



FCC 47 CFR PART 15 SUBPART E

CERTIFICATION TEST REPORT

FOR

802.11ac 3x3 Set Top Box Client with RF4CE for remote operation

MODEL NUMBER: ID:072

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Prepared for

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B	2/12/14	Updated rule part on pages 257, 267, 278, 418, 434, 453, 480, 500, and 526.	F. de Anda
C	2/14/14	Added KDB 644545 to documents reference list	F. de Anda
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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: ECHOSTAR
90 INVERNESS CIRCLE EAST
ENGLEWOOD, CO 80112, U.S.A.

EUT DESCRIPTION: 802.11ac 3x3 Set Top Box Client with RF4CE for remote operation

MODEL: ID: 072

SERIAL NUMBER: P2-224 (Conducted), P2-230 (Radiated)

DATE TESTED: DECEMBER 09, 2013 - JANUARY 24, 2014

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart E	Pass

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

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FRANCISCO DE ANDA
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FRANCISCO GUARNERO
EMC ENGINEER
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, FCC KDB 789033, FCC KDB 558074 and ANSI C63.10-2009.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
<input type="checkbox"/> Chamber A	<input checked="" type="checkbox"/> Chamber D
<input type="checkbox"/> Chamber B	<input checked="" type="checkbox"/> Chamber E
<input type="checkbox"/> Chamber C	<input checked="" type="checkbox"/> Chamber F

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ul.com>

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	±3.52 dB
Radiated Disturbance, 30 to 1000 MHz	±4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an 802.11ac 3x3 Set Top Box Client with RF4CE for remote operation.

The set-top box is intended to be connected to any secondary television in a consumer's home. Using an 802.11ac link to an 802.11ac AP it will decode and output high-definition TV2 programming from an Echostar host STB.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum conducted output power as follows:

5.2 GHz BAND

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.2 GHz band, 1TX			
5180 - 5240	802.11a 1TX SISO	14.46	27.93
5180 - 5240	802.11n HT20 1TX SISO	14.66	29.24
5190 - 5230	802.11n HT40 1TX SISO	16.95	49.55
5170 - 5250	802.11ac 80MHz 1TX SISO	12.76	18.88
5.2 GHz band, 3TX			
5180 - 5240	802.11n HT20 3TX CDD	13.40	21.88
5180 - 5240	802.11n HT20 3TX SDM	13.76	23.77
5190 - 5230	802.11n HT40 3TX CDD	16.25	42.17
5190 - 5230	802.11n HT40 3TX SDM	16.77	47.53
5170 - 5250	802.11ac 80MHz 3TX CDD	14.53	28.38
5170 - 5250	802.11ac 80MHz 3TX SDM	16.80	47.86

5.3 GHz BAND

5.3 GHz band, 1TX			
5260 - 5320	802.11a 1TX SISO	21.67	146.89
5260 - 5320	802.11n HT20 1TX SISO	21.82	152.05
5270 - 5310	802.11n HT40 1TX SISO	18.94	78.34
5250 - 5330	802.11ac 80MHz 1TX SISO	13.49	22.34
5.3 GHz band, 3TX			
5260 - 5320	802.11n HT20 3TX CDD	20.70	117.49
5260 - 5320	802.11n HT20 3TX SDM	21.66	146.55
5270 - 5310	802.11n HT40 3TX CDD	18.72	74.47
5270 - 5310	802.11n HT40 3TX SDM	22.12	162.93
5250 - 5330	802.11ac 80MHz 3TX CDD	15.58	36.14
5250 - 5330	802.11ac 80MHz 3TX SDM	16.85	48.42

5.6 GHz BAND

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5.6 GHz band, 1TX			
5500 - 5700	802.11a 1TX SISO	21.22	132.43
5500 - 5700	802.11n HT20 1TX SISO	22.17	164.82
5510 - 5670	802.11n HT40 1TX SISO	23.21	209.41
5490 - 5570	802.11ac 80MHz 1TX SISO	13.63	23.07
5.6 GHz band, 3TX			
5500-5700	802.11n HT20 3TX CDD	20.58	114.29
5500-5700	802.11n HT20 3TX SDM	21.14	130.02
5510-5670	802.11n HT40 3TX CDD	22.23	167.11
5510-5670	802.11n HT40 3TX SDM	23.43	220.29
5490 - 5570	802.11ac 80MHz 3TX CDD	14.58	28.71
5490 - 5570	802.11ac 80MHz 3TX SDM	15.67	36.90

5690 - 5730	802.11ac 40MHz 1TX SISO	23.31	214.29
5650 - 5730	802.11ac 80MHz 1TX SISO	21.68	147.23
5.6 GHz band, 3TX (Channels overlapping UNII and DTS bands)			
5710 - 5730	802.11ac 20MHz 3TX CDD	18.99	79.25
5710 - 5730	802.11ac 20MHz 3TX SDM	19.69	93.11
5690 - 5730	802.11ac 40MHz 3TX CDD	21.74	149.28
5690 - 5730	802.11ac 40MHz 3TX SDM	23.9	245.47
5650 - 5730	802.11ac 80MHz 3TX CDD	18.71	74.30
5650 - 5730	802.11ac 80MHz 3TX SDM	22.40	173.78

Testing performed was done on 1TX and 3TX modes only. All 2TX mode testing was waived because the power settings for these modes will leverage on the power setting for 3TX. 3TX modes are worst case representation of 2 TX modes.

The manufacturer will use 3TX power settings on 2TX modes.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an N5x20B Embedded antenna, with a maximum gain of;

Freq. Band (GHz)	Antenna Gain (dBi)
5.2	2.25
5.3	2.40
5.6	2.82

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was FCC2 ZDAH.

The test utility software used during testing was MTool version 2.0.1.1

5.5. WORST-CASE CONFIGURATION AND MODE

The EUT supports only one orientation; therefore, X orientation (Lay down) was investigated and is considered the worst case.

Worst-case data rates as provided by the client were:

- 802.11a SISO mode: 6 Mbps
- 802.11n HT20 1TX SISO mode: MCS0
- 802.11n HT20 3TX CDD mode: MCS0
- 802.11n HT20 3TX SDM mode: MCS0
- 802.11n HT40 1TX SISO mode: MCS0
- 802.11n HT40 3TX CDD mode: MCS0
- 802.11n HT40 3TX SDM mode: MCS0
- 802.11ac 20 1TX SISO mode: MCS0
- 802.11ac 20 3TX CDD mode: MCS0
- 802.11ac 20 3TX SDM mode: MCS0
- 802.11ac 40 1TX SISO mode: MCS0
- 802.11ac 40 3TX CDD mode: MCS0
- 802.11ac 40 3TX SDM mode: MCS0
- 802.11ac 80 1TX SISO mode: MCS0
- 802.11ac 80 3TX CDD mode: MCS0
- 802.11ac 80 3TX SDM mode: MCS0

Worst-case mode and channel used for 30-1000 MHz radiated and power line conducted emissions was the mode and channel with the highest output power.

5.6. DESCRIPTION OF TEST SETUP

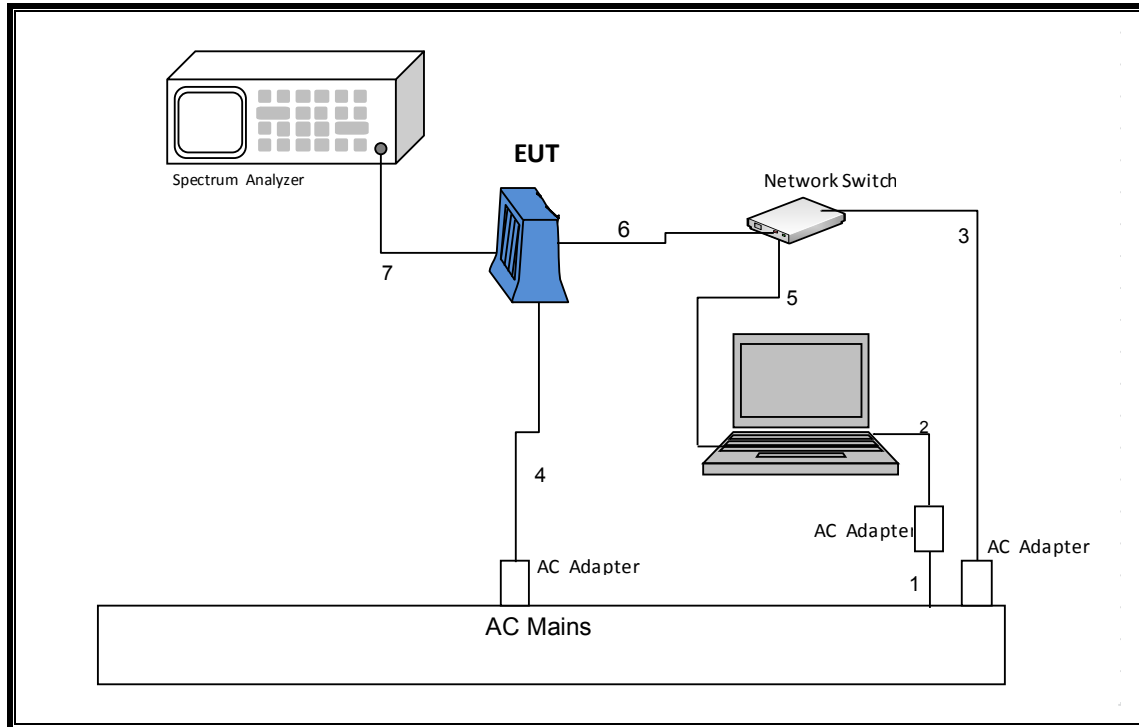
SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
EUT AC adapter	Delta Elect.	ADP-25AW B	115	N/A
Laptop	HP	8470p	Compliance 1-HP	DOC
AC adapter	HP	PA-1650-32HJ	606703	DoC
Access Point	Netgear	WNDR3700	21840B5K06E39	PY309200112
AC adapter	Netgear	MU30-5120250-A1	1023400U3	N/A

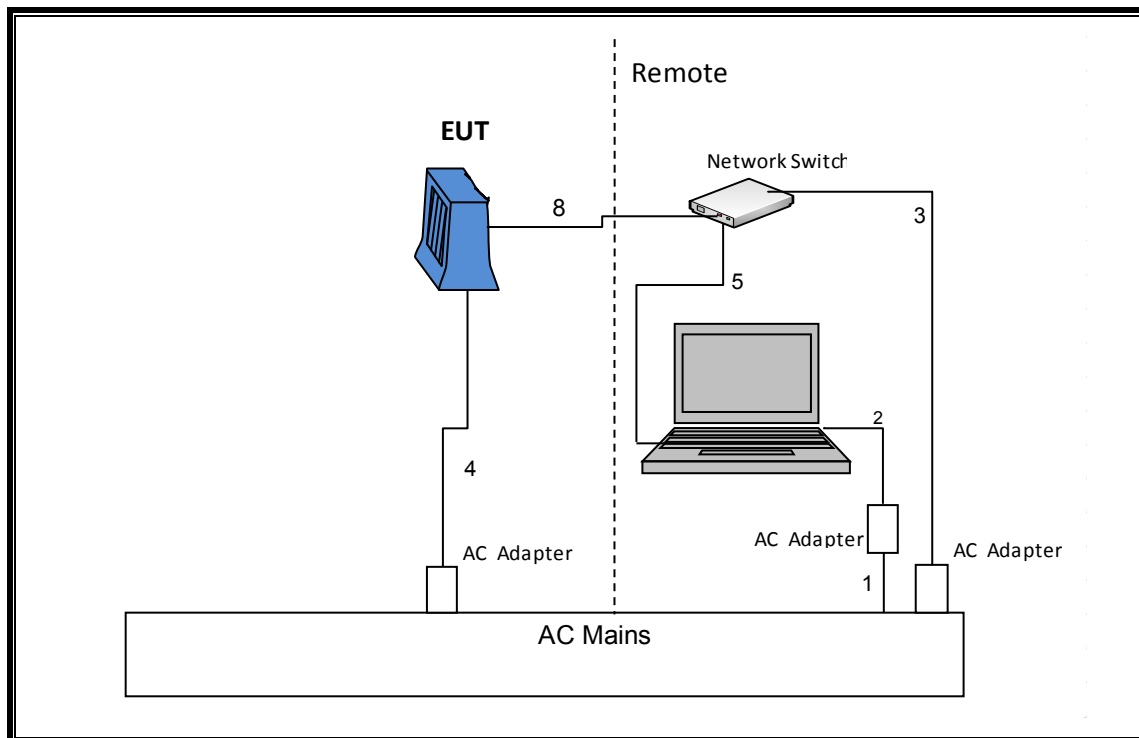
I/O CABLES

I/O Cable List						
Cable No.	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	3	2-Prong	Un-Shielded	1.8m	NA
2	DC	1	Barrel	Un-Shielded	1.8	NA
3	DC	1	Barrel	Un-Shielded	1.8	To Spectrum Analyzer
4	DC	1	Locking 2-Pin	Un-Shielded	1.8	NA
5	LAN	1	RJ45	Un-Shielded	2	NA
6	LAN	1	RJ45	Un-Shielded	2	To Spectrum Analyzer
7	Antenna	1	SMA	Coax	0.1	NA
8	LAN	1	RJ45	Un-Shielded	7.5	NA

SETUP DIAGRAM FOR CONDUCTED TESTS



SETUP DIAGRAM FOR RADIATED TESTS



6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	Manufacturer	Model	Asset	Cal Due
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB3	F00027	03/07/14
Antenna, Horn 1-18GHz	ETS Lindgren	3117	F00131	02/19/14
Antenna, Horn, 26.5 GHz	ARA	SWH-28	C01015	05/06/14
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	F00194	05/14/14
Spectrum Analyzer, 40 GHz	Agilent / HP	8564E	C00951	07/29/14
Spectrum Analyzer, 3Hz-44GHz	Agilent	N9030A	F00127	02/22/14
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	01/28/14
PreApmplifier, 1-26.5GHz	Agilent	8449B	C01052	06/26/14
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	08/20/14
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	08/15/14
LISN, 30 MHz	FCC	50/250-25-2	C00626	01/14/14
Peak / Average Power Sensor	Agilent / HP	E9323A	F00163	04/03/14
P-Series single channel Power Meter	Agilent / HP	N1911A	F00164	04/03/14

7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

7.1. MEASUREMENT METHODS

26 dB Emission BW: KDB 789033 D01 v01r03, Section C.

99% Occupied BW: KDB 789033 D01 v01r03, Section D.

Conducted Output Power: KDB 789033 D01 v01r03, Section E.2.b (Method SA-1).

Power Spectral Density: KDB 789033 D01 v01r03, Section F.

Peak Excursion: KDB 789033 D01 v01r03, Section G.

Conducted output power, radiated/conducted spurious emissions measurements: KDB 644545 D01 Guidance for IEEE 802.11ac v01r01

Unwanted emissions in restricted bands: KDB 789033 D01 v01r03, Sections H.3, H.4, H.5, and H.6.

Unwanted emissions in non-restricted bands: KDB 789033 D01 v01r03, Sections H.3, H.4, and H.5.

7.2. ON TIME AND DUTY CYCLE RESULTS

LIMITS

None; for reporting purposes only.

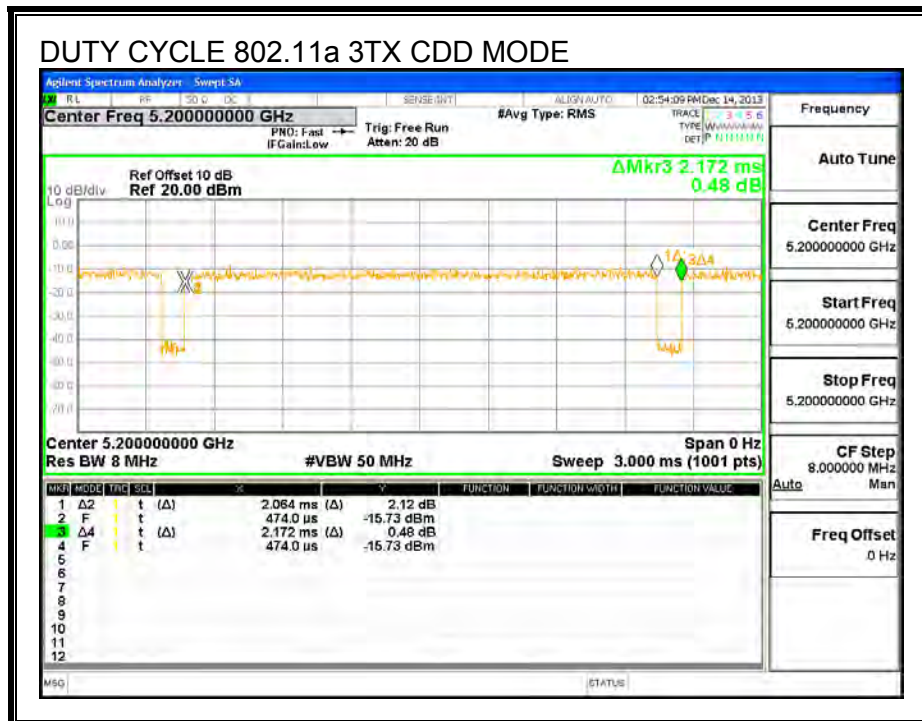
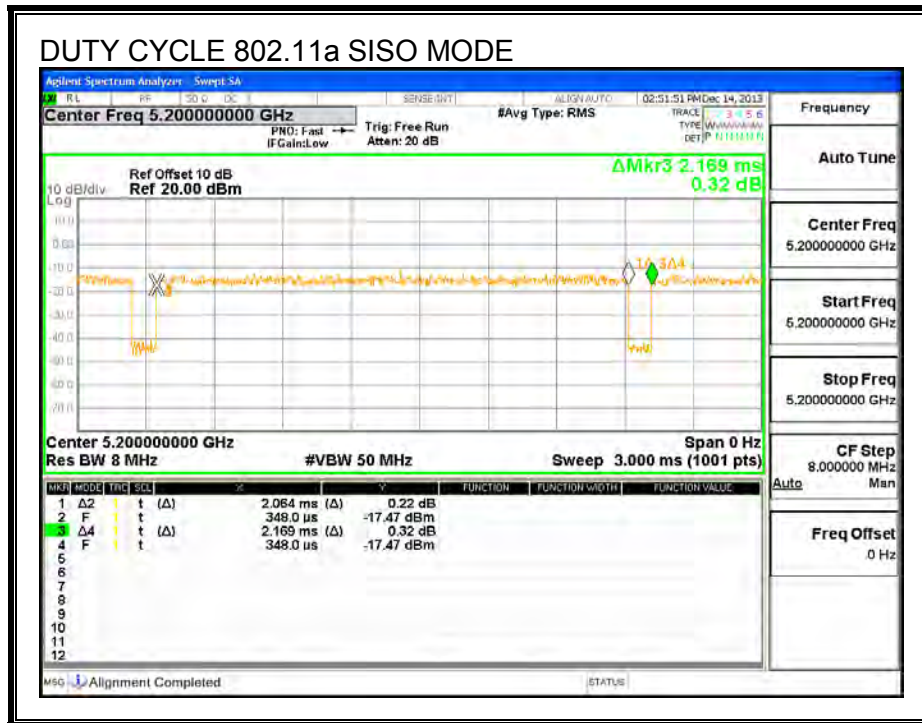
PROCEDURE

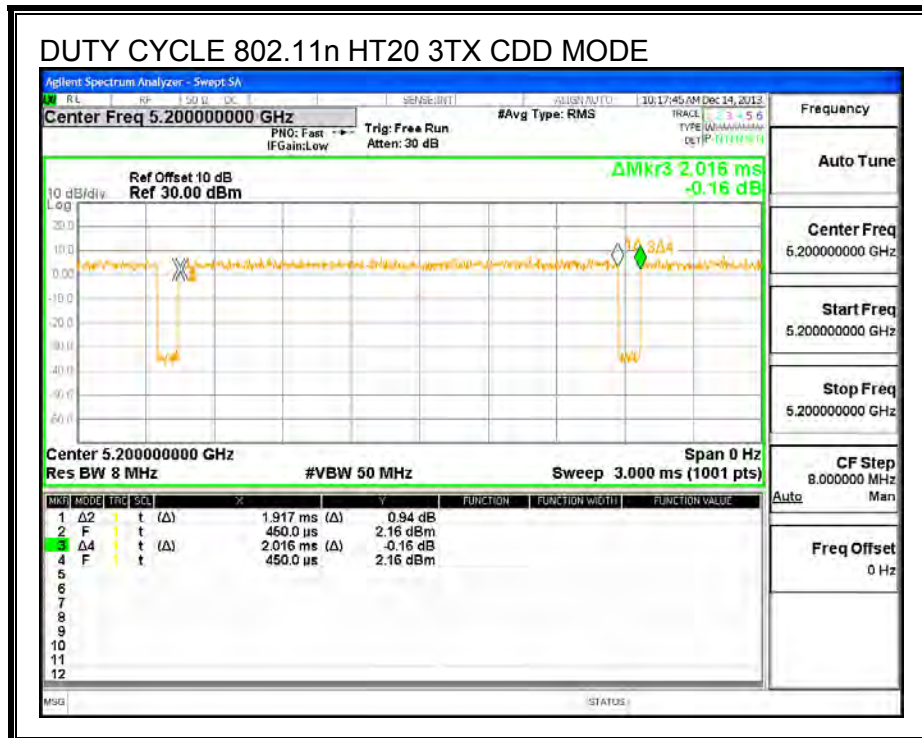
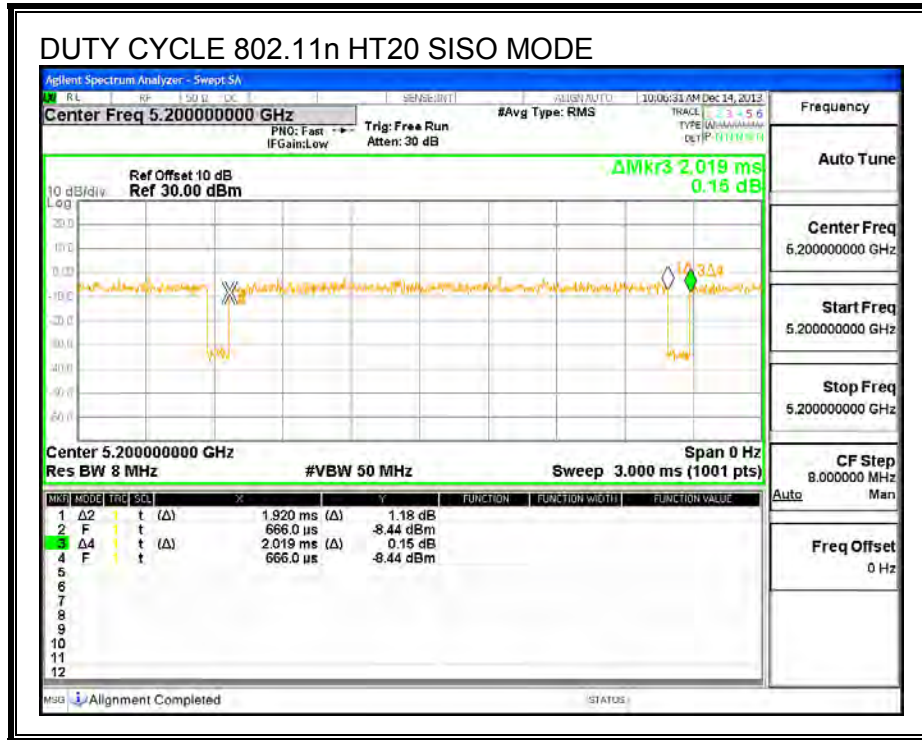
KDB 558074 Zero-Span Spectrum Analyzer Method.

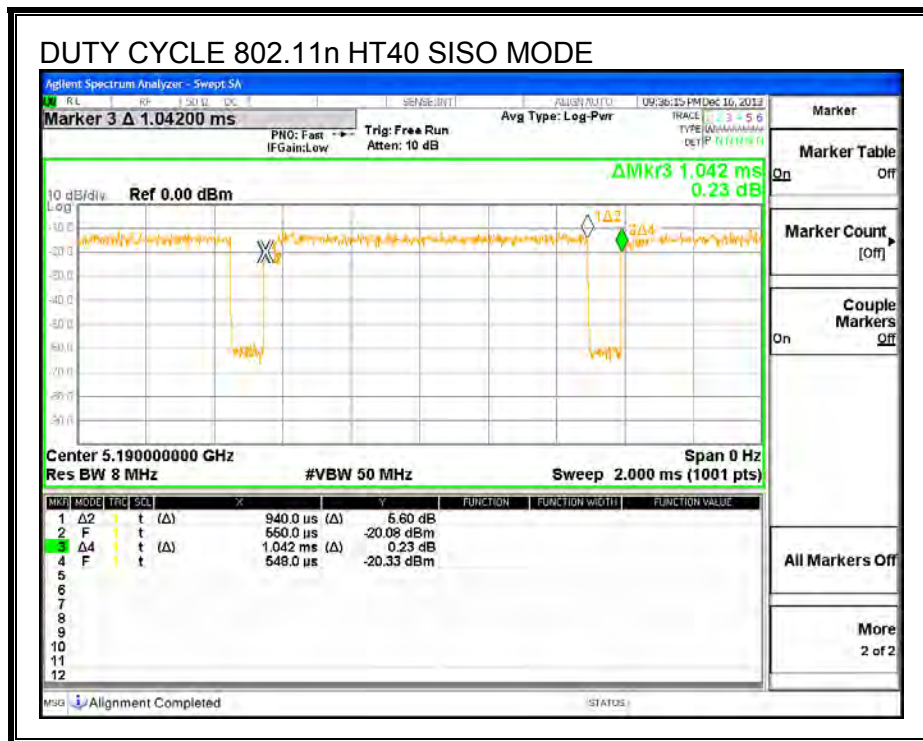
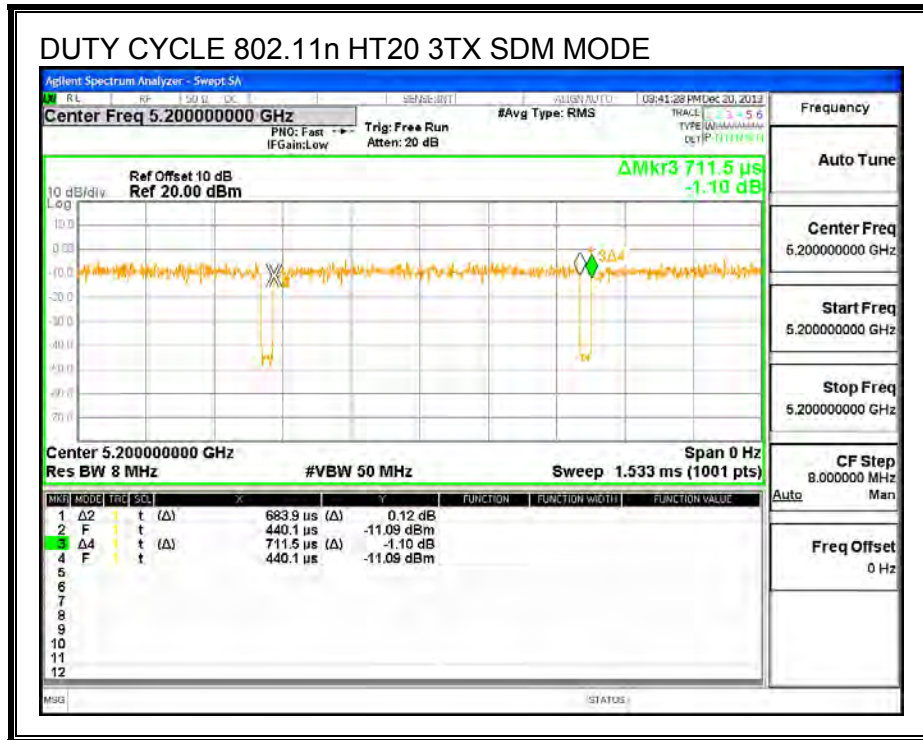
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
802.11a SISO	2.064	2.169	0.952	95.16%	0.22	0.484
802.11a 3TX CDD	2.064	2.172	0.950	95.03%	0.22	0.484
802.11n HT20 SISO	1.920	2.019	0.951	95.10%	0.22	0.521
802.11n HT20 3TX CDD	1.917	2.016	0.951	95.09%	0.22	0.522
802.11n HT20 3TX SDM	0.684	0.712	0.961	96.12%	0.17	1.462
802.11n HT40 SISO	0.945	1.041	0.908	90.78%	0.42	1.058
802.11n HT40 3TX CDD	0.9500	0.9820	0.967	96.74%	0.14	1.053
802.11n HT40 3TX SDM	0.355	0.384	0.924	92.45%	0.34	2.817
802.11ac 80MHz SISO	0.4590	0.4880	0.941	94.06%	0.27	2.179
802.11ac 80MHz CDD	0.4590	0.4880	0.941	94.06%	0.27	2.179
802.11ac 80MHz SDM	0.1915	0.2200	0.870	87.05%	0.60	5.222

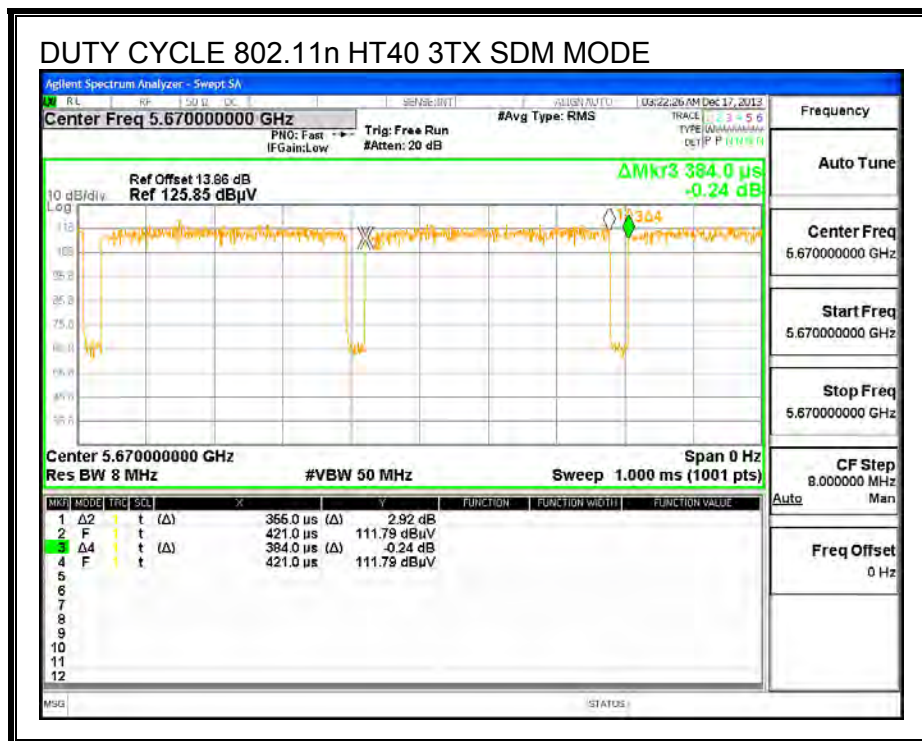
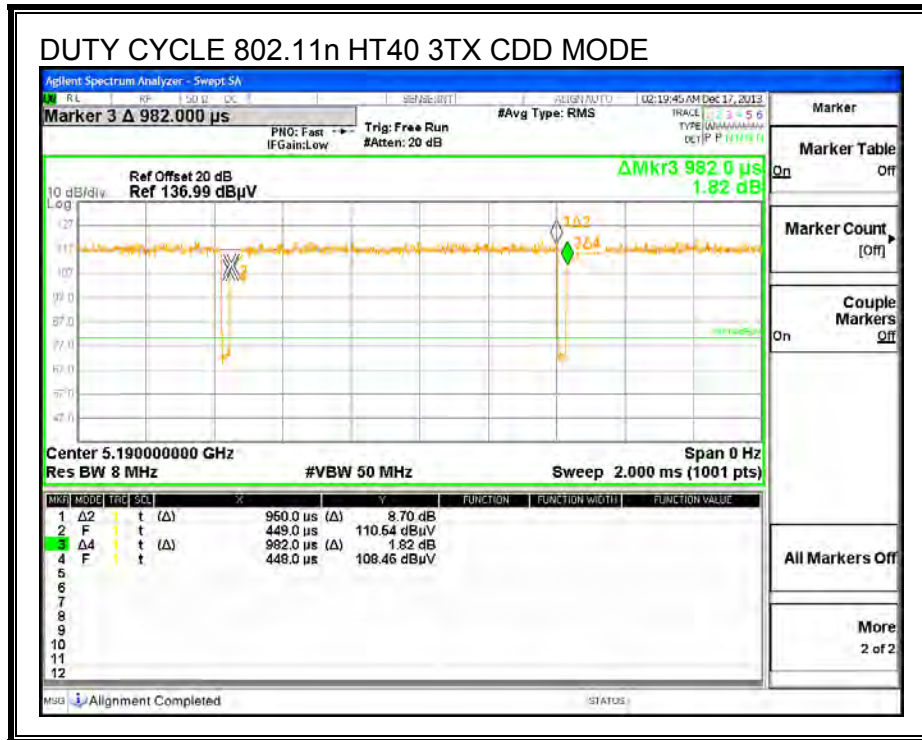
7.3. DUTY CYCLE PLOTS

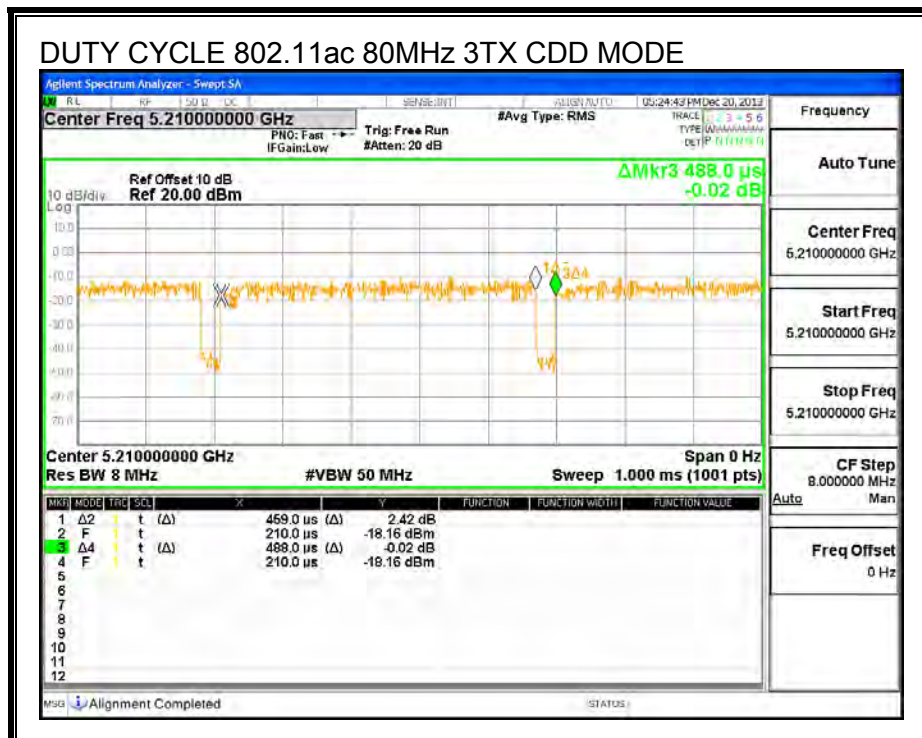
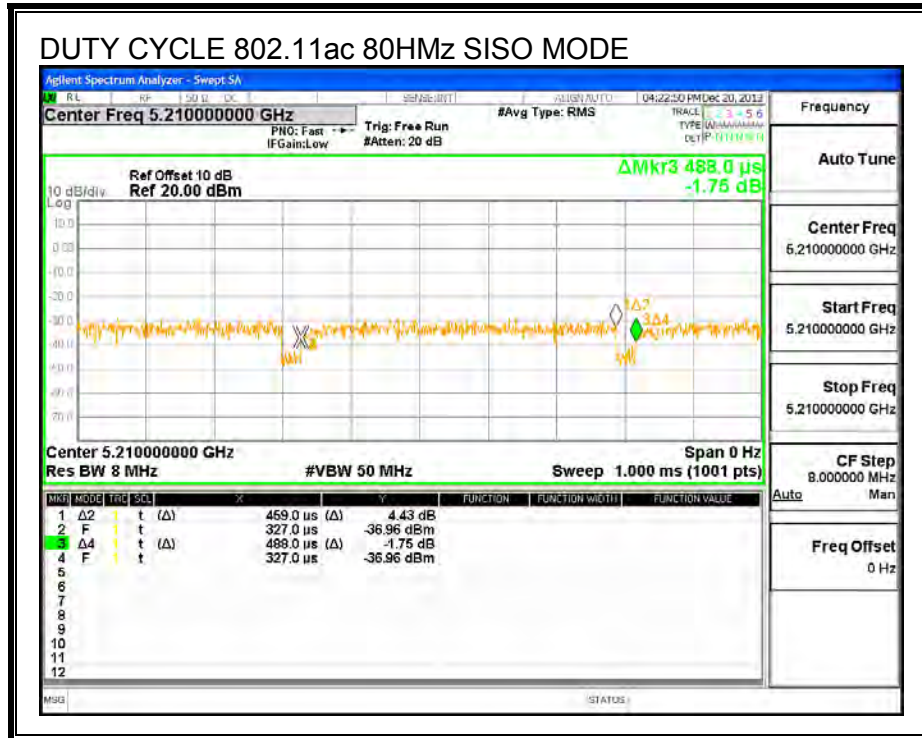
5 GHz BANDS

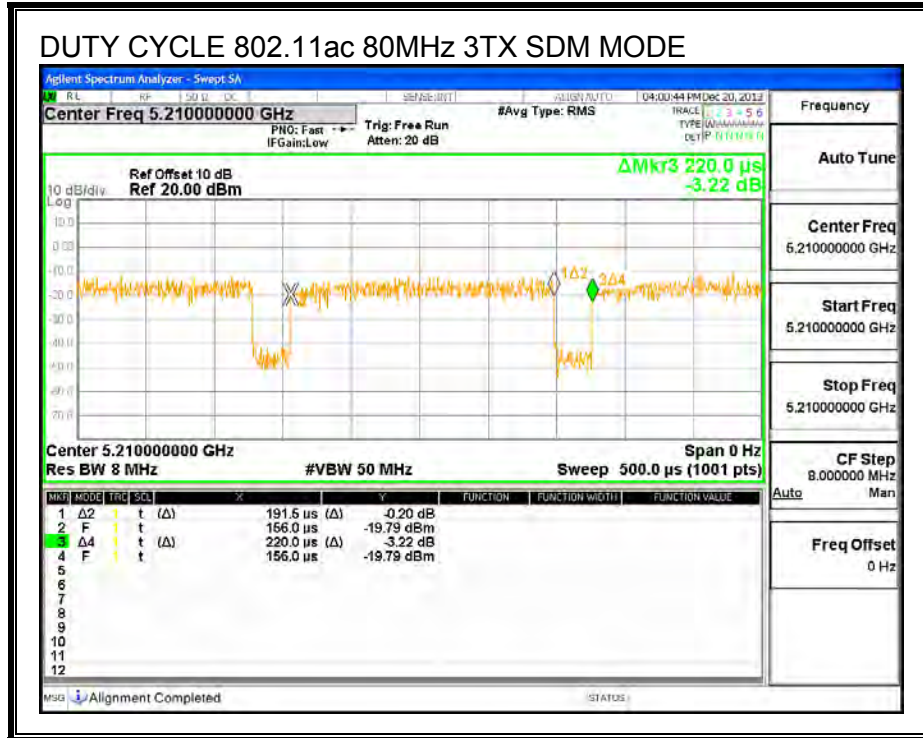












8. ANTENNA PORT TEST RESULTS

8.1. 802.11a 1TX SISO MODE IN THE 5.2 GHz BAND

8.1.1. 26 dB BANDWIDTH

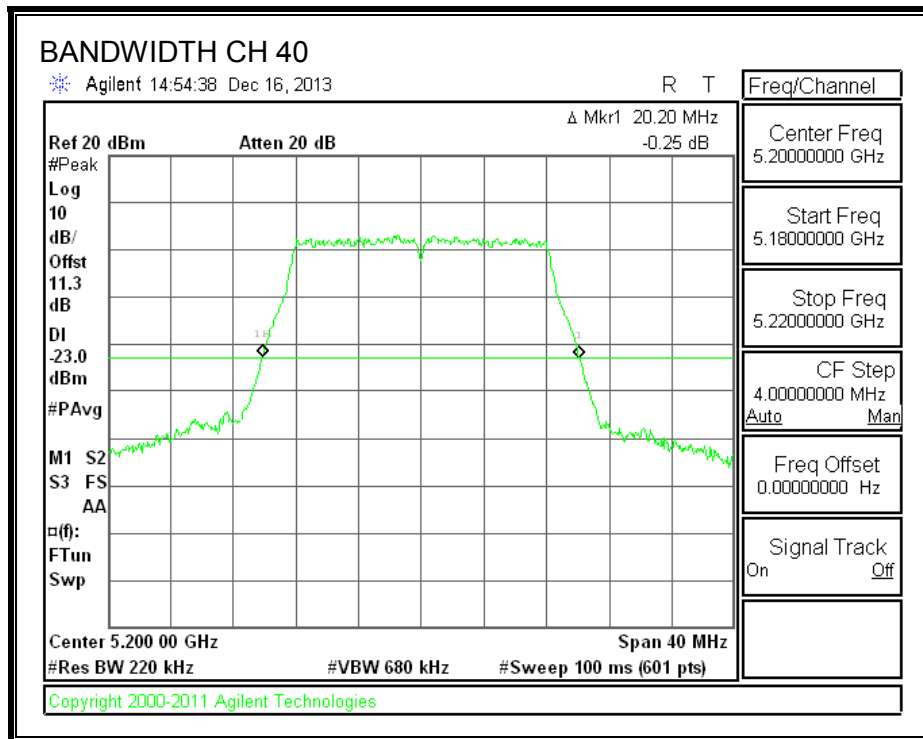
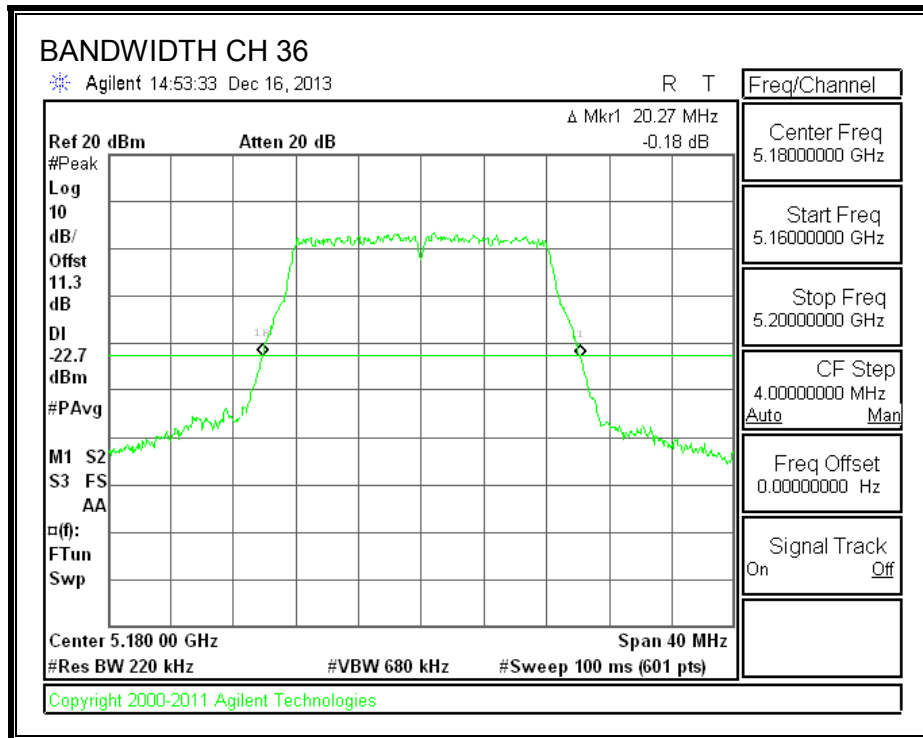
LIMITS

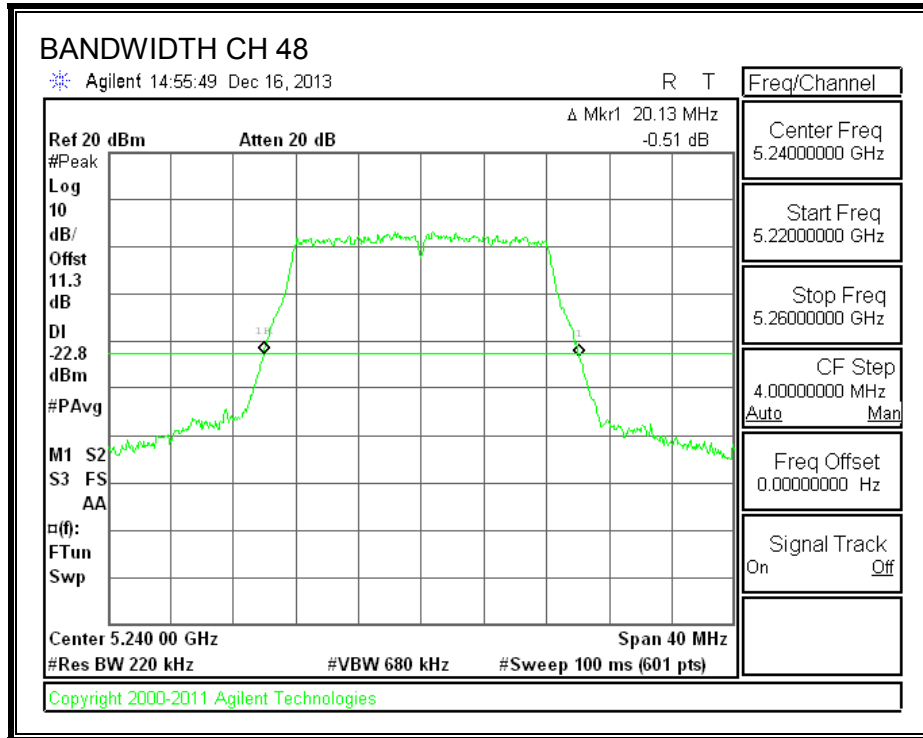
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	20.27
40	5200	20.20
48	5240	20.13

26 dB BANDWIDTH





8.1.2. 99% BANDWIDTH

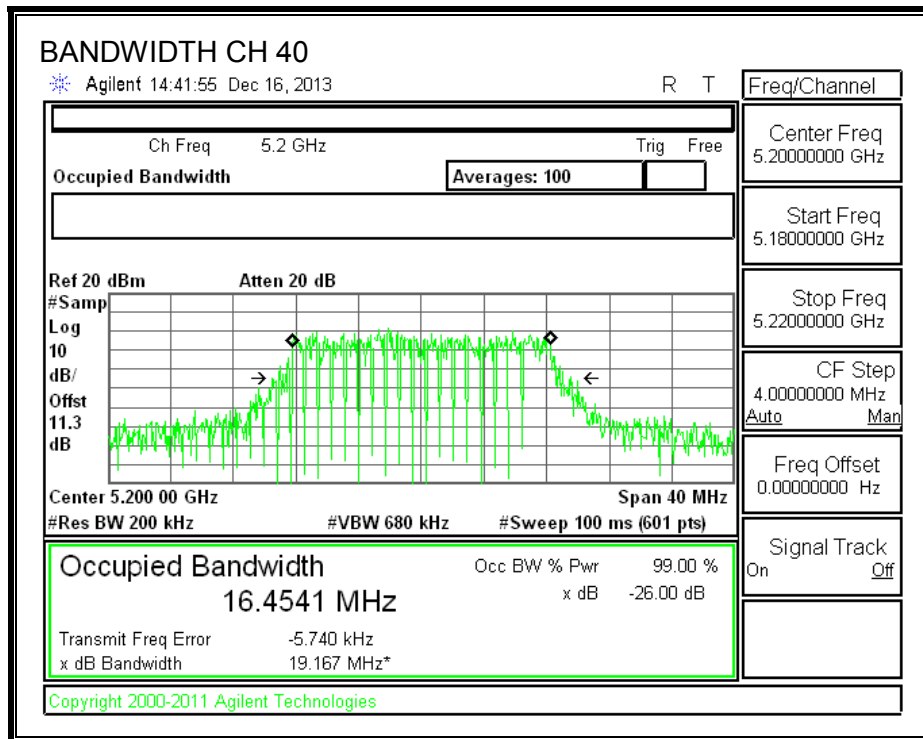
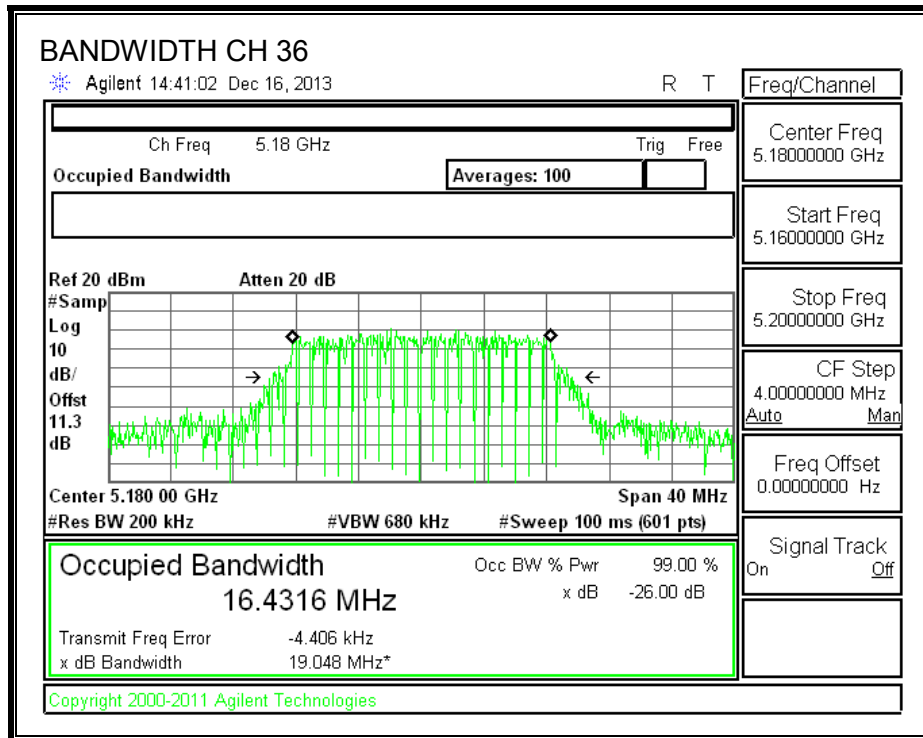
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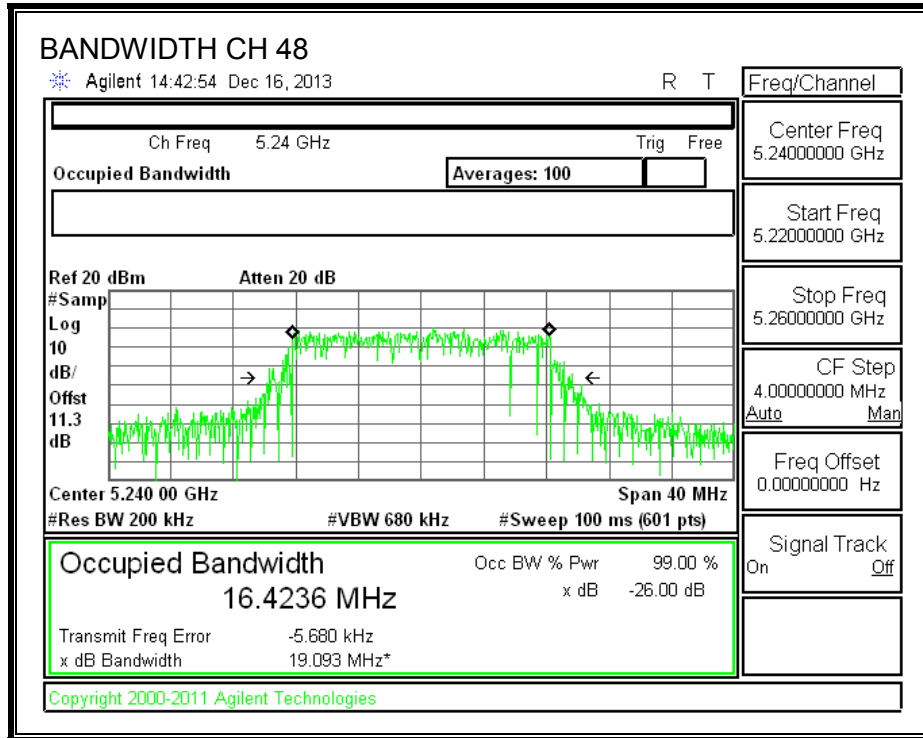
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
36	5180	16.4316
40	5200	16.4541
48	5240	16.4236

99% BANDWIDTH





8.1.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.26 dB (including 10 dB pad and 1.26 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
36	5180	12.45
40	5200	13.92
48	5240	13.60

8.1.4. OUTPUT POWER AND PSD

LIMITS

FCC §15.407 (a) (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26–dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Bandwidth and Antenna Gain

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Min 99% BW (MHz)	Directional Gain (dBi)
36	5180	20.3	16.4	2.25
40	5200	20.2	16.5	2.25
48	5240	20.1	16.4	2.25

Limits

Channel	Frequency (MHz)	FCC Power Limit (dBm)	IC EIRP Limit (dBm)	Max IC Power (dBm)	Power Limit (dBm)	FCC PSD Limit (dBm)	IC eirp PSD Limit (dBm)	PSD Limit (dBm)
36	5180	17.00	22.16	19.91	17.00	4.00	10.00	4.00
40	5200	17.00	22.16	19.91	17.00	4.00	10.00	4.00
48	5240	17.00	22.15	19.90	17.00	4.00	10.00	4.00

Duty Cycle CF (dB)	0.22	Included in Calculations of Corr'd Power & PSD
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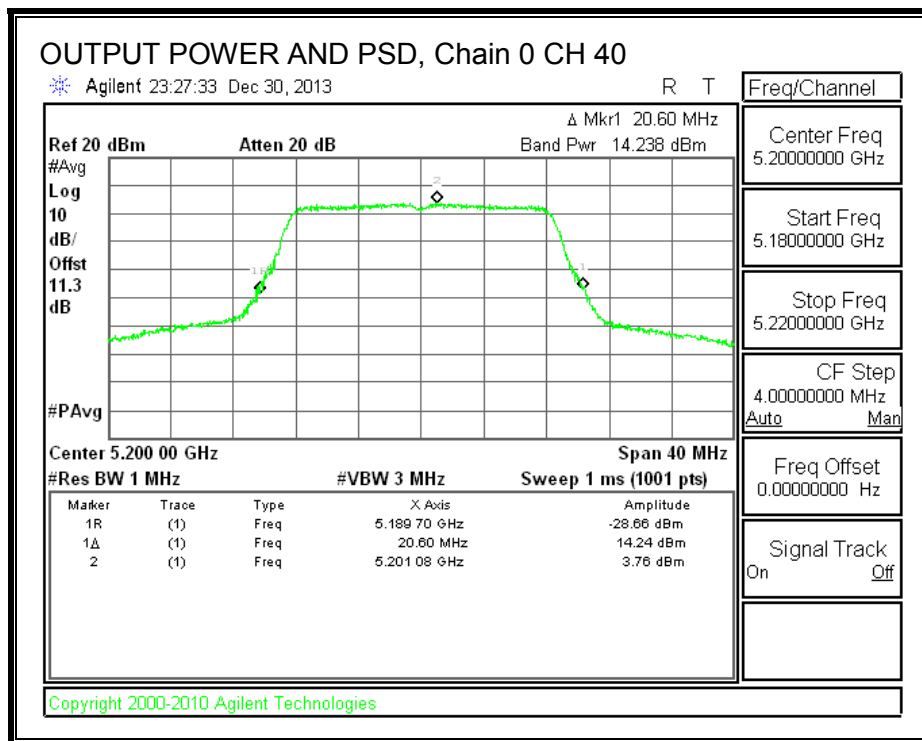
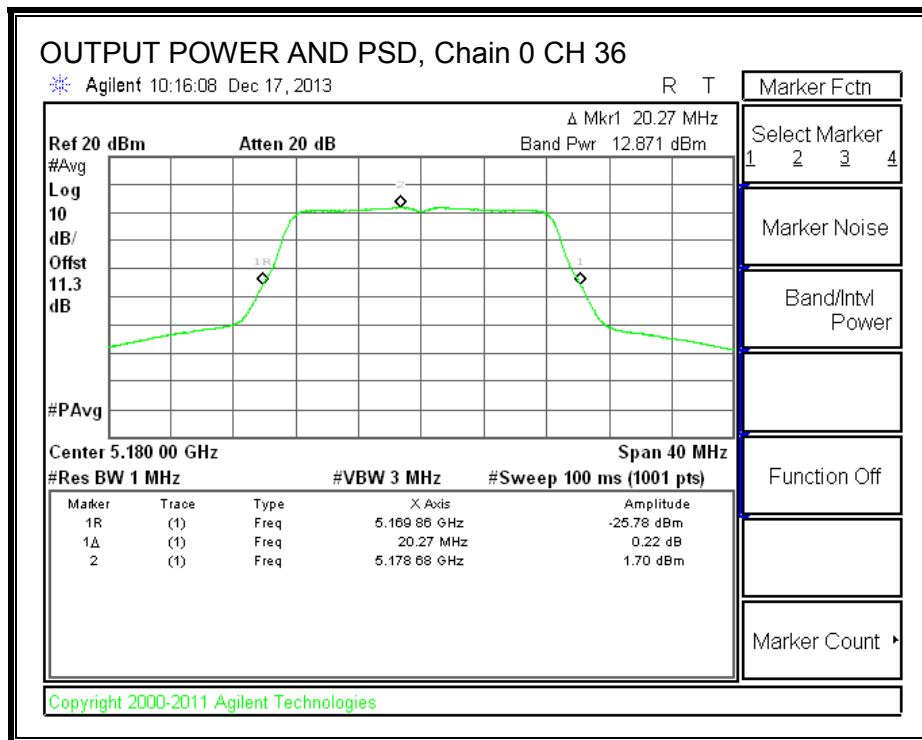
Output Power Results

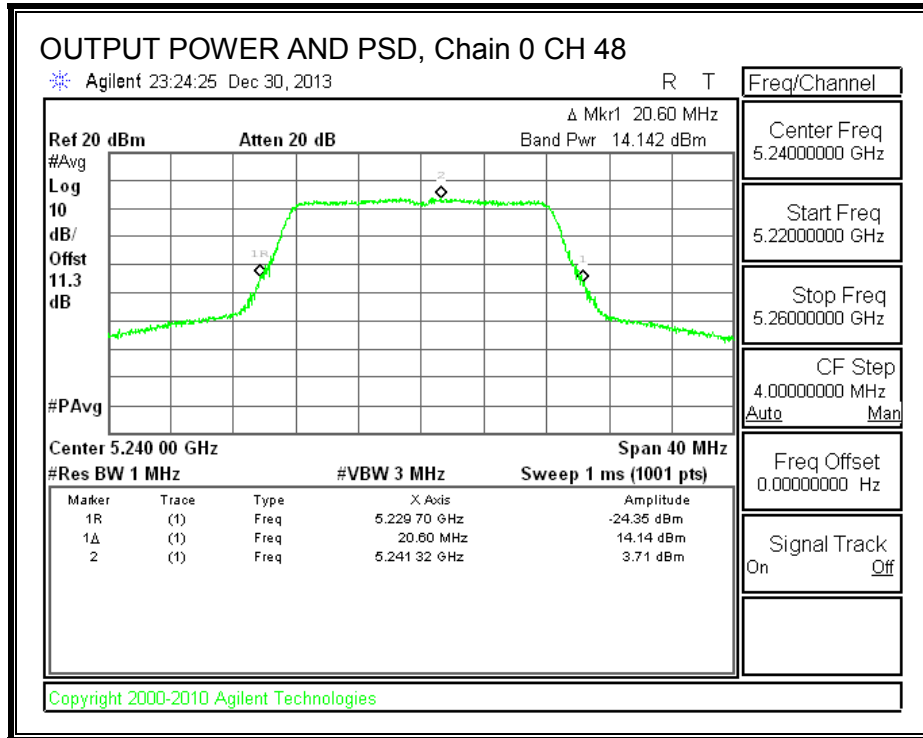
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
36	5180	12.87	13.09	17.00	-3.91
40	5200	14.24	14.46	17.00	-2.54
48	5240	14.14	14.36	17.00	-2.64

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
36	5180	1.70	1.92	4.00	-2.08
40	5200	3.76	3.98	4.00	-0.02
48	5240	3.71	3.93	4.00	-0.07

OUTPUT POWER AND PSD, Chain 0





8.2. 802.11n HT20 1TX SISO MODE IN THE 5.2 GHz BAND

8.2.1. 26 dB BANDWIDTH

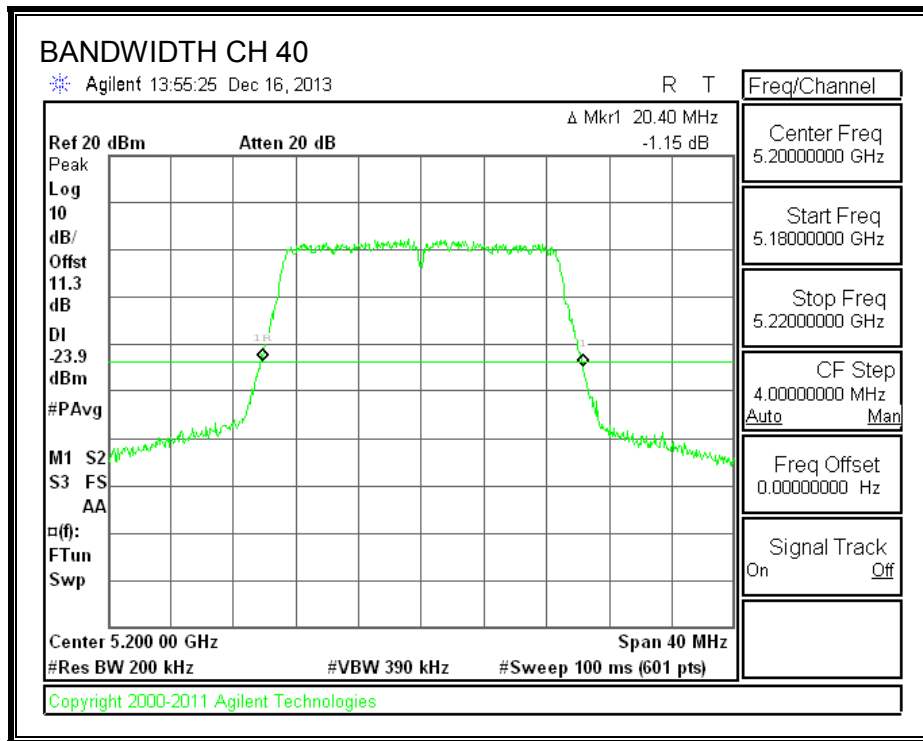
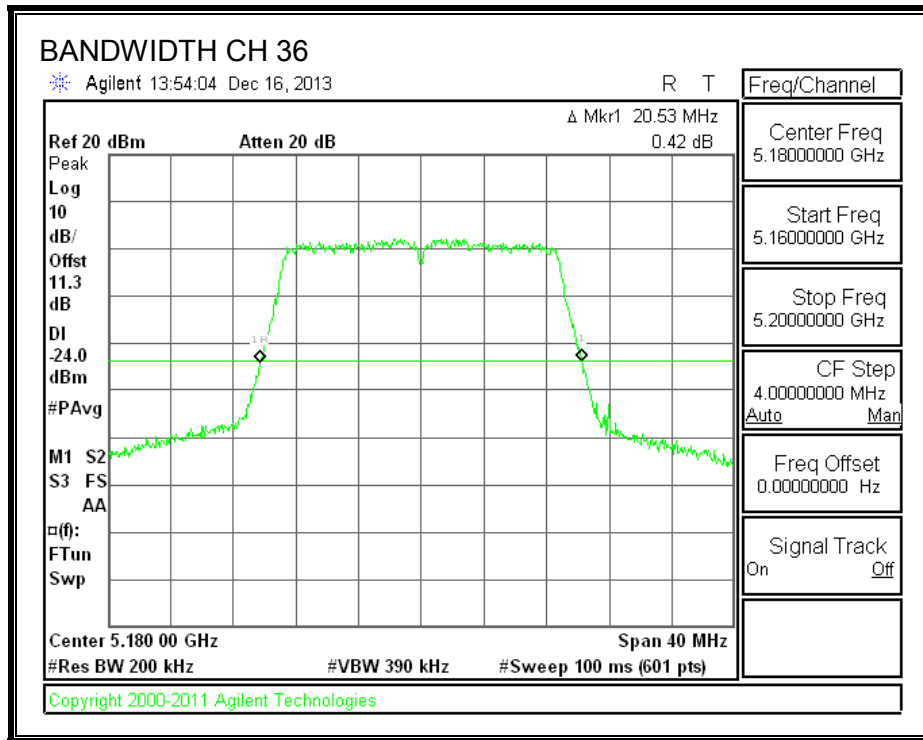
LIMITS

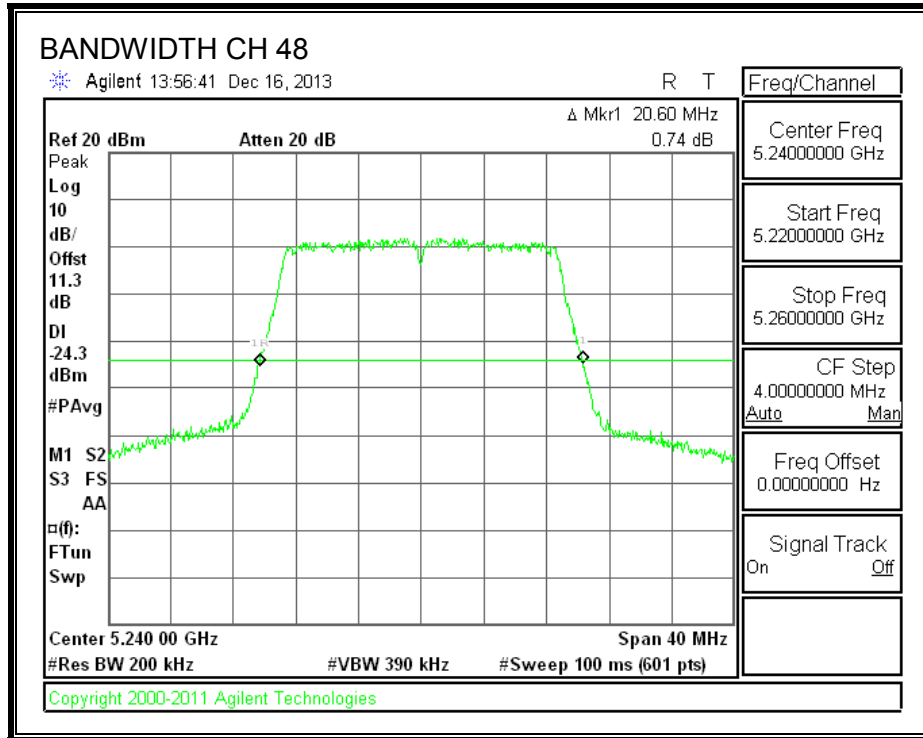
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	20.53
40	5200	20.40
48	5240	20.60

26 dB BANDWIDTH





8.2.2. 99% BANDWIDTH

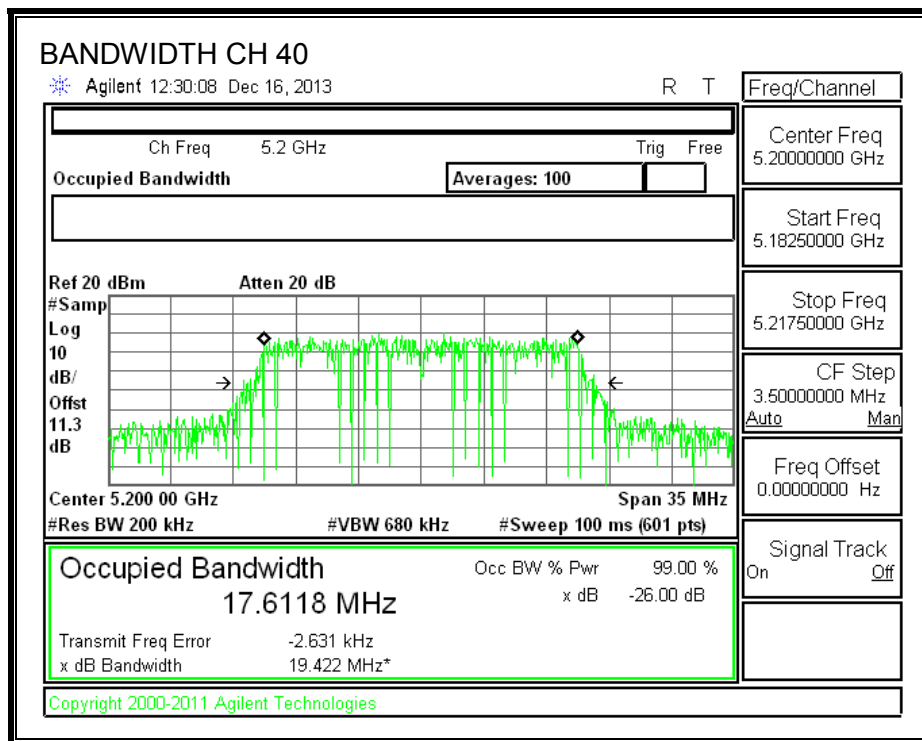
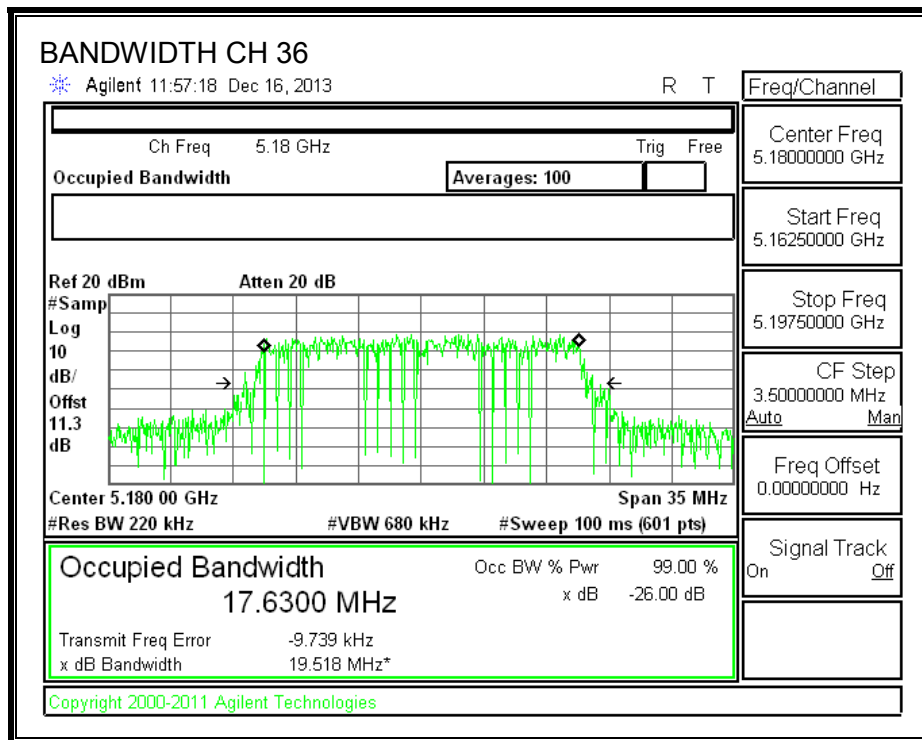
LIMITS

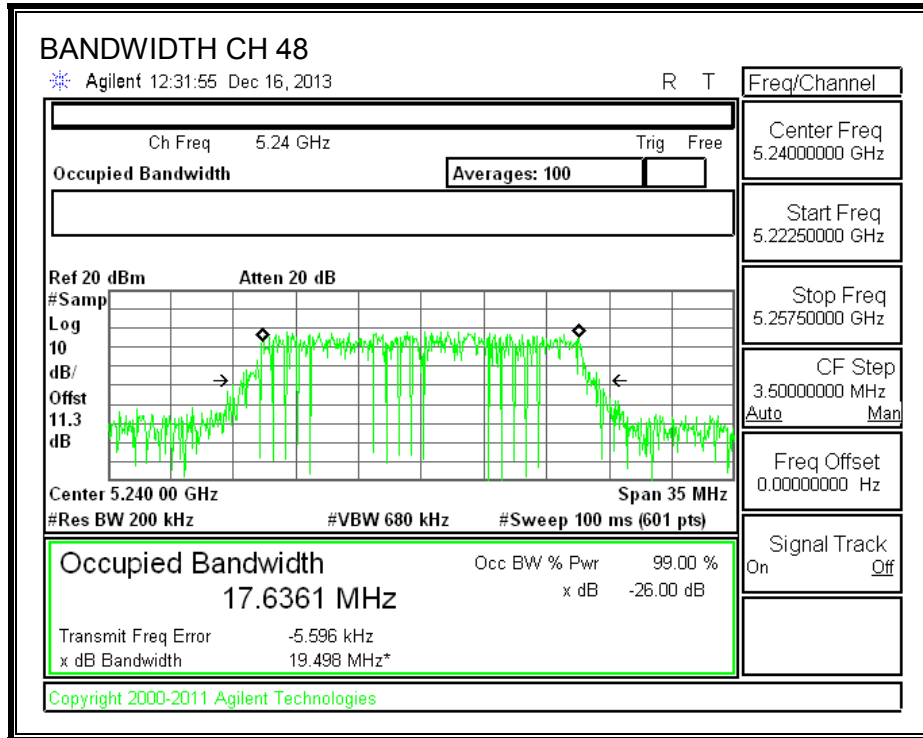
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
36	5180	17.6300
40	5200	17.6118
48	5240	17.6361

99% BANDWIDTH





8.2.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.26 dB (including 10 dB pad and 1.26 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
36	5180	12.17
40	5200	14.05
48	5240	13.89

8.2.4. OUTPUT POWER AND PSD

LIMITS

FCC §15.407 (a) (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26–dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Bandwidth and Antenna Gain

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Min 99% BW (MHz)	Directional Gain (dBi)
36	5180	20.5	17.6	2.25
40	5200	20.4	17.6	2.25
48	5240	20.6	17.6	2.25

Limits

Channel	Frequency (MHz)	FCC Power Limit (dBm)	IC EIRP Limit (dBm)	Max IC Power (dBm)	Power Limit (dBm)	FCC PSD Limit (dBm)	IC eirp PSD Limit (dBm)	PSD Limit (dBm)
36	5180	17.00	22.46	20.21	17.00	4.00	10.00	4.00
40	5200	17.00	22.46	20.21	17.00	4.00	10.00	4.00
48	5240	17.00	22.46	20.21	17.00	4.00	10.00	4.00

Duty Cycle CF (dB)	0.22	Included in Calculations of Corr'd Power & PSD
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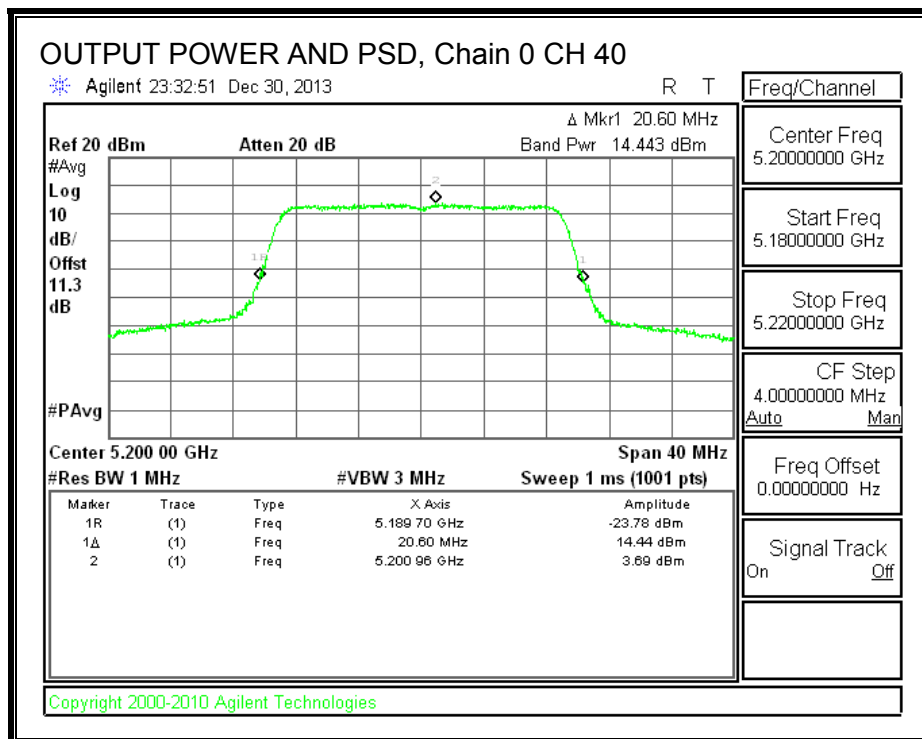
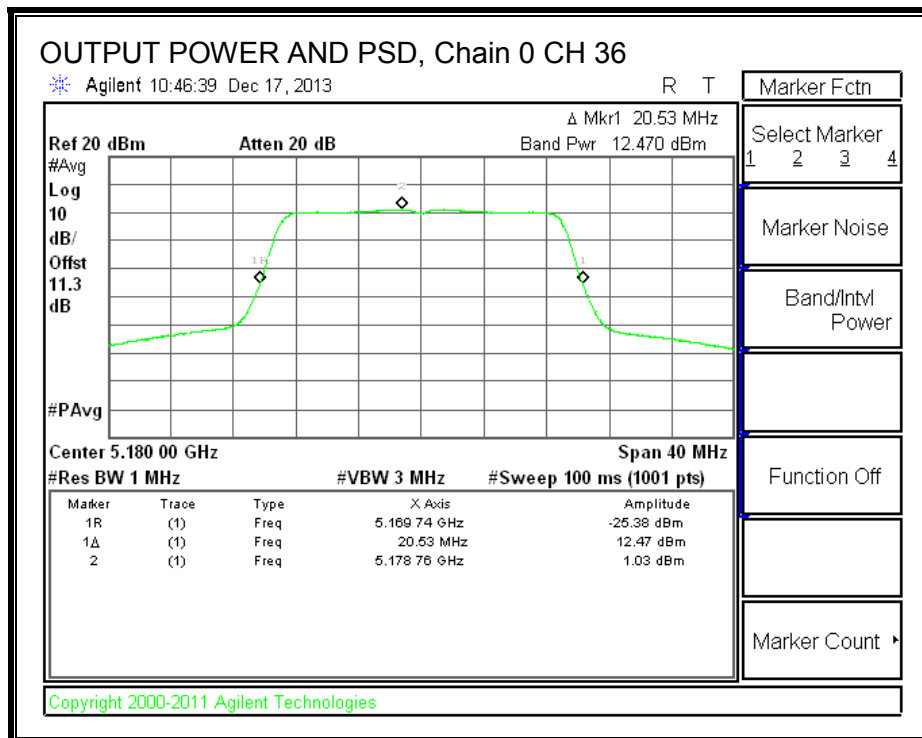
Output Power Results

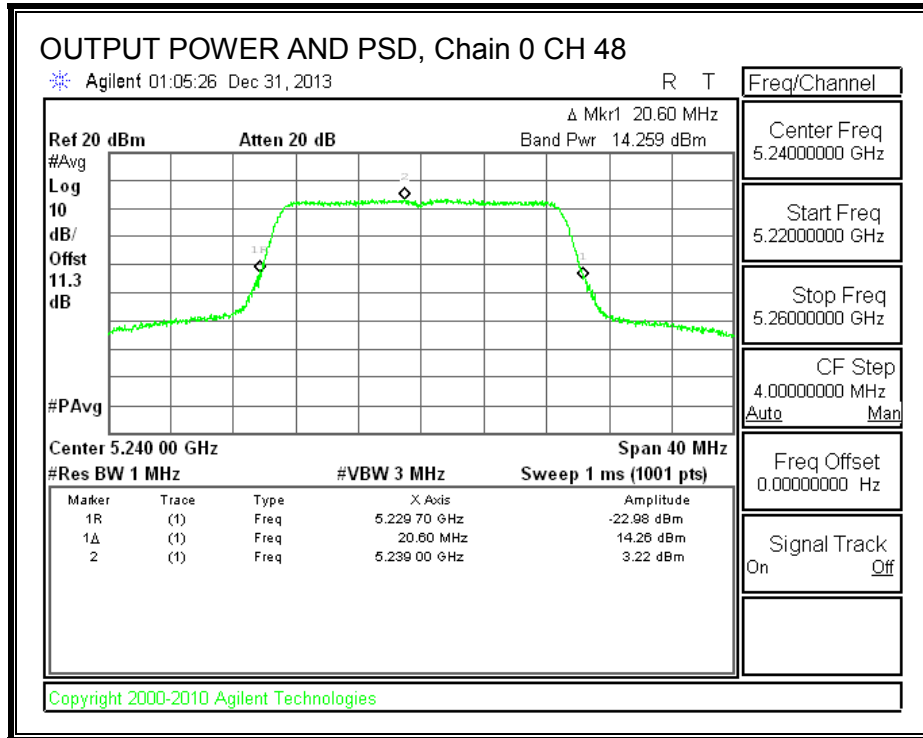
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
36	5180	12.47	12.69	17.00	-4.31
40	5200	14.44	14.66	17.00	-2.34
48	5240	14.26	14.48	17.00	-2.52

PSD Results

Channel	Frequency (MHz)	Chain 0 Meas PSD (dBm)	Total Corr'd PSD (dBm)	PSD Limit (dBm)	PSD Margin (dB)
36	5180	1.03	1.25	4.00	-2.75
40	5200	3.69	3.91	4.00	-0.09
48	5240	3.23	3.45	4.00	-0.55

OUTPUT POWER AND PSD, Chain 0





8.3. 802.11n HT20 3TX CDD MODE IN THE 5.2 GHZ BAND

8.3.1. 26 dB BANDWIDTH

LIMITS

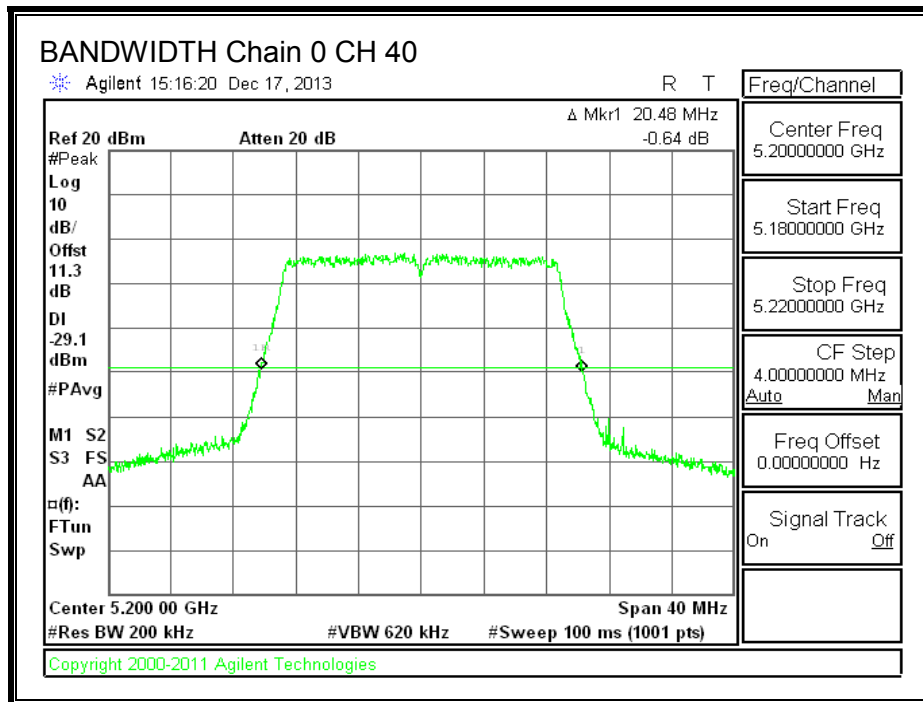
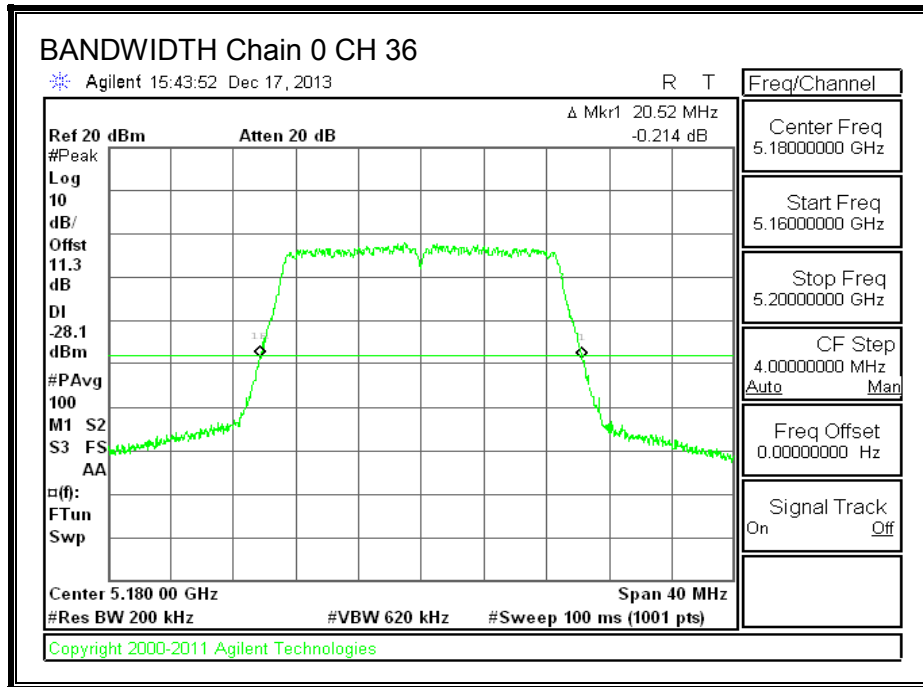
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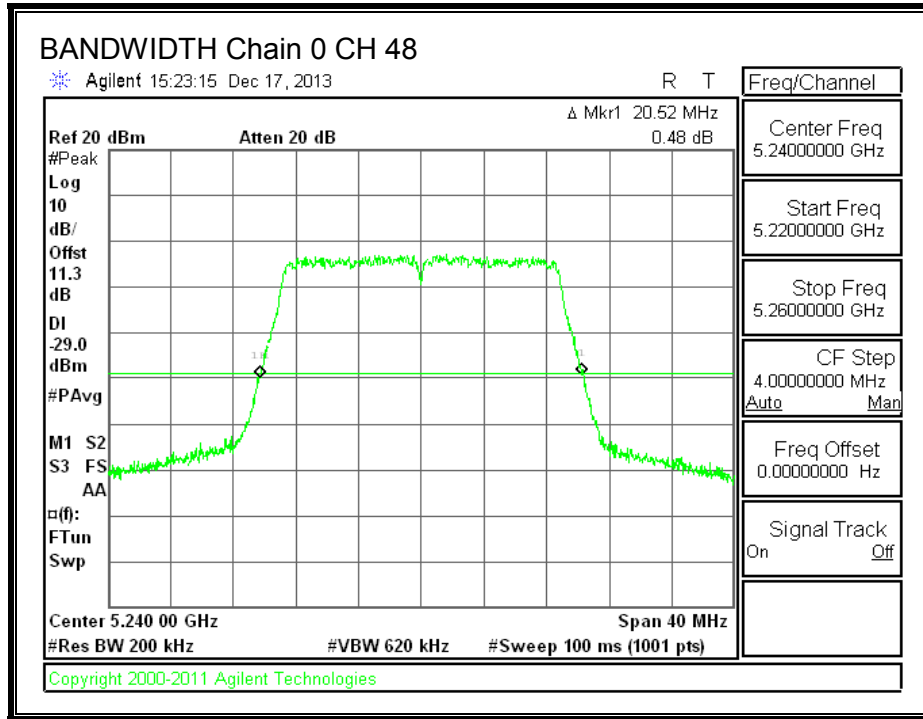
RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)	26 dB BW Chain 2 (MHz)
36	5180	20.52	20.32	20.40
40	5200	20.48	20.40	20.48
48	5240	20.52	20.48	20.44

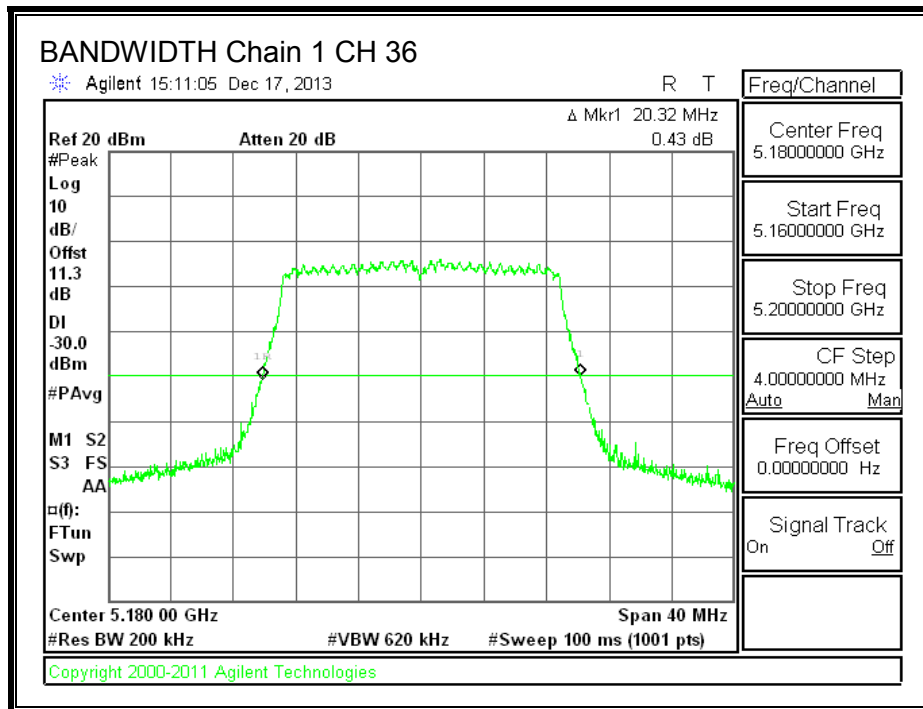
26 dB BANDWIDTH

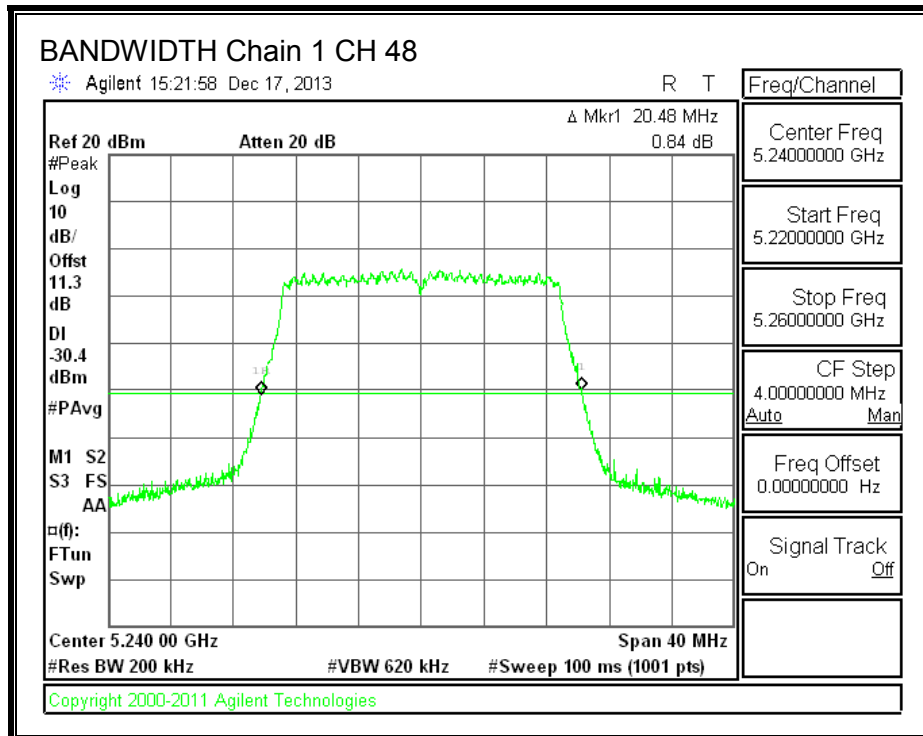
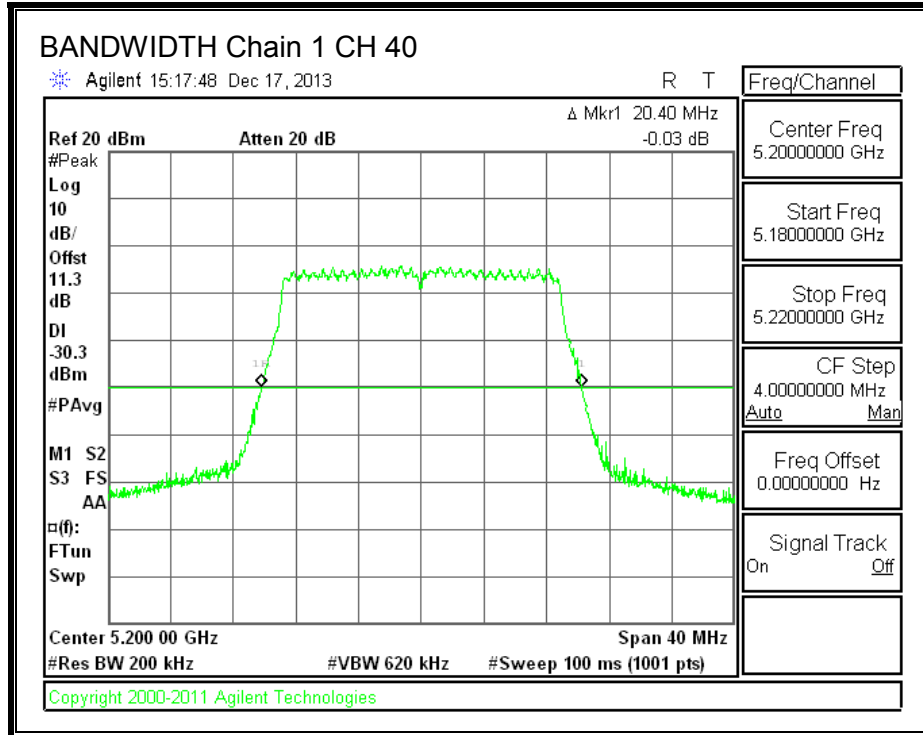
26 dB BANDWIDTH, Chain 0



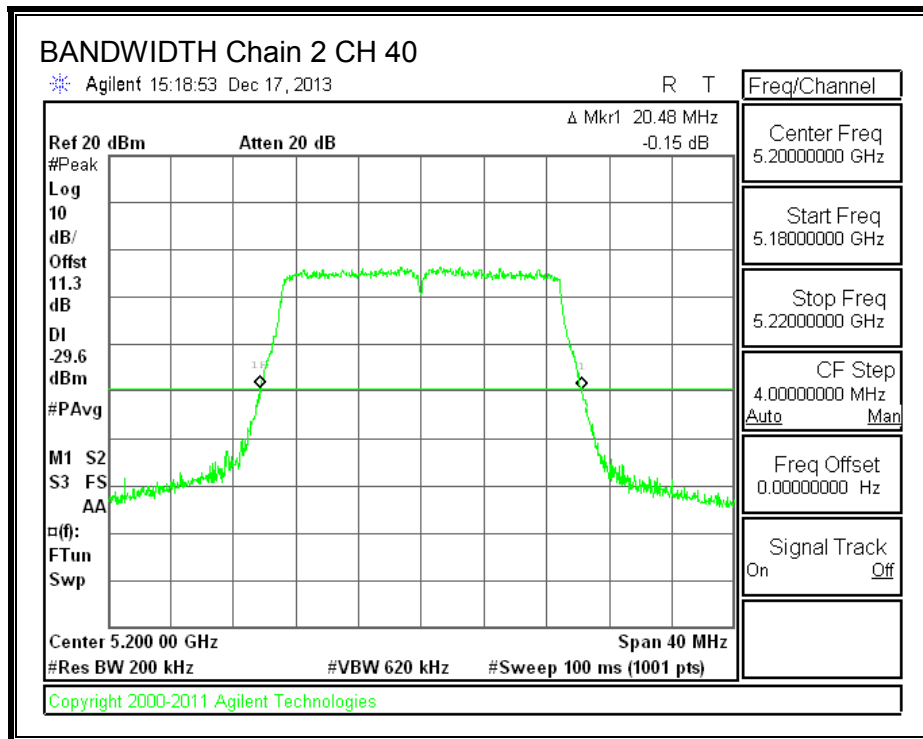
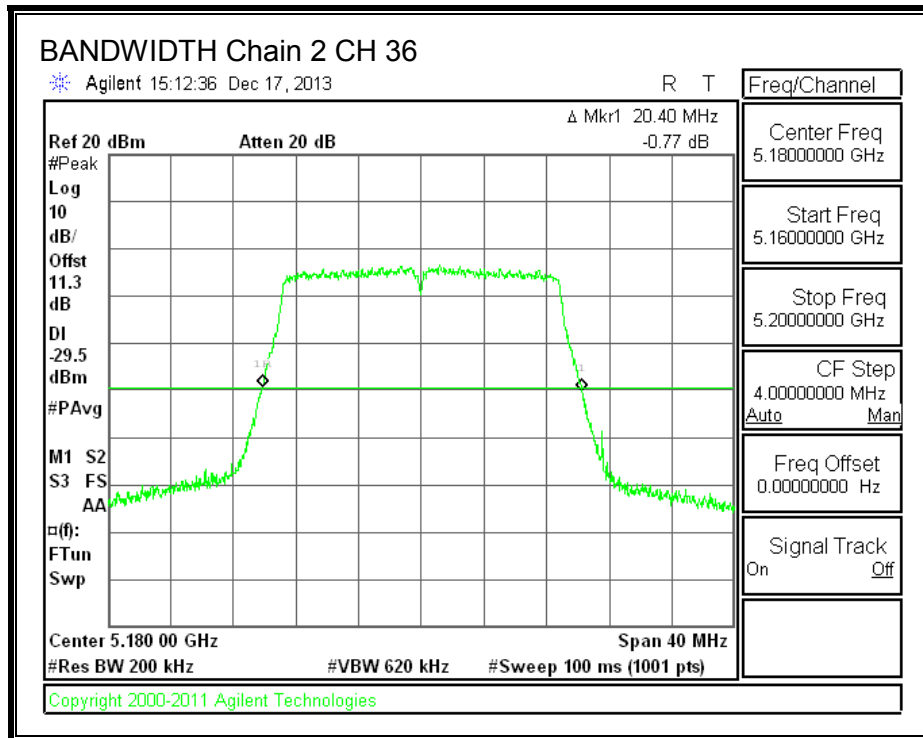


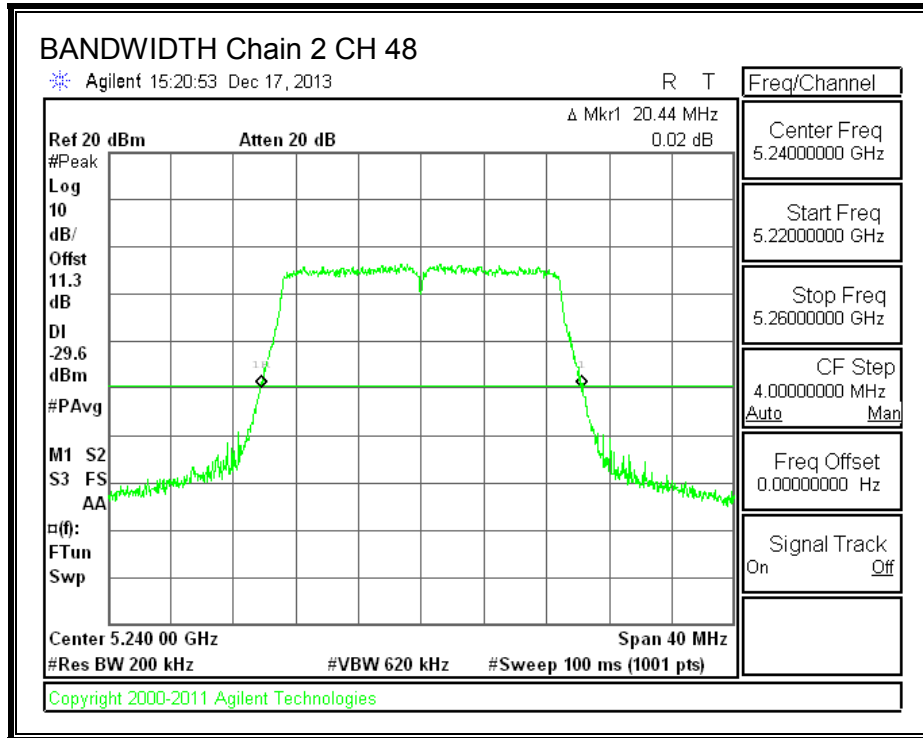
26 dB BANDWIDTH, Chain 1





26 dB BANDWIDTH, Chain 2





8.3.2. 99% BANDWIDTH

LIMITS

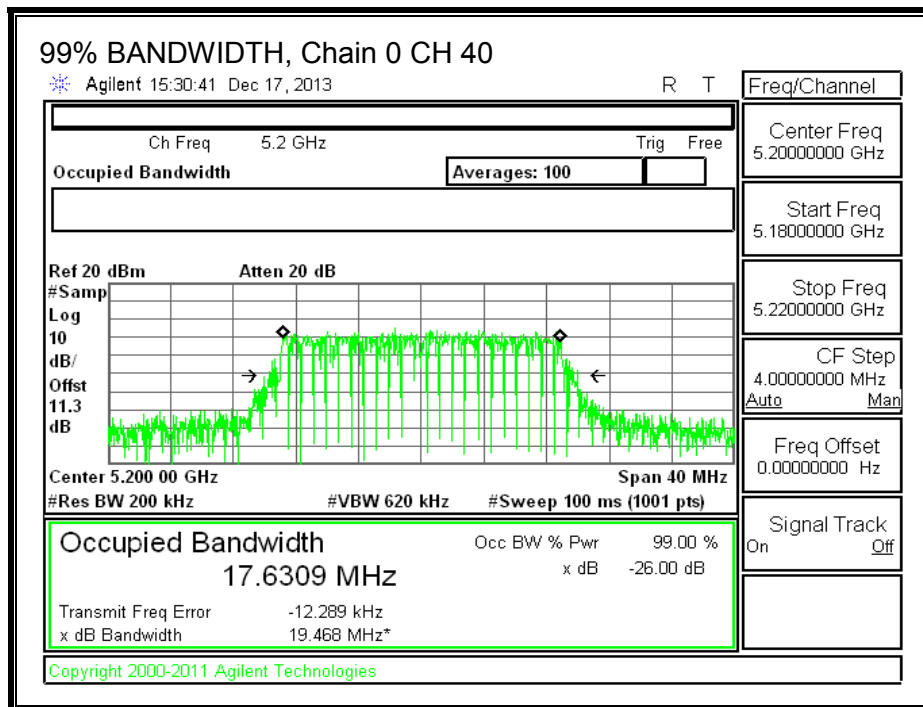
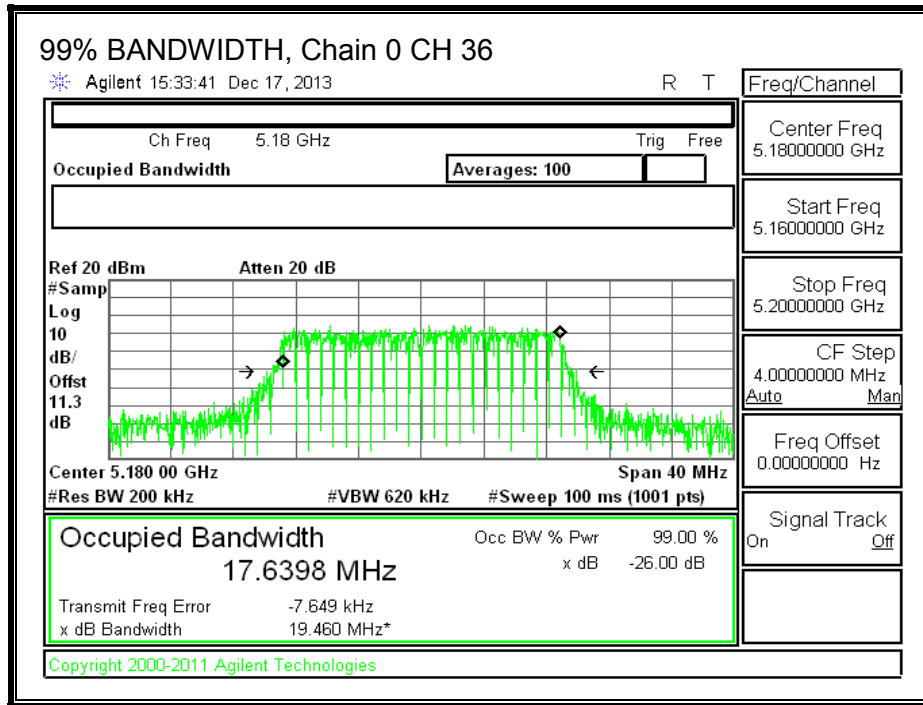
None; for reporting purposes only.

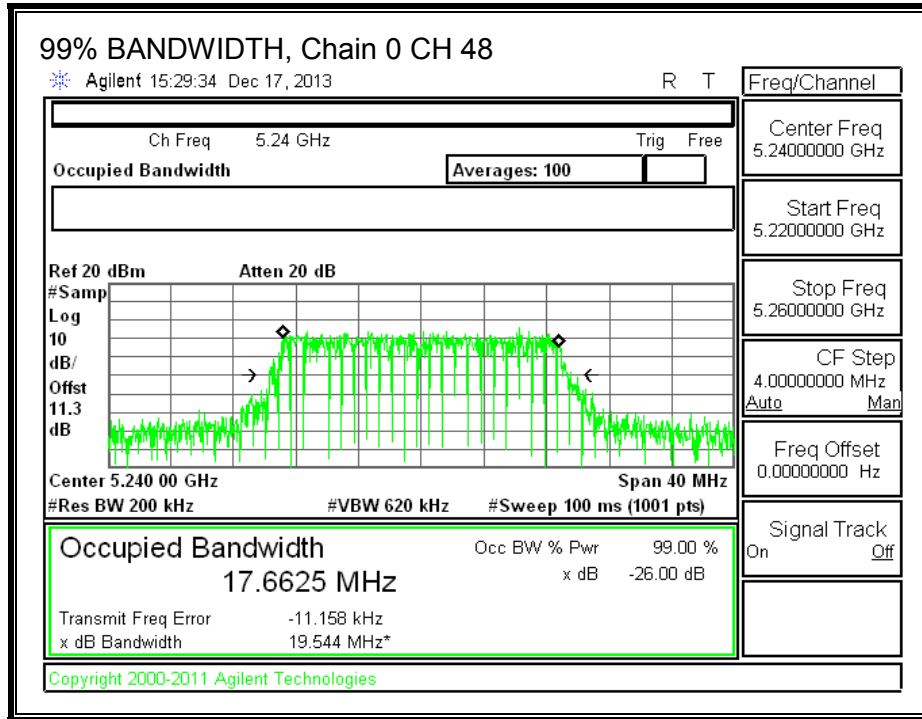
RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)	99% BW Chain 2 (MHz)
36	5180	17.6398	17.6339	17.6331
40	5200	17.6309	17.6385	17.6374
48	5240	17.6625	17.6516	17.6454

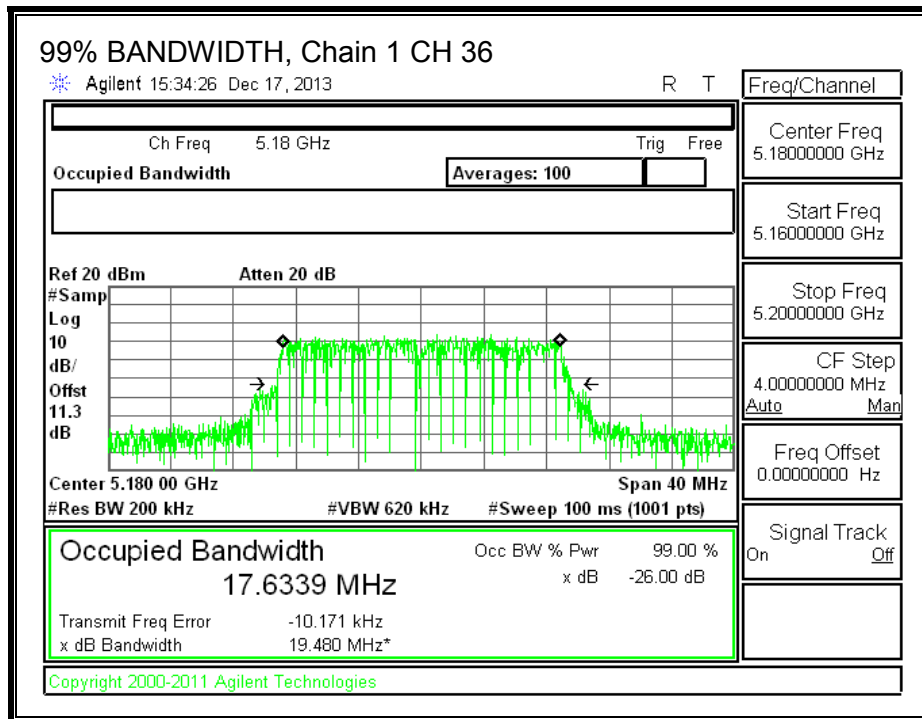
99% BANDWIDTH

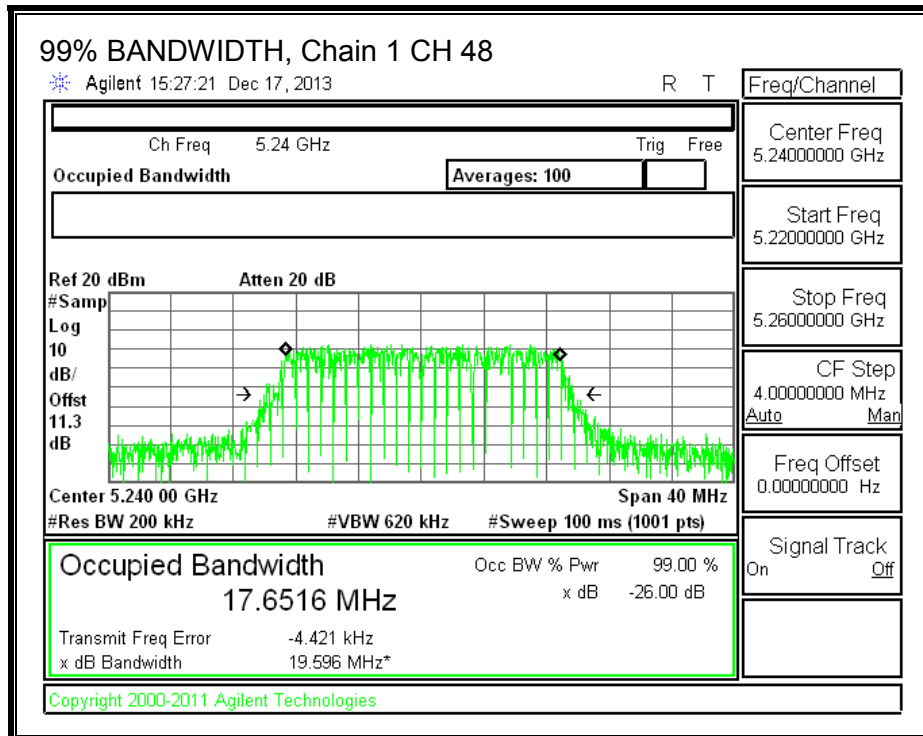
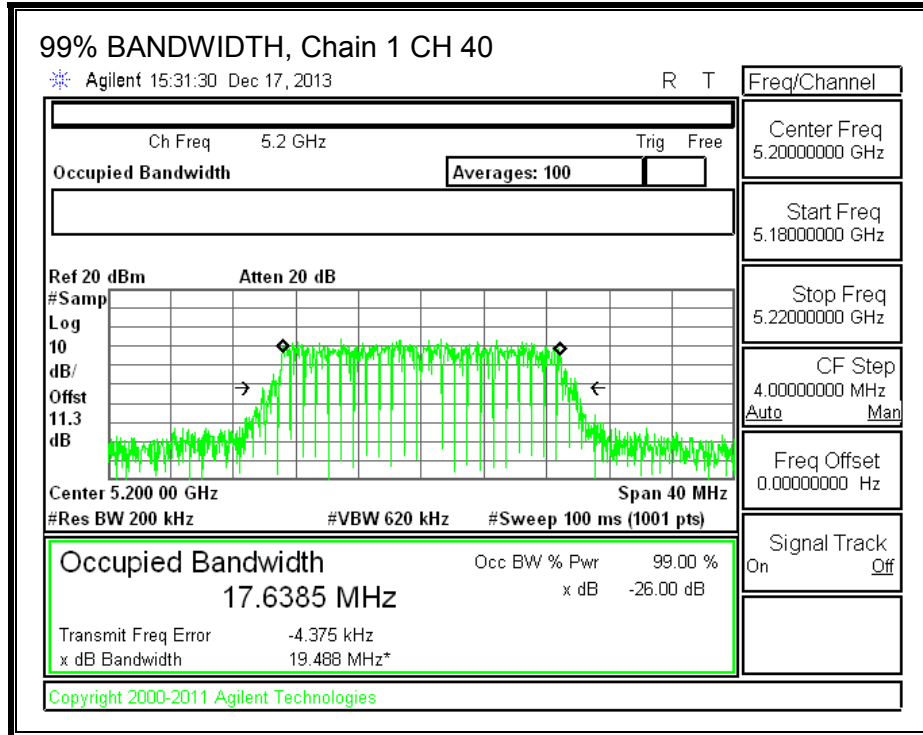
99% BANDWIDTH, Chain 0



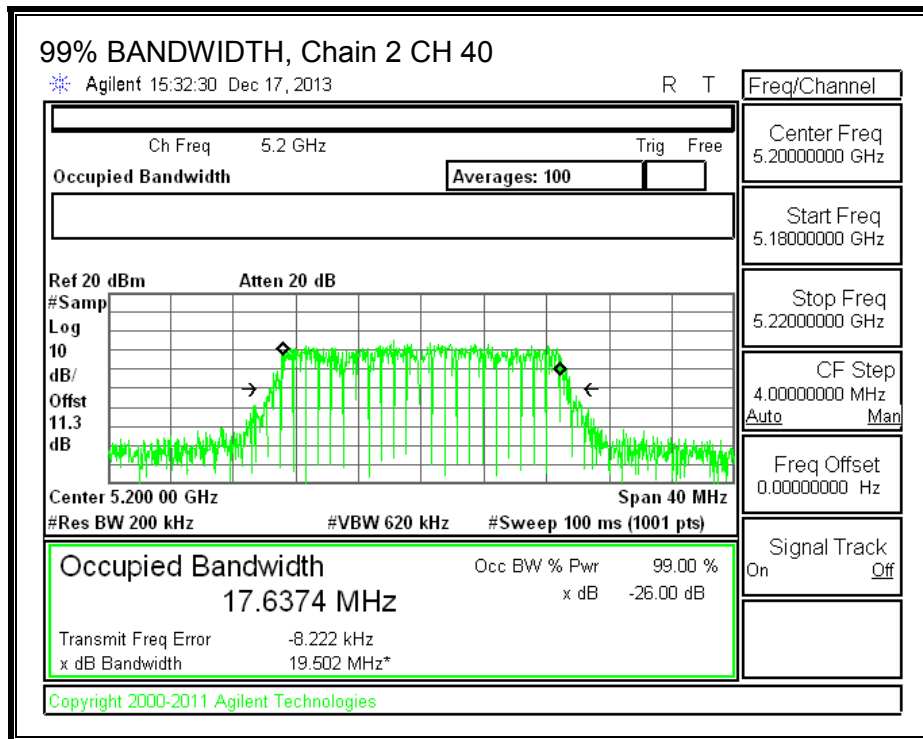
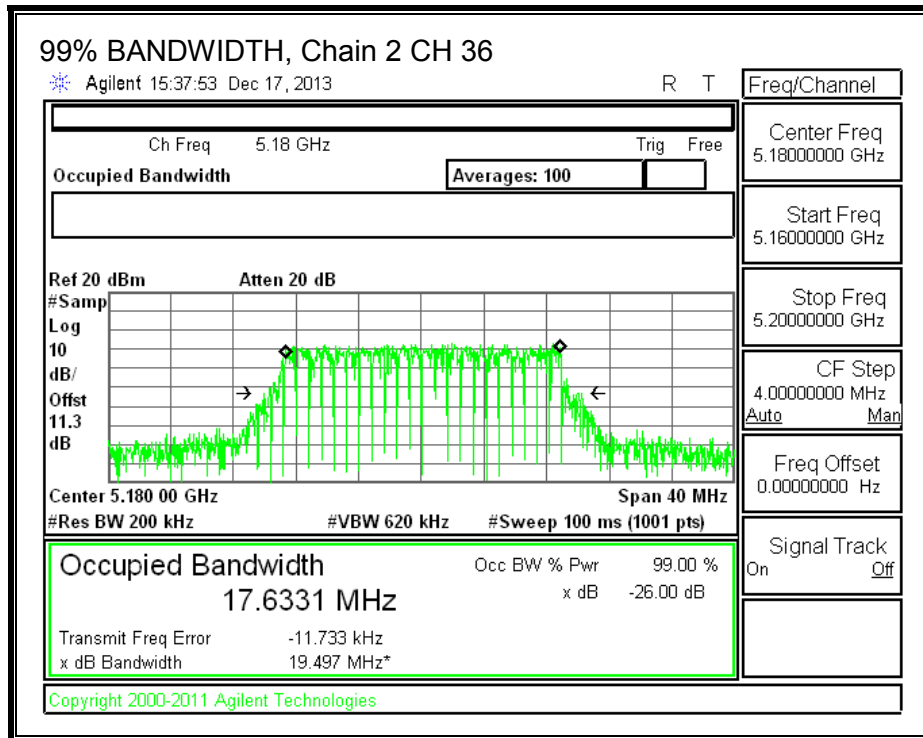


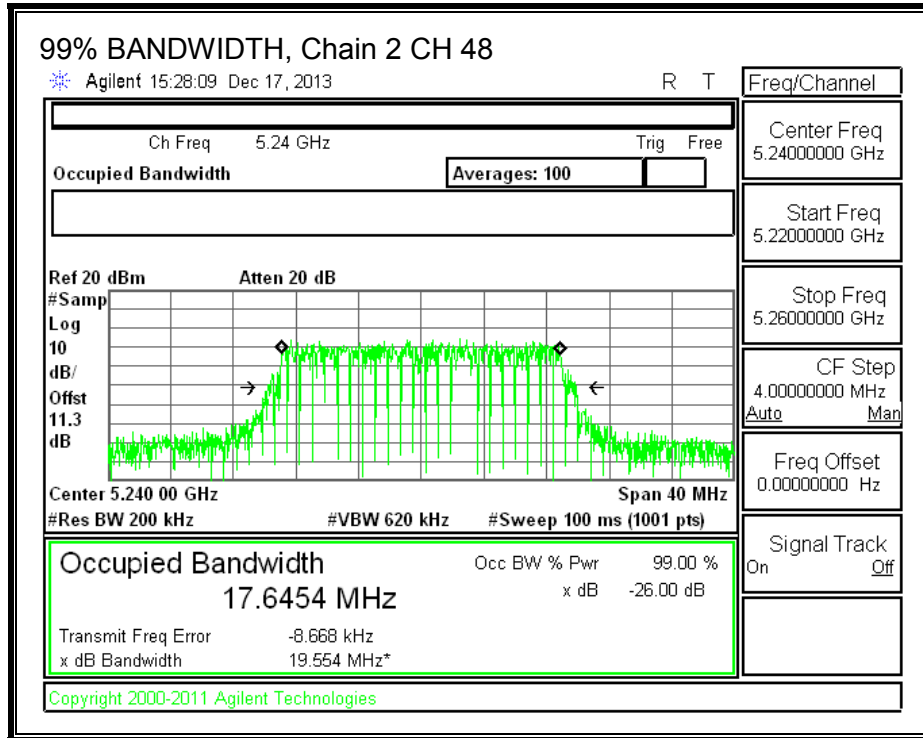
99% BANDWIDTH, Chain 1





99% BANDWIDTH, Chain 2





8.3.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.26 dB (including 10 dB pad and 1.26 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Average Power Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
36	5180	7.48	6.12	6.97	11.66
40	5200	8.38	7.55	8.43	12.91
48	5240	8.21	7.09	8.24	12.65

8.3.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26–dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are correlated and the antenna gain is the same for each chain. The directional gain is:

Antenna Gain (dBi)	10 * Log (3 chains) (dB)	Correlated Chains Directional Gain (dBi)
2.25	4.77	7.02

RESULTS

Bandwidth and Antenna Gain

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Min 99% BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PPSD (dBi)
36	5180	20.52	17.6398	2.25	7.02
40	5200	20.48	17.6309	2.25	7.02
48	5240	20.52	17.6625	2.25	7.02

Limits

Channel	Frequency (MHz)	FCC Power Limit (dBm)	IC EIRP Limit (dBm)	Max IC Power (dBm)	Power Limit (dBm)	FCC PPSD Limit (dBm)	IC eirp PSD Limit (dBm)	PPSD Limit (dBm)
36	5180	17.00	22.46	20.21	17.00	2.98	10.00	2.98
40	5200	17.00	22.46	20.21	17.00	2.98	10.00	2.98
48	5240	17.00	22.47	20.22	17.00	2.98	10.00	2.98

Duty Cycle CF (dB)	0.22	Included in Calculations of Corr'd Power & PPSD
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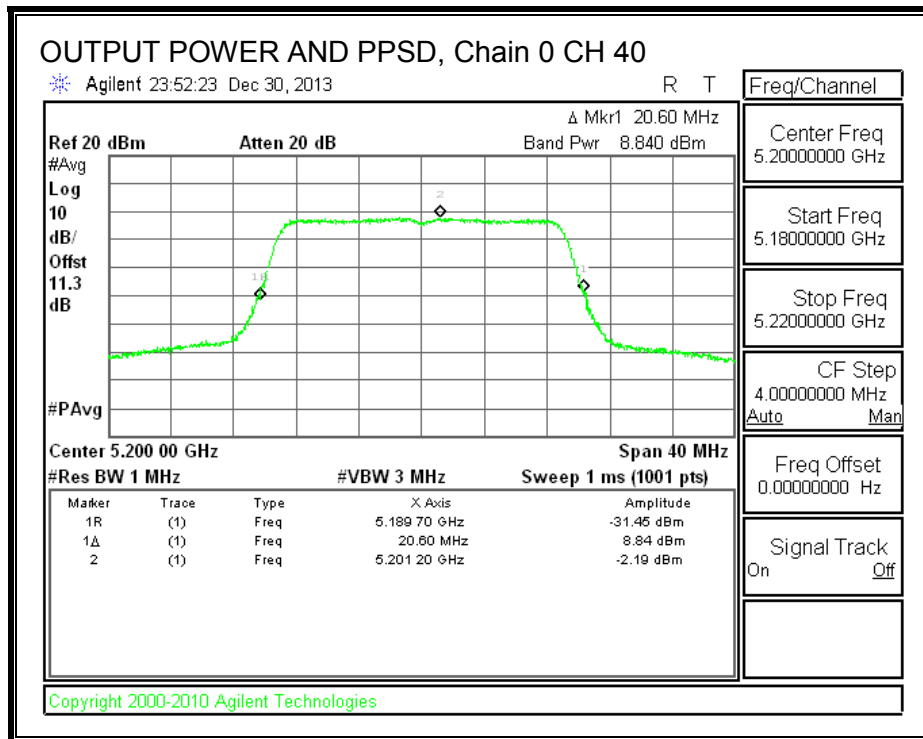
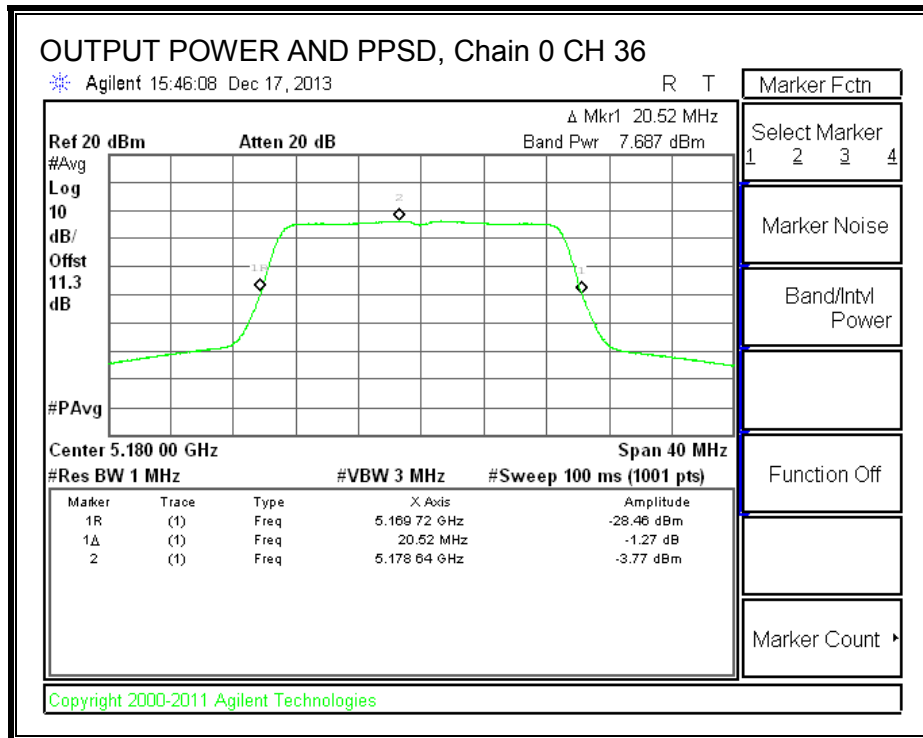
Output Power Results

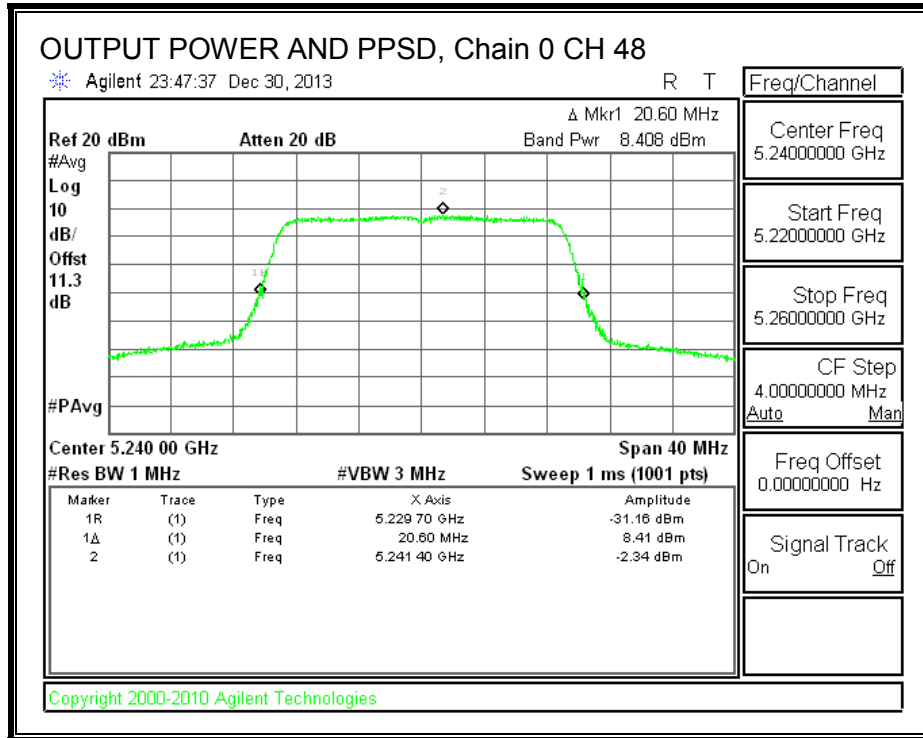
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
36	5180	7.69	6.54	7.00	12.09	17.00	-4.91
40	5200	8.84	7.72	8.60	13.40	17.00	-3.60
48	5240	8.41	7.40	8.21	13.02	17.00	-3.98

PPSD Results

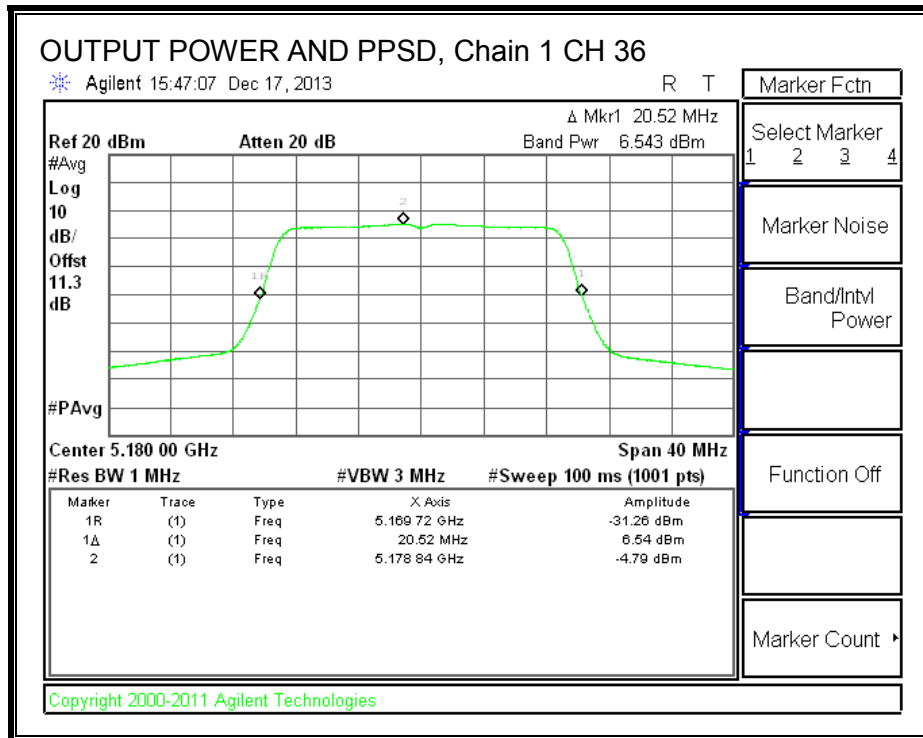
Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Chain 2 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
36	5180	-3.77	-4.79	-4.41	0.69	2.98	-2.29
40	5200	-2.19	-3.03	-2.51	2.43	2.98	-0.55
48	5240	-2.34	-3.46	-2.32	2.32	2.98	-0.66

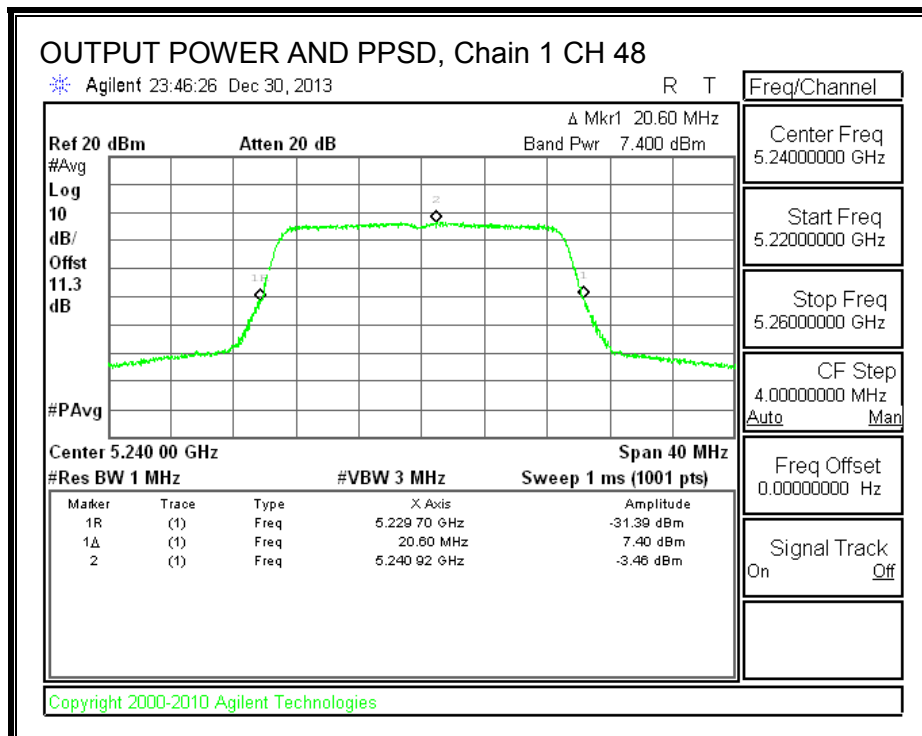
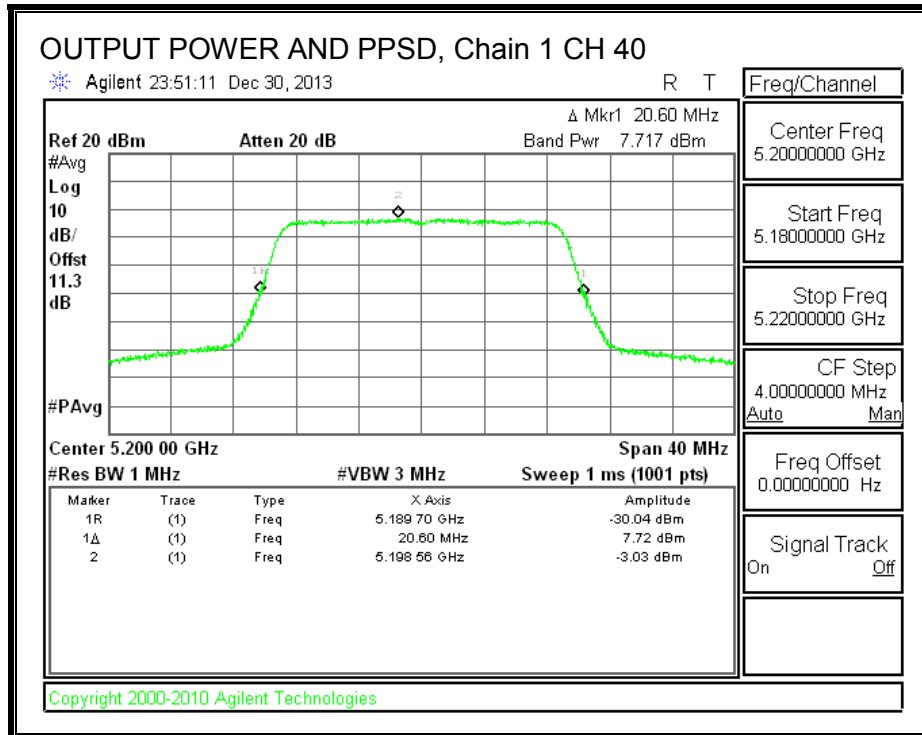
OUTPUT POWER AND PPSD, Chain 0



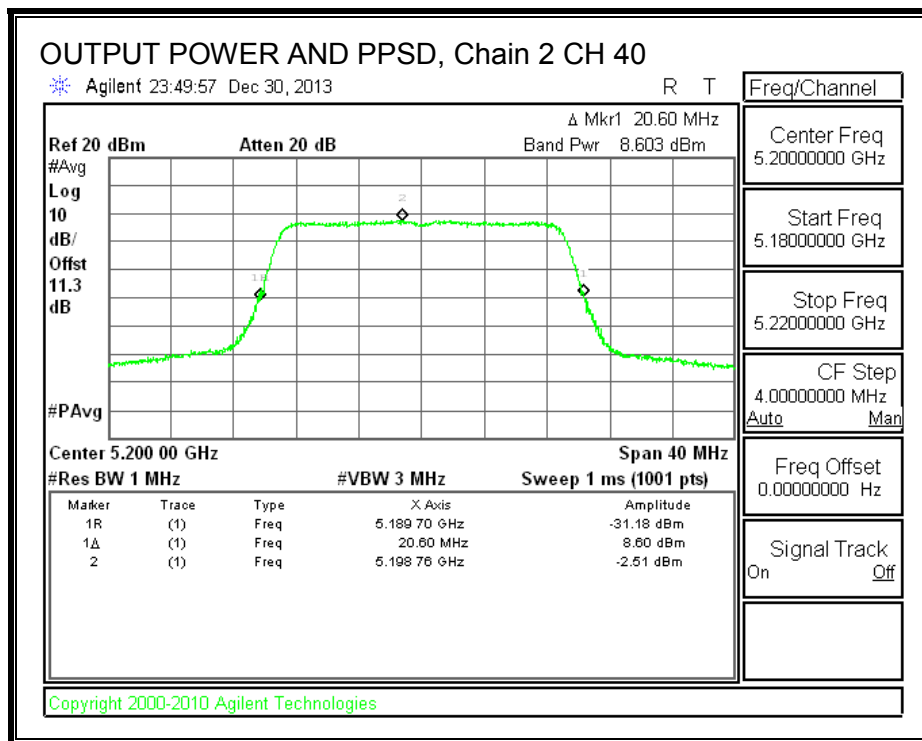
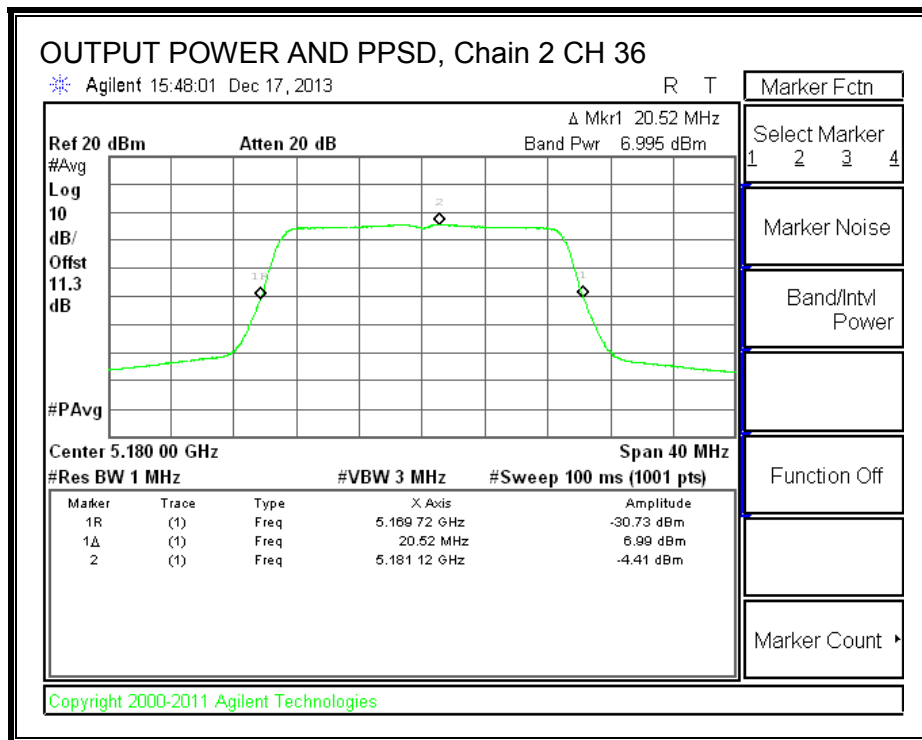


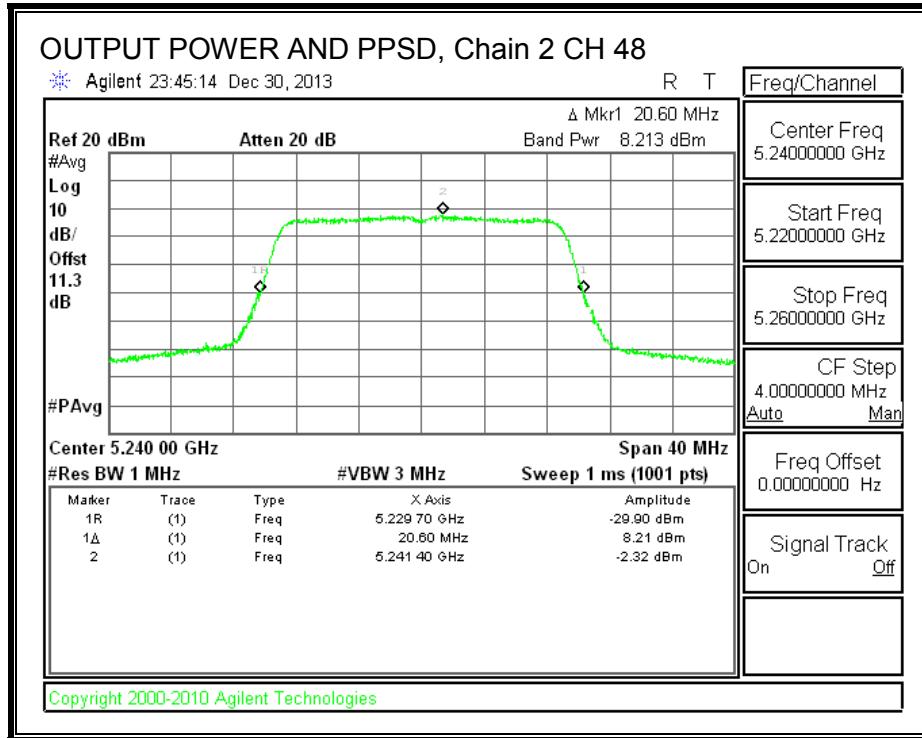
OUTPUT POWER AND PPSD, Chain 1





OUTPUT POWER AND PPSD, Chain 2





8.4. 802.11n HT20 3TX SDM MODE IN THE 5.2 GHz BAND

8.4.1. 26 dB BANDWIDTH

LIMITS

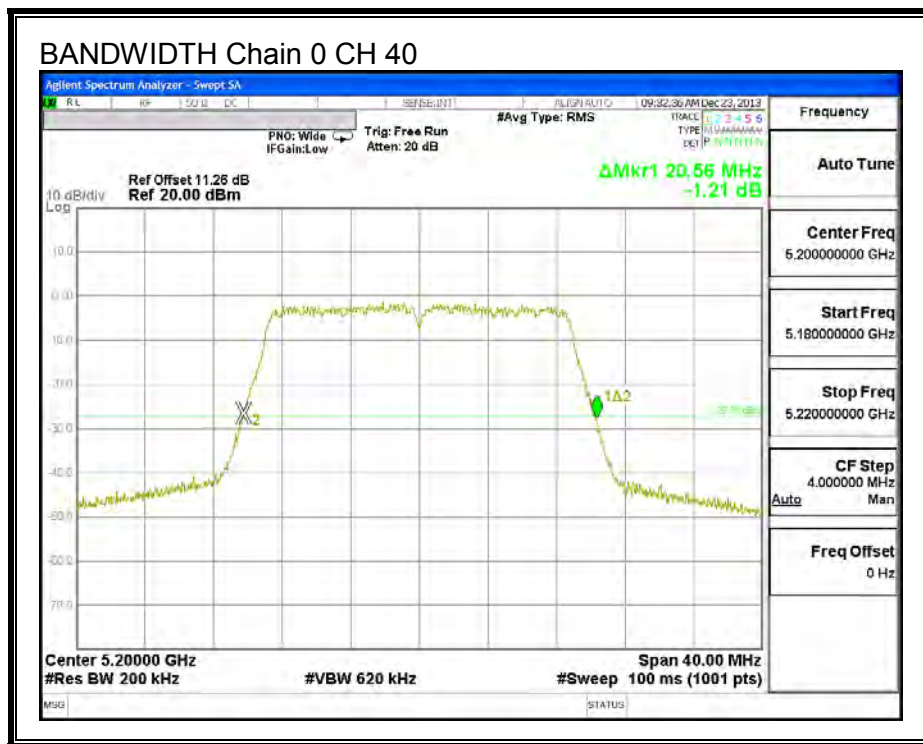
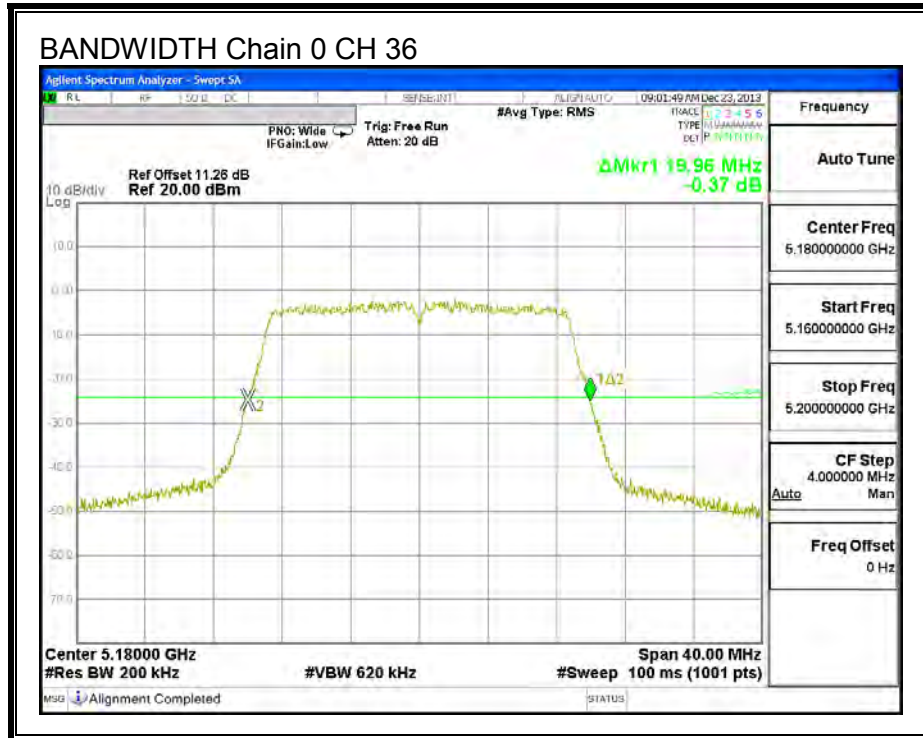
None; for reporting purposes only.

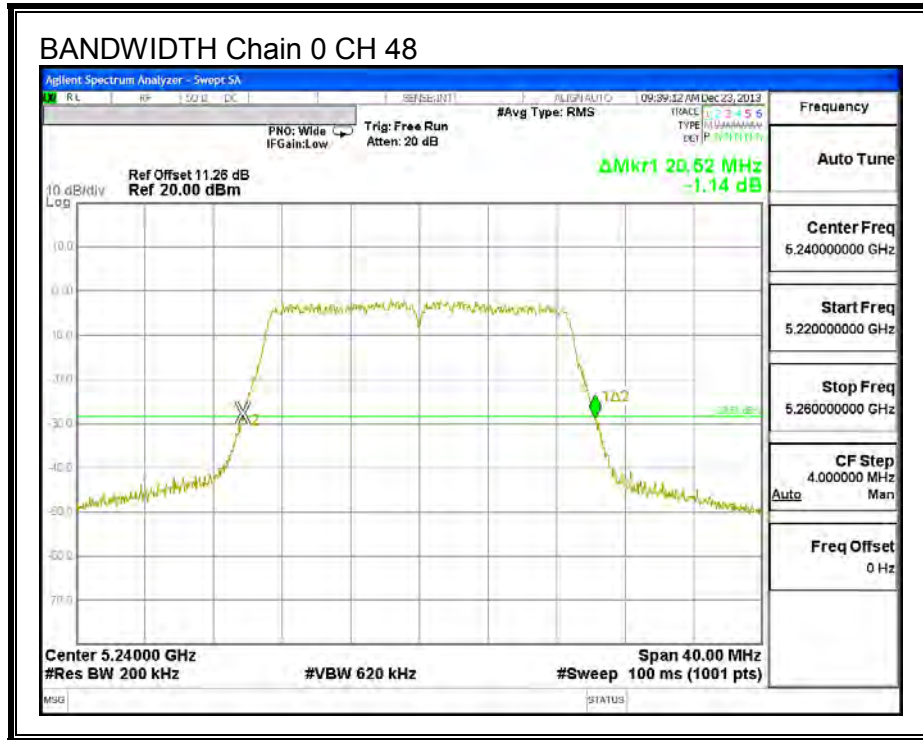
RESULTS

Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)	26 dB BW Chain 2 (MHz)
36	5180	19.96	20.32	20.40
40	5200	20.56	20.36	20.40
48	5240	20.52	20.36	20.44

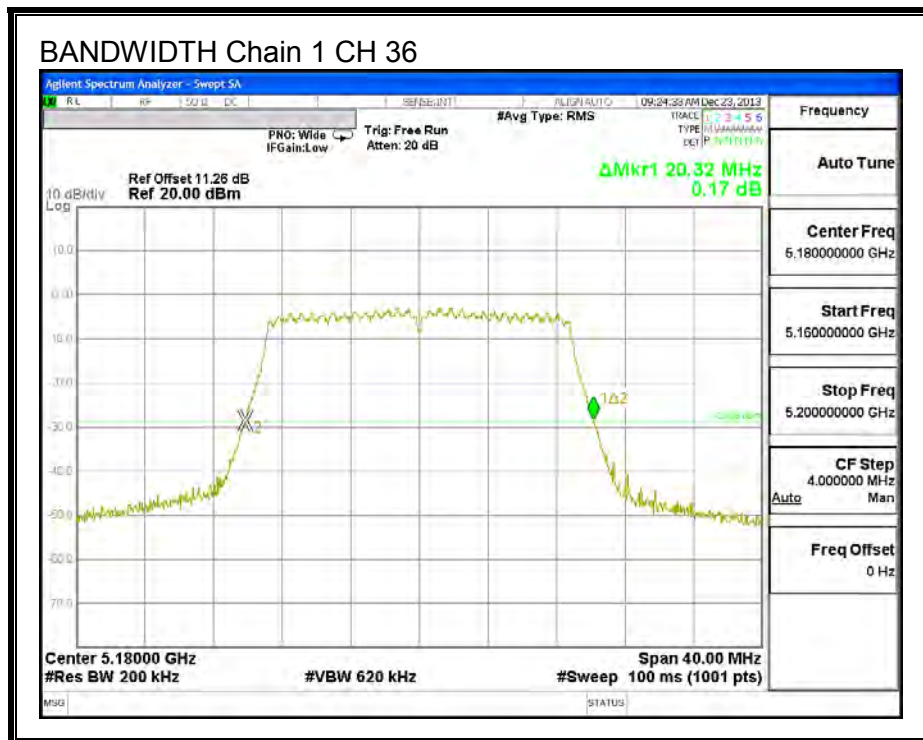
26 dB BANDWIDTH

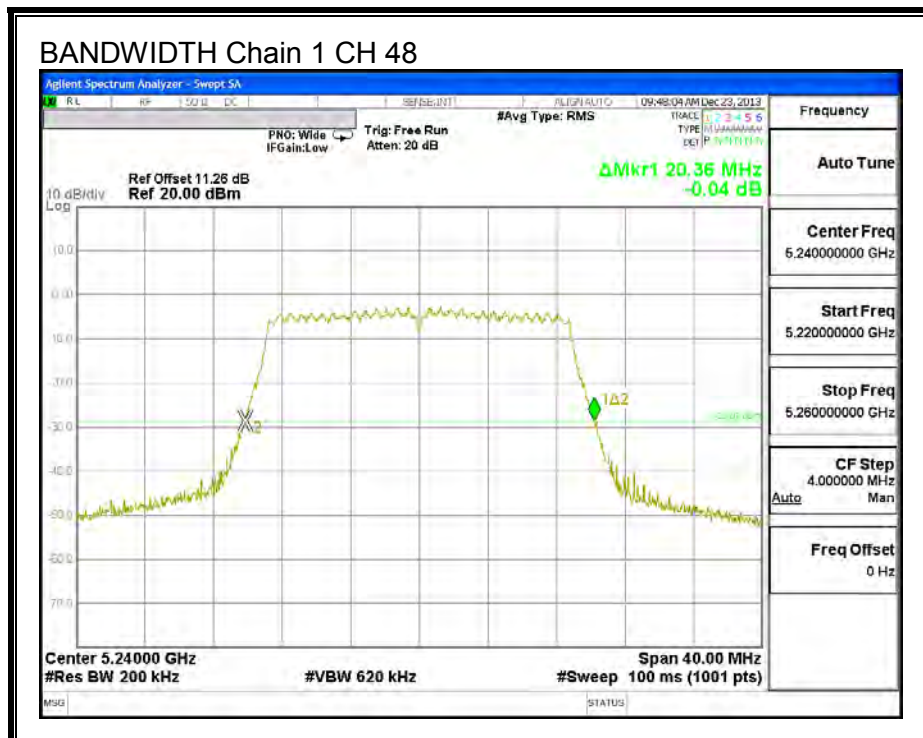
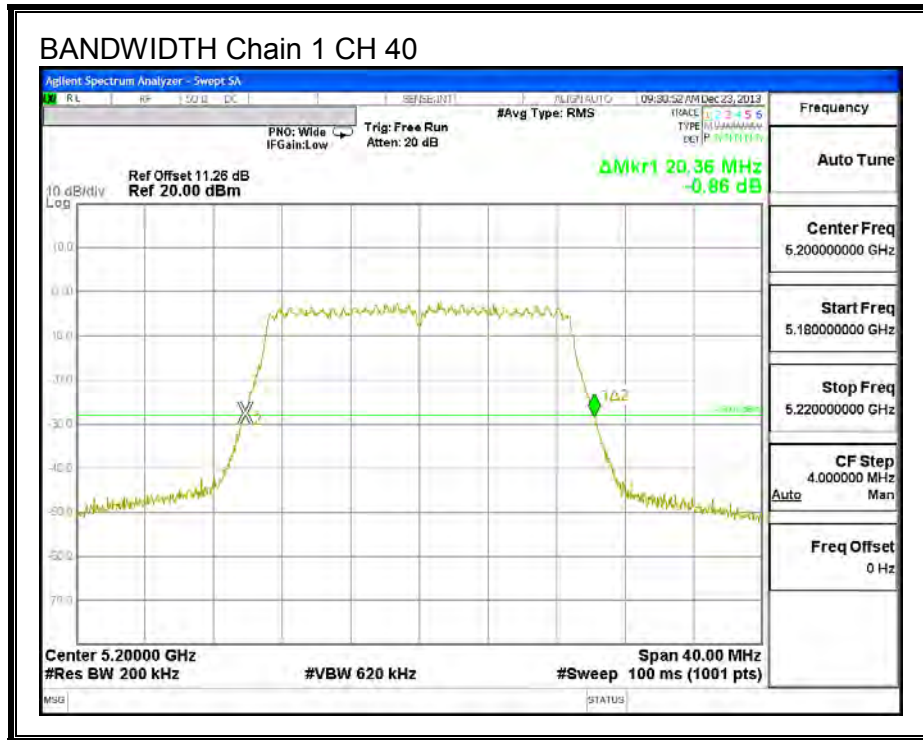
26 dB BANDWIDTH, Chain 0



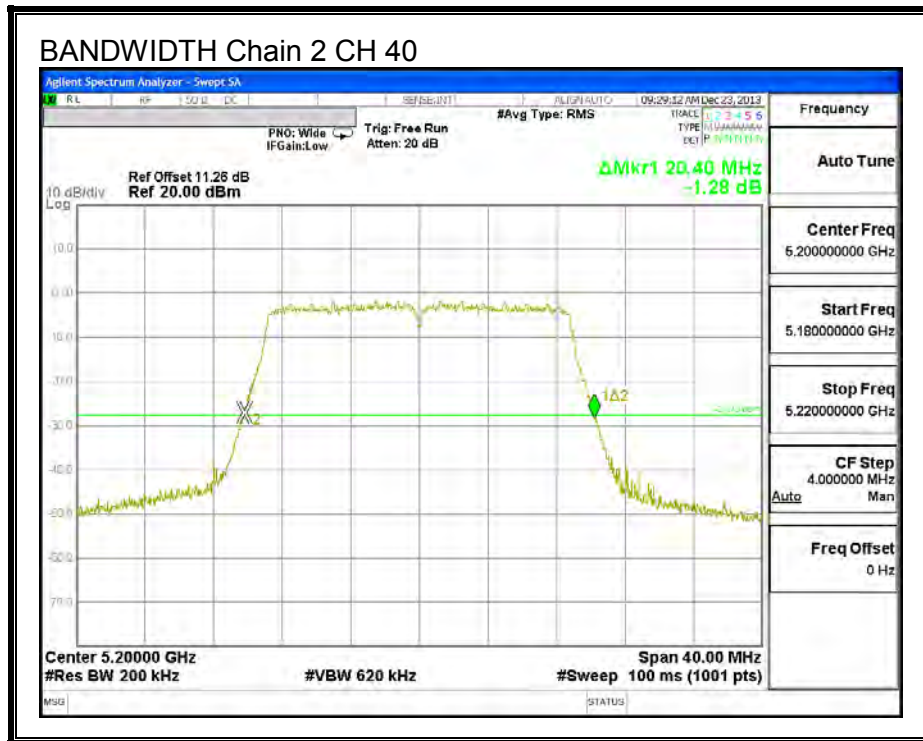
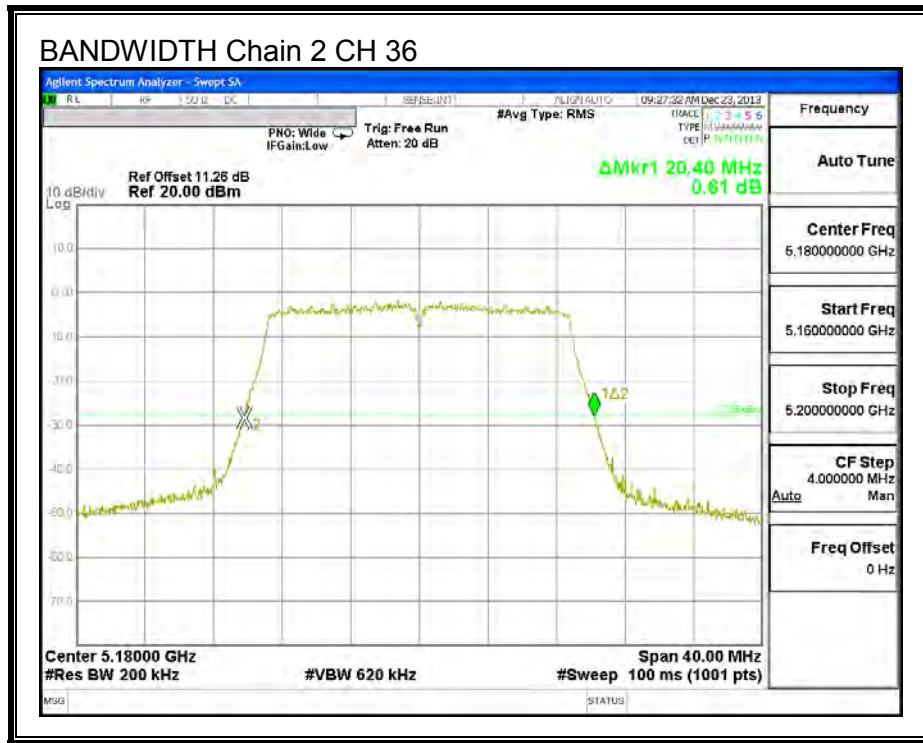


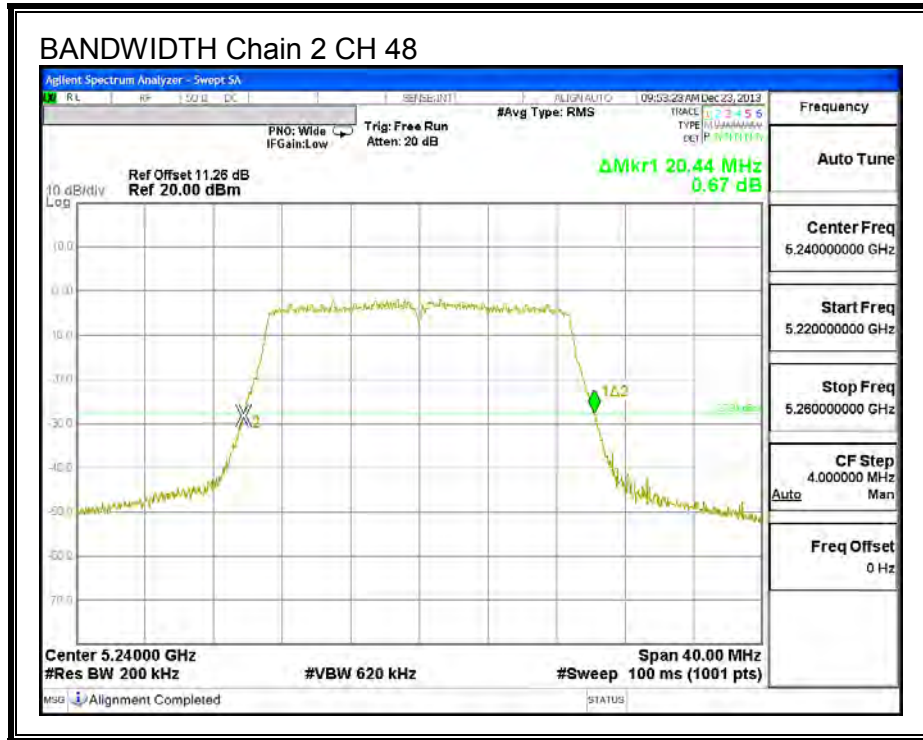
26 dB BANDWIDTH, Chain 1





26 dB BANDWIDTH, Chain 2





8.4.2. 99% BANDWIDTH

LIMITS

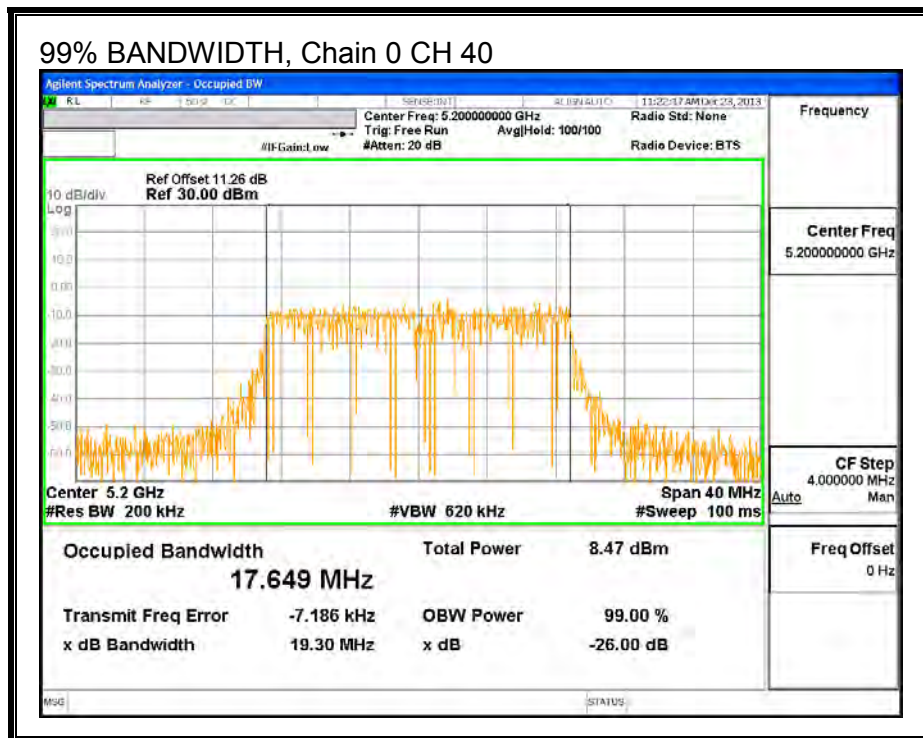
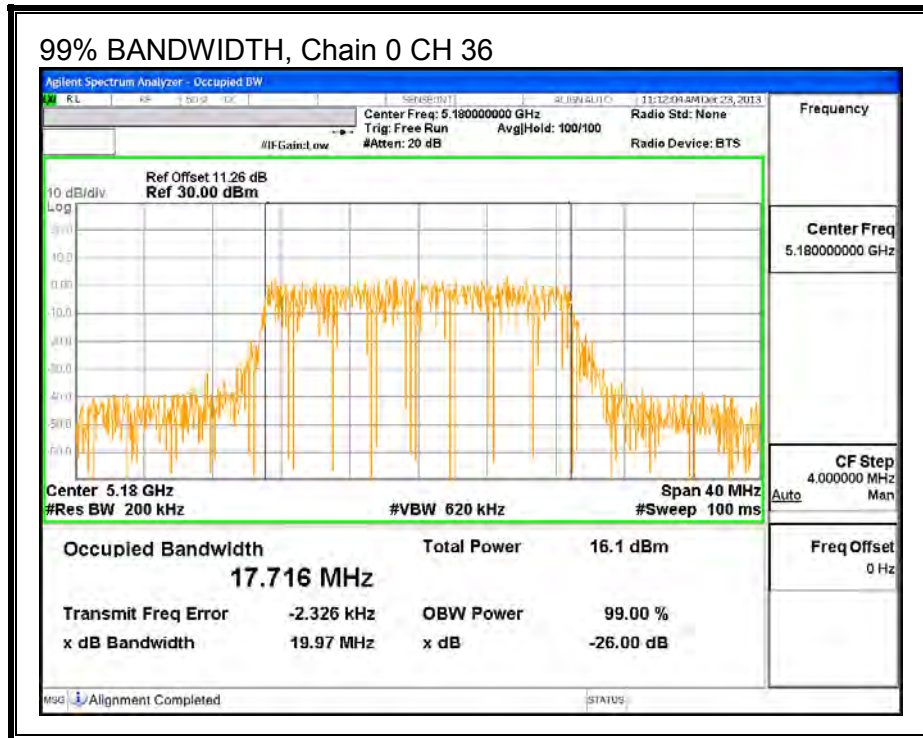
None; for reporting purposes only.

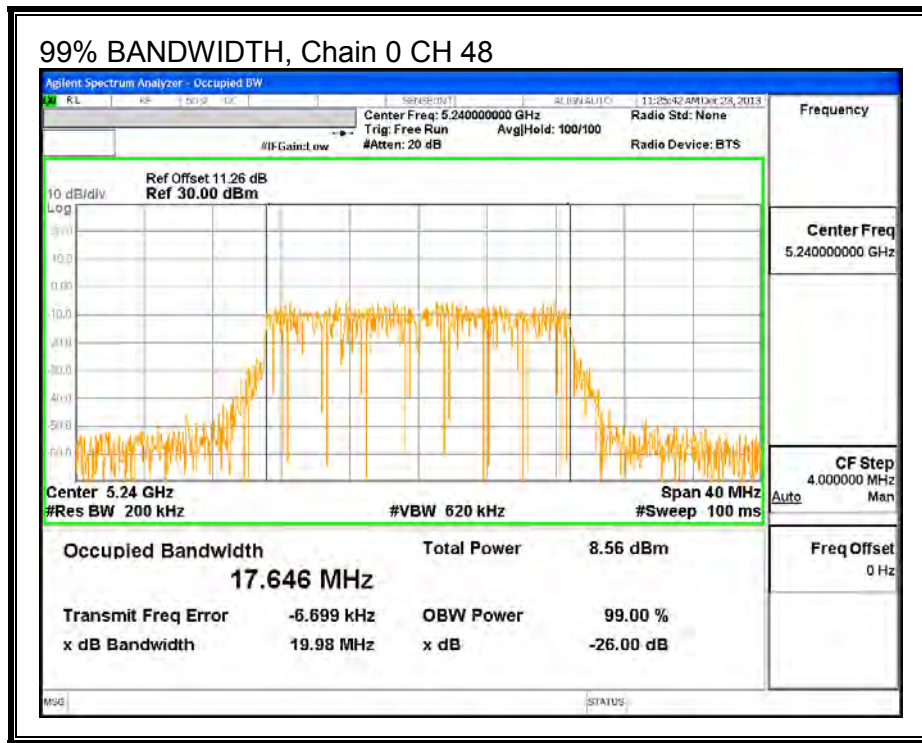
RESULTS

Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)	99% BW Chain 2 (MHz)
36	5180	17.716	17.619	17.678
40	5200	17.649	17.605	17.683
48	5240	17.646	17.728	17.657

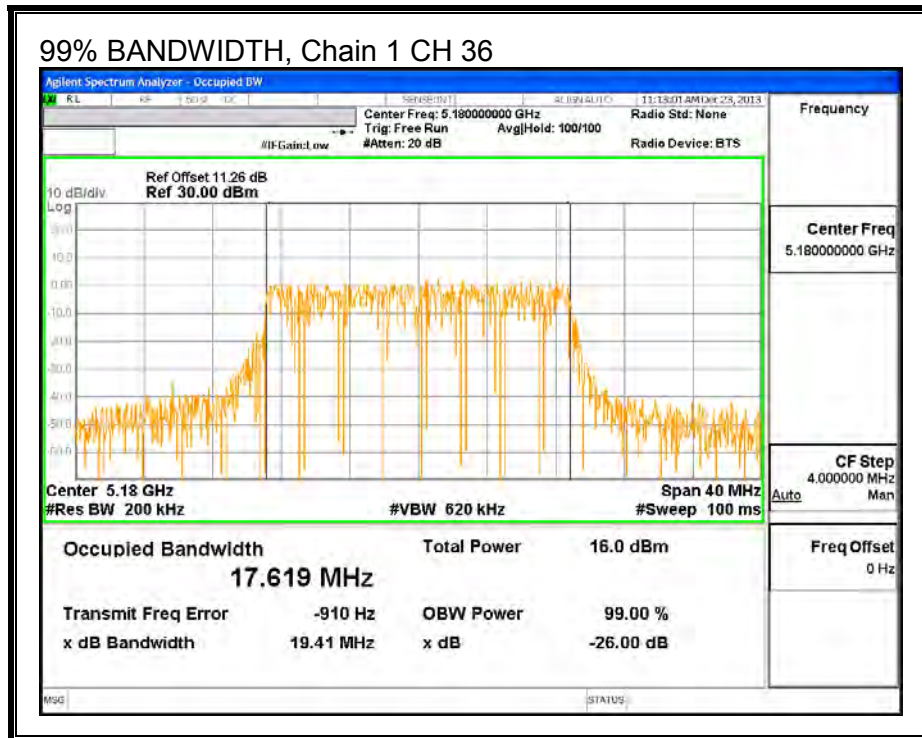
99% BANDWIDTH

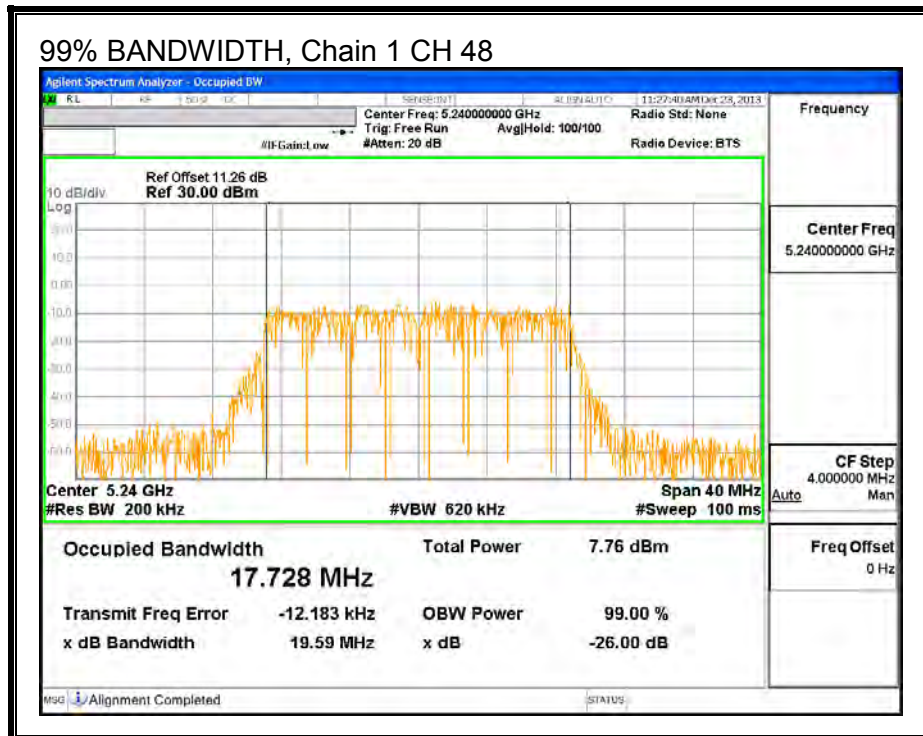
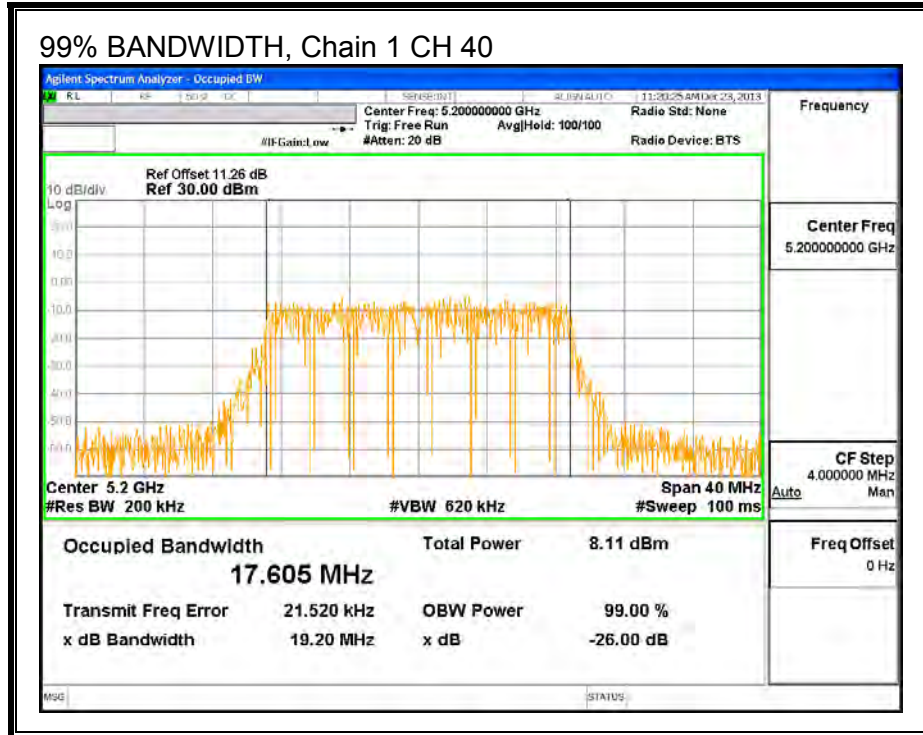
99% BANDWIDTH, Chain 0



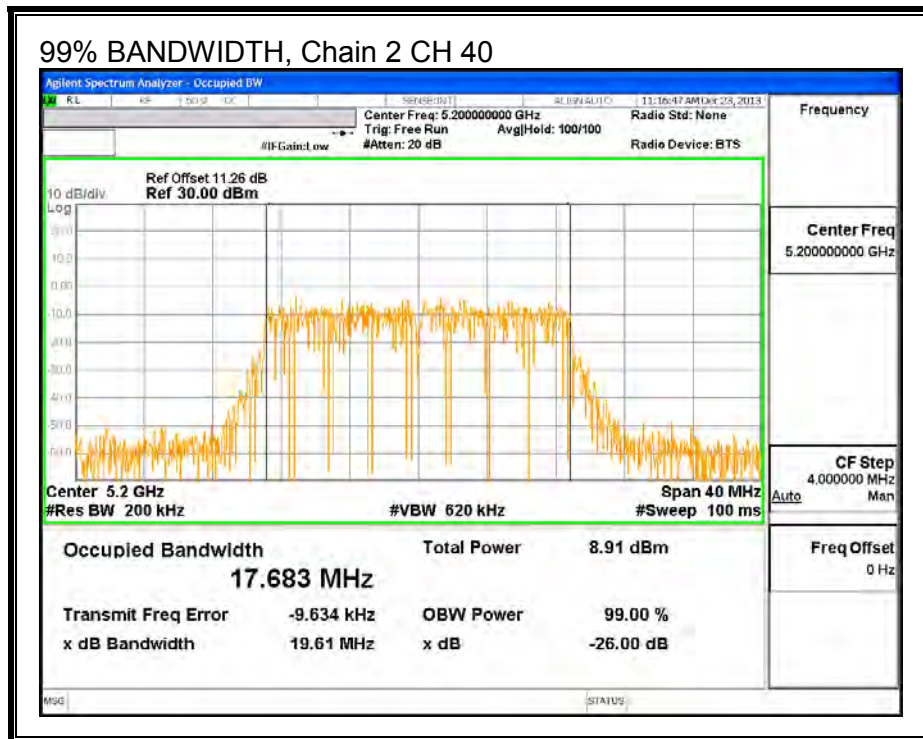
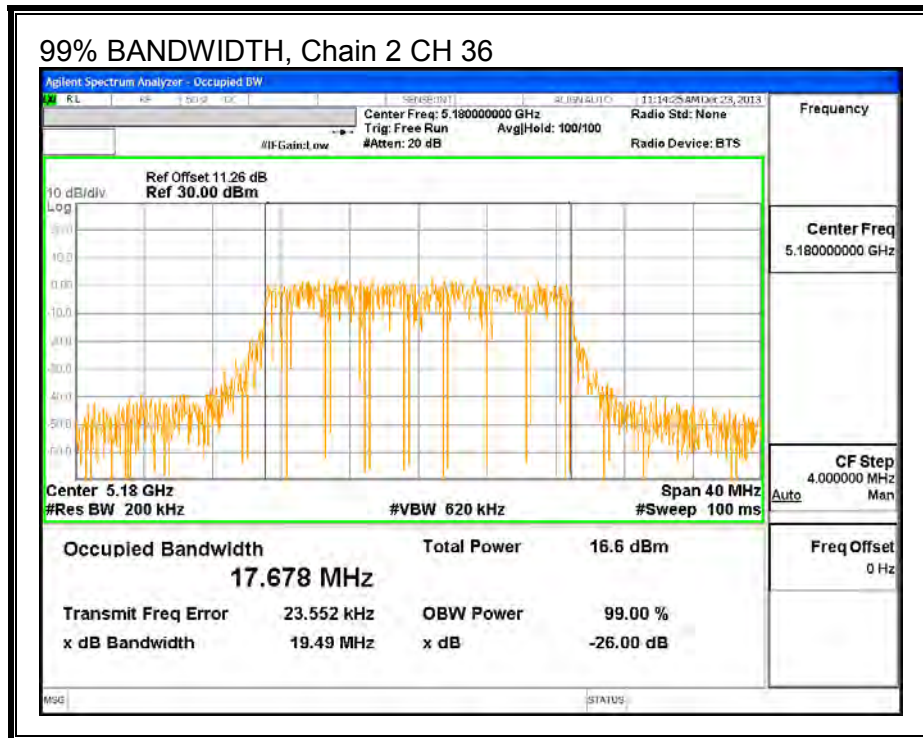


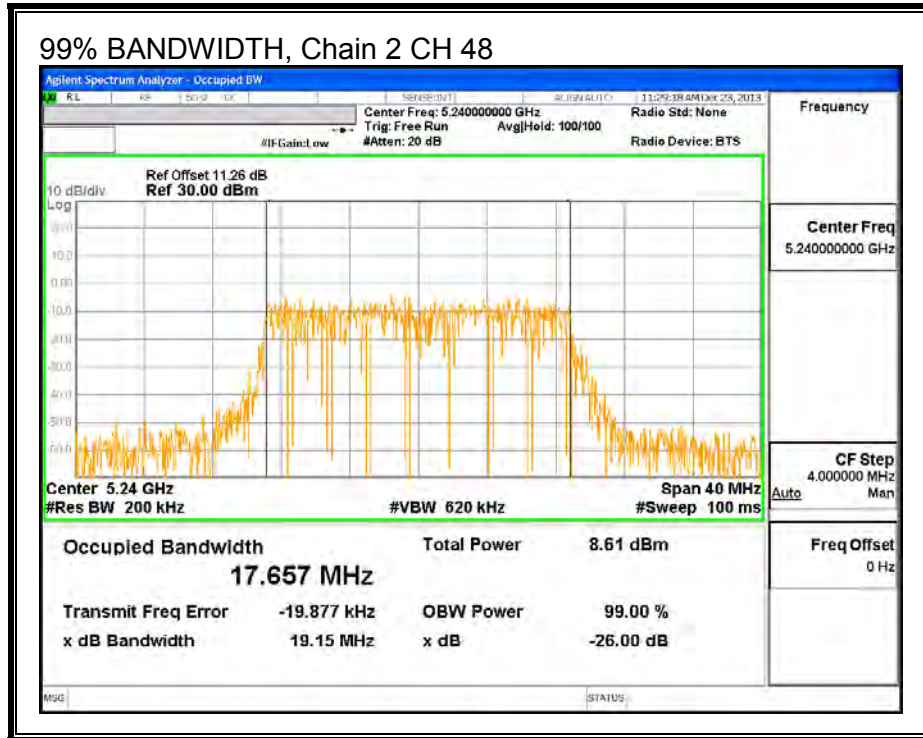
99% BANDWIDTH, Chain 1





99% BANDWIDTH, Chain 2





8.4.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.26 dB (including 10 dB pad and 1.26 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Average Power Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
36	5180	8.75	8.01	8.66	13.26
40	5200	8.83	7.95	8.92	13.36
48	5240	8.79	7.98	8.87	13.34

8.4.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26–dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is the same for each chain. The directional gain is equal to the antenna gain.

RESULTS

Bandwidth and Antenna Gain

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Min 99% BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PPSD (dBi)
36	5180	19.96	17.6190	2.25	2.25
40	5200	20.36	17.6050	2.25	2.25
48	5240	20.36	17.6460	2.25	2.25

Limits

Channel	Frequency (MHz)	FCC Power Limit (dBm)	IC EIRP Limit (dBm)	Max IC Power (dBm)	Power Limit (dBm)	FCC PPSD Limit (dBm)	IC eirp PSD Limit (dBm)	PPSD Limit (dBm)
36	5180	17.00	22.46	20.21	17.00	4.00	10.00	4.00
40	5200	17.00	22.46	20.21	17.00	4.00	10.00	4.00
48	5240	17.00	22.47	20.22	17.00	4.00	10.00	4.00

Duty Cycle CF (dB)	0.17	Included in Calculations of Corr'd Power & PPSD
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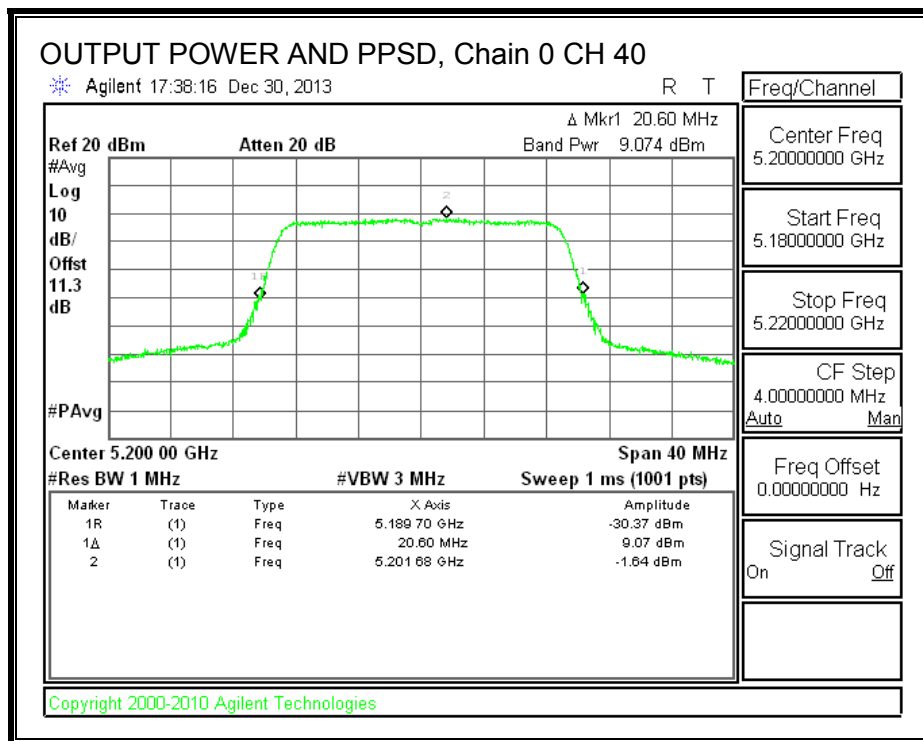
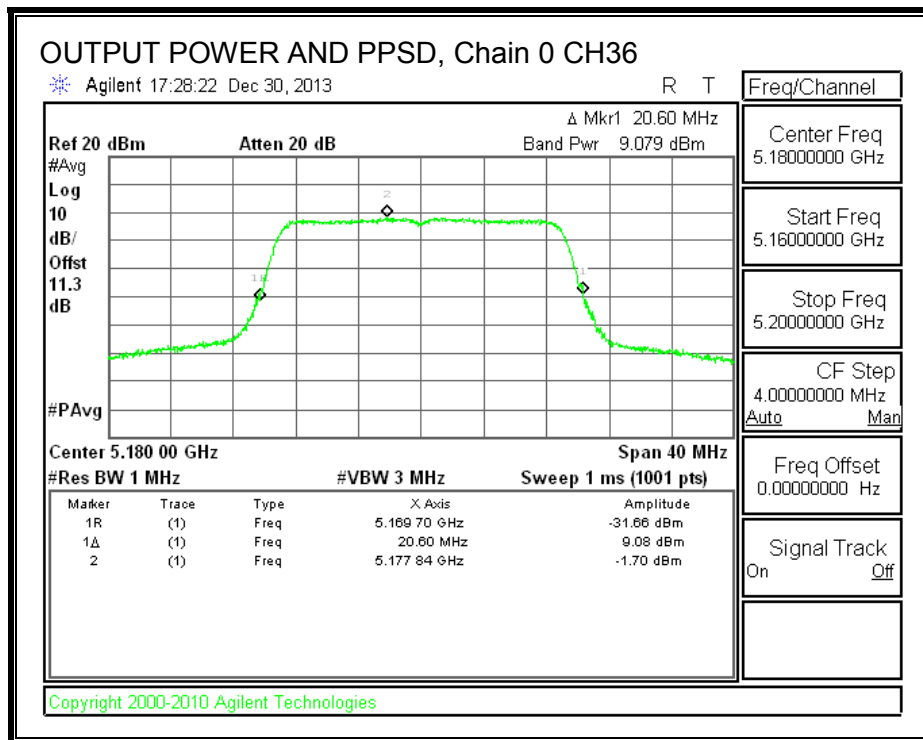
Output Power Results

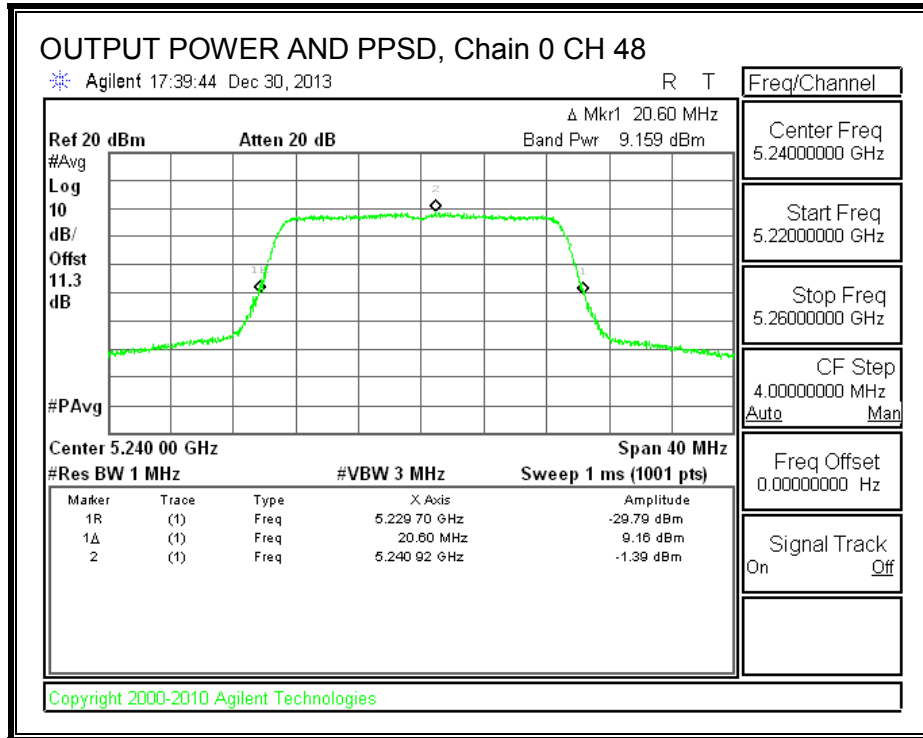
Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
36	5180	9.08	8.13	9.09	13.73	17.00	-3.27
40	5200	9.07	8.18	9.10	13.74	17.00	-3.26
48	5240	9.16	8.05	9.16	13.76	17.00	-3.24

PPSD Results

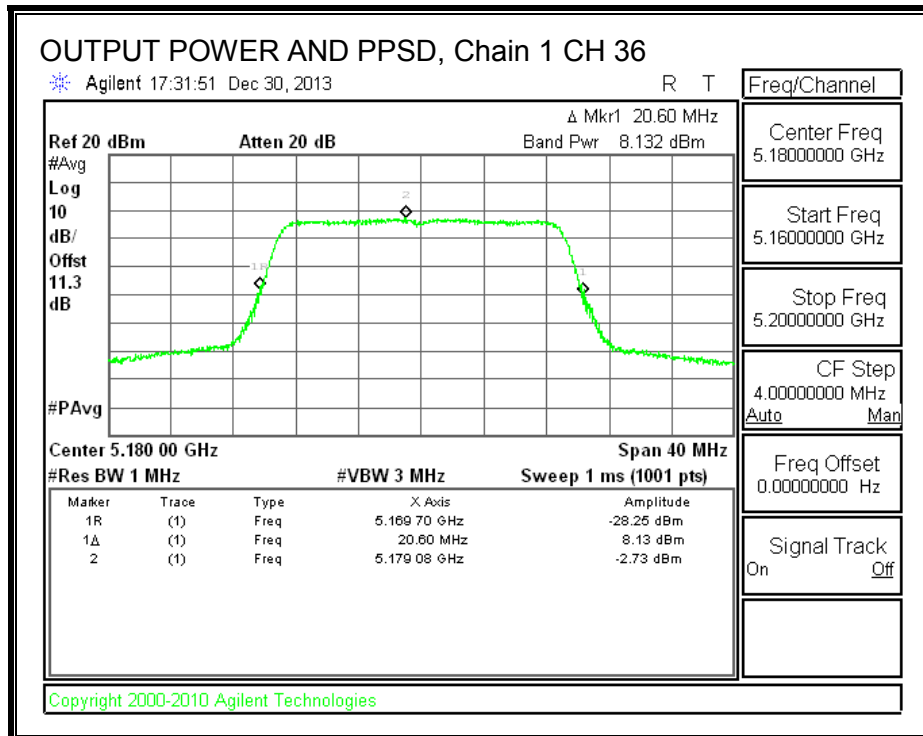
Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Chain 2 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
36	5180	-1.70	-2.73	-1.51	2.99	4.00	-1.01
40	5200	-1.54	-2.51	-1.73	3.03	4.00	-0.97
48	5240	-1.39	-2.33	-1.68	3.16	4.00	-0.84

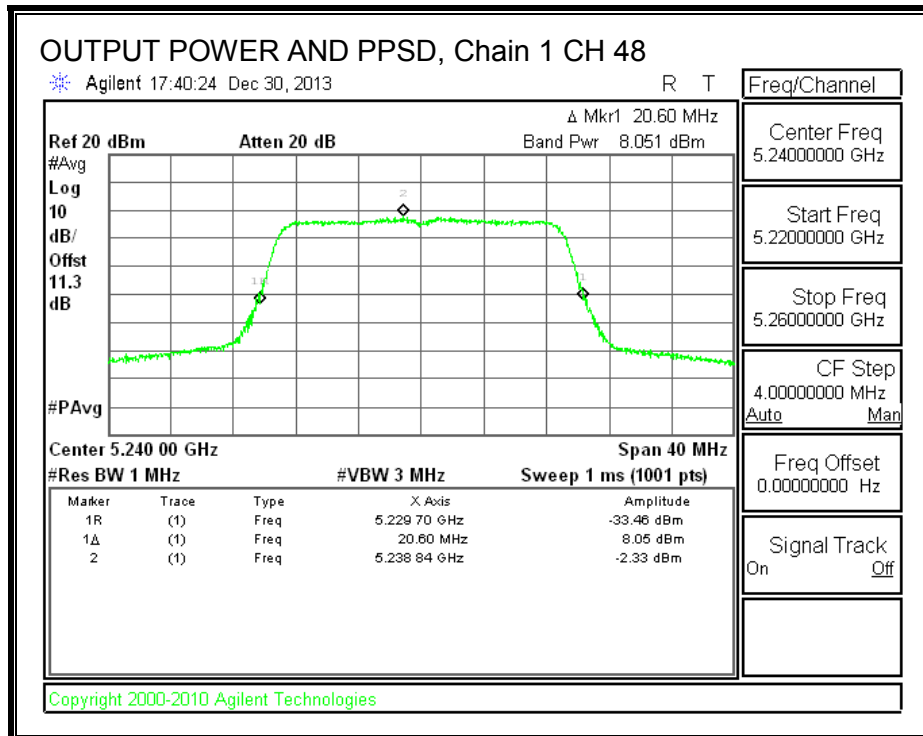
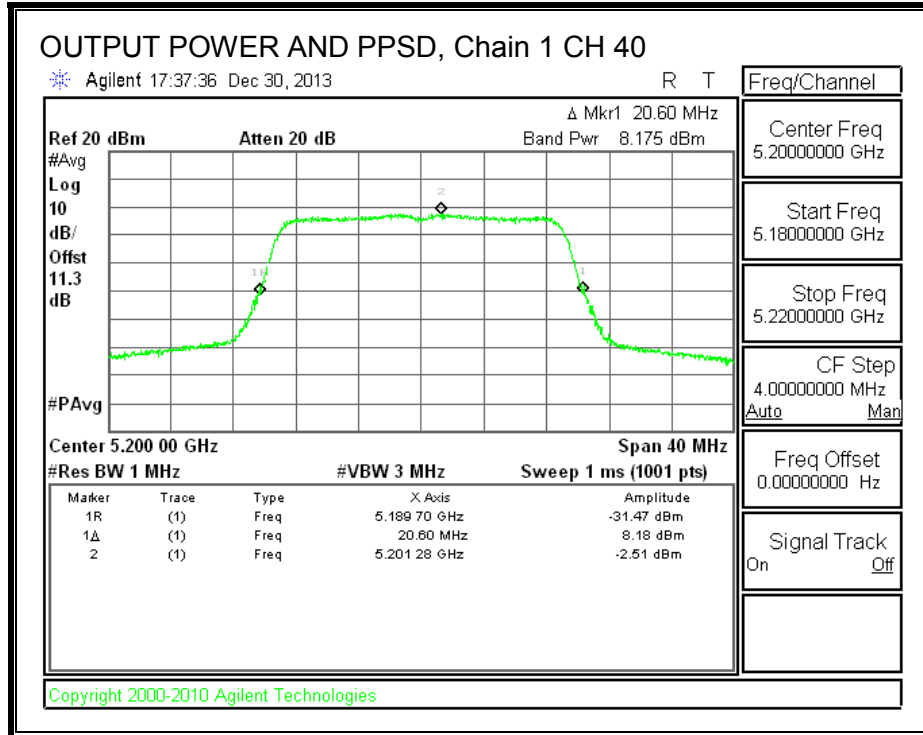
OUTPUT POWER AND PPSD, Chain 0



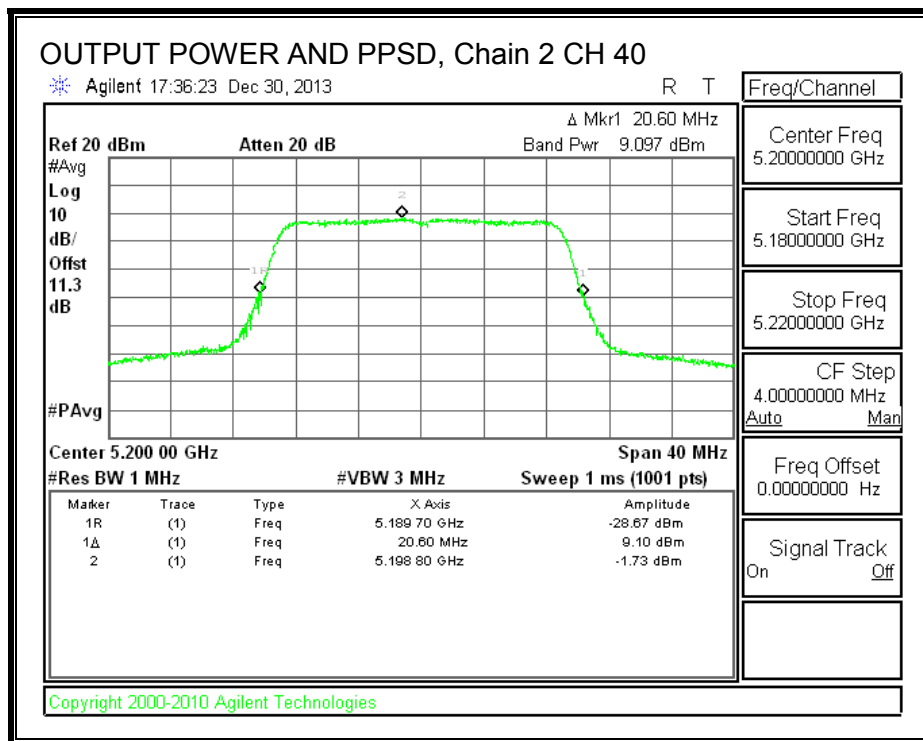
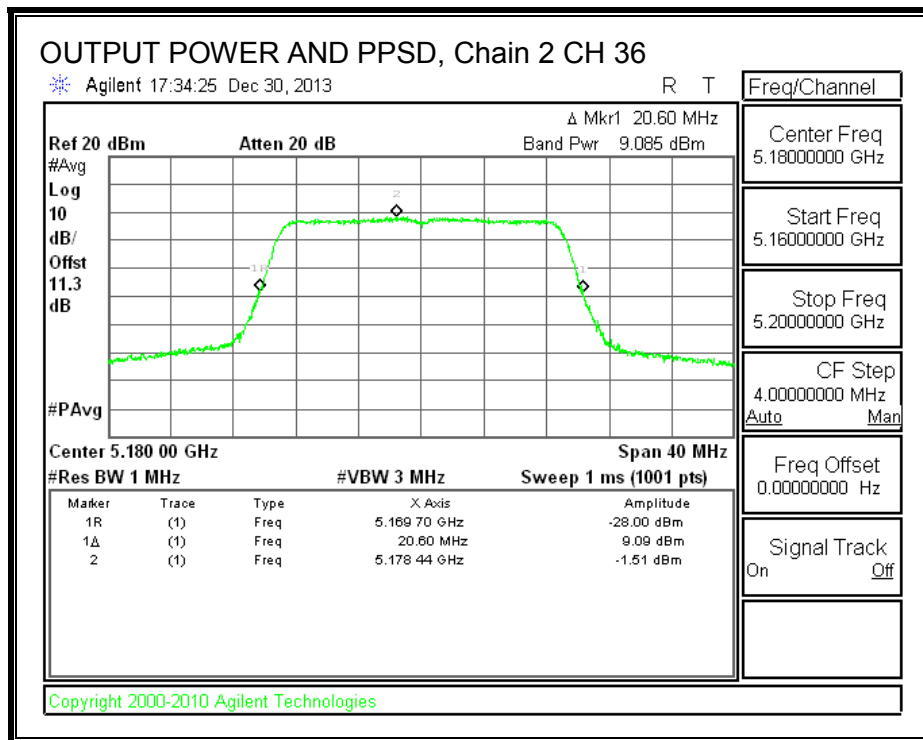


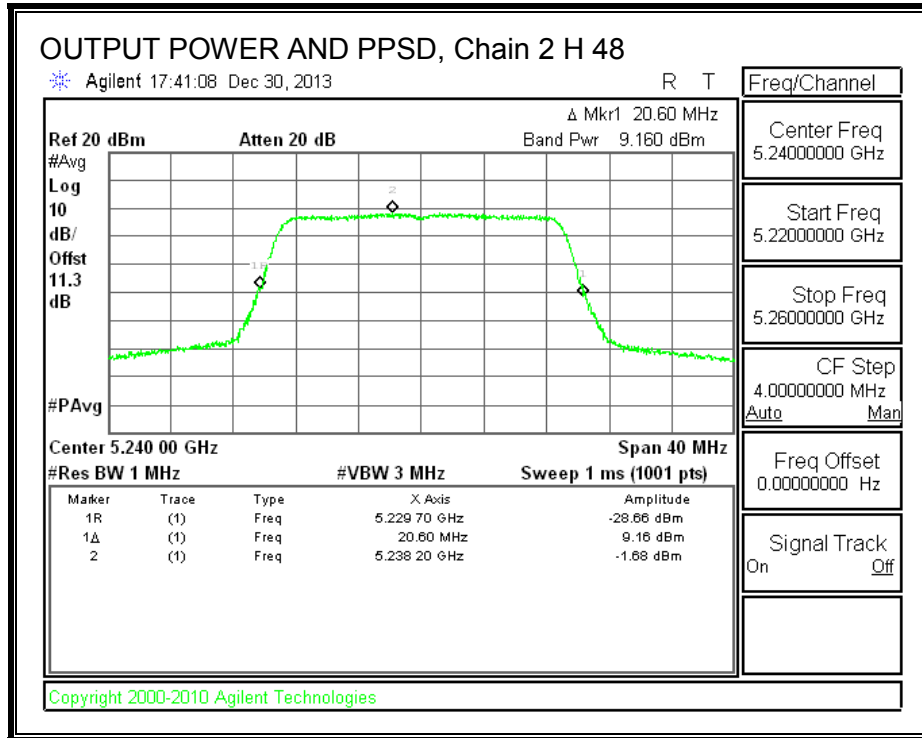
OUTPUT POWER AND PPSD, Chain 1





OUTPUT POWER AND PPSD, Chain 2





8.5. 802.11n HT40 1TX SISO MODE IN THE 5.2 GHz BAND

8.5.1. 26 dB BANDWIDTH

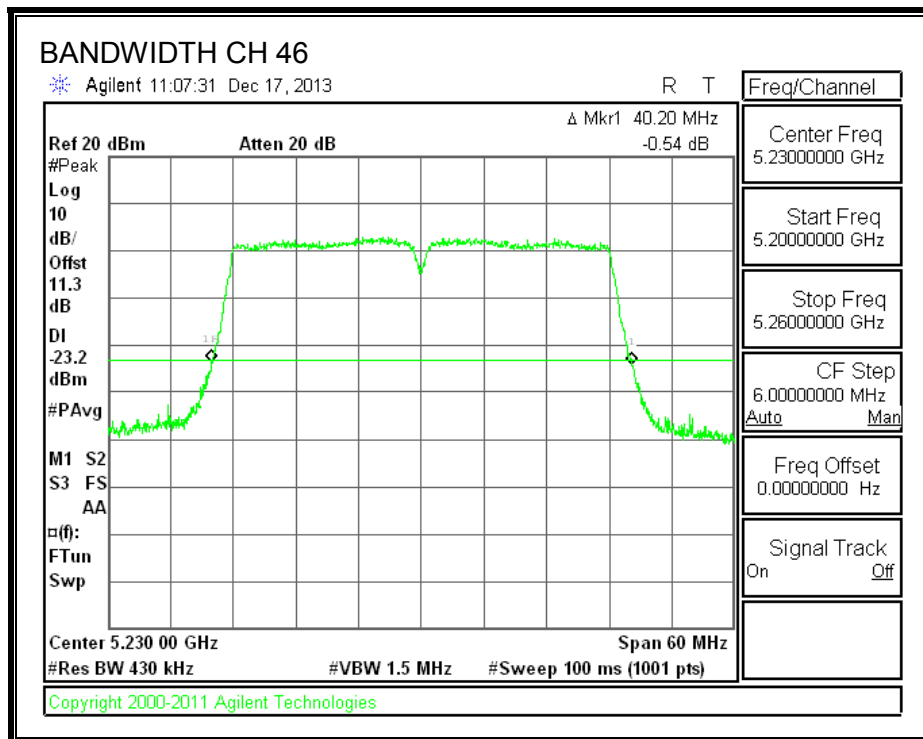
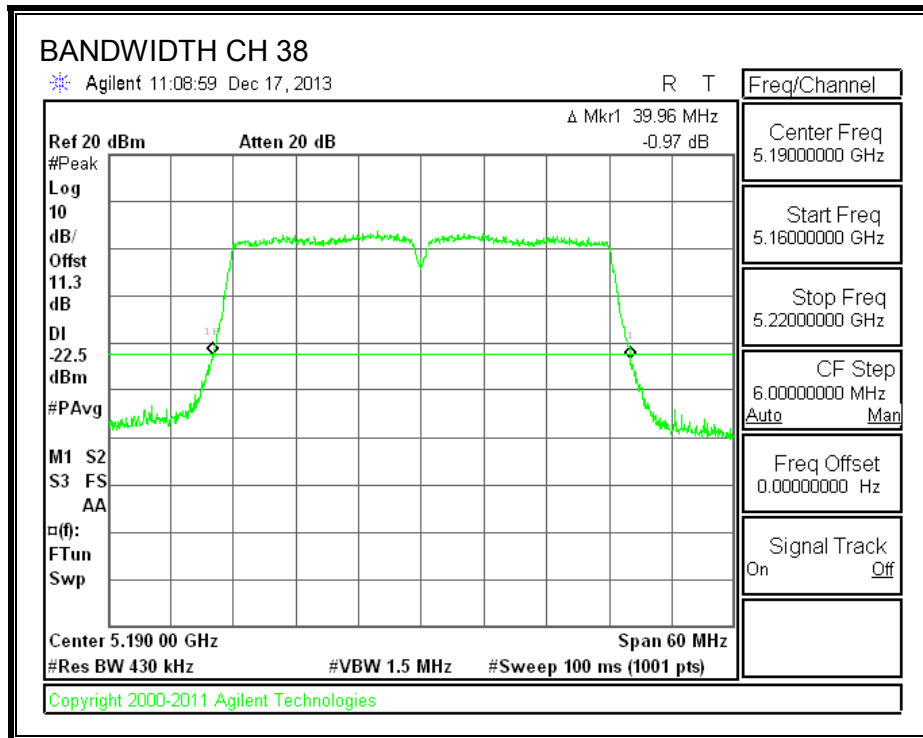
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
38	5190	39.96
46	5230	40.20

26 dB BANDWIDTH



8.5.2. 99% BANDWIDTH

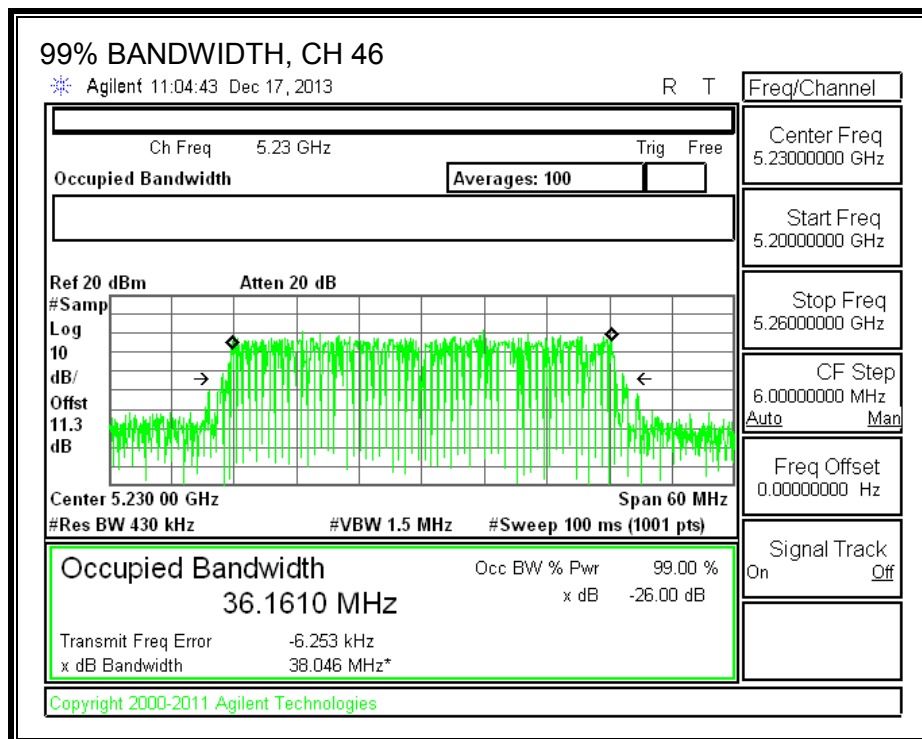
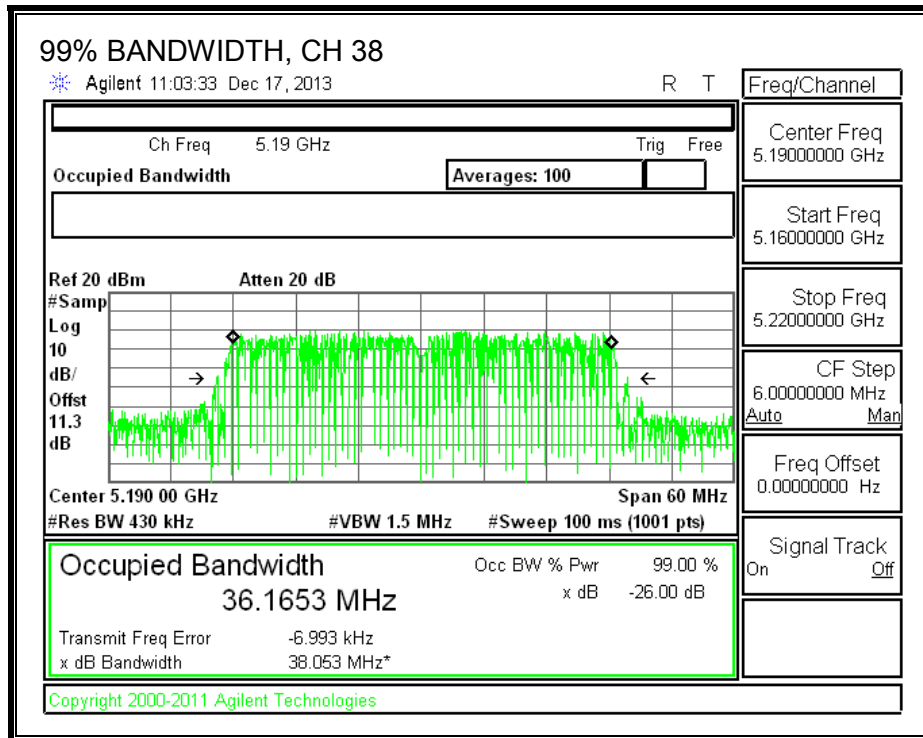
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
38	5190	36.1653
46	5230	36.1610

99% BANDWIDTH



8.5.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.26 dB (including 10 dB pad and 1.26 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Average Power Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)
38	5190	11.94
46	5230	15.90

8.5.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26–dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Bandwidth and Antenna Gain

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Min 99% BW (MHz)	Directional Gain (dBi)
38	5190	40.0	36.2	2.25
46	5230	40.2	36.2	2.25

Limits

Channel	Frequency (MHz)	FCC Power Limit (dBm)	IC EIRP Limit (dBm)	Max IC Power (dBm)	Power Limit (dBm)	FCC PPSD Limit (dBm)	IC eirp PSD Limit (dBm)	PPSD Limit (dBm)
38	5190	17.00	23.00	20.75	17.00	4.00	10.00	4.00
46	5230	17.00	23.00	20.75	17.00	4.00	10.00	4.00

Duty Cycle CF (dB)	0.42	Included in Calculations of Corr'd Power & PPSD
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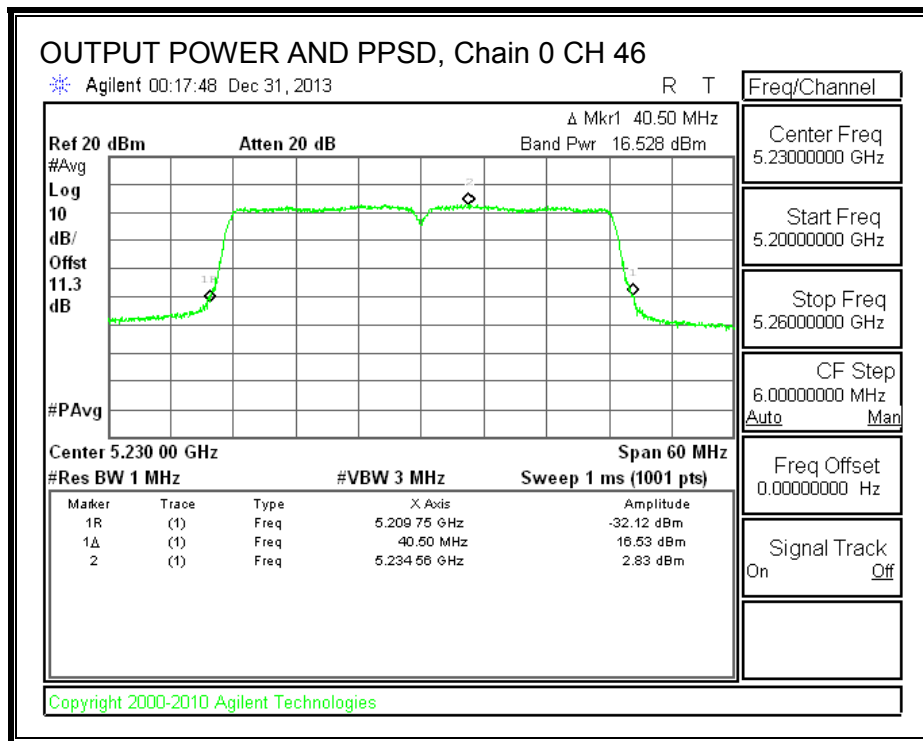
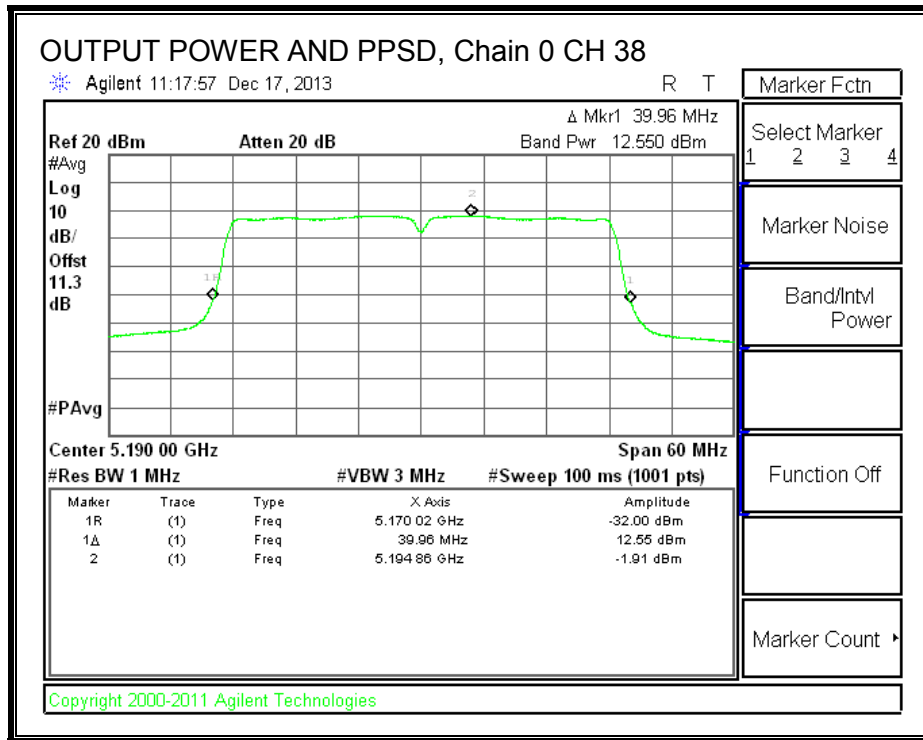
Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
38	5190	12.55	12.97	17.00	-4.03
46	5230	16.53	16.95	17.00	-0.05

PPSD Results

Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
38	5190	-1.91	-1.49	4.00	-5.49
46	5230	2.83	3.25	4.00	-0.75

OUTPUT POWER AND PPSD, Chain 0



8.6. 802.11n HT40 3TX CDD MODE IN THE 5.2 GHZ BAND

8.6.1. 26 dB BANDWIDTH

LIMITS

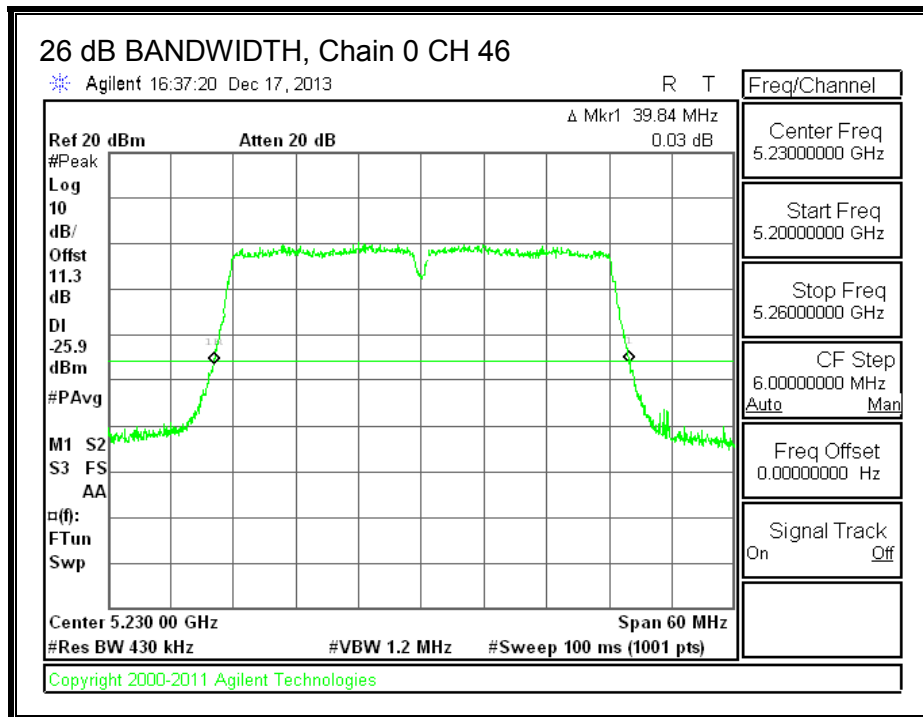
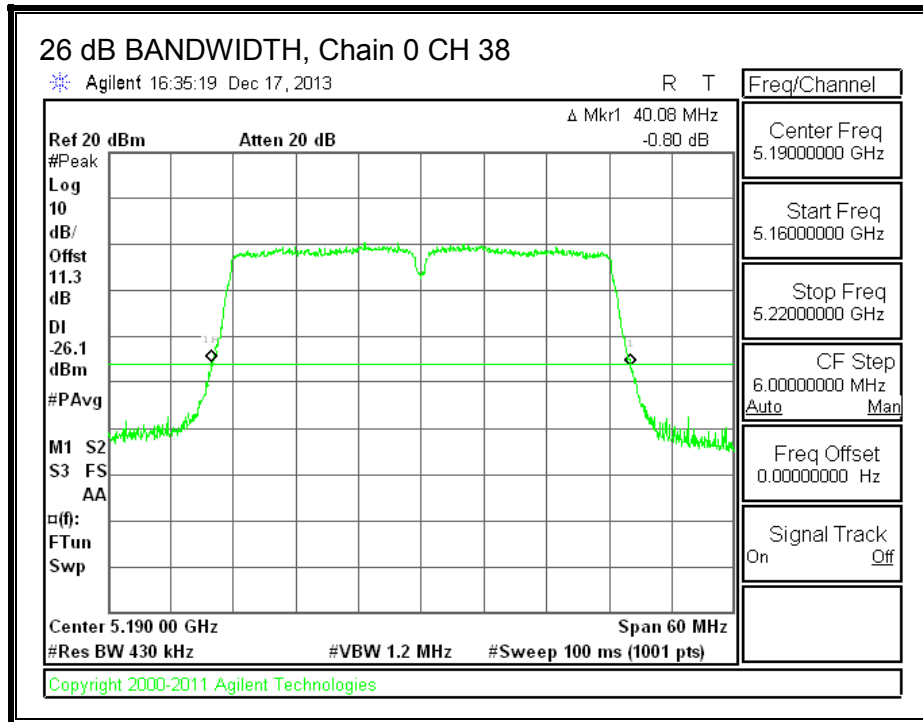
None; for reporting purposes only.

RESULTS

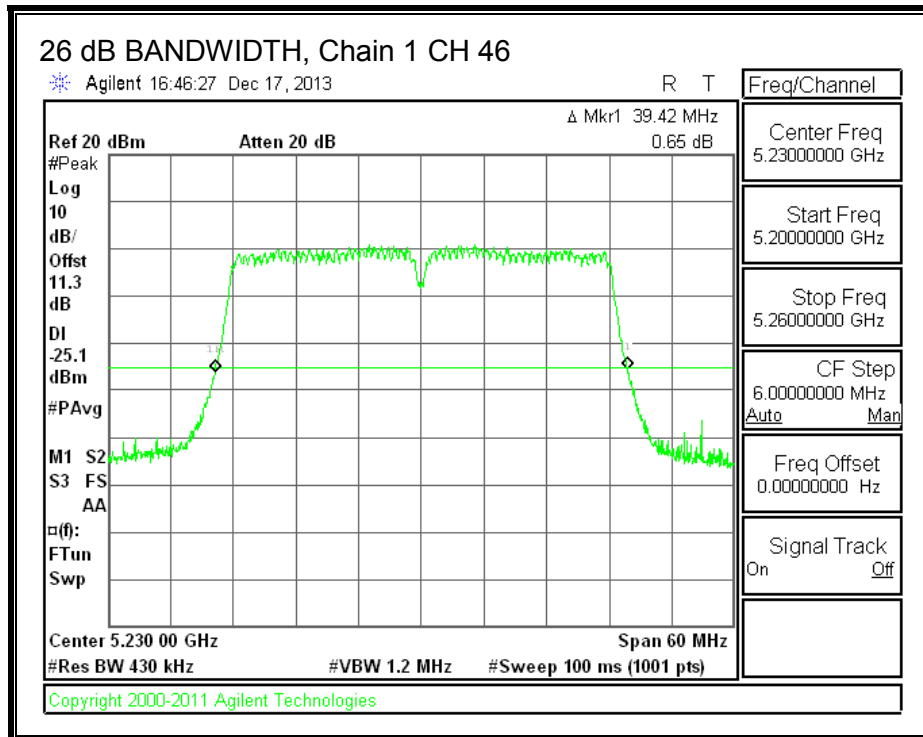
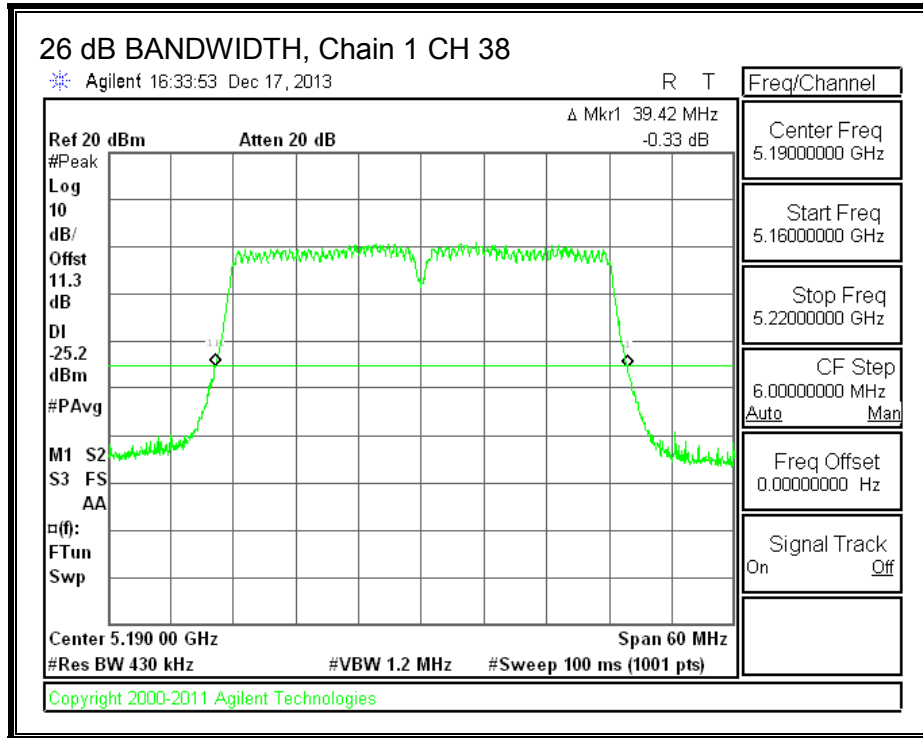
Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)	26 dB BW Chain 2 (MHz)
38	5190	40.08	39.42	39.54
46	5230	39.84	39.42	39.42

26 dB BANDWIDTH

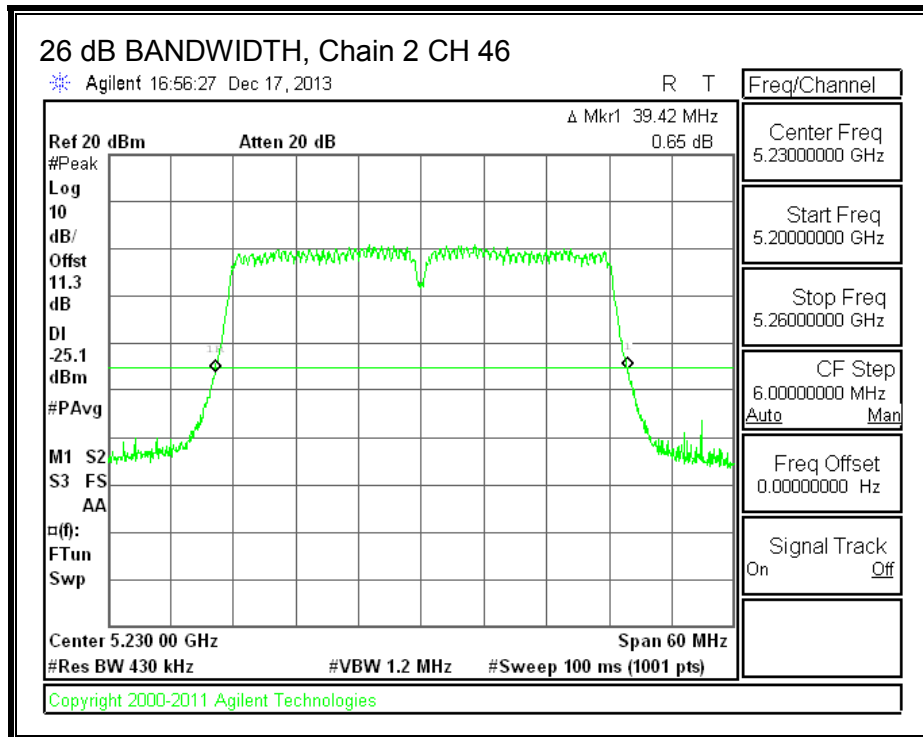
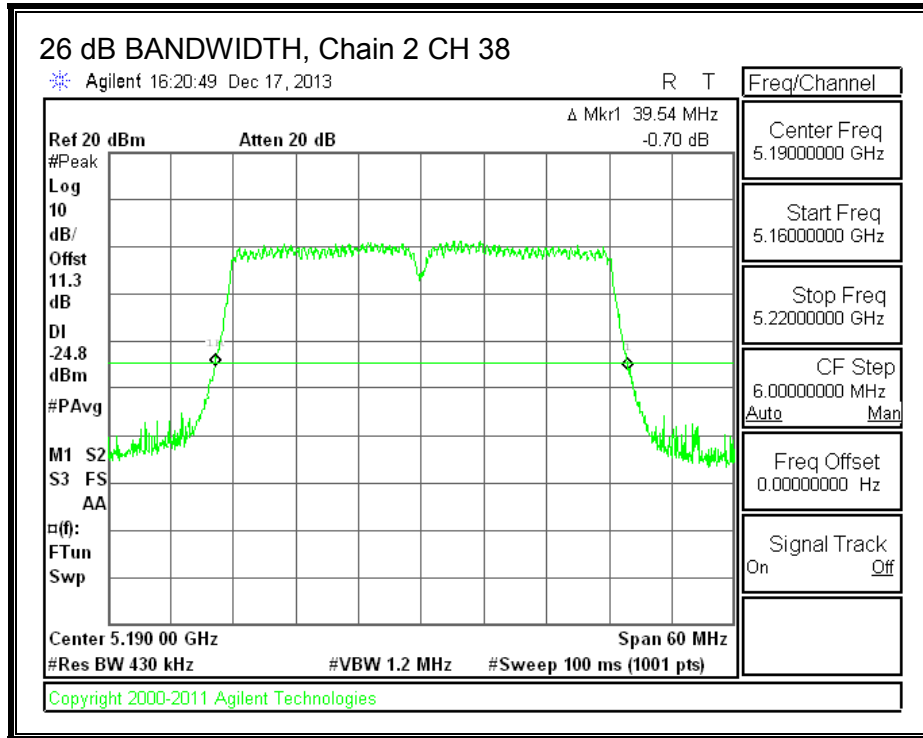
26 dB BANDWIDTH, Chain 0



26 dB BANDWIDTH, Chain 1



26 dB BANDWIDTH, Chain 2



8.6.2. 99% BANDWIDTH

LIMITS

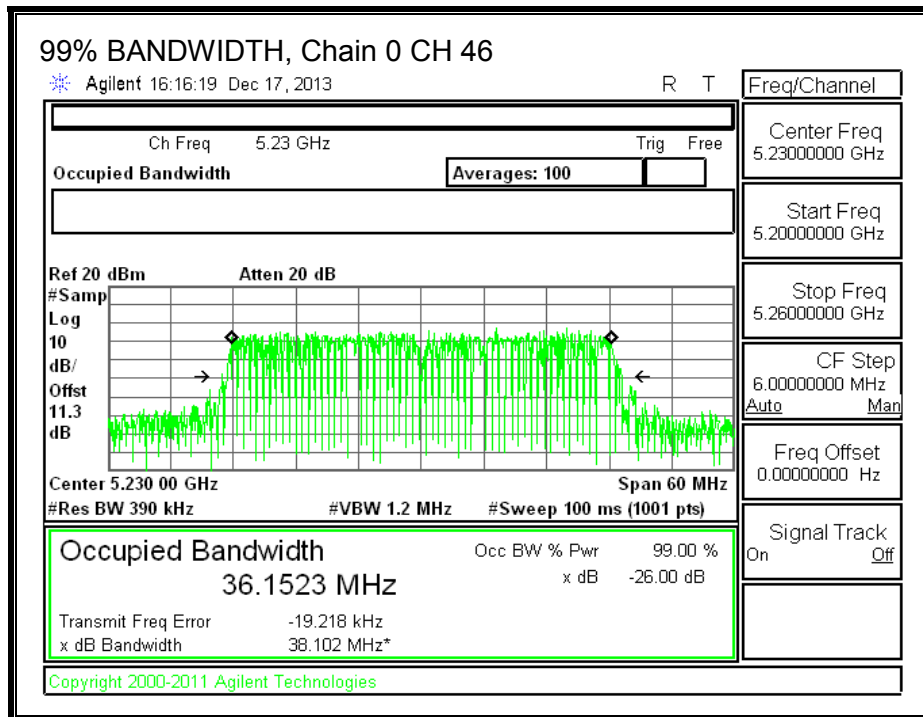
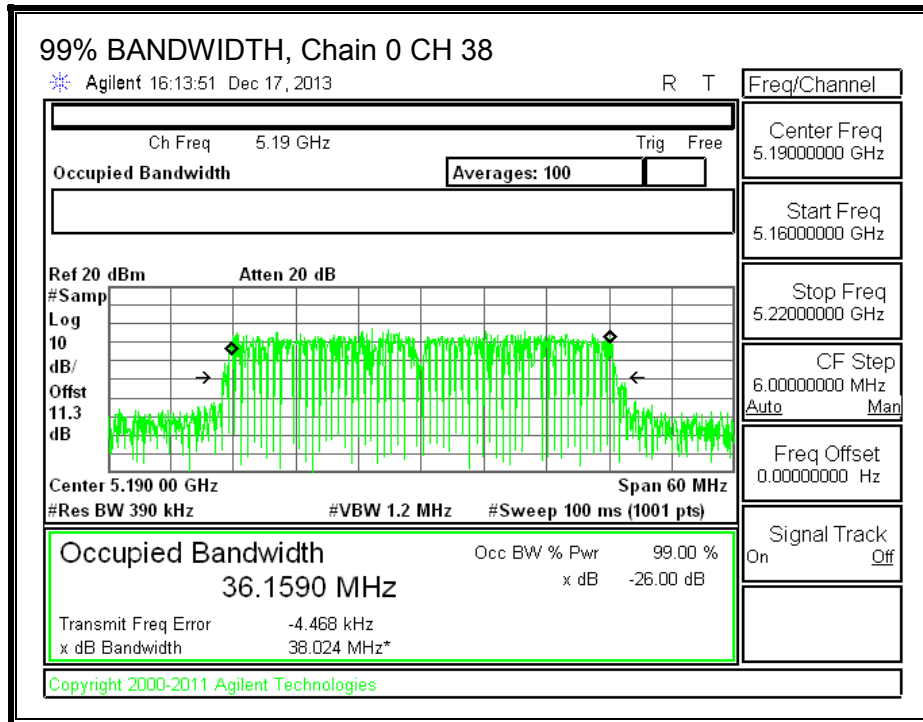
None; for reporting purposes only.

RESULTS

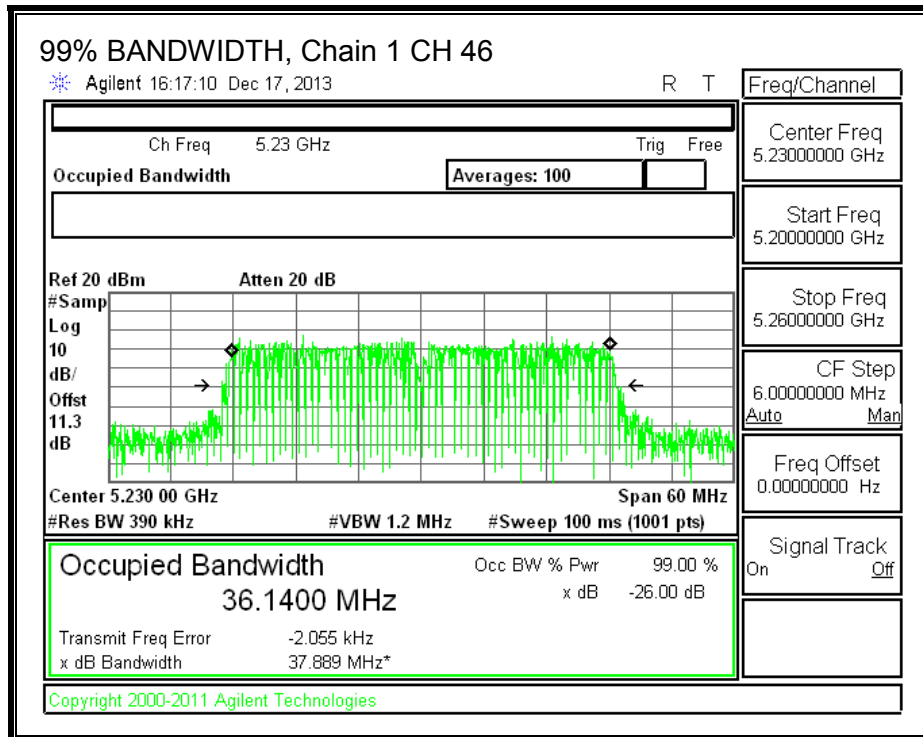
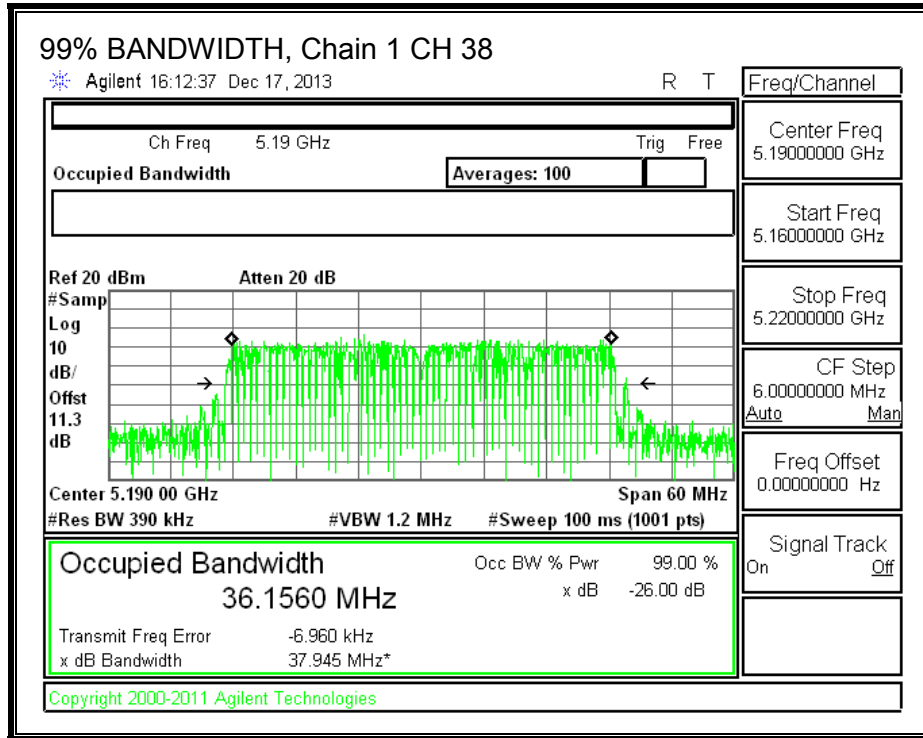
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)	99% BW Chain 2 (MHz)
38	5190	36.1590	36.1560	36.1115
46	5230	36.1523	36.1400	36.1584

99% BANDWIDTH

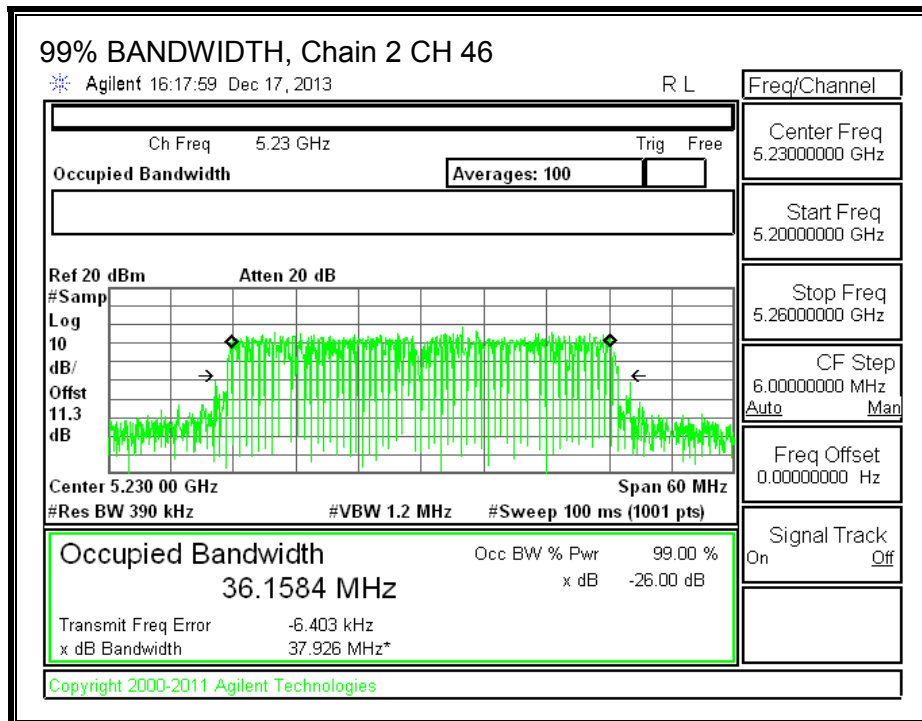
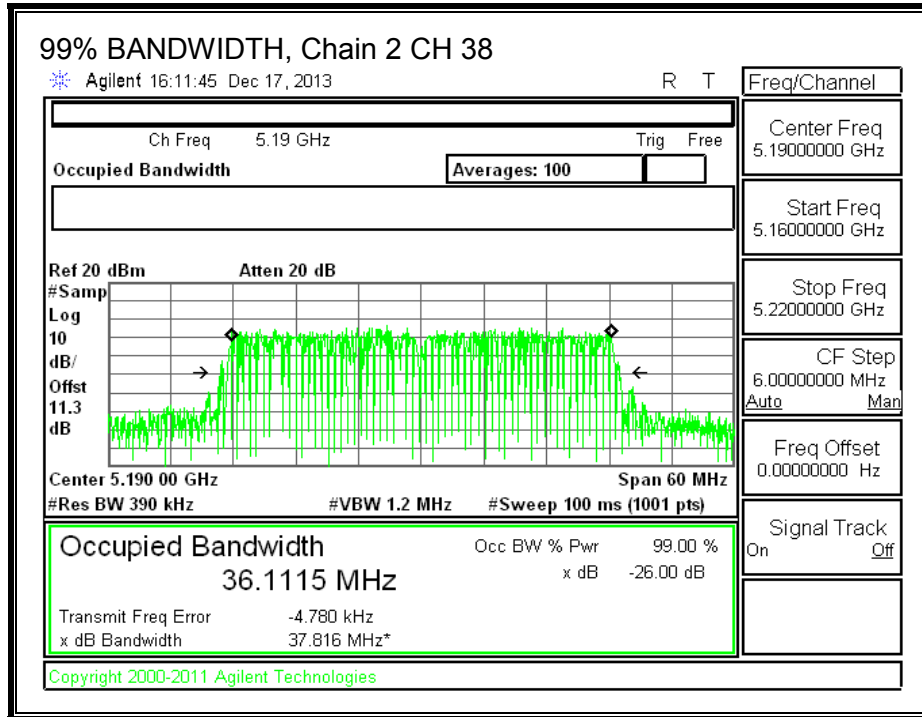
99% BANDWIDTH, Chain 0



99% BANDWIDTH, Chain 1



99% BANDWIDTH, Chain 2



8.6.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.26 dB (including 10 dB pad and 1.26 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Average Power Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
38	5190	8.70	7.68	8.76	13.18
46	5230	11.04	10.28	11.14	15.61

8.6.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are correlated and the antenna gain is the same for each chain. The directional gain is:

Antenna Gain (dBi)	10 * Log (3 chains) (dB)	Correlated Chains Directional Gain (dBi)
2.25	4.77	7.02

RESULTS

Bandwidth and Antenna Gain

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Min 99% BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PPSD (dBi)
38	5190	39.42	36.1115	2.25	7.02
46	5230	39.42	36.1400	2.25	7.02

Limits

Channel	Frequency (MHz)	FCC Power Limit (dBm)	IC EIRP Limit (dBm)	Max IC Power (dBm)	Power Limit (dBm)	FCC PPSD Limit (dBm)	IC eirp PSD Limit (dBm)	PPSD Limit (dBm)
38	5190	17.00	23.00	20.75	17.00	2.98	10.00	2.98
46	5230	17.00	23.00	20.75	17.00	2.98	10.00	2.98

Duty Cycle CF (dB)	0.14	Included in Calculations of Corr'd Power & PPSD
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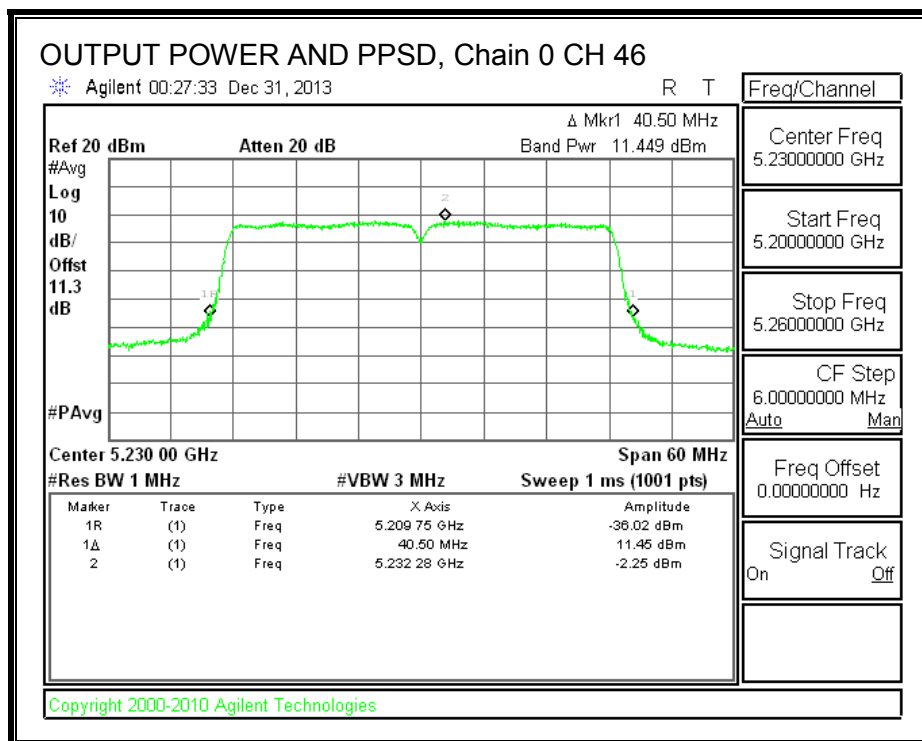
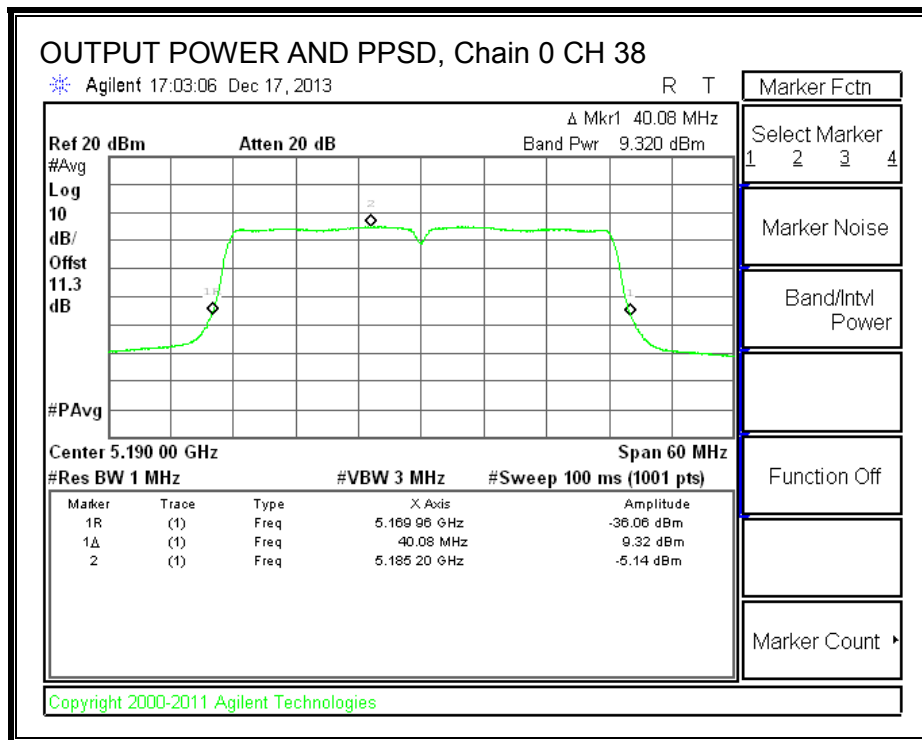
Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
38	5190	9.32	8.35	9.05	13.84	17.00	-3.16
46	5230	11.45	10.87	11.65	16.25	17.00	-0.75

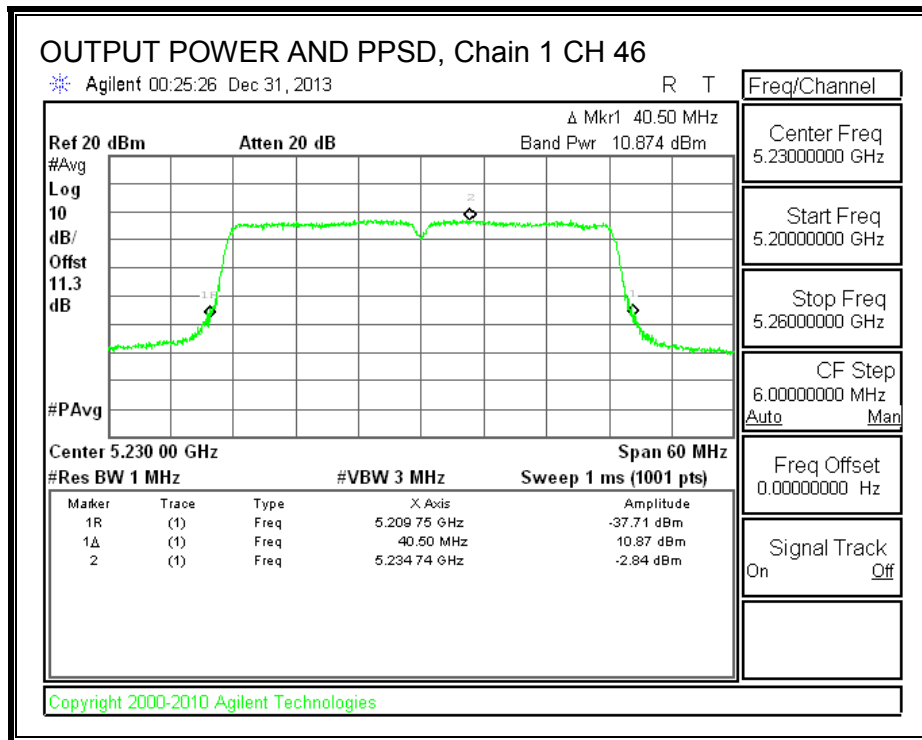
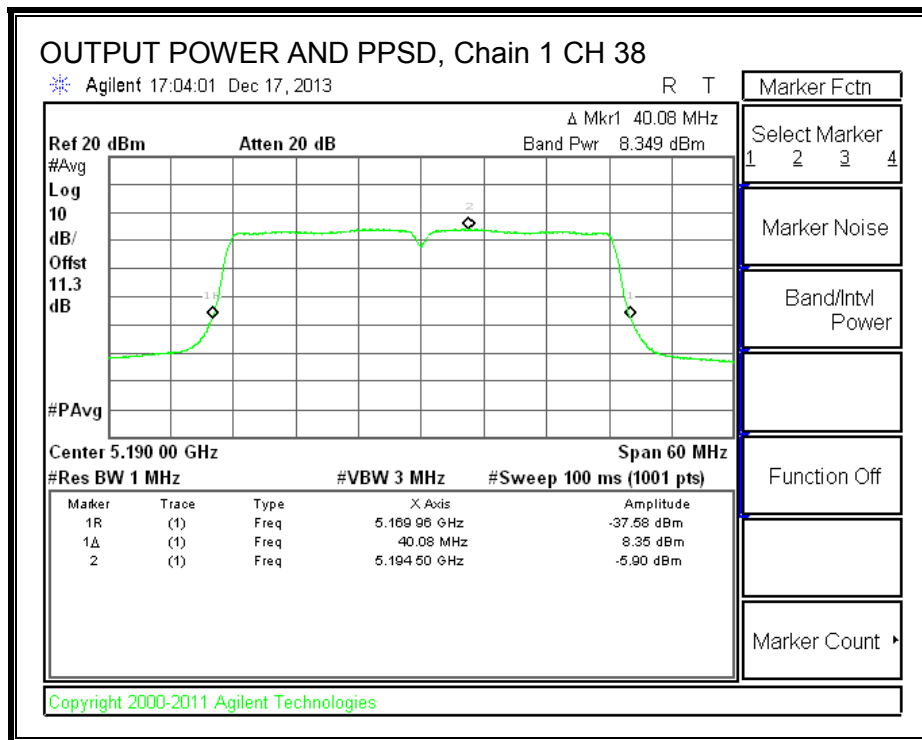
PPSD Results

Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Chain 2 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
38	5190	-5.14	-5.90	-5.24	-0.50	2.98	-3.48
46	5230	-2.25	-2.84	-2.05	2.54	2.98	-0.44

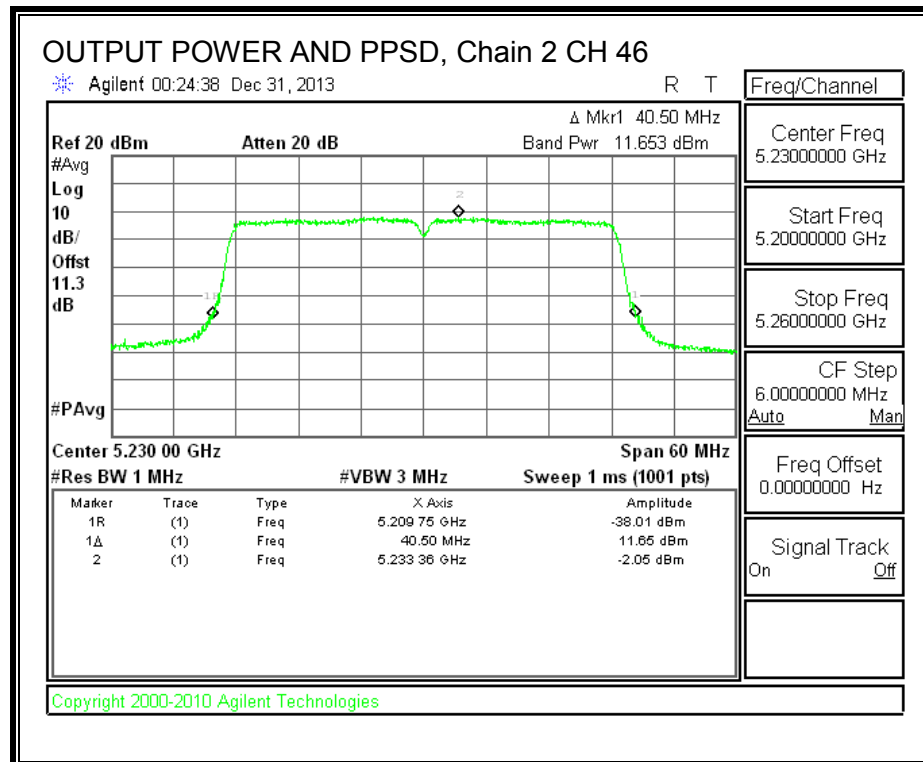
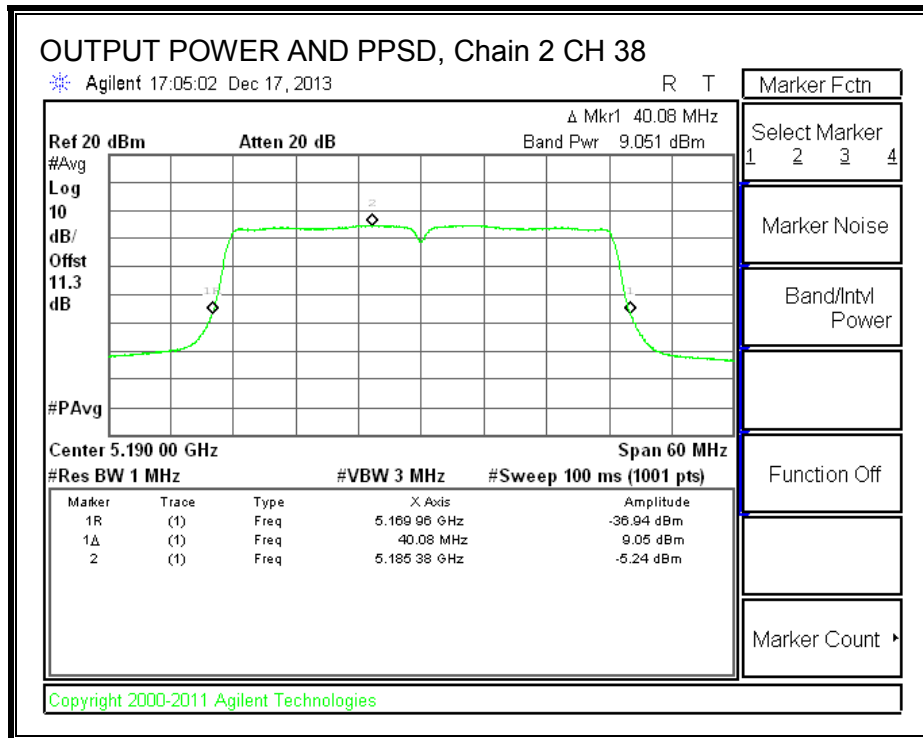
OUTPUT POWER AND PPSD, Chain 0



OUTPUT POWER AND PPSD, Chain 1



OUTPUT POWER AND PPSD, Chain 2



8.7. 802.11n HT40 3TX SDM MODE IN THE 5.2 GHz BAND

8.7.1. 26 dB BANDWIDTH

LIMITS

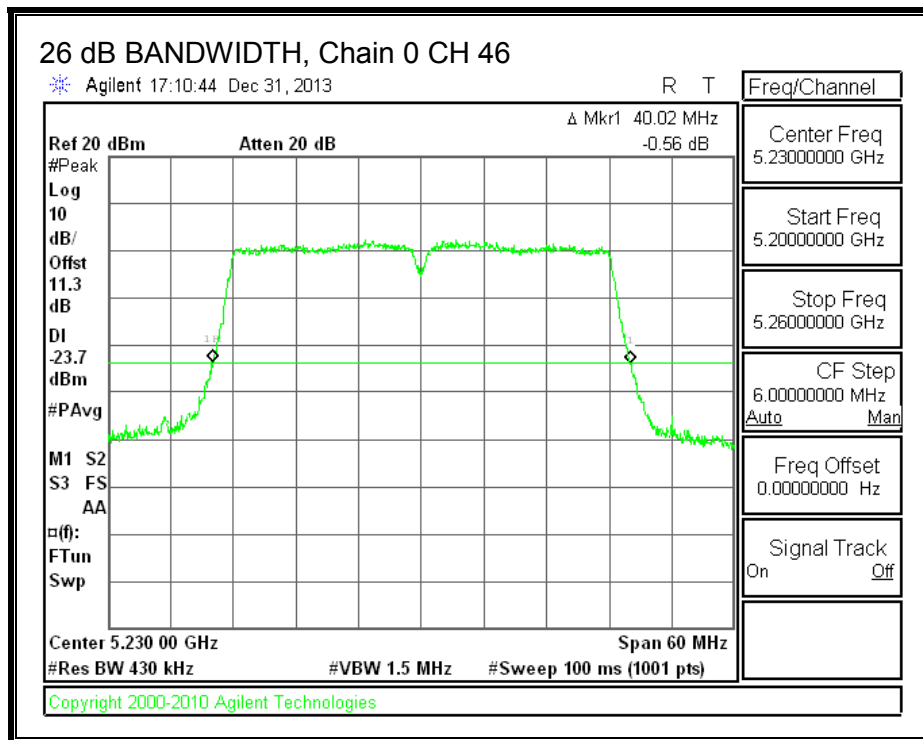
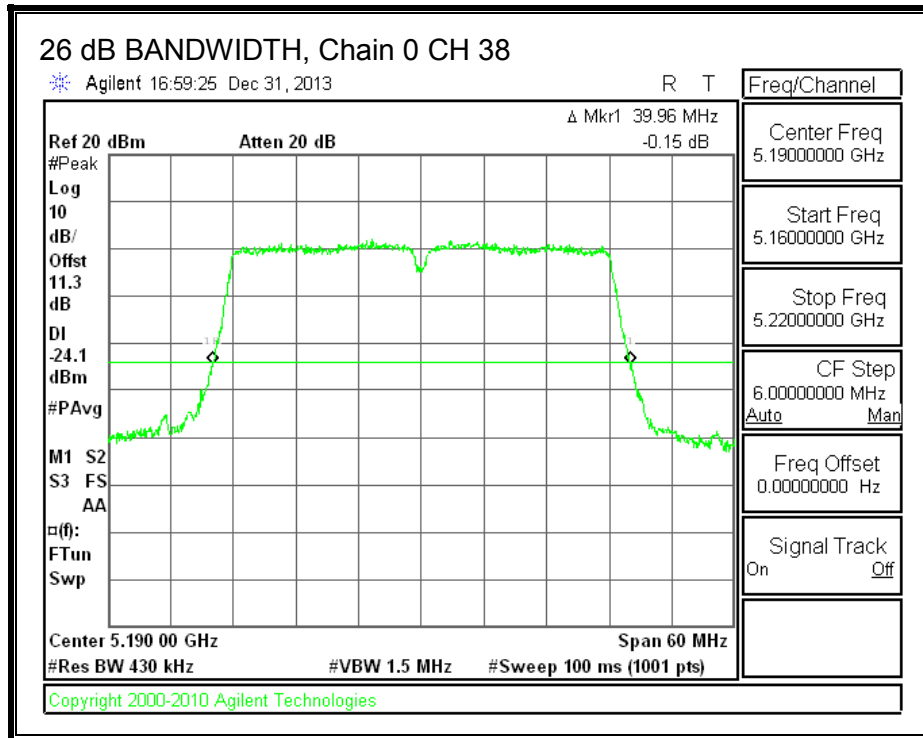
None; for reporting purposes only.

RESULTS

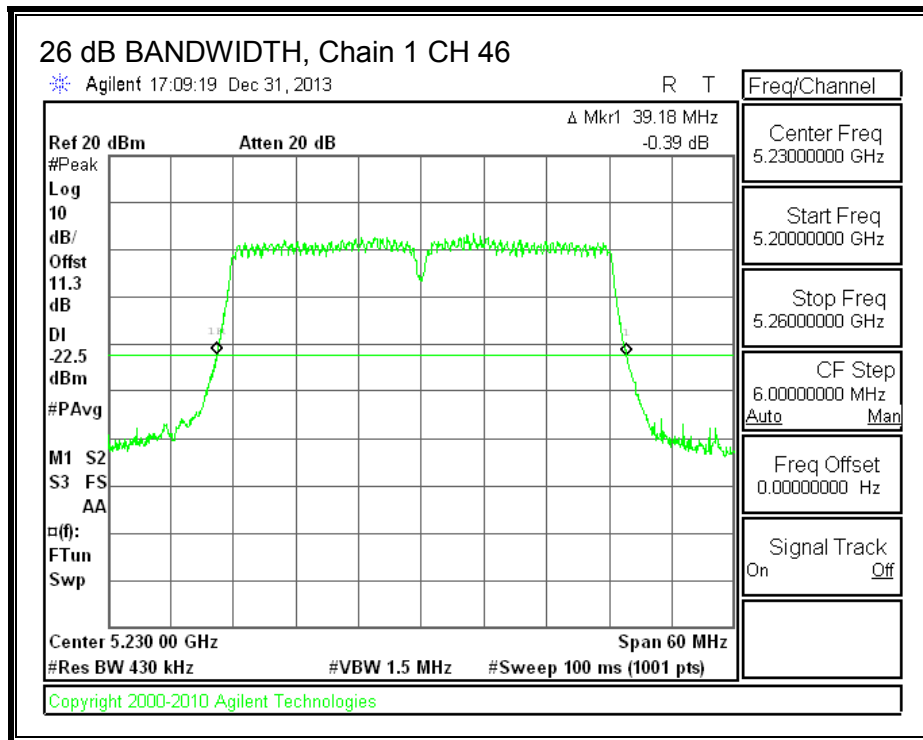
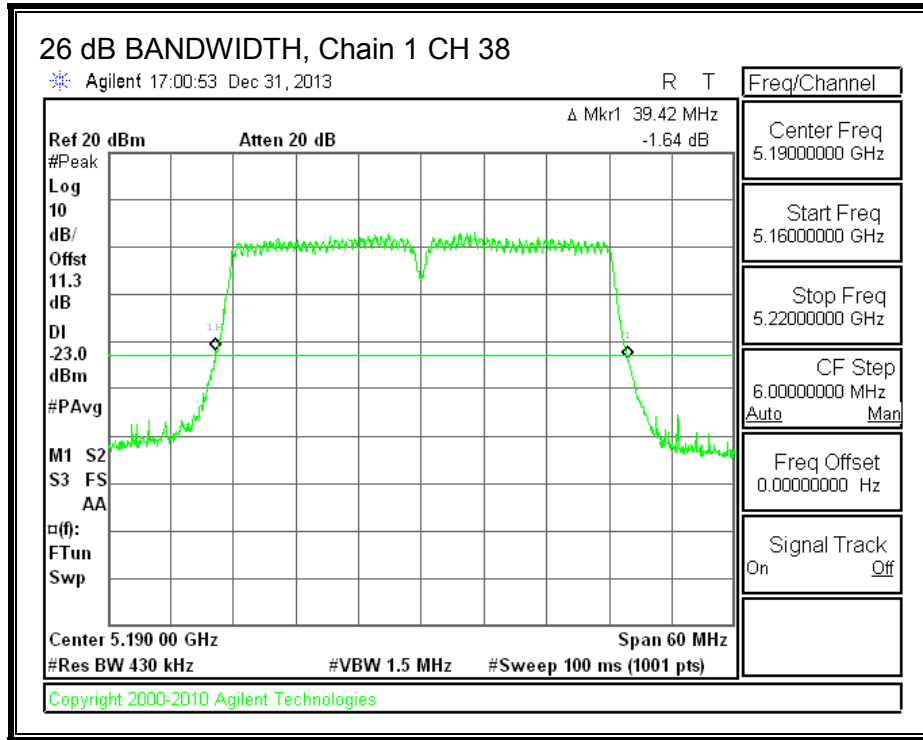
Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)	26 dB BW Chain 2 (MHz)
38	5190	39.96	39.42	39.42
46	5230	40.02	39.18	39.60

26 dB BANDWIDTH

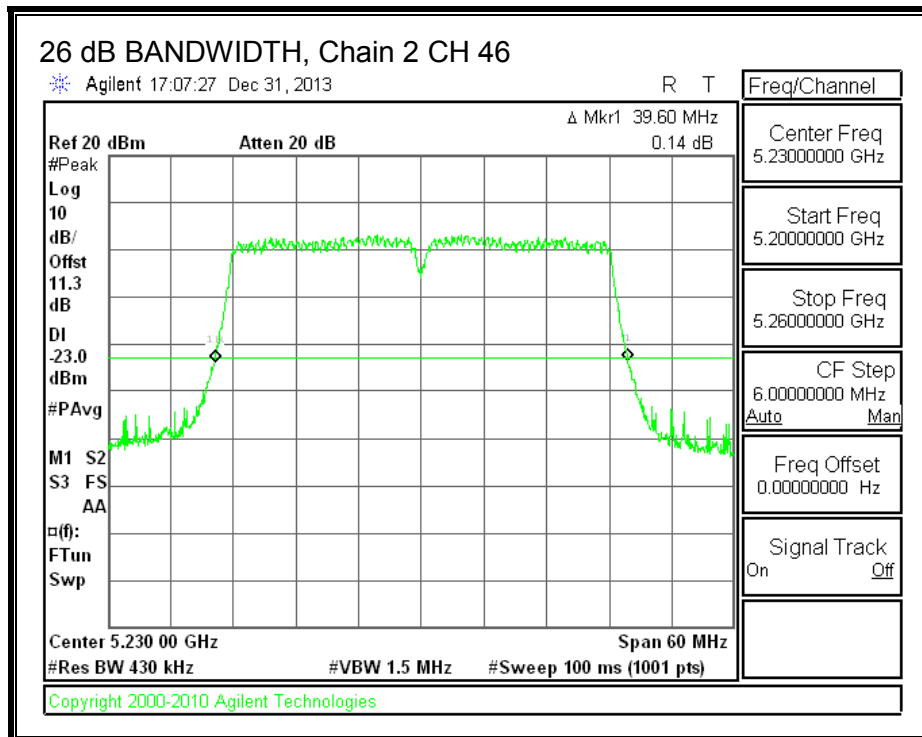
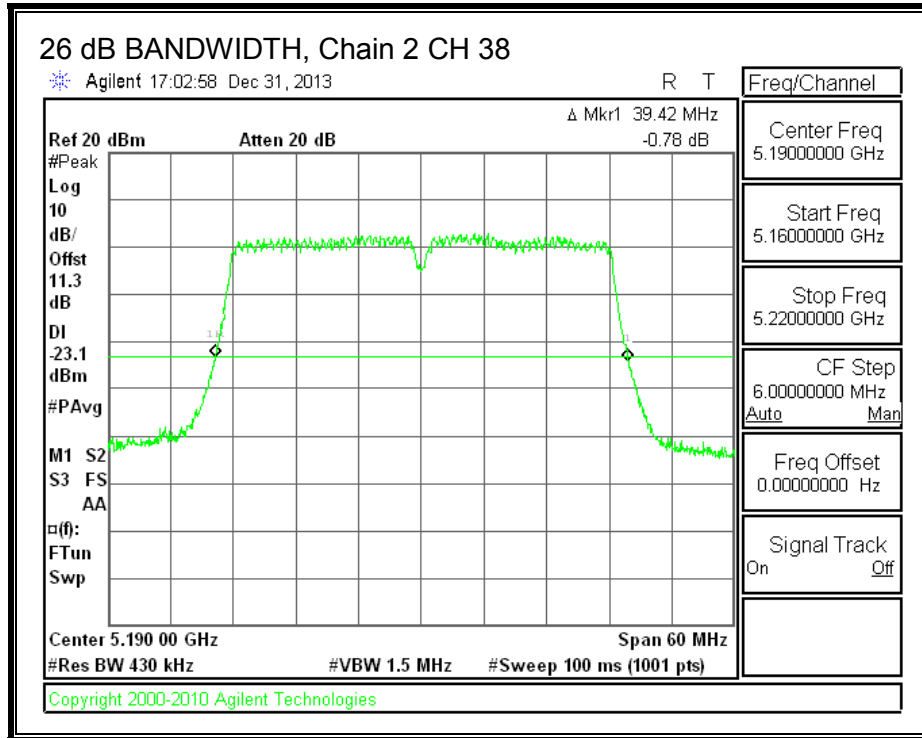
26 dB BANDWIDTH, Chain 0



26 dB BANDWIDTH, Chain 1



26 dB BANDWIDTH, Chain 2



8.7.2. 99% BANDWIDTH

LIMITS

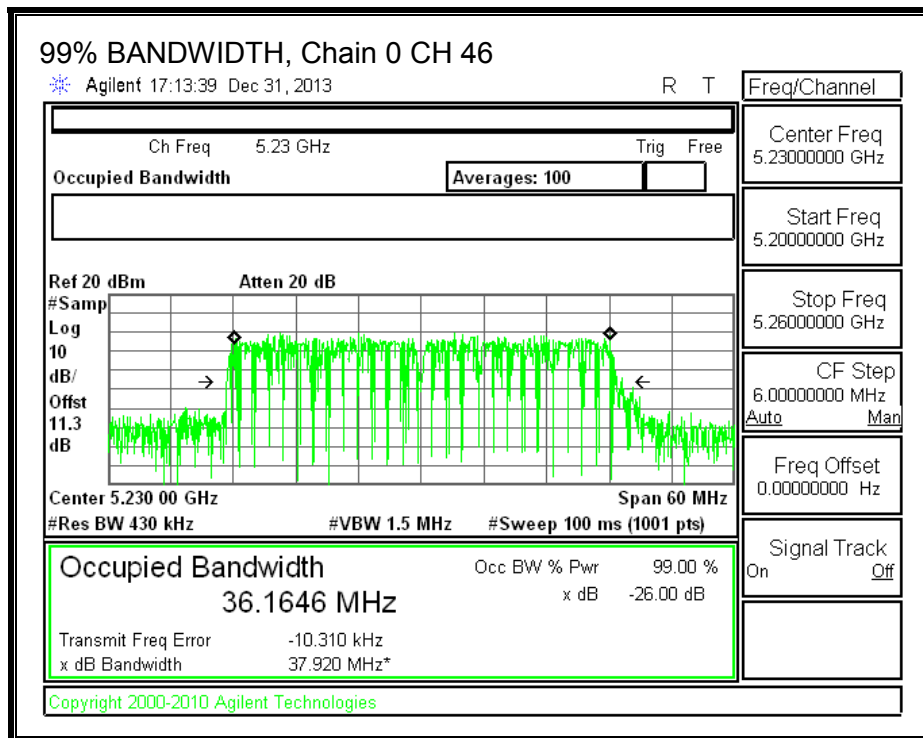
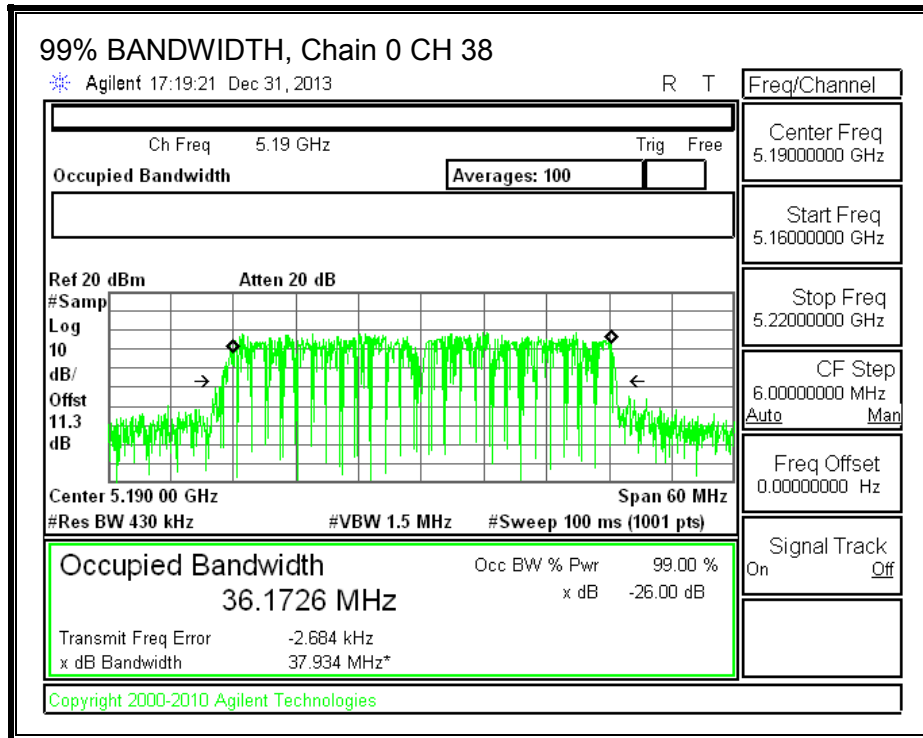
None; for reporting purposes only.

RESULTS

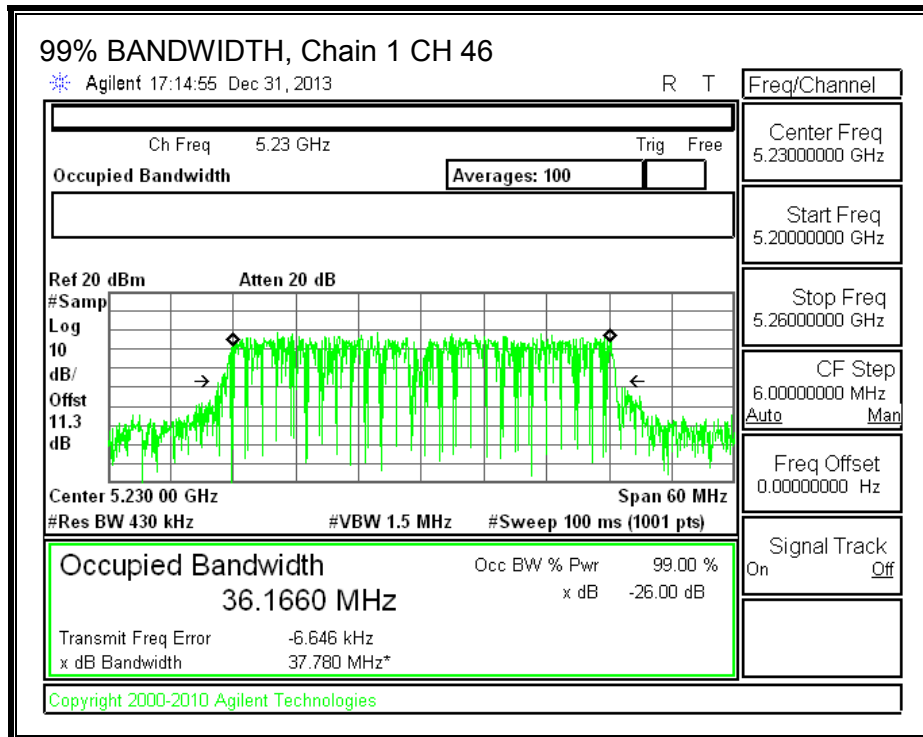
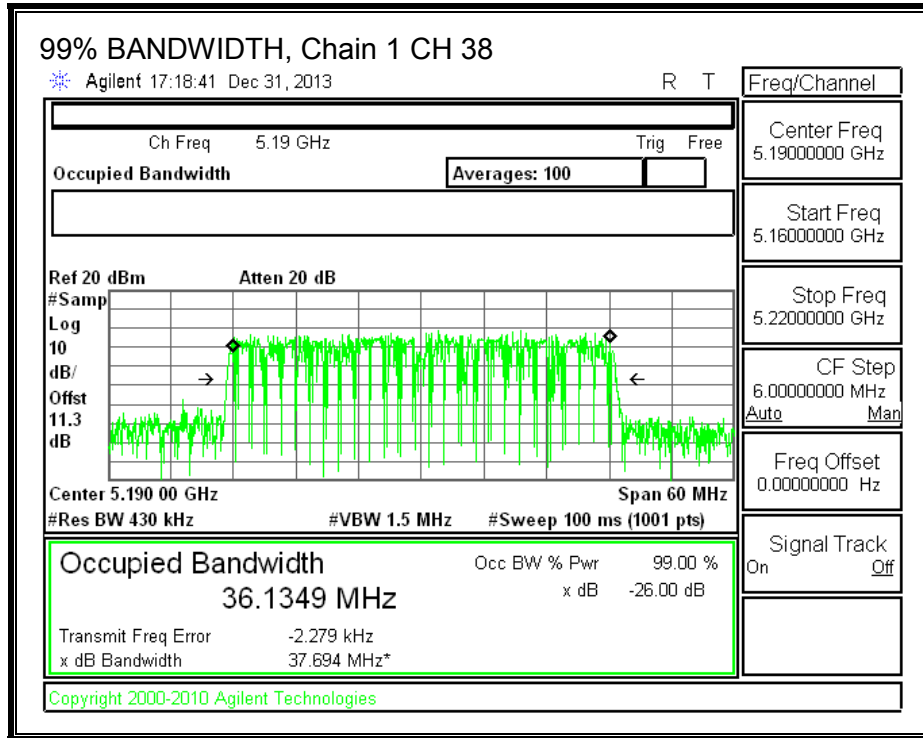
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)	99% BW Chain 2 (MHz)
38	5190	36.1726	36.1349	36.1436
46	5230	36.1646	36.1660	36.1571

99% BANDWIDTH

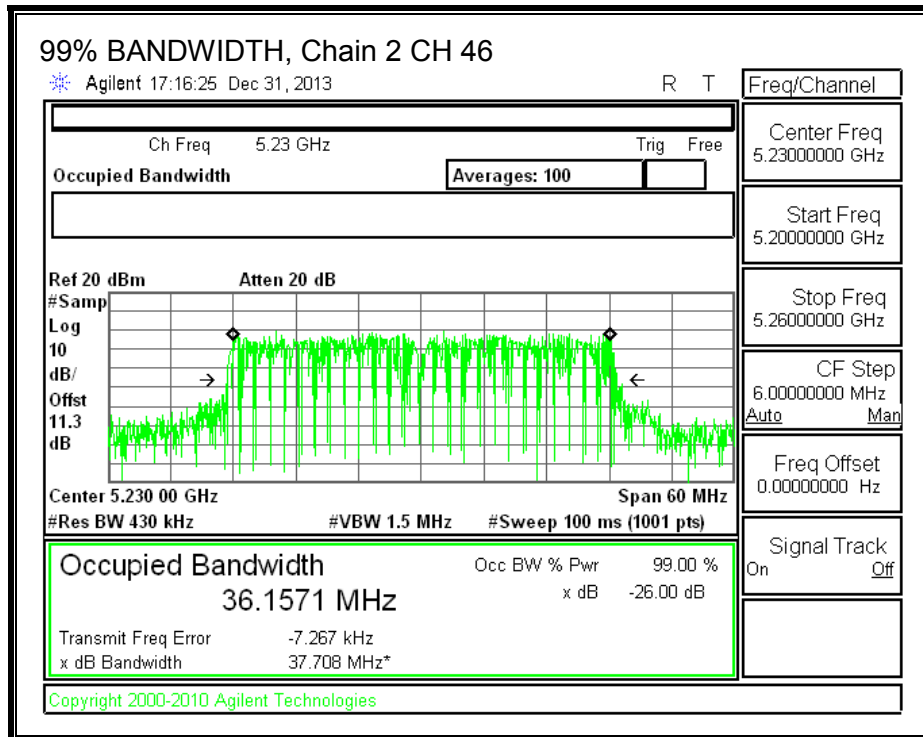
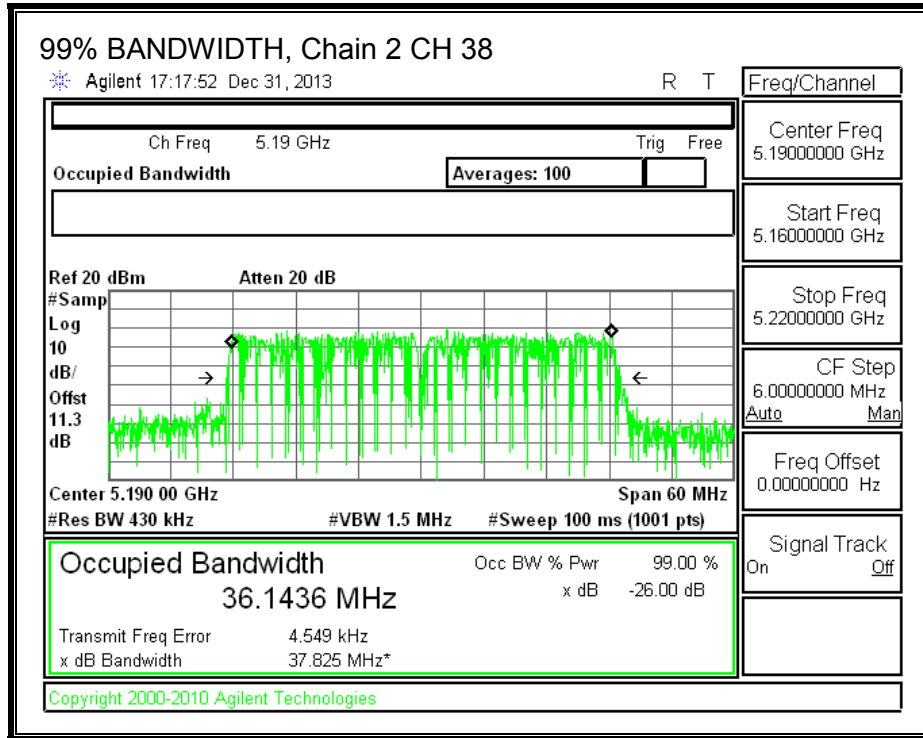
99% BANDWIDTH, Chain 0



99% BANDWIDTH, Chain 1



99% BANDWIDTH, Chain 2



8.7.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.26 dB (including 10 dB pad and 1.26 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Average Power Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
38	5190	11.32	10.53	11.27	15.83
46	5230	11.41	10.91	11.65	16.11

8.7.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26–dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is the same for each chain. The directional gain is equal to the antenna gain.

Antenna Gain (dBi)
2.25

RESULTS

Bandwidth and Antenna Gain

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Min 99% BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PPSD (dBi)
38	5190	39.42	36.1349	2.25	2.25
46	5230	39.18	36.1571	2.25	2.25

Limits

Channel	Frequency (MHz)	FCC Power Limit (dBm)	IC EIRP Limit (dBm)	Max IC Power (dBm)	Power Limit (dBm)	FCC PPSD Limit (dBm)	IC eirp PSD Limit (dBm)	PPSD Limit (dBm)
38	5190	17.00	23.00	20.75	17.00	4.00	10.00	4.00
46	5230	17.00	23.00	20.75	17.00	4.00	10.00	4.00

Duty Cycle CF (dB)	0.34	Included in Calculations of Corr'd Power & PPSD
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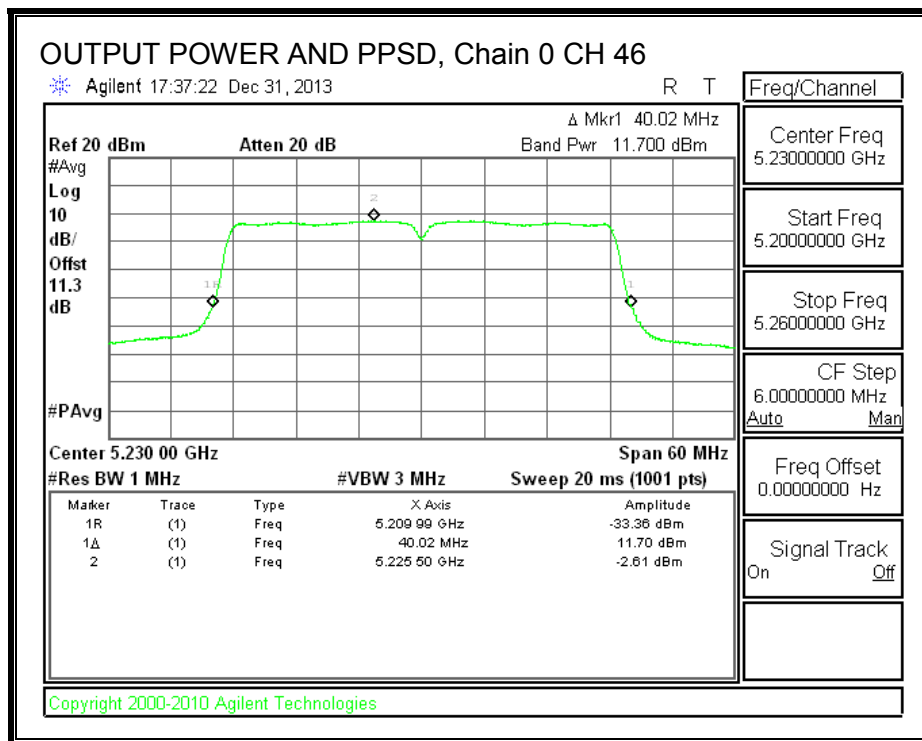
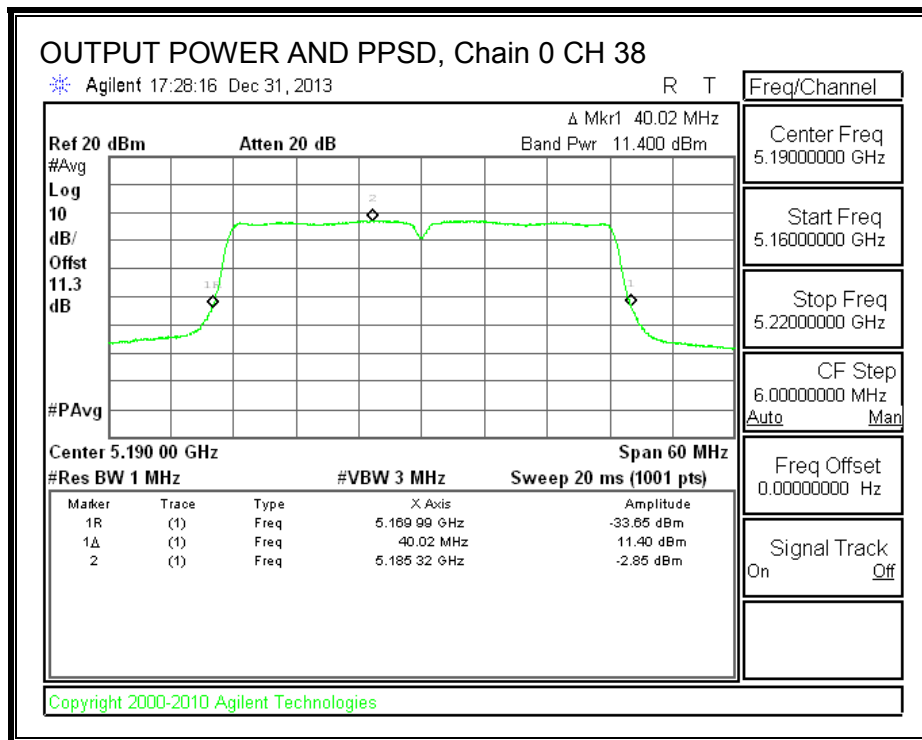
Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
38	5190	11.40	10.86	11.49	16.37	17.00	-0.63
46	5230	11.70	11.24	11.99	16.77	17.00	-0.23

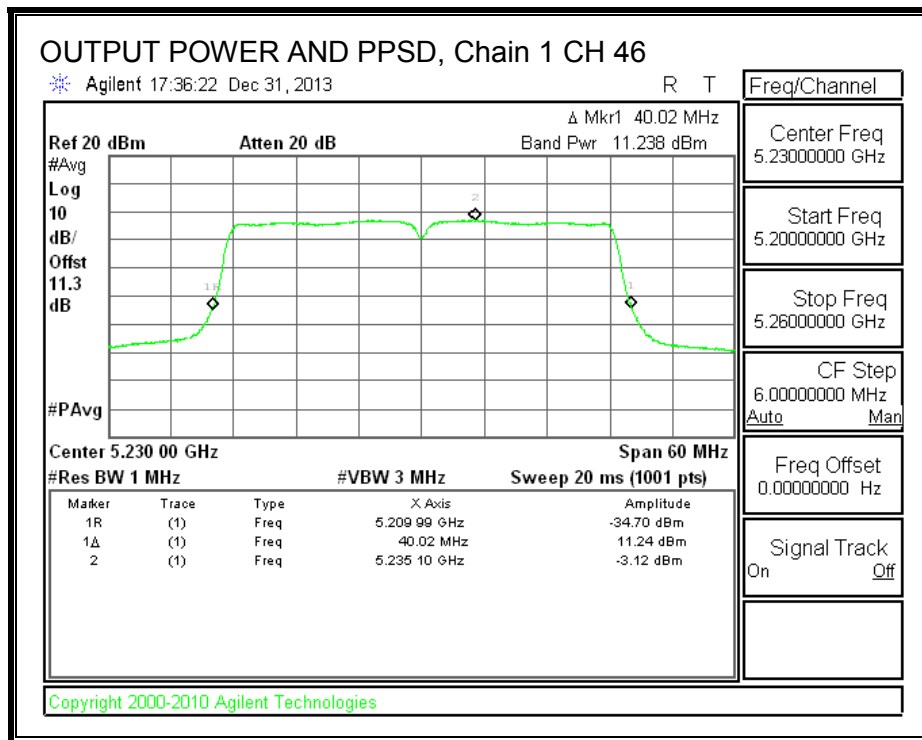
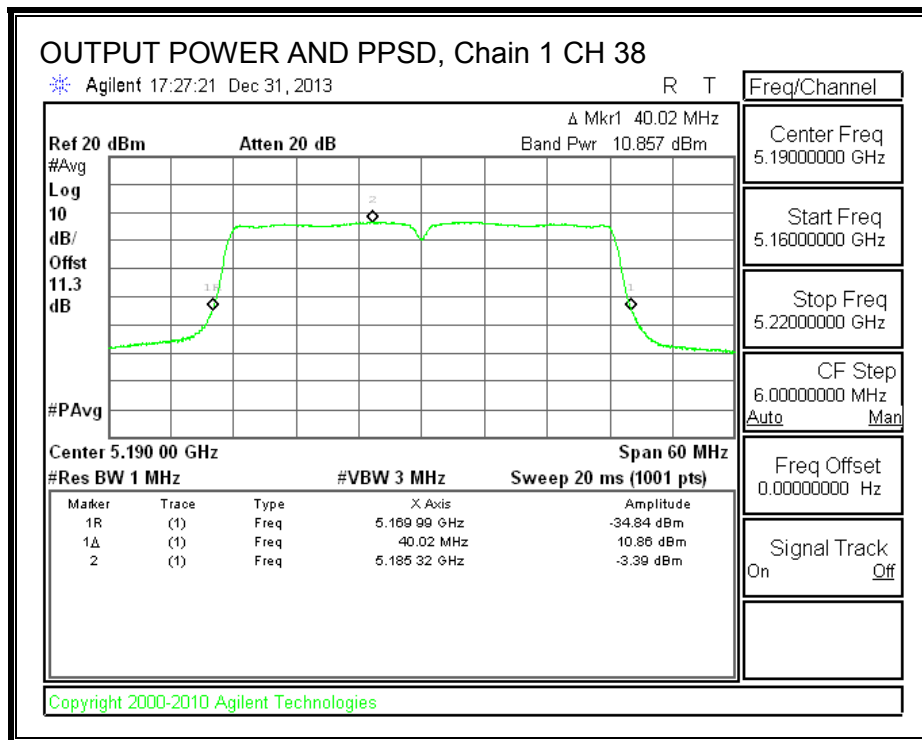
PPSD Results

Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Chain 2 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
38	5190	-2.85	-3.39	-2.86	2.09	4.00	-1.91
46	5230	-2.61	-3.12	-2.31	2.45	4.00	-1.55

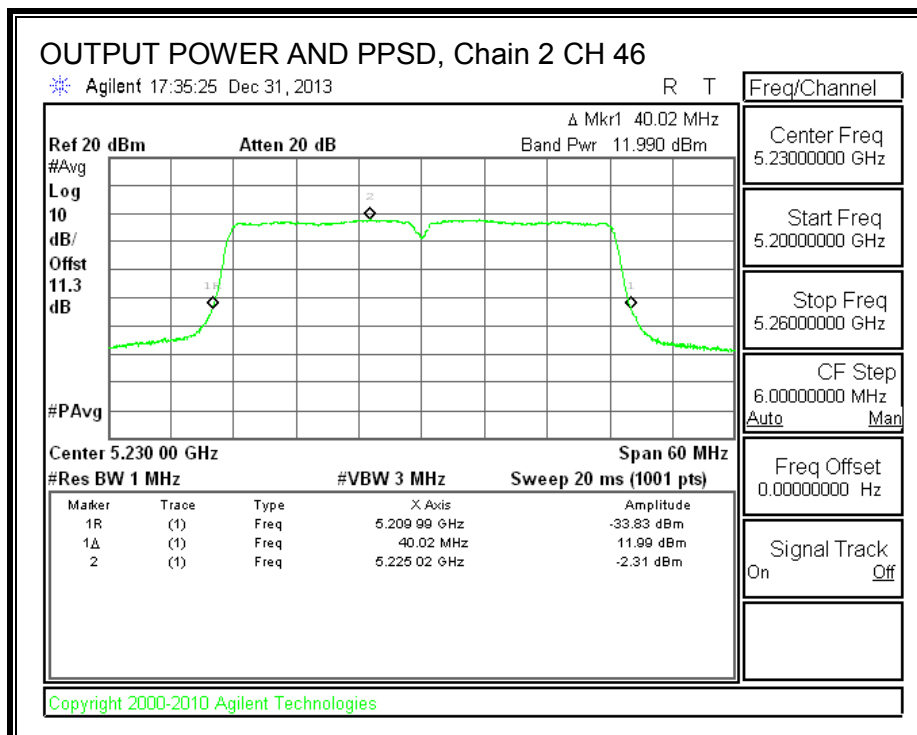
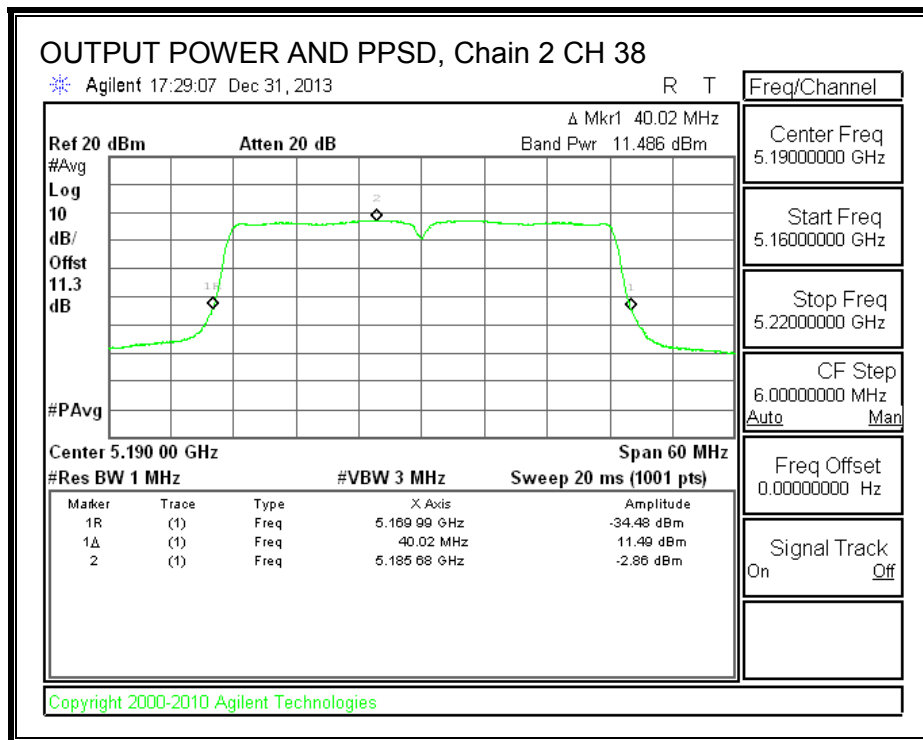
OUTPUT POWER AND PPSD, Chain 0



OUTPUT POWER AND PPSD, Chain 1



OUTPUT POWER AND PPSD, Chain 2



8.8. 802.11ac 80MHz 1TX SISO MODE IN THE 5.2 GHz BAND

8.8.1. 26 dB BANDWIDTH

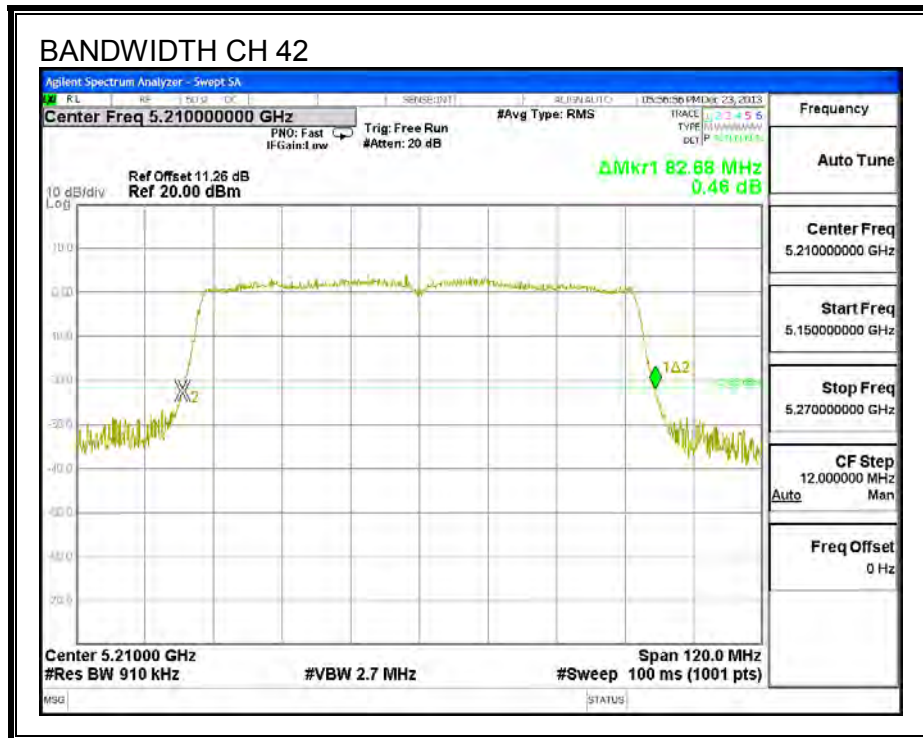
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
42	5210	82.68

26 dB BANDWIDTH



8.8.2. 99% BANDWIDTH

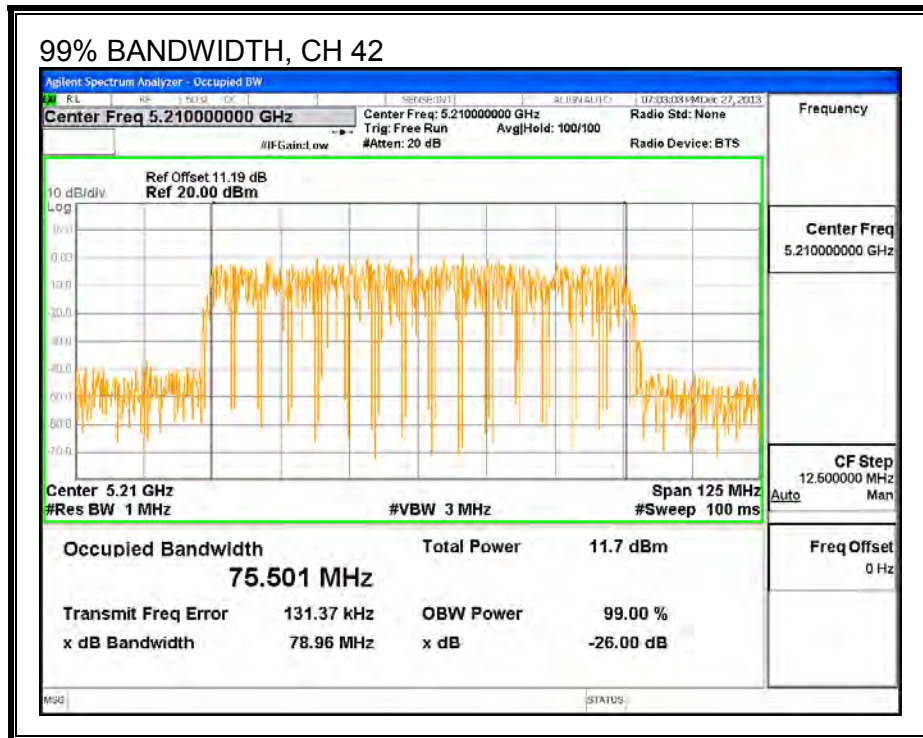
LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
42	5210	75.501

99% BANDWIDTH



8.8.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.26 dB (including 10 dB pad and 1.26 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
42	5210	11.91

8.8.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26–dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

Antenna Gain (dBi)
2.25

RESULTS

Bandwidth and Antenna Gain

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Min 99% BW (MHz)	Directional Gain (dBi)
42	5210	82.7	75.2	2.25

Limits

Channel	Frequency (MHz)	FCC Power Limit (dBm)	IC EIRP Limit (dBm)	Max IC Power (dBm)	Power Limit (dBm)	FCC PPSD Limit (dBm)	IC eirp PSD Limit (dBm)	PPSD Limit (dBm)
42	5210	17.00	23.00	20.75	17.00	4.00	10.00	4.00

Duty Cycle CF (dB)	0.27	Included in Calculations of Corr'd Power & PPSD
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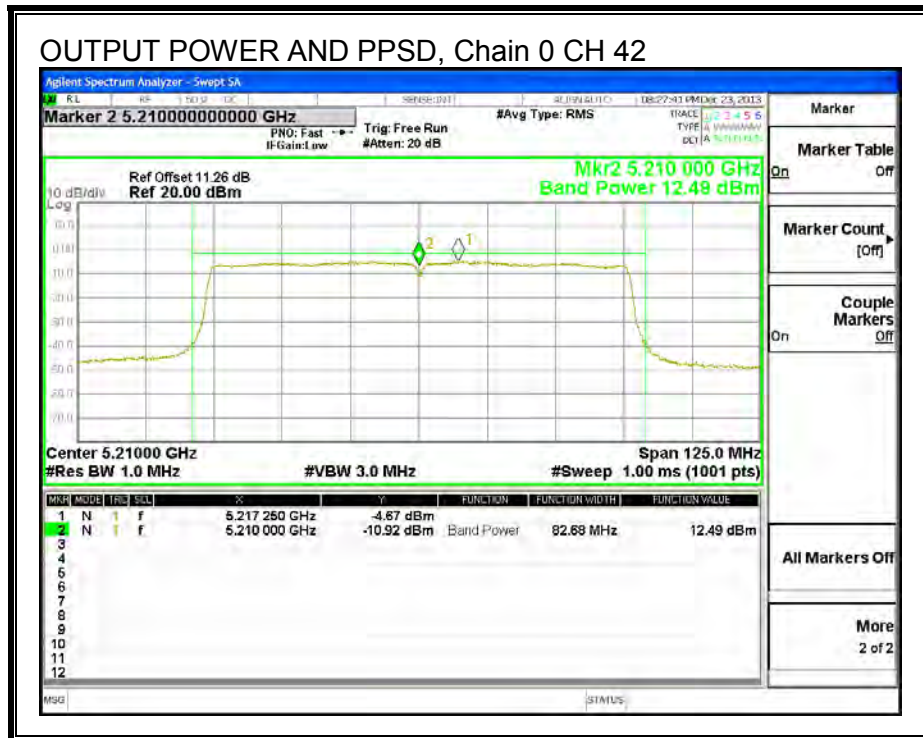
Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
42	5210	12.49	12.76	17.00	-4.24

PPSD Results

Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
42	5210	-4.67	-4.40	4.00	-8.40

OUTPUT POWER AND PPSD, Chain 0



8.9. 802.11ac 80MHz 3TX CDD MODE IN THE 5.2 GHz BAND

8.9.1. 26 dB BANDWIDTH

LIMITS

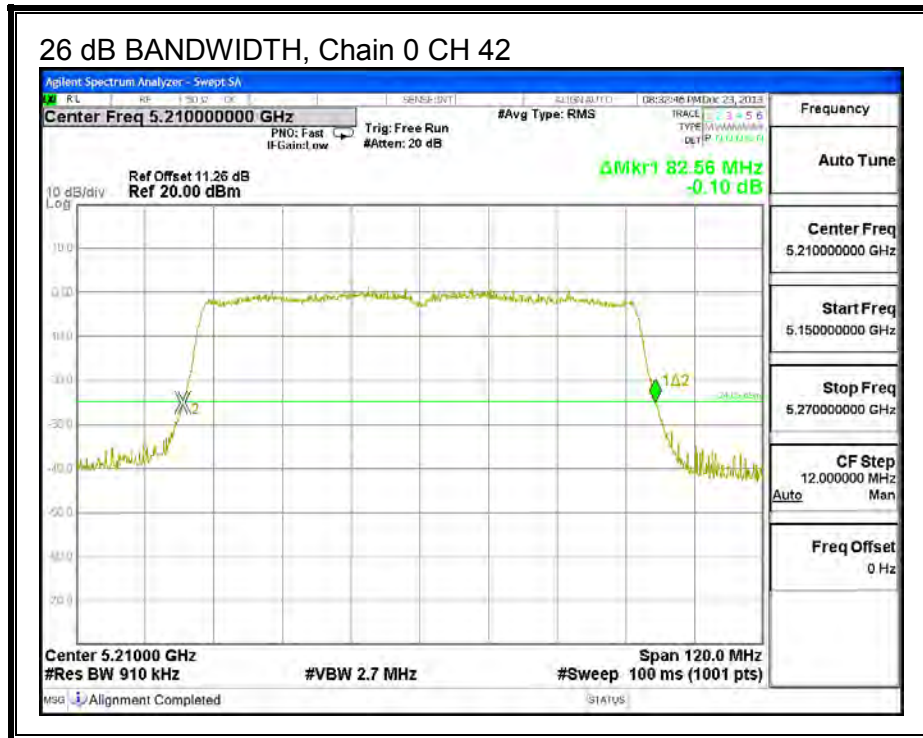
None; for reporting purposes only.

RESULTS

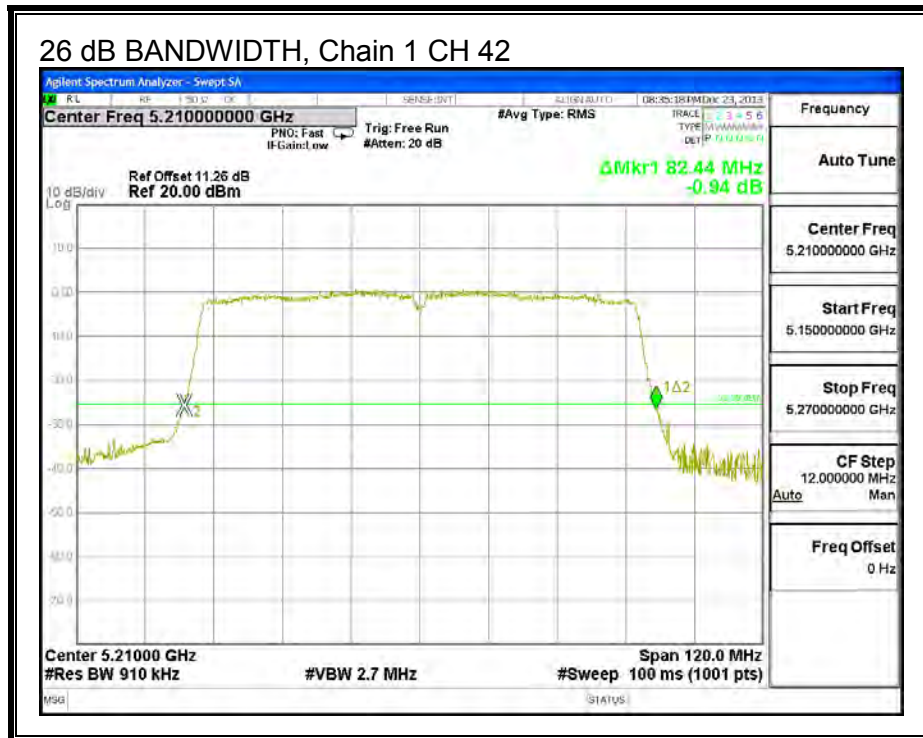
Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)	26 dB BW Chain 2 (MHz)
42	5210	82.56	82.44	81.96

26 dB BANDWIDTH

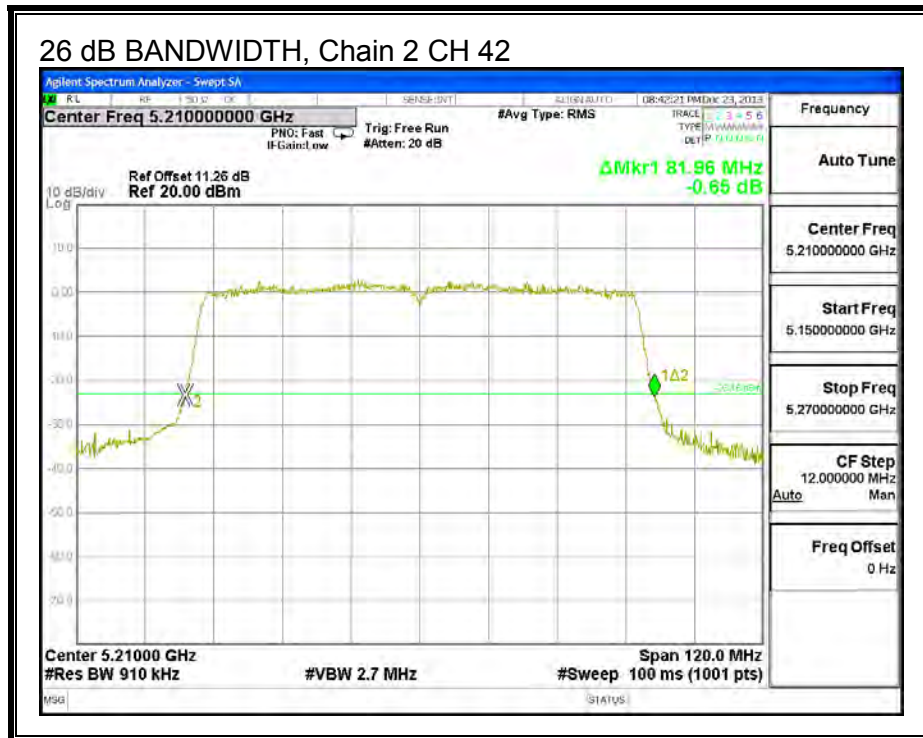
26 dB BANDWIDTH, Chain 0



26 dB BANDWIDTH, Chain 1



26 dB BANDWIDTH, Chain 2



8.9.2. 99% BANDWIDTH

LIMITS

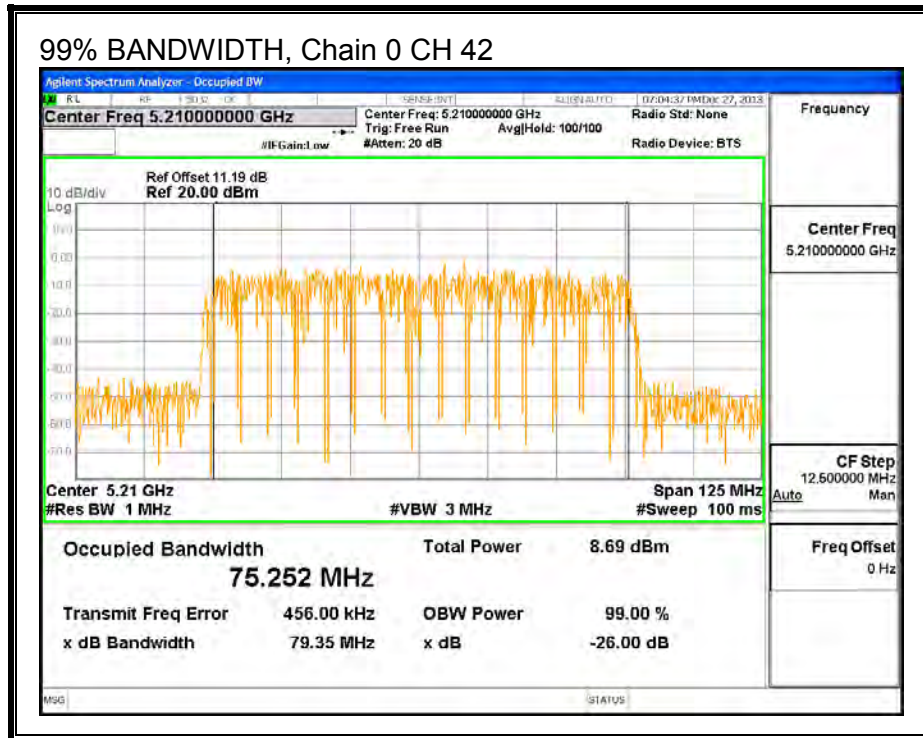
None; for reporting purposes only.

RESULTS

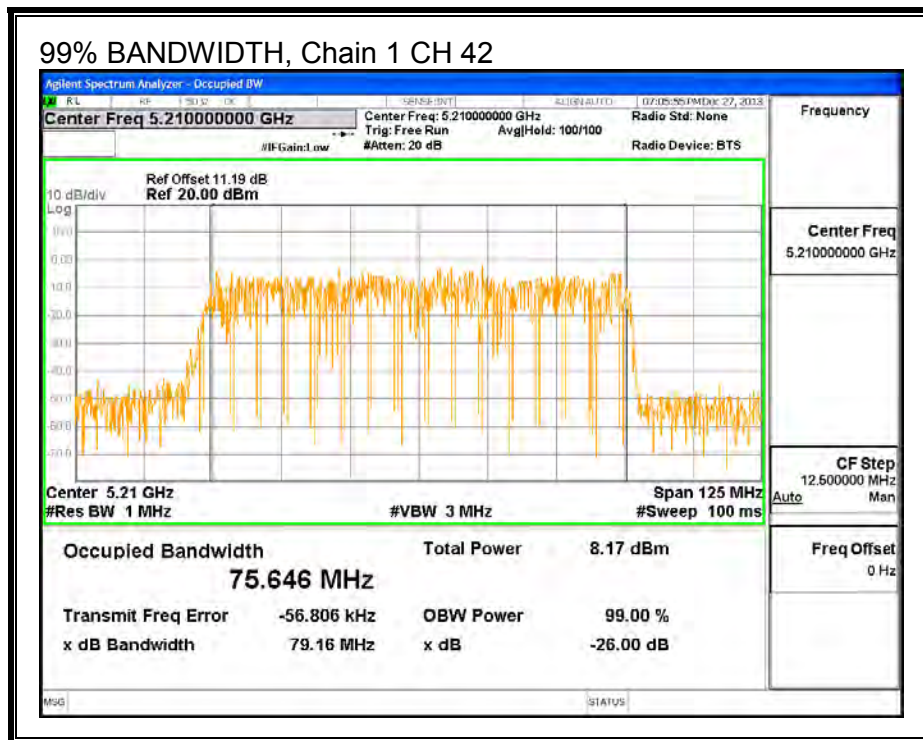
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)	99% BW Chain 2 (MHz)
42	5210	75.252	75.646	75.937

99% BANDWIDTH

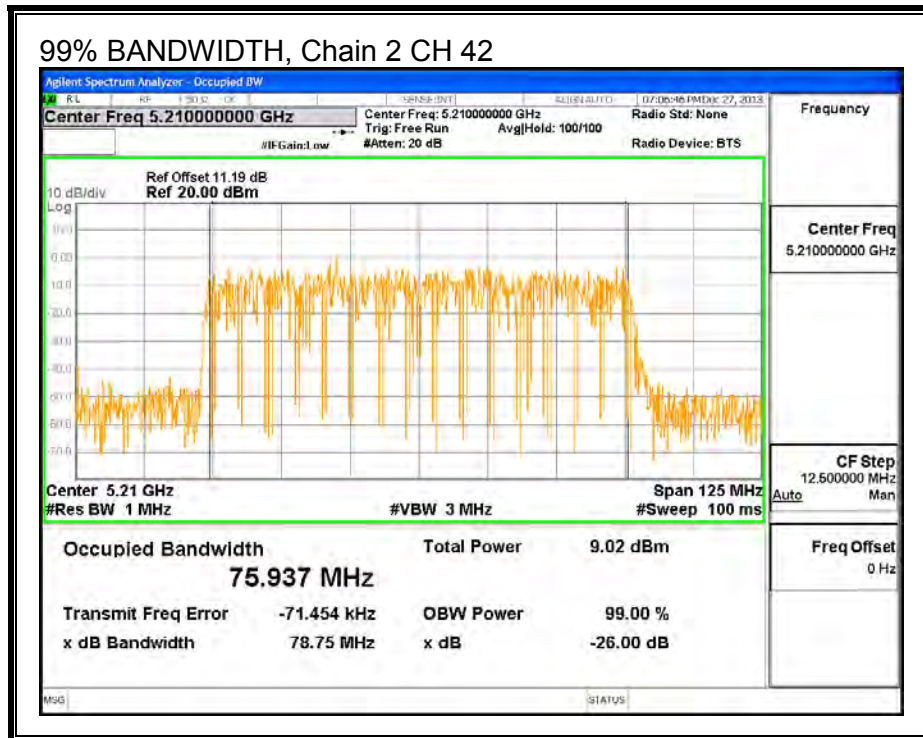
99% BANDWIDTH, Chain 0



99% BANDWIDTH, Chain 1



99% BANDWIDTH, Chain 2



8.9.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.26 dB (including 10 dB pad and 1.26 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Average Power Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
42	5210	9.18	8.47	9.55	13.86

8.9.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are correlated and the antenna gain is the same for each chain. The directional gain is:

Antenna Gain (dBi)	10 * Log (3 chains) (dB)	Correlated Chains Directional Gain (dBi)
2.25	4.77	7.02

RESULTS

Bandwidth and Antenna Gain

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Min 99% BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PPSD (dBi)
42	5210	82.56	75.5680	2.25	7.02

Limits

Channel	Frequency (MHz)	FCC Power Limit (dBm)	IC EIRP Limit (dBm)	Max IC Power (dBm)	Power Limit (dBm)	FCC PPSD Limit (dBm)	IC eirp PSD Limit (dBm)	PPSD Limit (dBm)
42	5210	17.00	23.00	20.75	17.00	2.98	10.00	2.98

Duty Cycle CF (dB)	0.26	Included in Calculations of Corr'd Power & PPSD
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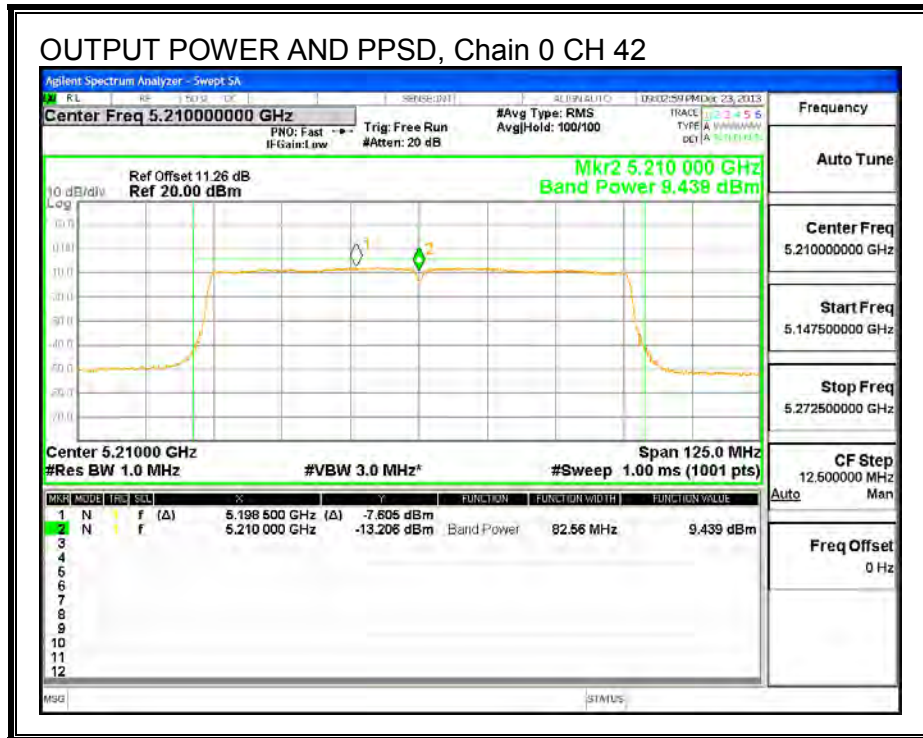
Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
42	5210	9.44	8.79	10.16	14.53	17.00	-2.47

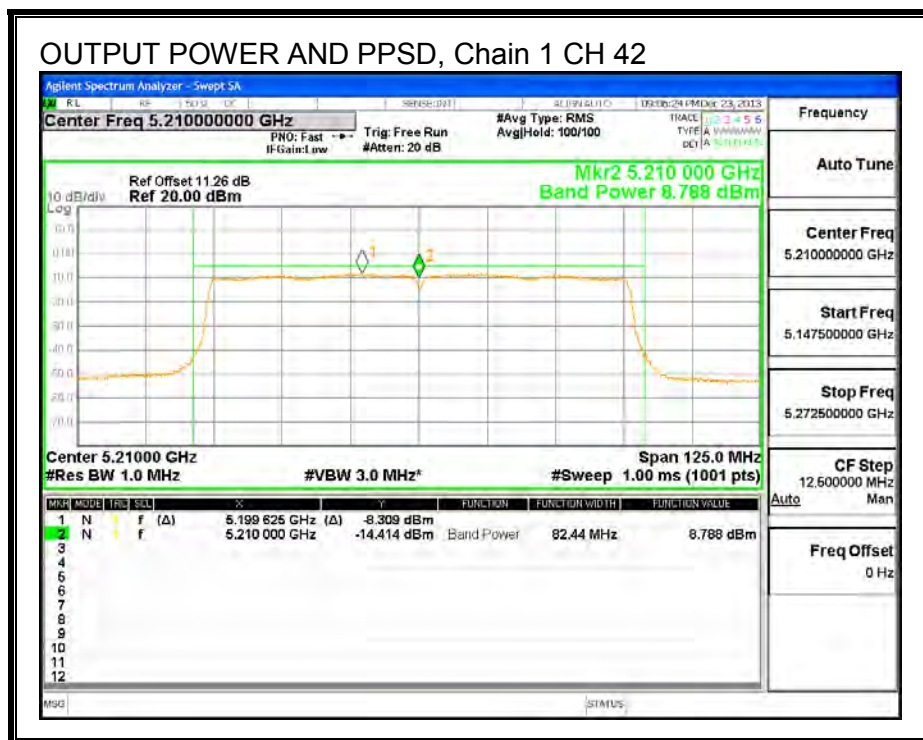
PPSD Results

Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Chain 2 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
42	5210	-7.61	-8.31	-7.19	-2.65	2.98	-5.63

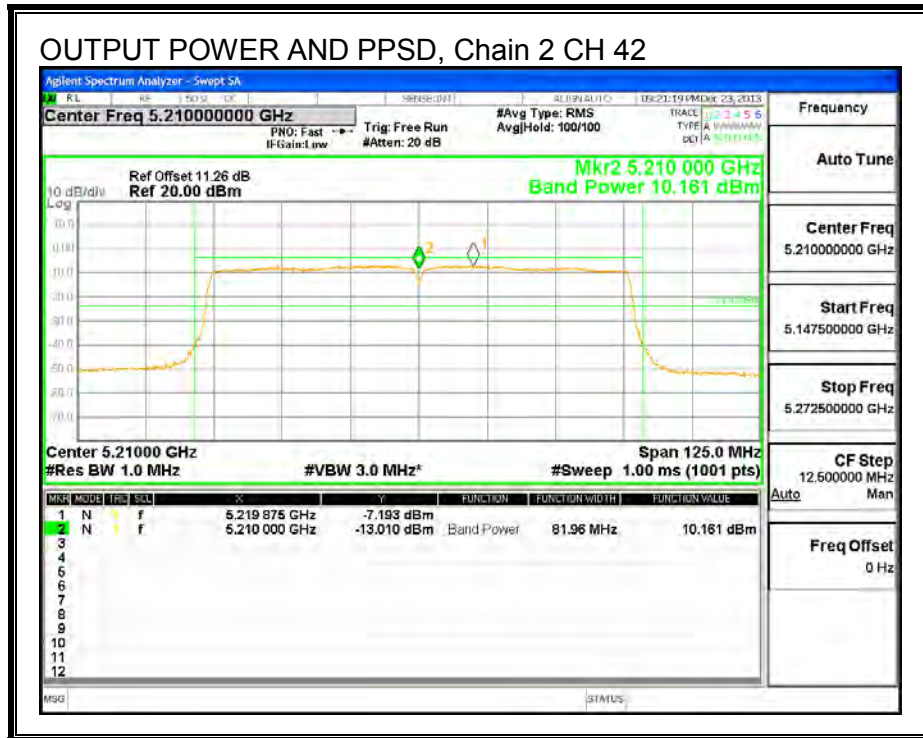
OUTPUT POWER AND PPSD, Chain 0



OUTPUT POWER AND PPSD, Chain 1



OUTPUT POWER AND PPSD, Chain 2



8.10. 802.11ac 80MHz 3TX SDM MODE IN THE 5.2 GHz BAND

8.10.1. 26 dB BANDWIDTH

LIMITS

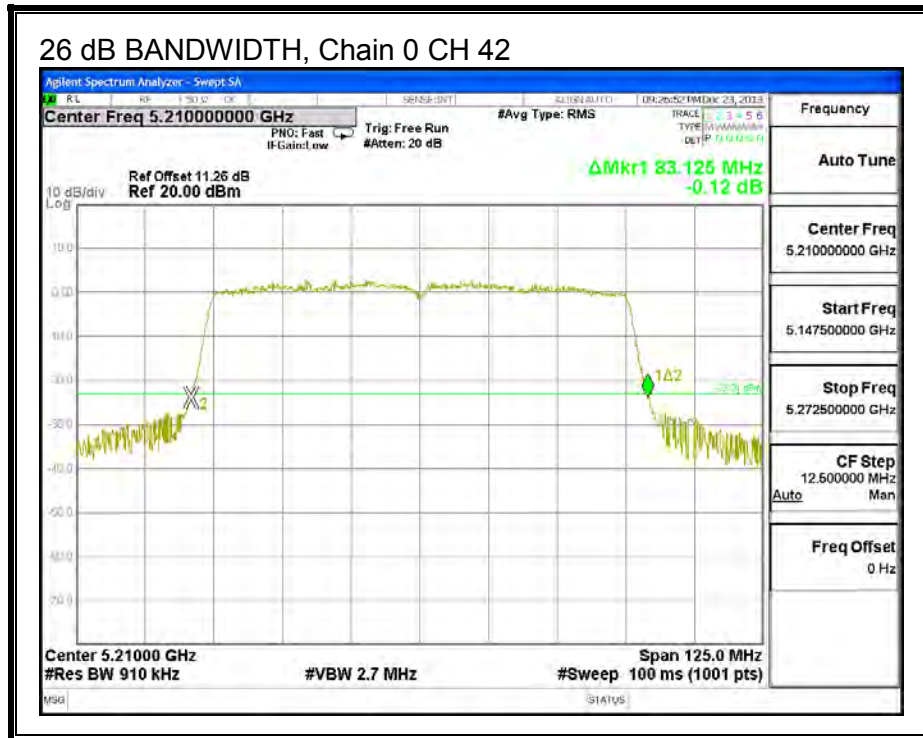
None; for reporting purposes only.

RESULTS

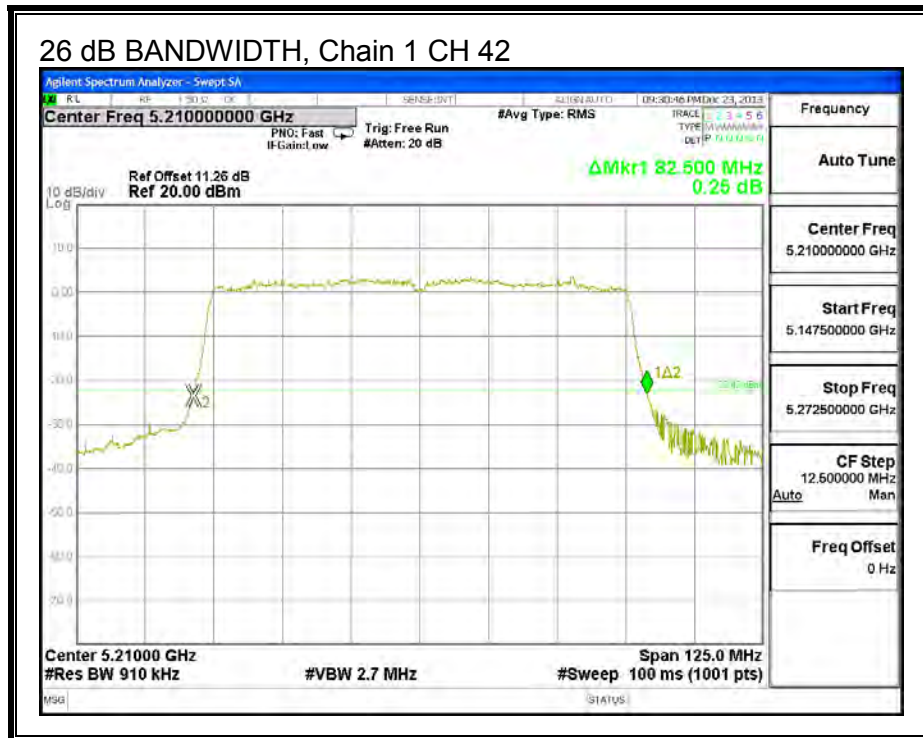
Channel	Frequency (MHz)	26 dB BW Chain 0 (MHz)	26 dB BW Chain 1 (MHz)	26 dB BW Chain 2 (MHz)
42	5210	83.125	82.500	82.250

26 dB BANDWIDTH

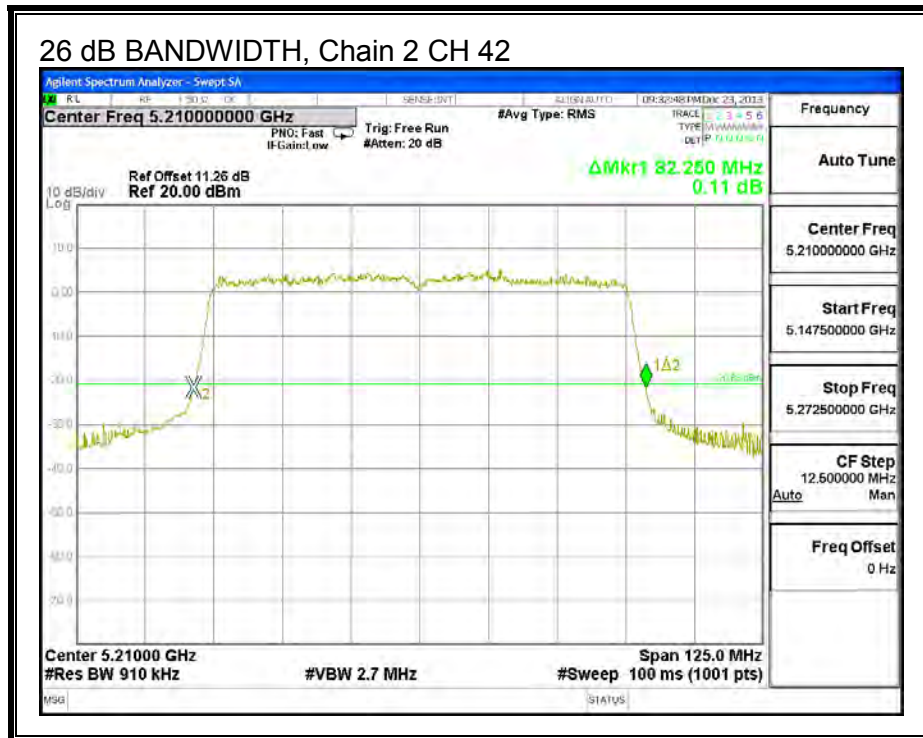
26 dB BANDWIDTH, Chain 0



26 dB BANDWIDTH, Chain 1



26 dB BANDWIDTH, Chain 2



8.10.2. 99% BANDWIDTH

LIMITS

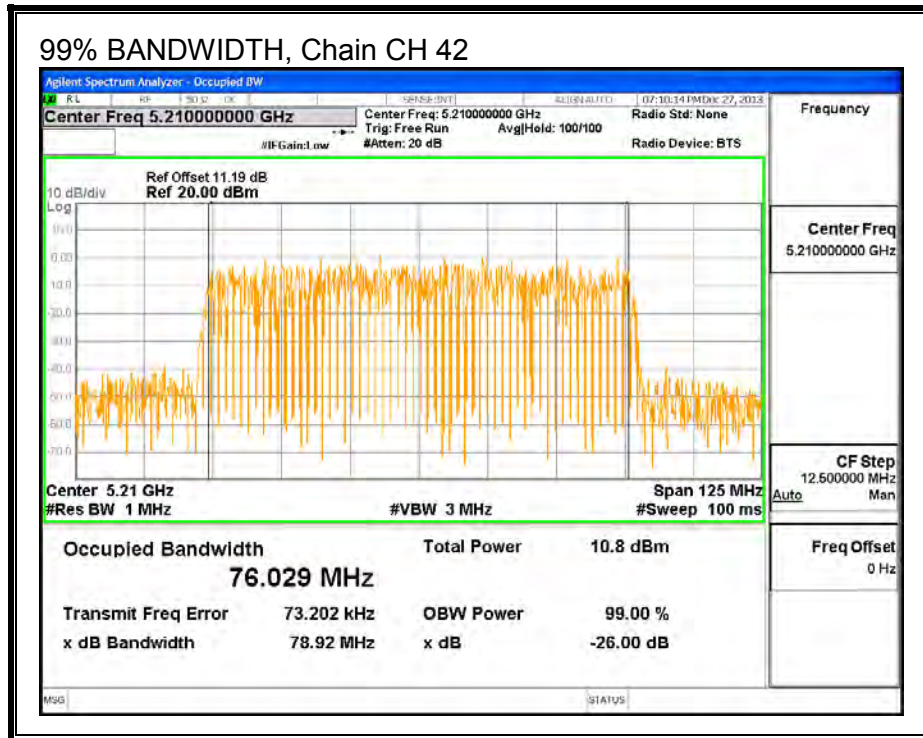
None; for reporting purposes only.

RESULTS

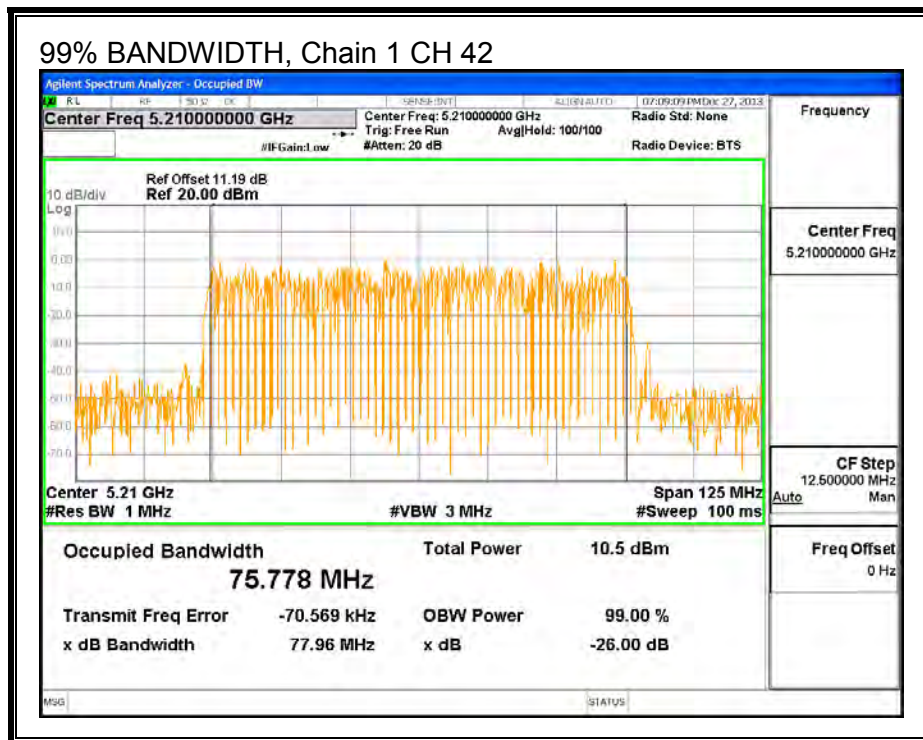
Channel	Frequency (MHz)	99% BW Chain 0 (MHz)	99% BW Chain 1 (MHz)	99% BW Chain 2 (MHz)
42	5210	76.029	75.778	75.040

99% BANDWIDTH

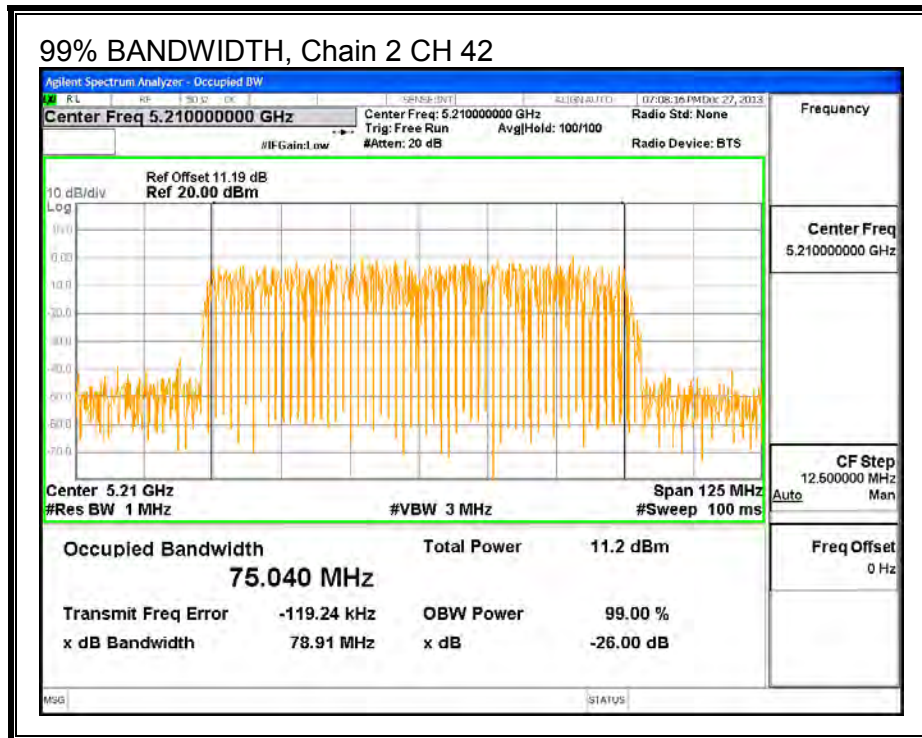
99% BANDWIDTH, Chain 0



99% BANDWIDTH, Chain 1



99% BANDWIDTH, Chain 2



8.10.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 11.26 dB (including 10 dB pad and 1.26 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Average Power Results

Channel	Frequency (MHz)	Chain 0 Power (dBm)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Total Power (dBm)
42	5210	11.27	10.91	11.61	16.04

8.10.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 26–dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1–MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

The TX chains are uncorrelated and the antenna gain is the same for each chain. The directional gain is equal to the antenna gain.

Antenna Gain (dBi)
2.25

RESULTS

Bandwidth and Antenna Gain

Channel	Frequency (MHz)	Min 26 dB BW (MHz)	Min 99% BW (MHz)	Directional Gain for Power (dBi)	Directional Gain for PPSD (dBi)
42	5210	83.13	76.0110	2.25	2.25

Limits

Channel	Frequency (MHz)	FCC Power Limit (dBm)	IC EIRP Limit (dBm)	Max IC Power (dBm)	Power Limit (dBm)	FCC PPSD Limit (dBm)	IC eirp PSD Limit (dBm)	PPSD Limit (dBm)
42	5210	17.00	23.00	20.75	17.00	4.00	10.00	4.00

Duty Cycle CF (dB)	0.60	Included in Calculations of Corr'd Power & PPSD
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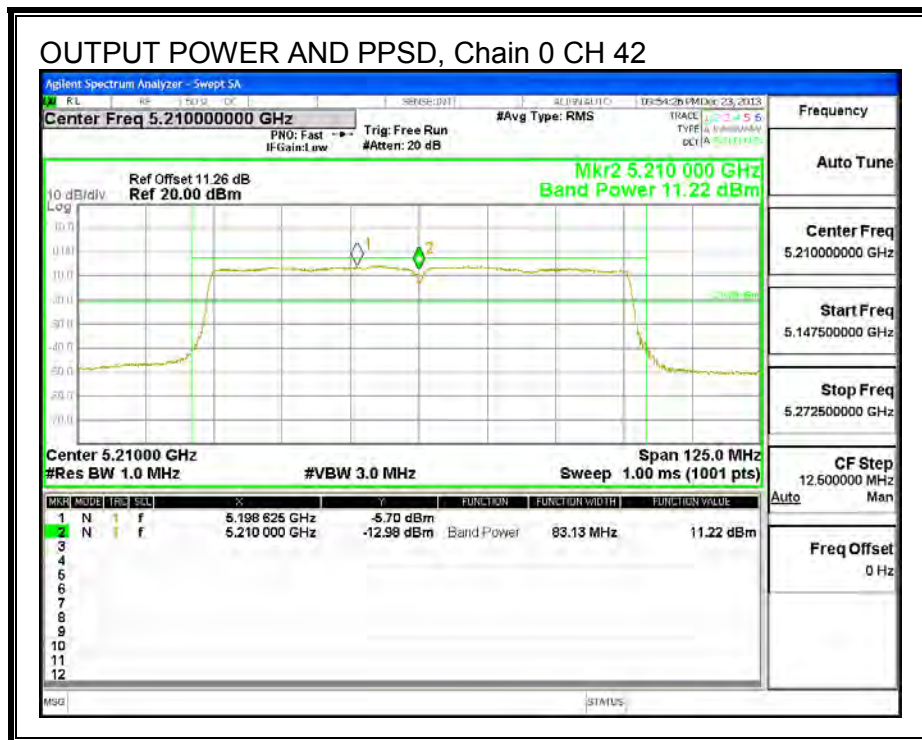
Output Power Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Chain 1 Meas Power (dBm)	Chain 2 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
42	5210	11.22	11.05	11.97	16.80	17.00	-0.20

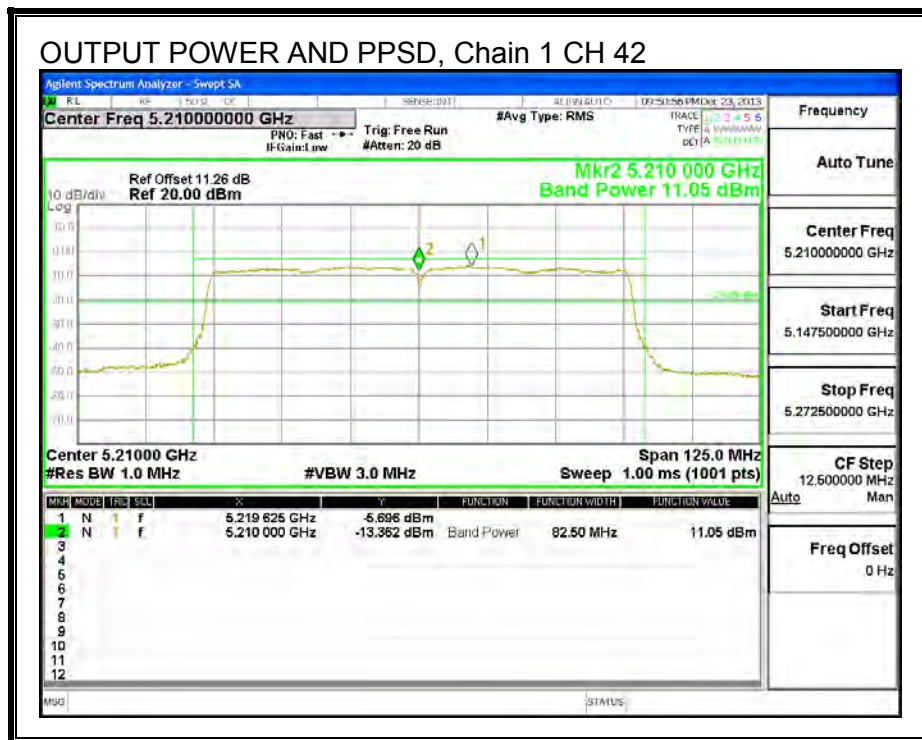
PPSD Results

Channel	Frequency (MHz)	Chain 0 Meas PPSD (dBm)	Chain 1 Meas PPSD (dBm)	Chain 2 Meas PPSD (dBm)	Total Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
42	5210	-5.70	-5.70	-4.82	-0.01	4.00	-4.01

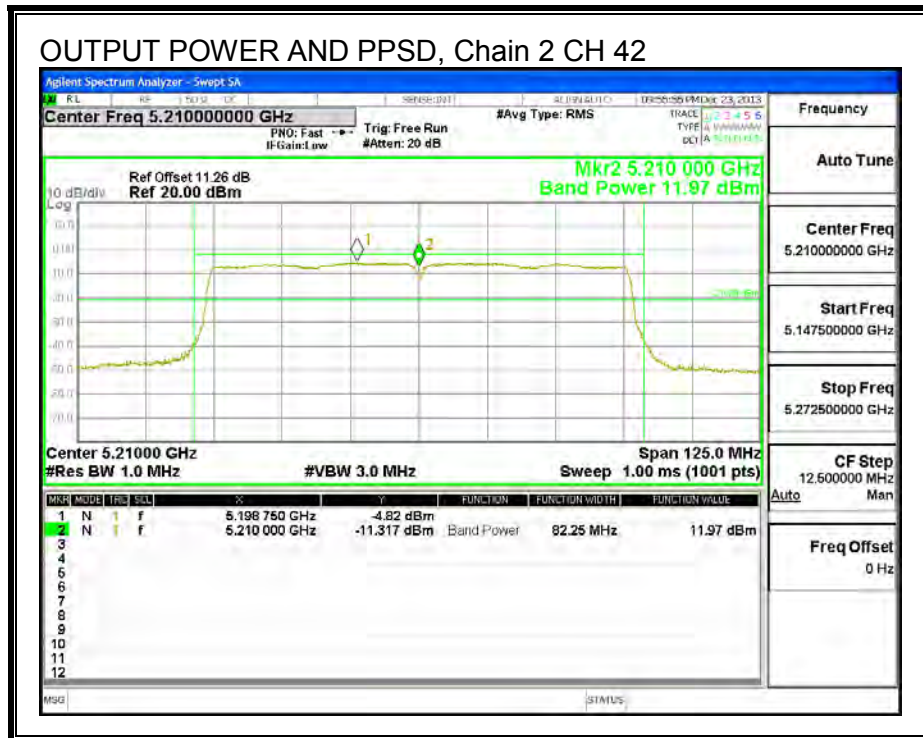
OUTPUT POWER AND PPSD, Chain 0



OUTPUT POWER AND PPSD, Chain 1



OUTPUT POWER AND PPSD, Chain 2



8.11. 802.11a 1TX SISO MODE IN THE 5.3 GHz BAND

8.11.1. 26 dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB BW (MHz)
52	5260	20.04
60	5300	20.08
64	5320	20.20

26 dB BANDWIDTH

26 dB BANDWIDTH, Chain 0

