



**FCC CFR47 PART 15 SUBPART E  
INDUSTRY CANADA RSS-210 ISSUE 8**

**CERTIFICATION TEST REPORT**

**FOR**

**Dual-Band 802.11 a/b/g/n Industrial Access Point with Integrated DOCSIS 3.0  
Modem**

**MODEL NUMBER: ZoneFlex7761-CM**

**FCC ID: S9GZF7761CM  
IC: 5912A-ZF7761CM**

**REPORT NUMBER: 10U13475-3, Revision C**

**ISSUE DATE: JUNE 06, 2011**

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**NVLAP LAB CODE 200065-0**

Revision History

Rev.	Issue Date	Revisions	Revised By
--	03/02/11	Initial Issue	F. Ibrahim
A	03/03/11	Inserted the conducted spurious data for the notch band of 5.6-5.65 GHz	F. Ibrahim
B	03/21/11	Revised output power values in sections 7.4.2, section 7.6.2, section 7.7.2, section 7.8.2, and section 7.9.2. Revised MPE section.	F. Ibrahim
C	06/06/11	Revised sections 7.4.6, 7.5.2, 7.5.4, 7.5.6, 7.6.2, 7.6.4, 7.6.6, 7.7.6, 7.8.2, 7.8.4, 7.8.6, 7.9.2, 7.9.4, and 7.9.6 for limits and test procedure paragraphs.	F. Ibrahim

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# 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** Ruckus Wireless  
880 West Maude Ave., Suite 101  
Sunnyvale, CA 94085, U.S.A

**EUT DESCRIPTION:** Dual-Band 802.11 a/b/g/n Industrial Access Point with Integrated DOCSIS 3.0 Modem

**MODEL:** ZoneFlex7761-CM

**SERIAL NUMBER:** C0C5200001BD

**DATE TESTED:** NOVEMBER 2, 2010 - MARCH 2, 2011

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart E	Pass
INDUSTRY CANADA RSS-210 Issue 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

Compliance Certification Services, Inc. (CCS) 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 CCS 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by CCS 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.

Approved & Released For CCS By:



FRANK IBRAHIM  
EMC SUPERVISOR  
COMPLIANCE CERTIFICATION SERVICES

Tested By:



WILLIAM ZHUANG  
EMC ENGINEER  
COMPLIANCE CERTIFICATION SERVICES

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2003, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.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 a Dual-Band 802.11 a/b/g/n Industrial Access Point with Integrated DOCSIS 3.0 Modem.

The radio module is manufactured by Ruckus Wireless.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

#### THREE CHAIN CONFIGURATION IN THE 5.2 GHz BAND

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5180 - 5240	802.11a	12.29	16.94
5180 - 5240	802.11n HT20	15.71	37.24
5190 - 5230	802.11n HT40	16.85	48.42

#### THREE CHAIN CONFIGURATION IN THE 5.3 GHz BAND

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5260 - 5320	802.11a	20.60	114.82
5260 - 5320	802.11n HT20	23.64	231.21
5270 - 5310	802.11n HT40	23.02	200.45

#### THREE CHAIN CONFIGURATION IN THE 5.6 GHz BAND

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5500 - 5700	802.11a	20.73	118.30
5500 - 5700	802.11n HT20	21.79	151.01
5510 - 5670	802.11n HT40	21.73	148.94



### **5.3. DESCRIPTION OF AVAILABLE ANTENNAS**

The radio utilizes MIMO dual-band antenna with a maximum peak gain of **5 dBi** in the 2.4 GHz band and a MIMO Omni antenna for only 5 GHz band with maximum peak gain of **5.5 dBi** in the 5 GHz bands.

### **5.4. SOFTWARE AND FIRMWARE**

The firmware installed in the EUT during testing was version 9.0.0.0.65 and the cable modem firmware was version V92004.

The RF conducted testing used Atheros Radio Test software which we call "ART". The version number is v0\_5\_b25ALL.

### **5.5. WORST-CASE CONFIGURATION AND MODE**

For Radiated Emissions and Power line Conducted Emissions, the channel with the highest conducted output power was selected.

Worst-case data rates as provided by the manufacturer are:

For 11a mode: 6Mbps

For 11n HT20 (5.2 GHz and 5.6 GHz bands): MCS8

For 11n HT40 (5.2 GHz and 5.6 GHz bands): MCS8

Peak Power Spectral Density was investigated for individual chains versus combiner, and it was determined that combiner is worst-case; therefore, all final measurements of PPSD were performed using a combiner.

RF Conducted Spurious was investigated for individual chains versus combiner, and it was determined that combiner is worst-case; therefore, all final measurements of RF conducted spurious were performed using a combiner.

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	Manufacturer	Model	Serial Number
Laptop PC	IBM	2366	78-BWY97
AC/DC Adapter	IBM	02K6665	1Z0Z0500ZF
POE	RUCKUS	NPE-5818	10A282617
AC/DC Adapter	RUCKUS	PA1060-48 T1A125	1022
USB Mouse	Microsoft	X09-13962	N/A
AC/DC Adapter	RUCKUS	MPC-1200201	101

**Note:** AC/DC adapter MPC-1200201 was used to power the radio for radiated emissions 3-1000 MHz and power line conducted emissions tests.

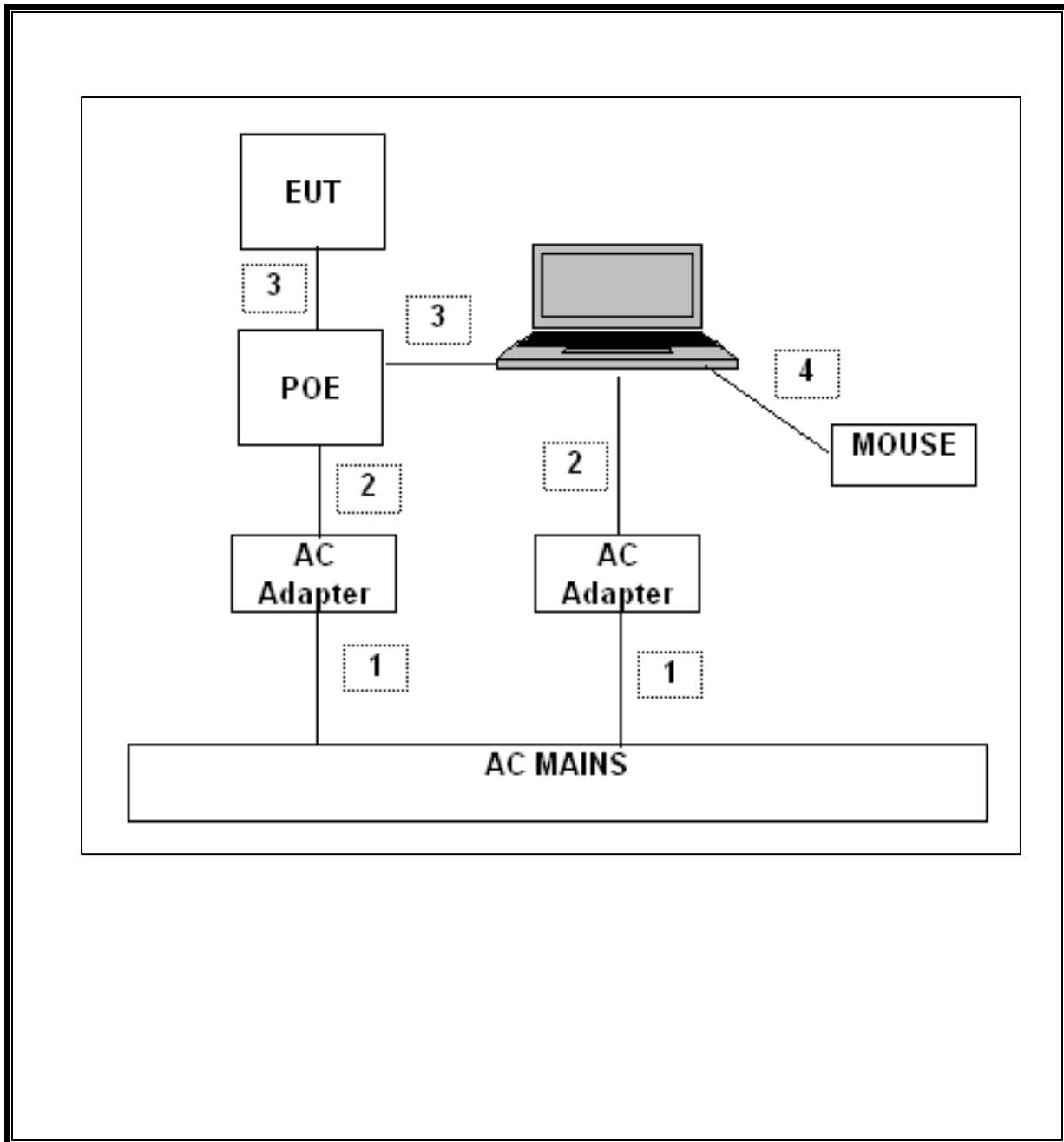
### I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC Input	2	AC	Un-Shielded	1.5m	N/A
2	DC Input	2	DC	Un-Shielded	1.8m	N/A
3	Ethernet	2	RJ45	Un-Shielded	1.5m	N/A
4	USB	1	USB	Un-Shielded	1.5m	N/A

### TEST SETUP

The Access Point EUT is controlled externally with a laptop, via Ethernet.

**SETUP DIAGRAM FOR RADIO 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
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01178	08/30/10
Peak Power Meter	Boonton	4541	C01185	03/01/10
Peak Power Sensor	Boonton	57006	C01203	02/24/10
Antenna, Bilog, 2 GHz	Sundt Sciences	JB1	C01011	07/12/11
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00885	01/06/12
Antenna, Horn, 18 GHz	EMCO	3115	C00945	06/29/11
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	07/14/11
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	05/06/11
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/10/11
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	11/10/11

## 7. ANTENNA PORT TEST RESULTS

### 7.1. 802.11a THREE CHAIN LEGACY MODE IN THE 5.2 GHz BAND

#### 7.1.1. 26 dB and 99% BANDWIDTH

##### LIMITS

None; for reporting purposes only.

##### TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

##### RESULTS

###### CHAIN 1

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5180	22.434	16.3921
Middle	5200	20.997	16.4137
High	5240	20.336	16.4002

###### CHAIN 2

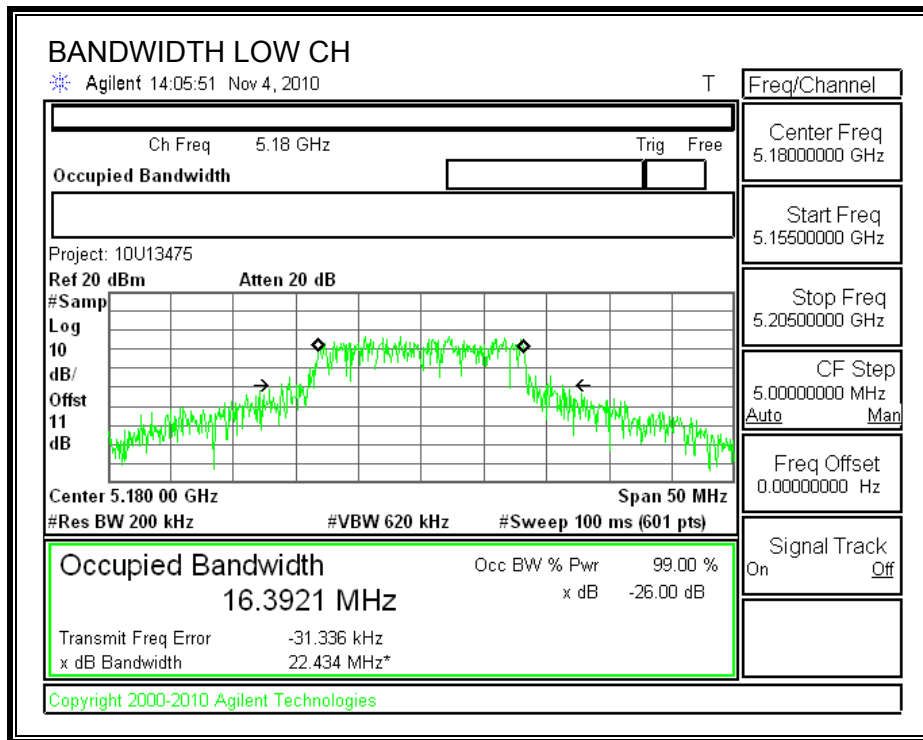
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5180	18.770	16.2711
Middle	5200	19.012	16.5410
High	5240	21.031	16.3638

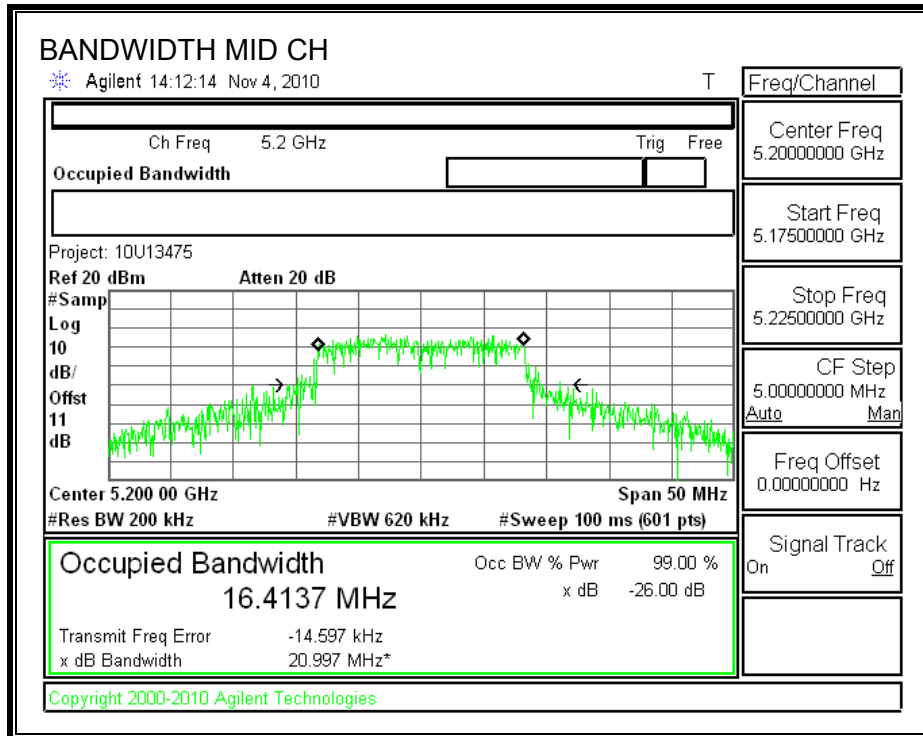
###### CHAIN 3

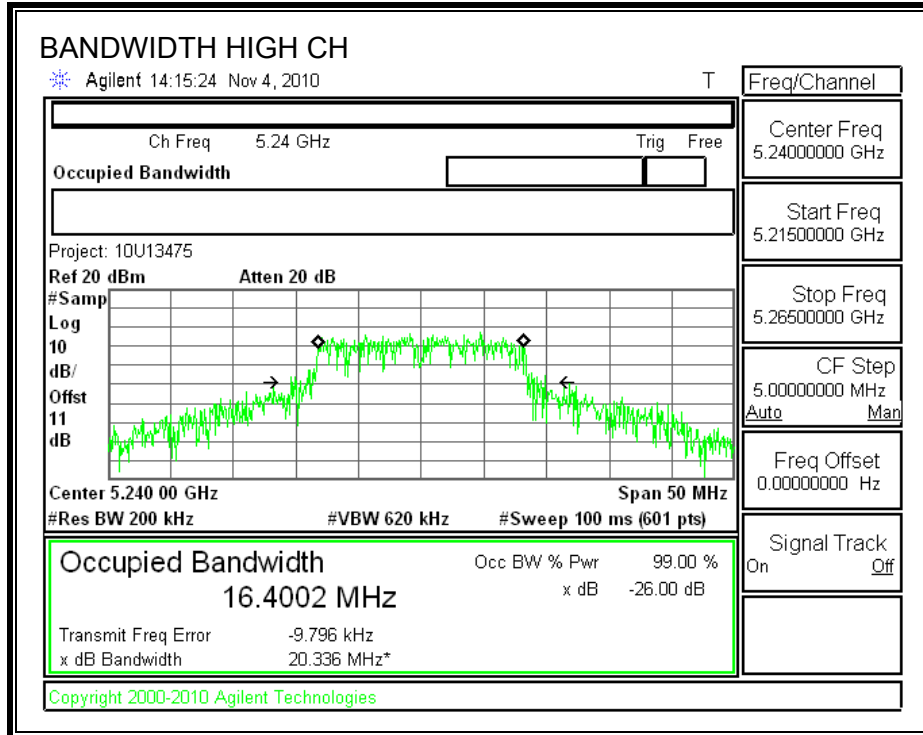
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5180	18.24	16.5538
Middle	5200	19.45	16.4851
High	5240	21.76	16.4216

**CHAIN 1**

**26 dB and 99% BANDWIDTH**



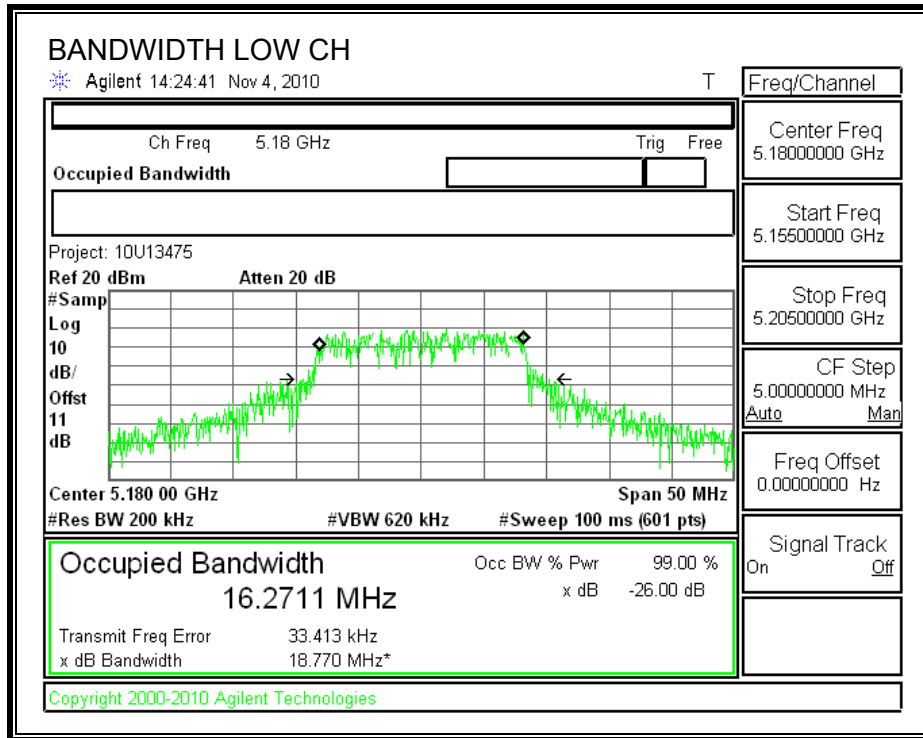


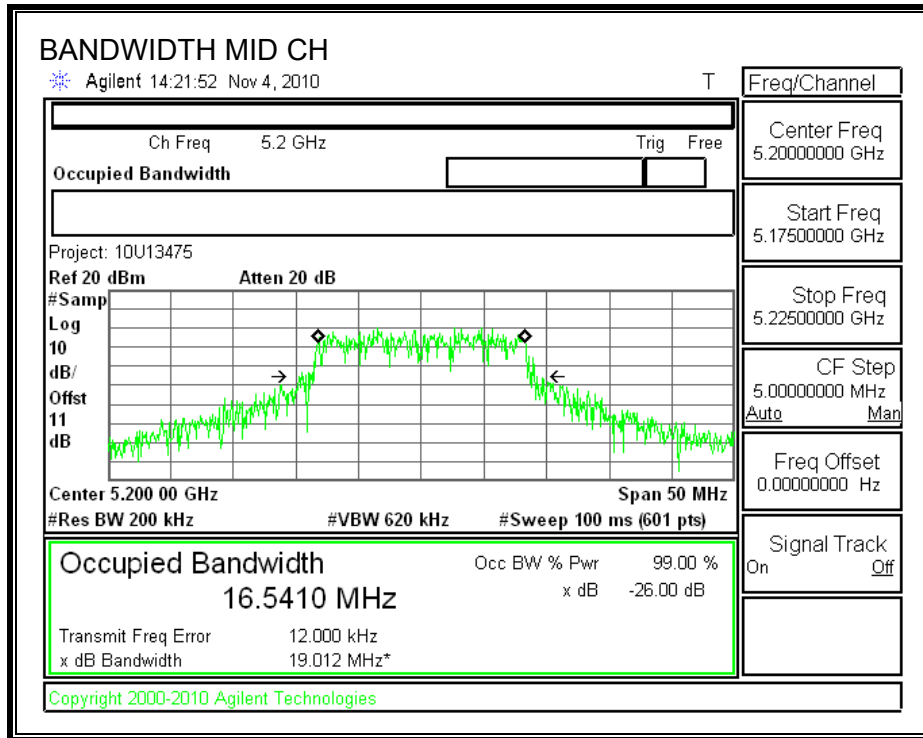


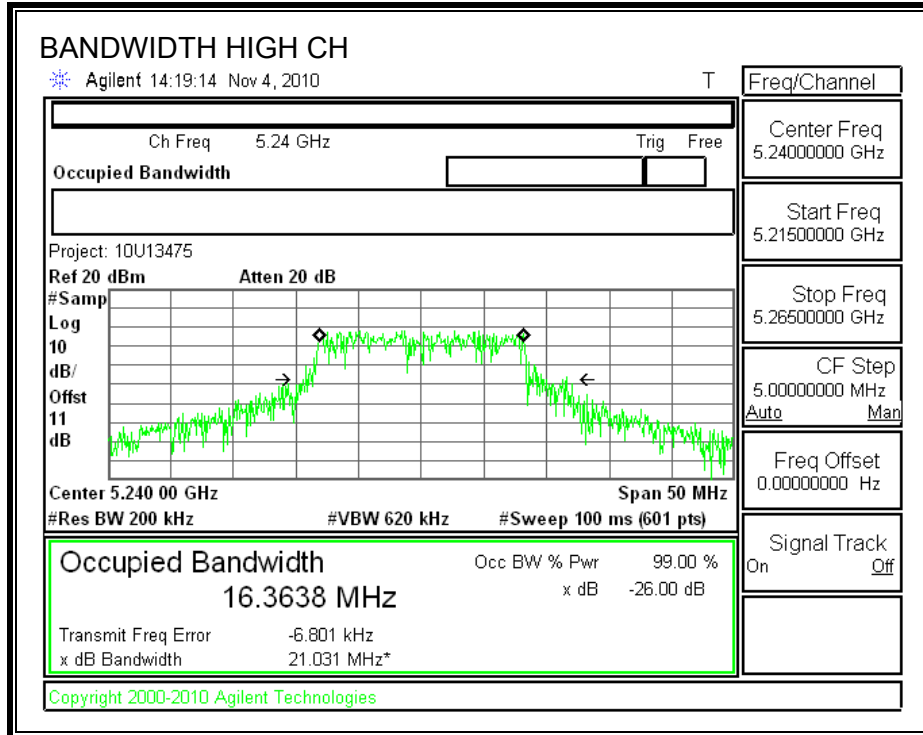


**CHAIN 2**

**26 dB and 99% BANDWIDTH**

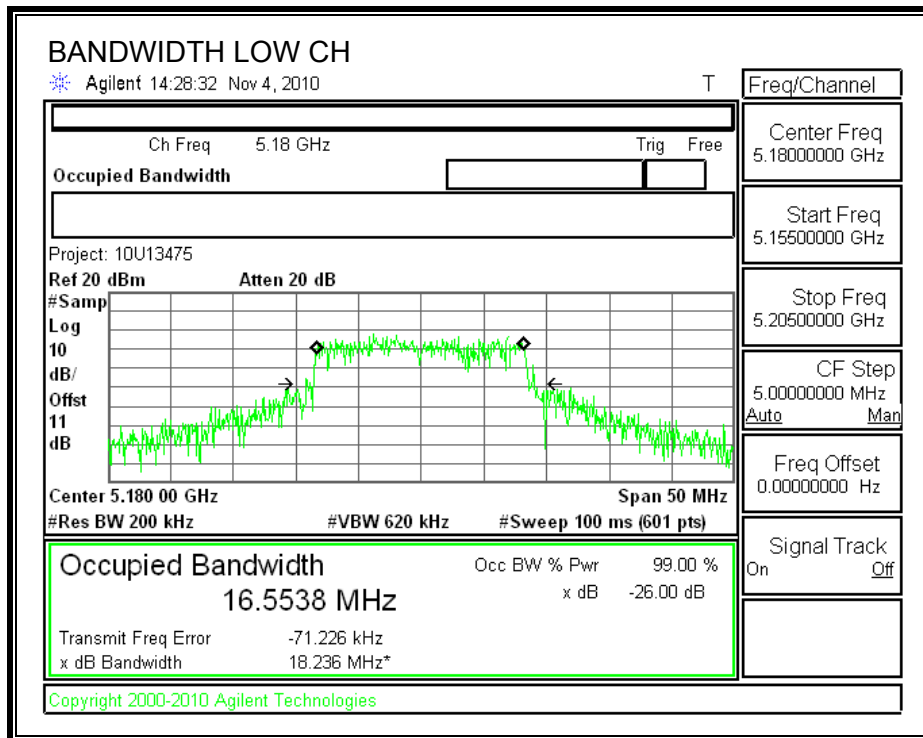


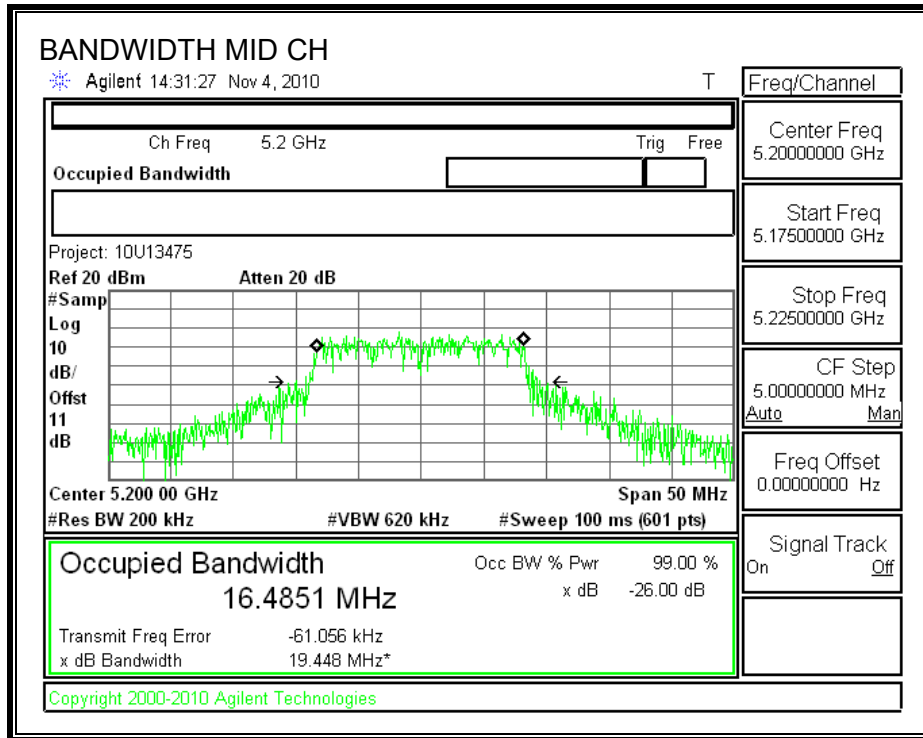


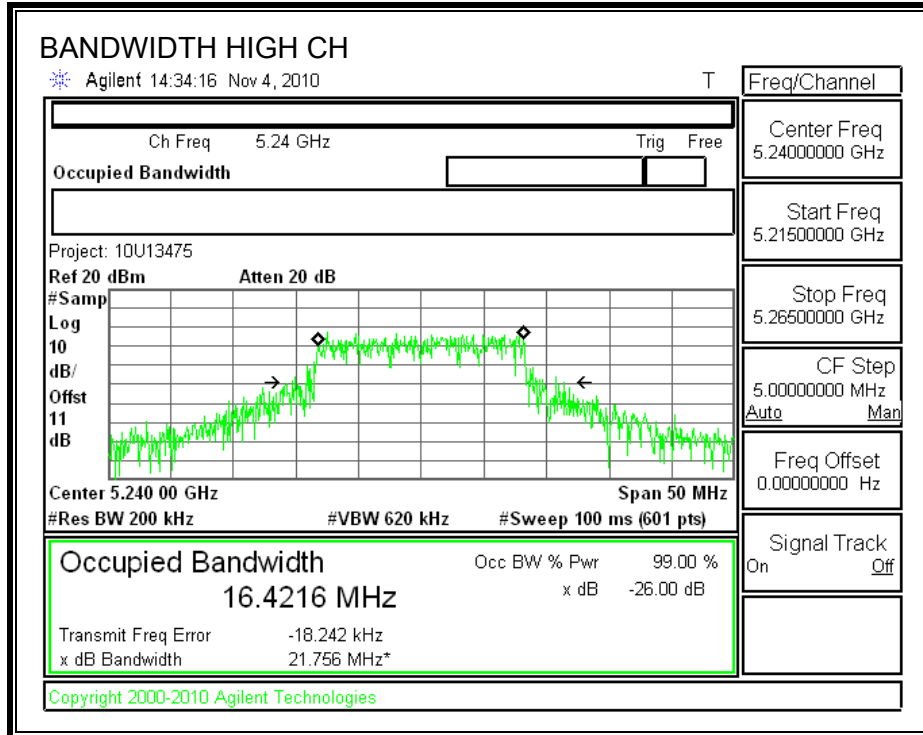


**CHAIN 3**

**26 dB and 99% BANDWIDTH**







## 7.1.2. OUTPUT POWER

### LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

Antenna Gain (dBi)	10 Log (# Tx Chains) (dB)	Effective Legacy Gain (dBi)
5.5	4.77	10.27

For the 5.15-5.25 GHz band, 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. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

**RESULTS**

**Limit**

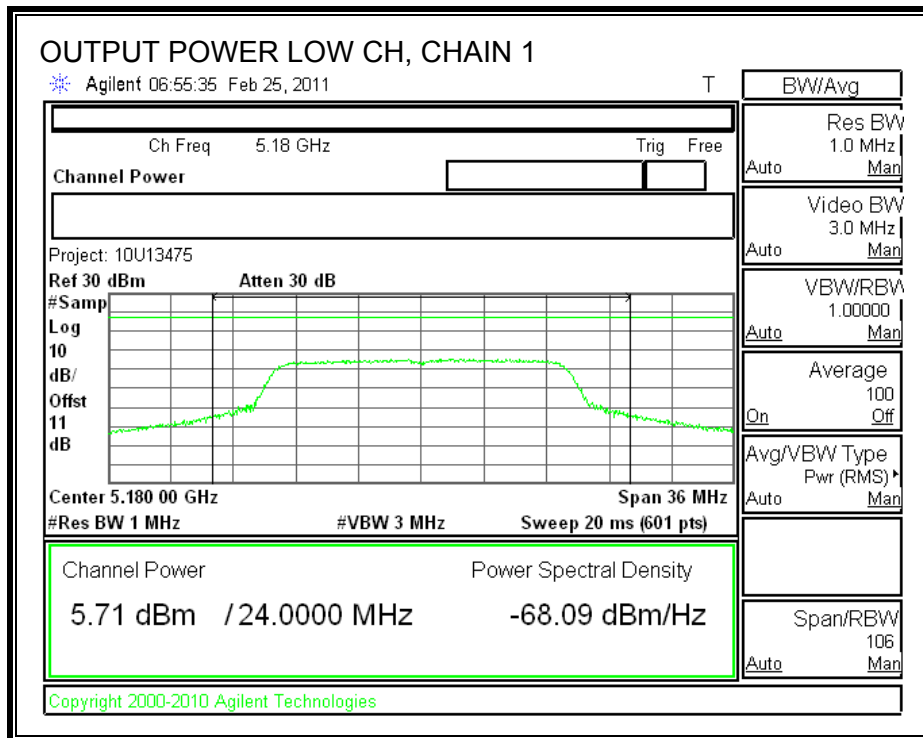
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Effective Ant. Gain (dBi)	Limit (dBm)
Low	5180	16.99	18.24	16.61	10.27	12.34
Mid	5200	16.99	19.012	16.79	10.27	12.52
High	5240	16.99	20.336	17.08	10.27	12.72

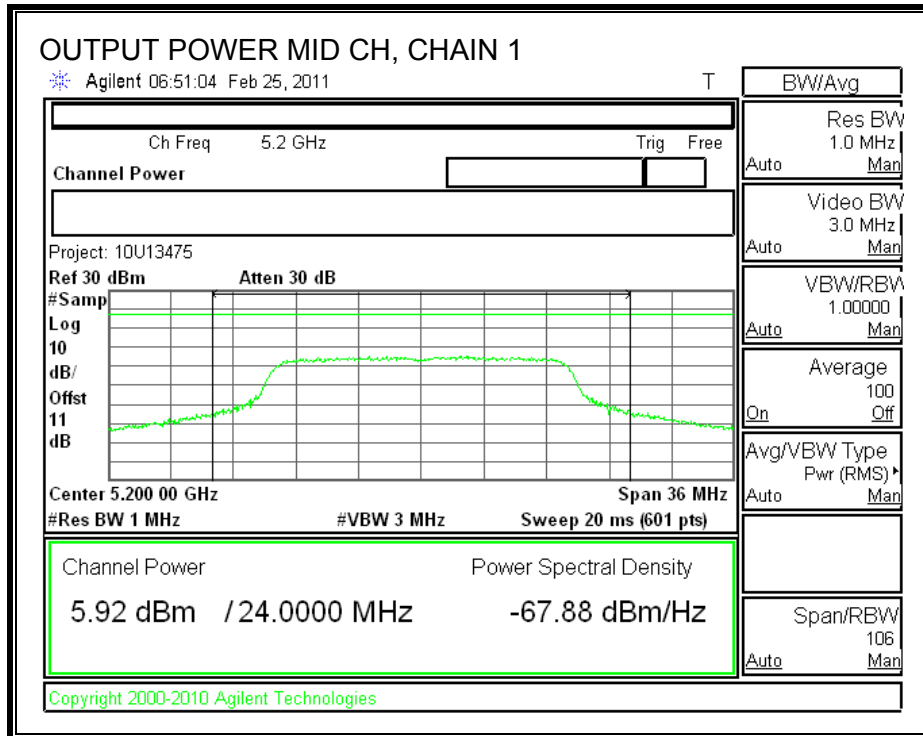
**Individual Chain Results**

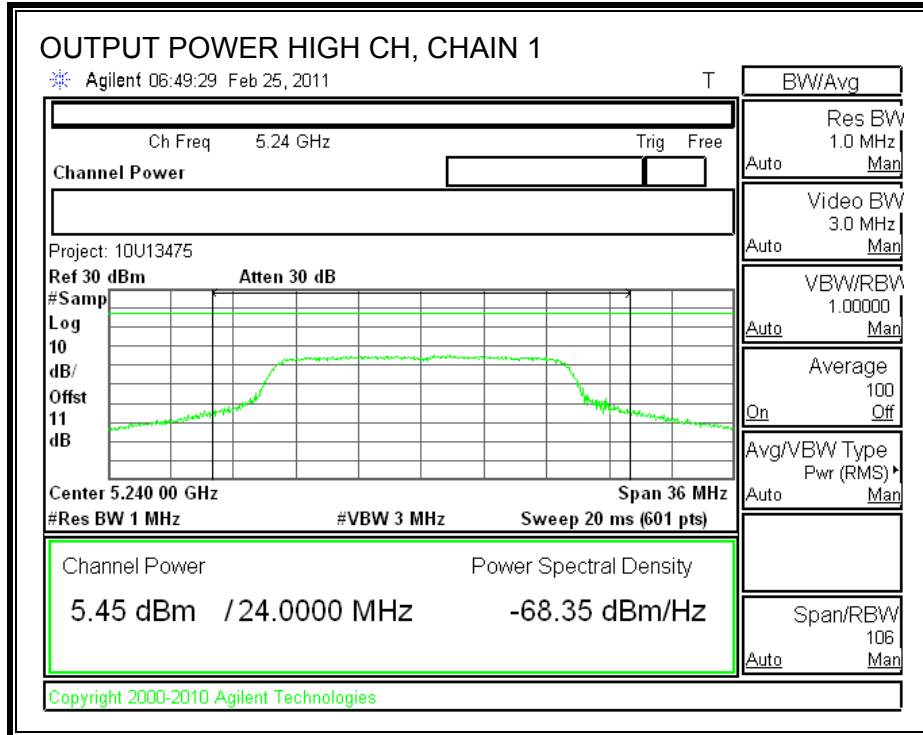
Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	5.71	9.14	6.95	12.27	12.34	-0.07
Mid	5200	5.92	8.54	7.70	12.29	12.52	-0.23
High	5240	5.45	8.63	7.77	12.25	12.72	-0.47



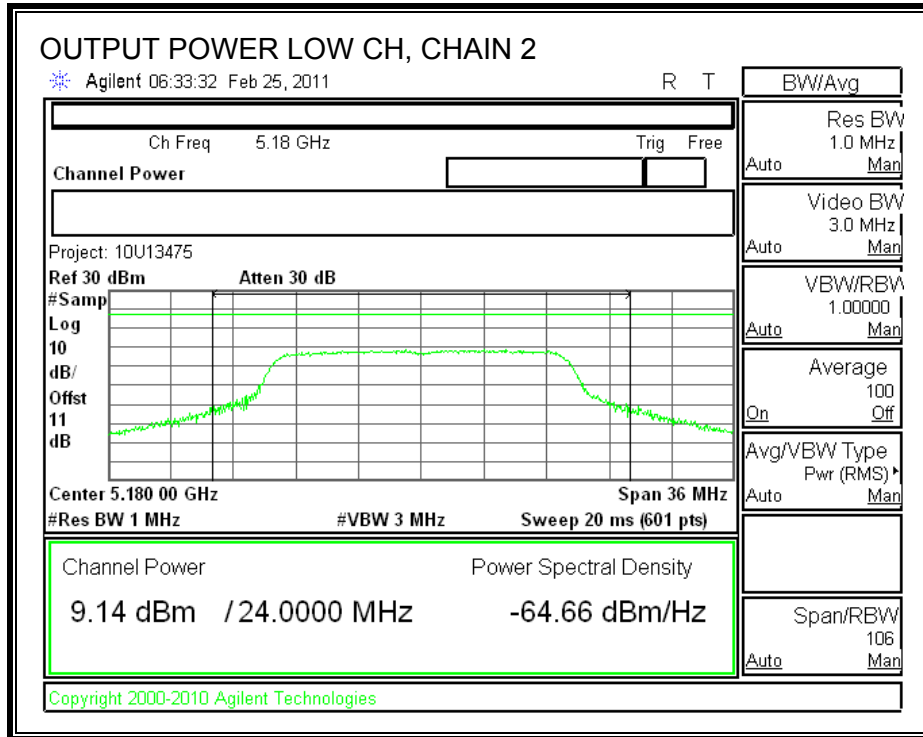
**CHAIN 1 OUTPUT POWER**

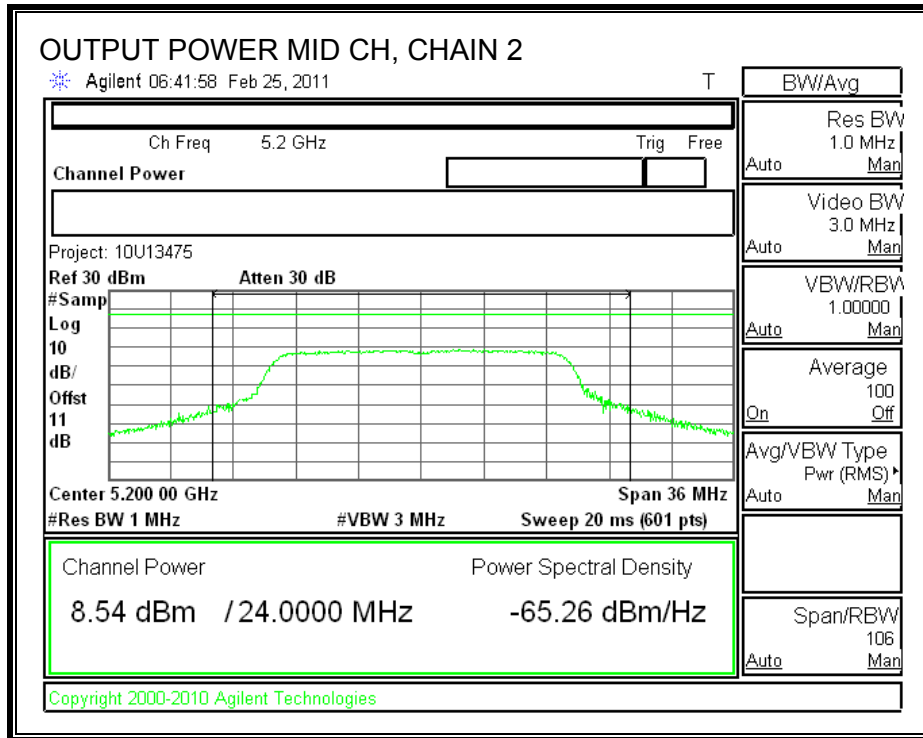


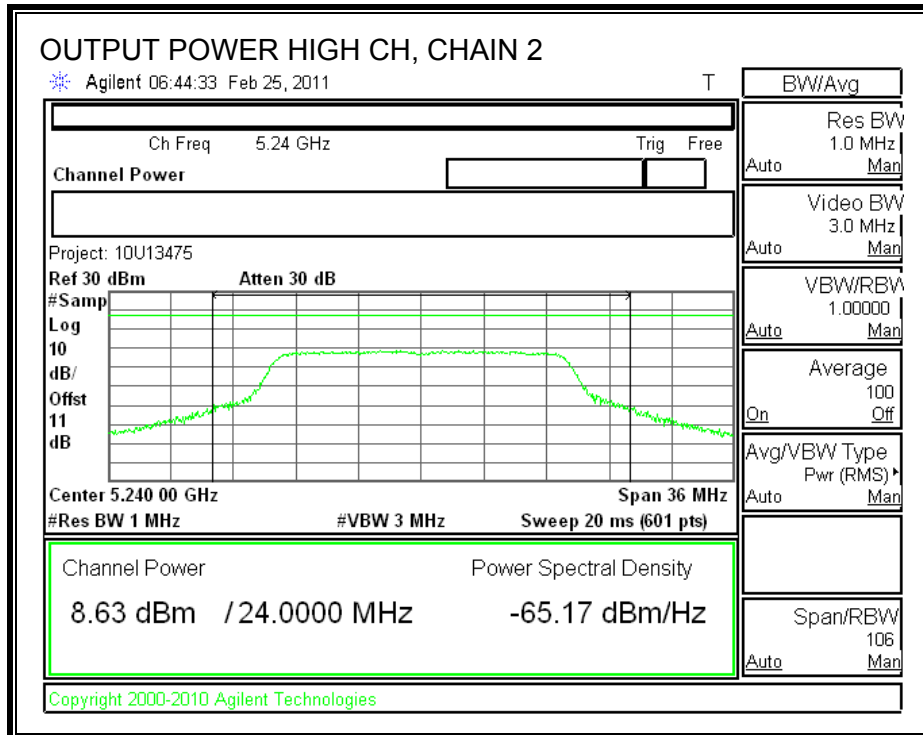




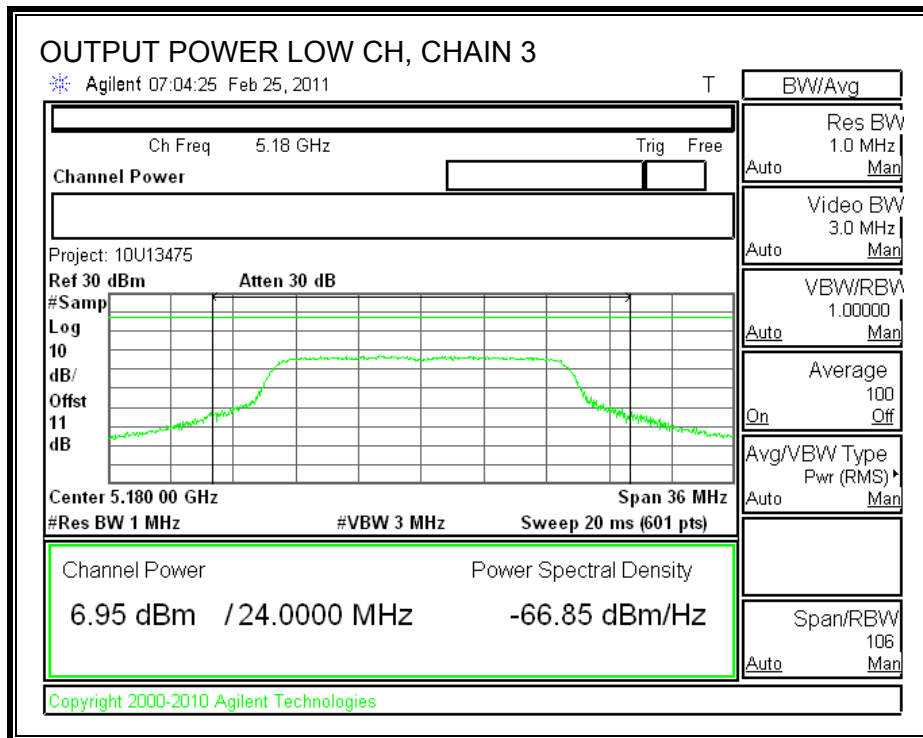
**CHAIN 2 OUTPUT POWER**

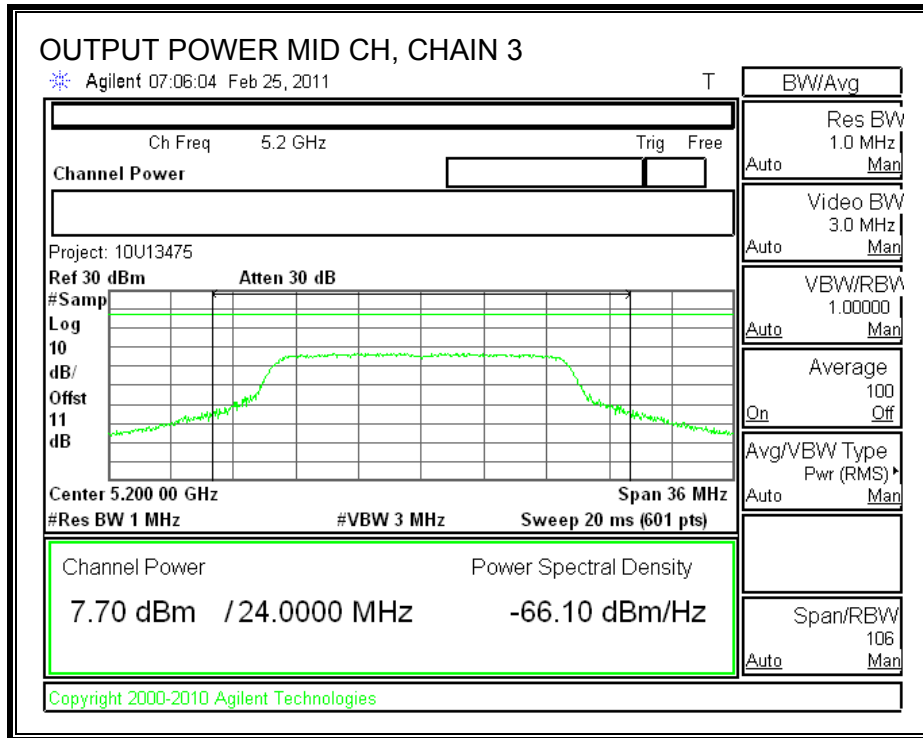




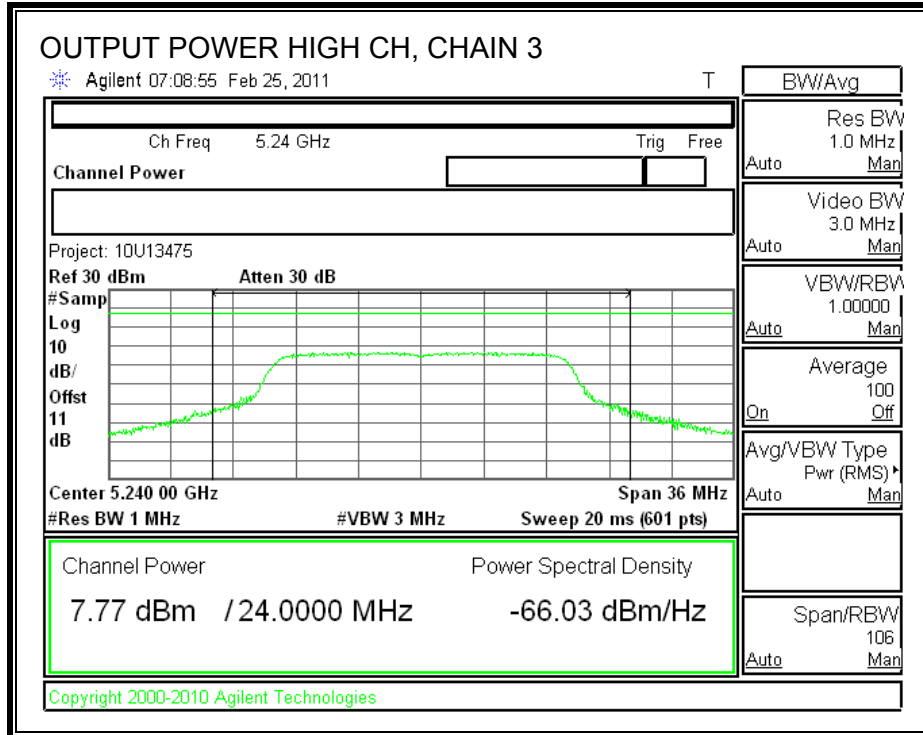


**CHAIN 3 OUTPUT POWER**









### 7.1.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1.0 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)
Low	5180	5.47	8.54	7.32	12.06
Middle	5200	5.25	8.97	7.17	12.16
High	5240	5.17	9.05	7.36	12.25

### 7.1.4. PEAK POWER SPECTRAL DENSITY

#### LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

Antenna Gain (dBi)	10 Log (# Tx Chains) (dB)	Effective Legacy Gain (dBi)
5.5	4.77	10.27

For the 5.15-5.25 GHz band, 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 peak transmit 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.

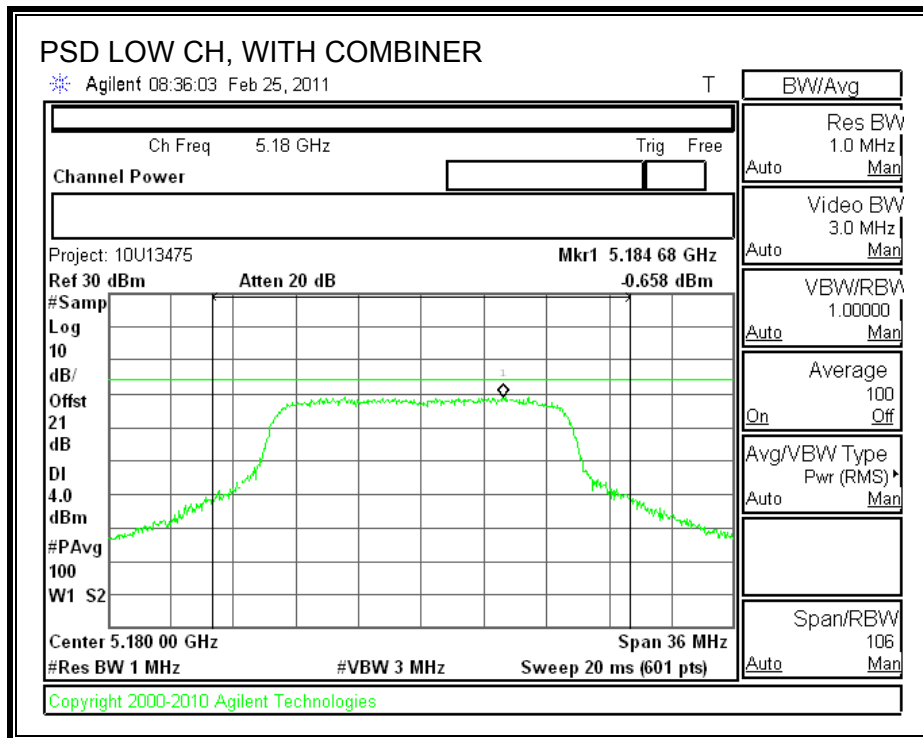
#### TEST PROCEDURE

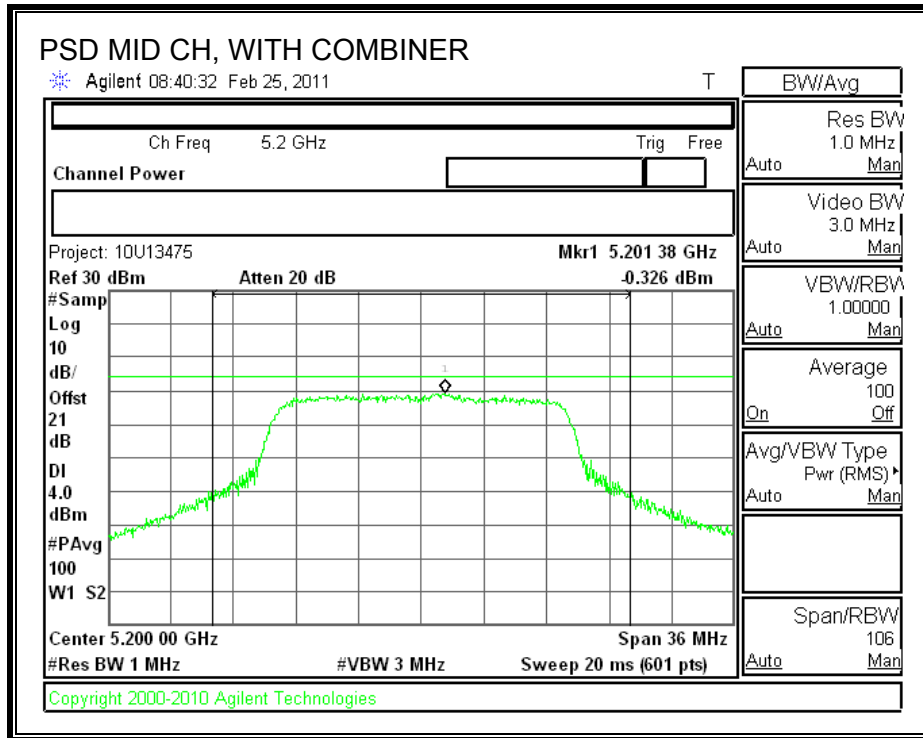
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

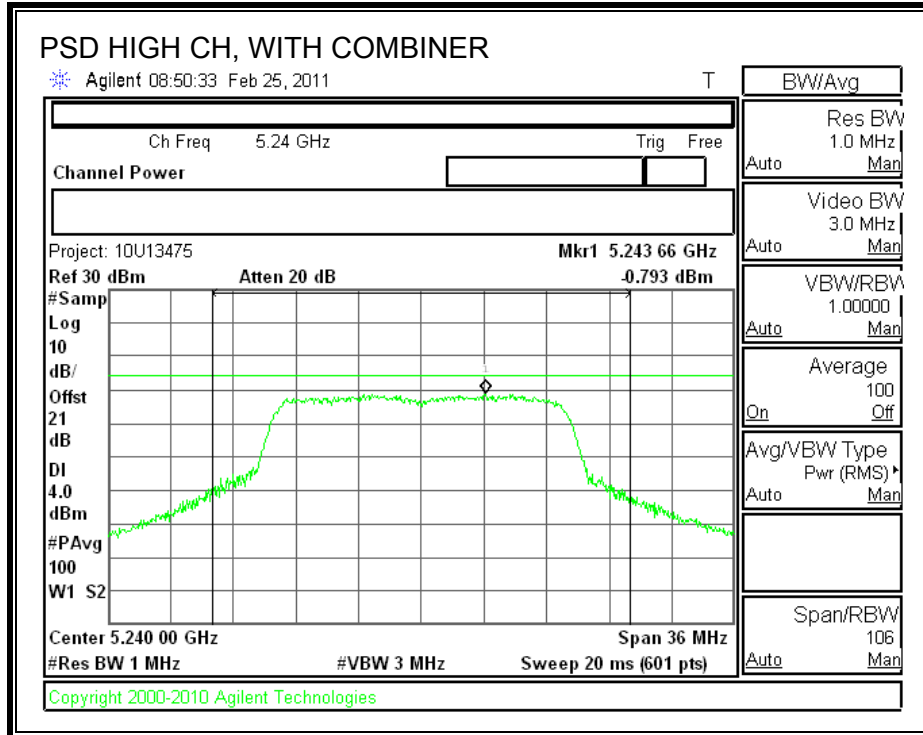
**RESULTS**

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>PPSD With Combiner (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
<b>Low</b>	<b>5180</b>	<b>-0.658</b>	<b>-0.27</b>	<b>-0.388</b>
<b>Middle</b>	<b>5200</b>	<b>-0.326</b>	<b>-0.27</b>	<b>-0.056</b>
<b>High</b>	<b>5240</b>	<b>-0.793</b>	<b>-0.27</b>	<b>-0.523</b>

**POWER SPECTRAL DENSITY WITH COMBINER**







## **7.1.5. PEAK EXCURSION**

### **LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

### **TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.



**RESULTS**

**CHAIN 1**

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Peak Excursion (dB)</b>	<b>Limit (dB)</b>	<b>Margin (dB)</b>
<b>Low</b>	<b>5180</b>	<b>9.17</b>	<b>13</b>	<b>-3.83</b>
<b>Middle</b>	<b>5200</b>	<b>9.44</b>	<b>13</b>	<b>-3.56</b>
<b>High</b>	<b>5240</b>	<b>8.55</b>	<b>13</b>	<b>-4.45</b>

**CHAIN 2**

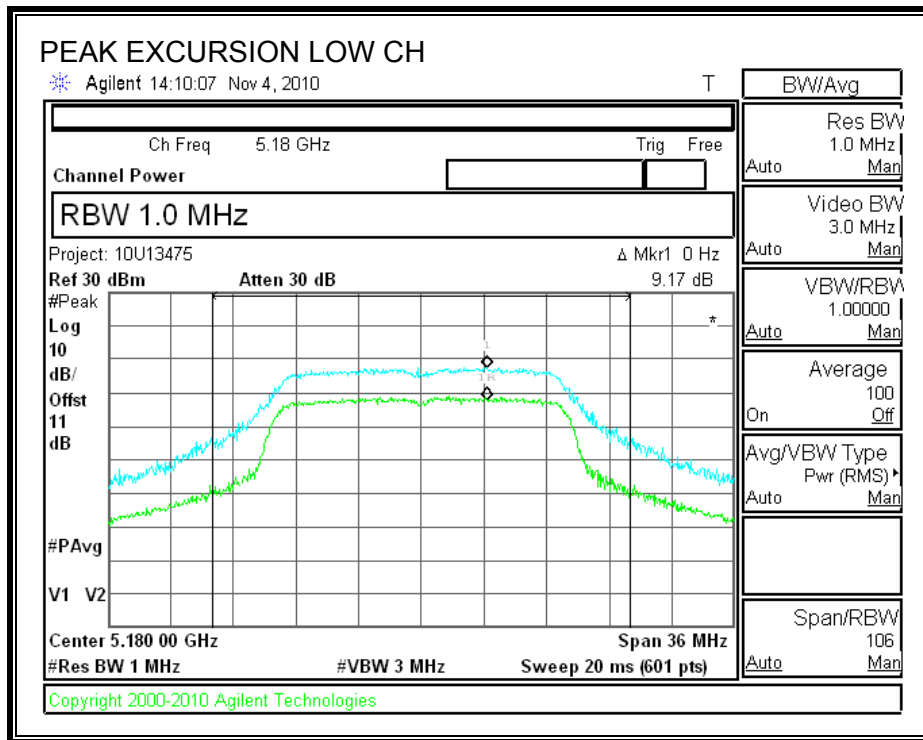
<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Peak Excursion (dB)</b>	<b>Limit (dB)</b>	<b>Margin (dB)</b>
<b>Low</b>	<b>5180</b>	<b>10.04</b>	<b>13</b>	<b>-2.96</b>
<b>Middle</b>	<b>5200</b>	<b>10.04</b>	<b>13</b>	<b>-2.96</b>
<b>High</b>	<b>5240</b>	<b>10.11</b>	<b>13</b>	<b>-2.89</b>

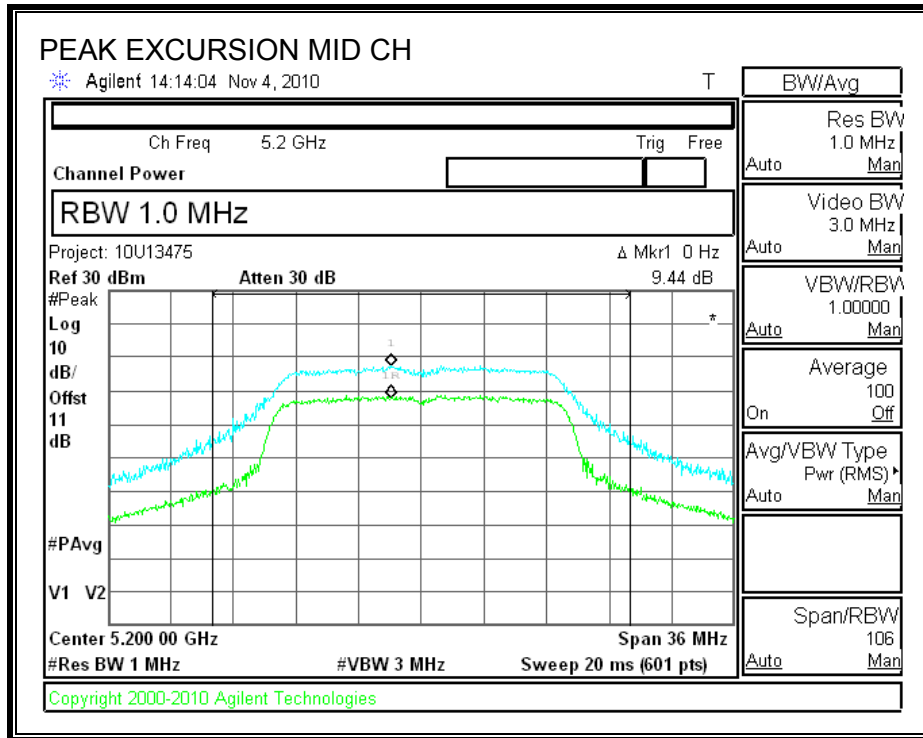
**CHAIN 3**

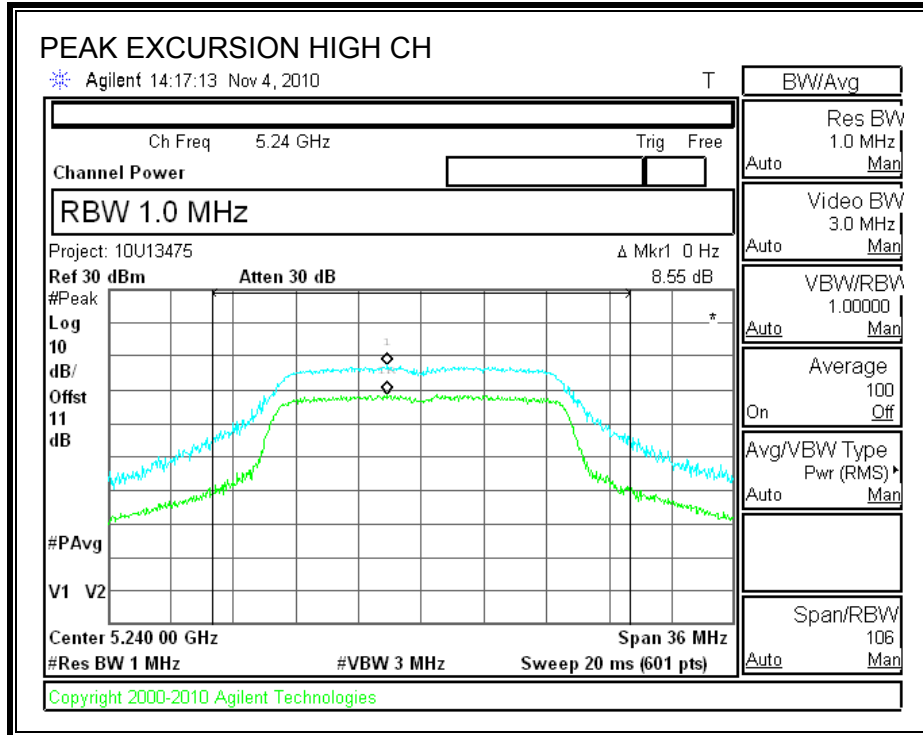
<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Peak Excursion (dB)</b>	<b>Limit (dB)</b>	<b>Margin (dB)</b>
<b>Low</b>	<b>5180</b>	<b>10.10</b>	<b>13</b>	<b>-2.90</b>
<b>Middle</b>	<b>5200</b>	<b>10.32</b>	<b>13</b>	<b>-2.68</b>
<b>High</b>	<b>5240</b>	<b>9.17</b>	<b>13</b>	<b>-3.83</b>

**CHAIN 1**

**PEAK EXCURSION**

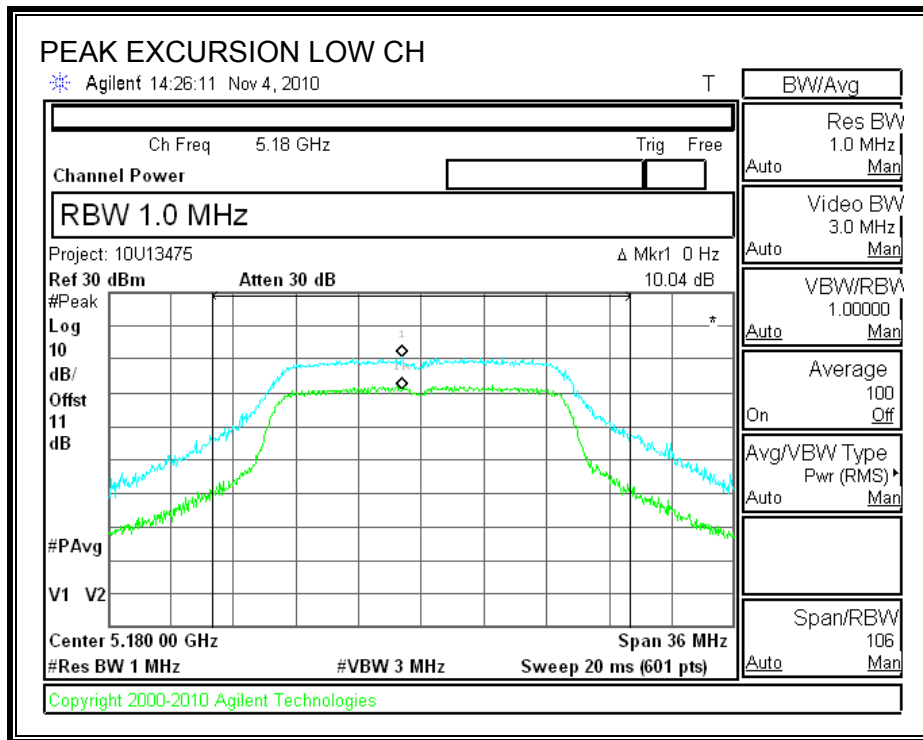


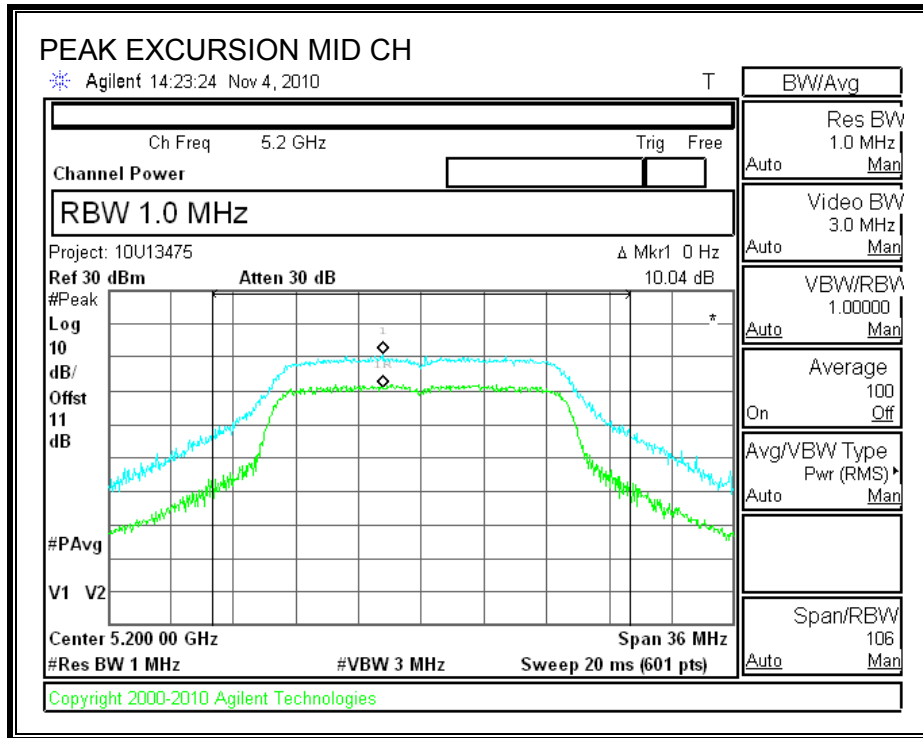


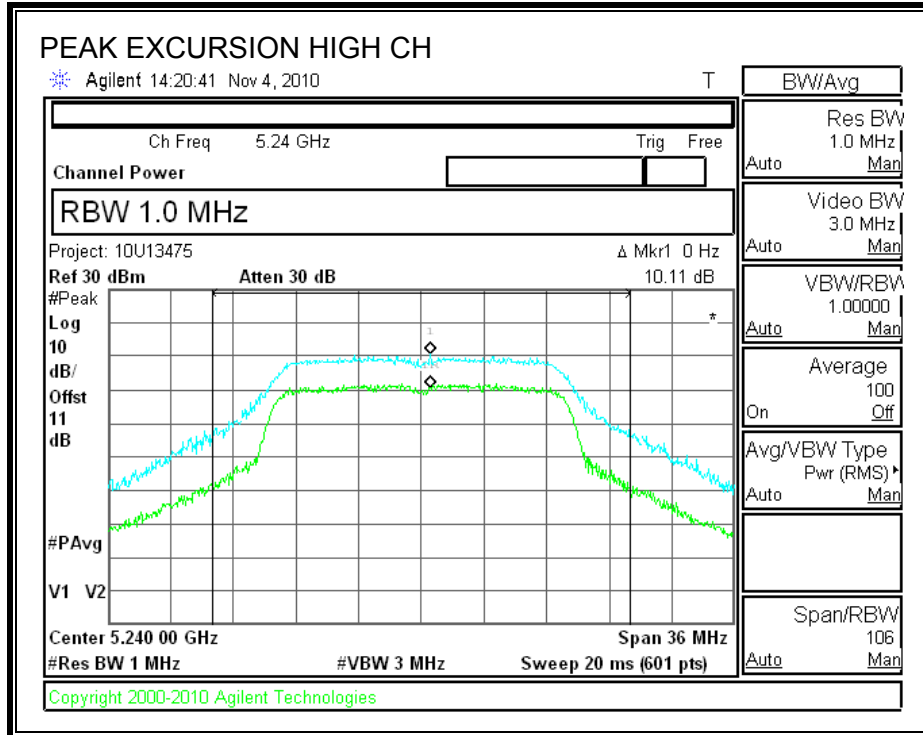


**CHAIN 2**

**PEAK EXCURSION**

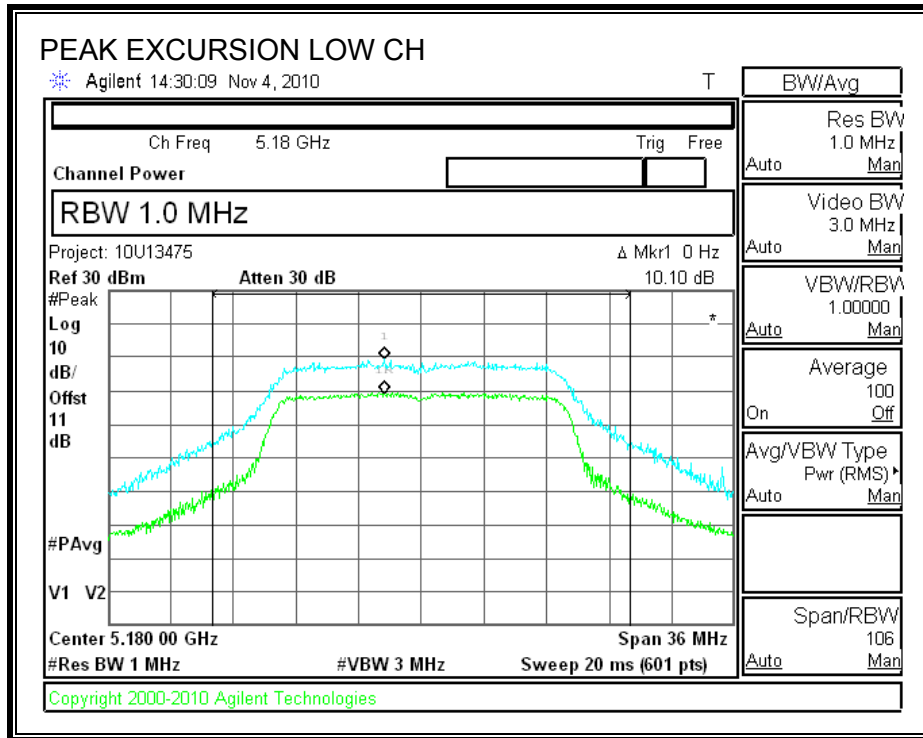




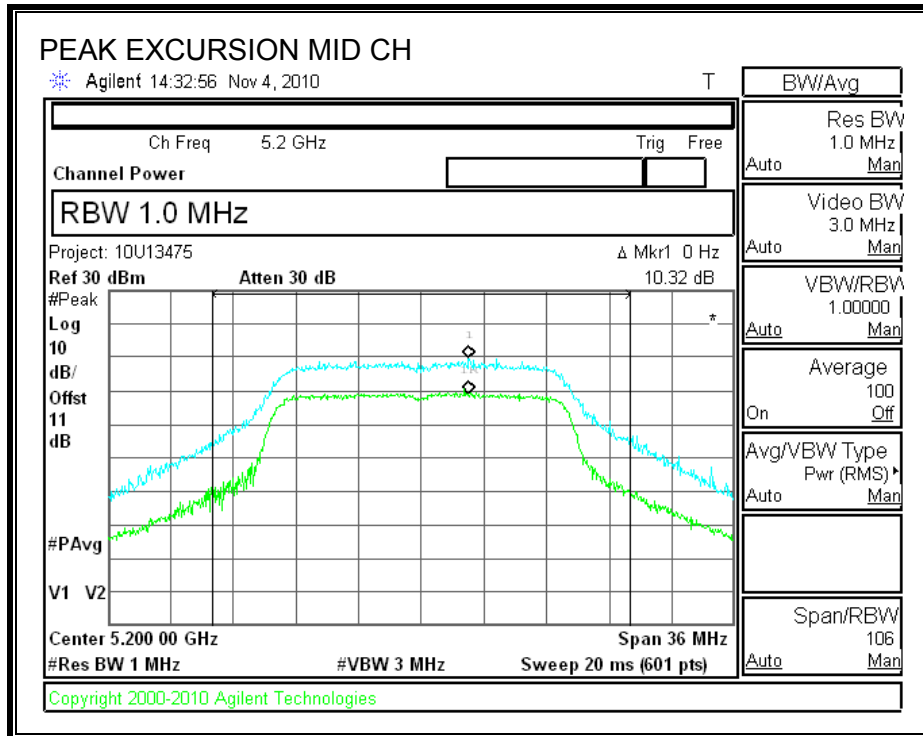


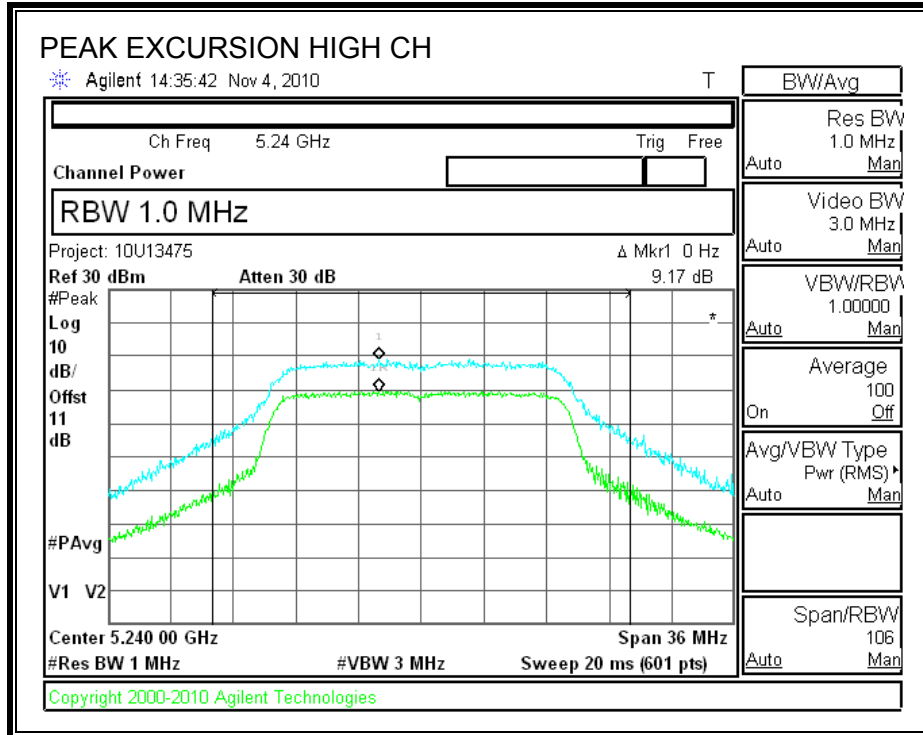
**CHAIN 3**

**PEAK EXCURSION**









## **7.1.6. CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (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 EIRP of -27 dBm / MHz.

### **TEST PROCEDURE**

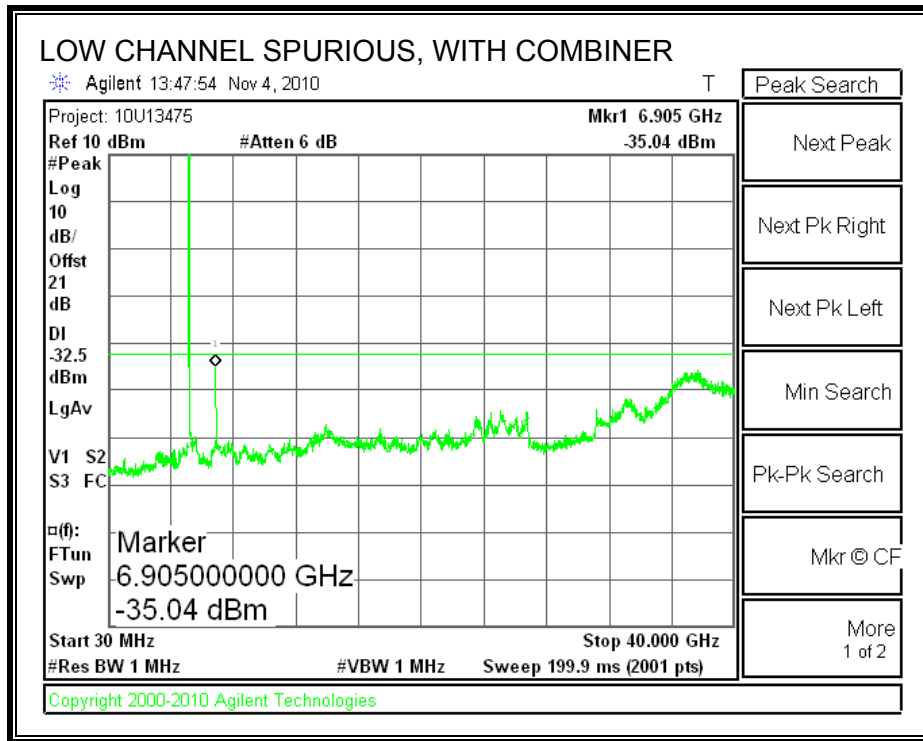
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

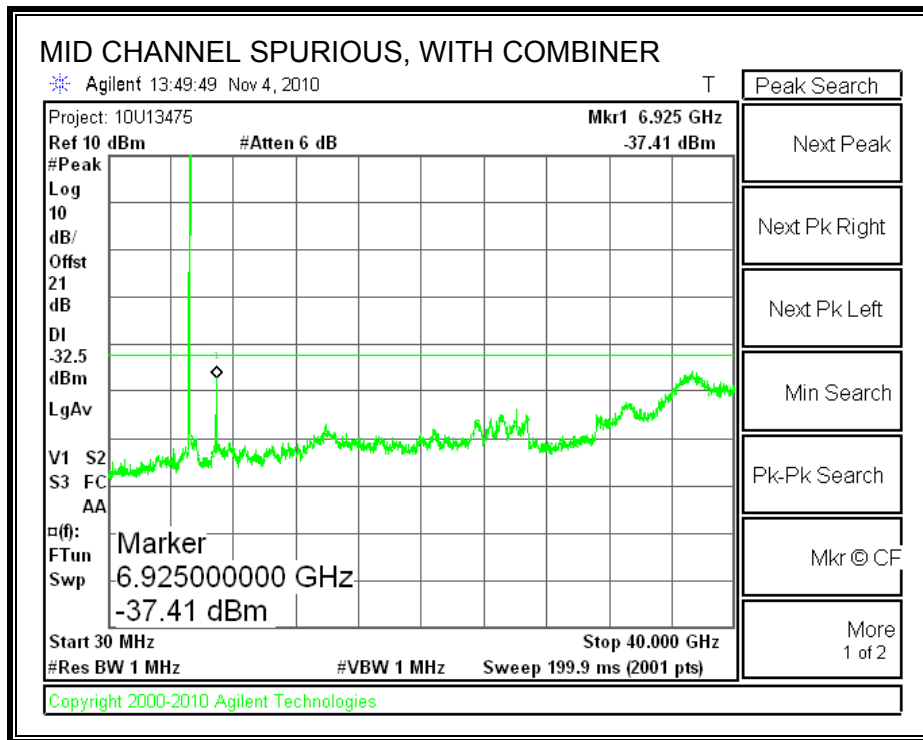
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

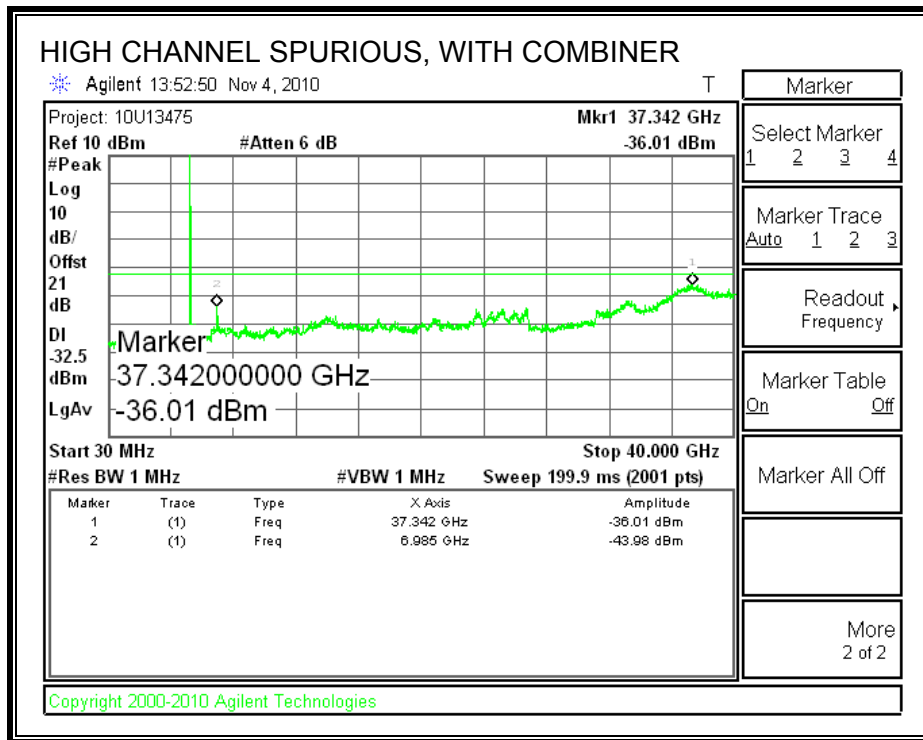
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

**RESULTS**

**SPURIOUS EMISSIONS WITH COMBINER**







## 7.2. 802.11n THREE CHAINS HT20 MODE IN THE 5.2 GHz BAND

### 7.2.1. 26 dB and 99% BANDWIDTH

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

#### RESULTS

##### CHAIN 1

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5180	20.028	17.4629
Middle	5200	20.142	17.6717
High	5240	19.635	17.5555

##### CHAIN 2

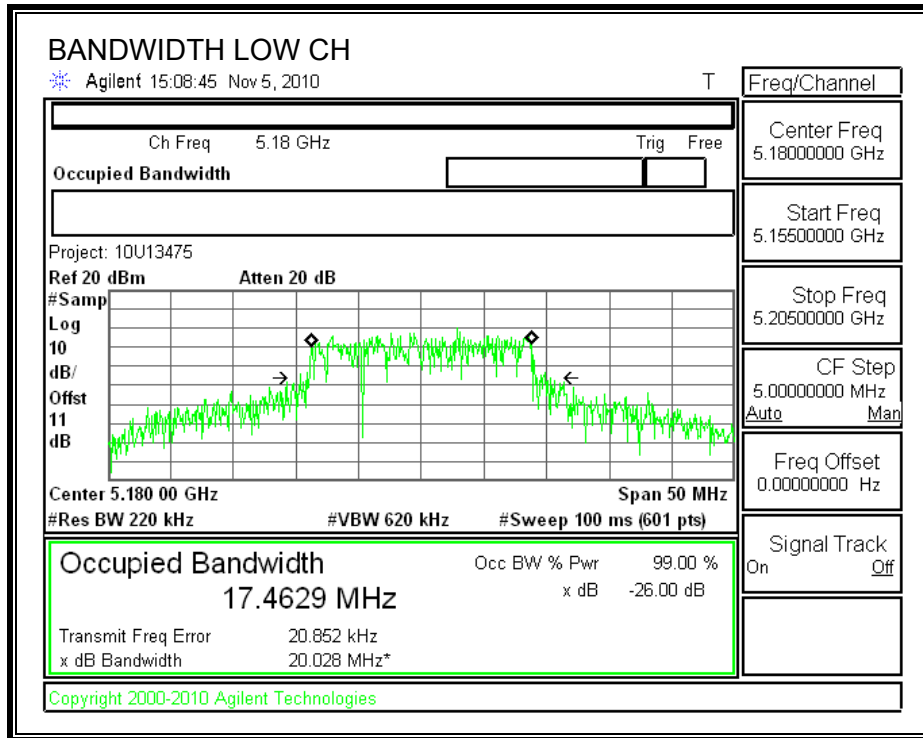
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5180	19.665	17.6511
Middle	5200	19.579	17.5286
High	5240	19.124	17.7595

##### CHAIN 3

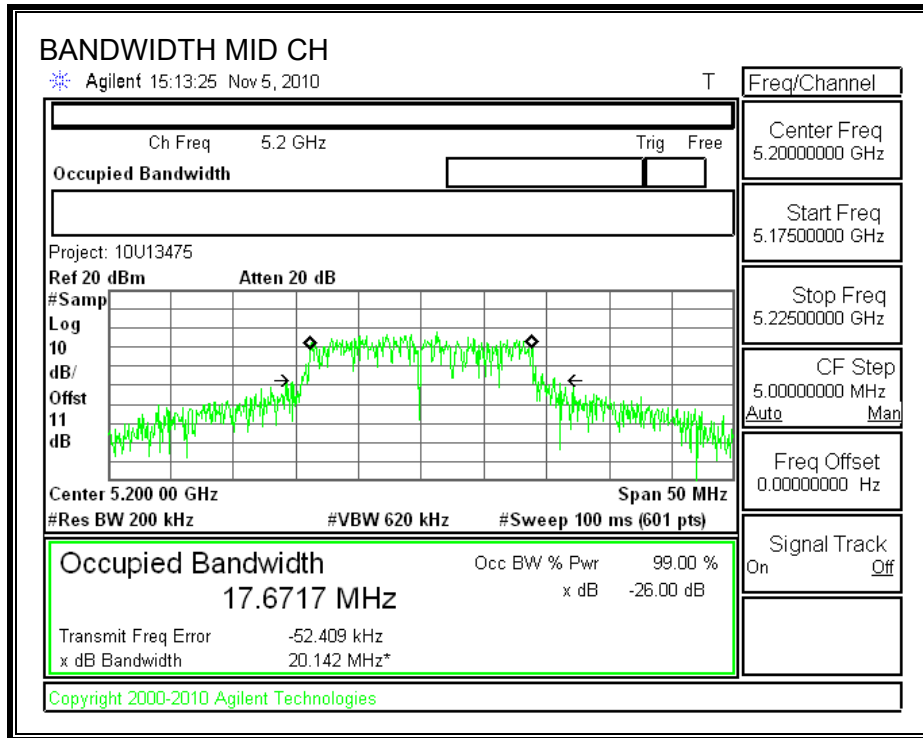
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5180	20.732	17.6570
Middle	5200	19.699	17.4910
High	5240	19.445	17.5278

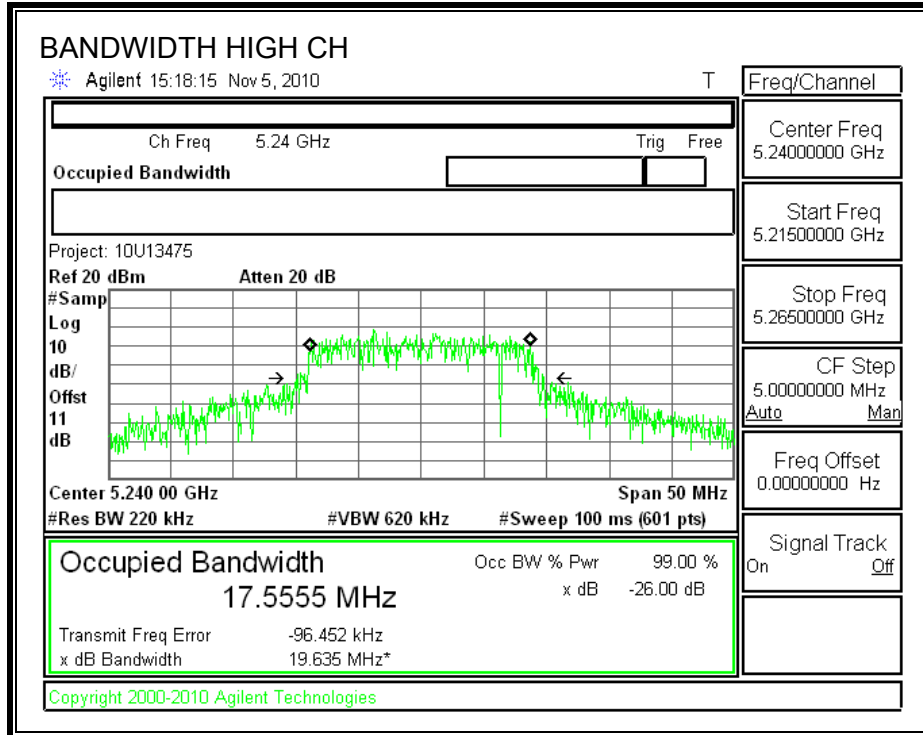
**CHAIN 1**

**26 dB and 99% BANDWIDTH**



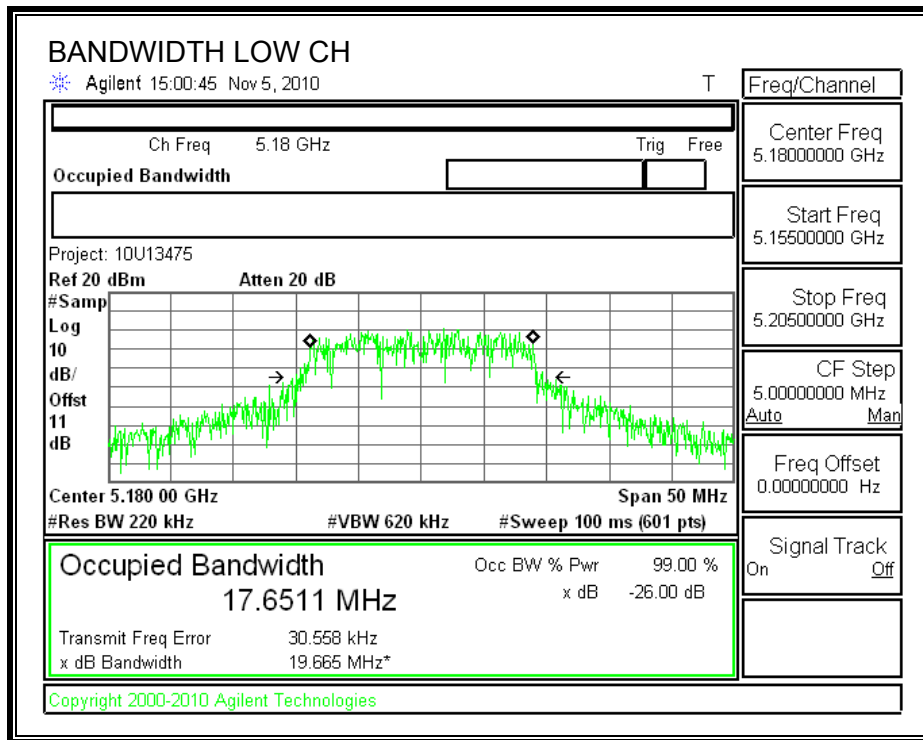


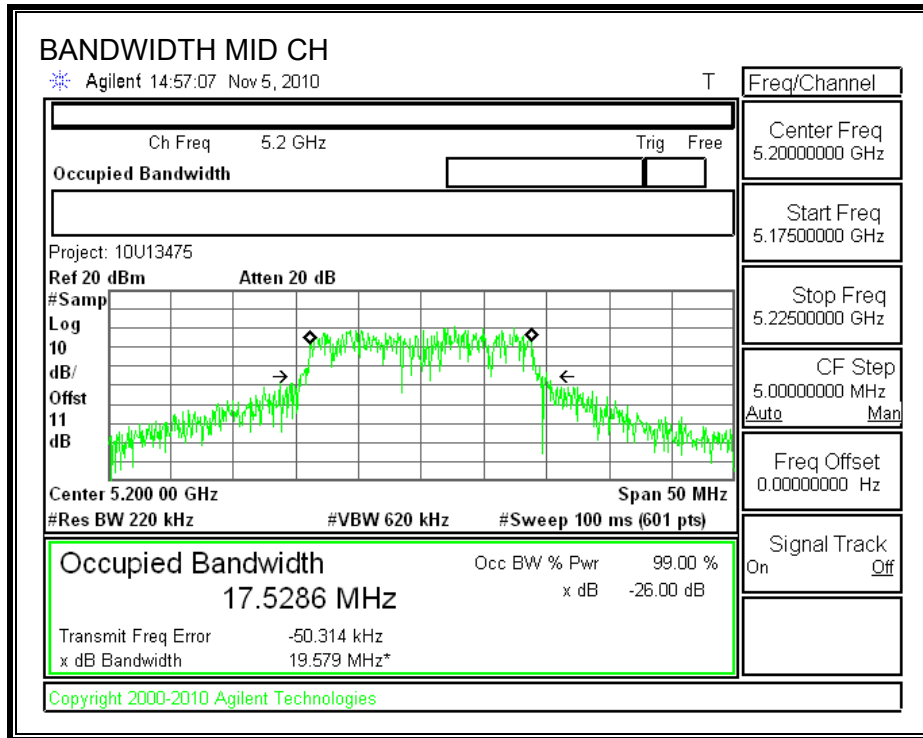


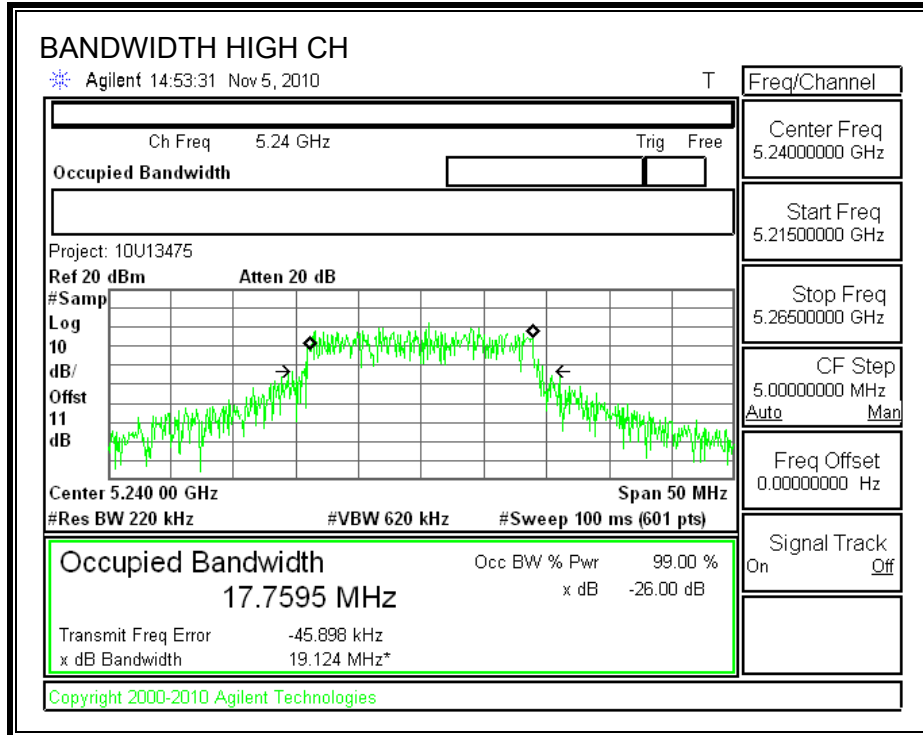


**CHAIN 2**

**26 dB and 99% BANDWIDTH**

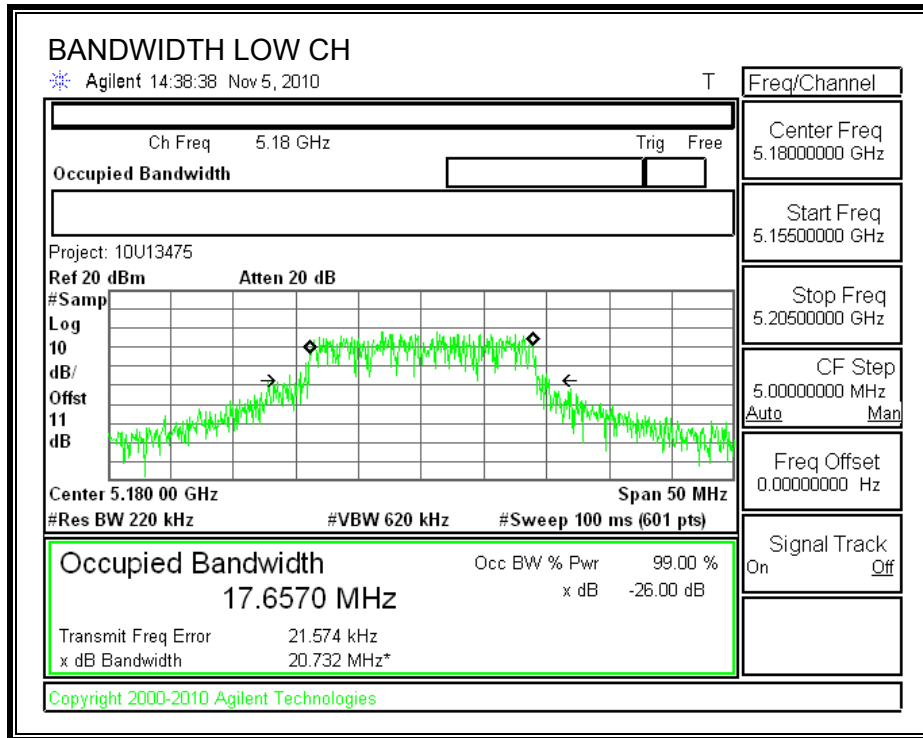


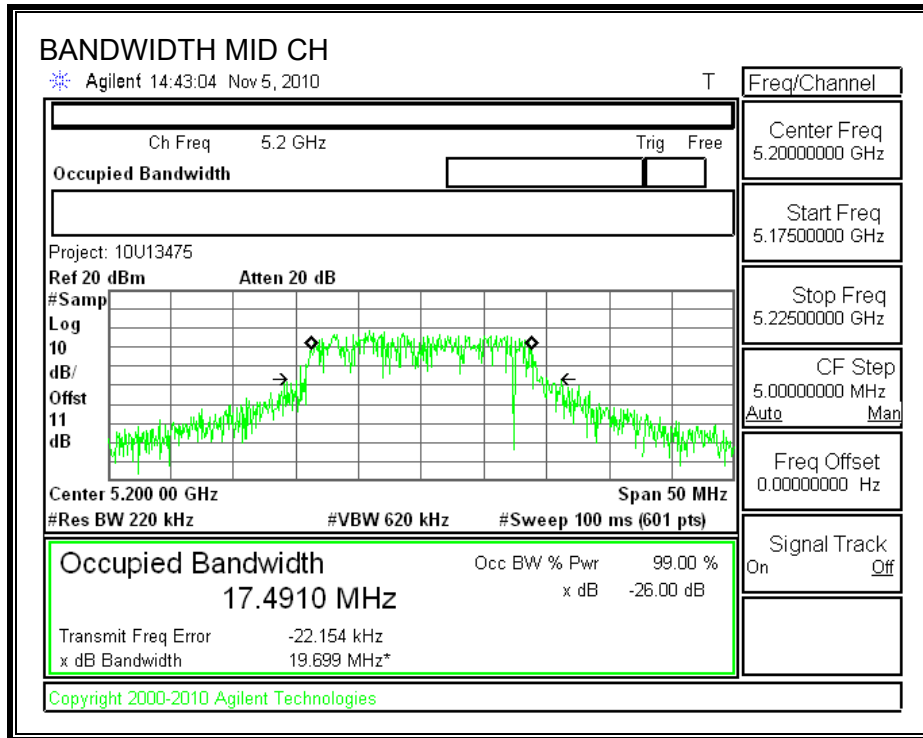


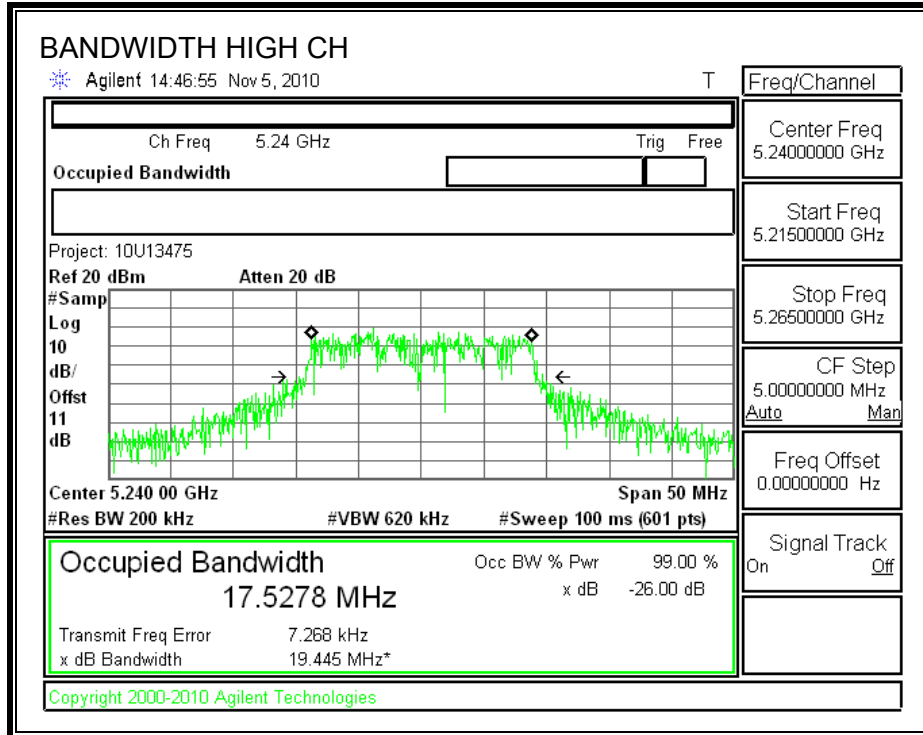


**CHAIN 3**

**26 dB and 99% BANDWIDTH**









## 7.2.2. OUTPUT POWER

### LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, 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. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

**RESULTS**

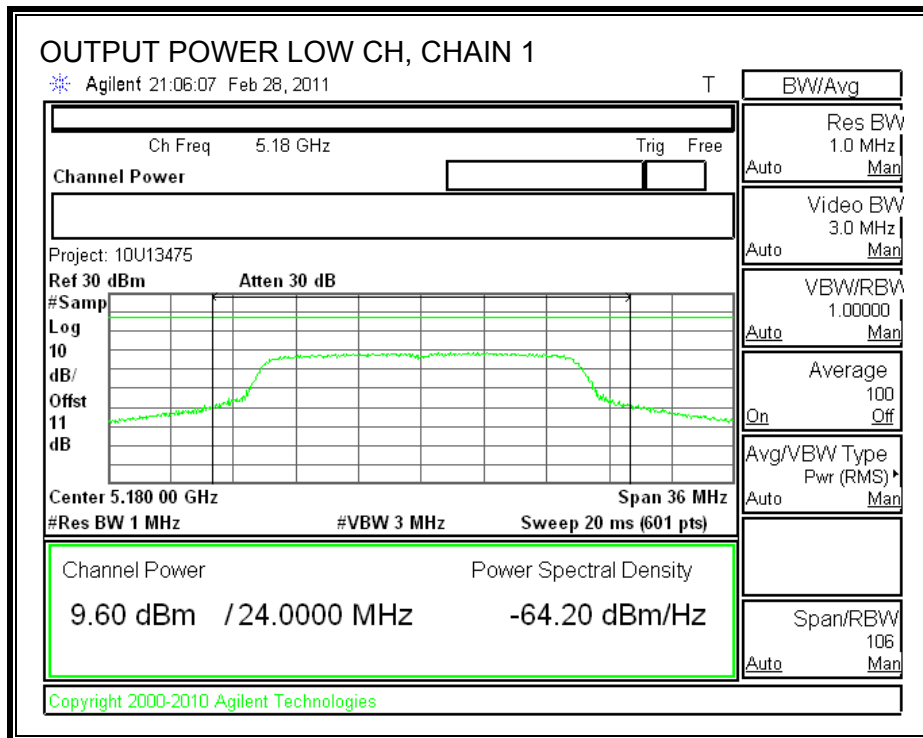
**Limit**

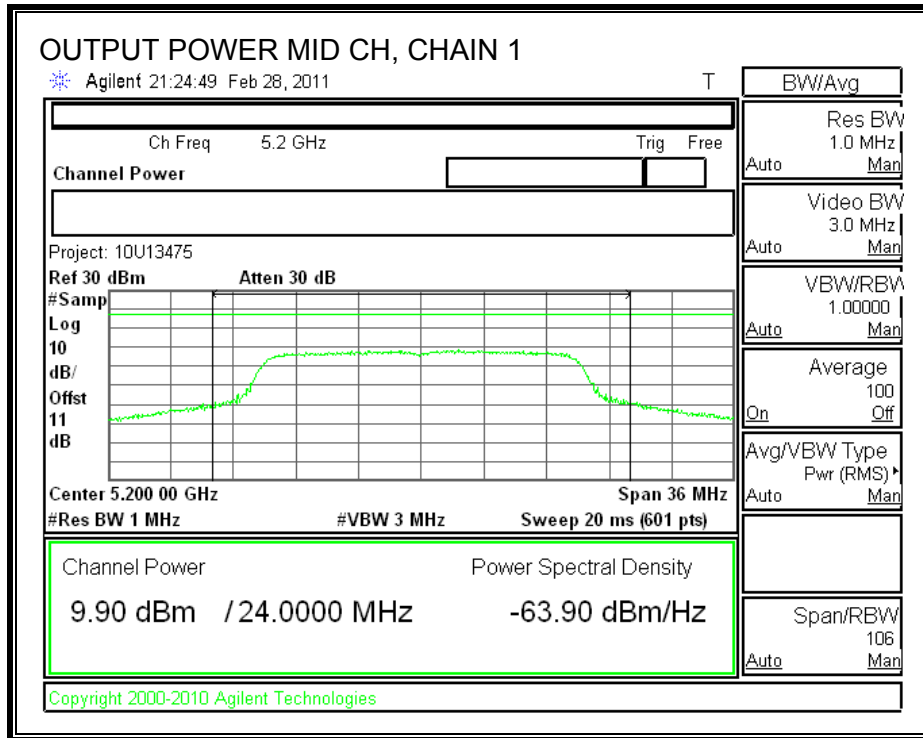
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5180	16.99	19.665	16.94	5.50	16.94
Mid	5200	16.99	19.579	16.92	5.50	16.92
High	5240	16.99	19.124	16.82	5.50	16.82

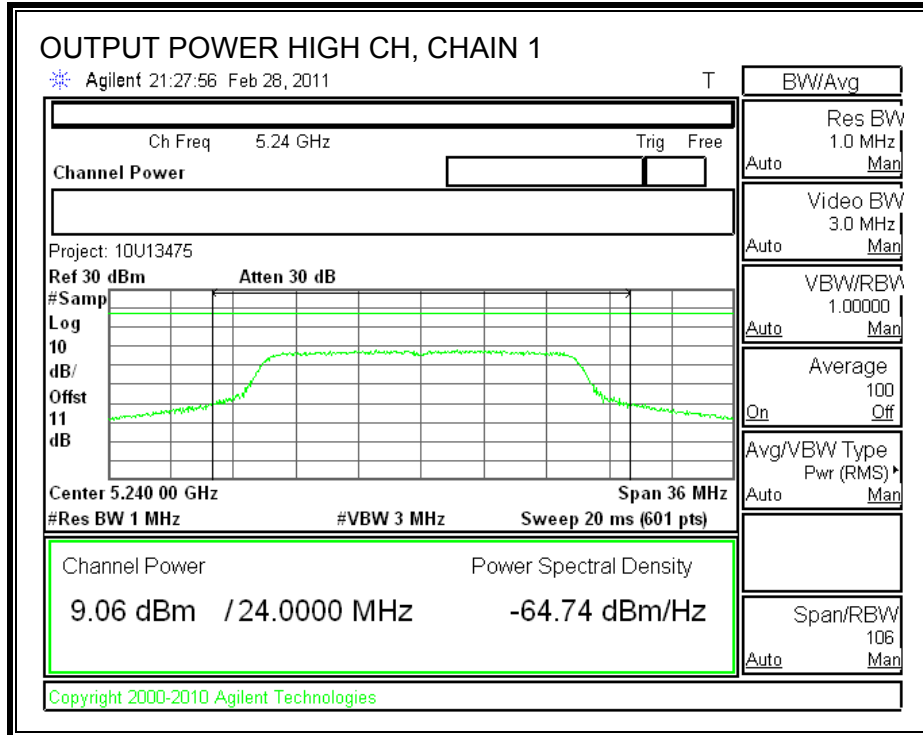
**Individual Chain Results**

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5180	9.60	12.23	10.44	15.67	16.94	-1.27
Mid	5200	9.90	12.35	10.14	15.71	16.92	-1.20
High	5240	9.06	12.19	10.29	15.48	16.82	-1.34

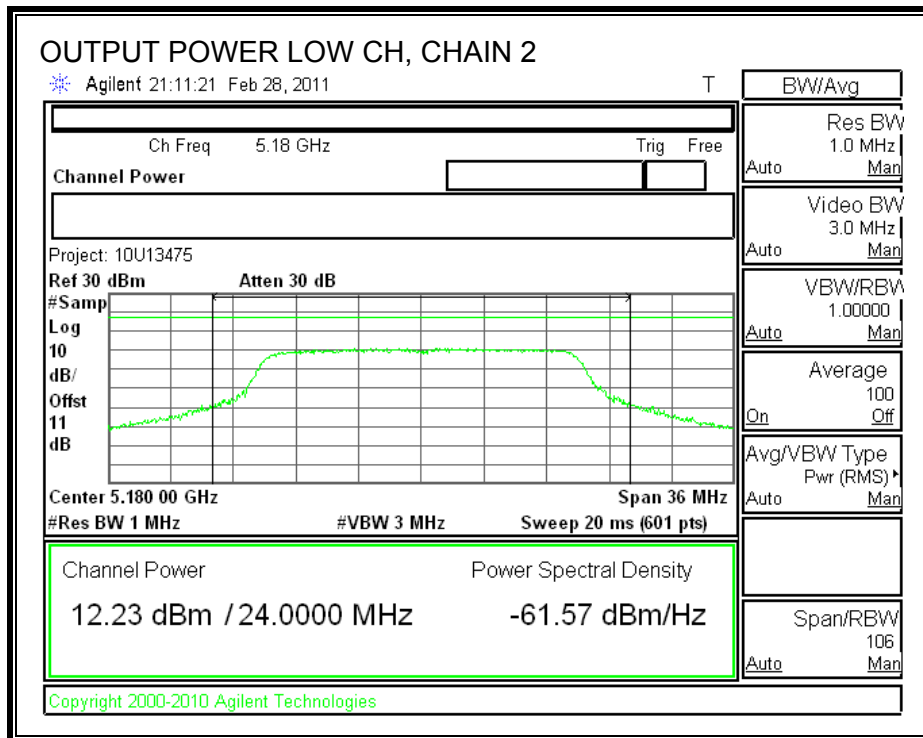
**CHAIN 1 OUTPUT POWER**

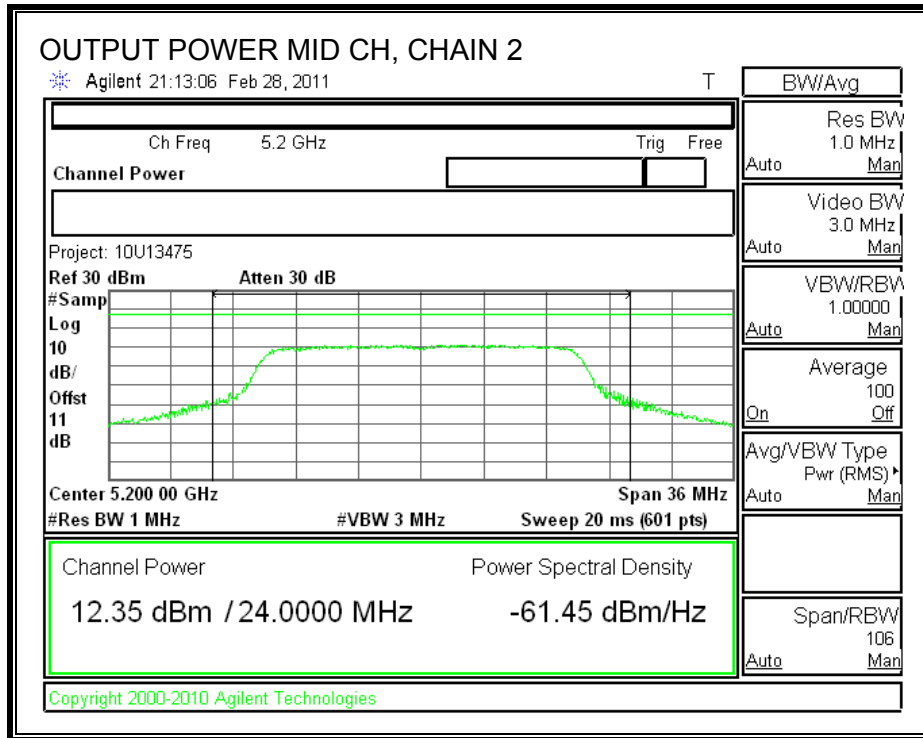


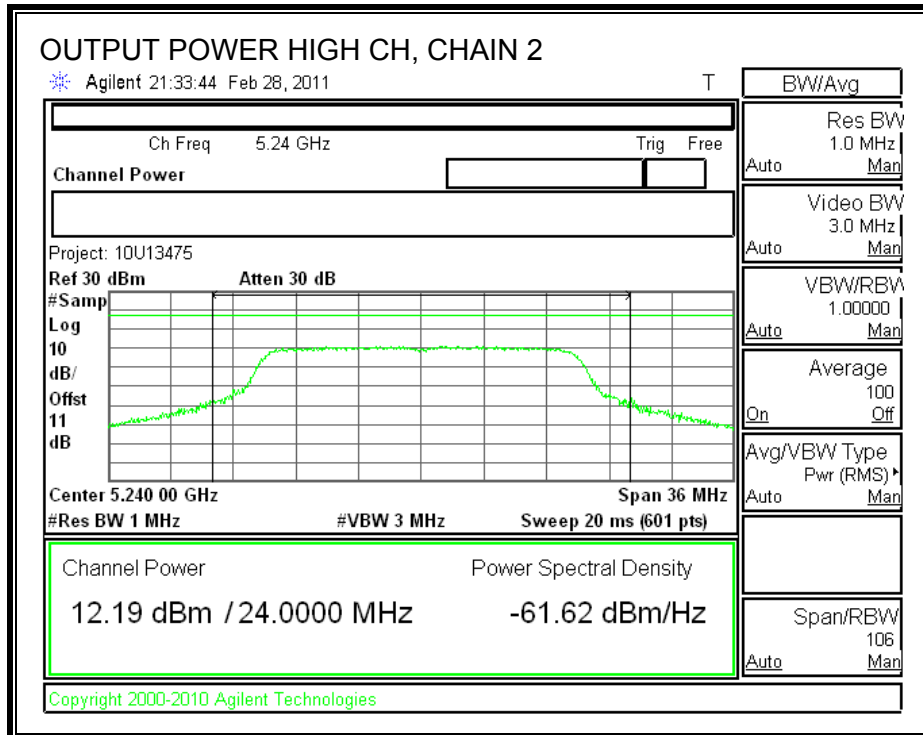




**CHAIN 2 OUTPUT POWER**

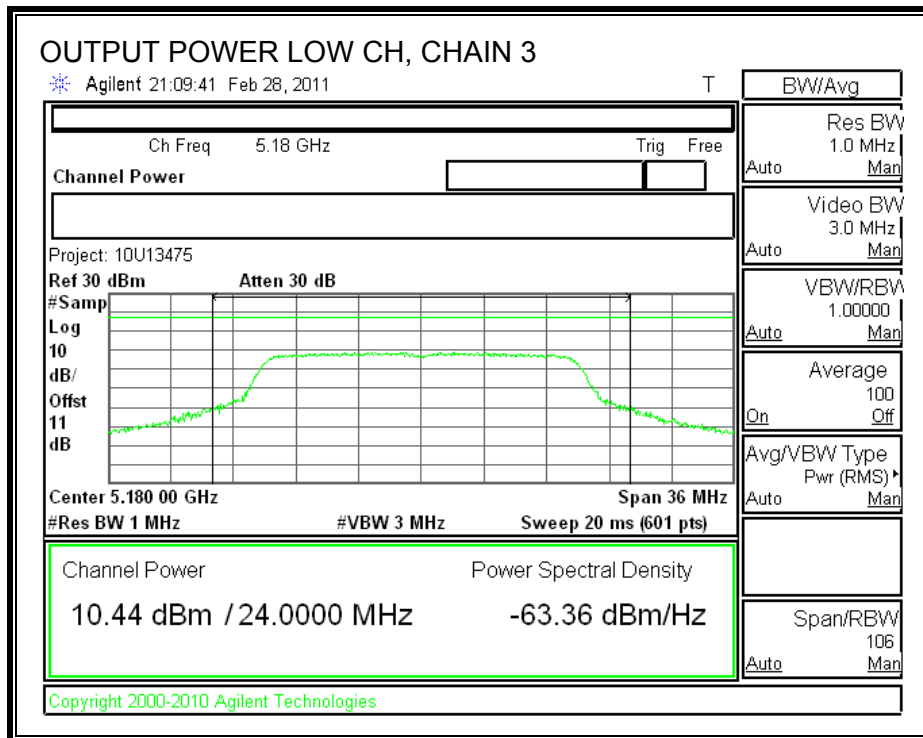


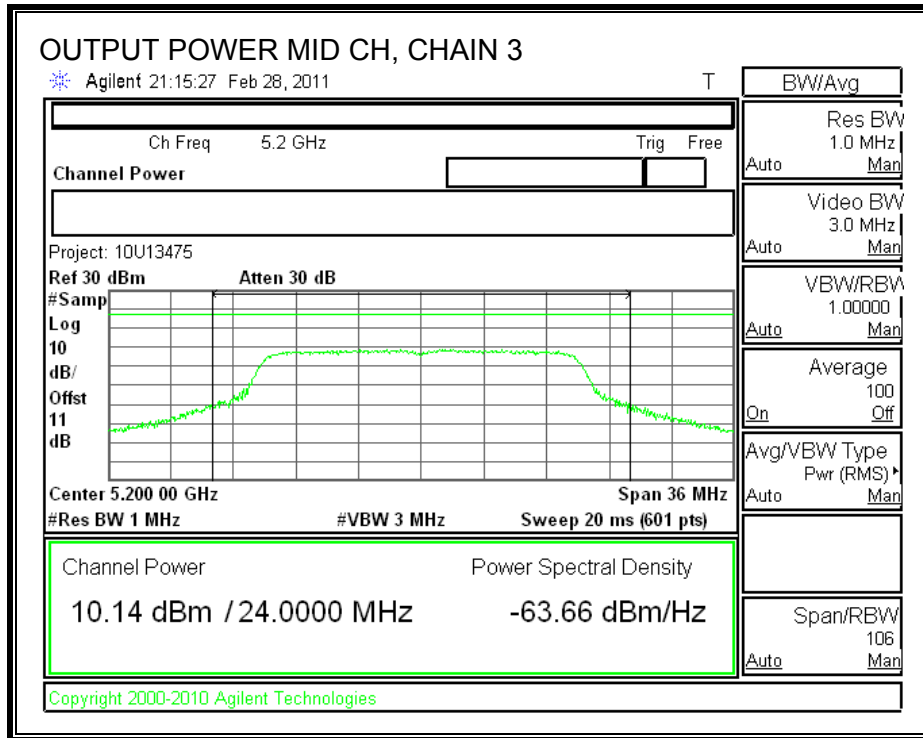


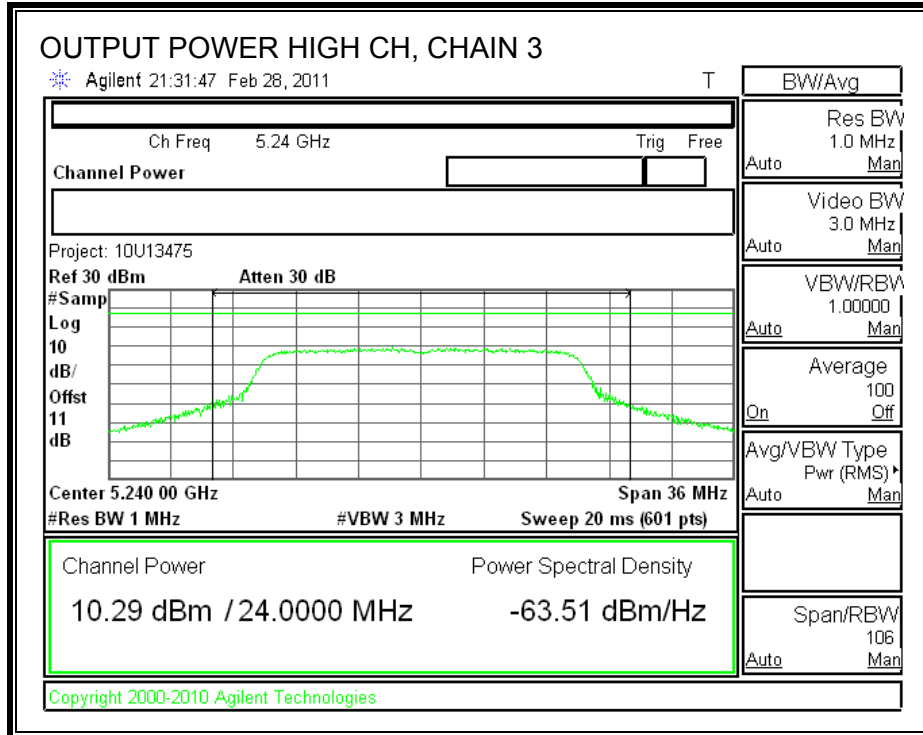




**CHAIN 3 OUTPUT POWER**







### 7.2.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1.0 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)
Low	5180	9.31	12.03	10.07	15.40
Middle	5200	9.32	11.91	10.11	15.36
High	5240	9.01	11.52	10.12	15.11

## 7.2.4. PEAK POWER SPECTRAL DENSITY

### LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, 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 peak transmit 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.

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 4 dBm.

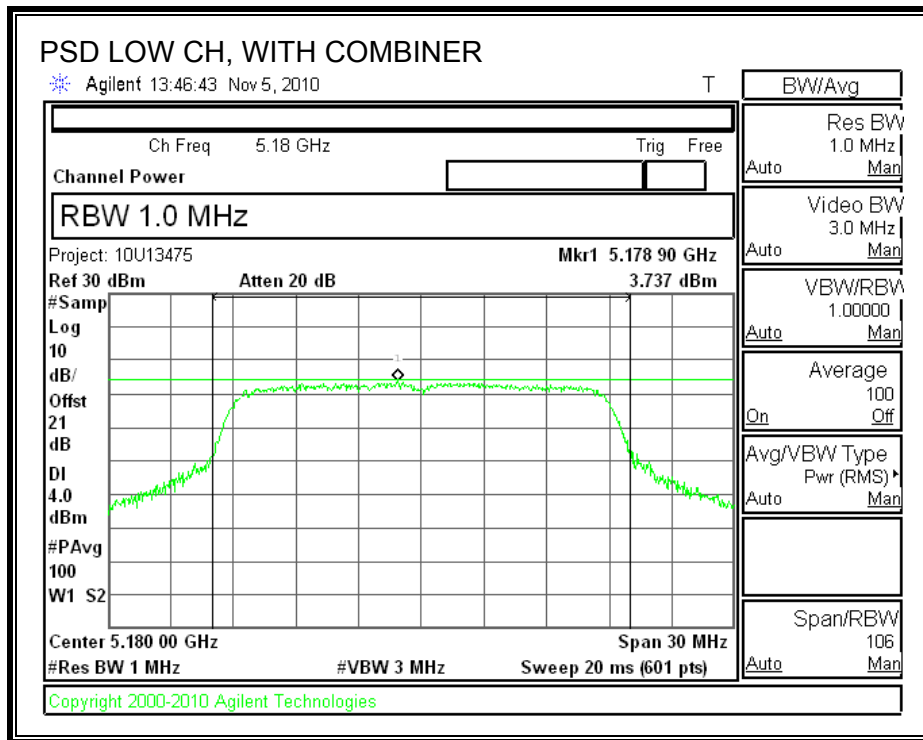
### TEST PROCEDURE

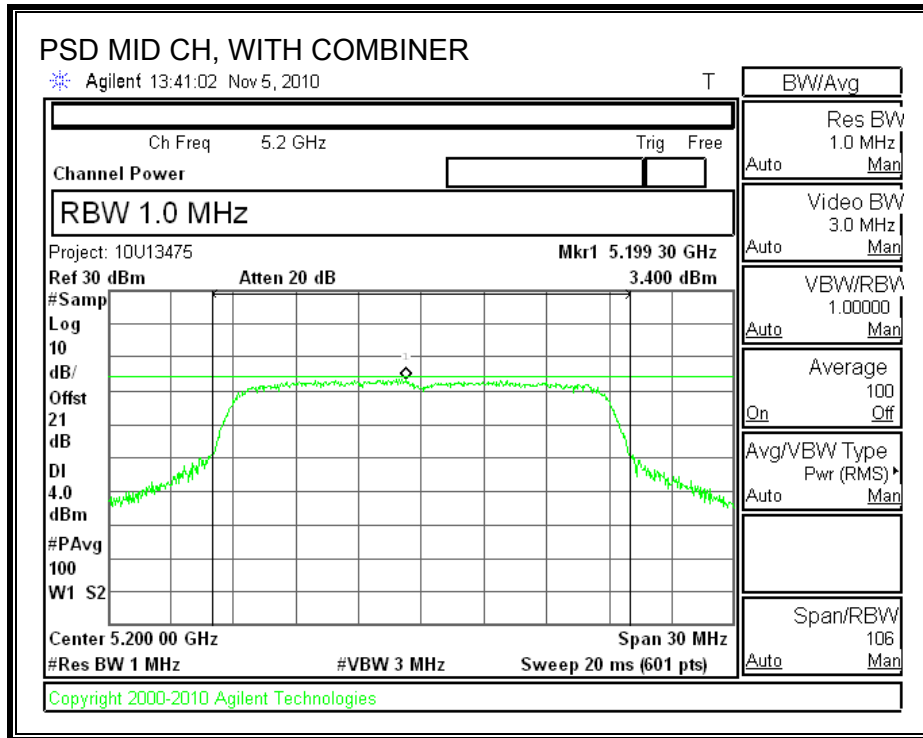
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

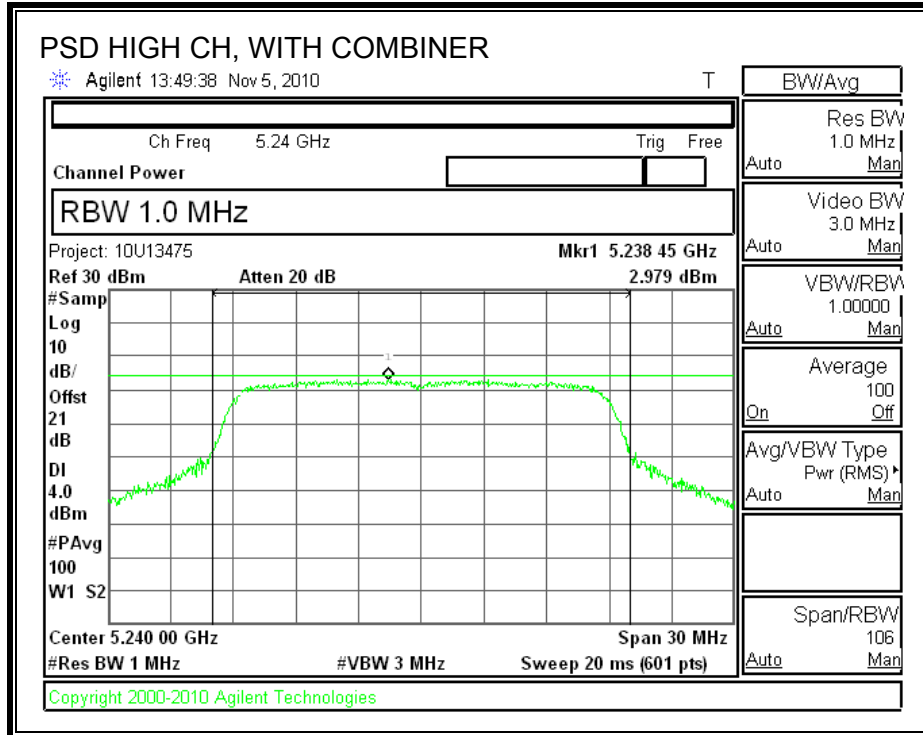
### RESULTS

Channel	Frequency (MHz)	PPSD With Combiner (dBm)	Limit (dBm)	Margin (dB)
Low	5180	3.74	4	-0.26
Middle	5200	3.40	4	-0.60
High	5240	2.98	4	-1.02

**POWER SPECTRAL DENSITY WITH COMBINER**









## 7.2.5. PEAK EXCURSION

### LIMITS

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

### TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner.

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

**RESULTS**

**CHAIN 1**

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Peak Excursion (dB)</b>	<b>Limit (dB)</b>	<b>Margin (dB)</b>
Low	5180	10.50	13	-2.50
Middle	5200	10.47	13	-2.53
High	5240	10.16	13	-2.84

**CHAIN 2**

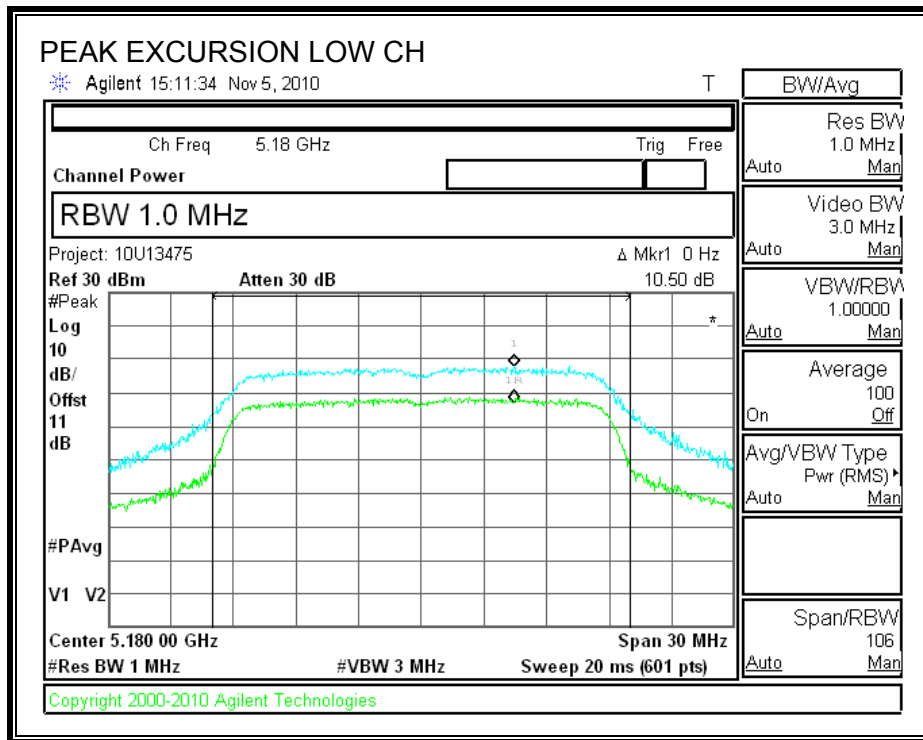
<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Peak Excursion (dB)</b>	<b>Limit (dB)</b>	<b>Margin (dB)</b>
Low	5180	9.64	13	-3.36
Middle	5200	9.23	13	-3.77
High	5240	9.52	13	-3.48

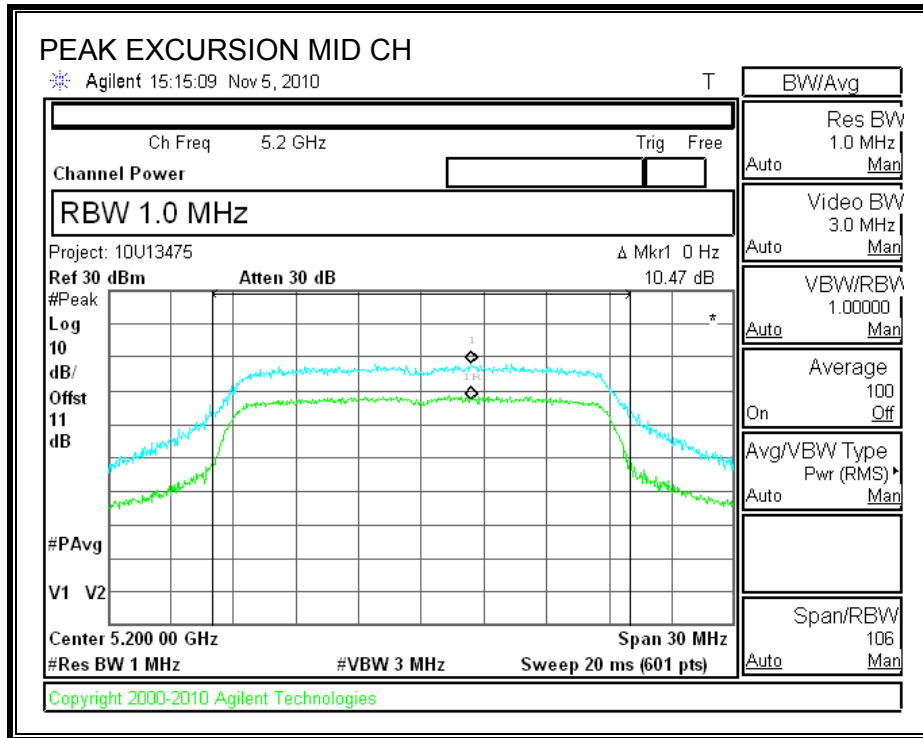
**CHAIN 3**

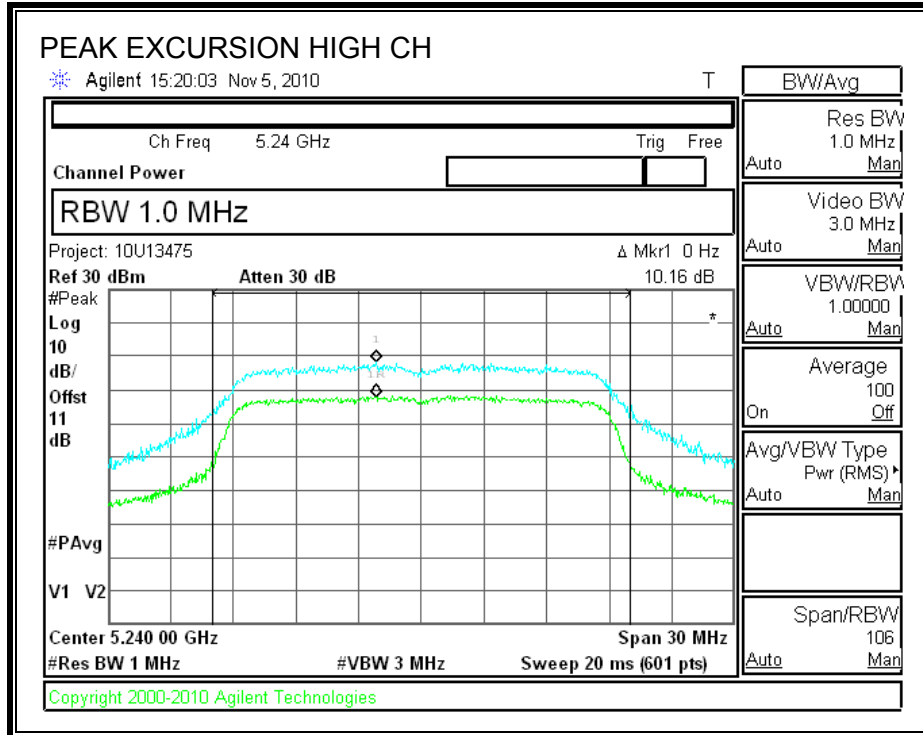
<b>Channel</b>	<b>Frequency (MHz)</b>	<b>Peak Excursion (dB)</b>	<b>Limit (dB)</b>	<b>Margin (dB)</b>
Low	5180	10.33	13	-2.67
Middle	5200	11.84	13	-1.16
High	5240	10.36	13	-2.64

**CHAIN 1**

**PEAK EXCURSION**

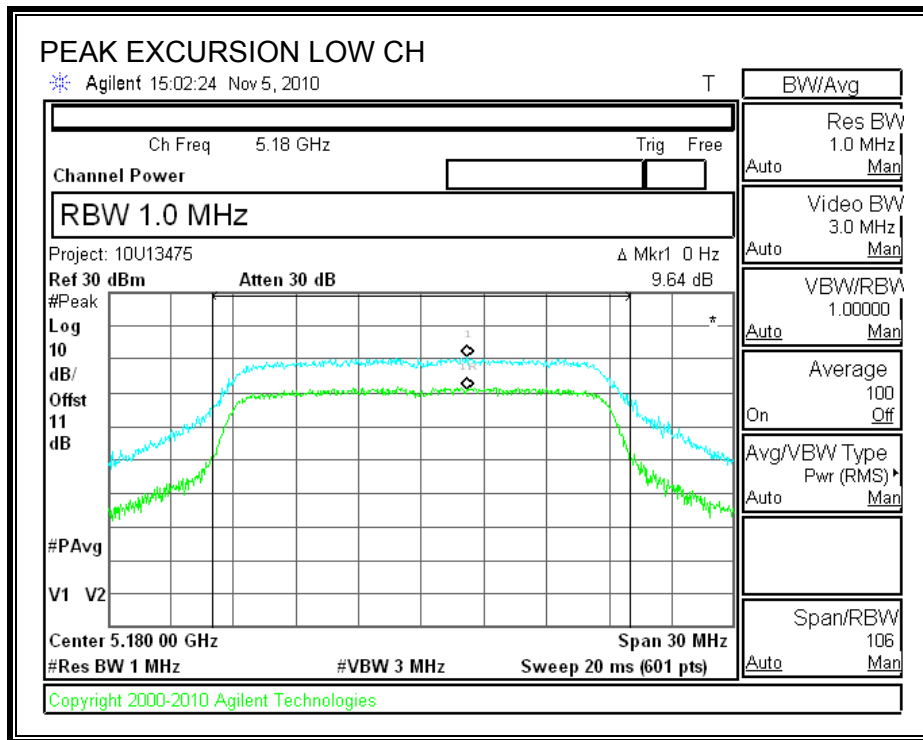


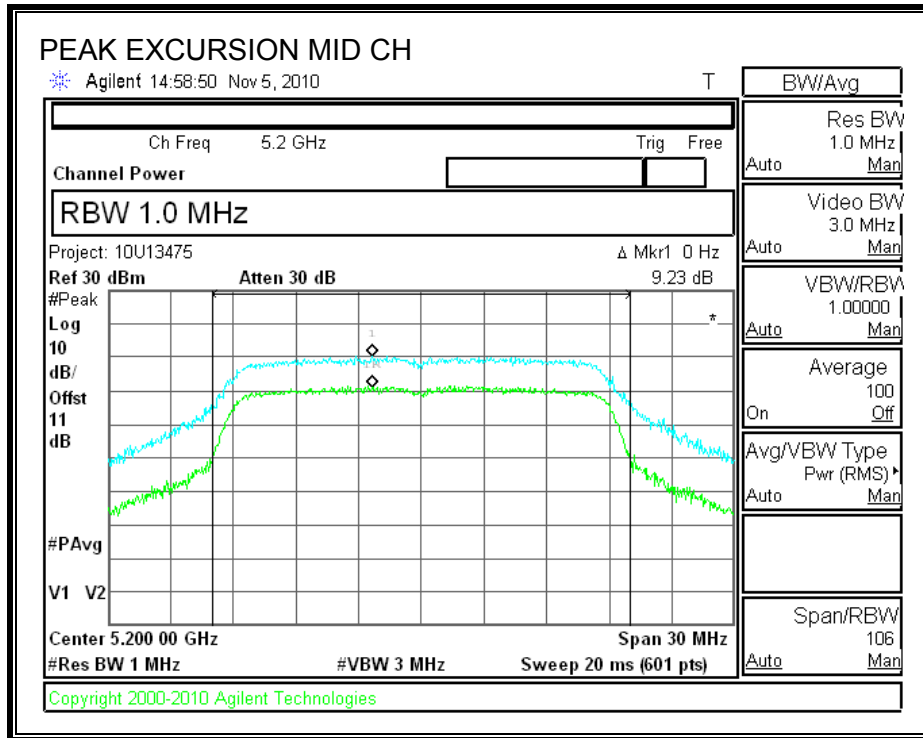


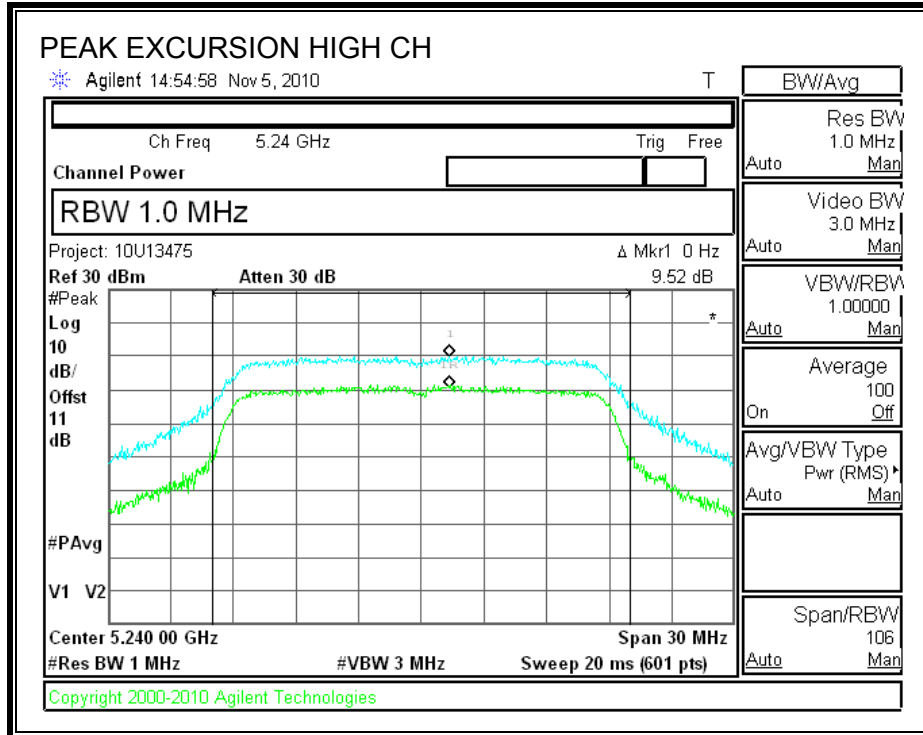


**CHAIN 2**

**PEAK EXCURSION**



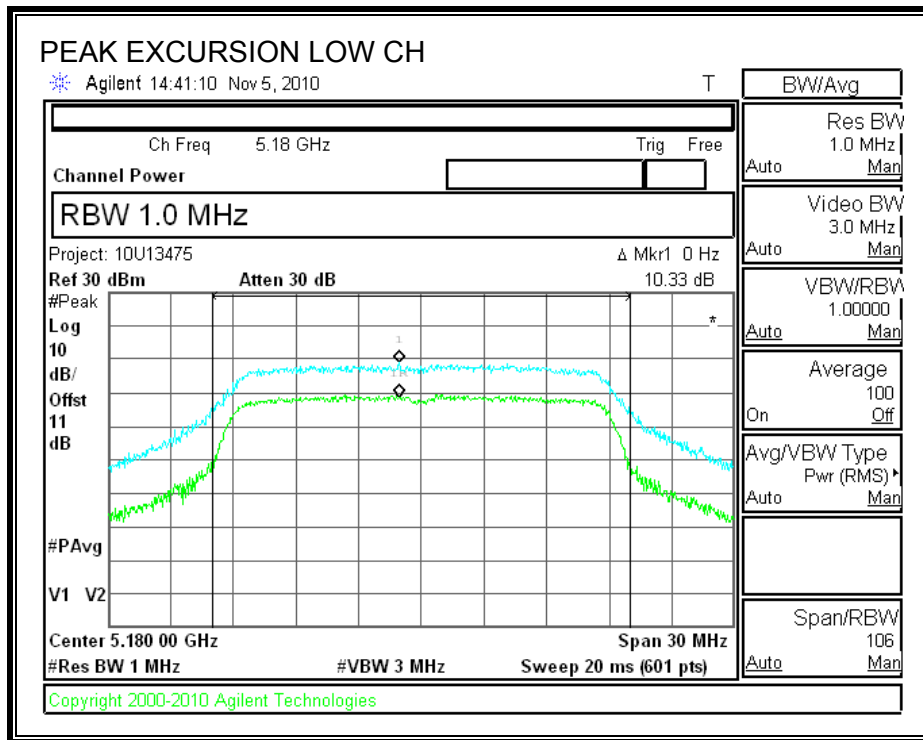


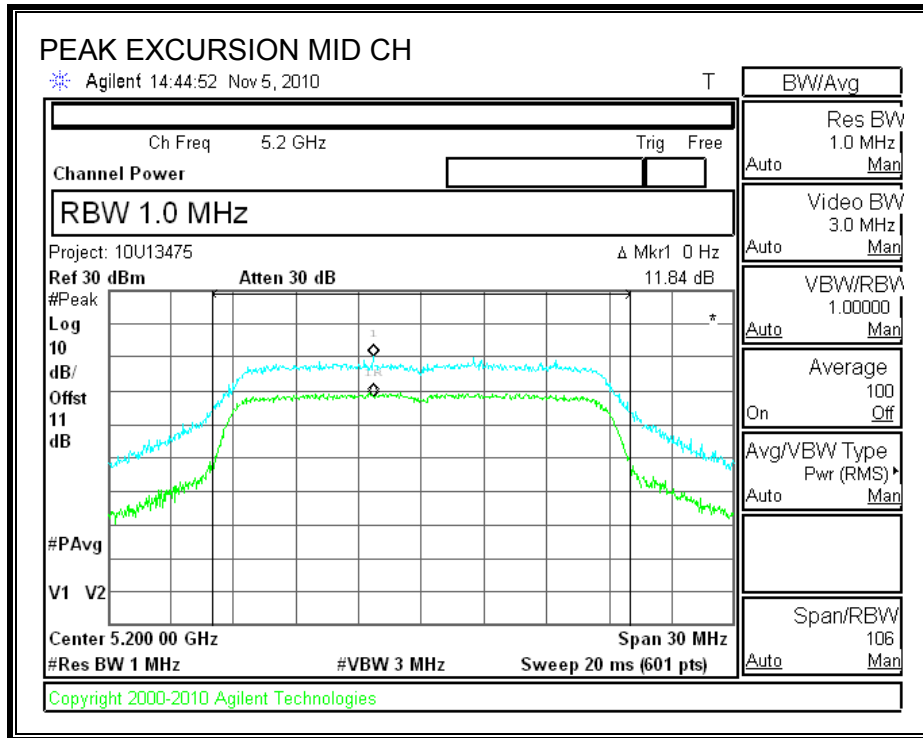


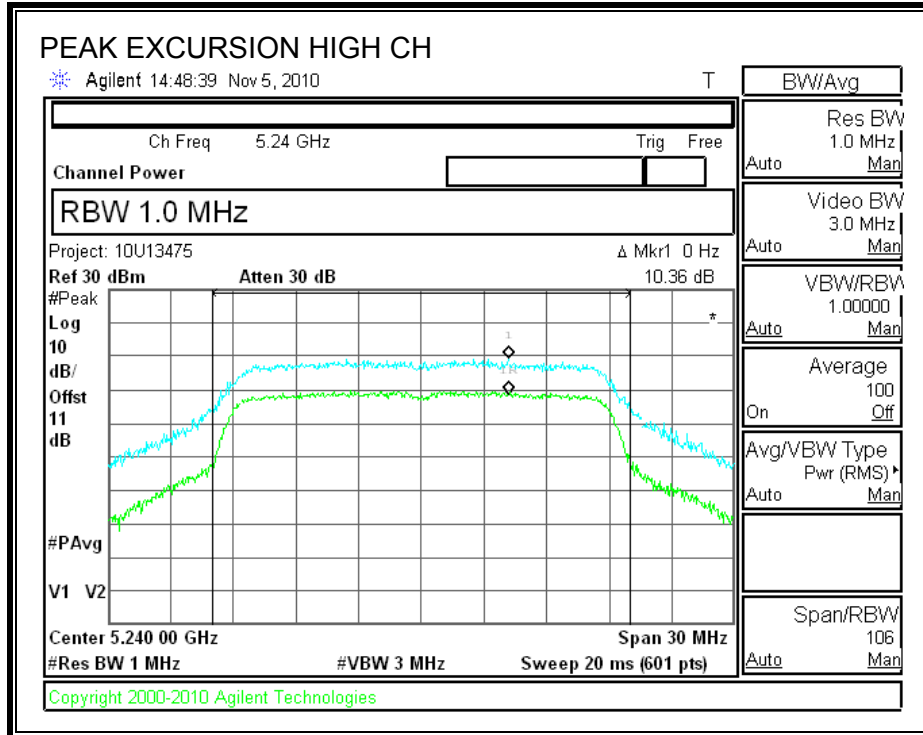


**CHAIN 3**

**PEAK EXCURSION**







## **7.2.6. CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (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 EIRP of -27 dBm / MHz.

### **TEST PROCEDURE**

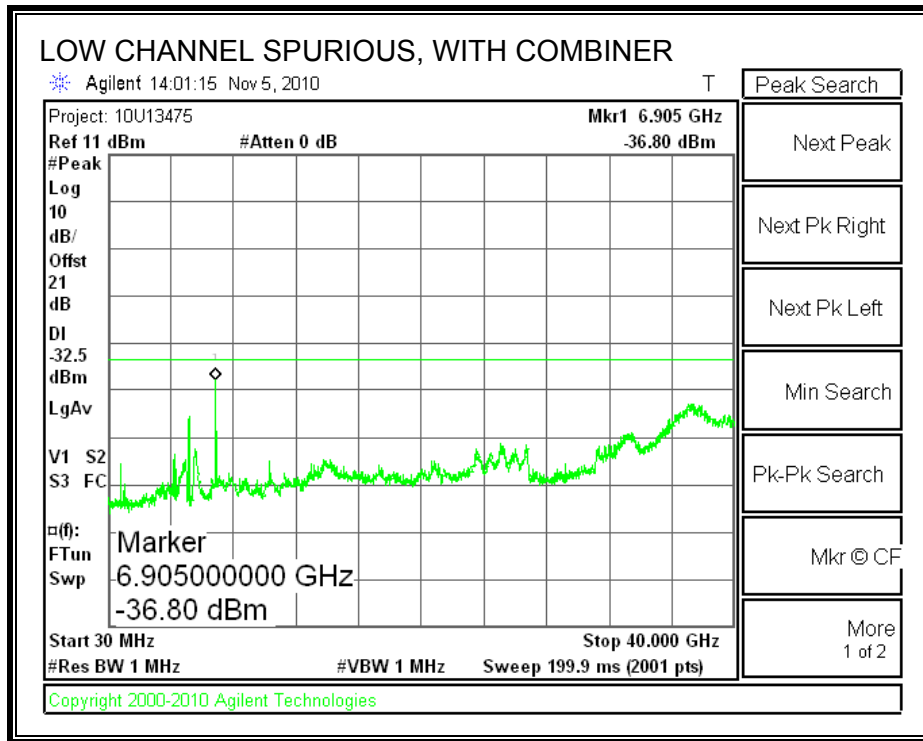
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

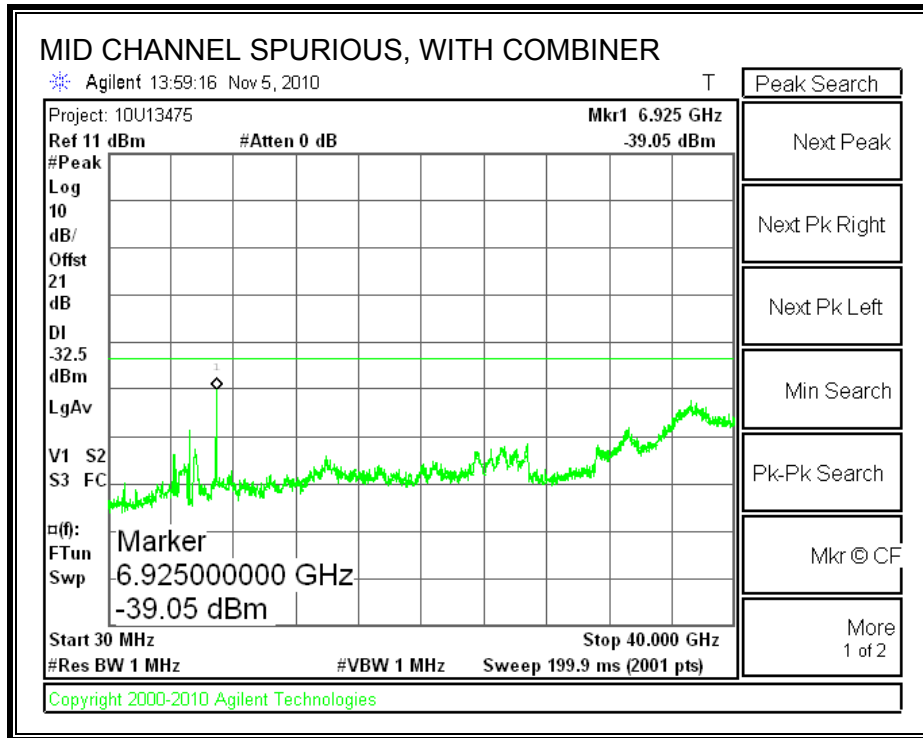
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

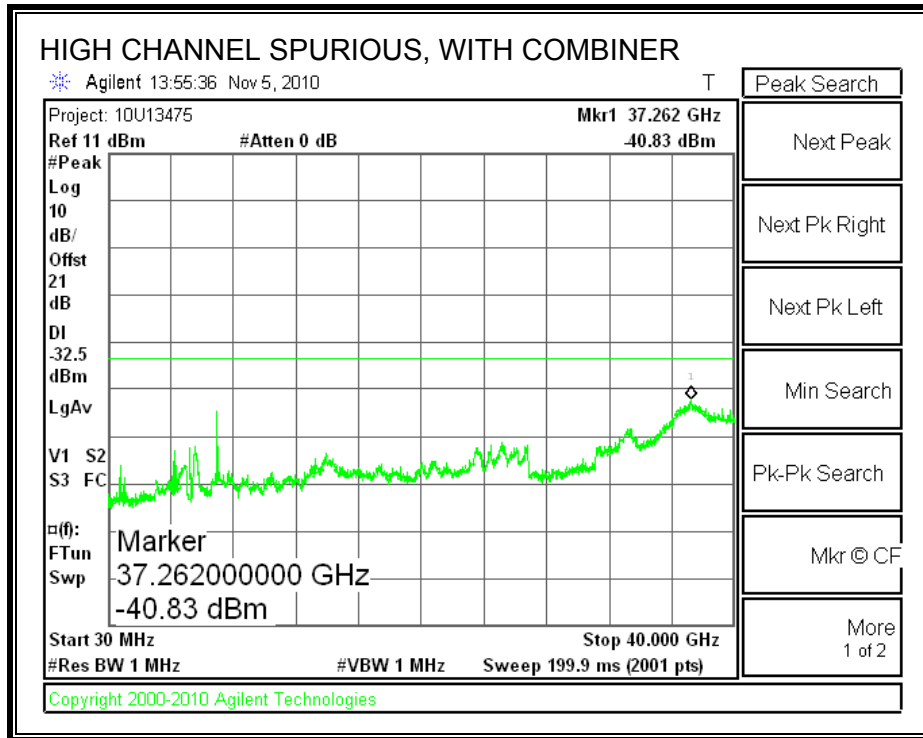
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

**RESULTS**

**SPURIOUS EMISSIONS WITH COMBINER**







### 7.3. 802.11n THREE CHAINS HT40 MODE IN THE 5.2 GHz BAND

#### 7.3.1. 26 dB and 99% BANDWIDTH

##### LIMITS

None; for reporting purposes only.

##### TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

##### RESULTS

###### CHAIN 1

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5190	38.101	36.3802
High	5230	39.237	36.1201

###### CHAIN 2

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5190	38.814	36.1397
High	5230	37.375	36.3575

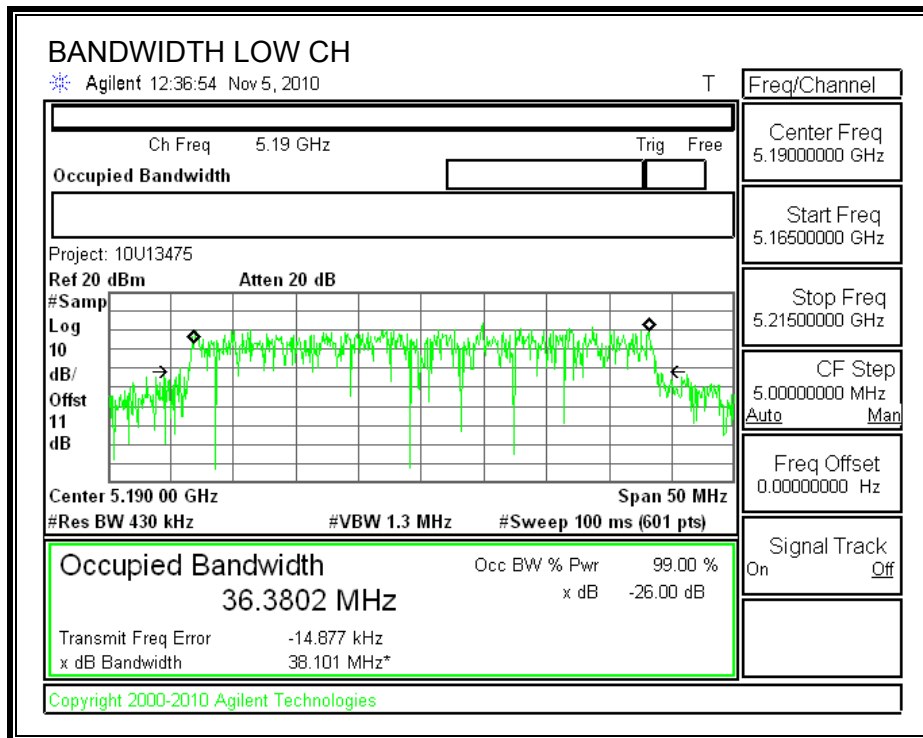
###### CHAIN 3

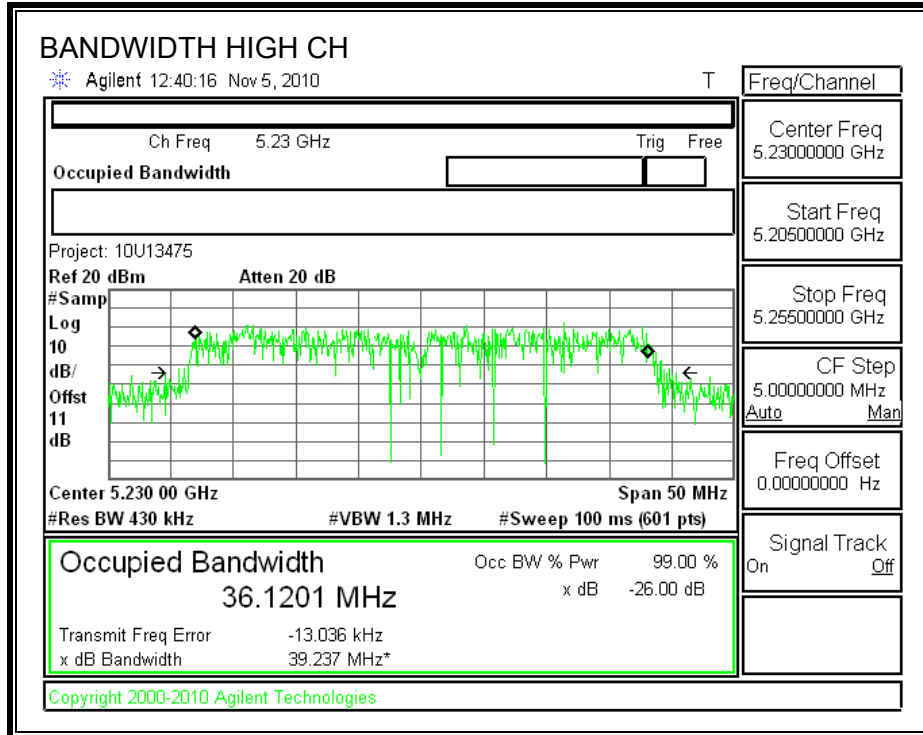
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5190	38.534	35.9210
High	5230	40.760	36.3548



**CHAIN 1**

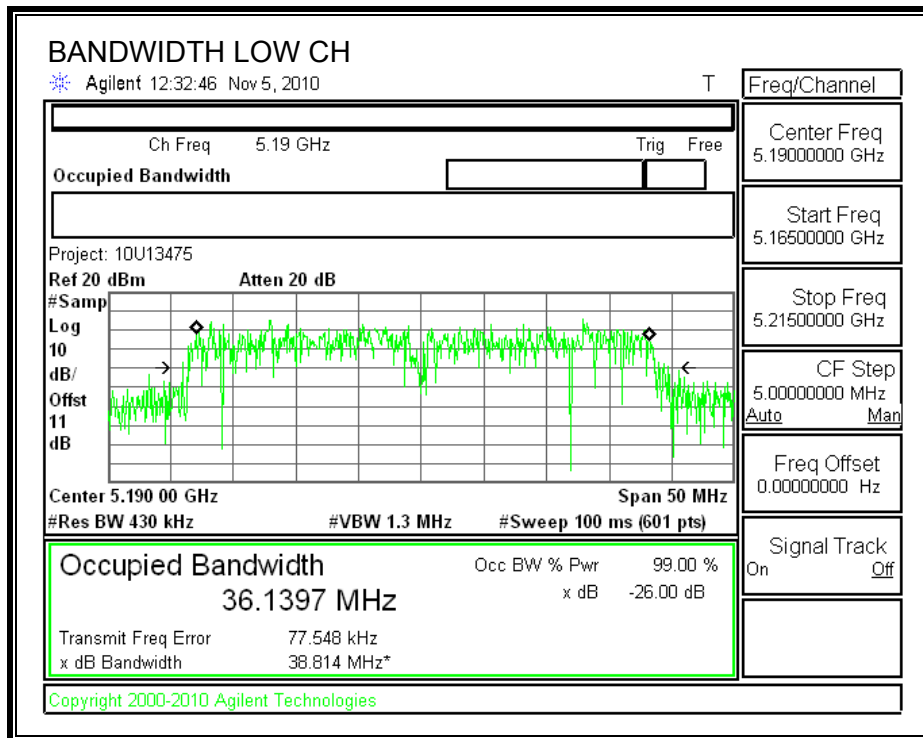
**26 dB and 99% BANDWIDTH**

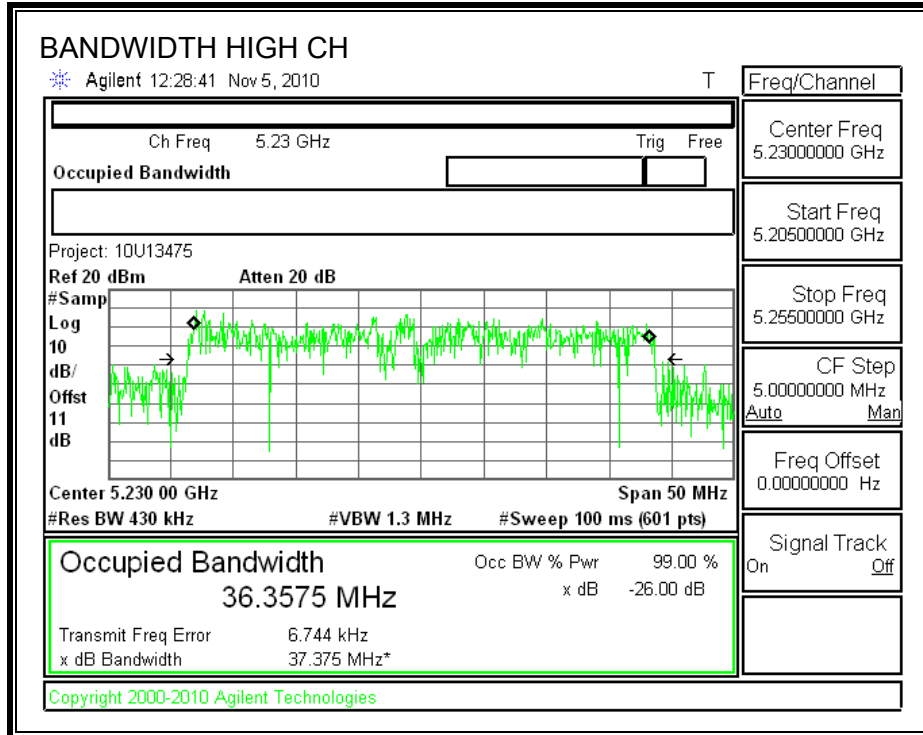




**CHAIN 2**

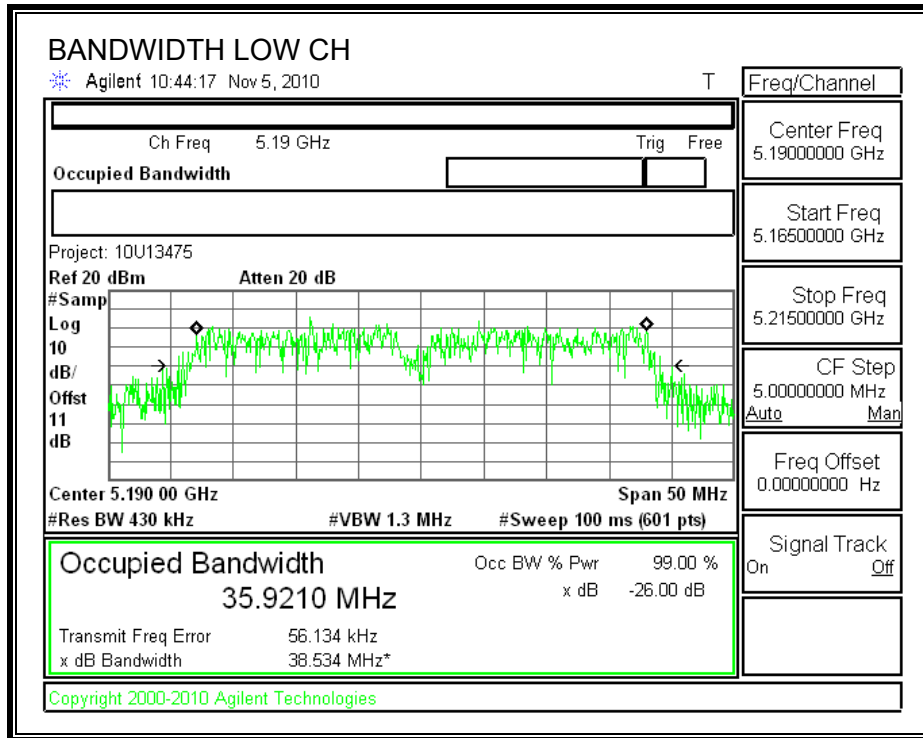
**26 dB and 99% BANDWIDTH**

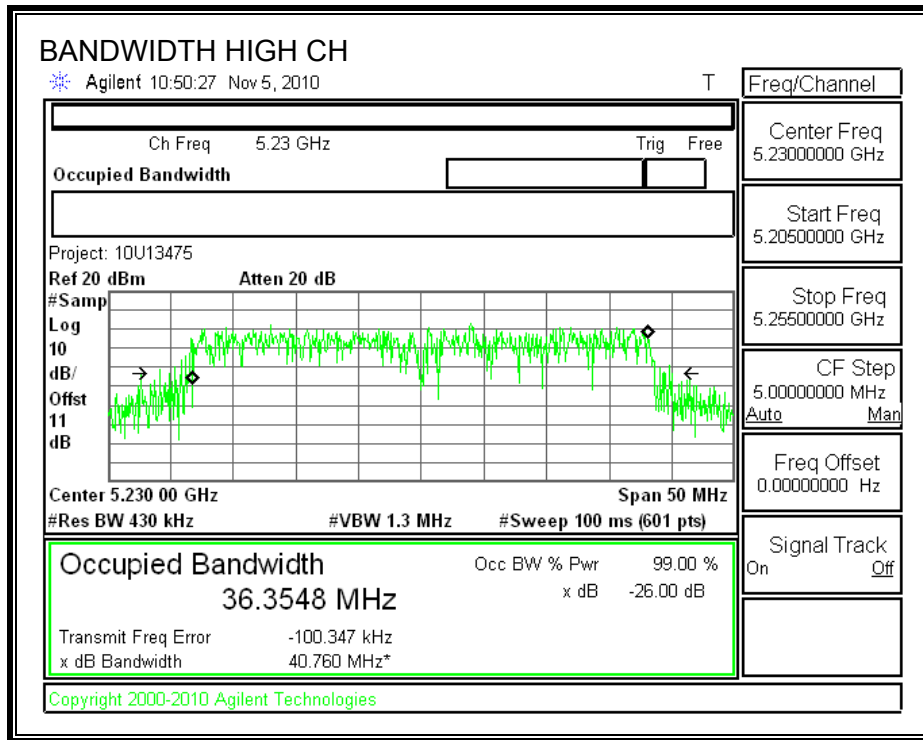




**CHAIN 3**

**26 dB and 99% BANDWIDTH**





### **7.3.2. OUTPUT POWER**

#### **LIMITS**

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, 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. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

#### **TEST PROCEDURE**

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

**RESULTS**

**Limit**

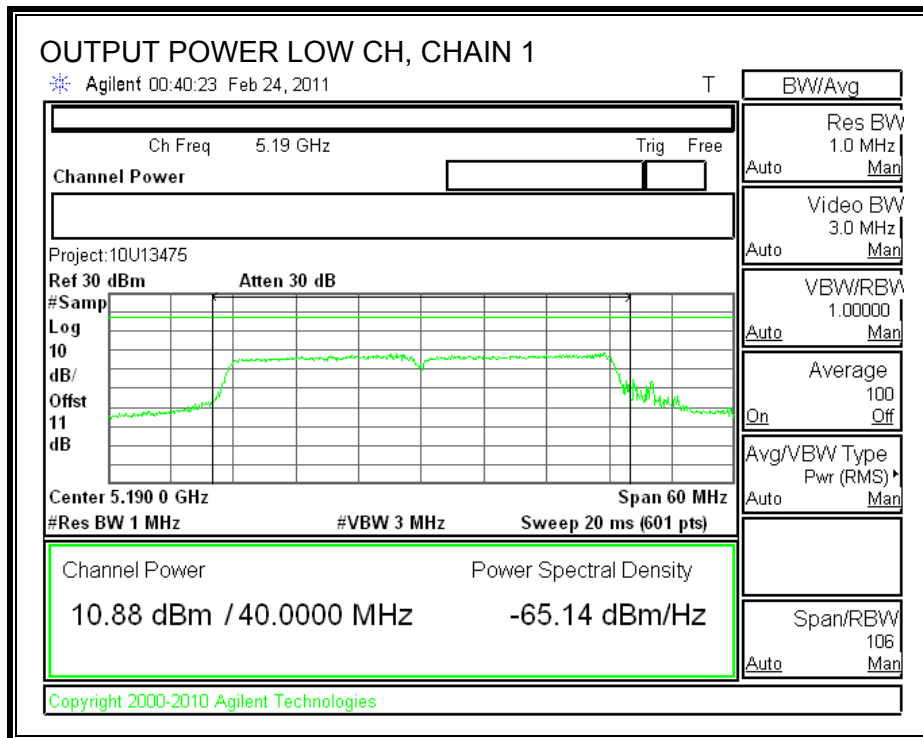
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5190	16.99	38.101	19.81	5.50	16.99
High	5230	16.99	37.275	19.71	5.50	16.99

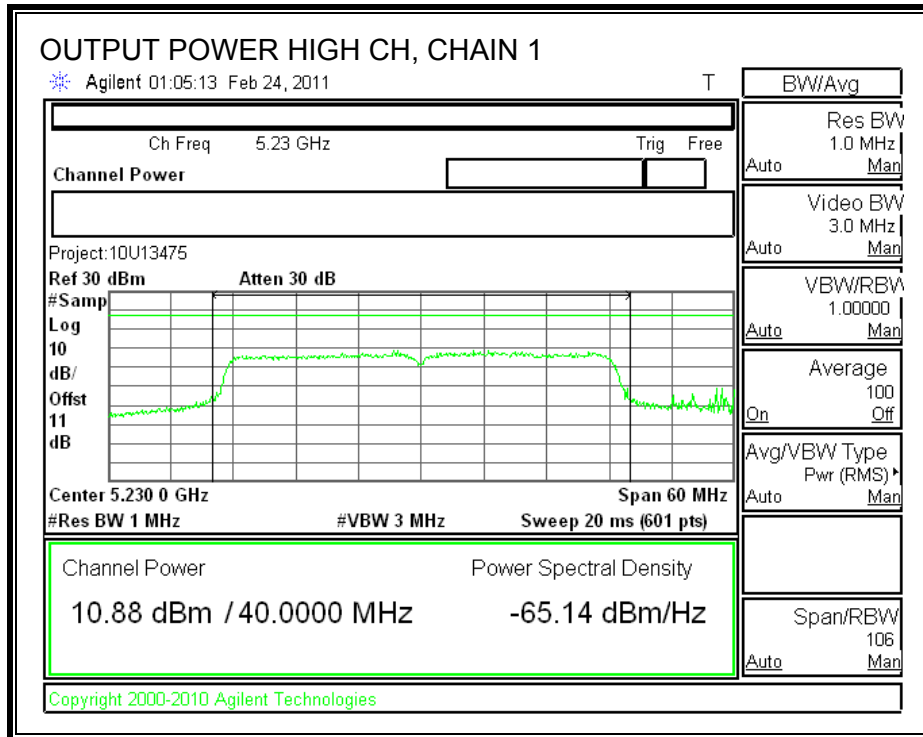
**Individual Chain Results**

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5190	10.88	12.96	11.83	16.74	16.99	-0.25
High	5230	10.88	13.50	11.40	16.85	16.99	-0.14

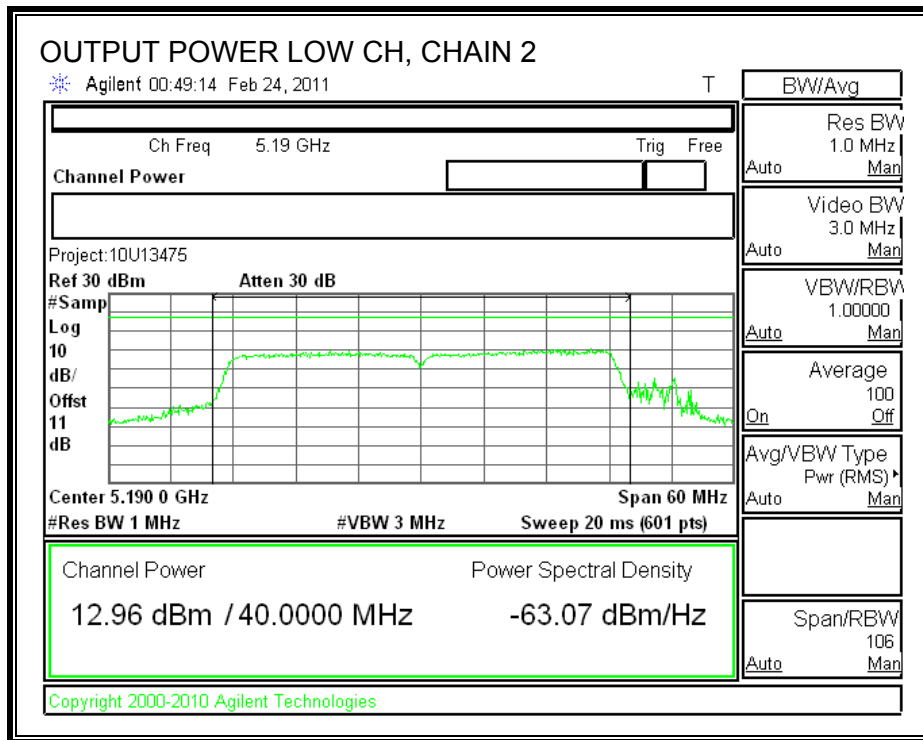


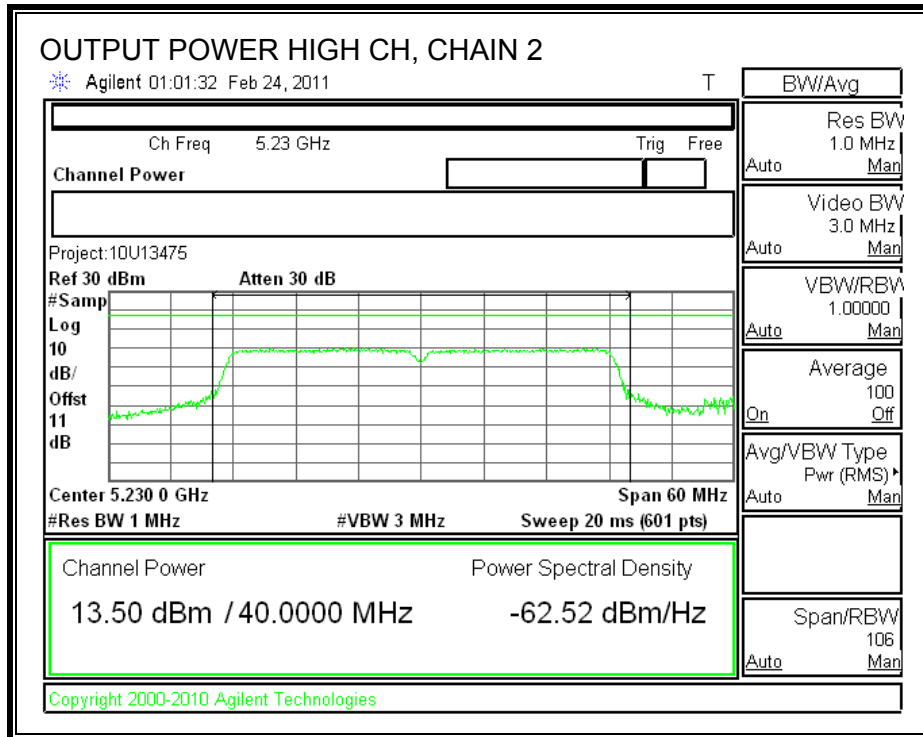
**CHAIN 1 OUTPUT POWER**



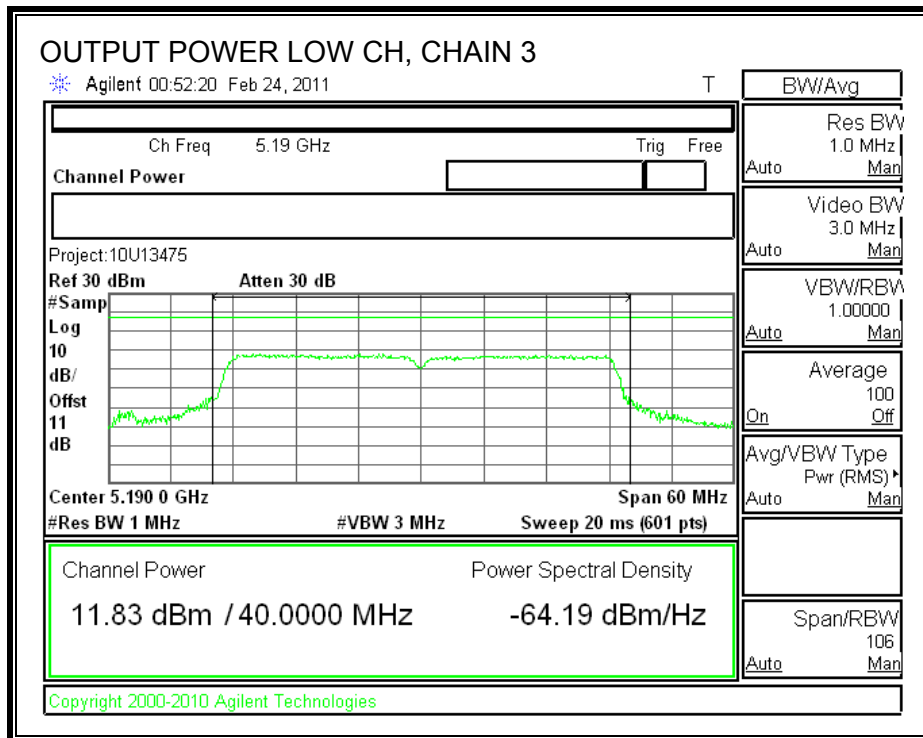


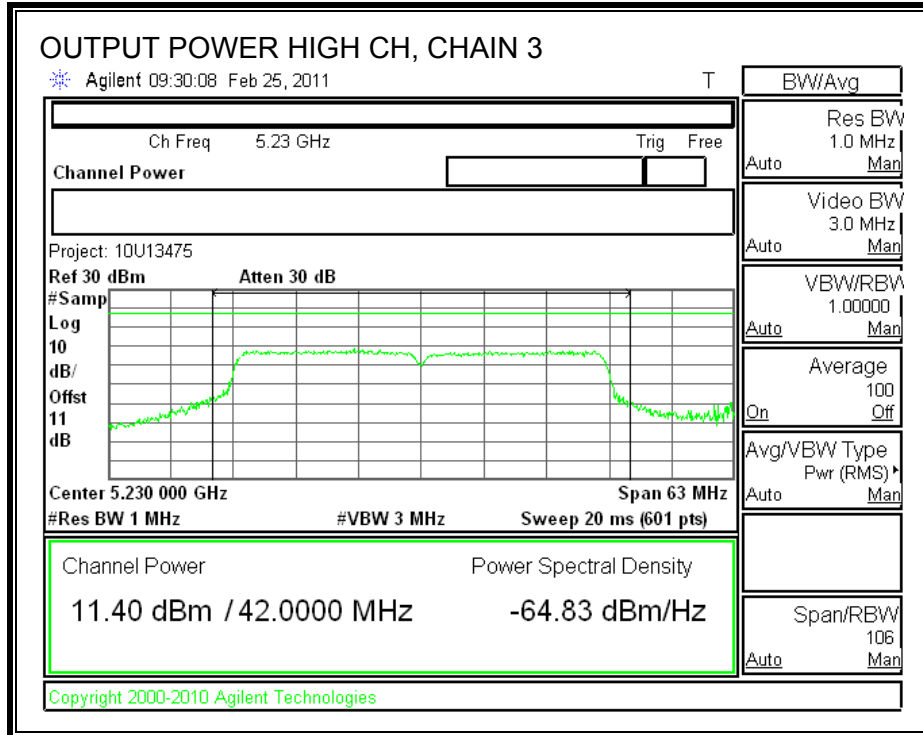
**CHAIN 2 OUTPUT POWER**





**CHAIN 3 OUTPUT POWER**





### 7.3.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1.0 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)
Low	5190	10.18	12.11	11.21	16.01
High	5230	10.03	13.02	11.47	16.45

### 7.3.4. PEAK POWER SPECTRAL DENSITY

#### LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the 5.15-5.25 GHz band, 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 peak transmit 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.

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 4 dBm.

#### TEST PROCEDURE

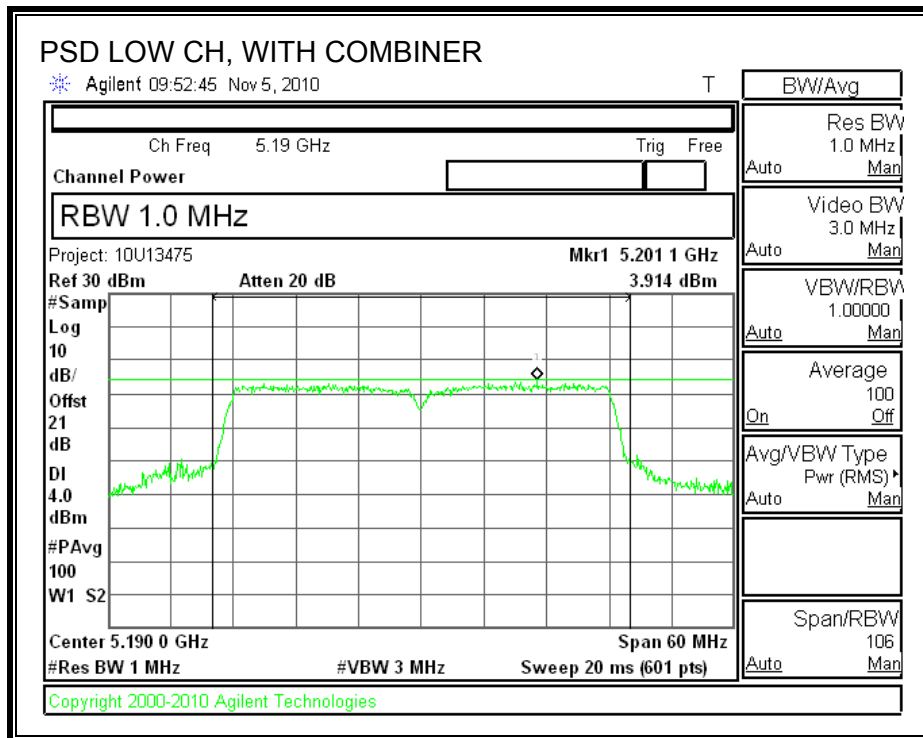
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

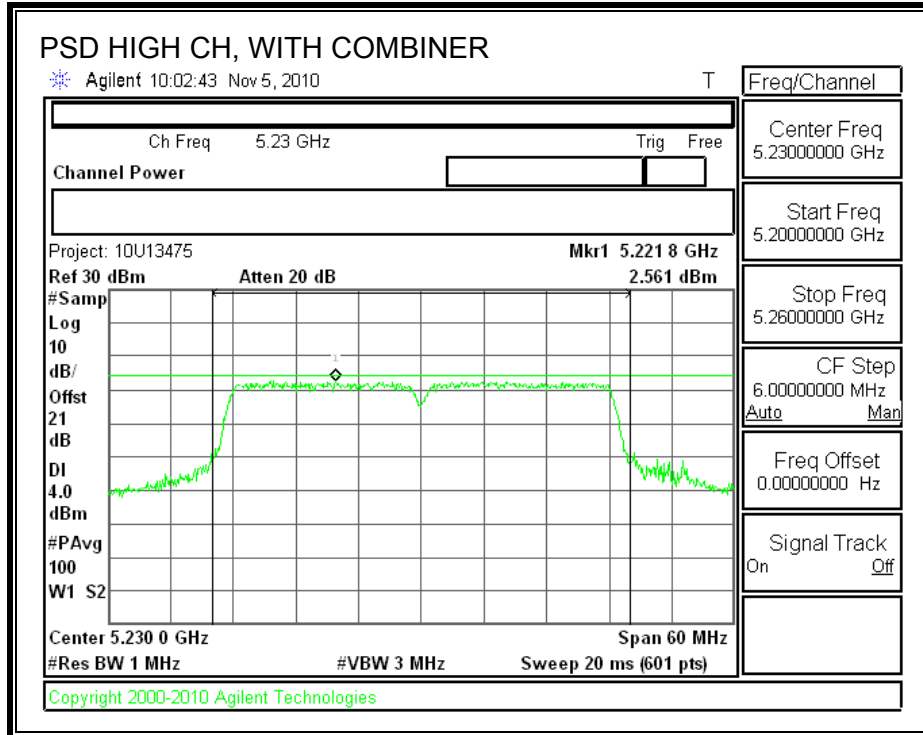
#### RESULTS

Channel	Frequency (MHz)	PPSD With Combiner (dBm)	Limit (dBm)	Margin (dB)
Low	5190	3.914	4	-0.086
High	5230	2.561	4	-1.439



**POWER SPECTRAL DENSITY WITH COMBINER**





### **7.3.5. PEAK EXCURSION**

#### **LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

#### **TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

**RESULTS**

**CHAIN 1**

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5190	11.18	13	-1.82
High	5230	11.64	13	-1.36

**CHAIN 2**

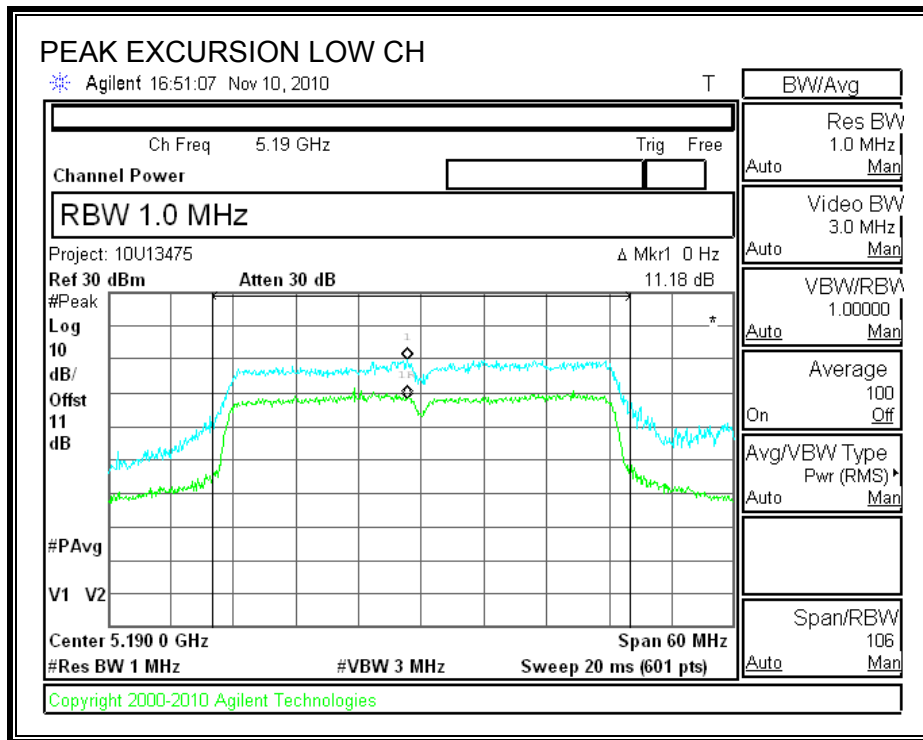
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5190	12.28	13	-0.72
High	5230	12.79	13	-0.21

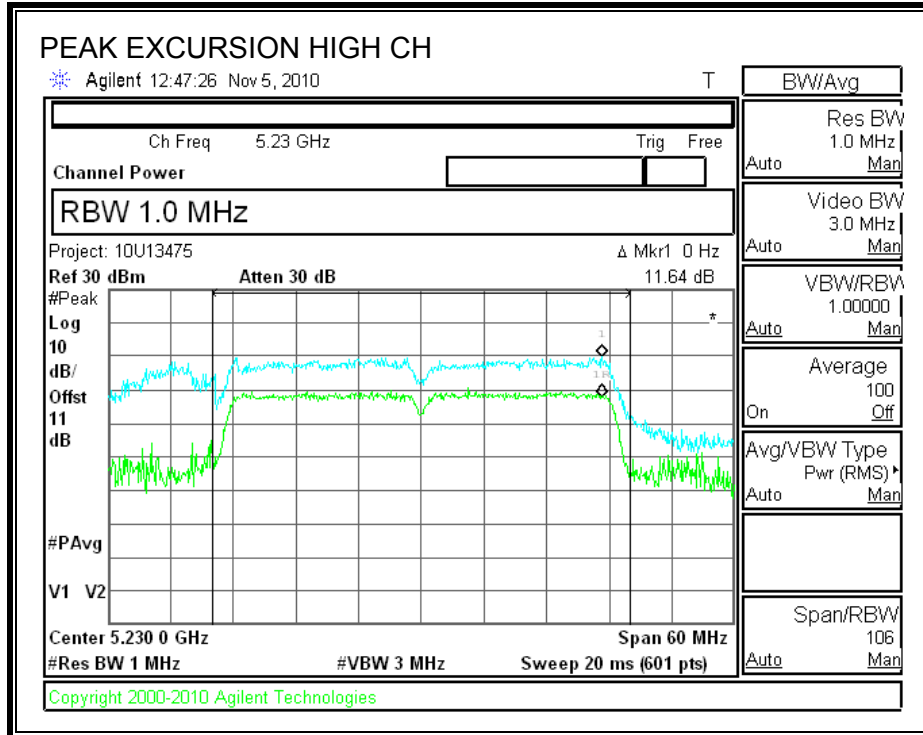
**CHAIN 3**

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5190	11.65	13	-1.35
High	5230	11.94	13	-1.06

**CHAIN 1**

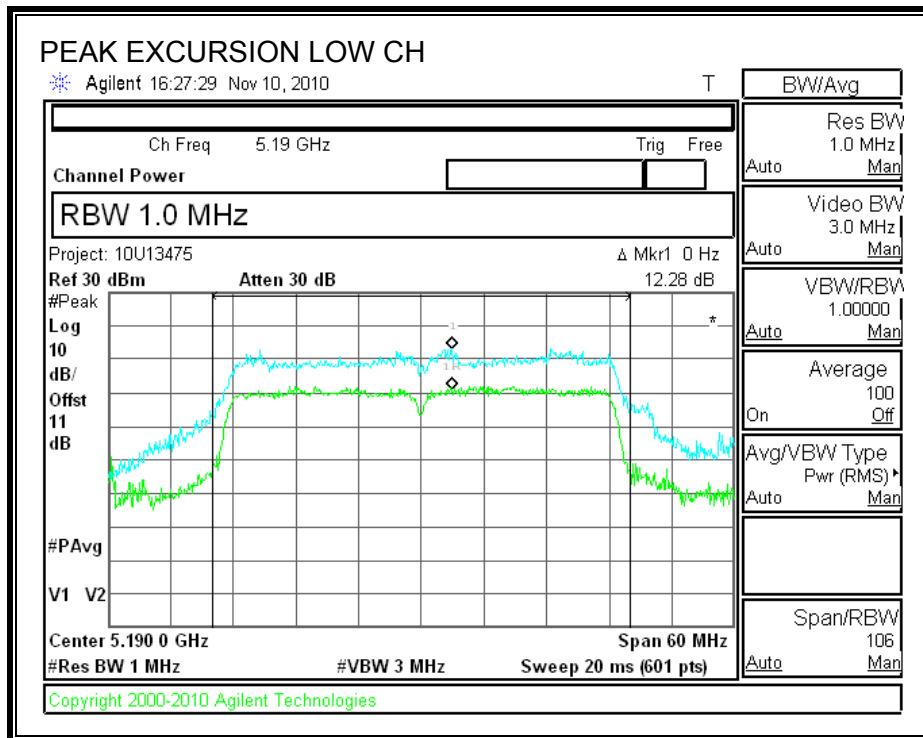
**PEAK EXCURSION**

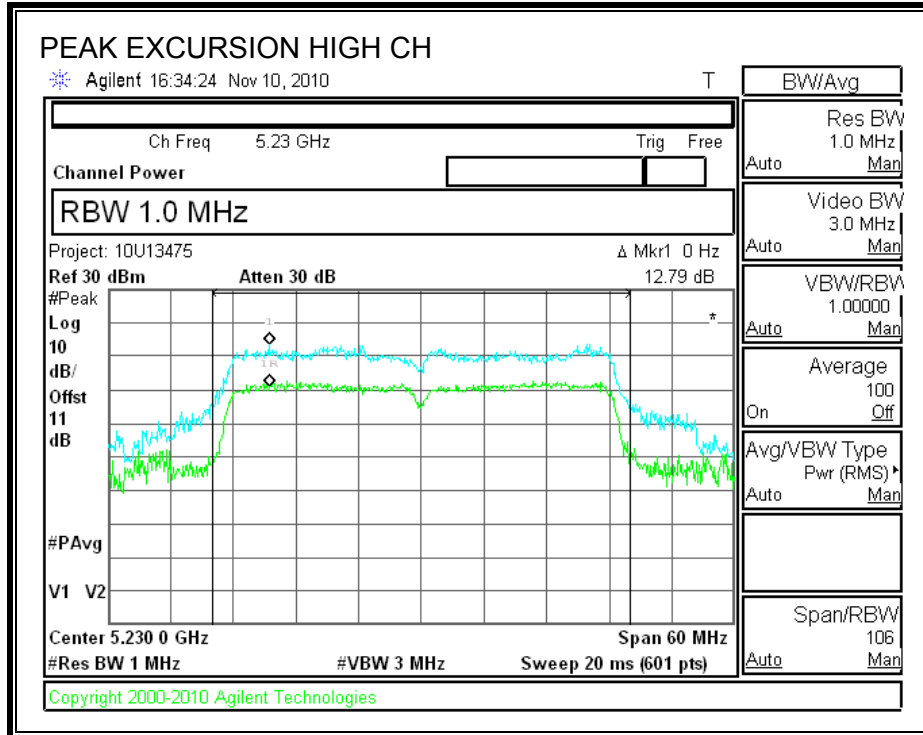




**CHAIN 2**

**PEAK EXCURSION**

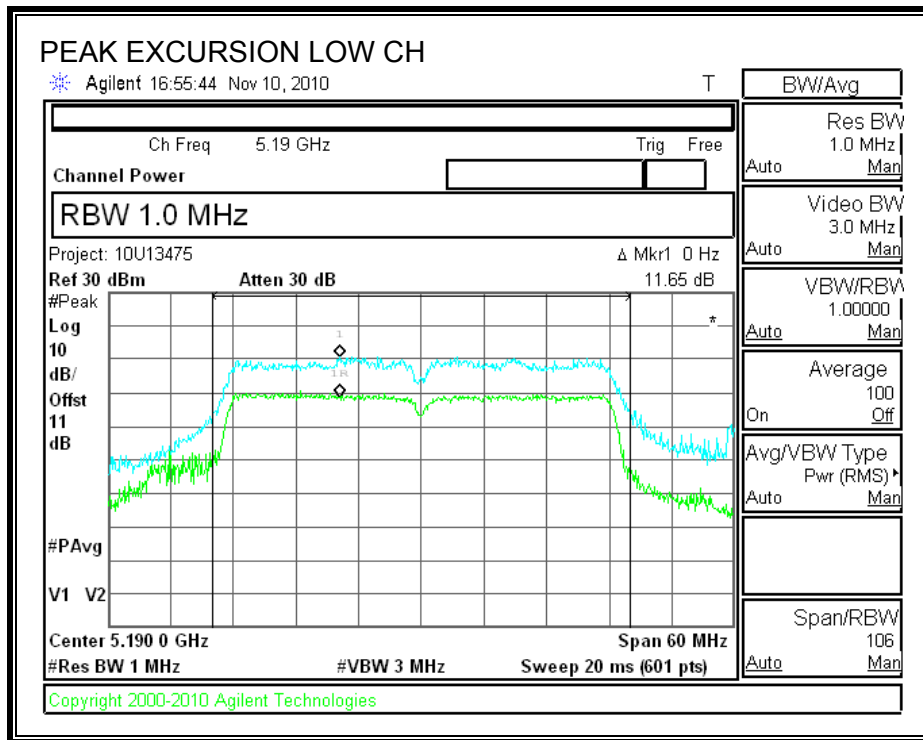


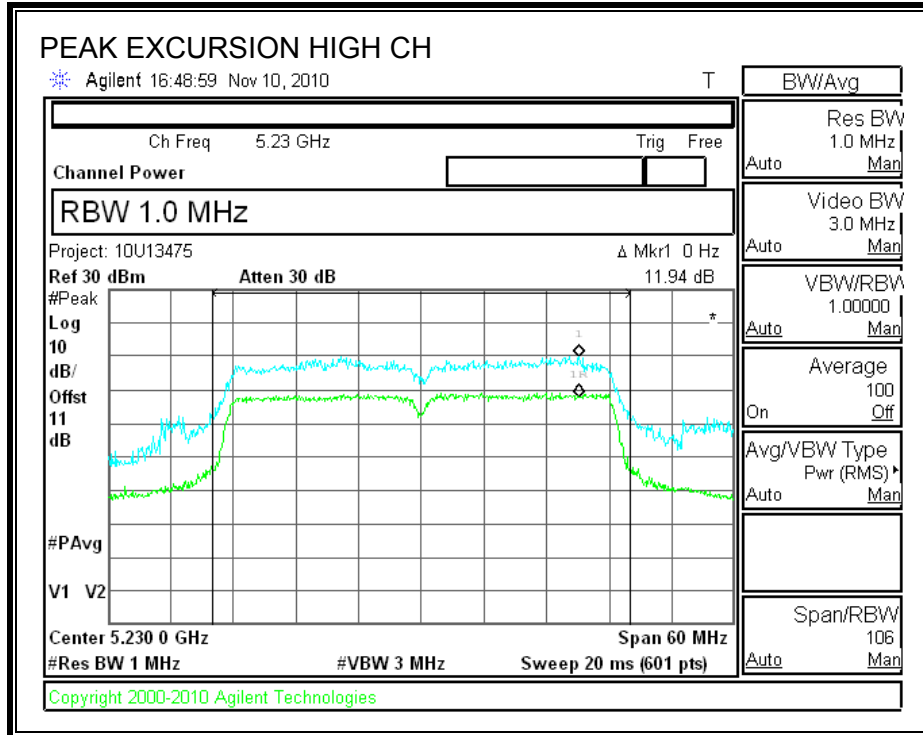




**CHAIN 3**

**PEAK EXCURSION**





### **7.3.6. CONDUCTED SPURIOUS EMISSIONS**

#### **LIMITS**

FCC §15.407 (b) (1)

IC RSS-210 A9.3 (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 EIRP of -27 dBm / MHz.

#### **TEST PROCEDURE**

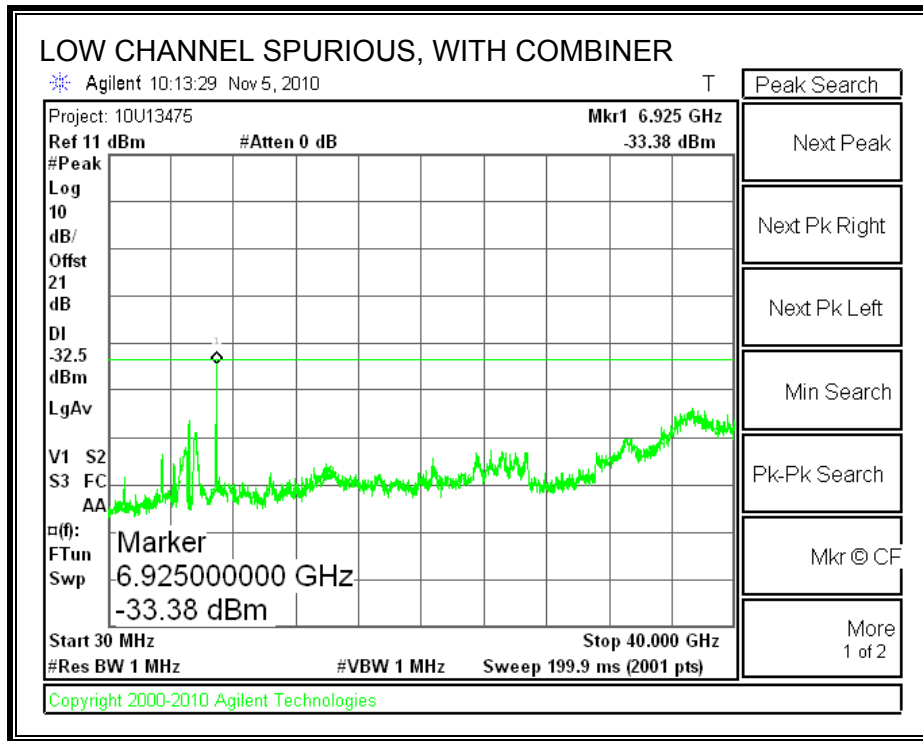
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

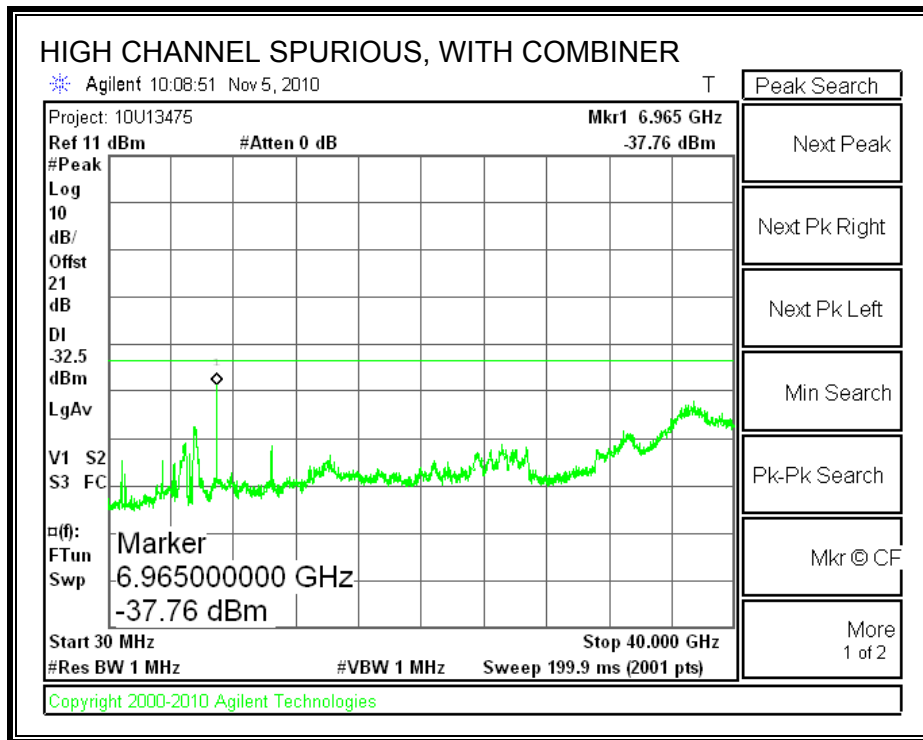
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

**RESULTS**

**SPURIOUS EMISSIONS WITH COMBINER**





## 7.4. 802.11a THREE CHAINS LEGACY MODE IN THE 5.3 GHz BAND

### 7.4.1. 26 dB and 99% BANDWIDTH

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

#### RESULTS

##### CHAIN 1

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5260	26.614	16.3992
Middle	5300	27.130	16.4699
High	5320	26.688	16.6184

##### CHAIN 2

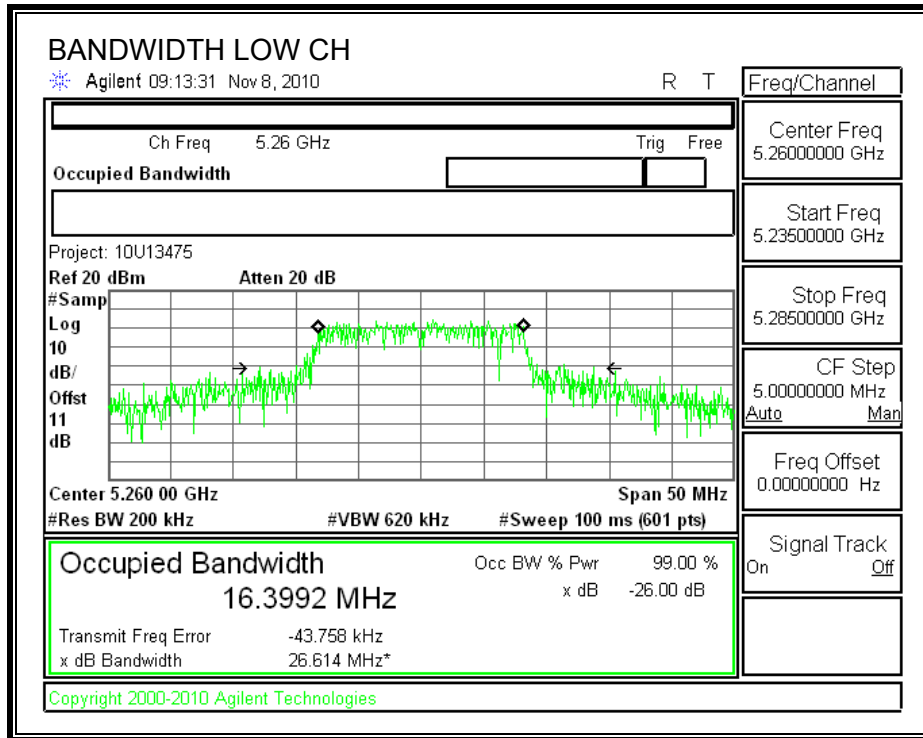
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5260	27.127	16.6643
Middle	5300	27.692	16.4628
High	5320	28.467	16.7663

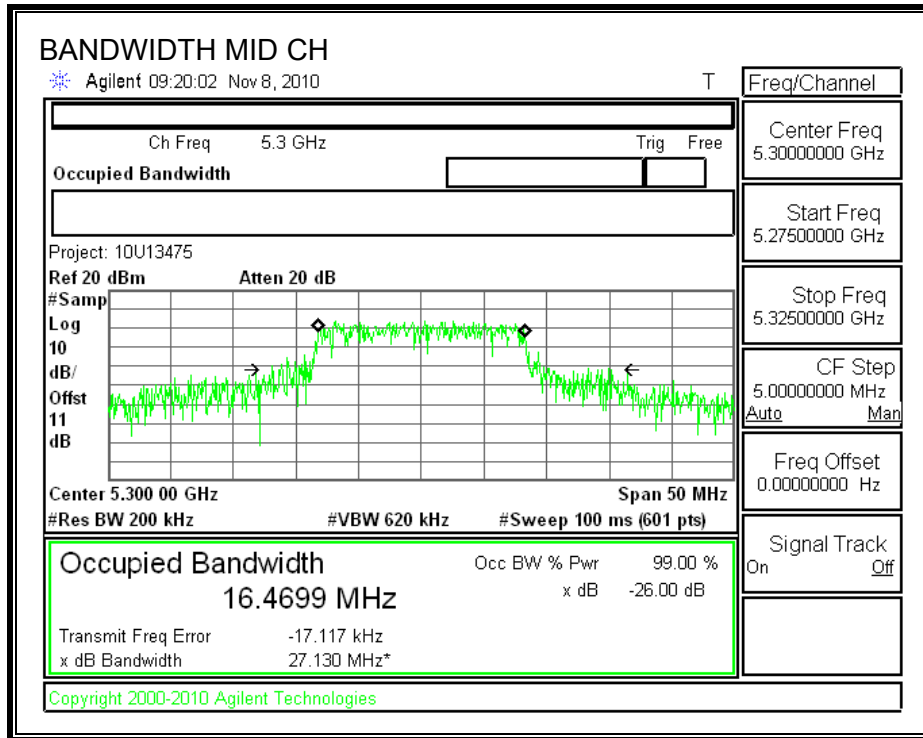
##### CHAIN 3

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5260	26.594	16.5814
Middle	5300	26.390	16.6829
High	5320	26.202	16.4907

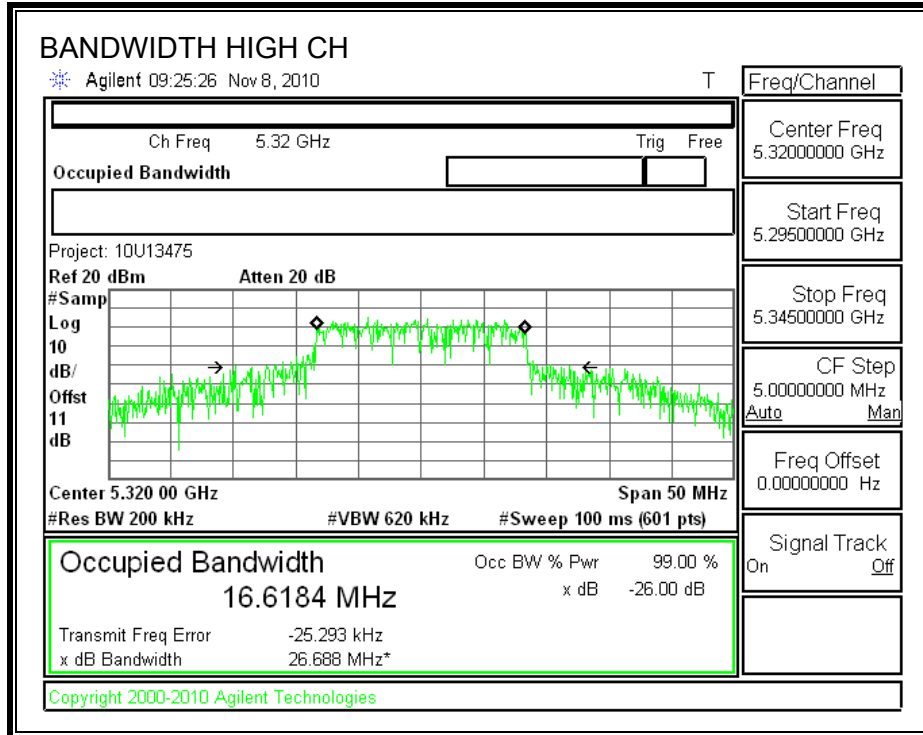
**CHAIN 1**

**26 dB and 99% BANDWIDTH**



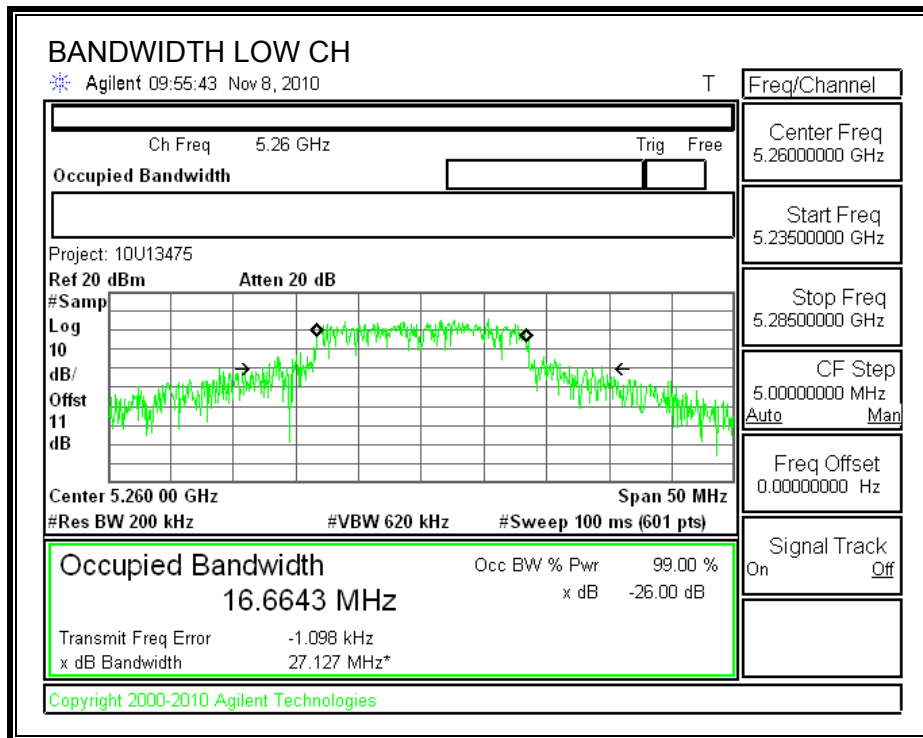


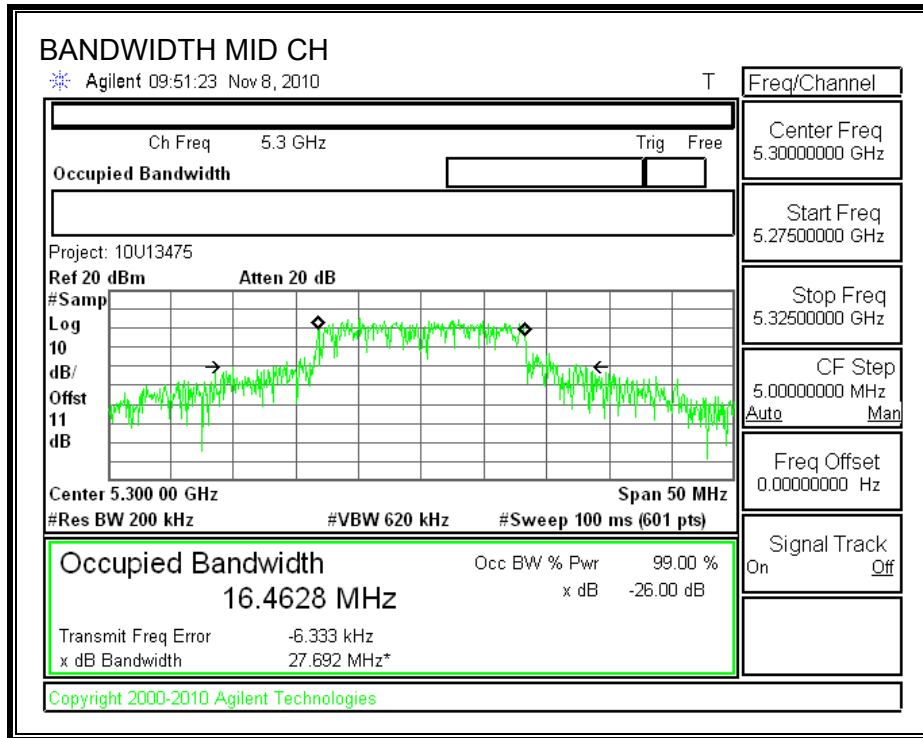


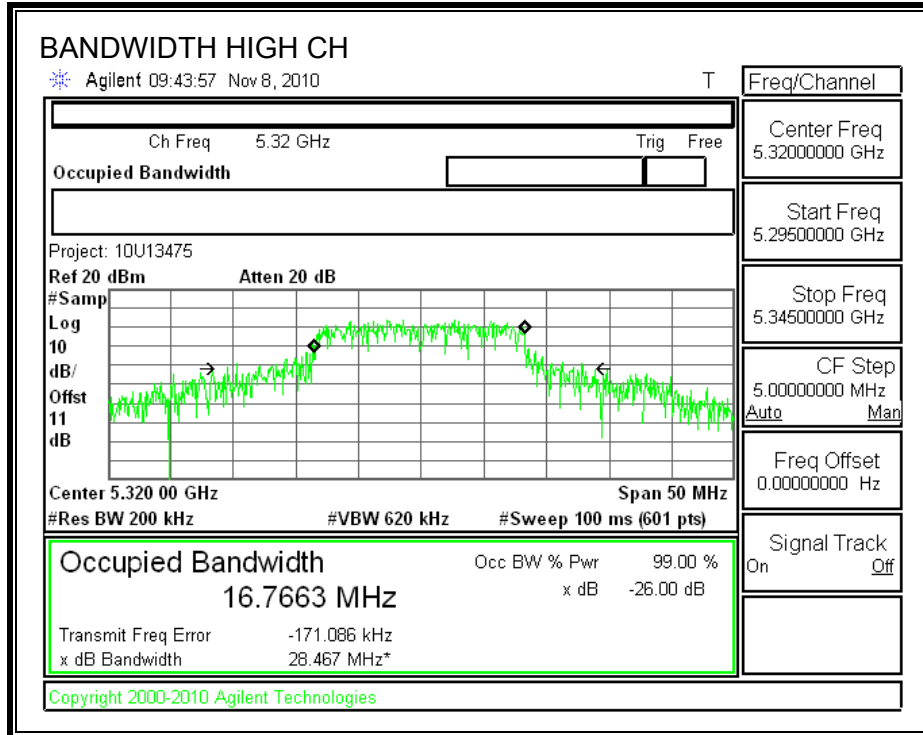


**CHAIN 2**

**26 dB and 99% BANDWIDTH**

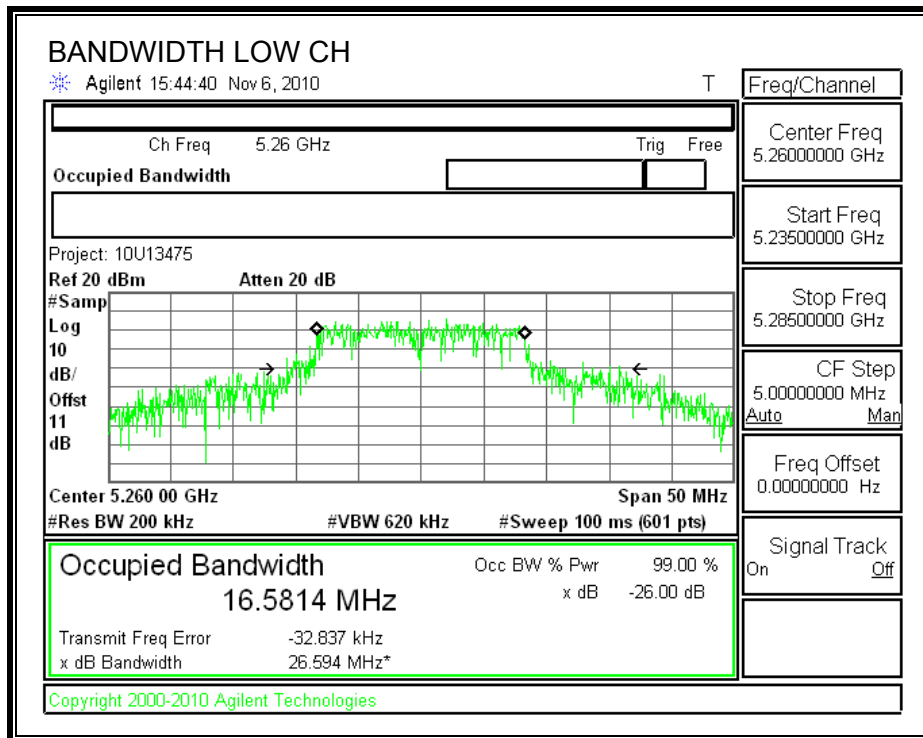


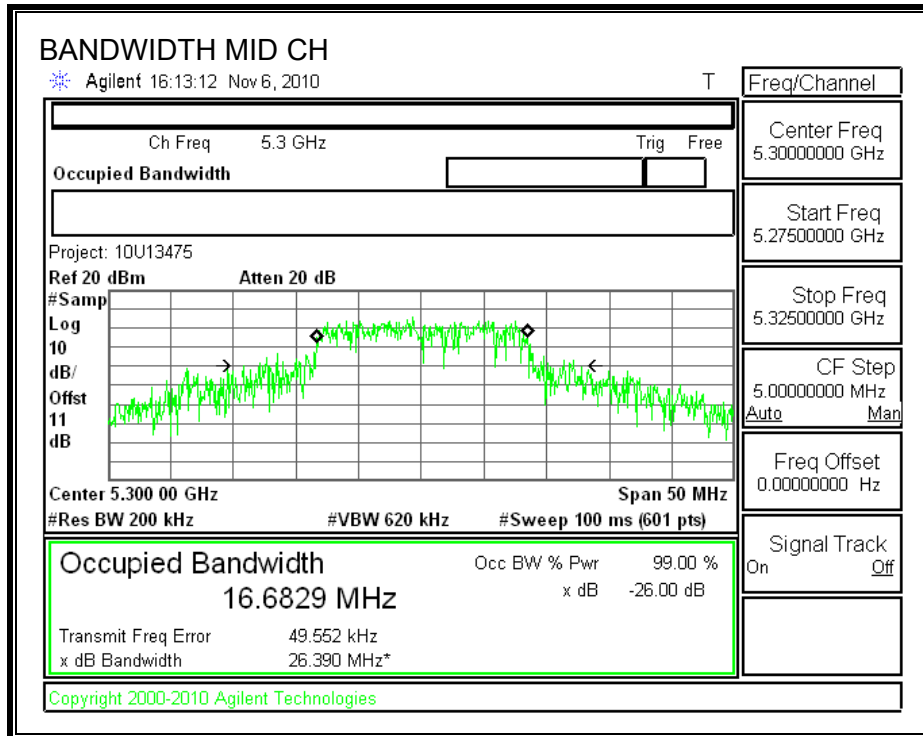


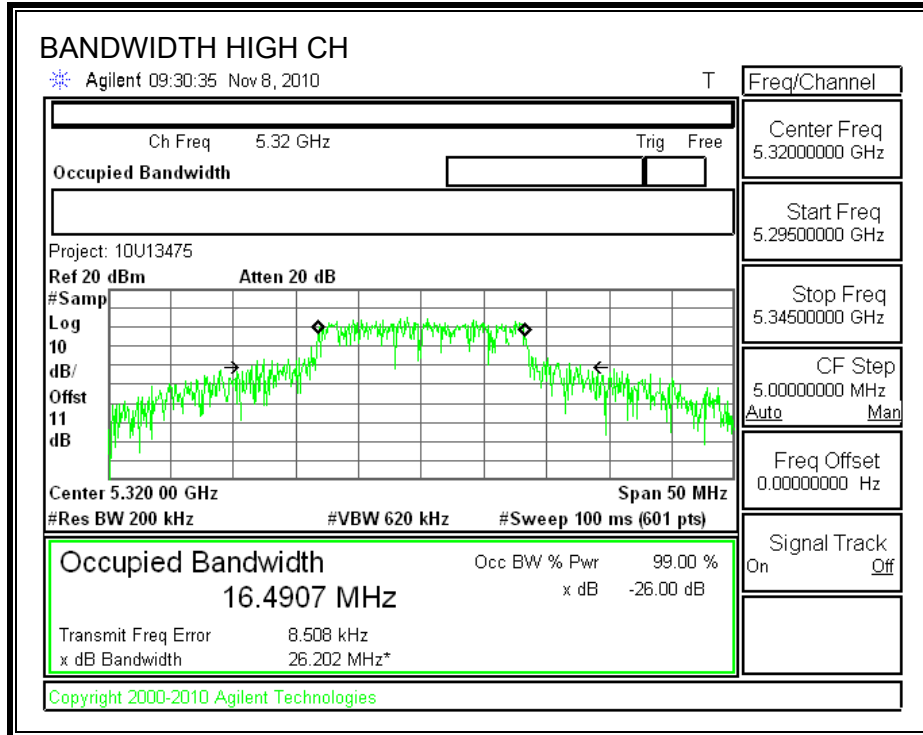


**CHAIN 3**

**26 dB and 99% BANDWIDTH**







## 7.4.2. OUTPUT POWER

### LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

Antenna Gain (dBi)	10 Log (# Tx Chains) (dB)	Effective Legacy Gain (dBi)
5.5	4.77	10.27

For the 5.25-5.35 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.



**RESULTS**

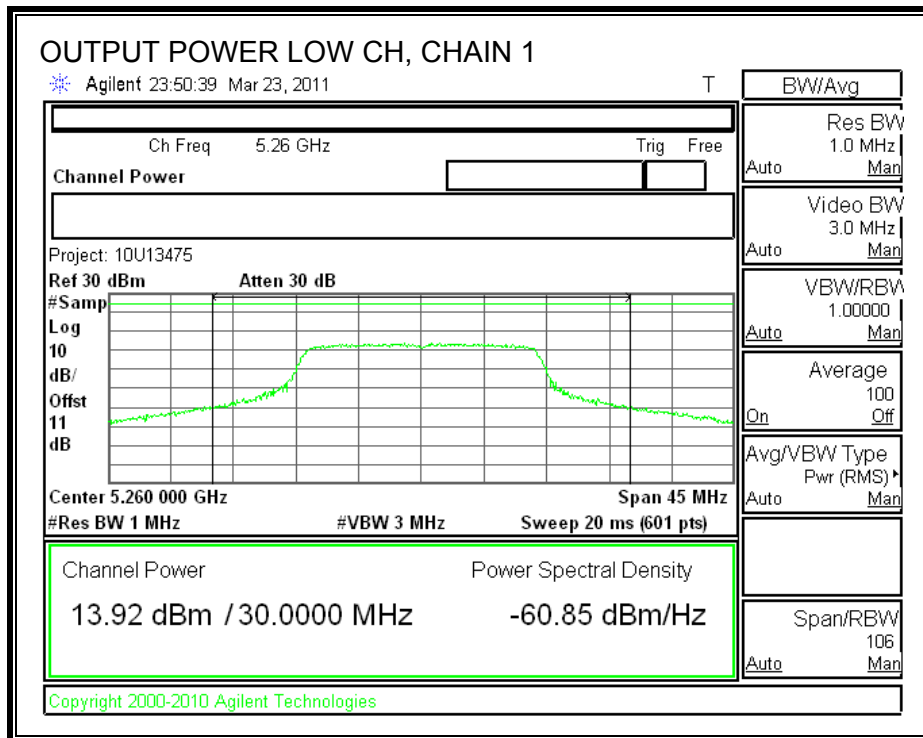
**Limit**

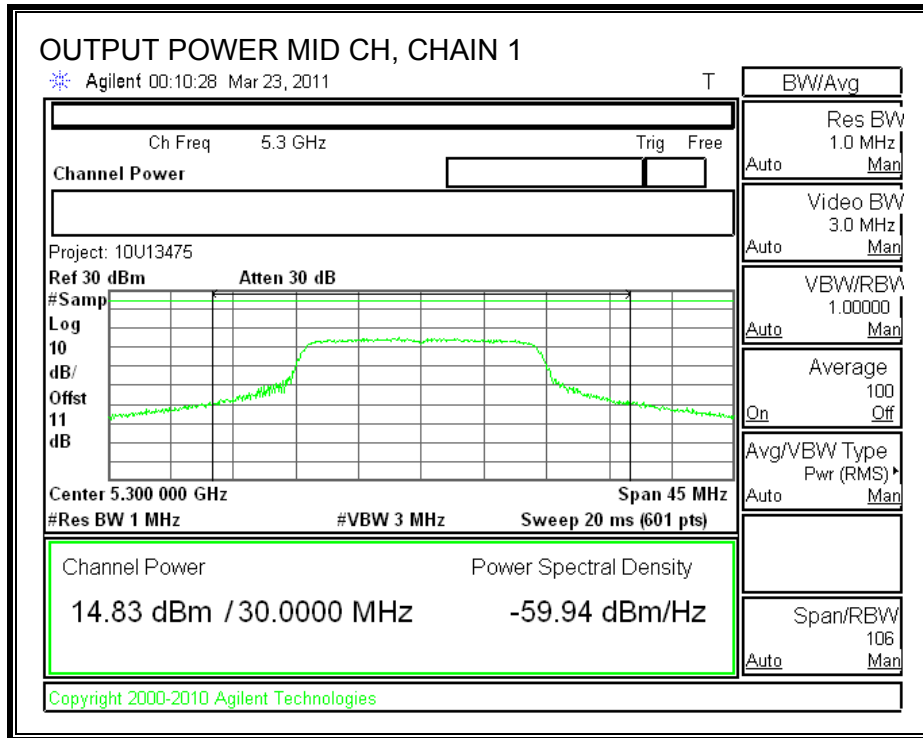
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Effective Ant. Gain (dBi)	Limit (dBm)
Low	5260	23.98	26.59	25.25	10.27	19.71
Mid	5300	23.98	26.39	25.21	10.27	19.71
High	5320	23.98	26.2	25.18	10.27	19.71

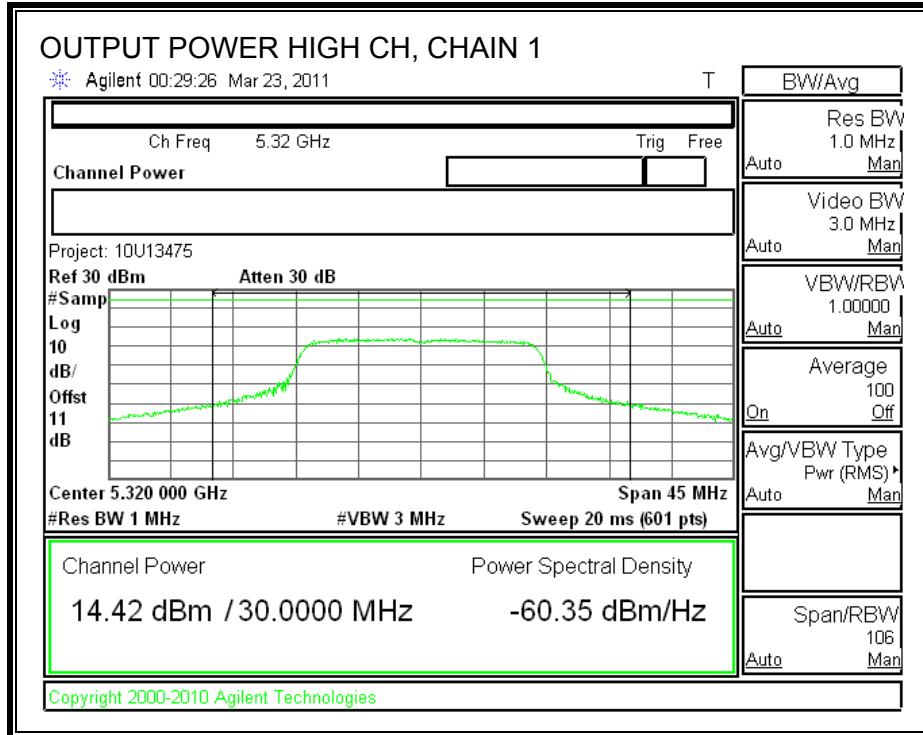
**Individual Chain Results**

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5260	13.92	15.01	14.42	19.24	19.71	-0.47
Mid	5300	14.83	14.85	14.71	19.57	19.71	-0.14
High	5320	14.42	14.71	15.08	19.52	19.71	-0.19

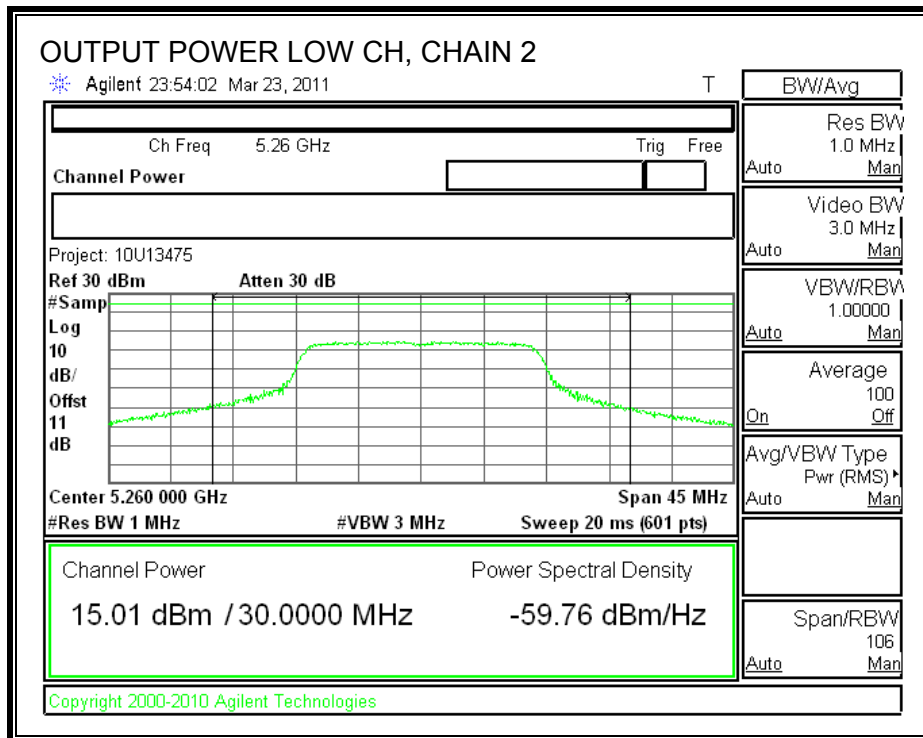
**CHAIN 1 OUTPUT POWER**

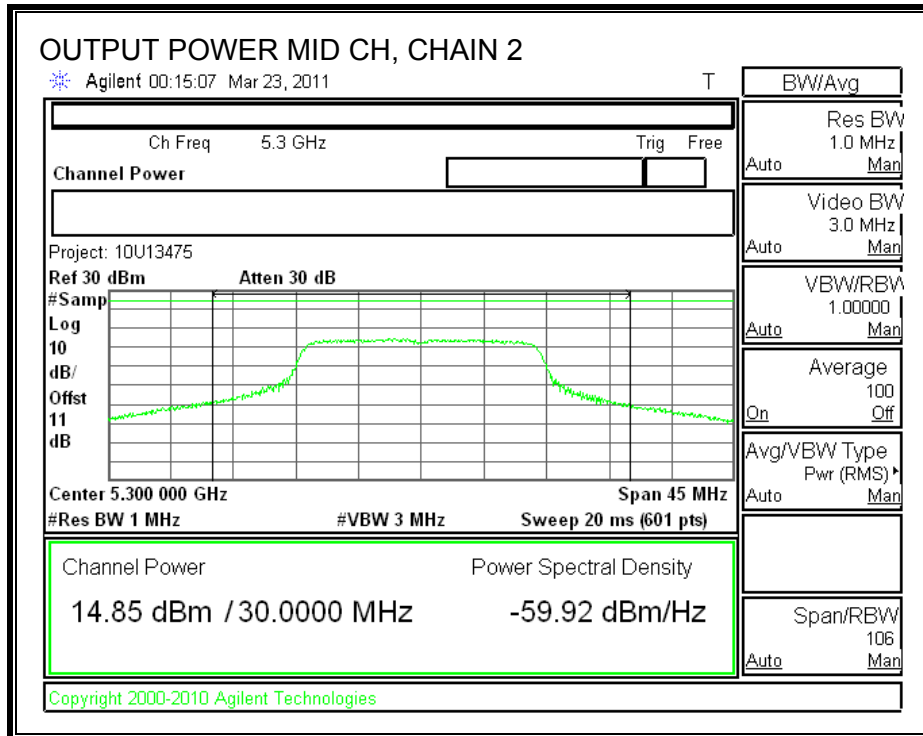


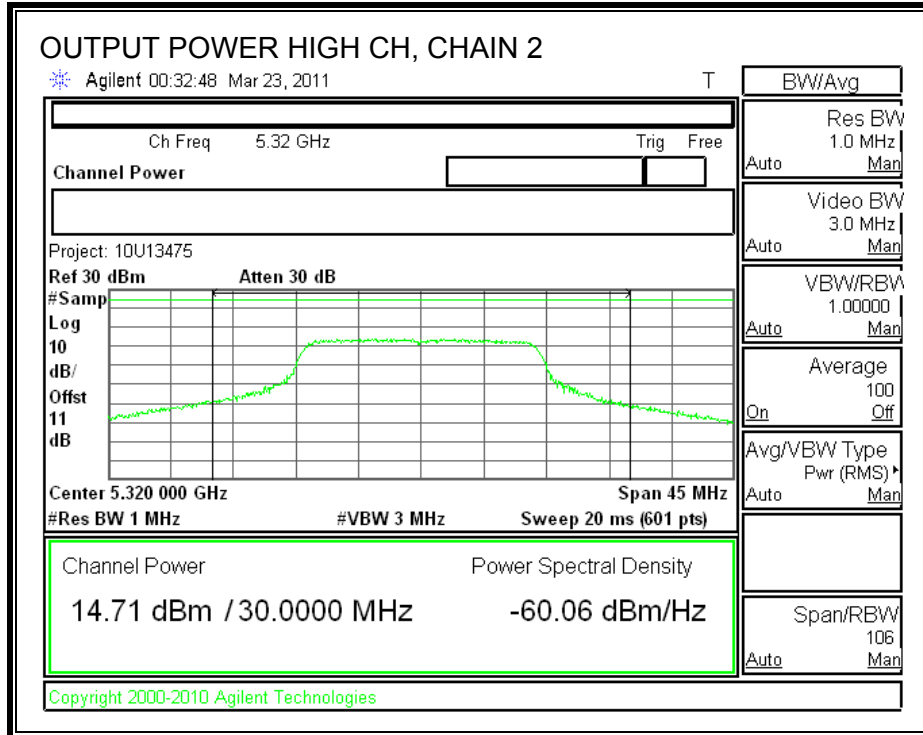




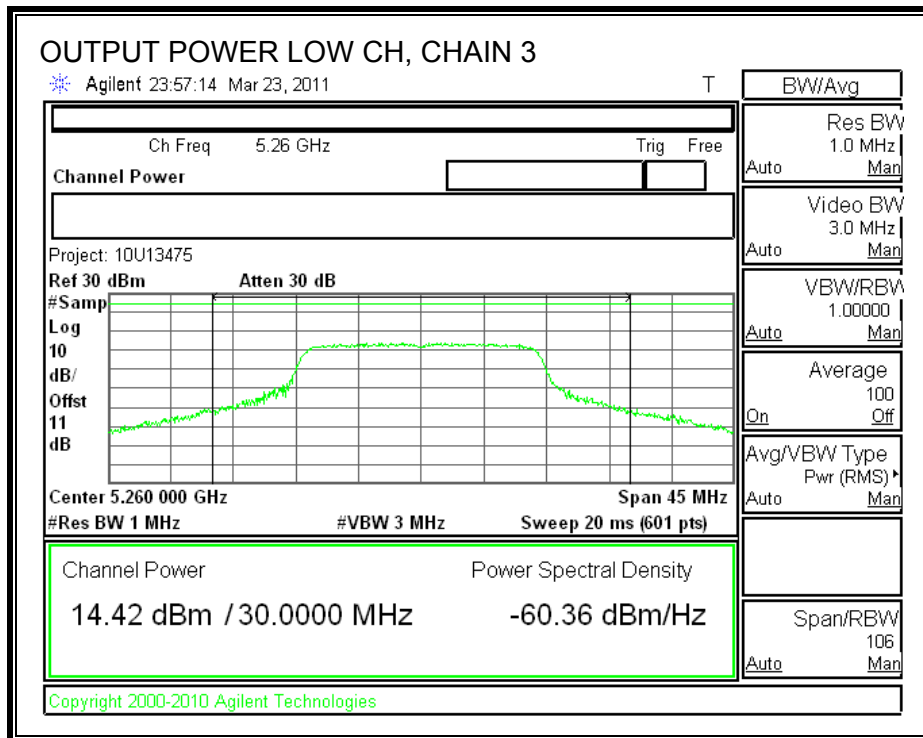
**CHAIN 2 OUTPUT POWER**



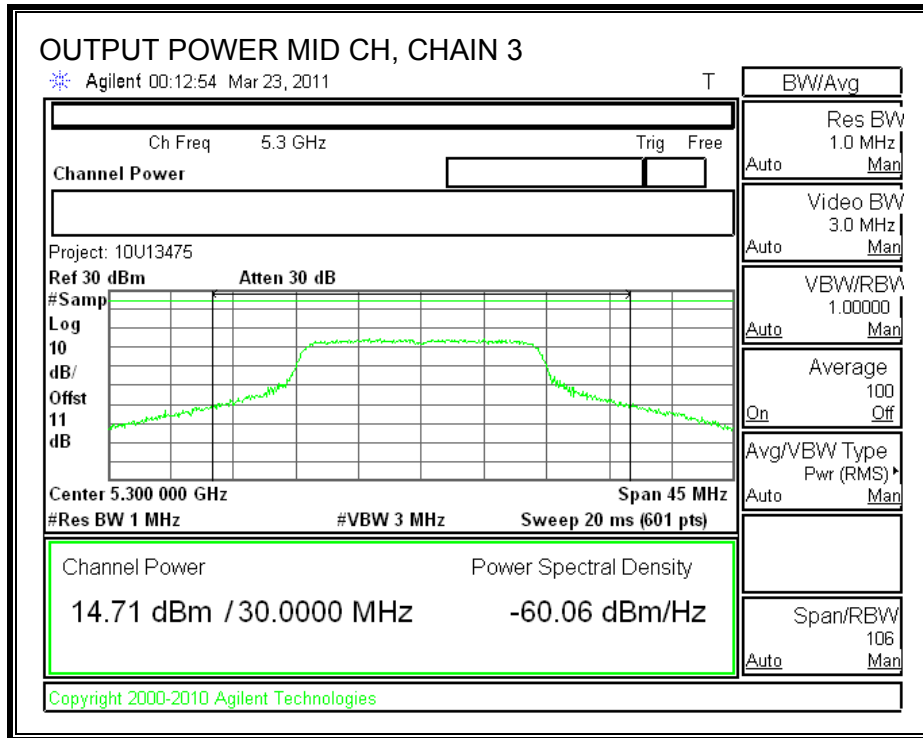


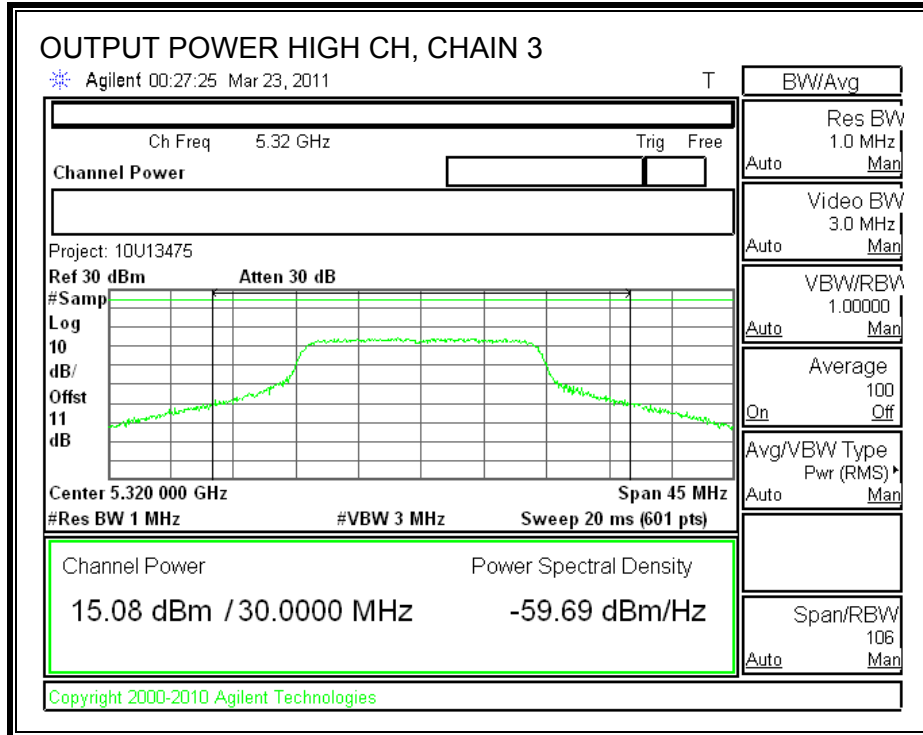


**CHAIN 3 OUTPUT POWER**









### 7.4.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1.0 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)
Low	5260	13.60	15.00	13.90	18.98
Middle	5300	14.80	14.50	14.50	19.37
High	5320	14.00	14.10	14.40	18.94

#### 7.4.4. PEAK POWER SPECTRAL DENSITY

##### LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

Antenna Gain (dBi)	10 Log (# Tx Chains) (dB)	Effective Legacy Gain (dBi)
5.5	4.77	10.27

For the 5.25–5.35 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

The maximum effective antenna gain is 10.27 dBi, therefore the limit is 6.73 dBm.

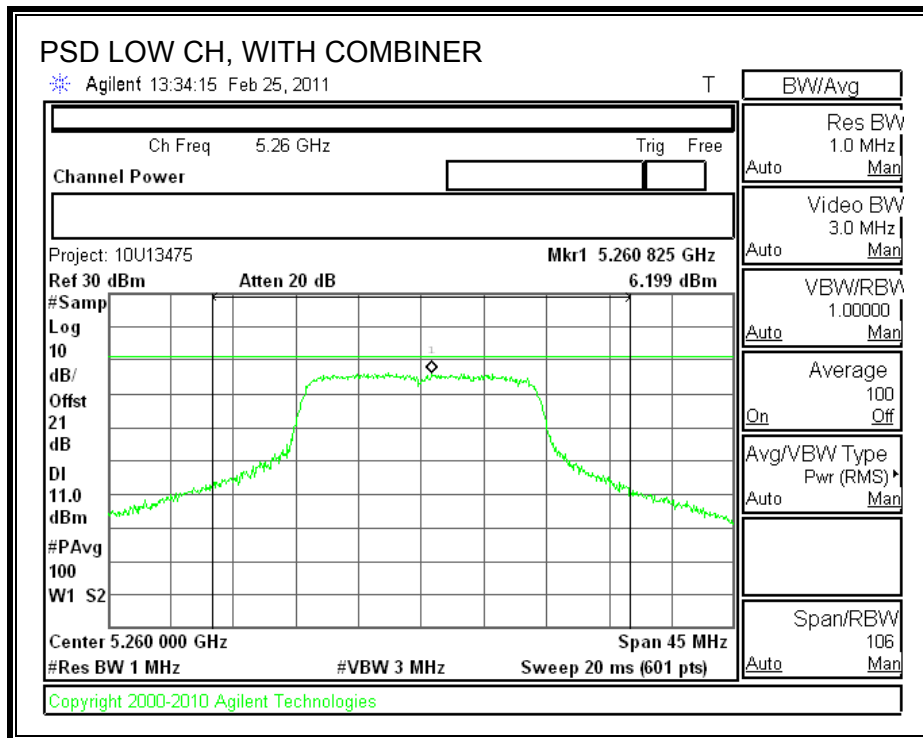
##### TEST PROCEDURE

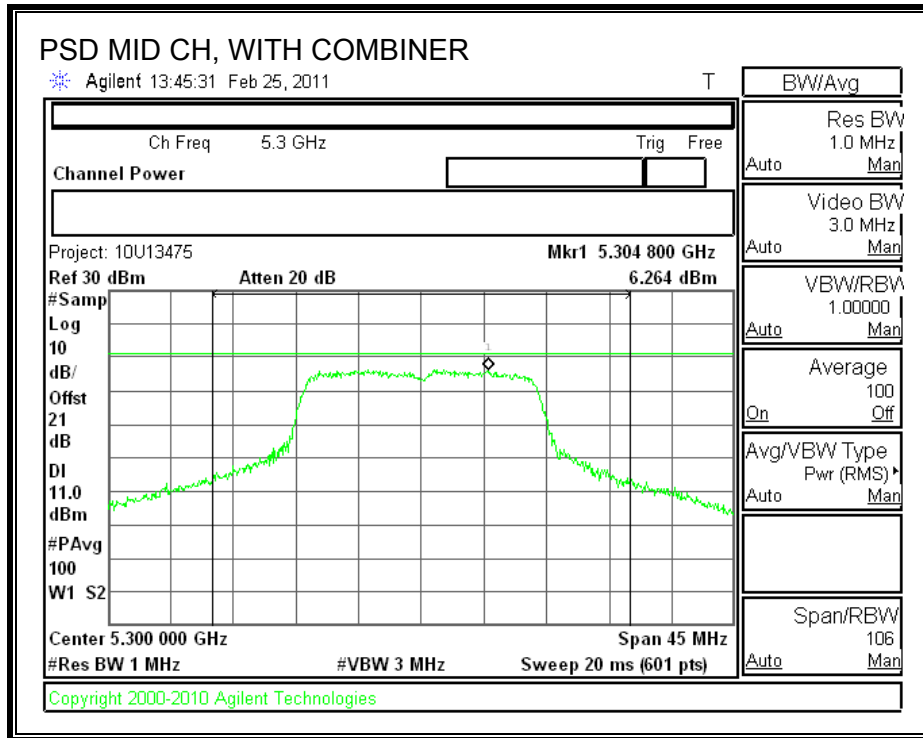
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

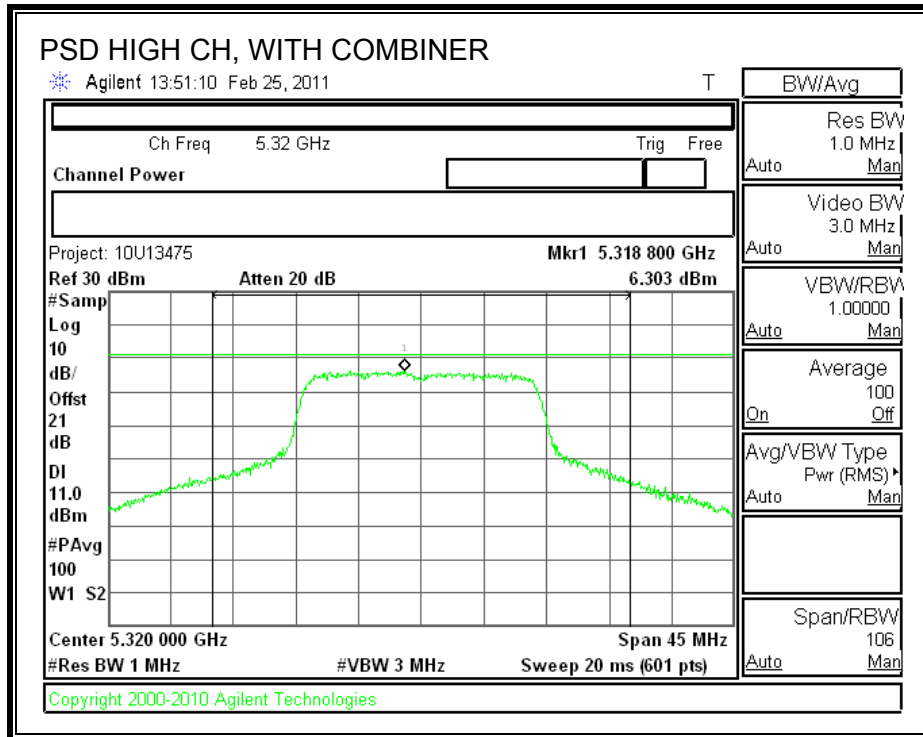
**RESULTS**

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>PPSD With Combiner (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
<b>Low</b>	<b>5260</b>	<b>6.199</b>	<b>6.73</b>	<b>-0.531</b>
<b>Middle</b>	<b>5300</b>	<b>6.264</b>	<b>6.73</b>	<b>-0.466</b>
<b>High</b>	<b>5320</b>	<b>6.303</b>	<b>6.73</b>	<b>-0.427</b>

**POWER SPECTRAL DENSITY WITH COMBINER**









## **7.4.5. PEAK EXCURSION**

### **LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

### **TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

**RESULTS**

**CHAIN 1**

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5260	9.68	13	-3.32
Middle	5300	8.37	13	-4.63
High	5320	8.23	13	-4.77

**CHAIN 2**

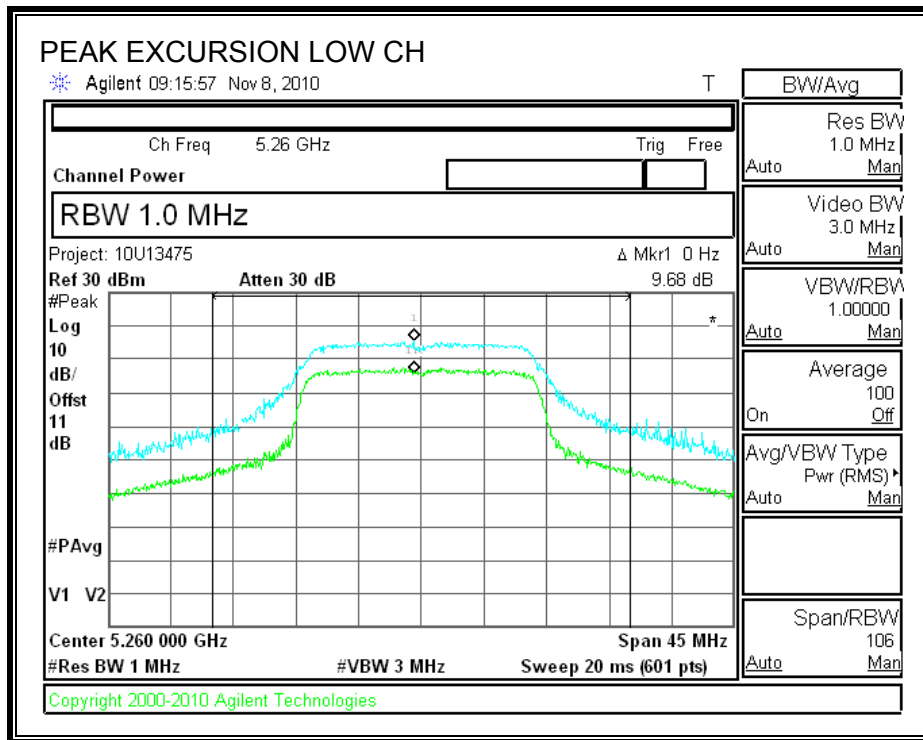
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5260	10.25	13	-2.75
Middle	5300	9.84	13	-3.16
High	5320	9.72	13	-3.28

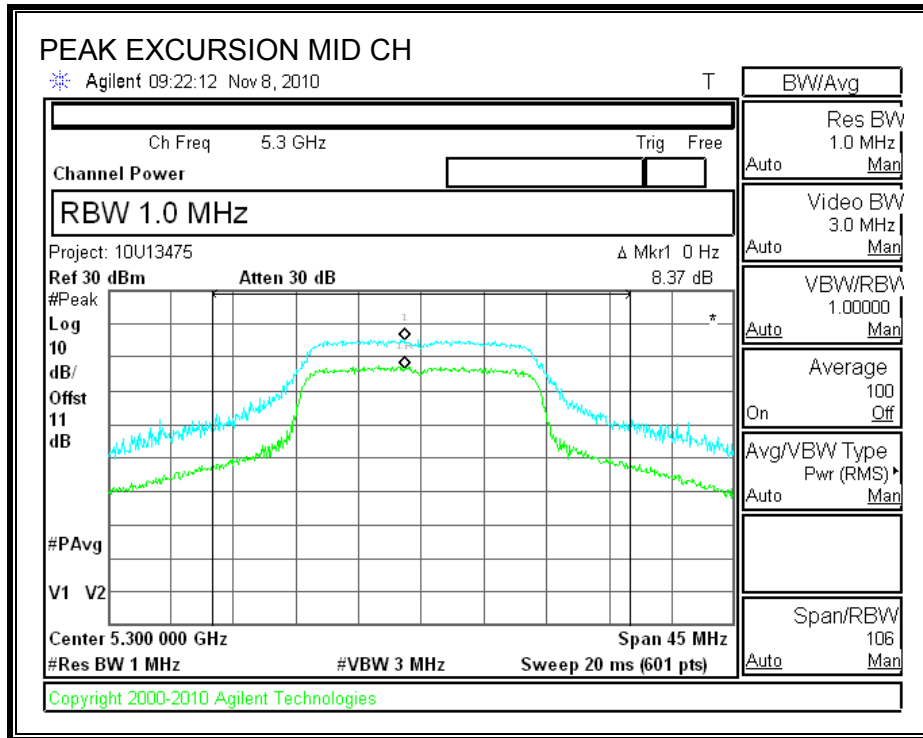
**CHAIN 3**

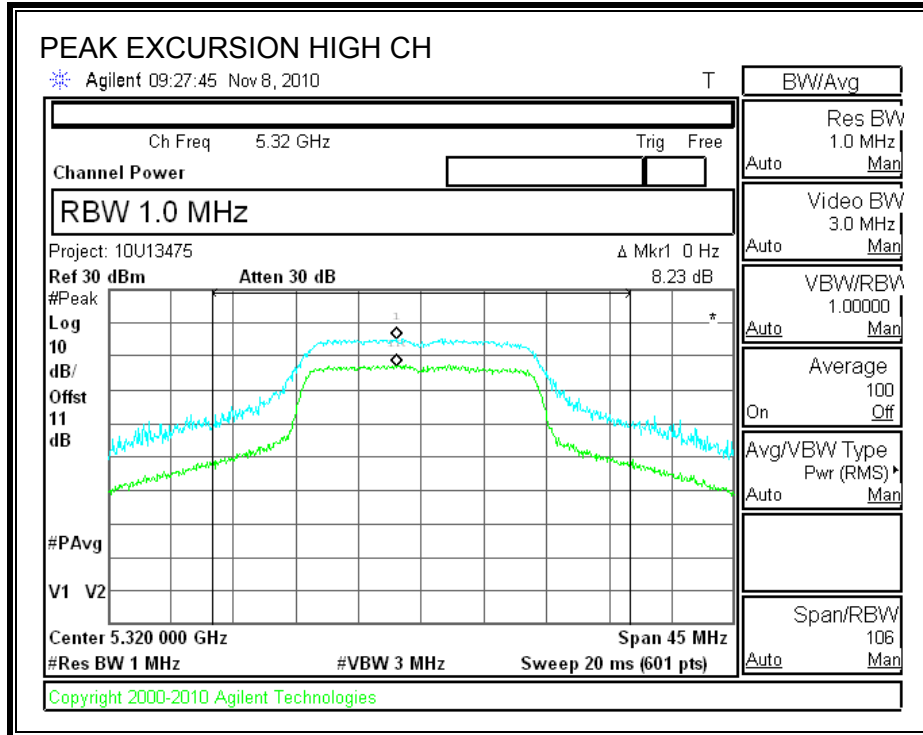
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5260	10.18	13	-2.82
Middle	5300	9.88	13	-3.12
High	5320	9.35	13	-3.65

**CHAIN 1**

**PEAK EXCURSION**

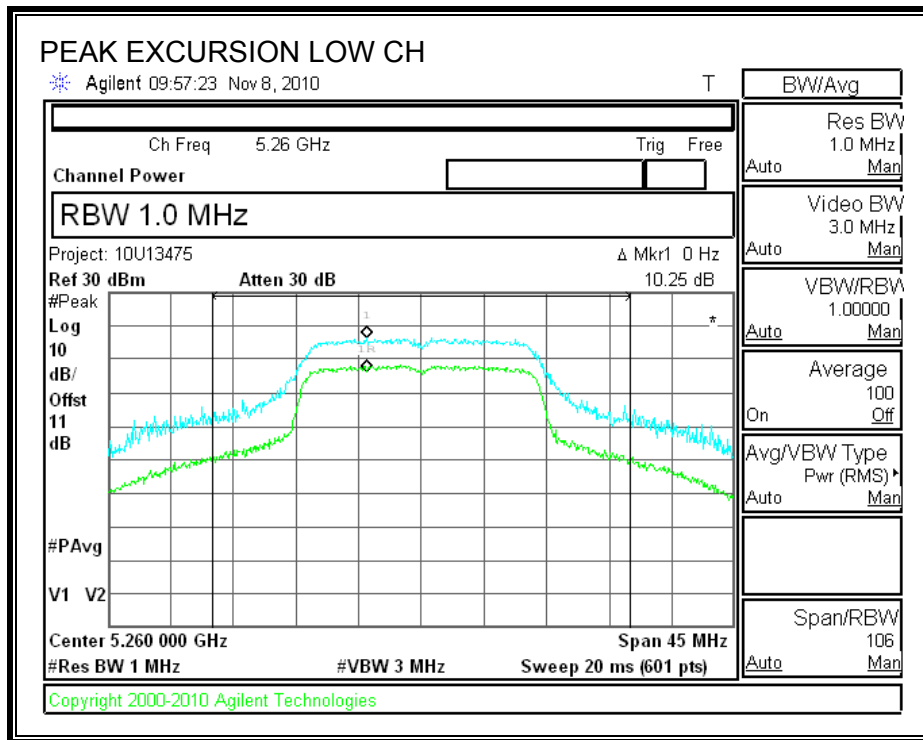


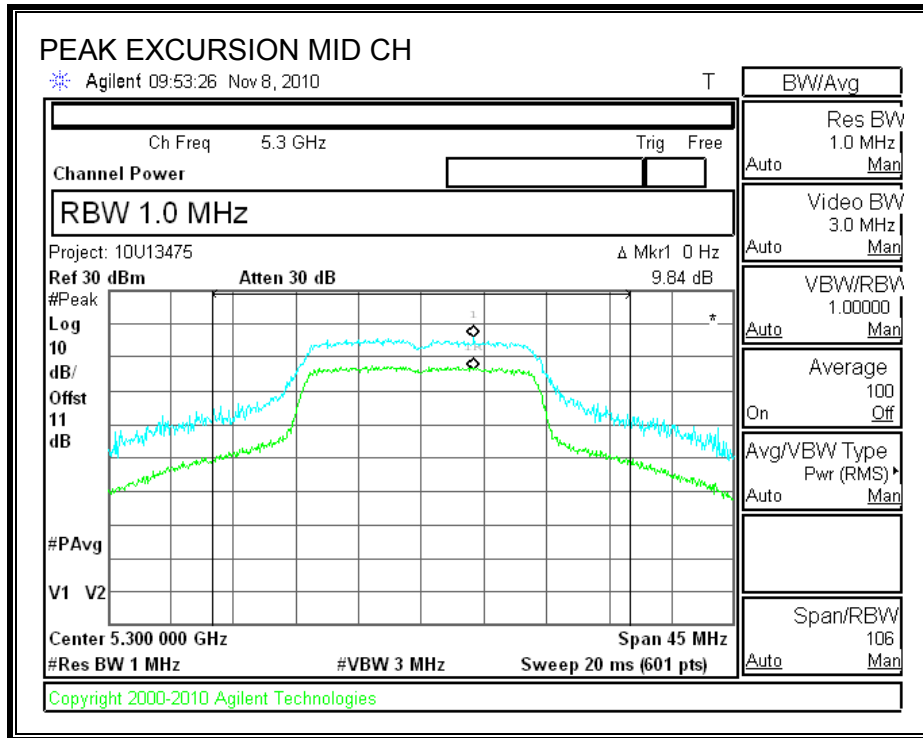


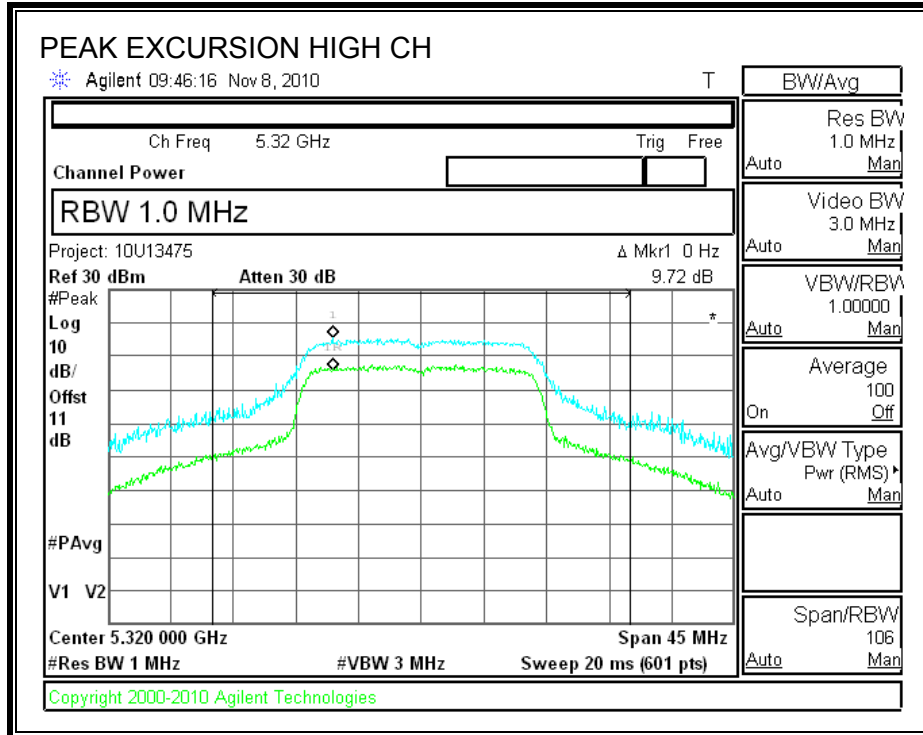


**CHAIN 2**

**PEAK EXCURSION**



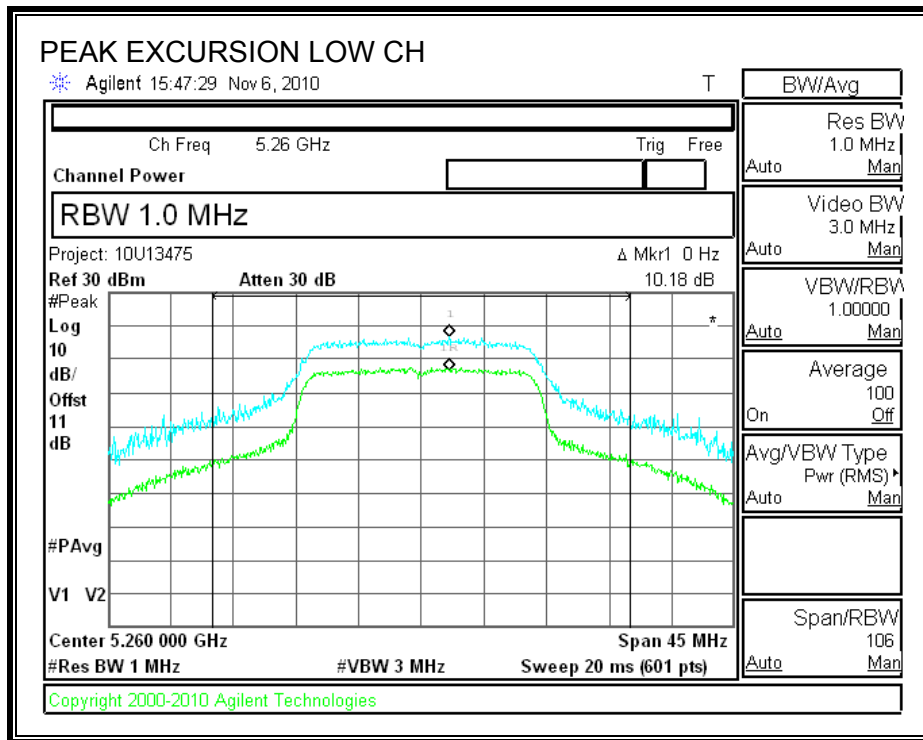


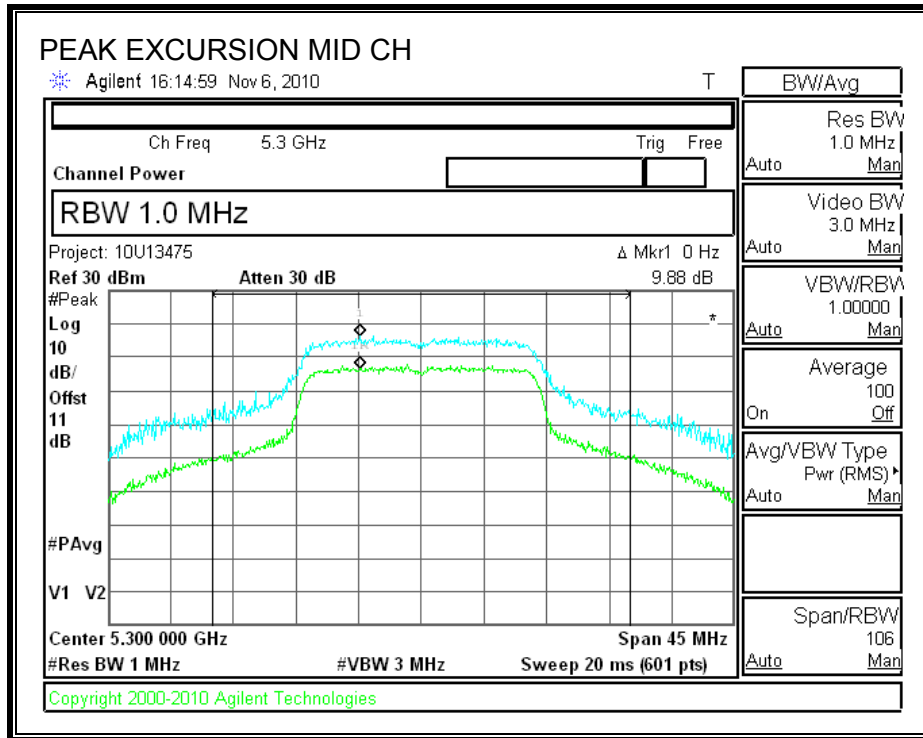


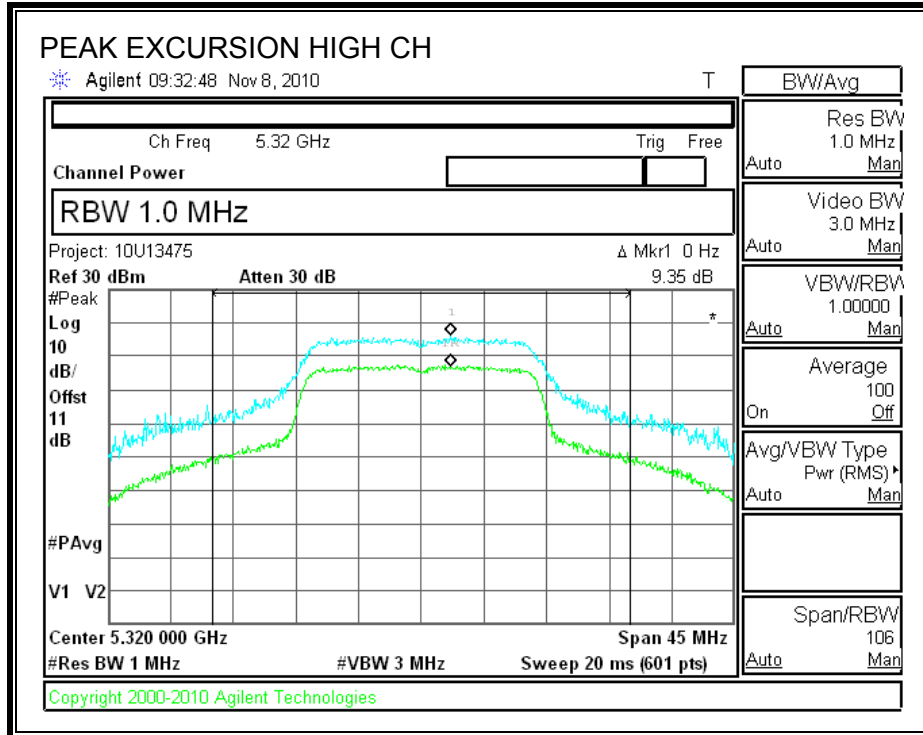


**CHAIN 3**

**PEAK EXCURSION**







## 7.4.6. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

FCC §15.407 (b) (2)

IC RSS-210 A9.3 (2)

For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.25-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

### TEST PROCEDURE

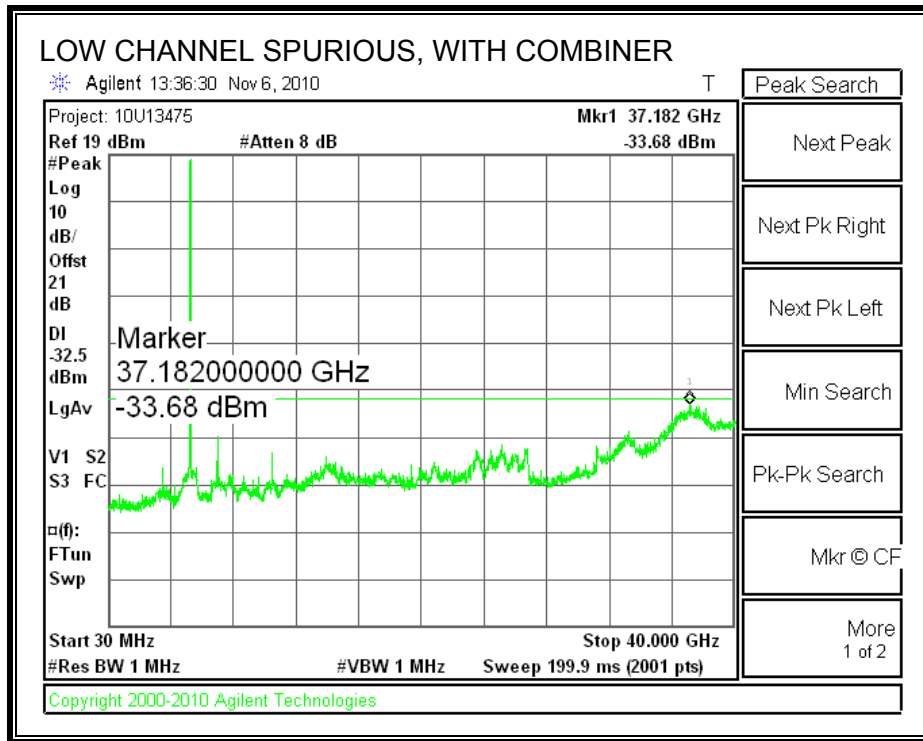
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

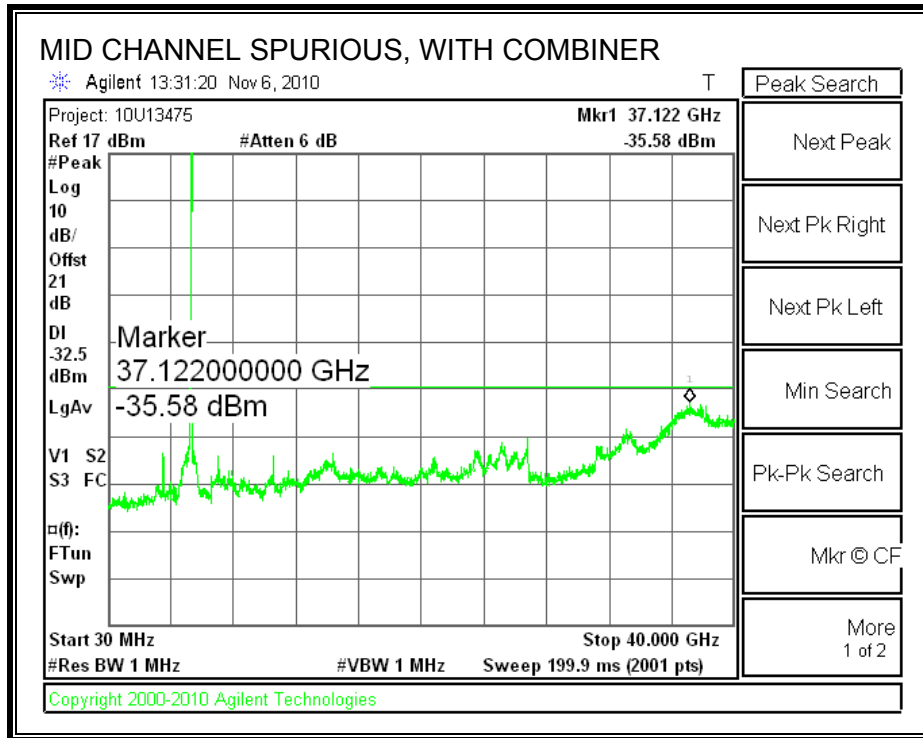
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

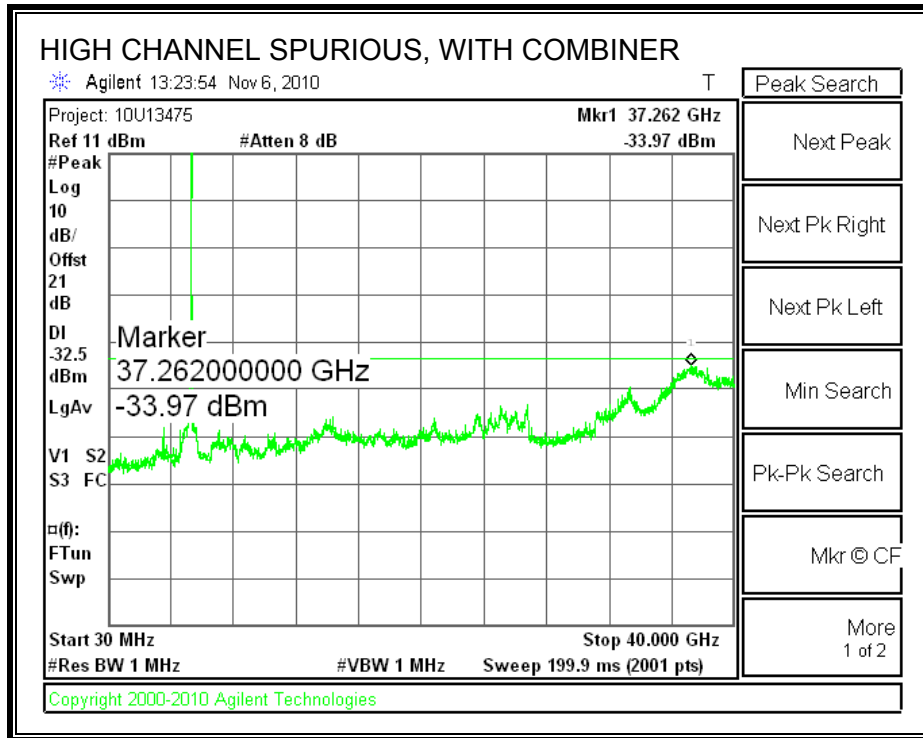
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

**RESULTS**

**SPURIOUS EMISSIONS WITH COMBINER**







## 7.5. 802.11n THREE CHAIN HT20 MODE IN THE 5.3 GHz BAND

### 7.5.1. 26 dB and 99% BANDWIDTH

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

#### RESULTS

##### CHAIN 1

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5260	24.026	17.7461
Middle	5300	26.450	17.8793
High	5320	26.011	17.5315

##### CHAIN 2

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5260	26.962	17.7806
Middle	5300	26.873	17.6020
High	5320	28.966	17.8666

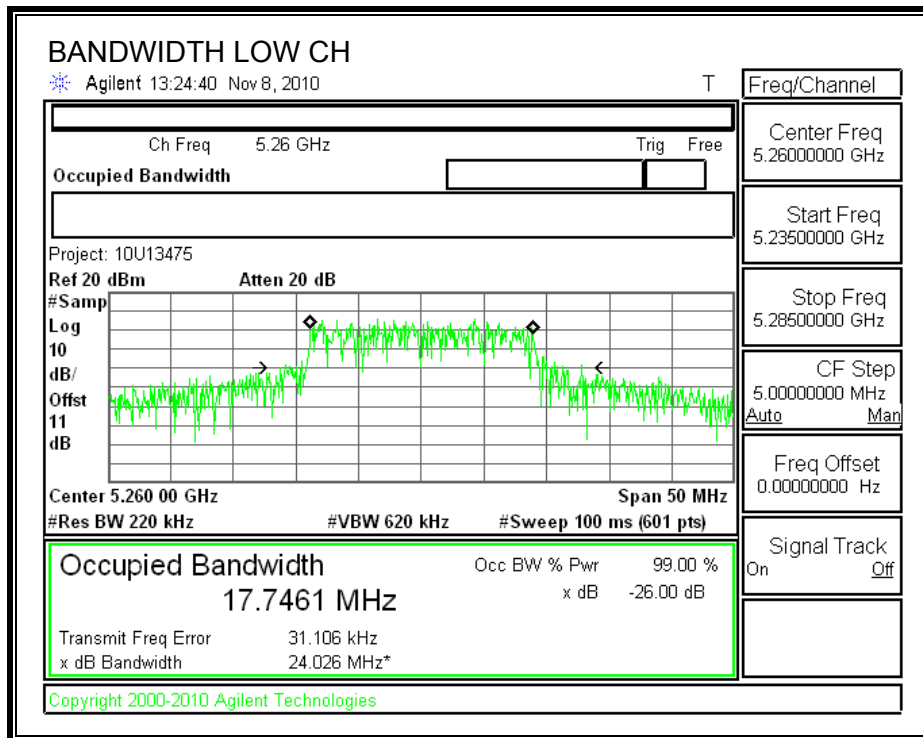
##### CHAIN 3

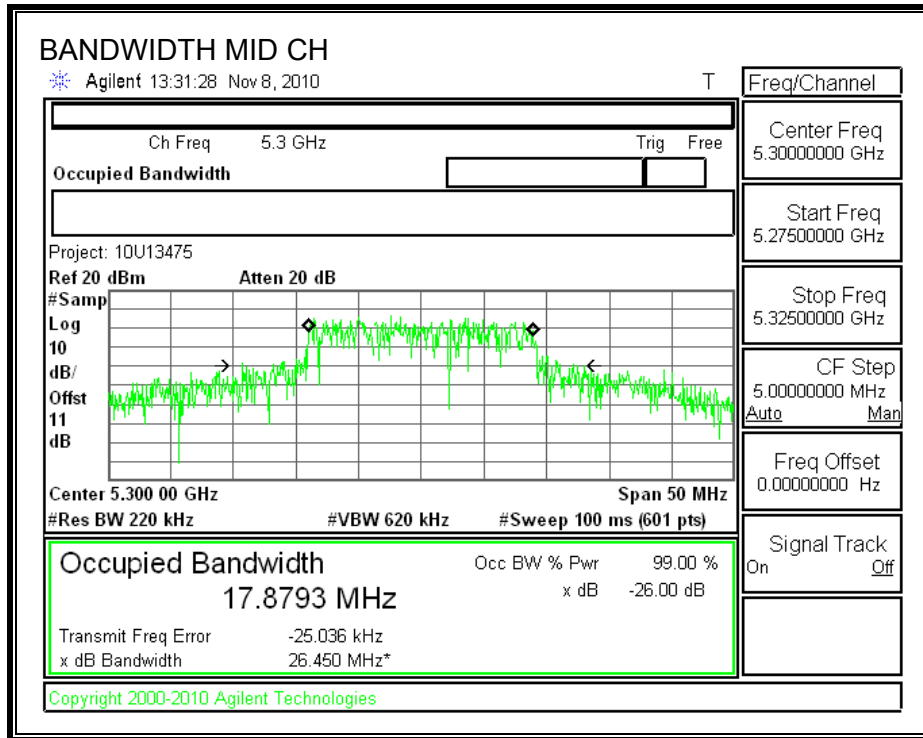
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5260	26.002	17.7563
Middle	5300	27.912	17.9305
High	5320	26.198	17.7968

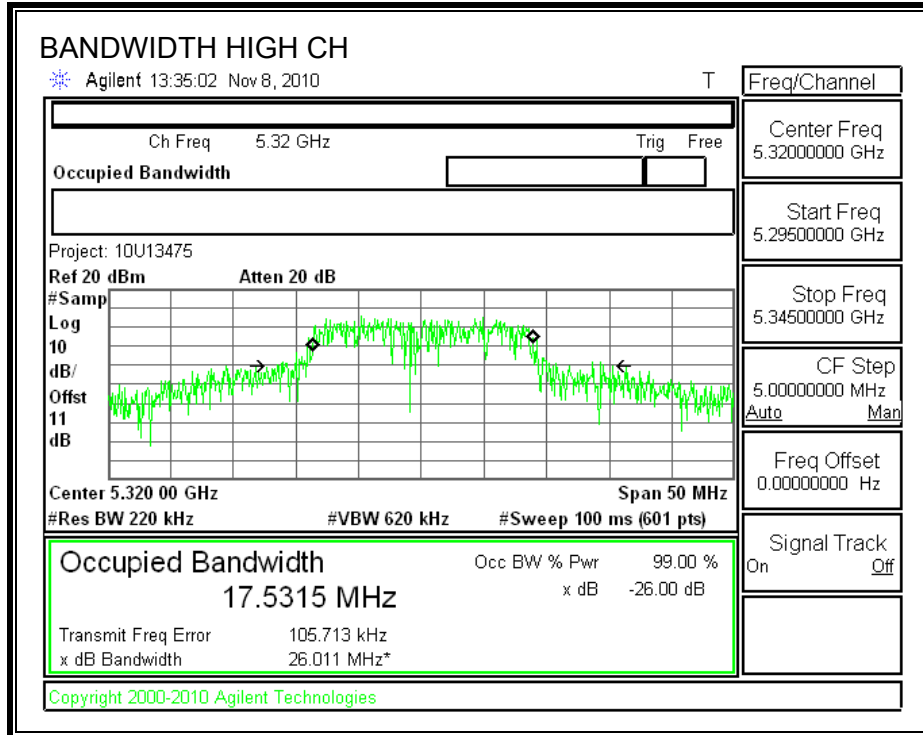


**CHAIN 1**

**26 dB and 99% BANDWIDTH**

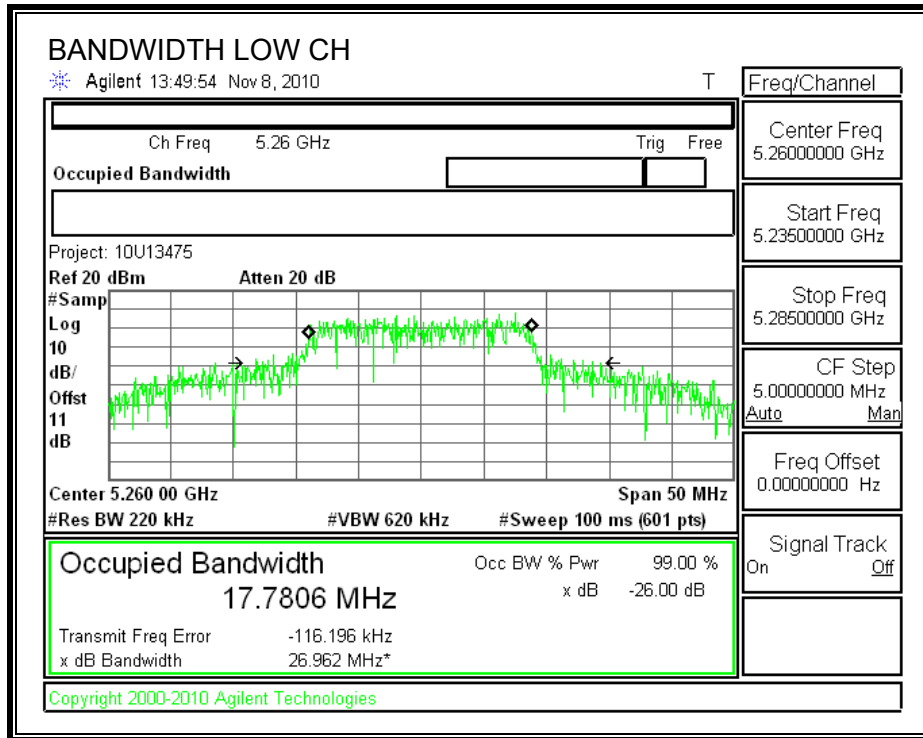


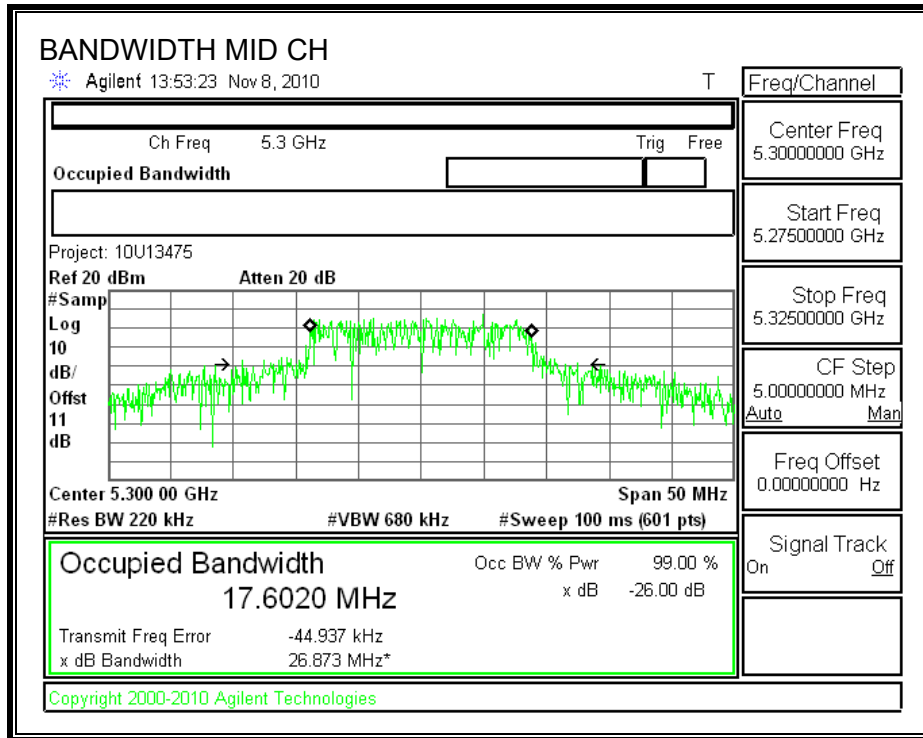


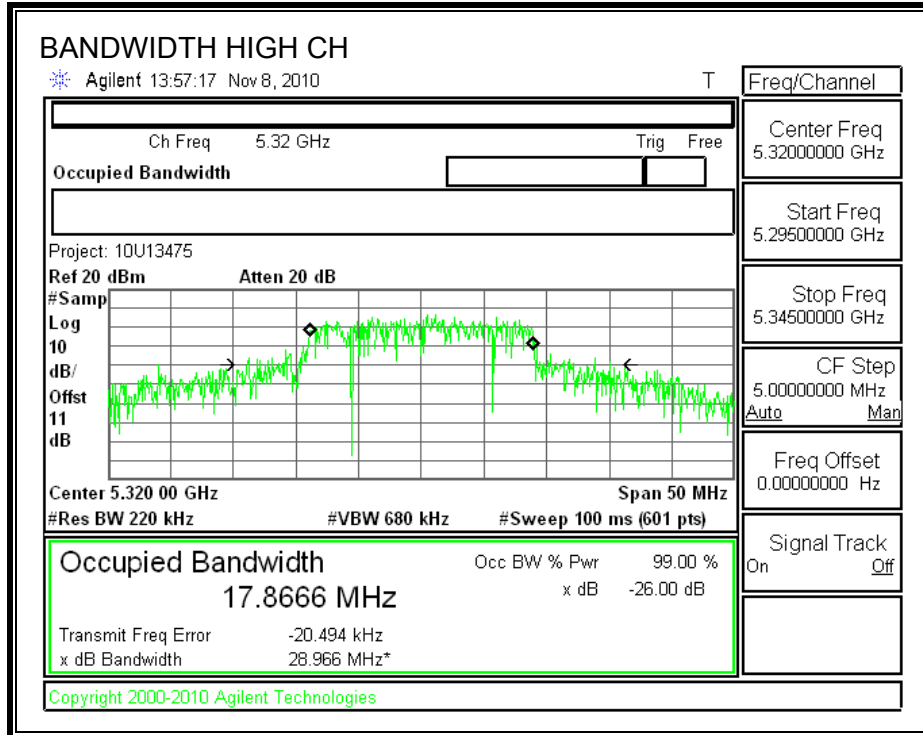


**CHAIN 2**

**26 dB and 99% BANDWIDTH**

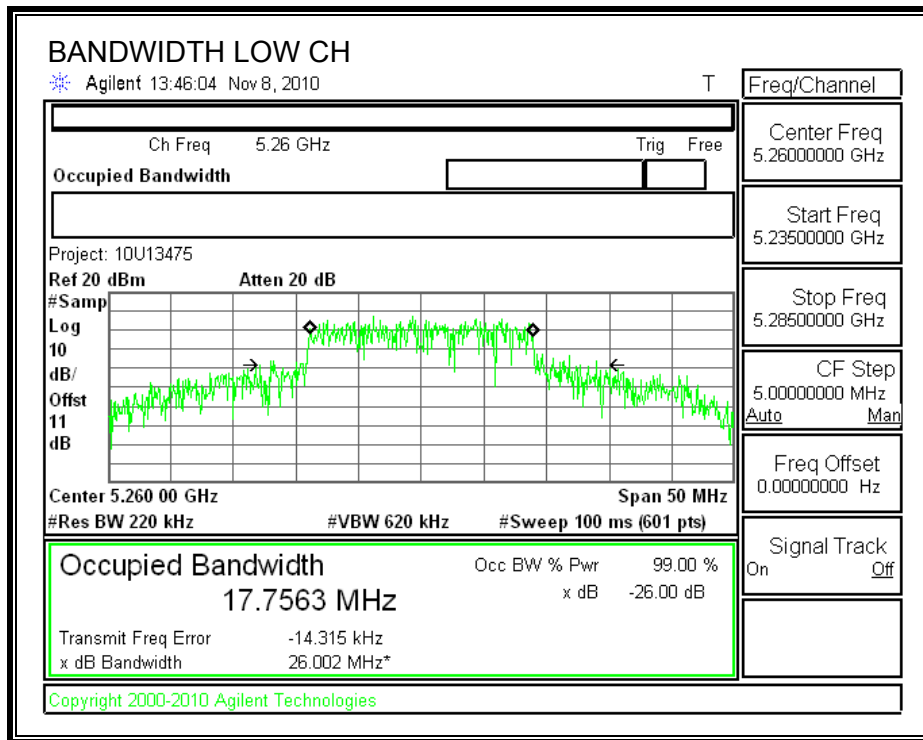


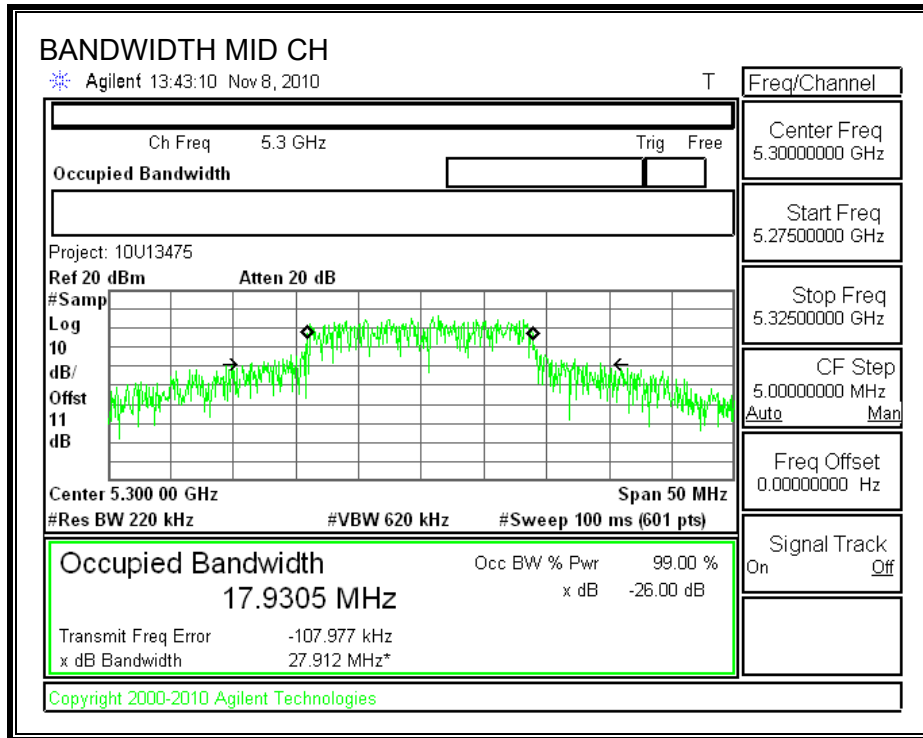




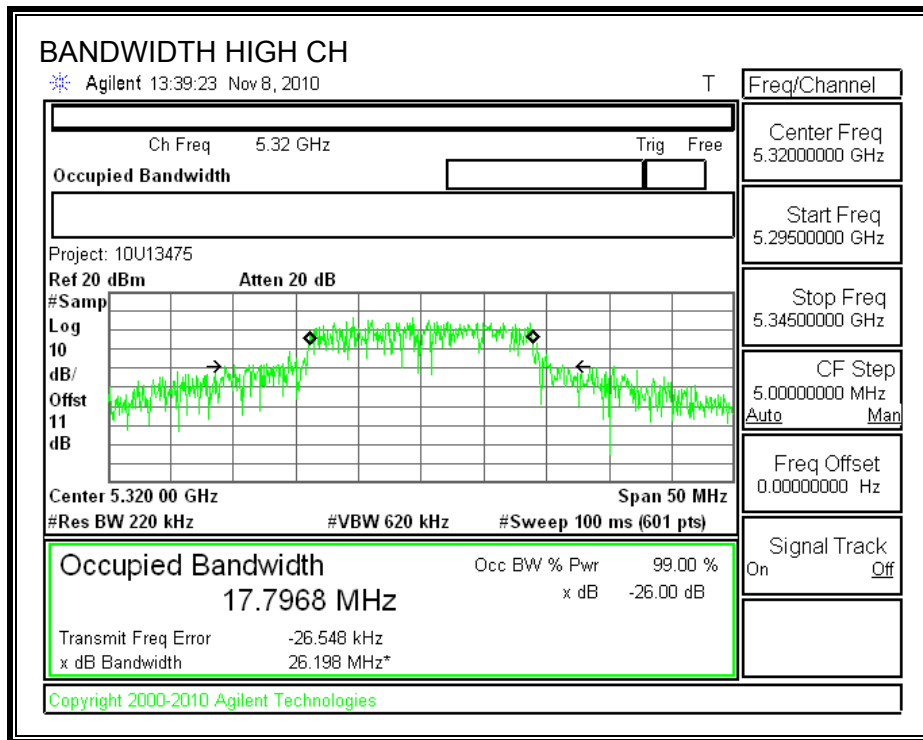
**CHAIN 3**

**26 dB and 99% BANDWIDTH**









## 7.5.2. OUTPUT POWER

### LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.25-5.35 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

**RESULTS**

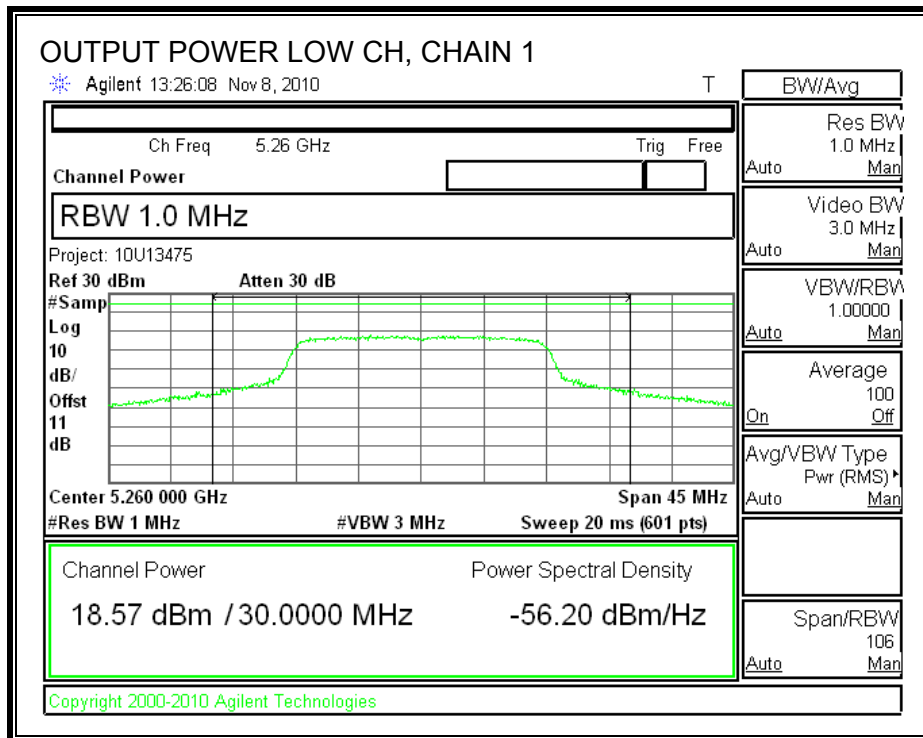
**Limit**

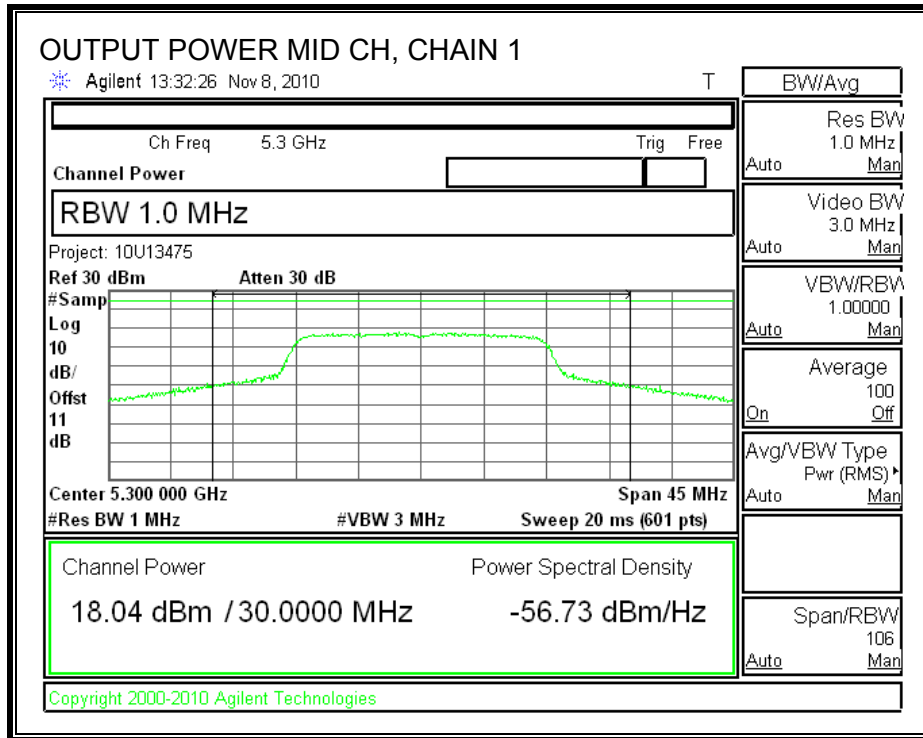
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5260	23.98	24.025	24.81	5.50	23.98
Mid	5300	23.98	26.45	25.22	5.50	23.98
High	5320	23.98	26.011	25.15	5.50	23.98

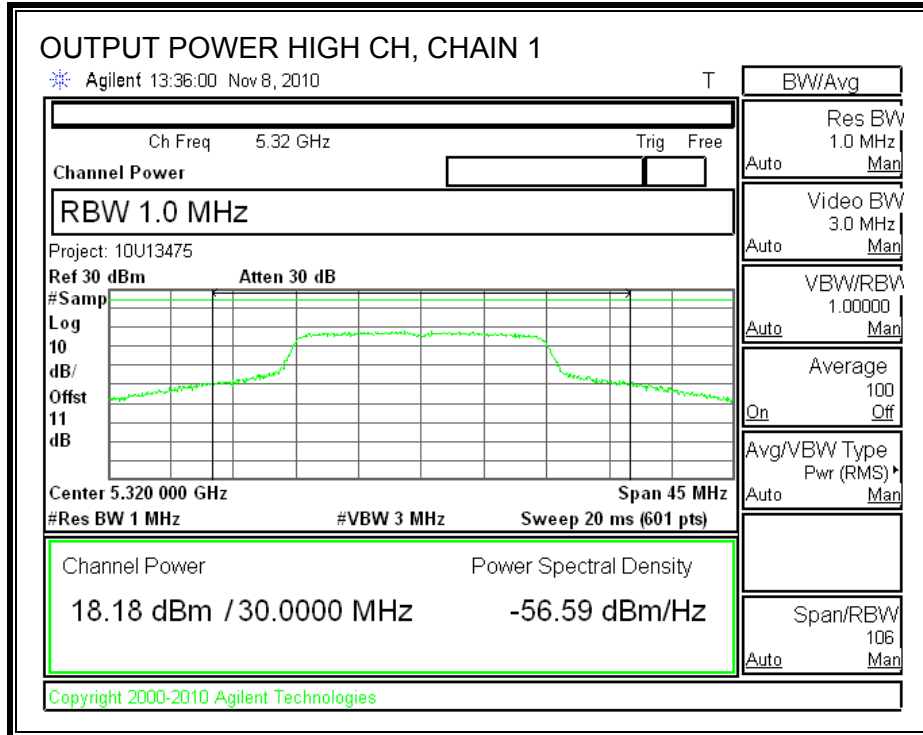
**Individual Chain Results**

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5260	18.57	19.49	18.48	23.64	23.98	-0.34
Mid	5300	18.04	18.45	18.12	22.98	23.98	-1.00
High	5320	18.18	18.69	18.25	23.15	23.98	-0.83

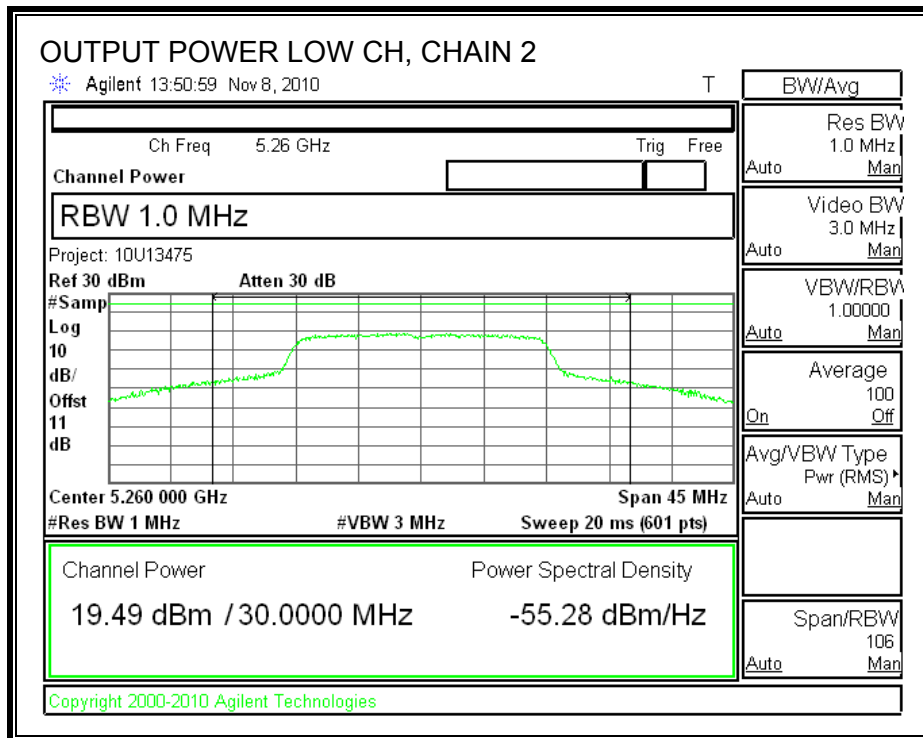
**CHAIN 1 OUTPUT POWER**

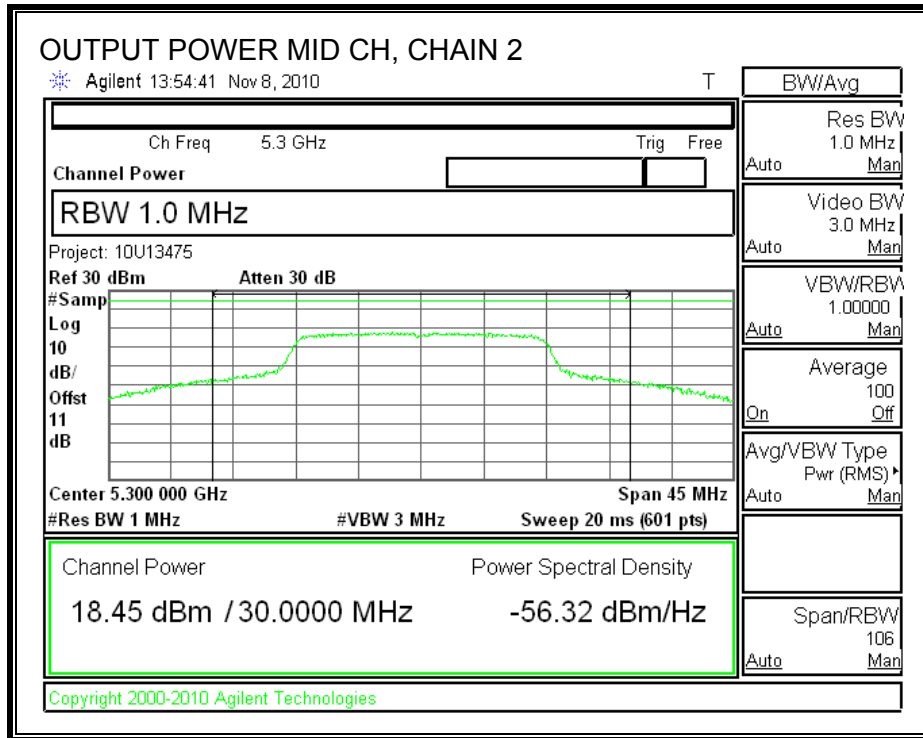




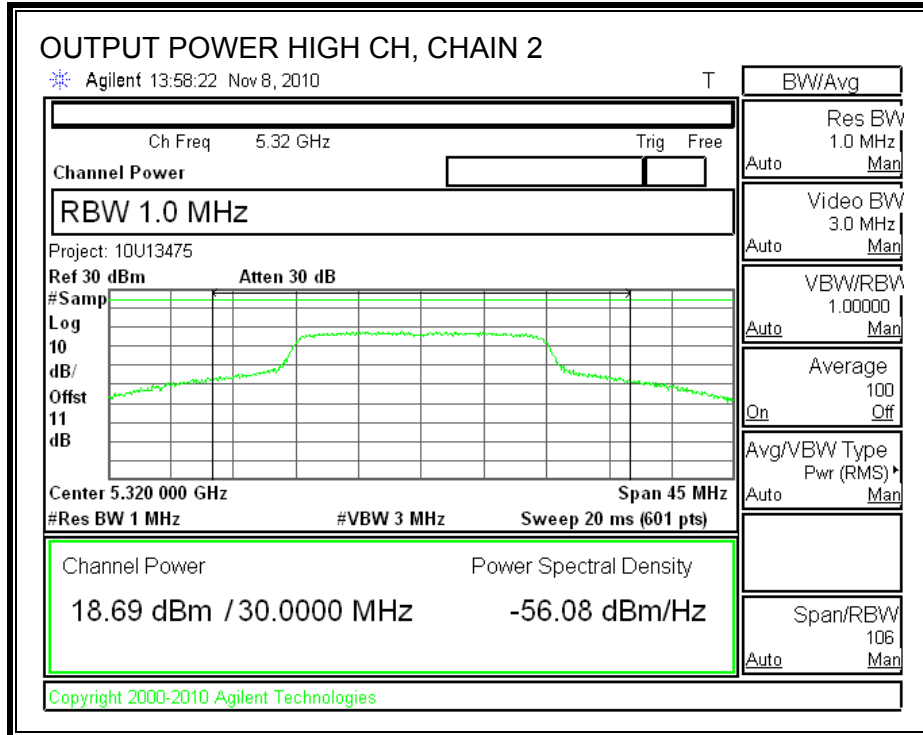


**CHAIN 2 OUTPUT POWER**

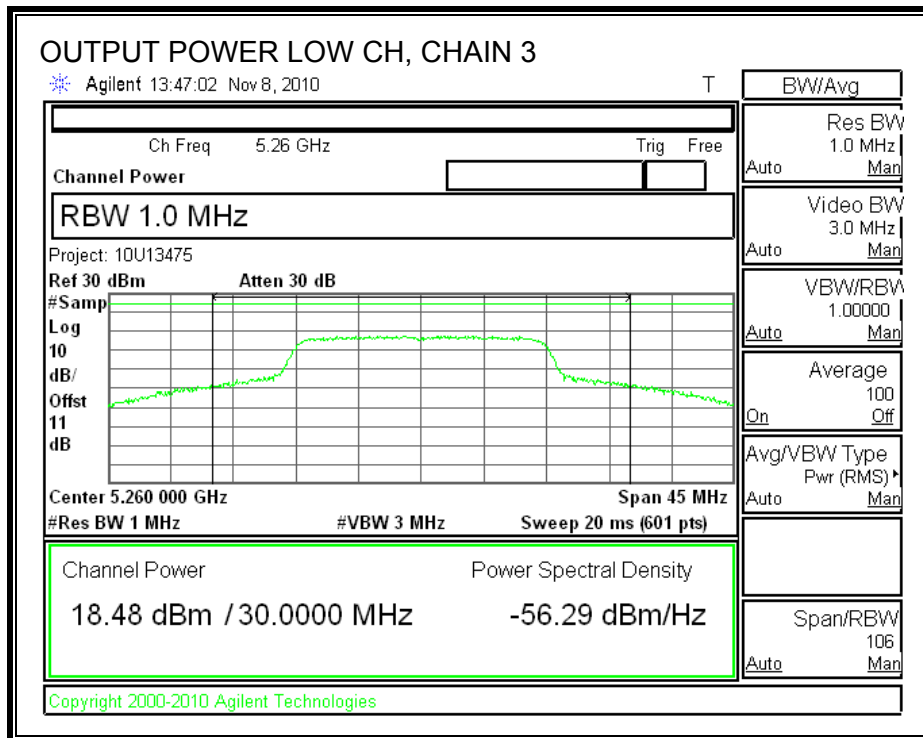


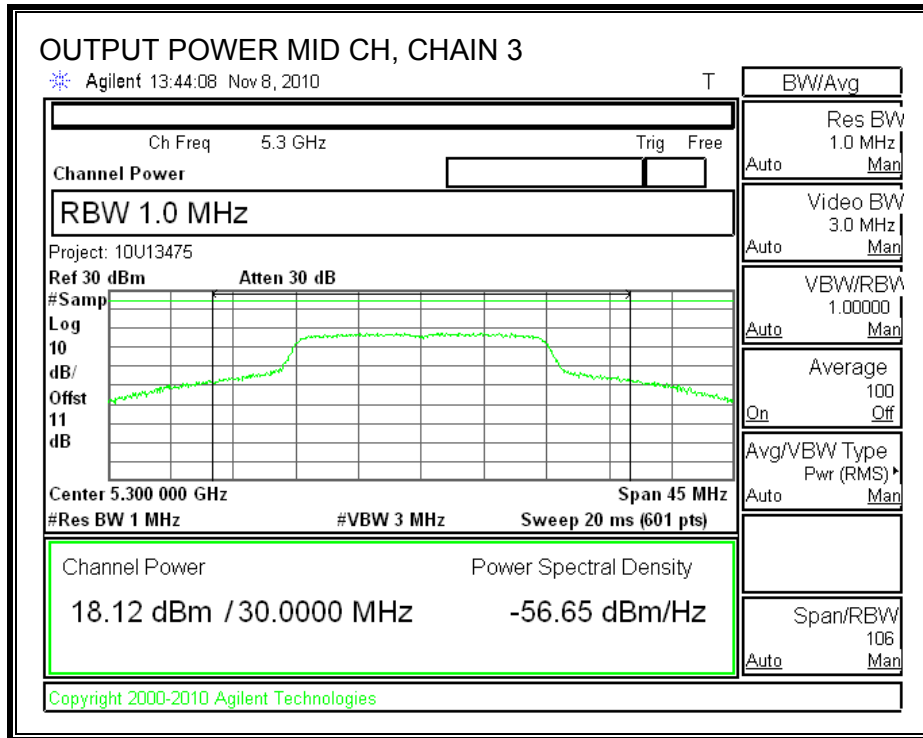


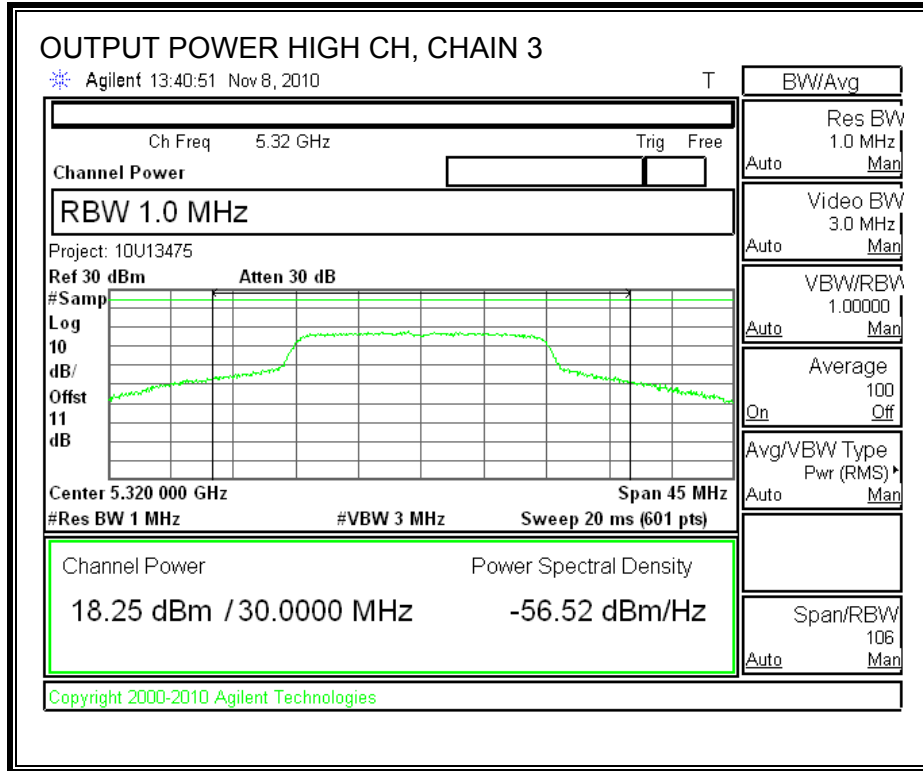




**CHAIN 3 OUTPUT POWER**







### 7.5.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1.0 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)
Low	5260	17.21	18.91	17.83	22.81
Middle	5300	17.33	18.08	17.75	22.50
High	5320	17.24	17.84	17.71	22.38

### 7.5.4. PEAK POWER SPECTRAL DENSITY

#### LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.25–5.35 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 11 dBm.

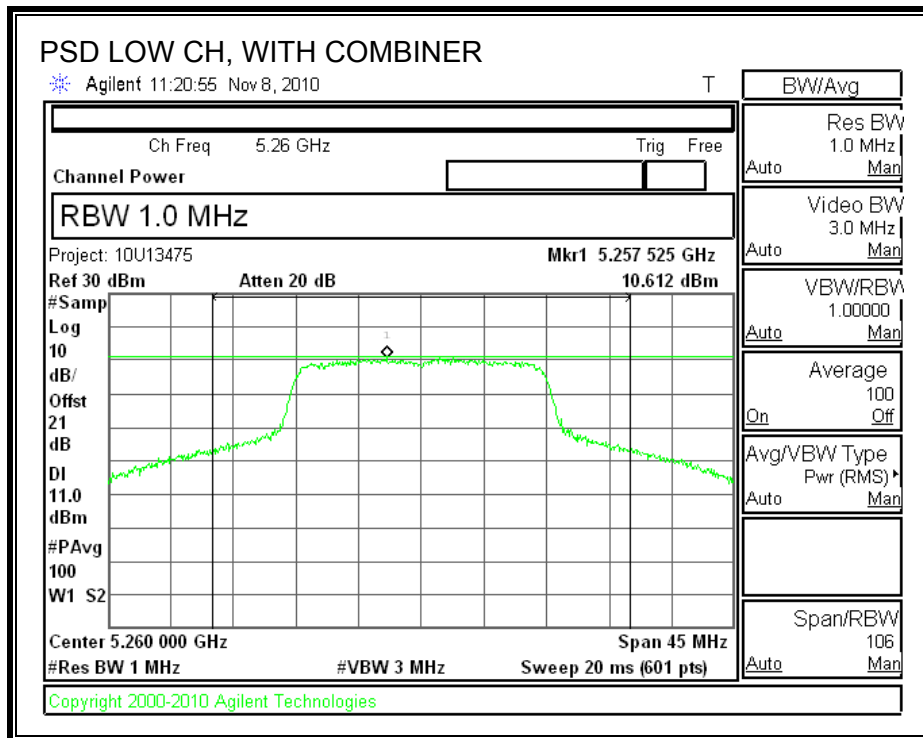
#### TEST PROCEDURE

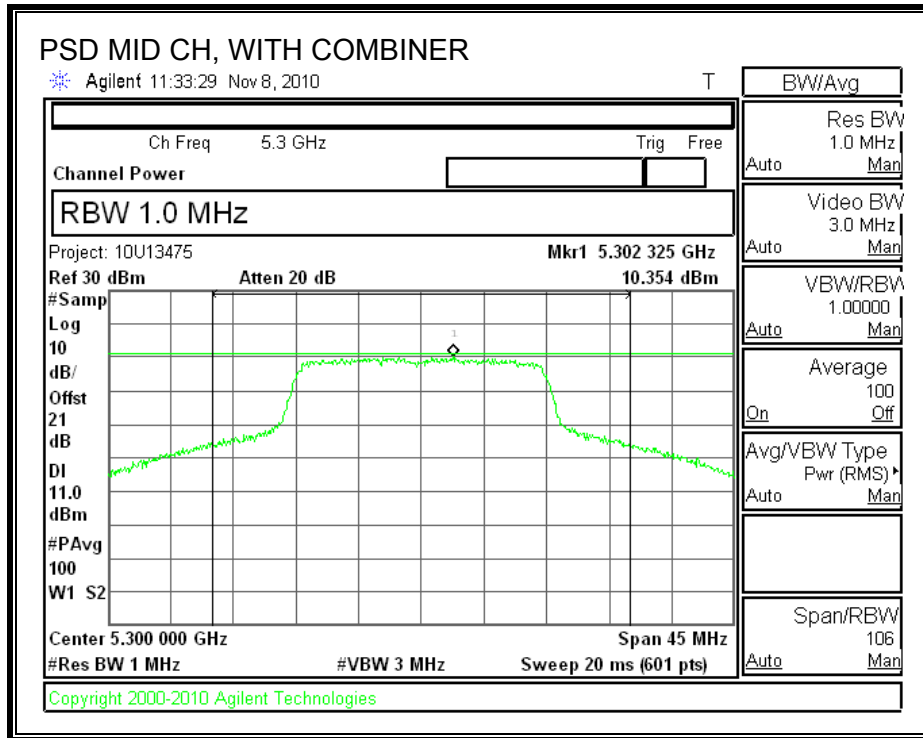
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

#### RESULTS

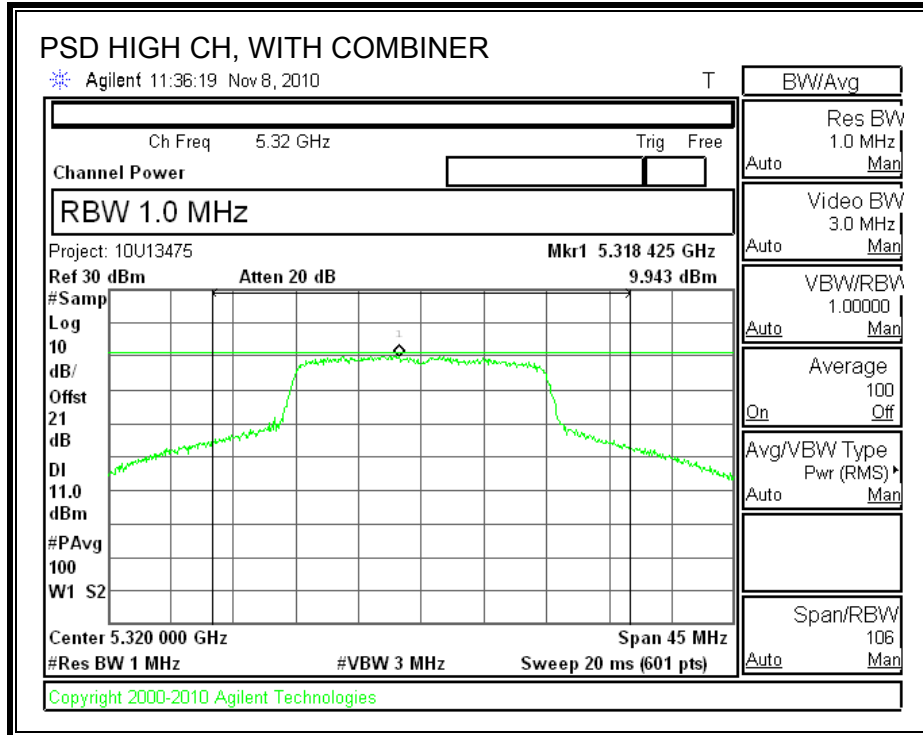
Channel	Frequency (MHz)	PPSD With Combiner (dBm)	Limit (dBm)	Margin (dB)
Low	5260	10.610	11	-0.390
Middle	5300	10.354	11	-0.646
High	5320	9.943	11	-1.057

**POWER SPECTRAL DENSITY WITH COMBINER**









## **7.5.5. PEAK EXCURSION**

### **LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

### **TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

**RESULTS**

**CHAIN 1**

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5260	9.13	13	-3.87
Middle	5300	10.72	13	-2.28
High	5320	9.57	13	-3.43

**CHAIN 2**

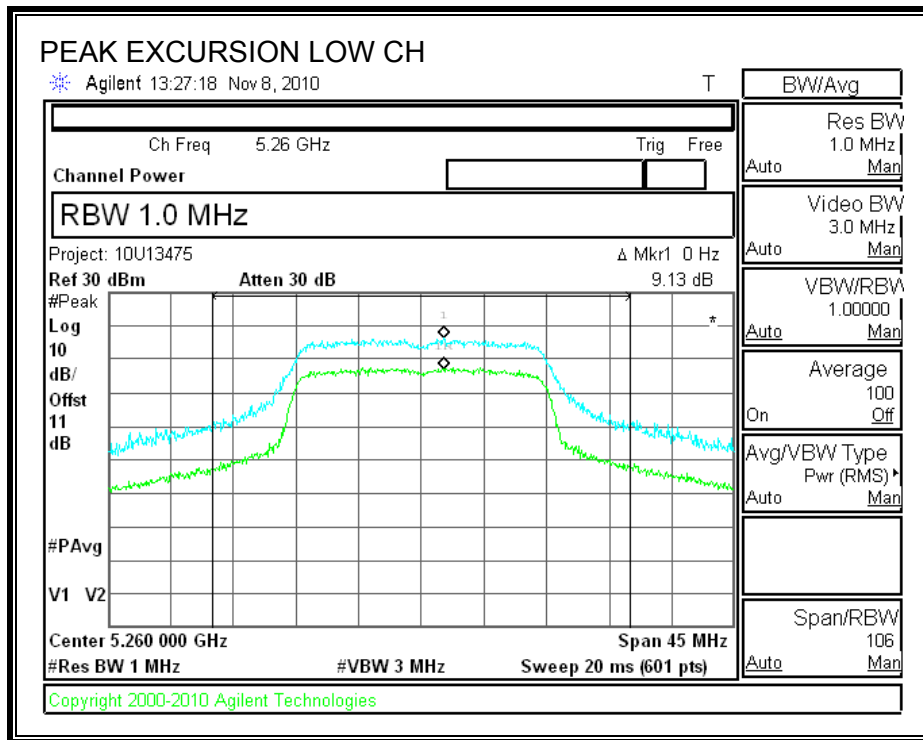
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5260	10.63	13	-2.37
Middle	5300	9.57	13	-3.43
High	5320	9.67	13	-3.33

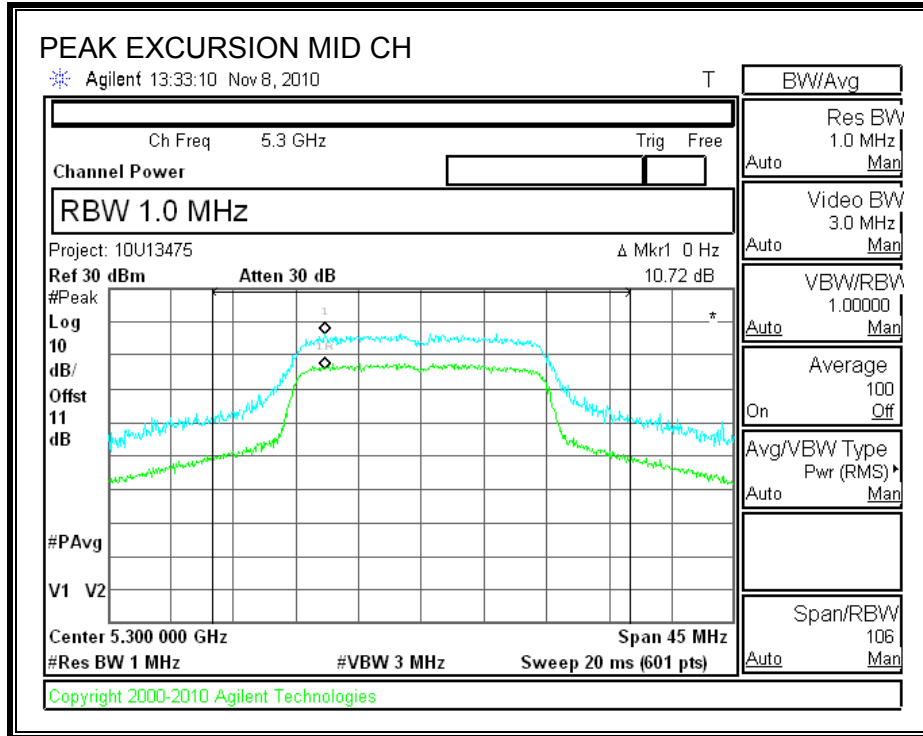
**CHAIN 3**

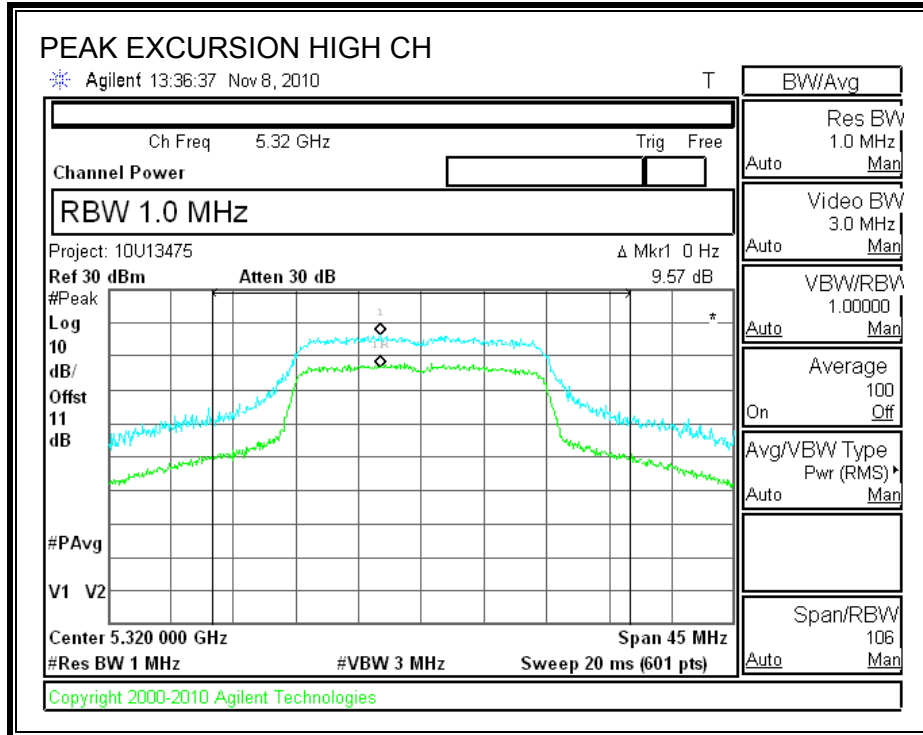
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5260	10.05	13	-2.95
Middle	5300	10.63	13	-2.37
High	5320	9.34	13	-3.66

**CHAIN 1**

**PEAK EXCURSION**

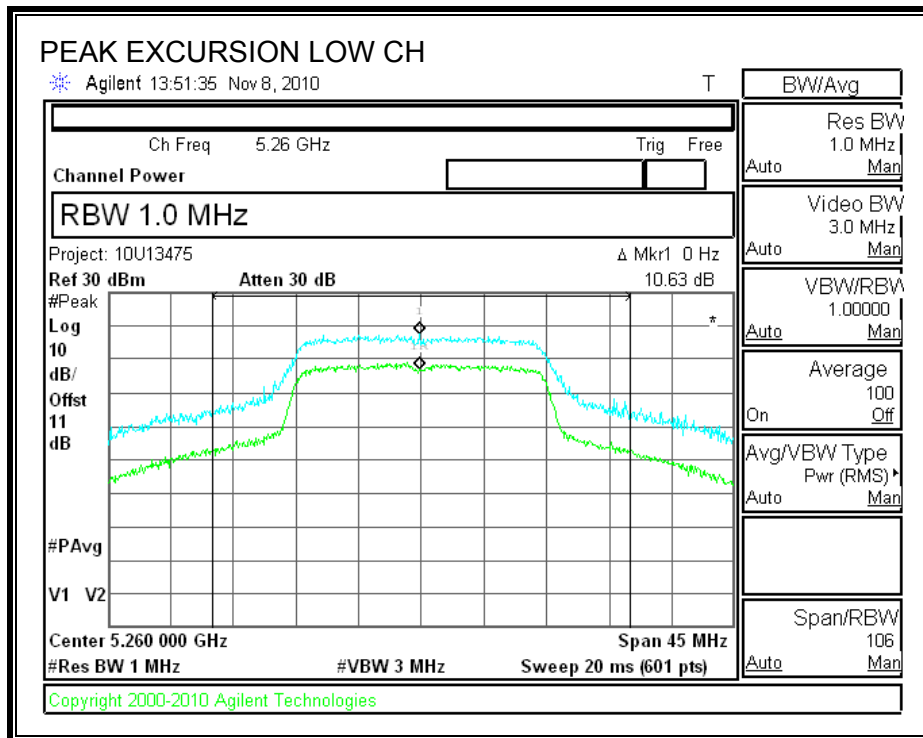


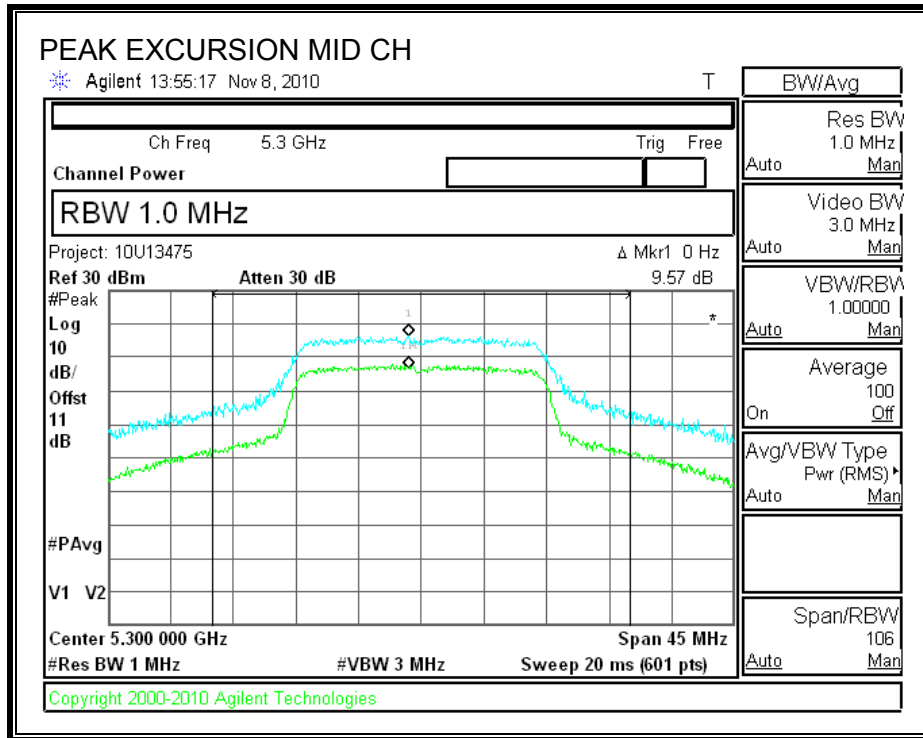




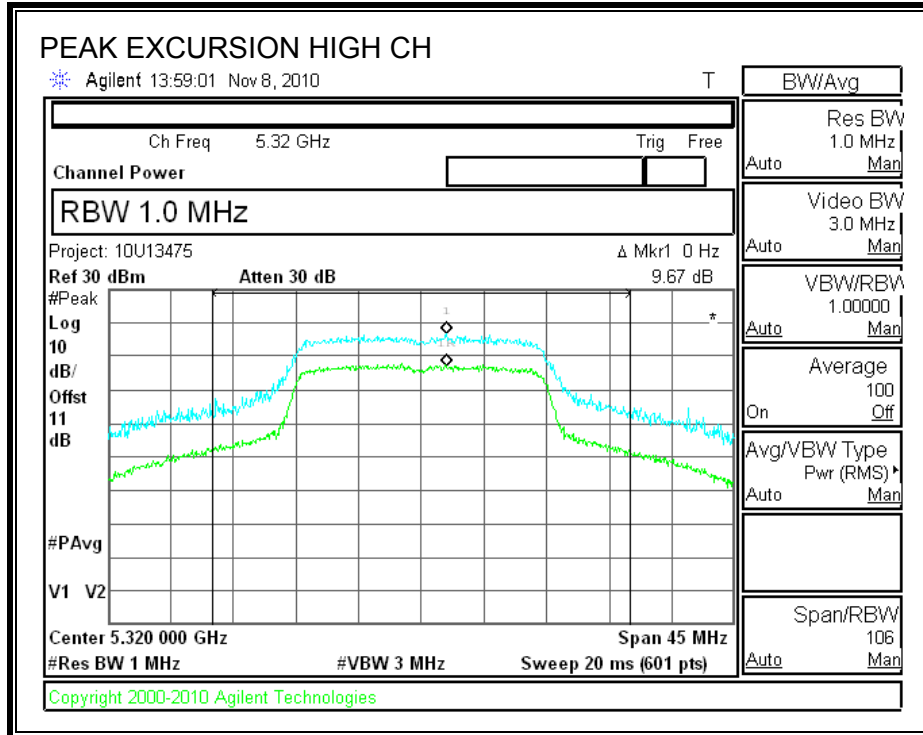
**CHAIN 2**

**PEAK EXCURSION**



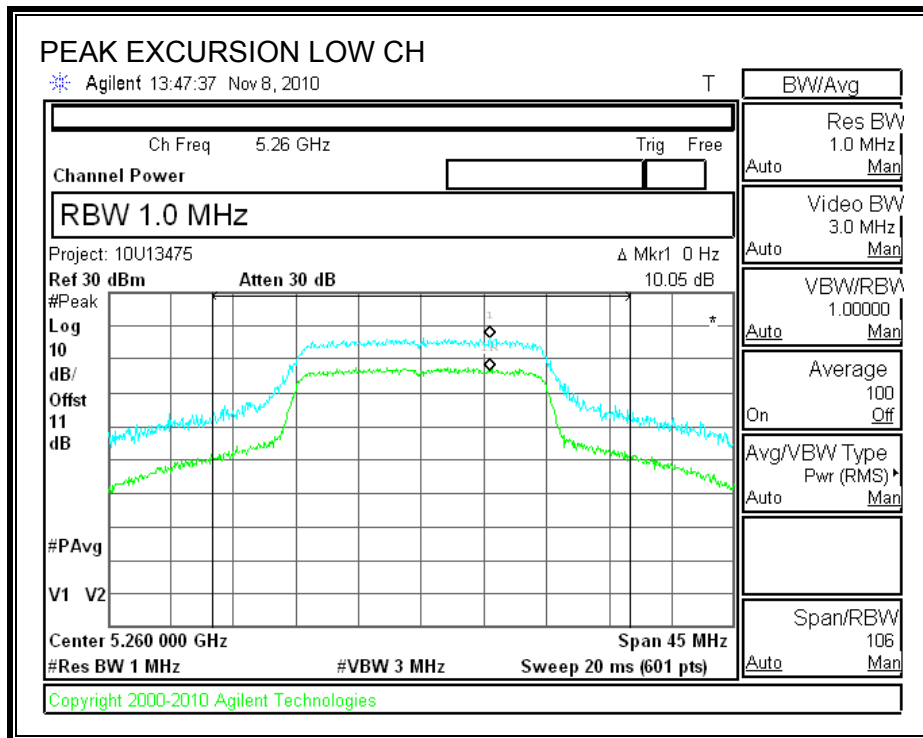


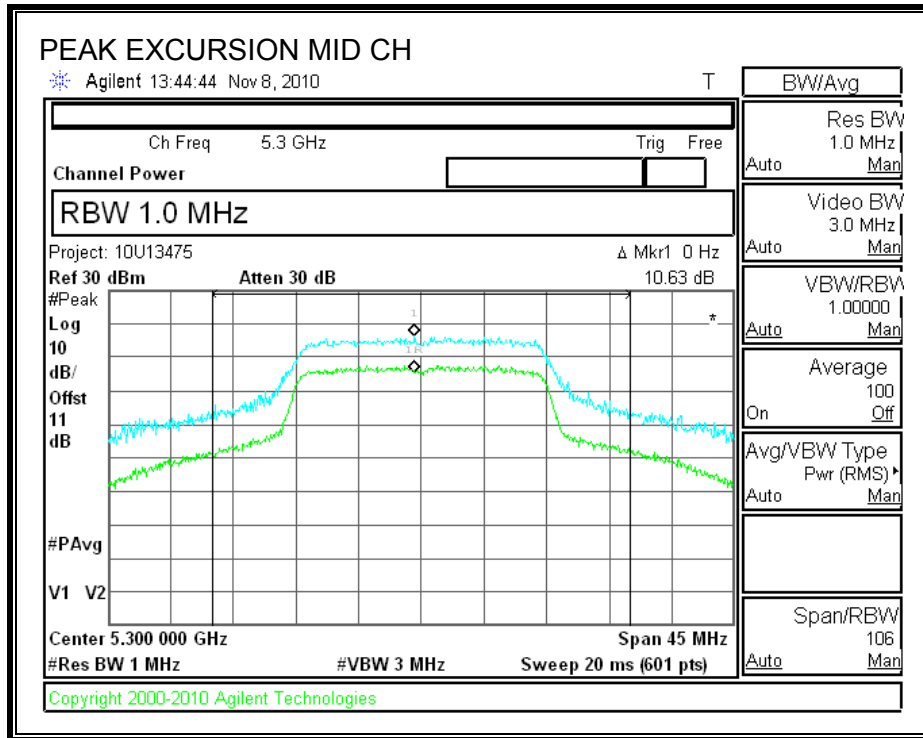


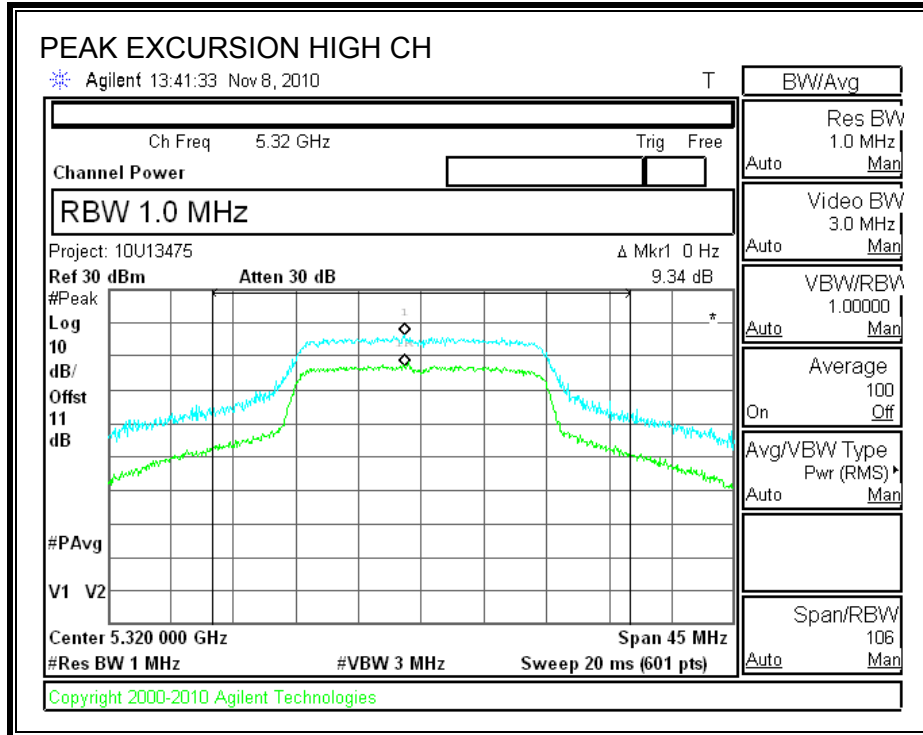


**CHAIN 3**

**PEAK EXCURSION**







## 7.5.6. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

FCC §15.407 (b) (2)

IC RSS-210 A9.3 (2)

For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.25-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

### TEST PROCEDURE

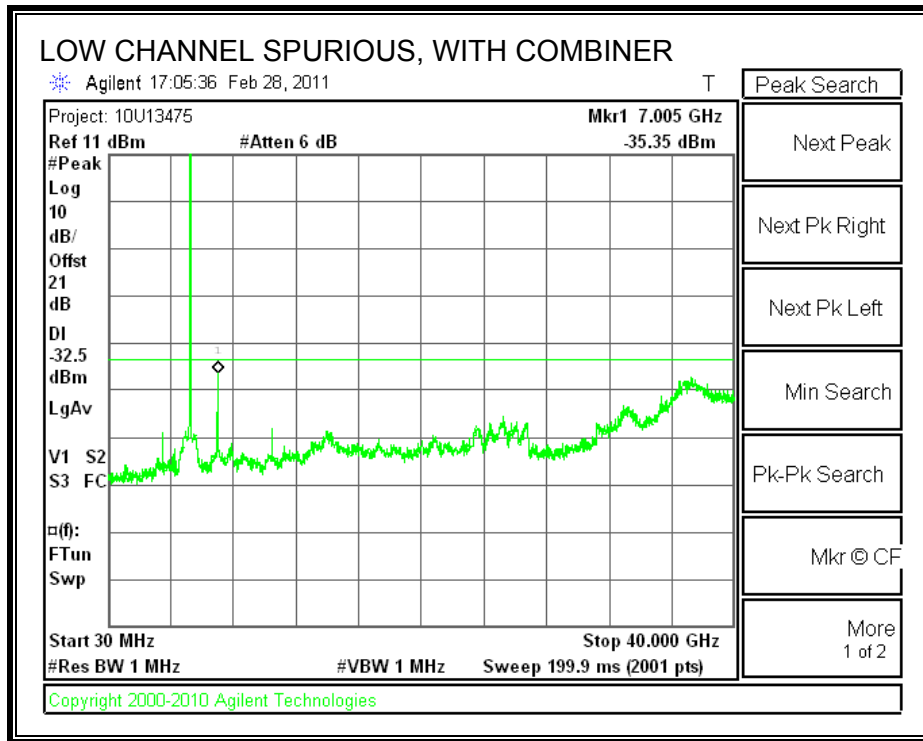
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

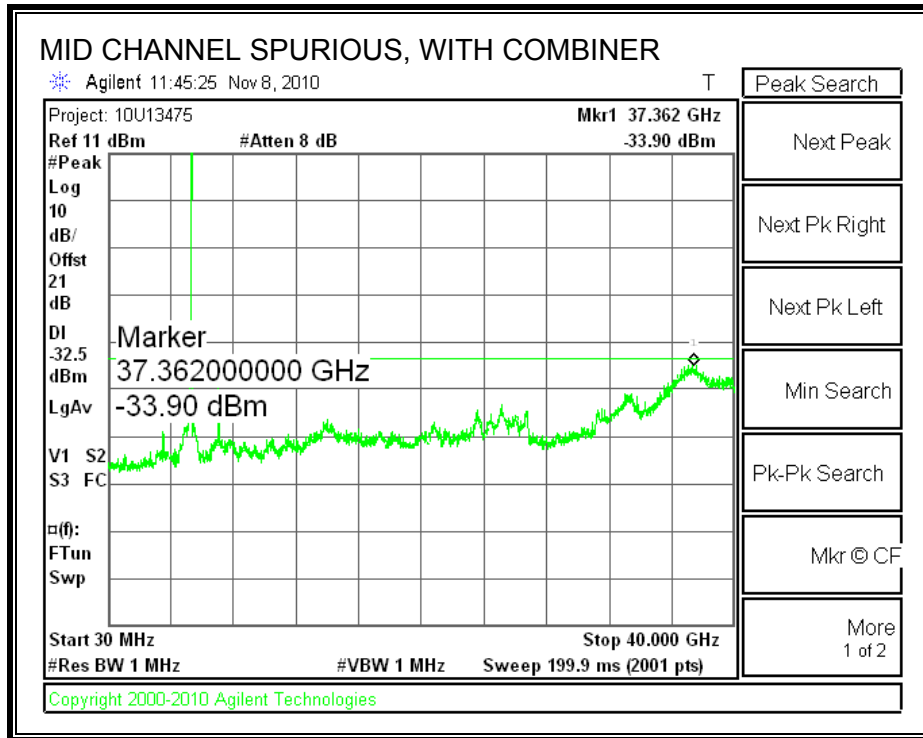
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

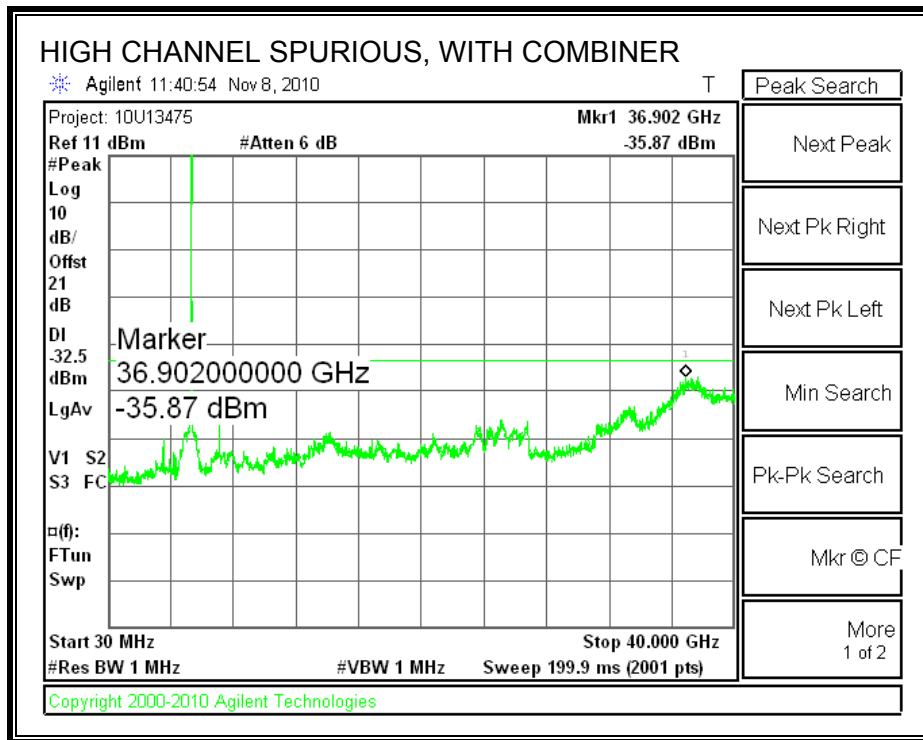
Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

**RESULTS**

**SPURIOUS EMISSIONS WITH COMBINER**









## 7.6. 802.11n THREE CHAINS HT40 MODE IN THE 5.3 GHz BAND

### 7.6.1. 26 dB and 99% BANDWIDTH

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

#### RESULTS

##### CHAIN 1

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5270	47.924	36.2173
High	5310	46.567	36.2879

##### CHAIN 2

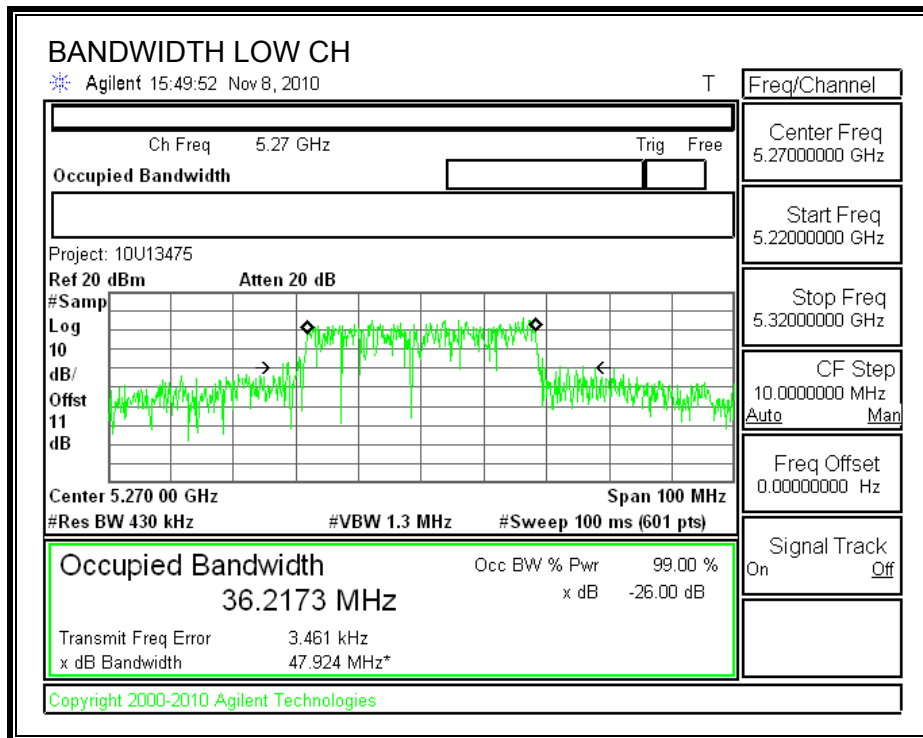
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5270	46.603	36.3378
High	5310	47.618	36.4785

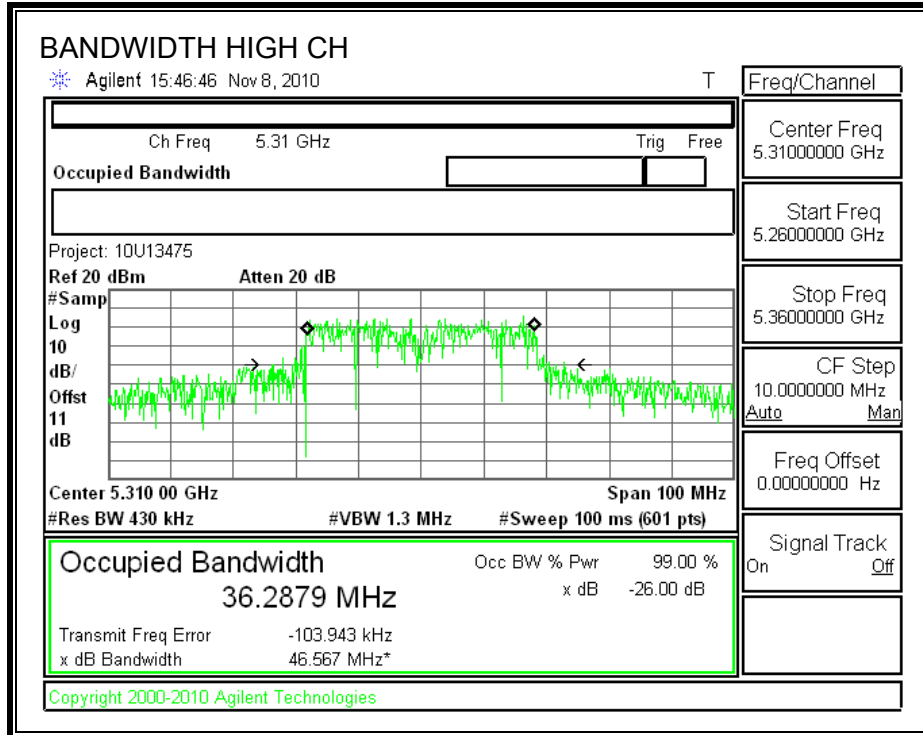
##### CHAIN 3

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5270	46.955	36.4813
High	5310	47.541	36.2204

**CHAIN 1**

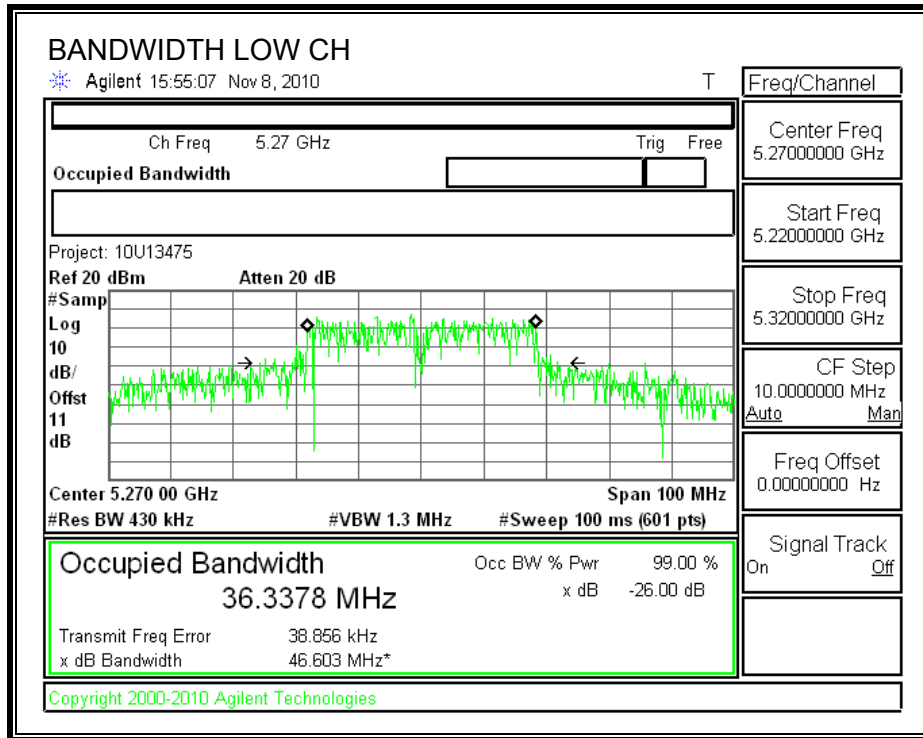
**26 dB and 99% BANDWIDTH**

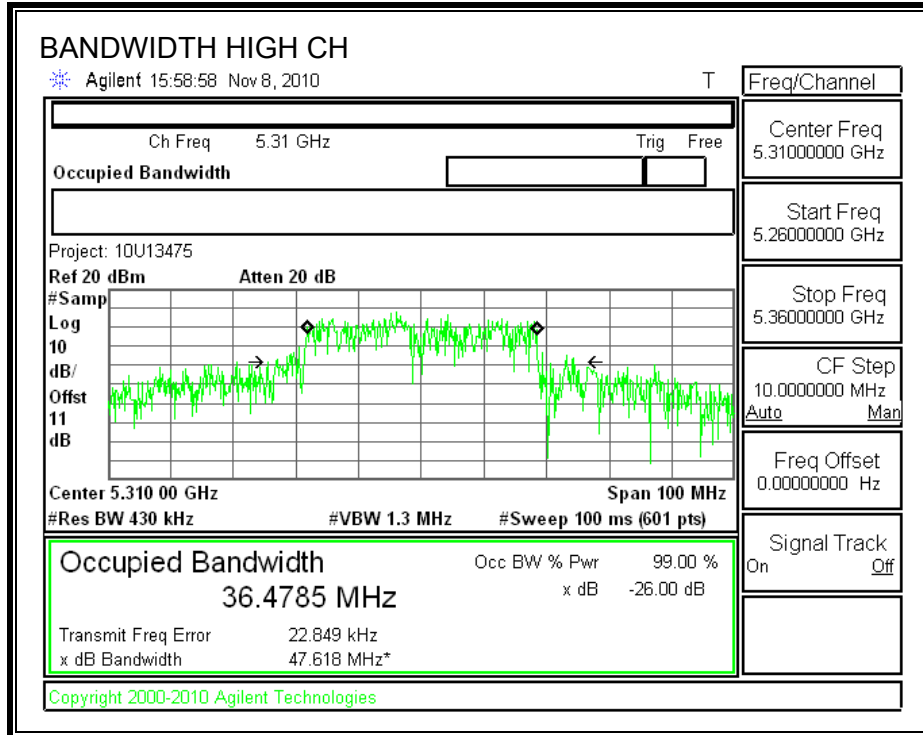




**CHAIN 2**

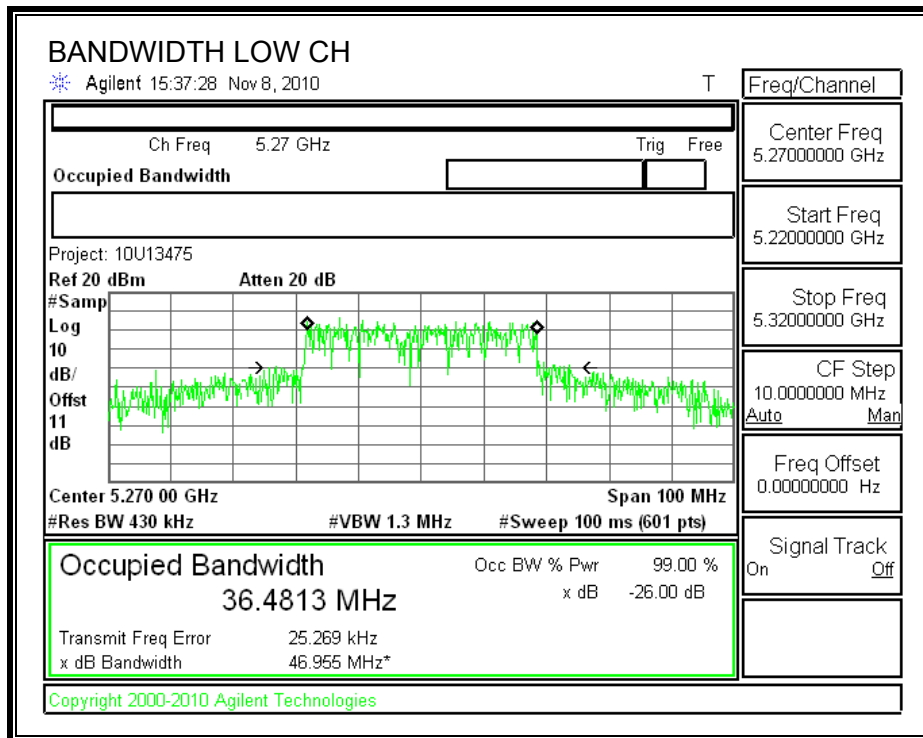
**26 dB and 99% BANDWIDTH**

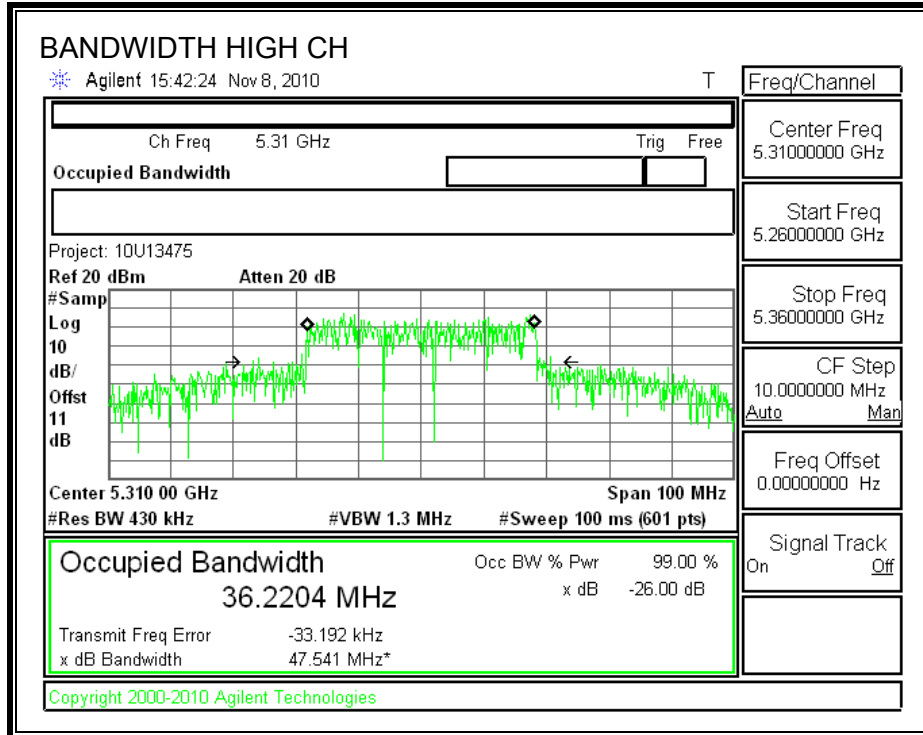




**CHAIN 3**

**26 dB and 99% BANDWIDTH**





## 7.6.2. OUTPUT POWER

### LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.25-5.35 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.



**RESULTS**

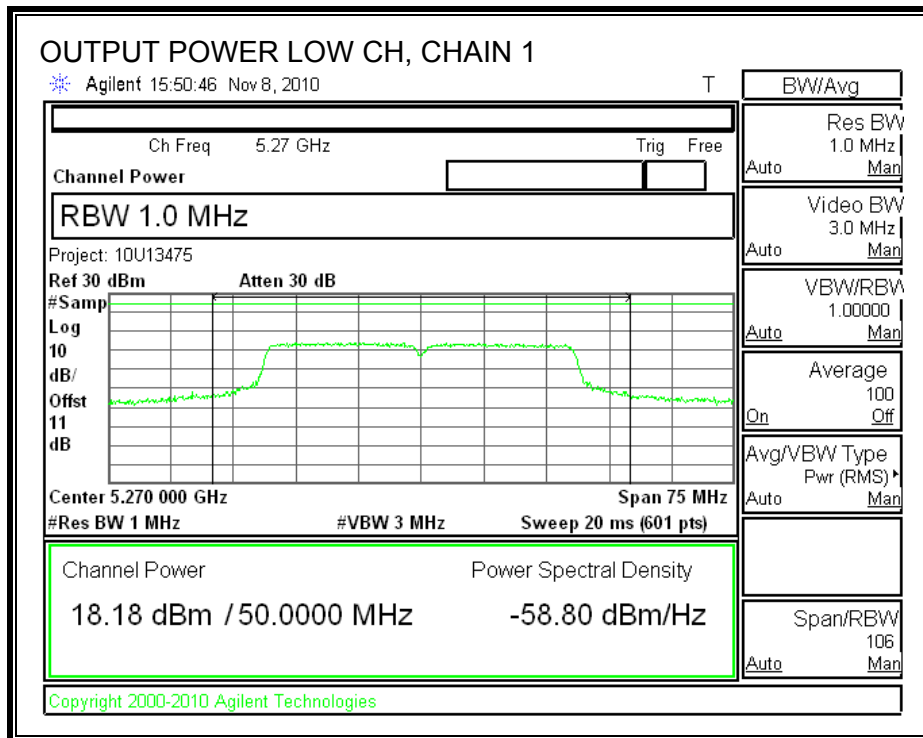
**Limit**

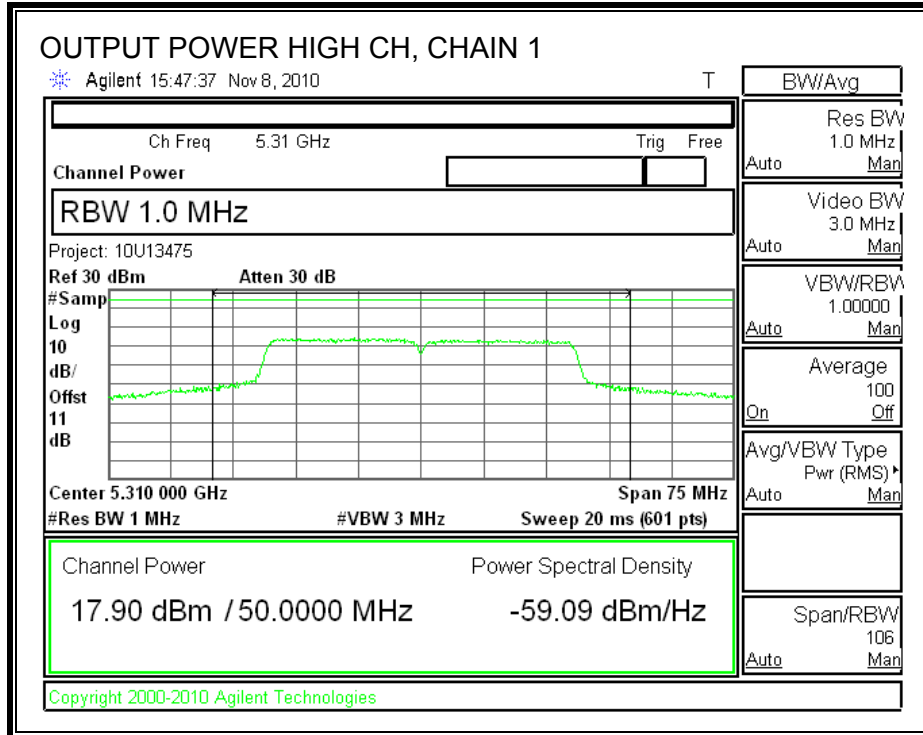
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5270	23.98	46.603	27.68	5.50	23.98
High	5310	23.98	46.567	27.68	5.50	23.98

**Individual Chain Results**

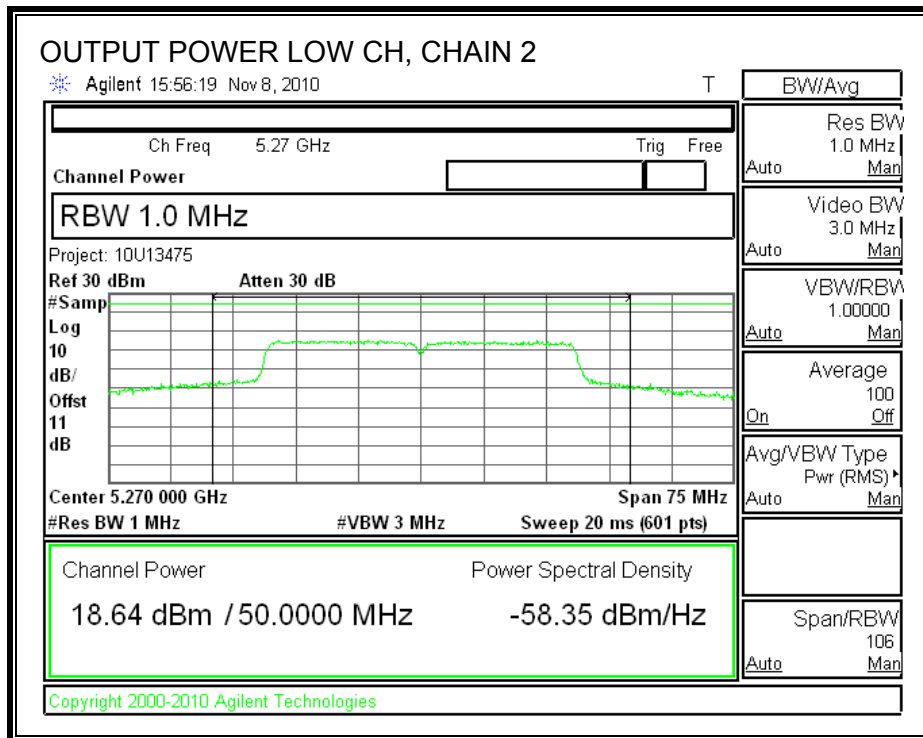
Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5270	18.18	18.64	17.90	23.02	23.98	-0.96
High	5310	17.90	18.19	18.08	22.83	23.98	-1.15

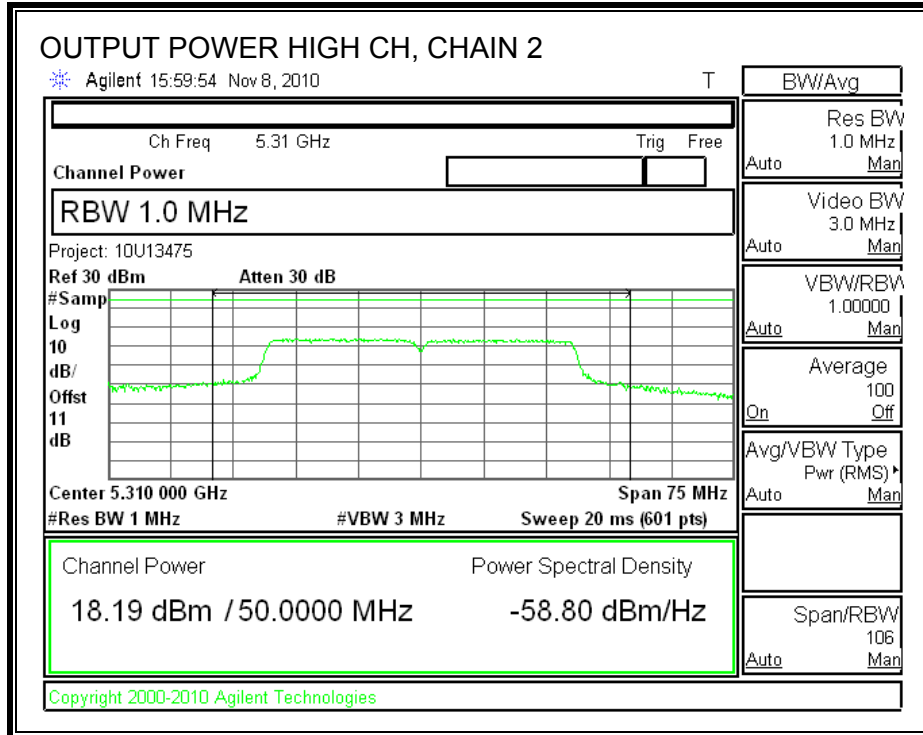
**CHAIN 1 OUTPUT POWER**



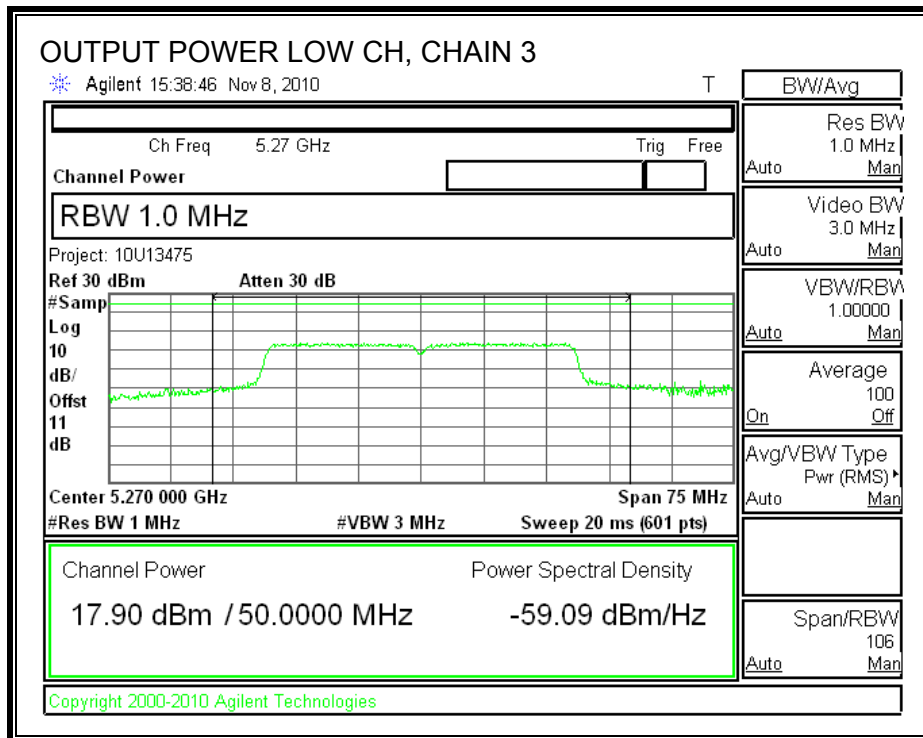


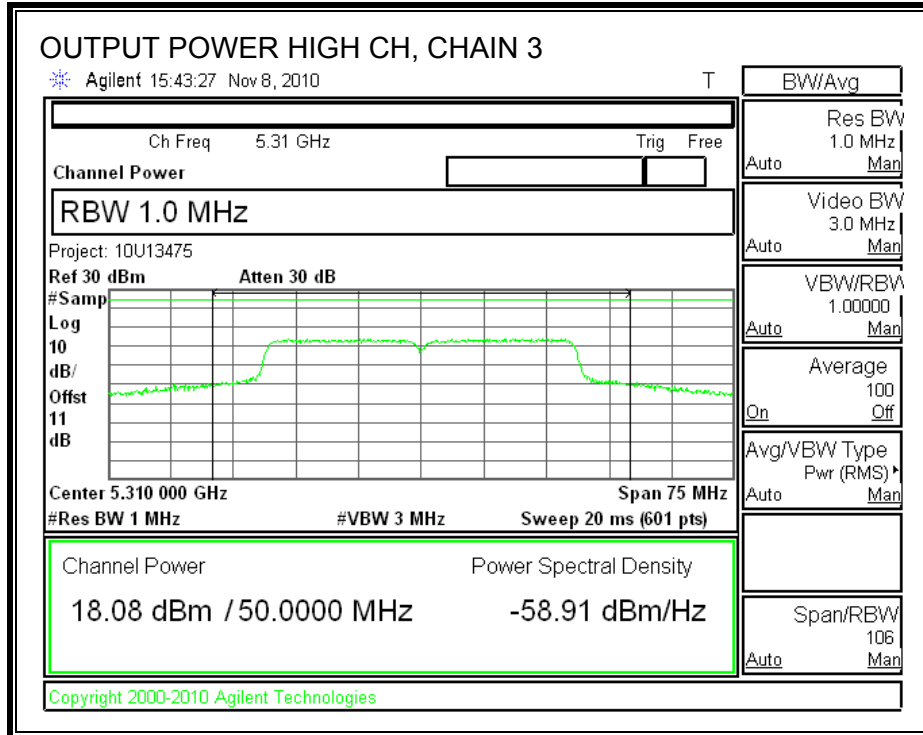
**CHAIN 2 OUTPUT POWER**





**CHAIN 3 OUTPUT POWER**





### 7.6.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1.0 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)
Low	5270	17.21	18.27	17.41	22.43
High	5310	17.03	17.17	17.27	21.93



#### **7.6.4. PEAK POWER SPECTRAL DENSITY**

##### **LIMITS**

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.25–5.35 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 11 dBm.

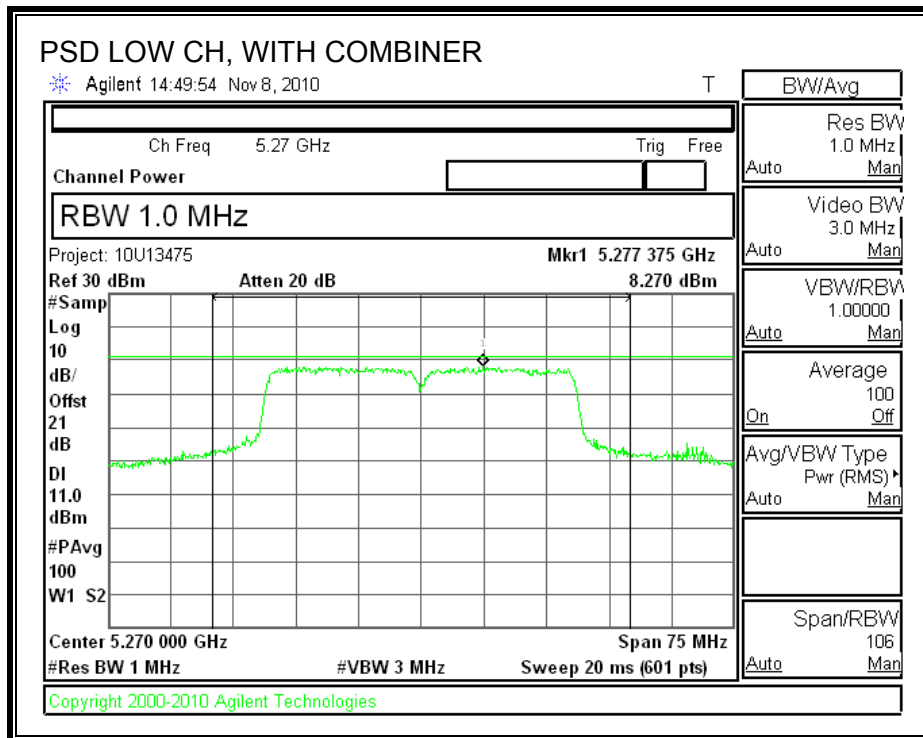
##### **TEST PROCEDURE**

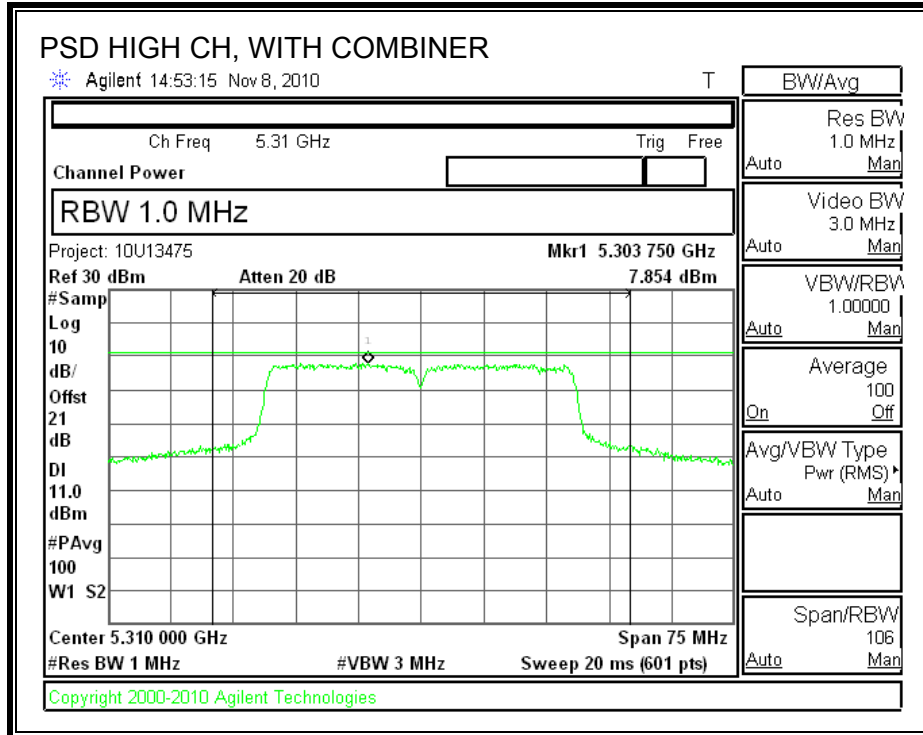
The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

**RESULTS**

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>PPSD With Combiner (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
<b>Low</b>	<b>5270</b>	<b>8.270</b>	<b>11</b>	<b>-2.730</b>
<b>High</b>	<b>5310</b>	<b>7.854</b>	<b>11</b>	<b>-3.146</b>

**POWER SPECTRAL DENSITY WITH COMBINER**





## **7.6.5. PEAK EXCURSION**

### **LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

### **TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

**RESULTS**

**CHAIN 1**

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5290	11.95	13	-1.05
High	5310	10.20	13	-2.80

**CHAIN 2**

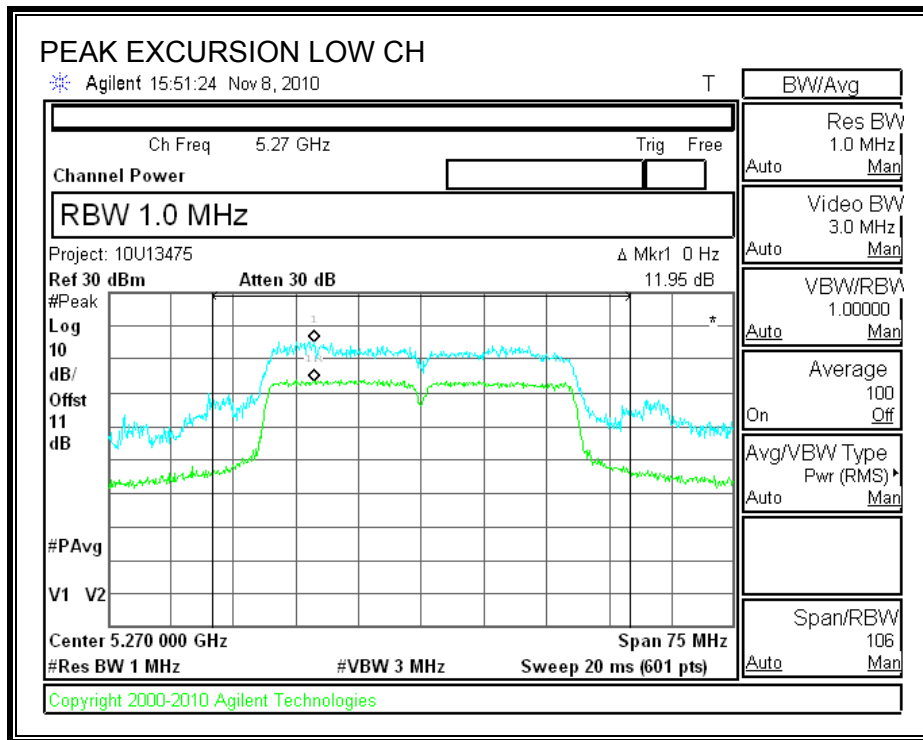
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5290	12.20	13	-0.80
High	5310	11.65	13	-1.35

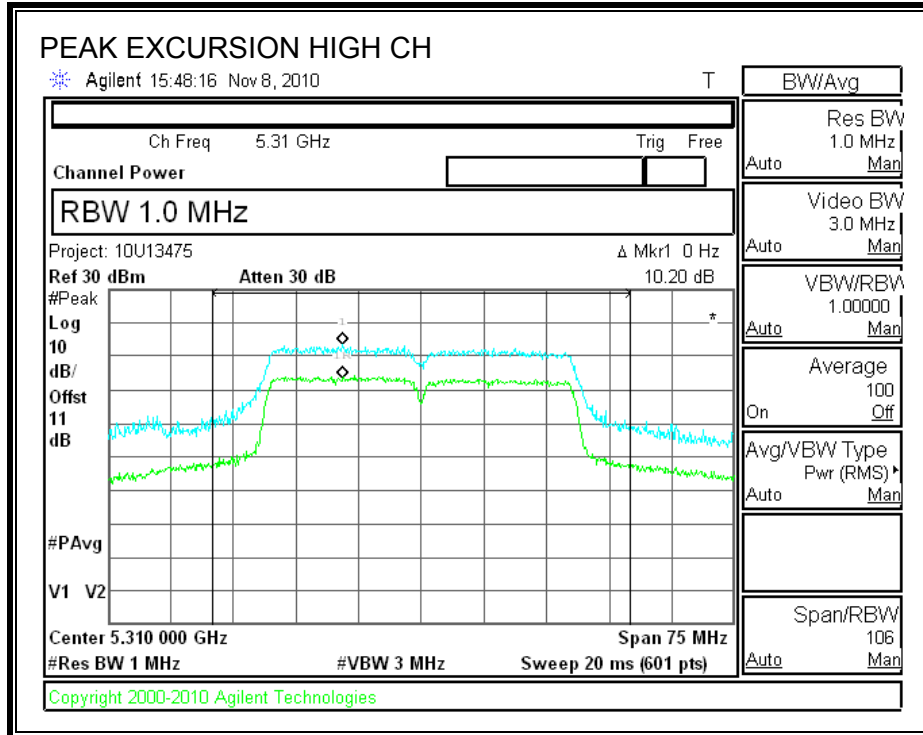
**CHAIN 3**

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5290	11.11	13	-1.89
High	5310	9.76	13	-3.24

**CHAIN 1**

**PEAK EXCURSION**

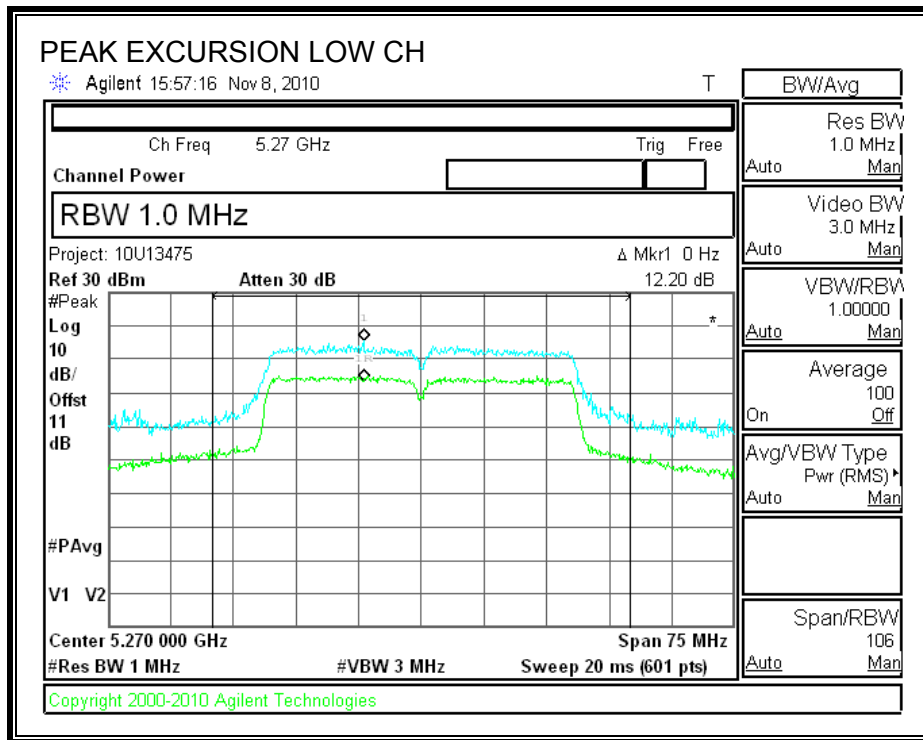


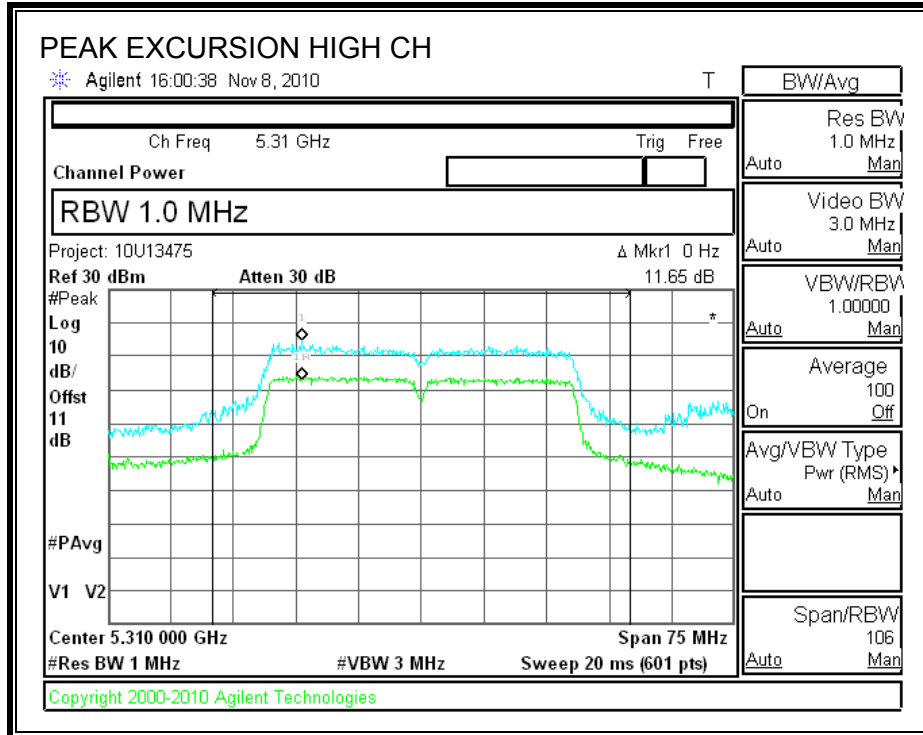




**CHAIN 2**

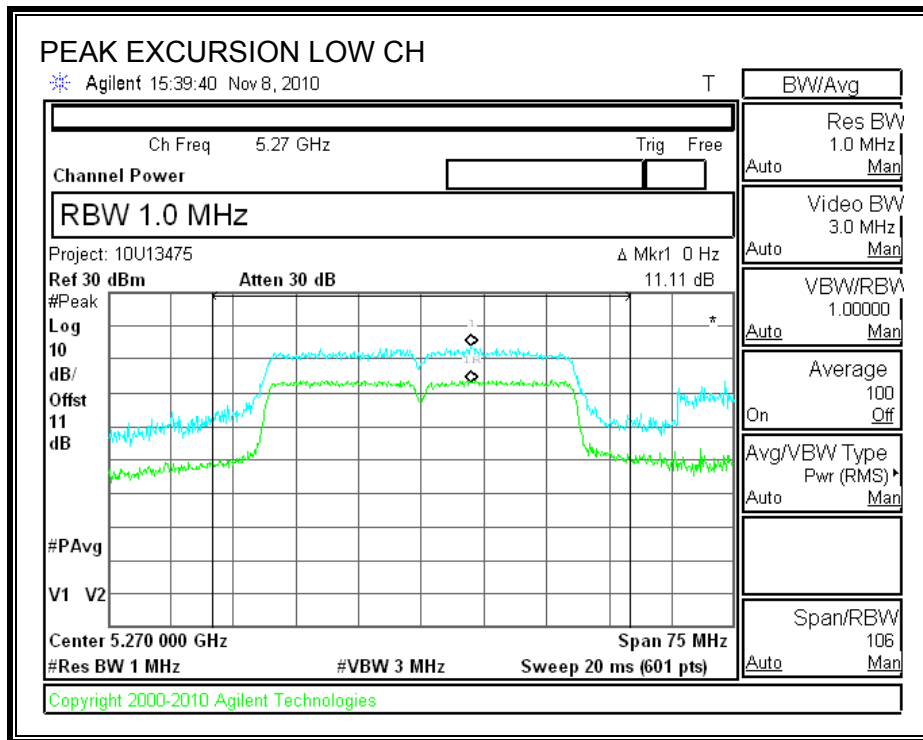
**PEAK EXCURSION**

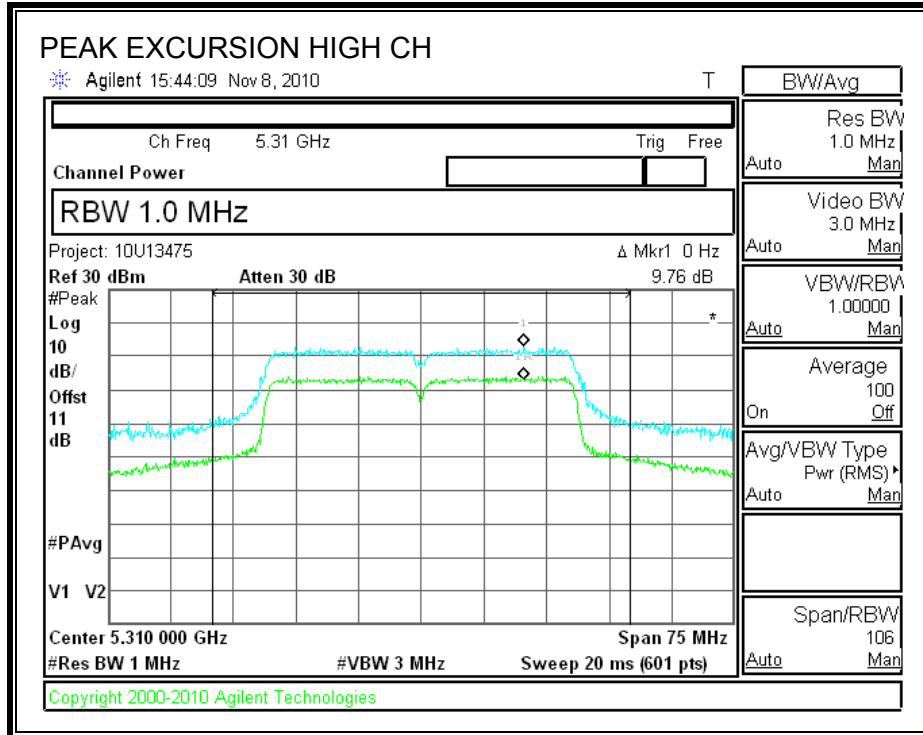




**CHAIN 3**

**PEAK EXCURSION**





## **7.6.6. CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

FCC §15.407 (b) (2)

IC RSS-210 A9.3 (2)

For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.25-5.35 GHz band shall not exceed an EIRP of -27 dBm / MHz.

Devices operating in the 5.25-5.35 GHz band that generate emissions in the 5.15-5.25 GHz band must meet all applicable technical requirements for operation in the 5.15-5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5.15-5.25 GHz band.

### **TEST PROCEDURE**

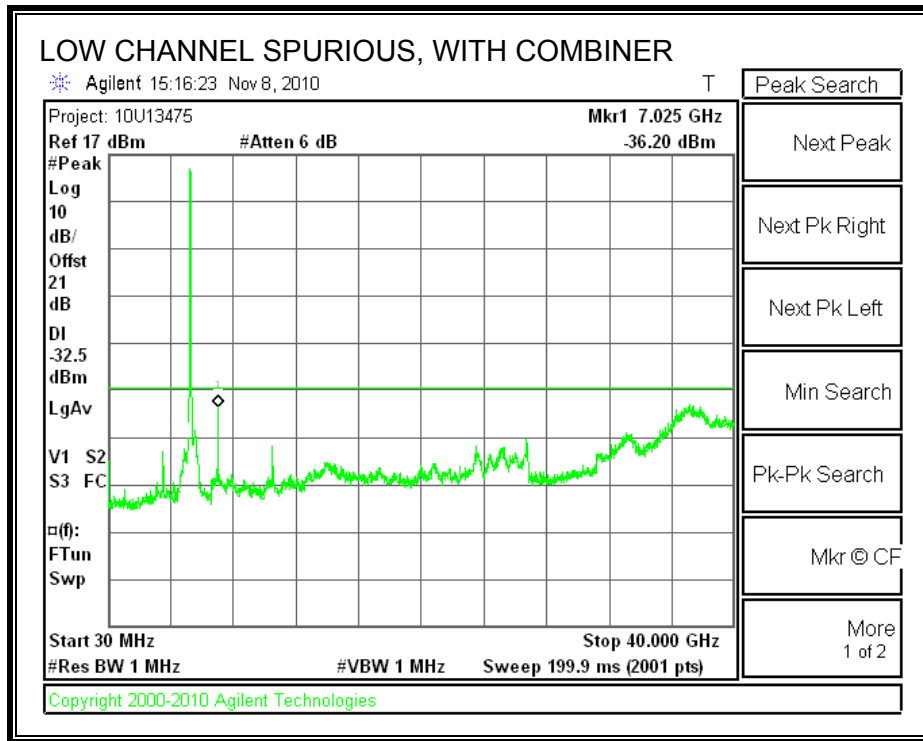
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

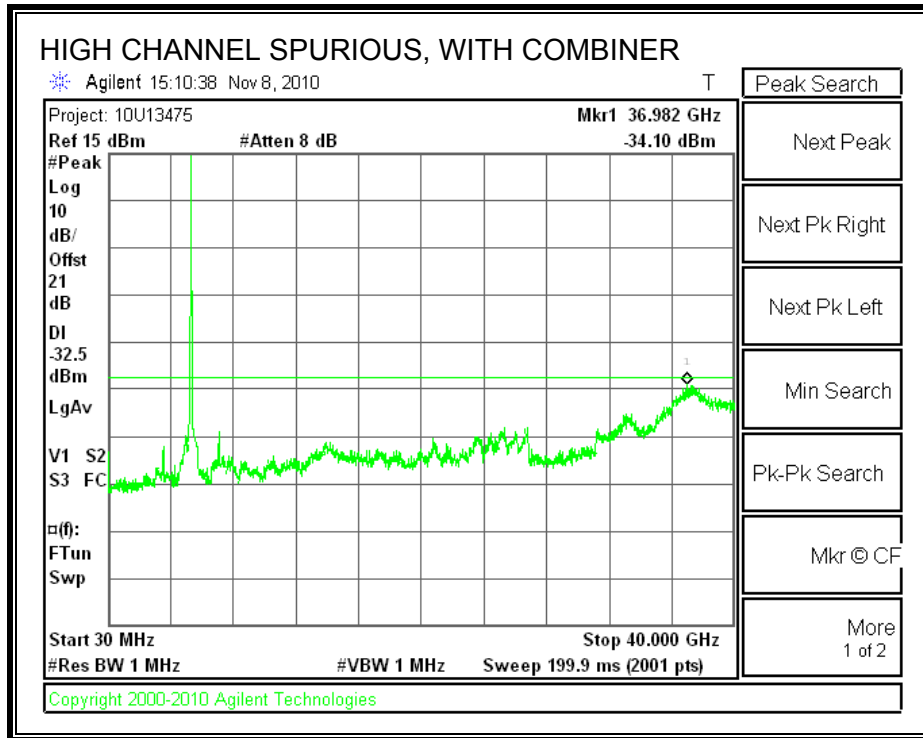
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

**RESULTS**

**SPURIOUS EMISSIONS WITH COMBINER**





## 7.7. 802.11a THREE CHAINS Legacy MODE IN THE 5.6 GHz BAND

### 7.7.1. 26 dB and 99% BANDWIDTH

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

#### RESULTS

##### CHAIN 1

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5500	22.486	16.5299
Middle	5580	22.112	16.4171
High	5700	21.006	16.5165

##### CHAIN 2

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5500	20.53	16.3539
Middle	5580	20.807	16.4059
High	5700	21.231	16.5752

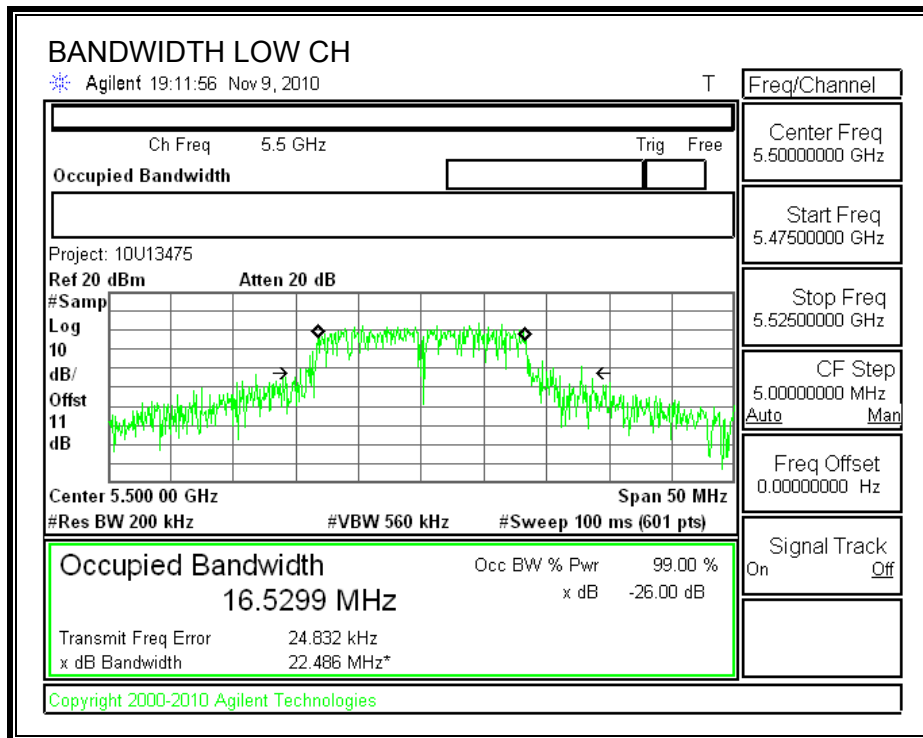
##### CHAIN 3

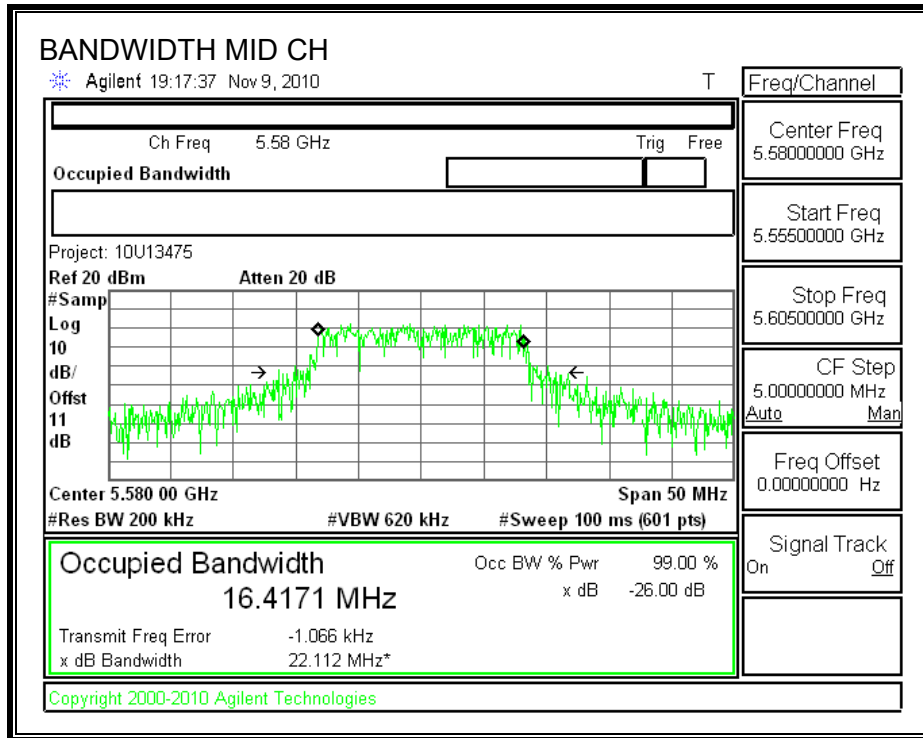
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5500	21.933	16.4185
Middle	5580	20.253	16.4405
High	5700	19.486	16.3874

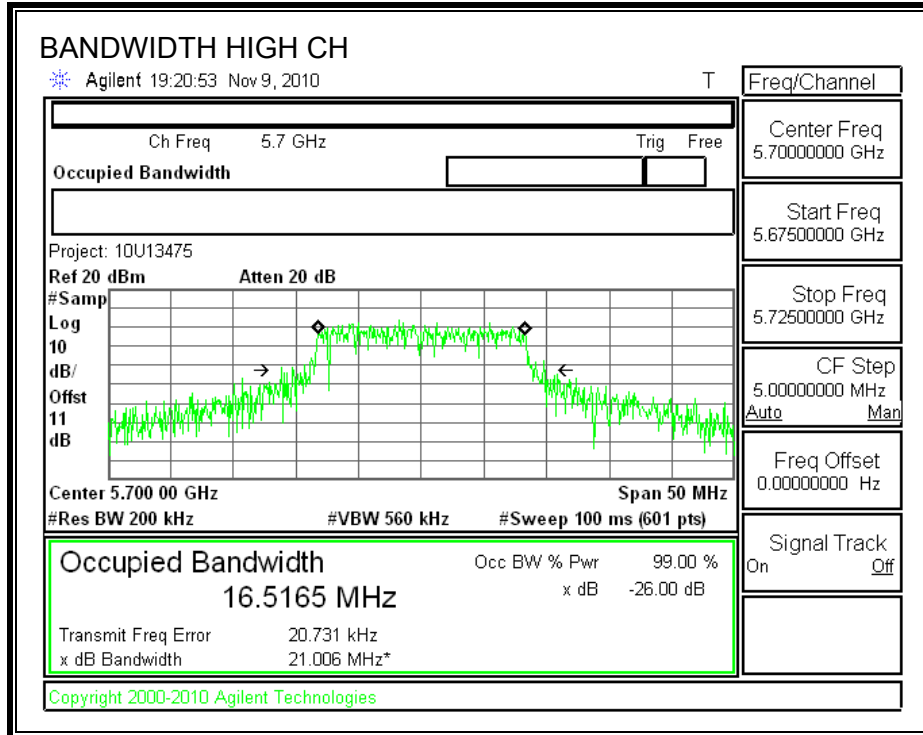


**CHAIN 1**

**26 dB and 99% BANDWIDTH**

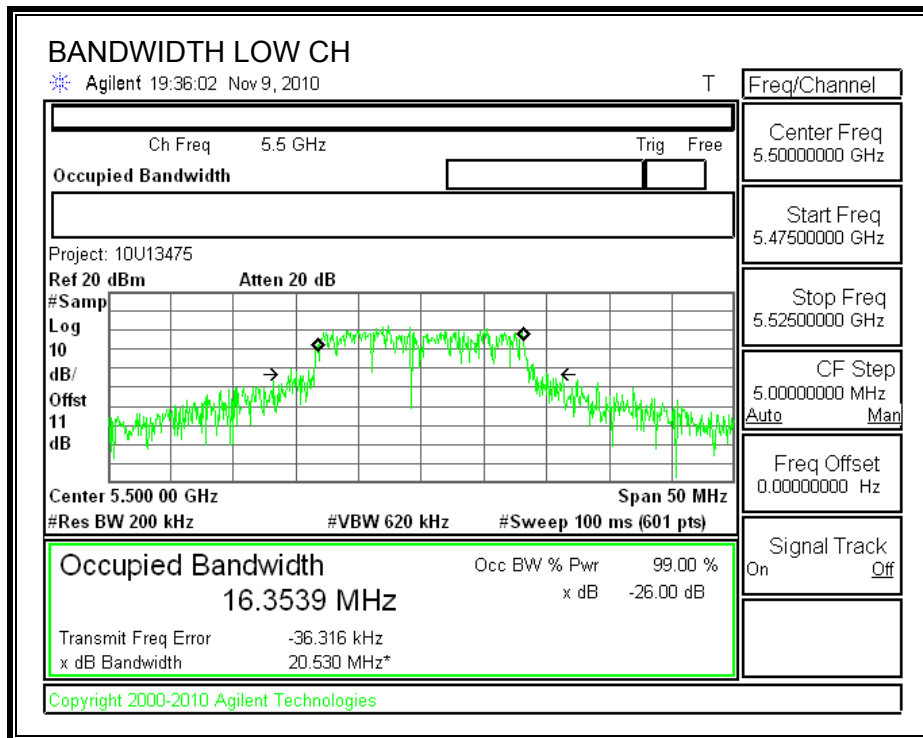


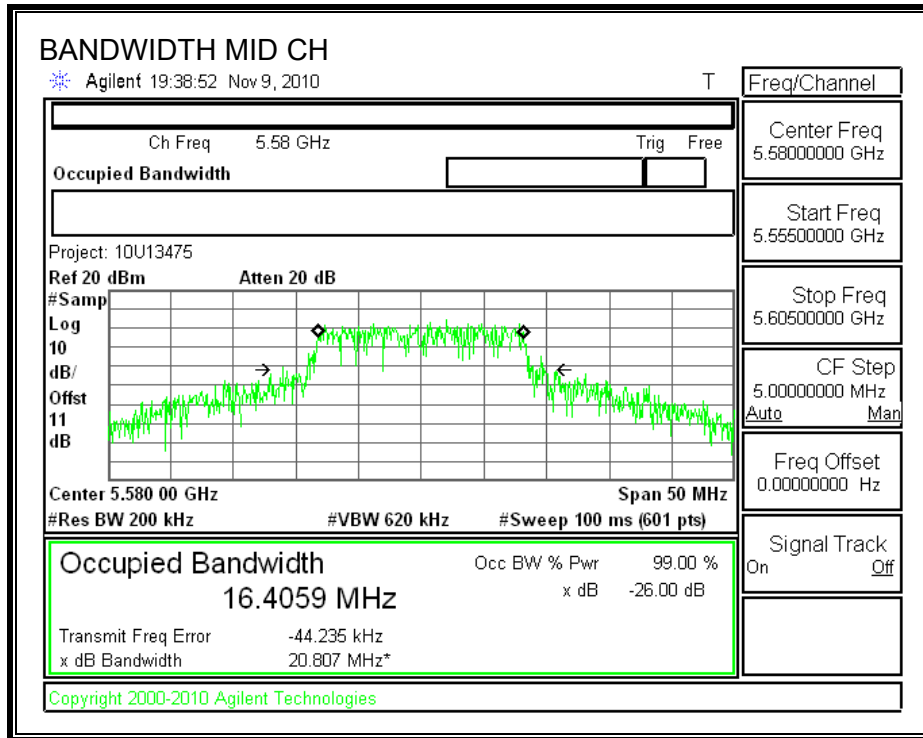


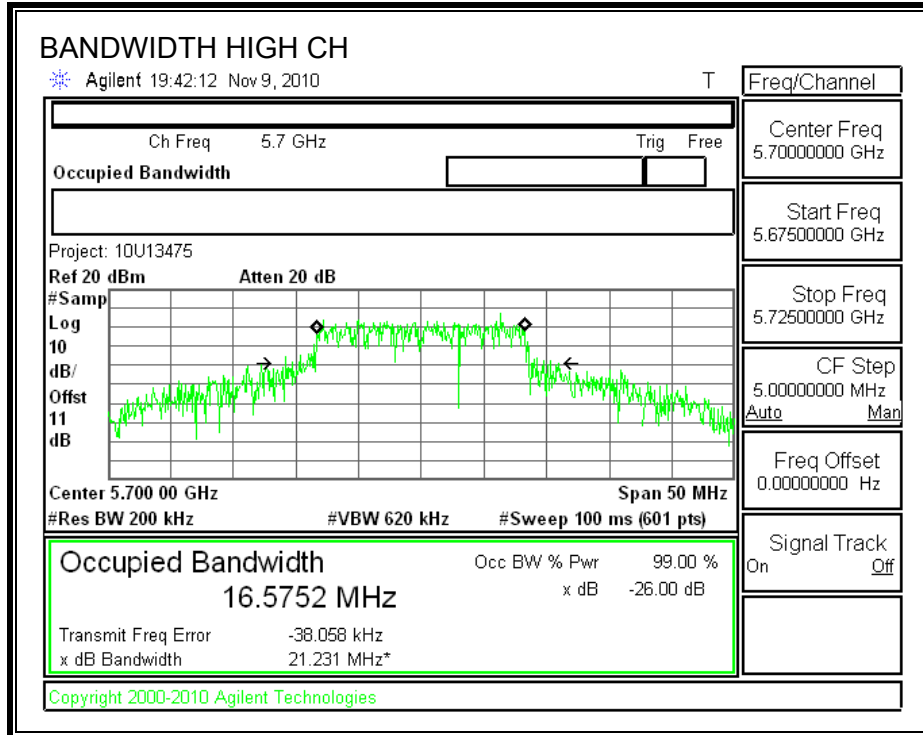


**CHAIN 2**

**26 dB and 99% BANDWIDTH**

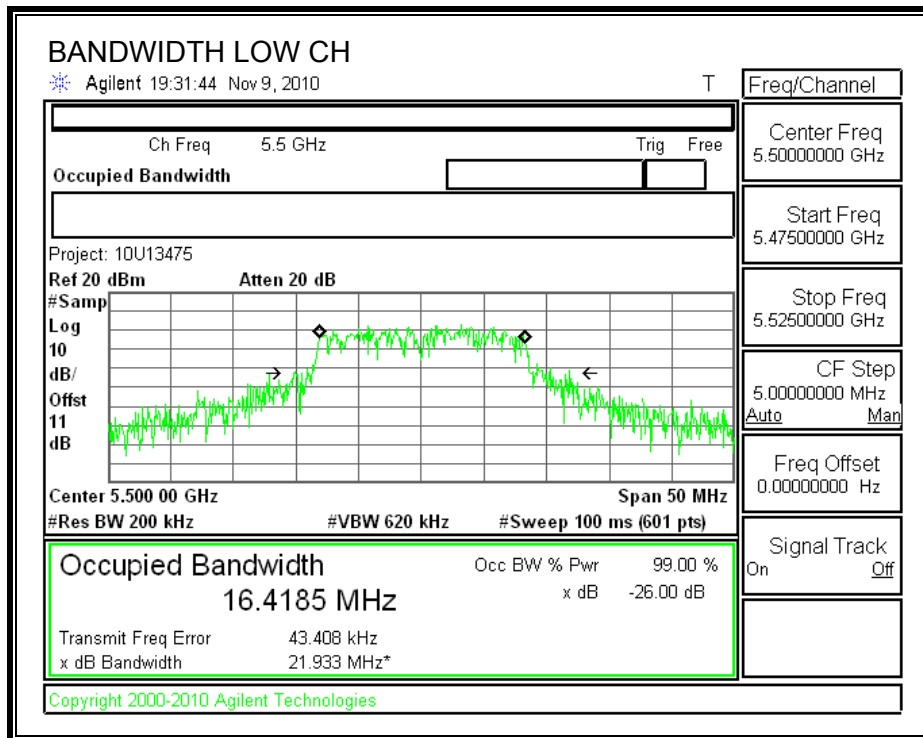


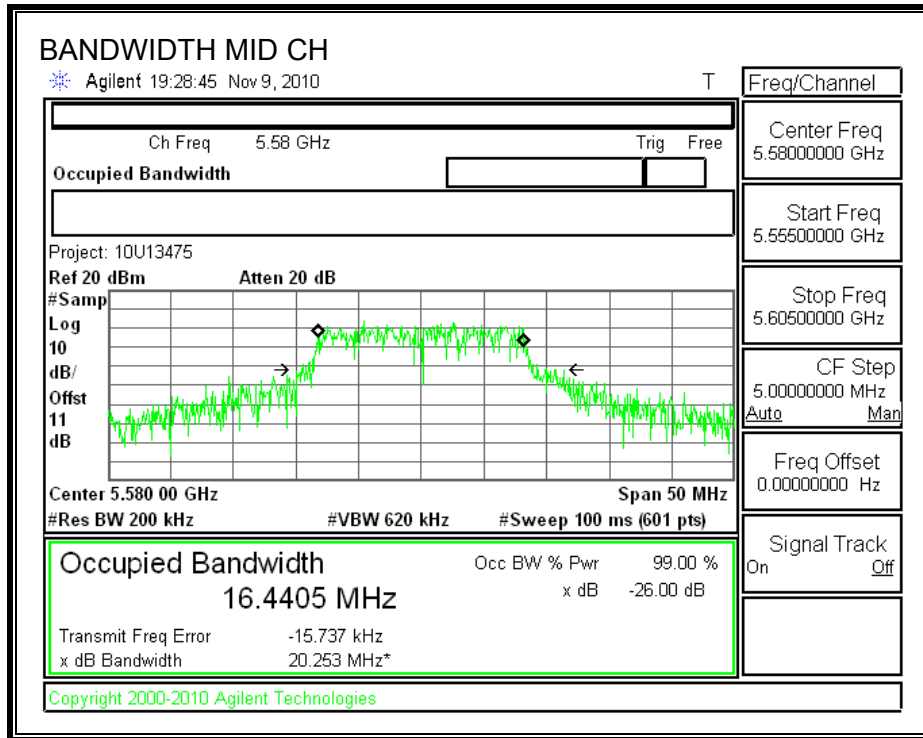




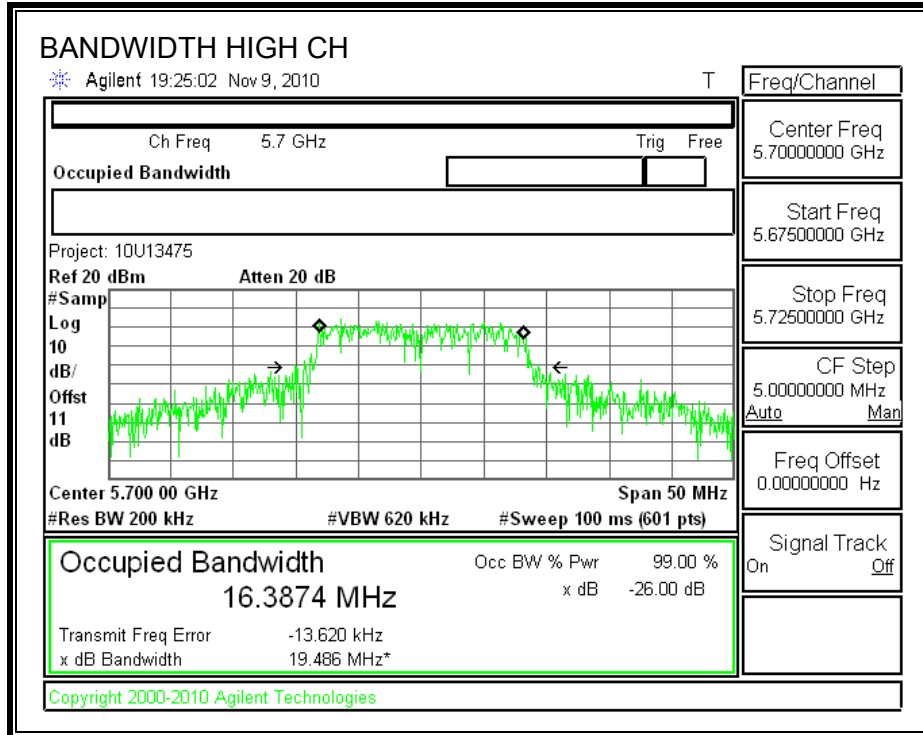
**CHAIN 3**

**26 dB and 99% BANDWIDTH**









## 7.7.2. OUTPUT POWER

### LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

Antenna Gain (dBi)	10 Log (# Tx Chains) (dB)	Effective Legacy Gain (dBi)
5.5	4.77	10.27

For the 5.47-5.725 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

**RESULTS**

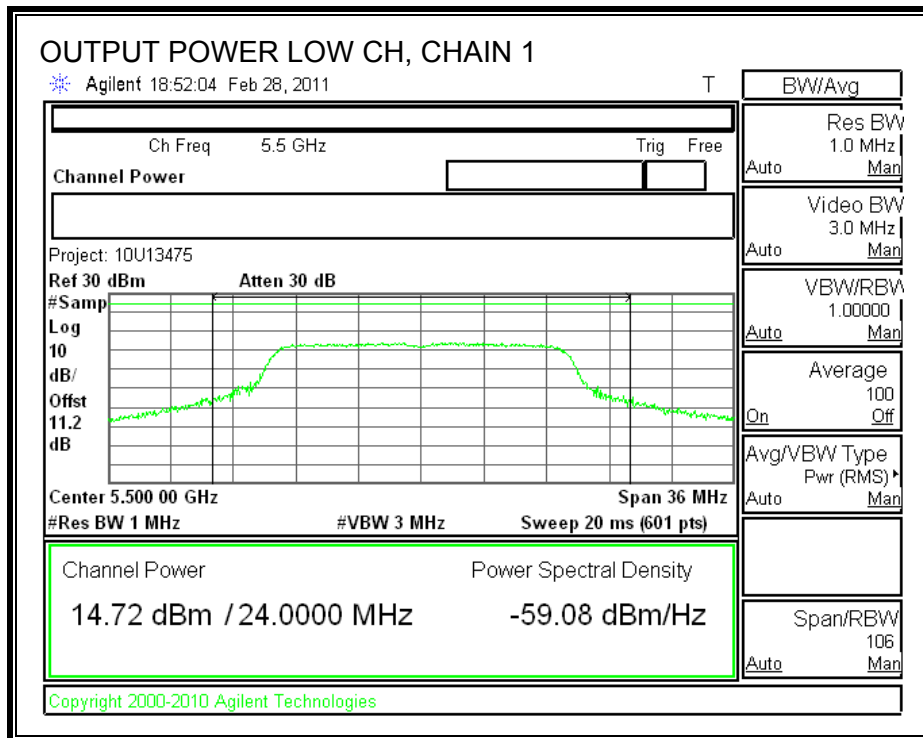
**Limit**

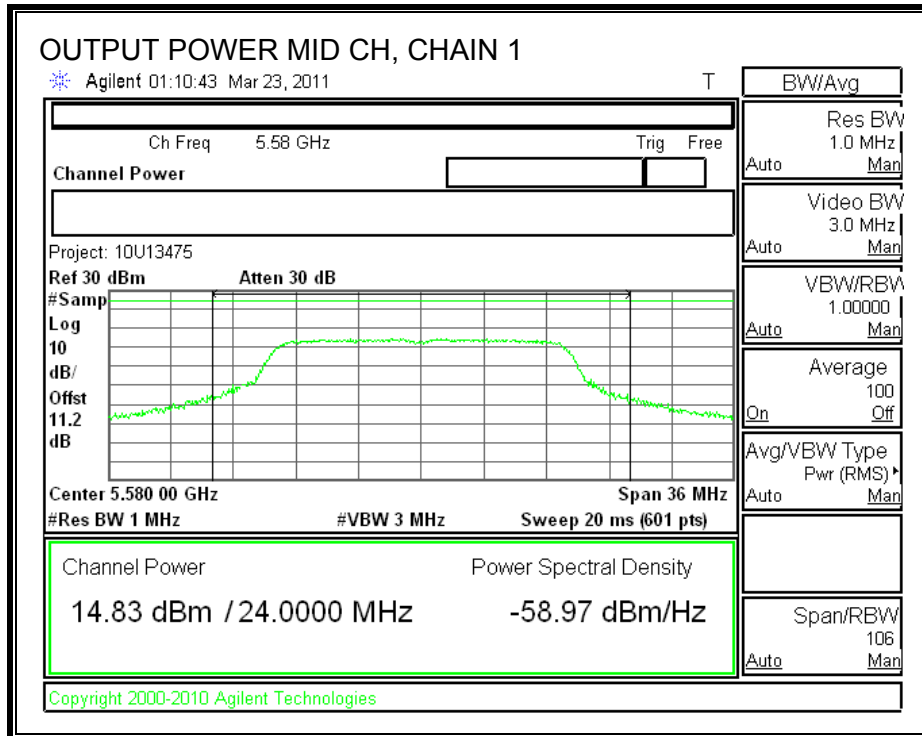
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Effective Ant. Gain (dBi)	Limit (dBm)
Low	5500	23.98	20.53	24.12	10.27	19.71
Mid	5580	23.98	20.253	24.06	10.27	19.71
High	5700	23.98	19.486	23.90	10.27	19.63

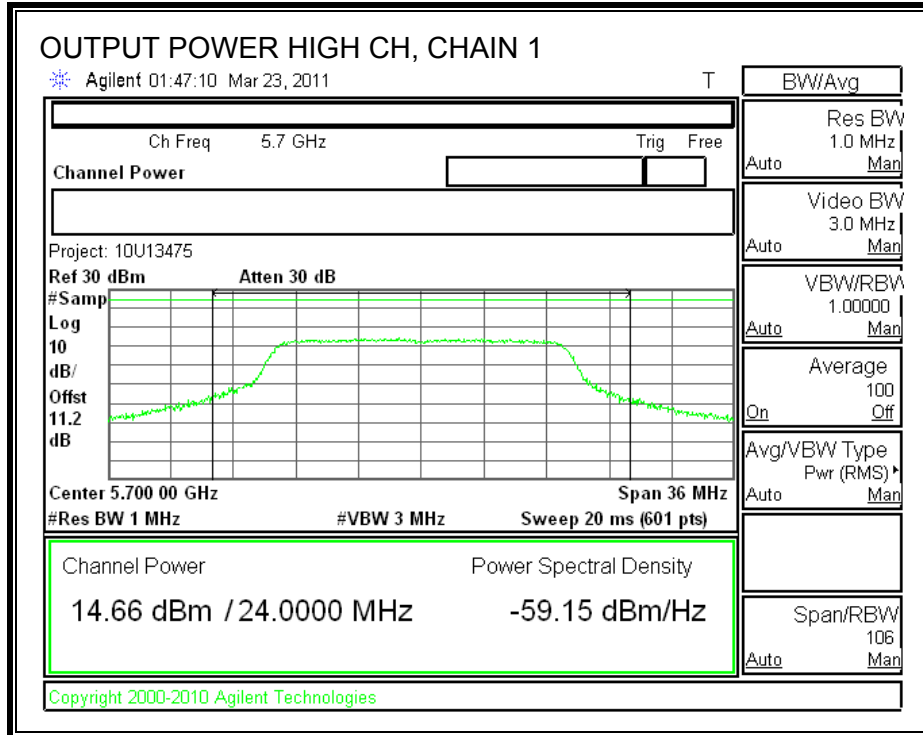
**Individual Chain Results**

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5500	14.72	12.66	14.96	19.00	19.71	-0.71
Mid	5580	14.83	14.51	15.15	19.61	19.71	-0.10
High	5700	14.66	14.82	14.58	19.46	19.63	-0.17

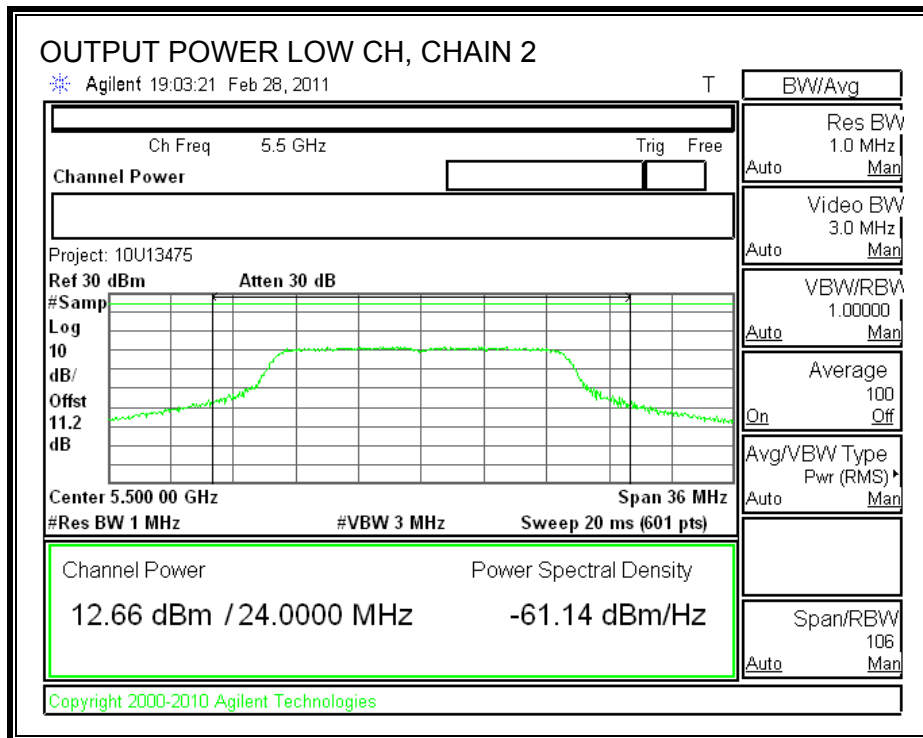
**CHAIN 1 OUTPUT POWER**

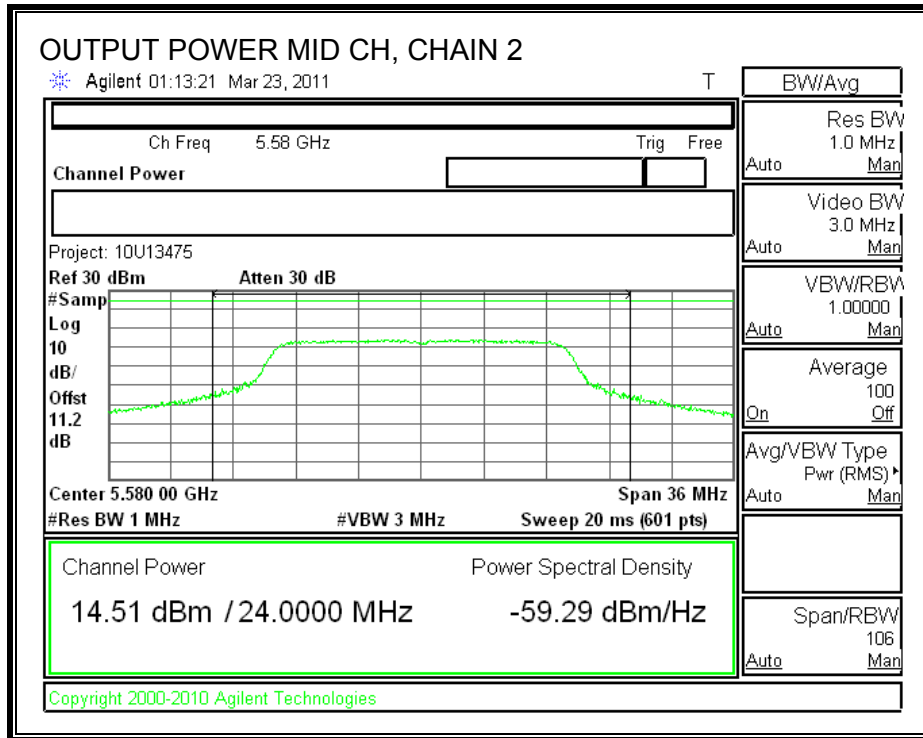




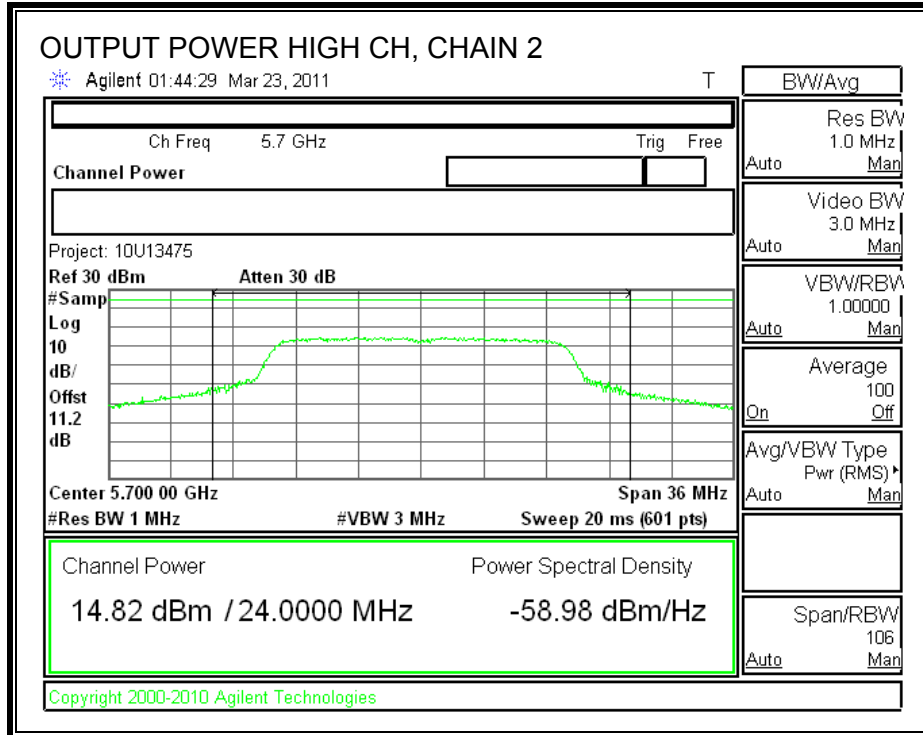


**CHAIN 2 OUTPUT POWER**

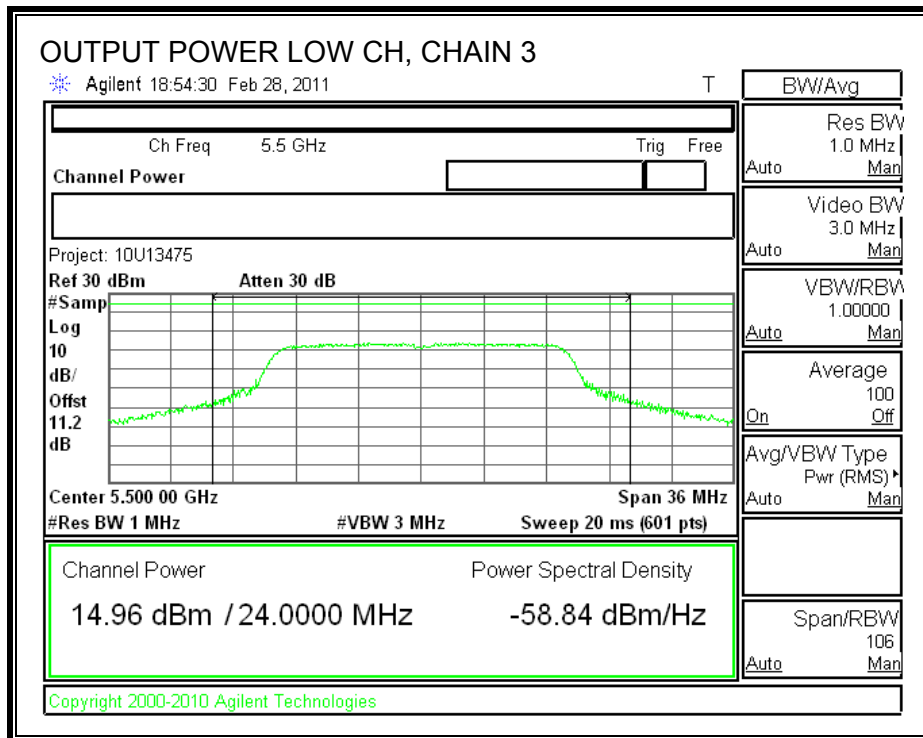


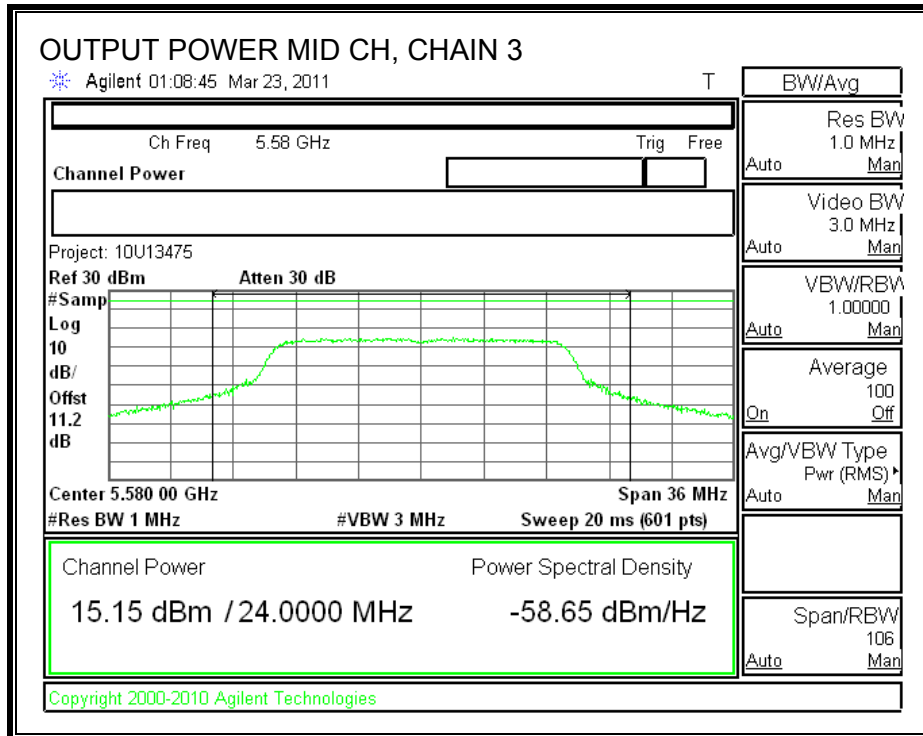


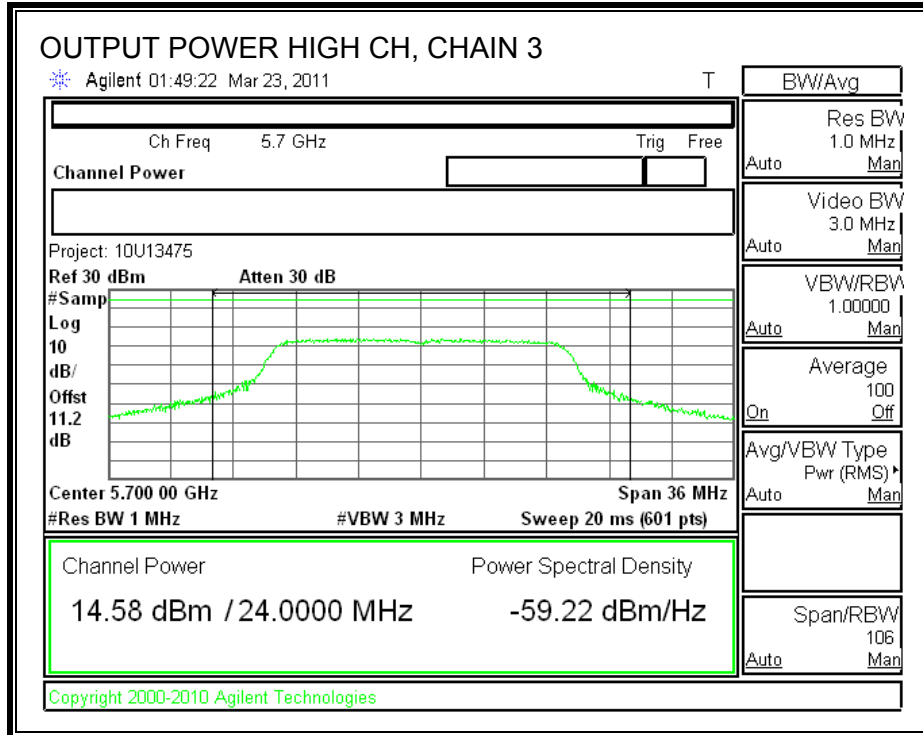




**CHAIN 3 OUTPUT POWER**







### 7.7.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1.0 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)
Low	5500	14.31	12.08	14.26	18.44
Middle	5580	14.49	13.78	14.87	19.17
High	5700	14.20	14.70	14.10	19.11

### 7.7.4. PEAK POWER SPECTRAL DENSITY

#### LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

Antenna Gain (dBi)	10 Log (# Tx Chains) (dB)	Effective Legacy Gain (dBi)
5.5	4.77	10.27

For the 5.47-5.725 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

The maximum effective antenna gain is 10.27 dBi, therefore the limit is 6.73 dBm.

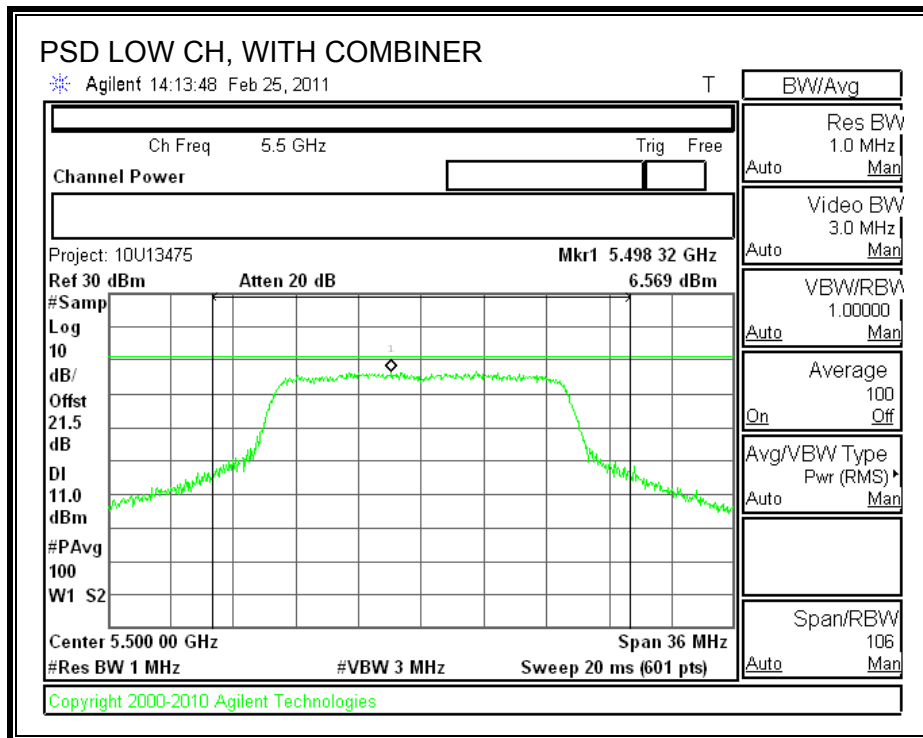
#### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

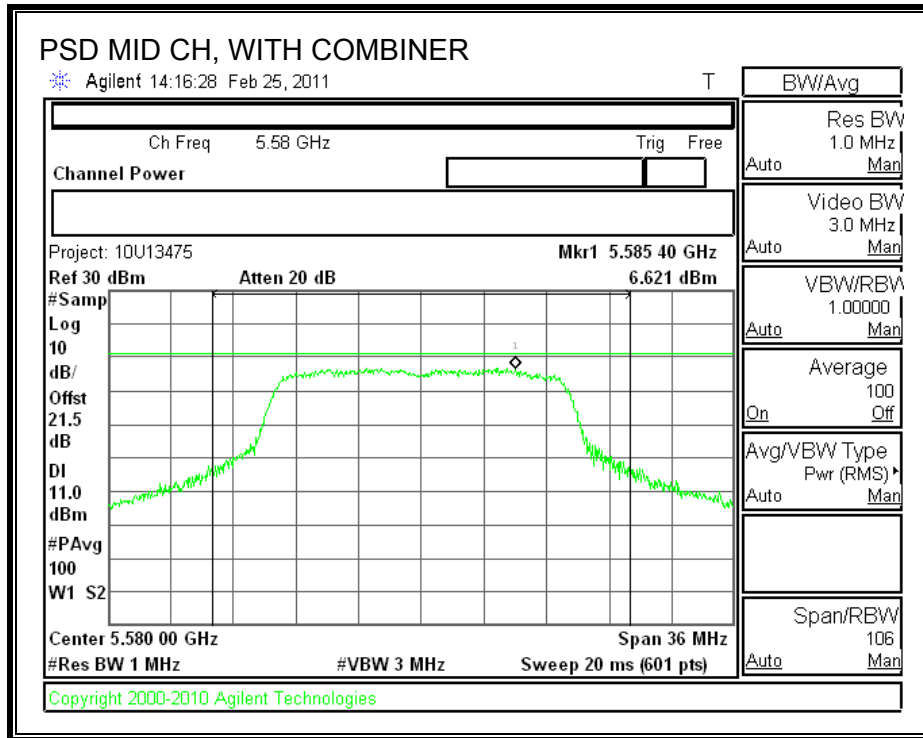
**RESULTS**

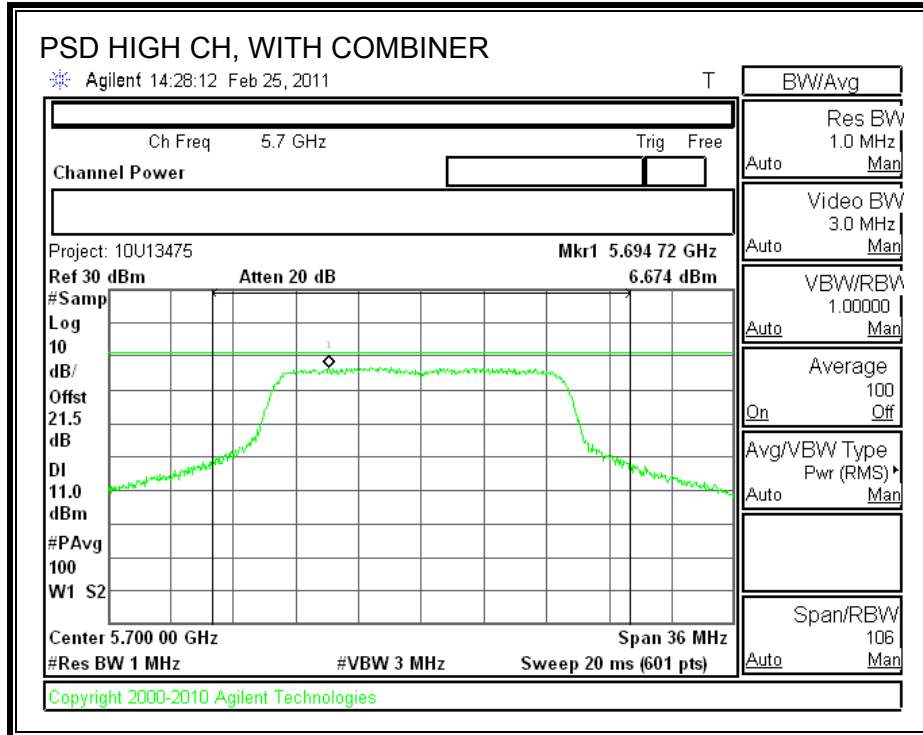
<b>Channel</b>	<b>Frequency (MHz)</b>	<b>PPSD With Combiner (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
<b>Low</b>	<b>5500</b>	<b>6.569</b>	<b>6.73</b>	<b>-0.161</b>
<b>Middle</b>	<b>5580</b>	<b>6.621</b>	<b>6.73</b>	<b>-0.109</b>
<b>High</b>	<b>5700</b>	<b>6.674</b>	<b>6.73</b>	<b>-0.056</b>

**POWER SPECTRAL DENSITY WITH COMBINER**









## **7.7.5. PEAK EXCURSION**

### **LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

### **TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

**RESULTS**

**CHAIN 1**

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5500	9.19	13	-3.81
Middle	5580	9.27	13	-3.73
High	5700	8.41	13	-4.59

**CHAIN 2**

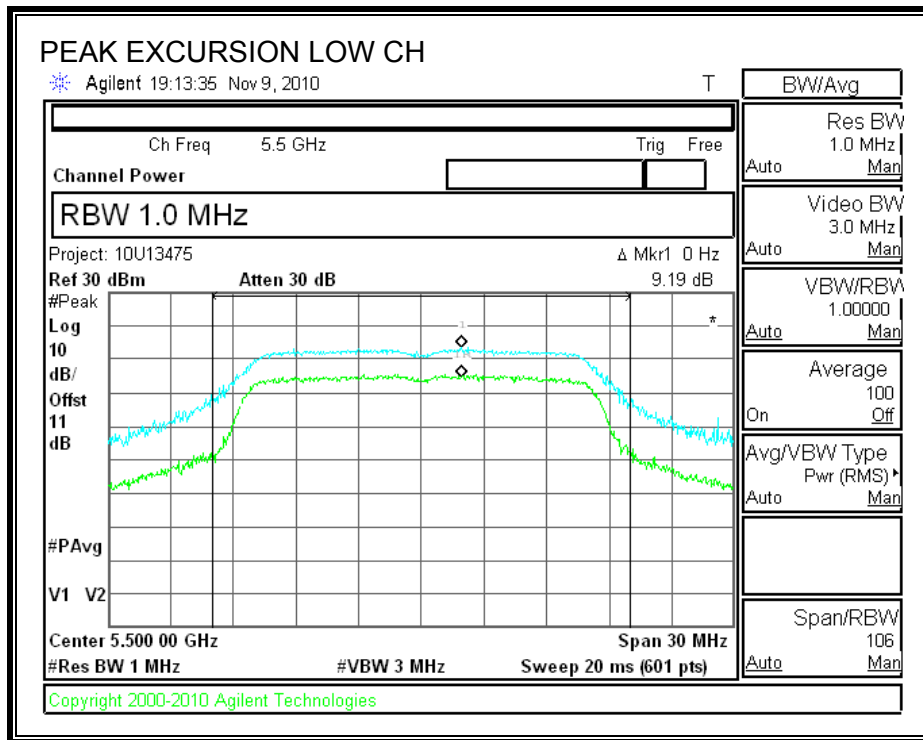
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5500	8.67	13	-4.33
Middle	5580	9.09	13	-3.91
High	5700	9.30	13	-3.70

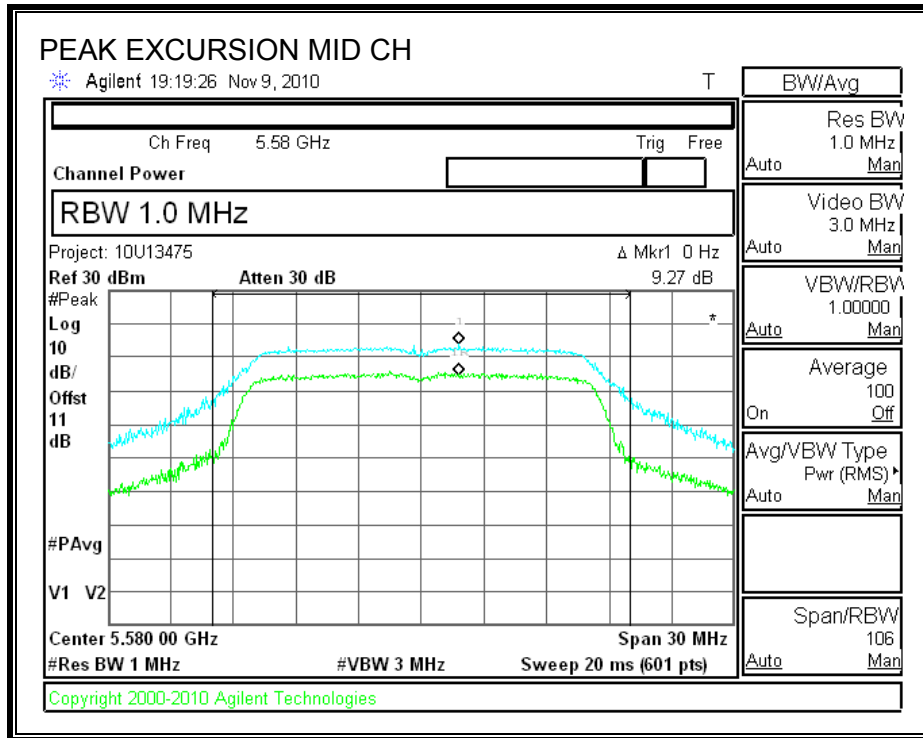
**CHAIN 3**

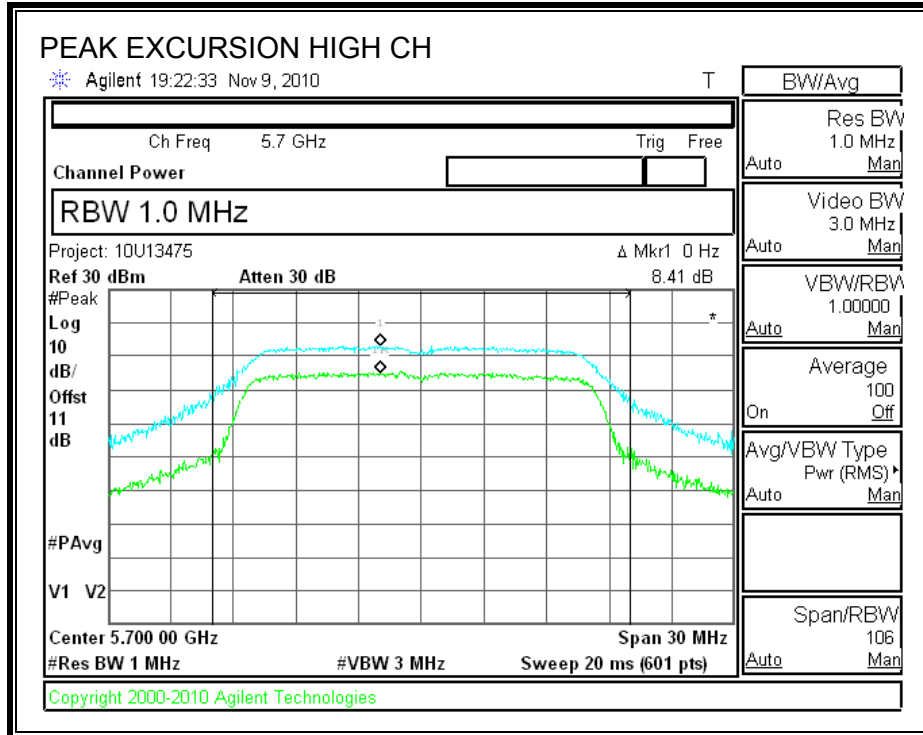
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5500	10.30	13	-2.70
Middle	5580	10.66	13	-2.34
High	5700	9.85	13	-3.15

**CHAIN 1**

**PEAK EXCURSION**

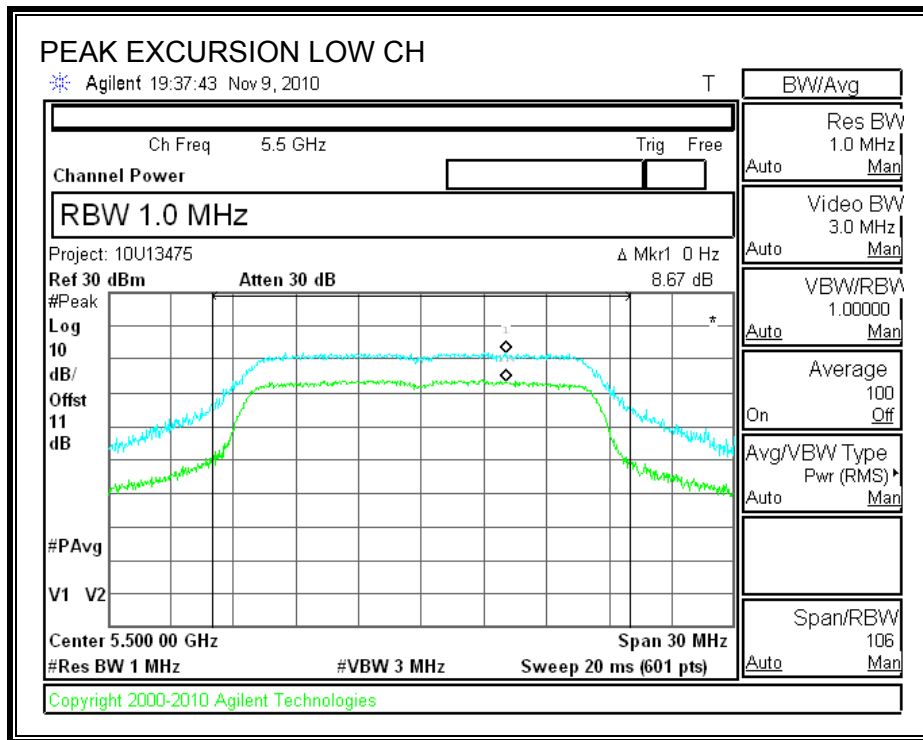




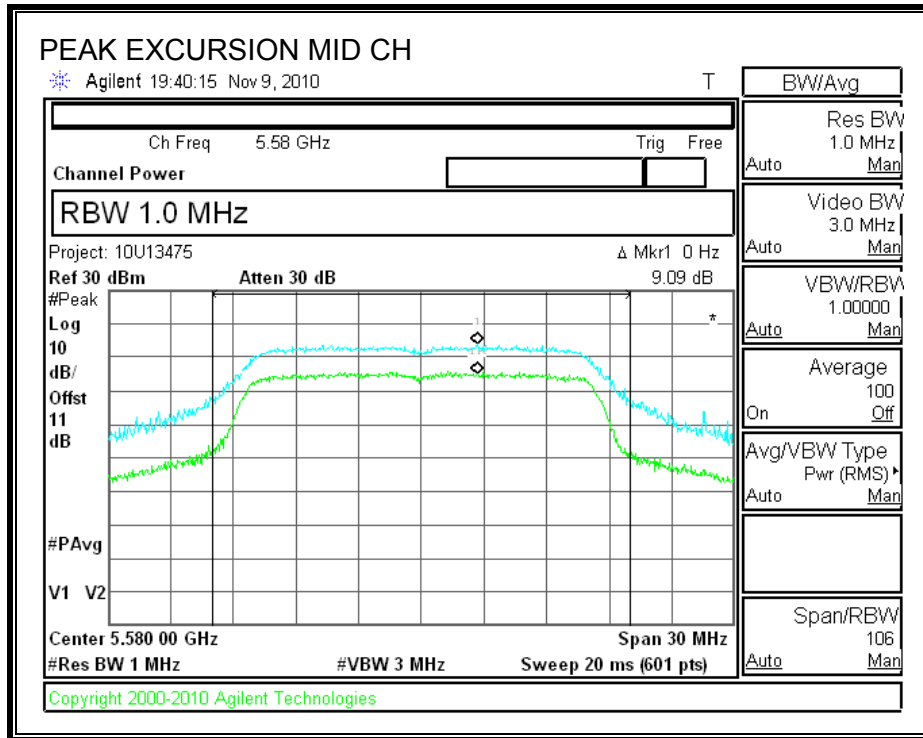


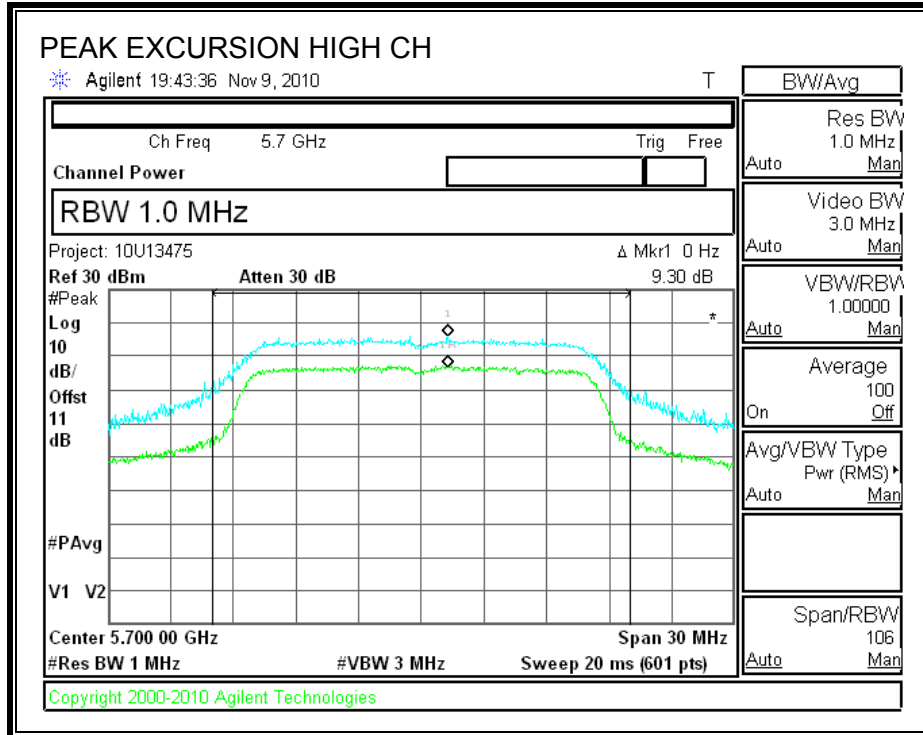
**CHAIN 2**

**PEAK EXCURSION**



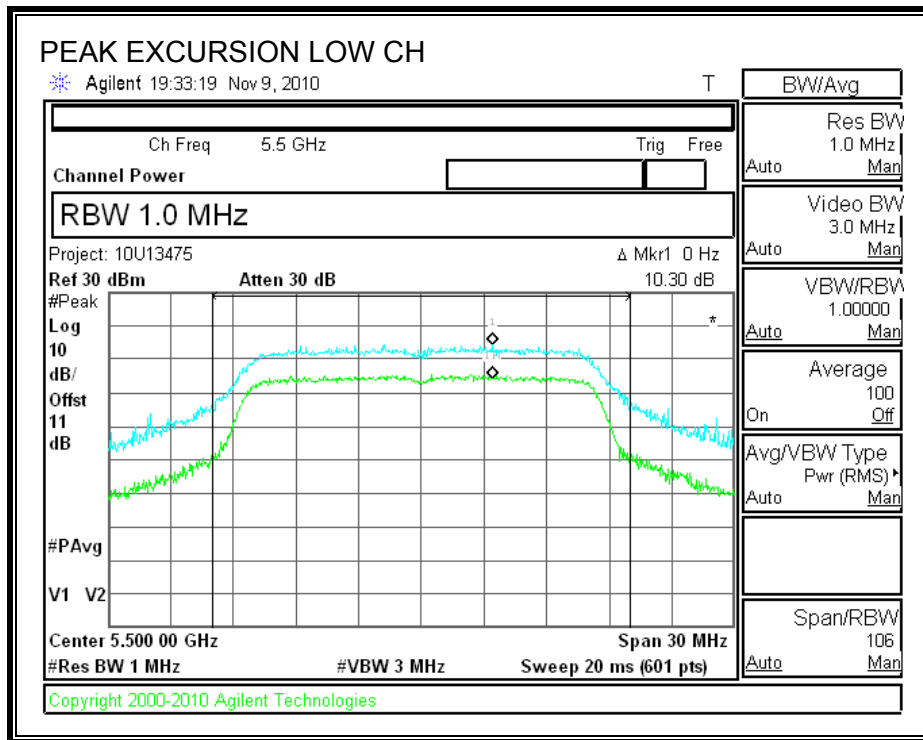


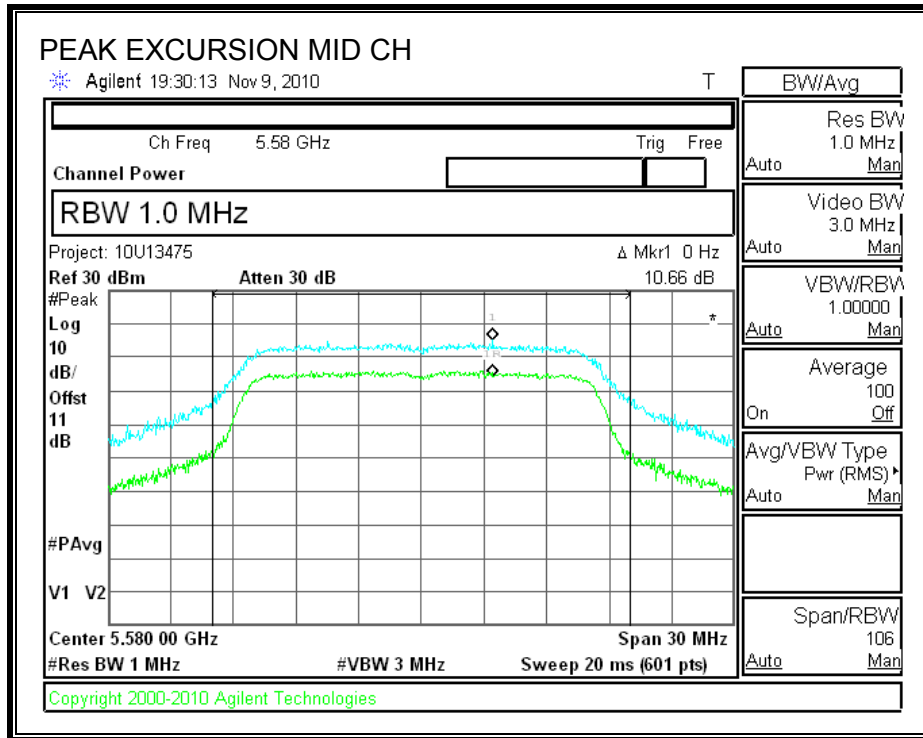


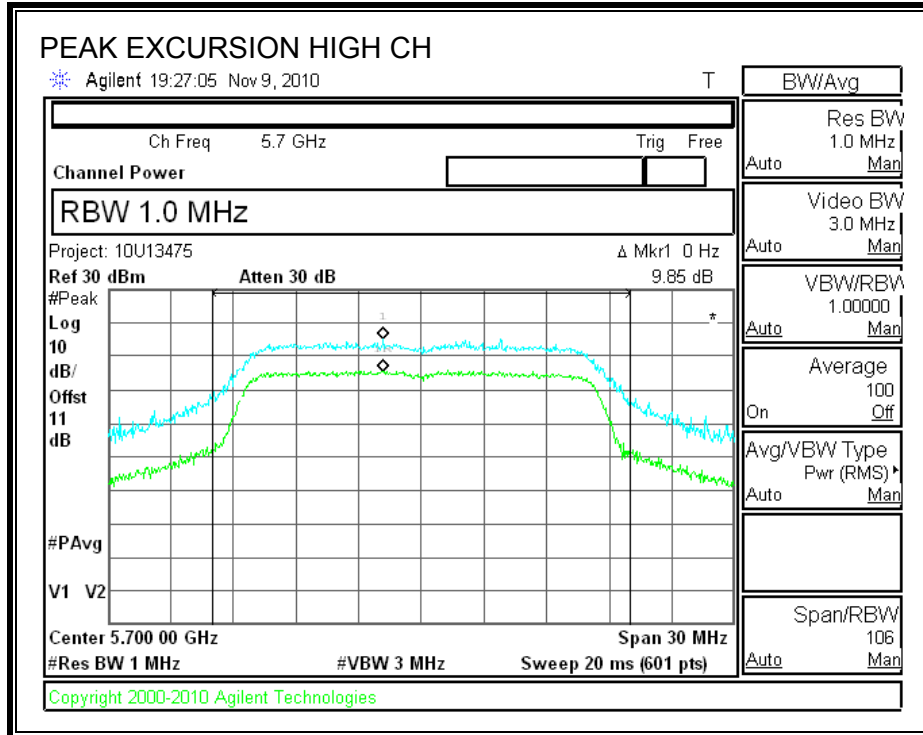


**CHAIN 3**

**PEAK EXCURSION**







## 7.7.6. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

FCC §15.407 (b) (3)

IC RSS-210 A9.3 (3)

For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm / MHz.

### TEST PROCEDURE

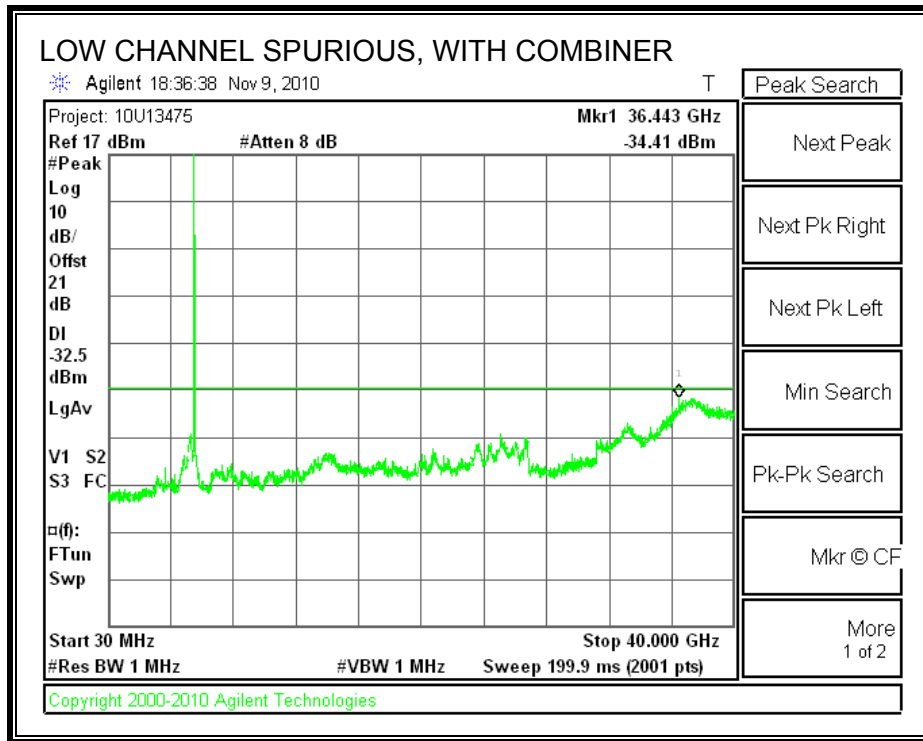
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

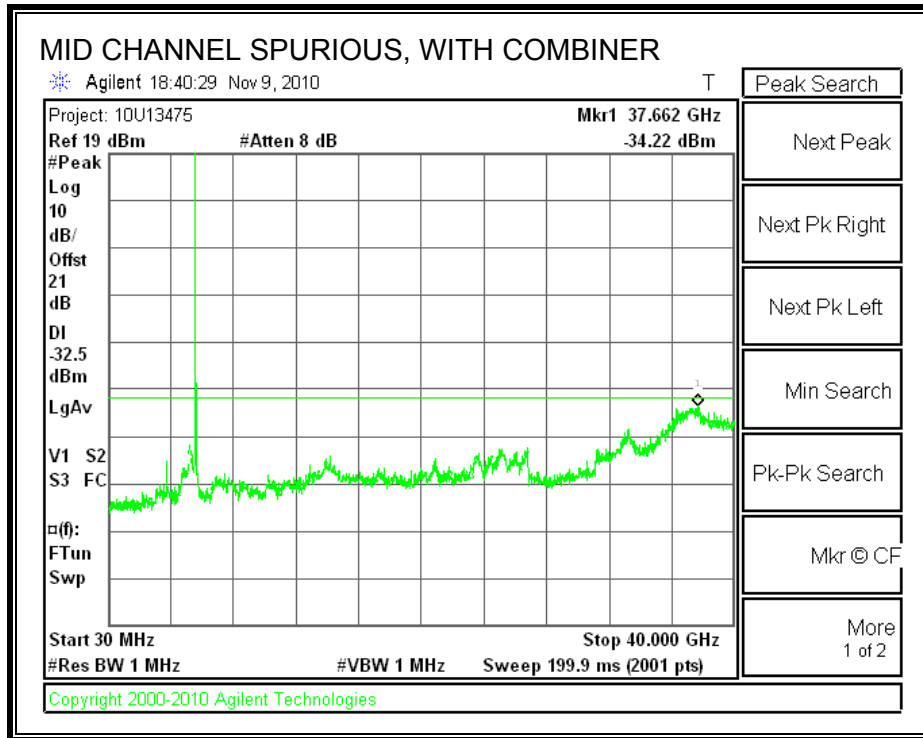
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

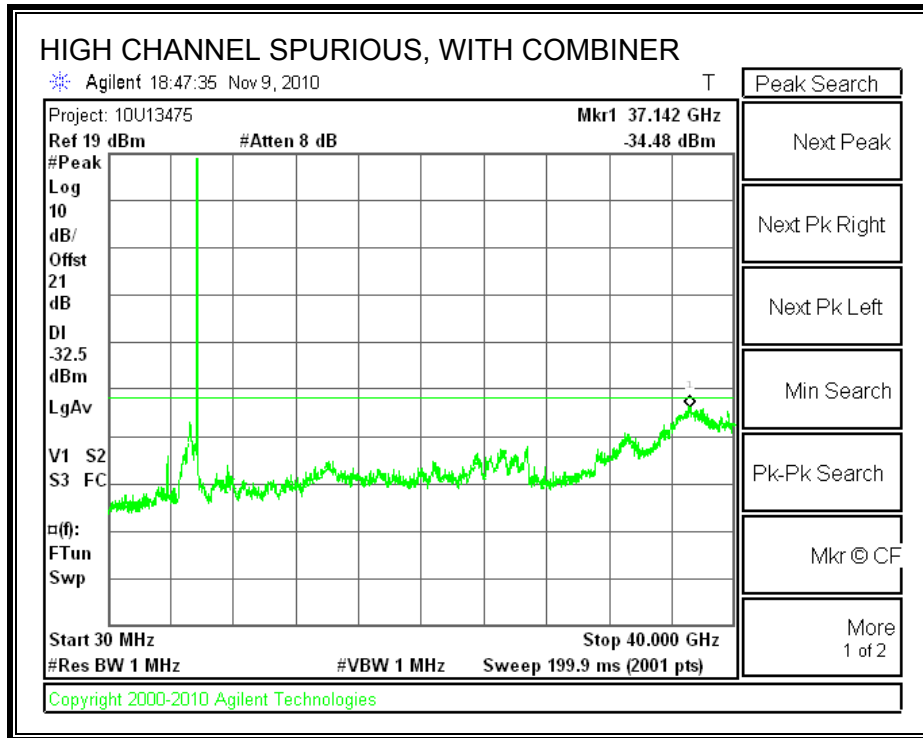
**RESULTS**

**SPURIOUS EMISSIONS WITH COMBINER**

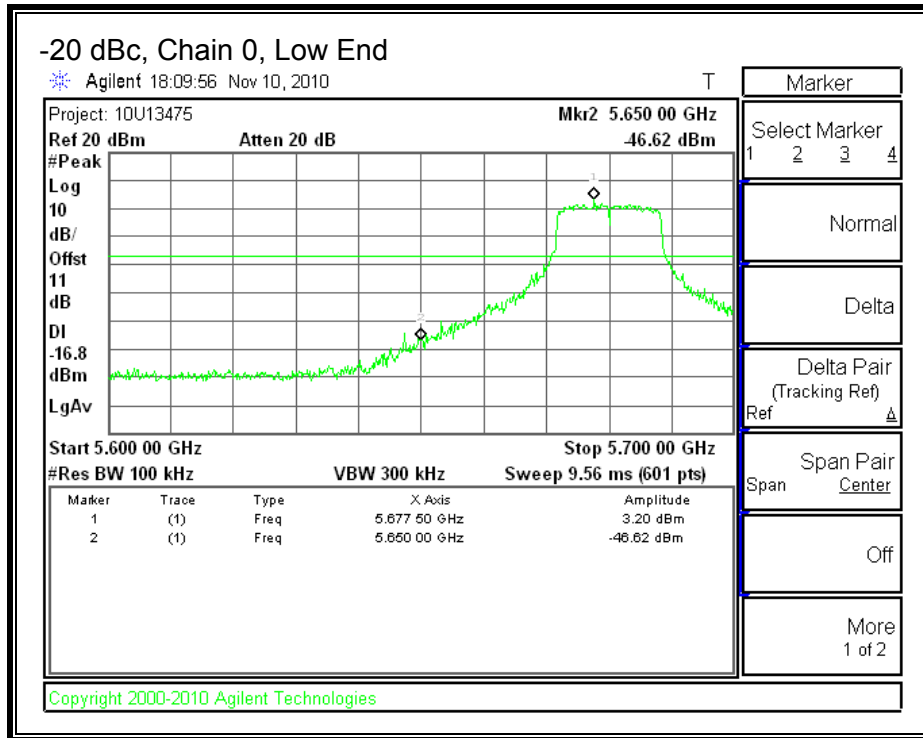


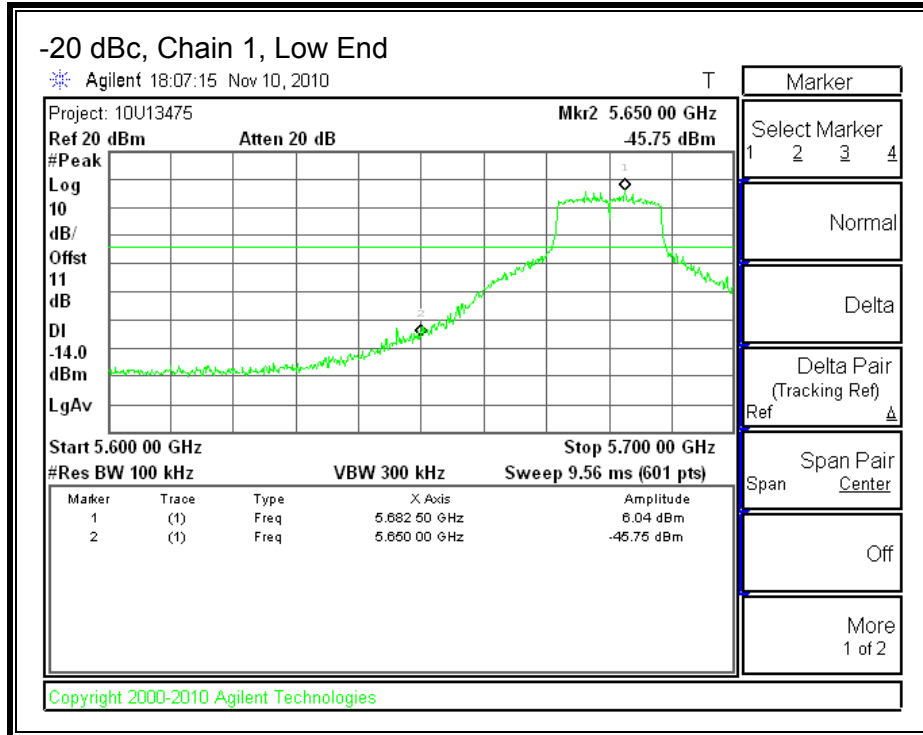


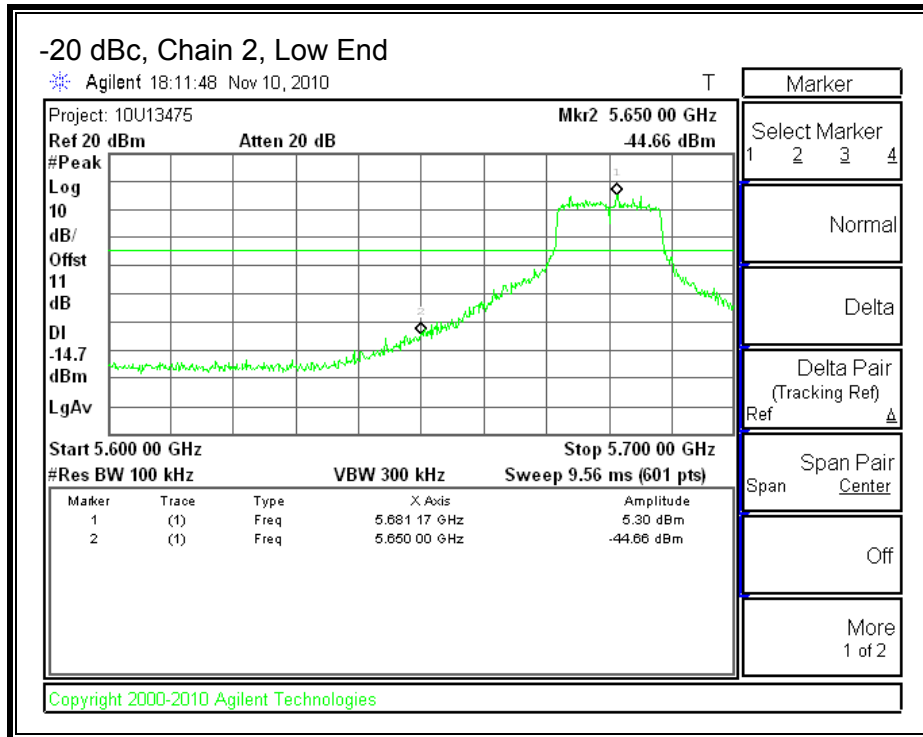


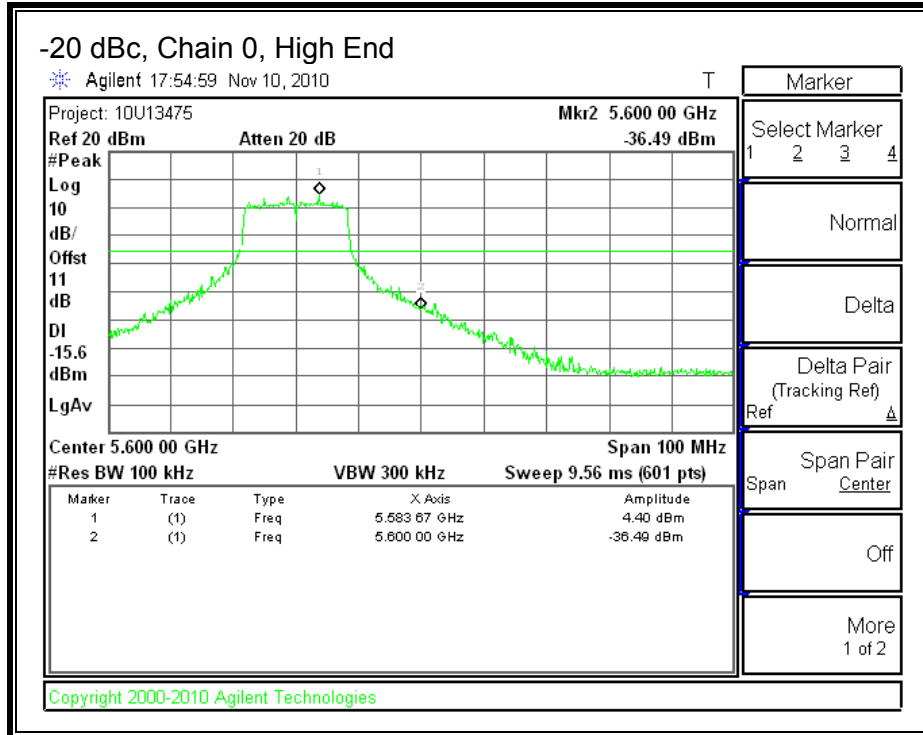


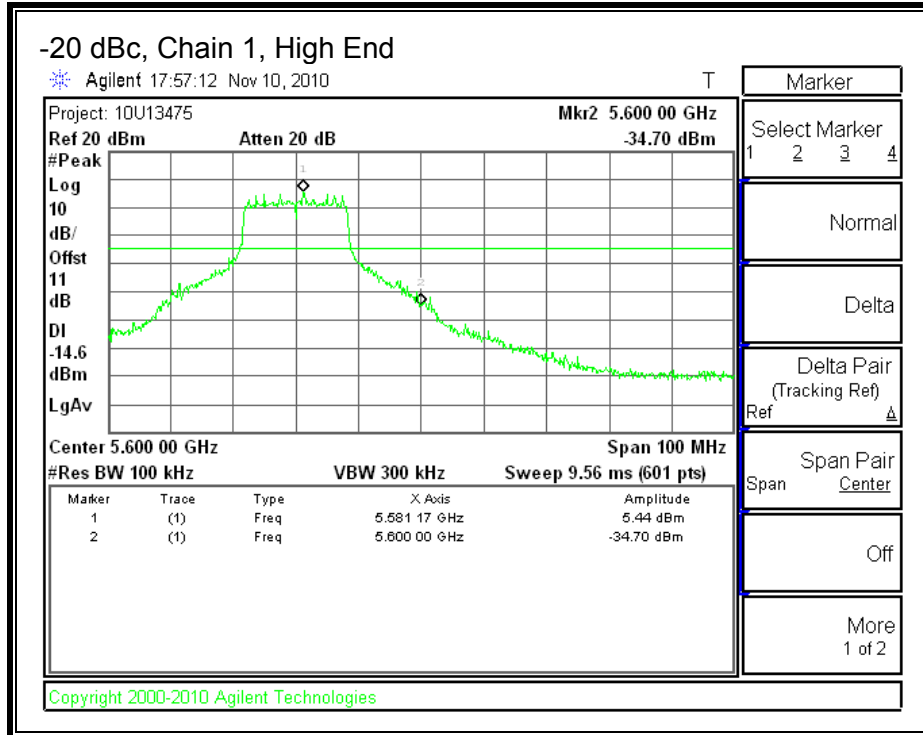
**-20 dBc RF CONDUCTED SPURIOUS IN THE NOTCH BAND OF 5.6-5.65 GHz**

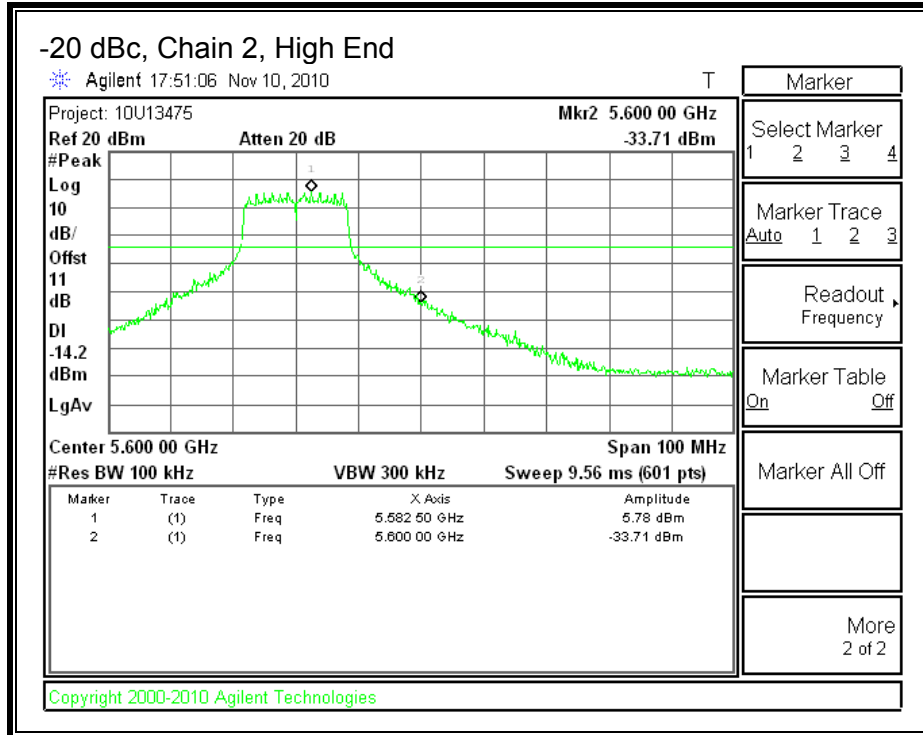












## 7.8. 802.11n THREE CHAINS HT20 MODE IN THE 5.6 GHz BAND

### 7.8.1. 26 dB and 99% BANDWIDTH

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

#### RESULTS

##### CHAIN 1

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5500	21.813	17.7303
Middle	5580	21.184	17.7186
High	5700	21.329	17.7968

##### CHAIN 2

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5500	22.422	17.6334
Middle	5580	21.845	17.6054
High	5700	23.894	17.7881

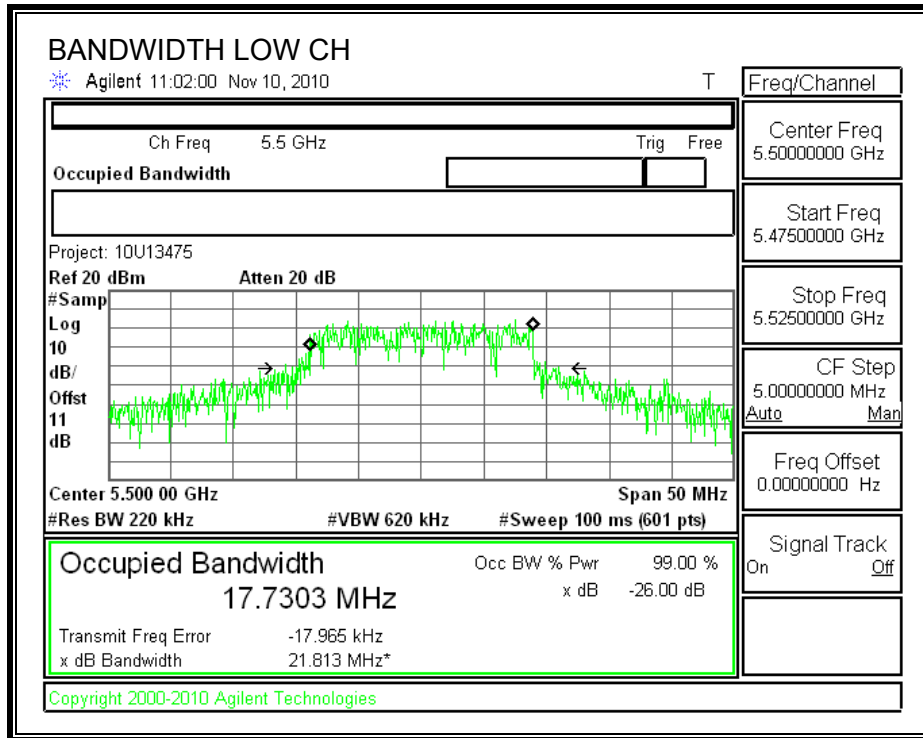
##### CHAIN 3

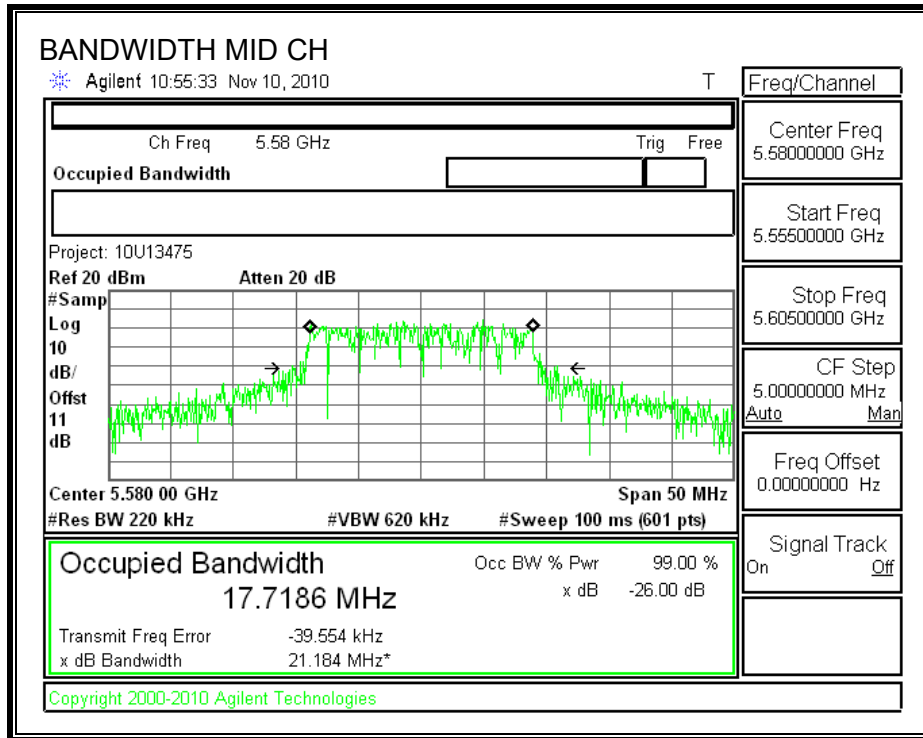
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5500	20.9	17.8508
Middle	5580	20.403	17.5262
High	5700	21.831	17.6642

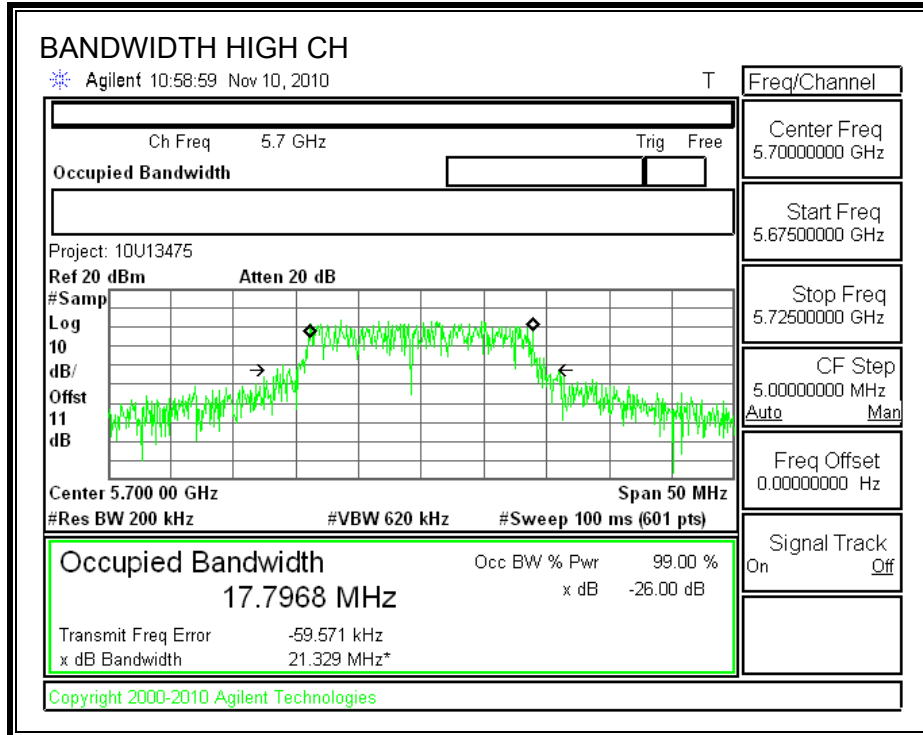


**CHAIN 1**

**26 dB and 99% BANDWIDTH**

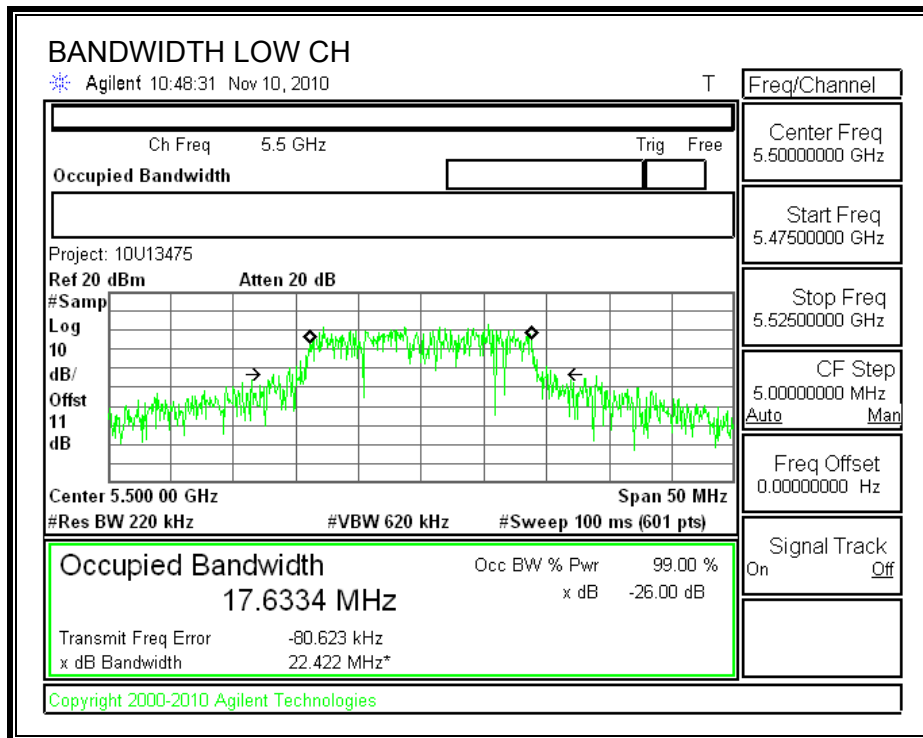


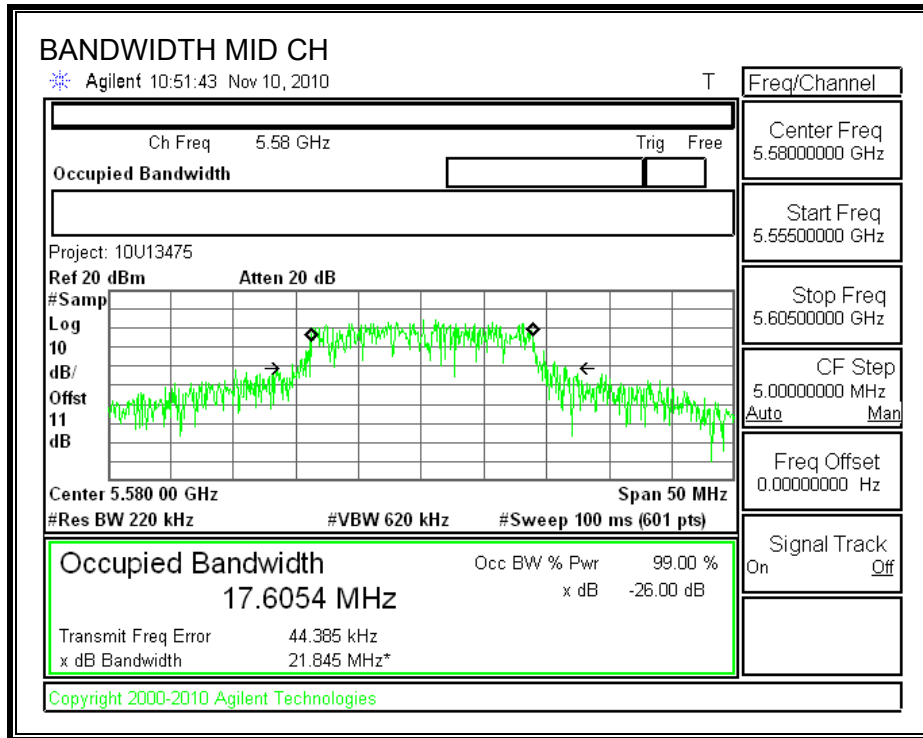


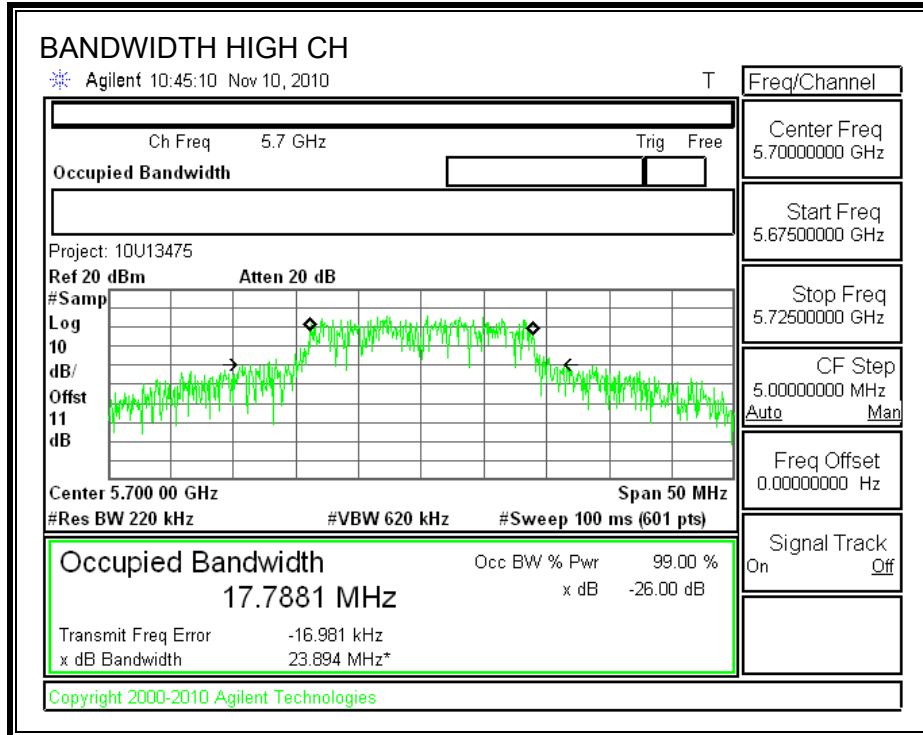


**CHAIN 2**

**26 dB and 99% BANDWIDTH**

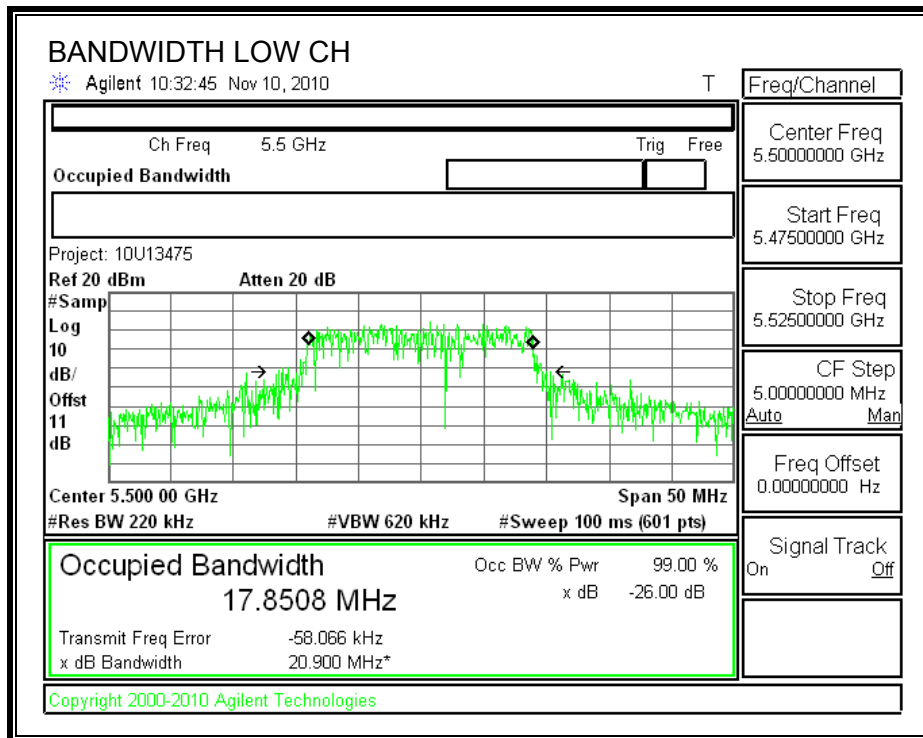


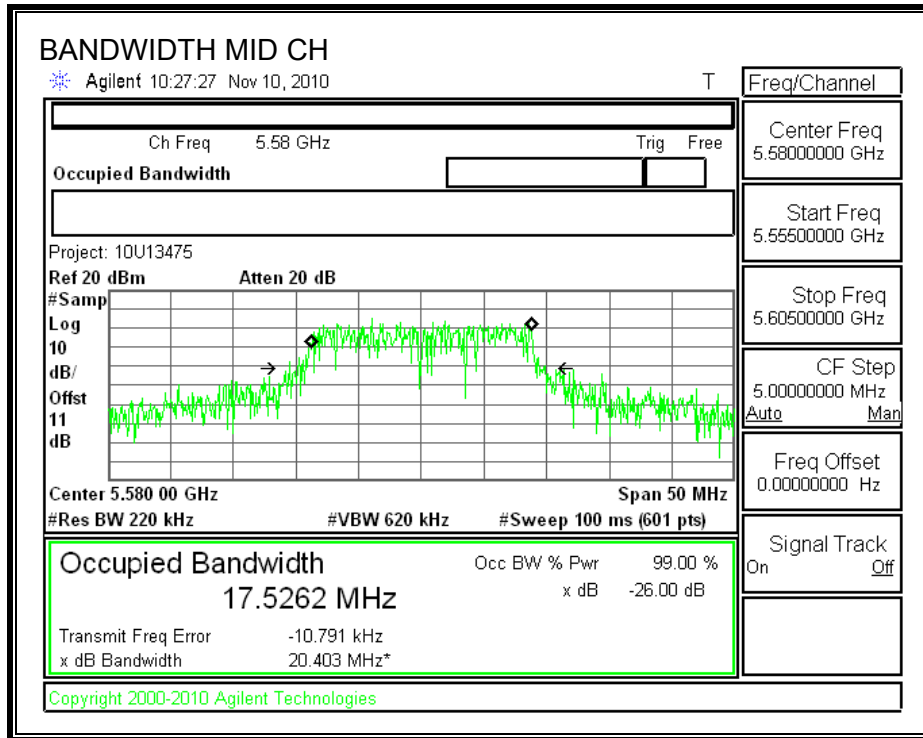




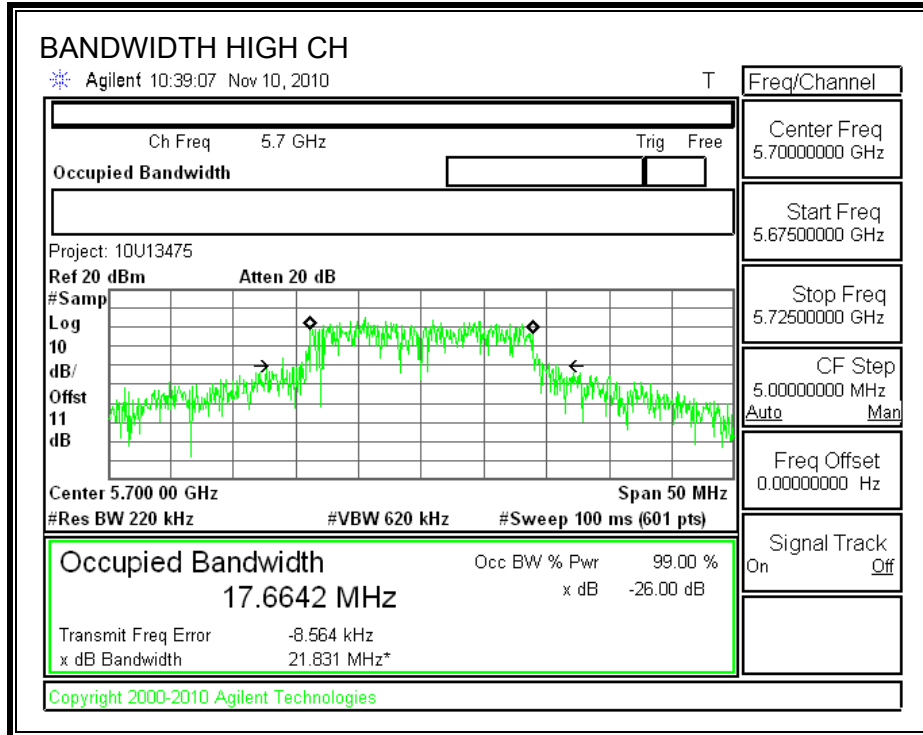
**CHAIN 3**

**26 dB and 99% BANDWIDTH**









## 7.8.2. OUTPUT POWER

### LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.47-5.725 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

**RESULTS**

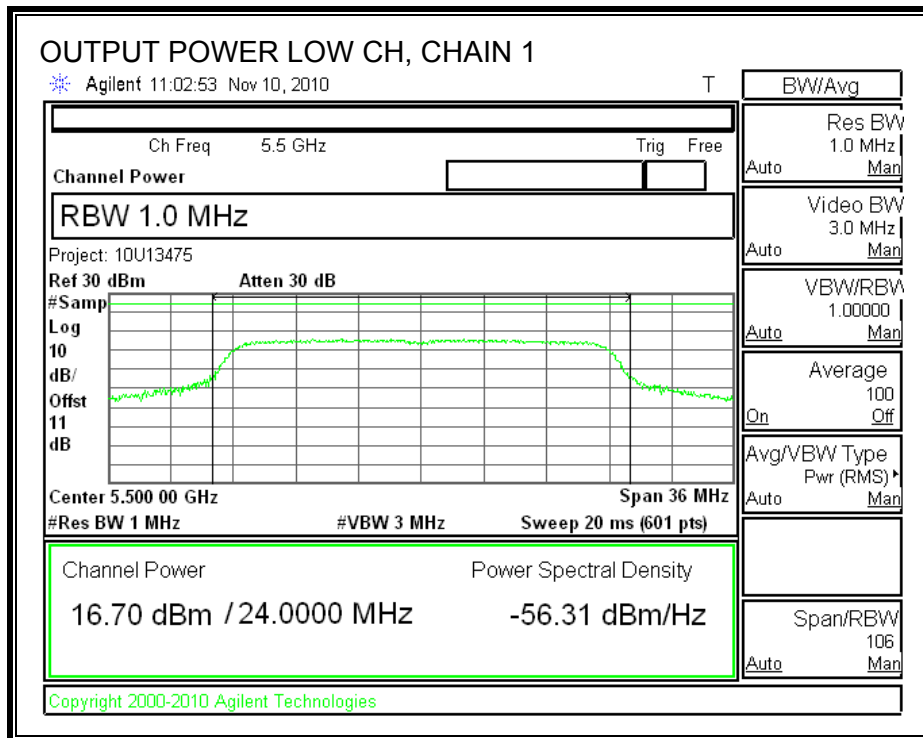
**Limit**

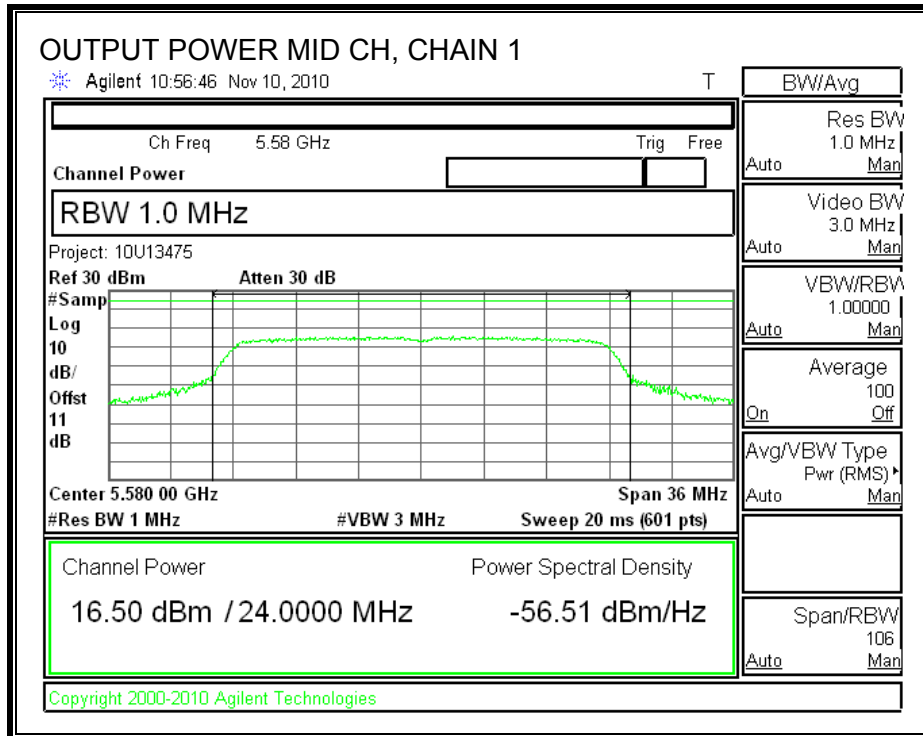
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5500	24	20.9	24.20	5.50	24.00
Mid	5580	24	20.403	24.10	5.50	24.00
High	5700	24	21.329	24.29	5.50	24.00

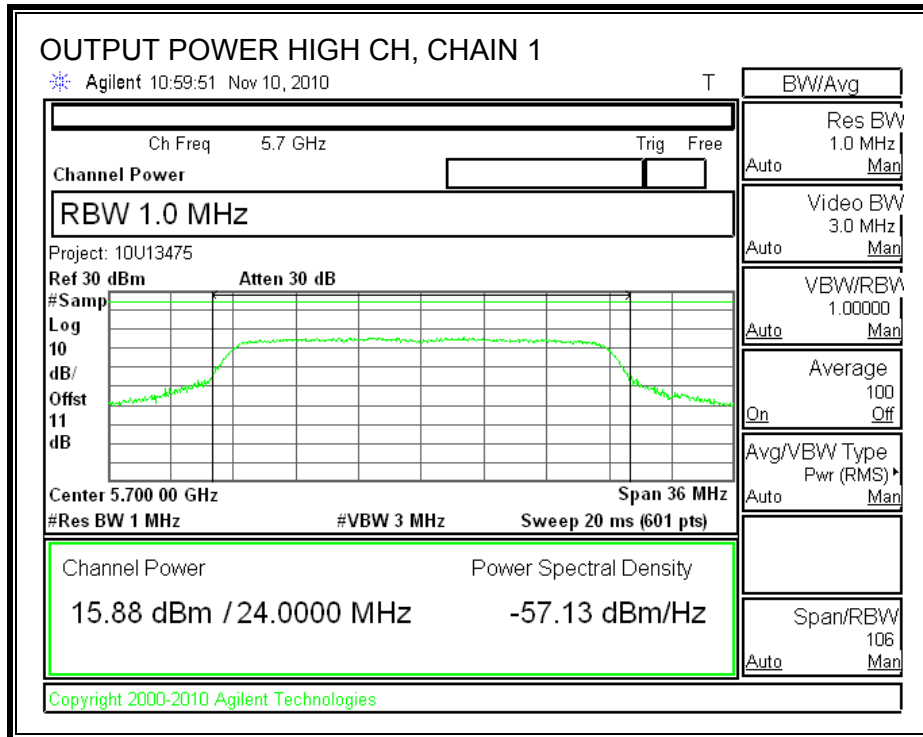
**Individual Chain Results**

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5500	16.70	15.50	16.31	20.97	24.00	-3.03
Mid	5580	16.50	16.92	16.43	21.39	24.00	-2.61
High	5700	15.88	18.10	16.79	21.79	24.00	-2.21

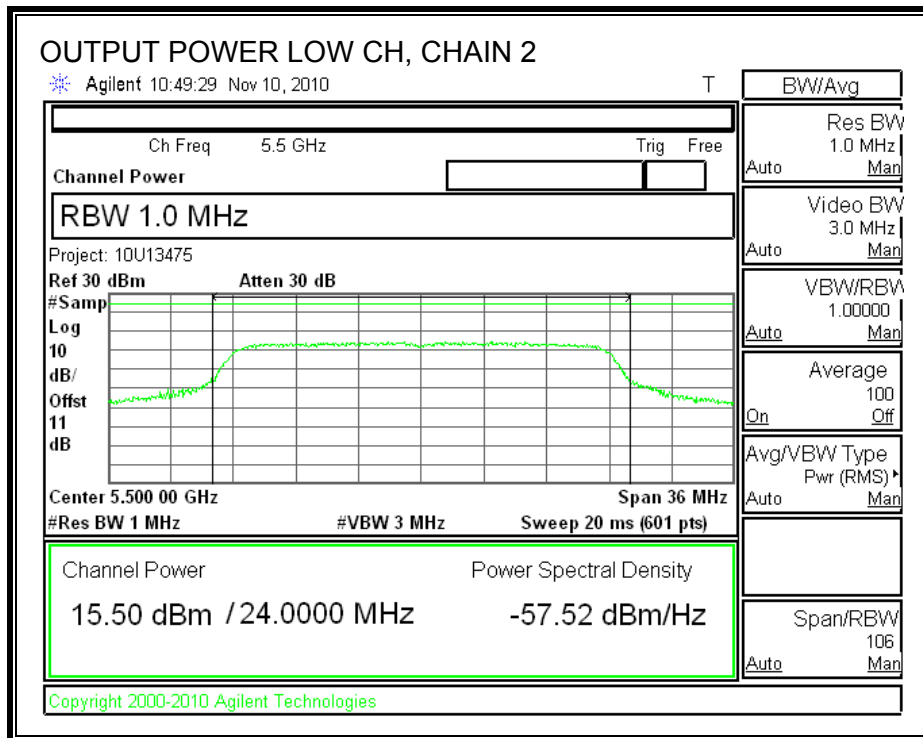
**CHAIN 1 OUTPUT POWER**

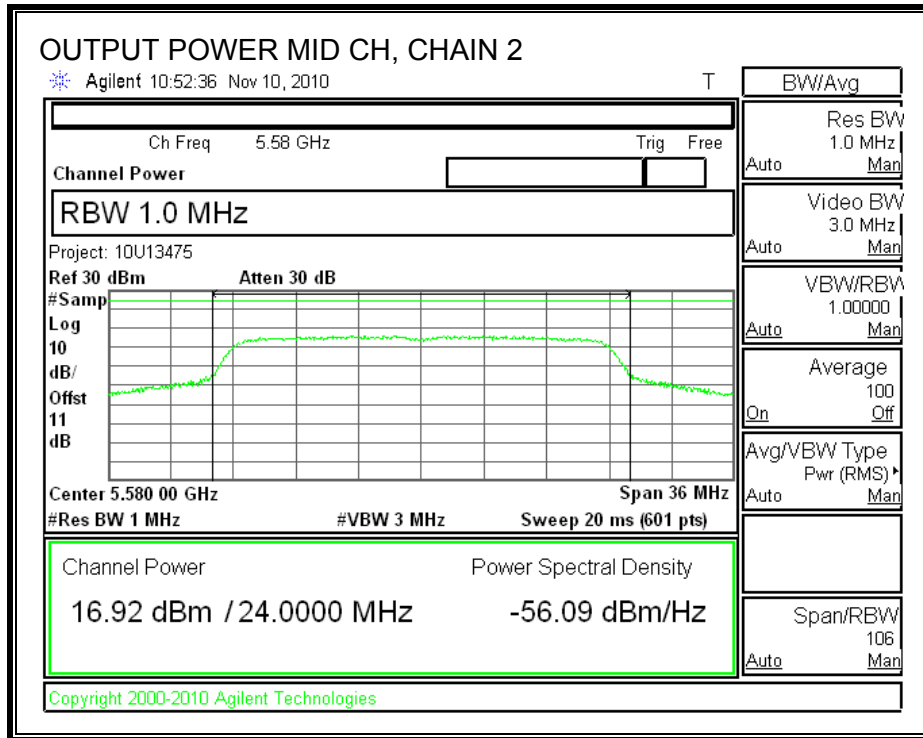




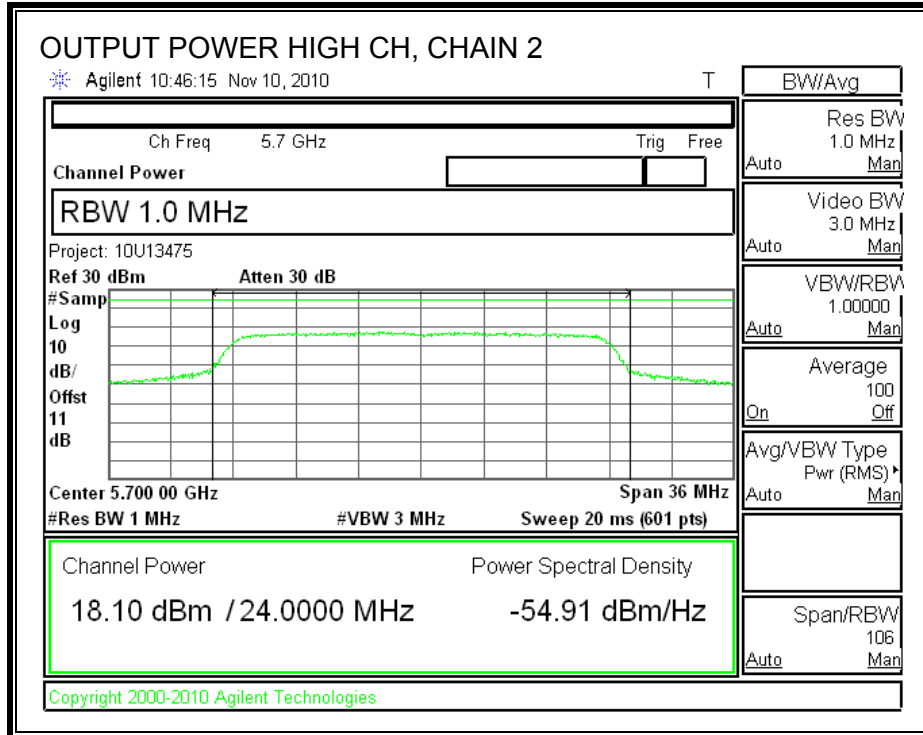


**CHAIN 2 OUTPUT POWER**

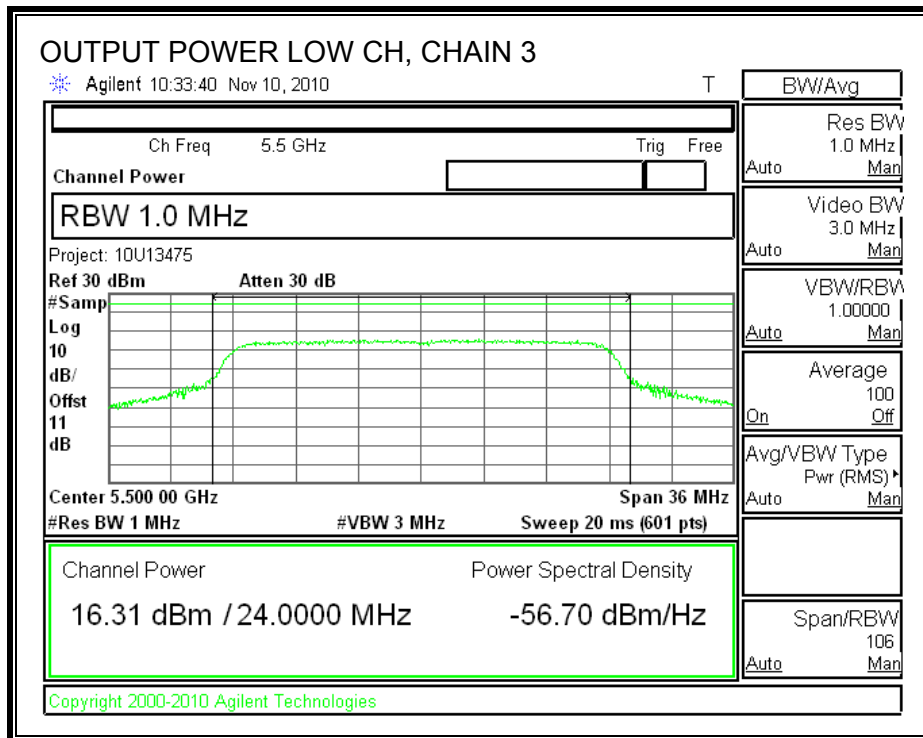


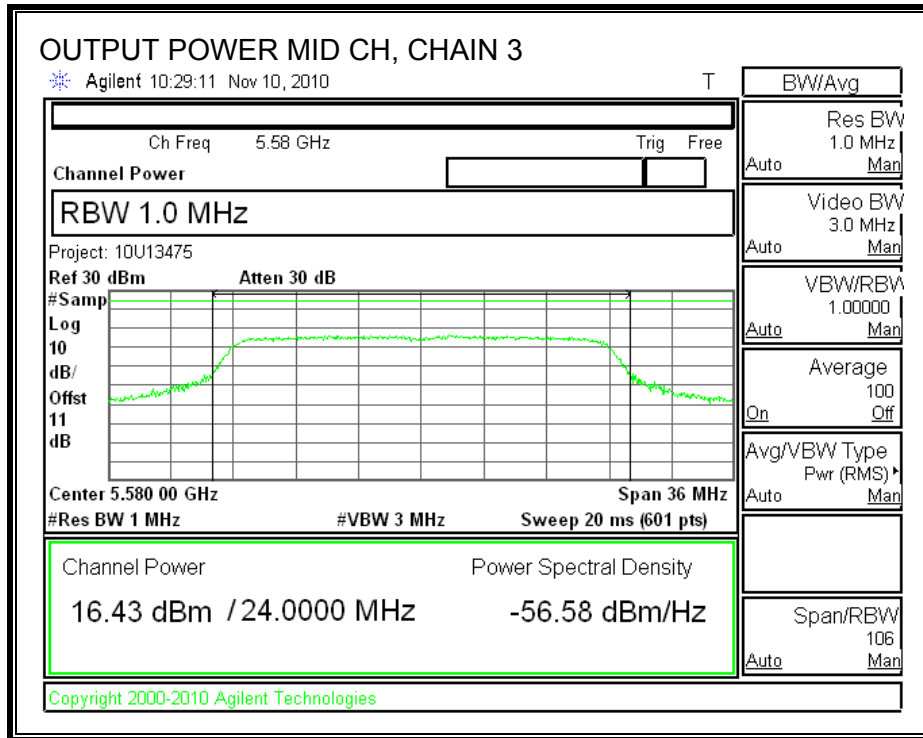


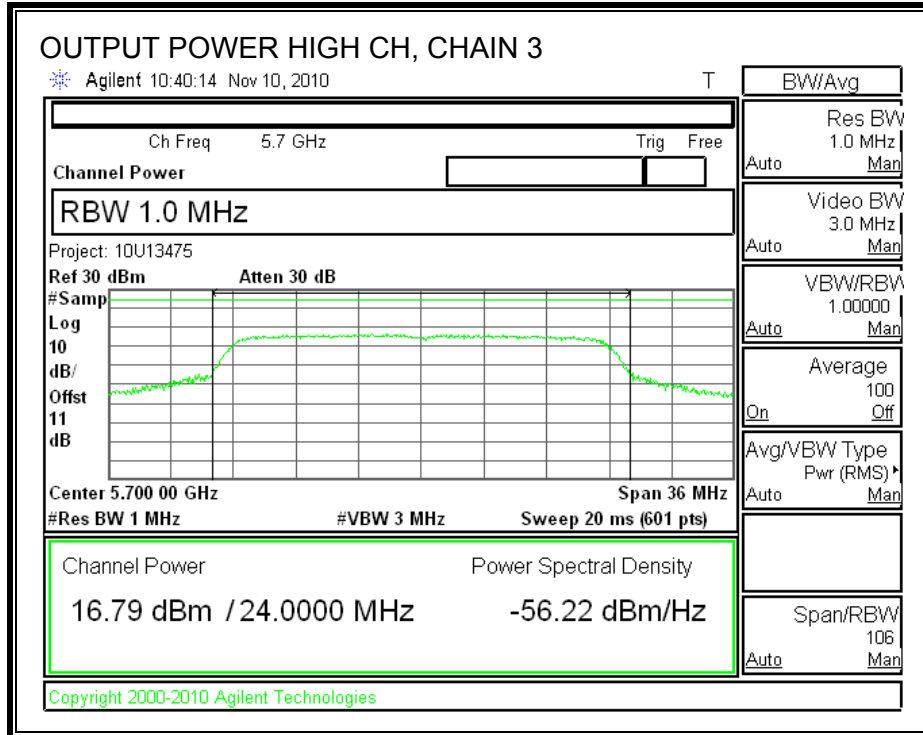




**CHAIN 3 OUTPUT POWER**







### 7.8.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1.0 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)
Low	5500	16.23	15.12	16.01	20.58
Middle	5580	15.83	16.35	16.22	20.91
High	5700	15.56	17.74	16.22	21.38

## 7.8.4. PEAK POWER SPECTRAL DENSITY

### LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.47-5.725 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 11 dBm.

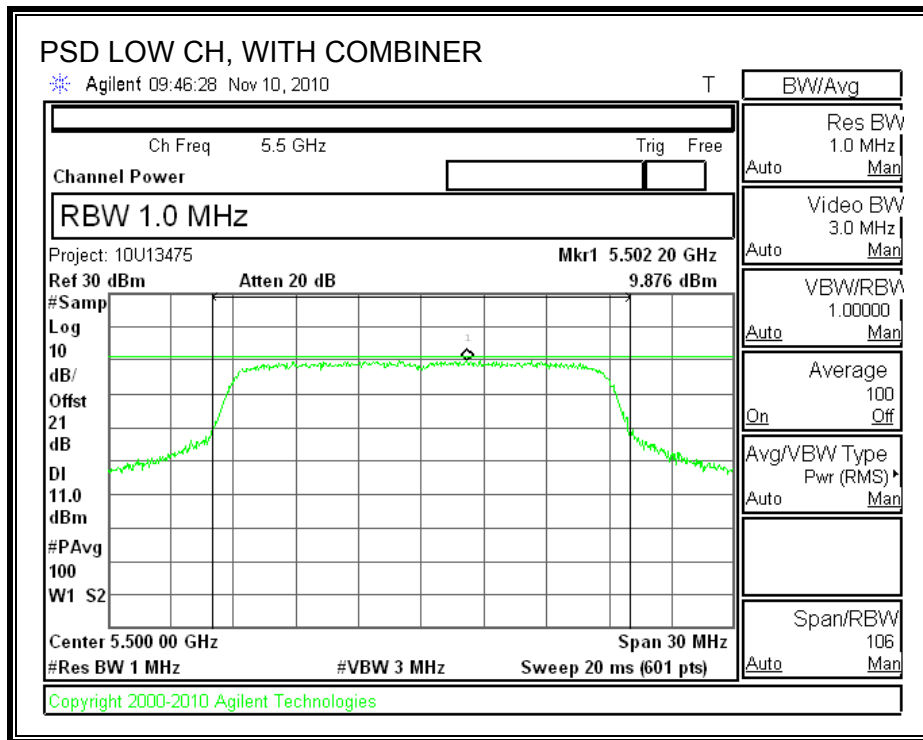
### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

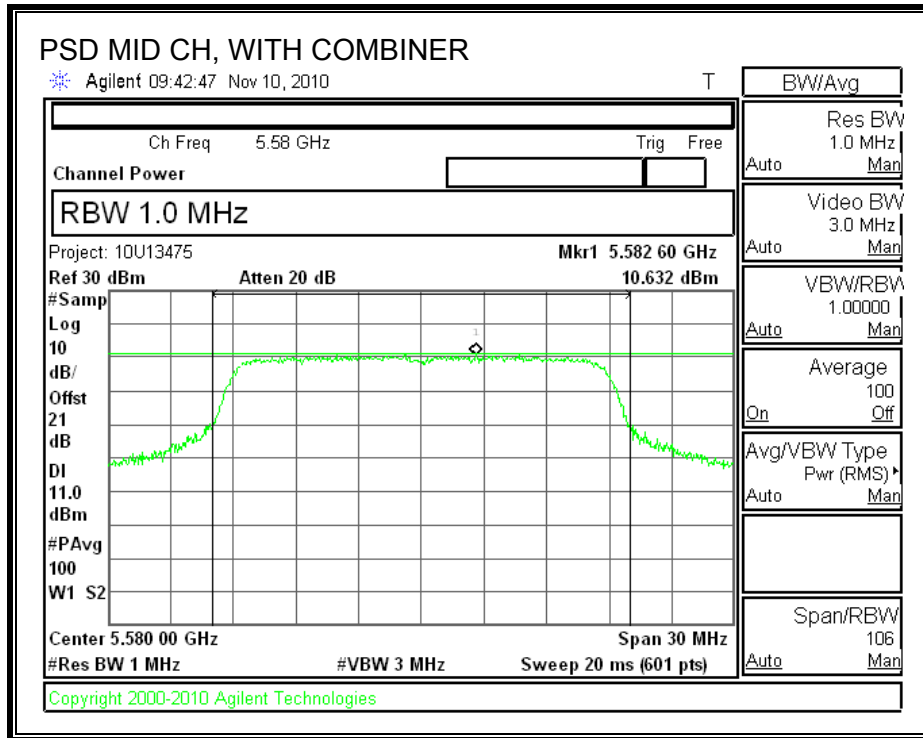
**RESULTS**

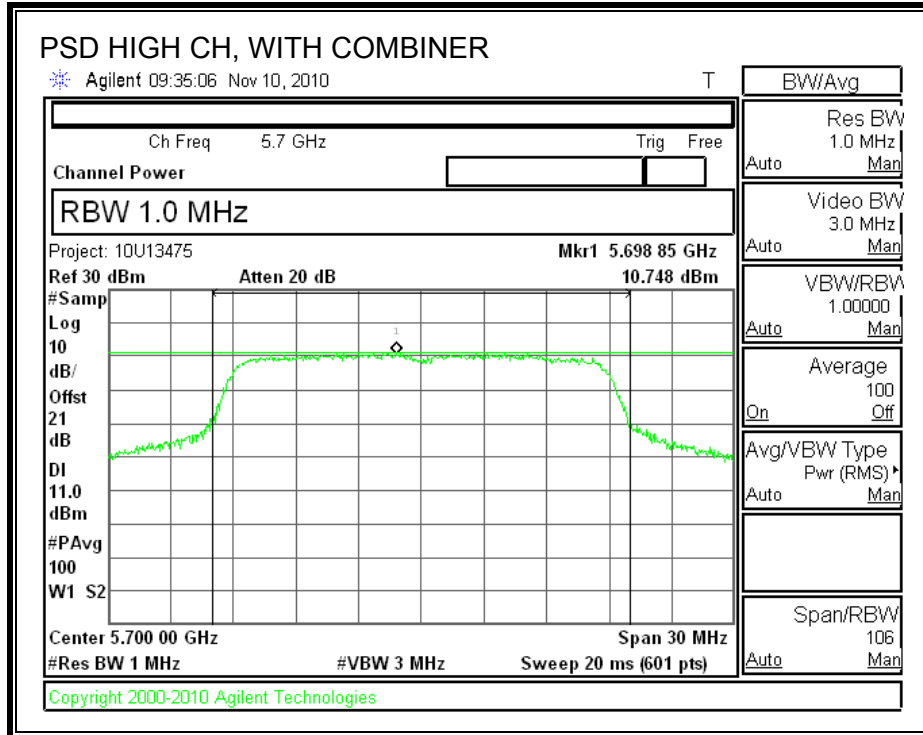
<b>Channel</b>	<b>Frequency (MHz)</b>	<b>PPSD With Combiner (dBm)</b>	<b>Limit (dBm)</b>	<b>Margin (dB)</b>
<b>Low</b>	<b>5500</b>	<b>9.876</b>	<b>11</b>	<b>-1.124</b>
<b>Middle</b>	<b>5580</b>	<b>10.632</b>	<b>11</b>	<b>-0.368</b>
<b>High</b>	<b>5700</b>	<b>10.748</b>	<b>11</b>	<b>-0.252</b>

**POWER SPECTRAL DENSITY WITH COMBINER**









## **7.8.5. PEAK EXCURSION**

### **LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

### **TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

**RESULTS**

**CHAIN 1**

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5500	9.95	13	-3.05
Middle	5580	10.44	13	-2.56
High	5700	10.60	13	-2.40

**CHAIN 2**

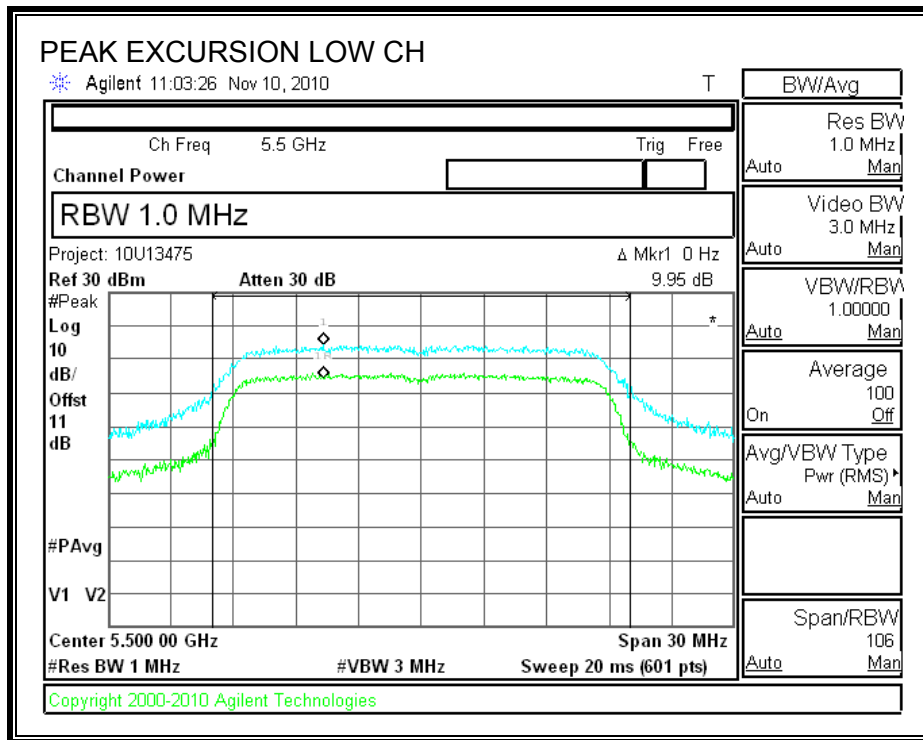
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5500	11.36	13	-1.64
Middle	5580	9.63	13	-3.37
High	5700	10.16	13	-2.84

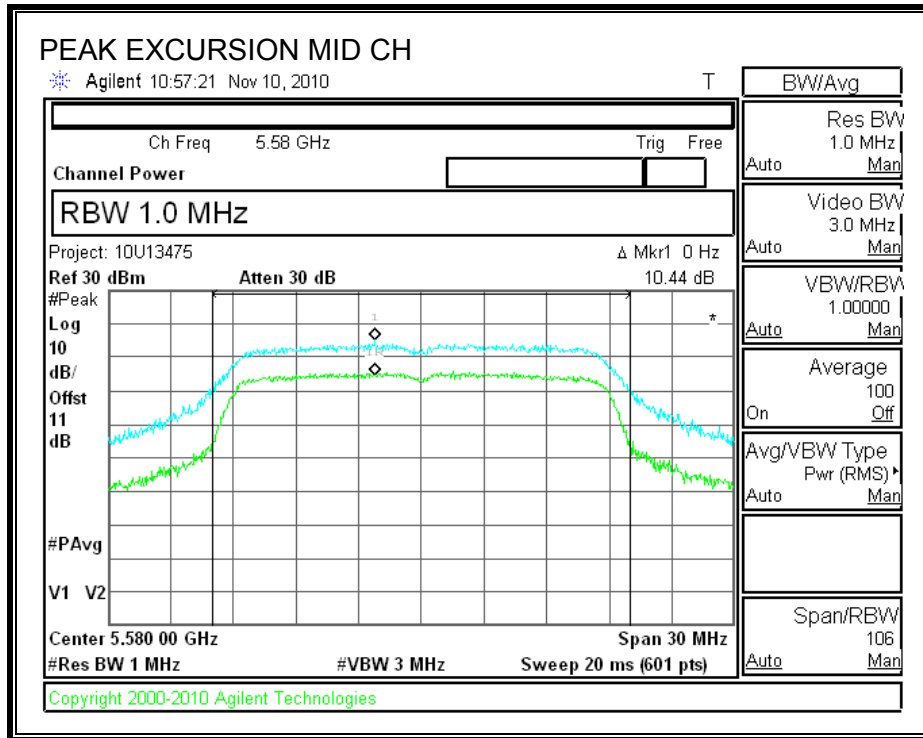
**CHAIN 3**

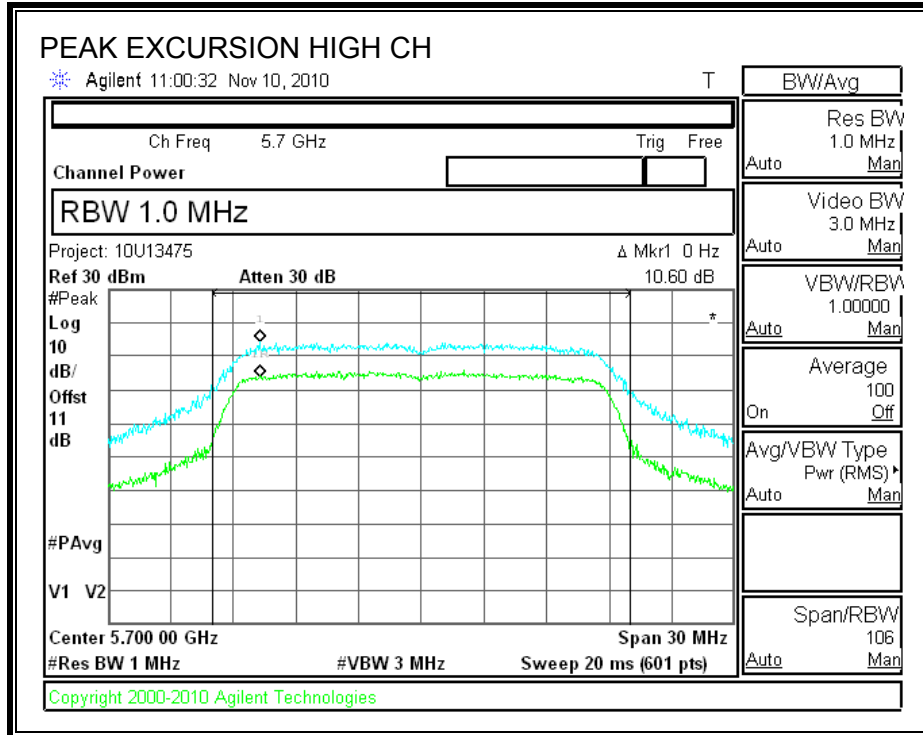
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5500	10.74	13	-2.26
Middle	5580	11.56	13	-1.44
High	5700	9.64	13	-3.36

**CHAIN 1**

**PEAK EXCURSION**

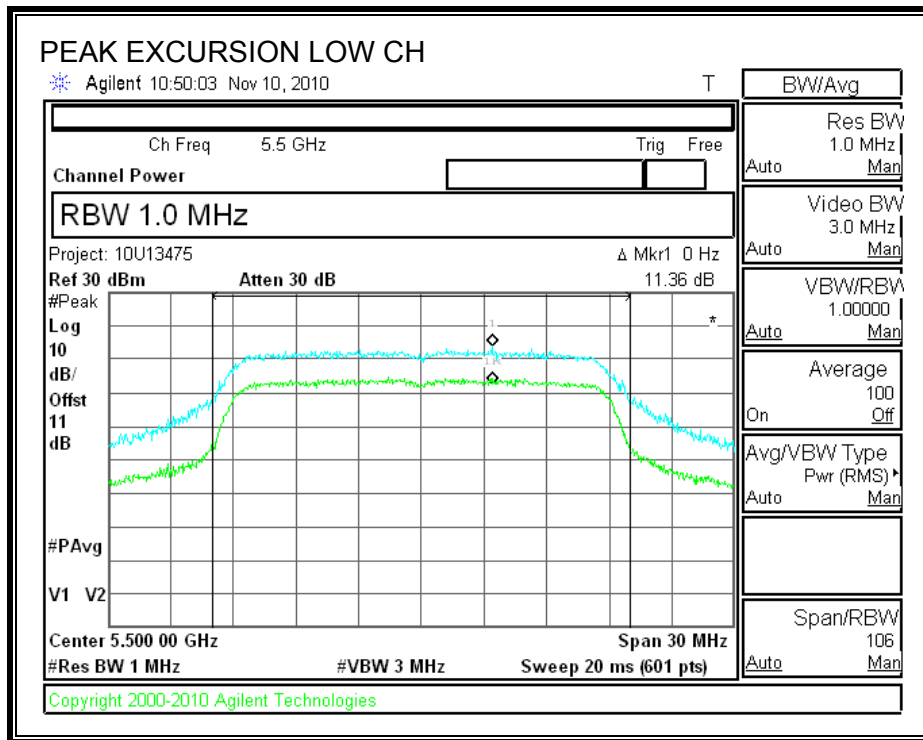




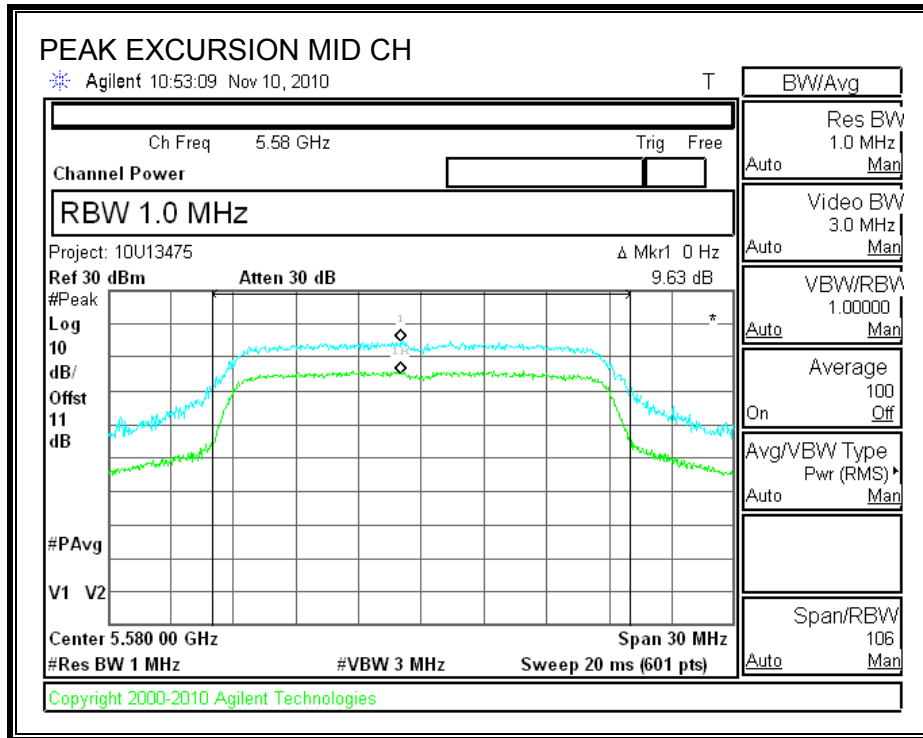


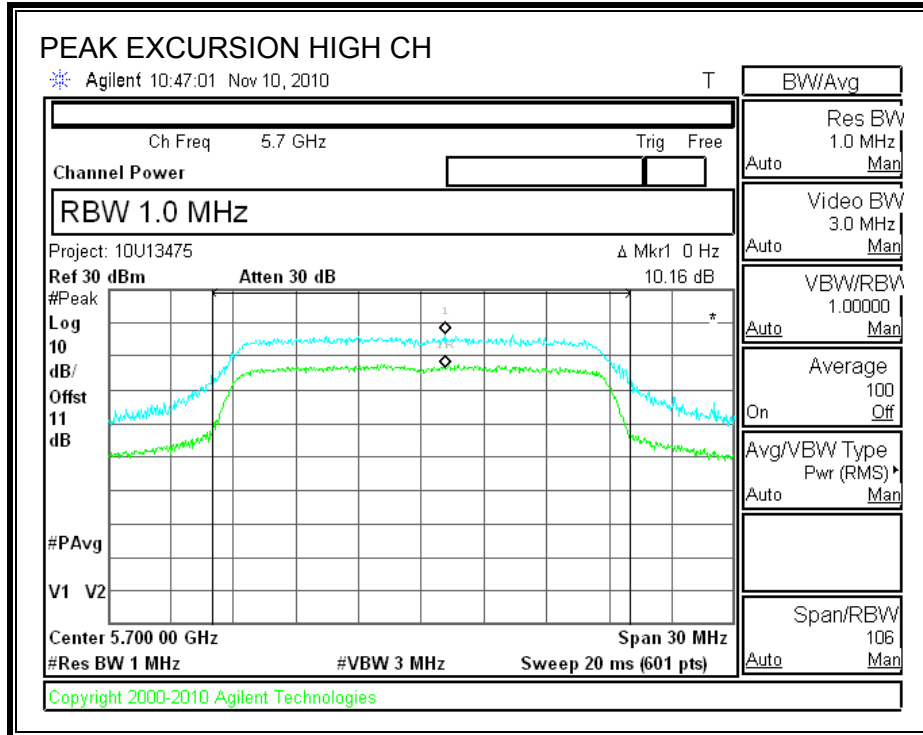
**CHAIN 2**

**PEAK EXCURSION**



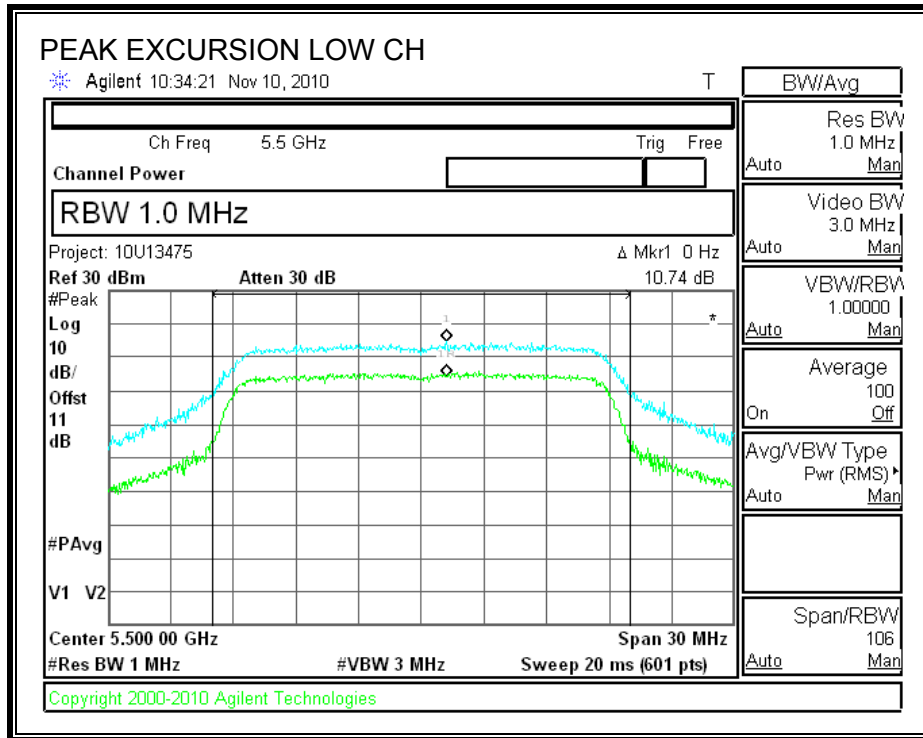


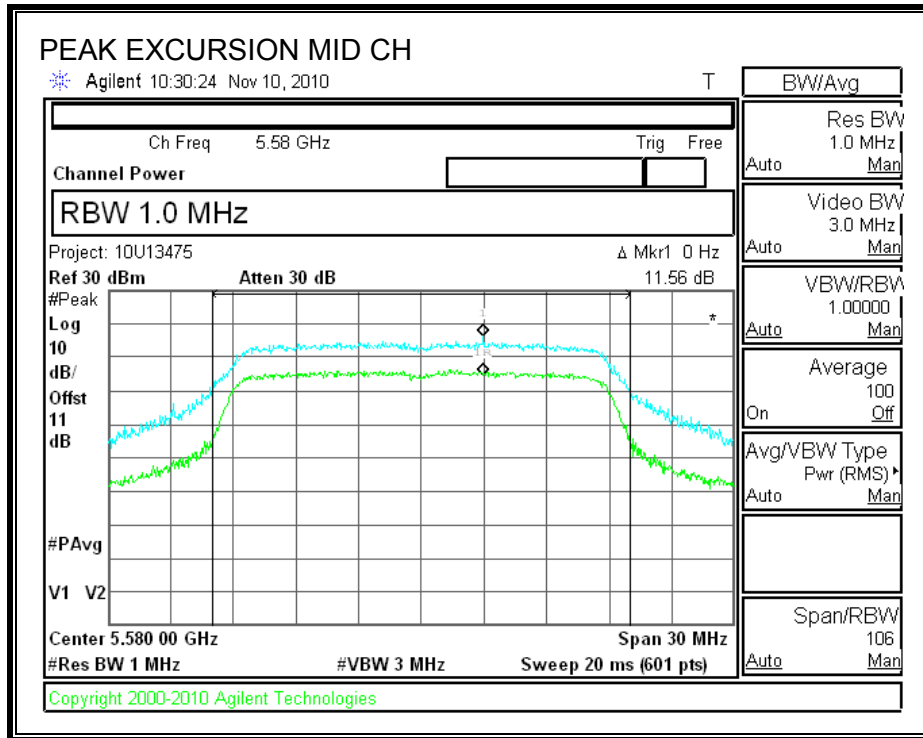


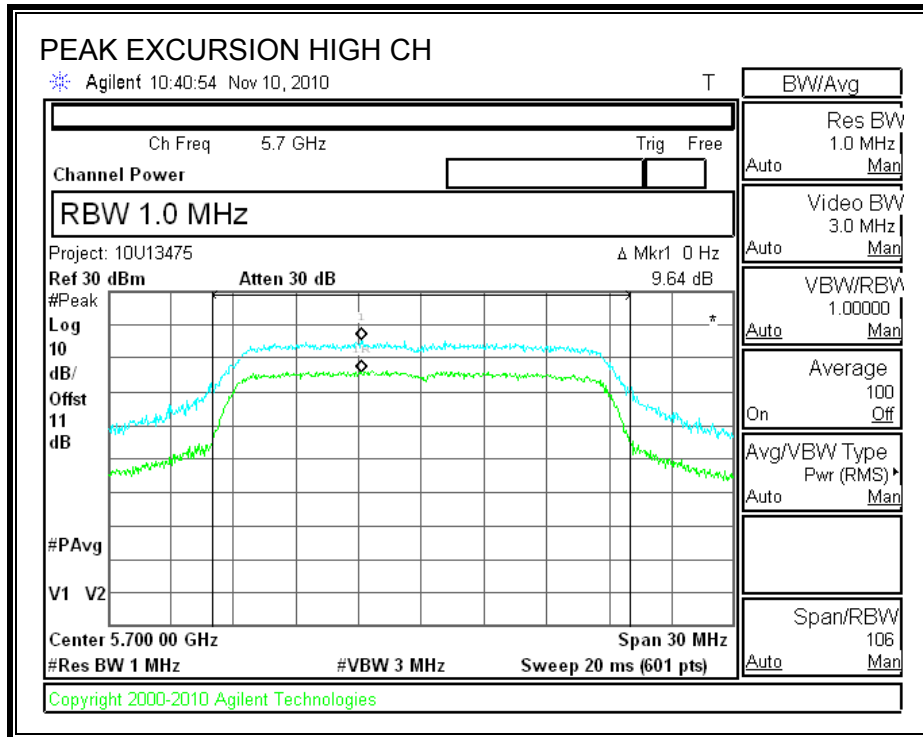


**CHAIN 3**

**PEAK EXCURSION**







## **7.8.6. CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

FCC §15.407 (b) (3)

IC RSS-210 A9.3 (3)

For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm / MHz.

### **TEST PROCEDURE**

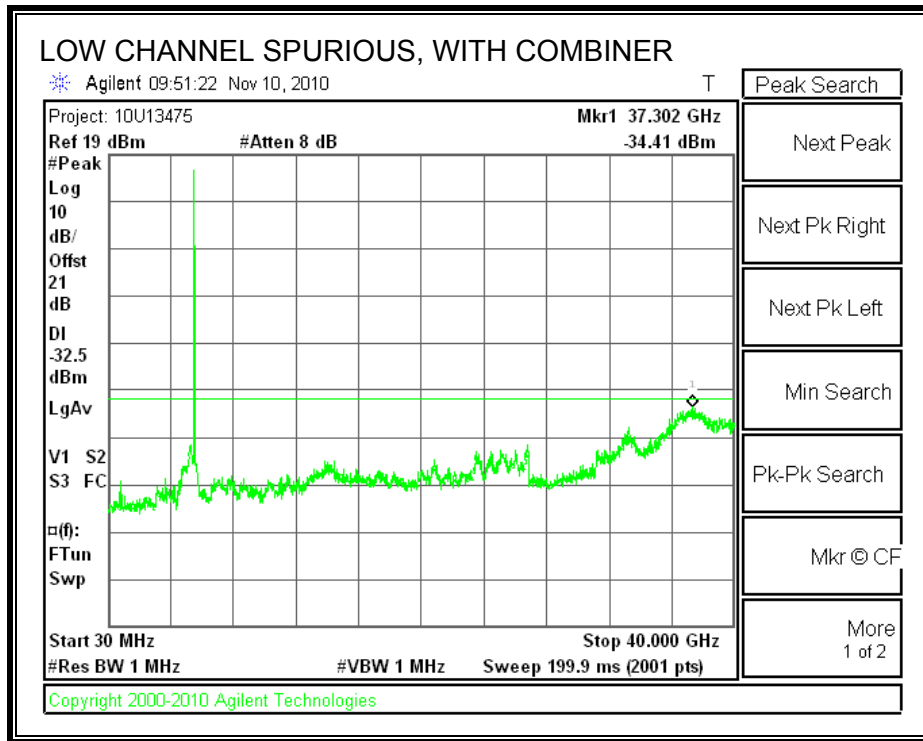
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

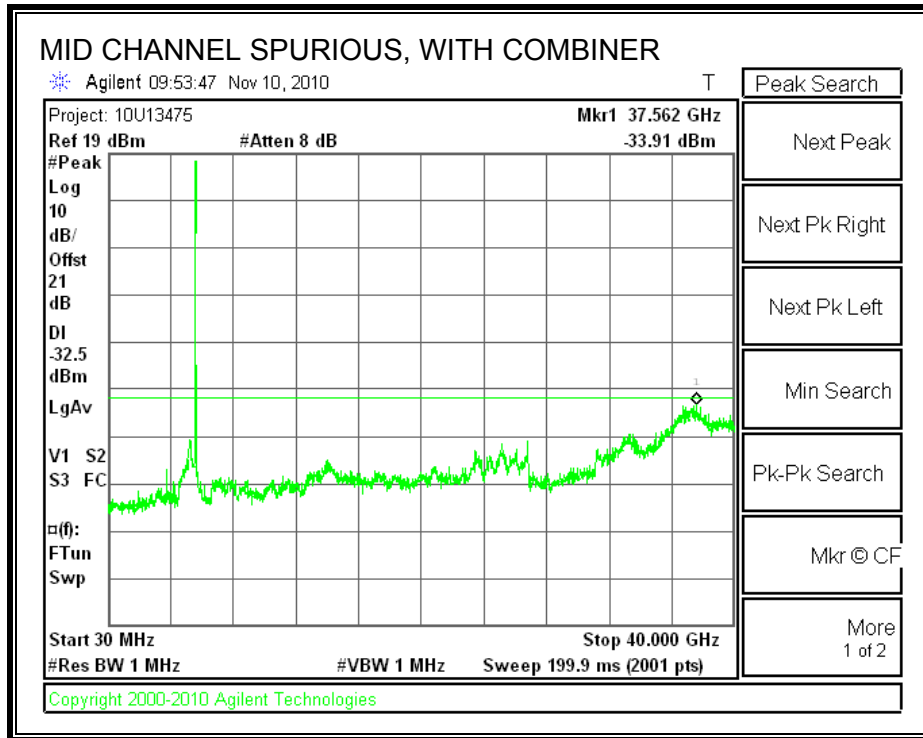
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

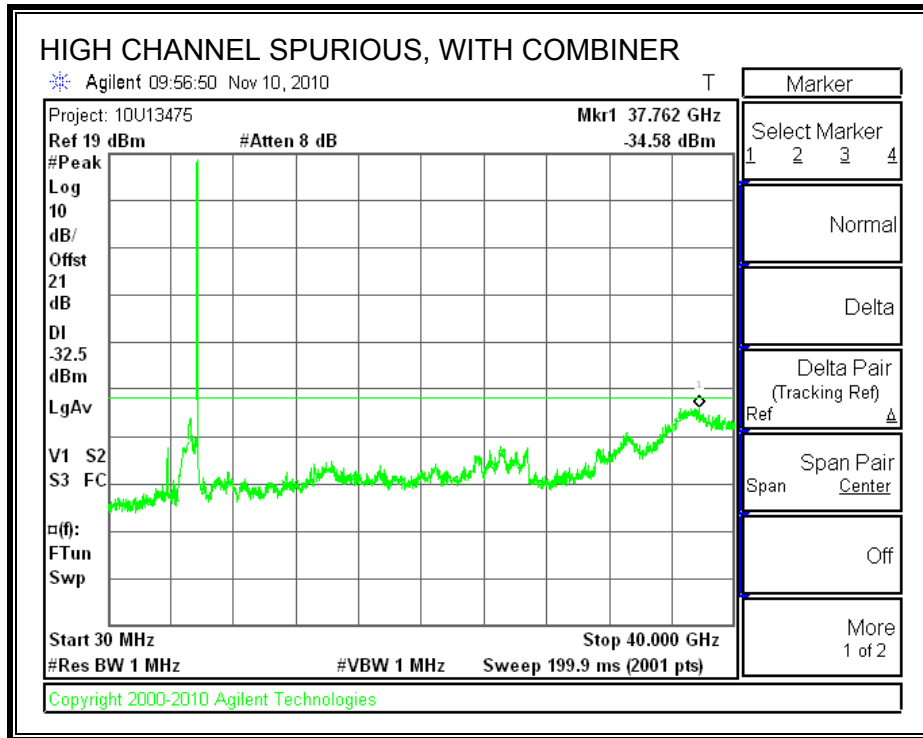
**RESULTS**

**SPURIOUS EMISSIONS WITH COMBINER**

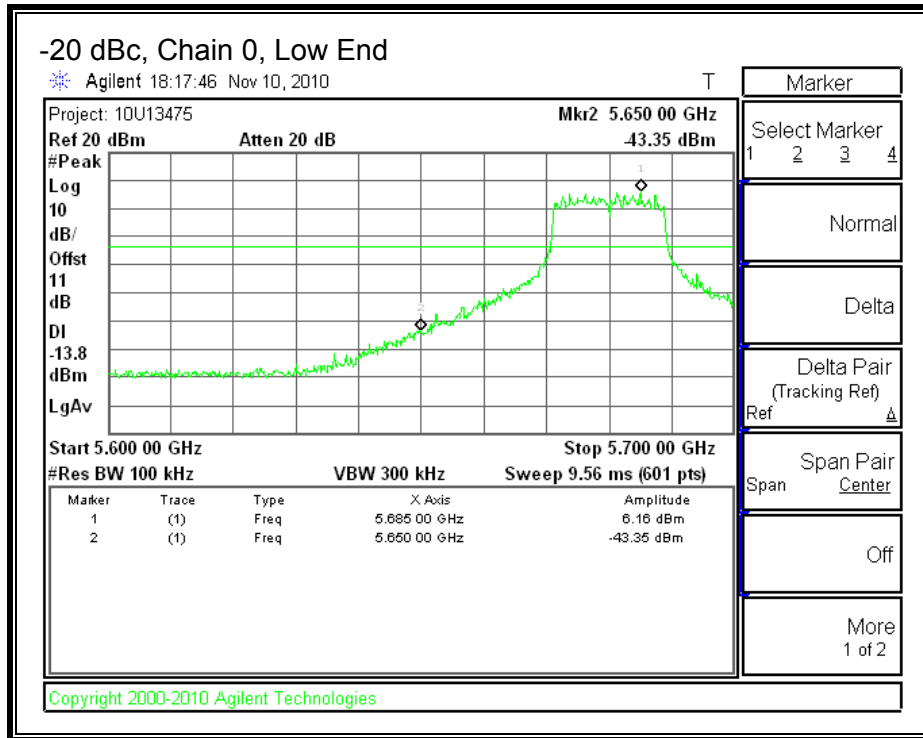


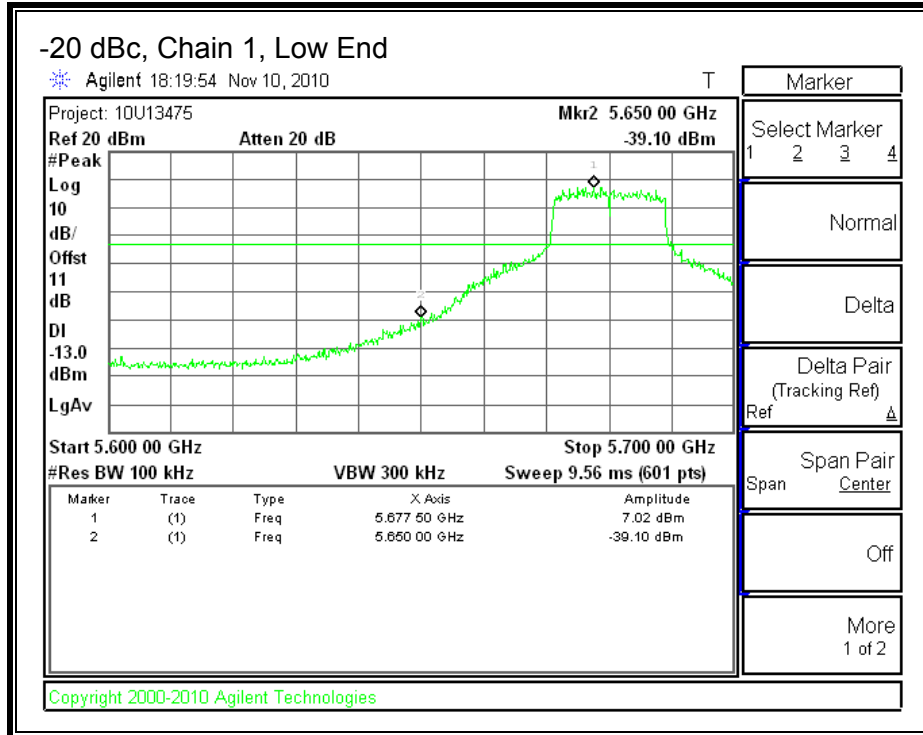


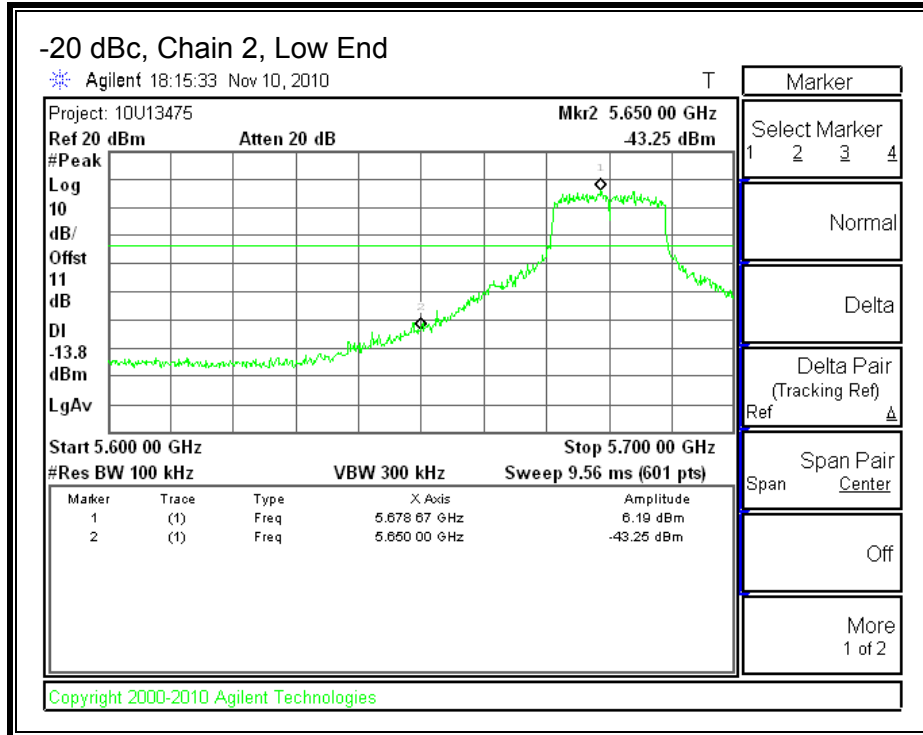


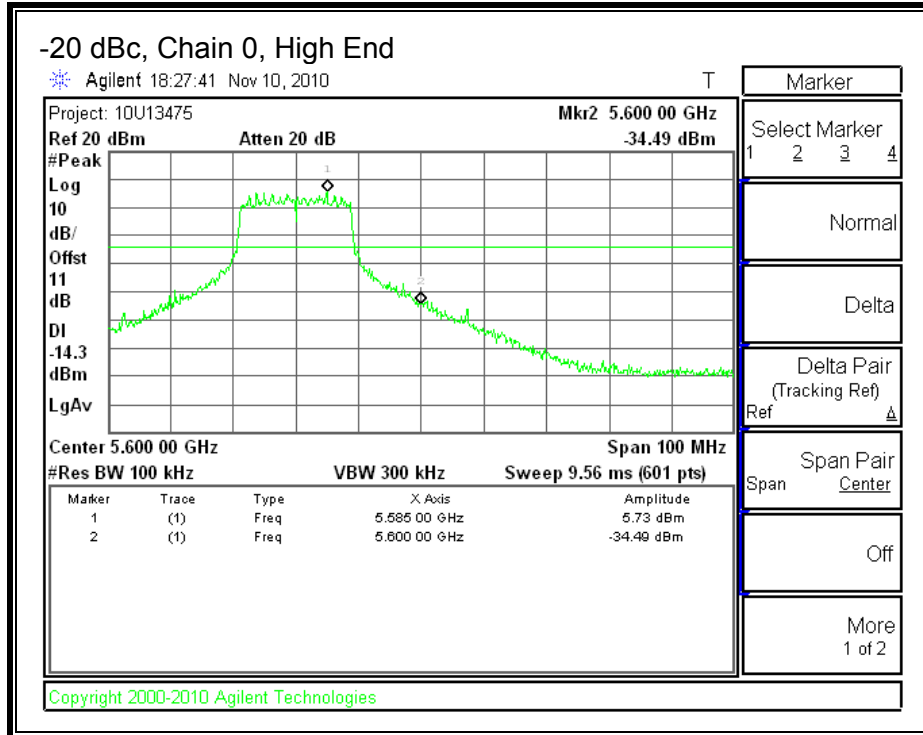


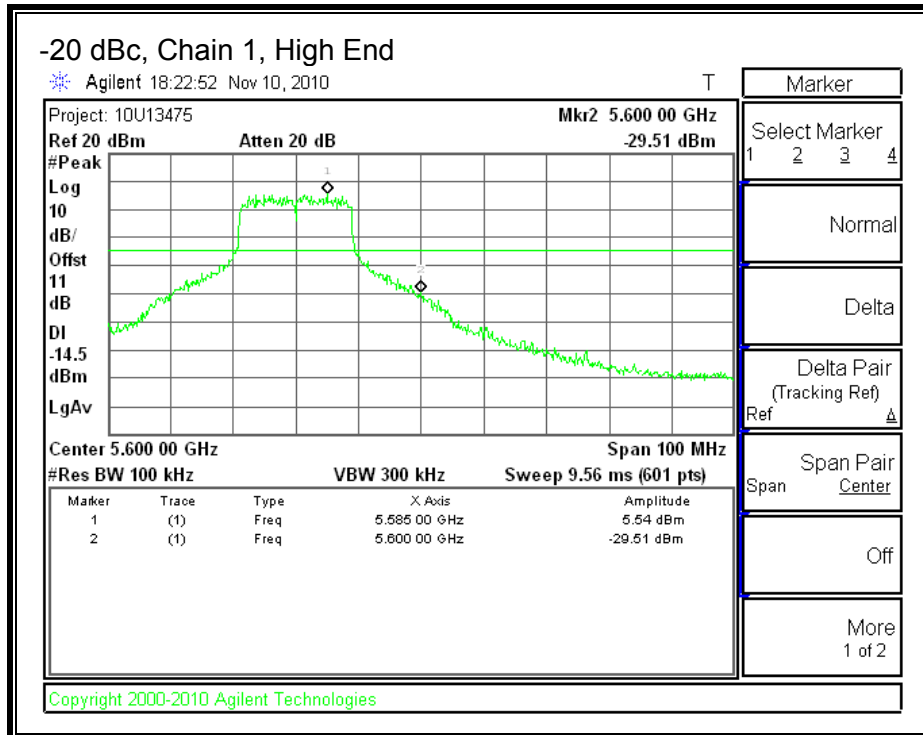
**-20 dBc RF CONDUCTED SPURIOUS IN THE NOTCH BAND OF 5.6-5.65 GHz**

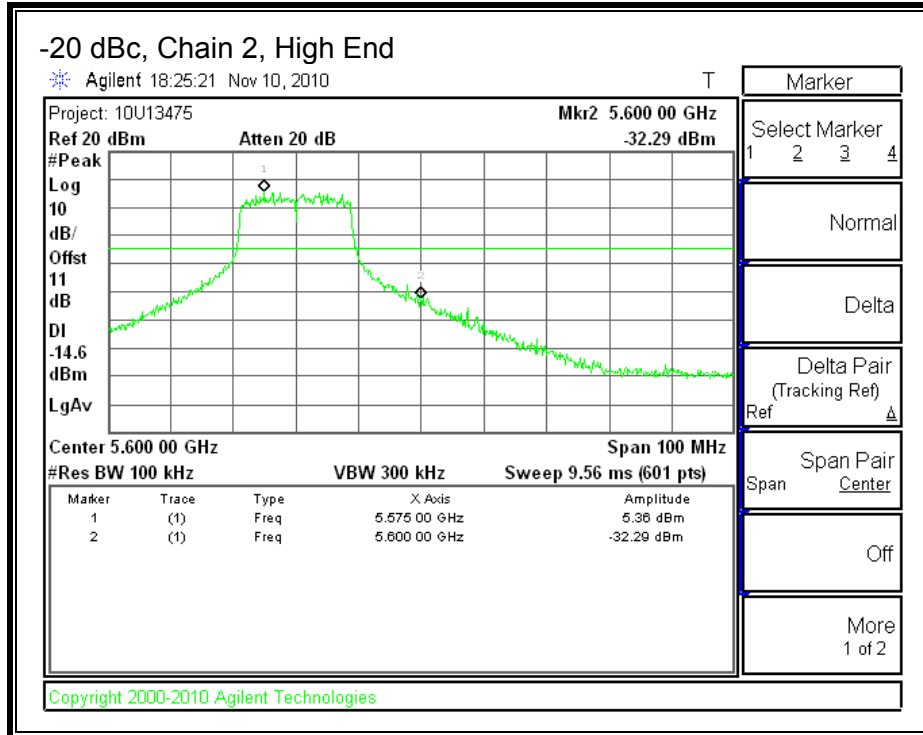












## 7.9. 802.11n THREE CHAINS HT40 MODE IN THE 5.6 GHz BAND

### 7.9.1. 26 dB and 99% BANDWIDTH

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter outputs are connected to the spectrum analyzer via a combiner. The RBW is set to 1% to 3% of the measured bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal bandwidth function is utilized.

#### RESULTS

##### CHAIN 1

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5510	40.387	36.467
Middle	5550	40.084	35.6656
High	5670	41.814	36.1641

##### CHAIN 2

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5510	40.59	36.2698
Middle	5550	40.175	35.9154
High	5670	40.849	35.9937

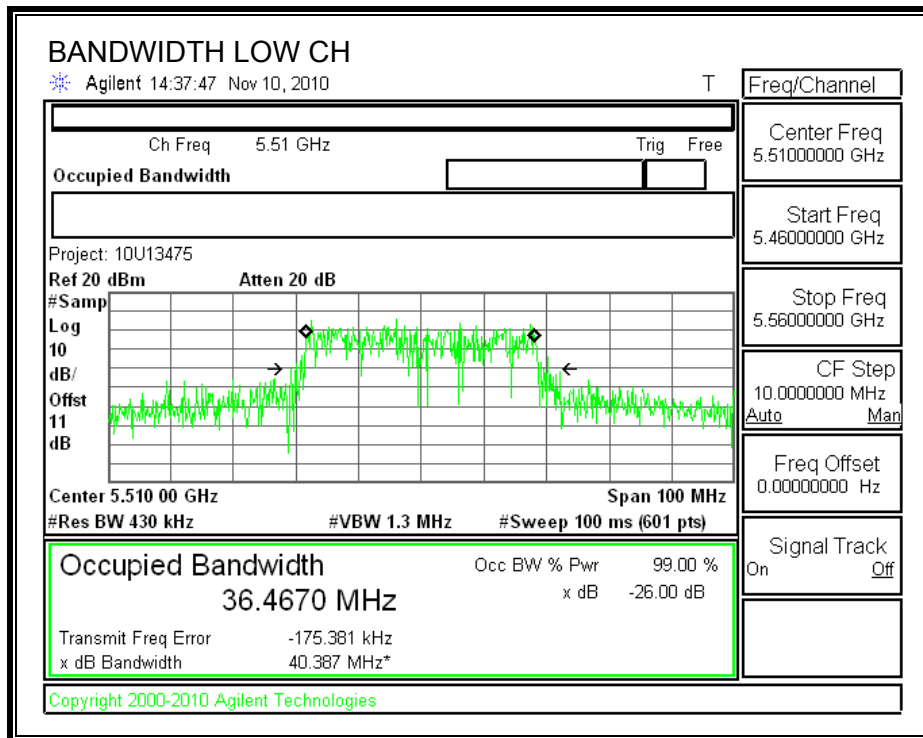
##### CHAIN 3

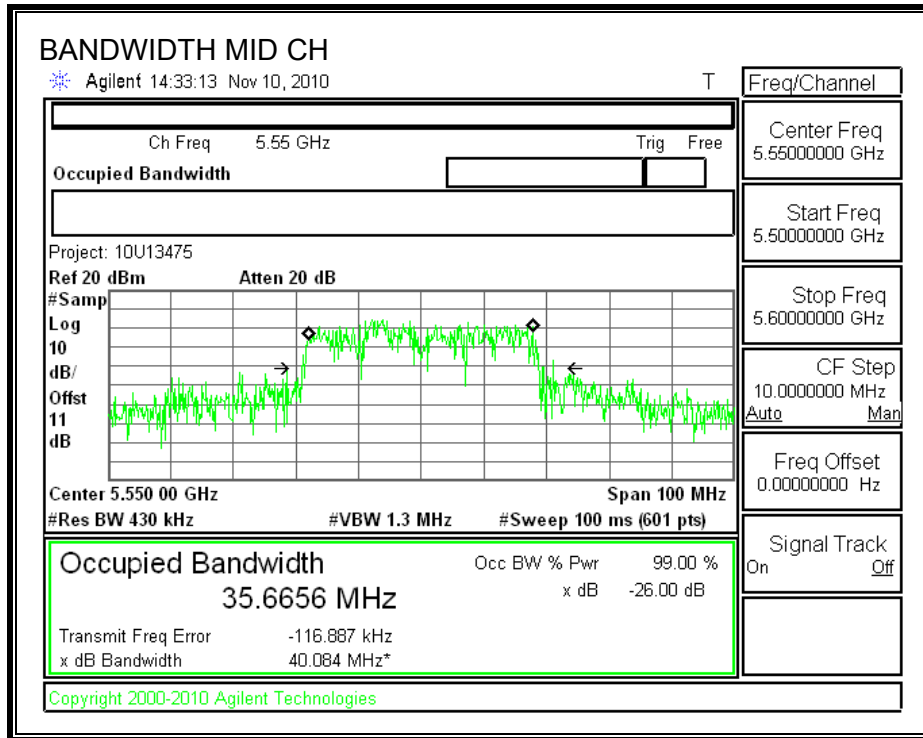
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	5510	40.623	36.4489
Middle	5550	40.9	36.0575
High	5670	40.391	36.321

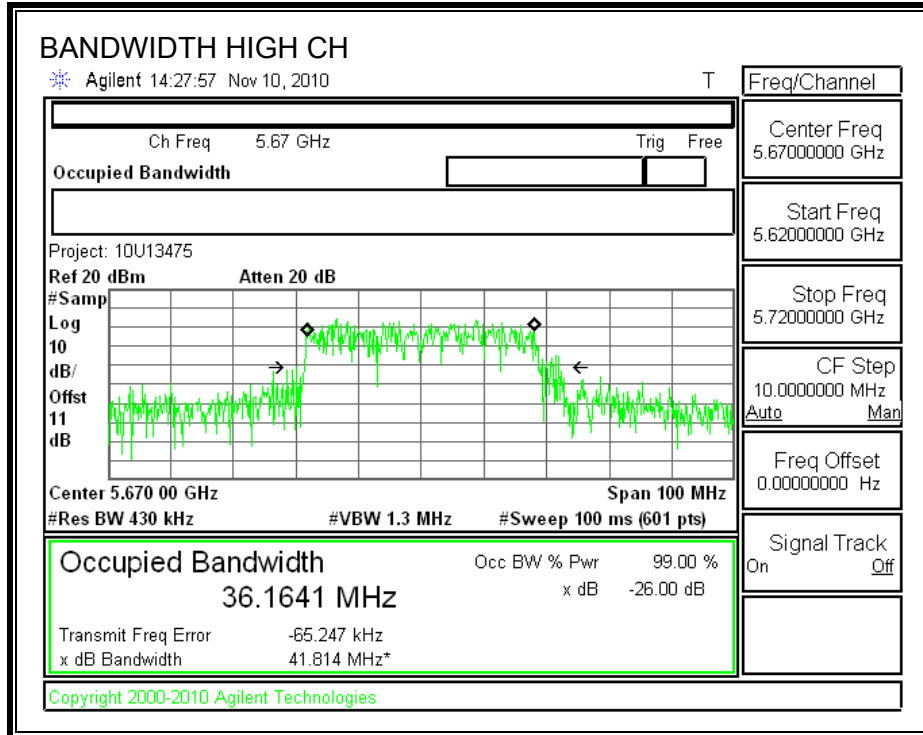


**CHAIN 1**

**26 dB and 99% BANDWIDTH**

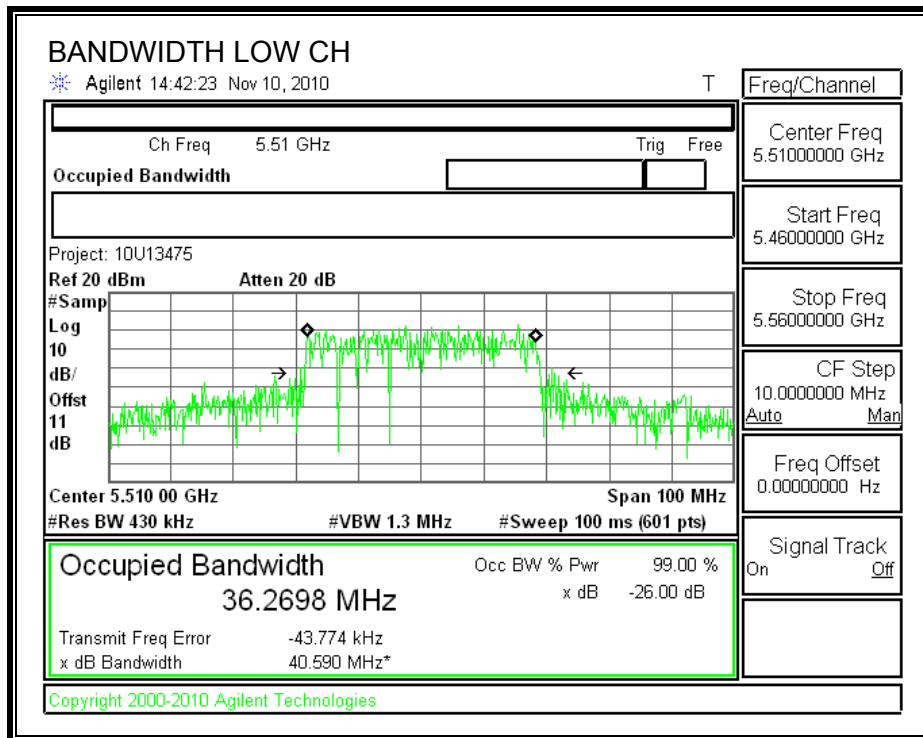


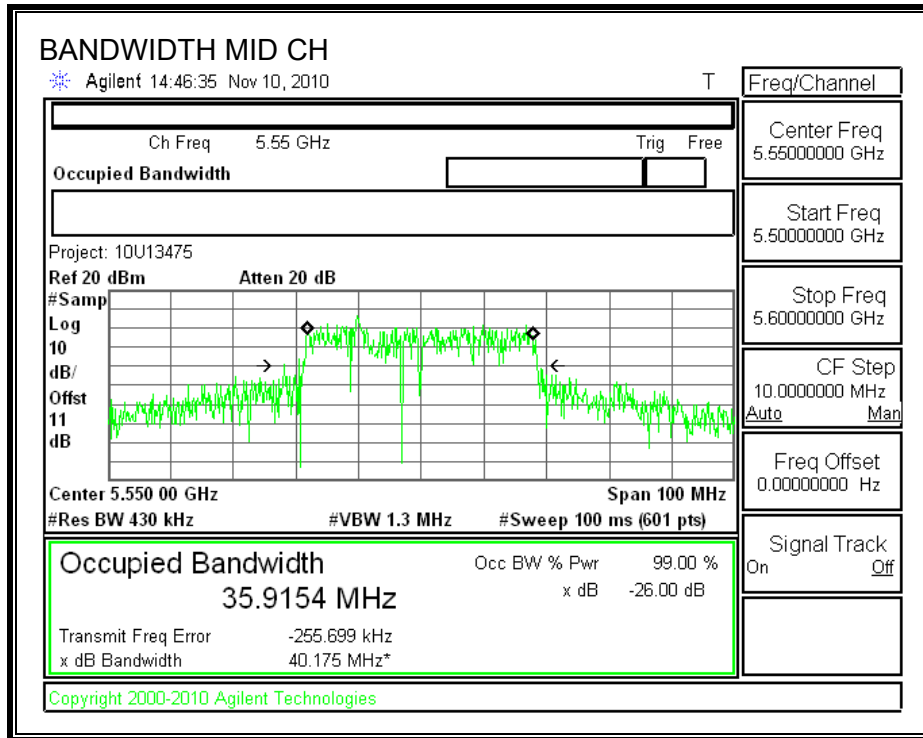


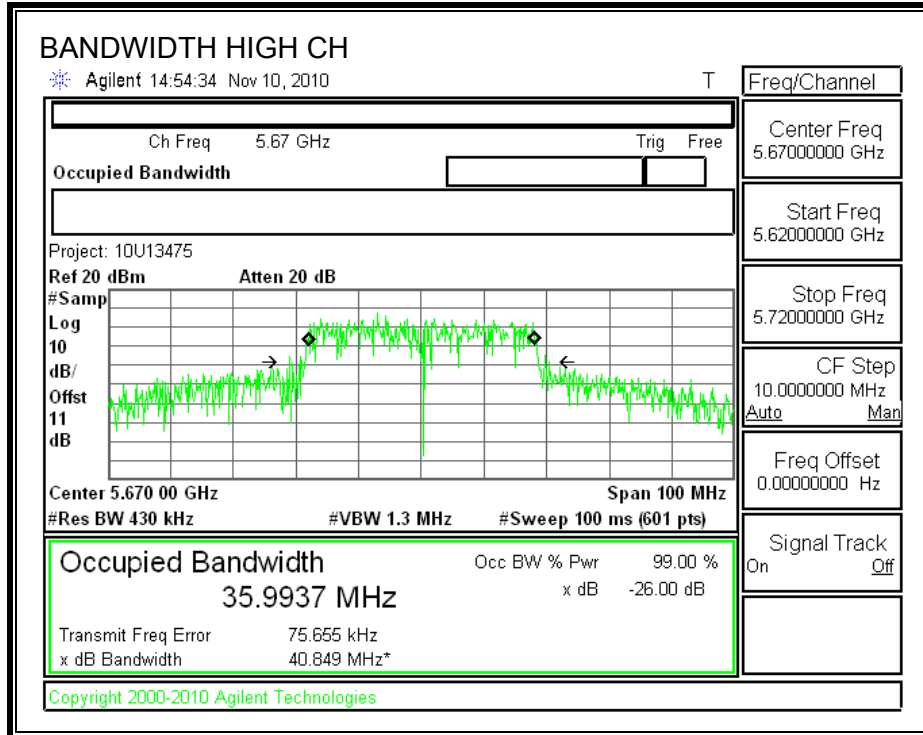


**CHAIN 2**

**26 dB and 99% BANDWIDTH**

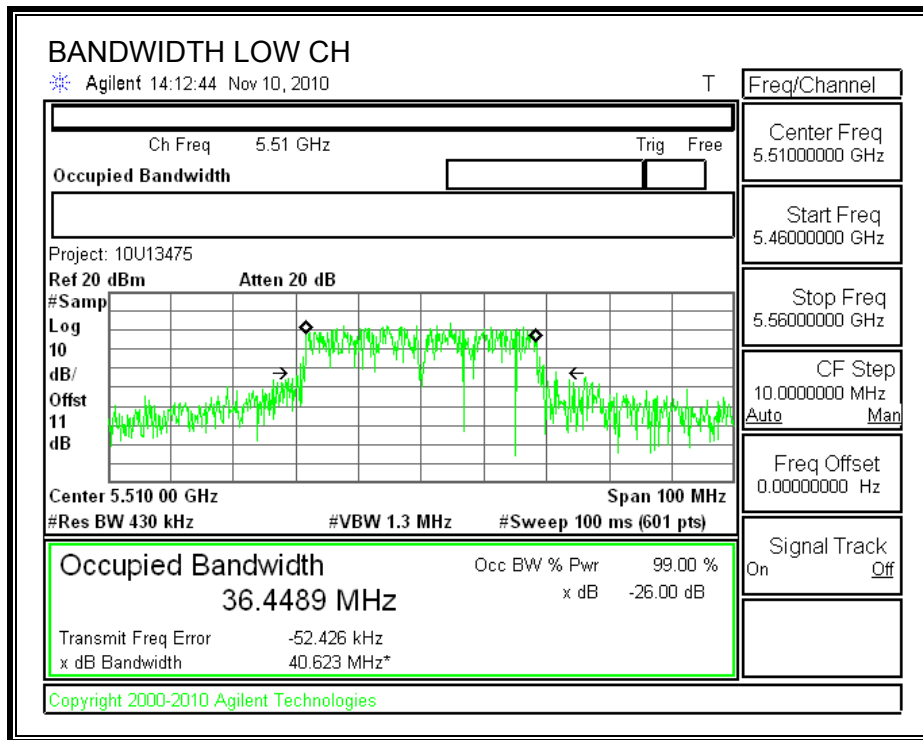


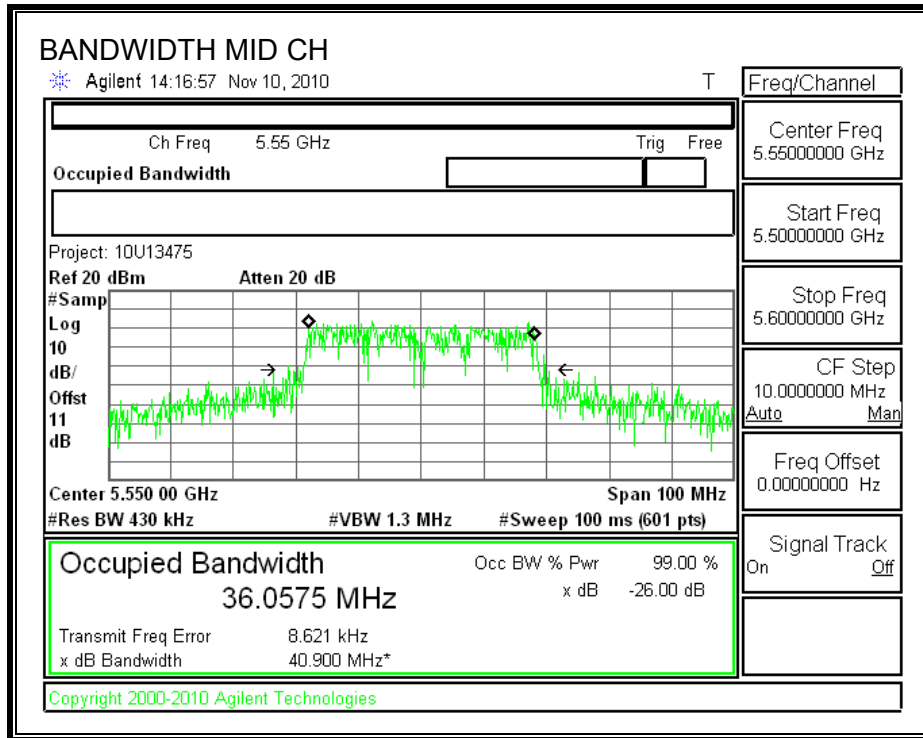




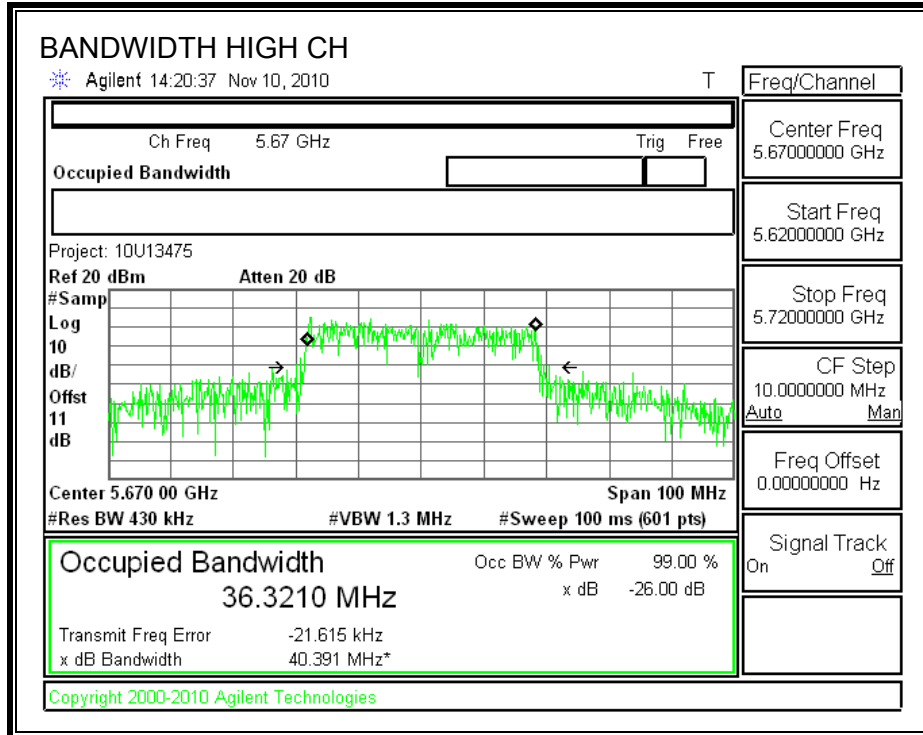
**CHAIN 3**

**26 dB and 99% BANDWIDTH**









## 7.9.2. OUTPUT POWER

### LIMITS

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.47-5.725 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 250 mW or  $11 \text{ dBm} + 10 \log B$ , where B is the 26-dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

### TEST PROCEDURE

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

The transmitter output operates continuously therefore Method # 1 is used.

**RESULTS**

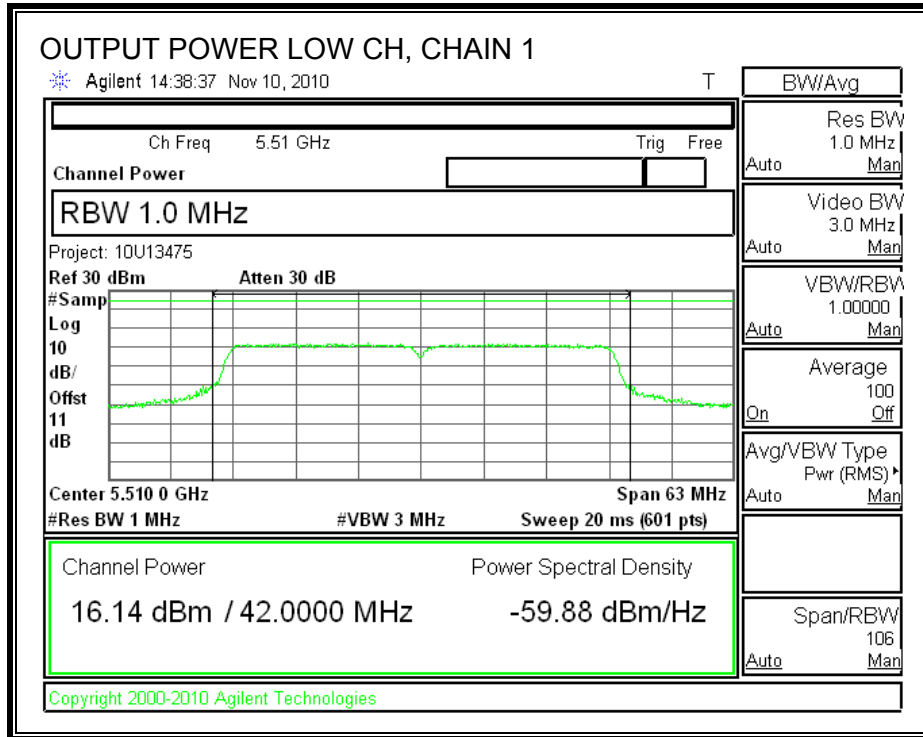
**Limit**

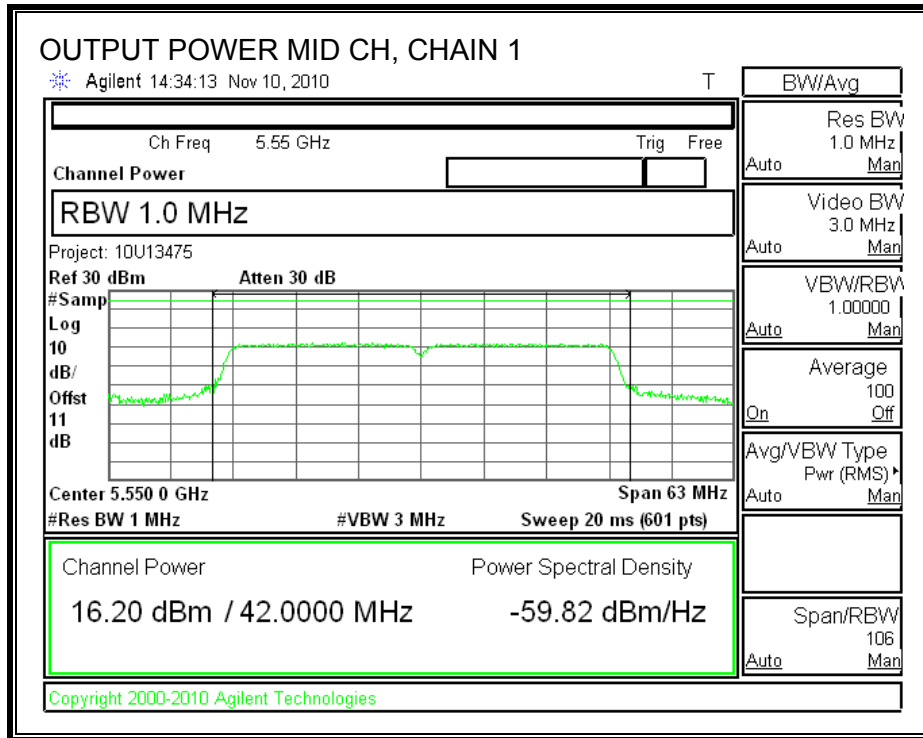
Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	11 + 10 Log B Limit (dBm)	Antenna Gain (dBi)	Limit (dBm)
Low	5510	23.98	40.387	27.06	5.50	23.98
Mid	5550	23.98	40.084	27.03	5.50	23.98
High	5670	23.98	40.391	27.06	5.50	23.98

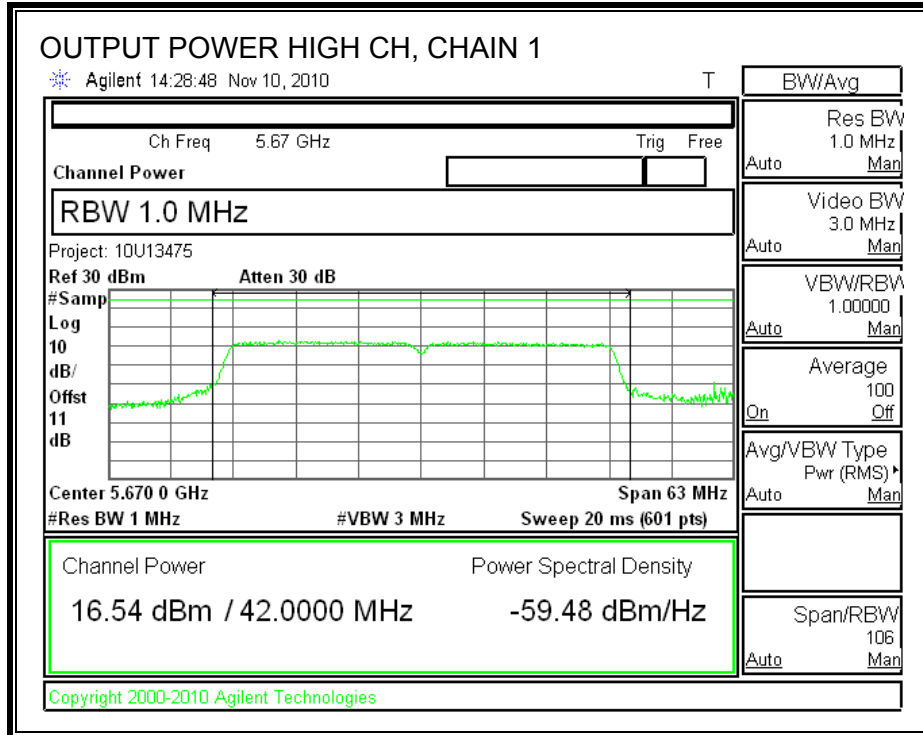
**Individual Chain Results**

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)	Limit (dBm)	Margin (dB)
Low	5510	16.14	14.45	16.02	20.37	23.98	-3.61
Mid	5550	16.20	14.49	15.87	20.35	23.98	-3.63
High	5670	16.54	17.38	16.91	21.73	23.98	-2.25

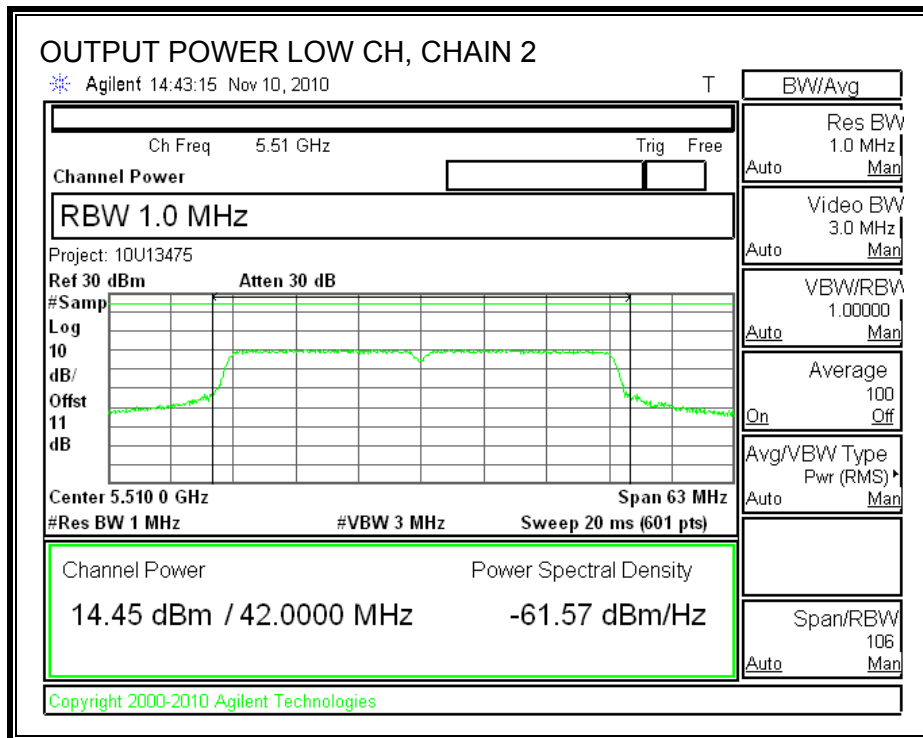
**CHAIN 1 OUTPUT POWER**

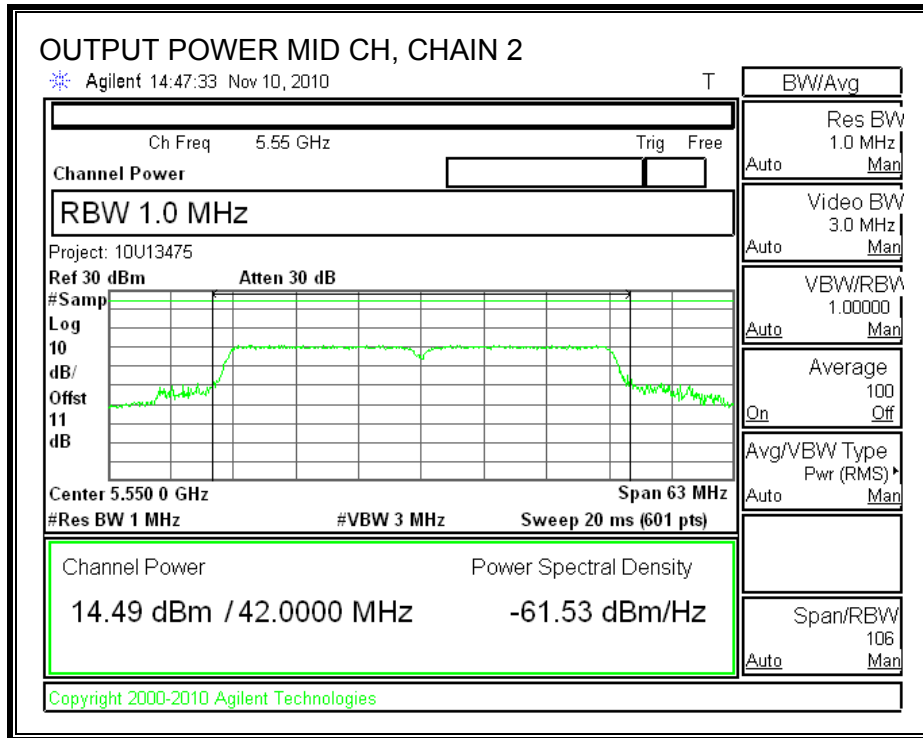




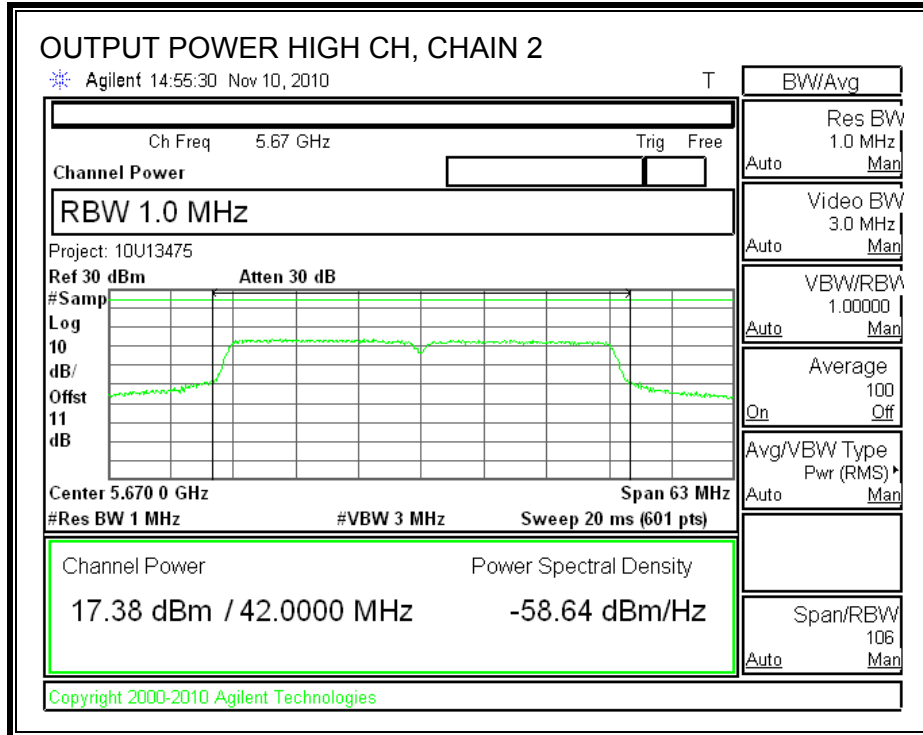


**CHAIN 2 OUTPUT POWER**

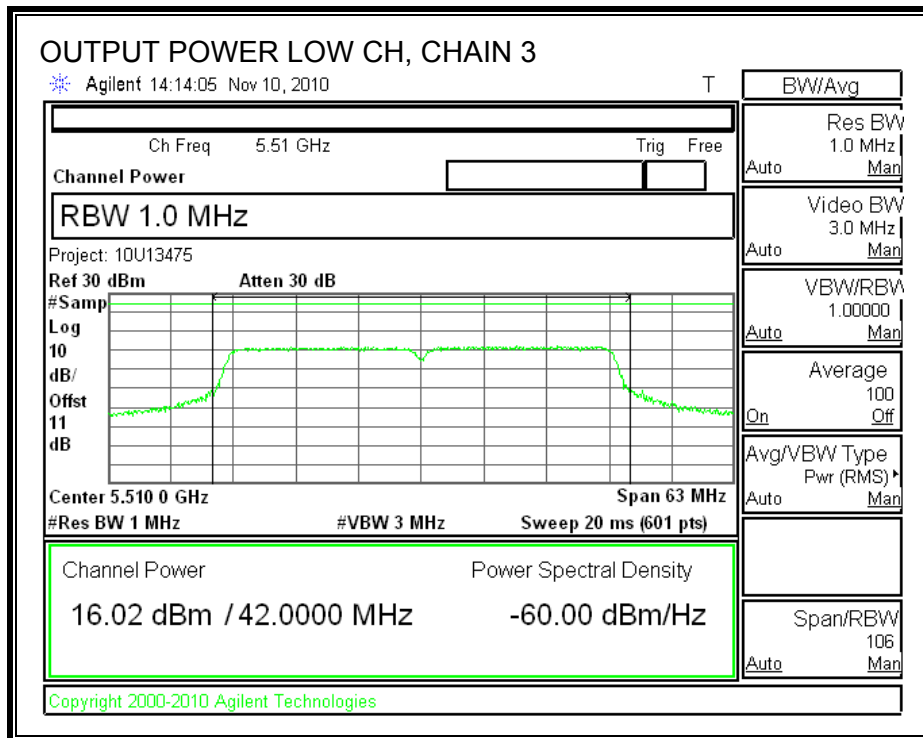


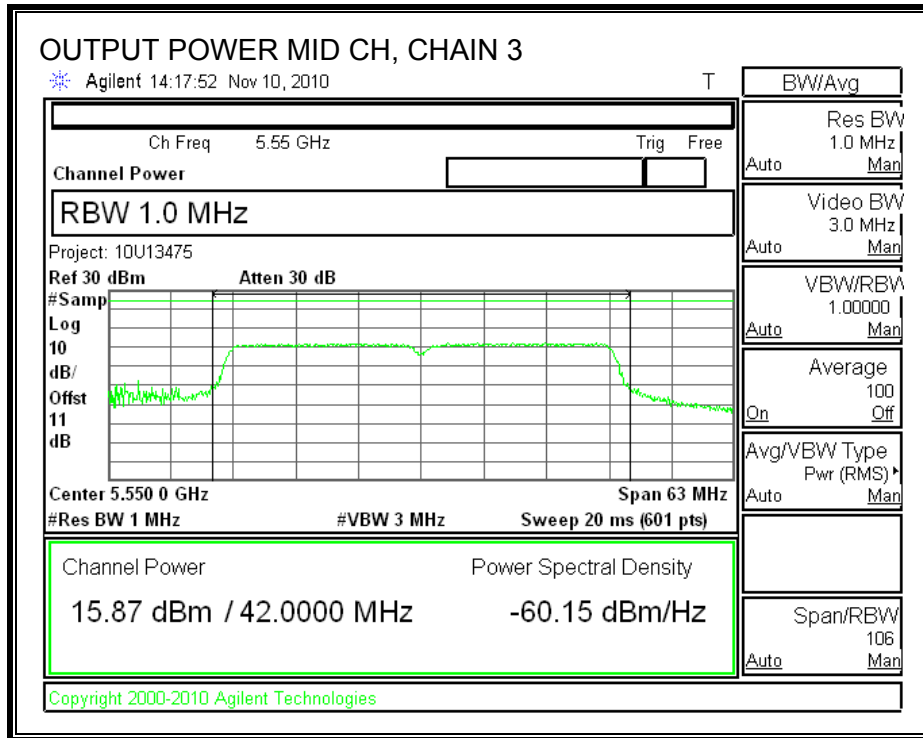


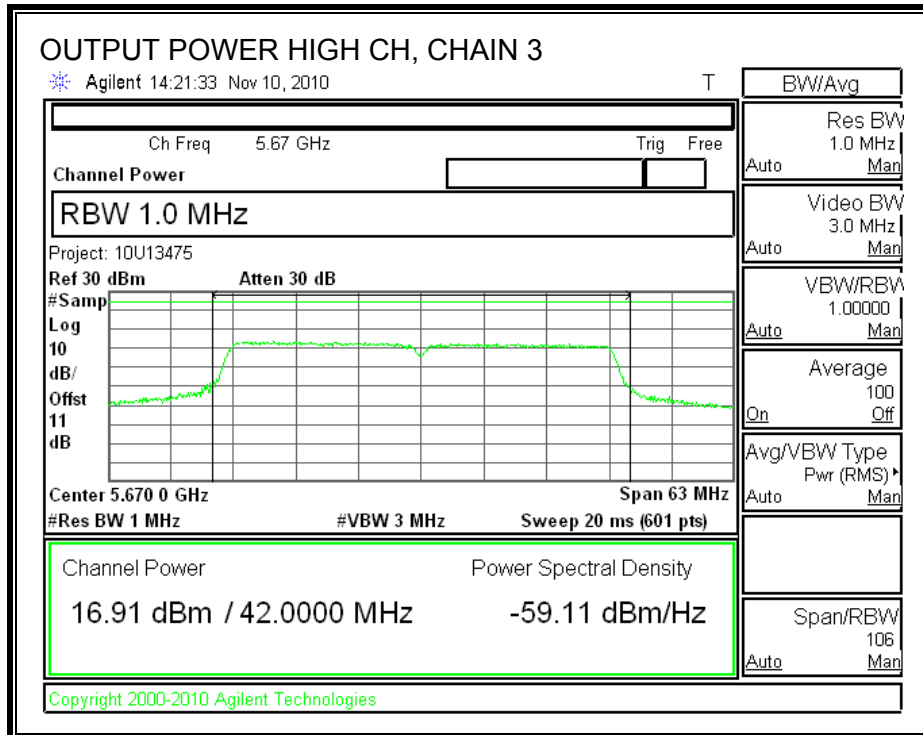




**CHAIN 3 OUTPUT POWER**







### 7.9.3. AVERAGE POWER

#### LIMITS

None; for reporting purposes only.

#### TEST PROCEDURE

The transmitter output is connected to a power meter.

#### RESULTS

The cable assembly insertion loss of 11 dB (including 10 dB pad and 1.0 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Chain 1 Power (dBm)	Chain 2 Power (dBm)	Chain 3 Power (dBm)	Total Power (dBm)
Low	5510	15.41	14.34	15.93	20.05
Middle	5550	15.53	15.02	15.87	20.26
High	5670	15.67	16.48	16.05	20.85

## **7.9.4. PEAK POWER SPECTRAL DENSITY**

### **LIMITS**

FCC §15.407 (a) (2)

IC RSS-210 A9.2 (2)

For the 5.47-5.725 GHz band, the peak power spectral density shall not exceed 11 dBm in any 1 MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit 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.

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 11 dBm.

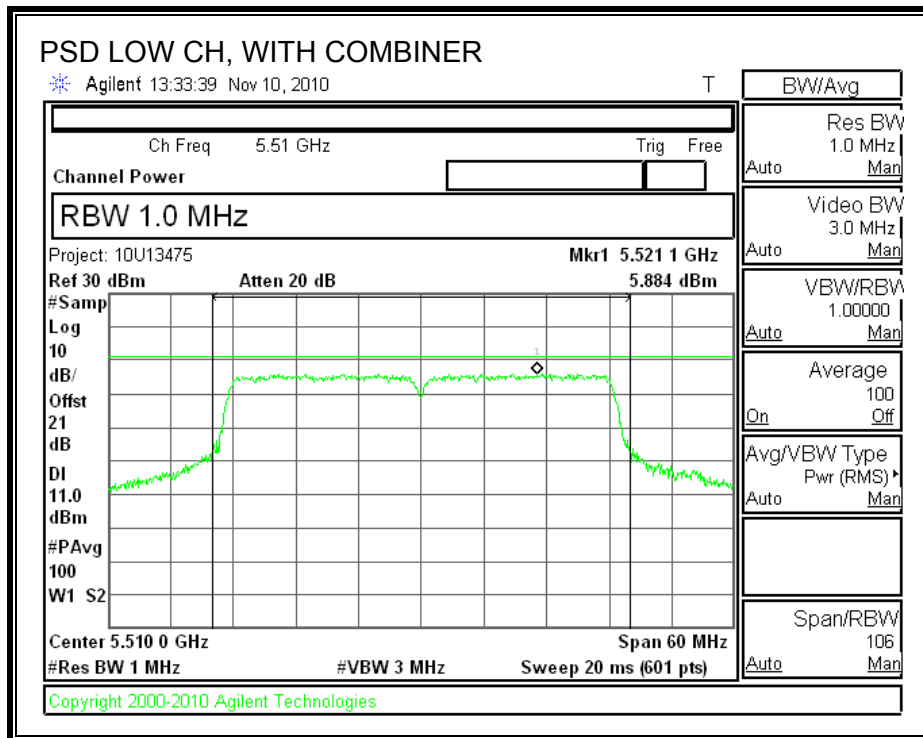
### **TEST PROCEDURE**

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002. PPSD method #2 was used.

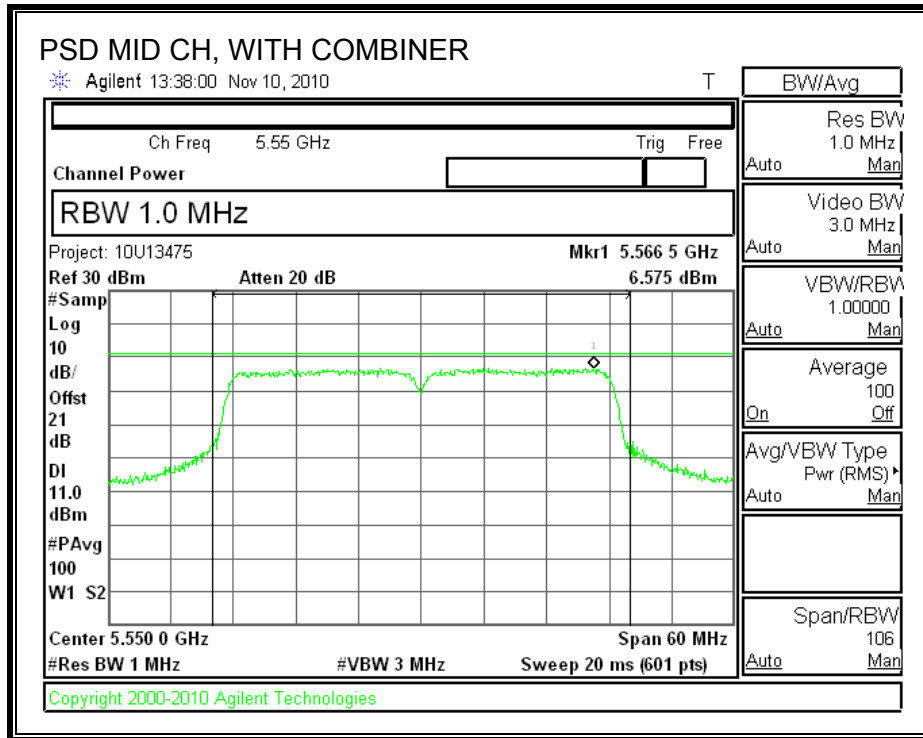
**RESULTS**

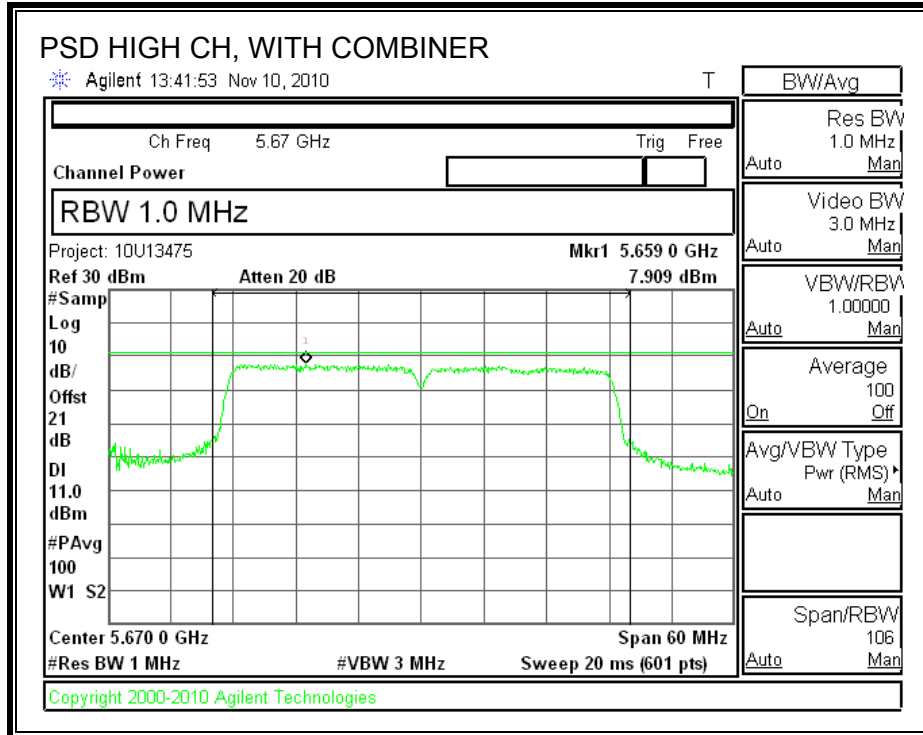
Channel	Frequency (MHz)	PPSD With Combiner (dBm)	Limit (dBm)	Margin (dB)
Low	5510	5.884	11	-5.116
Middle	5550	6.575	11	-4.425
High	5670	7.909	11	-3.091

**POWER SPECTRAL DENSITY WITH COMBINER**









## **7.9.5. PEAK EXCURSION**

### **LIMITS**

FCC §15.407 (a) (6)

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

### **TEST PROCEDURE**

The transmitter outputs are connected to the spectrum analyzer via a combiner.

The test is performed in accordance with FCC Public Notice: APPENDIX A Guidelines for Assessing Unlicensed National Information Infrastructure (U-NII) Devices – Part 15, Subpart E, August 2002.

Since Method # 1 was used for peak power measurements, Method # 1 settings are used for the second PPSD trace.

**RESULTS**

**CHAIN 1**

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5510	8.72	13	-4.28
Middle	5550	11.77	13	-1.23
High	5670	12.30	13	-0.70

**CHAIN 2**

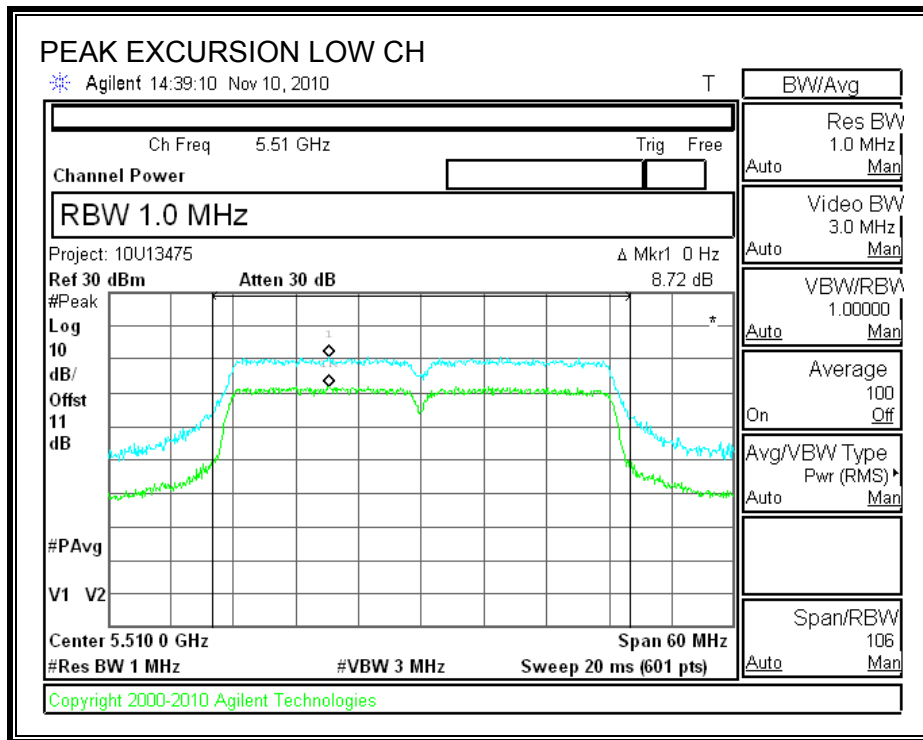
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5510	11.57	13	-1.43
Middle	5550	11.93	13	-1.07
High	5670	10.56	13	-2.44

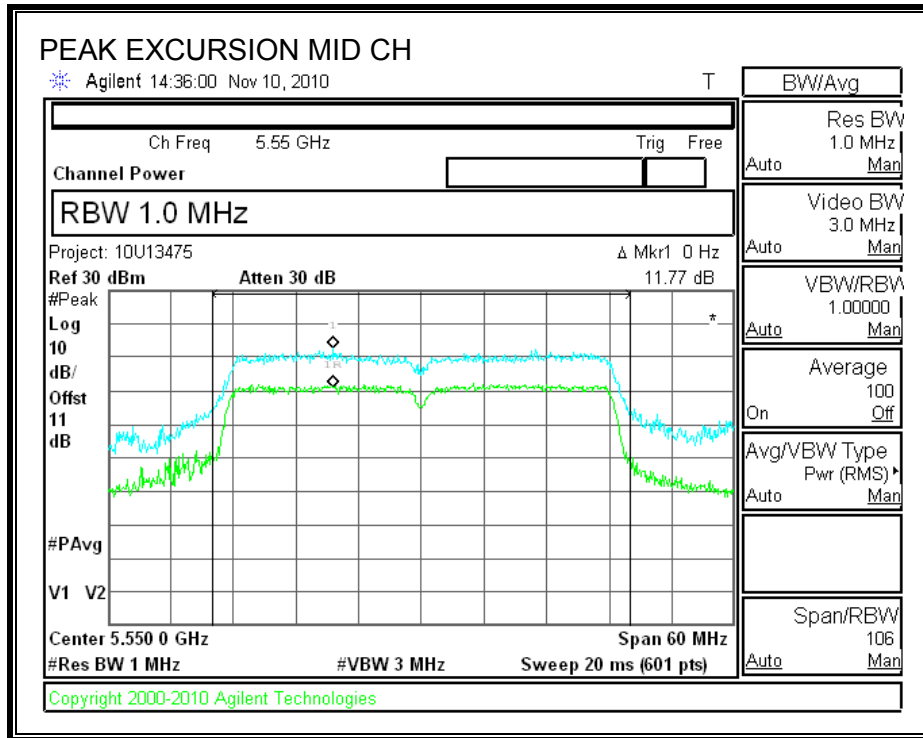
**CHAIN 3**

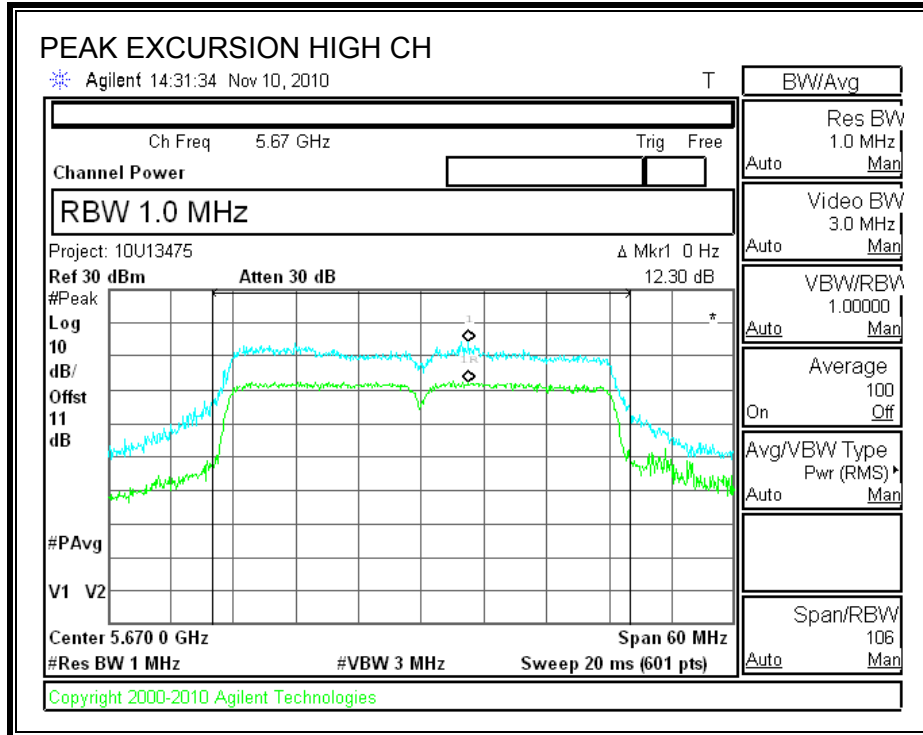
Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Low	5510	11.11	13	-1.89
Middle	5550	10.34	13	-2.66
High	5670	11.26	13	-1.74

**CHAIN 1**

**PEAK EXCURSION**

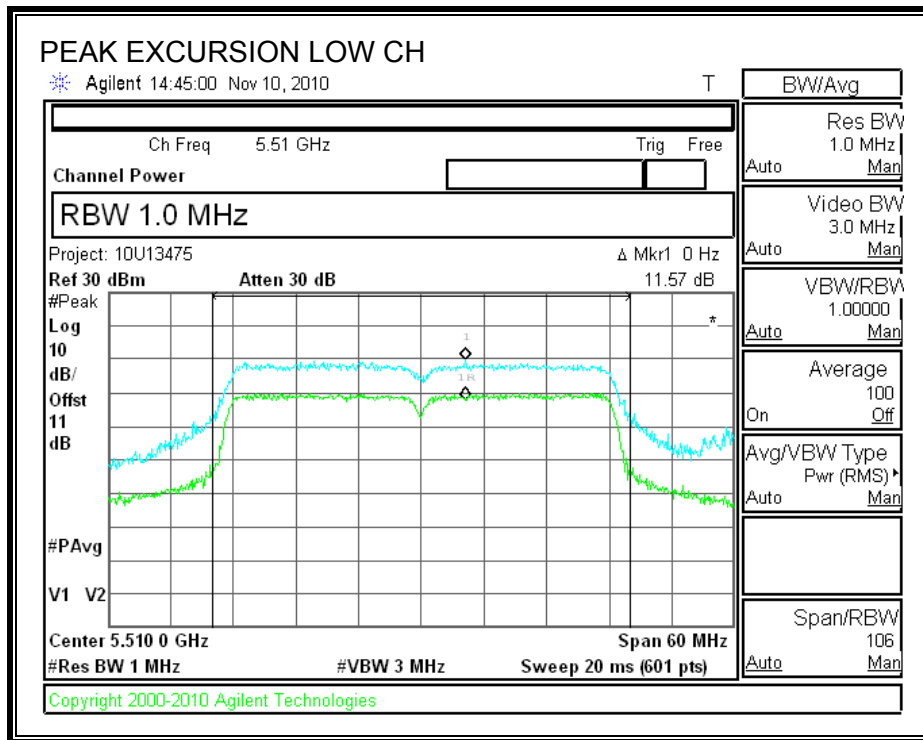




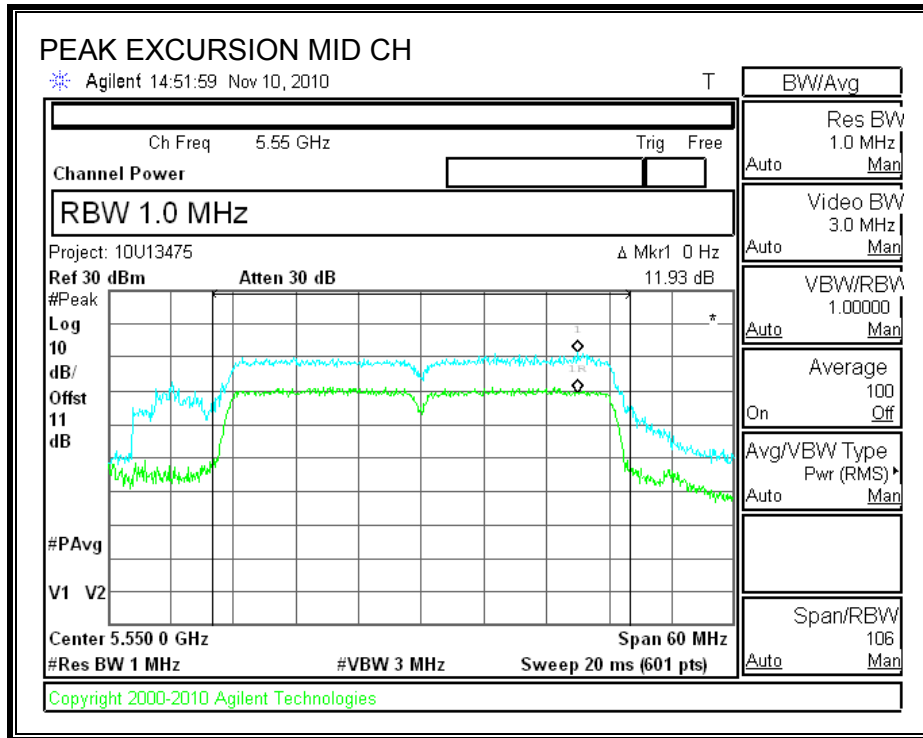


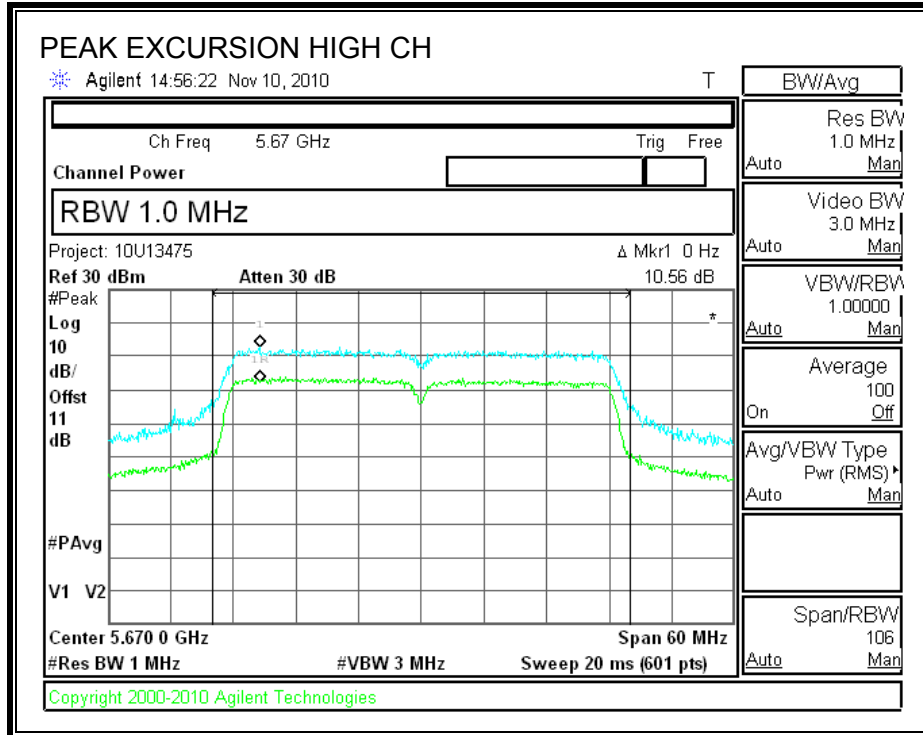
**CHAIN 2**

**PEAK EXCURSION**



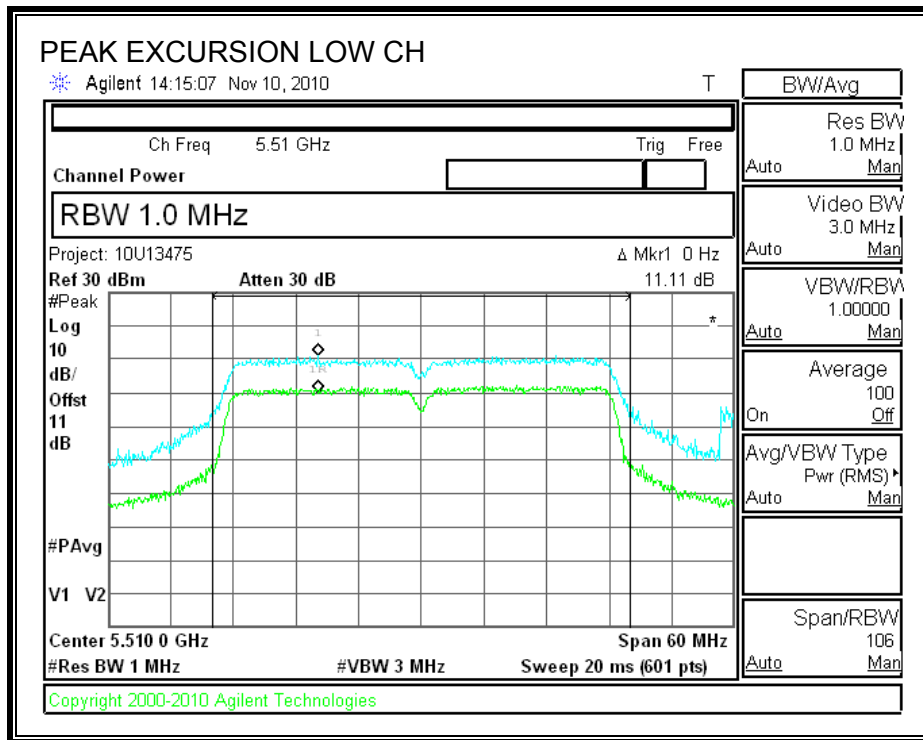


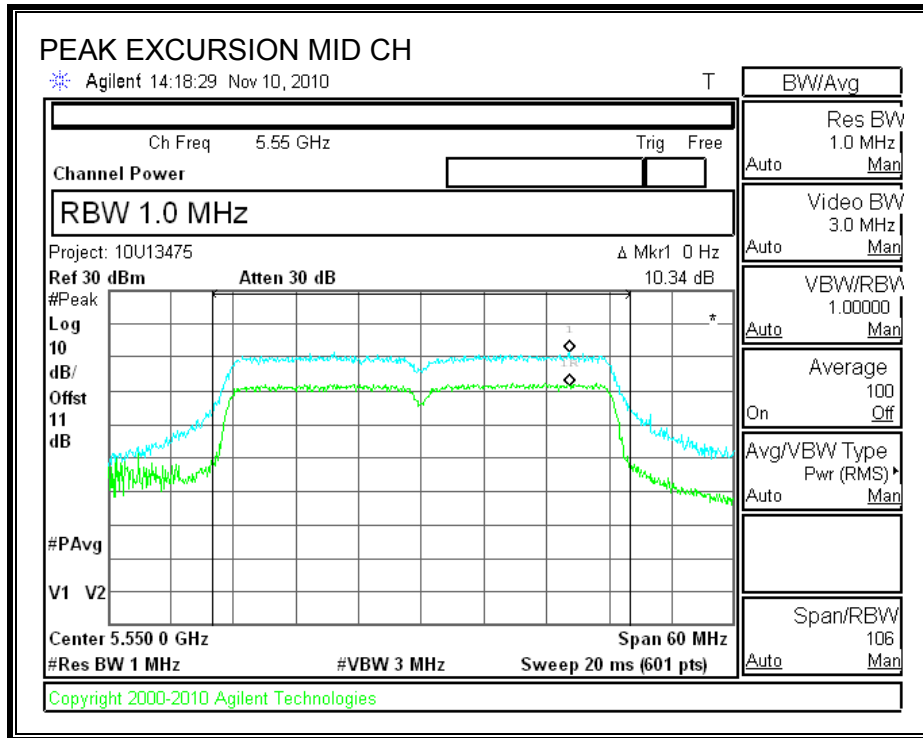


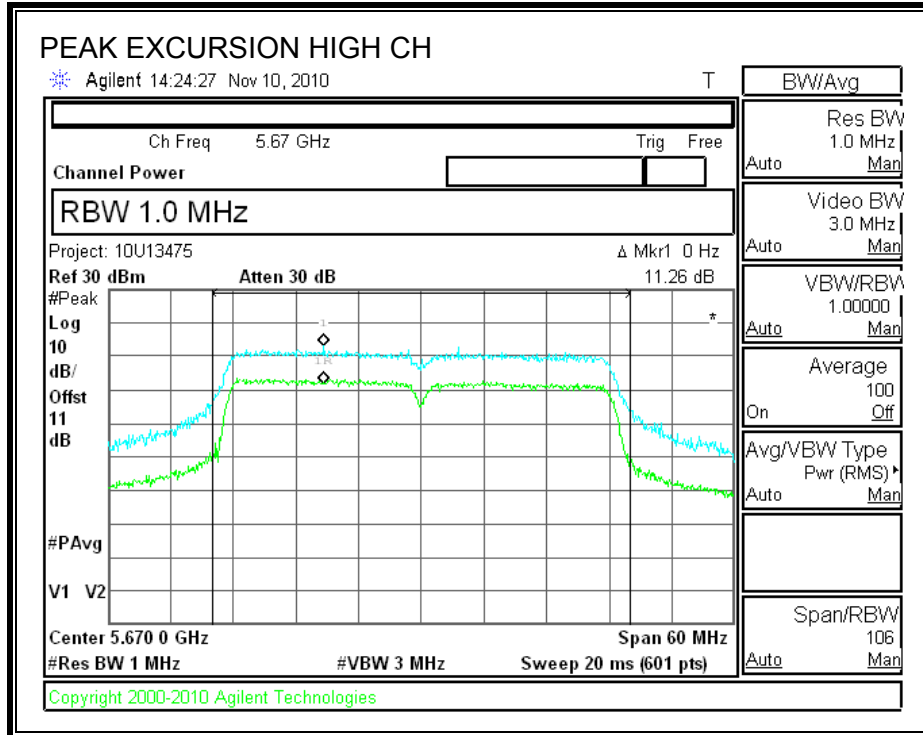


**CHAIN 3**

**PEAK EXCURSION**







## 7.9.6. CONDUCTED SPURIOUS EMISSIONS

### LIMITS

FCC §15.407 (b) (3)

IC RSS-210 A9.3 (3)

For transmitters operating in the 5.47-5.725 GHz band: all emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of -27 dBm / MHz.

### TEST PROCEDURE

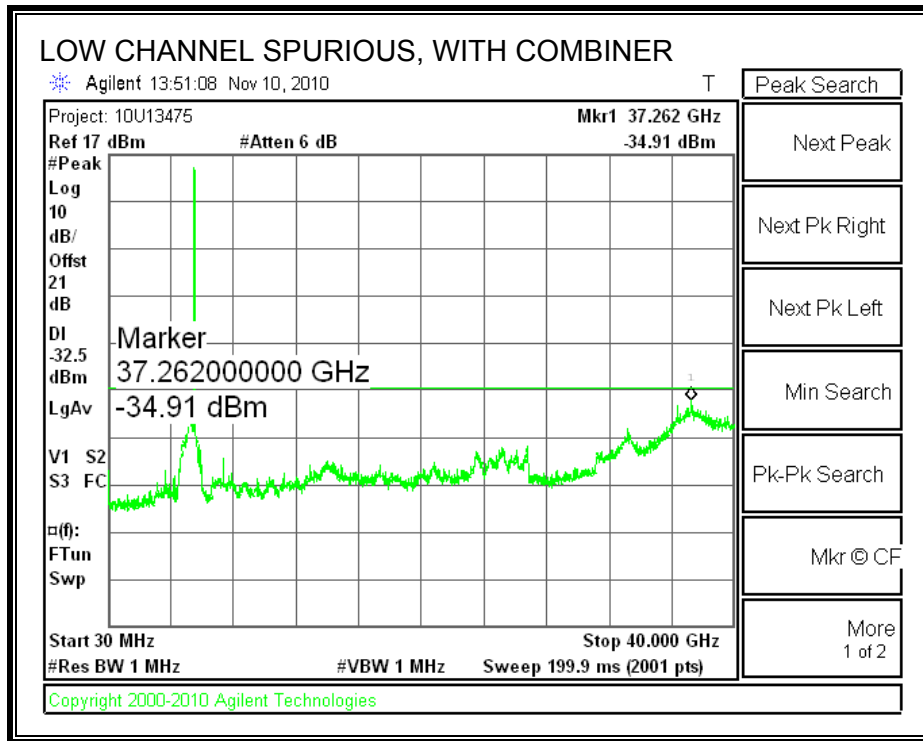
Conducted RF measurements of the transmitter output are made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

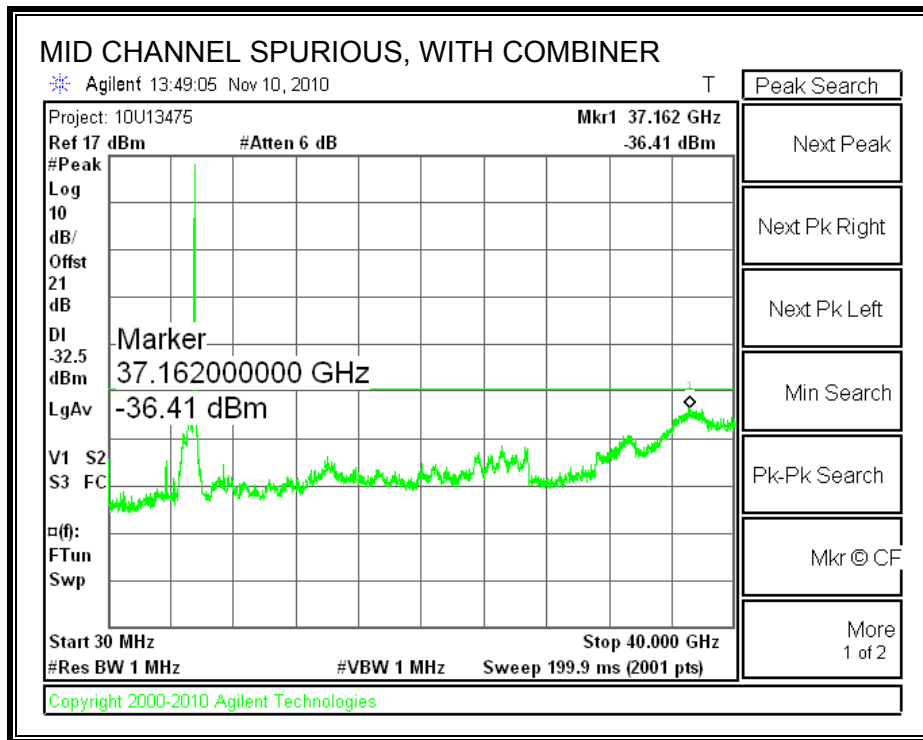
The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz. Peak detection measurements are compared to EIRP limit, adjusted for the maximum antenna gain.

Measurements are made over the 30 MHz to 40 GHz range with the transmitter set to the lowest, middle, and highest channels.

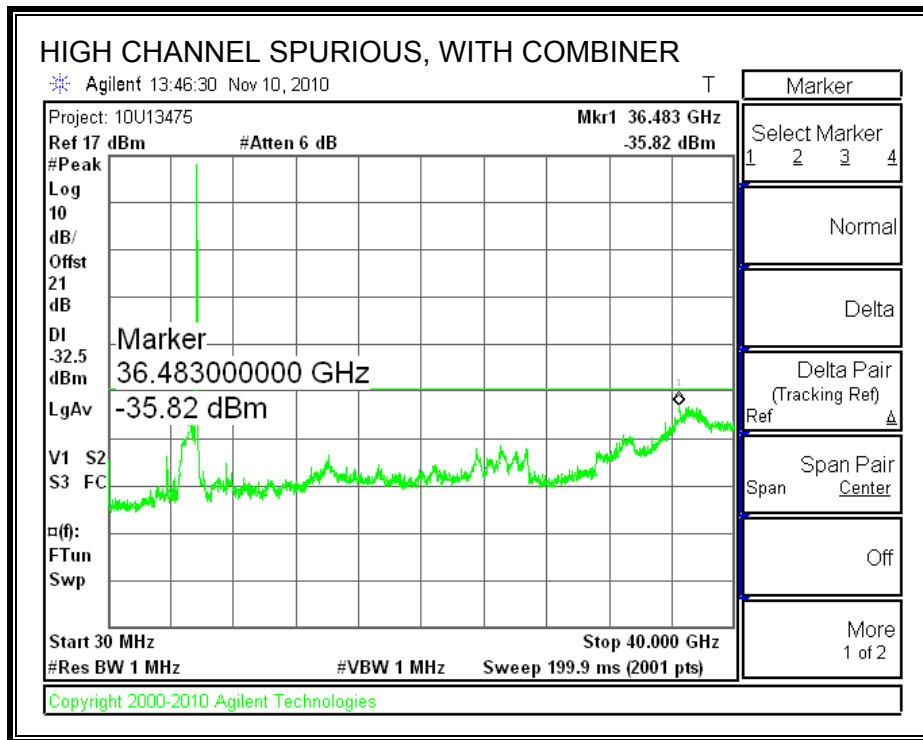
**RESULTS**

**SPURIOUS EMISSIONS WITH COMBINER**

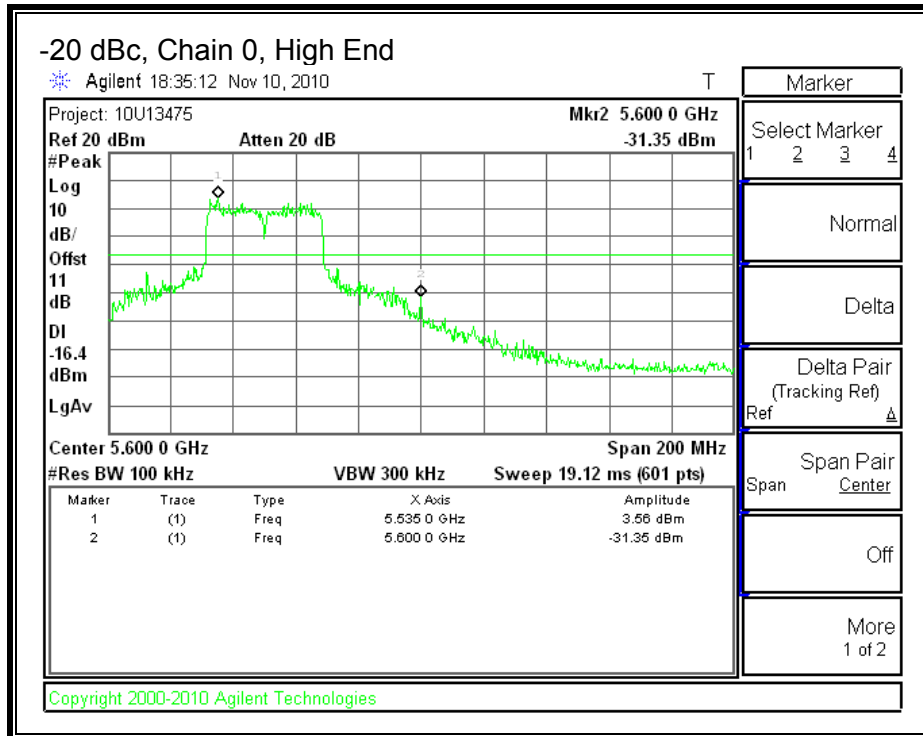


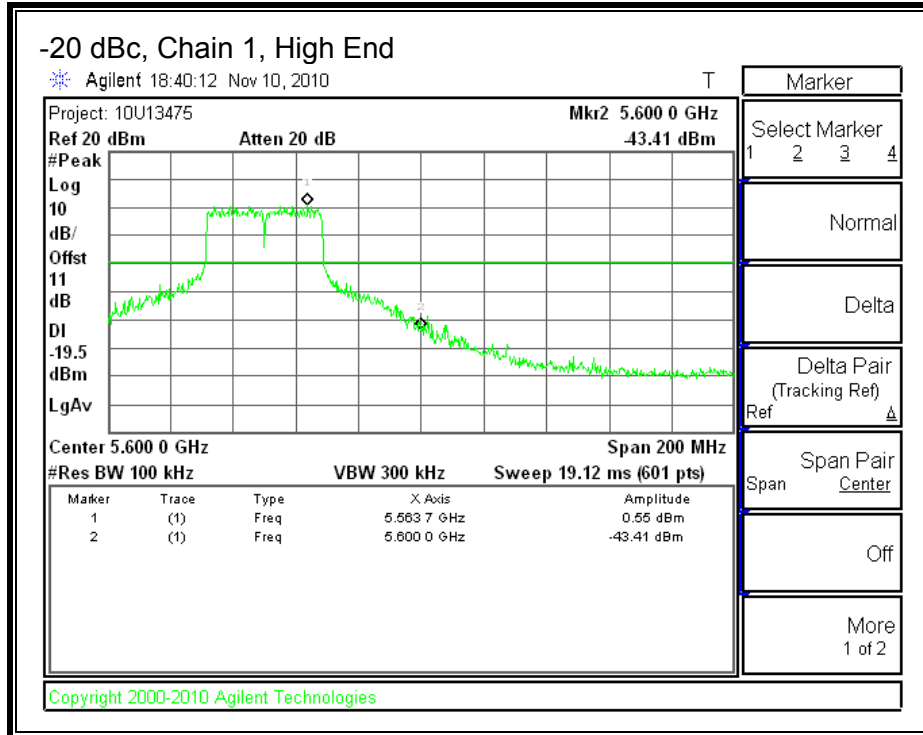


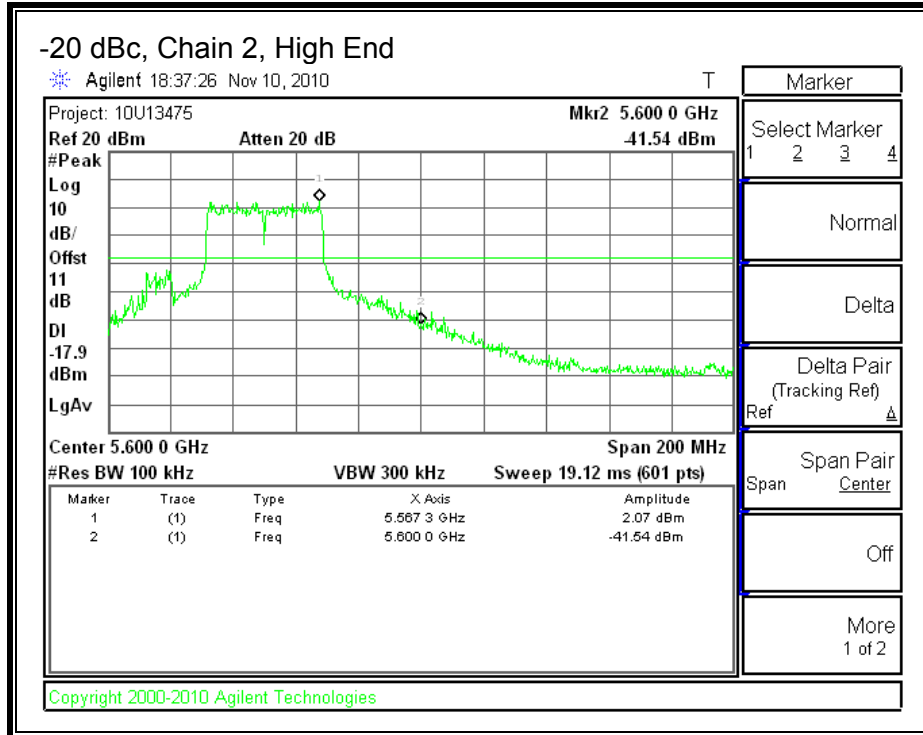




**-20 dBc RF CONDUCTED SPURIOUS IN THE NOTCH BAND OF 5.6-5.65 GHz**







## **7.10. RECEIVER CONDUCTED SPURIOUS EMISSIONS**

### **LIMITS**

#### IC RSS-GEN 7.2.3.1

Antenna Conducted Measurement: Receiver spurious emissions at any discrete frequency shall not exceed 2 nanowatts (-57 dBm) in the band 30-1000 MHz, or 5 nanowatts (-53 dBm) above 1 GHz.

### **TEST PROCEDURE**

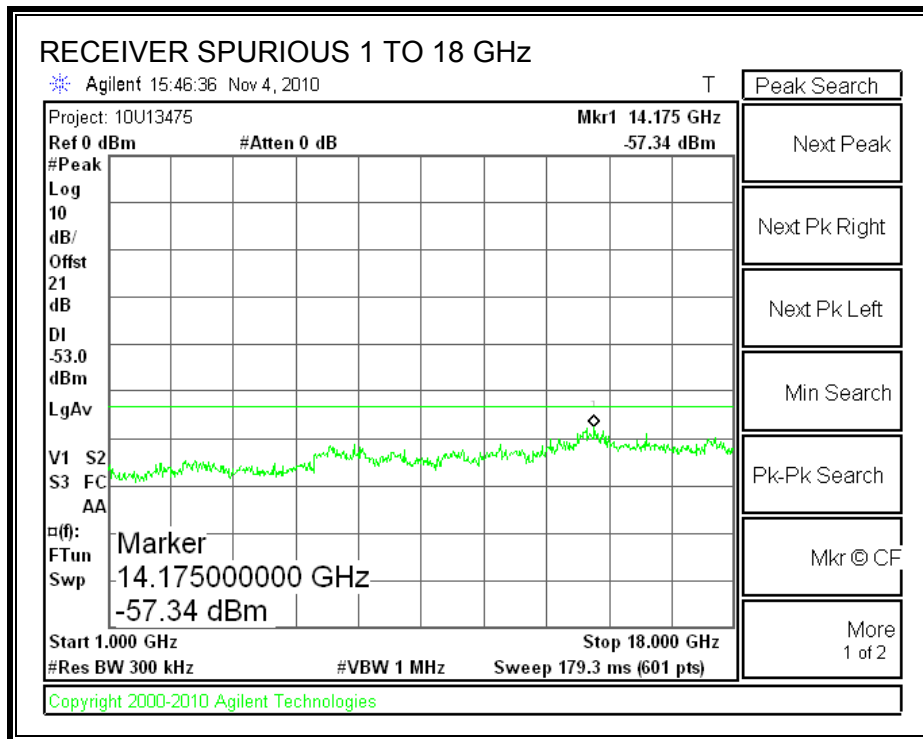
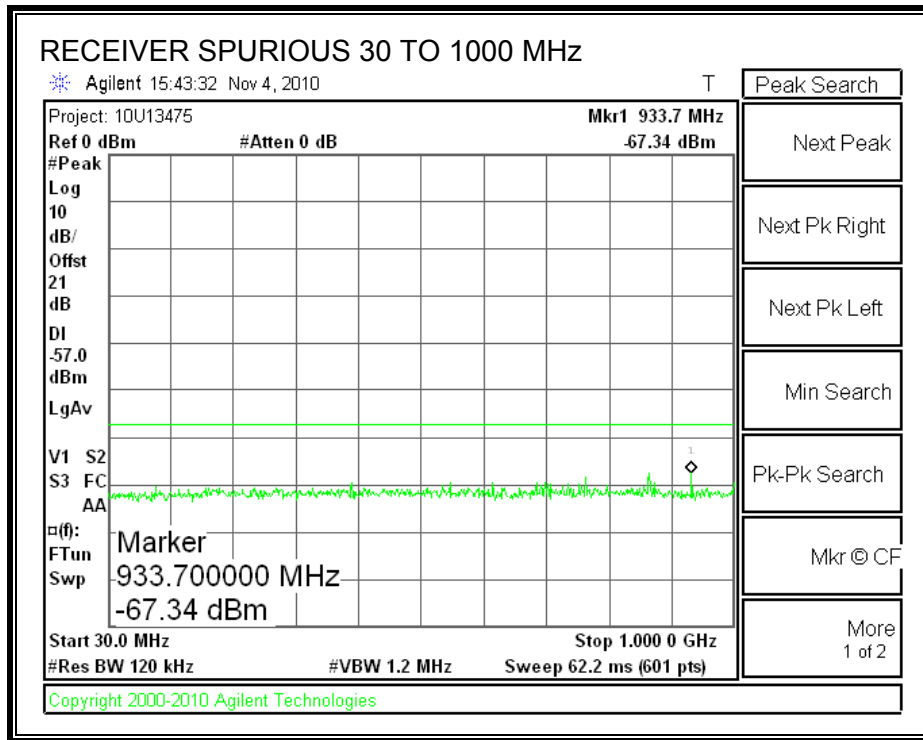
#### IC RSS-GEN 4.10, Conducted Method

The receiver antenna port is connected to a spectrum analyzer.

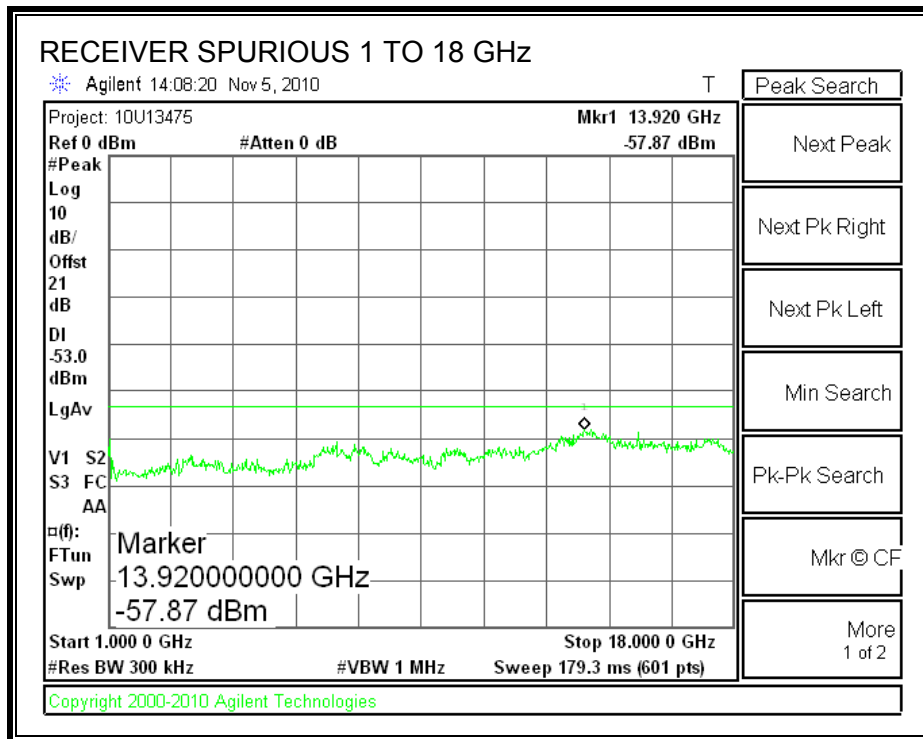
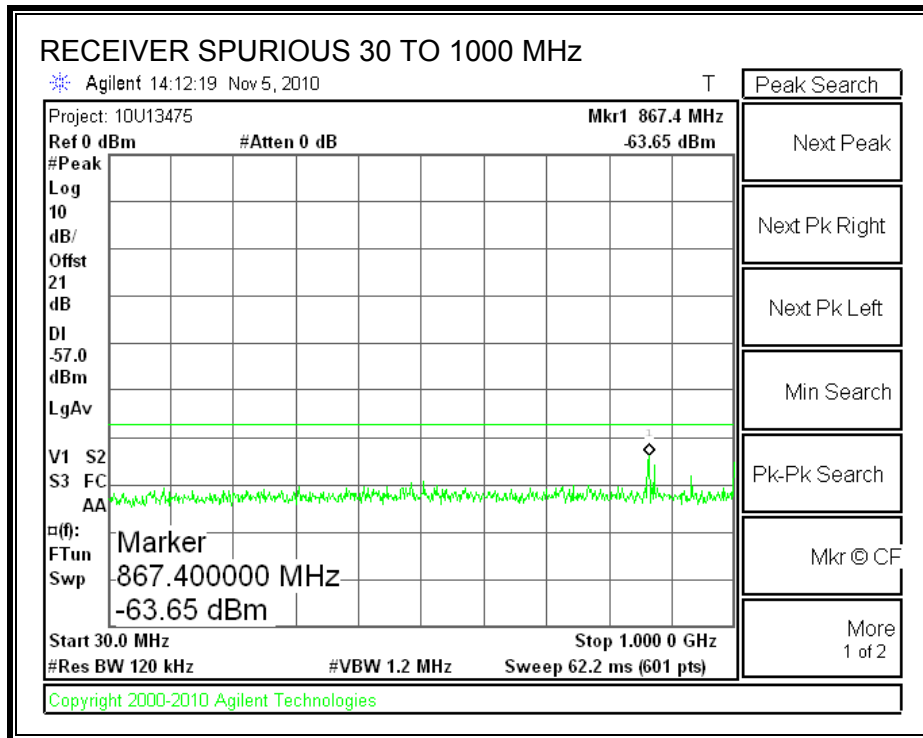
The spectrum from 30 MHz to 18 GHz is investigated with the receiver set to the middle channel of each 5 GHz band.

Preliminary tests on individual chains, and on all chains with a combiner, were performed. The worst-case configuration was with a combiner, therefore final test were performed with all chains feeding a combiner.

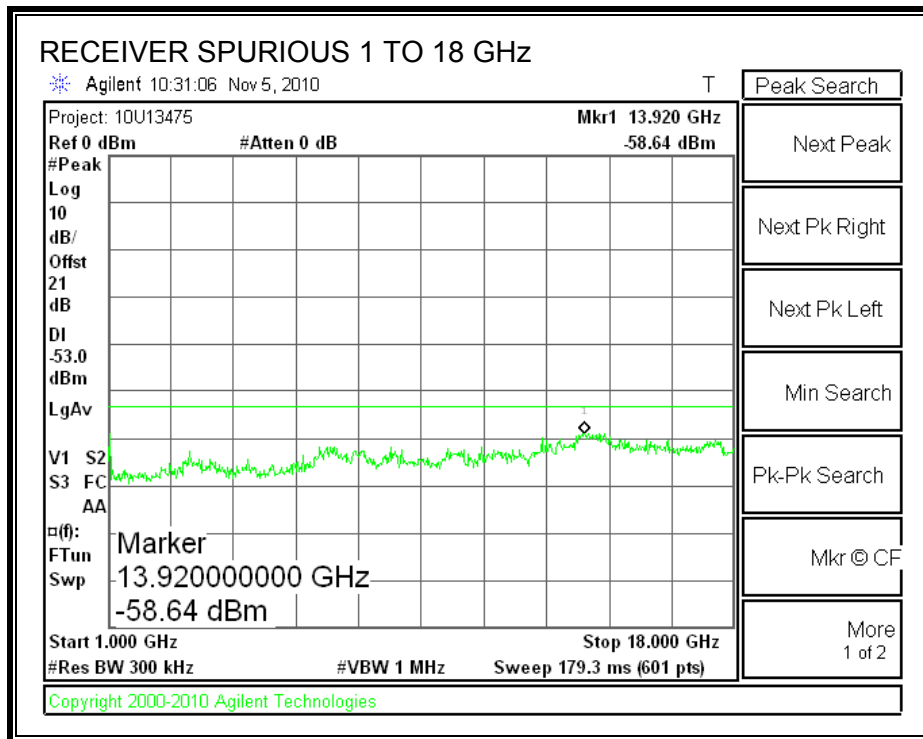
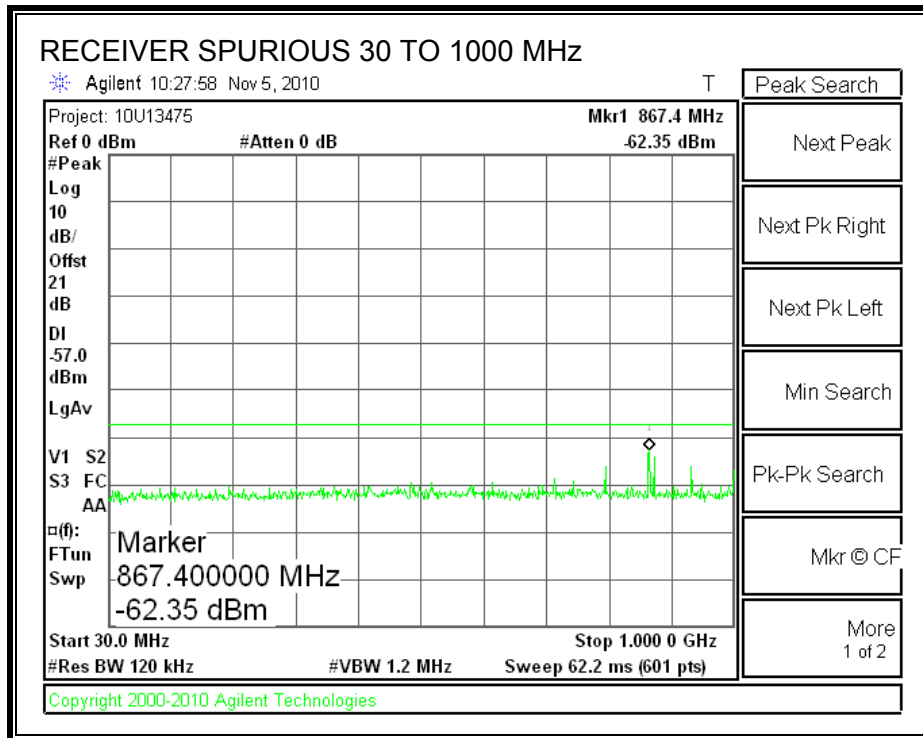
**RECEIVER SPURIOUS EMISSIONS FOR 802.11a MODE IN THE 5.2 GHz BAND**



**RECEIVER SPURIOUS EMISSIONS FOR 802.11n HT20 MODE IN THE 5.2 GHz BAND**

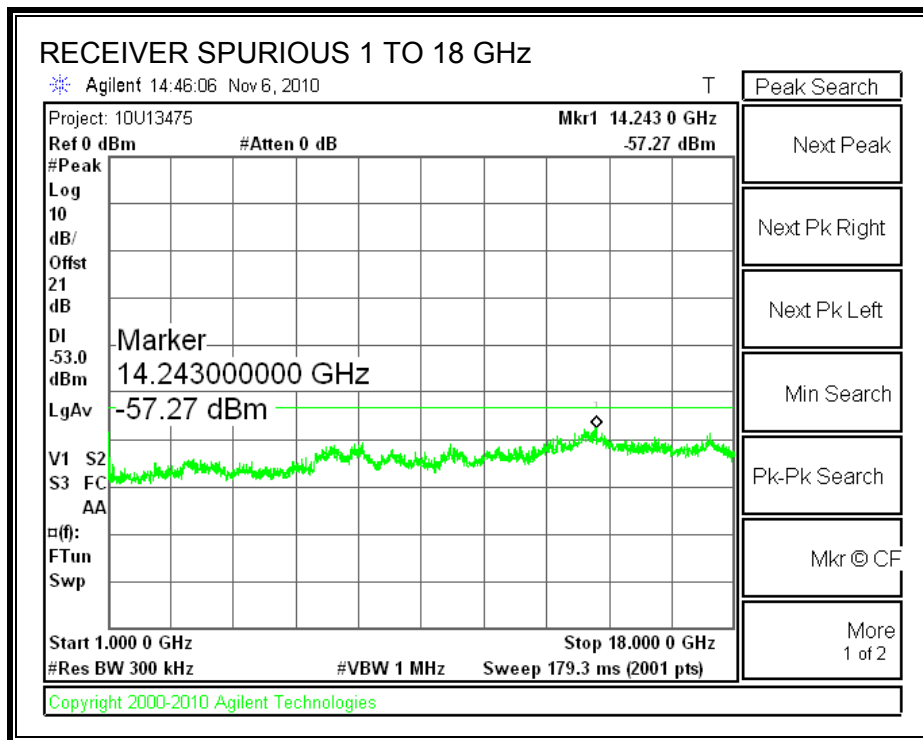
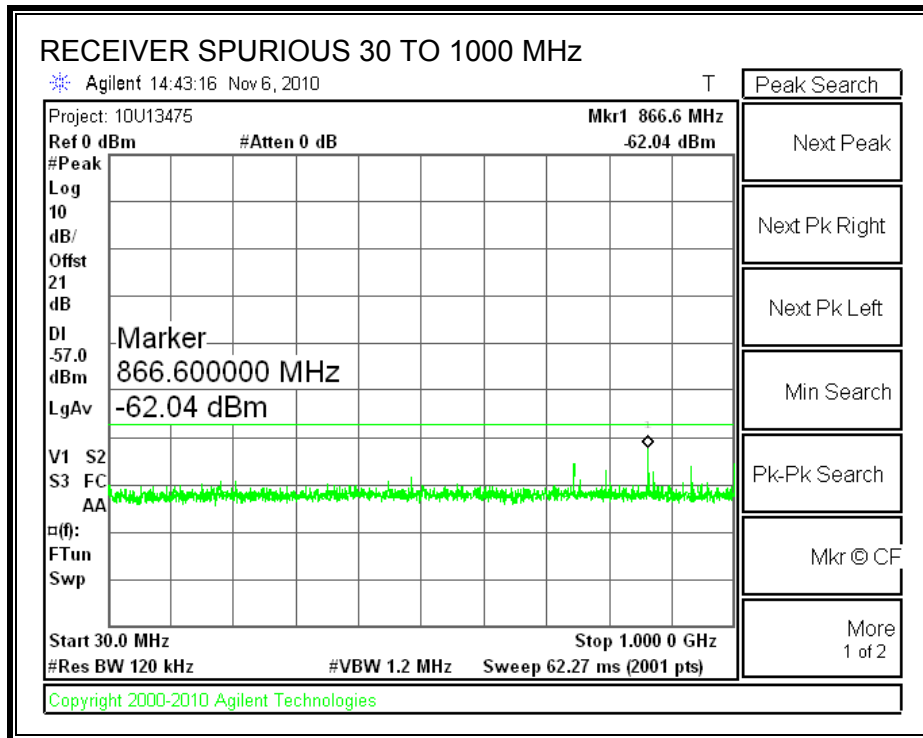


**RECEIVER SPURIOUS EMISSIONS FOR 802.11n HT40 MODE IN THE 5.2 GHz BAND**

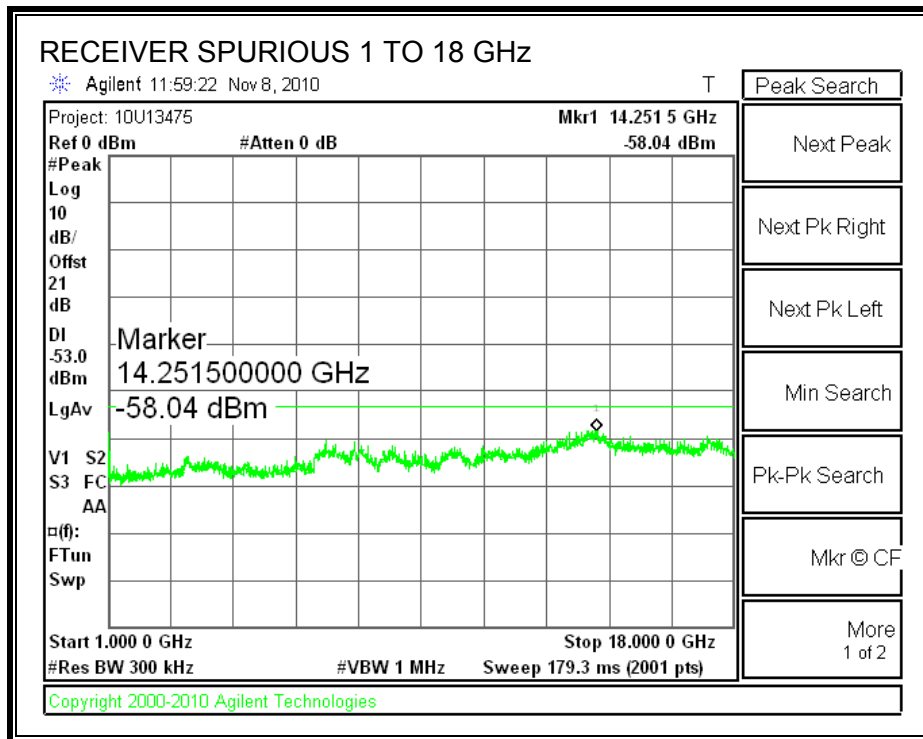
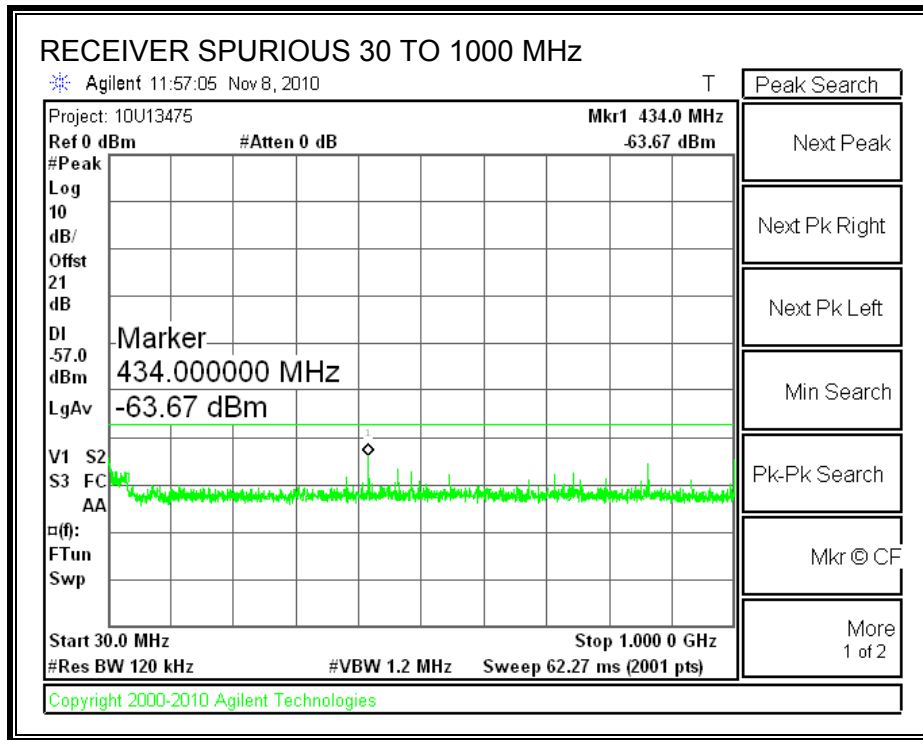




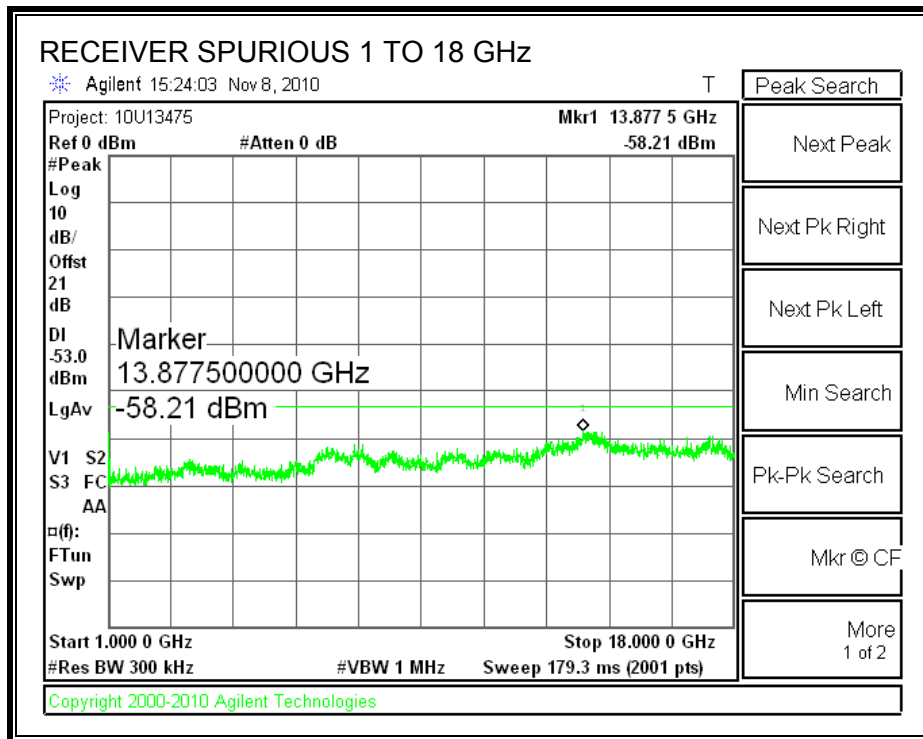
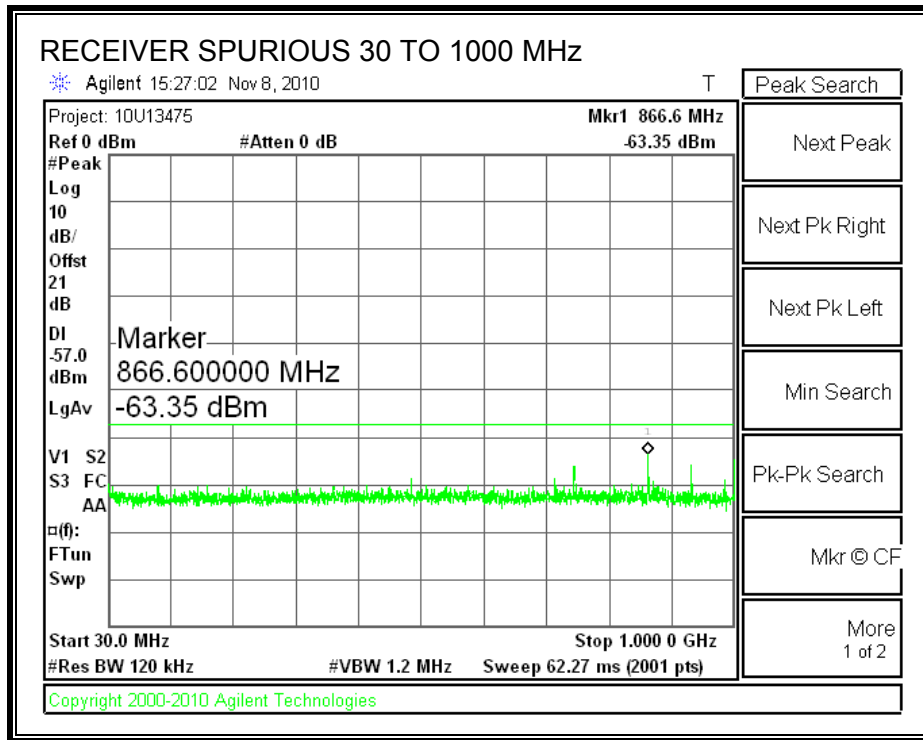
**RECEIVER SPURIOUS EMISSIONS FOR 802.11a MODE IN THE 5.3 GHz BAND**



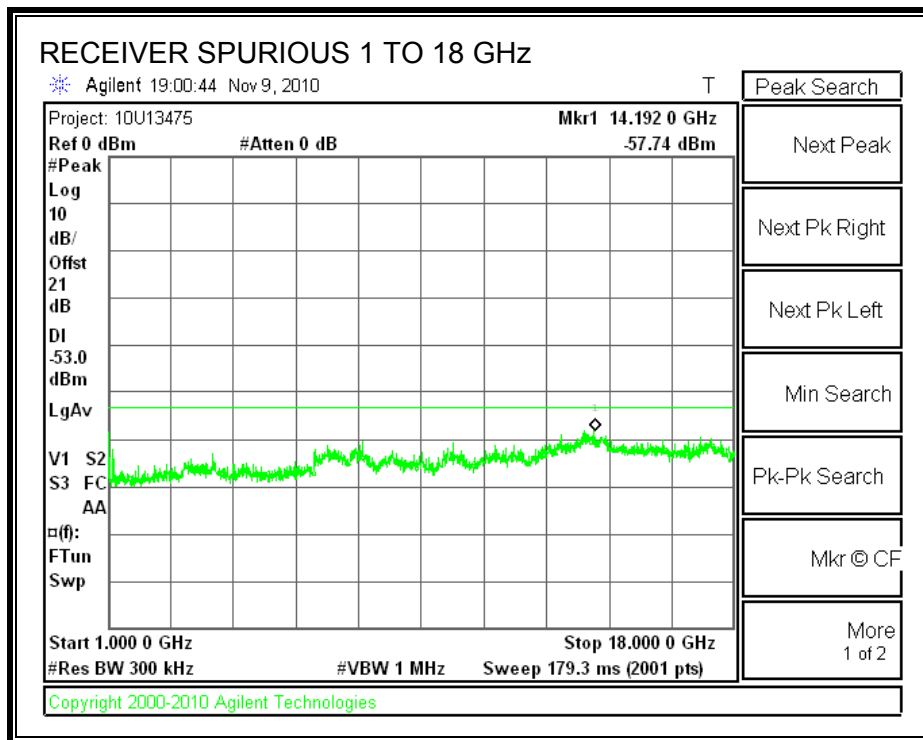
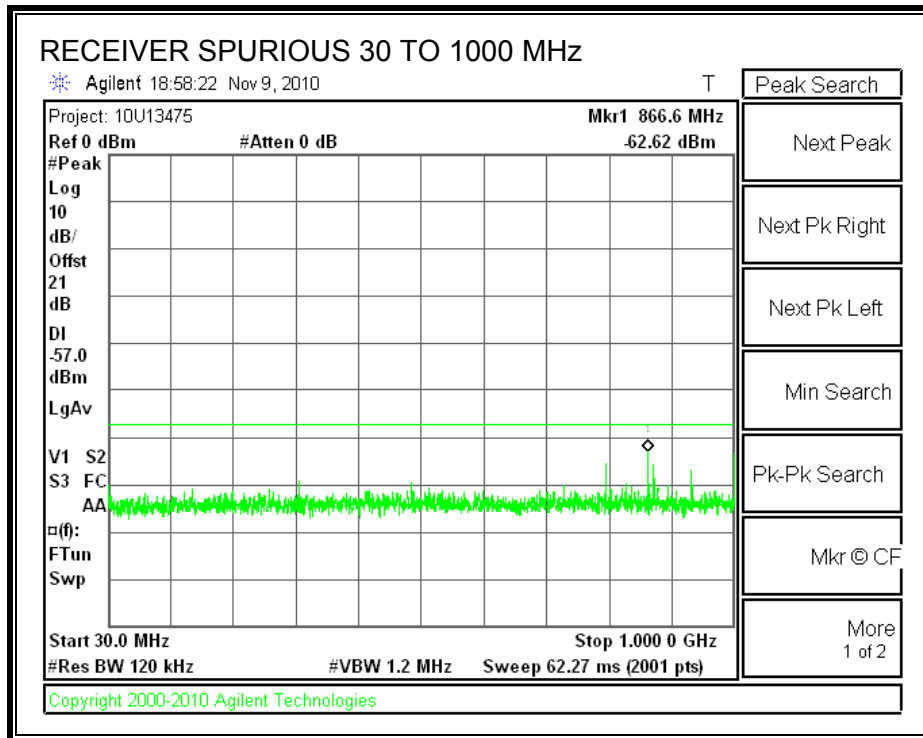
**RECEIVER SPURIOUS EMISSIONS FOR 802.11n HT20 MODE IN THE 5.3 GHz BAND**



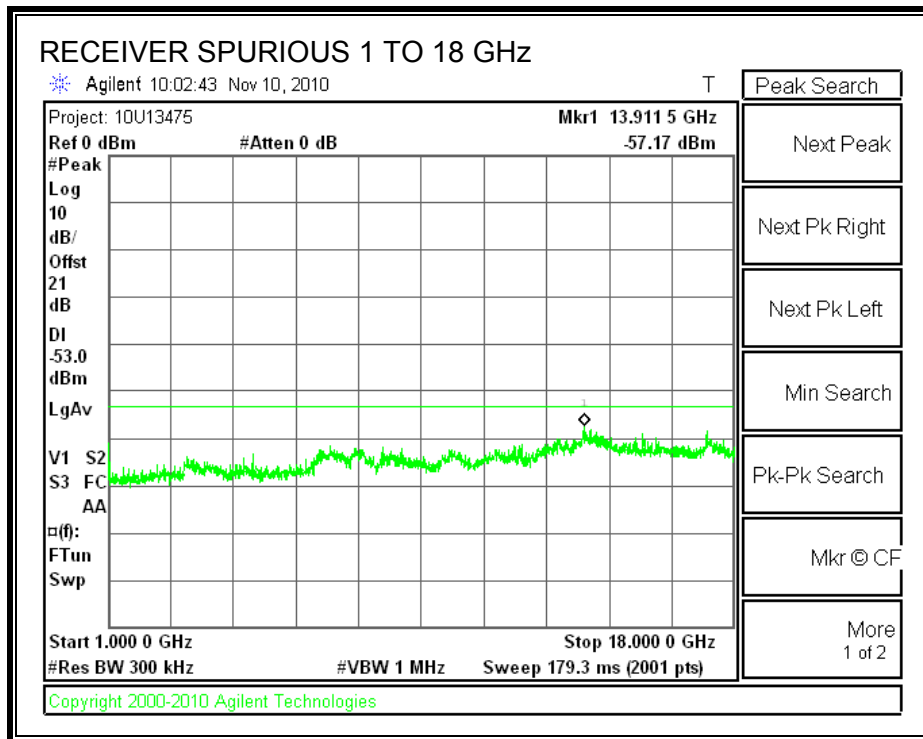
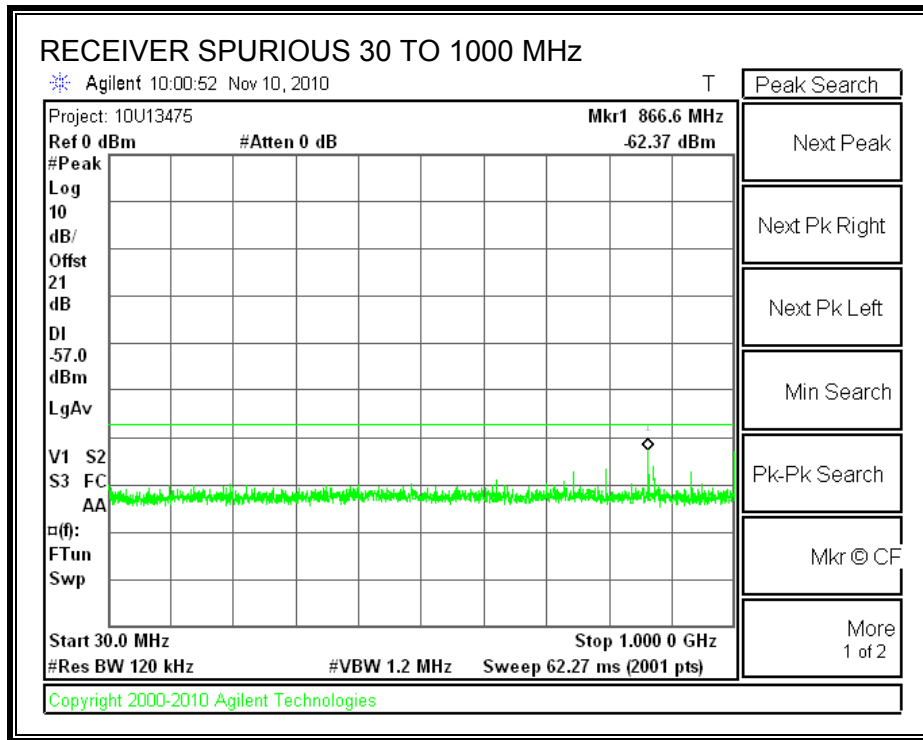
**RECEIVER SPURIOUS EMISSIONS FOR 802.11n HT40 MODE IN THE 5.3 GHz BAND**



**RECEIVER SPURIOUS EMISSIONS FOR 802.11a MODE IN THE 5.6 GHz BAND**



**RECEIVER SPURIOUS EMISSIONS FOR 802.11n HT20 MODE IN THE 5.6 GHz BAND**



**RECEIVER SPURIOUS EMISSIONS FOR 802.11n HT40 MODE IN THE 5.6 GHz BAND**

