

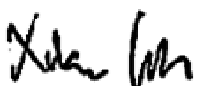


FCC PART 15.407
ISED C RSS-247, ISSUE 2, FEBRUARY 2017
TEST REPORT

For

GoPro, Inc.
3000 Clearview Way,
San Mateo, CA 94402, USA

FCC ID: CNFSPJB1
IC: 10193A-SPJB1

Report Type: Original Report	Product Type: Wireless Video Camera
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Report Number: R1903225-407	
Report Date: 2019-06-19	
Reviewed By: Xiao Lin RF Engineer	
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Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by A2LA*, NIST, or any agency of the Federal Government.

* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk “*” (Rev. 0)

TABLE OF CONTENTS

1	GENERAL DESCRIPTION.....	5
1.1	PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	5
1.2	OBJECTIVE.....	5
1.3	RELATED SUBMITTAL(S)/GRANT(S)	5
1.4	TEST METHODOLOGY	5
1.5	MEASUREMENT UNCERTAINTY	6
1.6	TEST FACILITY REGISTRATIONS	6
1.7	TEST FACILITY ACCREDITATIONS.....	6
2	EUT TEST CONFIGURATION.....	9
2.1	JUSTIFICATION.....	9
2.2	EUT EXERCISE SOFTWARE.....	9
2.3	DUTY CYCLE CORRECTION FACTOR.....	12
2.4	EQUIPMENT MODIFICATIONS	14
2.5	LOCAL SUPPORT EQUIPMENT	14
2.6	SUPPORT EQUIPMENT	14
2.7	INTERFACE PORTS AND CABLING	14
3	SUMMARY OF TEST RESULTS	15
4	FCC §2.1093, §15.407(F) & ISEDC RSS-102 - RF EXPOSURE.....	16
4.1	APPLICABLE STANDARD	16
4.2	TEST RESULTS	16
5	FCC §15.203 & ISEDC RSS-GEN §6.8 - ANTENNA REQUIREMENTS.....	17
5.1	APPLICABLE STANDARDS	17
5.2	ANTENNA LIST	18
6	FCC §15.207 & ISEDC RSS-GEN §8.8 - AC POWER LINE CONDUCTED EMISSIONS.....	19
6.1	APPLICABLE STANDARDS	19
6.2	TEST SETUP	19
6.3	TEST PROCEDURE	19
6.4	TEST SETUP BLOCK DIAGRAM.....	20
6.5	CORRECTED AMPLITUDE AND MARGIN CALCULATION	20
6.6	TEST EQUIPMENT LIST AND DETAILS	21
6.7	TEST ENVIRONMENTAL CONDITIONS.....	21
6.8	SUMMARY OF TEST RESULTS.....	21
6.9	CONDUCTED EMISSIONS TEST PLOTS AND DATA	22
7	FCC §15.209, §15.407(B) & ISEDC RSS-247 §6.2 - SPURIOUS RADIATED EMISSIONS	24
7.1	APPLICABLE STANDARD	24
7.2	TEST SETUP	26
7.3	TEST PROCEDURE	26
7.4	CORRECTED AMPLITUDE AND MARGIN CALCULATION	26
7.5	TEST EQUIPMENT LIST AND DETAILS	27
7.6	TEST ENVIRONMENTAL CONDITIONS.....	27
7.7	SUMMARY OF TEST RESULTS.....	28
7.8	RADIATED EMISSIONS TEST RESULT DATA	29
8	FCC §15.407(E) & ISEDC RSS-247 §6.2 - 6 DB, 26 DB, & 99% - OCCUPIED BANDWIDTH	42
8.1	APPLICABLE STANDARDS	42
8.2	MEASUREMENT PROCEDURE	42
8.3	TEST EQUIPMENT LIST AND DETAILS	42
8.4	TEST ENVIRONMENTAL CONDITIONS.....	42
8.5	TEST RESULTS	43

9 FCC §407(A) & ISEDC RSS-247 §6.2 - OUTPUT POWER..... 73

9.1 APPLICABLE STANDARDS 73

9.2 MEASUREMENT PROCEDURE 74

9.3 TEST EQUIPMENT LIST AND DETAILS 74

9.4 TEST ENVIRONMENTAL CONDITIONS..... 74

9.5 TEST RESULTS 75

10 FCC §15.407(A) & ISEDC RSS-247 §6.2 - POWER SPECTRAL DENSITY 80

10.1 APPLICABLE STANDARDS 80

10.2 MEASUREMENT PROCEDURE 81

10.3 TEST EQUIPMENT LIST AND DETAILS 81

10.4 TEST ENVIRONMENTAL CONDITIONS..... 82

10.5 TEST RESULTS 82

11 FCC §15.407(B) & ISEDC RSS-247 §6.2 - OUT OF BAND EMISSIONS..... 108

11.1 APPLICABLE STANDARDS 108

11.2 MEASUREMENT PROCEDURE 109

11.3 TEST EQUIPMENT LIST AND DETAILS 109

11.4 TEST ENVIRONMENTAL CONDITIONS..... 109

11.5 TEST RESULTS 110

12 APPENDIX A (NORMATIVE) – EUT TEST SETUP PHOTOGRAPHS..... 150

13 APPENDIX B (NORMATIVE) – EUT EXTERNAL PHOTOGRAPHS..... 151

14 APPENDIX C (NORMATIVE) – EUT INTERNAL PHOTOGRAPHS..... 152

15 APPENDIX D (NORMATIVE) - A2LA ELECTRICAL TESTING CERTIFICATE..... 153

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1903225-407	Original Report	2019-06-19

1 General Description

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *GoPro, Inc.*, and their product model: *SPJB1*, FCC ID: CNFSPJB1, IC: 10193A-SPJB1 or the “EUT” as referred to in this report. It is a Wireless video camera.

1.2 Objective

This report is prepared on behalf of GoPro, Inc in accordance with FCC CFR47 §15.407 and ISEDC RSS-247 Issue 2, February 2017.

The objective is to determine compliance with FCC Part 15.407 and ISEDC 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 DSS with FCC ID: CNFSPJB1, IC: 10193A-SPJB1
FCC Part 15, Subpart C, Equipment DTS with FCC ID: CNFSPJB1, IC: 10193A-SPJB1

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 ° 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 Efficient 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 & Fixed Radio Services;
 - 4 All Scope 4-Licensed Maritime & 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 & 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: (Innovation, Science and Economic development Canada - ISED) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
 - o BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
 - o NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
 - o EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
 - o Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
 - o Low Voltage Directive (LVD) 2014/35/EU
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Media Development Authority - IMDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
 - o ENERGY STAR Recognized Test Laboratory – US EPA
 - o Telecommunications Certification Body (TCB) – US FCC;
 - o Nationally Recognized Test Laboratory (NRTL) – US OSHA
- 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 software used was QRCT provided by *GoPro, 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 mode	36	5180	14.5
	40	5200	15
	48	5240	15
	52	5260	15
	56	5280	15
	64	5320	15
	100	5500	15
	116	5580	15
	140	5700	13.5
	144	5720	15
	149	5745	11.5
	157	5785	11.5
	165	5825	11.5

Modulation	Channel	Frequency (MHz)	Power Setting
802.11n20 mode	36	5180	14.5
	40	5200	15
	48	5240	15
	52	5260	15
	56	5280	15
	64	5320	15
	100	5500	13.5
	116	5580	13.5
	140	5700	13.5
	144	5720	13.5
	149	5745	11.5
	157	5785	11.5
	165	5825	11.5
802.11n40 mode	38	5190	12
	46	5230	15
	54	5270	15
	62	5310	11.5
	102	5510	15
	110	5550	15
	134	5670	15
	142	5710	15
	151	5755	11.5
	159	5795	11.5
802.11ac20 mode	36	5180	14.5
	40	5200	15
	48	5240	15
	52	5260	15
	56	5280	15
	64	5320	15
	100	5500	14.5
	116	5580	14.5
	140	5700	14.5
	144	5720	14.5
	149	5745	11.5
	157	5785	11.5
	165	5825	11.5

Modulation	Channel	Frequency (MHz)	Power Setting
802.11ac40 mode	38	5190	12
	46	5230	15
	54	5270	15
	62	5310	11.5
	102	5510	14
	110	5550	15
	134	5670	15
	142	5710	15
	151	5755	11.5
	159	5795	11.5
802.11ac80 mode	42	5210	11.5
	58	5290	10
	106	5530	12.5
	122*	5610	12.5
	138	5690	12.5
	155	5775	11.5

* Note: This is only an FCC channel.

*Data rates tested:

802.11a mode: 6Mbps

802.11n HT20: MCS0

802.11n HT40: MCS0

802.11ac VHT20: MCS0

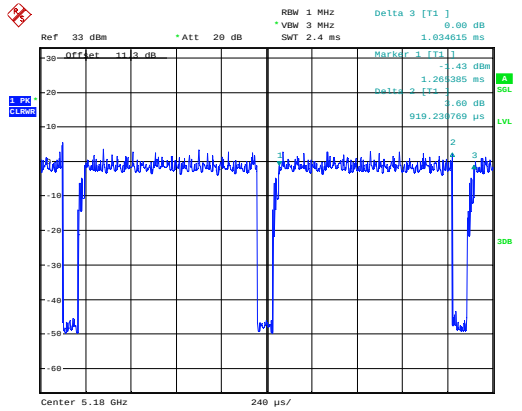
802.11ac VHT40: MCS0

802.11ac VHT80: MCS0

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.

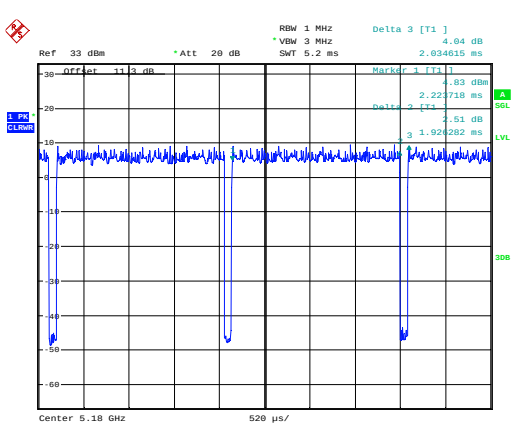
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802.11n40 mode



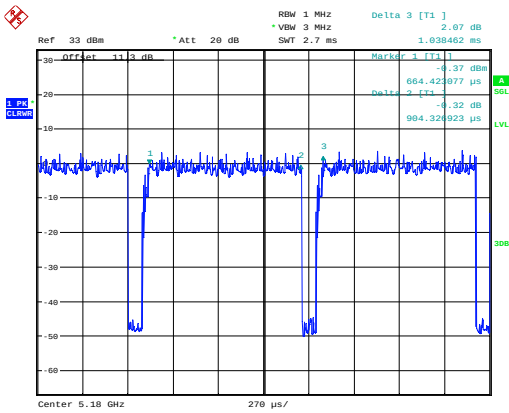
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802.11ac20 mode



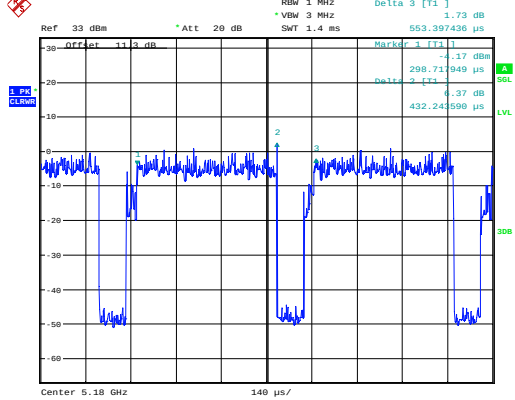
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802.11ac40 mode



Date: 16.APR.2019 12:02:21

802.11ac80 mode



Date: 16.APR.2019 12:04:07

2.4 Equipment Modifications

A hole was cut in the side of the EUT with a RF cable coming out to connect antenna ports to power spectrum analyzer.

2.5 Local Support Equipment

Manufacturer	Description	Model
Dell	Laptop	Latitude E7450

2.6 Support Equipment

There was no support equipment included, or intended for use with EUT during these tests.

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
USB Cable	< 1 m	Laptop	EUT
RF Cable	< 1 m	EUT	PSA

3 Summary of Test Results

FCC and ISEDC Rules	Description of Test	Result
FCC §2.1093, §15.407(f), ISEDC RSS-102	RF Exposure	Compliant ¹
FCC §15.203 ISEDC RSS-Gen §6.8	Antenna Requirement	Compliant
FCC §15.207 ISEDC RSS-Gen §8.8	AC Power Line Conducted Emissions	Compliant
FCC §2.1053, §15.205, §15.209, 15.407(b) ISEDC RSS-247 §6.2	Spurious Radiated Emissions	Compliant
FCC §15.407(e) ISEDC RSS-Gen §6.2	Emission Bandwidth	Compliant
FCC §407(a) ISEDC RSS-247 §6.2	Output Power	Compliant
FCC §2.1051, §15.407(b) ISEDC RSS-247 §6.2	Band Edges	Compliant
FCC §15.407(a) ISEDC RSS-247 §6.2	Power Spectral Density	Compliant
FCC §2.1051, §15.407(b) ISEDC RSS-247 §6.2	Spurious Emissions at Antenna Terminals	Compliant
FCC §15.407(h) ISEDC RSS-247 §6.3	Dynamic Frequency Selection (DFS)	Compliant ²

Note¹: RF exposure analysis is recorded in a separate report.

Note²: DFS measurement is recorded in a separate report.

4 FCC §2.1093, §15.407(f) & ISED RSS-102 - RF Exposure

4.1 Applicable Standard

FCC §2.1093, §15.407(f) and ISED RSS-102

4.2 Test Results

Please refer to the SAR Report: R1903225- SAR.

5 FCC §15.203 & ISEDC RSS-Gen §6.8 - 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 ISEDC RSS-Gen §6.8: Transmitter Antenna

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

5.2 Antenna List

The antennas used by the EUT are permanent attached antennas.

Antenna usage	Frequency Range (MHz)	Maximum Antenna Gain (dBi)
2.4GHz Wi-Fi/Bluetooth	2400	-0.6
2.4GHz Wi-Fi/Bluetooth	2442	0.1
2.4GHz Wi-Fi/Bluetooth	2484	0.4
5GHz Wi-Fi	5180	2.5
5GHz Wi-Fi	5260	1.7
5GHz Wi-Fi	5510	2.5
5GHz Wi-Fi	5785	2.2

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

6.1 Applicable Standards

As per FCC §15.207 and ISEDC 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 μ H/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 ISEDC 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.

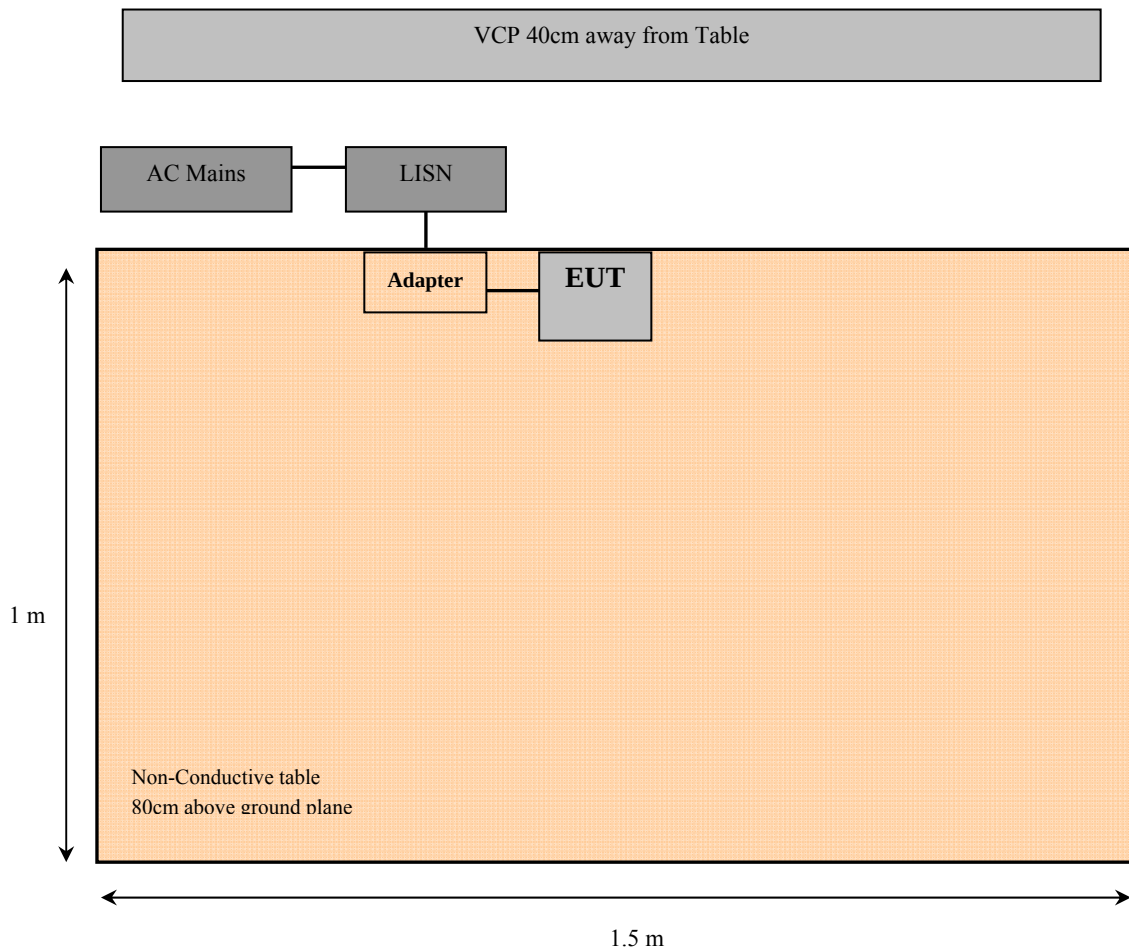
6.3 Test Procedure

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:

$$CA = A_i + CL + \text{Atten}$$

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:

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde and Schwarz	Receiver, EMI Test	ESCI 1166.5950.03	100338	2018-07-05	2 years
Rohde and Schwarz	Impulse Limiter	ESH3-Z2	101964	2018-07-27	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150204	2019-02-25	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	N/R	N/A
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160129	2019-04-11	1 year
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

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:	23° C
Relative Humidity:	42 %
ATM Pressure:	101.31 kPa

The testing was performed by Giovanni Munoz on 2019-05-02 at chamber 5m 3 test site.

6.8 Summary of Test Results

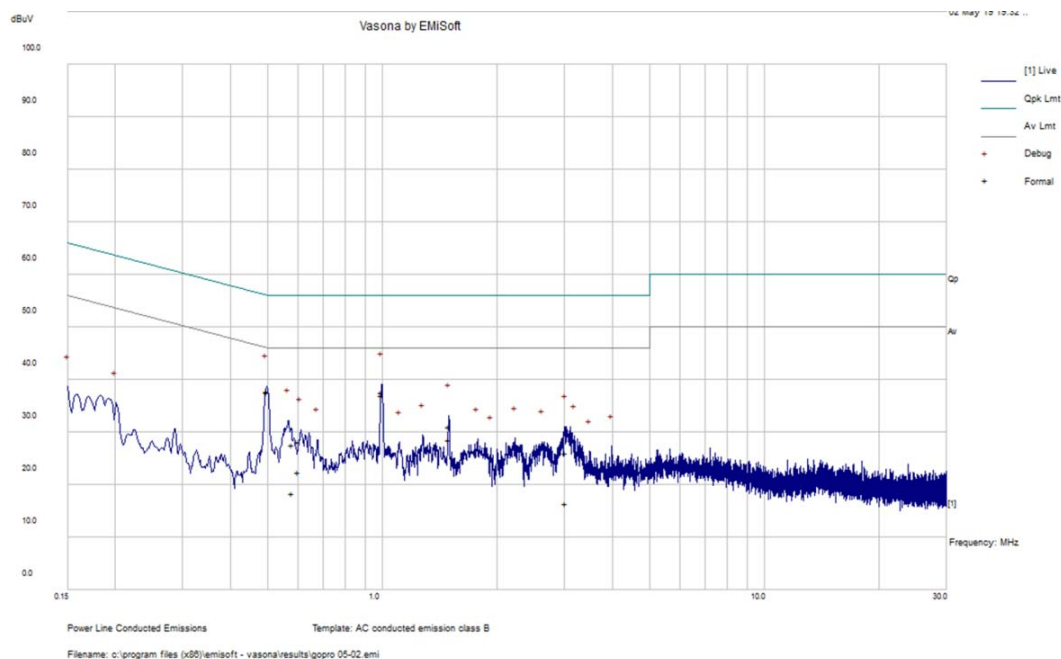
According to the recorded data in following table, the EUT complied with the FCC Part 15 and RSS-Gen standards conducted emissions limits, with the margin reading of:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	Frequency (MHz)	Conductor Mode (Live/Neutral)	Range (MHz)
-8.49	0.497973	Live	0.15-30

6.9 Conducted Emissions Test Plots and Data

Note: testing was prefomed at worst case.

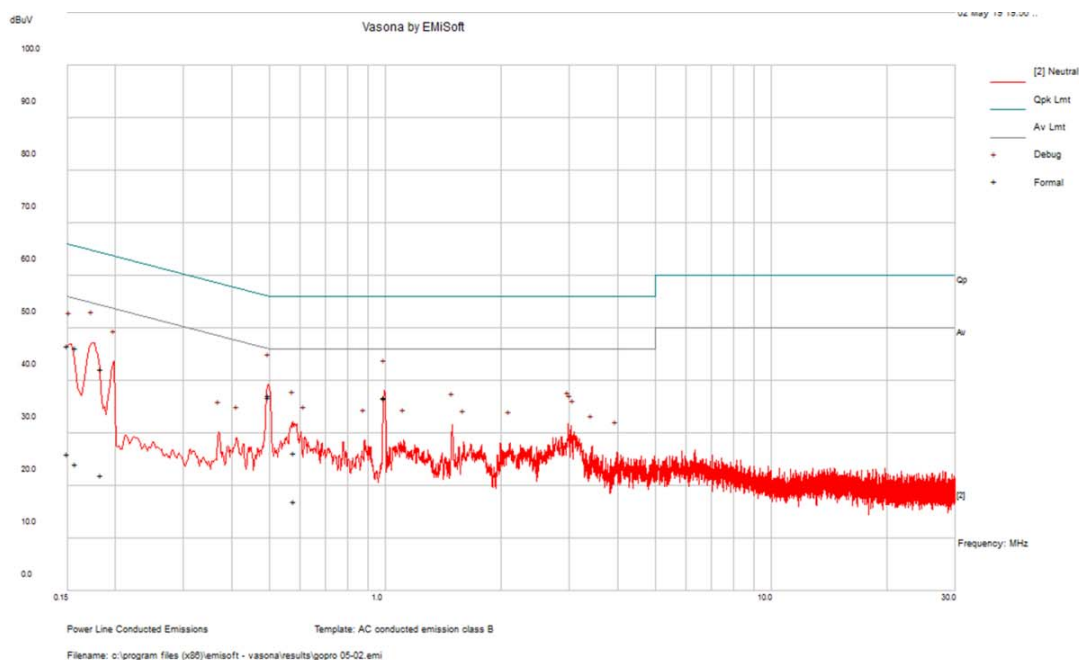
120 V, 60 Hz – Line



Frequency (MHz)	Corrected Amplitude (dBμV)	Conductor (Line/Neutral)	Limit (dBμV)	Margin (dB)	Detector (QP/Ave.)
0.994795	37.63	Line	56	-18.37	QP
0.497973	37.78	Line	56.03	-18.25	QP
1.493862	31.09	Line	56	-24.91	QP
0.582146	27.71	Line	56	-28.29	QP
3.017555	26.02	Line	56	-29.98	QP
0.600771	28.16	Line	56	-27.84	QP

Frequency (MHz)	Corrected Amplitude (dBμV)	Conductor (Line/Neutral)	Limit (dBμV)	Margin (dB)	Detector (QP/Ave.)
0.994795	37.07	Line	46	-8.93	Ave.
0.497973	37.55	Line	46.03	-8.49	Ave.
1.493862	28.57	Line	46	-17.43	Ave.
0.582146	18.39	Line	46	-27.61	Ave.
3.017555	16.39	Line	46	-29.61	Ave.
0.600771	22.43	Line	46	-23.57	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Corrected Amplitude (dBμV)	Conductor (Line/Neutral)	Limit (dBμV)	Margin (dB)	Detector (QP/Ave.)
0.498237	37.2	Neutral	56.03	-18.83	QP
0.157728	46.37	Neutral	65.58	-19.22	QP
0.993542	36.77	Neutral	56	-19.23	QP
0.150084	46.66	Neutral	66	-19.33	QP
0.183545	42.19	Neutral	64.32	-22.13	QP
0.581022	26.27	Neutral	56	-29.73	QP

Frequency (MHz)	Corrected Amplitude (dBμV)	Conductor (Line/Neutral)	Limit (dBμV)	Margin (dB)	Detector (QP/Ave.)
0.498237	36.89	Neutral	46.03	-9.14	Ave.
0.157728	24.14	Neutral	55.58	-31.44	Ave.
0.993542	36.7	Neutral	46	-9.3	Ave.
0.150084	26.05	Neutral	56	-29.94	Ave.
0.183545	22.08	Neutral	54.32	-32.24	Ave.
0.581022	17	Neutral	46	-29	Ave.

7 FCC §15.209, §15.407(b) & ISEDC 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 5.47-5.725 GHz band shall not exceed an e.i.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 not 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 ISERC 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 ISEDC 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:

$$RBW = 100 \text{ kHz} / VBW = 300 \text{ kHz} / \text{Sweep} = \text{Auto}$$

Above 1000 MHz:

- (1) Peak: $RBW = 1\text{MHz} / VBW = 3\text{MHz} / \text{Sweep} = 100\text{ms}$
- (2) Average: $RBW = 1\text{MHz} / VBW = 10\text{Hz} / \text{Sweep} = \text{Auto}$

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:

$$CA = Ai + AF + CL + \text{Atten} - Ga$$

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:

$$\text{Margin} = \text{Corrected Amplitude} - \text{Limit}$$

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	100044	2018-10-26	2 years
Agilent	Analyzer, Spectrum	E4446A	MY48250238	2018-05-08	1 year
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
Sunol Sciences	Antenna, Biconi-Log	JB1	A013105-3	2018-02-26	2 years
Agilent	Amplifier, Pre	8447D	2944A10187	2019-04-11	1 year
IW	AOBOR Hi frequency Co AX Cable	KPS-1501A3960KPS	DC 1917	2019-05-08	1 Year
UTiFLEX	High Frequency Cable	-	223458-003	2018-09-05	1 year
UTiFLEX	High Frequency Cable	-	223458-002	2018-09-05	1 year
-	N-Type Cable	-	C00014	Each time ¹	N/A
Agilent	Pre-Amplifier	8449B	3147A00400	2019-02-02	1 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2019-04-22	2 years
A.H. Systems	Pre-Amplifier	PAM 1840V	170	2018-09-10	1 year
Wisewave	Antenna, Horn	ARH-2823-02	10555-02	2017-12-15	2 years
Wisewave	Antenna, Horn	ARH-4223-02	10555-01	2018-02-14	2 years
A.R.A.	Antenna, Horn	DRG-118/A	1132	2018-02-13	2 years
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

Note¹: 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 °C
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

The testing was performed by Christian McCaig on 2019-04-22 to 2019-05-16 in 5m chamber 3.

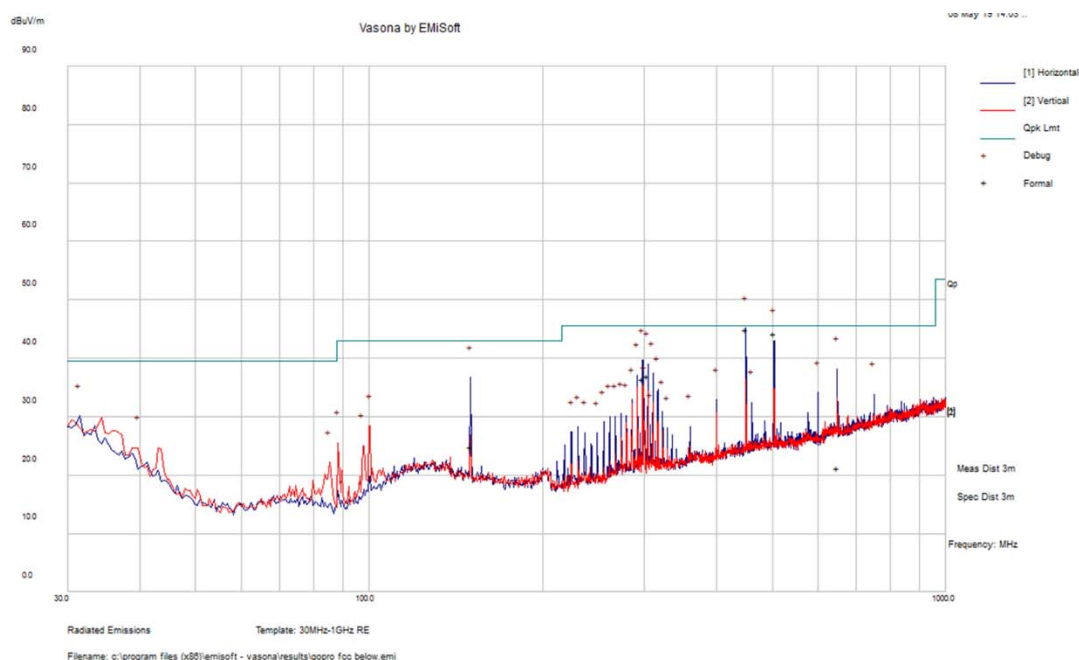
7.7 Summary of Test Results

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
-0.26	5150	Vertical	802.11ac40 mode, 5190 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.)
450.023	44.96	193	H	60	45.5	-0.54	QP
503.9875	44.24	168	H	49	45.5	-1.26	QP
297.97	36.5	160	H	11	45.5	-9	QP
149.98825	24.88	140	H	203	43	-18.12	QP
304.1535	37.03	169	H	9	45.5	-8.47	QP
648.53475	21.23	140	H	247	45.5	-24.27	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											
5150	58.92	84	213	H	33.55	8.96	35.67	65.76	74.00	-8.24	PK
5150	33.93	84	213	H	33.55	8.96	35.67	40.77	54.00	-13.23	AV
5150	66.79	318	118	V	33.46	8.96	35.67	73.54	74.00	-0.46	PK
5150	38.88	318	118	V	33.46	8.96	35.67	45.63	54.00	-8.37	AV
10360	44.92	0	100	V	38.13	21.15	34.93	69.26	84.00	-14.74	PK
10360	30.15	0	100	V	38.13	21.15	34.93	54.49	64.00	-9.51	AV
Middle Channel 5200 MHz											
10400	44.03	0	100	H	38.17	21.15	34.93	68.42	84.00	-15.59	PK
10400	29.51	0	100	H	38.17	21.15	34.93	53.90	64.00	-10.11	AV
10400	44.25	0	100	V	38.13	21.15	34.93	68.59	84.00	-15.41	PK
10400	29.69	0	100	V	38.13	21.15	34.93	54.03	64.00	-9.97	AV
High Channel 5240 MHz											
10480	43.59	0	100	H	38.17	21.15	34.93	67.98	84.00	-16.03	PK
10480	30.39	0	100	H	38.17	21.15	34.93	54.78	64.00	-9.23	AV
10480	44.50	0	100	V	38.13	21.15	34.93	68.84	84.00	-15.16	PK
10480	30.36	0	100	V	38.13	21.15	34.93	54.70	64.00	-9.30	AV

802.11 ac40 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 5190 MHz											
5150	60.80	122	133	H	33.55	8.96	35.67	67.64	74.00	-6.36	PK
5150	37.24	122	133	H	33.55	8.96	35.67	44.08	54.00	-9.92	AV
5150	66.99	321	116	V	33.46	8.96	35.67	73.74	74.00	-0.26	PK
5150	41.95	321	116	V	33.46	8.96	35.67	48.70	54.00	-5.30	AV
10380	44.32	0	100	V	38.13	21.15	34.93	68.66	84.00	-15.34	PK
10380	31.09	0	100	V	38.13	21.15	34.93	55.43	64.00	-8.57	AV
High Channel 5230 MHz											
10460	44.56	0	100	H	38.17	21.15	34.93	68.95	84.00	-15.06	PK
10460	31.22	0	100	H	38.17	21.15	34.93	55.61	64.00	-8.39	AV
10460	44.97	0	100	V	38.13	21.15	34.93	69.31	84.00	-14.69	PK
10460	31.11	0	100	V	38.13	21.15	34.93	55.45	64.00	-8.55	AV

802.11ac80 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)	
5210 MHz											
5150	53.62	120	160	H	33.55	8.96	35.67	60.46	74.00	-13.54	PK
5150	36.38	120	160	H	33.55	8.96	35.67	43.22	54.00	-10.78	AV
5150	61.11	319	116	V	33.46	8.96	35.67	67.86	74.00	-6.14	PK
5150	43.17	319	116	V	33.46	8.96	35.67	49.92	54.00	-4.08	AV
10420	43.85	0	100	V	38.13	21.15	34.93	68.19	84.00	-15.81	PK
10420	31.47	0	100	V	38.13	21.15	34.93	55.81	64.00	-8.19	AV

5250 - 5350 MHz

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 5260 MHz											
10520	43.09	0	100	H	38.26	21.26	34.81	67.34	84.00	-16.66	PK
10520	29.58	0	100	H	38.26	21.26	34.81	54.28	64.00	-9.72	AV
10520	42.71	0	100	V	38.23	21.26	34.81	67.65	84.00	-16.35	PK
10520	29.37	0	100	V	38.23	21.26	34.81	54.08	64.00	-9.92	AV
Middle Channel 5280 MHz											
10560	43.75	0	100	H	38.26	21.26	34.81	68.46	84.00	-15.54	PK
10560	29.66	0	100	H	38.26	21.26	34.81	54.37	64.00	-9.63	AV
10560	43.40	0	100	V	38.23	21.26	34.81	68.08	84.00	-15.92	PK
10560	29.71	0	100	V	38.23	21.26	34.81	54.39	64.00	-9.61	AV
High Channel 5320 MHz											
5350	59.24	27	195	H	33.69	8.98	34.81	67.09	74.00	-6.91	PK
5350	34.22	27	195	H	33.69	8.98	34.81	42.07	54.00	-11.93	AV
5350	65.45	318	129	V	33.60	8.98	34.81	73.22	74.00	-0.78	PK
5350	38.32	318	129	V	33.60	8.98	34.81	46.09	54.00	-7.91	AV
10640	43.82	0	100	V	38.23	21.26	34.81	68.50	84.00	-15.50	PK
10640	29.79	0	100	V	38.23	21.26	34.81	54.47	64.00	-9.53	AV

802.11ac40 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 5270 MHz											
10540	43.42	0	100	H	38.26	21.26	34.81	68.13	84.00	-15.87	PK
10540	29.81	0	100	H	38.26	21.26	34.81	54.52	64.00	-9.48	AV
10540	44.07	0	100	V	38.23	21.26	34.81	68.75	84.00	-15.25	PK
10540	29.98	0	100	V	38.23	21.26	34.81	54.66	64.00	-9.34	AV
High Channel 5310 MHz											
5350	58.86	287	124	H	33.69	8.98	34.81	66.71	74.00	-7.29	PK
5350	35.33	287	124	H	33.69	8.98	34.81	43.18	54.00	-10.82	AV
5350	65.33	309	126	V	33.60	8.98	34.81	73.10	74.00	-0.90	PK
5350	40.05	309	126	V	33.60	8.98	34.81	47.82	54.00	-6.18	AV
10620	44.02	0	100	V	38.23	21.26	34.81	68.70	84.00	-15.30	PK
10620	29.88	0	100	V	38.23	21.26	34.81	54.56	64.00	-9.44	AV

802.11ac80 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)	
5290 MHz											
5350	53.19	263	125	H	33.69	8.98	34.81	61.04	74.00	-12.96	PK
5350	35.28	263	125	H	33.69	8.98	34.81	43.13	54.00	-10.87	AV
5350	59.46	328	125	V	33.60	8.98	34.81	67.23	74.00	-6.77	PK
5350	40.60	328	125	V	33.60	8.98	34.81	48.37	54.00	-5.63	AV
10580	44.86	0	100	V	38.23	21.26	34.81	69.54	84.00	-14.46	PK
10580	29.76	0	100	V	38.23	21.26	34.81	54.44	64.00	-9.56	AV

5470 - 5725 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 5500 MHz											
5470	55.36	113	108	H	33.78	14.15	35.45	67.84	74.00	-6.16	PK
5470	33.23	113	108	H	33.78	14.15	35.45	45.71	54.00	-8.29	AV
5470	60.09	151	147	V	33.79	14.15	35.45	72.58	74.00	-1.42	PK
5470	35.56	151	147	V	33.79	14.15	35.45	48.05	54.00	-5.95	AV
11000	42.91	0	100	V	38.42	21.90	34.61	68.62	84.00	-15.38	PK
11000	29.27	0	100	V	38.42	21.90	34.61	54.98	64.00	-9.02	AV
Middle Channel 5580 MHz											
11160	43.53	0	100	H	38.45	21.90	34.61	69.27	84.00	-14.73	PK
11160	29.07	0	100	H	38.45	21.90	34.61	54.81	64.00	-9.19	AV
11160	42.35	0	100	V	38.42	21.90	34.61	68.06	84.00	-15.94	PK
11160	29.03	0	100	V	38.42	21.90	34.61	54.74	64.00	-9.26	AV
5700 MHz											
5725	56.23	111	100	H	34.05	14.19	35.47	69.00	74.00	-5.00	PK
5725	34.17	111	100	H	34.05	14.19	35.47	46.94	54.00	-7.06	AV
5725	60.66	164	128	V	34.02	14.19	35.47	73.40	74.00	-0.60	PK
5725	36.48	164	128	V	34.02	14.19	35.47	49.22	54.00	-4.78	AV
11400	42.89	0	100	V	38.42	21.90	34.61	68.60	84.00	-15.40	PK
11400	29.19	0	100	V	38.42	21.90	34.61	54.90	64.00	-9.10	AV
High Channel 5720 MHz											
11440	43.44	0	100	H	38.45	21.90	34.61	69.18	84.00	-14.82	PK
11440	29.17	0	100	H	38.45	21.90	34.61	54.91	64.00	-9.09	AV
11440	43.52	0	100	V	38.42	21.90	34.61	69.23	84.00	-14.77	PK
11440	29.21	0	100	V	38.42	21.90	34.61	54.92	64.00	-9.08	AV

802.11n40 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 5510 MHz											
5470	56.20	104	100	H	33.78	14.15	35.45	68.68	74.00	-5.32	PK
5470	36.96	104	100	H	33.78	14.15	35.45	49.44	54.00	-4.56	AV
5470	60.89	143	150	V	33.79	14.15	35.45	73.38	74.00	-0.62	PK
5470	40.56	143	150	V	33.79	14.15	35.45	53.05	54.00	-0.95	AV
11020	43.93	0	100	V	38.42	21.90	34.61	69.64	84.00	-14.36	PK
11020	29.34	0	100	V	38.42	21.90	34.61	55.05	64.00	-8.95	AV
Middle Channel 5550 MHz											
11100	42.71	0	100	H	38.45	21.90	34.61	68.45	84.00	-15.55	PK
11100	29.13	0	100	H	38.45	21.90	34.61	54.87	64.00	-9.13	AV
11100	43.09	0	100	V	38.42	21.90	34.61	68.80	84.00	-15.20	PK
11100	29.22	0	100	V	38.42	21.90	34.61	54.93	64.00	-9.07	AV
5670 MHz											
5725	49.01	114	100	H	34.05	14.19	35.47	61.78	74.00	-12.22	PK
5725	34.17	114	100	H	34.05	14.19	35.47	46.94	54.00	-7.06	AV
5725	54.54	151	136	V	34.02	14.19	35.47	67.28	74.00	-6.72	PK
5725	38.17	151	136	V	34.02	14.19	35.47	50.91	54.00	-3.09	AV
11340	42.92	0	100	V	38.42	21.90	34.61	68.63	84.00	-15.37	PK
11340	29.20	0	100	V	38.42	21.90	34.61	54.91	64.00	-9.09	AV
High Channel 5710 MHz											
11420	42.95	0	100	H	38.45	21.90	34.61	68.69	84.00	-15.31	PK
11420	29.23	0	100	H	38.45	21.90	34.61	54.97	64.00	-9.03	AV
11420	43.15	0	100	V	38.42	21.90	34.61	68.86	84.00	-15.14	PK
11420	29.01	0	100	V	38.42	21.90	34.61	54.72	64.00	-9.28	AV

802.11ac80 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: 5530 MHz											
5470	52.19	100	117	H	33.78	14.15	35.45	64.67	74.00	-9.33	PK
5470	37.73	100	117	H	33.78	14.15	35.45	50.21	54.00	-3.79	AV
5470	55.67	142	130	V	33.79	14.15	35.45	68.16	74.00	-5.84	PK
5470	41.05	142	130	V	33.79	14.15	35.45	53.54	54.00	-0.46	AV
11060	43.10	0	100	V	38.42	21.90	34.61	68.81	84.00	-15.19	PK
11060	29.78	0	100	V	38.42	21.90	34.61	55.49	64.00	-8.51	AV
Middle Channel: 5610 MHz											
5725	47.33	113	100	H	34.05	14.19	35.47	60.10	74.00	-13.90	PK
5725	33.73	113	100	H	34.05	14.19	35.47	46.50	54.00	-7.50	AV
5725	52.25	164	100	V	34.02	14.19	35.47	64.99	74.00	-9.01	PK
5725	37.00	164	100	V	34.02	14.19	35.47	49.74	54.00	-4.26	AV
11220	43.02	0	100	V	38.42	21.90	34.61	68.73	84.00	-15.27	PK
11220	29.91	0	100	V	38.42	21.90	34.61	55.62	64.00	-8.38	AV
High Channel: 5690 MHz											
11380	42.98	0	100	H	38.45	21.90	34.61	68.72	84.00	-15.28	PK
11380	29.39	0	100	H	38.45	21.90	34.61	55.13	64.00	-8.87	AV
11380	43.21	0	100	V	38.42	21.90	34.61	68.92	84.00	-15.08	PK
11380	29.54	0	100	V	38.42	21.90	34.61	55.25	64.00	-8.75	AV

5725 - 5850 MHz

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											
5725	56.08	205	134	H	34.05	14.24	35.47	68.90	122.26	-53.36	PK
5725	35.01	205	134	H	34.05	14.24	35.47	47.83	122.26	-74.43	AV
5725	61.03	348	123	V	34.02	14.24	35.47	73.82	122.26	-48.44	PK
5725	39.14	348	123	V	34.02	14.24	35.47	51.93	122.26	-70.33	AV
5650	44.56	343	122	V	34.02	14.24	35.47	57.35	74.00	-16.65	PK
5650	31.09	343	122	V	34.02	14.24	35.47	43.88	54.00	-10.12	AV
11490	43.39	0	100	H	38.44	22.58	34.36	70.06	84.00	-13.94	PK
11490	30.59	0	100	H	38.44	22.58	34.36	57.26	64.00	-6.74	AV
11490	42.16	0	100	V	38.43	22.58	34.36	68.81	84.00	-15.19	PK
11490	32.00	0	100	V	38.43	22.58	34.36	58.65	64.00	-5.35	AV
Middle Channel 5785 MHz											
11570	44.19	0	100	H	38.45	22.58	34.61	70.61	84.00	-13.39	PK
11570	29.34	0	100	H	38.45	22.58	34.61	55.76	64.00	-8.24	AV
11570	43.22	0	100	V	38.42	22.58	34.61	69.61	84.00	-14.39	PK
11570	31.56	0	100	V	38.42	22.58	34.61	57.95	64.00	-6.05	AV
High Channel 5825 MHz											
5850	51.22	203	113	H	34.05	14.24	35.47	64.04	122.26	-58.22	PK
5850	31.27	203	113	H	34.05	14.24	35.47	44.09	122.26	-78.17	AV
5850	55.12	337	137	V	34.02	14.24	35.47	67.91	122.26	-54.35	PK
5850	31.95	337	137	V	34.02	14.24	35.47	44.74	122.26	-77.52	AV
5925	44.61	345	120	V	34.02	14.24	35.47	57.40	74.00	-16.60	PK
5925	31.05	345	120	V	34.02	14.24	35.47	43.84	54.00	-10.16	AV
11650	43.24	0	100	H	38.44	22.58	34.36	69.91	84.00	-14.09	PK
11650	31.65	0	100	H	38.44	22.58	34.36	58.32	64.00	-5.68	AV
11650	42.60	0	100	V	38.43	22.58	34.36	69.25	84.00	-14.75	PK
11650	31.61	0	100	V	38.43	22.58	34.36	58.26	64.00	-5.74	AV

802.11n40 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 5755 MHz											
5725	55.11	209	127	H	34.05	14.24	35.47	67.93	122.26	-54.33	PK
5725	36.30	209	127	H	34.05	14.24	35.47	49.12	122.26	-73.14	AV
5725	61.59	331	113	V	34.02	14.24	35.47	74.38	122.26	-47.88	PK
5725	41.13	331	113	V	34.02	14.24	35.47	53.92	122.26	-68.34	AV
11510	43.19	0	100	H	38.44	22.58	34.36	69.86	84.00	-14.14	PK
11510	31.53	0	100	H	38.44	22.58	34.36	58.20	64.00	-5.80	AV
11510	43.27	0	100	V	38.43	22.58	34.36	69.92	84.00	-14.08	PK
11510	31.27	0	100	V	38.43	22.58	34.36	57.92	64.00	-6.08	AV
High Channel 5795 MHz											
11590	42.22	0	100	H	38.44	22.58	34.36	68.89	84.00	-15.11	PK
11590	31.47	0	100	H	38.44	22.58	34.36	58.14	64.00	-5.86	AV
11590	42.38	0	100	V	38.43	22.58	34.36	69.03	84.00	-14.97	PK
11590	31.08	0	100	V	38.43	22.58	34.36	57.73	64.00	-6.27	AV

802.11ac80 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)	
5775 MHz											
5725	50.54	209	125	H	34.05	14.24	35.47	63.36	122.26	-58.90	PK
5725	35.61	209	125	H	34.05	14.24	35.47	48.43	122.26	-73.83	AV
5725	54.66	337	127	V	34.02	14.24	35.47	67.45	122.26	-54.81	PK
5725	39.96	337	127	V	34.02	14.24	35.47	52.75	122.26	-69.51	AV
5650	43.45	208	126	H	34.05	14.24	35.47	56.27	74.00	-17.73	PK
5650	31.27	208	126	H	34.05	14.24	35.47	44.09	54.00	-9.91	AV
5650	46.44	335	130	V	34.02	14.24	35.47	59.23	74.00	-14.77	PK
5650	33.26	335	130	V	34.02	14.24	35.47	46.05	54.00	-7.95	AV
5925	42.92	211	137	H	34.05	14.24	35.47	55.74	74.00	-18.26	PK
5925	30.68	211	137	H	34.05	14.24	35.47	43.50	54.00	-10.50	AV
5925	43.69	337	126	V	34.02	14.24	35.47	56.48	74.00	-17.52	PK
5925	30.51	337	126	V	34.02	14.24	35.47	43.30	54.00	-10.70	AV
11550	43.41	0	100	H	38.44	22.58	34.36	70.08	84.00	-13.92	PK
11550	32.46	0	100	H	38.44	22.58	34.36	59.13	64.00	-4.87	AV
11550	43.64	0	100	V	38.43	22.58	34.36	70.29	84.00	-13.71	PK
11550	32.23	0	100	V	38.43	22.58	34.36	58.88	64.00	-5.12	AV

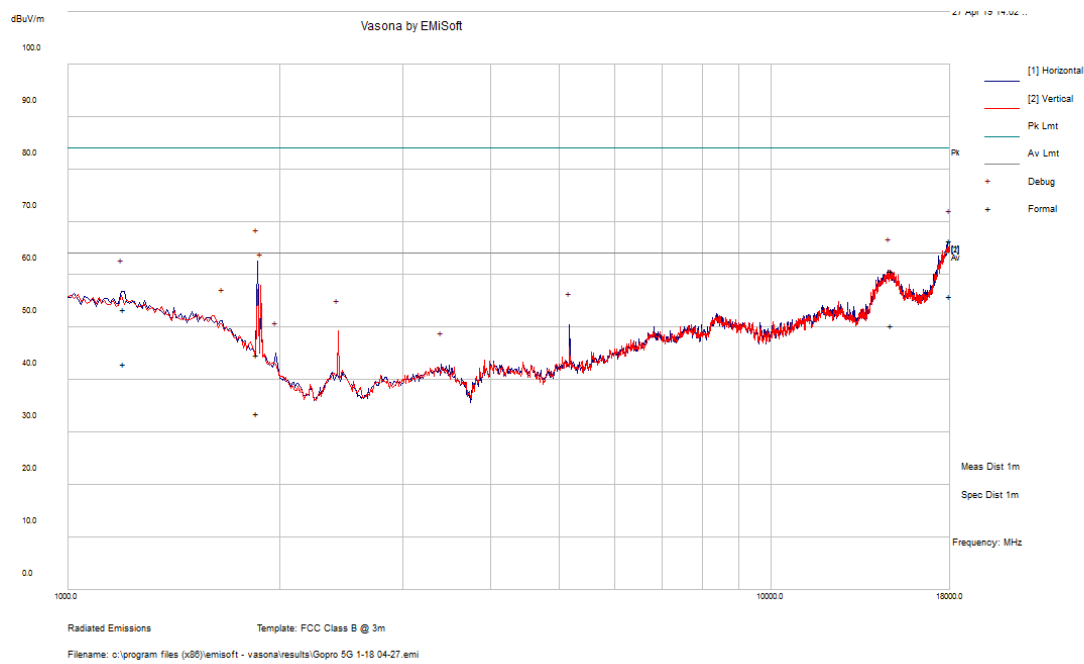
Note 1: Emissions above 10 GHz are measured at 1 meter.

Note 2: Any emissions above 12 GHz are emissions from the noise floor.

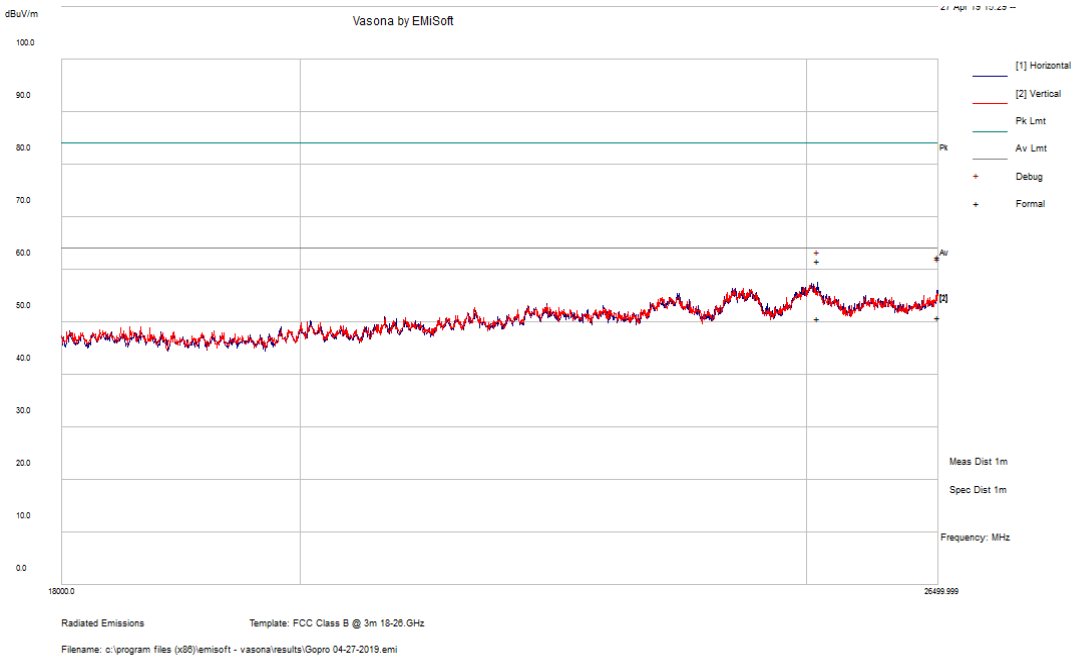
Note 3: Duty Cycle Correction Factor has been added to the measurements.

Note 4: The worst-case modulations were used to show compliance.

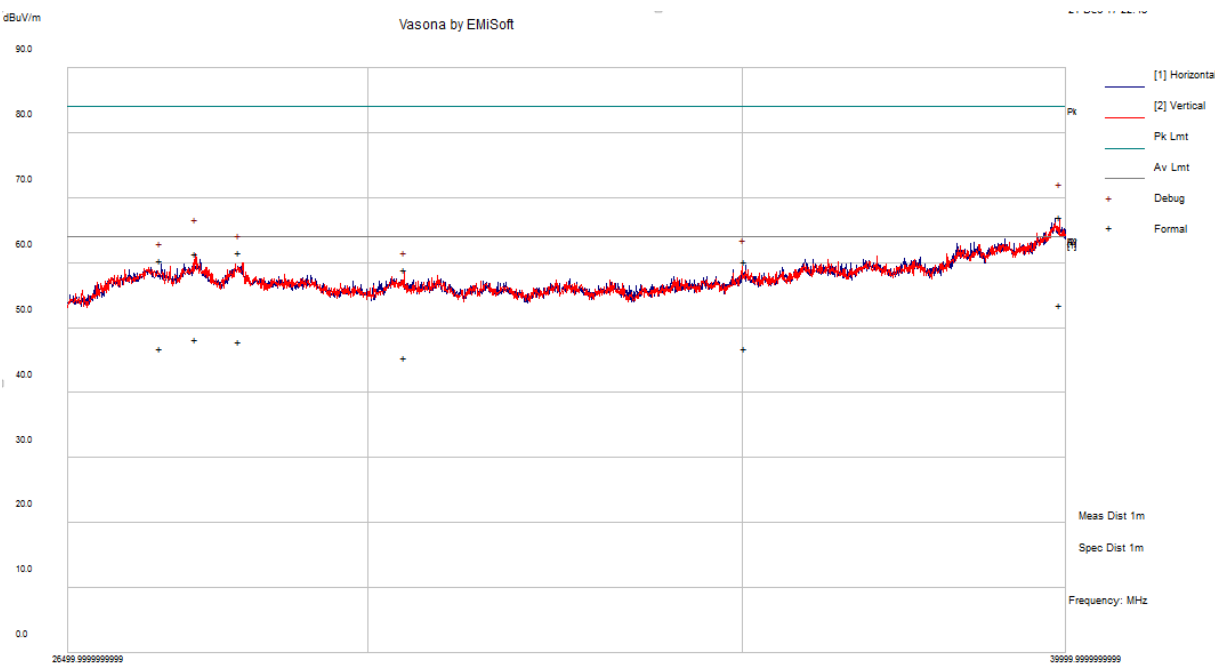
1 GHz – 18 GHz Worst Case Scan at 1 Meter



18 GHz – 26.5 Worst Case GHz Scan at 1 Meter



26.5 GHz – 40 Worst Case GHz Scan at 1 Meter



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

8.1 Applicable Standards

As per FCC §15.407(e) and ISEDC 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	MY48250238	2018-05-08	1 year
-	10dB attenuator	-	-	Each time ¹	N/A
-	RF cable	-	-	Each time ¹	N/A

Note¹: 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 °C
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

The testing was performed by Christian McCaig on 2019-04-22 at RF site.

8.5 Test Results

Please refer to the following tables and plots.

5150 - 5250 MHz

Channel	Frequency (MHz)	99% OBW (kHz)	26 dB OBW (kHz)
802.11 a mode			
36	5180	16256.3	19330
40	5200	16256.1	20552
48	5240	16272.0	18357
802.11n20 mode			
36	5180	17453.3	20066
40	5200	17367.9	19963
48	5240	17408.7	19605
802.11n40 mode			
38	5190	35834.4	39866
46	5230	35686.1	40845
802.11ac20 mode			
36	5180	17572.0	22428
40	5200	17577.2	28800
48	5240	17559.2	23751
802.11ac40 mode			
38	5190	35779.6	39082
46	5230	35745.3	39893
802.11ac80 mode			
42	5210	74878.5	82104

5250 - 5350 MHz

Channel	Frequency (MHz)	99% OBW (kHz)	26 dB OBW (kHz)
802.11 a mode			
52	5260	16217.7	18233
56	5280	16276.4	19866
64	5320	16274.5	19003
802.11n20 mode			
52	5260	17481.4	19726
56	5280	17413.8	20483
64	5320	17435.9	18892
802.11n40 mode			
54	5270	35725.1	39469
62	5310	35791.6	39432
802.11ac20 mode			
52	5260	17472.0	20686
56	5280	17533.5	20296
64	5320	17437.6	19834
802.11ac40 mode			
54	5270	35723.3	38980
62	5310	35785.9	39104
802.11ac80 mode			
58	5290	74839.5	80797

5470 - 5725 MHz

Channel	Frequency (MHz)	99% OBW (kHz)	26 dB OBW (kHz)
802.11 a mode			
100	5500	16256.1	18685
116	5580	16268.5	18433
140	5700	16259.1	18141
144	5720	16266.4	18363
802.11n20 mode			
100	5500	17403.7	19067
116	5580	17413.1	19266
140	5700	17393.9	18991
144	5720	17419.8	20104
802.11n40 mode			
102	5510	35822.0	39637
110	5550	35779.0	39860
134	5670	35743.9	39467
142	5710	35873.4	47586
802.11ac20 mode			
100	5500	17425.8	19705
116	5580	17438.1	20576
140	5700	17484.5	19438
144	5720	17484.5	22594
802.11ac40 mode			
102	5510	35660.0	39800
110	5550	35742.1	39938
134	5670	35737.3	40377
142	5710	35818.9	41214
802.11ac80 mode			
106	5530	74871.8	81892
122	5610	75114.9	79826
138	5690	74850.5	81905

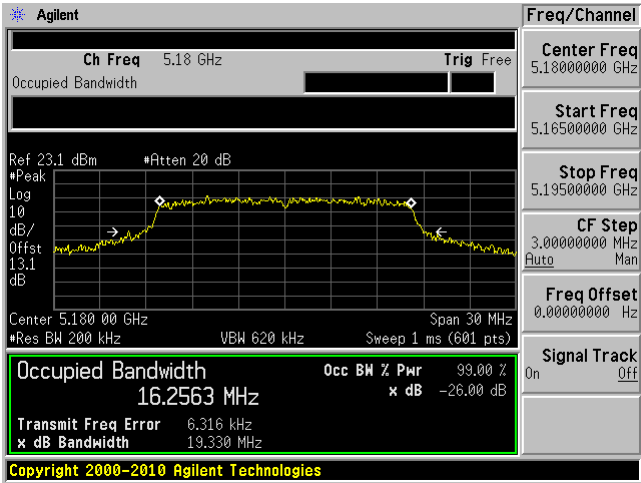
5725 - 5850 MHz

Channel	Frequency (MHz)	99% OBW (kHz)	6 dB OBW (kHz)	6 dB OBW Limit(kHz)	26 dB OBW (kHz)
802.11 a mode					
149	5745	16307.1	15337	500	19291
157	5785	16296.9	13059	500	19151
165	5825	16308.2	16310	500	18776
802.11n20 mode					
149	5745	17411.9	15983	500	20162
157	5785	17434.1	16319	500	20143
165	5825	17422.3	17325	500	19816
802.11n40 mode					
151	5755	35791.5	29810	500	40652
159	5795	35884.6	35194	500	45232
802.11ac20 mode					
149	5745	17413.3	17382	500	19520
157	5785	17371.0	17162	500	20177
165	5825	17415.9	17611	500	19876
802.11ac40 mode					
151	5755	35772.4	27744	500	40332
159	5795	35875.0	32650	500	40950
802.11ac80 mode					
155	5775	74831.1	68834	500	82201

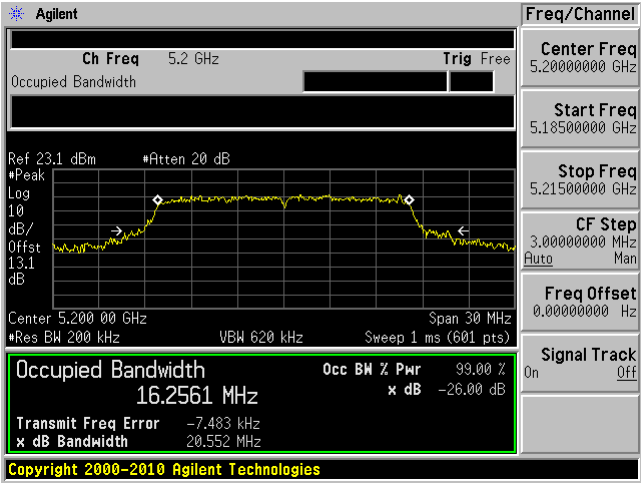
5150 – 5250 MHz

802.11a mode

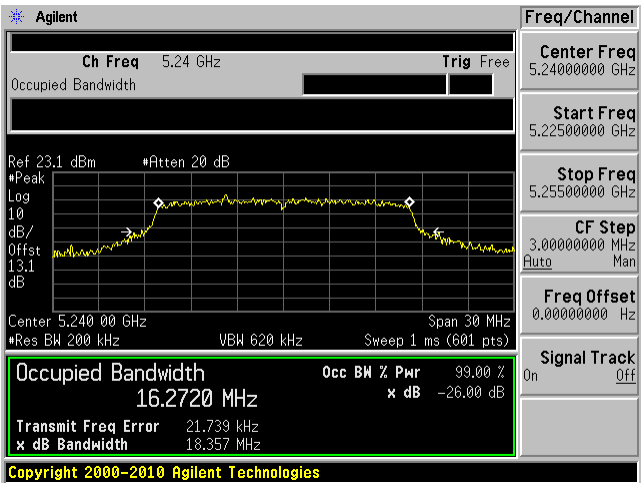
5180 MHz



5200 MHz

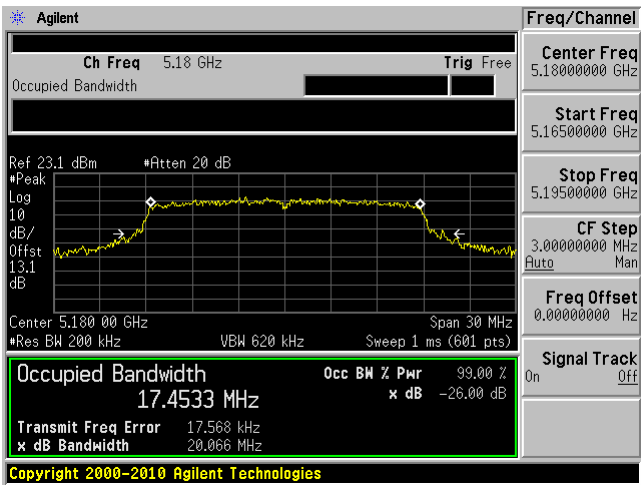


5240 MHz

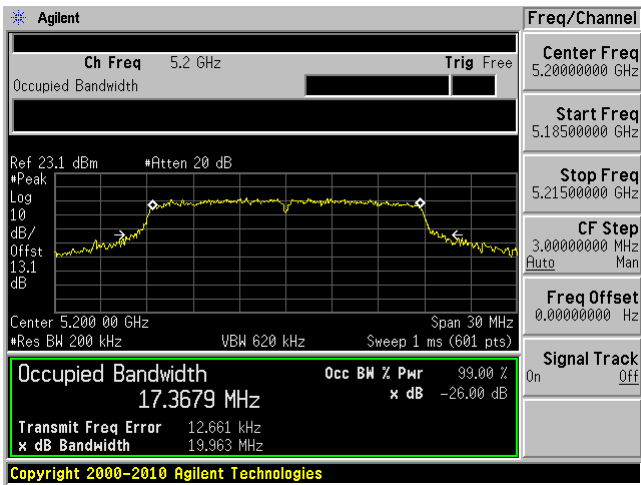


802.11n20 mode

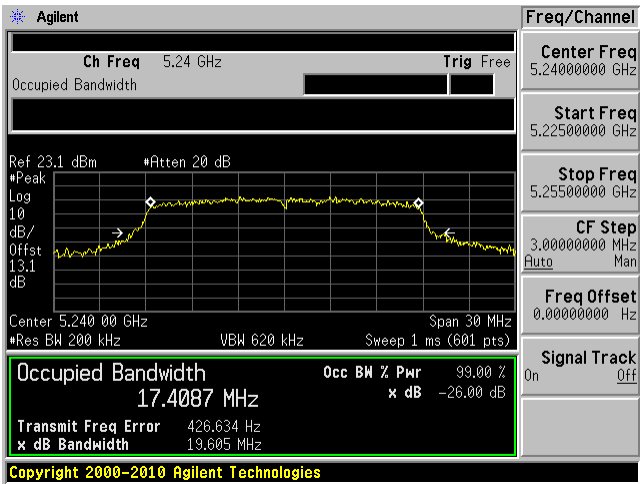
5180 MHz



5200 MHz

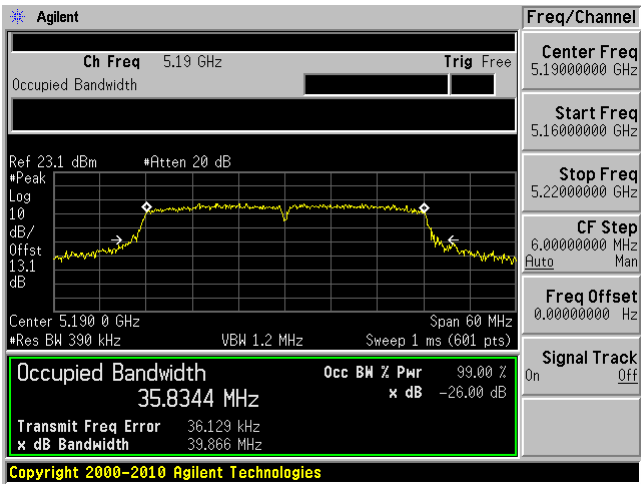


5240 MHz

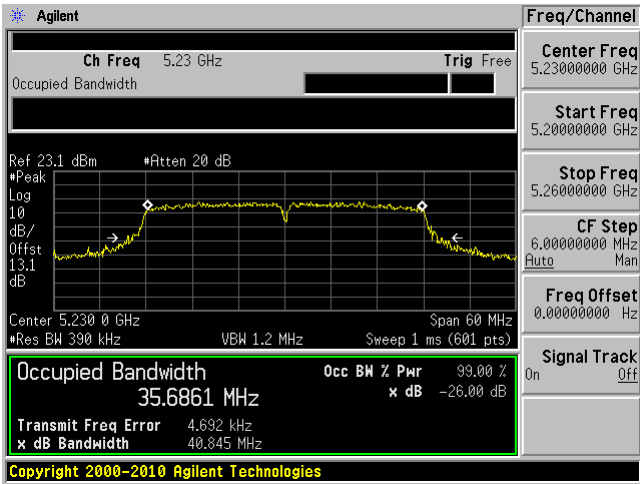


802.11n40 mode

5190 MHz



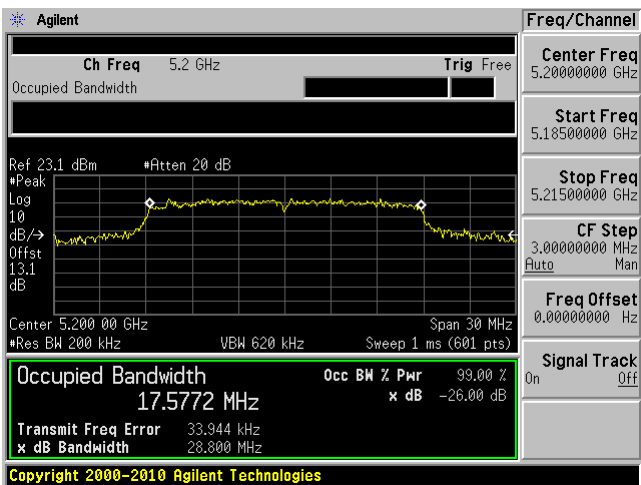
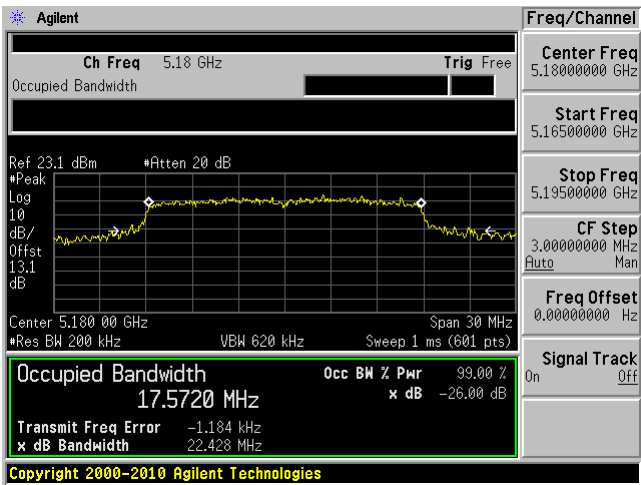
5230 MHz



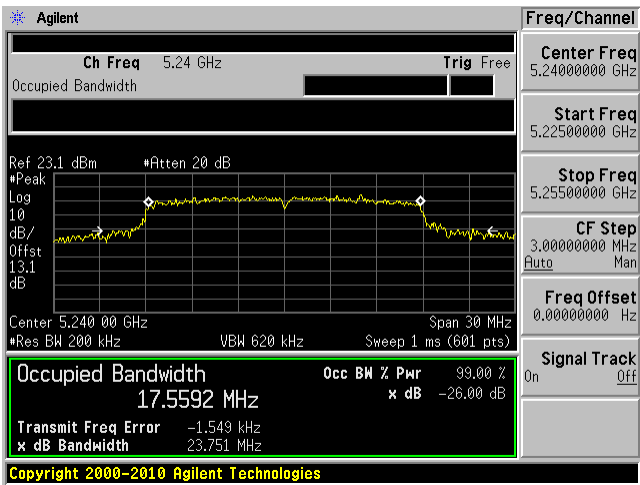
802.11ac20 mode

5180 MHz

5200 MHz

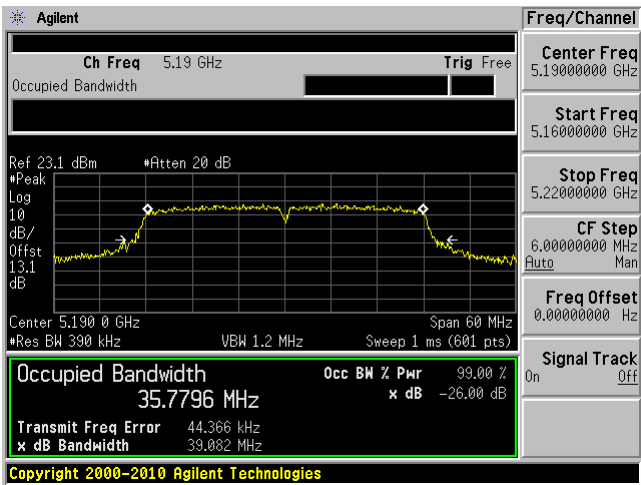


5240 MHz

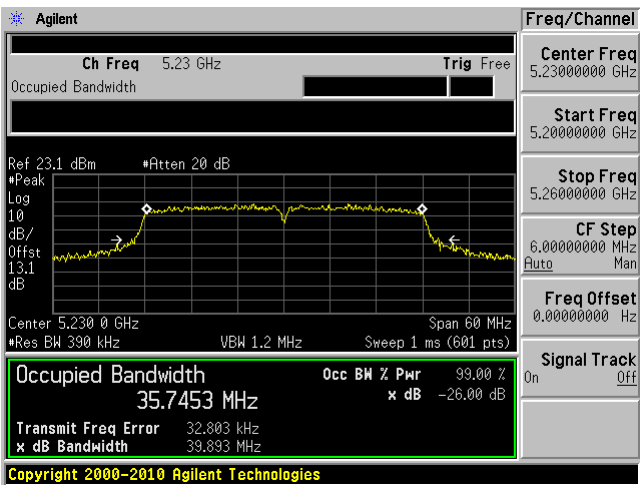


802.11ac40 mode

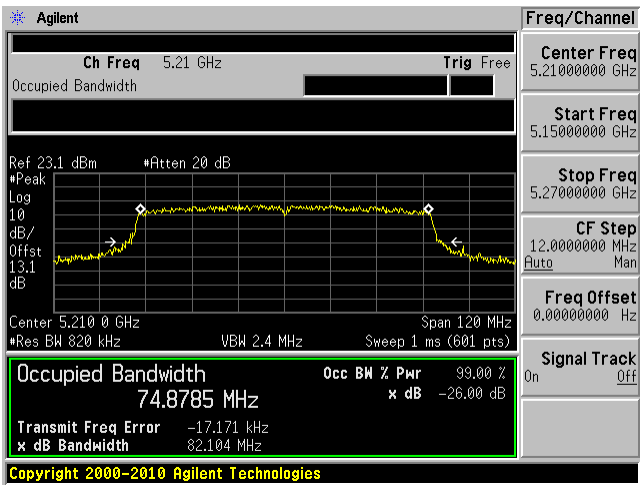
5190 MHz



5230 MHz



802.11ac80 mode, 5210 MHz

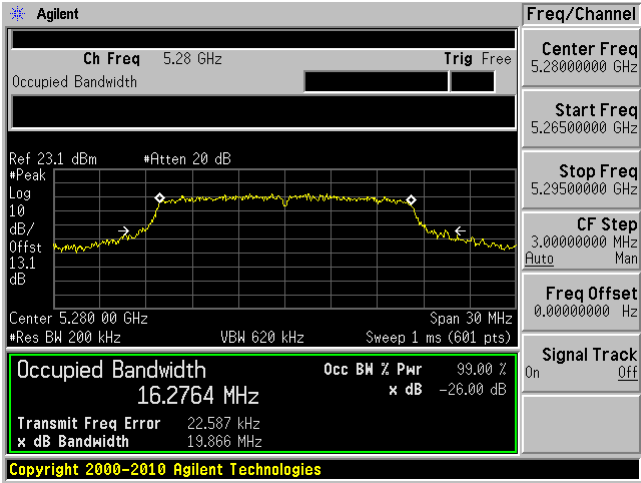
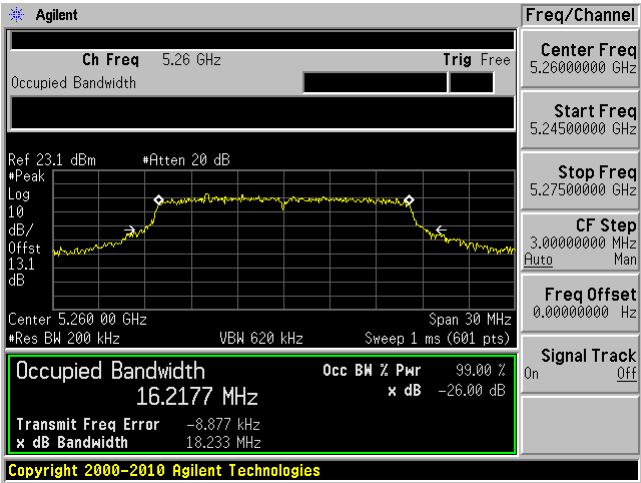


5250 – 5350 MHz

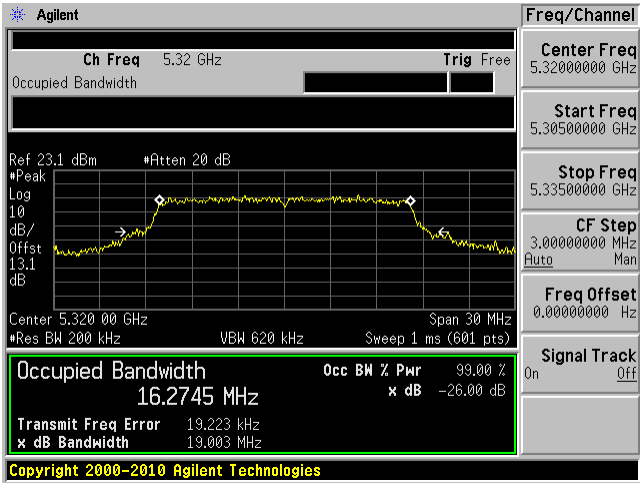
802.11a mode

5260 MHz

5280 MHz

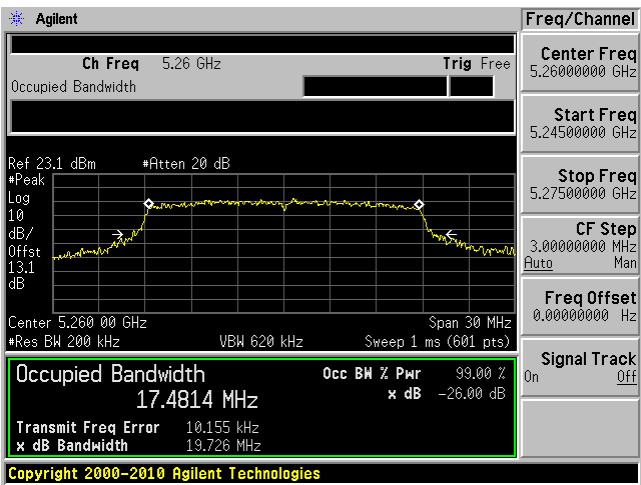


5320 MHz

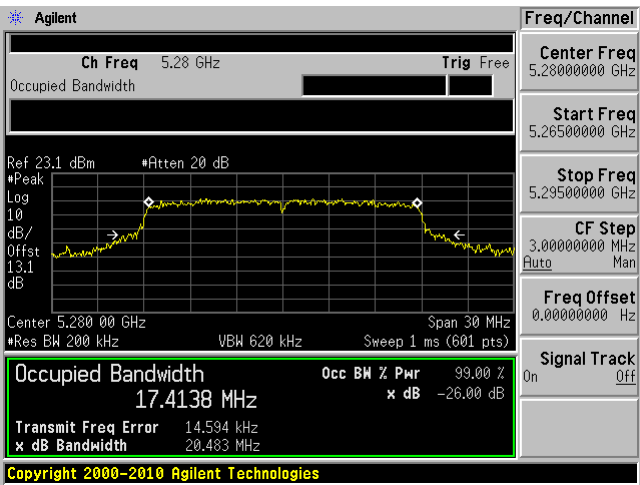


802.11n20 mode

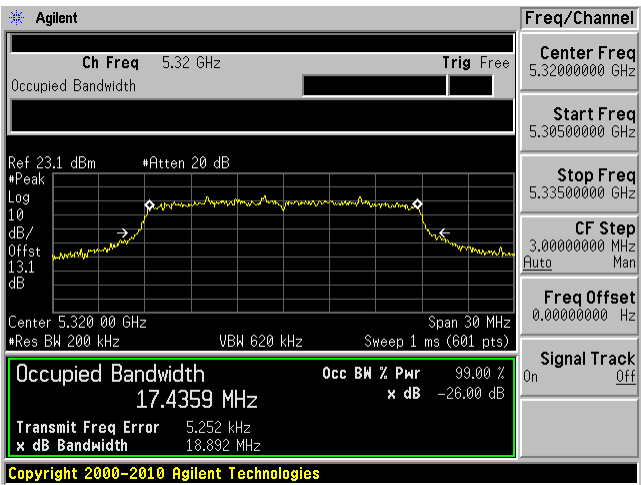
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5280 MHz



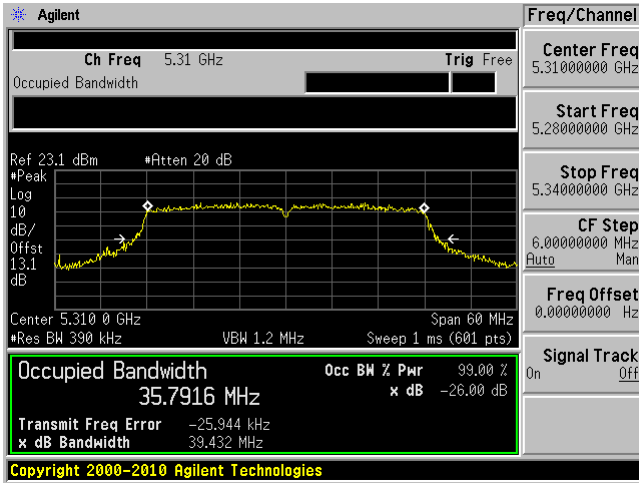
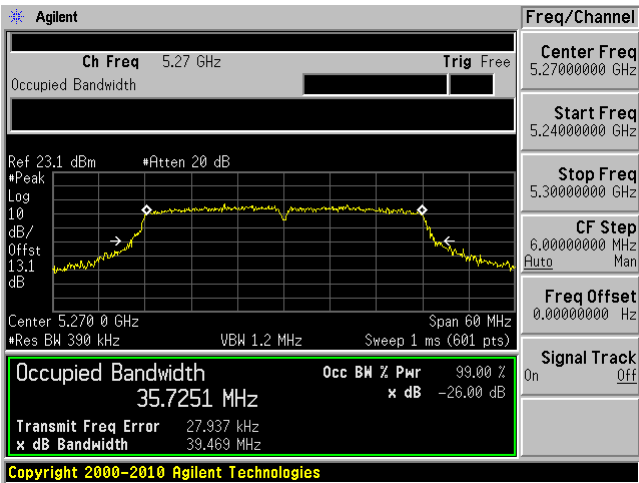
5320 MHz



802.11n40 mode

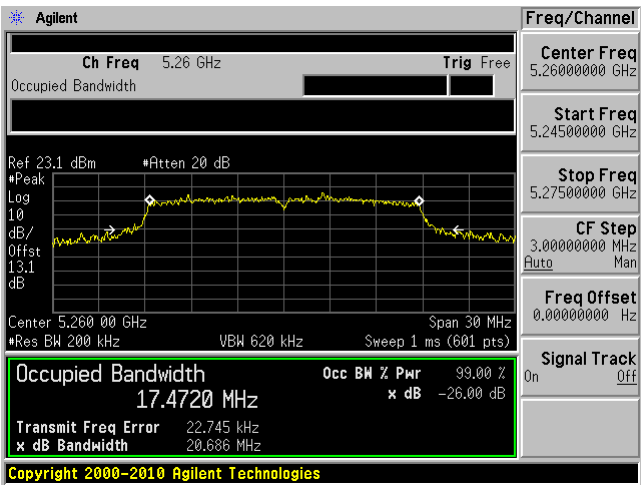
5270 MHz

5310 MHz

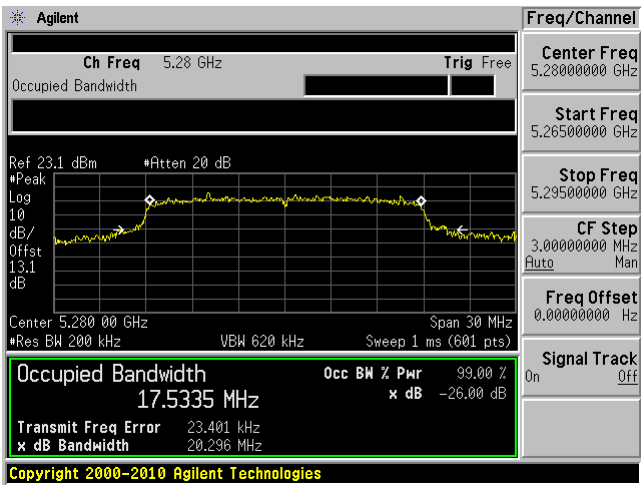


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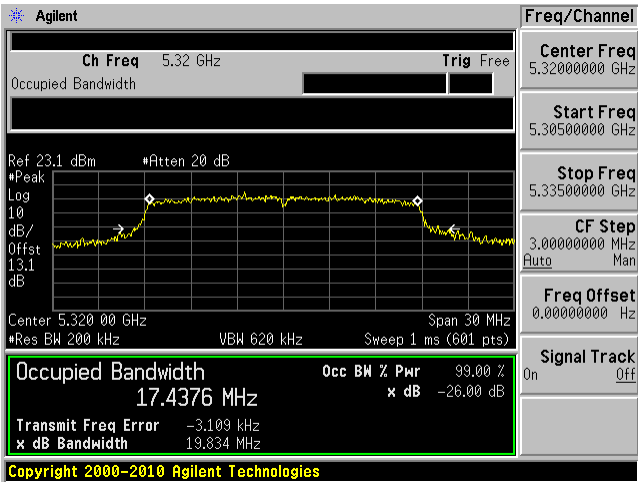
5260 MHz



5280 MHz

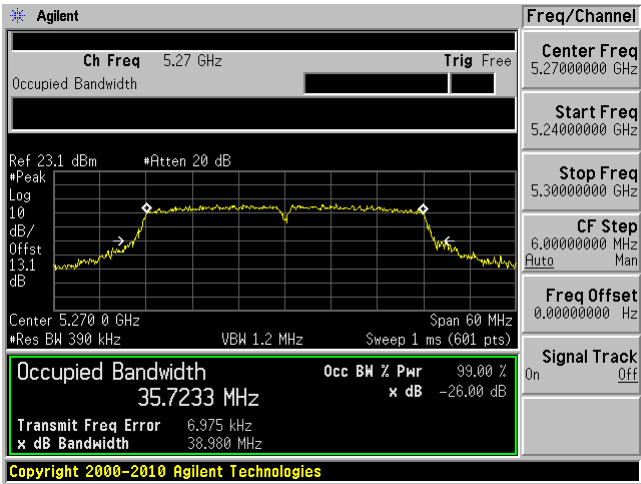


5320 MHz

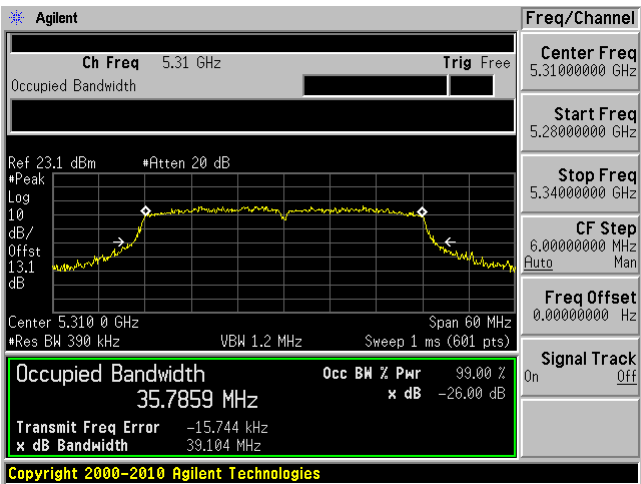


802.11ac40 mode

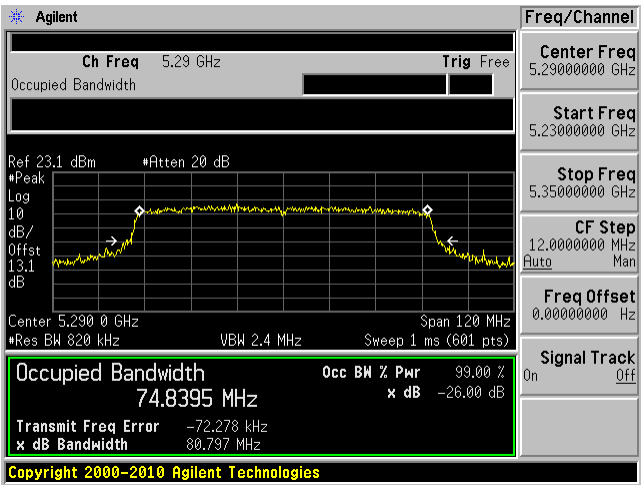
5270 MHz



5310 MHz



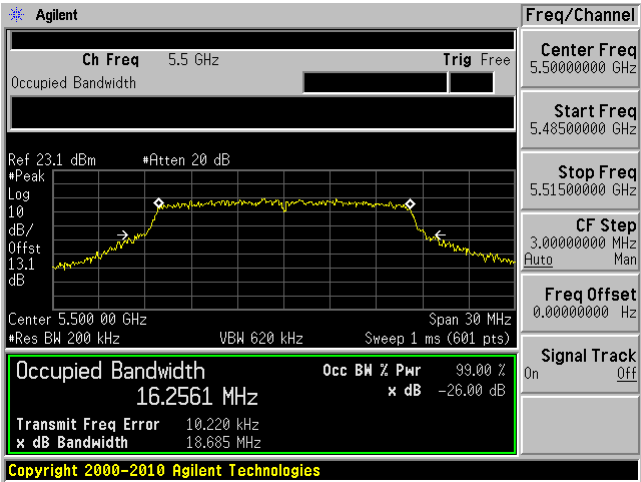
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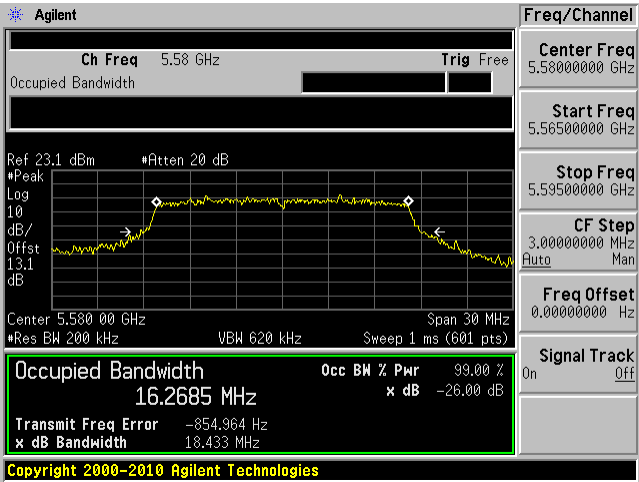
5470 – 5725 MHz

802.11a mode

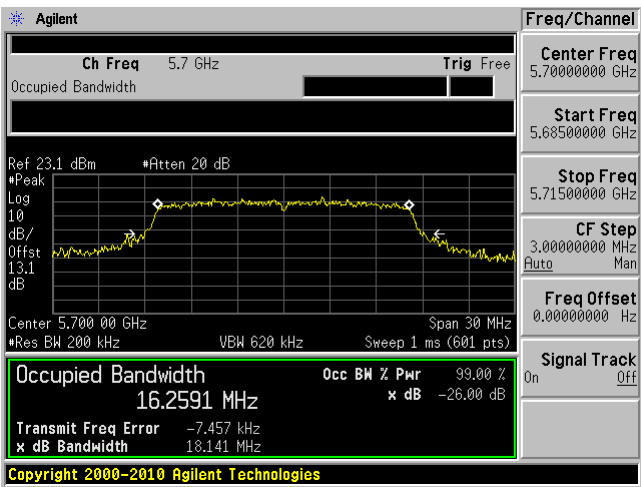
5500 MHz



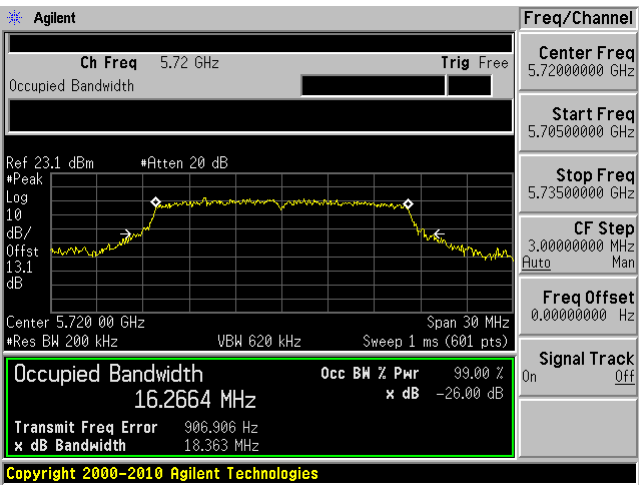
5580 MHz



5700 MHz

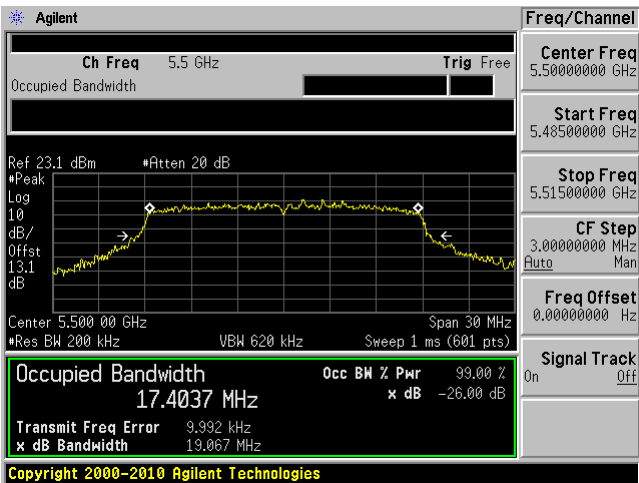


5720 MHz

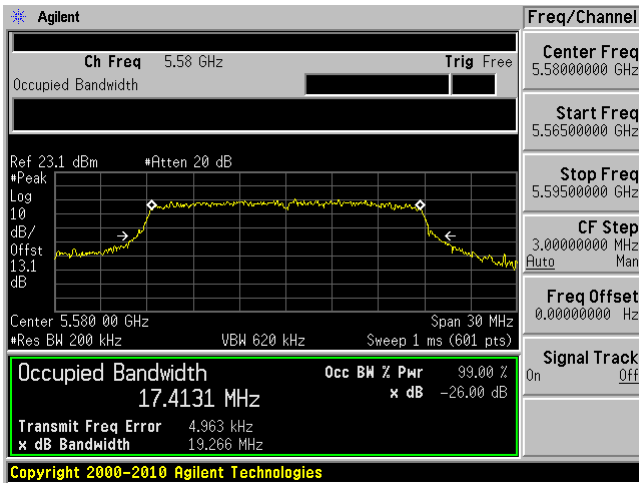


802.11n20 mode

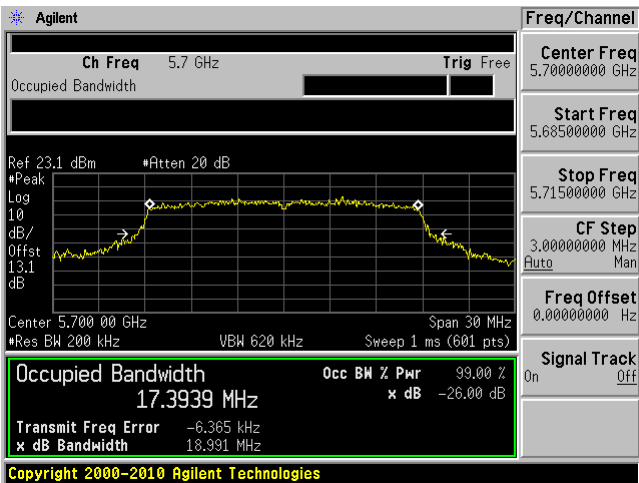
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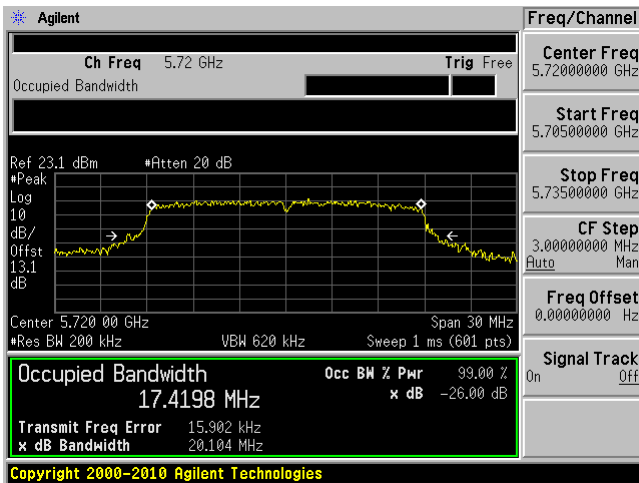
5580 MHz



5700 MHz

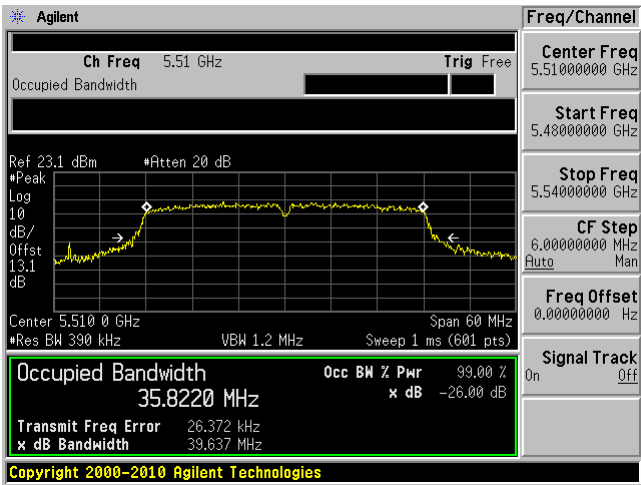


5720 MHz

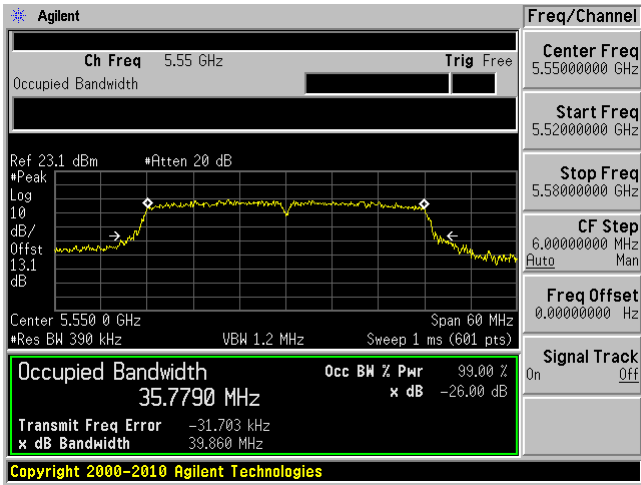


802.11n40 mode

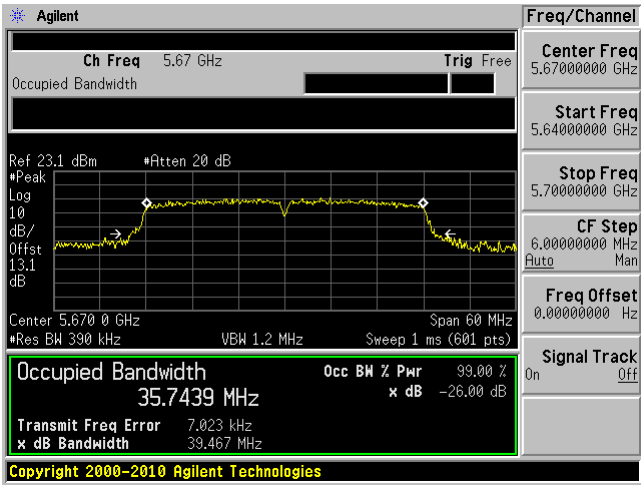
5510 MHz



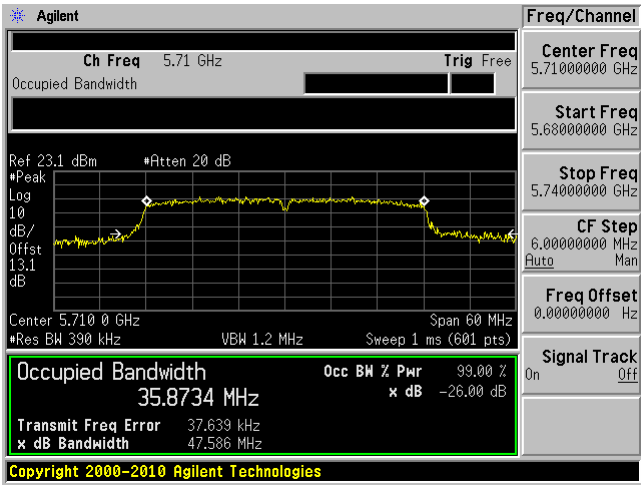
5550 MHz



5670 MHz

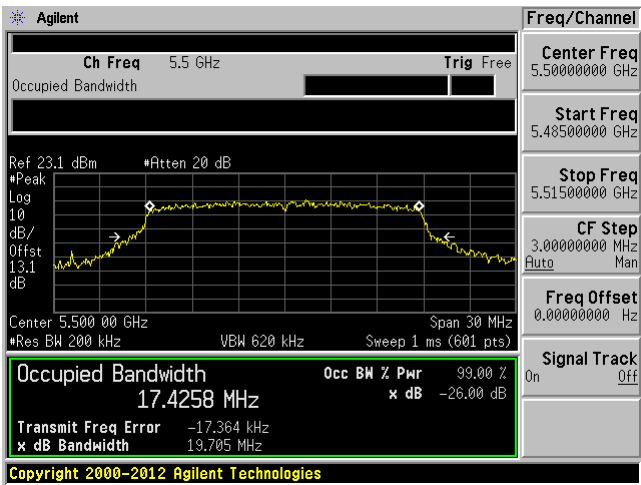


5710 MHz

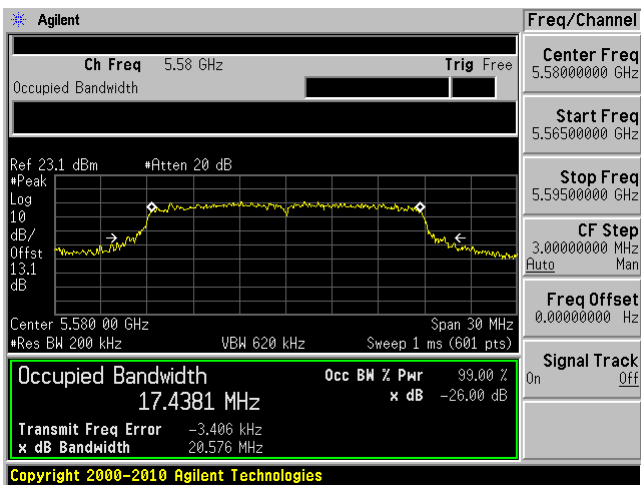


802.11ac20 mode

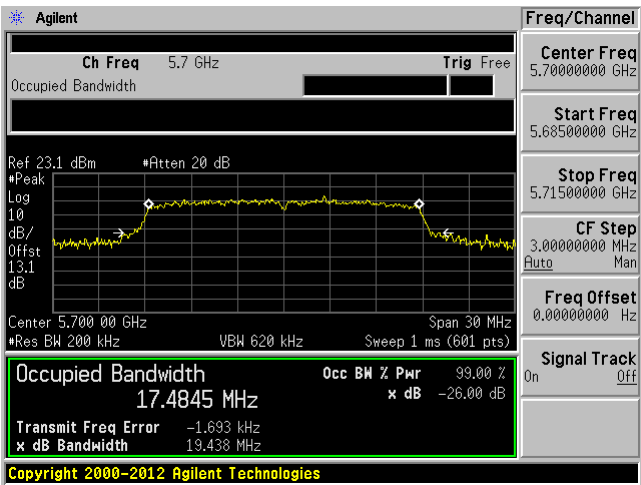
5500 MHz



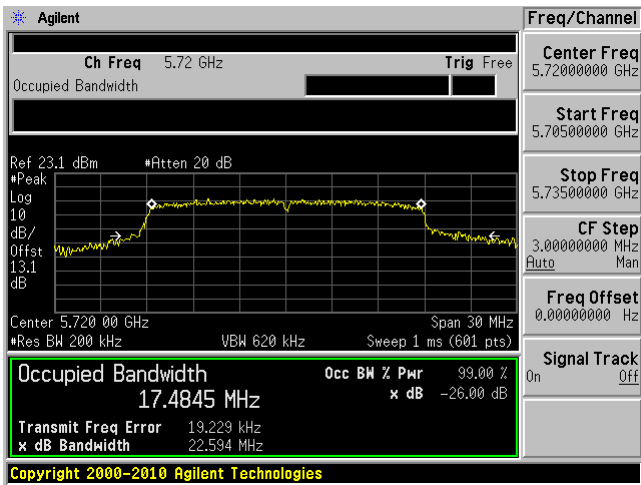
5580 MHz



5700 MHz

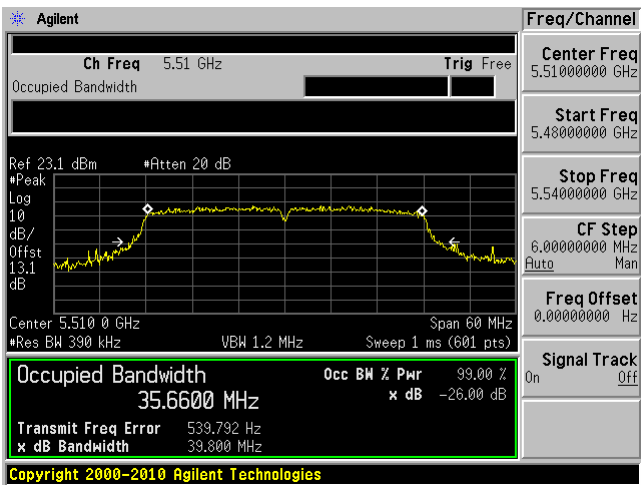


5720 MHz

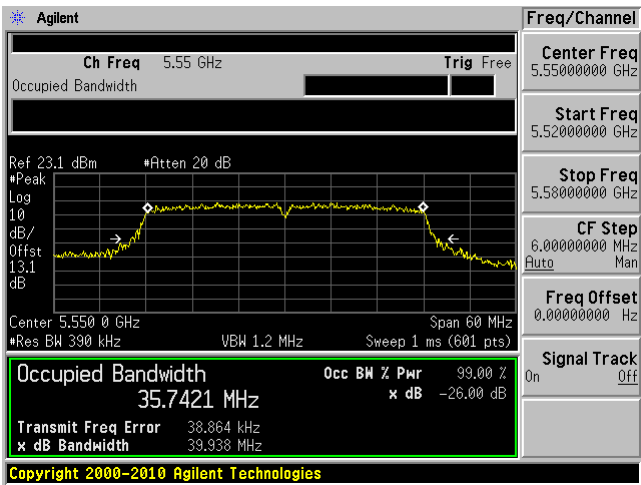


802.11ac40 mode

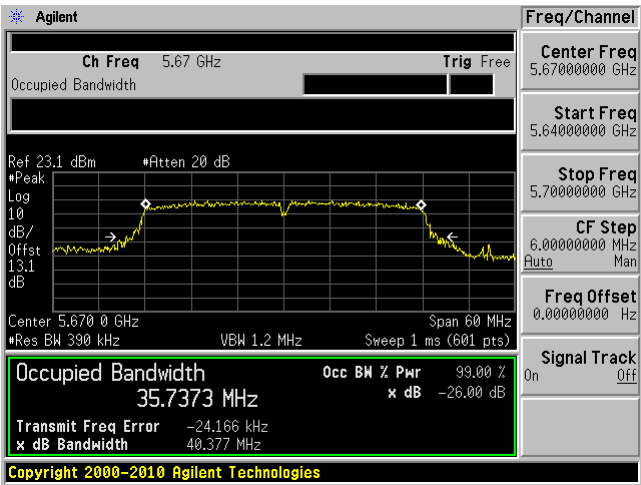
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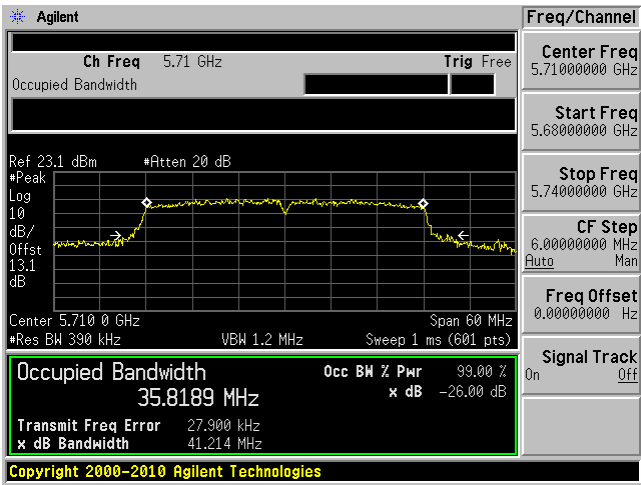
5550 MHz



5670 MHz

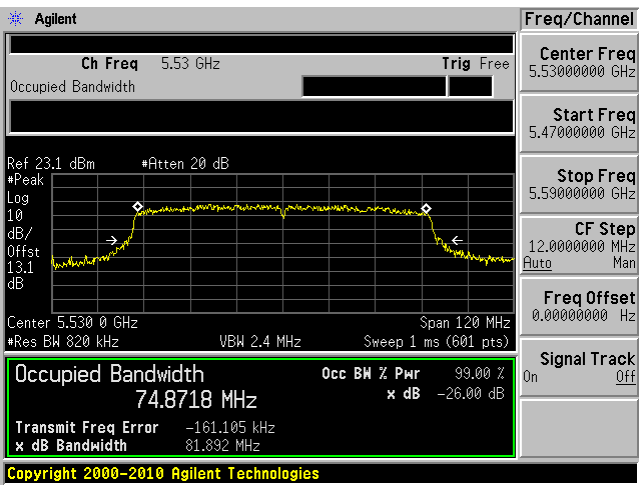


5710 MHz

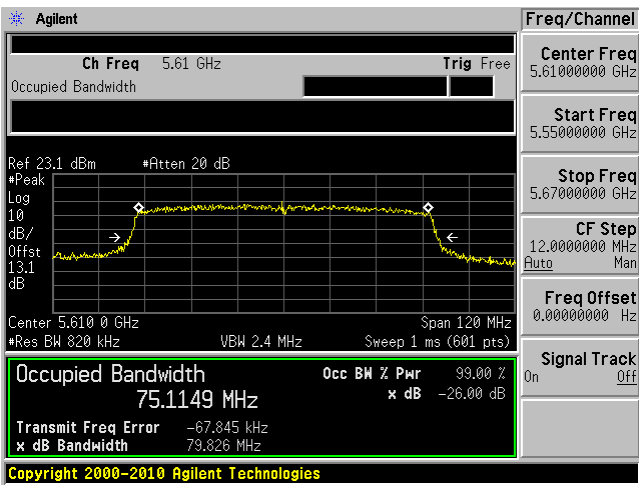


802.11ac80 mode

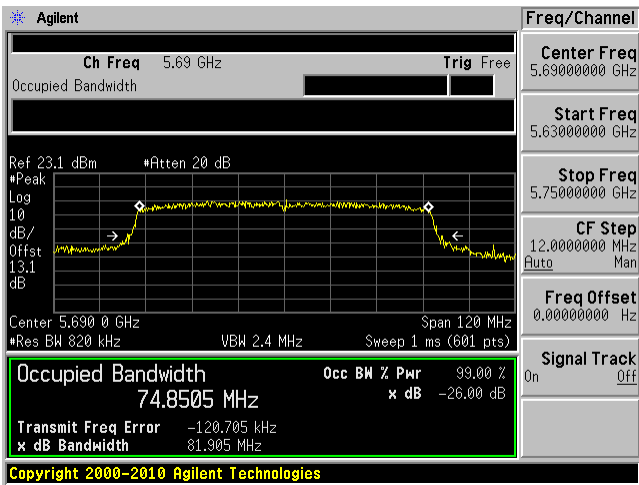
5530 MHz



5610 MHz



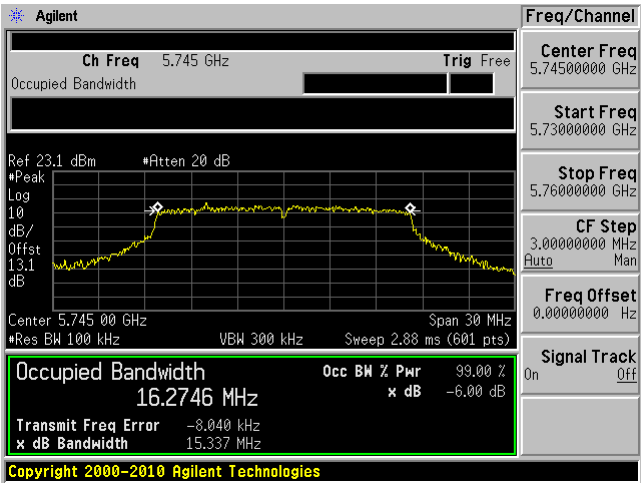
5690 MHz



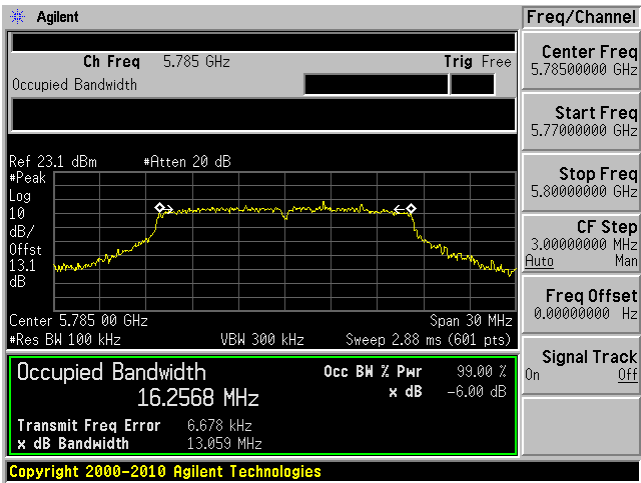
5725 – 5850 MHz

-6dB
802.11a mode

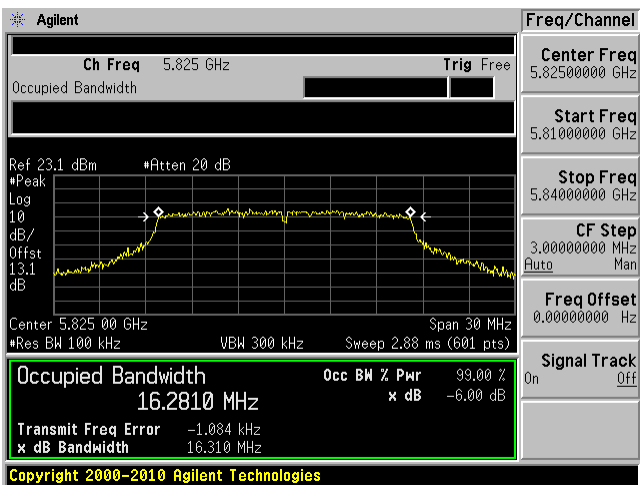
5745 MHz



5785 MHz

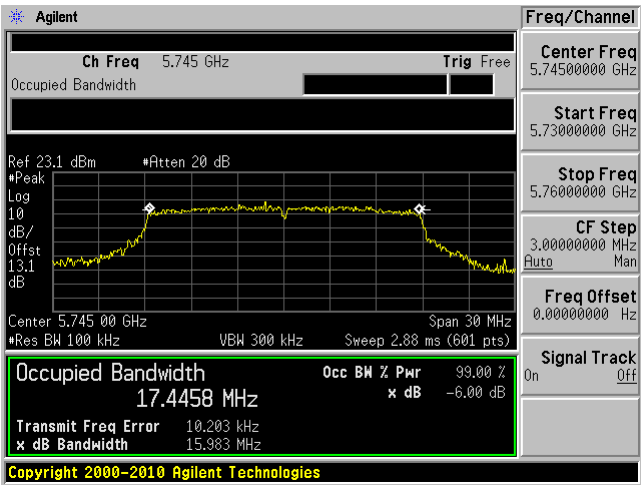


5825 MHz

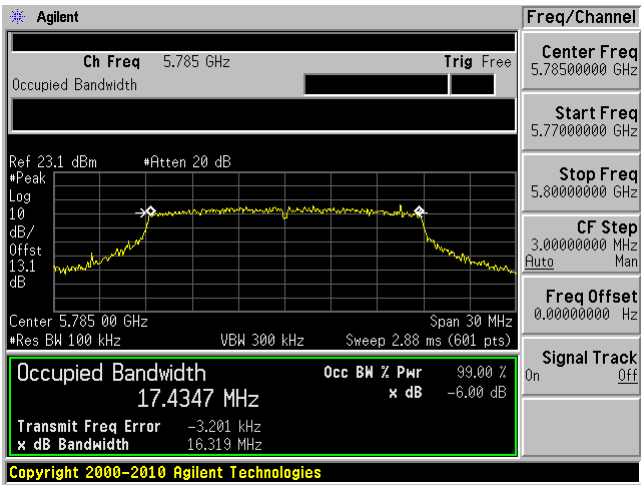


802.11n20 mode

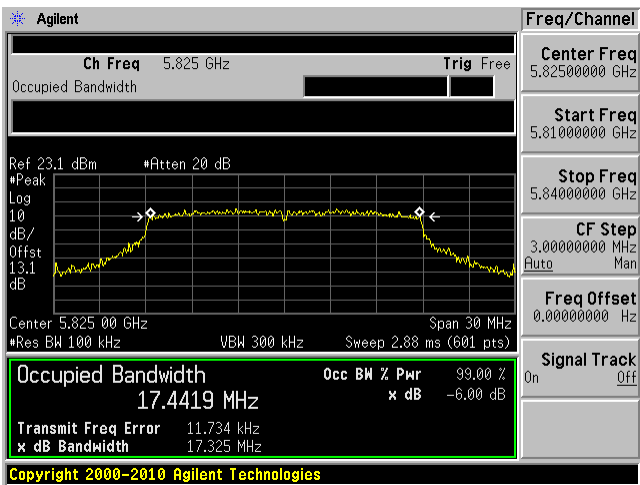
5745 MHz



5785 MHz

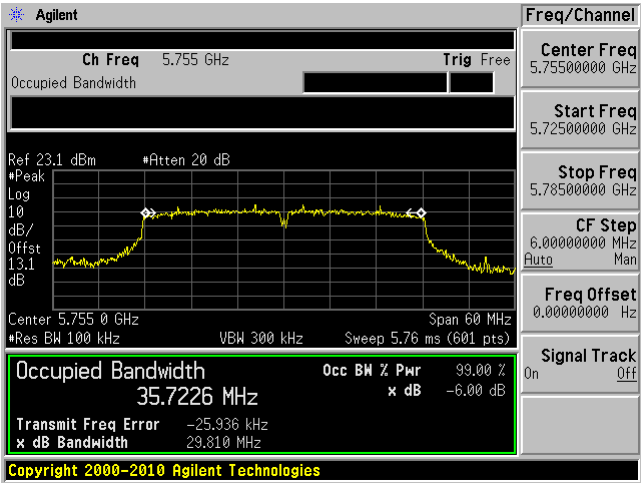


5825 MHz

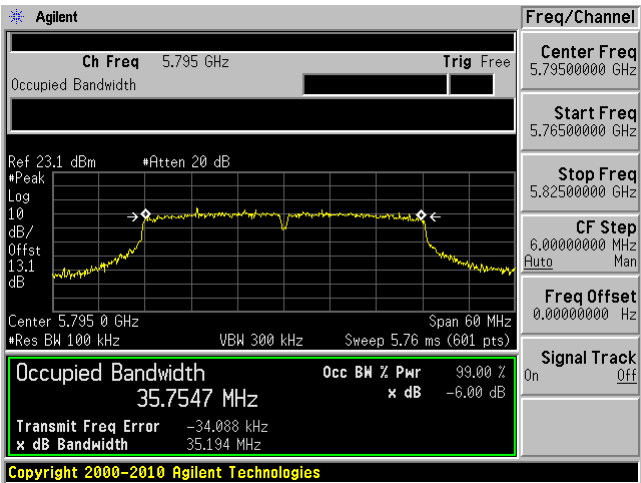


802.11n40 mode

5755 MHz

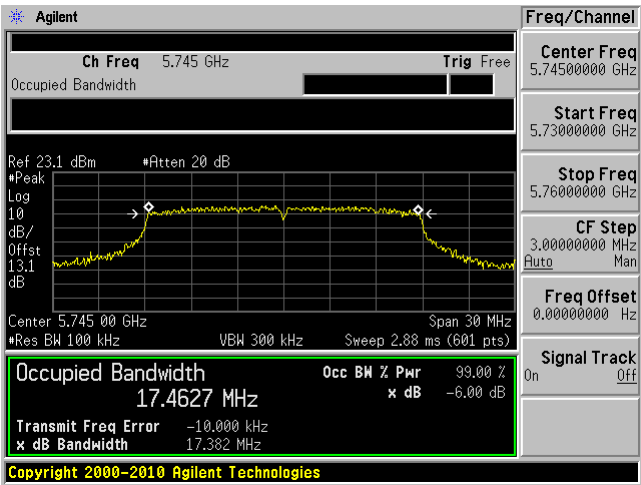


5795 MHz

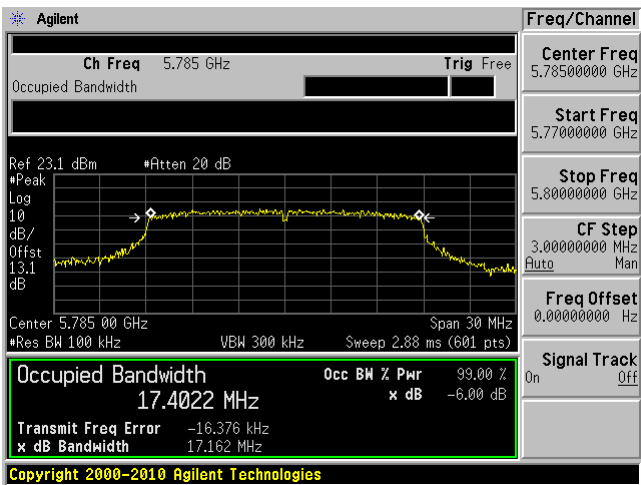


802.11ac20 mode

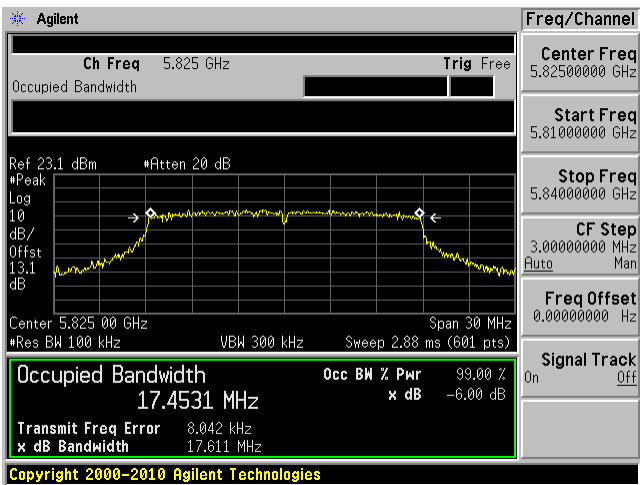
5745 MHz



5785 MHz



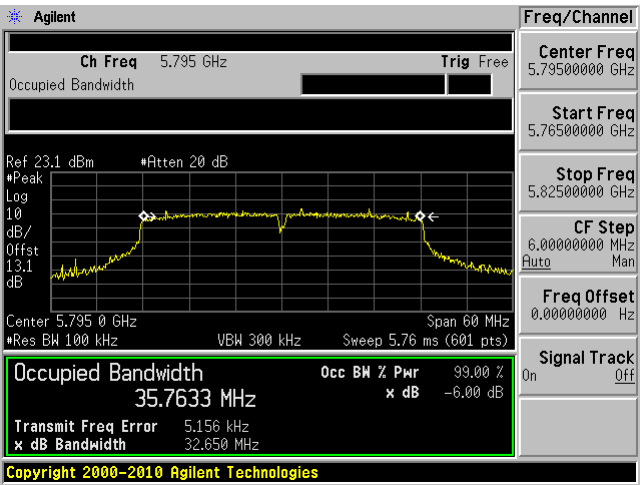
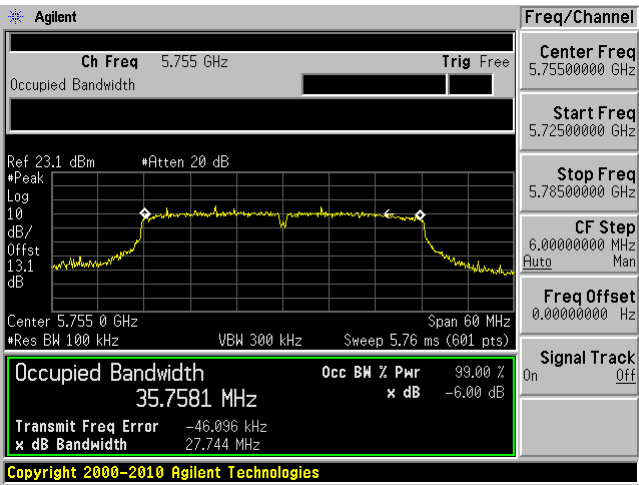
5825 MHz



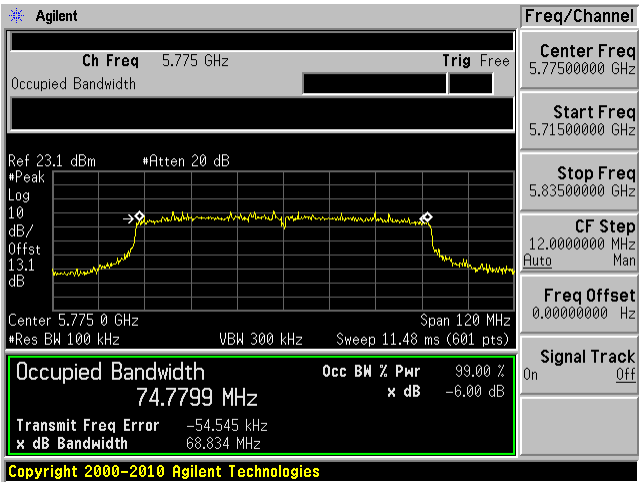
802.11ac40 mode

5755 MHz

5795 MHz

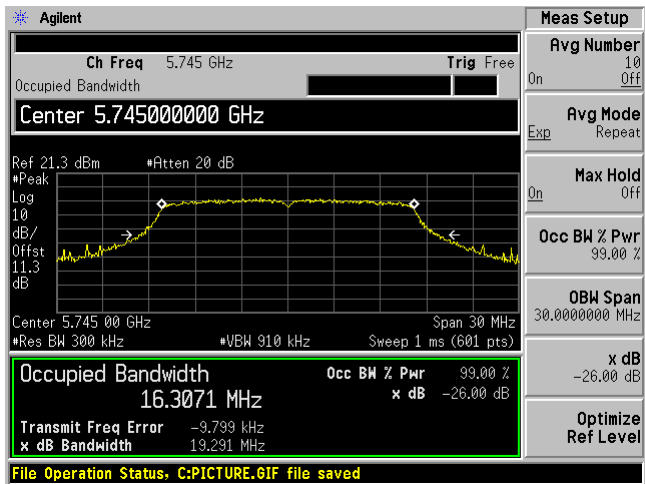


802.11ac80 mode, 5775 MHz

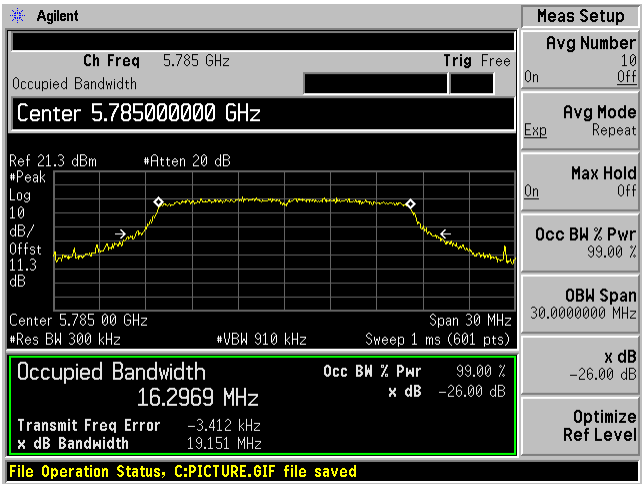


99% OBW & -26dB
802.11a mode

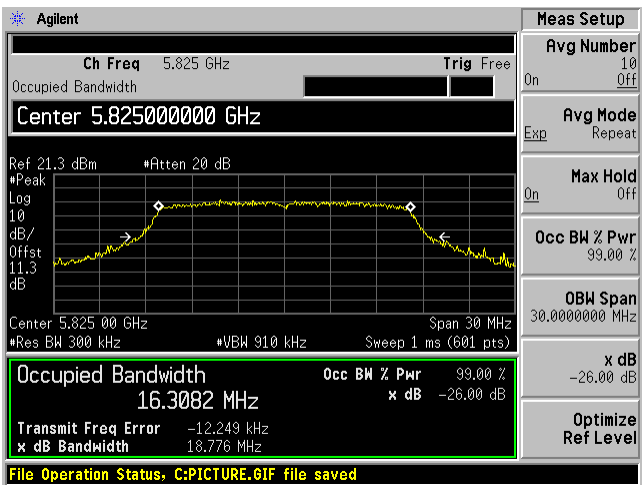
5745 MHz



5785 MHz

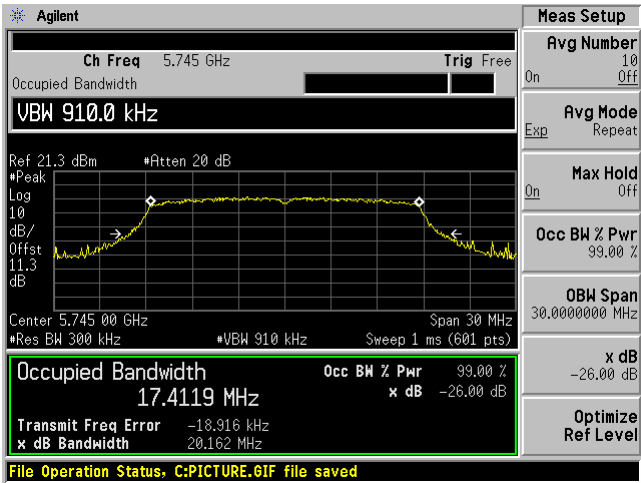


5825 MHz

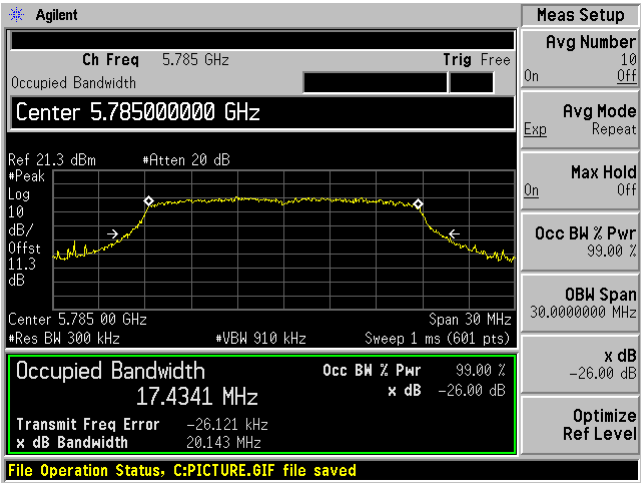


802.11n20 mode

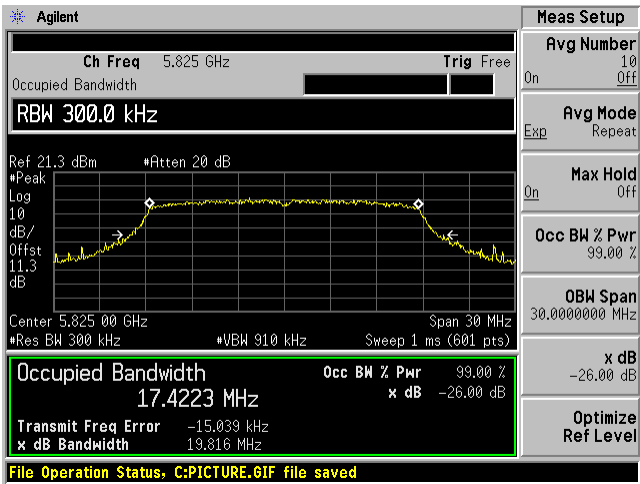
5745 MHz



5785 MHz

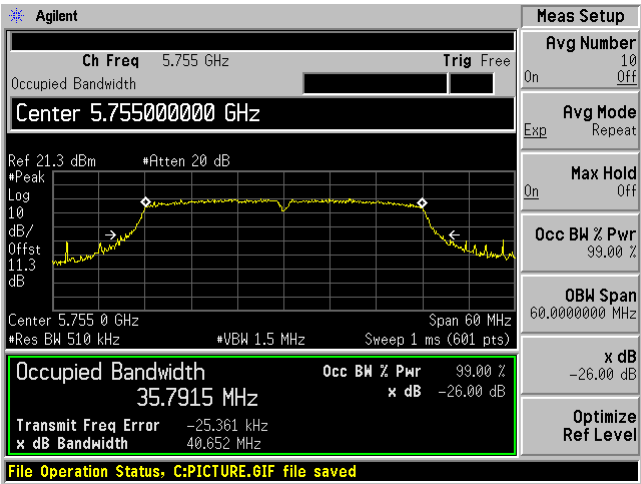


5825 MHz

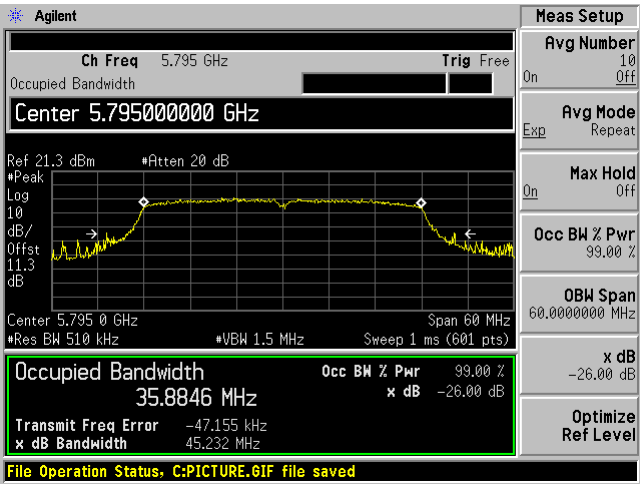


802.11n40 mode

5755 MHz

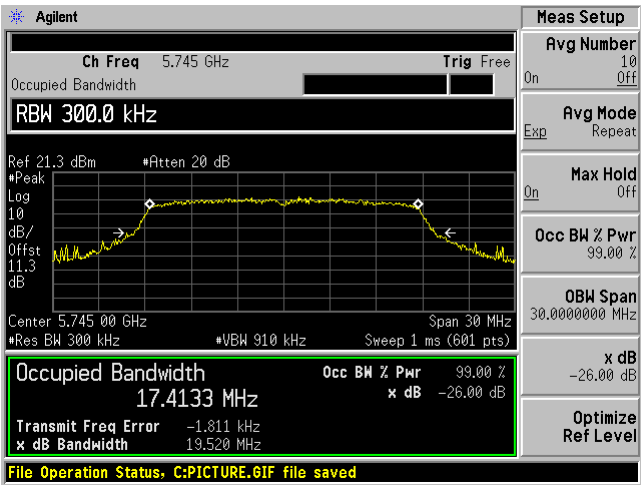


5795 MHz

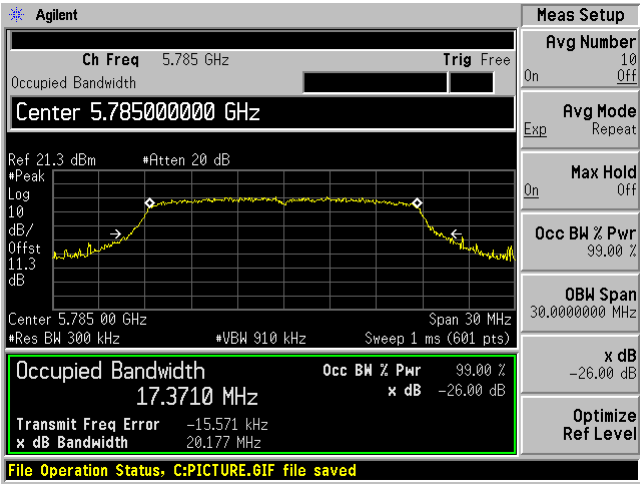


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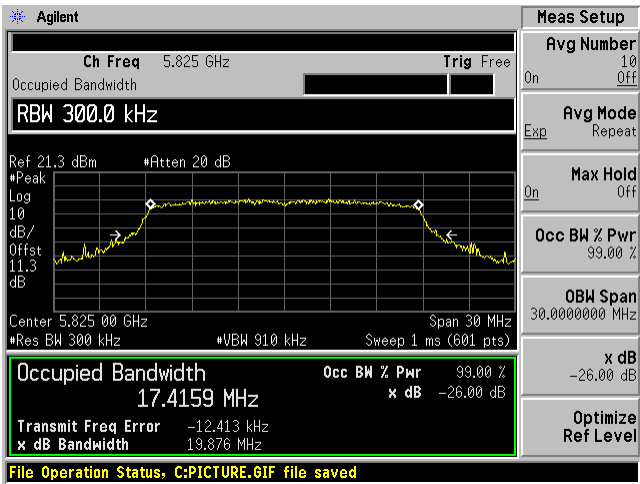
5745 MHz



5785 MHz

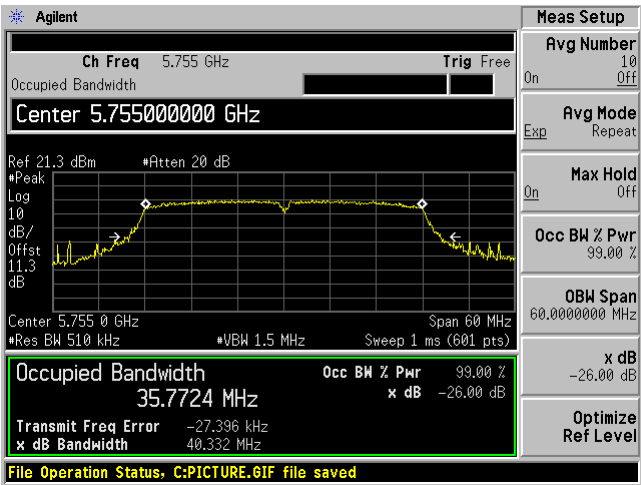


5825 MHz

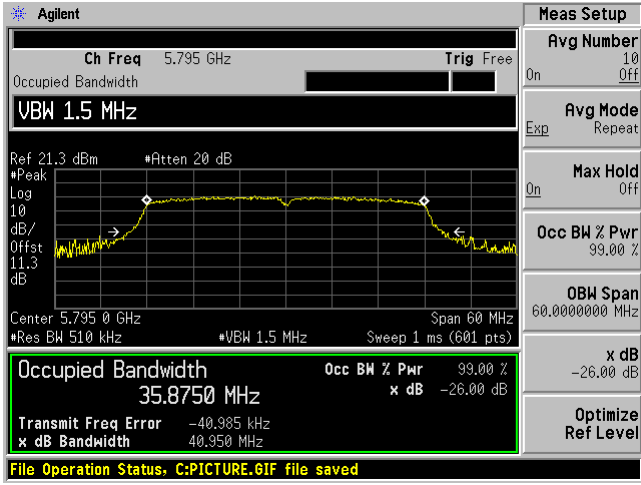


802.11ac40 mode

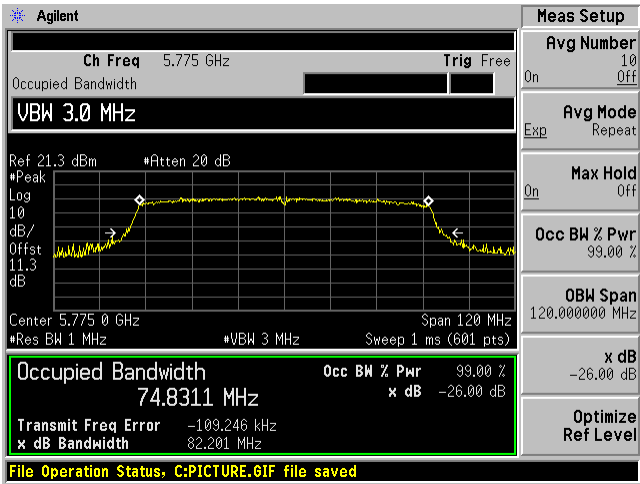
5755 MHz



5795 MHz



802.11ac80 mode, 5775 MHz



9 FCC §407(a) & ISEDC 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 $11 \text{ dBm} + 10 \log B$, 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 ISEDC RSS-247 §6.2.1 for frequency band 5150-5250 MHz:

The maximum e.i.r.p. shall not exceed 200 mW or $10 + 10 \log 10B$, 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 ISEDC RSS-247 §6.2.2 for frequency band 5250-5350 MHz:

The maximum conducted output power shall not exceed 250 mW or $11 + 10 \log 10B$, 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 $17 + 10 \log 10B$, 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 ISEDC 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 $11 + 10 \log 10B$, 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 $17 + 10 \log 10B$, 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
Agilent	Analyzer, Spectrum	E4446A	MY48250238	2018-05-08	1 year
-	10dB attenuator	-	-	Each time ¹	N/A
-	RF cable	-	-	Each time ¹	N/A
ETS- Lindgren	Power Sensor	7002-006	160097	2018-12-31	2 years

Note¹: 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:	23° C
Relative Humidity:	42 %
ATM Pressure:	102.7 KPa

The testing was performed by Christian McCaig on 2019-04-22 in RF site.

9.5 Test Results

5150 - 5250 MHz

FCC Results

Frequency (MHz)	Conducted Average Power (dBm)	FCC Limit (dBm)
802.11a mode		
5180	16.13	24
5200	16.72	24
5240	17.07	24
802.11n20 mode		
5180	16.05	24
5200	16.75	24
5240	17.16	24
802.11n40 mode		
5190	14.10	24
5230	16.58	24
802.11ac20 mode		
5180	16.14	24
5200	16.68	24
5240	17.17	24
802.11ac40 mode		
5190	14.11	24
5230	16.62	24
802.11ac80 mode		
5210	13.49	24

ISED Results

Modulation	Frequency (MHz)	Conducted Output Power (dBm)	Antenna Gain (dBi)	EIRP Output Power (dBm)	ISED Limit (dBm)
a	5180	16.13	2.5	18.63	22.1
	5200	16.72	2.5	19.22	22.1
	5240	17.07	2.5	19.57	22.1
n20	5180	16.05	2.5	18.55	22.4
	5200	16.75	2.5	19.25	22.4
	5240	17.16	2.5	19.66	22.4
n40	5190	14.1	2.5	16.6	23
	5230	16.58	2.5	19.08	23
ac20	5180	16.14	2.5	18.64	22.4
	5200	16.68	2.5	19.18	22.4
	5240	17.17	2.5	19.67	22.4
ac40	5190	14.11	2.5	16.61	23
	5230	16.62	2.5	19.12	23
ac80	5210	13.49	2.5	15.99	23

5250 - 5350 MHz

Frequency (MHz)	Conducted Average Power (dBm)	FCC Limit (dBm)	ISED Limit (dBm)
802.11a mode			
5260	17.02	24	23.1
5280	17.22	24	23.1
5320	16.58	24	23.1
802.11n20 mode			
5260	17.05	24	23.4
5280	17.21	24	23.4
5320	16.56	24	23.4
802.11n40 mode			
5270	15.24	24	24
5310	13.07	24	24
802.11ac20 mode			
5260	17.06	24	23.4
5280	17.31	24	23.4
5320	16.61	24	23.4
802.11ac40 mode			
5270	16.19	24	24
5310	13.06	24	24
802.11ac80 mode			
5290	12.43	24	24

5470 - 5725 MHz

Frequency (MHz)	Conducted Average Power (dBm)	FCC Limit (dBm)	ISED Limit (dBm)
802.11a mode			
5500	14.18	24	23.1
5580	15.33	24	23.1
5700	14.67	24	23.1
5720	15.99	24	23.1
802.11n20 mode			
5500	13.97	24	23.4
5580	14.37	24	23.4
5700	14.75	24	23.4
5720	14.88	24	23.4
802.11n40 mode			
5510	14.00	24	24
5550	14.70	24	24
5670	15.31	24	24
5710	15.79	24	24
802.11ac20 mode			
5500	14.52	24	23.4
5580	15.14	24	23.4
5700	15.61	24	23.4
5720	15.85	24	23.4
802.11ac40 mode			
5510	13.01	24	24
5550	14.34	24	24
5670	15.03	24	24
5710	15.62	24	24
802.11ac80 mode			
5530	12.86	24	24
5610	12.59	24	24
5690	13.93	24	24

5725 - 5850 MHz

Frequency (MHz)	Conducted Average Power (dBm)	FCC/ ISED Limit (dBm)
802.11a mode		
5745	12.28	30
5785	11.73	30
5825	11.77	30
802.11n20 mode		
5745	12.23	30
5785	11.73	30
5825	11.70	30
802.11n40 mode		
5755	11.79	30
5795	11.68	30
802.11ac20 mode		
5745	12.22	30
5785	11.72	30
5825	11.59	30
802.11ac40 mode		
5755	11.76	30
5795	11.73	30
802.11ac80 mode		
5775	11.57	30

Note: Duty cycle correction factor has already been added to the measurements.

10 FCC §15.407(a) & ISEDC 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 $11 \text{ dBm} + 10 \log B$, 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 ISEDC RSS-247 §6.2.1 for frequency band 5150-5250 MHz:

The maximum e.i.r.p. shall not exceed 200 mW or $10 + 10 \log_{10} B$, 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 ISEDC 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 ISEDC 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 ISEDC 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 $\geq$ 3 MHz.
- (iv) Number of points in sweep $\geq$ 2 Span / RBW. (This ensures that bin-to-bin spacing is $\leq$ 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 $\geq$ 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	MY48250238	2018-05-08	1 year
-	RF Cable	-	-	Each time ¹	N/A
-	10dB attenuator	-	-	Each time ¹	N/A

Note¹: 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 °C
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

The testing was performed by Christian McCaig on 2019-04-22 at RF site.

10.5 Test Results

5150 – 5250 MHz

FCC Results:

Frequency (MHz)	Measured PSD (dBm/MHz)	Corrected PSD (dBm/MHz)	FCC Limit (dBm/MHz)
802.11a mode			
5180	3.799	3.999	11
5200	4.975	5.175	11
5240	5.028	5.228	11
802.11n20 mode			
5180	5.281	5.521	11
5200	4.842	5.082	11
5240	5.049	5.289	11
802.11n40 mode			
5190	-2.397	-1.887	11
5230	3.085	3.595	11
802.11ac20 mode			
5180	6.153	6.393	11
5200	6.321	6.561	11
5240	6.939	7.179	11
802.11ac40 mode			
5190	-2.513	-1.913	11
5230	2.777	3.377	11
802.11ac80 mode			
5210	-6.919	-5.849	11

ISED Results:

Frequency (MHz)	PSD (dBm/MHz)	Corrected PSD (dBm/MHz)	EIRP PSD (dBm/MHz)	ISED Limit (dBm/MHz)
802.11a mode				
5180	3.799	3.999	6.499	10
5200	4.975	5.175	7.675	10
5240	5.028	5.228	7.728	10
802.11n20 mode				
5180	5.281	5.521	8.021	10
5200	4.842	5.082	7.582	10
5240	5.049	5.289	7.789	10
802.11n40 mode				
5190	-2.397	-1.887	0.613	10
5230	3.085	3.595	6.095	10
802.11ac20 mode				
5180	6.153	6.393	8.893	10
5200	6.321	6.561	9.061	10
5240	6.939	7.179	9.679	10
802.11ac40 mode				
5190	-2.513	-1.913	0.587	10
5230	2.777	3.377	5.877	10
802.11ac80 mode				
5210	-6.919	-5.849	-3.349	10

5250 – 5350 MHz

Frequency (MHz)	Measured PSD (dBm/MHz)	Corrected PSD (dBm/MHz)	FCC/ ISED Limit (dBm/MHz)
802.11a mode			
5260	4.815	5.015	11
5280	5.529	5.729	11
5320	4.953	5.153	11
802.11n20 mode			
5260	4.977	5.217	11
5280	5.079	5.319	11
5320	4.64	4.88	11
802.11n40 mode			
5270	2.335	2.835	11
5310	-4.134	-3.624	11
802.11ac20 mode			
5260	6.859	7.099	11
5280	6.943	7.183	11
5320	6.118	6.358	11
802.11ac40 mode			
5270	2.108	2.708	11
5310	-4.018	-3.418	11
802.11ac80 mode			
5290	-8.256	-7.186	11

5470 – 5725 MHz

Frequency (MHz)	Measured PSD (dBm/MHz)	Corrected PSD (dBm/MHz)	FCC/ ISED Limit (dBm/MHz)
802.11a mode			
5500	3.816	4.016	11
5580	4.958	5.158	11
5700	4.822	5.022	11
5720	5.065	5.265	11
802.11n20 mode			
5500	2.163	2.403	11
5580	3.531	3.771	11
5700	4.375	4.615	11
5720	4.336	4.576	11
802.11n40 mode			
5510	-1.75	-1.24	11
5550	-0.76	-0.25	11
5670	1.12	1.63	11
5710	0.423	0.933	11
802.11ac20 mode			
5500	3.191	3.431	11
5580	4.078	4.318	11
5700	4.73	4.97	11
5720	4.889	5.129	11
802.11ac40 mode			
5510	-2.786	-2.186	11
5550	0.574	1.174	11
5670	1.129	1.729	11
5710	1.298	1.898	11
802.11ac80 mode			
5530	-6.279	-5.209	11
5610	-6.226	-5.156	11
5690	-4.54	-3.47	11

5725 - 5850 MHz

Frequency (MHz)	Measured PSD (dBm/100 kHz)	Corrected PSD (dBm/500 kHz)	FCC/ ISED Limit (dBm/500 kHz)
802.11a mode			
5745	-7.485	-0.2953	30
5785	-7.847	-0.6573	30
5825	-7.614	-0.4243	30
802.11n20 mode			
5745	-6.941	0.2887	30
5785	-7.845	-0.6153	30
5825	-7.861	-0.6313	30
802.11n40 mode			
5755	-11.167	-3.6673	30
5795	-11.973	-4.4733	30
802.11ac20 mode			
5745	-6.831	0.3987	30
5785	-8.168	-0.9383	30
5825	-8.398	-1.1683	30
802.11ac40 mode			
5755	-11.455	-3.8653	30
5795	-12.197	-4.6073	30
802.11ac80 mode			
5775	-15.864	-7.8043	30

Corrected PSD (dBm/MHz) = PSD (dBm/MHz) + Duty Cycle Correction (dB)

Note: For the 5725-5850 MHz band, the Corrected PSD (dBm/500 kHz) is equal to:

Correct PSD (dBm/500 kHz) = PSD (dBm/100 kHz) + Duty Cycle Correction (dB) + $10 \cdot \log(500 \text{ kHz}/100 \text{ kHz})$

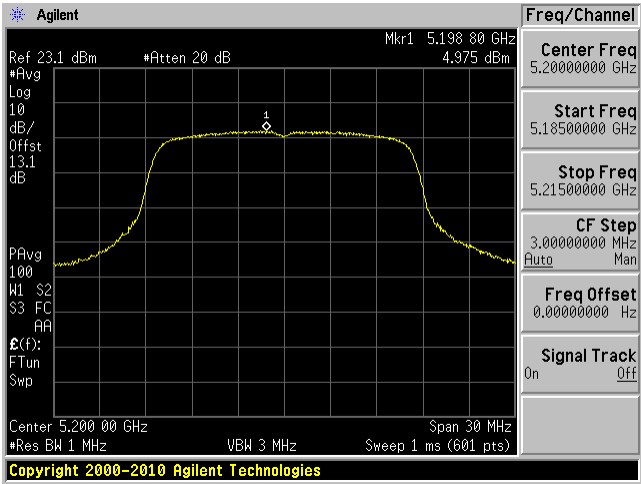
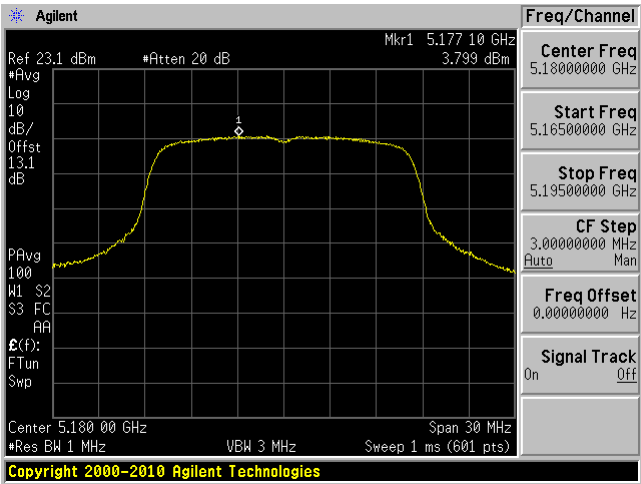
Please refer to the following plots.

5150 – 5250 MHz

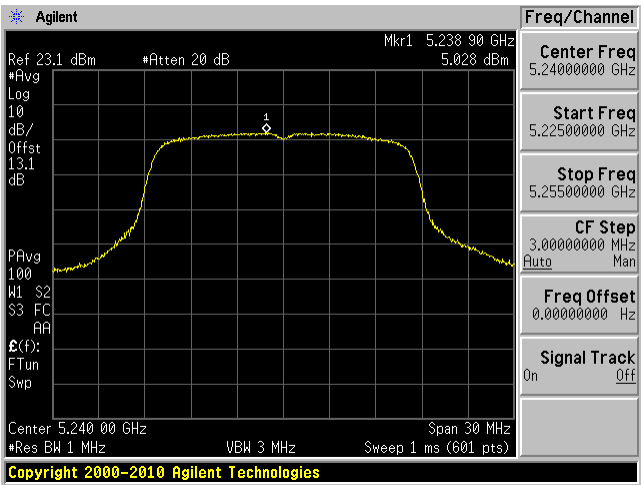
802.11a mode

5180 MHz

5200 MHz

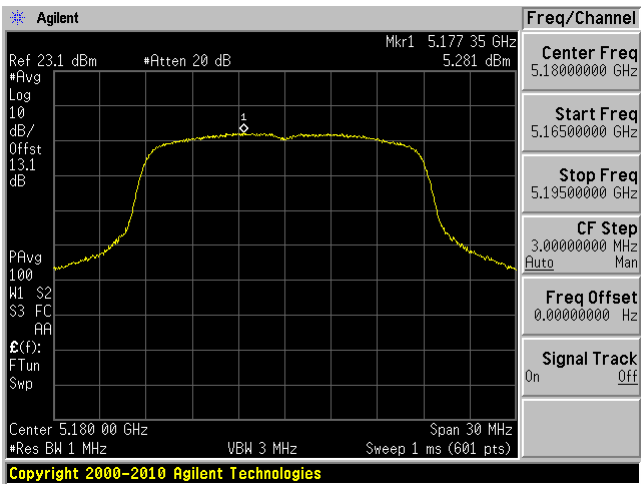


5240 MHz

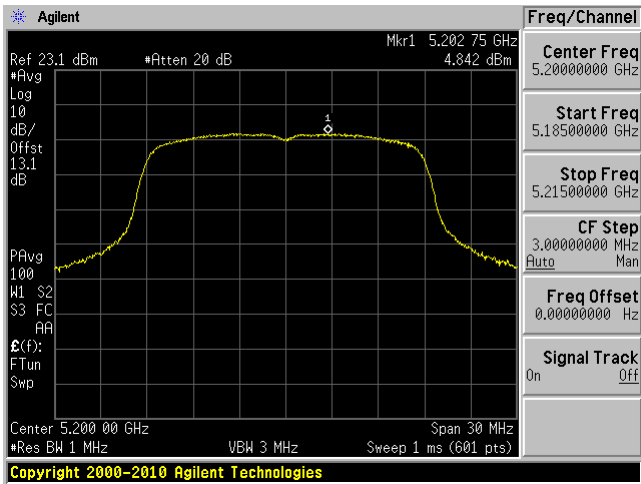


802.11n20 mode

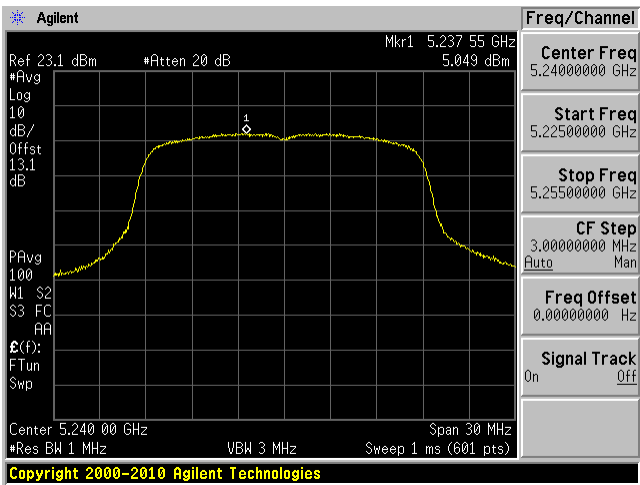
5180 MHz



5200 MHz

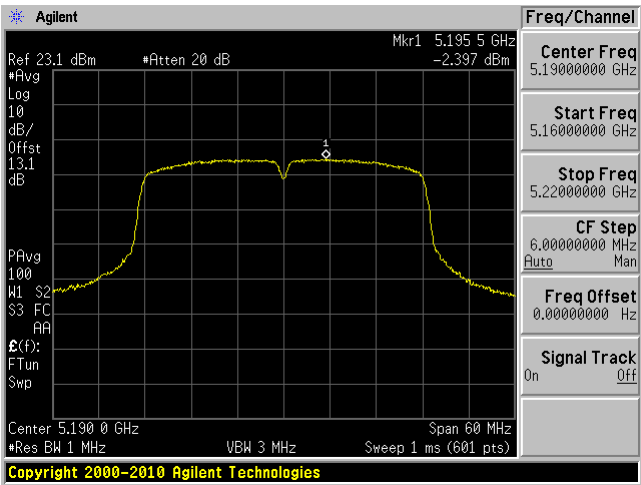


5240 MHz

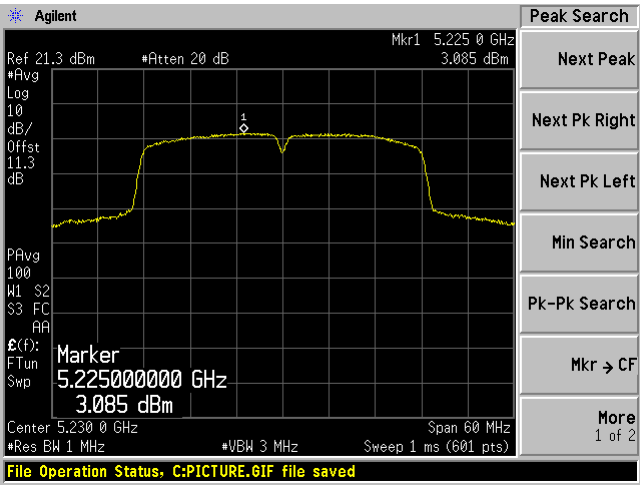


802.11n40 mode

5190 MHz

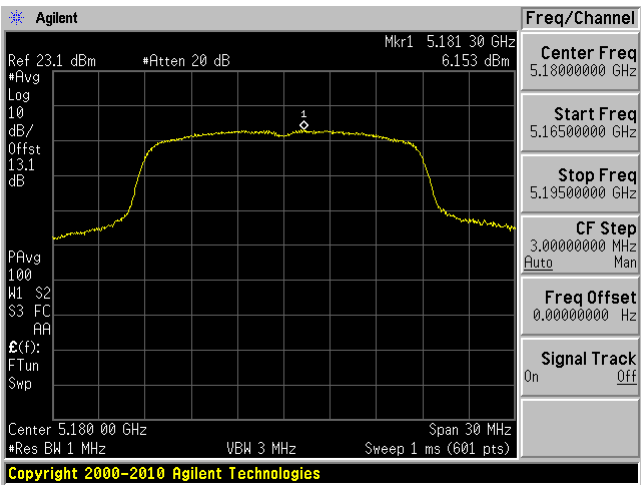


5230 MHz

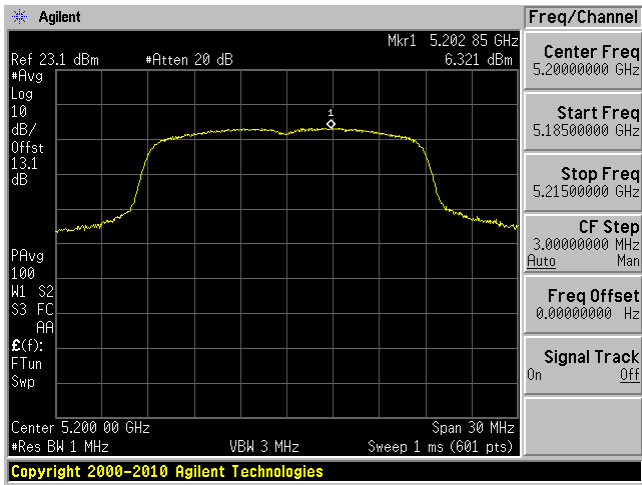


802.11ac20 mode

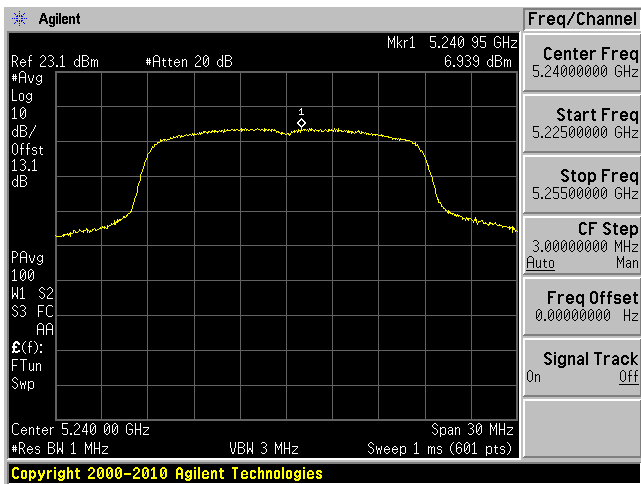
5180 MHz



5200 MHz

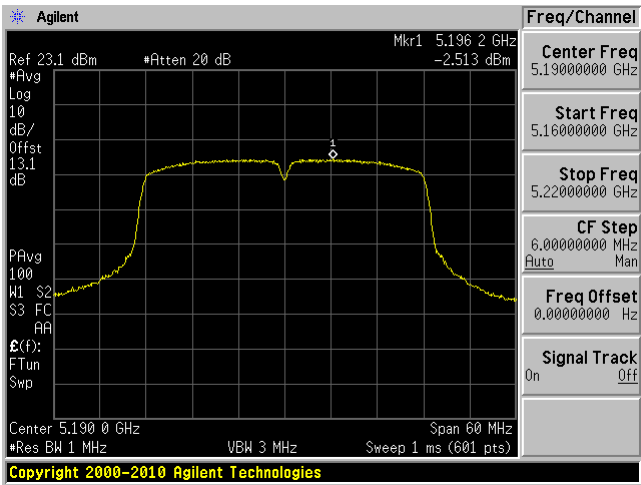


5240 MHz

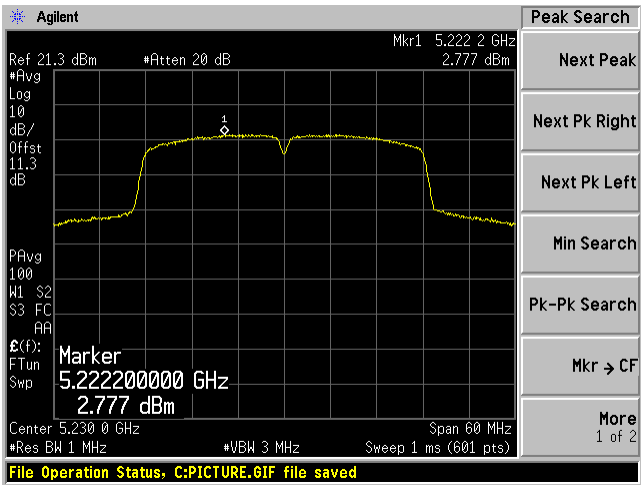


802.11ac40 mode

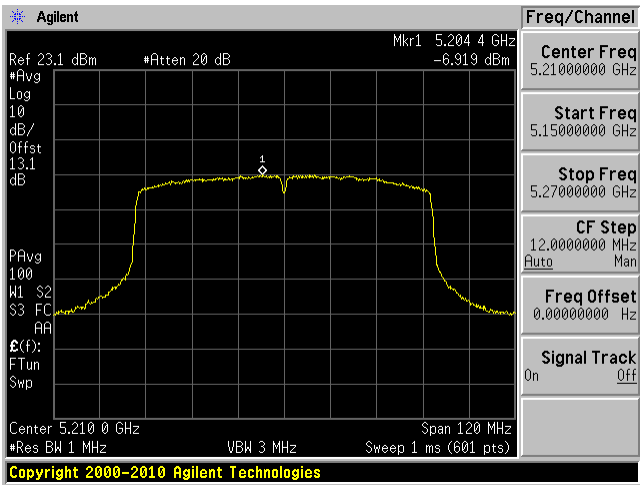
5190 MHz



5230 MHz



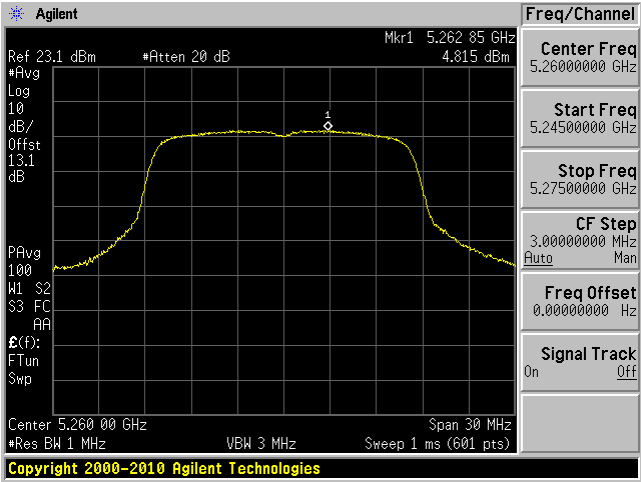
802.11ac80 mode, 5210 MHz



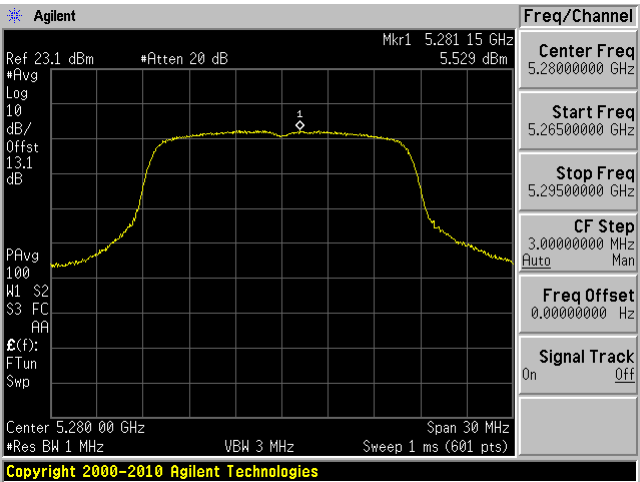
5250 – 5350 MHz

802.11a mode

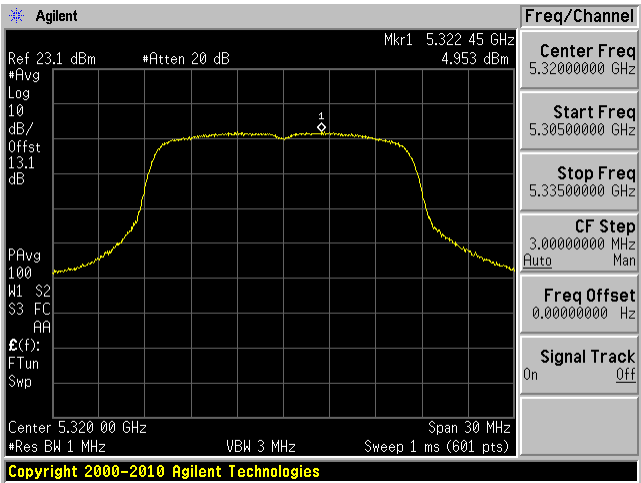
5260 MHz



5280 MHz

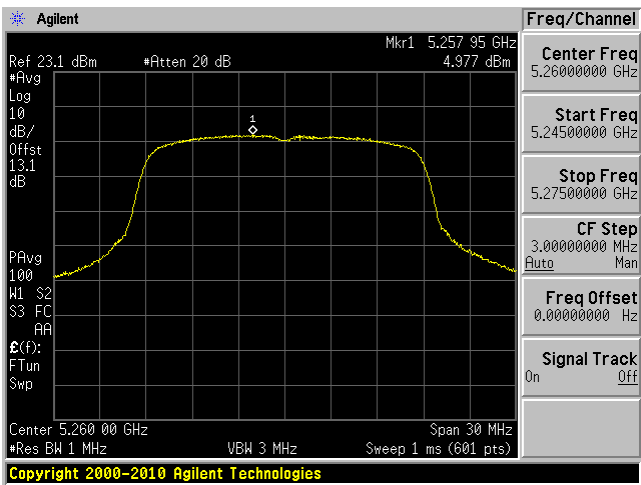


5320 MHz

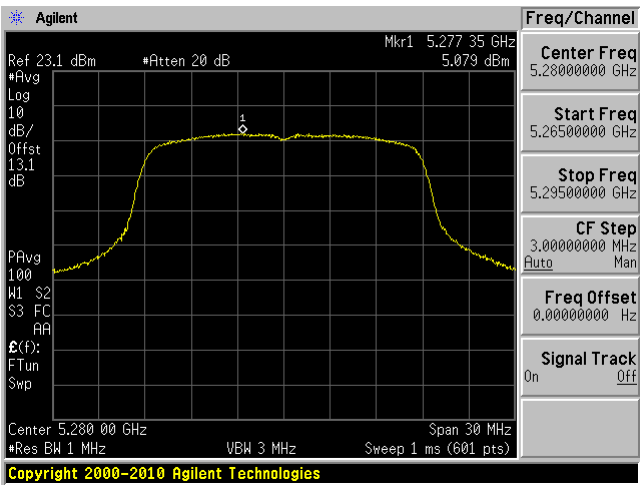


802.11n20 mode

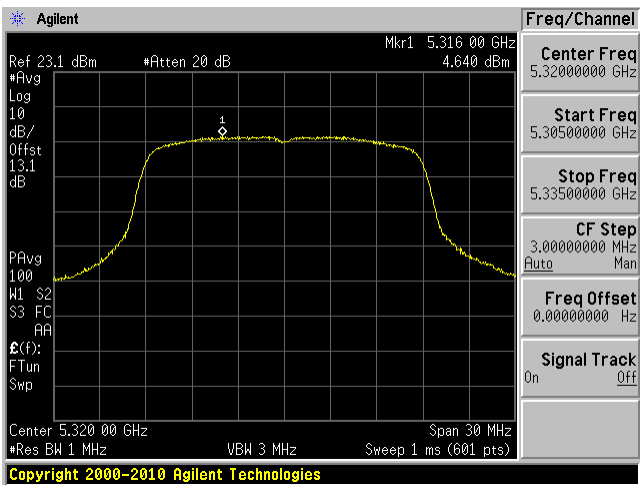
5260 MHz



5280 MHz

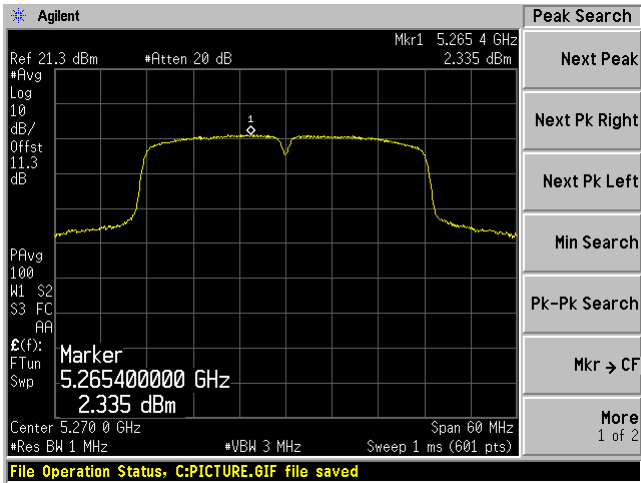


5320 MHz

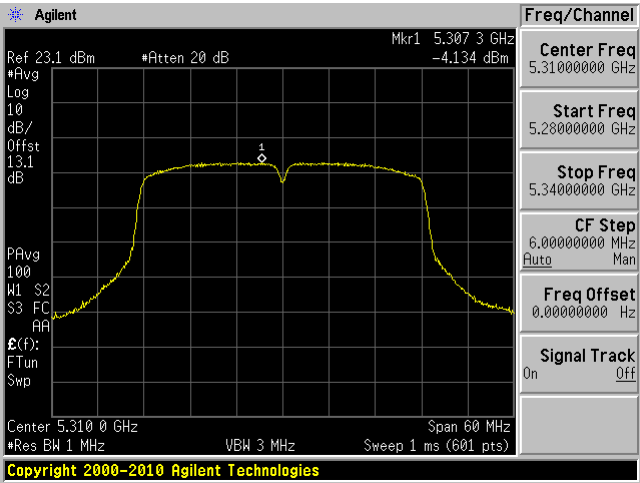


802.11n40 mode

5270 MHz

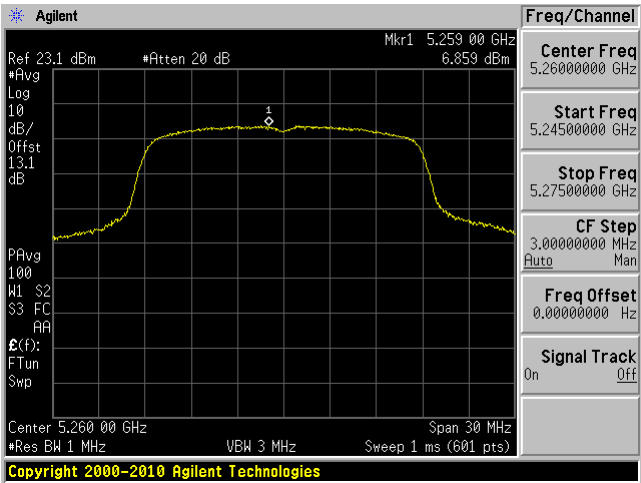


5310 MHz

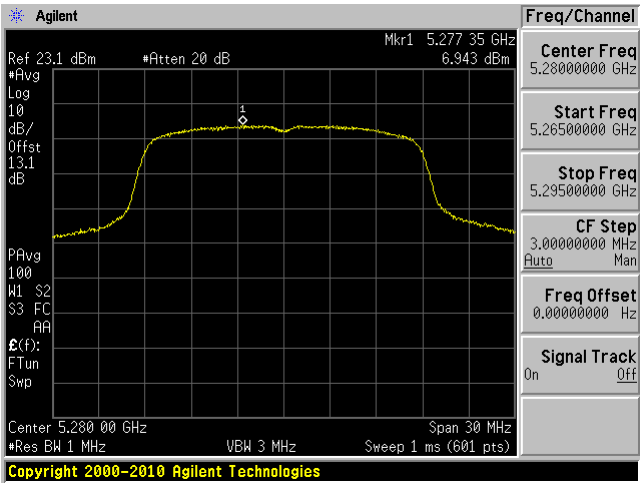


802.11ac20 mode

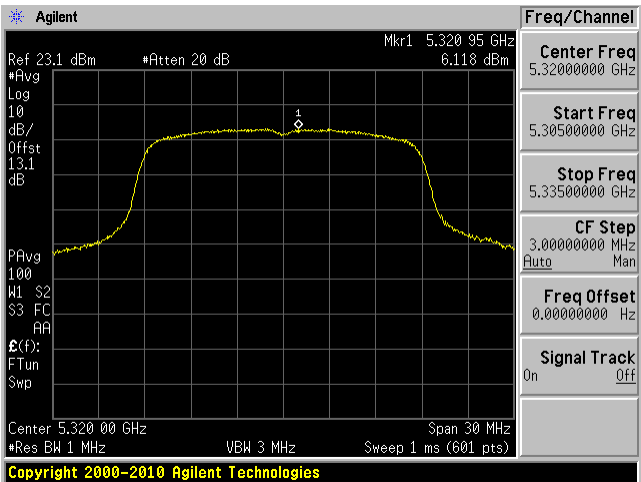
5260 MHz



5280 MHz

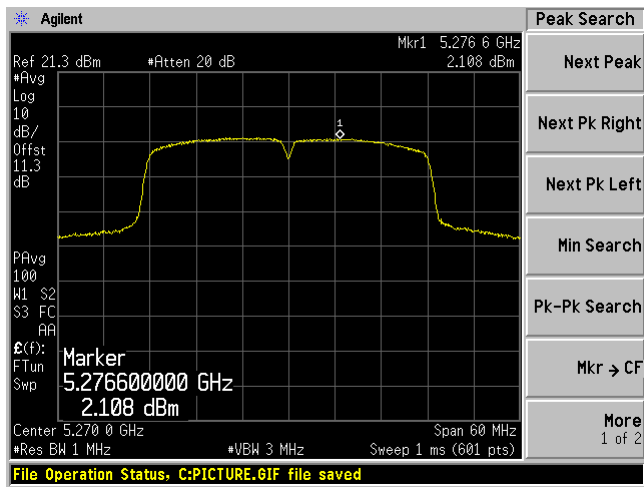


5320 MHz

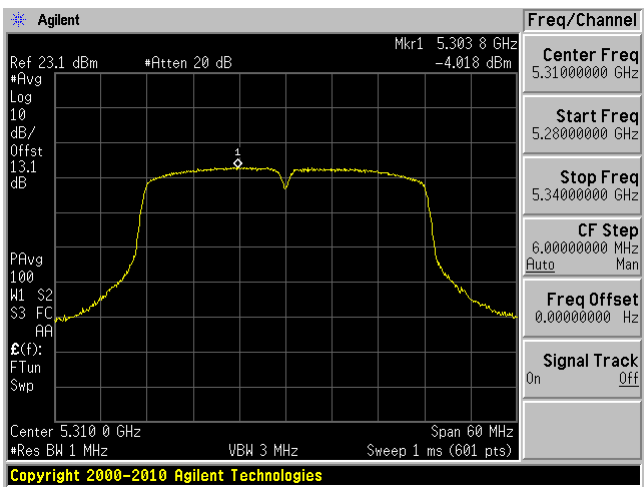


802.11ac40 mode

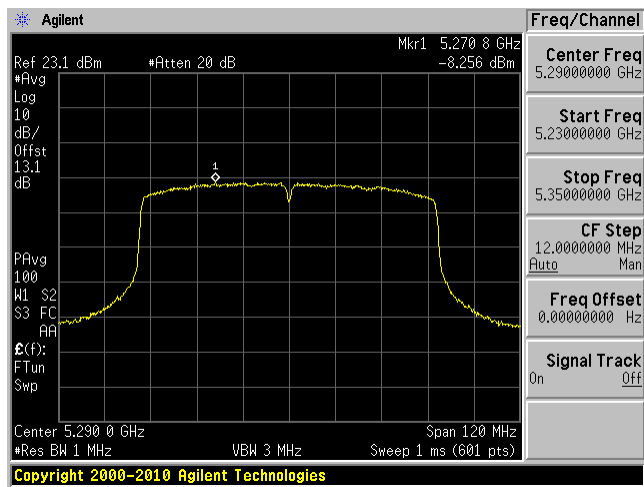
5270 MHz



5310 MHz



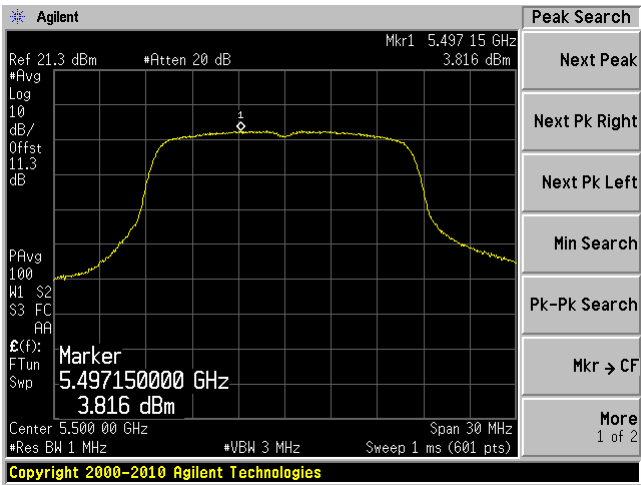
802.11ac80 mode, 5290 MHz



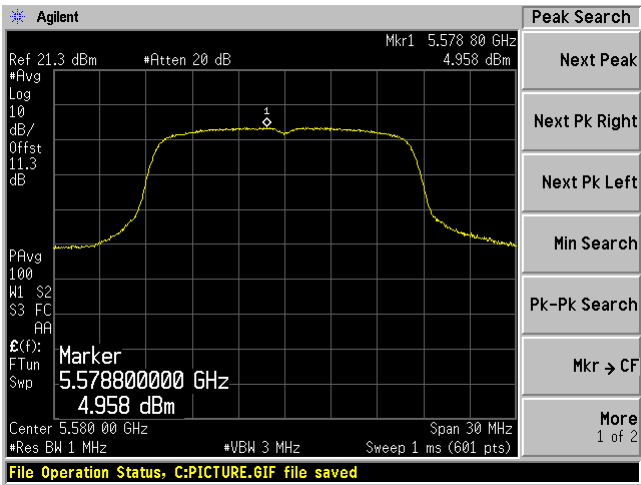
5470 – 5725 MHz

802.11a mode

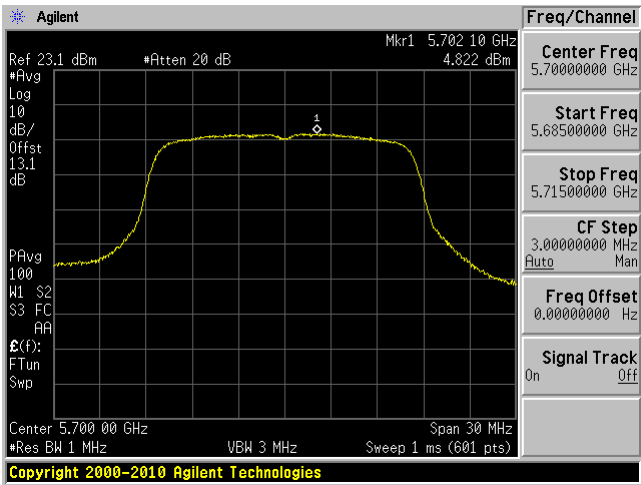
5500 MHz



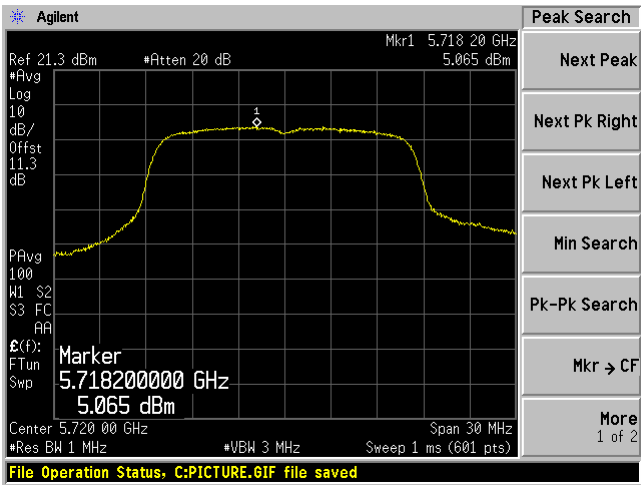
5580 MHz



5700 MHz

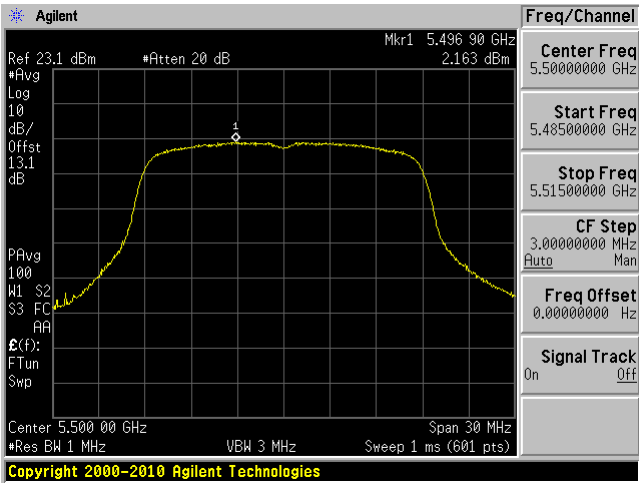


5720 MHz

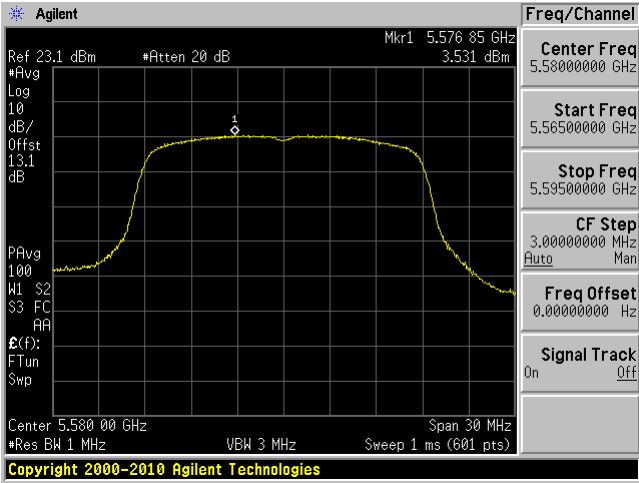


802.11n20 mode

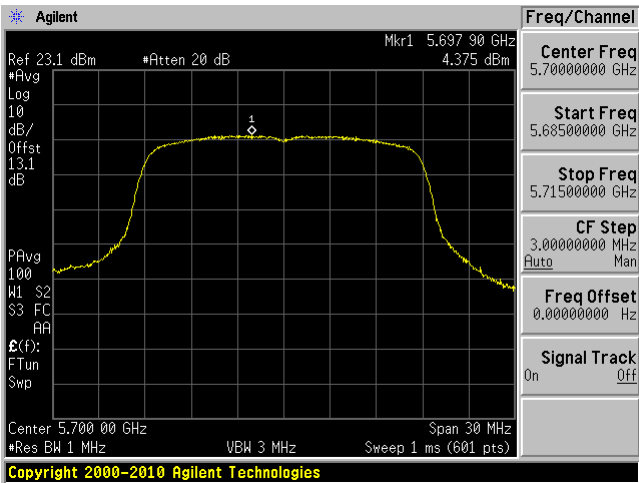
5500 MHz



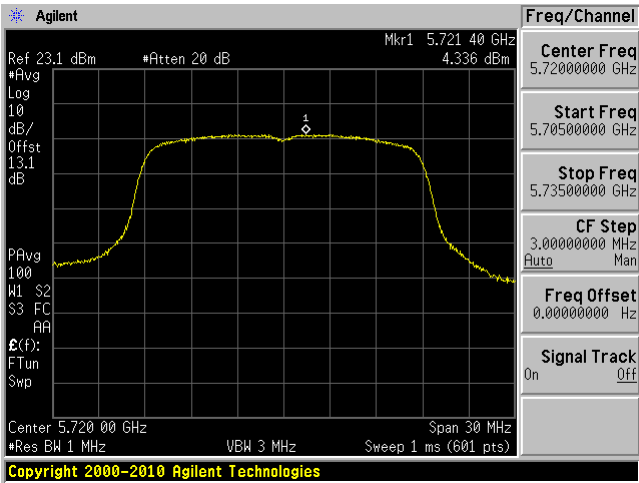
5580 MHz



5700 MHz

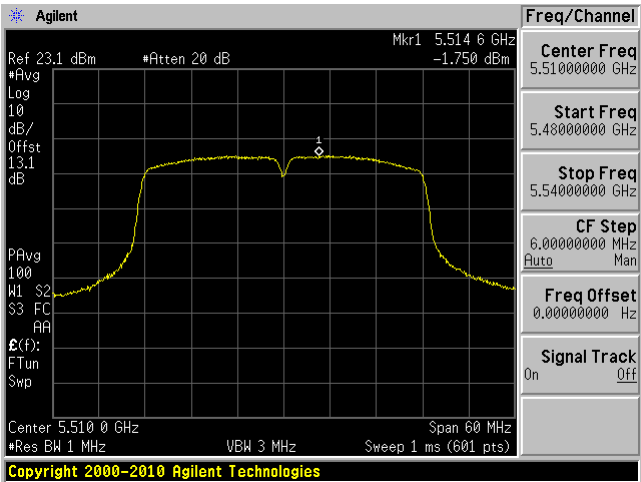


5720 MHz

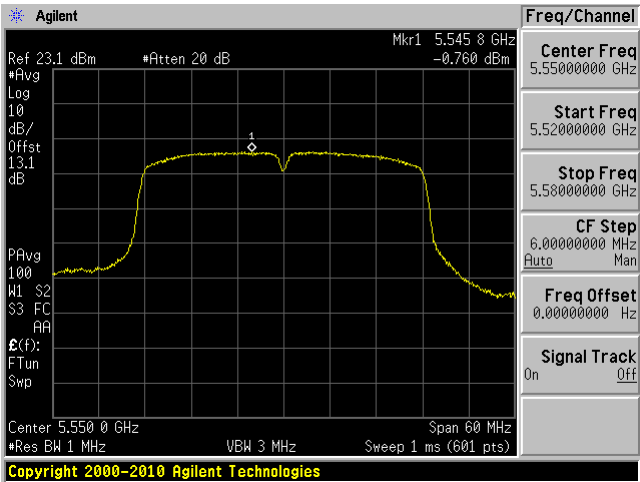


802.11n40 mode

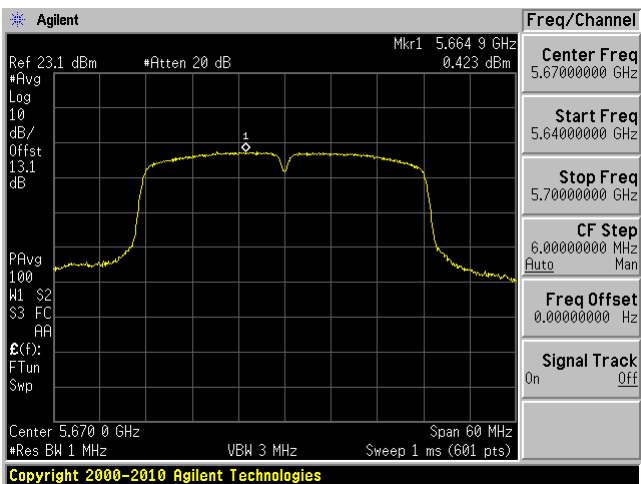
5510 MHz



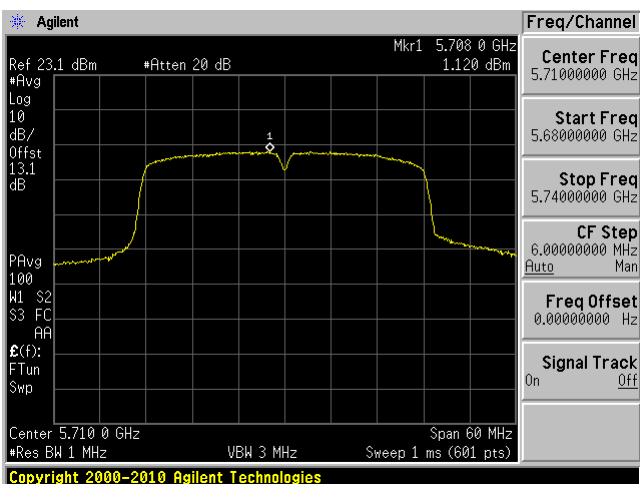
5550 MHz



5670 MHz

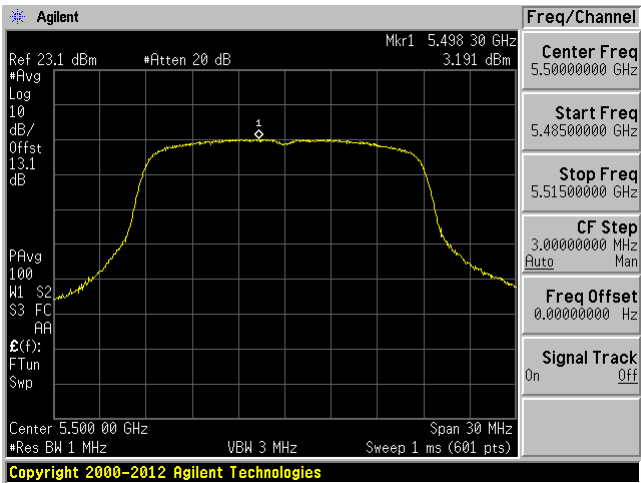


5710 MHz

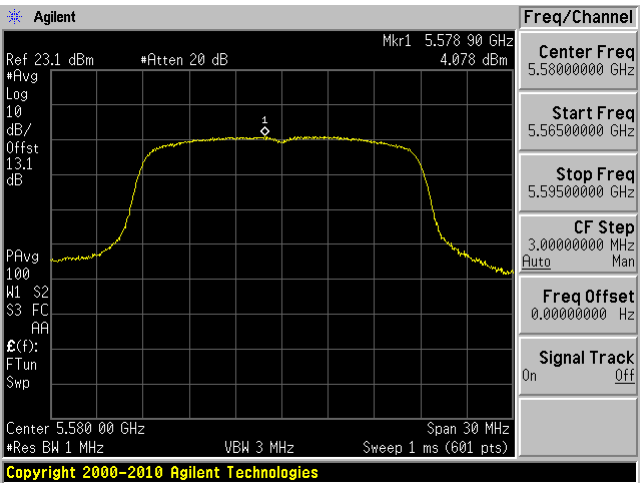


802.11ac20 mode

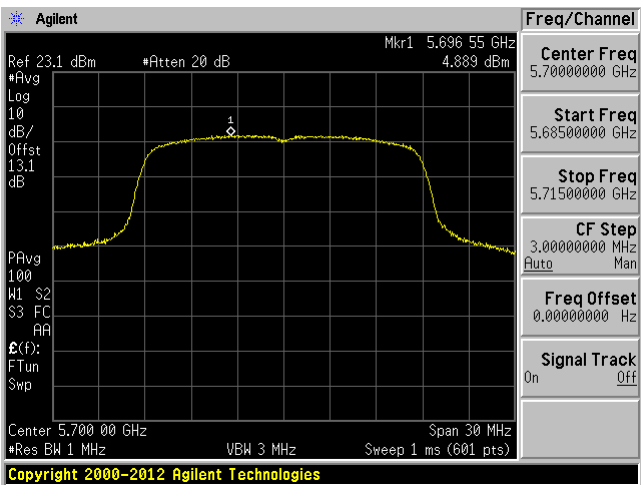
5500 MHz



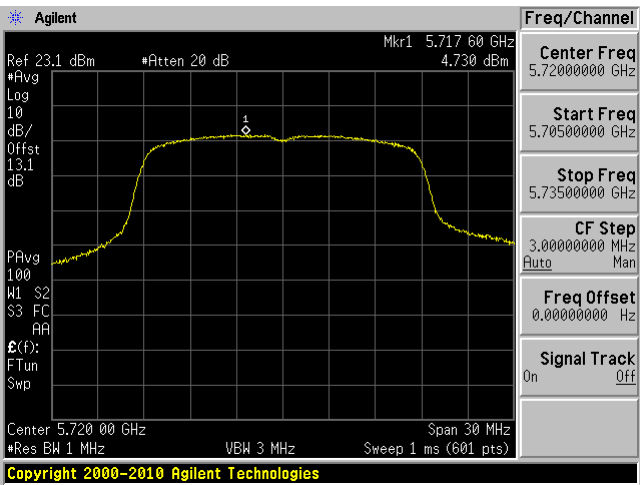
5580 MHz



5700 MHz

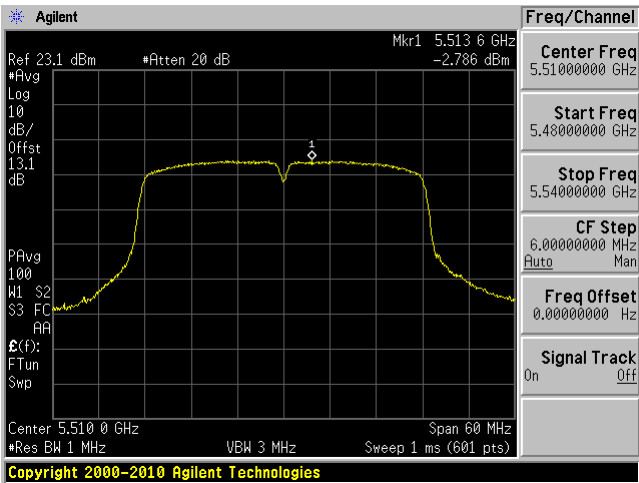


5720 MHz

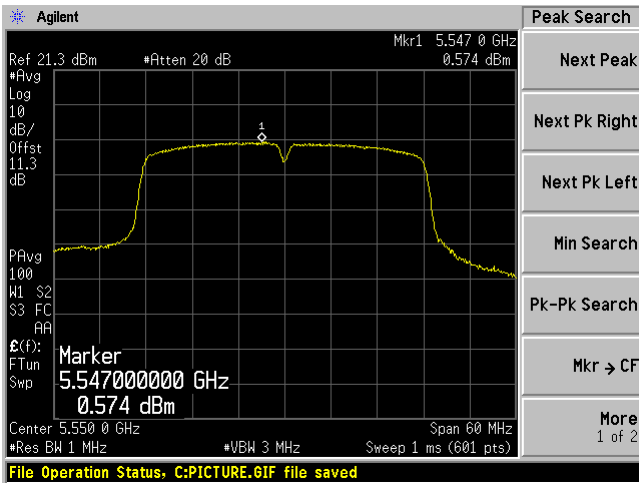


802.11ac40 mode

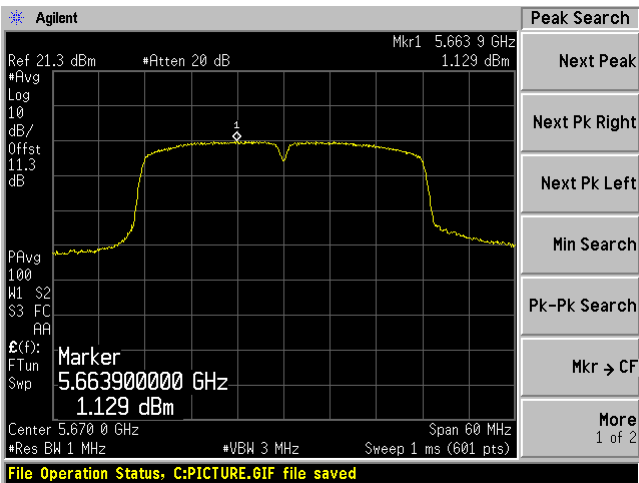
5510 MHz



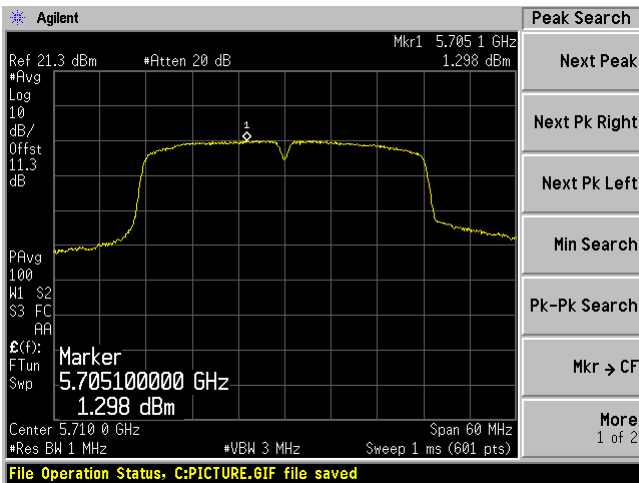
5550 MHz



5670 MHz

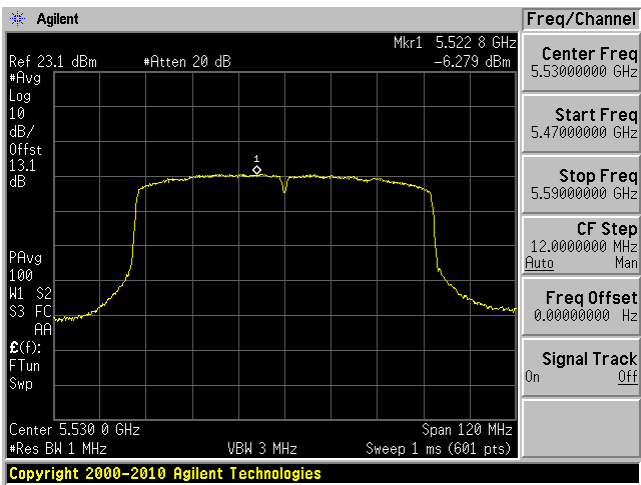


5710 MHz

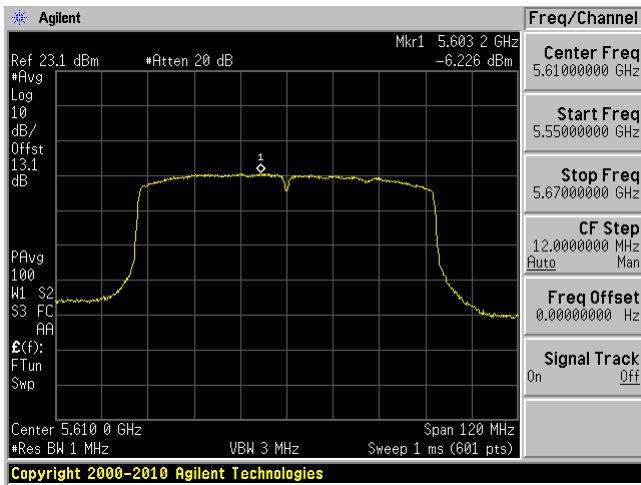


802.11ac80 mode

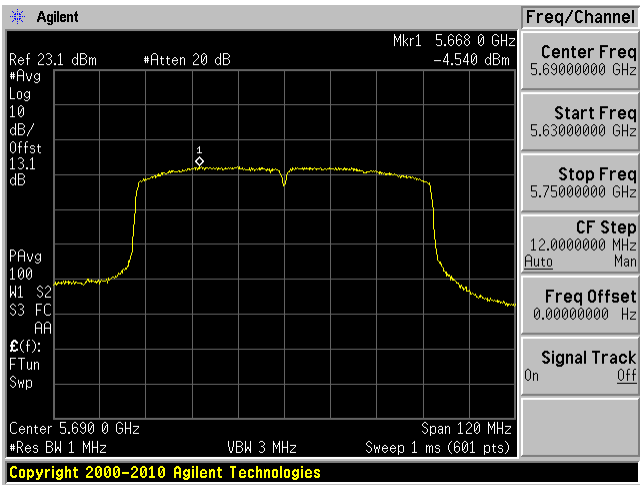
5530 MHz



5610 MHz



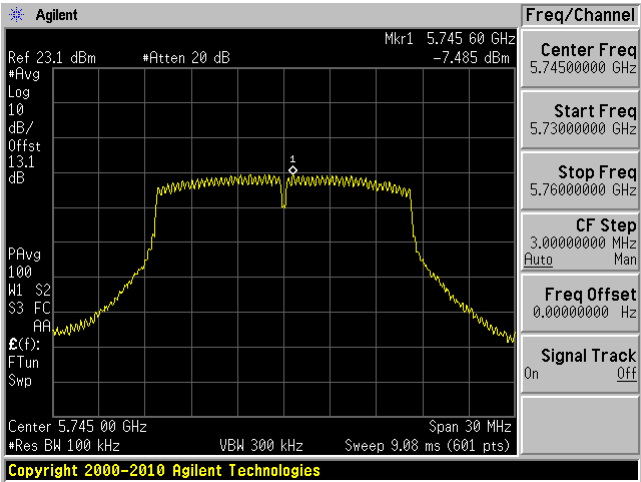
5690 MHz



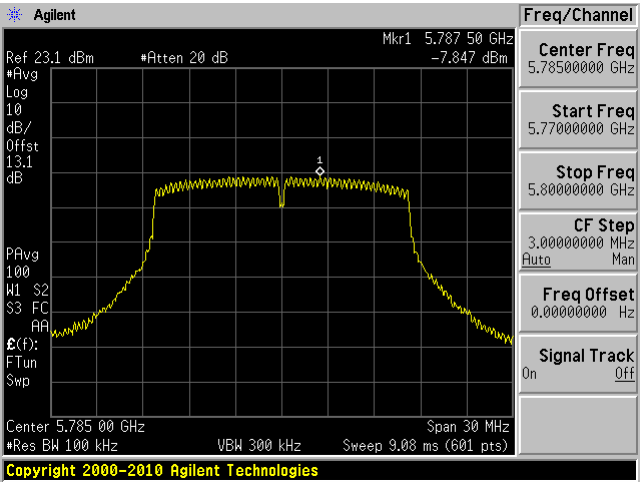
5725 – 5850 MHz

802.11a mode

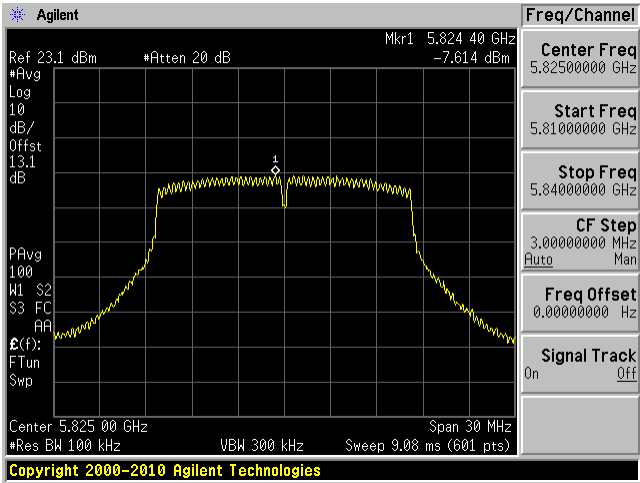
5745 MHz



5785 MHz



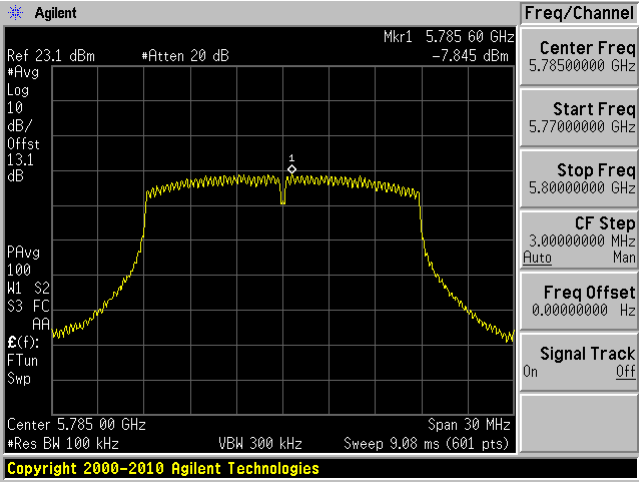
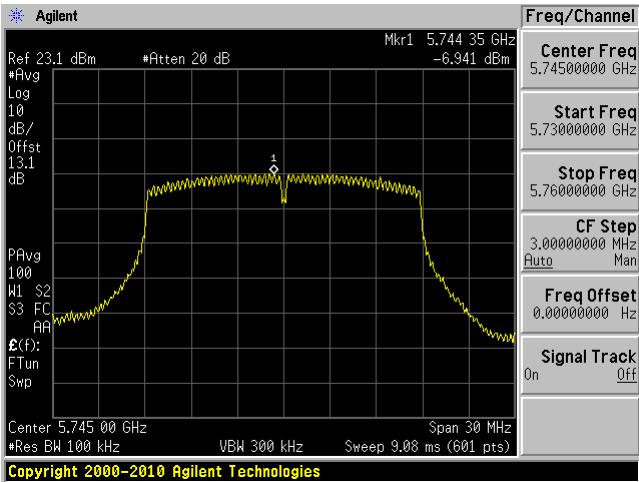
5825 MHz



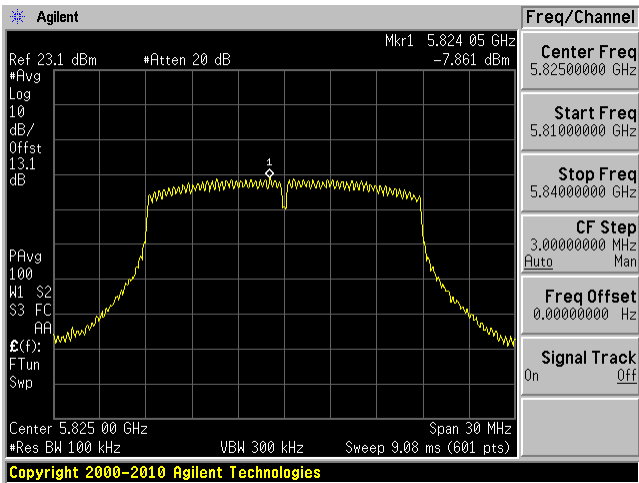
802.11n20 mode

5745 MHz

5785 MHz

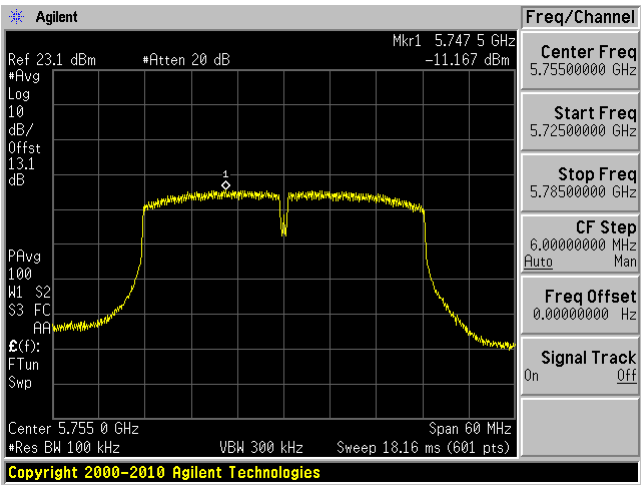


5825 MHz

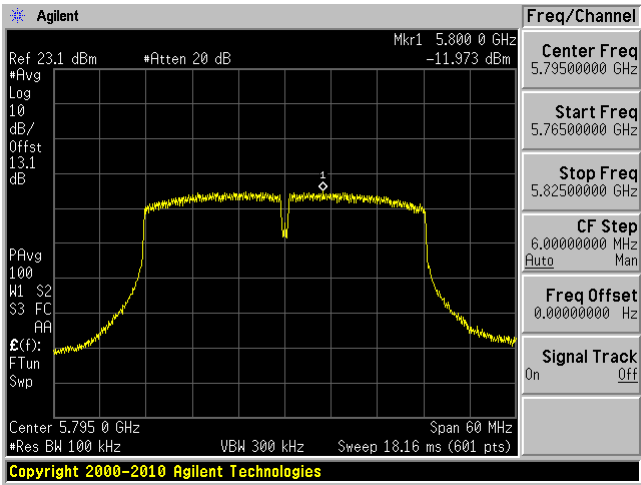


802.11n40 mode

5755 MHz

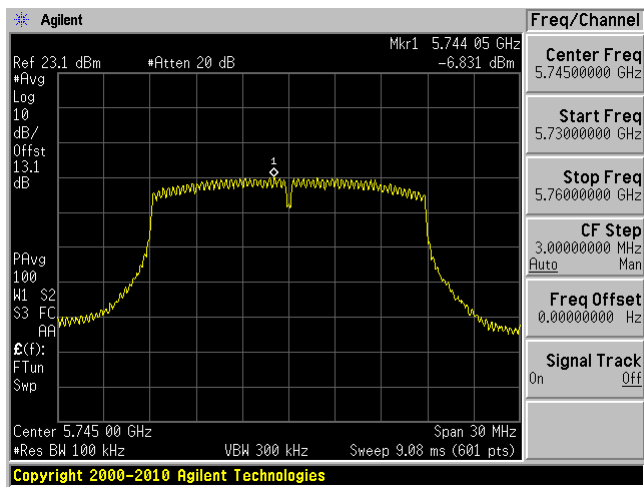


5795 MHz

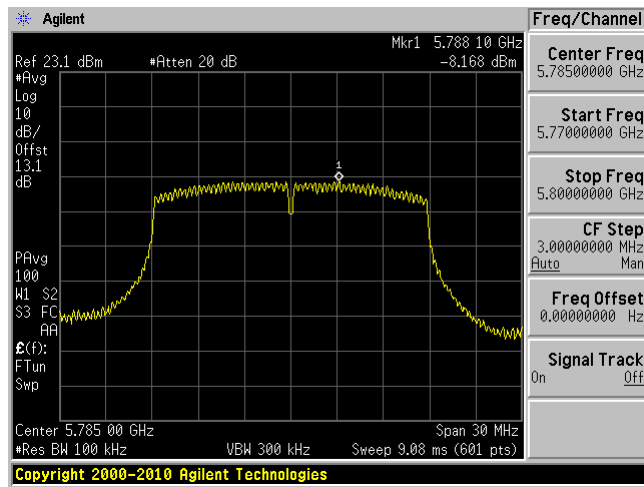


802.11ac20 mode

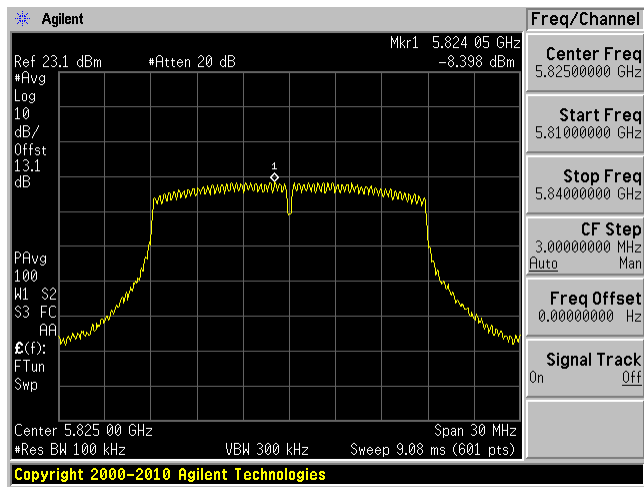
5745 MHz



5785 MHz



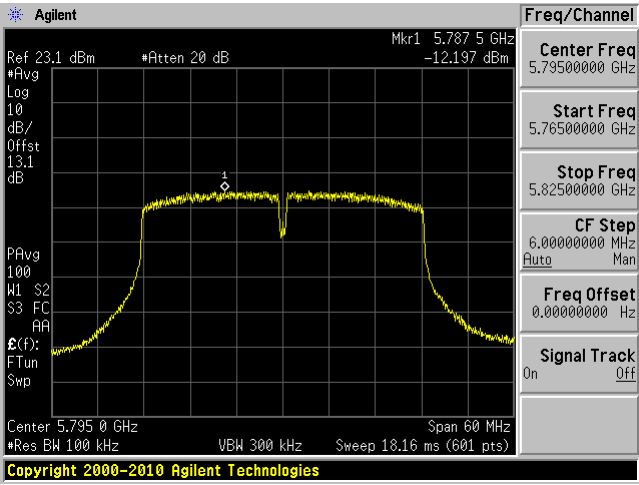
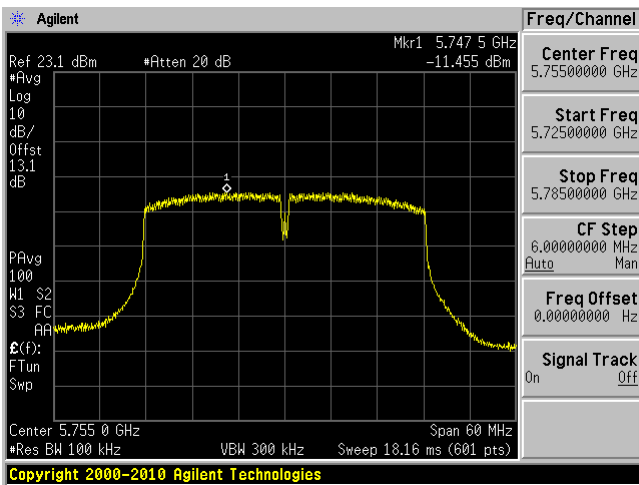
5825 MHz



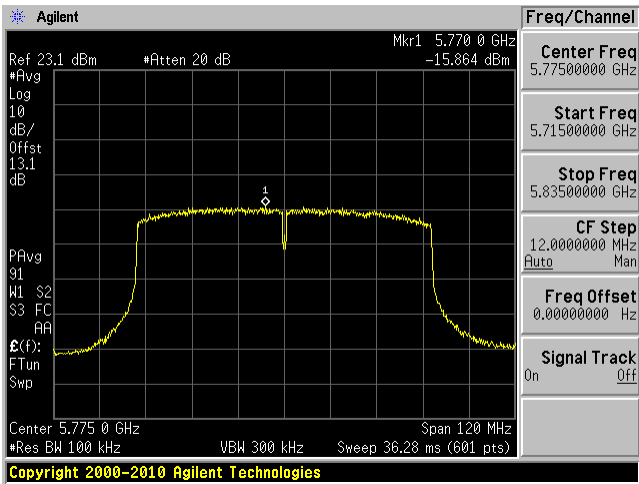
802.11ac40 mode

5755 MHz

5795 MHz



802.11ac80 mode, 5775 MHz



11 FCC §15.407(b) & ISEDC 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 ISEDC RSS-247 §6.2.1 for devices operating 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 ISEDC RSS-247 §6.2.2 for devices operating 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 ISEDC RSS-247 §6.2.3 for devices operating 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 operating 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

- 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.
- 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	MY48250238	2018-05-08	1 year
Rohde & Schwarz	Signal Analyzer	FSV40	1321.3008K3 9-101203- UW	2018-07-23	1 year
-	RF cable	-	-	Each time ¹	N/A
-	10dB attenuator	-	-	Each time ¹	N/A

Note¹: 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:	22-24° C
Relative Humidity:	40-41 %
ATM Pressure:	103.1-104.1 kPa

The testing was performed by Christian McCaig 2019-04-22 at RF site.

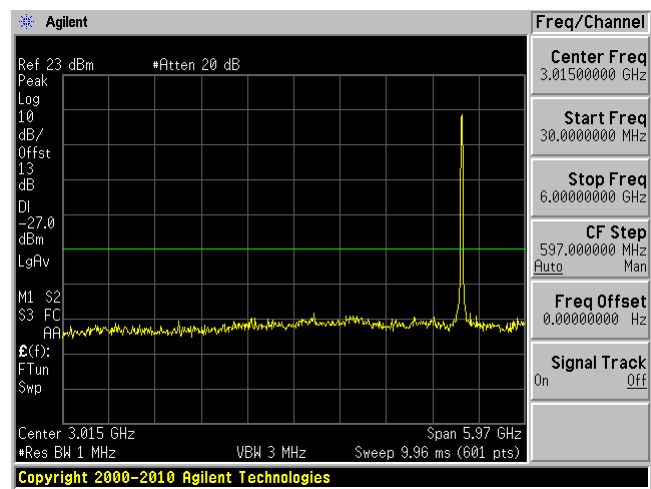
11.5 Test Results

Please refer to the following plots

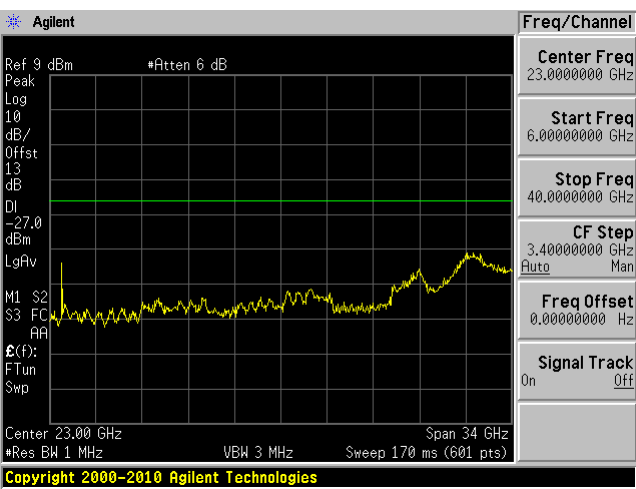
5150 - 5250 MHz

802.11a mode

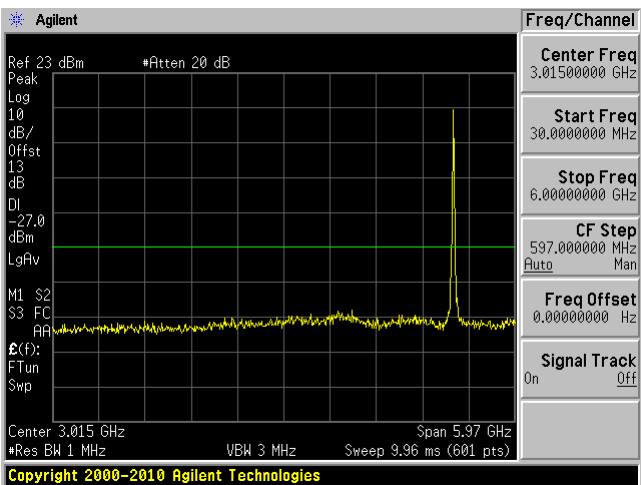
Low Channel 5180MHz (30MHz-6GHz)



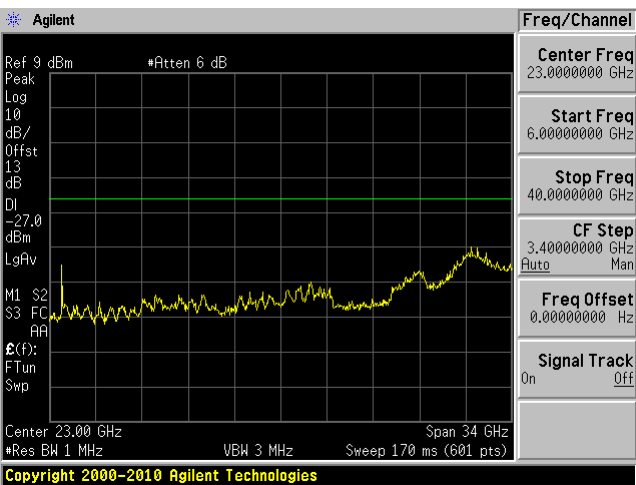
Low Channel 5180 MHz (6-40GHz)



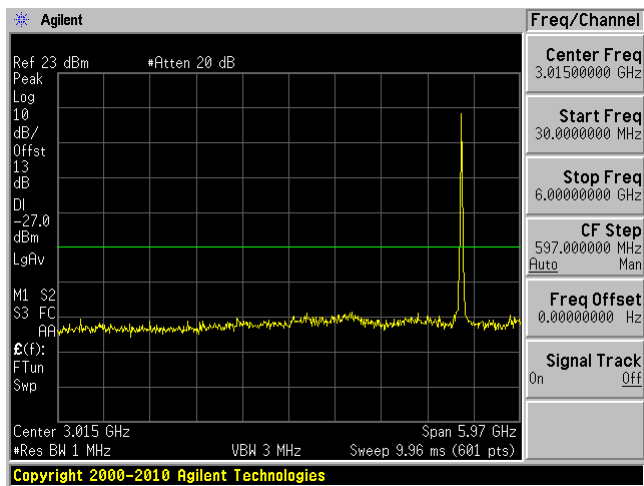
Middle Channel 5200MHz (30MHz-6GHz)



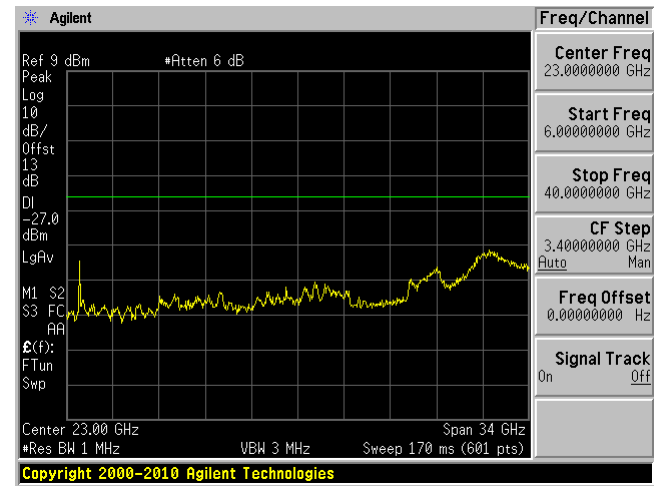
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

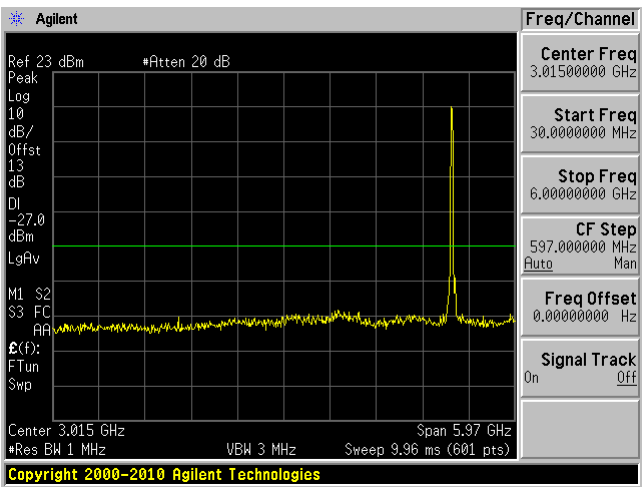


High Channel 5240 MHz (6-40GHz)

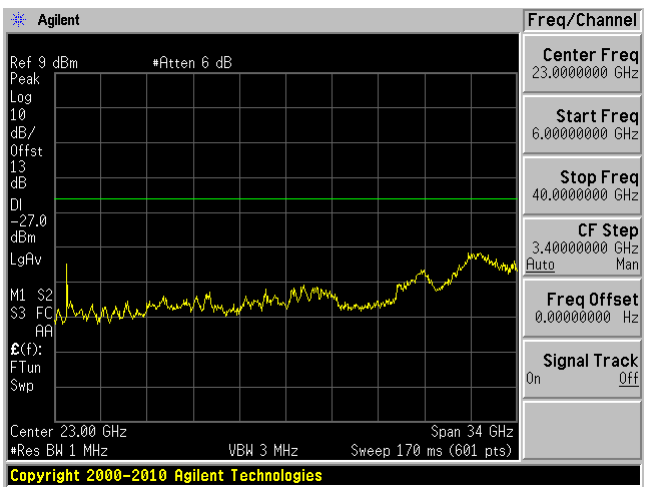


802.11n20 mode

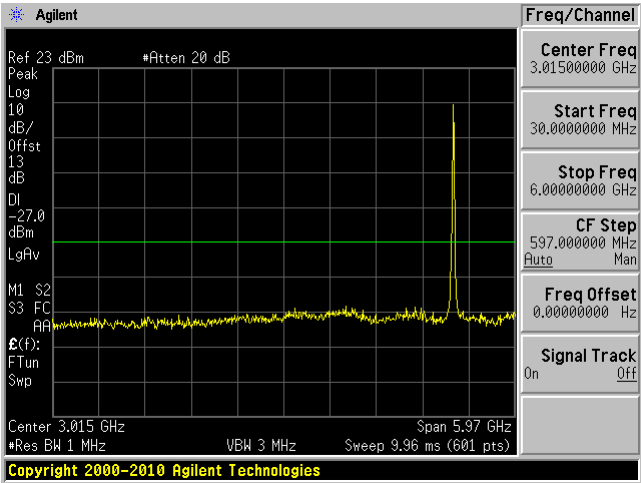
Low Channel 5180MHz (30MHz-6GHz)



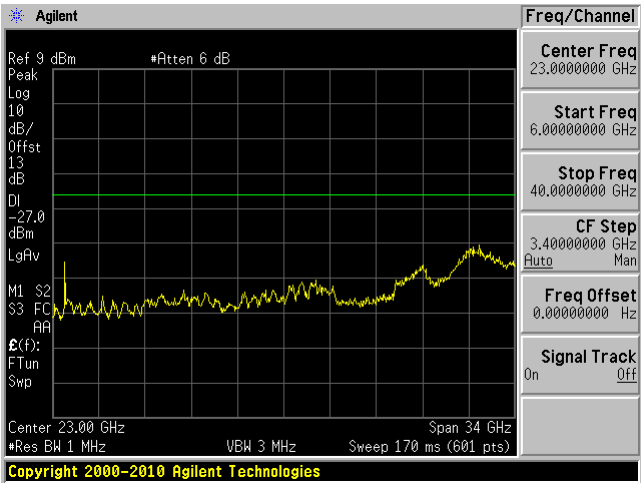
Low Channel 5180 MHz (6-40GHz)



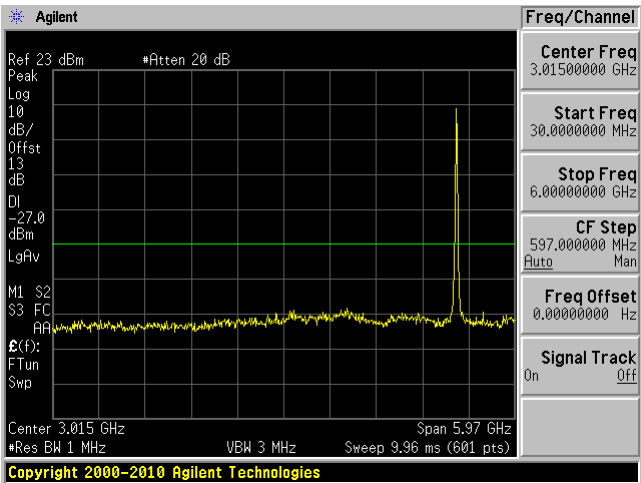
Middle Channel 5200MHz (30MHz-7GHz)



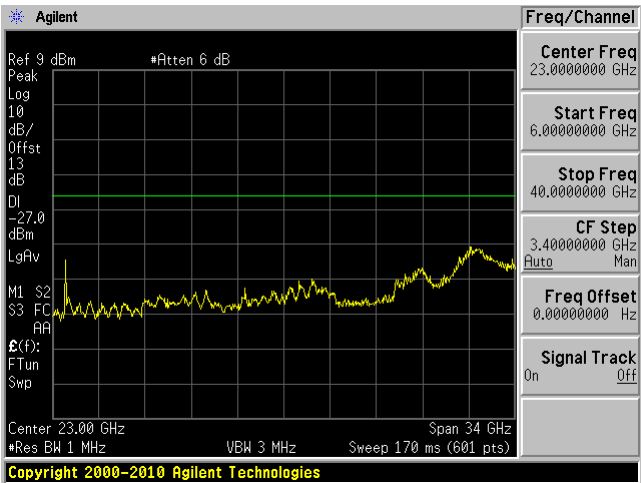
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

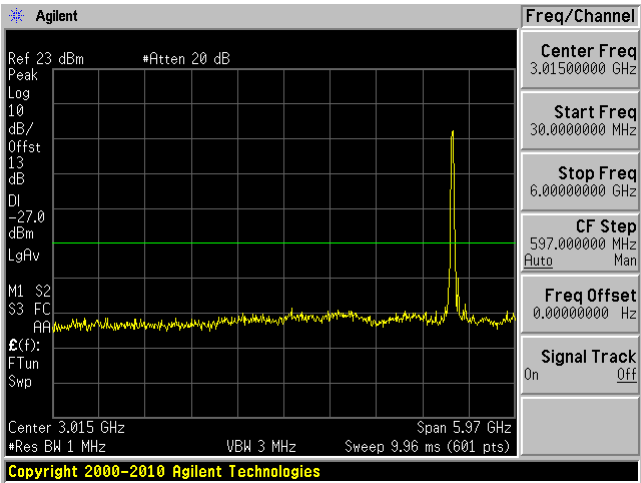


High Channel 5240 MHz (6-40GHz)

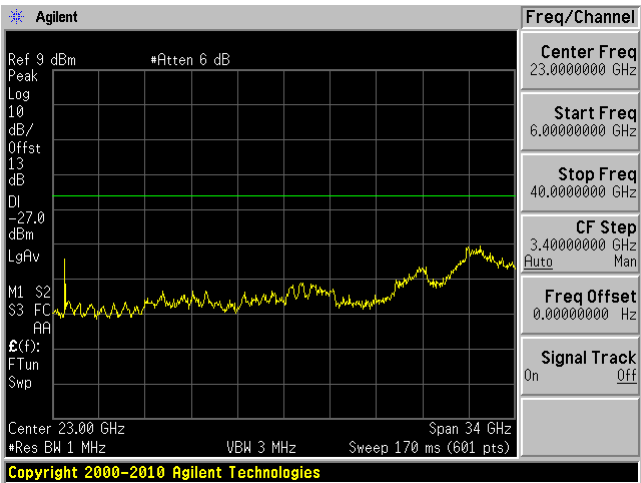


802.11n40 mode

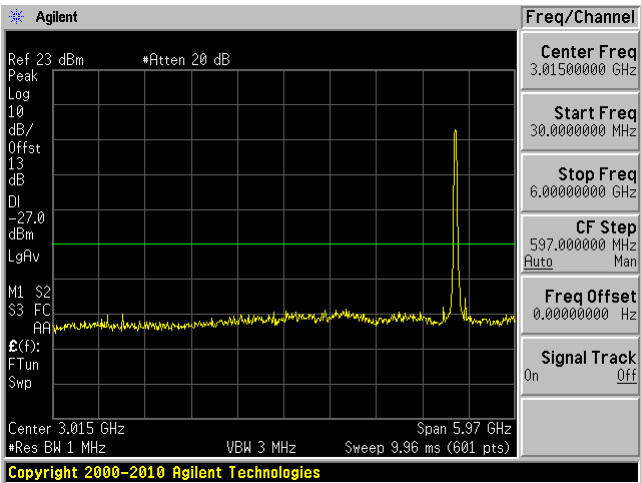
Low Channel 5190MHz (30MHz-6GHz)



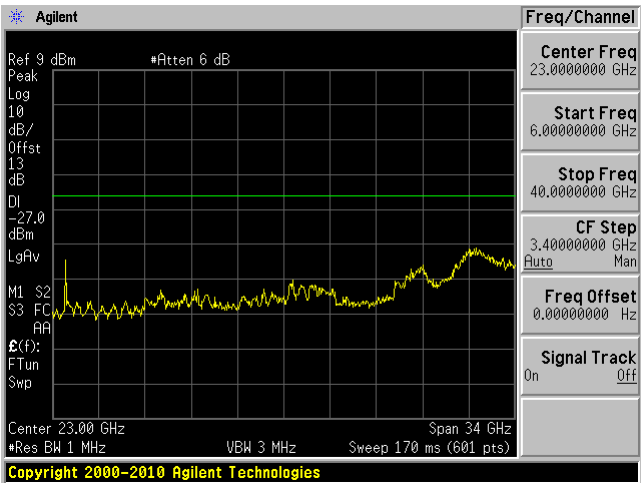
Low Channel 5190 MHz (6-40GHz)



High Channel 5230MHz (30MHz-6GHz)



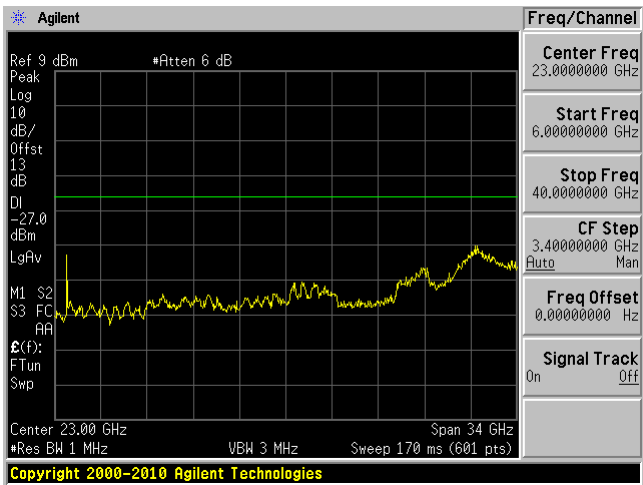
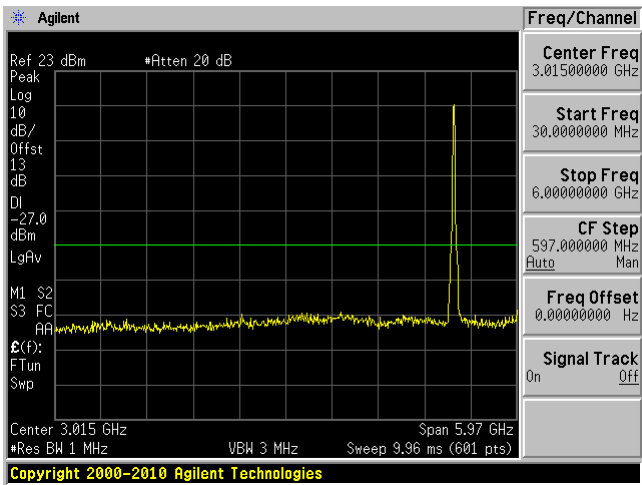
High Channel 5230 MHz (6-40GHz)



802.11ac20 mode

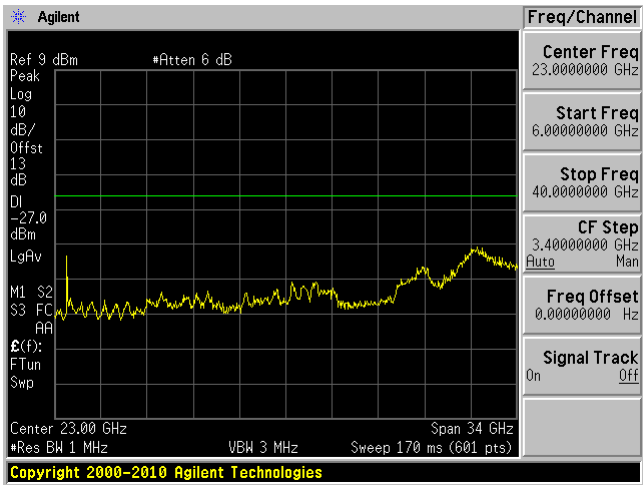
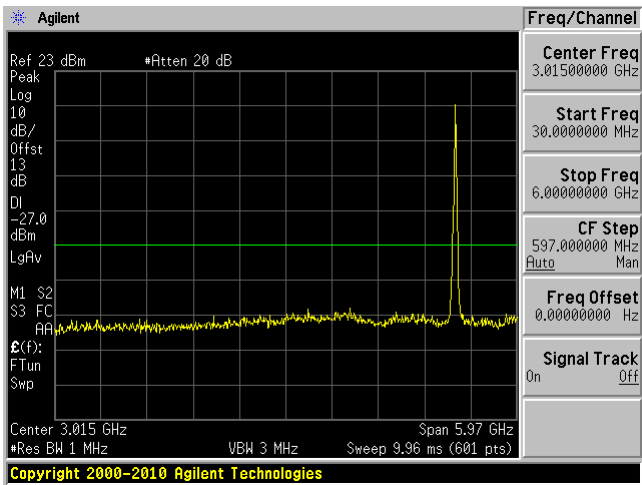
Low Channel 5180MHz (30MHz-6GHz)

Low Channel 5180 MHz (6-40GHz)

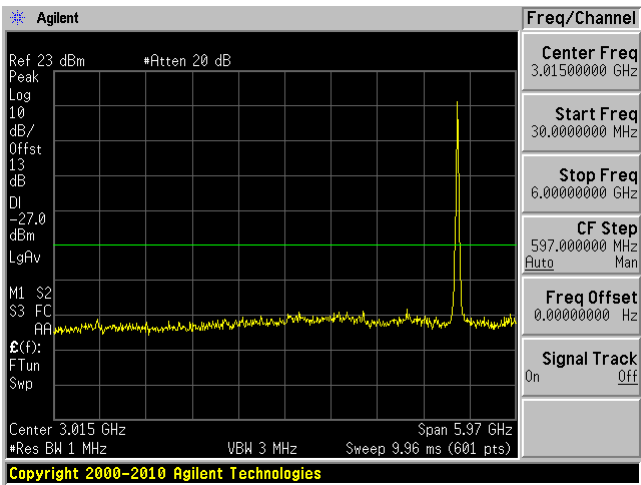


Middle Channel 5200MHz (30MHz-6GHz)

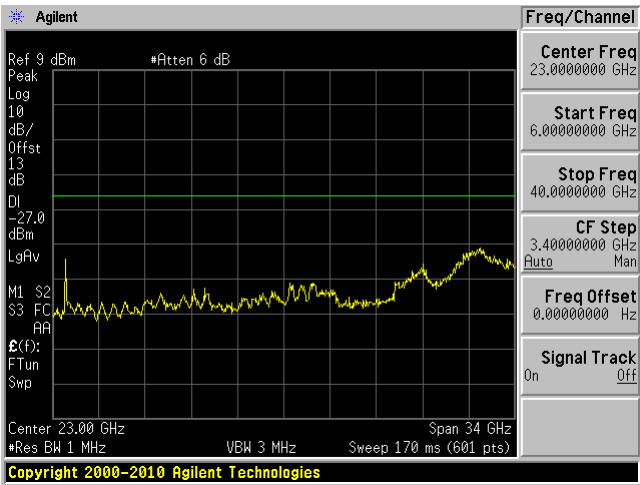
Middle Channel 5200 MHz (6GHz – 40GHz)



High Channel 5240MHz (30MHz-6GHz)

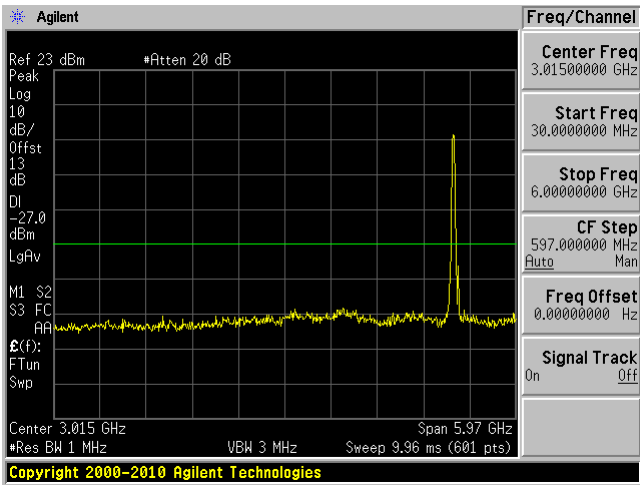


High Channel 5240 MHz (6GHz – 40GHz)

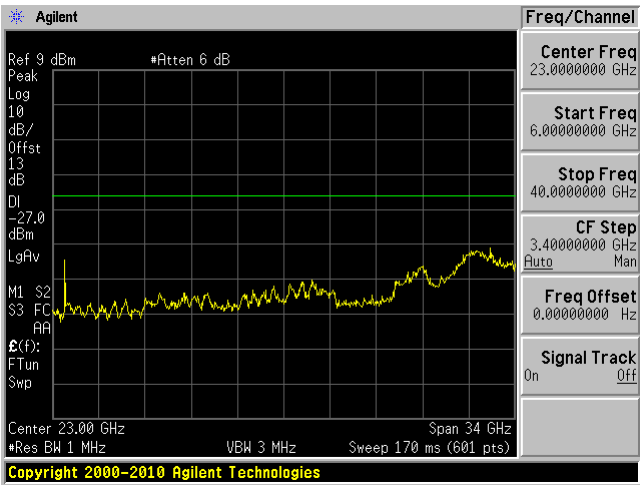


802.11ac40 mode

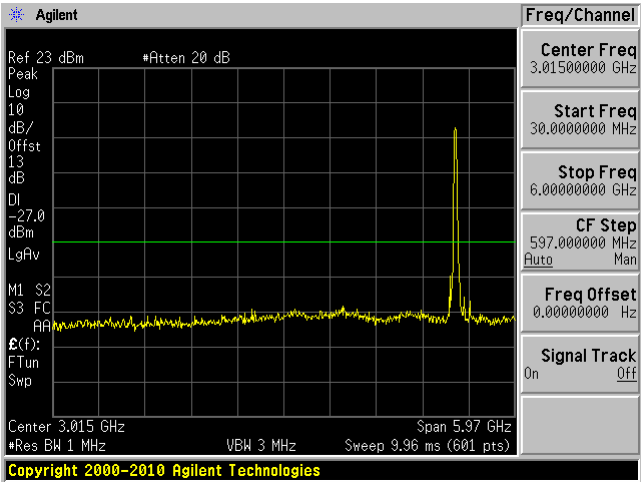
Low Channel 5190MHz (30MHz-6GHz)



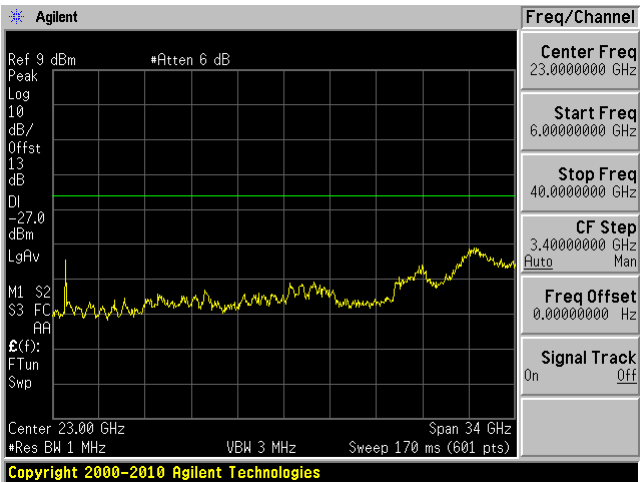
Low Channel 5190 MHz (6-40GHz)



High Channel 5230MHz (30MHz-6GHz)

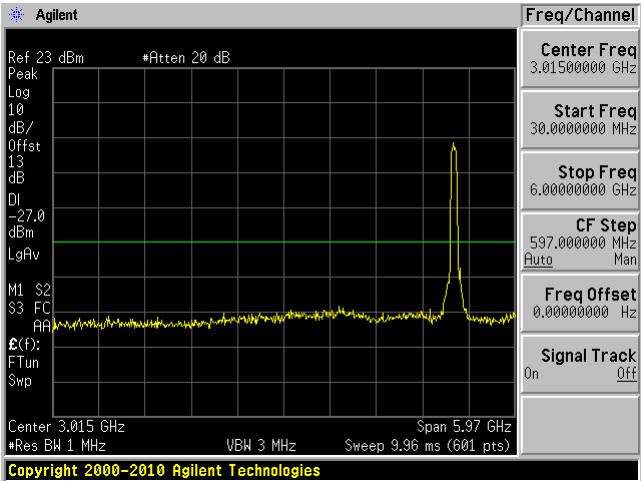


High Channel 5230 MHz (6GHz – 40GHz)

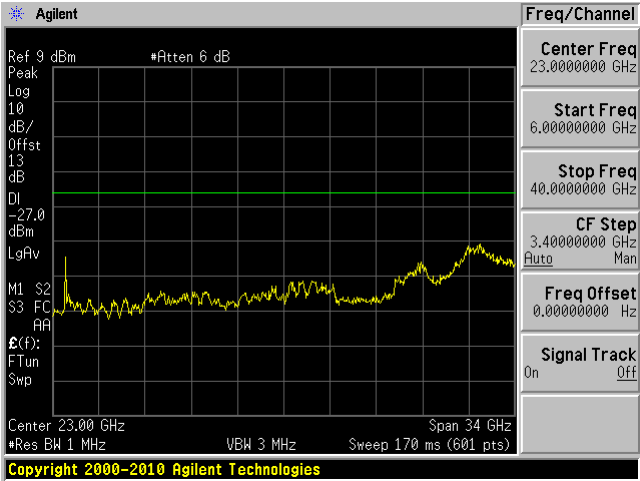


802.11ac80 mode

5210 MHz (30MHz-6GHz)



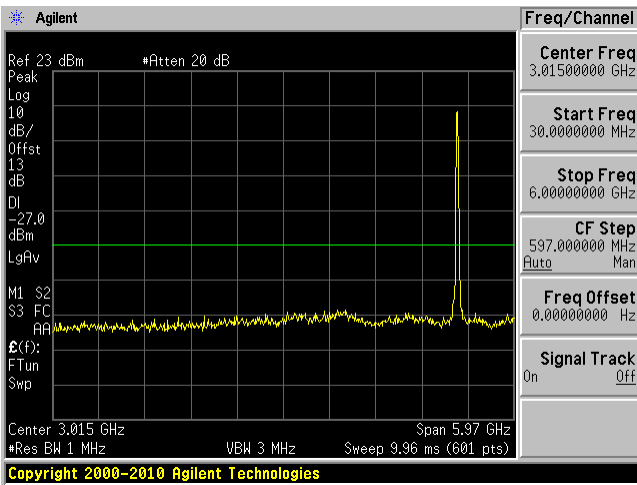
5210 MHz (6GHz – 40GHz)



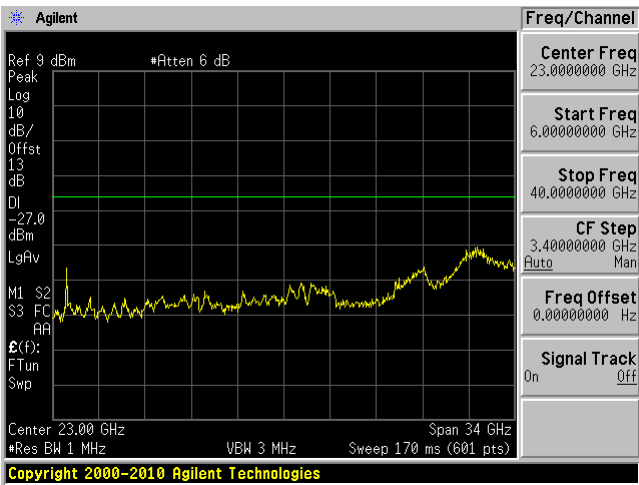
5250 – 5350 MHz

802.11a mode

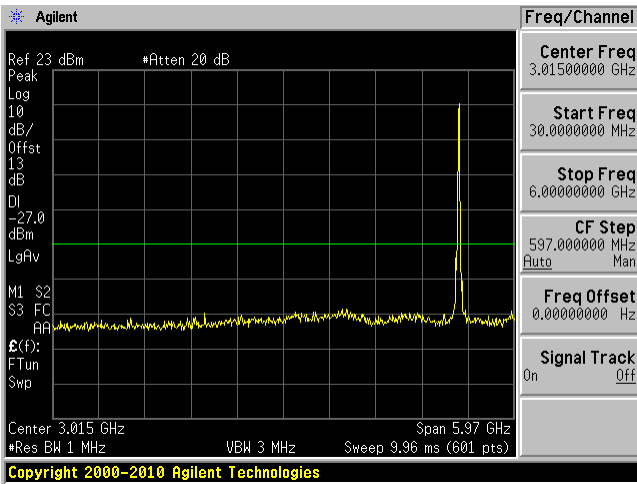
Low Channel 5260 MHz (30MHz-6GHz)



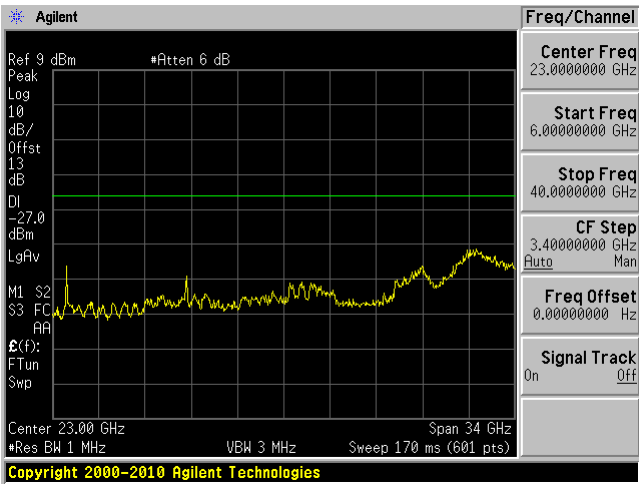
Low Channel 5260 MHz (6-40GHz)



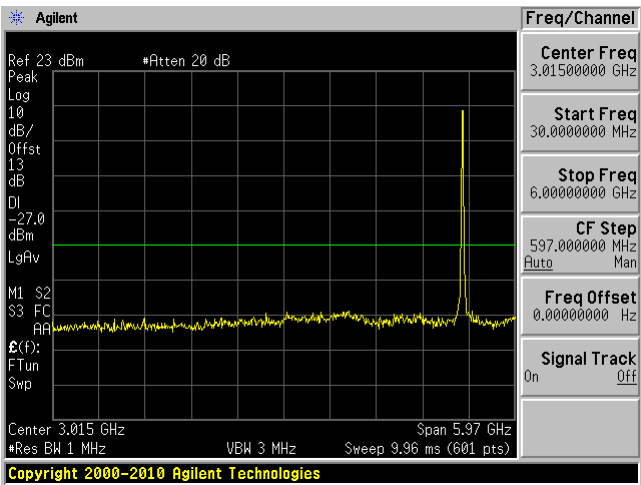
Middle Channel 5280 MHz (30MHz-6GHz)



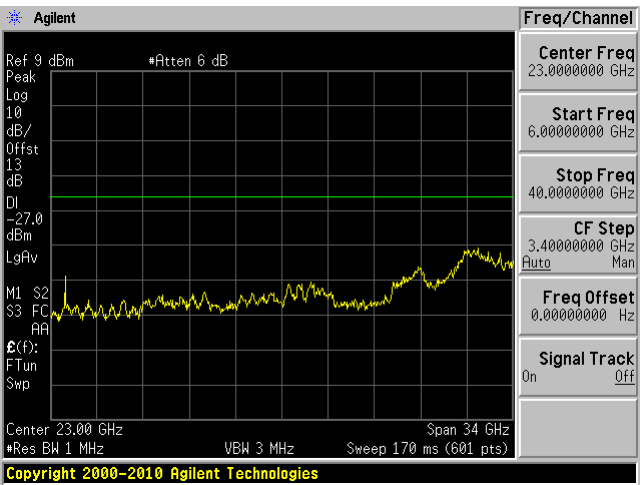
Middle Channel 5280 MHz (6-40GHz)



High Channel 5320 MHz (30MHz-6GHz)

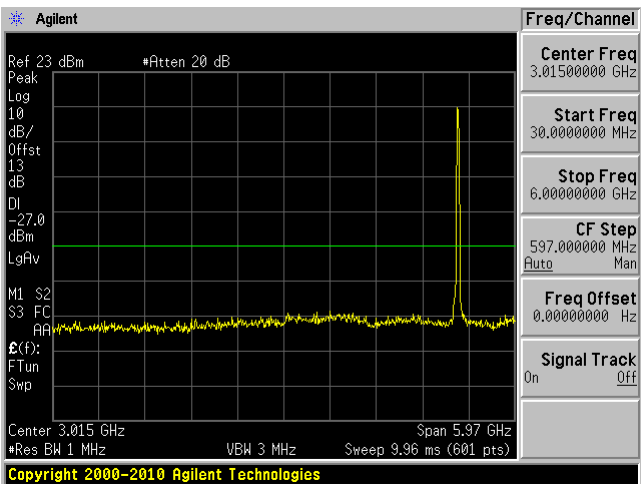


High Channel 5320 MHz (7-40GHz)

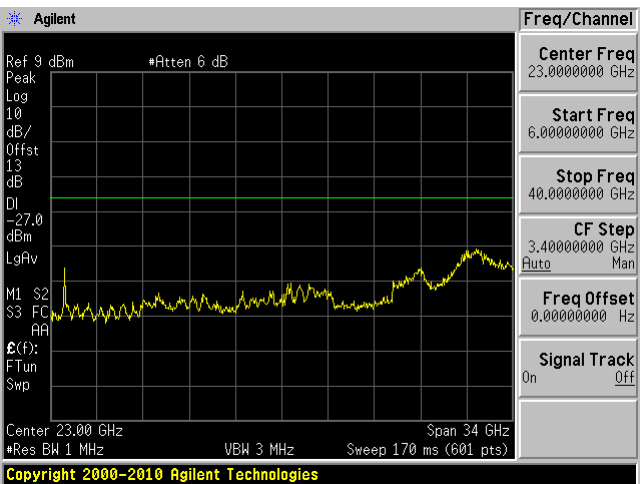


802.11n20 mode

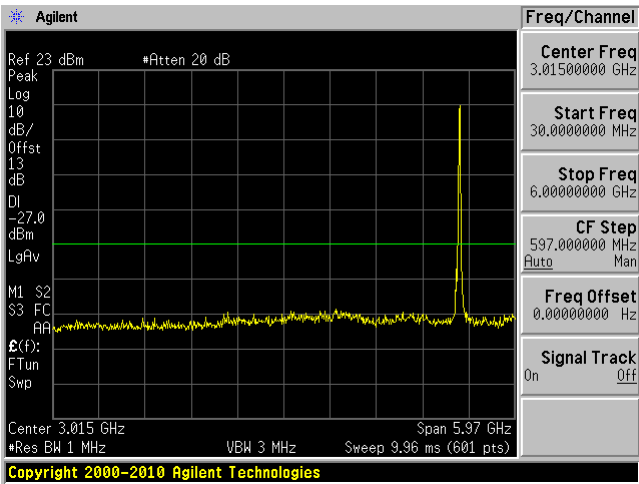
Low Channel 5260 MHz (30MHz-6GHz)



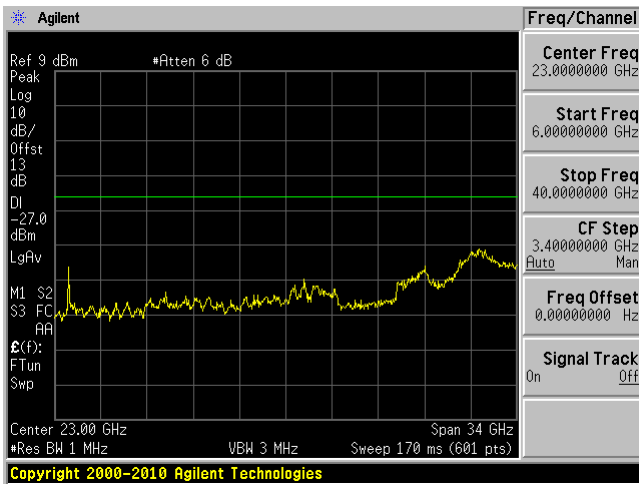
Low Channel 5260 MHz (6-40GHz)



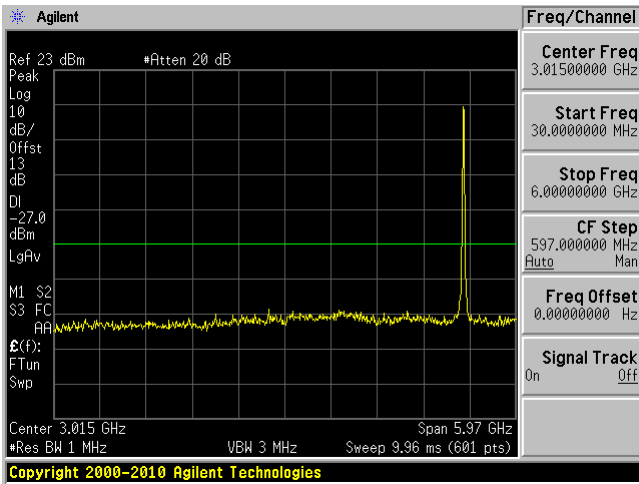
Middle Channel 5280MHz (30MHz-6GHz)



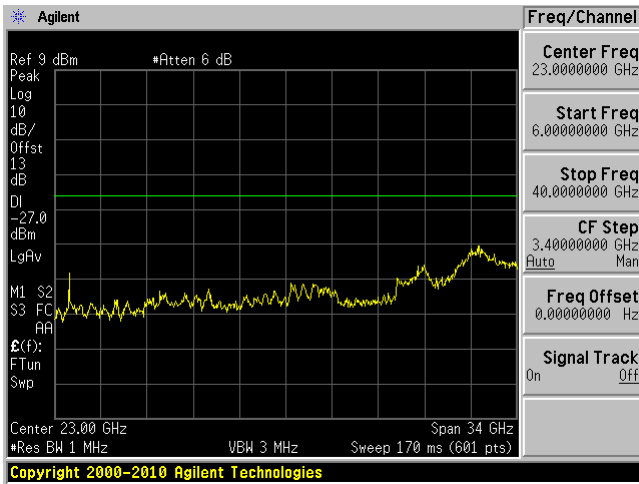
Middle Channel 5280 MHz (6-40GHz)



High Channel 5320 MHz (30MHz-6GHz)

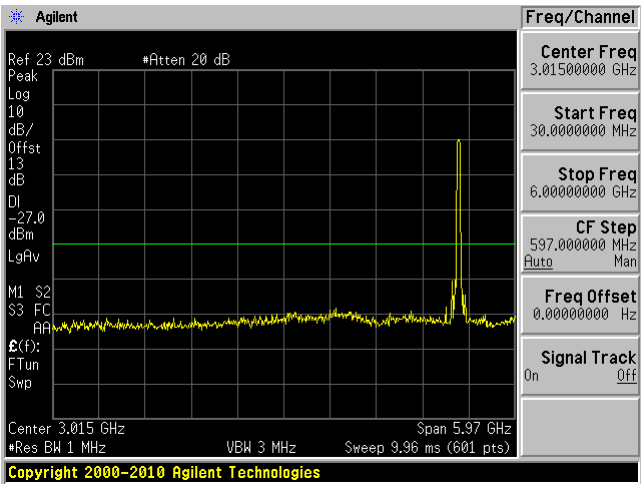


High Channel 5320 MHz (6-40GHz)

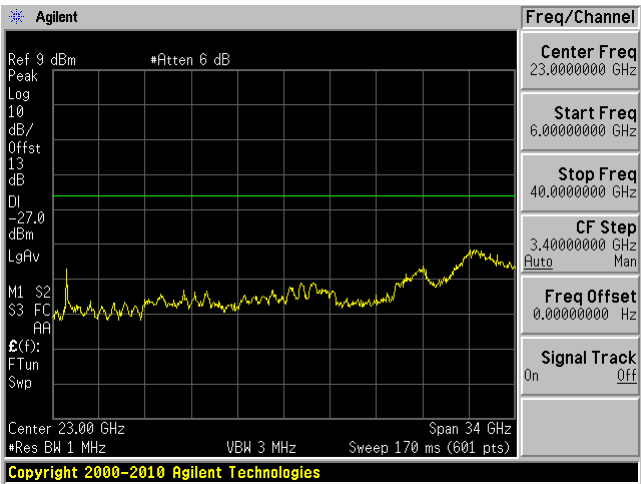


802.11n40 mode

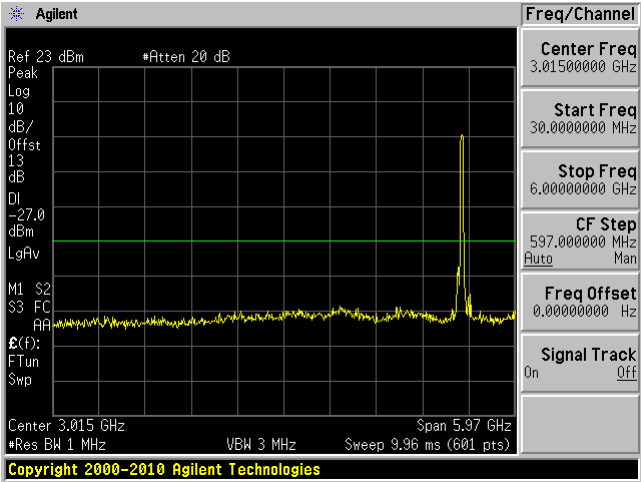
Low Channel 5270 MHz (30MHz-6GHz)



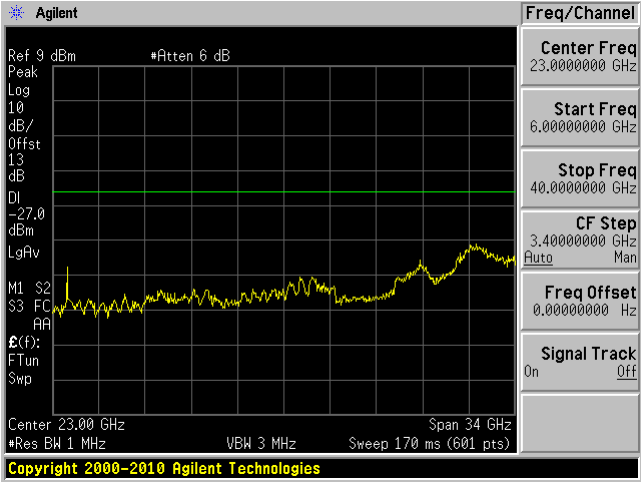
Low Channel 5270 MHz (6-40GHz)



High Channel 5310 MHz (30MHz-6GHz)

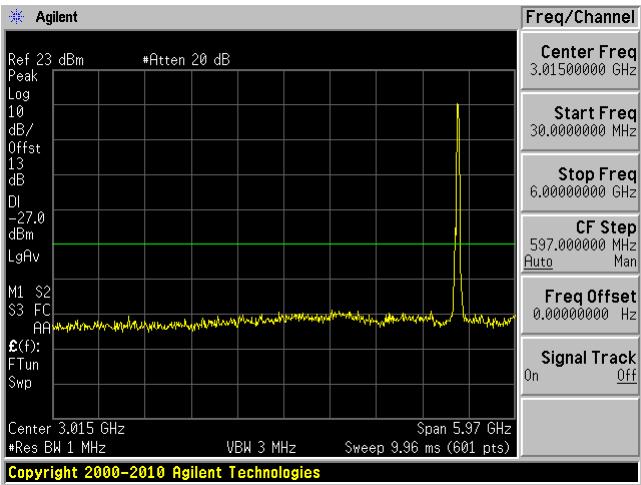


High Channel 5310 MHz (6-40GHz)

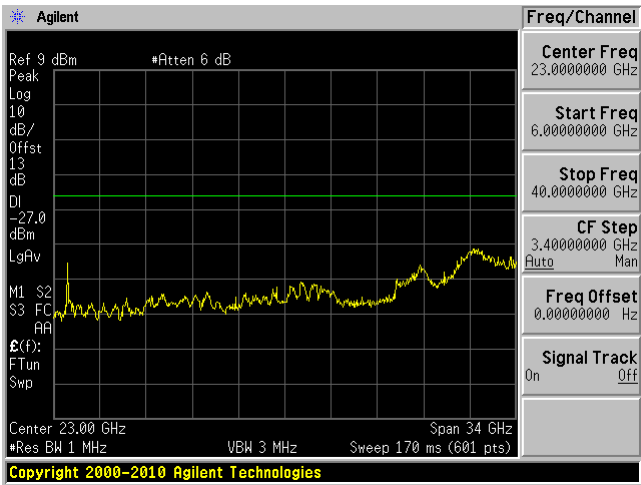


802.11ac20 mode

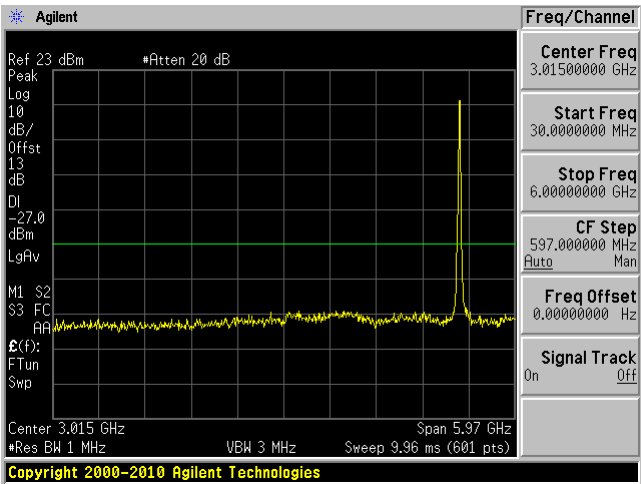
Low Channel 5260MHz (30MHz-6GHz)



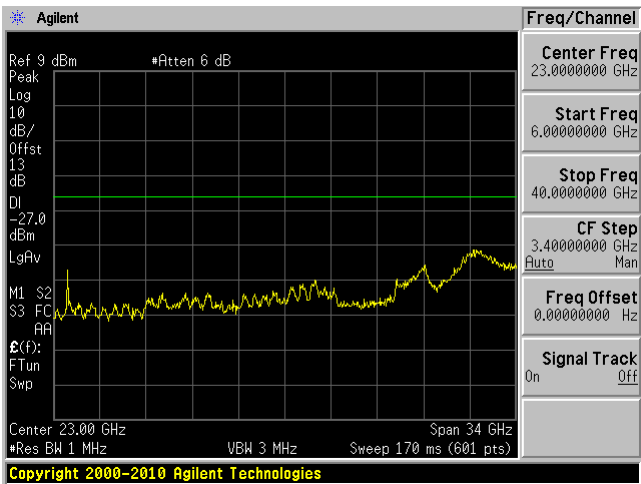
Low Channel 5260 MHz (6-40GHz)



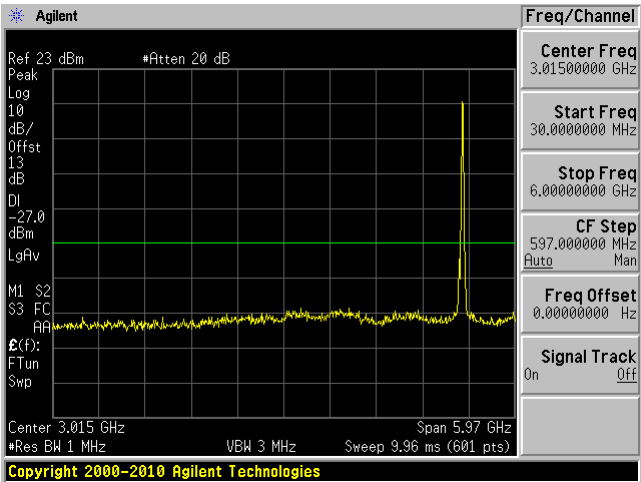
Middle Channel 5280 MHz (30MHz-6GHz)



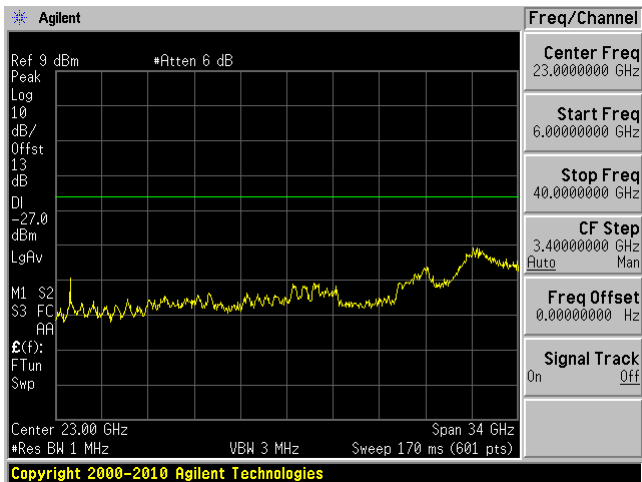
Middle Channel 5280 MHz (6GHz – 40GHz)



High Channel 5320 MHz (30MHz-6GHz)

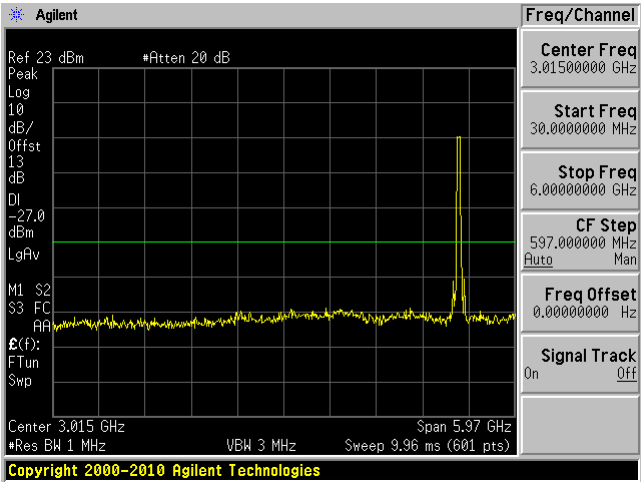


High Channel 5320 MHz (6GHz – 40GHz)

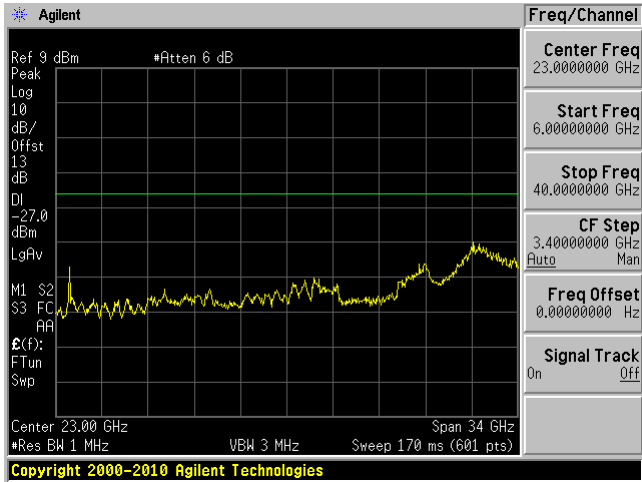


802.11ac40 mode

Low Channel 5270 MHz (30MHz-6GHz)

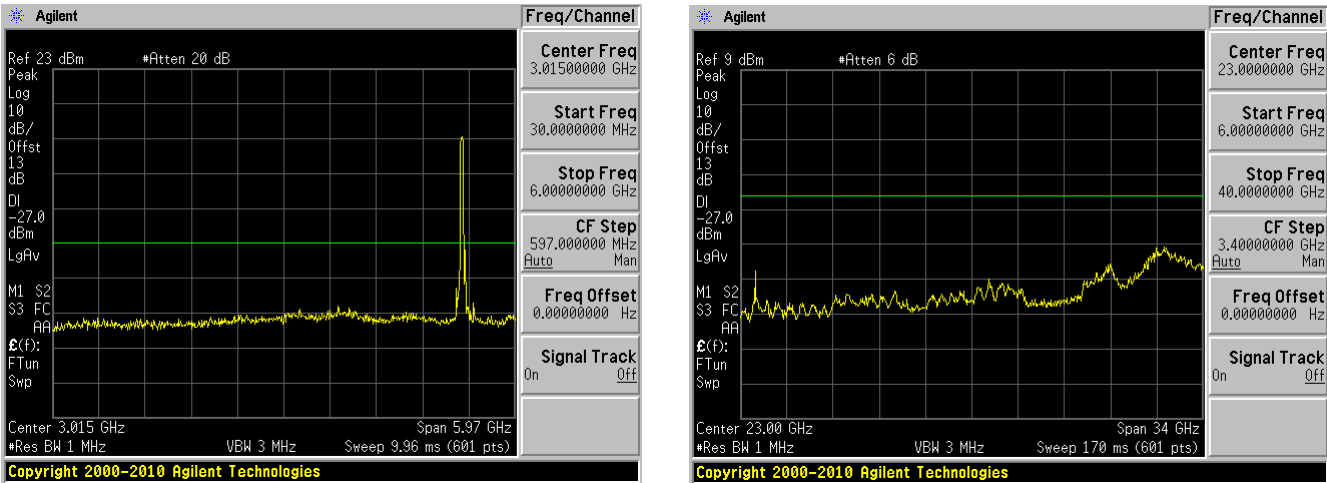


Low Channel 5270 MHz (6-40GHz)



High Channel 5310 MHz (30MHz-6GHz)

High Channel 5310 MHz (6GHz – 40GHz)



802.11ac80 mode

5290 MHz (30MHz-6GHz)

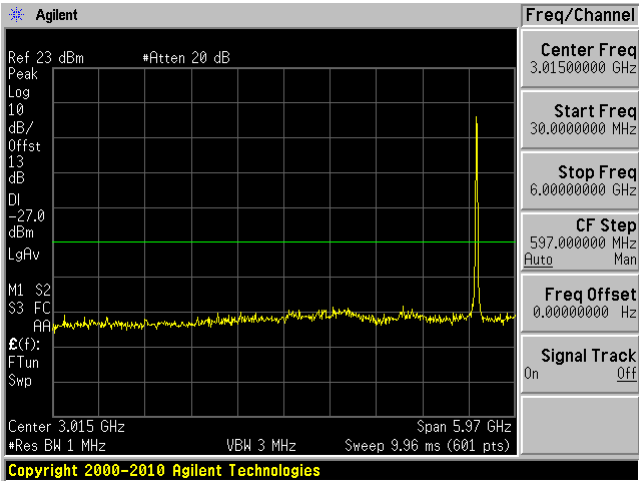
5290 MHz (6GHz – 40GHz)



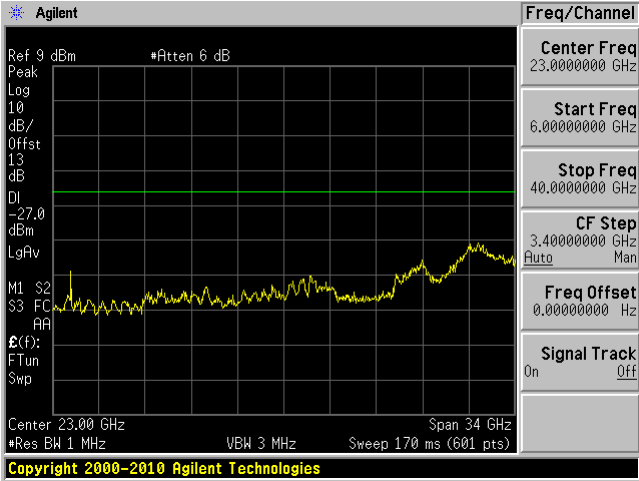
5470 – 5725 MHz

802.11a mode

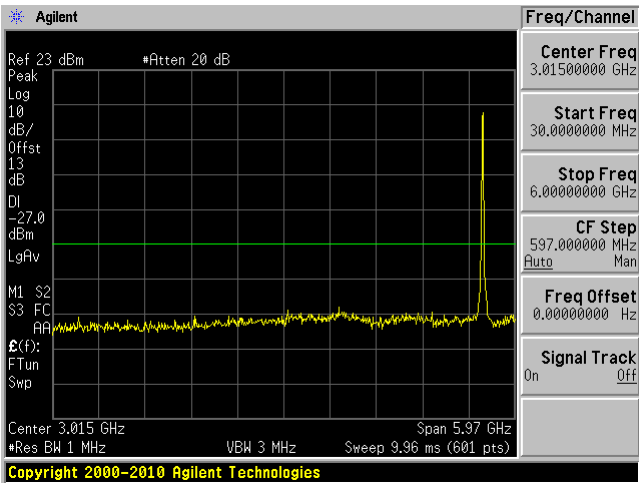
Low Channel 5500 MHz (30MHz-6GHz)



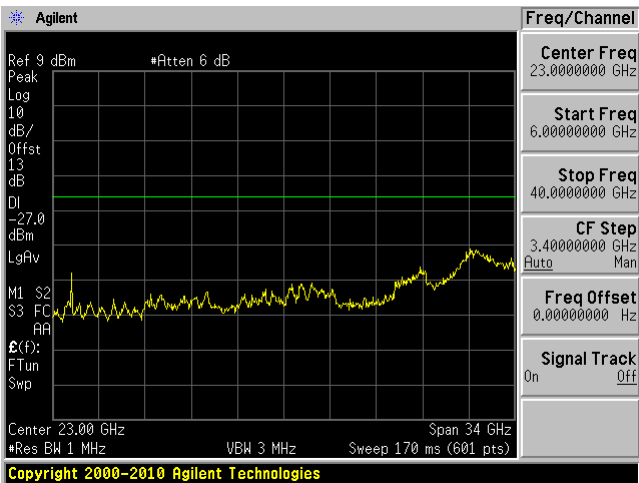
Low Channel 5500 MHz (6-40GHz)



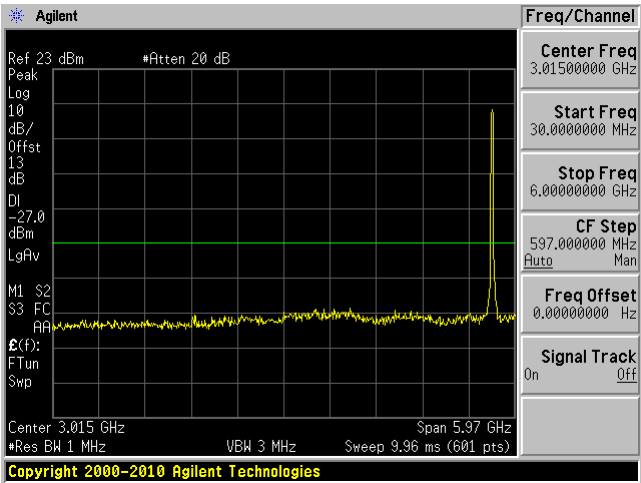
Middle Channel 5580 MHz (30MHz-6GHz)



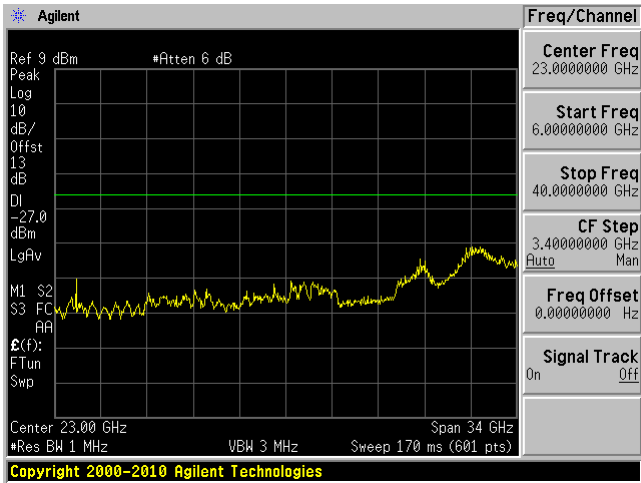
Middle Channel 5580 MHz (6-40GHz)



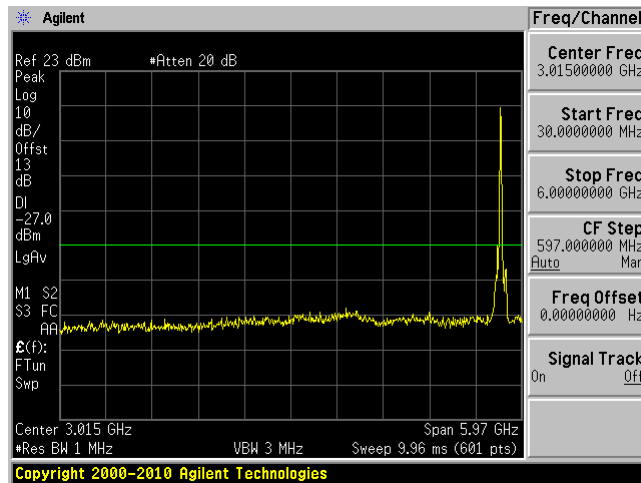
Middle Channel 5700 MHz (30MHz-6GHz)



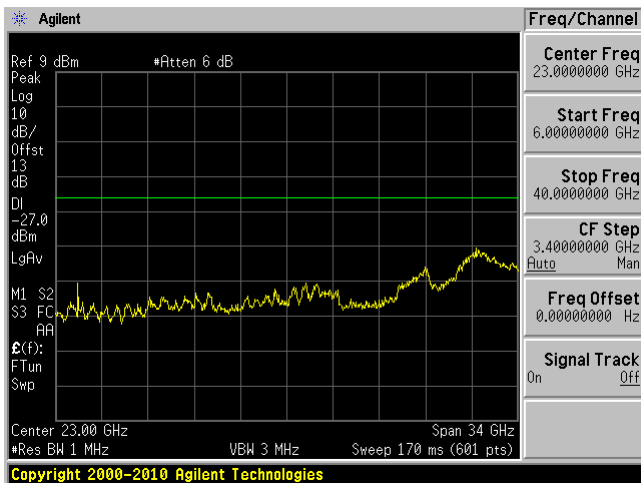
Middle Channel 5700 MHz (6-40GHz)



High Channel 5720 MHz (30MHz-6GHz)

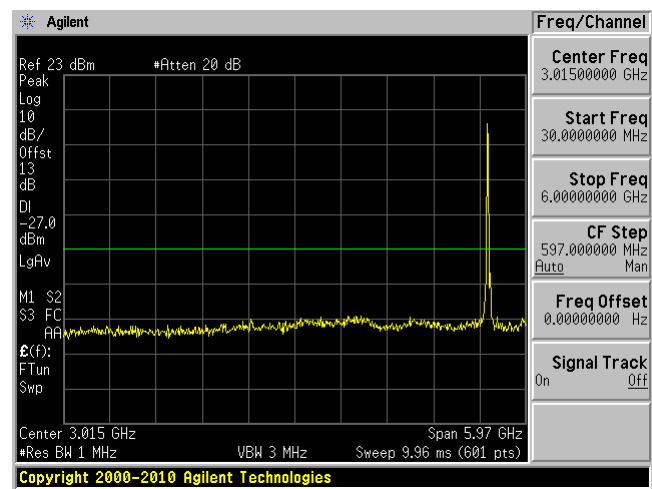


High Channel 5720 MHz (6-40GHz)

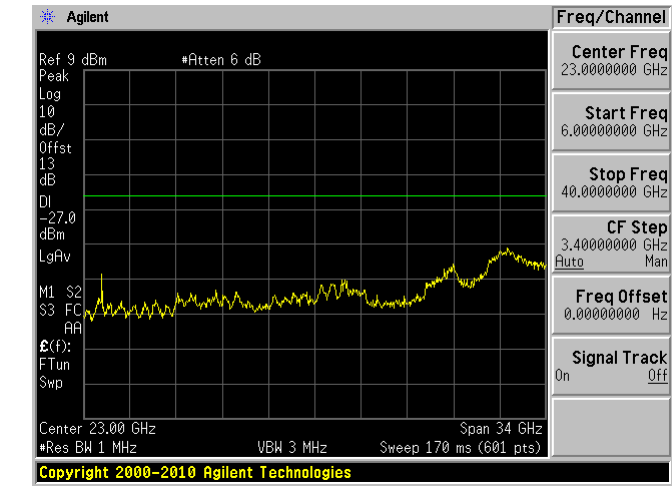


802.11n20 mode

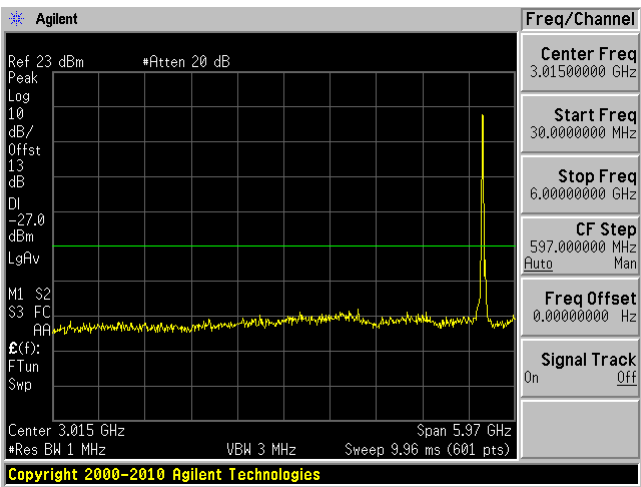
Low Channel 5500 MHz (30MHz-6GHz)



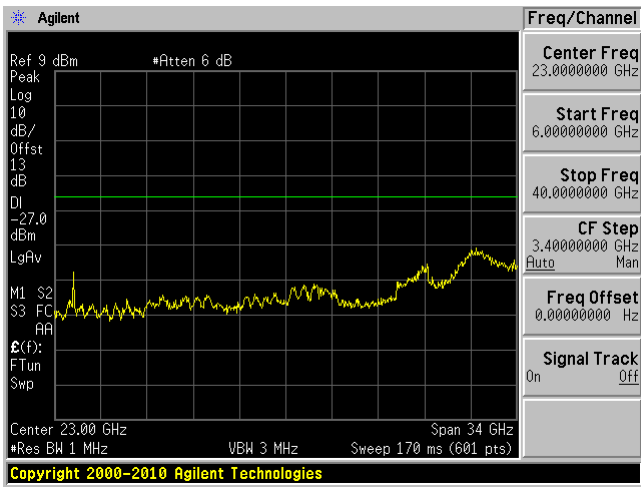
Low Channel 5500 MHz (6-40GHz)



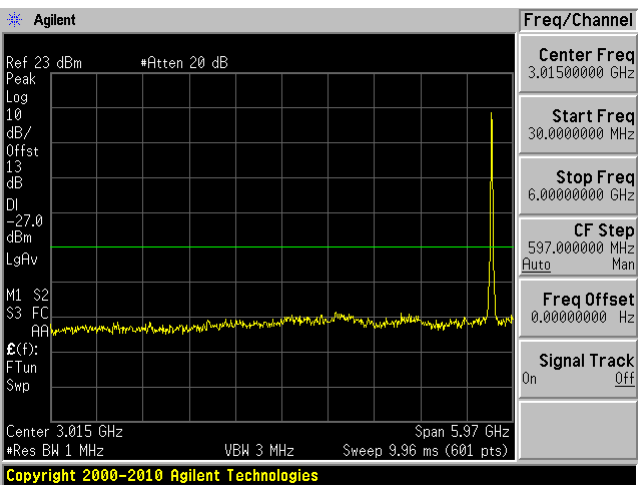
Middle Channel 5580 MHz (30MHz-6GHz)



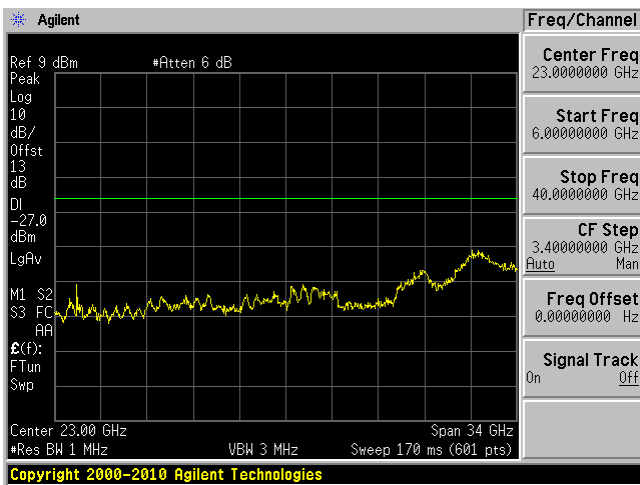
Middle Channel 5580 MHz (6-40GHz)



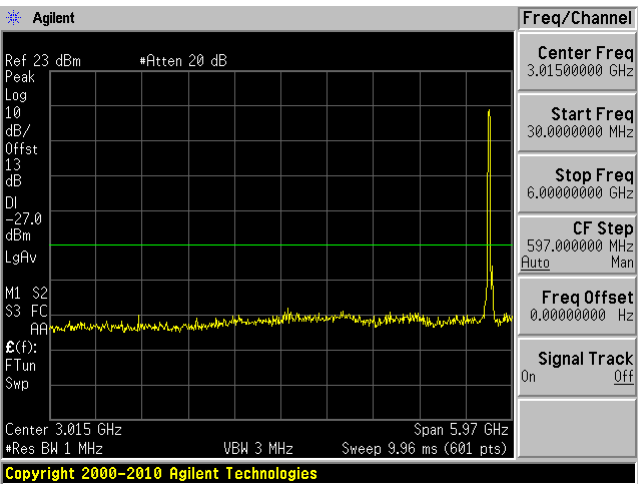
Middle Channel 5700 MHz (30MHz-6GHz)



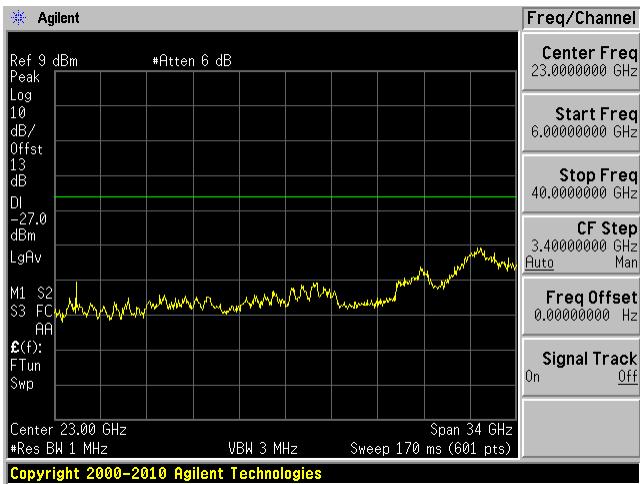
Middle Channel 5700 MHz (6-40GHz)



High Channel 5720 MHz (30MHz-6GHz)

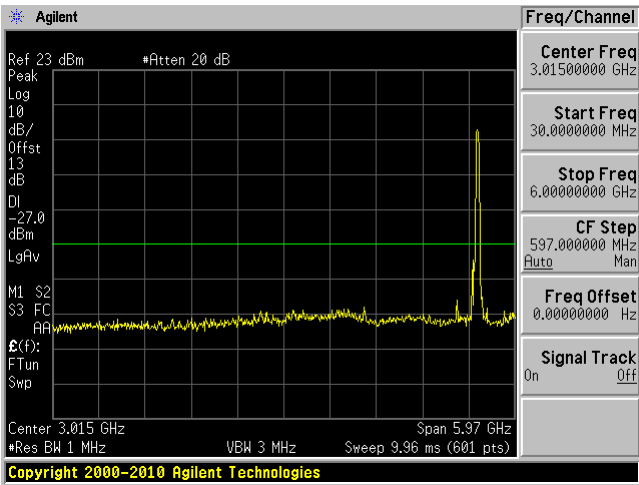


High Channel 5720 MHz (6-40GHz)

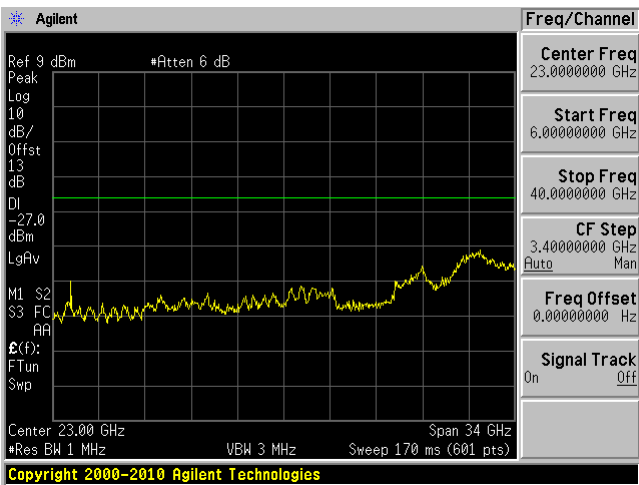


802.11n40 mode

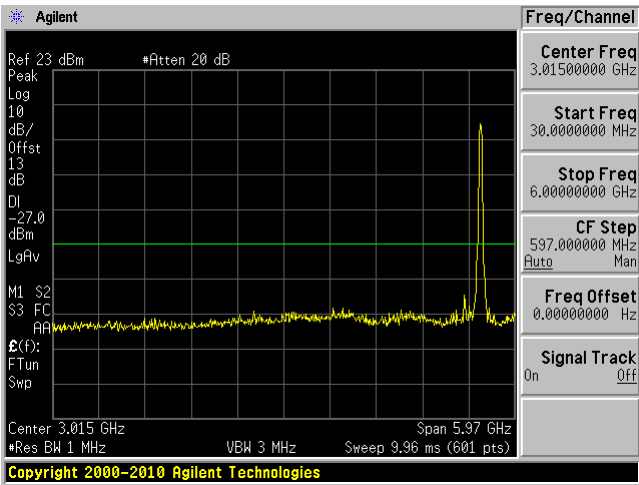
Low Channel 5510 MHz (30MHz-6GHz)



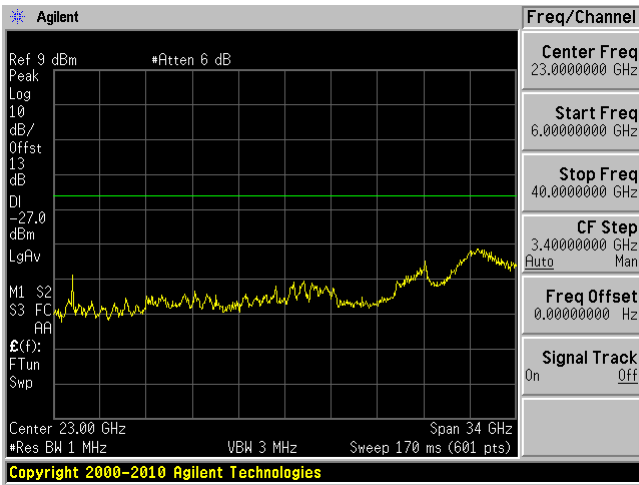
Low Channel 5510 MHz (6-40GHz)



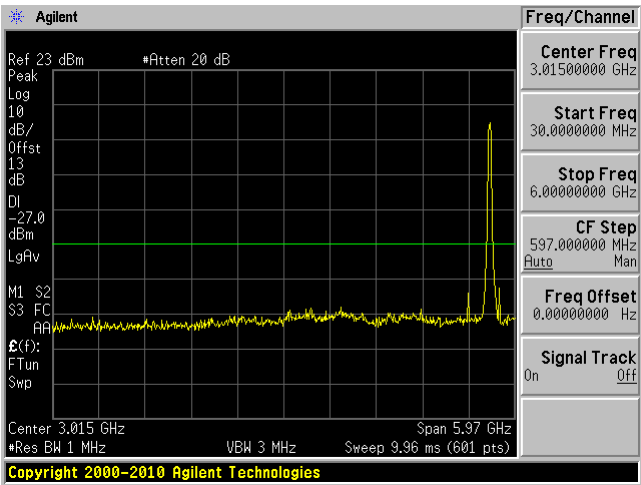
Middle Channel 5550 MHz (30MHz-6GHz)



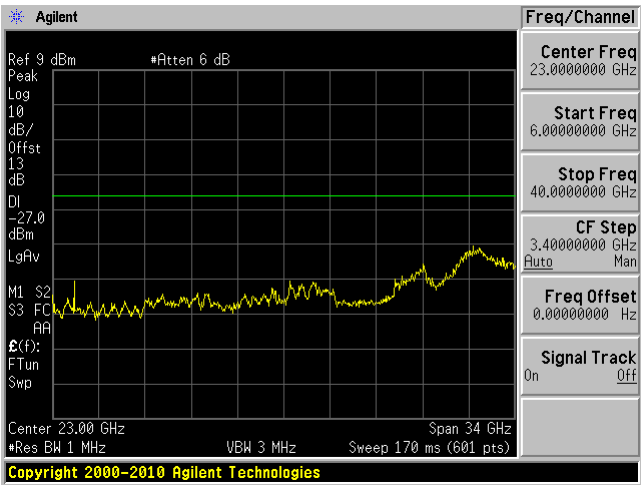
Middle Channel 5550 MHz (6-40GHz)



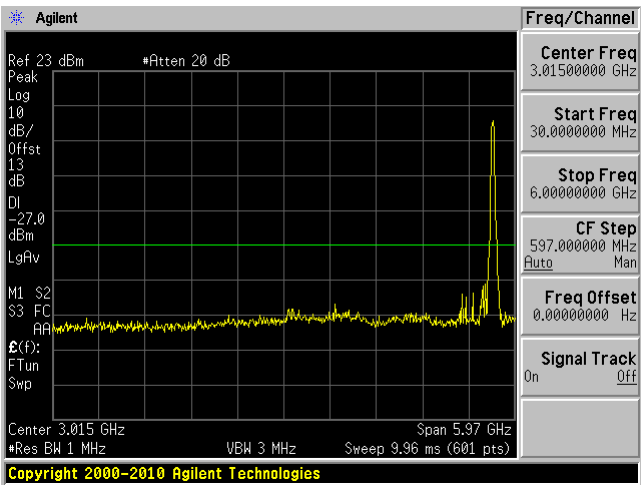
Middle Channel 5670 MHz (30MHz-6GHz)



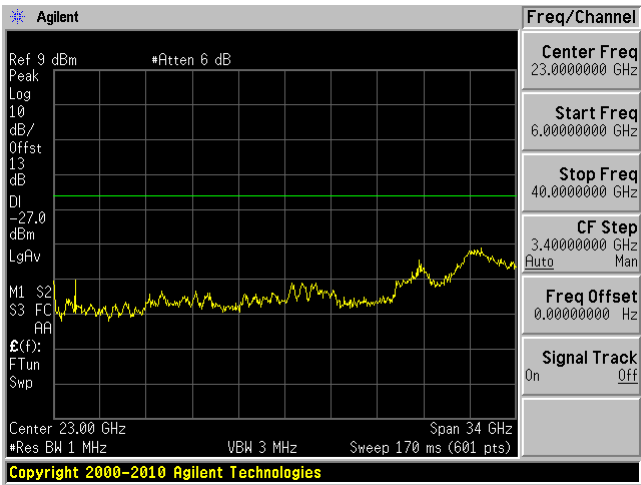
Middle Channel 5670 MHz (6-40GHz)



High Channel 5710 MHz (30MHz-6GHz)

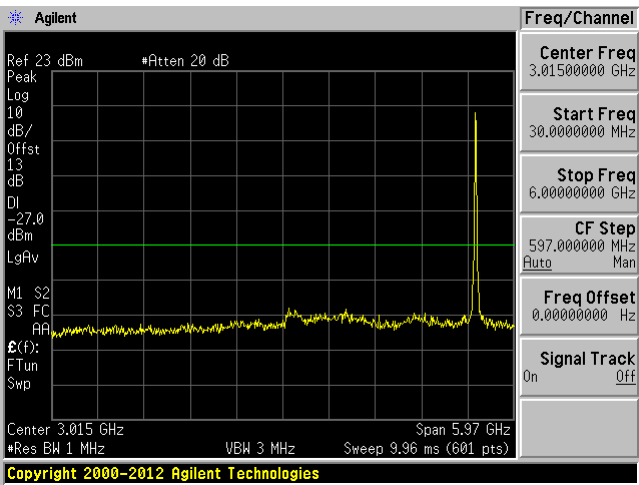


High Channel 5710 MHz (6-40GHz)

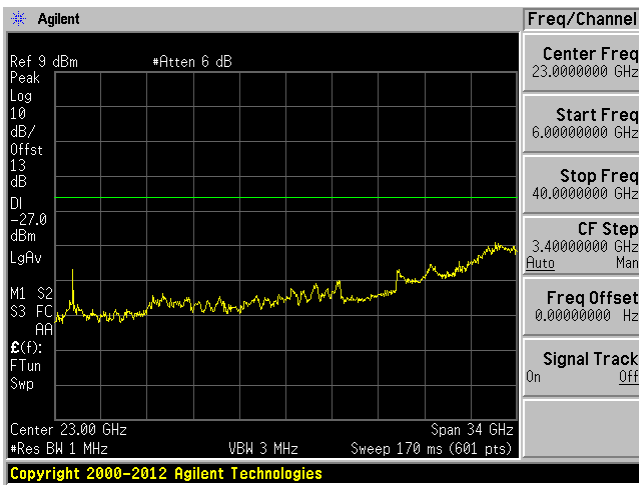


802.11ac20 mode

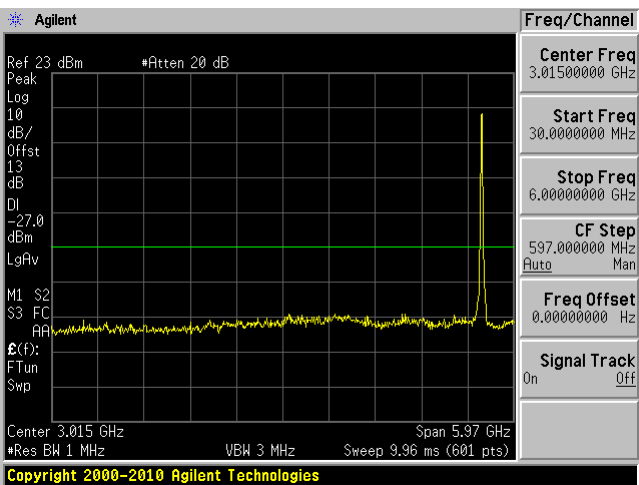
Low Channel 5500 MHz (30MHz-6GHz)



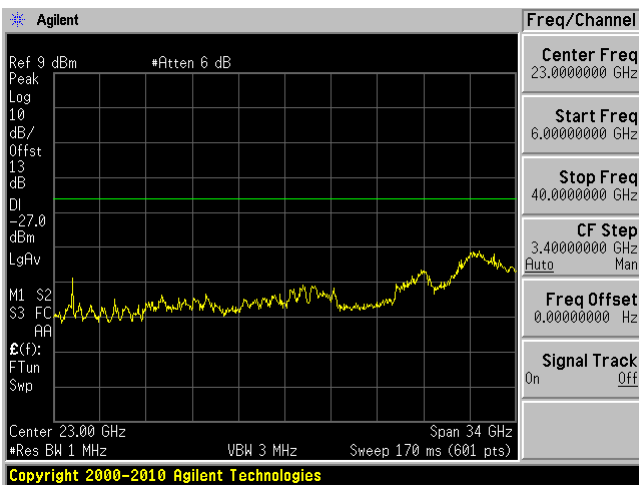
Low Channel 5500 MHz (6-40GHz)



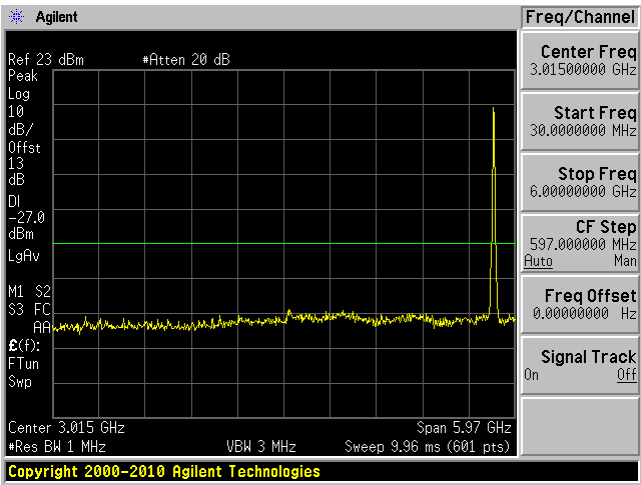
Middle Channel 5580 MHz (30MHz-6GHz)



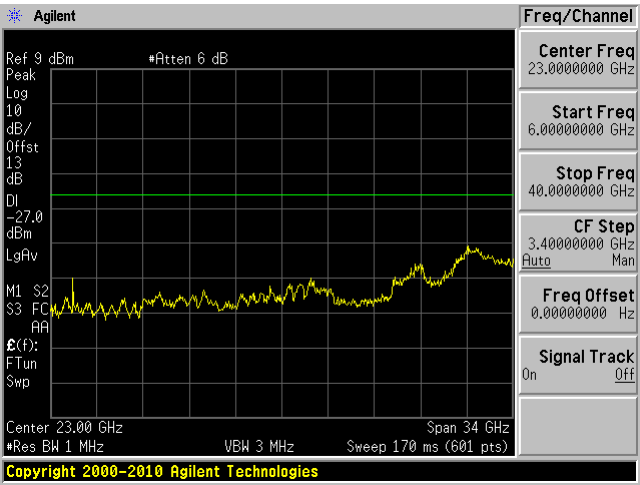
Middle Channel 5580 MHz (6GHz – 40GHz)



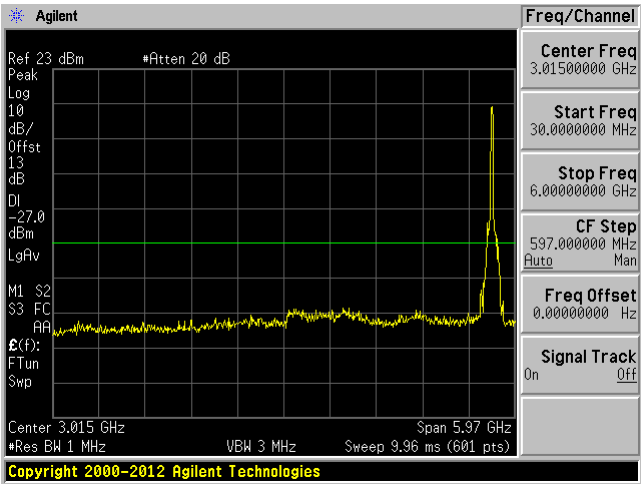
Middle Channel 5700 MHz (30MHz-6GHz)



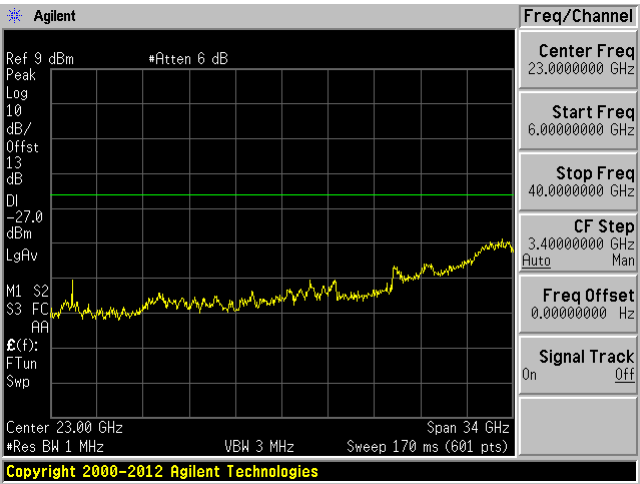
Middle Channel 5700 MHz (6GHz – 40GHz)



High Channel 5720MHz (30MHz-6GHz)

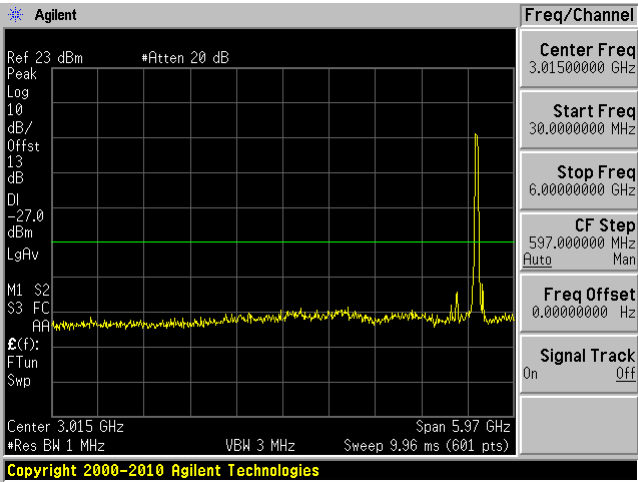


High Channel 5720 MHz (6-40GHz)

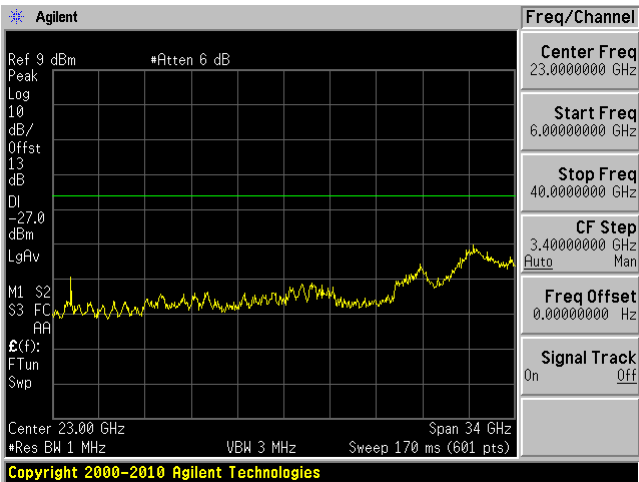


802.11ac40 mode

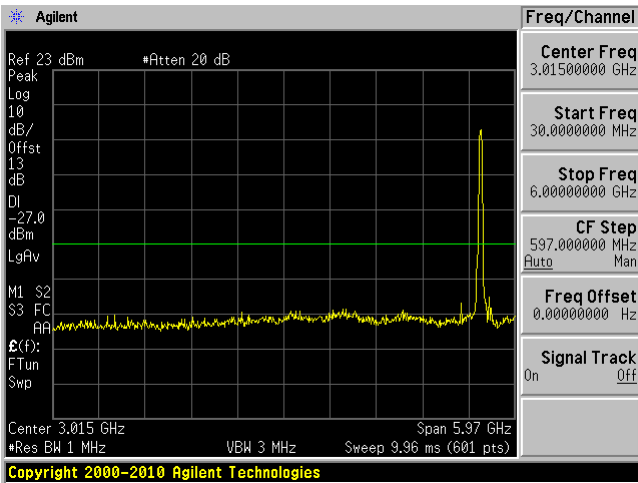
Low Channel 5510 MHz (30MHz-6GHz)



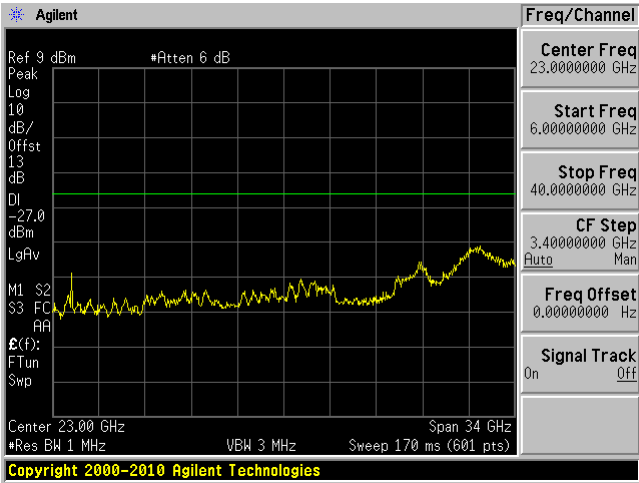
Low Channel 5510 MHz (6-40GHz)



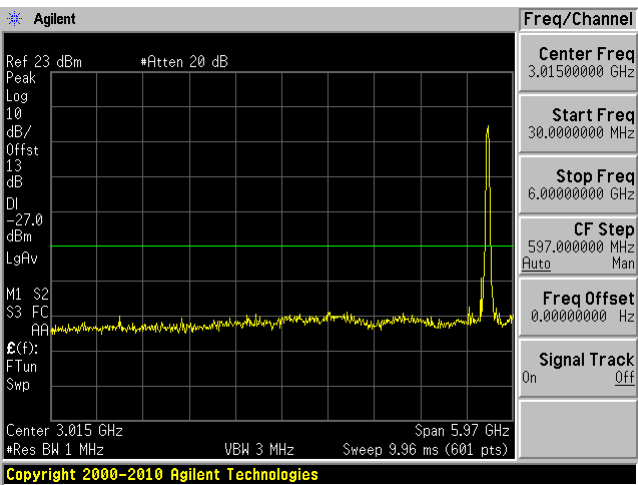
Middle Channel 5550 MHz (30MHz-6GHz)



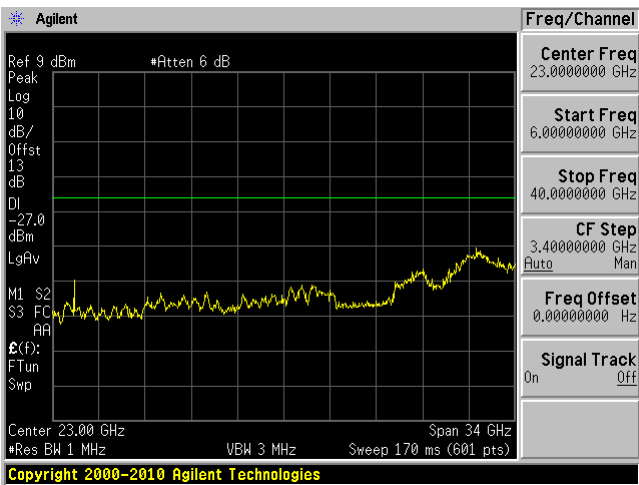
Middle Channel 5550 MHz (6-40GHz)



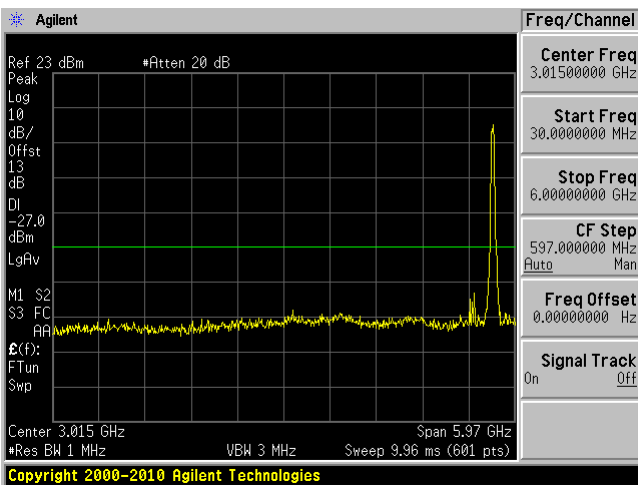
Middle Channel 5670 MHz (30MHz-6GHz)



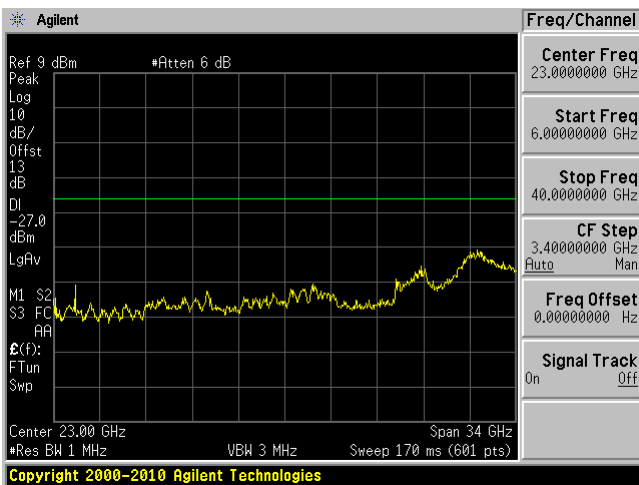
Middle Channel 5670 MHz (6-40GHz)



High Channel 5710 MHz (30MHz-6GHz)

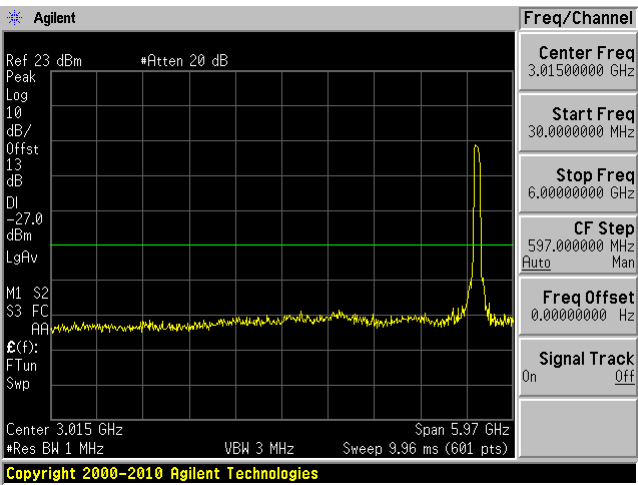


High Channel 5710 MHz (6-40GHz)

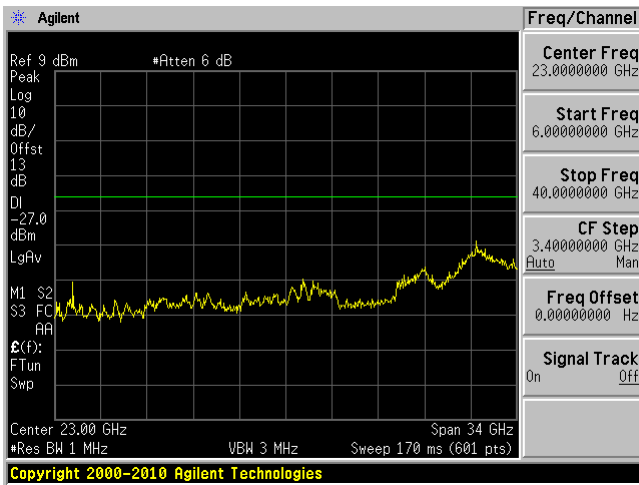


802.11ac80 mode

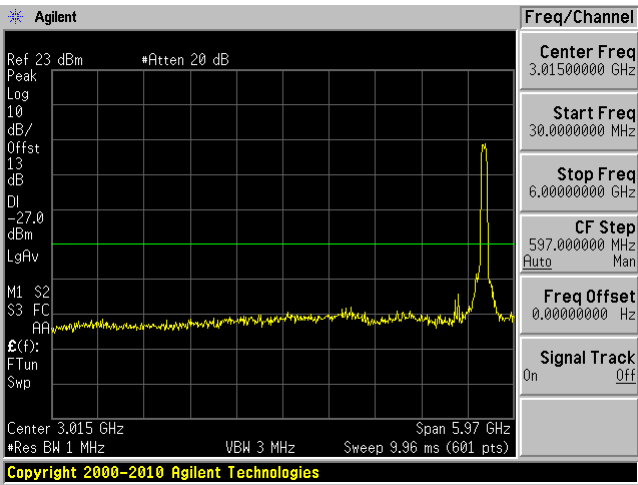
Low Channel 5530 MHz (30MHz-6GHz)



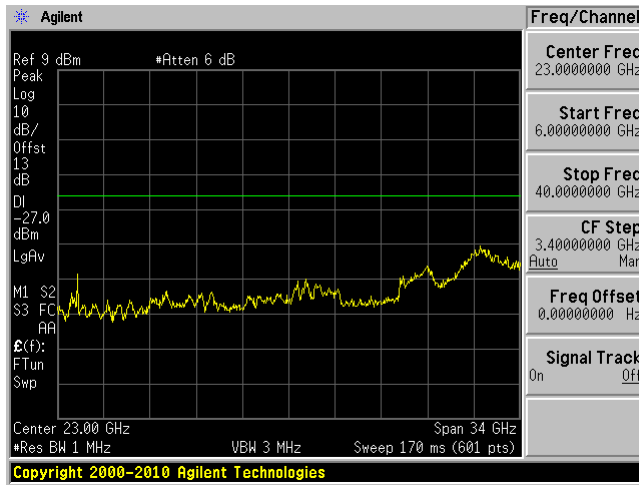
Low Channel 5530 MHz (6GHz – 40GHz)



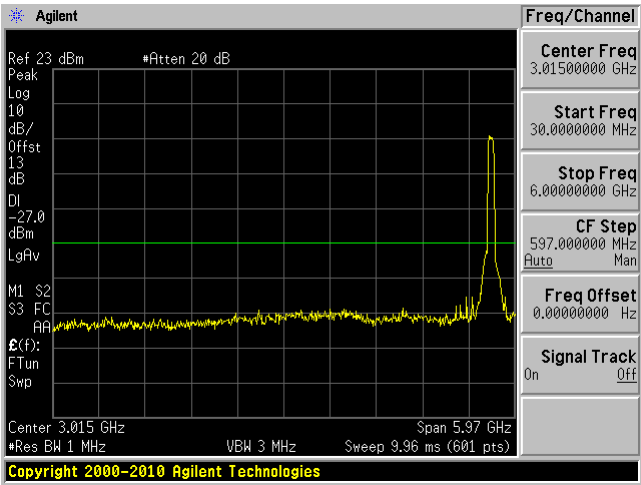
Middle Channel 5610 MHz (30MHz-6GHz)



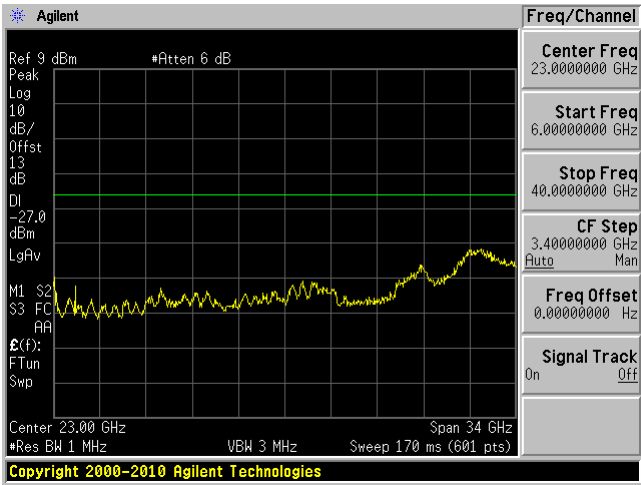
Middle Channel 5610 MHz (6GHz – 40GHz)



High Channel 5690 MHz (30MHz-6GHz)



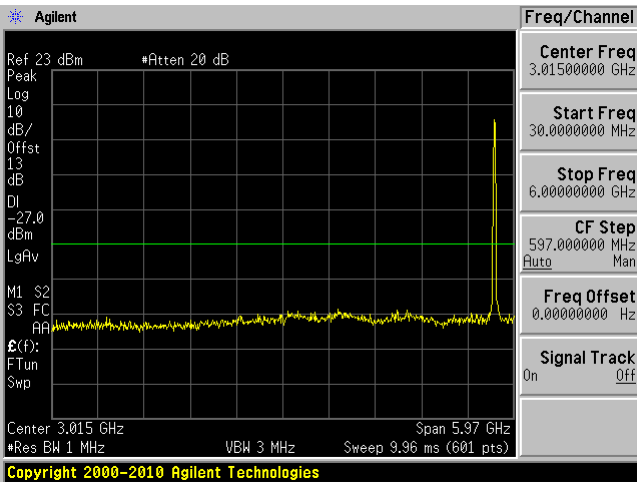
High Channel 5690 MHz (6GHz – 40GHz)



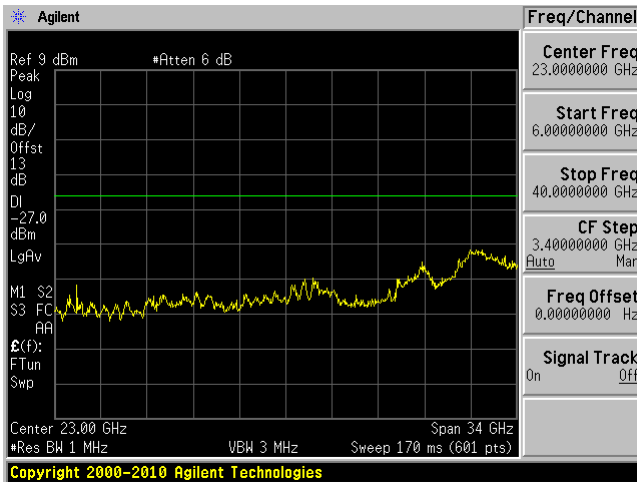
5725 – 5850 MHz

802.11a

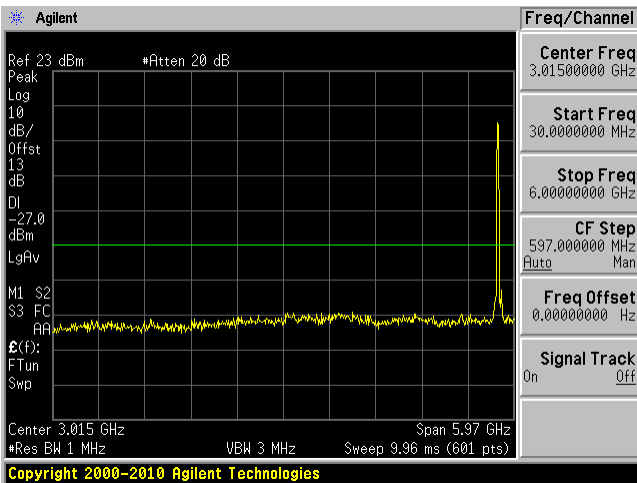
Low Channel 5745 MHz (30MHz-6GHz)



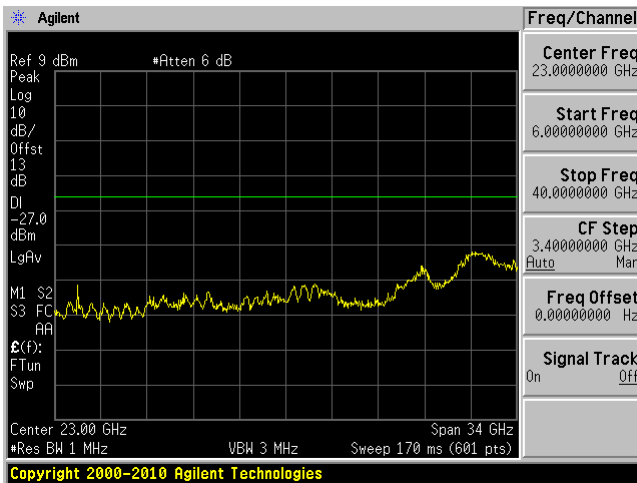
Low Channel 5745 MHz (6-40GHz)



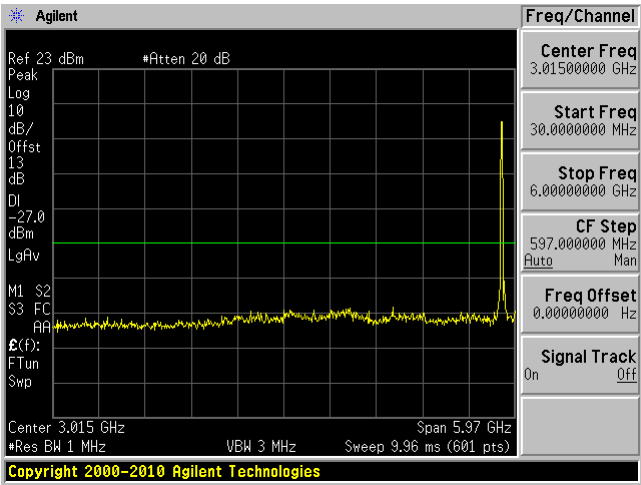
Middle Channel 5785 MHz (30MHz-6GHz)



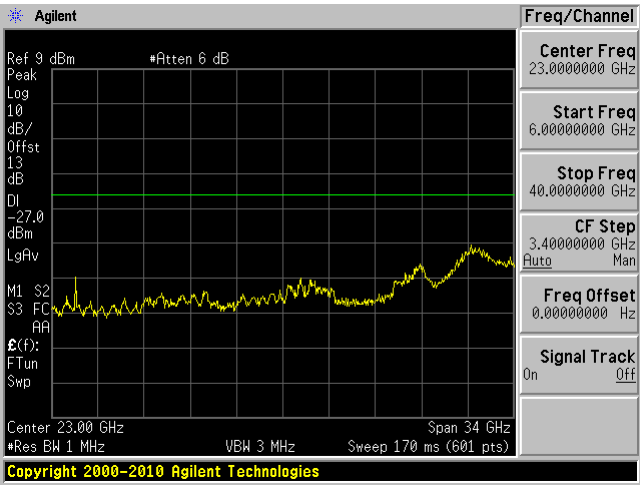
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825 MHz (30MHz-6GHz)

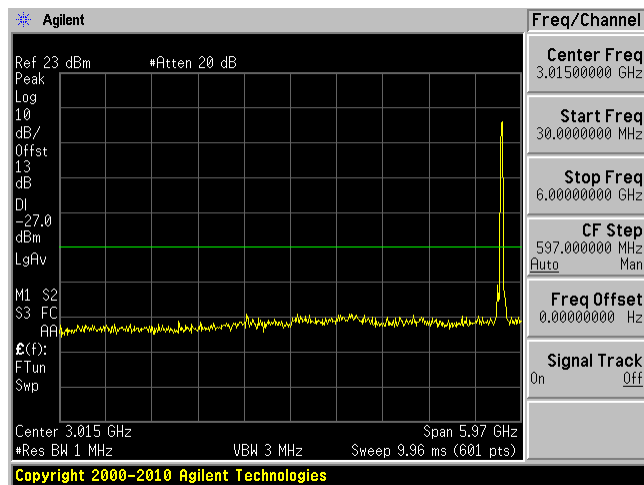


High Channel 5825 MHz (6-40GHz)

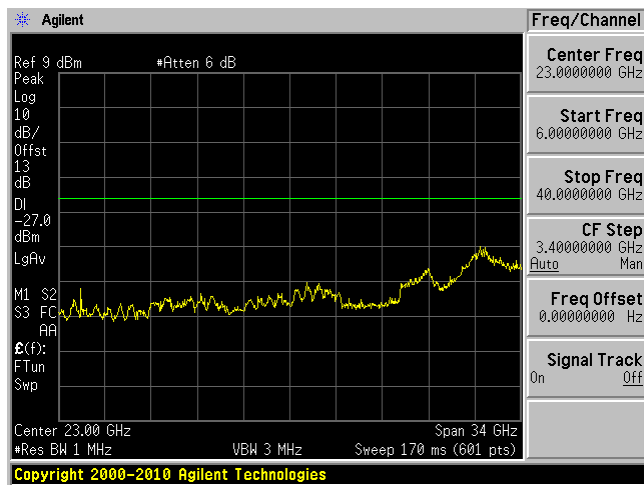


802.11n20 mode

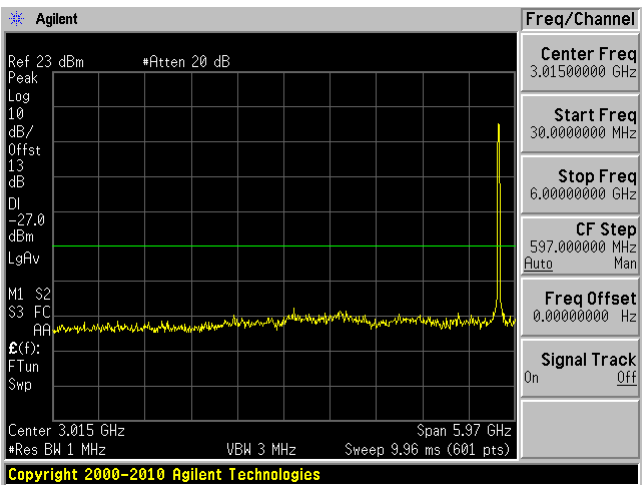
Low Channel 5745 MHz (30MHz-6GHz)



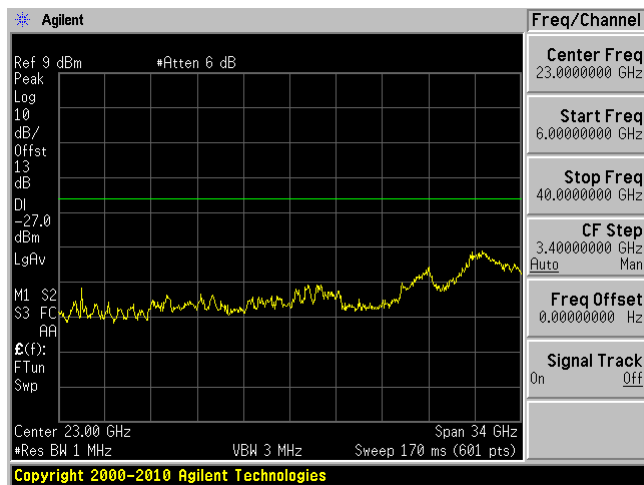
Low Channel 5745 MHz (6-40GHz)



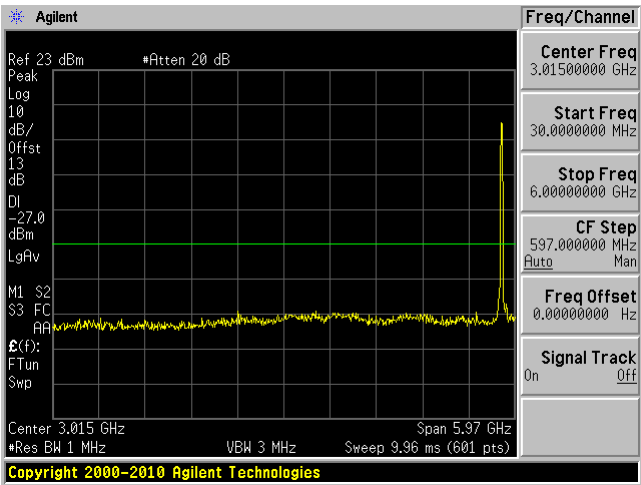
Middle Channel 5785 MHz (30MHz-6GHz)



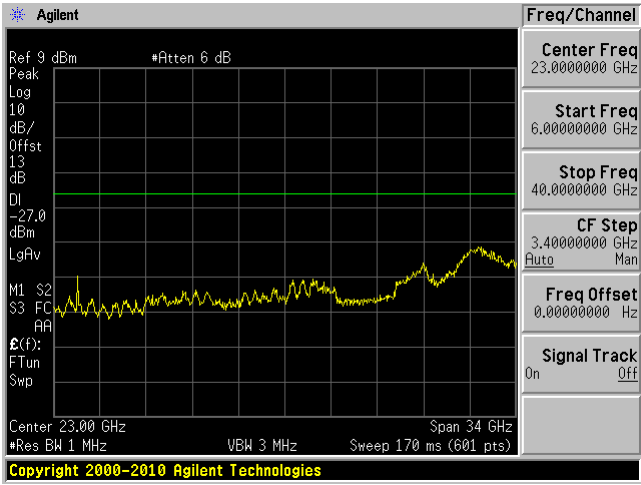
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825 MHz (30MHz-6GHz)

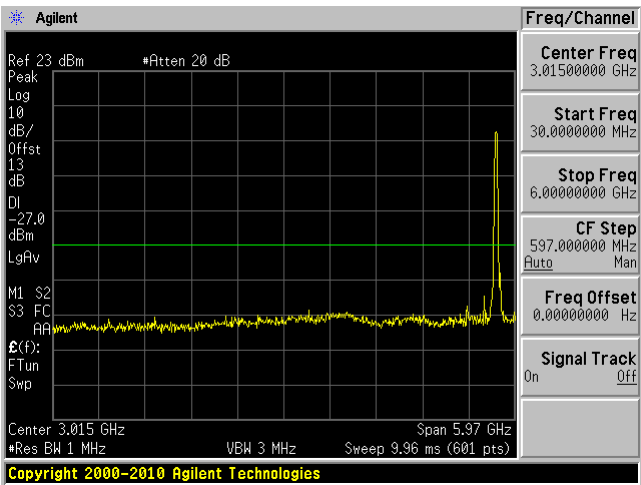


High Channel 5825 MHz (6-40GHz)

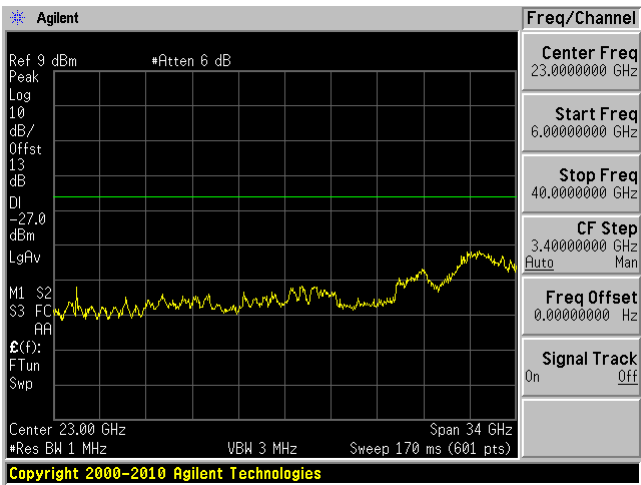


802.11n40 mode

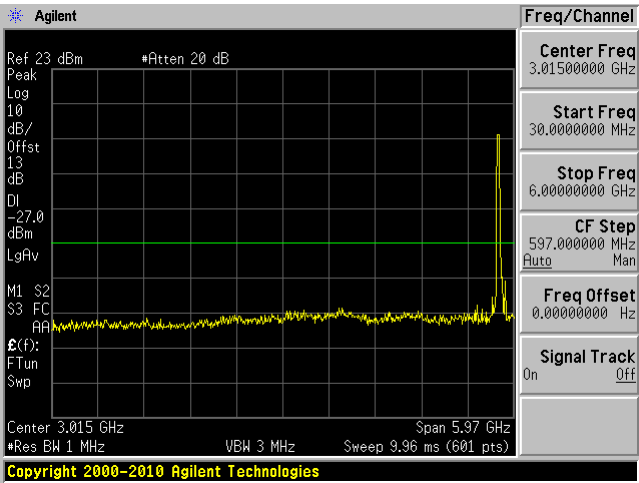
Low Channel 5755 MHz (30MHz-6GHz)



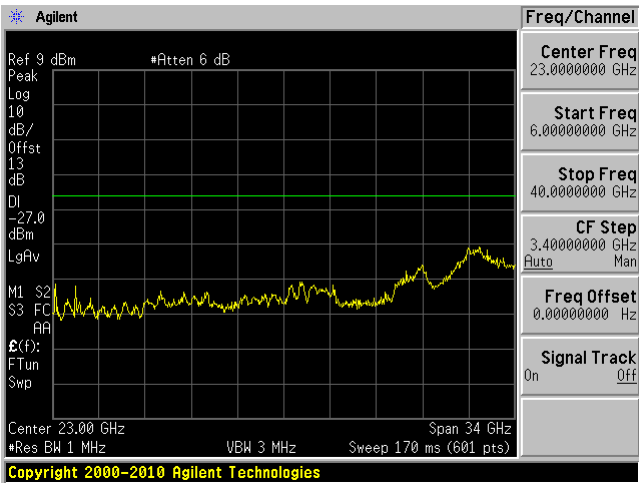
Low Channel 5755 MHz (6-40GHz)



High Channel 5795 MHz (30MHz-6GHz)

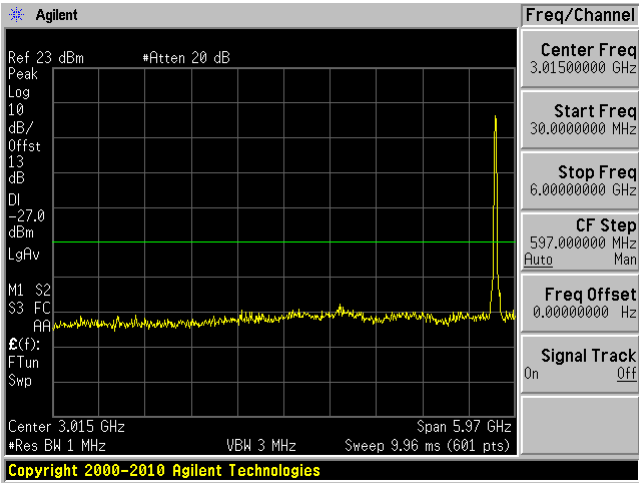


High Channel 5795 MHz (6-40GHz)

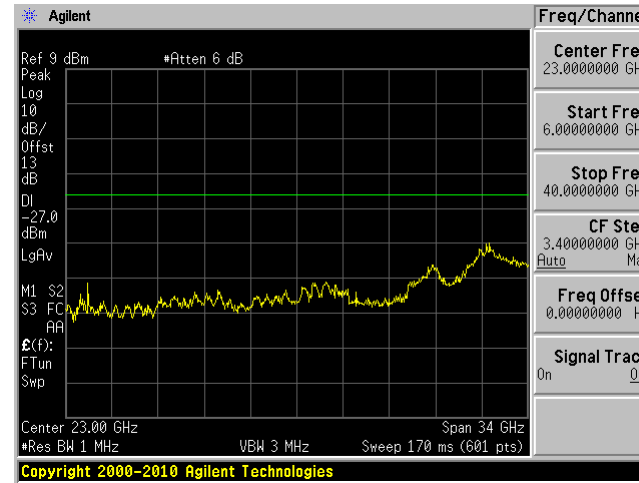


802.11ac20 mode

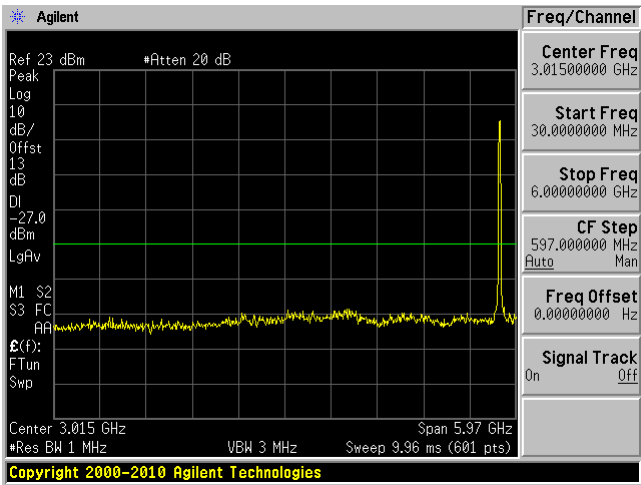
Low Channel 5745 MHz (30MHz-6GHz)



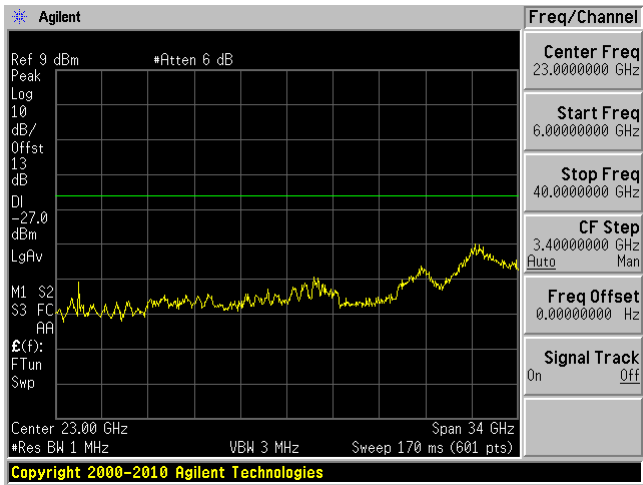
Low Channel 5745 MHz (6-40GHz)



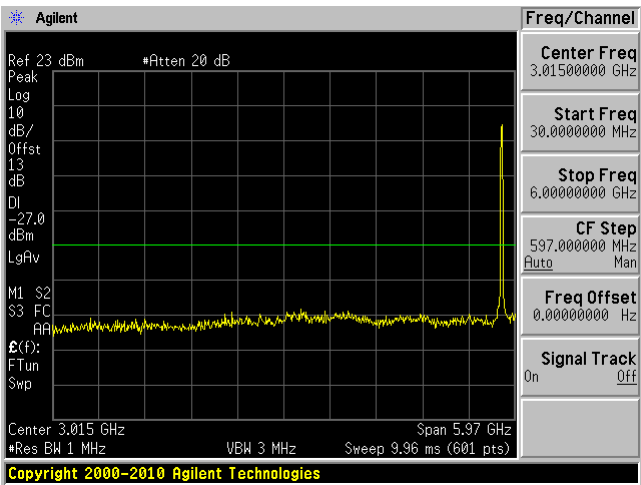
Middle Channel 5785 MHz (30MHz-6GHz)



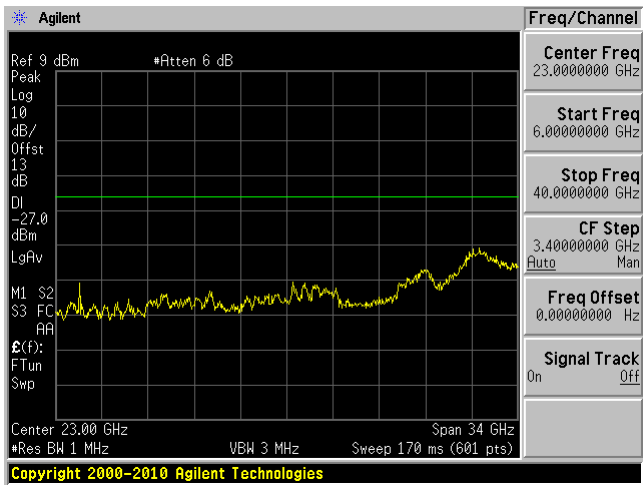
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825 MHz (30MHz-6GHz)

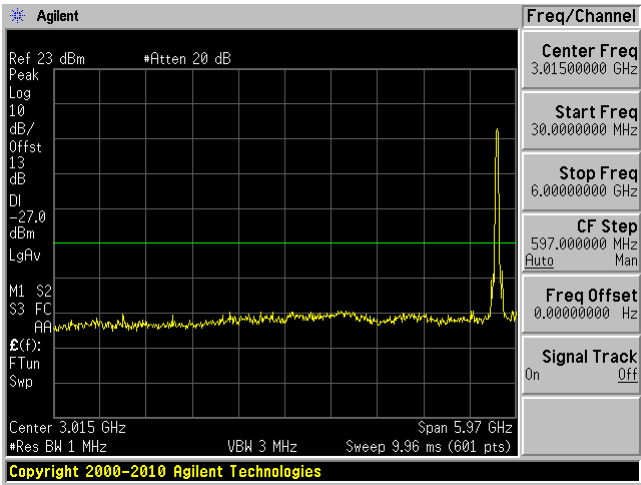


High Channel 5825 MHz (6-40GHz)

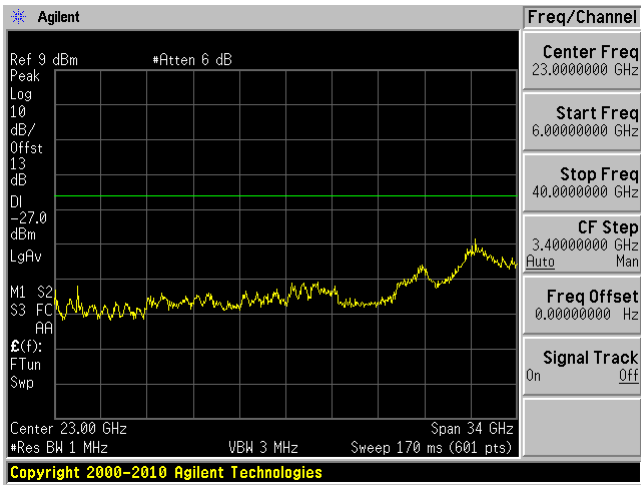


802.11ac40 mode

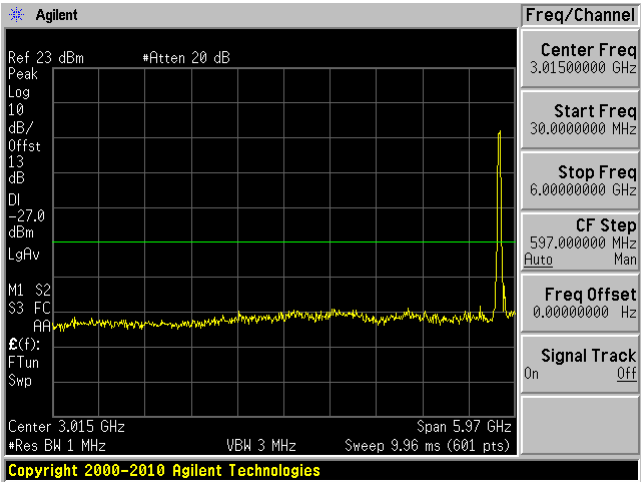
Low Channel 5755 MHz (30MHz-6GHz)



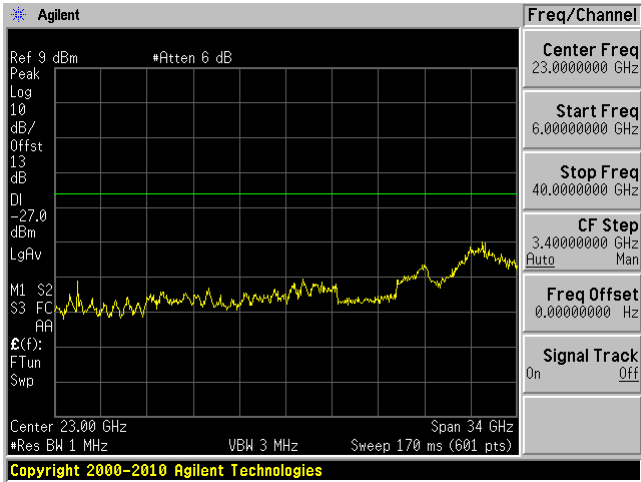
Low Channel 5755 MHz (6-40GHz)



High Channel 5795 MHz (30MHz-6GHz)

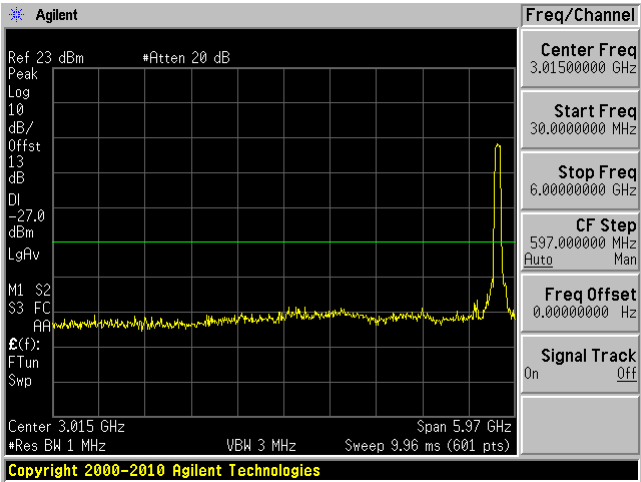


High Channel 5795 MHz (6-40GHz)

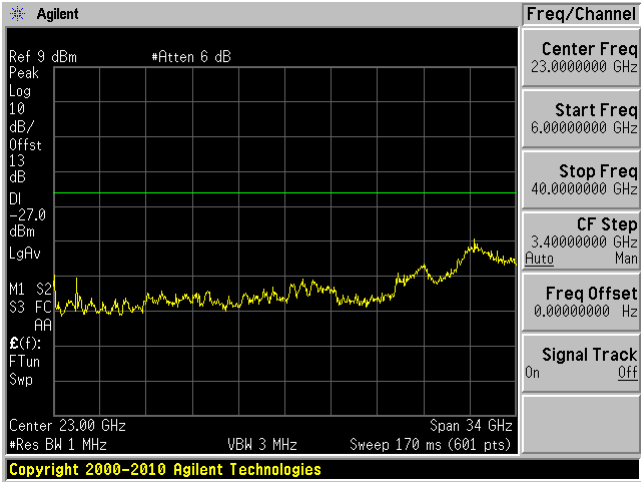


802.11ac80 mode

5755 MHz (30MHz-6GHz)



5755 MHz (6GHz – 40GHz)



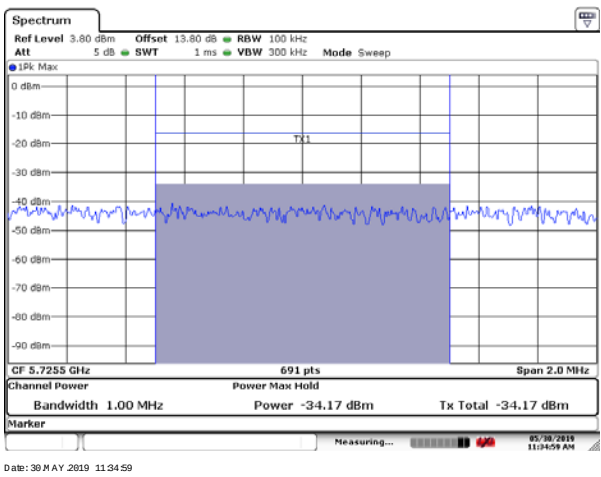
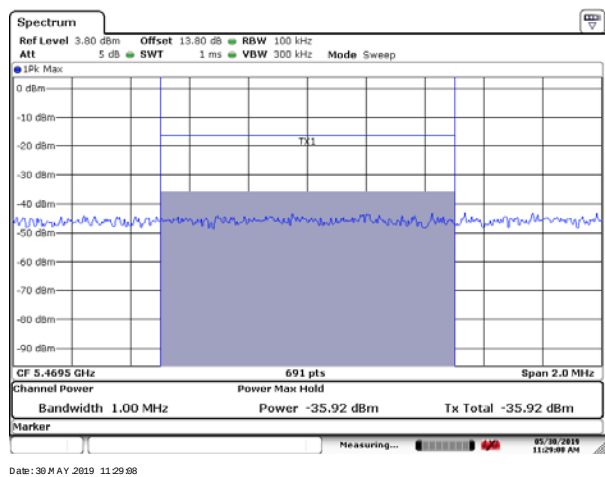
Band Edge Emissions

5470 - 5725 MHz

802.11a mode

Low Channel: 5500 MHz

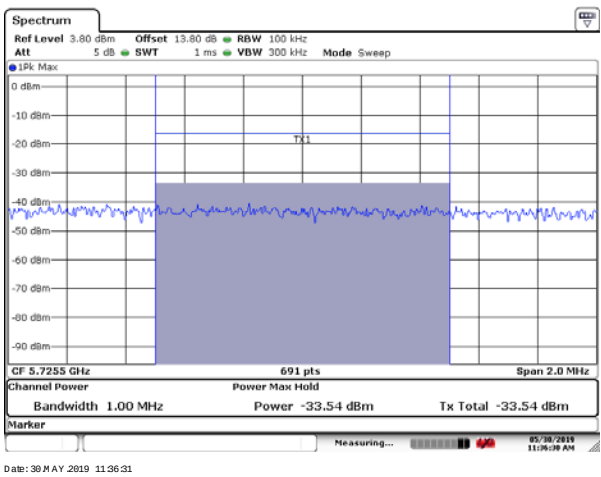
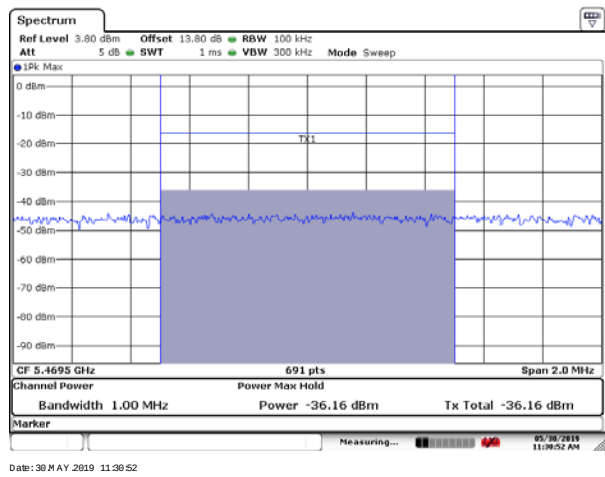
High channel: 5700 MHz



802.11n20 mode

Low Channel: 5500 MHz

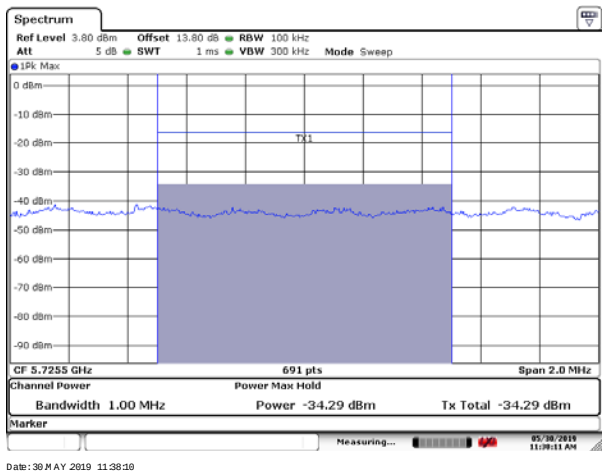
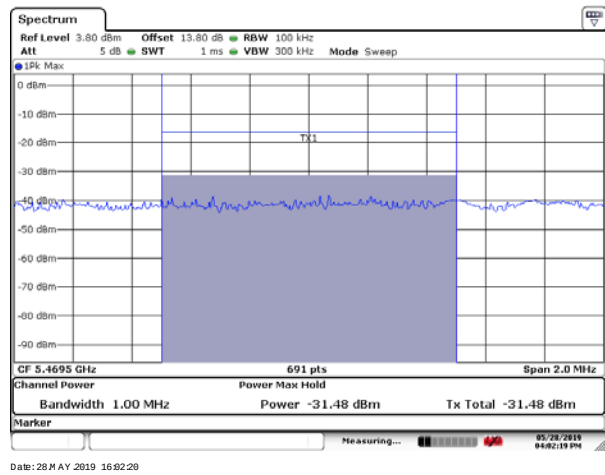
High channel: 5700 MHz



802.11n40 mode

Low Channel: 5510 MHz

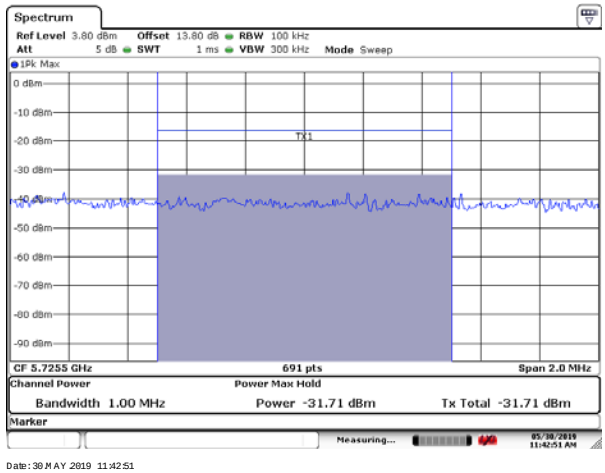
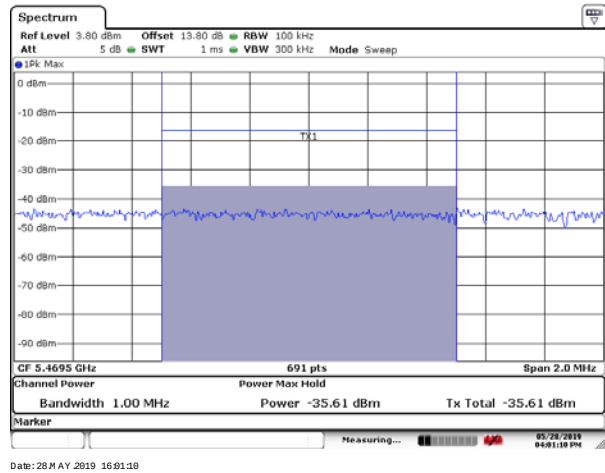
High channel: 5670 MHz



802.11ac20 mode

Low Channel: 5500 MHz

High channel: 5700 MHz



802.11ac40 mode

Low Channel: 5510 MHz

High channel: 5670 MHz

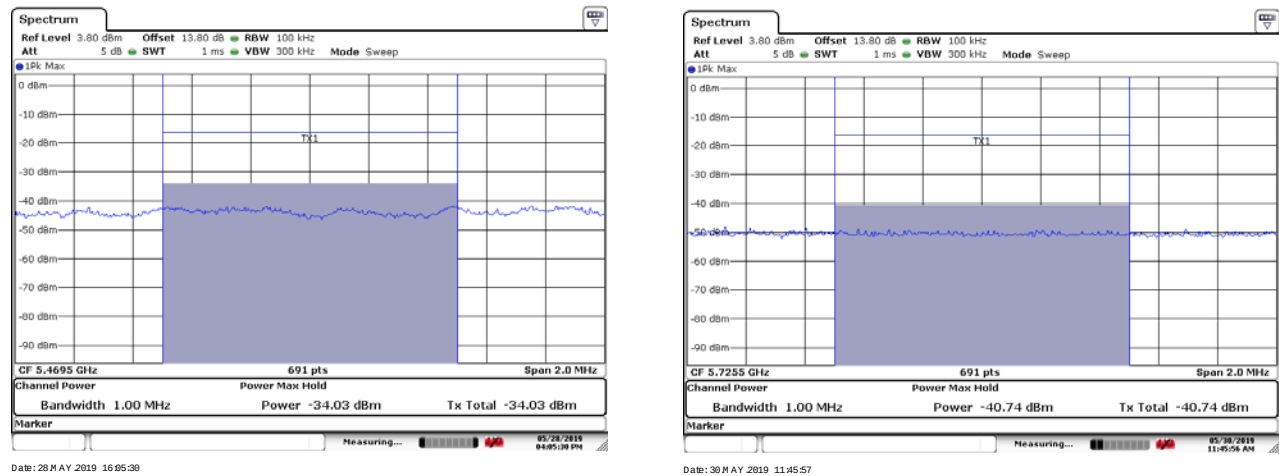


802.11ac80 mode

5530 MHz

Low Channel: 5530 MHz

High channel: 5610 MHz



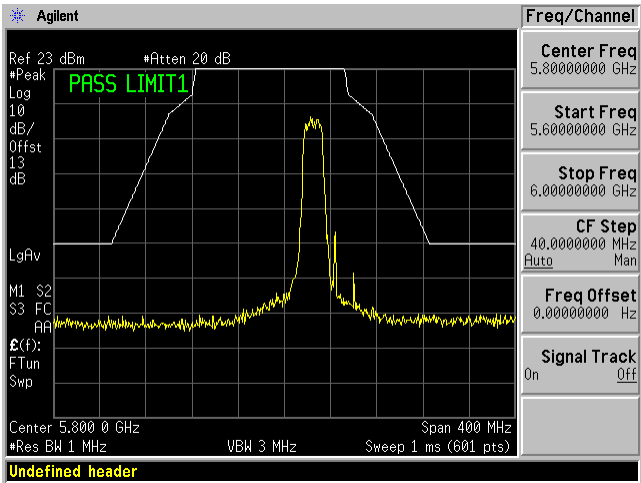
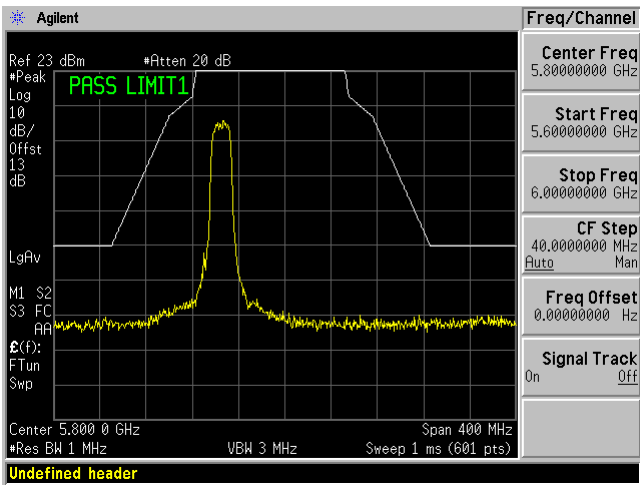
5725 – 5850 MHz

FCC Emission Mask

802.11a mode

5745 MHz

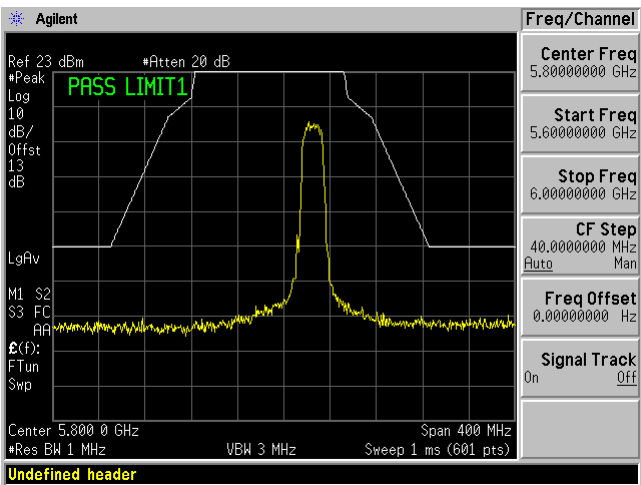
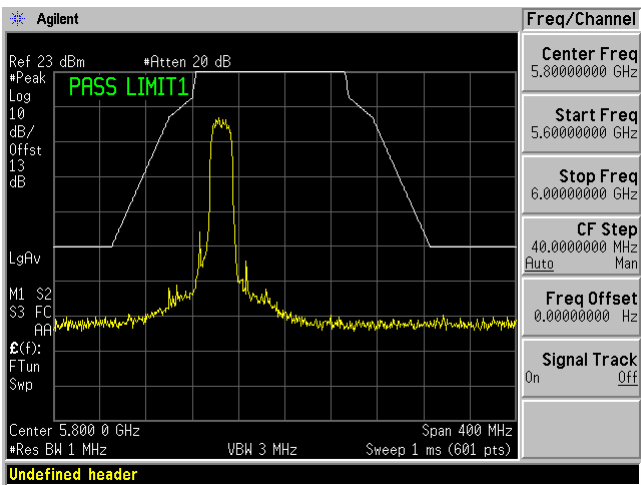
5825 MHz



802.11n20 mode

5745 MHz

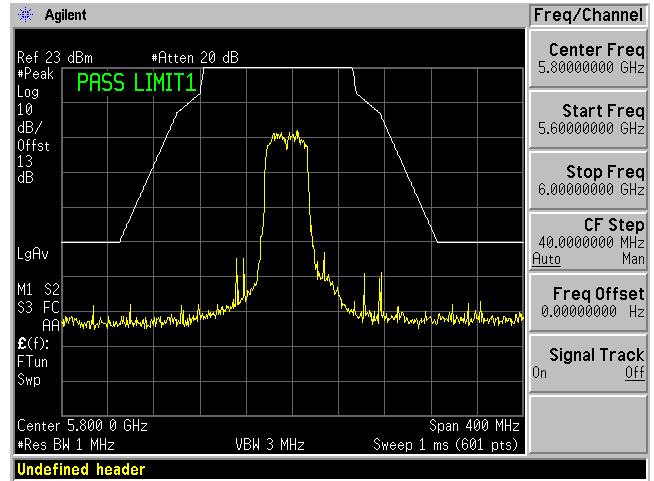
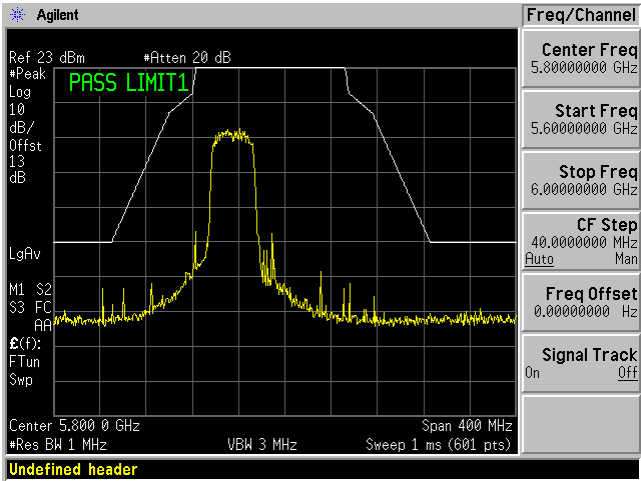
5825 MHz



802.11n40 mode

5755 MHz

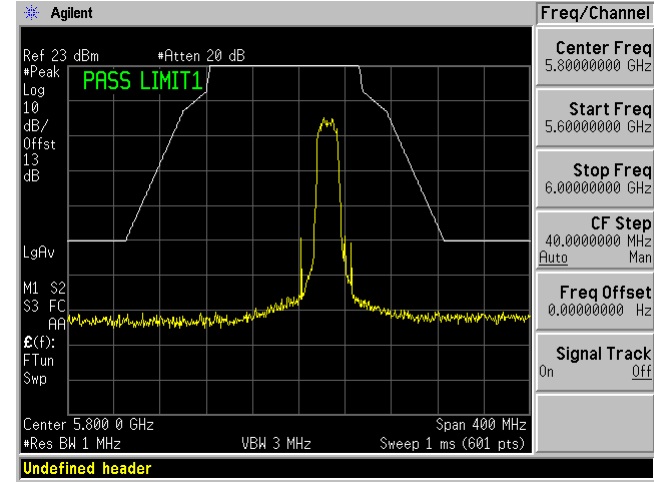
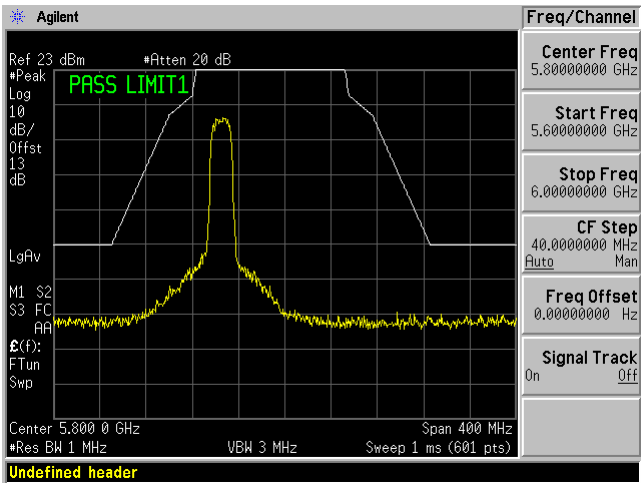
5795 MHz



802.11ac20 mode

5745 MHz

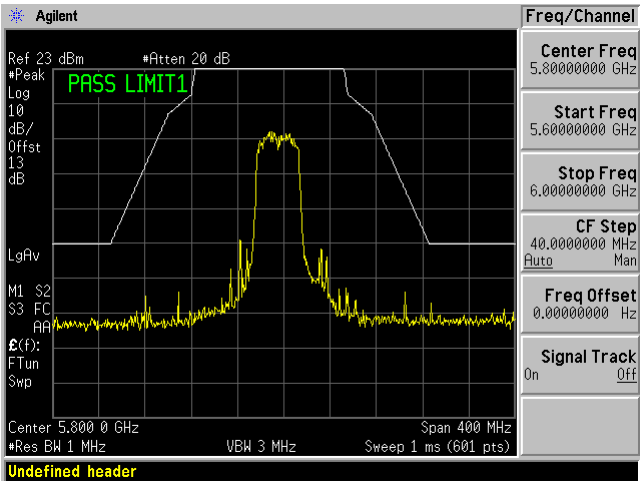
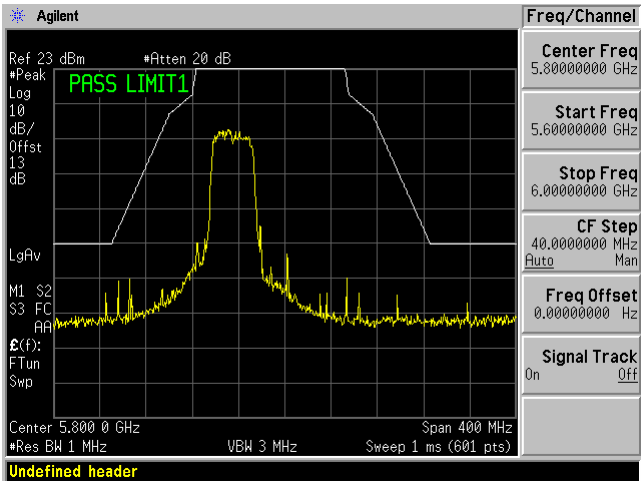
5825 MHz



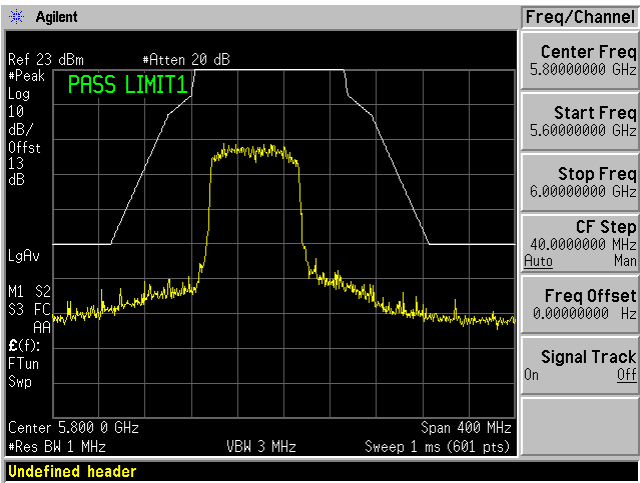
802.11ac40 mode

5755 MHz

5795 MHz



802.11ac80 mode, 5775 MHz



12 Appendix A (Normative) – EUT Test Setup Photographs

Please refer to the attachment.

13 Appendix B (Normative) – EUT External Photographs

Please refer to the attachment.

14 Appendix C (Normative) – EUT Internal Photographs

Please refer to the attachment.

15 Appendix D (Normative) - A2LA Electrical Testing Certificate



Please follow the web link below for a full ISO 17025 scope

<https://www.a2la.org/scopepdf/3297-02.pdf>

--- END OF REPORT ---