

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART E REQUIREMENT OF

Product Name: WLAN 11ac USB Adapter,1T1R

Brand Name: CC&C

Marketing Name: WLAN 11ac USB Adapter,1T1R

Model No.: WL-8211-V1

Model Difference: N/A

FCC ID: PANWL8211

Report No.: ER/2013/80084

Issue Date: Oct. 07, 2013

FCC Rule Part: §15.407

CC&C Technologies, Inc.

Prepared for: 8F, No. 150, Jian Yi Road, Chung Ho City,
Taipei County, Taiwan 235, R. O. C

SGS Taiwan Ltd.

Electronics & Communication Laboratory

Prepared by: No.134, Wu Kung Road, New Taipei Industrial
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VERIFICATION OF COMPLIANCE

Applicant: CC&C Technologies, Inc.
8F, No. 150, Jian Yi Road, Chung Ho City, Taipei County, Taiwan 235, R. O. C

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Brand Name: CC&C

Marketing Name: WLAN 11ac USB Adapter,1T1R

Model No.: WL-8211-V1

Model Difference: N/A

FCC ID: PANWL8211

File Number: ER/2013/80084

Date of test: Aug. 29, 2013 ~ Oct. 01, 2013

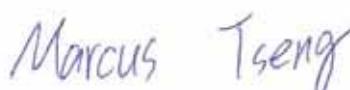
Date of EUT Received: Aug. 29, 2013

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4:2009 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.407.

The test results of this report relate only to the tested sample identified in this report.

Test By:

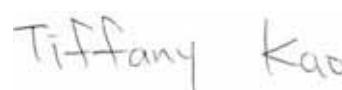


Date:

Oct. 07, 2013

Marcus Tseng / Engineer

Prepared By:

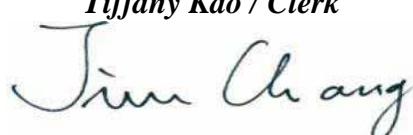


Date:

Oct. 07, 2013

Tiffany Kao / Clerk

Approved By:



Date:

Oct. 07, 2013

Jim Chang / Supervisor

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Version

Version No.	Date	Description
00	Oct. 07, 2013	Initial creation of document

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1. GENERAL INFORMATION

1.1. Product Description

General:

Product Name:	WLAN 11ac USB Adapter,1T1R
Brand Name:	CC&C
Marketing Name:	WLAN 11ac USB Adapter,1T1R
Model No.:	WL-8211-V1
Model Difference:	N/A
Hardware Version:	289G133000-B0
Software Version:	00-033000-01[F/W, WL-8211-V1]
Power Supply:	5Vdc from USB Port

WLAN 5GHz:

Wi-Fi	Frequency Range	Channels	Rated Power (Avg.)	Modulation Technology
11a	5150~5250	4	7.94dBm (Avg.)	OFDM
11n / ac	HT20 / VHT20 5150~5250	4	HT20: 7.86dBm (Avg.) VHT20:7.81dBm (Avg.)	OFDM
11n / ac	HT40 / VHT40 5150-5250	2	HT20: 7.82dBm (Avg.) VHT20: 7.77dBm (Avg.)	OFDM
11ac	VHT80: 5210	1	VHT80:7.83dBm (Avg.)	OFDM
Antenna Designation		PIFA Antenna, 5GHz Gain: 4.7dBi (5150MHz-5250MHz)		
Modulation type		64QAM, 16QAM, 256QAM QPSK, BPSK for OFDM		
Transition Rate:		802.11 a: 6/9/12/18/24/36/48/54 Mbps 802.11 n_20MHz: 6.5 – 72.2Mbps 802.11 n_40MHz: 13.5 – 150Mbps 802.11ac_80MHz:6.5-86.7 Mbps 802.11ac_80MHz:13.5-200 Mbps 802.11ac_80MHz:29.3-433.3 Mbps		

This report applies for frequency bands 5150MHz-5250MHz.

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IEEE 802.11 a/n Spec:

MCS Index	Nss	Modulation	R	NBPSC	NCBPS		NDBPS		Datarate(Mbps)			
					20MHz		40MHz		20MHz		40MHz	
					20MHz	40MHz	20MHz	40MHz	20MHz	40MHz	20MHz	40MHz
0	1	BPSK	1/2	1	52	108	26	54	6.5	13.5	7.200	15
1	1	QPSK	1/2	2	104	216	52	108	13.0	27.0	14.400	30
2	1	QPSK	3/4	2	104	216	78	162	19.5	40.5	21.700	45
3	1	16-QAM	1/2	4	208	432	104	216	26.0	54.0	28.900	60
4	1	16-QAM	3/4	4	208	432	156	324	39.0	81.0	43.300	90
5	1	64-QAM	2/3	6	312	648	208	432	52.0	108.0	57.800	120
6	1	64-QAM	3/4	6	312	648	234	486	58.5	121.5	65.000	135
7	1	64-QAM	5/6	6	312	648	260	540	65.0	135.0	72.200	150

Symbol	Explanation
NSS	Number of spatial streams
R	Code rate
NBPSC	Number of coded bite per single carrier
NCBPS	Number of coded bite per symbol
NDBPS	Number of data bite per symbol
GI	Guard interval

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802.11ac VHT Spec

Bandwidth = 20MHz, NSS = 1, where NSS denotes spatial stream

MCS Index	Modulation	R	N _{BPSCS}	N _{SD}	N _{SP}	N _{CBPS}	N _{DBPS}	N _{ES}	Data rate (Mb/s)	
									800 ns GI	400 ns GI
0	BPSK	1/2	1	52	4	52	26	1	6.5	7.2
1	QPSK	1/2	2	52	4	104	52	1	13.0	14.4
2	QPSK	3/4	2	52	4	104	78	1	19.5	21.7
3	16-QAM	1/2	4	52	4	208	104	1	26.0	28.9
4	16-QAM	3/4	4	52	4	208	156	1	39.0	43.3
5	64-QAM	2/3	6	52	4	312	208	1	52.0	57.8
6	64-QAM	3/4	6	52	4	312	234	1	58.5	65.0
7	64-QAM	5/6	6	52	4	312	260	1	65.0	72.2
8	256-QAM	3/4	8	52	4	416	312	1	78.0	86.7
9									Not valid	

Bandwidth = 40MHz, NSS = 1, where NSS denotes spatial stream

MCS Index	Modulation	R	N _{BPSCS}	N _{SD}	N _{SP}	N _{CBPS}	N _{DBPS}	N _{ES}	Data rate (Mb/s)	
									800 ns GI	400 ns GI
0	BPSK	1/2	1	108	6	108	54	1	13.5	15.0
1	QPSK	1/2	2	108	6	216	108	1	27.0	30.0
2	QPSK	3/4	2	108	6	216	162	1	40.5	45.0
3	16-QAM	1/2	4	108	6	432	216	1	54.0	60.0
4	16-QAM	3/4	4	108	6	432	324	1	81.0	90.0
5	64-QAM	2/3	6	108	6	648	432	1	108.0	120.0
6	64-QAM	3/4	6	108	6	648	486	1	121.5	135.0
7	64-QAM	5/6	6	108	6	648	540	1	135.0	150.0
8	256-QAM	3/4	8	108	6	864	648	1	162.0	180.0
9	256-QAM	5/6	8	108	6	864	720	1	180.0	200.0

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Bandwidth = 80MHz, NSS = 1, where NSS denotes spatial stream

MCS Index	Modulation	R	N _{BPSCS}	N _{SD}	N _{SP}	N _{CBPS}	N _{DBPS}	N _{ES}	Data rate (Mb/s)	
									800 ns GI	400 ns GI
0	BPSK	1/2	1	234	8	234	117	1	29.3	32.5
1	QPSK	1/2	2	234	8	468	234	1	58.5	65.0
2	QPSK	3/4	2	234	8	468	351	1	87.8	97.5
3	16-QAM	1/2	4	234	8	936	468	1	117.0	130.0
4	16-QAM	3/4	4	234	8	936	702	1	175.5	195.0
5	64-QAM	2/3	6	234	8	1404	936	1	234.0	260.0
6	64-QAM	3/4	6	234	8	1404	1053	1	263.3	292.5
7	64-QAM	5/6	6	234	8	1404	1170	1	292.5	325.0
8	256-QAM	3/4	8	234	8	1872	1404	1	351.0	390.0
9	256-QAM	5/6	8	234	8	1872	1560	1	390.0	433.3

Where NBPSCS = Number of coded bits per subcarrier per spatial stream

NSD = Number of complex data numbers per frequency segment

NSP = Number of pilot values per frequency segments

NCBPS = Number of coded bits per symbol

NDBPS = Number of data bits per symbol for user

NES = Number of BCC encoders for the Data field for user

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1.2. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: PANWL8211** filing to comply with Section 15.407 of the FCC Part 15, Subpart C Rules. The composite system (digital device) is compliance with Subpart B is authorized under a DoC procedure.

1.3. Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4:2009 & KDB 789033 D01 published on 04, 08, 2013. Radiated testing was performed at an antenna to EUT distance 3 meters.

Tested in accordance with FCC KDB789033 D01 for compliance to FCC 47CFR 15.407 requirements.

1.4. Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No.134, Wu Kung Road, Wuku Industrial Zone, Taipei County, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4:2009. FCC Registration Number is: 990257.

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No. 29, Pau-Tou-Tsuo Valley Chia-Pau Tsuen, Linkou Hsiang, Taipei county, which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. SGS Site No. 1(3 &10 meters) and FCC Registration Number: 94644.

1.5. Special Accessories

There are no special accessories used while test was conducted.

1.6. Equipment Modifications

There was no modification incorporated into the EUT.

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2. SYSTEM TEST CONFIGURATION

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

2.3. Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. According to the general criterion in Section 7.1 of ANSI C63.4:2009. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz, and the measurement procedure 7.3 in ANSI 63.4:2009 & 6.2.2, is followed to carry out the test. The CISPR Quasi-Peak and Average detector mode is employed according to §15.107

2.3.2 Radiated Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna according to the requirements in Section 8 and 13 and of ANSI C63.4:2009.,

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2.4. Configuration of Tested System

Fig. 2-1 Radiated Emission & Conducted (Antenna Port) Emission Configuration

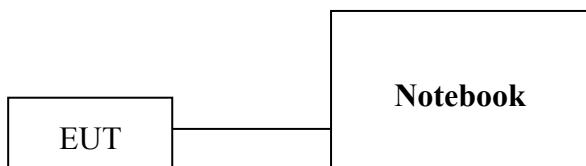


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	Notebook	DELL	E5400	3704625136	Shield	Un-shield

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3. SUMMARY OF TEST RESULT

FCC Rules	Description Of Test	Result
§15.207	AC Power Line Conducted Emission	N/A
§15.407(a) (1) (2)	26 dB and 99% Emission Bandwidth	Compliant
§15.407(a) (1) (2)	The Maximum Output Power Measurement	Compliant
§15.407(a) (5)	Peak Power Spectral Density Measurement	Compliant
15.407(a)(6)	Peak Excursion Measurement	Compliant
§15.407(b) (1) (2) (3)	Undesirable Emission – Conducted Measurement	Compliant
§15.407(b) (1) (2) (3)(6) (7)	Undesirable Emission – Radiated Measurement	Compliant
§15.407(c)	Transmission in case of Absence of Information	Compliant
§15.407(g)	Frequency Stability	Compliant
§15.203	Antenna Requirement	Compliant

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4. DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting mode is programmed.

a mode:

5150MHz-5250MHz: Channel lowest(5180MHz)、Mid(5220MHz) and Highest(5240MHz). and with 6Mbps data rate are chosen for full testing.

n HT 20/ ac VHT20 mode:

5150MHz-5250MHz: Channel lowest(5180MHz)、Mid(5220MHz) and Highest(5240MHz). with 6.5Mbps data rate are chosen for full testing

n HT 40/ ac VHT 40 mode:

5150MHz-5250MHz: Channel lowest (5190MHz) and Highest (5230MHz). with 13.5Mbps data rate are chosen for full testing

ac VHT 80 mode:

Channel (5210MHz) with 29.3Mbps data rate are chosen for full testing

For ac_VHT20, and ac_VHT40, the operation of simultaneous transmission is not supported

The worst case is determined by the output power that generates the highest emission. As examined in the section of output power measurement, the section 7.5, the lowest data rate at a/b/g/n_HT20/n_HT40/ac_VHT20, ac_VHT40, ac_VHT80 resulted the highest level of fundamental emission, and therefore, the lowest data rate is chosen as the worst-case to conduct the mandatory test items relevant to output power. The following test items are reduced with worst-case mode configuration

Peak Power Spectral Density Measurement

Undesirable Emission – Conducted Measurement

Undesirable Emission – Radiated Measurement

Frequency Stability

The Undesirable Emission of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for 802.11a/n WLAN Transmitter for default test channel as describes above, the worst case H position was reported.

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Duty Cycle Analysis:

Pre-analysis Check: While conducting average power measurement, duty cycle of each mode (a/n_ht20/n_ht40) shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle. All duty cycle is pre-scanned, resulted as obtained below, and showed only the most representative ones

Tabular results as indicates below entails the results of duty factor for all supported modes.

Formula:

$$\text{Duty Cycle} = T_{on} / (T_{on} + T_{off})$$

Test Procedure:

Set span = 0, RBW = 8MHz, the largest as possible, VBW = 8MHz, Detector = Peak, and RBW, and VBW = the highest RBW the spectrum is capable of, where zero-span is permissible, that > 50/T, where T is ~ 4.3ms

Duty Cycle:

5150-5725MHz	Duty Cycle	Duty Factor (dBm)
802.11a	100%	0
802.11n_20	100%	0
802.11n_40	100%	0
802.11ac_VHT20	100%	0
802.11ac_VHT20	100%	0
802.11ac_VHT80	100%	0

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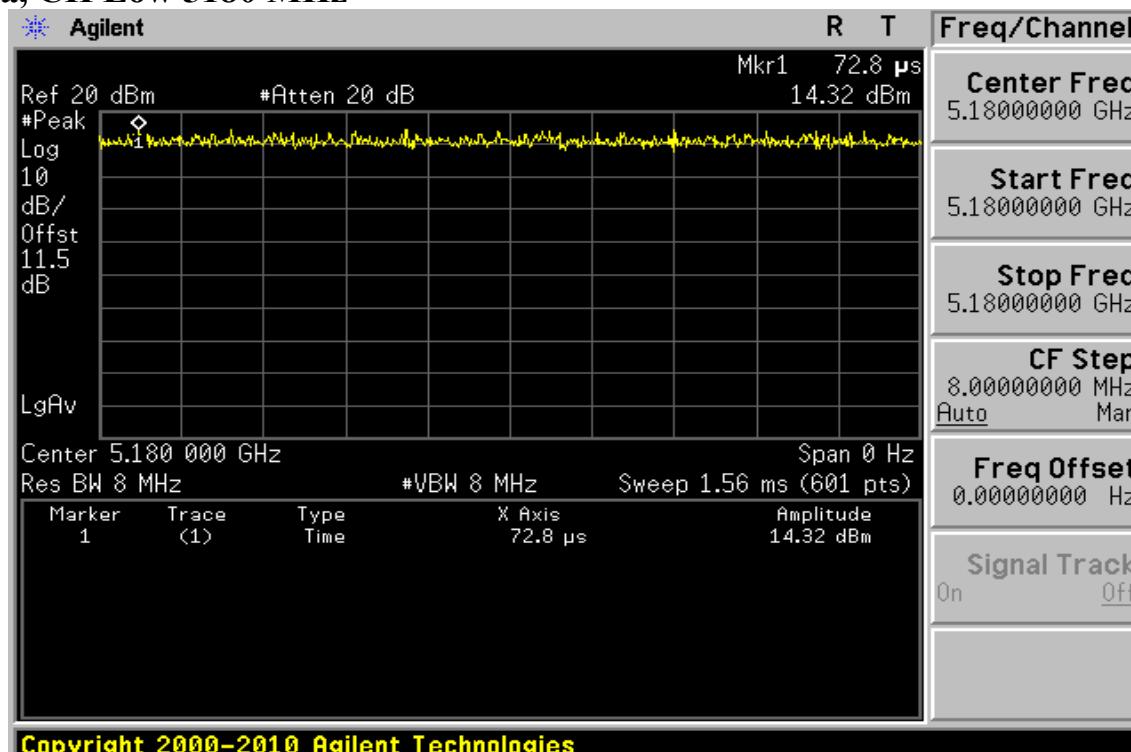
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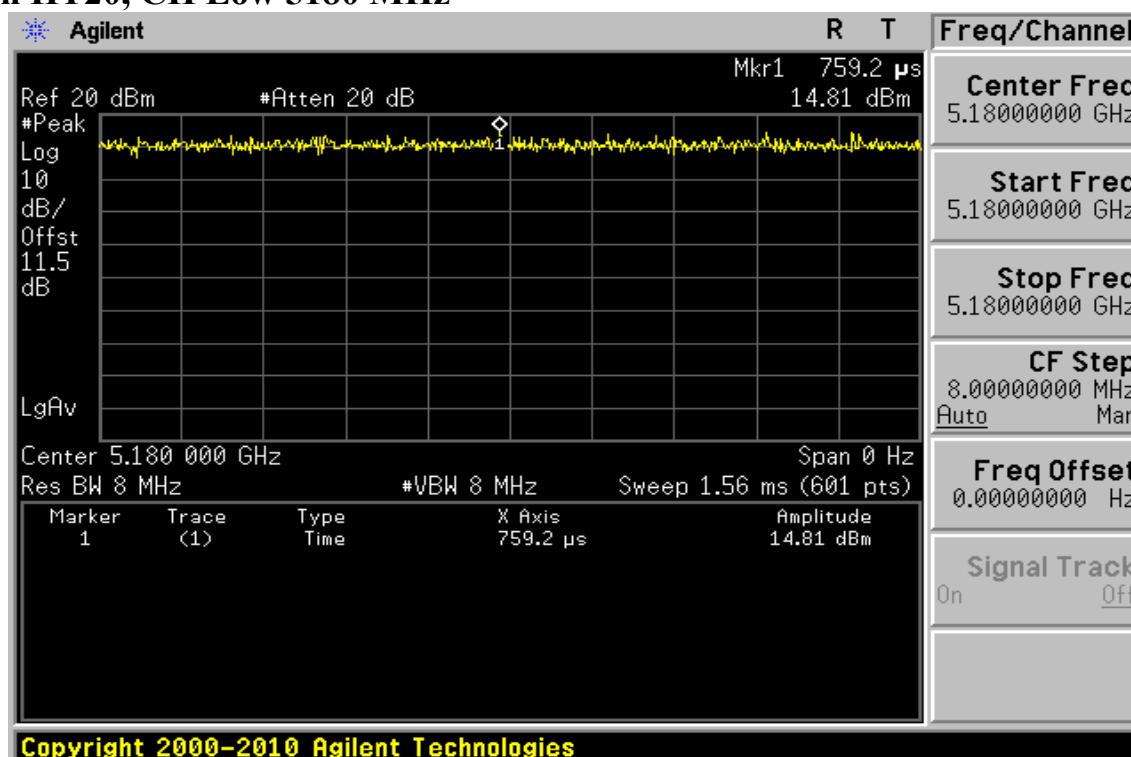
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DUTY CYCLE OF TEST SIGNAL

802.11a, CH Low 5180 MHz



802.11n HT20, CH Low 5180 MHz



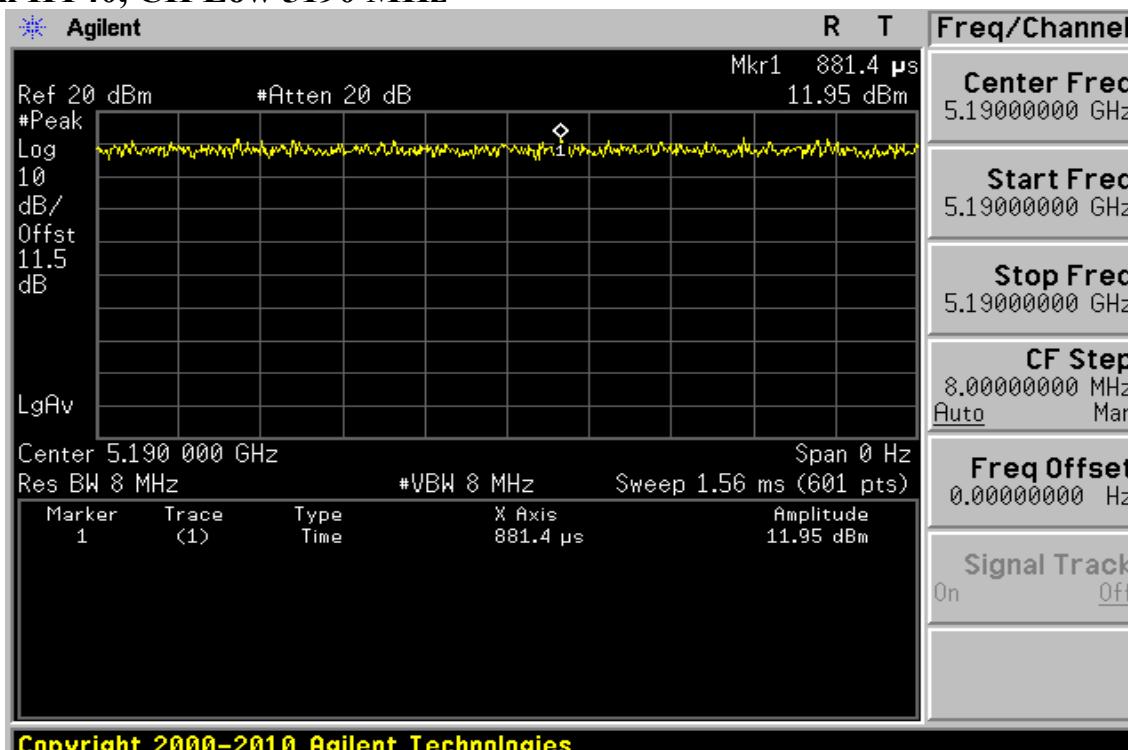
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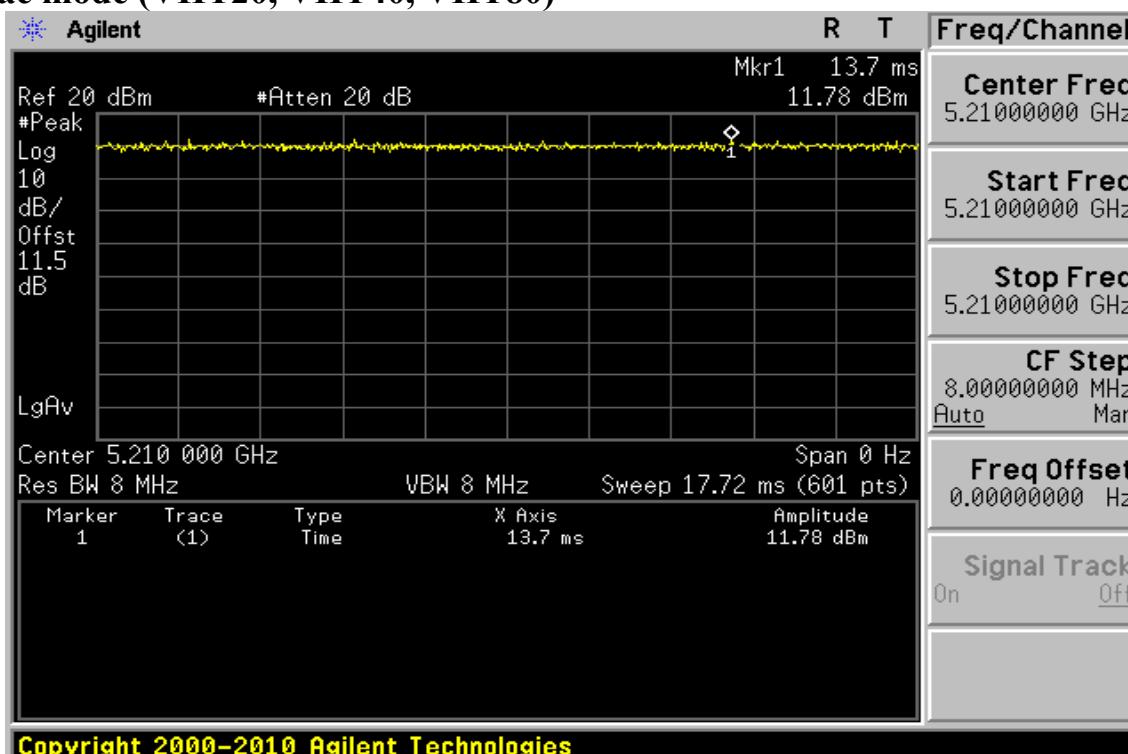
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802.11n HT40, CH Low 5190 MHz



802.11ac mode (VHT20, VHT40, VHT80)



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5. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
26 dB Emission Bandwidth	+/- 123.36 Hz
The Maximum Output Power Measurement	+/- 1.42 dB
Peak Power Spectral Density Measurement	+/- 1.55 dB
Peak Excursion Measurement	+/- 1.55 dB
Undesirable Emission – Conducted Measurement	+/- 1.55 dB
Transmission in case of Absence of Information	+/- 1.55 dB
Frequency Stability	+/- 123.36 Hz
TPC and DFS Measurement	+/- 123.36 Hz
Temperature	+/- 0.8 °C
Humidity	+/- 4.7 %
DC / AC Power Source	DC= +/- 1%, AC=+/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (Polarization : Vertical)	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : Horizontal)	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

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6. CONDUCTED EMISSION TEST

6.1. Standard Applicable

According to §15.207, frequency range within 150 KHz to 30 MHz shall not exceed the Limit table as below.

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note

- 1.The lower limit shall apply at the transition frequencies
- 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

6.2. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100760	05/27/2013	05/26/2014
LISN	Rolf-Heine	NNB-2/16Z	99012	03/23/2013	03/22/2014
LISN	FCC	FCC-LISN-50/250-25-2-01	04034	03/23/2013	03/22/2014
Coaxial Cables	N/A	WK CE Cable	N/A	01/05/2013	01/04/2014

6.3. EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4:2009.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The LISN was connected with 120Vac/60Hz power source.

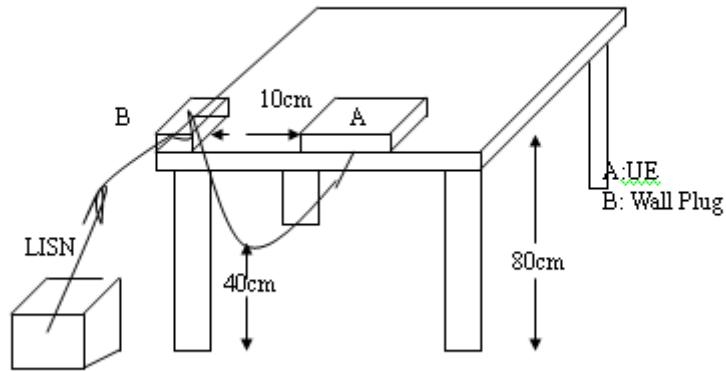
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6.4. Test SET-UP (Block Diagram of Configuration)



6.5. Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all phases of power being supplied by given UE are completed

6.6. Measurement Result

N/A. EUT is powered in DC

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7. 26dB EMISSION BANDWIDTH MEASUREMENT

7.1 Standard Applicable

According to §15.407(a). No Limit required.

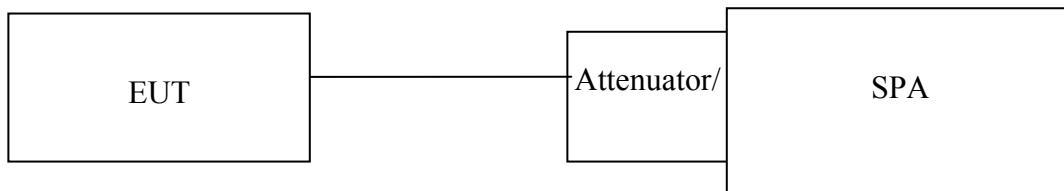
7.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the Antenna port to the spectrum analyzer.
- 3.
- a. 26dB Band width Measurement: Set the spectrum analyzer as 1% of emission BW Sweep=auto, Detector = Peak, Trace Mode = Max Hold, Manually readjust RBW until the RBW/EBW ratio is 1% based on EBW as observed on the result of pre-sequence measurement.
- b. B) Mark the peak frequency and -26dB (upper and lower) frequency.
4. Repeat the procedures as list above until all test default channels are completed.

7.3 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2495A	1005007	02/08/2012	02/07/2014
Power Sensor	Anritsu	MA2411B	917032	02/08/2012	02/07/2014
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/30/2013	05/29/2014
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/15/2013	03/14/2014
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2013	02/27/2014
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2013	01/04/2014
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2013	02/27/2014
Splitter	Agilent	11636B	N/A	02/28/2013	02/27/2014

7.4 Test Set-up:



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7.5 Measurement Result

26dB Bandwidth

802.11a, 5150~5250 MHz

Frequency (MHz)	26dB Bandwidth (B) (MHz)	10 Log (B) (dB)
5180	20.684	13.16
5220	20.590	13.14
5240	20.292	13.07

802.11n HT20, 5150~5250 MHz

Frequency (MHz)	26dB Bandwidth (B) (MHz)	10 Log (B) (dB)
5180	21.255	13.27
5220	21.268	13.28
5240	21.232	13.27

802.11n HT40, 5150~5250 MHz

Frequency (MHz)	26dB Bandwidth (B) (MHz)	10 Log (B) (dB)
5190	43.487	16.38
5230	42.371	16.27

802.11ac VHT80, 5210MHz

Frequency (MHz)	26dB Bandwidth (B) (MHz)	10 Log (B) (dB)
5210	83.984	19.24

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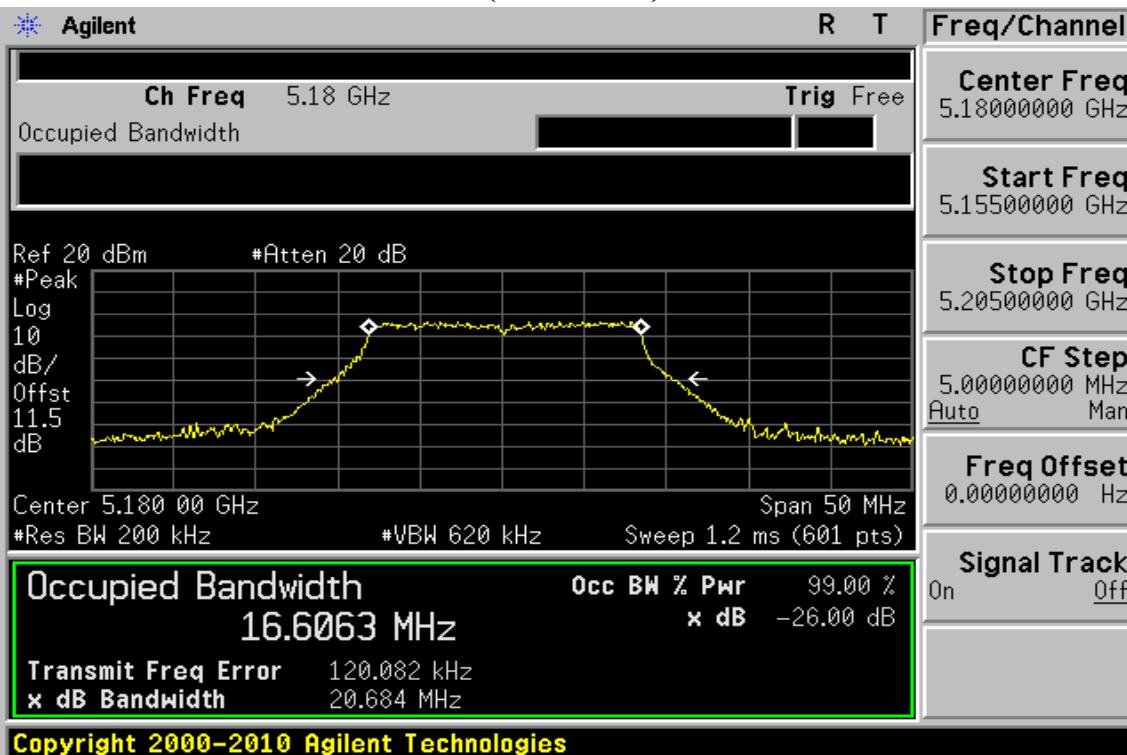
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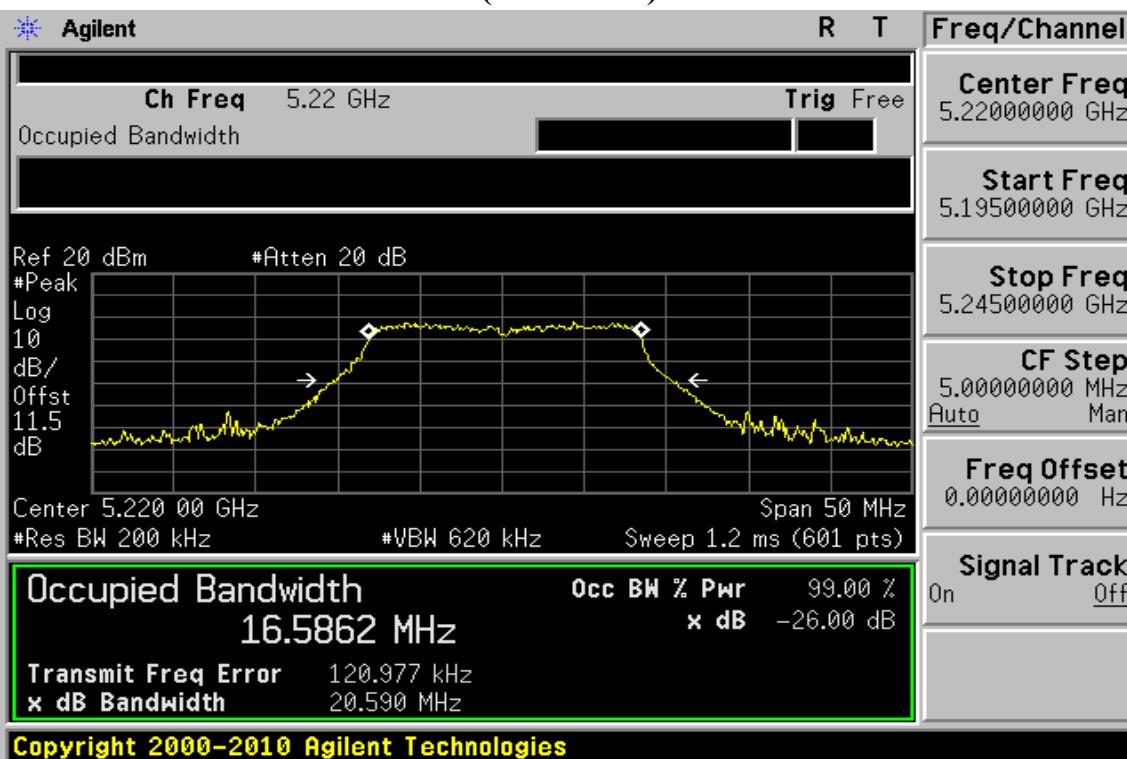
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802.11a, 5150~5250 MHz

26dB Band Width Test Data CH-Low (5180MHz)



26dB Band Width Test Data CH-Mid (5220MHz)



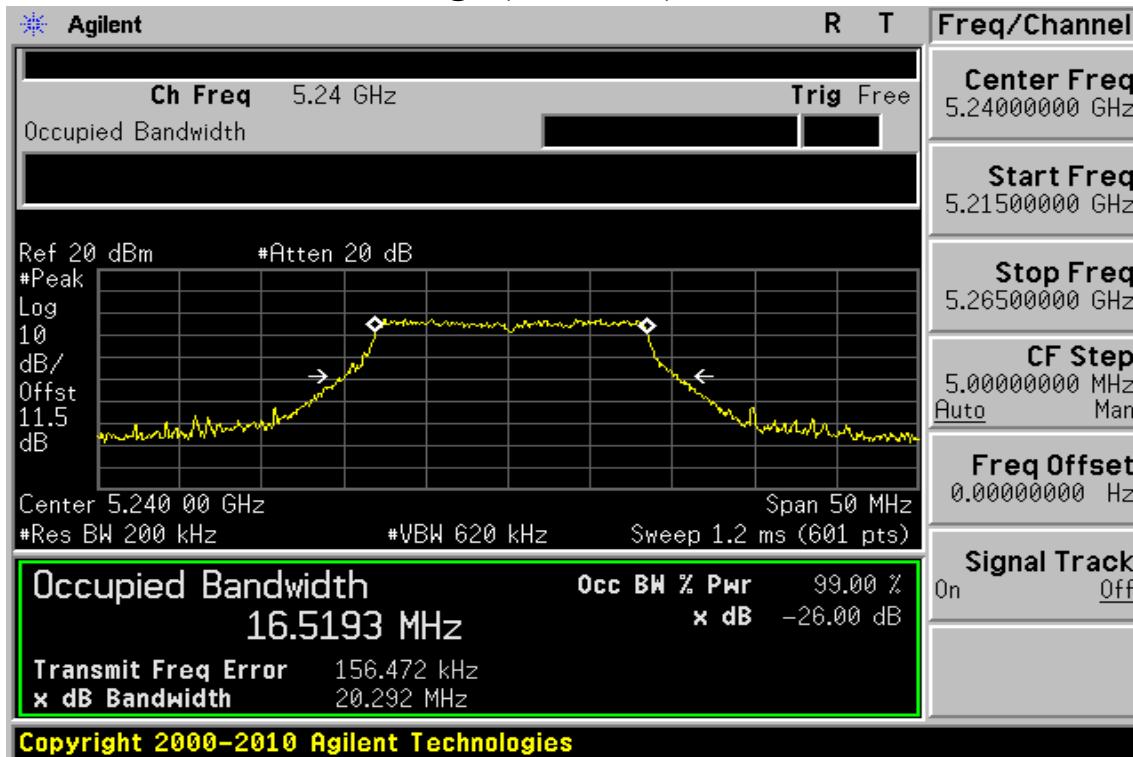
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26dB Band Width Test Data CH-High (5240MHz)



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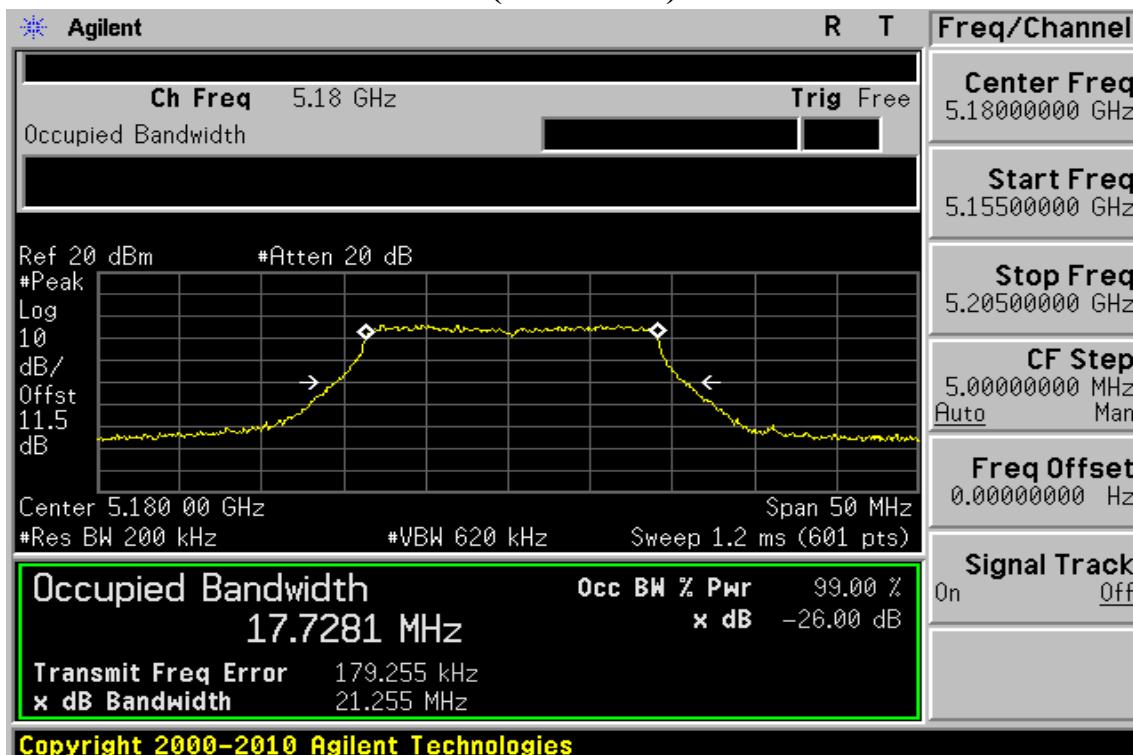
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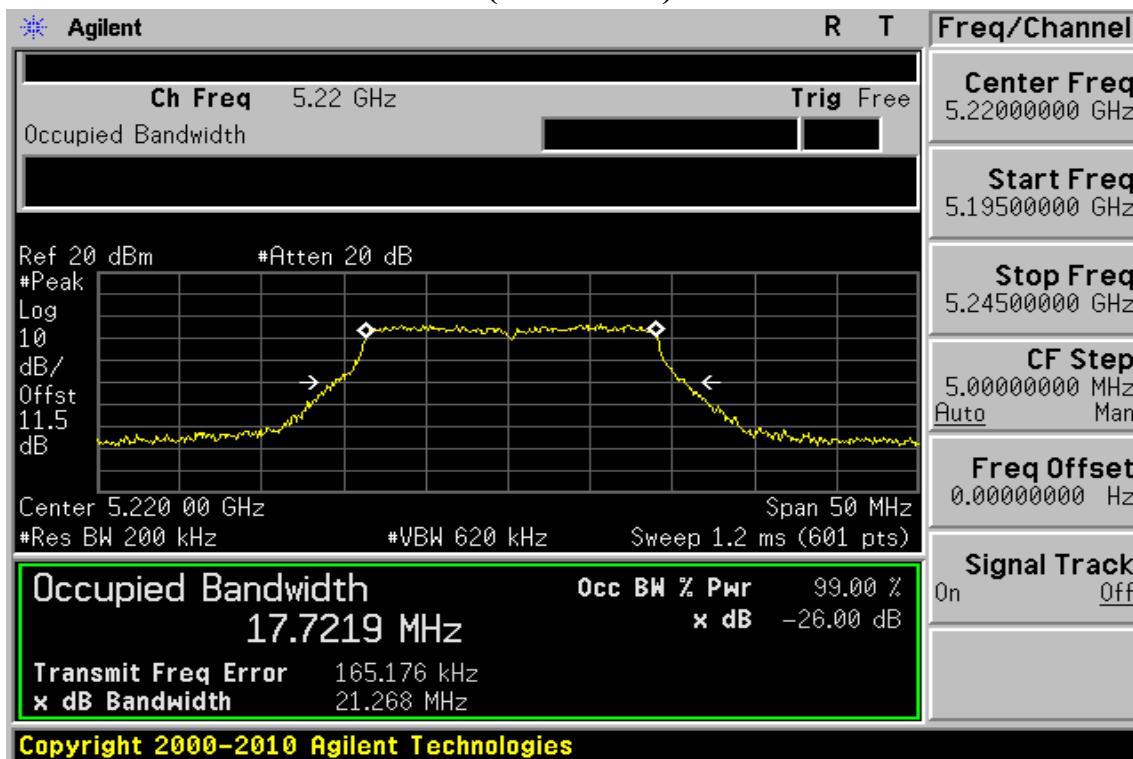
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802.11n HT20, 5150~5250 MHz

26dB Band Width Test Data CH-Low (5180 MHz)



26dB Band Width Test Data CH-Mid (5220 MHz)

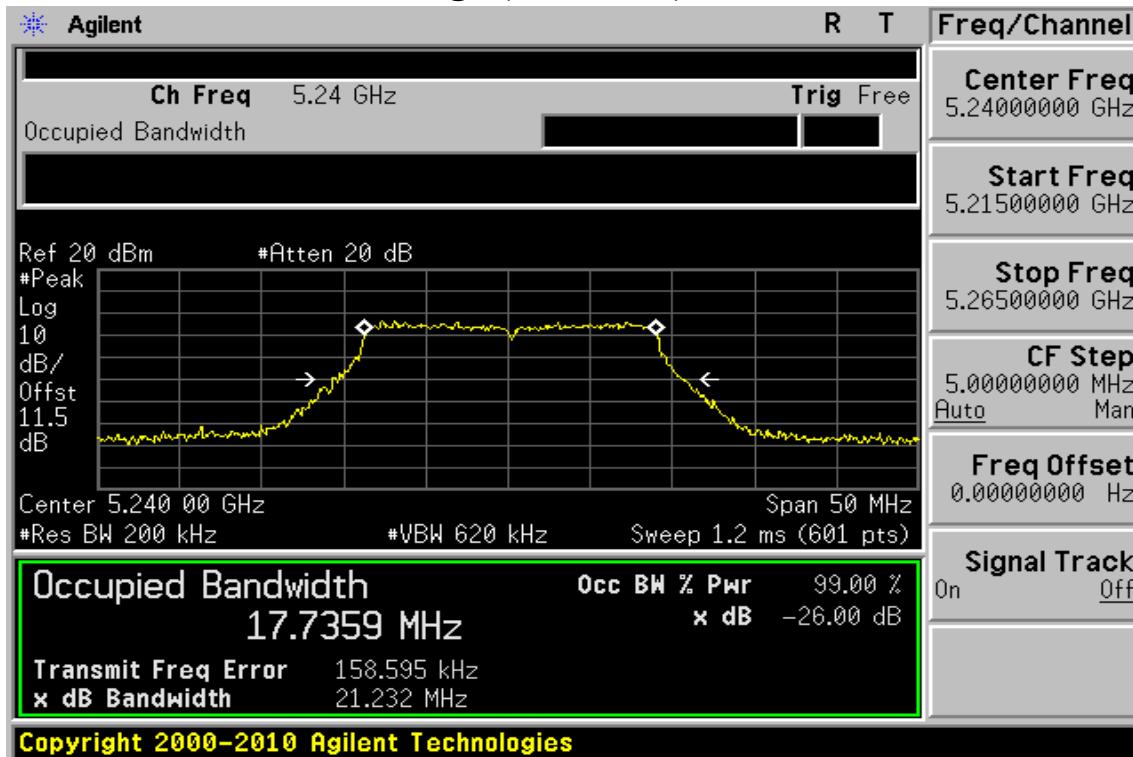


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26dB Band Width Test Data CH-High (5240 MHz)

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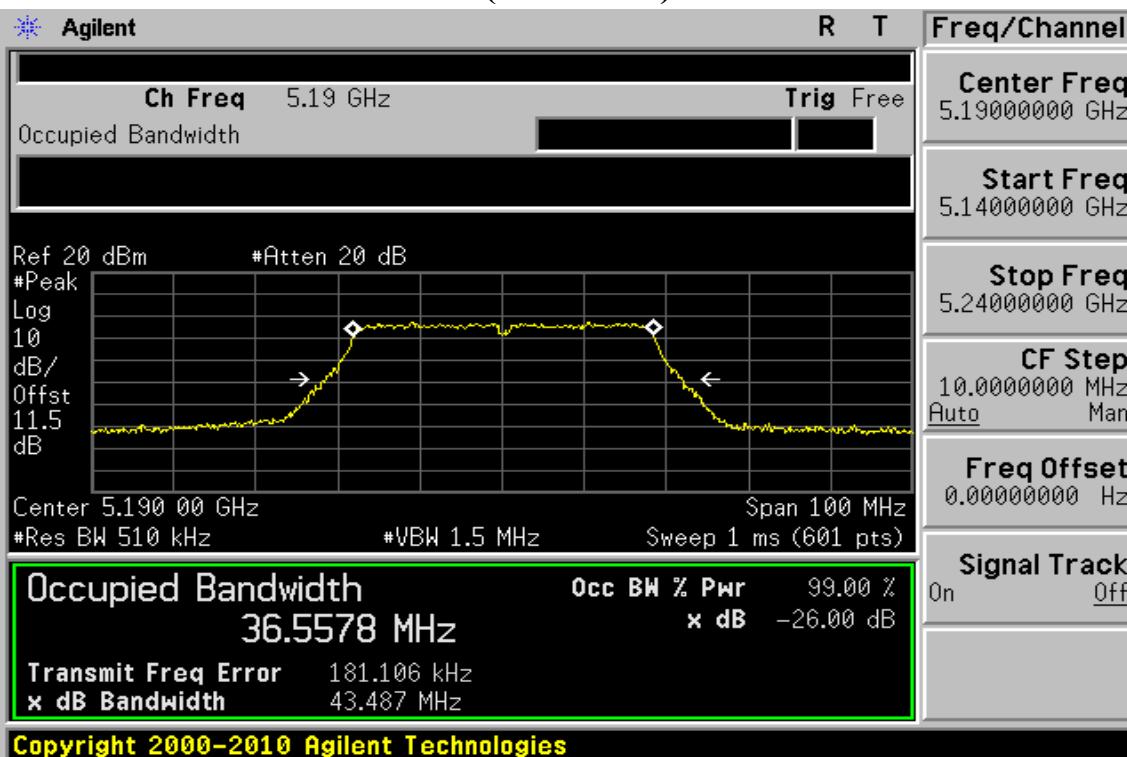
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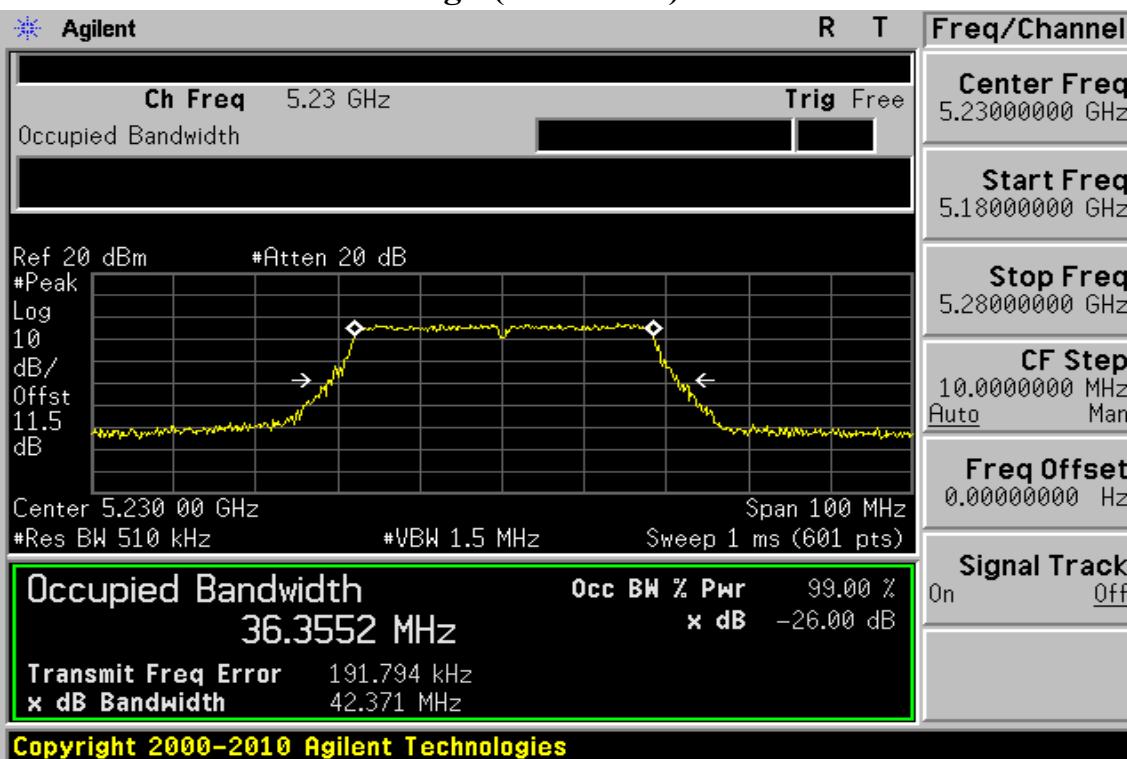
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802.11n HT40, 5150~5250 MHz

26dB Band Width Test Data CH-Low (5190 MHz)



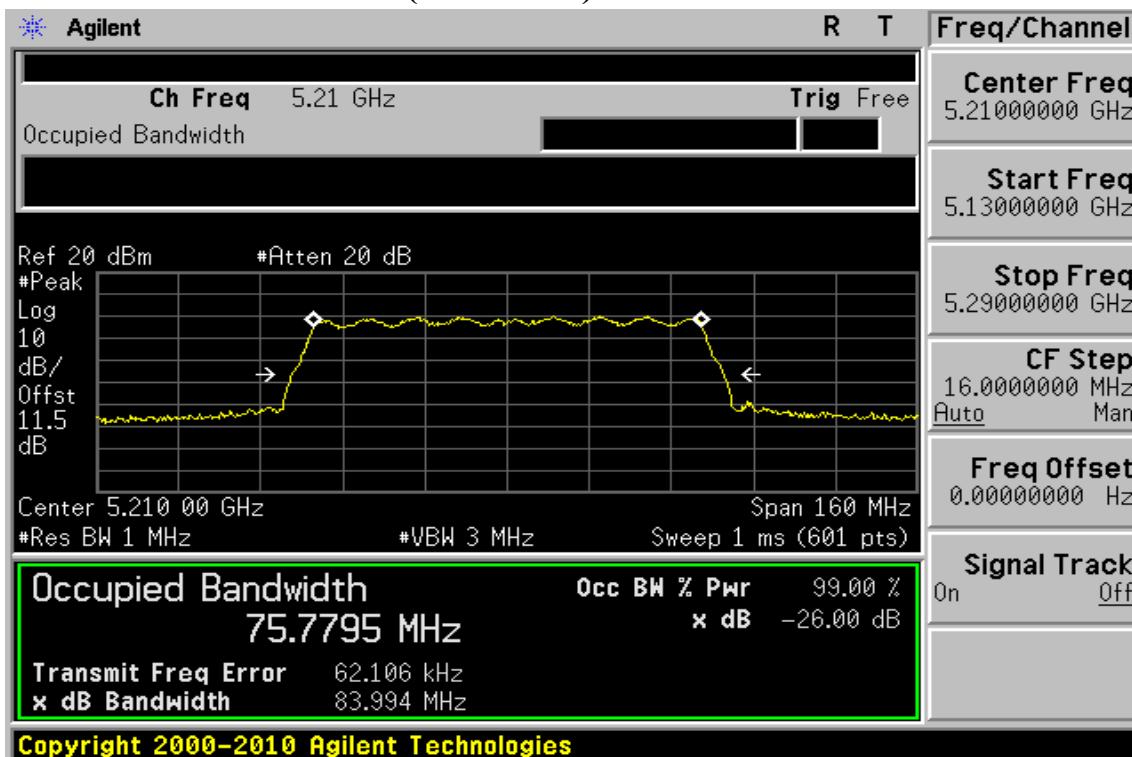
26dB Band Width Test Data CH-High (5230 MHz)



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**802.11ac VHT80,
26dB Band Width Test Data CH (5210 MHz)**

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8. The MAXIMUM OUTPUT POWER MEASUREMENT

8.1 Standard Applicable

According to §15.407(a)

1. For the band 5.15-5.25 GHz, the maximum conducted power over the frequency of operation shall not exceed the lesser of 50 mW (17dBm) or 4 dBm + 10log B.
2. For the band 5.25-5.35 GHz and 5.47-5.725GHz, the maximum conducted power over the frequency of operation shall not exceed the lesser of 250 mW (24dBm) or 11 dBm + 10log B.
3. For the band 5.725-5.825 GHz, the maximum conducted power over the frequency of operation shall not exceed the lesser of 1W (30dBm) or 17 dBm + 10log B.

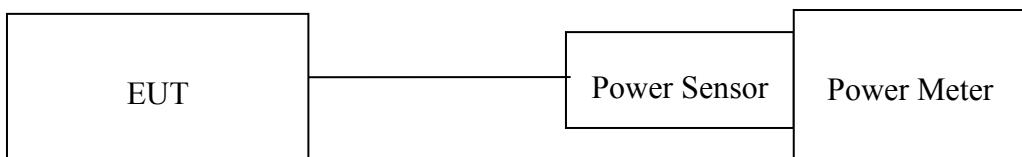
8.2 Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter
3. Set the offset $10 * \log(1/x)$, 0
4. Record the max. reading.
5. Repeat above procedures until all test default test channels measured were complete.

8.3 Measurement Equipment Used:

Refer to section 7.3 for details.

8.4 Test Set-up:



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8.5 Measurement Result

802.11a

Cable loss = 0		The Maximum Output Power								
CH	Frequency (MHz)	Data Rate								Required Limit
		6	9	12	18	24	36	48	54	
36	5180	7.81	7.73	7.71	7.64	7.59	7.58	7.55	7.52	16.99dBm or 4+10log(B) = 17.16dBm
44	5220	7.94	7.89	7.84	7.78	7.74	7.70	7.66	7.61	16.99dBm or 4+10log(B) = 17.14dBm
48	5240	7.65	7.62	7.55	7.46	7.39	7.33	7.32	7.23	16.99dBm or 4+10log(B) = 17.07dBm

Note: Limit is re-adjusted in terms of dBm

$10 * \log(50mW) = 16.99dBm$ for the limit on the band of 5150~5250MHz

Note: Cable loss is 11.8dB is set as the offset on the spectrum to compensate the loss causing by cable

802.11n HT20

Cable loss = 0		The Maximum Output Power								
CH	Frequency (MHz)	Data Rate								Required Limit
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	
36	5180	7.70	7.69	7.62	7.62	7.56	7.49	7.46	7.43	16.99dBm or 4+10log(B) = 17.27dBm
44	5220	7.86	7.83	7.78	7.71	7.66	7.58	7.52	7.46	16.99dBm or 4+10log(B) = 17.28dBm
48	5240	7.73	7.66	7.65	7.56	7.48	7.45	7.41	7.34	16.99dBm or 4+10log(B) = 17.27dBm

Note: Offset 1.5dB

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802.11ac VHT20

Cable loss = 0		The Maximum Output Power									
CH	Frequency (MHz)	Data Rate									Required Limit
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	
36	5180	7.66	7.63	7.62	7.60	7.53	7.49	7.42	7.28	7.24	16.99dBm or 4+10log(B) = 17.27dBm
44	5220	7.81	7.68	7.57	7.46	7.35	7.24	7.16	7.13	7.04	16.99dBm or 4+10log(B) = 17.28dBm
48	5240	7.69	7.66	7.62	7.52	7.44	7.31	7.20	7.18	7.15	16.99dBm or 4+10log(B) = 17.27dBm

802.11n HT40

Cable loss = 0		The Maximum Output Power									
CH	Frequency (MHz)	Data Rate									Required Limit
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	
38	5190	7.75	7.73	7.70	7.66	7.65	7.60	7.53	7.47		16.99dBm or 4+10log(B) = 20.38dBm
46	5230	7.82	7.74	7.71	7.70	7.68	7.65	7.64	7.63		16.99dBm or 4+10log(B) = 20.27dBm

802.11ac VHT40

Cable loss = 0		The Maximum Output Power									
CH	Frequency (MHz)	Data Rate									Required Limit
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	
38	5190	7.70	7.59	7.51	7.42	7.30	7.16	7.13	7.01	6.95	16.99dBm or 4+10log(B) = 20.38dBm
46	5230	7.77	7.68	7.65	7.51	7.48	7.34	7.32	7.21	7.20	16.99dBm or 4+10log(B) = 20.27dBm

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802.11ac VHT80:

Cable loss = 0		The Maximum Output Power										
CH	Frequency (MHz)	Data Rate										Required Limit
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	MCS8	MCS9	
42	5210	7.83	7.80	7.77	7.71	7.66	7.62	7.55	7.52	7.50	7.47	16.99dBm or 4+10log(B) = 23.24dBm

Note: Offset 1.5dB

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9. PEAK POWER SPECTRAL DENSITY

9.1 Standard Applicable

According to §15.407(a)

1. For the band 5.15-5.25 GHz, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band.
2. For the band 5.25-5.35 GHz and 5.47-5.725GHz, 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.

9.2 Measurement Procedure (following procedure F, & E) d) method SA-2 in KDB789033 D01)

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to Spectrum.
3. Set RBW=1MHz, VBW=3MHz, Span=50MHz/80MHz/160MHz (Base Mode), where span is enough to capture the entire bandwidth, Sweep time = Auto (601 pts), detector = sample, traces 100 sweeps of video averaging. (SA-2 with the omission of procedure x, the integration with 26dB EBW bandwidth)
4. User the cursor on spectrum to peak search the highest level of trace
5. Add offset, duty factor, 0.
6. Record the max. reading.
7. Repeat the above procedure for other test default channel, and required test configuration.

9.3 Measurement Equipment Used:

Refer to section 7.3 for details.

9.4 Test Set-up:

Refer to section 7.4 for details.

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9.5 Measurement Result

802.11a, 5150~5250 MHz

Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
5180	-3.30	4.00	-7.30
5220	-4.71	4.00	-8.71
5240	-2.77	4.00	-6.77

802.11n HT20, 5150~5250 MHz

Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
5180	-4.59	4.00	-8.59
5220	-3.76	4.00	-7.76
5240	-2.70	4.00	-6.70

802.11n HT40, 5150~5250 MHz

Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
5190	-6.46	4.00	-10.46
5230	-6.48	4.00	-10.48

802.11ac VHT80, 5210 MHz

Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
5210	-7.34	4.00	-11.34

Note: Offset 11.5dB

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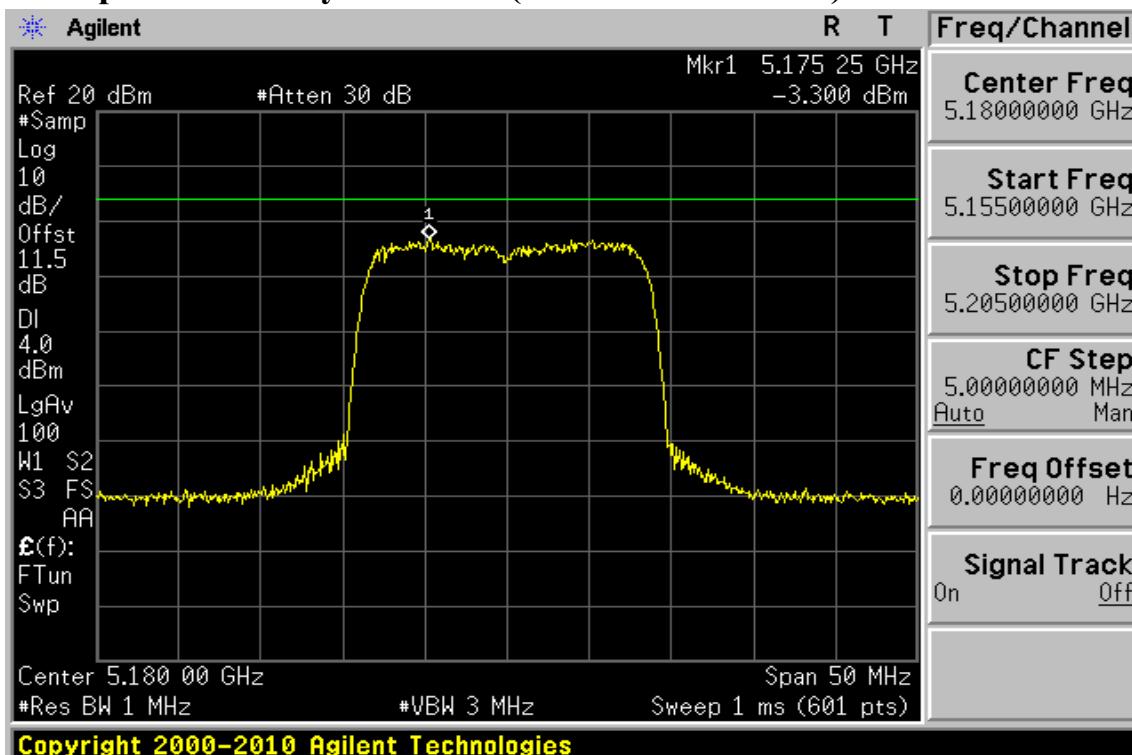
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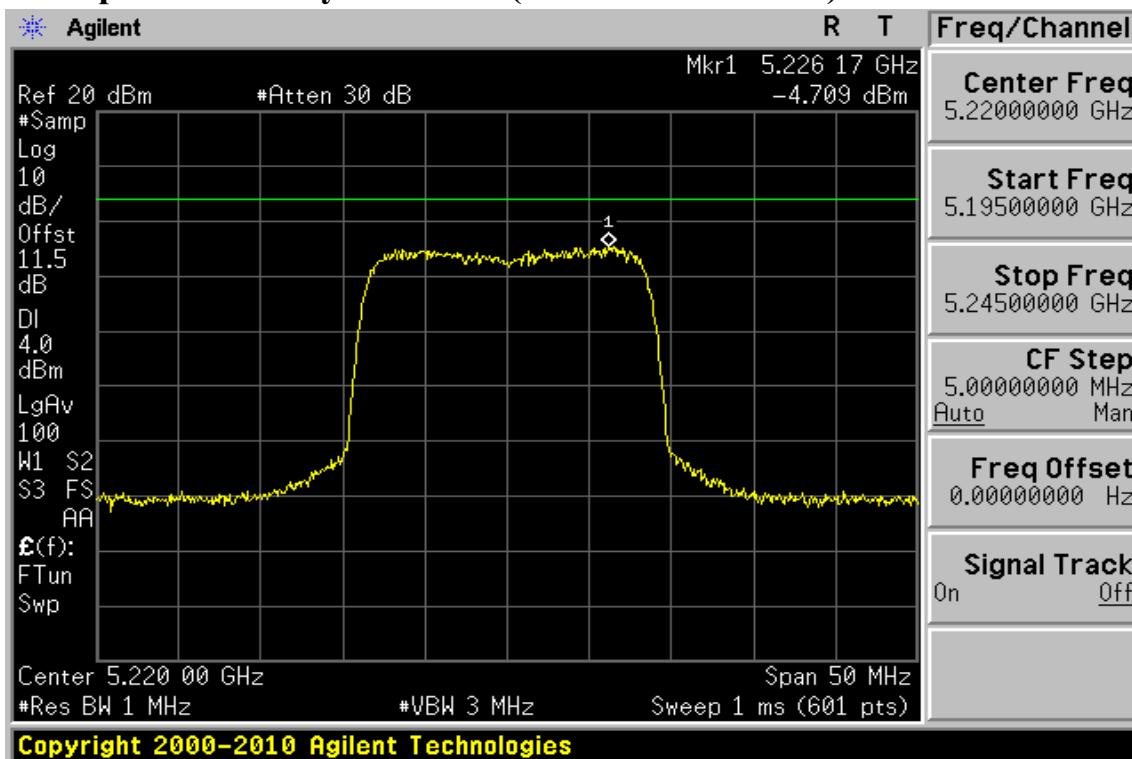
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802.11a, 5150~5250 MHz

Peak Power Spectral Density Data Plot (CH Low 5180 MHz)



Peak Power Spectral Density Data Plot (CH Mid 5220 MHz)



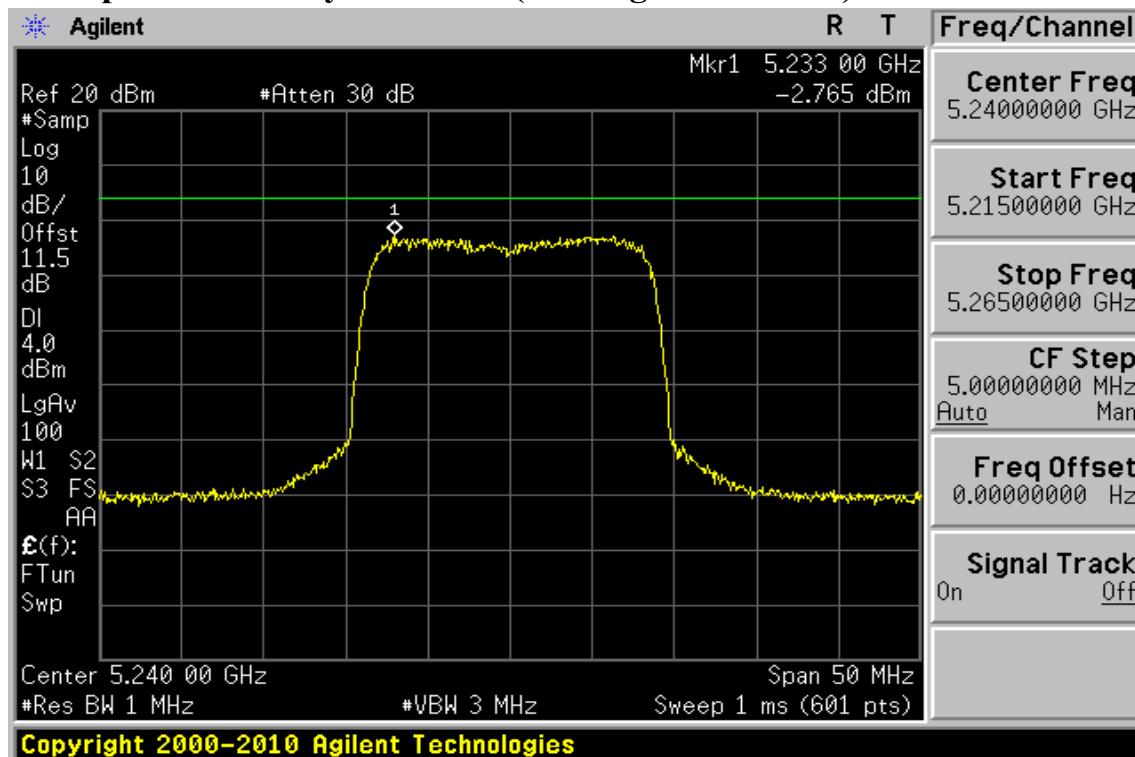
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Peak Power Spectral Density Data Plot (CH High 5240 MHz)



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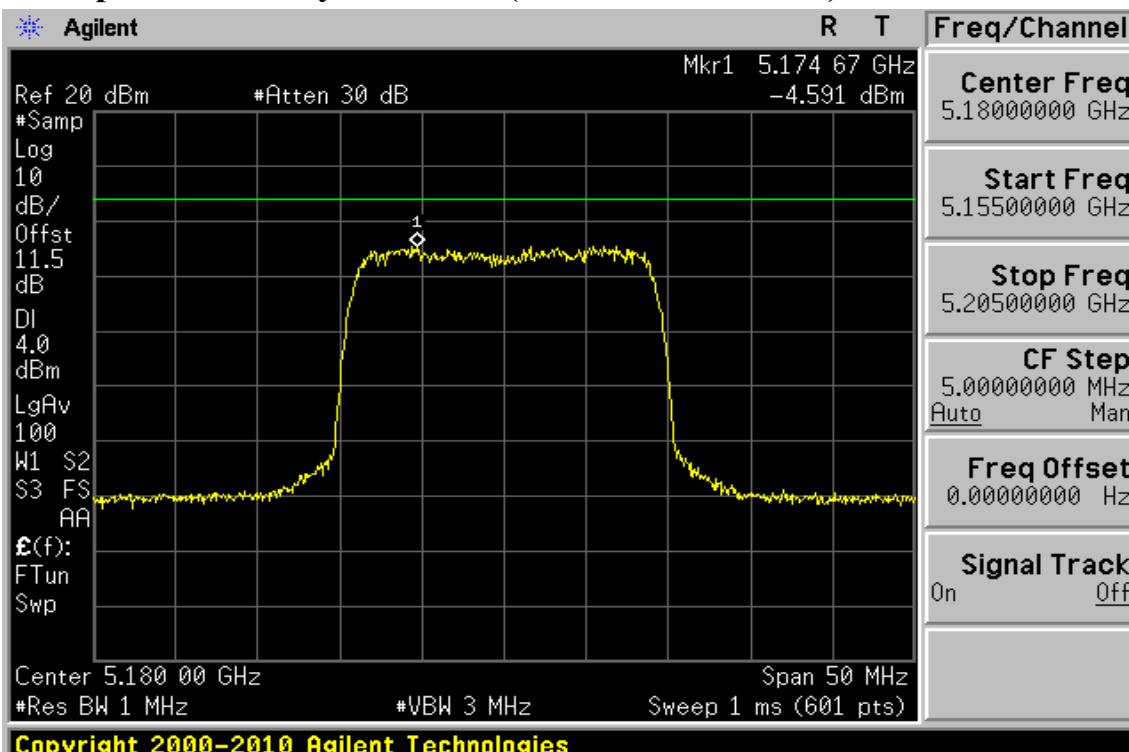
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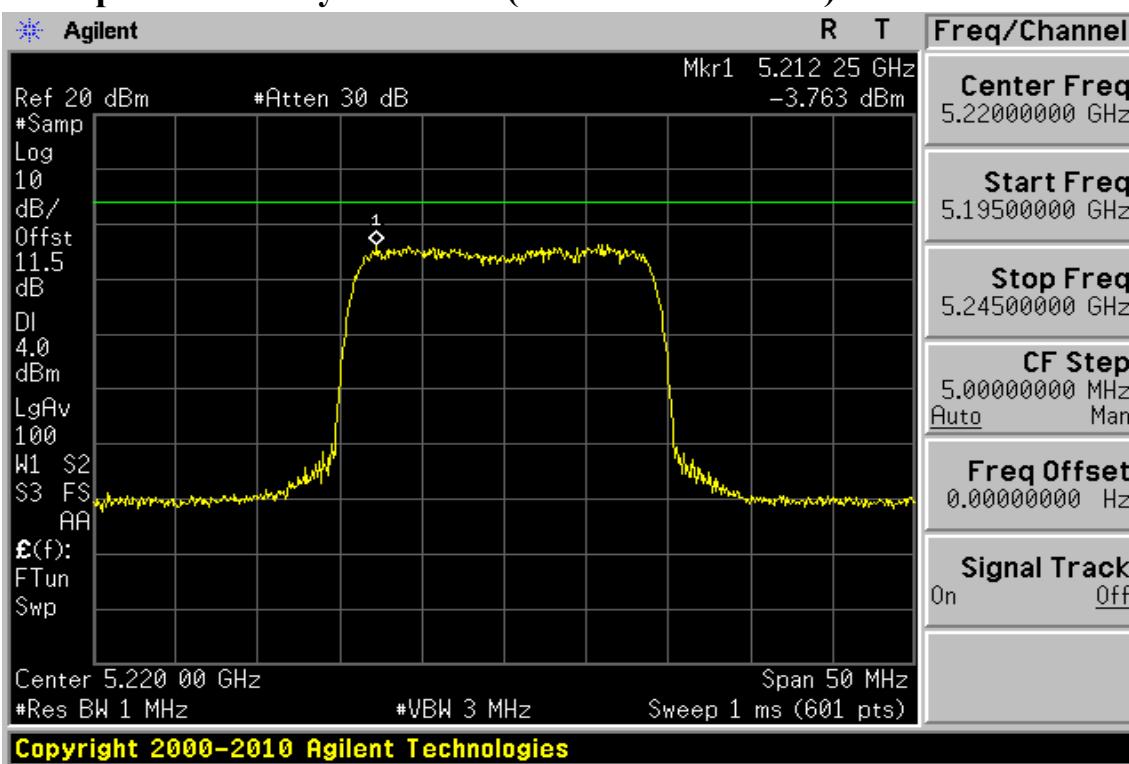
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802.11n HT20, 5150~5250 MHz

Peak Power Spectral Density Data Plot (CH Low 5180 MHz)



Peak Power Spectral Density Data Plot (CH Mid 5220 MHz)



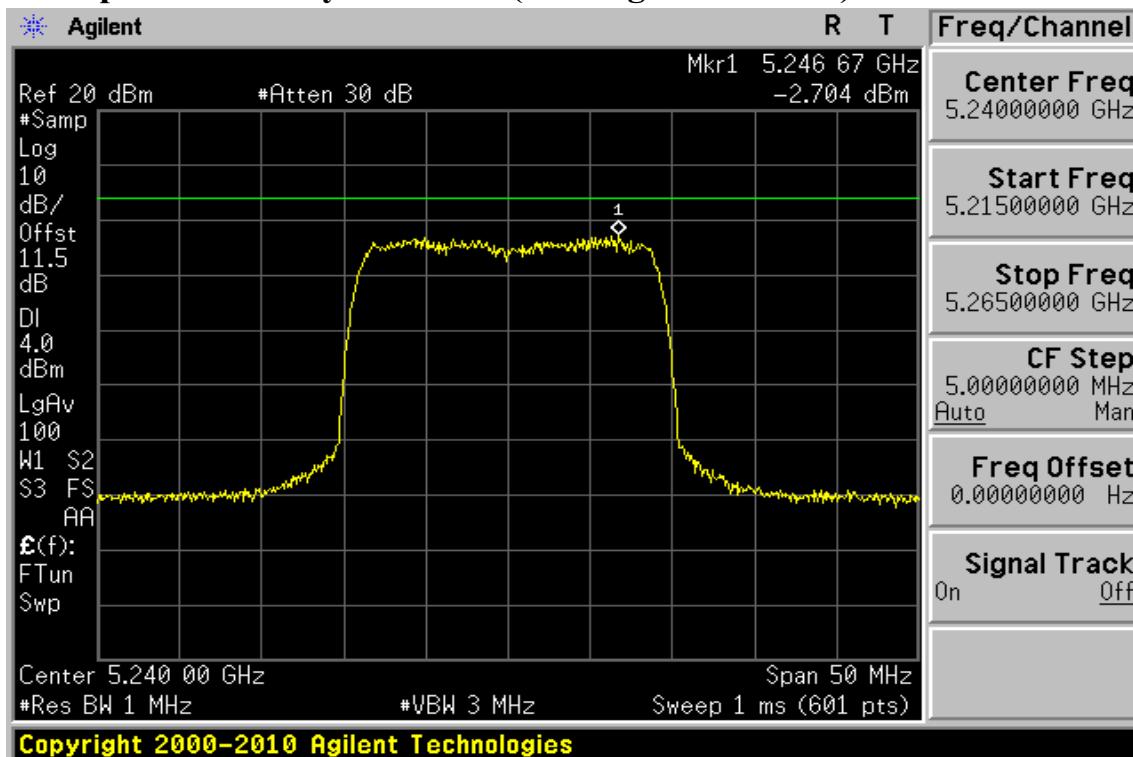
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Peak Power Spectral Density Data Plot (CH High 5240 MHz)



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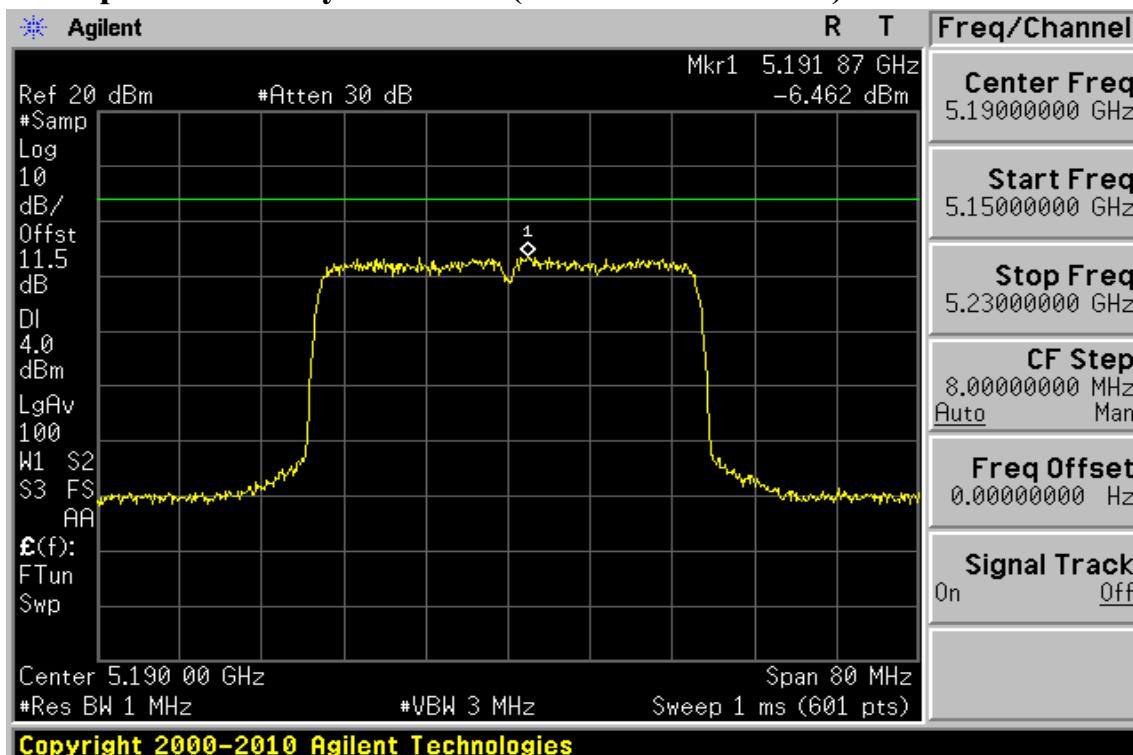
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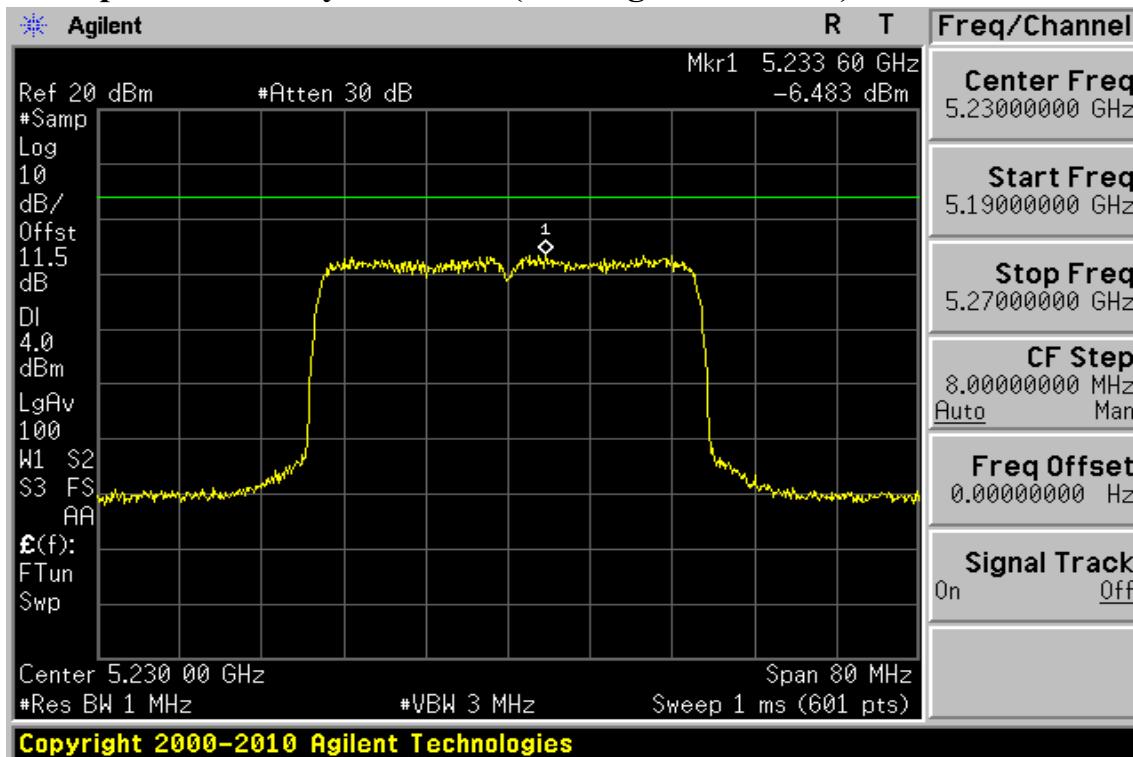
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802.11n HT40, 5150~5250 MHz

Peak Power Spectral Density Data Plot (CH Low 5190 MHz)



Peak Power Spectral Density Data Plot (CH High 5230 MHz)

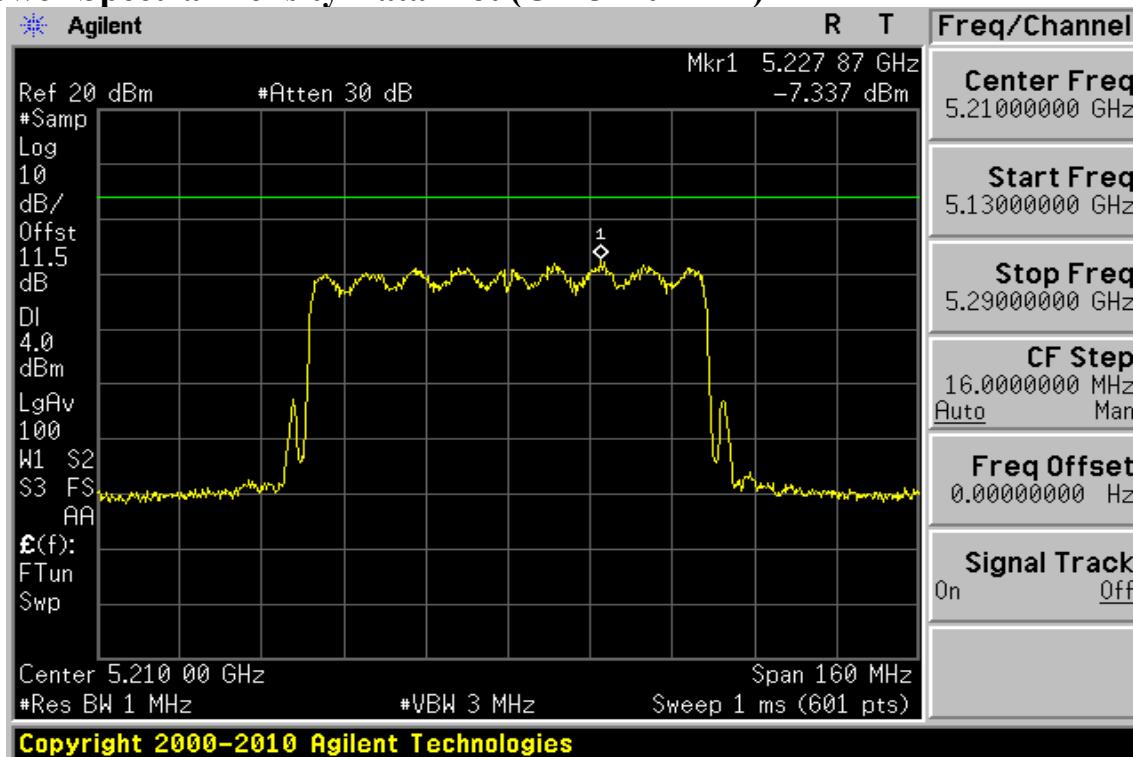


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802.11ac VHT80**Peak Power Spectral Density Data Plot (CH 5210 MHz)**

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10. PEAK EXCURSION MEASUREMENT

10.1 Standard Applicable

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.

10.2 Measurement Procedure (following procedure G in KDB789033)

1. Pre-evaluation in selection for test mode based on KDB789033
2. Tests mode selection is based on the variations in signal structure,
 - (i) All signal types - OFDM;
 - (ii) All modulation types (BPSK, QPSK, 16-QAM, 64-QAM, 256QAM);
 - (iii) All bandwidth modes (20MHz, and 40MHz for 802.11n, 20MHz, 40MHz, and 80MHz for 802.11ac);
 - (iv) All variations in signal parameters (inapplicable);
 - (v) Error-correction coding rate (not required);
3. Place the EUT on the table and set it in transmitting mode.
4. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to spectrum.
5. Set RBW=1MHz, VBW = 3MHz, span =enough to capture the signal of the interest, Max. Hold, Detector = peak
6. use the procedure specified in KDB 789033 F) to determine the PPSD
7. compute the ratio of the maximum of the peak-max-hold spectrum to the PPSD by the subtraction
8. Repeat above procedures until all default test mode of default frequency band of the test is completed.

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802.11a

Table 18-4—Modulation-dependent parameters

Modulation	Coding rate (R)	Coded bits per subcarrier (N_{BPSC})	Coded bits per OFDM symbol (N_{CBPS})	Data bits per OFDM symbol (N_{DBPS})	Data rate (Mb/s) (20 MHz channel spacing)	Data rate (Mb/s) (10 MHz channel spacing)	Data rate (Mb/s) (5 MHz channel spacing)
BPSK	1/2	1	48	24	6	3	1.5
BPSK	3/4	1	48	36	9	4.5	2.25
QPSK	1/2	2	96	48	12	6	3
QPSK	3/4	2	96	72	18	9	4.5
16-QAM	1/2	4	192	96	24	12	6
16-QAM	3/4	4	192	144	36	18	9
64-QAM	2/3	6	288	192	48	24	12
64-QAM	3/4	6	288	216	54	27	13.5

802.11n_20

Table 20-30—MCS parameters for mandatory 20 MHz, $N_{SS} = 1$, $N_{ES} = 1$

MCS Index	Modulation	R	$N_{BPSCS}(i_{SS})$	N_{SD}	N_{SP}	N_{CBPS}	N_{DBPS}	Data rate (Mb/s)	
								800 ns GI	400 ns GI (see NOTE)
0	BPSK	1/2	1	52	4	52	26	6.5	7.2
1	QPSK	1/2	2	52	4	104	52	13.0	14.4
2	QPSK	3/4	2	52	4	104	78	19.5	21.7
3	16-QAM	1/2	4	52	4	208	104	26.0	28.9
4	16-QAM	3/4	4	52	4	208	156	39.0	43.3
5	64-QAM	2/3	6	52	4	312	208	52.0	57.8
6	64-QAM	3/4	6	52	4	312	234	58.5	65.0
7	64-QAM	5/6	6	52	4	312	260	65.0	72.2

NOTE—Support of 400 ns GI is optional on transmit and receive.

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802.11n_40

Table 20-34—MCS parameters for optional 40 MHz, $N_{SS} = 1$, $N_{ES} = 1$

MCS Index	Modulation	R	$N_{BPSCS}(i_{SS})$	N_{SD}	N_{SP}	N_{CBPS}	N_{DBPS}	Data rate (Mb/s)	
								800 ns GI	400 ns GI
0	BPSK	1/2	1	108	6	108	54	13.5	15.0
1	QPSK	1/2	2	108	6	216	108	27.0	30.0
2	QPSK	3/4	2	108	6	216	162	40.5	45.0
3	16-QAM	1/2	4	108	6	432	216	54.0	60.0
4	16-QAM	3/4	4	108	6	432	324	81.0	90.0
5	64-QAM	2/3	6	108	6	648	432	108.0	120.0
6	64-QAM	3/4	6	108	6	648	486	121.5	135.0
7	64-QAM	5/6	6	108	6	648	540	135.0	150.0

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802.11ac

Bandwidth = 20MHz, NSS = 1, where NSS denotes spatial stream

MCS Index	Modulation	R	N _{BPSCS}	N _{SD}	N _{SP}	N _{CBPS}	N _{DBPS}	N _{ES}	Data rate (Mb/s)	
									800 ns GI	400 ns GI
0	BPSK	1/2	1	52	4	52	26	1	6.5	7.2
1	QPSK	1/2	2	52	4	104	52	1	13.0	14.4
2	QPSK	3/4	2	52	4	104	78	1	19.5	21.7
3	16-QAM	1/2	4	52	4	208	104	1	26.0	28.9
4	16-QAM	3/4	4	52	4	208	156	1	39.0	43.3
5	64-QAM	2/3	6	52	4	312	208	1	52.0	57.8
6	64-QAM	3/4	6	52	4	312	234	1	58.5	65.0
7	64-QAM	5/6	6	52	4	312	260	1	65.0	72.2
8	256-QAM	3/4	8	52	4	416	312	1	78.0	86.7
9									Not valid	

Bandwidth = 40MHz, NSS = 1, where NSS denotes spatial stream

MCS Index	Modulation	R	N _{BPSCS}	N _{SD}	N _{SP}	N _{CBPS}	N _{DBPS}	N _{ES}	Data rate (Mb/s)	
									800 ns GI	400 ns GI
0	BPSK	1/2	1	108	6	108	54	1	13.5	15.0
1	QPSK	1/2	2	108	6	216	108	1	27.0	30.0
2	QPSK	3/4	2	108	6	216	162	1	40.5	45.0
3	16-QAM	1/2	4	108	6	432	216	1	54.0	60.0
4	16-QAM	3/4	4	108	6	432	324	1	81.0	90.0
5	64-QAM	2/3	6	108	6	648	432	1	108.0	120.0
6	64-QAM	3/4	6	108	6	648	486	1	121.5	135.0
7	64-QAM	5/6	6	108	6	648	540	1	135.0	150.0
8	256-QAM	3/4	8	108	6	864	648	1	162.0	180.0
9	256-QAM	5/6	8	108	6	864	720	1	180.0	200.0

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Bandwidth = 80MHz, $N_{\text{ss}} = 1$, where N_{ss} denotes spatial stream

MCS Index	Modulation	R	N_{BPSCS}	N_{SD}	N_{SP}	N_{CBPS}	N_{DBPS}	N_{ES}	Data rate (Mb/s)	
									800 ns GI	400 ns GI
0	BPSK	1/2	1	234	8	234	117	1	29.3	32.5
1	QPSK	1/2	2	234	8	468	234	1	58.5	65.0
2	QPSK	3/4	2	234	8	468	351	1	87.8	97.5
3	16-QAM	1/2	4	234	8	936	468	1	117.0	130.0
4	16-QAM	3/4	4	234	8	936	702	1	175.5	195.0
5	64-QAM	2/3	6	234	8	1404	936	1	234.0	260.0
6	64-QAM	3/4	6	234	8	1404	1053	1	263.3	292.5
7	64-QAM	5/6	6	234	8	1404	1170	1	292.5	325.0
8	256-QAM	3/4	8	234	8	1872	1404	1	351.0	390.0
9	256-QAM	5/6	8	234	8	1872	1560	1	390.0	433.3

Note: The test mode to be performed is circle in red as presents above

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10.3 Measurement Equipment Used:

Refer to section 7.3 for details.

10.4 Test Set-up:

Refer to section 7.4 for details.

10.5 Test Results:

Modulation Type: BPSK

Coding Rate: 1/2

802.11a, 5150~5250 MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
Mid	5220	6.21	-4.71	10.92	13.00

802.11n HT20, 5150~5250 MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
Mid	5220	4.47	-3.76	8.23	13.00

802.11n HT40, 5150~5250 MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
Low	5190	2.32	-6.46	8.78	13.00

802.11ac VHT80, 5210MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
	5210	3.33	-7.34	10.67	13.00

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Modulation Type: QPSK**Coding Rate: 1/2**

802.11a, 5150~5250 MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
Mid	5220	4.84	-4.48	9.32	13.00

802.11n HT20, 5150~5250 MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
Mid	5220	4.70	-3.38	8.08	13.00

802.11n HT40, 5150~5250 MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
Low	5190	1.92	-7.09	9.01	13.00

802.11ac VHT80, 5210MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
	5210	2.96	-7.51	10.47	13.00

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Modulation Type: 16-QAM**Coding Rate: 1/2**

802.11a, 5150~5250 MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
Mid	5220	7.59	-3.90	11.49	13.00

802.11n HT20, 5150~5250 MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
Mid	5220	4.87	-3.66	8.53	13.00

802.11n HT40, 5150~5250 MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
Low	5190	1.76	-7.63	9.39	13.00

802.11ac VHT80, 5210MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
	5210	3.88	-6.39	10.27	13.00

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Modulation Type: 64-QAM**Coding Rate: 2/3**

802.11a, 5150~5250 MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
Mid	5220	7.97	0.49	7.48	13.00

802.11n HT20, 5150~5250 MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
Mid	5220	4.57	-3.80	8.37	13.00

802.11n HT40, 5150~5250 MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
Low	5190	2.69	-7.69	10.38	13.00

802.11ac VHT80, 5210MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
	5210	2.76	-6.22	8.98	13.00

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Modulation Type: 256-QAM**Coding Rate: 5/6**

802.11ac VHT20, 5210MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
Mid	5220	-0.43	9.57	-10.00	13.00

802.11ac VHT40, 5210MHz

Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
Low	5190	1.76	5.57	-3.81	13.00

802.11ac VHT80, 5210MHz

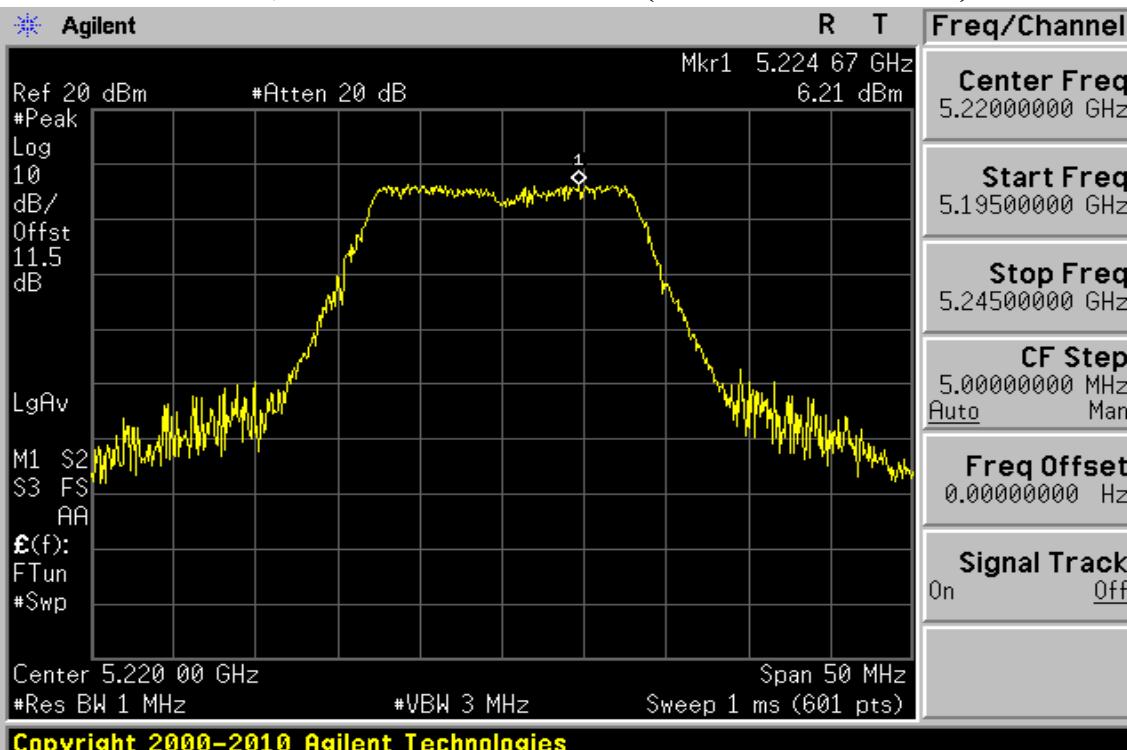
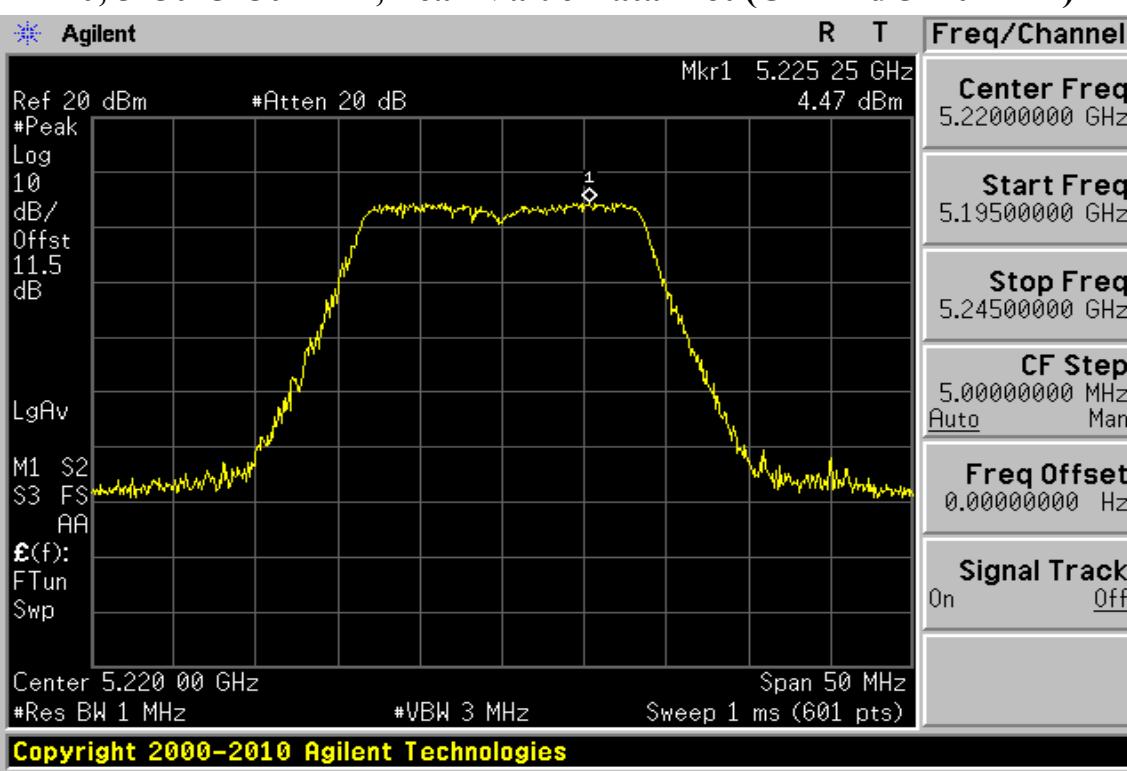
Channel	Frequency (MHz)	Peak Value(dBm)	PPSD (dBm)	Peak Excursion (dB)	Limit (dB)
	5210	3.78	-5.87	9.65	13.00

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Modulation Type: BPSK, Coding Rate: 1/2
802.11a, 5150~5250 MHz, Peak Value Data Plot (CH Mid 5220 MHz)

802.11n HT20, 5150~5250 MHz, Peak Value Data Plot (CH Mid 5220 MHz)


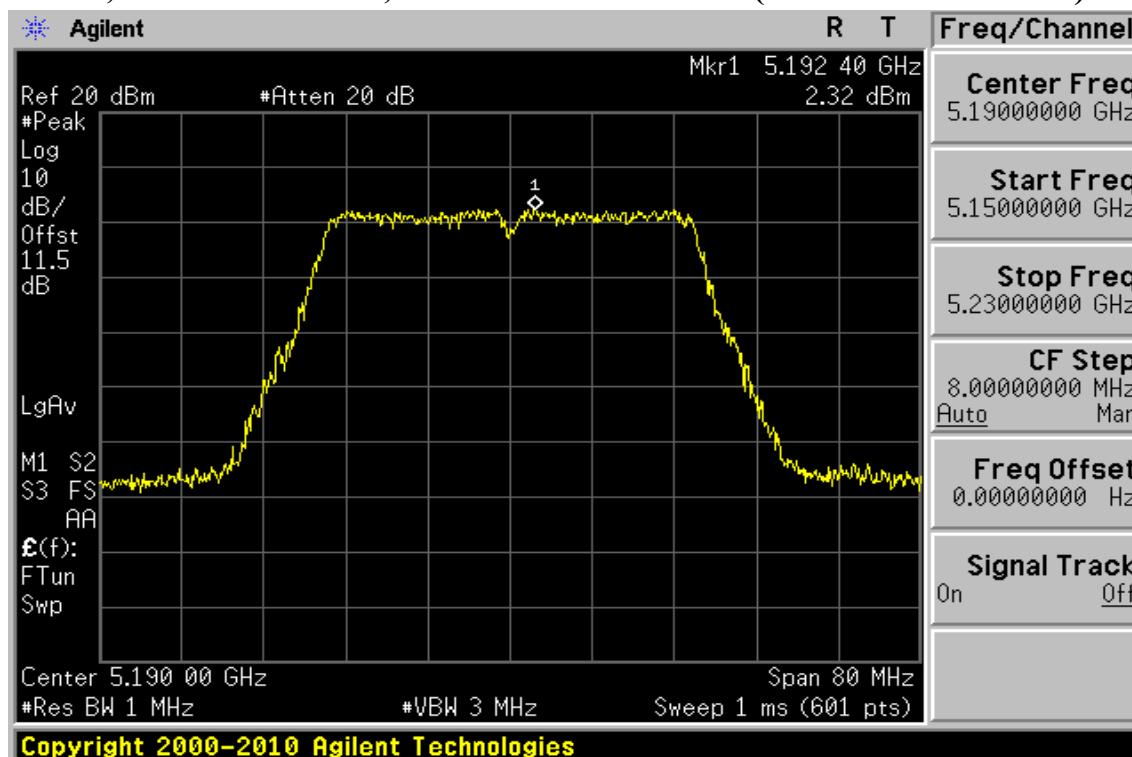
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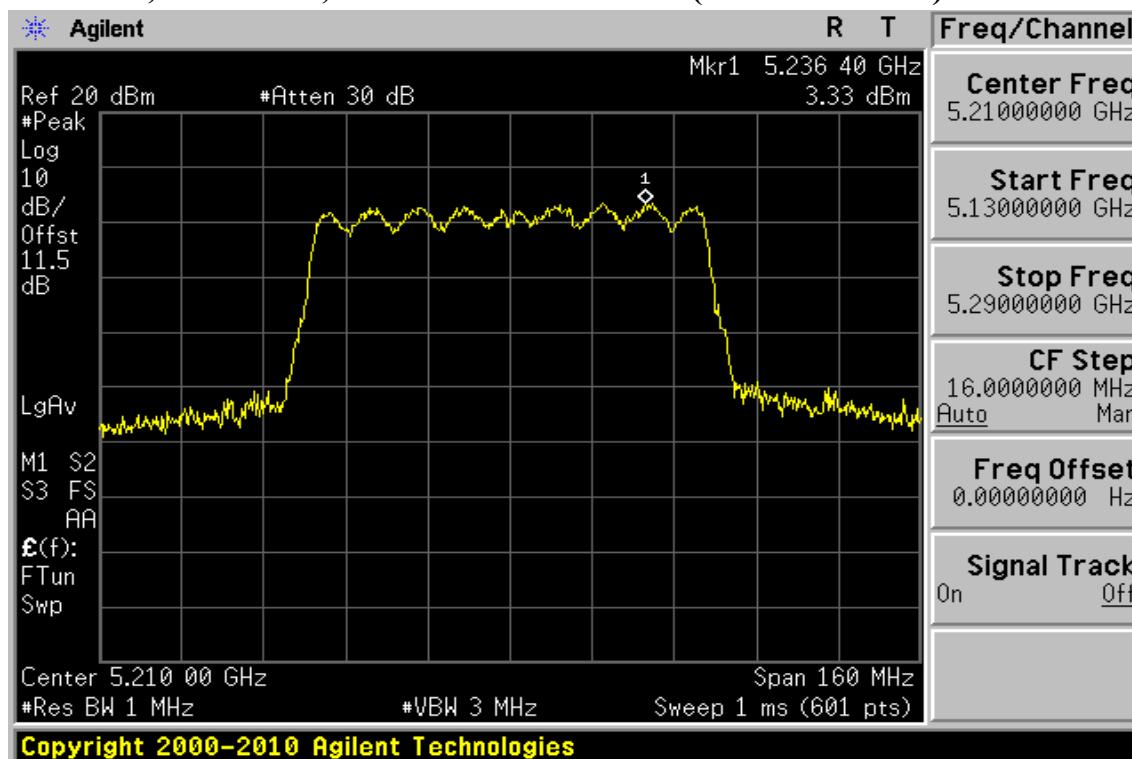
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802.11n HT40, 5150~5250 MHz, Peak Value Data Plot (CH Low 5190 MHz)



802.11ac VHT80, 5210MHz, Peak Value Data Plot (CH 5210 MHz)

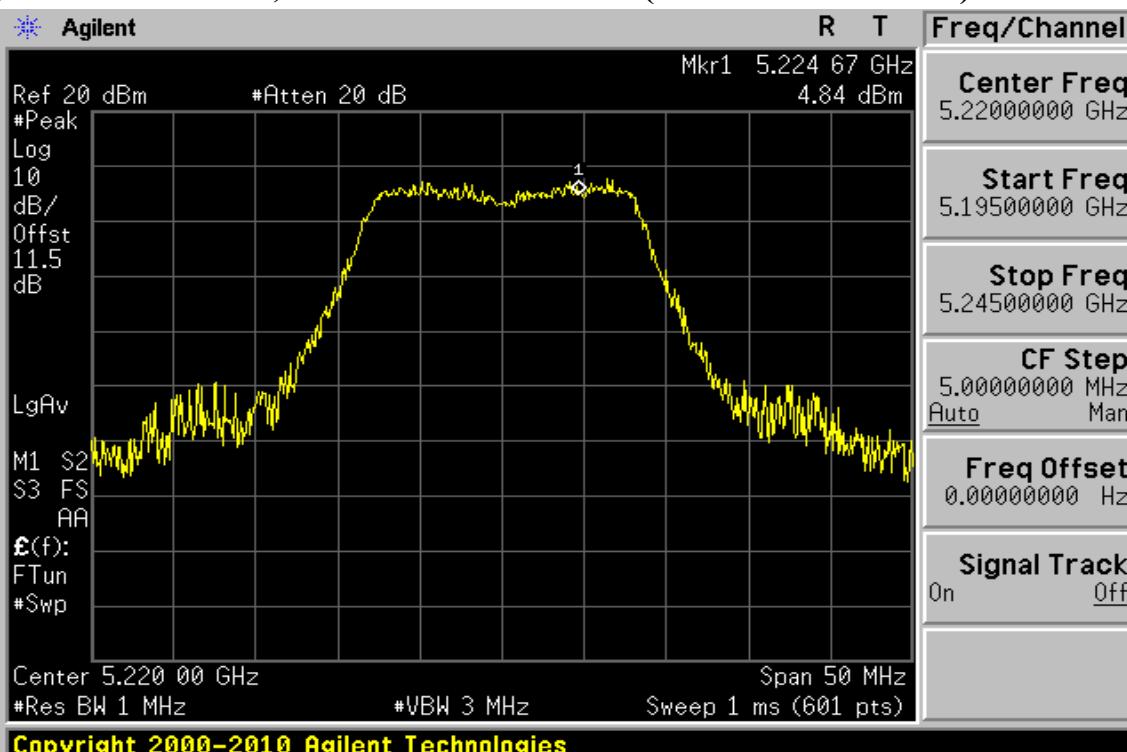
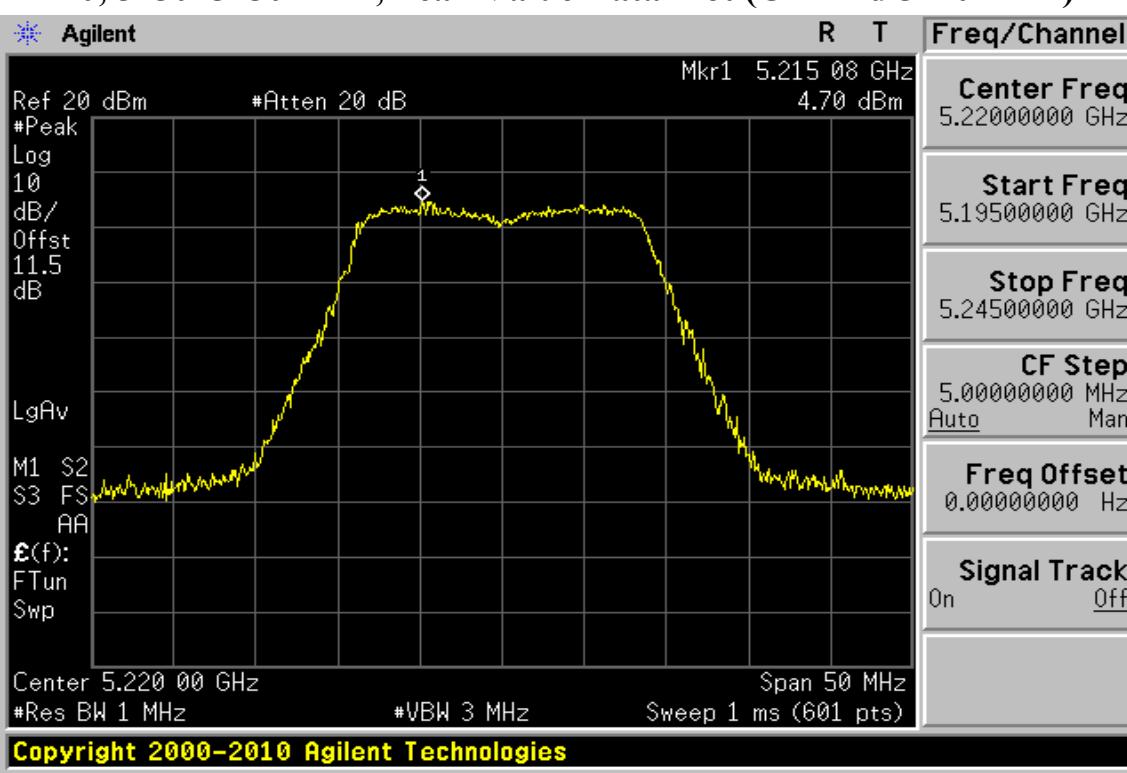


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Modulation Type: QPSK, Coding Rate: 1/2
802.11a, 5150~5250 MHz, Peak Value Data Plot (CH Mid 5220 MHz)

802.11n HT20, 5150~5250 MHz, Peak Value Data Plot (CH Mid 5220 MHz)


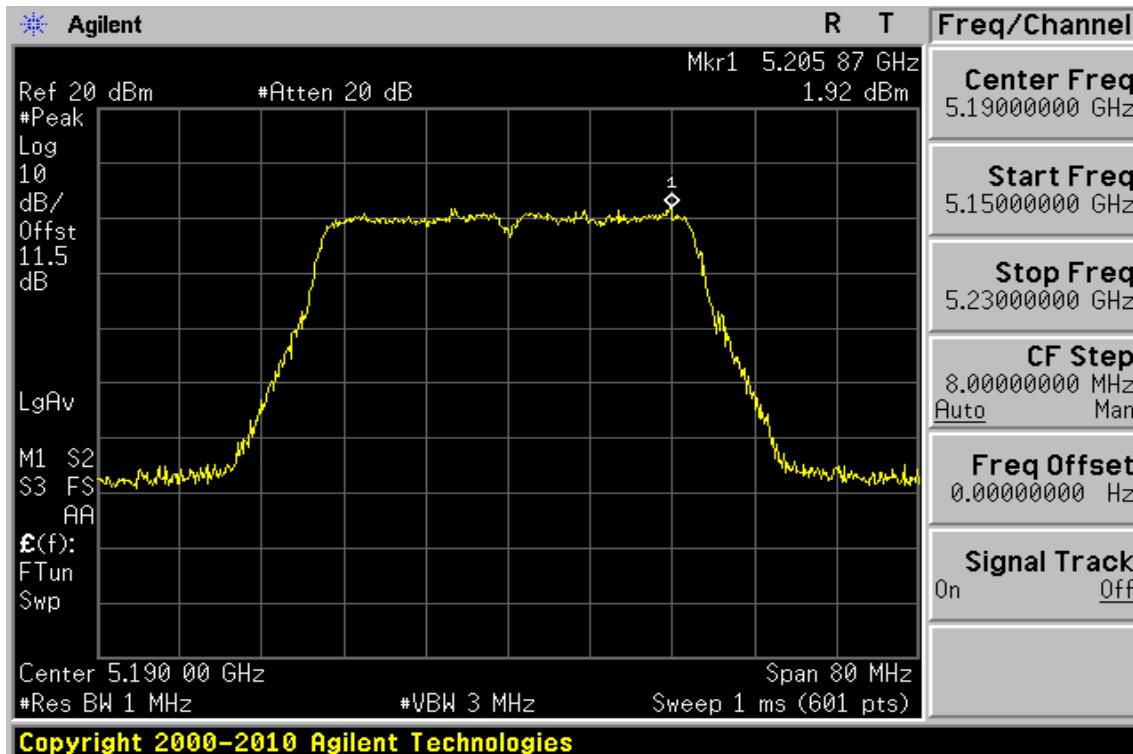
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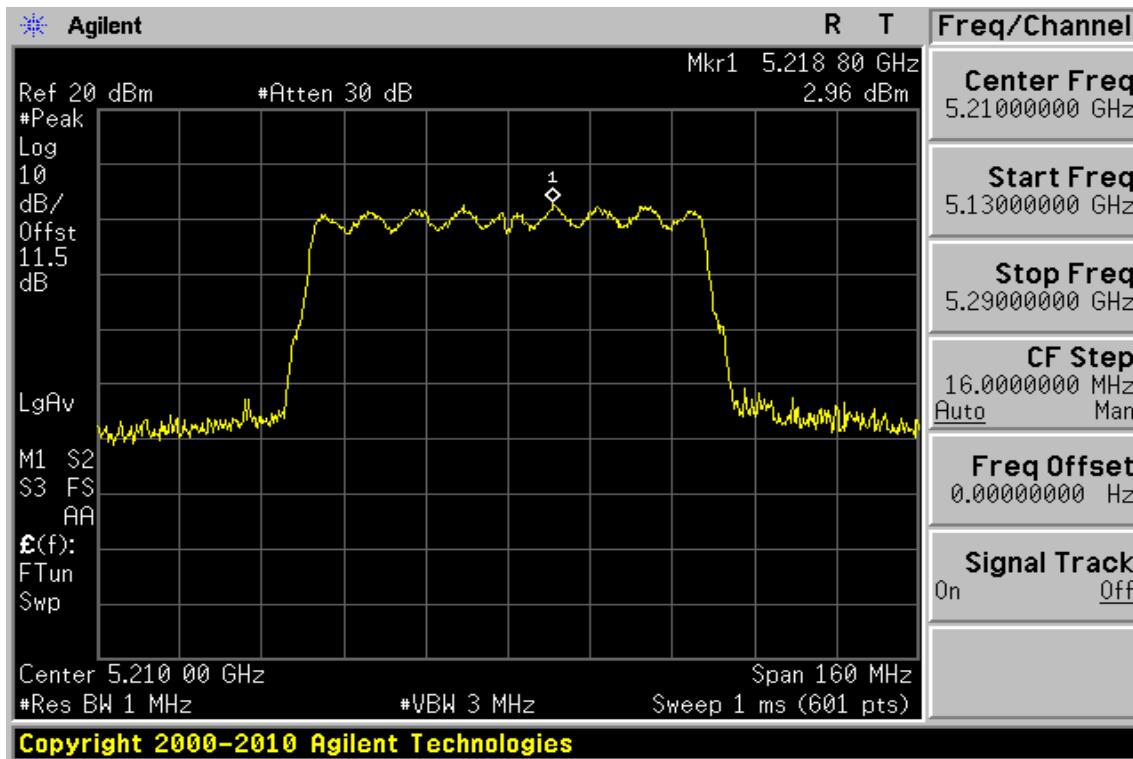
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802.11n HT40, 5150~5250 MHz, Peak Value Data Plot (CH Low 5190 MHz)



802.11ac VHT80, 5210MHz, Peak Value Data Plot (CH 5210 MHz)

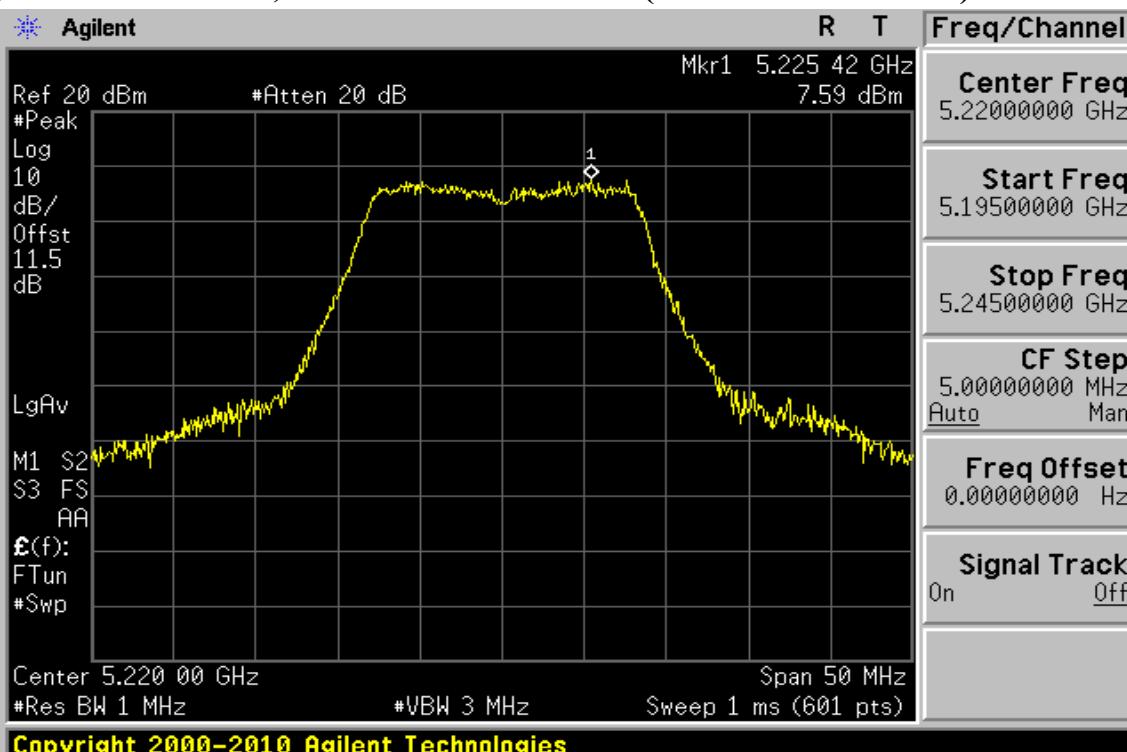
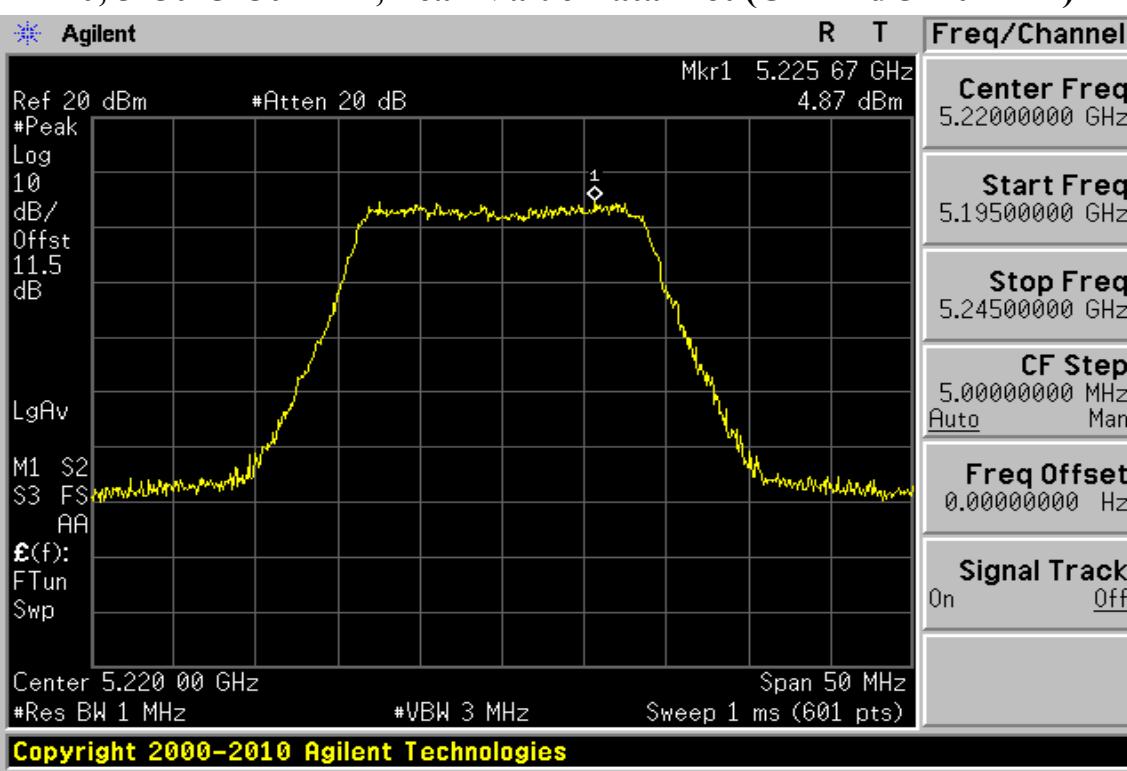


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Modulation Type: 16-QAM, Coding Rate: 1/2
802.11a, 5150~5250 MHz, Peak Value Data Plot (CH Mid 5220 MHz)

802.11n HT20, 5150~5250 MHz, Peak Value Data Plot (CH Mid 5220 MHz)


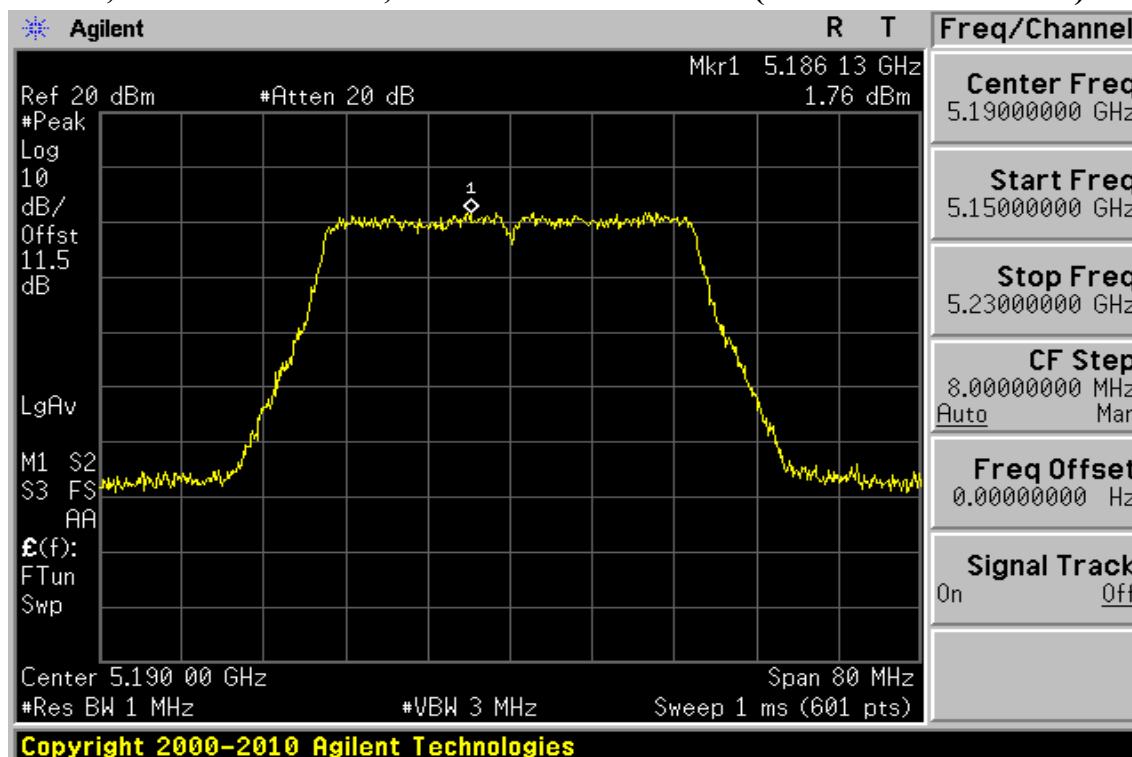
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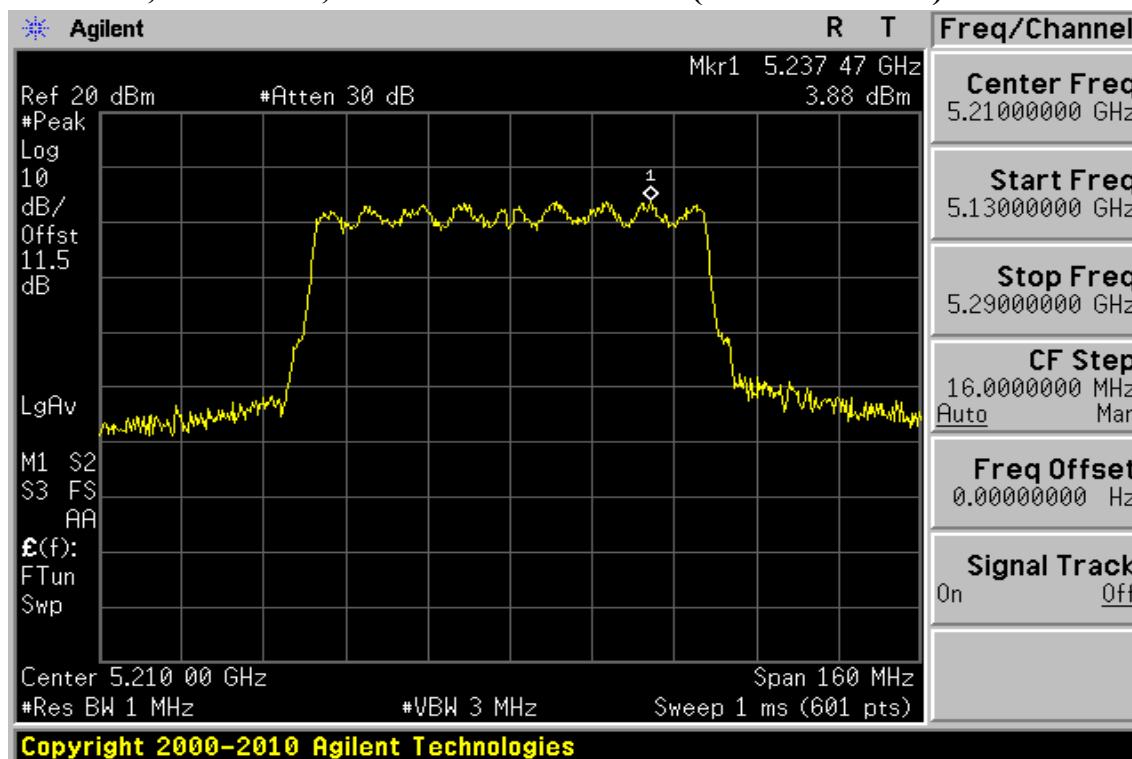
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802.11n HT40, 5150~5250 MHz, Peak Value Data Plot (CH Low 5190 MHz)



802.11ac VHT80, 5210MHz, Peak Value Data Plot (CH 5210 MHz)

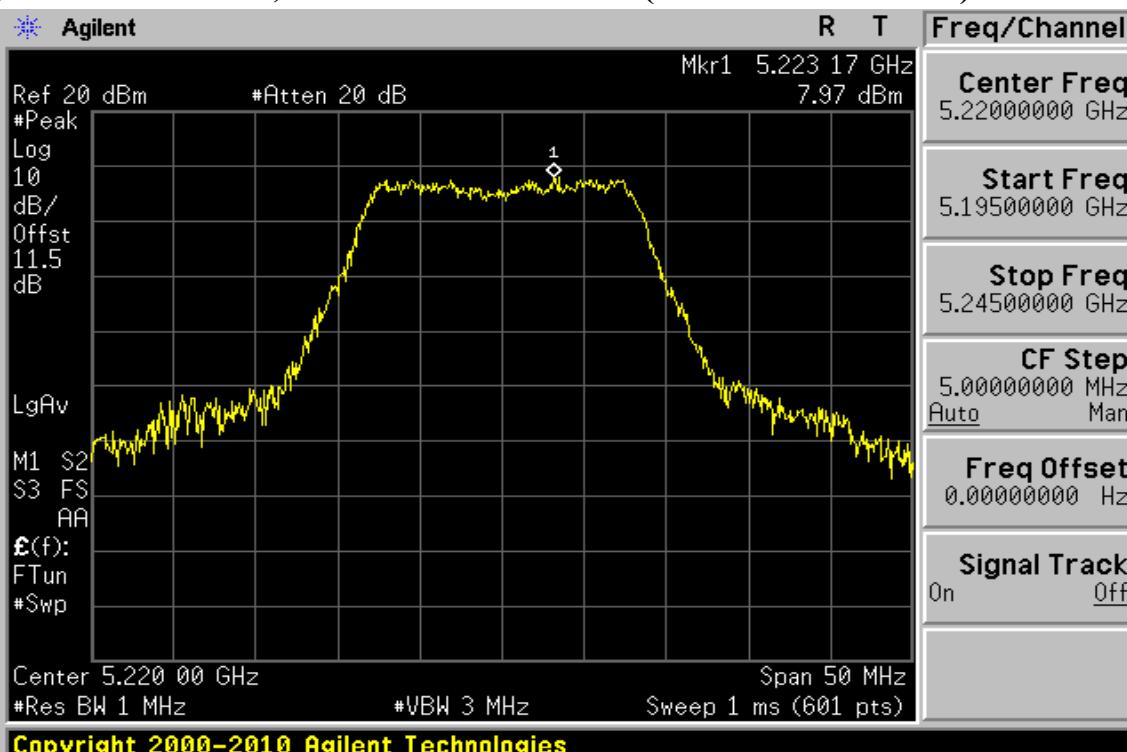
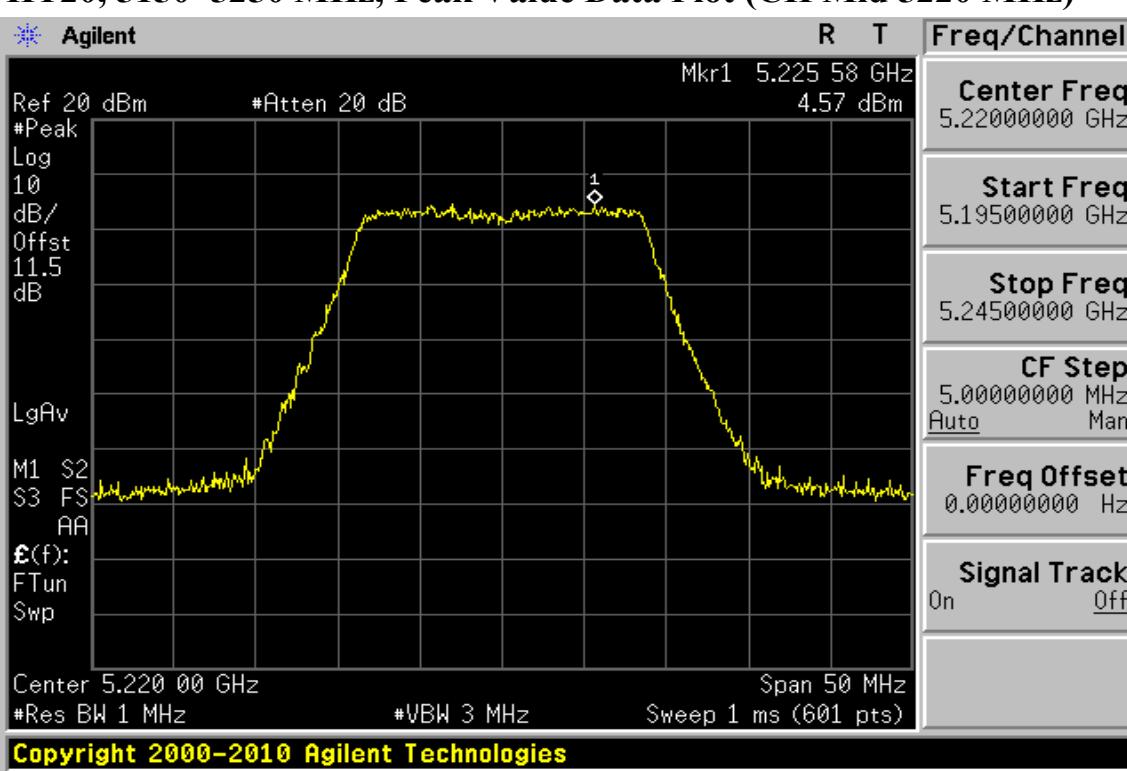


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Modulation Type: 64-QAM, Coding Rate: 2/3
802.11a, 5150~5250 MHz, Peak Value Data Plot (CH Mid 5220 MHz)

802.11n HT20, 5150~5250 MHz, Peak Value Data Plot (CH Mid 5220 MHz)


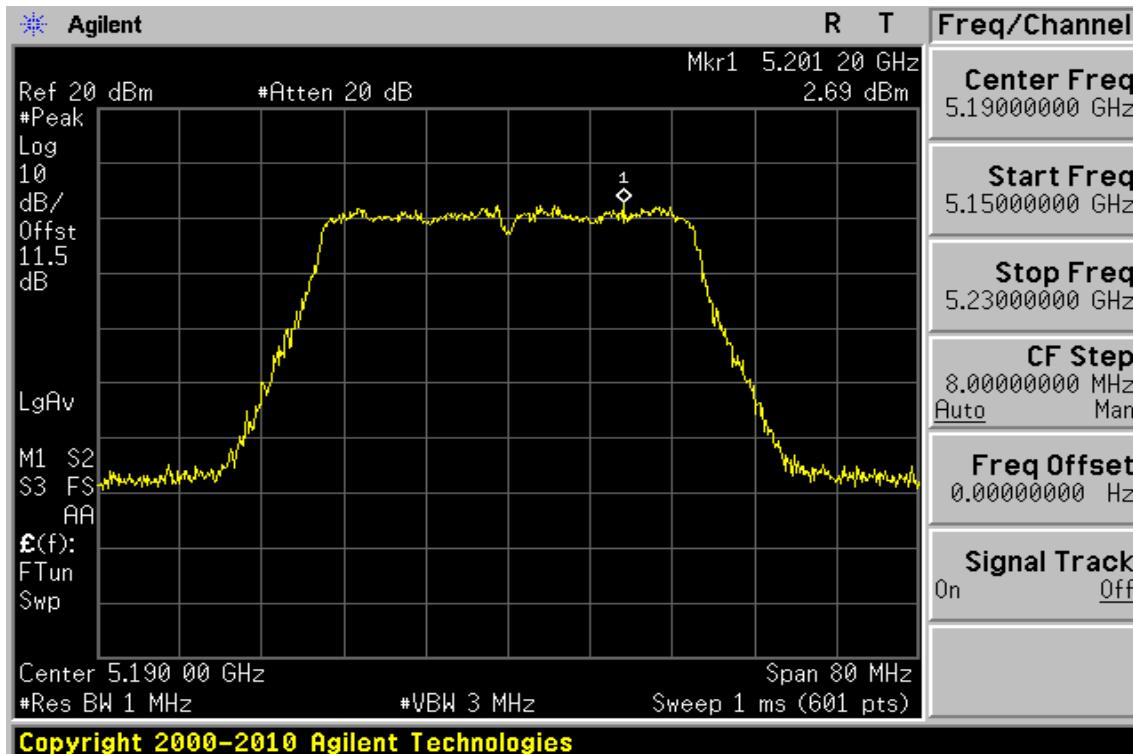
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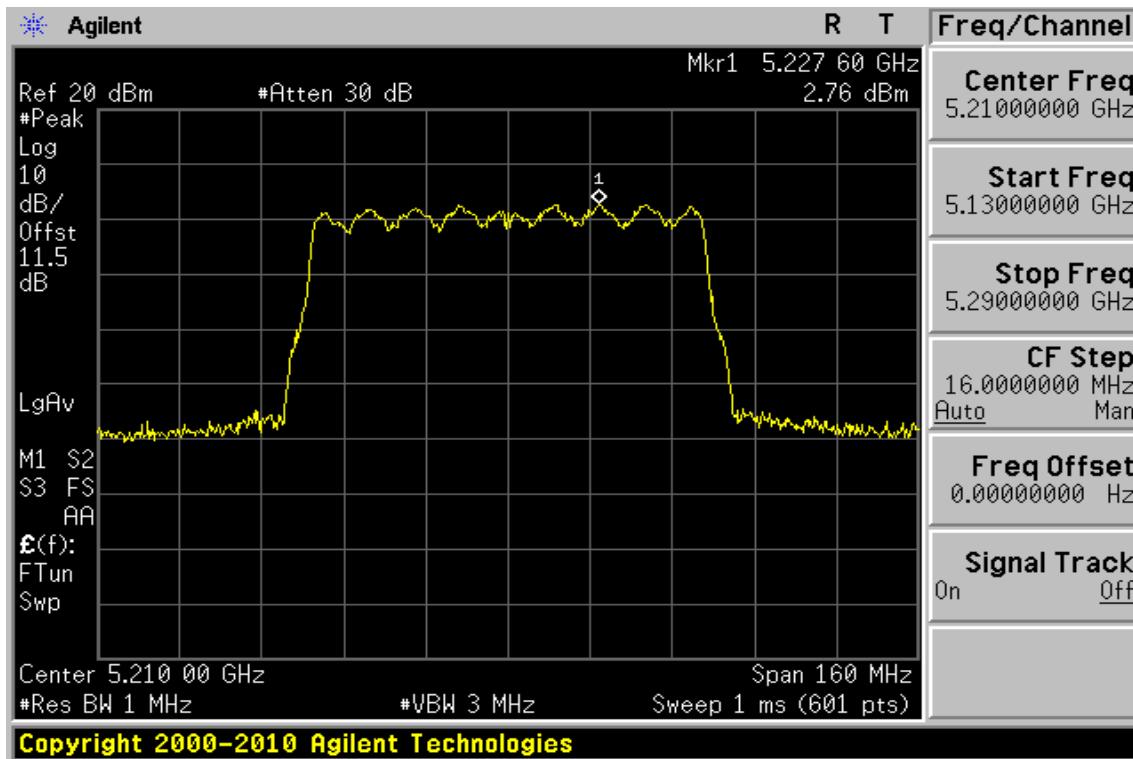
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802.11n HT40, 5150~5250 MHz, Peak Value Data Plot (CH Low 5190 MHz)



802.11ac VHT80, 5210MHz, Peak Value Data Plot (CH 5210 MHz)



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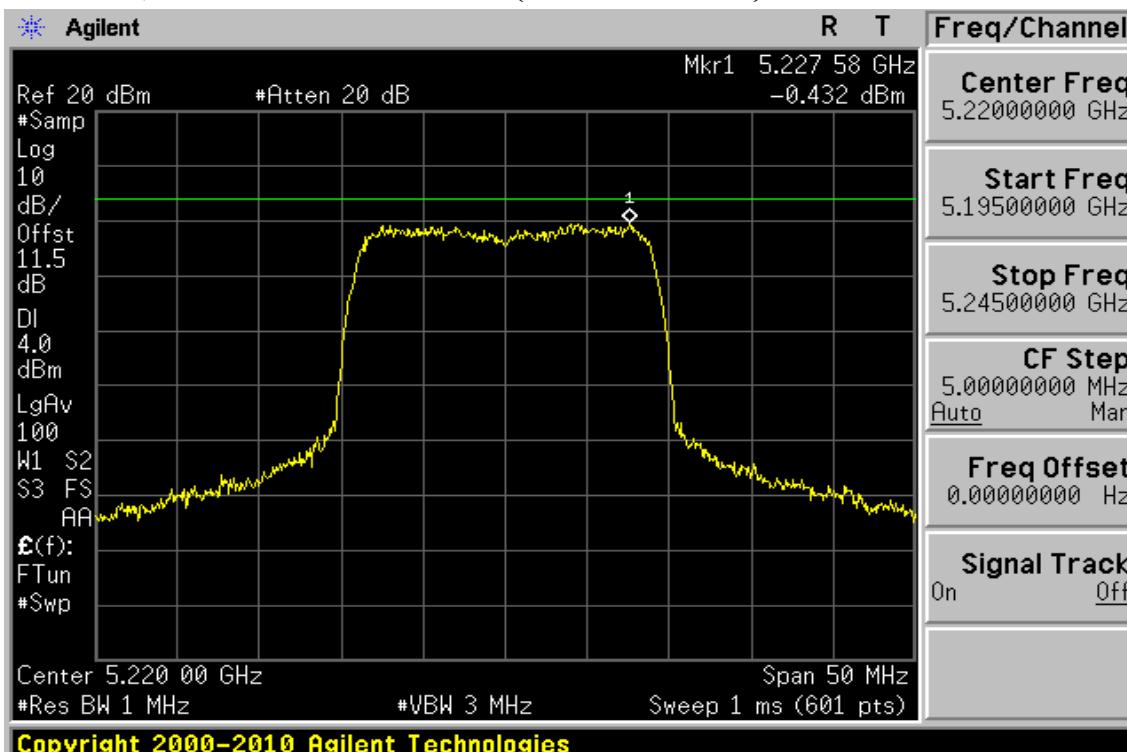
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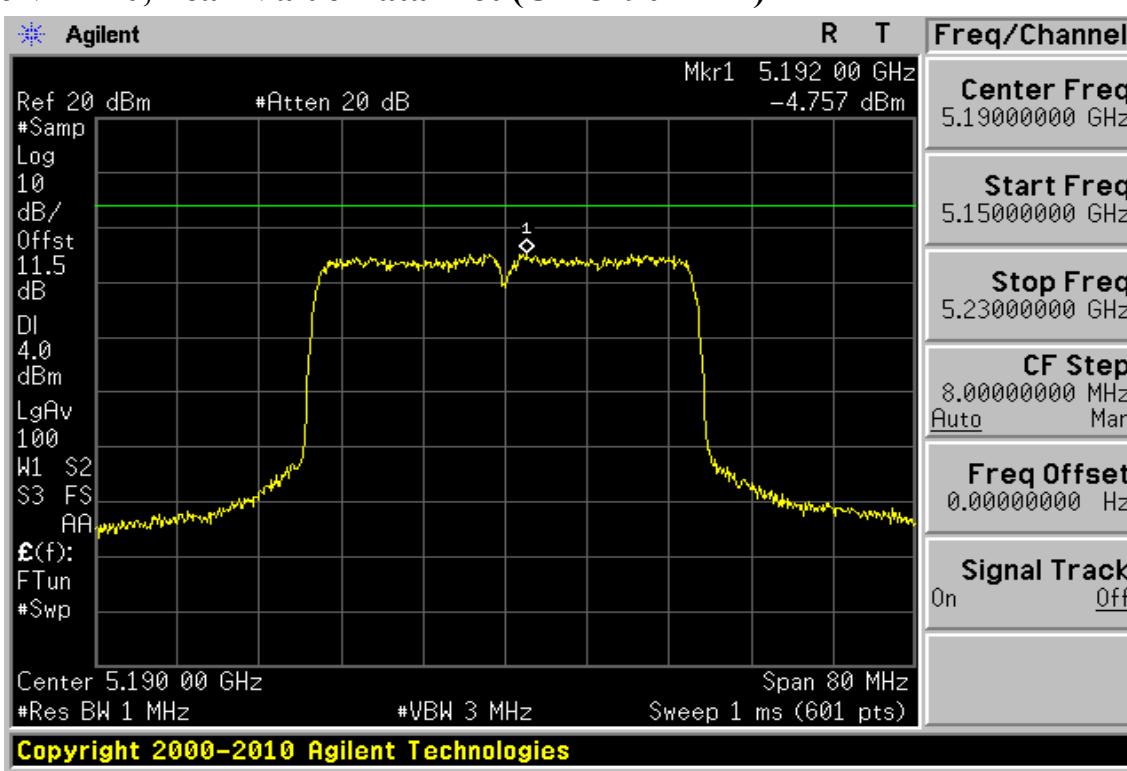
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Modulation Type: 256-QAM, Coding Rate: 5/6

802.11ac VHT20, Peak Value Data Plot (CH 5220 MHz)



802.11ac VHT40, Peak Value Data Plot (CH 5190 MHz)

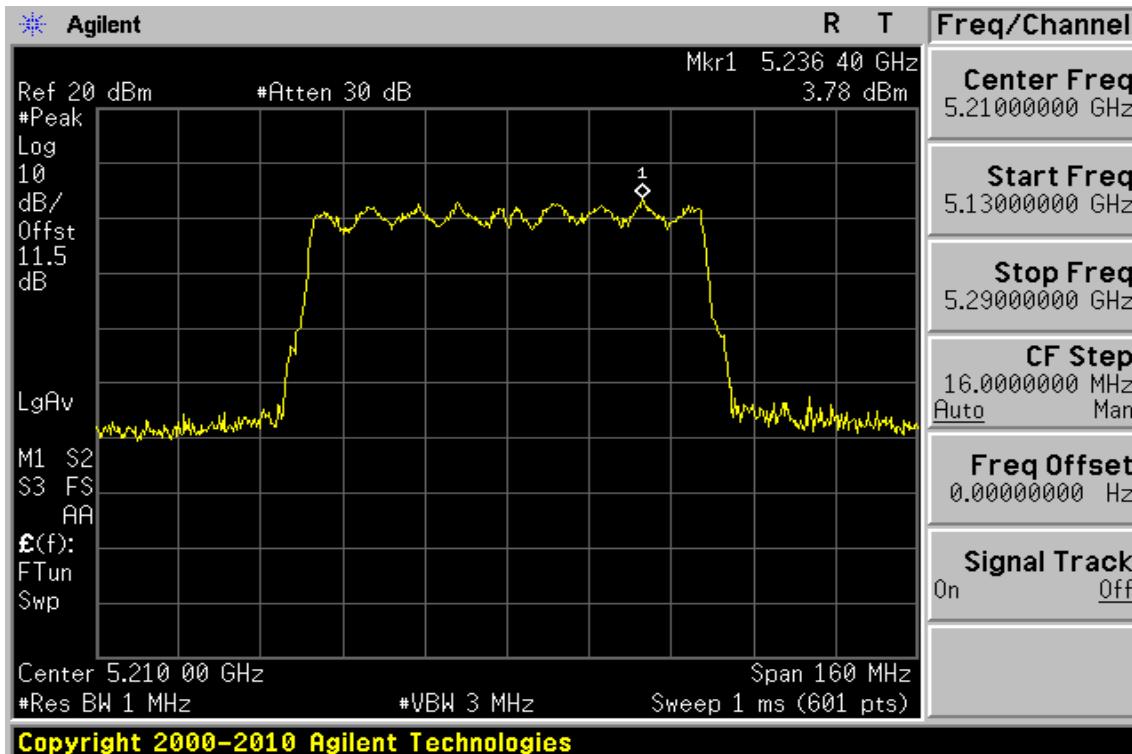


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802.11ac VHT80, Peak Value Data Plot (CH 5210 MHz)

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t (886-2) 2299-3279

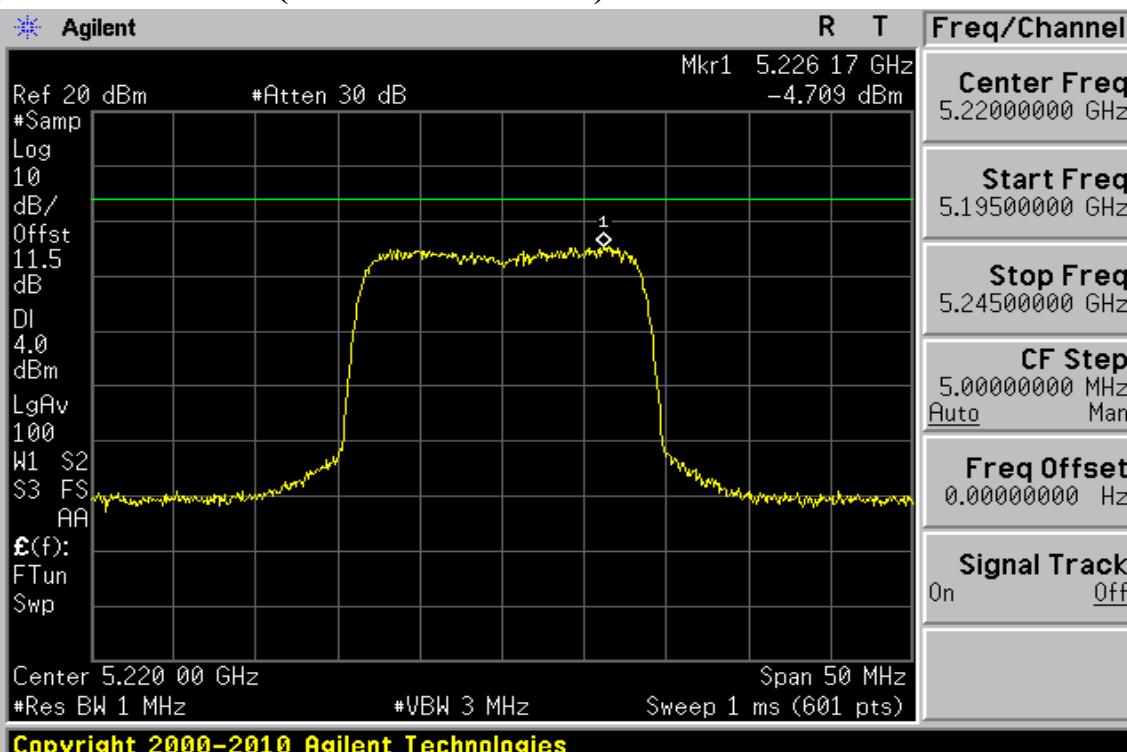
f (886-2) 2298-0488

www.tw.sgs.com

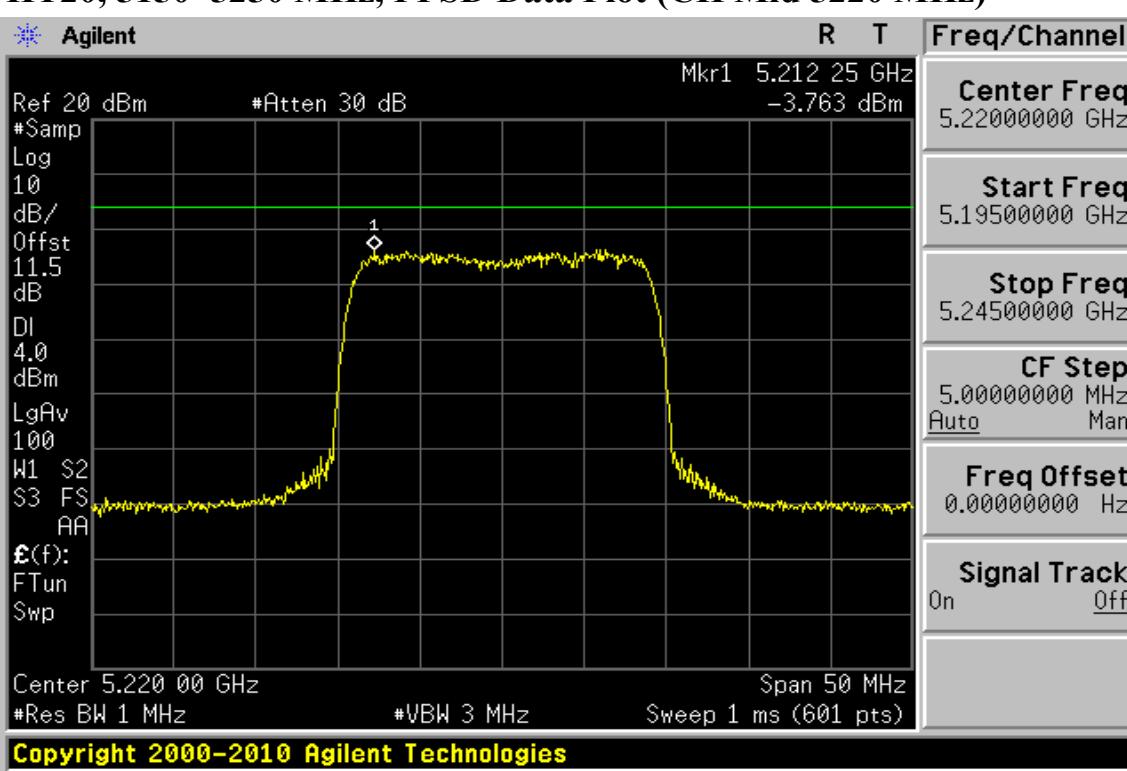
Member of SGS Group

Modulation Type: BPSK, Coding Rate: 1/2

802.11a, PPSD Data Plot (CH Mid 5220 MHz)



802.11n HT20, 5150~5250 MHz, PPSD Data Plot (CH Mid 5220 MHz)



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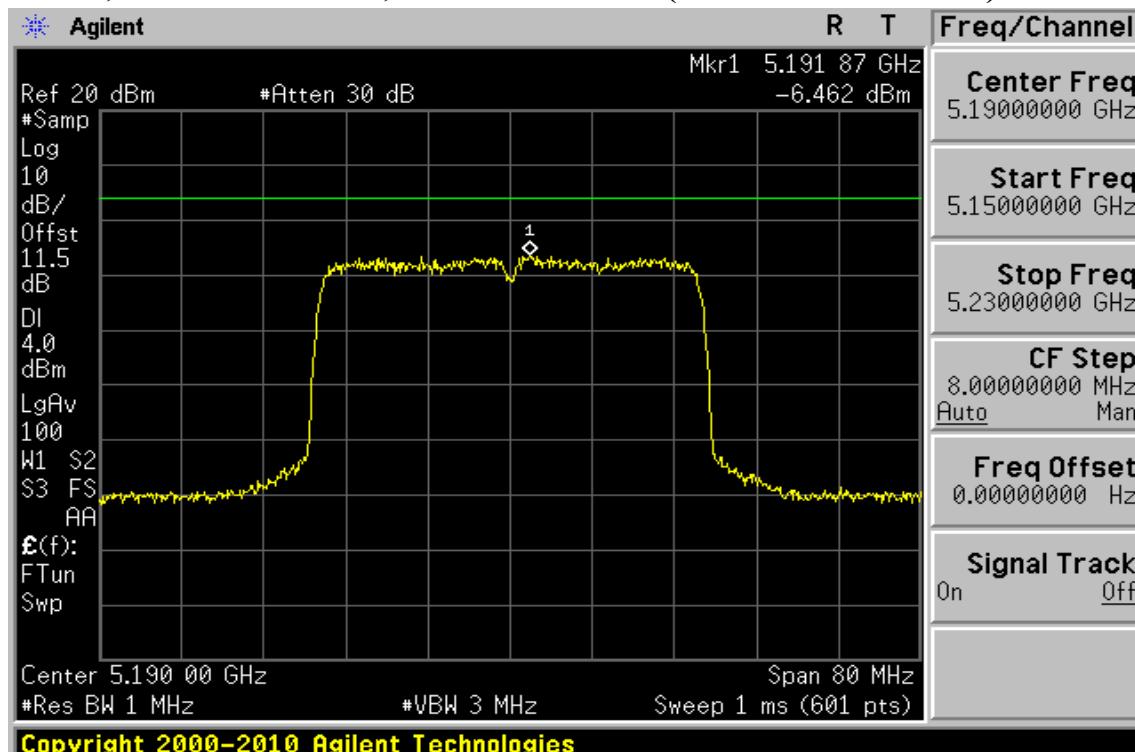
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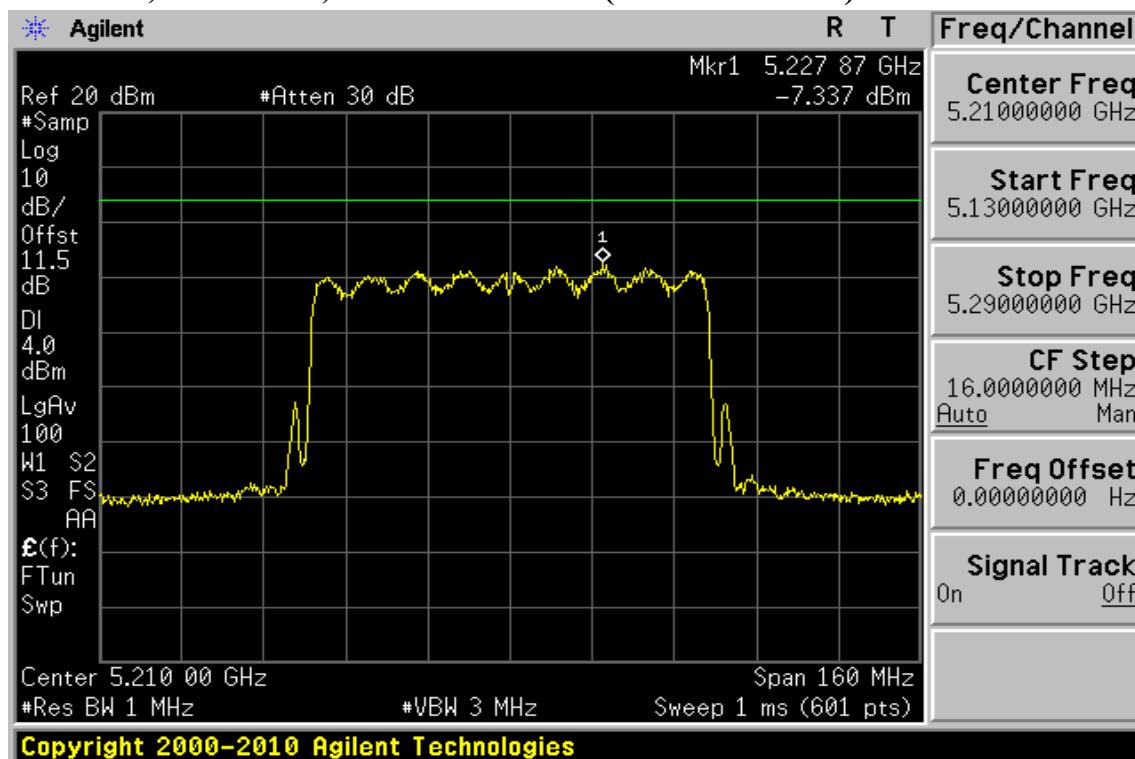
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802.11n HT40, 5150~5250 MHz, PPSD Data Plot (CH Low 5190 MHz)



802.11ac VHT80, 5210MHz, PPSD Data Plot (CH 5210 MHz)



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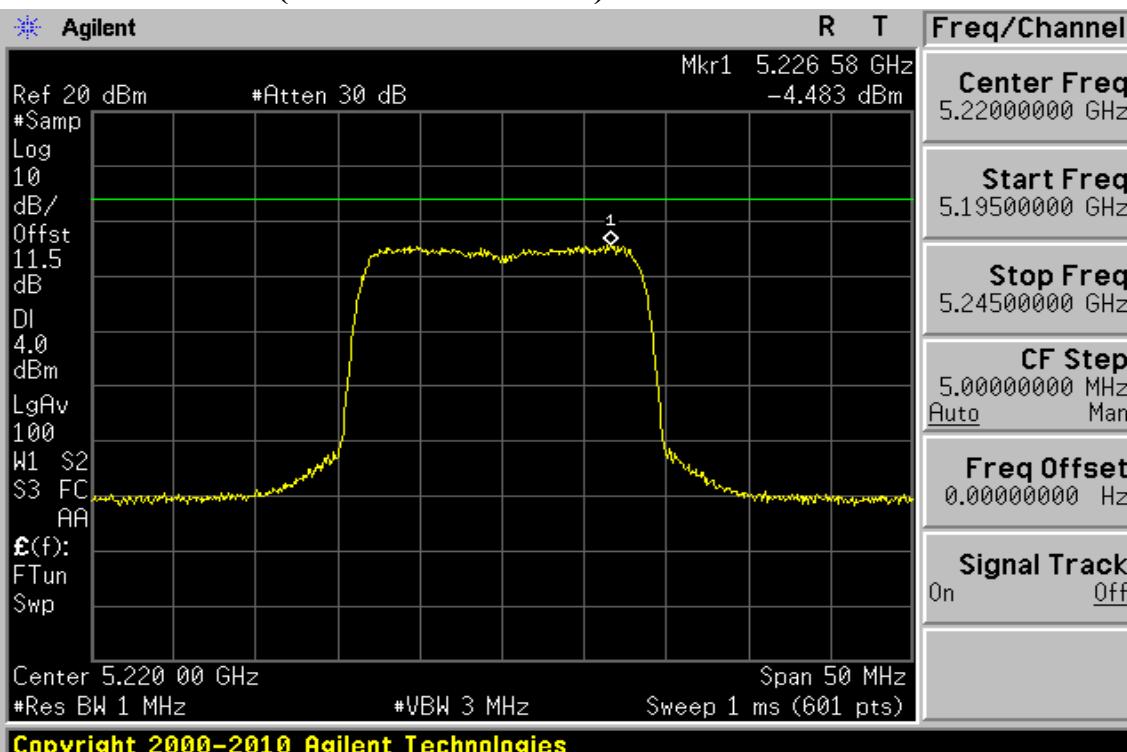
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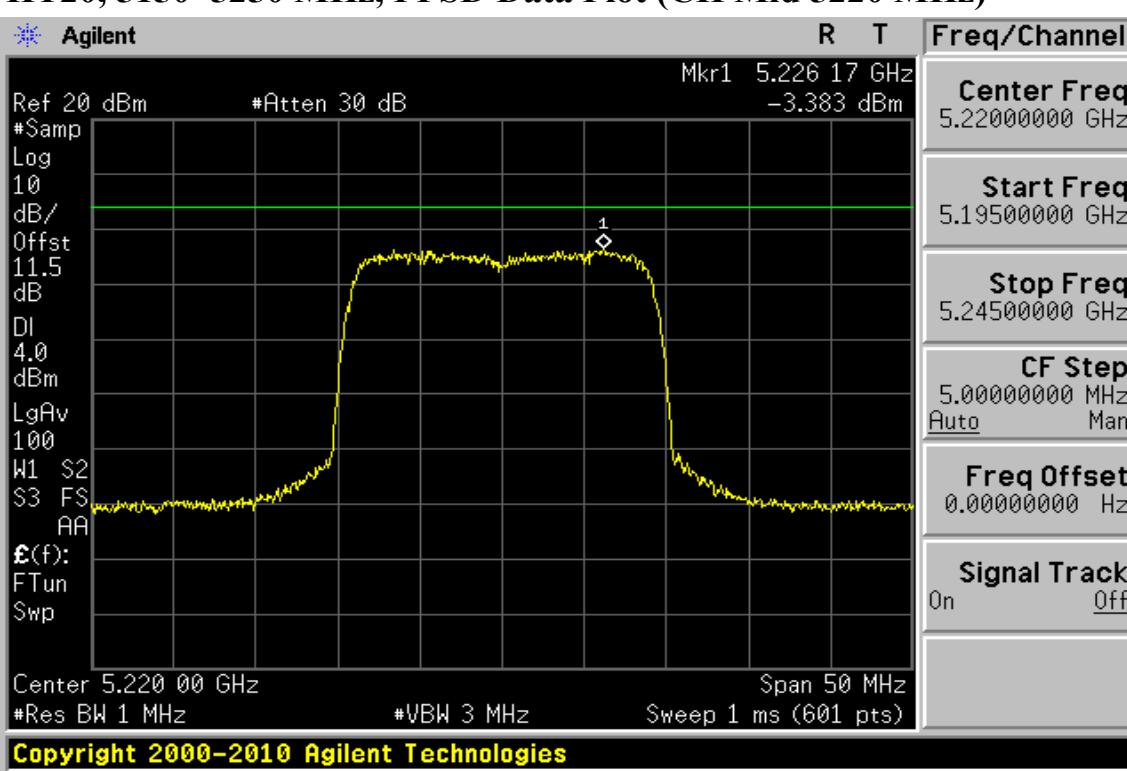
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Modulation Type: QPSK, Coding Rate: 1/2

802.11a. PPSD Data Plot (CH Mid 5220 MHz)



802.11n HT20, 5150~5250 MHz, PPSD Data Plot (CH Mid 5220 MHz)



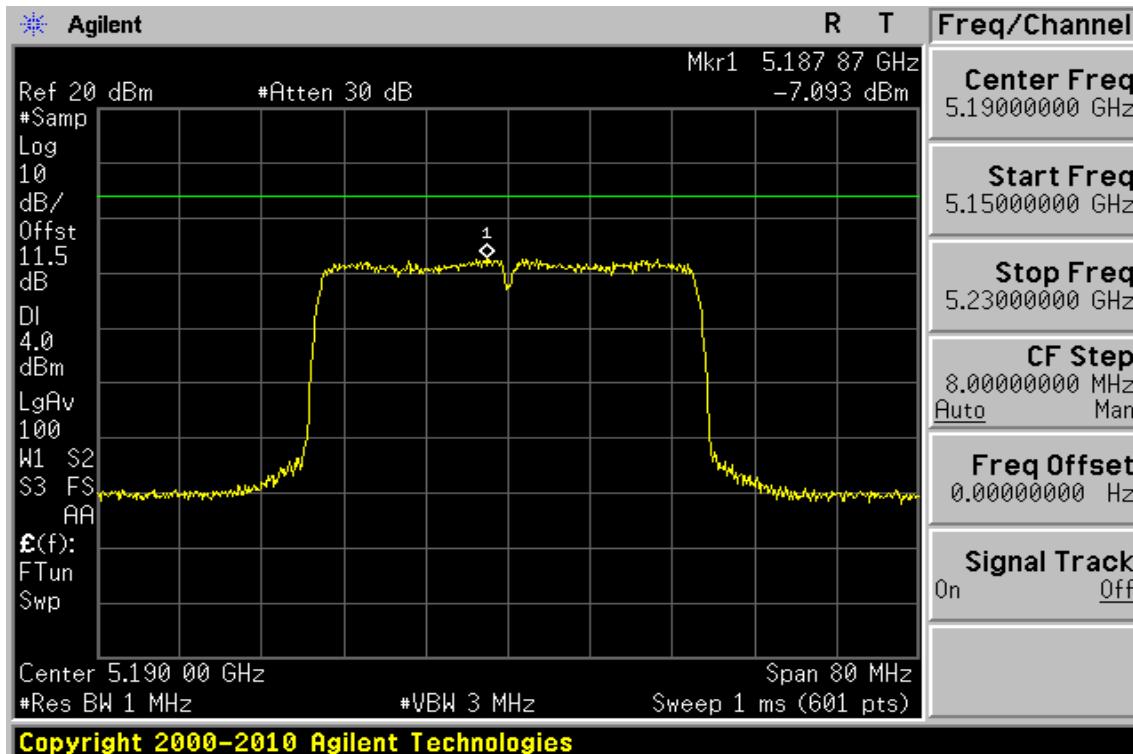
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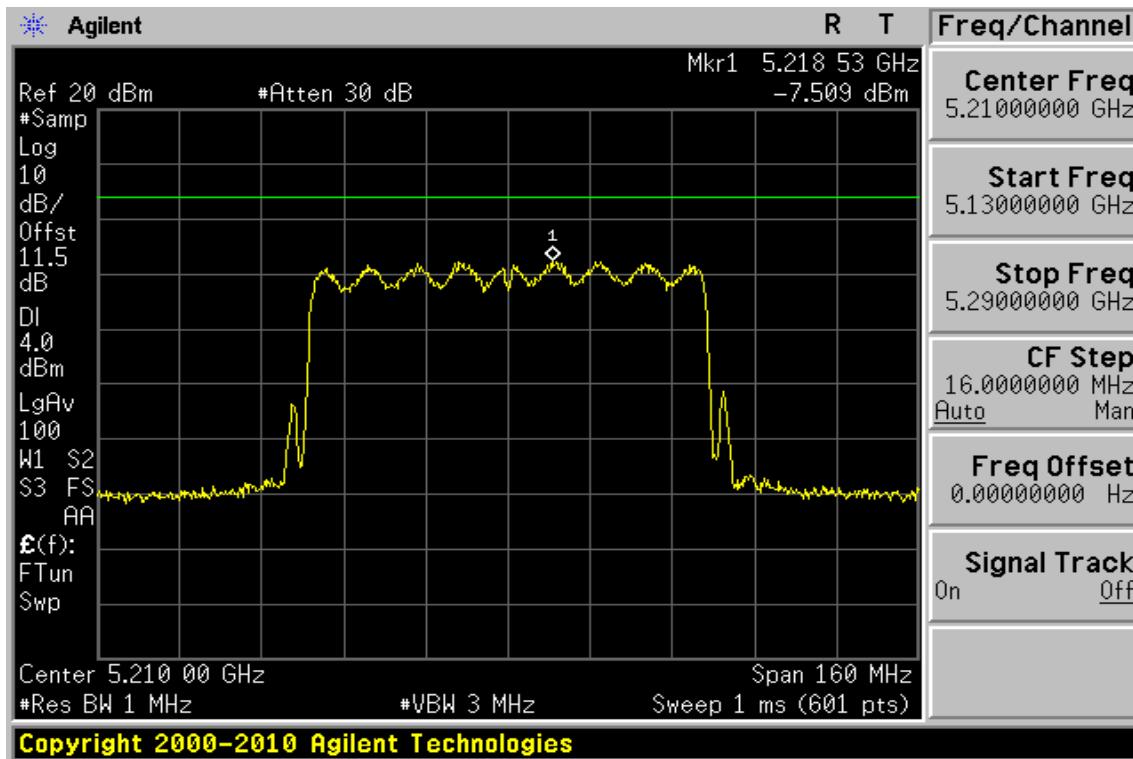
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802.11n HT40, 5150~5250 MHz, PPSD Data Plot (CH Low 5190 MHz)



802.11ac VHT80, 5210MHz, PPSD Data Plot (CH 5210 MHz)

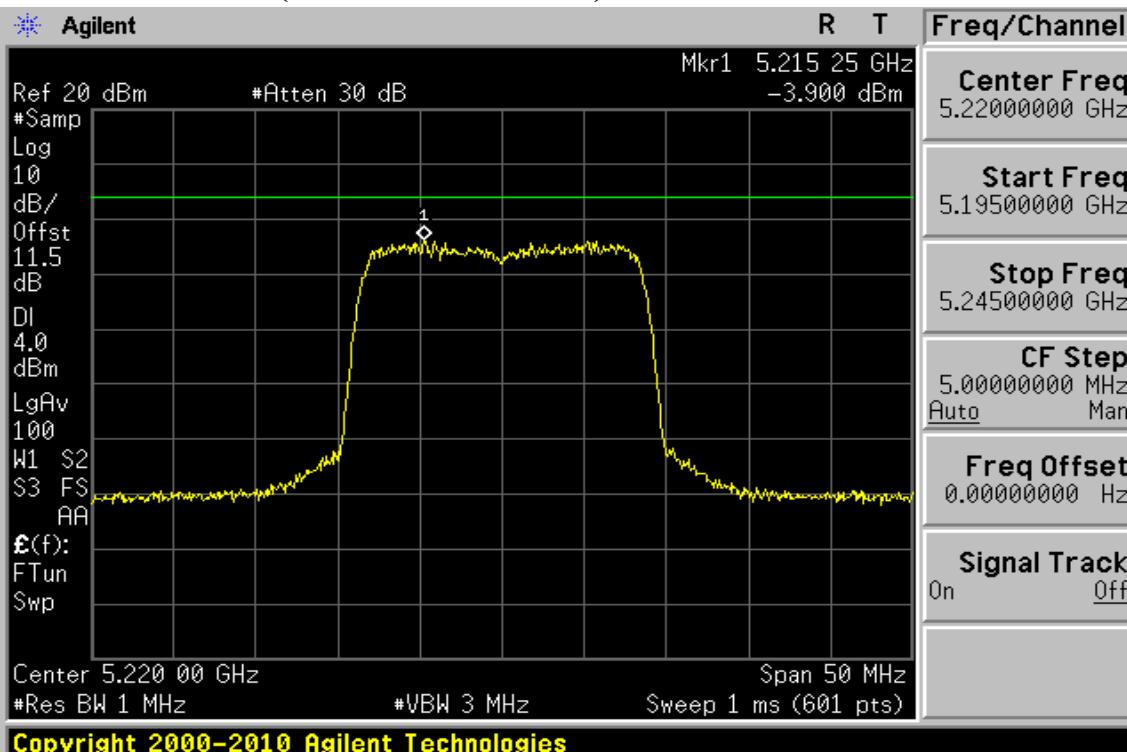
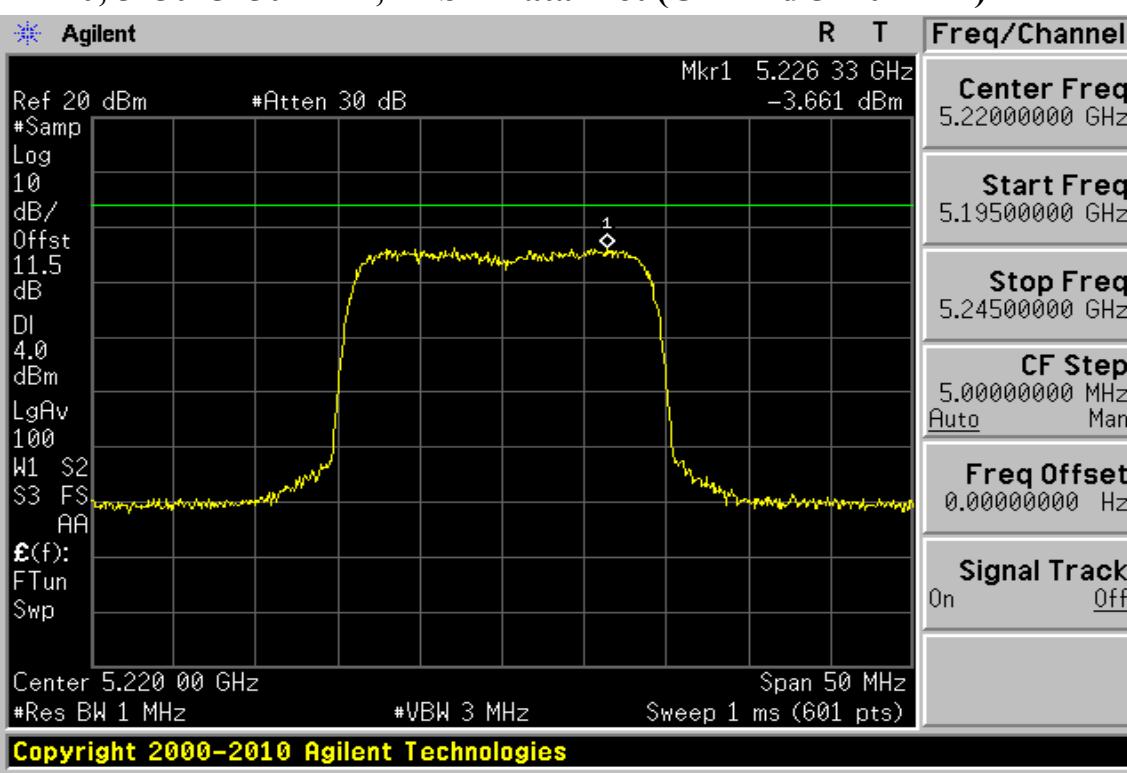


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Modulation Type: 16-QAM, Coding Rate: 1/2
802.11a, PPSD Data Plot (CH Mid 5220 MHz)

802.11n HT20, 5150~5250 MHz, PPSD Data Plot (CH Mid 5220 MHz)


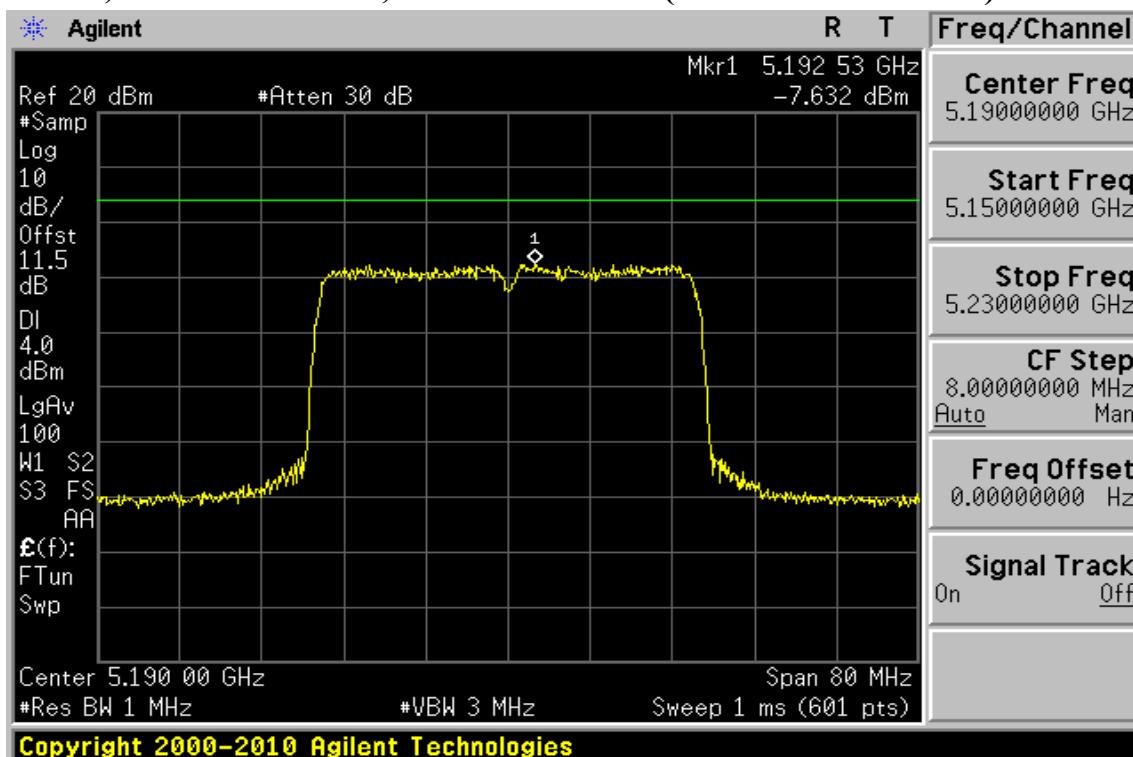
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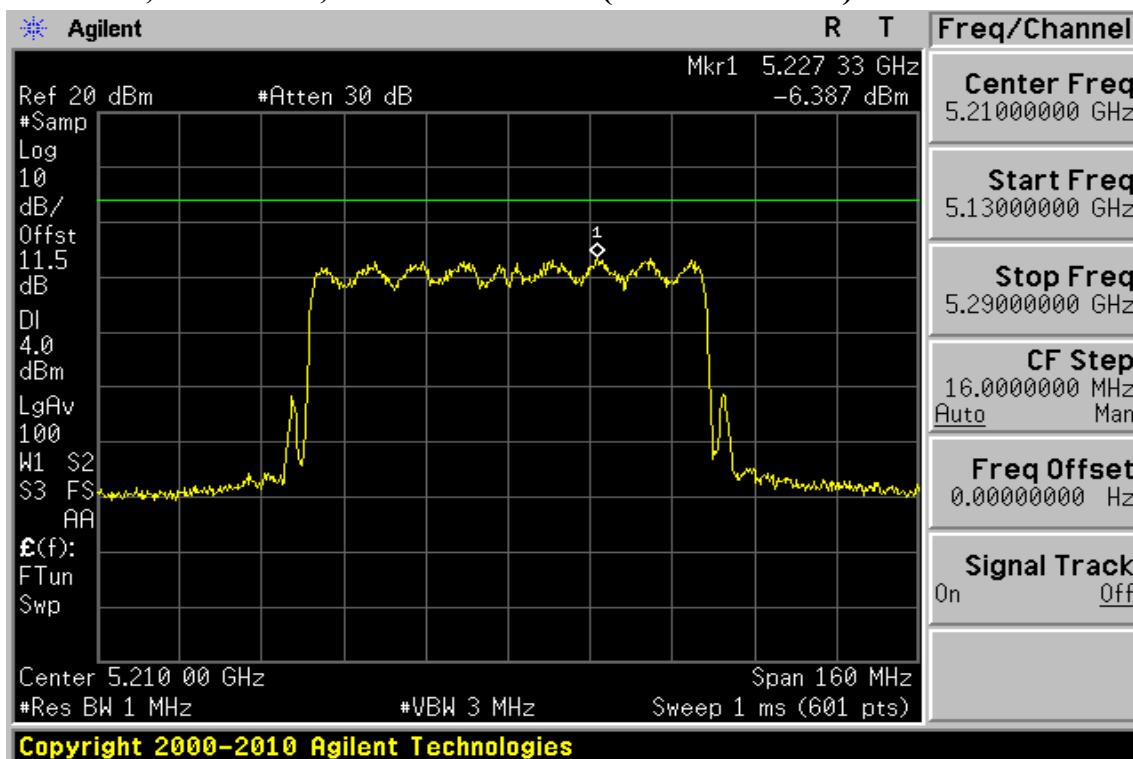
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802.11n HT40, 5150~5250 MHz, PPSD Data Plot (CH Low 5190 MHz)



802.11ac VHT80, 5210MHz, PPSD Data Plot (CH 5210 MHz)

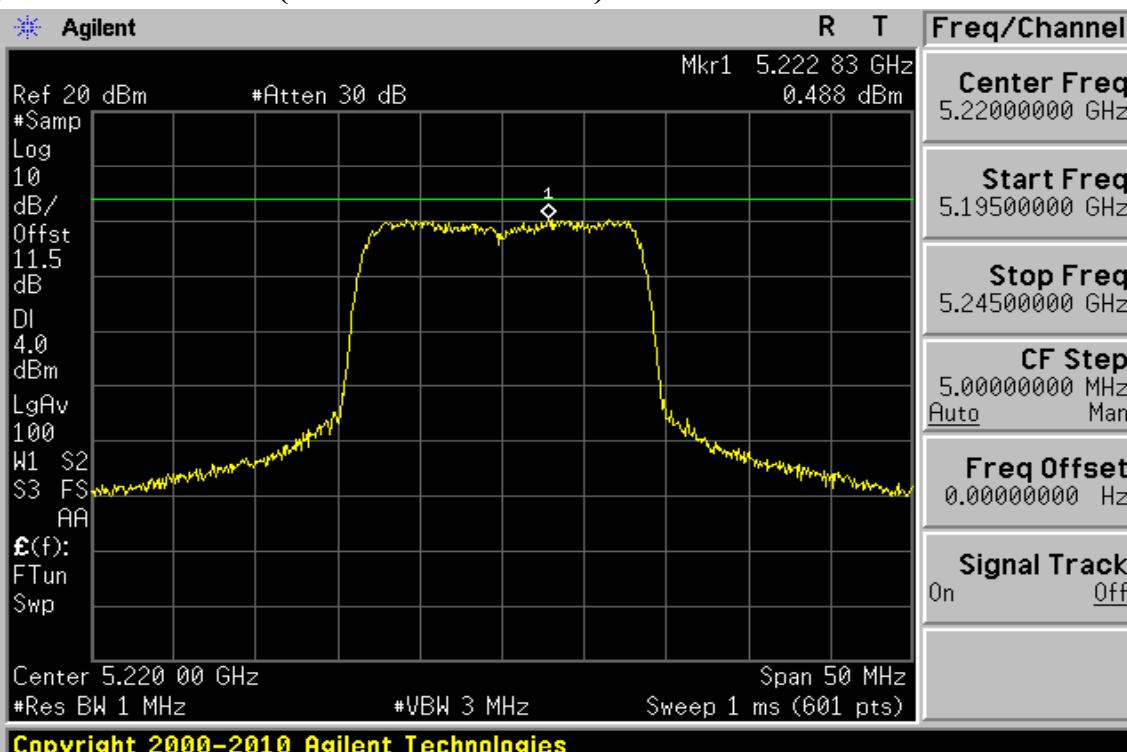


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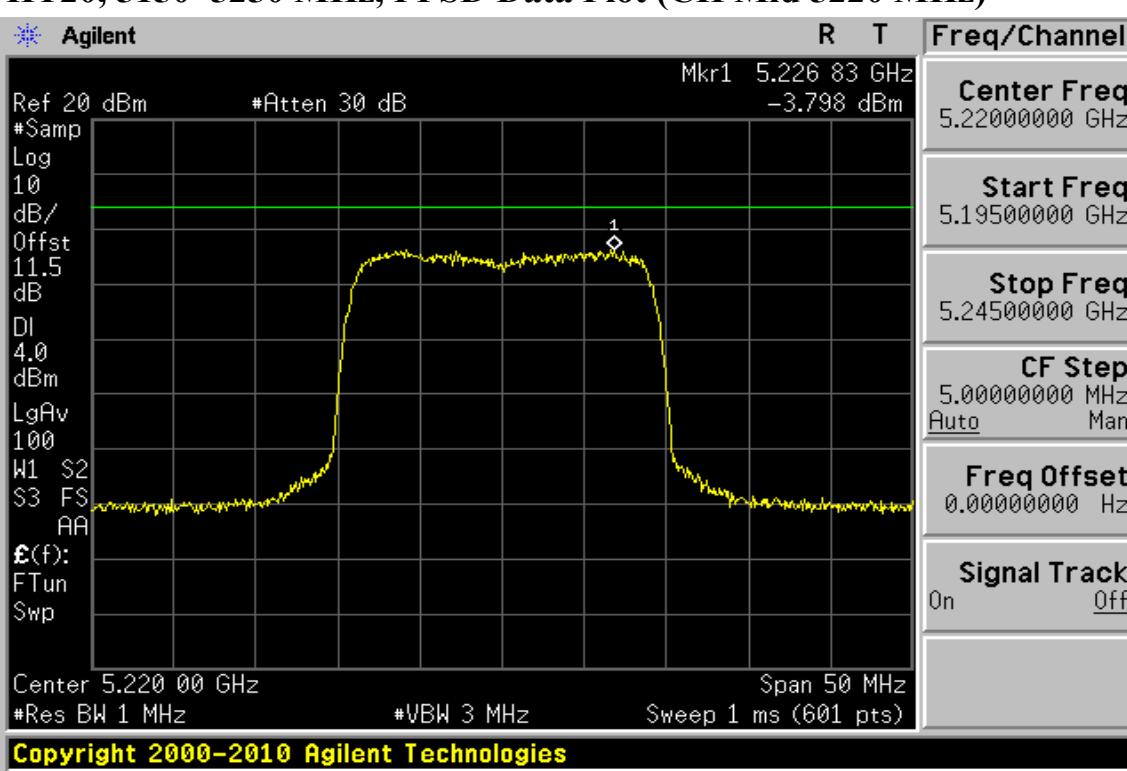
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**Modulation Type: 64-QAM, Coding Rate: 2/3
802.11a, PPSD Data Plot (CH Mid 5220 MHz)**



802.11n HT20, 5150~5250 MHz, PPSD Data Plot (CH Mid 5220 MHz)



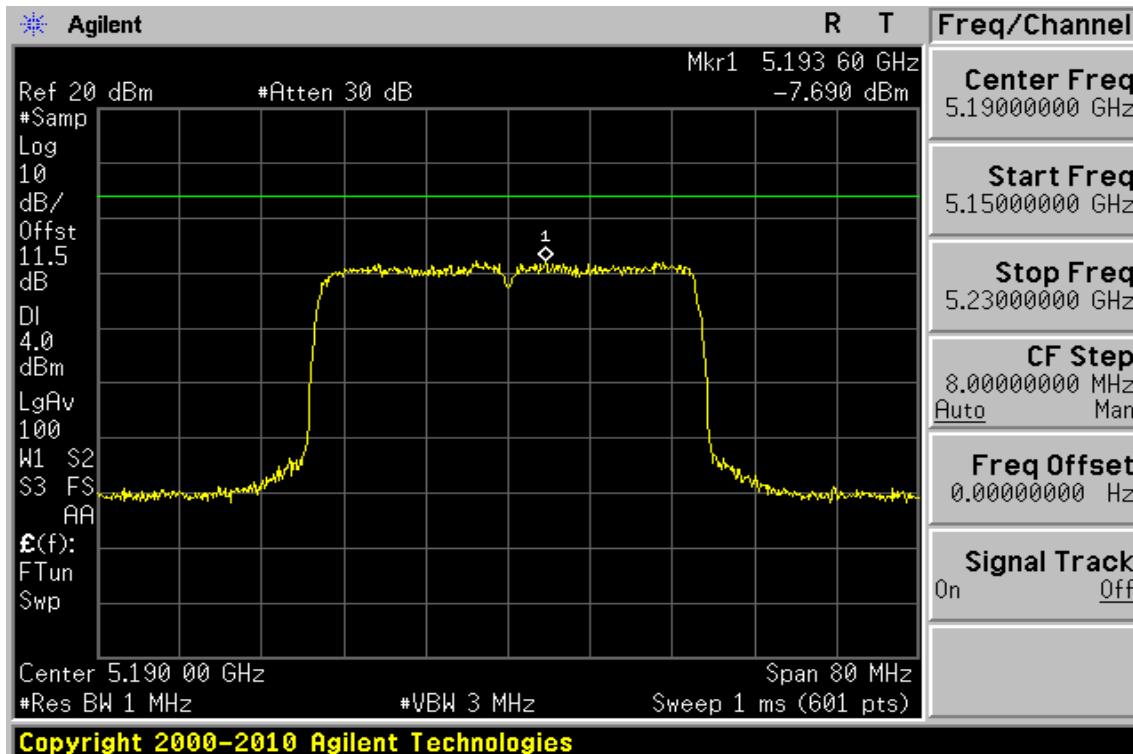
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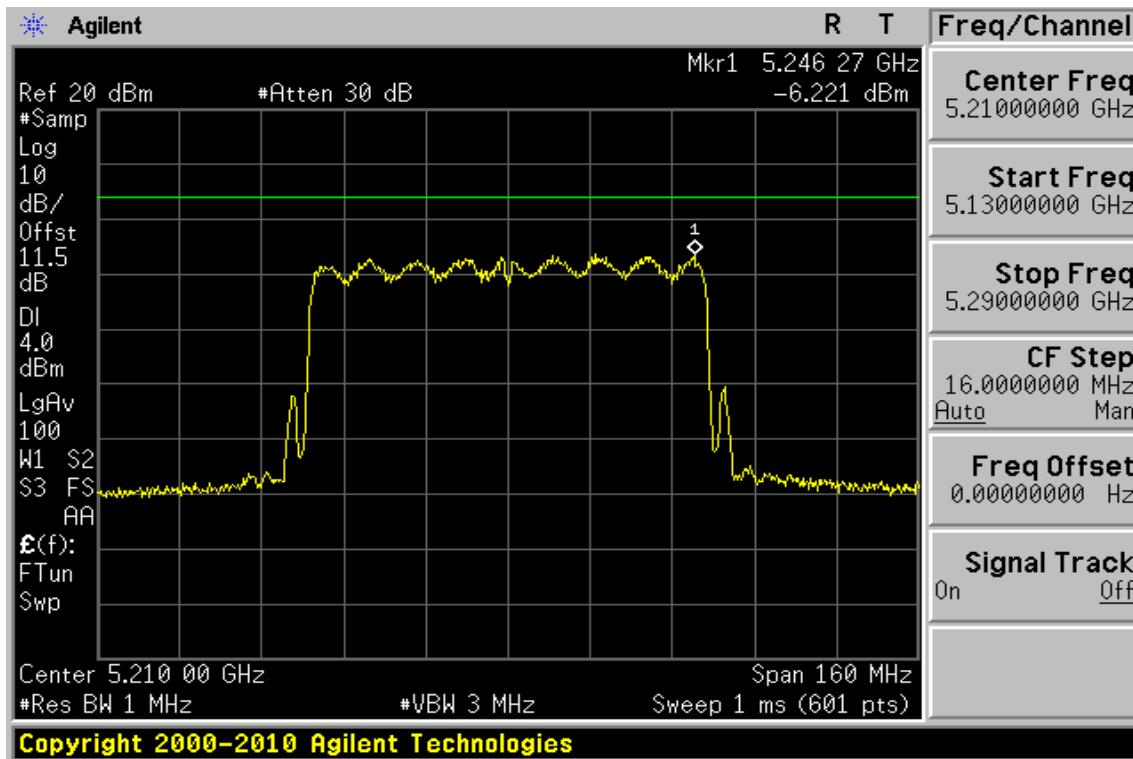
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802.11n HT40, 5150~5250 MHz, PPSD Data Plot (CH Low 5190 MHz)



802.11ac VHT80, 5210MHz, PPSD Data Plot (CH 5210 MHz)



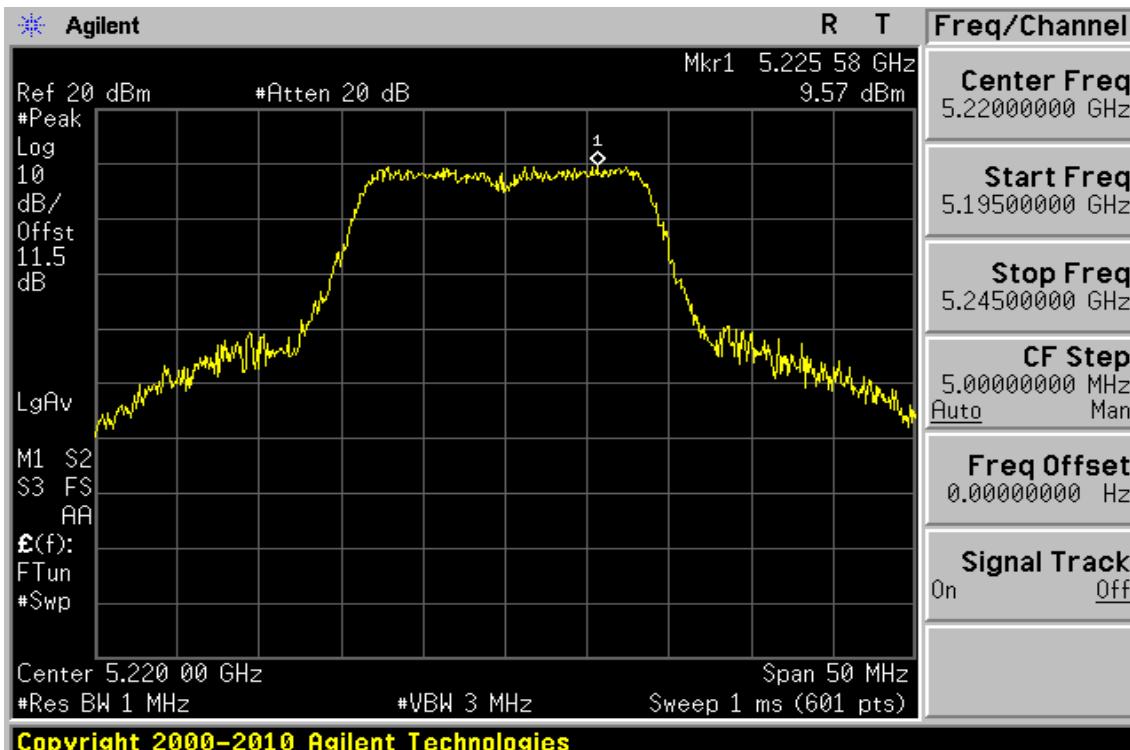
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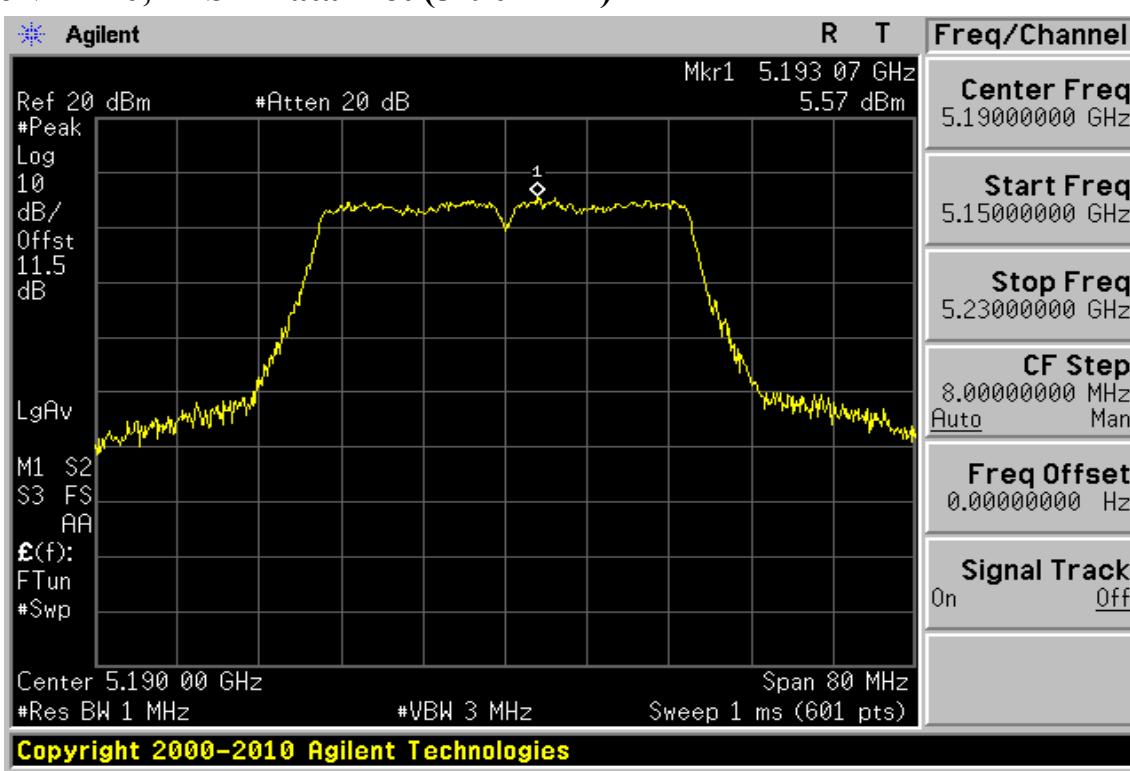
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Modulation Type: 256-QAM, Coding Rate: 5/6 802.11ac VHT20, PPSD Data Plot (5220 MHz)



802.11ac VHT20, PPSD Data Plot (5190 MHz)

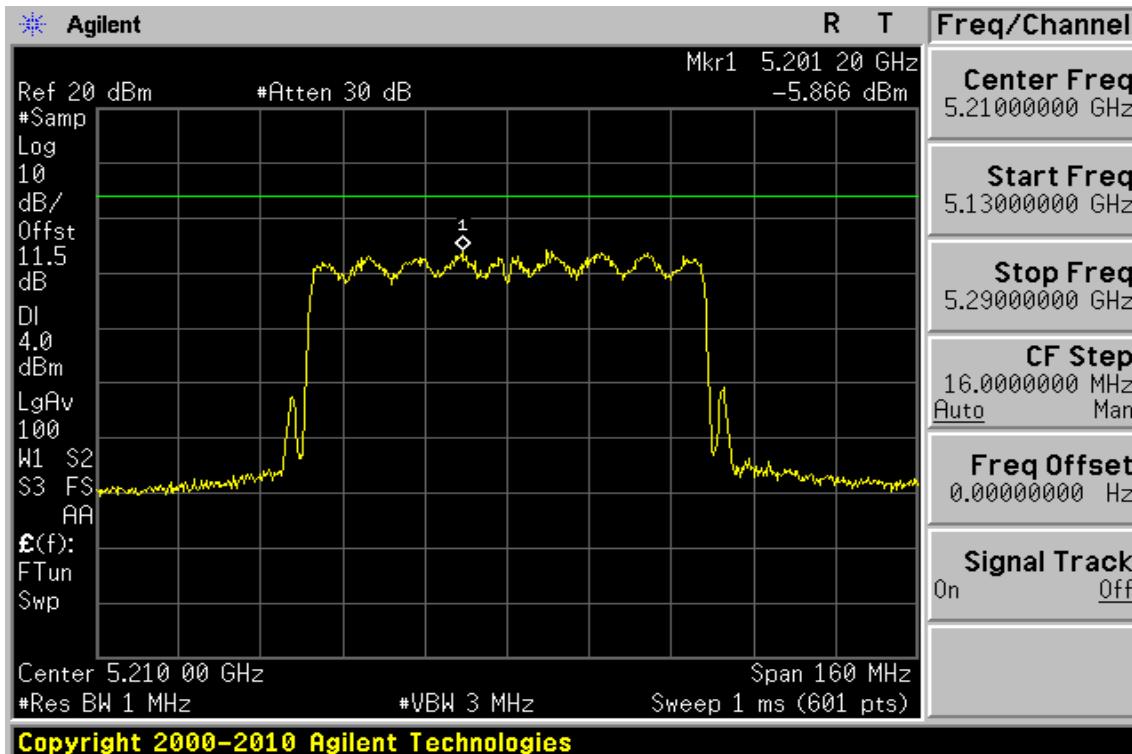


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802.11ac VHT80, PPSD Data Plot (CH 5210 MHz)

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11. UNDESIRABLE EMISSION - CONDUCTED MEASUREMENT

11.1 Standard Applicable

According to §15.407(b),

(b) Undesirable Emission Limits: Except as shown in Paragraph (b)(6) of this section, the peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (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.
- (2) For transmitters operating in the 5.25-5.35 GHz band: all emissions outside of the 5.15-5.35 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.
- (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.
- (4) The above emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

11.2 Measurement Procedure

Conducted Emission:

1. To connect Antenna Port of EUT to Spectrum.
2. Set RBW = 100 kHz, VBW = 300 kHz while frequency of the measurement is swept below 1GHz, RBW = 1MHz & VBW = 3MHz while frequency of the measurement is swept above 1GHz on Spectrum. Detector = Peak, set DL as the limit line to -27dBm, add the offset = 4.7dB for frequency below 1GHz, and 2dB or nominal gain of UE for frequency above 1GHz (if gain of UE is less than 2dBi, offset = 2 otherwise offset = nominal gain.)
3. Sweep the frequency to determine spurious emission as seen on spectrum from span of 30 to 1G, 1G to 3G, 3G to 6G, 6G to 13G, 13G to 18G, 18G to 26.5G and 26.5G to 40GHz
4. Via Software, combine 6 spans of frequency range into one plot

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Conducted RF measurements of the transmitter output were made at the band edges and the adjacent restricted bands.

Also, conducted RF measurements of the transmitter output over the 30 MHz to 40 GHz band were made in order to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

Note: the spike on the spectrum is the fundamental emission that does not account for the test outside the frequency band as required by associative regulatory provision.

Offset = Cable loss + Attenuator + Gain Factor = 1.5dB + 10dB + 4.7 dBi (below 1G, and above 1G)

11.3 Measurement Equipment Used:

Refer to section 7.3 for details.

11.4 Test Set-up:

Refer to section 7.4 for details.

11.5 Measurement Result:

Refer to next page for plots.

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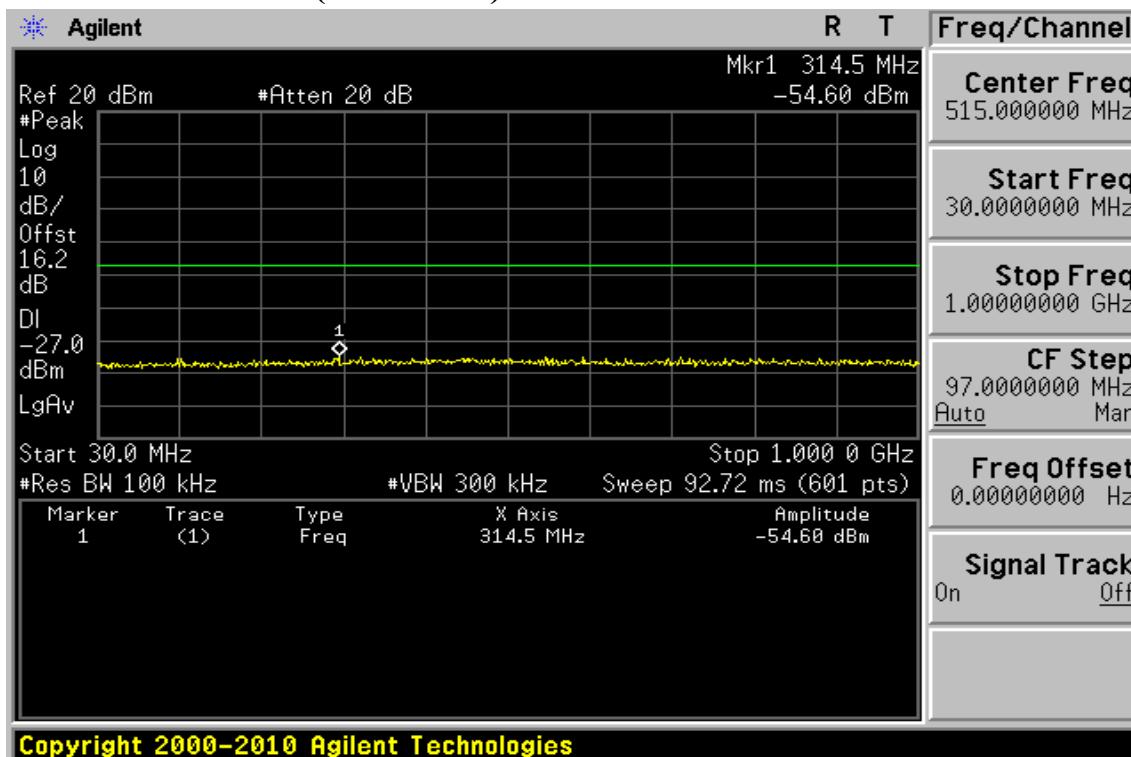
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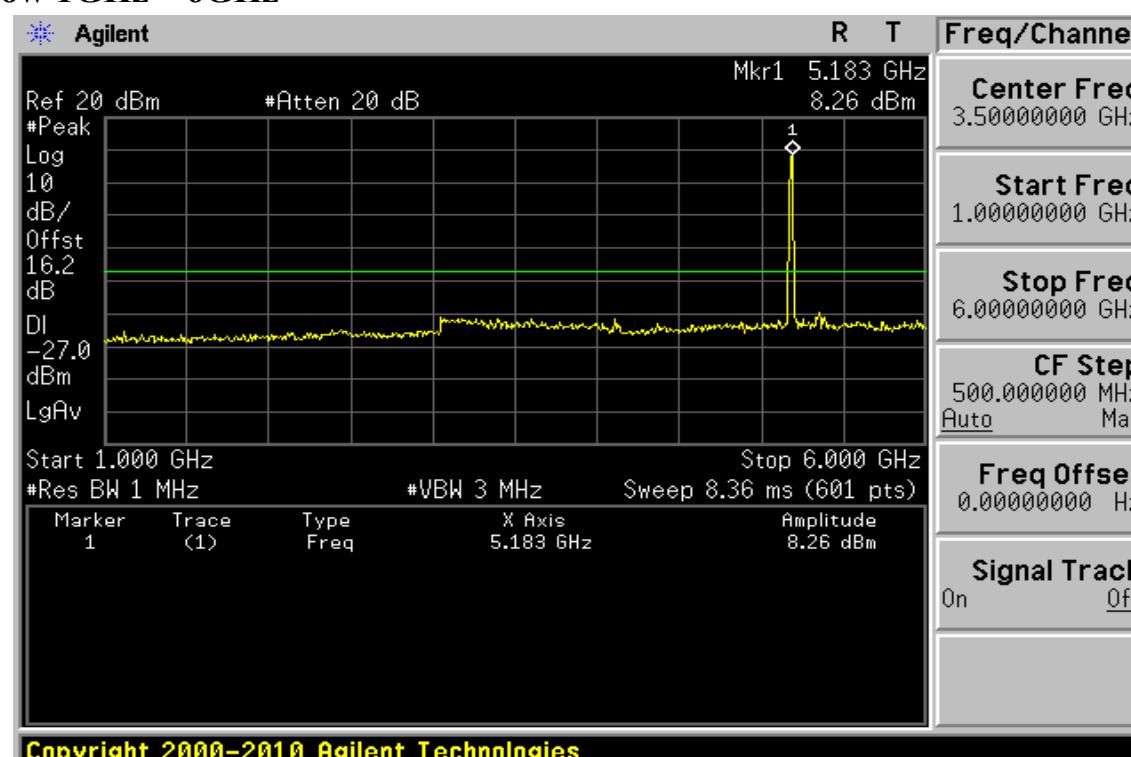
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802.11a, 5150~5250 MHz

Ch Low 30MHz – 1GHz (5180 MHz)



Ch Low 1GHz – 6GHz



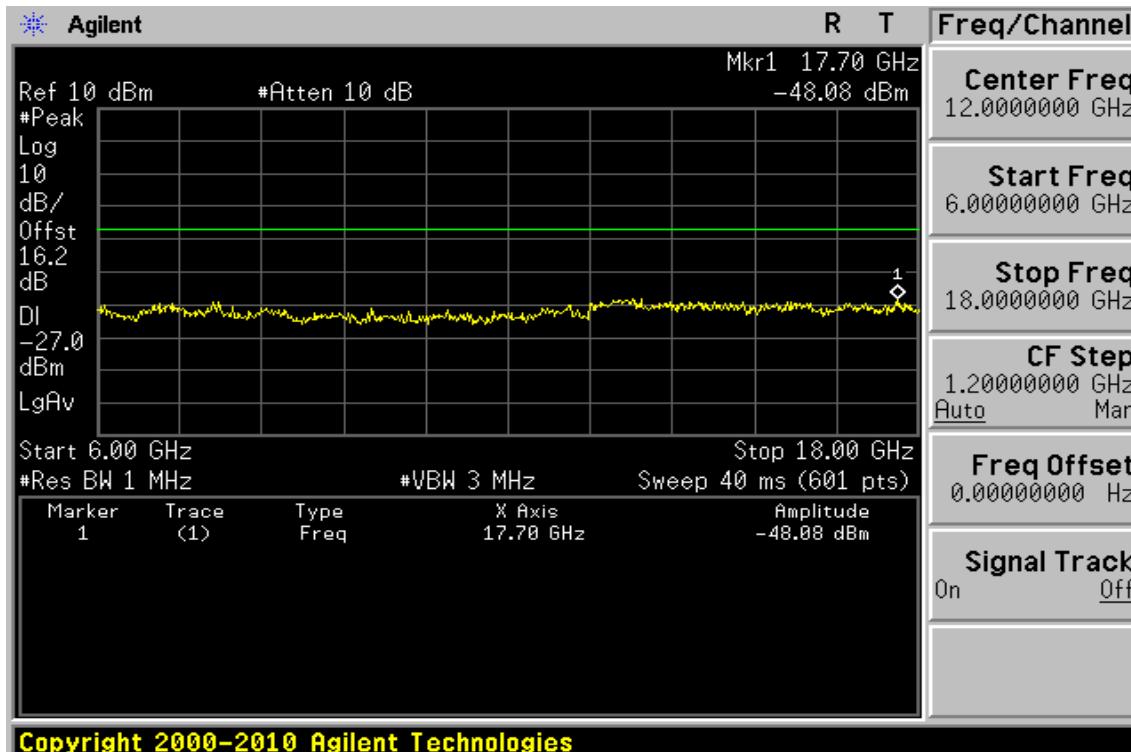
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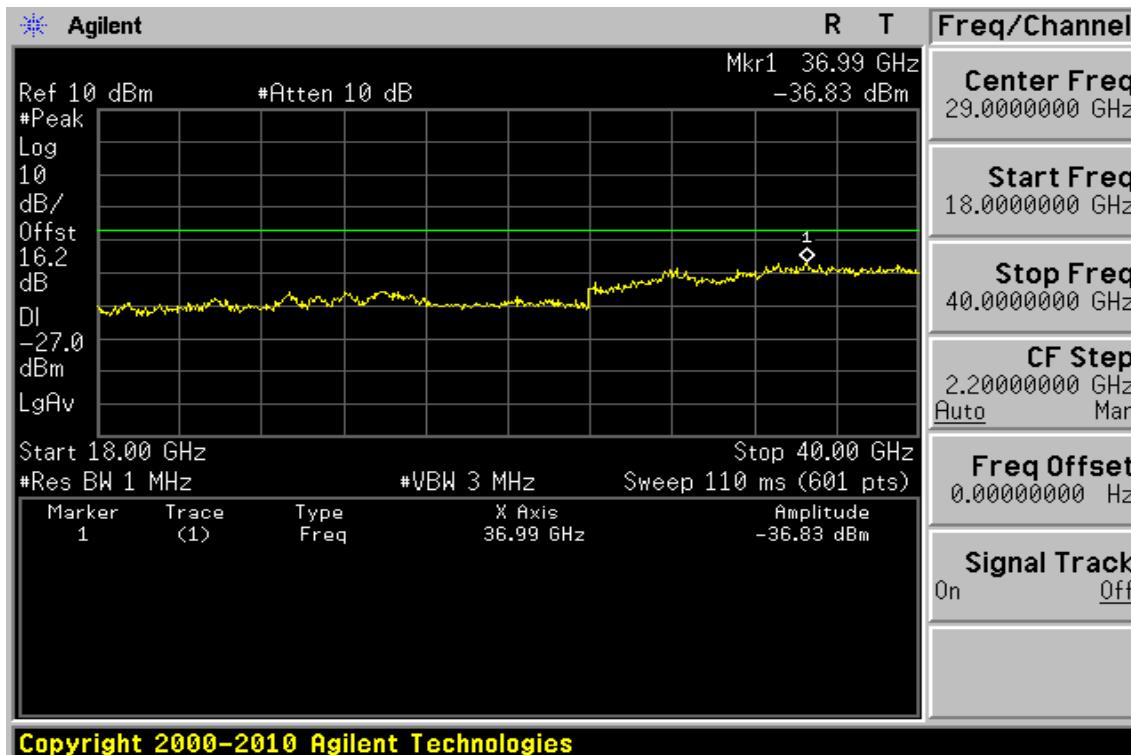
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Ch Low 6GHz – 18GHz



Ch Low 18GHz – 40GHz



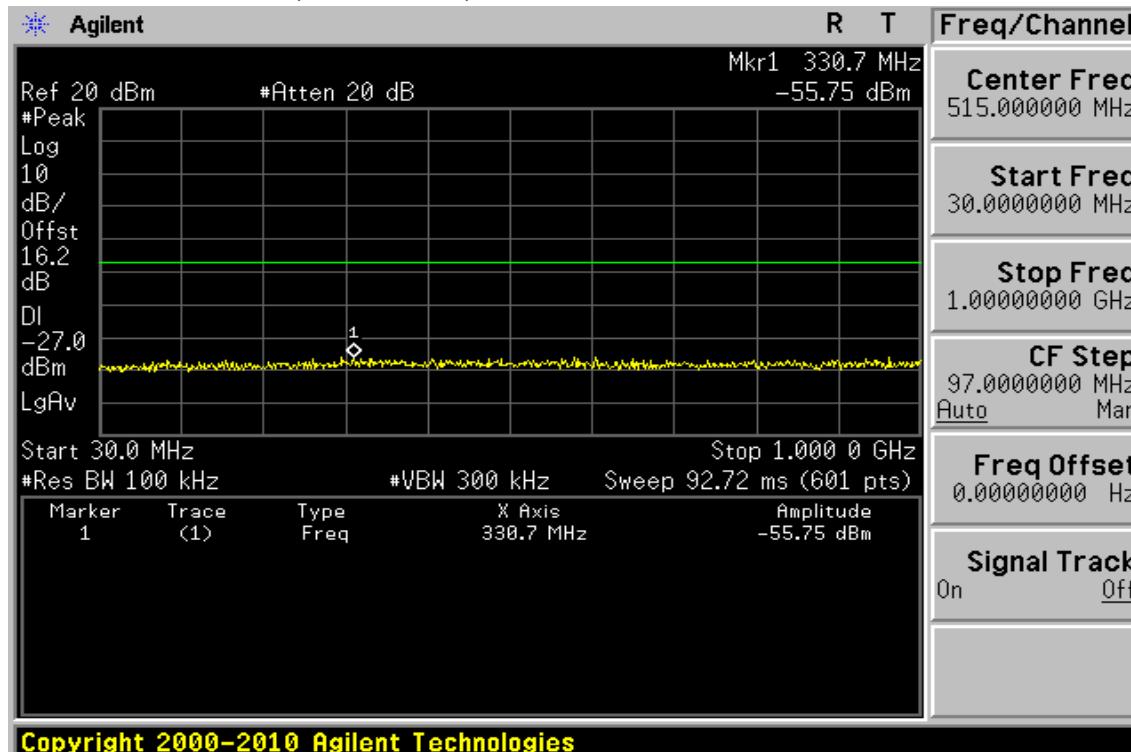
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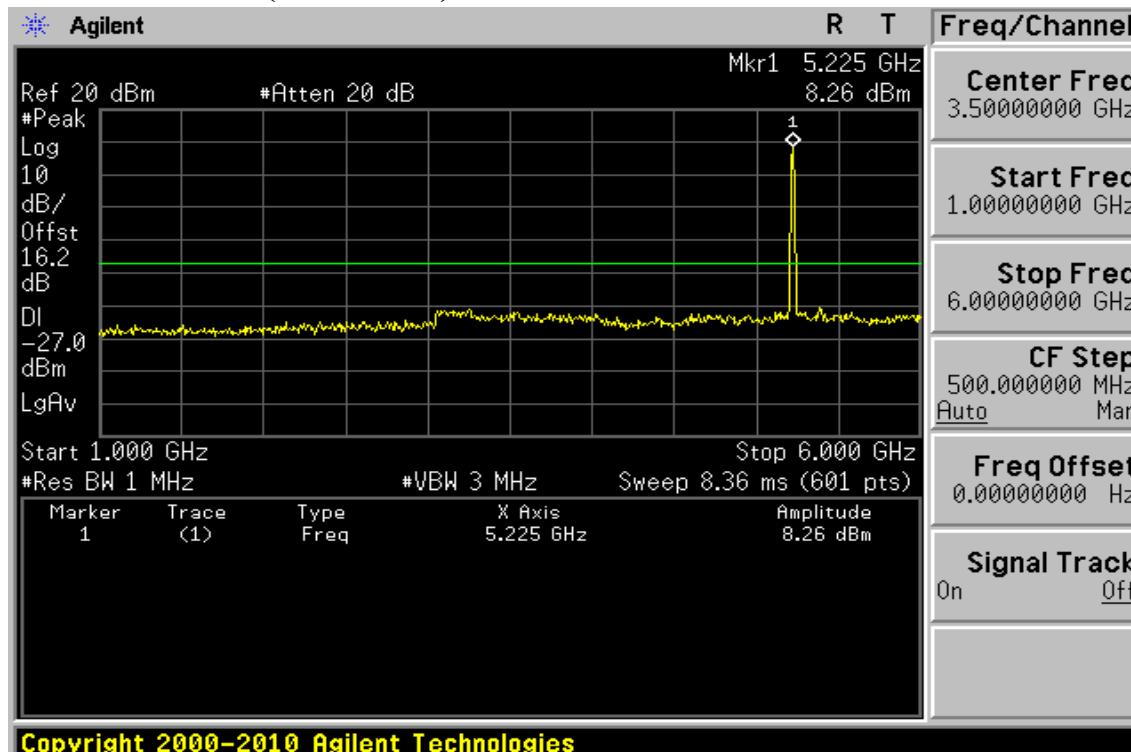
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Ch Mid 30MHz – 1GHz (5220 MHz)



Ch Mid 1GHz – 6GHz (5220 MHz)



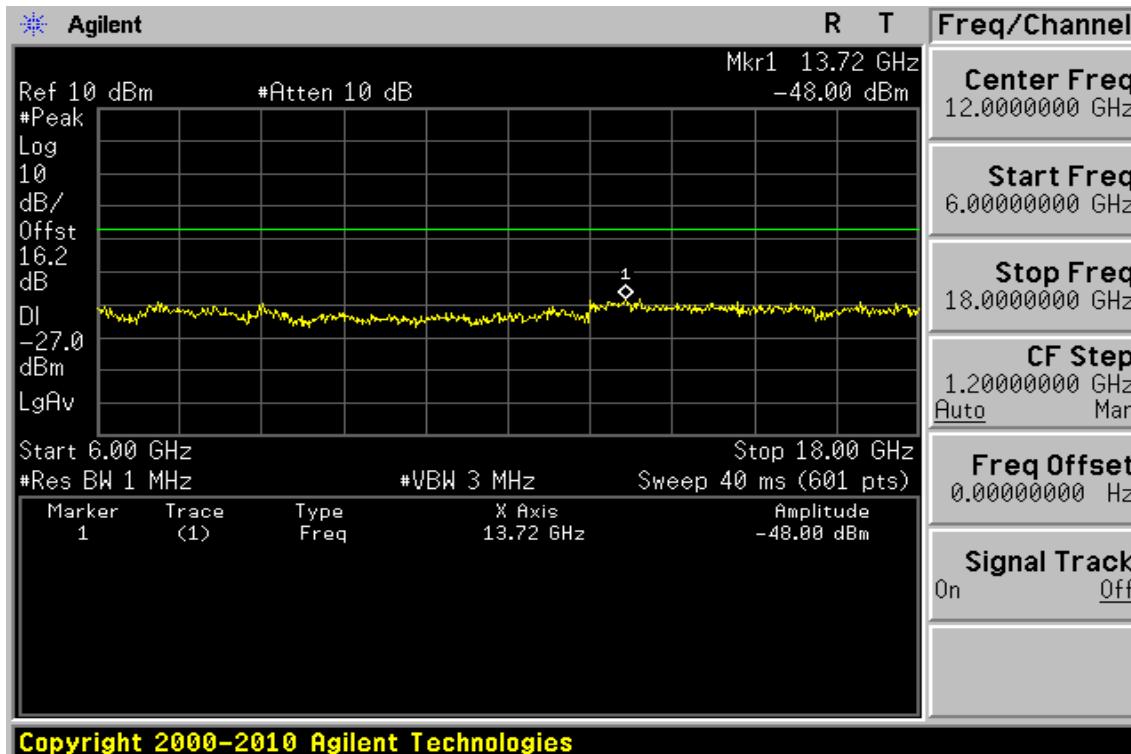
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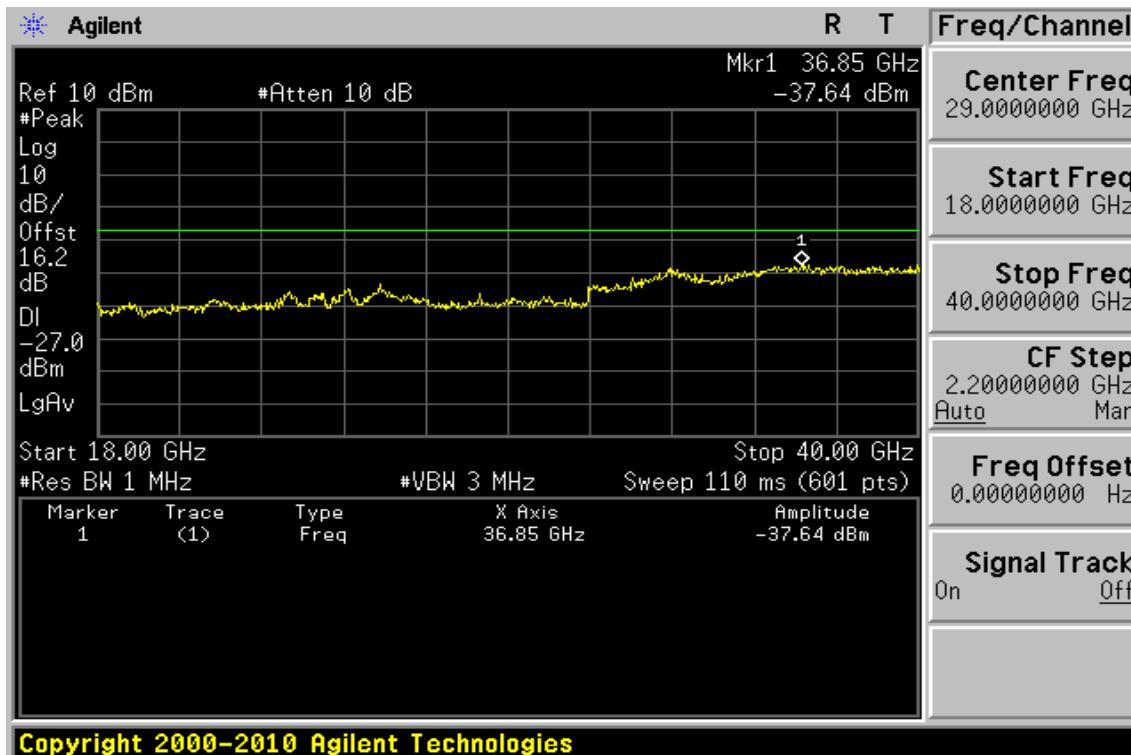
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Ch Mid 6GHz – 18GHz



Ch Mid 18GHz – 40GHz



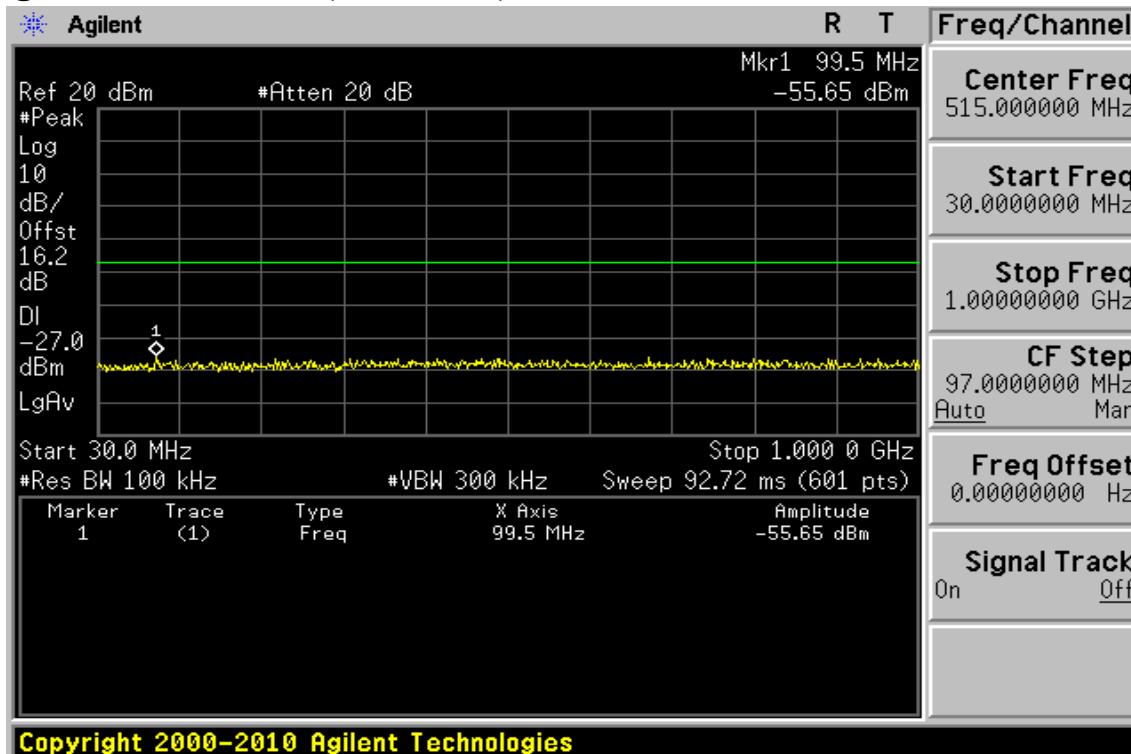
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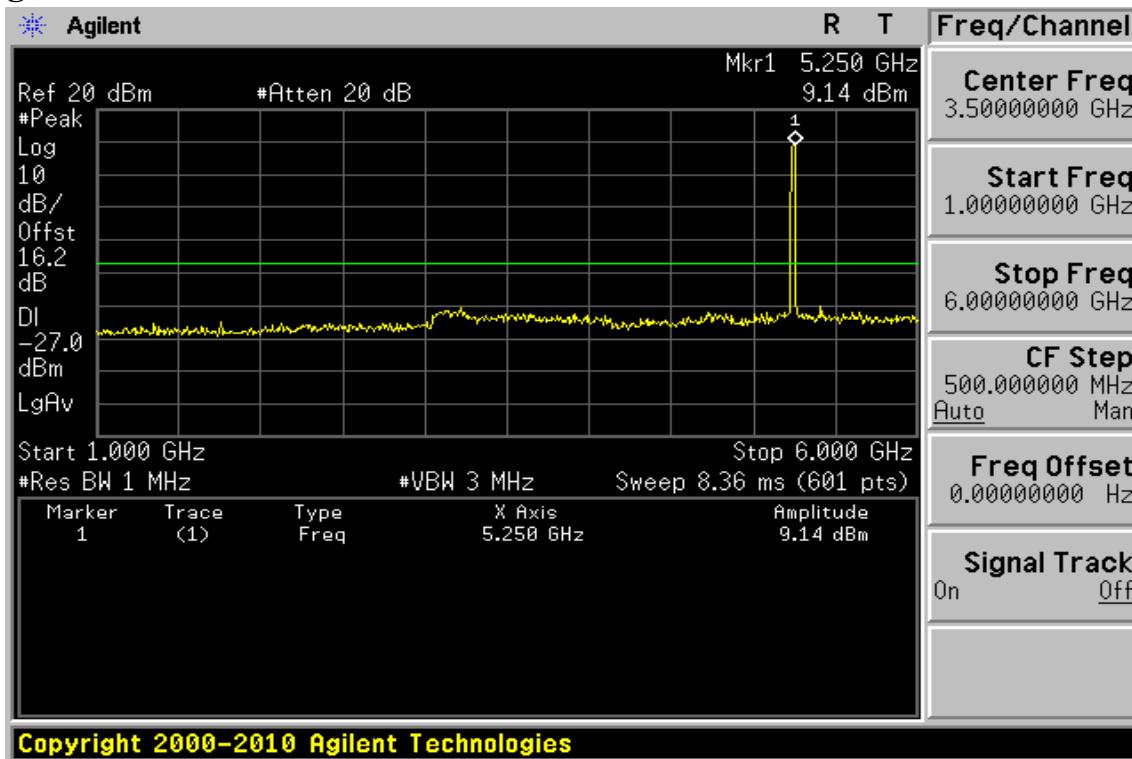
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Ch High 30MHz – 1GHz (5240 MHz)



Ch High 1GHz – 6GHz



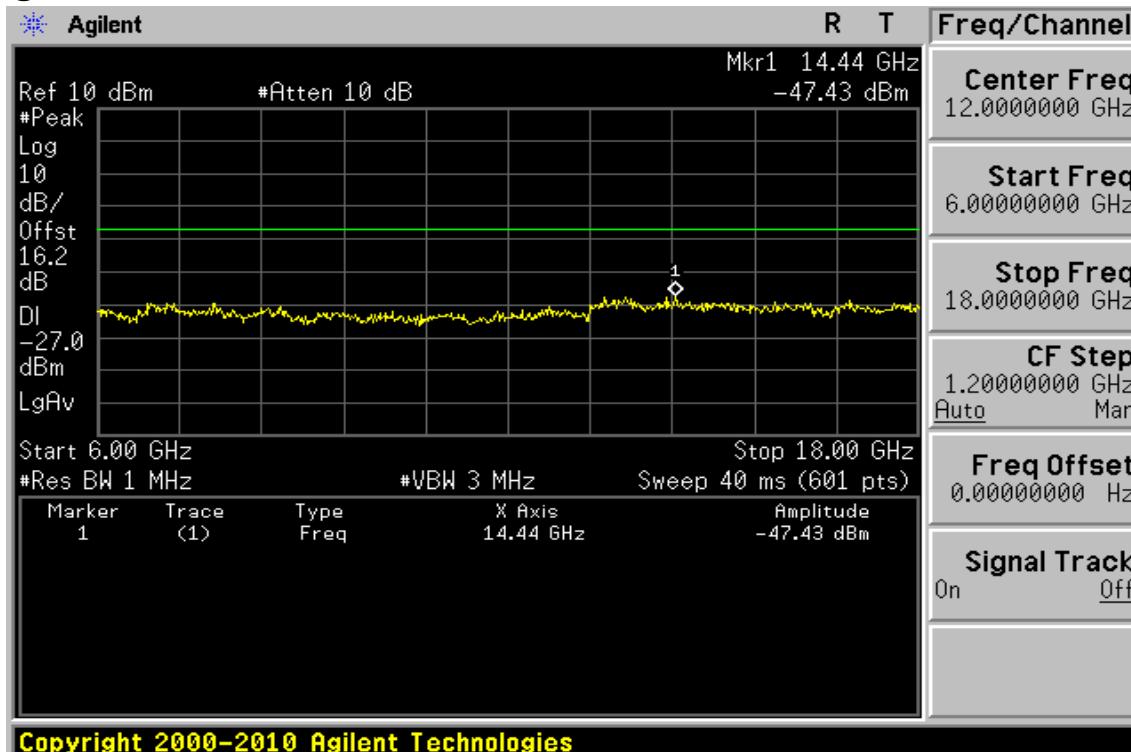
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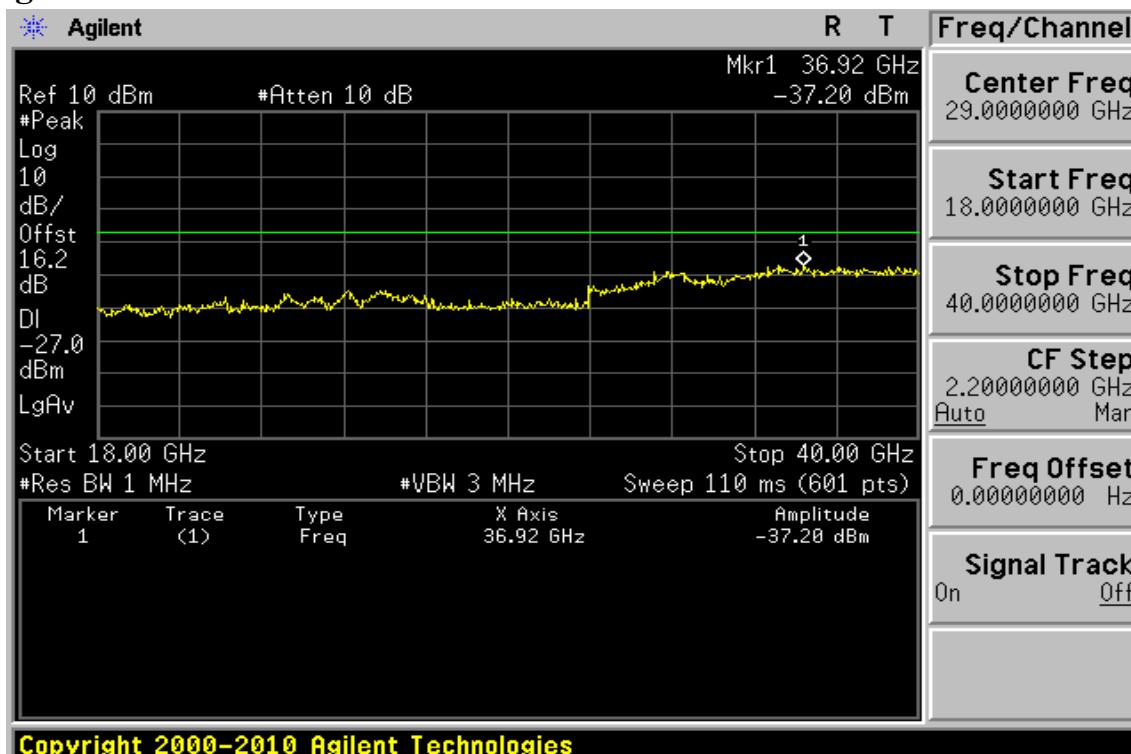
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Ch High 6GHz – 18GHz



Ch High 18GHz – 40GHz



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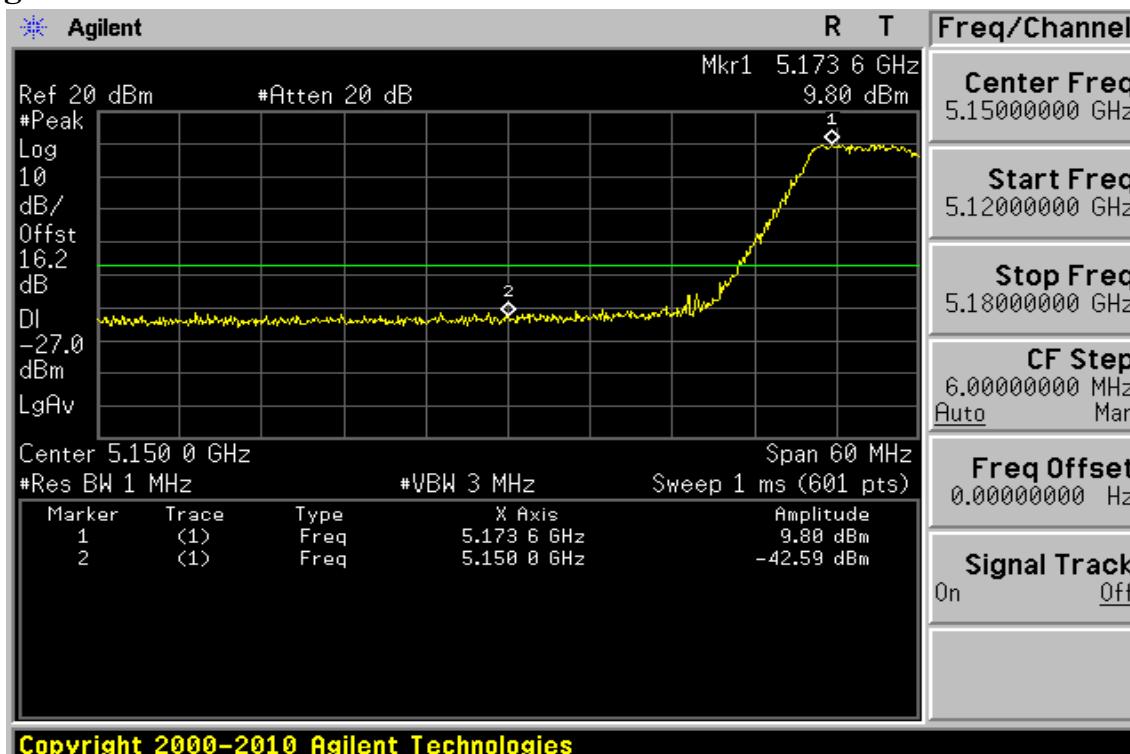
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802.11a 5150~5250 MHz

Band Edges Test Data CH 5150



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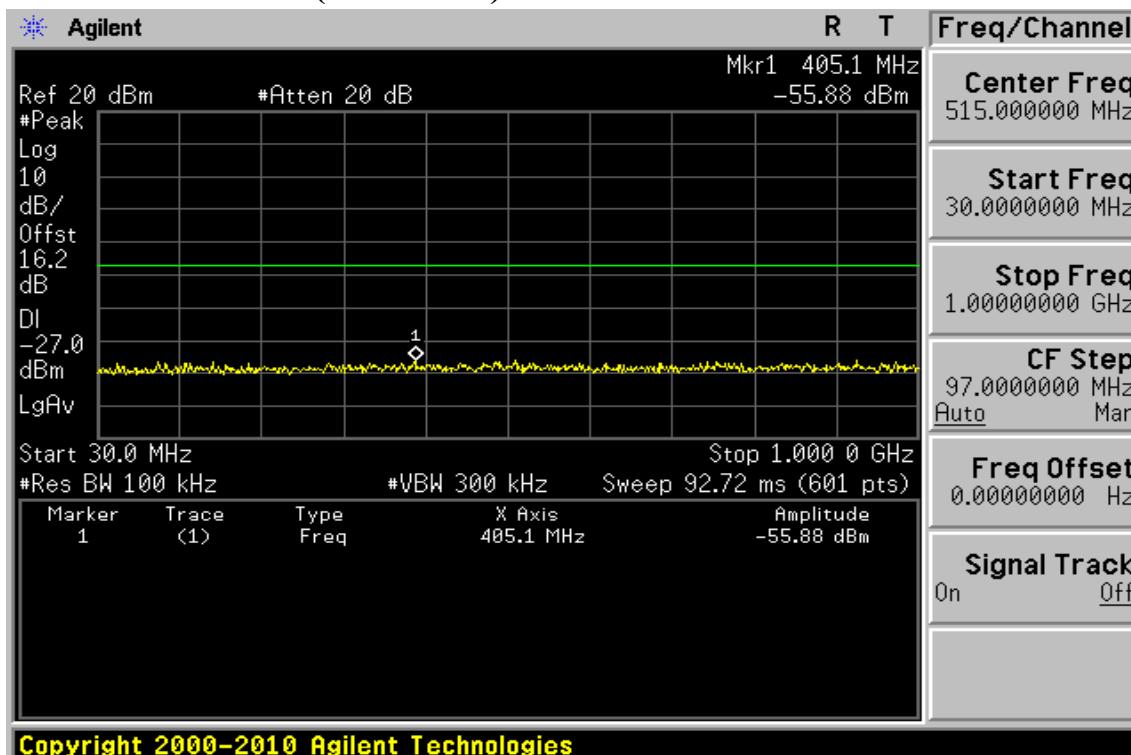
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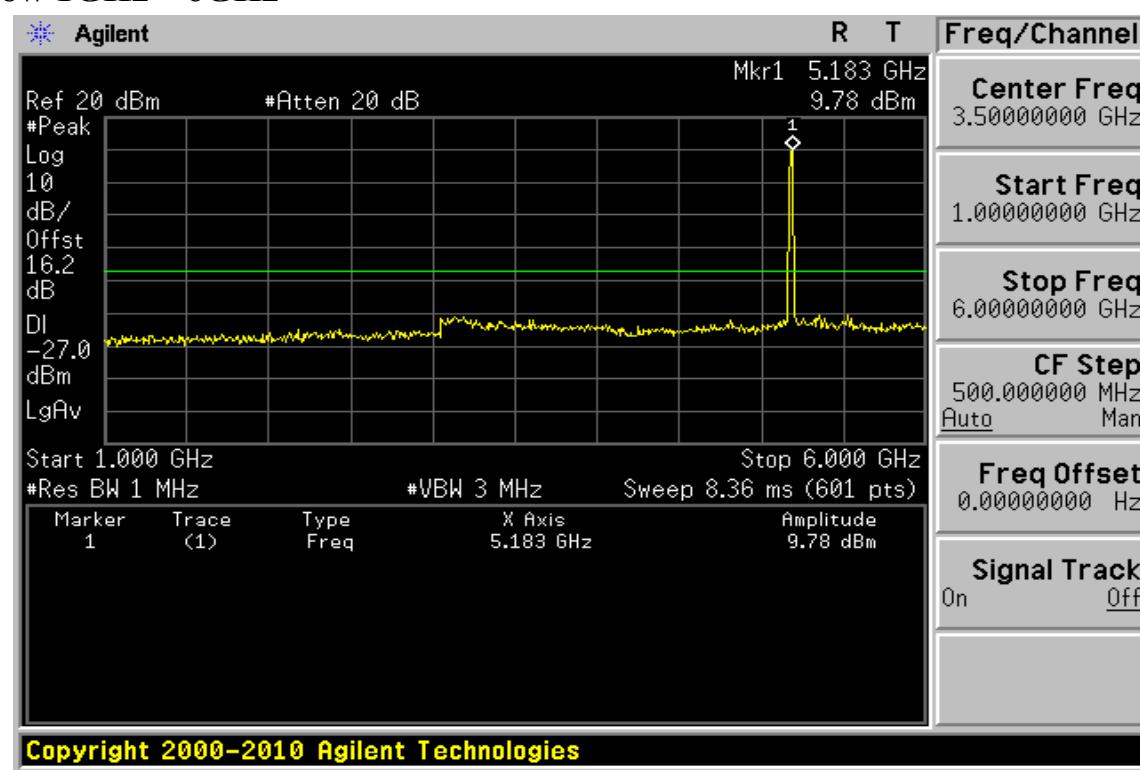
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802.11n HT20, 5150~5250 MHz

Ch Low 30MHz – 1GHz (5180 MHz)



Ch Low 1GHz – 6GHz



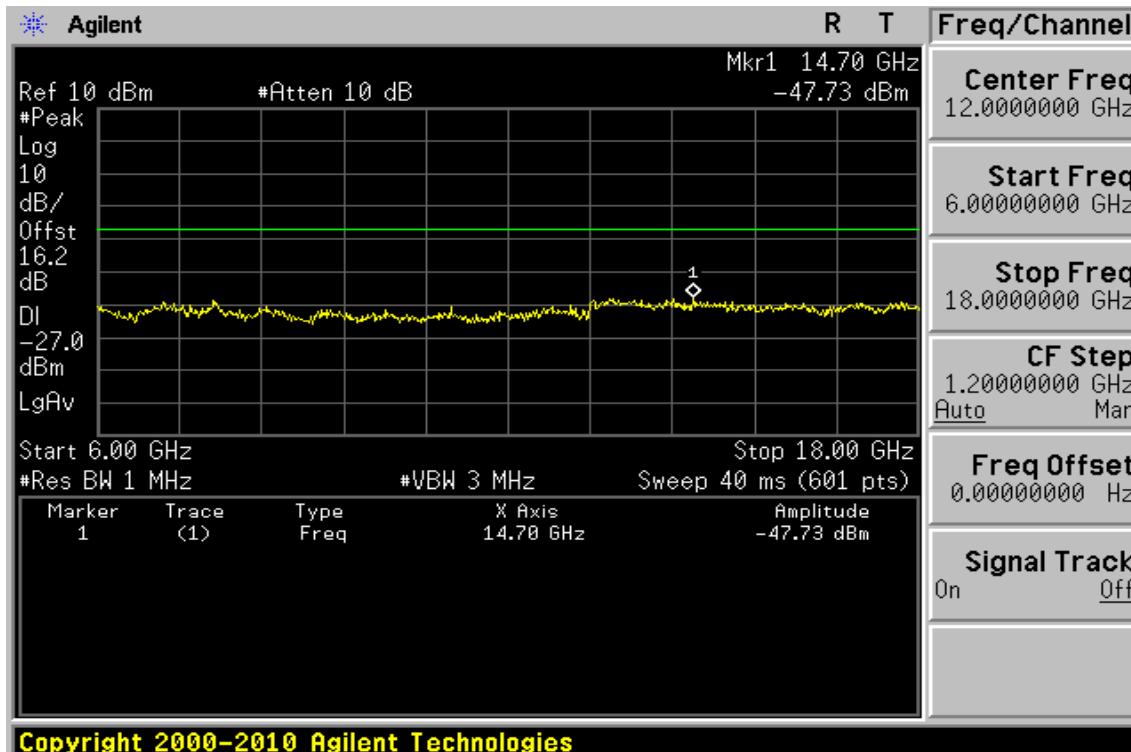
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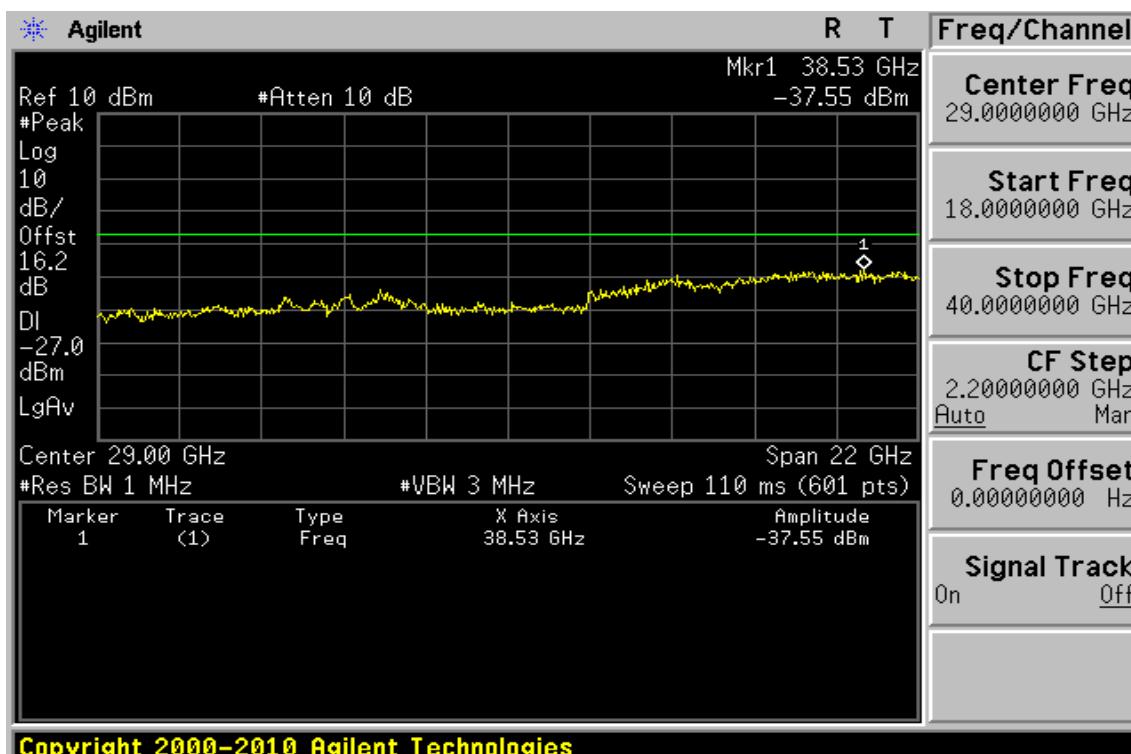
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Ch Low 6GHz – 18GHz



Ch Low 18GHz – 40GHz



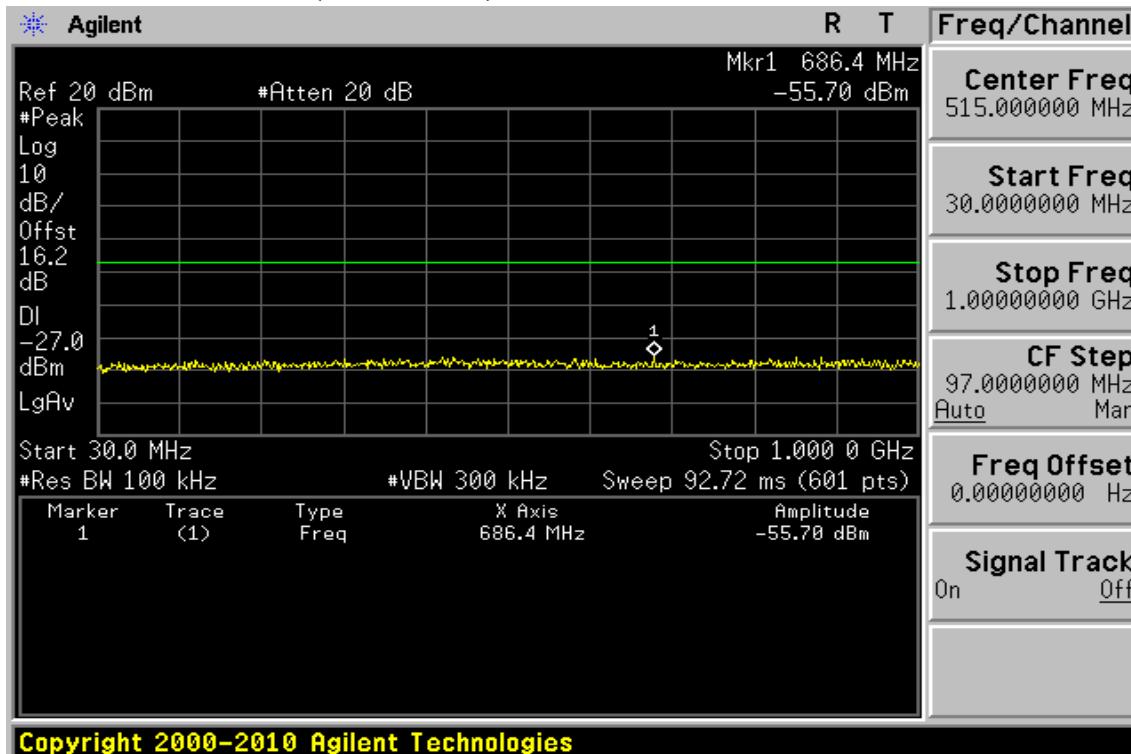
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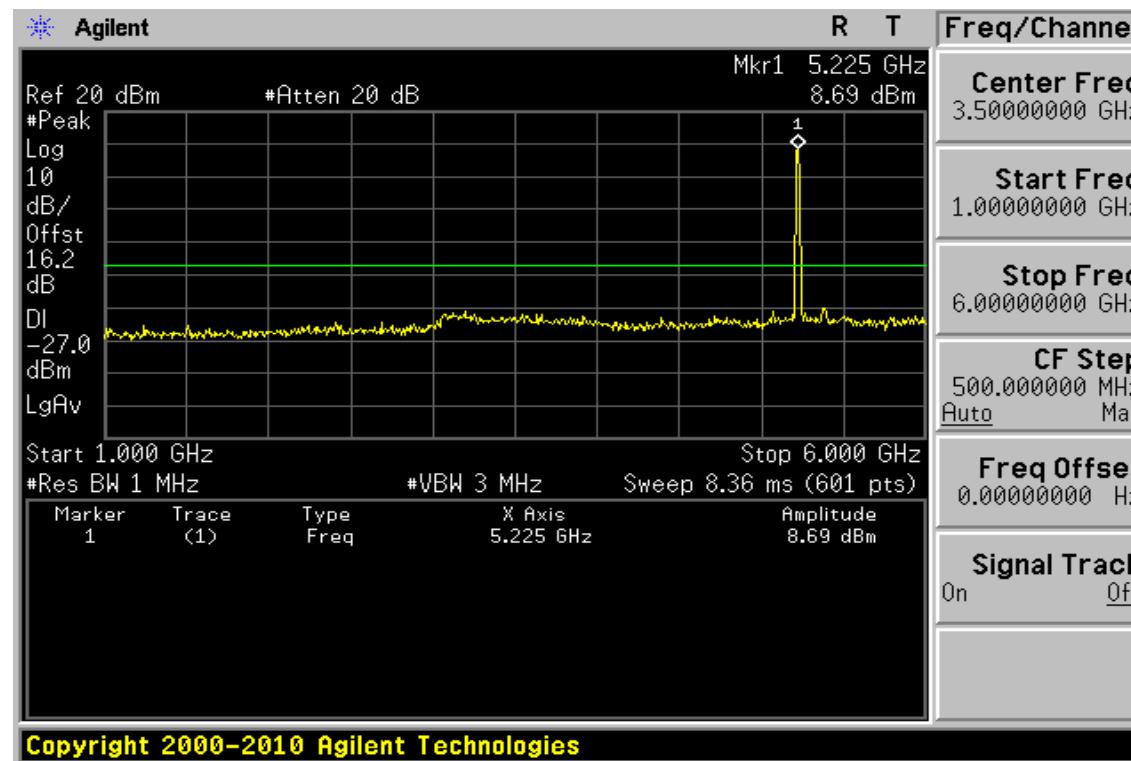
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Ch Mid 30MHz – 1GHz (5220 MHz)



Ch Mid 1GHz – 6GHz



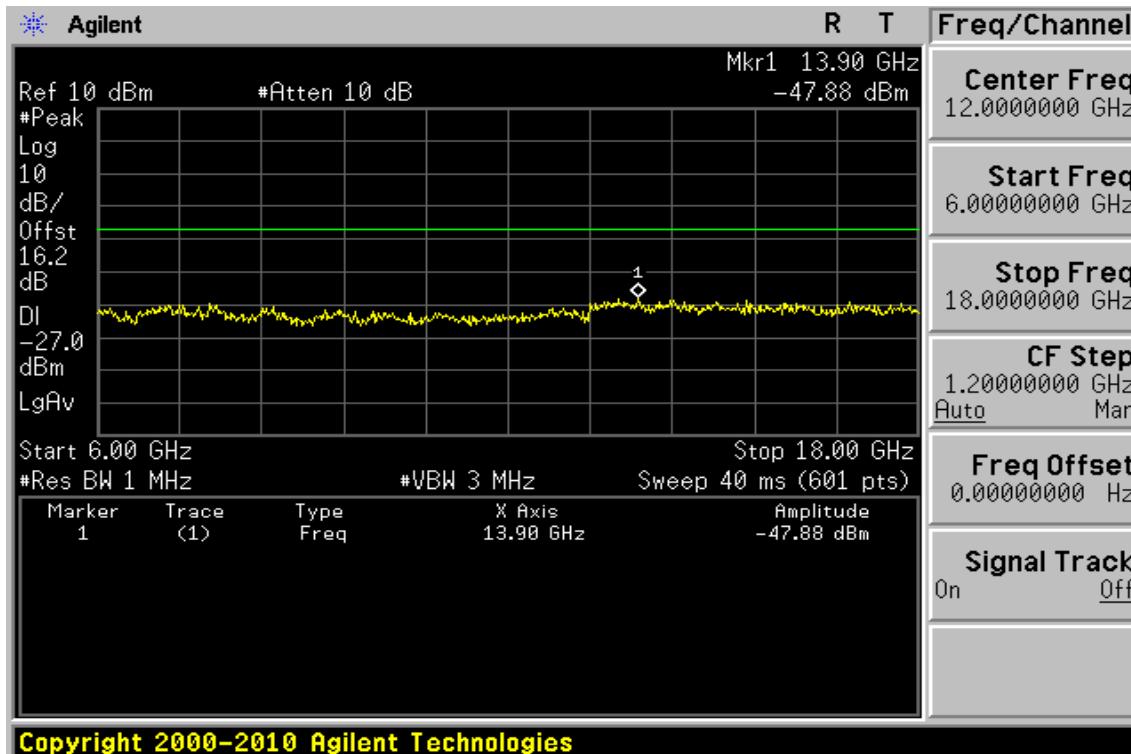
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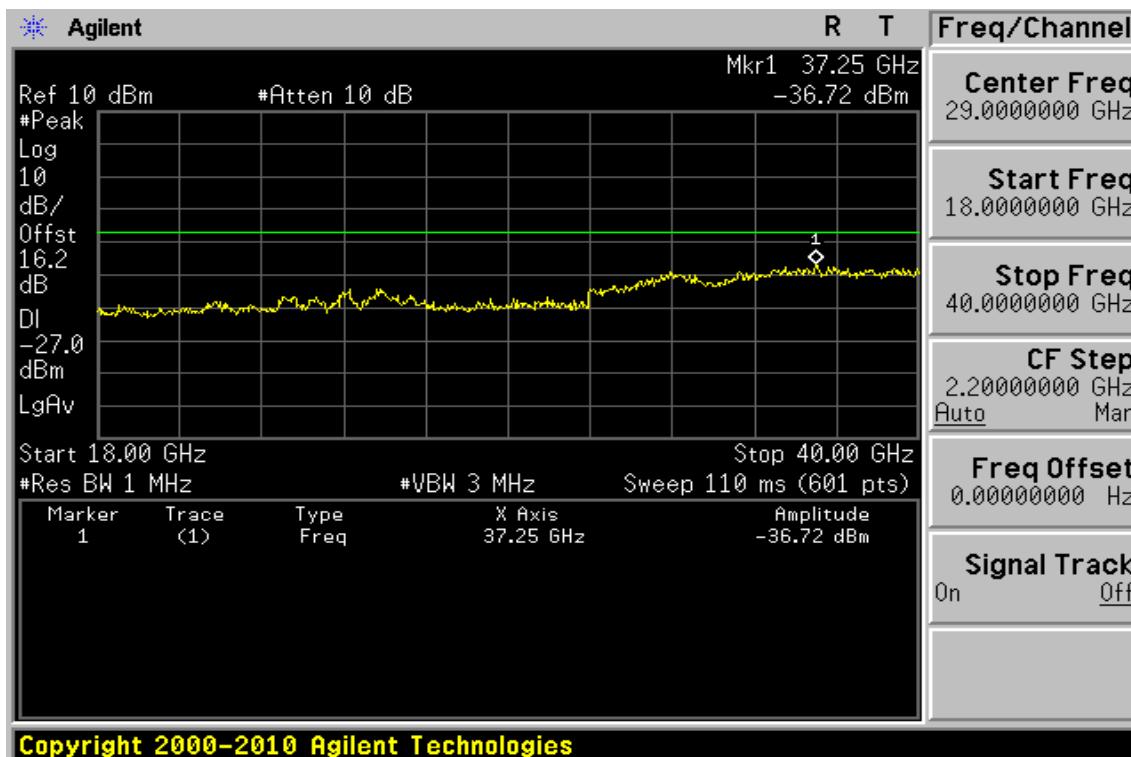
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Ch Mid 6GHz – 18GHz



Ch Mid 18GHz – 40GHz



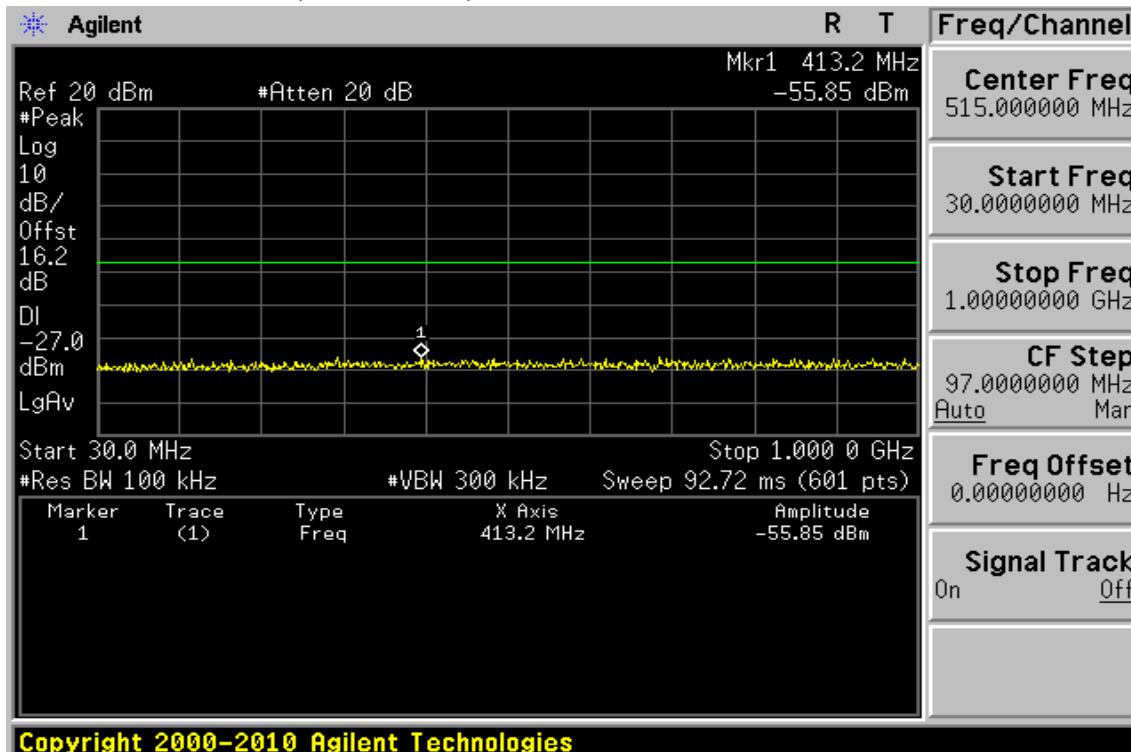
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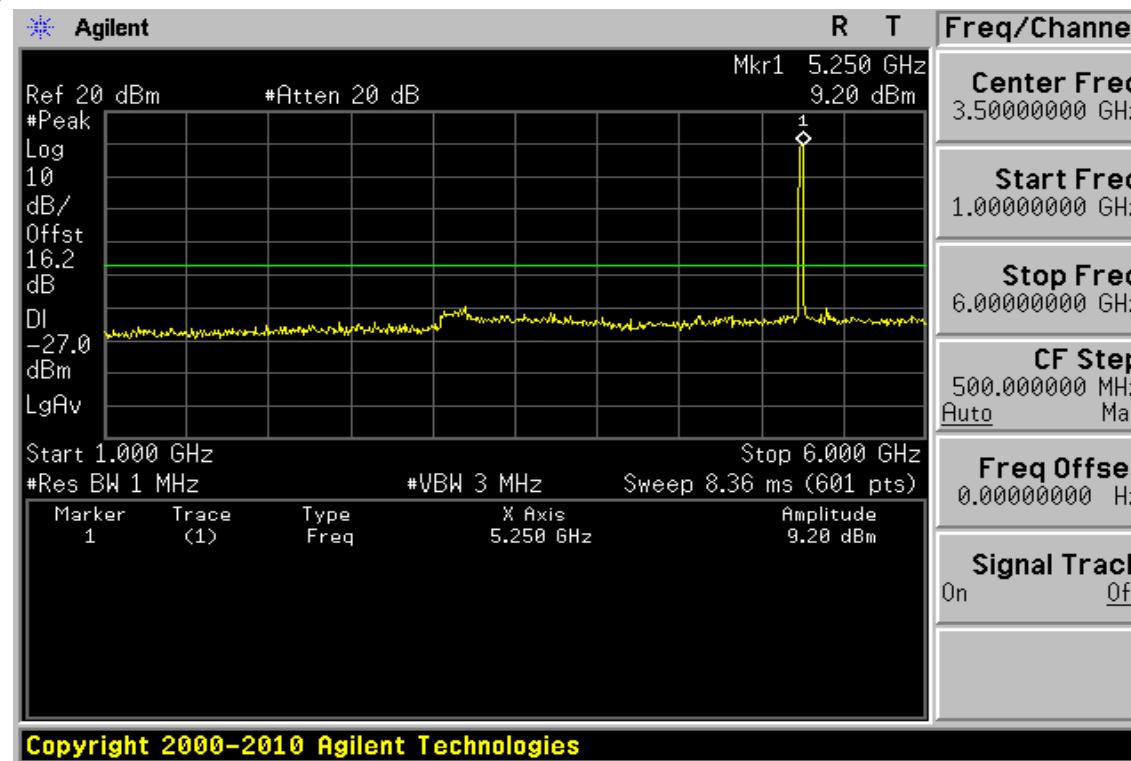
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Ch High 30MHz – 1GHz (5240 MHz)



Ch High 1GHz – 6GHz



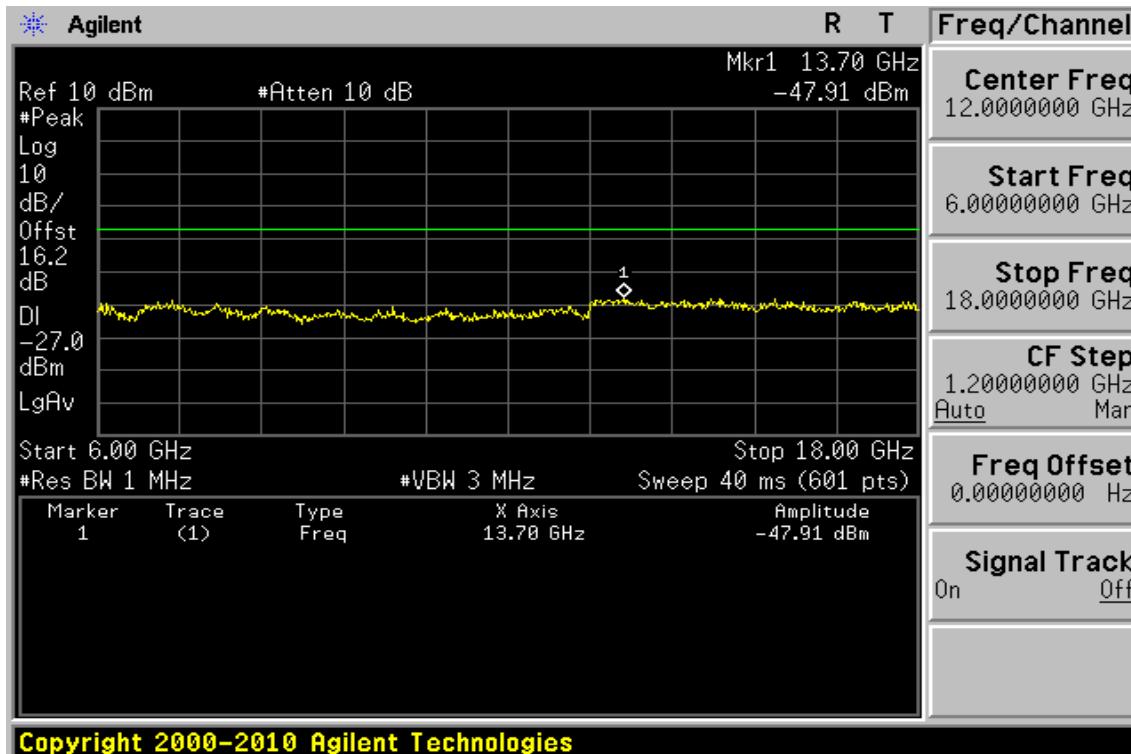
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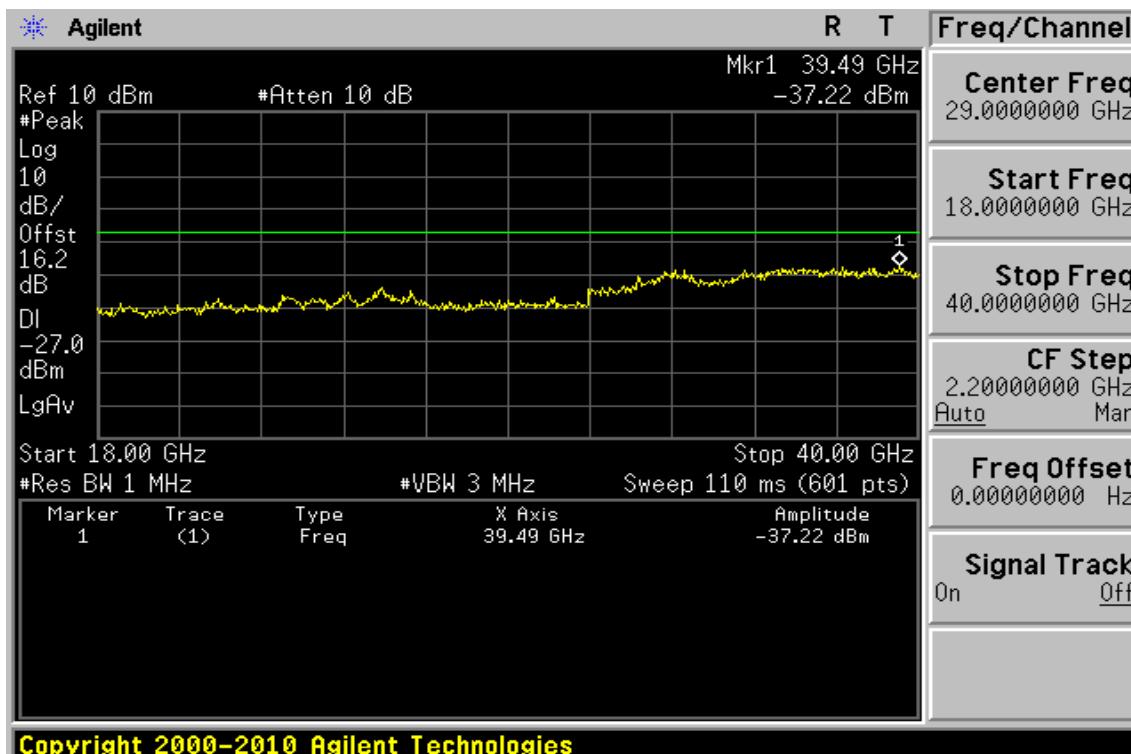
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Ch High 6GHz – 18GHz



Ch High 18GHz – 40GHz

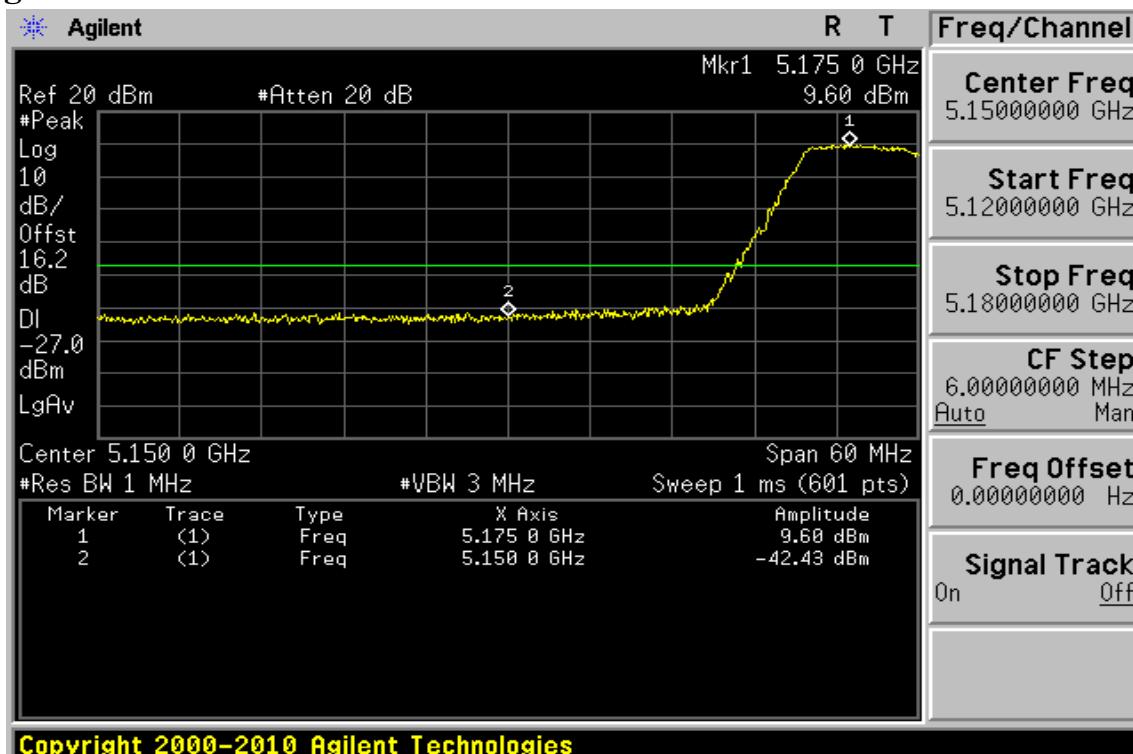


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**802.11n HT20 5150~5350 MHz
Band Edges Test Data CH 5250**

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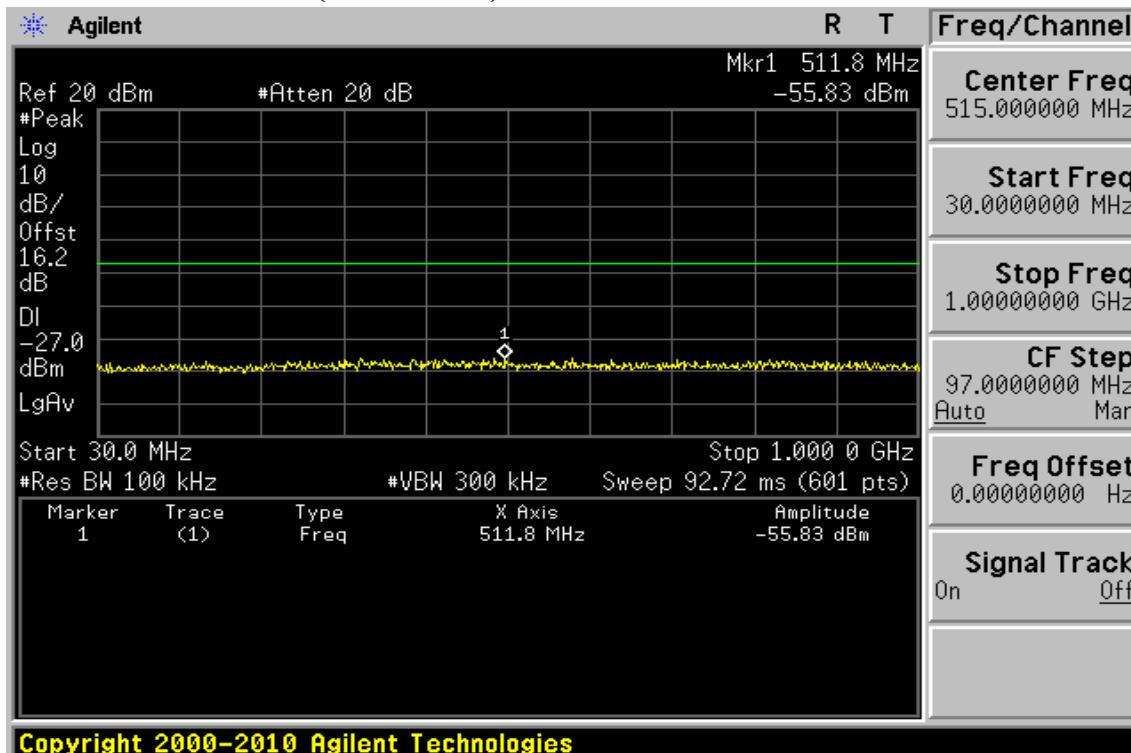
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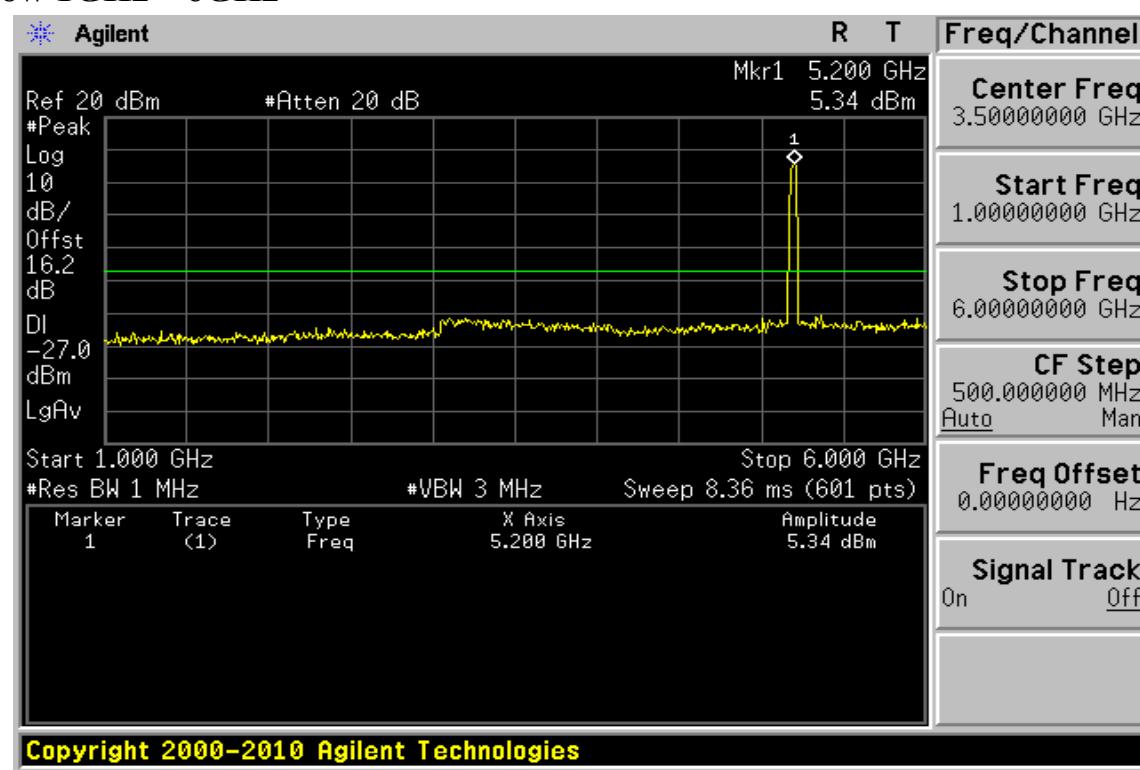
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802.11n HT40, 5150~5250 MHz

Ch Low 30MHz – 1GHz (5190 MHz)



Ch Low 1GHz – 6GHz



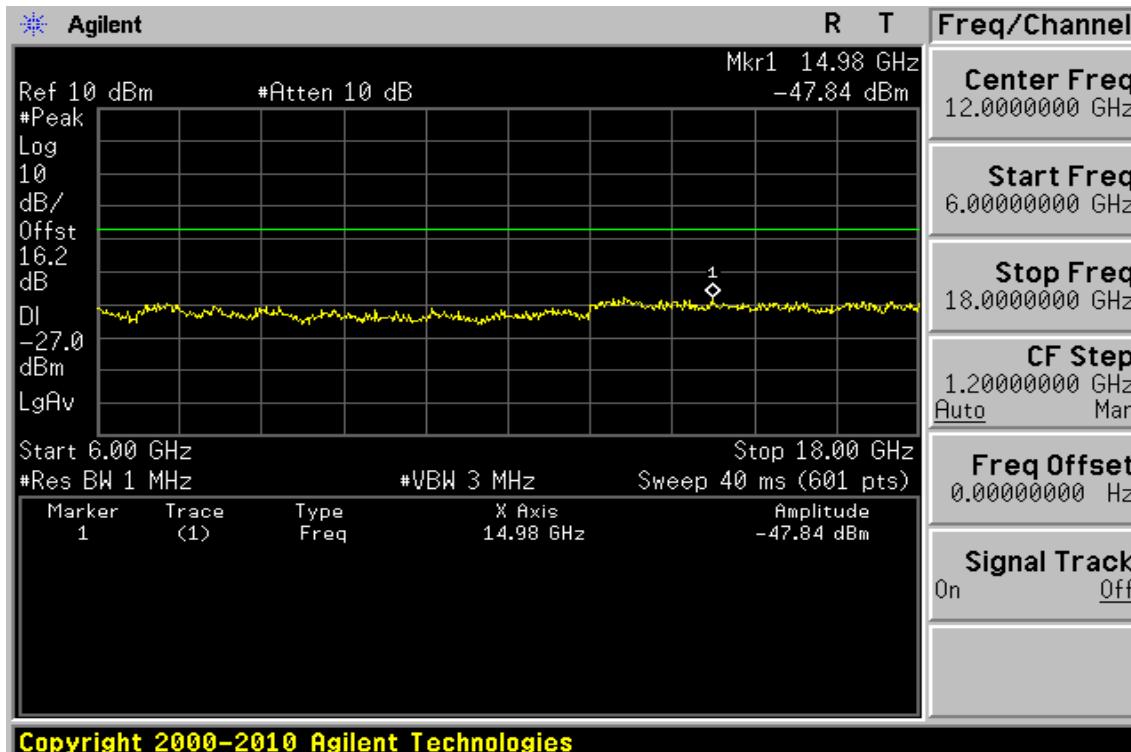
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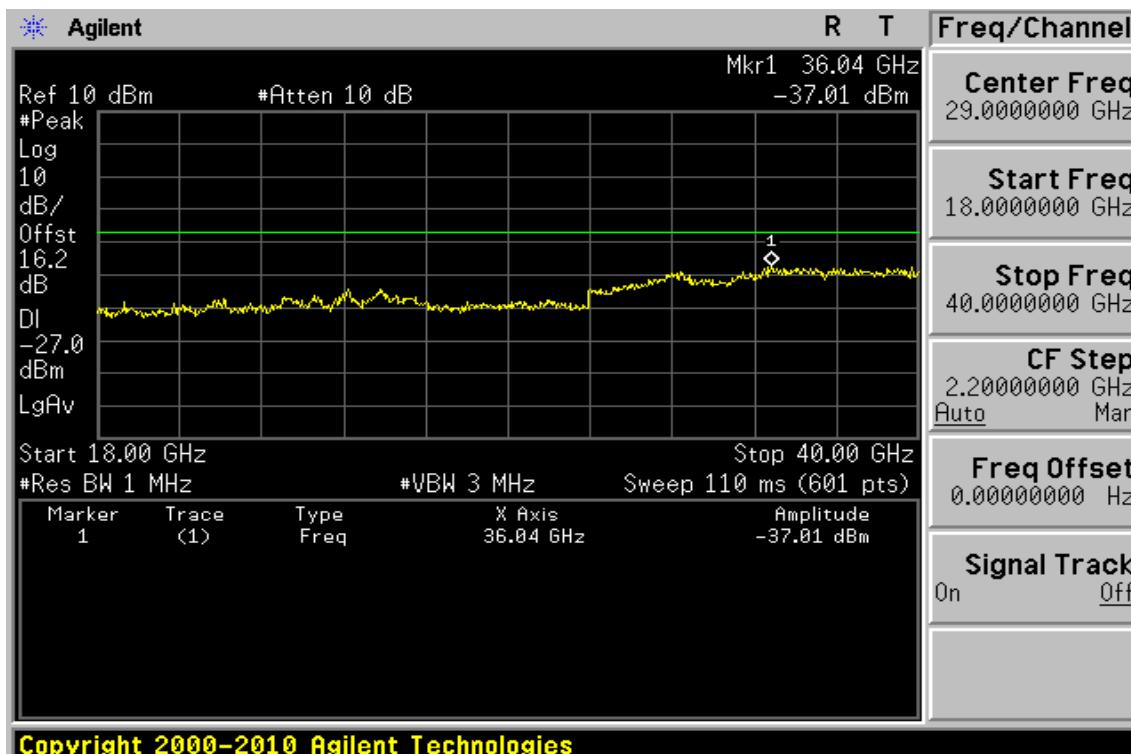
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Ch Low 6GHz – 18GHz



Ch Low 18GHz – 40GHz



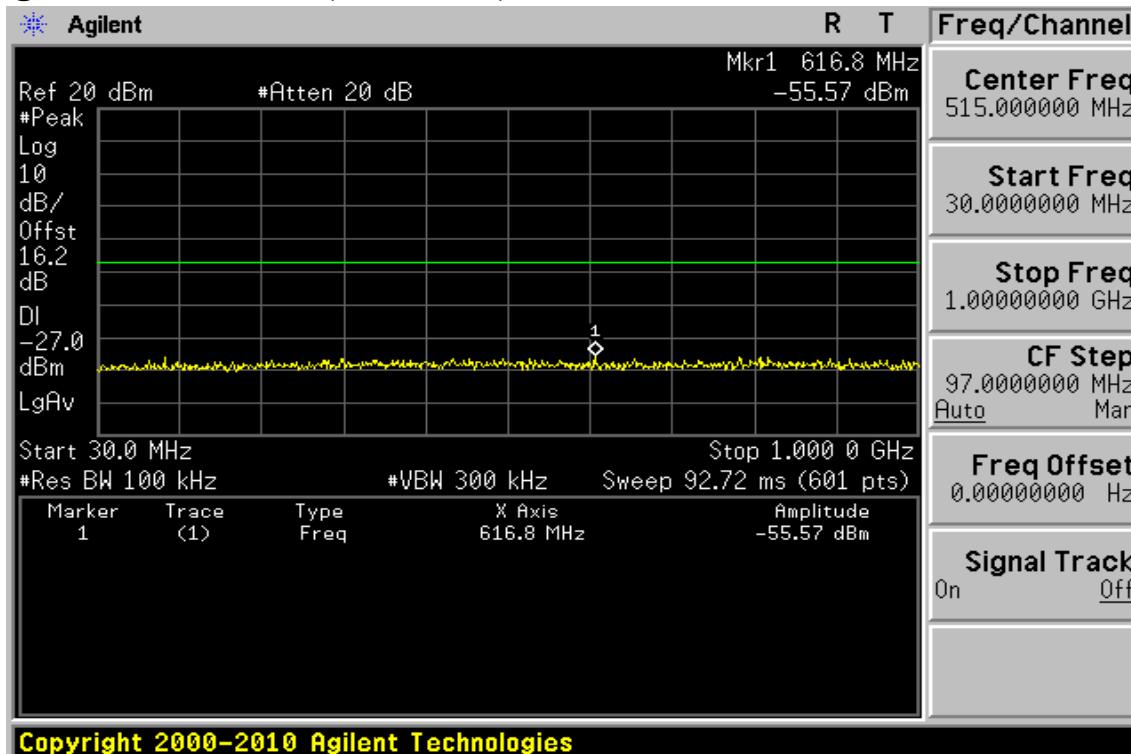
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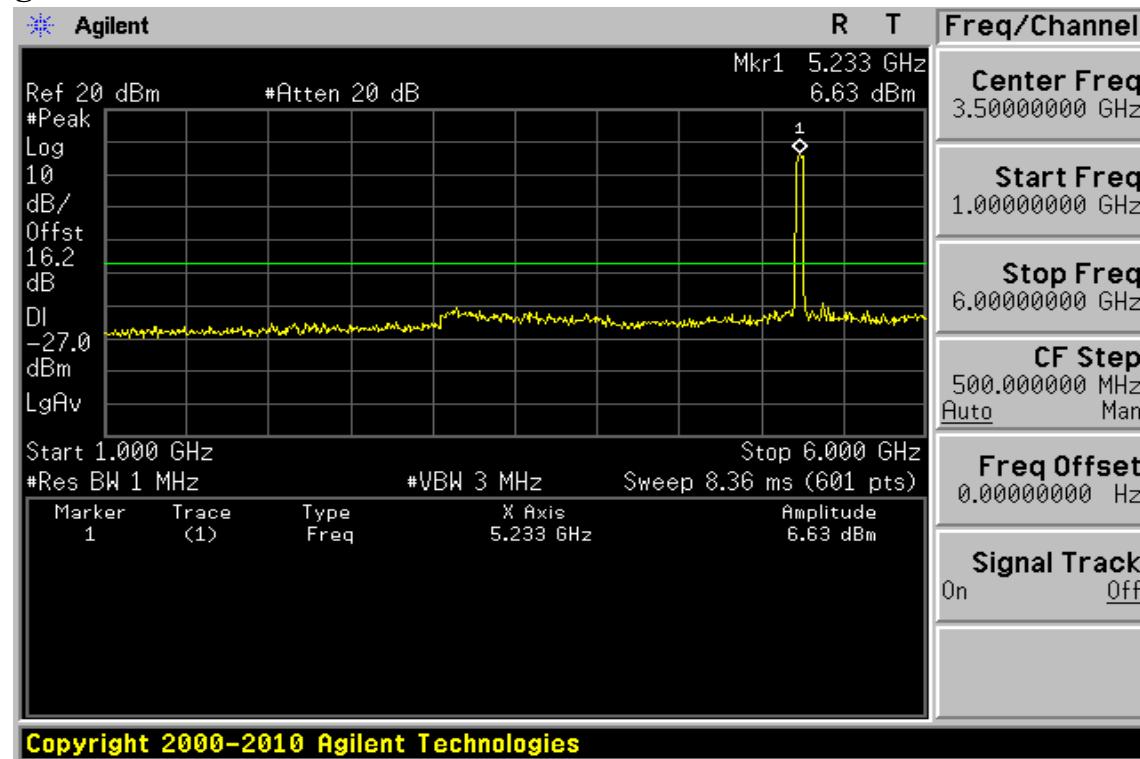
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Ch High 30MHz – 1GHz (5230 MHz)



Ch High 1GHz – 6GHz



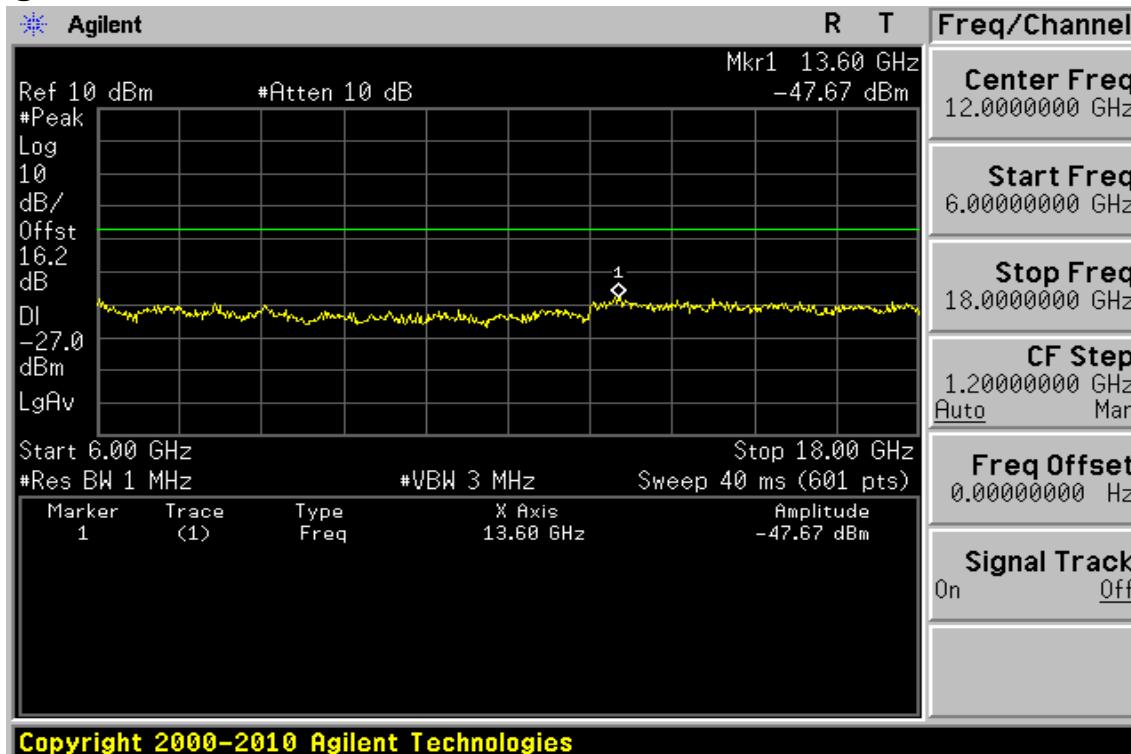
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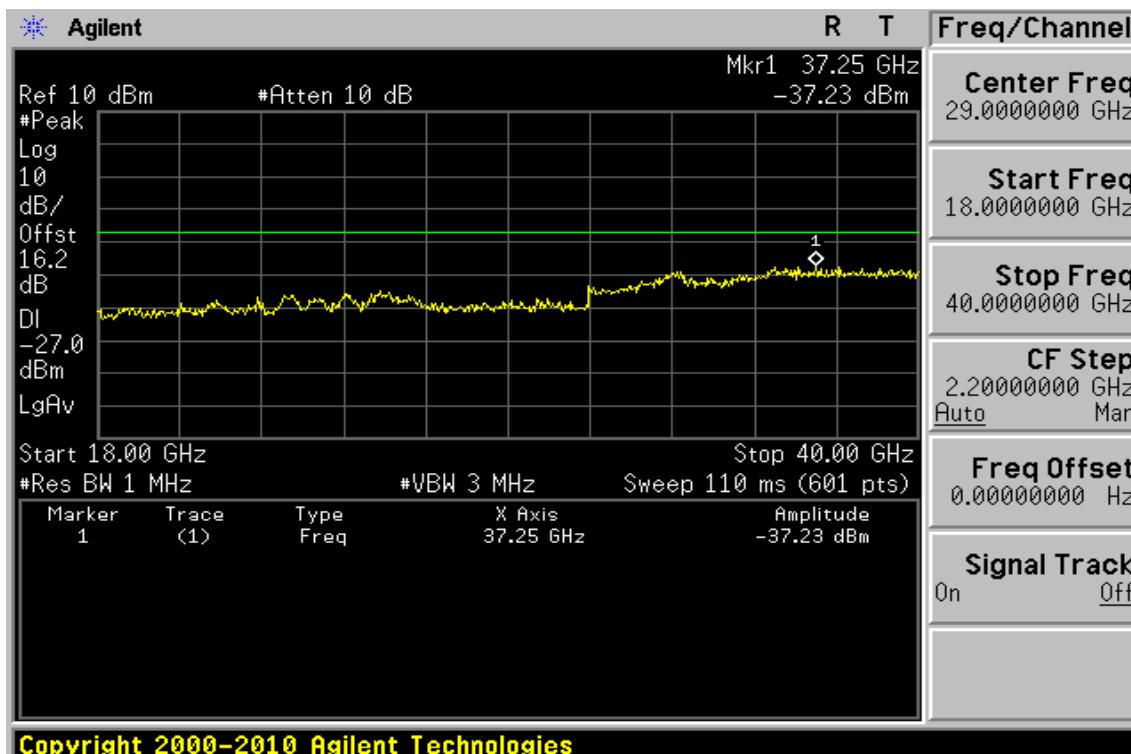
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Ch High 6GHz – 18GHz



Ch High 18GHz – 40GHz



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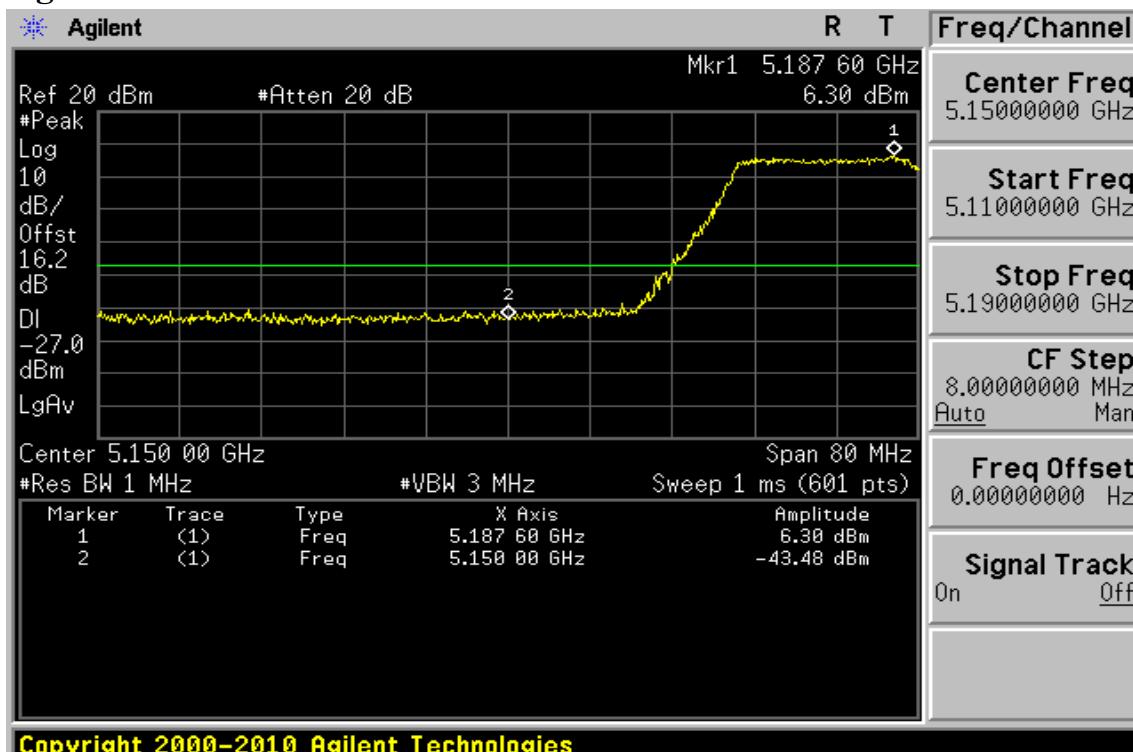
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802.11n HT40 5150~5250 MHz

Band Edges Test Data CH 5150



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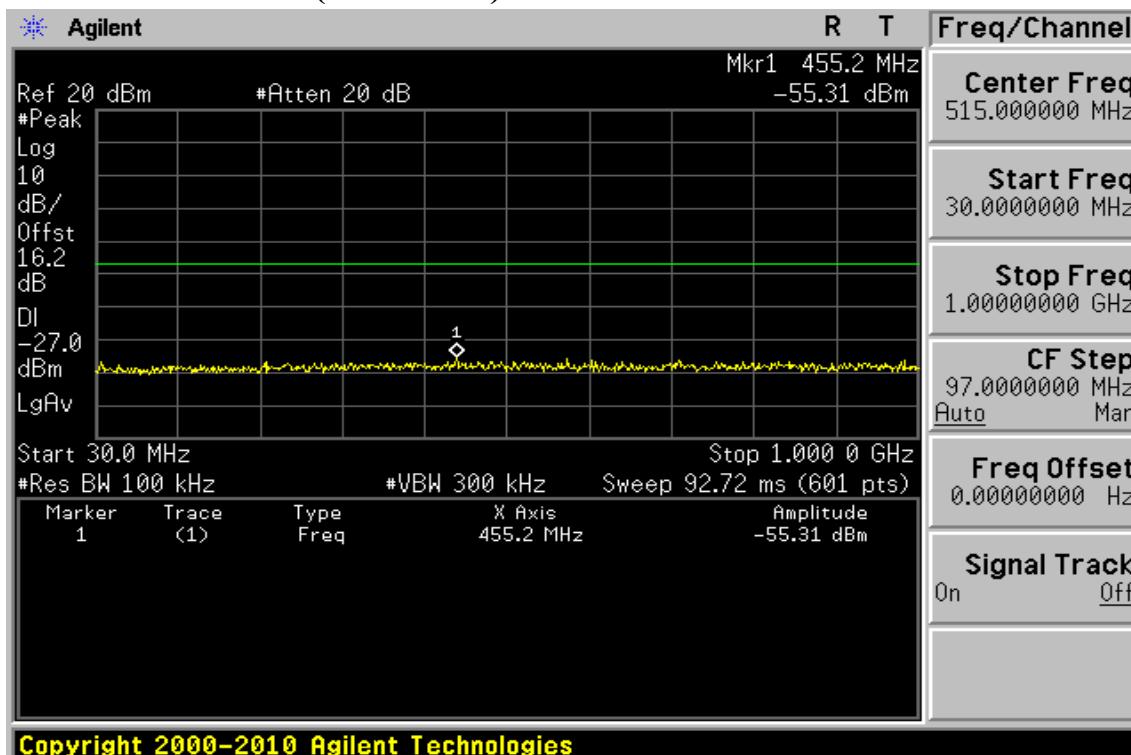
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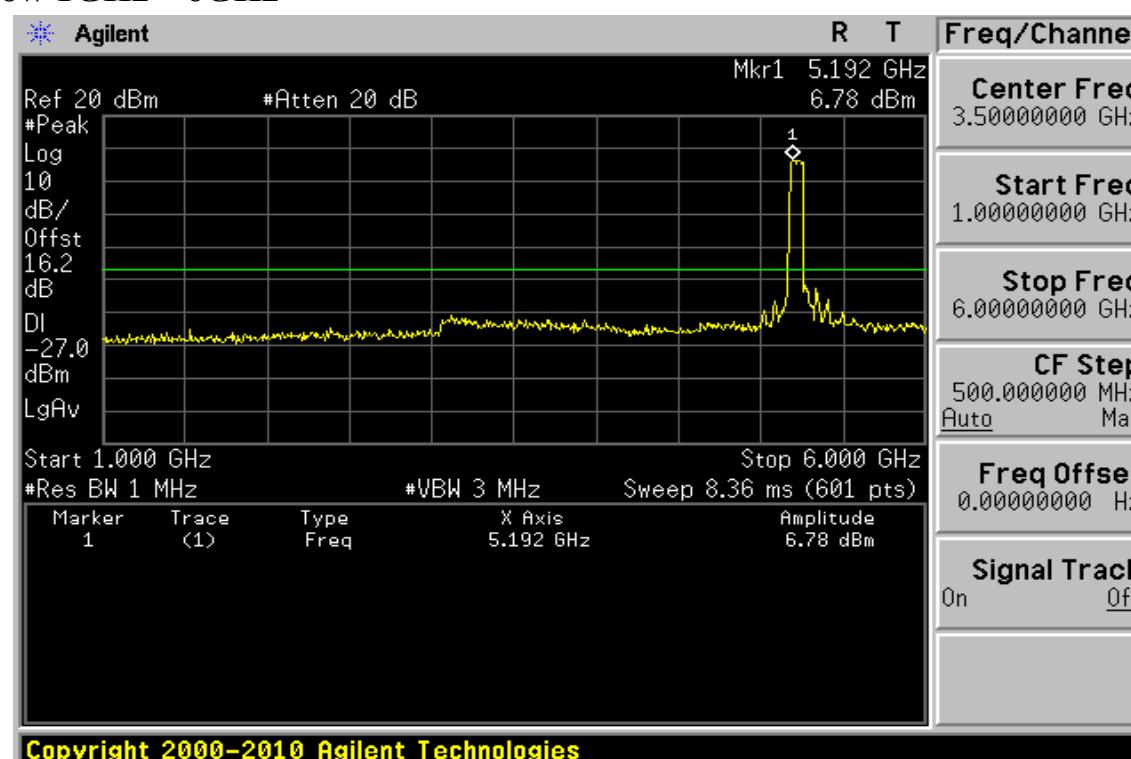
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802.11ac VHT80, 5210MHz

Ch Low 30MHz – 1GHz (5210 MHz)



Ch Low 1GHz – 6GHz



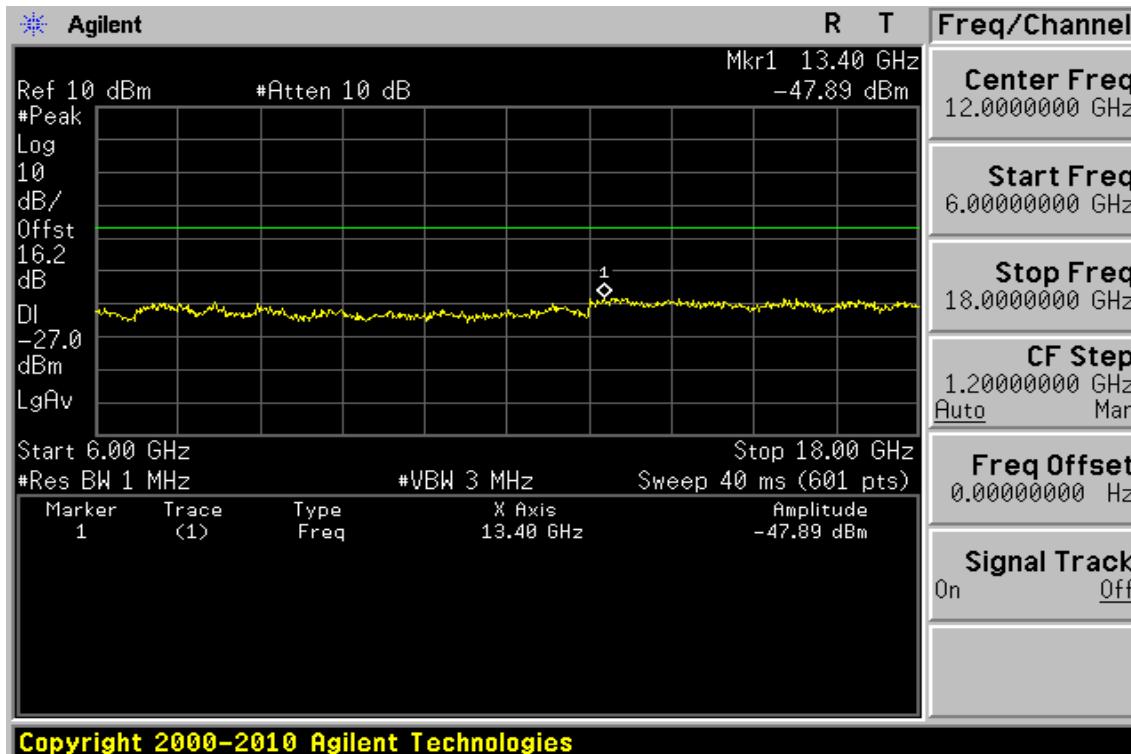
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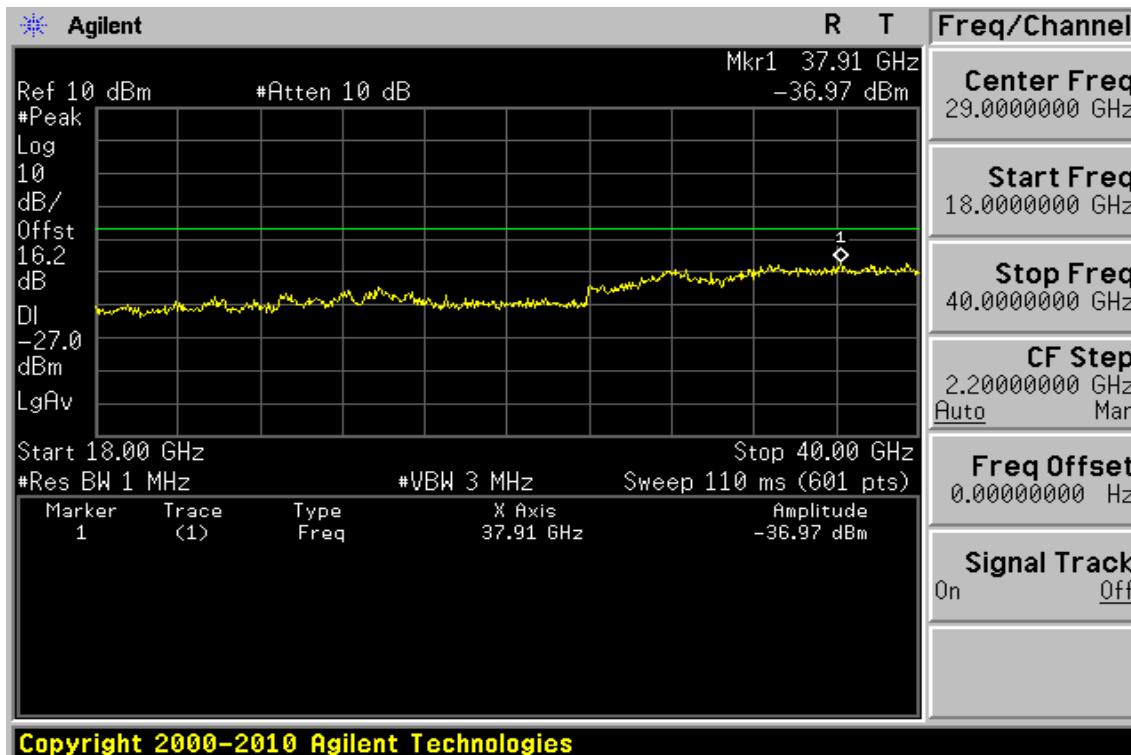
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Ch Low 6GHz – 18GHz



Ch Low 18GHz – 40GHz

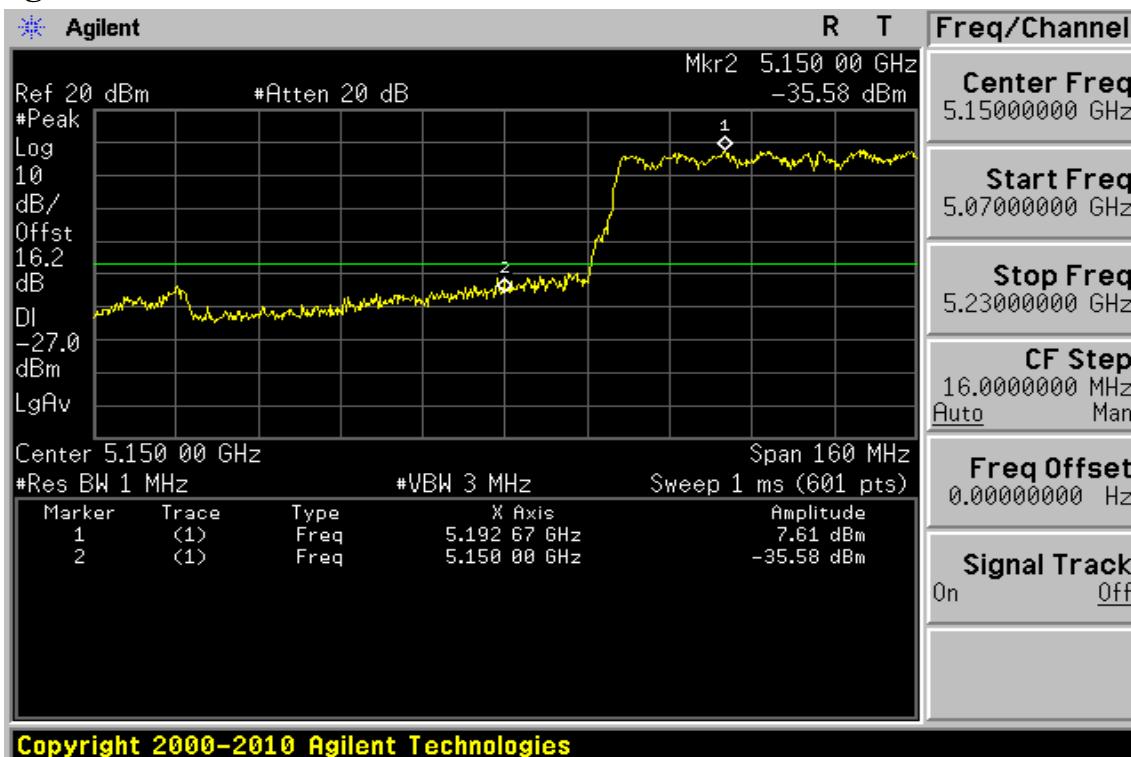


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**802.11ac, VHT80, 5210MHz
Band Edges Test Data CH 5210**

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12. UNDESIRABLE EMISSION - RADIATED MEASUREMENT

12.1 Standard Applicable

According to §15.407(b) (6) (7),

(b) Undesirable Emission Limits: Except as shown in Paragraph (b)(6) of this section, the peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

- (1) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in Section 15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in Section 15.207.
- (2) The provisions of Section 15.205 of this part apply to intentional radiators operating under this section.
- (3) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency block edges as the design of the equipment permits.

Procedure H1) a) b) c) are adopted, KDB 789033 D01, where the conducted measurement is being used to comply with out of emission requirement as per FCC 15.407 b) 6) 7).

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§15.205- RESTRICTED BANDS OF OPERATIONS

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	(²)
13.36 - 13.41	322 - 335.4		

¹ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

² Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

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§15.209- RADIATED EMISSION LIMITS: GENERAL REQUIREMENTS**FCC PART 15.209**

MEASURING DISTANCE OF 3 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

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12.1.1 Transmitter Spurious Emission Limits

Spurious emissions from FCC Part 15 transmitters shall comply with the field strength limits as given above. Additionally, the level of any transmitter spurious emission shall not exceed the level of the transmitter's fundamental emission.

12.1.2 Unwanted Emission that complies with the undesirable emission ruling by 15.407 (b) (1) (2) (3), RSS-210 A9.2 (1) (2) (3)

Frequencies (MHz)	EIRP Limit (dBm)	Equivalent Field Strength at 3m (dBuV/m)
5150 – 5250	-27	68.3
5250 – 5350	-27	68.3
5470 - 5725	-27	68.3

Limit derivation in terms of Field Strength:

$EIRP = ((E \cdot d)^2) / 30$, where E is the field in V/m, d is the measurement distance (3m), EIRP is the equivalent isotropically radiated power in Watts.

$$E = 1000000 * (30 * EIRP)^{(1/2)} / 3 \text{ uV/m}$$
$$= 68.3 \text{ dBuV/m}$$

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12.2 EUT Setup

1. The radiated emission tests were performed in the 3 meter open-test site, using the setup in accordance with the ANSI C63.4:2009.
2. The EUT was put in the front of the test table. The host PC system was placed on the center of the back edge on the test table. The peripherals like modem, monitor printer, K/B, and mouse were placed on the side of the host PC system. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The keyboard was placed directly in the front of the monitor, flushed with the front tabletop. The mouse was placed next to the Keyboard, flushed with the back of keyboard.
4. The spacing between the peripherals was 10 centimeters.
5. External I/O cables were draped along the edge of the test table and bundle when necessary.
6. The host PC system was connected with 120Vac/60Hz power source.

12.3 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until all frequency measured were complete.

For measurements below 1GHz, follow the KDB 789033 D01 requirements in section H3), “General Requirements for Unwanted Emissions Measurements” Compliance shall be demonstrated using CISPR quasi-peak detection; however, peak detection is permitted as an alternative to quasi-peak detection.

For Measurement above 1GHz, for peak unwanted emission measurements follow the KDB 789033 D01 requirements in section H5) b), for average unwanted emission measurements follow the KDB 789033 D01 requirements in section H6) c) or d).

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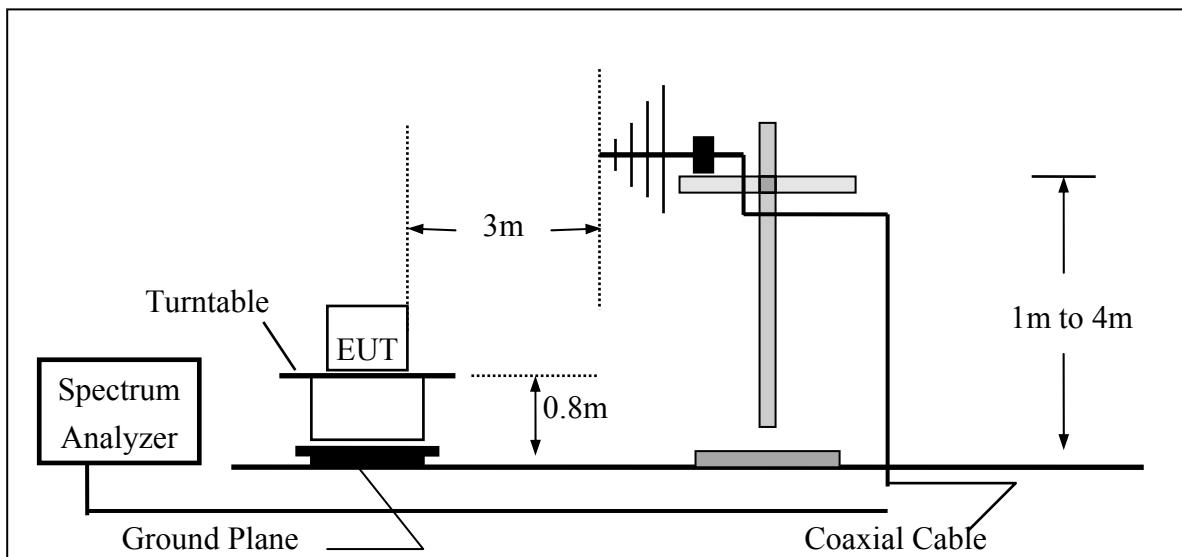
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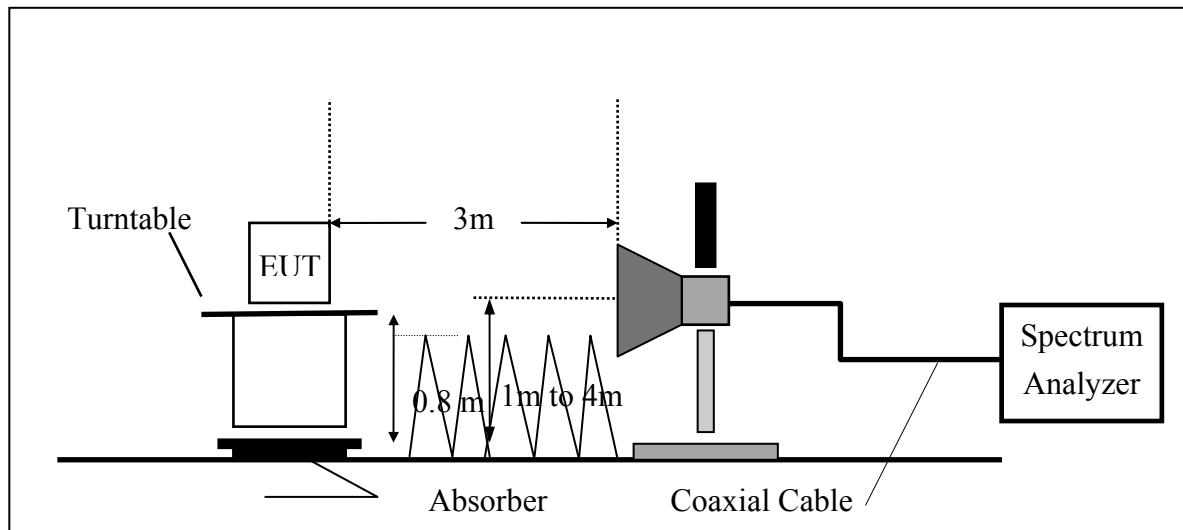
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12.4 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-UP Frequency Over 1 GHz



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12.5 Measurement Equipment Used:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100759	02/08/2013	02/07/2014
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/30/2013	05/29/2014
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	02/06/2013	02/07/2014
Spectrum Analyzer	R&S	FSV-30	101398	10/18/2011	10/17/2013
Bilog Antenna	SCHWAZBECK	VULB9168	378	01/10/2012	01/09/2014
Horn antenna	ETS.LINDGREN	3117	123995	05/31/2013	05/30/2014
Horn Antenna	Schwarzbeck	BBHA9170	184	01/17/2012	01/16/2014
RF amplifier	Miteq	AMF-6F-2600 400-40-8P	971576	01/29/2013	01/28/2014
Pre-Amplifier	Agilent	8447D	2944A07676	01/04/2013	01/03/2014
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/04/2013	01/03/2014
5150-5350 Band Reject Filter	Micro-Tronics	BRM50703	1	01/04/2013	01/03/2014
5470-5725 Band Reject Filter	Micro-Tronics	BRM50704	1	01/04/2013	01/03/2014
5725-5875 Band Reject Filter	Micro-Tronics	BRM50705	1	01/04/2013	01/03/2014
1GHz High Pass Filter	Micro-Tronics	HPM50108	32	02/28/2013	02/27/2014
2GHz High Pass Filter	Micro-Tronics	HPM50110	36	02/28/2013	02/27/2014
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2013	02/27/2014
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	HD	MA240-N	240/657	N.C.R	N.C.R
Controller	HD	HD100	N/A	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_Rx	9	01/04/2013	01/03/2014
3m Site NSA	SGS	966 chamber	N/A	07/15/2013	07/14/2014

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12.6 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

12.7 Measurement Result

Refer to attach tabular data sheets.

NOTE:

The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 100kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.

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Radiated Spurious Emission Measurement Result 802.11a, 5150~5250 MHz

Operation Band	:802.11 a	Test Date	:2013-09-17
Fundamental Frequency	:5180 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:TX LOW	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“--“ : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual FS dB μ V	Limit @3m dB μ V/m	Margin dB
70.74	S	Peak	37.29	-16.35	20.94	40.00	-19.06
184.23	S	Peak	36.96	-14.73	22.23	43.50	-21.27
258.92	S	Peak	42.50	-13.57	28.93	46.00	-17.07
320.03	S	Peak	39.88	-11.85	28.03	46.00	-17.97
480.08	S	Peak	37.22	-9.23	27.99	46.00	-18.01
532.46	S	Peak	32.32	-8.23	24.09	46.00	-21.91
10360.00	H	Peak	23.59	15.10	38.69	68.30	-29.61
15540.00	H	---					
20720.00	H	---					
25900.00	H	---					
31080.00	H	---					
36260.00	H	---					

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Operation Band :802.11 a
 Fundamental Frequency :5180 MHz
 Operation Mode :TX LOW
 EUT Pol. :H PLAN

Test Date :2013-09-17
 Temp./Humi. :25.6 deg_C / 58 RH
 Engineer :Allen
 Measurement Antenna Pol. :HORIZONTAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“--“ : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit @3m dB μ V/m	Margin dB
					FS dB μ V/m		
78.50	S	Peak	37.22	-17.51	19.71	40.00	-20.29
183.26	S	Peak	46.76	-14.62	32.14	43.50	-11.36
262.80	S	Peak	41.63	-13.44	28.19	46.00	-17.81
320.03	S	Peak	38.90	-11.85	27.05	46.00	-18.95
480.08	S	Peak	37.02	-9.23	27.79	46.00	-18.21
721.61	S	Peak	32.65	-4.53	28.12	46.00	-17.88
10360.00	H	Peak	23.84	15.13	38.97	68.30	-29.33
15540.00	H	---					
20720.00	H	---					
25900.00	H	---					
31080.00	H	---					
36260.00	H	---					

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Operation Band :802.11 a
 Fundamental Frequency :5220 MHz
 Operation Mode :TX MID
 EUT Pol. :H PLAN

Test Date :2013-09-17
 Temp./Humi. :25.6 deg_C / 58 RH
 Engineer :Allen
 Measurement Antenna Pol. :VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
					FS dB μ V	@3m dB μ V/m	dB μ V/m
71.71	S	Peak	38.31	-16.50	21.81	40.00	-18.19
184.23	S	Peak	37.83	-14.73	23.10	43.50	-20.40
258.92	S	Peak	42.57	-13.57	29.00	46.00	-17.00
320.03	S	Peak	39.30	-11.85	27.45	46.00	-18.55
480.08	S	Peak	34.07	-9.23	24.84	46.00	-21.16
533.43	S	Peak	33.67	-8.21	25.46	46.00	-20.54
10440.00	H	Peak	23.24	15.21	38.45	68.30	-29.85
15660.00	H	---					
20880.00	H	---					
26100.00	H	---					
31320.00	H	---					
36540.00	H	---					

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Operation Band :802.11 a
 Fundamental Frequency :5220 MHz
 Operation Mode :TX MID
 EUT Pol. :H PLAN

Test Date :2013-09-17
 Temp./Humi. :25.6 deg_C / 58 RH
 Engineer :Allen
 Measurement Antenna Pol. :HORIZONTAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
					FS dB μ V	@3m dB μ V/m	dB μ V/m
184.23	S	Peak	47.55	-14.73	32.82	43.50	-10.68
249.22	S	Peak	40.83	-13.83	27.00	46.00	-19.00
320.03	S	Peak	37.02	-11.85	25.17	46.00	-20.83
480.08	S	Peak	34.59	-9.23	25.36	46.00	-20.64
667.29	S	Peak	33.32	-5.33	27.99	46.00	-18.01
719.67	S	Peak	33.06	-4.57	28.49	46.00	-17.51
10440.00	H	Peak	23.54	15.29	38.83	68.30	-29.47
15660.00	H	---					
20880.00	H	---					
26100.00	H	---					
31320.00	H	---					
36540.00	H	---					

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Operation Band :802.11 a
Fundamental Frequency :5240 MHz
Operation Mode :TX HIGH
EUT Pol. :H PLAN

Test Date :2013-09-17
Temp./Humi. :25.6 deg_C / 58 RH
Engineer :Allen
Measurement Antenna Pol. :VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
					FS dB μ V	dB μ V/m	dB μ V/m
71.71	S	Peak	37.46	-16.50	20.96	40.00	-19.04
184.23	S	Peak	36.61	-14.73	21.88	43.50	-21.62
242.43	S	Peak	39.91	-13.95	25.96	46.00	-20.04
260.86	S	Peak	42.73	-13.51	29.22	46.00	-16.78
320.03	S	Peak	38.52	-11.85	26.67	46.00	-19.33
533.43	S	Peak	32.69	-8.21	24.48	46.00	-21.52
10480.00	H	Peak	23.59	15.27	38.86	68.30	-29.44
15720.00	H	---					
20960.00	H	---					
26200.00	H	---					
31440.00	H	---					
36680.00	H	---					

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Operation Band :802.11 a
Fundamental Frequency :5240 MHz
Operation Mode :TX HIGH
EUT Pol. :H PLAN

Test Date :2013-09-17
Temp./Humi. :25.6 deg_C / 58 RH
Engineer :Allen
Measurement Antenna Pol. :HORIZONTAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
					FS dB μ V	@3m dB μ V/m	dB μ V/m
183.26	S	Peak	45.28	-14.62	30.66	43.50	-12.84
245.34	S	Peak	39.73	-13.90	25.83	46.00	-20.17
320.03	S	Peak	39.73	-11.85	27.88	46.00	-18.12
457.77	S	Peak	34.52	-9.45	25.07	46.00	-20.93
540.22	S	Peak	34.44	-8.06	26.38	46.00	-19.62
721.61	S	Peak	32.19	-4.53	27.66	46.00	-18.34
10480.00	H	Peak	23.10	15.36	38.46	68.30	-29.84
15720.00	H	---					
20960.00	H	---					
26200.00	H	---					
31440.00	H	---					
36680.00	H	---					

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Operation Band	:802.11 a	Test Date	:2013-09-17
Fundamental Frequency	:5180 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:Bandedge LOW	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
			Mode			FS	
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
5150.00	E	Peak	43.43	8.08	51.51	74.00	-22.49
5150.00	E	Average	30.13	8.08	38.21	54.00	-15.79

Operation Band	:802.11 a	Test Date	:2013-09-17
Fundamental Frequency	:5180 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:Bandedge LOW	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
			Mode			FS	
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
5150.00	E	Peak	43.15	8.18	51.33	74.00	-22.67
5150.00	E	Average	29.36	8.18	37.54	54.00	-16.46

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Radiated Spurious Emission Measurement Result 802.11n HT20, 5150~5250 MHz

Operation Band	:802.11 n20M	Test Date	:2013-09-17
Fundamental Frequency	:5180 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:TX LOW	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
					FS dB μ V	dB μ V/m	dB μ V/m
71.71	S	Peak	39.59	-16.50	23.09	40.00	-16.91
185.20	S	Peak	38.33	-14.84	23.49	43.50	-20.01
262.80	S	Peak	43.10	-13.44	29.66	46.00	-16.34
320.03	S	Peak	40.71	-11.85	28.86	46.00	-17.14
495.60	S	Peak	32.63	-9.03	23.60	46.00	-22.40
580.96	S	Peak	31.36	-7.16	24.20	46.00	-21.80
10360.00	H	Peak	22.88	15.10	37.98	68.30	-30.32
15540.00	H	---					
20720.00	H	---					
25900.00	H	---					
31080.00	H	---					
36260.00	H	---					

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Operation Band	:802.11 n20M	Test Date	:2013-09-17
Fundamental Frequency	:5180 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:TX LOW	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
					FS dB μ V	@3m dB μ V/m	dB μ V/m
71.71	S	Peak	36.20	-16.50	19.70	40.00	-20.30
185.20	S	Peak	47.72	-14.84	32.88	43.50	-10.62
265.71	S	Peak	40.58	-13.33	27.25	46.00	-18.75
320.03	S	Peak	42.42	-11.85	30.57	46.00	-15.43
495.60	S	Peak	34.58	-9.03	25.55	46.00	-20.45
723.55	S	Peak	33.68	-4.51	29.17	46.00	-16.83
10360.00	H	Peak	23.82	15.13	38.95	68.30	-29.35
15540.00	H	---					
20720.00	H	---					
25900.00	H	---					
31080.00	H	---					
36260.00	H	---					

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Operation Band :802.11 n20M Test Date :2013-09-17
Fundamental Frequency :5220 MHz Temp./Humi. :25.6 deg_C / 58 RH
Operation Mode :TX MID Engineer :Allen
EUT Pol. :H PLAN Measurement Antenna Pol. :VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
					FS dB μ V	dB μ V/m	dB μ V/m
70.74	S	Peak	37.85	-16.35	21.50	40.00	-18.50
185.20	S	Peak	37.08	-14.84	22.24	43.50	-21.26
263.77	S	Peak	43.50	-13.40	30.10	46.00	-15.90
320.03	S	Peak	38.86	-11.85	27.01	46.00	-18.99
480.08	S	Peak	33.03	-9.23	23.80	46.00	-22.20
530.52	S	Peak	33.06	-8.28	24.78	46.00	-21.22
10440.00	H	Peak	22.75	15.21	37.96	68.30	-30.34
15660.00	H	---					
20880.00	H	---					
26100.00	H	---					
31320.00	H	---					
36540.00	H	---					

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Operation Band	:802.11 n20M	Test Date	:2013-09-17
Fundamental Frequency	:5220 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:TX MID	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
					FS dB μ V	dB μ V/m	dB μ V/m
185.20	S	Peak	47.65	-14.84	32.81	43.50	-10.69
255.04	S	Peak	39.73	-13.68	26.05	46.00	-19.95
320.03	S	Peak	43.20	-11.85	31.35	46.00	-14.65
480.08	S	Peak	36.01	-9.23	26.78	46.00	-19.22
543.13	S	Peak	33.22	-8.00	25.22	46.00	-20.78
720.64	S	Peak	33.01	-4.56	28.45	46.00	-17.55
10440.00	H	Peak	22.82	15.29	38.11	68.30	-30.19
15660.00	H	---					
20880.00	H	---					
26100.00	H	---					
31320.00	H	---					
36540.00	H	---					

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Operation Band :802.11 n20M Test Date :2013-09-17
Fundamental Frequency :5240 MHz Temp./Humi. :25.6 deg_C / 58 RH
Operation Mode :TX HIGH Engineer :Allen
EUT Pol. :H PLAN Measurement Antenna Pol. :VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
					FS dB μ V	dB μ V/m	dB μ V/m
71.71	S	Peak	37.81	-16.50	21.31	40.00	-18.69
193.93	S	Peak	38.33	-15.58	22.75	43.50	-20.75
270.56	S	Peak	42.50	-13.14	29.36	46.00	-16.64
320.03	S	Peak	39.98	-11.85	28.13	46.00	-17.87
480.08	S	Peak	33.28	-9.23	24.05	46.00	-21.95
663.41	S	Peak	32.09	-5.40	26.69	46.00	-19.31
10480.00	H	Peak	23.19	15.27	38.46	68.30	-29.84
15720.00	H	---					
20960.00	H	---					
26200.00	H	---					
31440.00	H	---					
36680.00	H	---					

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Operation Band	:802.11 n20M	Test Date	:2013-09-17
Fundamental Frequency	:5240 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:TX HIGH	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
					FS dB μ V	@3m dB μ V/m	dB μ V/m
184.23	S	Peak	48.13	-14.73	33.40	43.50	-10.10
263.77	S	Peak	40.41	-13.40	27.01	46.00	-18.99
320.03	S	Peak	40.98	-11.85	29.13	46.00	-16.87
499.48	S	Peak	33.81	-8.99	24.82	46.00	-21.18
532.46	S	Peak	32.84	-8.23	24.61	46.00	-21.39
717.73	S	Peak	32.81	-4.59	28.22	46.00	-17.78
10480.00	H	Peak	23.25	15.36	38.61	68.30	-29.69
15720.00	H	---					
20960.00	H	---					
26200.00	H	---					
31440.00	H	---					
36680.00	H	---					

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Operation Band	:802.11 n20M	Test Date	:2013-09-17
Fundamental Frequency	:5180 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:Bandedge LOW	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
5150.00	E	Peak	43.48	8.08	51.56	74.00	-22.44	
5150.00	E	Average	31.31	8.08	39.39	54.00	-14.61	

Operation Band	:802.11 n20M	Test Date	:2013-09-17
Fundamental Frequency	:5180 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:Bandedge LOW	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
5150.00	E	Peak	42.23	8.18	50.41	74.00	-23.59	
5150.00	E	Average	29.38	8.18	37.56	54.00	-16.44	

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Radiated Spurious Emission Measurement Result 802.11n HT40, 5150~5250 MHz

Operation Band	:802.11 n40M	Test Date	:2013-09-17
Fundamental Frequency	:5190 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:TX LOW	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
					FS dB μ V	dB μ V/m @3m	dB μ V/m
71.71	S	Peak	37.42	-16.50	20.92	40.00	-19.08
184.23	S	Peak	37.81	-14.73	23.08	43.50	-20.42
268.62	S	Peak	43.05	-13.21	29.84	46.00	-16.16
320.03	S	Peak	40.23	-11.85	28.38	46.00	-17.62
533.43	S	Peak	34.19	-8.21	25.98	46.00	-20.02
664.38	S	Peak	31.71	-5.37	26.34	46.00	-19.66
10380.00	H	Peak	22.65	15.11	37.76	68.30	-30.54
15570.00	H	---					
20760.00	H	---					
25950.00	H	---					
31140.00	H	---					
36330.00	H	---					

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Operation Band	:802.11 n40M	Test Date	:2013-09-17
Fundamental Frequency	:5190 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:TX LOW	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
					FS dB μ V	@3m dB μ V/m	dB μ V/m
183.26	S	Peak	46.90	-14.62	32.28	43.50	-11.22
243.40	S	Peak	41.60	-13.94	27.66	46.00	-18.34
320.03	S	Peak	41.99	-11.85	30.14	46.00	-15.86
495.60	S	Peak	33.75	-9.03	24.72	46.00	-21.28
719.67	S	Peak	33.81	-4.57	29.24	46.00	-16.76
797.27	S	Peak	32.37	-3.77	28.60	46.00	-17.40
10380.00	H	Peak	23.65	15.16	38.81	68.30	-29.49
15570.00	H	---					
20760.00	H	---					
25950.00	H	---					
31140.00	H	---					
36330.00	H	---					

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Operation Band	:802.11 n40M	Test Date	:2013-09-17
Fundamental Frequency	:5230 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:TX HIGH	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
					FS dB μ V	dB μ V/m	dB μ V/m
71.71	S	Peak	38.11	-16.50	21.61	40.00	-18.39
187.14	S	Peak	38.44	-15.06	23.38	43.50	-20.12
269.59	S	Peak	41.87	-13.17	28.70	46.00	-17.30
320.03	S	Peak	40.50	-11.85	28.65	46.00	-17.35
495.60	S	Peak	33.27	-9.03	24.24	46.00	-21.76
530.52	S	Peak	32.87	-8.28	24.59	46.00	-21.41
10460.00	H	Peak	23.23	15.23	38.46	68.30	-29.84
15690.00	H	---					
20920.00	H	---					
26150.00	H	---					
31380.00	H	---					
36610.00	H	---					

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Operation Band	:802.11 n40M	Test Date	:2013-09-17
Fundamental Frequency	:5230 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:TX HIGH	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
					FS dB μ V	@3m dB μ V/m	dB μ V/m
76.56	S	Peak	36.41	-17.23	19.18	40.00	-20.82
184.23	S	Peak	47.24	-14.73	32.51	43.50	-10.99
264.74	S	Peak	40.16	-13.37	26.79	46.00	-19.21
320.03	S	Peak	38.30	-11.85	26.45	46.00	-19.55
496.57	S	Peak	33.38	-9.02	24.36	46.00	-21.64
715.79	S	Peak	32.48	-4.62	27.86	46.00	-18.14
10460.00	H	Peak	23.73	15.31	39.04	68.30	-29.26
15690.00	H	---					
20920.00	H	---					
26150.00	H	---					
31380.00	H	---					
36610.00	H	---					

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Operation Band	:802.11 n40M	Test Date	:2013-09-17
Fundamental Frequency	:5190 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:Bandedge LOW	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
5150.00	E	Peak	46.03	8.08	54.11	74.00	-19.89	
5150.00	E	Average	33.08	8.08	41.16	54.00	-12.84	

Operation Band	:802.11 n40M	Test Date	:2013-09-17
Fundamental Frequency	:5190 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:Bandedge LOW	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
5150.00	E	Peak	42.72	8.18	50.90	74.00	-23.10	
5150.00	E	Average	29.61	8.18	37.79	54.00	-16.21	

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Radiated Spurious Emission Measurement Result 802.11ac VHT80, 5210MHz

Operation Band :802.11 ac80M Test Date :2013-09-17
Fundamental Frequency :5210 MHz Temp./Humi. :25.6 deg_C / 58 RH
Operation Mode : Engineer :Allen
EUT Pol. :H PLAN Measurement Antenna Pol. :VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
					FS dB μ V	dB μ V/m	dB μ V/m
70.74	S	Peak	37.29	-16.35	20.94	40.00	-19.06
184.23	S	Peak	36.96	-14.73	22.23	43.50	-21.27
258.92	S	Peak	42.50	-13.57	28.93	46.00	-17.07
320.03	S	Peak	39.88	-11.85	28.03	46.00	-17.97
480.08	S	Peak	37.22	-9.23	27.99	46.00	-18.01
532.46	S	Peak	32.32	-8.23	24.09	46.00	-21.91
10420.00	H	Peak	23.10	15.18	38.28	68.30	-30.02
15630.00	H	---					
20840.00	H	---					
26050.00	H	---					
31260.00	H	---					
36470.00	H	---					

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Operation Band	:802.11 ac80M	Test Date	:2013-09-17
Fundamental Frequency	:5210 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) - Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode	Spectrum Reading Level	Factor dB	Actual	Limit	Margin
					FS dB μ V	@3m dB μ V/m	dB μ V/m
78.50	S	Peak	37.22	-17.51	19.71	40.00	-20.29
183.26	S	Peak	46.76	-14.62	32.14	43.50	-11.36
262.80	S	Peak	41.63	-13.44	28.19	46.00	-17.81
320.03	S	Peak	38.90	-11.85	27.05	46.00	-18.95
480.08	S	Peak	37.02	-9.23	27.79	46.00	-18.21
721.61	S	Peak	32.65	-4.53	28.12	46.00	-17.88
10420.00	H	Peak	26.75	15.25	42.00	68.30	-26.30
15630.00	H	---					
20840.00	H	---					
26050.00	H	---					
31260.00	H	---					
36470.00	H	---					

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Operation Band	:802.11 ac80M	Test Date	:2013-09-17
Fundamental Frequency	:5210 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:Bandedge	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
5150.00	E	Average	41.98	7.82	49.80	54.00	-4.20	
5150.00	E	Peak	56.35	7.82	64.17	74.00	-9.83	

Operation Band	:802.11 ac80M	Test Date	:2013-09-17
Fundamental Frequency	:5210 MHz	Temp./Humi.	:25.6 deg_C / 58 RH
Operation Mode	:Bandedge	Engineer	:Allen
EUT Pol.	:H PLAN	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we've employed is peak detector.

Freq.	Note	Detector	Spectrum		Factor	Actual	Limit	Margin
			Mode	Reading Level				
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB	
5150.00	E	Average	35.83	7.92	43.75	54.00	-10.25	
5150.00	E	Peak	49.81	7.92	57.73	74.00	-16.27	

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13. TRANSMISSION IN THE ABSENCE OF DATA

13.1 Standard Applicable

According to §15.407(c)

The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signaling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization a description of how this requirement is met.

13.2 Result:

No non-compliance noted:

Refer to the theory of operation.

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14. FREQUENCY STABILITY

14.1 Standard Applicable

According to §15.407 (g) Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

14.2 Result:

Refer to next page for plots.

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Operation Mode	802.11 a	Test Date	2013,9,30
Temperature	:25	Test By	Ben
Humidity	:62 %		

Test Temp.	Test Voltage	Channel	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
25	5v	36	5180.0000	5,179.986401	0.0136
		44	5220.0000	5,219.988266	0.0117
		48	5240.0000	5,239.987467	0.0125
55	5.5v	36	5180.0000	5,180.105854	-0.1059
		44	5220.0000	5,220.117808	-0.1178
		48	5240.0000	5,240.123113	-0.1231
55	4.5v	36	5180.0000	5,180.094954	-0.0950
		44	5220.0000	5,220.117841	-0.1178
		48	5240.0000	5,240.119313	-0.1193
0	5.5v	36	5180.0000	5,179.990383	0.0096
		44	5220.0000	5,219.994066	0.0059
		48	5240.0000	5,239.997300	0.0027
0	4.5v	36	5180.0000	5,179.991983	0.0080
		44	5220.0000	5,219.997633	0.0024
		48	5240.0000	5,239.992933	0.0071

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Operation Mode	802.11n_HT20	Test Date	2013,9,30
Temperature	:25	Test By	Ben
Humidity	:62 %		

Test Temp.	Test Voltage	Channel	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
25	5v	36	5180.0000	5,179.989200	0.0108
		44	5220.0000	5,219.988450	0.0116
		48	5240.0000	5,239.989383	0.0106
55	5.5v	36	5180.0000	5,180.134517	-0.1345
		44	5220.0000	5,220.131417	-0.1314
		48	5240.0000	5,240.137194	-0.1372
55	4.5v	36	5180.0000	5,180.123617	-0.1236
		44	5220.0000	5,220.134167	-0.1342
		48	5240.0000	5,240.129594	-0.1296
0	5.5v	36	5180.0000	5,179.995517	0.0045
		44	5220.0000	5,219.993467	0.0065
		48	5240.0000	5,239.993983	0.0060
0	4.5V	36	5180.0000	5,179.983517	0.0165
		44	5220.0000	5,219.992750	0.0072
		48	5240.0000	5,239.995016	0.0050

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Operation Mode	802.11 n_HT40	Test Date	2013,9,30
Temperature	:25	Test By	Ben
Humidity	:62 %		

Test Temp.	Test Voltage	Channel	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
25	5v	38	5190.0000	5,189.988000	0.0120
		46	5230.0000	5,229.987517	0.0125
55	5.5v	38	5190.0000	5,190.147033	-0.1470
		46	5230.0000	5,230.133393	-0.1334
55	4.5v	38	5190.0000	5,190.144899	-0.1449
		46	5230.0000	5,230.119944	-0.1199
0	5.5V	38	5190.0000	5,189.997483	0.0025
		46	5230.0000	5,229.992950	0.0071
0	4.5V	38	5190.0000	5,189.994700	0.0053
		46	5230.0000	5,229.994300	0.0057

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Operation Mode	802.11 ac	Test Date	2013,9,30
Temperature	:25	Test By	Ben
Humidity	:62 %		

Test Temp.	Test Voltage	Channel	Measured Frequency (MHz)	Spectrum Frequency (MHz)	ΔFrequency (MHz)
25	5v	42	5210.0000	5,209.989717	0.0103
55	5.5v	42	5210.0000	5,209.897176	0.1028
55	4.5v	42	5210.0000	5,209.897452	0.1025
0	5.5v	42	5210.0000	5,210.131774	-0.1318
0	4.5v	42	5210.0000	5,210.147452	-0.1475
25	5v	42	5210.0000	5,209.989717	0.0103
55	5.5v	42	5210.0000	5,209.897176	0.1028

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15. ANTENNA REQUIREMENT

15.1 Standard Applicable

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

15.2 Antenna Connected Construction

The directional gains of antenna used for transmitting is 4.7dBi for frequency band of 5150~5250MHz, 802.11 a/n20/n40/ ac_VHT20/ ac_VHT40/ac_VHT80 and the antenna connector is designed with unique type RF connector and no consideration of replacement. Please see EUT photo and antenna spec. for details.

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16. RF EXPOSURE

16.1 Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Portable device with its physical nature to be used nearby, the distance between radiating structure and human is less than 20cm.

As per KDB 447498 D01 §4.3.1, The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR, where}$$

$f(\text{GHz})$ is the RF channel transmit frequency in GHz

Power and distance are rounded to the nearest mW and mm before calculation

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16.2 Measurement Result:

Step 1: (<50mW)

802.11a:

This is a portable device and the Max peak output power is (6.22mW) lower than the threshold given and derived as formula given above, where

$$= 6.22 \text{ (mW)}/5 \text{ (mm)} * \sqrt{5220 \text{ (GHz)}} = 2.84 < 3.0$$

Frequency	Power (avg in dBm)	Power (avg mw)	Distance (mm)	Threshold (<5mm)
5220	7.94	6.223002852	5	2.843578665
Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)	
5220	7.94	0.00622	16.99dBm or 4+10log(B) = 17.14dBm	

802.11n HT20:

This is a portable device and the Max peak output power is (6.11mW) lower than the threshold given and derived as formula given above, where

$$= 6.11 \text{ (mW)}/5 \text{ (mm)} * \sqrt{5220 \text{ (GHz)}} = 2.79 < 3.0$$

Frequency	Power (avg in dBm)	Power (avg mw)	Distance (mm)	Threshold (<5mm)
5220	7.86	6.109420249	5	2.791677506
Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)	
5220	7.86	0.00610	16.99dBm or 4+10log(B) = 17.28dBm	

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802.11n HT40:

This is a portable device and the Max peak output power is (6.05mW) lower than the threshold given and derived as formula given above, where

$$= 6.05 \text{ (mW)} / 5 \text{ (mm)} * \sqrt{5230 \text{ (GHz)}} = 2.77 < 3.0$$

Frequency	Power (avg in dBm)	Power (avg mw)	Distance (mm)	Threshold (<5mm)
5230	7.82	6.053408748	5	2.76873149
Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)	
5230	7.82	0.00605	16.99dBm or 4+10log(B) = 20.27dBm	

802.11ac VHT80:

This is a portable device and the Max peak output power is (6.07mW) lower than the threshold given and derived as formula given above, where

$$= 6.07 \text{ (mW)} / 5 \text{ (mm)} * \sqrt{5210 \text{ (GHz)}} = 2.76 < 3.0$$

Frequency	Power (avg in dBm)	Power (avg mw)	Distance (mm)	Threshold (<5mm)
5210	7.83	6.067363296	5	2.769802847
Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)	
5210	7.83	0.00607	16.99dBm or 4+10log(B) = 23.24dBm	

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As the result of calculation result indicates, the RF exposure generating from given transmitter (transmitter employed digital modulation) can be excluded from SAR measurement, and is deemed compliant with RF exposure as per FCC.

The table of quick reference in terms of power threshold

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm

Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distances are illustrated in the following Table.

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

Note that the table present above is the table of quick reference, indexing the level of power threshold with respect to the corresponding frequency. The value of the index may be deviated, and therefore, the derivation of exemption based on KDB447498 D01 is used in this test report, relevantly.

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