



# Nemko Korea CO., Ltd.

300-2, Osan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyunggi-Do, KOREA

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## FCC EVALUATION REPORT FOR CERTIFICATION

**Applicant : Samsung Electronics Co., Ltd.**

**Visual Display Division,R&D Dept, 416,Maetan3-dong,**

**YeongTong-gu Suwon-Si,Gyunggi-Do, Korea,**

**(Post code : 442-742)**

**Attn. : Mr.ChangSeub Eum**

**Dates of Issue : July 31, 2007**

**Test Report No. : NK2HR101**

**Test Site : Nemko Korea Co., Ltd.**

FCC ID

**A3LSWLN01**

Brand Name

**SAMSUNG**

Contact Person

Samsung Electronics Co., Ltd.  
Visual Display Division,R&D Dept,#416 Maetan3-dong,  
YeongTong-gu,Suwon-Si,Gyunggi-do, Korea , 442-742.  
Mr. ChangSeub Eum  
Telephone No. : +82 31 200 7611

Applied Standard: 47 CFR Part 15, Subpart E Section 15.407 (UNII Devices)

EUT Type: Wireless LAN Mini PCI Card

The device bearing the brand name and FCC ID specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2003.

I attest to the accuracy of data and all measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

**Tested By : S.Lee**

**Engineer**

**Reviewed By : H.H.Kim**

**Manager & Chief Engineer**

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## 1.Scope

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*Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission under FCC part 15.*

<b>Responsible Party :</b>	Samsung Electronics Co., Ltd.
<b>Contact Person :</b>	Mr. ChangSeub Eum
<b>Manufacturer :</b>	Samyoung Electronics.Co.Ltd 146-1,SangDaeWon-Dong,JoongWon-Gu, SungNam-City,Gyunggil-Do, 462-807 KOREA

- FCC ID: A3LSWLN01
- Model: SWLN01
- Brand Name: SAMSUNG
- EUT Type: Wireless LAN Mini PCI Card
- Applied Standard: 47 CFR Part 15, Subpart E Section 15.407
- FCC Classification: Unlicensed National Information Infrastructure (UNII)
- Test Procedure(s): ANSI C63.4 (2003)
- Dates of Test: June 14, 2007 to July 30, 2007
- Place of Tests: Nemko Korea Co., Ltd.
- Test Report No.: NK2HR101

## 2.Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-2003) was used in determining radiated and conducted emissions emanating from Samsung Electronics Co., Ltd.

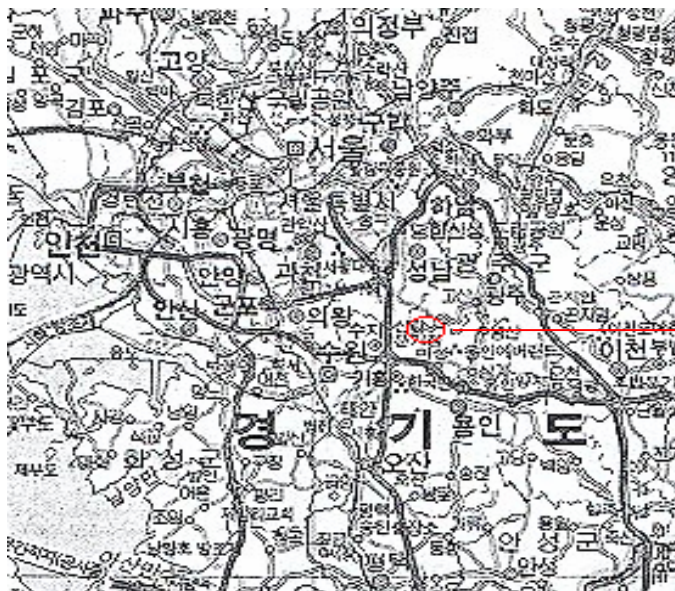
FCC ID : **A3LSWLN01**

These measurement tests were conducted at **Nemko Korea Co., Ltd.**

The site address is 300-2, Osan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do, KOREA  
The area of Nemko Korea Corporation Ltd. Test Site is located in a mountain area at 80 kilometers (48 miles) southeast and Incheon International Airport (Incheon Airport), 30 kilometers (18miles) south-southeast from central Seoul.

It is located in the valley surrounded by mountains in all directions where ambient radio signal conditions are quiet and a favorable area to measure the radio frequency interference on open field test site for the computing and ISM devices manufactures.

The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 2003.



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Fig. 1. The map above shows the Seoul in Korea vicinity area.  
The map also shows Nemko Korea Corporation Ltd. EMC Lab. and Incheon Airport.

### 3. Test Conditions & EUT Information

#### Environmental Conditions

Temperature	20°C ~ 25°C
Relative Humidity	38% ~ 55%

#### Operating During Test

The EUT was tested at the lowest channel, middle channel and the highest channel with the maximum RF power and all data recorded in the report.

The EUT was connected to notebook PC and then a test program was executed to operate EUT continuously.

During the spurious radiated and conducted emission tests, Both chains were transmitting simultaneously.

This module is just for the wireless TV solution. The applicant's TV solutions want to transmit Video and Audio signal with this module. (Those signals are high bit rate data) So the applicant needs large bandwidth. 802.11a is not adjustable to use for wireless TV solution. The applicant does not support 802.11a.

So all test about this EUT were measured with 802.11n mode only.

The EUT was programmed with the following data rate setting that was used during testing:

For 5150MHz ~ 5250MHz Band:

Frequency	5180MHz	5220MHz	5240MHz
Power Level	10	10	10
20MHz Data Rate	MCS12	MCS12	MCS12
Frequency	5190MHz	-	5230MHz
Power Level	14	-	14
40MHz Data Rate	MCS10	-	MCS10

For 5725MHz ~ 5825MHz Band:

Frequency	5745MHz	5765MHz	5805MHz
Power Level	12	12	12
20MHz Data Rate	MCS10	MCS10	MCS10
Frequency	5775MHz	-	5795MHz
Power Level	12	-	12
40MHz Data Rate	MCS13	-	MCS13

**Description of EUT**

The EUT is an 802.11n MIMO transceiver chipset and manufactured by Samyoung. The chipset is installed on a Mini PCI card, model number is SWLN01.

Frequency Bands	5150MHz~5250MHz 5725MHz~5825MHz
Bandwidth	20 MHz / 40 MHz
Modulation Method	QPSK,16QAM
Data Rate	MCS 0~15
Antenna Type	PIFA Antenna
Dimensions	59mm x 50mm x 4mm
Weight	Approx.15g
Operating Conditions	0°C ~ +70°C (Storage), 95% (non-condensing)

**Support Equipment**

802.11n Wireless LAN mini PCI Card (EUT)	Samsung Electronics Co., Ltd. FCC ID : A3LSWLN01	S/N: N/A
Notebook PC	Samsung Electronics Co., Ltd. Model: SX10 Adaptor : Samsung Electro- Mechanics Co., Ltd. Model : AD-6019 1.8m unshielded AC cable, 1.6m shielded DC cable	S/N: F80791EW500149 S/N: N/A
USB Mouse	Suzhou Logitech Electronics Co., Ltd. Model : M-UR69 1.5m shielded USB cable	S/N: N/A
LCD Monitor	Tianjin Samsung Electronics Display Model : BR20BS 1.6m shielded D-sub cable	S/N: N667HVZLC00915P

## 4. Summary of Test Results

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The EUT has been tested according to the following specification:

Description of Test	FCC Rules	Result
Antenna Requirement	15.203	Complies
26dB & 99% Emission Bandwidth	15.403 (i)	Complies
Peak Power Spectral Density	15.407 (a)(1) & (3)	Complies
Maximum Peak Output Power	15.407 (a)(1) & (3)	Complies
Peak Excursion	15.407 (a)(6)	Complies
Conducted Spurious Emissions	15.407 (b)(1)	Complies
Frequency Stability / Temperature Variation	15.407 (g)	Complies
Spurious Radiated Emissions	15.205 & 15.209, & 15.407(a)(1)	Complies
Power line Conducted Emission	15.207	Complies
Maximum Permissible Exposure	1.1307(b)	Complies



## 5. Antenna Requirement

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According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be with the device. The used of a Permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by user, but the use of a standard antenna jack or electrical connector is prohibited.

The antenna for this device is three integral antennas with the gain of:

Antenna A (Tx,Rx): 15Cm Cable Antenna / 55Cm Cable Antenna

5150MHz ~ 5250MHz Band : 3.25dBi / 0.57dBi

5725MHz ~ 5825MHz Band : 3.26dBi / 0.49dBi

Antenna B (Tx,Rx) : 25Cm Cable Antenna / 55Cm Cable Antenna

5150MHz ~ 5250MHz Band : 2.68dBi / 0.57dBi

5725MHz ~ 5825MHz Band : 2.54dBi / 0.49dBi

Antenna C (Diversity Rx) : 20Cm Cable Antenna / 55Cm Cable Antenna

5150MHz ~ 5250MHz Band : 3.00dBi / 0.57dBi

5725MHz ~ 5825MHz Band : 3.04dBi / 0.49dBi

## 6.Recommendation/Conclusion

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The data collected shows that the **Samsung Electronics Co., Ltd.**

FCC ID : **A3LSWLN01**

The highest emission observed was at **0.18MHz** for conducted emissions with a average margin of **14.5 dB**, at **17420MHz** for radiated emissions with a average margin of **3.10dB**.

## 7.Sample Calculation

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$$\text{dB } \mu\text{V} = 20 \log_{10} (\mu\text{V}/\text{m})$$

$$\mu\text{V} = 10^{(\text{dB } \mu\text{V}/20)}$$

### **EX. 1.**

@57.7 MHz

Class B limit = 100  $\mu\text{V}/\text{m}$  = 40.0 dB  $\mu\text{V}/\text{m}$

Reading = 19.1 dB  $\mu\text{V}$  (calibrated level)

Antenna factor + Cable Loss = 10.12 dB

Total = 29.22 dB  $\mu\text{V}/\text{m}$

Margin = 40.0 - 29.22 = 10.78

10.78 dB below the limit

## 8. Description of Test

### 8.1 Conducted Emissions

The Line conducted emission test facility is located inside a 4 X 7 X 2.5 meter shielded enclosure.

It is manufactured by EM engineering. The shielding effectiveness of the shielded room is in Accordance with MIL-STD-285 or NSA 65-6.

A 1mX 1.5M wooden table 0.8m height is placed 0.4m away from the vertical wall and 1.5m away from the side of wall of the shielded room

Rohde & Schwarz LISN and Kyoritsu KNW-407 50ohm/50uH line impedance stabilization Network are bonded to the shielded room.

The EUT is powered from the Rohde & Schwarz LISN and the support equipment is powered from the Kyoritsu LISN. Power to the LISN s are filtered by high-current high insertion loss Power line filters. The purpose of filter is to attenuate ambient signal interference and this filter is also bonded to shielded enclosure. All electrical cables are shielded by tinned copper zipper tubing with inner diameter of 1/2".

If DC power device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the LISNs,

All interconnecting cables more than 1 meter were shortened by non inductive bundling (Serpentine fashion) to a 1 meter length.

Sufficient time for EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT. The spectrum was scanned from 150KHz to 30MHz with 200msec sweep time.

The frequency producing the maximum level was re-examined using the EMI test receiver. (Rohde & Schwarz, ESCS30).

The detector function was set to CISPR quasi-peak mode and average mode.

The bandwidth of receiver was set to 9KHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission.

Each emission was maximized by; switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux AC outlet, if applicable; which ever determined the worst case emission.

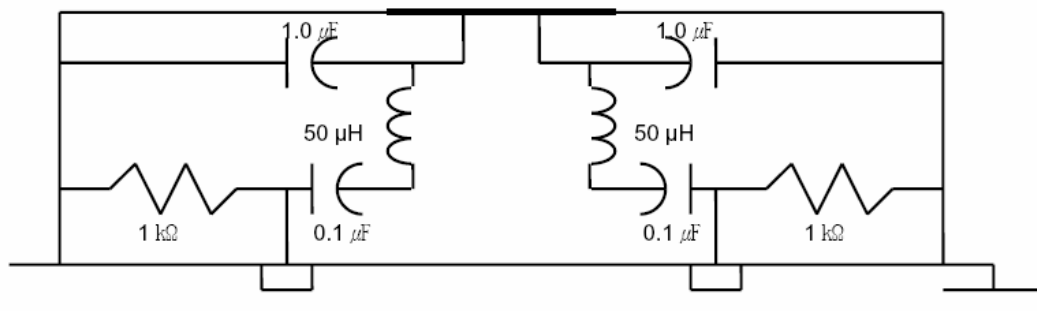


Fig. 2. LISN Schematic Diagram

## 8.2 Radiated Emissions

Preliminary measurement were made indoors at 3 meter using broad band antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The Technology configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna was note for each frequency found.

The spectrum was scanned from 30 to 1000MHz using Biconical log Antenna (ARA, LPB-2520/A). Above 1GHz, Horn antenna (Schwarzbeck BBHA 9120D: upto 18GHz )was used.

Final Measurements were made outdoors at 3 or 10m test range using Logbicon Super Antenna(Schwarzbeck,VULB9166)or Horn antenna.( Schwarzbeck BBHA9120D:upto18GHz , BBHA9170:Upto40GHz)

The test equipment was placed on a wooden table.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

Each frequency found during pre-scan measurements was reexamined and investigated using EMI test receiver.(ESCS30)

The detector function was set to CISPR quasi-peak mode or Average mode and the bandwidth of the receiver was set to 120KHz or 1MHz depending on the frequency or type of signal.

The half wave dipole antenna was tuned to the frequency found during preliminary radiated measurements.

The EUT support equipment and interconnecting cables were re configured to the setup producing the maximum emission for the frequency and were placed on top of a 0.8m high non- metallic 1.0X 1.5 meter table.

The EUT, support equipment and interconnecting cables were re-arranged and manipulated to maximize each EME emission.

The turn table containing the Technology was rotated; the antenna height was varied 1 to 4meter and stopped at the azimuth or height producing the maximum emission Each emission was maximized by : switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and of support equipment, and powering the monitor from the floor mounted outlet box and computer aux AC outlet, if applicable; which ever determined the worst case emission.

Each EME reported was calibrated using the R/S signal generator.

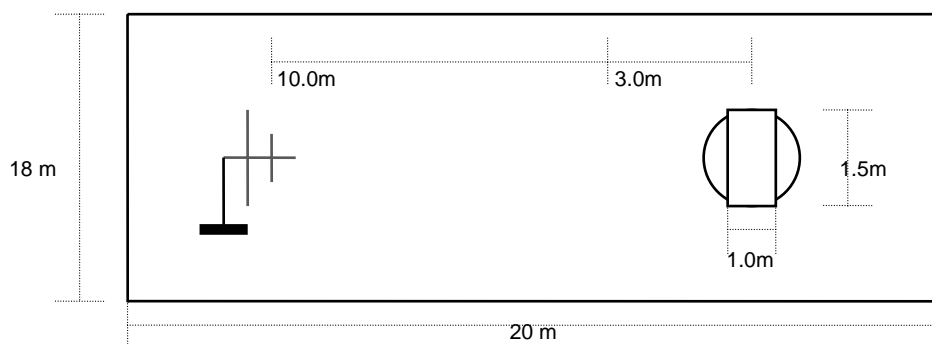
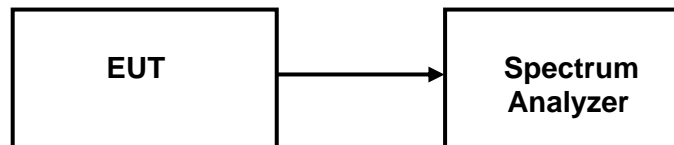


Fig. 2. Dimensions of Outdoor Test Site

### **8.3 Emission Bandwidth (26dB Bandwidth & 99% Bandwidth)**

#### **Test Setup**



#### **Test Procedure**

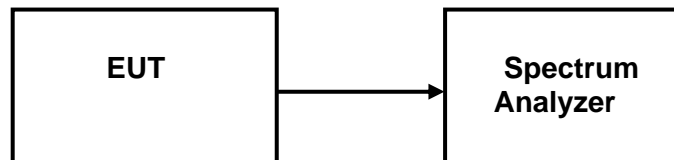
The transmitter output is connected to a spectrum analyzer. The RBW is set to 1% to 3% of the 26 dB bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled.

#### **Limit**

For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emission bandwidth is based on the use of a measurement instrument employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

## 8.4 Peak Power Spectral Density

### Test Setup



### Test Procedure

The test is performed in accordance with FCC Public Notice : APPENDIX A Guideline for Assessing Unlicensed National Information Infrastructure (U-NII) Devices -Part 15, Subpart E, August 2002. PPSD method #1 was used.

Each chain is measured separately and the total power is calculated using the following formula:

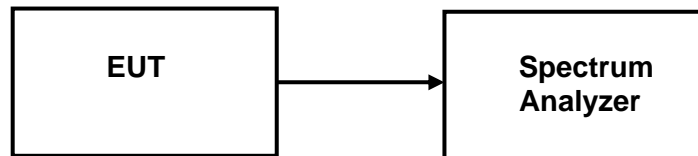
$$\begin{aligned} \text{Total Power} &= 10 \log (10^{\wedge} (\text{Chain A PPSD} / 10) + 10^{\wedge} (\text{Chain B PPSD} / 10)) \\ \text{Effective Antenna Gain} &= 10 \log (10^{\wedge} (\text{Chain A Antenna Gain} / 10) + 10^{\wedge} (\text{Chain B Antenna Gain} / 10)) \end{aligned}$$

### Limit

§ 15.407 (a)(1) For the band 5.15 – 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or 4 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power and the peak power spectral density shall be reduced by amount in dB that the directional gain of the antenna exceeds 6 dBi. And § 15.407 (a)(3) For the band 5.725 – 5.825 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 1W or 17 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 17dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6dBi 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 6dBi.

## 8.5 Maximum Peak Output Power

### Test Setup



### Test Procedure

The test is performed in accordance with FCC Public Notice : APPENDIX A Guideline 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.

Each chain is measured separately and the total power is calculated using the following formula:

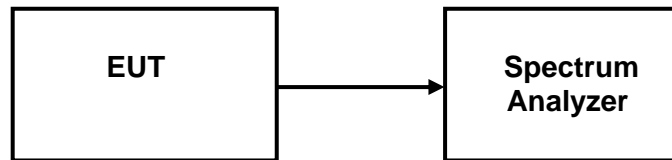
$$\begin{aligned} \text{Total Power} &= 10 \log (10^{\text{Chain A Power} / 10} + 10^{\text{Chain B Power} / 10}) \\ \text{Effective Antenna Gain} &= 10 \log (10^{\text{Chain A Antenna Gain} / 10} + 10^{\text{Chain B Antenna Gain} / 10}) \end{aligned}$$

### Limit

§ 15.407 (a)(1) For the band 5.15 – 5.25 GHz, the maximum conducted output power over the frequency band of operation shall not Exceed the lesser of 50 Mw or  $4 \text{ dBm} + 10 \log B$ , where is the 26 dB emission bandwidth in MHz. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power and the peak power spectral density shall be reduced by amount in dB that the directional gain of the antenna exceeds 6 dBi. And § 15.407 (a)(3) For the band 5.725 – 5.825 GHz, the peak transmit power over the frequency band of operation shall not exceed the lesser of 1W or  $17 \text{ dBm} + 10 \log B$ , where is the 26 dB emission bandwidth in MHz. In addition, the peak power spectral density shall not exceed 17dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6dBi 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 6dBi.

## **8.6 Peak Excursion**

### **Test Setup**



### **Test Procedure**

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

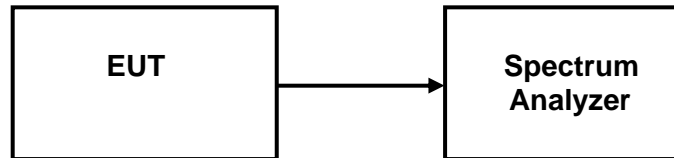
### **Limit**

§ 15.407 (a)(6) The ratio of 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 1MHz bandwidth or the emission bandwidth whichever is less.



## 8.7 Conducted Spurious Emission

### Test Setup



### Test Procedure

Conducted RF measurement of the transmitter output are to confirm that the EUT antenna Port conducted emissions meet the specified limit and to identify any spurious signals That required 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 the average EIRP Limit, adjusted for the maximum antenna gain. If necessary, additional average detection measurements are made.

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

### Limit

§ 15.407 (b)(1 & 2) For transmitters operating in the 5.15 – 5.25 GHz band: all emissions outside of the 5.15 – 5.35GHzband shall not exceed an EIRP of -27dBm / MHz.

And § 15.407 (b)(4) For transmitters operating in the 5.725 – 5.825 GHz band: all emissions within the frequency range from the band edge to 10MHz above or below the band edge shall not exceed an EIRP of – 17dBm/MHz:for frequencies 10MHz or greater above or below the band edge, emissions shall not exceed an EIRP of -27dBm / MHz.

## 9. Test Data

### 9.1 Emission Bandwidth (26dB Bandwidth & 99% Bandwidth)

Test Results: 5150MHz ~ 5250MHz Band

◆ 802.11n : 20MHz rate

Channel	Frequency (MHz)	26dB Bandwidth (MHz)		99% Bandwidth (MHz)	
		Chain A	Chain B	Chain A	Chain B
Low	5180	20.096	20.029	17.643	17.699
Middle	5220	20.081	20.062	17.682	17.698
High	5240	19.997	19.964	17.637	17.689

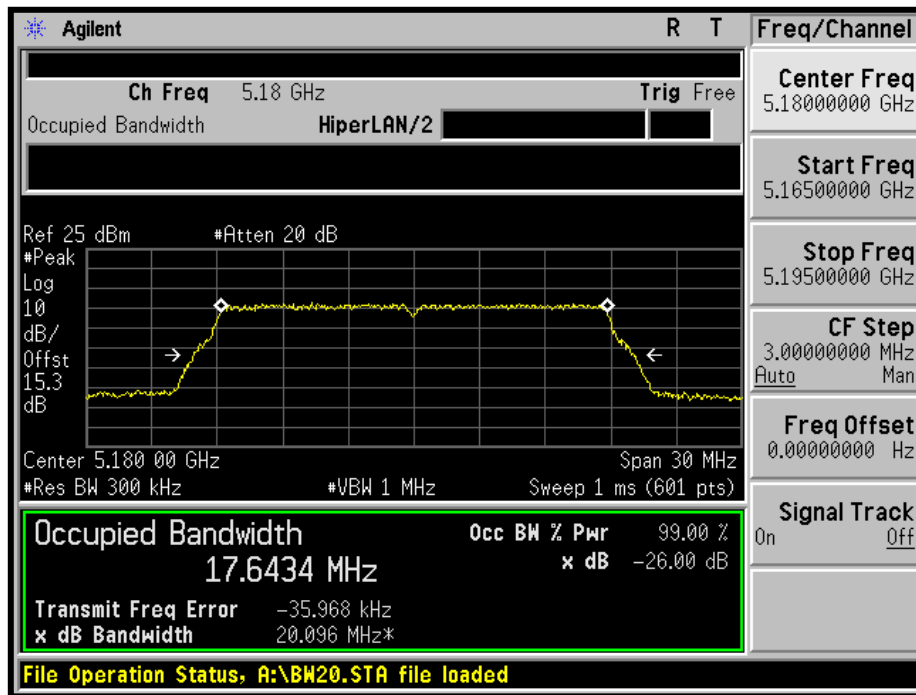
◆ 802.11n : 40MHz rate

Channel	Frequency (MHz)	26dB Bandwidth (MHz)		99% Bandwidth (MHz)	
		Chain A	Chain B	Chain A	Chain B
Low	5190	39.674	39.331	36.144	36.181
High	5230	39.644	39.926	36.015	36.091

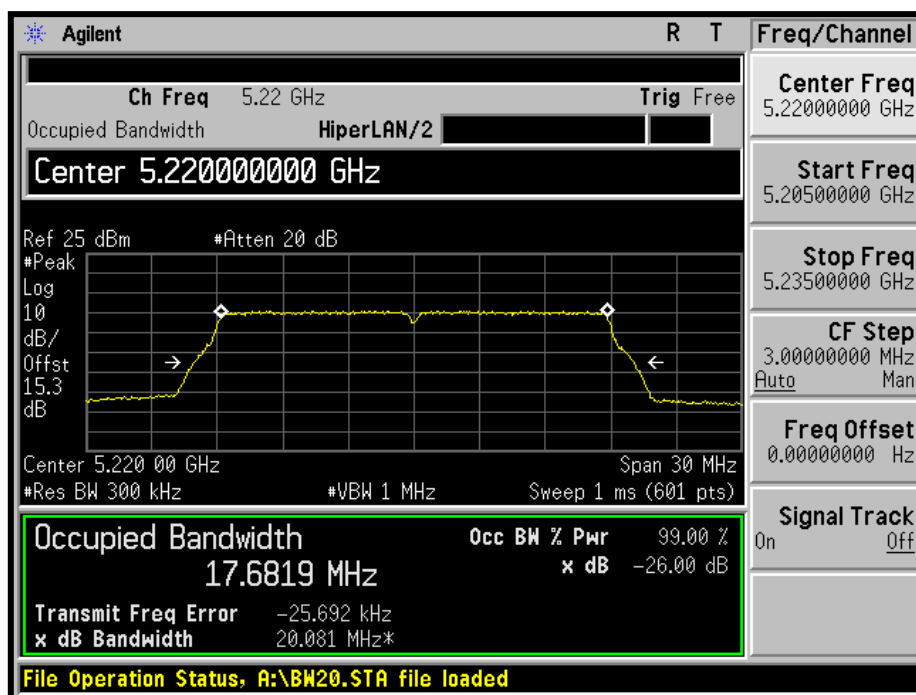
5150 MHz ~ 5250 MHz

802.11n : 20MHz rate, Chain A

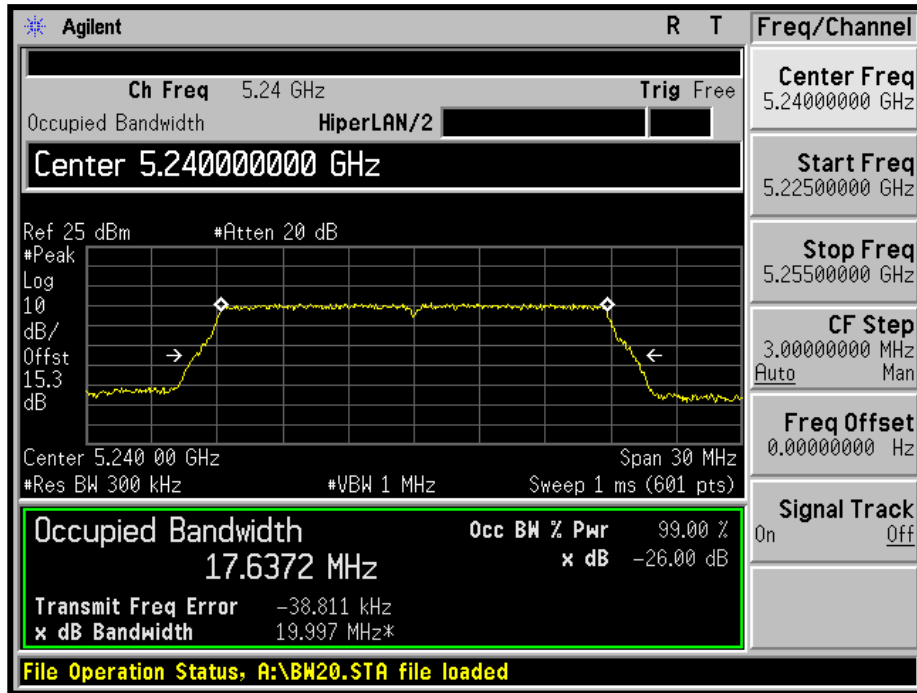
Low Channel



Middle Channel



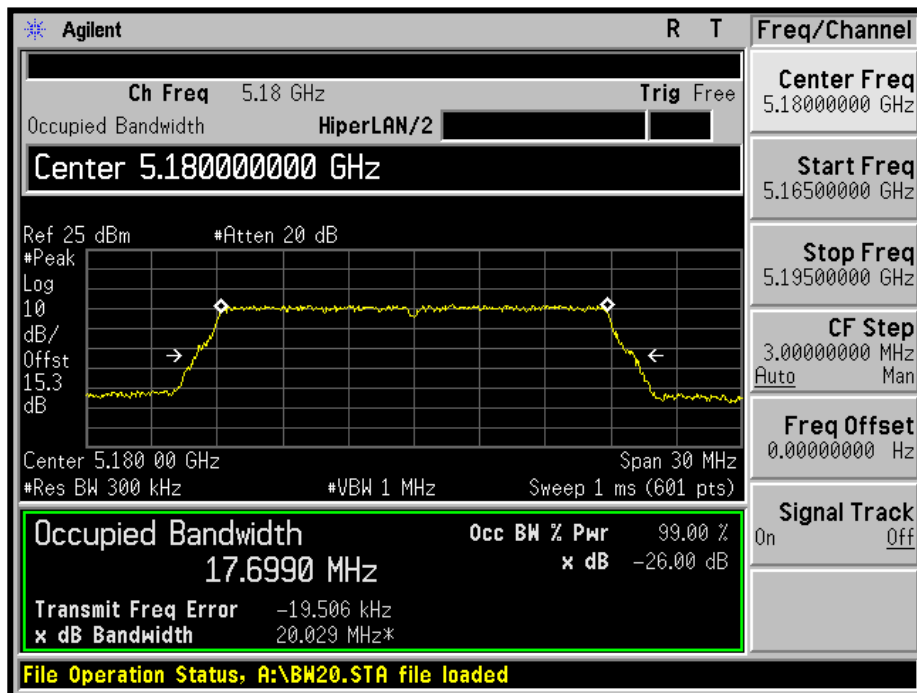
### High Channel



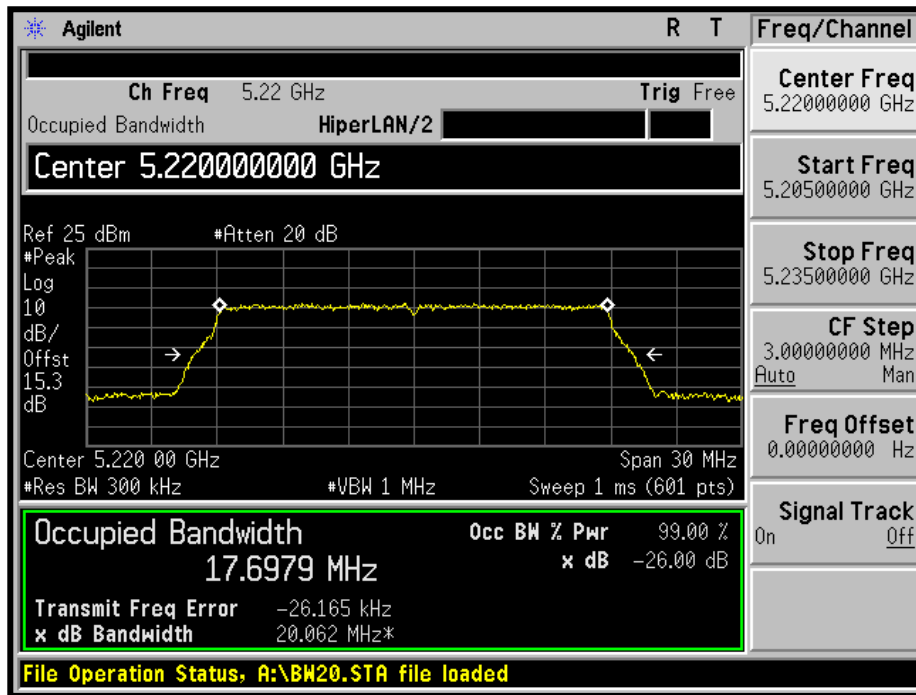
5150 MHz ~ 5250 MHz

802.11n : 20MHz rate, Chain B

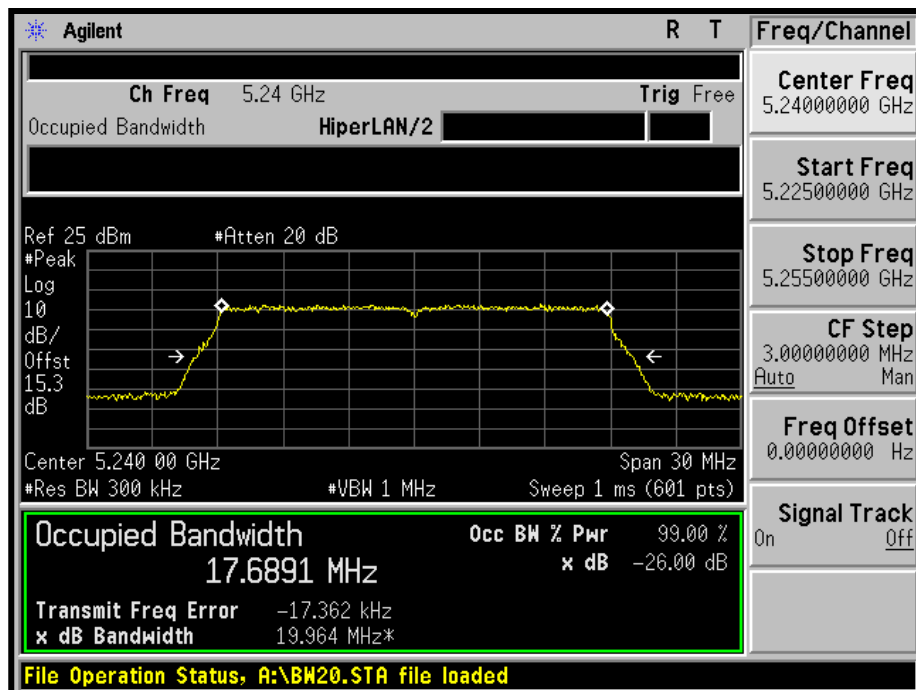
### Low Channel



### Middle Channel



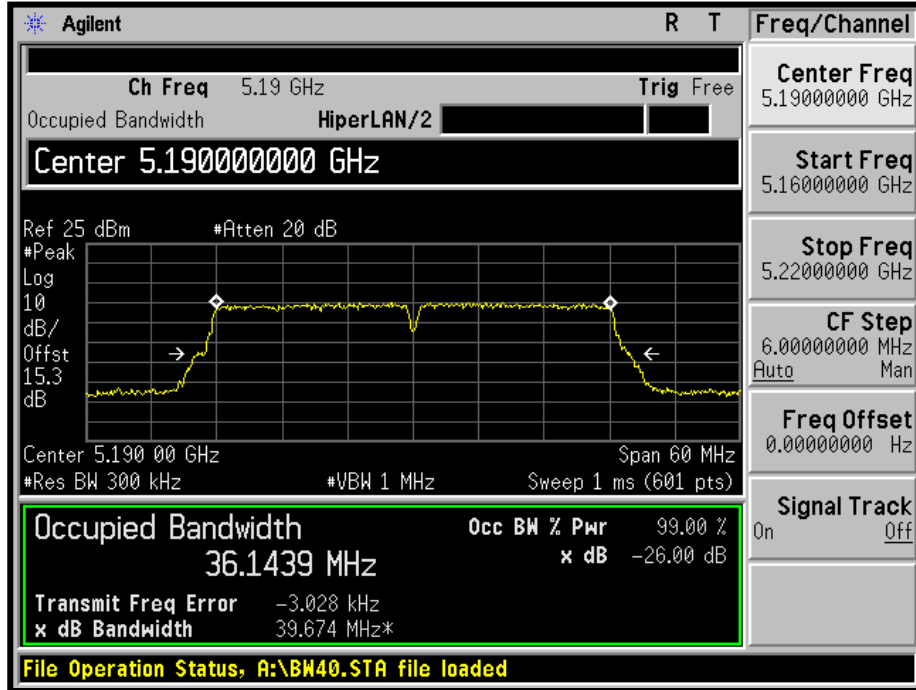
### High Channel



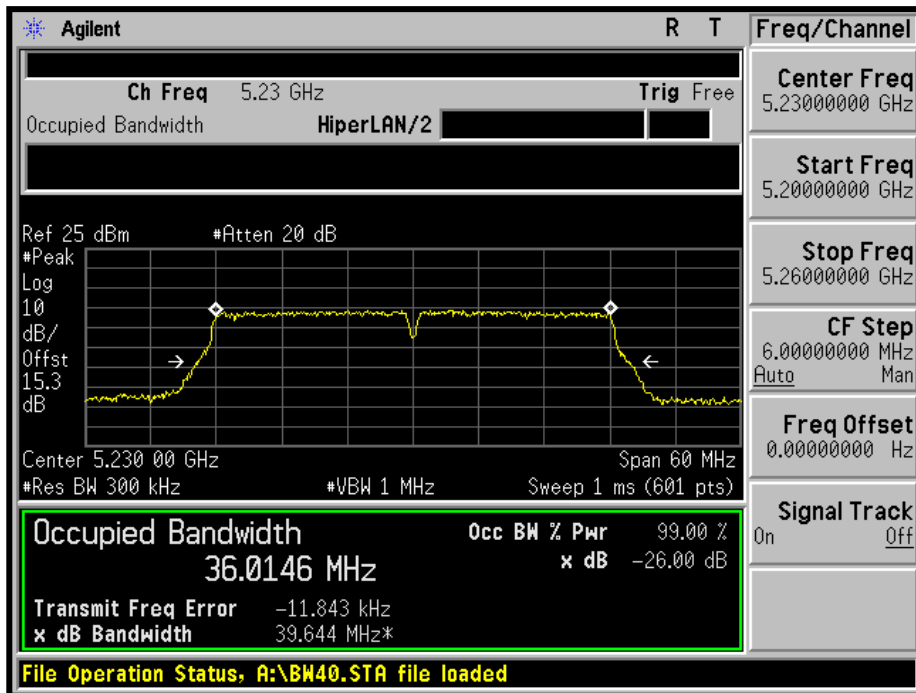
5150 MHz ~ 5250 MHz

802.11n : 40MHz rate, Chain A

Low Channel



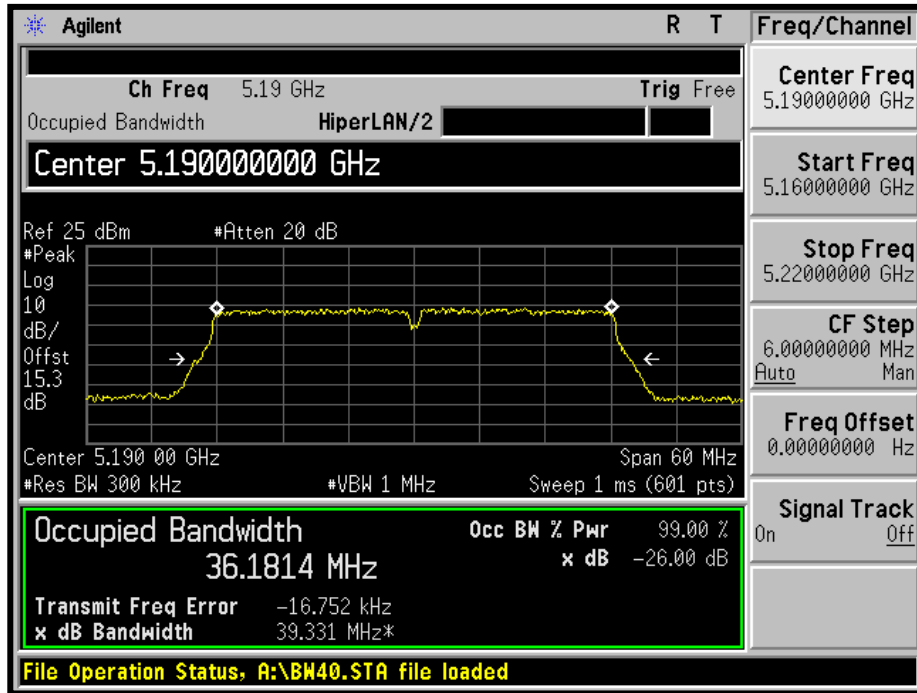
High Channel



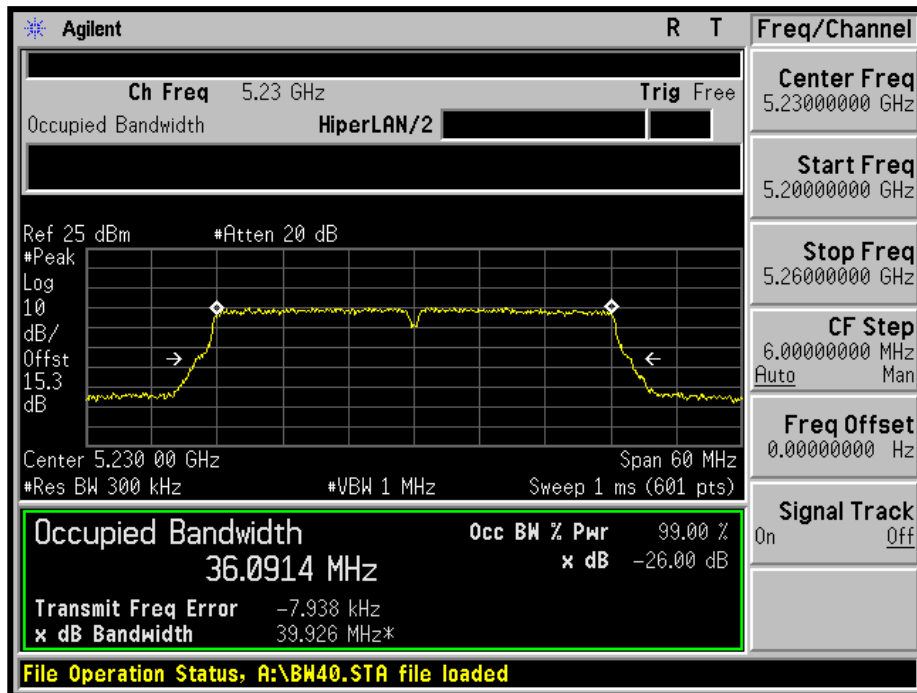
5150 MHz ~ 5250 MHz

802.11n : 40MHz rate, Chain B

Low Channel



High Channel



**Test Results: 5725MHz ~ 5825MHz Band**

◆ 802.11n : 20MHz rate

Channel	Frequency (MHz)	26dB Bandwidth (MHz)		99% Bandwidth (MHz)	
		Chain A	Chain B	Chain A	Chain B
Low	5745	20.064	20.056	17.655	17.654
Middle	5765	20.030	20.123	17.667	17.660
High	5805	20.118	20.101	17.661	17.667

◆ 802.11n : 40MHz rate

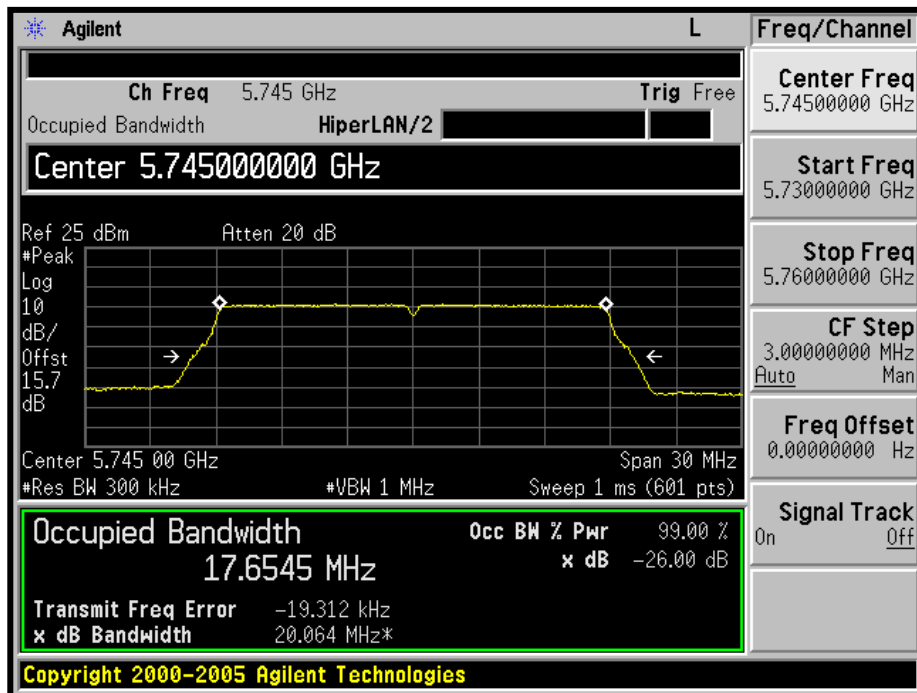
Channel	Frequency (MHz)	26dB Bandwidth (MHz)		99% Bandwidth (MHz)	
		Chain A	Chain B	Chain A	Chain B
Low	5755	39.589	39.598	36.086	36.123
High	5795	39.662	39.757	36.127	36.137



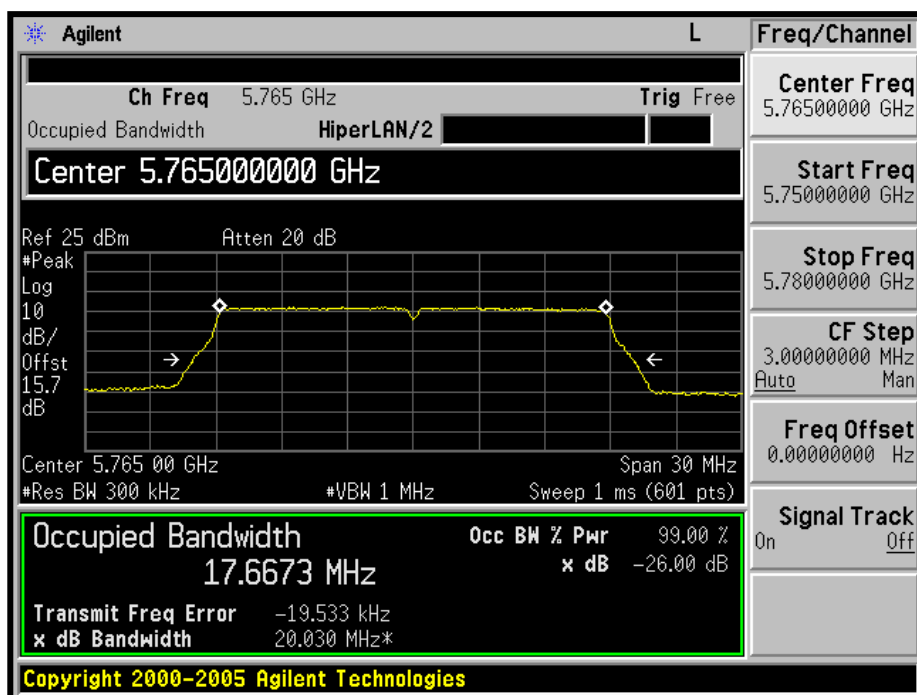
5725 MHz ~ 5825 MHz

802.11n : 20MHz rate, Chain A

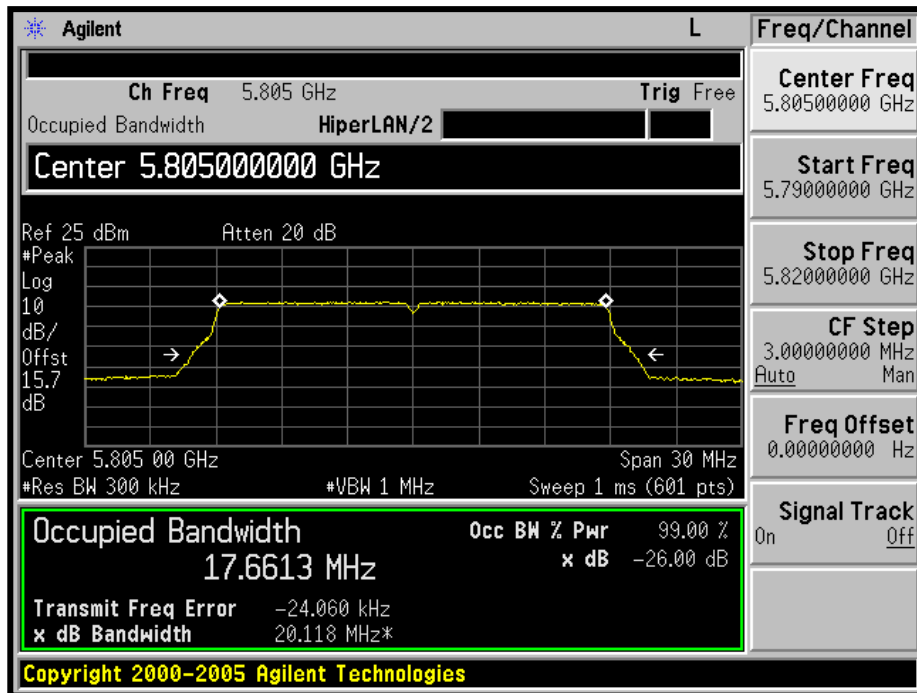
Low Channel



Middle Channel



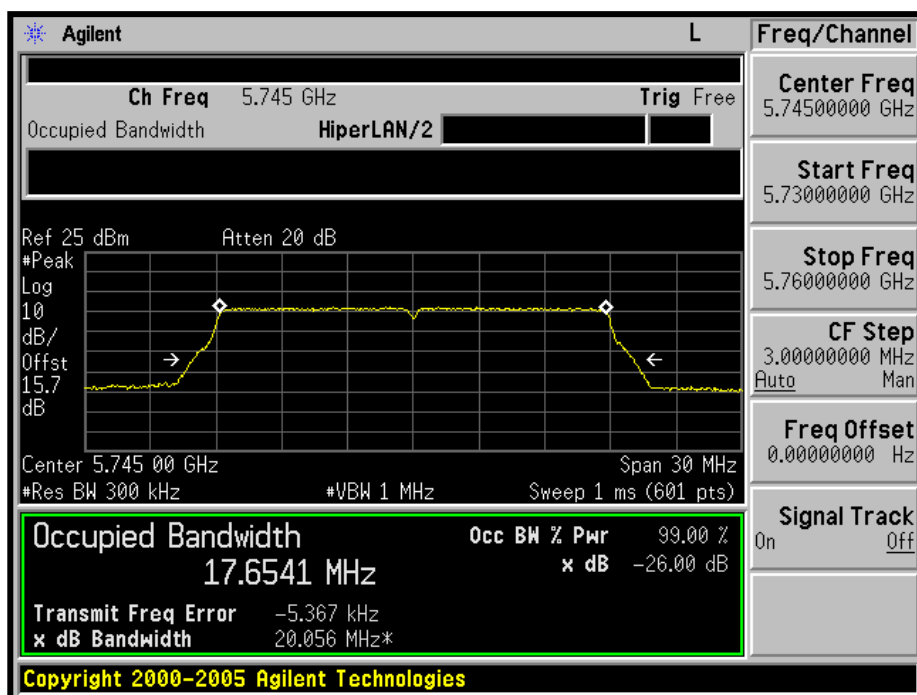
### High Channel



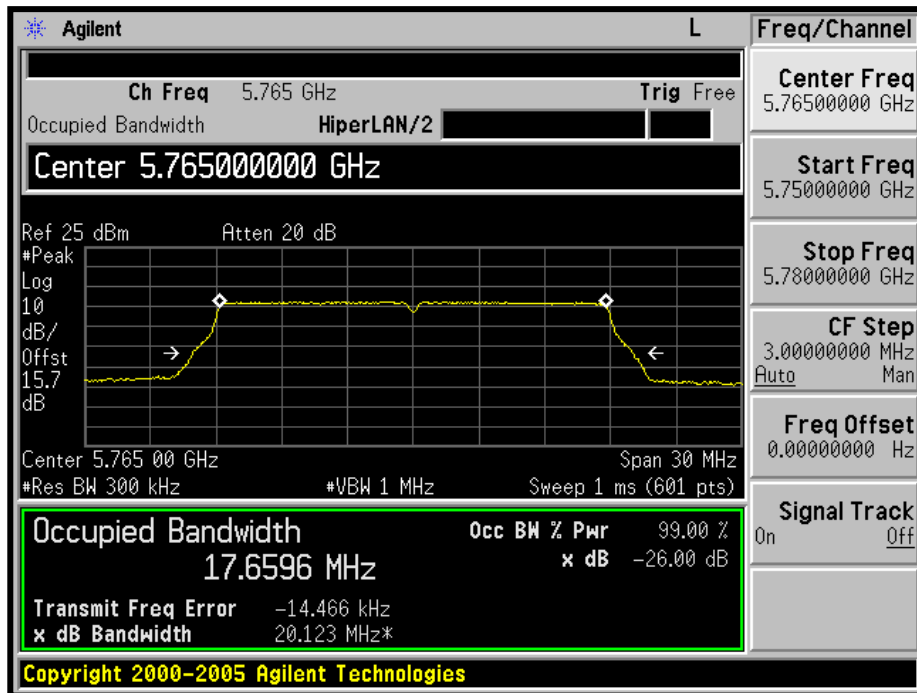
5725 MHz ~ 5825 MHz

802.11n : 20MHz rate, Chain B

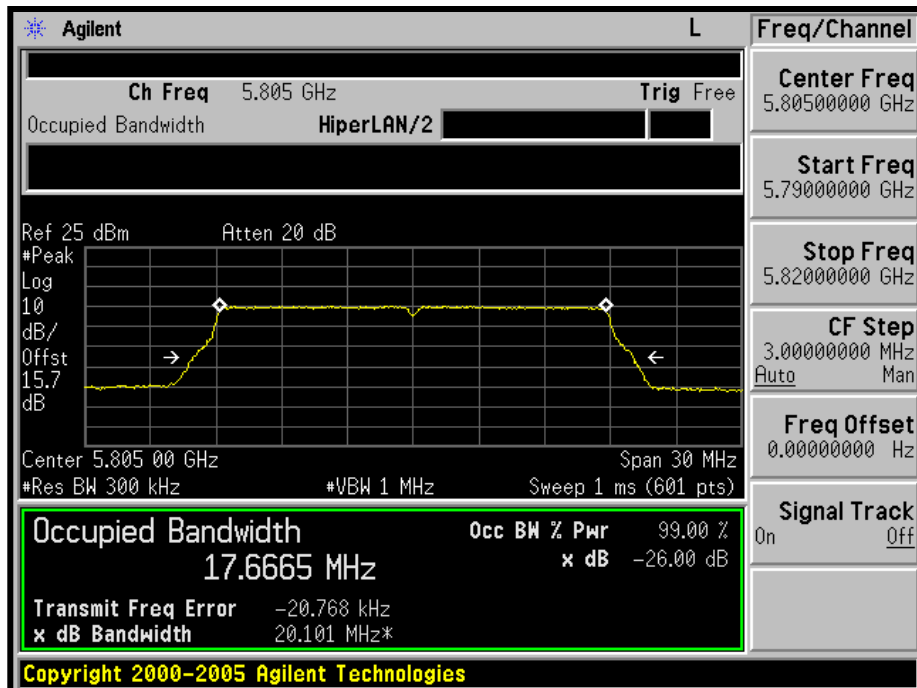
### Low Channel



### Middle Channel



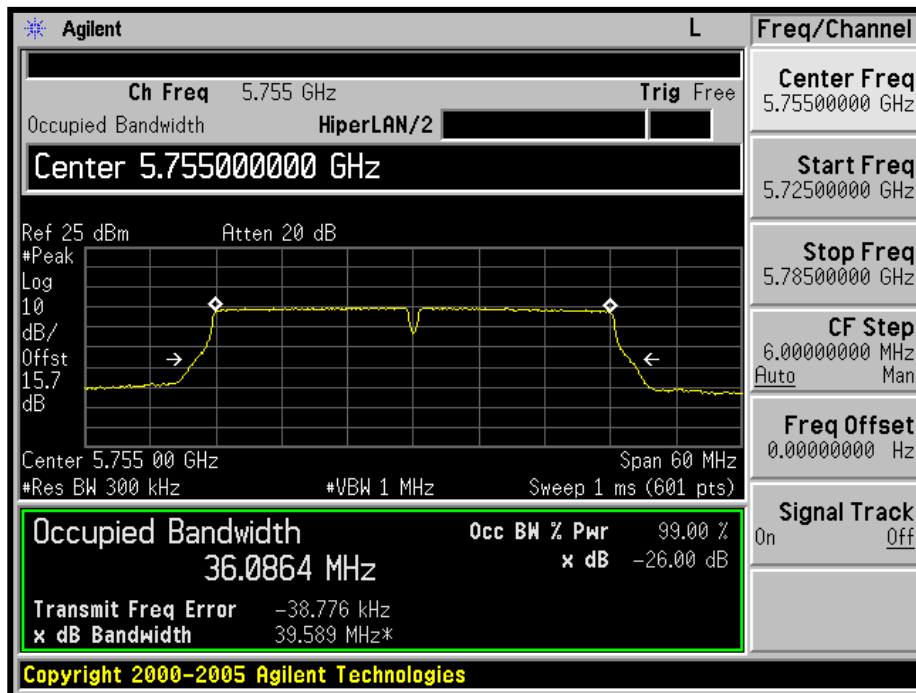
### High Channel



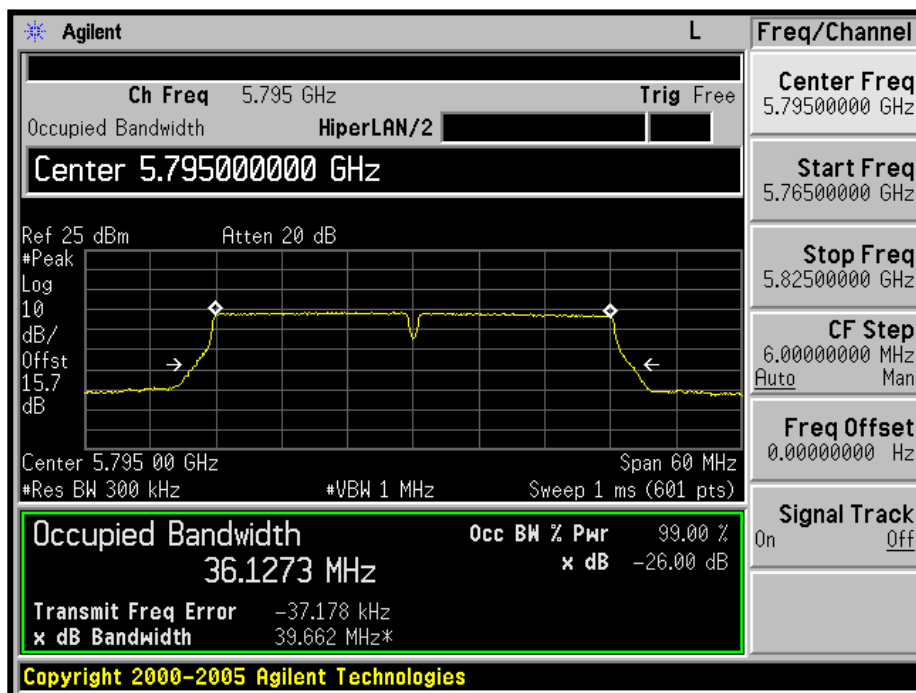
5725 MHz ~ 5825 MHz

802.11n : 40MHz rate, Chain A

Low Channel



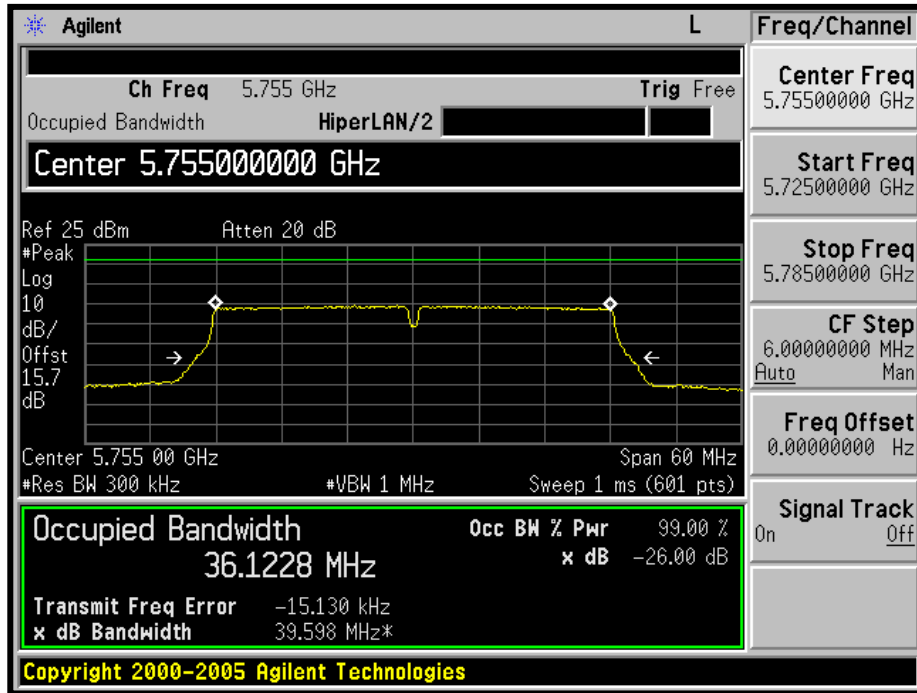
High Channel



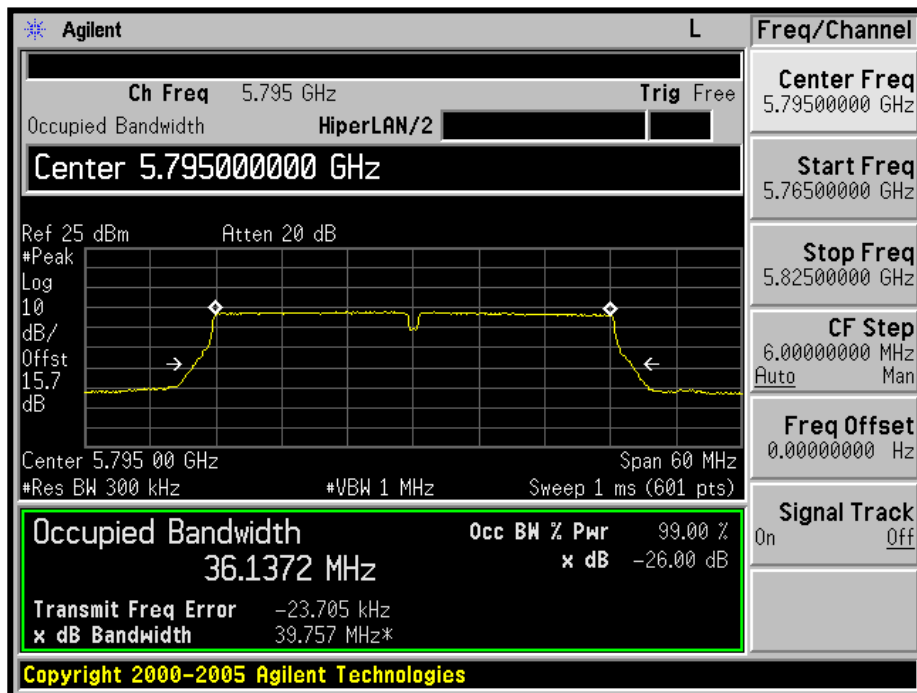
5725 MHz ~ 5825 MHz

802.11n : 40MHz rate, Chain B

Low Channel



High Channel



## 9.2 Peak Power Spectral Density

Test Results: 5150MHz ~ 5250MHz Band

◆ 802.11n : 20MHz rate

Channel	Frequency (MHz)	Chain A (dBm)	Chain B (dBm)	*Total (dBm)	Limit (dBm)	Result
Low	5180	-0.070	-0.294	2.83	4	Pass
Middle	5220	-0.096	0.387	3.16	4	Pass
High	5240	-0.986	0.926	3.08	4	Pass

◆ 802.11n : 40MHz rate

Channel	Frequency (MHz)	Chain A (dBm)	Chain B (dBm)	*Total (dBm)	Limit (dBm)	Result
Low	5190	-1.751	-3.130	0.62	4	Pass
High	5230	-2.865	-1.476	0.90	4	Pass

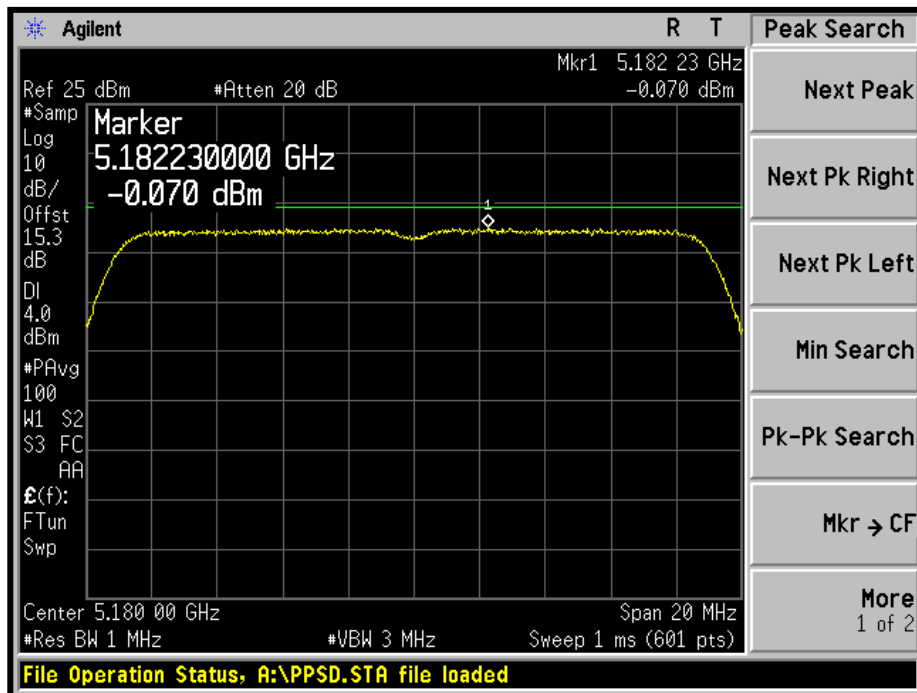
Note : \* Total (dBm) :  $10\log(10^{(\text{Chain A PPSD}/10)}+10^{(\text{Chain B PPSD}/10)})$   
 (The directional gain of the antenna does not exceeds 6dBi)

	5150MHz ~ 5250MHz	5725MHz ~ 5825MHz
Chain A Antenna Gain	3.25 dBi	3.26 dBi
Chain B Antenna Gain	2.68 dBi	2.54 dBi
Directional Antenna Gain	5.98 dBi	5.93 dBi

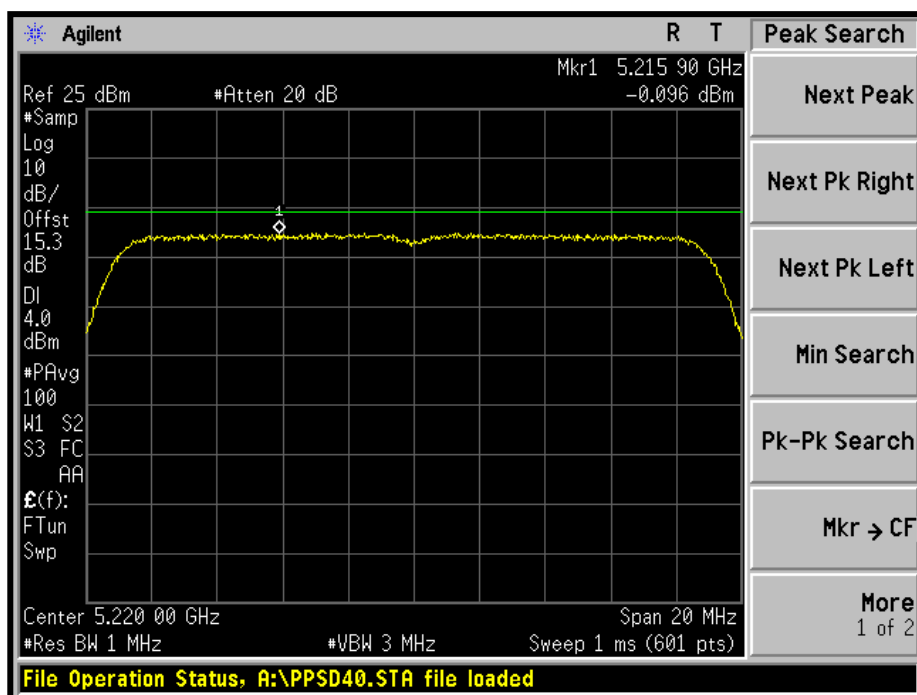
5150 MHz ~ 5250 MHz

802.11n : 20MHz rate, Chain A

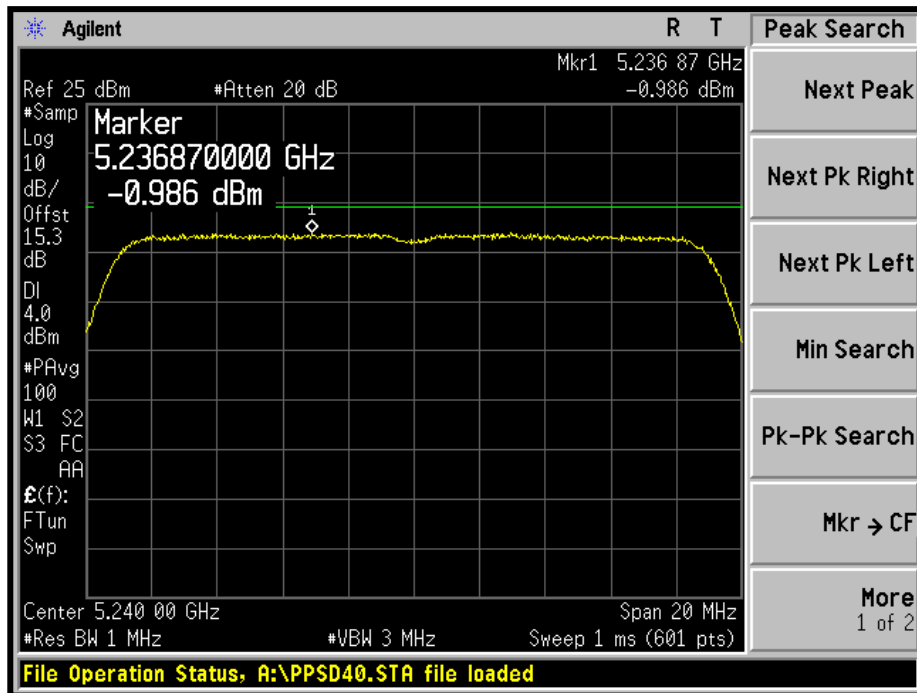
Low Channel



Middle Channel



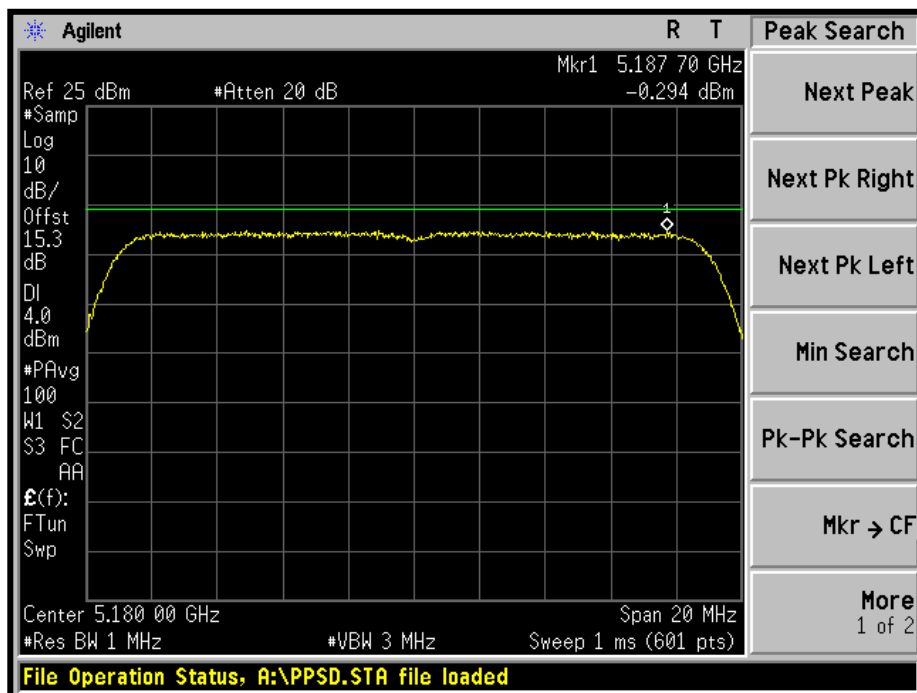
### High Channel



5150 MHz ~ 5250 MHz

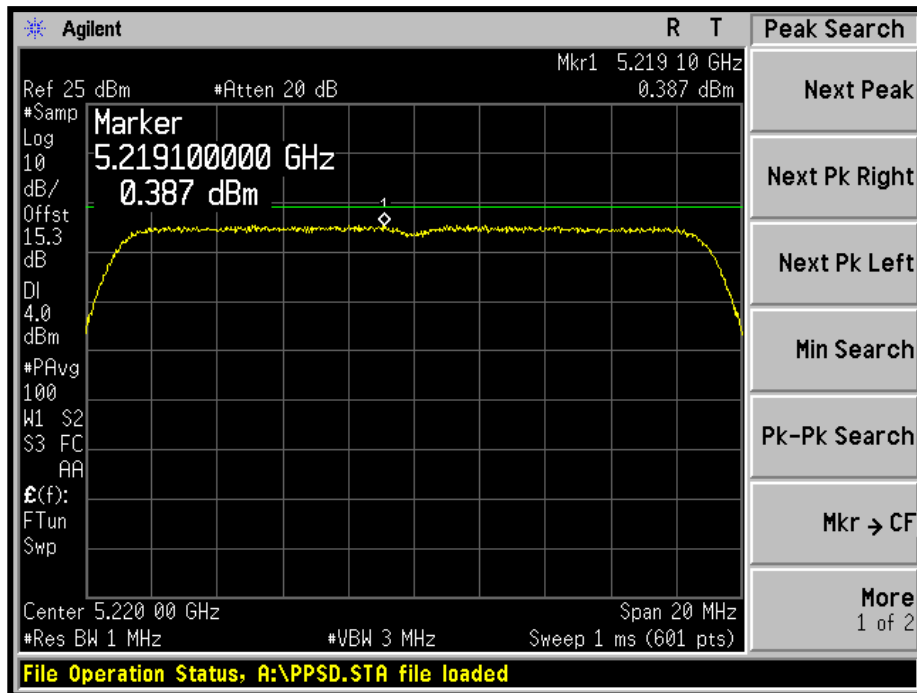
802.11n : 20MHz rate, Chain B

### Low Channel

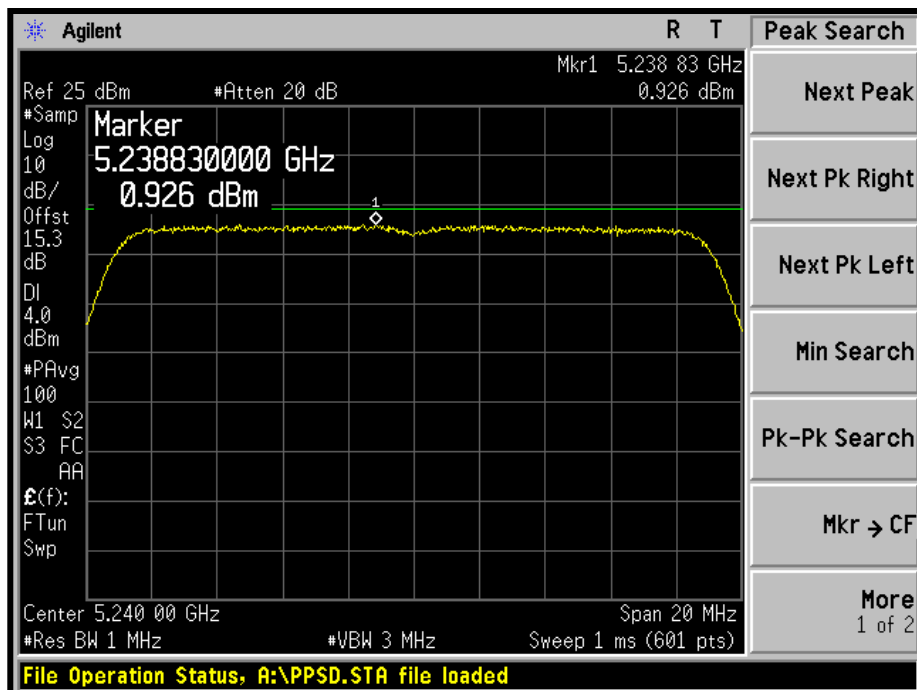




### Middle Channel



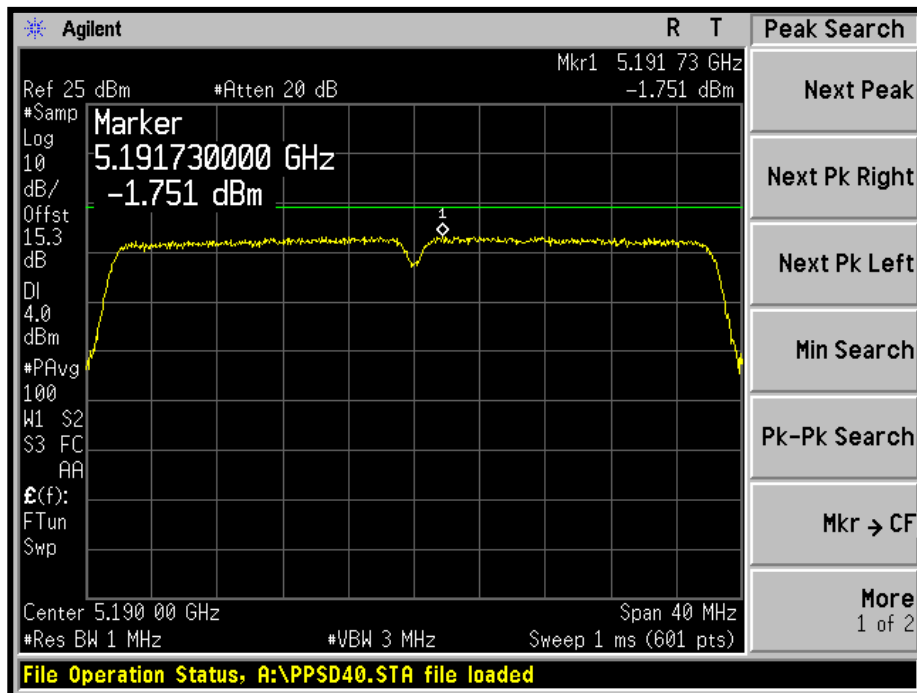
### High Channel



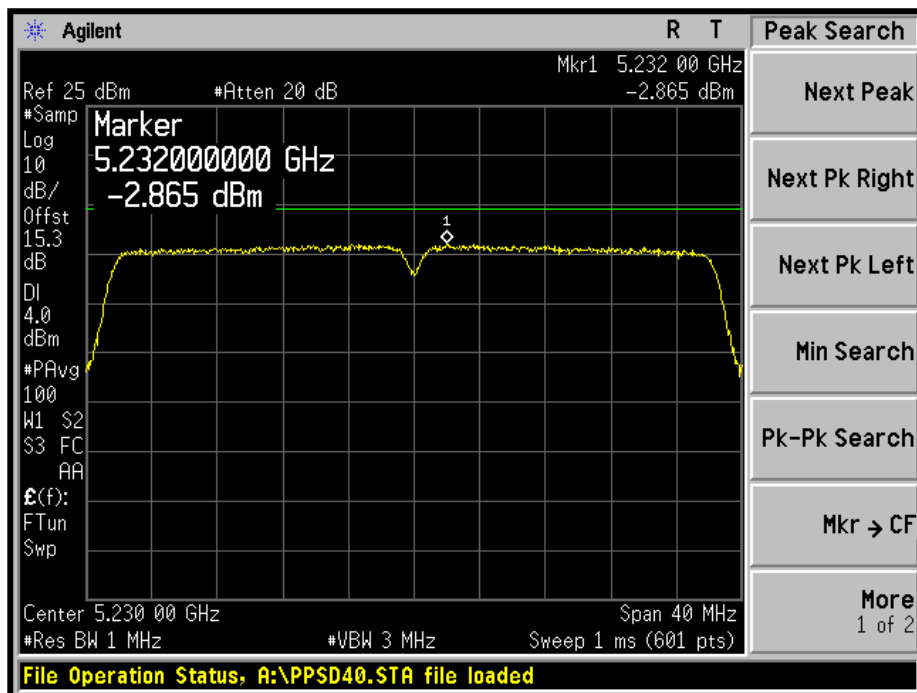
5150 MHz ~ 5250 MHz

802.11n : 40MHz rate, Chain A

Low Channel



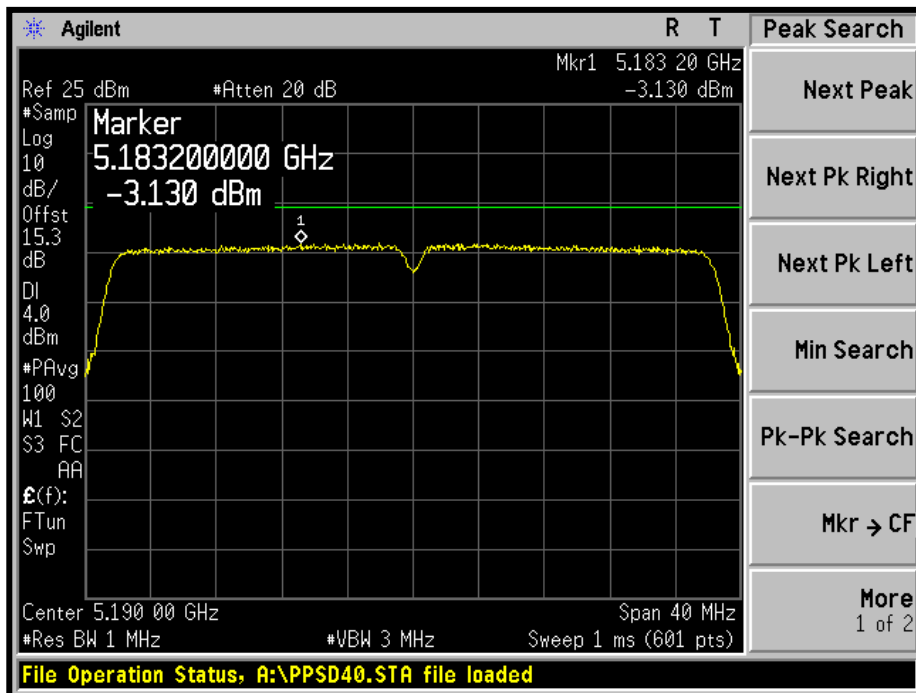
High Channel



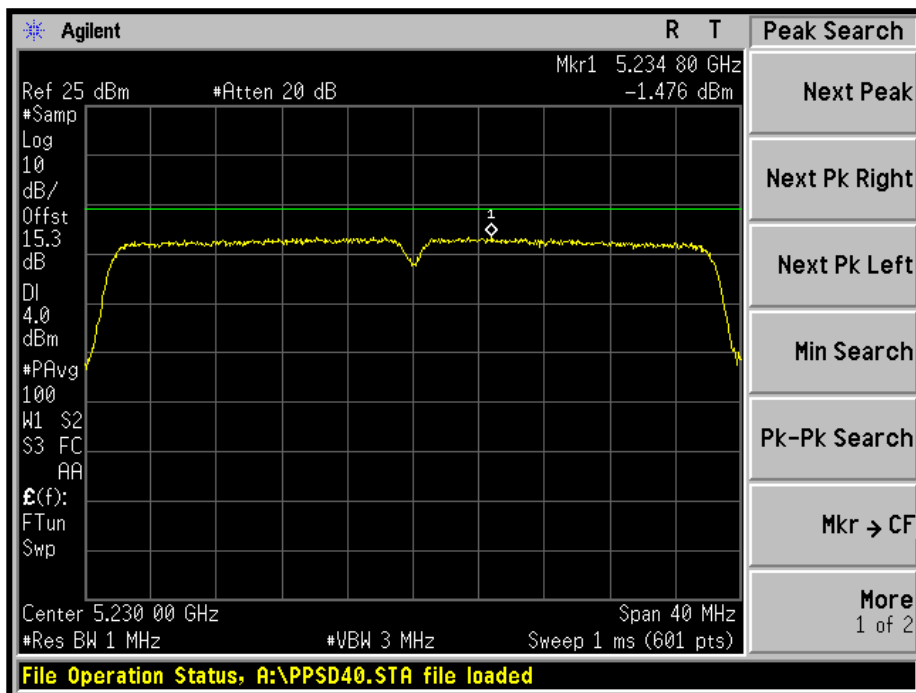
5150 MHz ~ 5250 MHz

802.11n : 40MHz rate, Chain B

Low Channel



High Channel



**Test Results: 5725MHz ~ 5825MHz Band**

◆ **802.11n : 20MHz rate**

Channel	Frequency (MHz)	Chain A (dBm)	Chain B (dBm)	*Total (dBm)	Limit (dBm)	Result
Low	5745	0.386	0.947	3.69	17	Pass
Middle	5765	1.070	1.754	4.44	17	Pass
High	5805	1.772	-0.741	3.70	17	Pass

◆ **802.11n : 40MHz rate**

Channel	Frequency (MHz)	Chain A (dBm)	Chain B (dBm)	*Total (dBm)	Limit (dBm)	Result
Low	5755	-1.244	-2.045	1.38	17	Pass
High	5795	-2.532	-3.181	0.17	17	Pass

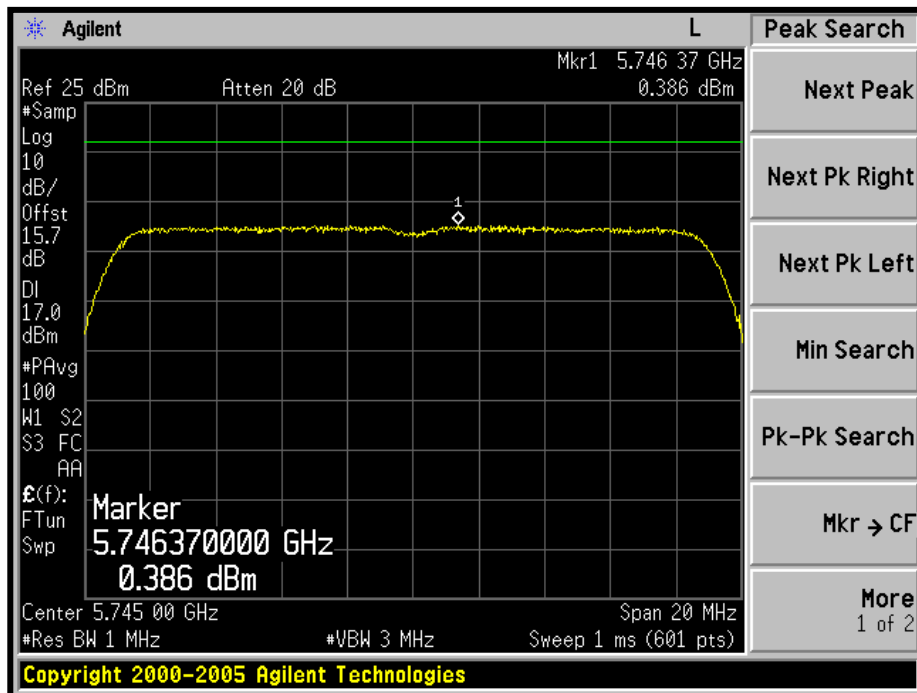
Note : \* Total(dBm) :  $10\log(10^{(Chain\ A\ PPSD/10)}+10^{(Chain\ B\ PPSD/10)})$   
 (The directional gain of the antenna does not exceeds 6dBi)

	5150MHz ~ 5250MHz	5725MHz ~ 5825MHz
Chain A Antenna Gain	3.25 dBi	3.26 dBi
Chain B Antenna Gain	2.68 dBi	2.54 dBi
Directional Antenna Gain	5.98 dBi	5.93 dBi

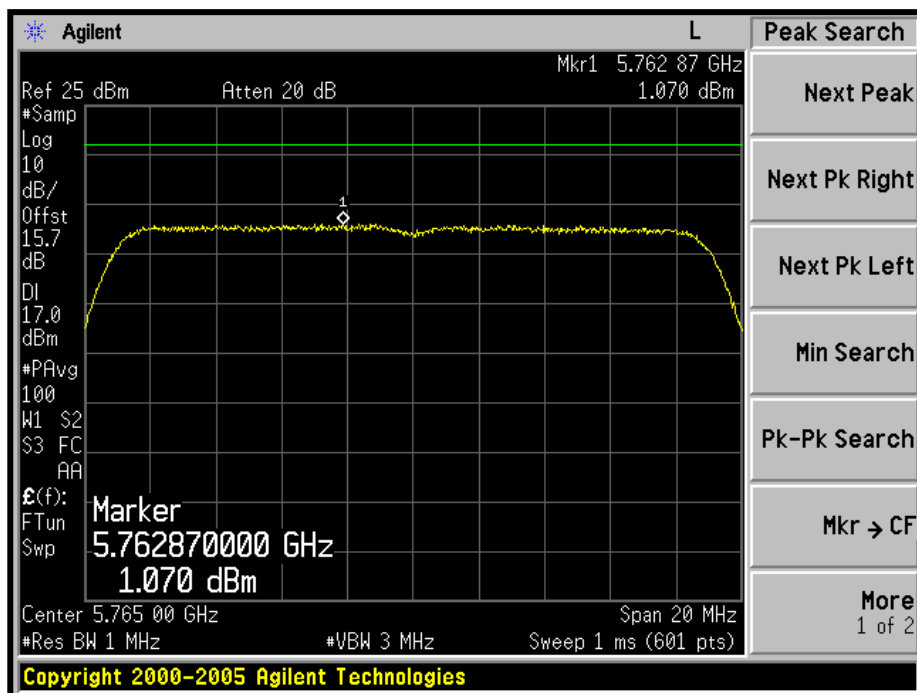
5725 MHz ~ 5825 MHz

802.11n : 20MHz rate, Chain A

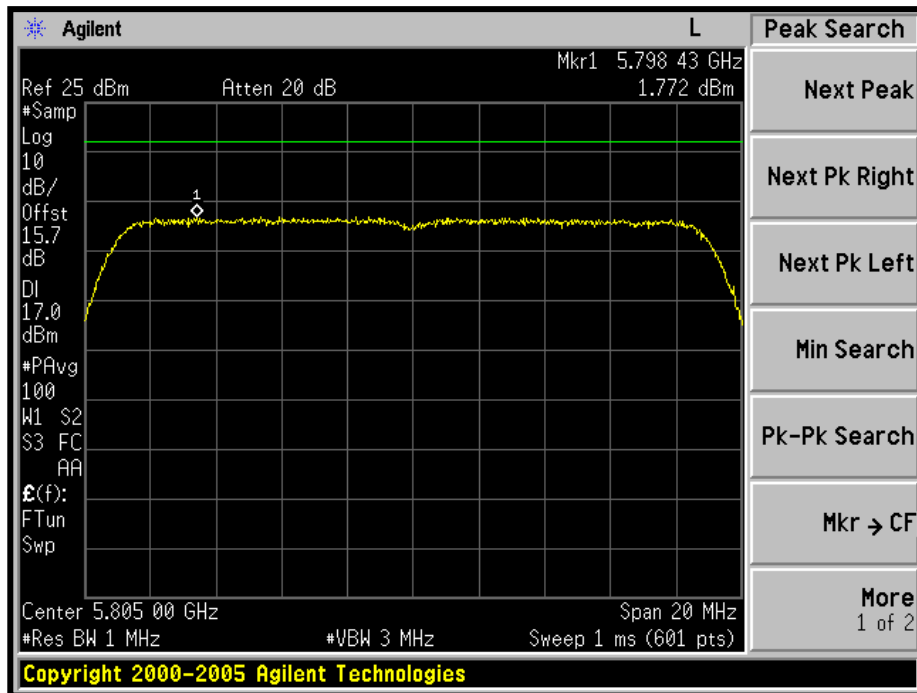
Low Channel



Middle Channel



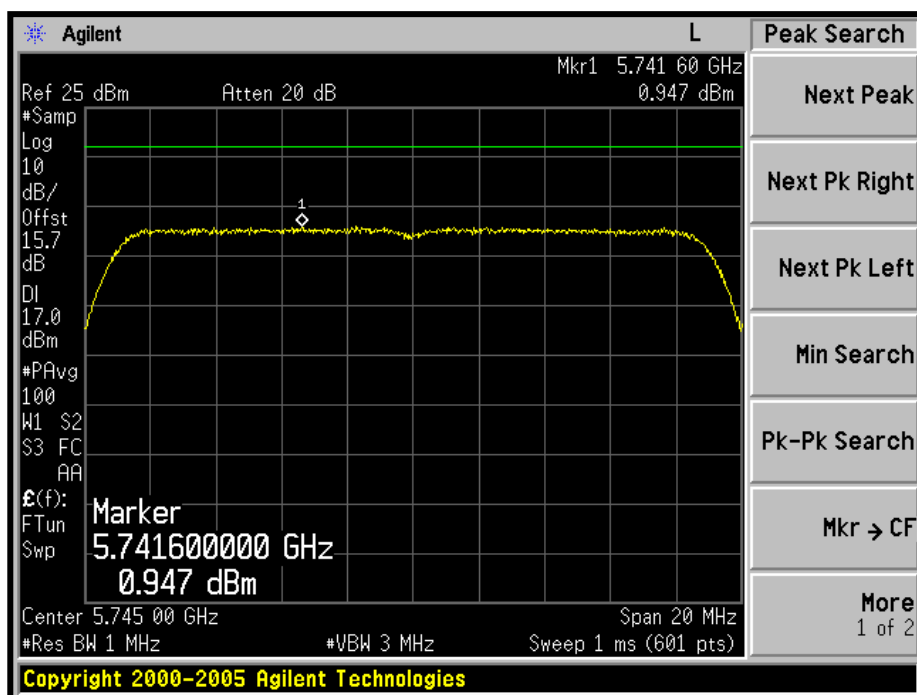
### High Channel



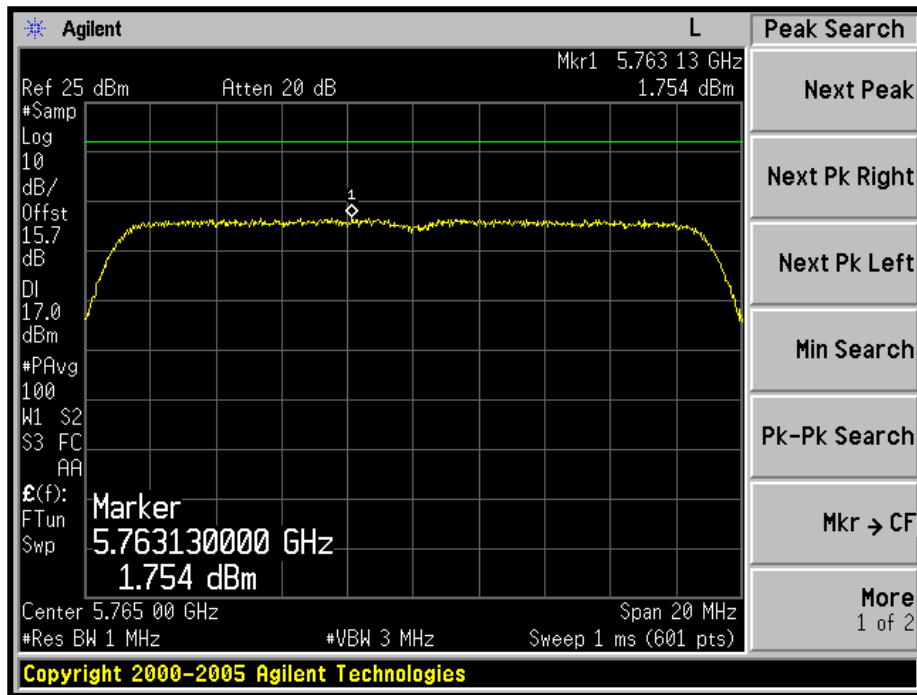
5725 MHz ~ 5825 MHz

802.11n : 20MHz rate, Chain B

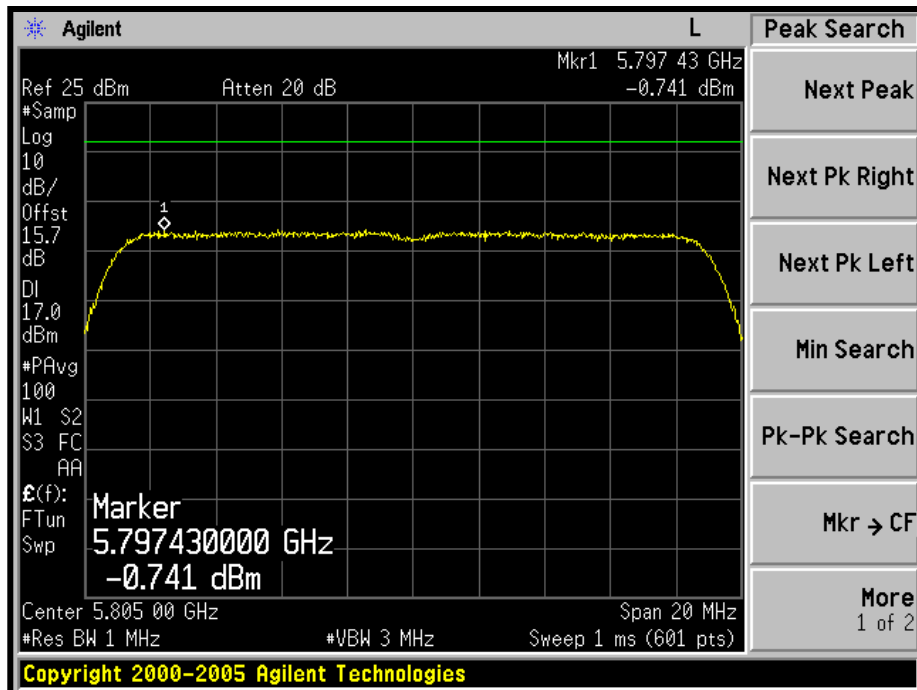
### Low Channel



### Middle Channel



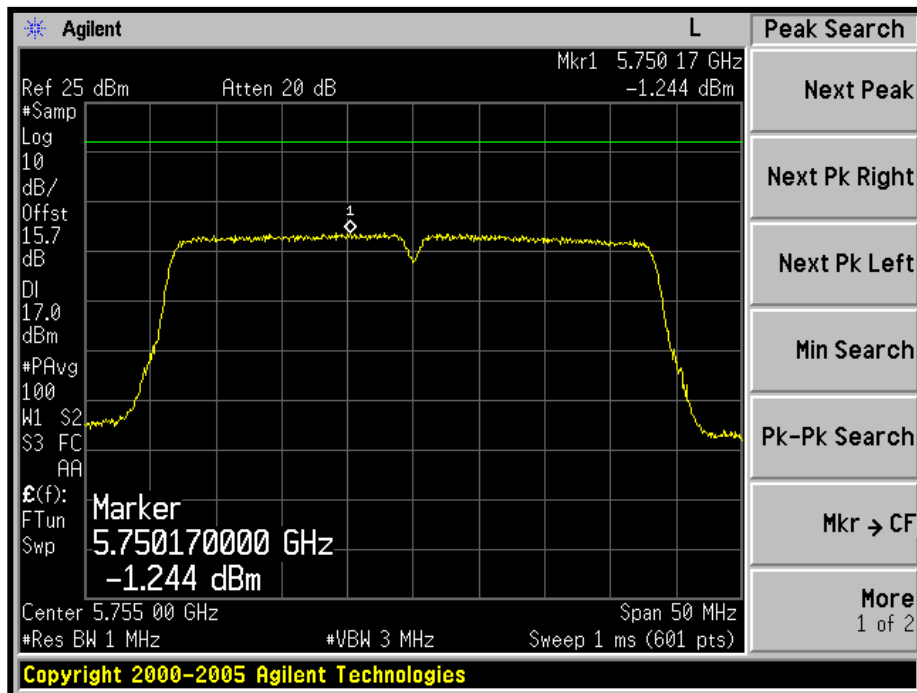
### High Channel



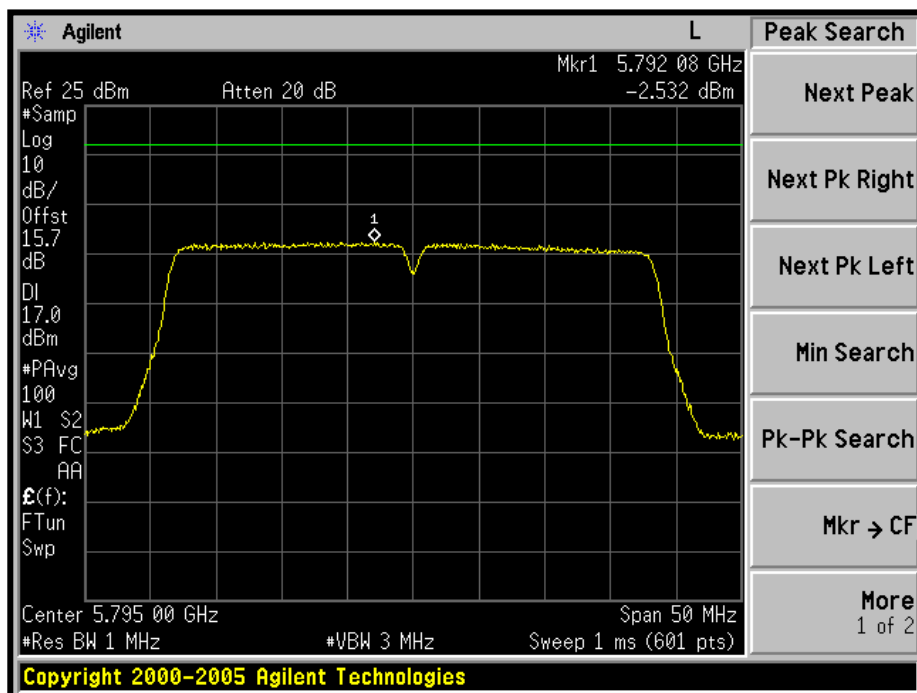
5725 MHz ~ 5825 MHz

802.11n : 40MHz rate, Chain A

Low Channel



High Channel

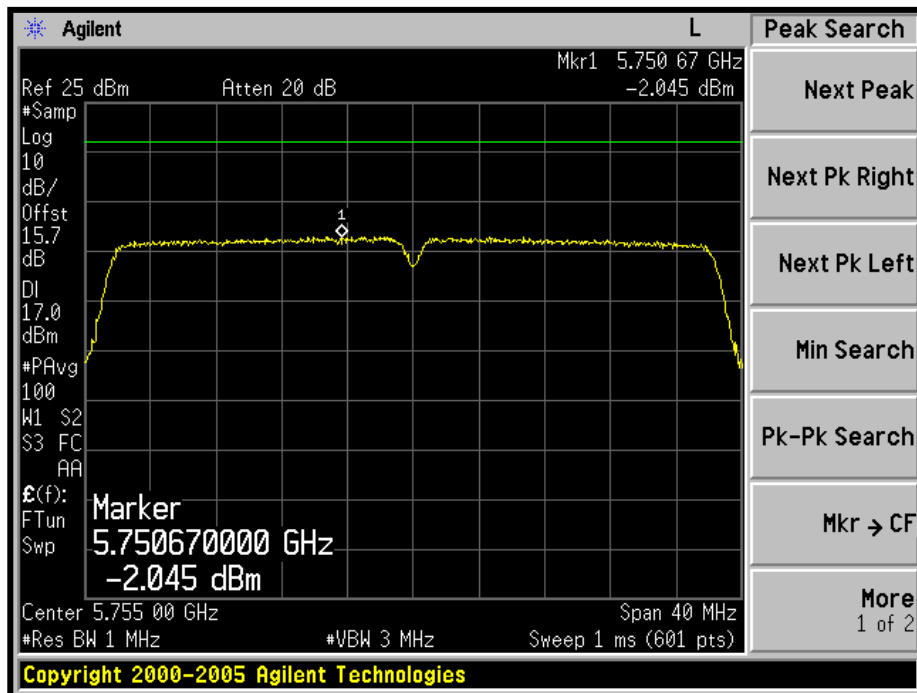




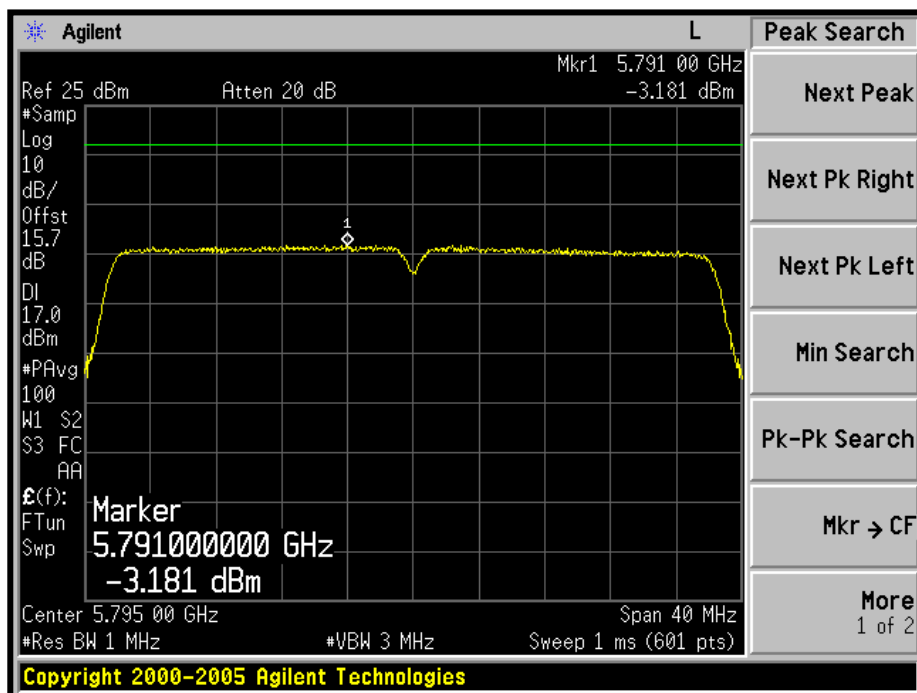
5725 MHz ~ 5825 MHz

802.11n : 40MHz rate, Chain B

Low Channel



High Channel



### 9.3 Maximum Peak Output Power

Test Results: 5150MHz ~ 5250MHz Band

◆ 802.11n : 20MHz rate

Channel	Frequency (MHz)	Chain A (dBm)	Chain B (dBm)	Total (dBm)	4+10logB (dBm)	Limit (dBm)	Result
Low	5180	11.27	11.16	14.23	17.03	16.99	Pass
Middle	5220	11.49	11.86	14.69	17.03	16.99	Pass
High	5240	10.07	12.06	14.19	17.01	16.99	Pass

◆ 802.11n : 40MHz rate

Channel	Frequency (MHz)	Chain A (dBm)	Chain B (dBm)	Total (dBm)	4+10logB (dBm)	Limit (dBm)	Result
Low	5180	12.41	11.01	14.78	19.64	16.99	Pass
High	5240	11.17	13.20	15.31	19.98	16.99	Pass

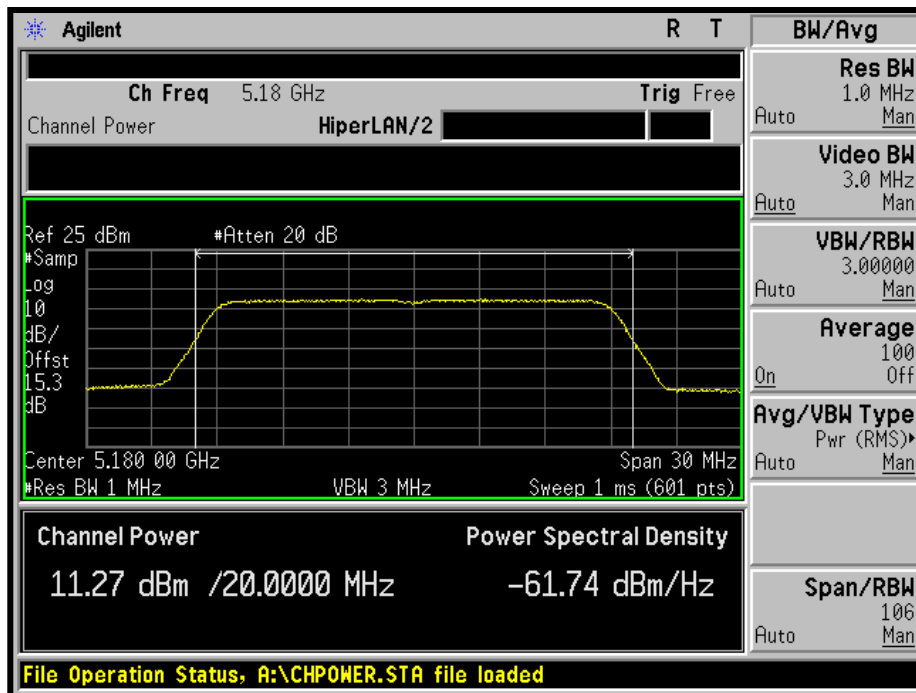
Note : \* Total(dBm) :  $10\log(10^{(Chain\ A\ Power/10)}+10^{(Chain\ B\ Power/10)})$   
 (The directional gain of the antenna does not exceeds 6dBi)

	5150MHz ~ 5250MHz	5725MHz ~ 5825MHz
Chain A Antenna Gain	3.25 dBi	3.26 dBi
Chain B Antenna Gain	2.68 dBi	2.54 dBi
Directional Antenna Gain	5.98 dBi	5.93 dBi

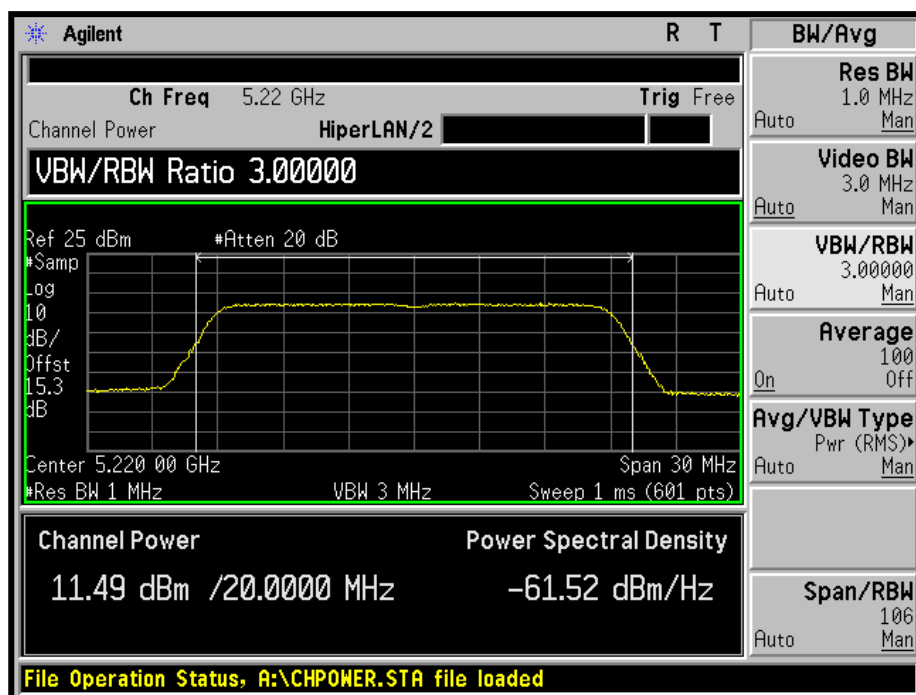
5150 MHz ~ 5250 MHz

802.11n : 20MHz rate, Chain A

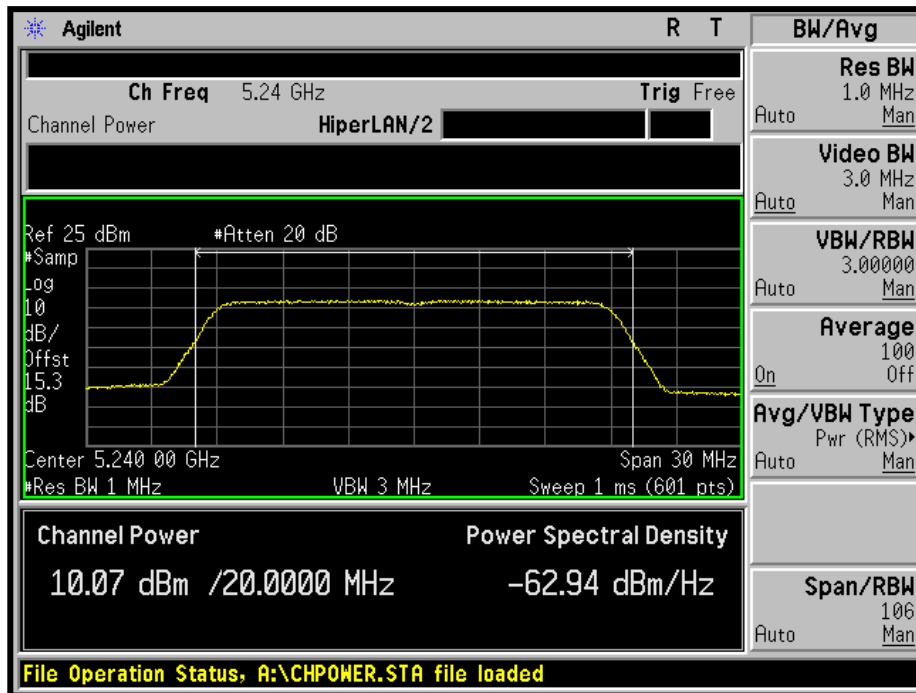
Low Channel



Middle Channel



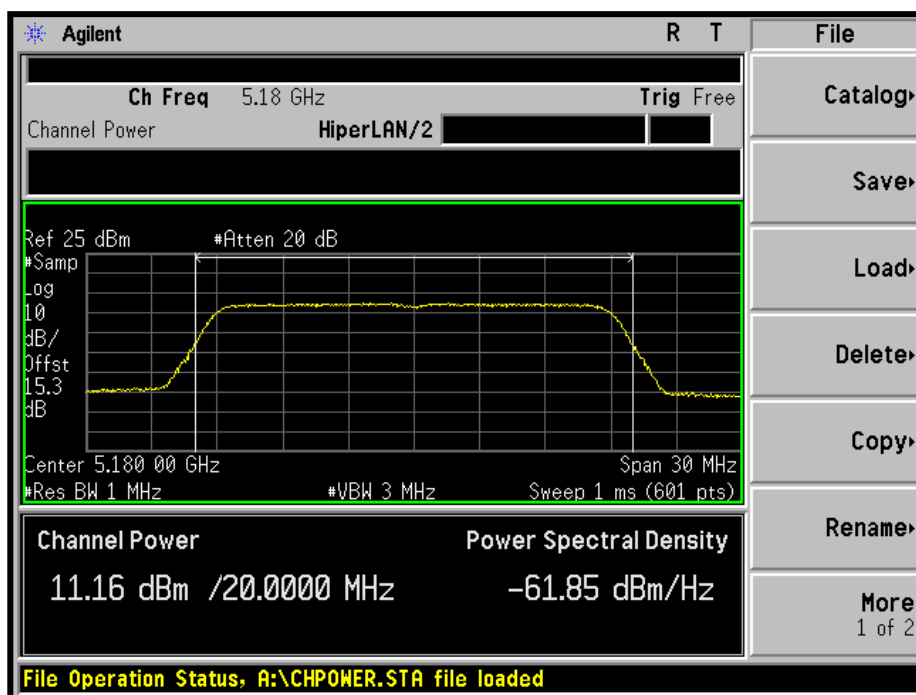
### High Channel



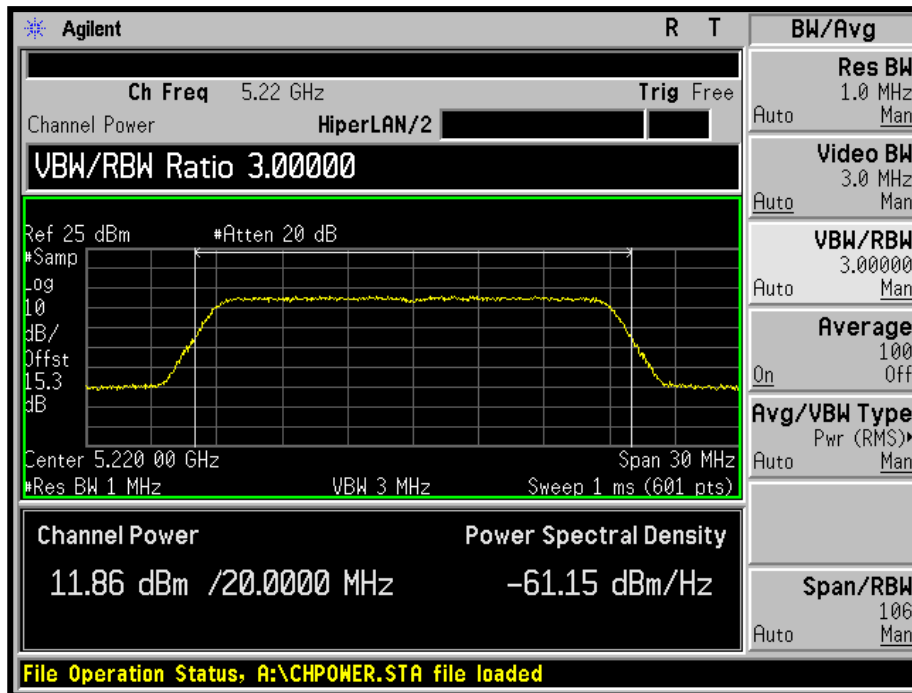
5150 MHz ~ 5250 MHz

802.11n : 20MHz rate, Chain B

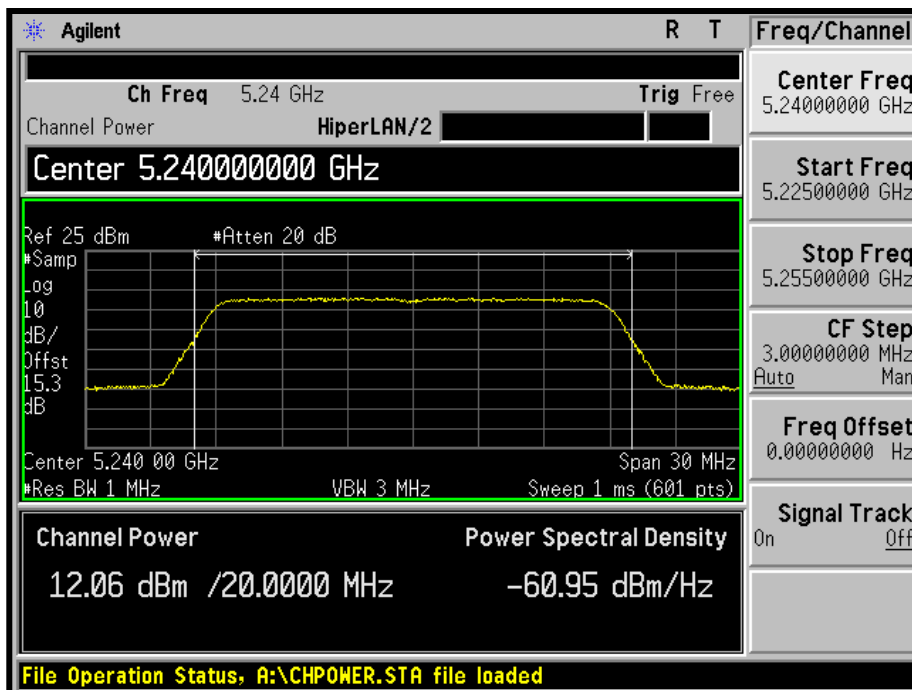
### Low Channel



### Middle Channel



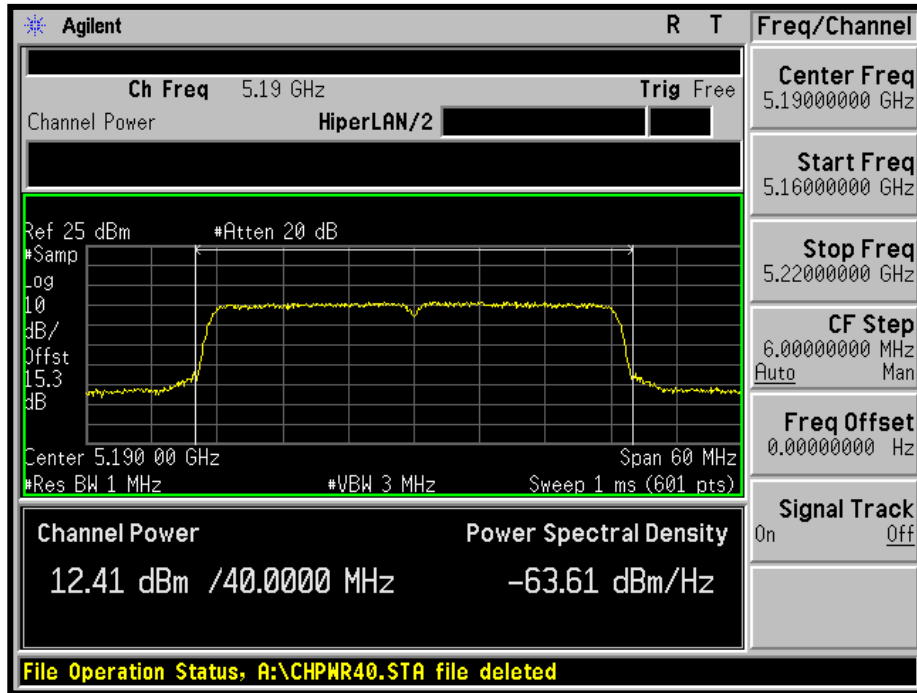
### High Channel



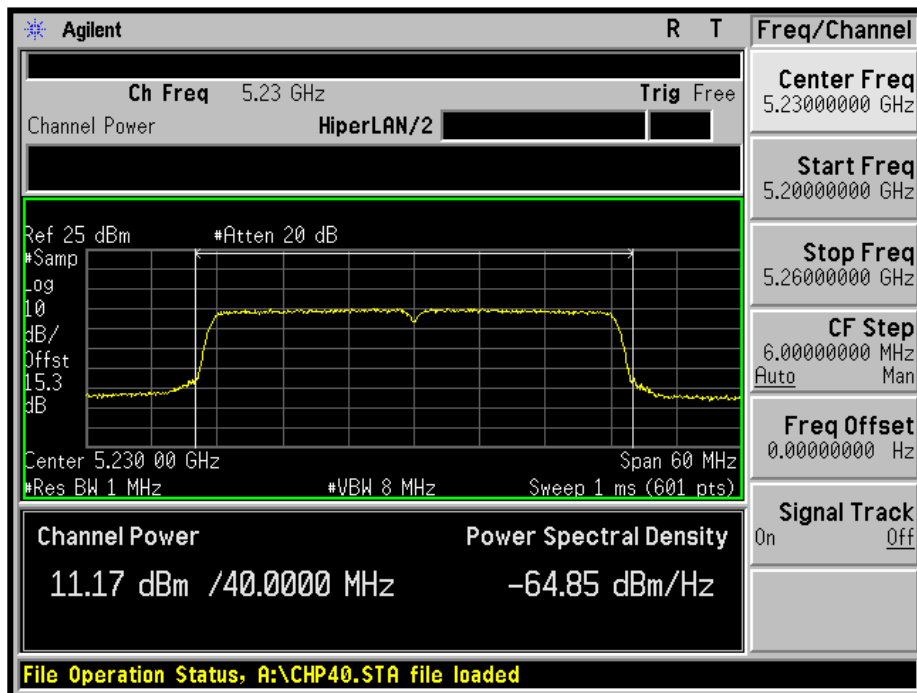
5150 MHz ~ 5250 MHz

802.11n : 40MHz rate, Chain A

Low Channel



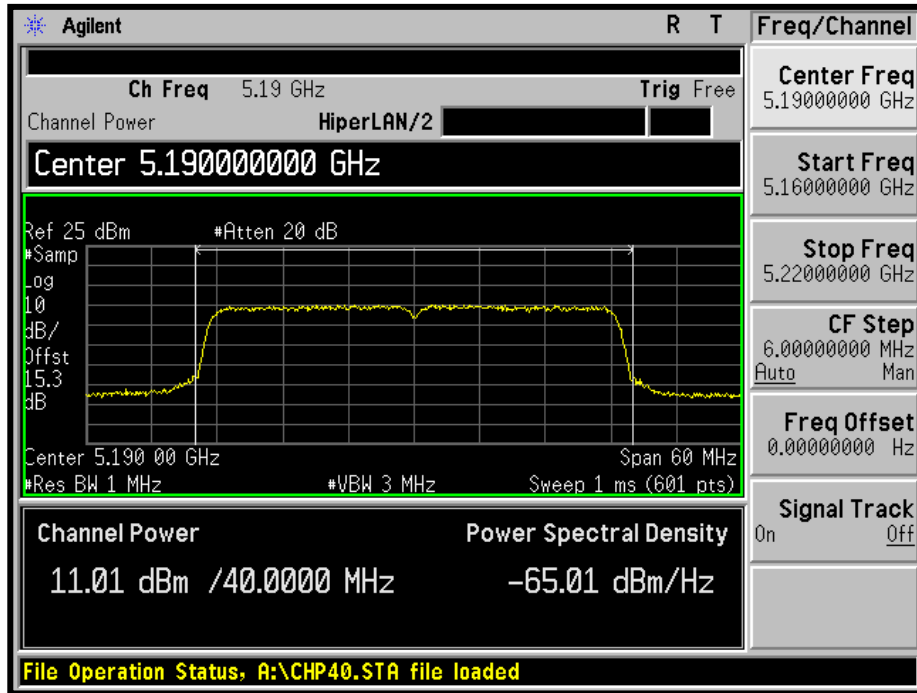
High Channel



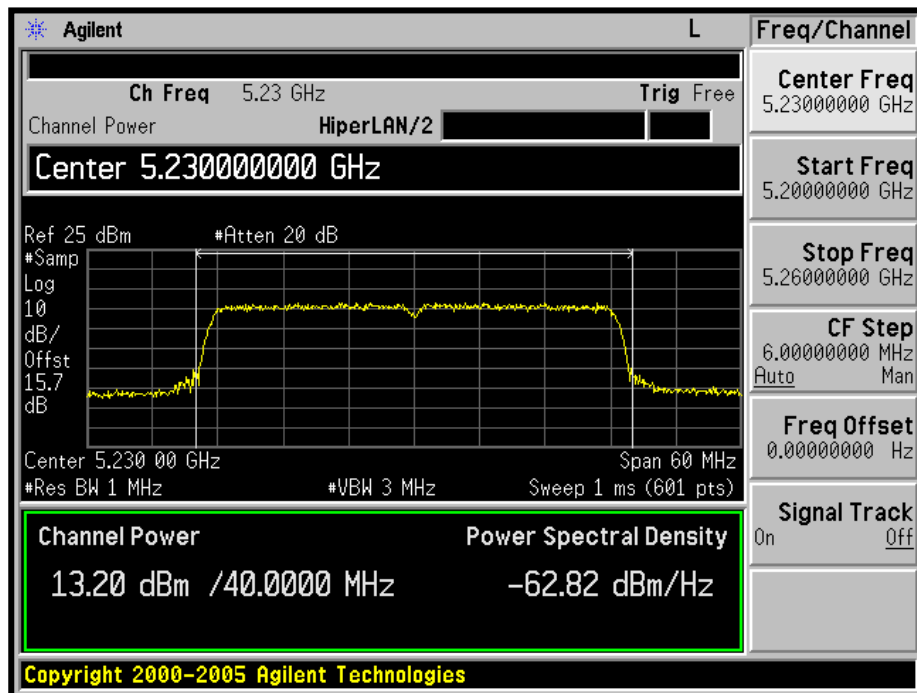
5150 MHz ~ 5250 MHz

802.11n : 40MHz rate, Chain B

Low Channel



High Channel



**Test Results: 5725MHz ~ 58250MHz Band**

◆ **802.11n : 20MHz rate**

Channel	Frequency (MHz)	Chain A (dBm)	Chain B (dBm)	Total (dBm)	4+10logB (dBm)	Limit (dBm)	Result
Low	5745	12.15	12.36	15.27	30.02	30	Pass
Middle	5765	12.63	12.87	15.76	30.04	30	Pass
High	5805	12.81	10.49	14.81	30.04	30	Pass

◆ **802.11n : 40MHz rate**

Channel	Frequency (MHz)	Chain A (dBm)	Chain B (dBm)	Total (dBm)	4+10logB (dBm)	Limit (dBm)	Result
Low	5755	12.97	12.15	15.59	32.98	30	Pass
High	5795	11.63	11.18	14.42	32.99	30	Pass

Note : \* Total (dBm) :  $10\log(10^{Chain\ A\ Power/10}+10^{Chain\ B\ Power/10})$   
 (The directional gain of the antenna does not exceeds 6dBi)

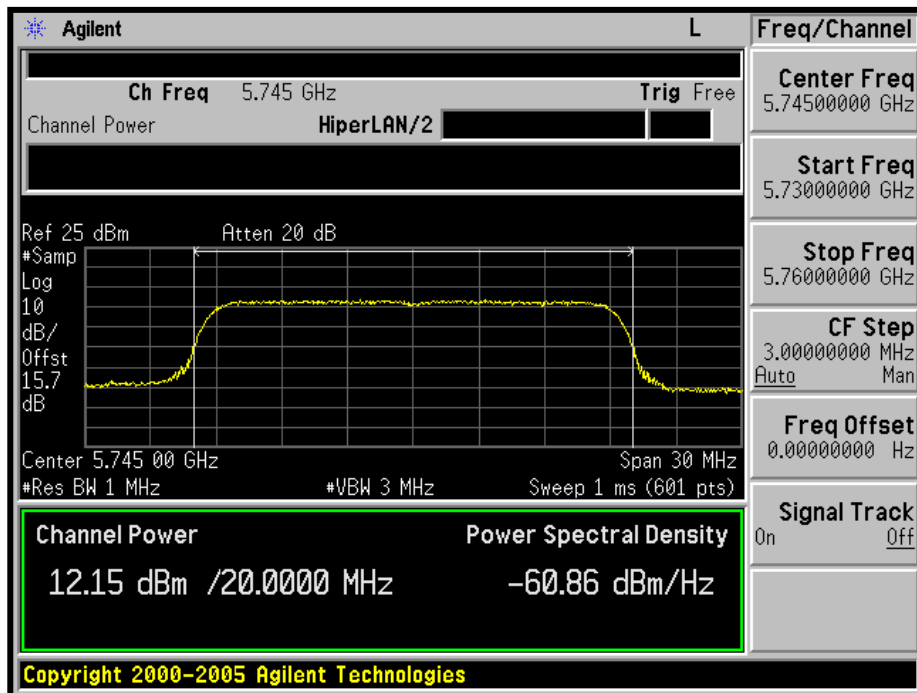
	5150MHz ~ 5250MHz	5725MHz ~ 5825MHz
Chain A Antenna Gain	3.25 dBi	3.26 dBi
Chain B Antenna Gain	2.68 dBi	2.54 dBi
Directional Antenna Gain	5.98 dBi	5.93 dBi



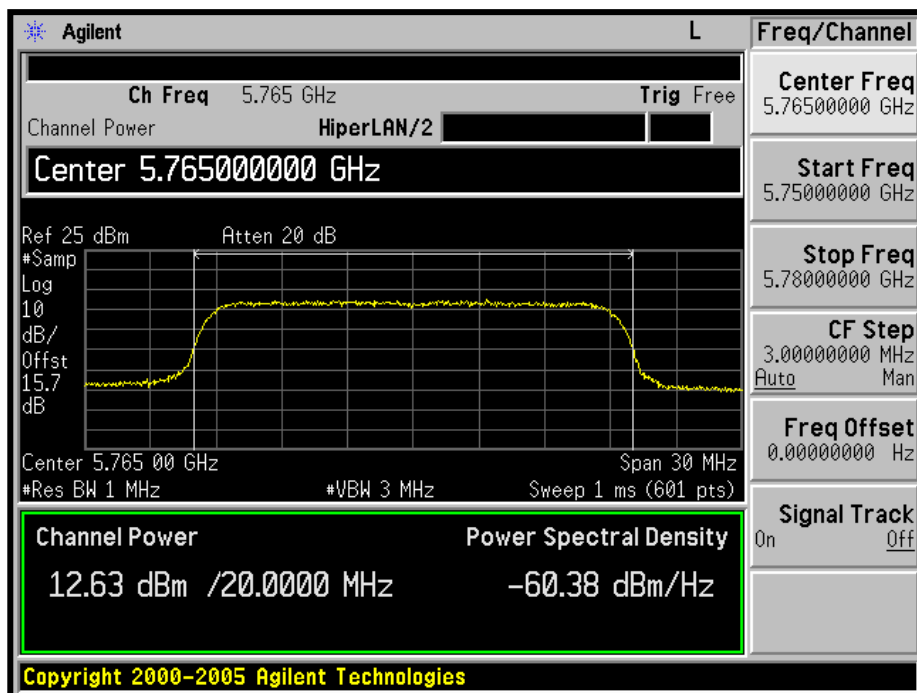
5725 MHz ~ 5825 MHz

802.11n : 20MHz rate, Chain A

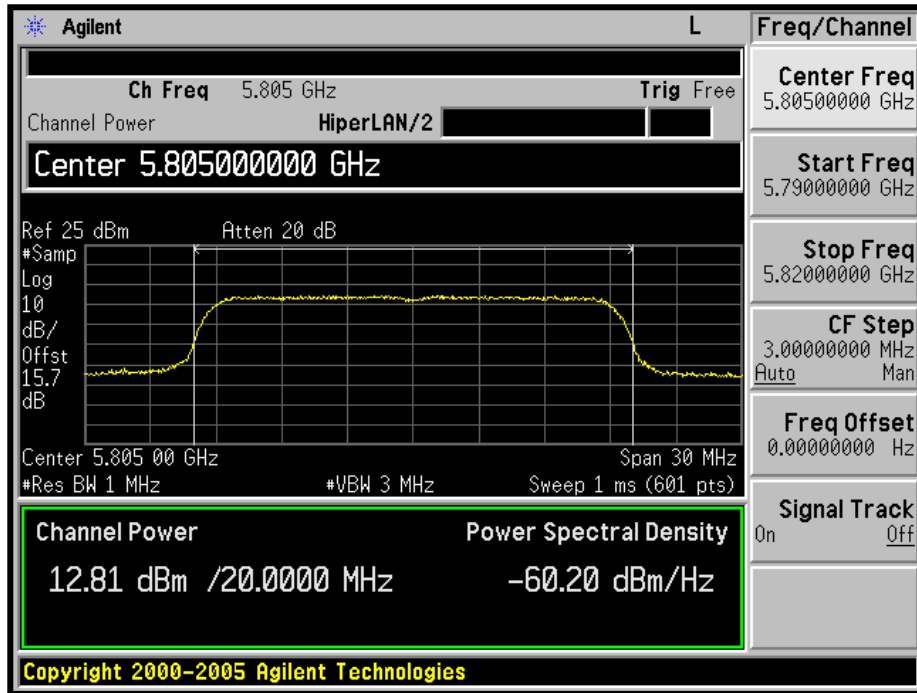
Low Channel



Middle Channel



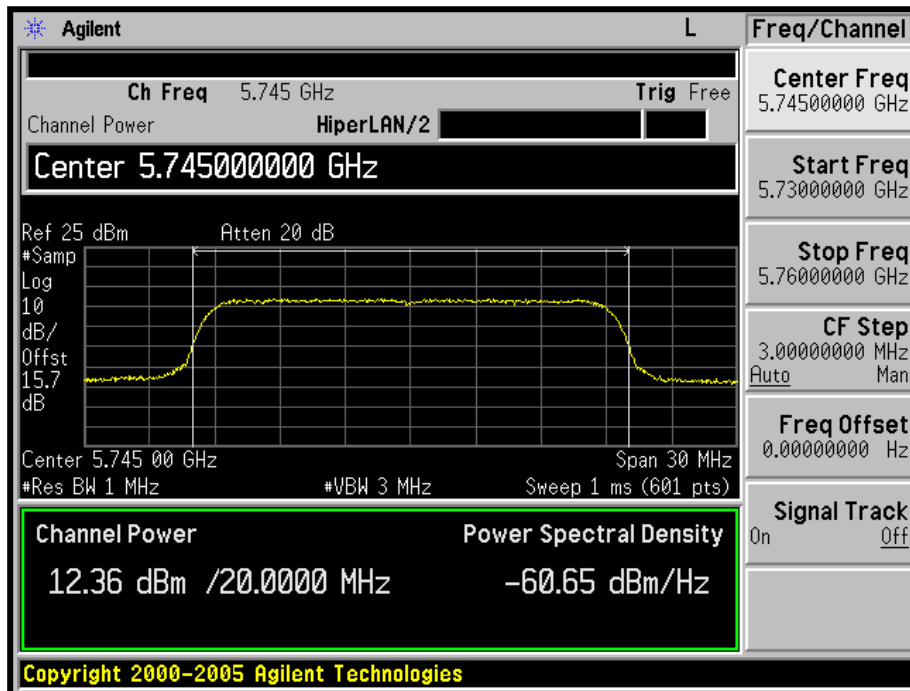
### High Channel



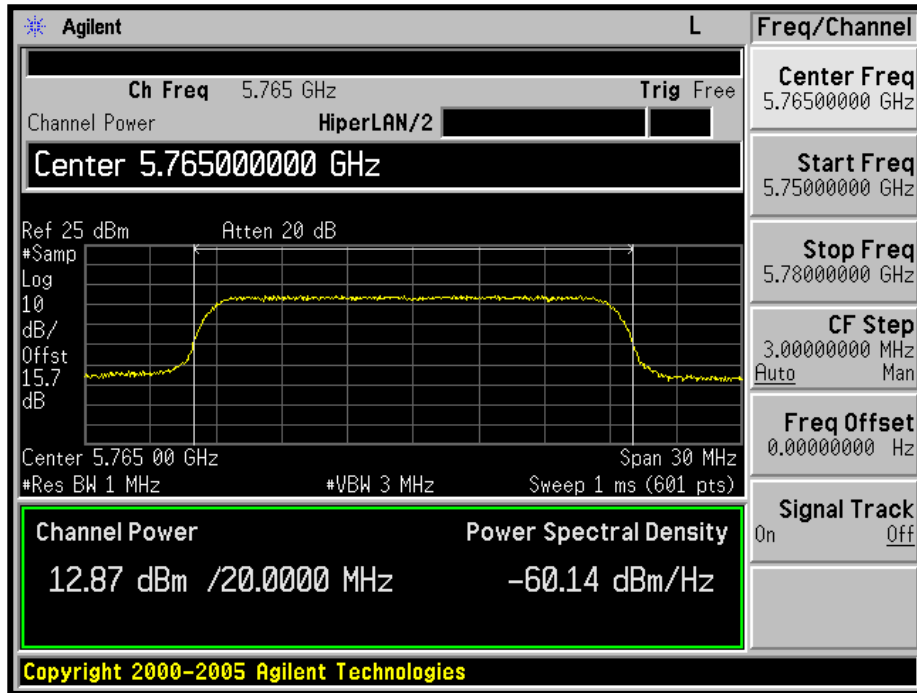
5725 MHz ~ 58250 MHz

802.11n : 20MHz rate, Chain B

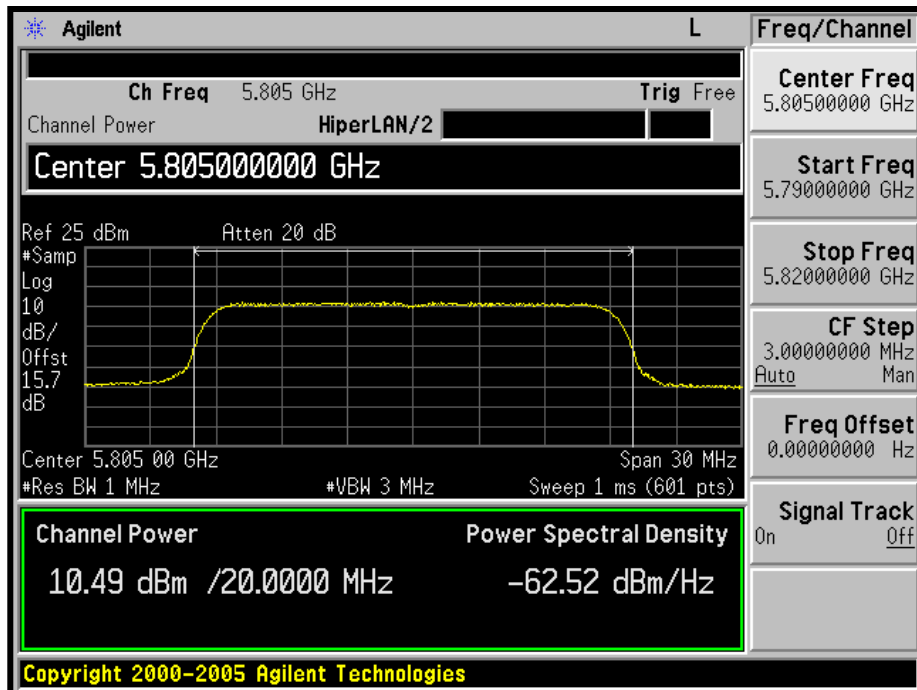
### Low Channel



**Middle Channel**



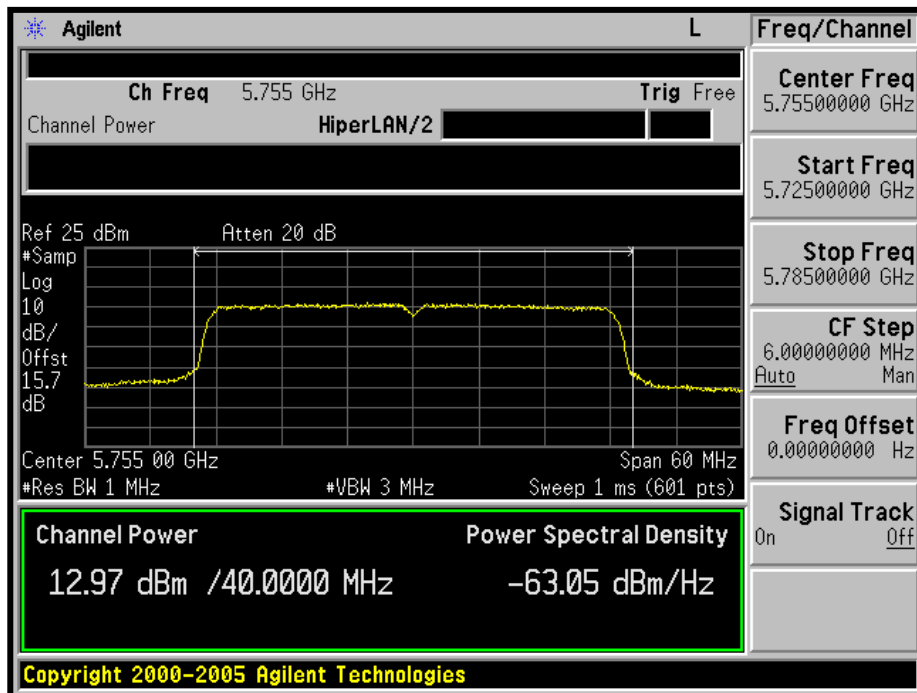
**High Channel**



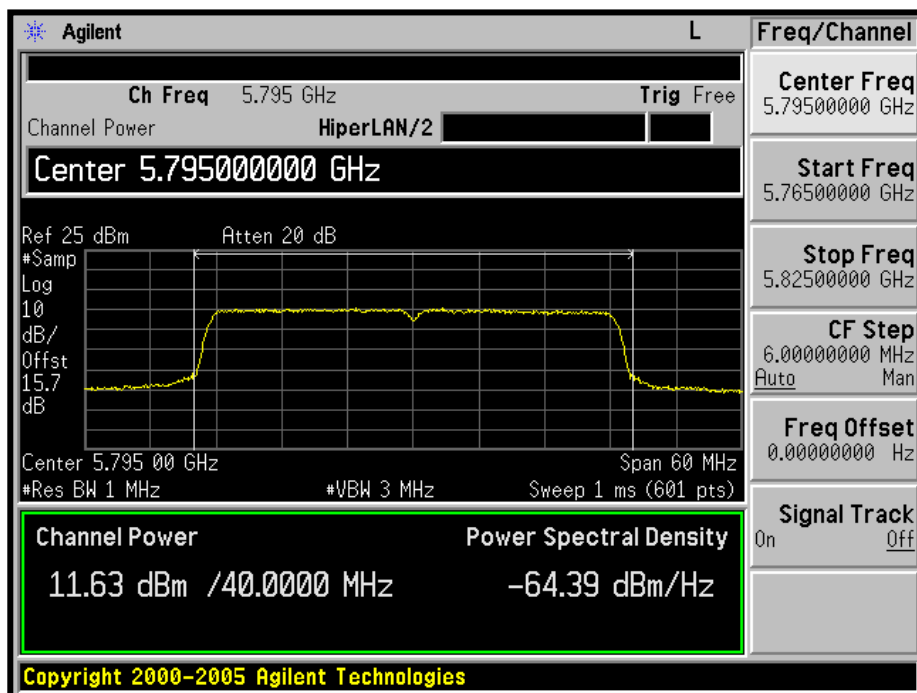
5725 MHz ~ 5825 MHz

802.11n : 40MHz rate, Chain A

Low Channel



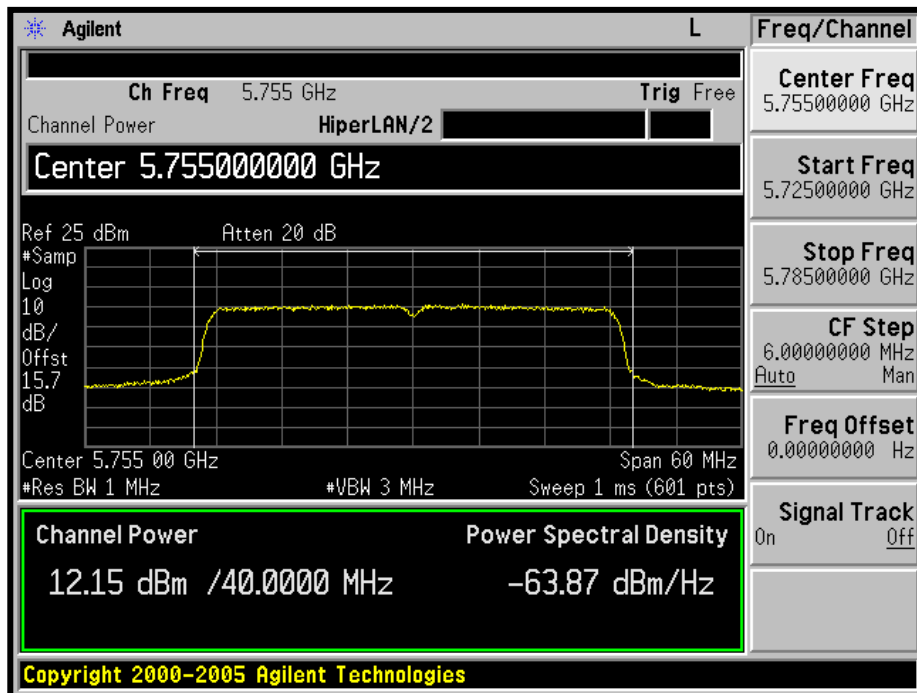
High Channel



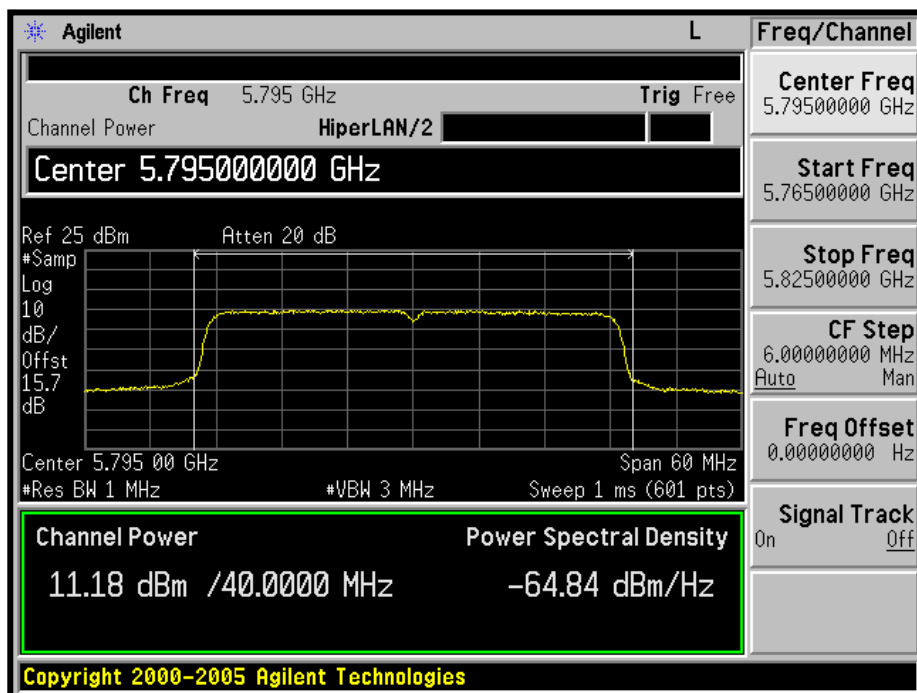
5725 MHz ~ 5825 MHz

802.11n : 40MHz rate, Chain B

Low Channel



High Channel



### 9.4 Peak Excursion

Test Results: 5150MHz ~ 5250MHz Band

◆ 802.11n : 20MHz rate

Channel	Frequency (MHz)	Chain A (dB)	Chain B (dB)	Limit (dB)	Result
Low	5180	9.27	9.14	13	Pass
Middle	5220	8.76	9.34	13	Pass
High	5240	8.99	9.14	13	Pass

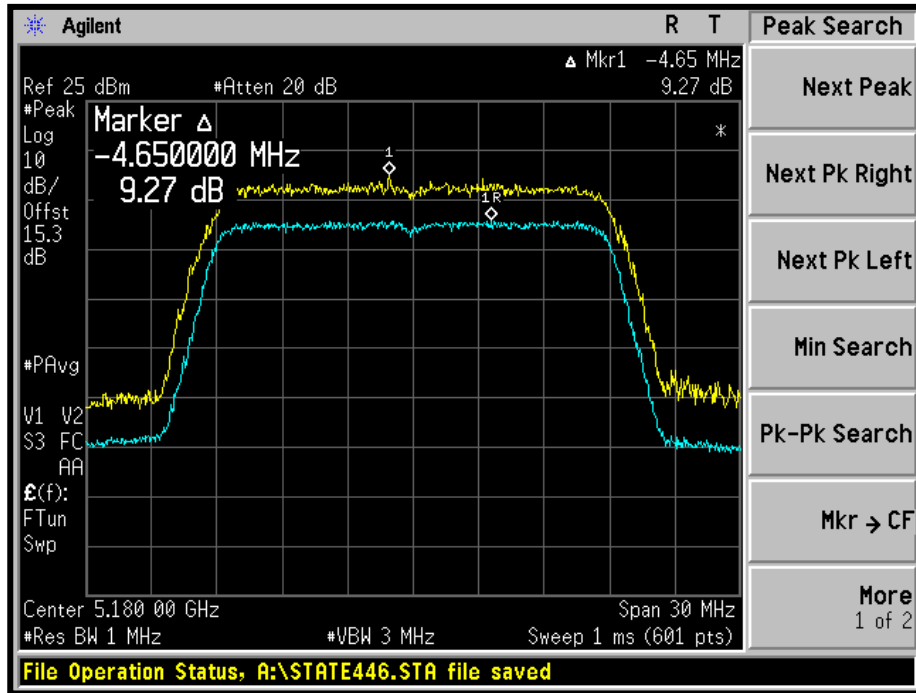
◆ 802.11n : 40MHz rate

Channel	Frequency (MHz)	Chain A (dB)	Chain B (dB)	Limit (dB)	Result
Low	5180	6.78	8.33	13	Pass
High	5240	8.51	8.63	13	Pass

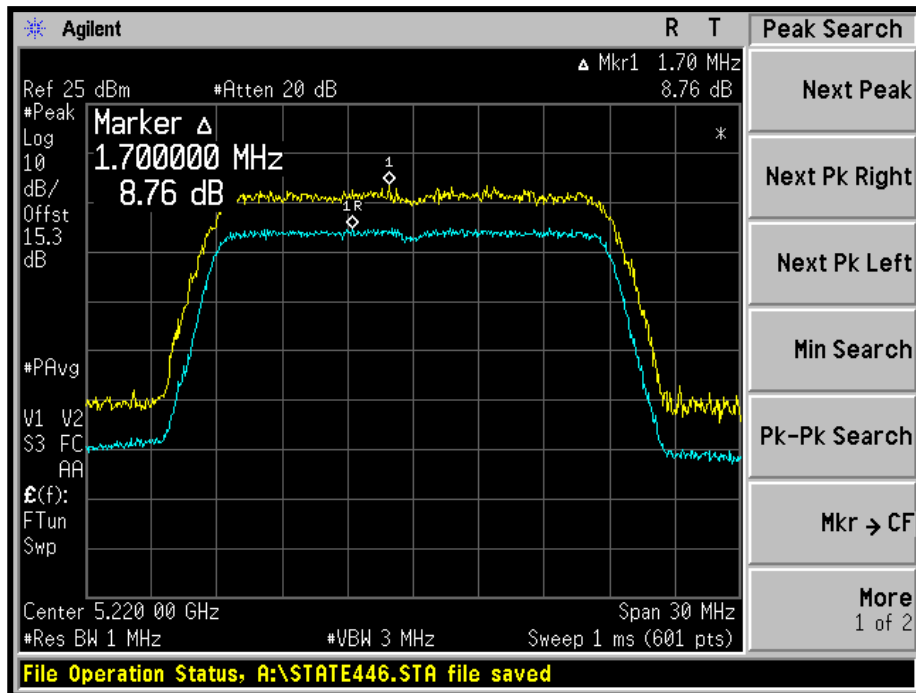
5150 MHz ~ 5250 MHz

802.11n : 20MHz rate, Chain A

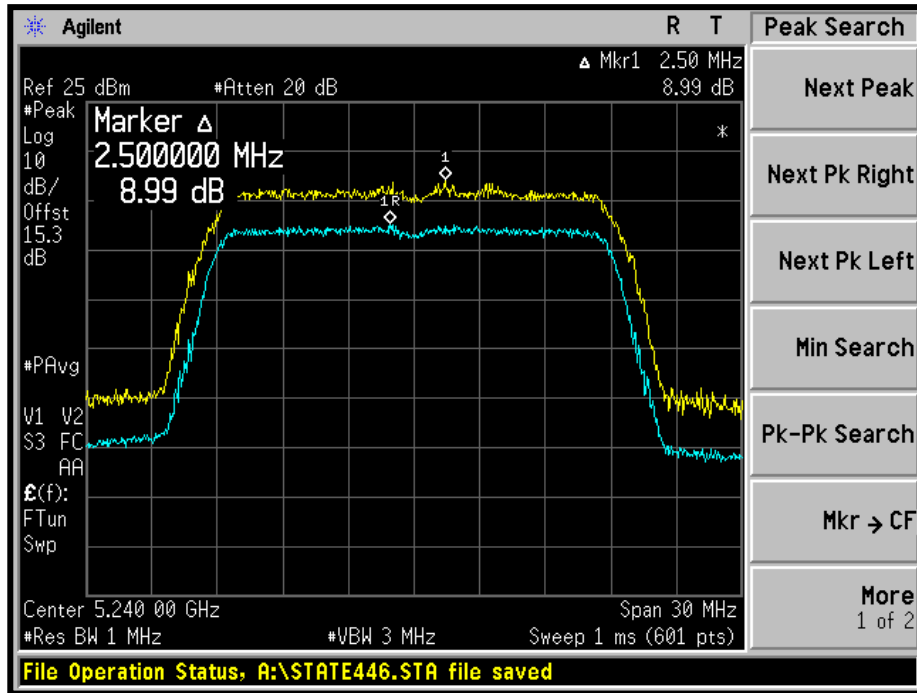
Low Channel



Middle Channel



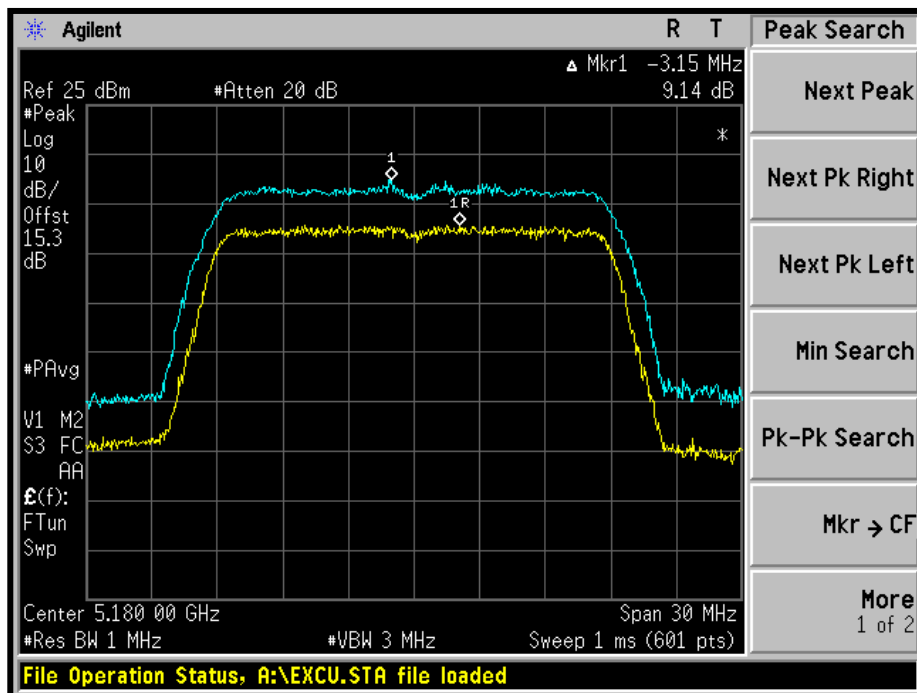
### High Channel



5150 MHz ~ 5250 MHz

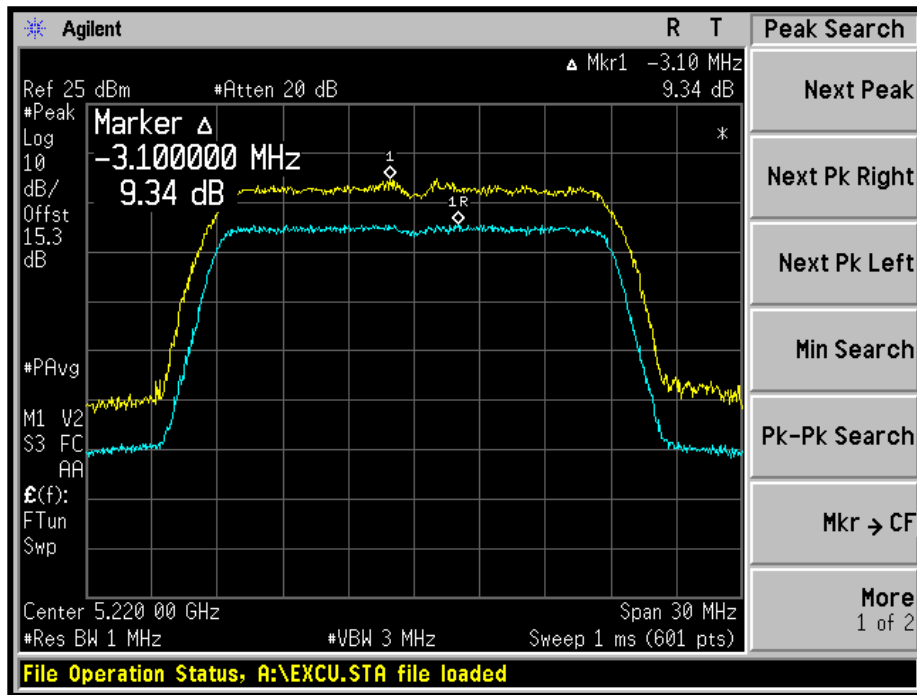
802.11n : 20MHz rate, Chain B

### Low Channel

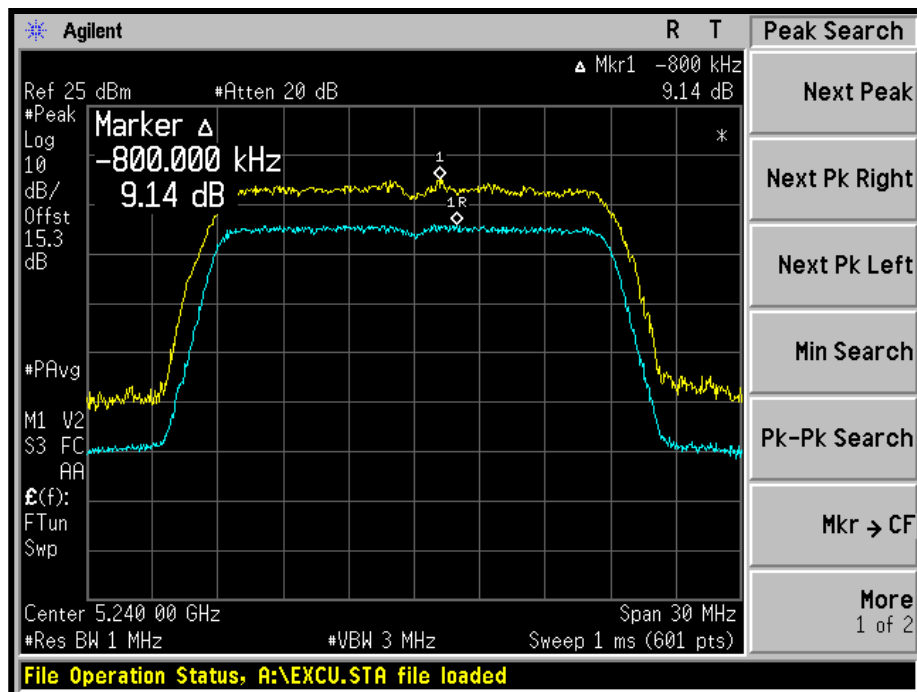




### Middle Channel



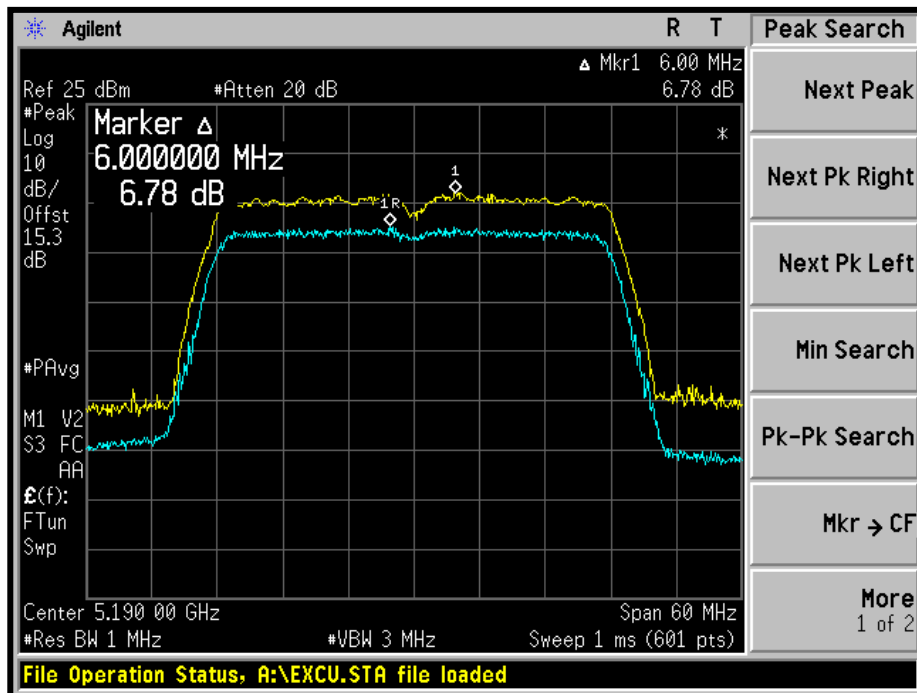
### High Channel



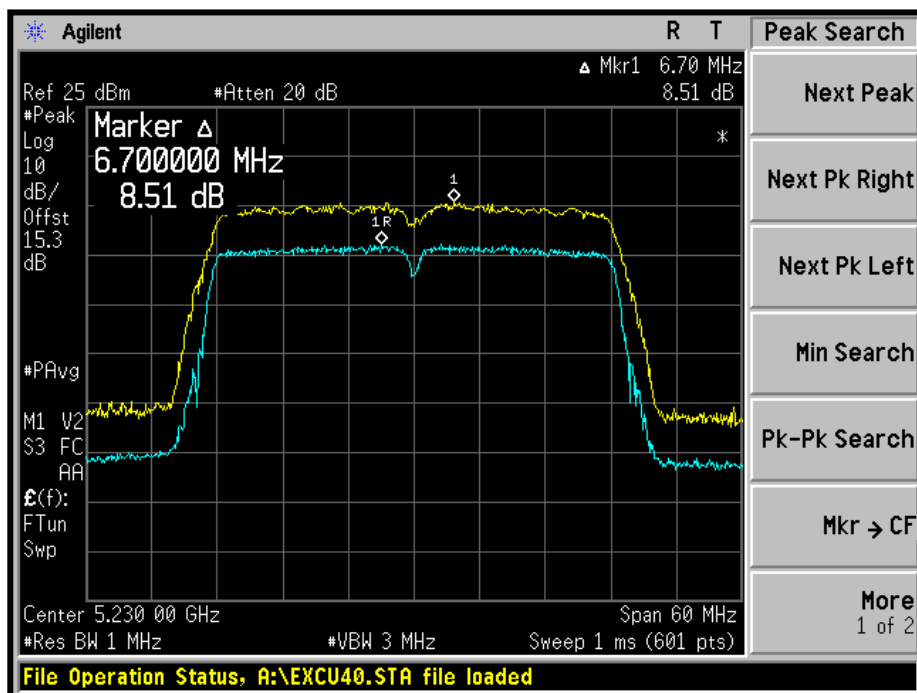
5150 MHz ~ 5250 MHz

802.11n : 40MHz rate, Chain A

Low Channel



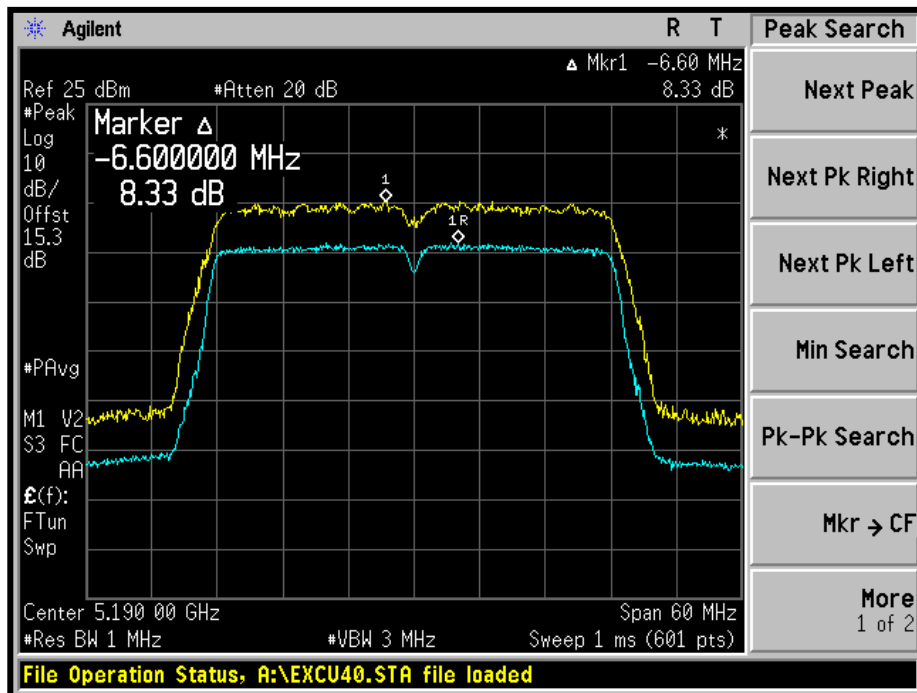
High Channel



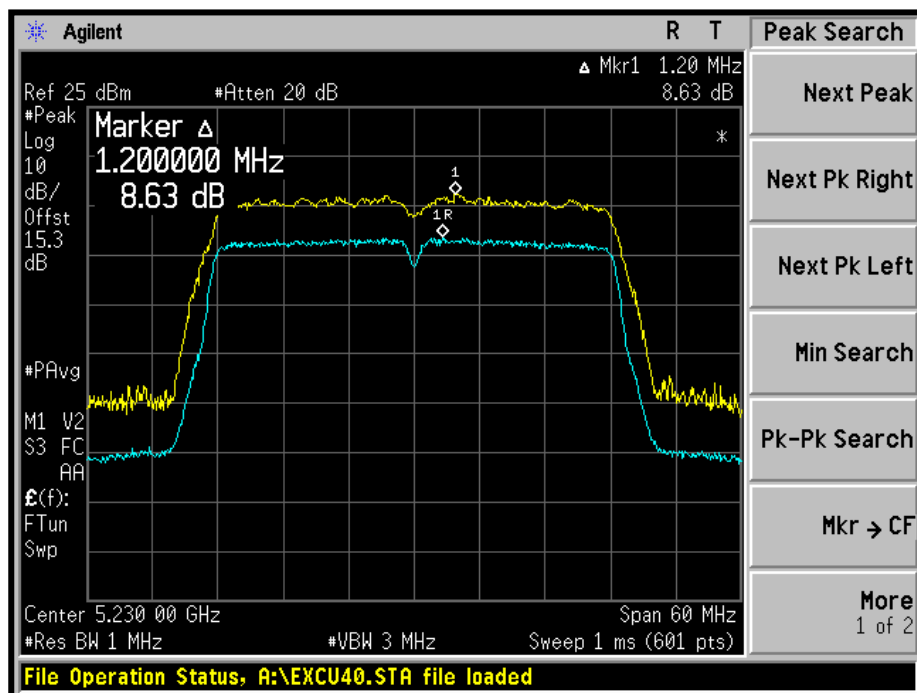
5150 MHz ~ 5250 MHz

802.11n : 40MHz rate, Chain B

Low Channel



High Channel



**Test Results: 5725MHz ~ 5825MHz Band**

◆ **802.11n : 20MHz rate**

Channel	Frequency (MHz)	Chain A (dB)	Chain B (dB)	Limit (dB)	Result
Low	5745	8.71	8.37	13	Pass
Middle	5765	8.02	8.59	13	Pass
High	5805	8.27	8.51	13	Pass

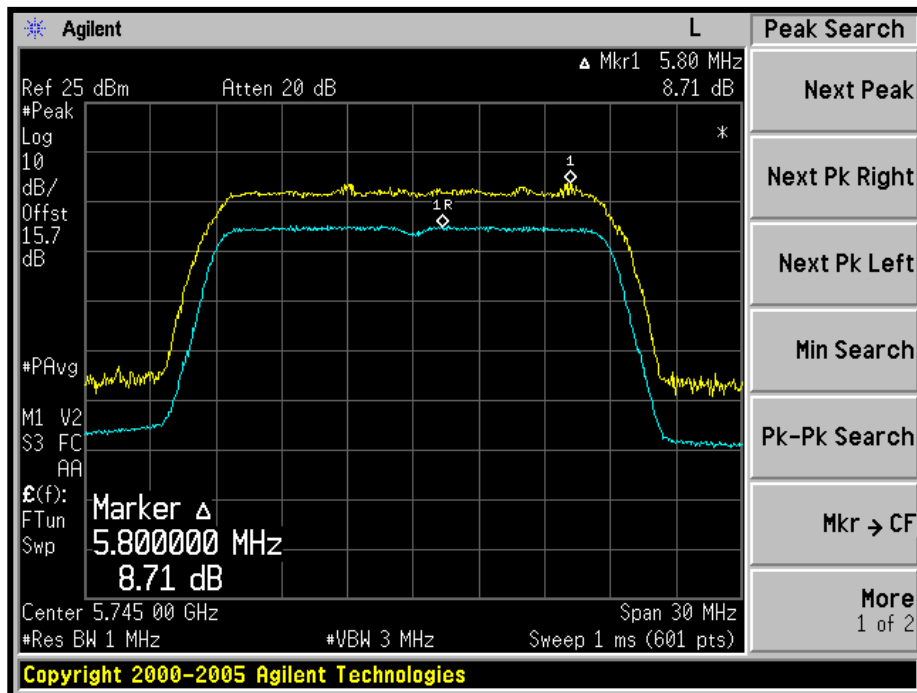
◆ **802.11n : 40MHz rate**

Channel	Frequency (MHz)	Chain A (dB)	Chain B (dB)	Limit (dB)	Result
Low	5755	8.39	8.44	13	Pass
High	5795	8.65	8.53	13	Pass

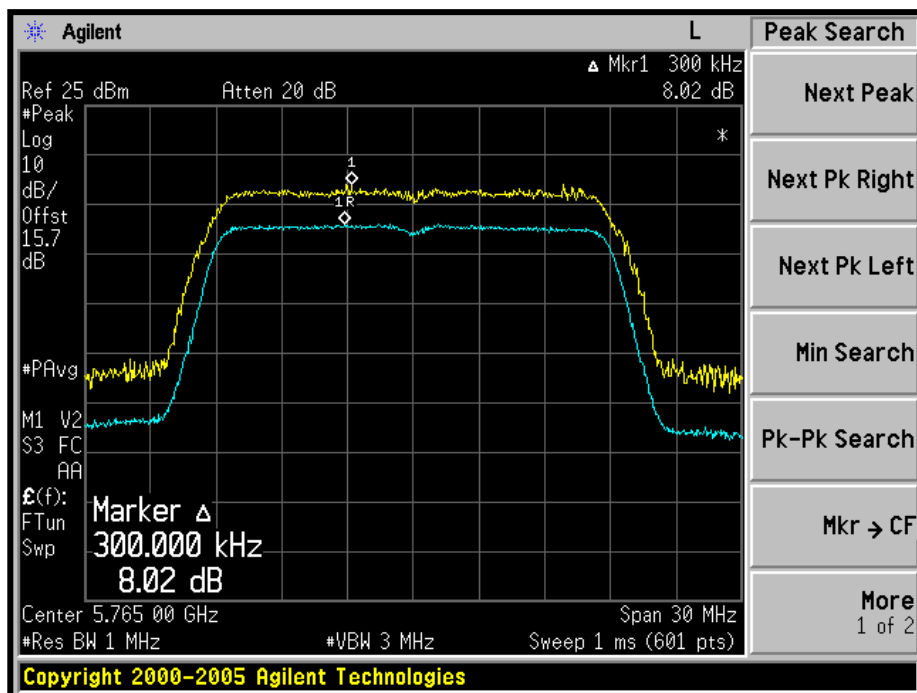
5725 MHz ~ 5825 MHz

802.11n : 20MHz rate, Chain A

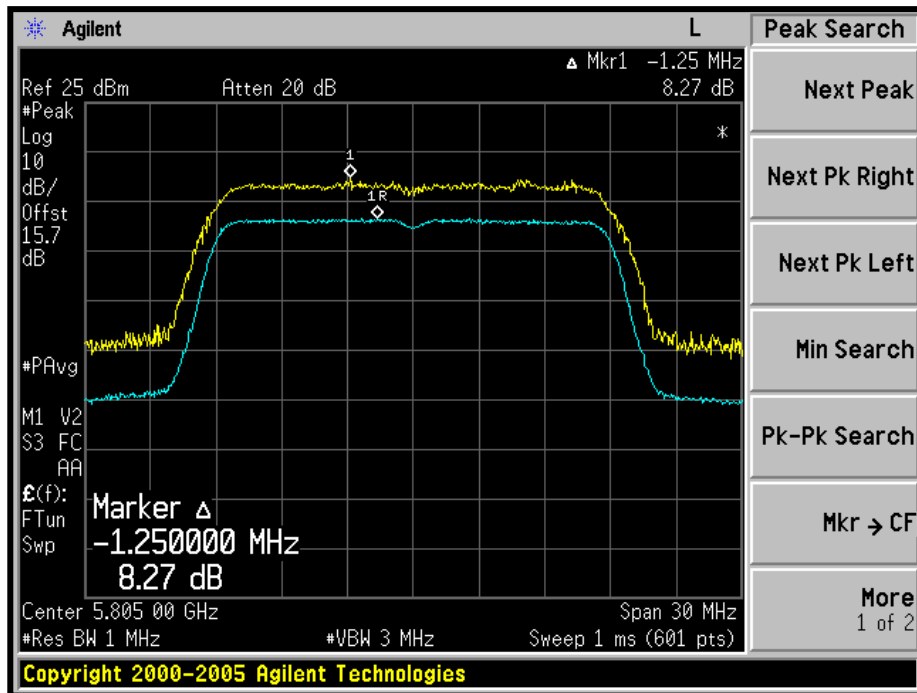
Low Channel



Middle Channel



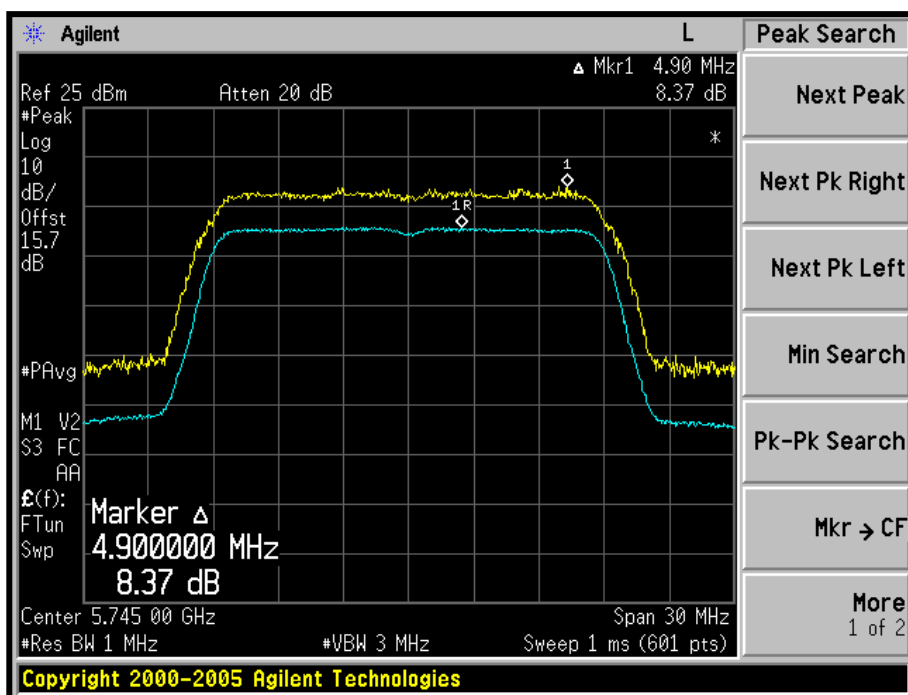
### High Channel



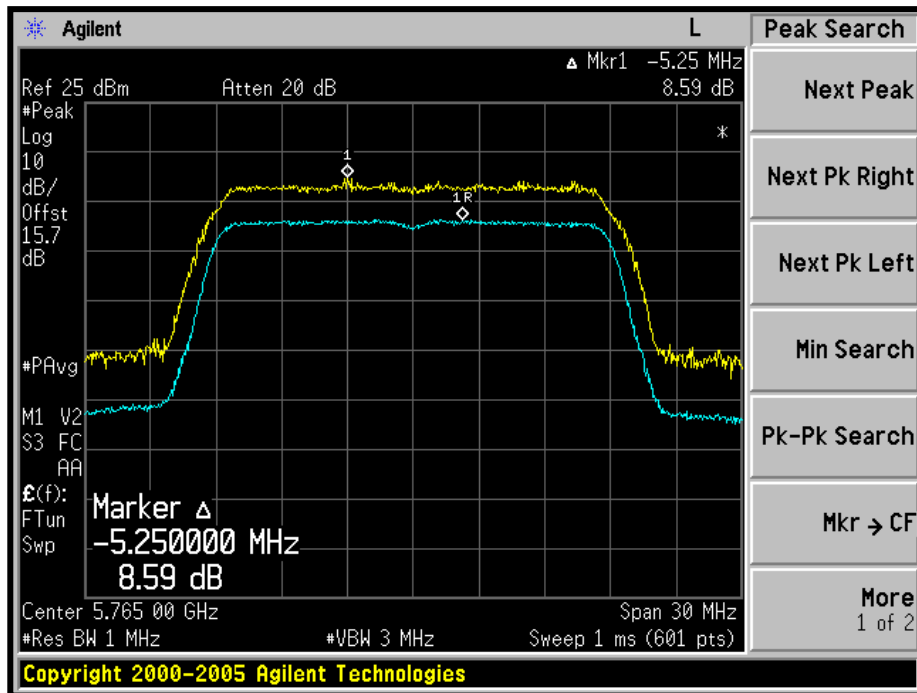
5725 MHz ~ 5825 MHz

802.11n : 20MHz rate, Chain B

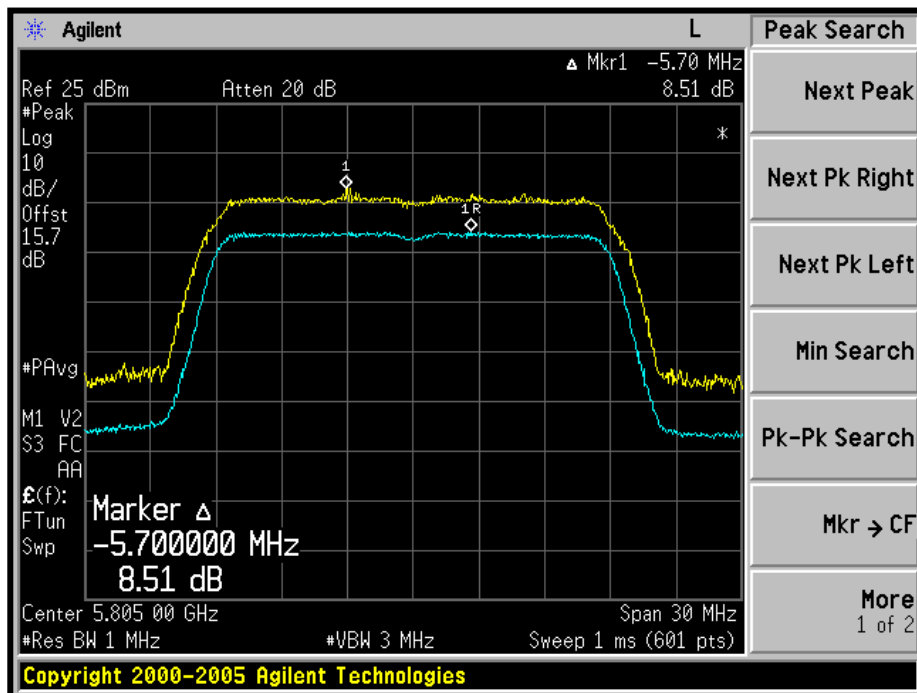
### Low Channel



### Middle Channel



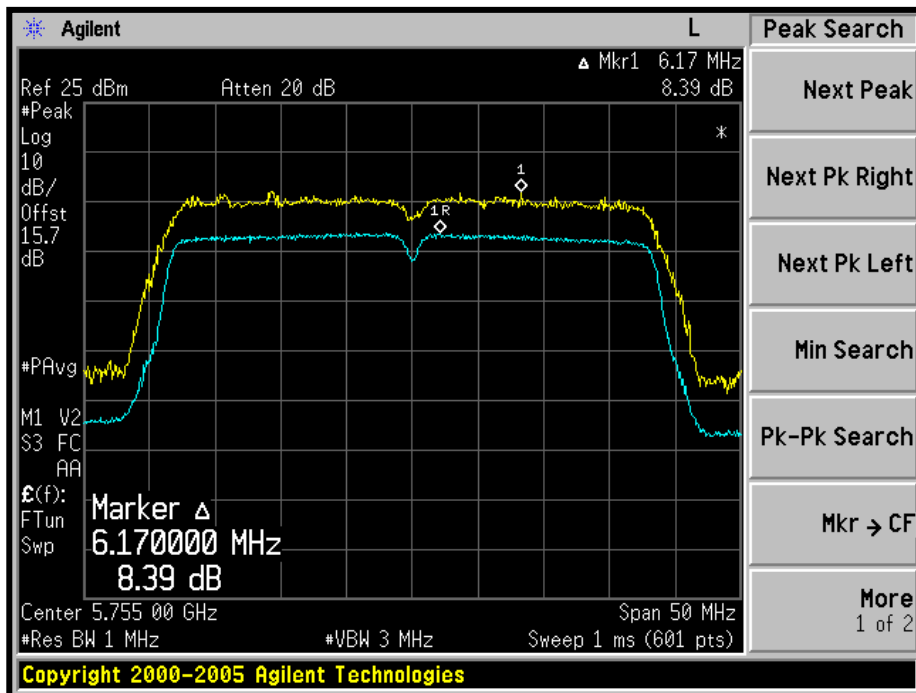
### High Channel



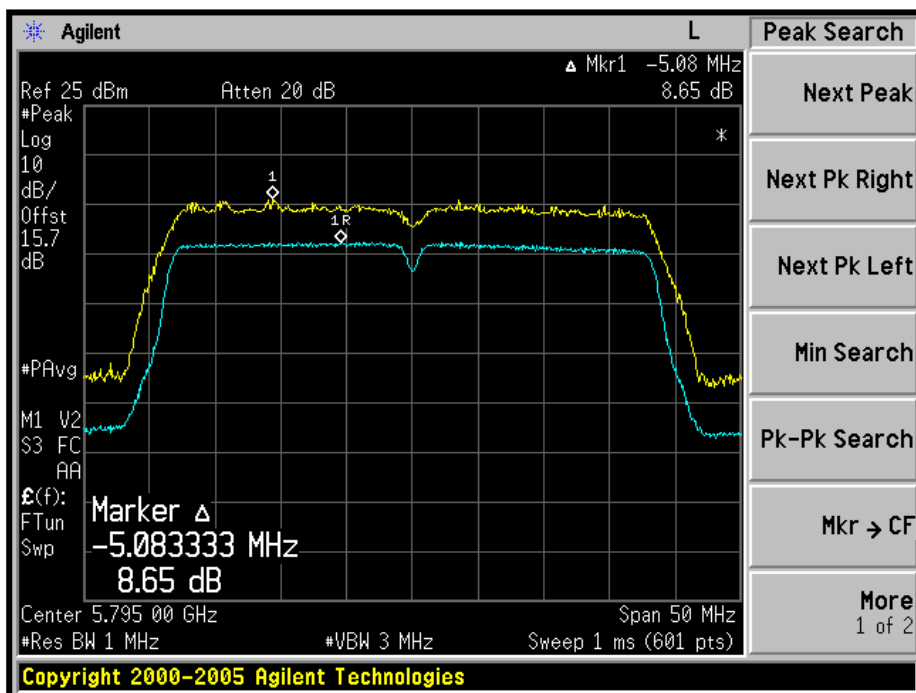
5725 MHz ~ 5825 MHz

802.11n : 40MHz rate, Chain A

Low Channel



High Channel

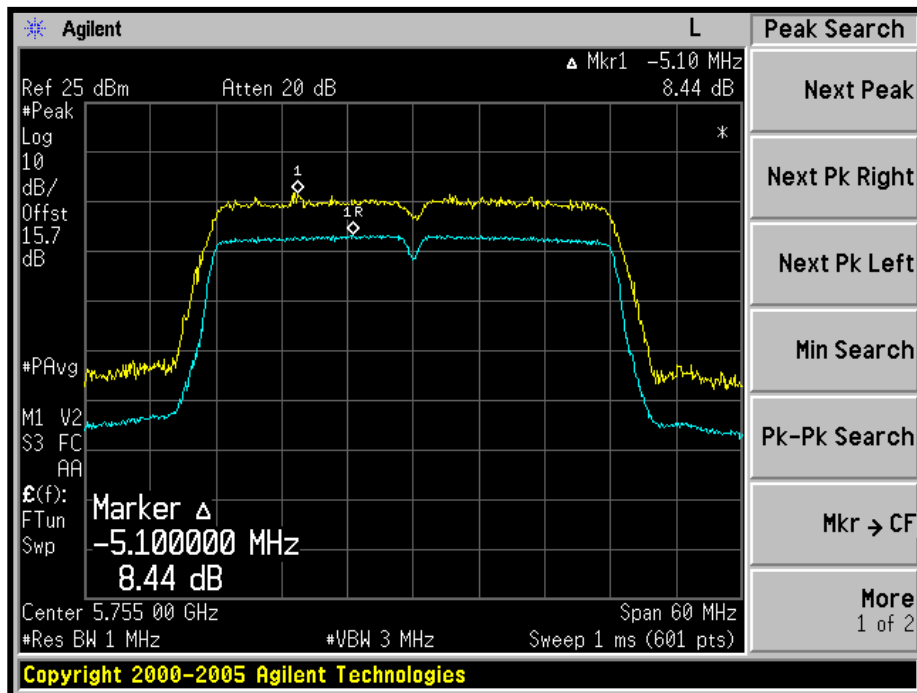




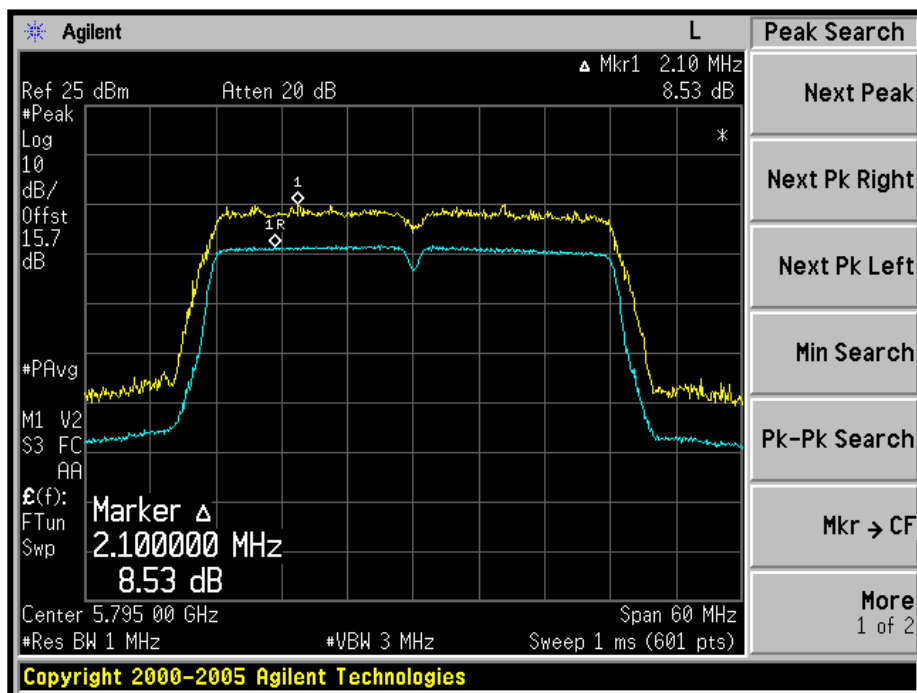
5725 MHz ~ 5825 MHz

802.11n : 40MHz rate, Chain B

Low Channel



High Channel

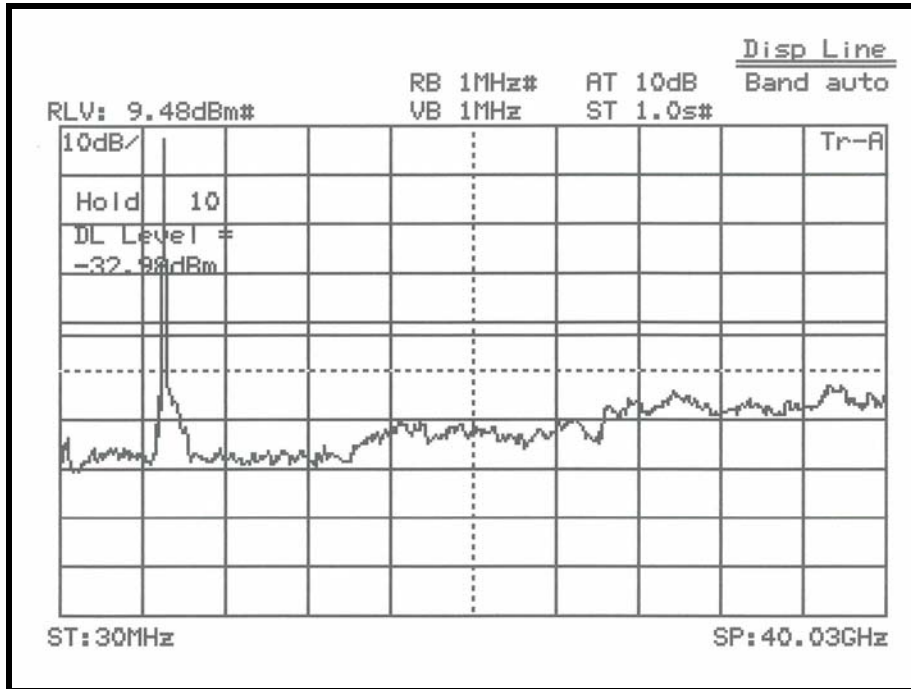


**9.5 Conducted Spurious Emissions**

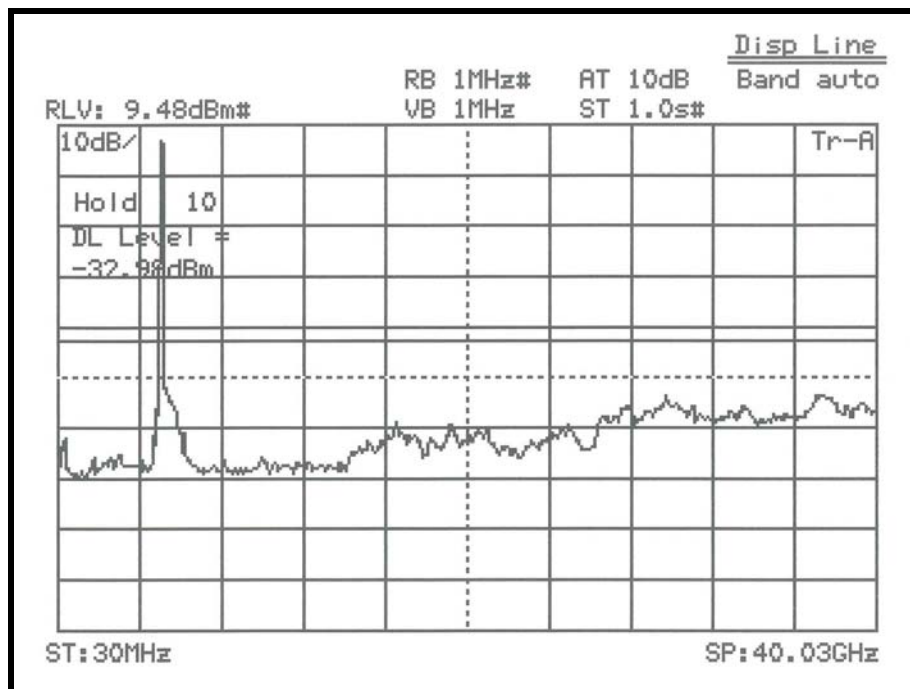
5150 MHz ~ 5250 MHz

802.11n : 20MHz rate

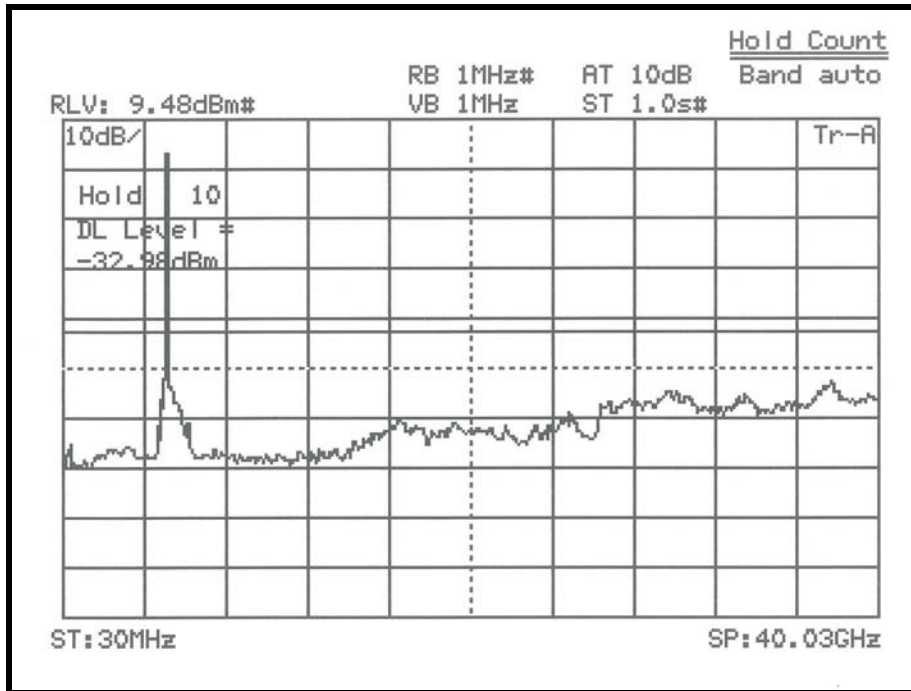
Low Channel



Middle Channel



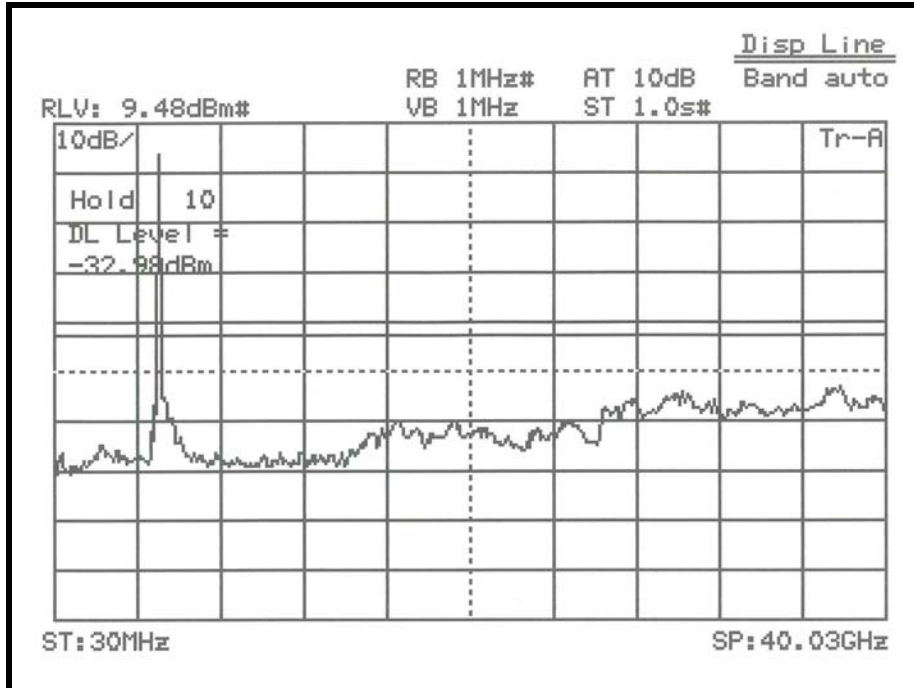
**High Channel**



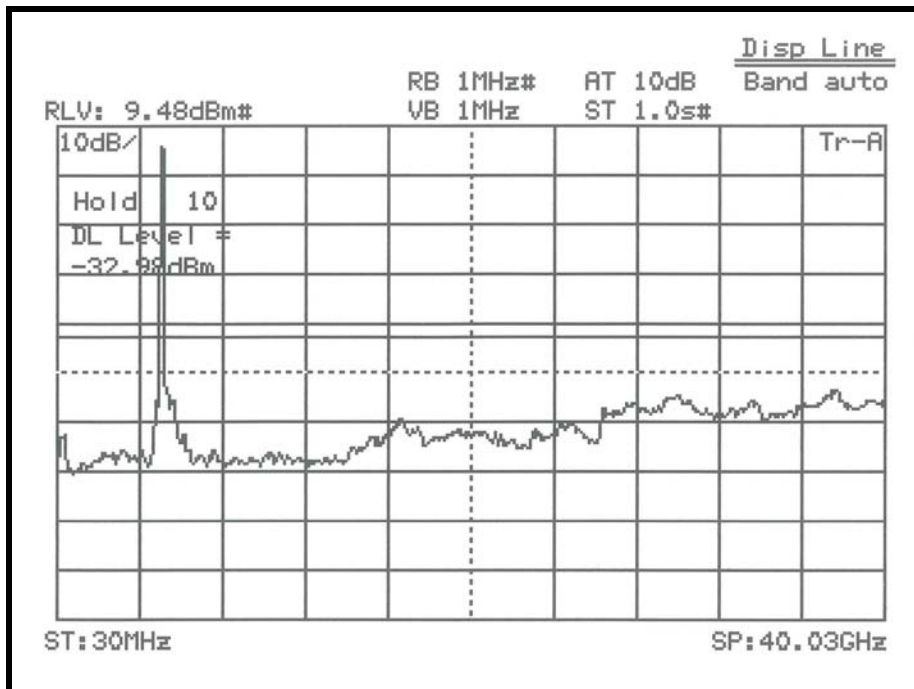
5150 MHz ~ 5250 MHz

802.11n : 40MHz rate

**Low Channel**



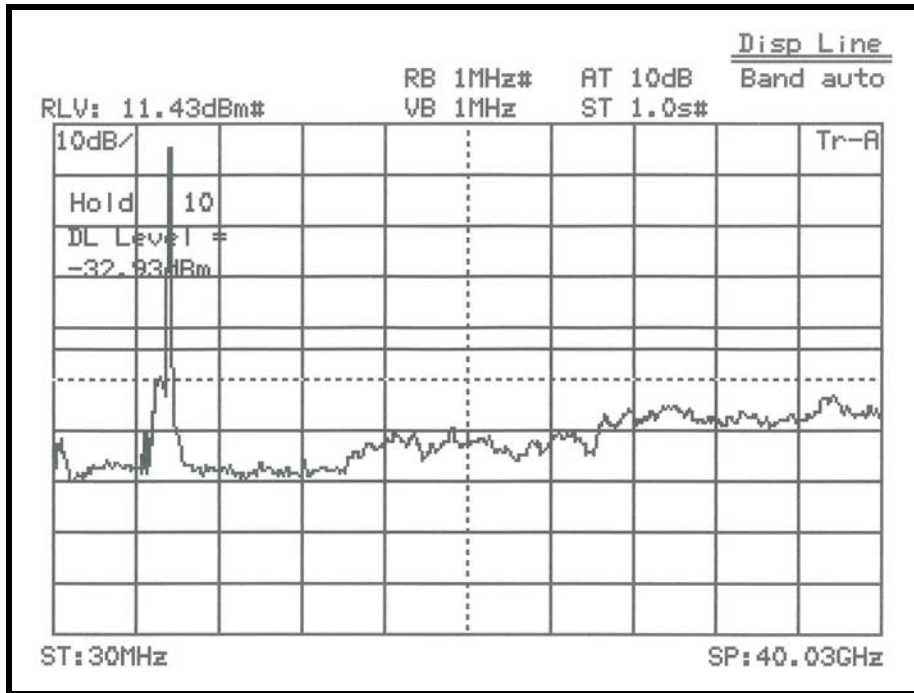
**High Channel**



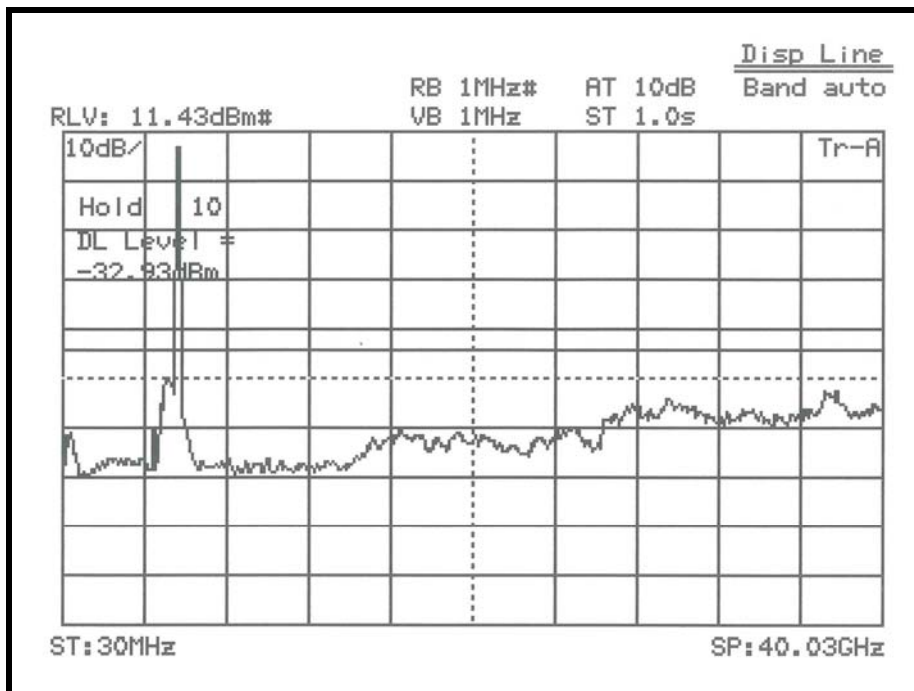
5725 MHz ~ 5825 MHz

802.11n : 20MHz rate

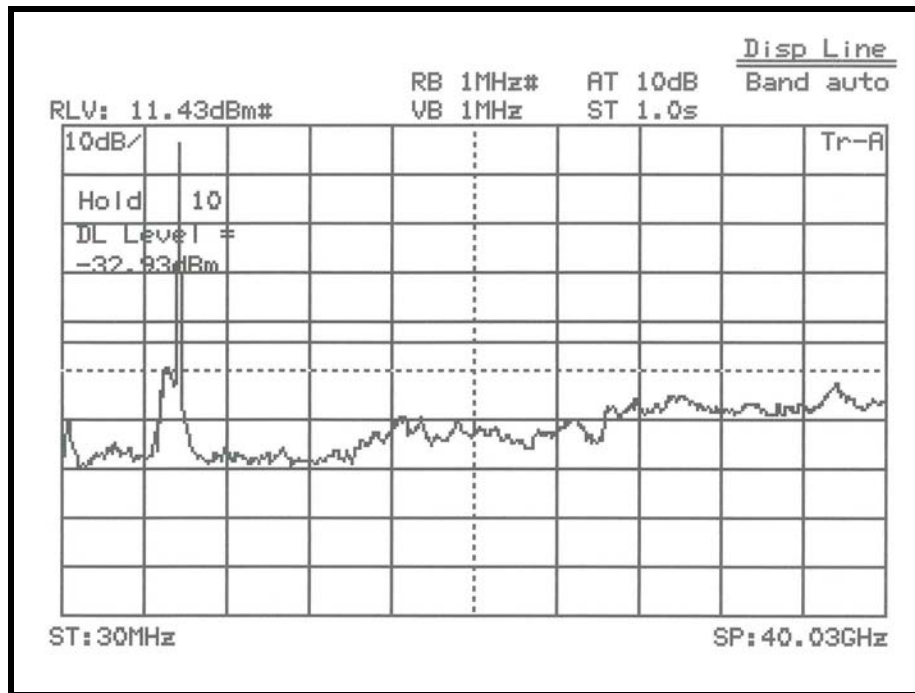
Low Channel



Middle Channel



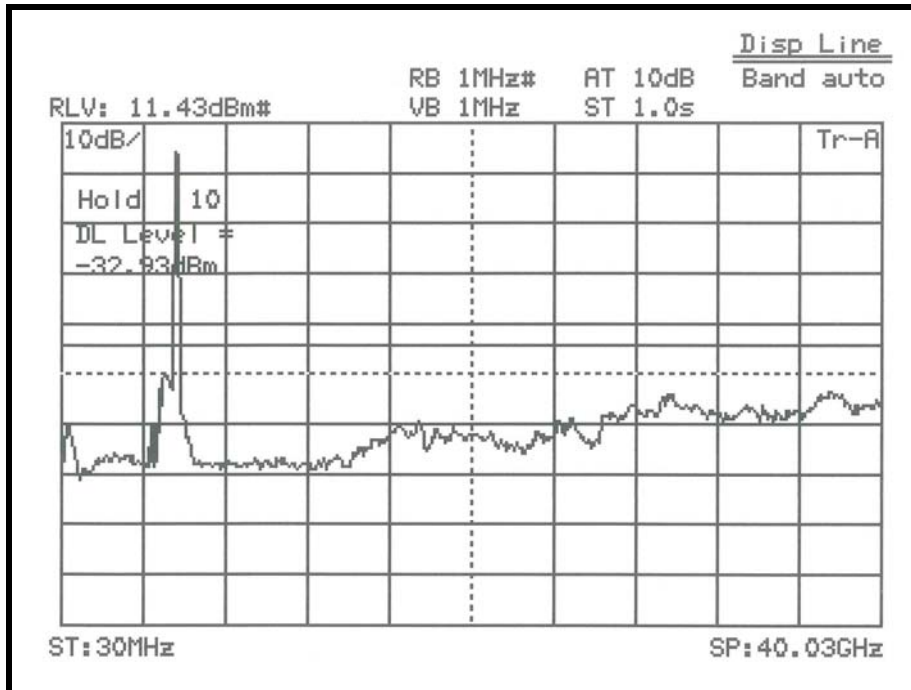
**High Channel**



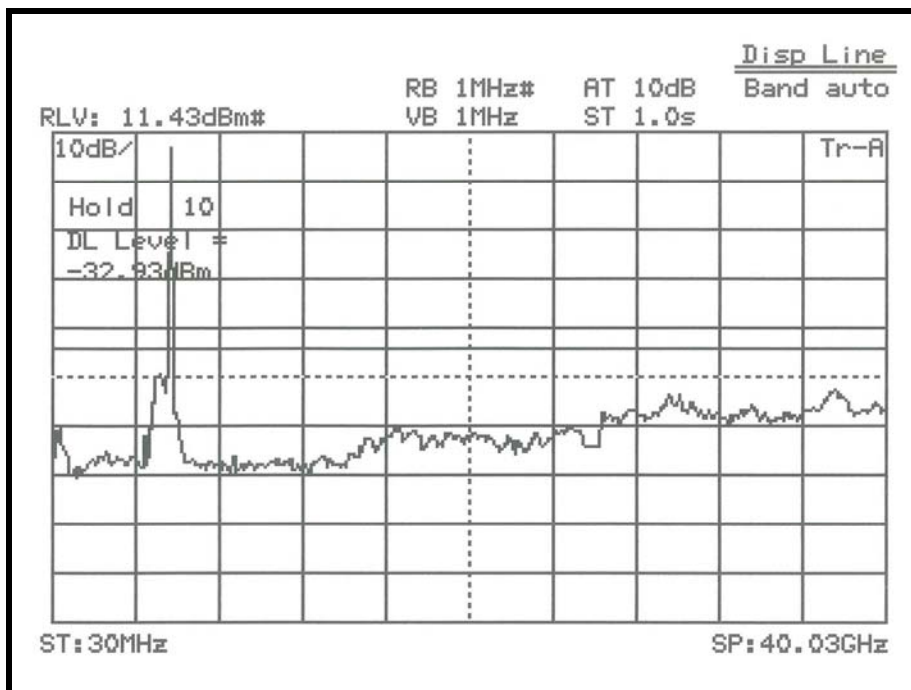
5725 MHz ~ 5825 MHz

802.11n : 40MHz rate

**Low Channel**



**High Channel**



## 9.6 Frequency Stability / Temperature Variation

Deviation Limit :  $\pm 20\text{ppm}$

Measurement Result : Set to Middle channel ( 5220MHz )

Voltage (%)	Power (Vdc)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	ppm
100%	3.3	+23(Ref.)	5,220,023,516	23516	4.5
100%		0	5,220,015,857	15857	3.0
100%		10	5,220,000,156	156	0.0
100%		20	5,220,009,108	9108	1.7
100%		30	5,220,022,189	22189	4.3
100%		40	5,220,027,821	27821	5.3
100%		50	5,220,032,543	32543	6.2
100%		60	5,220,036,234	36234	6.9
100%		70	5,220,038,356	38356	7.3
85%		2.805	23	5,220,023,012	23012
115%	3.795	23	5,220,023,128	23128	4.4

Measurement Result : Set to Middle channel ( 5765MHz )

Voltage (%)	Power (Vdc)	Temp. (°C)	Frequency (Hz)	Frequency Error (Hz)	ppm
100%	3.3	+23(Ref.)	5,765,024,125	24125	4.2
100%		0	5,765,012,524	12524	2.2
100%		10	5,765,005,923	5923	1.0
100%		20	5,765,017,156	17156	3.0
100%		30	5,765,022,289	22289	3.9
100%		40	5,765,027,125	27125	4.7
100%		50	5,765,030,954	30954	5.4
100%		60	5,765,032,028	32028	5.6
100%		70	5,765,035,004	35004	6.1
85%		2.805	23	5,765,023,765	23765
115%	3.795	23	5,765,023,937	23937	4.2

\*The temperature is varied from  $-30^{\circ}\text{C}$  to  $+60^{\circ}\text{C}$  using an environmental chamber.

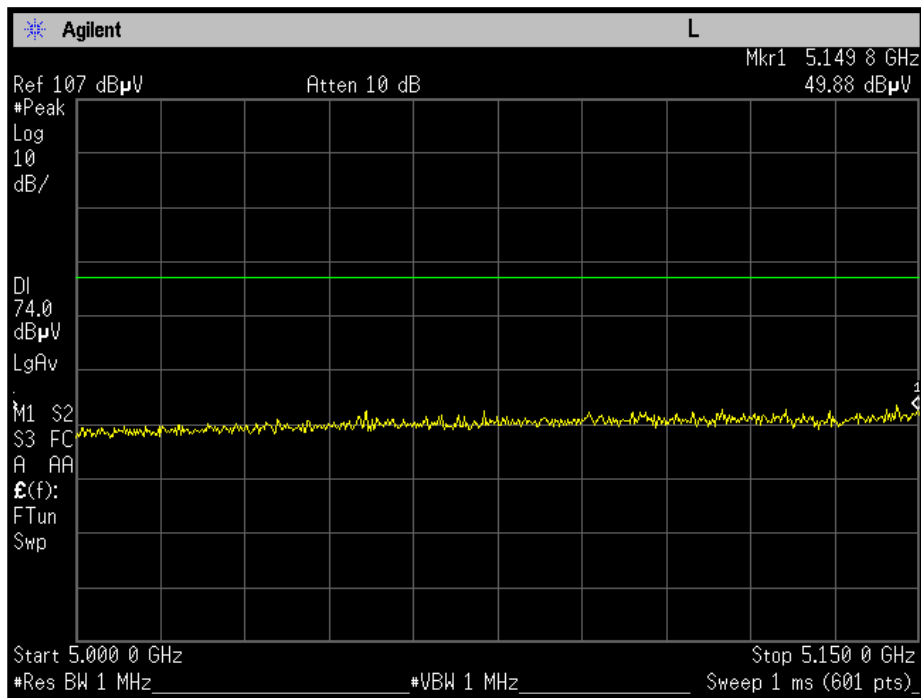


### 9.7 Band Edge

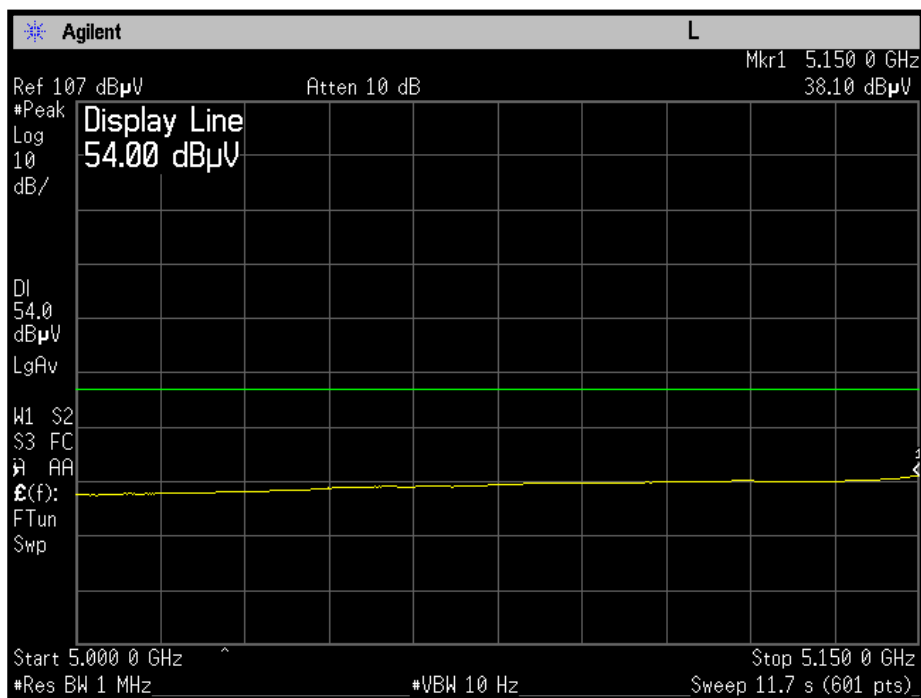
Test Results: 5150MHz ~ 5250MHz Band

802.11n : 20MHz rate

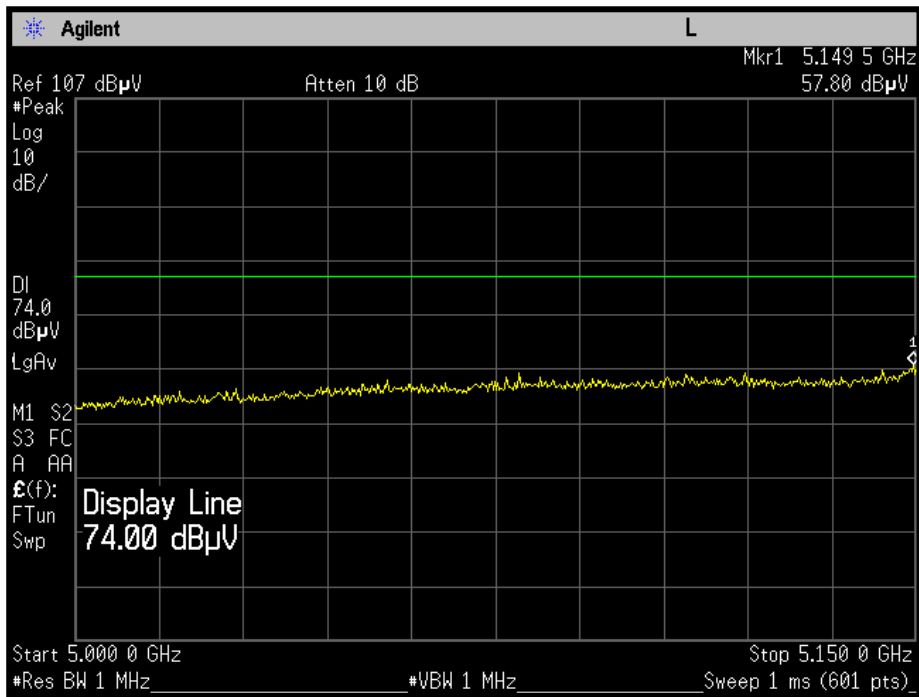
Horizontal Peak



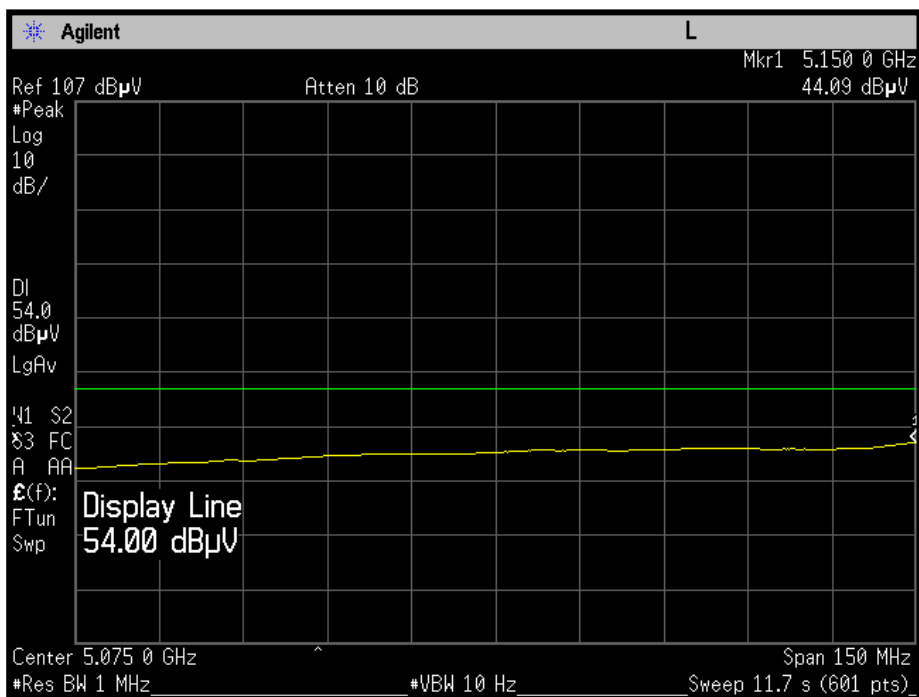
Horizontal Average



### Vertical Peak



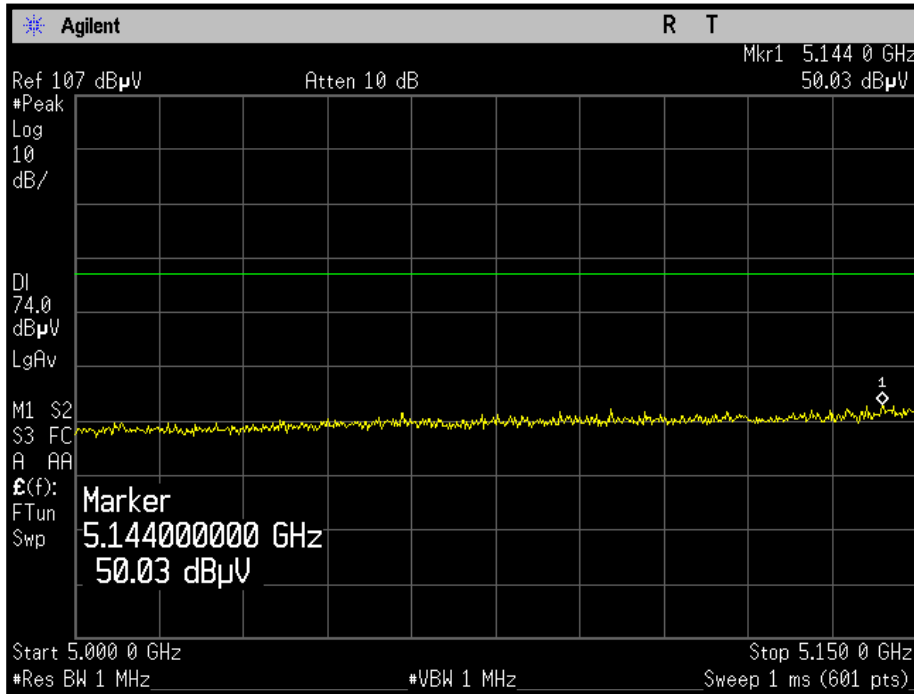
### Vertical Average



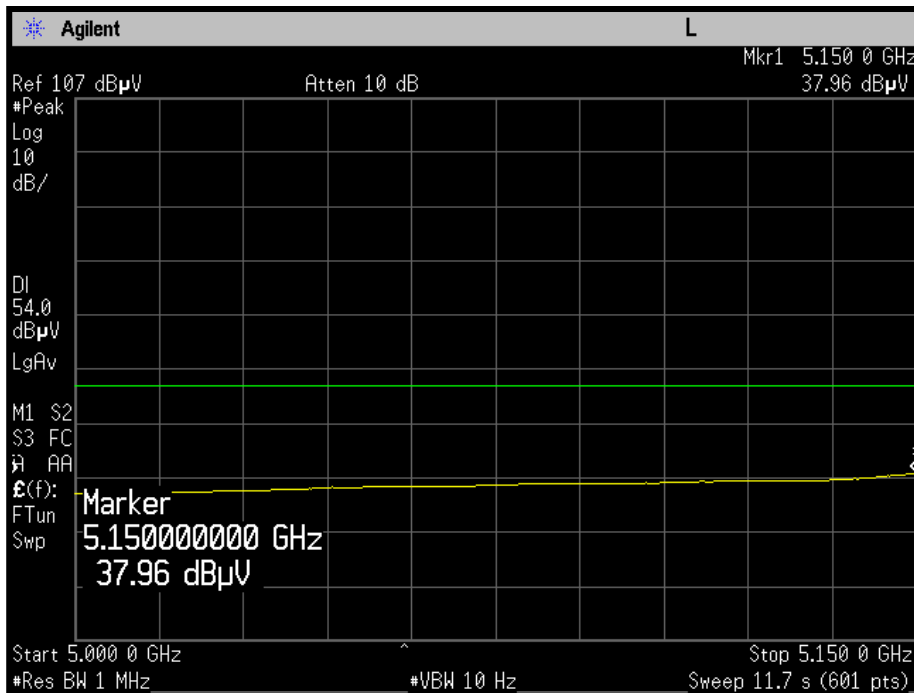
**Test Results: 5150MHz ~ 5250MHz Band**

**802.11n : 40MHz rate**

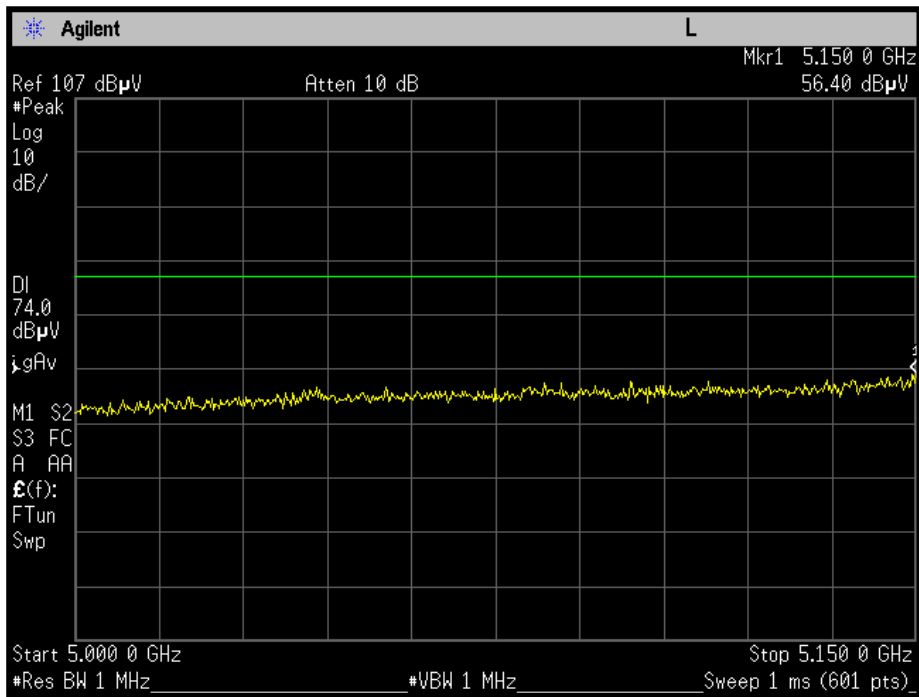
**Horizontal Peak**



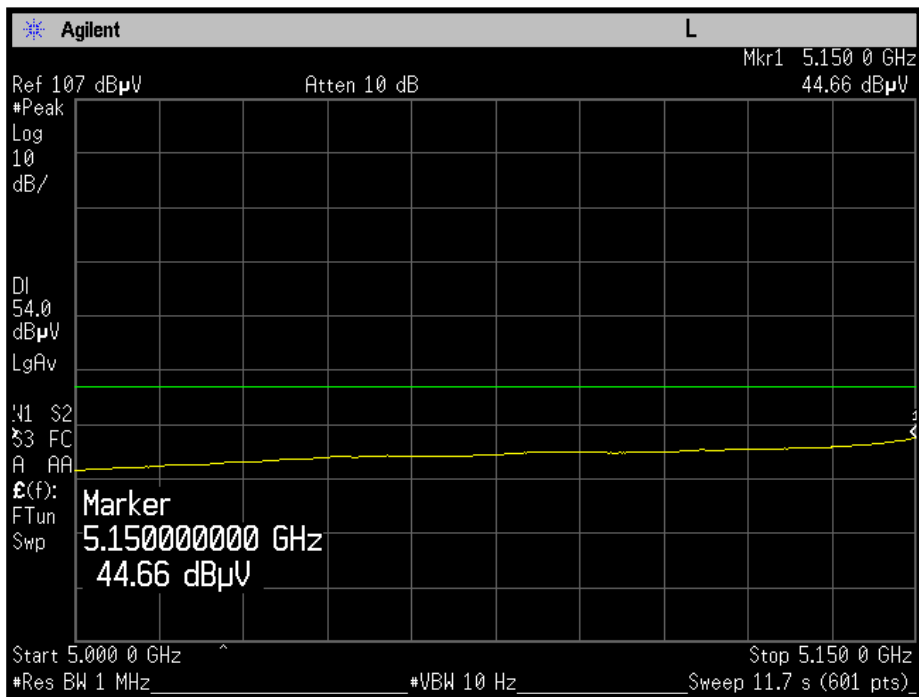
**Horizontal Average**



### Vertical Peak



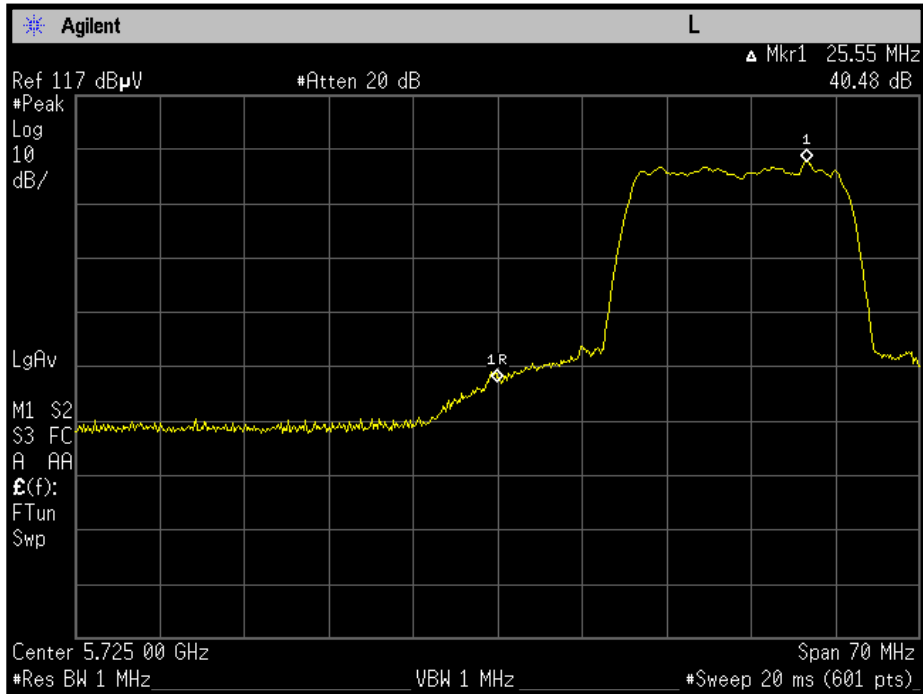
### Vertical Average



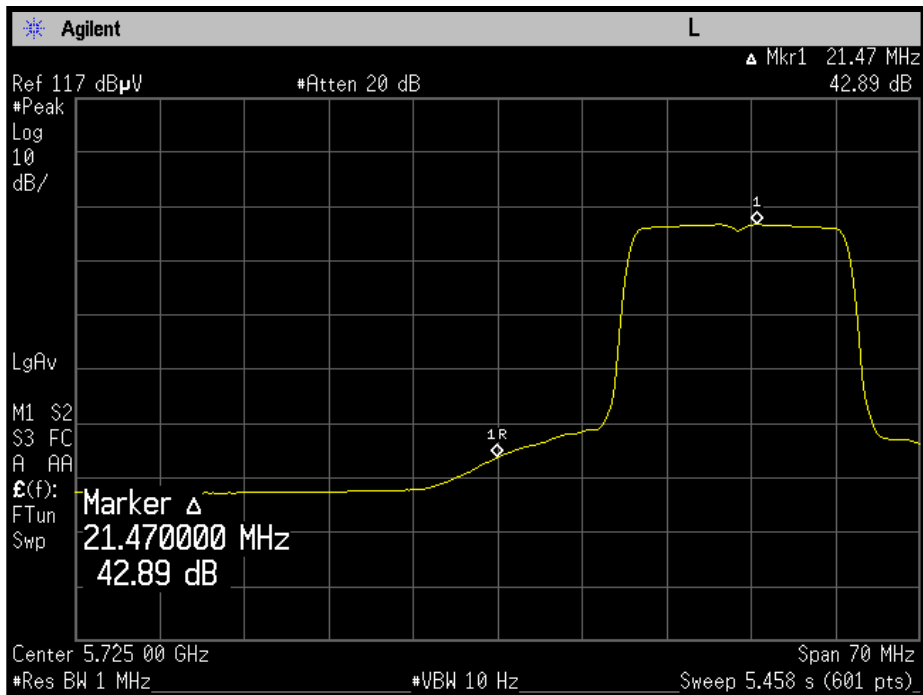
**Test Results: 5725MHz ~ 5825MHz Band**

802.11n : 20MHz rate

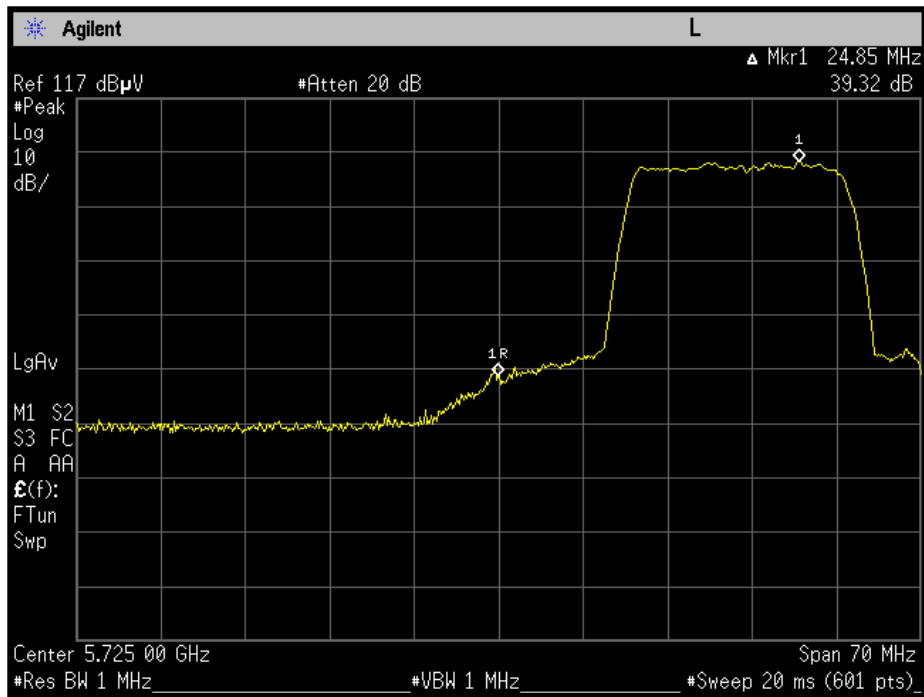
**Low Channel Horizontal Peak**



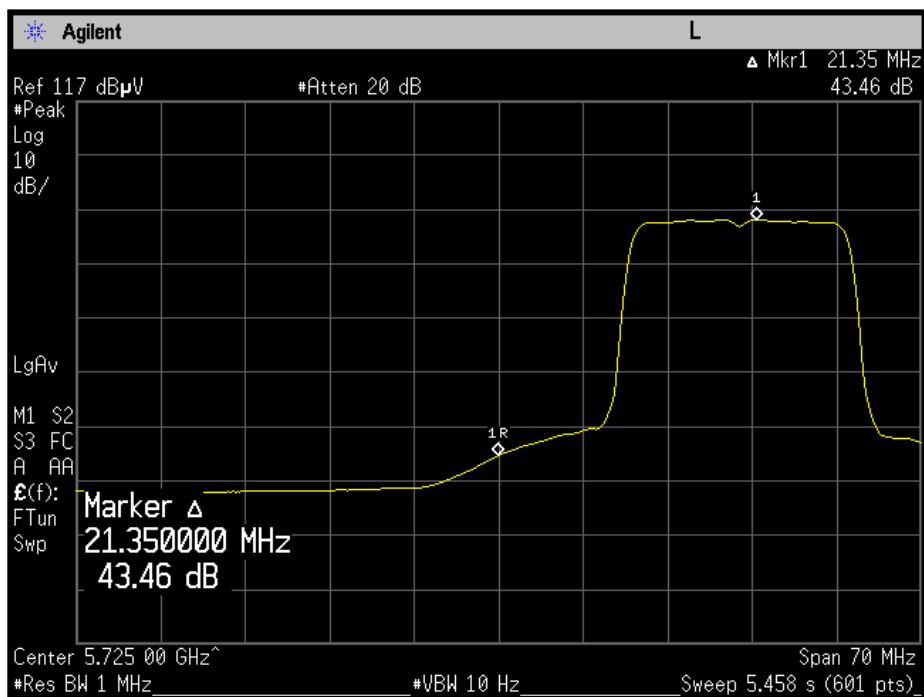
**Low Channel Horizontal Average**



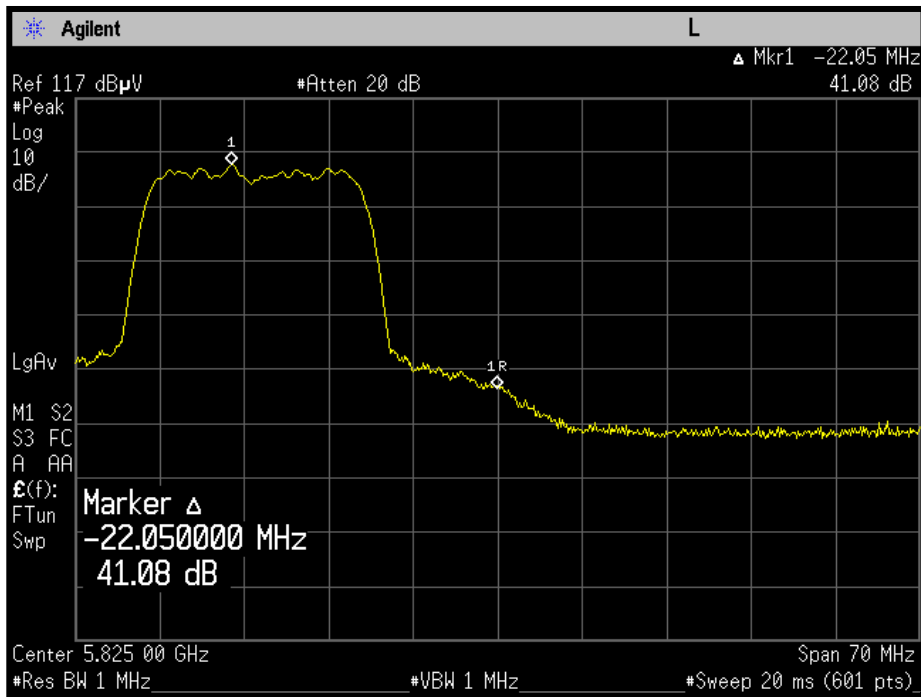
### Low Channel Vertical Peak



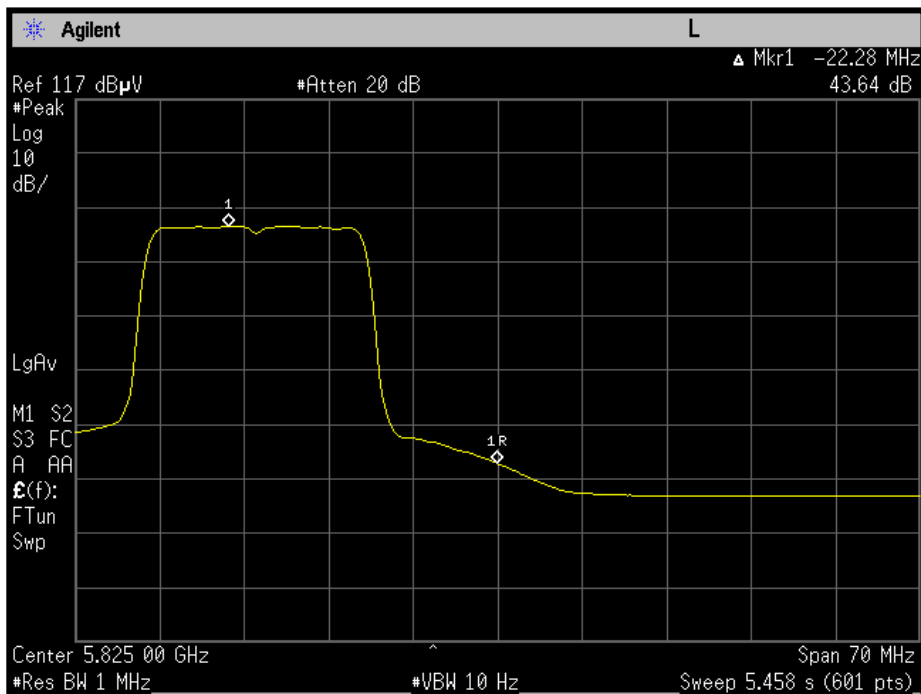
### Low Channel Vertical Average



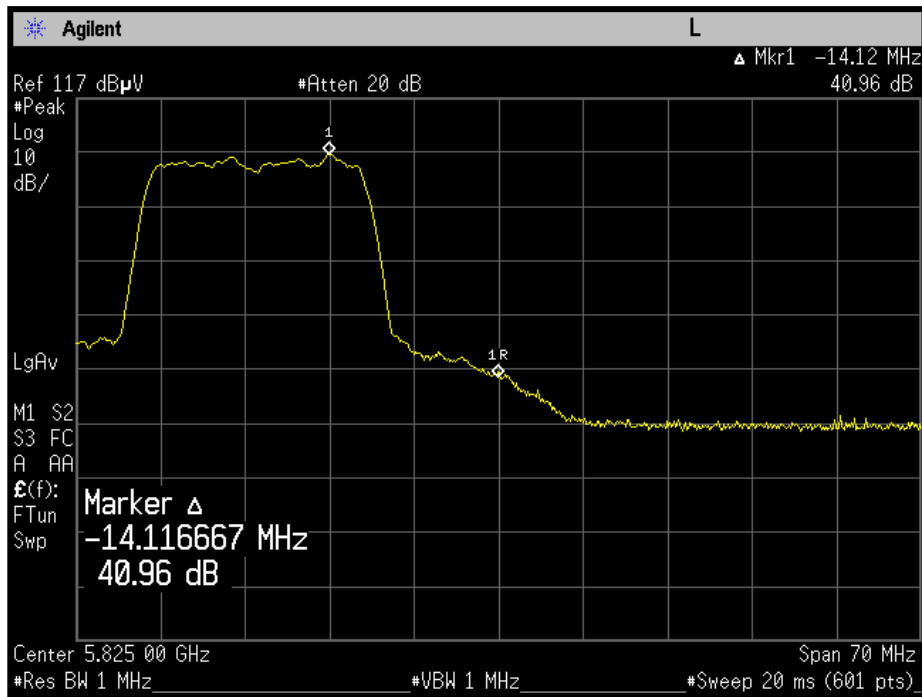
### High Channel Horizontal Peak



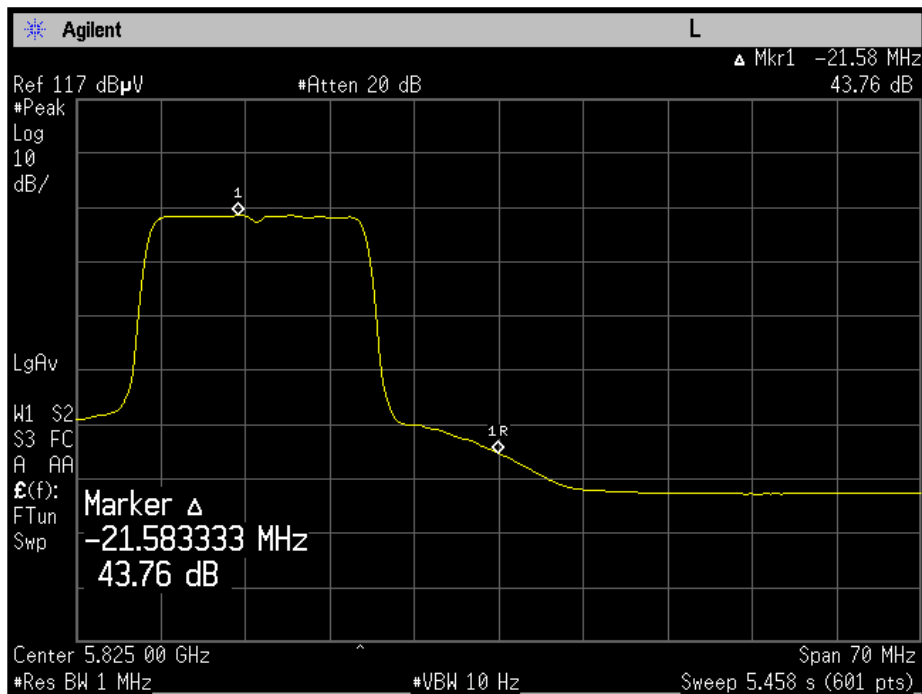
### High Channel Horizontal Average



### High Channel Vertical Peak



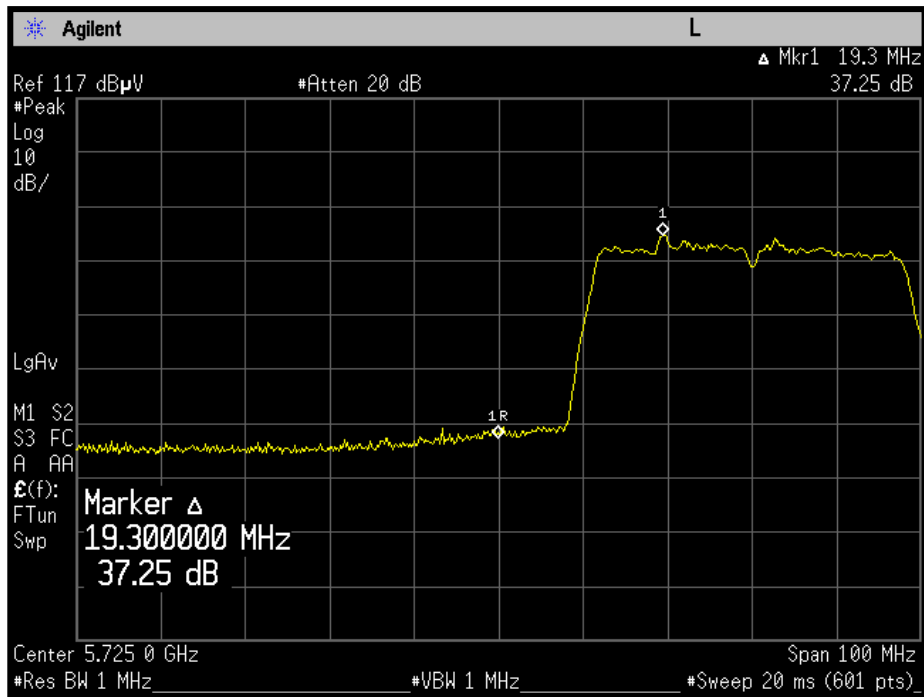
### High Channel Vertical Average



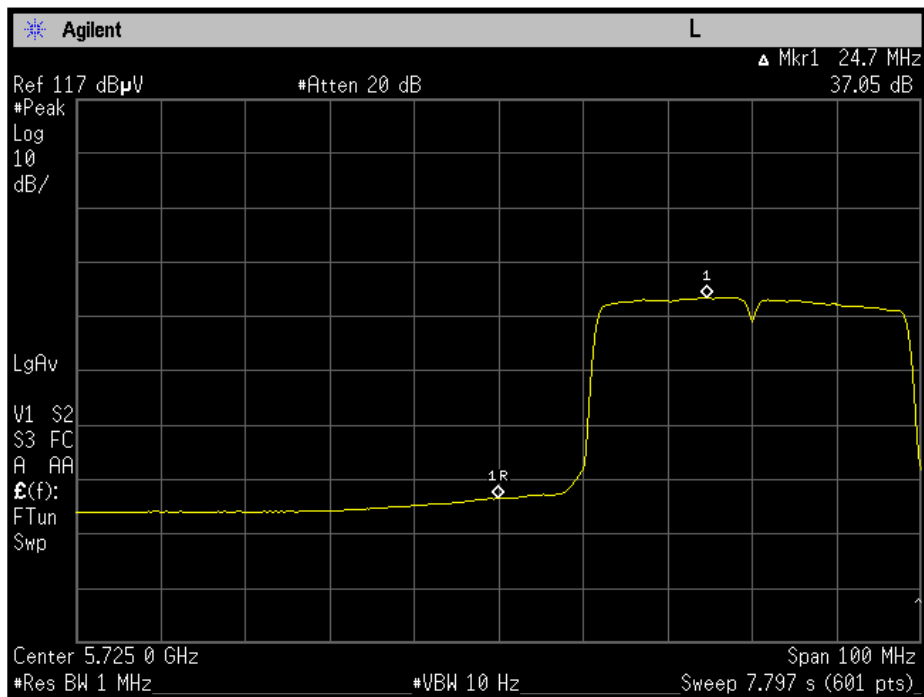


802.11n : 40MHz rate

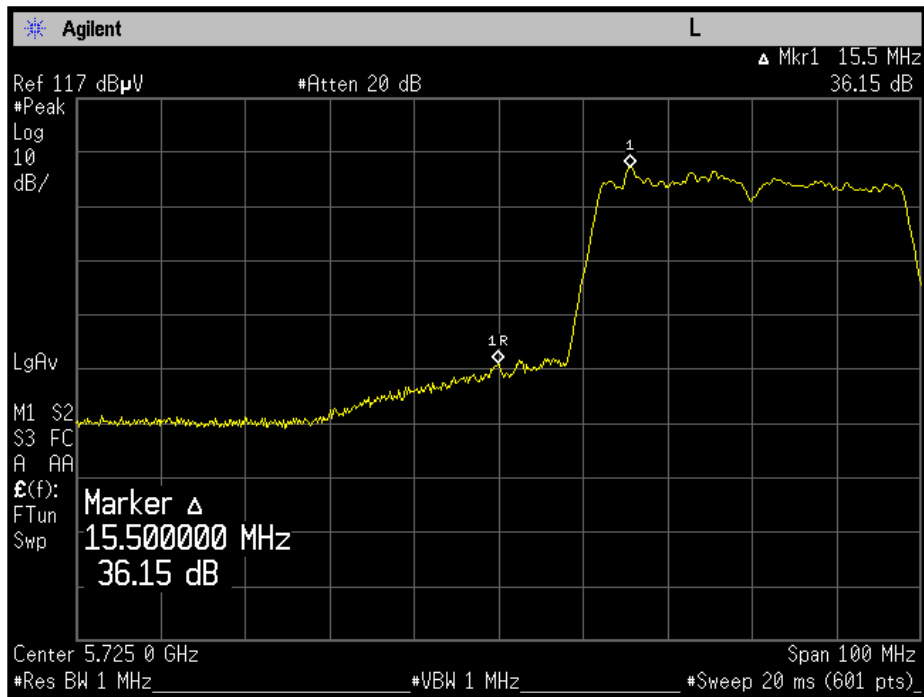
Low Channel Horizontal Peak



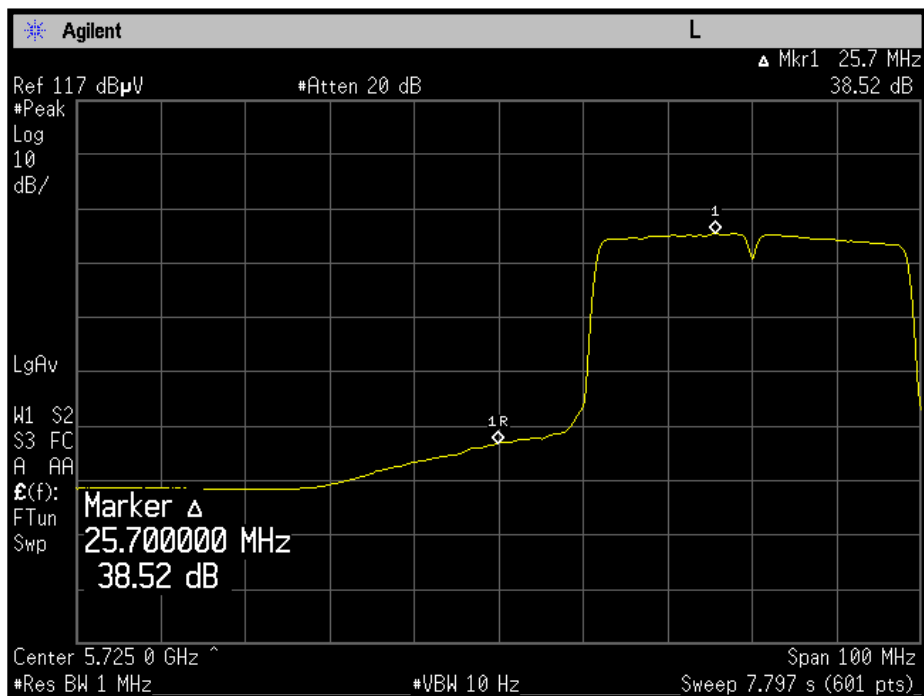
Low Channel Horizontal Average



### Low Channel Vertical Peak

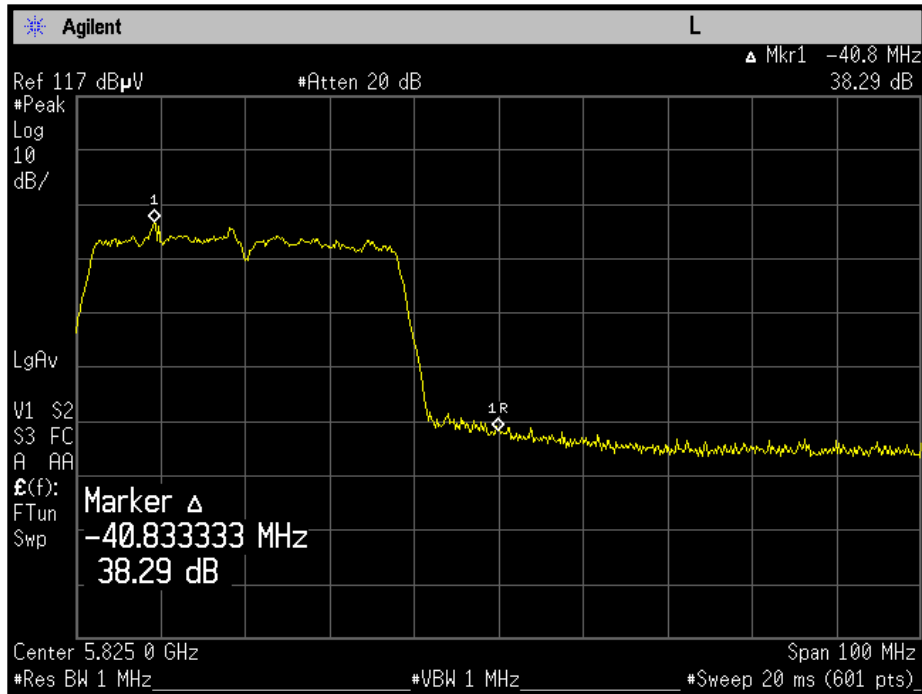


### Low Channel Vertical Average

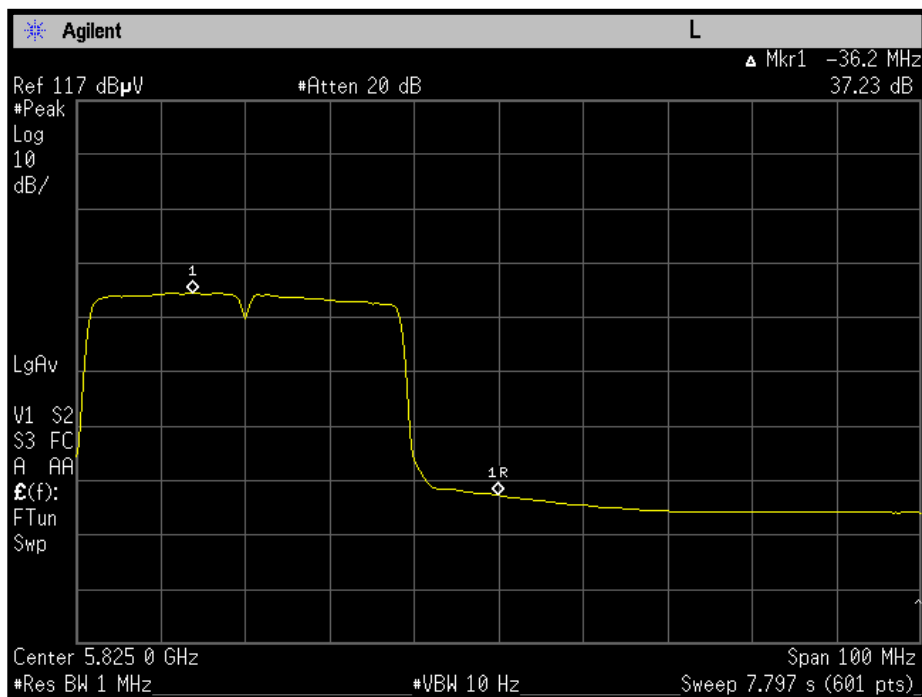


802.11n : 40MHz rate

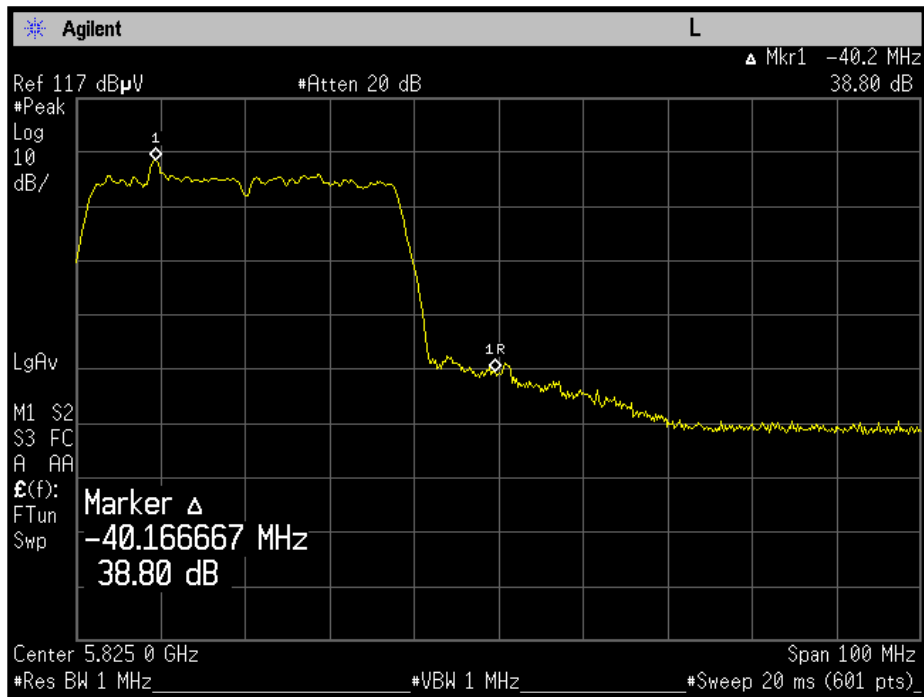
High Channel Horizontal Peak



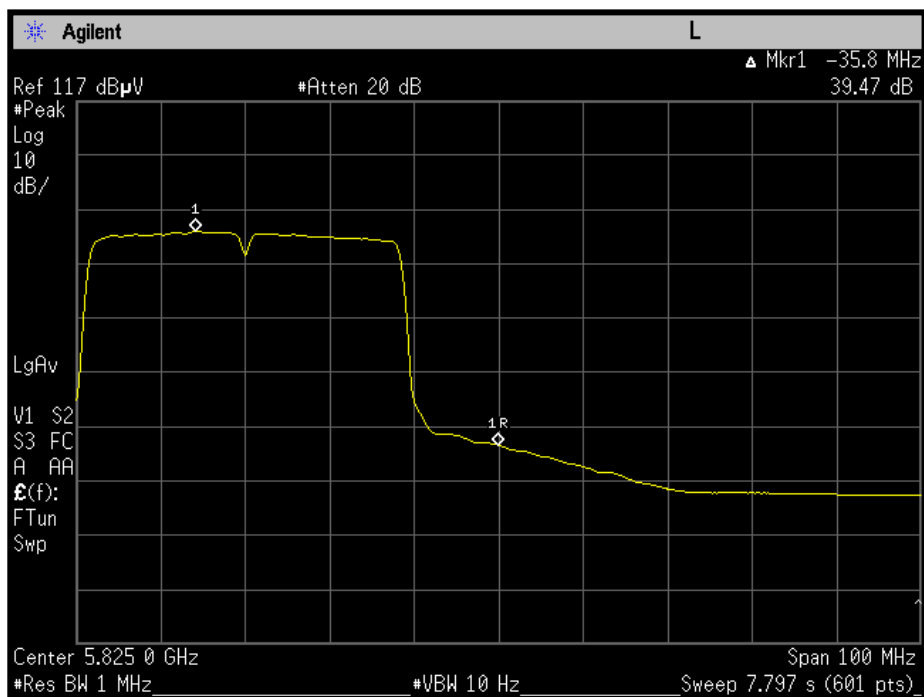
High Channel Horizontal Average



### High Channel Vertical Peak



### High Channel Vertical Average



### 9.8 Radiated Emissions below 1GHz

FCC ID : A3LSWLN01

● 30MHz ~ 1GHz

Frequency (MHz)	Reading (dB $\mu$ V/m)	Pol* (H/V)	AF+CL+Amp (dB)**	Result (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
160.00	49.1	H	-8.2	40.9	43.5	2.6
166.26	45.8	H	-9.6	36.2	43.5	7.3
196.60	43.9	H	-11.2	32.7	43.5	10.8
232.64	43.6	H	-11.5	32.1	46.0	13.9
299.20	46.5	H	-9.4	37.1	46.0	8.9
387.05	40.0	H	-8.2	31.8	46.0	14.2

Notes: The lowest, middle, highest of channel were measured and the worst data was recorded

Table 1. Radiated Measurements at 3meters

### 9.9 Radiated Emissions above 1GHz

5150 MHz ~ 5250 MHz

802.11n : 20MHz rate

#### Low Channel

Frequency (MHz)	Reading (dBuV/m)	Pol* (H/V)	AF+CL+AMP (dB)**	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
1580	33.73	H	-5.25	38.98	74	35.02	Peak
1980	36.53	H	-3.69	40.22	74	33.78	Peak
1993	39.49	V	-3.68	43.17	74	30.83	Peak
3127	42.88	H	0.05	42.83	74	31.17	Peak
10350	74.15	V	14.30	59.85	74	14.15	Peak
10350	63.31	V	14.30	49.01	54	4.99	Average
15360	75.99	H	16.50	59.49	74	14.51	Peak
15360	63.27	H	16.50	46.77	54	7.23	Average

Table 2. Radiated Measurements at 3meters

#### Middle Channel

Frequency (MHz)	Reading (dBuV/m)	Pol* (H/V)	AF+CL+AMP (dB)**	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
1013	33.79	H	-6.67	40.46	74	33.54	Peak
1380	37.59	V	-5.50	43.09	74	30.91	Peak
1613	33.70	H	-5.19	38.89	74	35.11	Peak
1980	38.11	V	-3.69	41.80	74	32.20	Peak
10440	76.43	V	14.35	62.08	74	11.92	Peak
10440	64.56	V	14.35	50.21	54	3.79	Average
15660	76.07	V	16.86	59.21	74	14.79	Peak
15660	63.86	V	16.86	47.00	54	7.00	Average

Table 3. Radiated Measurements at 3meters

**High Channel**

Frequency (MHz)	Reading (dBuV/m)	Pol* (H/V)	AF+CL+AMP (dB)**	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
1013	32.11	H	-6.67	38.78	74	35.22	Peak
1213	33.39	V	-6.21	39.60	74	34.40	Peak
1620	36.51	V	-5.17	41.68	74	32.32	Peak
2420	41.67	V	-1.46	43.13	74	30.87	Peak
10480	74.83	V	14.50	60.33	74	13.67	Peak
10480	65.14	V	14.50	50.64	54	3.36	Average
15550	76.80	V	17.02	59.78	74	14.22	Peak
15550	63.63	V	17.02	46.61	54	7.39	Average

**Table 4. Radiated Measurements at 3meters**

**5150 MHz ~ 5250 MHz**

**802.11n : 40MHz rate**

**Low Channel**

Frequency (MHz)	Reading (dBuV/m)	Pol* (H/V)	AF+CL+AMP (dB)**	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
1200	32.64	V	-6.27	38.91	74	35.09	Peak
1460	37.23	V	-5.36	42.59	74	31.41	Peak
1613	36.45	V	-5.19	41.64	74	32.36	Peak
2420	41.45	V	-1.46	42.91	74	31.09	Peak
10370	73.13	V	14.26	58.87	74	15.13	Peak
10370	61.97	V	14.26	47.71	54	6.29	Average
15610	75.83	V	17.22	58.61	74	15.39	Peak
15610	64.10	V	17.22	46.88	54	7.12	Average

**Table 5. Radiated Measurements at 3meters**

**High Channel**

Frequency (MHz)	Reading (dBuV/m)	Pol* (H/V)	AF+CL+AMP (dB)**	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
1113	34.33	V	-6.46	40.79	74	33.21	Peak
1400	37.17	V	-5.41	42.58	74	31.42	Peak
1607	37.55	V	-5.21	42.76	74	31.24	Peak
2427	42.20	V	-1.46	43.66	74	30.34	Peak
10460	77.11	V	14.43	62.68	74	11.32	Peak
10460	64.40	V	14.43	49.97	54	4.03	Average
15650	76.00	V	16.93	59.07	74	14.93	Peak
15650	63.71	V	16.93	46.78	54	7.22	Average

**Table 6. Radiated Measurements at 3meters**

**NOTES:**

1. \*Pol. H=Horizontal V=Vertical
2. \*\*AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.
3. Measurements using CISPR quasi-peak mode. Above 1GHz, peak detector function mode is used using a resolution bandwidth of 1MHz and a video bandwidth of 1MHz. Peak mode is used with linearly polarized horn antenna and low-loss microwave cable..



**5725 MHz ~ 5825 MHz Band**
**802.11n : 20MHz rate**
**Low Channel**

Frequency (MHz)	Reading (dBuV/m)	Pol* (H/V)	AF+CL+AMP (dB)**	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
1009	32.72	H	-6.68	39.40	74	34.6	Peak
1403	36.43	V	-5.41	41.84	74	32.16	Peak
2427	41.78	V	-1.46	43.24	74	30.76	Peak
4593	51.59	V	3.66	47.93	74	26.07	Peak
11490	76.86	V	15.87	60.99	74	13.01	Peak
11490	66.33	V	15.87	50.46	54	3.54	Average
17000	82.07	H	20.58	61.49	74	12.51	Peak
17000	70.02	H	20.58	49.44	54	4.56	Average

**Table 7. Radiated Measurements at 3meters**
**Middle Channel**

Frequency (MHz)	Reading (dBuV/m)	Pol* (H/V)	AF+CL+AMP (dB)**	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
1007	33.49	H	-6.68	40.17	74	33.83	Peak
1623	36.41	V	-5.16	41.57	74	32.43	Peak
2427	42.56	V	-1.46	44.02	74	29.98	Peak
4613	51.52	V	3.69	47.83	74	26.17	Peak
11530	77.76	V	15.85	61.91	74	12.09	Peak
11530	64.97	V	15.85	49.12	54	4.88	Average
17120	82.48	V	20.45	62.03	74	11.97	Peak
17120	70.25	V	20.45	49.80	54	4.20	Average

**Table 8. Radiated Measurements at 3meters**

**High Channel**

Frequency (MHz)	Reading (dBuV/m)	Pol* (H/V)	AF+CL+AMP (dB)**	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
1007	33.13	H	-6.68	39.81	74	34.19	Peak
1393	34.57	H	-5.44	40.01	74	33.99	Peak
1607	36.08	V	-5.21	41.29	74	32.71	Peak
4647	51.94	V	3.74	48.20	74	25.80	Peak
11610	77.53	V	15.80	61.73	74	12.27	Peak
11610	66.70	V	15.80	50.90	54	3.10	Average
17420	85.34	V	21.95	63.39	74	10.61	Peak
17420	72.37	V	21.95	50.42	54	3.58	Average

**Table 9. Radiated Measurements at 3meters**

**5725 MHz ~ 5825 MHz Band**

**802.11n : 40MHz rate**

**Low Channel**

Frequency (MHz)	Reading (dBuV/m)	Pol* (H/V)	AF+CL+AMP (dB)**	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
1393	38.07	V	-5.44	43.51	74	30.49	Peak
1420	34.62	H	-5.39	40.01	74	33.99	Peak
2407	41.45	V	-1.38	42.83	74	31.17	Peak
4607	52.59	V	3.68	48.91	74	25.09	Peak
11510	75.19	V	15.86	59.33	74	14.67	Peak
11510	64.24	V	15.86	48.38	54	5.62	Average
17370	83.95	V	21.64	62.31	74	11.69	Peak
17370	71.04	V	21.64	49.40	54	4.60	Average

**Table 10. Radiated Measurements at 3meters**

**High Channel**

Frequency (MHz)	Reading (dBuV/m)	Pol* (H/V)	AF+CL+AMP (dB)**	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comments
1007	31.69	H	-6.68	38.37	74	35.63	Peak
1207	33.54	H	-6.24	39.78	74	34.22	Peak
2407	42.34	V	-1.38	43.72	74	30.28	Peak
4633	51.49	V	3.72	47.77	74	26.23	Peak
13750	87.74	V	20.12	67.62	74	6.38	Peak
13750	68.81	V	20.12	48.69	54	5.31	Average
17490	84.71	V	22.23	62.48	74	11.52	Peak
17490	72.51	V	22.23	50.28	54	3.72	Average

**Table11. Radiated Measurements at 3meters**

**NOTES:**

1. \*Pol. H =Horizontal V=Vertical
2. \*\*AF+CL+Amp. = Antenna Factor + Cable Loss + Amplifier.
3. Measurements using CISPR quasi-peak mode. Above 1GHz, peak detector function mode is used using a resolution bandwidth of 1MHz and a video bandwidth of 1MHz. Peak mode is used with linearly polarized horn antenna and low-loss microwave cable..

**9.10 Conducted Emissions****FCC ID : A3LSWLN01**

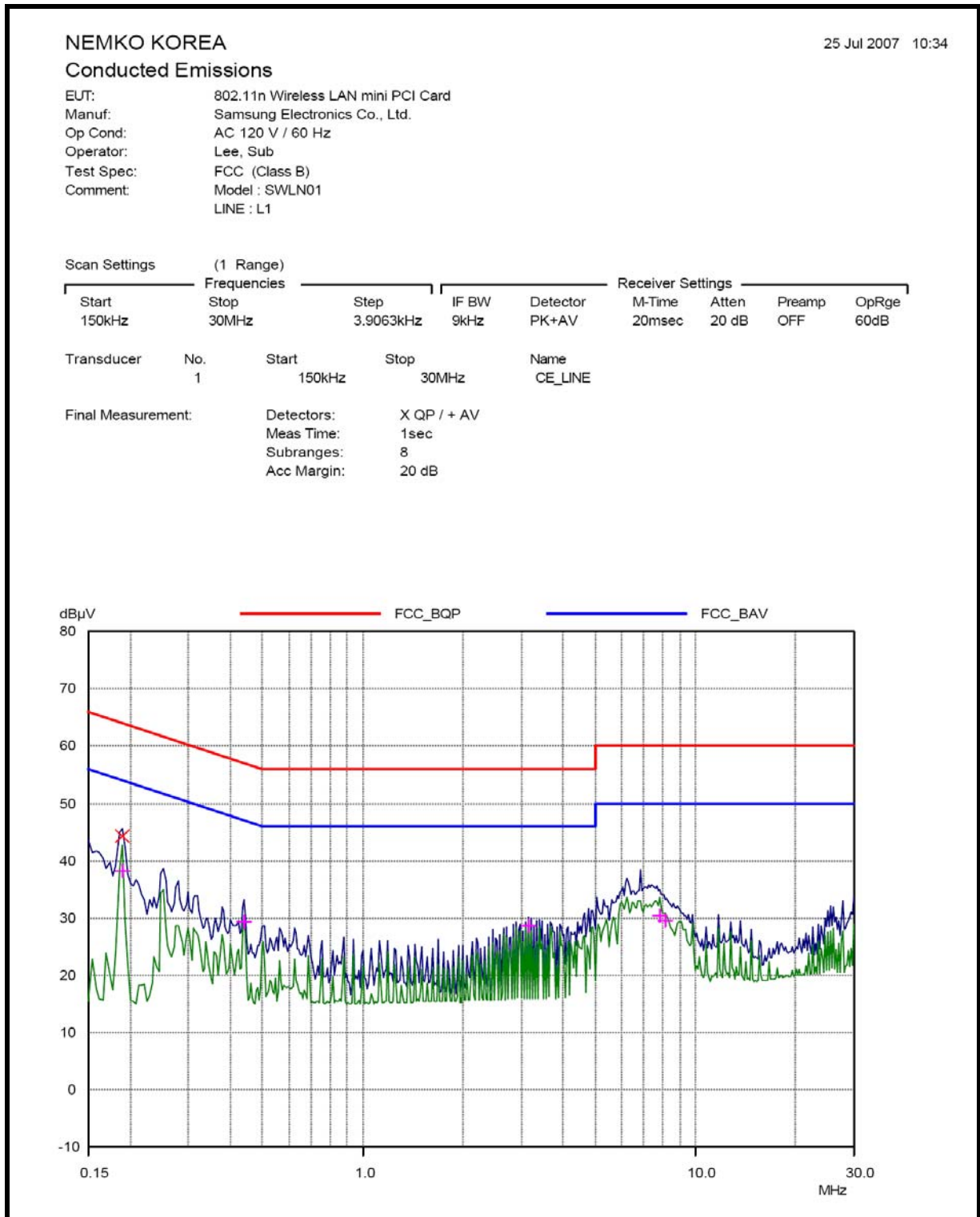
Frequency (MHz)	Level(dB $\mu$ V)		Line	Limit(dB $\mu$ V)		Margin(dB)	
	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.18	45.6	40.0	N	64.5	54.5	18.9	14.5
0.25	36.5	32.7	L	61.8	51.8	25.3	19.1
0.31	33.3	31.3	N	60.0	50.0	26.7	18.7
0.37	34.6	31.5	N	58.5	48.5	23.9	17.0
7.01	32.5	30.6	L	60.0	50.0	27.5	19.4
29.73	29.4	27.4	L	60.0	50.0	30.6	22.6

**Table 12. Line Conducted Emissions Tabulated Data****NOTES:**

1. **Measurements using CISPR quasi-peak mode & average mode.**
2. **All modes of operation were investigated and the worst -case emission are reported. See attached Plots.**
3. **The limit for Class B device is on the FCC Part section 15.107(a).**
4. **Line L = Line**                      **Line N = Neutral**

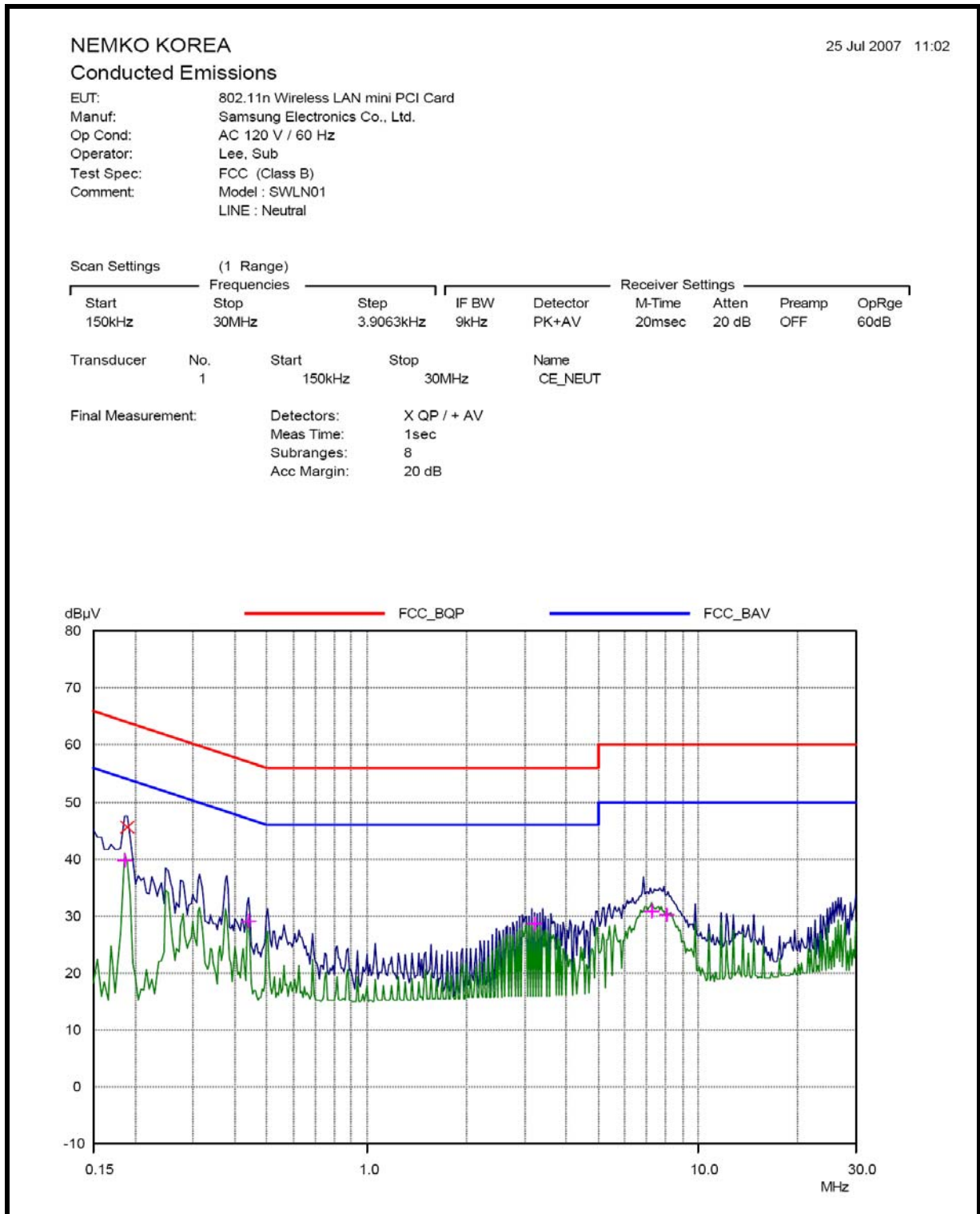
# Plot of Test Data

- Conducted Emission at the Mains port (Line)



# Plot of Test Data

- Conducted Emission at the Mains port (Neutral)



### 9.11 Maximum Permissible Exposure

#### RF Exposure Limit

According to FCC 1.1310: The criteria listed in the following table shall be used to evaluate the environmental of human exposure to radio frequency (RF) radiation as specified in 1.1307(b)

Limits for Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm <sup>2</sup> )	Average Time (Minutes)
<b>(A) Limits for Occupational / Control Exposure</b>				
30 - 300	6.14	0.163	1.0	6
300 - 1500	...	...	F/300	6
1500 - 100000	...	...	5	6
<b>(B) Limits for General Population / Uncontrolled Exposure</b>				
30 - 300	27.5	0.073	0.2	30
300 - 1500	...	...	F/1500	30
1500 - 100000	...	...	1	30

F = Frequency (MHz)

#### Fries Formula

Fries transmission formula :  $Pd = (Pout * G) / (4 * \pi * r^2)$

$$r = \sqrt{((Pout * G) / 4 * \pi * Pd)}$$

Where

Pd = Power density in mW/cm<sup>2</sup>

Pout = Output power to antenna in mW

G = Gain of antenna in linear scale

$\pi = 3.1416$

r = Distance between observation point center of the radiator in cm

Pd is the limit of MPE, 1 mW/cm<sup>2</sup>. If we know the Maximum Gain of the antenna and the total power input to the antenna, through the calculation, we will know the distance r where the MPE limit is reached.

The maximum antenna gain is 3.26dBi or 2.118(Numeric)

Output power into antenna and RF Exposure Distance

Frequency (MHz)	Output power to Antenna (mW)	Antenna Gain (Numeric)	RF Exposure Distance (cm)
5765	37.67	2.118	2.52

**MPE Safe Distance = 2.52cm**



## 10. Accuracy of Measurement

The Measurement Uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 with the confidence level of 95%

### 1. Radiation Uncertainty Calculation

<i>Contribution</i>	<i>Probability Distribution</i>	<i>Uncertainty(+/-dB)</i>
Antenna Factor	Normal (k=2)	± 0.5
Cable Loss	Normal (k=2)	± 0.04
Receiver Specification	Rectangular	± 2.0
Antenna directivity	Rectangular	± 1.0
Antenna Factor variation with Height		
Antenna Phase Center Variation		
Antenna Factor Frequency Interpolation		
Measurement Distance Variation		
Site Imperfections	Rectangular	± 2.0
Mismatch:Receiver VRC $r_i=0.3$ Antenna VRC $r_R=0.1(B_i)0.4(L_p)$ Uncertainty Limits $20\text{Log}(1+/-r_i r_R)$	U-Shaped	+ 0.25 / - 0.26
System Repeatability	Std.deviation	± 0.05
Repeatability of EUT	-	-
Combined Standard Uncertainty	Normal	± 1.77
Expanded Uncertainty U	Normal (k=2)	± 3.5

### 2. Conducted Uncertainty Calculation

<i>Contribution</i>	<i>Probability Distribution</i>	<i>Uncertainty(+/-dB)</i>
Receiver Specification	Normal (k=2)	± 2.0
LISN coupling spec.	Normal (k=2)	± 0.4
Cable and input attenuator cal.	Rectangular	± 0.4
Mismatch:Receiver VRC $r_i=0.3$ LISN vrc $r_g=0.1$ Uncertainty Limits $20\text{Log}(1+/-r_i r_R)$	U-Shaped	± 0.26
System Repeatability	Std.deviation	± 0.68
Repeatability of EUT	-	-
Combined Standard Uncertainty	Normal	± 1.18
Expanded Uncertainty U	Normal (k=2)	± 2.4

## 11. Test Equipment

No.	Instrument	Manufacturer	Model	Serial No.	Calibration Date	Calibration Interval
1	Test Receiver	R & S	ESCS 30	833364/020	Apr. 02 2007	1year
2	*Test Receiver	R & S	ESCS 30	100302	Dec. 04 2006	1year
3	Amplifier	Agilent	8447F	3113A04549	Aug. 17 2006	1year
4	Amplifier	HP	8447F	2805A03427	Aug. 07 2006	1year
5	*Amplifier	HP	8447F	2805A03351	Oct. 25 2006	1year
6	*Amplifier	HP	8449B	3008A00107	Mar. 06 2007	1year
7	*Spectrum Analyzer	HP	8566B	267A03469	Mar.06 2007	1year
8	*Spectrum Analyzer	Agilent	E4440A	MY44303257	Nov.29 2006	1year
9	*Biconical Log-Perio. Antenna	ARA	LBP-2520/A	1180	Feb. 28 2007	1year
10	* Horn Antenna	Schwarzbeck	BBHA 9170	9170223	May. 03 2006	2year
11	Biconical Log Antenna	ARA	LPB-2520/A	1209	Dec. 14 2006	1year
12	Signal Generater	R & S	SMP02	833286/003	Aug. 07 2006	1year
13	*LISN	R & S	ESH3-Z5	833874/006	Nov. 02 2006	1year
14	*Position Controller	DAEIL EMC	N/A	N/A	N/A	N/A
15	*Turn Table	DAEIL EMC	N/A	N/A	N/A	N/A
16	*Antenna Mast	DAEIL EMC	N/A	N/A	N/A	N/A
17	*Anechoic Chamber	EM Eng.	N/A	N/A	N/A	N/A
18	*Shielded Room	EM Eng.	N/A	N/A	N/A	N/A
19	*Position Controller	Inn-co	CO2000	N/A	N/A	N/A
20	*Turn Table	Inn-co	DS1200S	N/A	N/A	N/A
21	*Antenna Mast	Inn-co	AS2000P	N/A	N/A	N/A
22	*Anechoic Chamber	Seo-Young EMC	N/A	N/A	N/A	N/A
23	*Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120 D	9120D-508	Oct. 30 2006	1year
24	*Spectrum Analyzer	Anritsu	MS2668C	6200072510	Dec. 16 2006	1year
25	*Spectrum Analyzer	Agilent	E4440A	MY44022567	Dec.05 2006	1year
26	*Signal Generator	Anritsu	68245B	983206	Dec.06 2006	1year

\* ) Test equipment used during the test