

B.5 Radiated spurious emission

Standard references:

FCC part	RSS part	Limits			
15.247 (d)	RSS-247 Clause 5.5	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):			
		Freq Range (MHz)	Field Strength ($\mu\text{V}/\text{m}$)	Field Strength ($\text{dB}\mu\text{V}/\text{m}$)	Meas. 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
		Above 960	500	54	3
		<p>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.</p> <p>For average radiated emission measurements above 1000 MHz, there is also a limit specified when measuring with peak detector function corresponding to 20 dB above the indicated values in the table.</p>			

Test procedure:

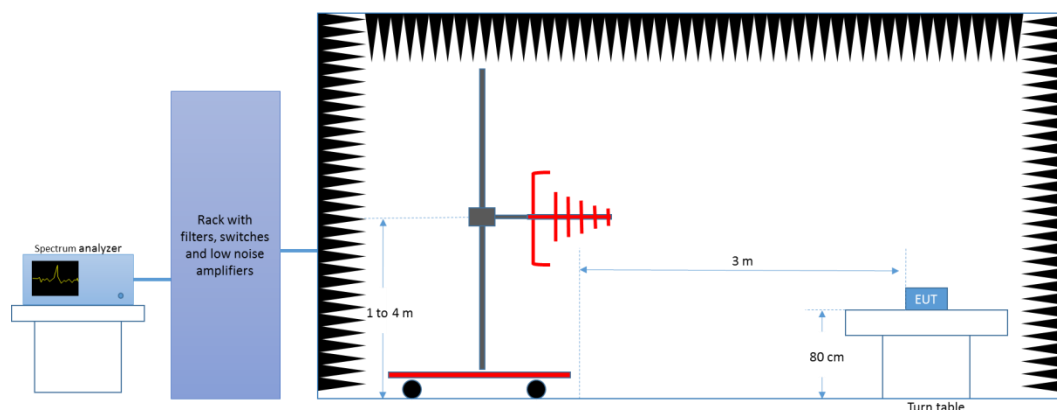
The setups below were used to measure the radiated spurious emissions.

Depending of the frequency range and bands being tested, different antennas and filters were used.

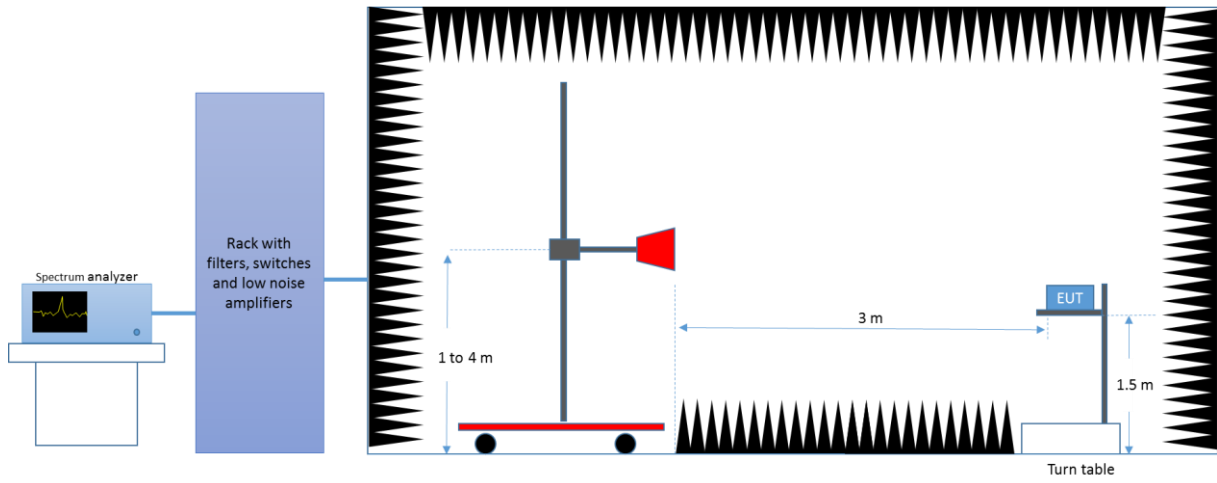
The final measurement is done by varying the antenna height from 1 to 4 meters, the EUT azimuth over 360° and for both Vertical and Horizontal polarizations.

The radiated spurious emissions were measured on the worst case configuration selected from the chapter *B.2 Maximum Output Power and* and using the lowest, middle and highest channels.

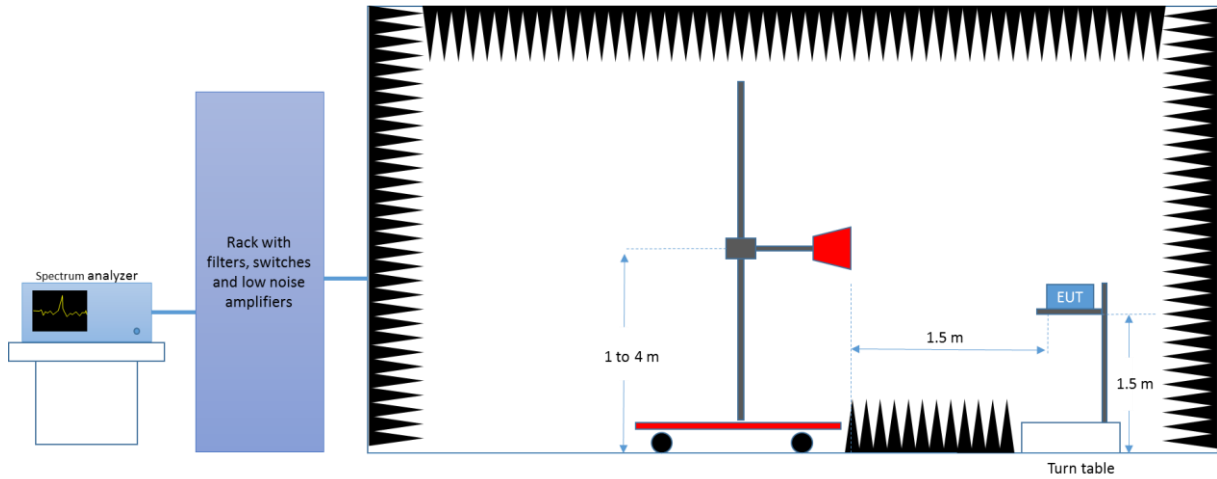
Radiated Setup < 1GHz



Radiated Setup 1GHz - 18GHz



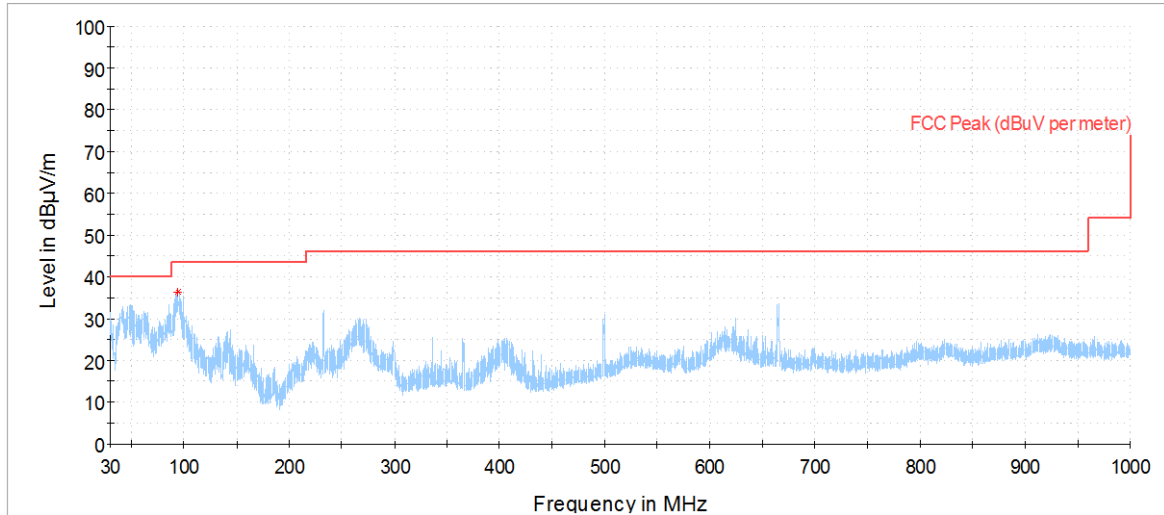
Radiated Setup > 18GHz



Test Results:

Radiated Spurious – 30MHz – 1GHz

Radiated Spurious – All Modes



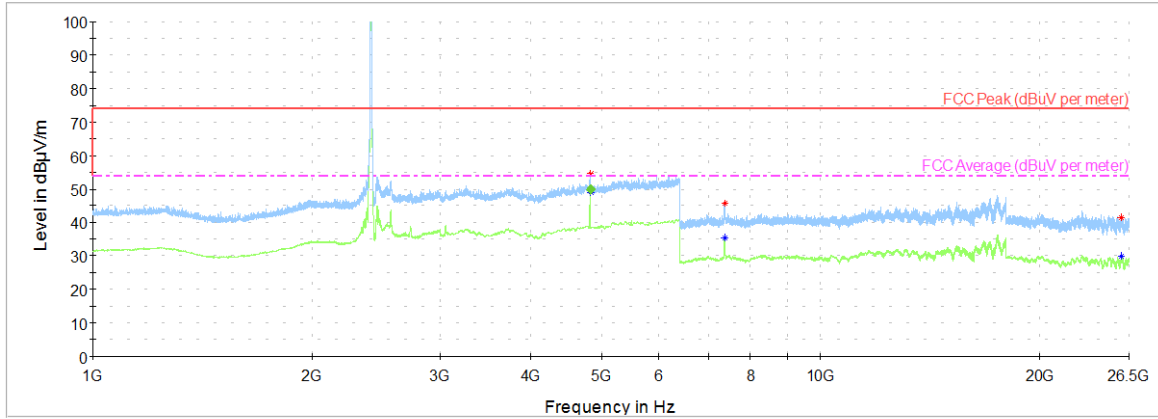
— Peak measurements
 — AVG measurements
 — Limit FCC Peak

Frequency	Max Peak	Limit	Margin
MHz	dBuV/m	dBuV/m	dB
94.87	36.40	43.56	7.15

Note 1: The spurious signals detected do not depend on either the operating channel or the modulation mode.

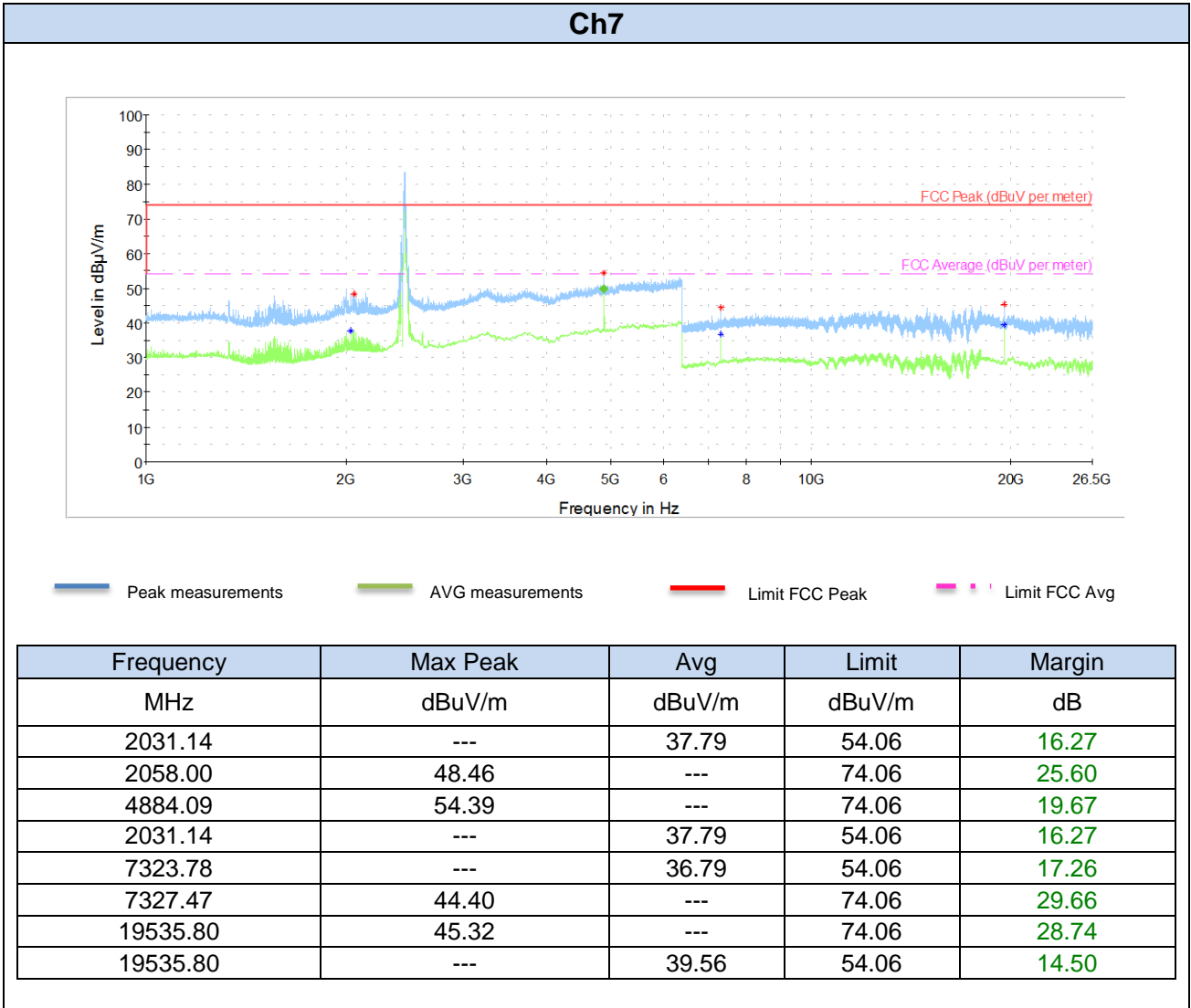
Radiated Spurious – 1 GHz to 26.5GHz 802.11b, 1Mbps, Chain A

Ch1

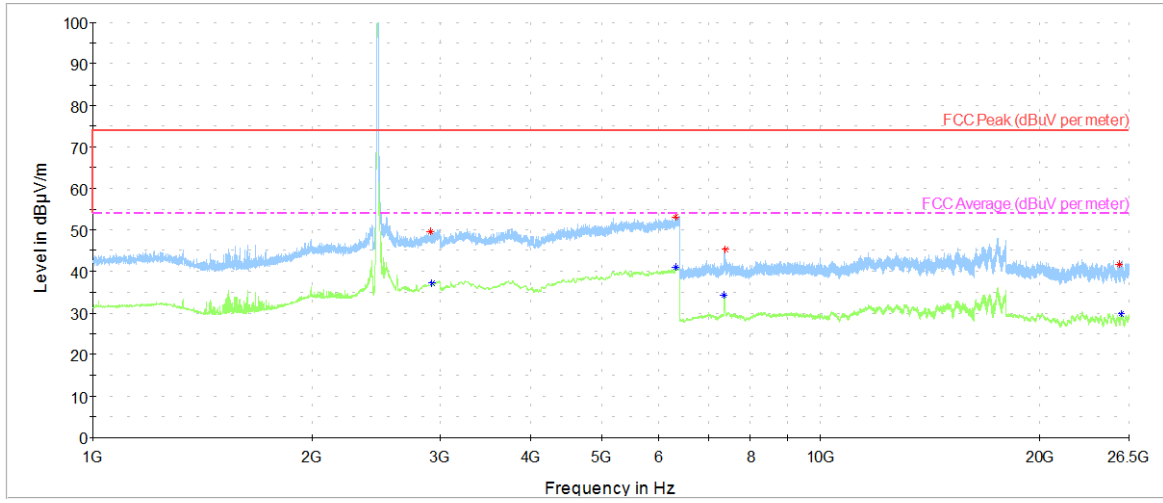


— Peak measurements
 — AVG measurements
 — Limit FCC Peak
 - - - Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
4823.86	54.54	---	74.06	19.52
4823.86	---	48.99	54.06	5.07
7388.11	---	35.32	54.06	18.74
7388.11	45.67	---	74.06	28.38
25872.55	---	29.79	54.06	24.26
25888.39	41.46	---	74.06	32.59



Ch11

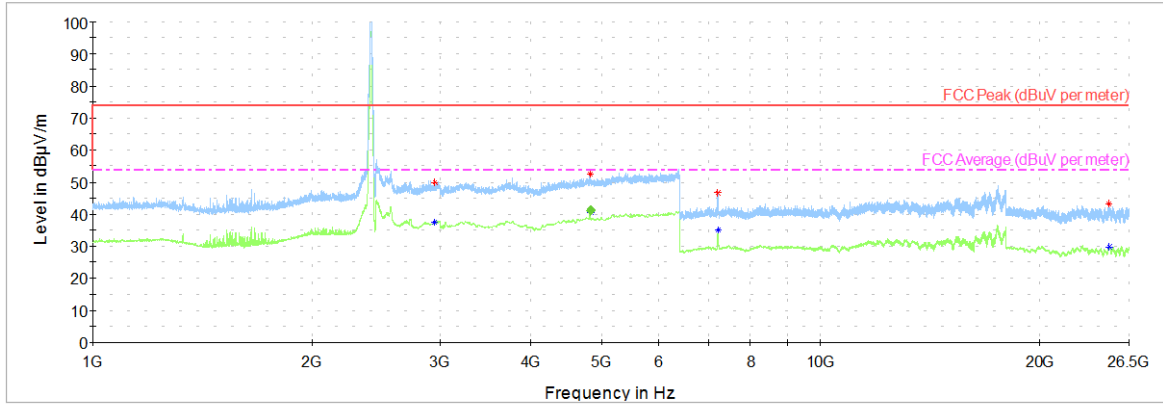


— Peak measurements
 — AVG measurements
 - - - Limit FCC Peak
 - - - Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
2914.00	49.62	---	74.06	24.44
2923.14	---	37.14	54.06	16.92
6323.74	---	40.98	54.06	13.08
6329.57	53.17	---	74.06	20.89
7382.31	---	34.23	54.06	19.82
7389.16	45.29	---	74.06	28.76
25712.20	41.59	---	74.06	32.47
25879.11	---	29.69	54.06	24.37

Radiated Spurious – 1 GHz to 26.5GHz 802.11g, 6Mbps, Chain A

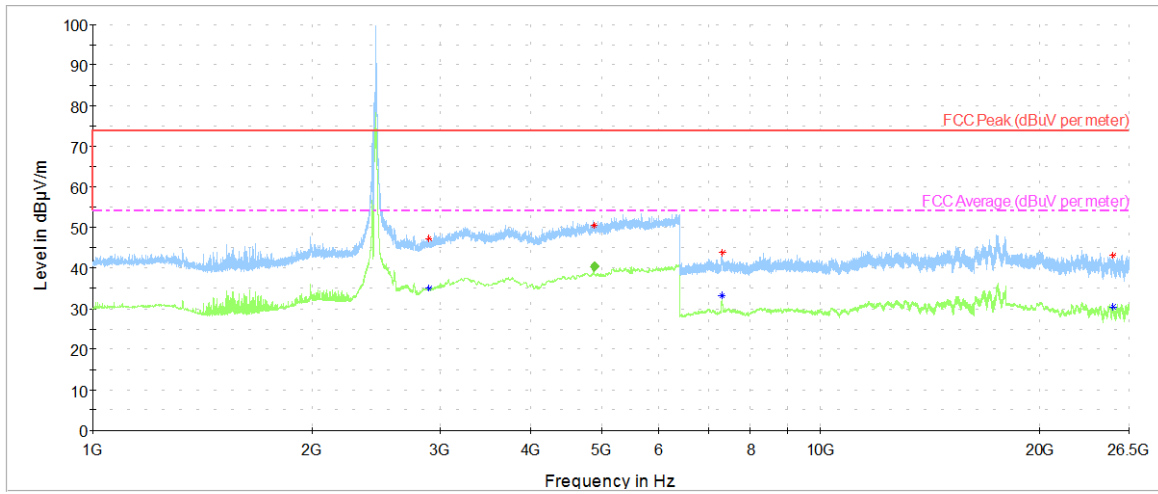
Ch1



— Peak measurements
 — AVG measurements
 — Limit FCC Peak
 - - - Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
2952.00	49.97	---	74.06	24.09
2952.57	---	37.30	54.06	16.76
4826.77	---	40.65	54.06	13.40
4829.20	52.50	---	74.06	21.55
7228.35	46.57	---	74.06	27.49
7234.15	---	34.87	54.06	19.19
24932.14	43.13	---	74.06	30.92
24941.41	---	29.81	54.06	24.25

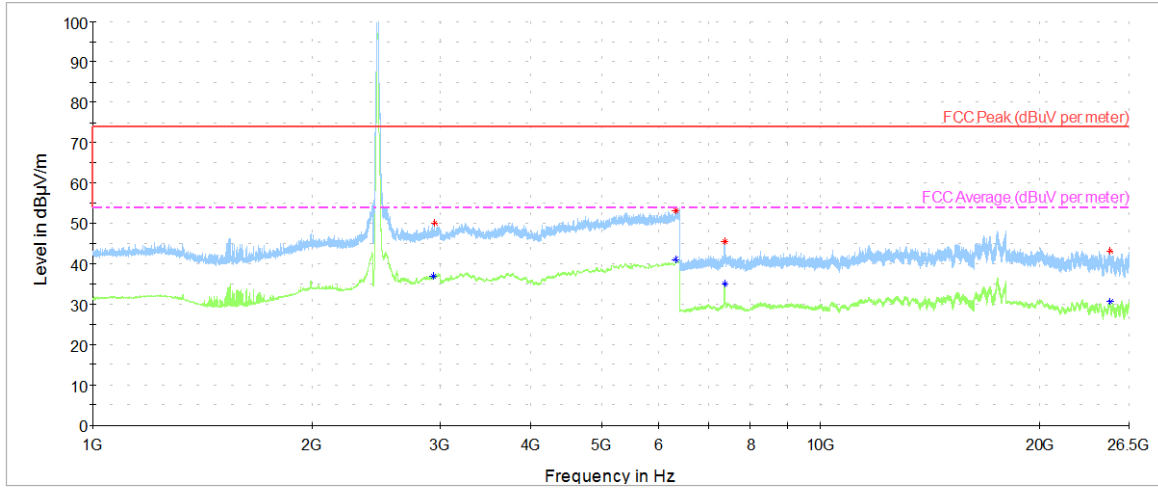
Ch7



— Peak measurements
 — AVG measurements
 — Limit FCC Peak
 - - - Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
2895.43	47.29	---	74.06	26.77
2900.86	---	35.00	54.06	19.06
4882.63	50.49	---	74.06	23.57
4883.11	---	40.32	54.06	13.73
7323.78	---	33.11	54.06	20.95
7327.47	43.69	---	74.06	30.37
25177.09	---	30.46	54.06	23.60
25225.00	43.03	---	74.06	31.02

Ch11

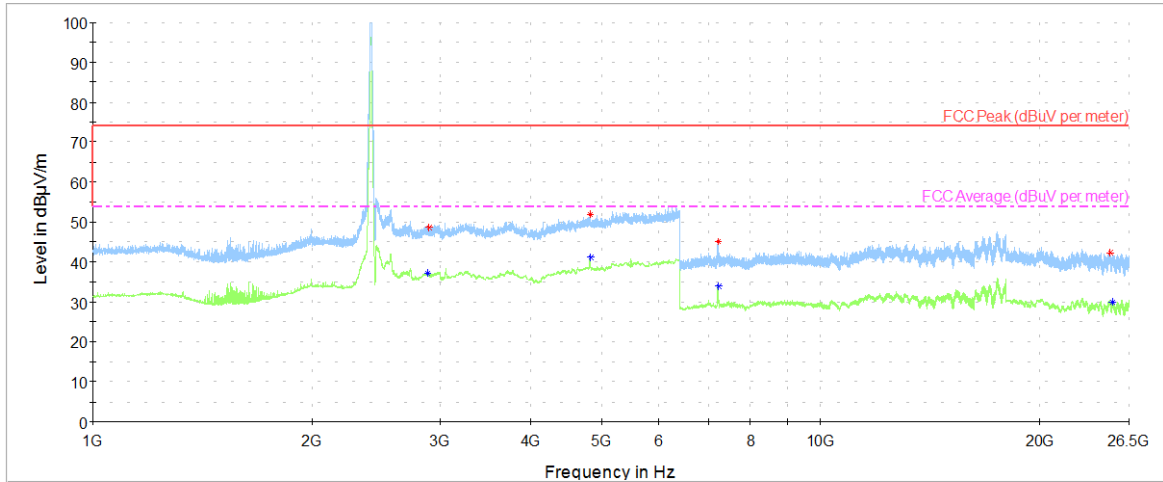


— Peak measurements
 — AVG measurements
 — Limit FCC Peak
 - - - Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
2944.57	---	36.90	54.06	17.15
2947.71	50.06	---	74.06	24.00
6324.23	---	41.04	54.06	13.02
6326.17	53.07	---	74.06	20.99
7385.47	---	35.07	54.06	18.98
7387.05	45.57	---	74.06	28.49
24947.59	---	30.58	54.06	23.48
25006.32	43.07	---	74.06	30.99

Radiated Spurious – 1 GHz to 26.5GHz 802.11n20, HT0, Chain A

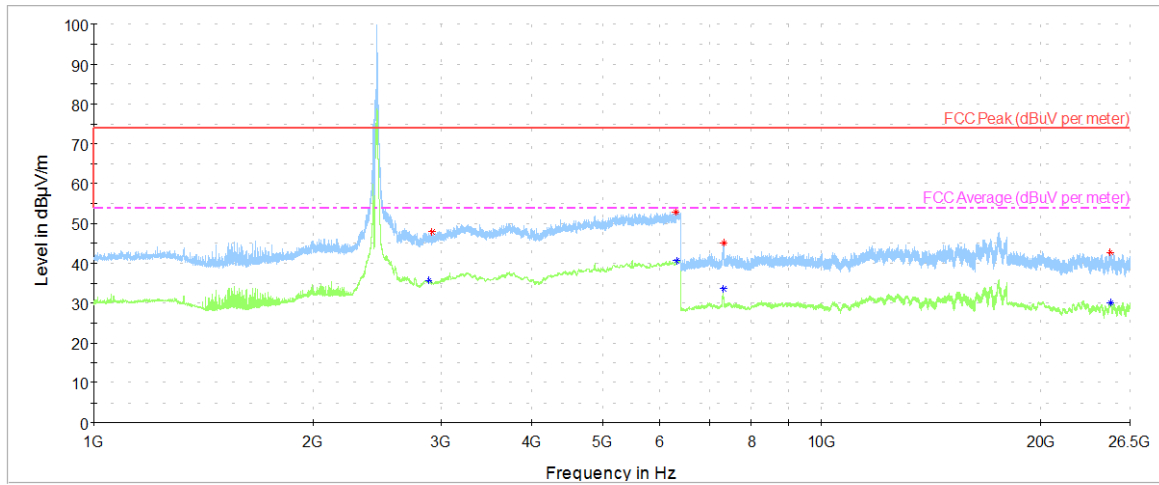
Ch1



— Peak measurements
 — AVG measurements
 — Limit FCC Peak
 - - - Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
2892.29	---	37.08	54.06	16.98
2894.00	48.63	---	74.06	25.43
4824.34	---	41.01	54.06	13.05
4831.14	51.91	---	74.06	22.15
7232.04	45.05	---	74.06	29.01
7235.73	---	33.95	54.06	20.11
25006.70	42.29	---	74.06	31.76
25179.41	---	29.79	54.06	24.27

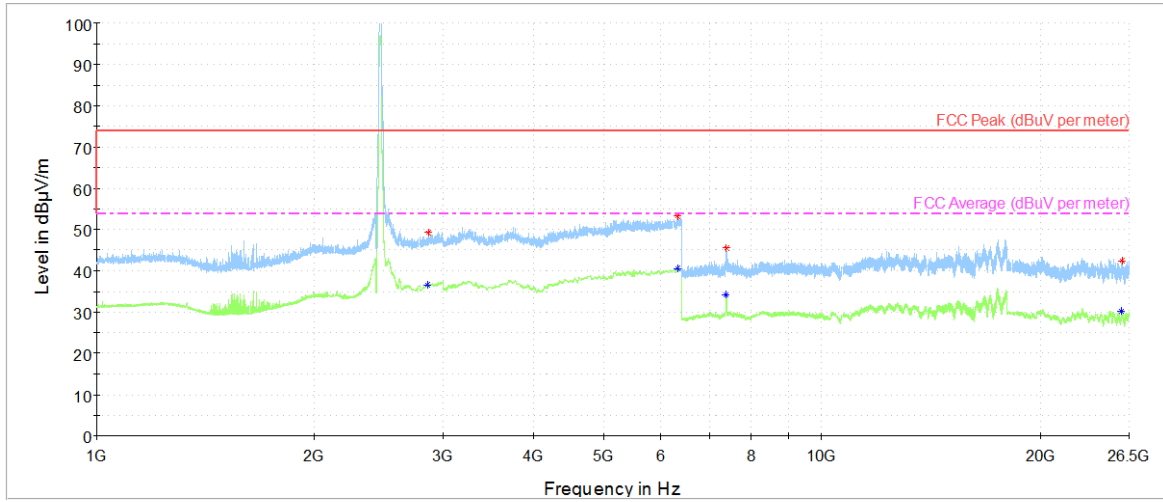
Ch7



— Peak measurements
 — AVG measurements
 — Limit FCC Peak
 - - - Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
2890.29	---	35.57	54.06	18.49
2914.29	47.85	---	74.06	26.21
6296.54	52.84	---	74.06	21.21
6322.29	---	40.68	54.06	13.38
7326.42	---	33.61	54.06	20.44
7339.60	44.96	---	74.06	29.10
24919.00	42.74	---	74.06	31.32
24953.77	---	30.16	54.06	23.89

Ch11

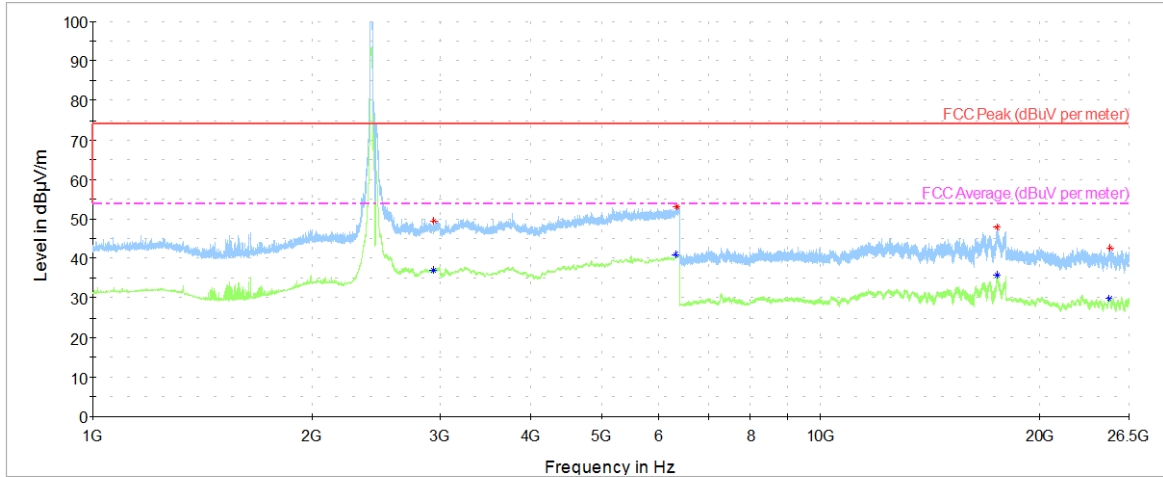


— Peak measurements
 — AVG measurements
 — Limit FCC Peak
 - - - Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
2859.43	---	36.66	54.06	17.39
2865.14	49.18	---	74.06	24.88
6315.00	53.21	---	74.06	20.85
6315.97	---	40.60	54.06	13.45
7380.73	45.57	---	74.06	28.48
7381.78	---	34.10	54.06	19.96
25892.64	---	30.22	54.06	23.84
25939.39	42.53	---	74.06	31.53

Radiated Spurious – 1 GHz to 26.5GHz 802.11n40, HT0, Chain A

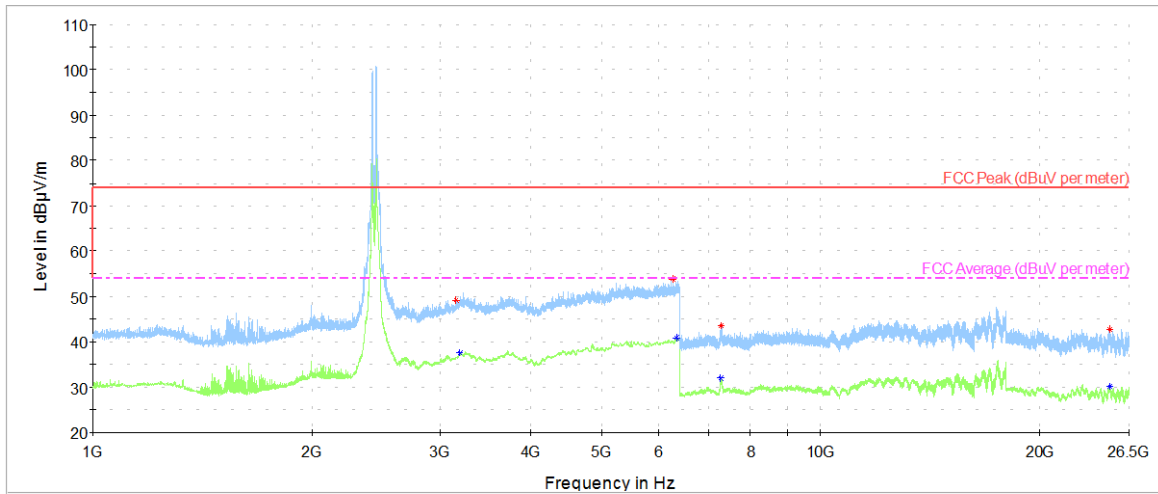
Ch3F



— Peak measurements
 — AVG measurements
 - - - Limit FCC Peak
 - - - Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
2937.43	49.55	---	74.06	24.51
2939.71	---	37.08	54.06	16.97
6328.60	---	40.94	54.06	13.11
6342.69	53.02	---	74.06	21.03
17476.42	47.98	---	74.06	26.08
17490.65	---	35.89	54.06	18.17
24941.80	---	29.96	54.06	24.10
24990.86	42.61	---	74.06	31.44

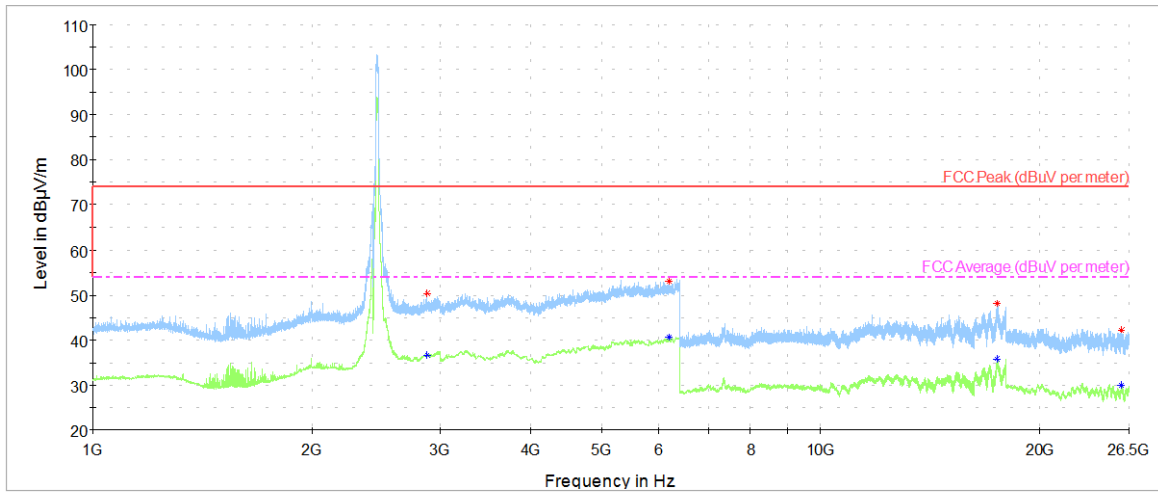
Ch7F



█ Peak measurements
 █ AVG measurements
 █ Limit FCC Peak
 - - - Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
3159.80	49.19	---	74.06	24.86
3196.23	---	37.45	54.06	16.61
6263.51	53.88	---	74.06	20.17
6332.00	---	40.86	54.06	13.20
7291.62	---	31.90	54.06	22.16
7310.07	43.45	---	74.06	30.60
24950.30	42.61	---	74.06	31.45
24951.07	---	30.03	54.06	24.03

Ch9F



— Peak measurements
 — AVG measurements
 — Limit FCC Peak
 - - - Limit FCC Avg

Frequency	Max Peak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
2879.714286	50.40	---	74.06	23.65
2881.142857	---	36.66	54.06	17.39
6185.314286	---	40.55	54.06	13.50
6196.000000	53.11	---	74.06	20.95
17480.636364	---	35.77	54.06	18.29
17487.490909	48.07	---	74.06	25.99
25898.818182	---	30.04	54.06	24.02
25910.022727	42.33	---	74.06	31.73

Annex C. Test Results - 802.11a/n/ac 5.8 GHz

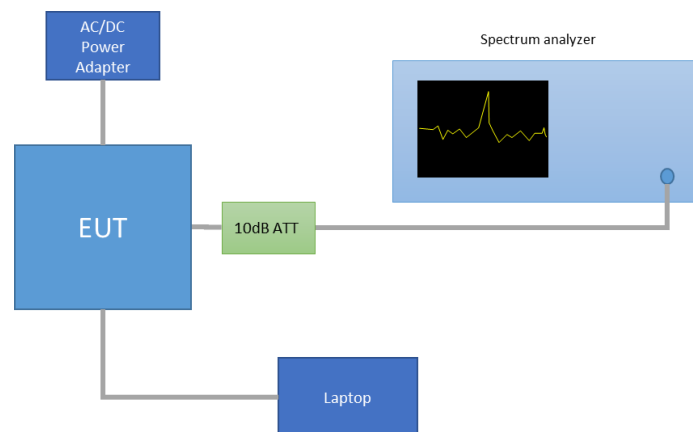
C.1 6dB & 99% Bandwidth

Test limits:

FCC part	RSS part	Limits
15.247 (a) (2)	RSS-247 Clause 5.2 (1)	Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test procedure:

The setup below was used to measure the 6dB & 99% Bandwidth. The antenna terminal of the EUT is connected to the spectrum analyzer through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.

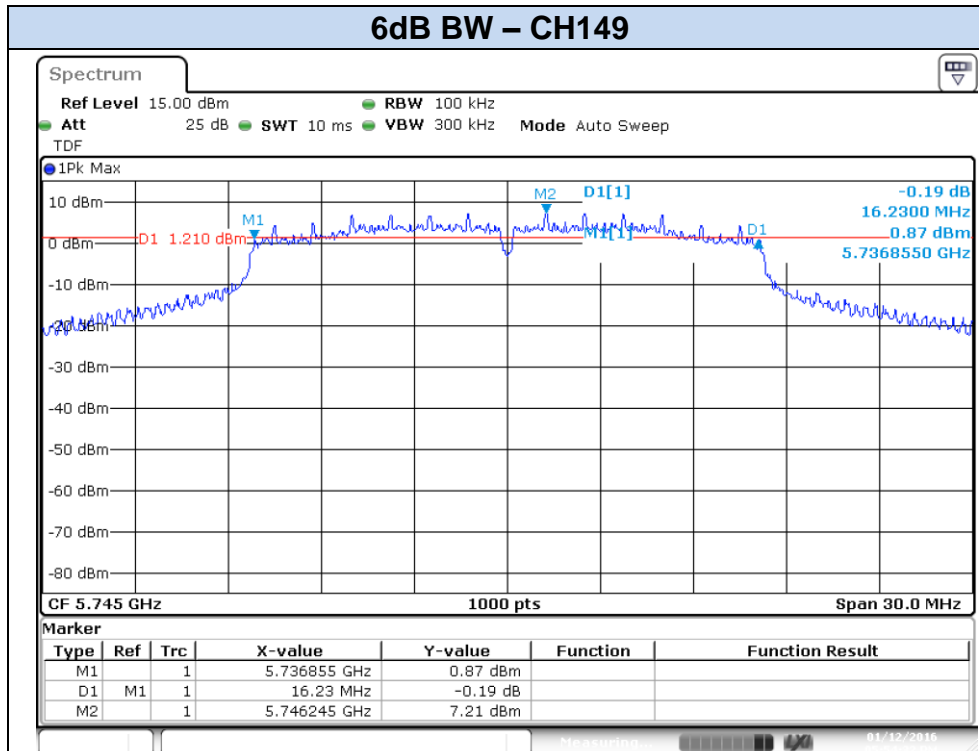


Results tables:

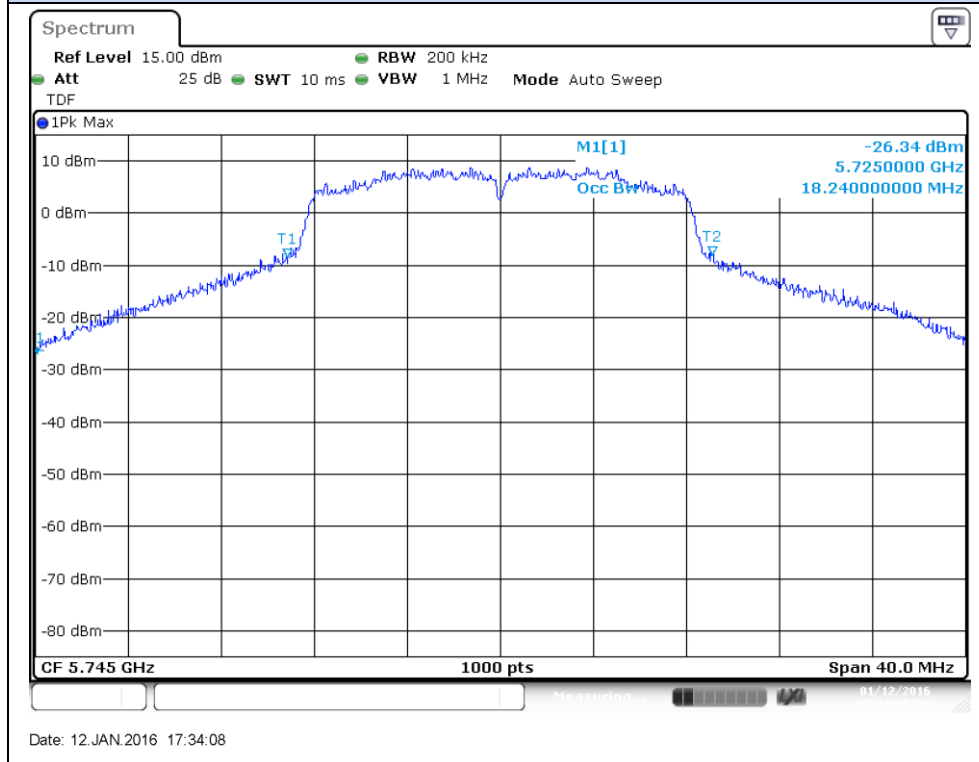
Mode	Rate	Antenna	Channel	Frequency [MHz]	6dB BW [MHz]	99% BW [MHz]
802.11a	6Mbps	SISO CHAIN A	149	5745	16.23	18.24
			157	5785	15.90	18.12
			165	5825	16.02	18.64
802.11n20	HT0	SISO CHAIN A	144*	5720	12.17	17.84
			149	5745	16.74	19.80
			157	5785	16.89	19.84
			165	5825	17.10	19.72
802.11n40	HT0	SISO CHAIN A	142F*	5670	12.94	36.80
			151F	5755	35.67	37.12
			159F	5795	35.45	37.68
802.11ac80	VHT0	SISO CHAIN A	138ac80*	5690	36.35	77.33
			155ac80	5775	75.00	76.44

Max Value

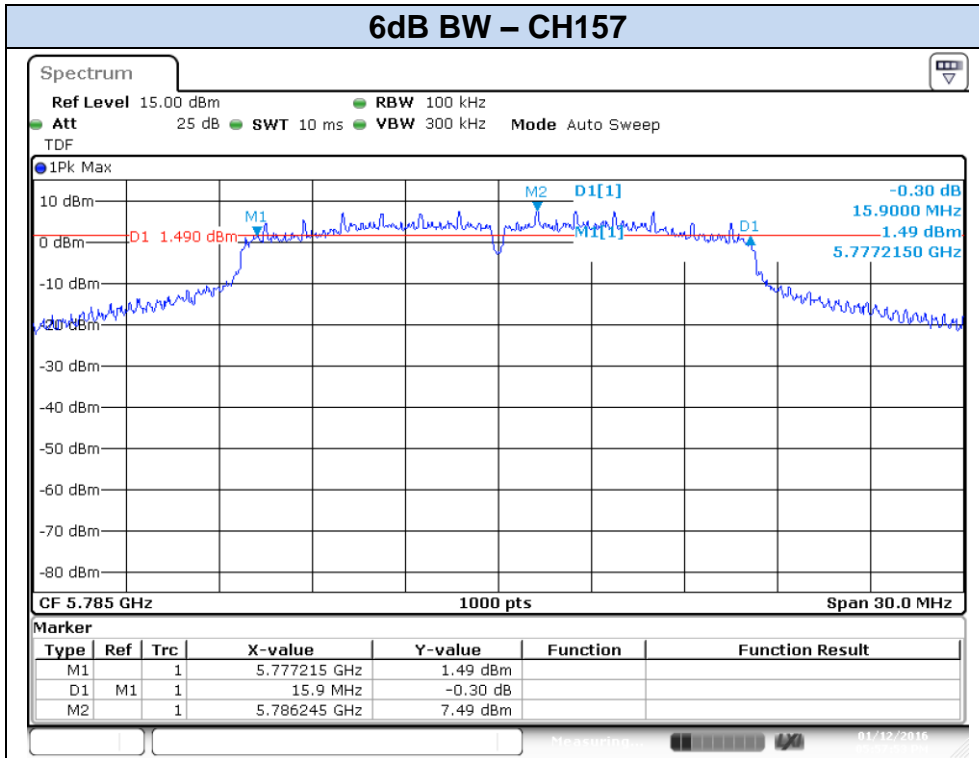
* Overlapped channels between U-NII-2C and 5.8 GHz DTS

Results screenshot:**802.11a, 6Mbps – Chain A**

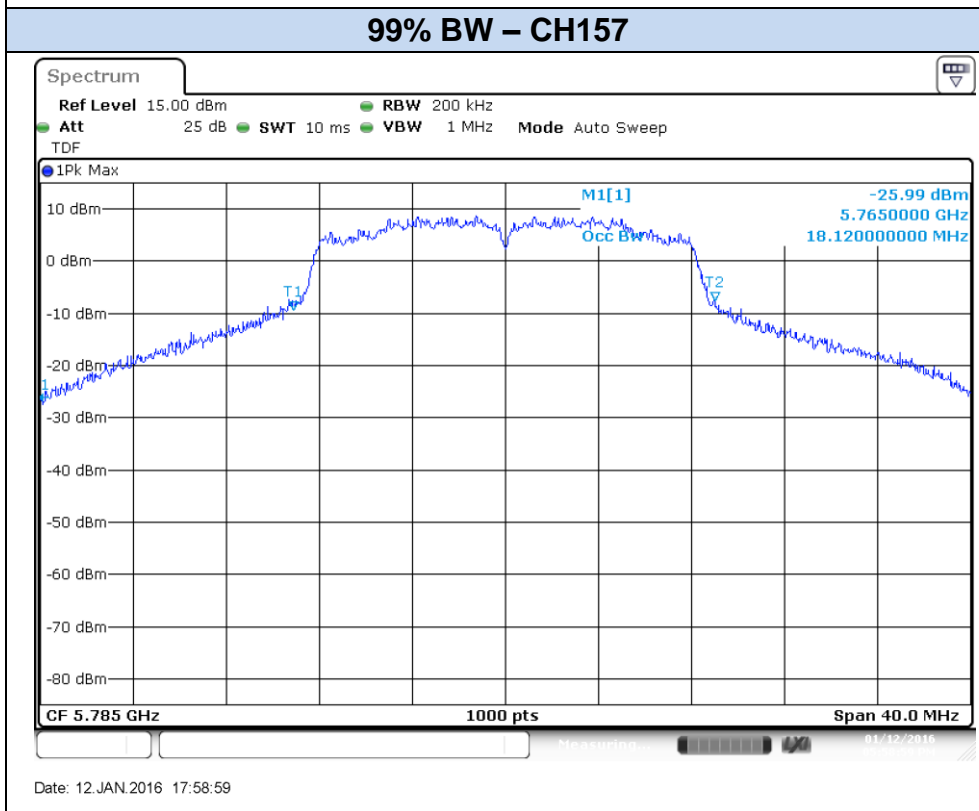
Date: 12.JAN.2016 17:54:32

99% BW – CH149

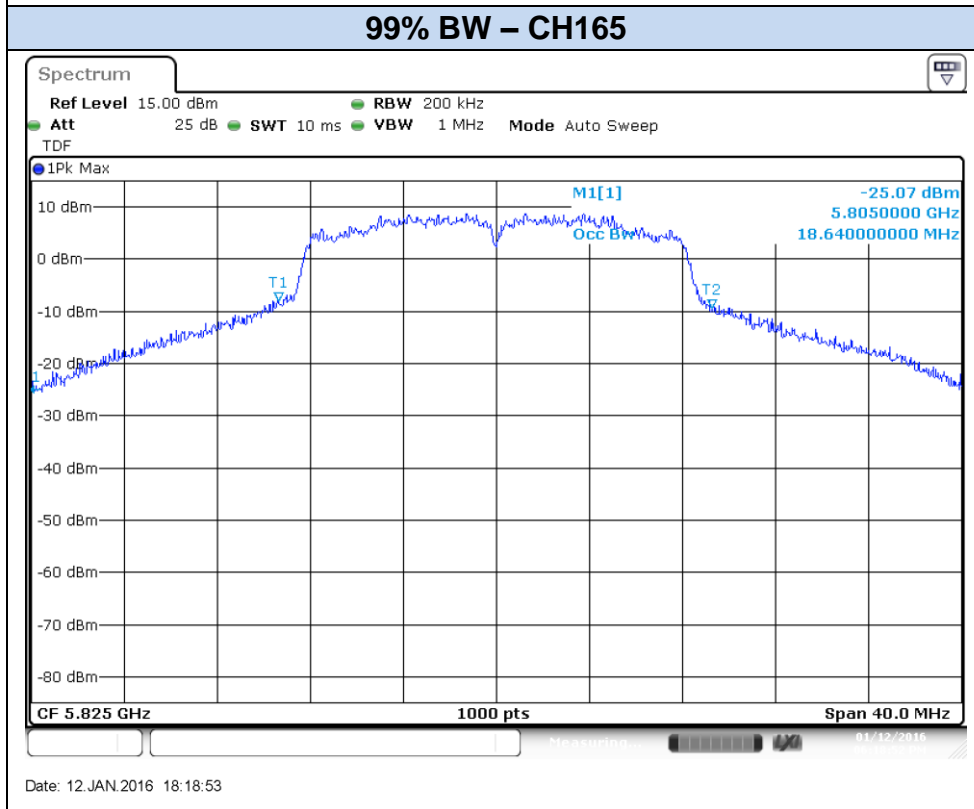
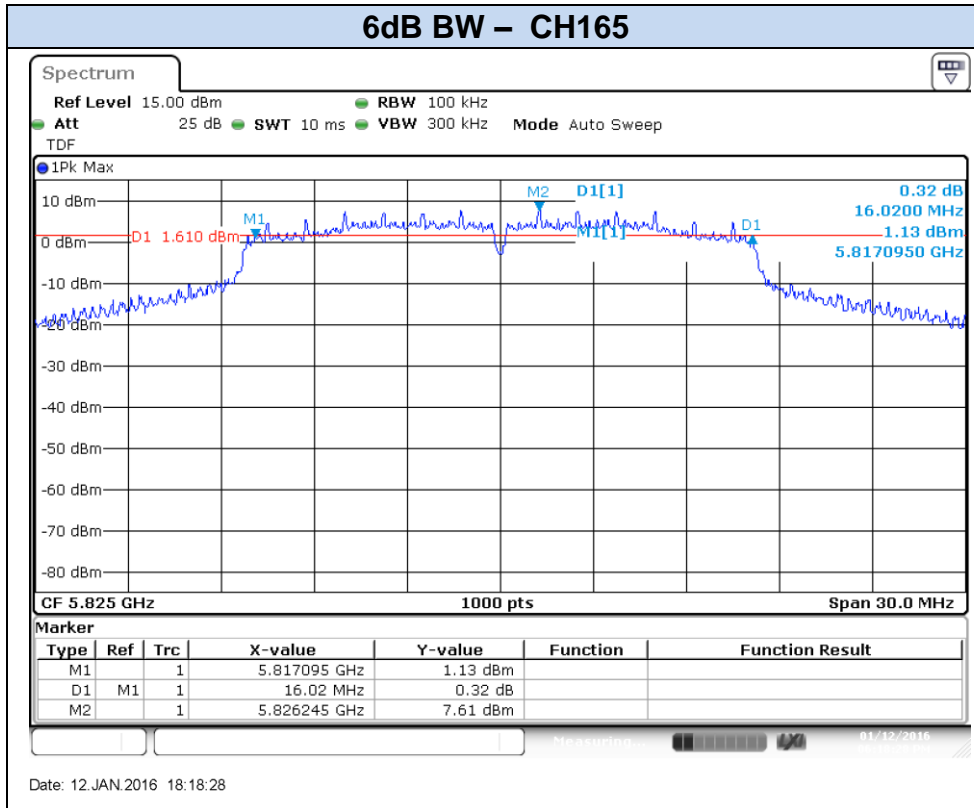
Date: 12.JAN.2016 17:34:08



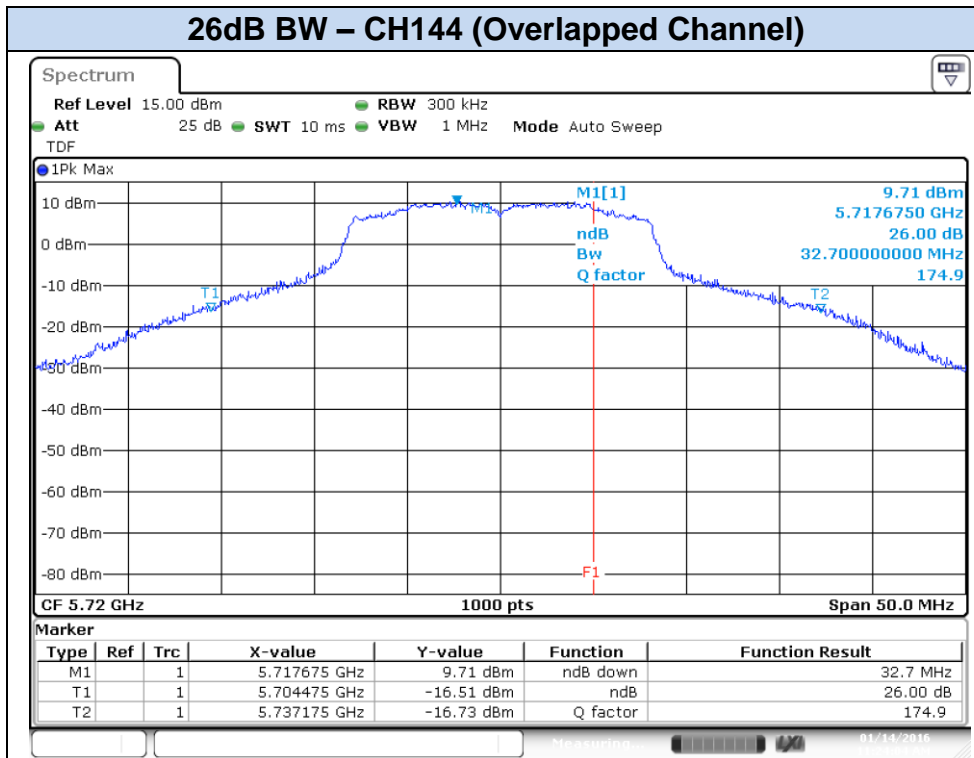
Date: 12.JAN.2016 17:57:53



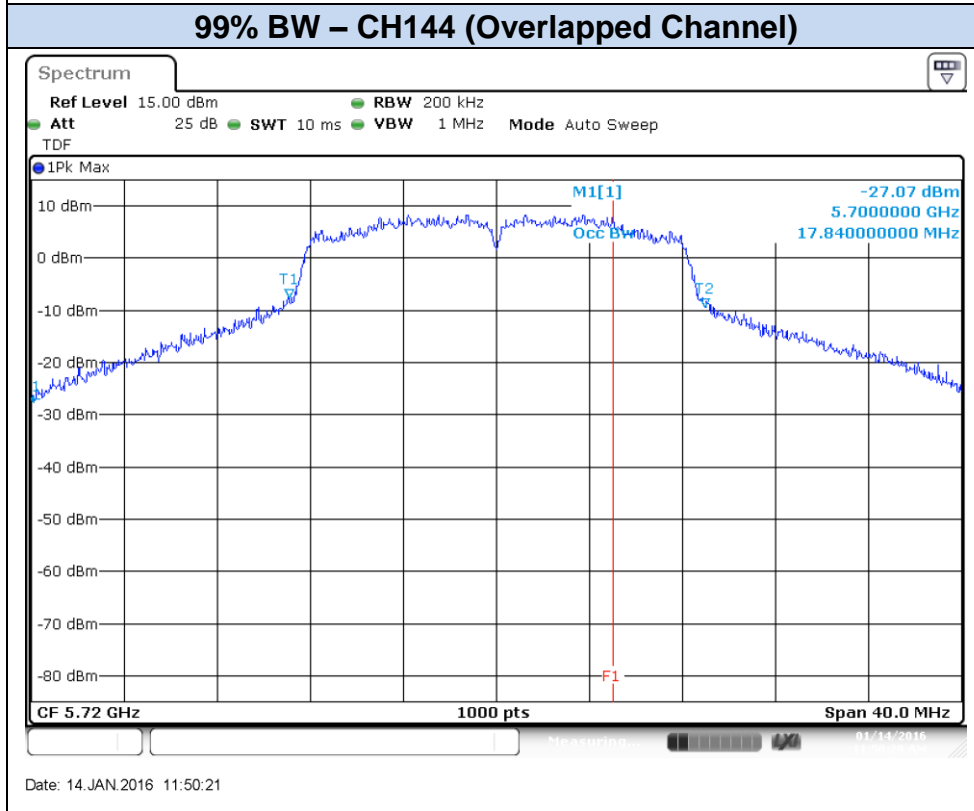
Date: 12.JAN.2016 17:58:59



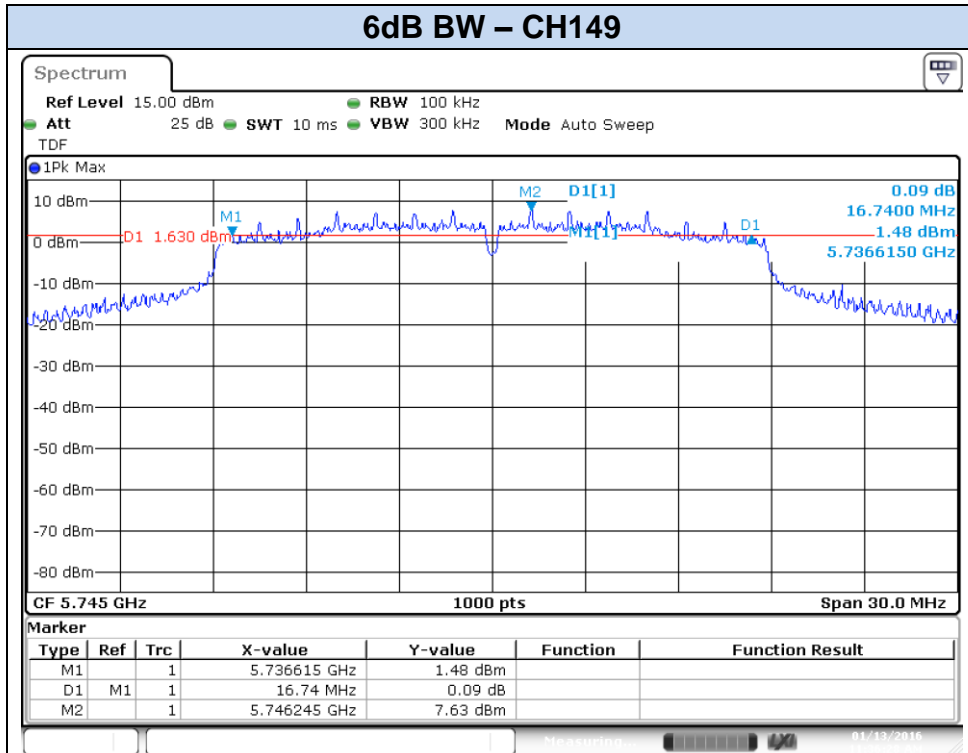
802.11n20, HT0 – Chain A



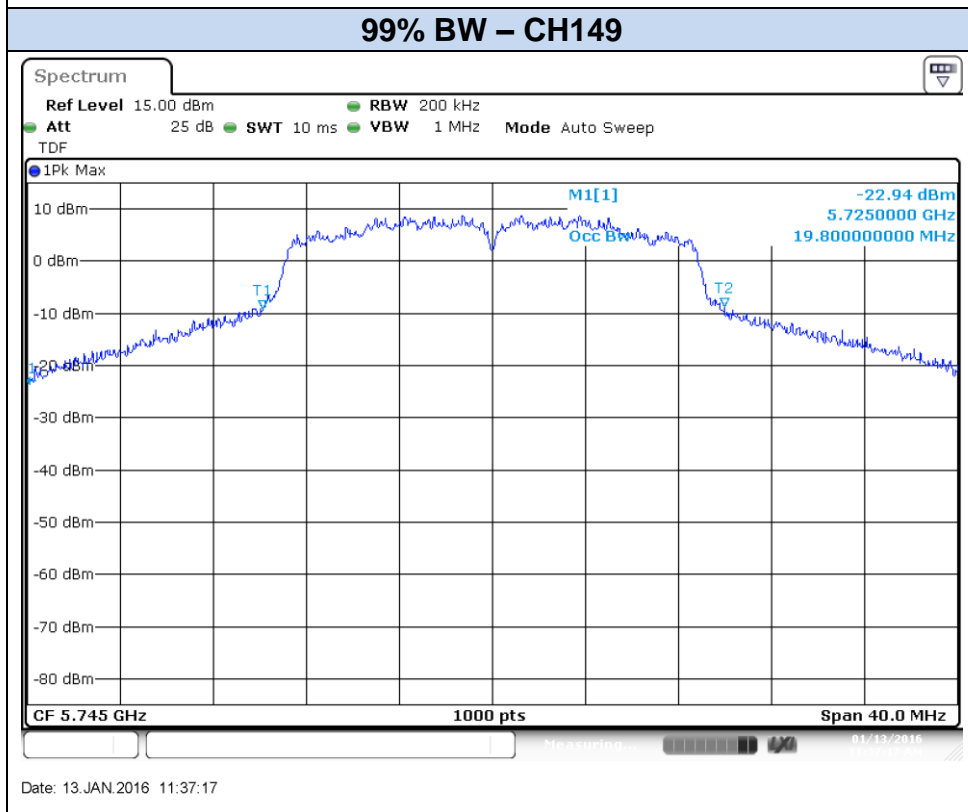
Date: 14.JAN.2016 11:24:04



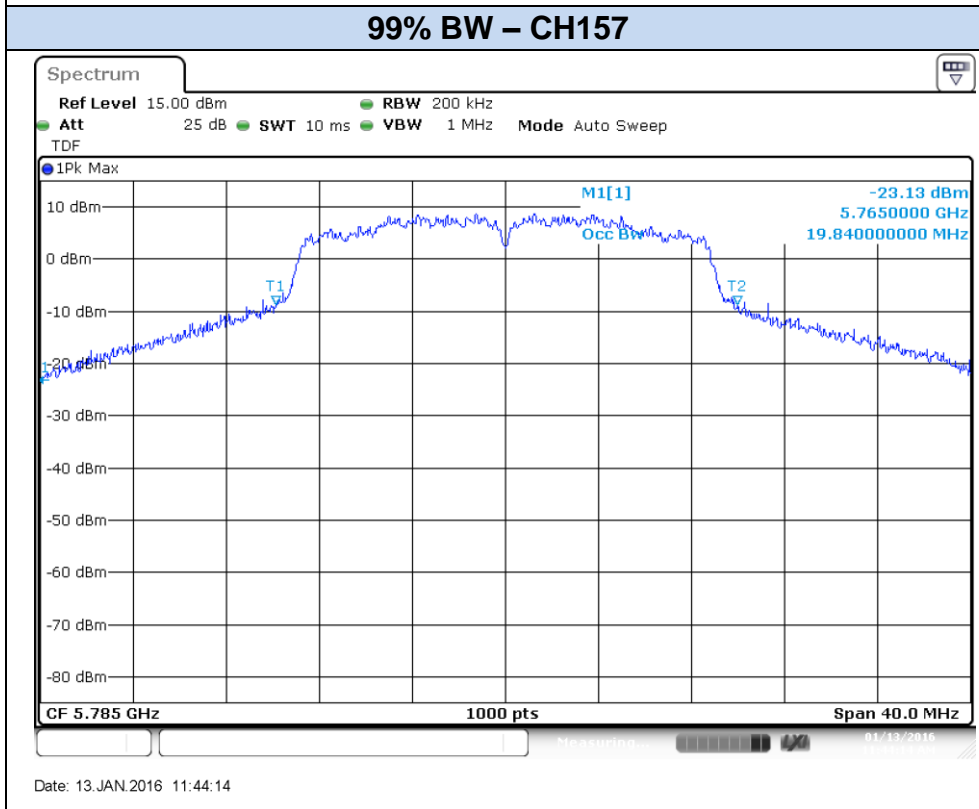
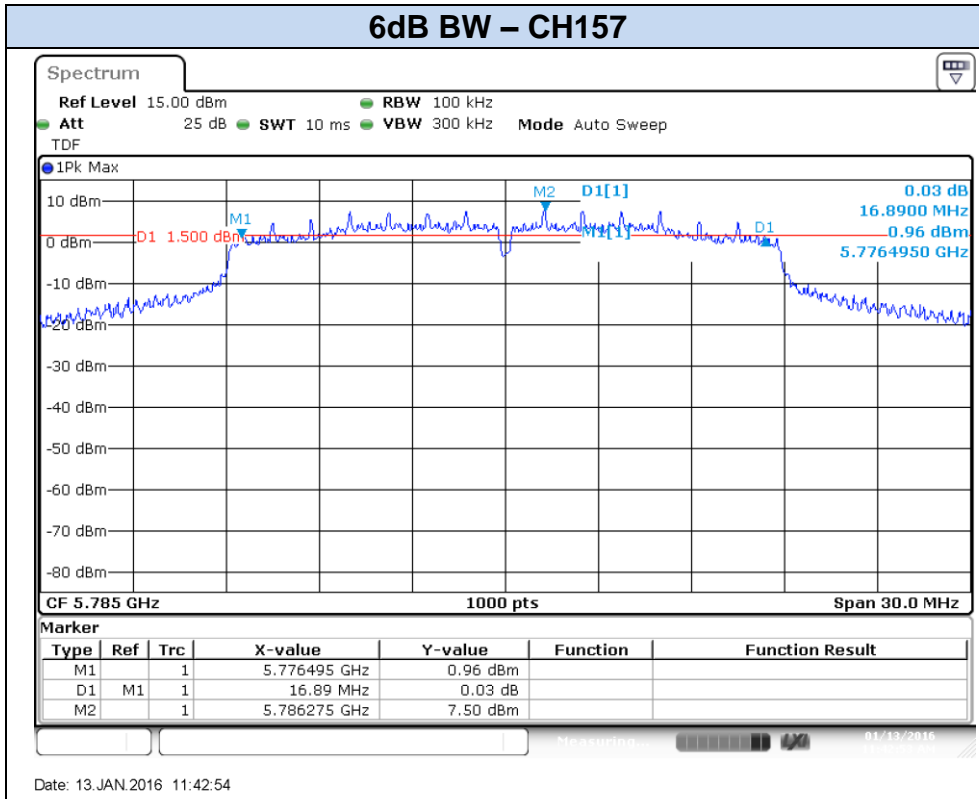
Date: 14.JAN.2016 11:50:21

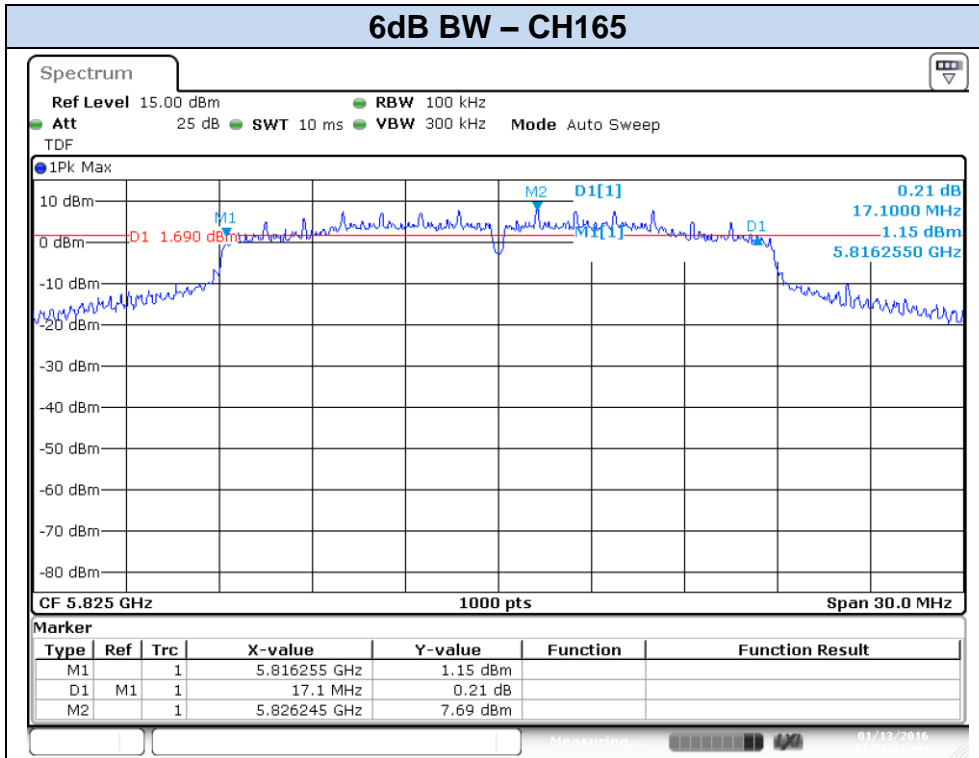


Date: 13.JAN.2016 11:36:28

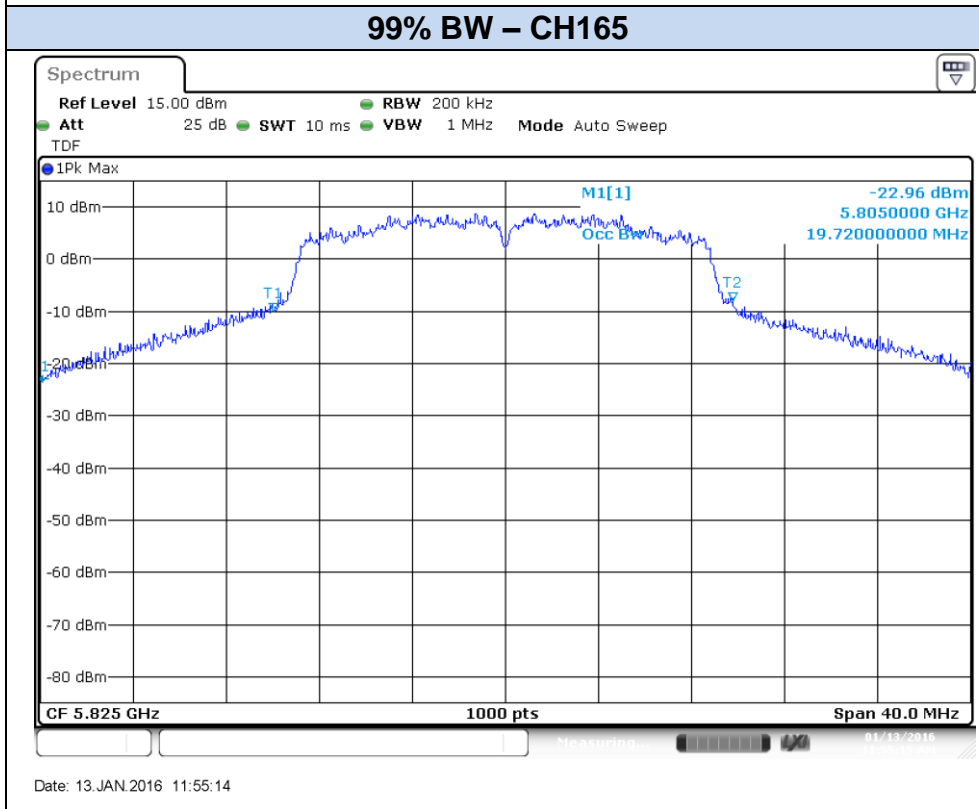


Date: 13.JAN.2016 11:37:17



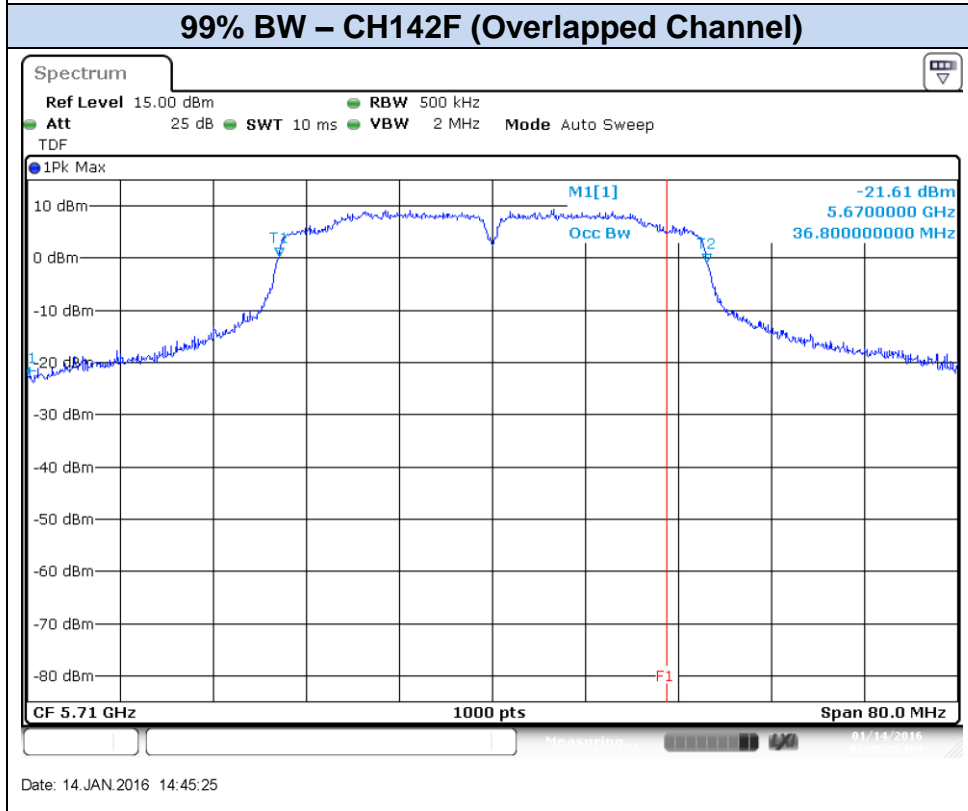
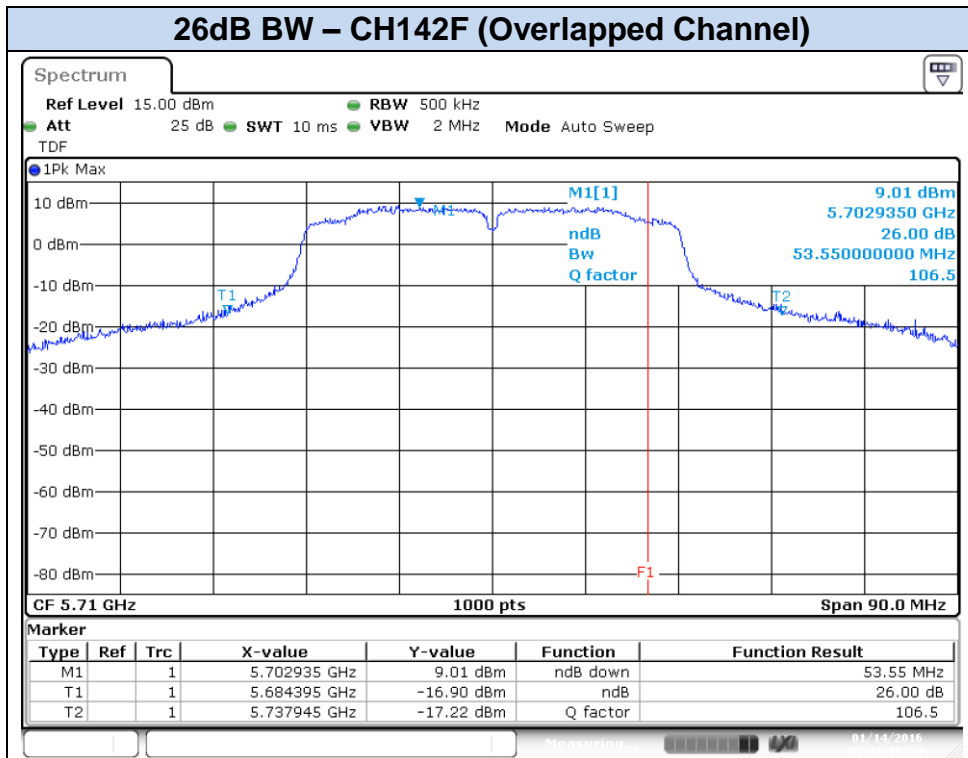


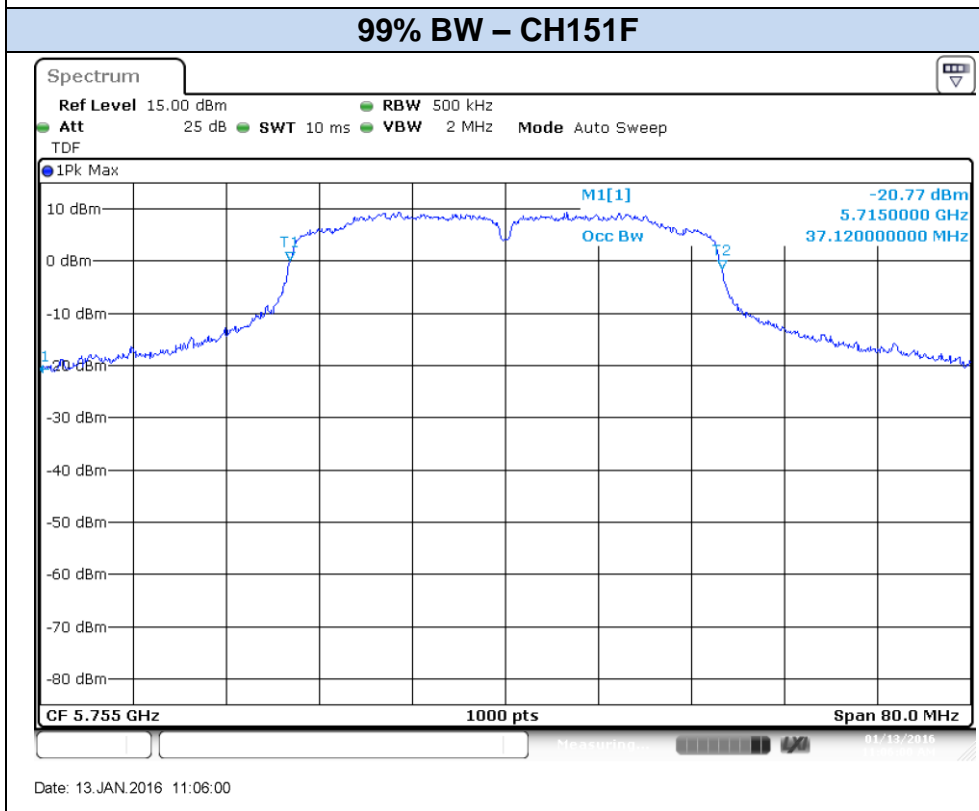
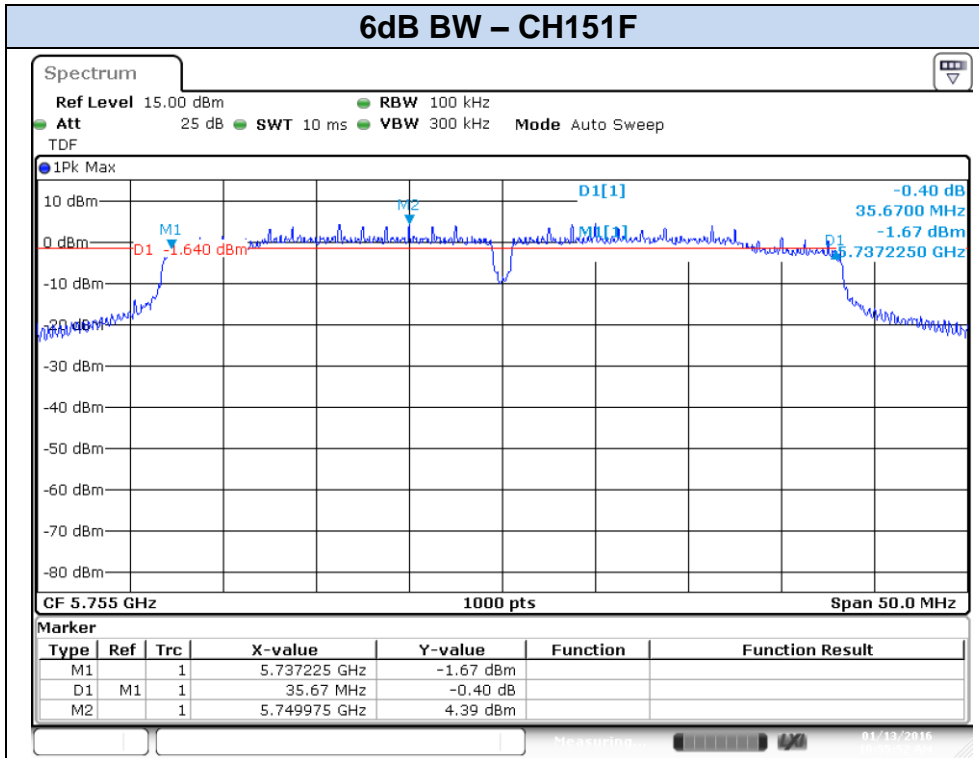
Date: 13.JAN.2016 11:54:53

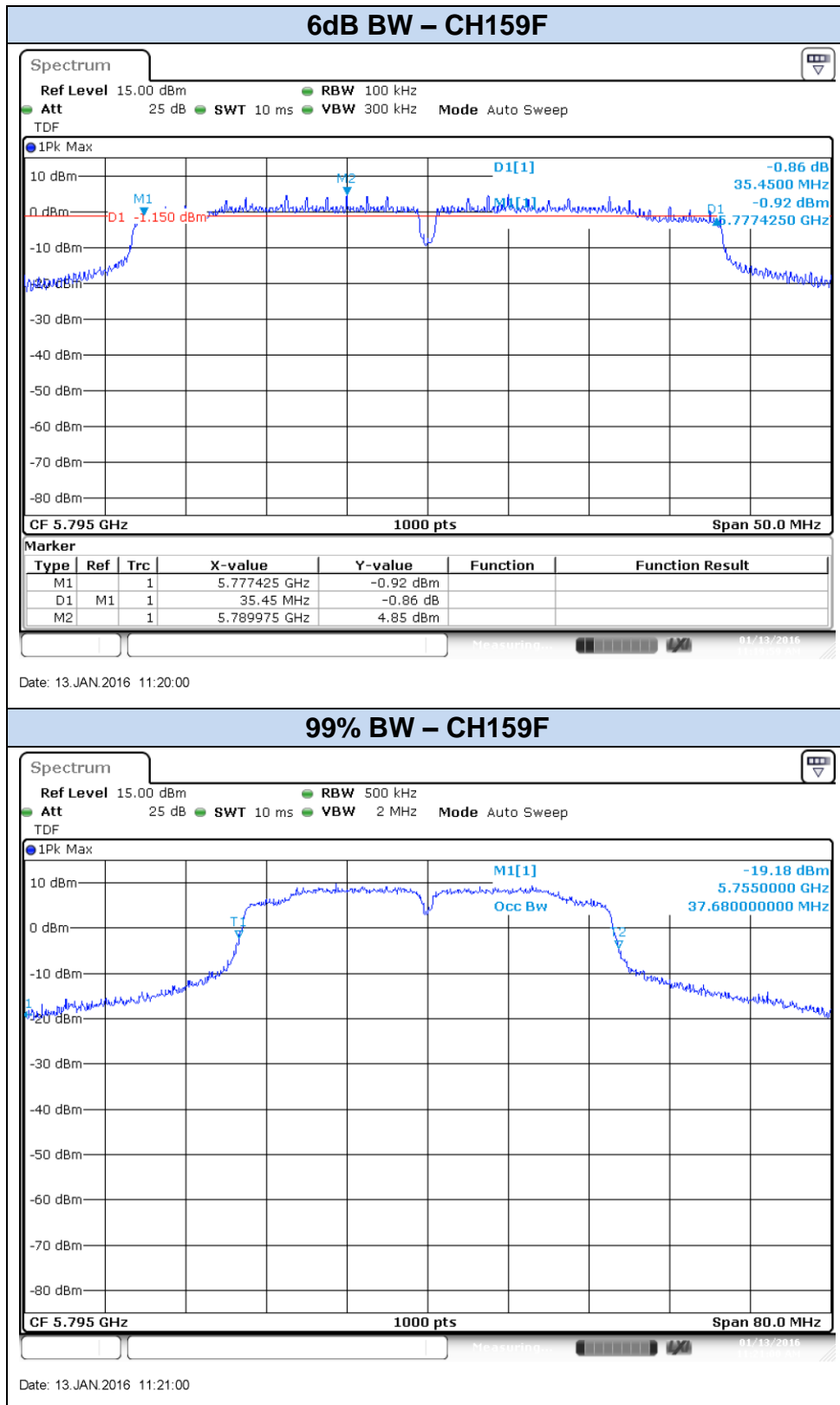


Date: 13.JAN.2016 11:55:14

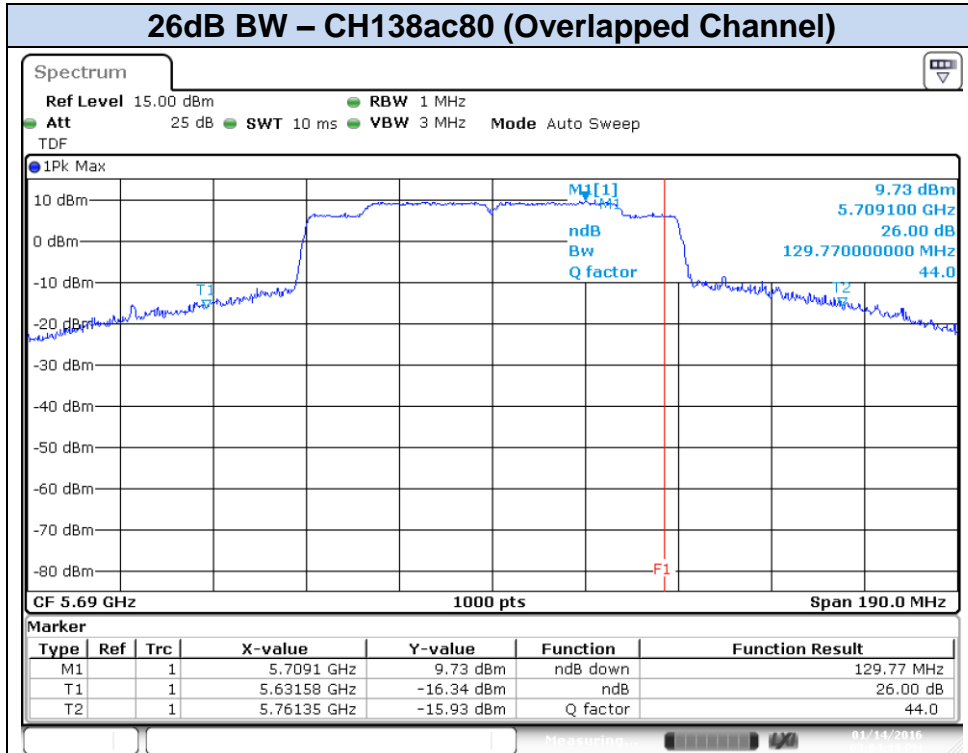
802.11n40, HT0 – Chain A



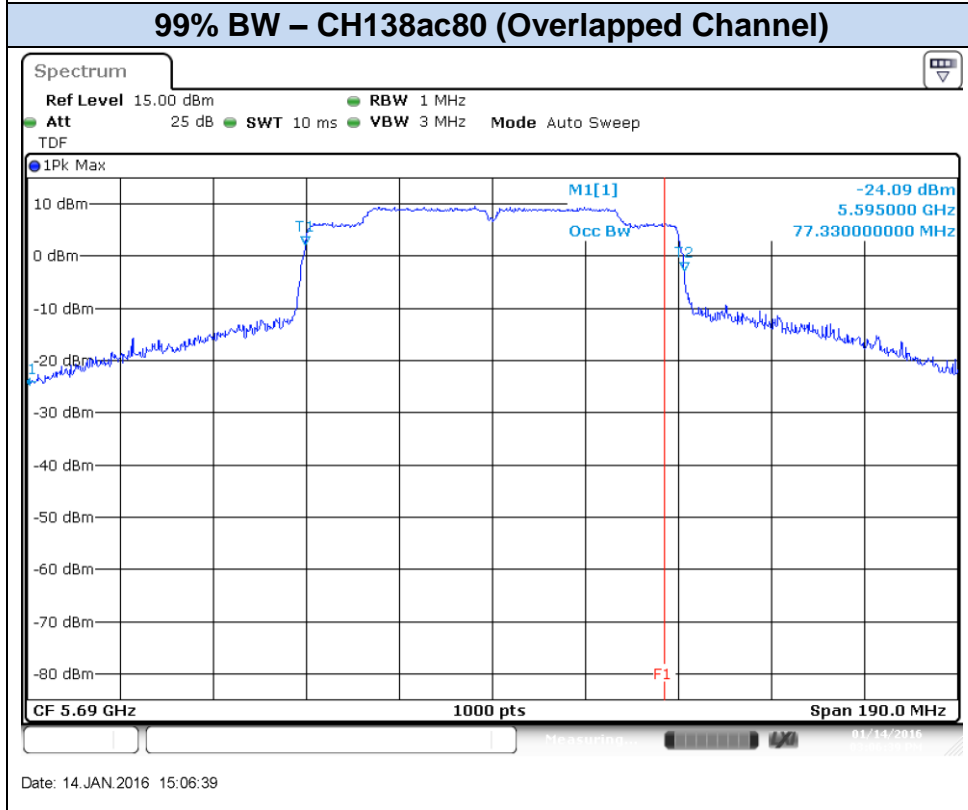




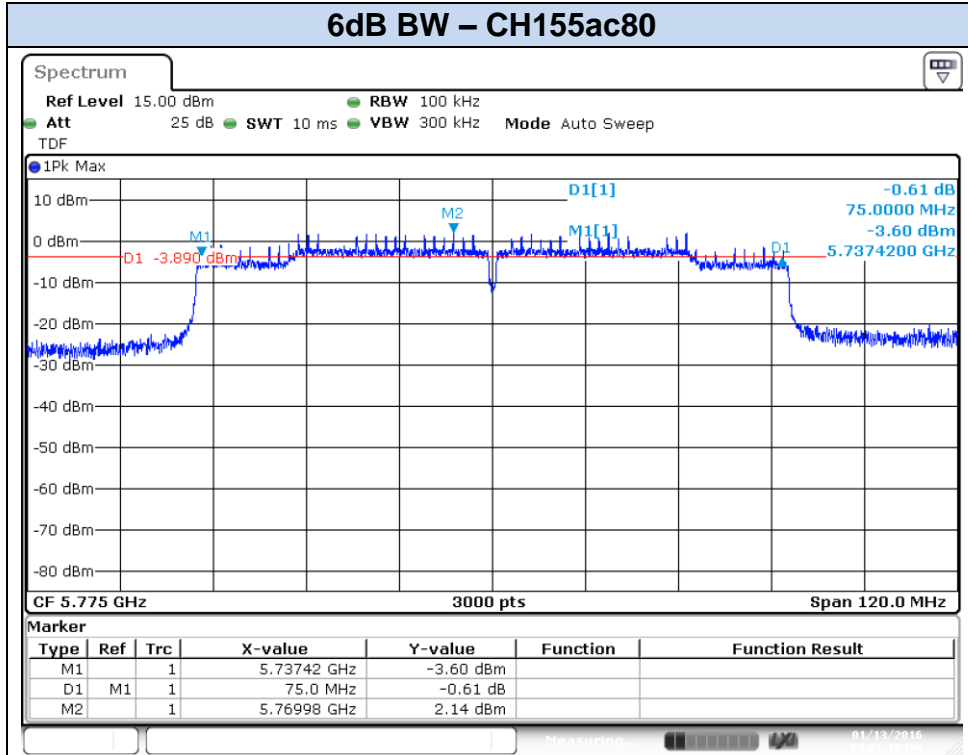
802.11ac80, VHT0 – Chain A



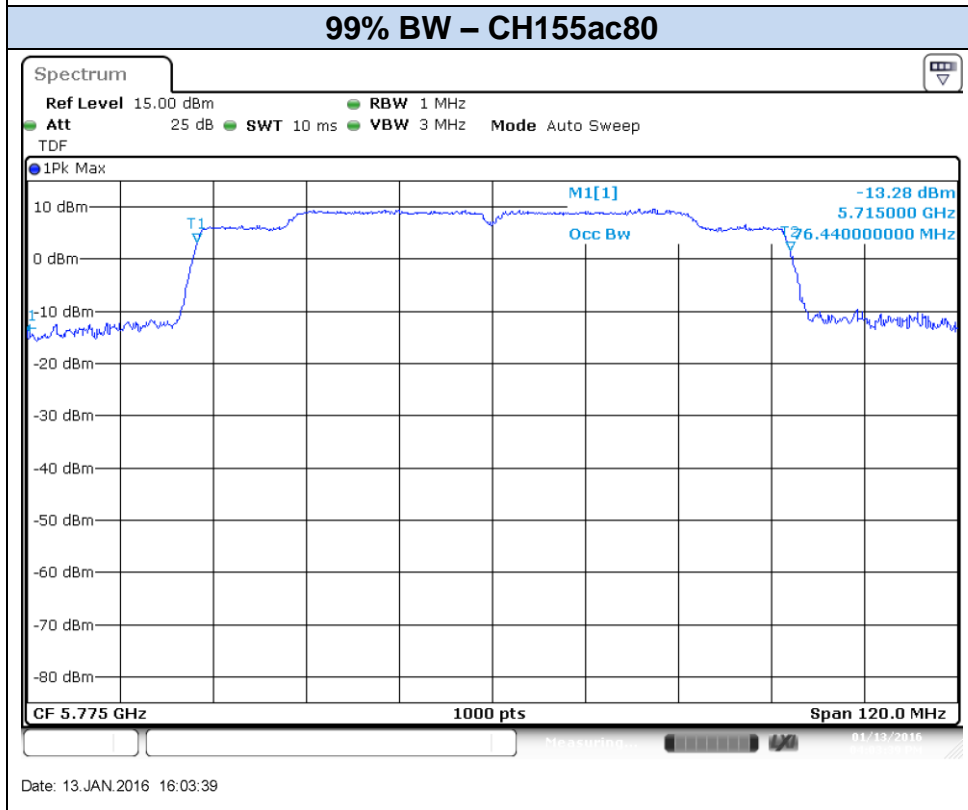
Date: 14.JAN.2016 15:04:19



Date: 14.JAN.2016 15:08:39



Date: 13.JAN.2016 16:02:12



Date: 13.JAN.2016 16:03:39

C.2 Maximum Output Power and E.I.R.P.

Test limits:

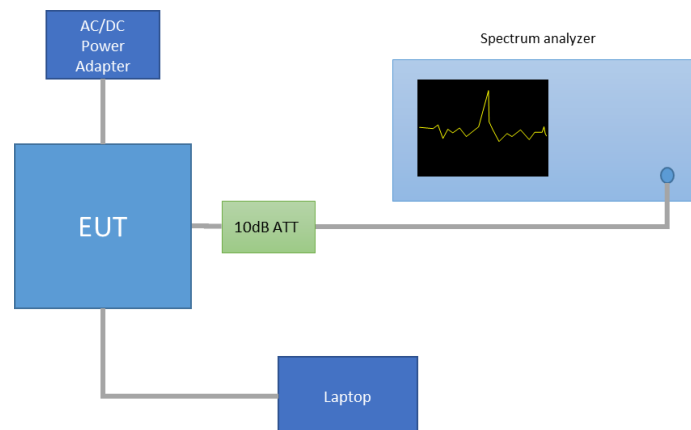
FCC part	RSS part	Limits
15.247 (b) (3)	RSS-247 Clause 5.4 (4)	<p>(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:</p> <p>(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level.</p> <p>(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.</p>

Test procedure:

The Maximum Peak Conducted Output Power was measured using the channel integration method as authorized in chapter 2.0 “Power limits, definitions and device configuration” of KDB 558074 D01.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power. The declared maximum antenna gain is 5 dBi.

The setup below was used to measure the maximum conducted output power. The antenna terminal of the EUT is connected to the spectrum through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.



Results tables:

Maximum Peak Conducted Output Power values

Mode	Rate	Meas. Duty Cycle [%]	CH	Freq. [MHz]	Antenna	Measured Conducted Peak Output power [dBm]	EIRP [dBm]	Peak Output Power [mW]
802.11a	6Mbps	97.1	149	5745	SISO CHAIN A	26.55	31.55	451.86
			157	5785	SISO CHAIN A	26.45	31.45	441.57
			165	5825	SISO CHAIN A	26.64	31.64	461.32
802.11n20	HT0	97.8	144*	5720	SISO CHAIN A	18.05	23.05	63.83
			149	5745	SISO CHAIN A	26.58	31.58	454.99
			157	5785	SISO CHAIN A	26.54	31.54	450.82
			165	5825	SISO CHAIN A	26.61	31.61	458.14
802.11n40	HT0	97.4	142F*	5670	SISO CHAIN A	14.22	19.22	26.42
			151F	5755	SISO CHAIN A	26.91	31.91	490.91
			159F	5795	SISO CHAIN A	27.07	32.07	509.33
802.11ac80	VHT0	96.0	138ac80*	5690	SISO CHAIN A	11.42	16.42	13.87
			155ac80	5775	SISO CHAIN A	26.60	31.60	457.09

Max Value

Min Value

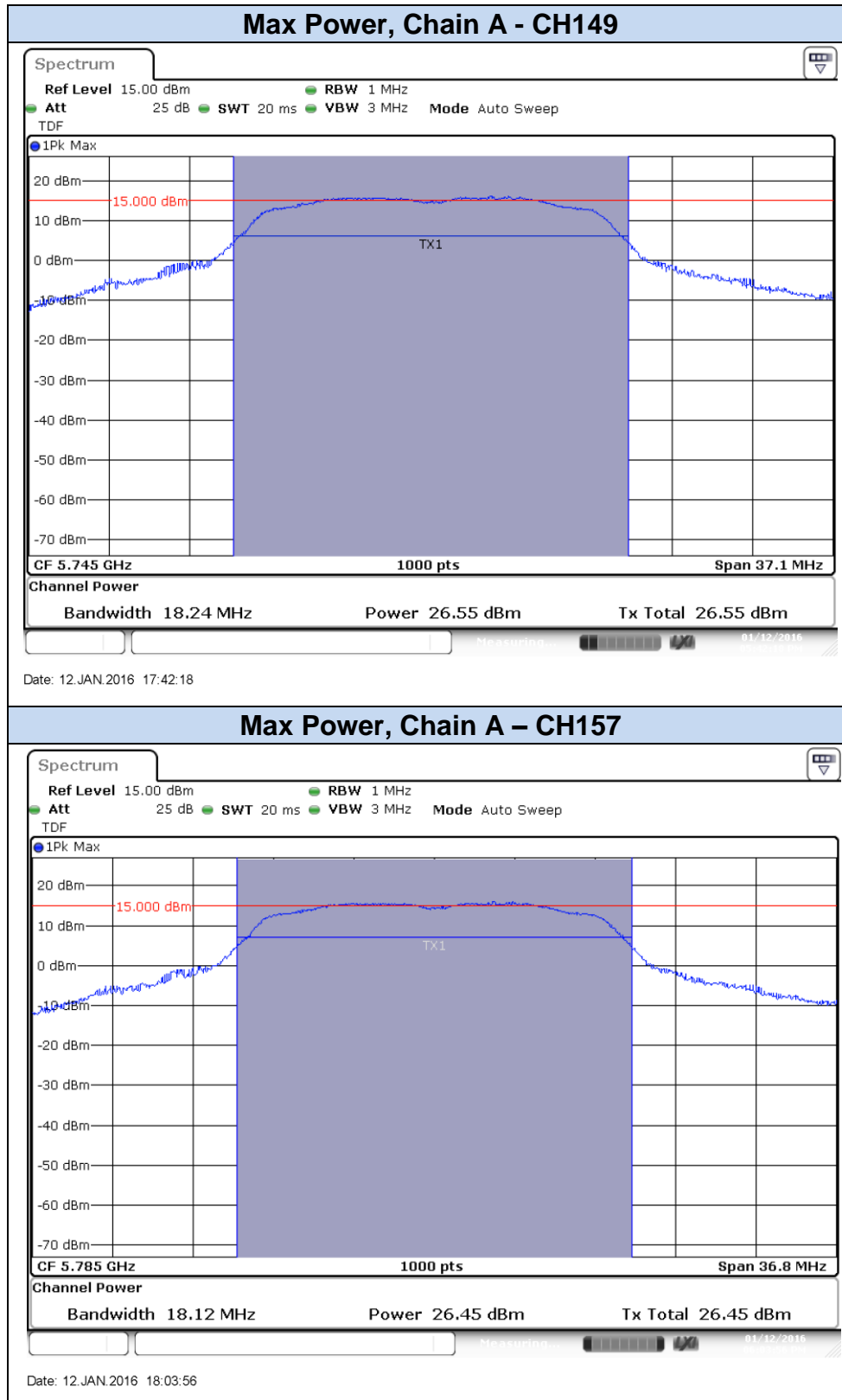
Maximum (average) Conducted Output Power values (for informative purposes only)

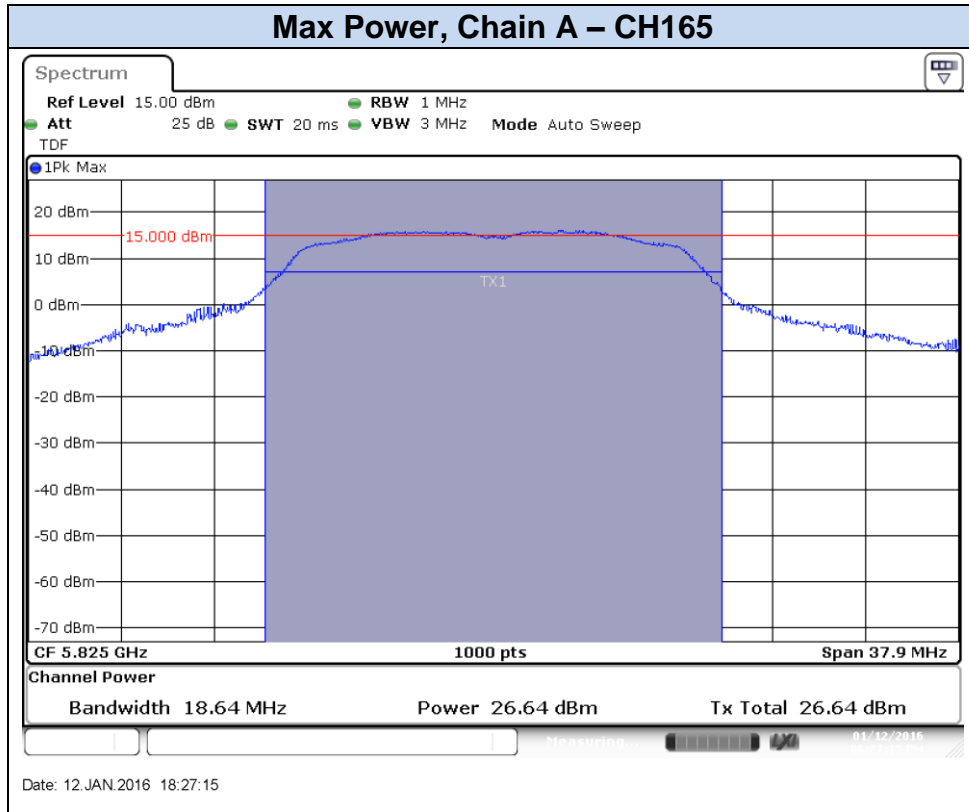
Mode	Rate	Meas. Duty Cycle [%]	CH	Freq. [MHz]	Antenna	Maximum (average) Conducted Output Power [dBm]	Duty cycle Compensated	EIRP [dBm]	Average Output Power [mW]
802.11a	6Mbps	97.1	149	5745	SISO CHAIN A	17.66	17.79	22.79	60.08
			157	5785	SISO CHAIN A	17.58	17.71	22.71	58.98
			165	5825	SISO CHAIN A	17.76	17.89	22.89	61.48
802.11n20	HT0	97.8	144*	5720	SISO CHAIN A	8.76	8.82	13.82	7.62
			149	5745	SISO CHAIN A	17.68	17.78	22.78	59.96
			157	5785	SISO CHAIN A	17.58	17.68	22.68	58.60
			165	5825	SISO CHAIN A	17.67	17.77	22.77	59.82
802.11n40	HT0	97.4	142F*	5670	SISO CHAIN A	4.72	4.85	9.85	3.05
			151F	5755	SISO CHAIN A	17.76	17.87	22.87	61.28
			159F	5795	SISO CHAIN A	17.90	18.01	23.01	63.29
802.11ac80	VHT0	96.0	138ac80*	5690	SISO CHAIN A	2.00	2.18	7.18	1.65
			155ac80	5775	SISO CHAIN A	17.66	17.84	22.84	60.79

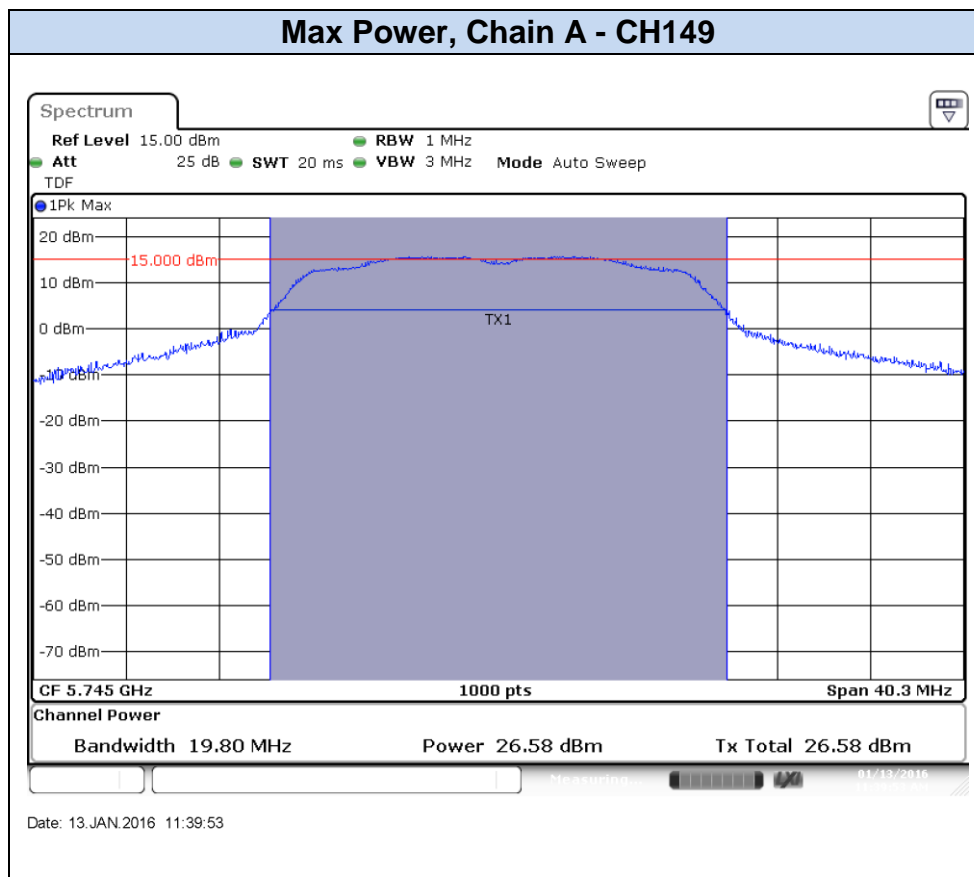
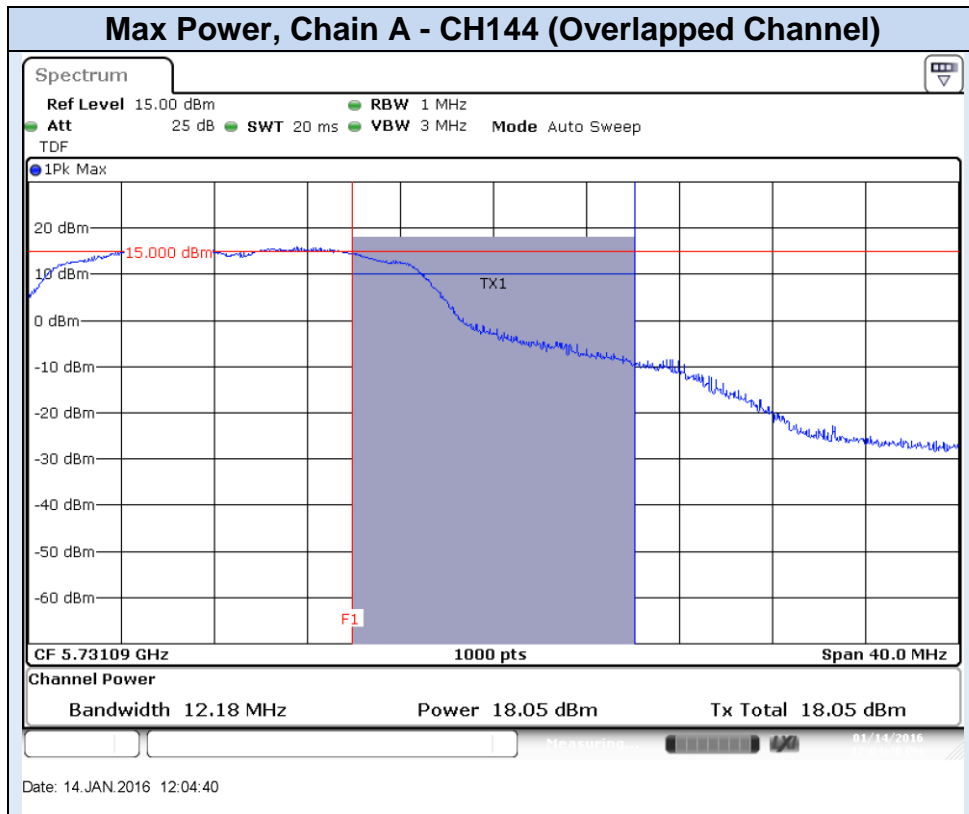
Max Value

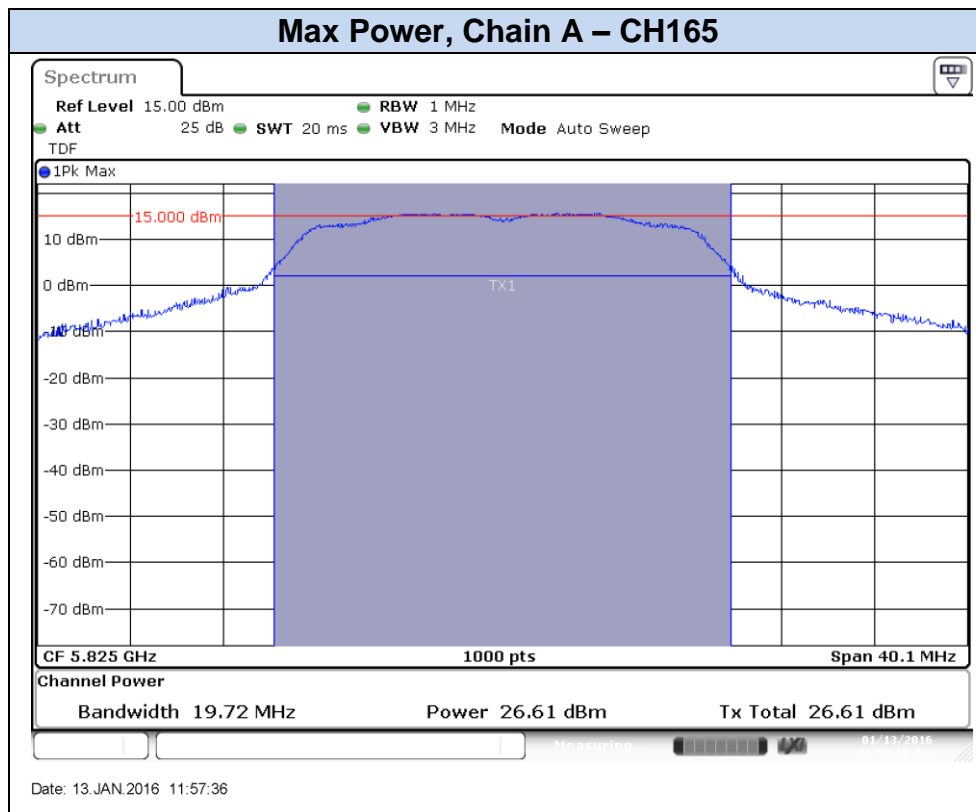
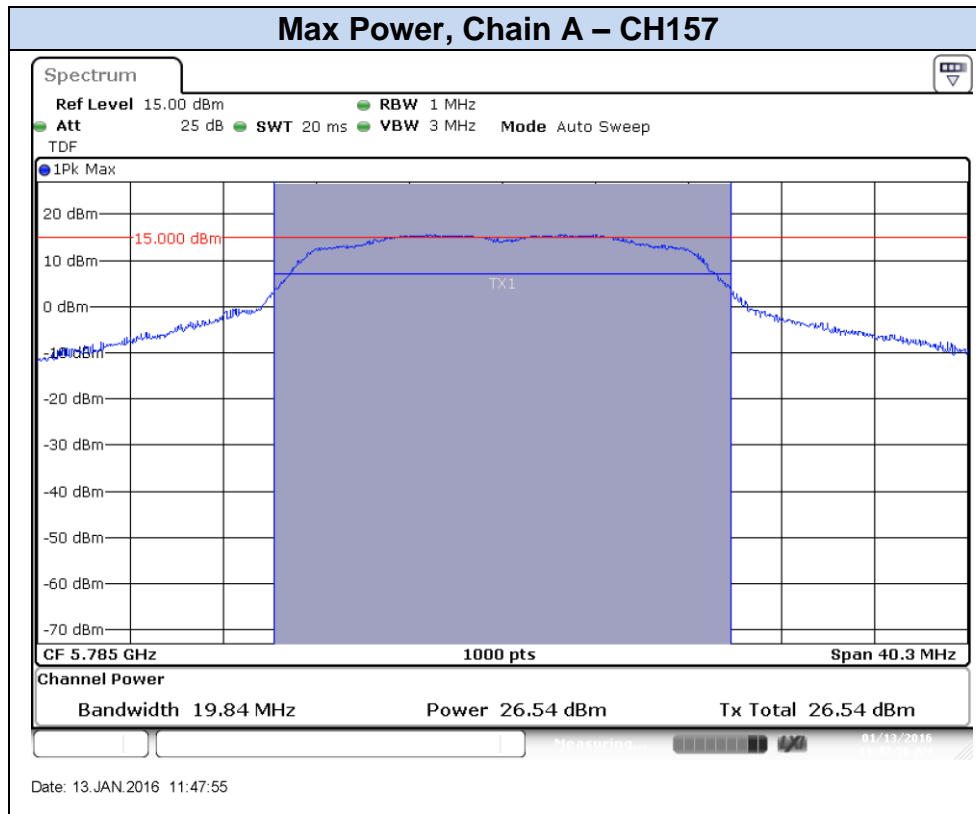
Min Value

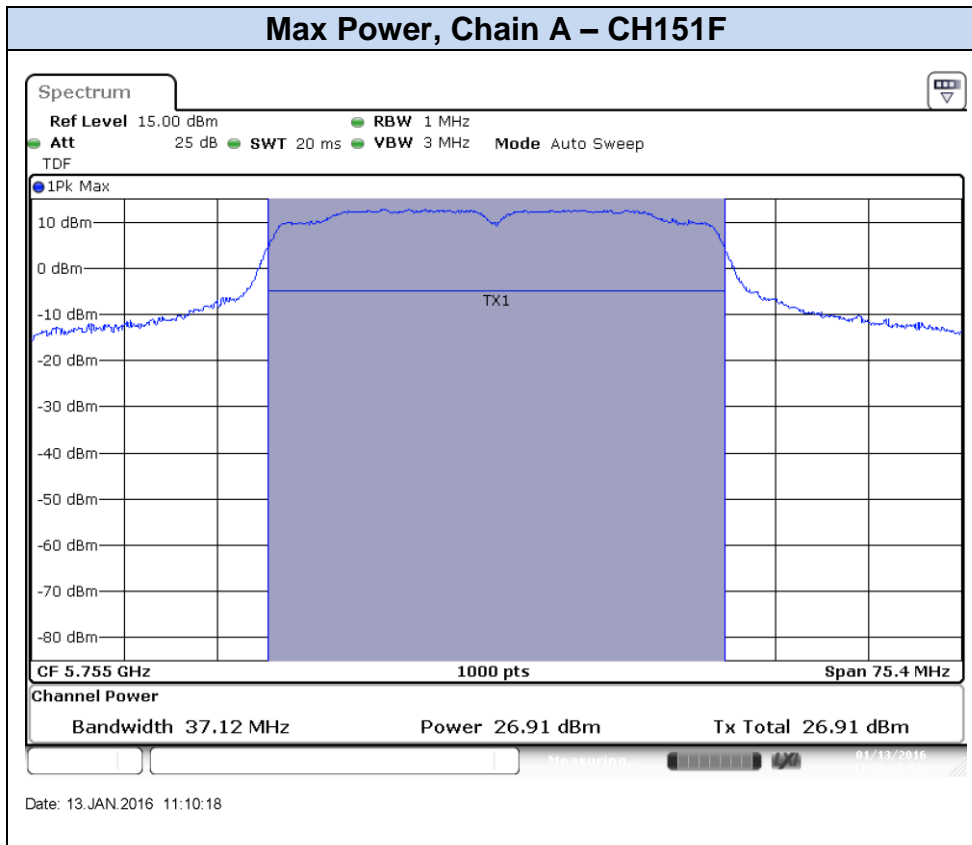
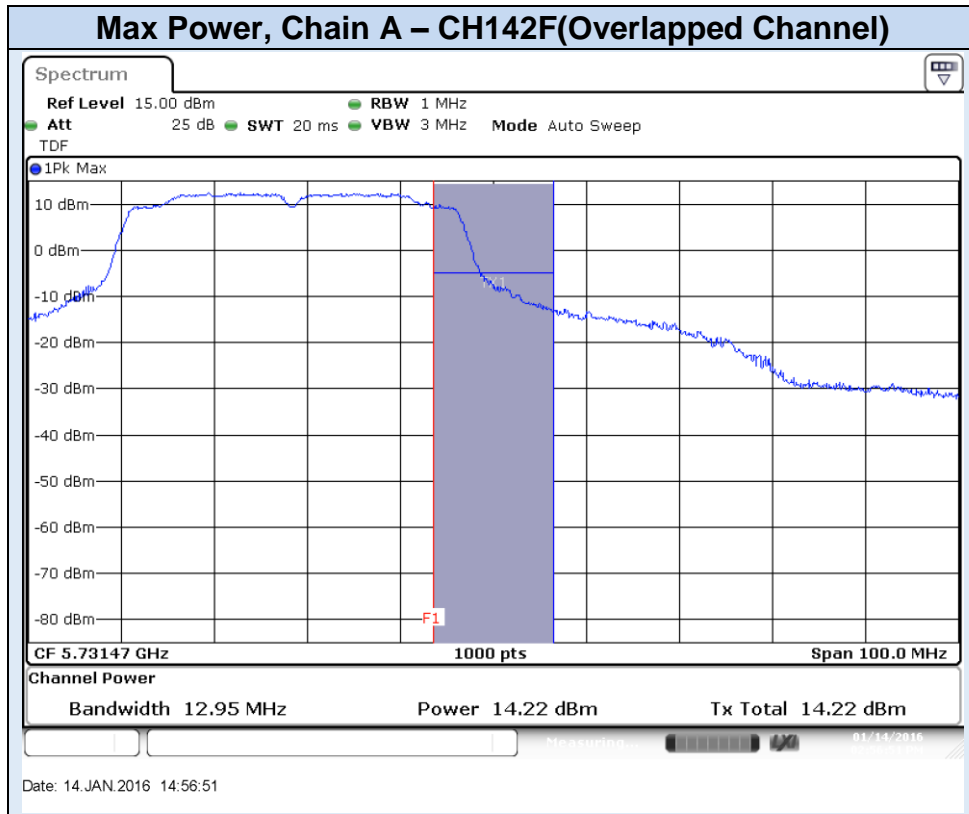
* Overlapped channels between U-NII-2C and 5.8 GHz DTS

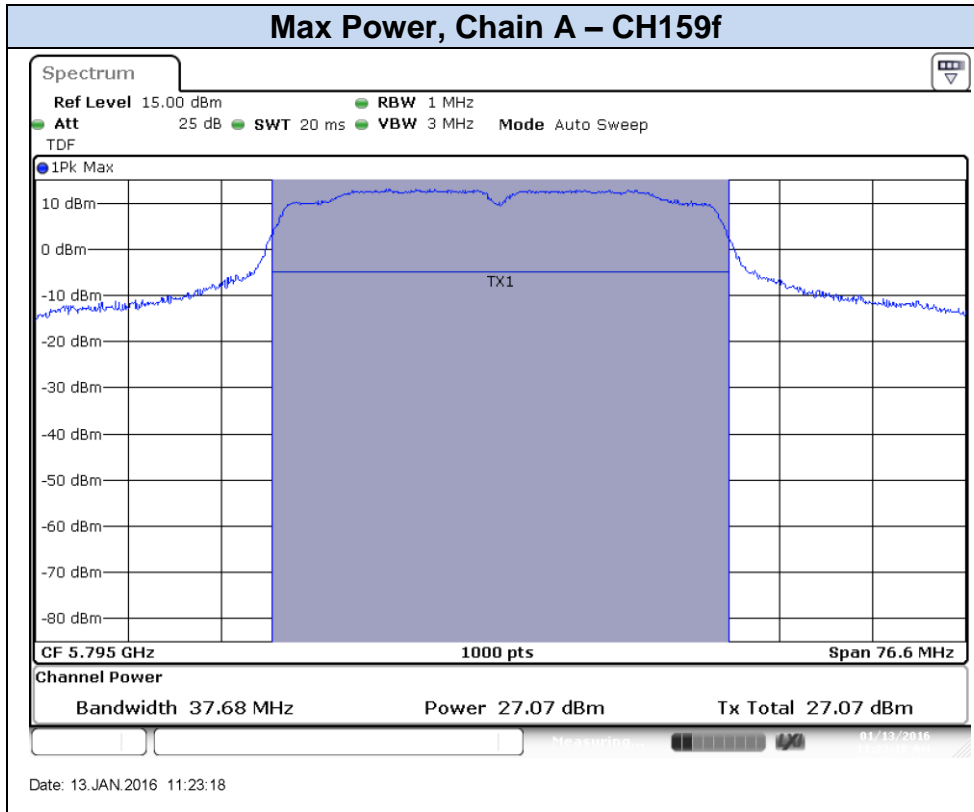
Results screenshot**802.11a, 6Mbps**

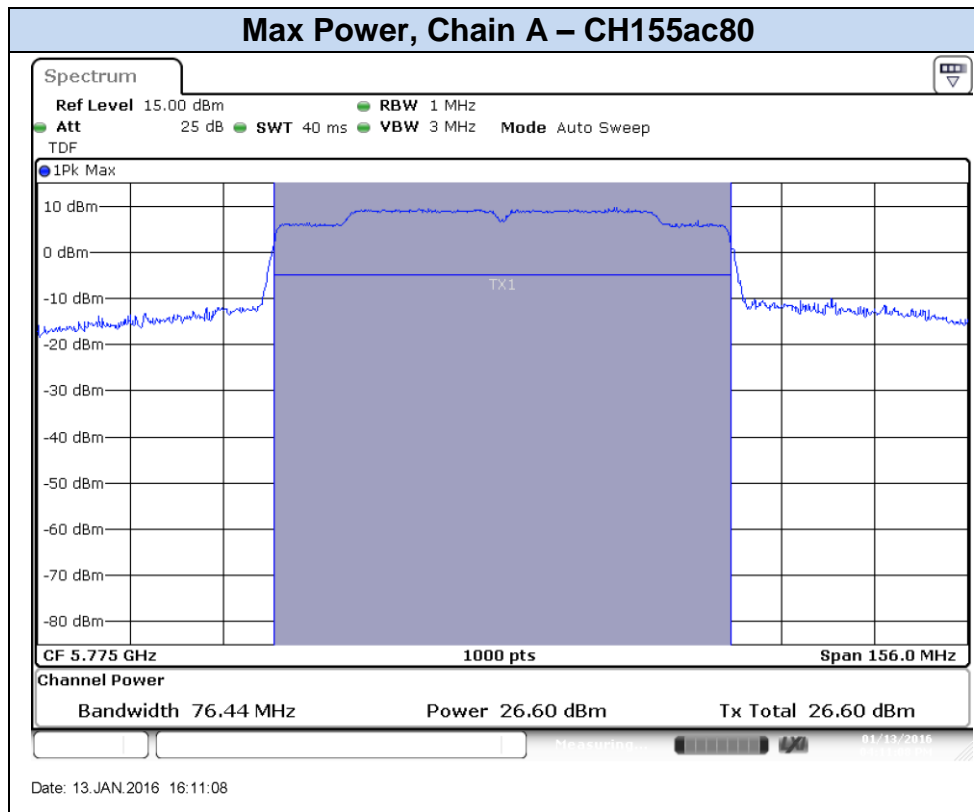
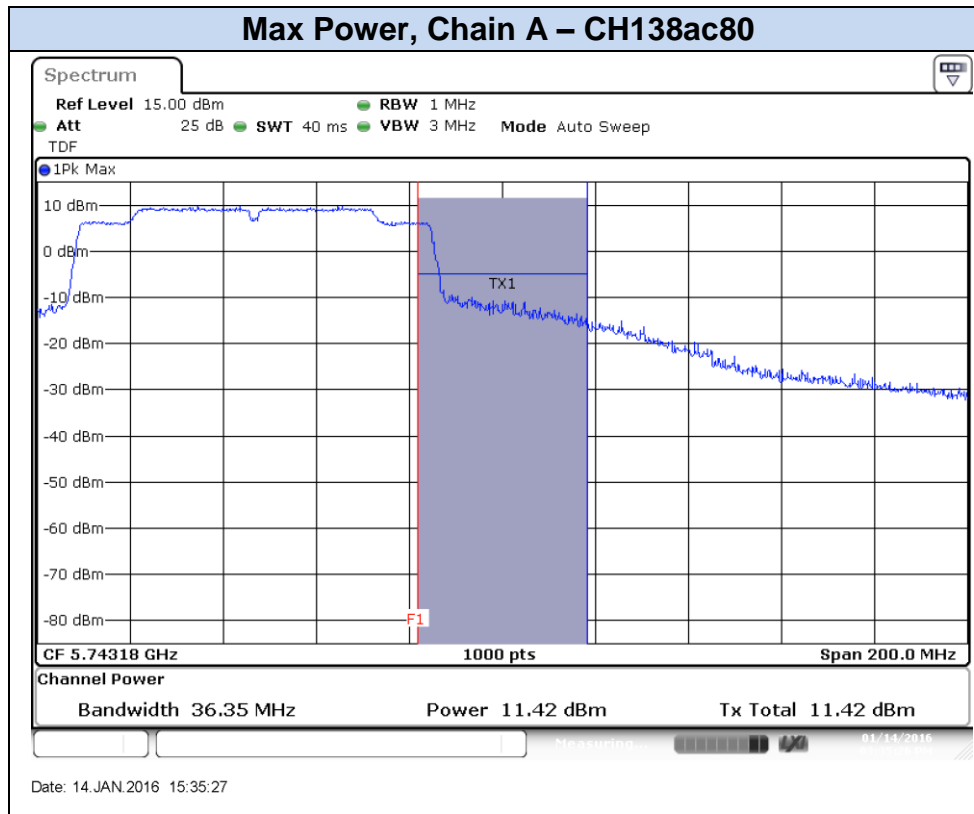


802.11n20, HT0



802.11n40, HT0



802.11ac80, VHT0

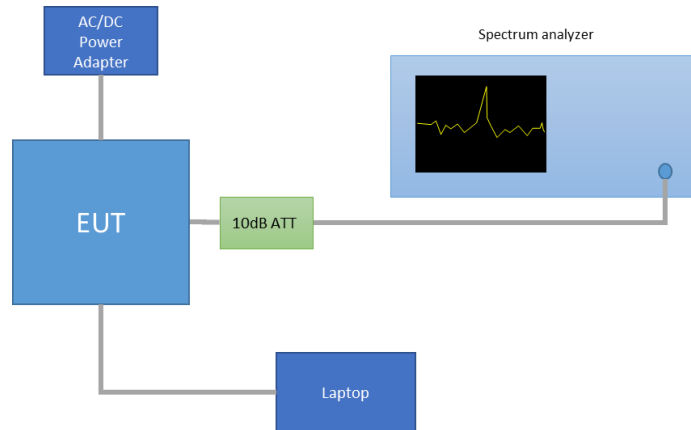
C.3 Out-of-band emissions (conducted)

Test limits:

FCC part	RSS part	Limits
15.247 (d)	RSS-247 Clause 5.5	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits.

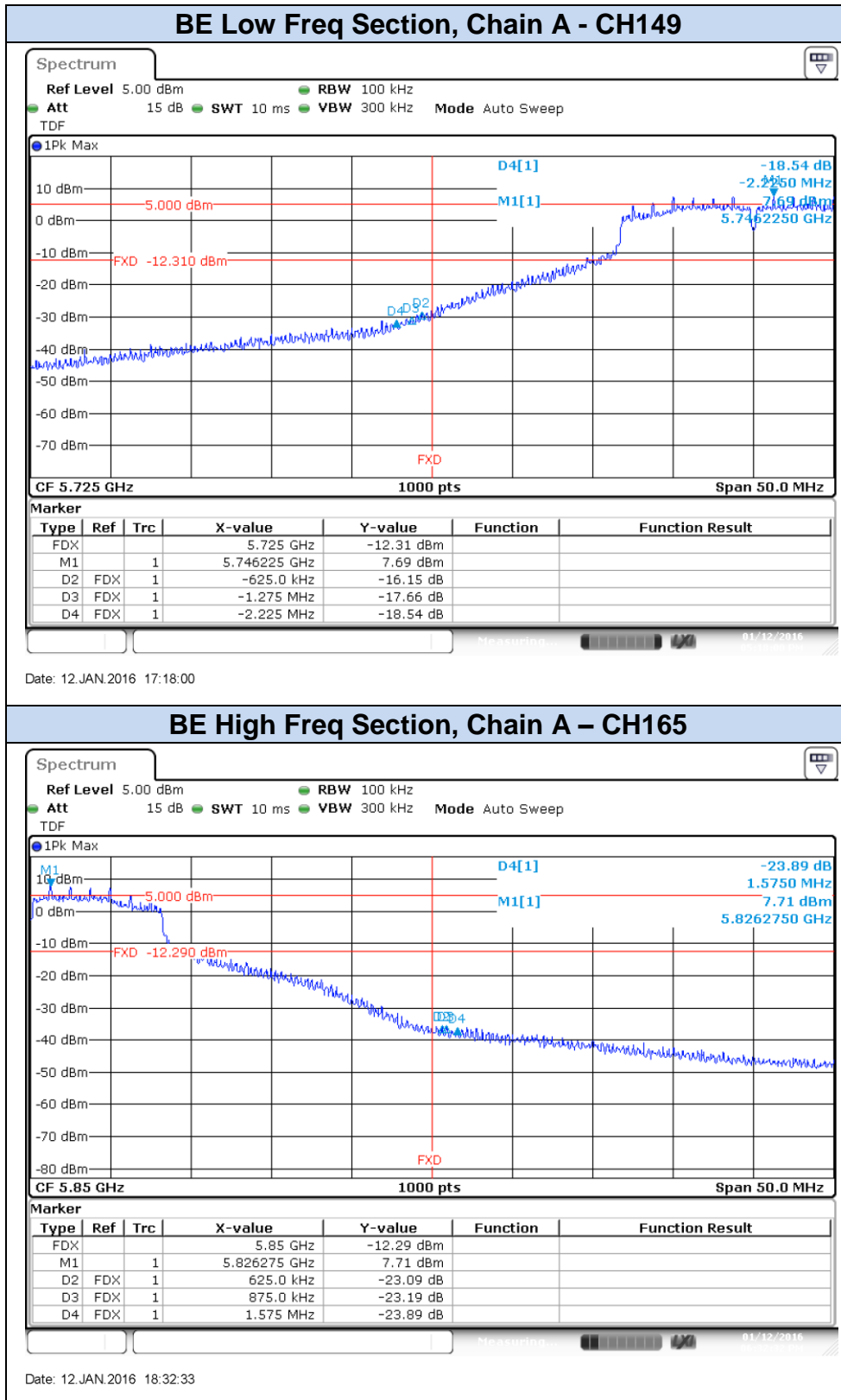
Test procedure:

The setup below was used to measure the out-of-band emissions. The antenna terminal of the EUT is connected to the spectrum analyzer through an attenuator, and the spectrum analyzer reading is compensated to include the RF path loss.

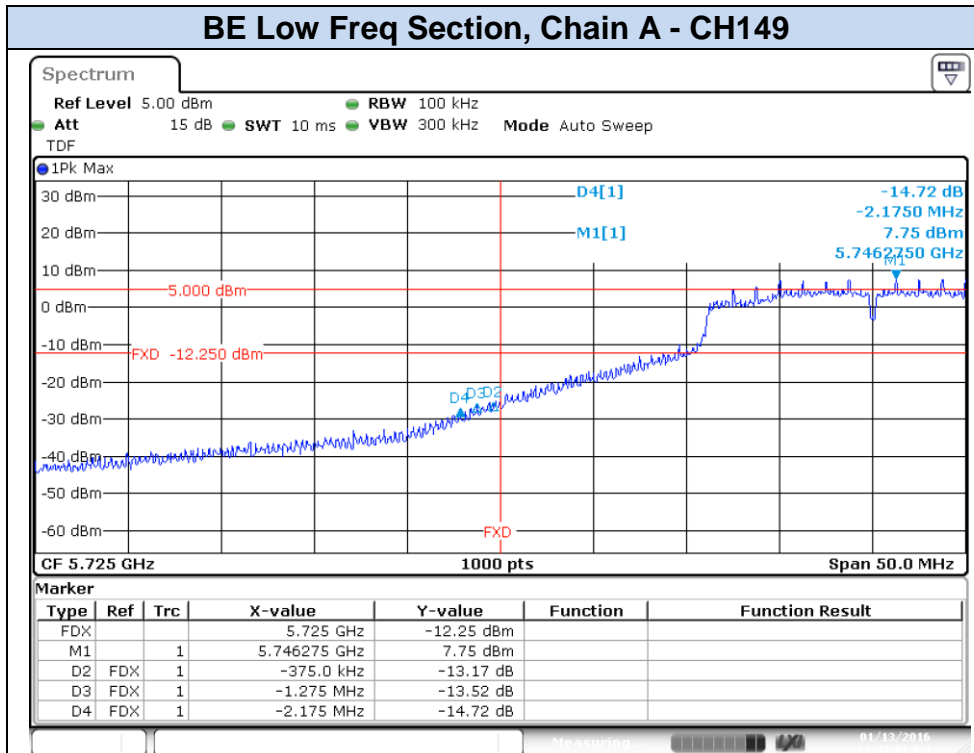


Band Edge results Screenshot:

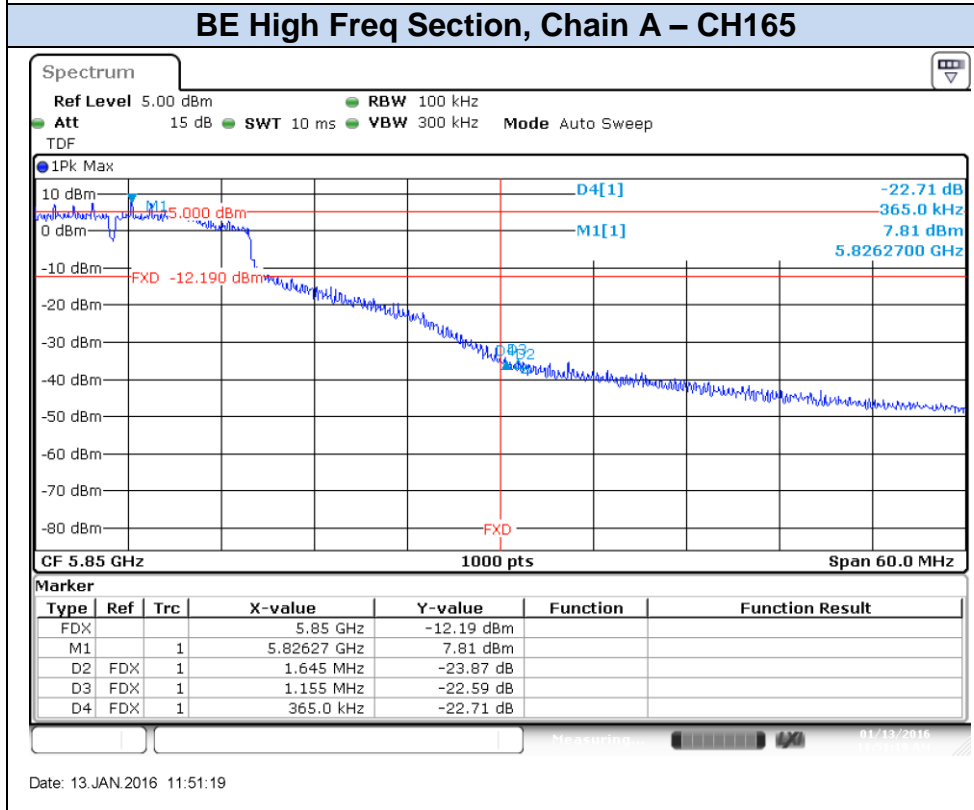
802.11a, 6Mbps



802.11n20, HT0

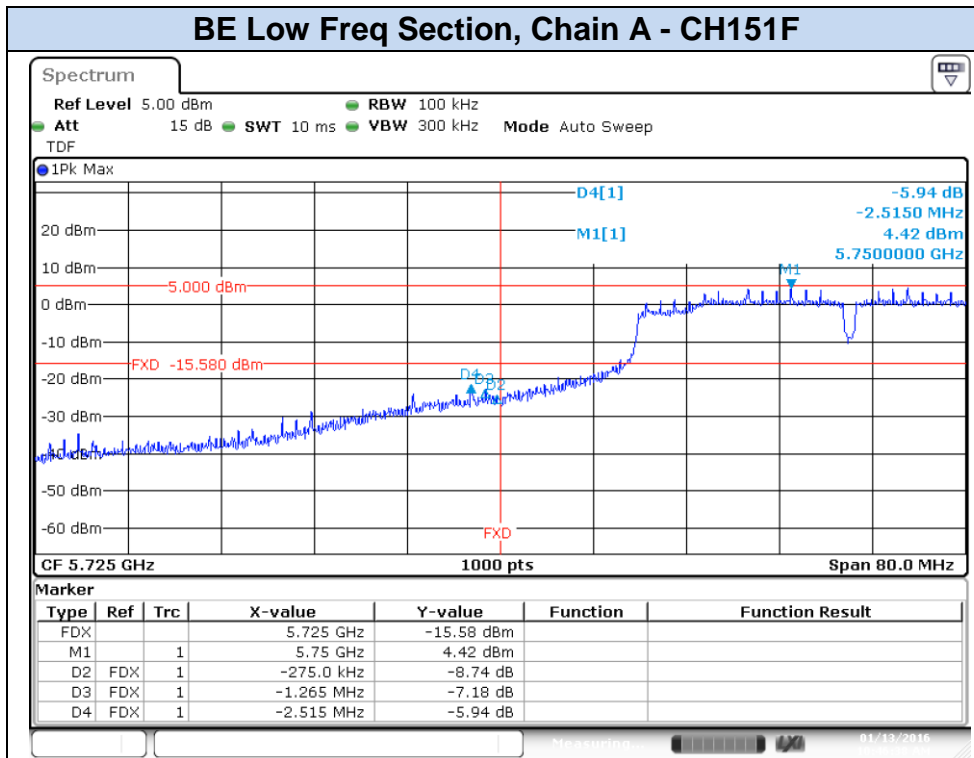


Date: 13.JAN.2016 11:33:02

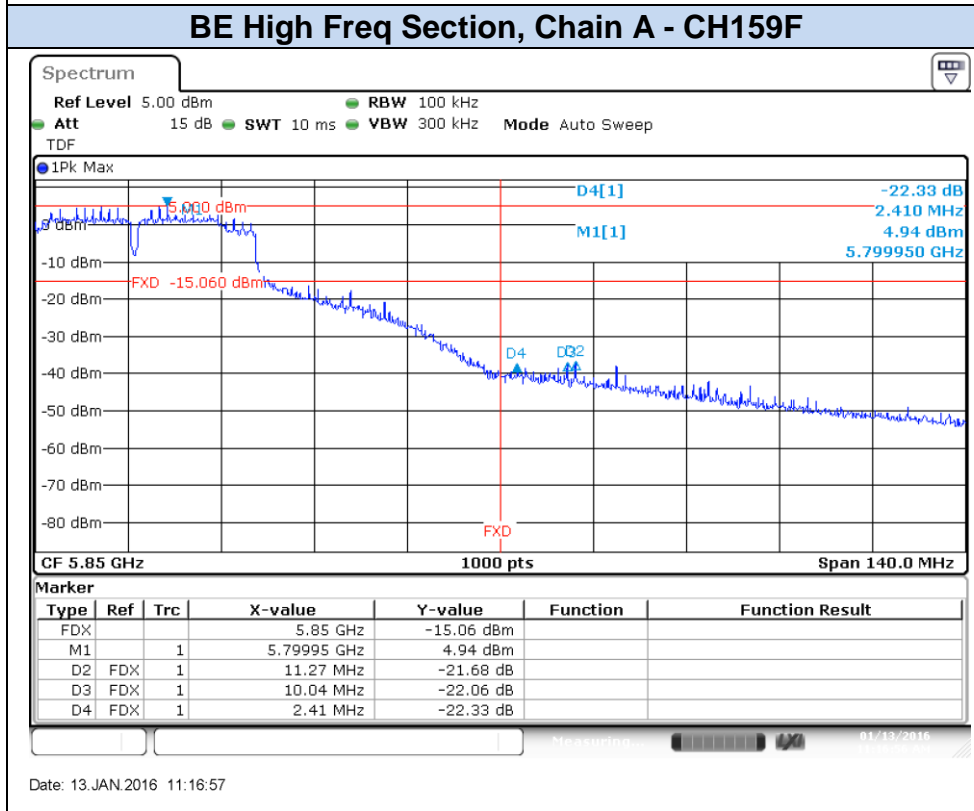


Date: 13.JAN.2016 11:51:19

802.11n40, HT0

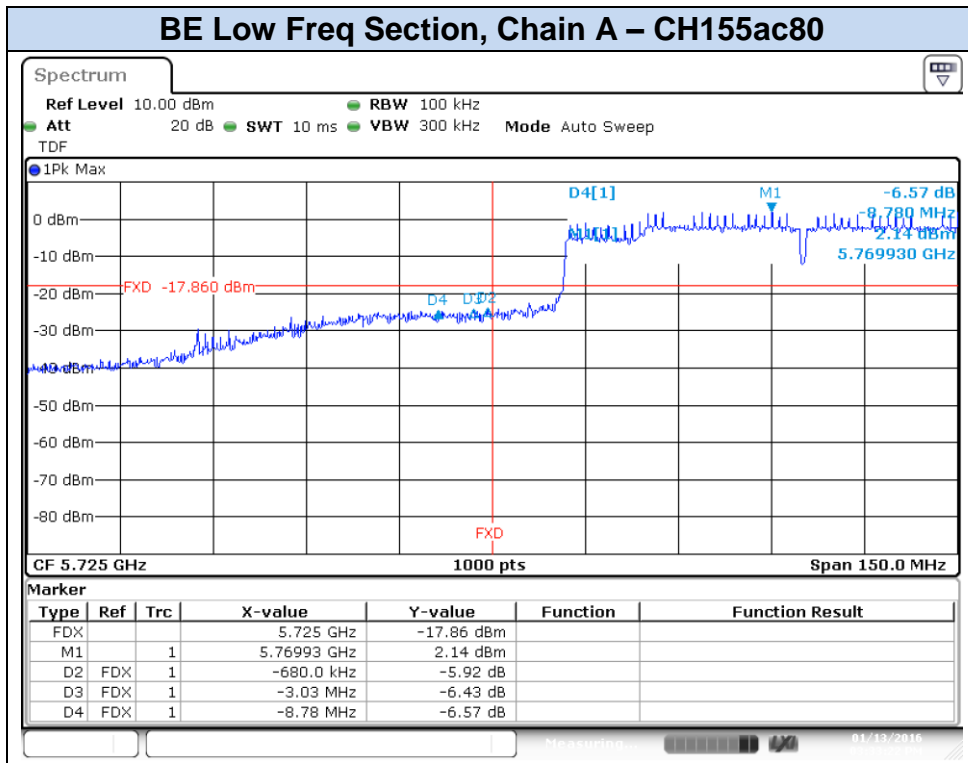


Date: 13.JAN.2016 10:46:38

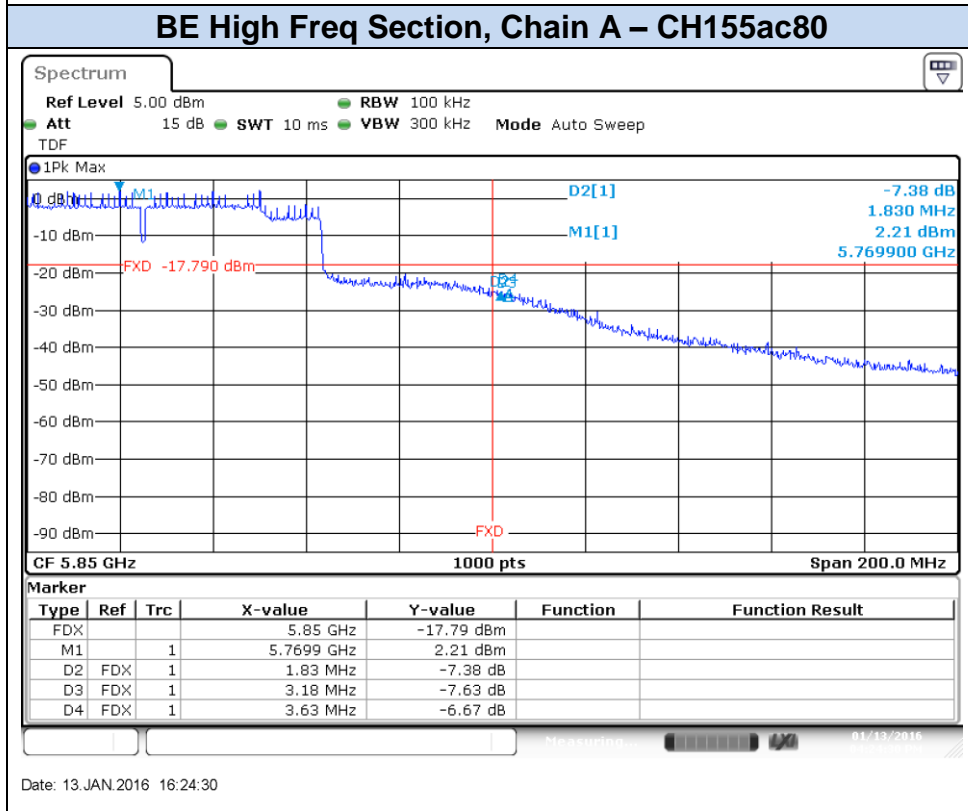


Date: 13.JAN.2016 11:16:57

802.11ac80, VHT0



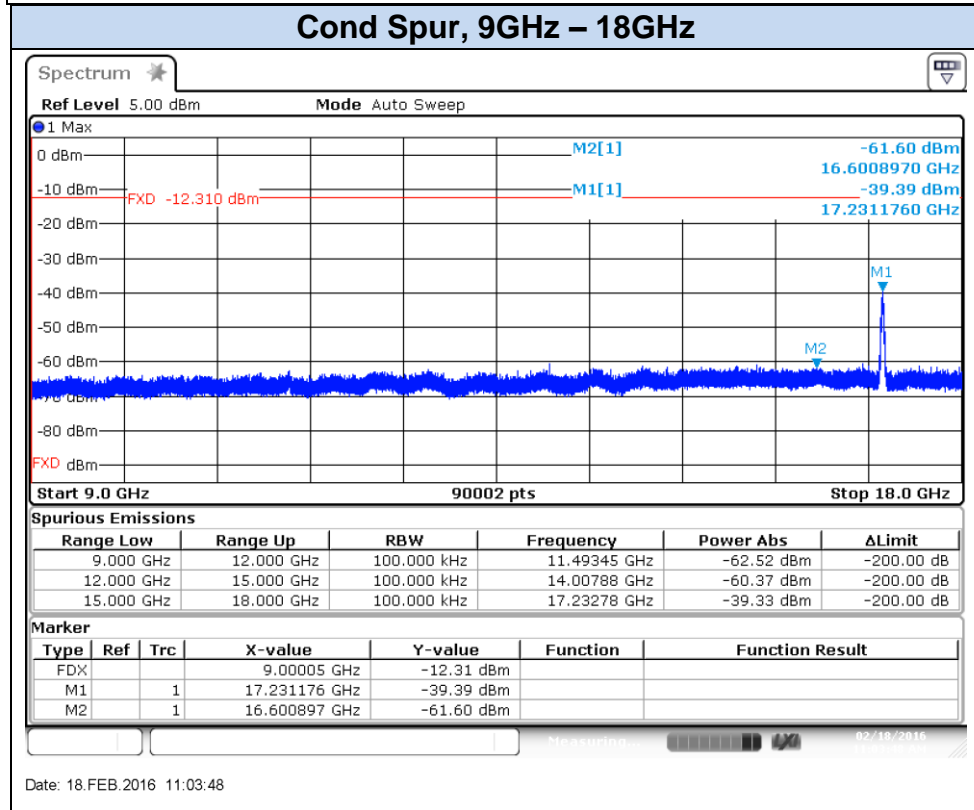
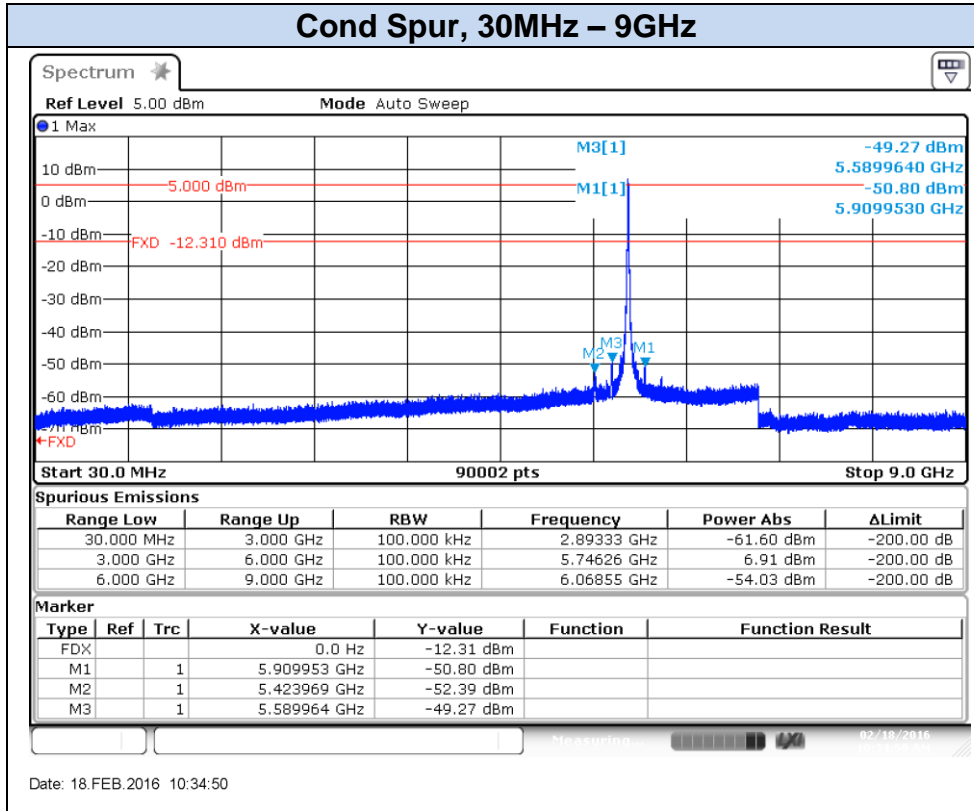
Date: 13.JAN.2016 15:33:22

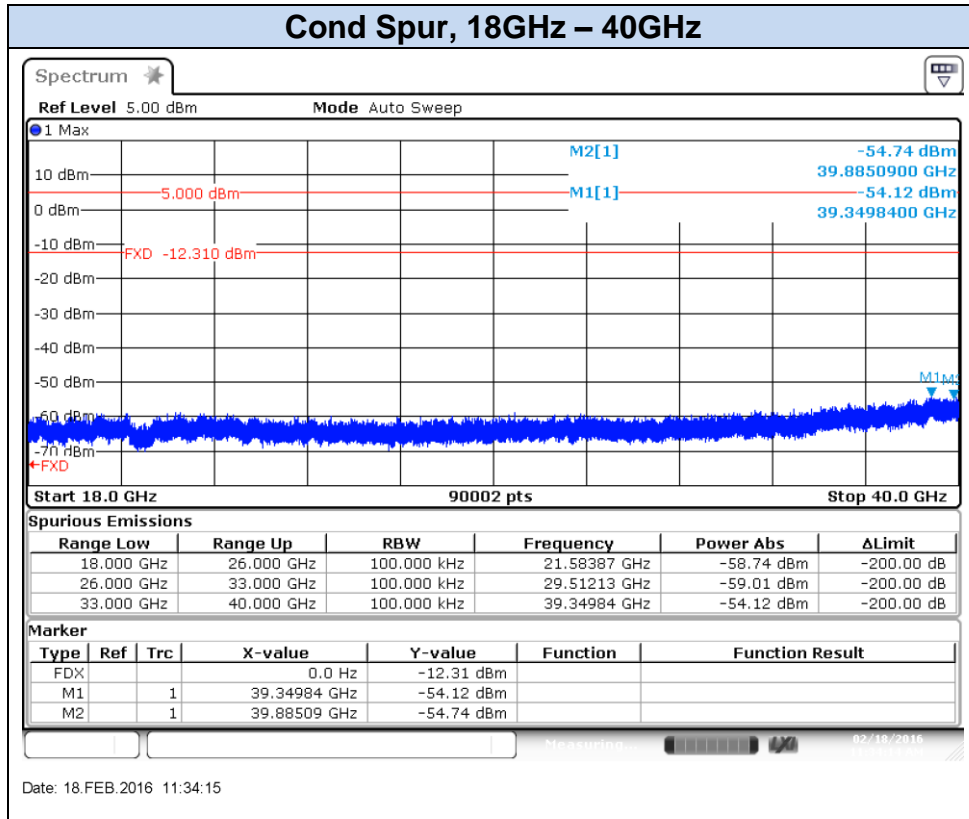


Date: 13.JAN.2016 16:24:30

Conducted Spurious results Screenshot:

802.11a, 6Mbps – Chain A, CH149





802.11a, 6Mbps – Chain A, CH157

