



TESTING CERT #3478.01



# TEST REPORT

EUT Description	WiGig, WLAN and BT, 2x2 PCIe M.2 2230 adapter card
Brand Name	Intel® Tri-Band Wireless-AC 18265
Model Name	1865NGW, 18265NGW LC
Serial Number	TA#: J30458-002 WF MAC: 34:13:E8:34:53:E4 / 34:13:E8:44:A8:B2 / 34:13:E8:34:54:98 / 34:13:E8:44:CF:34 (see section 4)
FCC ID	FCC ID: PD918265NG
Antenna type	Universe Technology
Hardware/Software Version	HW Cfg:33.10 Test SW: DRTU version 03789_1_9_0G (driver version: 19.1.0.1)
Date of Sample Receipt	2016-08-30
Date of Test Start/End	2016-09-07 / 2016-10-28
Features	WiGig + 802.11 a/b/g/n/ac Wireless LAN + BDR/EDR 2.1 + BLE 4.2 (see section 5)

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Reference Standards	FCC CFR Title 47 Part 15 E RSS-247 issue 1, RSS-Gen issue 4 (see section 1)
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Test Report number	160830-01.TR01
Revision Control	Rev. 00

The test results relate only to the samples tested.  
The test report shall not be reproduced in full, without written approval of the laboratory.

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## 1. Standards, reference documents and applicable test methods

1. FCC 47 CFR part 15 – Subpart E – Unlicensed National Information Infrastructure Devices.
2. FCC 47 CFR part 15 - Subpart C – §15.209 Radiated emission limits; general requirements.
3. FCC OET KDB 789033 D02 General UNII Test Procedures New Rules – Guidelines for compliance testing of Unlicensed National Information Infrastructure (U-NII) Devices.
4. FCC OET KDB 644545 D03 Guidance for IEEE 802.11ac v01 - GUIDANCE FOR IEEE Std 802.11ac™ DEVICES EMISSION TESTING.
5. ANSI C63.10-2013 American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

## 2. General conditions, competences and guarantees

- ✓ Intel Mobile Communications Wireless RF Lab (Intel WRF Lab) is a testing laboratory accredited by the American Association for Laboratory Accreditation (A2LA).
- ✓ Intel Mobile Communications Wireless RF Lab (Intel WRF Lab) is an Accredited Test Firm listed by the FCC, with Designation Number FR0011.
- ✓ Intel WRF Lab only provides testing services and is committed to providing reliable, unbiased test results and interpretations.
- ✓ Intel WRF Lab is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.
- ✓ Intel WRF Lab has developed calibration and proficiency programs for its measurement equipment to ensure correlated and reliable results to its customers.
- ✓ This report is only referred to the item that has undergone the test.
- ✓ This report does not imply an approval of the product by the Certification Bodies or competent Authorities.
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## 3. Environmental Conditions

- ✓ At the site where the measurements were performed the following limits were not exceeded during the tests:

Temperature	22.5 °C ± 4 °C
Humidity	50 % ± 20 %

#### 4. Test samples

Sample	Control #	Description	Model	Serial #	Date of reception	Note
#01	160830-01.S05	WiGig/ WiFi/BT Module	18265NGW	WFM: 34:13:E8:34:53:E4 BDM: 34:13:E8:34:53:E8 WGM: 34:13:E8:34:53:E9	2016-08-30	Used for conducted tests
	15081801.S05	Extender board	PCB00469	4694213-0134	2016-08-30	
	160107-01.S18	AC/DC Adapter	SPU60-102	08741164 1350	2016-01-07	
	160107-01.S15	Laptop	DELL Latitude	4Z2YG12	2016-01-07	
#02	160830-01.S06	WiGig/ WiFi/BT Module	18265NGW	WFM: 34:13:E8:44:A8:B2 BDM: 34:13:E8:44:A8:B6 WGM: 34:13:E8:44:A8:B7	2016-08-30	Used for all radiated tests (from 30MHz to 1 GHz and 18GHz to 40GHz) and for 802.11n20,HT 0, CH48,CH56 Chain A from 6.4GHz to 18GHz
	160830-01.S38	Extender board	PCB00469	ASS00469-001 4694213-099	2016-09-27	
	15051101.S09	Laptop	DELL E5440	9FSYN32	2015-05-12	
#03	160830-01.S12	WiGig/ WiFi/BT Module	18265NGW	WFM: 34:13:E8:34:54:98 BDM: 34:13:E8:34:54:9C WGM: 34:13:E8:34:54:9D	2016-08-30	Used for radiated tests (from 1GHz to 6.4GHz)
	160830-01.S21	Extender Rev-2	PCB00469	4694213-245	2016-09-02	
	160202-02.S29	Control Laptop	Dell Latitude E6430	D41QVY1	2016-03-18	
	160202-02.S19	PCI Extender	PCB00284	ASS0248 2480614- 071	2016-02-10	
	160202-02.S20	ExpressCard Adapter	Not available	600010757	2016-02-12	

Sample	Control #	Description	Model	Serial #	Date of reception	Note
#04	160830-01.S11	WiGig/ WiFi/BT Module	18265NGW	WFM: 34:13:E8:44:CF:34 BDM: 34:13:E8:44:CF:38 WGM: 34:13:E8:44:CF:39	2016-08-30	Used for radiated tests (from 6.4GHz to 18GHz) except the cases indicated in sample #02 notes
	160830-01.S21	Extender Rev-2	PCB00469	4694213-245	2016-09-02	
	160202-02.S29	Control Laptop	Dell Latitude E6430	D41QVY1	2016-03-18	
	160202-02.S19	PCI Extender	PCB00284	ASS0248 2480614-071	2016-02-10	
	160202-02.S20	ExpressCard Adapter	Not available	600010757	2016-02-12	

NA: Not Applicable

### 5. EUT features

These are the detailed bands and modes supported by the Equipment Under Test:

WiGig	60GHz (57.24 – 63.72 GHz)
802.11b/g/n	2.4GHz (2400.0 – 2483.5 MHz)
802.11a/n/ac	5.2GHz (5150.0 – 5250.0 MHz)
	5.3GHz (5250.0 – 5350.0 MHz)
	5.6GHz (5470.0 – 5725.0 MHz)
	5.8GHz (5725.0 – 5850.0 MHz)
BDR/EDR/BLE 4.2	2.4GHz (2400.0 – 2483.5 MHz)

### 6. Remarks and comments

N/A

## 7. Test Verdicts summary

### 7.1. 802.11 a/n/ac – U-NII-1

FCC part	Test name	Verdict
15.407 (a) (1)	Power Limits. Maximum output power	P
15.407 (a) (1)	Peak power spectral density	P
15.407 (b) (1) 15.209	Undesirable emissions limits: Band Edge (conducted)	P
15.407 (b) (1) 15.209	Undesirable emissions limits (radiated)	P

### 7.2. 802.11 a/n/ac – U-NII-2A

FCC part	Test name	Verdict
15.407 (a) (2)	Power Limits. Maximum output power	P
15.407 (a) (2)	Peak power spectral density	P
15.407 (b) (2) 15.209	Undesirable emissions limits: Band Edge (conducted)	P
15.407 (b) (2) 15.209	Undesirable emissions limits (radiated)	P

P: Pass  
 F: Fail  
 NM: Not Measured  
 NA: Not Applicable

## 8. Document Revision History

Revision #	Date	Modified by	Details
Rev. 00	2016/10/28	I.Kharrat M.Lefebvre E. Garcia	First issue Radiated spurious emission section Radiated spurious emission section Conducted section

# Annex A. Test & System Description

## A.1 Test Conditions

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

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

The conducted RF output power at chain A 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 spectrum analyser with the channel integration method according to point II) E) 2) e) (Method SA-2 Alternative) of Guidance 789033 D02.

Measured values for adjustment were within +/- 0.25 dB from the declared Target values.

U-NII-1					Conducted Power, Target Value (dBm)		
Mode	BW (MHz)	Data Rate	CH #	Freq. (MHz)	SISO Chain A	SISO Chain B	MIMO at both ports A and B
802.11a	20	6Mbps	36	5180	19.0	19.0	-
			40	5200	21.0	20.0	-
			48	5240	19.5	20.5	-
802.11n	20	HT0 HT8*	36	5180	18.5	19.0	17.0
			40	5200	20.5	20.0	19.0
			48	5240	19.5	20.5	19.0
	40	HT0 HT8*	38F	5190	16.0	17.0	15.0
46F			5230	21.0	21.0	19.0	
802.11ac	80	VHT0	42ac80	5210	15.0	14.5	13.0

U-NII-2A					Conducted Power, Target Value (dBm)		
Mode	BW (MHz)	Data Rate	CH #	Freq. (MHz)	SISO Chain A	SISO Chain B	MIMO at both ports A and B
802.11a	20	6Mbps	52	5260	20.5	20.0	-
			56	5280	20.0	20.0	-
			64	5320	18.5	18.5	-
802.11n	20	HT0 HT8*	52	5260	20.5	20.0	18.5
			56	5280	19.0	20.0	18.5
			64	5320	18.5	18.5	15.0
	40	HT0 HT8*	54F	5270	20.5	20.5	18.5
62F			5310	13.5	13.5	12.5	
802.11ac	80	VHT0	58ac80	5290	13.0	12.5	11.0

The following data rates were selected based on preliminary testing that identified those rates as the worst cases for output power and spurious levels at the band edges:

802.11a → 6Mbps

802.11n20 and 802.11n40 (SISO) → HT0

802.11n20 and 802.11n40 (MIMO) → HT8

802.11ac80 (SISO) → VHT0

802.11ac80 (MIMO) → VHT0

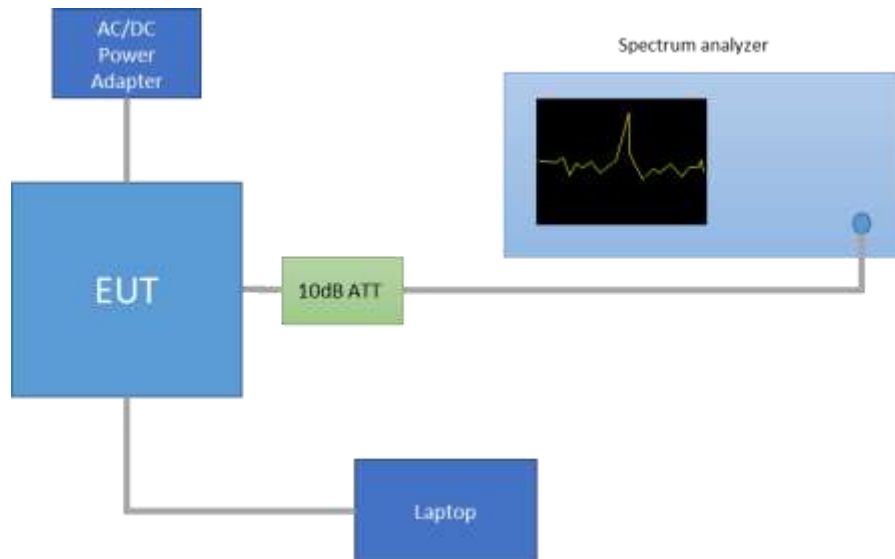
Alternative channels to the lowest and highest channels per band have been also tested for Band Edge compliance.

## A.2 Measurement system

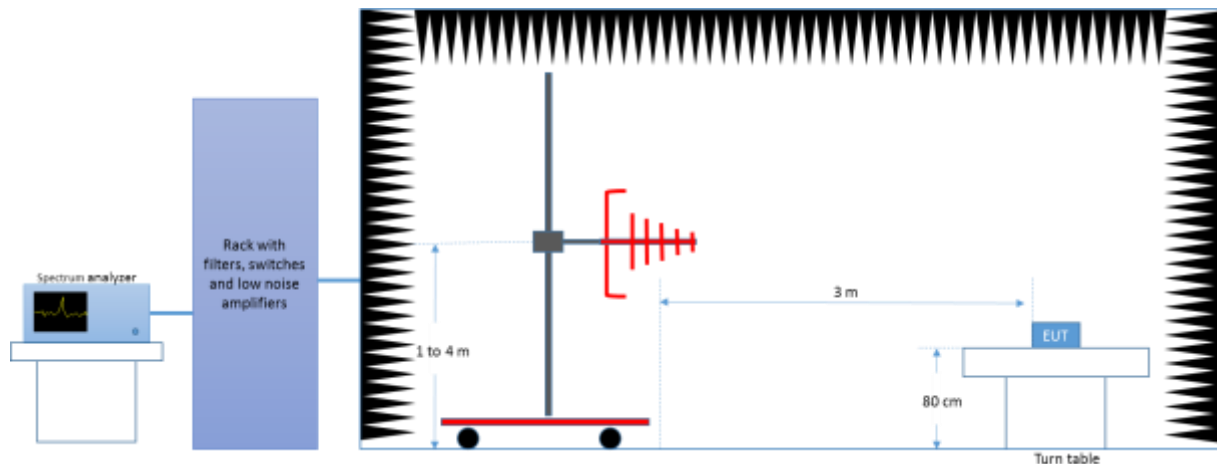
Measurements were performed using the following setups, made in accordance to the general provisions of FCC KDB 789033 D02 General UNII Test Procedures.

The DUT was installed in a test fixture and this test fixture is connected to a laptop computer and AC/DC power adapter. The laptop computer was used to configure the EUT to continuously transmit at a specified output power using all different modes and modulation schemes, using the Intel proprietary tool DRTU.

### Conducted Setup

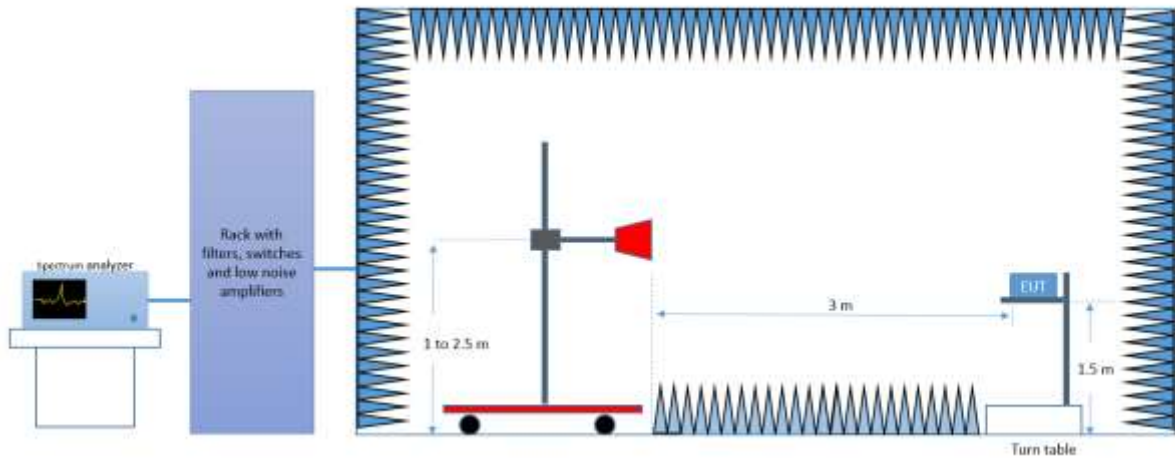


### Radiated Setup < 1GHz

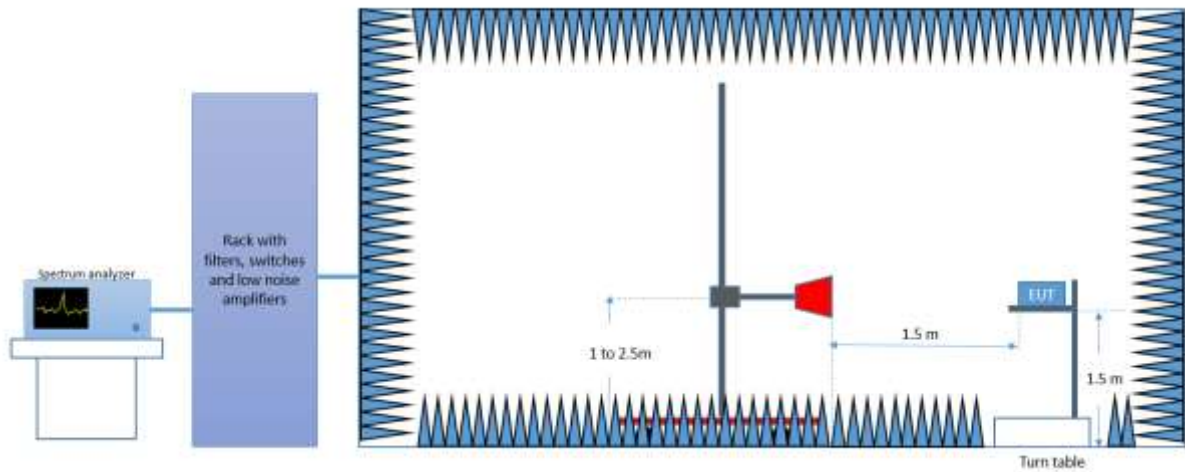




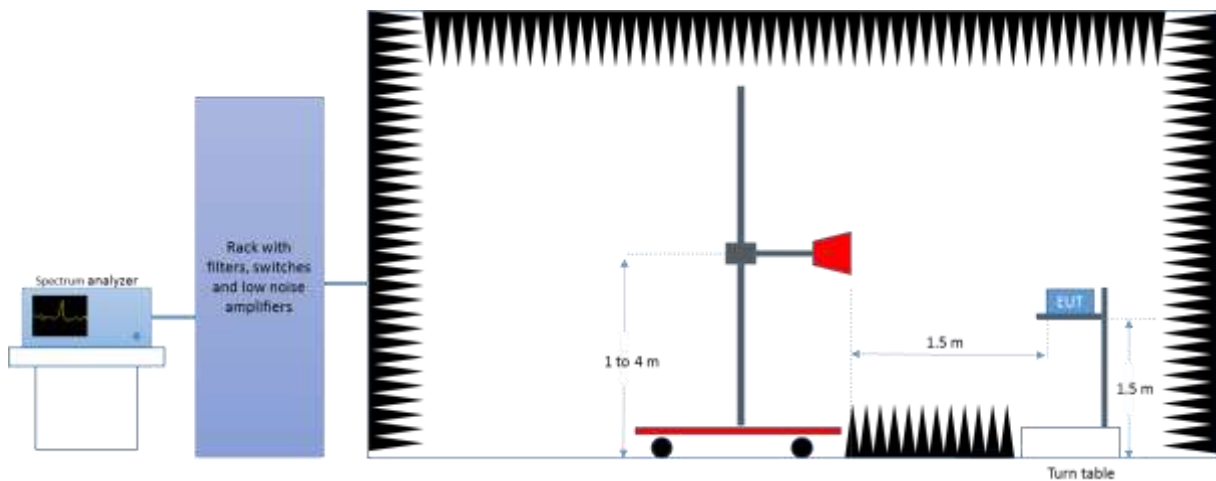
*Radiated Setup 1 GHz - 18 GHz*



*Radiated Setup 18 GHz - 26.5 GHz*



*Radiated Setup > 26.5 GHz*



### A.3 Test Equipment List

#### Conducted Setup

ID#	Device	Type/Model	Serial Number	Manufacturer	Cal. Date	Cal. Due Date
0316	Spectrum Analyser	FSV30	103309	Rohde & Schwarz	2015-03-20	2017-03-20

#### Radiated Setup

ID#	Device	Type/Model	Serial Number	Manufacturer	Cal. Date	Cal. Due Date
0420	Spectrum analyzer	FSV40	101556	Rohde & Schwarz	2016-04-15	2018-04-15
0133	Spectrum analyzer	FSV40	101358	Rohde & Schwarz	2016-04-15	2018-04-15
0137	Log antenna 30 MHz – 1 GHz	3142E	00156946	ETS Lindgren	2015-12-11	2017-12-11
0138	Horn antenna 1 GHz – 6.4 GHz	3117	00152266	ETS Lindgren	2016-03-14	2018-03-14
0248	Double Ridge Antenna with preamplifier 1 GHz – 18 GHz	3117	00167062	ETS Lindgren	2016-07-26	2018-07-26
0141	Double Ridge Horn Antenna 1 GHz – 18 GHz	3117	00157736	ETS Lindgren	2016-04-13	2018-04-13
0409	PreAmplifier	3117-PA	00157993	ETS Lindgren	N/A	N/A
0139	Horn Antenna 18 GHz - 26.5 GHz	114514	00167100	ETS Lindgren	2016-03-16	2018-03-16
0140	Horn Antenna 26.5 GHz – 40 GHz	120722	00169638	ETS Lindgren	2016-07-26	2018-07-26
0135	Semi Anechoic chamber	FACT 3	5720	ETS Lindgren	2016-04-28	2018-04-28
0337	Full Anechoic chamber	RFD_FA_100	5996	ETS Lindgren	2016-04-28	2018-04-28
0329	Measurement Software	EMC32	100401	Rohde & Schwarz	N/A	N/A
0530	Measurement Software	EMC32	100623	Rohde & Schwarz	N/A	N/A
0296	Power Supply	6673A	MY41000318	Agilent	N/A	N/A
0346	Multimeter	34401A	US36054685	HP	2016-02-04	2018-02-04
0038	Power Meter	ML2487B	952010	ANRITSU	2015-09-24	2017-09-24

#### A.4 Measurement Uncertainty Evaluation

The system uncertainty evaluation is shown in the below table:

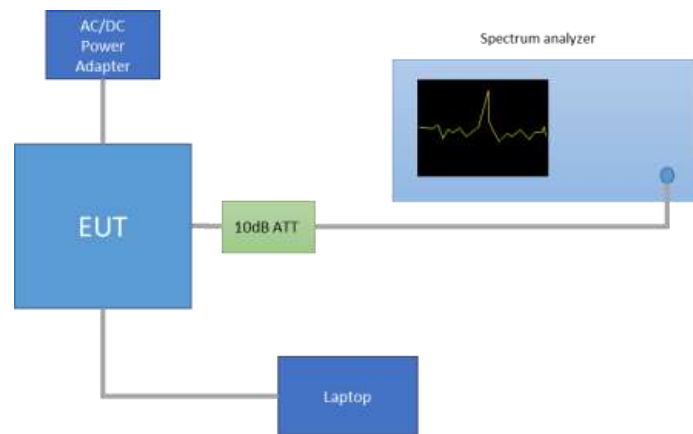
Measurement type	Uncertainty [ ±dB]
Conducted Power	±1.0
Conducted Spurious Emission	±2.9
Radiated tests <1GHz	±3.8
Radiated tests 1GHz - 40 GHz	±4.7

# Annex B. Test Results UNII-1

## B.1 26dB & 99% Bandwidth

### Test procedure

The setup below was used to measure the 26dB & 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.

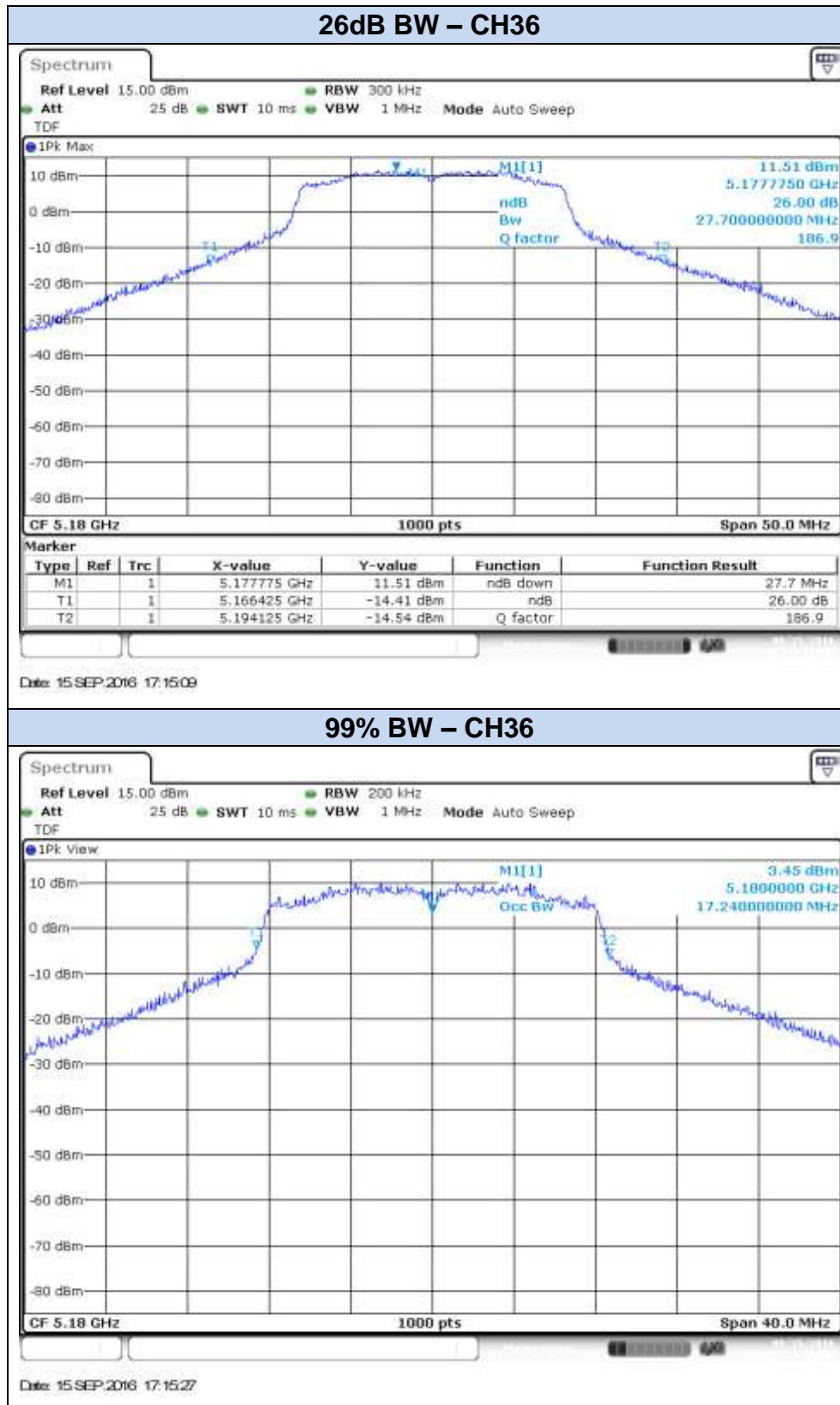


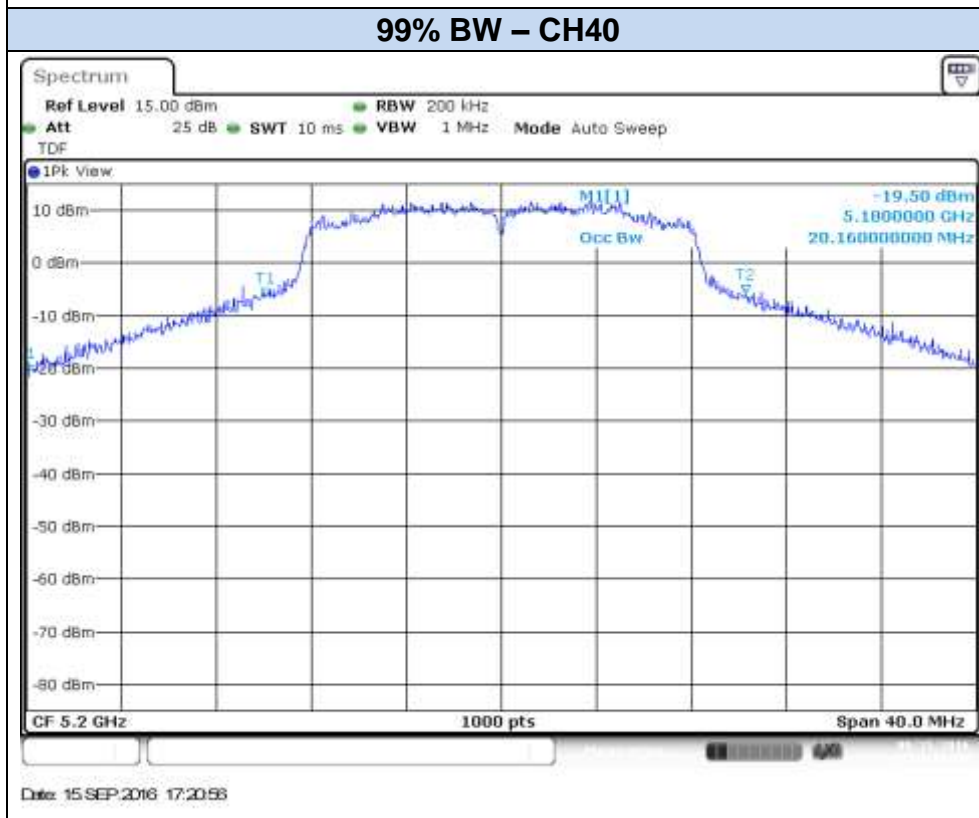
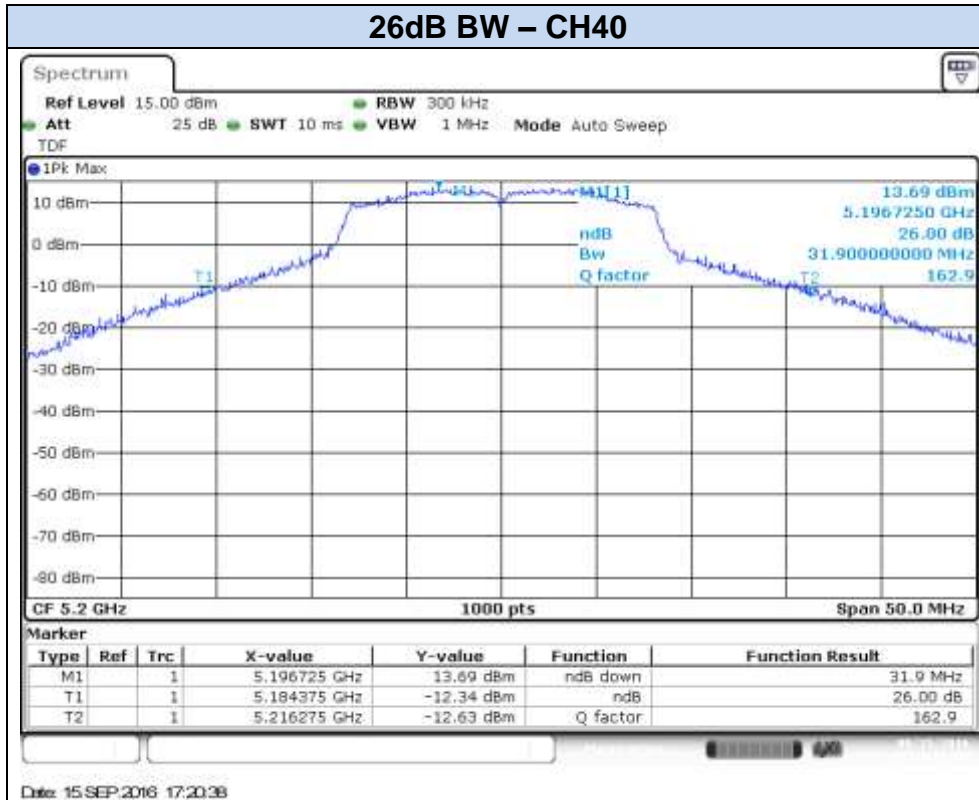
### Results tables

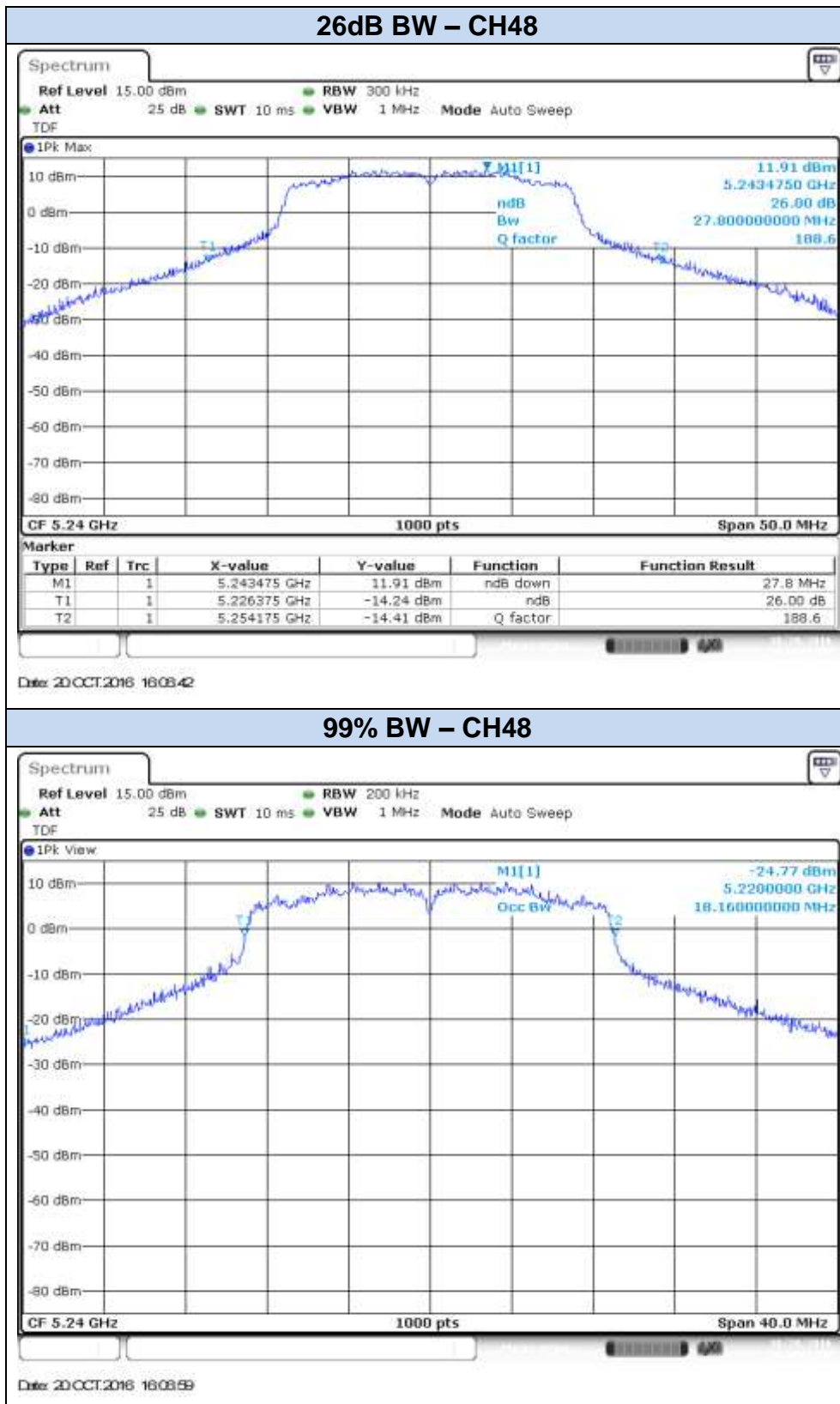
Mode	Rate	Antenna	Channel	Frequency [MHz]	26dB BW [MHz]	99% BW [MHz]
802.11a	6Mbps	SISO CHAIN A	36	5180	27.70	17.24
			40	5200	31.90	20.16
			48	5240	27.80	18.16
		SISO CHAIN B	36	5180	27.15	17.04
			40	5200	30.30	19.00
			48	5240	32.30	20.20
802.11n20	HT0	SISO CHAIN A	36	5180	27.25	18.04
			40	5200	32.30	20.28
			48	5240	27.80	18.16
		SISO CHAIN B	36	5180	27.70	18.08
			40	5200	32.45	19.80
			48	5240	34.50	20.68
802.11n20	HT8	MIMO CHAIN A	36	5180	25.05	17.80
			40	5200	28.55	18.24
			48	5240	28.95	18.20
		MIMO CHAIN B	36	5180	24.40	17.76
			40	5200	24.70	17.92
			48	5240	25.75	17.88

Mode	Rate	Antenna	Channel	Frequency [MHz]	26dB BW [MHz]	99% BW [MHz]
802.11n40	HT0	SISO CHAIN A	38F	5190	46.44	36.40
			46F	5230	67.23	<b>40.80</b>
		SISO CHAIN B	38F	5190	46.62	36.40
			46F	5230	59.76	38.00
	HT8	MIMO CHAIN A	38F	5190	46.17	36.32
			46F	5230	49.32	36.72
		MIMO CHAIN B	38F	5190	43.74	36.08
			46F	5230	45.45	36.24
802.11ac80	VHT0	SISO CHAIN A	42ac80	5210	85.69	<b>75.00</b>
		SISO CHAIN B	42ac80	5210	85.12	74.88
	VHT0	MIMO CHAIN A	42ac80	5210	86.07	75.00
		MIMO CHAIN B	42ac80	5210	84.74	74.88

**Max Value**

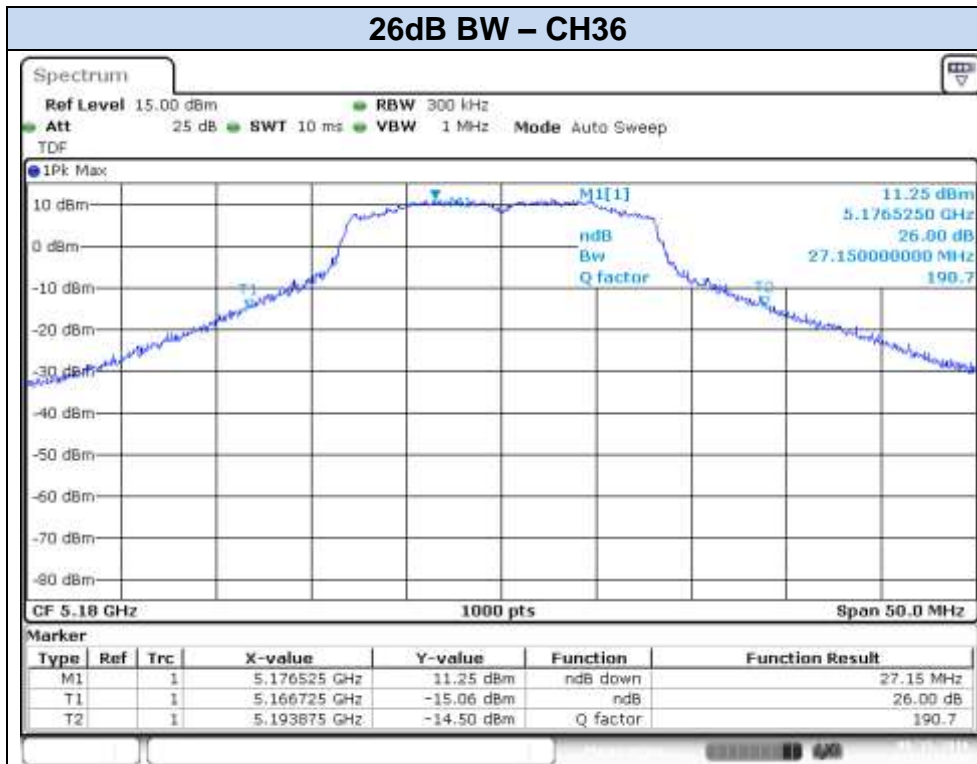
**Results screenshot****802.11a, 6Mbps – SISO - Chain A**





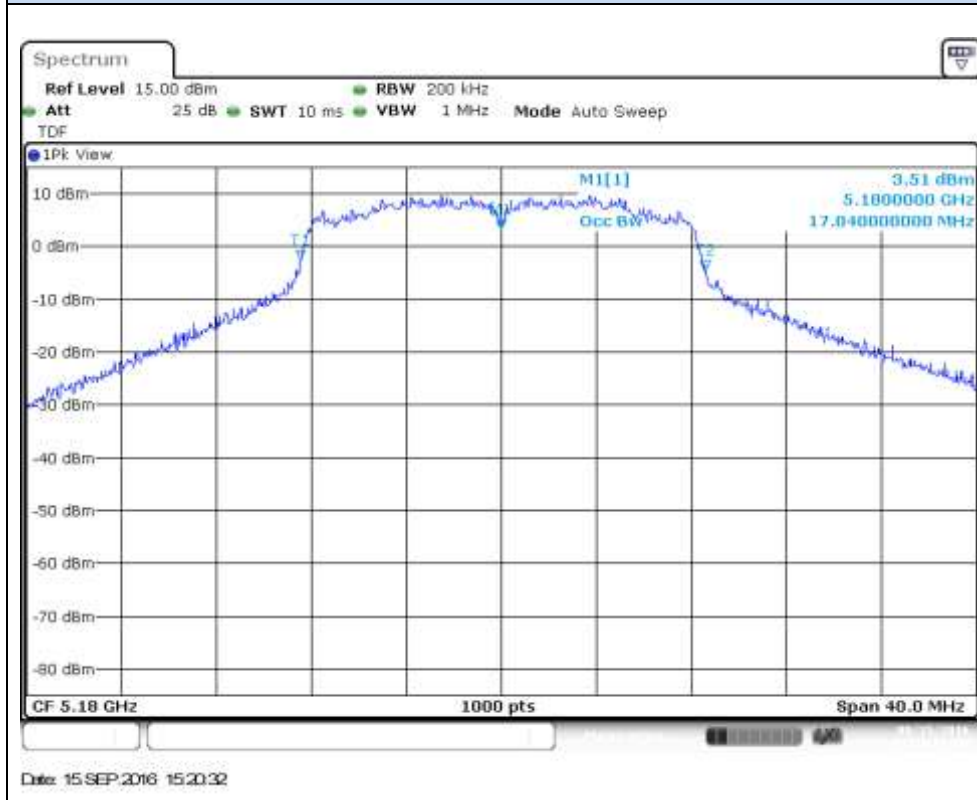


## 802.11a, 6Mbps – SISO - Chain B

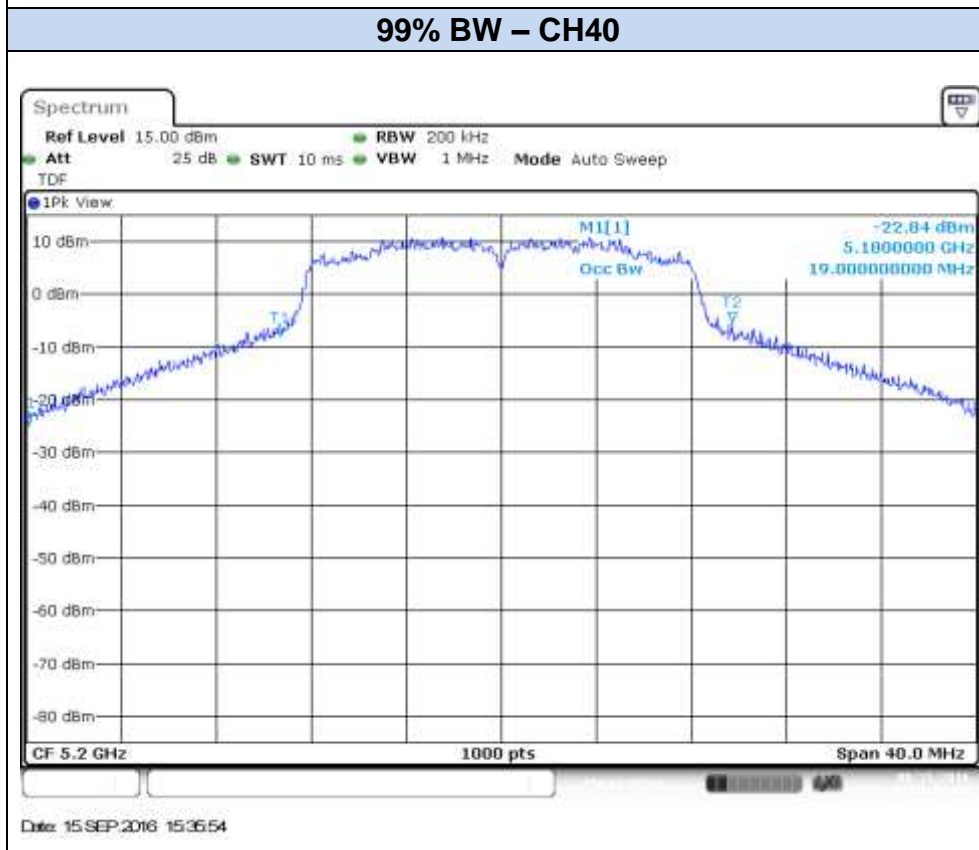
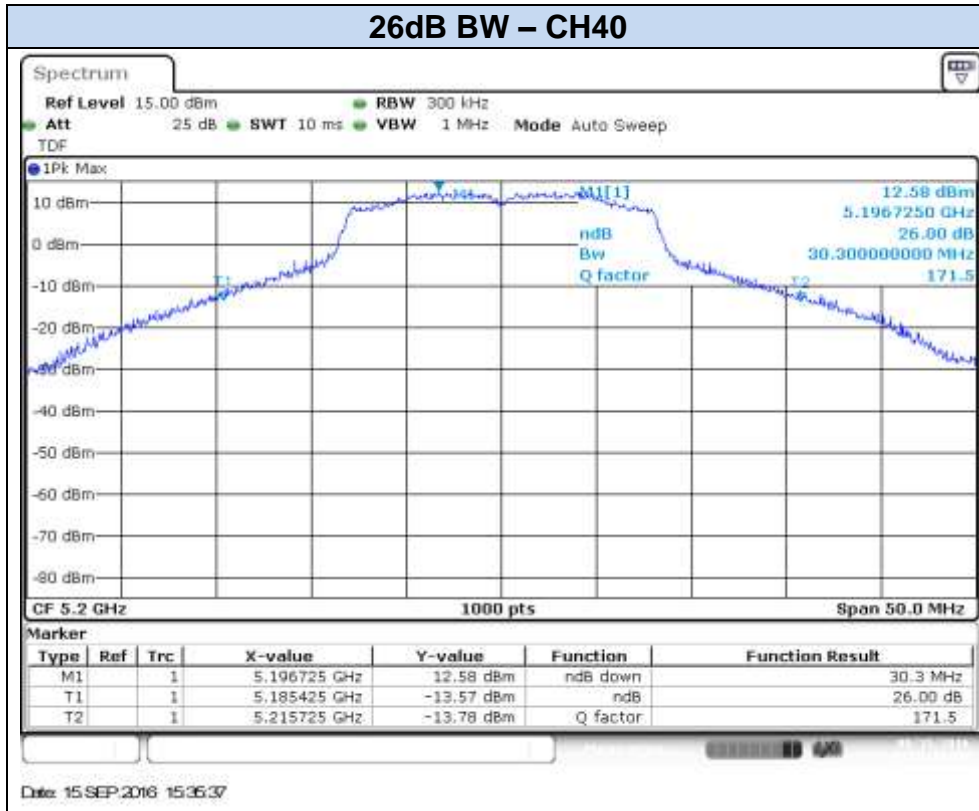


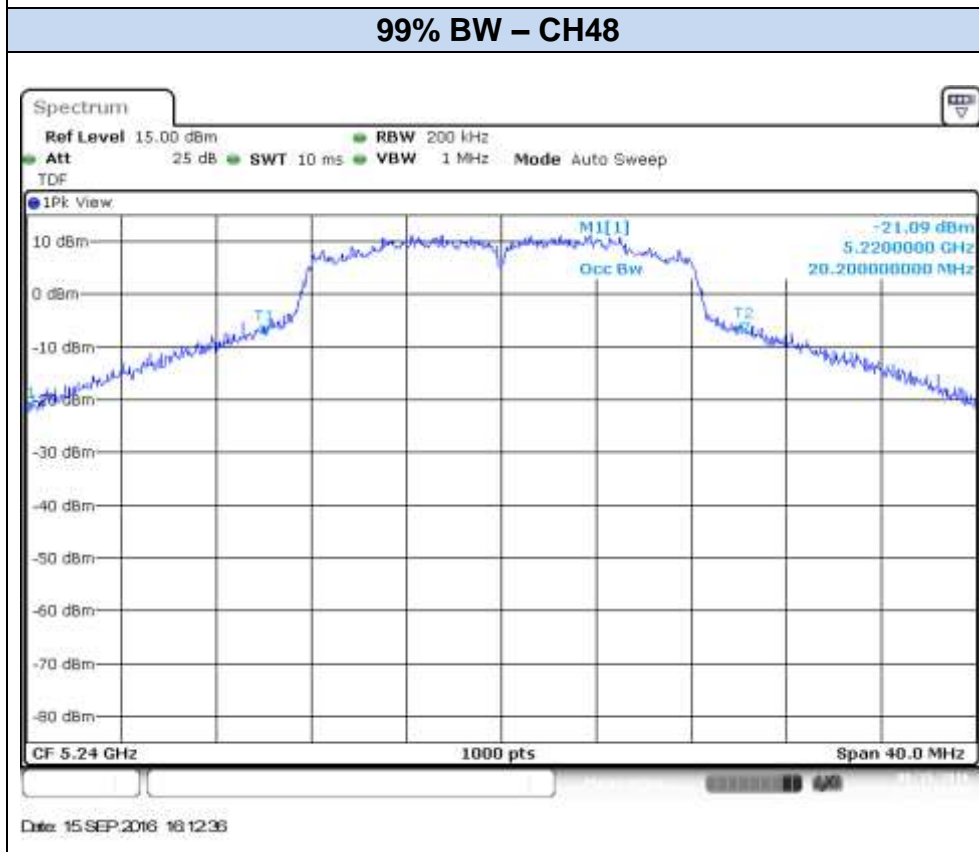
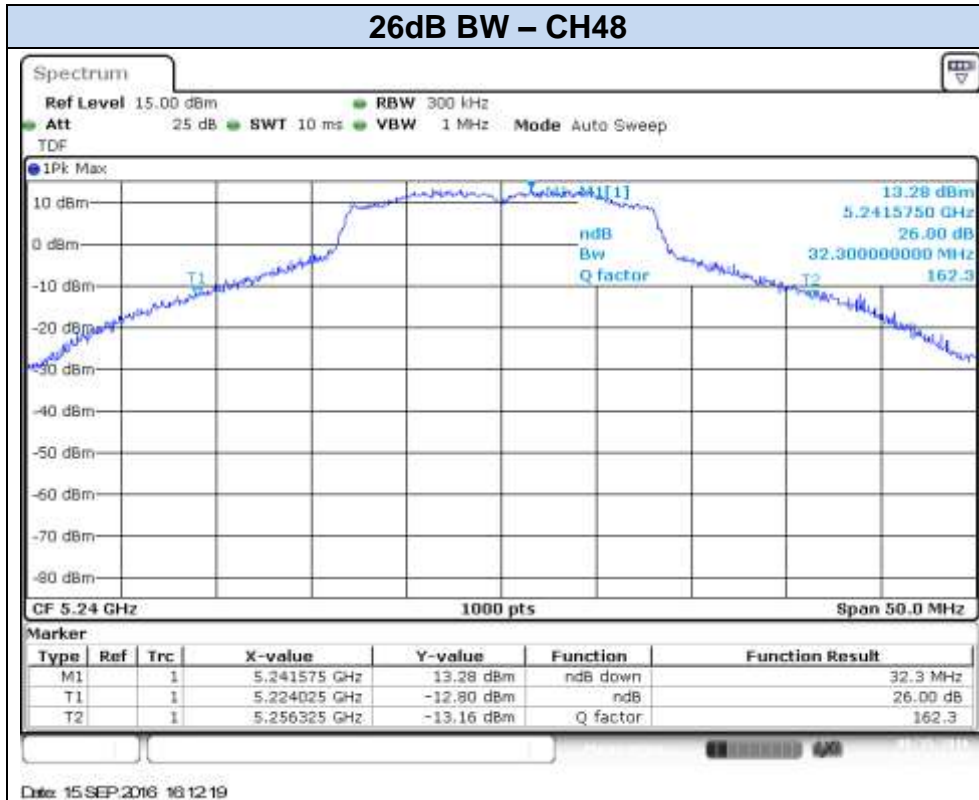
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### 99% BW – CH36

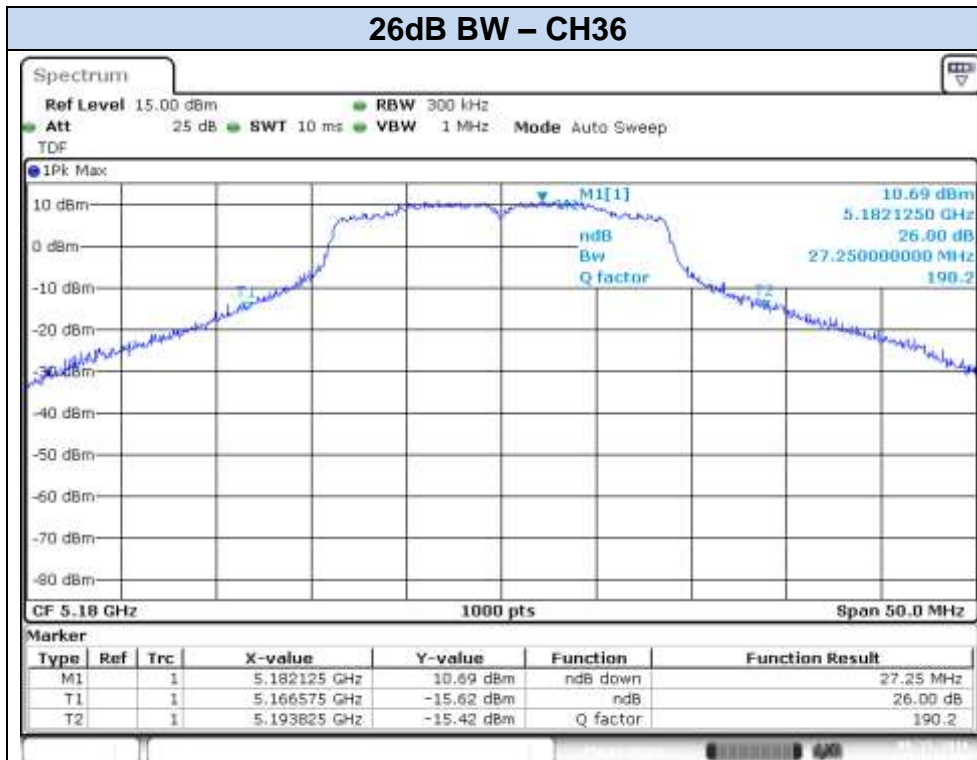


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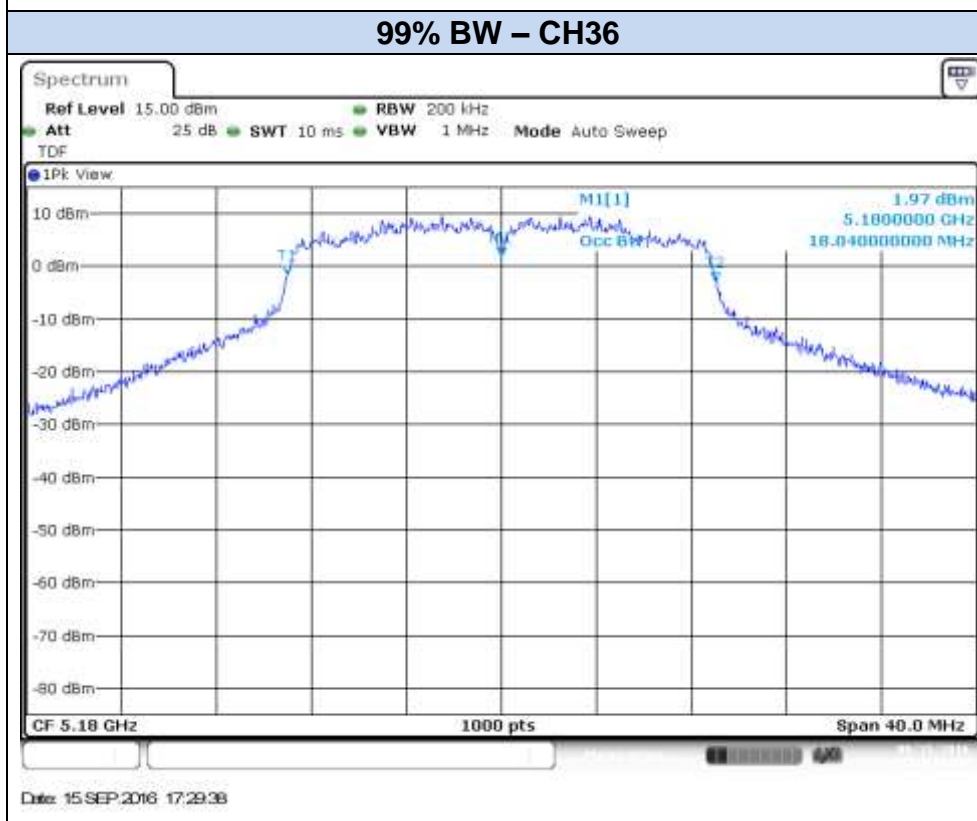




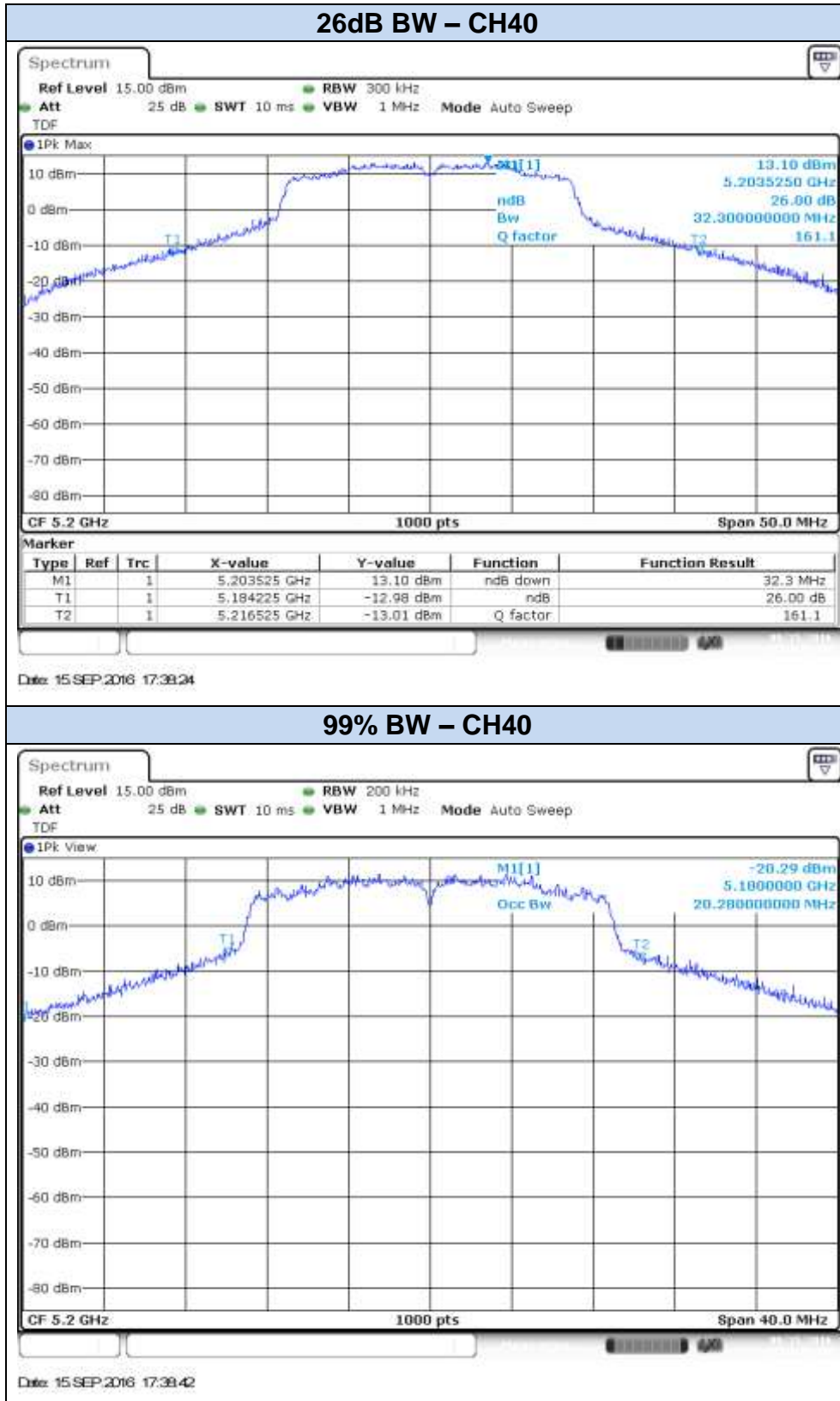
### 802.11n20, HT0 – SISO - Chain A

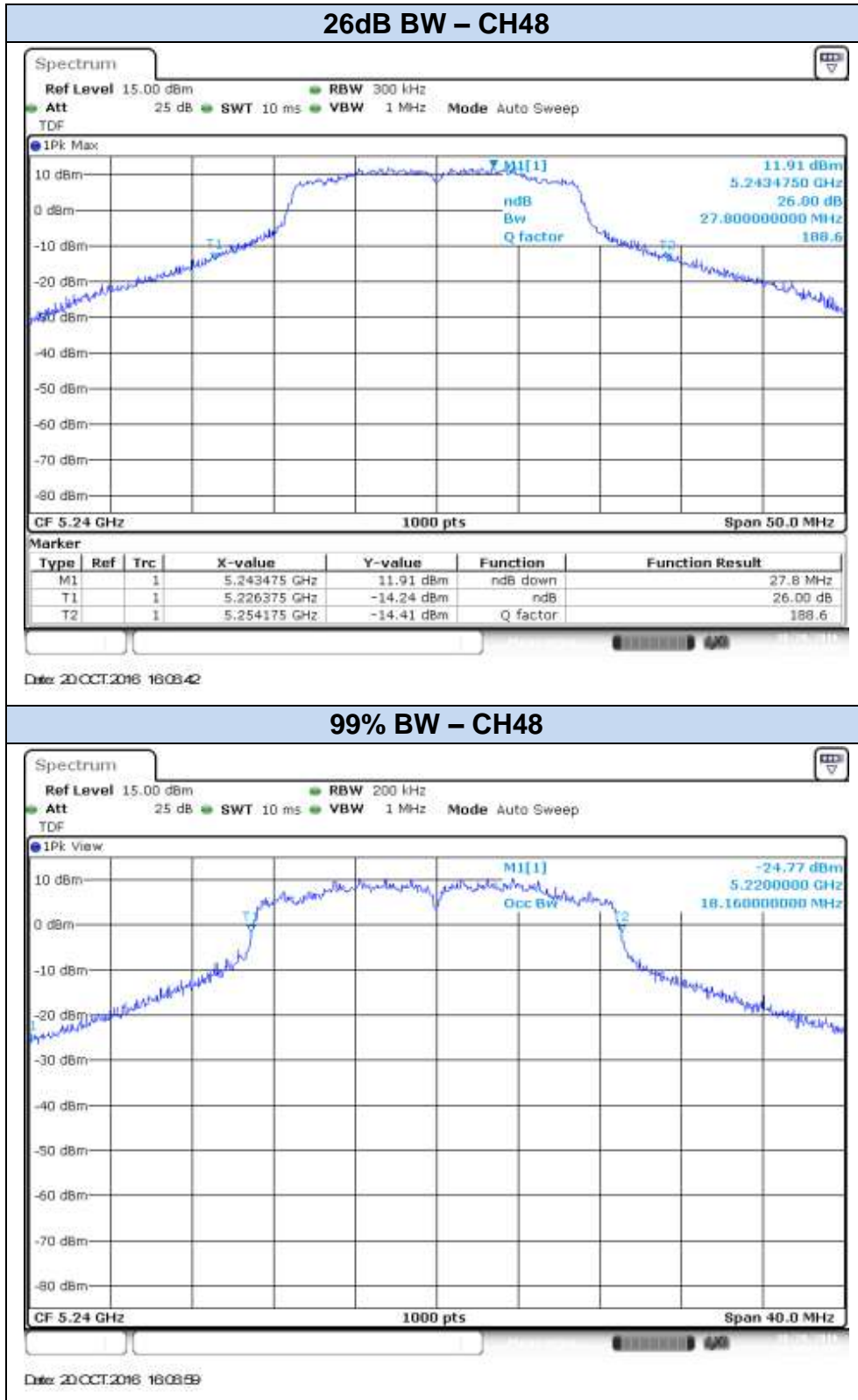


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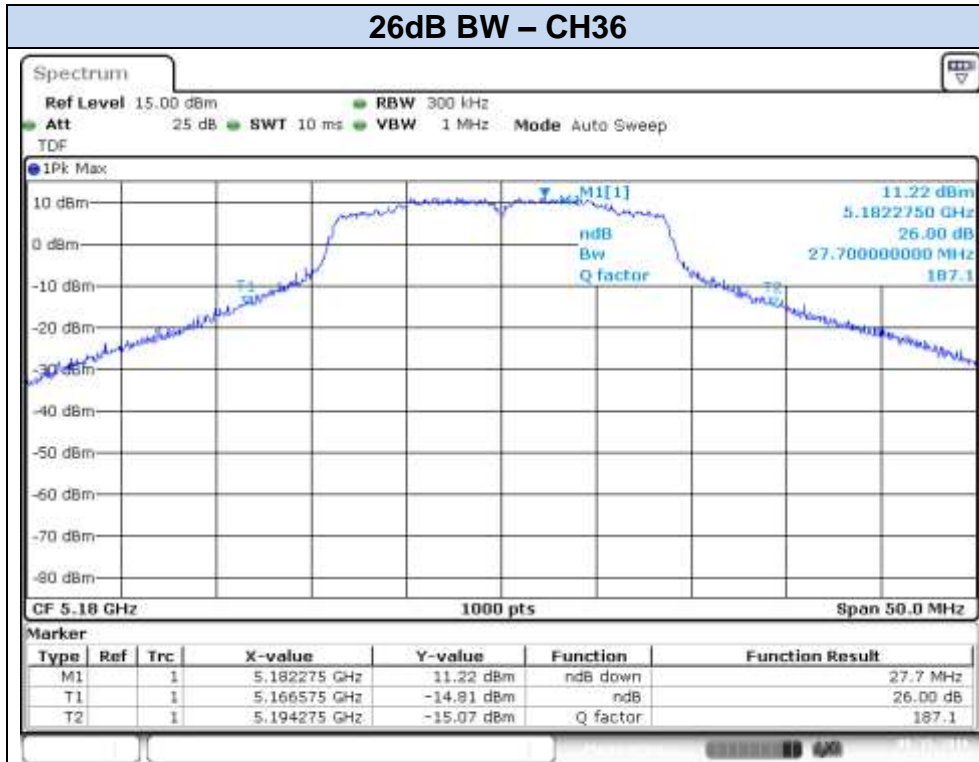
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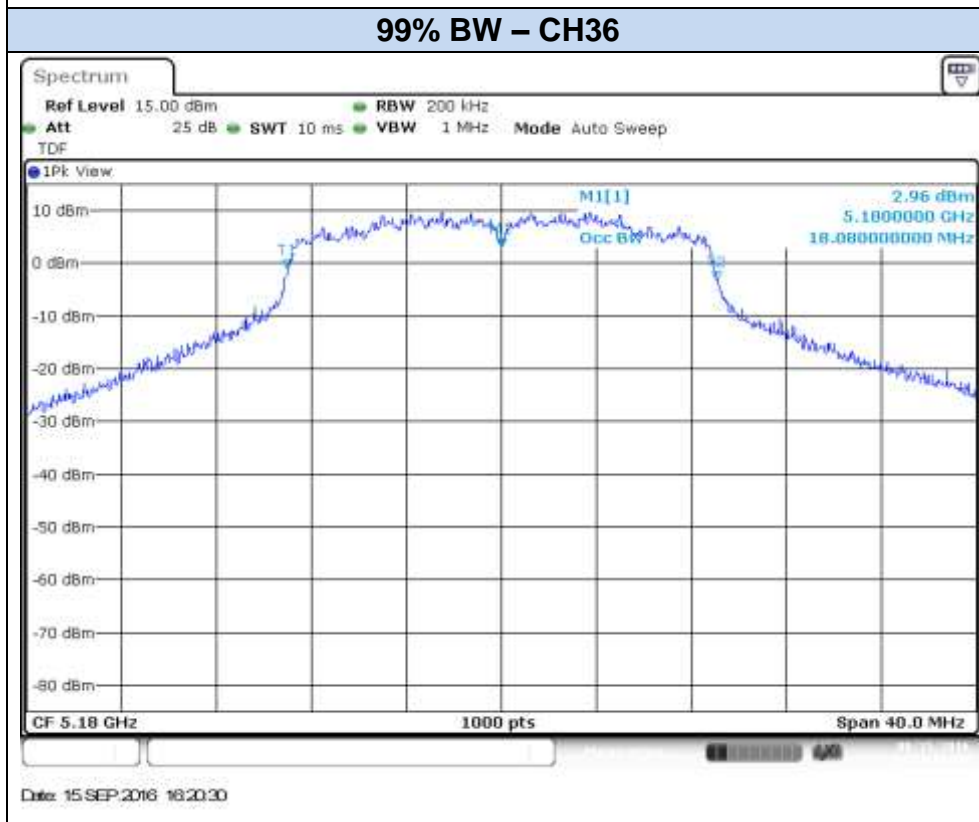




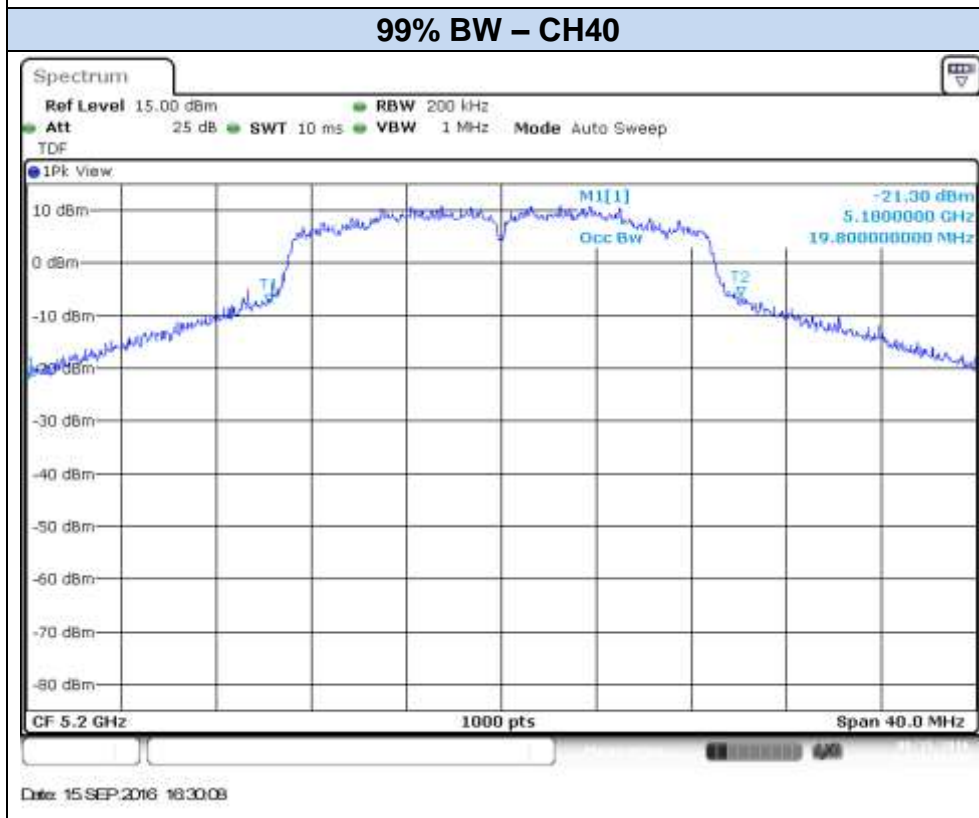
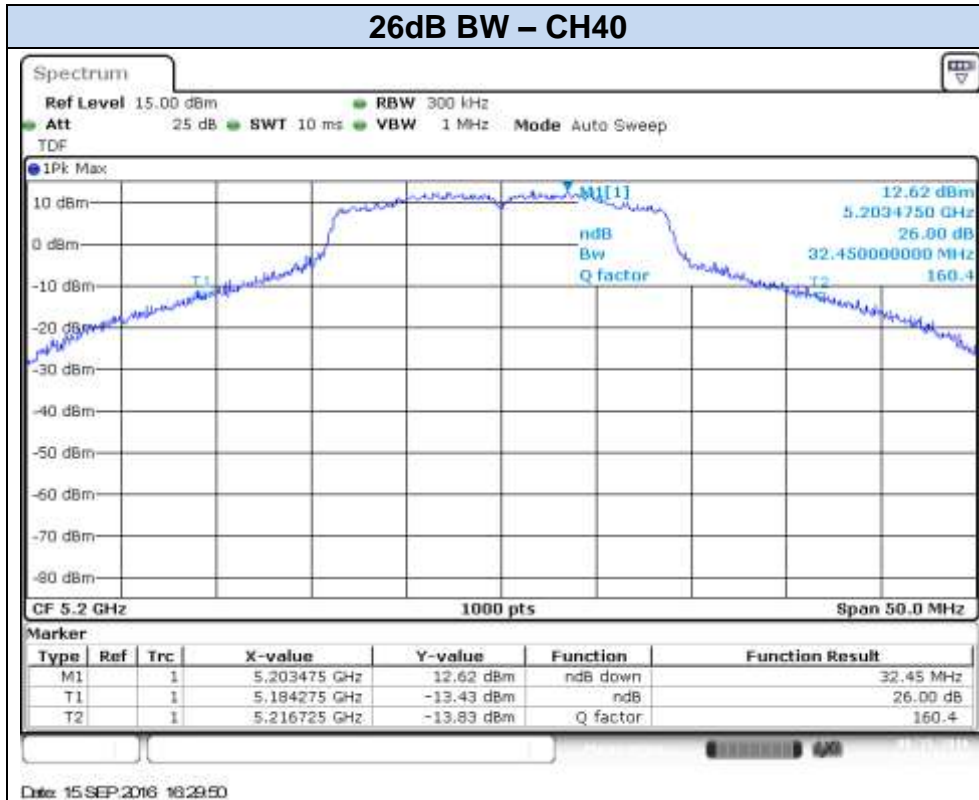
**802.11n20, HT0 – SISO - Chain B**



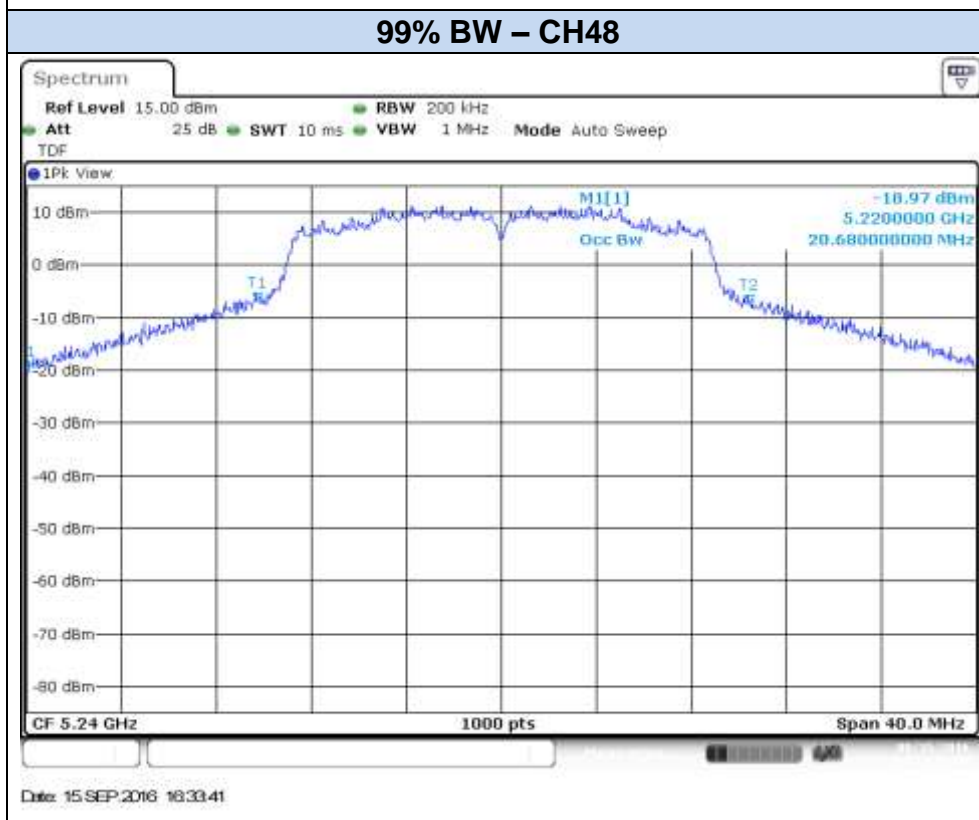
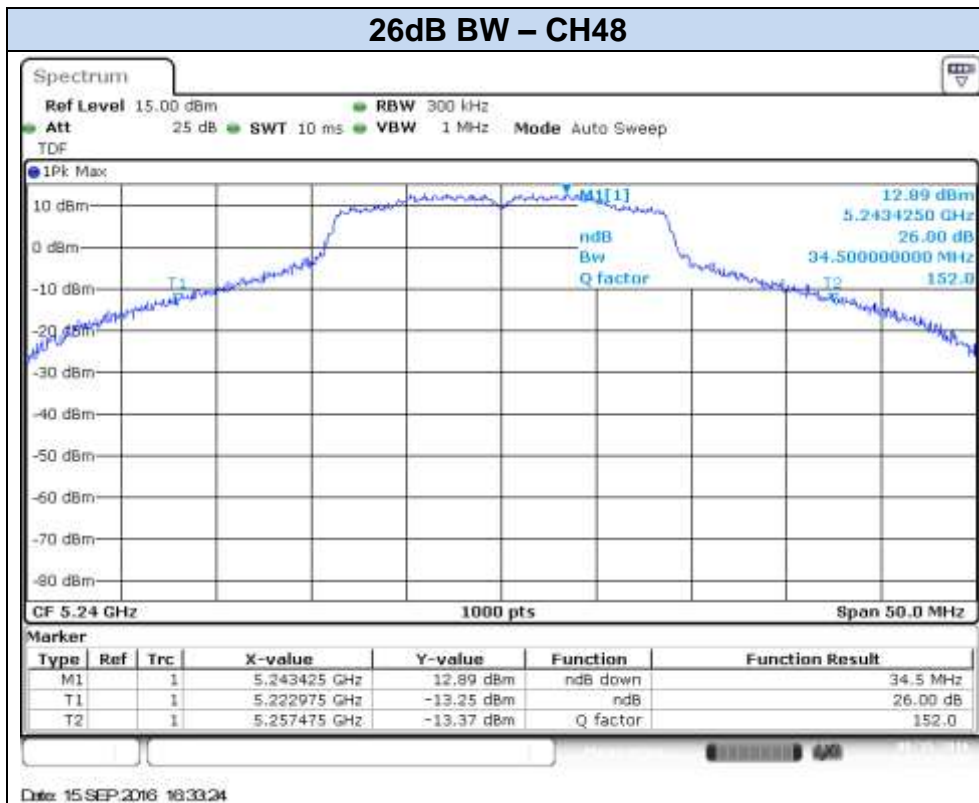
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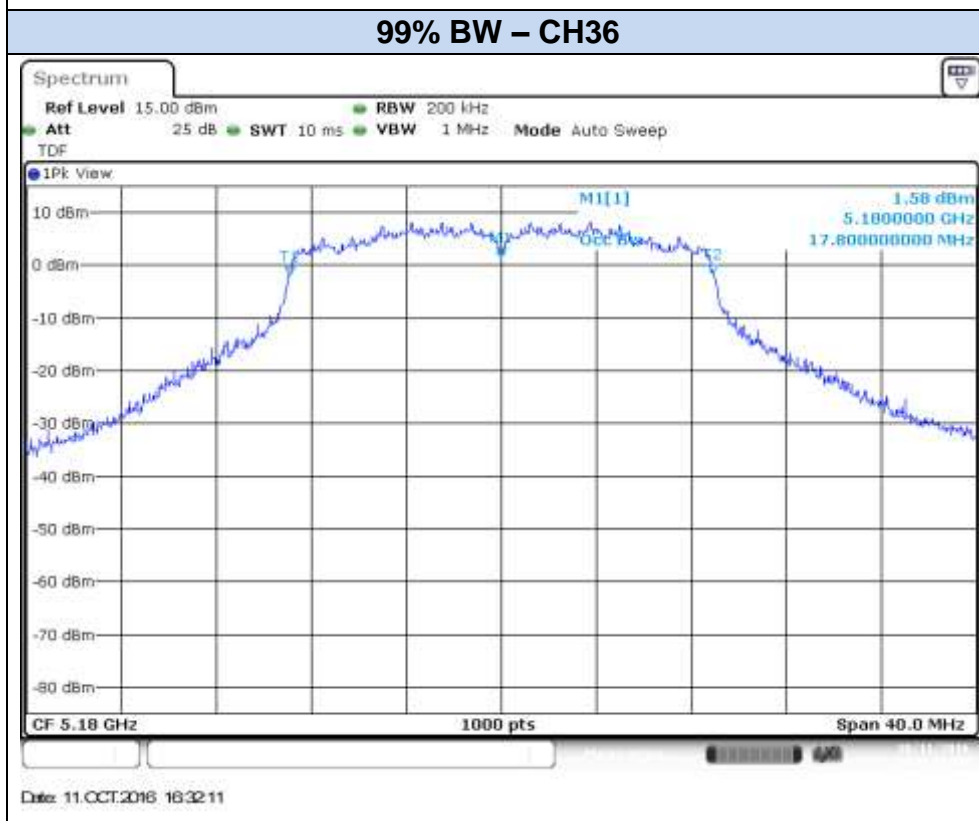
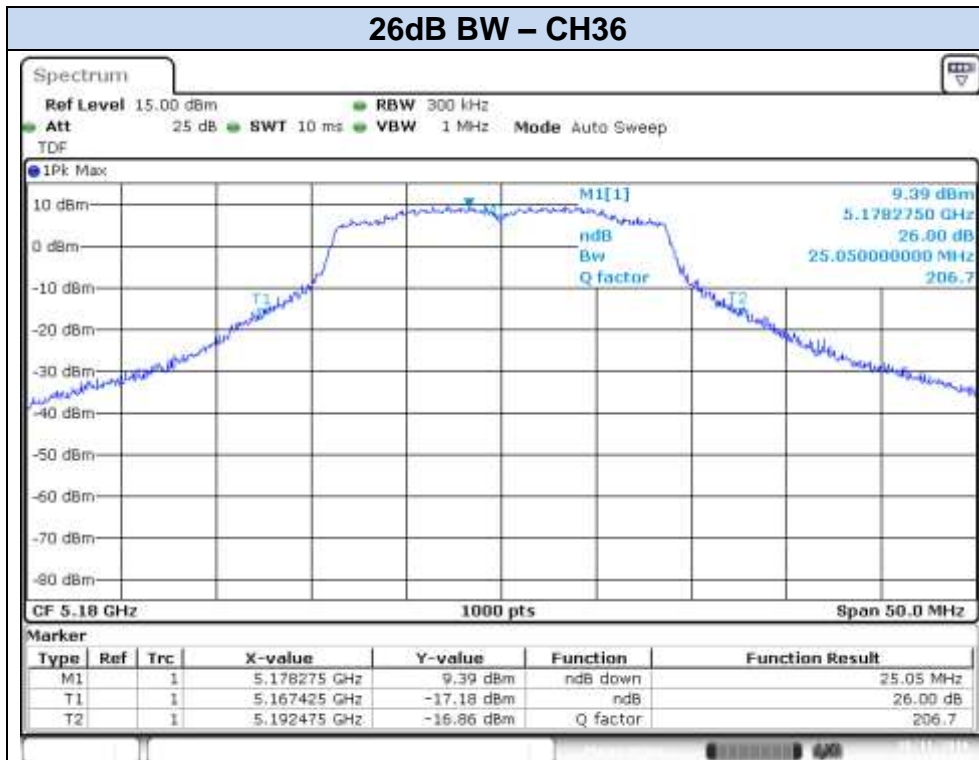
Date: 15 SEP 2016 16:20:30

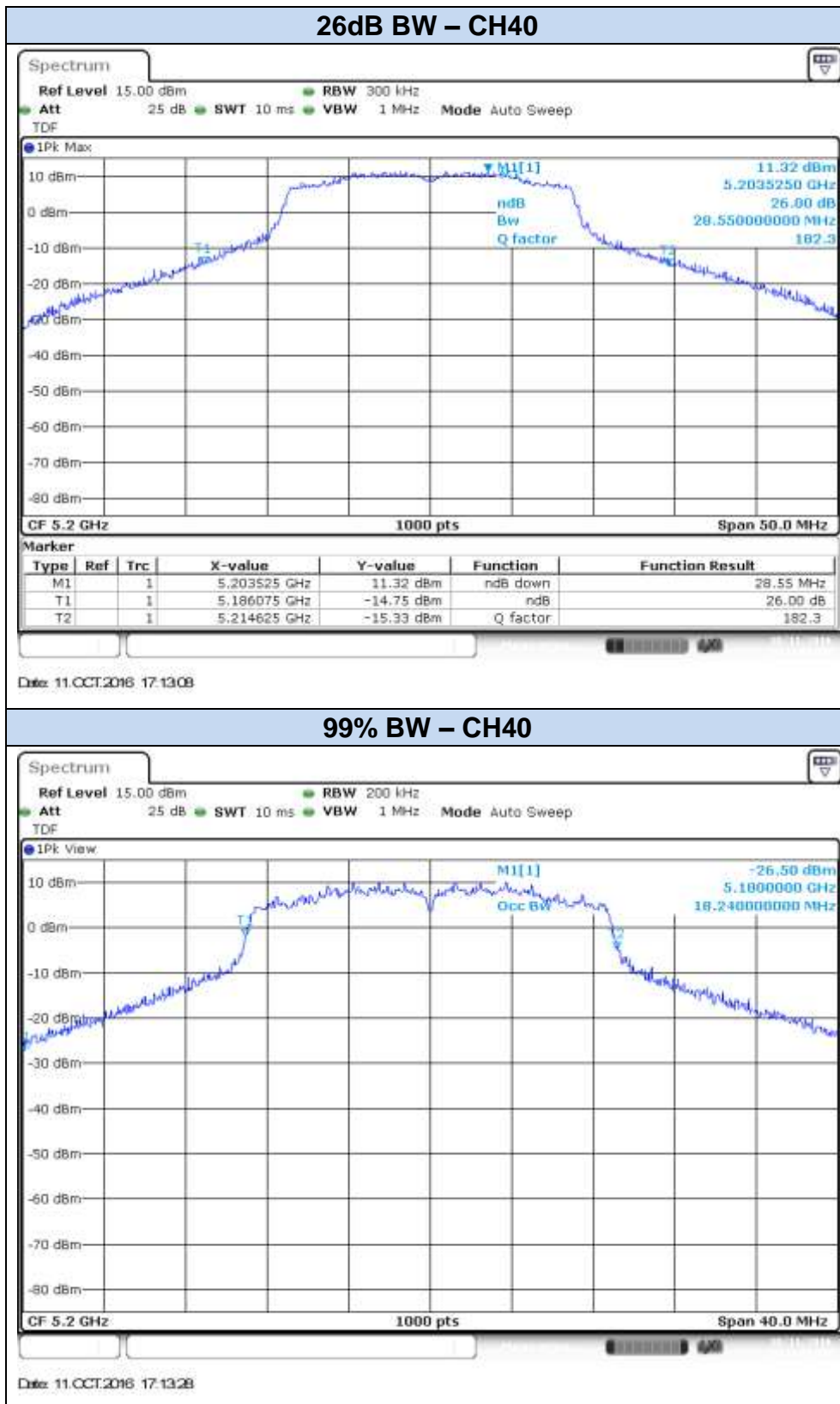


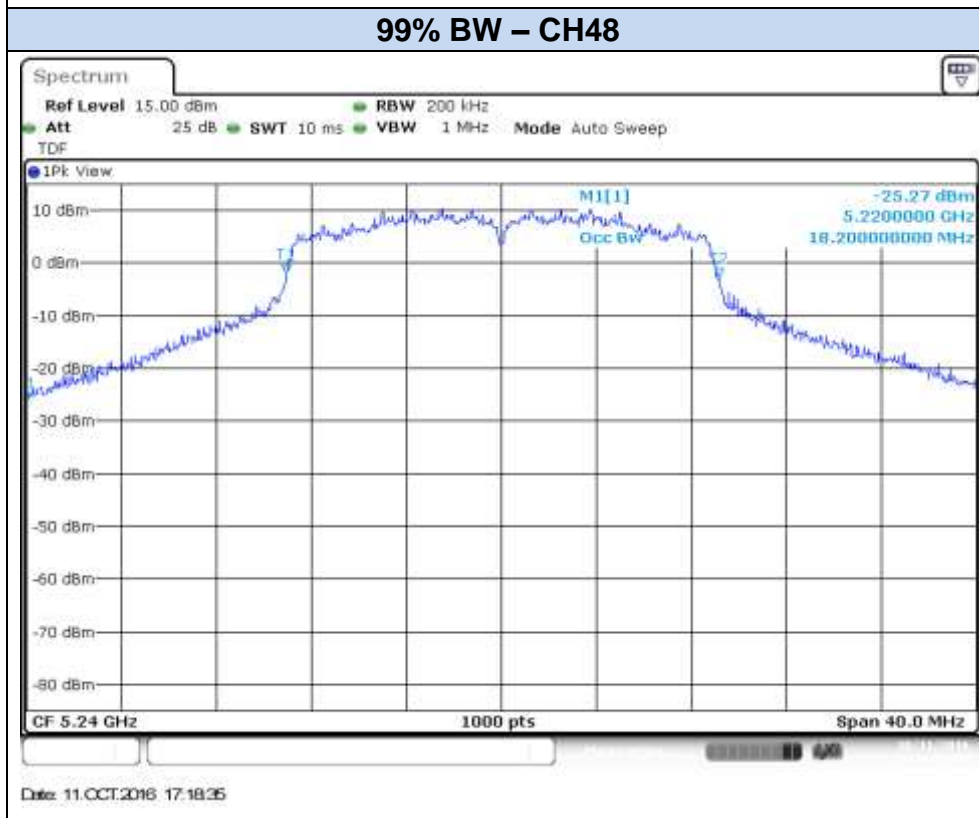
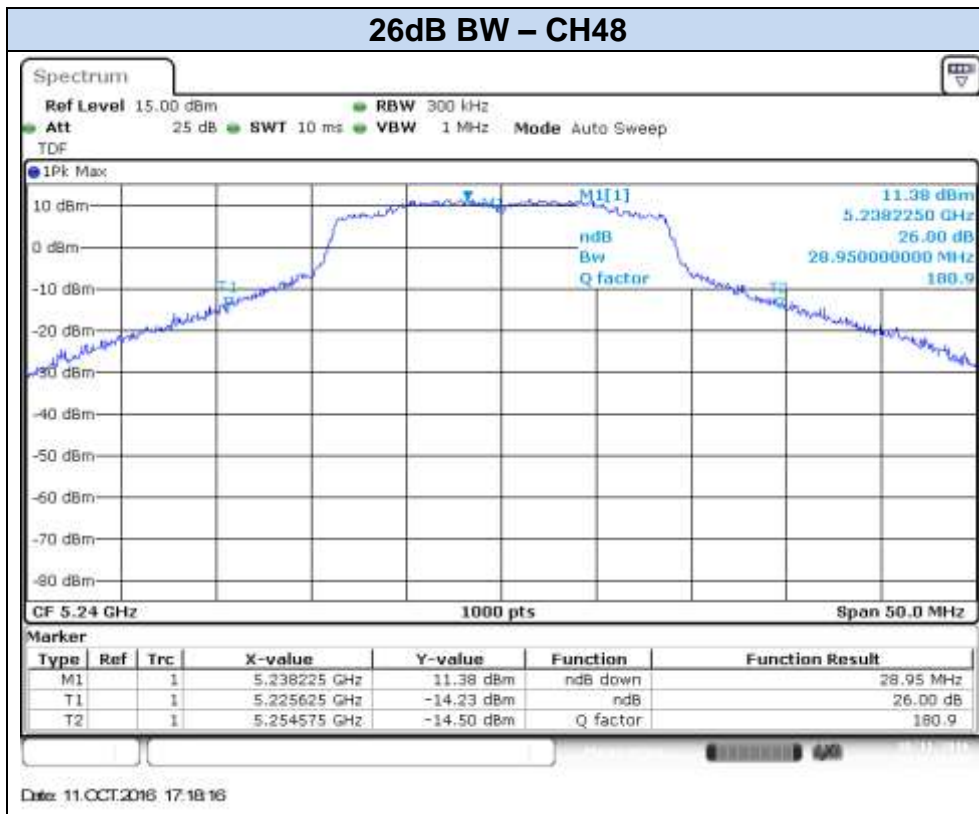




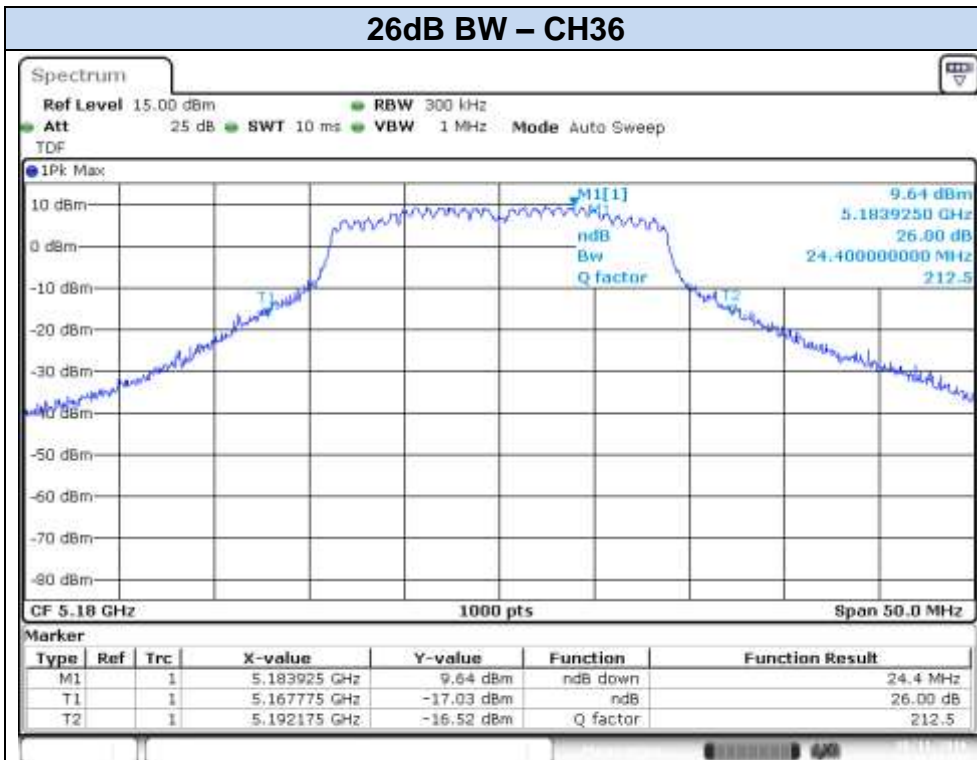
**802.11n20, HT0 – MIMO - Chain A**



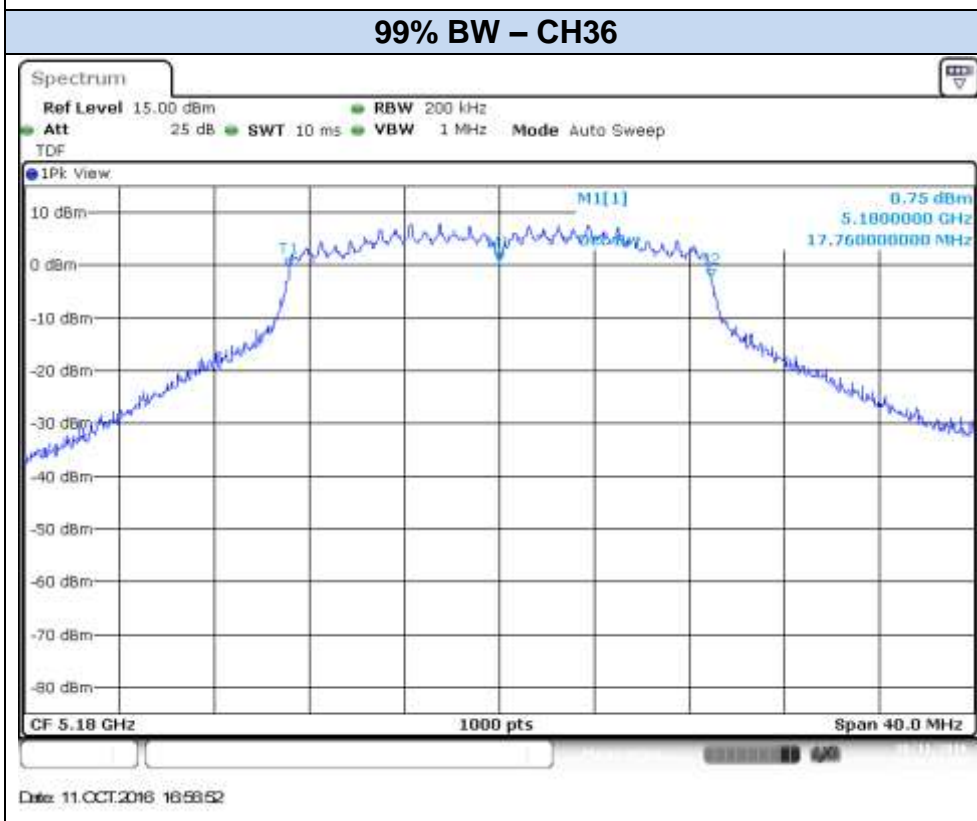




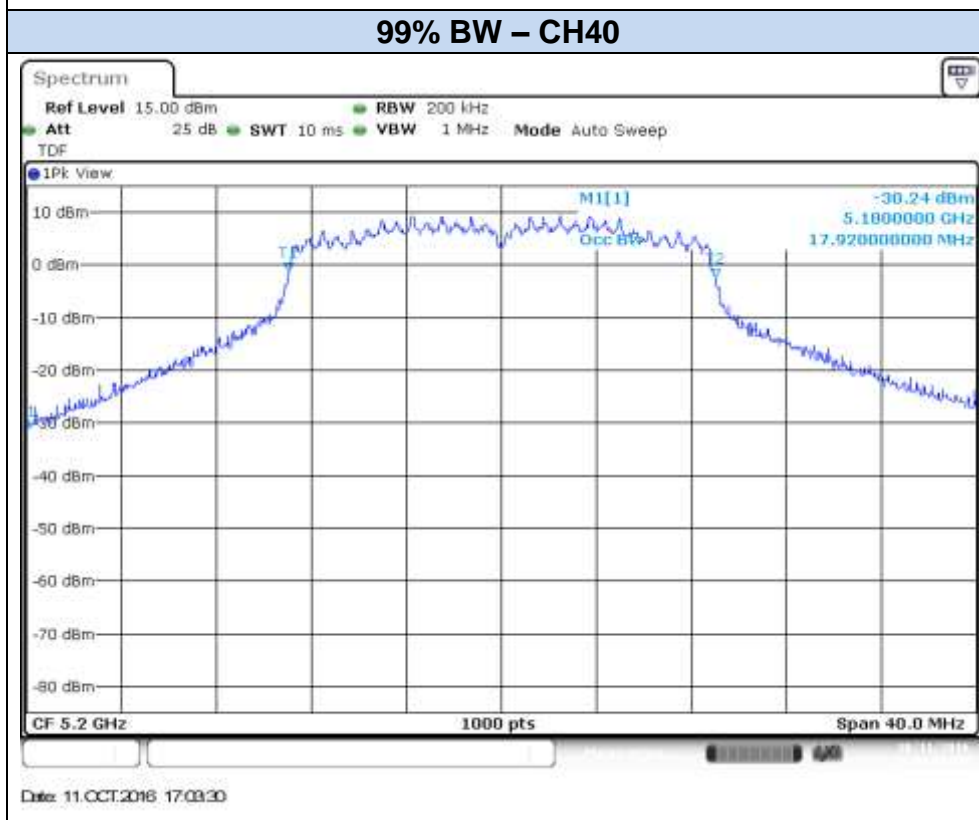
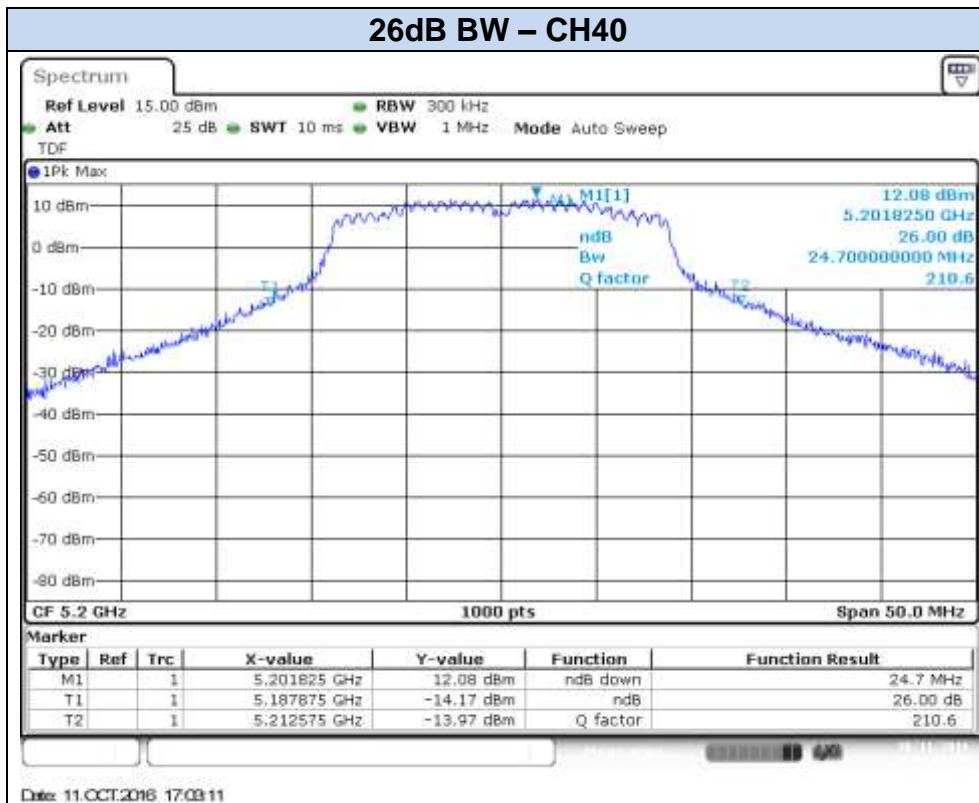
**802.11n20, HT0 – MIMO - Chain B**



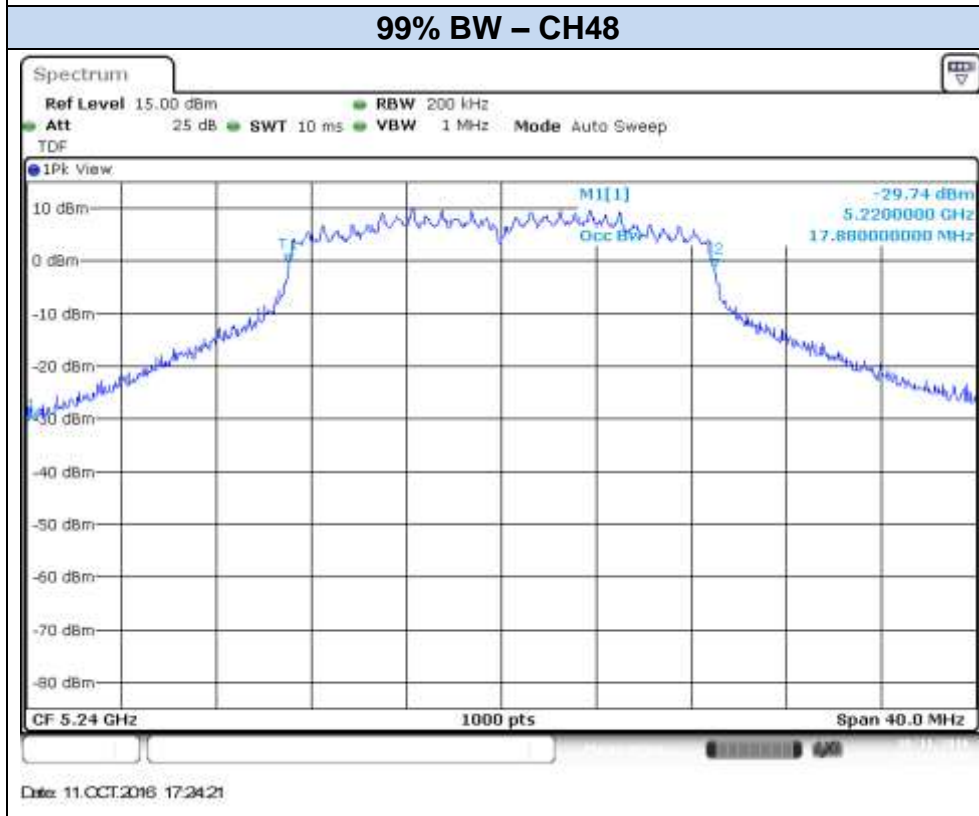
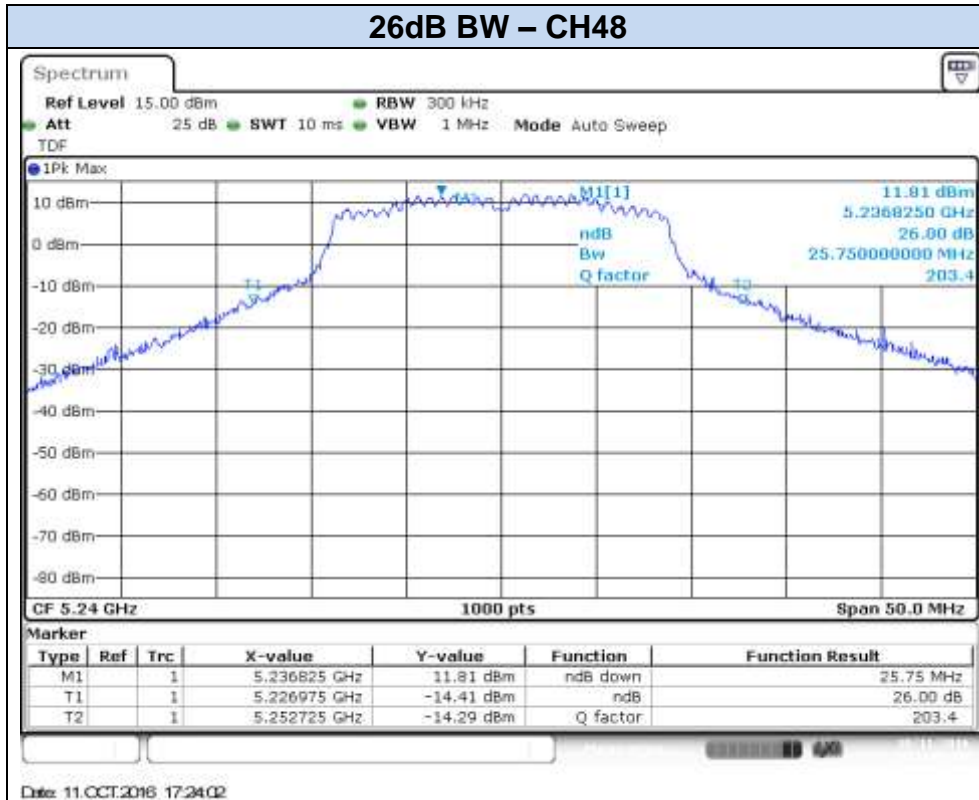
Date: 11.OCT.2016 16:58:33



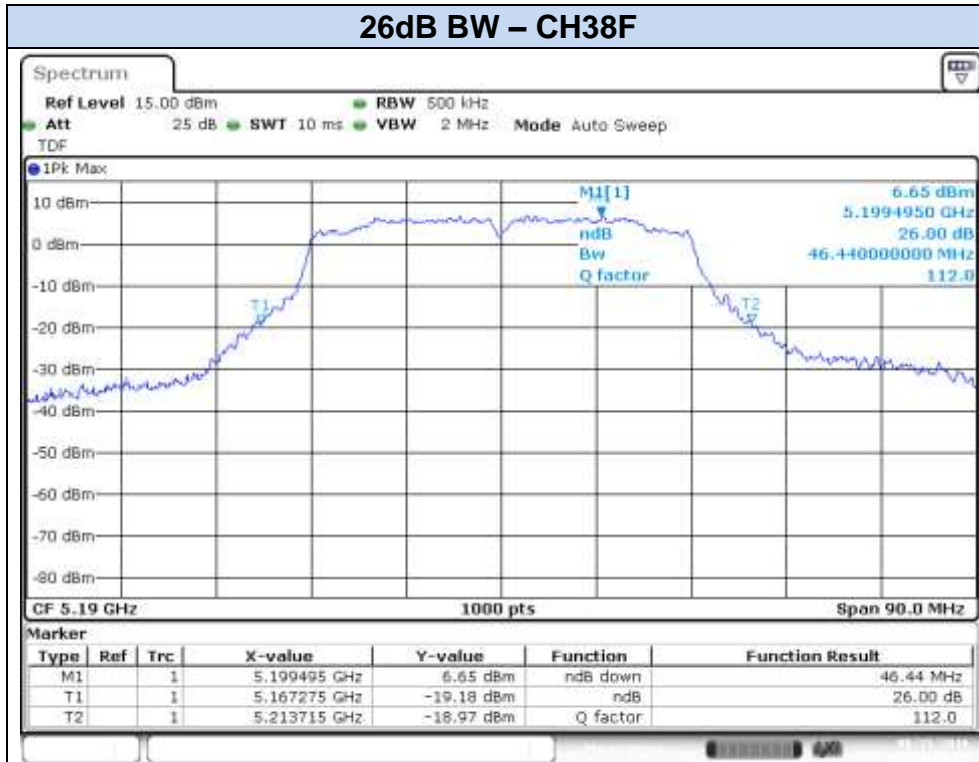
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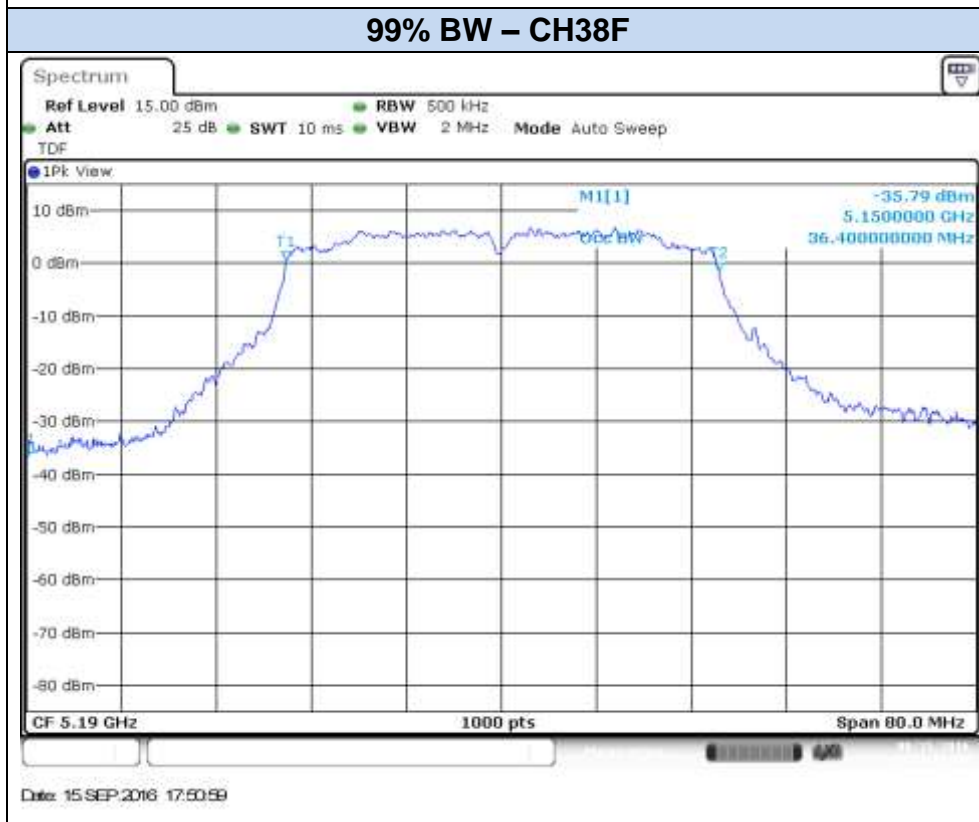




**802.11n40, HT0 – SISO - Chain A**

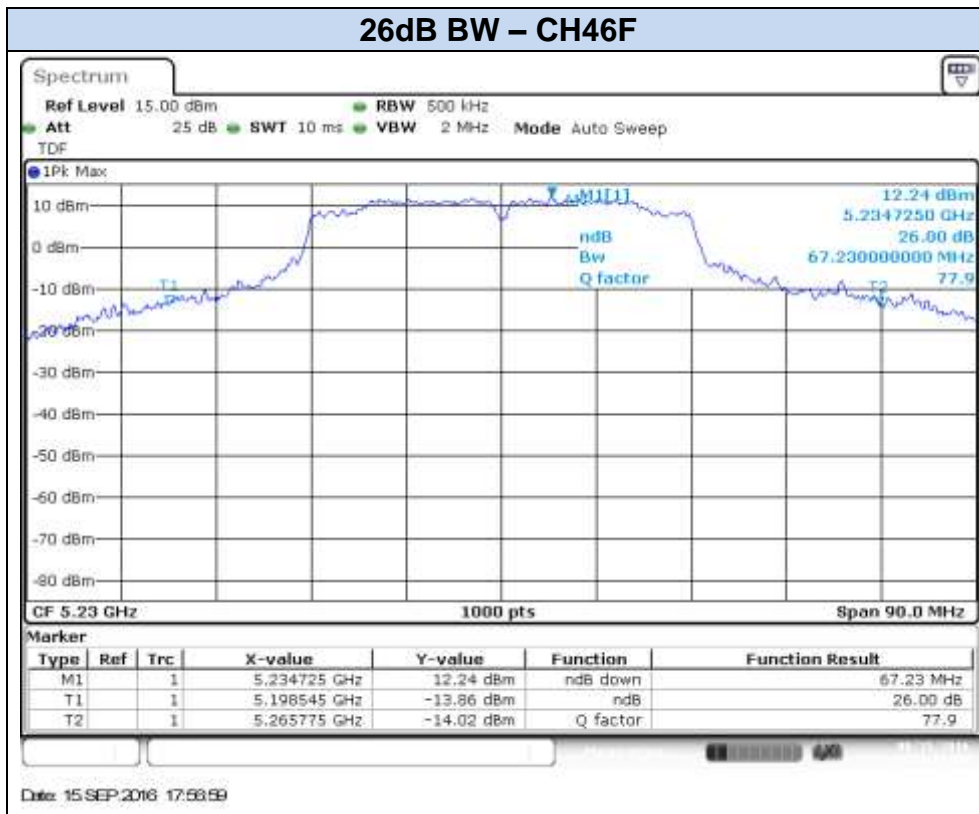


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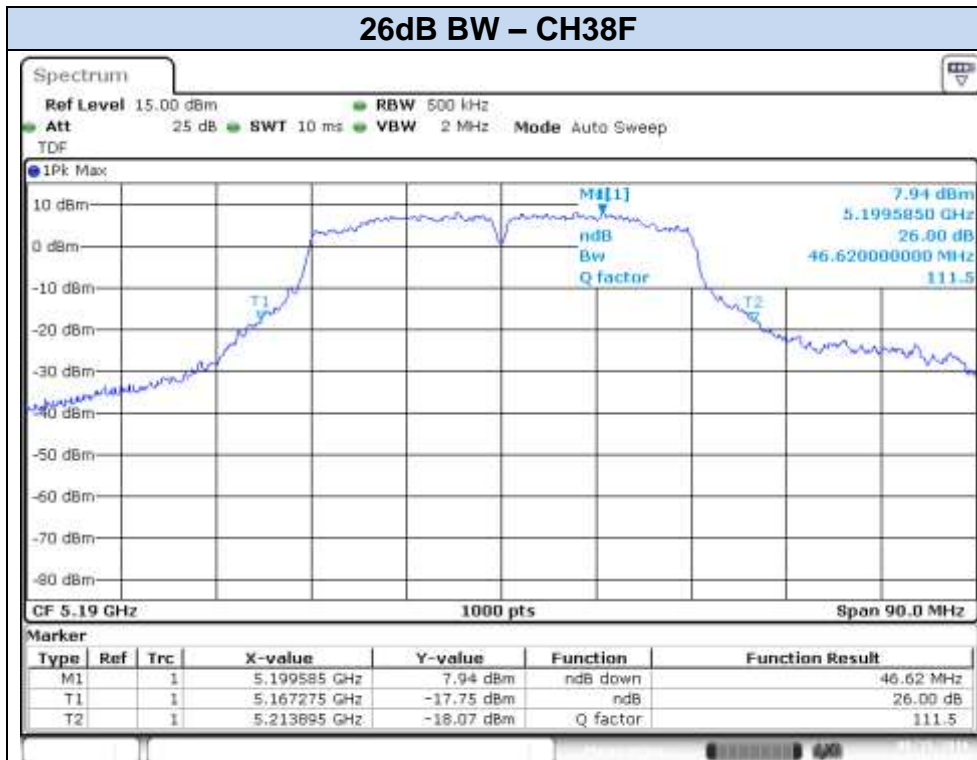


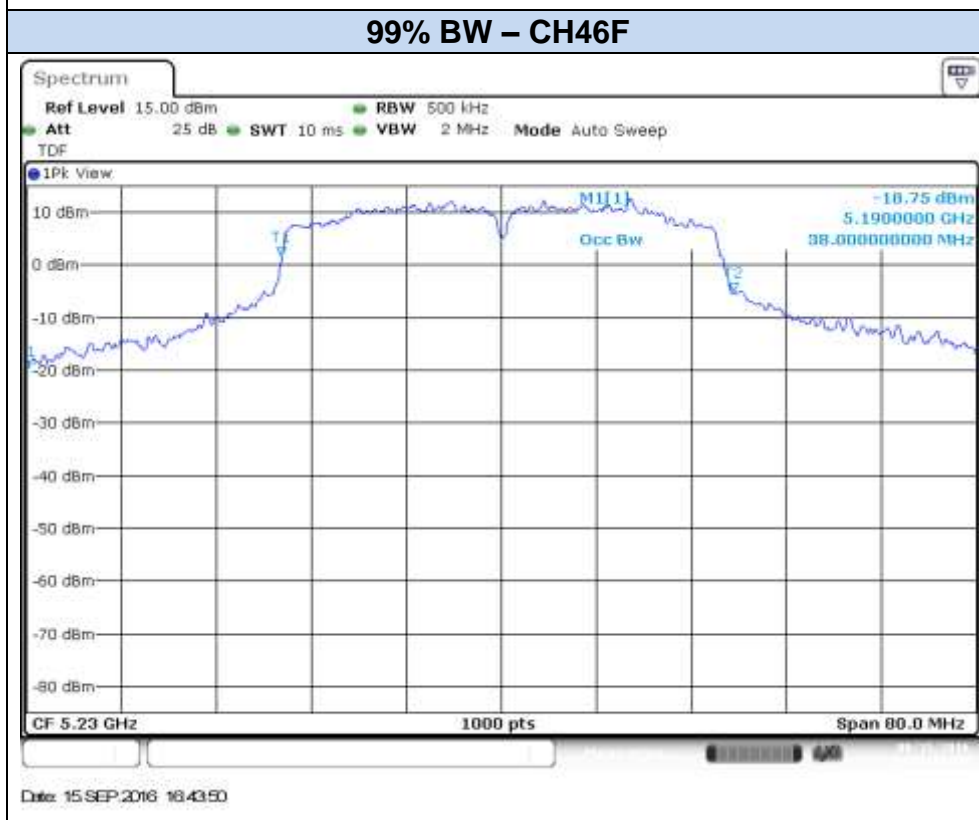
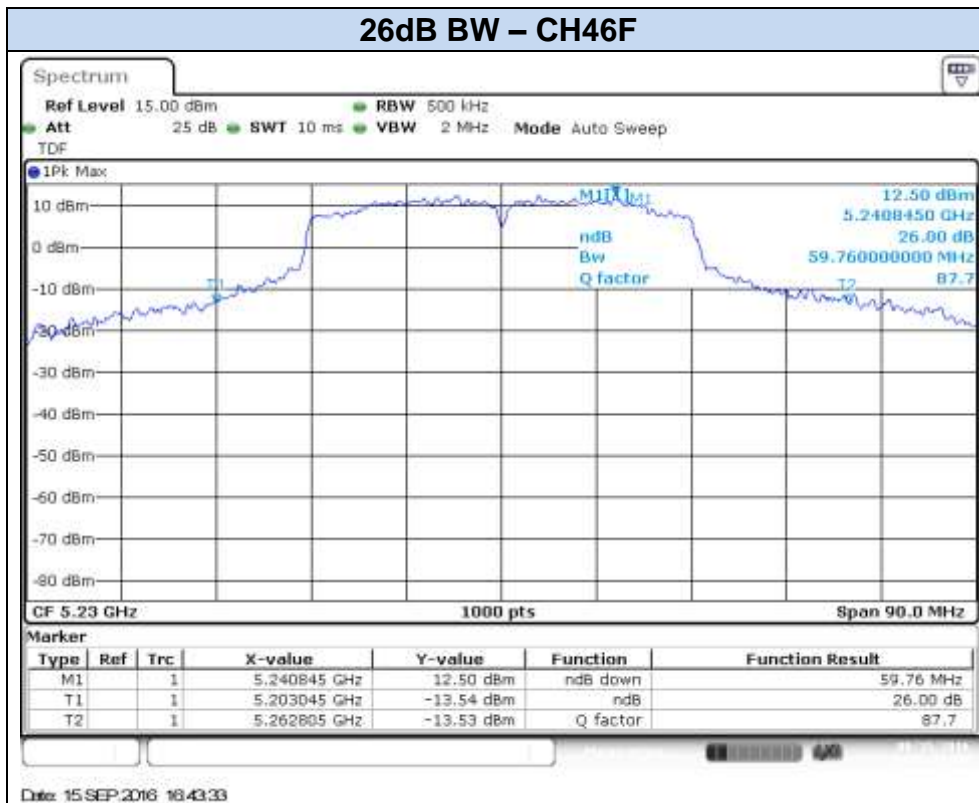
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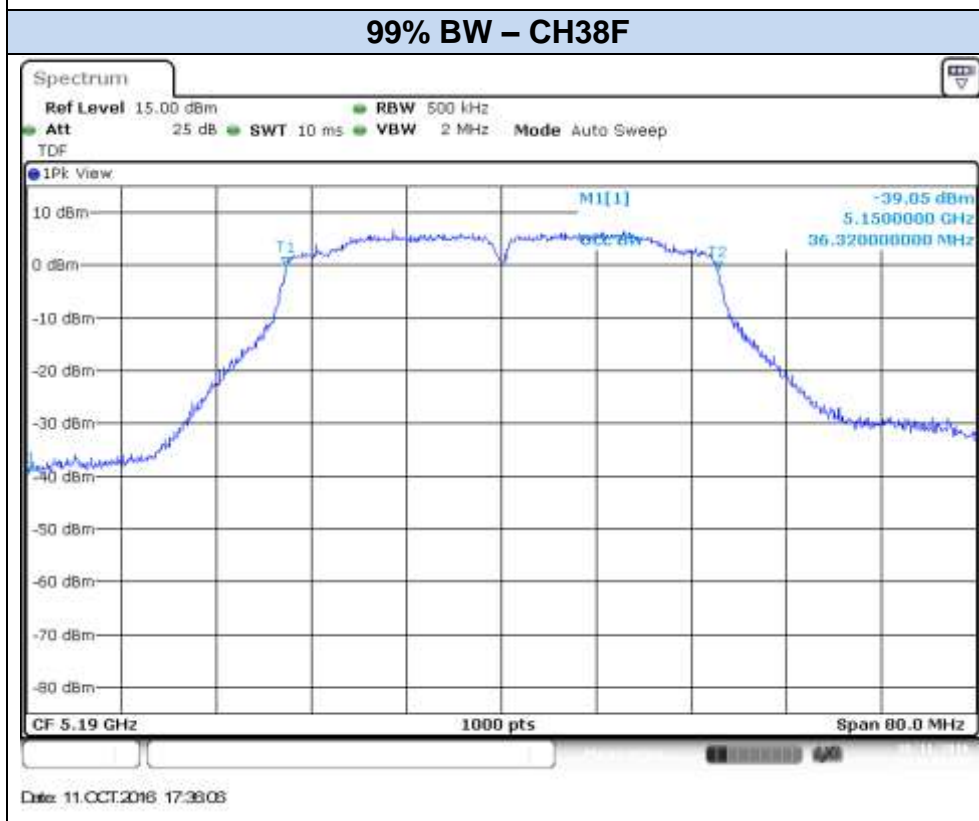
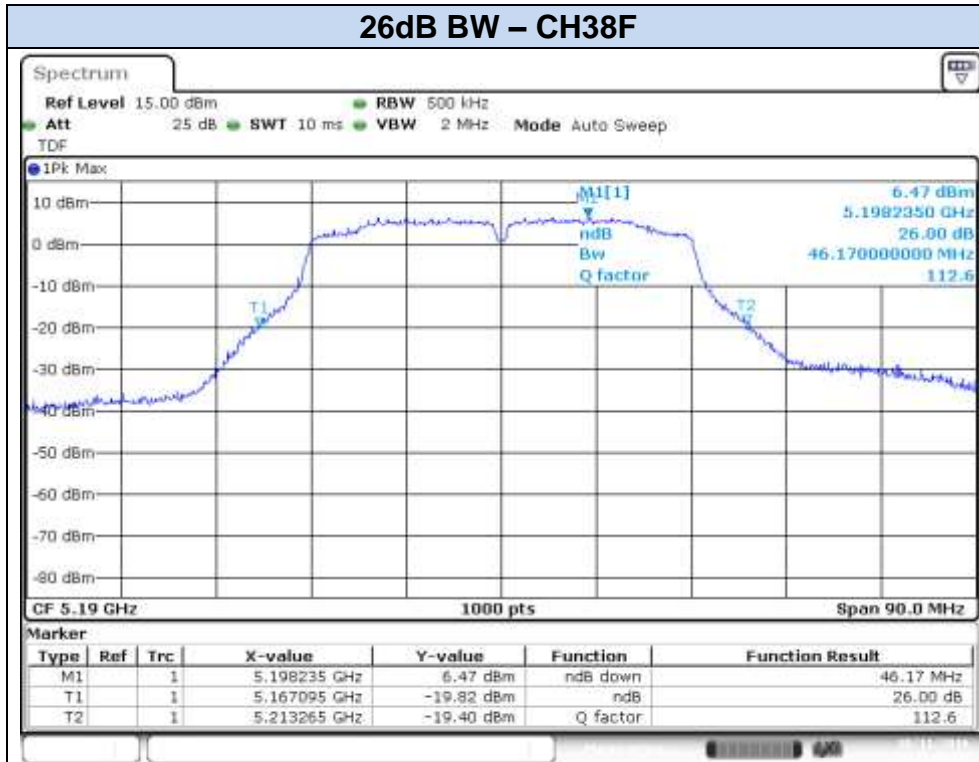


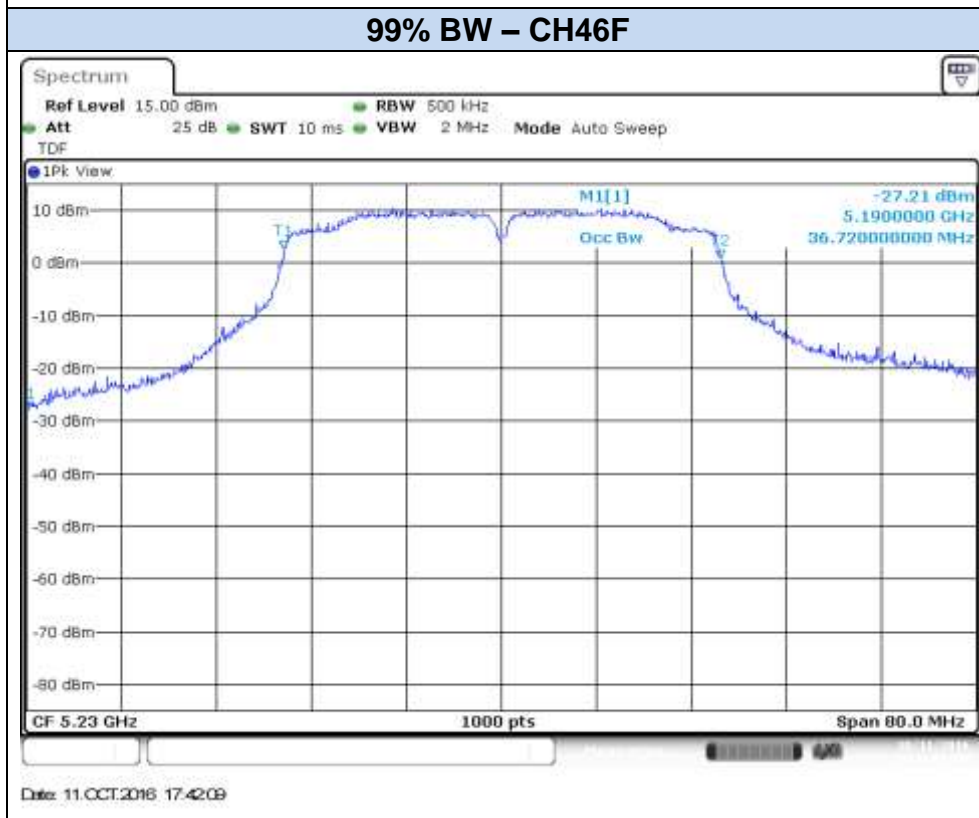
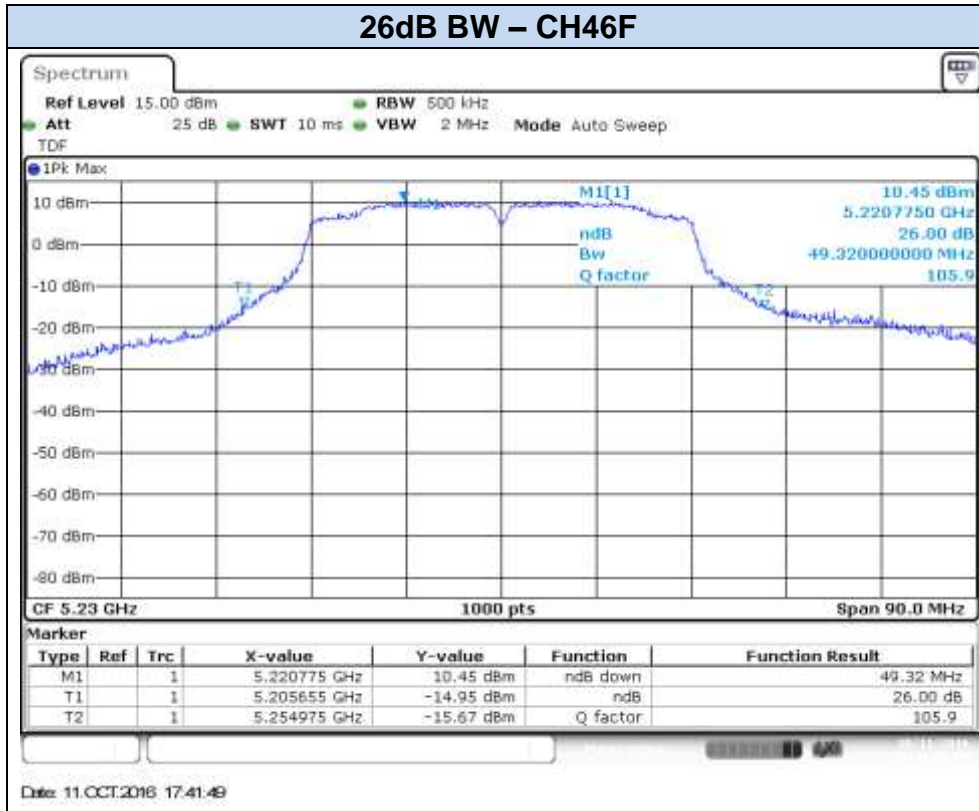
**802.11n40, HT0 – SISO - Chain B**



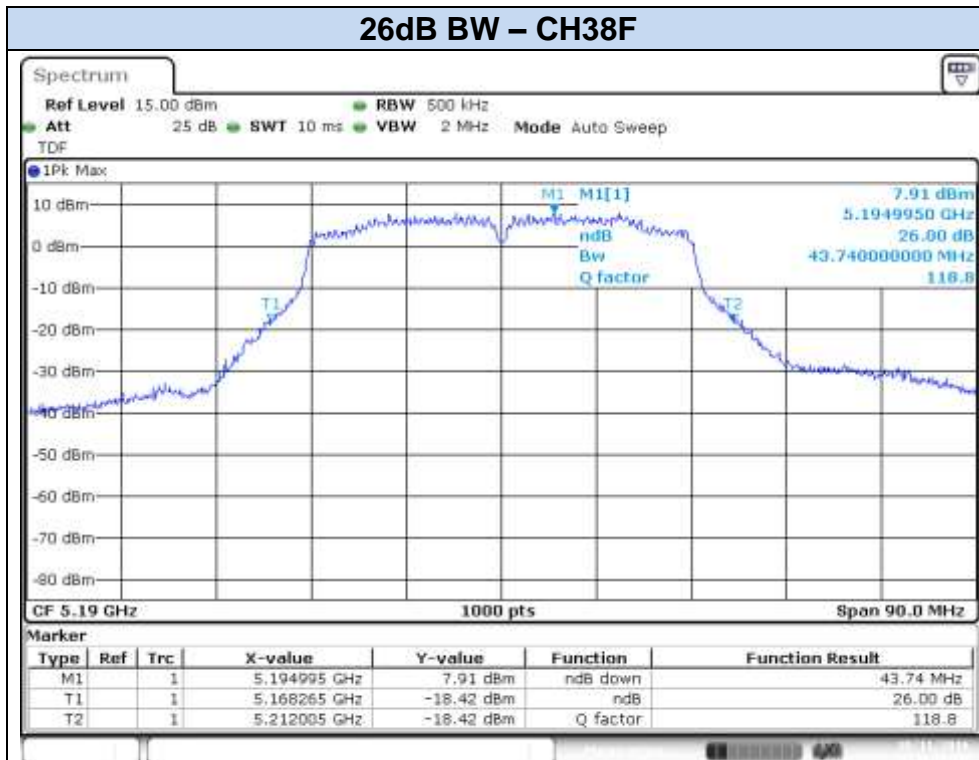


**802.11n40, HT0 – MIMO - Chain A**





**802.11n40, HT0 – MIMO - Chain B**

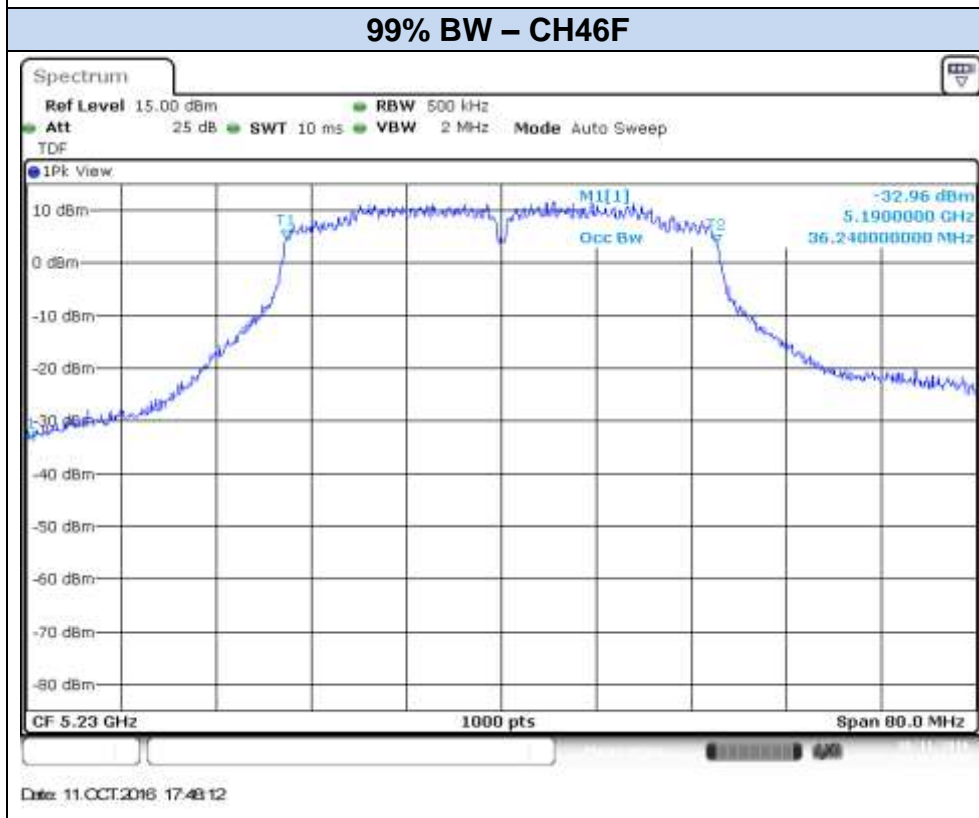
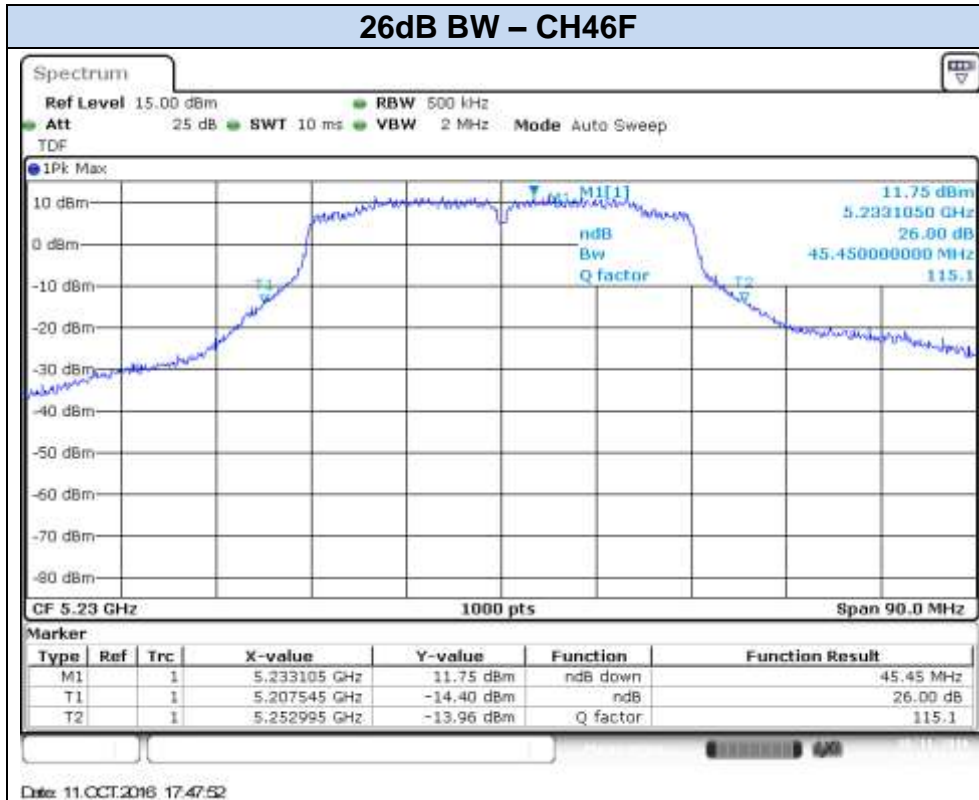


Date: 11.OCT.2016 17:29:28

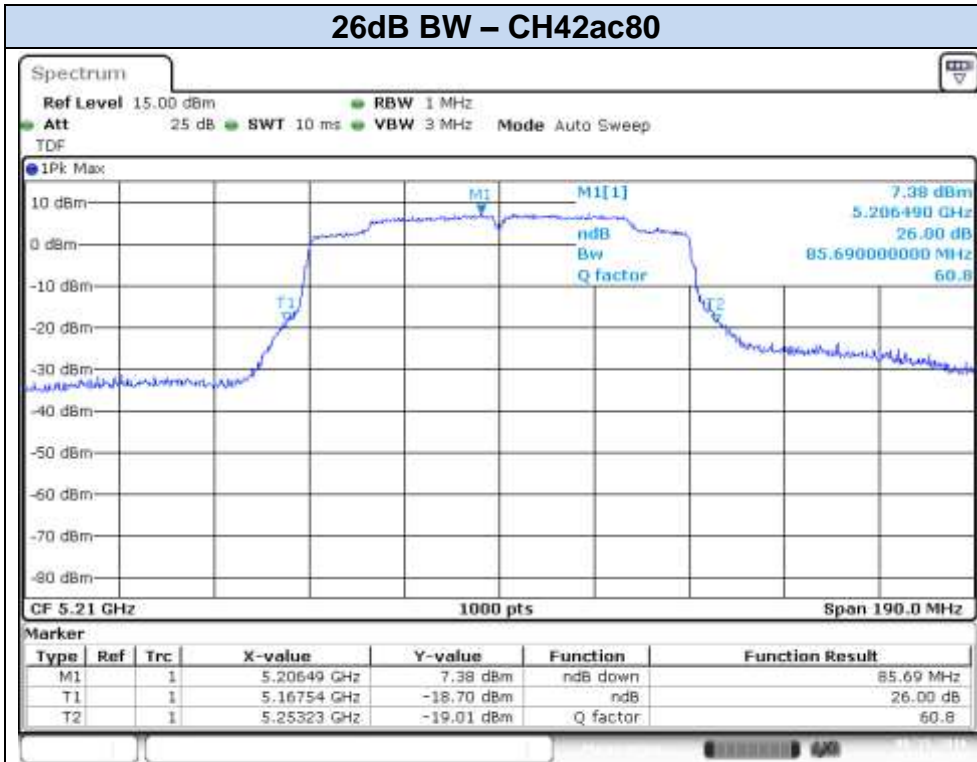


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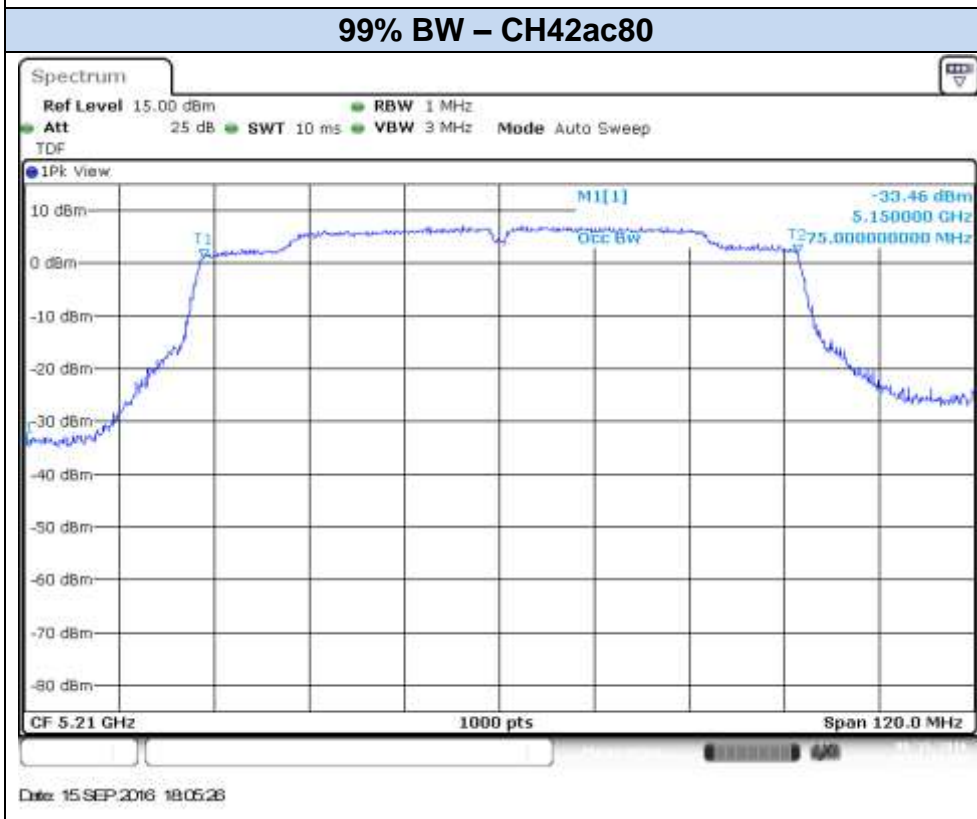




**802.11ac80, VHT0 – SISO - Chain A**



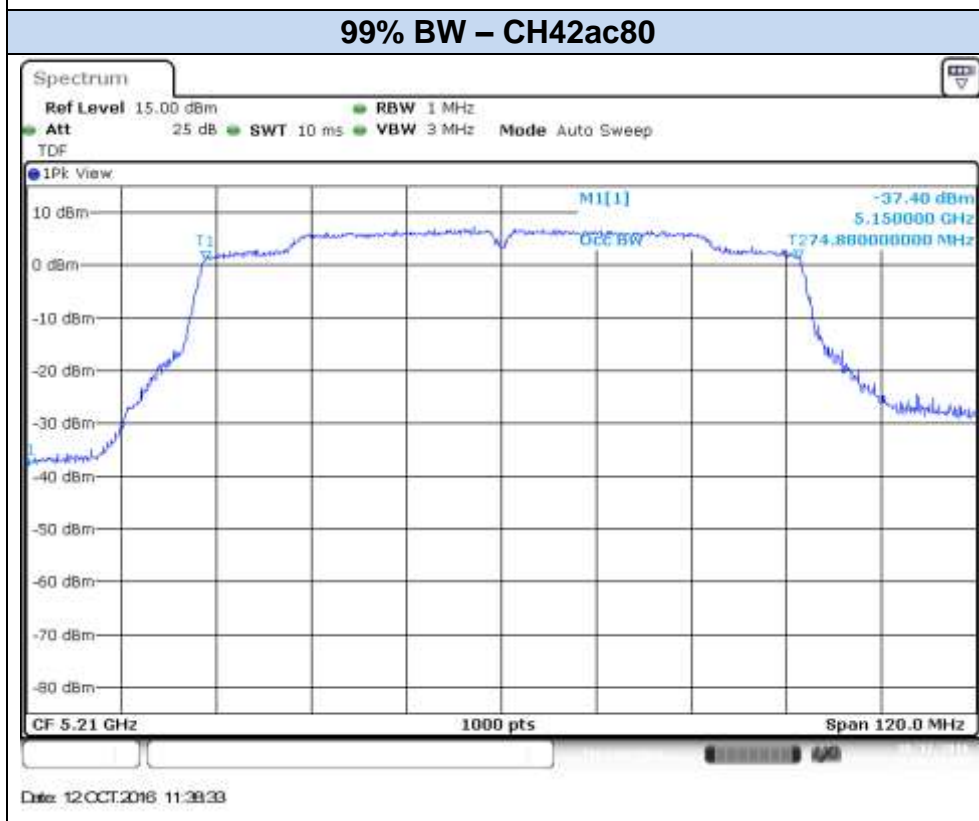
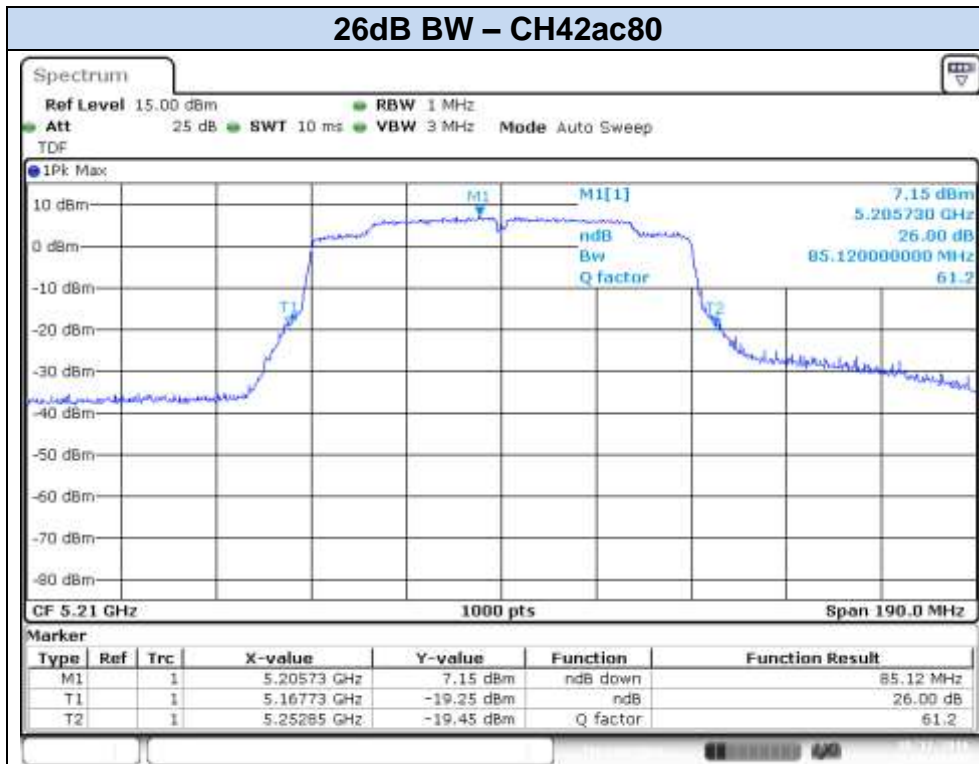
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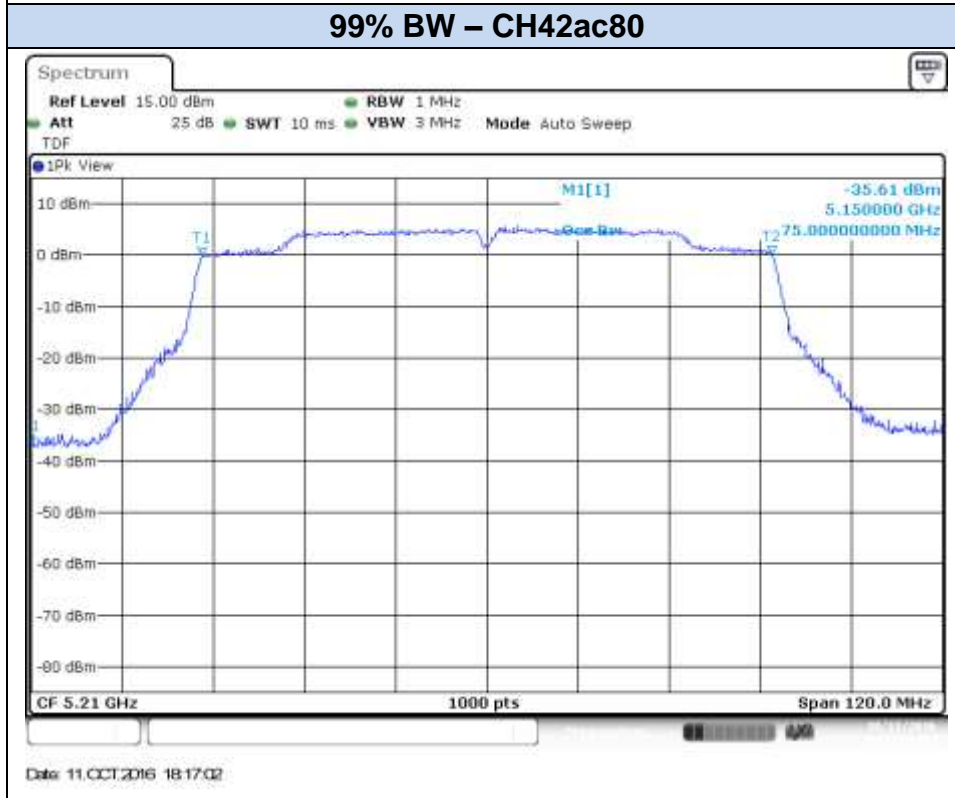
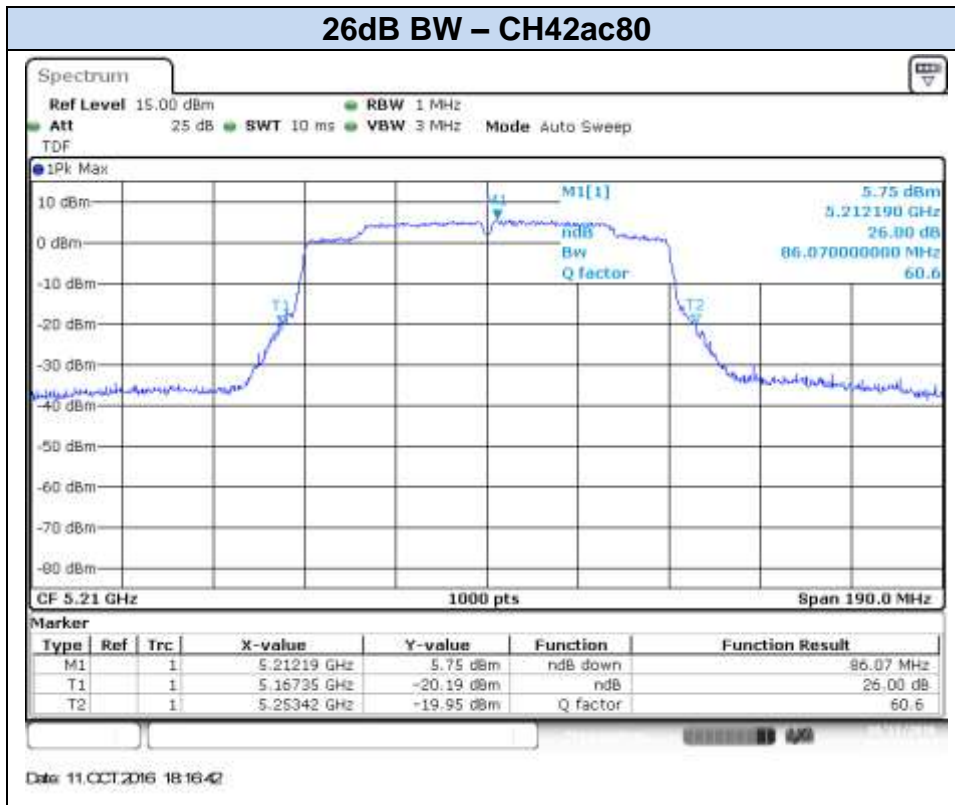
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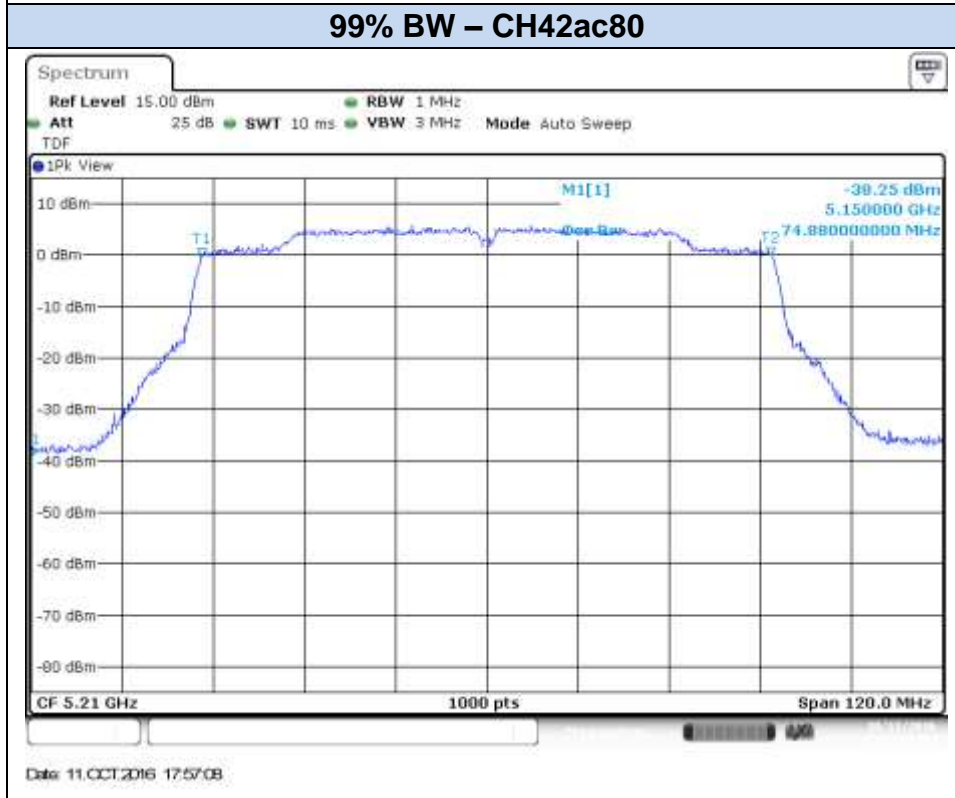
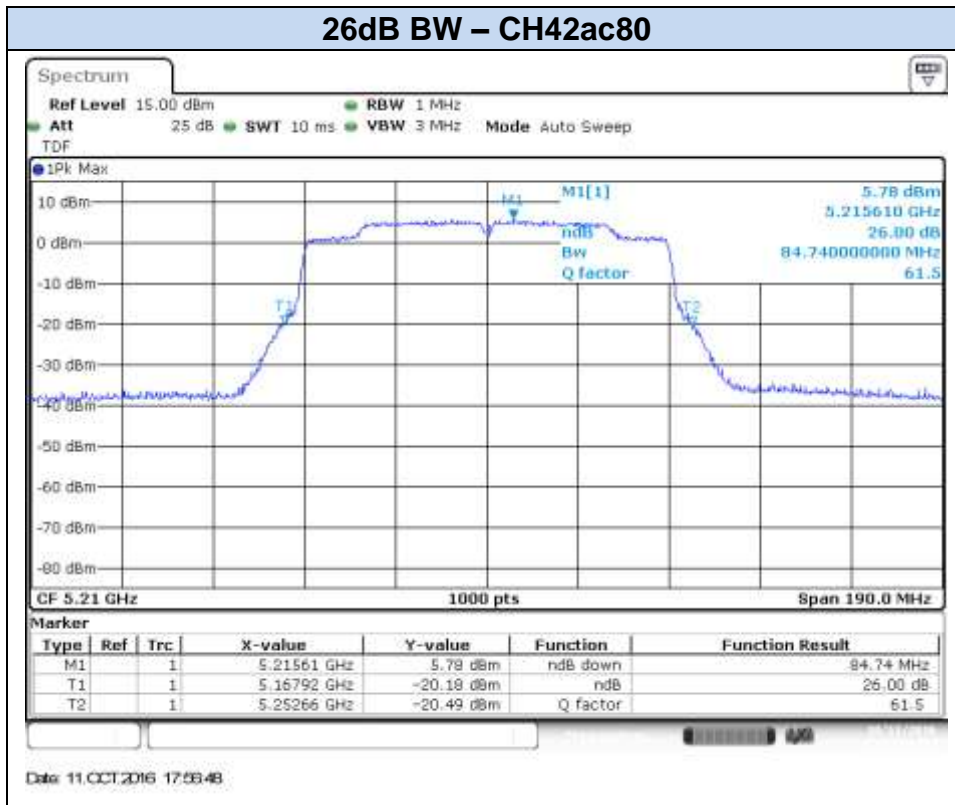
**802.11ac80, VHT0 – SISO - Chain B**



**802.11ac80, VHT0 – MIMO - Chain A**



**802.11ac80, VHT0 – MIMO - Chain B**



## B.2 Power Limits. Maximum Output power & Maximum power spectral density

### Test limits

FCC part	Limits
15.407 (a) (1) (iv)	For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band.

### Test procedure

The Maximum Conducted Output Power was measured using the channel integration method according to point E) 2) e) (Method SA-2 Alternative) of KDB 789033 D02.

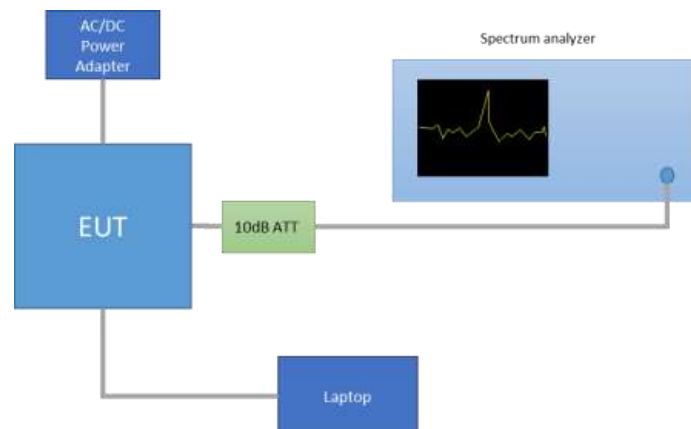
The maximum power spectral density (PSD) was measured using the method according to point F) (Method SA-2 Alternative) of KDB 789033 D02.

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 in linear power units to determine the total emission level from the device.

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

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

The declared maximum antenna gain is 5dBi.



## Results tables

### Duty cycle

Mode	Rate	Antenna	Transmission Duration [ms]	Transmission Period [ms]	Duty Cycle [%]
802.11a	6Mbps	SISO-A	2.03	2.07	98.0%
		SISO-B	2.04	2.07	98.2%
802.11n20	HT0	SISO-A	1.90	1.93	98.4%
		SISO-B	1.90	1.94	98.2%
	HT8	MIMO-A	0.97	1.01	96.1%
		MIMO-B	0.97	1.01	96.1%
802.11n40	HT0	SISO-A	0.93	0.96	96.5%
		SISO-B	0.94	0.97	96.8%
	HT8	MIMO-A	0.49	0.53	92.3%
		MIMO-B	0.49	0.53	92.1%
802.11ac80	VHT0	SISO-A	0.46	0.49	93.5%
		SISO-B	0.45	0.49	93.2%
		MIMO-A	0.26	0.29	87.3%
		MIMO-B	0.25	0.29	86.6%

**Maximum output power**

Mode	Rate	Channel	Freq. [MHz]	Antenna	Average Conducted Output Power [dBm]	Maximum* Conducted Output Power [dBm]	Maximum* Conducted Output Power [mW]	Max of EIRP [dBm]	
802.11a	6Mbps	36	5180	SISO CHAIN A	19.12	19.12	81.66	24.12	
				SISO CHAIN B	18.85	18.85	76.74	23.85	
		40	5200	SISO CHAIN A	20.91	20.91	123.31	25.91	
				SISO CHAIN B	19.99	19.99	99.77	24.99	
		48	5240	SISO CHAIN A	20.99	20.99	125.60	25.99	
				SISO CHAIN B	20.40	20.40	109.65	25.40	
802.11n20	HT0	36	5180	SISO CHAIN A	18.47	18.47	70.31	23.47	
				SISO CHAIN B	18.85	18.85	76.74	23.85	
		40	5200	SISO CHAIN A	20.56	20.56	113.76	25.56	
				SISO CHAIN B	20.03	20.03	100.69	25.03	
		48	5240	SISO CHAIN A	19.39	19.39	86.90	24.39	
				SISO CHAIN B	20.38	20.38	109.14	25.38	
	HT8	36	5180	MIMO CHAIN A	17.20	17.37	54.63	22.37	
				MIMO CHAIN B	16.65	16.82	48.12	21.82	
				Combined A+B	19.94	20.12	102.75	25.12	
		40	5200	MIMO CHAIN A	19.01	19.18	82.88	24.18	
				MIMO CHAIN B	18.31	18.48	70.52	23.48	
				Combined A+B	21.68	21.86	153.40	26.86	
	48	5240	MIMO CHAIN A	18.46	18.63	73.02	23.63		
			MIMO CHAIN B	18.71	18.88	77.33	23.88		
			Combined A+B	21.60	21.77	150.35	26.77		
	802.11n40	HT0	38F	5190	SISO CHAIN A	15.77	15.92	39.11	20.92
					SISO CHAIN B	16.78	16.92	49.20	21.92
			46F	5230	SISO CHAIN A	20.92	21.07	128.02	26.07
SISO CHAIN B					20.68	20.82	120.78	25.82	
HT8		38F	5190	MIMO CHAIN A	14.70	15.05	31.99	20.05	
				MIMO CHAIN B	14.25	14.61	28.90	19.61	
				Combined A+B	17.49	17.85	60.89	22.85	
		46F	5230	MIMO CHAIN A	18.75	19.10	81.28	24.10	
				MIMO CHAIN B	18.02	18.38	68.86	23.38	
				Combined A+B	21.41	21.77	150.14	26.77	
802.11ac80		VHT0	42ac80	5210	SISO CHAIN A	14.55	14.84	30.50	19.84
					SISO CHAIN B	14.41	14.72	29.62	19.72
	MIMO CHAIN A				12.59	13.18	20.80	18.18	
	MIMO CHAIN B				12.31	12.93	19.65	17.93	
	Combined A+B				15.46	16.07	40.45	21.07	

\* Maximum values are the duty cycle compensated values calculated from the average (measured) values

Max Value

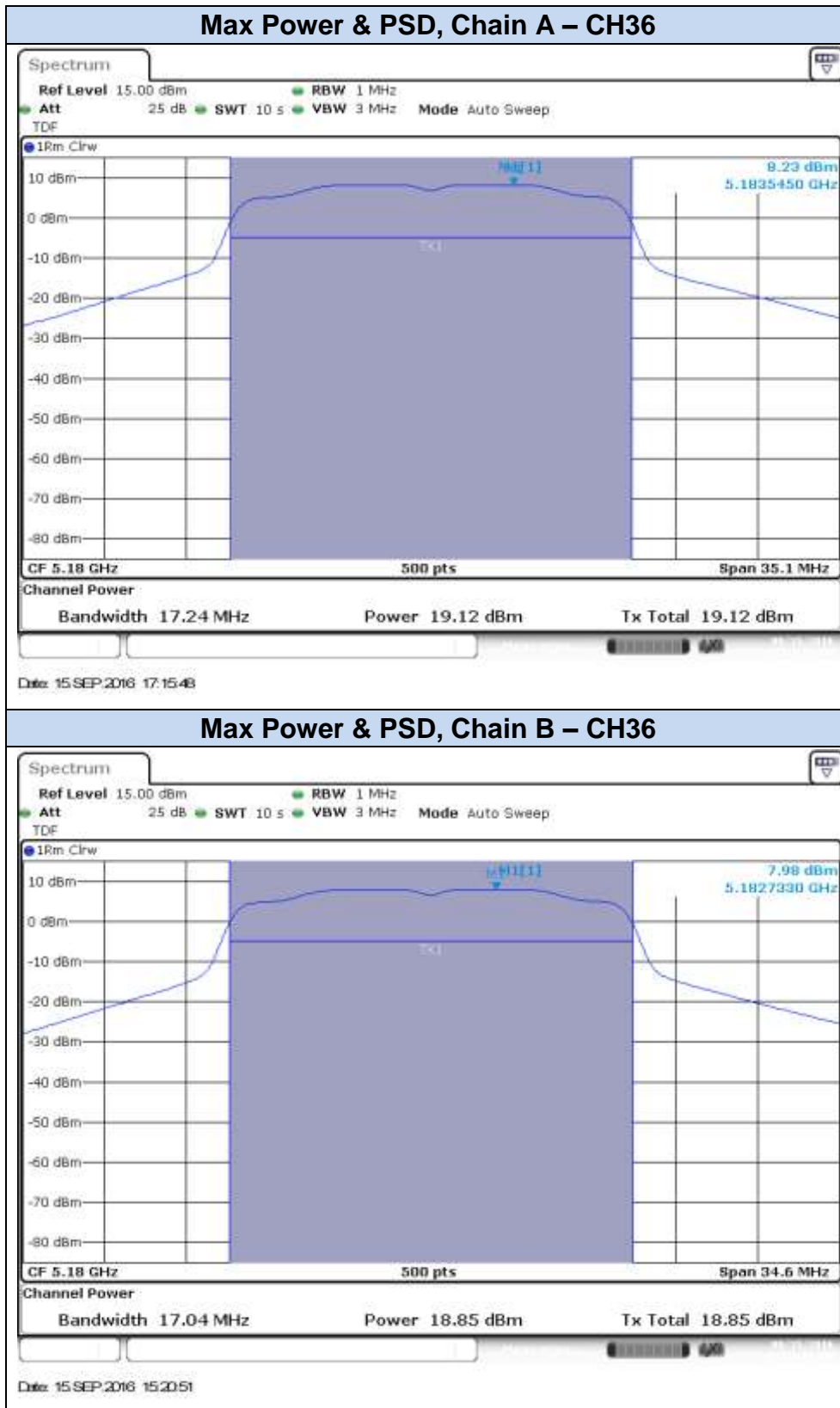
Min Value

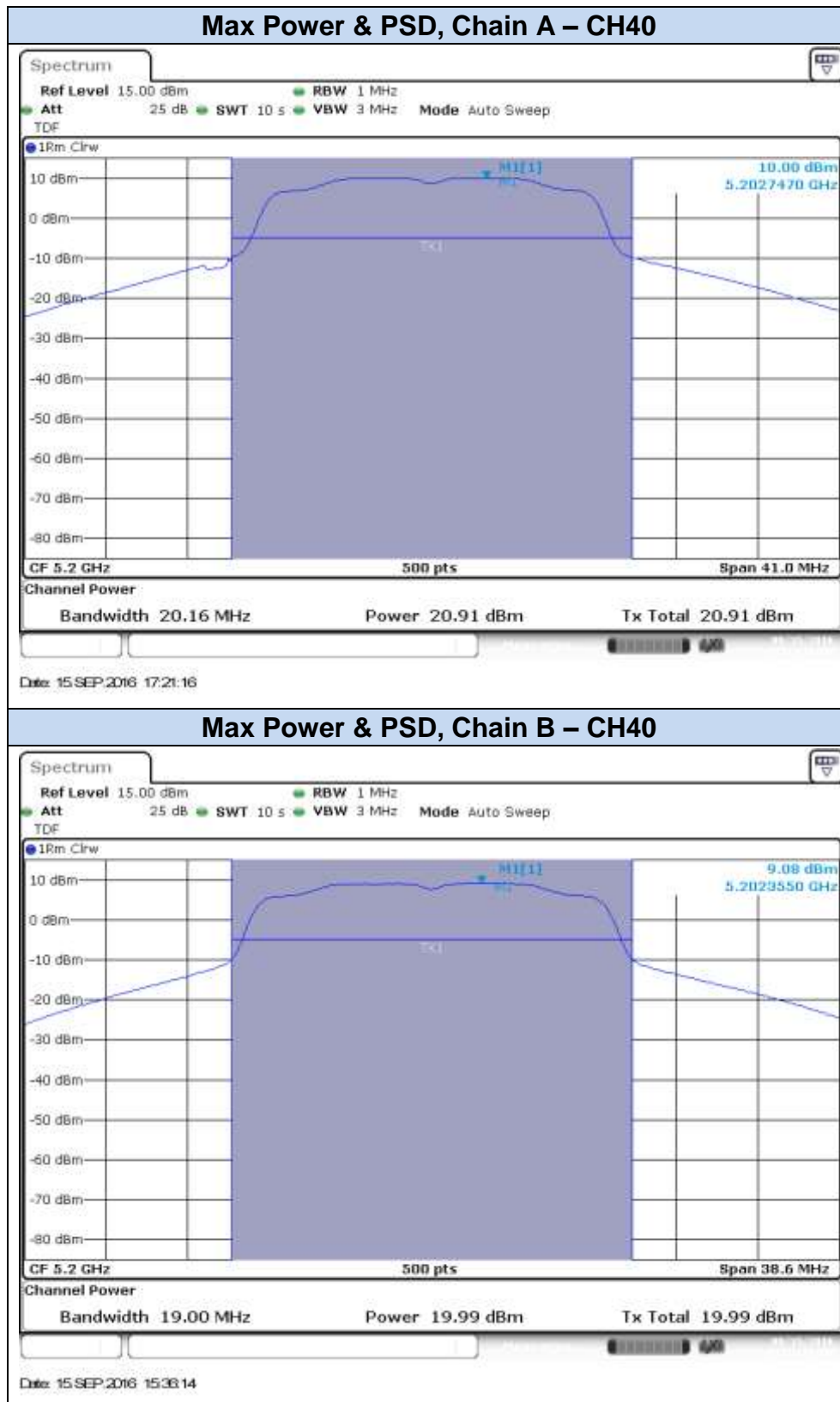
**Maximum Power Spectral Density (PSD)**

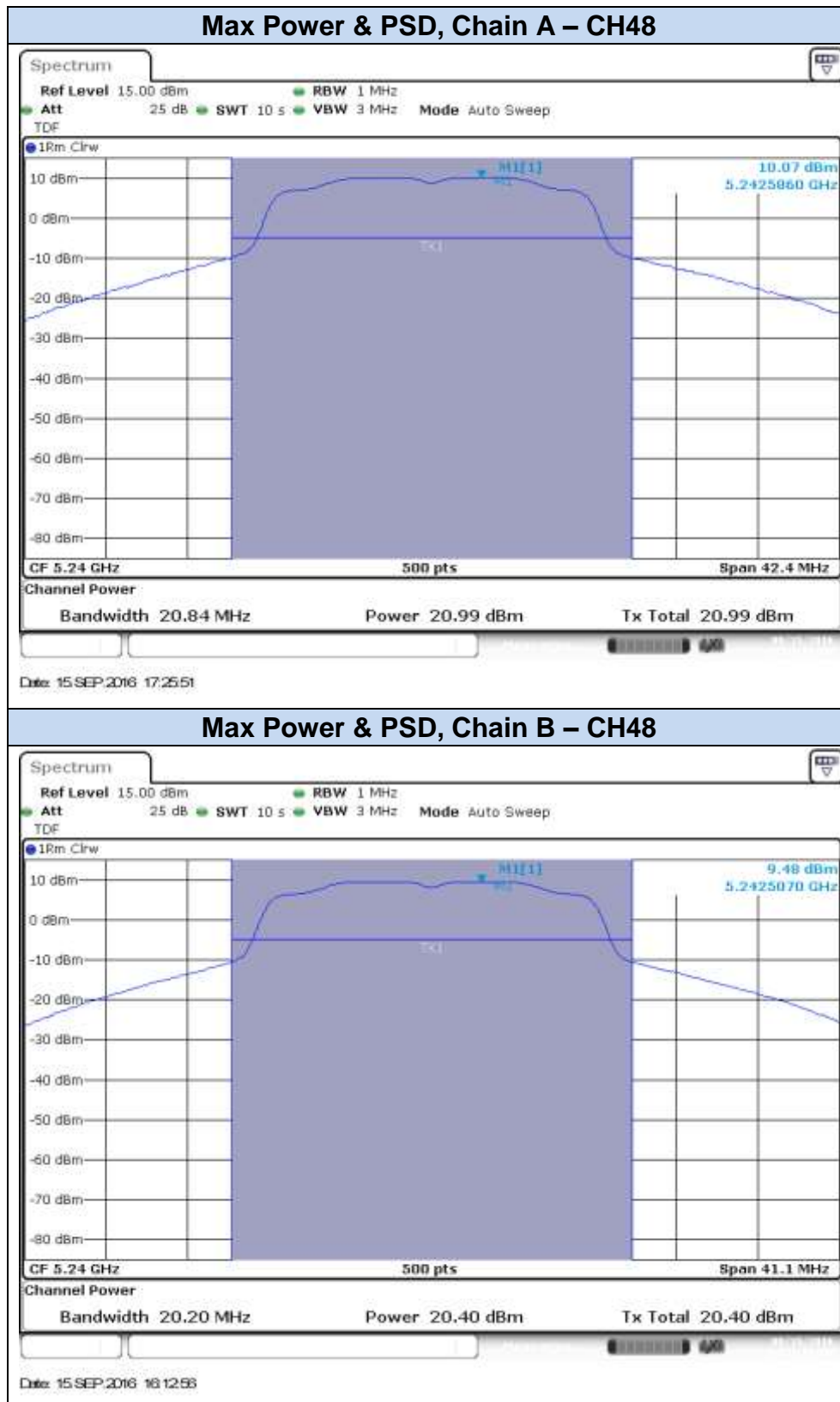
Mode	Rate	Channel	Freq. [MHz]	Antenna	Average conducted PSD [dBm/MHz]	Maximum* conducted PSD [dBm/MHz]	Maximum* EIRP PSD [dBm/MHz]	
802.11a	6Mbps	36	5180	SISO CHAIN A	8.23	8.23	13.23	
				SISO CHAIN B	7.98	7.98	12.98	
		40	5200	SISO CHAIN A	10.00	10.00	15.00	
				SISO CHAIN B	9.08	9.08	14.08	
		48	5240	SISO CHAIN A	10.07	10.07	15.07	
				SISO CHAIN B	9.48	9.48	14.48	
802.11n20	HT0	36	5180	SISO CHAIN A	7.41	7.41	12.41	
				SISO CHAIN B	7.79	7.79	12.79	
		40	5200	SISO CHAIN A	9.45	9.45	14.45	
				SISO CHAIN B	8.91	8.91	13.91	
		48	5240	SISO CHAIN A	8.31	8.31	14.66	
				SISO CHAIN B	9.24	9.24	14.24	
	HT8	36	5180	MIMO CHAIN A	6.19	6.36	11.36	
				MIMO CHAIN B	5.66	5.83	10.83	
				Combined A+B	8.94	9.12	14.12	
		40	5200	MIMO CHAIN A	7.98	8.15	13.15	
				MIMO CHAIN B	7.29	7.46	12.46	
				Combined A+B	10.66	10.83	15.83	
	48	5240	MIMO CHAIN A	7.42	7.59	12.59		
			MIMO CHAIN B	7.65	7.82	12.82		
			Combined A+B	10.55	10.72	15.72		
	802.11n40	HT0	38F	5190	SISO CHAIN A	1.48	1.63	6.63
					SISO CHAIN B	2.44	2.58	7.58
			46F	5230	SISO CHAIN A	6.55	6.70	11.70
HT8		38F	5190	MIMO CHAIN A	0.37	0.72	5.72	
				MIMO CHAIN B	-0.03	0.33	5.33	
				Combined A+B	3.18	3.54	8.54	
46F	5230	MIMO CHAIN A	4.36	4.71	9.71			
		MIMO CHAIN B	3.66	4.02	9.02			
		Combined A+B	7.03	7.39	12.39			
802.11ac80	VHT0	42ac80	5210	SISO CHAIN A	-2.61	-2.32	2.68	
				SISO CHAIN B	-2.70	-2.39	2.61	
				MIMO CHAIN A	-4.46	-3.87	1.13	
				MIMO CHAIN B	-4.73	-4.11	0.89	
				Combined A+B	-1.58	-0.98	4.02	

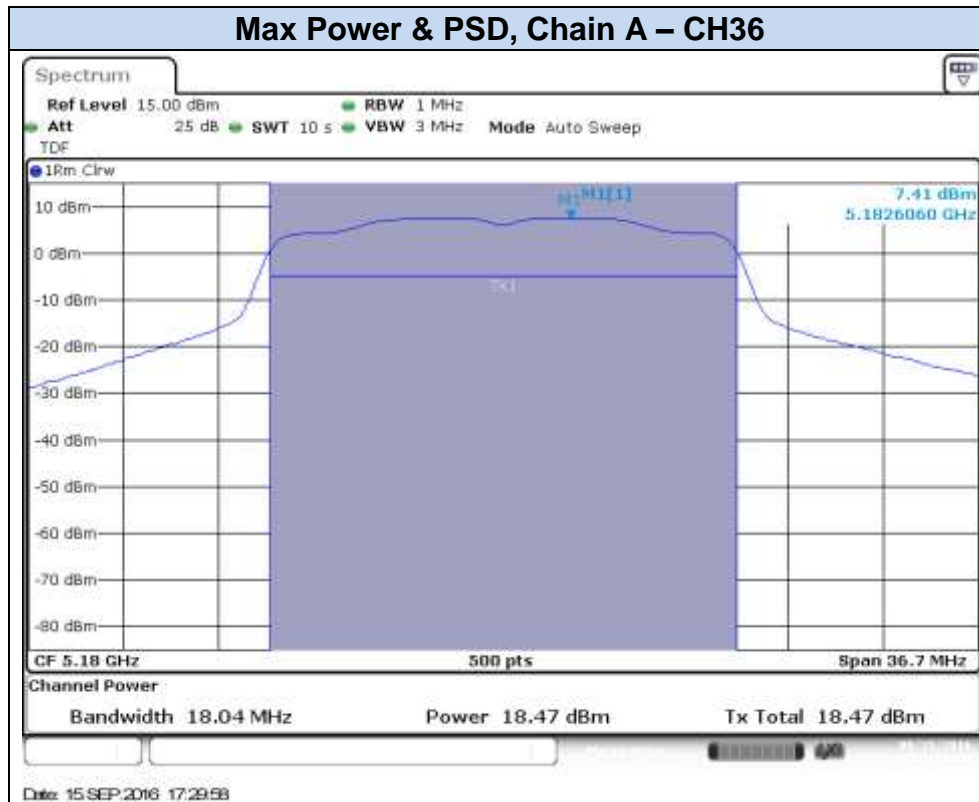
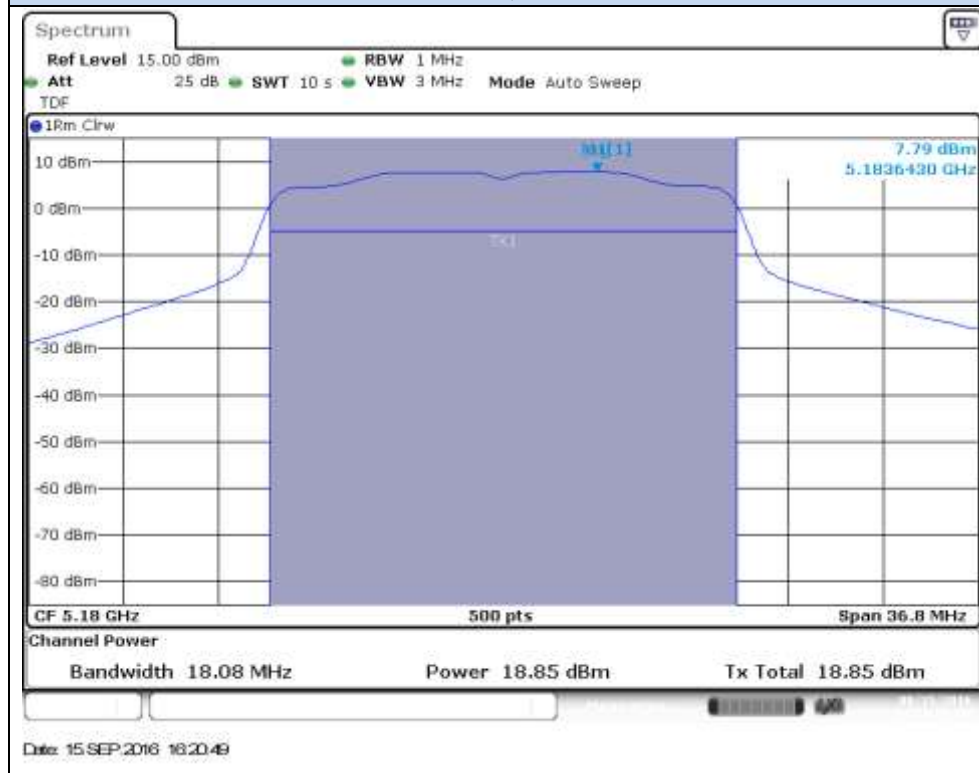
\* Maximum values are the duty cycle compensated values calculated from the measured average values

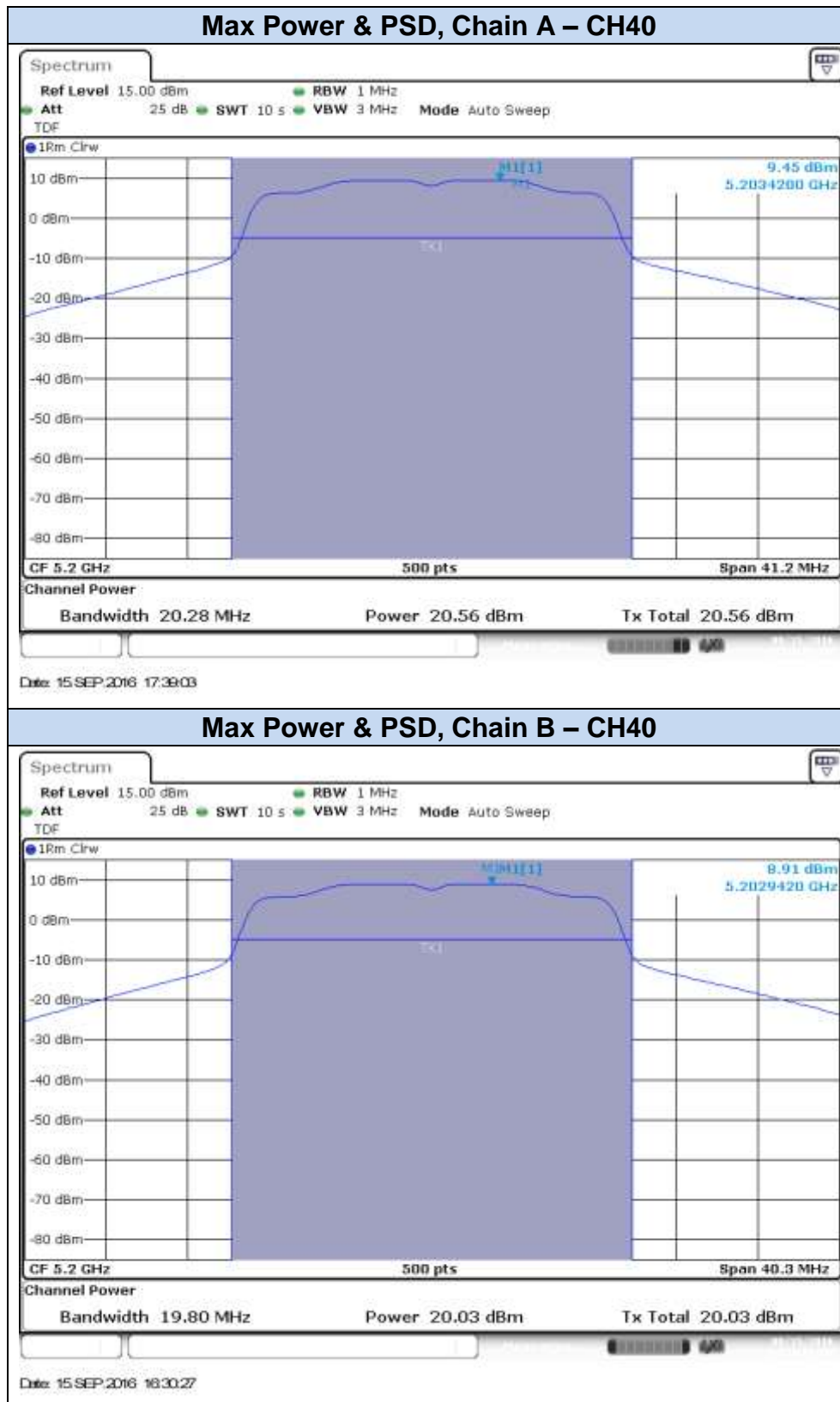


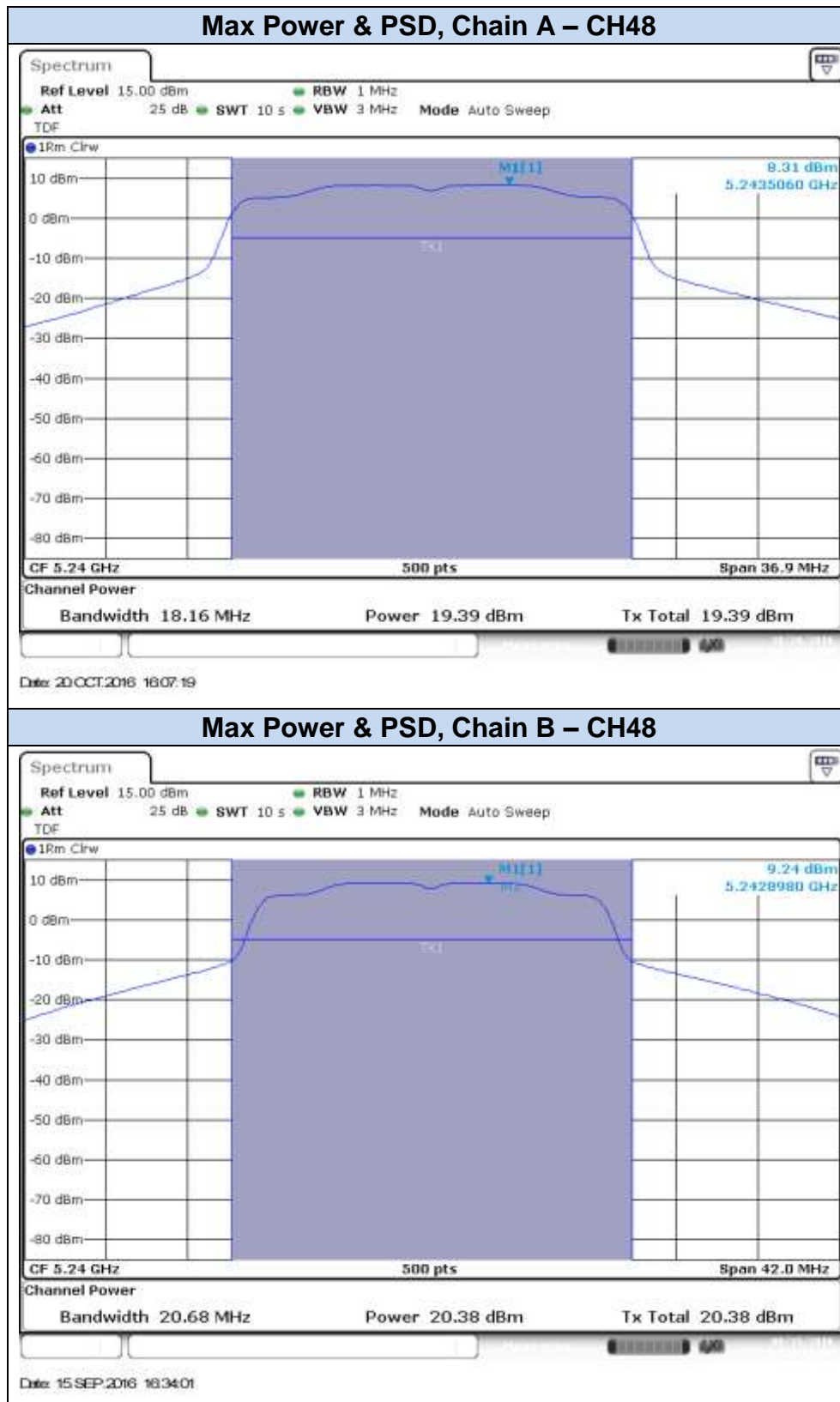
**Results screenshot****802.11a, 6Mbps**

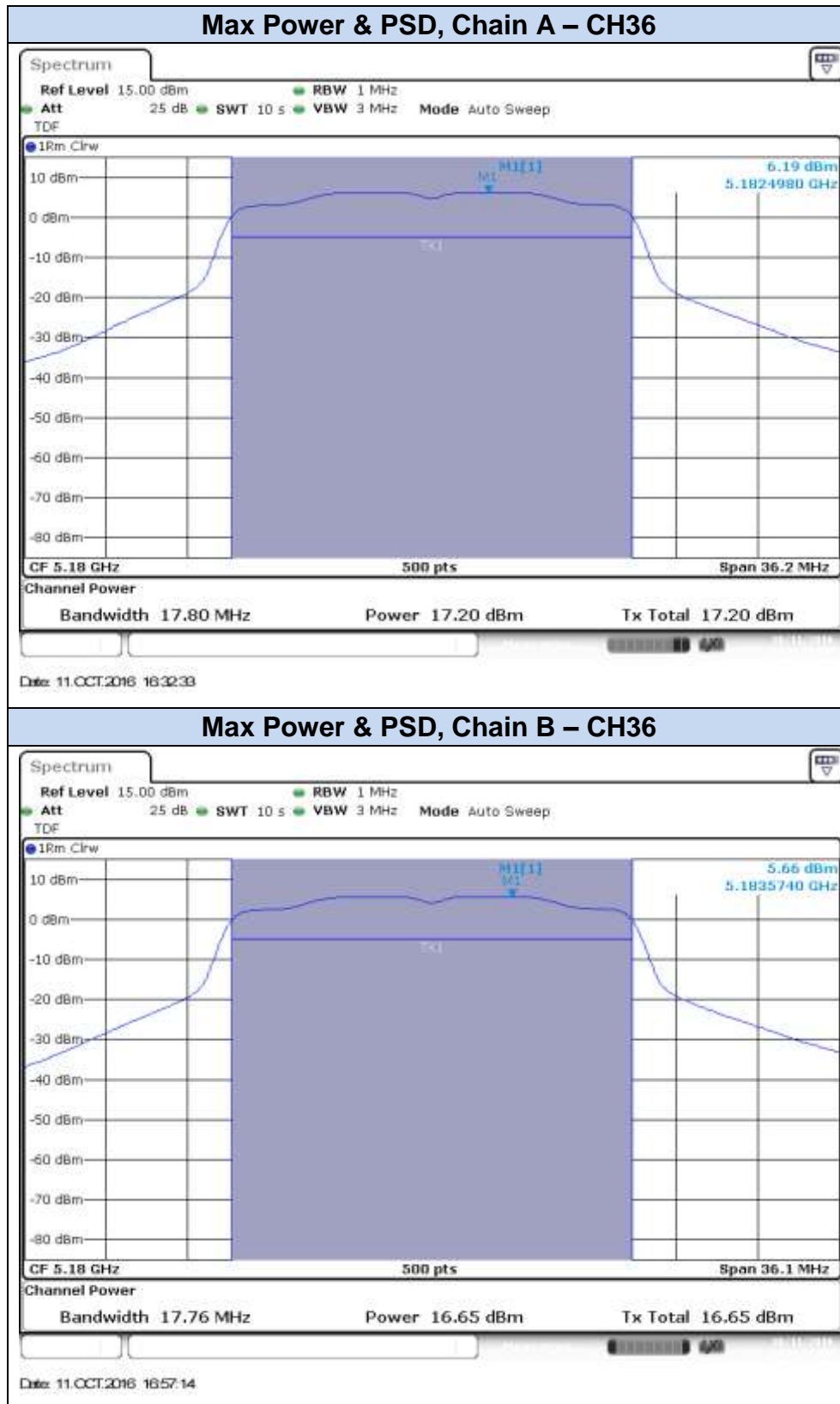




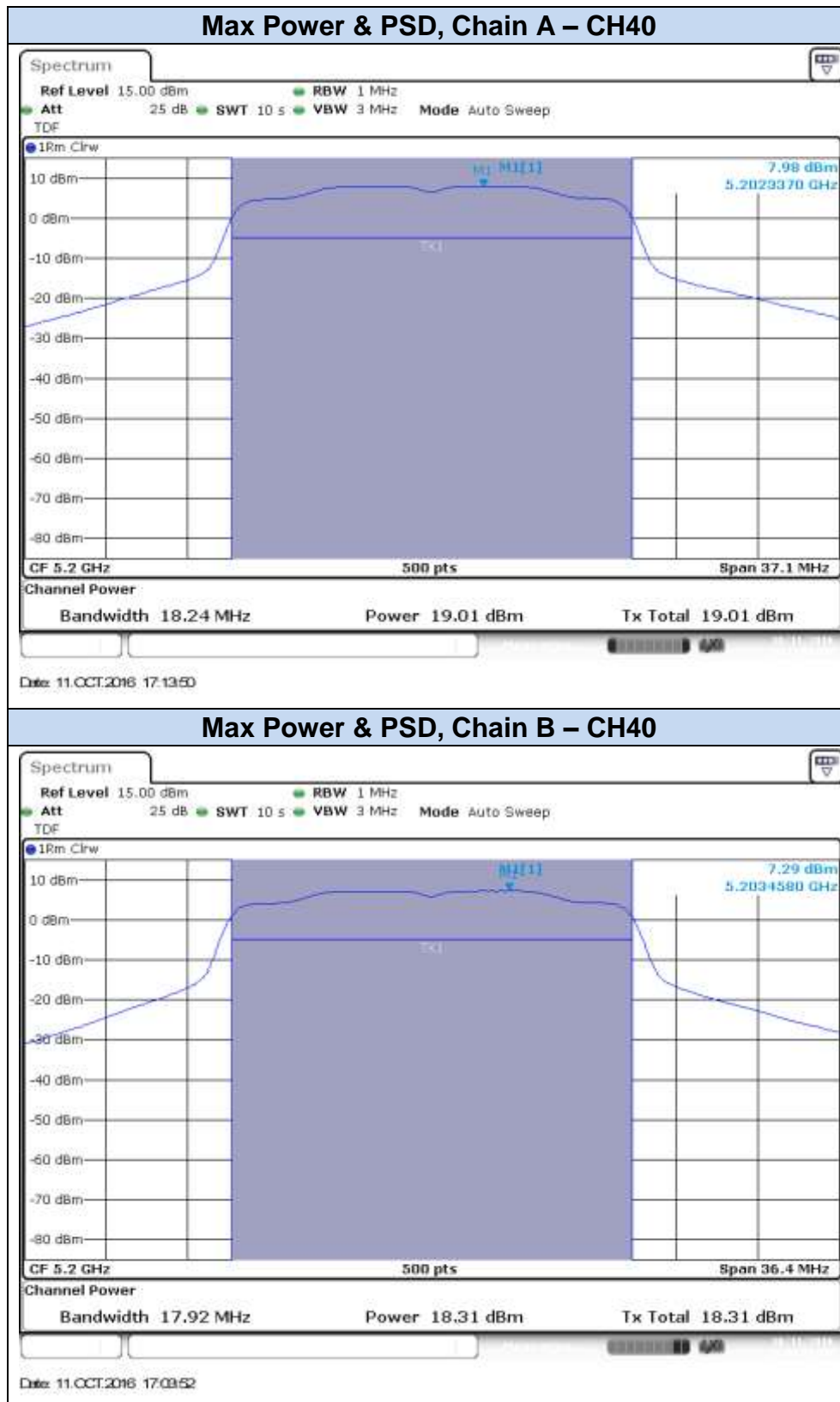
**802.11n20, HT0 (SISO)****Max Power & PSD, Chain A – CH36****Max Power & PSD, Chain B – CH36**

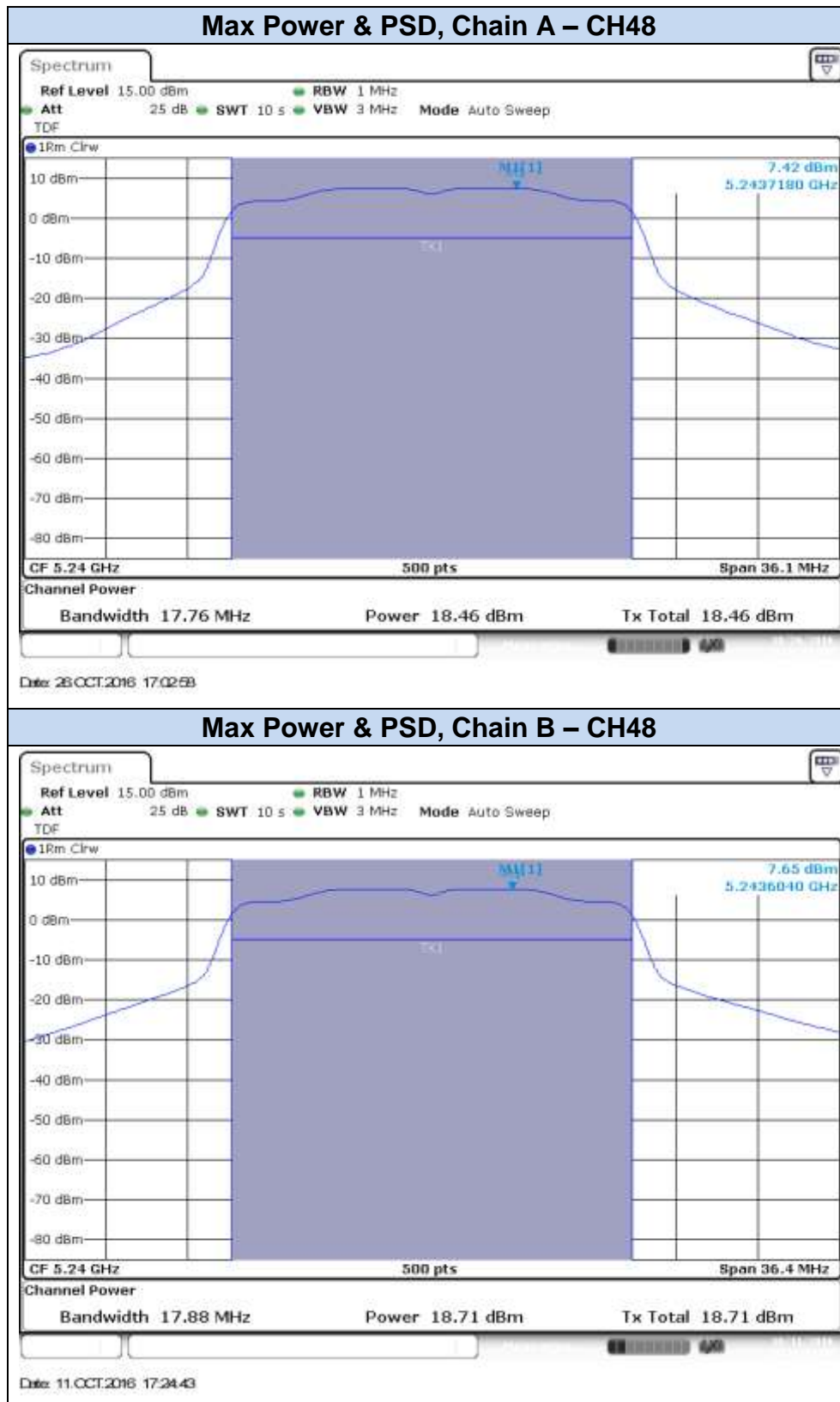


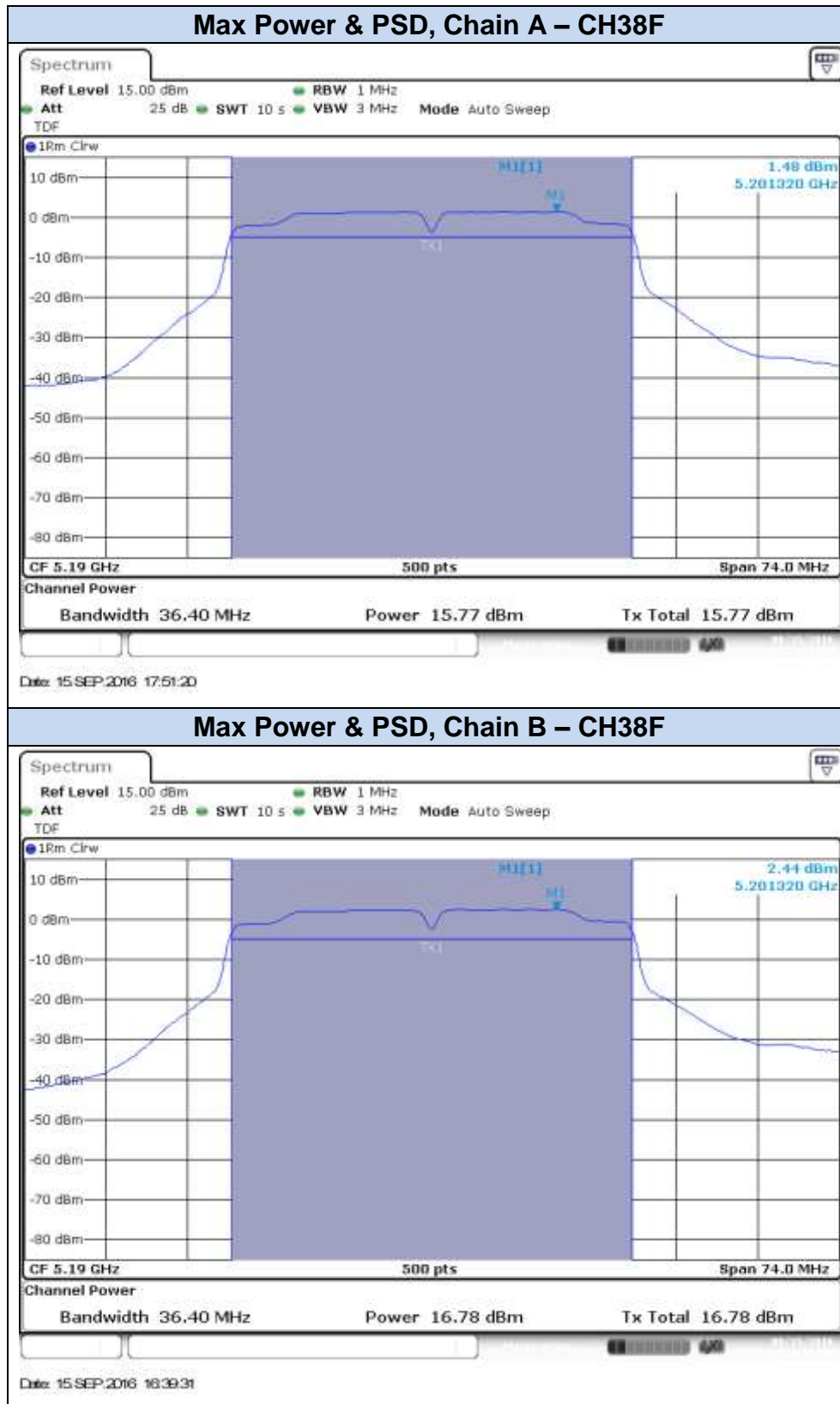


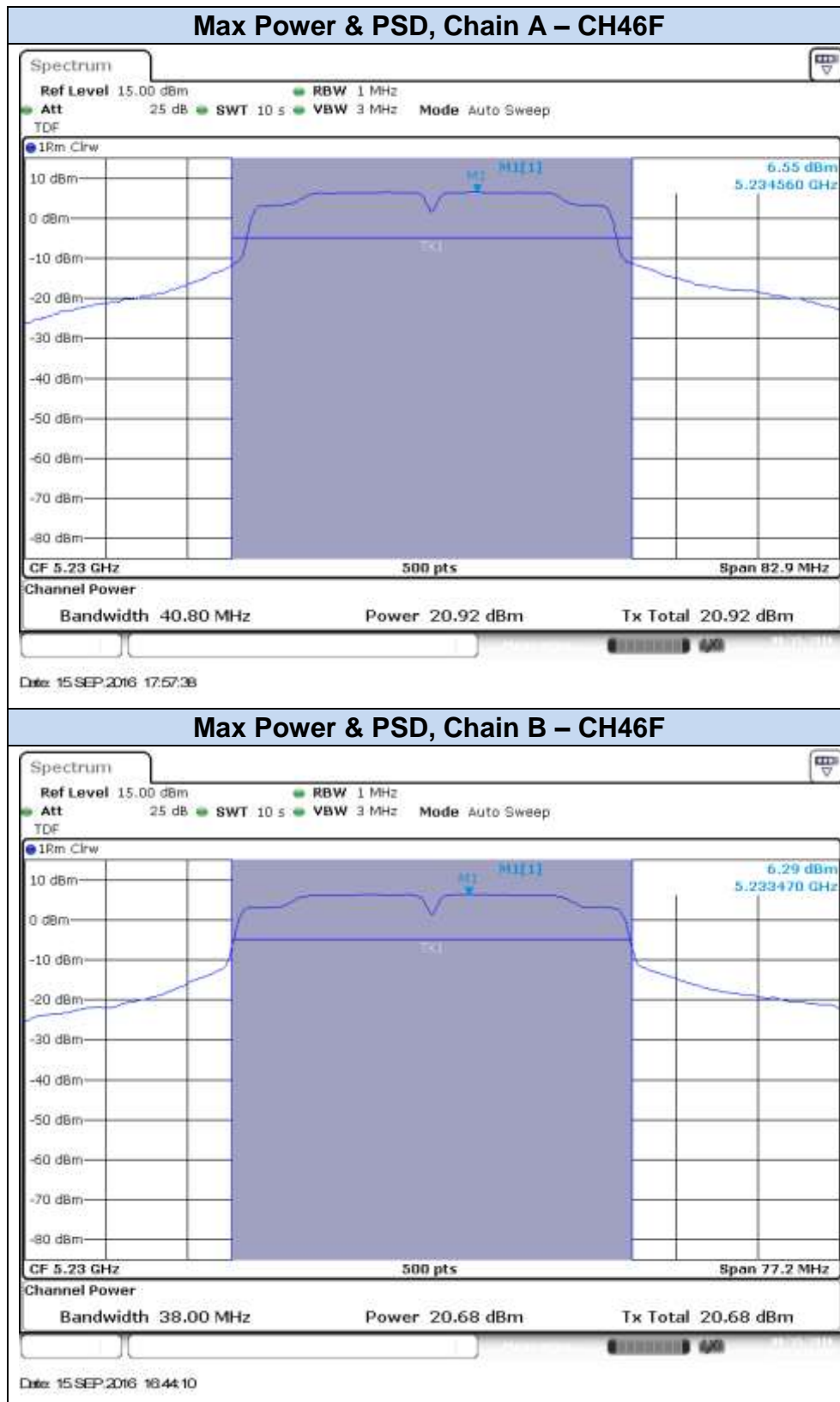
**802.11n20, HT8 (MIMO)**

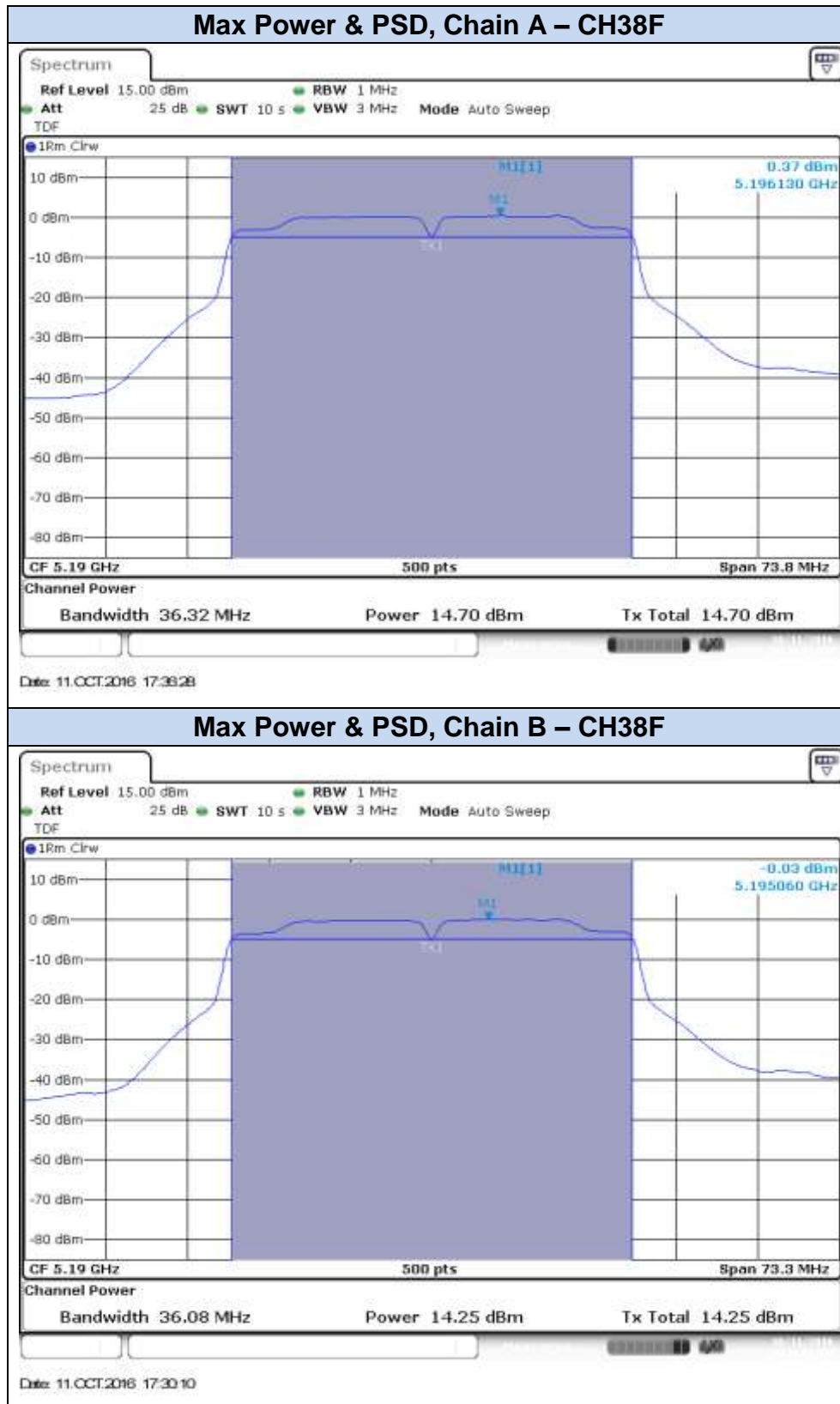


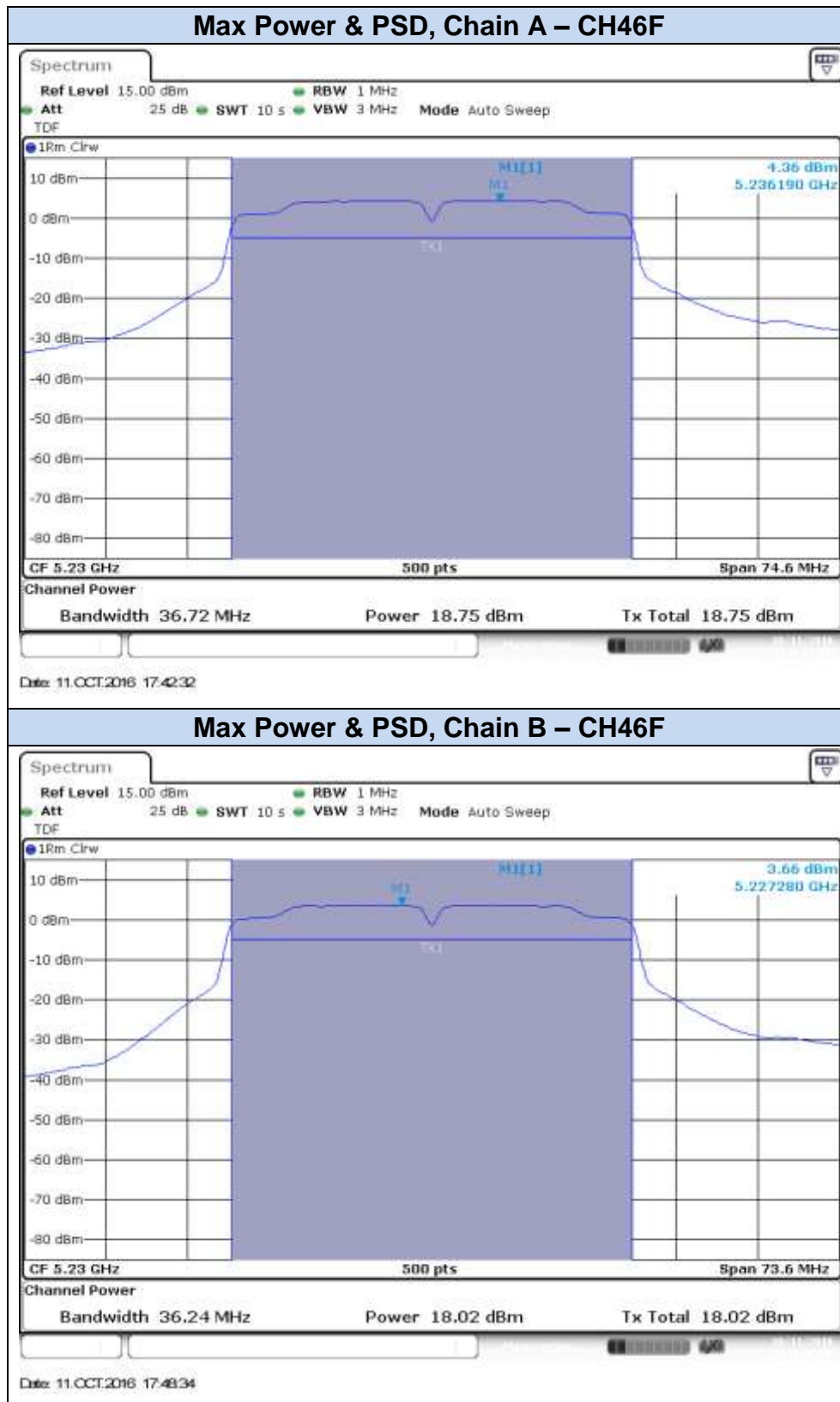




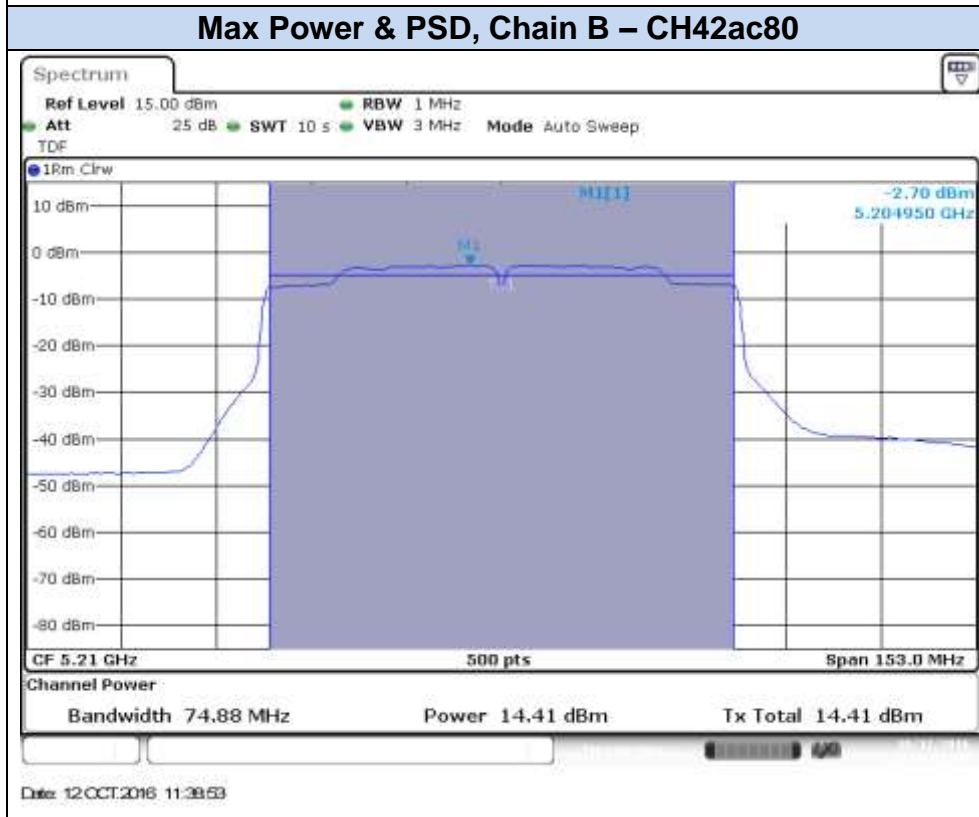
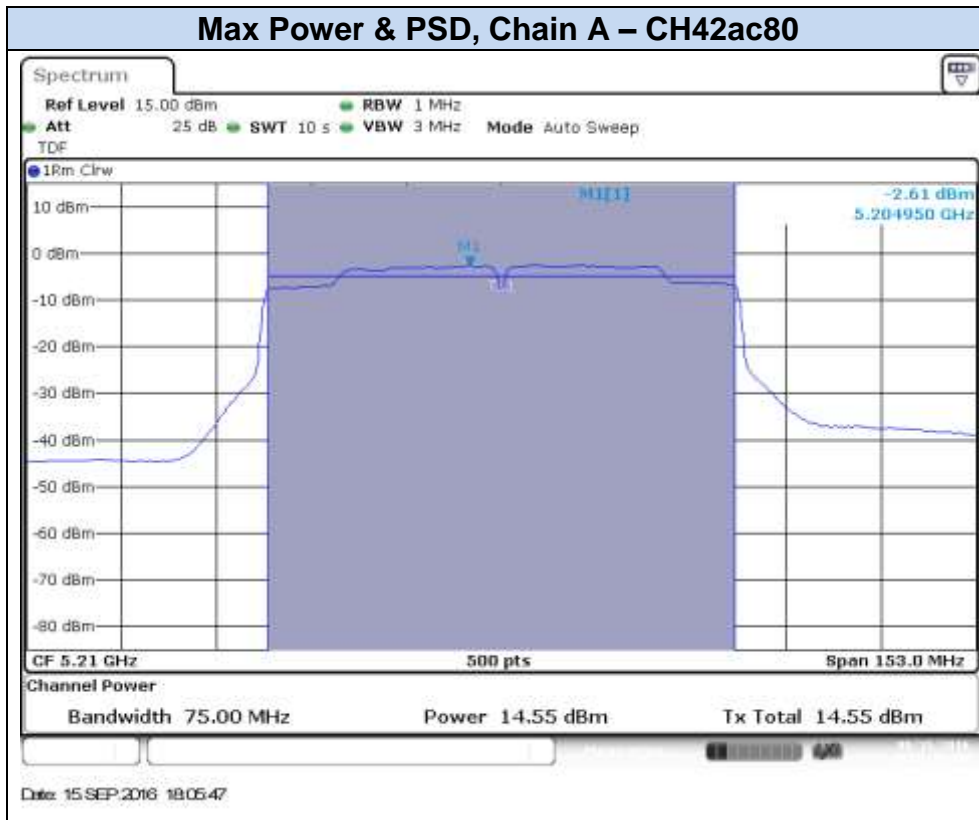
**802.11n40, HT0 (SISO)**



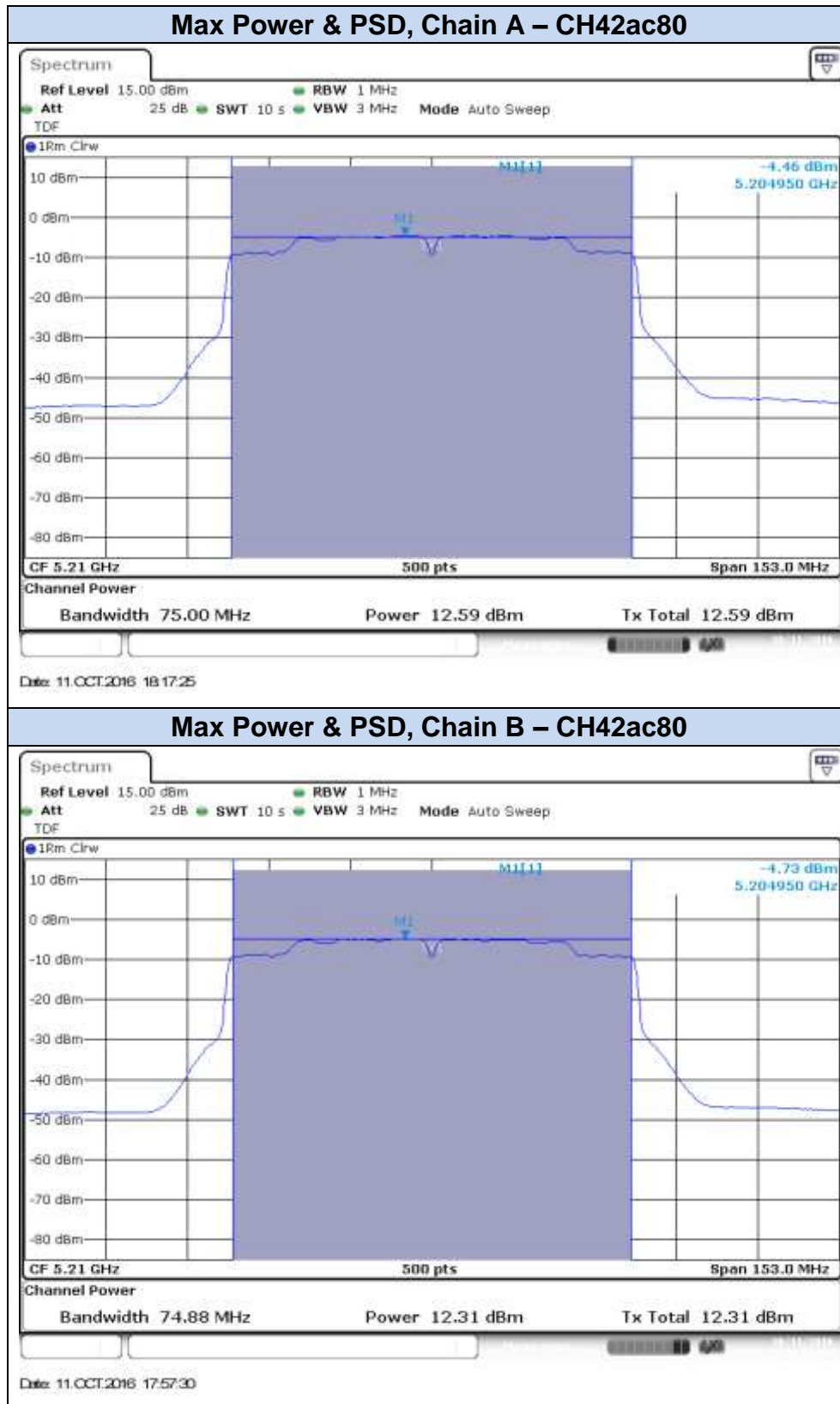
**802.11n40, HT8 (MIMO)**



### 802.11ac80, VHT0 (SISO)





**802.11ac80, VHT0 (MIMO)**

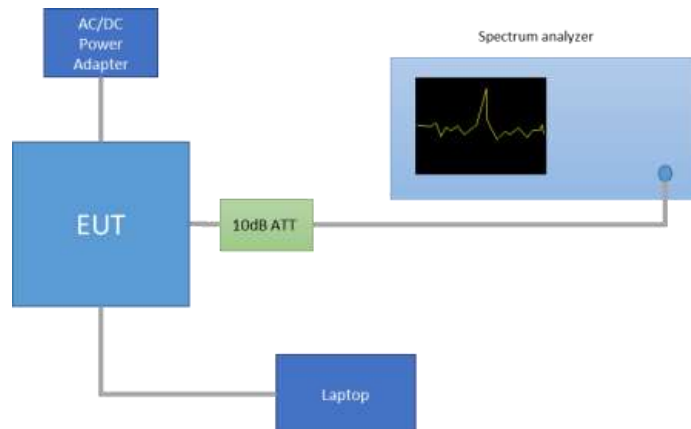
### B.3 Undesirable emissions limits: Band Edge (conducted)

#### Test limits

FCC part	Limits																																
15.407 (b) (1)	For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.																																
15.209	<p>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):</p> <table border="1"> <thead> <tr> <th>Freq Range (MHz)</th> <th>Field Strength (μV/m)</th> <th>Field Strength (dBμV/m)</th> <th>Meas. Distance (m)</th> </tr> </thead> <tbody> <tr> <td>0.009-0.490</td> <td>2400/f(kHz)</td> <td>-</td> <td>300</td> </tr> <tr> <td>0.490-1.705</td> <td>24000/f(kHz)</td> <td>-</td> <td>300</td> </tr> <tr> <td>1.705-30.0</td> <td>30</td> <td>-</td> <td>30</td> </tr> <tr> <td>30-88</td> <td>100</td> <td>40</td> <td>3</td> </tr> <tr> <td>88-216</td> <td>150</td> <td>43.5</td> <td>3</td> </tr> <tr> <td>216-960</td> <td>200</td> <td>46</td> <td>3</td> </tr> <tr> <td>Above 960</td> <td>500</td> <td>54</td> <td>3</td> </tr> </tbody> </table> <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>	Freq Range (MHz)	Field Strength (μV/m)	Field Strength (dBμV/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
Freq Range (MHz)	Field Strength (μV/m)	Field Strength (dBμV/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																														

#### Test procedure

The setup below was used to measure undesirable emissions on the Band Edge domain. 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 and the declared Antenna Gain.



Band Edge measurements in average mode on the low frequency section was done with the Video Bandwidth Method was used according to section G) 6) (KDB 789033 D02), with the following parameters:

- When the duty cycle is > 98 %, VBW = 10Hz
- When the duty cycle is < 98 %, VBW > 1/T, where T is defined in section II.B.1.a

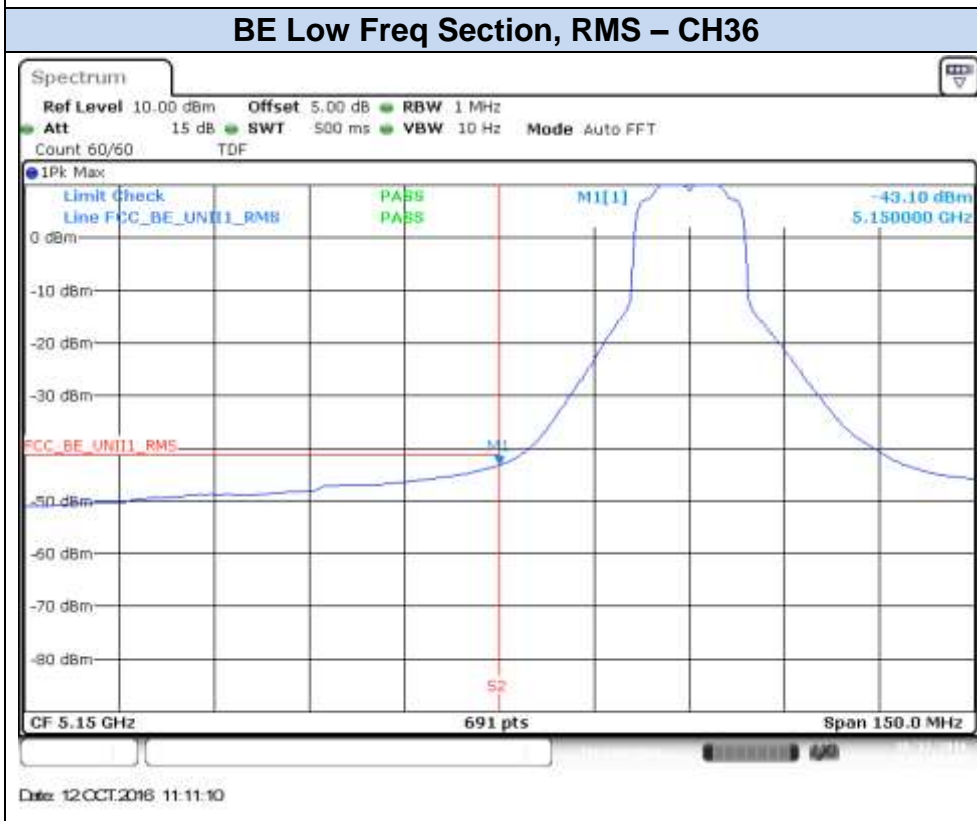
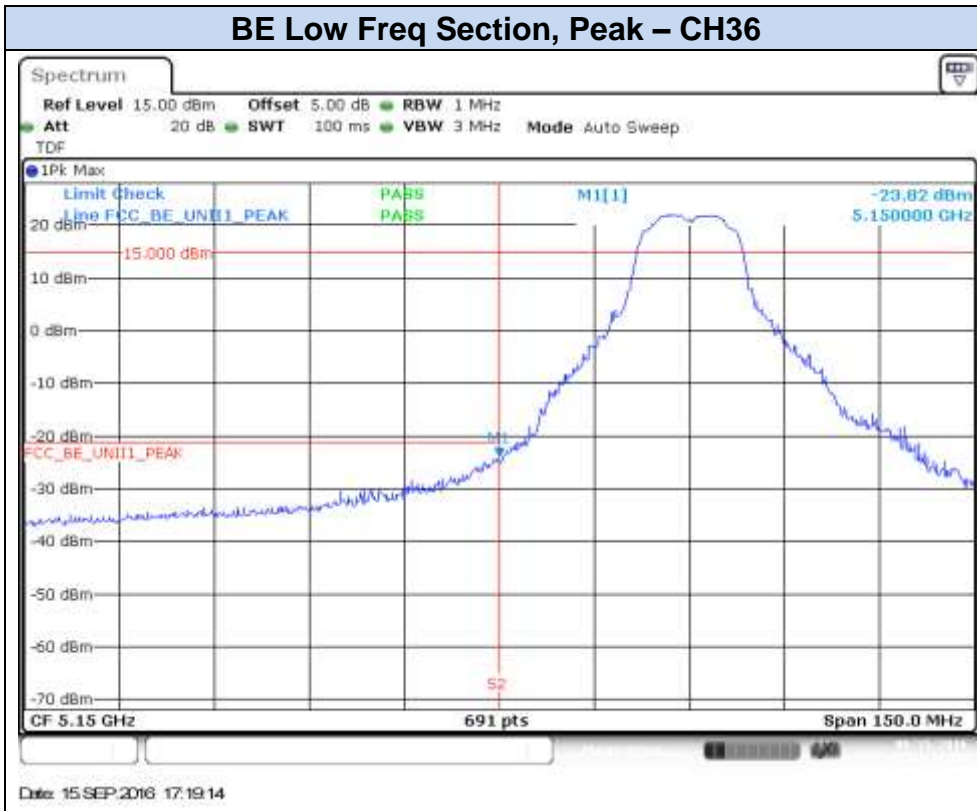
In case of Band Edge measurements falling in restricted bands, the declared Antenna Gain is also compensated in the graph. The declared maximum antenna gain is 5dBi.

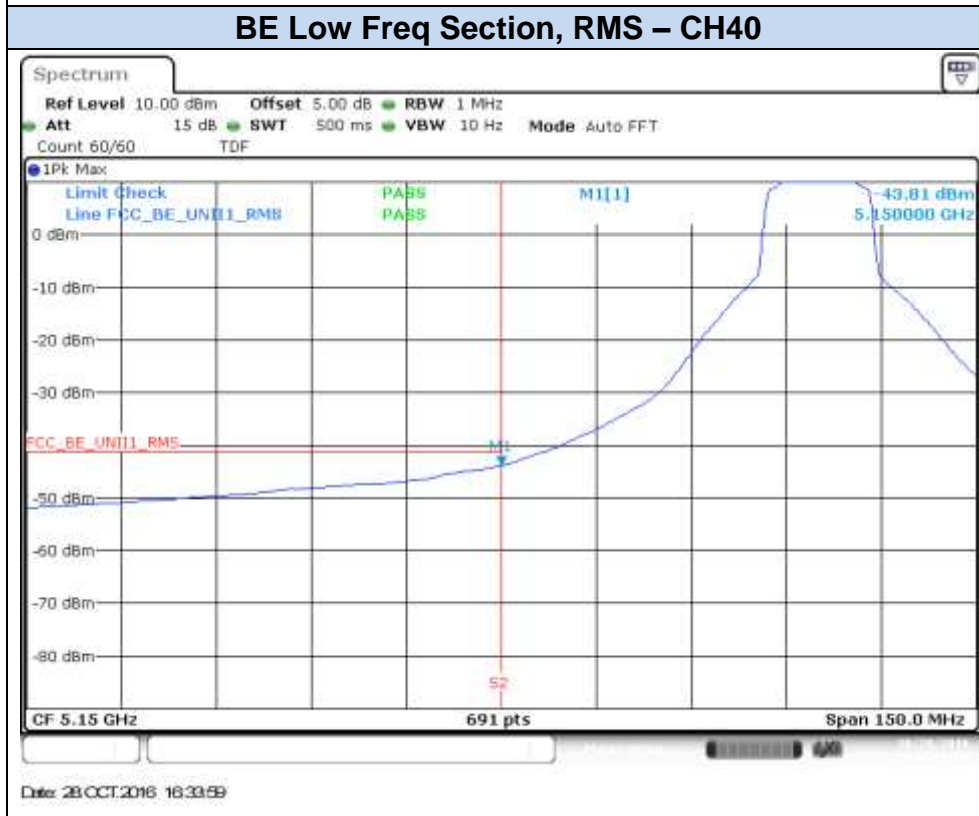
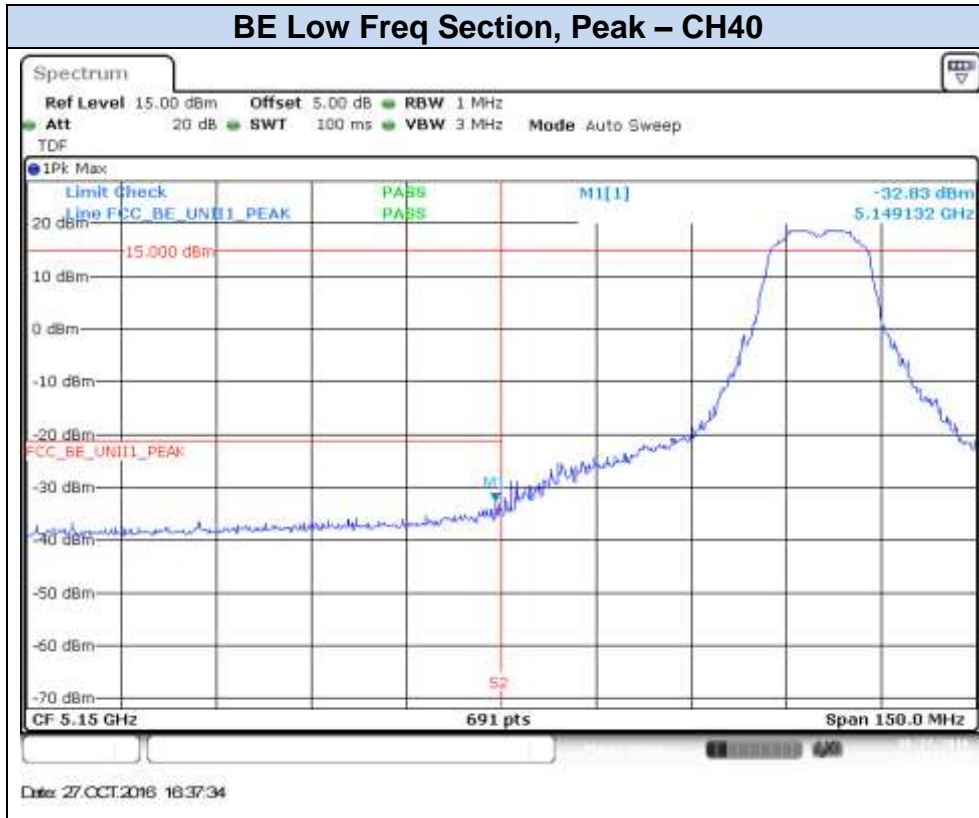
For Band Edge measurements falling in restricted bands, the following limits in dBm were applied for the average detector after the conversion from the limits detailed above in dB $\mu$ V/m, according to FCC 47 CFR part 15 - Subpart C – §15.209(a). The limits in dBm for peak detector are 20dB above the indicated values in the table.

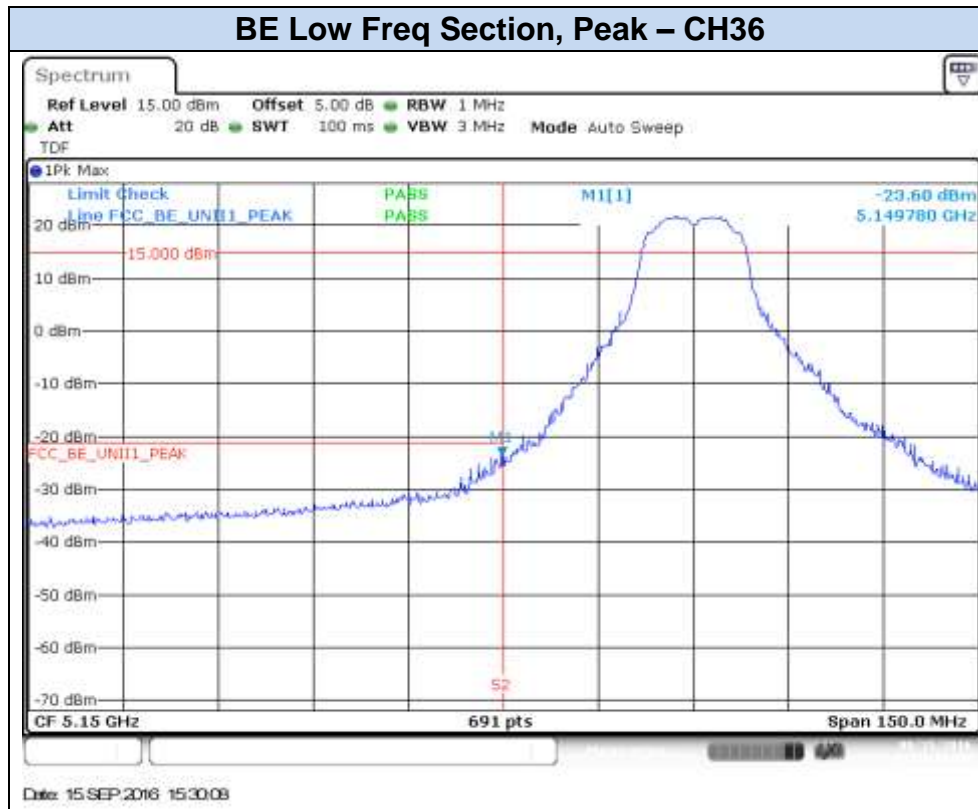
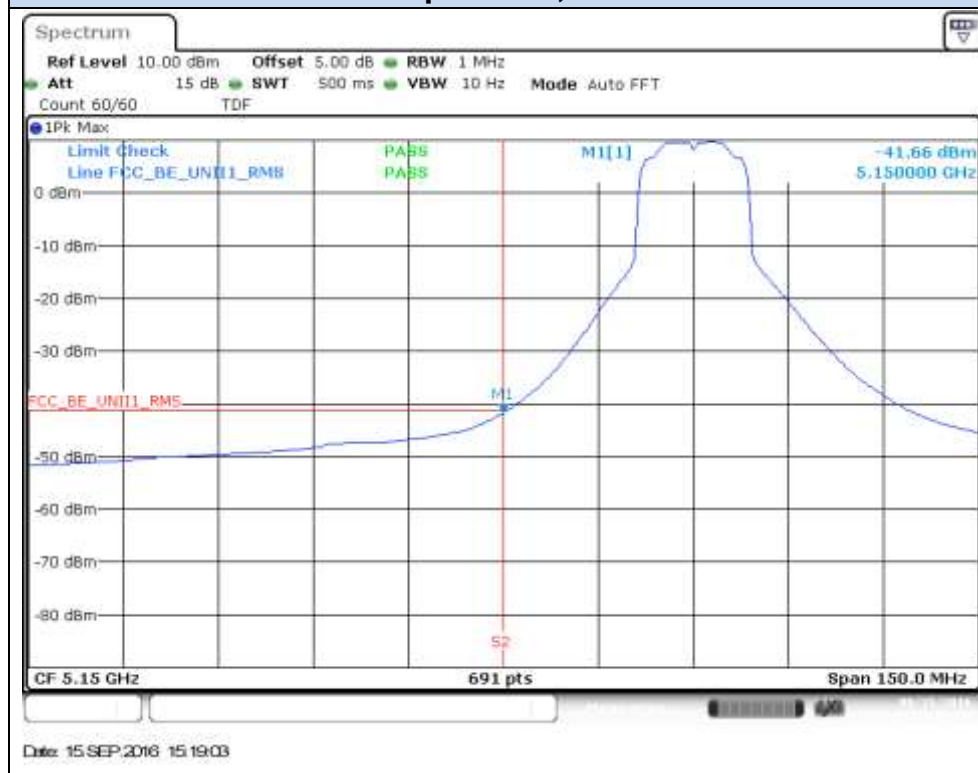
§15.209(a)			Converted values	
Freq Range (MHz)	Distance (m)	Field strength (microvolts/meter)	Field strength (dB microvolts/meter)	Power (dBm)
Above 960	3	500	54.0	-41.2

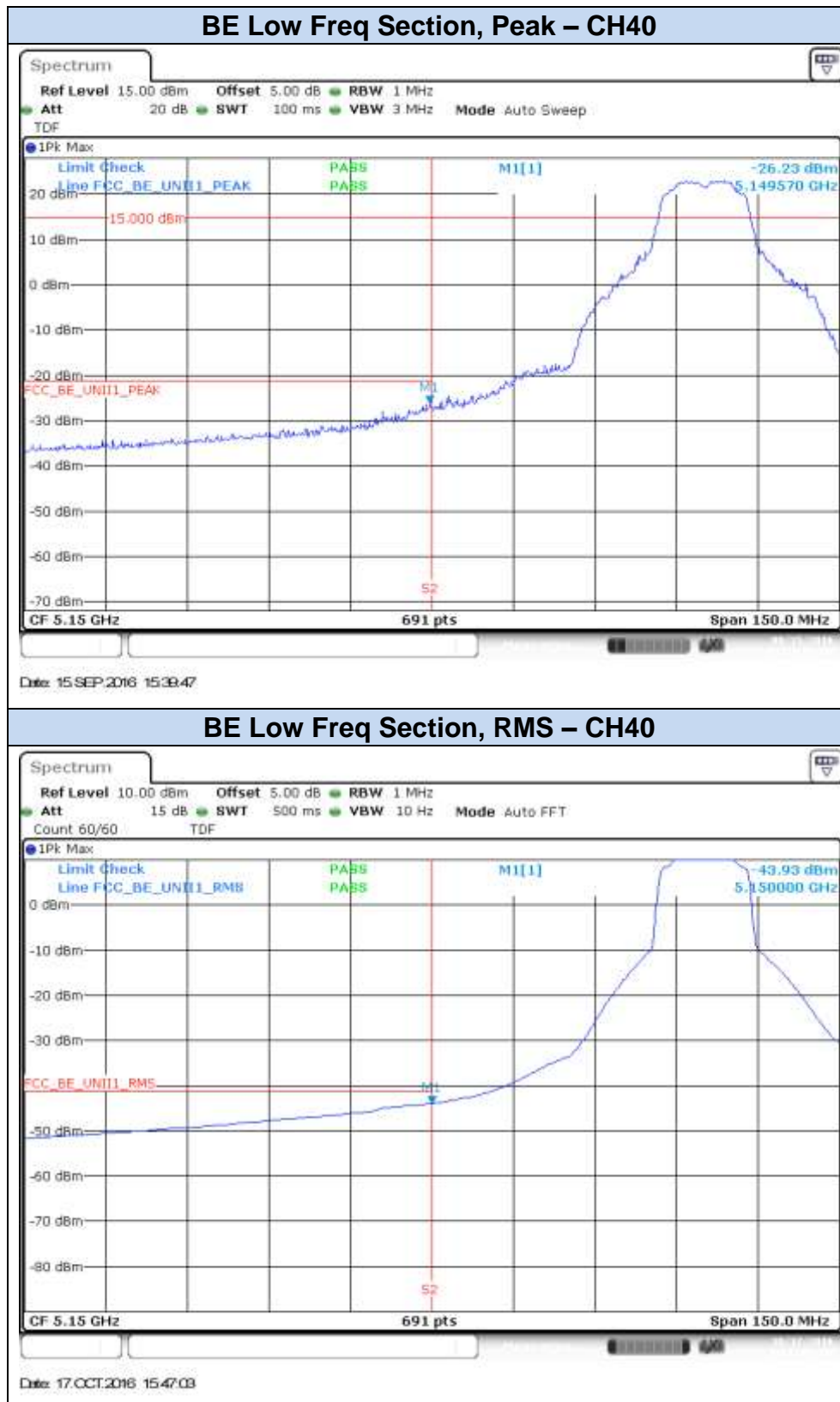
**Results Screenshot**

**802.11a, 6Mbps – Chain A**



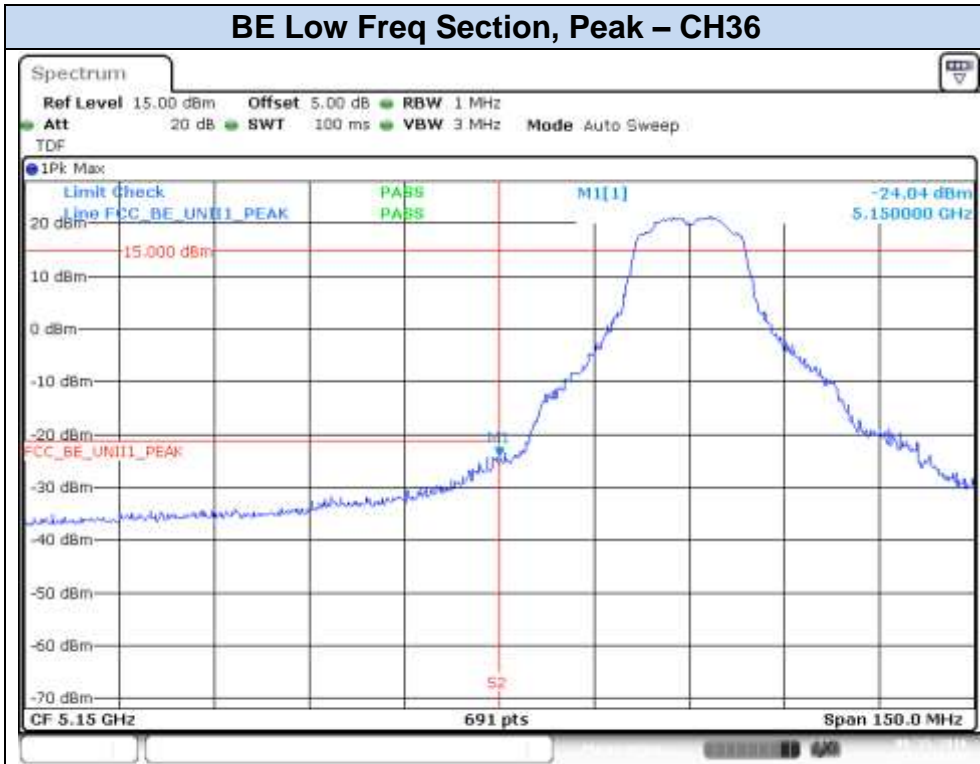


**802.11a, 6Mbps – Chain B****BE Low Freq Section, Peak – CH36****BE Low Freq Section, RMS – CH36**

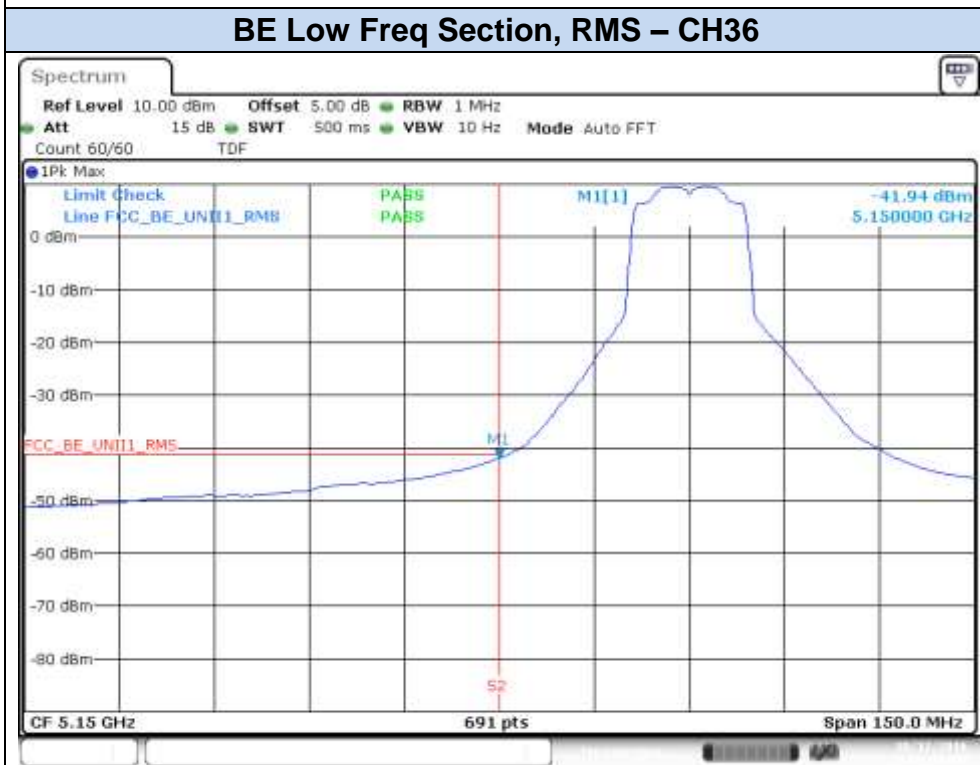




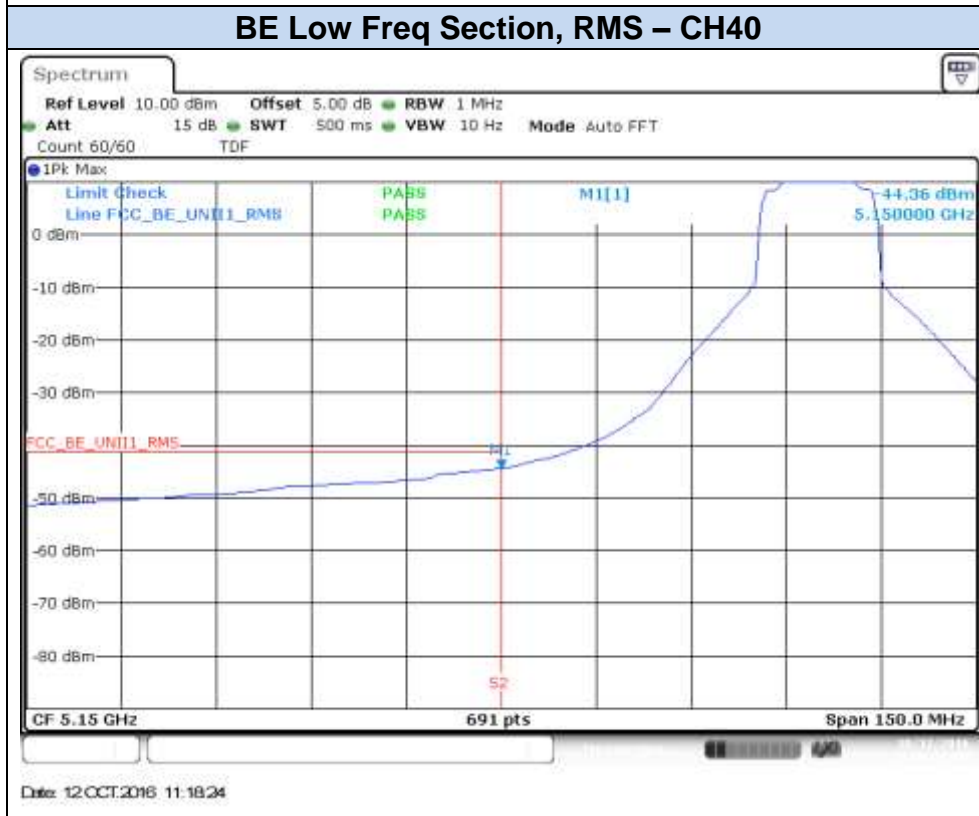
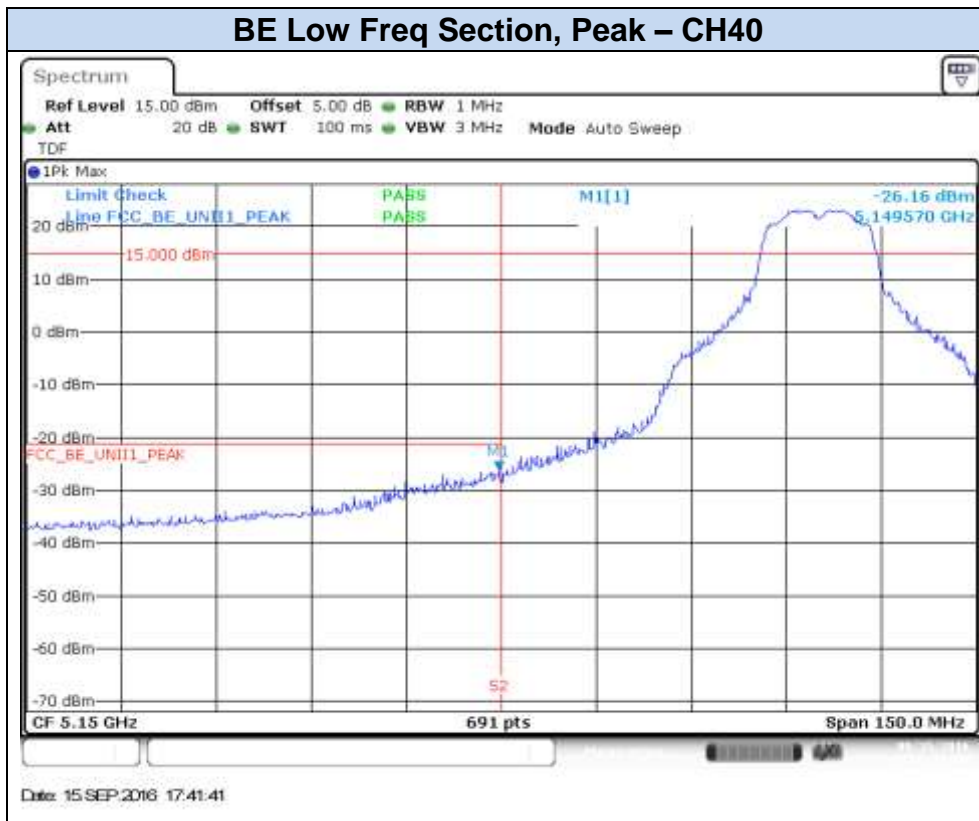
### 802.11n20, HT0 (SISO) – Chain A



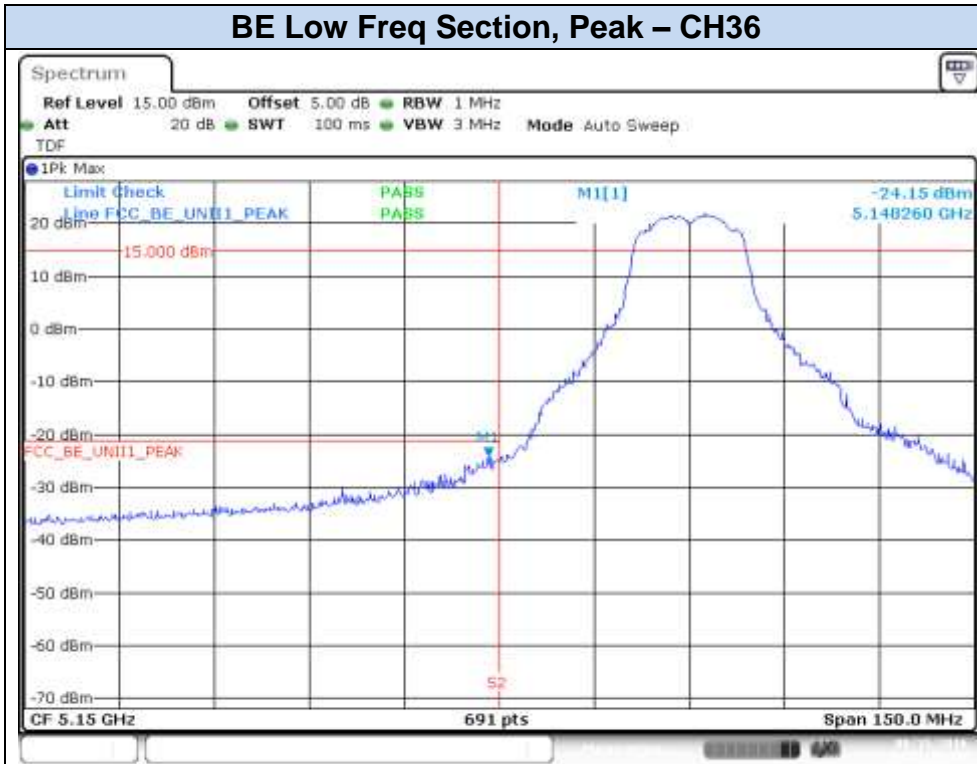
Date: 15 SEP.2016 17:34:38



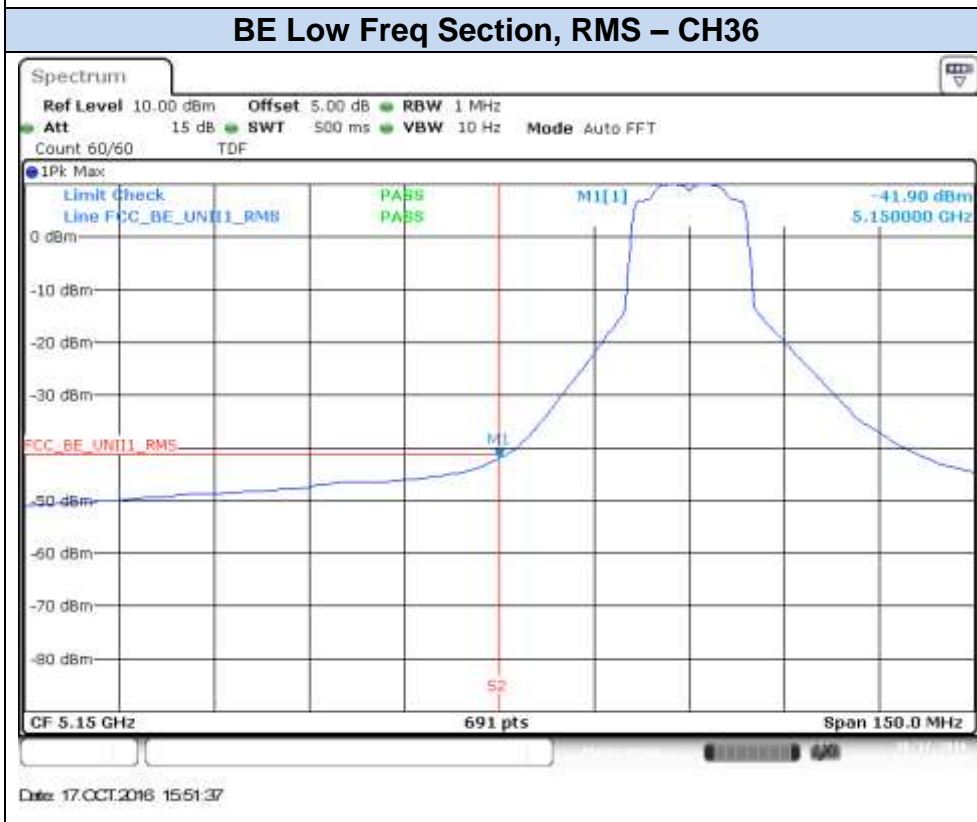
Date: 12 OCT.2016 11:22:11



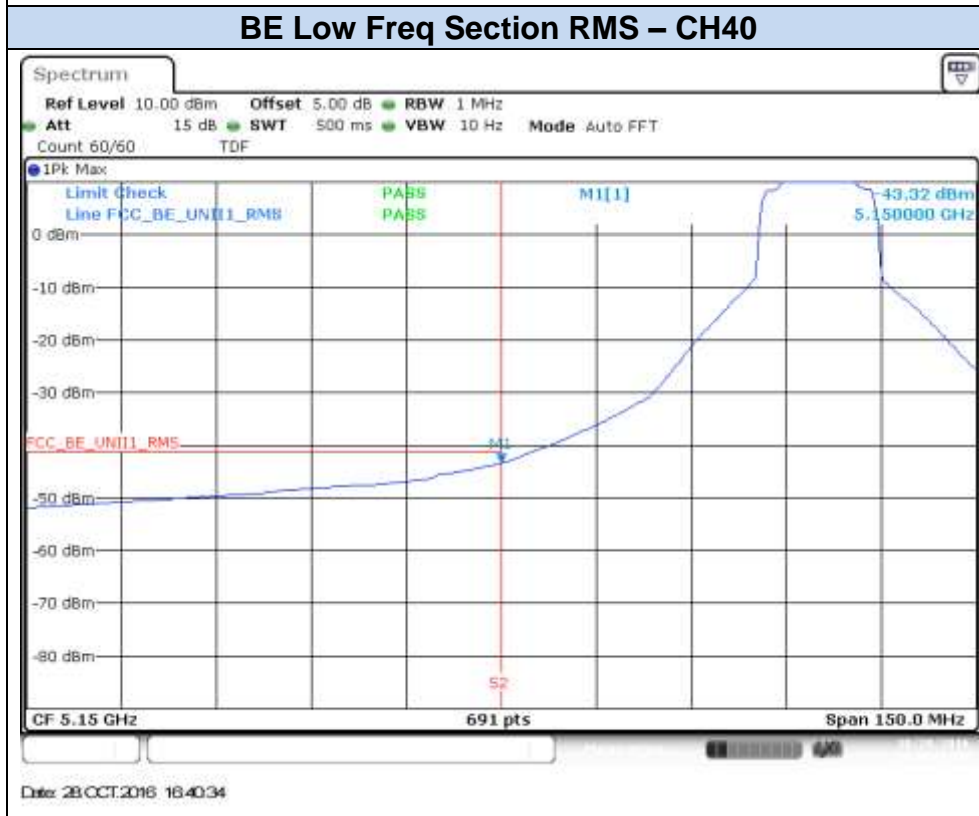
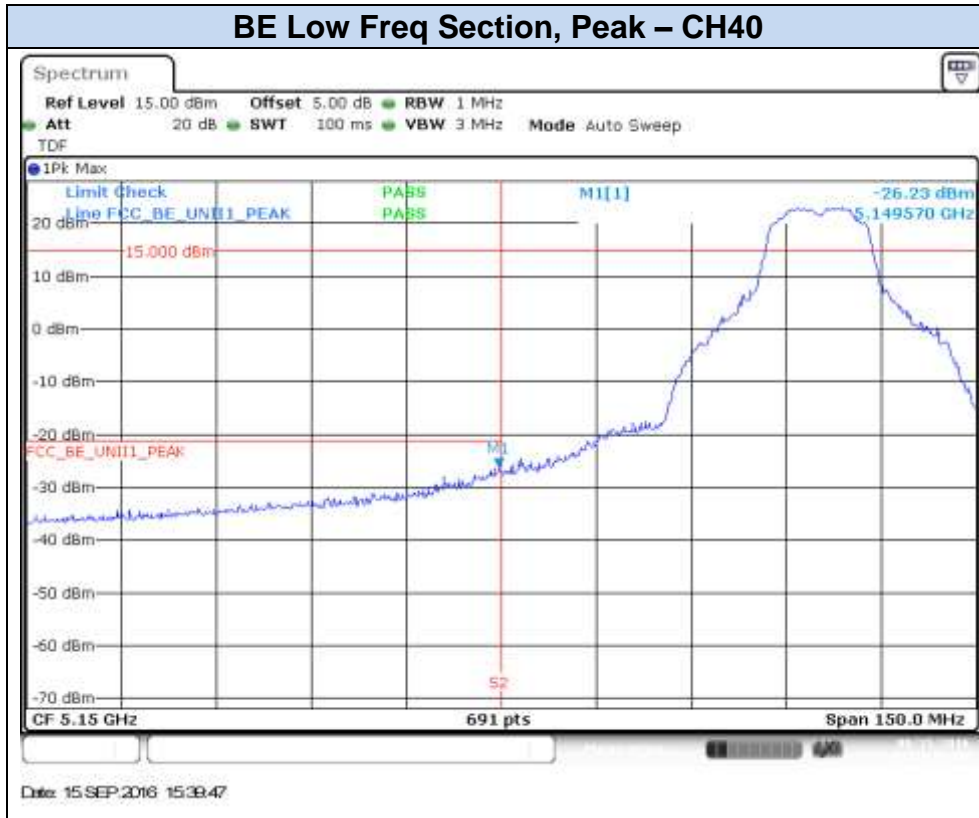
### 802.11n20, HT0 (SISO) – Chain B

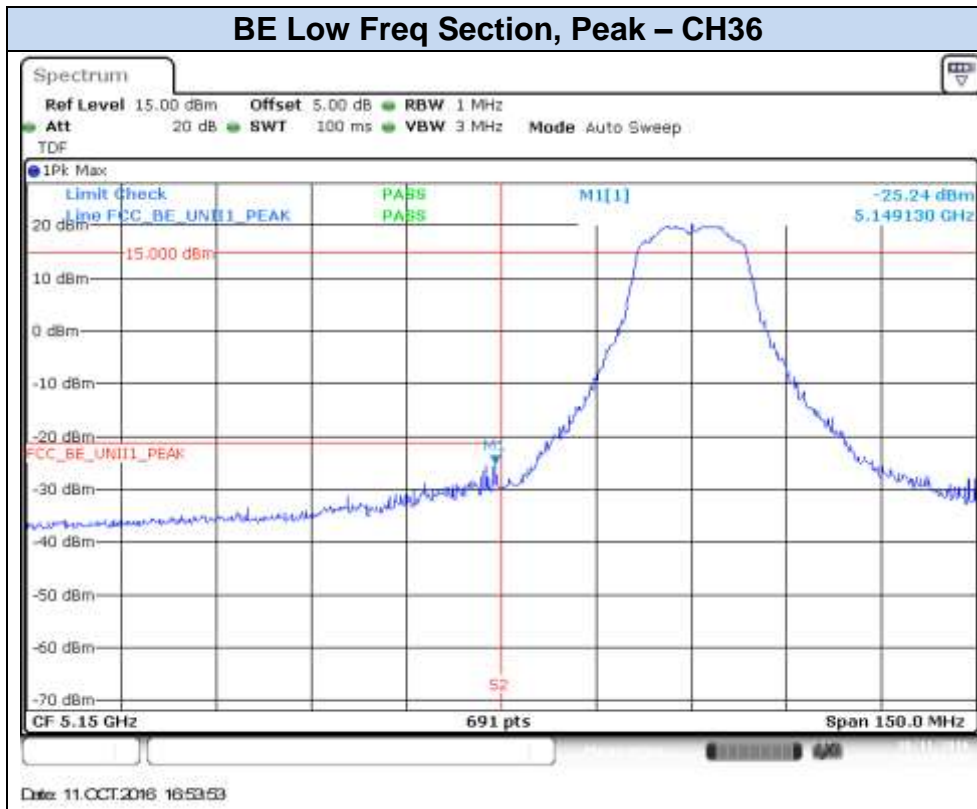
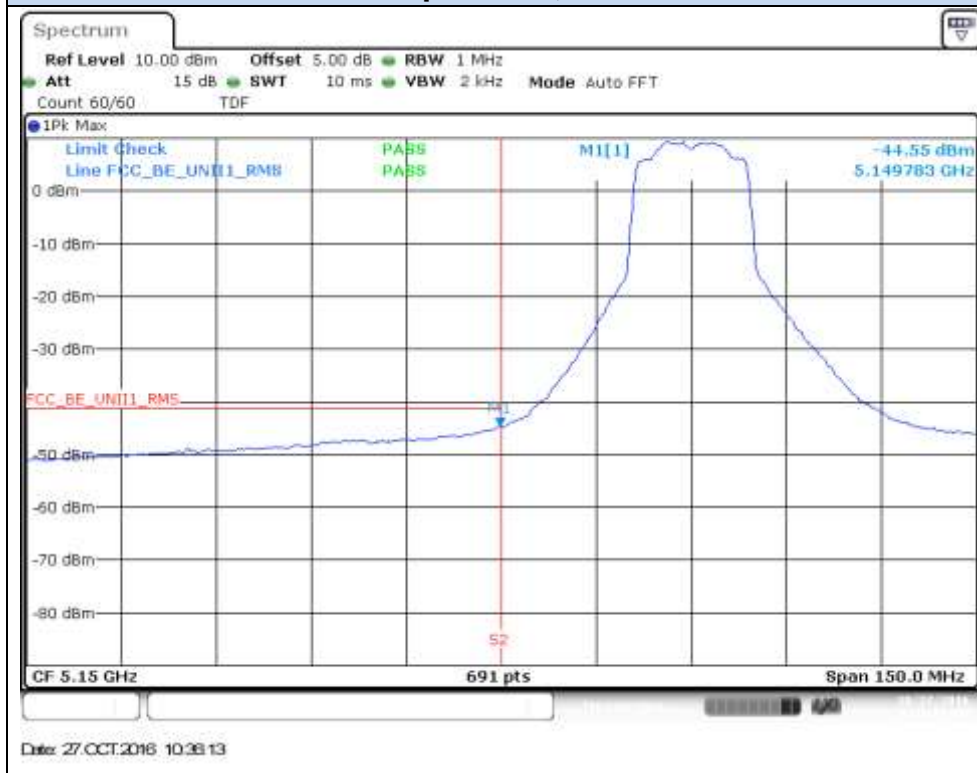


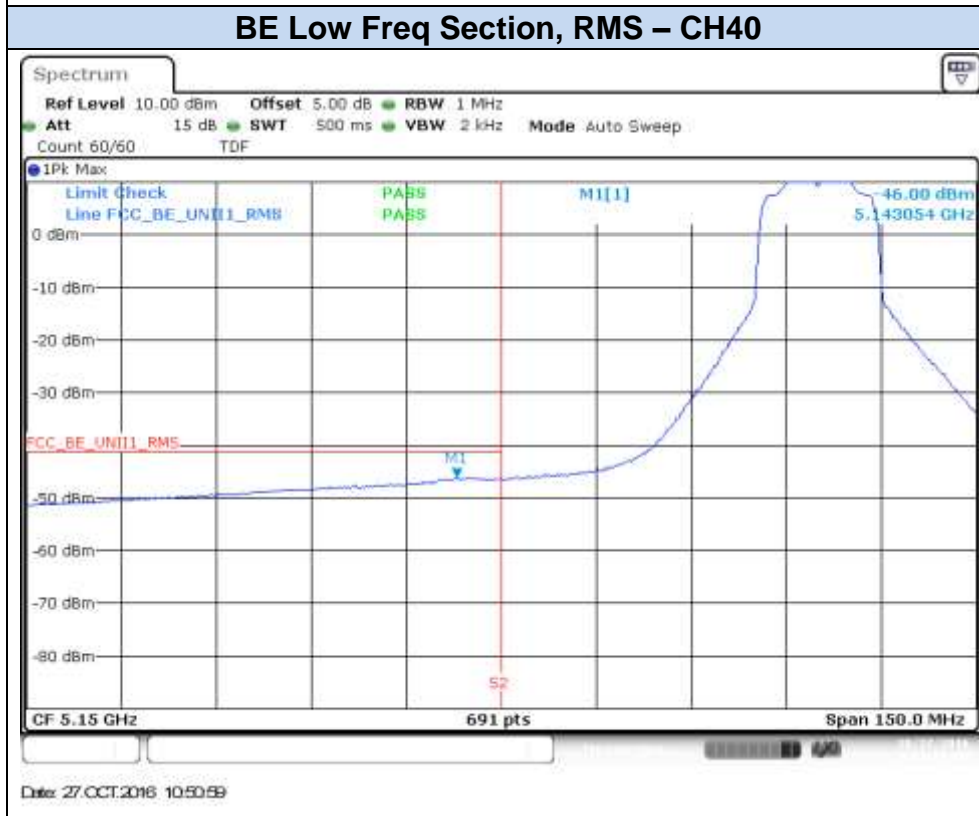
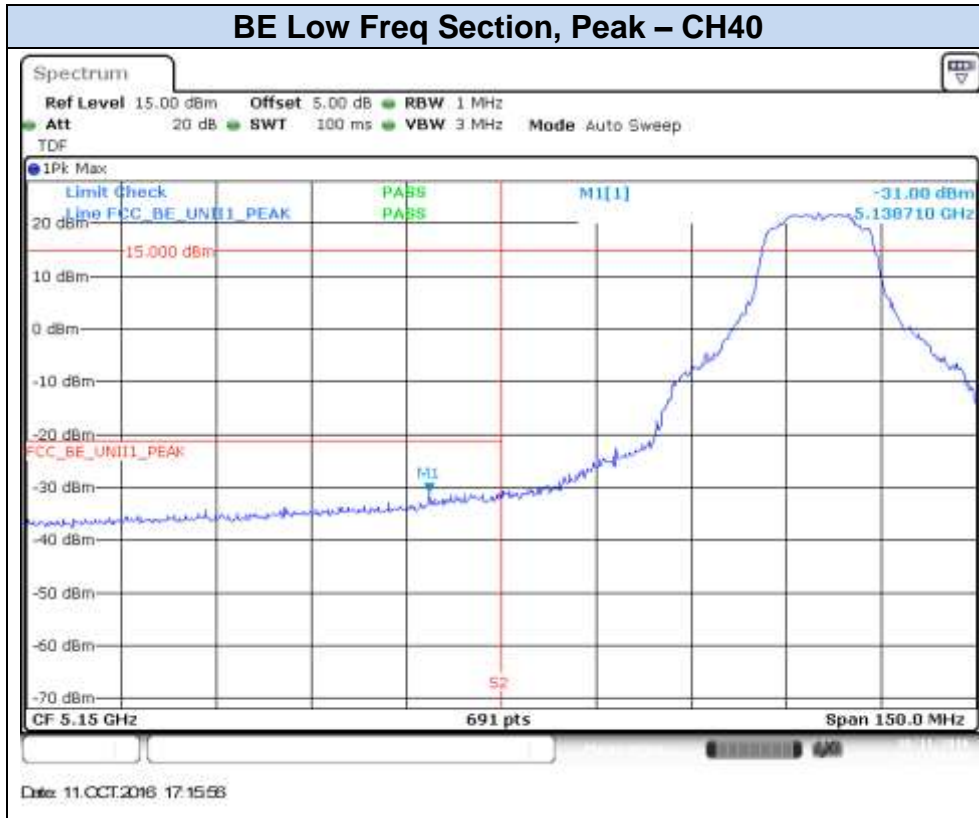
Date: 15 SEP.2016 16:25:47



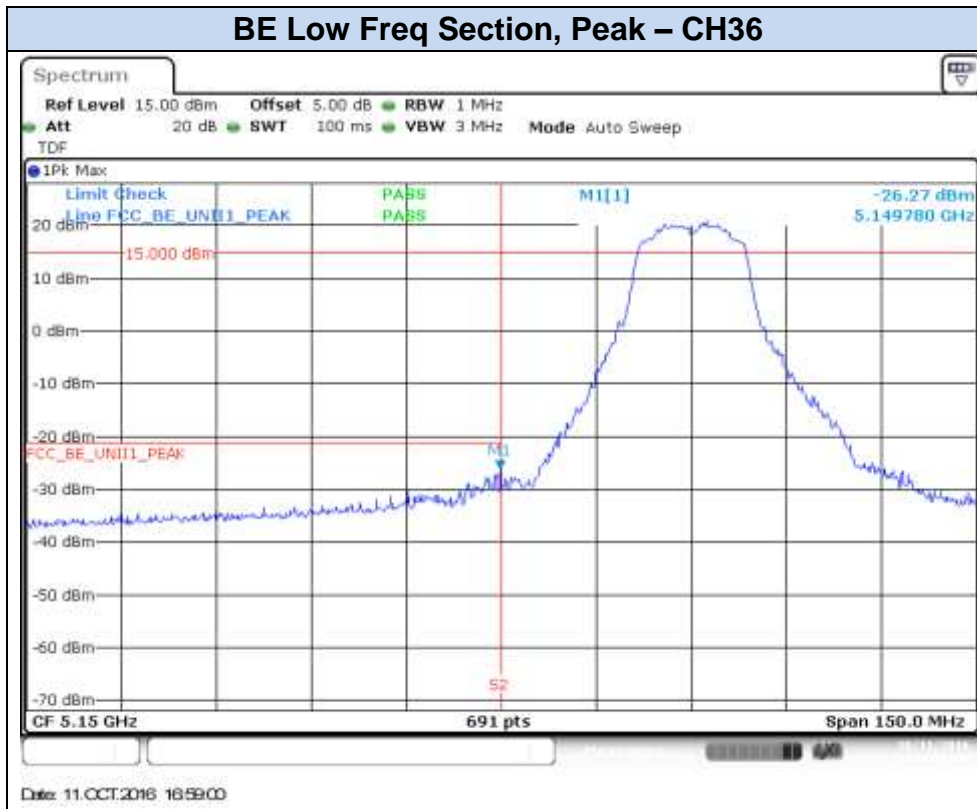
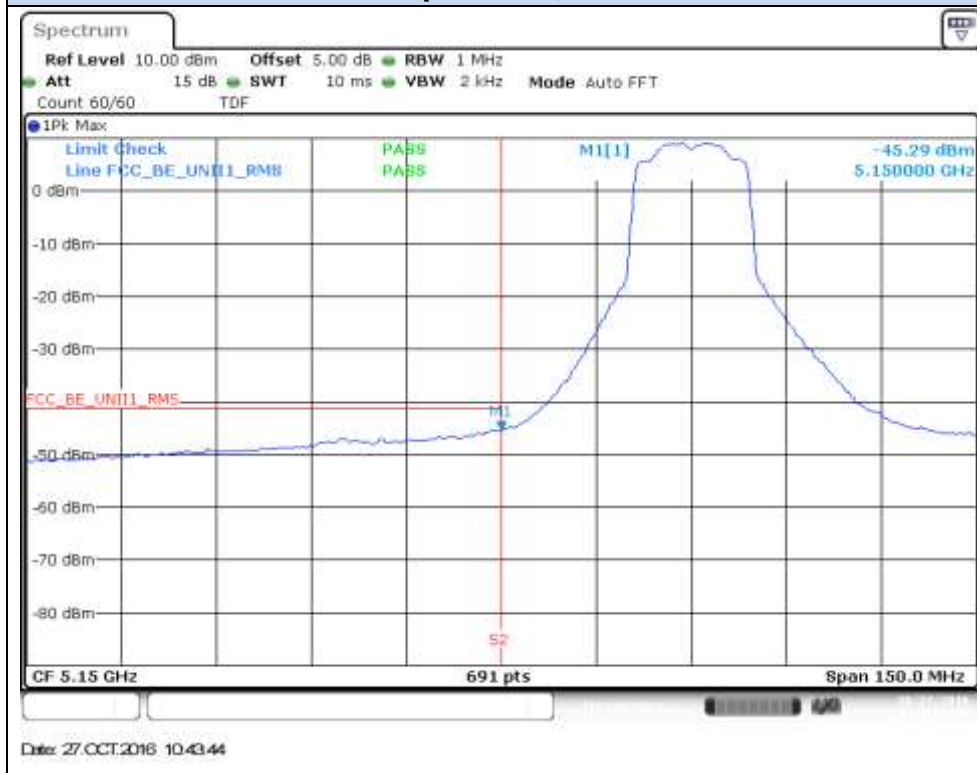
Date: 17.OCT.2016 15:51:37



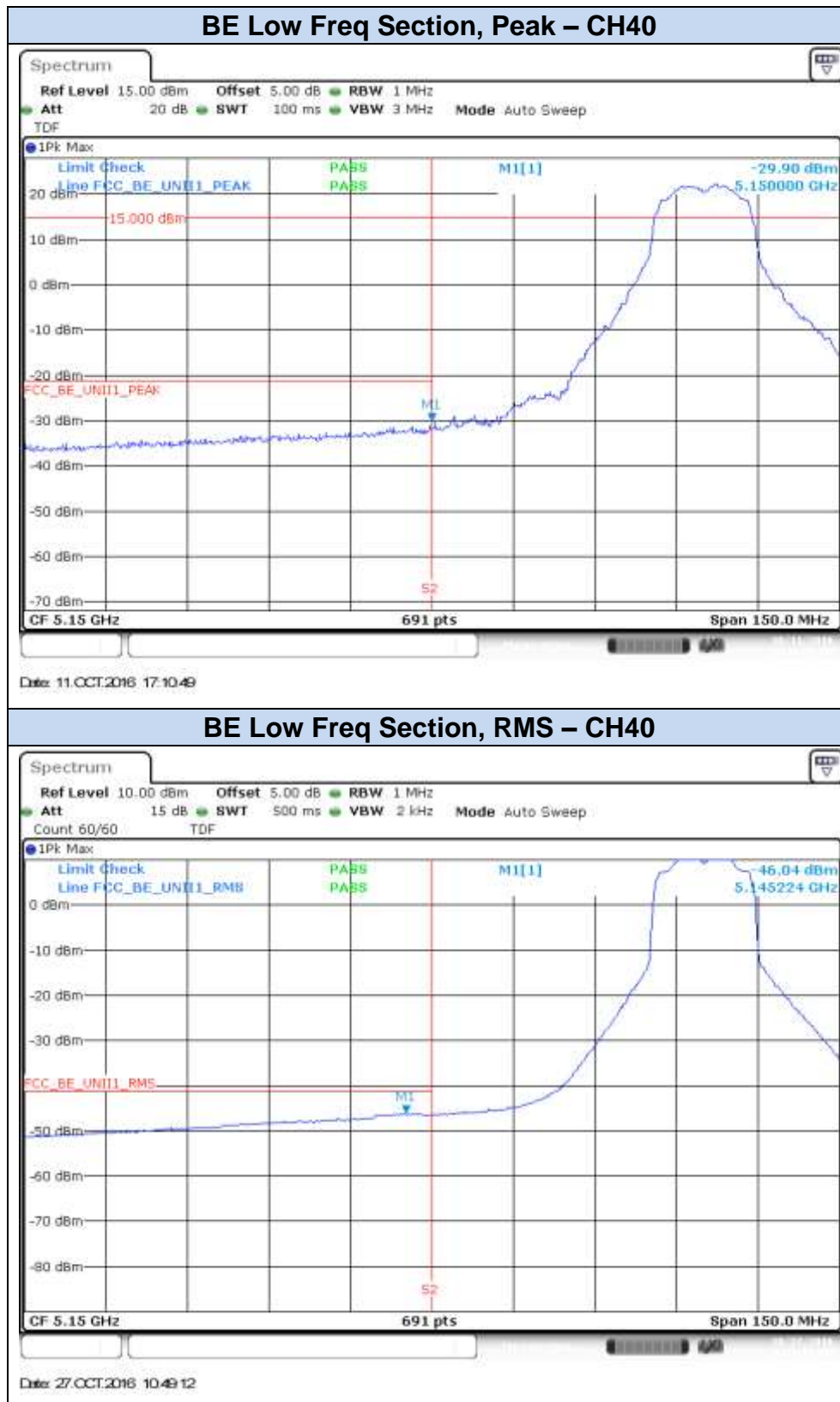
**802.11n20, HT8 (MIMO) – Chain A****BE Low Freq Section, Peak – CH36****BE Low Freq Section, RMS – CH36**



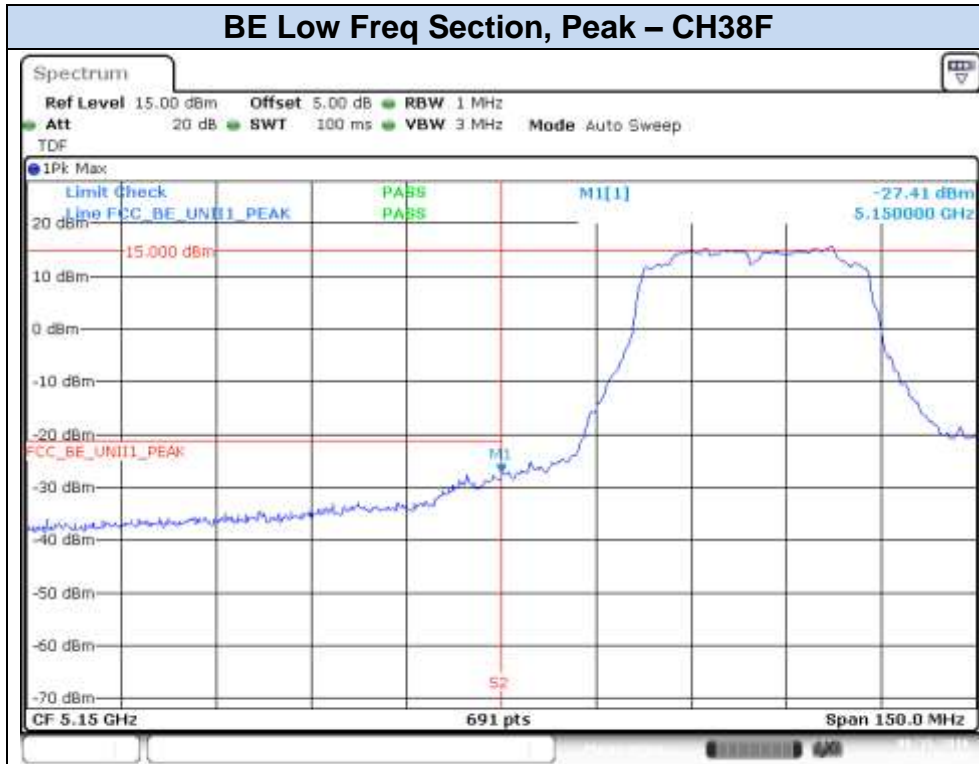


**802.11n20, HT8 (MIMO) – Chain B****BE Low Freq Section, Peak – CH36****BE Low Freq Section, RMS – CH36**

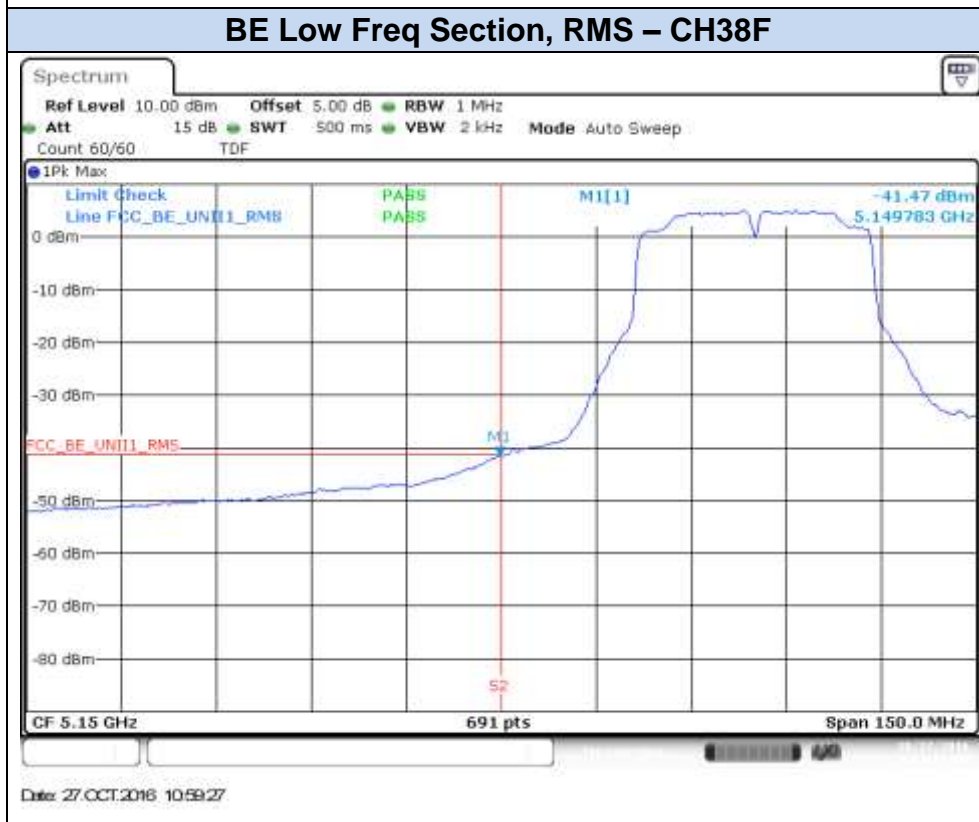




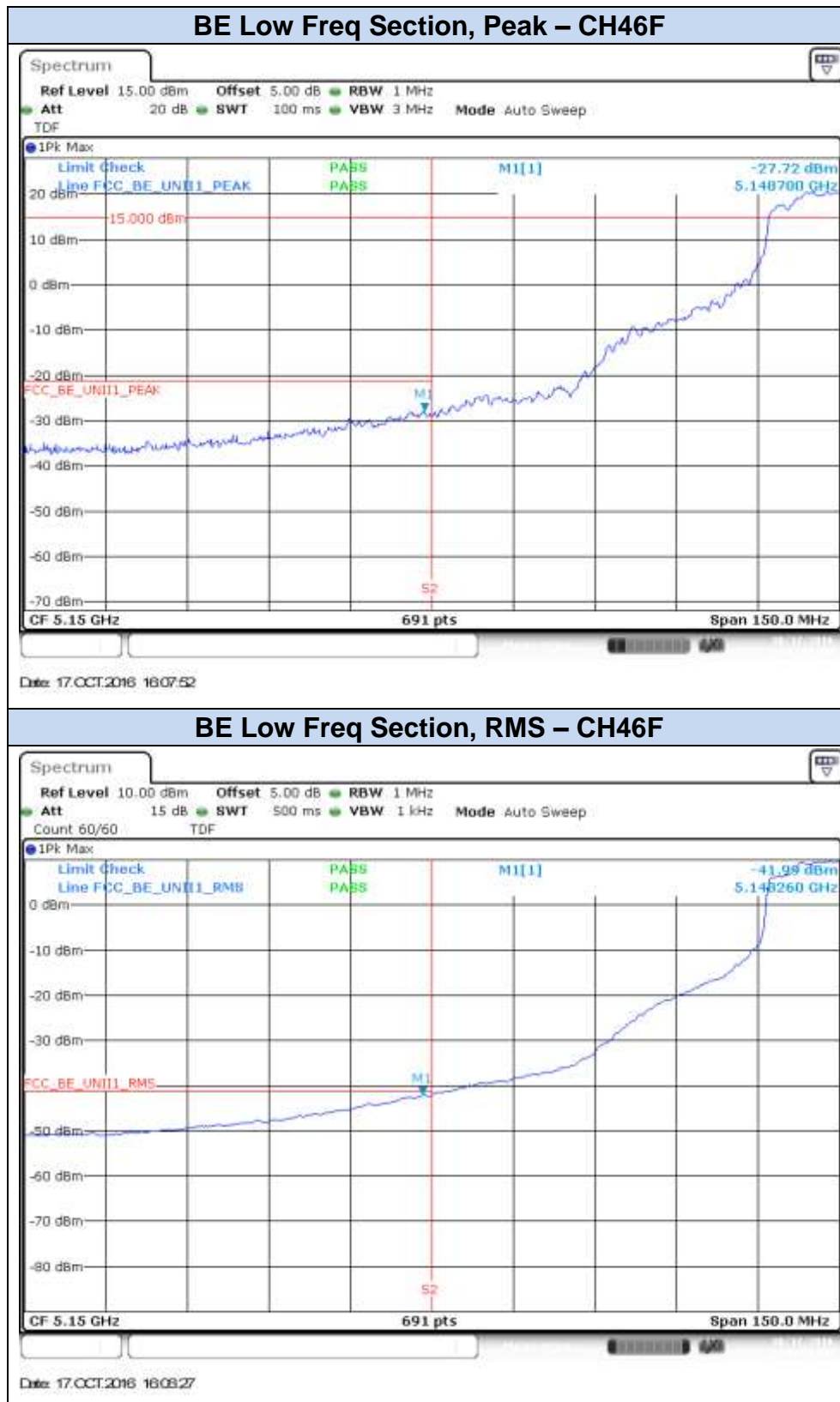
### 802.11n40, HT0 (SISO) – Chain A



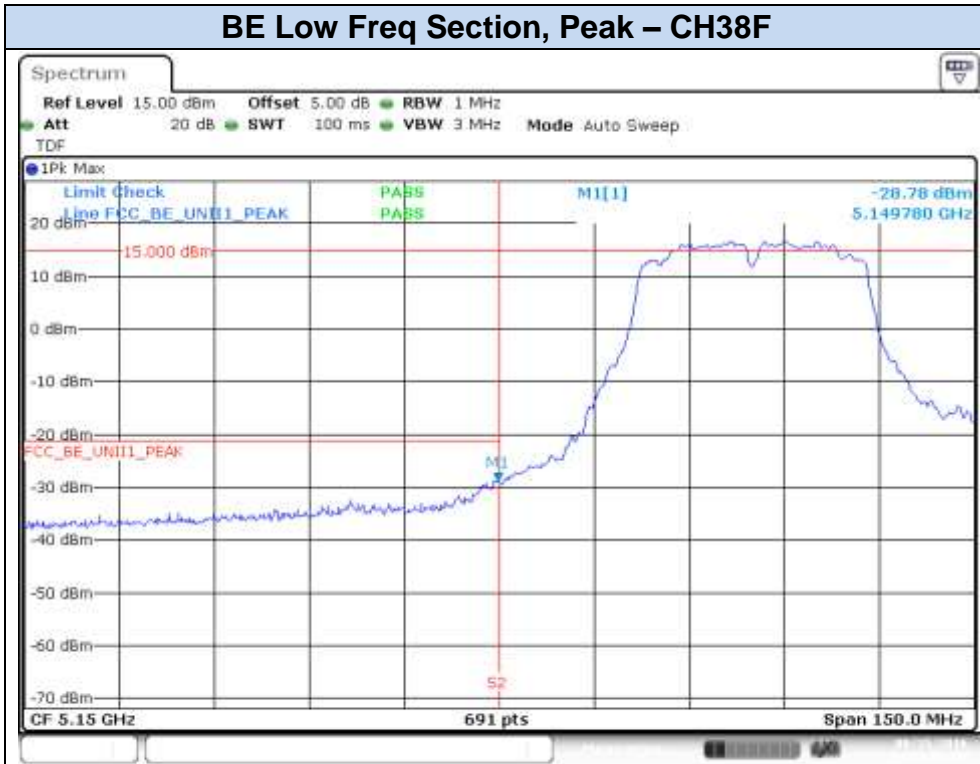
Date: 15 SEP 2016 17:52:47



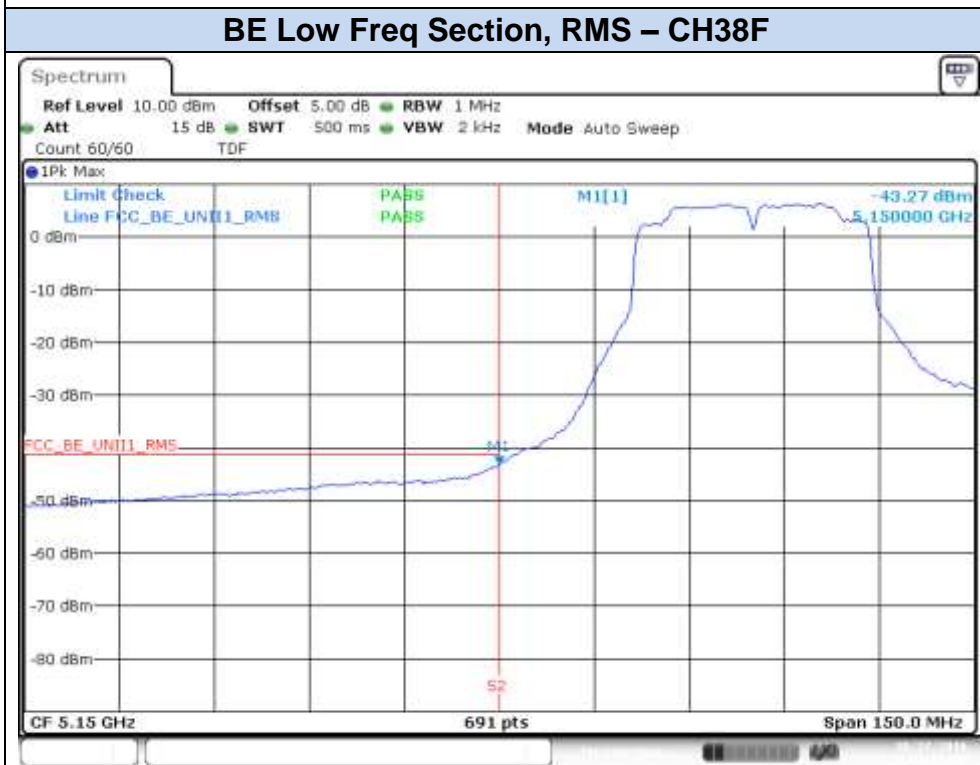
Date: 27 OCT 2016 10:59:27



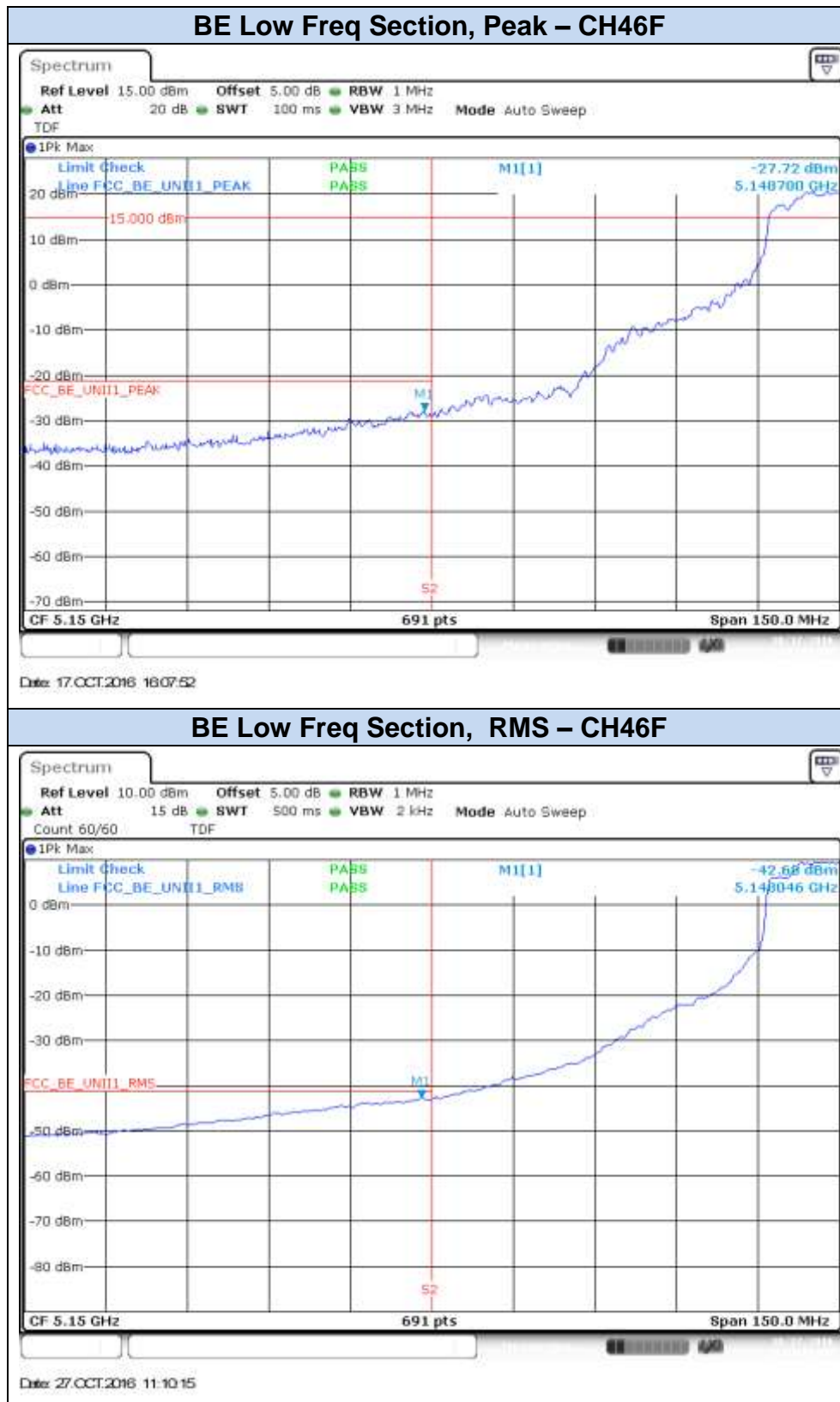
### 802.11n40, HT0 (SISO) – Chain B



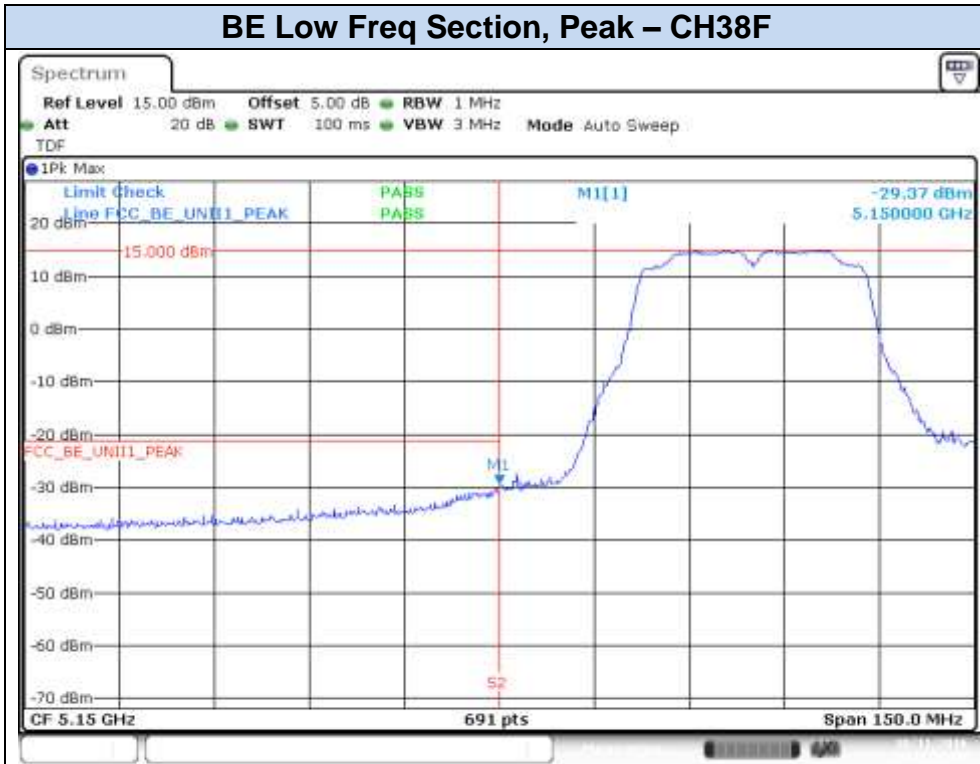
Date: 15 SEP 2016 16:41:00



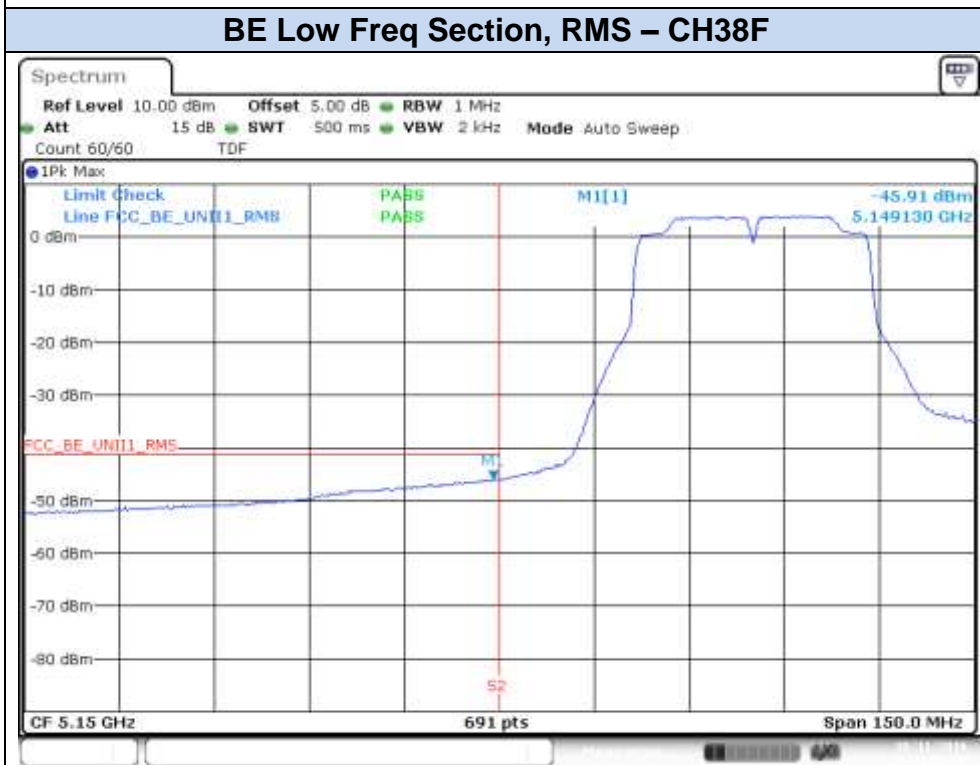
Date: 27 OCT 2016 11:03:09



### 802.11n40, HT8 (MIMO) – Chain A

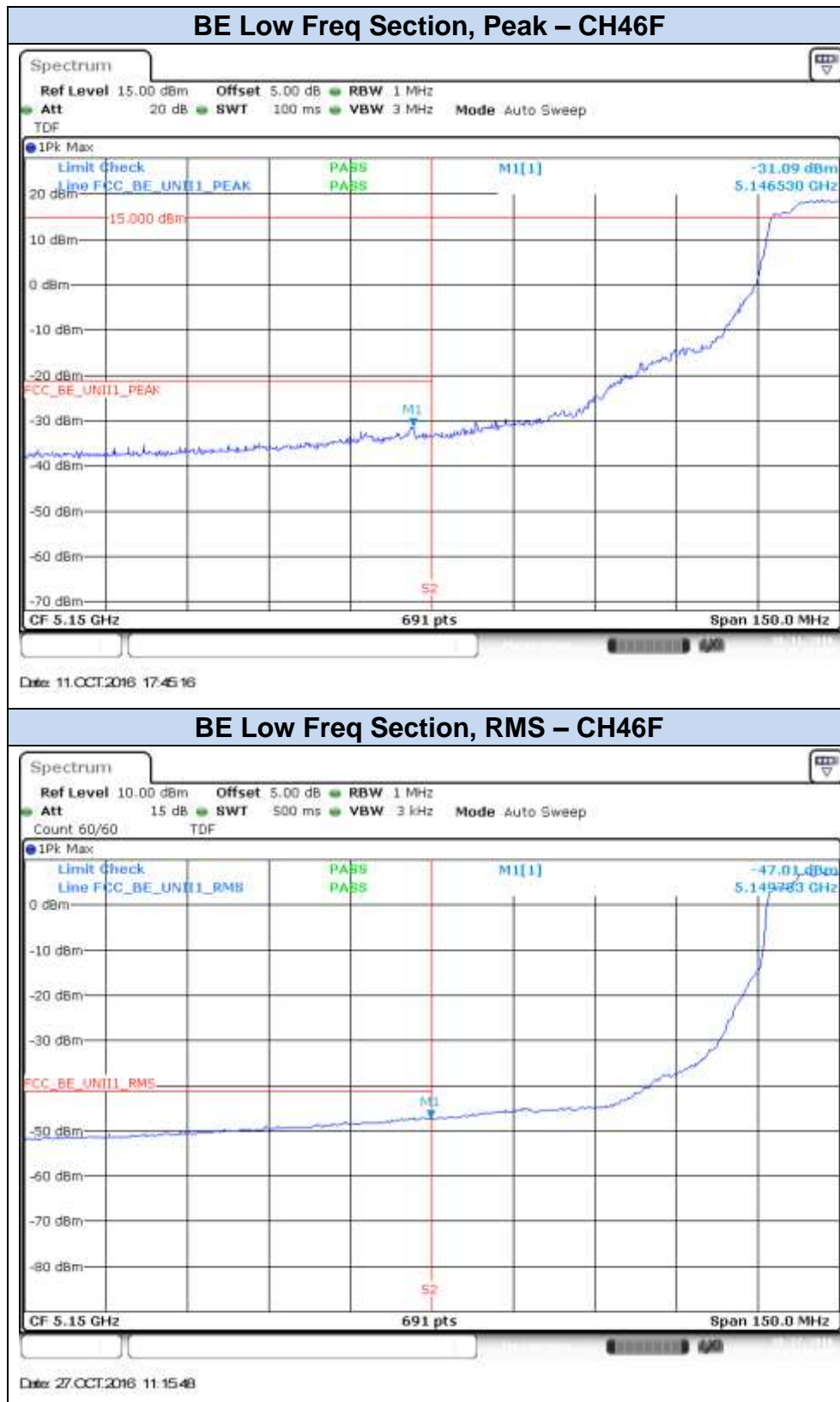


Date: 11.OCT.2016 17:37:55

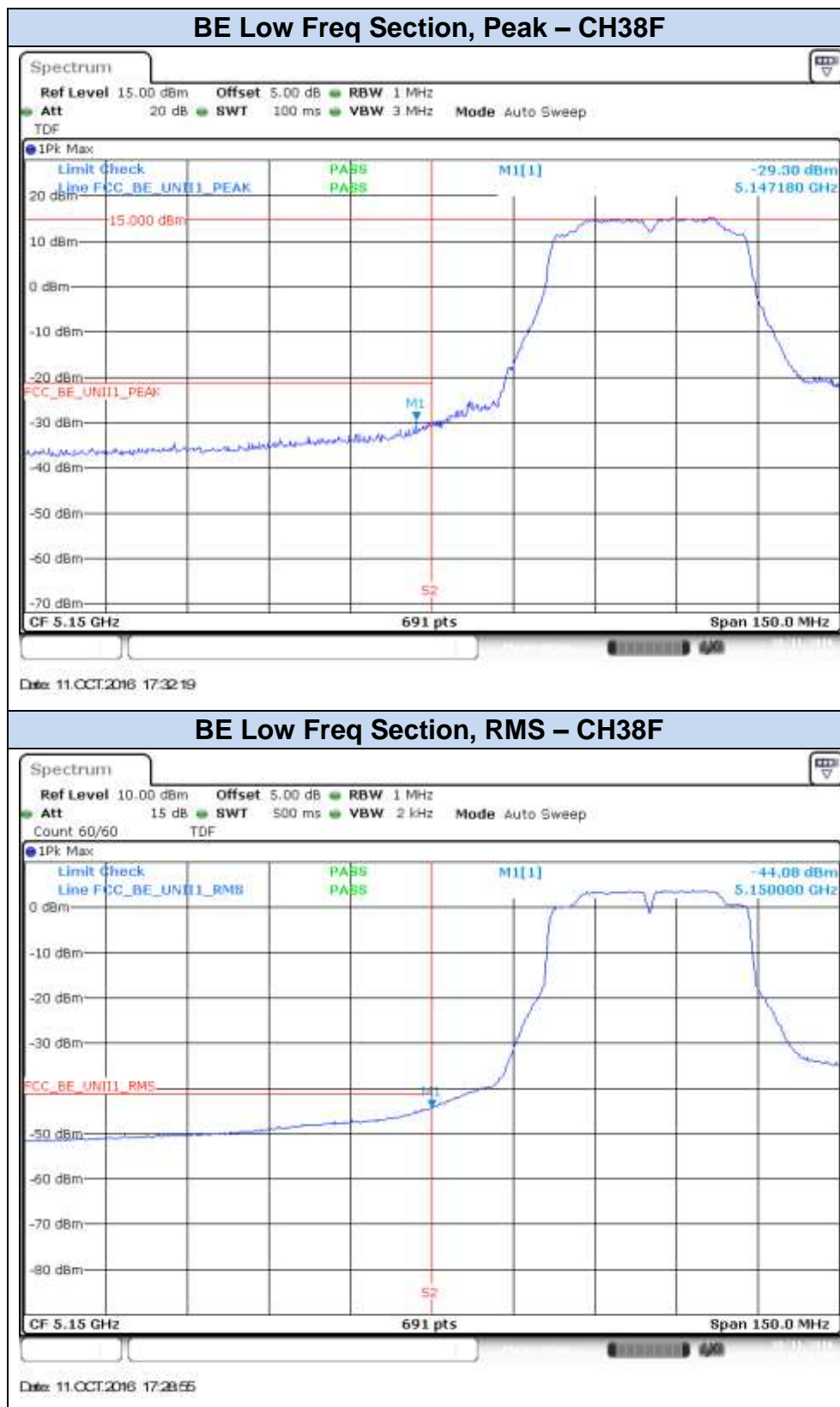


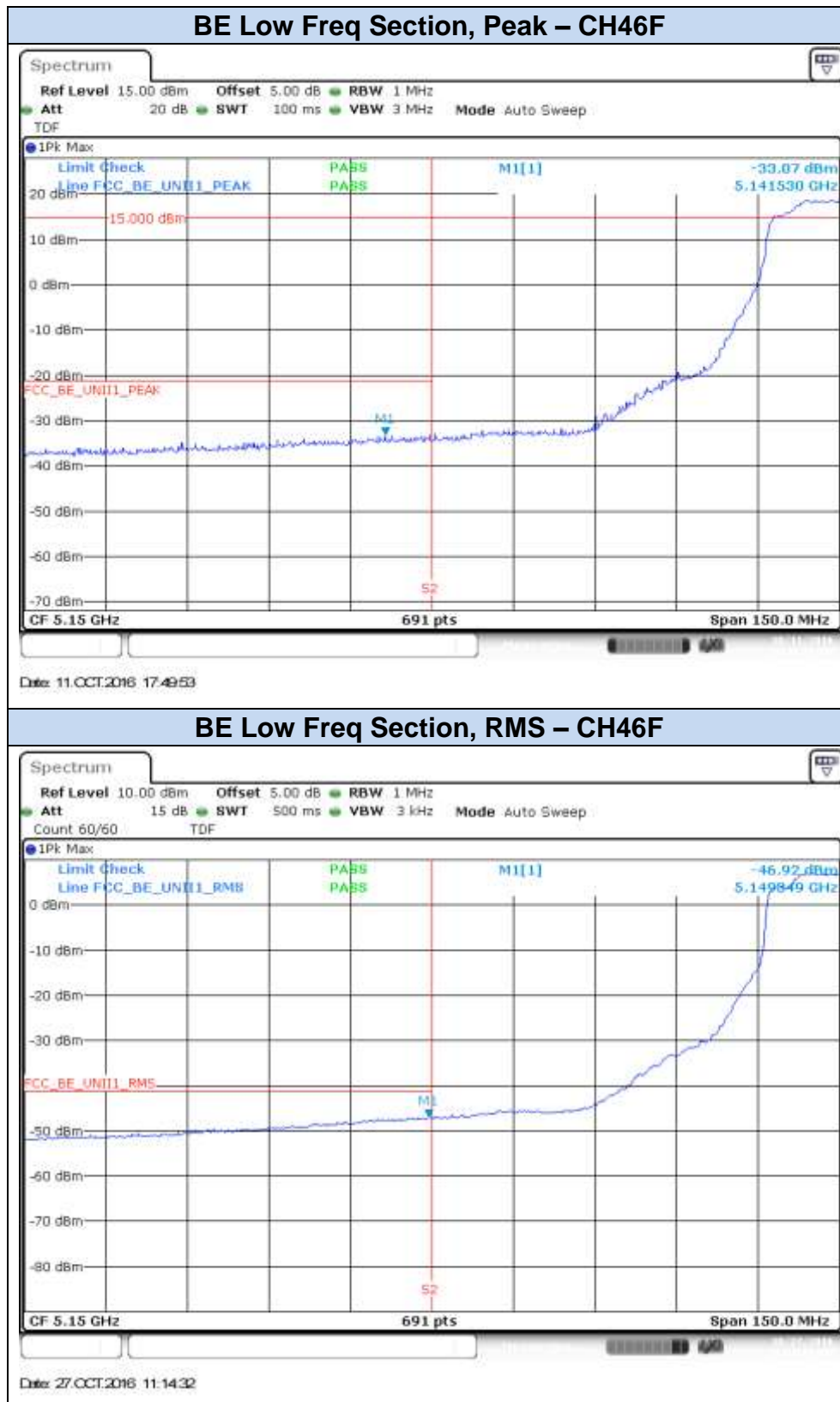
Date: 11.OCT.2016 18:22:03



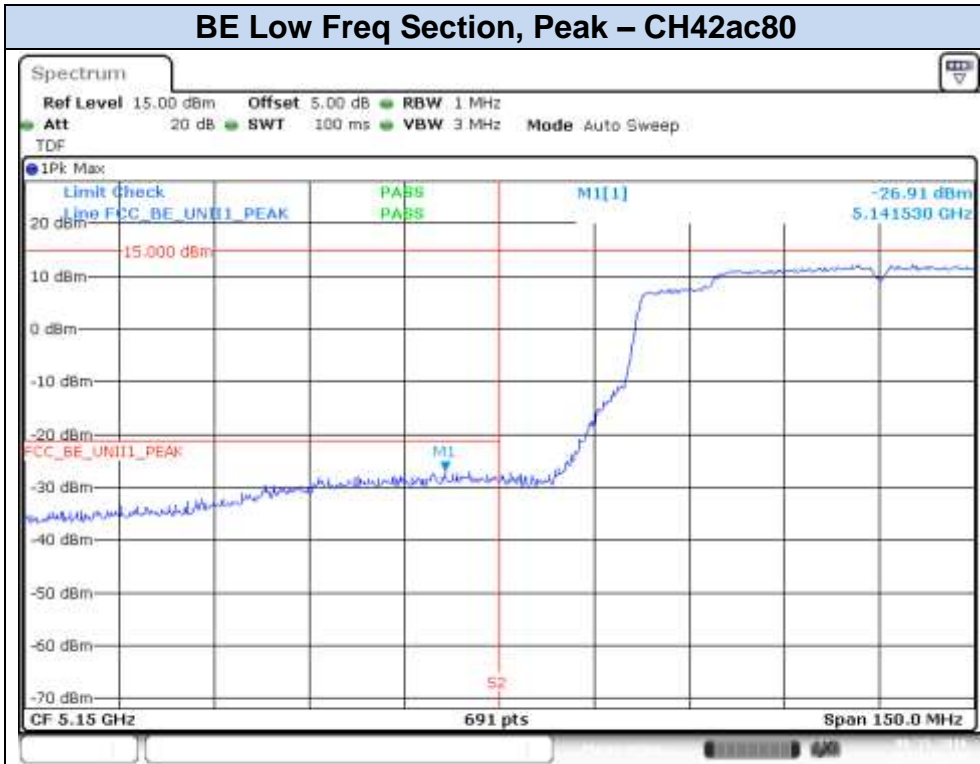




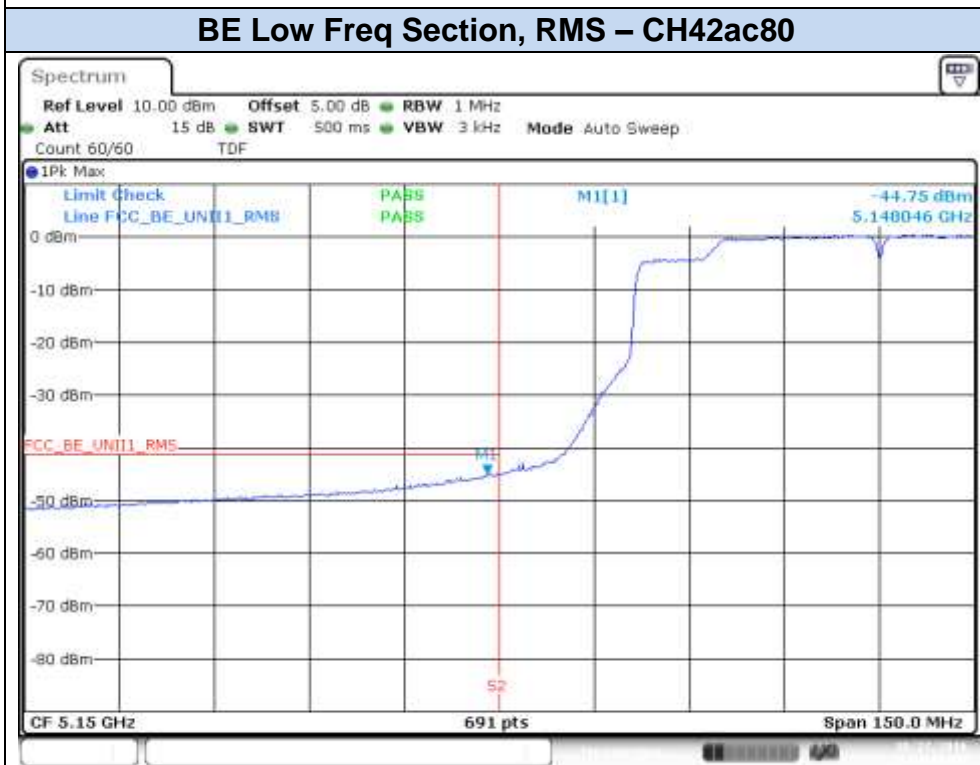
**802.11n40, HT8 (MIMO) – Chain B**



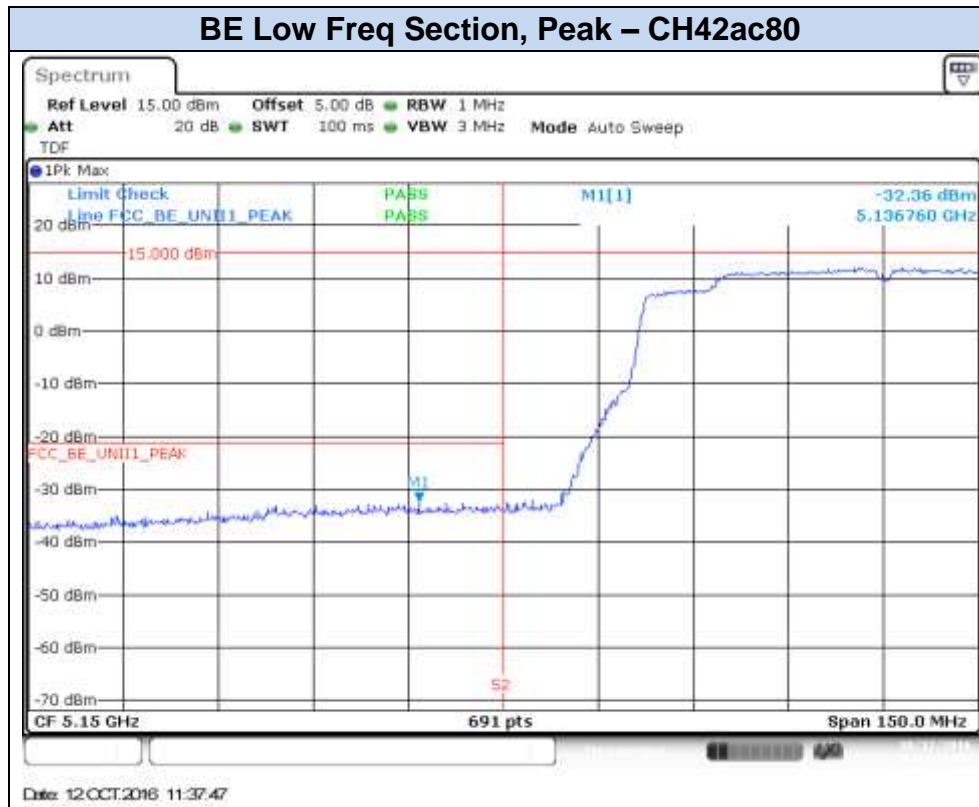
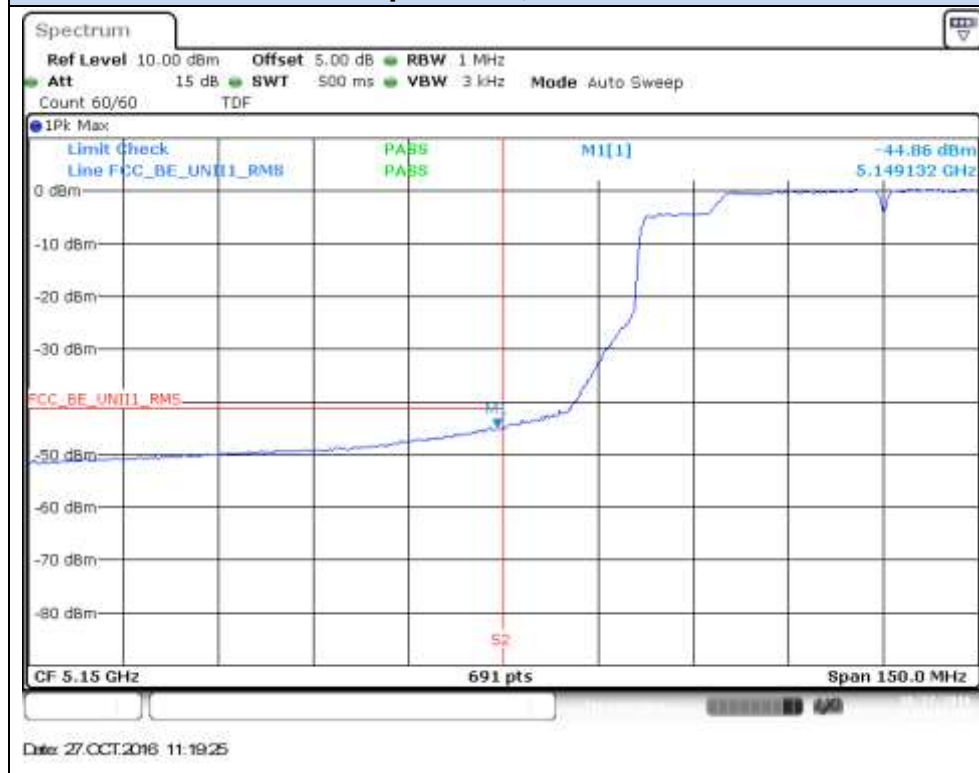
### 802.11ac80, VHT0 (SISO)- Chain A



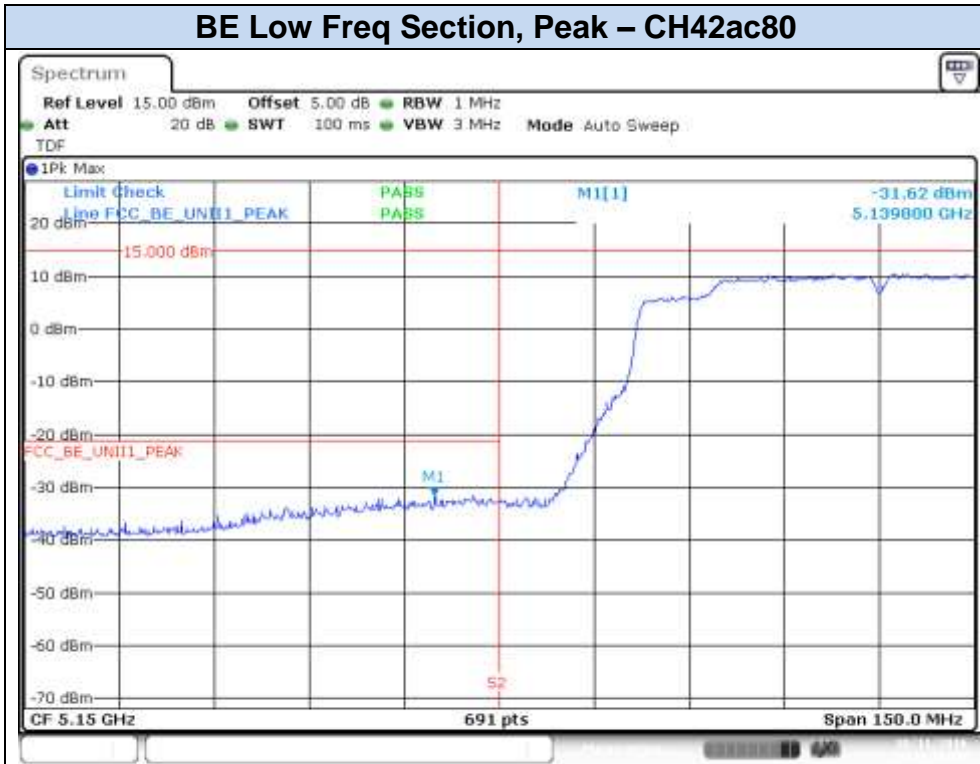
Date: 15 SEP.2016 18:08:46



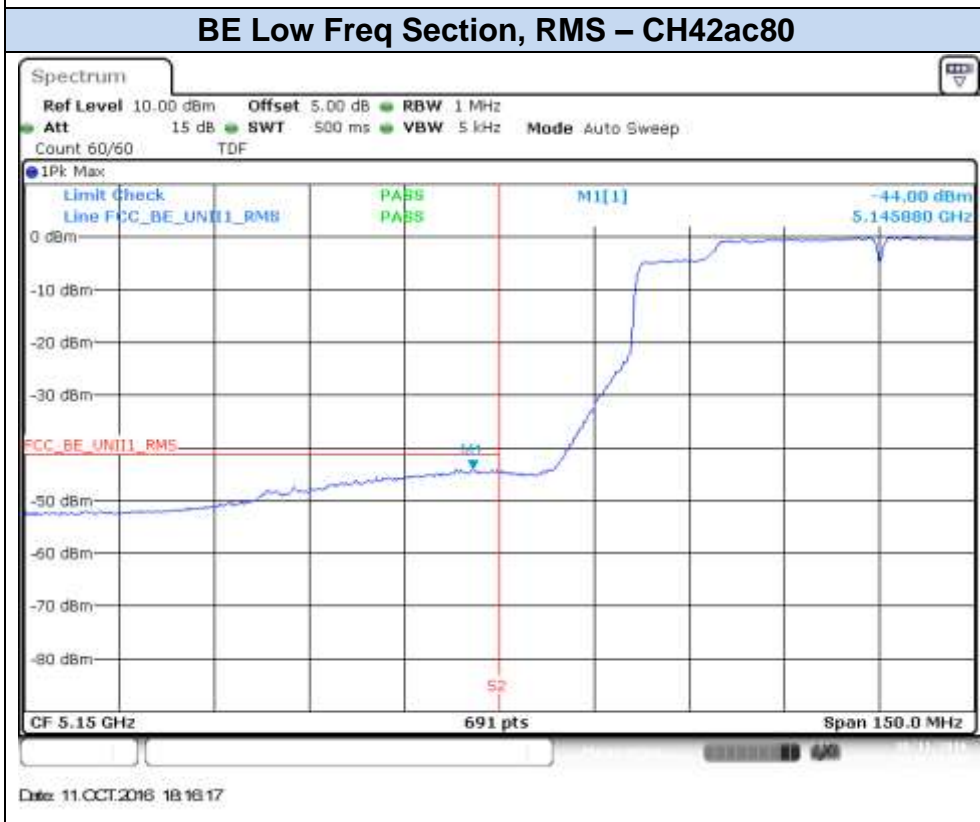
Date: 27 OCT.2016 11:20:48

**802.11ac80, VHT0 (SISO)- Chain B****BE Low Freq Section, Peak – CH42ac80****BE Low Freq Section, RMS – CH42ac80**

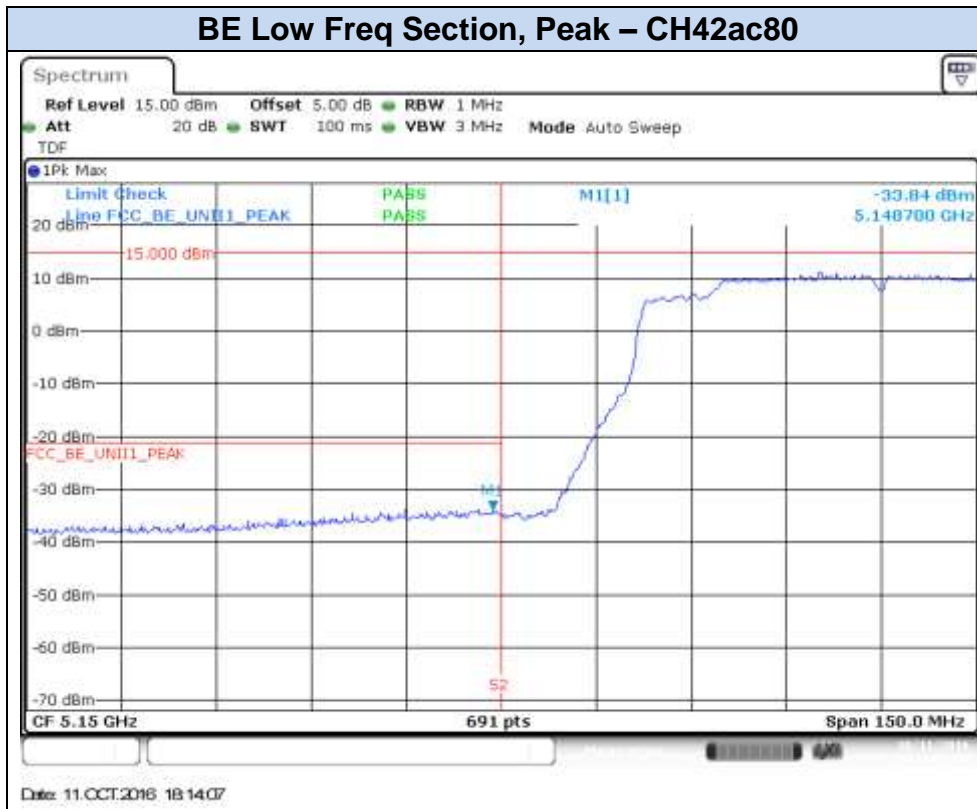
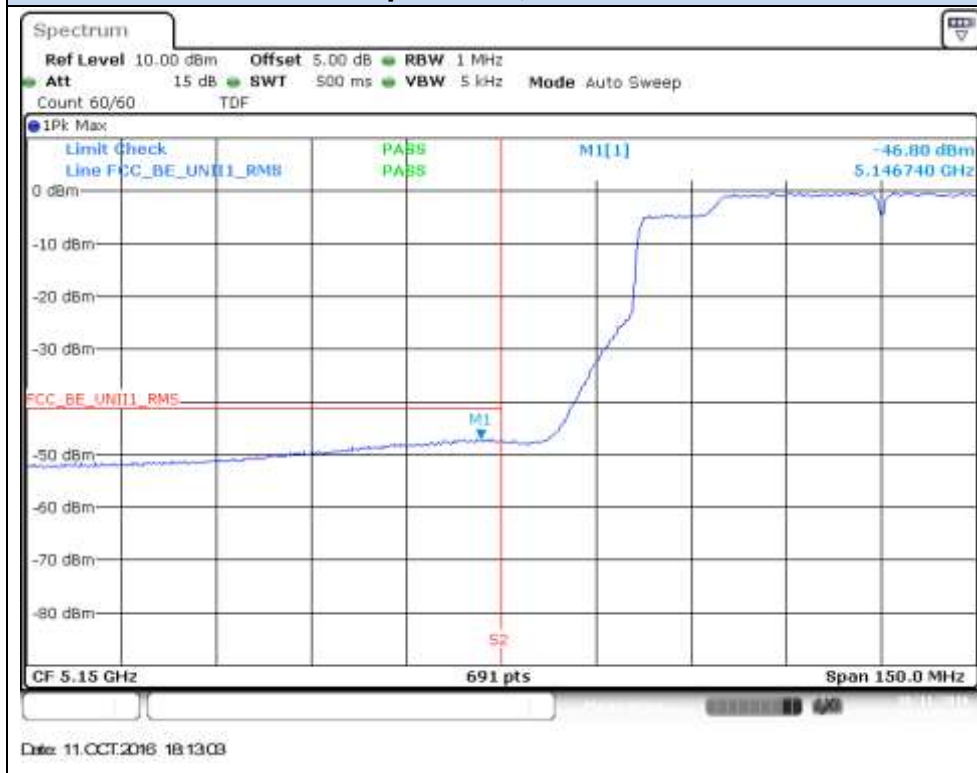
### 802.11ac80, VHT0 (MIMO)- Chain A



Date: 11.OCT.2016 18:19:18



Date: 11.OCT.2016 18:18:17

**802.11ac80, VHT0 (MIMO)- Chain B****BE Low Freq Section, Peak – CH42ac80****BE Low Freq Section, RMS – CH42ac80**



## B.4 Radiated spurious emission

### Standard references

FCC part	Limits																																
15.407 (b) (1)	For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.																																
15.209	<p>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):</p> <table border="1"> <thead> <tr> <th>Freq Range (MHz)</th> <th>Field Strength (<math>\mu\text{V}/\text{m}</math>)</th> <th>Field Strength (<math>\text{dB}\mu\text{V}/\text{m}</math>)</th> <th>Meas. Distance (m)</th> </tr> </thead> <tbody> <tr> <td>0.009-0.490</td> <td>2400/f(kHz)</td> <td>-</td> <td>300</td> </tr> <tr> <td>0.490-1.705</td> <td>24000/f(kHz)</td> <td>-</td> <td>300</td> </tr> <tr> <td>1.705-30.0</td> <td>30</td> <td>-</td> <td>30</td> </tr> <tr> <td>30-88</td> <td>100</td> <td>40</td> <td>3</td> </tr> <tr> <td>88-216</td> <td>150</td> <td>43.5</td> <td>3</td> </tr> <tr> <td>216-960</td> <td>200</td> <td>46</td> <td>3</td> </tr> <tr> <td>Above 960</td> <td>500</td> <td>54</td> <td>3</td> </tr> </tbody> </table> <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>	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
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																														

### Test procedure

The setup below was used to measure the radiated spurious emissions.

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

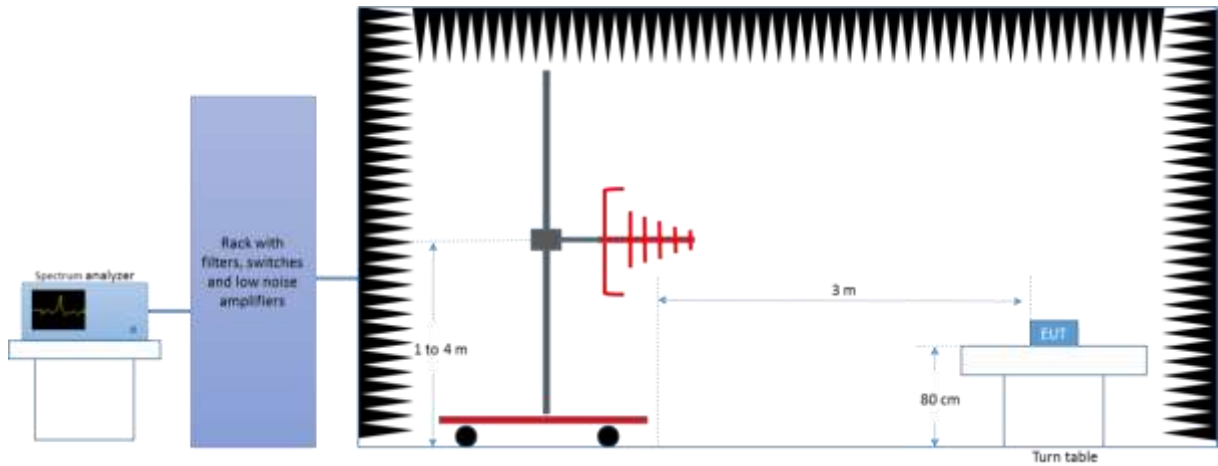
The final measurement is done by varying the antenna height, the EUT azimuth over 360° and for both Vertical and Horizontal polarizations.

The radiated spurious emission was measured on the worst case configuration selected from the chapter B.2 and using the low, middle and high channel.

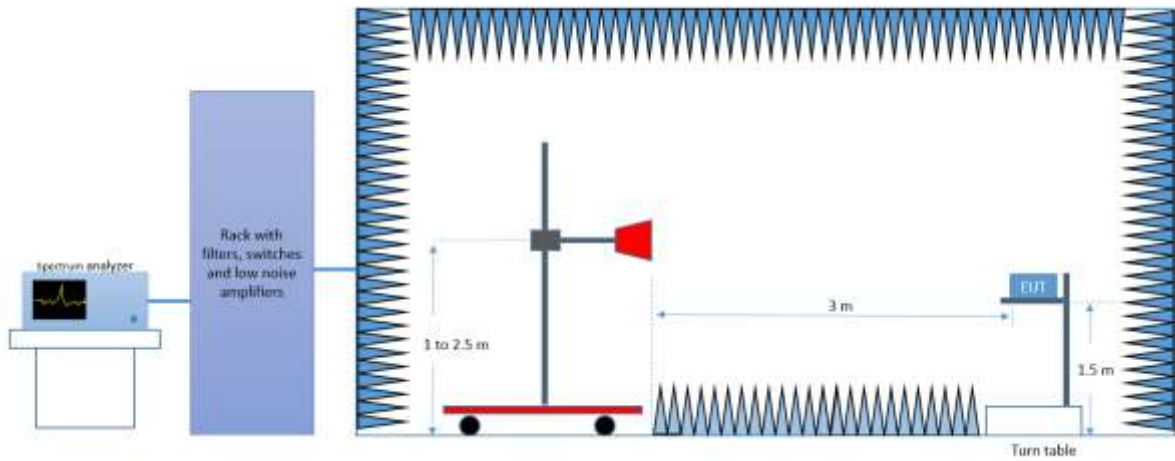
For technologies 802.n20, 802.n40 and 802.ac80 the worst case in terms of spurious emissions found among the low, mid and high channels when tested on chain A and B separately is used to perform the test in MIMO mode (Chain A+B).



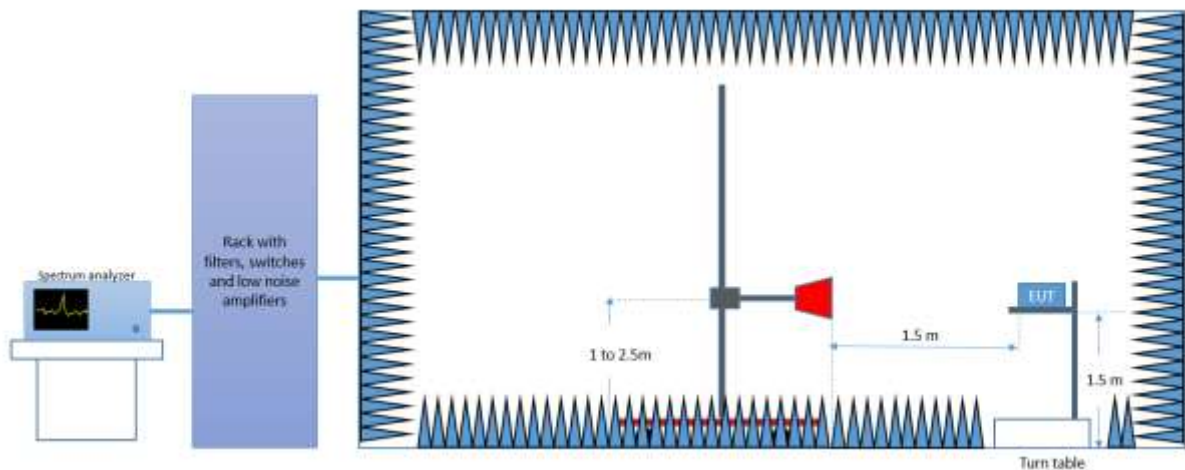
*Radiated Setup < 1GHz*



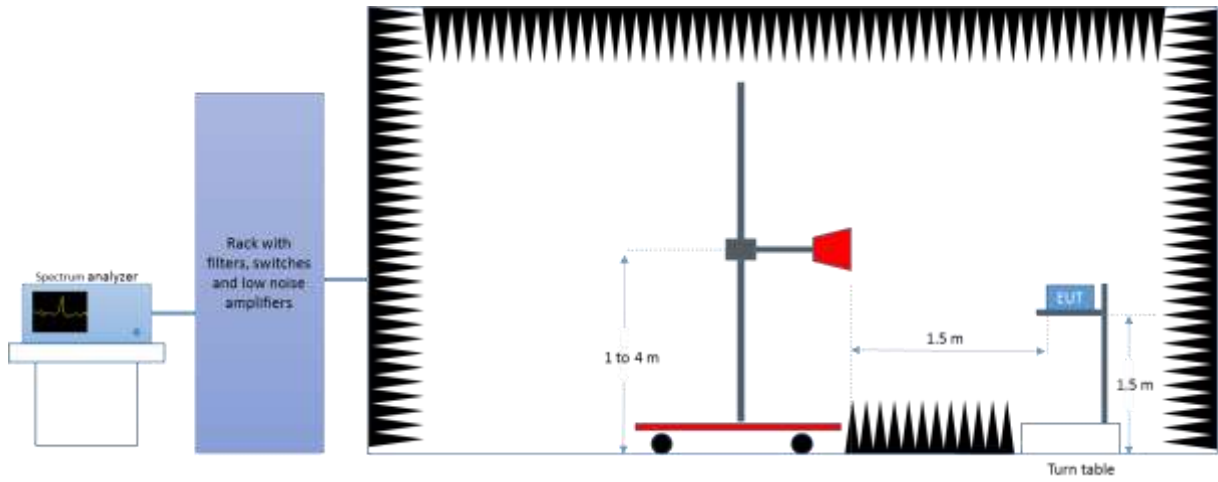
*Radiated Setup 1 GHz - 18 GHz*



*Radiated Setup 18 GHz - 26.5 GHz*



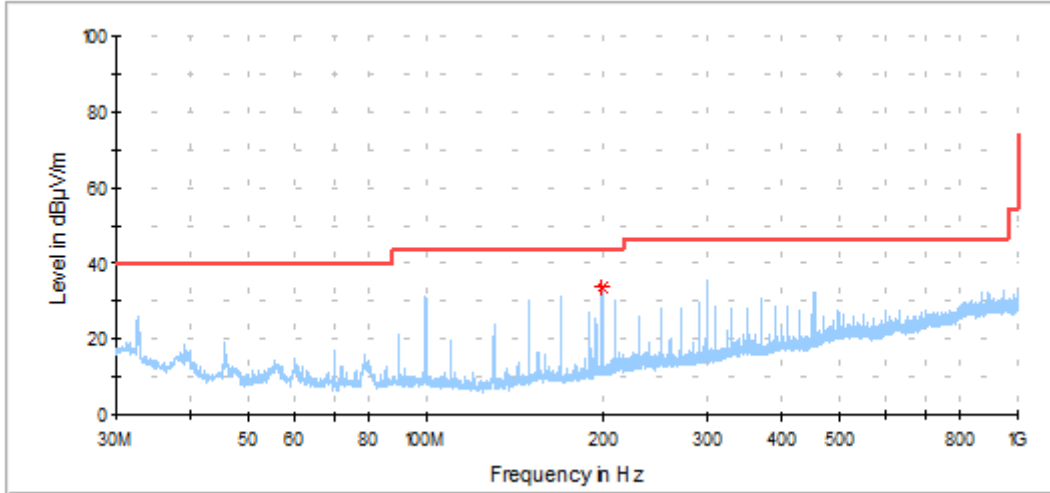
*Radiated Setup > 26.5 GHz*



**Test Results**

**30 MHz – 1 GHz**

**Radiated Spurious – All modes**



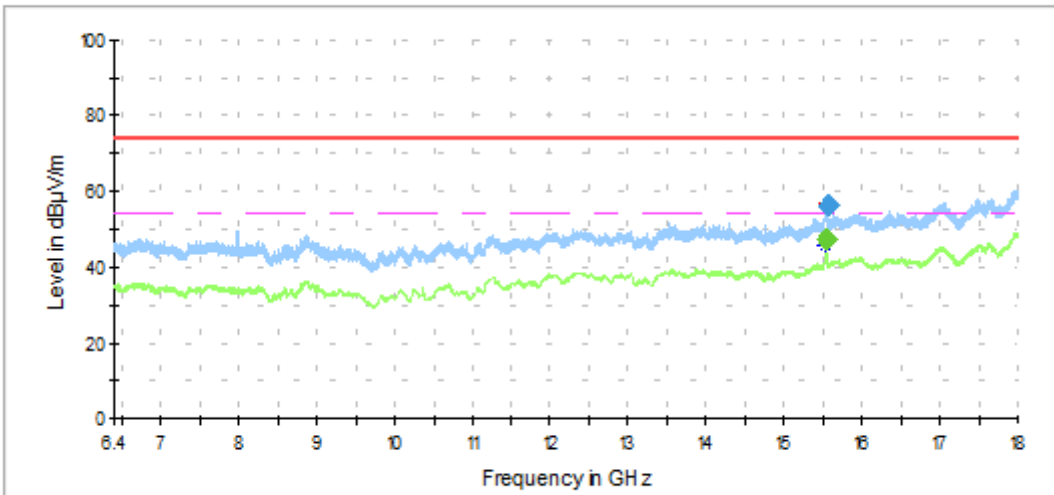
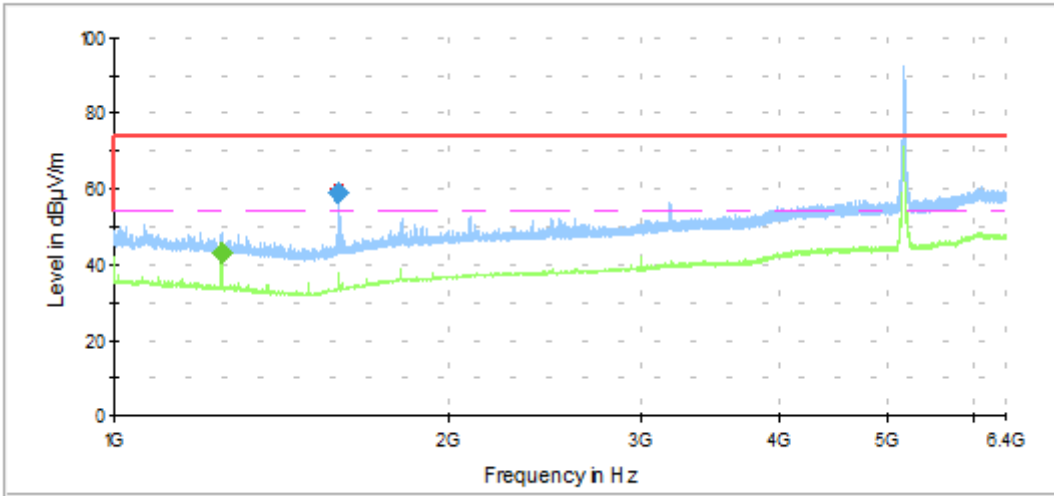
— Peak measurements      — Limit FCC Peak

Frequency	MaxPeak	Limit	Margin
MHz	dBuV/m	dBuV/m	dB
199.1	33.8	43.6	9.8

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

**1 GHz – 18 GHz, 802.11a, 6Mbps, Chain A**

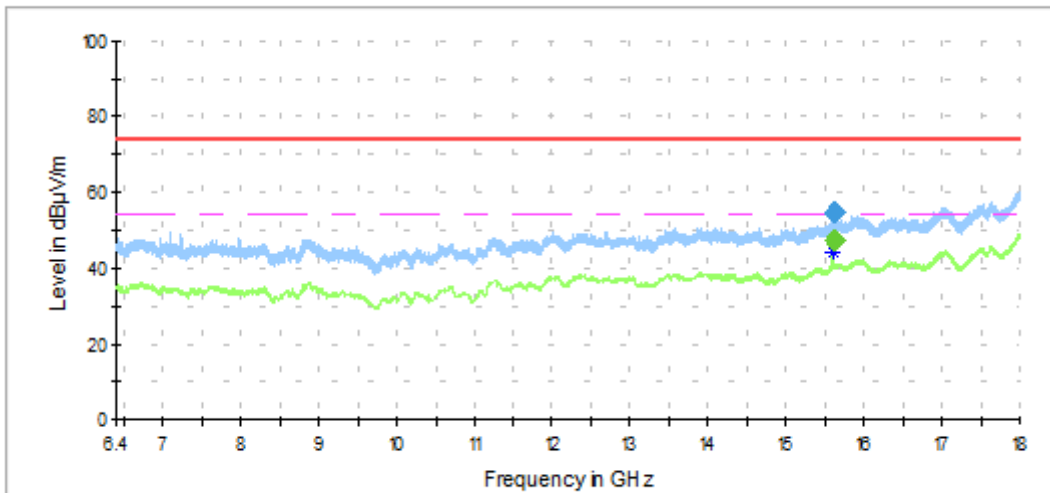
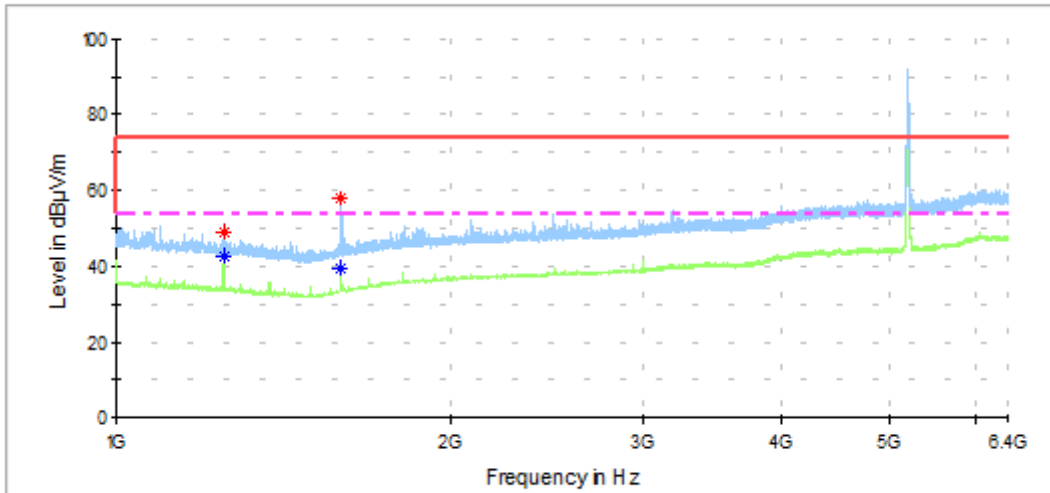
**Radiated Spurious – CH36**



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

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
1250.1	---	43.3	54	11
1593.0	59.0	---	74	15.0
15543.9	---	47.3	54	6.7
15552.4	56.4	---	74	17.6

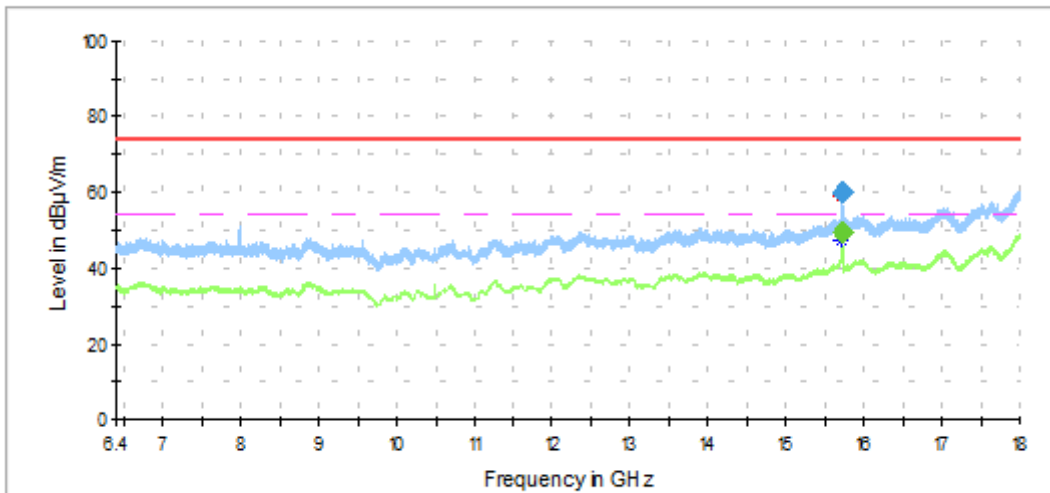
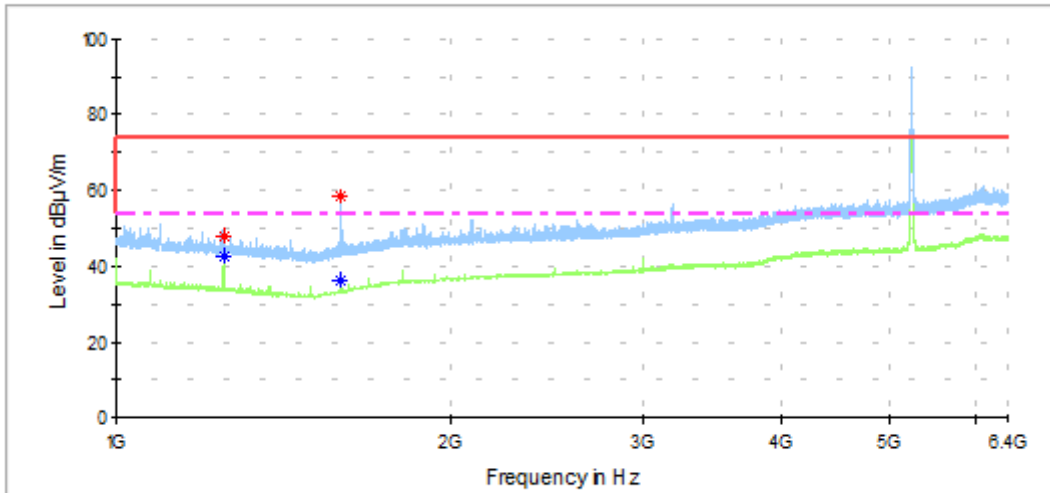
### Radiated Spurious – CH40



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

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
1249.9	---	42.5	54	11.5
1250.1	48.9	---	74	25.1
1596.5	---	39.7	54	14.3
1596.5	58.0	---	74	16.0
15601.0	---	47.5	54	6.5
15612.6	54.5	---	74	19.5

### Radiated Spurious – CH48

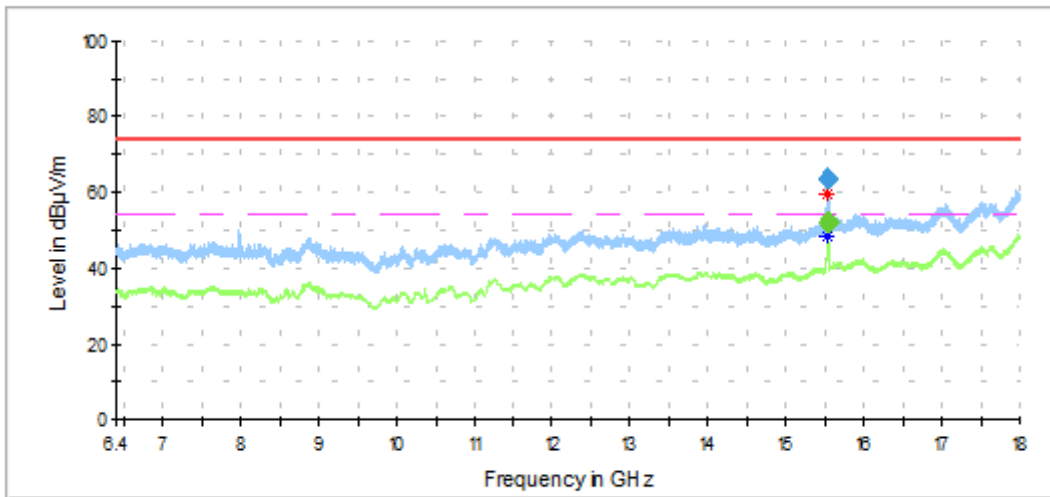
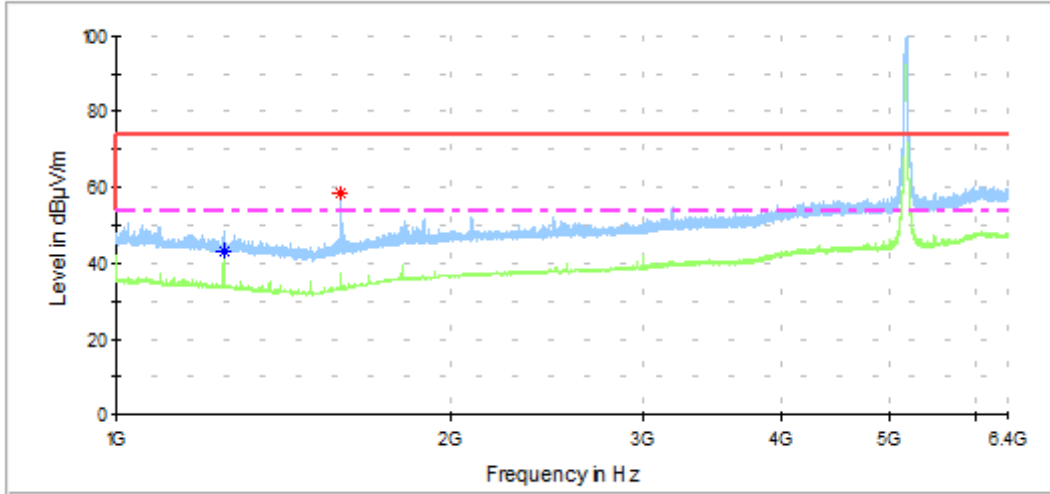


— Peak measurements     
 — Avg measurements     
 — Limit FCC Peak     
 - - - Limit FCC Avg

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
1249.9	48.1	---	74	25.9
1250.1	---	42.7	54	11.3
1593.0	58.2	---	74	15.8
1594.2	---	36.1	54	17.9
15723.3	60.1	---	74	13.9
15723.7	---	49.5	54	4.5

**1 GHz – 18 GHz, 802.11a, 6Mbps, Chain B**

**Radiated Spurious – CH36**

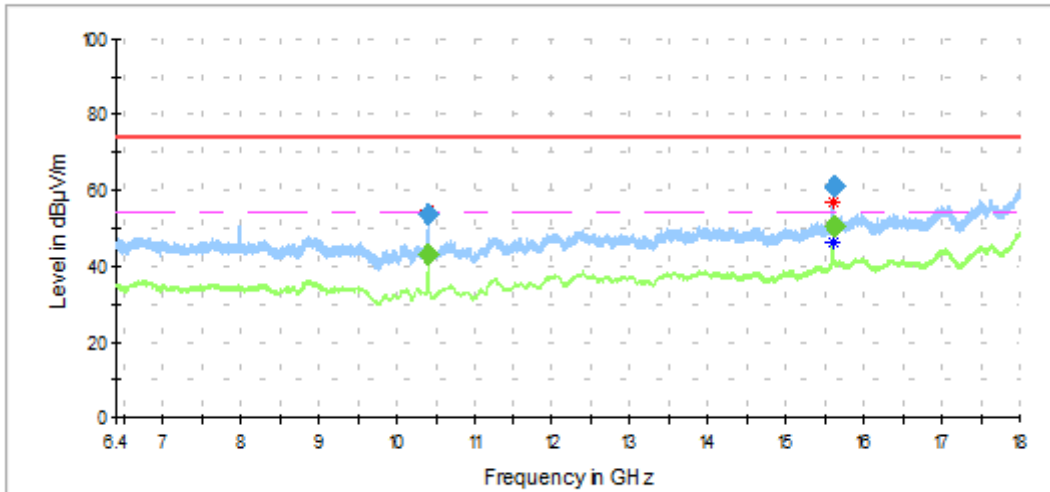
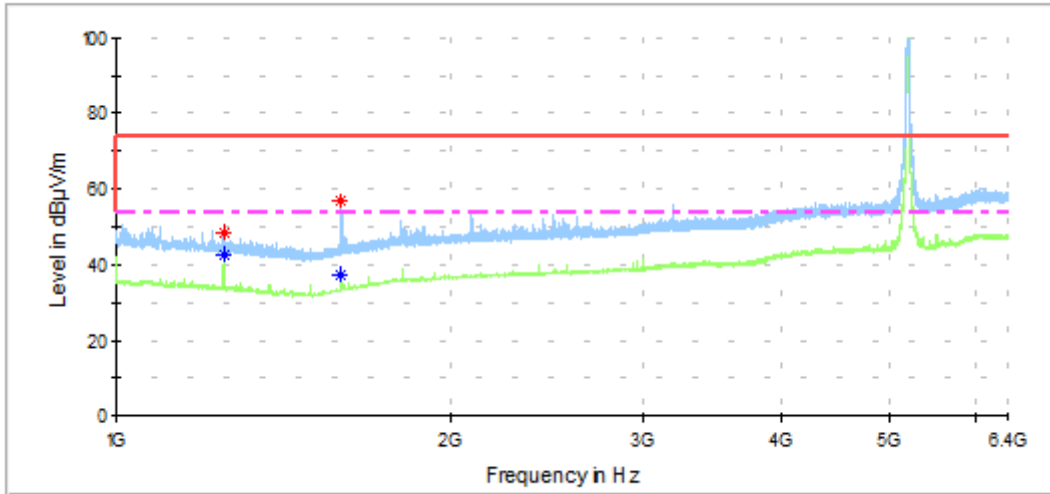


— Peak measurements      — Avg measurements      — Limit FCC Peak      - - - Limit FCC Avg

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
1249.9	---	43.0	54	11
1596.5	58.3	---	74	15.7
15539.5	---	52.1	54	1.9
15541.7	63.6	---	74	10.4



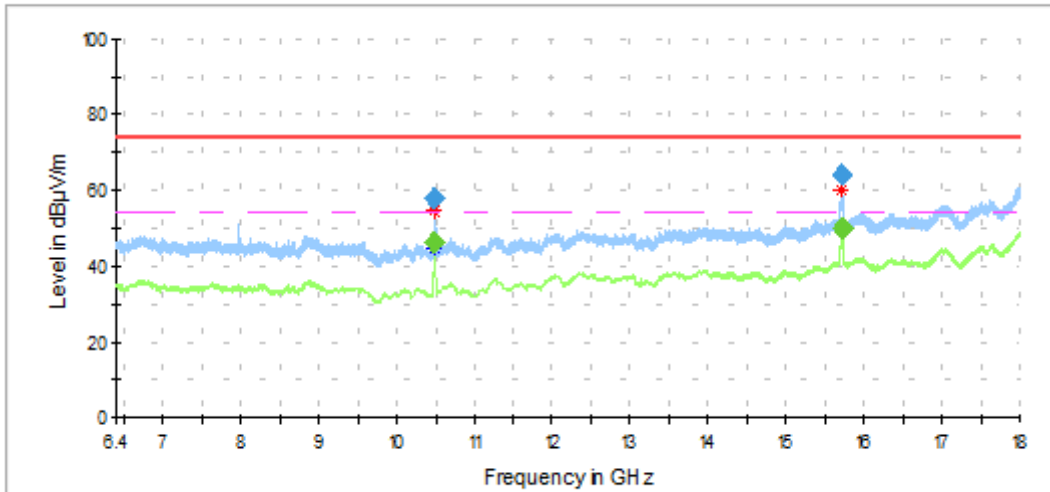
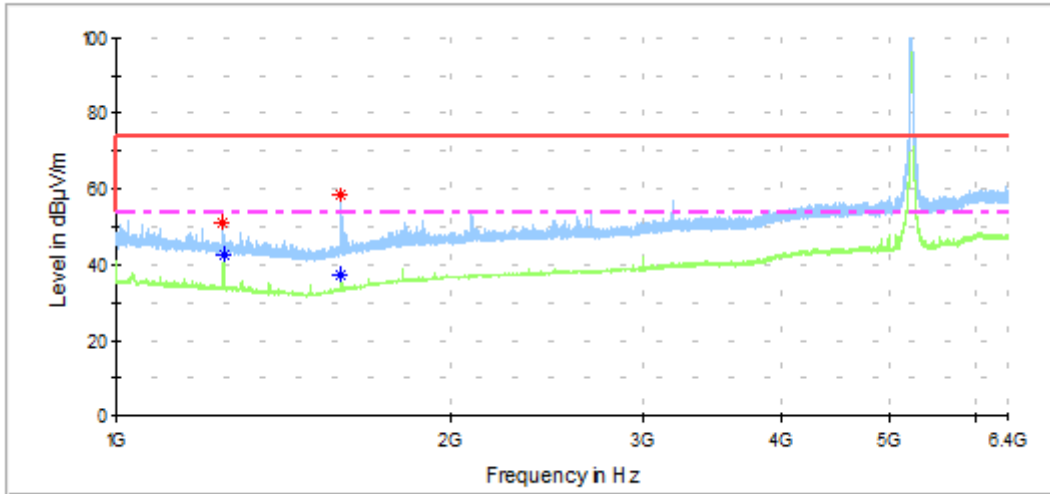
### Radiated Spurious – CH40



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

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
1249.9	---	42.5	54	11.5
1249.9	48.2	---	74	25.8
1592.8	56.9	---	74	17.1
1596.5	---	37.1	54	16.9
10398.9	53.5	---	74	20.5
10400.7	---	43.4	54	10.6
15601.9	---	50.5	54	3.5
15601.9	60.9	---	74	13.1

### Radiated Spurious – CH48

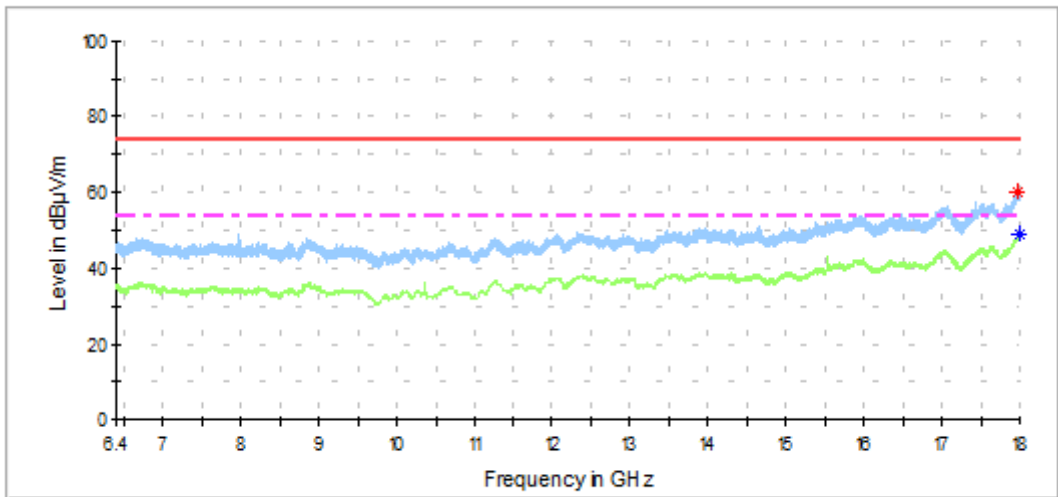
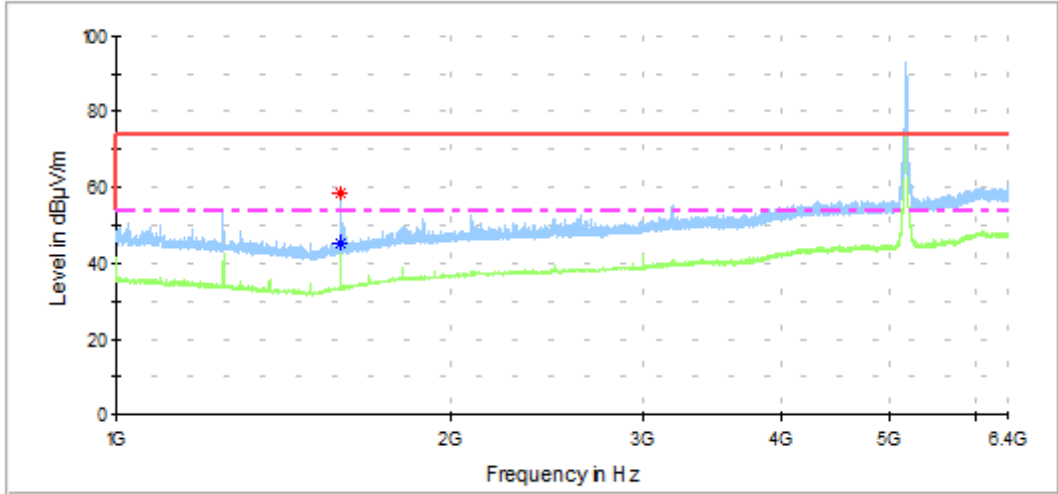


— Peak measurements     
 — Avg measurements     
 — Limit FCC Peak     
 - - - Limit FCC Avg

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
1245.0	51.1	---	74	22.9
1250.1	---	42.5	54	11.5
1596.2	---	37.6	54	16.4
1596.2	58.3	---	74	15.7
10480.1	---	46.3	54	7.7
10480.5	58.0	---	74	16.0
15720.2	---	50.1	54	3.9
15724.6	64.0	---	74	10.0

**1 GHz – 18 GHz, 802.11n20, HT0, Chain A**

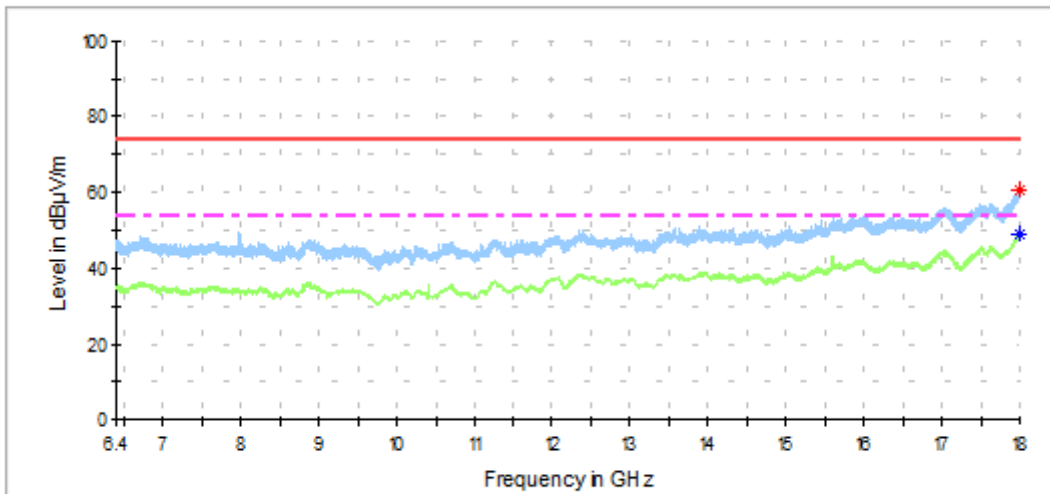
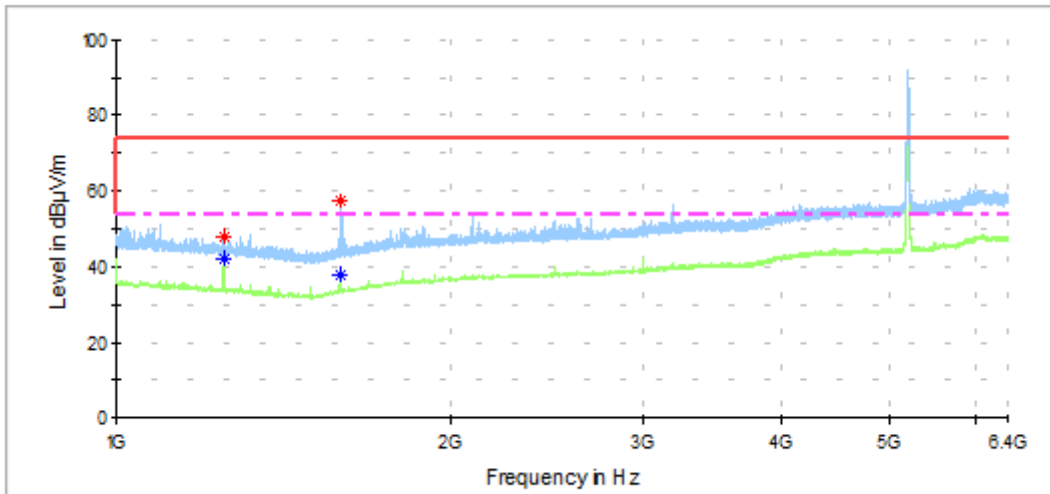
**Radiated Spurious – CH36**



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

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
1596.0	---	45.2	54	8.8
1596.2	58.6	---	74	15.4
17985.3	59.9	---	74	14.1
17990.2	---	48.9	54	5.1

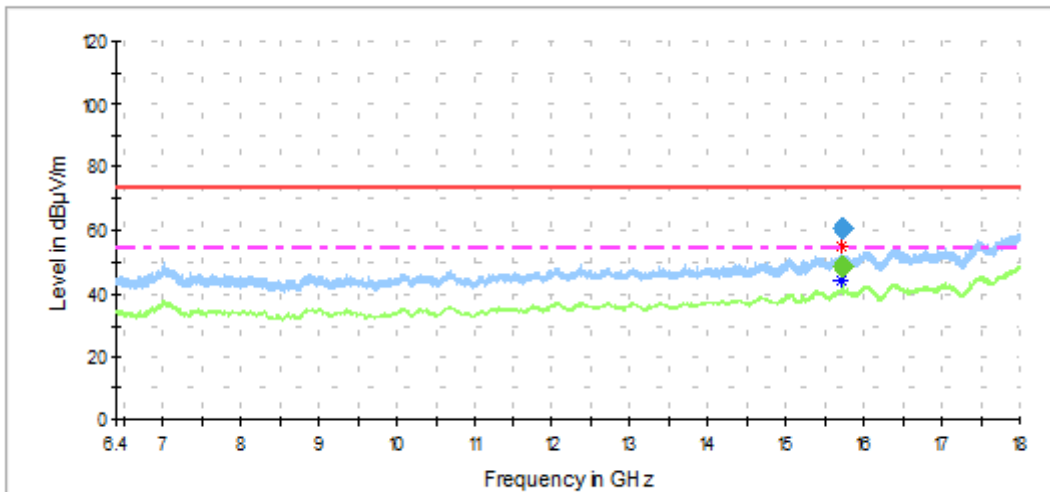
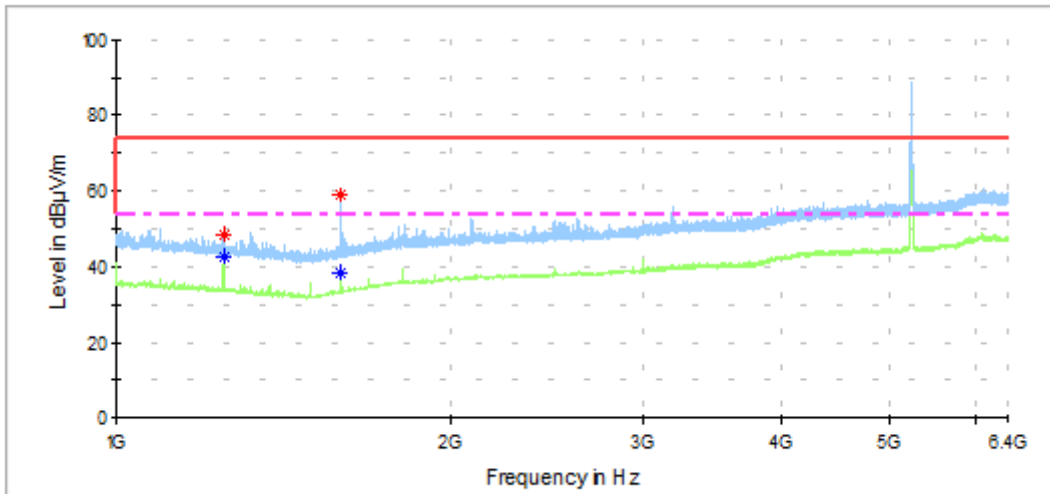
### Radiated Spurious – CH40



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

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
1249.9	---	42.2	54	11.8
1250.1	47.8	---	74	26.2
1593.3	---	37.9	54	16.1
1594.2	57.3	---	74	16.7
17988.0	60.6	---	74	13.4
17996.0	---	48.9	54	5.1

### Radiated Spurious – CH48

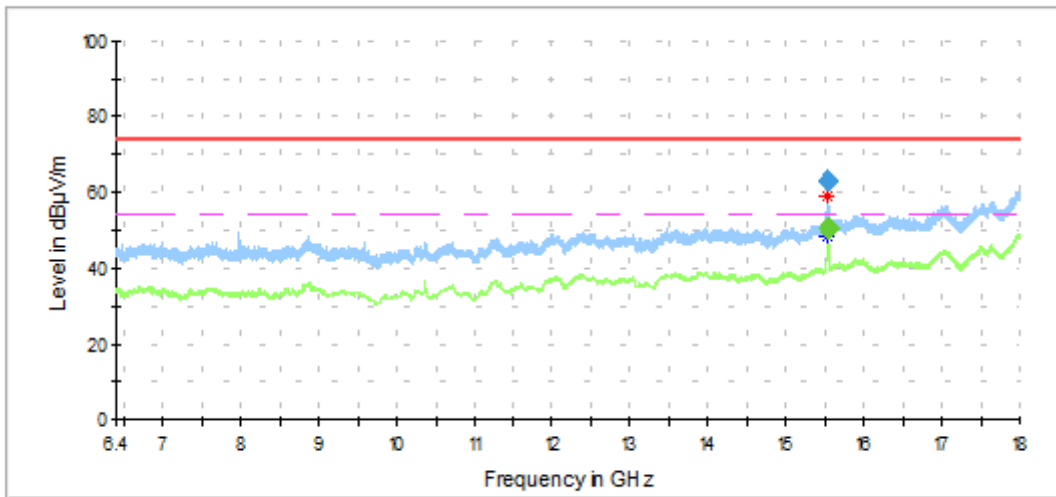
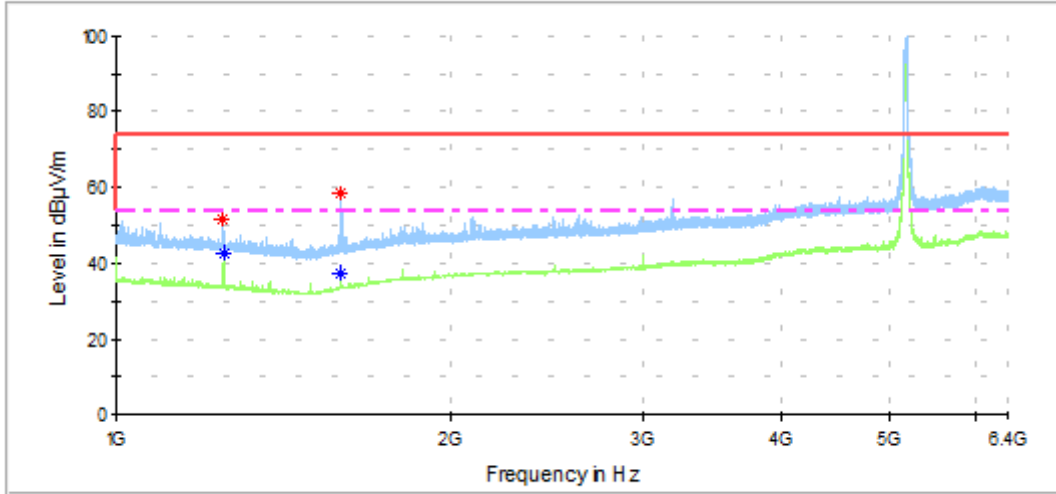


— Peak measurements     
 — Avg measurements     
 — Limit FCC Peak     
 - - - Limit FCC Avg

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
1249.6	48.5	---	74	25.5
1249.9	---	42.7	54	11.3
1594.7	---	38.2	54	15.1
1595.5	58.8	---	74	15.2
15711.9	60.7	---	74	13.3
15717.7	---	48.7	54	5.3

**1 GHz – 18 GHz, 802.11n20, HT0, Chain B**

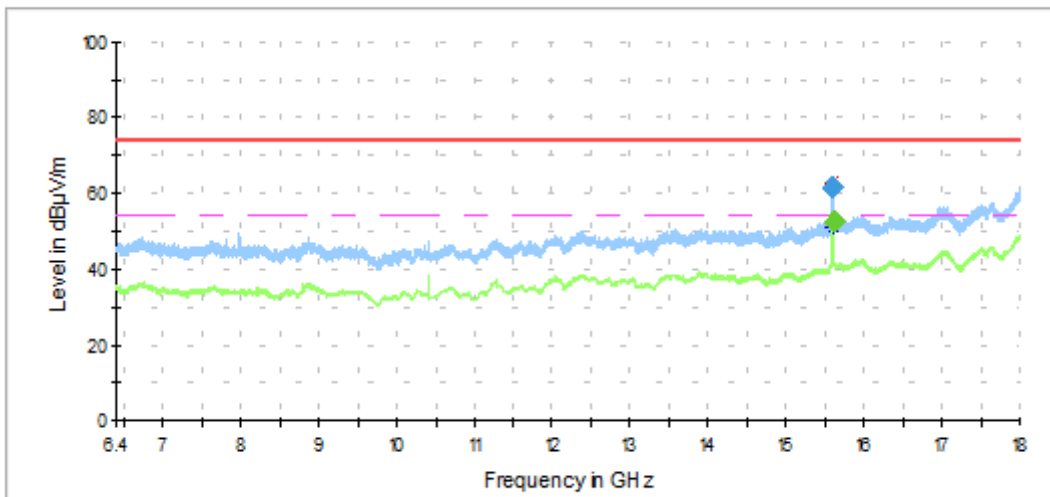
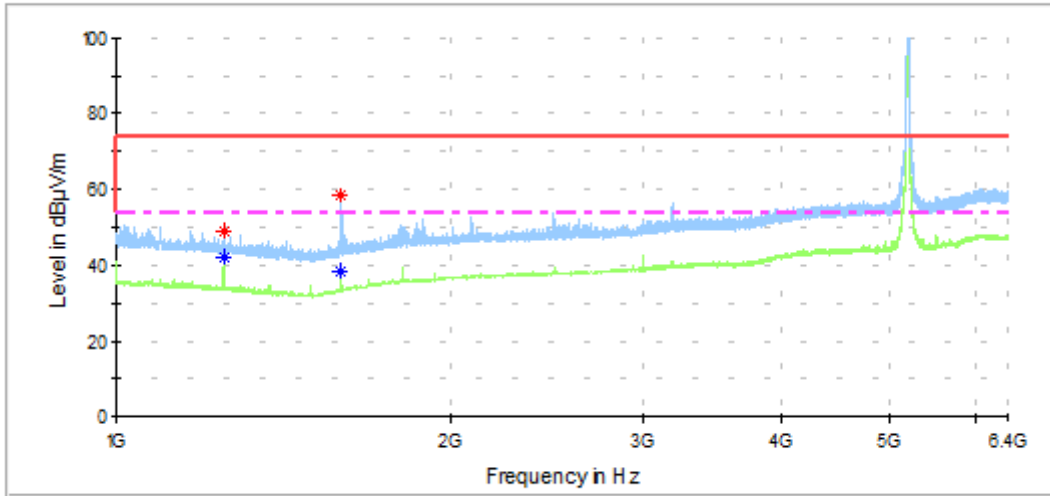
**Radiated Spurious – CH36**



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

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
1246.4	51.4	---	74	22.6
1249.9	---	42.5	54	11.5
1594.0	58.3	---	74	15.7
1596.0	---	37.4	54	16.6
15541.2	---	50.3	54	3.7
15543.0	63.3	---	74	10.7

### Radiated Spurious – CH40

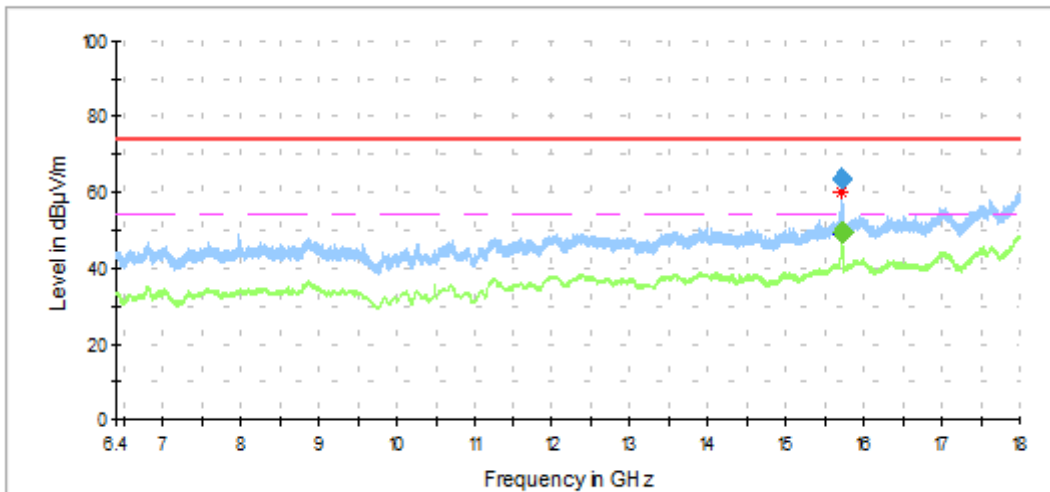
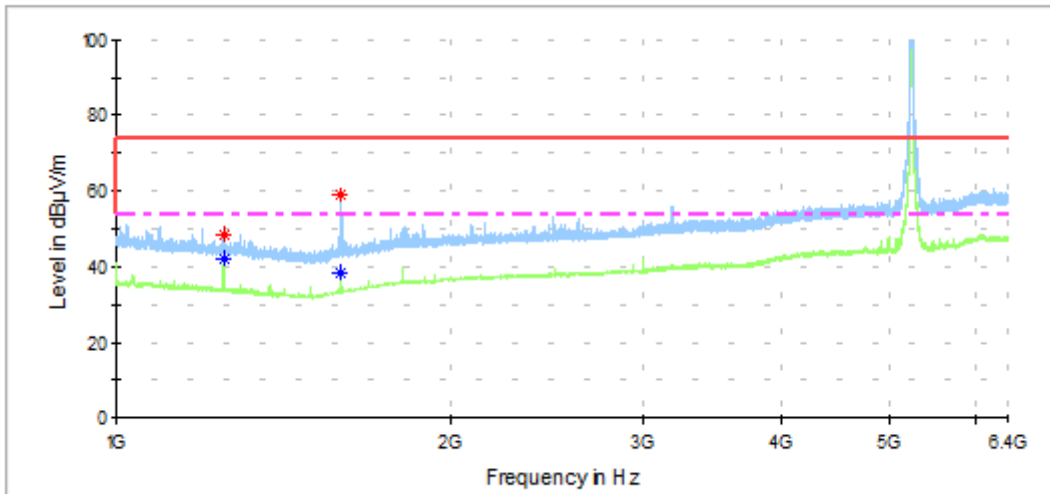


— Peak measurements     
 — Avg measurements     
 — Limit FCC Peak     
 - - - Limit FCC Avg

Frequency MHz	MaxPeak dBuV/m	Avg dBuV/m	Limit dBuV/m	Margin dB
1249.9	---	42.3	54	11.7
1250.1	49.0	---	74	25.0
1594.5	58.6	---	74	15.4
1596.5	---	38.5	54	15.5
15593.9	61.7	---	74	12.3
15601.9	---	52.6	54	1.4



### Radiated Spurious – CH48

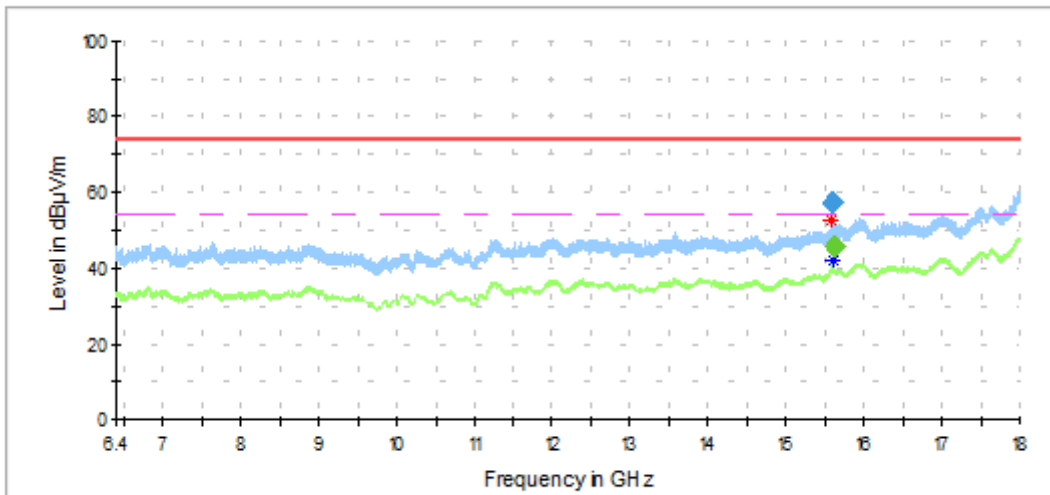
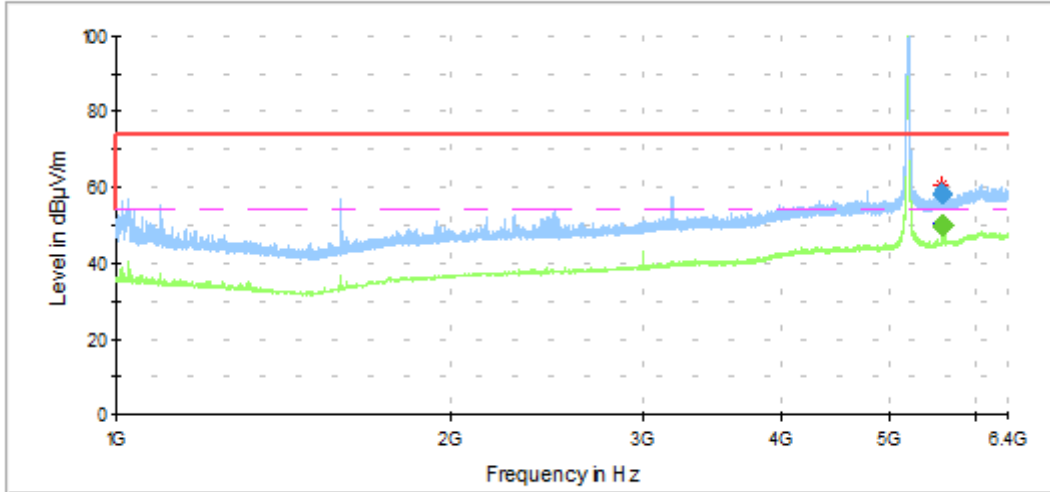


— Peak measurements     
 — Avg measurements     
 — Limit FCC Peak     
 - - - Limit FCC Avg

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
1249.9	---	42.2	54	11.8
1250.4	48.6	---	74	25.4
1596.2	---	38.3	54	15.7
1596.2	58.7	---	74	15.3
15719.7	---	49.6	54	4.4
15720.2	63.9	---	74	10.1

**1 GHz – 18 GHz, 802.11n20, HT8, Chain A+B**

**Radiated Spurious – CH40**

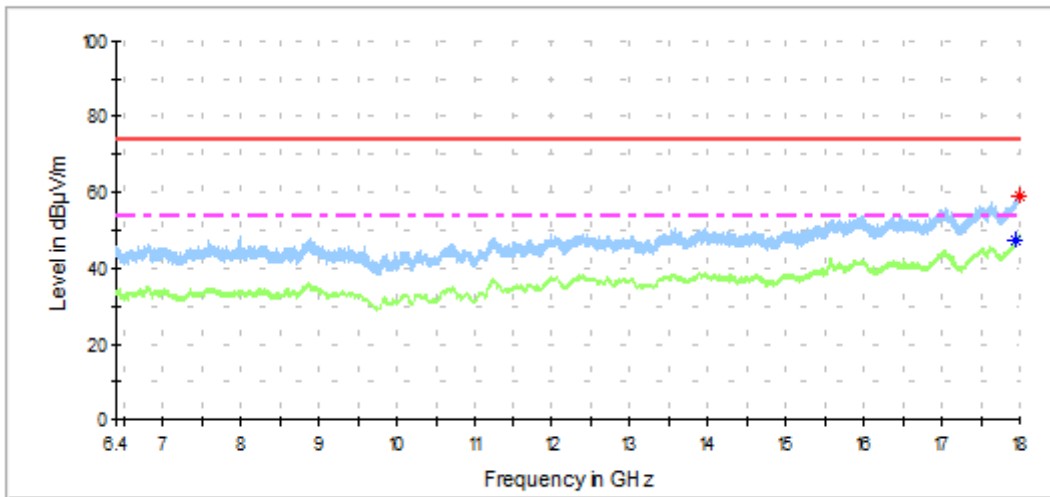
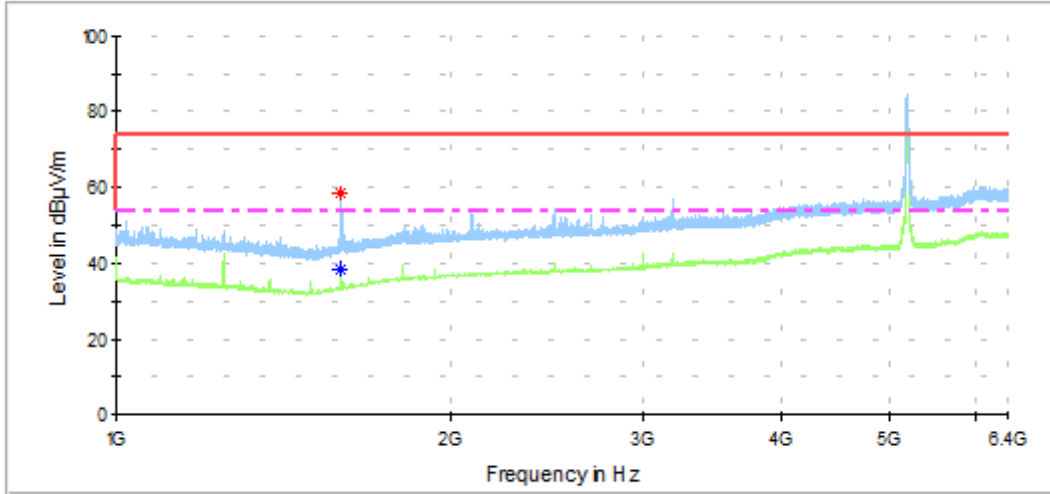


— Peak measurements     
 — Avg measurements     
 — Limit FCC Peak     
 - - - Limit FCC Avg

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
5580.7	58.4	---	74	15.6
5580.9	---	49.9	54	4.1
15598.8	57.4	---	74.1	16.7
15601.5	---	45.7	54.1	8.3

**1 GHz – 18 GHz, 802.11n40, HT0, Chain A**

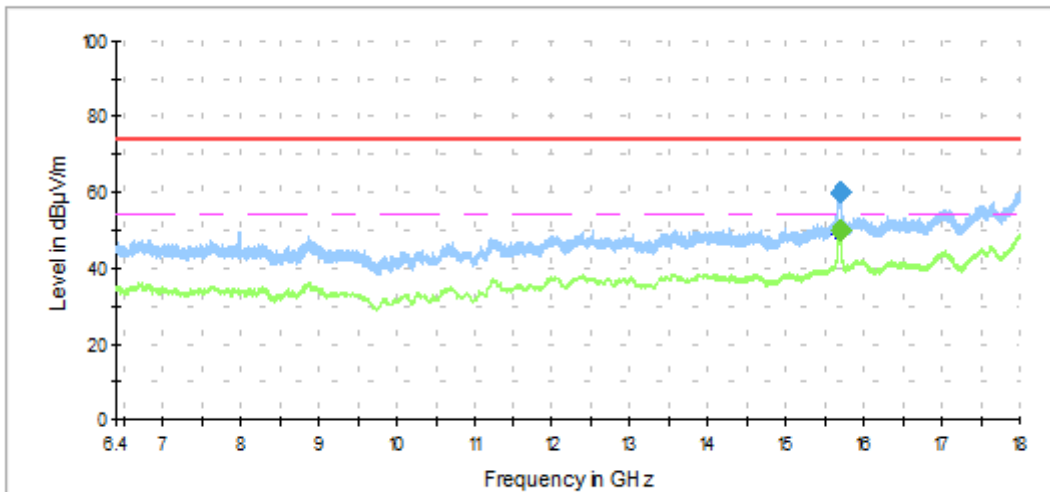
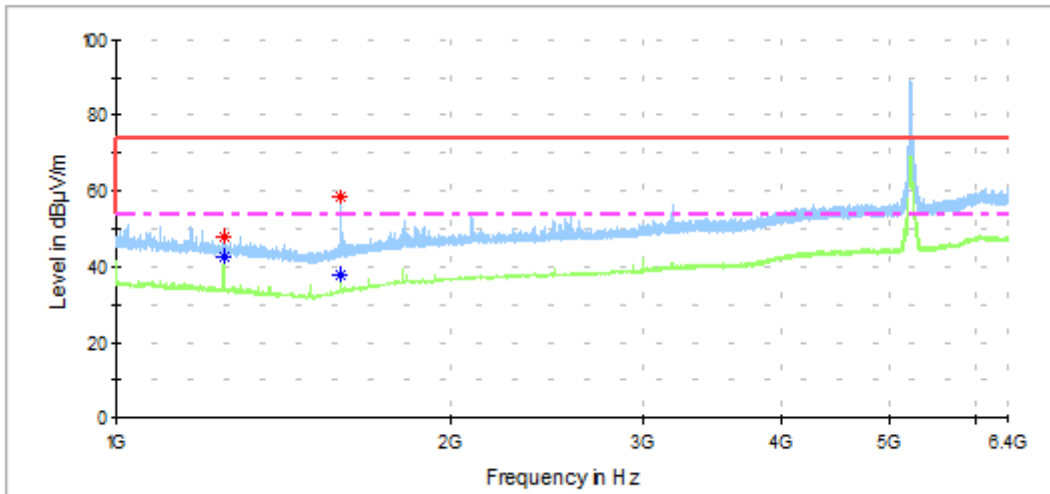
**Radiated Spurious – CH38F**



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

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
1593.8	---	38.5	54	15.5
1593.8	58.5	---	74	15.5
17958.1	---	47.2	54	6.8
17988.8	59.1	---	74	14.9

### Radiated Spurious – CH46F

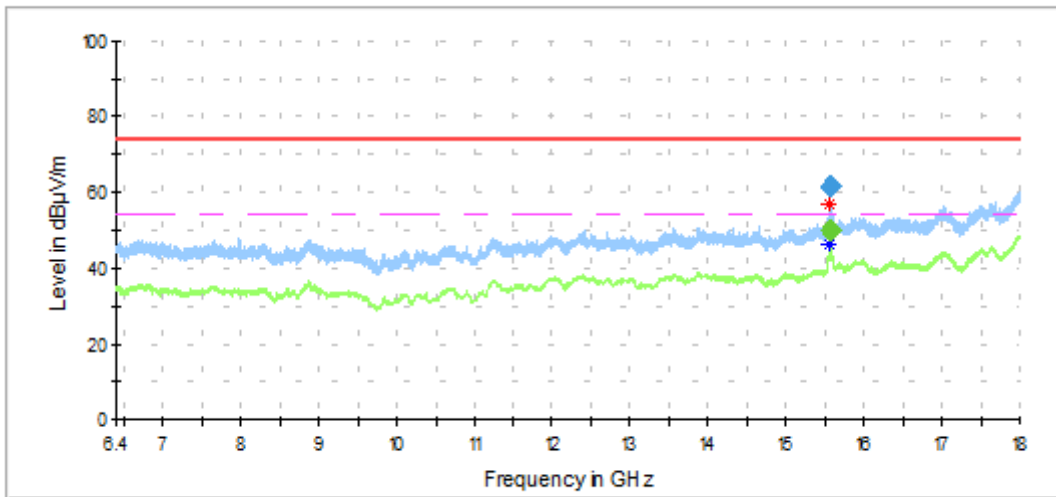
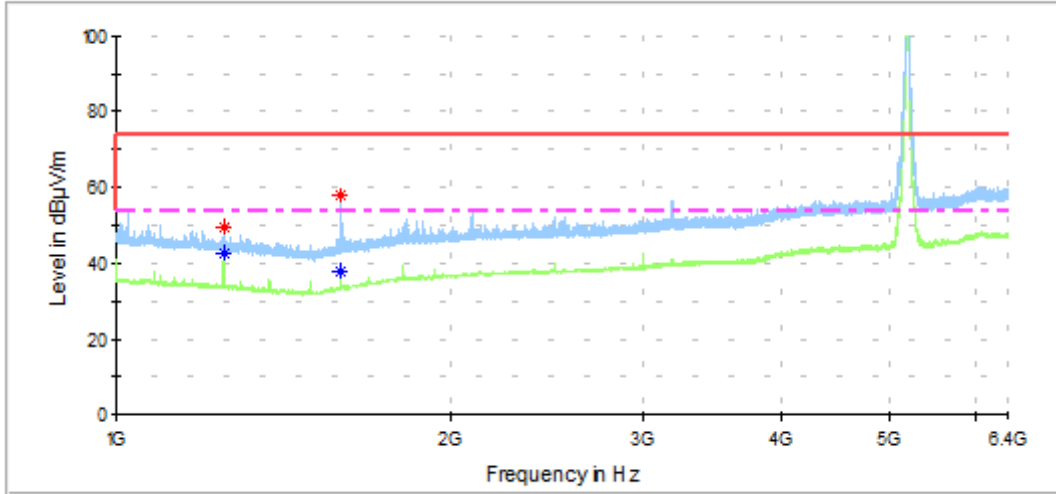


— Peak measurements     
 — Avg measurements     
 — Limit FCC Peak     
 - - - Limit FCC Avg

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
1249.9	---	42.9	54	11.1
1250.1	48.1	---	74	25.9
1596.2	---	37.8	54	16.2
1596.2	58.5	---	74	15.5
15692.0	---	50.2	54	3.8
15692.0	60.1	---	74	13.9

**1 GHz – 18 GHz, 802.11n40, HT0, Chain B**

**Radiated Spurious – CH38F**



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

Frequency	MaxPeak	Avg	Limit	Margin
MHz	dBuV/m	dBuV/m	dBuV/m	dB
1250.1	---	42.7	54	11.3
1250.1	49.5	---	74	24.5
1595.7	58.1	---	74	15.9
1596.5	---	38.1	54	15.9
15571.6	61.6	---	74	12.4
15574.7	---	50.2	54	3.8