FCC PART 15.407
ISED RSS-247, ISSUE 2, FEBRUARY 2017

TEST REPORT

For

Roku, Inc.

150 Winchester Circle,

Los Gatos, CA 95032, USA

FCC ID: TC2-R1016
IC: 5959A-R1016

Report Type:	**Model:**
Original Report	4660X2

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Report Number:	R1706267-407
Report Date:	2017-08-17
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1706267-407	Original Report	2017-08-17

1 General Description

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Roku, Inc.*, and their product model: *4660X2,* FCC ID: TC2-R1016, IC: 5959A-R1016 or the "EUT" as referred to in this report.

1.2 Objective

This report is prepared on behalf of Roku, Inc in accordance with FCC CFR47 §15.407 and ISED RSS-247 Issue 2, February2017.

The objective is to determine compliance with FCC Part 15.407 and ISED RSS-247 rules for Output Power, Antenna Requirements, AC Line Conducted Emissions, Emission Bandwidth, Power spectral density, Conducted and Radiated Spurious Emissions.

1.3 Related Submittal(s)/Grant(s)

FCC Part 15, Subpart C, Equipment DTS with FCC ID: TC2-R1016, IC: 5959A-R1016 report: R1706267-247
FCC Part 15, Subpart E, Equipment NII with FCC ID: TC2-RCB16, IC: 5959A-RCB16 report: R1706268-407
FCC Part 15, Subpart C, Equipment DTS with FCC ID: TC2-RCB16, IC: 5959A-RCB16 report: R1706268-247

1.4 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz, and FCC KDB 789033 D02 General UNII Test Procedure New Rules v01r04.

1.5 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Parameter	Measurement uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.57 dB
Power Spectral Density, conducted	±1.48dB
Unwanted Emissions, conducted	±1.57dB
All emissions, radiated	±4.0 dB
AC power line Conducted Emission	±2.0 dB
Temperature	±2 º C
Humidity	±5 %
DC and low frequency voltages	±1.0 %
Time	±2 %
Duty Cycle	±3 %

1.6 Test Facility Registrations

BACLs test facilities that are used to perform Radiated and Conducted Emissions tests are currently recognized by the Federal Communications Commission as Accredited with NIST Designation Number US1129.

BACL's test facilities that are used to perform Radiated and Conducted Emissions tests are currently registered with Industry Canada under Registration Numbers: 3062A-1, 3062A-2, and 3062A-3.

BACL is a Chinese Taipei Bureau of Standards Metrology and Inspection (BSMI) validated Conformity Assessment Body (CAB), under Appendix B, Phase I Procedures of the APEC Mutual Recognition Arrangement (MRA). BACL's BSMI Lab Code Number is: SL2-IN-E-1002R

BACL's test facilities that are used to perform AC Line Conducted Emissions, Telecommunications Line Conducted Emissions, Radiated Emissions from 30 MHz to 1 GHz, and Radiated Emissions from 1 GHz to 6 GHz are currently recognized as Accredited in accordance with the Voluntary Control Council for Interference [VCCI] Article 15 procedures under Registration Number A-0027.

1.7 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3279.02),*** in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficienct Lighting.

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3279.03)*** to certify

- For the USA (Federal Communications Commission):
    1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
    2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
    3- All Telephone Terminal Equipment within FCC Scope C.
- For the Canada (Industry Canada):
    1 All Scope 1-Licence-Exempt Radio Frequency Devices;
    2 All Scope 2-Licensed Personal Mobile Radio Services;
    3 All Scope 3-Licensed General Mobile and Fixed Radio Services;
    4 All Scope 4-Licensed Maritime and Aviation Radio Services;
    5 All Scope 5-Licensed Fixed Microwave Radio Services
    6 All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.
- For Singapore (Info-Communications Development Authority (IDA)):
    1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
    2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2

- For the Hong Kong Special Administrative Region:
  1 All Radio Equipment, per KHCA 10XX-series Specifications;
  2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
  3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
  1 MIC Telecommunication Business Law (Terminal Equipment):
  - All Scope A1 - Terminal Equipment for the Purpose of Calls;
  - All Scope A2 - Other Terminal Equipment
  2 Radio Law (Radio Equipment):
  - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
  - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
  - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3279.01)*** to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

1 Electronics and Office Equipment:
- for Telephony (ver. 3.0)
- for Audio/Video (ver. 3.0)
- for Battery Charging Systems (ver. 1.1)
- for Set-top Boxes and Cable Boxes (ver. 4.1)
- for Televisions (ver. 6.1)
- for Computers (ver. 6.0)
- for Displays (ver. 6.0)
- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)

2 Commercial Food Service Equipment
- for Commercial Dishwashers (ver. 2.0)
- for Commercial Ice Machines (ver. 2.0)
- for Commercial Ovens (ver. 2.1)
- for Commercial Refrigerators and Freezers

3 Lighting Products
- For Decorative Light Strings (ver. 1.5)
- For Luminaires (including sub-components) and Lamps (ver. 1.2)
- For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
- For Integral LED Lamps (ver. 1.4)

4 Heating, Ventilation, and AC Products
- for Residential Ceiling Fans (ver. 3.0)
- for Residential Ventilating Fans (ver. 3.2)

5 Other
- For Water Coolers (ver. 3.0)

D- ***A NIST Designated Phase-I and Phase-II Conformity Assessment Body (CAB) for the following economies and regulatory authorities under the terms of the stated MRAs/Treaties:***

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Industry Canada - IC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I and Phase II;
- Chinese Taipei (Republic of China – Taiwan):
  - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
  - NCC (National Communications Commission) APEC Tel MRA -Phase I;

- European Union:
  - EMC Directive 2004/108/EC US-EU EMC and Telecom MRA CAB
  - Radio and Teleterminal Equipment (RandTTE) Directive 1995/5/EC US -EU EMC and Telecom MRA CAB
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I and Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Development Authority - IDA) APEC Tel MRA -Phase I and Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
  - ENERGY STAR Recognized Test Laboratory – US EPA
  - Telecommunications Certification Body (TCB) – US FCC;
- Vietnam: APEC Tel MRA -Phase I;

2 EUT Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.10-2013 and FCC KDB 789033 D02 General UNII Test Procedures New Rules v01r04.

The EUT was tested in a testing mode to represent worst-case results during the final qualification test.

The worst-case data rates are determined by measuring the average power, peak power and PPSD across all data rates bandwidths, and modulations.

2.2 EUT Exercise Software

The test firmware used was Putty provided by *Roku, Inc.*, the software is comply with the standard requirements being tested against.
Please refer to the following power setting table.

Modulation	Channel	Frequency (MHz)	Power Setting
802.11a	36	5180	49
	40	5200	62
	48	5240	62
	149	5745	49
	157	5785	56
	165	5825	54
802.11n20	36	5180	53
	40	5200	56
	48	5240	56
	149	5745	56
	157	5785	56
	165	5825	56
802.11ac20	36	5180	53
	40	5200	56
	48	5240	56
	149	5745	56
	157	5785	56
	165	5825	56

* Note: This is only an FCC channel.
*Data rates tested:
802.11a mode: 6Mbps
802.11n HT20: MCS0
802.11ac VHT20: MCS0

2.3 Duty Cycle Correction Factor

According to KDB 789033 D02 General UNII Test Procedures New Rules v01r04 section B:

All measurements are to be performed with the EUT transmitting at 100% duty cycle at its maximum power control level; however, if 100% duty cycle cannot be achieved, measurements of duty cycle, x, and maximum-power transmission duration, T, are required for each tested mode of operation.

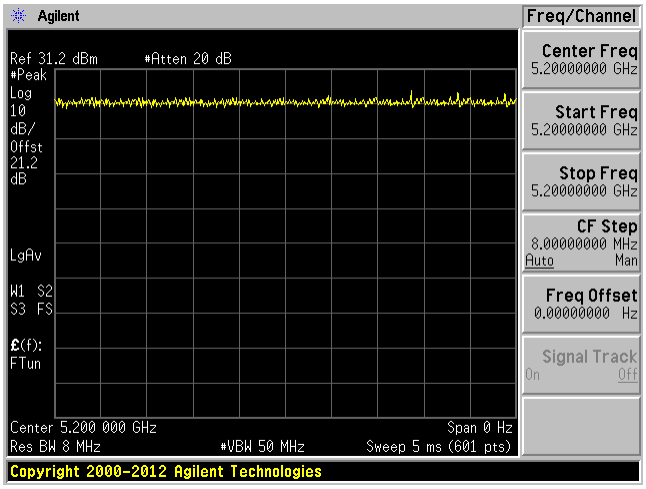
Radio Mode	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
802.11a	100	0
802.11n20	100	0
802.11ac20	100	0

Note: Duty Cycle Correction Factor = 10*log(1/duty cycle)

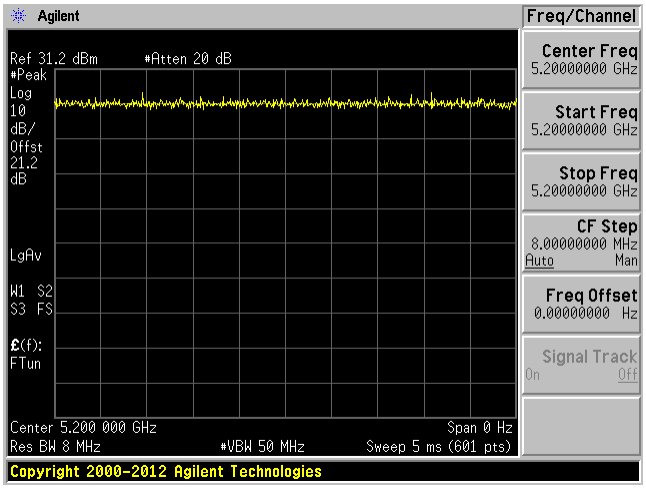
Please refer to the following plots.

Antena Port A

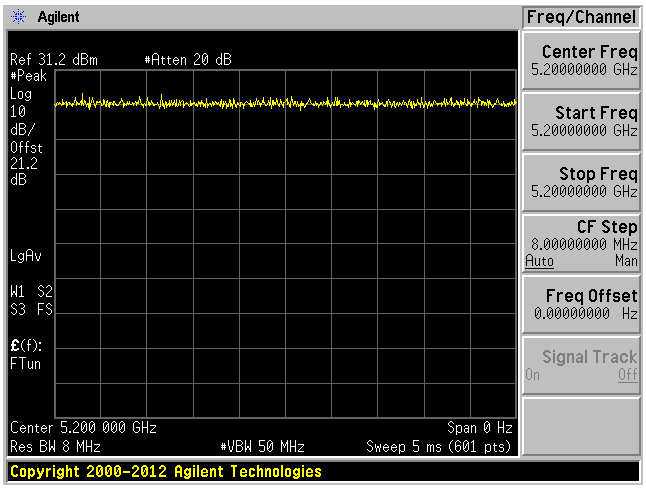
802.11a mode



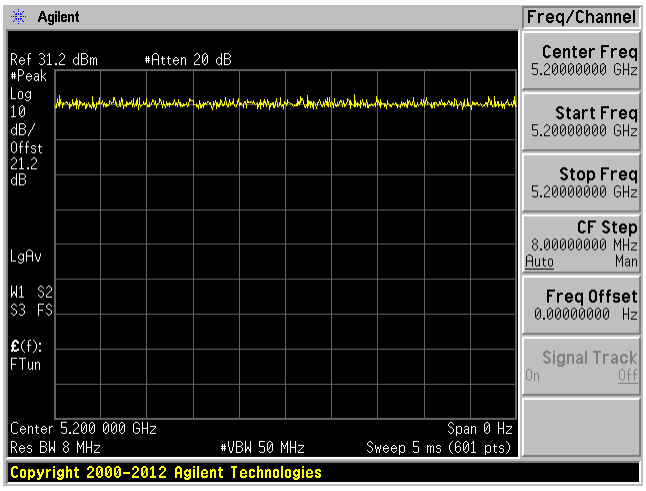
802.11n20 mode



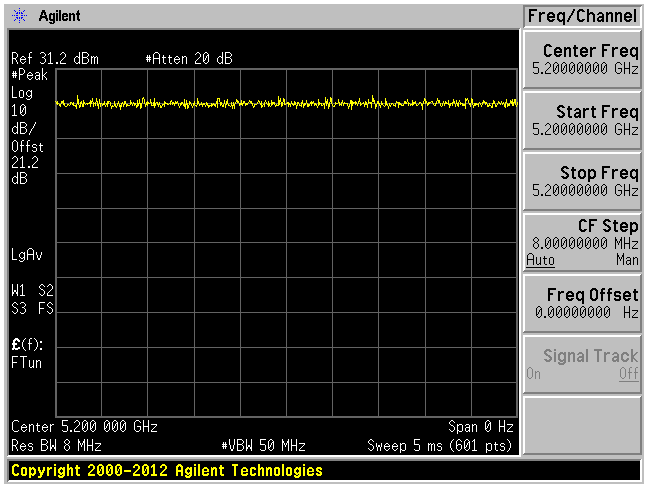
802.11n20 mode MIMO



802.11ac20 mode

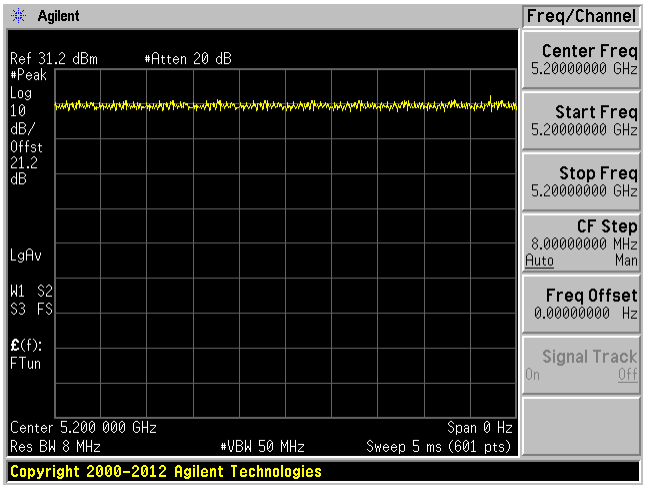


802.11ac20 mode MIMO

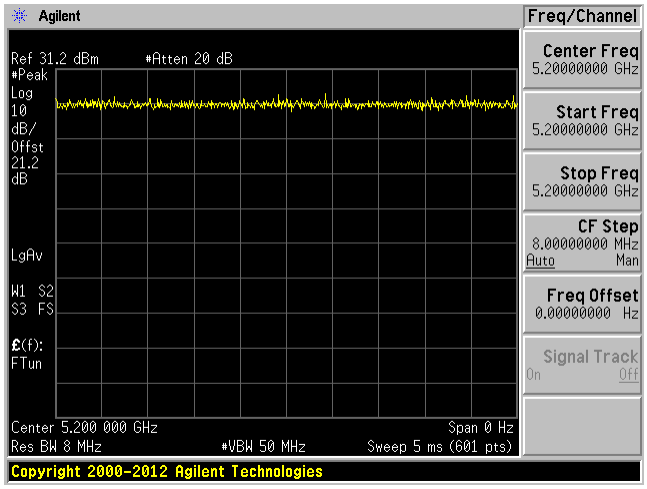


Antenna Port B

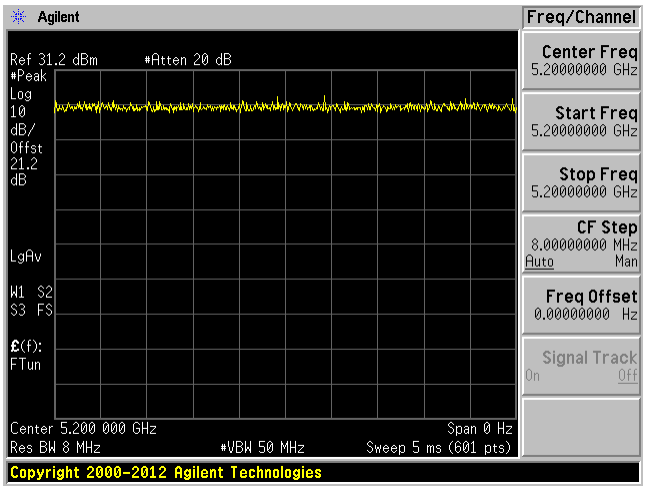
802.11a mode



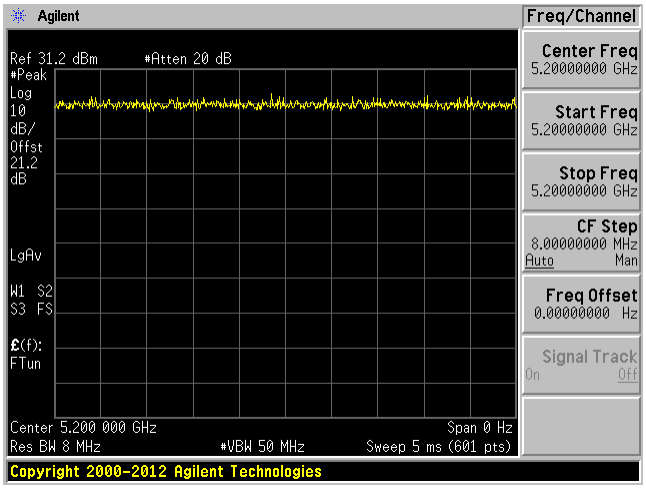
802.11n20 mode



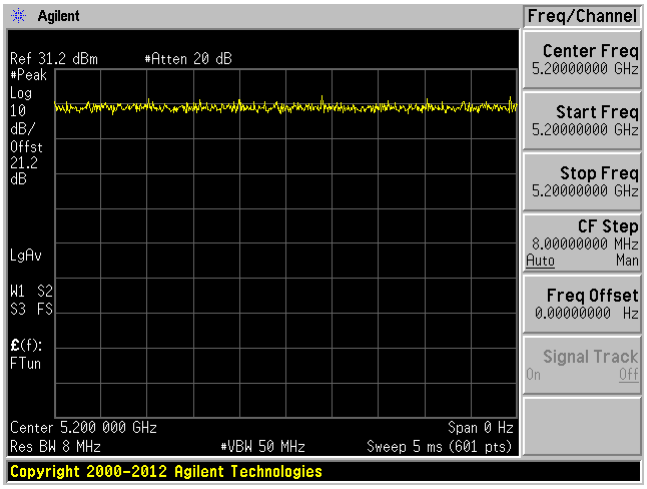
802.11n20 mode MIMO



802.11ac20 mode



802.11ac20 mode MIMO



2.4 Equipment Modifications

No equipment modificaitons were made to EUT.

2.5 Local Support Equipment

Manufacturer	Description	Model
Dell	Laptop	Latitude E6410

2.6 Support Equipment

Manufacturer	Description	Model
Roku	Debug Board	Unknown

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
USB 2.0 A-Male to B-Male	2 m	Laptop	EUT
RF Cable	< 1 m	EUT	PSA

3 Summary of Test Results

Results reported relate only to the product tested.

FCC and ISED Rules	Description of Test	Result
FCC §2.1091, §15.407(f), ISED RSS-102	RF Exposure	Compliant
FCC §15.203 ISED RSS-Gen §8.3	Antenna Requirement	Compliant
FCC §15.207 ISED RSS-Gen §8.8	AC Power Line Conducted Emissions	Compliant
FCC §2.1053, §15.205, §15.209, 15.407(b) ISED RSS-247 §6.2	Spurious Radiated Emissions	Compliant
FCC §15.407(e) ISED RSS-Gen §6.2	Emission Bandwidth	Compliant
FCC §407(a) ISED RSS-247 §6.2	Output Power	Compliant
FCC §2.1051, §15.407(b) ISED RSS-247 §6.2	Band Edges	Compliant
FCC §15.407(a) ISED RSS-247 §6.2	Power Spectral Density	Compliant
FCC §2.1051, §15.407(b) ISED RSS-247 §6.2	Spurious Emissions at Antenna Terminals	Compliant

4 FCC §2.1091, §15.407(f) & ISED RSS-102 - RF Exposure

4.1 Applicable Standards

According to FCC §15.247(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	* (100)	30
1.34-30	824/f	2.19/f	* ($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

Before equipment certification is granted, the procedure of IC RSS-102 must be followed concerning the exposure of humans to RF field

According to ISED RSS-102 Issue 5:

2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz[6] and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

4.3 MPE Results

W52 band:

Maximum peak output power at antenna input terminal (dBm):	20.85
Maximum peak output power at antenna input terminal (mW):	121.62
Prediction distance (cm):	20
Prediction frequency (MHz):	5200
Maximum Antenna Gain, typical (dBi):	1.1
Maximum Antenna Gain (numeric):	1.288
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0312
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0312 mW/cm^2. Limit is 1.0 mW/cm^2.

W58 band:

Maximum peak output power at antenna input terminal (dBm):	19.70
Maximum peak output power at antenna input terminal (mW):	93.33
Prediction distance (cm):	20
Prediction frequency (MHz):	5785
Maximum Antenna Gain, typical (dBi):	2.4
Maximum Antenna Gain (numeric):	1.738
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0323
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0323 mW/cm^2. Limit is 1.0 mW/cm^2.

4.4 RF exposure evaluation exemption for IC

W52 band: 20.85 + 1.1 dBi = 21.95 dBm < $1.31\times10^{-2}f^{0.6834}$ = 4.537 W = 36.57 dBm

W58 band: 19.70 + 2.4 dBi = 22.10 dBm < $1.31\times10^{-2}f^{0.6834}$ = 4.880 W = 36.88 dBm

Therefore the RF exposure is not required.

5 FCC §15.203 & ISED RSS-Gen §8.3 - Antenna Requirements

5.1 Applicable Standards

According to FCC §15.203:

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

And according to FCC §15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to ISED RSS-Gen §8.3: Transmitter Antenna

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the license-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

License-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotopically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the license-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of license-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.[9] When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

5.2 Antenna List

The antennas used by the EUT are permanent attached antennas.

Antenna usage	Frequency Range (MHz)	Maximum Antenna Gain (dBi)
Wi-Fi	2400-2500	2.6
Wi-Fi	5150-5250	1.1
Wi-Fi	5725-5850	2.4

6 FCC §15.207 & ISED RSS-Gen §8.8 - AC Power Line Conducted Emissions

6.1 Applicable Standards

As per FCC §15.207 and ISED RSS GEN §8.8

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note1	56 to 46 Note2
0.5-5	56	46
5-30	60	50

Note1: Decreases with the logarithm of the frequency.
Note2: A linear average detector is required

6.2 Test Setup

The measurement was performed at shield room, using the setup per ANSI C63.10-2013 measurement procedure. The specification used was FCC §15.207 limits and and ISED RSS-GEN §8.8.

External I/O cables were draped along the edge of the test table and bundle when necessary.
The AC/DC power adapter of the EUT was connected with LISN-1 which provided 120 V / 60 Hz AC power.

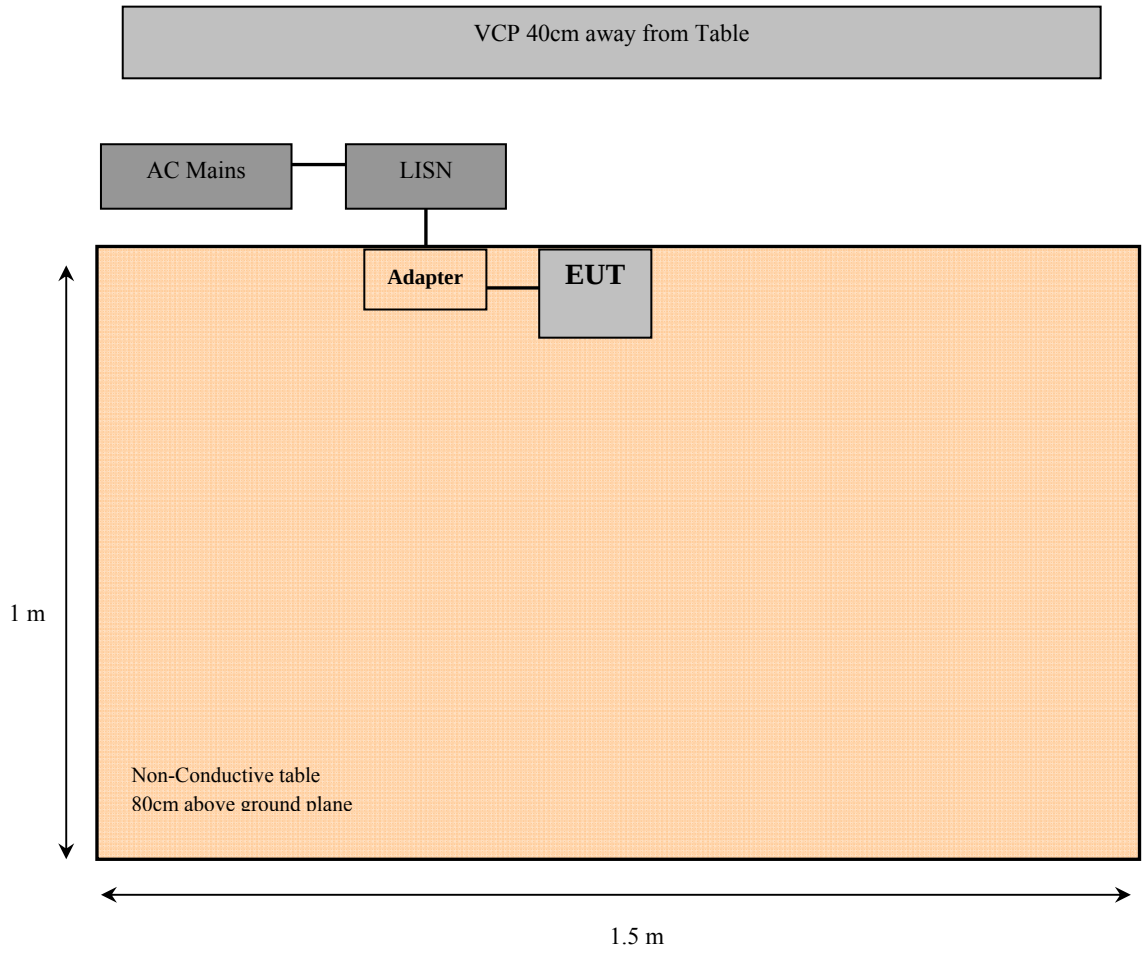
6.3 Test Procedure

During the conducted emissions test, the power cord of the EUT host system was connected to the mains outlet of the LISN-1 and the power cords of support equipment were connected to LISN-2.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the peak, quasi-peak, and average detection mode. Quasi-Peak readings are distinguished with a “QP.” Average readings are distinguished with an “Ave”.

6.4 Test Setup Block Diagram



6.5 Corrected Amplitude and Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Cable Loss (CL), the Attenuator Factor (Atten) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + CL + Atten

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Cable Loss (3.7 dB) + Attenuator (10 dB)

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde and Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100338	2016-02-04	2 years
Rohde and Schwarz	Impulse Limiter	ESH3-Z2	101964	2017-07-25	1 year
Keysight Technologies	RF Limiter	11867A	MY42242931	2017-01-12	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150204	2017-03-13	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	N/R	N/A
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160129	2017-04-24	1 year

Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

6.7 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	42 %
ATM Pressure:	101.31 kPa

The testing was performed by Chin Ming Lui on 2017-07-26 at chamber 5m 3 test site.

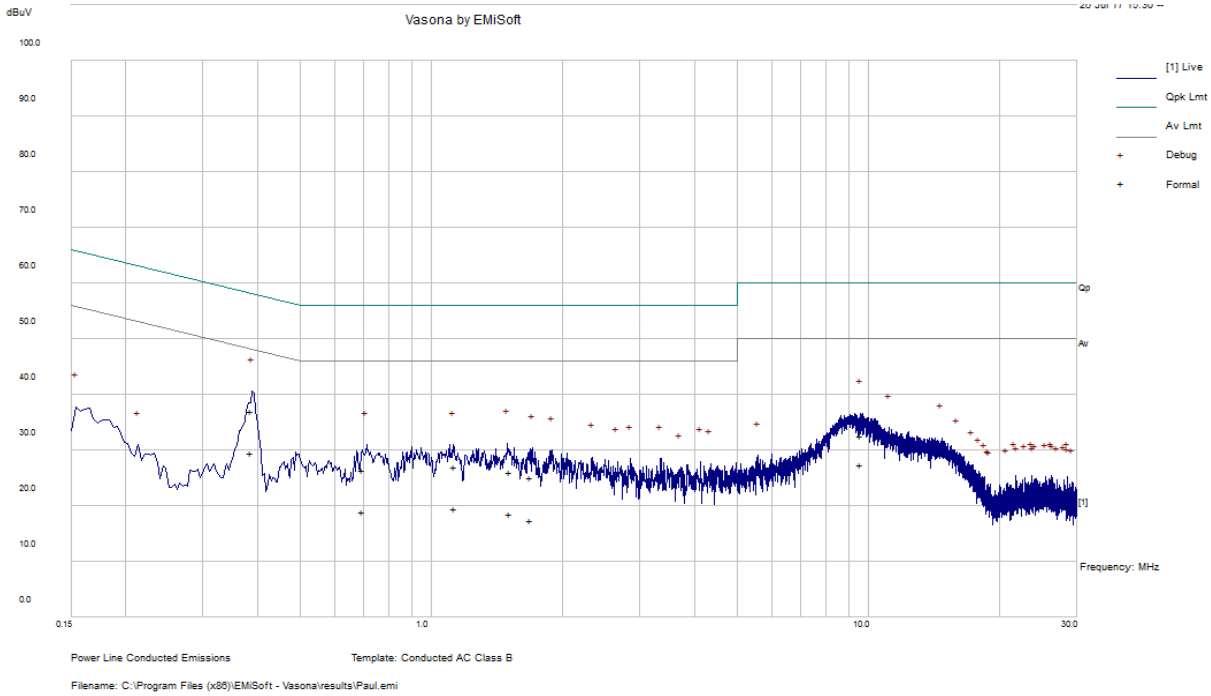
6.8 Summary of Test Results

According to the recorded data in following table, the EUT complied with the FCC Part 15 and RSS-Gen standards' conducted emissions limits, with the margin reading of:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-18.54	0.386728	Line	0.15-0.5

6.9 Conducted Emissions Test Plots and Data

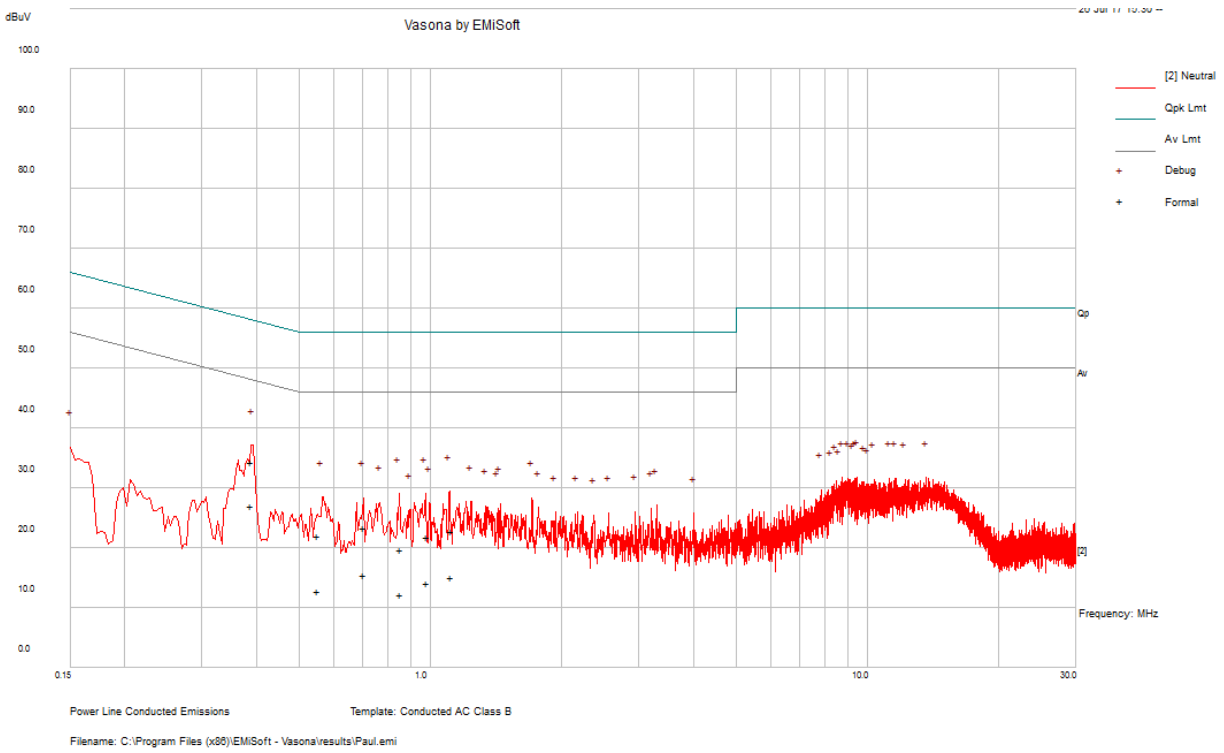
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.386728	37.09	Line	58.13	-21.04	QP
9.579005	32.67	Line	60	-27.33	QP
1.511196	26.1	Line	56	-29.9	QP
1.131356	26.97	Line	56	-29.03	QP
0.694623	26.5	Line	56	-29.5	QP
1.684988	25.19	Line	56	-30.81	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.386728	**29.59**	**Line**	**48.13**	**-18.54**	**Ave.**
9.579005	27.35	Line	50	-22.65	Ave.
1.511196	18.62	Line	46	-27.38	Ave.
1.131356	19.5	Line	46	-26.5	Ave.
0.694623	18.95	Line	46	-27.05	Ave.
1.684988	17.37	Line	46	-28.63	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.389506	23.82	Neutral	58.07	-23.78	QP
1.117162	12.33	Neutral	56	-33.16	QP
0.983608	11.39	Neutral	56	-34.1	QP
0.856917	9.21	Neutral	56	-36.28	QP
0.551453	11.54	Neutral	56	-33.98	QP
0.70453	12.83	Neutral	56	-32.68	QP

Frequency (MHz)	Corrected Amplitude (dBµV)	Conductor (Line/Neutral)	Limit (dBµV)	Margin (dB)	Detector (QP/Ave.)
0.389506	16.67	Neutral	48.07	-20.93	Ave.
1.117162	4.64	Neutral	46	-30.85	Ave.
0.983608	3.66	Neutral	46	-31.83	Ave.
0.856917	1.74	Neutral	46	-33.75	Ave.
0.551453	2.32	Neutral	46	-33.2	Ave.
0.70453	4.96	Neutral	46	-30.55	Ave.

7 FCC §15.209, §15.407(b) & ISED RSS-247 §6.2 - Spurious Radiated Emissions

7.1 Applicable Standard

As Per FCC §15.205(a) except as show 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	960 – 1240	4. 5 – 5. 15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5. 35 – 5. 46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 –167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3 3458 – 3 358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

As per FCC §15.209: The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100 Note 1	3
88 - 216	150 Note 1	3
216 - 960	200 Note 1	3
Above 960	500	3

Note 1: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC Part 15.407 (b)

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(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 e.i.r.p. of −27 dBm/MHz.

(3) For transmitters operating in the 5.47 -5.725 GHz band: All emissions outside of the 5.47-5725 GHz band shall not exceed an ei.r.p. of -27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall noet exceed an e.i.r.p. of -27 dBm/MHz.

(5) The 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.

(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(7) The provisions of §15.205 apply to intentional radiators operating under this section.

As per ISED RSS-247 §6.2

For transmitters operating in the band 5150-5250 MHz, all emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. However, any unwanted emissions that fall into the band 5250- 5350 MHz must be 26 dBc, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth, above 5.25 GHz. Otherwise, the transmission is considered as intentional and the devices shall implement dynamic frequency selection (DFS) and transmitter power control (TPC) as per the requirements for the band 5250-5350 MHz

For devices with both operating frequencies and channel bandwidths contained within the band 5250-5350 MHz, the device shall comply with the following:

1. All emissions outside the band 5250-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. if the equipment is intended for outdoor use; or
2. All emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. and any emissions within the band 5150-5250 MHz shall meet the power spectral density limits of Section 6.2.1. The device shall be labelled “for indoor use only.”

For devices with operating frequencies in the band 5250-5350 MHz but having a channel bandwidth that overlaps the band 5150-5250 MHz, the devices’ unwanted emission shall not exceed -27 dBm/MHz e.i.r.p. outside the band 5150-5350 MHz and its power shall comply with the spectral power density for operation within the band 5150-5250 MHz. The device shall be labelled “for indoor use only.”

For transmitters operating in the band 5470-5725 MHz, emissions outside the band shall not exceed -27 dBm/MHz e.i.r.p.

For the band 5725-5850 MHz, emissions at frequencies from the band edges to 10 MHz above or below the band edges shall not exceed -17 dBm/MHz e.i.r.p. For emissions at frequencies more than 10 MHz above or below the band edges, the emissions power shall not exceed -27 dBm/MHz.

7.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC 15.407 and ISED RSS-247 limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

7.3 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords were connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter or 1.5 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000 MHz:

(1) Peak: RBW = 1MHz / VBW = 3MHz / Sweep = 100ms
(2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

7.4 Corrected Amplitude and Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit for Class A. The equation for margin calculation is as follows:

Margin = Corrected Amplitude - Limit

7.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde and Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100338	2016-02-04	2 years
Agilent	Analyzer, Spectrum	E4446A	US44300386	2017-04-20	1 year
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
Sunol Sciences	Antenna, Biconi-Log	JB1	A013105-3	2015-07-11	25 months
EMCO	Antenna, Horn	3115	9511-4627	2016-01-28	2 years
Agilent	Pre-Amplifier	8447D	2944A06639	2017-06-15	1 year
IW	AOBOR Hi frequency Co AX Cable	DC 1531	KPS-1501A3960KPS	2016-08-05	1 year
-	SMA cable	-	C0002	Each time[1]	N/A
-	N-Type Cable	-	C00012	Each time[1]	N/A
-	N-Type Cable	-	C00014	Each time[1]	N/A
Agilent	Pre-Amplifier	8449B	3147A00400	2017-06-15	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2017-03-27	2 years
A.R.A.	Antenna, Horn	DRG-118/A	1132	2015-09-21	2 years
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

Note[1]: cables and attenuators included in the test set-up will be checked each time before testing.
***Statement of Traceability: BACL** attests that all calibrations have been performed per the A2LA requirements, traceable to NIST.*

7.6 Test Environmental Conditions

Temperature:	22-24 ºC
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

The testing was performed by Vincent Licata 2017-07-31 to 2017-08-02 in 5m chamber 3.

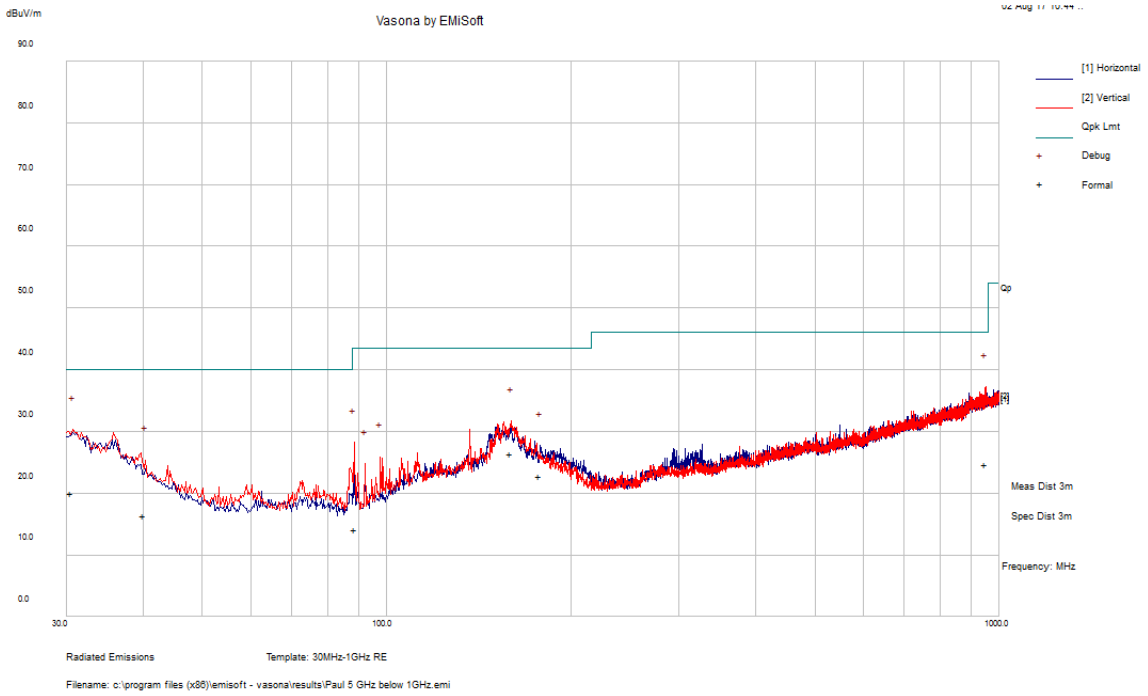
7.7 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Part 15.407 and RSS-247 standards' radiated emissions limits, and had the worst margin of:

Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Mode, Channel**
-0.31	11650	Vertical	802.11a, 5825 MHz

7.8 Radiated Emissions Test Result Data

1) 30 MHz – 1 GHz



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comments (PK/QP/Ave.)
950.4385	24.74	222	V	115	46	-21.26	QP
30.52225	20.06	204	V	67	40	-19.94	QP
159.6275	26.42	186	H	278	43.5	-17.08	QP
40.125	16.38	244	V	314	40	-23.62	QP
88.55125	14.13	102	V	184	43.5	-29.37	QP
177.8855	22.86	172	H	288	43.5	-20.64	QP

2) 1–40 GHz

5150 - 5250 MHz

802.11a mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISED		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5180 MHz											
5180	69.16	35	100	H	33.59	8.35	0.00	111.10	-	-	PK
5180	61.45	35	100	H	33.59	8.35	0.00	103.39	-	-	AV
5180	66.39	334	257	V	33.58	8.35	0.00	108.32	-	-	PK
5180	59.05	334	257	V	33.58	8.35	0.00	100.98	-	-	AV
5150	59.12	33	100	H	33.53	9.24	36.19	65.70	74.00	-8.30	PK
5150	46.82	33	100	H	33.53	9.24	36.19	53.40	54.00	-0.60	AV
5150	54.87	336	100	V	33.42	9.24	36.19	61.35	74.00	-12.66	PK
5150	42.39	336	100	V	33.42	9.24	36.19	48.87	54.00	-5.14	AV
10360	42.29	0	100	H	38.15	14.58	35.51	59.51	68.23	-8.72	PK
10360	41.72	0	100	V	38.09	14.58	35.51	58.88	68.23	-9.35	PK
Middle Channel 5200 MHz											
5200	69.22	18	100	H	33.59	8.35	0.00	111.16	-	-	PK
5200	61.18	18	100	H	33.59	8.35	0.00	103.12	-	-	AV
5200	65.17	323	100	V	33.58	8.35	0.00	107.10	-	-	PK
5200	57.20	323	100	V	33.58	8.35	0.00	99.13	-	-	AV
10400	41.22	0	100	H	38.20	14.58	35.51	58.49	68.23	-9.74	PK
10400	40.70	0	100	V	38.12	14.58	35.51	57.89	68.23	-10.34	PK
High Channel 5240 MHz											
5240	67.78	21	100	H	33.62	8.35	0.00	109.75	-	-	PK
5240	59.43	21	100	H	33.66	8.35	0.00	101.45	-	-	AV
5240	63.85	316	243	V	33.56	8.35	0.00	105.76	-	-	PK
5240	55.85	316	243	V	33.56	8.35	0.00	97.76	-	-	AV
10480	41.02	0	100	H	38.26	14.90	35.44	58.74	68.23	-9.49	PK
10480	40.89	0	100	V	38.19	14.90	35.44	58.54	68.23	-9.69	PK

802.11 n20 mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISED		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5180 MHz											
5180	67.31	19	100	H	33.59	8.35	0.00	109.25	-	-	PK
5180	59.24	19	100	H	33.59	8.35	0.00	101.18	-	-	AV
5180	65.38	321	100	V	33.58	8.35	0.00	107.31	-	-	PK
5180	57.39	321	100	V	33.58	8.35	0.00	99.32	-	-	AV
5150	60.17	33	100	H	33.53	9.24	36.19	66.75	74.00	-7.25	PK
5150	46.81	33	100	H	33.53	9.24	36.19	53.39	54.00	-0.61	AV
5150	56.70	325	140	V	33.42	9.24	36.19	63.18	74.00	-10.83	PK
5150	43.01	325	140	V	33.42	9.24	36.19	49.49	54.00	-4.52	AV
10360	47.85	256	100	H	38.15	14.58	35.51	65.07	68.23	-3.16	PK
10360	47.20	312	100	V	38.09	14.58	35.51	64.36	68.23	-3.87	PK
Middle Channel 5200 MHz											
5200	69.66	19	100	H	33.59	8.35	0.00	111.60	-	-	PK
5200	61.28	19	100	H	33.59	8.35	0.00	103.22	-	-	AV
5200	68.38	321	100	V	33.58	8.35	0.00	110.31	-	-	PK
5200	59.81	321	100	V	33.58	8.35	0.00	101.74	-	-	AV
10400	48.61	256	100	H	38.20	14.58	35.51	65.88	68.23	-2.35	PK
10400	50.01	314	100	V	38.12	14.58	35.51	67.20	68.23	-1.03	PK
High Channel 5240 MHz											
5240	66.46	248	100	H	33.62	8.35	0.00	108.43	-	-	PK
5240	58.29	248	100	H	33.66	8.35	0.00	100.31	-	-	AV
5240	64.71	140	100	V	33.56	8.35	0.00	106.62	-	-	PK
5240	56.65	140	100	V	33.56	8.35	0.00	98.56	-	-	AV
10480	49.85	261	100	H	38.26	14.90	35.44	67.57	68.23	-0.66	PK
10480	50.13	281	100	V	38.19	14.90	35.44	67.78	68.23	-0.45	PK

802.11ac20 mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISED		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5180 MHz											
5180	67.11	19	140	H	33.59	8.35	0.00	109.05	-	-	PK
5180	59.00	19	140	H	33.59	8.35	0.00	100.94	-	-	AV
5180	65.32	288	100	V	33.58	8.35	0.00	107.25	-	-	PK
5180	57.40	288	100	V	33.58	8.35	0.00	99.33	-	-	AV
5150	60.72	28	100	H	33.53	9.24	36.19	67.30	74.00	-6.70	PK
5150	46.64	28	100	H	33.53	9.24	36.19	53.22	54.00	-0.78	AV
5150	56.84	323	100	V	33.42	9.24	36.19	63.32	74.00	-10.69	PK
5150	43.07	323	100	V	33.42	9.24	36.19	49.55	54.00	-4.46	AV
10360	48.66	260	100	H	38.15	14.58	35.51	65.88	68.23	-2.35	PK
10360	48.02	285	100	V	38.09	14.58	35.51	65.18	68.23	-3.05	PK
Middle Channel 5200 MHz											
5200	69.69	1	100	H	33.59	8.35	0.00	111.63	-	-	PK
5200	62.15	1	100	H	33.59	8.35	0.00	104.09	-	-	AV
5200	65.93	320	100	V	33.58	8.35	0.00	107.86	-	-	PK
5200	57.86	320	100	V	33.58	8.35	0.00	99.79	-	-	AV
10400	48.84	259	100	H	38.20	14.58	35.51	66.11	68.23	-2.12	PK
10400	47.70	294	100	V	38.12	14.58	35.51	64.89	68.23	-3.34	PK
High Channel 5240 MHz											
5240	67.34	15	254	H	33.62	8.35	0.00	109.31	-	-	PK
5240	59.39	15	254	H	33.66	8.35	0.00	101.41	-	-	AV
5240	64.81	140	100	V	33.56	8.35	0.00	106.72	-	-	PK
5240	56.22	140	100	V	33.56	8.35	0.00	98.13	-	-	AV
10480	47.75	257	100	H	38.26	14.90	35.44	65.47	68.23	-2.76	PK
10480	46.92	287	100	V	38.19	14.90	35.44	64.57	68.23	-3.66	PK

5725 - 5850 MHz

802.11a mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISED		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5745 MHz											
5745	60.57	31	100	H	34.07	8.87	0.00	103.51	-	-	PK
5745	52.38	31	100	H	34.07	8.87	0.00	95.32	-	-	AV
5745	63.53	190	100	V	33.97	8.87	0.00	106.37	-	-	PK
5745	55.02	190	100	V	33.97	8.87	0.00	97.86	-	-	AV
5700	46.54	92	100	H	34.07	9.79	36.16	54.24	68.23	-13.99	PK
5700	47.85	272	100	V	33.97	9.79	36.16	55.46	68.23	-12.78	PK
5720	61.26	92	100	H	34.07	9.79	36.16	68.96	105.20	-36.24	PK
5720	63.89	272	100	V	33.97	9.79	36.16	71.50	105.20	-33.71	PK
5725	72.19	92	100	H	34.07	9.79	36.16	79.89	110.80	-30.91	PK
5725	74.91	272	100	V	33.97	9.79	36.16	82.52	110.80	-28.29	PK
11490	41.21	0	100	H	38.45	18.67	35.09	63.24	74.00	-10.76	PK
11490	29.07	0	100	H	38.45	18.67	35.09	51.10	54.00	-2.90	AV
11490	43.32	0	300	V	38.38	18.67	35.09	65.28	74.00	-8.72	PK
11490	31.67	0	300	V	38.38	18.67	35.09	53.63	54.00	-0.37	AV
Middle Channel 5785 MHz											
5785	62.97	1	102	H	34.17	8.88	0.00	106.02	-	-	PK
5785	55.18	1	102	H	34.17	8.88	0.00	98.23	-	-	AV
5785	65.51	266	102	V	34.04	8.88	0.00	108.43	-	-	PK
5785	58.18	266	102	V	34.04	8.88	0.00	101.10	-	-	AV
5725	46.44	0	100	H	34.07	9.79	36.16	54.14	74.00	-19.86	PK
5725	31.60	0	100	H	34.07	9.79	36.16	39.30	54.00	-14.70	AV
5725	47.78	0	100	V	33.97	9.79	36.16	55.39	74.00	-18.62	PK
5725	32.96	0	100	V	33.97	9.79	36.16	40.57	54.00	-13.44	AV
5850	44.54	0	100	H	34.24	9.82	36.24	52.36	74.00	-21.64	PK
5850	31.90	0	100	H	34.24	9.82	36.24	39.72	54.00	-14.28	AV
5850	47.56	349	100	V	34.14	9.82	36.24	55.28	74.00	-18.72	PK
5850	33.69	349	100	V	34.14	9.82	36.24	41.41	54.00	-12.59	AV
11570	40.46	0	100	H	38.46	19.11	35.14	62.89	74.00	-11.11	PK
11570	28.02	0	100	H	38.46	19.11	35.14	50.45	54.00	-3.55	AV
11570	43.95	0	300	V	38.38	19.11	35.14	66.30	74.00	-7.70	PK
11570	31.25	0	300	V	38.38	19.11	35.14	53.60	54.00	-0.40	AV

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISED		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
High Channel 5825 MHz											
5825	62.98	78	270	H	34.24	8.88	0.00	106.10	-	-	PK
5825	55.45	78	270	H	34.24	8.88	0.00	98.57	-	-	AV
5825	66.30	266	100	V	34.14	8.88	0.00	109.32	-	-	PK
5825	58.85	266	100	V	34.14	8.88	0.00	101.87	-	-	AV
5850	58.55	71	140	H	34.24	9.82	36.24	66.37	110.80	-44.43	PK
5850	62.80	270	100	V	34.14	9.82	36.24	70.52	110.80	-40.28	PK
5855	53.66	71	140	H	34.24	9.82	36.24	61.48	105.20	-43.72	PK
5855	57.30	270	100	V	34.14	9.82	36.24	65.02	105.20	-40.18	PK
5875	44.60	71	140	H	34.24	9.82	36.24	52.42	68.23	-15.81	PK
5875	44.34	270	100	V	34.14	9.82	36.24	52.06	68.23	-16.17	PK
11650	40.64	0	100	H	38.60	19.02	35.16	63.10	74.00	-10.90	PK
11650	28.64	0	100	H	38.60	19.02	35.16	51.10	54.00	-2.90	AV
11650	43.80	0	300	V	38.55	19.02	35.16	66.21	74.00	-7.79	PK
11650	31.28	0	300	V	38.55	19.02	35.16	53.69	54.00	**-0.31**	**AV**

802.11n20 mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISED		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5745 MHz											
5745	63.21	32	100	H	34.07	8.87	0.00	106.15	-	-	PK
5745	55.11	32	100	H	34.07	8.87	0.00	98.05	-	-	AV
5745	65.94	310	100	V	33.97	8.87	0.00	108.78	-	-	PK
5745	58.05	310	100	V	33.97	8.87	0.00	100.89	-	-	AV
5700	47.45	98	120	H	34.07	9.79	36.16	55.15	68.23	-13.08	PK
5700	49.97	352	295	V	33.97	9.79	36.16	57.58	68.23	-10.66	PK
5720	59.19	98	120	H	34.07	9.79	36.16	66.89	105.20	-38.31	PK
5720	63.34	352	295	V	33.97	9.79	36.16	70.95	105.20	-34.26	PK
5725	71.68	98	120	H	34.07	9.79	36.16	79.38	110.80	-31.42	PK
5725	76.08	352	295	V	33.97	9.79	36.16	83.69	110.80	-27.12	PK
11490	40.92	0	100	H	38.45	18.67	35.09	62.95	74.00	-11.05	PK
11490	28.40	0	100	H	38.45	18.67	35.09	50.43	54.00	-3.57	AV
11490	44.07	0	300	V	38.38	18.67	35.09	66.03	74.00	-7.97	PK
11490	31.58	0	300	V	38.38	18.67	35.09	53.54	54.00	-0.46	AV
Middle Channel 5785 MHz											
5785	63.08	11	100	H	34.17	8.88	0.00	106.13	-	-	PK
5785	55.13	11	100	H	34.17	8.88	0.00	98.18	-	-	AV
5785	67.19	262	100	V	34.04	8.88	0.00	110.11	-	-	PK
5785	59.19	262	100	V	34.04	8.88	0.00	102.11	-	-	AV
11570	41.49	0	100	H	38.46	19.11	35.14	63.92	74.00	-10.08	PK
11570	28.57	0	100	H	38.46	19.11	35.14	51.00	54.00	-3.00	AV
11570	43.35	333	300	V	38.38	19.11	35.14	65.70	74.00	-8.31	PK
11570	31.13	333	300	V	38.38	19.11	35.14	53.48	54.00	-0.52	AV
High Channel 5825 MHz											
5825	64.09	13	122	H	34.24	8.88	0.00	107.21	-	-	PK
5825	56.58	13	122	H	34.24	8.88	0.00	99.70	-	-	AV
5825	68.43	267	100	V	34.14	8.88	0.00	111.45	-	-	PK
5825	60.77	267	100	V	34.14	8.88	0.00	103.79	-	-	AV
5850	58.80	98	235	H	34.24	9.82	36.24	66.62	110.80	-44.18	PK
5850	63.79	270	100	V	34.14	9.82	36.24	71.51	110.80	-39.29	PK
5855	53.19	98	235	H	34.24	9.82	36.24	61.01	105.20	-44.19	PK
5855	58.08	270	100	V	34.14	9.82	36.24	65.80	105.20	-39.40	PK
5875	43.76	98	235	H	34.24	9.82	36.24	51.58	68.23	-16.65	PK
5875	46.65	270	100	V	34.14	9.82	36.24	54.37	68.23	-13.86	PK
11650	39.54	0	100	H	38.60	19.02	35.16	62.00	74.00	-12.00	PK
11650	27.79	0	100	H	38.60	19.02	35.16	50.25	54.00	-3.75	AV
11650	43.25	0	300	V	38.55	19.02	35.16	65.66	74.00	-8.34	PK
11650	31.04	0	300	V	38.55	19.02	35.16	53.45	54.00	-0.55	AV

802.11ac20 mode

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISED		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 5745 MHz											
5745	62.96	33	100	H	34.07	8.87	0.00	105.90	-	-	PK
5745	55.05	33	100	H	34.07	8.87	0.00	97.99	-	-	AV
5745	66.17	308	100	V	33.97	8.87	0.00	109.01	-	-	PK
5745	58.10	308	100	V	33.97	8.87	0.00	100.94	-	-	AV
5700	47.75	89	100	H	34.07	9.79	36.16	55.45	68.23	-12.78	PK
5700	51.10	344	240	V	33.97	9.79	36.16	58.71	68.23	-9.53	PK
5720	59.98	89	100	H	34.07	9.79	36.16	67.68	105.20	-37.52	PK
5720	62.76	344	240	V	33.97	9.79	36.16	70.37	105.20	-34.84	PK
5725	71.44	89	100	H	34.07	9.79	36.16	79.14	110.80	-31.66	PK
5725	75.90	344	240	V	33.97	9.79	36.16	83.51	110.80	-27.30	PK
11490	40.50	0	100	H	38.45	18.67	35.09	62.53	74.00	-11.47	PK
11490	29.61	0	100	H	38.45	18.67	35.09	51.64	54.00	-2.36	AV
11490	44.40	0	300	V	38.38	18.67	35.09	66.36	74.00	-7.64	PK
11490	31.62	0	295	V	38.38	18.67	35.09	53.58	54.00	-0.42	AV
Middle Channel 5785 MHz											
5785	63.32	219	100	H	34.17	8.88	0.00	106.37	-	-	PK
5785	55.25	219	100	H	34.17	8.88	0.00	98.30	-	-	AV
5785	66.80	327	100	V	34.04	8.88	0.00	109.72	-	-	PK
5785	59.38	327	100	V	34.04	8.88	0.00	102.30	-	-	AV
11570	40.86	0	100	H	38.46	19.11	35.14	63.29	74.00	-10.71	PK
11570	28.97	0	100	H	38.46	19.11	35.14	51.40	54.00	-2.60	AV
11570	44.11	0	300	V	38.38	19.11	35.14	66.46	74.00	-7.54	PK
11570	31.24	0	300	V	38.38	19.11	35.14	53.59	54.00	-0.41	AV
High Channel 5825 MHz											
5825	63.24	48	100	H	34.24	8.88	0.00	106.36	-	-	PK
5825	55.47	48	100	H	34.24	8.88	0.00	98.59	-	-	AV
5825	68.06	325	233	V	34.14	8.88	0.00	111.08	-	-	PK
5825	60.60	325	233	V	34.14	8.88	0.00	103.62	-	-	AV
5850	58.46	85	100	H	34.24	9.82	36.24	66.28	110.80	-44.52	PK
5850	63.09	263	100	V	34.14	9.82	36.24	70.81	110.80	-39.99	PK
5855	52.78	85	100	H	34.24	9.82	36.24	60.60	105.20	-44.60	PK
5855	58.10	263	100	V	34.14	9.82	36.24	65.82	105.20	-39.38	PK
5875	44.25	85	100	H	34.24	9.82	36.24	52.07	68.23	-16.16	PK
5875	45.10	263	100	V	34.14	9.82	36.24	52.82	68.23	-15.41	PK
11650	40.79	0	100	H	38.60	19.02	35.16	63.25	74.00	-10.75	PK
11650	28.40	0	100	H	38.60	19.02	35.16	50.86	54.00	-3.14	AV
11650	44.30	0	300	V	38.55	19.02	35.16	66.71	74.00	-7.29	PK
11650	31.06	0	300	V	38.55	19.02	35.16	53.47	54.00	-0.53	AV

Note 1: The worst-case modulations were used to show compliance.
Note 2: Vertical polarization was used to clearly show the presence of harmonics

8 FCC §15.407(e) & ISED RSS-247 §6.2 - 6 dB, 26 dB, and 99% Occupied Bandwidth

8.1 Applicable Standards

As per FCC §15.407(e) and ISED RSS-247 6.2.4(1): for equipment operating in the band 5725 – 5850 MHz, the minimum 6 dB bandwidth of U-NII devices shall be 500 kHz.

8.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 6 or 26 dB from the reference level. Record the frequency difference as the minimum emission or emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2017-04-20	1 year
Rohde & Schwarz	Signal Analyzer	FSQ26	200749	2017-06-08	2 years
-	20 dB attenuator	-	-	Each time[1]	N/A
-	RF cable	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

8.4 Test Environmental Conditions

Temperature:	22-24 ºC
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

The testing was performed by Vincent Licata on 2017-08-03 at RF site.

8.5 Test Results

Please refer to the following tables and plots.
Note: per client requirement, both SISO and MIMO mode for 802.11n/ac were tested.

5150 - 5250 MHz

Antenna Port	Channel	Frequency (MHz)	99% OBW (kHz)	26 dB OBW (kHz)
802.11 a mode				
A	36	5180	16590.3	22500.0
	40	5200	20697.9	39134.6
	48	5240	19950.1	39038.5
B	36	5180	16496.6	21153.8
	40	5200	19212.0	37211.5
	48	5240	18401.7	37307.7
802.11n20 mode				
A	36	5180	17728.2	28173.1
	40	5200	19819.4	41826.9
	48	5240	19685.9	41634.6
A MIMO	36	5180	17672.5	22115.4
	40	5200	18261.0	40673.1
	48	5240	18189.0	38846.2
B	36	5180	17649.1	22403.8
	40	5200	18530.9	37500.0
	48	5240	18676.0	37884.6
B MIMO	36	5180	17612.7	21346.2
	40	5200	17911.1	36153.8
	48	5240	17915.5	35961.5
802.11ac20 mode				
A	36	5180	17779.1	27019.2
	40	5200	20662.7	41346.2
	48	5240	19949.5	41346.2
A MIMO	36	5180	17684.1	22596.2
	40	5200	18586.4	40673.1
	48	5240	18291.8	39615.4
B	36	5180	17717.9	21923.1
	40	5200	19174.7	37019.2
	48	5240	18532.5	37019.2
B MIMO	36	5180	17642.4	21153.8
	40	5200	18027.1	35961.5
	48	5240	17914.2	36250.0

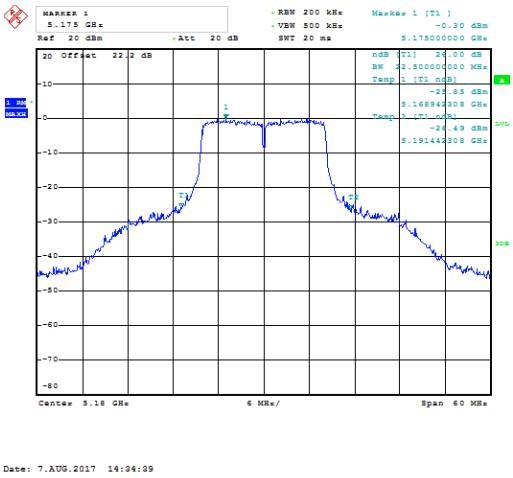
5725 - 5850 MHz

Antenna Port	Channel	Frequency (MHz)	99% OBW (kHz)	6 dB OBW (kHz)
802.11 a mode				
A	149	5745	16818.3	16466
	157	5785	18607.3	16508
	165	5825	17435.4	16536
B	149	5745	17583.0	16509
	157	5785	16563.3	16532
	165	5825	16533.4	16503
802.11n20 mode				
A	149	5745	19203.2	17717
	157	5785	18672.6	17809
	165	5825	18818.3	17726
A MIMO	149	5745	18167.7	17762
	157	5785	18052.7	17732
	165	5825	18033.7	17751
B	149	5745	17657.2	17689
	157	5785	17669.5	17655
	165	5825	17649.6	17622
B MIMO	149	5745	17654.5	17661
	157	5785	17650.7	17715
	165	5825	17643.0	17645
802.11ac20 mode				
A	149	5745	19123.3	17726
	157	5785	18954.6	17678
	165	5825	18642.3	17728
A MIMO	149	5745	18162.7	17742
	157	5785	18147.8	17685
	165	5825	18072.6	17650
B	149	5745	17656.7	17655
	157	5785	17664.9	17729
	165	5825	17636.7	17685
B MIMO	149	5745	17652.3	17659
	157	5785	17617.4	17664
	165	5825	17637.1	17604

5150 – 5250 MHz

802.11a mode Port A 26 dB OBW

5180 MHz



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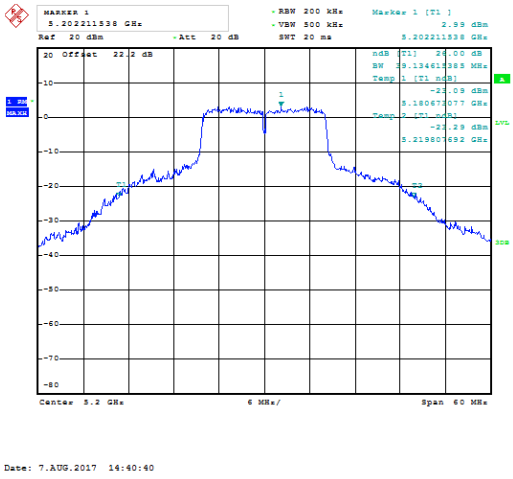
5200 MHz



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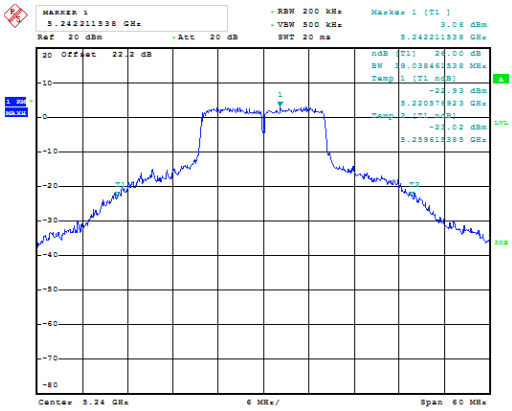
5240 MHz



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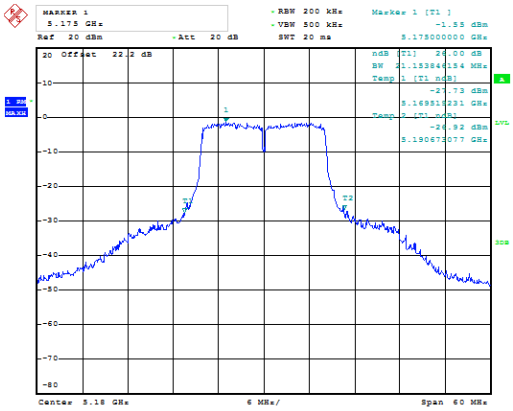
802.11a mode Port B 26 dB OBW

5180 MHz



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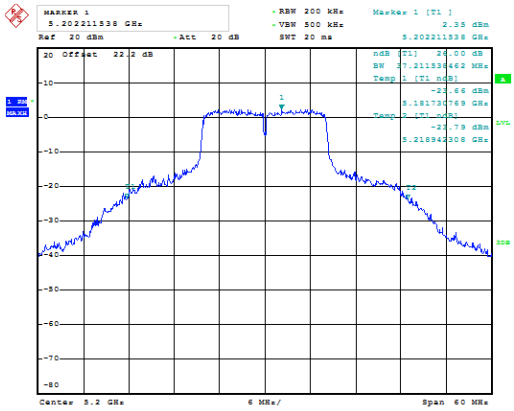
5200 MHz



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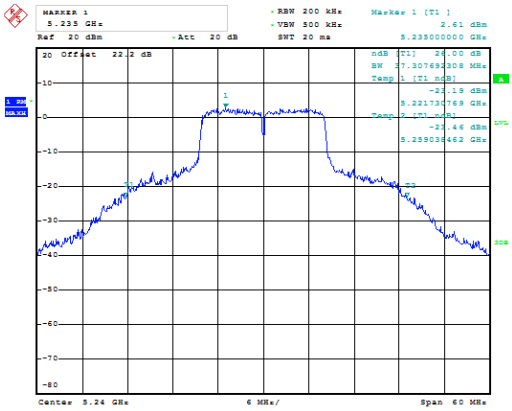
5240 MHz



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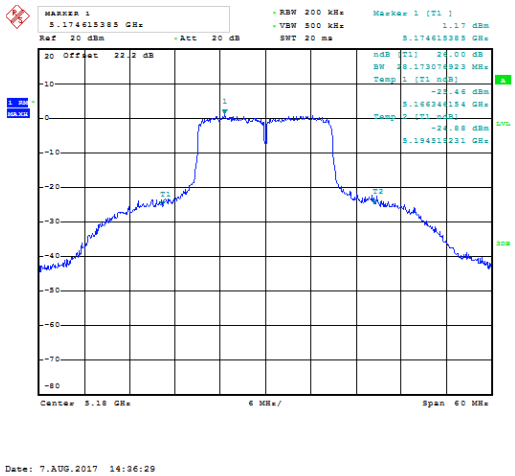
802.11n20 mode Port A 26 dB OBW

5180 MHz



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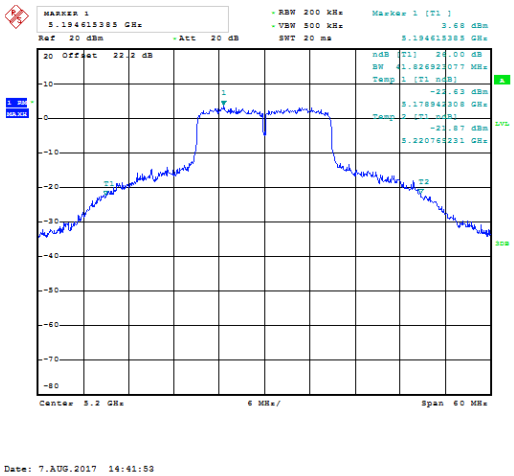
5200 MHz



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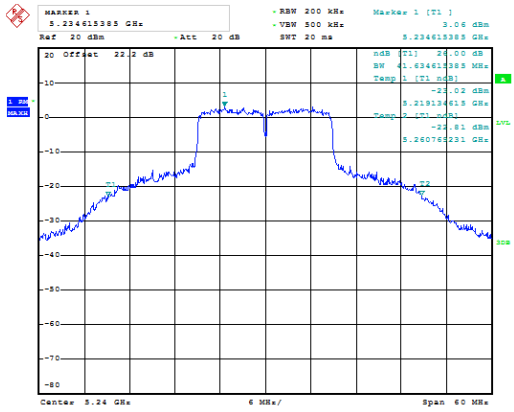
5240 MHz



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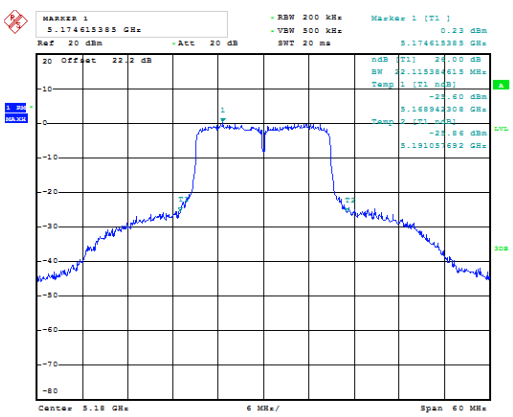
802.11n20 mode Port A MIMO 26 dB OBW

5180 MHz



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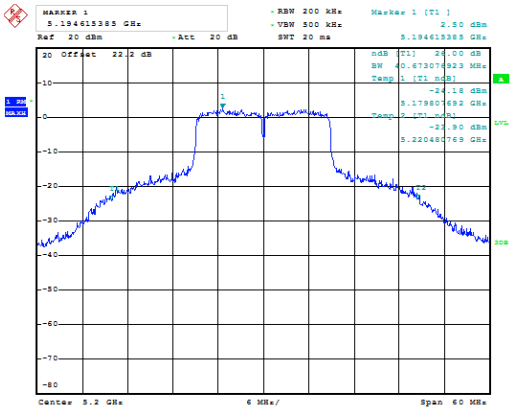
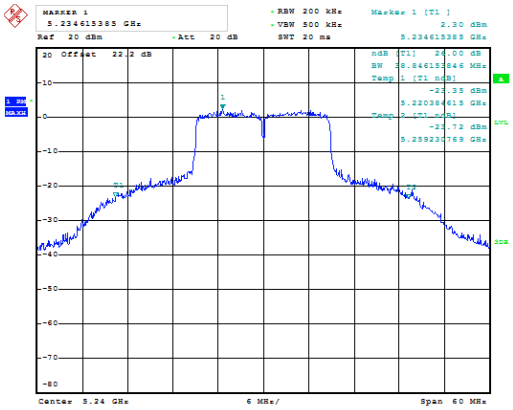
5200 MHz



Date: 7.AUG.2017 14:42:39

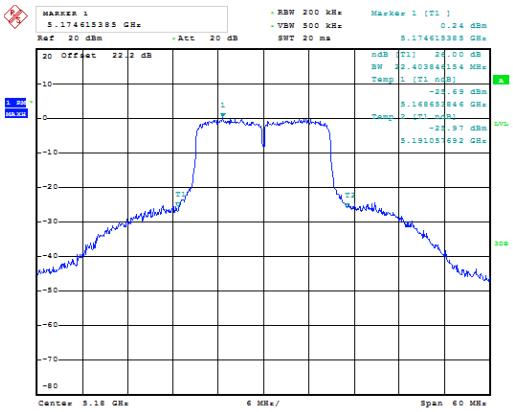
5240 MHz



Date: 7.AUG.2017 14:48:11

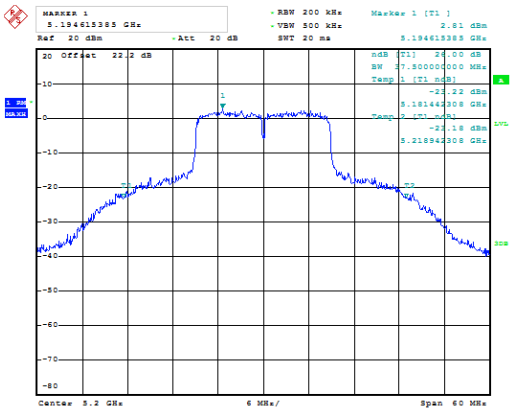
802.11n20 mode Port B 26 dB OBW

5180 MHz



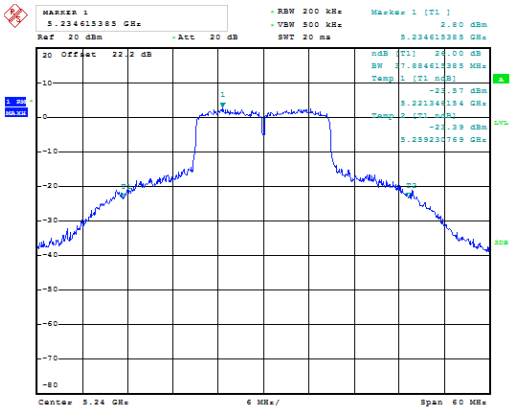
Date: 7.AUG.2017 15:01:54

5200 MHz



Date: 7.AUG.2017 14:59:23

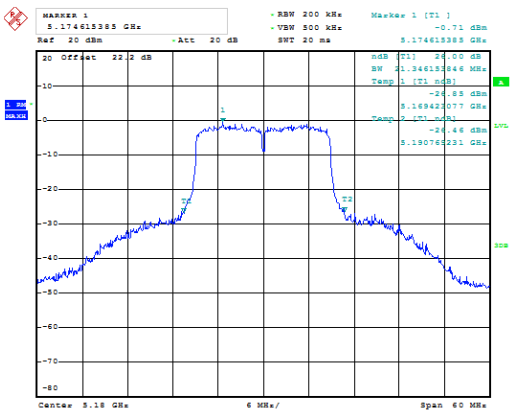
5240 MHz



Date: 7.AUG.2017 14:53:58

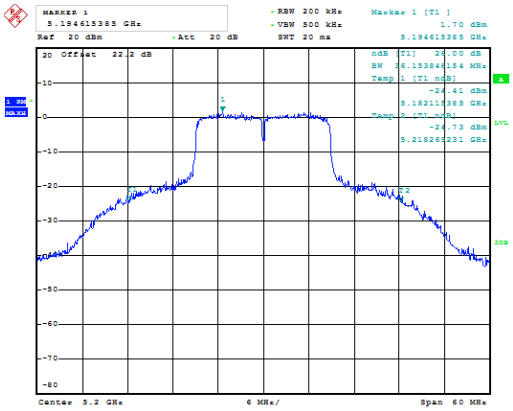
802.11n20 mode Port B MIMO 26 dB OBW

5180 MHz



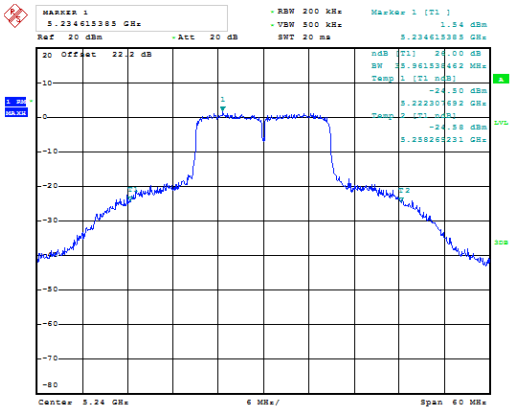
Date: 7.AUG.2017 15:02:34

5200 MHz



Date: 7.AUG.2017 14:58:44

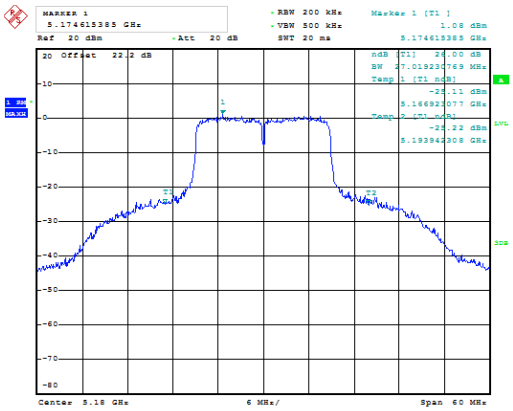
5240 MHz



Date: 7.AUG.2017 14:54:42

802.11ac20 mode Port A 26 dB OBW

5180 MHz



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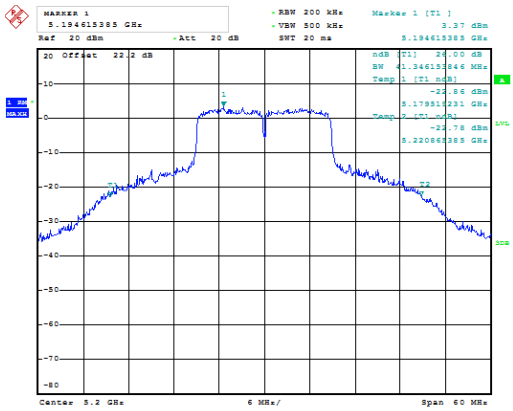
5200 MHz



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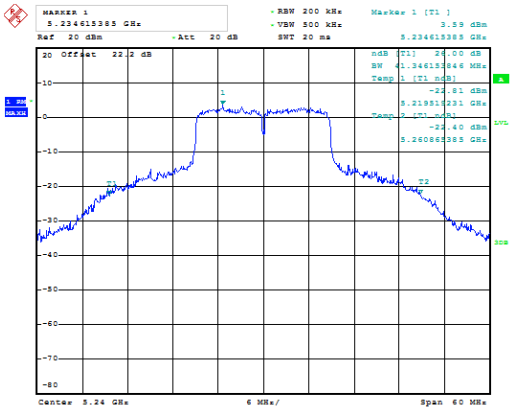
5240 MHz



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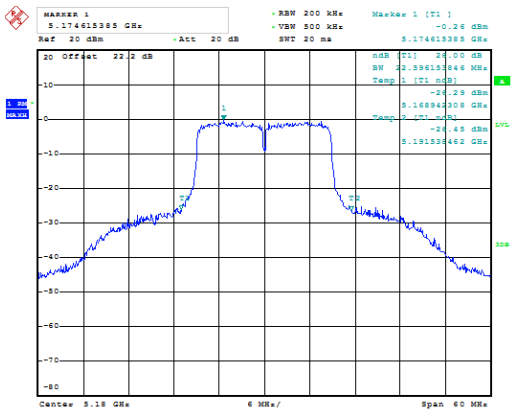
802.11ac20 mode Port A MIMO 26 dB OBW

5180 MHz



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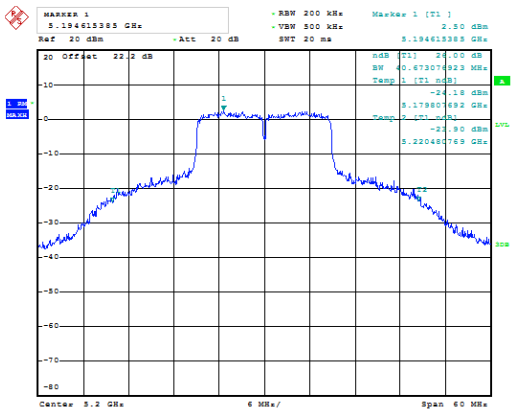
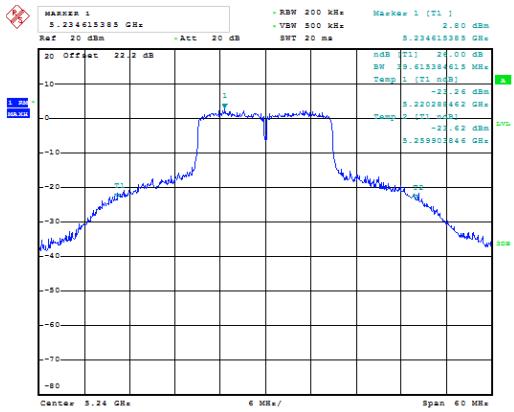
5200 MHz



Date: 7.AUG.2017 14:42:39

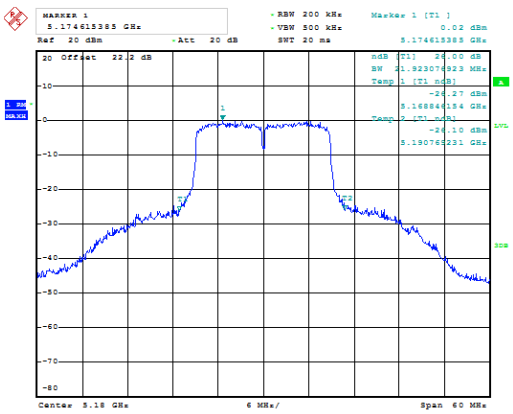
5240 MHz



Date: 7.AUG.2017 14:47:14

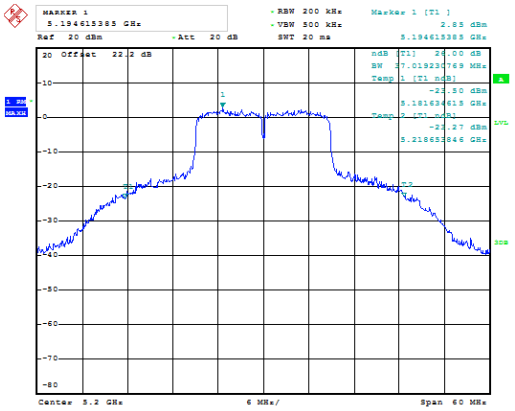
802.11ac20 mode Port B 26 dB OBW

5180 MHz



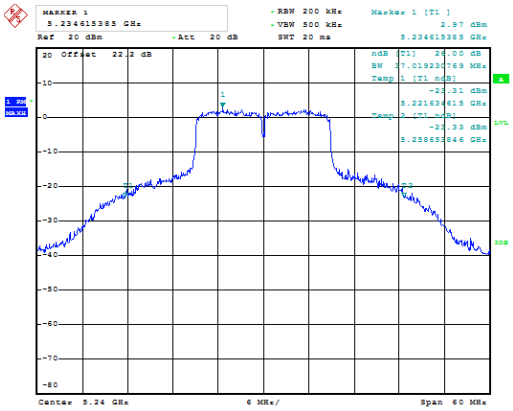
Date: 7.AUG.2017 15:03:58

5200 MHz



Date: 7.AUG.2017 14:57:20

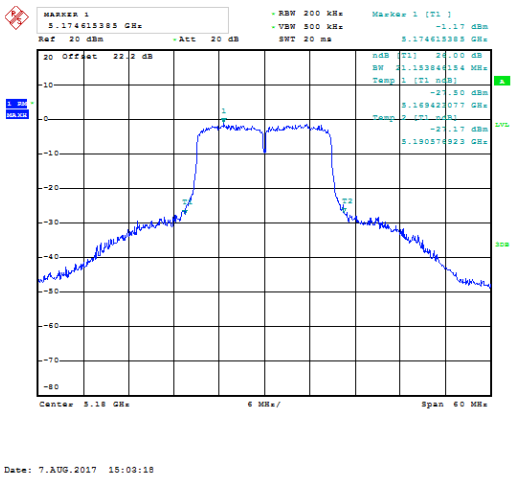
5240 MHz



Date: 7.AUG.2017 14:56:08

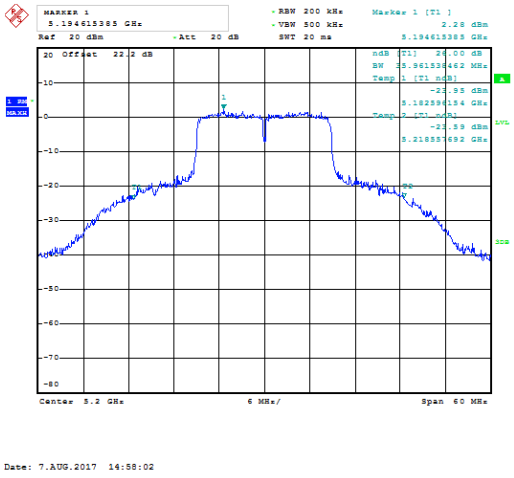
802.11ac20 mode Port B MIMO 26 dB OBW

5180 MHz



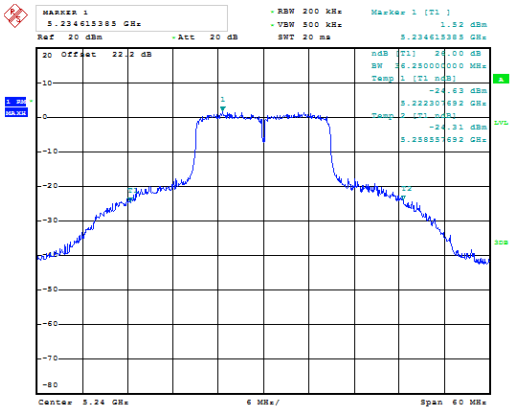
Date: 7.AUG.2017 15:03:18

5200 MHz



Date: 7.AUG.2017 14:58:02

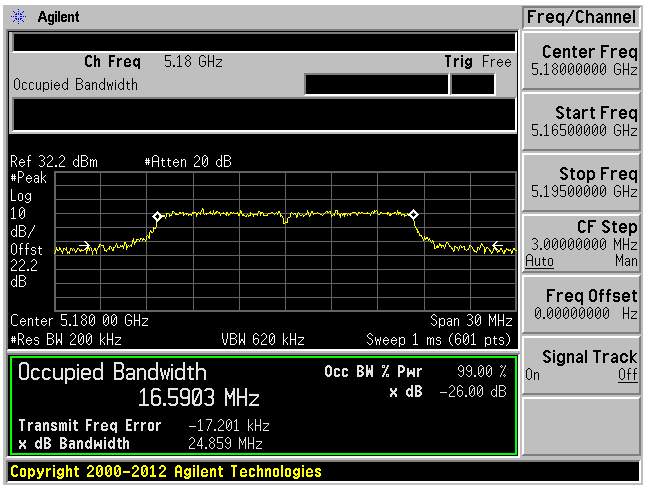
5240 MHz



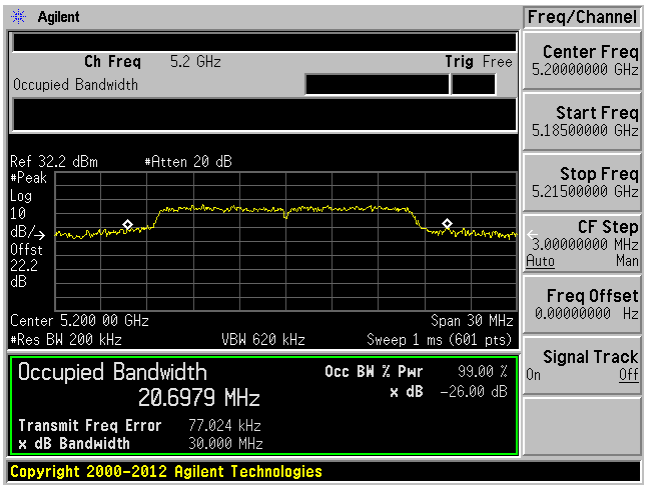
Date: 7.AUG.2017 14:55:25

802.11a mode Port A 99% OBW

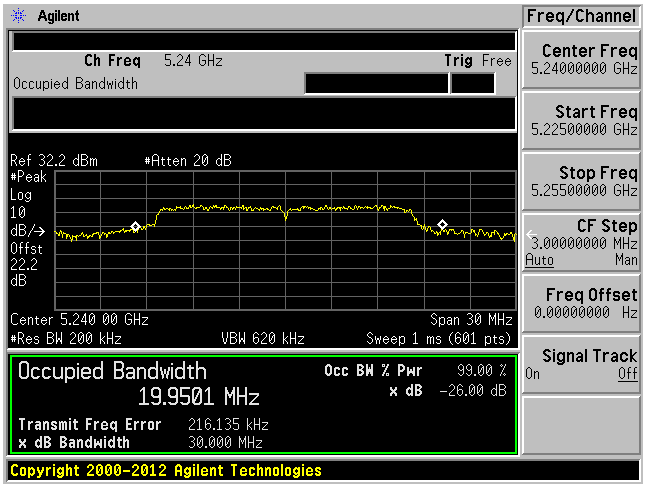
5180 MHz



5200 MHz

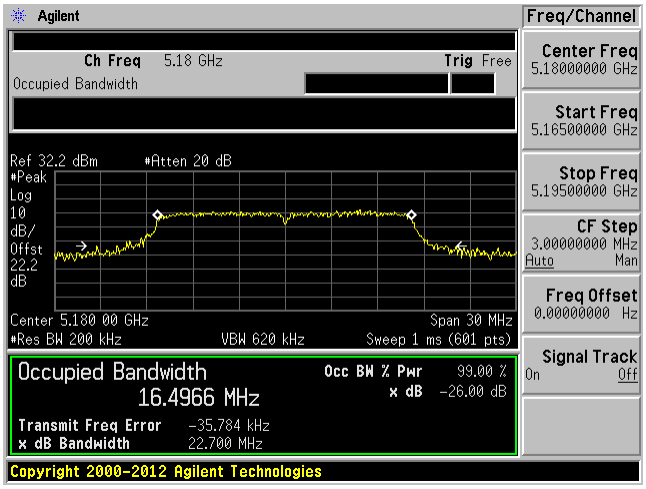


5240 MHz

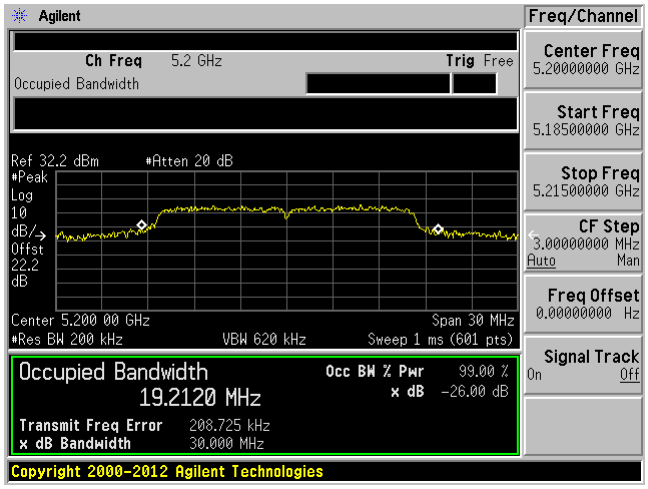


802.11a mode Port B 99% OBW

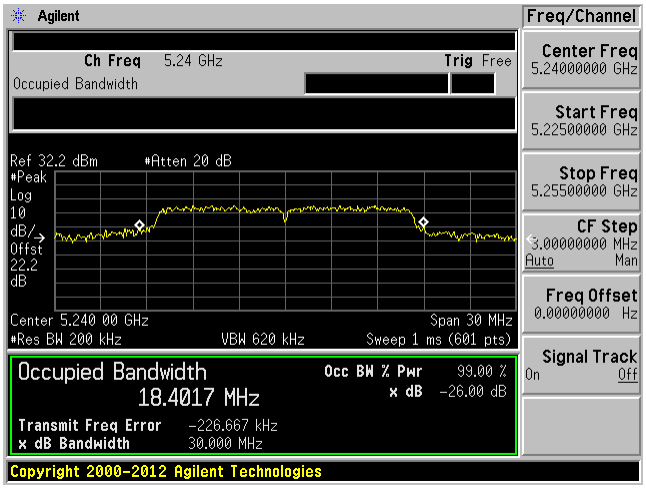
5180 MHz



5200 MHz

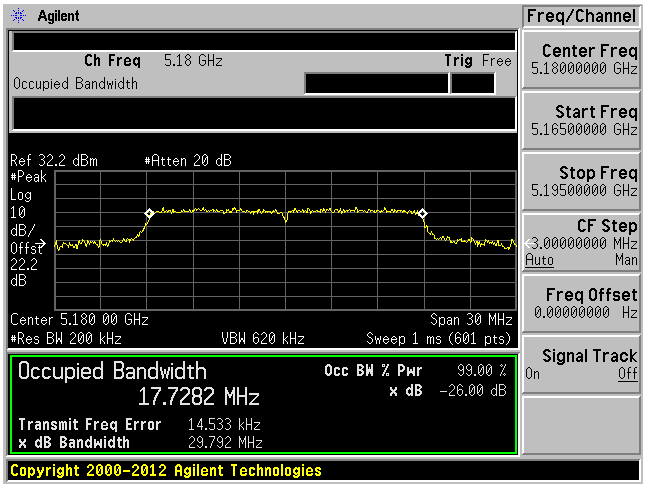


5240 MHz

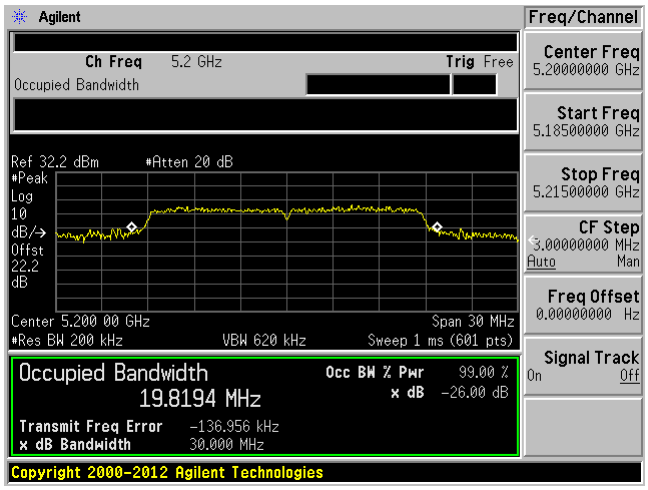


802.11n20 mode Port A 99% OBW

5180 MHz



5200 MHz



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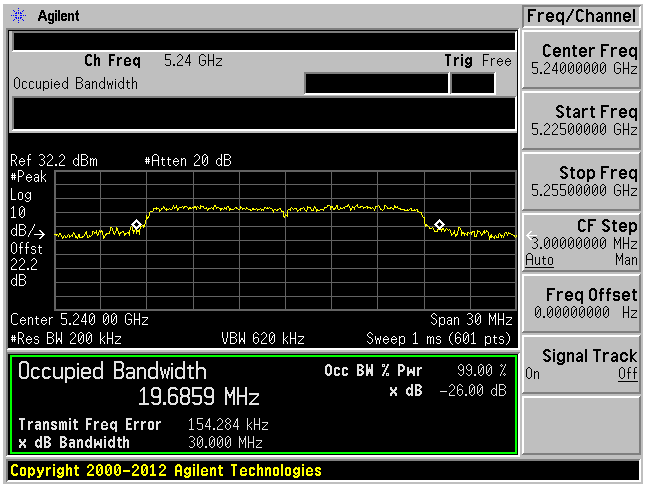
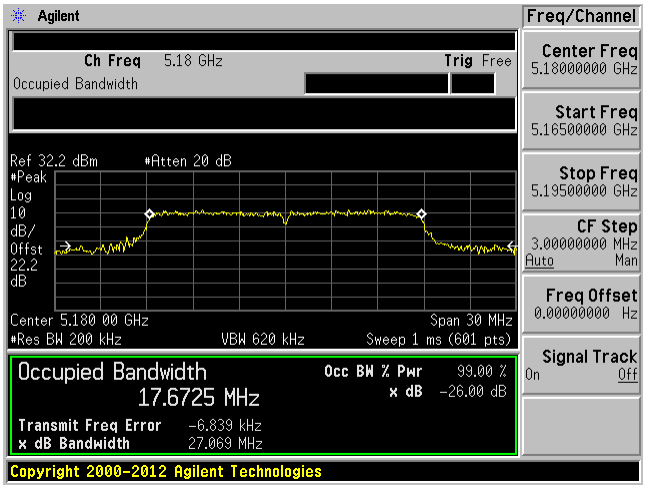
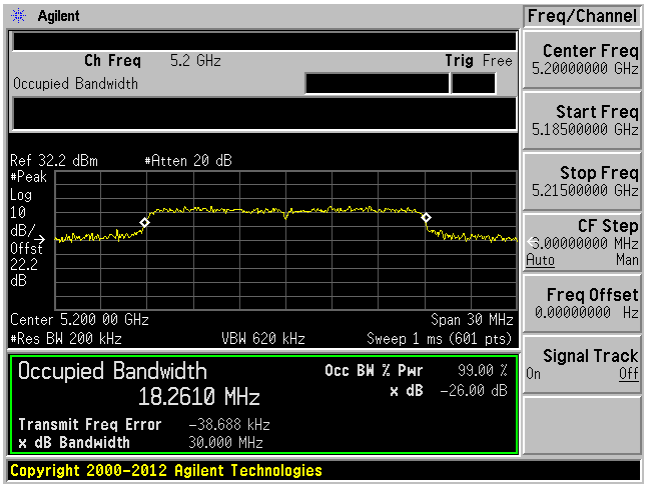


802.11n20 mode Port A MIMO 99% OBW

5180 MHz



5200 MHz



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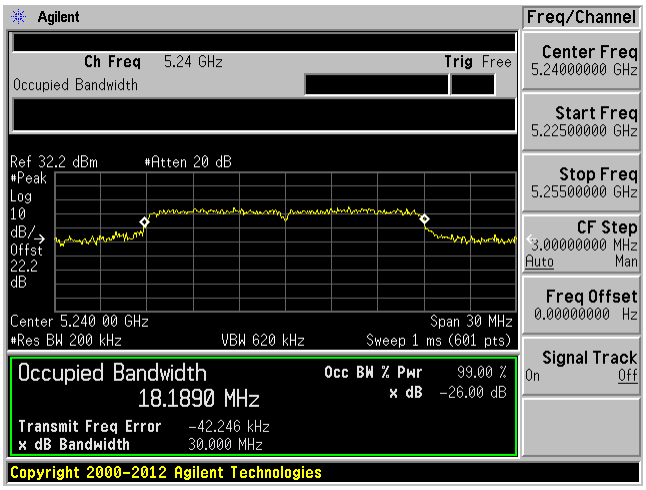
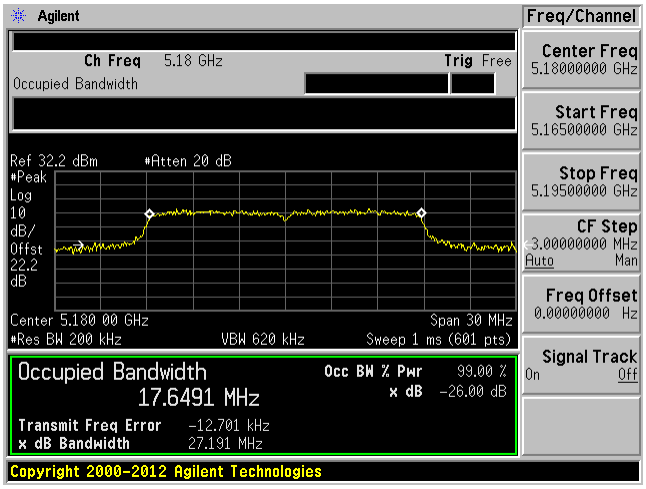


802.11n20 mode Port B 99% OBW

5180 MHz



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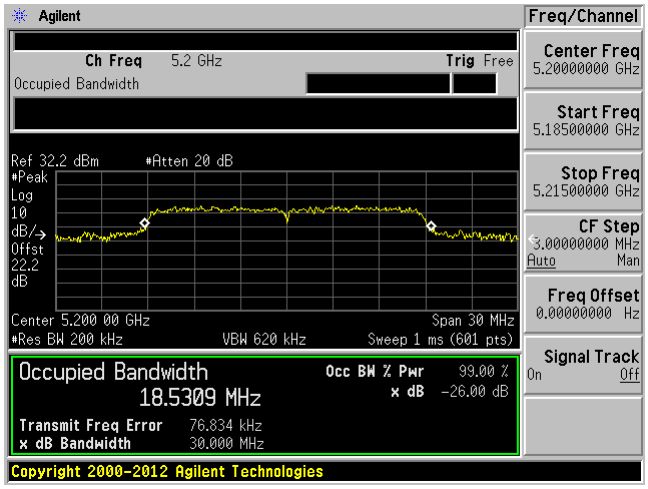

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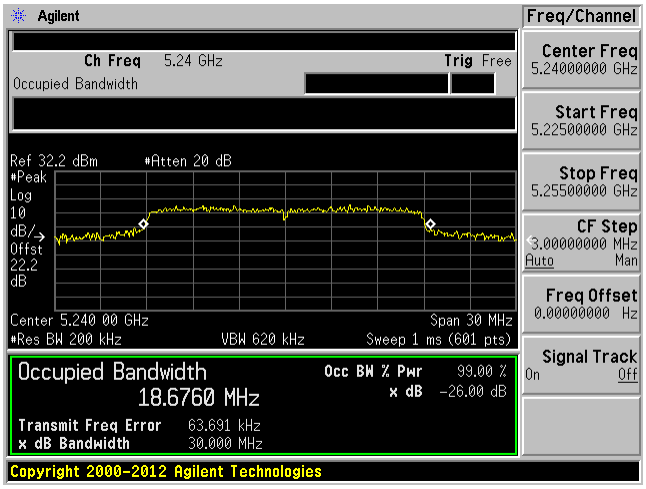
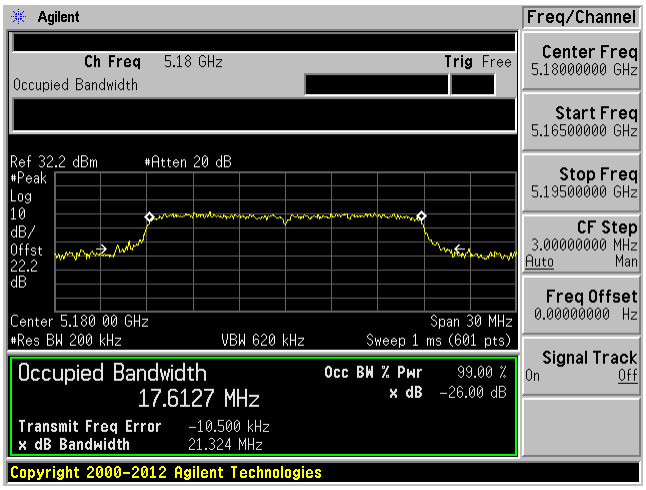


802.11n20 mode Port B MIMO 99% OBW

5180 MHz



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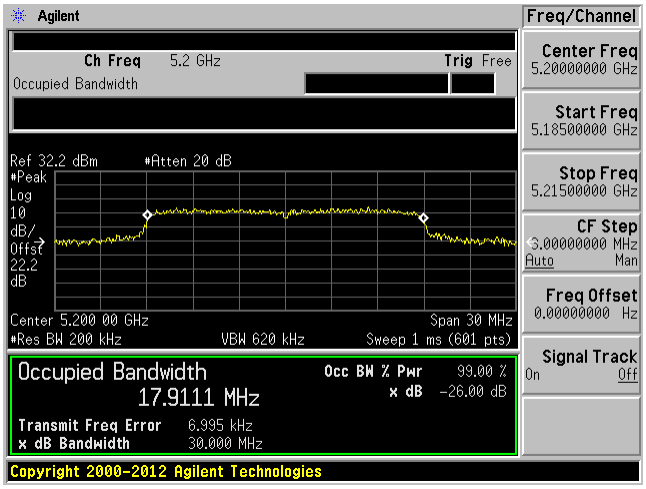

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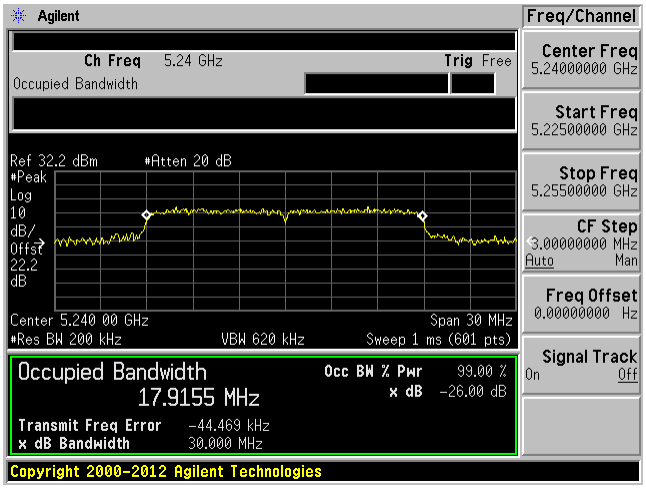
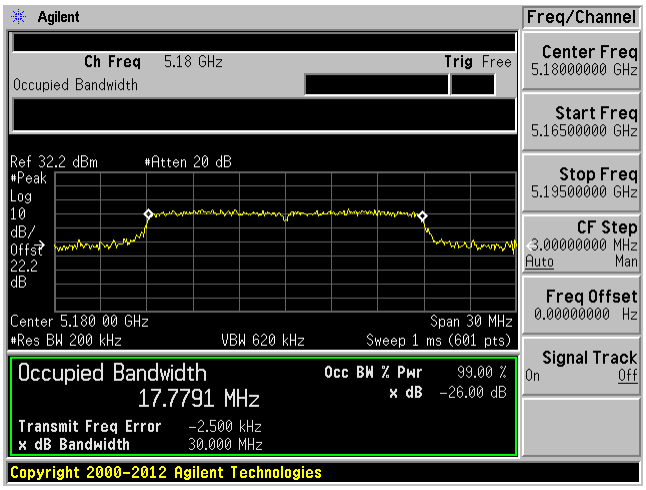


802.11ac20 mode Port A 99% OBW

5180 MHz



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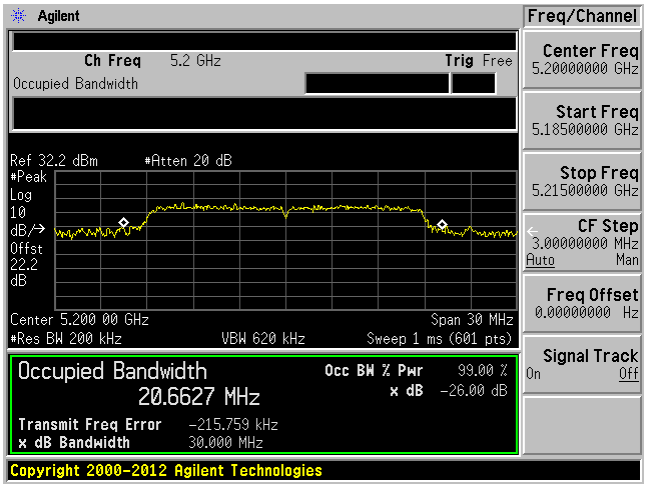

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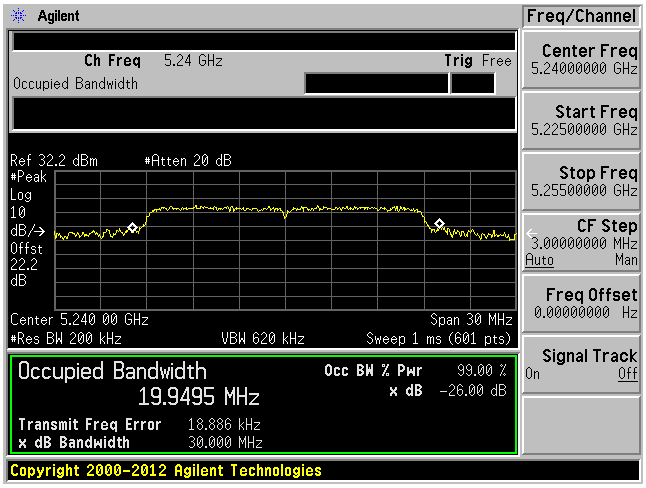
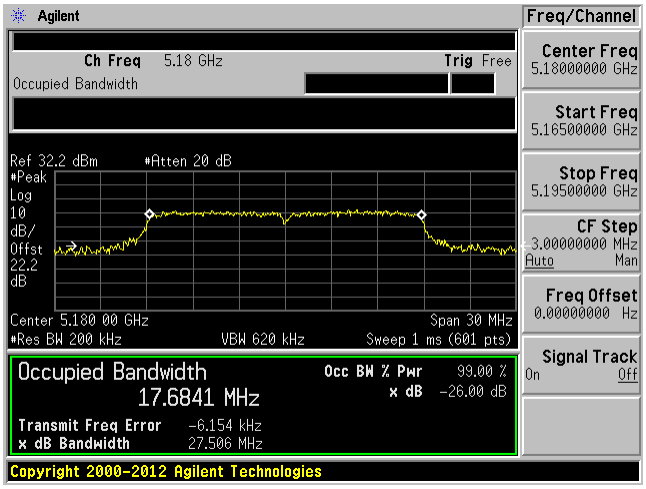


802.11ac20 mode Port A MIMO 99% OBW

5180 MHz



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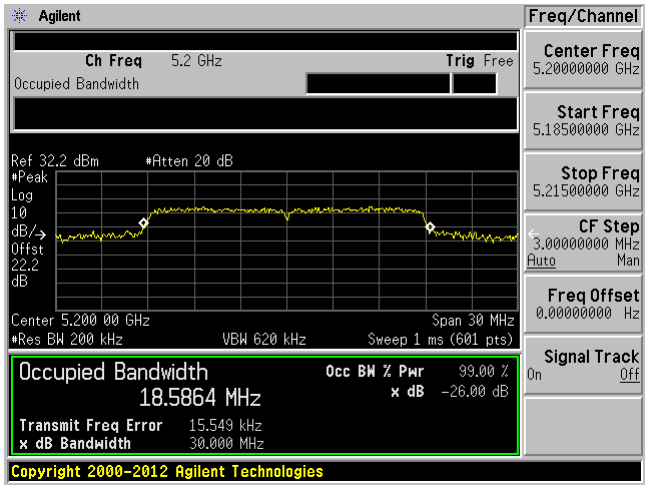

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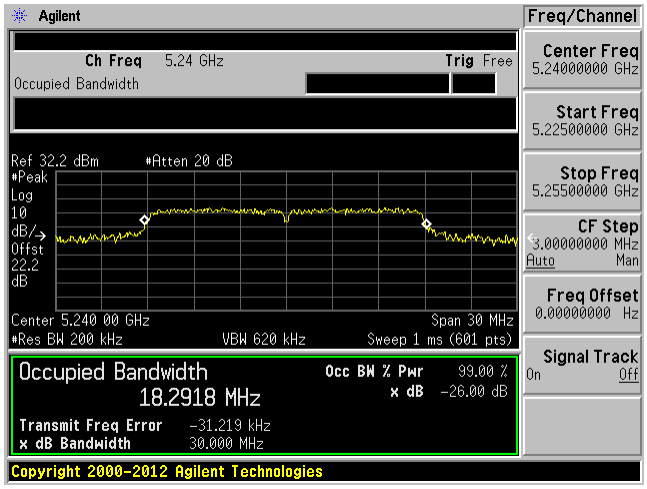
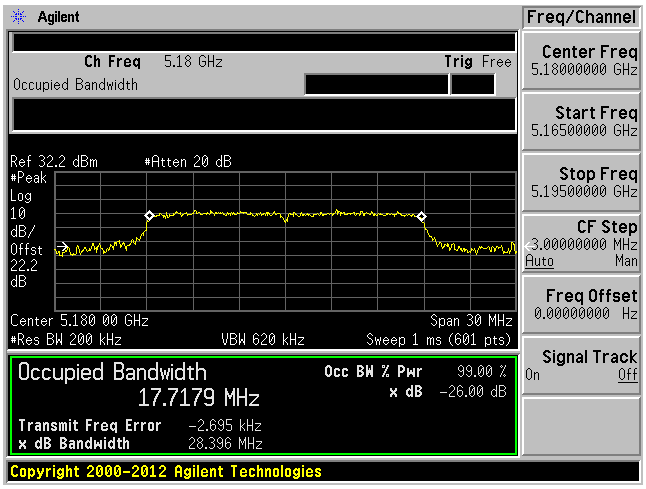


802.11ac20 mode Port B 99% OBW

5180 MHz



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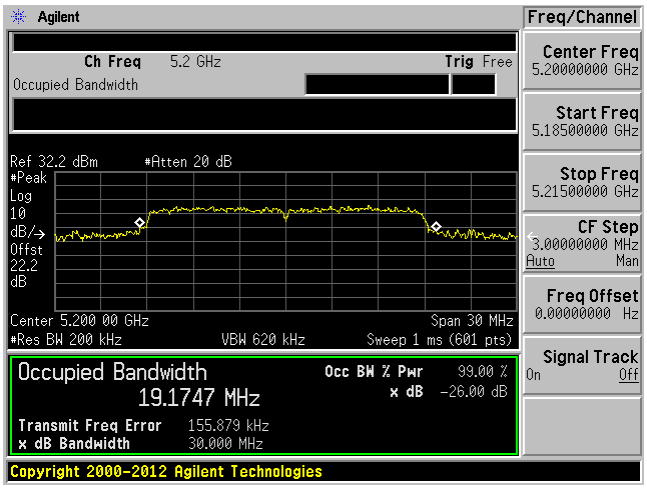
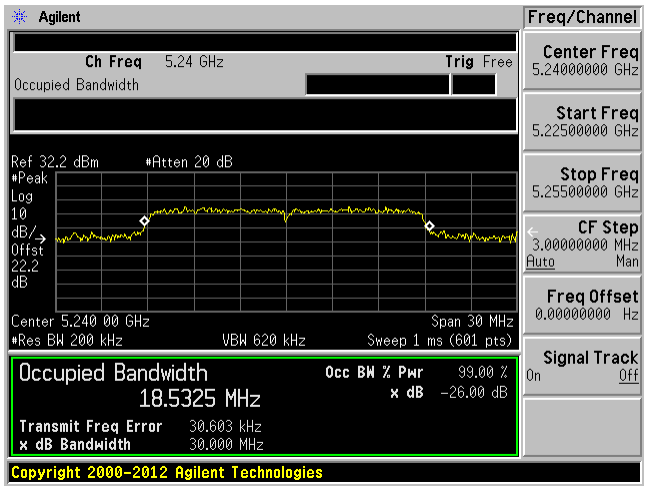
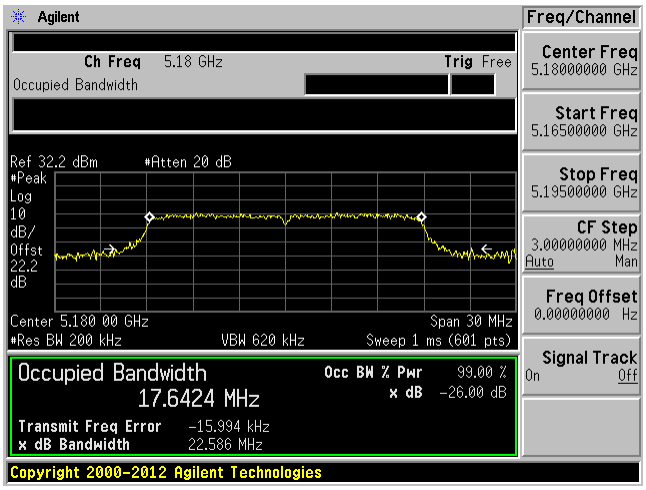


5240 MHz

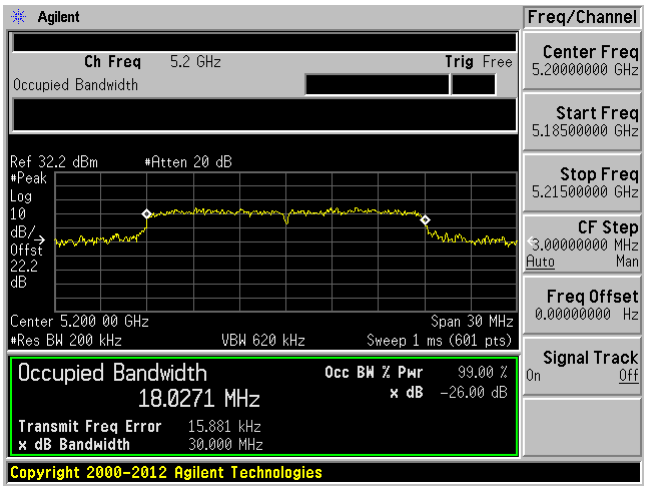


802.11ac20 mode Port B MIMO 99% OBW

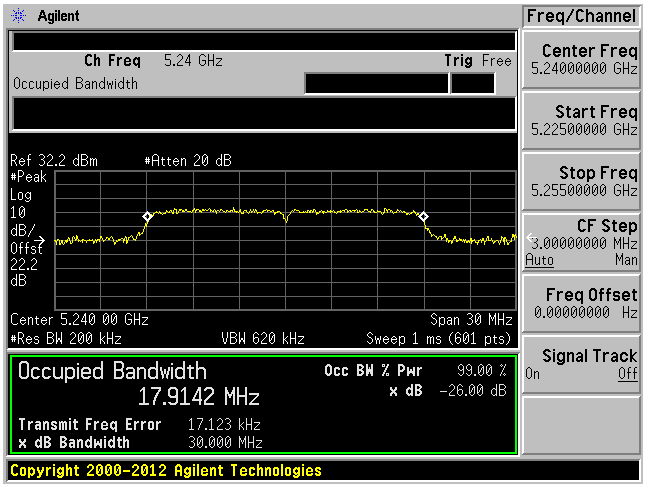
5180 MHz



5200 MHz



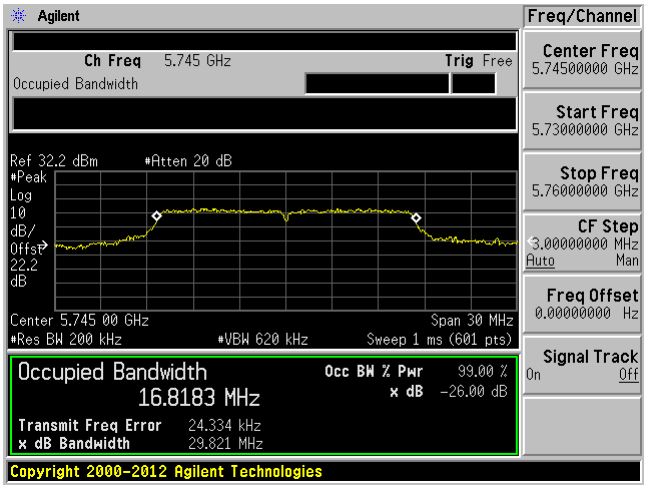
5240 MHz



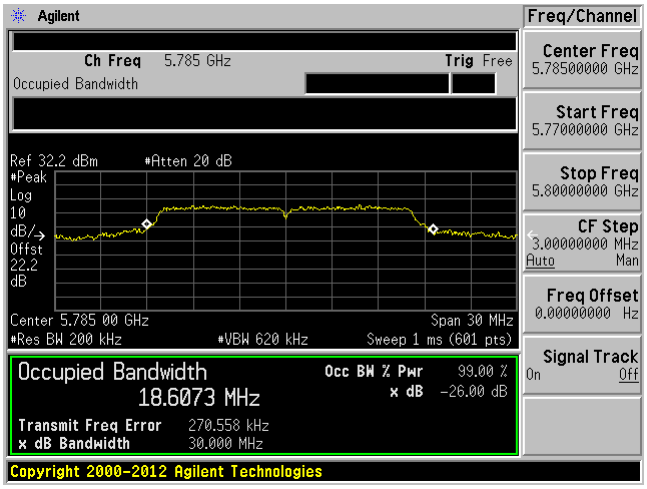
5725 - 5850 MHz

802.11a mode Port A 99% OBW

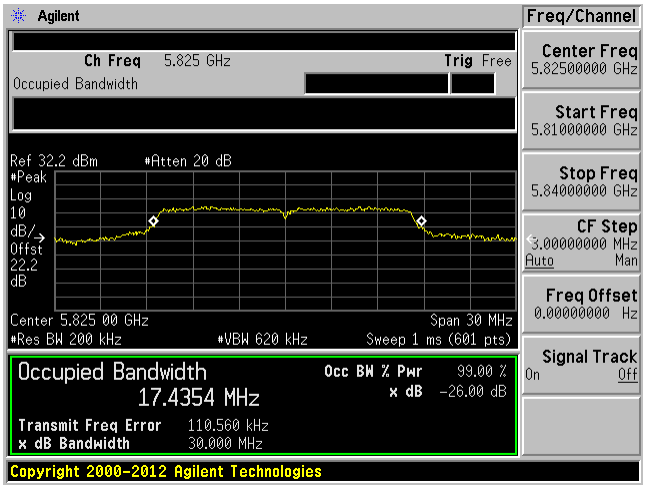
5745 MHz



5785 MHz

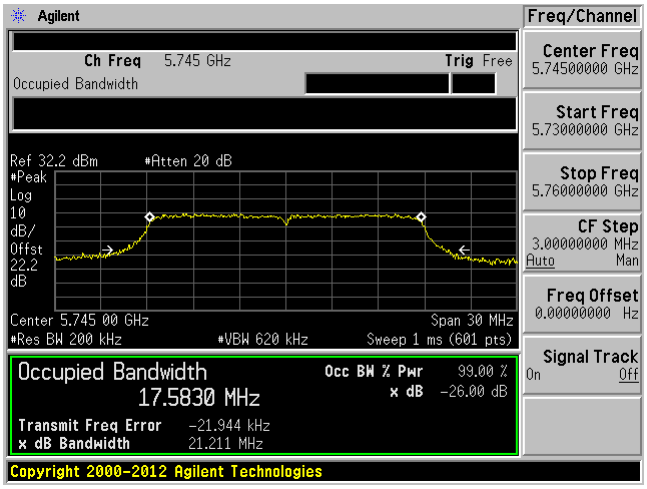


5825 MHz

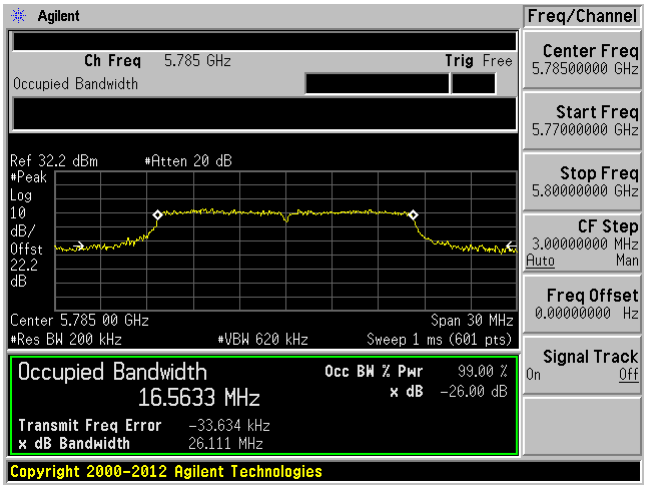


802.11a mode Port B 99% OBW

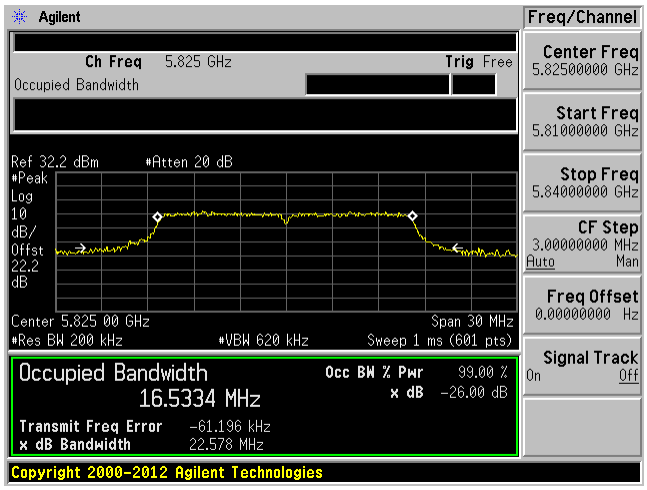
5745 MHz



5785 MHz

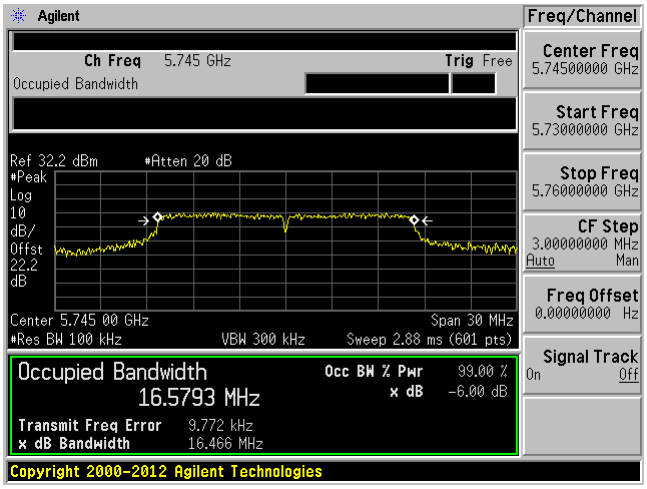


5825 MHz

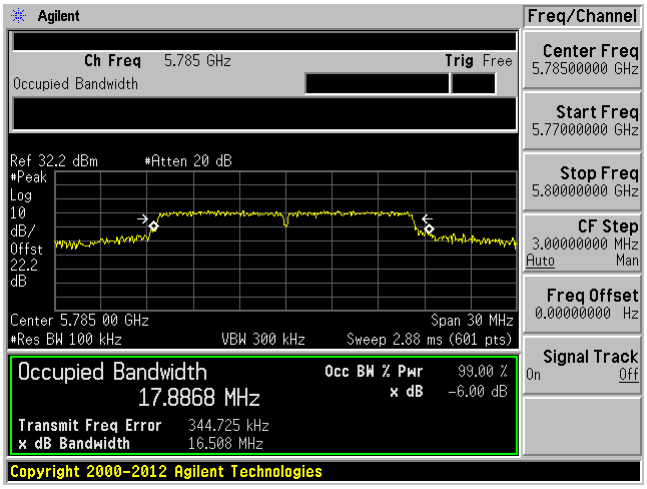


802.11a mode Port A 6dB OBW

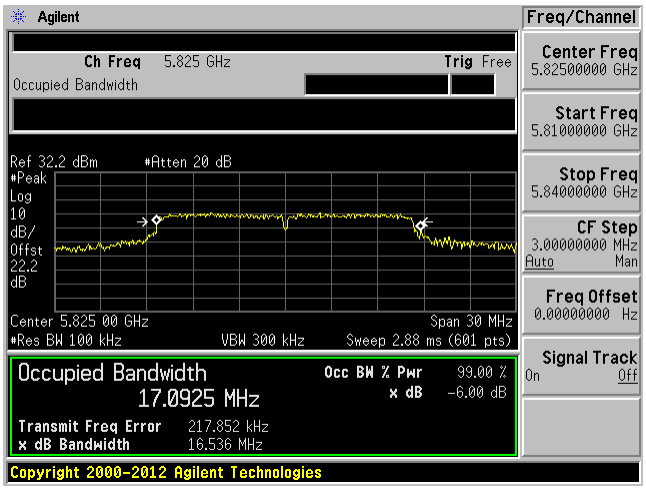
5745 MHz



5785 MHz

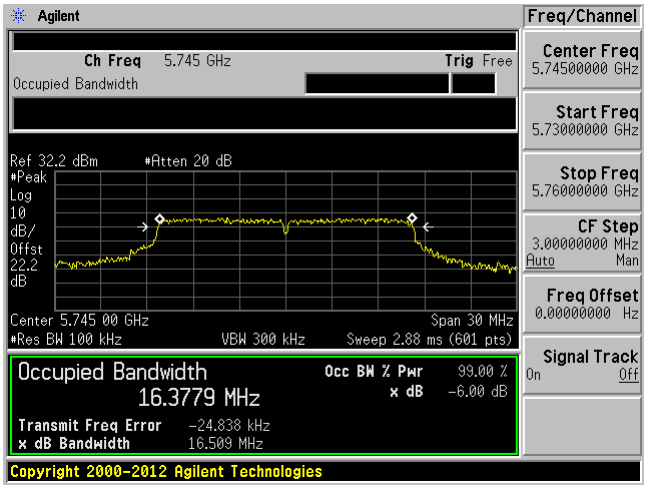


5825 MHz



802.11a mode Port B 6 dB OBW

5745 MHz



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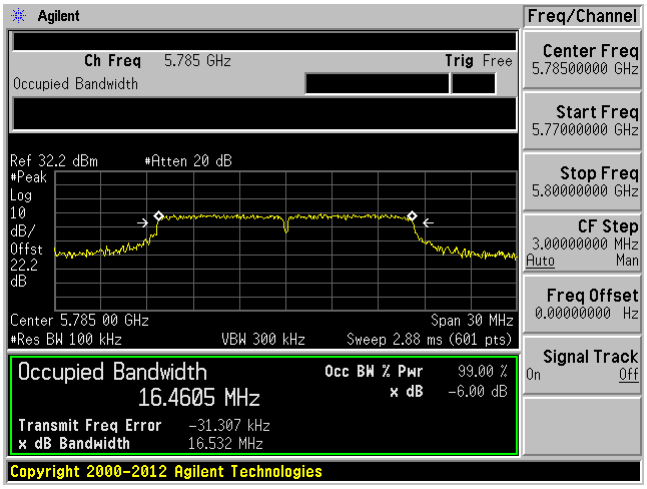

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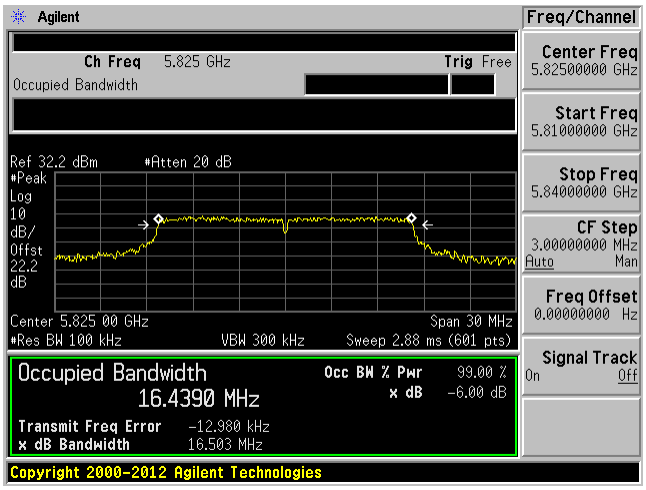
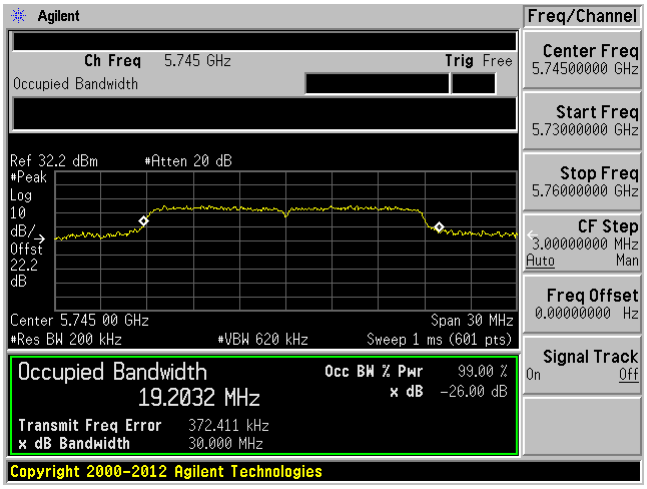


802.11n20 mode Port A 99% OBW

5745 MHz



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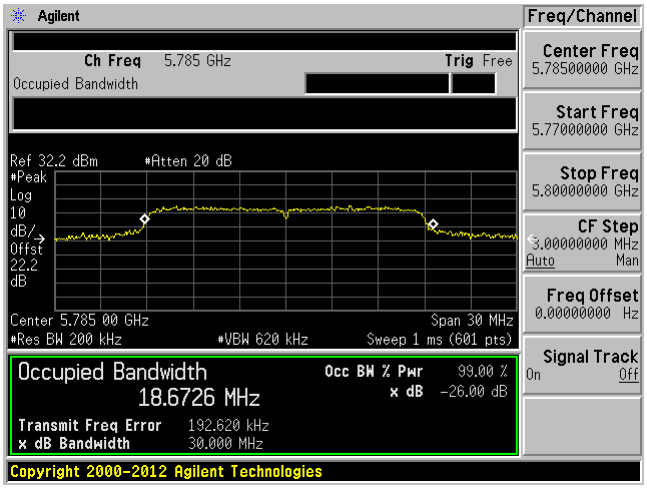

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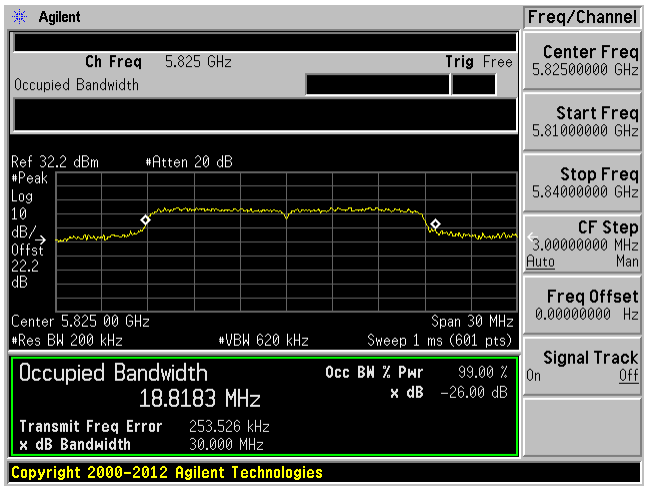
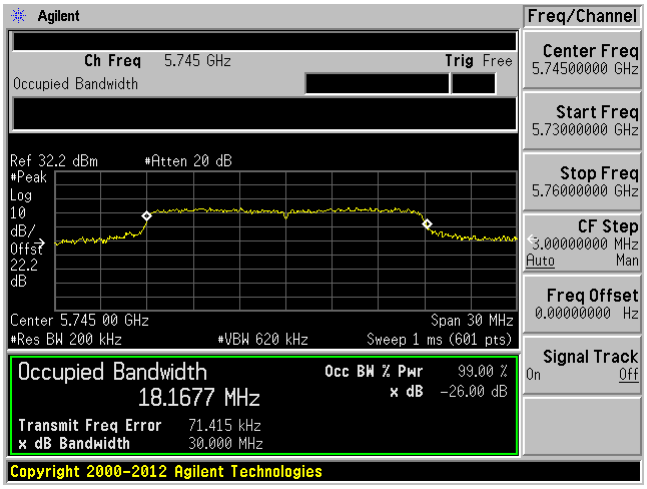


802.11n20 mode Port A MIMO 99% OBW

5745 MHz



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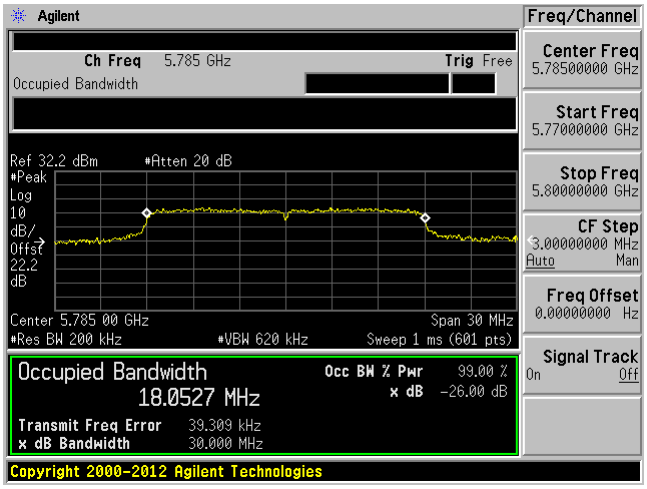

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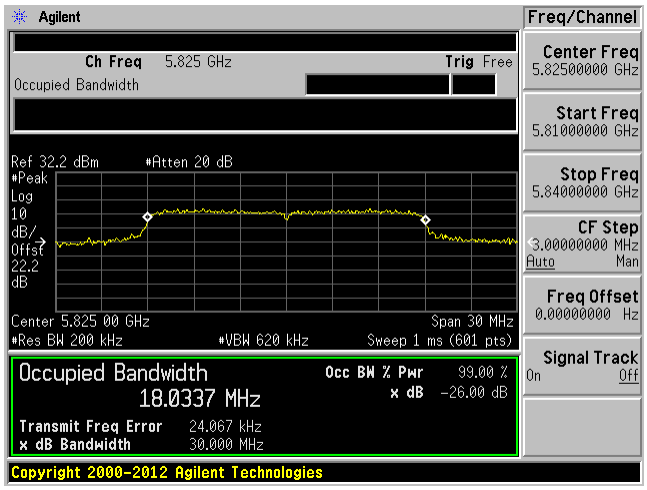
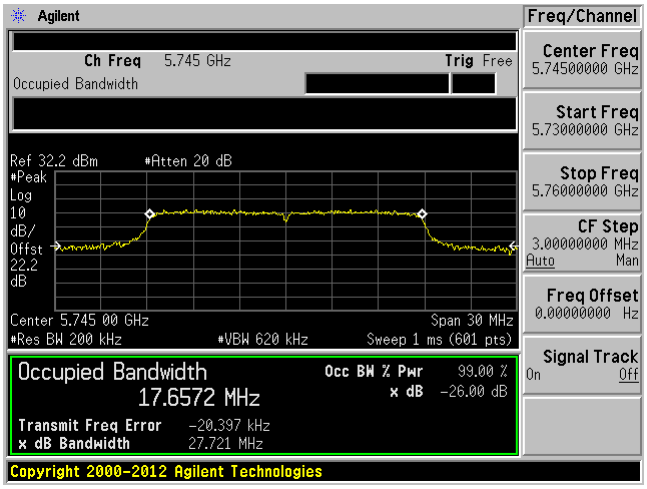


802.11n20 mode Port B 99% OBW

5745 MHz



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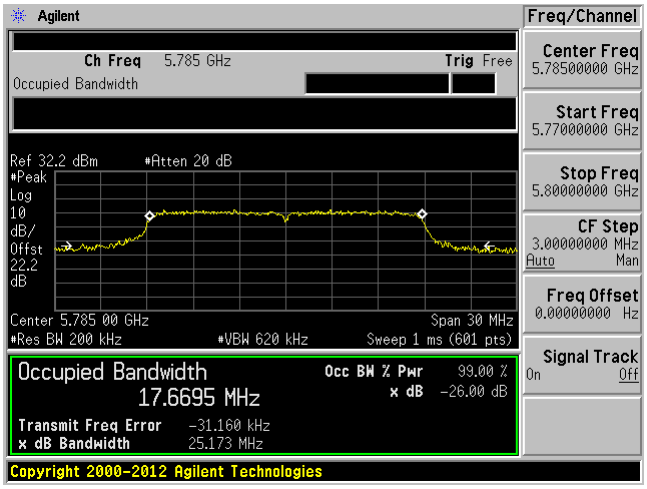

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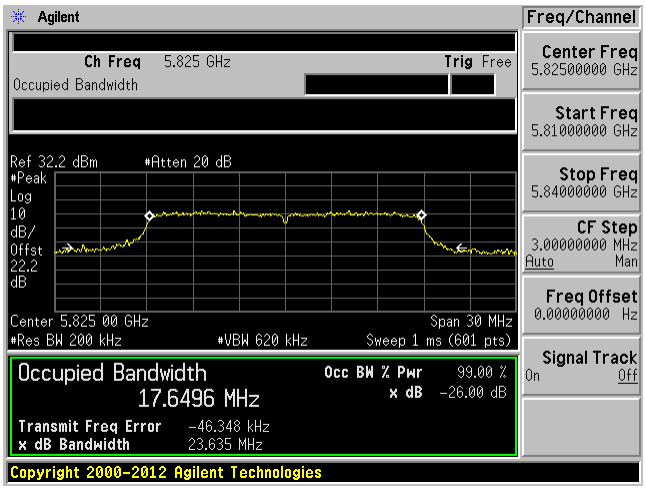
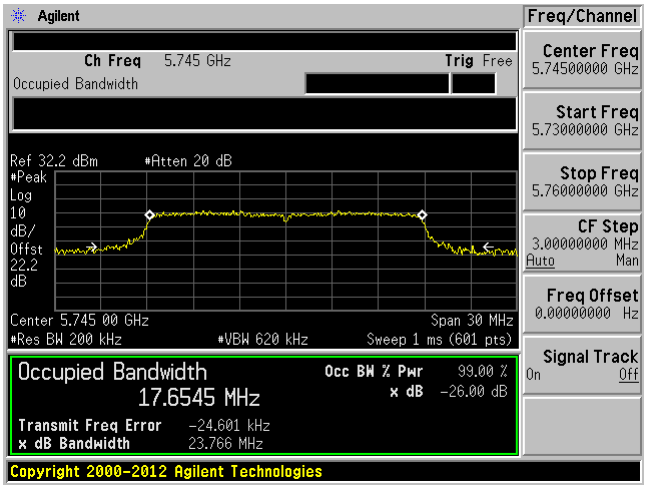


802.11n20 mode Port B MIMO 99% OBW

5745 MHz



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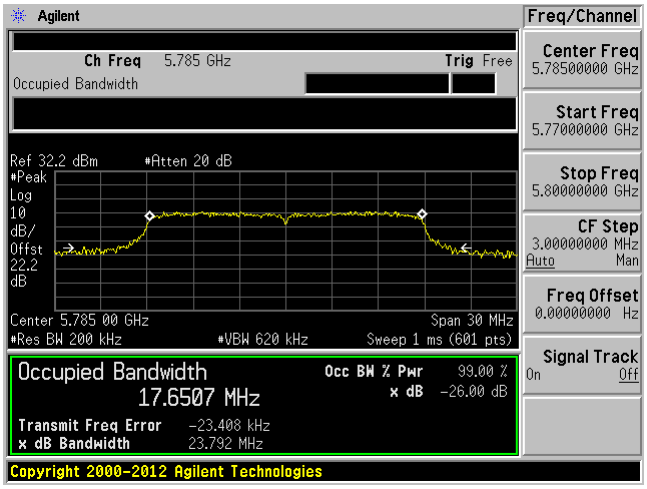

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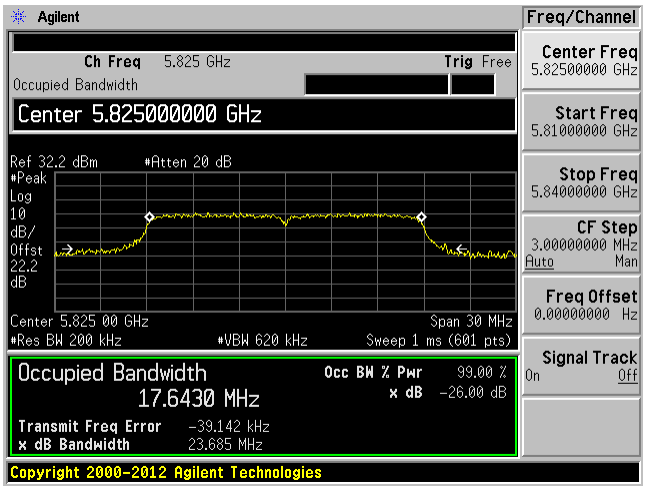
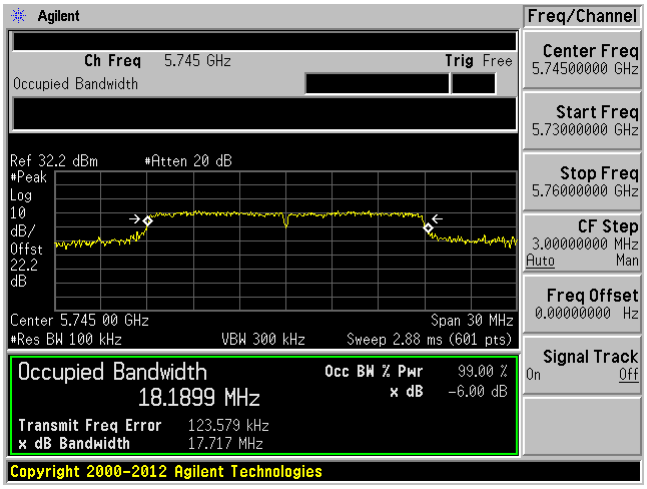
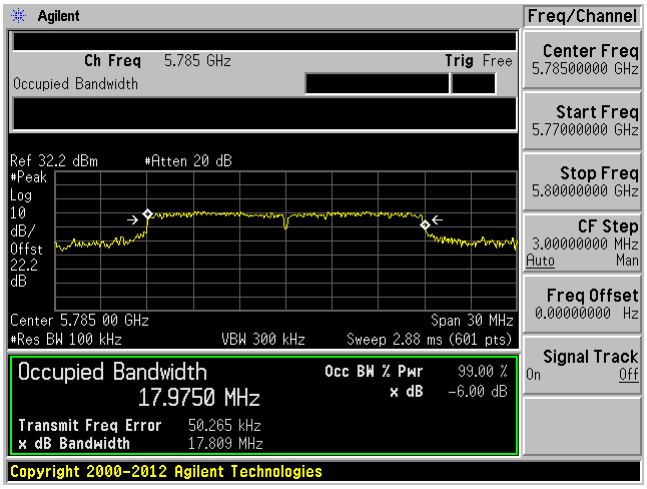


802.11n20 mode Port A 6dB OBW

5745 MHz



5785 MHz



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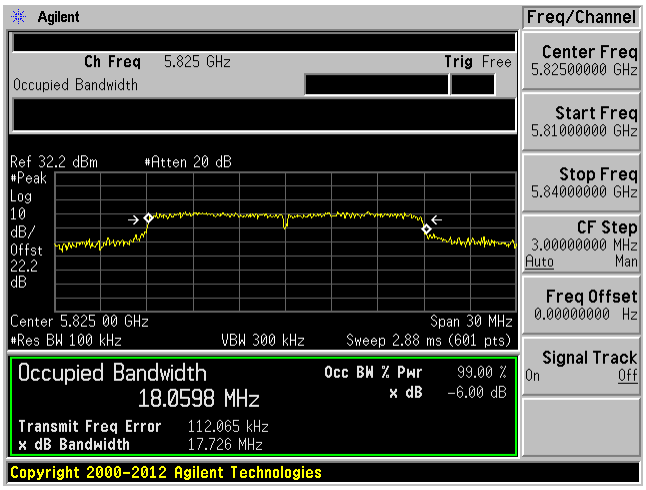
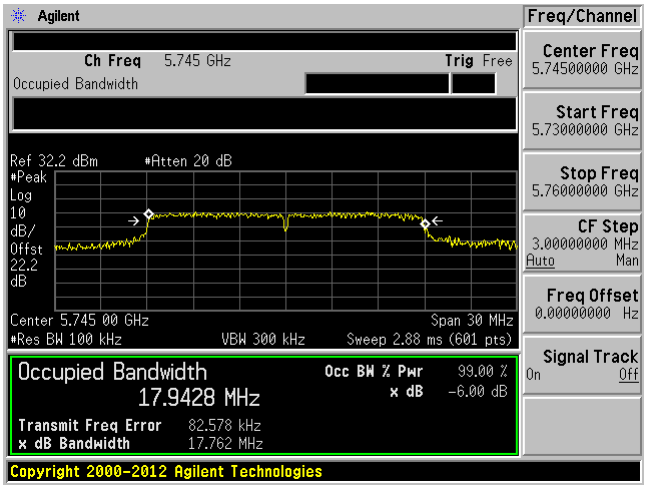
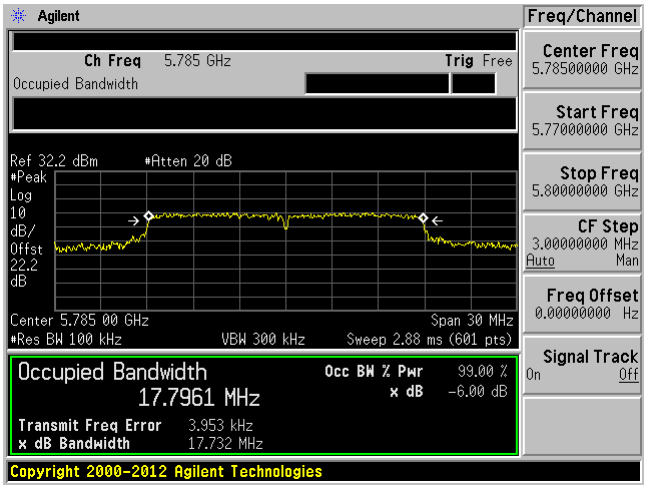


802.11n20 mode Port A MIMO 6 dB OBW

5745 MHz



5785 MHz



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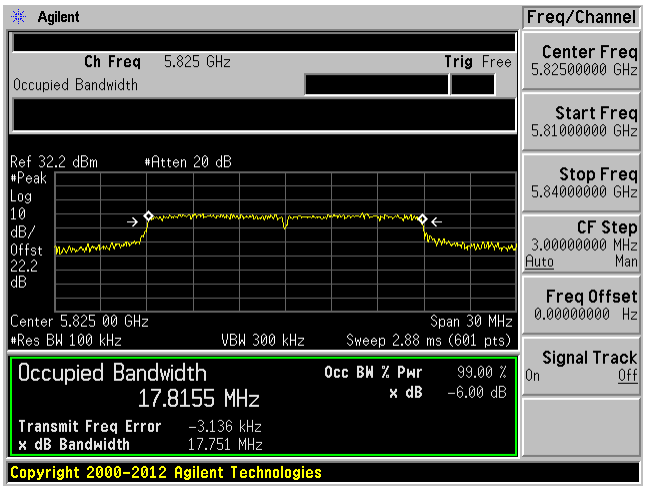
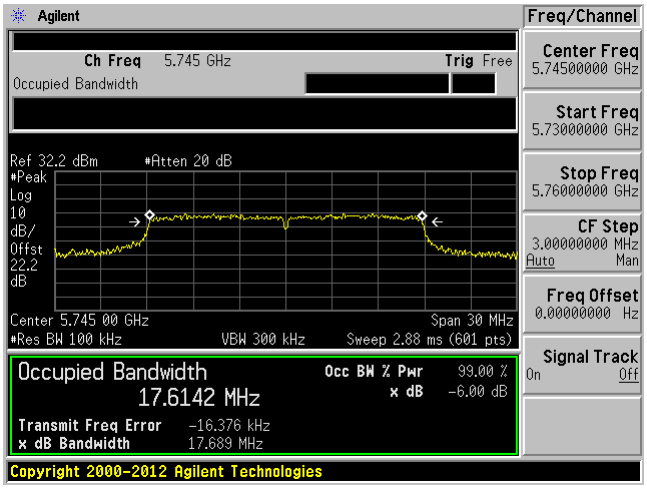


802.11n20 mode Port B 6 dB OBW

5745 MHz



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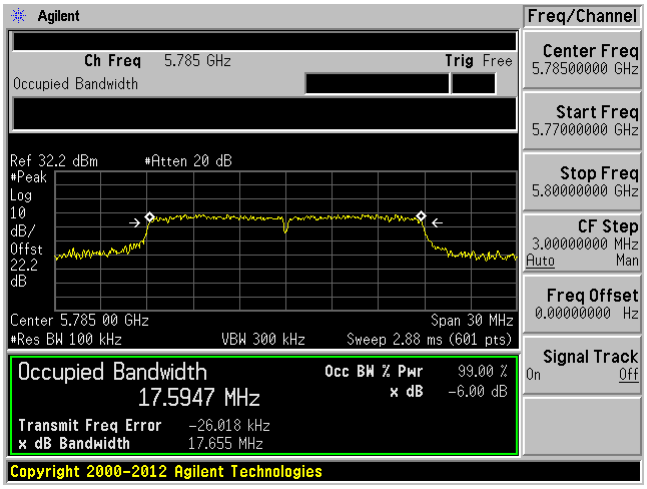

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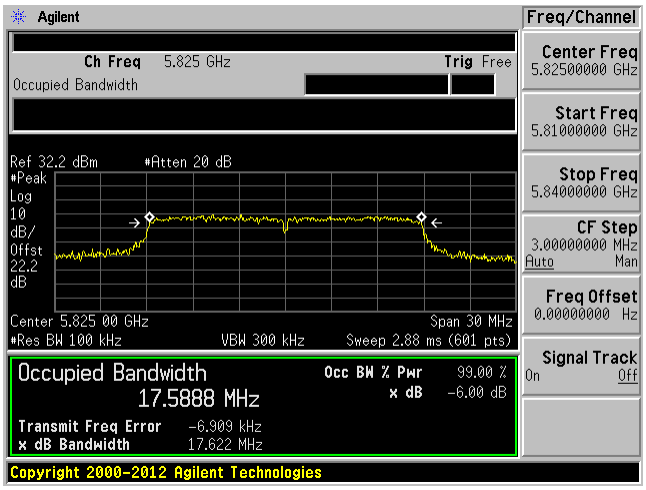
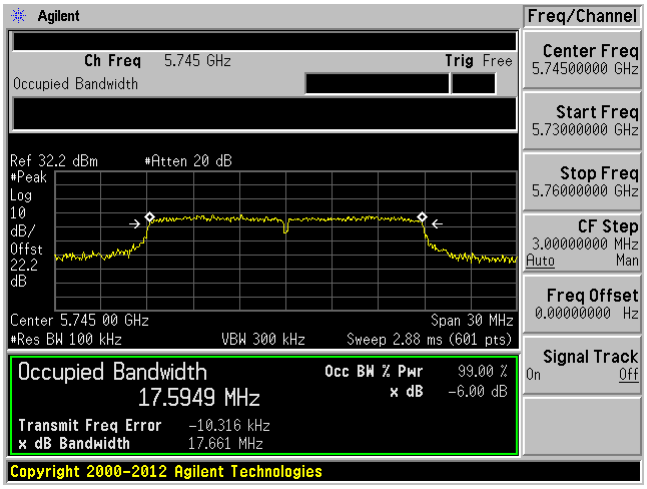


802.11n20 mode Port B MIMO 6 dB OBW

5745 MHz



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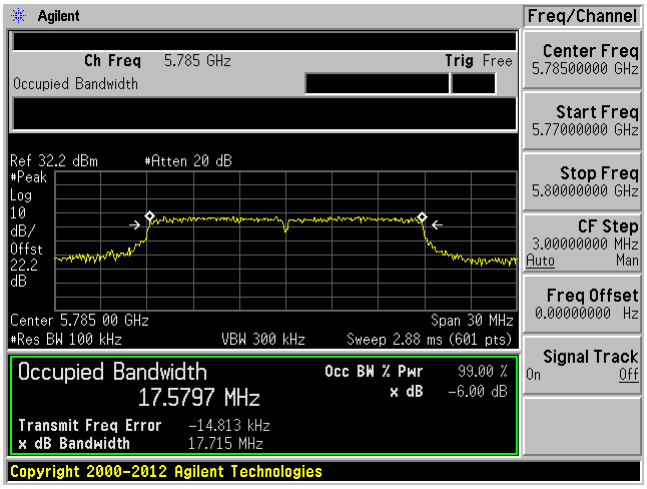

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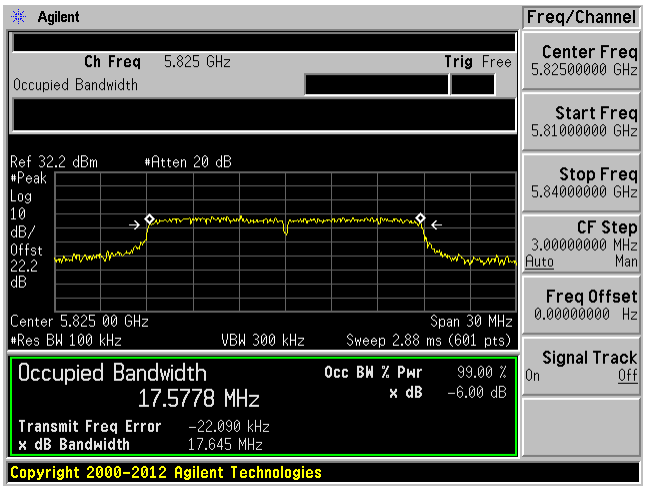
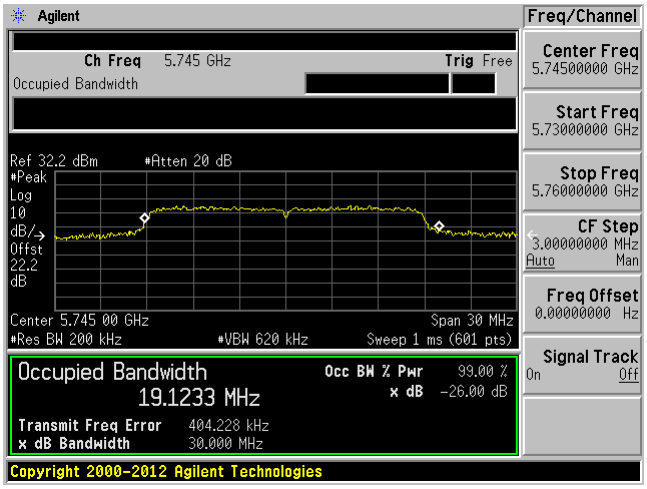


802.11ac20 mode Port A 99% OBW

5745 MHz



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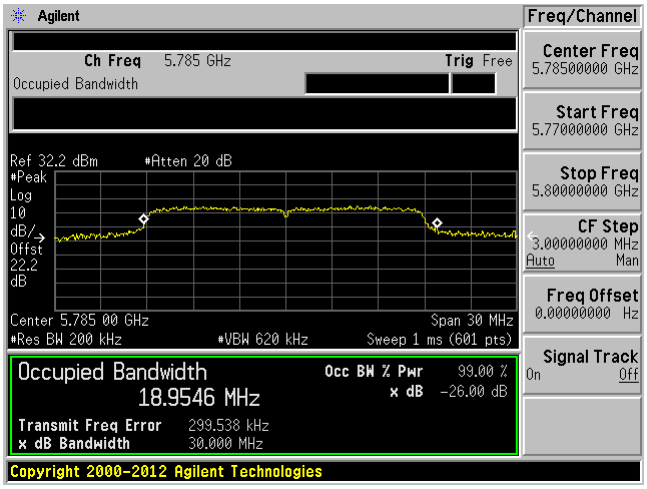
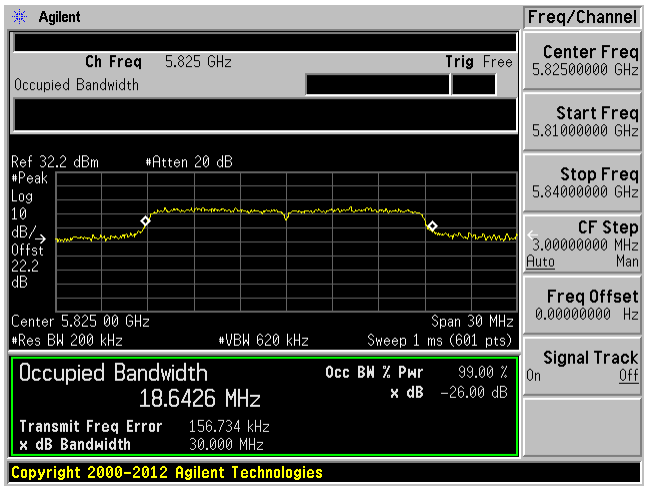
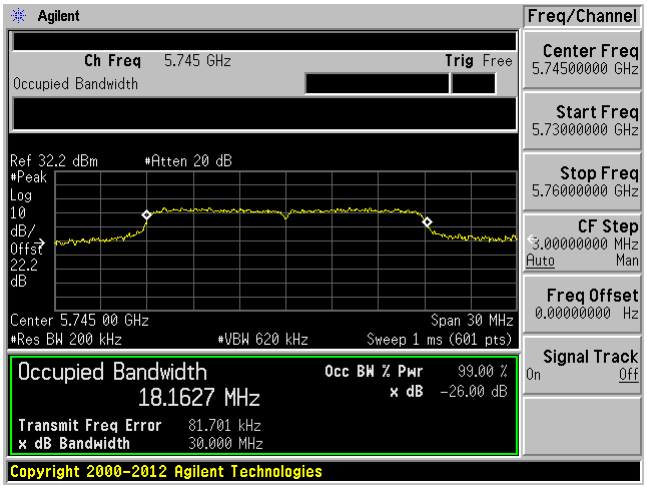


5825 MHz

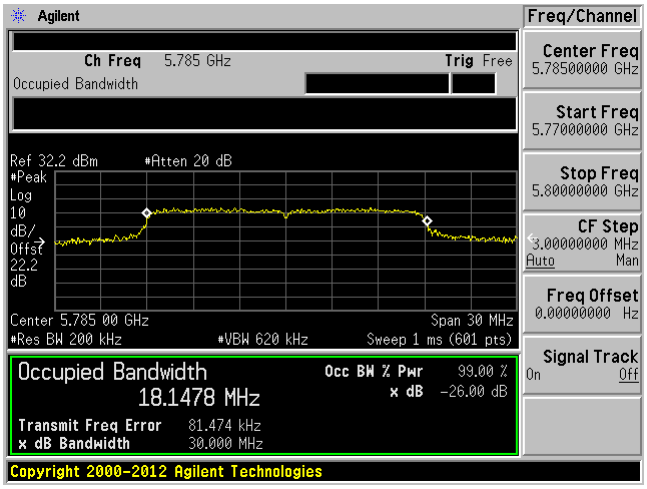


802.11ac20 mode Port A MIMO 99% OBW

5745 MHz



5785 MHz



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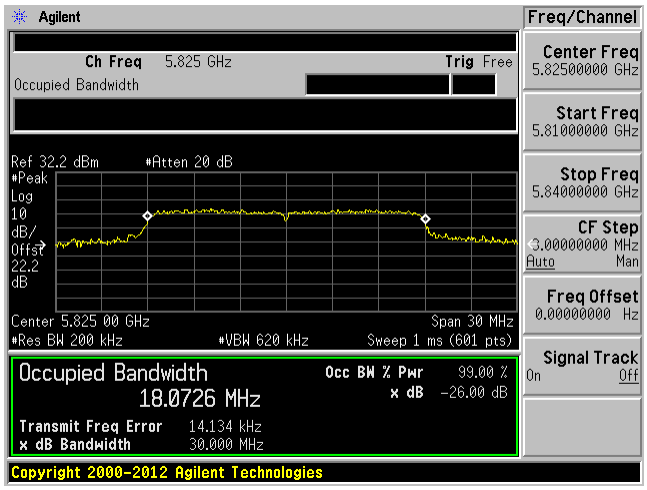
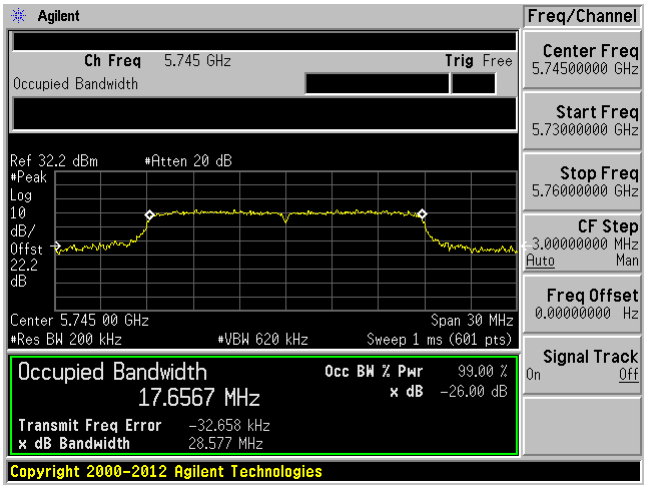


802.11ac20 mode Port B 99% OBW

5745 MHz



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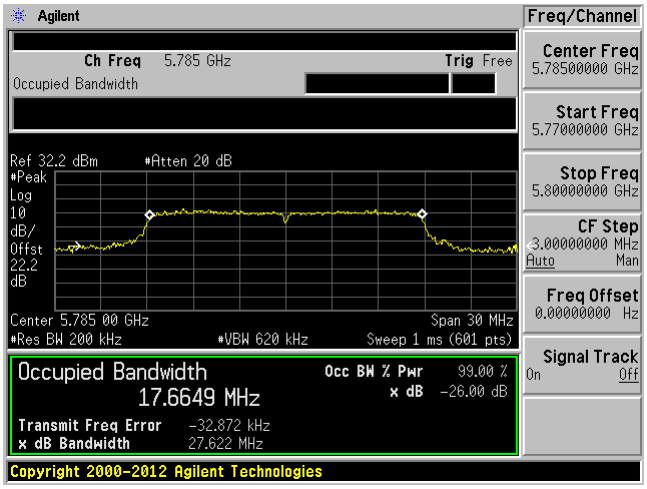

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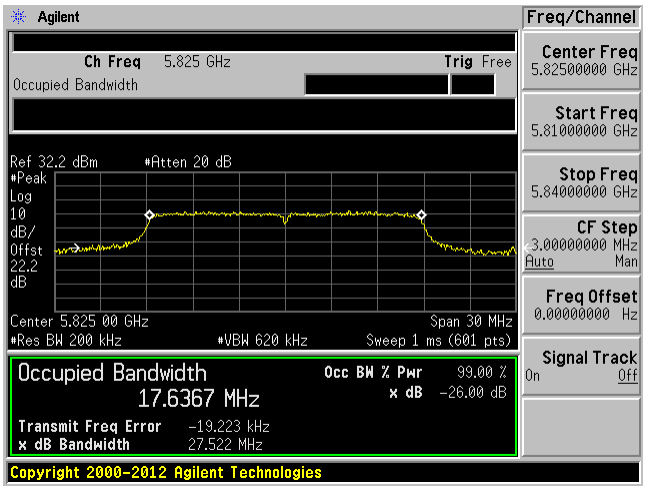
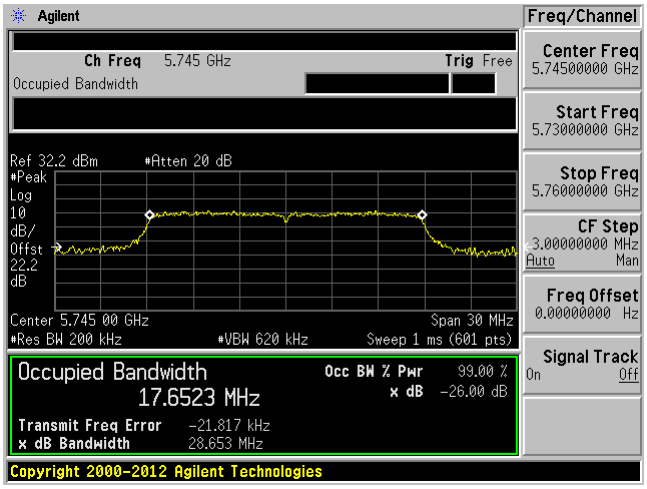


802.11ac20 mode Port B MIMO 99% OBW

5745 MHz



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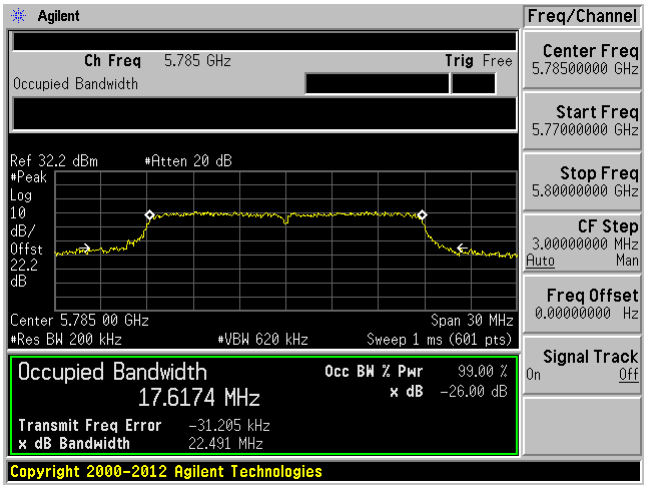

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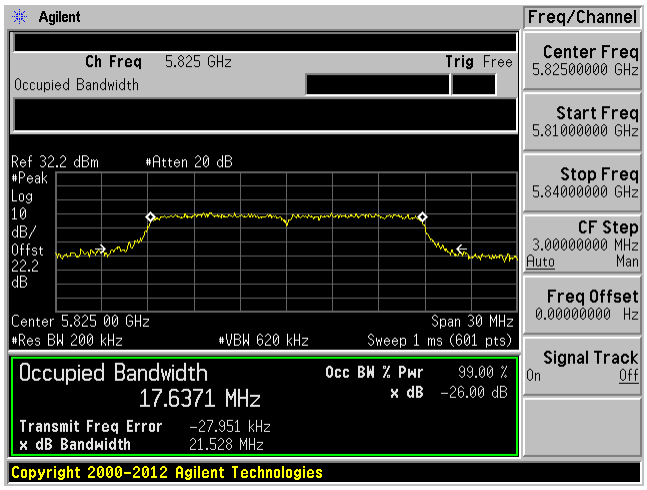
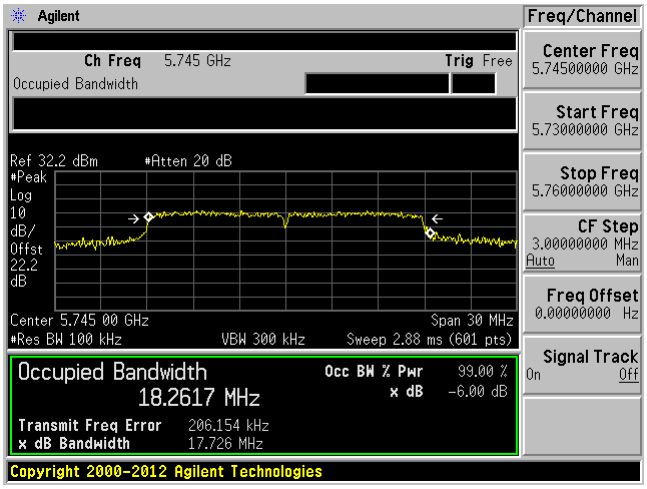


802.11ac20 mode Port A 6dB OBW

5745 MHz



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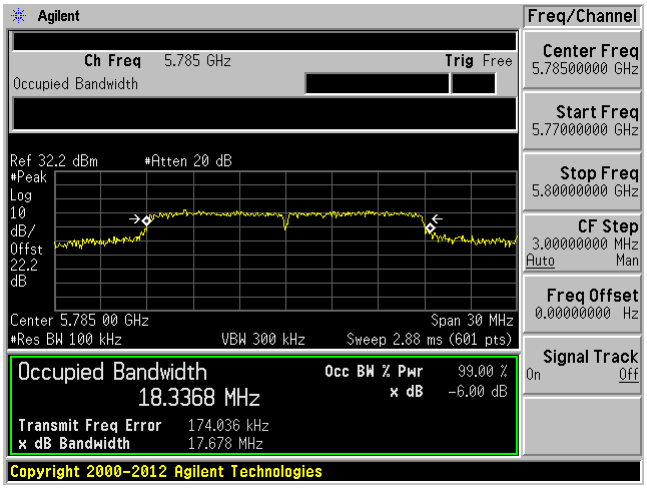

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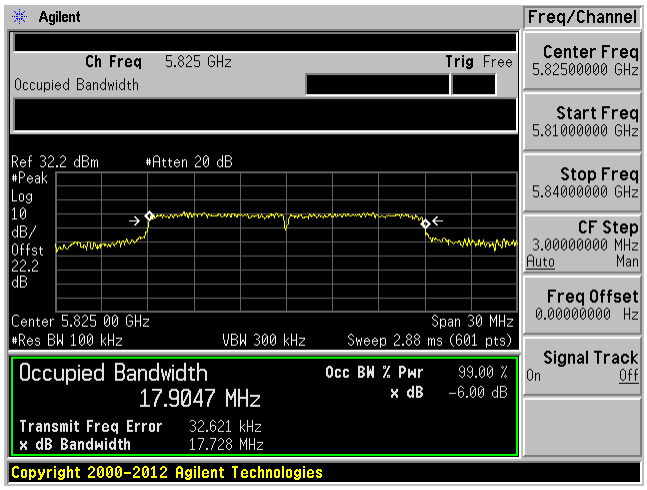
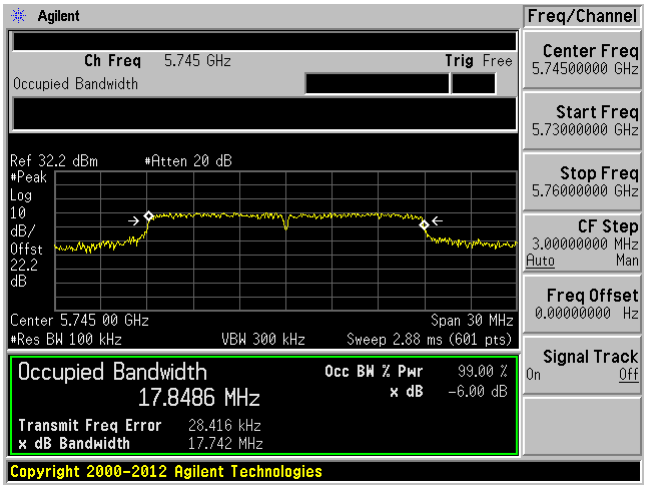
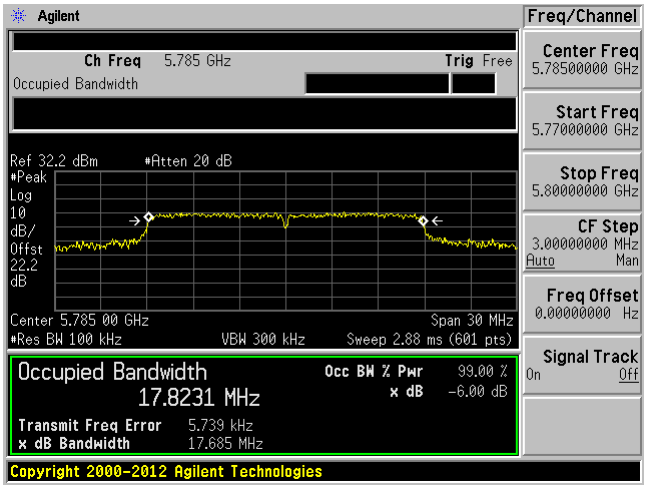


802.11ac20 mode Port A MIMO 6 dB OBW

5745 MHz



5785 MHz



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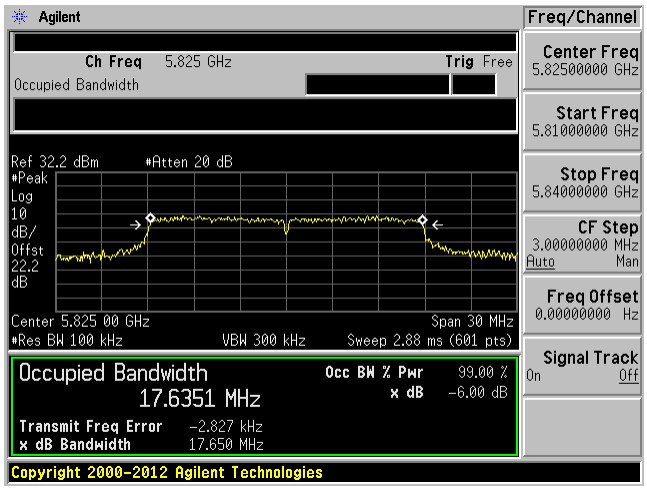
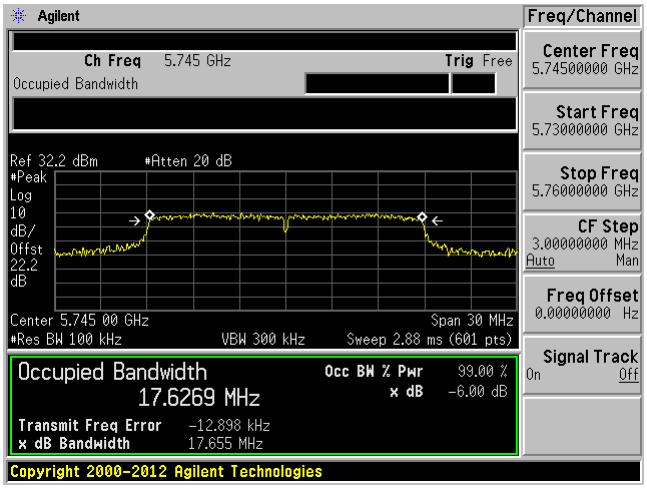


802.11ac20 mode Port B 6 dB OBW

5745 MHz



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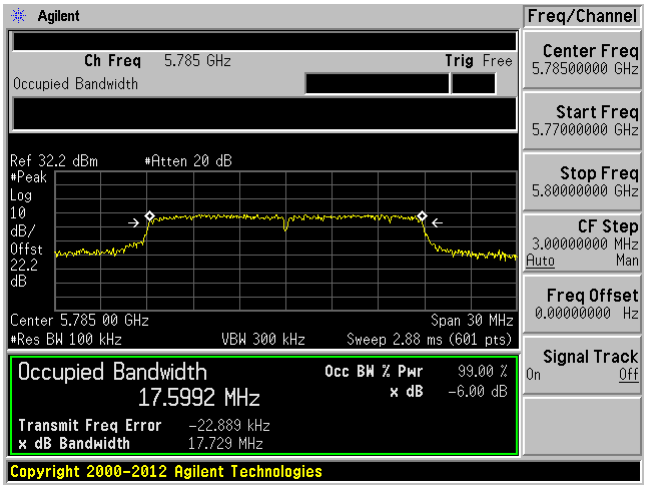

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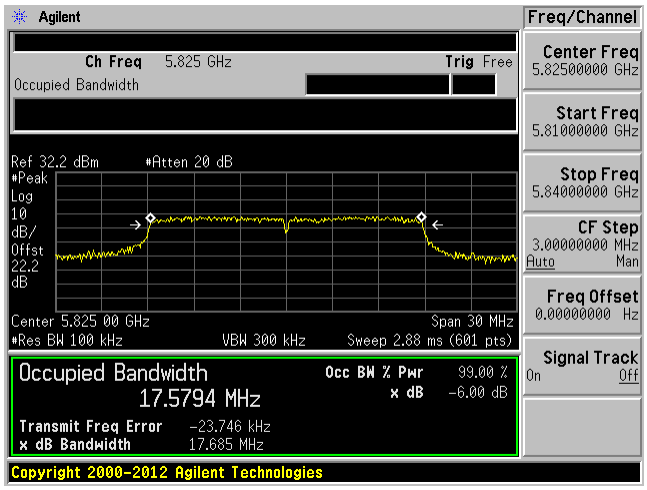
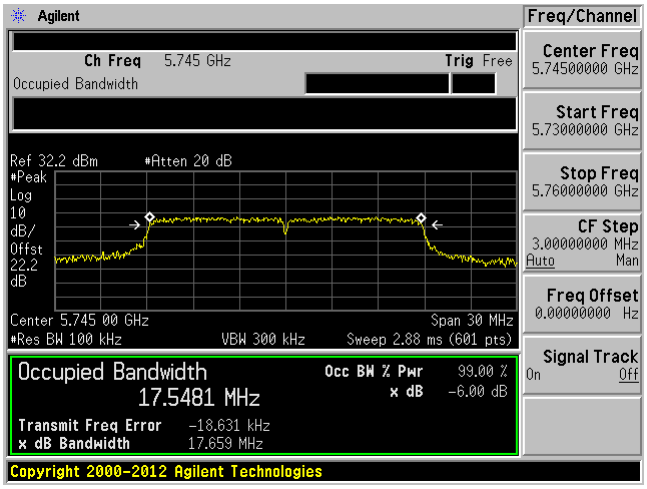


802.11ac20 mode Port B MIMO 6 dB OBW

5745 MHz



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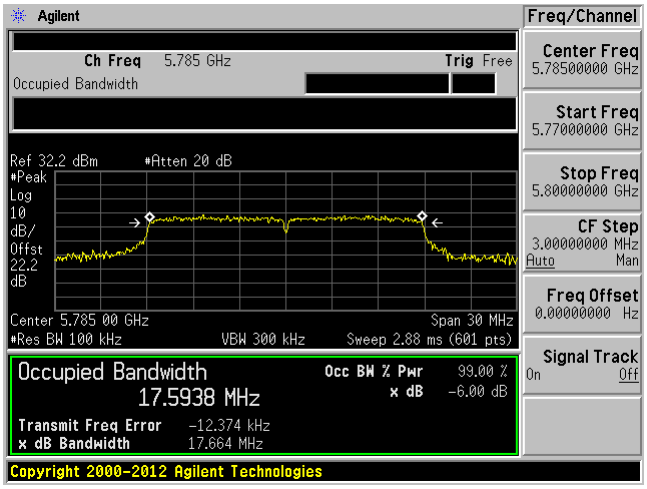

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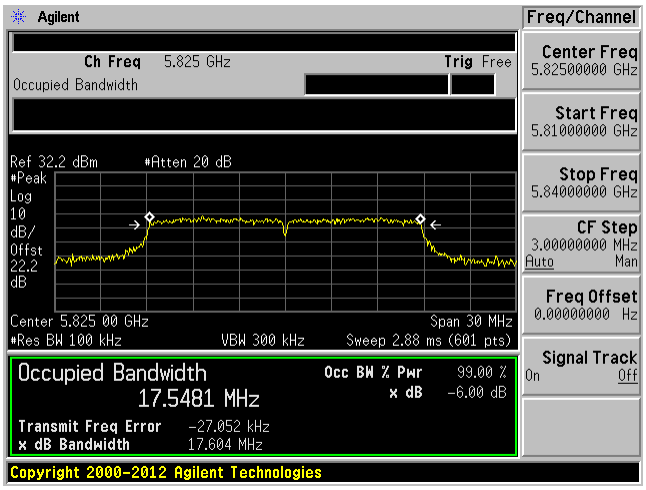


9 FCC §407(a) & ISED RSS-247 §6.2 - Output Power

9.1 Applicable Standards

According to FCC §15.407(a):

For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

According to ISED RSS-247 §6.2.1 for frequency band 5150-5250 MHz:

The maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

According to ISED RSS-247 §6.2.2 for frequency band 5250-5350 MHz:

The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

According to ISED RSS-247 §6.2.3 for frequency band 5470-5600 MHz and 5650-5725 MHz:

The maximum conducted output power shall not exceed 250 mW or 11 + 10 log10B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 log10B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

According to ISED RSS-247 §6.2.4 for frequency band 5725-5850 MHz:

The maximum conducted output power shall not exceed 1 W. The power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

9.2 Measurement Procedure

1. Place the EUT on a bench 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 a power meter.

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
ETS- Lingerin	Power Sensor	7002-006	160097	2016-12-05	2 years
-	RF Cable	-	-	Each time[1]	N/A
-	20 dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

9.4 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Vincent Licata on 2017-08-02 in RF site.

9.5 Test Results

5150 - 5250 MHz

FCC Results

Frequency (MHz)	Mode	TX Paths	Ant A (dBm)	Ant B (dBm)	Cable Loss (dBm)	Total Conducted Average Power (dBm)	FCC Limit (dBm)
5180	802.11a	1	14.1	-	2.2	16.30	24
	802.11a	1	-	12.98	2.2	15.18	24
	802.11n20	1	14.84	-	2.2	17.04	24
	802.11n20	1	-	14.27	2.2	16.47	24
	802.11n20	2	13.58	12.63	2.2	18.34	24
	802.11ac20	1	14.95	-	2.2	17.15	24
	802.11ac20	1	-	14.32	2.2	16.52	24
	802.11ac20	2	13.65	12.79	2.2	18.45	24
5200	802.11a	1	17.21	-	2.2	19.41	24
	802.11a	1	-	16.79	2.2	18.99	24
	802.11n20	1	14.94	-	2.2	17.14	24
	802.11n20	1	-	14.41	2.2	16.61	24
	802.11n20	2	14.31	13.43	2.2	19.10	24
	802.11ac20	1	14.97	-	2.2	17.17	24
	802.11ac20	1	-	14.53	2.2	16.73	24
	802.11ac20	2	14.35	13.34	2.2	19.08	24
5240	802.11a	1	17.2	-	2.2	19.40	24
	802.11a	1	-	16.68	2.2	18.88	24
	802.11n20	1	14.96	-	2.2	17.16	24
	802.11n20	1	-	14.26	2.2	16.46	24
	802.11n20	2	14.3	13.14	2.2	18.97	24
	802.11ac20	1	14.99	-	2.2	17.19	24
	802.11ac20	1	-	14.43	2.2	16.63	24
	802.11ac20	2	14.13	13.06	2.2	18.84	24

ISED Results

Frequency (MHz)	Mode	TX Paths	Ant A (dBm)	Ant B (dBm)	Cable Loss (dBm)	Total Conducted Average Power (dBm)	Antenna Gain	EIRP	ISED Limit (dBm)
5180	802.11a	1	14.1	-	2.2	16.30	1.1	17.40	22.20
	802.11a	1	-	12.98	2.2	15.18	1.1	16.28	22.17
	802.11n20	1	14.84	-	2.2	17.04	1.1	18.14	22.49
	802.11n20	1	-	14.27	2.2	16.47	1.1	17.57	22.47
	802.11n20	2	13.58	12.63	2.2	18.34	1.1	19.44	22.47
	802.11ac20	1	14.95	-	2.2	17.15	1.1	18.25	22.50
	802.11ac20	1	-	14.32	2.2	16.52	1.1	17.62	22.48
	802.11ac20	2	13.65	12.79	2.2	18.45	1.1	19.55	22.47
5200	802.11a	1	17.21	-	2.2	19.41	1.1	20.51	23.16
	802.11a	1	-	16.79	2.2	18.99	1.1	20.09	22.84
	802.11n20	1	14.94	-	2.2	17.14	1.1	18.24	22.97
	802.11n20	1	-	14.41	2.2	16.61	1.1	17.71	22.68
	802.11n20	2	14.31	13.43	2.2	19.10	1.1	20.20	22.61
	802.11ac20	1	14.97	-	2.2	17.17	1.1	18.27	23.15
	802.11ac20	1	-	14.53	2.2	16.73	1.1	17.83	22.83
	802.11ac20	2	14.35	13.34	2.2	19.08	1.1	20.18	22.69
5240	802.11a	1	17.2	-	2.2	19.40	1.1	20.50	22.99
	802.11a	1	-	16.68	2.2	18.88	1.1	19.98	22.65
	802.11n20	1	14.96	-	2.2	17.16	1.1	18.26	22.94
	802.11n20	1	-	14.26	2.2	16.46	1.1	17.56	22.71
	802.11n20	2	14.3	13.14	2.2	18.97	1.1	20.07	22.59
	802.11ac20	1	14.99	-	2.2	17.19	1.1	18.29	22.62
	802.11ac20	1	-	14.43	2.2	16.63	1.1	17.73	22.83
	802.11ac20	2	14.13	13.06	2.2	18.84	1.1	19.94	22.62

5725 - 5850 MHz

Frequency (MHz)	Mode	TX Paths	Ant A (dBm)	Ant B (dBm)	Cable Loss (dBm)	Total Conducted Average Power (dBm)	FCC/ ISED Limit (dBm)
5745	802.11a	1	14.31	-	2.2	16.51	30
	802.11a	1	-	11.27	2.2	13.47	30
	802.11n20	1	16.27	-	2.2	18.47	30
	802.11n20	1	-	13.73	2.2	15.93	30
	802.11n20	2	15.52	12.88	2.2	19.61	30
	802.11ac20	1	16.09	-	2.2	18.29	30
	802.11ac20	1	-	13.89	2.2	16.09	30
	802.11ac20	2	15.35	12.92	2.2	19.51	30
5765	802.11a	1	13.41	-	2.2	15.61	30
	802.11a	1	-	10.44	2.2	12.64	30
	802.11n20	1	15.13	-	2.2	17.33	30
	802.11n20	1	-	12.57	2.2	14.77	30
	802.11n20	2	14.19	11.56	2.2	18.28	30
	802.11ac20	1	15.07	-	2.2	17.27	30
	802.11ac20	1	-	12.53	2.2	14.73	30
	802.11ac20	2	14.22	11.5	2.2	18.28	30
5785	802.11a	1	16.1	-	2.2	18.30	30
	802.11a	1	-	13.97	2.2	16.17	30
	802.11n20	1	16.05	-	2.2	18.25	30
	802.11n20	1	-	13.77	2.2	15.97	30
	802.11n20	2	15.16	13.7	2.2	19.70	30
	802.11ac20	1	15.95	-	2.2	18.15	30
	802.11ac20	1	-	13.72	2.2	15.92	30
	802.11ac20	2	15.28	12.91	2.2	19.47	30
	802.11ac20	2	15.12	12.42	2.2	19.19	30

Frequency (MHz)	Mode	TX Paths	Ant A (dBm)	Ant B (dBm)	Cable Loss (dBm)	Total Conducted Average Power (dBm)	FCC/ ISED Limit (dBm)
5805	802.11a	1	14.49	-	2.2	16.69	30
	802.11a	1	-	11.88	2.2	14.08	30
	802.11n20	1	16.02	-	2.2	18.22	30
	802.11n20	1	-	13.56	2.2	15.76	30
	802.11n20	2	15.25	12.68	2.2	19.36	30
	802.11ac20	1	16.09	-	2.2	18.29	30
	802.11ac20	1	-	13.57	2.2	15.77	30
	802.11ac20	2	15.26	12.71	2.2	19.38	30
5825	802.11a	1	15.52	-	2.2	17.72	30
	802.11a	1	-	12.92	2.2	15.12	30
	802.11n20	1	16.03	-	2.2	18.23	30
	802.11n20	1	-	13.51	2.2	15.71	30
	802.11n20	2	15.31	12.48	2.2	19.33	30
	802.11ac20	1	16.01	-	2.2	18.21	30
	802.11ac20	1	-	13.53	2.2	15.73	30
	802.11ac20	2	15.12	12.42	2.2	19.19	30

Note: per client requirement, both SISO and MIMO mode for 802.11n/ac were tested.

10 FCC §15.407(a) & ISED RSS-247 §6.2 - Power Spectral Density

10.1 Applicable Standards

According to FCC §15.407(a):

For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

According to ISED RSS-247 §6.2.1 for frequency band 5150-5250 MHz:

The maximum e.i.r.p. shall not exceed 200 mW or 10 + 10 log10B, dBm, whichever power is less. B is the 99% emission bandwidth in megahertz. The e.i.r.p. spectral density shall not exceed 10 dBm in any 1.0 MHz band.

According to ISED RSS-247 §6.2.2 for frequency band 5250-5350 MHz:

The maximum conducted output power shall not exceed 250 mW or 11 + 10 $\log_{10}$B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 $\log_{10}$B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

According to ISED RSS-247 §6.2.3 for frequency band 5470-5600 MHz and 5650-5725 MHz:

The maximum conducted output power shall not exceed 250 mW or 11 + 10 $\log_{10}$B, dBm, whichever is less. The power spectral density shall not exceed 11 dBm in any 1.0 MHz band.

The maximum e.i.r.p. shall not exceed 1.0 W or 17 + 10 $\log_{10}$B, dBm, whichever is less. B is the 99% emission bandwidth in megahertz. Note that devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

According to ISED RSS-247 §6.2.4 for frequency band 5725-5850 MHz:

The maximum conducted output power shall not exceed 1 W. The power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

10.2 Measurement Procedure

(i) Set span to encompass the entire emission bandwidth (EBW) of the signal.
(ii) Set RBW = 1 MHz.
(iii) Set VBW ≥ 3 MHz.
(iv) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)
(v) Sweep time = auto.
(vi) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
(vii) If transmit duty cycle < 98 percent, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 percent, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run".
(viii) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
(ix) Compute power by integrating the spectrum across the 26 dB EBW of the signal using the spectrum analyzer's band power measurement function with band limits set equal to the EBW band edges. If the spectrum analyzer does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the 26 dB EBW of the spectrum.

10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2017-04-20	1 year
-	RF Cable	-	-	Each time[1]	N/A
-	20 dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

10.4 Test Environmental Conditions

Temperature:	22-24 ºC
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

The testing was performed by Vincent Licata on 2017-08-03 at RF site.

10.5 Test Results

Note: per client requirement, both SISO and MIMO mode for 802.11n/ac were tested.

5150 – 5250 MHz

FCC Results:

Antenna Port A

Frequency (MHz)	Measured PSD (dBm/MHz)	Corrected PSD (dBm/MHz)	FCC Limit (dBm/MHz)
802.11a mode			
5180	5.077	5.077	11
5200	8.207	8.207	11
5240	8.200	8.200	11
802.11n20 mode			
5180	6.371	6.371	11
5200	7.549	7.549	11
5240	8.096	8.096	11
802.11ac20 mode			
5180	5.620	5.620	11
5200	8.387	8.387	11
5240	7.816	7.816	11

Antenna Port B

Frequency (MHz)	Measured PSD (dBm/MHz)	Corrected PSD (dBm/MHz)	FCC Limit (dBm/MHz)
802.11a mode			
5180	3.812	3.812	11
5200	7.496	7.496	11
5240	7.534	7.534	11
802.11n20 mode			
5180	3.697	3.697	11
5200	7.087	7.087	11
5240	7.518	7.518	11
802.11ac20 mode			
5180	4.915	4.915	11
5200	7.986	7.986	11
5240	7.259	7.259	11

Antenna Port A+B MIMO

Frequency (MHz)	PSD Port A MIMO (dBm/MHz)	PSD Port B MIMO (dBm/MHz)	Measured PSD Port A+B MIMO[1] (dBm/MHz)	Corrected PSD[2] (dBm/MHz)	FCC Limit (dBm/MHz)
802.11n20 mode					
5180	4.829	3.697	7.310	7.310	11
5200	5.514	4.946	8.250	8.250	11
5240	5.620	5.285	8.466	8.466	11
802.11ac20 mode					
5180	4.667	3.906	7.313	7.313	11
5200	5.598	4.866	8.258	8.258	11
5240	5.626	5.088	8.376	8.376	11

Note 1: For Port A+B MIMO, PSD = 10*log(10^(Port A MIMO/10)+10^(Port B MIMO/10)) dBm/MHz
Note 2: Corrected PSD (dBm/MHz) = Measured PSD (dBm/MHz) + Duty Cycle Correction (dB)

ISED Results:

Antenna Port A

Frequency (MHz)	PSD (dBm/MHz)	Corrected PSD (dBm/MHz)	EIRP PSD (dBm/MHz)	ISED Limit (dBm/MHz)
802.11a mode				
5180	5.077	5.077	6.177	10
5200	8.207	8.207	9.307	10
5240	8.200	8.200	9.300	10
802.11n20 mode				
5180	6.371	6.371	7.471	10
5200	7.549	7.549	8.649	10
5240	8.096	8.096	9.196	10
802.11ac20 mode				
5180	5.620	5.620	6.720	10
5200	8.387	8.387	9.487	10
5240	7.816	7.816	8.916	10

Antenna Port B

Frequency (MHz)	PSD (dBm/MHz)	Corrected PSD (dBm/MHz)	EIRP PSD (dBm/MHz)	ISED Limit (dBm/MHz)
802.11a mode				
5180	3.812	3.812	4.912	10
5200	7.496	7.496	8.596	10
5240	7.534	7.534	8.634	10
802.11n20 mode				
5180	5.323	5.323	6.423	10
5200	7.087	7.087	8.187	10
5240	7.518	7.518	8.618	10
802.11ac20 mode				
5180	4.915	4.915	6.015	10
5200	7.986	7.986	9.086	10
5240	7.259	7.259	8.359	10

Antenna Port A+B MIMO

Frequency (MHz)	PSD Port A MIMO (dBm/MHz)	PSD Port B MIMO (dBm/MHz)	Measured PSD Port A+B MIMO[1] (dBm/MHz)	Corrected PSD[2] (dBm/MHz)	EIRP PSD[3] (dBm/MHz)	ISED Limit (dBm/MHz)
802.11n20 mode						
5180	4.829	3.697	7.310	7.310	8.410	10
5200	5.514	4.946	8.250	8.250	9.350	10
5240	5.620	5.285	8.466	8.466	9.566	10
802.11ac20 mode						
5180	4.667	3.906	7.313	7.313	8.413	10
5200	5.598	4.866	8.258	8.258	9.358	10
5240	5.626	5.088	8.376	8.376	9.476	10

Note 1: For Port A+B MIMO, PSD = 10*log(10^(Port A MIMO/10)+10^(Port B MIMO/10)) dBm/MHz
Note 2: Corrected PSD (dBm/MHz) = Measured PSD (dBm/MHz) + Duty Cycle Correction (dB)
Note 3: EIRP PSD (dBm/MHz) = Corrected PSD (dBm/MHz) + Antenna Gain (dBi)

5725 - 5850 MHz

Antenna Port A

Frequency (MHz)	Measured PSD (dBm/100 kHz)	Corrected PSD (dBm/500 kHz)	FCC/ ISED Limit (dBm/500 kHz)
802.11a mode			
5745	-3.966	3.024	30
5785	-2.338	4.652	30
5825	-2.879	4.111	30
802.11n20 mode			
5745	-2.121	4.869	30
5785	-2.563	4.427	30
5825	-2.456	4.534	30
802.11ac20 mode			
5745	-2.379	4.611	30
5785	-2.264	4.726	30
5825	-2.918	4.072	30

Antenna Port B

Frequency (MHz)	Measured PSD (dBm/100 kHz)	Corrected PSD (dBm/500 kHz)	FCC/ ISED Limit (dBm/500 kHz)
802.11a mode			
5745	-6.944	0.046	30
5785	-4.688	2.302	30
5825	-5.673	1.317	30
802.11n20 mode			
5745	-4.571	2.419	30
5785	-4.803	2.187	30
5825	-5.018	1.972	30
802.11ac20 mode			
5745	-4.254	2.736	30
5785	-4.494	2.496	30
5825	-5.261	1.729	30

Antenna Port A+B MIMO

Frequency (MHz)	PSD Port A MIMO (dBm/100 kHz)	PSD Port B MIMO (dBm/100 kHz)	Port A+B MIMO[1] Measured PSD (dBm/100 kHz)	Corrected PSD[2] (dBm/500 kHz)	FCC/ ISED Limit (dBm/500 kHz)
802.11n20 mode					
5745	-3.394	-6.020	-1.501	5.489	30
5785	-3.682	-6.358	-1.807	5.183	30
5825	-3.973	-6.688	-2.111	4.879	30
802.11ac20 mode					
5745	-3.697	-6.008	-1.690	5.300	30
5785	-3.540	-6.241	-1.674	5.316	30
5825	-5.773	-6.532	-3.126	3.864	30

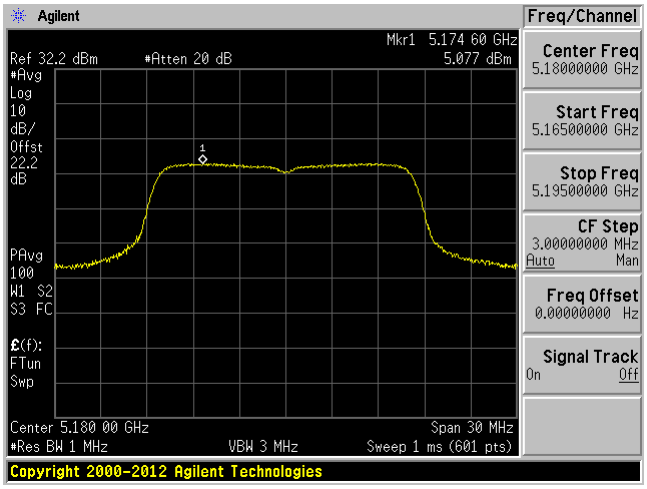
Note 1: For Port A+B MIMO, PSD = 10*log(10^(Port A MIMO/10)+10^(Port B MIMO/10)) dBm/100KHz
Note 2: For the 5725-5850 MHz band, the Corrected PSD (dBm/500 kHz) is equal to:
Corrected PSD (dBm/500 kHz) = PSD (dBm/100 kHz) + Duty Cycle Correction (dB) + 10*log(500 kHz/100 kHz)

Please refer to the following plots.

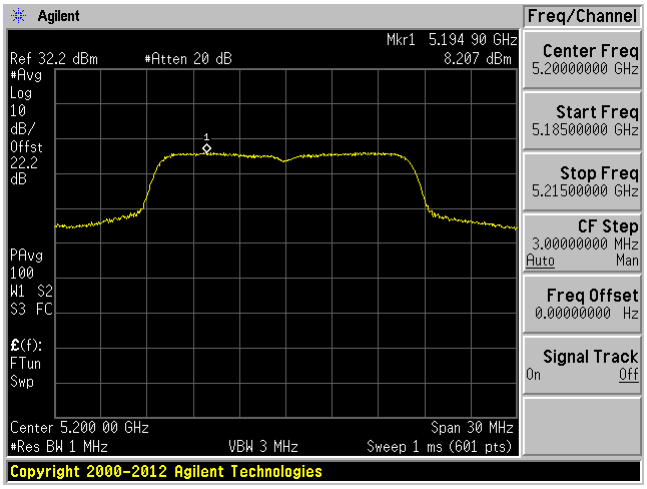
5150 – 5250 MHz

802.11a mode (Port A)

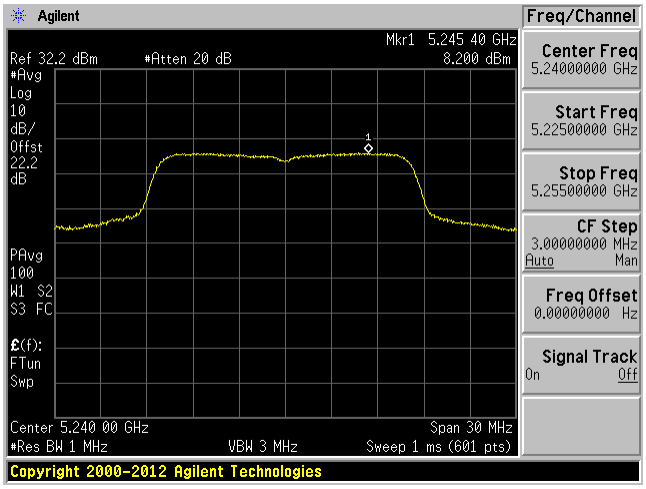
5180 MHz



5200 MHz

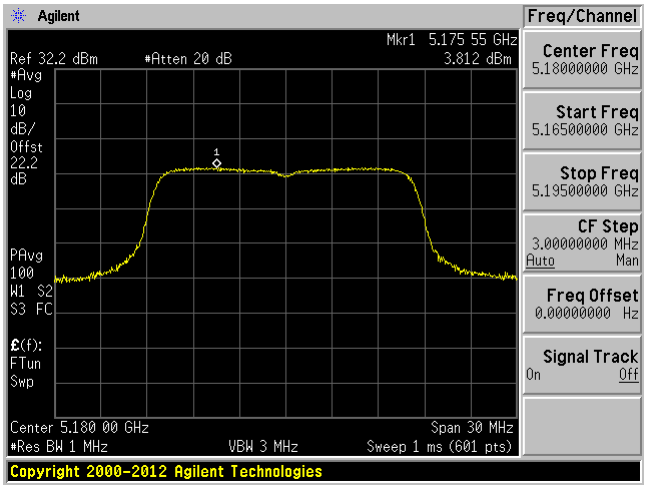


5240 MHz

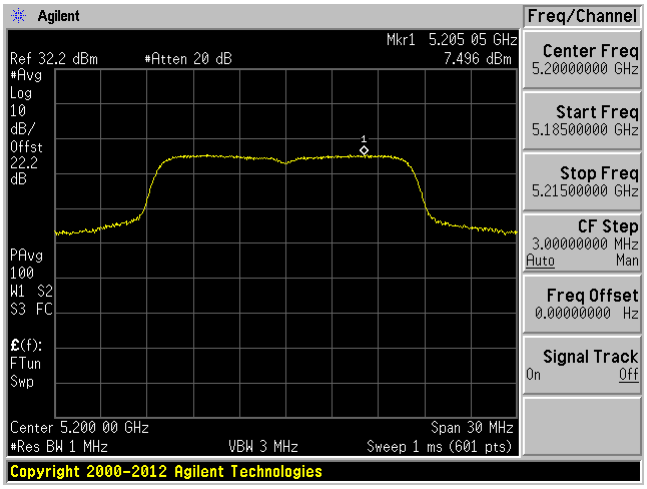


802.11a mode (Port B)

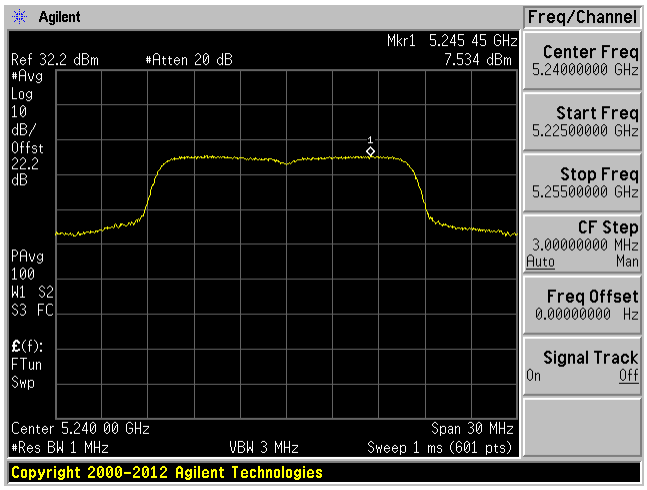
5180 MHz



5200 MHz

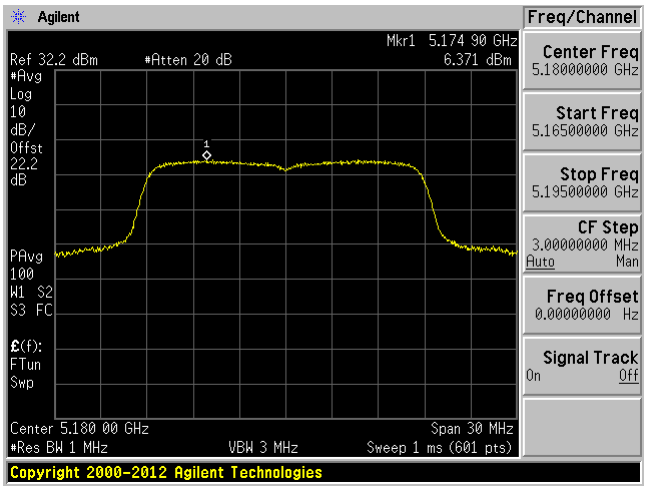


5240 MHz

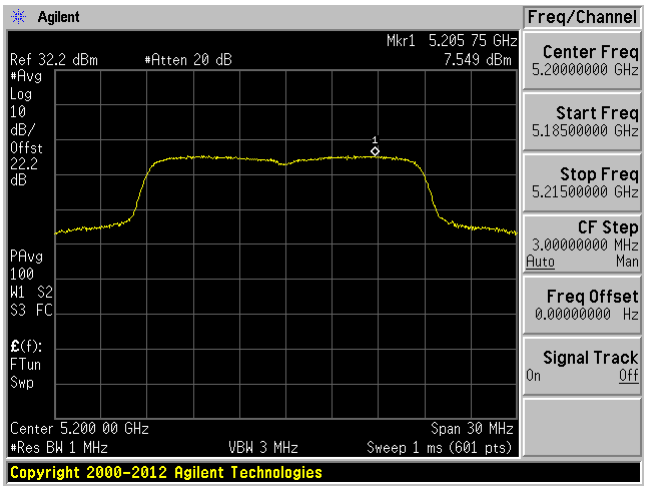


802.11n20 mode (Port A)

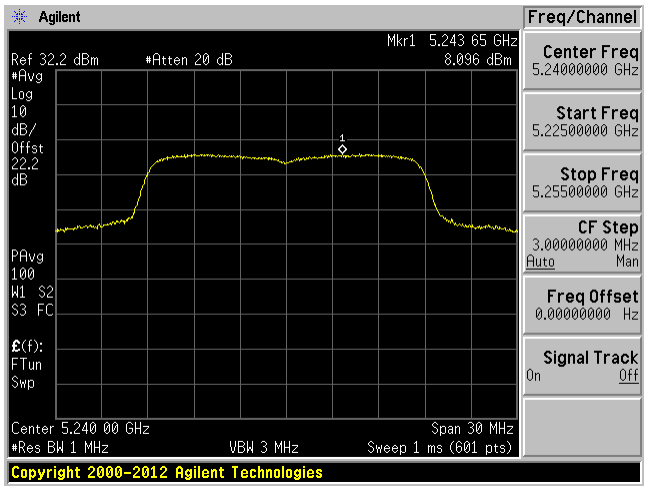
5180 MHz



5200 MHz

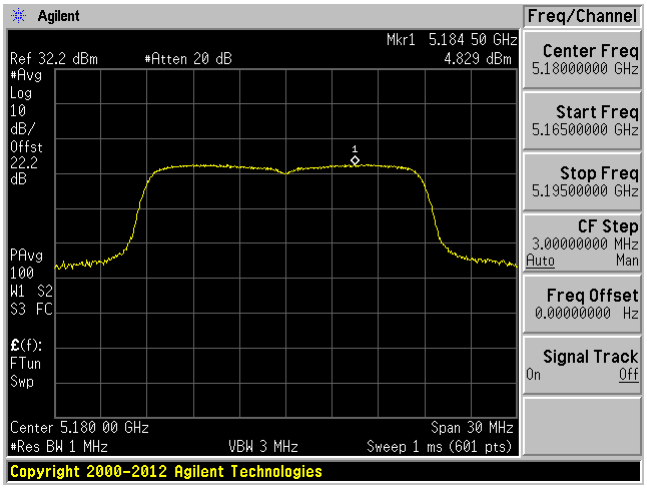


5240 MHz

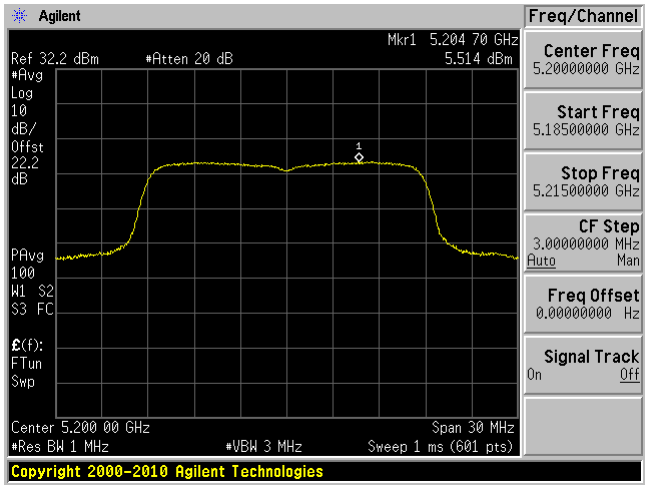


802.11n20 mode (Port A MIMO)

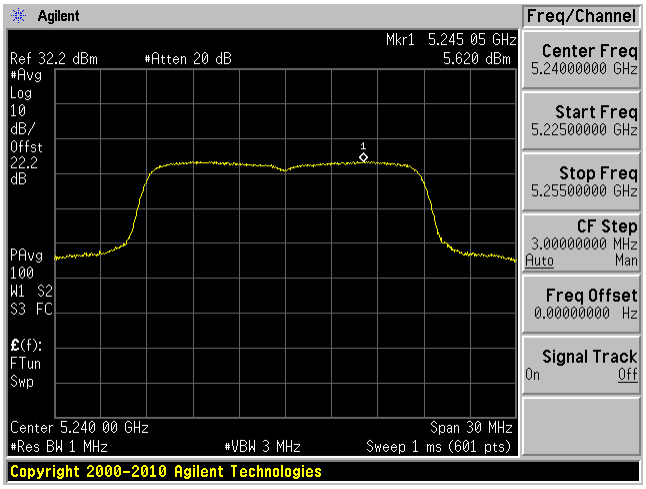
5180 MHz



5200 MHz

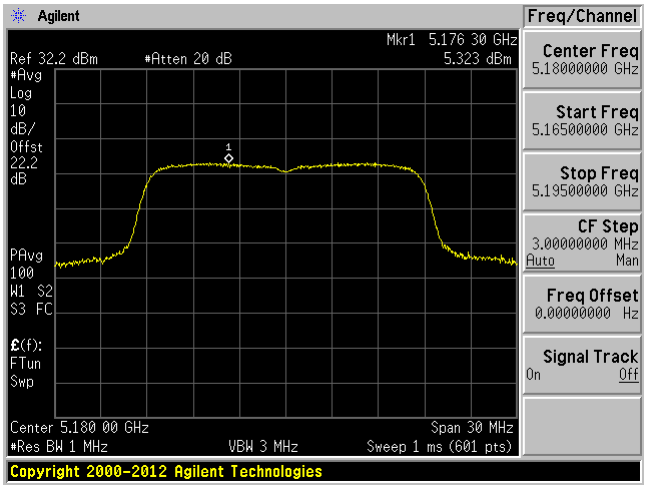


5240 MHz

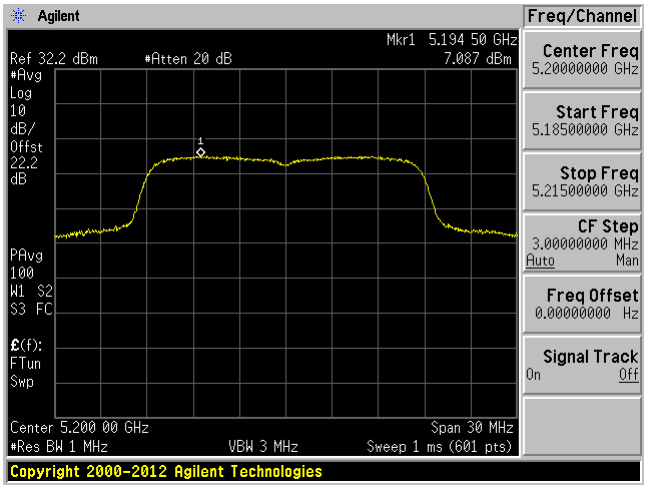


802.11n20 mode (Port B)

5180 MHz



5200 MHz



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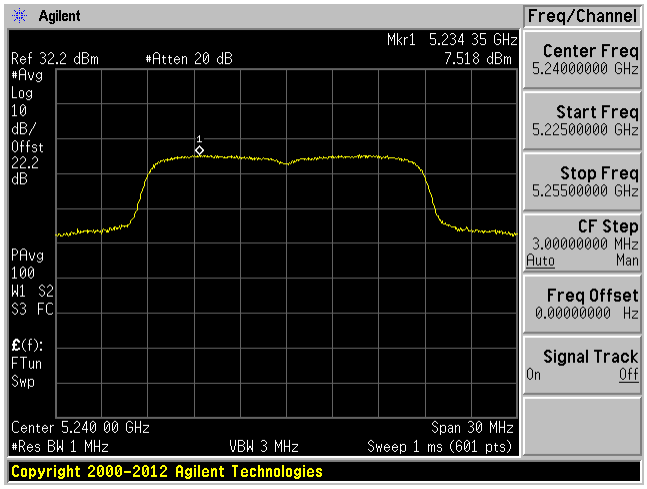
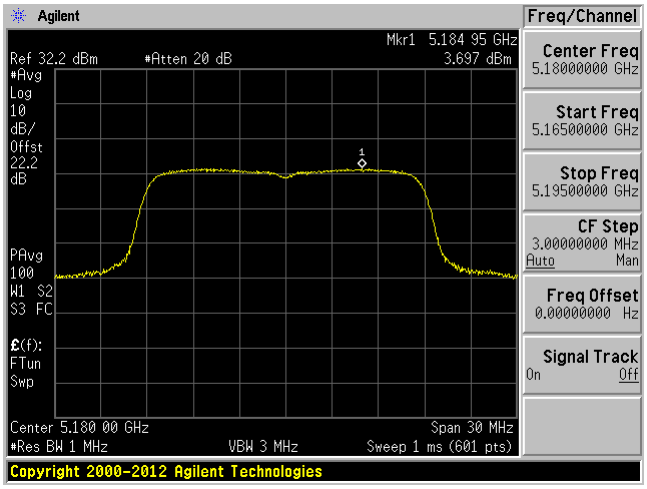
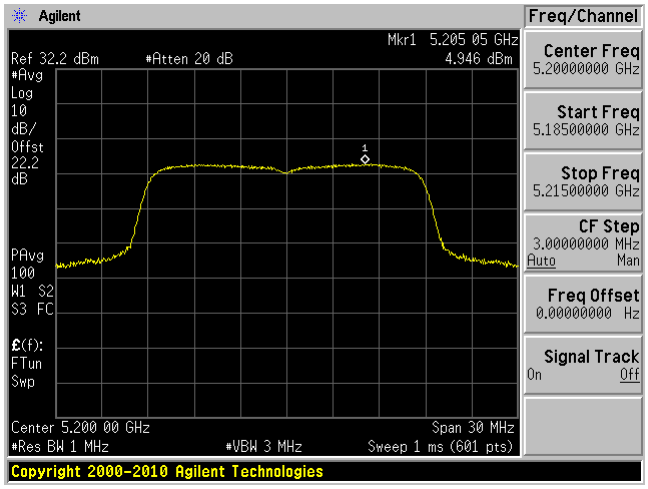


802.11n20 mode (Port B MIMO)

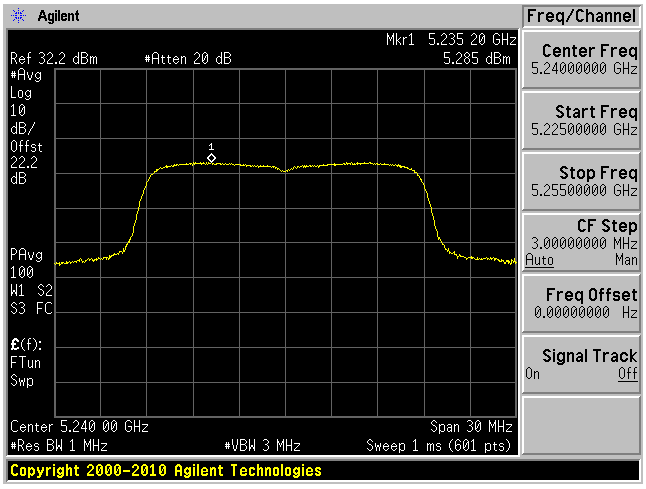
5180 MHz



5200 MHz

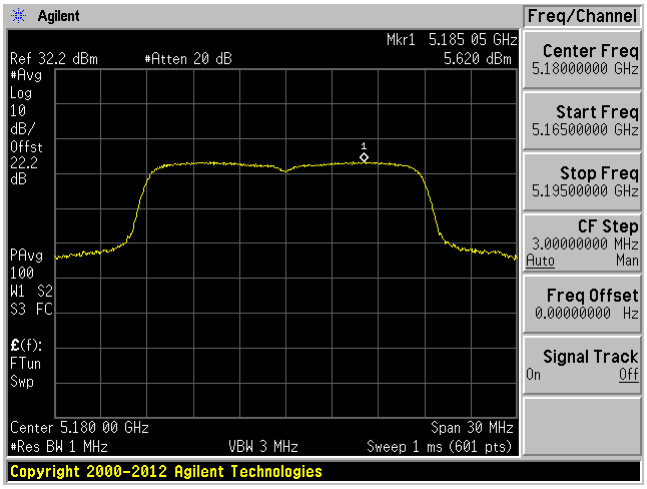


5240 MHz

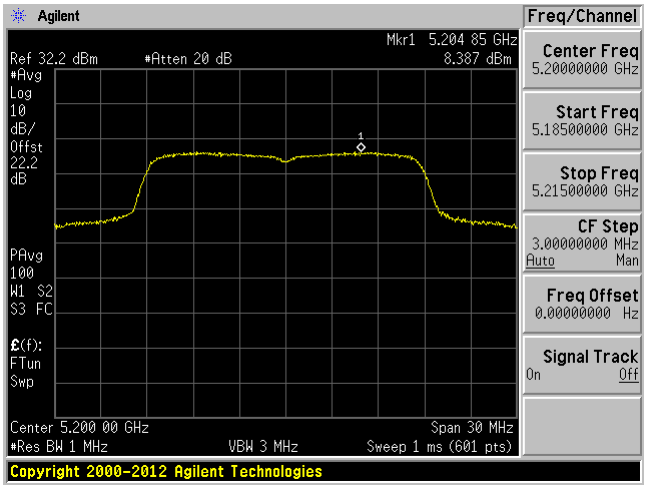


802.11ac20 mode (Port A)

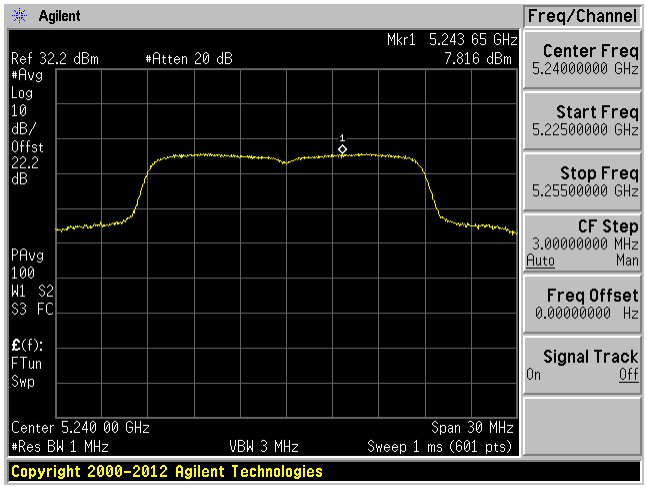
5180 MHz



5200 MHz

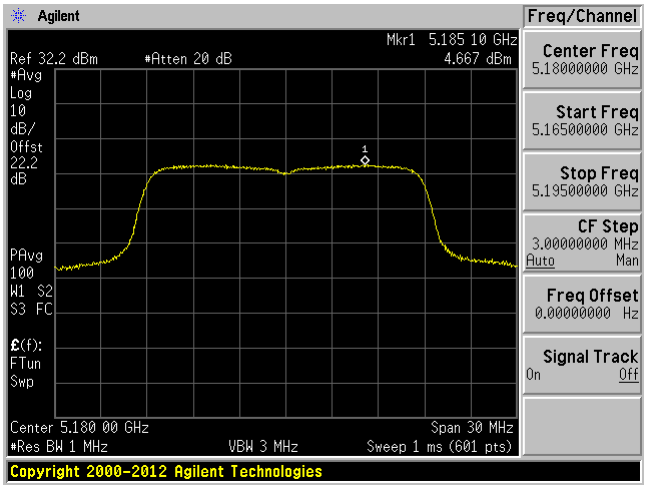


5240 MHz

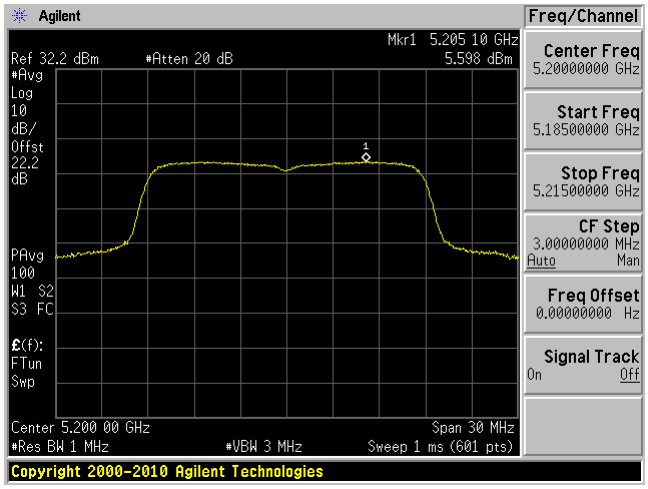


802.11ac20 mode (Port A MIMO)

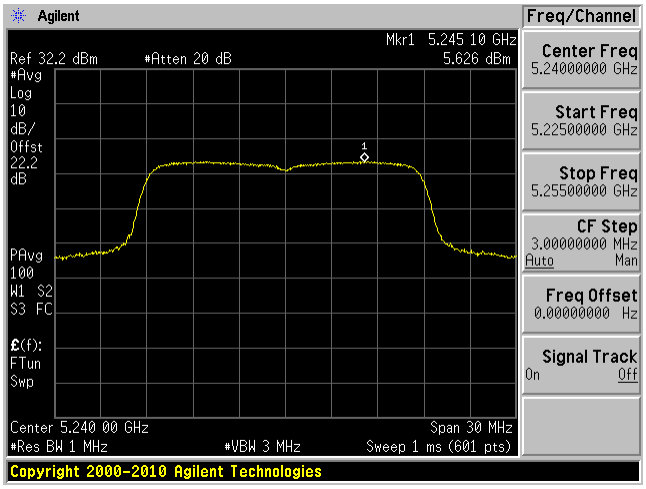
5180 MHz



5200 MHz

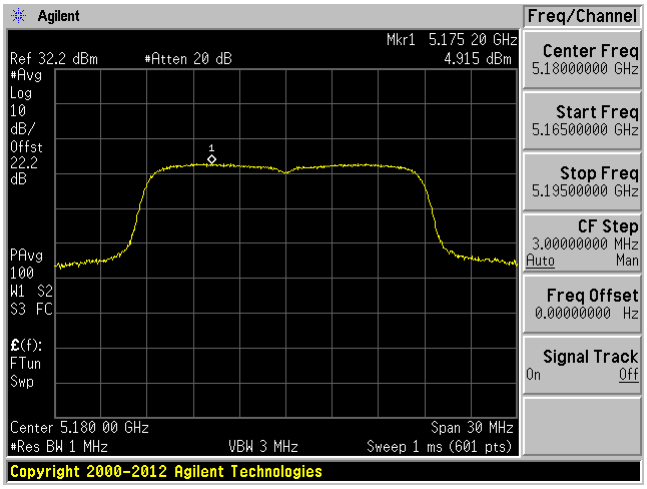


5240 MHz

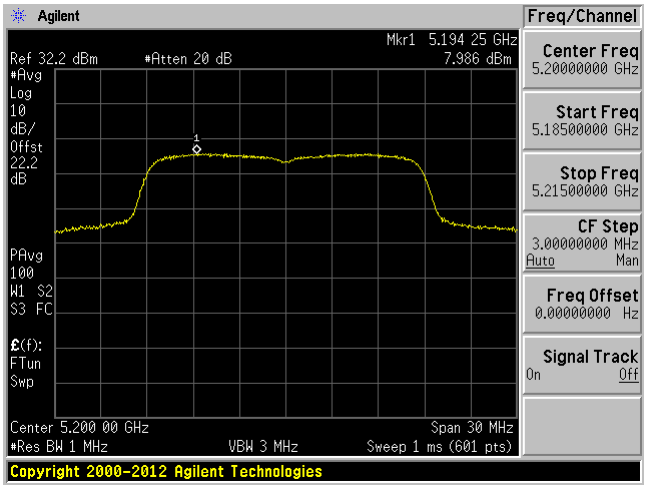


802.11ac20 mode (Port B)

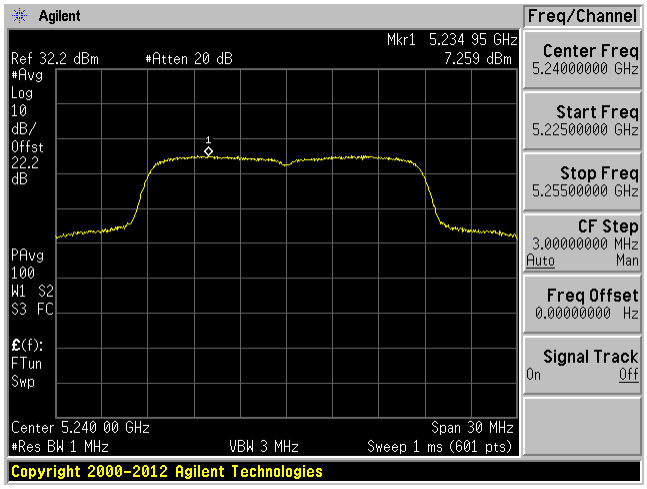
5180 MHz



5200 MHz

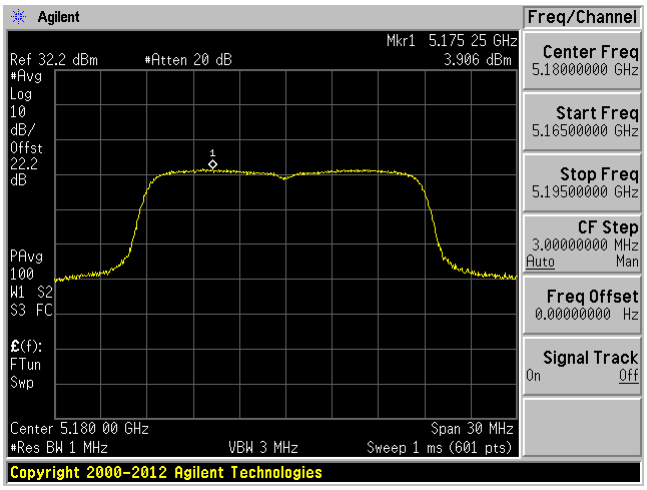


5240 MHz

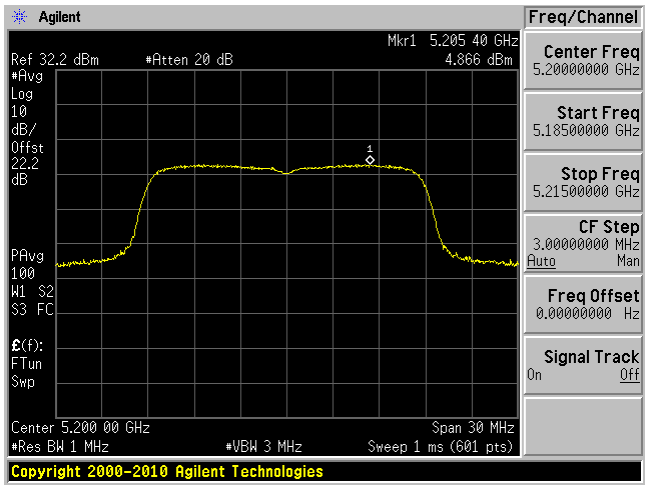


802.11ac20 mode (Port B MIMO)

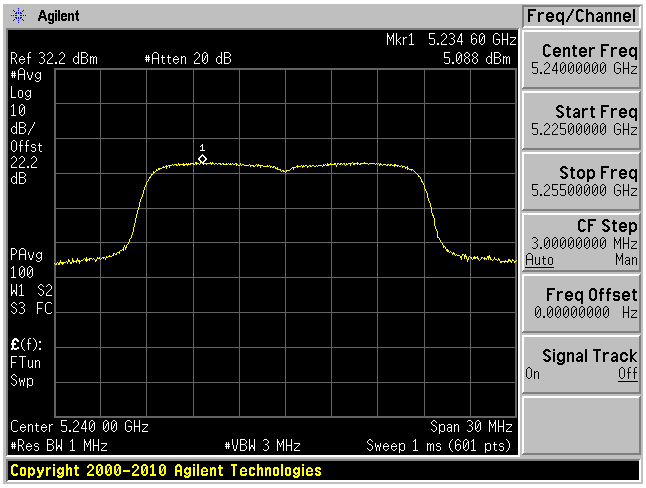
5180 MHz



5200 MHz



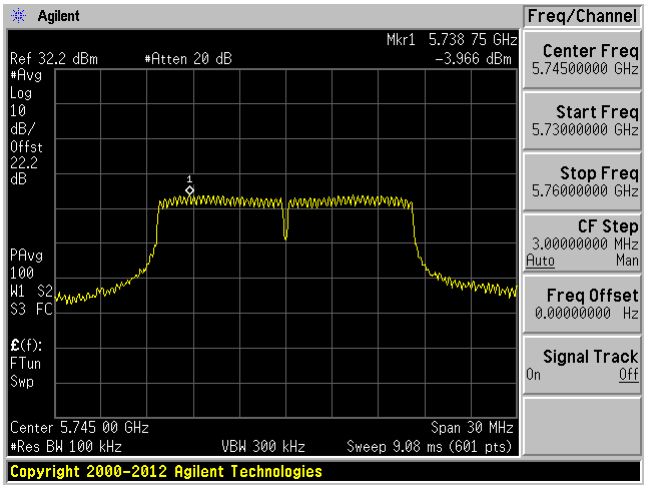
5240 MHz



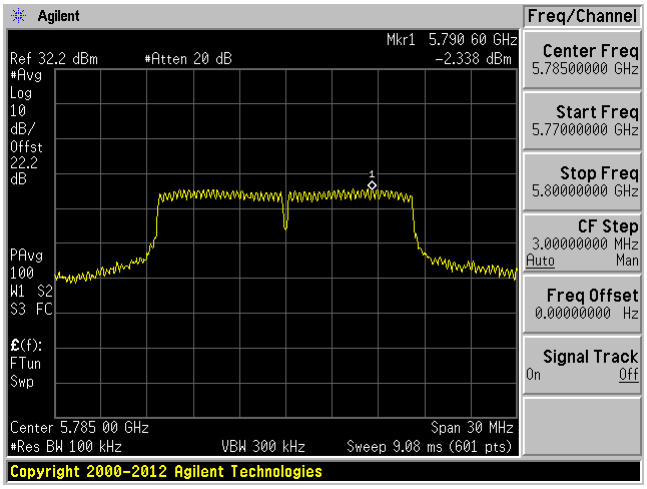
5725 – 5850 MHz

802.11a mode (Port A)

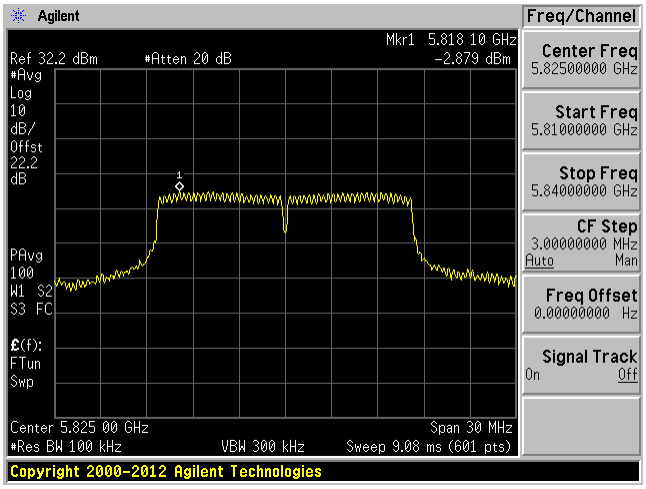
5745 MHz



5785 MHz

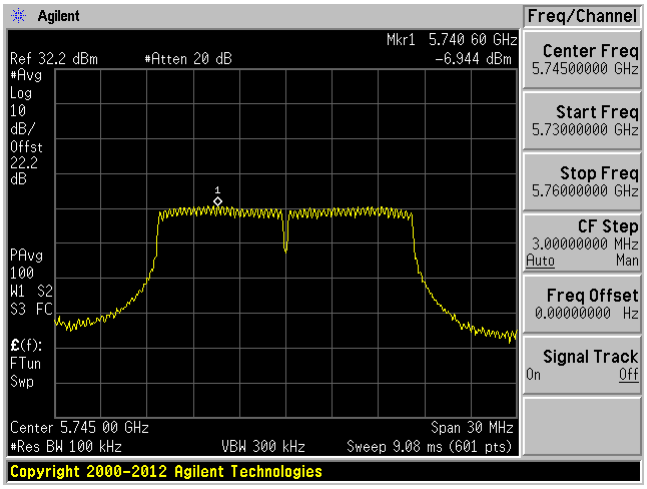


5825 MHz

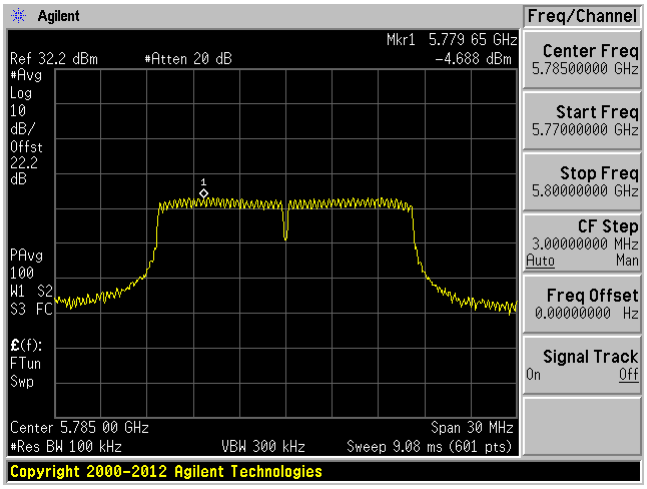


802.11a mode (Port B)

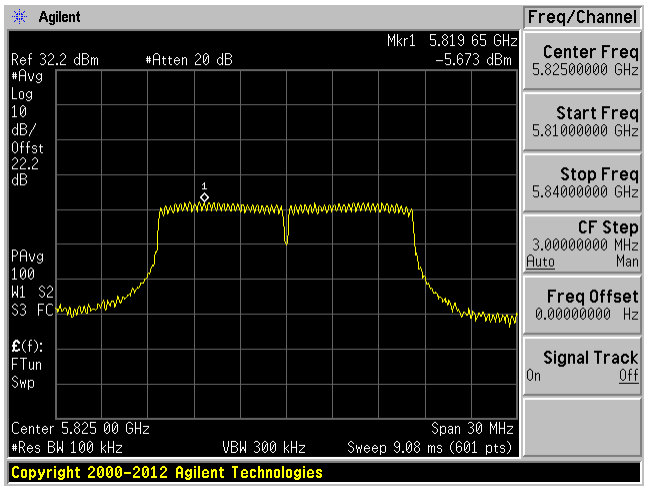
5745 MHz



5785 MHz

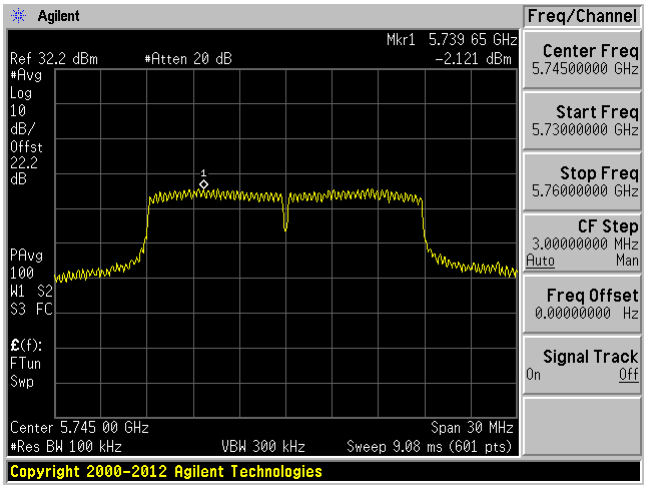


5825 MHz

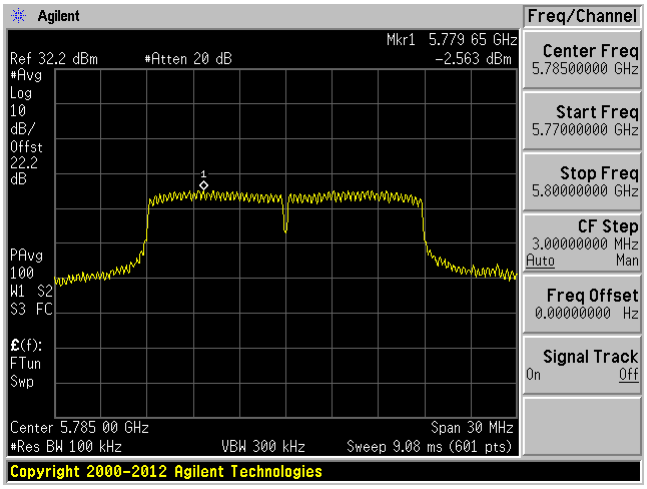


802.11n20 mode (Port A)

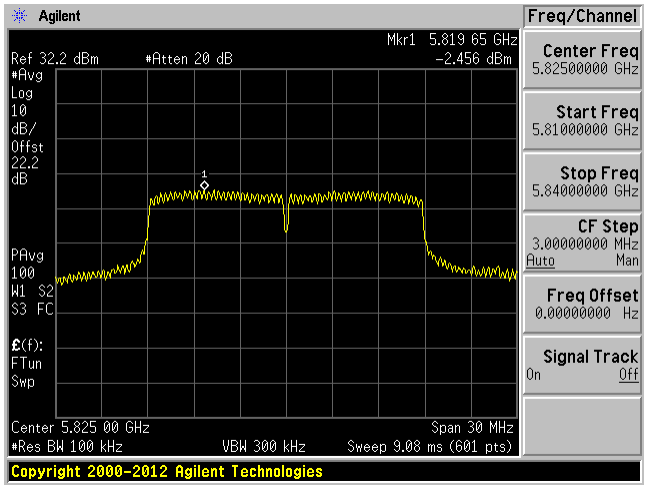
5745 MHz



5785 MHz

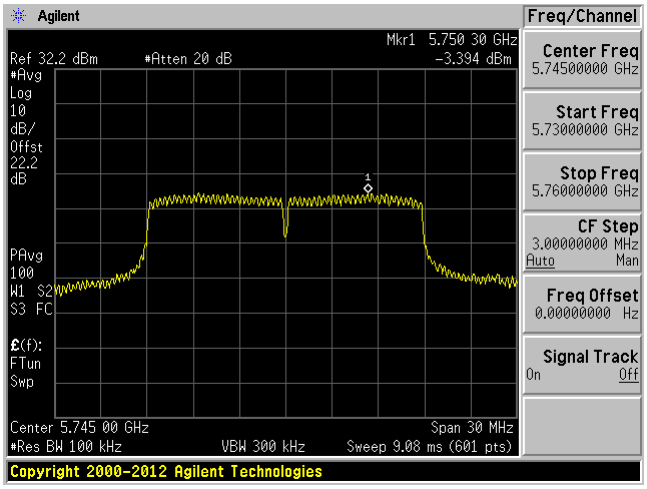


5825 MHz

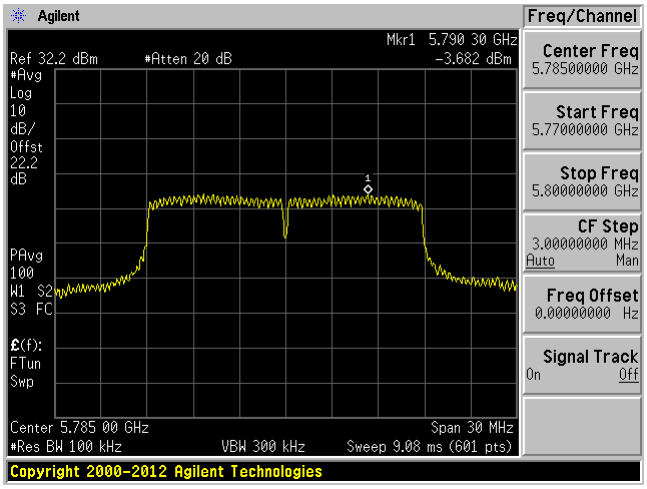


802.11n20 mode (Port A MIMO)

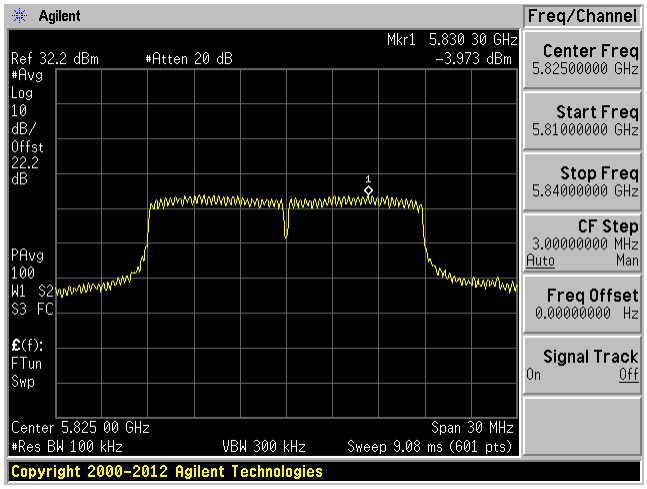
5745 MHz



5785 MHz

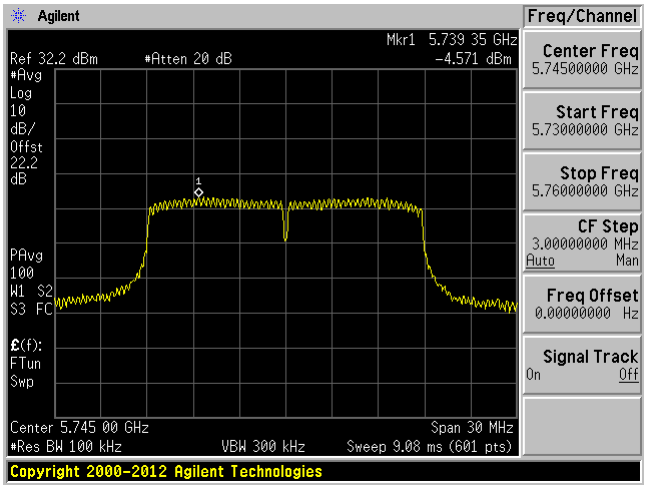


5825 MHz

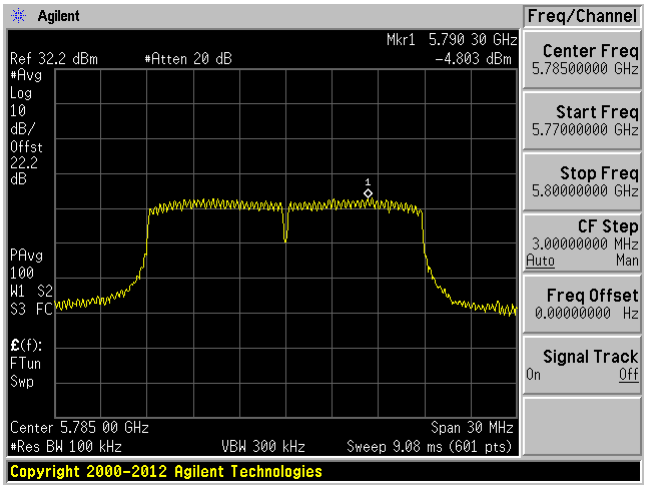


802.11n20 mode (Port B)

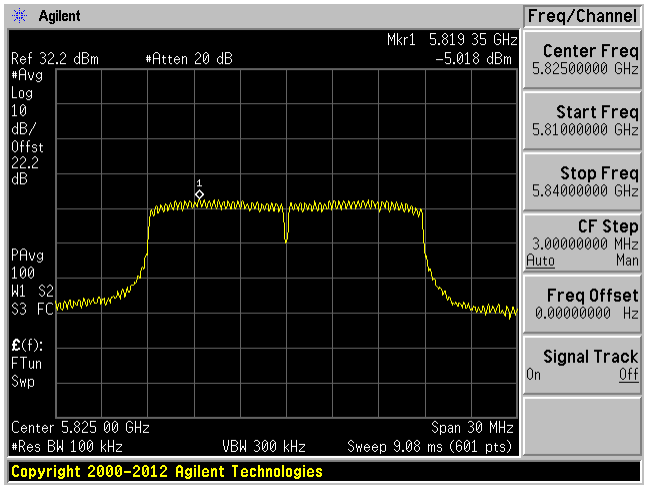
5745 MHz



5785 MHz

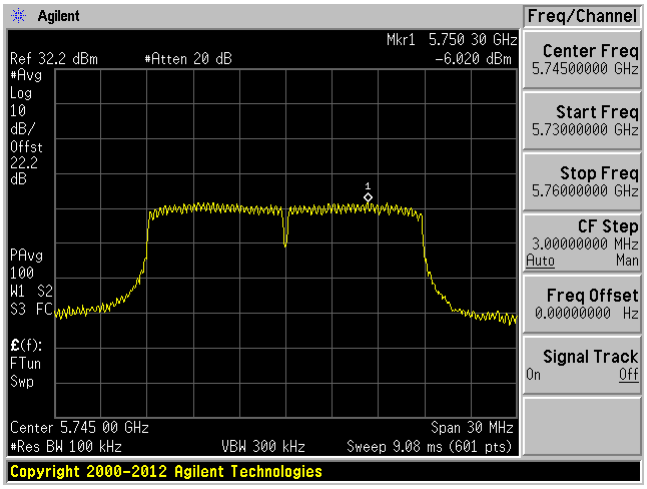


5825 MHz

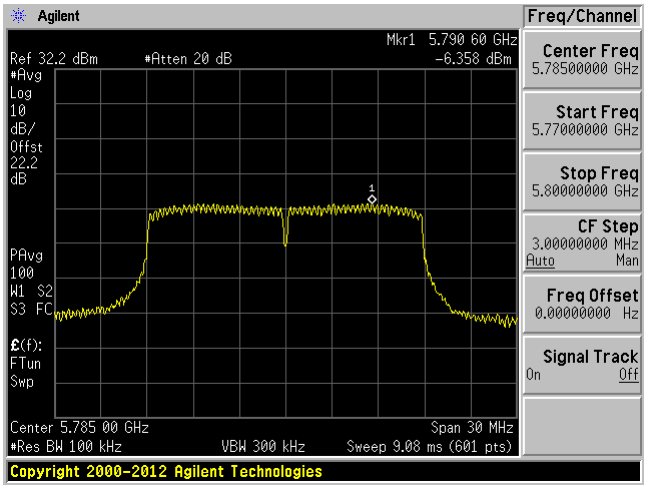


802.11n20 mode (Port B MIMO)

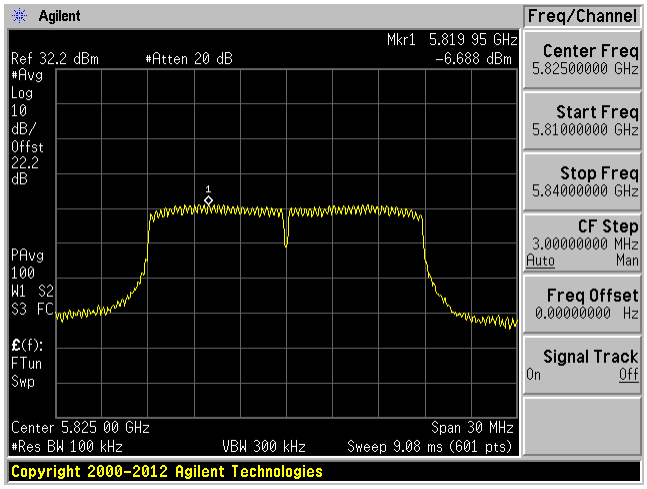
5745 MHz



5785 MHz

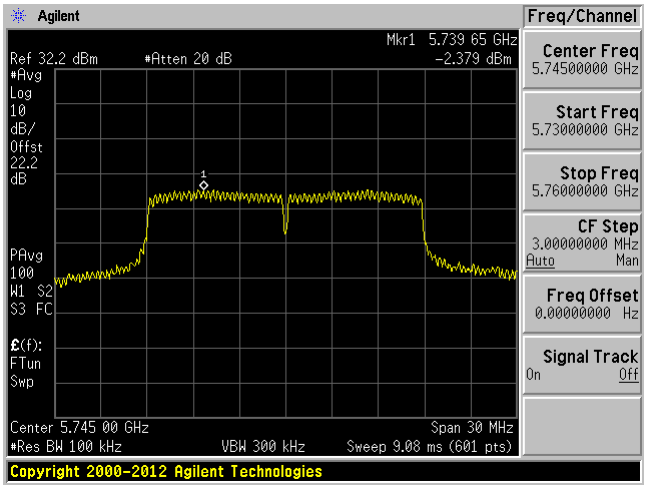


5825 MHz

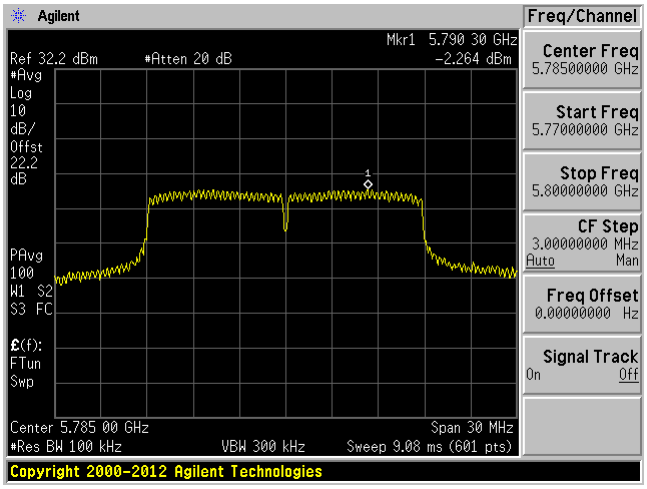


802.11ac20 mode (Port A)

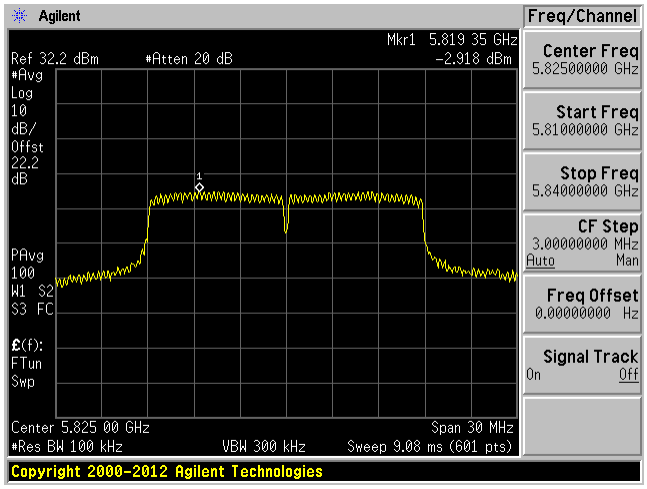
5745 MHz



5785 MHz

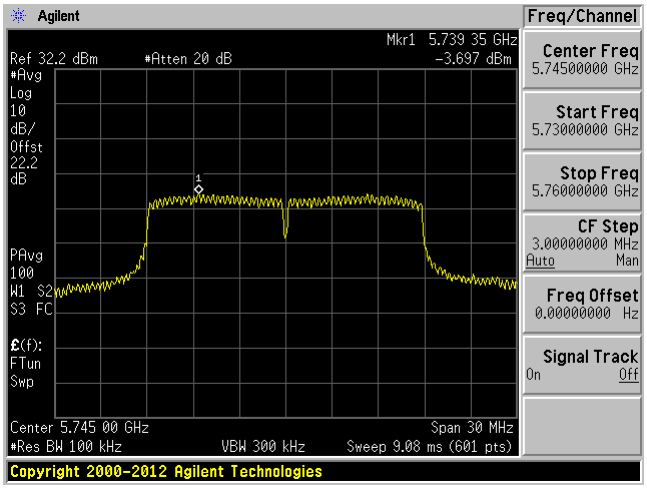


5825 MHz

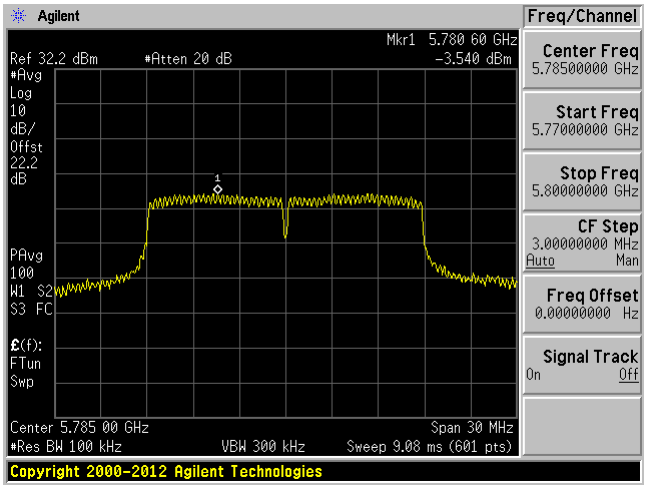


802.11ac20 mode (Port A MIMO)

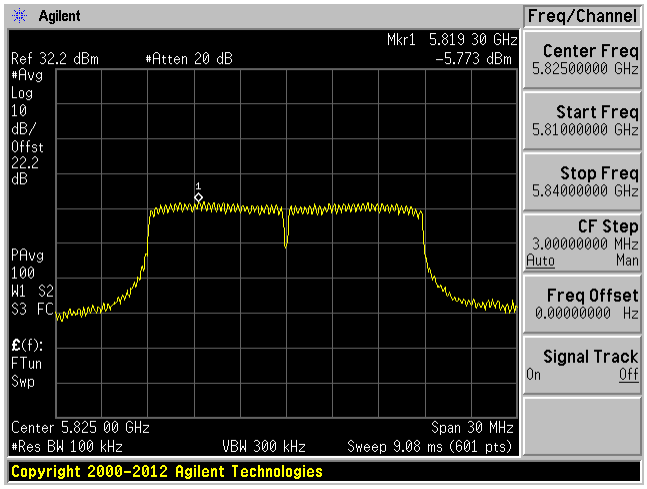
5745 MHz



5785 MHz

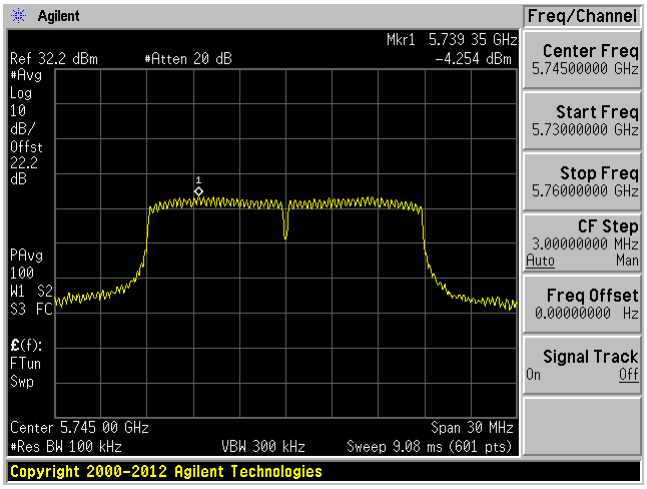


5825 MHz

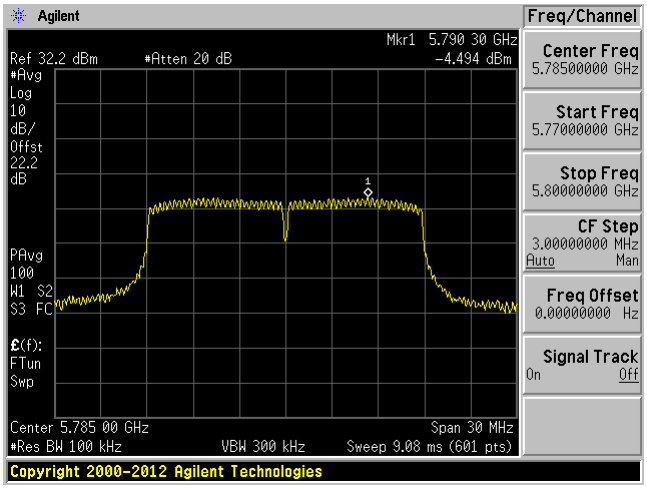


802.11ac20 mode (Port B)

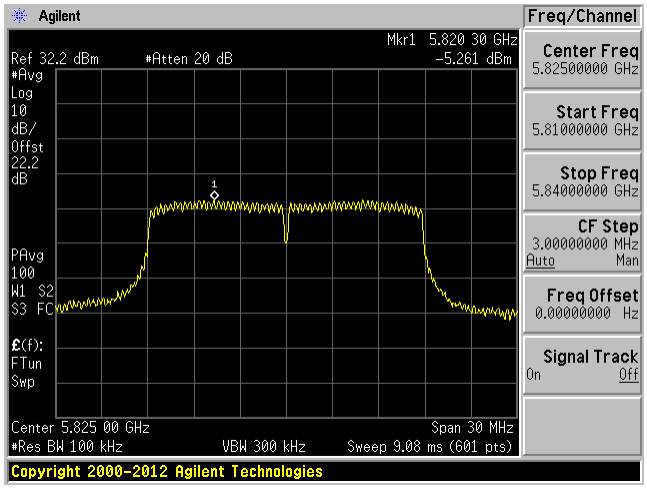
5745 MHz



5785 MHz

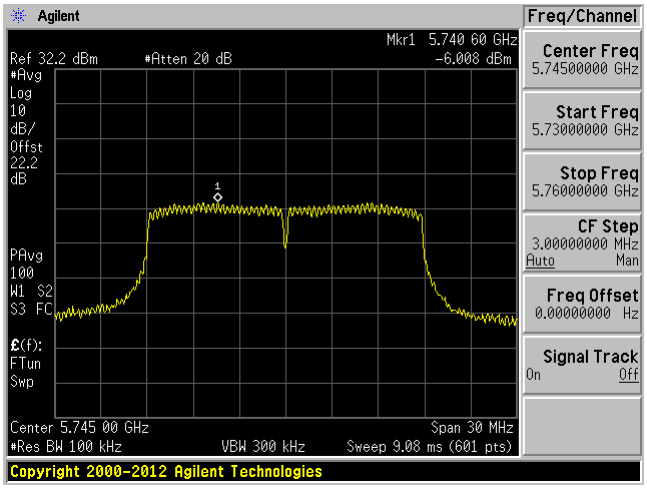


5825 MHz

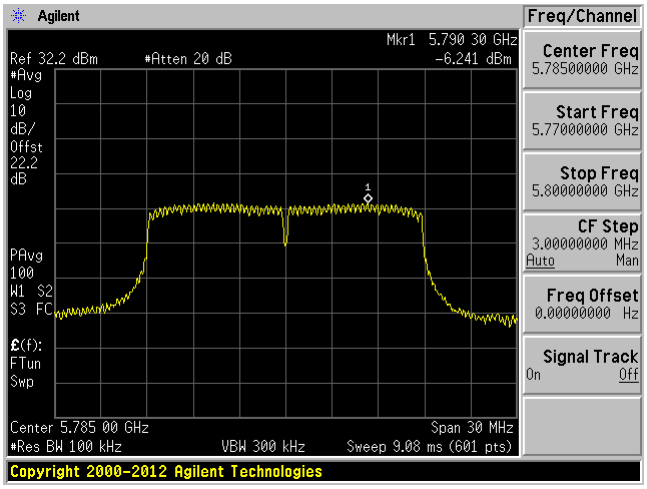


802.11ac20 mode (Port B MIMO)

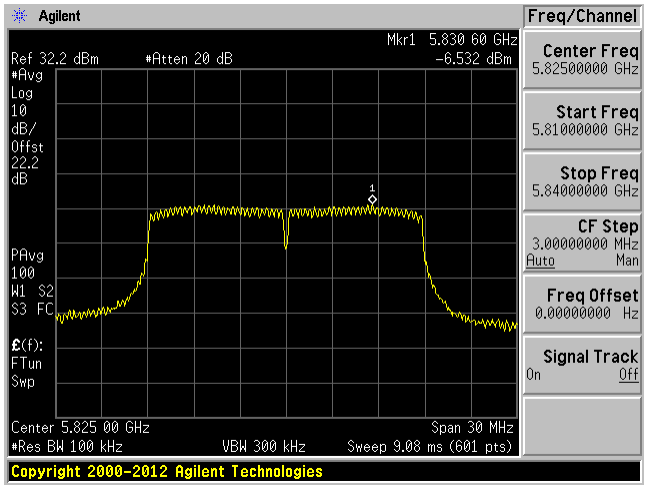
5745 MHz



5785 MHz



5825 MHz



11 FCC §15.407(b) & ISED RSS-247 §6.2 - Out of Band Emissions

11.1 Applicable Standards

According to FCC §15.407(b):

For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.

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 e.i.r.p. of −27 dBm/MHz.

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 e.i.r.p. of −27 dBm/MHz.

For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

The provisions of §15.205 apply to intentional radiators operating under this section.

According to ISED RSS-247 §6.2.1 for devices operatinging in the frequency band 5150-5250 MHz:

For transmitters operating in the band 5150-5250 MHz, all emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. However, any unwanted emissions that fall into the band 5250-5350 MHz must be 26 dBc, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth, above 5.25 GHz. Otherwise, the transmission is considered as intentional and the devices shall implement dynamic frequency selection (DFS) and transmitter power control (TPC) as per the requirements for the band 5250-5350 MHz.

According to ISED RSS-247 §6.2.2 for devices operatinging in the frequency band 5250-5350 MHz:

For devices with both operating frequencies and channel bandwidths contained within the band 5250-5350 MHz, the device shall comply with the following:

1. All emissions outside the band 5250-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. if the equipment is intended for outdoor use; or
2. All emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. and any emissions within the band 5150-5250 MHz shall meet the power spectral density limits of Section 6.2.1. The device shall be labelled “for indoor use only.”

For devices with operating frequencies in the band 5250-5350 MHz but having a channel bandwidth that overlaps the band 5150-5250 MHz, the devices’ unwanted emission shall not exceed -27 dBm/MHz e.i.r.p. outside the band 5150-5350 MHz and its power shall comply with the spectral power density for operation within the band 5150-5250 MHz. The device shall be labelled “for indoor use only.”
According to ISED RSS-247 §6.2.3 for devices operatinging in the frequency band 5470-5600 MHz and 5650-5725 MHz. Emissions outside the band 5470-5725 MHz shall not exceed -27 dBm/MHz e.i.r.p.

According to ISED RSS-247 §6.2.4 for devices operatinging in the frequency band 5725-5850 MHz:
For the band 5725-5850 MHz, emissions at frequencies from the band edges to 10 MHz above or below the band edges shall not exceed -17 dBm/MHz e.i.r.p.
For emissions at frequencies more than 10 MHz above or below the band edges, the emissions power shall not exceed -27 dBm/MHz.

11.2 Measurement Procedure

Add a correction factor (antenna gain+ Attenuator loss+cable loss) to the offset of the spectrum analyzer.
Integration Method

1. For peak emissions measurements, follow the procedures described in section H)5), "Procedures for Peak Unwanted Emissions Measurements above 1000 MHz", except for the following changes:

- Set RBW = 100 kHz
- Set VBW = 3RBW
- Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured. CAUTION: You must ensure that the spectrum analyzer or EMI receiver is set for peak-detection and max-hold for this measurement.

2. For average emissions measurements, follow the procedures described in section H)6), "Procedures for Average Unwanted Emissions Measurements above 1000 MHz", except for the following changes:

- Set RBW = 100 kHz
- Set VBW = 3RBW
- Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured.

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2017-04-20	1 year
-	RF cable	-	-	Each time[1]	N/A
-	20dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.*

11.4 Test Environmental Conditions

Temperature:	22-24º C
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

The testing was performed by Vincent Licata 2017-08-03 at RF site.

11.5 Test Results

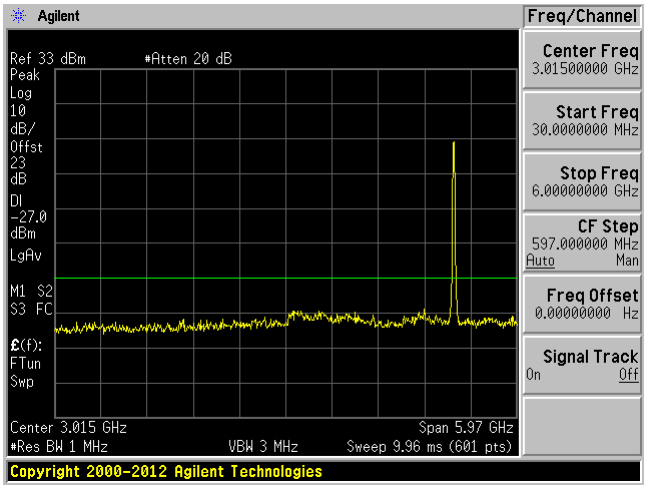
Please refer to the following plots

Note: per client requirement, both SISO and MIMO mode for 802.11n/ac were tested.

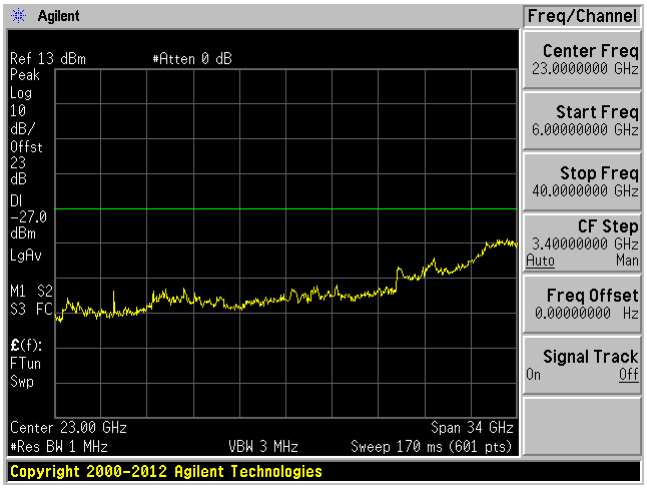
5150 - 5250 MHz

802.11a mode (Port A)

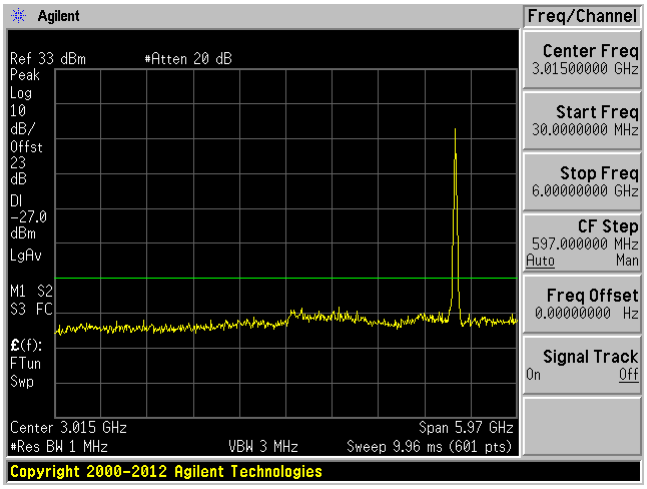
Low Channel 5180MHz (30MHz-6GHz)



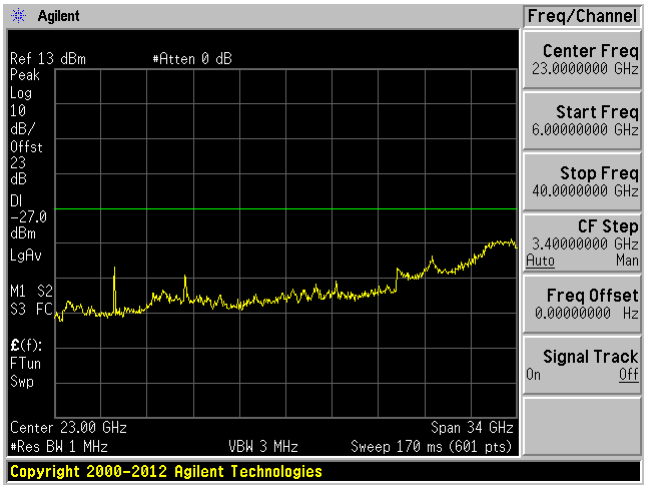
Low Channel 5180 MHz (6-40GHz)



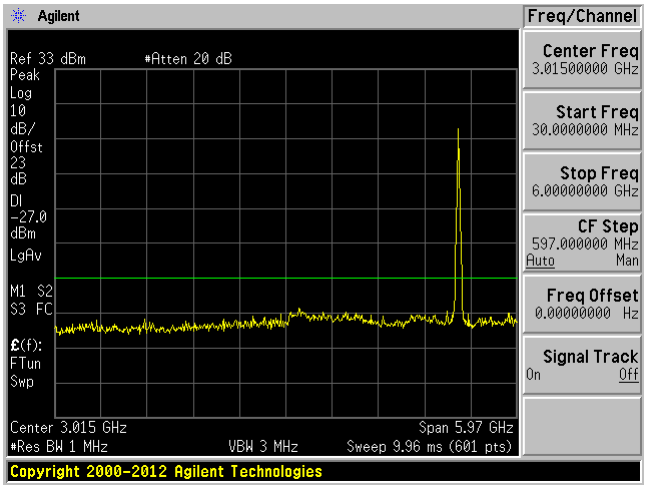
Middle Channel 5200MHz (30MHz-6GHz)



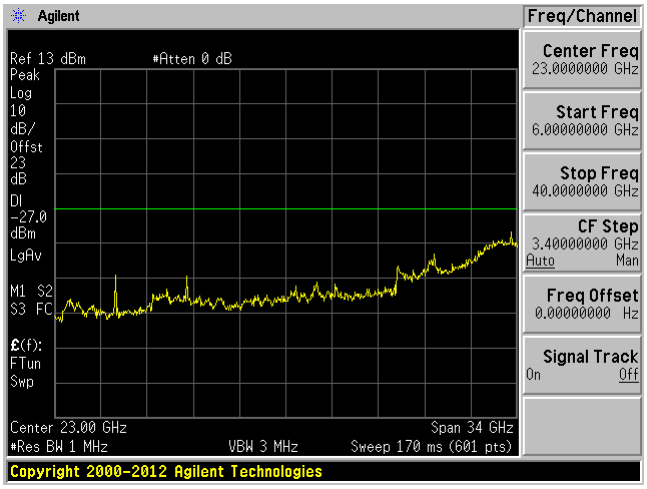
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

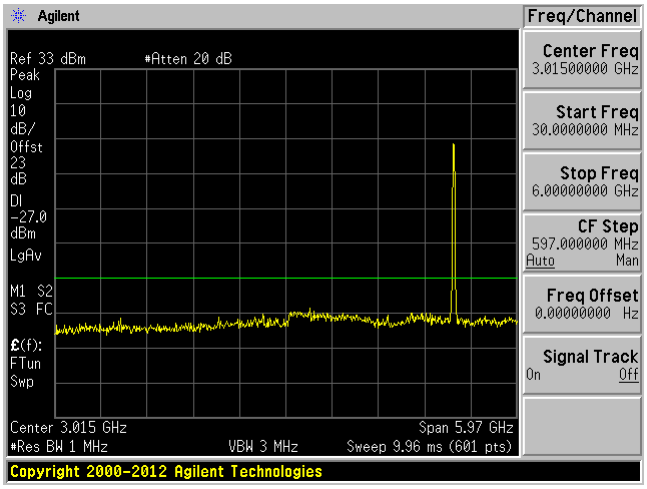


High Channel 5240 MHz (6-40GHz)

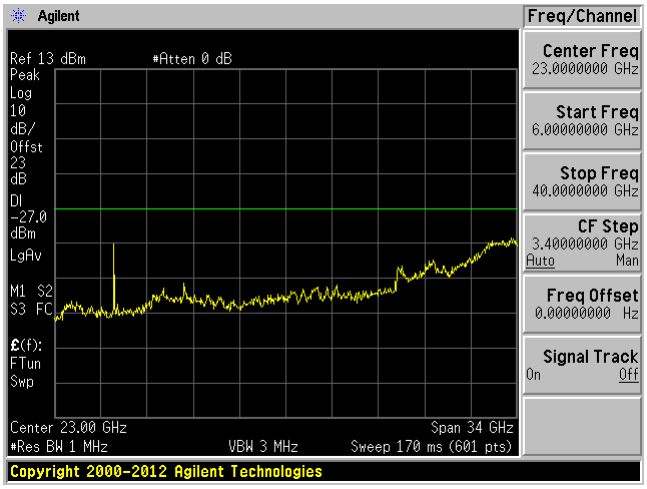


802.11a mode (Port B)

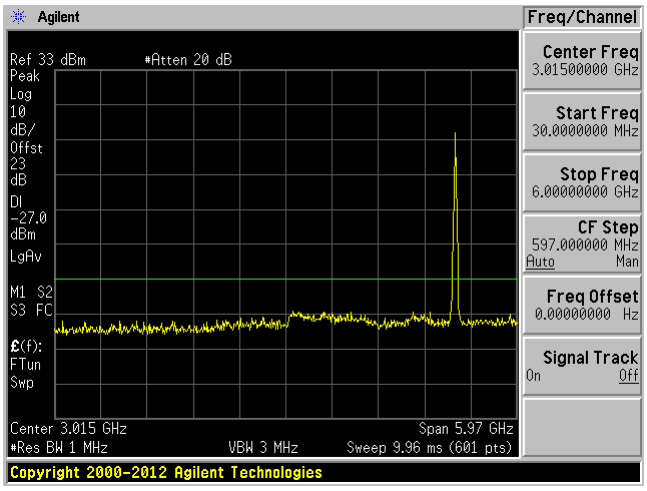
Low Channel 5180MHz (30MHz-6GHz)



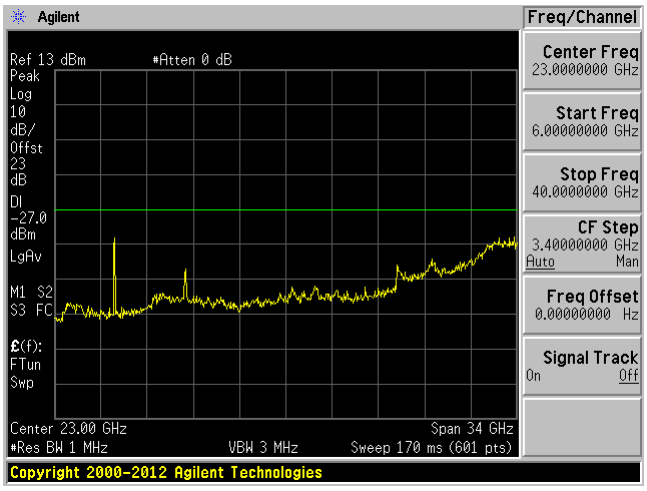
Low Channel 5180 MHz (6-40GHz)



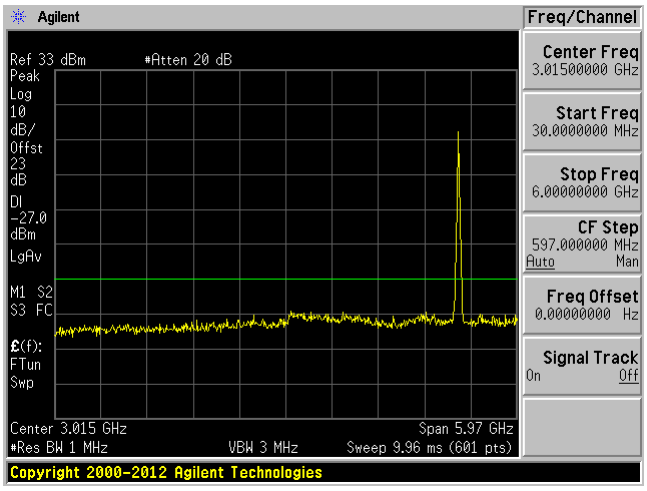
Middle Channel 5200MHz (30MHz-6GHz)



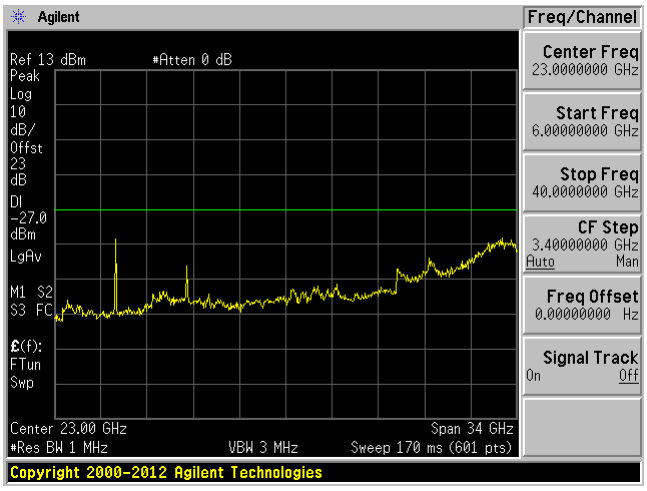
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

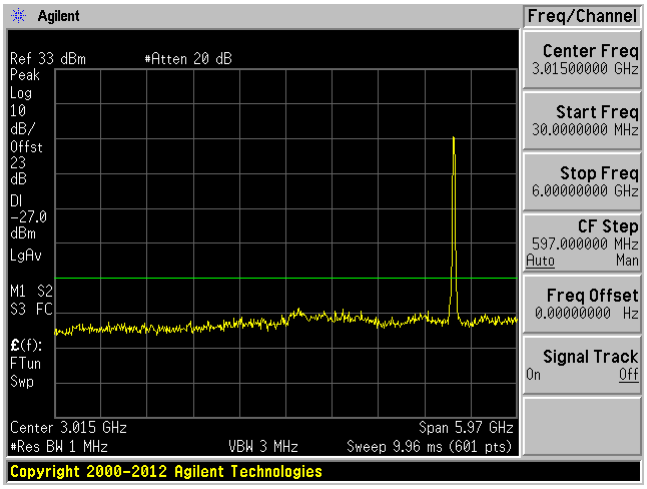


High Channel 5240 MHz (6-40GHz)

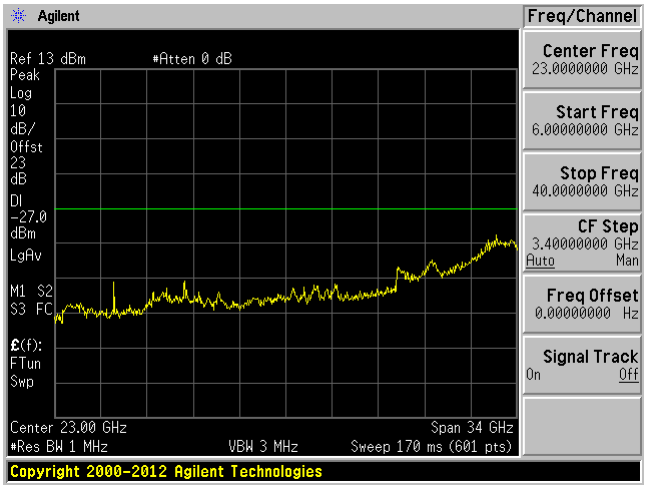


802.11n20 mode (Port A)

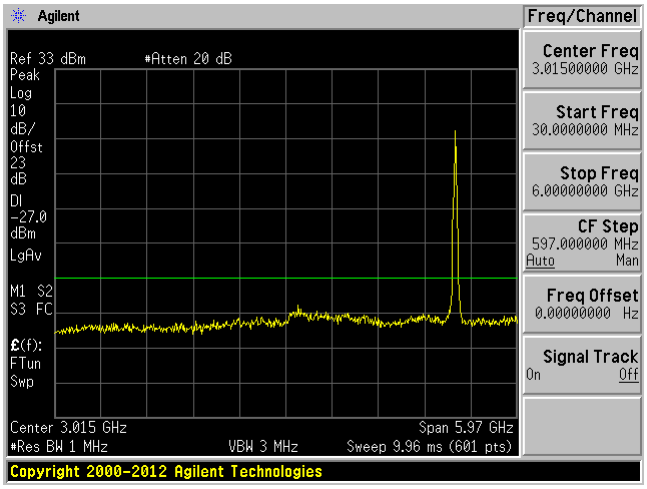
Low Channel 5180MHz (30MHz-6GHz)



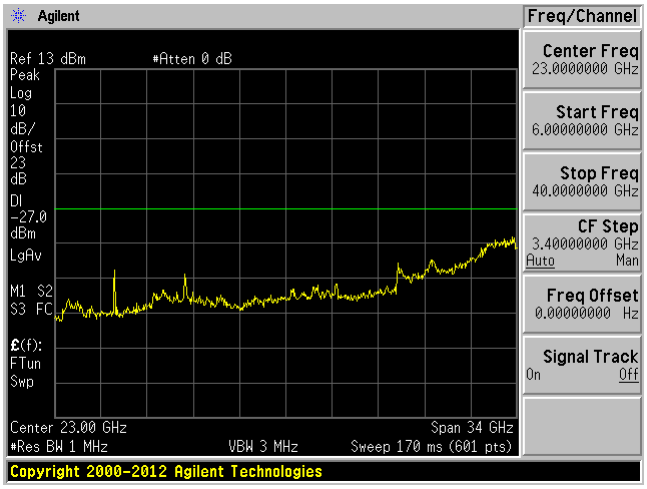
Low Channel 5180 MHz (6-40GHz)



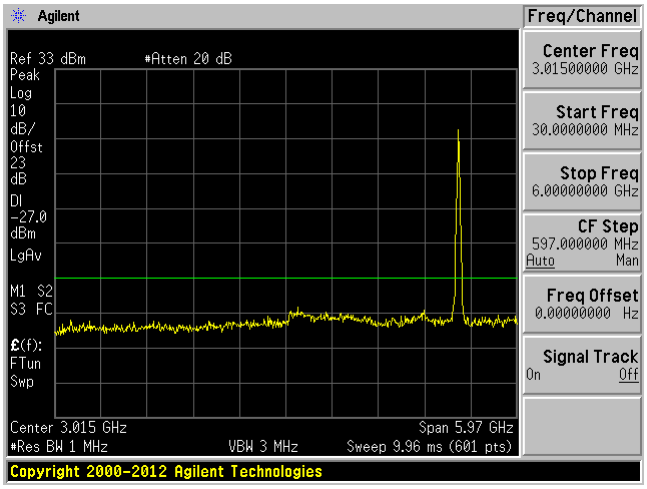
Middle Channel 5200MHz (30MHz-6GHz)



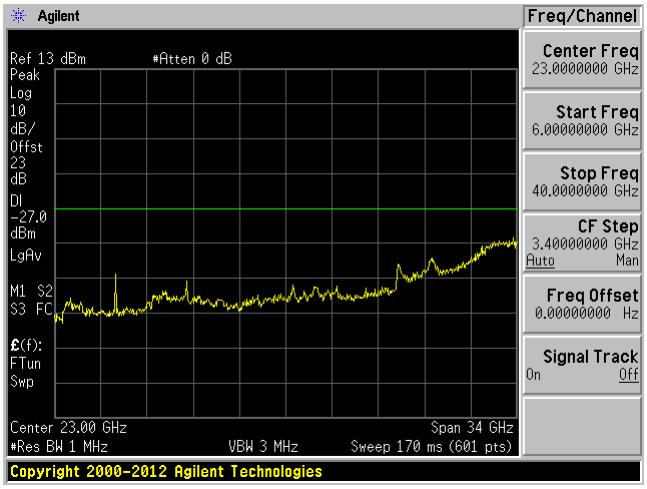
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

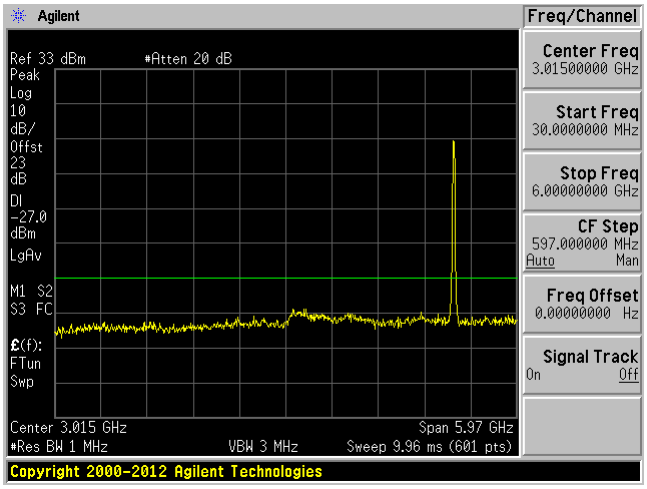


High Channel 5240 MHz (6-40GHz)

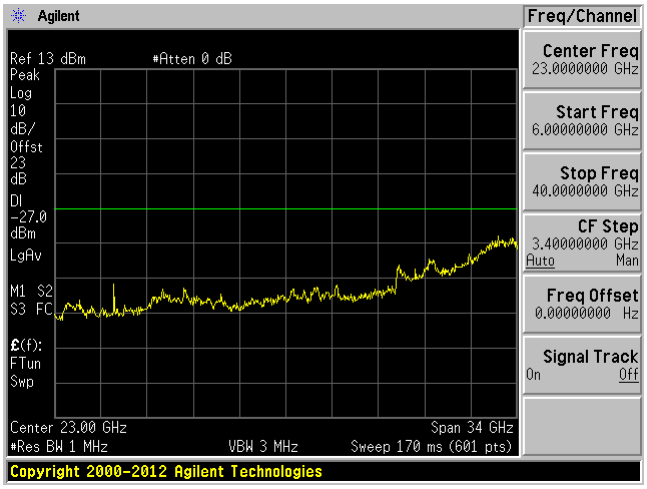


802.11n20 mode (Port A MIMO)

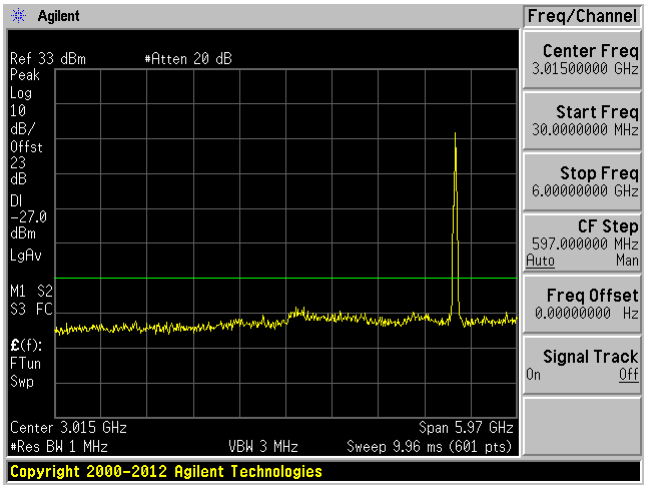
Low Channel 5180MHz (30MHz-6GHz)



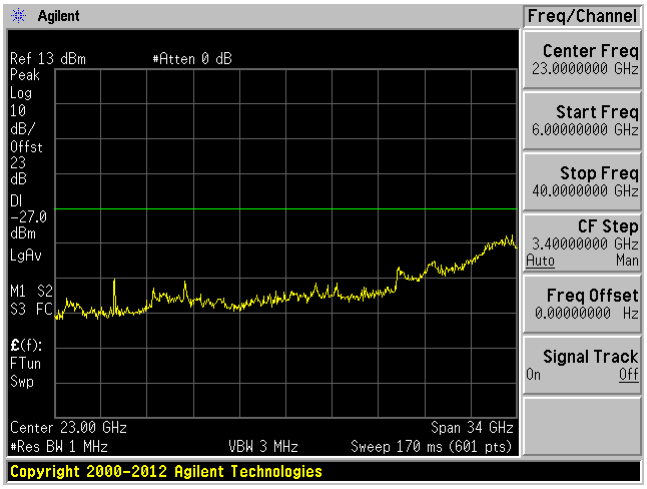
Low Channel 5180 MHz (6-40GHz)



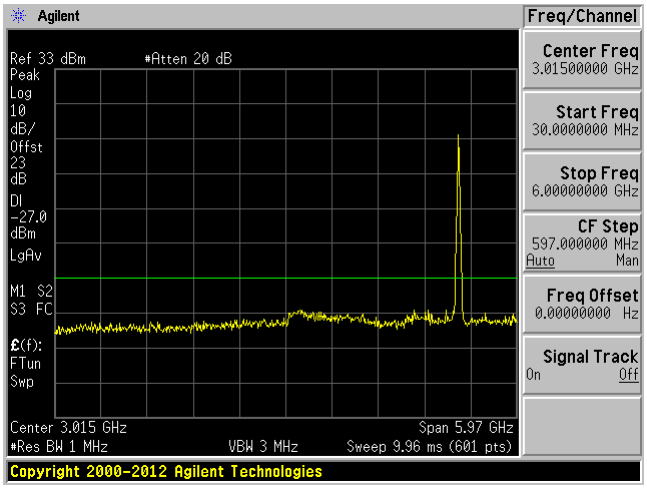
Middle Channel 5200MHz (30MHz-6GHz)



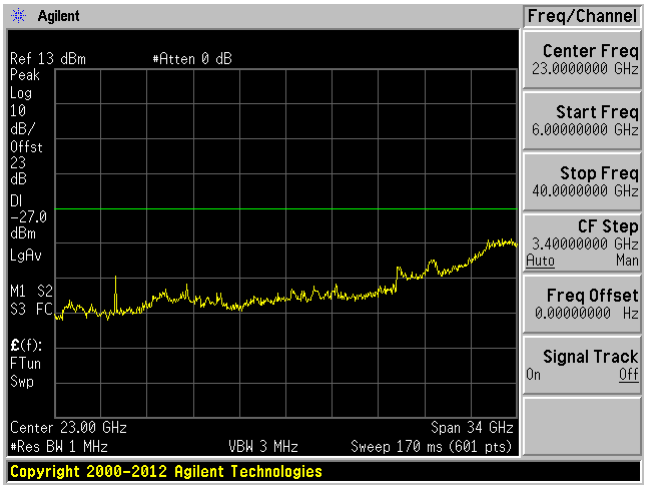
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

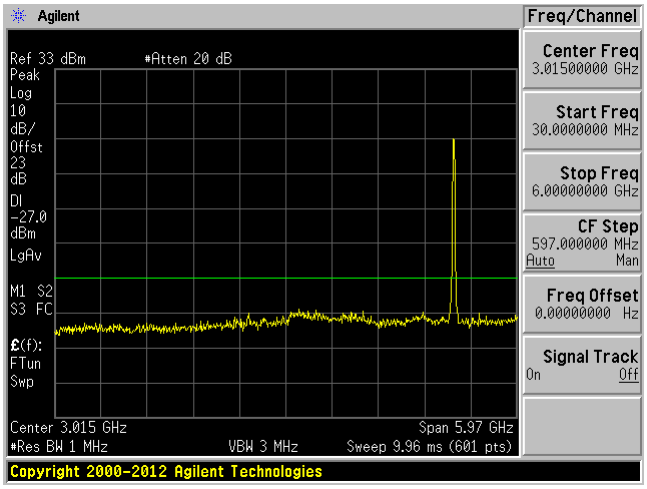


High Channel 5240 MHz (6-40GHz)

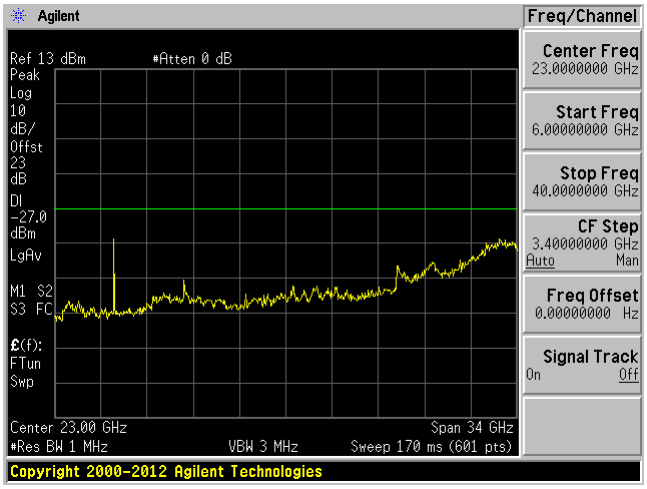


802.11n20 mode (Port B)

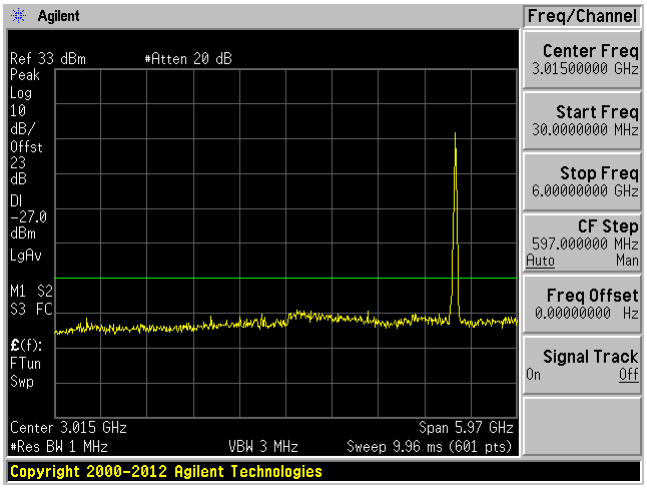
Low Channel 5180MHz (30MHz-6GHz)



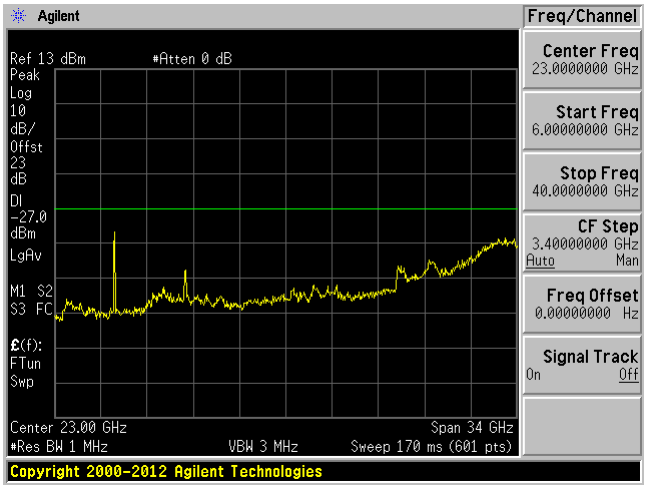
Low Channel 5180 MHz (6-40GHz)



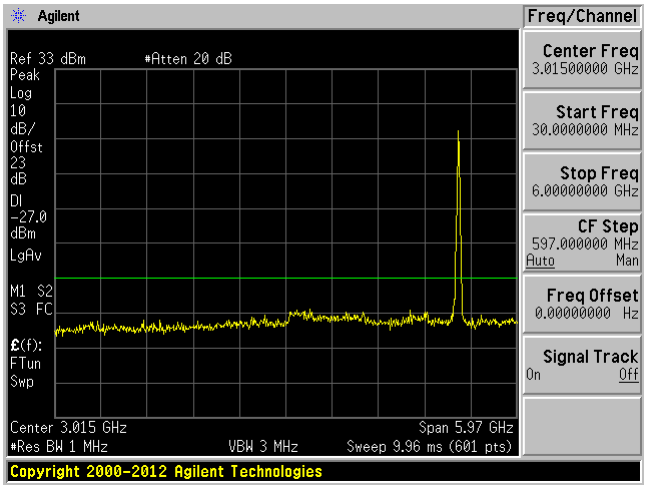
Middle Channel 5200MHz (30MHz-6GHz)



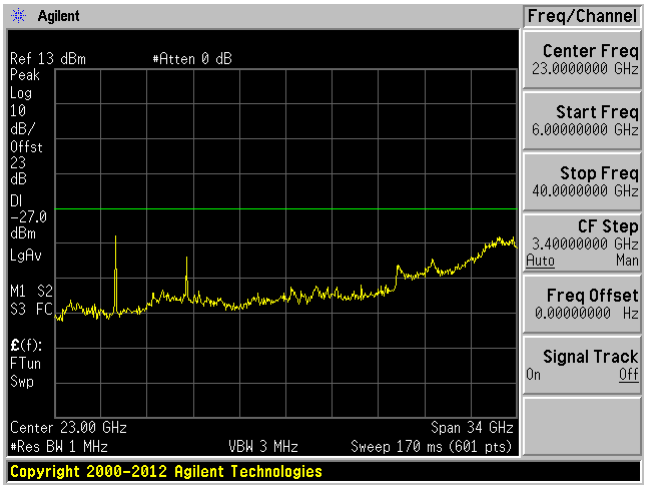
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

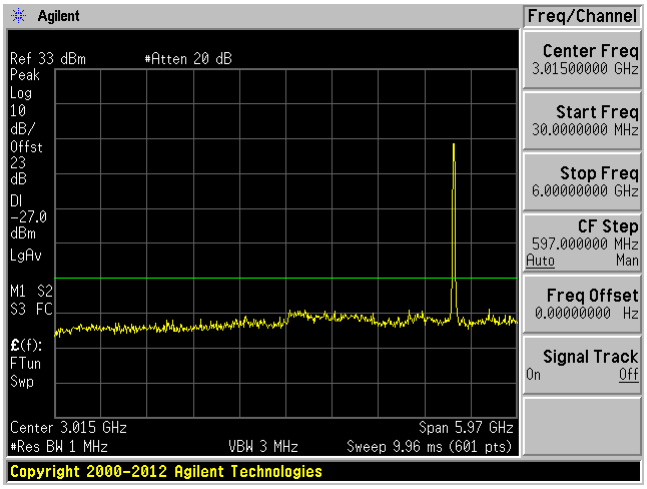


High Channel 5240 MHz (6-40GHz)

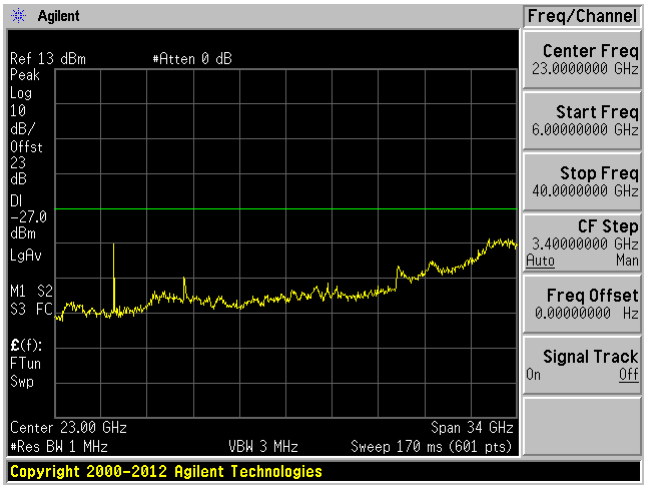


802.11n20 mode (Port B MIMO)

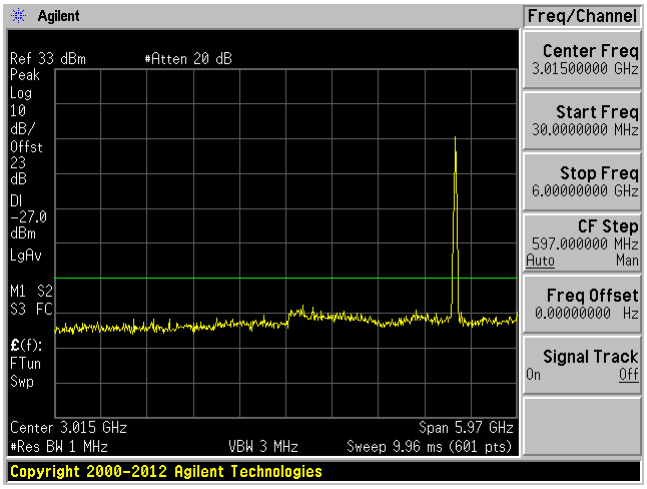
Low Channel 5180MHz (30MHz-6GHz)



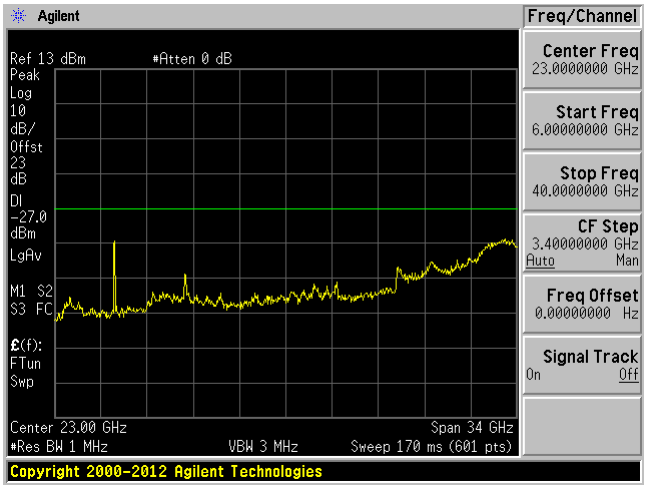
Low Channel 5180 MHz (6-40GHz)



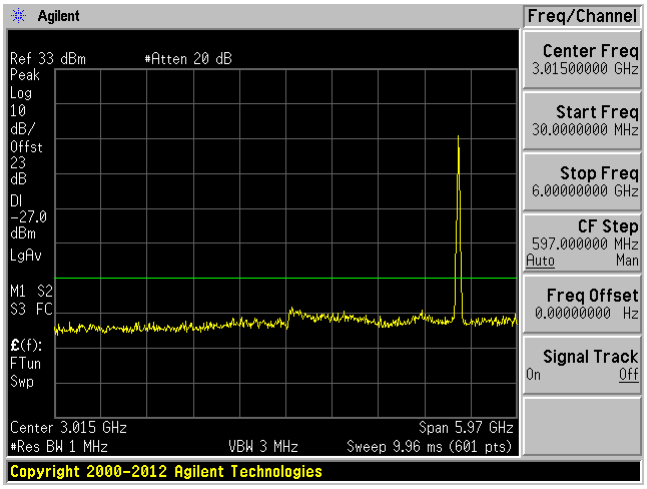
Middle Channel 5200MHz (30MHz-6GHz)



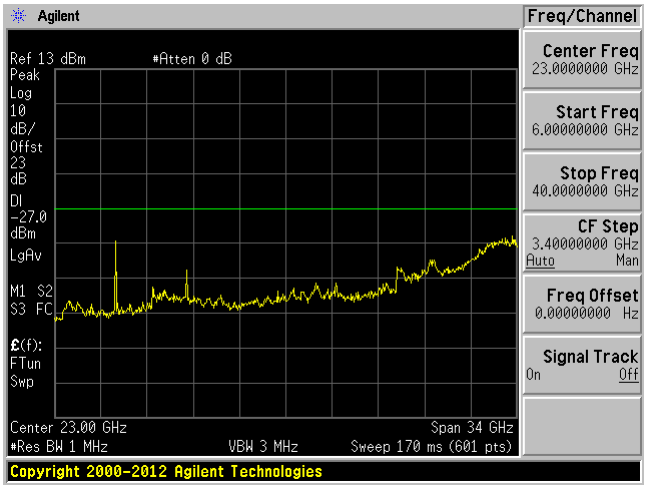
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

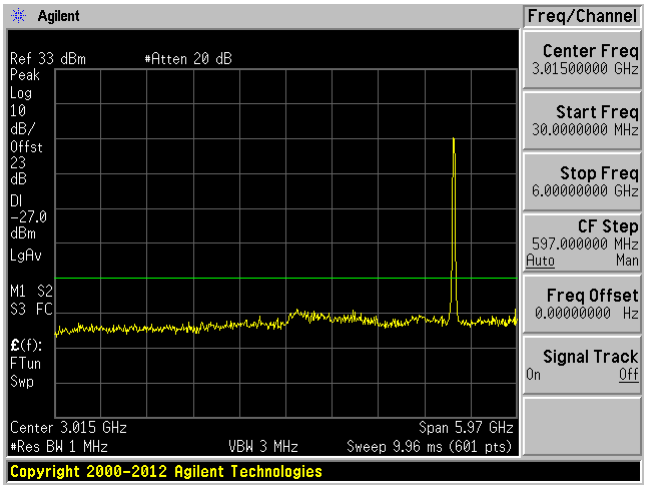


High Channel 5240 MHz (6-40GHz)

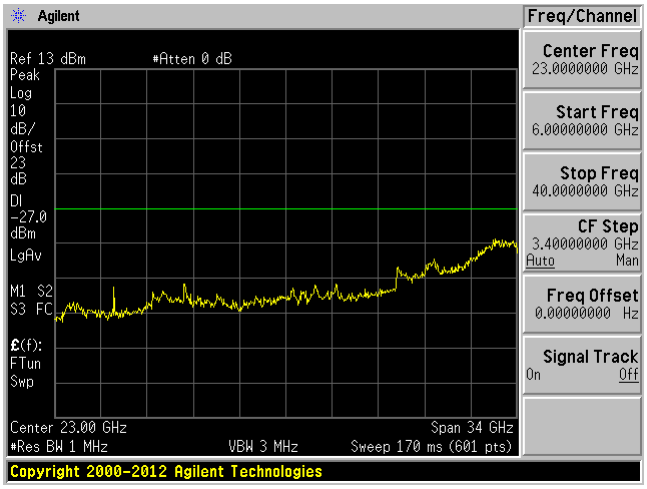


802.11ac20 mode (Port A)

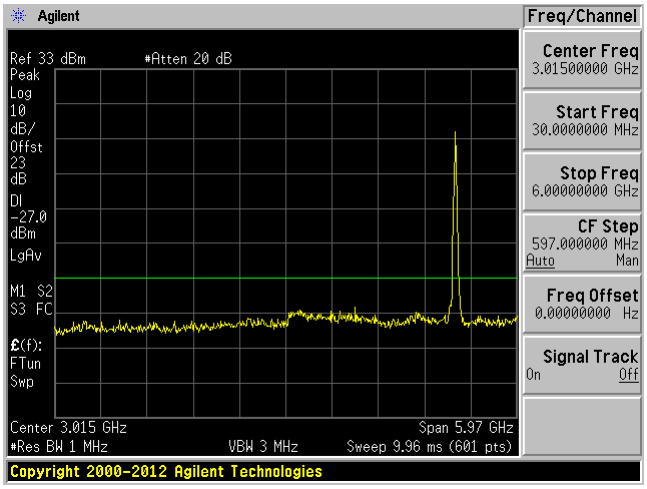
Low Channel 5180MHz (30MHz-6GHz)



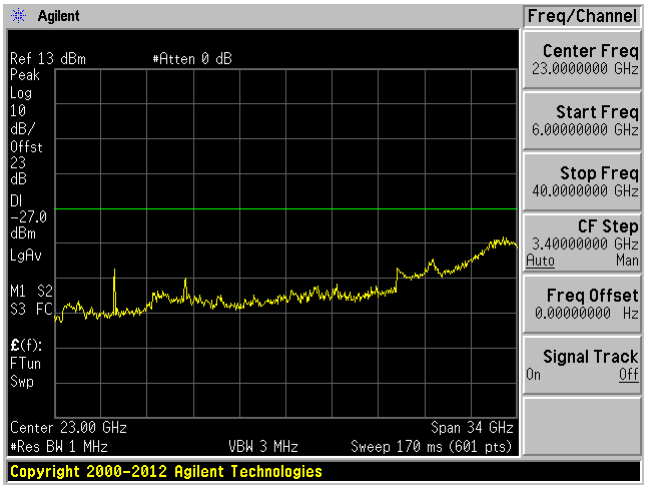
Low Channel 5180 MHz (6-40GHz)



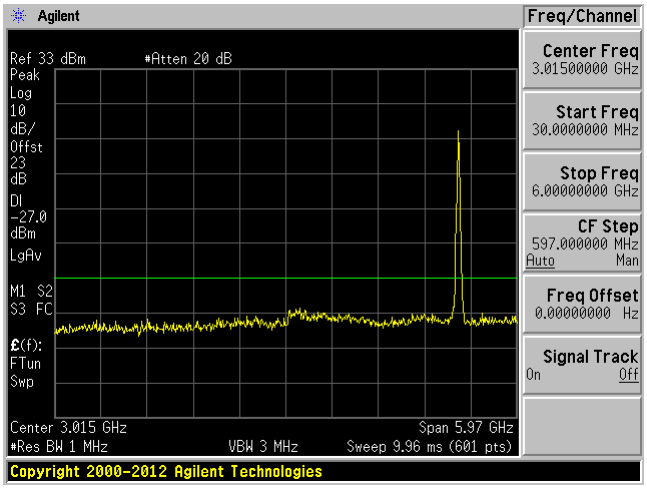
Middle Channel 5200MHz (30MHz-6GHz)



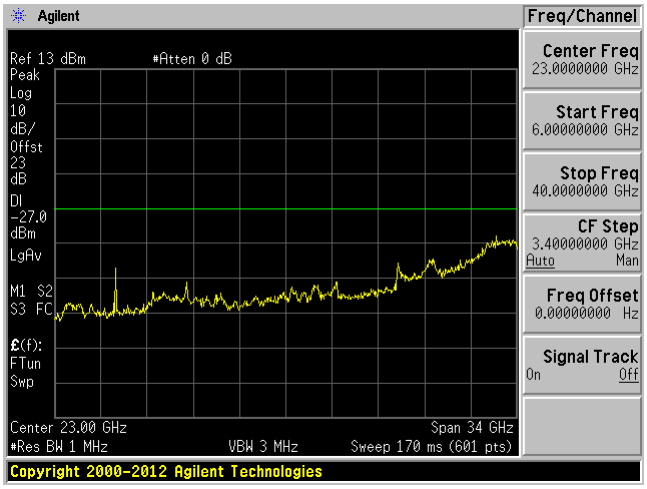
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

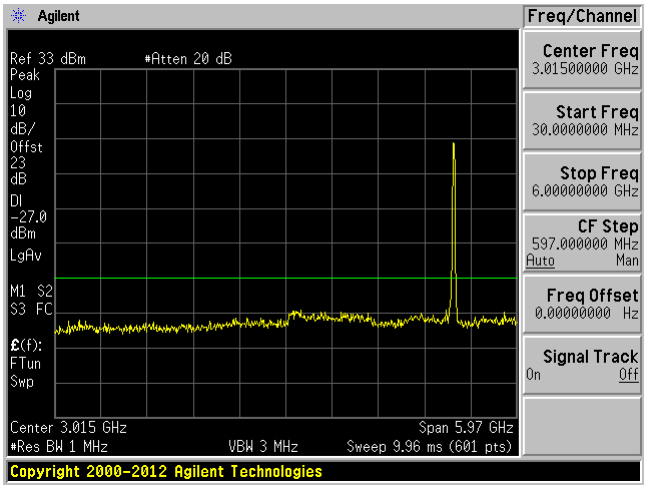


High Channel 5240 MHz (6-40GHz)

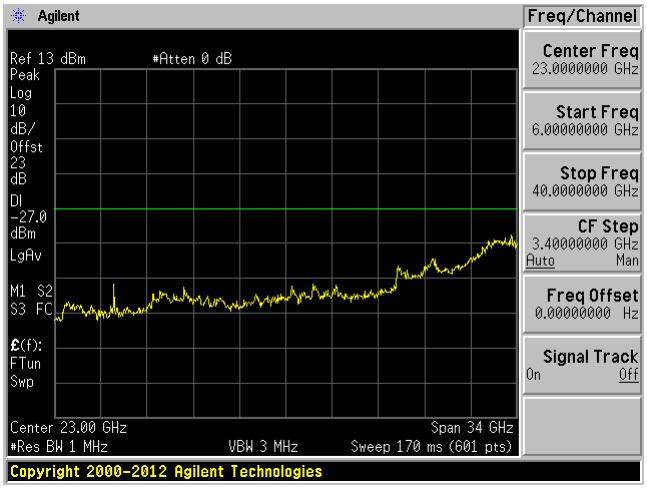


802.11ac20 mode (Port A MIMO)

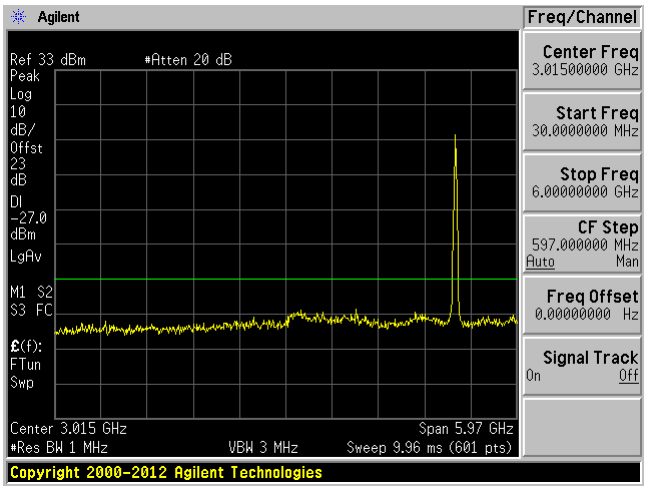
Low Channel 5180MHz (30MHz-6GHz)



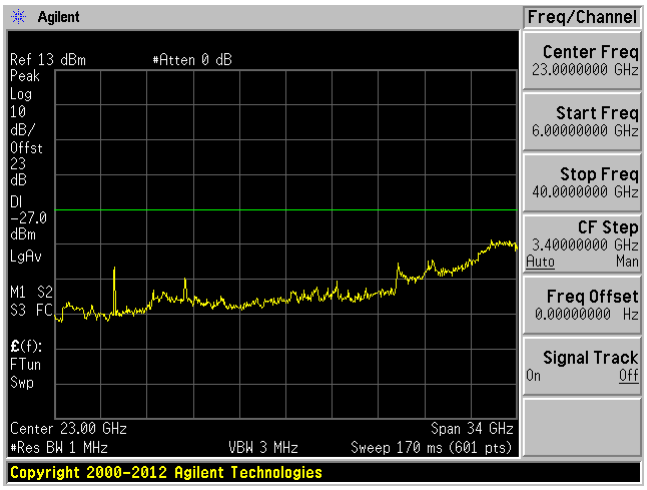
Low Channel 5180 MHz (6-40GHz)



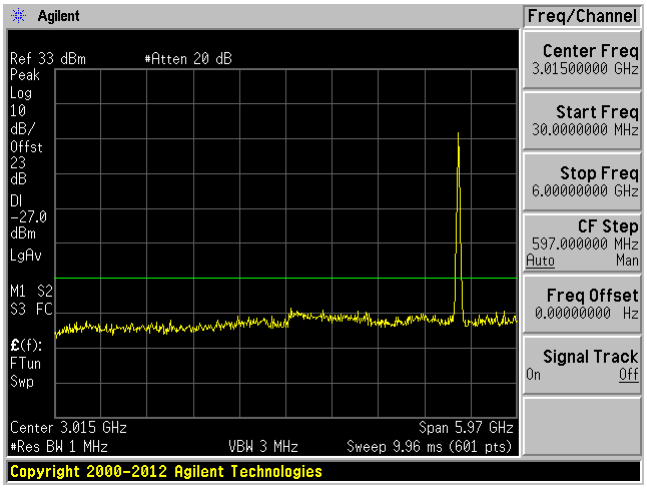
Middle Channel 5200MHz (30MHz-6GHz)



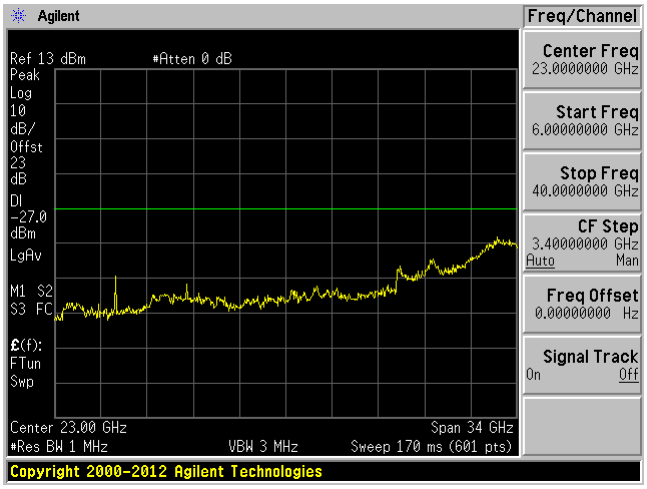
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

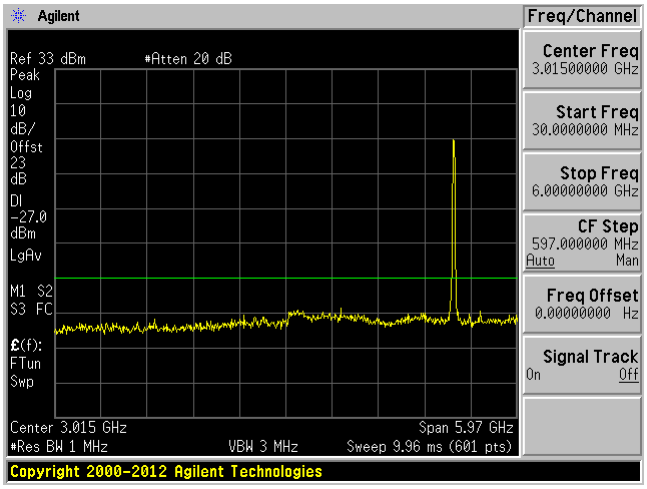


High Channel 5240 MHz (6-40GHz)

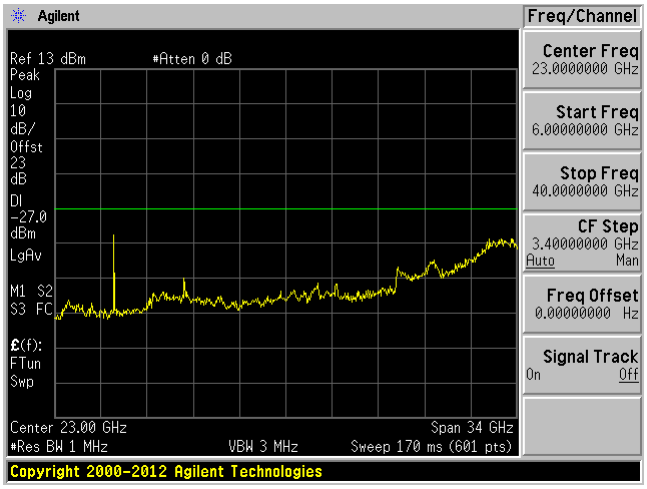


802.11ac20 mode (Port B)

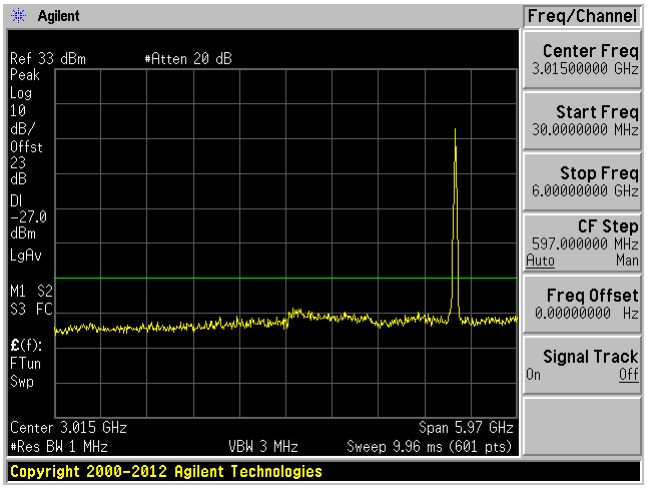
Low Channel 5180MHz (30MHz-6GHz)



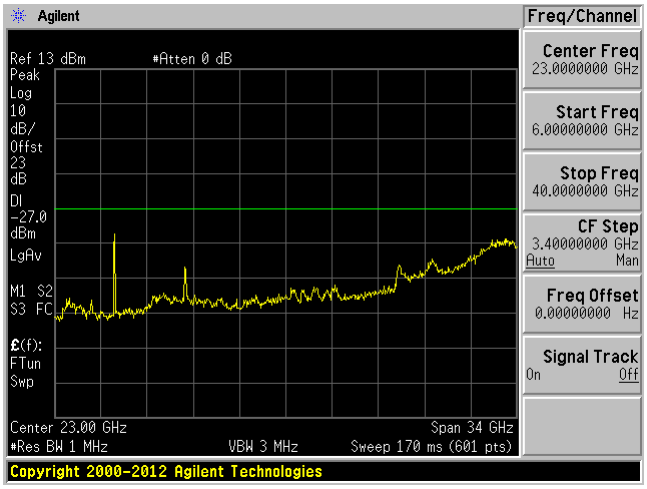
Low Channel 5180 MHz (6-40GHz)



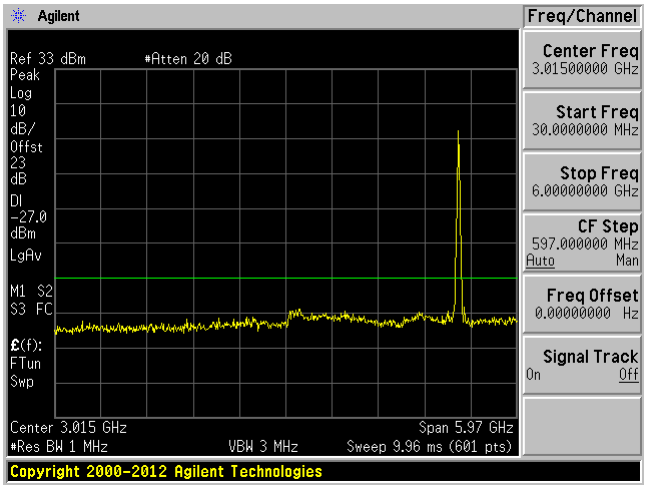
Middle Channel 5200MHz (30MHz-6GHz)



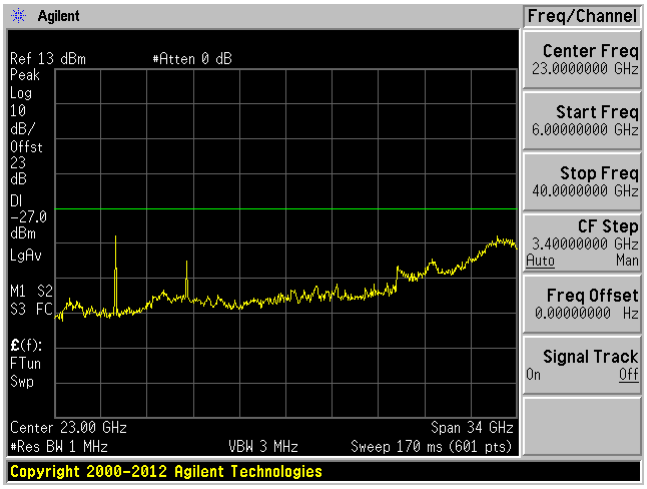
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

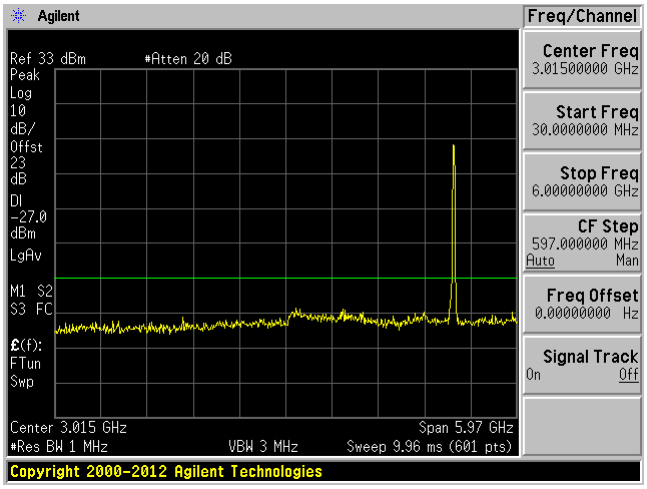


High Channel 5240 MHz (6-40GHz)

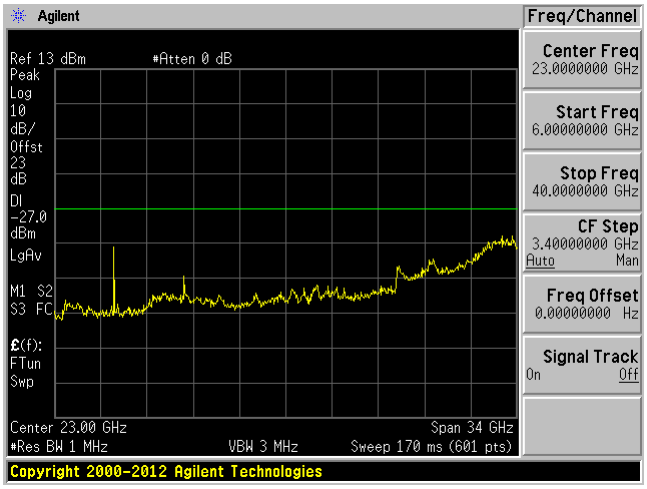


802.11ac20 mode (Port B MIMO)

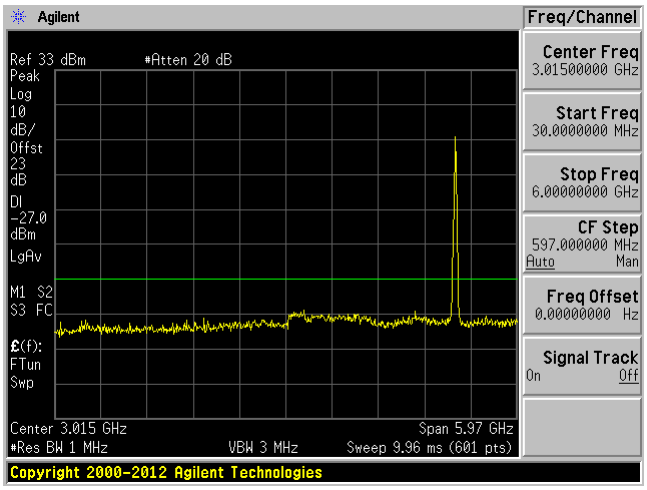
Low Channel 5180MHz (30MHz-6GHz)



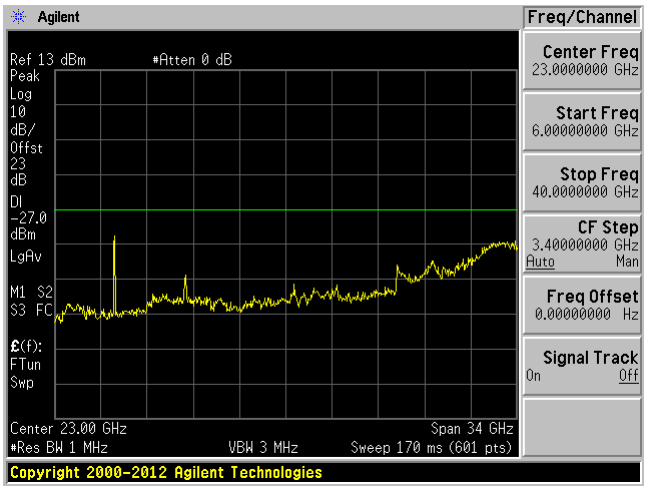
Low Channel 5180 MHz (6-40GHz)



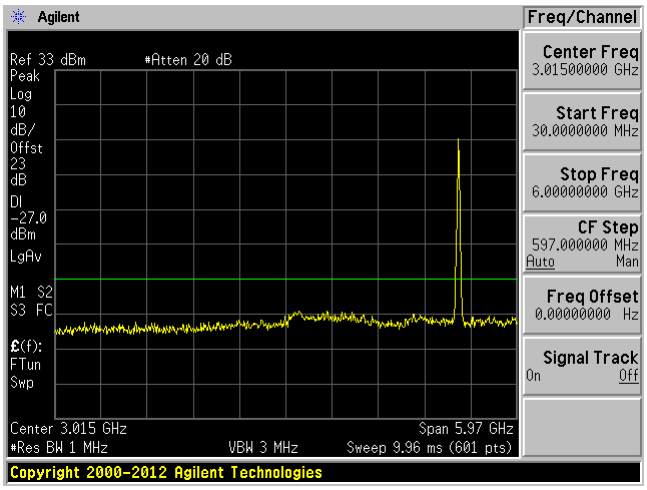
Middle Channel 5200MHz (30MHz-6GHz)



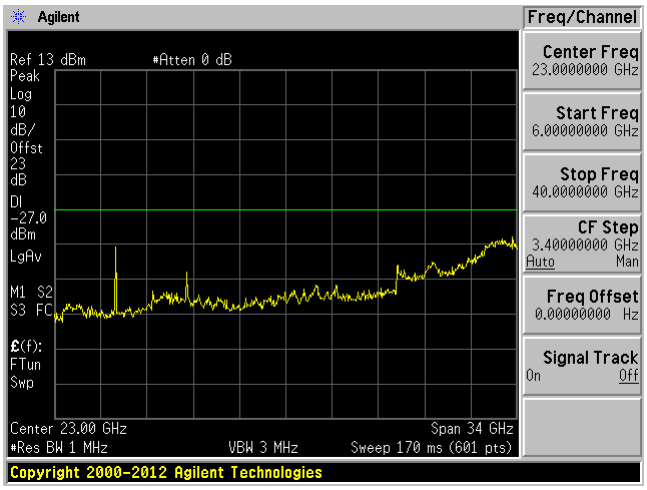
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)



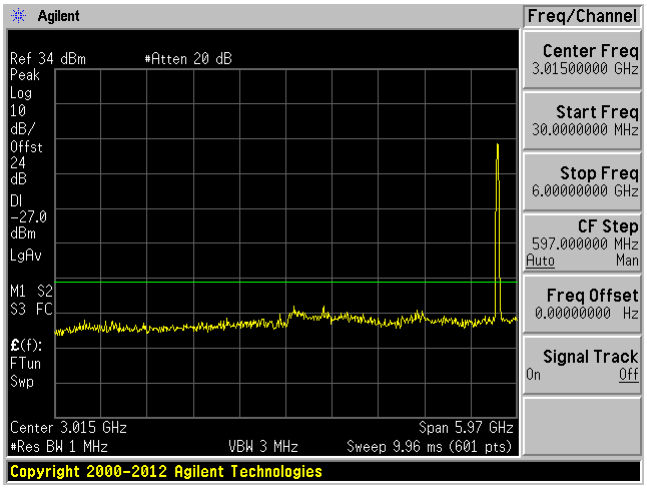
High Channel 5240 MHz (6-40GHz)



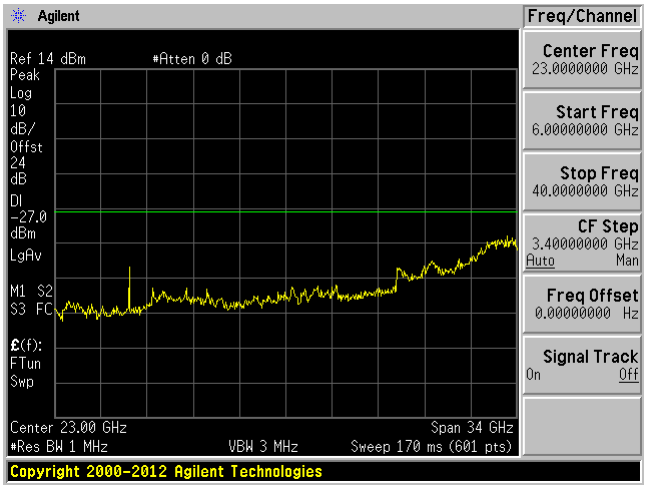
5725 - 5850 MHz

802.11a mode (Port A)

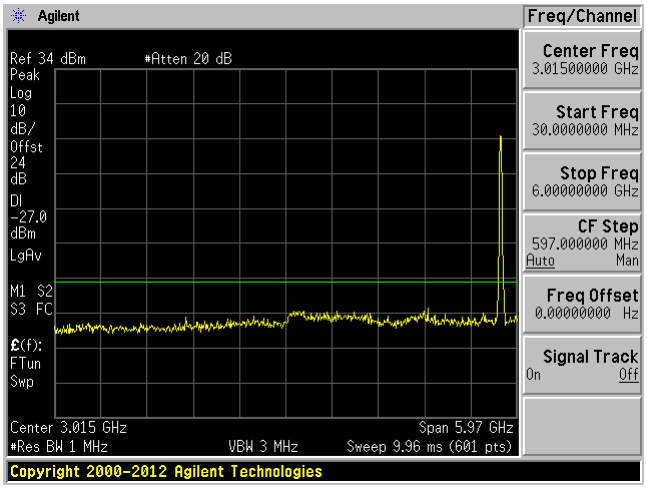
Low Channel 5745MHz (30MHz-6GHz)



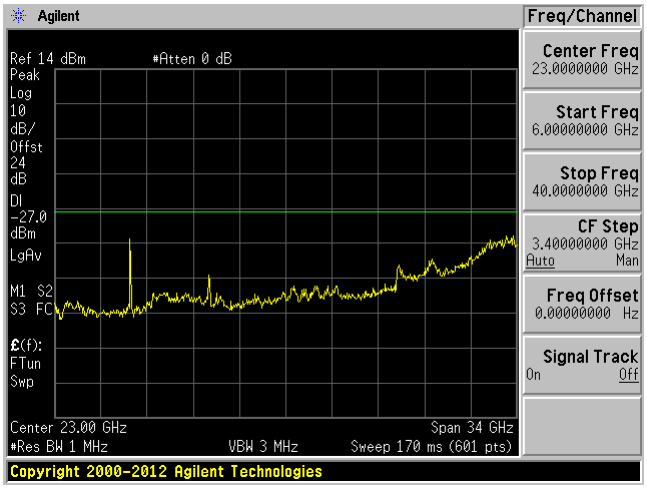
Low Channel 5745 MHz (6-40GHz)



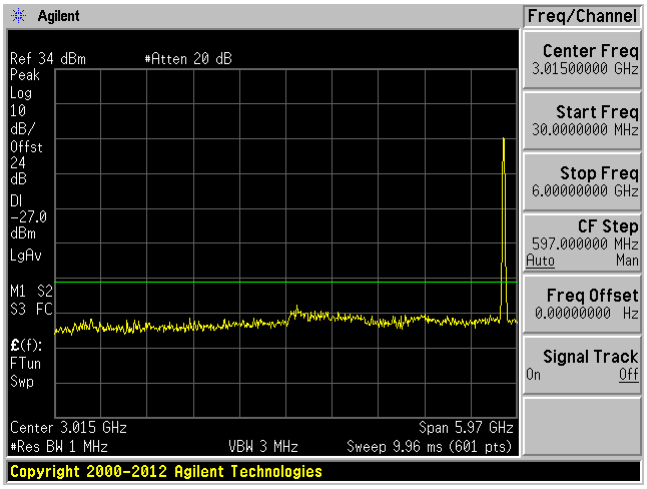
Middle Channel 5785MHz (30MHz-6GHz)



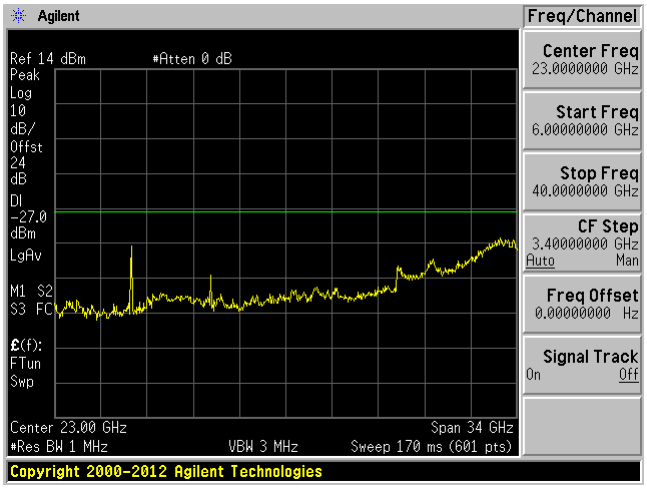
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

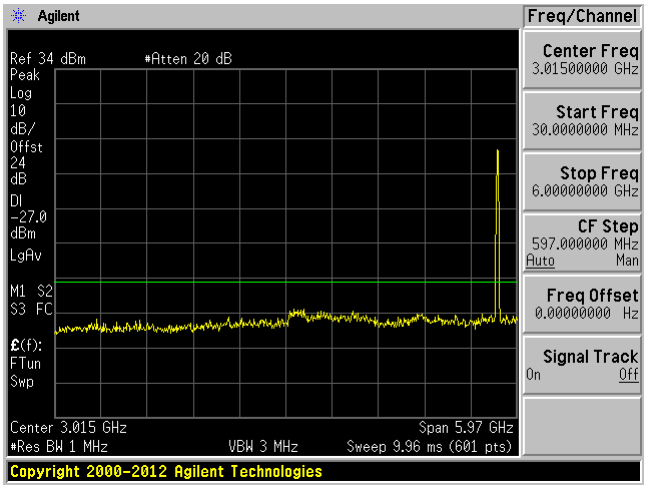


High Channel 5825 MHz (6-40GHz)

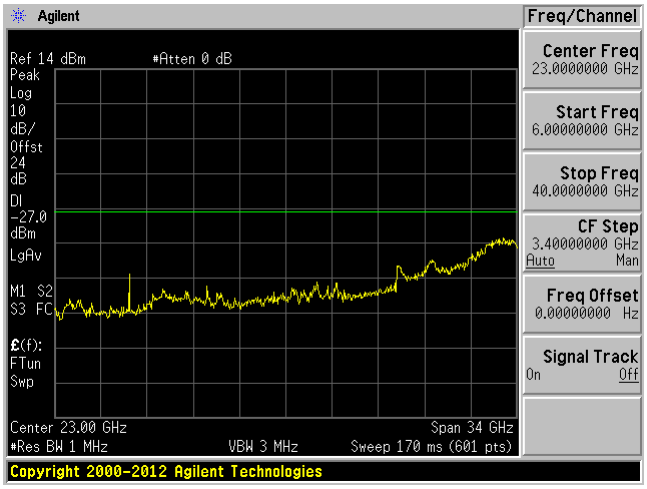


802.11a mode (Port B)

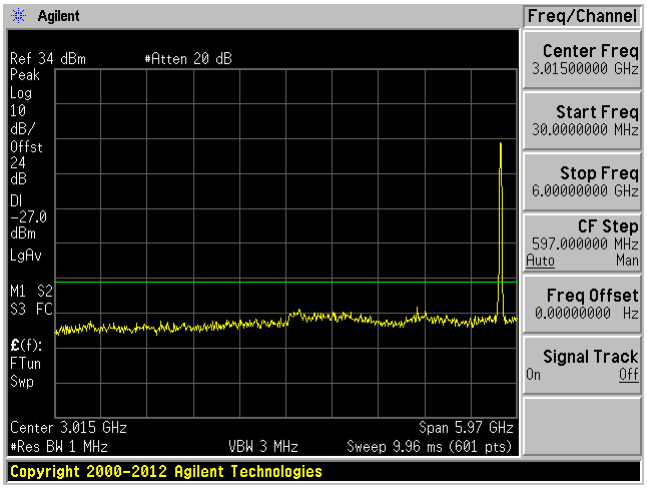
Low Channel 5745MHz (30MHz-6GHz)



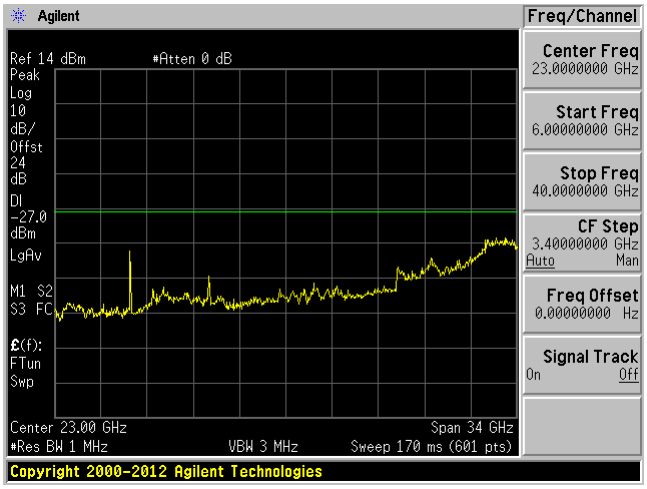
Low Channel 5745 MHz (6-40GHz)



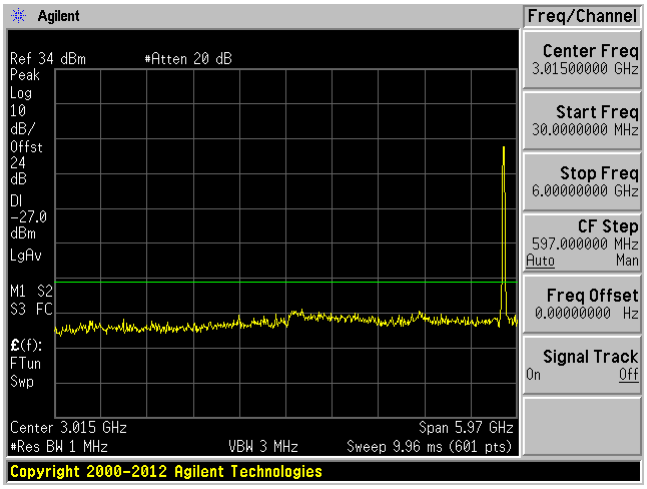
Middle Channel 5785MHz (30MHz-6GHz)



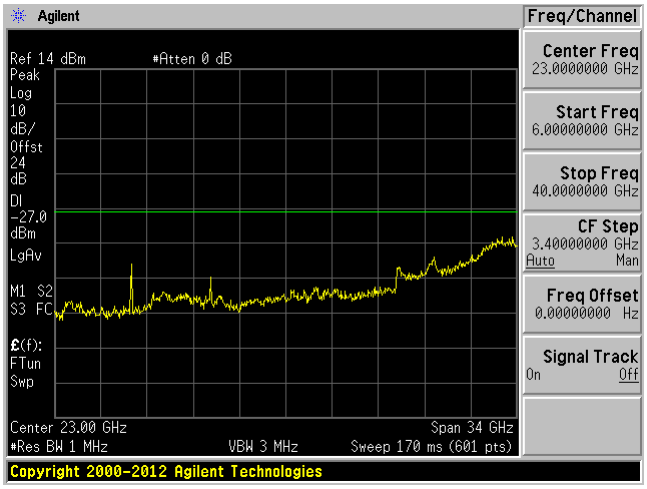
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

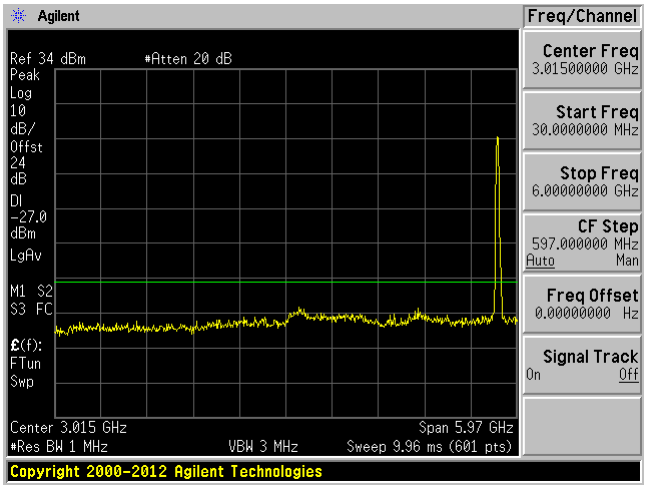


High Channel 5825 MHz (6-40GHz)

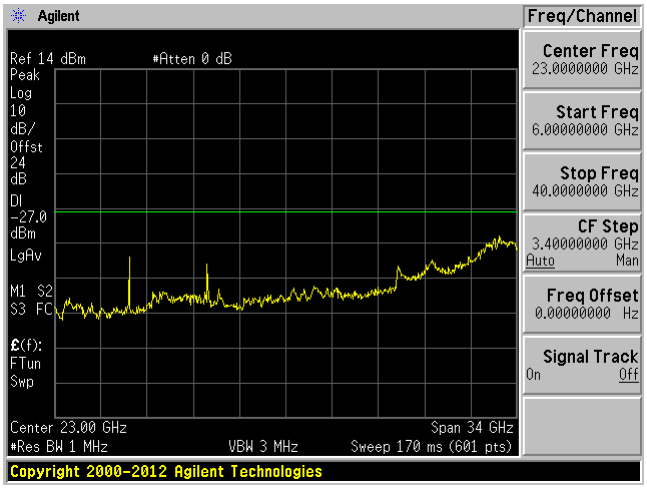


802.11n20 mode (Port A)

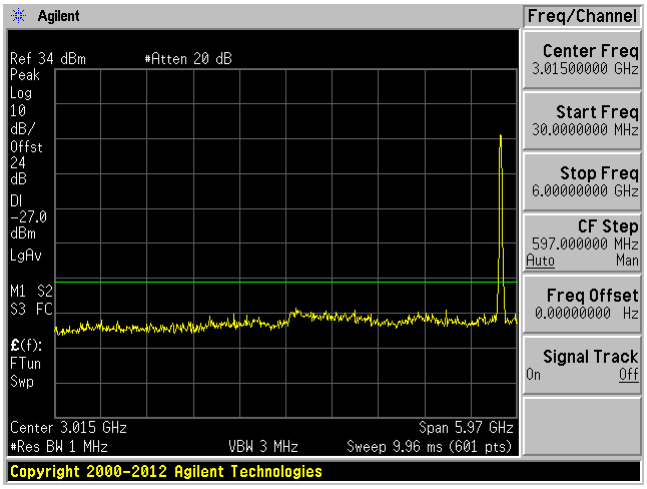
Low Channel 5745MHz (30MHz-6GHz)



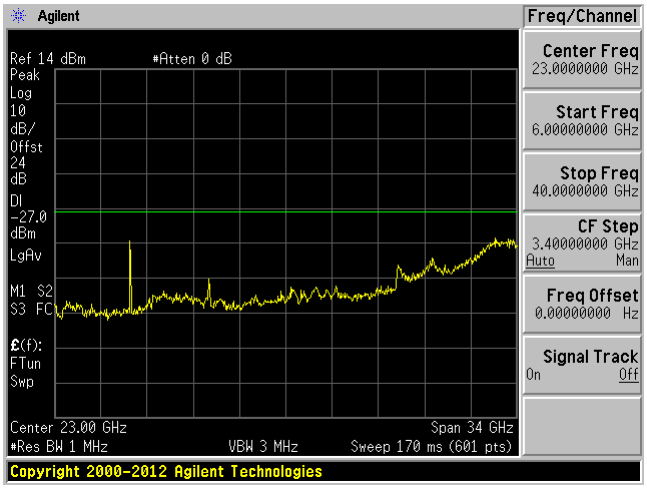
Low Channel 5745 MHz (6-40GHz)



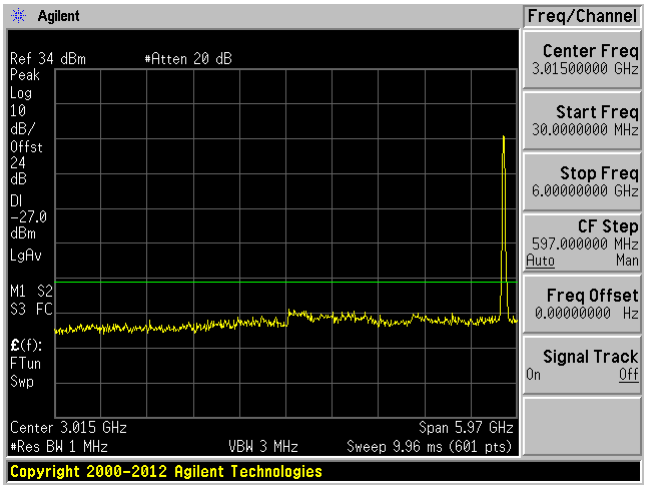
Middle Channel 5785MHz (30MHz-6GHz)



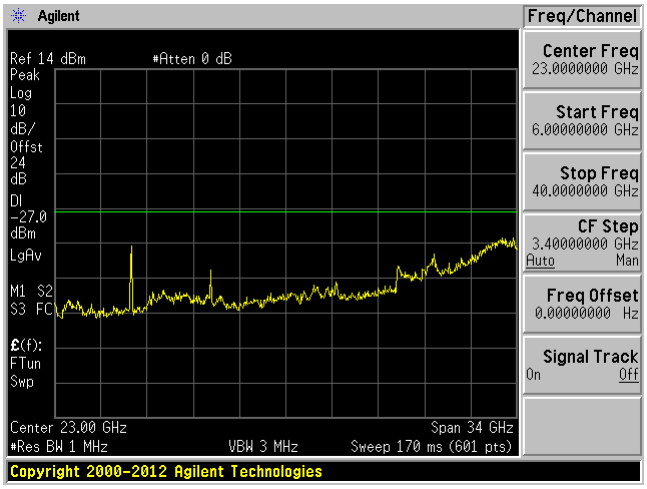
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

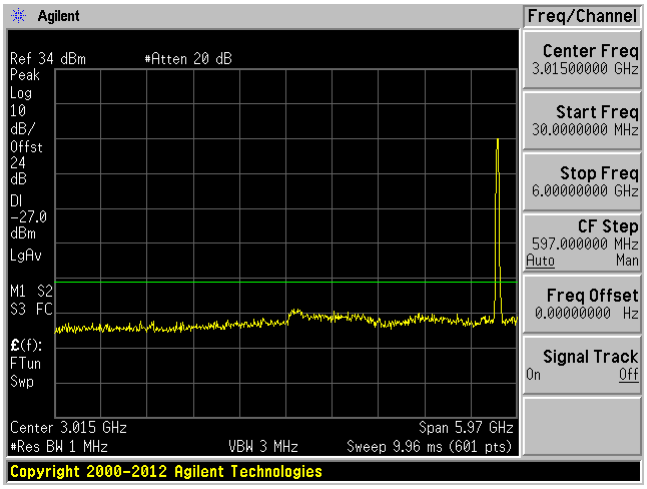


High Channel 5825 MHz (6-40GHz)

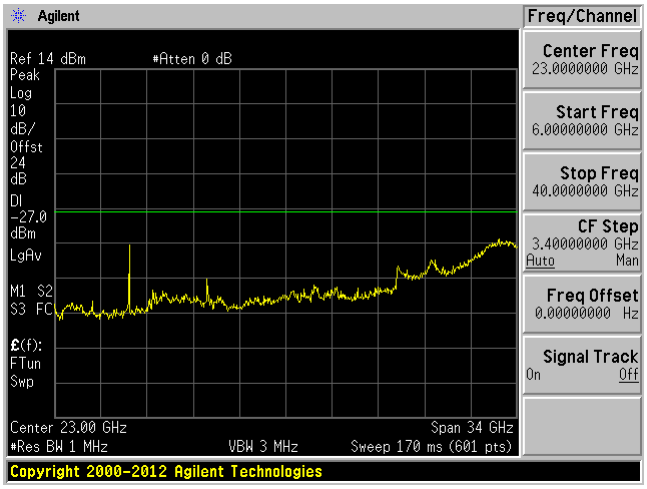


802.11n20 mode (Port A MIMO)

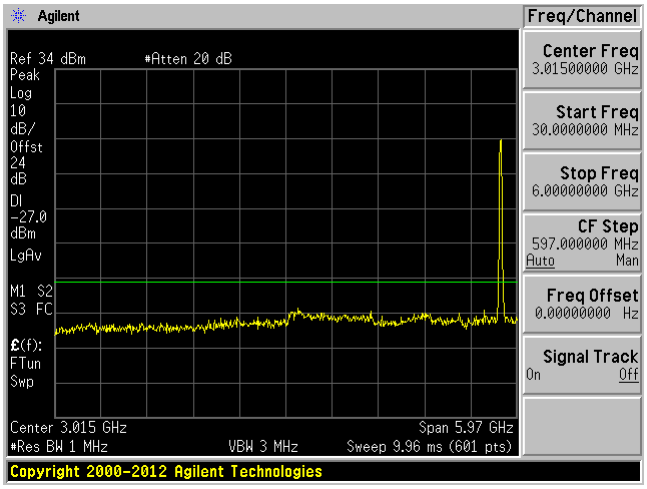
Low Channel 5745MHz (30MHz-6GHz)



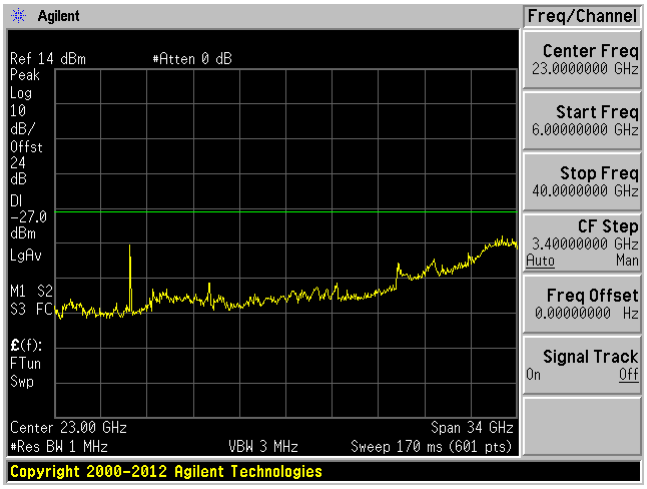
Low Channel 5745 MHz (6-40GHz)



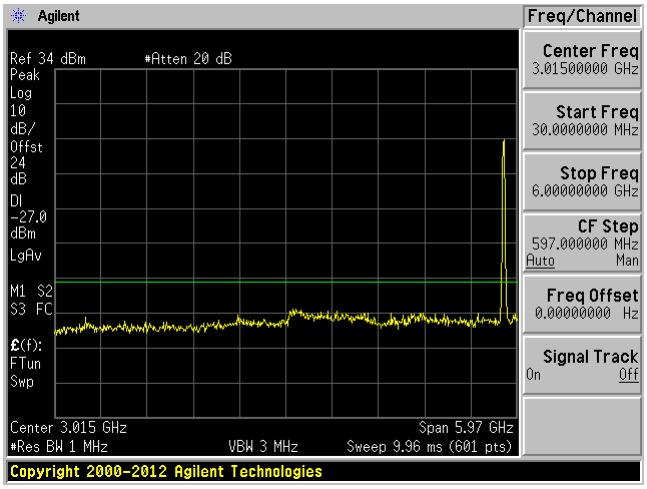
Middle Channel 5785MHz (30MHz-6GHz)



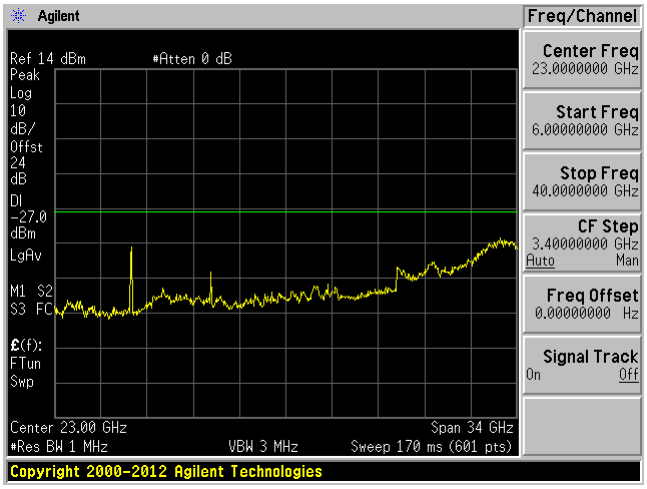
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

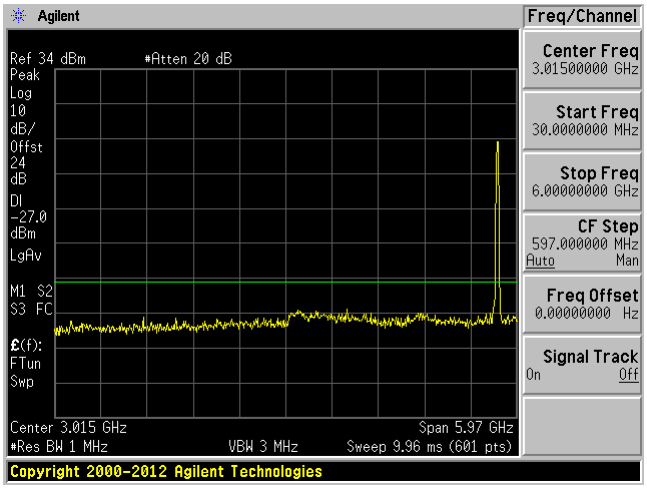


High Channel 5825 MHz (6-40GHz)

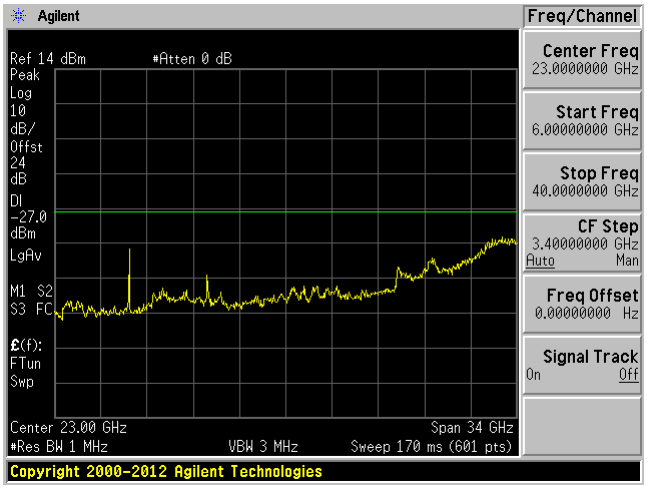


802.11n20 mode (Port B)

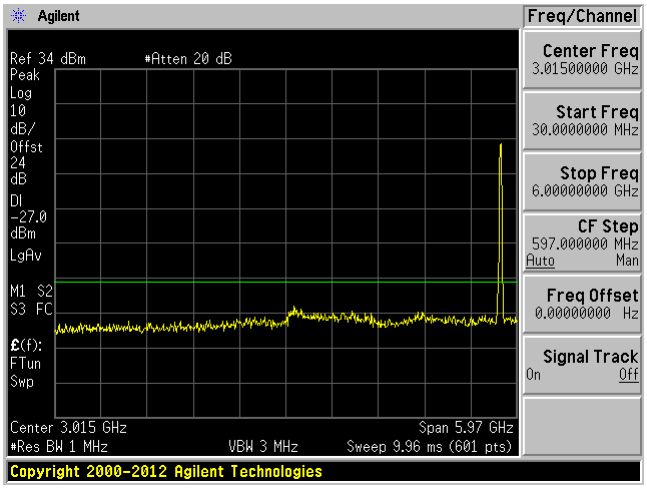
Low Channel 5745MHz (30MHz-6GHz)



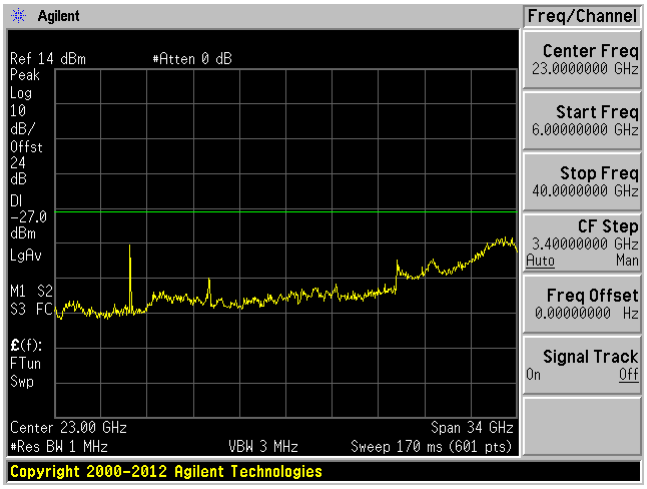
Low Channel 5745 MHz (6-40GHz)



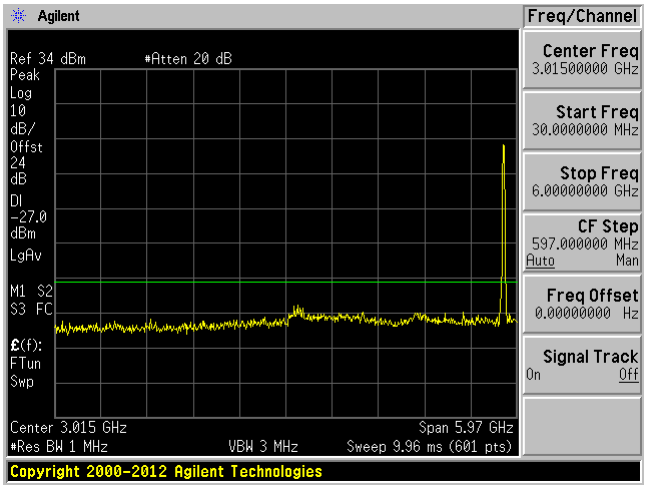
Middle Channel 5785MHz (30MHz-6GHz)



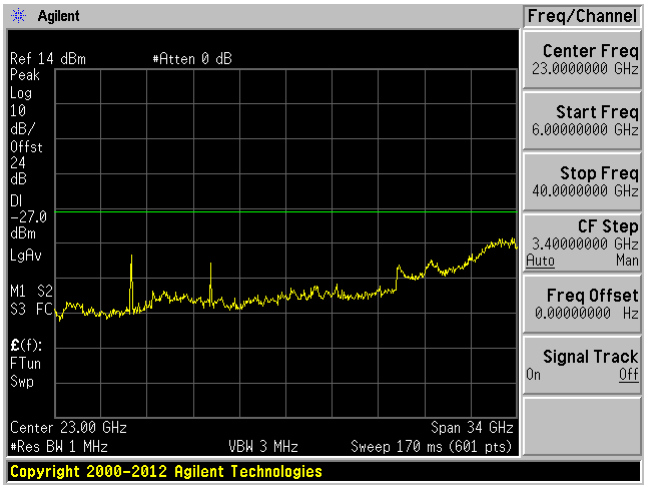
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

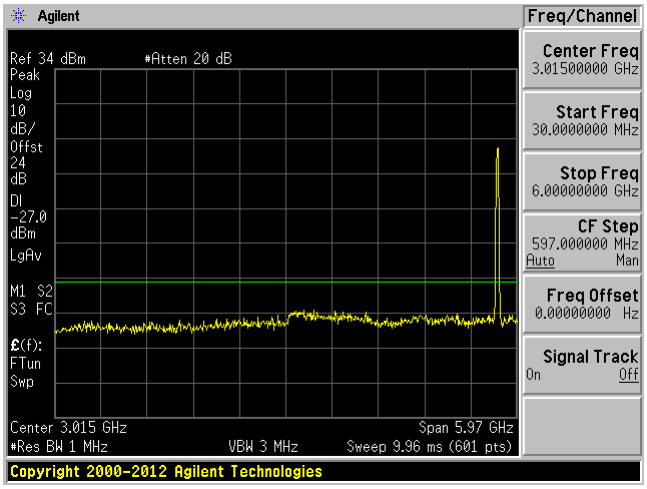


High Channel 5825 MHz (6-40GHz)

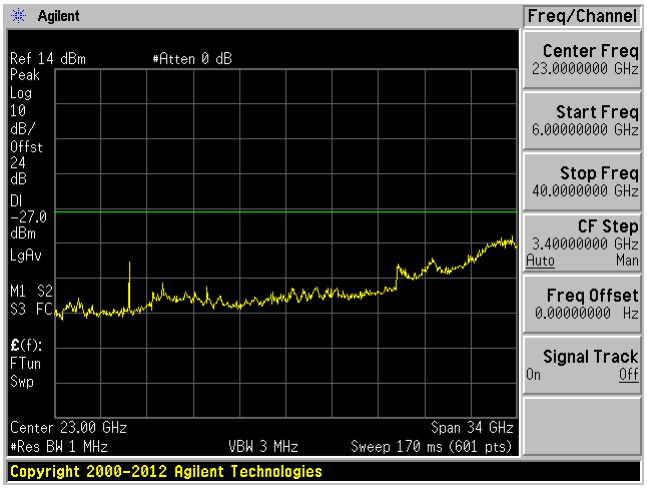


802.11n20 mode (Port B MIMO)

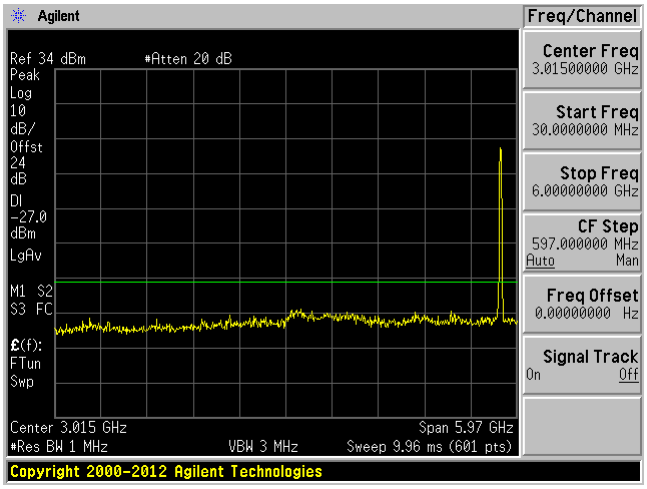
Low Channel 5745MHz (30MHz-6GHz)



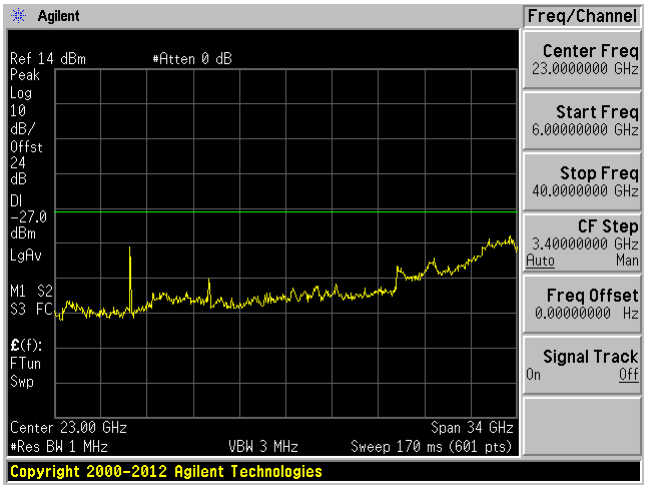
Low Channel 5745 MHz (6-40GHz)



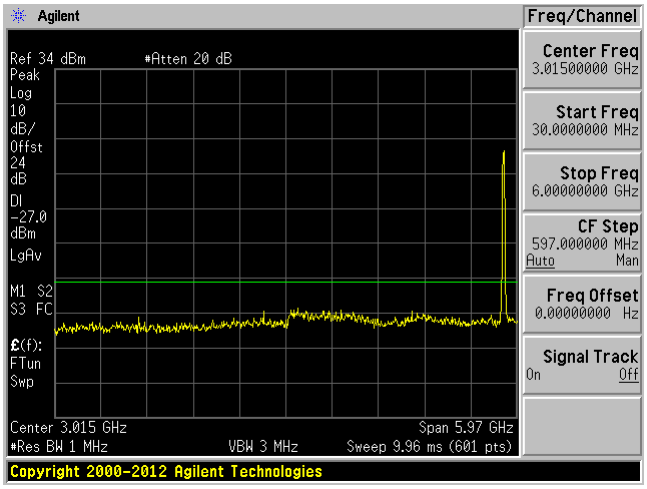
Middle Channel 5785MHz (30MHz-6GHz)



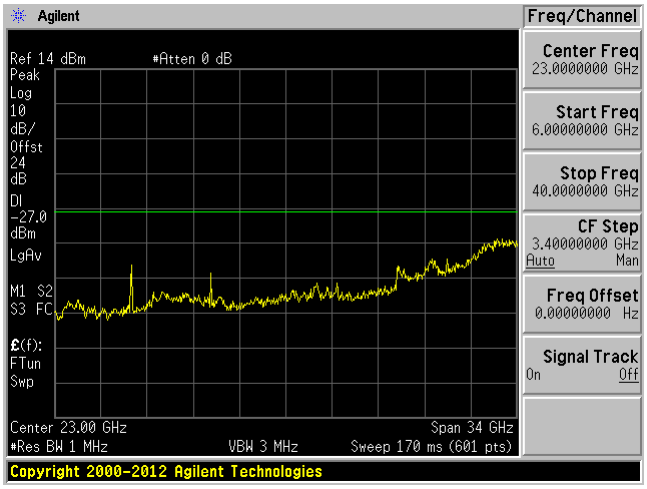
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

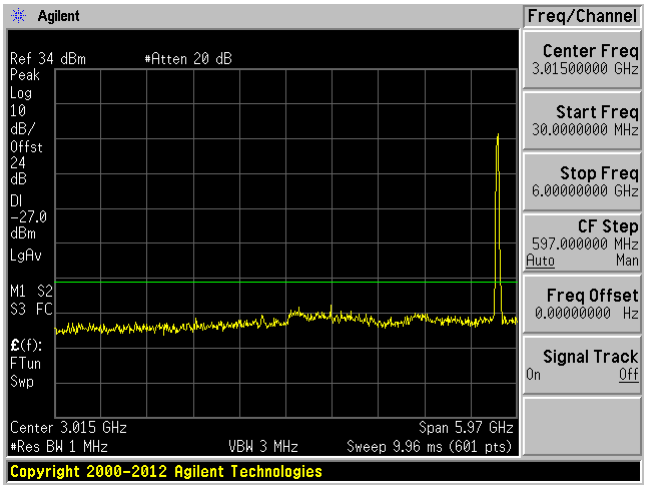


High Channel 5825 MHz (6-40GHz)

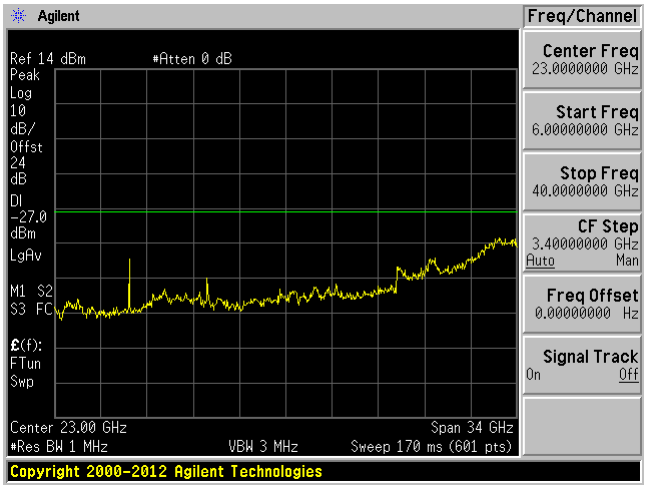


802.11ac20 mode (Port A)

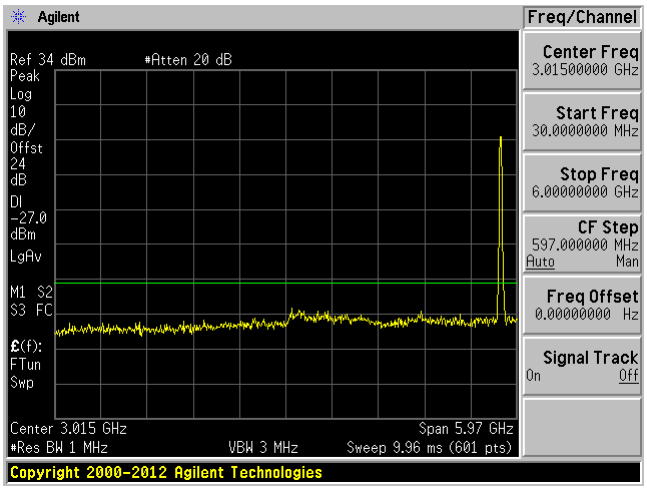
Low Channel 5745MHz (30MHz-6GHz)



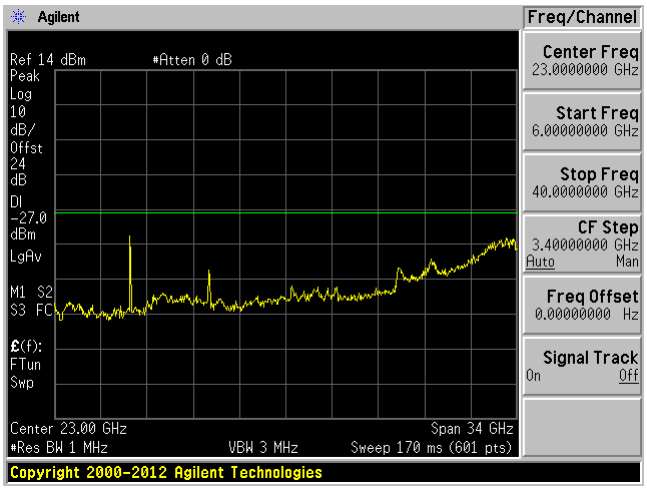
Low Channel 5745 MHz (6-40GHz)



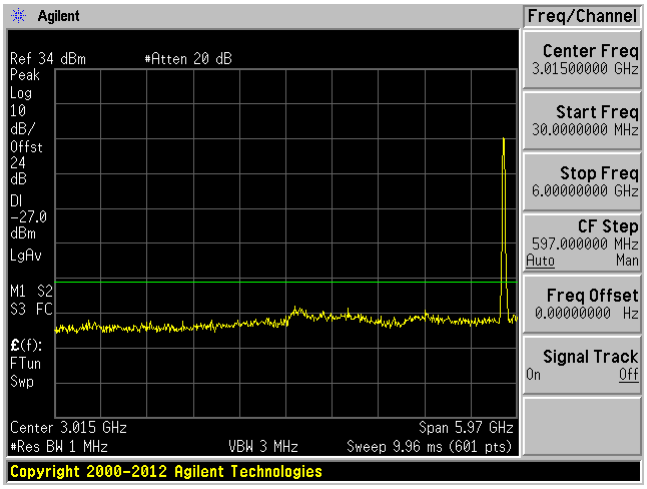
Middle Channel 5785MHz (30MHz-6GHz)



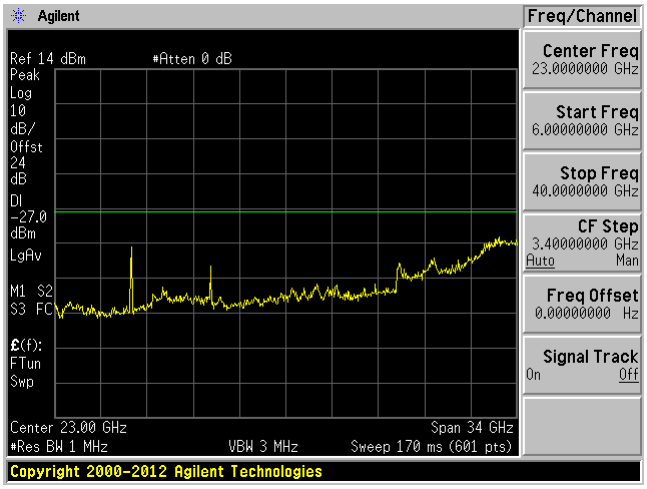
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

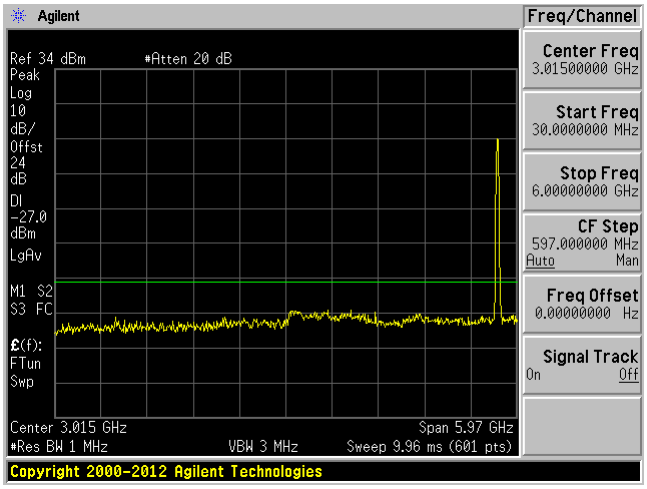


High Channel 5825 MHz (6-40GHz)

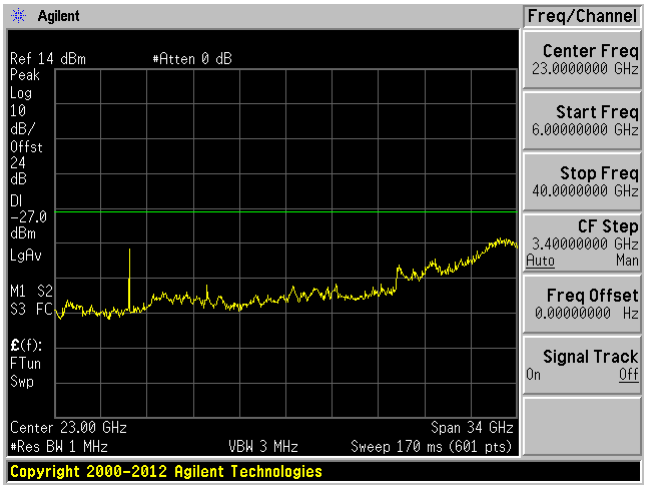


802.11ac20 mode (Port A MIMO)

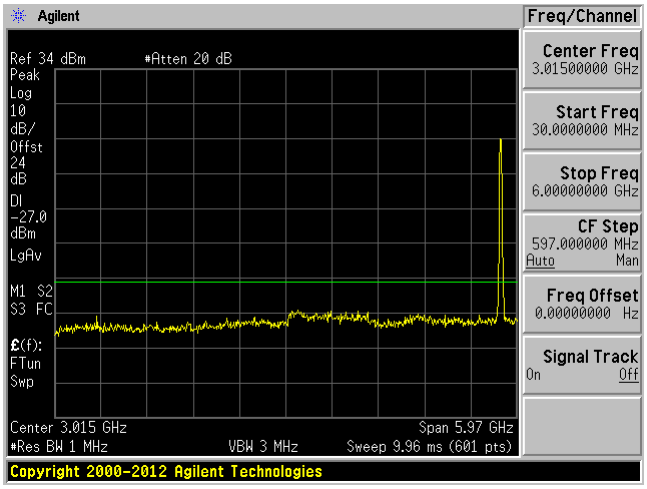
Low Channel 5745MHz (30MHz-6GHz)



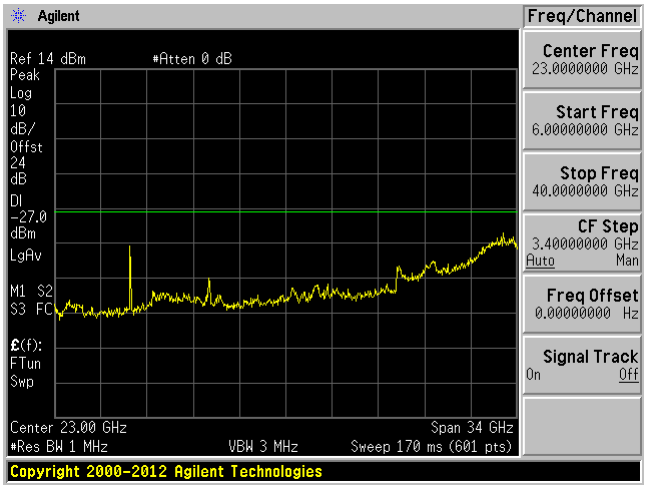
Low Channel 5745 MHz (6-40GHz)



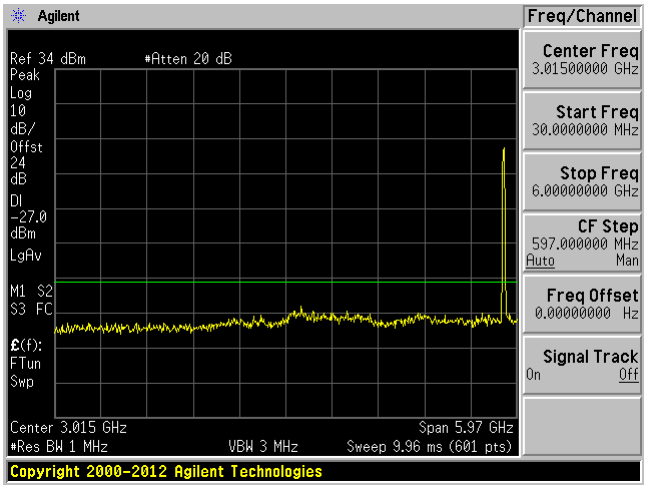
Middle Channel 5785MHz (30MHz-6GHz)



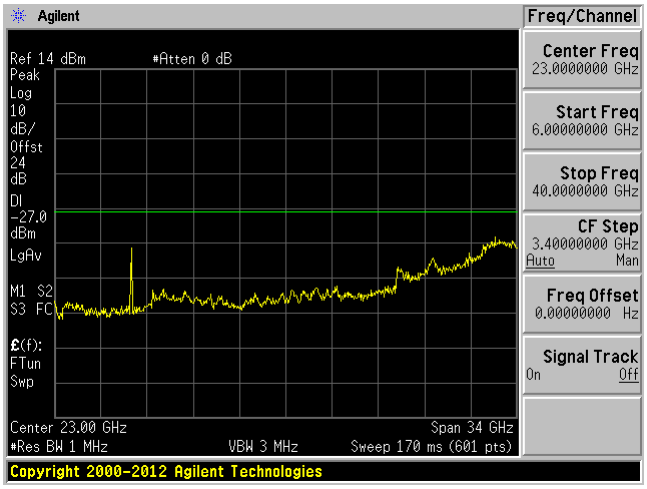
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

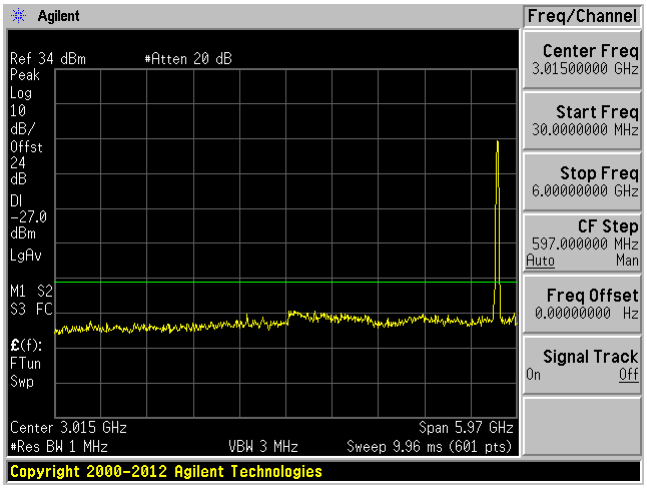


High Channel 5825 MHz (6-40GHz)

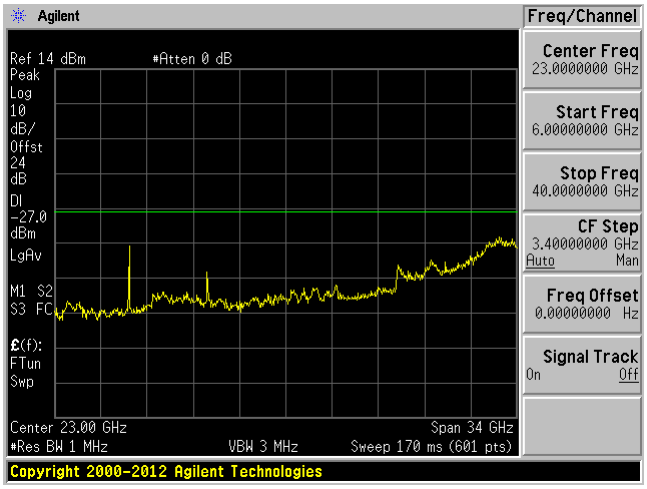


802.11ac20 mode (Port B)

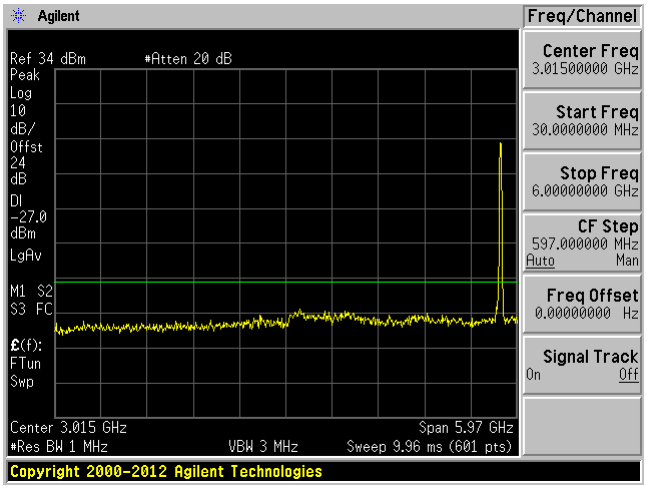
Low Channel 5745MHz (30MHz-6GHz)



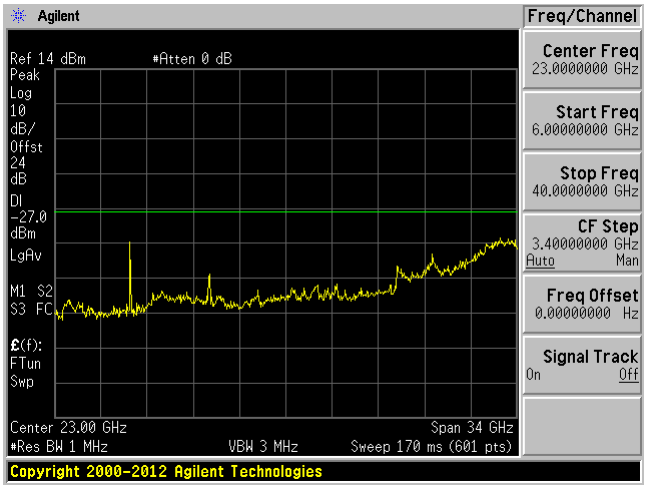
Low Channel 5745 MHz (6-40GHz)



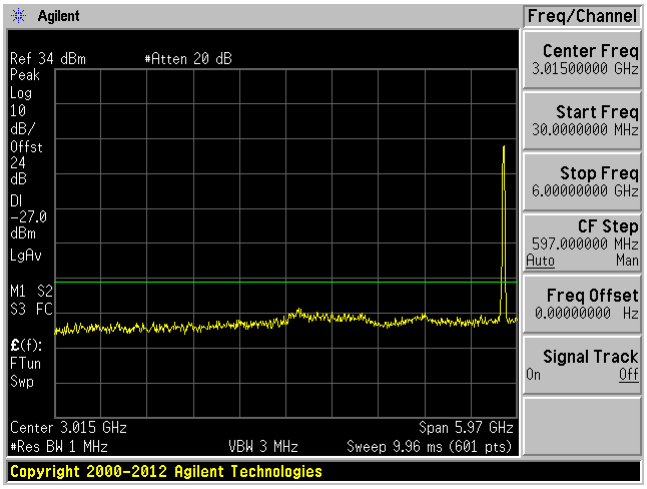
Middle Channel 5785MHz (30MHz-6GHz)



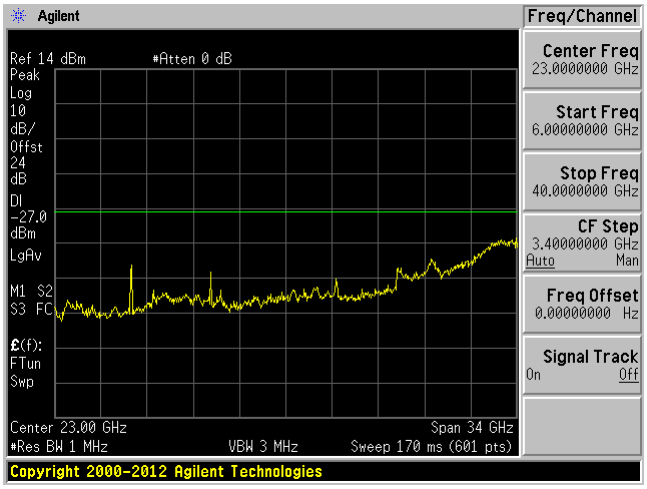
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)

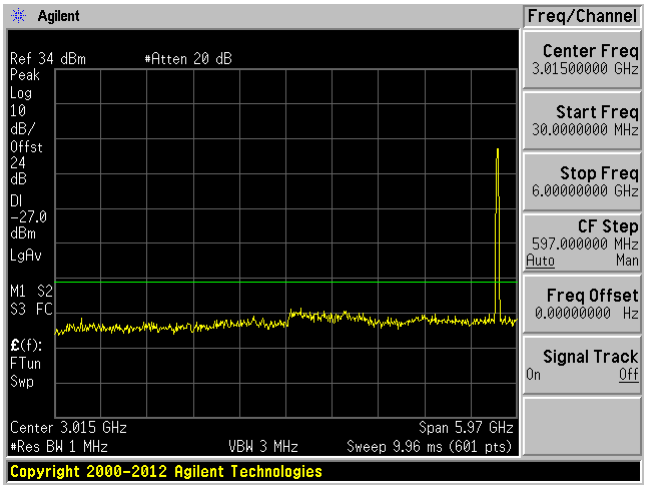


High Channel 5825 MHz (6-40GHz)

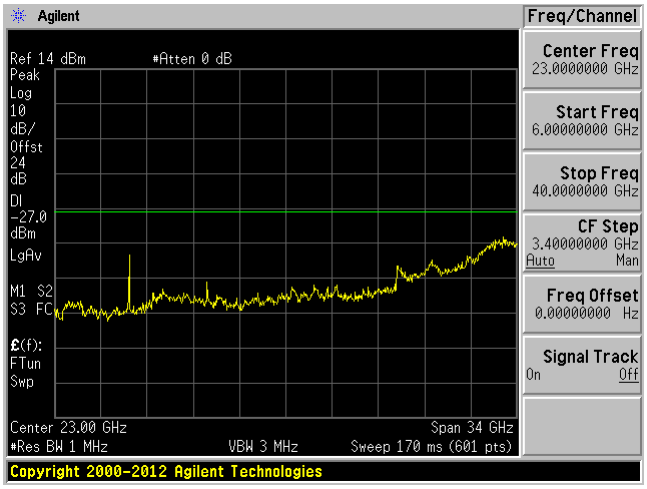


802.11ac20 mode (Port B MIMO)

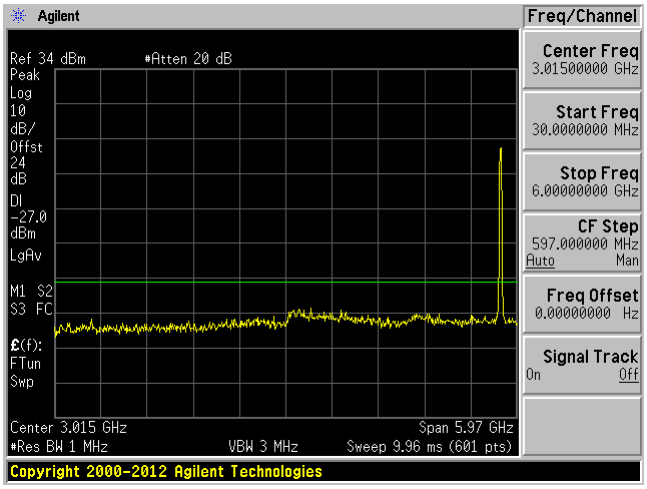
Low Channel 5745MHz (30MHz-6GHz)



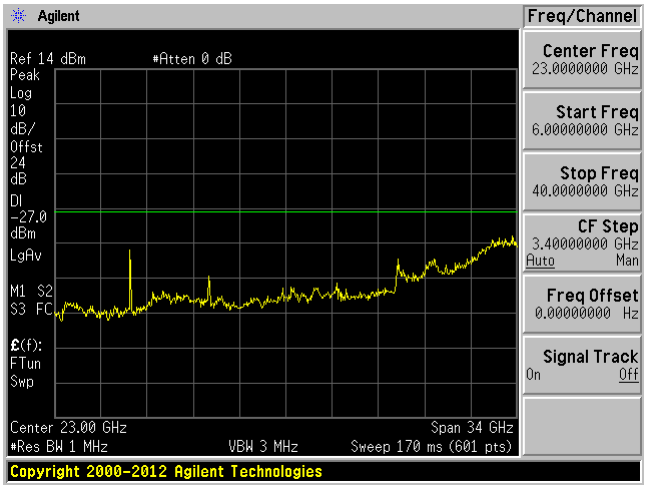
Low Channel 5745 MHz (6-40GHz)



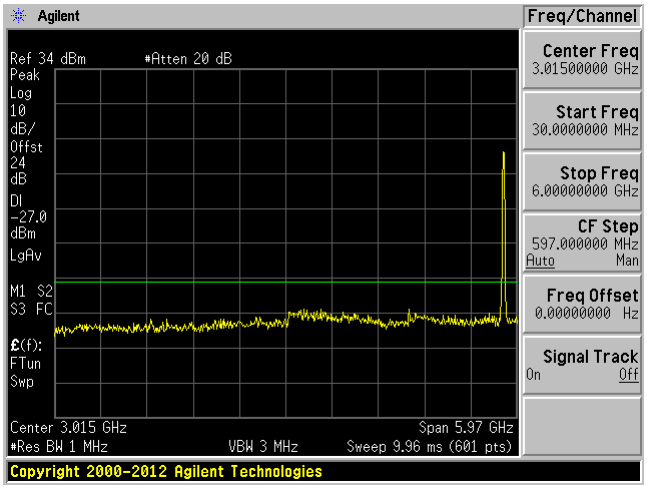
Middle Channel 5785MHz (30MHz-6GHz)



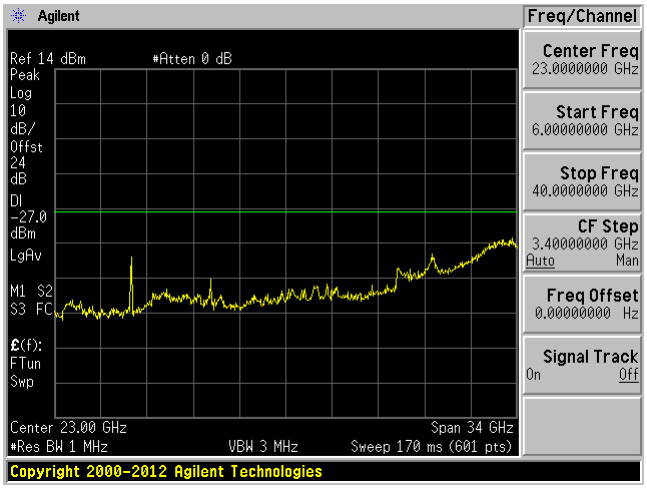
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825MHz (30MHz-6GHz)



High Channel 5825 MHz (6-40GHz)

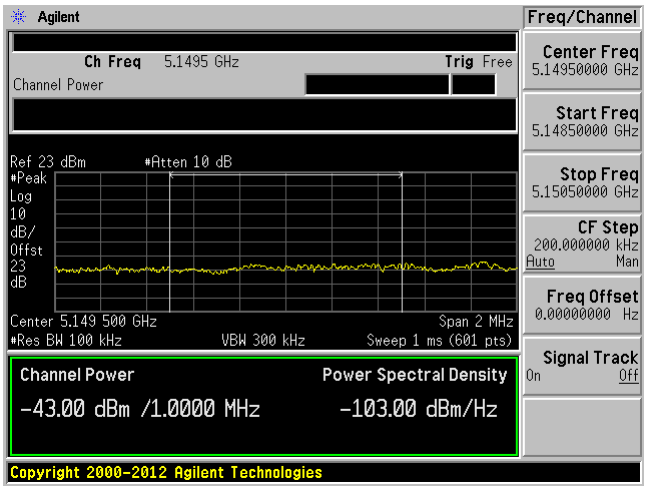


Band Edge Emissions

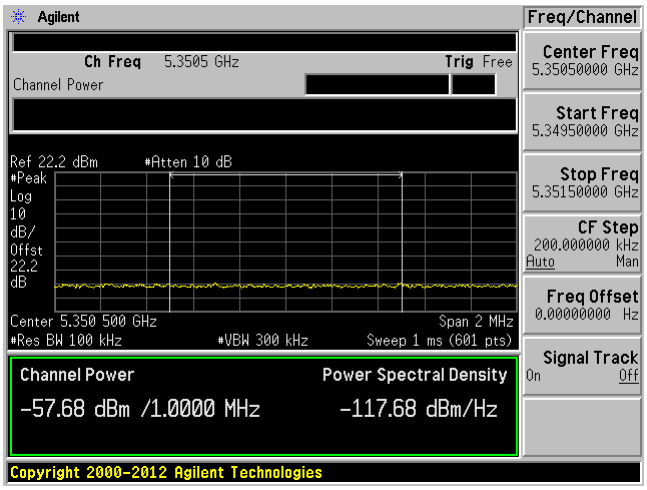
5150 - 5250 MHz

802.11a mode (Port A)

Low Channel: 5180 MHz

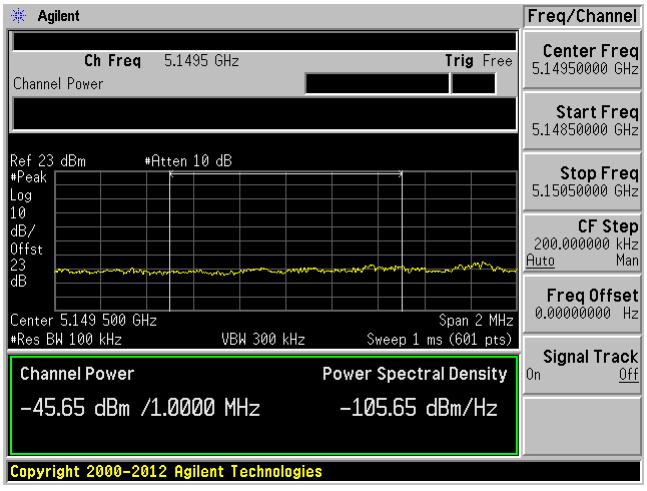


High channel: 5240 MHz

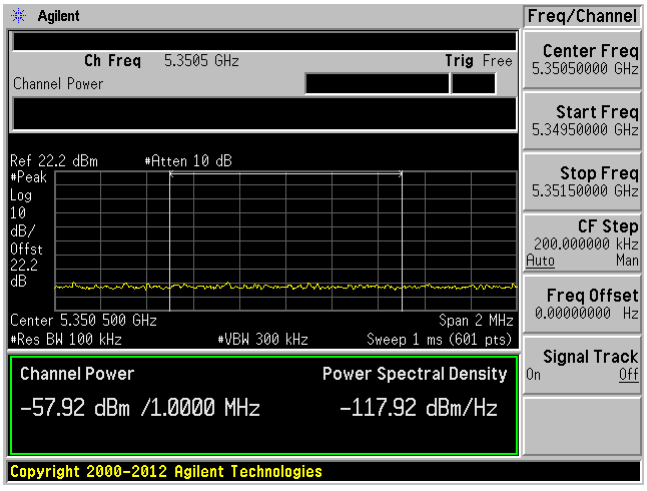


802.11a mode (Port B)

Low Channel: 5180 MHz

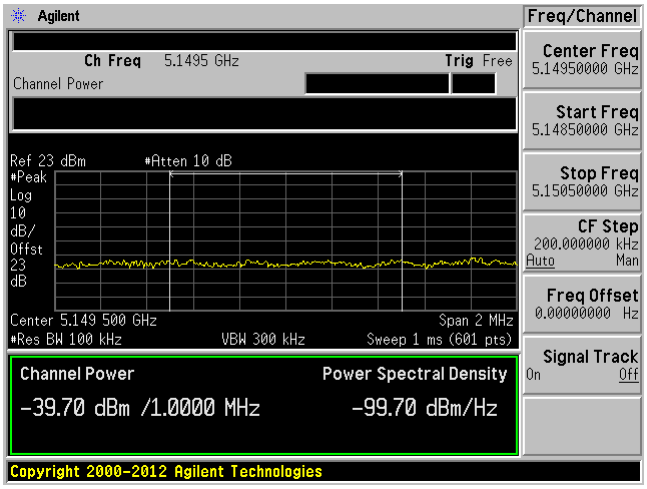


High channel: 5240 MHz

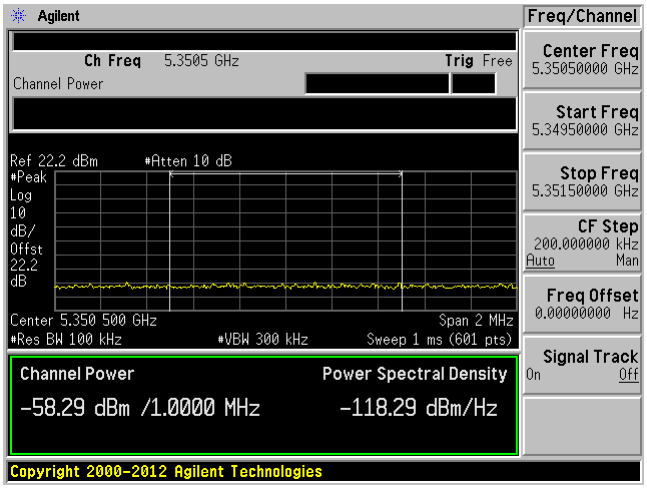


802.11n20 mode (Port A)

Low Channel: 5180 MHz

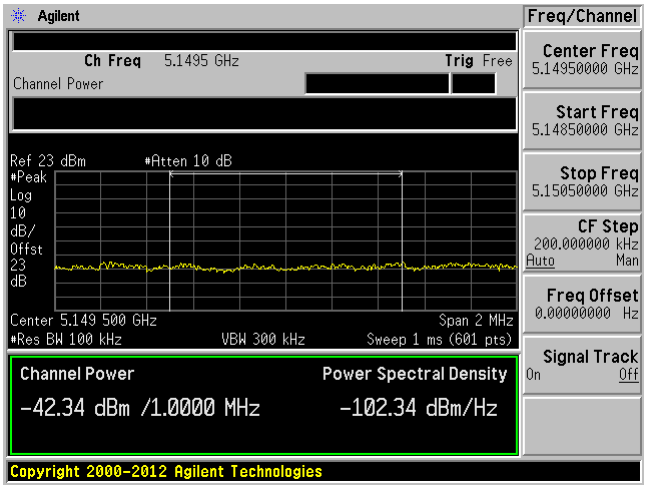


High channel: 5240 MHz

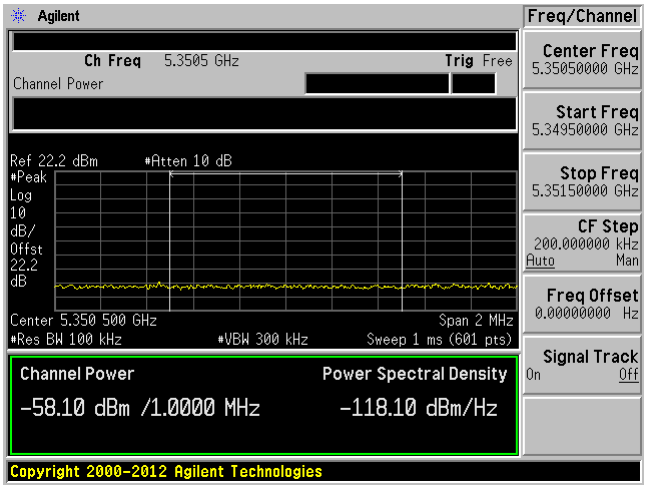


802.11n20 mode (Port A MIMO)

Low Channel: 5180 MHz

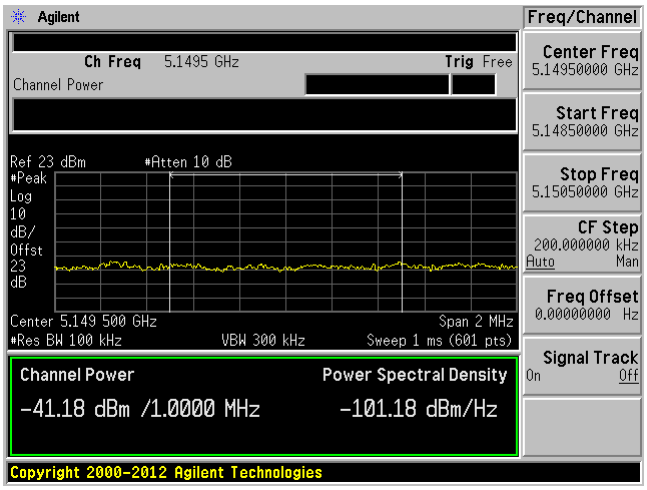


High channel: 5240 MHz

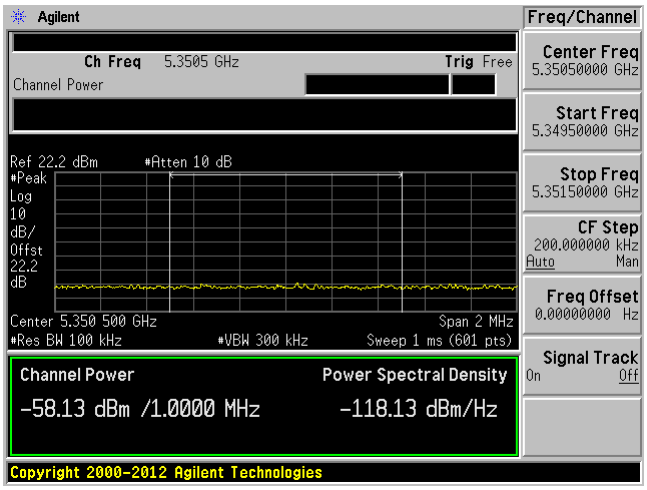


802.11n20 mode (Port B)

Low Channel: 5180 MHz

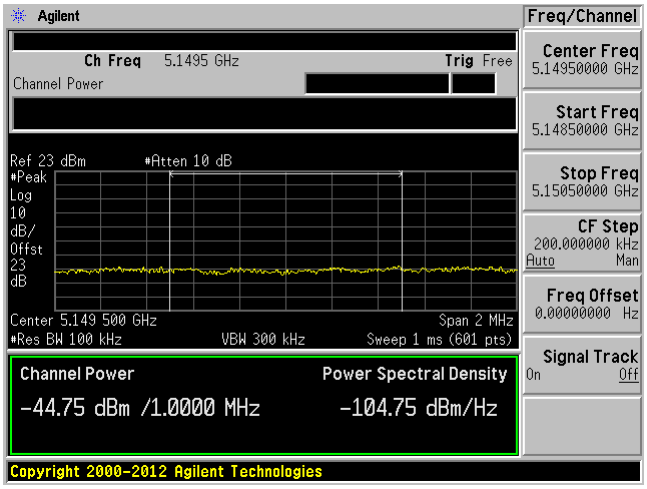


High channel: 5240 MHz

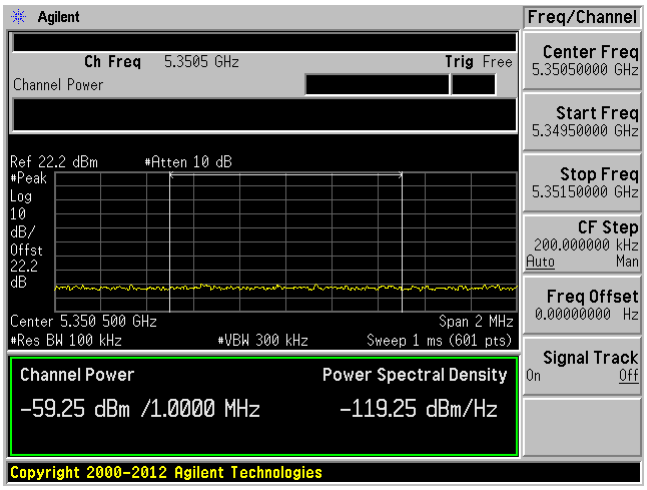


802.11n20 mode (Port B MIMO)

Low Channel: 5180 MHz

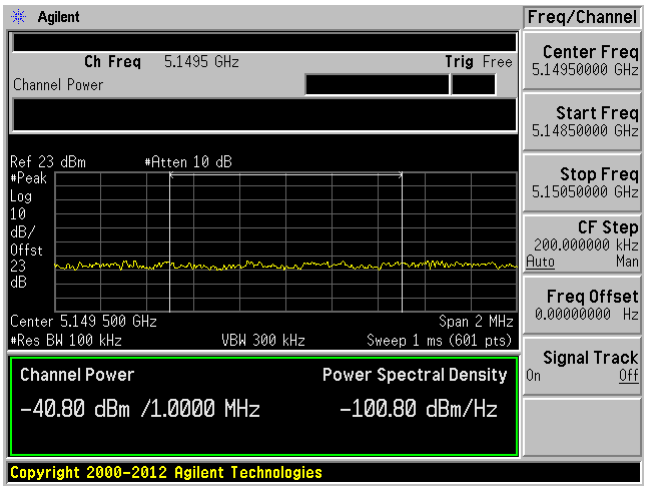


High channel: 5240 MHz

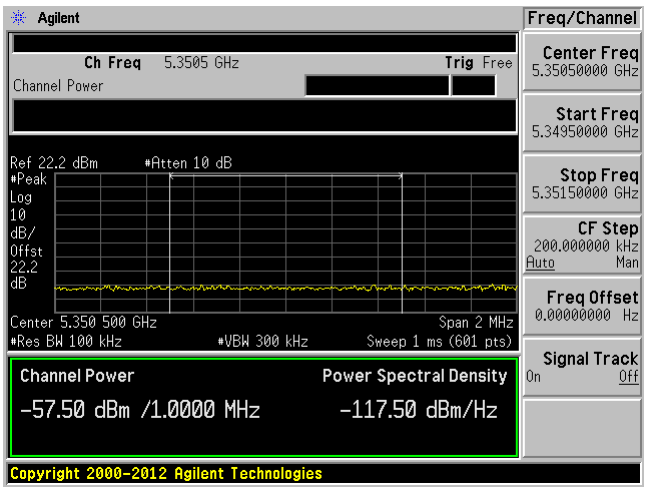


802.11ac20 mode (Port A)

Low Channel: 5180 MHz

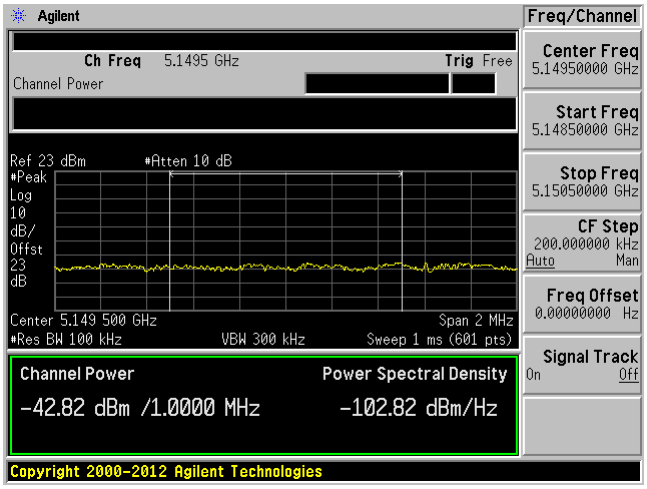


High channel: 5240 MHz

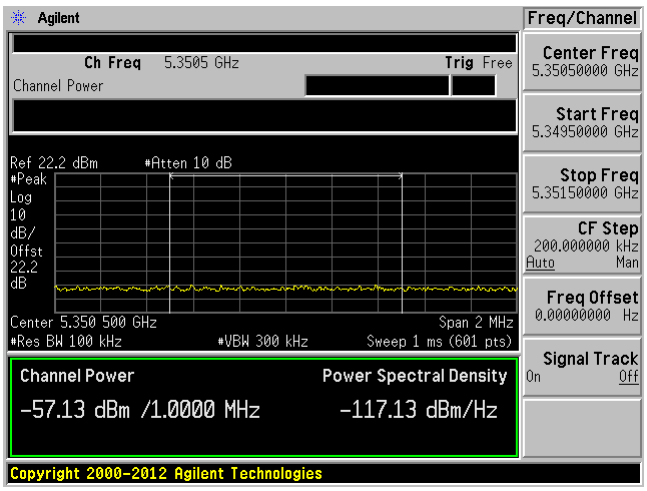


802.11ac20 mode (Port A MIMO)

Low Channel: 5180 MHz

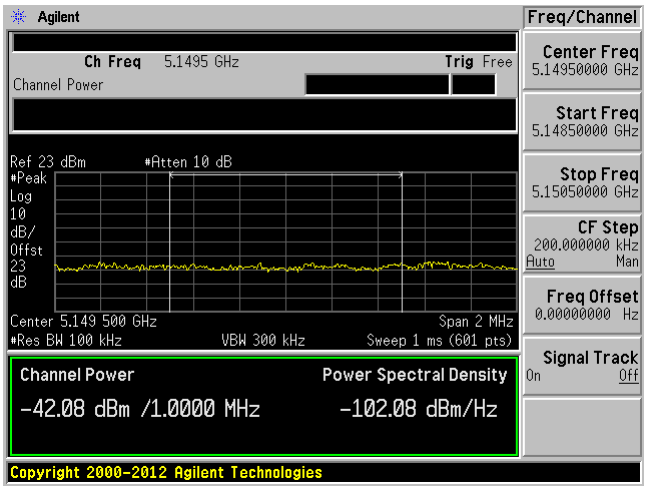


High channel: 5240 MHz

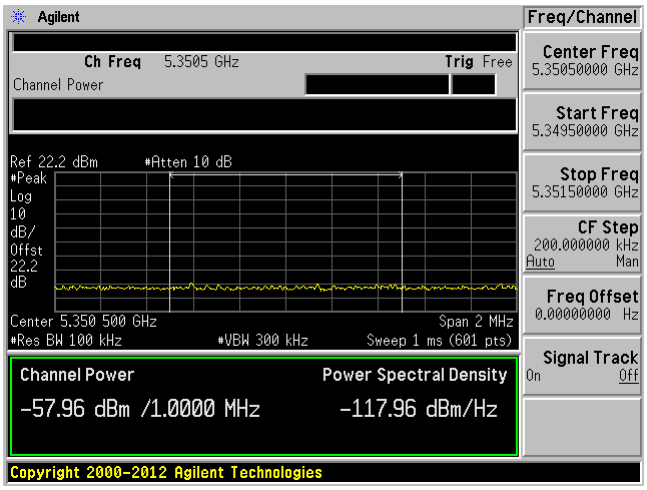


802.11ac20 mode (Port B)

Low Channel: 5180 MHz

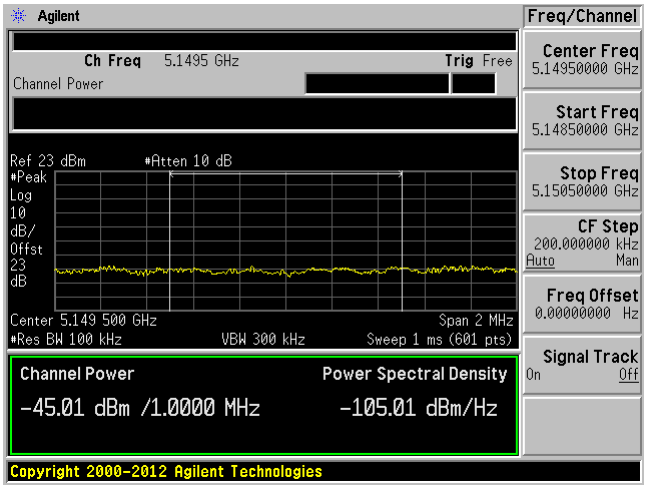


High channel: 5240 MHz

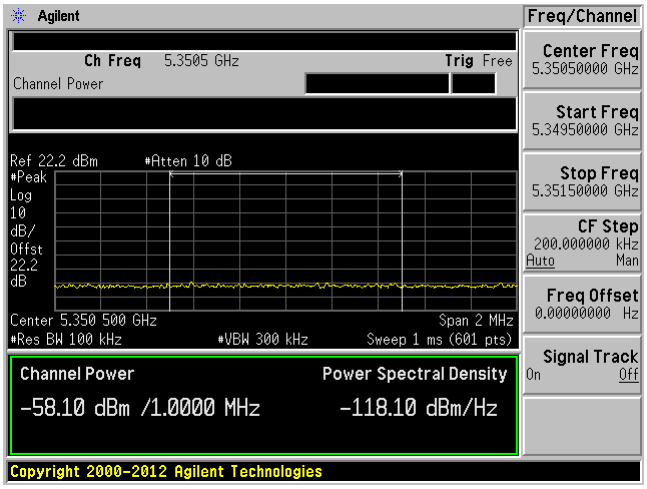


802.11ac20 mode (Port B MIMO)

Low Channel: 5180 MHz



High channel: 5240 MHz

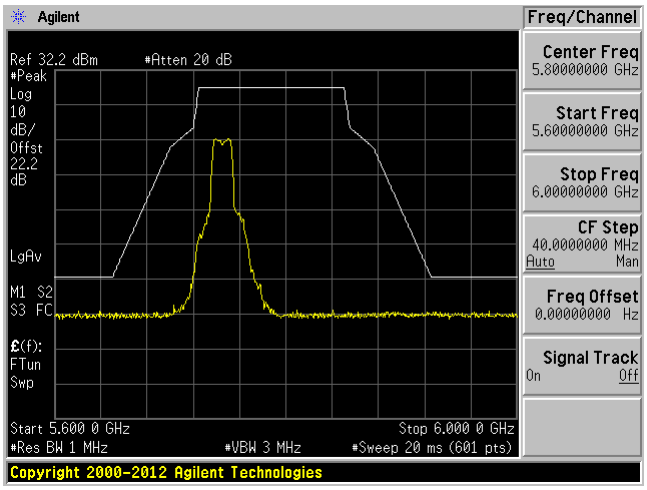


FCC Emission Mask

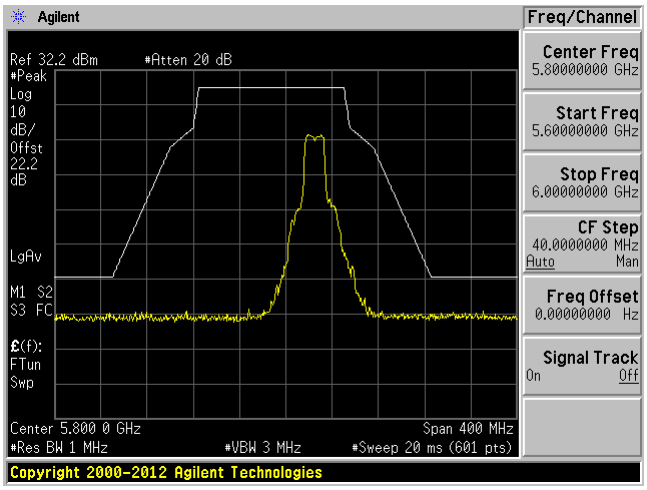
5725 - 5850 MHz

802.11a mode (Port A)

Low Channel: 5745 MHz

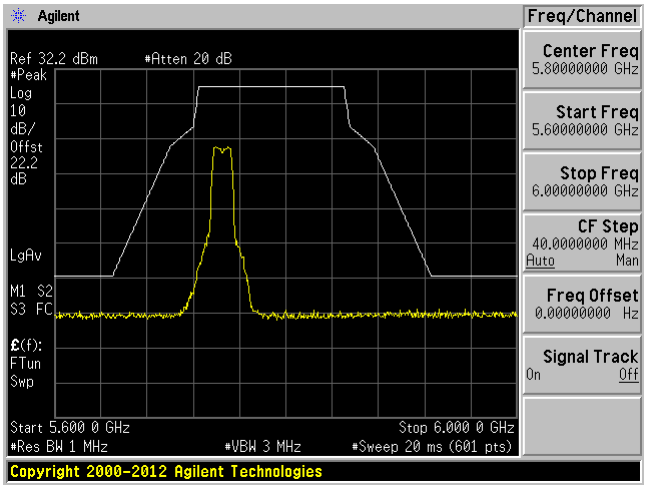


High Channel: 5825 MHz

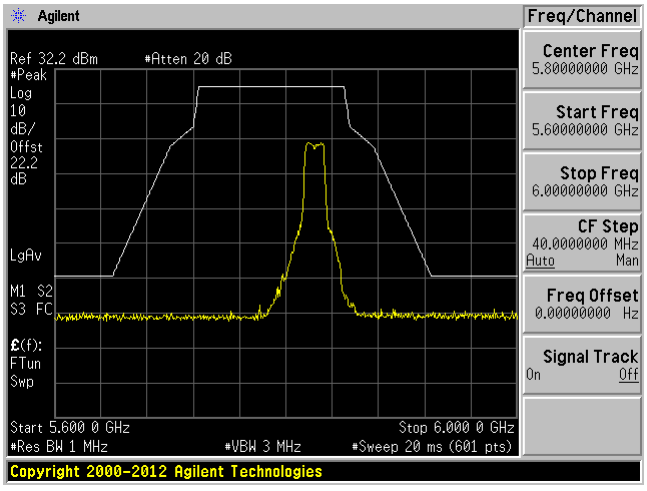


802.11a mode (Port B)

Low Channel: 5745 MHz

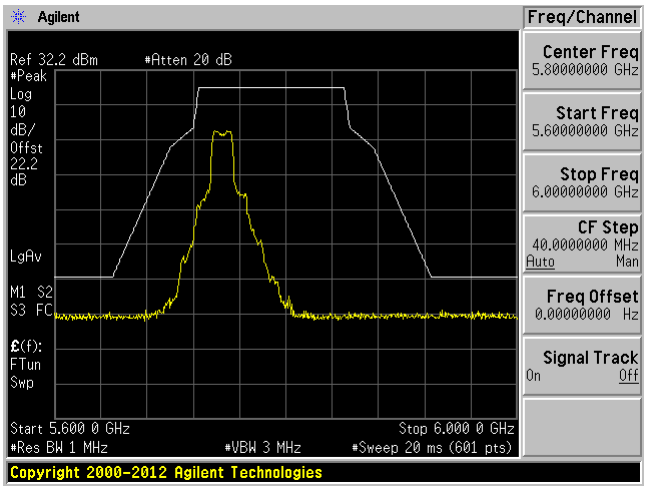


High channel: 5825 MHz

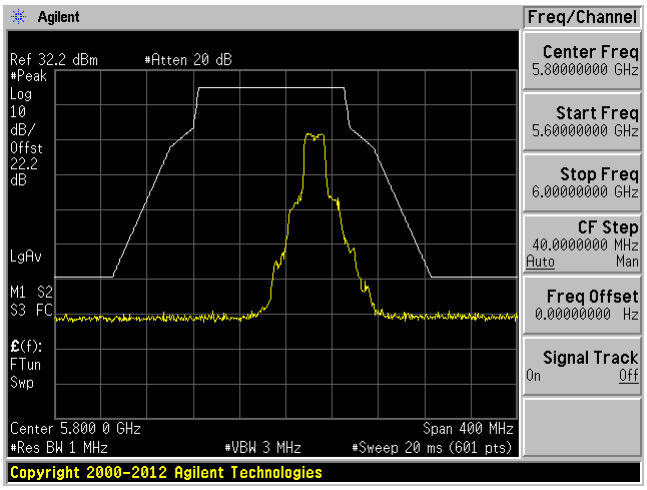


802.11n20 mode (Port A)

Low Channel: 5745 MHz

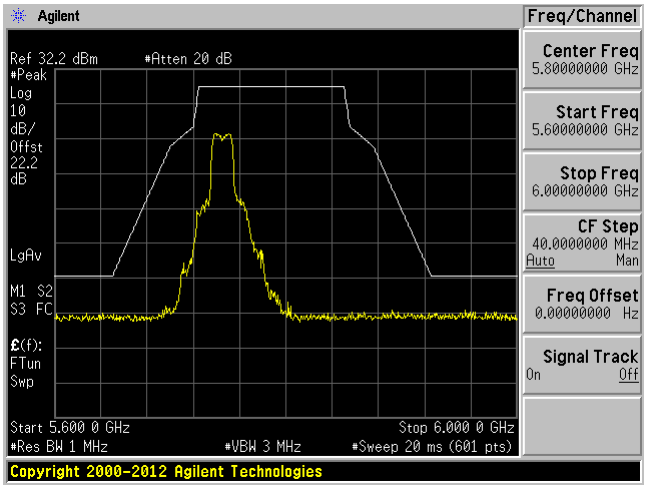


High Channel: 5825 MHz

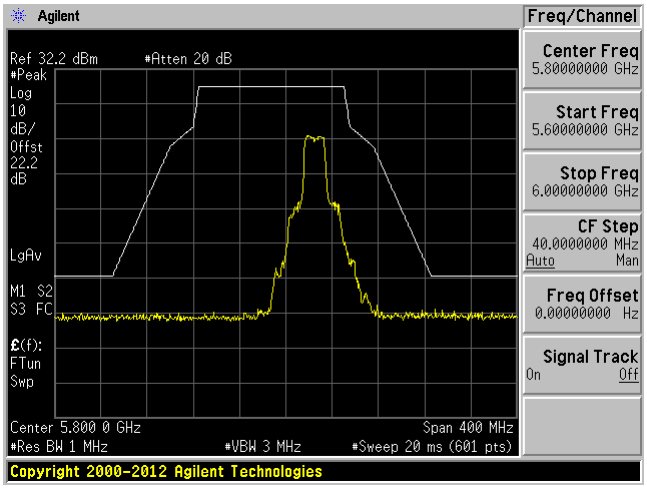


802.11n20 mode (Port A MIMO)

Low Channel: 5745 MHz

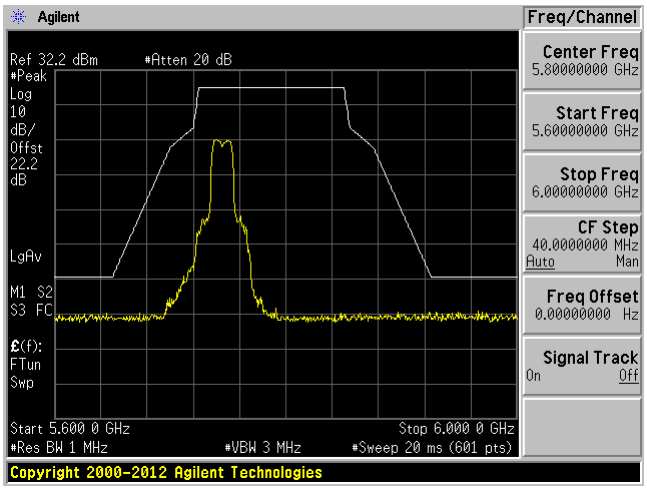


High channel: 5825 MHz

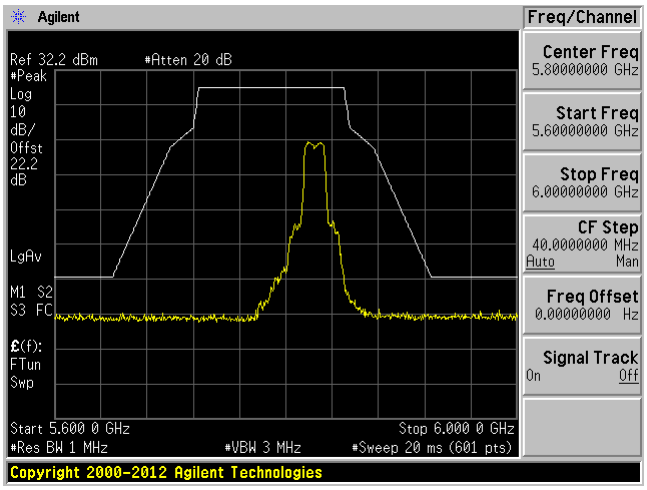


802.11n20 mode (Port B)

Low Channel: 5745 MHz

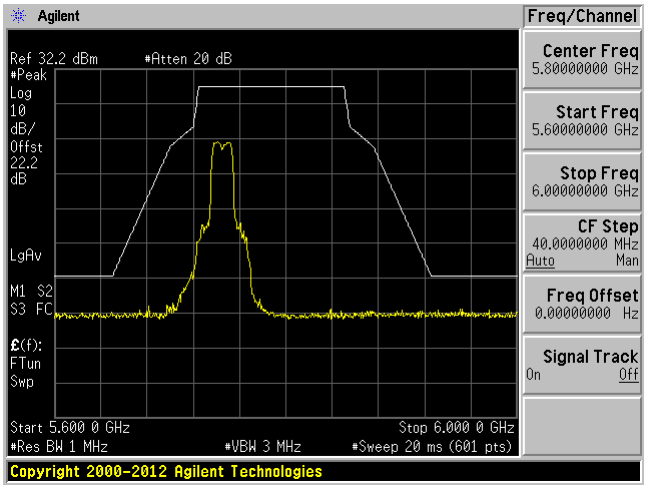


High Channel: 5825 MHz

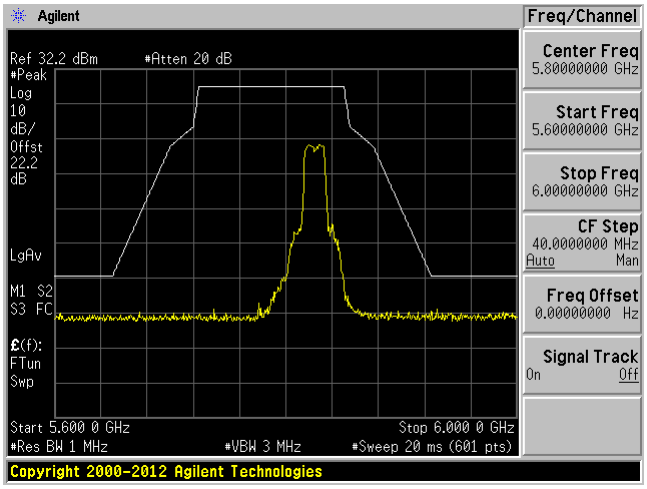


802.11n20 mode (Port B MIMO)

Low Channel: 5745 MHz

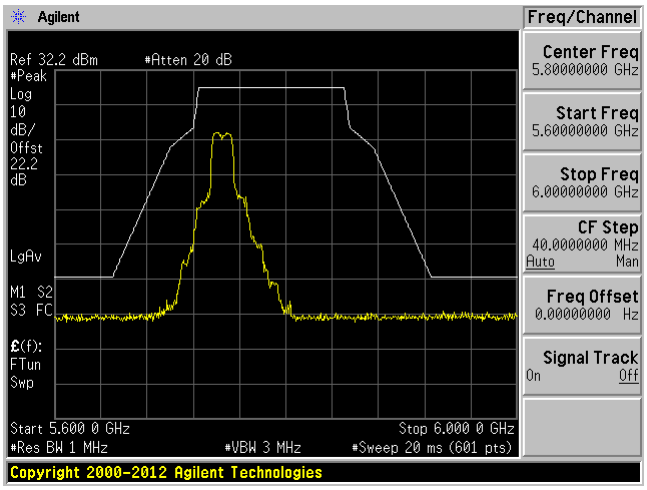


High channel: 5825 MHz

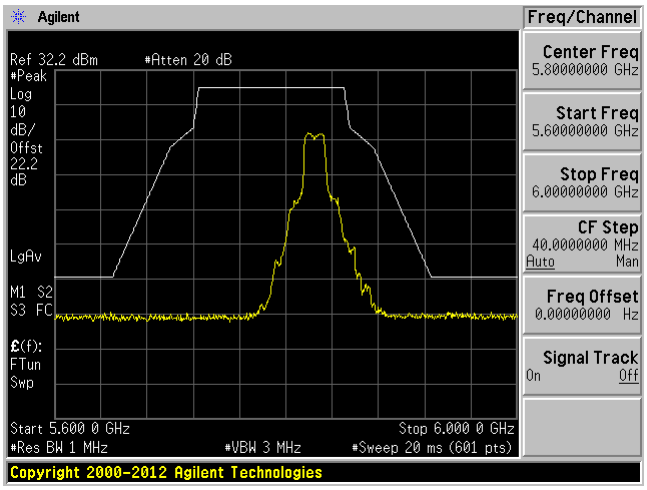


802.11ac20 mode (Port A)

Low Channel: 5745 MHz

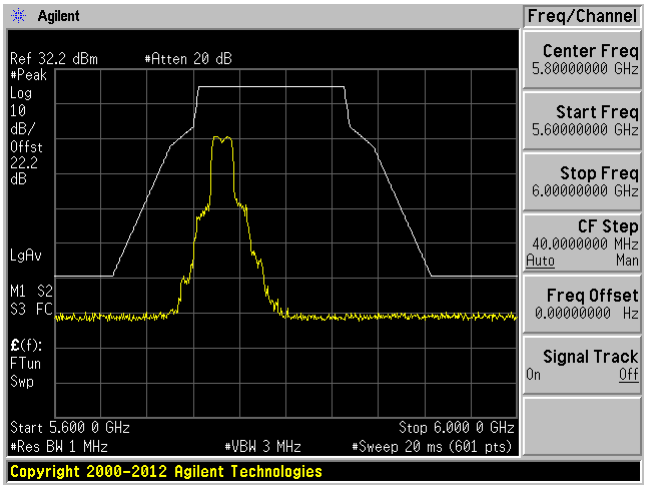


High Channel: 5825 MHz

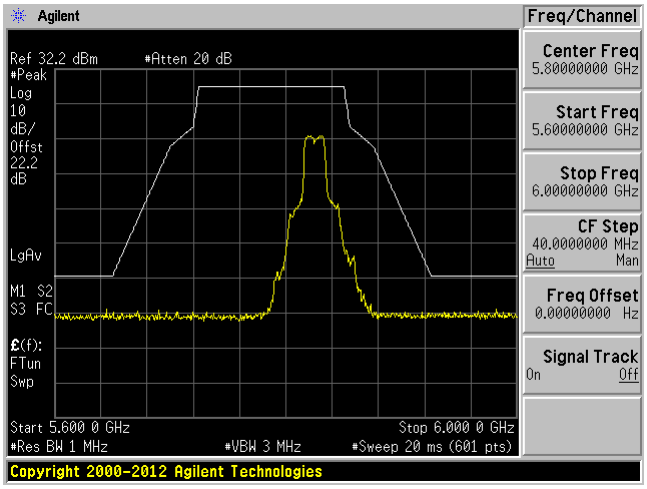


802.11ac20 mode (Port A MIMO)

Low Channel: 5745 MHz

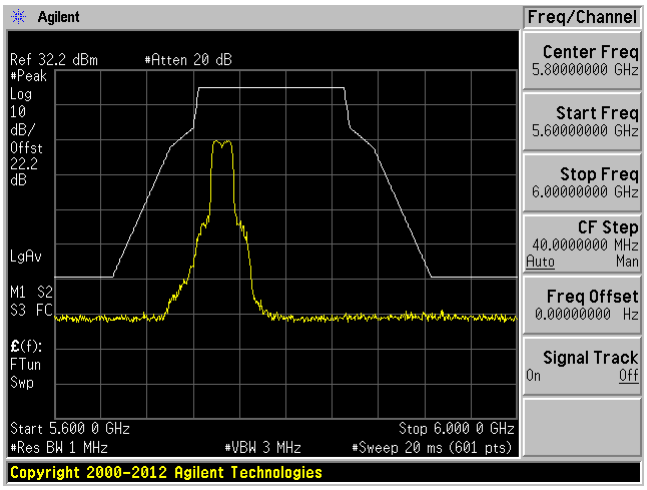


High channel: 5825 MHz

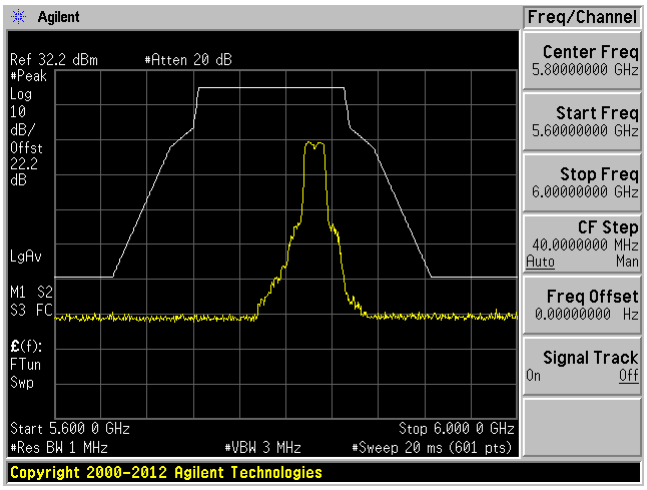


802.11ac20 mode (Port B)

Low Channel: 5745 MHz

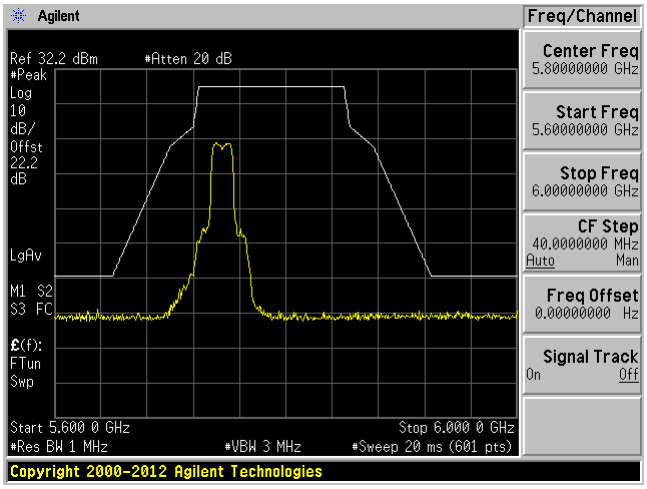


High Channel: 5825 MHz

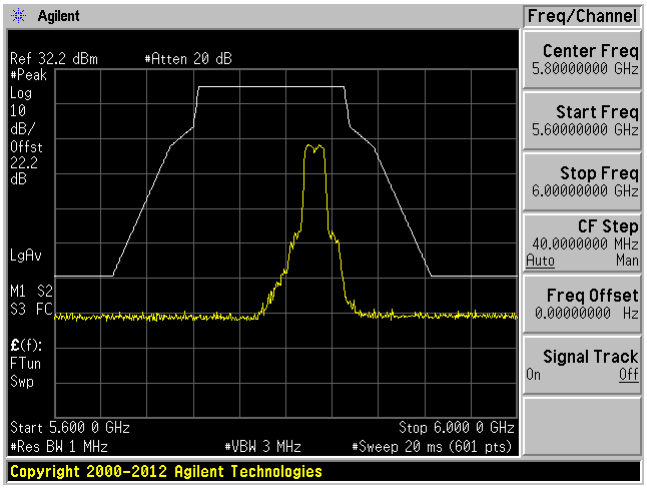


802.11ac20 mode (Port B MIMO)

Low Channel: 5745 MHz



High channel: 5825 MHz



12 Annex A (Informative) - A2LA Electrical Testing Certificate

Accredited Laboratory

A2LA has accredited

BAY AREA COMPLIANCE LABORATORIES CORP.

Sunnyvale, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of A2LA *R222 - Specific Requirements - EPA ENERGY STAR Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009*).

Presented this 30th day of August 2016.

Senior Director of Quality & Communications
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2018

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

--- END OF REPORT ---