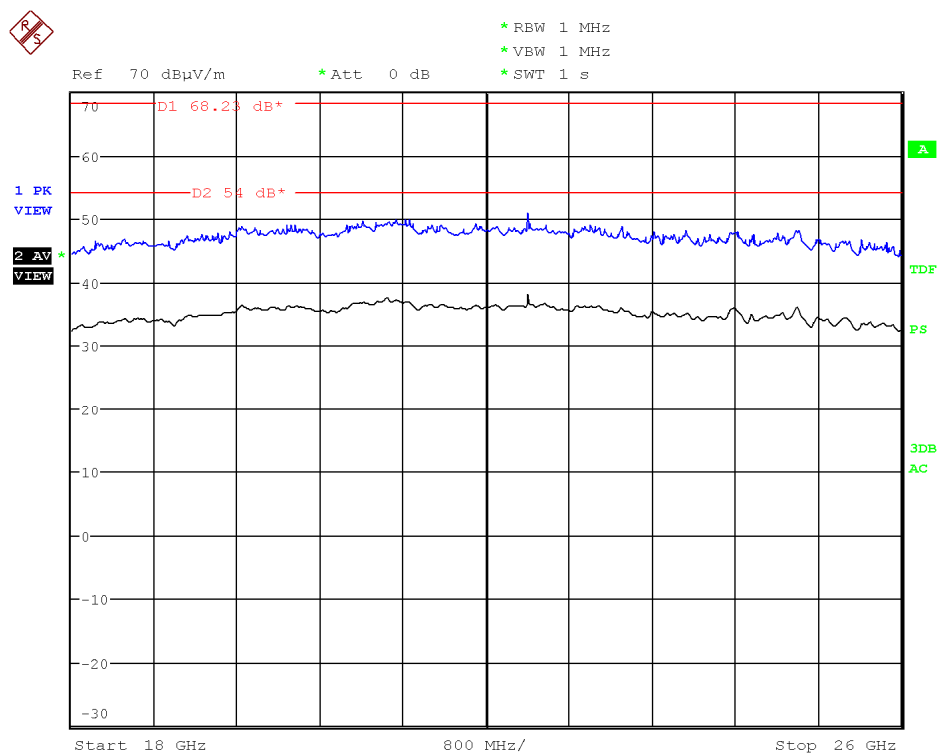
Chain A



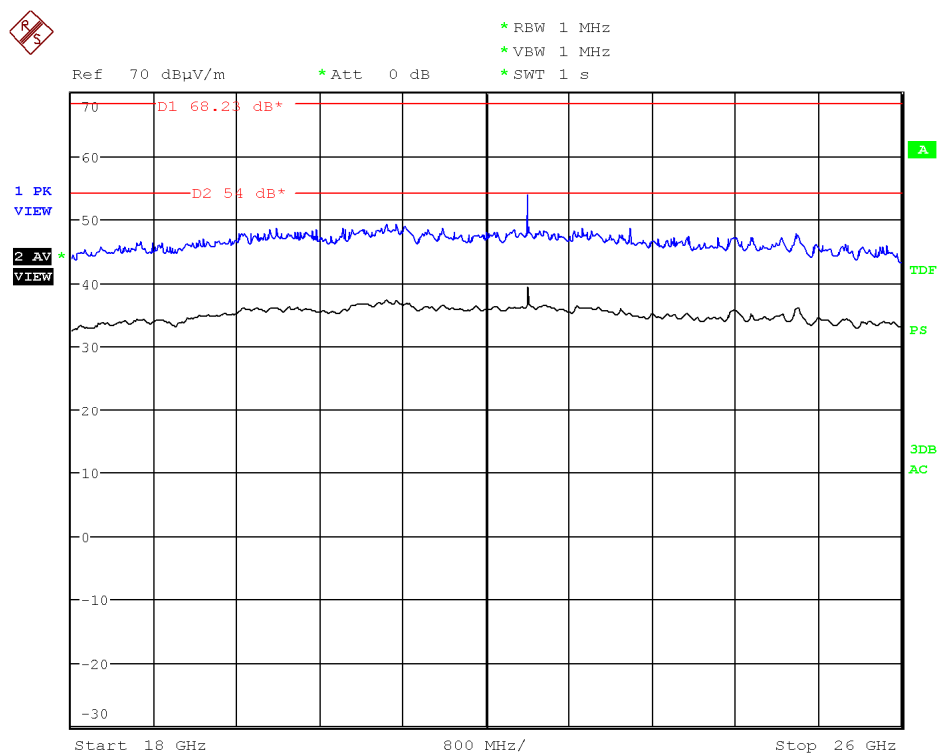
Chain B



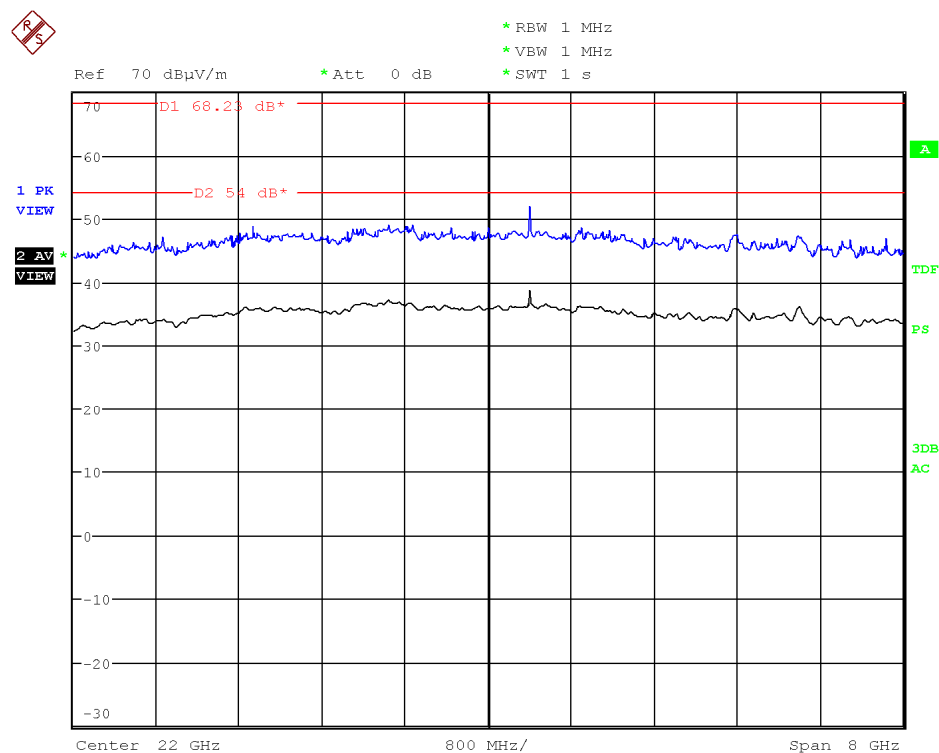
Middle frequency (120) 5600 MHz. Chain A



Chain B

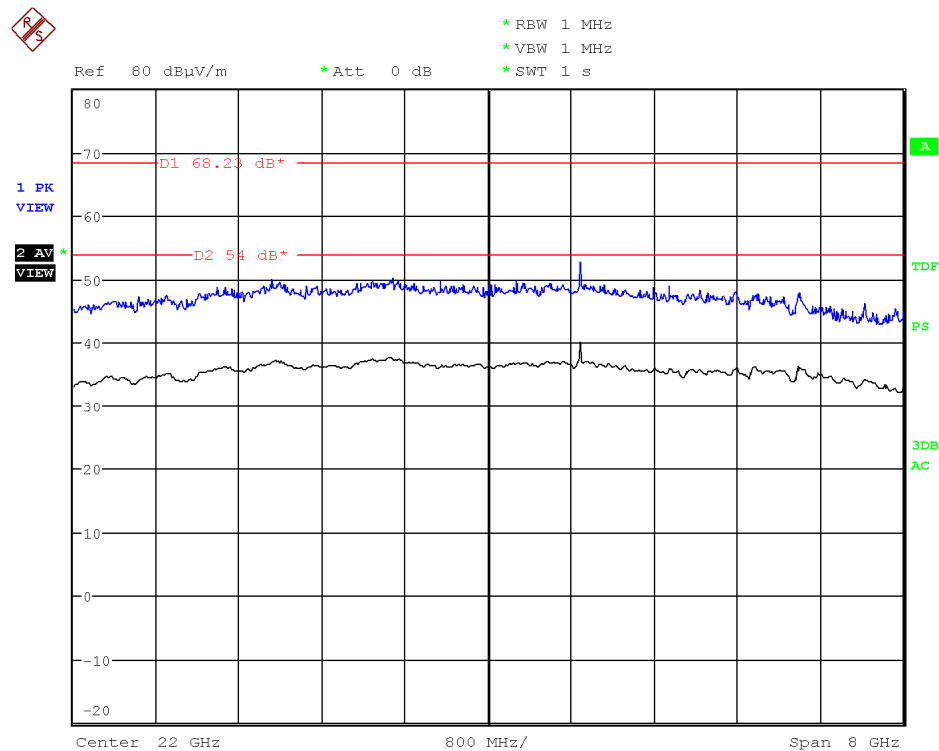


Chain A+B

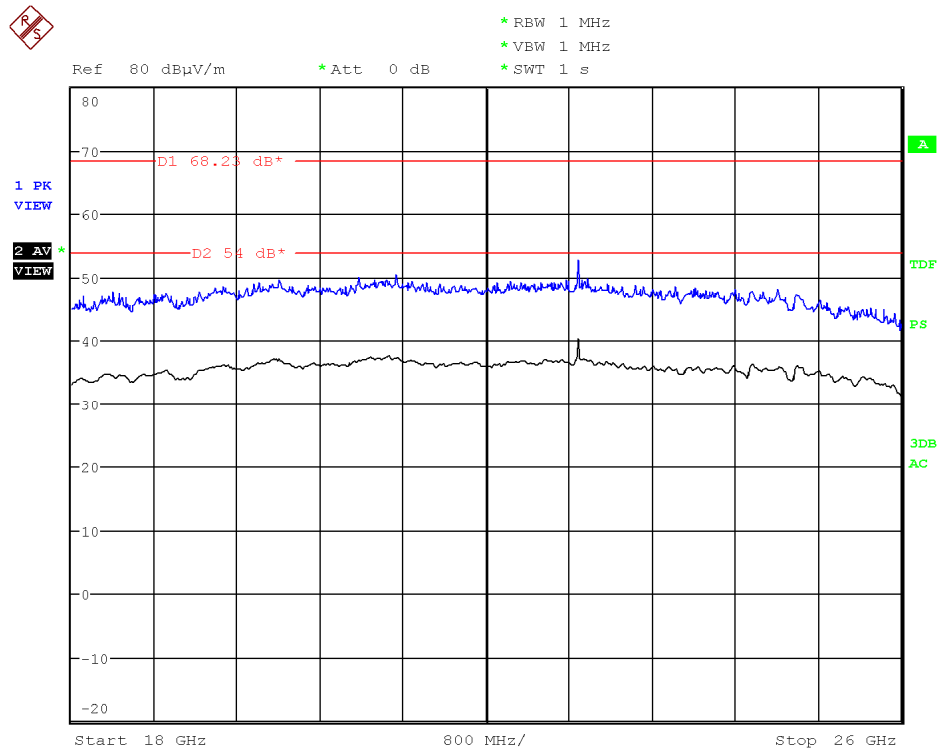


802.11ac20 mode: CH 144 (5720 MHz)

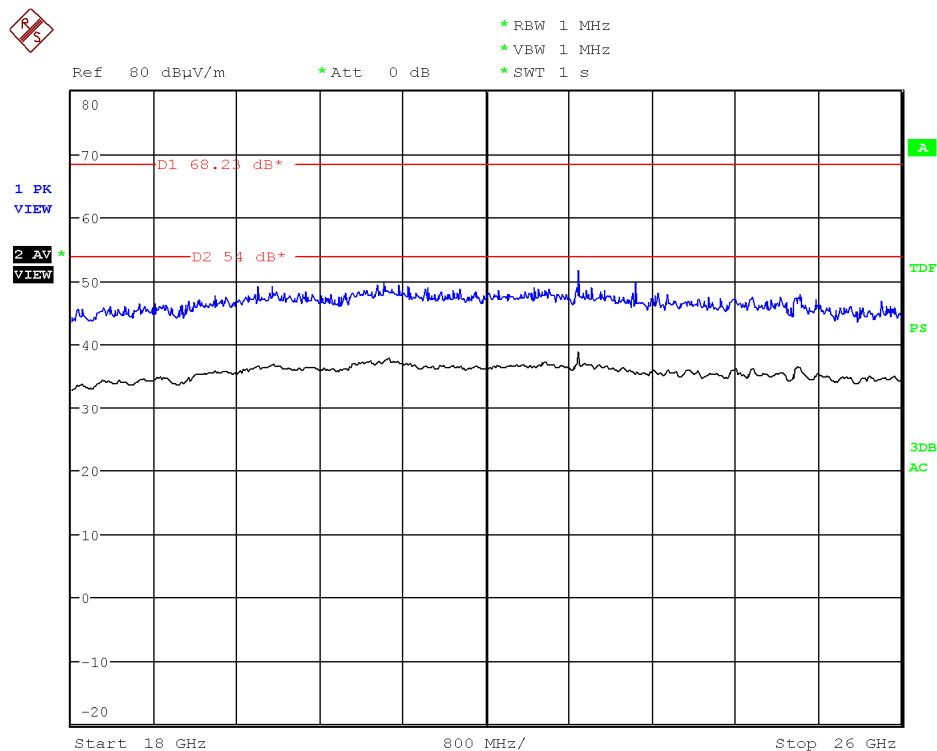
Chain A



Chain B



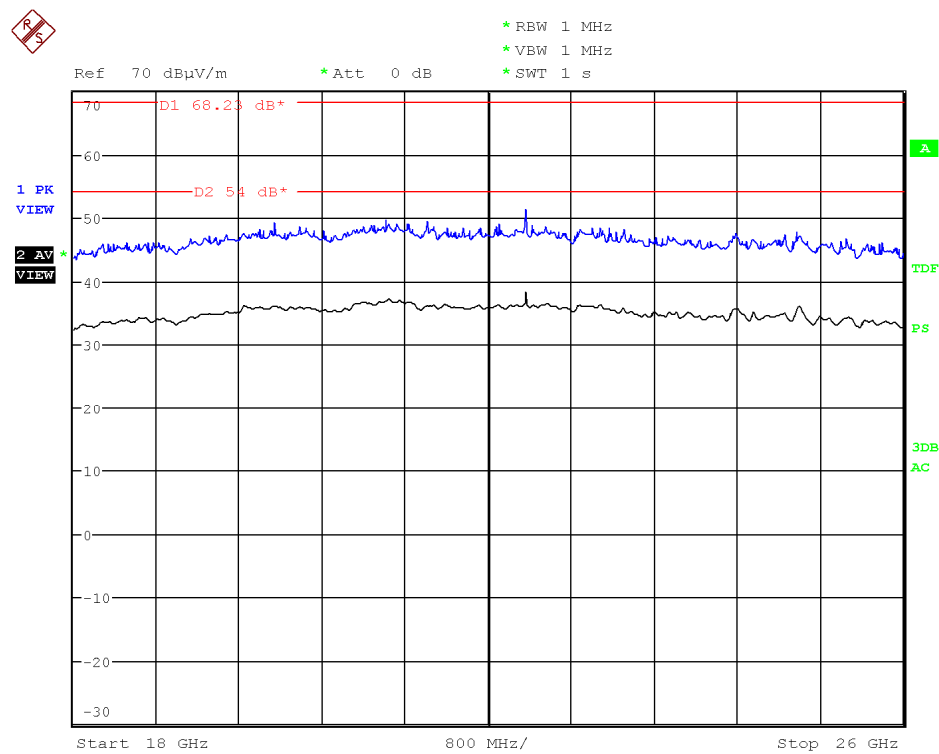
Chain A+B



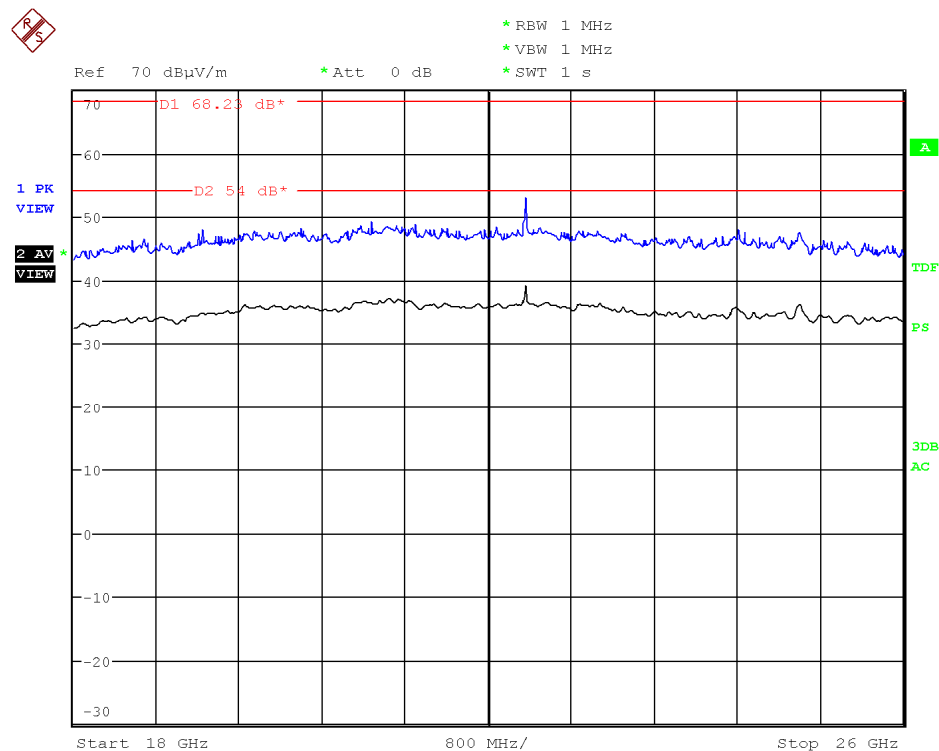
3. WiFi 5GHz 802.11 n40 mode

Middle frequency (118) 5590 MHz.

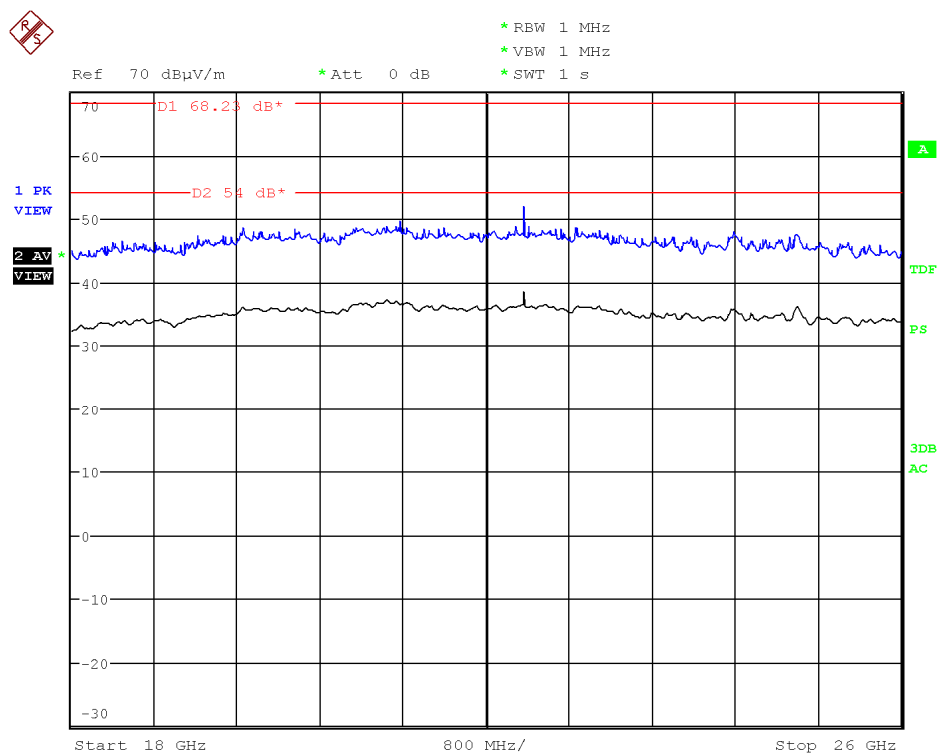
Chain A



Chain B



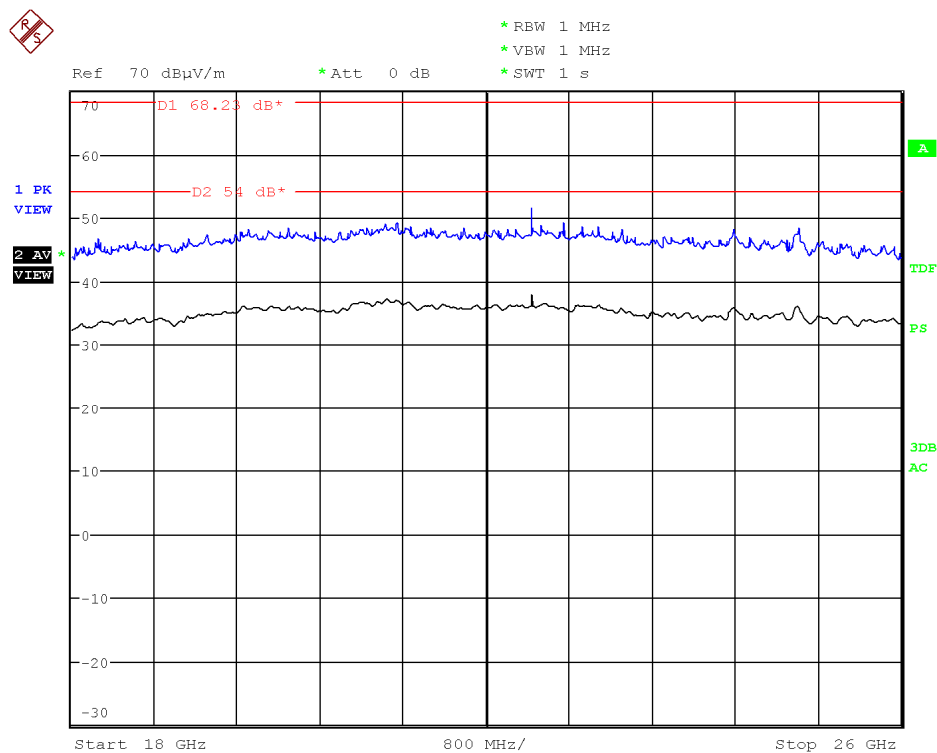
Chain A+B



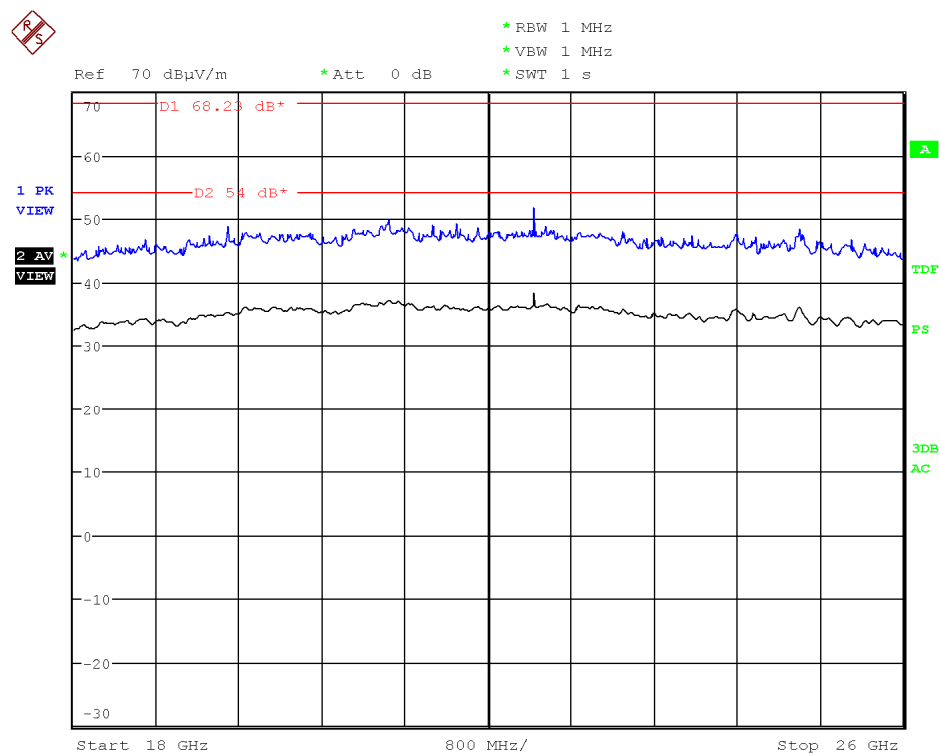
4. WiFi 5GHz 802.11 ac80 mode

Middle frequency (122) 5610 MHz.

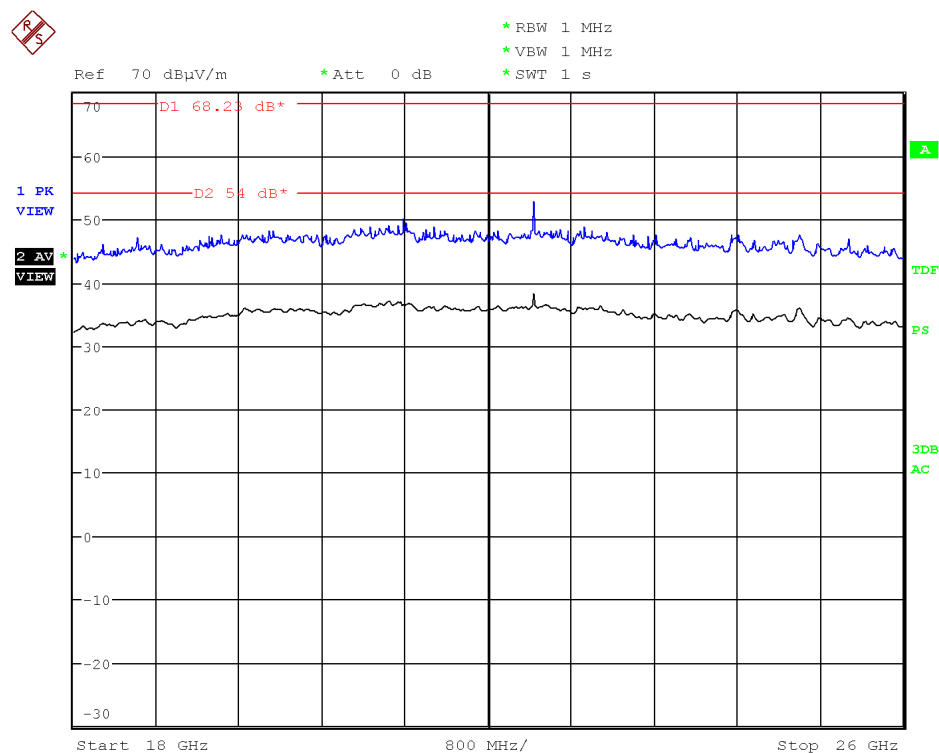
Chain A



Chain B

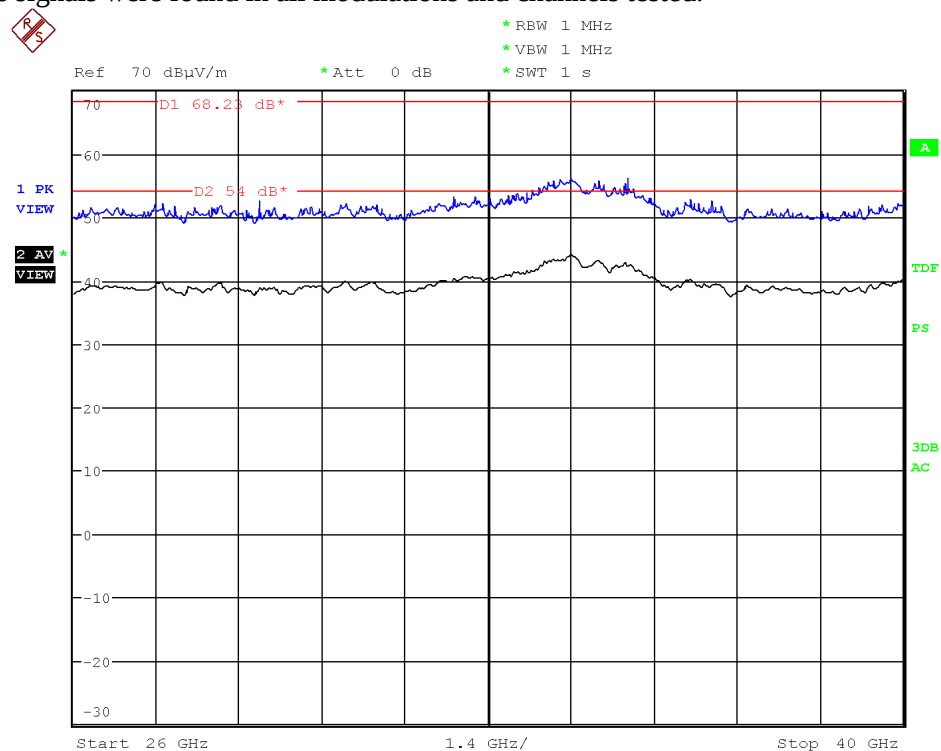


Chain A+B



FREQUENCY RANGE 26GHz to 40GHz.

No spurious signals were found in all modulations and channels tested.

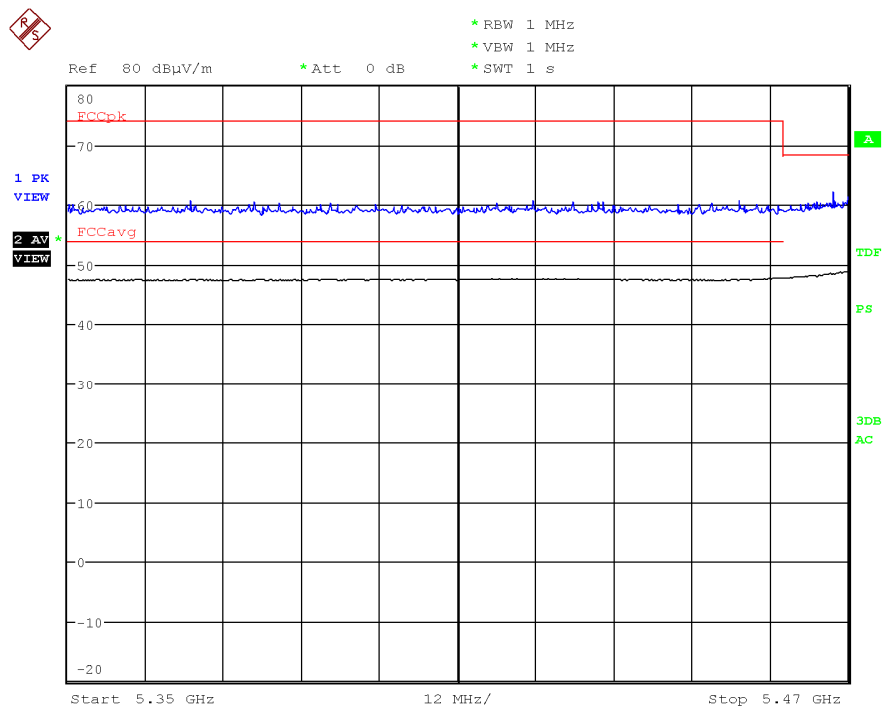


(This plot is valid for both SISO and MIMO modes).

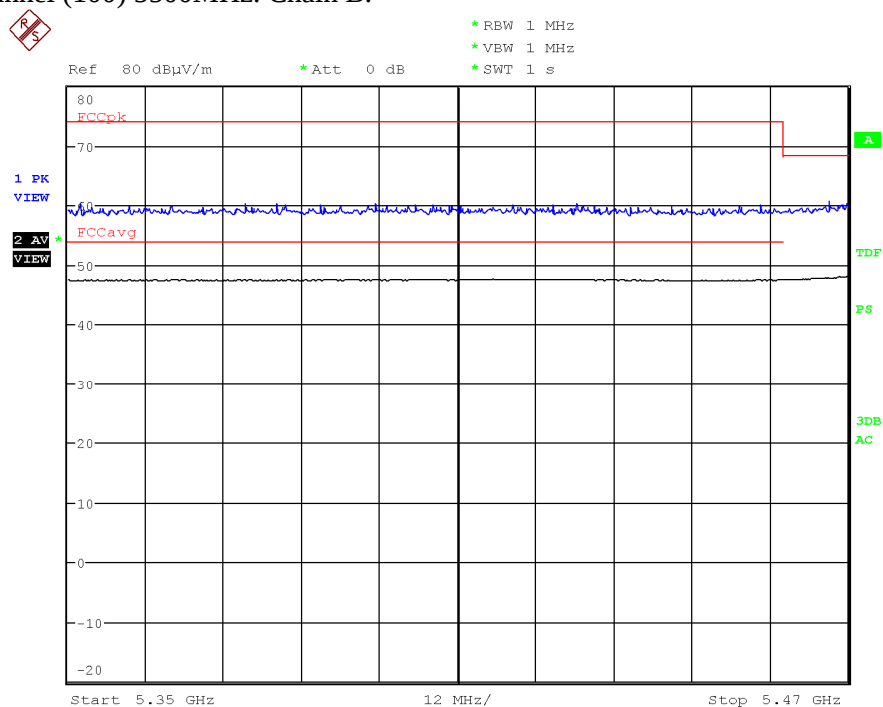
Radiated spurious emissions at band-edges and inside restricted band 5.35 – 5.46 GHz and adjacent band 5.46 – 5.47 GHz.

1. WiFi 5GHz 802.11 a mode

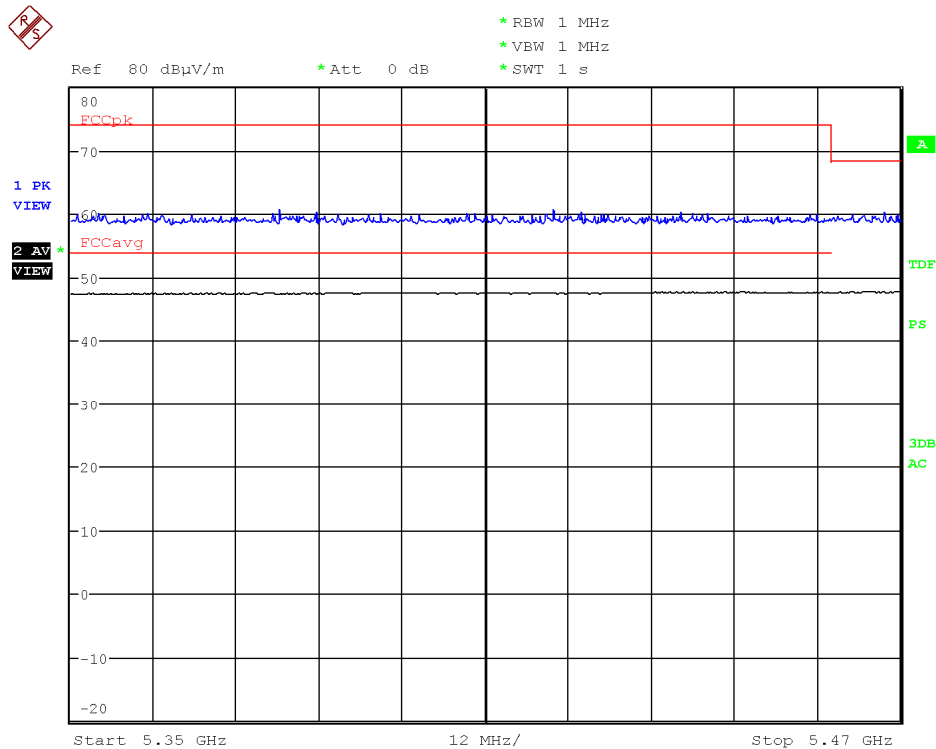
Lowest Channel (100) 5500 MHz. Chain A.



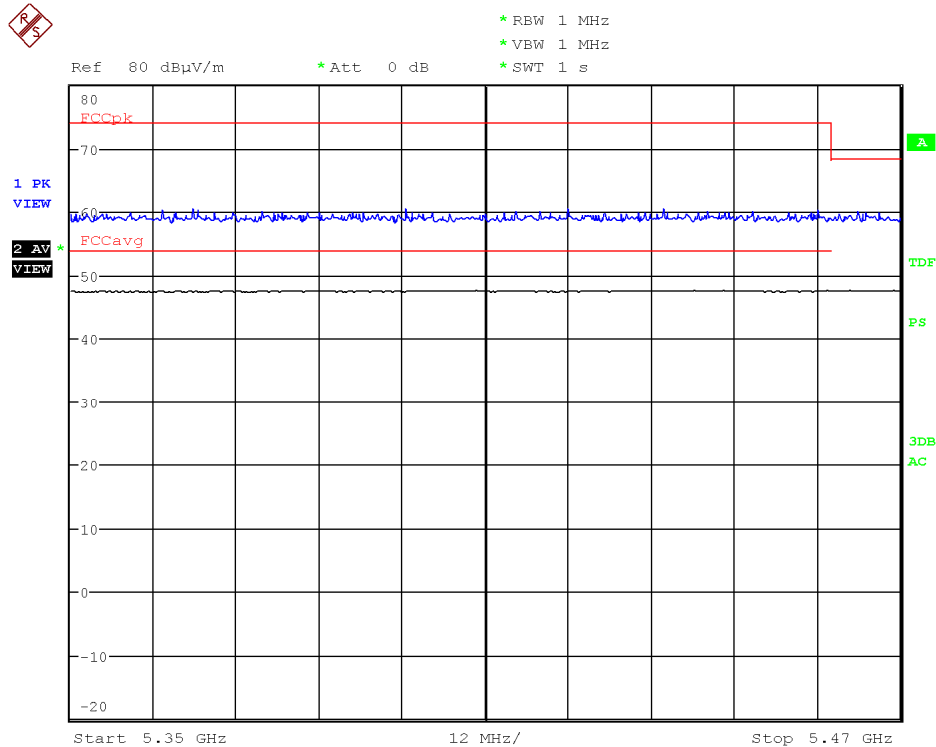
Lowest Channel (100) 5500MHz. Chain B.



Channel 104. 5520MHz. Chain A.

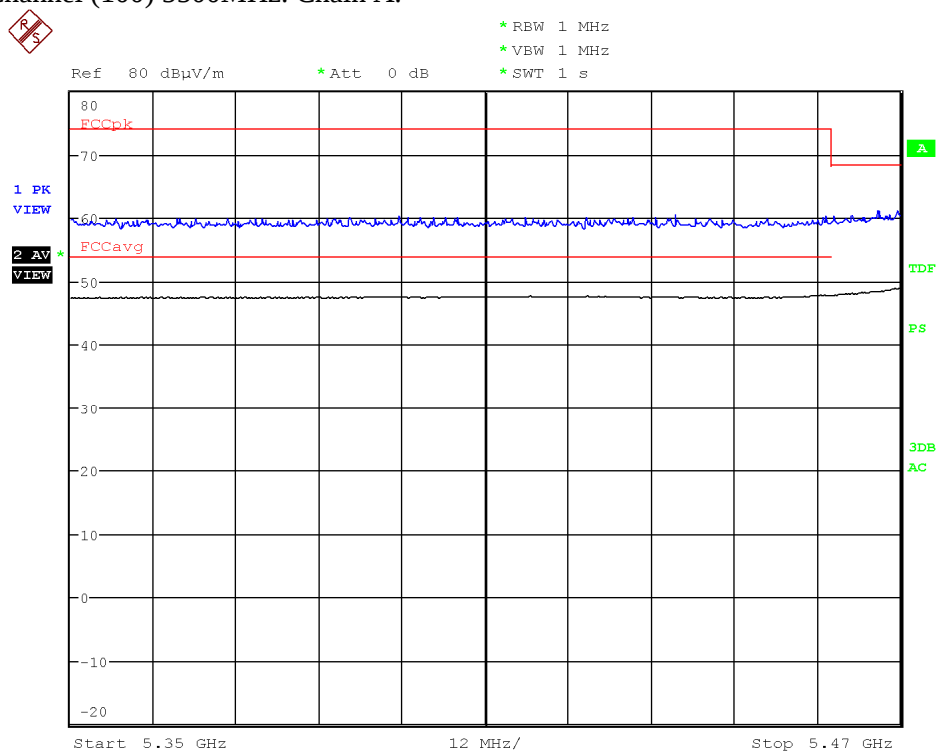


Channel 104. 5520MHz. Chain B.

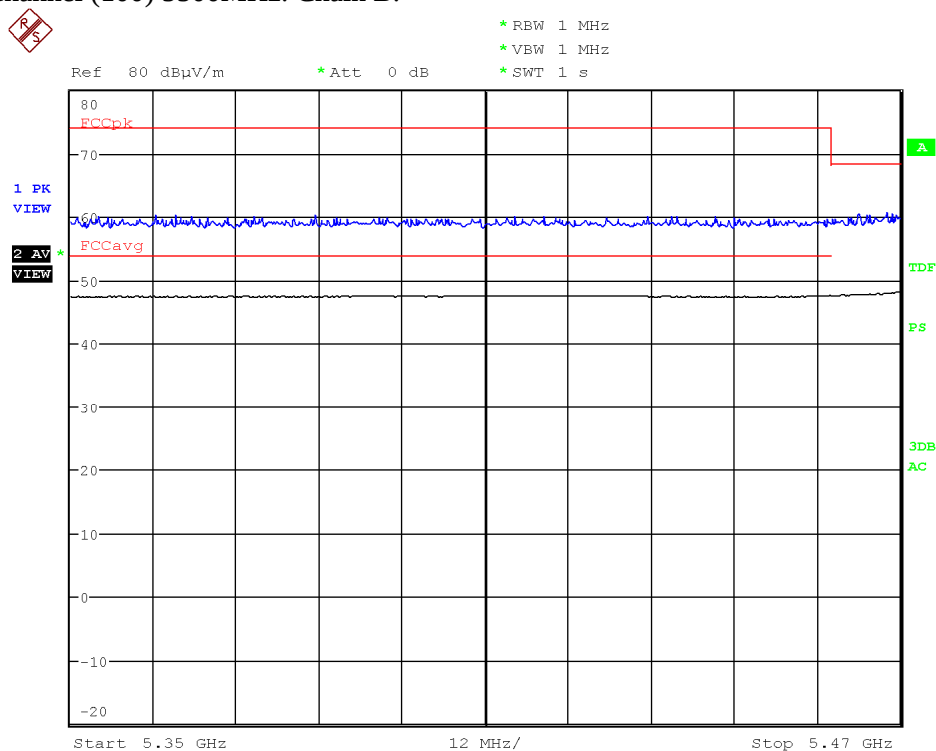


2. WiFi 5GHz 802.11 n20 mode

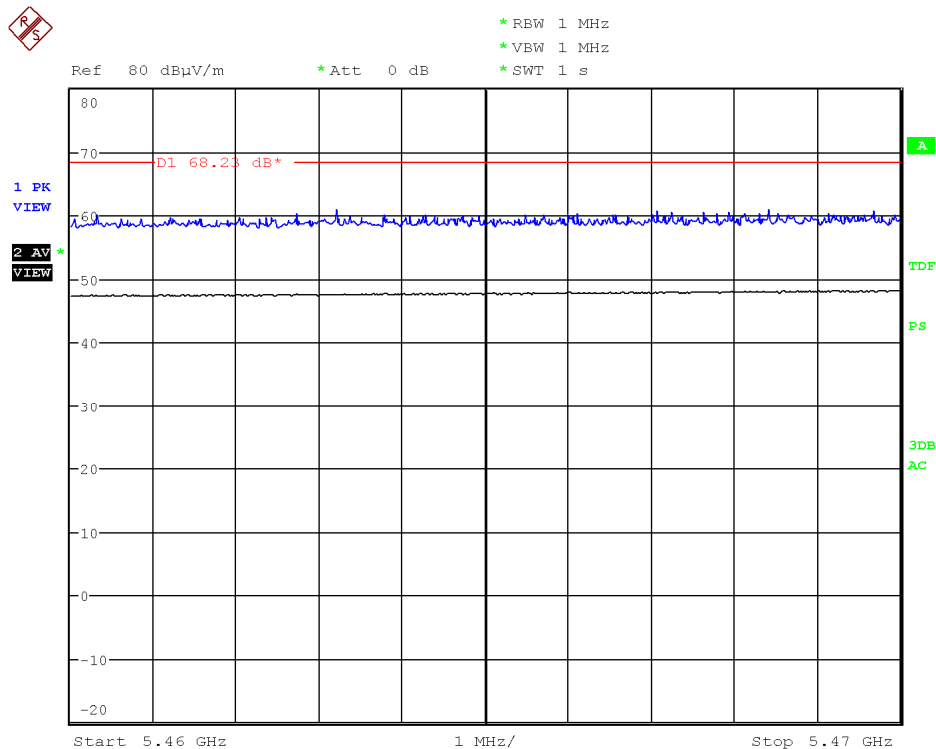
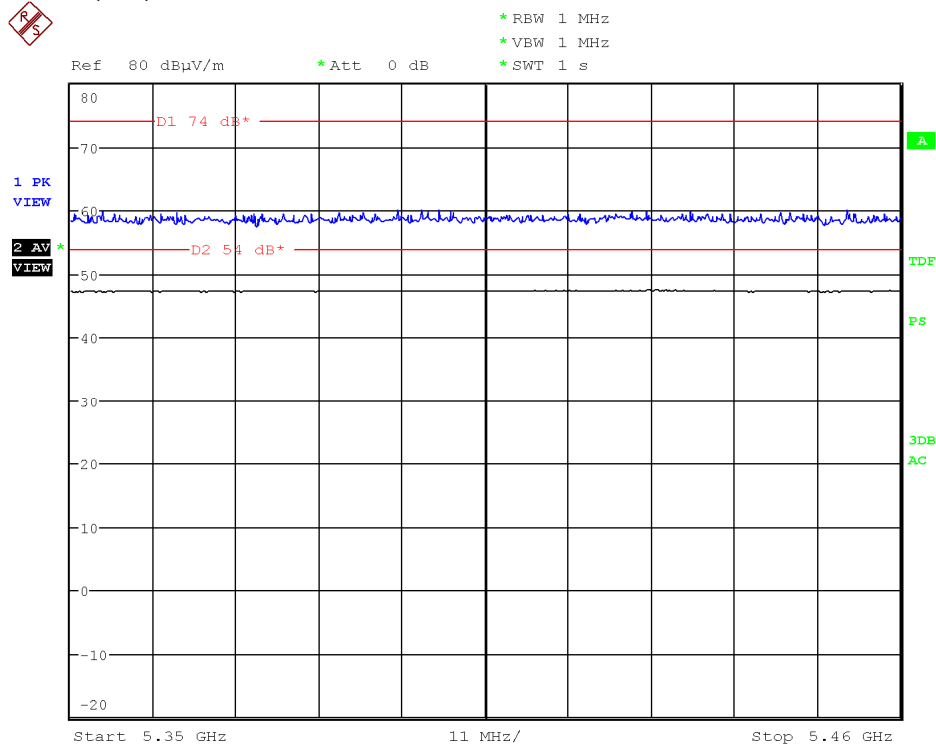
Lowest Channel (100) 5500MHz. Chain A.



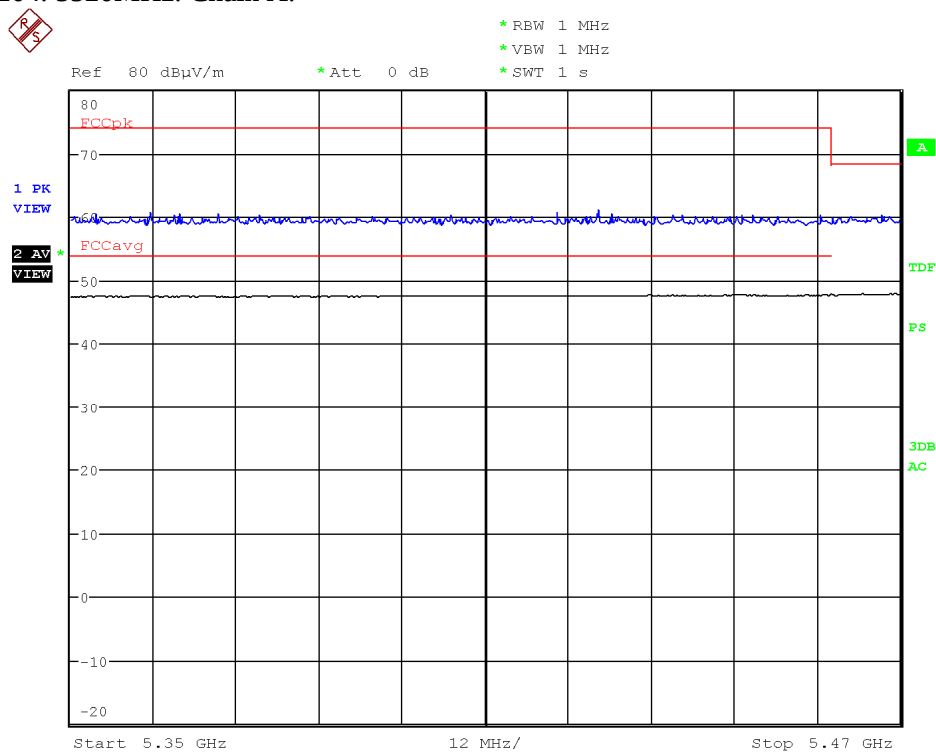
Lowest Channel (100) 5500MHz. Chain B.



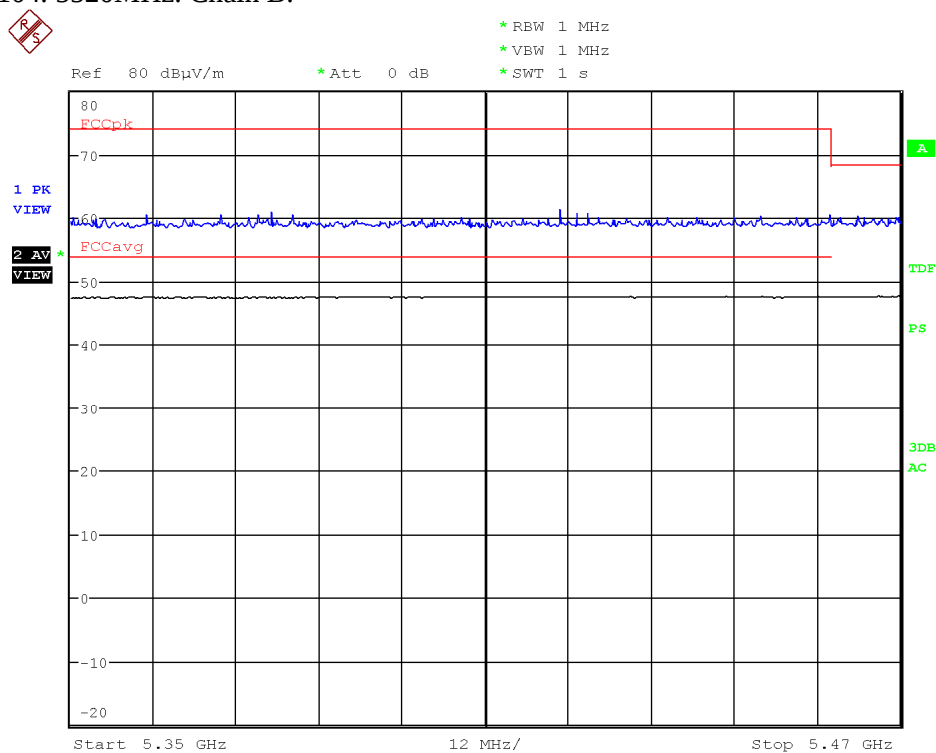
Lowest Channel (120) 5500MHz. Chain A+B.



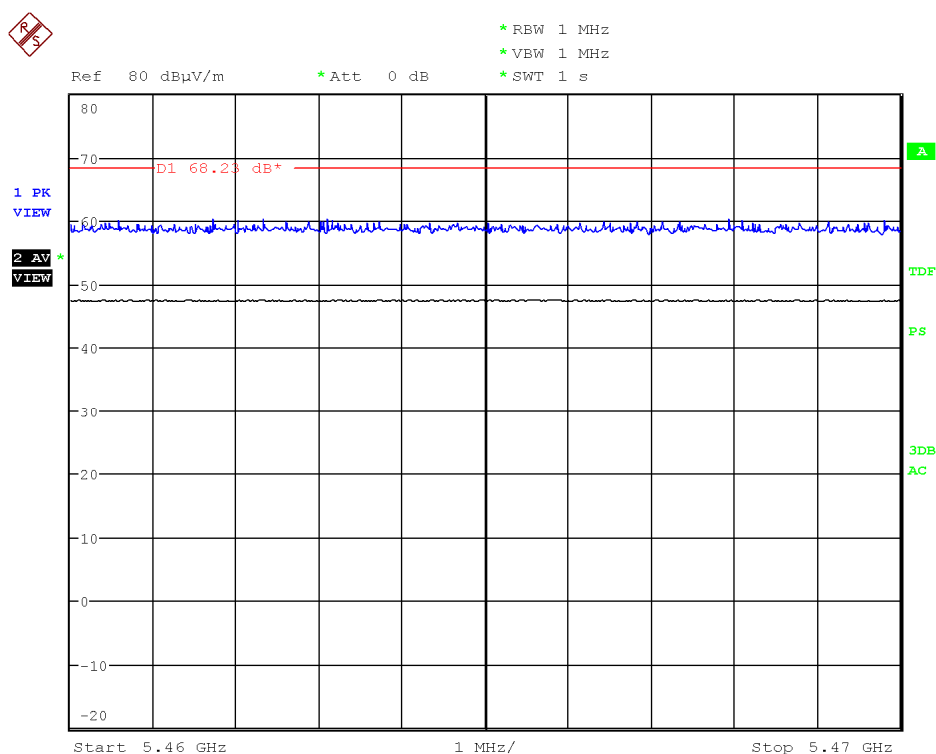
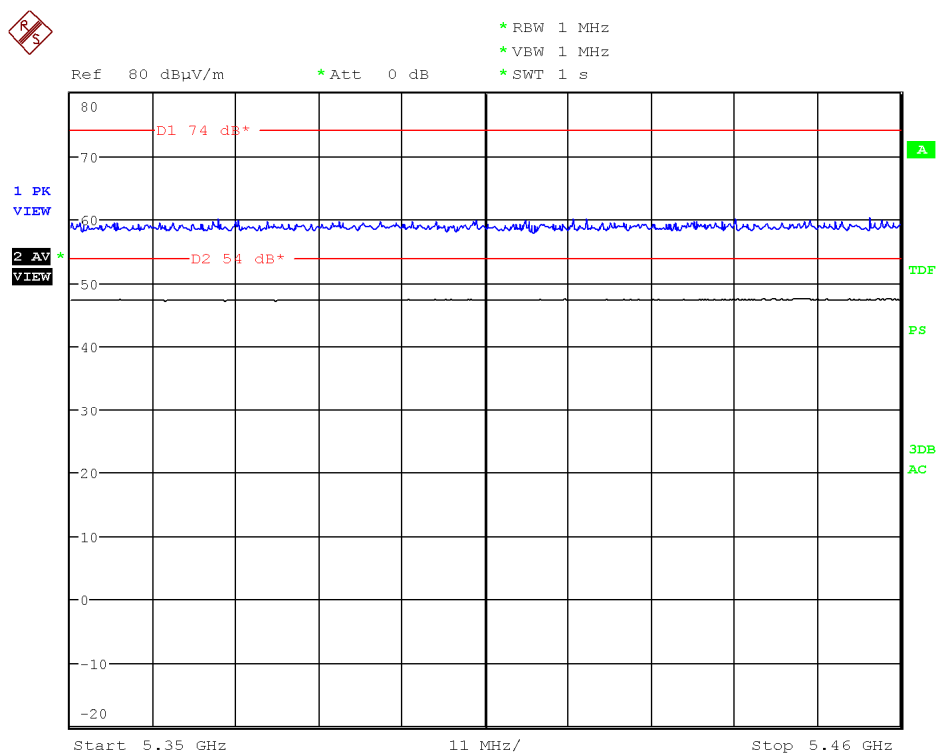
Channel 104. 5520MHz. Chain A.



Channel 104. 5520MHz. Chain B.

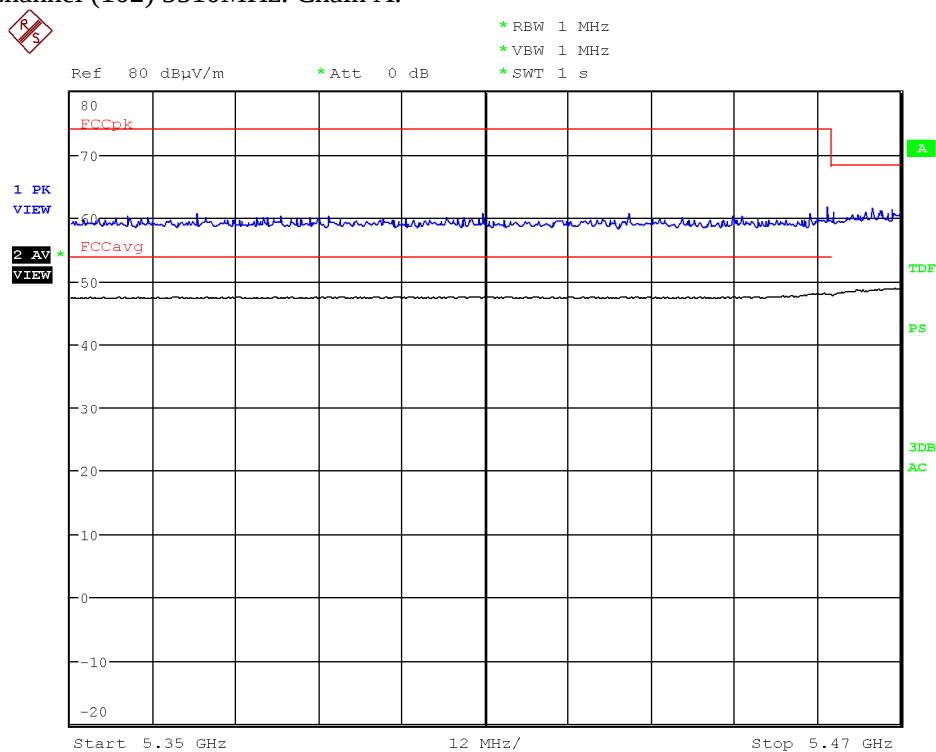


Channel 104. 5520MHz. Chain A+B.

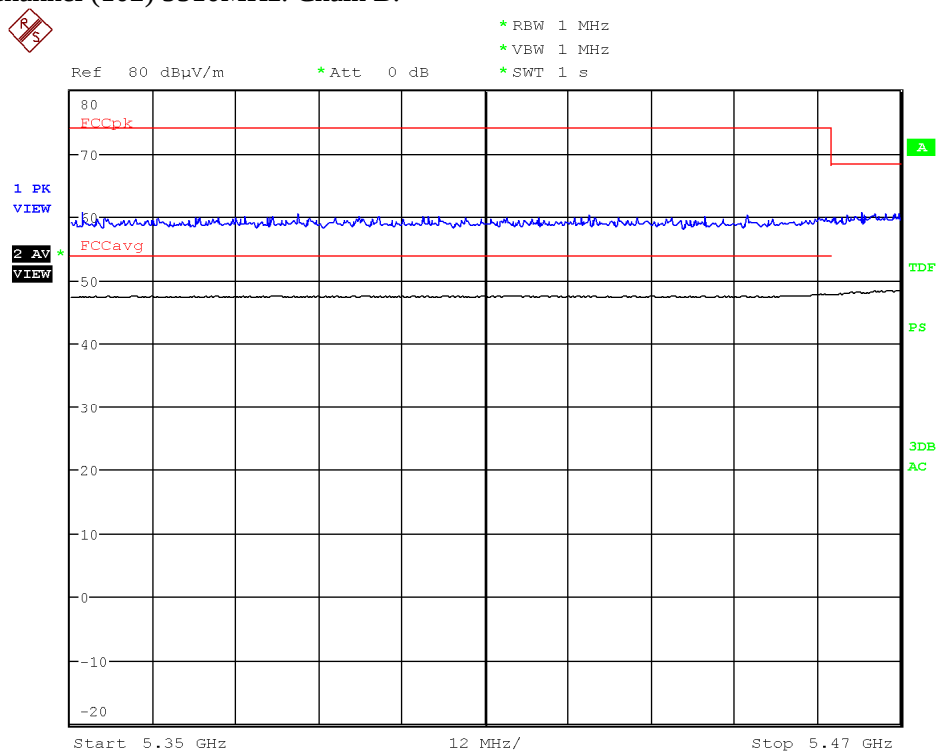


3. WiFi 5GHz 802.11 n40 mode

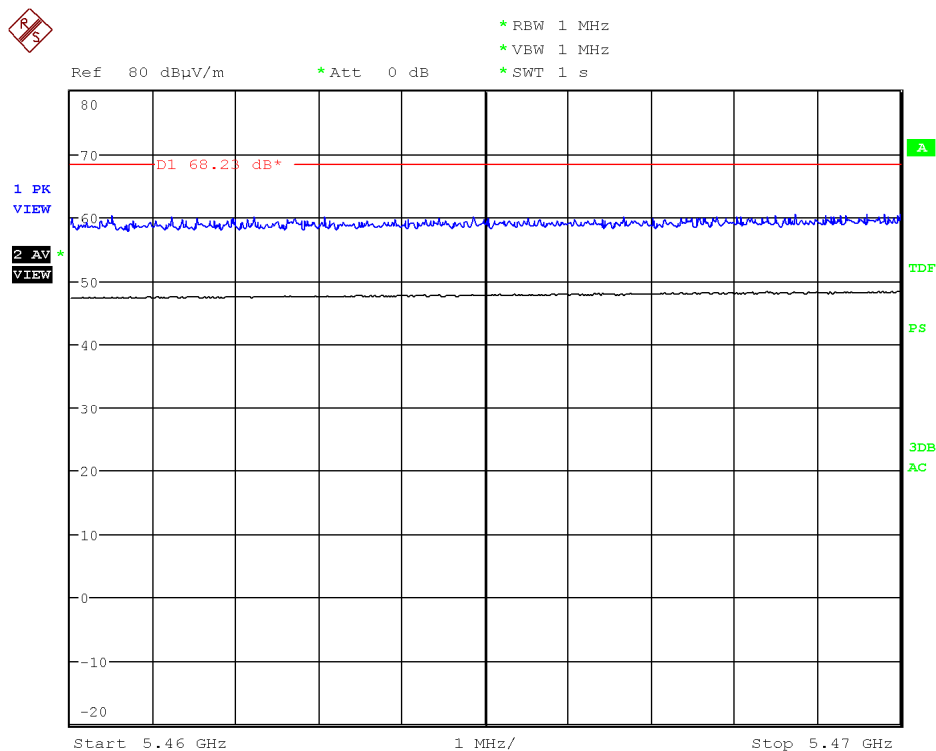
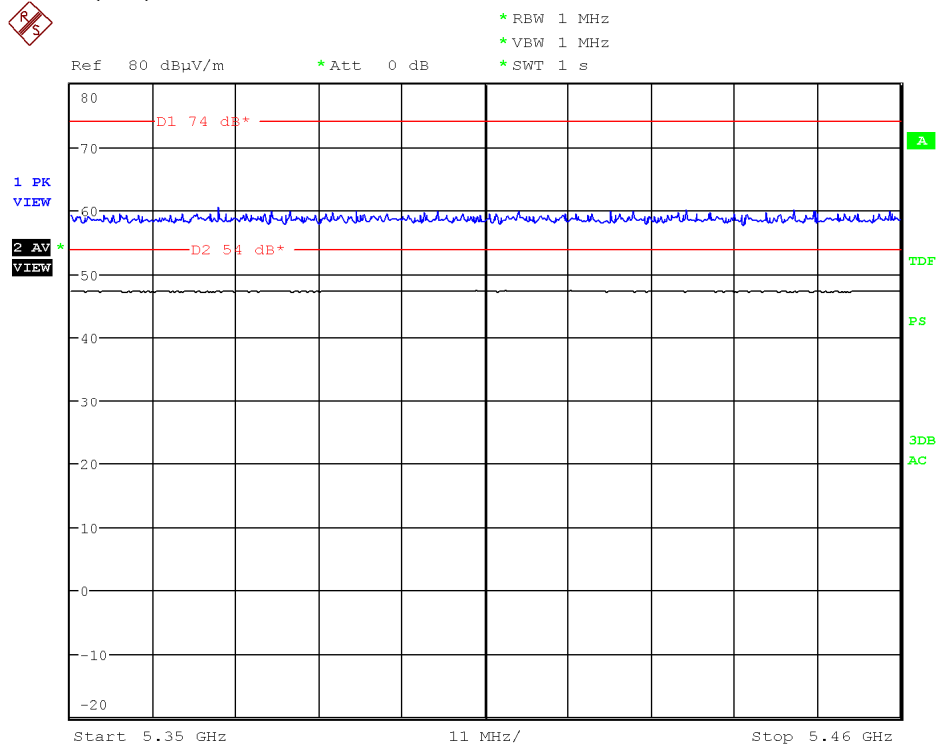
Lowest Channel (102) 5510MHz. Chain A.



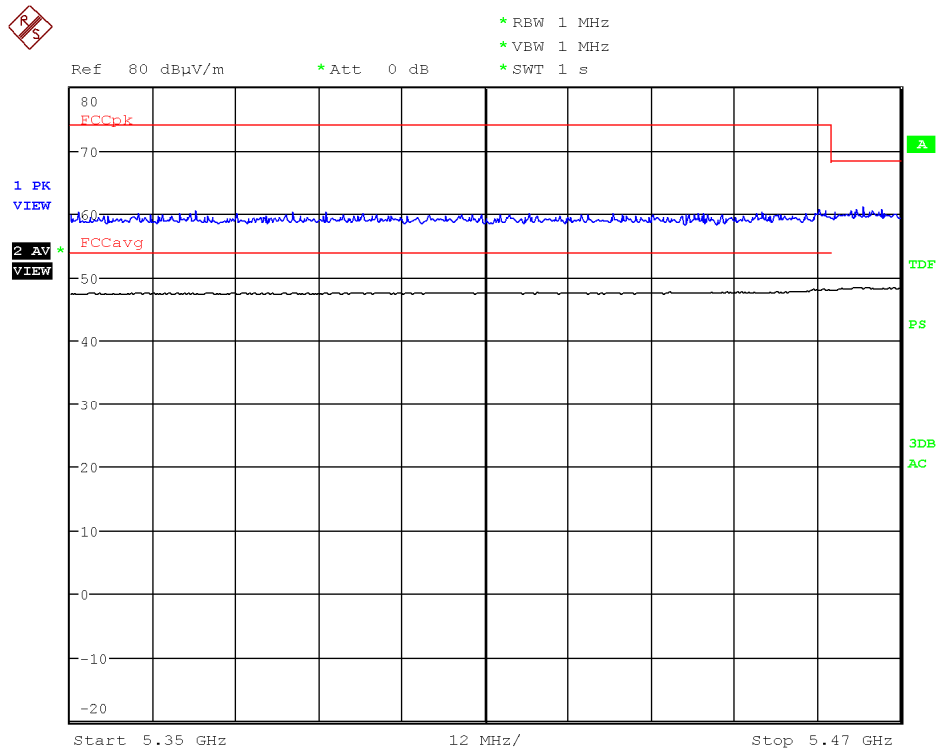
Lowest Channel (102) 5510MHz. Chain B.



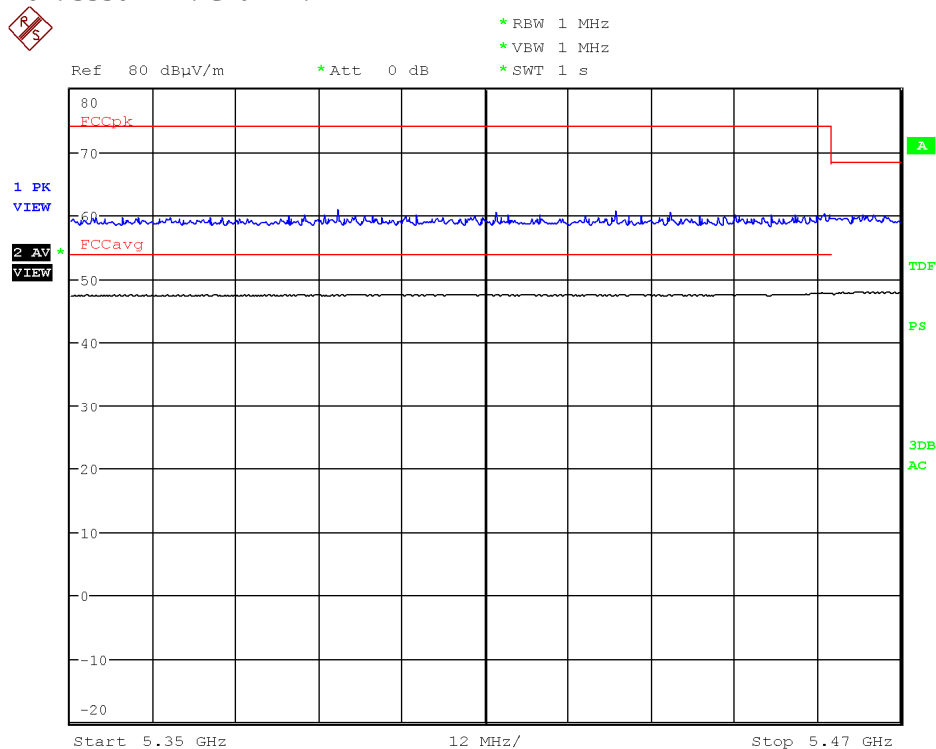
Lowest Channel (102) 5510MHz. Chain A+B.



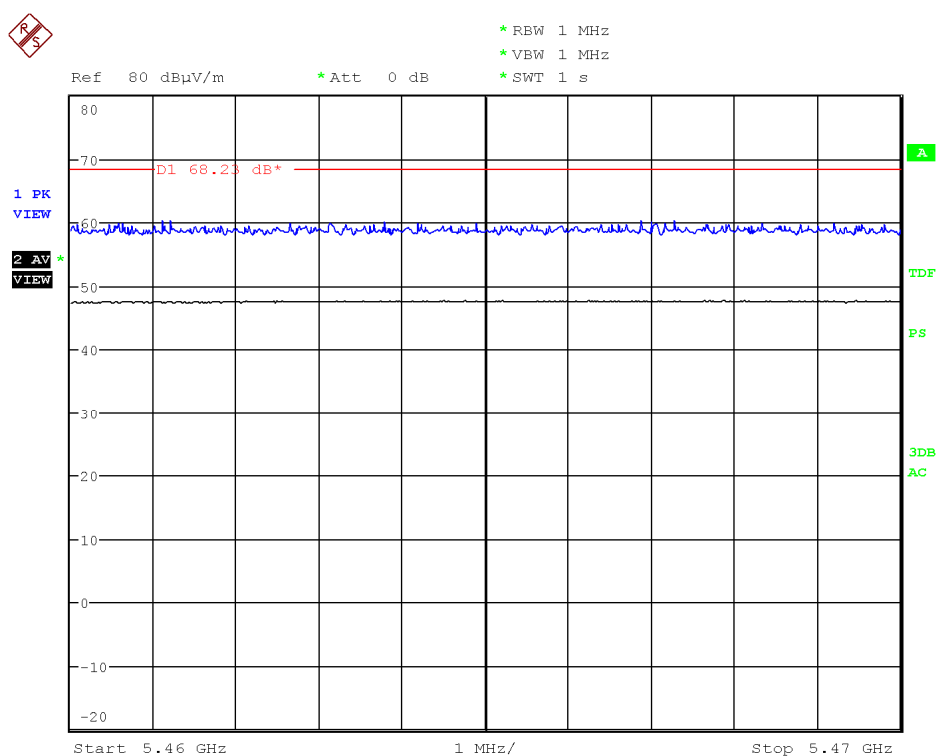
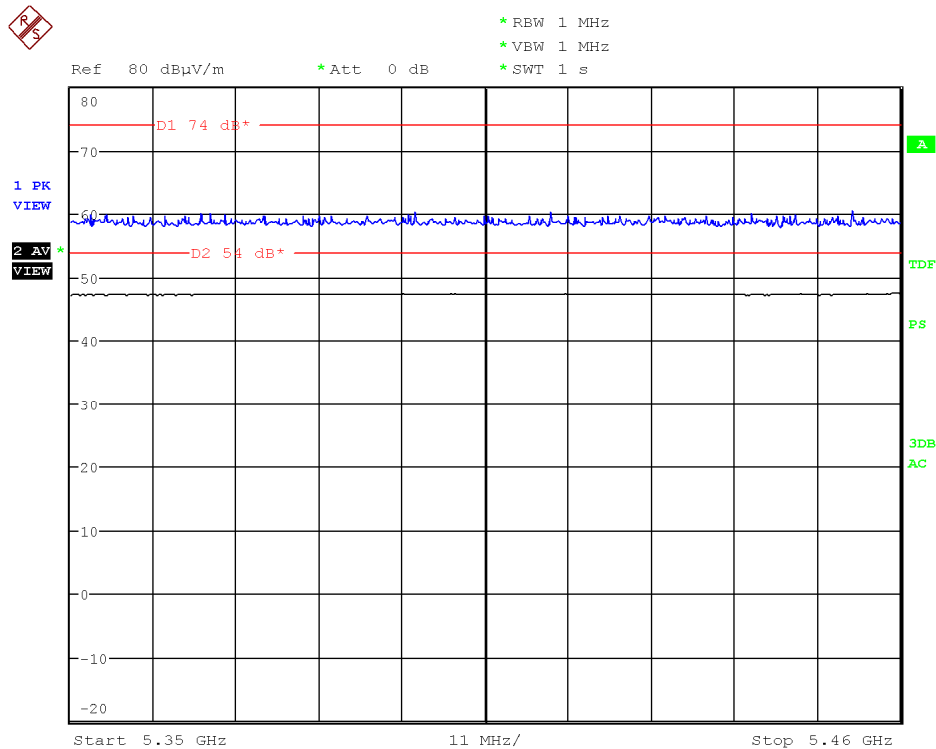
Channel 110F, 5550MHz. Chain A.



Channel 110F, 5550MHz. Chain B.

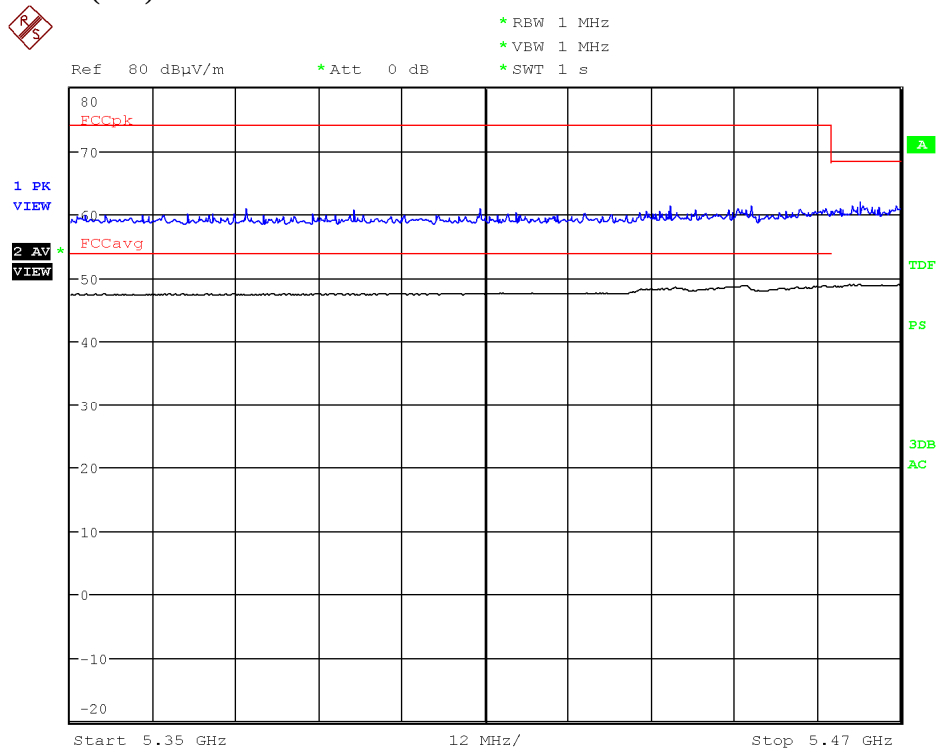


Channel 110F, 5550MHz. Chain A+B.

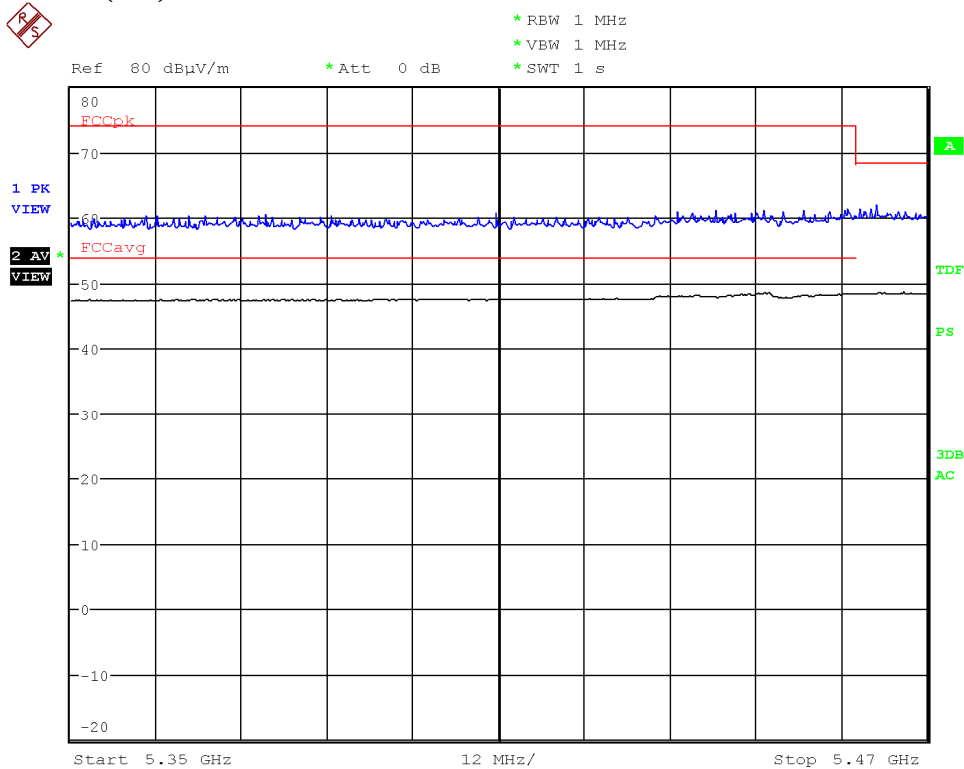


4. WiFi 5GHz 802.11 ac80 mode

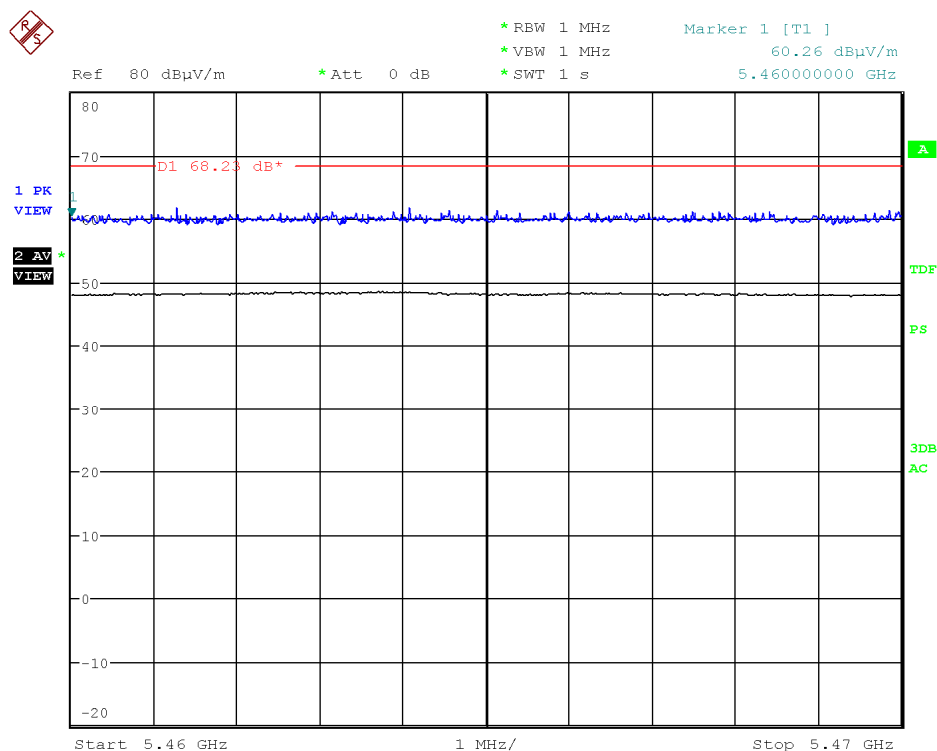
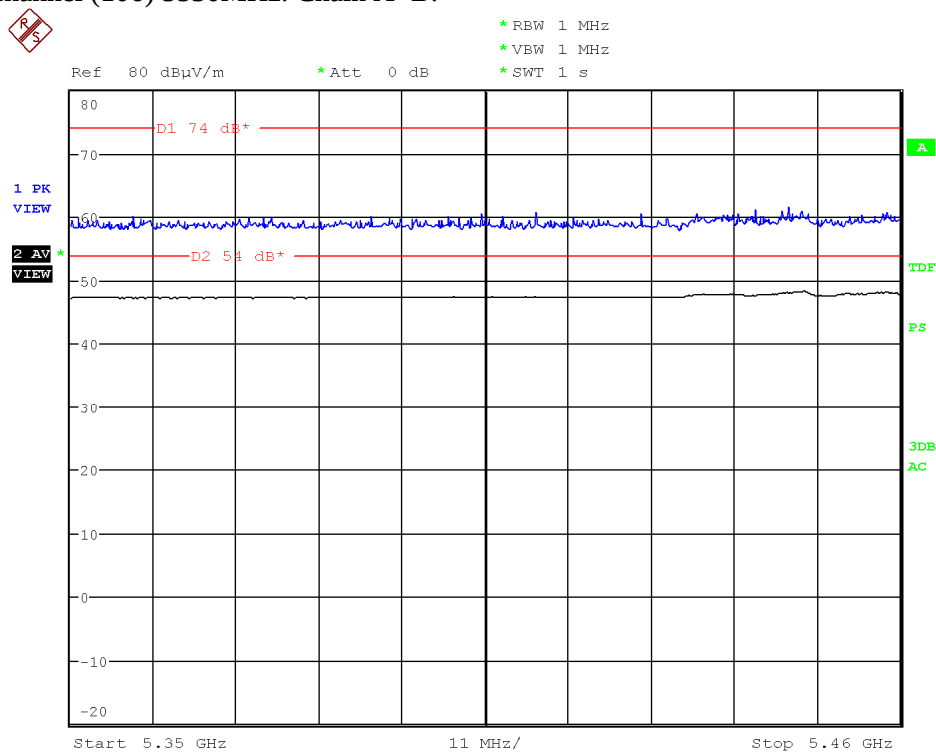
Lowest Channel (106) 5530MHz. Chain A.



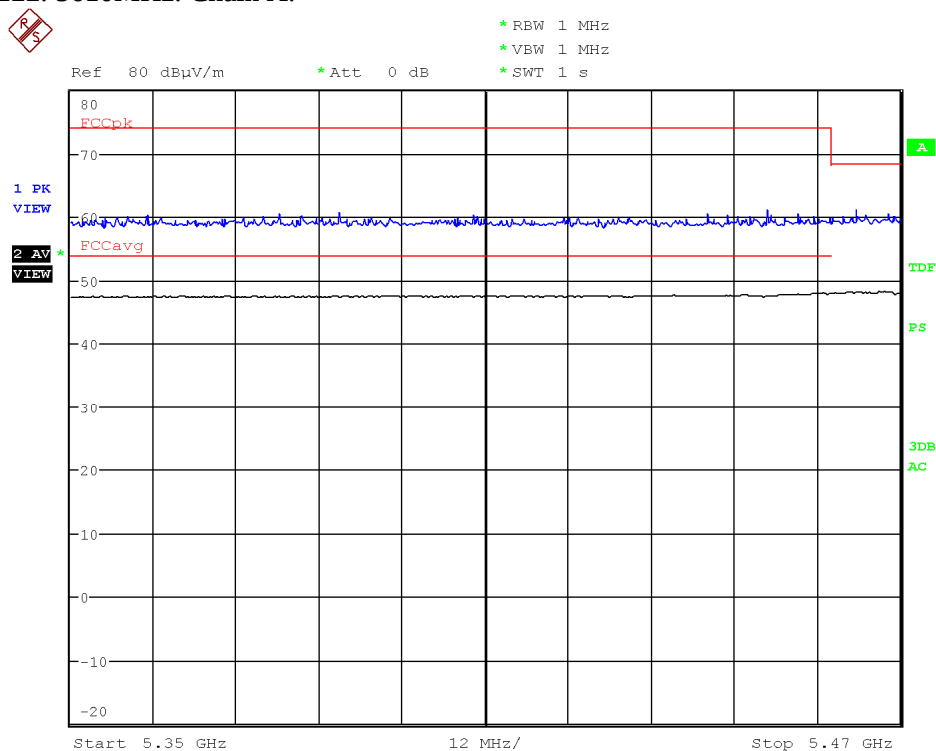
Lowest Channel (106) 5530MHz. Chain B.



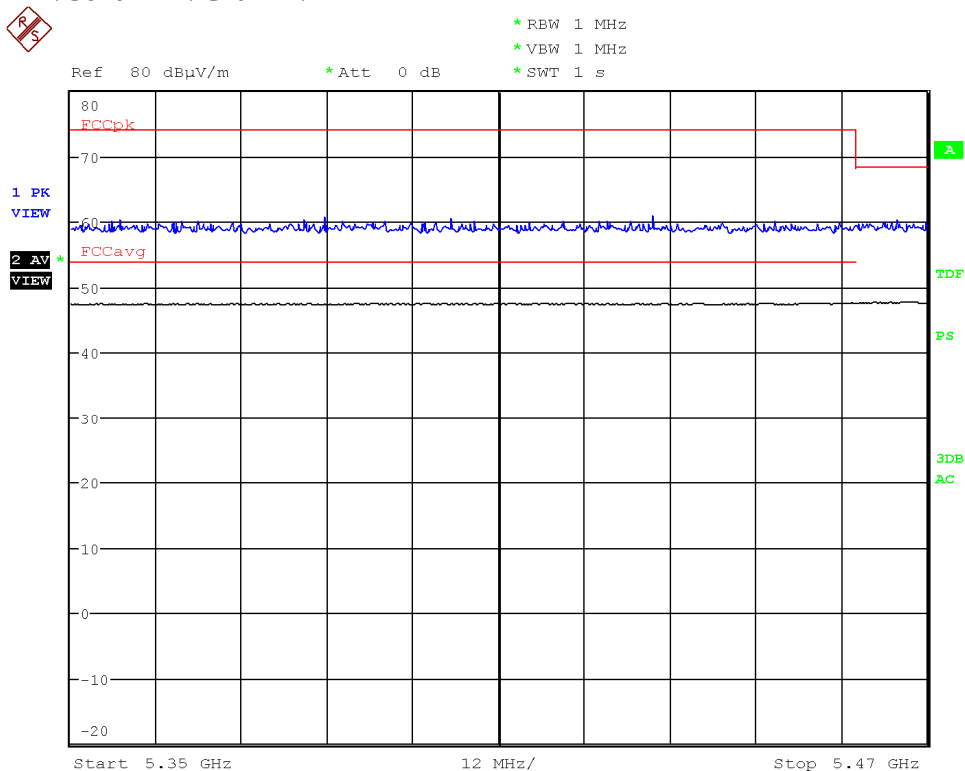
Lowest Channel (106) 5530MHz. Chain A+B.



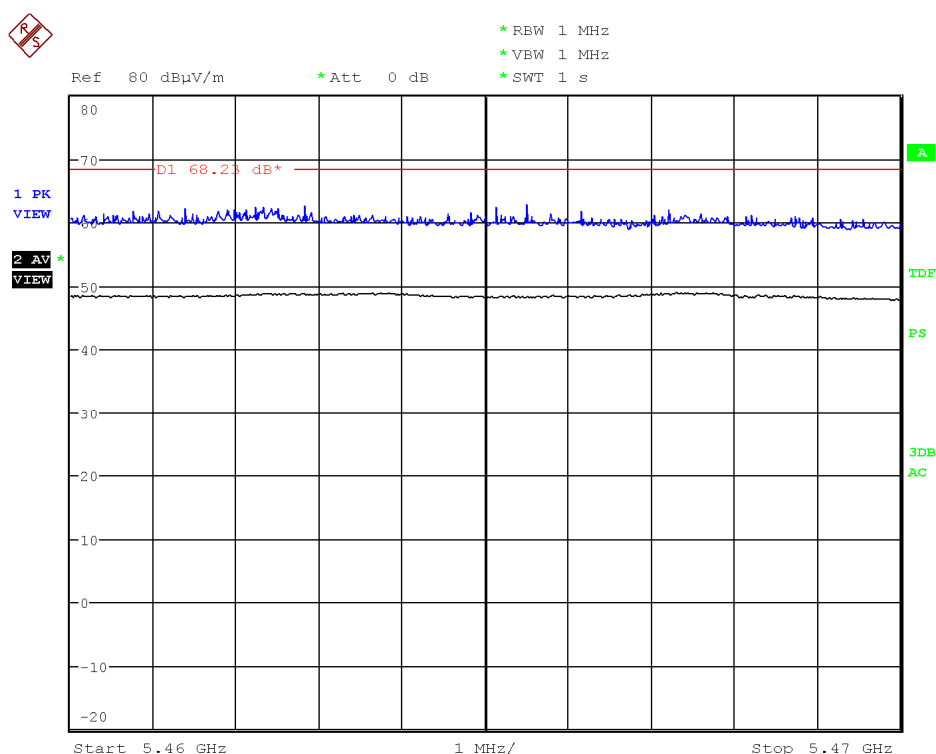
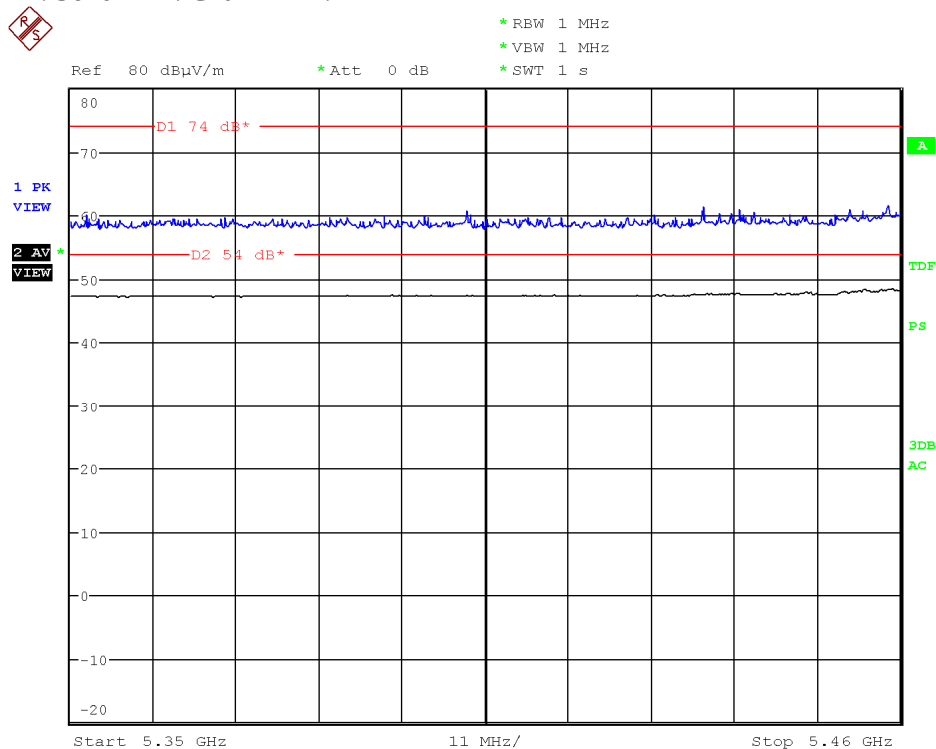
Channel 122. 5610MHz. Chain A.



Channel 122. 5610MHz. Chain B.



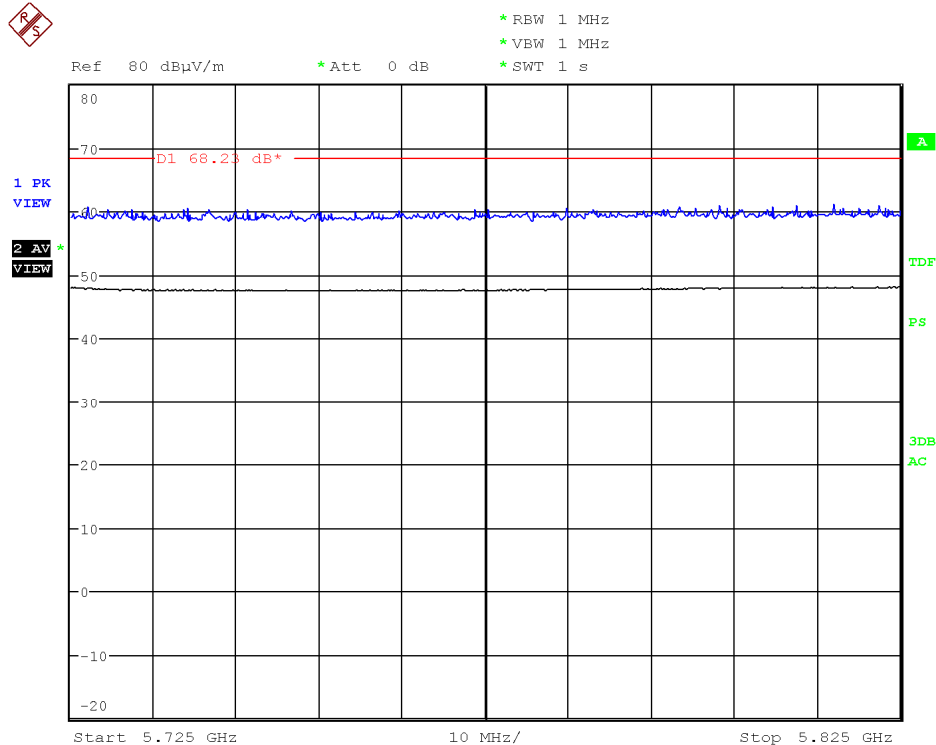
Channel 122. 5610MHz. Chain A+B.



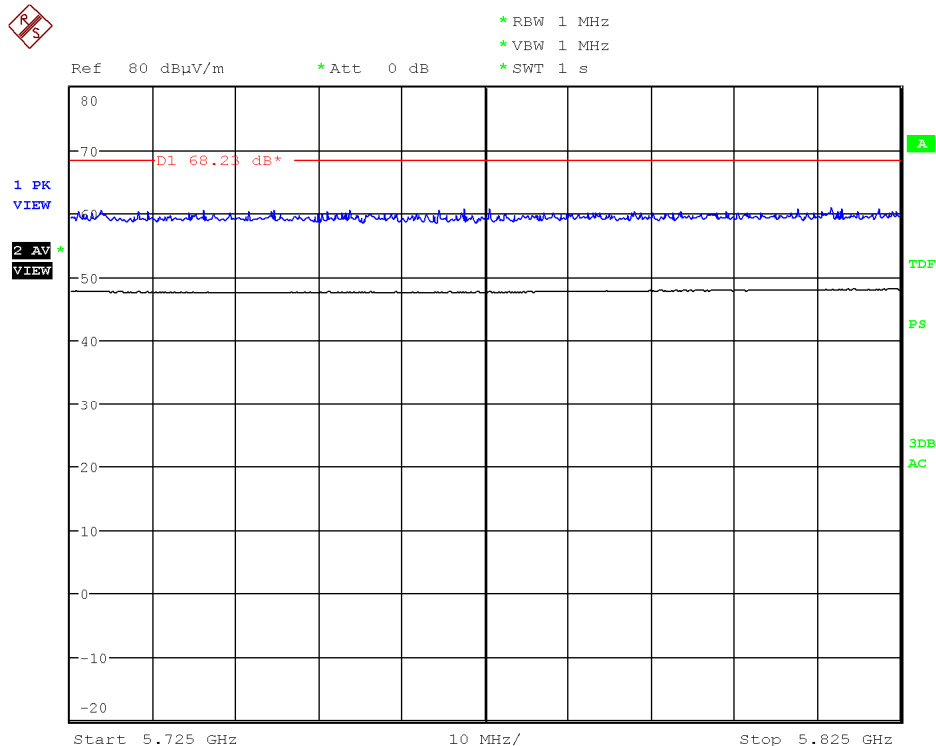
Radiated spurious emissions at band-edges and inside adjacent band 5.725 – 5.825 GHz.

1. WiFi 5GHz 802.11 a mode

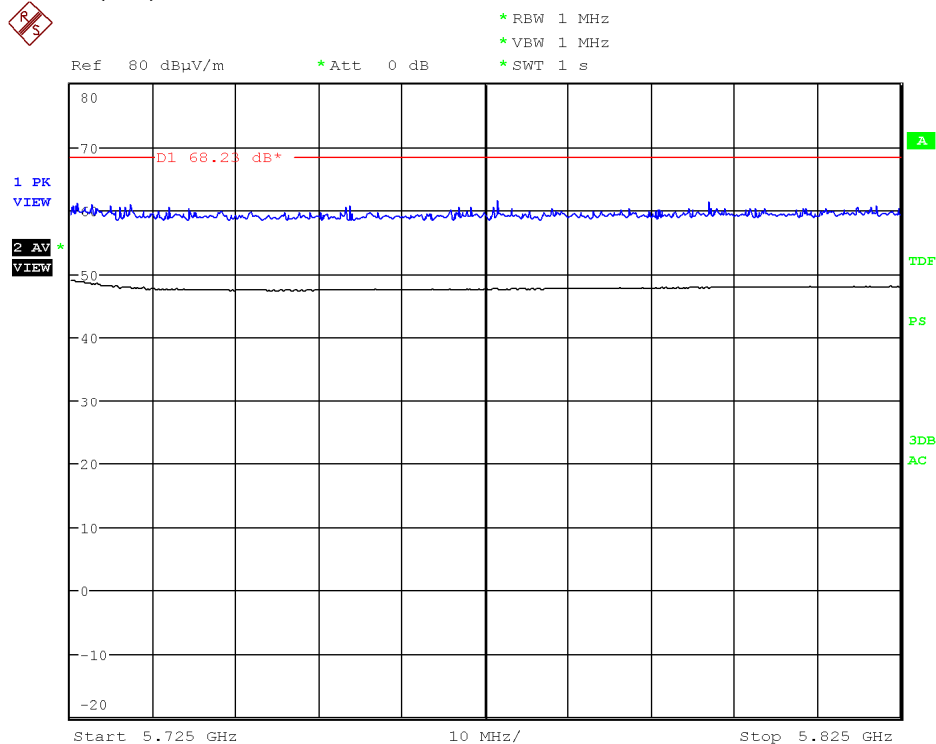
Channel 136. 5680MHz. Chain A.



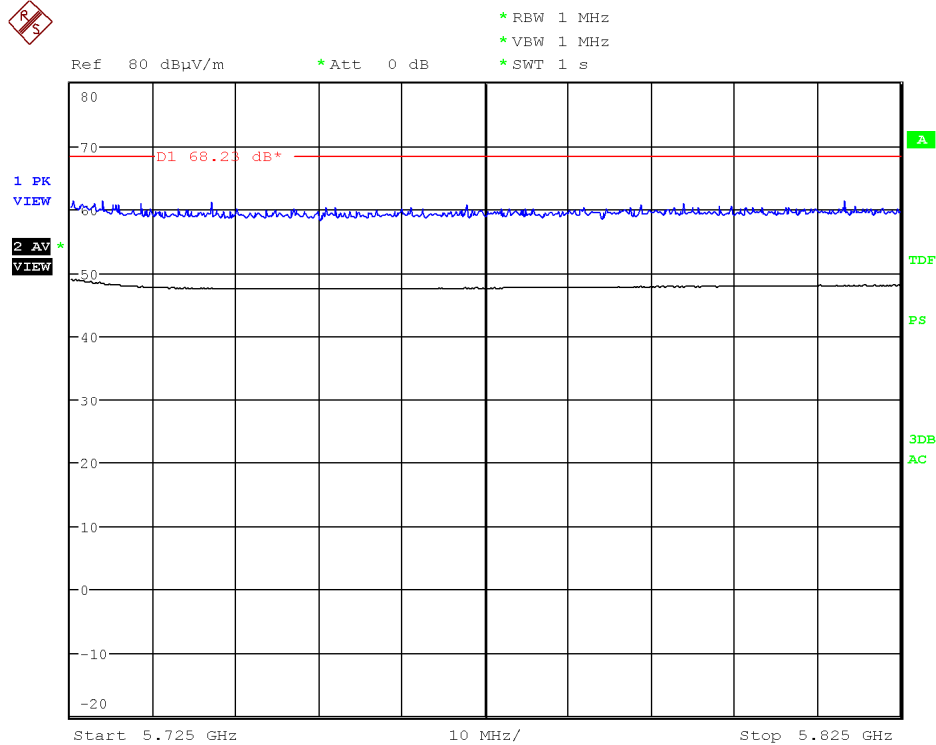
Channel 136. 5680MHz. Chain B.



Highest Channel (140) 5700 MHz. Chain A.

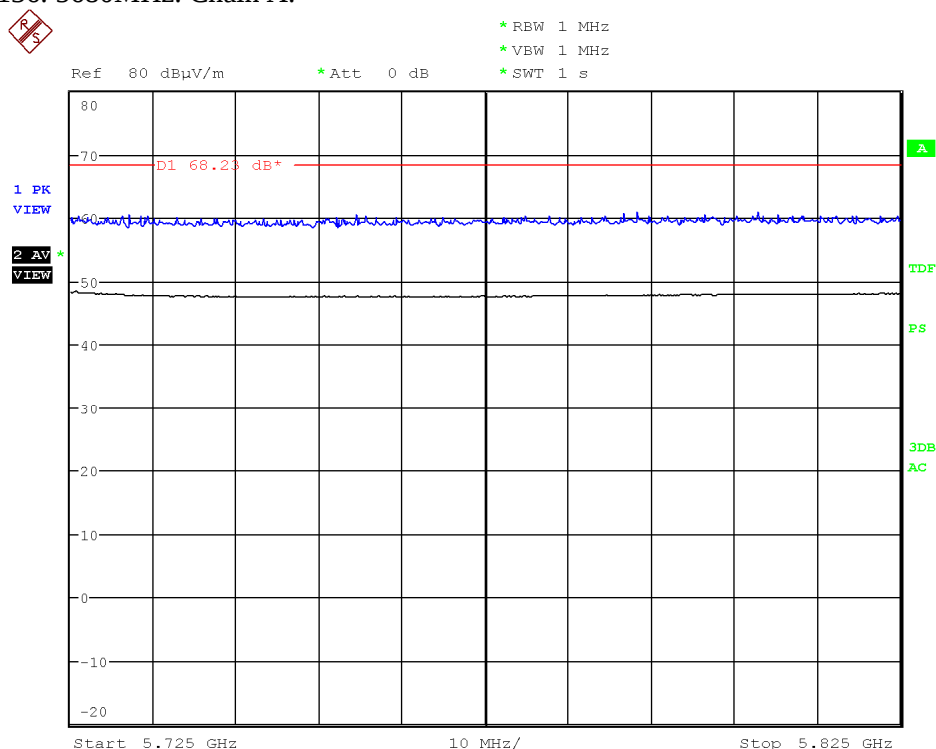


Highest Channel (140) 5700 MHz. Chain B.

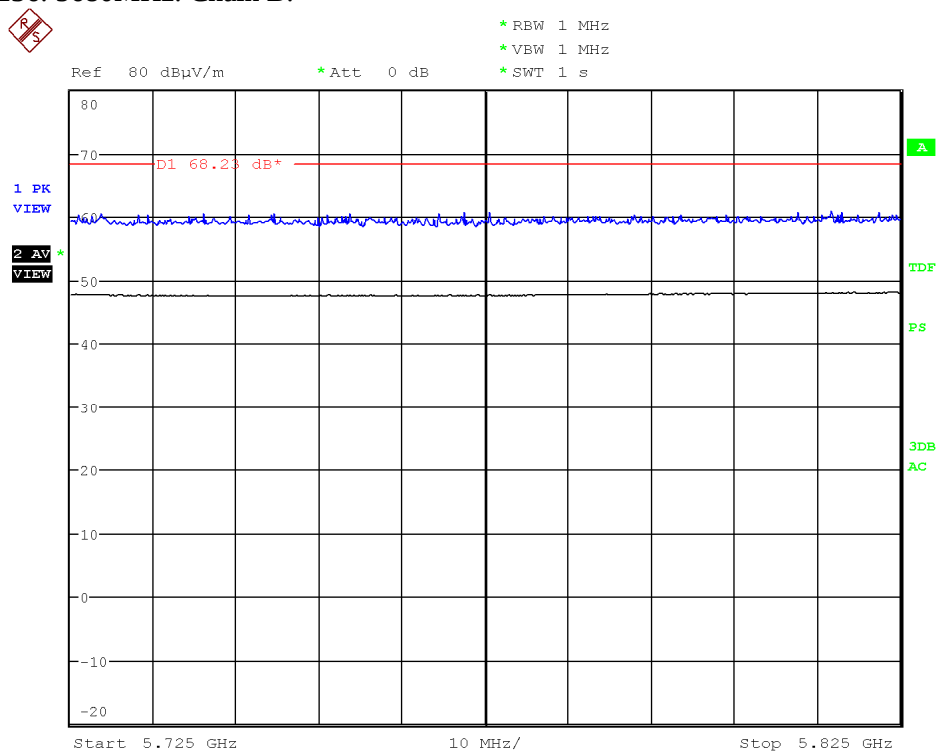


2. WiFi 5GHz 802.11 n20 mode

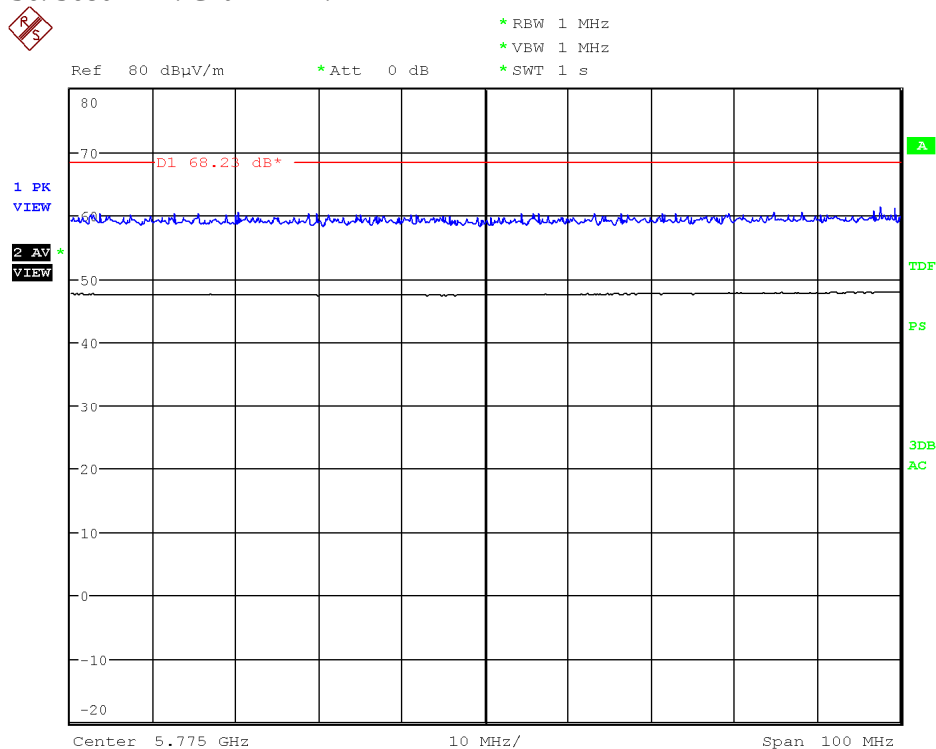
Channel 136. 5680MHz. Chain A.



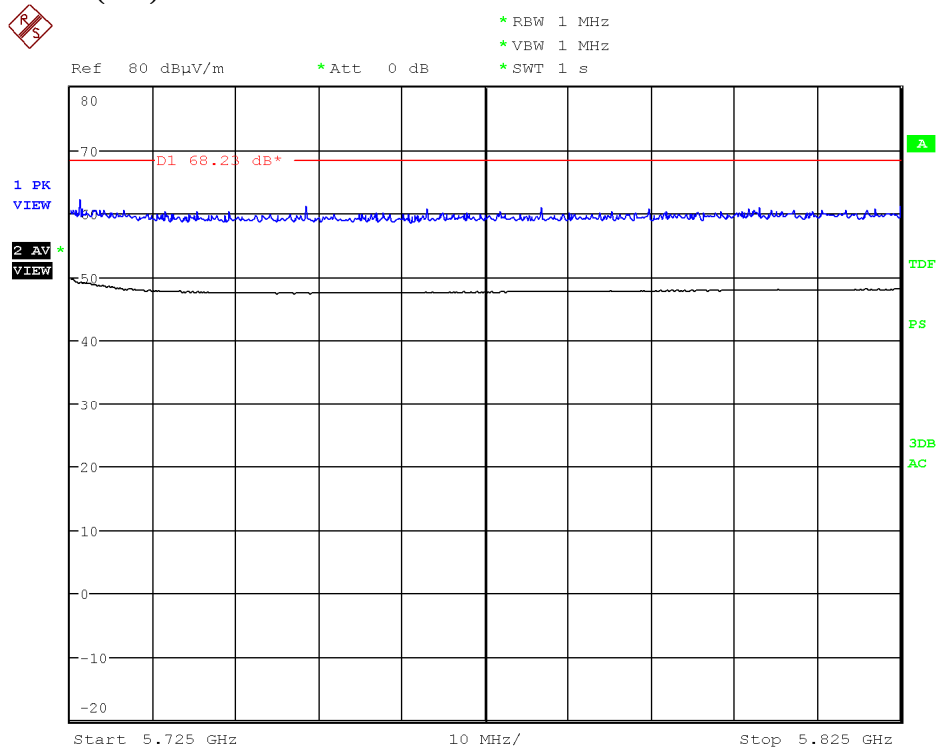
Channel 136. 5680MHz. Chain B.



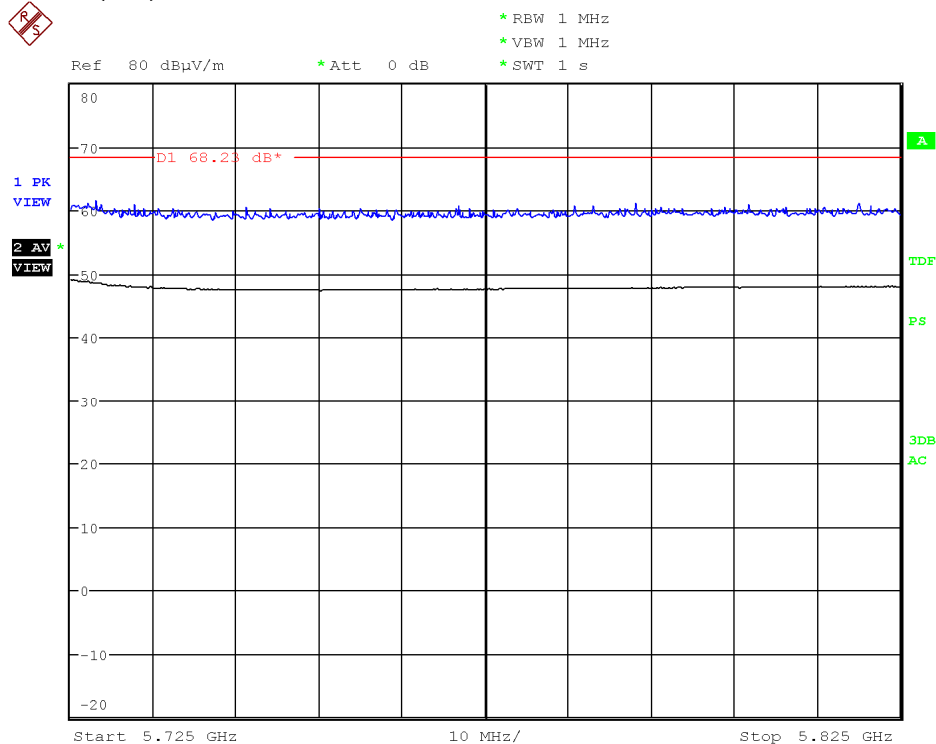
Channel 136. 5680MHz. Chain A+B.



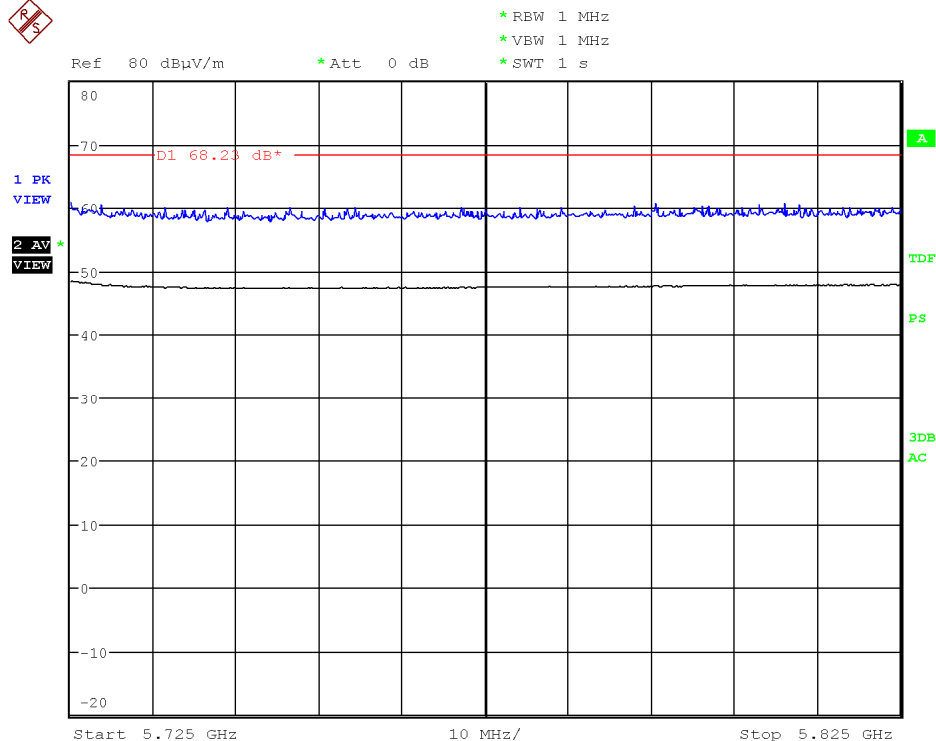
Highest Channel (140) 5700 MHz. Chain A.



Highest Channel (140) 5700 MHz. Chain B.

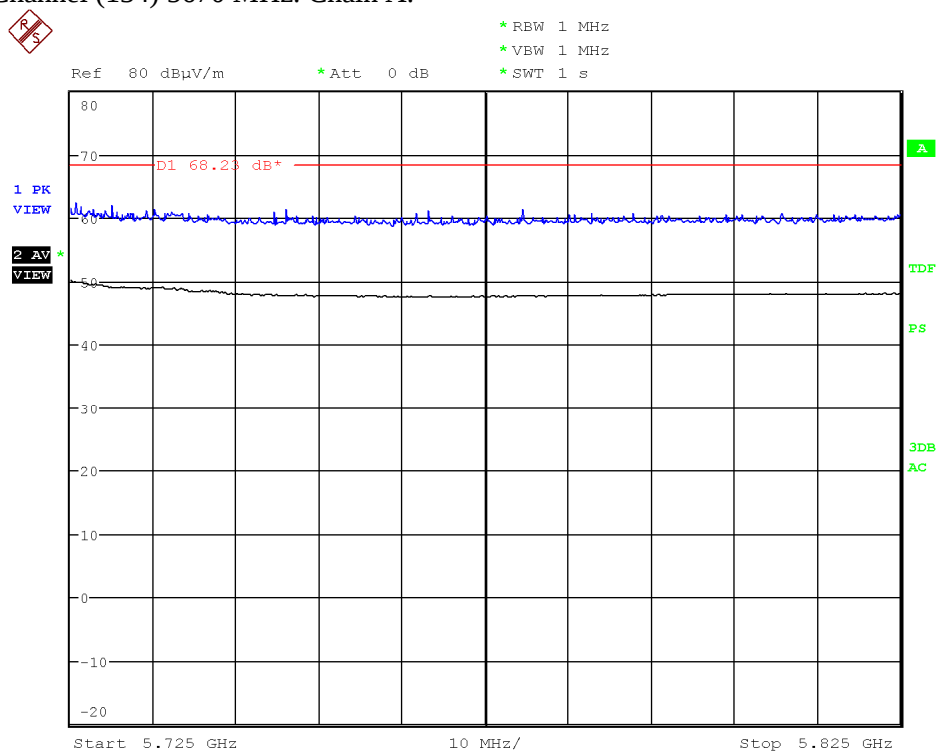


Highest Channel (140) 5700 MHz. Chain A+B.

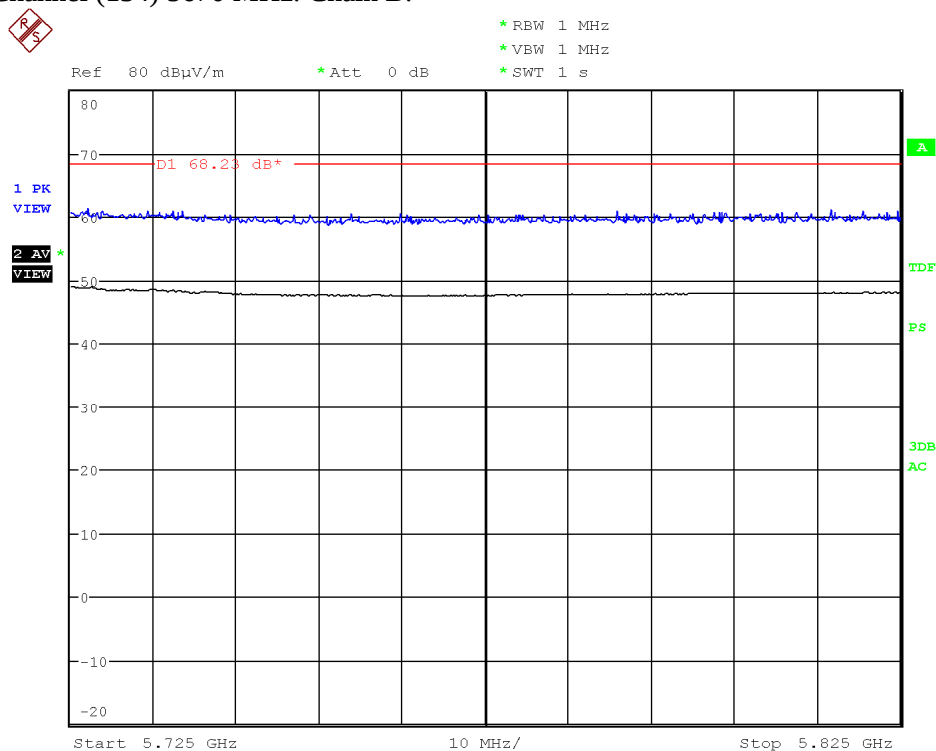


3. WiFi 5GHz 802.11 n40 mode

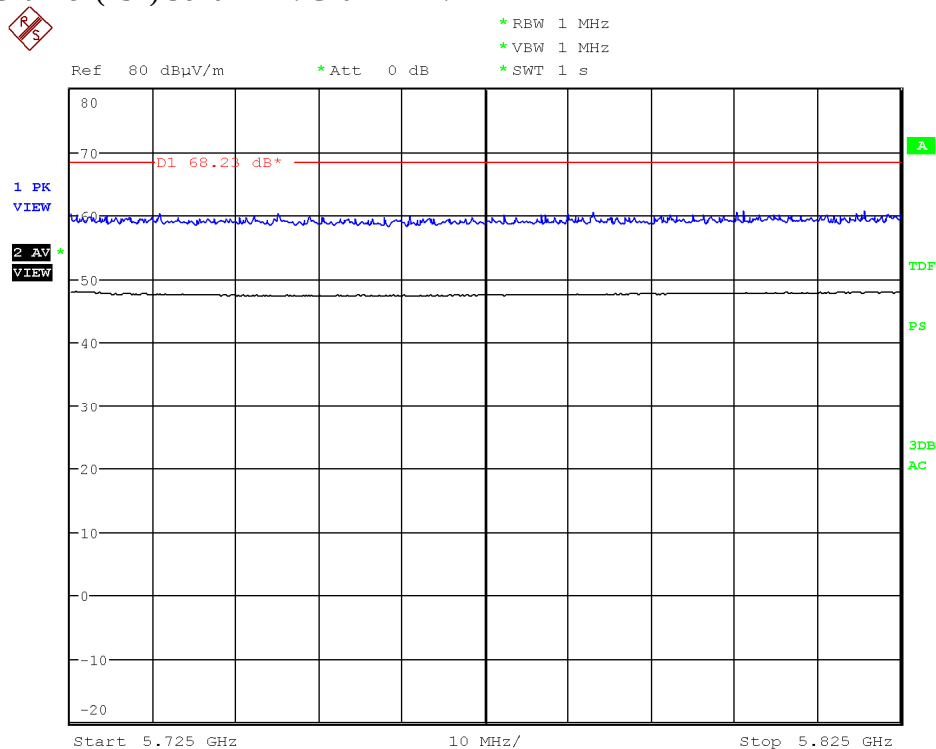
Highest Channel (134) 5670 MHz. Chain A.



Highest Channel (134) 5670 MHz. Chain B.

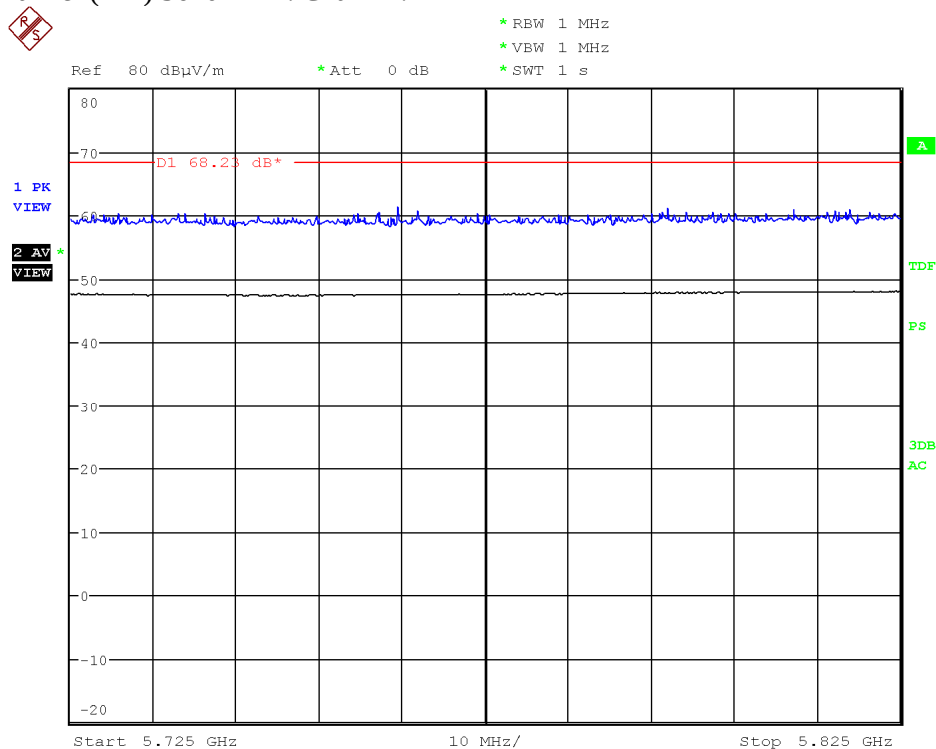


Highest Channel (134) 5670 MHz. Chain A+B.

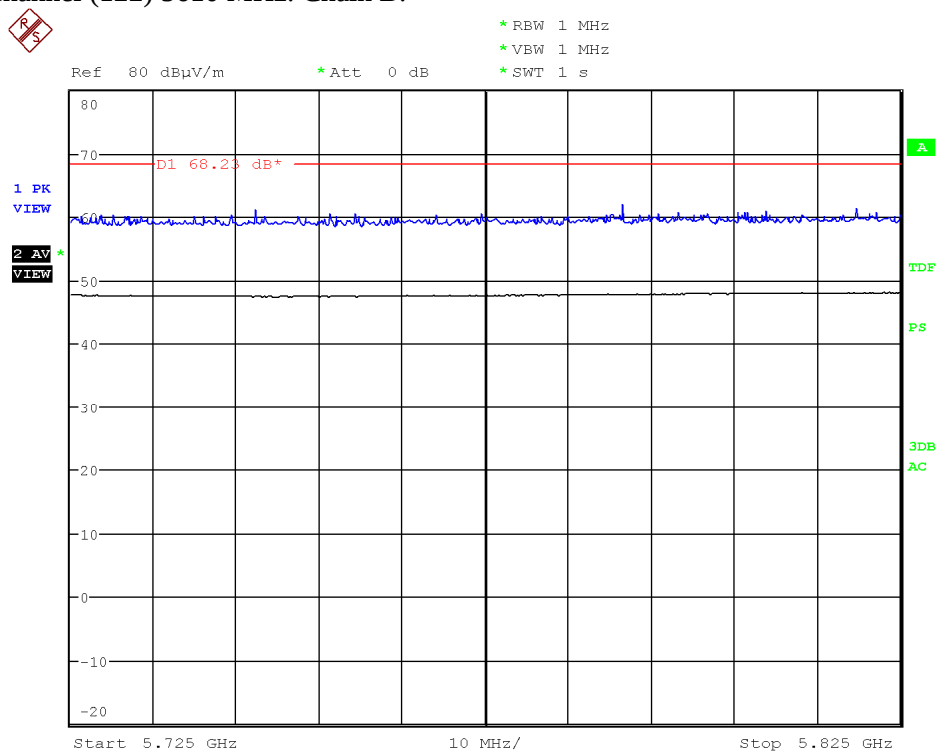


4. WiFi 5GHz 802.11 ac80 mode

Middle Channel (122) 5610 MHz. Chain A.



Middle Channel (122) 5610 MHz. Chain B.



Middle Channel (122) 5610 MHz. Chain A+B.

