



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

TEST REPORT

For

August Home, Inc.

657 Bryant Street,
San Francisco, CA 94107, USA

FCC ID: 2AB6UASL05-5G
IC: 12163A-ASL055G

Report Type: Original Report	Product Type: Wi-Fi Smart Lock
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* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*" 08/11

TABLE OF CONTENTS

1	GENERAL DESCRIPTION.....	5
1.1	PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	5
1.2	OBJECTIVE.....	5
1.3	TEST METHODOLOGY	5
1.4	MEASUREMENT UNCERTAINTY	5
1.5	TEST FACILITY REGISTRATIONS	6
1.6	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.....	11
2.4	EQUIPMENT MODIFICATIONS	12
2.5	LOCAL SUPPORT EQUIPMENT	12
2.6	SUPPORT EQUIPMENT	12
2.7	INTERFACE PORTS AND CABLING	12
3	SUMMARY OF TEST RESULTS.....	13
4	FCC §2.1093, §15.407(F) & ISEDC RSS-102 - RF EXPOSURE.....	14
4.1	APPLICABLE STANDARD	14
4.2	MPE PREDICTION	15
4.3	MPE RESULTS	15
4.4	RF EXPOSURE EVALUATION EXEMPTION FOR ISED	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 §15.209, §15.407(B) & ISEDC RSS-247 §6.2 - SPURIOUS RADIATED EMISSIONS	19
6.1	APPLICABLE STANDARD	19
6.2	TEST SETUP	21
6.3	TEST PROCEDURE	21
6.4	CORRECTED AMPLITUDE AND MARGIN CALCULATION	21
6.5	TEST SETUP BLOCK DIAGRAM.....	22
6.6	TEST EQUIPMENT LIST AND DETAILS	24
6.7	TEST ENVIRONMENTAL CONDITIONS.....	24
6.8	SUMMARY OF TEST RESULTS.....	25
6.9	RADIATED EMISSIONS TEST RESULTS	26
7	FCC §15.407(E) & ISEDC RSS-247 §6.2 - 6 DB, 26 DB, & 99% - OCCUPIED BANDWIDTH	37
7.1	APPLICABLE STANDARDS	37
7.2	MEASUREMENT PROCEDURE	37
7.3	TEST EQUIPMENT LIST AND DETAILS	37
7.4	TEST ENVIRONMENTAL CONDITIONS.....	37
7.5	TEST RESULTS	37
8	FCC §407(A) & ISEDC RSS-247 §6.2 - OUTPUT POWER.....	55
8.1	APPLICABLE STANDARDS	55
8.2	MEASUREMENT PROCEDURE	56
8.3	TEST EQUIPMENT LIST AND DETAILS	56
8.4	TEST ENVIRONMENTAL CONDITIONS.....	56
8.5	TEST RESULTS	57
9	FCC §15.407(A) & ISEDC RSS-247 §6.2 - POWER SPECTRAL DENSITY	59
9.1	APPLICABLE STANDARDS	59

9.2 MEASUREMENT PROCEDURE 60

9.3 TEST EQUIPMENT LIST AND DETAILS 60

9.4 TEST ENVIRONMENTAL CONDITIONS..... 61

9.5 TEST RESULTS 61

10 FCC §15.407(B) & ISED RSS-247 §6.2 - OUT OF BAND EMISSIONS..... 76

10.1 APPLICABLE STANDARDS 76

10.2 MEASUREMENT PROCEDURE 77

10.3 TEST EQUIPMENT LIST AND DETAILS 77

10.4 TEST ENVIRONMENTAL CONDITIONS..... 77

10.5 TEST RESULTS 78

11 ANNEX A (NORMATIVE) - A2LA ELECTRICAL TESTING CERTIFICATE 98

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2209203-407	Original Report	2022-10-19

1 General Description

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *August Home, Inc.*, and their product model: *Titan*, Model number: *ASL05-5G*, FCC ID: *2AB6UASL05-5G*; IC: *12163A-ASL055G* or the “EUT” as referred to in this report. It is a Wireless smart lock.

1.2 Objective

This report is prepared on behalf of August Home, 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 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard for MeCompliance Testing of Unlicensed Wireless Devices, and FCC KDB 789033 D02 General UNII Test Procedure New Rules v02r01.

1.4 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 %

1.5 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.

1.6 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2017 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 17025:2017 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 17025:2017 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 and Fixed Radio Services;
- 4 All Scope 4-Licensed Maritime and Aviation Radio Services;
- 5 All Scope 5-Licensed Fixed Microwave Radio Services
- 6 All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.

- For Singapore (Info-Communications Development Authority (IDA)):

- 1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2

2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2
- For the Hong Kong Special Administrative Region:
 - 1 All Radio Equipment, per KHCA 10XX-series Specifications;
 - 2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
 - 3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
 - 1 MIC Telecommunication Business Law (Terminal Equipment):
 - All Scope A1 - Terminal Equipment for the Purpose of Calls;
 - All Scope A2 - Other Terminal Equipment
 - 2 Radio Law (Radio Equipment):
 - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
 - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
 - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

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

- 1 Electronics and Office Equipment:
 - for Telephony (ver. 3.0)
 - for Audio/Video (ver. 3.0)
 - for Battery Charging Systems (ver. 1.1)
 - for Set-top Boxes and Cable Boxes (ver. 4.1)
 - for Televisions (ver. 6.1)
 - for Computers (ver. 6.0)
 - for Displays (ver. 6.0)
 - for Imaging Equipment (ver. 2.0)
 - for Computer Servers (ver. 2.0)
- 2 Commercial Food Service Equipment
 - for Commercial Dishwashers (ver. 2.0)
 - for Commercial Ice Machines (ver. 2.0)
 - for Commercial Ovens (ver. 2.1)
 - for Commercial Refrigerators and Freezers
- 3 Lighting Products
 - For Decorative Light Strings (ver. 1.5)
 - For Luminaires (including sub-components) and Lamps (ver. 1.2)
 - For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
 - For Integral LED Lamps (ver. 1.4)
- 4 Heating, Ventilation, and AC Products
 - for Residential Ceiling Fans (ver. 3.0)
 - for Residential Ventilating Fans (ver. 3.2)
- 5 Other
 - For Water Coolers (ver. 3.0)

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

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Industry Canada - IC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I and Phase II;

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

2 EUT Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.10-2013 and FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

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 WICED Studio provided by *August Home, Inc.*, the software complies 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
	40	5200	14
	48	5240	14
	52	5260	14
	56	5280	14
	64	5320	14
	100	5500	14
	120	5600	14
	140	5700	14
	149	5745	14
	157	5785	14
	165	5825	14

Modulation	Channel	Frequency (MHz)	Power Setting
802.11n20 mode	36	5180	16
	40	5200	16
	48	5240	16
	52	5260	16
	56	5280	16
	64	5320	16
	100	5500	16
	120	5600	16
	140	5700	16
	149	5745	16
	157	5785	16
	165	5825	16
802.11ac20 mode	36	5180	10
	40	5200	10
	48	5240	10
	52	5260	10
	56	5280	10
	64	5320	10
	100	5500	10
	120	5600	10
	140	5700	10
	149	5745	10
	157	5785	10
	165	5825	10

*Data rates tested:

802.11a mode: 6Mbps

802.11n HT20: MCS0

802.11ac VHT20: MCS0

Note: 5600-5650MHz range is not used in Canada

Note: 5.2 band is not used for outdoor use in Canada

2.3 Duty Cycle Correction Factor

According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01 section B:

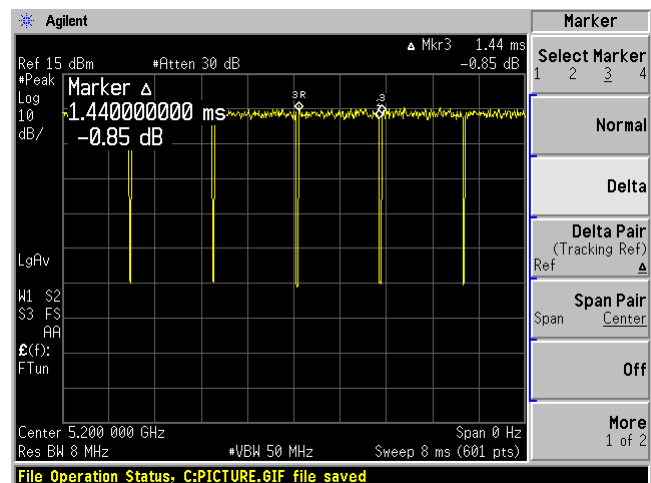
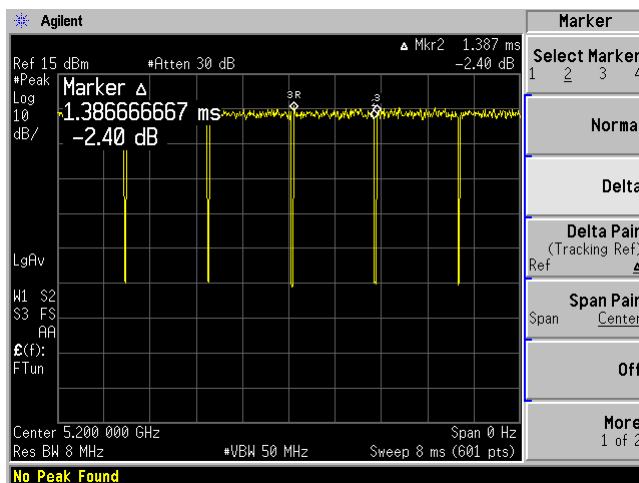
All measurements are to be performed with the EUT transmitting at 100% duty cycle at its maximum power control level; however, if 100% duty cycle cannot be achieved, measurements of duty cycle, x, and maximum-power transmission duration, T, are required for each tested mode of operation.

Radio Mode	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
802.11a	1.39	1.44	96.5	0.155
802.11n20	0.162	0.212	76.4	1.169
802.11ac20	0.148	0.197	75.1	1.244

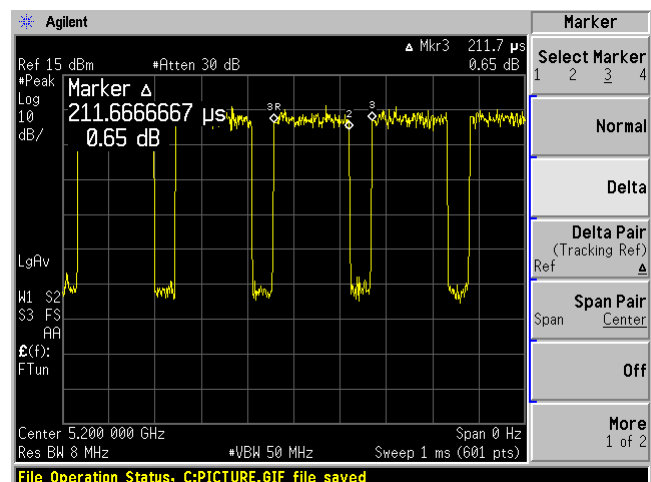
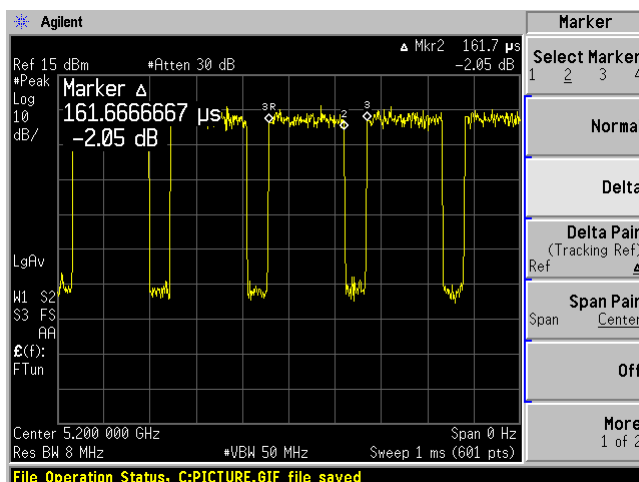
Note: Duty Cycle Correction Factor = $10 \cdot \log(1/\text{duty cycle})$

Please refer to the following plots.

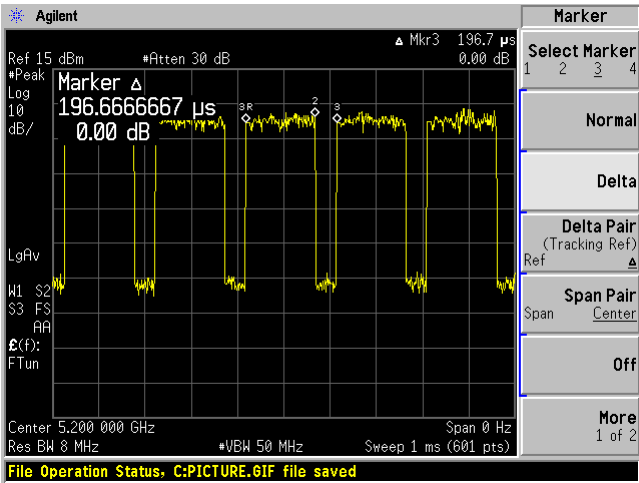
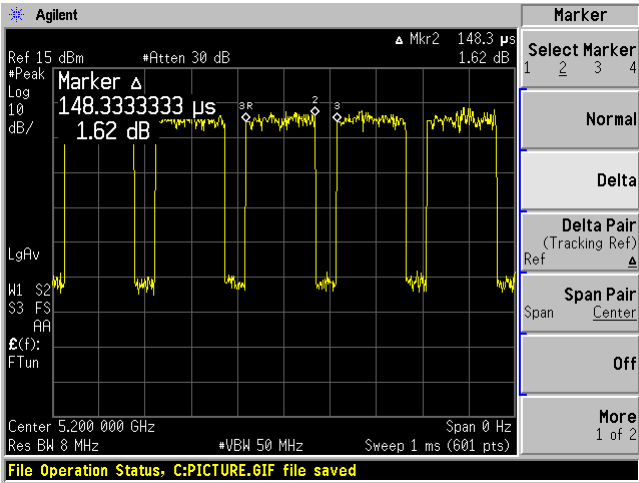
802.11a mode



802.11n20 mode



802.11ac20 mode



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

Note¹: EUT is battery-powered

Note²: DFS measurement is recorded in a separate report R2209203-DFS

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

4.1 Applicable Standard

According to FCC §15.407(i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

Limits for General Population/Uncontrolled Exposure

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

f = frequency in MHz

* = Plane-wave equivalent power density

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

According to ISED RSS-102 Issue 5, Exemption Limits for Routine Evaluation – RF Exposure Evaluation:

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

- Below 20 MHz ^{Note1} and the source-based, time-average maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- At or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.o. of the device is equal to or less than $4.49/f$ W (adjusted for tune-up tolerance), where f is in MHz;
- At or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.o. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- At or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- At or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

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

Note1: Transmitters operating between 0.003 – 10 MHz, meeting the exemption from routine RF Exposure evaluation, shall demonstrate compliance to the instantaneous limits in following table..

RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)

Frequency Range (MHz)	Electric Field Strength (V/m rms)	Magnetic Field Strength (A/m rms)	Power Density (mW/m ²)	Averaging Time (minutes)
0.003-10	83	90	-	Instantaneous *
0.1-10	-	$0.73/f$	-	6**
1.1-10	$87/f^{0.5}$	-	-	6**
010-20	27.46	0.0728	-2	6
20-48	$58.07/f^{0.25}$	$0.1540/f^{0.25}$	$8.944/f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	$3.142 f^{0.3417}$	$0.005335 f^{0.3417}$	$0.02619 f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	$616000/f^{1.2}$
150000-300000	$0.158 f^{0.5}$	$4.21 * 10^{-4} f^{0.5}$	$6.67 * 10^{-5} f$	$616000/f^{1.2}$

f = frequency in MHz

* = Based on nerve stimulation (NS)

** = Based on specific absorption rate (SAR).

4.2 MPE Prediction

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

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

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

4.3 MPE Results

Maximum output power at antenna input terminal (dBm):	12.02
Maximum output power at antenna input terminal tune-up(dBm):	13.02
Maximum output power at antenna input terminal tune-up(mW):	20.045
Prediction distance (cm):	20
Prediction frequency (MHz):	5260
Maximum Antenna Gain, typical (dBi):	1.25
Maximum Antenna Gain (numeric):	1.33
Power density of prediction frequency at 20.0 cm (mW/cm ²):	0.005
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm ²):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.005 mW/cm². Limit is 1.0 mW/cm².

The conducted power used for MPE calculation is the total power across all chains, and the maximum antenna gain used for MPE calculation is the directional gain.

Note: Client declares that no combination of Bluetooth, 2.4 GHz Wi-Fi and 5GHz Wi-Fi cannot transmit simultaneously.

4.4 RF exposure evaluation exemption for ISED

$$13.02 + 1.25 \text{ dBi} = 14.27 \text{ dBm} < 1.31 \times 10^{-2} f^{0.6834} = 4.57 \text{ W} = 36.6 \text{ dBm}$$

Therefore the RF exposure is not required.

Note: Client declares that no combination of Bluetooth, 2.4 GHz Wi-Fi and 5GHz Wi-Fi cannot transmit simultaneously.

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)
5GHz Wi-Fi	5180-5825	1.25

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

6.1 Applicable Standard

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	960 – 1240	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5.35 – 5.46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 – 167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3.3458 – 3.358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

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

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

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

As per FCC Part 15.407 (b)

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

- (2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.
- (3) For transmitters operating in the 5.47 -5.725 GHz band: All emissions outside of the 5.47-5725 GHz band shall not exceed an 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 ISSED 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.

6.2 Test Setup

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

The spacing between the peripherals was 10 centimeters.

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

6.3 Test Procedure

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: $RBW = 1\text{MHz} / VBW = 10\text{Hz} / \text{Sweep} = \text{Auto}$

6.4 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:

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

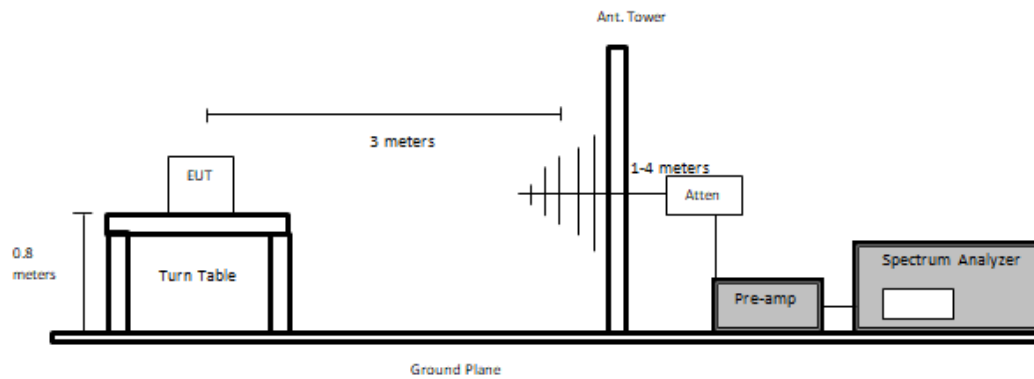
For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

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:

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

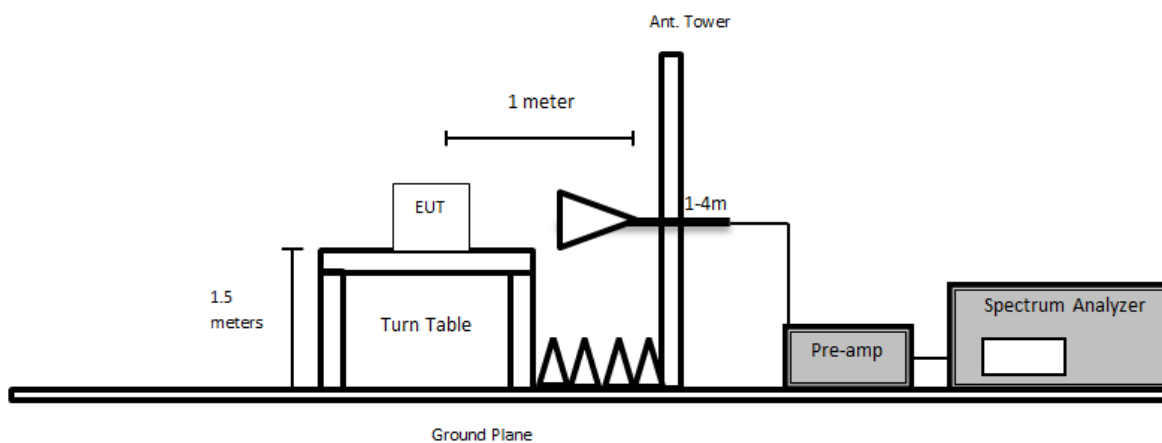
6.5 Test Setup Block Diagram

Below 1GHz:

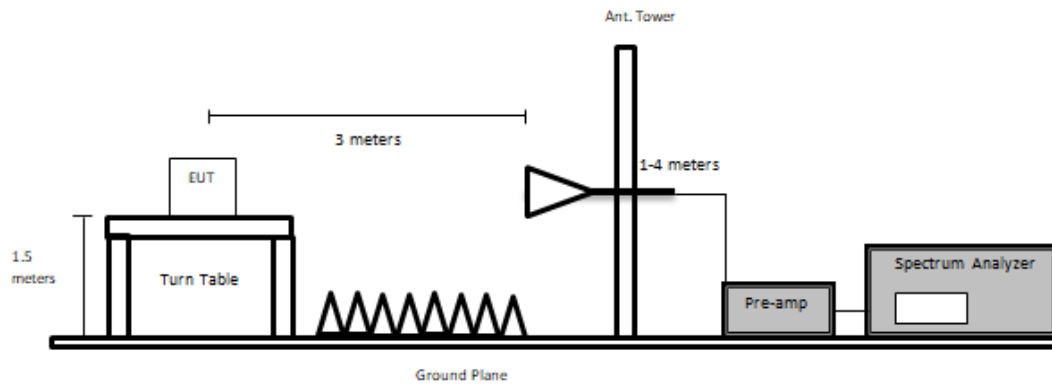


Above 1GHz:

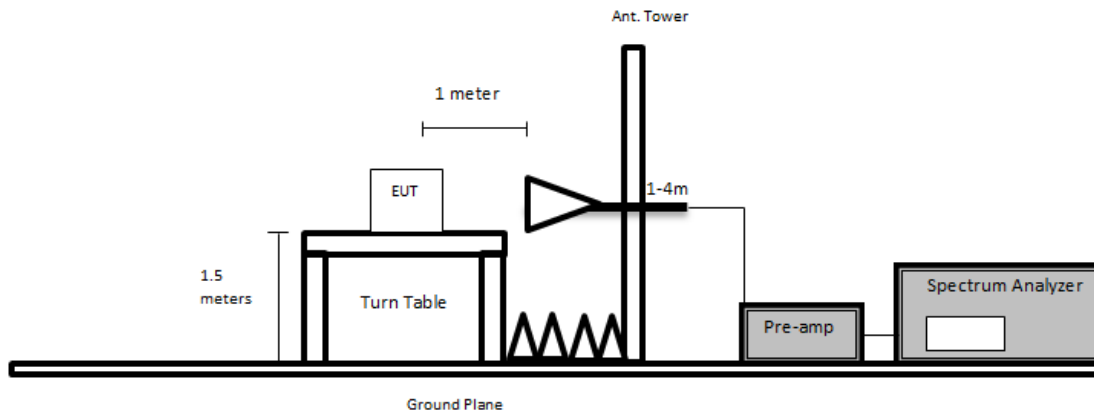
At 1 meter for 1-18GHz



At 3 meters for 1-18GHz



At 1 meters for 18-40 GHz



6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950.03	100338	2018-07-05	2 year
Agilent	Analyzer, Spectrum	E4446A	US44300386	2019-06-26	1 year
Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/R
Sunol Sciences	Antenna, Biconi-Log	JB1	A013105-3	2018-02-26	2 year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2019-04-02	2 years
Agilent	Amplifier, Pre	8447D	2944A10187	2019-07-31	1 year
HP	Pre-Amplifier	8449B	3008A01978	2019-09-27	1year
AH Systems	Pre-Amplifier 18-40GHz	PAM-1840VH	170	2019-09-24	1 year
Wisewave	Antenna, Horn 18-26.5GHz	ARH-4223-02	10555-02	2017-12-15	2 years
Wisewave	Antenna, Horn 26.5-40GHz	ARH-2823-02	10555-01	2018-02-14	28 months
Insulated Wire Corp.	157 Series 2.92 SM (x2) Armored 33 ft. Cable	KPS-1571AN-3960- KPS	DC 1917	2019-05-08	1 Year
-	SMA cable	-	C0002	Each time ¹	N/A
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.*

6.7 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 2019-11-15 in 5m chamber 3.

6.8 Summary of Test Results

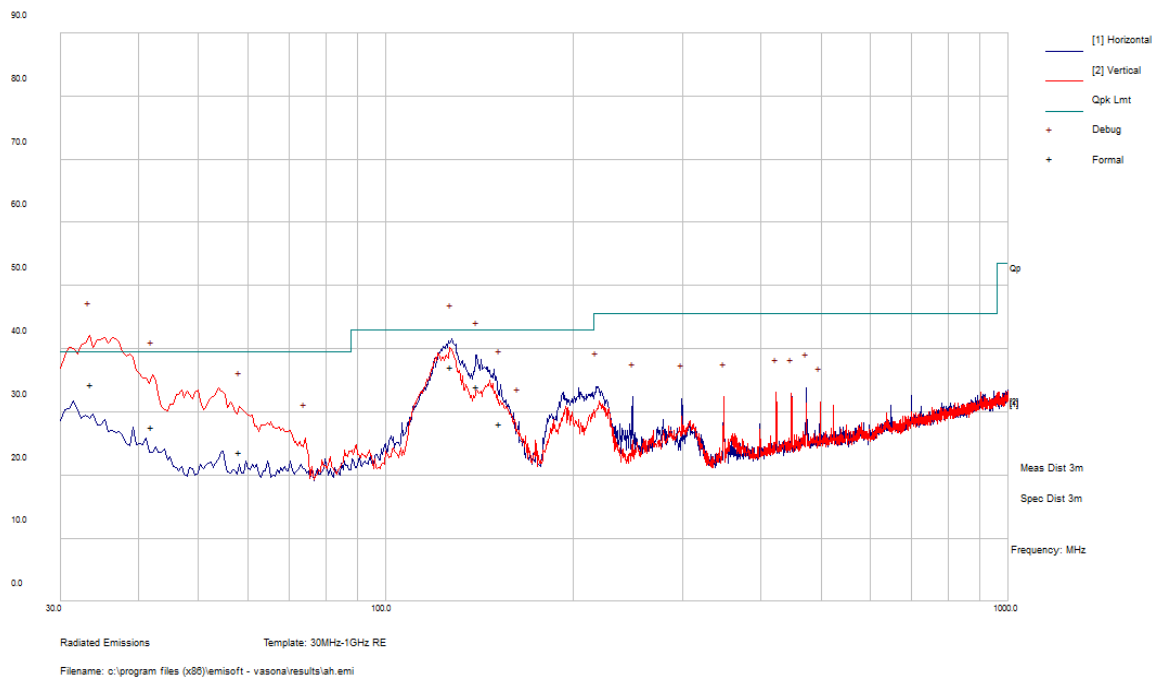
According to the data hereinafter, the EUT complied with the FCC Part 15.407 and RSS-247 standards' radiated emissions limits, and had the worst margin of:

Mode: Transmitting			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Mode, Channel
-1.32	11490	Vertical	802.11ac20 mode, 5745 MHz

6.9 Radiated Emissions Test Results

Note: Pre-scan was performed in order to determine worst-case orientation of device[shown in Test Setup Photos] with respect to measurement antenna. Plots/data shown represent measurements made in worst-case orientation.

1) 30 MHz – 1 GHz at 3 meter



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.)
33.5675	34.43	105	V	309	40	-5.57	QP
127.24325	37.18	157	H	92	43.5	-6.32	QP
42.0315	27.6	104	V	241	40	-12.4	QP
140.1125	34.01	197	H	73	43.5	-9.49	QP
58.247	23.58	126	V	310	40	-16.42	QP
152.5735	28.12	218	H	240	43.5	-15.38	QP

2) 1–40 GHz at 3 meter

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		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Low Channel 5180 MHz											
5150	53.18	135	300	H	33.55	8.70	37.58	57.84	74.00	-16.16	PK
5150	34.70	135	300	H	33.55	8.70	37.58	39.36	54.00	-14.64	AV
5150	59.40	15	296	V	33.46	8.70	37.58	63.98	74.00	-10.03	PK
5150	36.40	15	296	V	33.46	8.70	37.58	40.98	54.00	-13.03	AV
10360	47.37	0	100	H	38.17	13.04	39.28	59.29	68.00	-8.71	PK
10360	47.11	0	100	V	38.13	13.04	39.28	58.99	68.00	-9.01	PK
Middle Channel 5200 MHz											
10400	46.51	0	100	H	38.20	13.04	39.95	57.81	68.00	-10.19	PK
10400	46.87	0	100	V	38.15	13.04	39.95	58.11	68.00	-9.89	PK
High Channel 5240 MHz											
10480	47.28	0	100	H	38.26	13.04	39.95	58.64	68.00	-9.37	PK
10480	47.08	0	100	V	38.21	13.04	39.95	58.39	68.00	-9.61	PK

802.11n20 mode

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Low Channel 5180 MHz											
5150	47.44	0	100	H	33.55	8.70	37.58	52.10	74.00	-21.90	PK
5150	34.66	0	100	H	33.55	8.70	37.58	39.32	54.00	-14.68	AV
5150	47.29	0	100	V	33.46	8.70	37.58	51.87	74.00	-22.14	PK
5150	35.45	0	100	V	33.46	8.70	37.58	40.03	54.00	-13.98	AV
10360	47.22	0	100	H	38.17	13.04	39.28	59.14	68.00	-8.86	PK
10360	47.29	0	100	V	38.13	13.04	39.28	59.17	68.00	-8.83	PK
Middle Channel 5200 MHz											
10400	46.74	0	100	H	38.20	13.04	39.95	58.04	68.00	-9.96	PK
10400	46.32	0	100	V	38.15	13.04	39.95	57.56	68.00	-10.44	PK
High Channel 5240 MHz											
10480	47.75	0	100	H	38.26	13.04	39.95	59.11	68.00	-8.90	PK
10480	47.86	0	100	V	38.21	13.04	39.95	59.17	68.00	-8.83	PK

802.11ac20 mode

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Low Channel 5180 MHz											
5150	47.62	150	200	H	33.55	8.70	37.58	52.28	74.00	-21.72	PK
5150	34.49	150	200	H	33.55	8.70	37.58	39.15	54.00	-14.85	AV
5150	47.43	75	150	V	33.46	8.70	37.58	52.01	74.00	-22.00	PK
5150	35.37	75	150	V	33.46	8.70	37.58	39.95	54.00	-14.06	AV
10360	46.75	0	100	H	38.17	13.04	39.28	58.67	68.00	-9.33	PK
10360	46.98	0	100	V	38.13	13.04	39.28	58.86	68.00	-9.14	PK
Middle Channel 5200 MHz											
10400	46.51	0	100	H	38.20	13.04	39.95	57.81	68.00	-10.19	PK
10400	46.93	0	100	V	38.15	13.04	39.95	58.17	68.00	-9.83	PK
High Channel 5240 MHz											
10480	47.48	0	100	H	38.26	13.04	39.95	58.84	68.00	-9.17	PK
10480	47.14	0	100	V	38.21	13.04	39.95	58.45	68.00	-9.55	PK

5250 - 5350 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 5260 MHz											
10520	46.42	0	100	H	38.26	13.02	39.95	57.76	68.00	-10.25	PK
10520	46.67	0	100	V	38.21	13.02	39.95	57.96	68.00	-10.04	PK
Middle Channel 5280 MHz											
10560	46.78	0	100	H	38.27	13.02	39.95	58.13	68.00	-9.87	PK
10560	46.16	0	100	V	38.23	13.02	39.95	57.47	68.00	-10.53	PK
High Channel 5320 MHz											
5350	50.30	251	100	H	33.69	8.81	37.45	55.35	74.00	-18.66	PK
5350	35.70	251	100	H	33.69	8.81	37.45	40.75	54.00	-13.26	AV
5350	51.31	350	146	V	33.60	8.81	37.45	56.27	74.00	-17.73	PK
5350	36.04	350	146	V	33.60	8.81	37.45	41.00	54.00	-13.00	AV
10640	46.83	0	100	H	38.22	13.02	39.93	58.15	74.00	-15.85	PK
10640	32.22	0	100	H	38.22	13.02	39.93	43.54	54.00	-10.46	AV
10640	46.19	0	100	V	38.18	13.02	39.93	57.46	74.00	-16.54	PK
10640	32.29	0	100	V	38.18	13.02	39.93	43.56	54.00	-10.44	AV

802.11n20 mode

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC/ISED		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Low Channel 5260 MHz											
10520	46.09	0	100	H	38.26	13.02	39.95	57.43	68.00	-10.58	PK
10520	46.74	0	100	V	38.21	13.02	39.95	58.03	68.00	-9.97	PK
Middle Channel 5280 MHz											
10560	47.03	0	100	H	38.27	13.02	39.95	58.38	68.00	-9.62	PK
10560	46.86	0	100	V	38.23	13.02	39.95	58.17	68.00	-9.83	PK
High Channel 5320 MHz											
5350	48.28	0	100	H	33.69	8.81	37.45	53.33	74.00	-20.68	PK
5350	34.96	0	100	H	33.69	8.81	37.45	40.01	54.00	-14.00	AV
5350	47.55	0	100	V	33.60	8.81	37.45	52.51	74.00	-21.49	PK
5350	36.13	0	100	V	33.60	8.81	37.45	41.09	54.00	-12.91	AV
10640	46.65	0	100	H	38.22	13.02	39.93	57.97	74.00	-16.03	PK
10640	34.47	0	100	H	38.22	13.02	39.93	45.79	54.00	-8.21	AV
10640	46.89	0	100	V	38.18	13.02	39.93	58.16	74.00	-15.84	PK
10640	34.41	0	100	V	38.18	13.02	39.93	45.68	54.00	-8.32	AV

802.11ac20 mode

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC/ISED		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Low Channel 5260 MHz											
10520	46.29	0	100	H	38.26	13.02	39.95	57.63	68.00	-10.38	PK
10520	46.23	0	100	V	38.23	13.02	39.95	57.54	68.00	-10.47	PK
Middle Channel 5280 MHz											
10560	46.94	0	100	H	38.27	13.02	39.95	58.29	68.00	-9.71	PK
10560	46.74	0	100	V	38.23	13.02	39.95	58.05	68.00	-9.95	PK
High Channel 5320 MHz											
5350	47.07	20	200	H	33.69	8.81	37.45	52.12	74.00	-21.89	PK
5350	35.12	20	200	H	33.69	8.81	37.45	40.17	54.00	-13.84	AV
5350	47.97	50	200	V	33.60	8.81	37.45	52.93	74.00	-21.07	PK
5350	35.46	50	200	V	33.60	8.81	37.45	40.42	54.00	-13.58	AV
10640	46.72	0	100	H	38.22	13.02	39.93	58.04	74.00	-15.96	PK
10640	33.87	0	100	H	38.22	13.02	39.93	45.19	54.00	-8.81	AV
10640	46.87	0	100	V	38.18	13.02	39.93	58.14	74.00	-15.86	PK
10640	34.11	0	100	V	38.18	13.02	39.93	45.38	54.00	-8.62	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	57.01	250	100	H	33.78	8.64	37.44	61.99	74.00	-12.01	PK
5470	35.70	250	100	H	33.78	8.64	37.44	40.68	54.00	-13.32	AV
5470	56.12	302	300	V	33.79	8.64	37.44	61.11	74.00	-12.89	PK
5470	35.08	302	300	V	33.79	8.64	37.44	40.07	54.00	-13.93	AV
11000	46.44	0	100	H	38.45	13.31	39.35	58.85	74.00	-15.15	PK
11000	32.65	0	100	H	38.45	13.31	39.35	45.06	54.00	-8.94	AV
11000	46.50	0	100	V	38.42	13.31	39.35	58.88	74.00	-15.12	PK
11000	32.23	0	100	V	38.42	13.31	39.35	44.61	54.00	-9.39	AV
Middle Channel 5600 MHz											
11200	46.70	0	100	H	38.53	14.15	38.18	61.20	74.00	-12.80	PK
11200	34.59	0	100	H	38.53	14.15	38.18	49.09	54.00	-4.91	AV
11200	46.13	0	100	V	38.44	14.15	38.18	60.54	74.00	-13.46	PK
11200	34.37	0	100	V	38.44	14.15	38.18	48.78	54.00	-5.22	AV
High Channel 5700 MHz											
11400	46.55	0	100	H	38.47	14.88	36.92	62.98	74.00	-11.02	PK
11400	32.23	0	100	H	38.47	14.88	36.92	48.66	54.00	-5.34	AV
11400	46.76	0	100	V	38.39	14.88	36.92	63.11	74.00	-10.89	PK
11400	32.37	0	100	V	38.39	14.88	36.92	48.72	54.00	-5.28	AV

802.11n20 mode

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC/ISED		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Low Channel 5500 MHz											
5470	47.34	360	260	H	33.78	8.64	37.44	52.32	74.00	-21.68	PK
5470	35.30	360	260	H	33.78	8.64	37.44	40.28	54.00	-13.72	AV
5470	52.24	360	300	V	33.79	8.64	37.44	57.23	74.00	-16.77	PK
5470	36.04	360	300	V	33.79	8.64	37.44	41.03	54.00	-12.97	AV
11000	46.29	0	100	H	38.45	13.31	39.35	58.70	74.00	-15.30	PK
11000	33.45	0	100	H	38.45	13.31	39.35	45.86	54.00	-8.14	AV
11000	46.24	0	100	V	38.42	13.31	39.35	58.62	74.00	-15.38	PK
11000	33.83	0	100	V	38.42	13.31	39.35	46.21	54.00	-7.79	AV
Middle Channel 5600 MHz											
11200	45.98	0	100	H	38.53	14.15	38.18	60.48	74.00	-13.52	PK
11200	33.67	0	100	H	38.53	14.15	38.18	48.17	54.00	-5.83	AV
11200	46.12	0	100	V	38.44	14.15	38.18	60.53	74.00	-13.47	PK
11200	33.78	0	100	V	38.44	14.15	38.18	48.19	54.00	-5.81	AV
High Channel 5700 MHz											
11400	46.39	0	100	H	38.47	14.88	36.92	62.81	74.00	-11.19	PK
11400	33.79	0	100	H	38.47	14.88	36.92	50.21	54.00	-3.79	AV
11400	46.24	0	100	V	38.39	14.88	36.92	62.59	74.00	-11.41	PK
11400	33.93	0	100	V	38.39	14.88	36.92	50.28	54.00	-3.72	AV

802.11ac20 mode

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC/ISED		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Low Channel 5500 MHz											
5470	48.48	235	100	H	33.78	8.64	37.44	53.46	74.00	-20.54	PK
5470	34.89	235	100	H	33.78	8.64	37.44	39.87	54.00	-14.13	AV
5470	47.27	320	300	V	33.79	8.64	37.44	52.26	74.00	-21.74	PK
5470	35.37	320	300	V	33.79	8.64	37.44	40.36	54.00	-13.64	AV
11000	46.56	0	100	H	38.45	13.31	39.35	58.97	74.00	-15.03	PK
11000	33.99	0	100	H	38.45	13.31	39.35	46.40	54.00	-7.60	AV
11000	46.23	0	100	V	38.42	13.31	39.35	58.61	74.00	-15.39	PK
11000	33.80	0	100	V	38.42	13.31	39.35	46.18	54.00	-7.82	AV
Middle Channel 5600 MHz											
11200	45.44	0	100	H	38.53	14.15	38.18	59.94	74.00	-14.06	PK
11200	32.97	0	100	H	38.53	14.15	38.18	47.47	54.00	-6.53	AV
11200	45.70	0	100	V	38.44	14.15	38.18	60.11	74.00	-13.89	PK
11200	33.88	0	100	V	38.44	14.15	38.18	48.29	54.00	-5.71	AV
High Channel 5700 MHz											
11400	46.37	0	100	H	38.47	14.88	36.92	62.80	74.00	-11.20	PK
11400	34.17	0	100	H	38.47	14.88	36.92	50.60	54.00	-3.40	AV
11400	46.14	0	100	V	38.39	14.88	36.92	62.49	74.00	-11.51	PK
11400	34.14	0	100	V	38.39	14.88	36.92	50.49	54.00	-3.51	AV

5725 - 5850 MHz

802.11a mode

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC/ISED		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Low Channel 5745 MHz											
11490	46.36	0	100	H	38.44	16.17	36.33	64.65	74.00	-9.35	PK
11490	32.20	0	100	H	38.44	16.17	36.33	50.49	54.00	-3.51	AV
11490	46.23	0	100	V	38.43	16.17	36.33	64.50	74.00	-9.50	PK
11490	32.31	0	100	V	38.43	16.17	36.33	50.58	54.00	-3.42	AV
Middle Channel 5785 MHz											
11570	46.74	0	100	H	38.48	15.56	36.33	64.46	74.00	-9.54	PK
11570	32.38	0	100	H	38.48	15.56	36.33	50.10	54.00	-3.90	AV
11570	46.72	0	100	V	38.48	15.56	36.33	64.43	74.00	-9.57	PK
11570	32.28	0	100	V	38.48	15.56	36.33	49.99	54.00	-4.01	AV
High Channel 5825 MHz											
11650	46.17	0	100	H	38.67	15.05	36.17	63.72	74.00	-10.28	PK
11650	32.07	0	100	H	38.67	15.05	36.17	49.62	54.00	-4.38	AV
11650	46.96	0	100	V	38.59	15.05	36.17	64.43	74.00	-9.57	PK
11650	32.10	0	100	V	38.59	15.05	36.17	49.57	54.00	-4.43	AV

802.11n20 mode

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC/ISED		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Low Channel 5745 MHz											
11490	46.74	0	100	H	38.44	16.17	36.33	65.03	74.00	-8.97	PK
11490	34.02	0	100	H	38.44	16.17	36.33	52.31	54.00	-1.69	AV
11490	46.38	0	100	V	38.43	16.17	36.33	64.65	74.00	-9.35	PK
11490	33.94	0	100	V	38.43	16.17	36.33	52.21	54.00	-1.79	AV
Middle Channel 5785 MHz											
11570	46.99	0	100	H	38.48	15.56	36.33	64.70	74.00	-9.30	PK
11570	34.05	0	100	H	38.48	15.56	36.33	51.76	54.00	-2.24	AV
11570	46.70	0	100	V	38.48	15.56	36.33	64.41	74.00	-9.59	PK
11570	34.14	0	100	V	38.48	15.56	36.33	51.85	54.00	-2.15	AV
High Channel 5825 MHz											
11650	46.53	0	100	H	38.67	15.05	36.17	64.08	74.00	-9.92	PK
11650	34.13	0	100	H	38.67	15.05	36.17	51.68	54.00	-2.32	AV
11650	45.90	0	100	V	38.59	15.05	36.17	63.37	74.00	-10.63	PK
11650	33.79	0	100	V	38.59	15.05	36.17	51.26	54.00	-2.74	AV

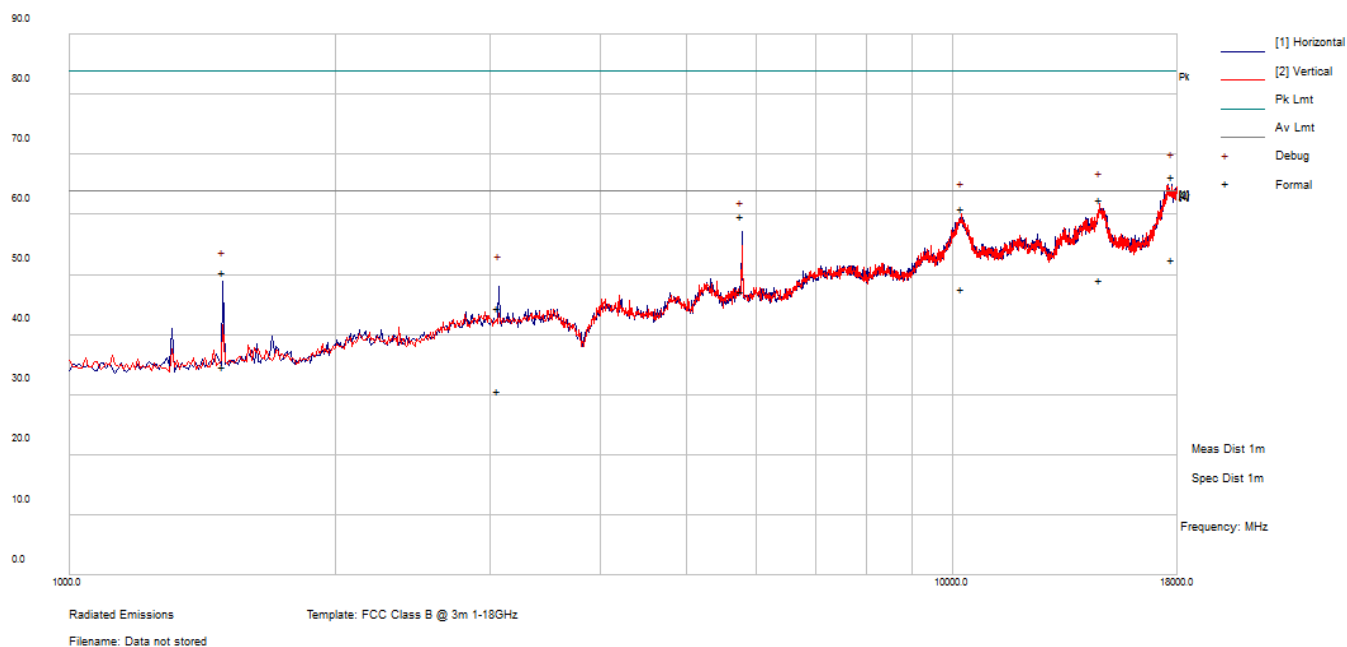
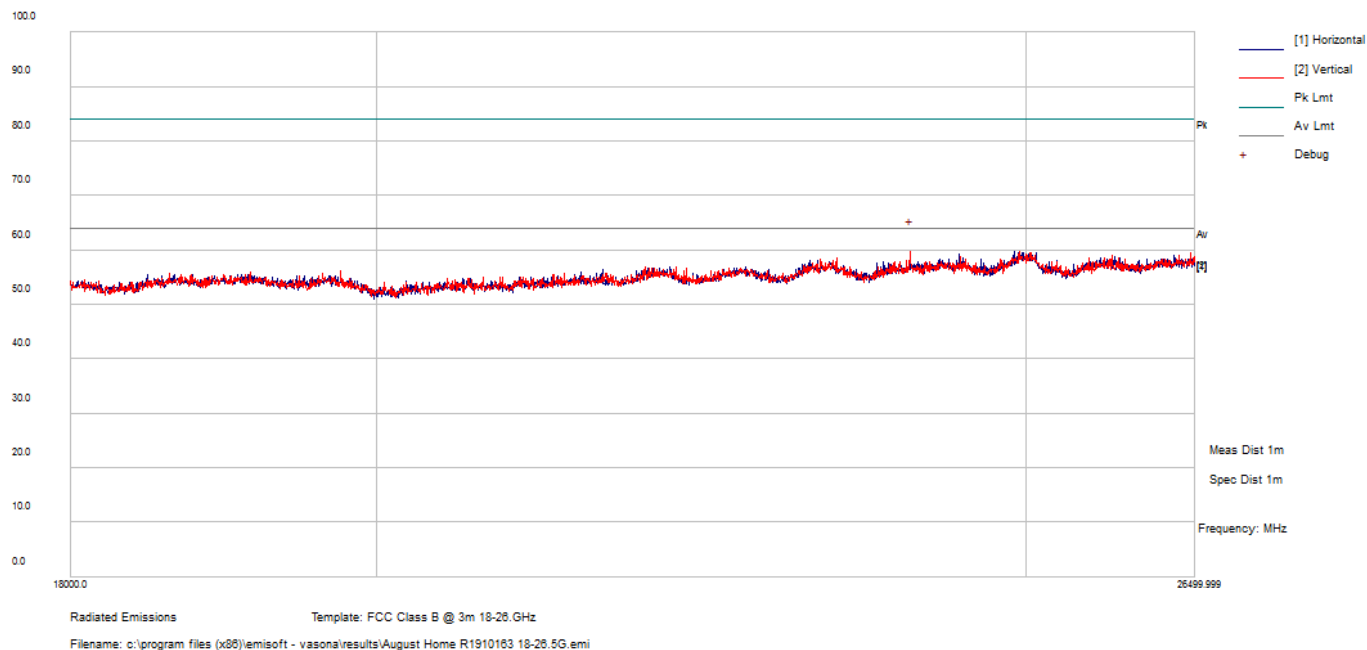
802.11ac20 mode

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC/ISED		Comments (PK/Ave.)
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Low Channel 5745 MHz											
11490	46.30	0	100	H	38.44	16.17	36.33	64.59	74.00	-9.41	PK
11490	34.28	0	100	H	38.44	16.17	36.33	52.57	54.00	-1.43	AV
11490	46.95	0	100	V	38.43	16.17	36.33	65.22	74.00	-8.78	PK
11490	34.41	0	100	V	38.43	16.17	36.33	52.68	54.00	-1.32	AV
Middle Channel 5785 MHz											
11570	46.33	0	100	H	38.48	15.56	36.33	64.04	74.00	-9.96	PK
11570	34.07	0	100	H	38.48	15.56	36.33	51.78	54.00	-2.22	AV
11570	46.34	0	100	V	38.48	15.56	36.33	64.05	74.00	-9.95	PK
11570	34.37	0	100	V	38.48	15.56	36.33	52.08	54.00	-1.92	AV
High Channel 5825 MHz											
11650	46.41	0	100	H	38.67	15.05	36.17	63.96	74.00	-10.04	PK
11650	33.83	0	100	H	38.67	15.05	36.17	51.38	54.00	-2.62	AV
11650	46.37	0	100	V	38.59	15.05	36.17	63.84	74.00	-10.16	PK
11650	34.08	0	100	V	38.59	15.05	36.17	51.55	54.00	-2.45	AV

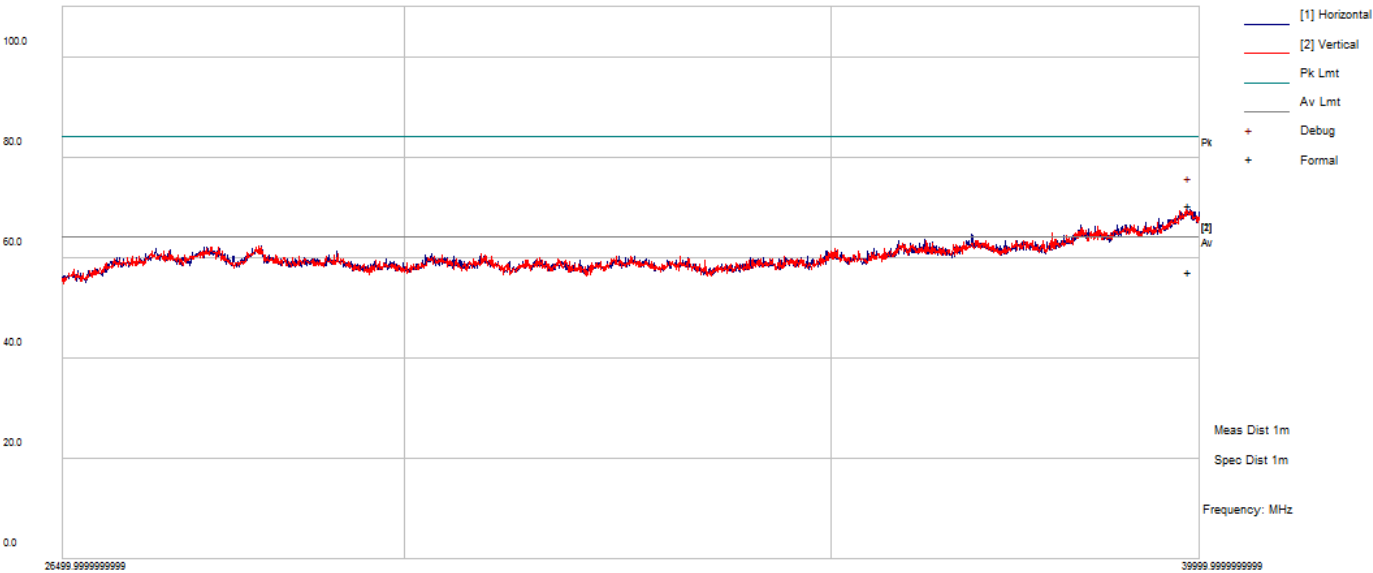
Note 1: Any emissions above 12 GHz are emissions from the noise floor.

Note 2: Duty Cycle Correction Factor has been added to the measurements.

Note 3: 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



Radiated Emissions Template: FCC Class B @ 1m 26.5-40GHz
Filename: c:\program files (x86)\emisoft - vasona\results\R1910163 26.5-40GHz.emi

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

7.1 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.

7.2 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.

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2019-06-26	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.

7.4 Test Environmental Conditions

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

The testing was performed by Christopher Casteel on 2019-11-18 at RF site.

7.5 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	16766.3	21302
40	5200	16741.7	21318
48	5240	16759.0	21247
802.11n20 mode			
36	5180	17769.7	21291
40	5200	17790.5	21352
48	5240	17757.0	21278
802.11ac20 mode			
36	5180	17754.1	21240
40	5200	17772.7	21359
48	5240	17774.9	21224

5250 - 5350 MHz

Channel	Frequency (MHz)	99% OBW (kHz)	26 dB OBW (kHz)
802.11 a mode			
52	5260	16767.6	21288
56	5280	16782.4	21209
64	5320	16784.8	21327
802.11n20 mode			
52	5260	17823.3	21410
56	5280	17800.0	21426
64	5320	17800.5	21316
802.11ac20 mode			
52	5260	17778.6	21368
56	5280	17795.8	21233
64	5320	17788.7	21102

5470 - 5725 MHz

Channel	Frequency (MHz)	99% OBW (kHz)	26 dB OBW (kHz)
802.11 a mode			
100	5500	16794.5	21458
120	5600	16793.2	21345
140	5700	16780.8	21450
802.11n20 mode			
100	5500	17821.5	21254
120	5600	17774.4	21454
140	5700	17770.4	21457
802.11ac20 mode			
100	5500	17792.1	21312
120	5600	17807.2	21521
140	5700	17798.1	21160

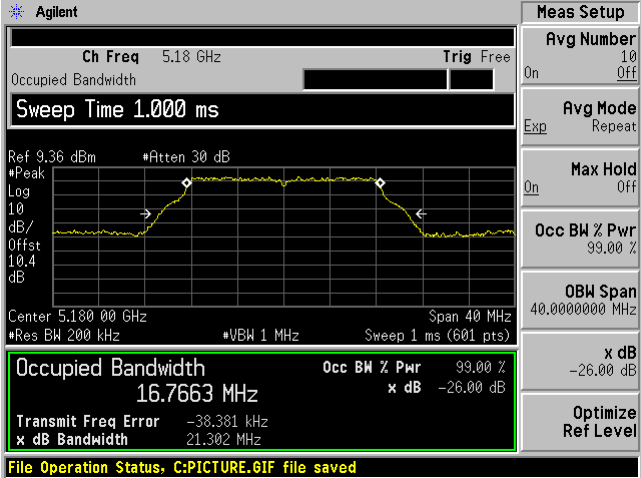
5725 - 5850 MHz

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	16790.3	16425	500	21381
157	5785	16804.6	16417	500	21369
165	5825	16786.7	16437	500	21336
802.11n20 mode					
149	5745	17821.4	17780	500	21472
157	5785	17817.5	17768	500	21418
165	5825	17814.9	17771	500	21422
802.11ac20 mode					
149	5745	17784.2	17756	500	21355
157	5785	17785.2	17759	500	21281
165	5825	17792.6	17764	500	21314

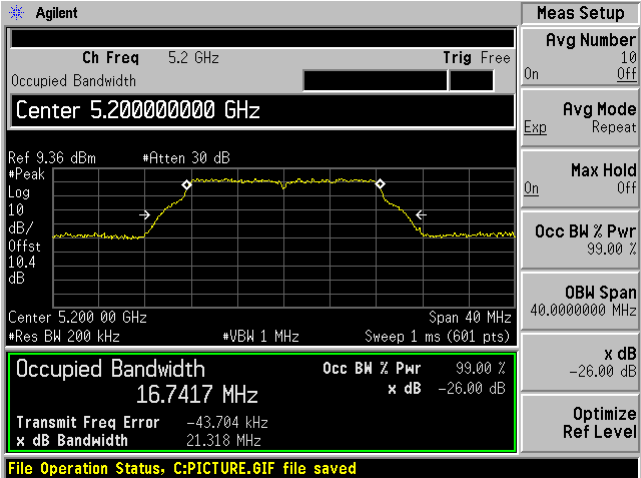
5150 – 5250 MHz

802.11a mode

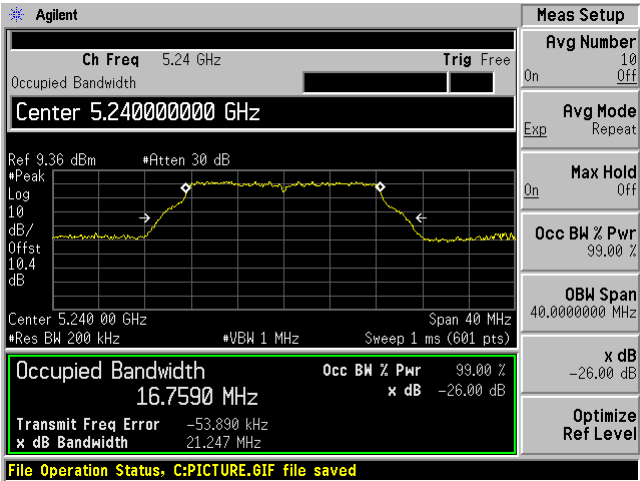
5180 MHz



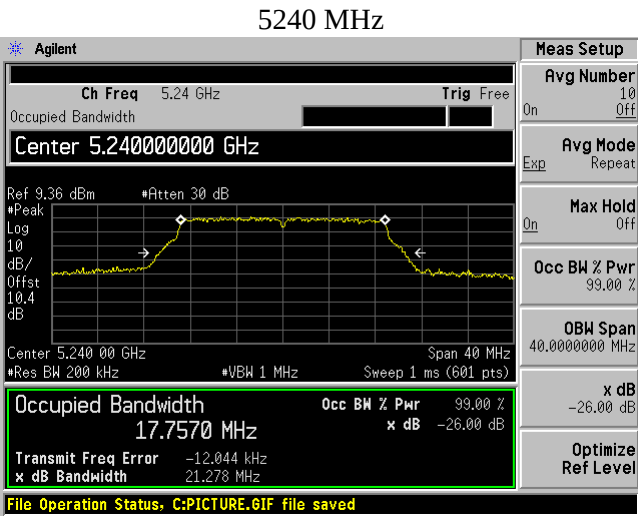
5200 MHz



5240 MHz

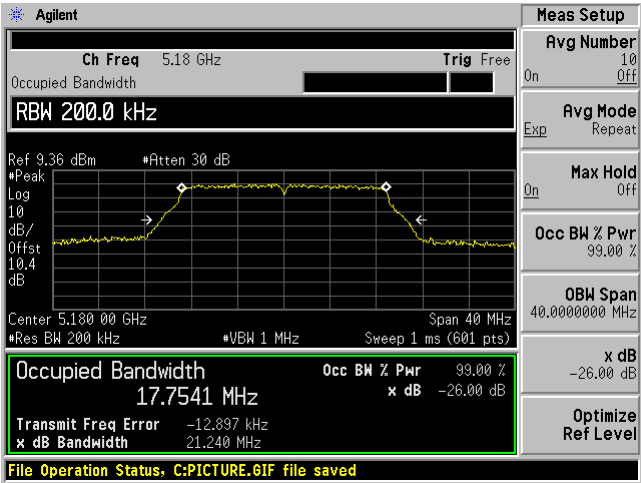


802.11n20 mode

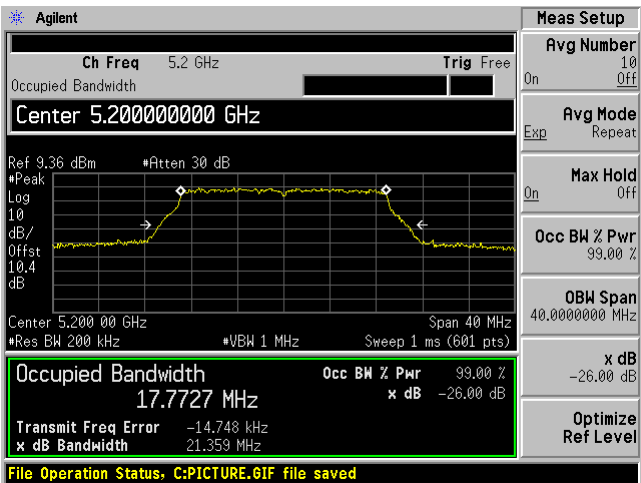


802.11ac20 mode

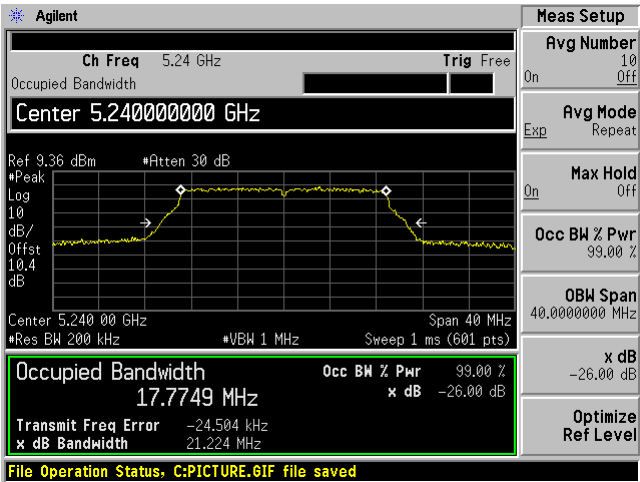
5180 MHz



5200 MHz



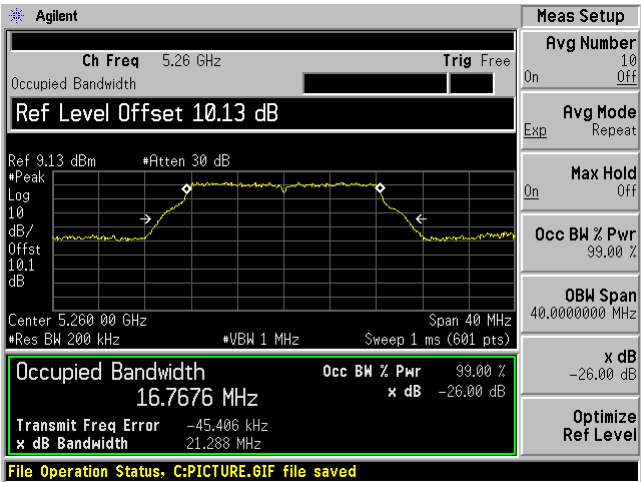
5240 MHz



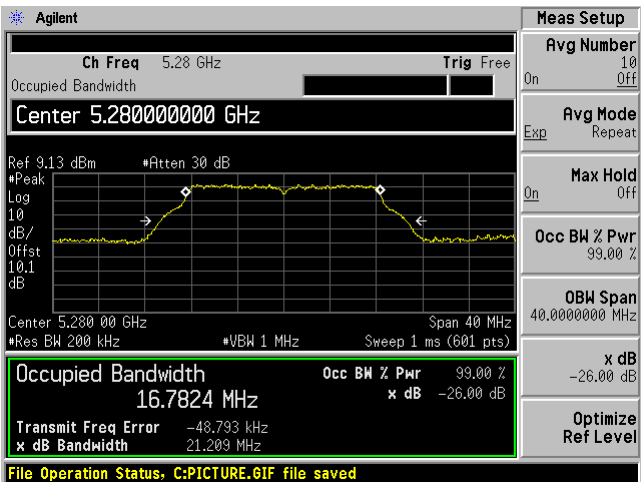
5250 – 5350 MHz

802.11a mode

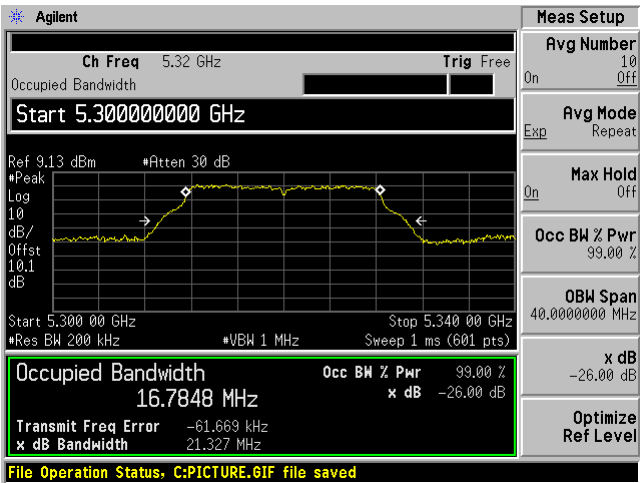
5260 MHz



5280 MHz

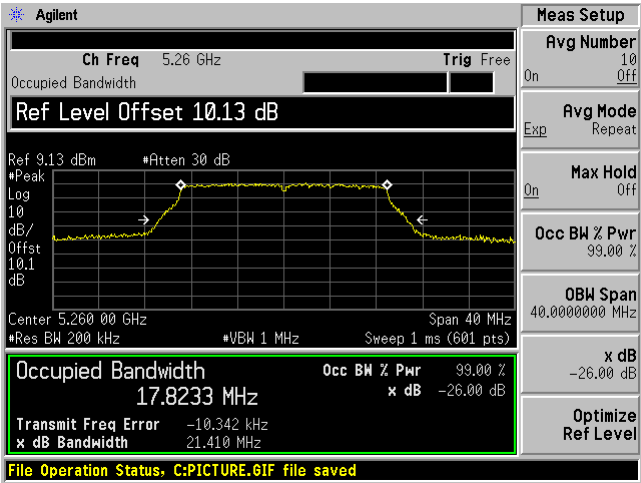


5320 MHz

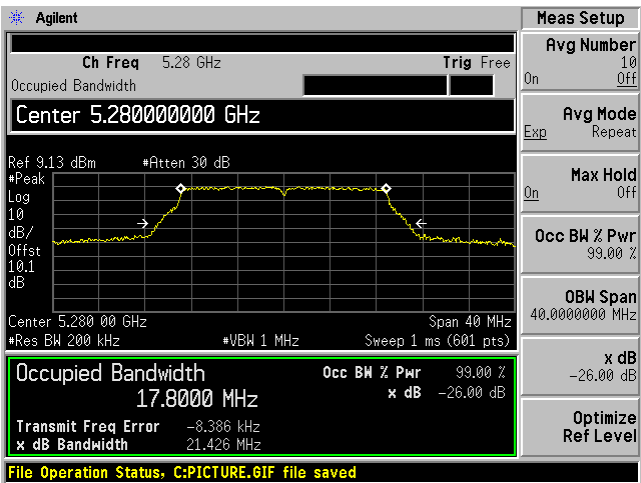


802.11n20 mode

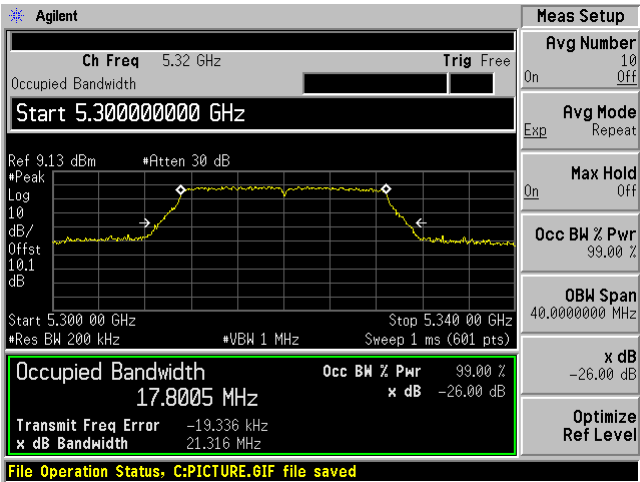
5260 MHz



5280 MHz



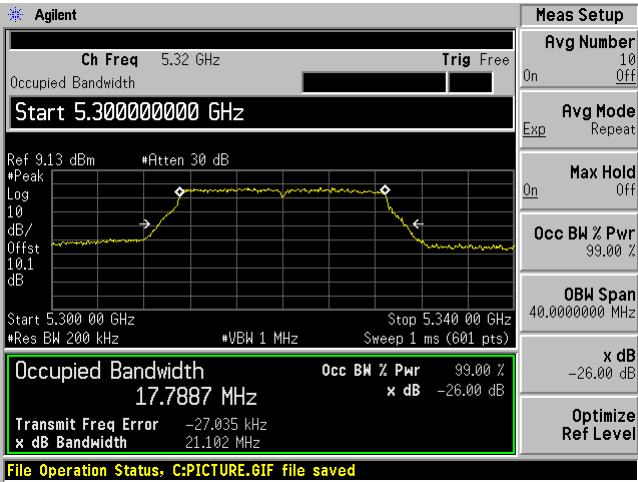
5320 MHz



802.11ac20 mode



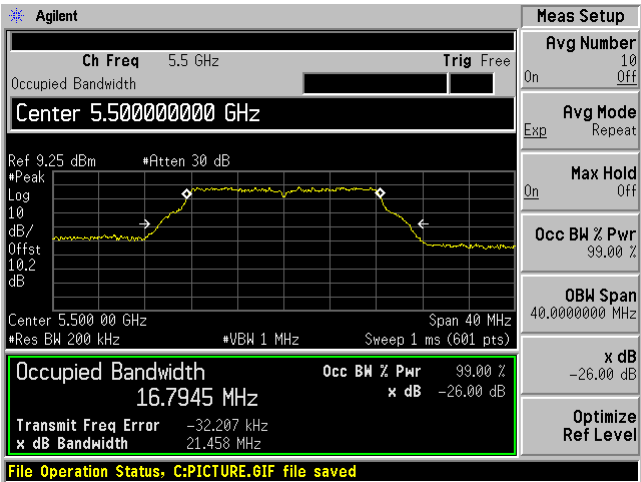
5320 MHz



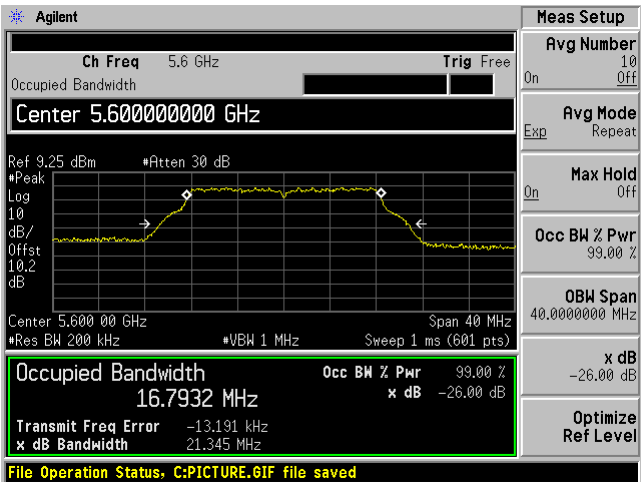
5470 – 5725 MHz

802.11a mode

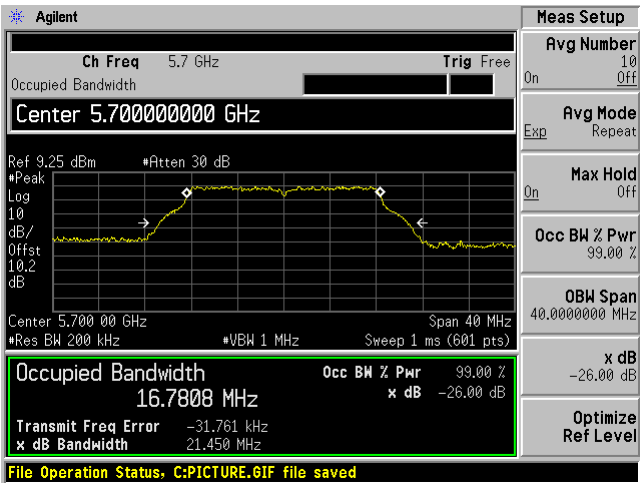
5500 MHz



5600 MHz

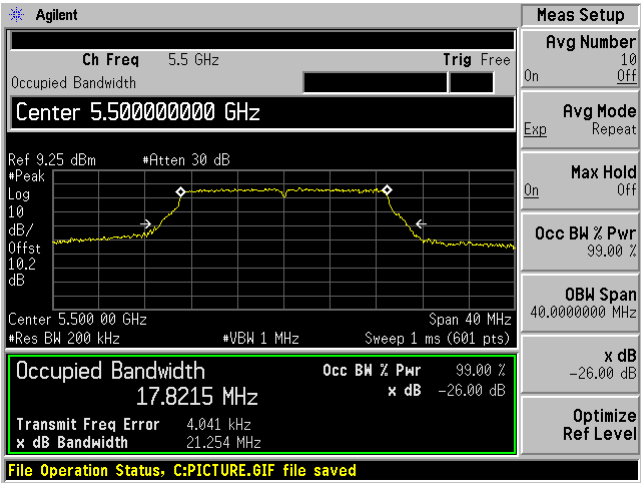


5700 MHz

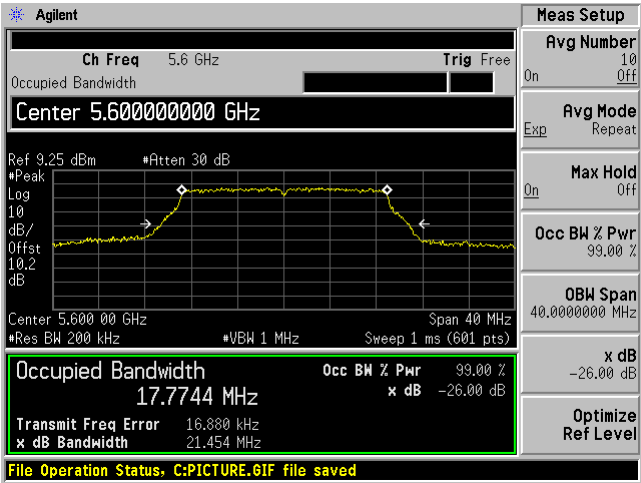


802.11n20 mode

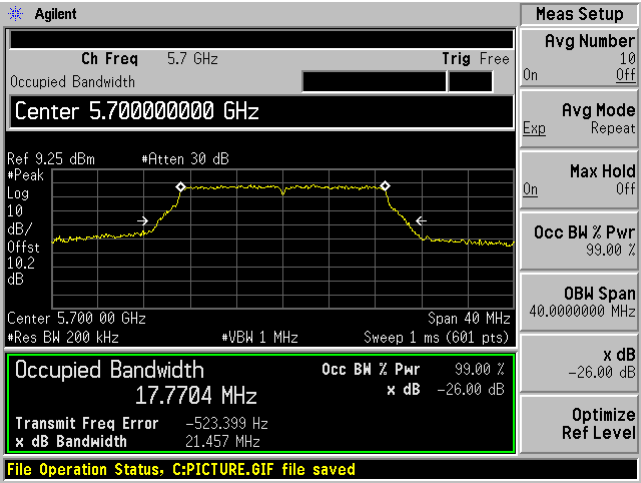
5500 MHz



5600 MHz

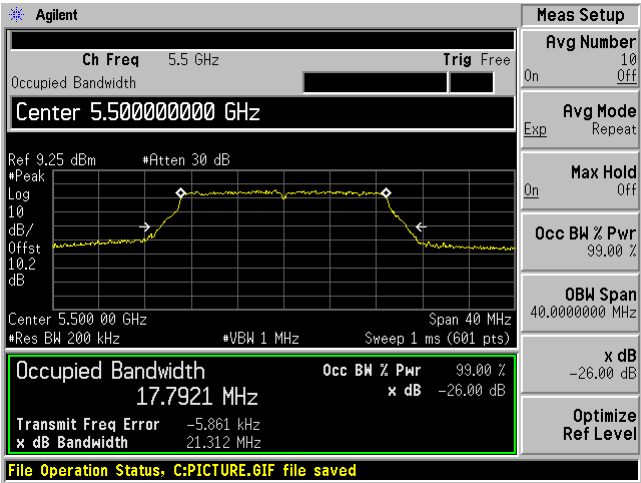


5700 MHz

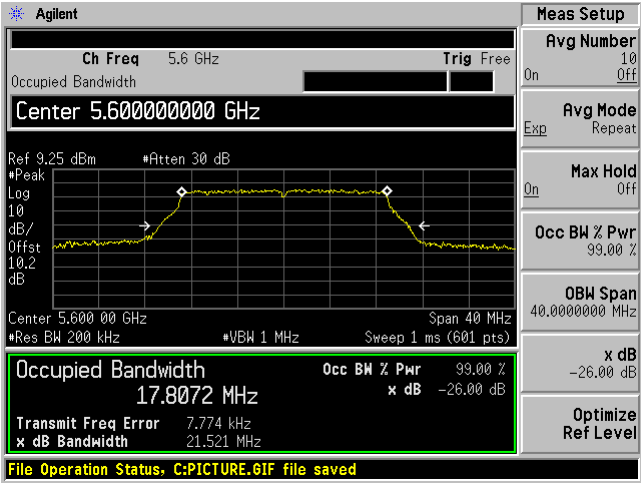


802.11ac20 mode

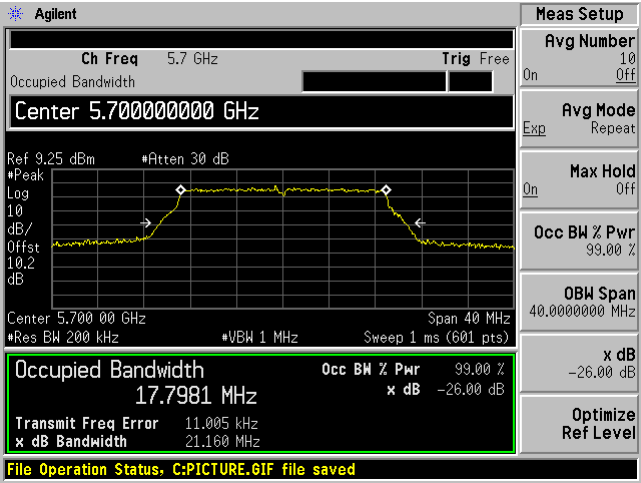
5500 MHz



5600 MHz



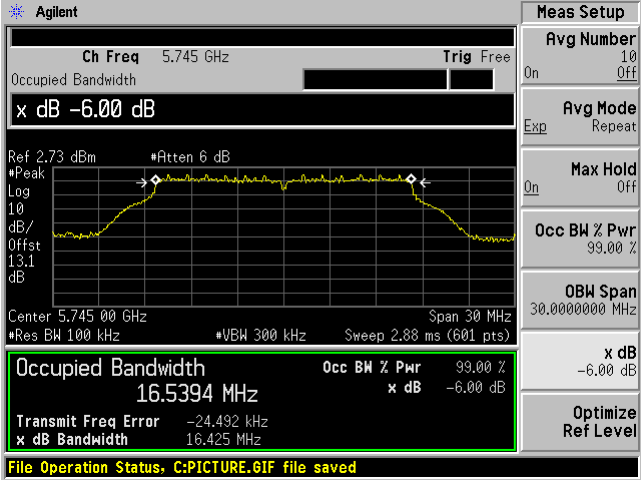
5700 MHz



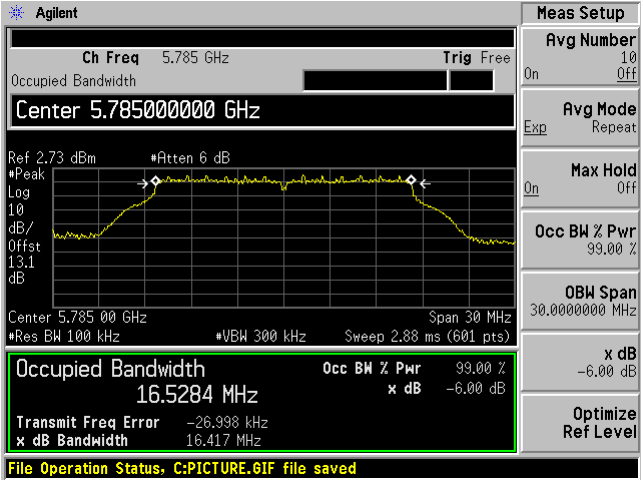
5725 – 5850 MHz

6dB bandwidth
802.11a mode

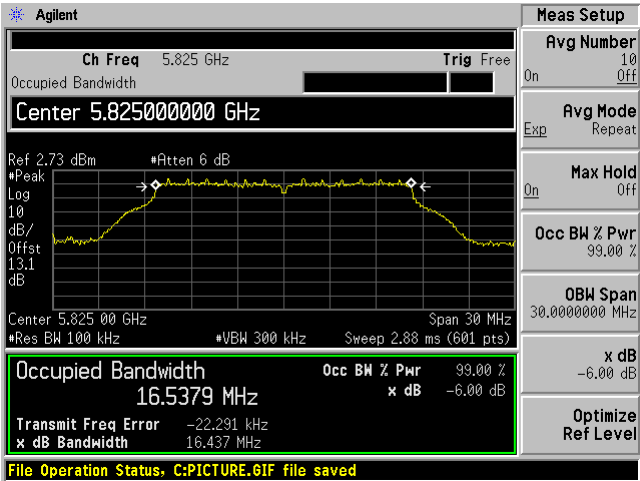
5745 MHz



5785 MHz

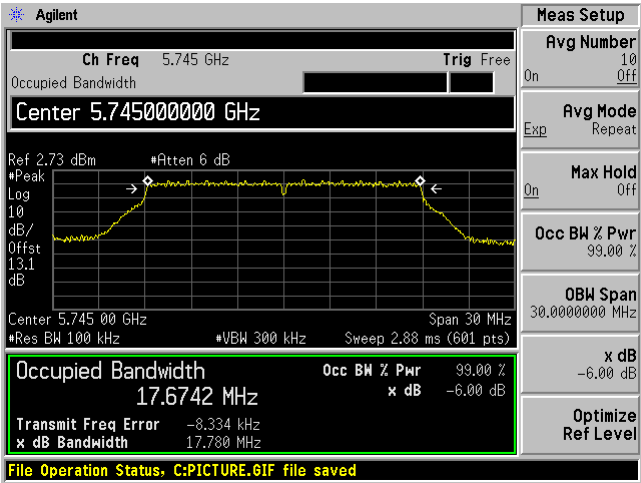


5825 MHz

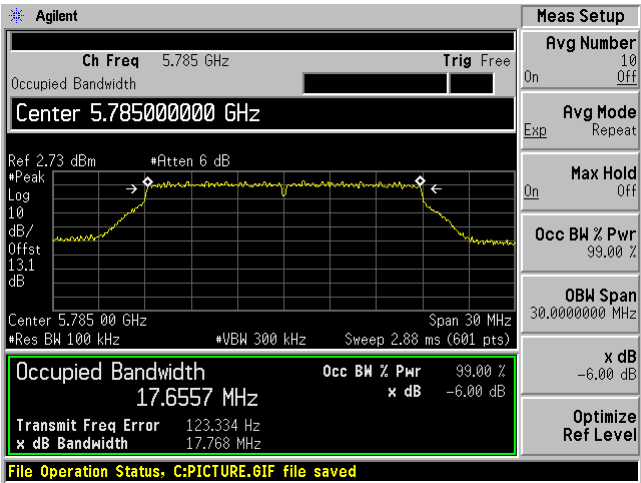


802.11n20 mode

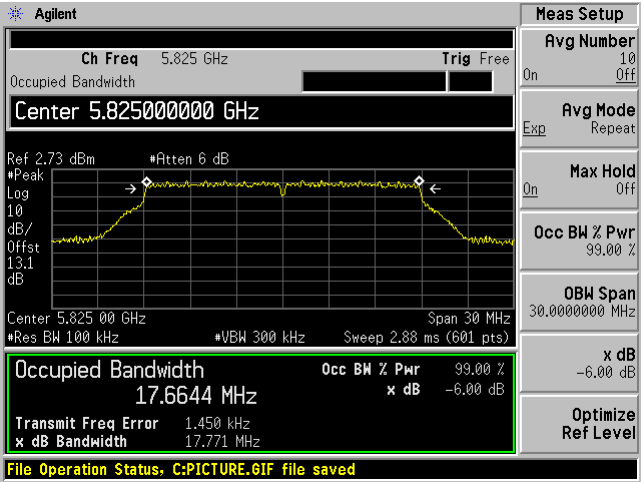
5745 MHz



5785 MHz

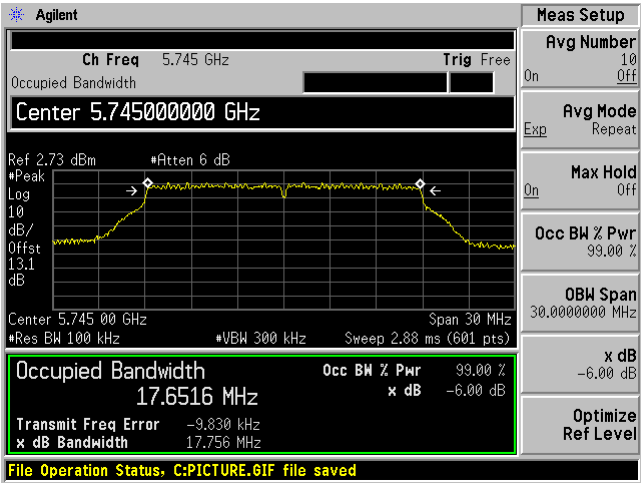


5825 MHz

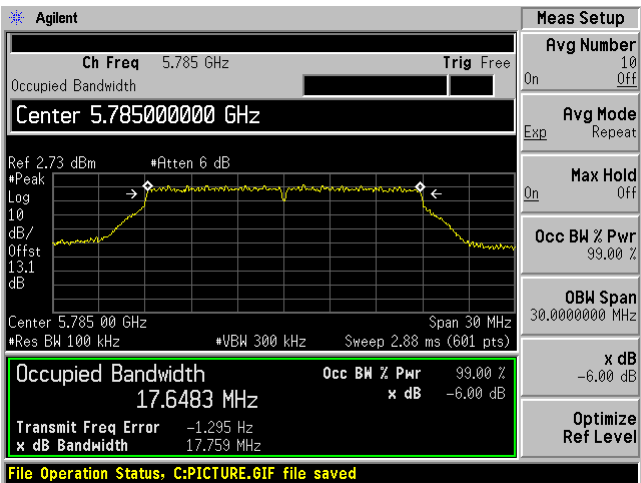


802.11ac20 mode

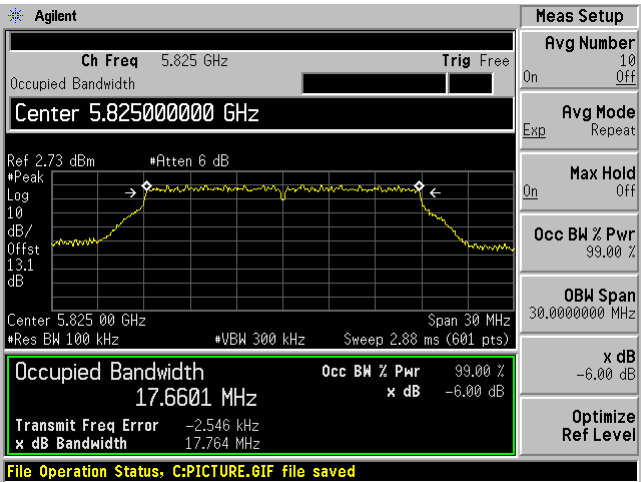
5745 MHz



5785 MHz

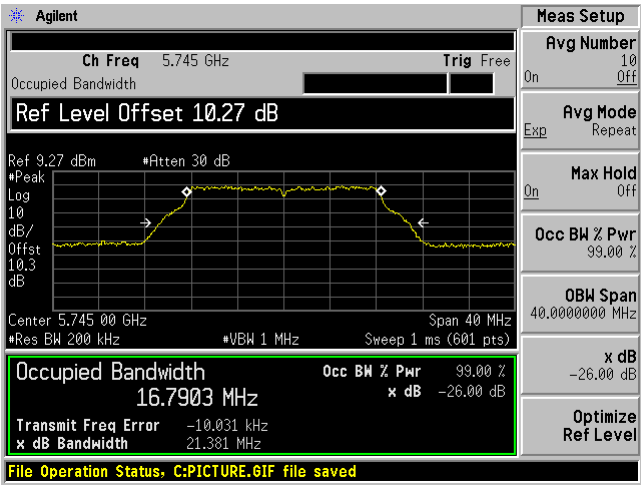


5825 MHz

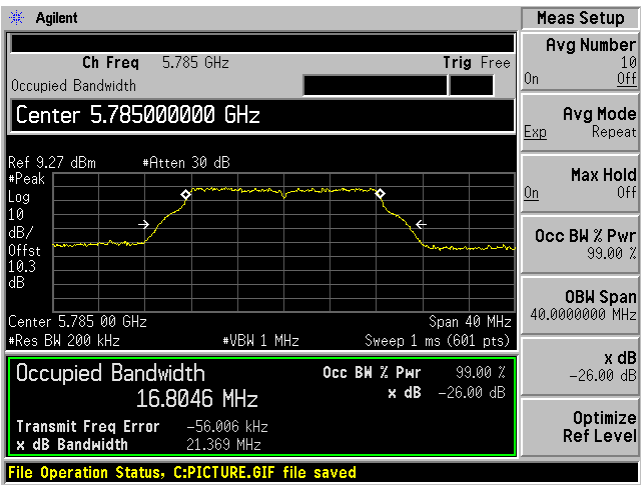


-26dB & 99%
802.11a mode

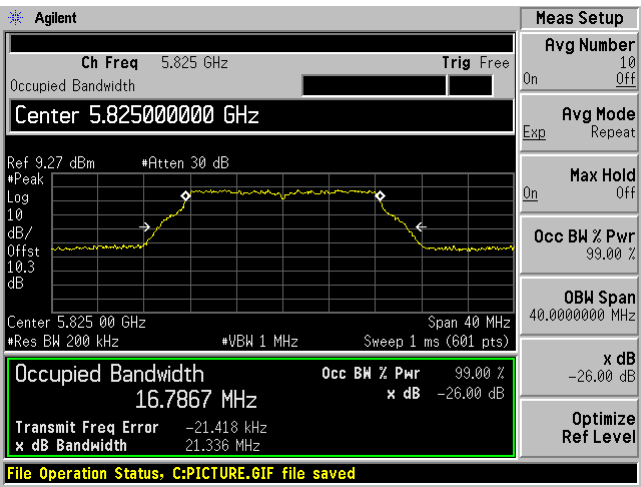
5745 MHz



5785 MHz

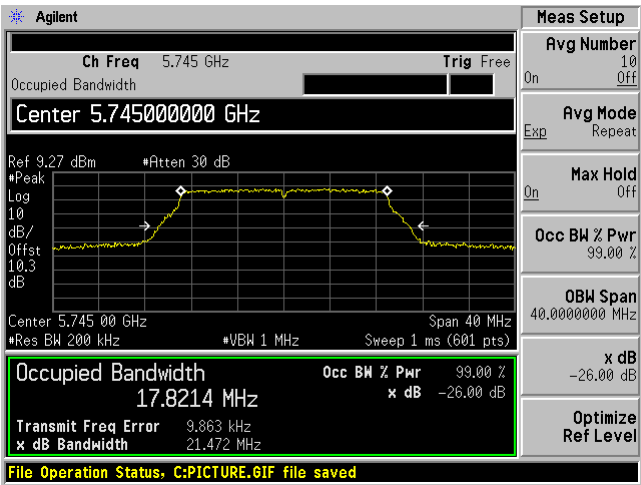


5825 MHz

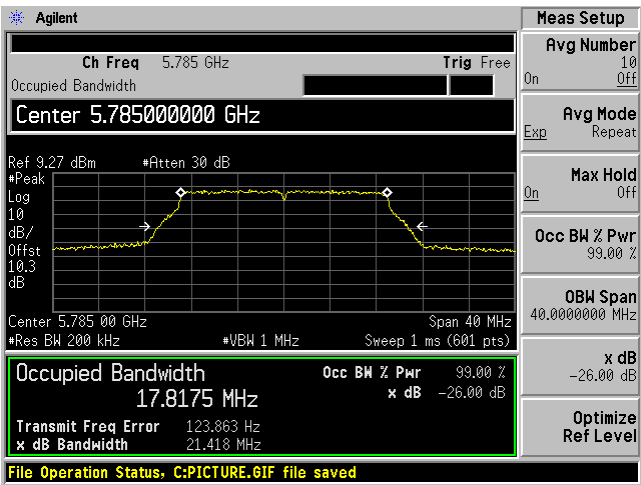


802.11n20 mode

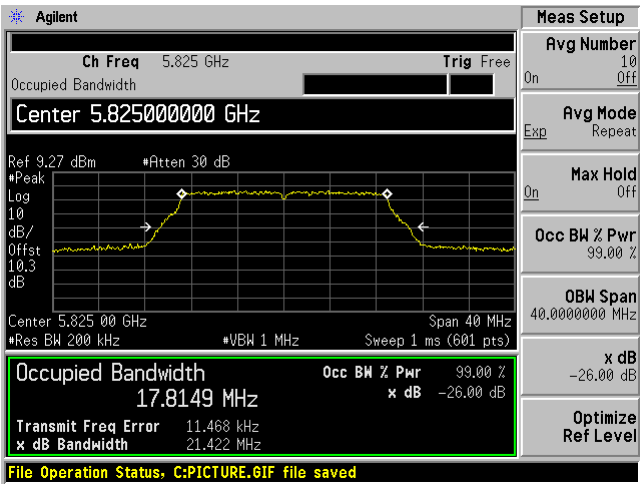
5745 MHz



5785 MHz

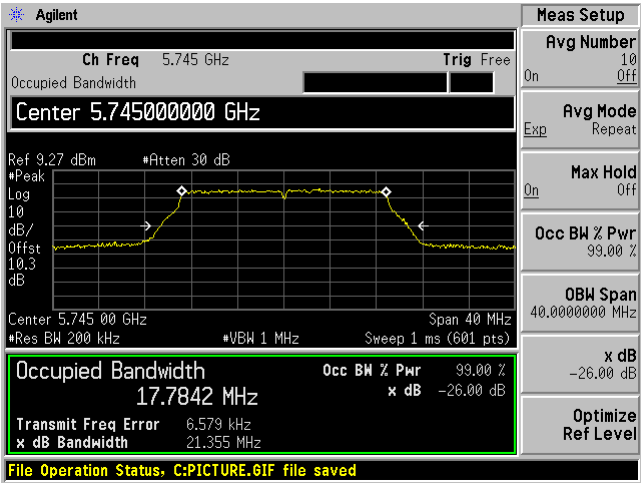


5825 MHz

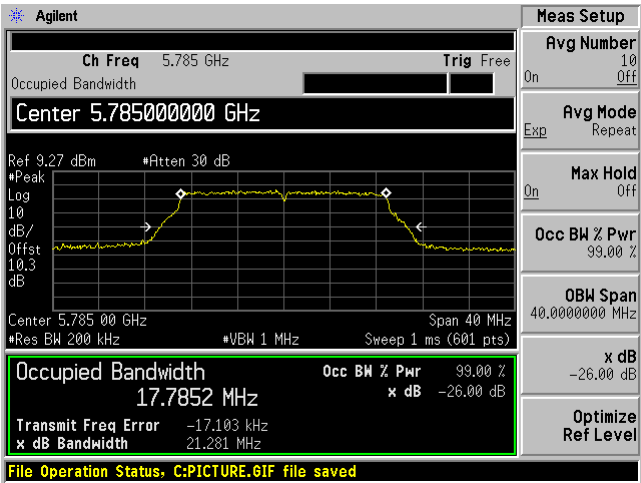


802.11ac20 mode

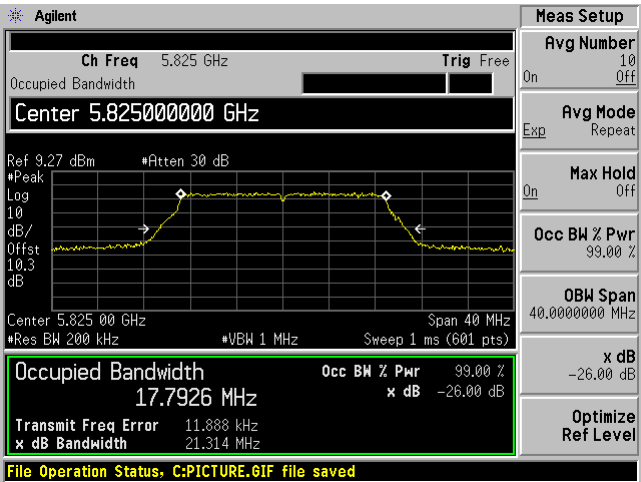
5745 MHz



5785 MHz



5825 MHz



8 FCC §407(a) & ISEDC RSS-247 §6.2 - Output Power

8.1 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 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.

8.2 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.

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
-	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.

8.4 Test Environmental Conditions

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

The testing was performed by Christopher Casteel on 2019-11-06 in RF site.

8.5 Test Results

5150 - 5250 MHz

Frequency (MHz)	Conducted Average Power (dBm)	FCC Limit (dBm)
802.11a mode		
5180	11.3	24
5200	11.63	24
5240	10.9	24
802.11n20 mode		
5180	11.36	24
5200	11.91	24
5240	11.11	24
802.11ac20 mode		
5180	9.58	24
5200	9.74	24
5240	8.77	24

Note: W5.2 is not allowed for outdoor use in Canada

5250 - 5350 MHz

Frequency (MHz)	Conducted Average Power (dBm)	EIRP (dBm)	FCC Output Power Limit (dBm)	ISED Output Power Limit (dBm)	ISED EIRP Limit (dBm)
802.11a mode					
5260	10.82	12.02	24	23.24	29.23
5280	10.58	11.78	24	23.24	29.23
5320	9.95	11.15	24	23.24	29.23
802.11n20 mode					
5260	10.79	11.99	24	23.24	29.23
5280	10.52	11.72	24	23.24	29.23
5320	9.94	11.14	24	23.24	29.23
802.11ac20 mode					
5260	8.63	9.83	24	23.24	29.23
5280	8.27	9.47	24	23.24	29.23
5320	7.84	9.04	24	23.24	29.23

5470 - 5725 MHz

Frequency (MHz)	Conducted Average Power (dBm)	EIRP (dBm)	FCC Output Power Limit (dBm)	ISED Output Power Limit (dBm)	ISED EIRP Limit (dBm)
802.11a mode					
5500	7.41	8.61	24	23.24	29.23
5600	7.97	9.17	24	23.24	29.23
5700	9.28	10.48	24	23.24	29.23
802.11n20 mode					
5500	7.63	8.83	24	23.24	29.23
5600	7.91	9.11	24	23.24	29.23
5700	9.23	10.43	24	23.24	29.23
802.11ac20 mode					
5500	5.77	6.97	24	23.24	29.23
5600	6.39	7.59	24	23.24	29.23
5700	7.24	8.44	24	23.24	29.23

5725 - 5850 MHz

Frequency (MHz)	Conducted Average Power (dBm)	FCC/ ISED Limit (dBm)
802.11a mode		
5745	8.55	30
5785	7.95	30
5825	6.84	30
802.11n20 mode		
5745	8.38	30
5785	7.85	30
5825	6.86	30
802.11ac20 mode		
5745	6.61	30
5785	6.2	30
5825	5.17	30

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

9 FCC §15.407(a) & ISEDC RSS-247 §6.2 - Power Spectral Density

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 $10 + 10 \log_{10} B$, 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 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

- (i) Set span to encompass the entire emission bandwidth (EBW) of the signal.
- (ii) Set RBW = 1 MHz.
- (iii) Set VBW ≥ 3 MHz.
- (iv) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is $\leq$ 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 ≥ 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.

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2019-06-26	1 year
Rohde & Schwarz	Signal Analyzer	FSV40	1321.3008K3 9-101203- UW	2019-08-05	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.

9.4 Test Environmental Conditions

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

The testing was performed by Christopher Casteel on 2019-11-18 at RF site.

9.5 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	5.78	5.94	11
5200	5.51	5.67	11
5240	4.67	4.83	11
802.11n20 mode			
5180	5.04	6.21	11
5200	4.59	5.76	11
5240	4.34	5.51	11
802.11ac20 mode			
5180	3.47	4.714	11
5200	2.95	4.194	11
5240	1.39	2.634	11

Note: W5.2 is not allowed for outdoor use in Canada

5250 – 5350 MHz

Frequency (MHz)	Measured PSD (dBm/MHz)	Corrected PSD (dBm/MHz)	FCC/ ISSED Limit (dBm/MHz)
802.11a mode			
5260	4.34	4.5	11
5280	4.29	4.45	11
5320	3.34	3.5	11
802.11n20 mode			
5260	4.06	5.23	11
5280	3.75	4.92	11
5320	2.57	3.74	11
802.11ac20 mode			
5260	1.76	3.004	11
5280	1.87	3.114	11
5320	0.85	2.094	11

5470 – 5725 MHz

Frequency (MHz)	Measured PSD (dBm/MHz)	Corrected PSD (dBm/MHz)	FCC/ ISSED Limit (dBm/MHz)
802.11a mode			
5500	0.97	1.13	11
5600	1.2	1.36	11
5700	2.42	2.58	11
802.11n20 mode			
5500	0.75	1.92	11
5600	0.72	1.89	11
5700	1.35	2.52	11
802.11ac20 mode			
5500	-1.34	-1.34	11
5600	-0.6	-0.6	11
5700	0.38	0.38	11

5725 - 5850 MHz

Frequency (MHz)	Measured PSD (dBm/500 kHz)	Corrected PSD (dBm/500 kHz)	FCC/ ISED Limit (dBm/500 kHz)
802.11a mode			
5745	0.68	0.84	30
5785	0.55	0.71	30
5825	-0.30	-0.14	30
802.11n20 mode			
5745	0	1.17	30
5785	-0.28	0.89	30
5825	-0.89	0.28	30
802.11ac20 mode			
5745	-1.6	-0.356	30
5785	-1.37	-0.126	30
5825	-2.15	-0.906	30

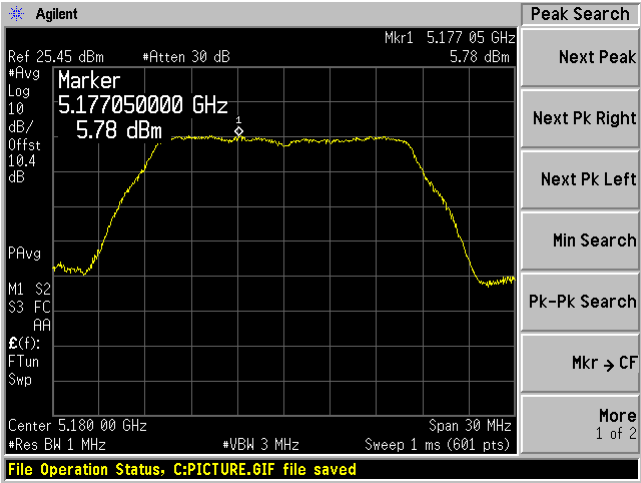
Corrected PSD (dBm/MHz) = PSD (dBm/MHz) + Duty Cycle Correction (dB)

Please refer to the following plots.

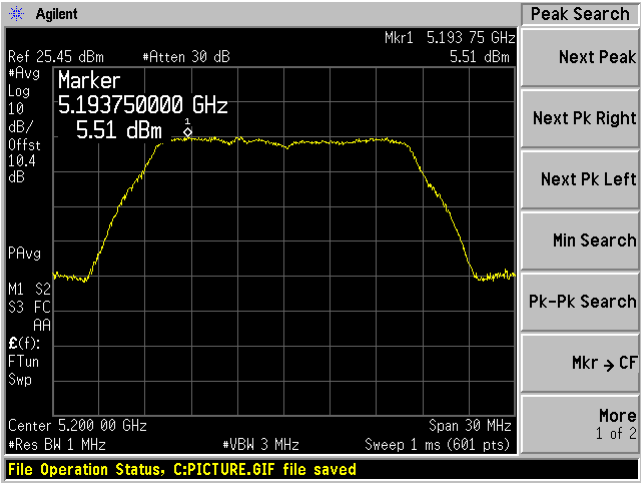
5150 – 5250 MHz

802.11a mode

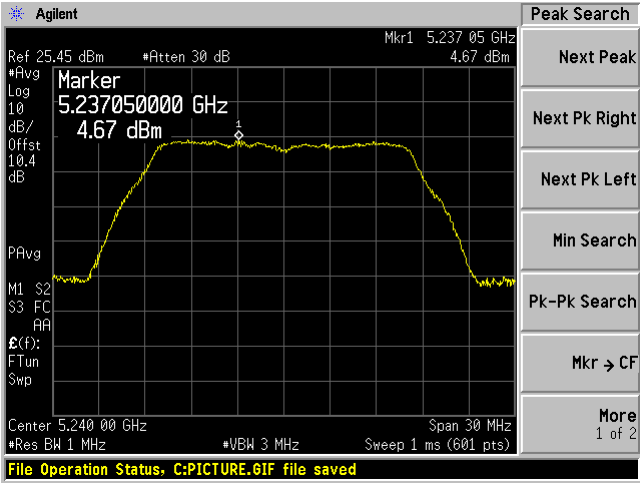
5180 MHz



5200 MHz

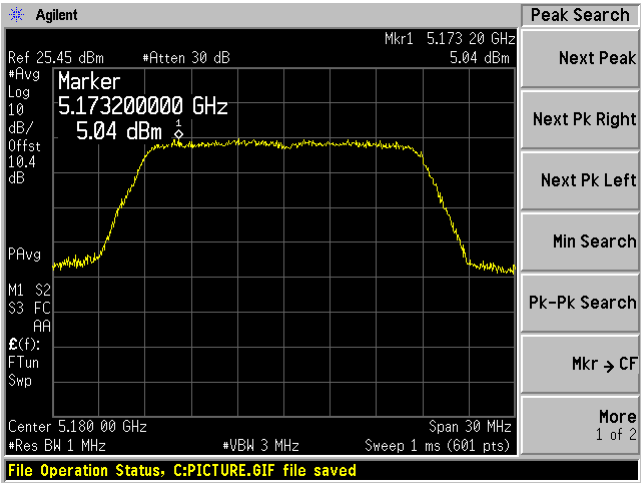


5240 MHz

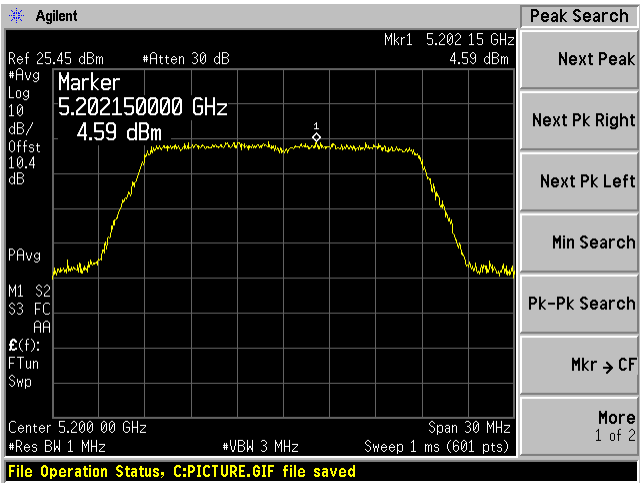


802.11n20 mode

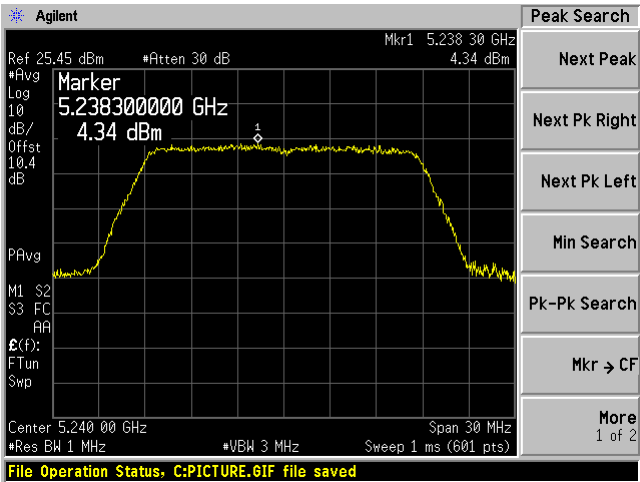
5180 MHz



5200 MHz

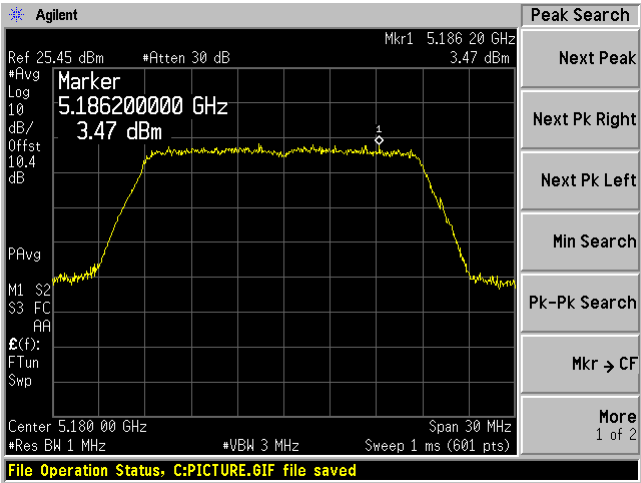


5240 MHz

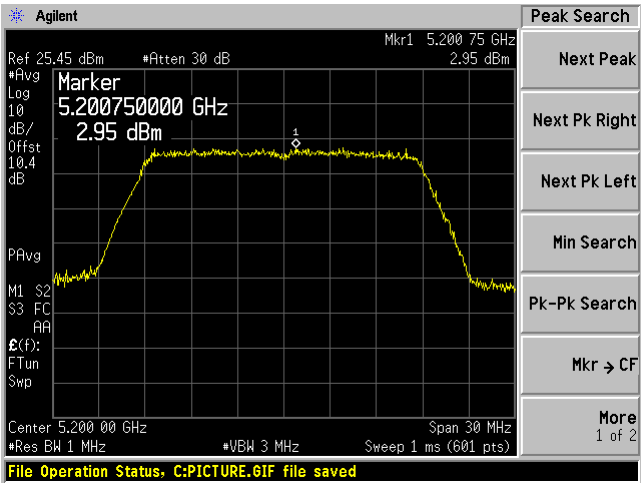


802.11ac20 mode

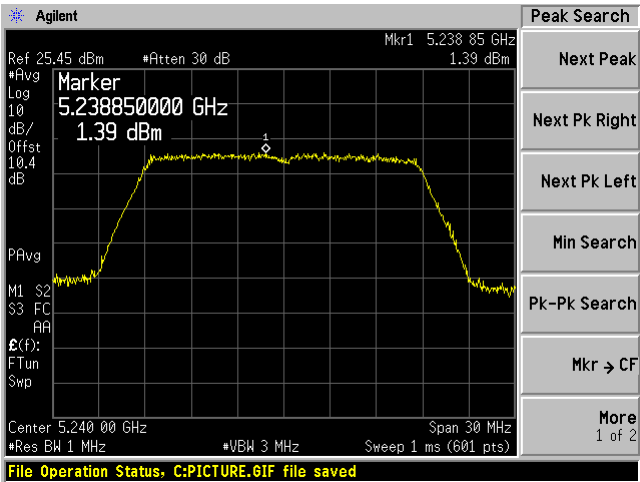
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5200 MHz



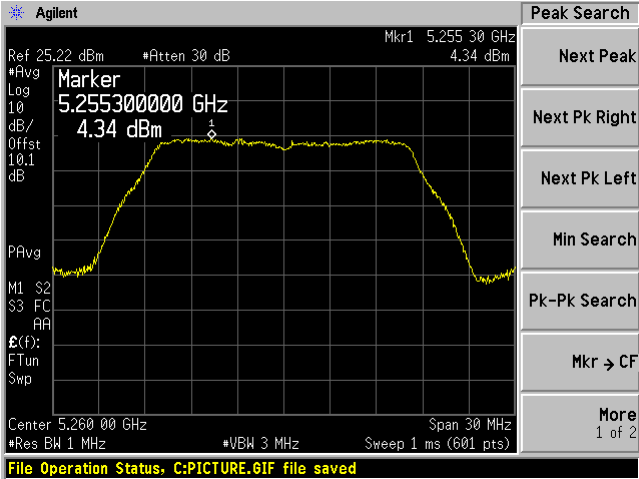
5240 MHz



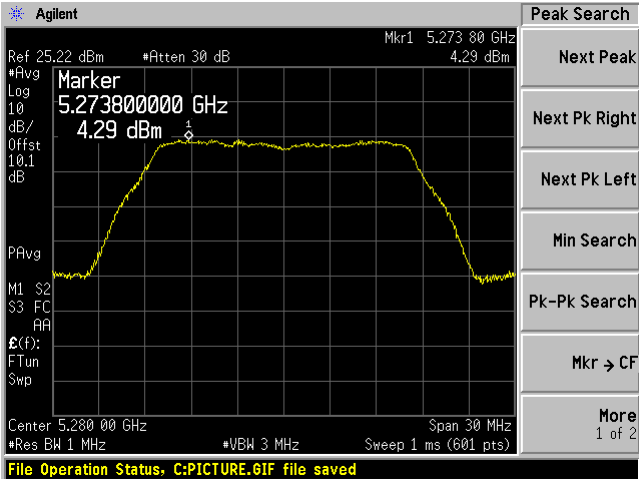
5250 – 5350 MHz

802.11a mode

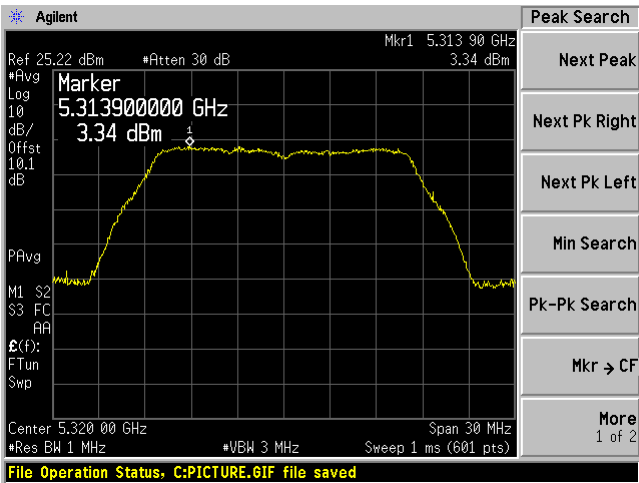
5260 MHz



5280 MHz

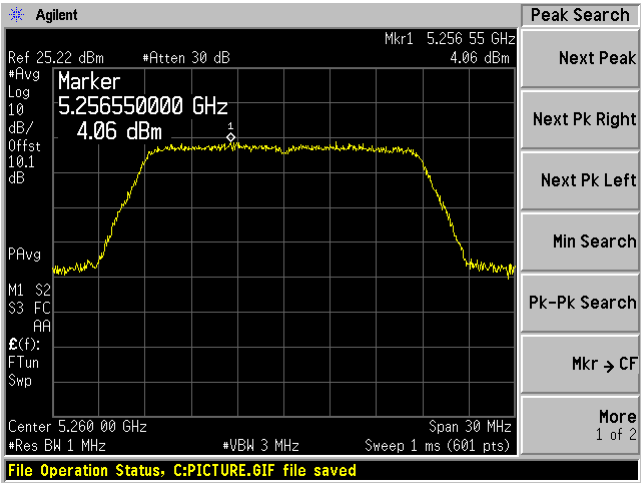


5320 MHz

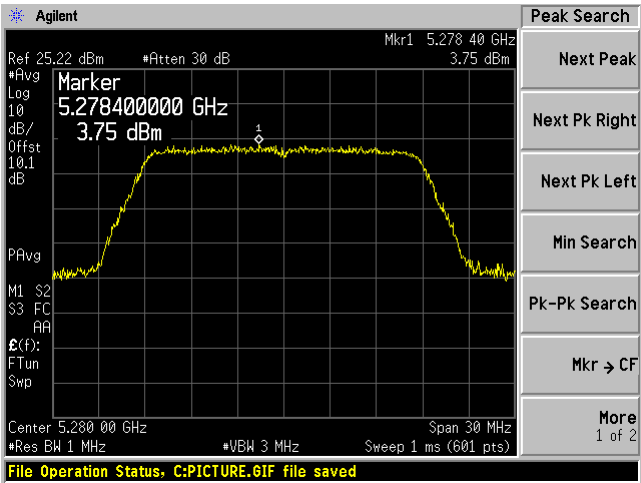


802.11n20 mode

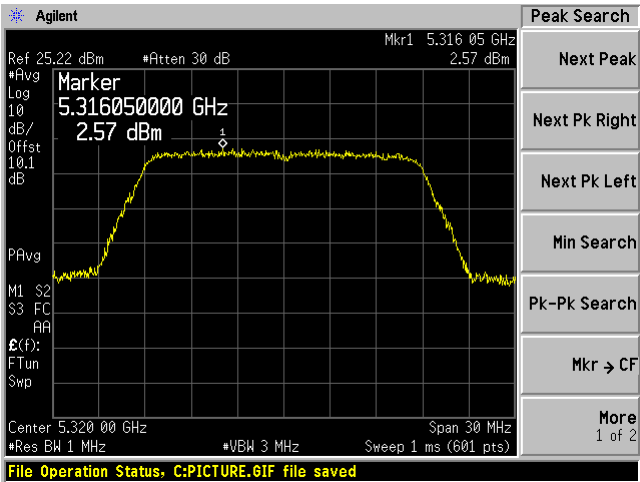
5260 MHz



5280 MHz

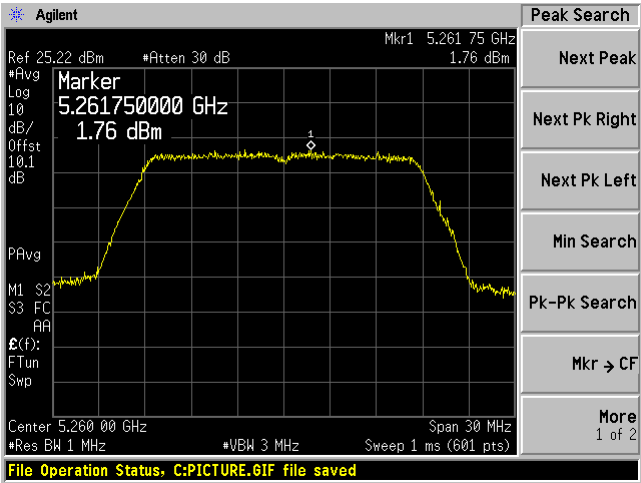


5320 MHz

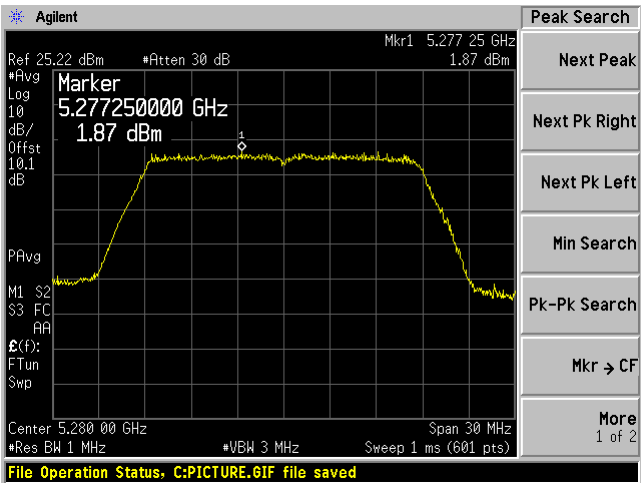


802.11ac20 mode

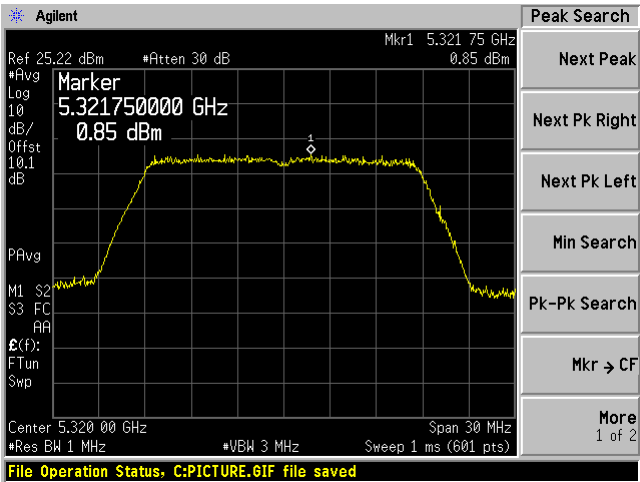
5260 MHz



5280 MHz



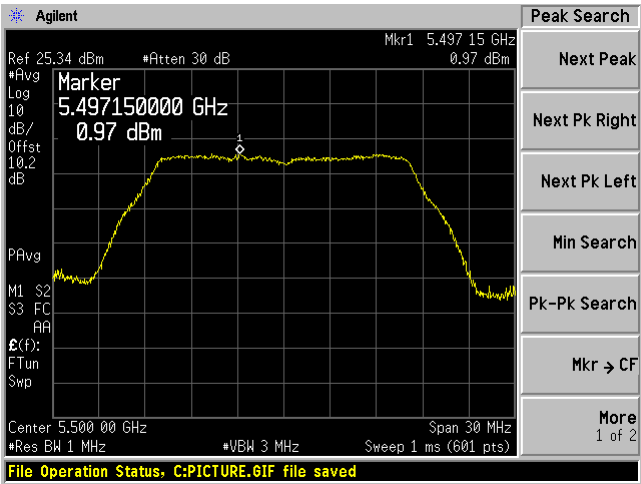
5320 MHz



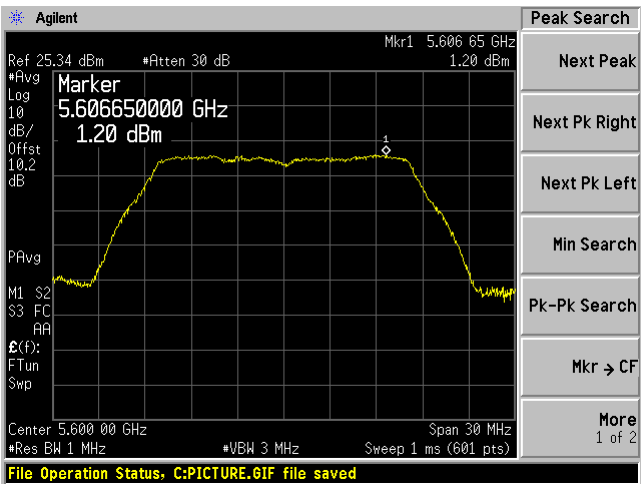
5470 – 5725 MHz

802.11a mode

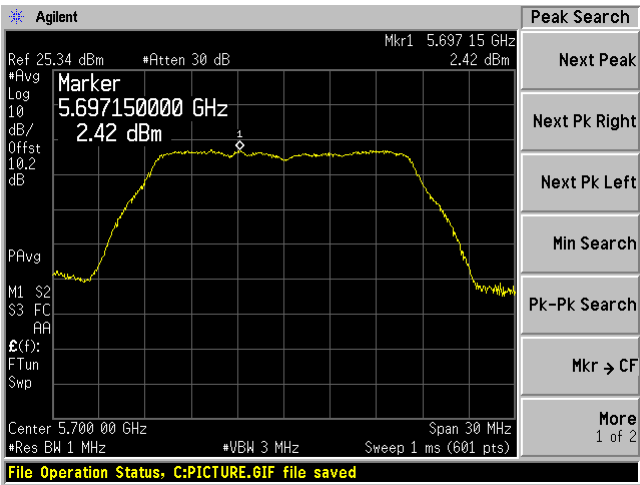
5500 MHz



5600 MHz

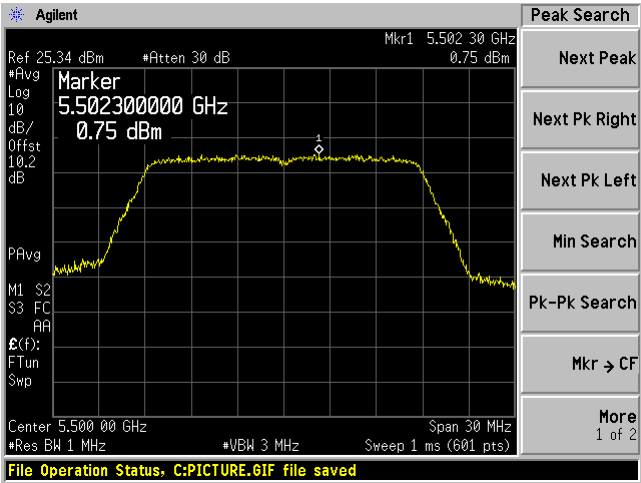


5700 MHz

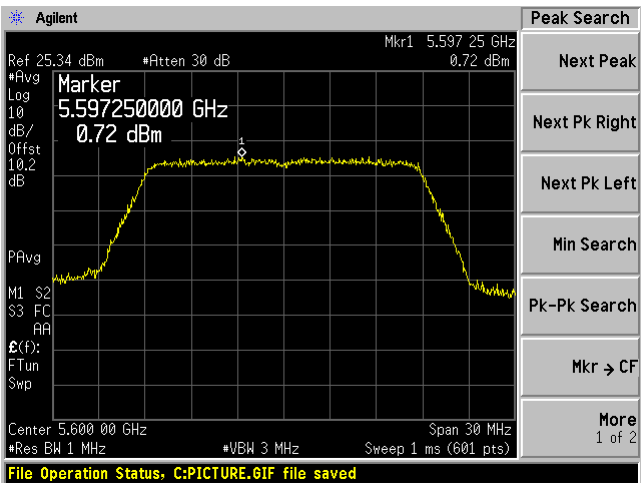


802.11n20 mode

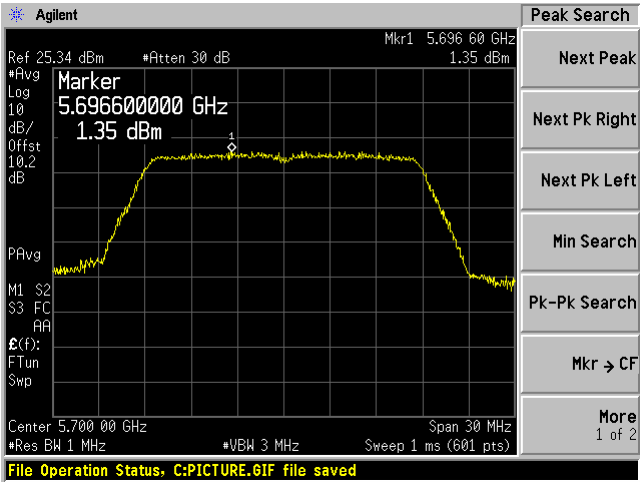
5500 MHz



5600 MHz

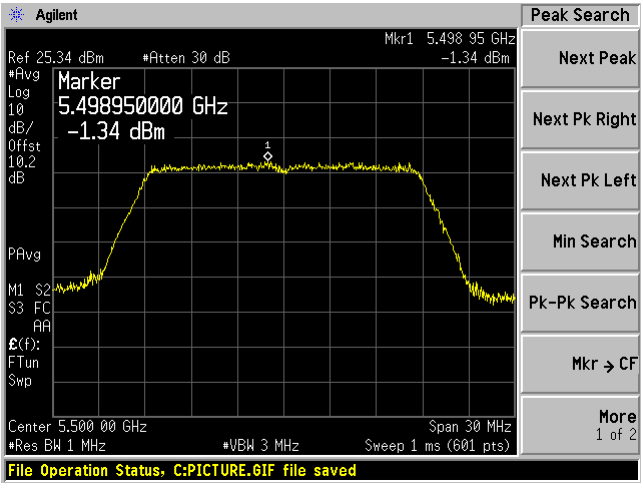


5700 MHz

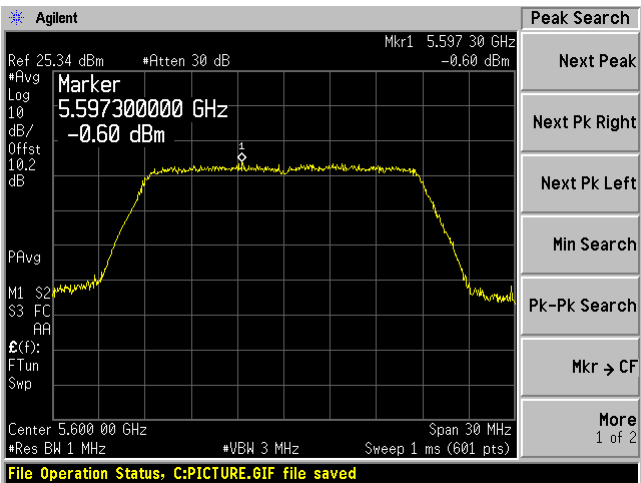


802.11ac20 mode

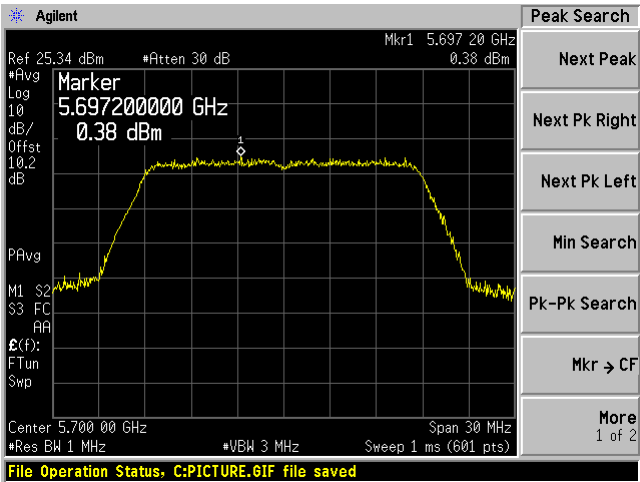
5500 MHz



5600 MHz



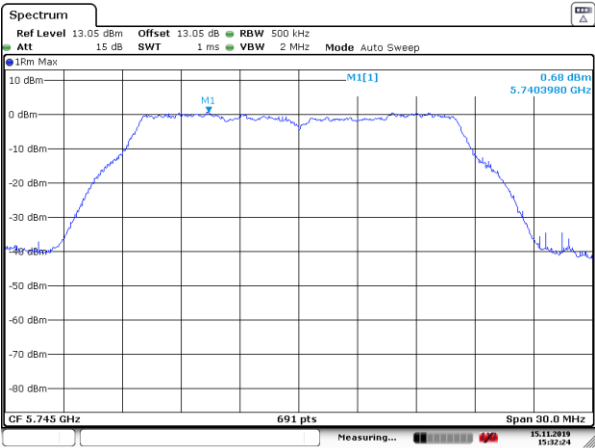
5700 MHz



5725 – 5850 MHz

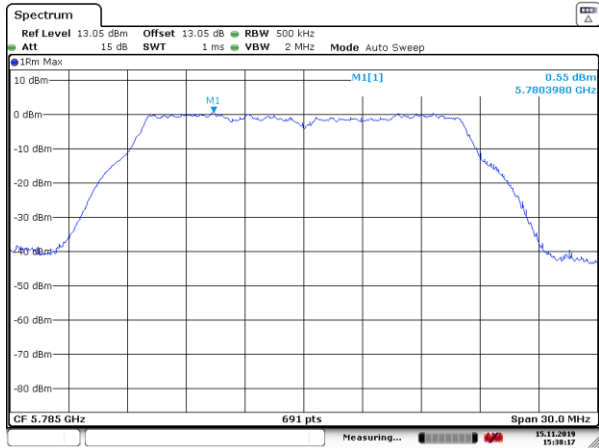
802.11a mode

5745 MHz



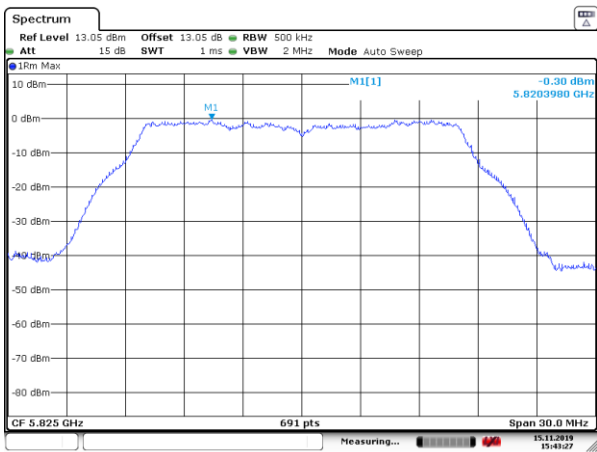
Date: 15 NOV 2019 15:32:24

5785 MHz



Date: 15 NOV 2019 15:38:17

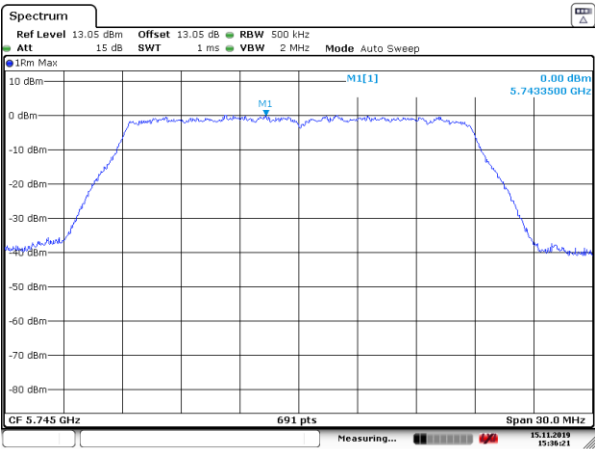
5825 MHz



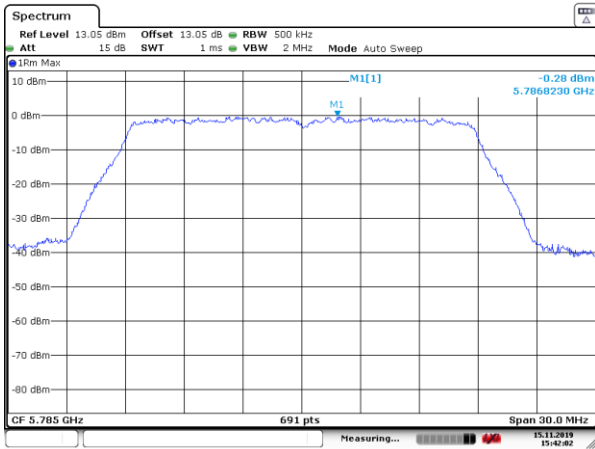
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802.11n20 mode

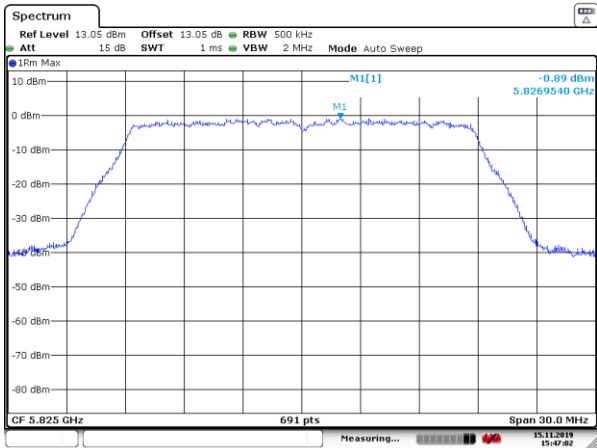
5745 MHz



5785 MHz

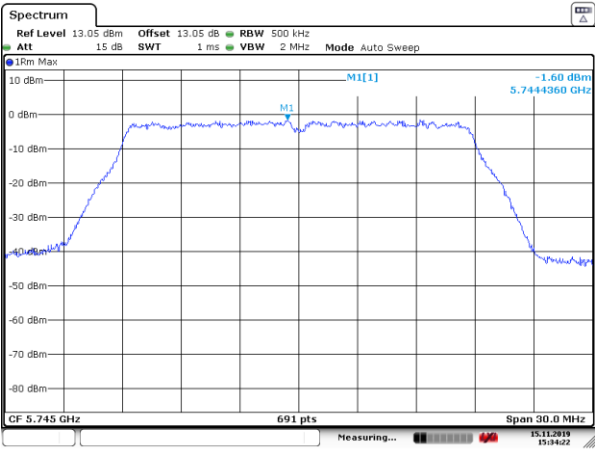


5825 MHz

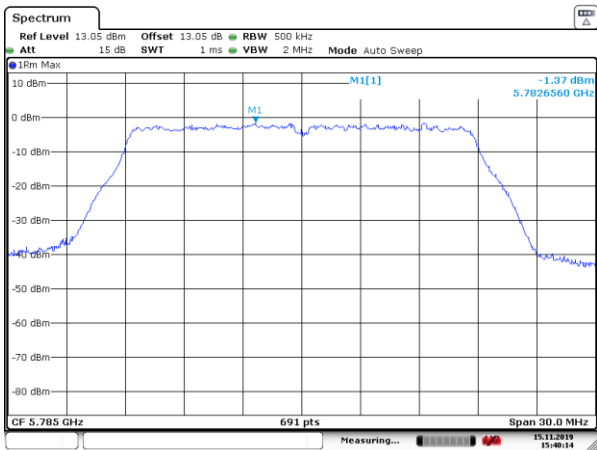


802.11ac20 mode

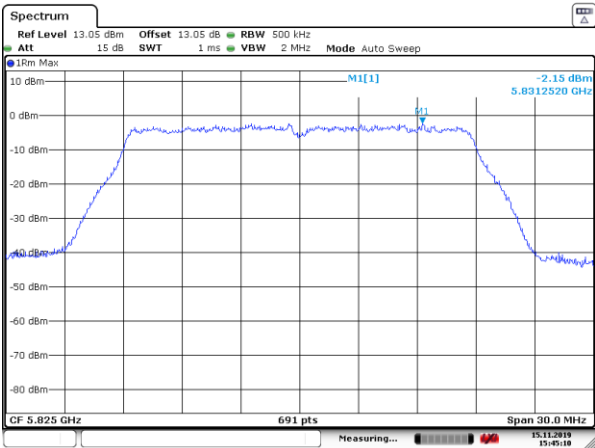
5745 MHz



5785 MHz



5825 MHz



10 FCC §15.407(b) & ISEDC RSS-247 §6.2 - Out of Band Emissions

10.1 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.

10.2 Measurement Procedure

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

Integration Method

1. For peak emissions measurements, follow the procedures described in section H)5), “Procedures for Peak Unwanted Emissions Measurements above 1000 MHz”, except for the following changes:
 - Set RBW = 100 kHz
 - Set VBW = 3RBW
 - Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured. CAUTION: You must ensure that the spectrum analyzer or EMI receiver is set for peak-detection and max-hold for this measurement.
2. For average emissions measurements, follow the procedures described in section H)6), “Procedures for Average Unwanted Emissions Measurements above 1000 MHz”, except for the following changes:
 - Set RBW = 100 kHz
 - Set VBW = 3RBW
 - Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured.

10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2019-06-26	1 year
Rohde & Schwarz	Signal Analyzer	FSV40	1321.3008K3 9-101203- UW	2019-08-05	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 Christopher Casteel 2019-11-18 at RF site.

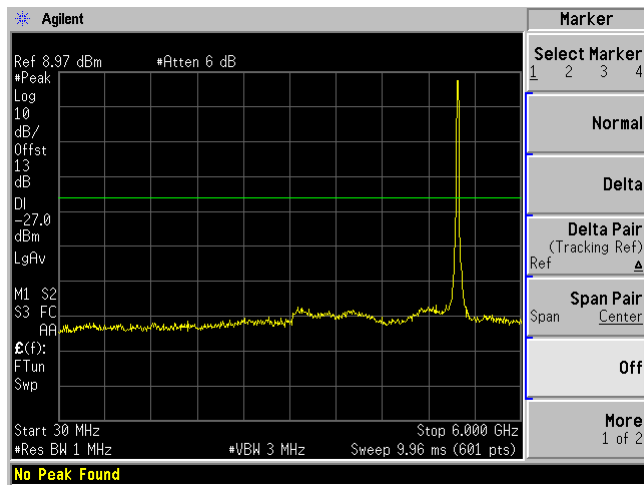
10.5 Test Results

Please refer to the following plots

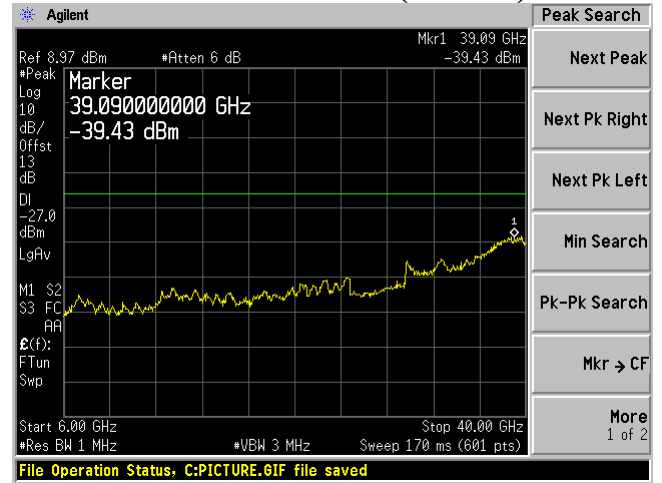
5150 - 5250 MHz

802.11a mode

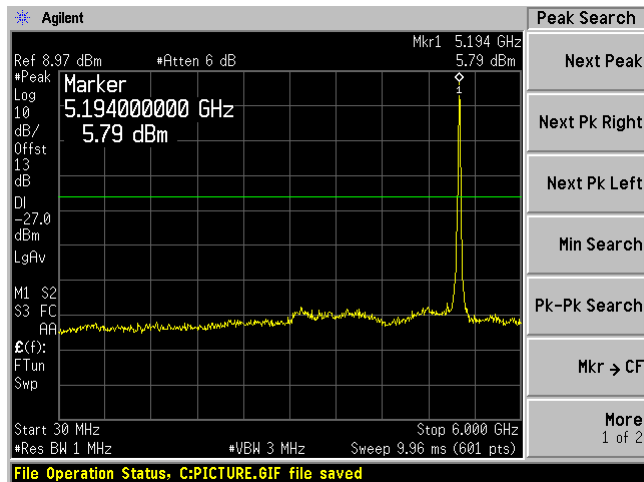
Low Channel 5180MHz (30MHz-6GHz)



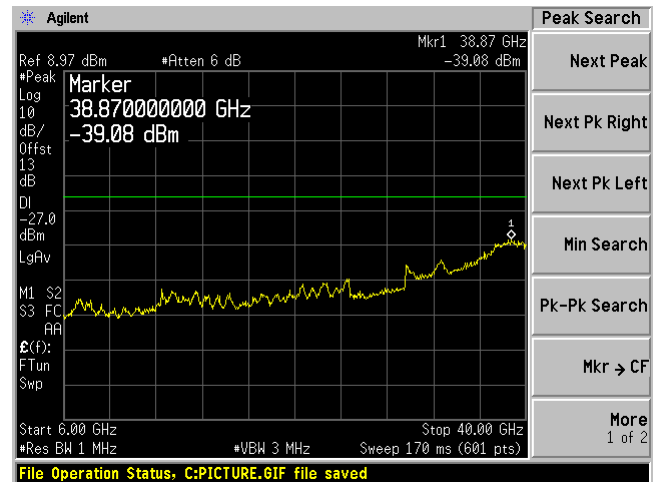
Low Channel 5180 MHz (6-40GHz)



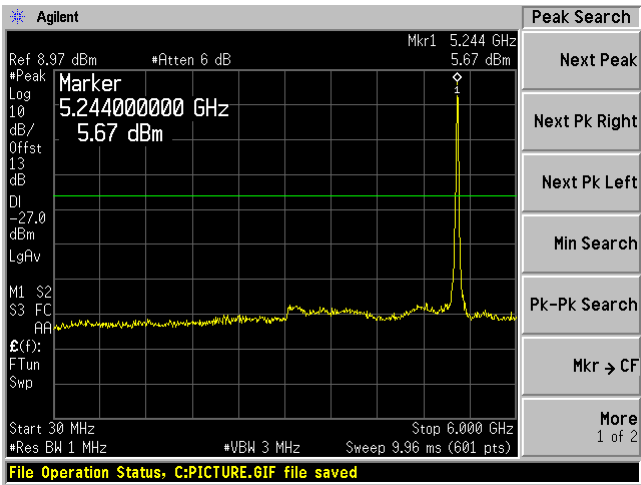
Middle Channel 5200MHz (30MHz-6GHz)



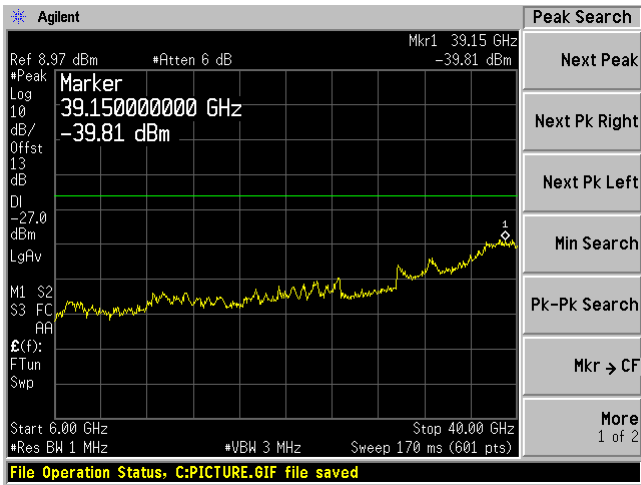
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

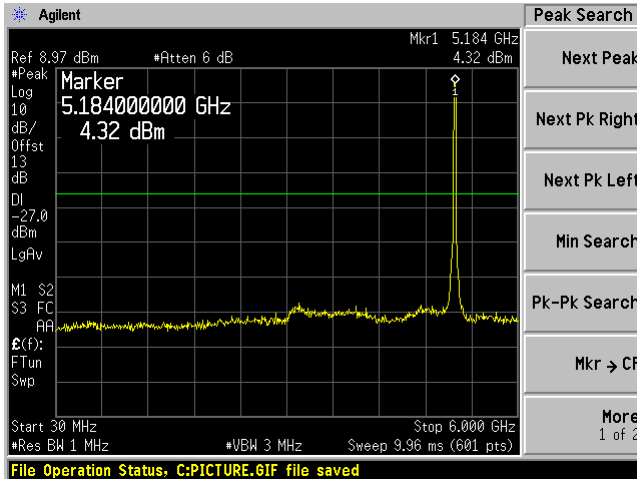


High Channel 5240 MHz (6-40GHz)

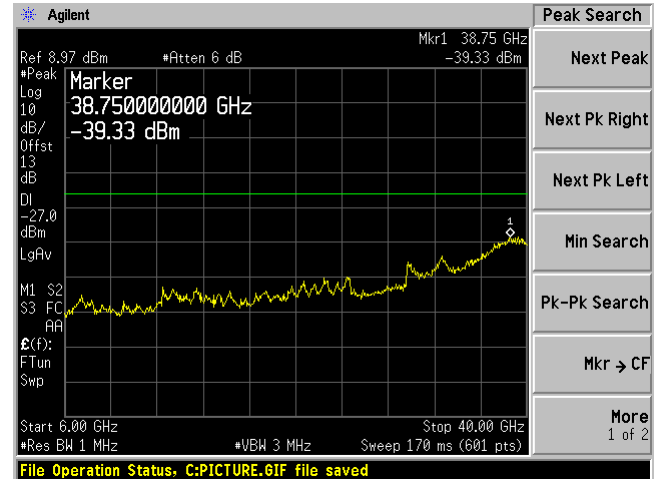


802.11n20 mode

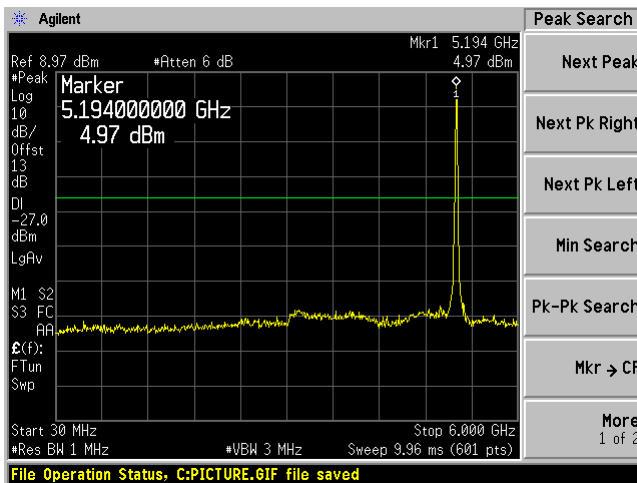
Low Channel 5180MHz (30MHz-6GHz)



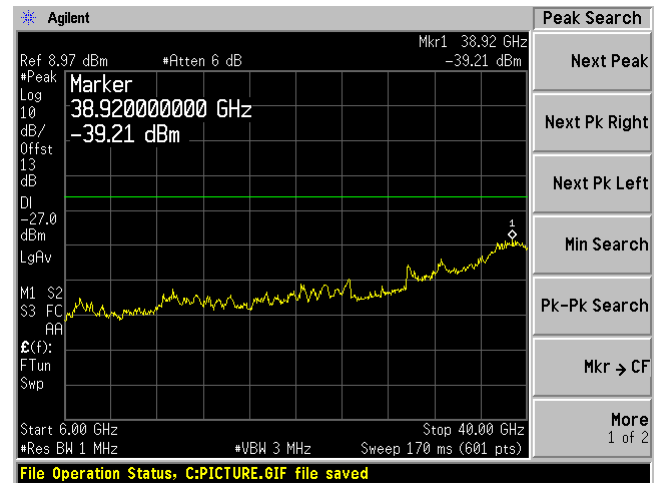
Low Channel 5180 MHz (6-40GHz)



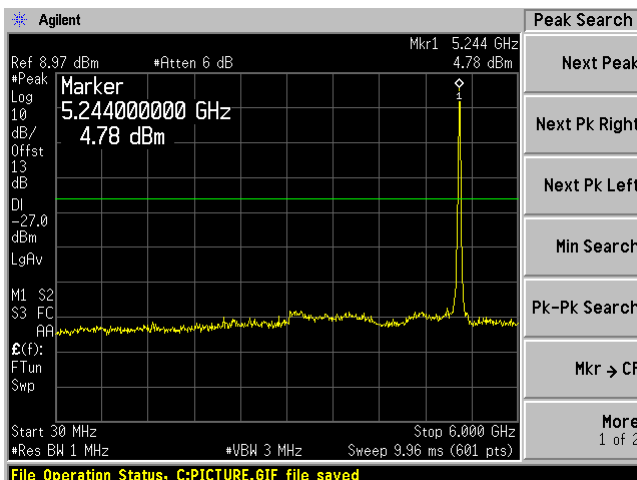
Middle Channel 5200MHz (30MHz-6GHz)



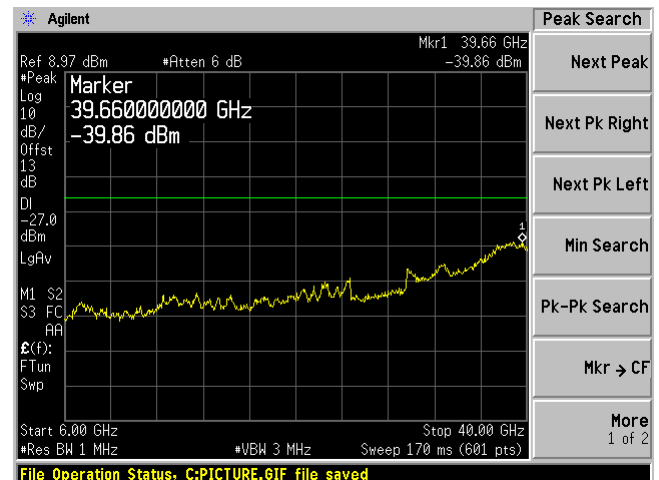
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)

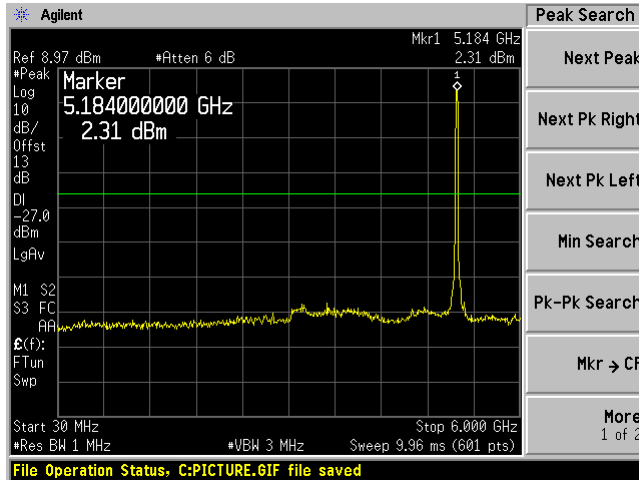


High Channel 5240 MHz (6-40GHz)

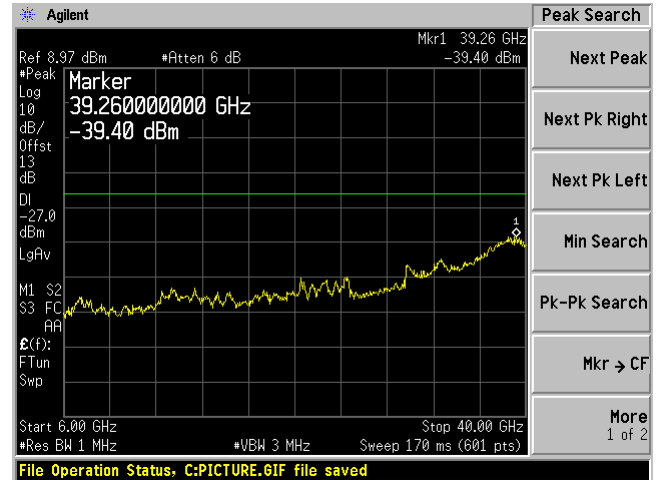


802.11ac20 mode

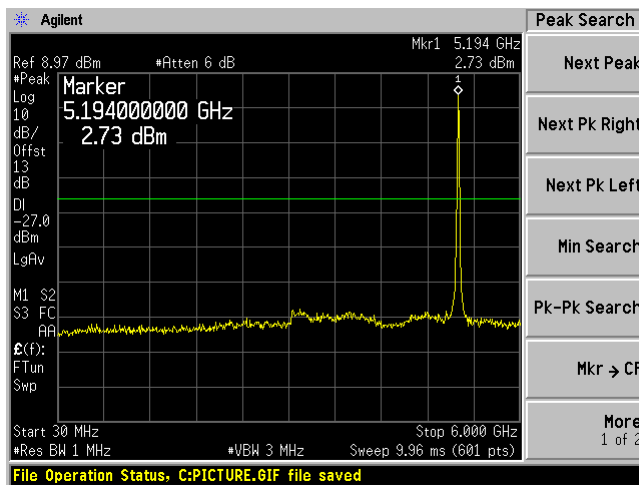
Low Channel 5180MHz (30MHz-6GHz)



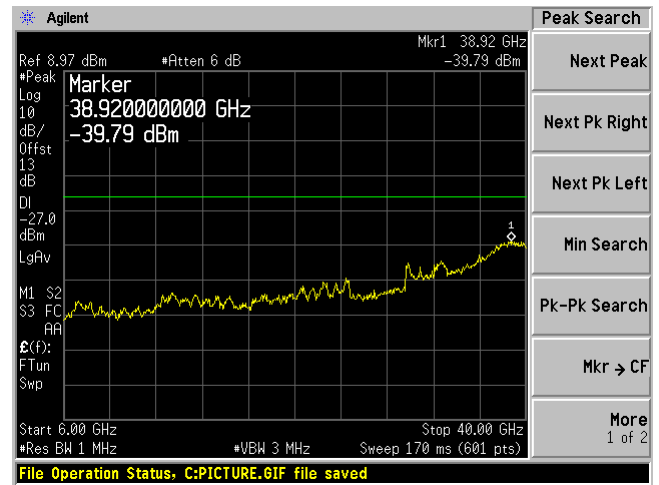
Low Channel 5180 MHz (6-40GHz)



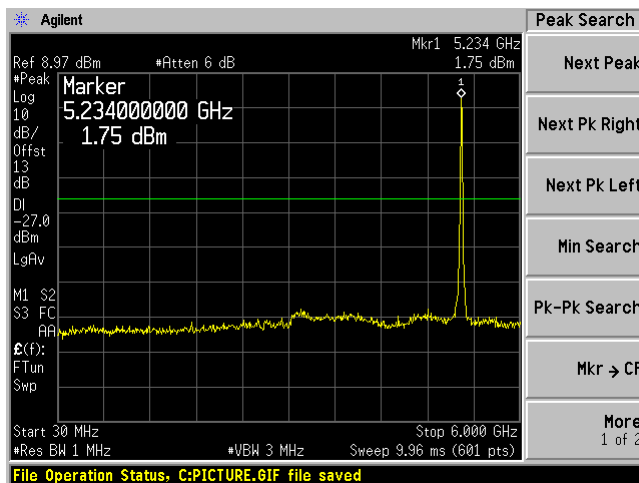
Middle Channel 5200MHz (30MHz-6GHz)



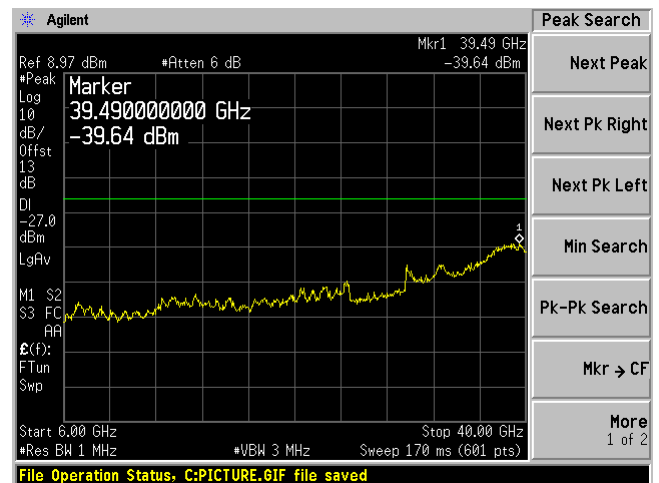
Middle Channel 5200 MHz (6-40GHz)



High Channel 5240MHz (30MHz-6GHz)



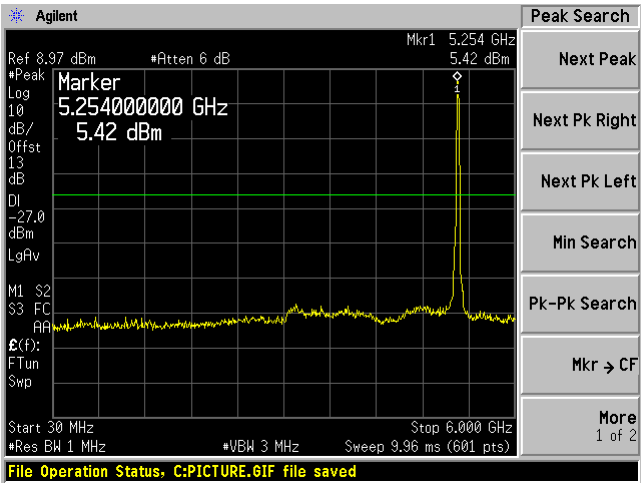
High Channel 5240 MHz (6-40GHz)



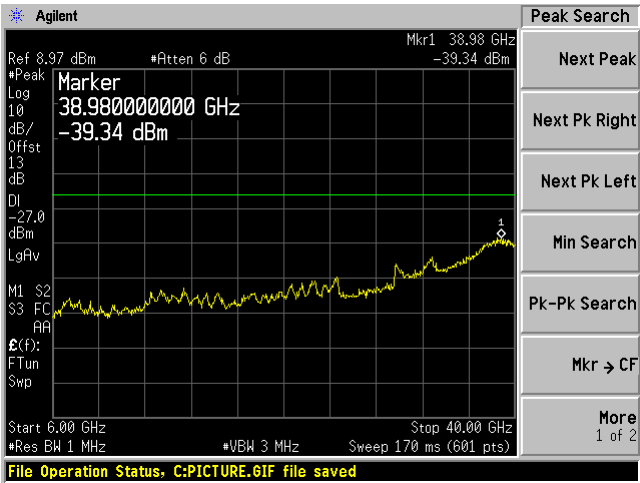
5250 – 5350 MHz

802.11a mode

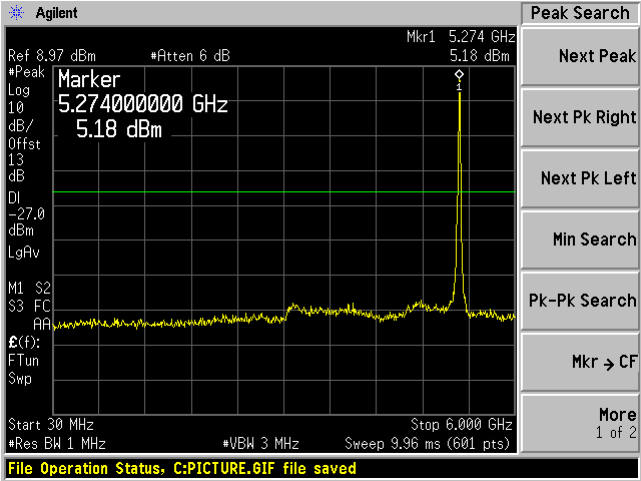
Low Channel 5260 MHz (30MHz-6GHz)



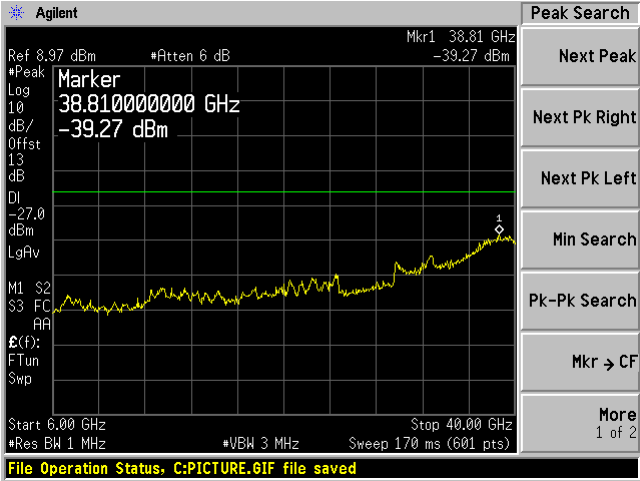
Low Channel 5260 MHz (6-40GHz)



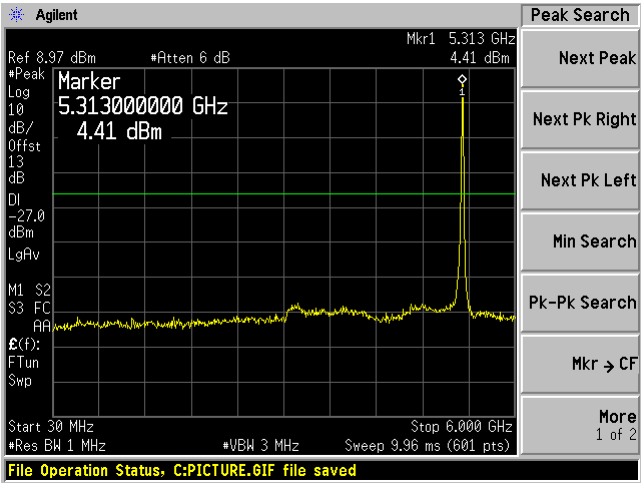
Middle Channel 5280 MHz (30MHz-6GHz)



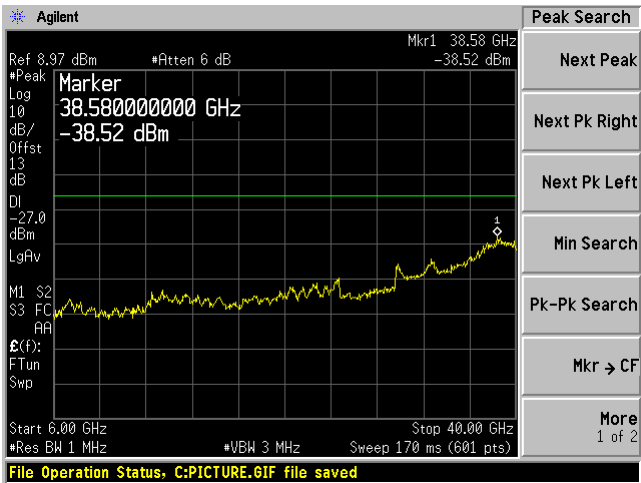
Middle Channel 5280 MHz (6-40GHz)



High Channel 5320 MHz (30MHz-6GHz)

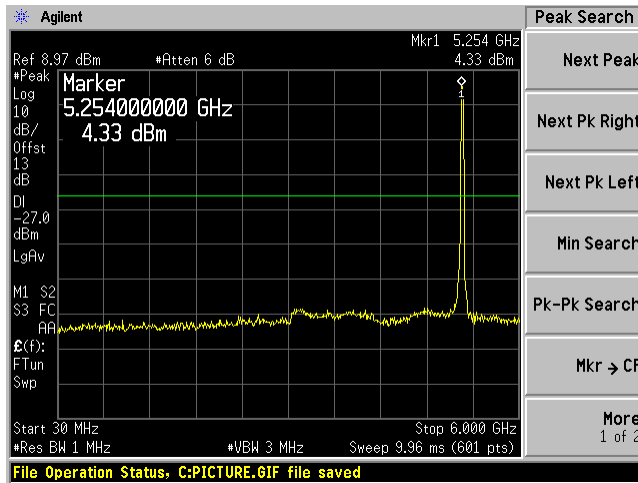


High Channel 5320 MHz (6-40GHz)

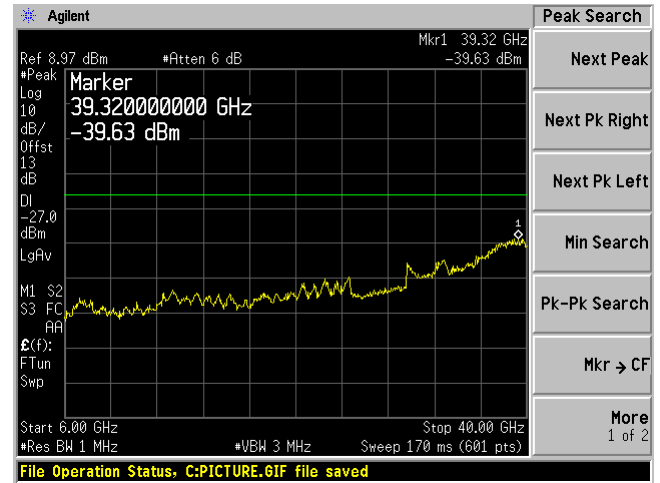


802.11n20 mode

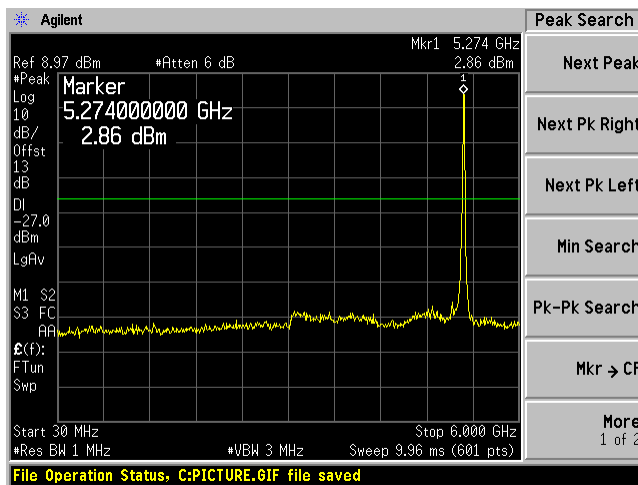
Low Channel 5260 MHz (30MHz-6GHz)



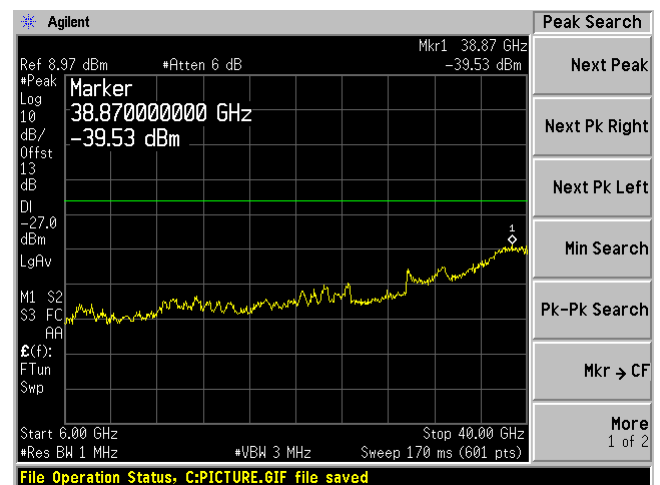
Low Channel 5260 MHz (6-40GHz)



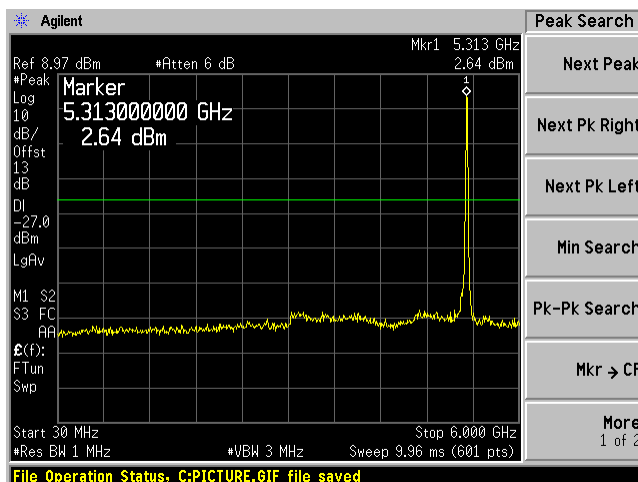
Middle Channel 5280MHz (30MHz-6GHz)



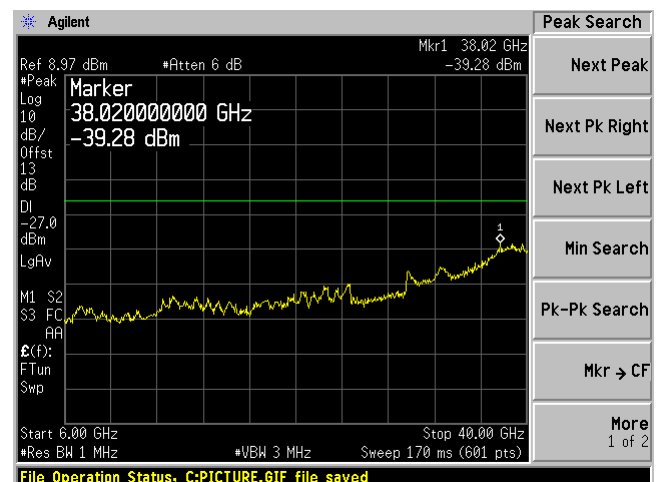
Middle Channel 5280 MHz (6-40GHz)



High Channel 5320 MHz (30MHz-6GHz)

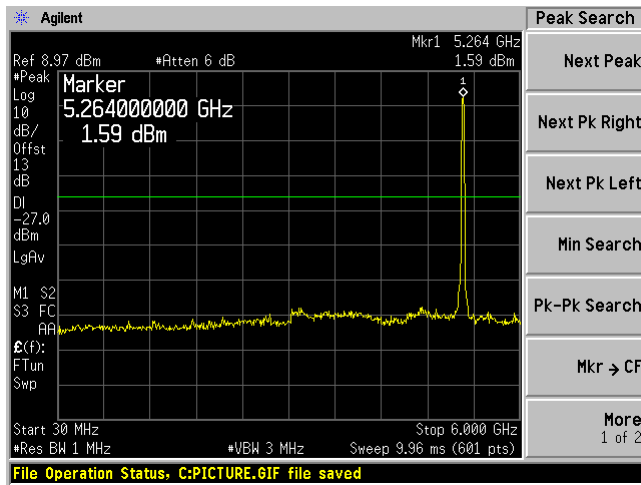


High Channel 5320 MHz (6-40GHz)

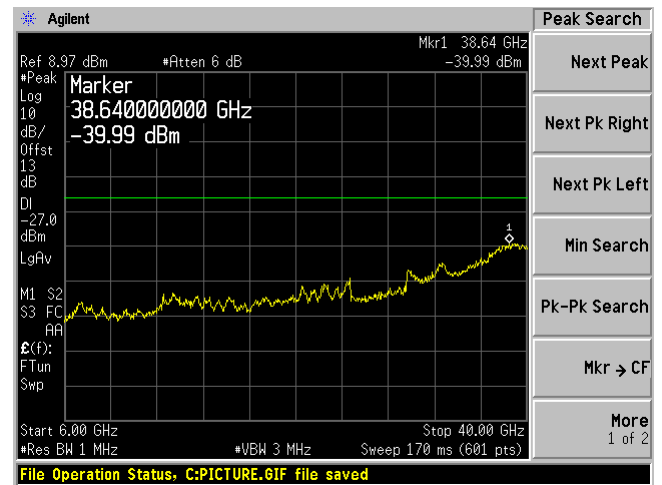


802.11ac20 mode

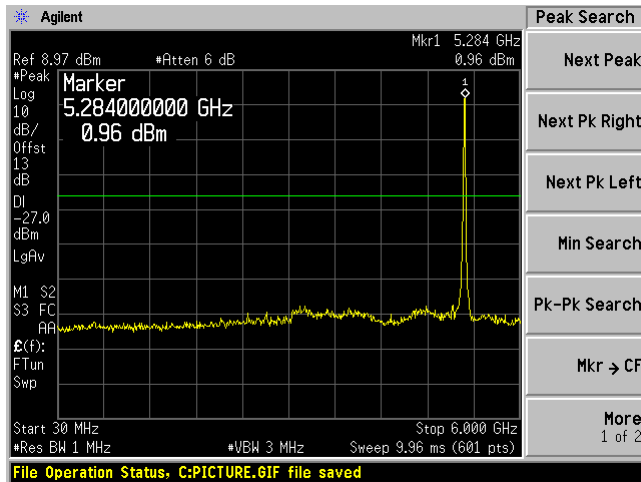
Low Channel 5260MHz (30MHz-6GHz)



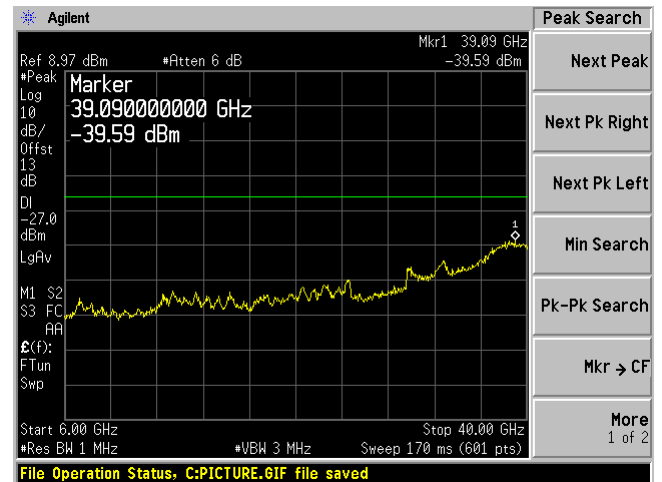
Low Channel 5260 MHz (6-40GHz)



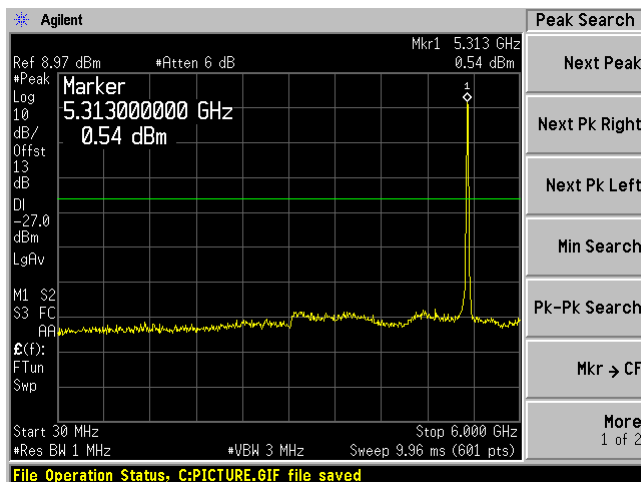
Middle Channel 5280 MHz (30MHz-6GHz)



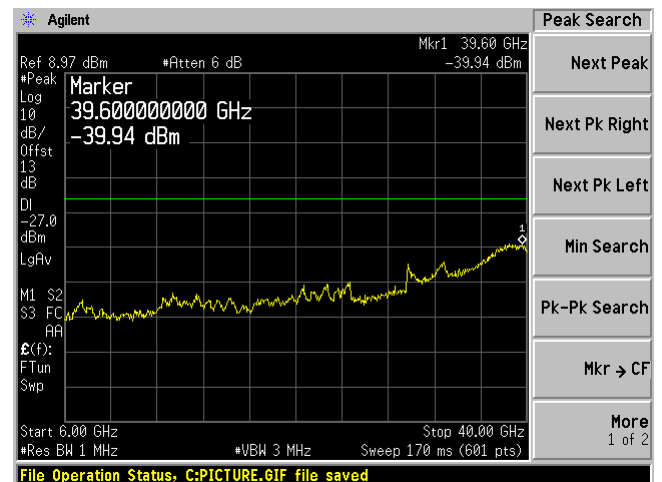
Middle Channel 5280 MHz (6-40GHz)



High Channel 5320 MHz (30MHz-6GHz)



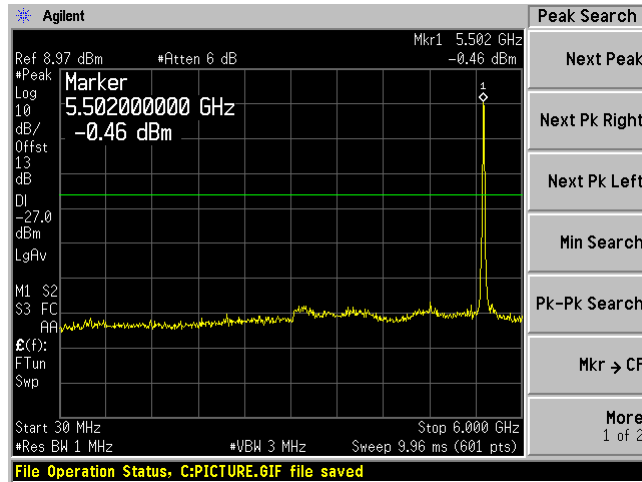
High Channel 5320 MHz (6-40GHz)



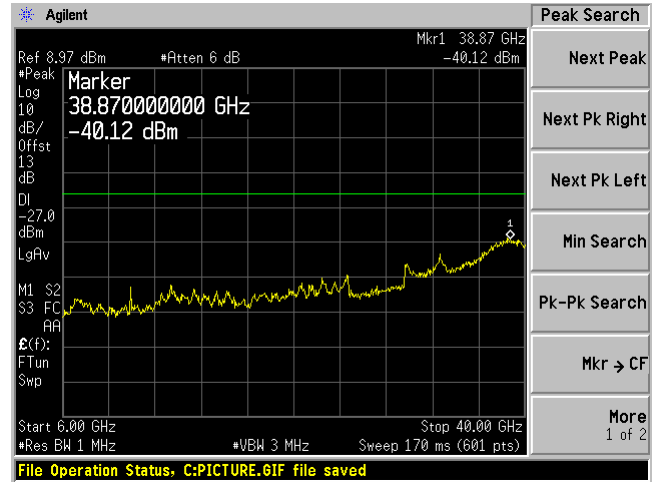
5470 – 5725 MHz

802.11a mode

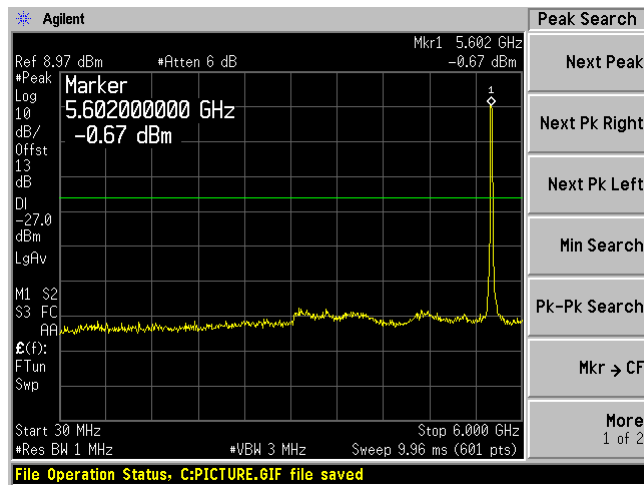
Low Channel 5500 MHz (30MHz-6GHz)



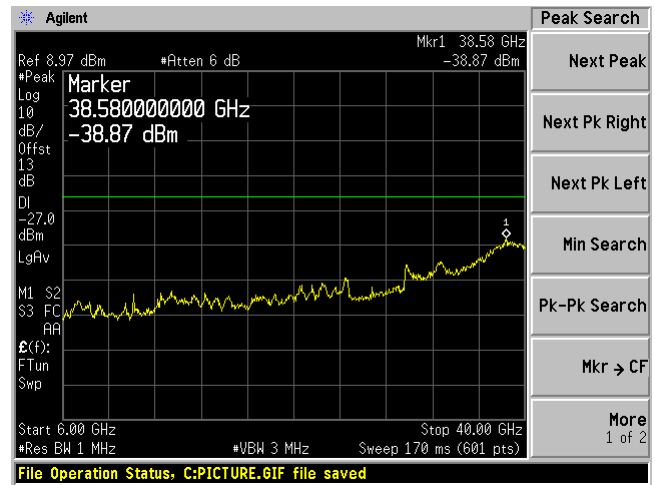
Low Channel 5500 MHz (6-40GHz)



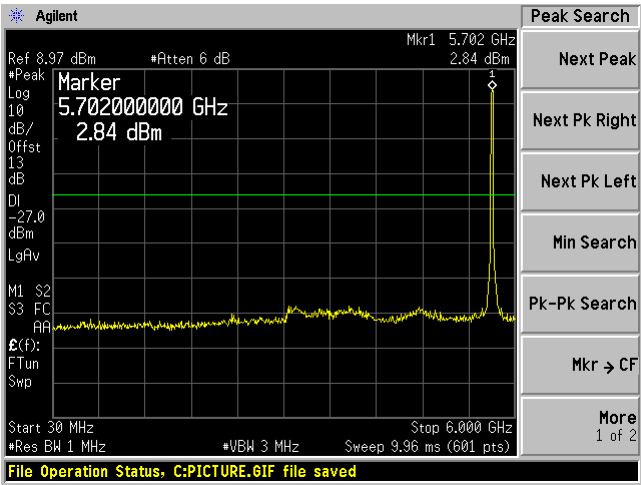
Middle Channel 5600 MHz (30MHz-6GHz)



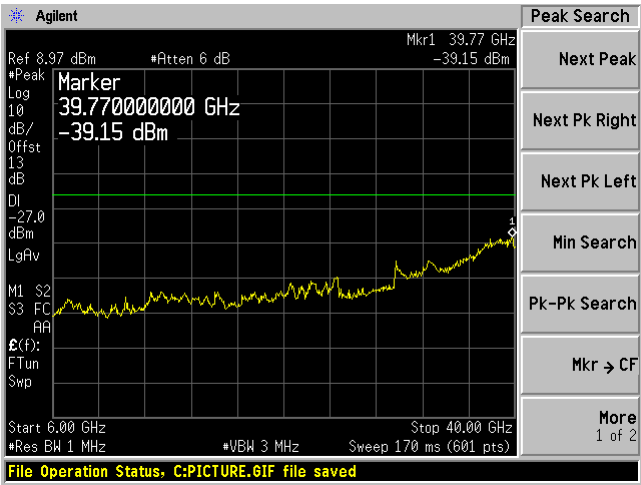
Middle Channel 5600 MHz (6-40GHz)



High Channel 5700 MHz (30MHz-6GHz)

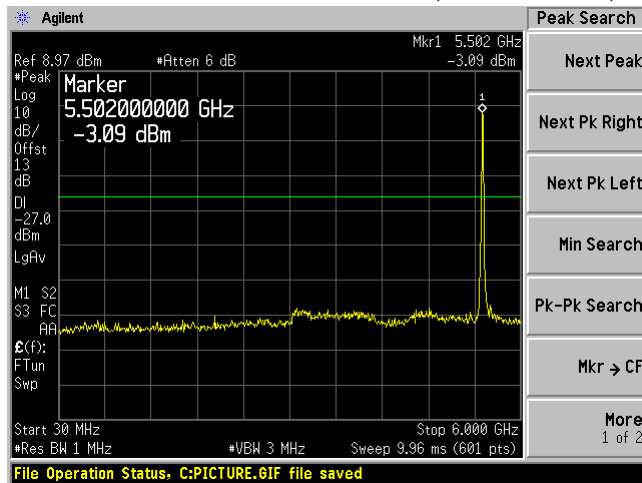


High Channel 5700 MHz (6-40GHz)

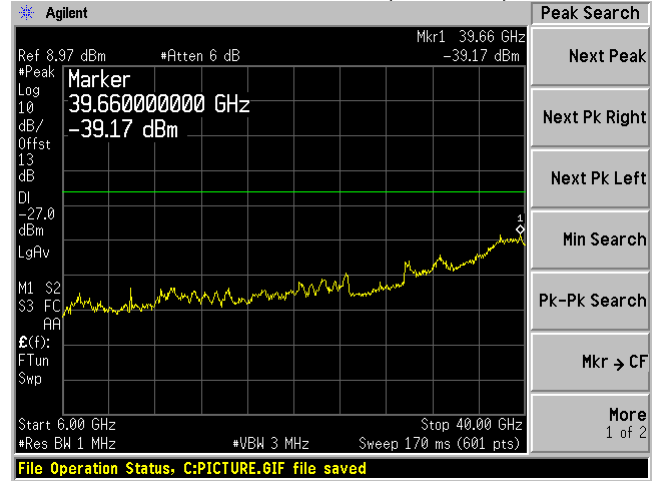


802.11n20 mode

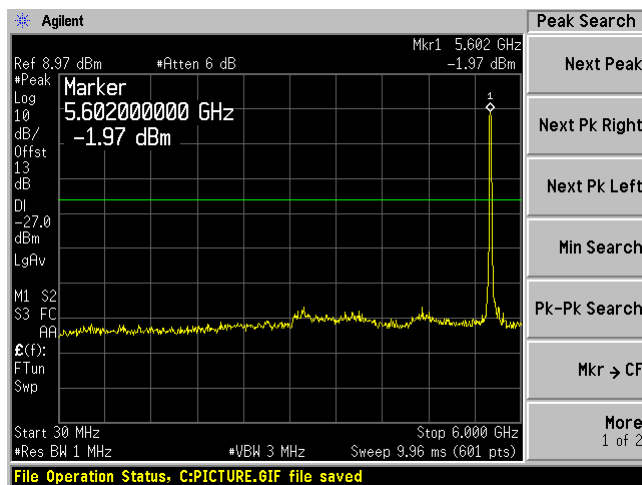
Low Channel 5500 MHz (30MHz-6GHz)



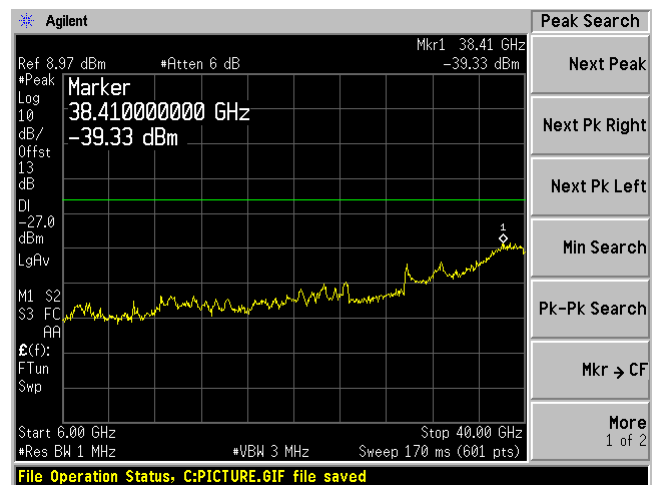
Low Channel 5500 MHz (6-40GHz)



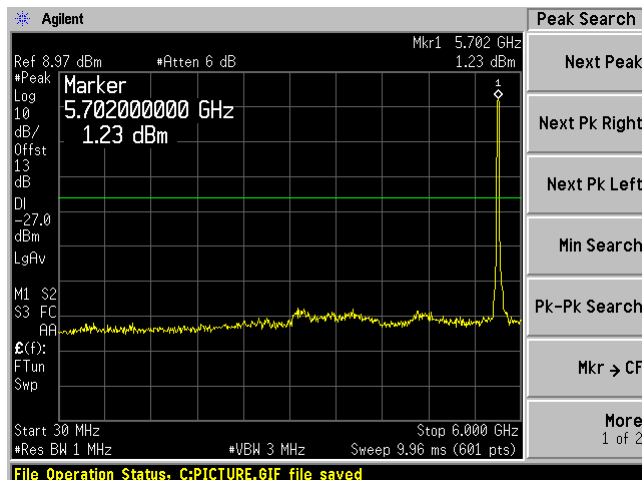
Middle Channel 5600 MHz (30MHz-6GHz)



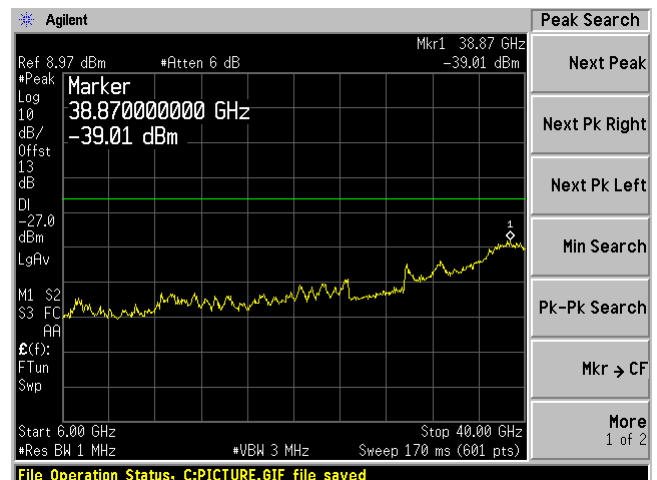
Middle Channel 5600 MHz (6-40GHz)



High Channel 5700 MHz (30MHz-6GHz)

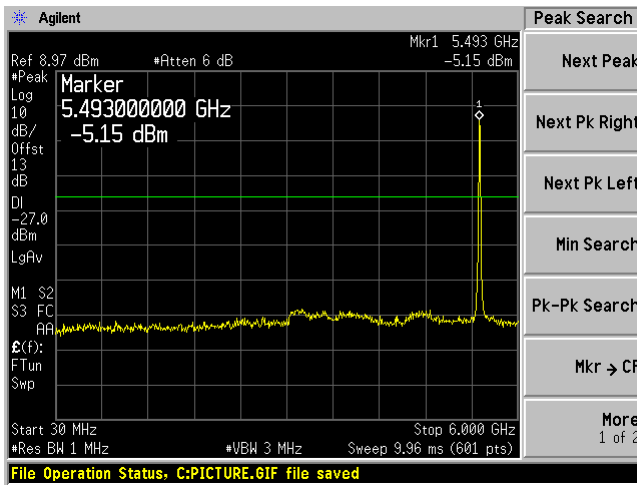


High Channel 5700 MHz (6-40GHz)

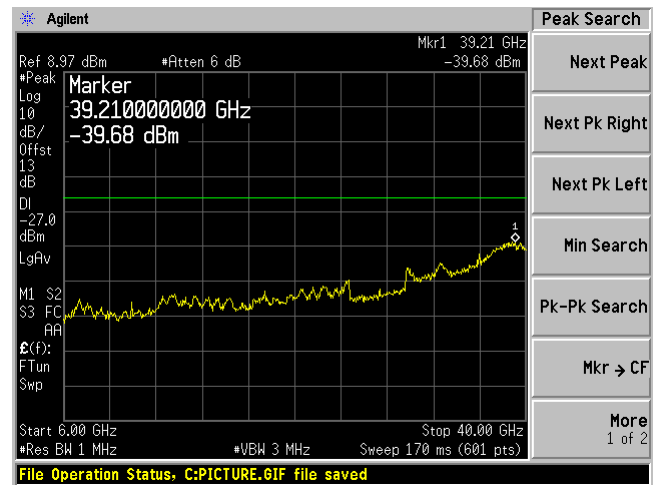


802.11ac20 mode

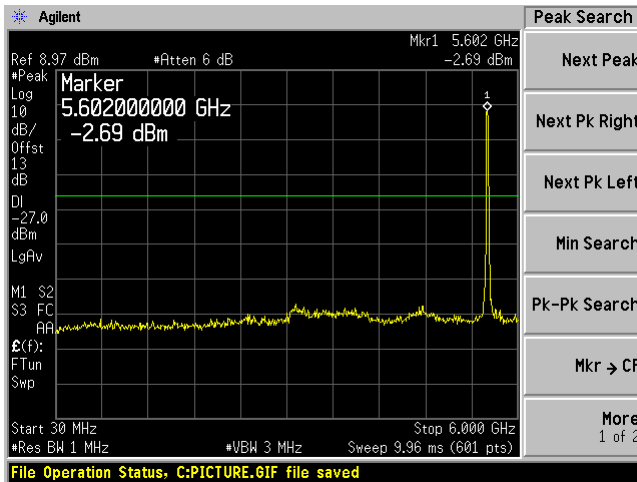
Low Channel 5500 MHz (30MHz-6GHz)



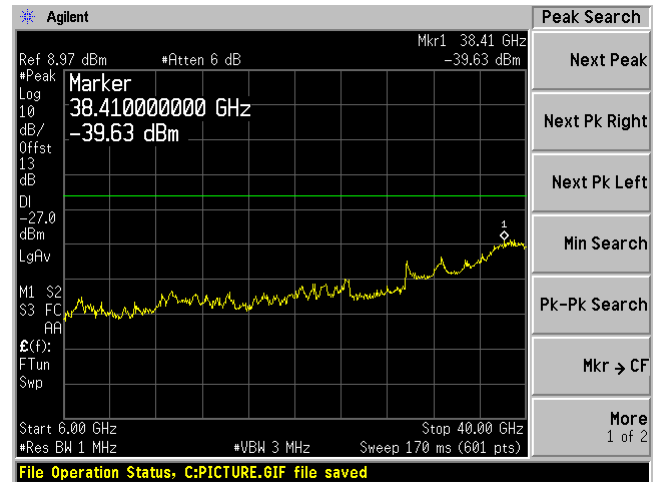
Low Channel 5500 MHz (6-40GHz)



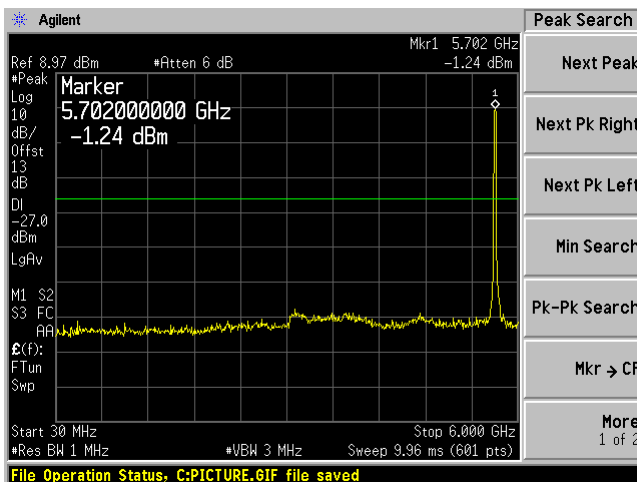
Middle Channel 5600 MHz (30MHz-6GHz)



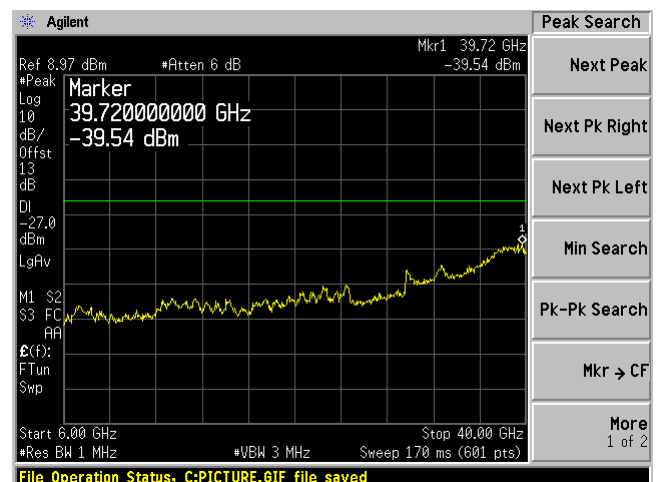
Middle Channel 5600 MHz (6-40GHz)



High Channel 5700 MHz (30MHz-6GHz)



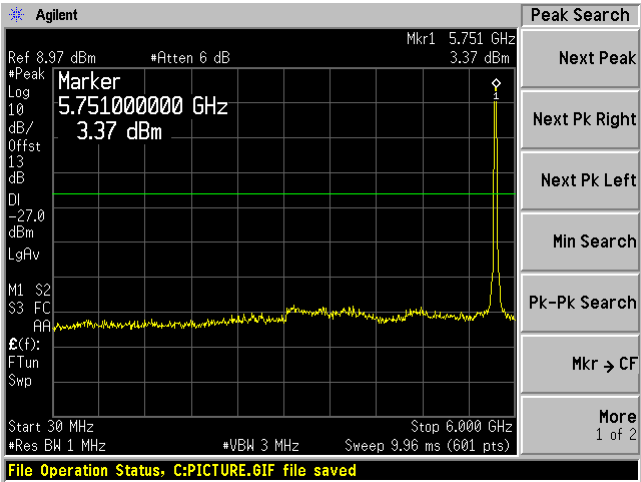
High Channel 5700 MHz (6-40GHz)



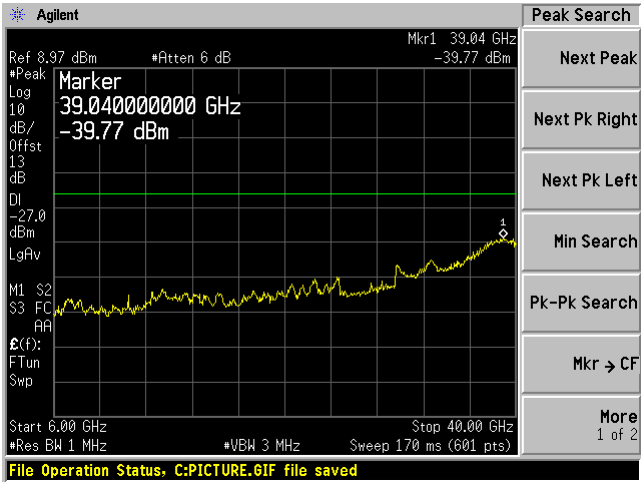
5725 – 5850 MHz

802.11a

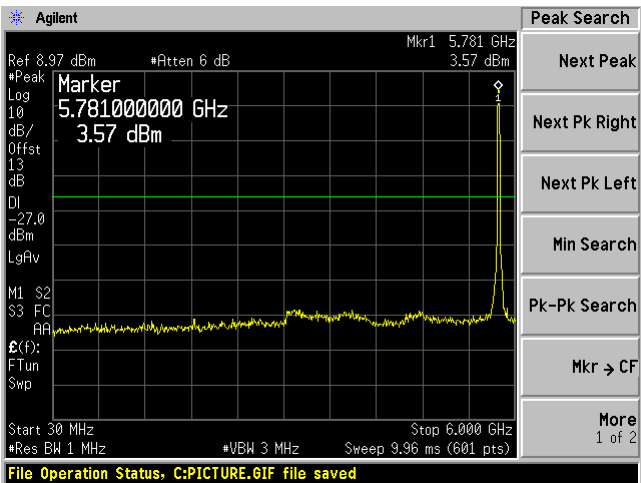
Low Channel 5745 MHz (30MHz-6GHz)



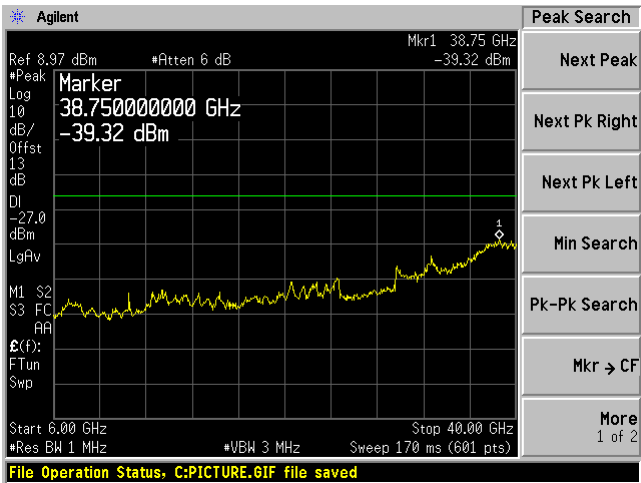
Low Channel 5745 MHz (6-40GHz)



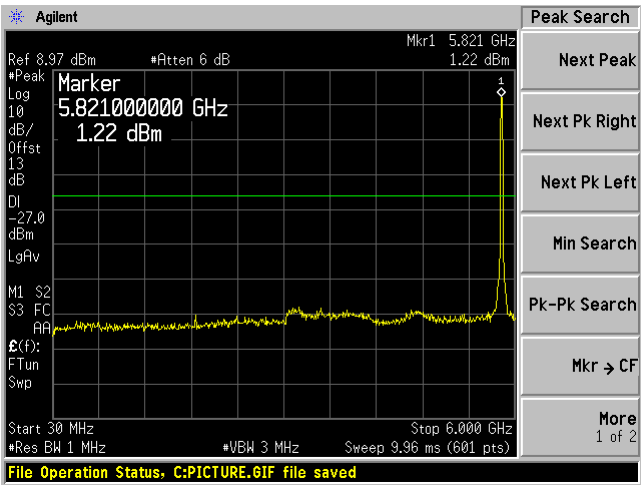
Middle Channel 5785 MHz (30MHz-6GHz)



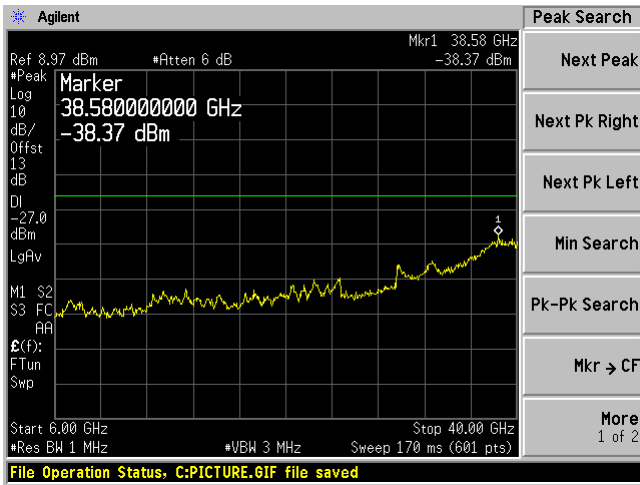
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825 MHz (30MHz-6GHz)

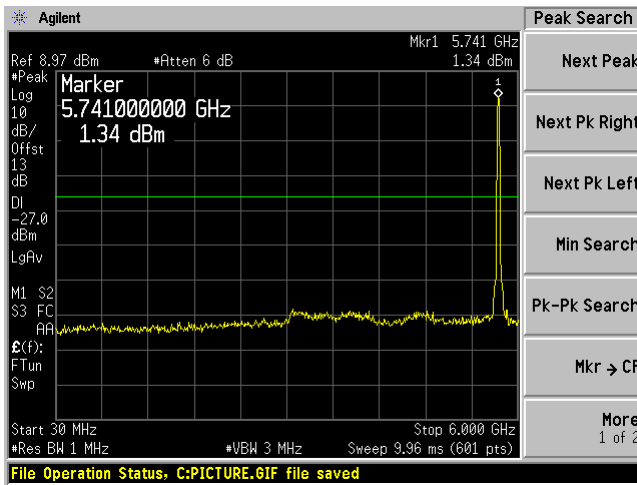


High Channel 5825 MHz (6-40GHz)

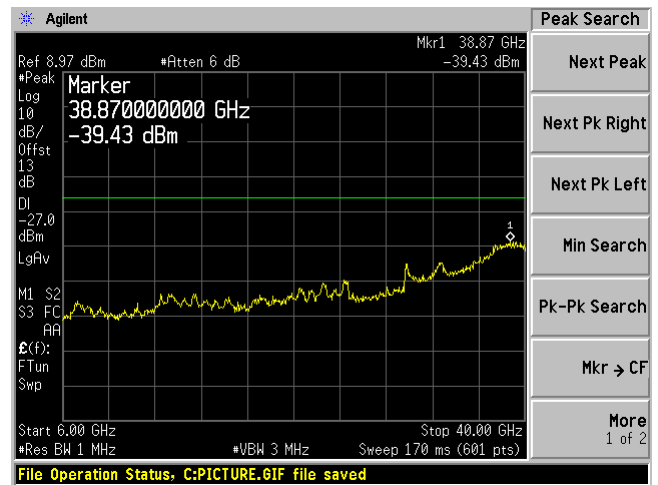


802.11n20 mode

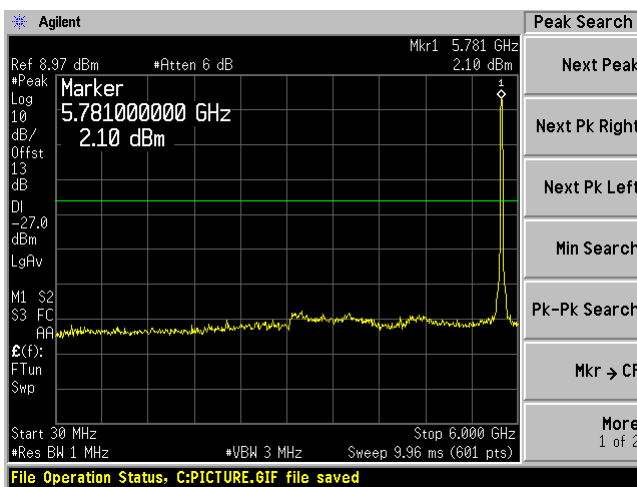
Low Channel 5745 MHz (30MHz-6GHz)



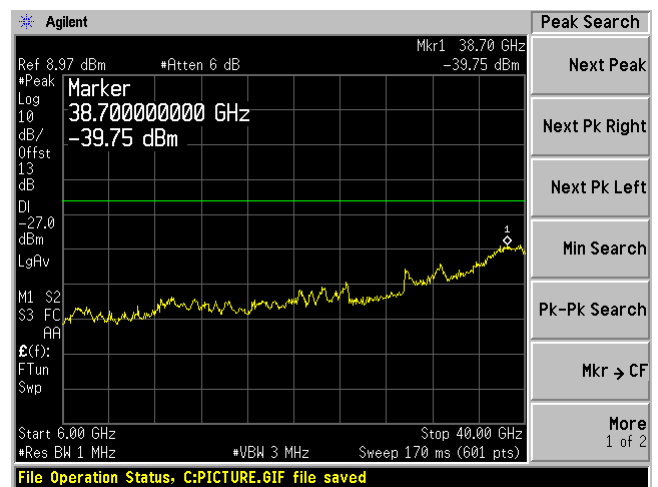
Low Channel 5745 MHz (6-40GHz)



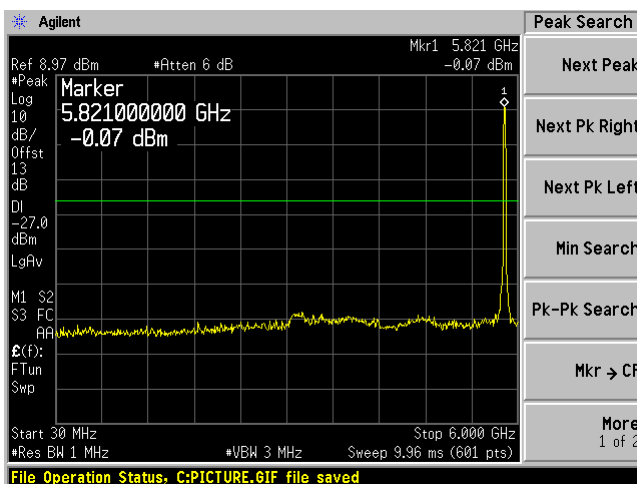
Middle Channel 5785 MHz (30MHz-6GHz)



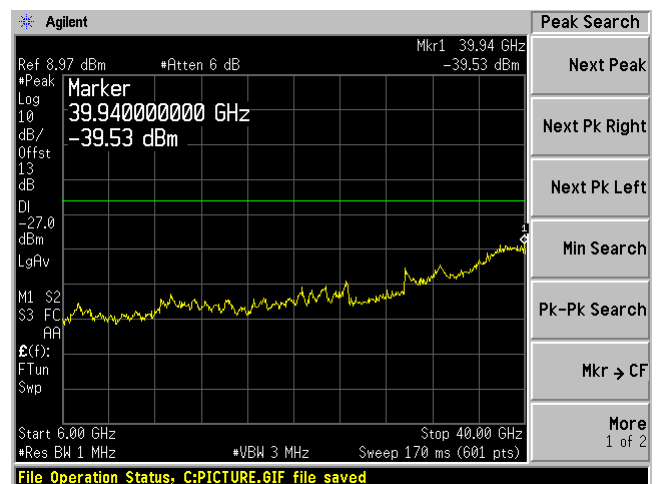
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825 MHz (30MHz-6GHz)

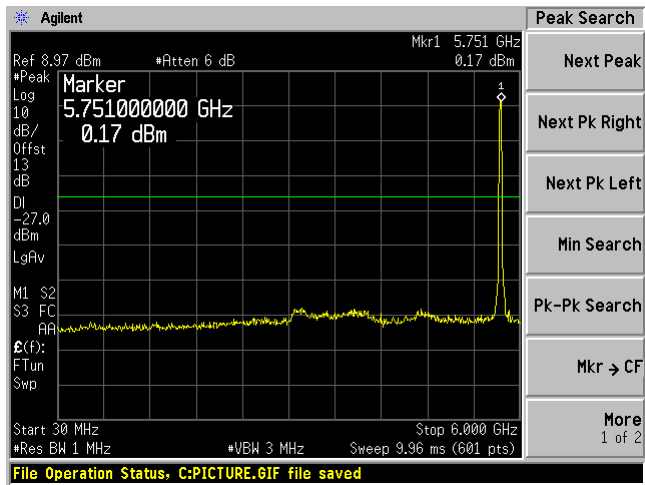


High Channel 5825 MHz (6-40GHz)

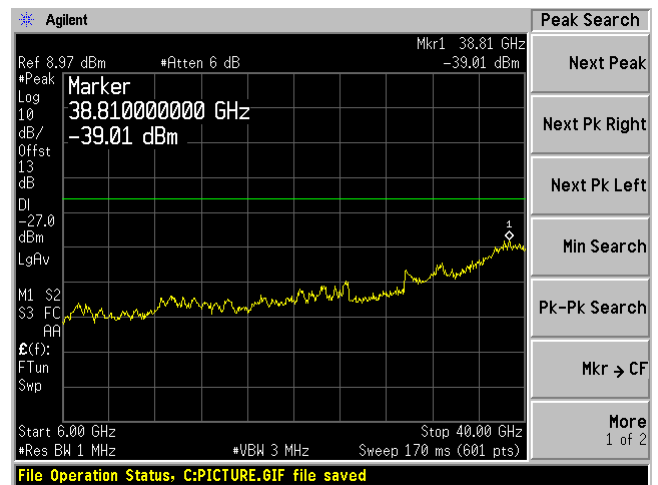


802.11ac20 mode

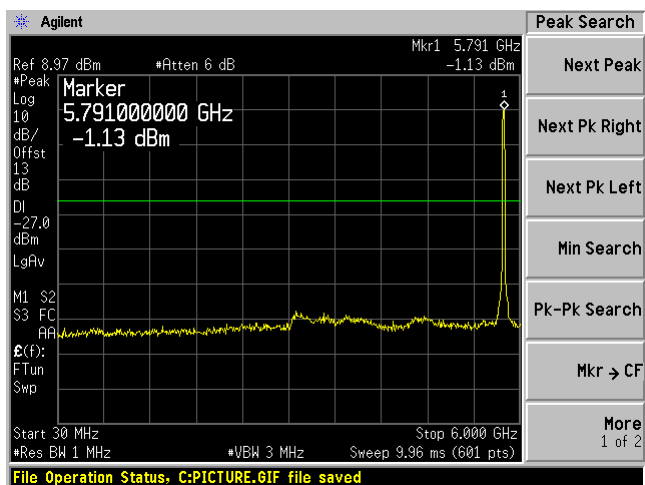
Low Channel 5745 MHz (30MHz-6GHz)



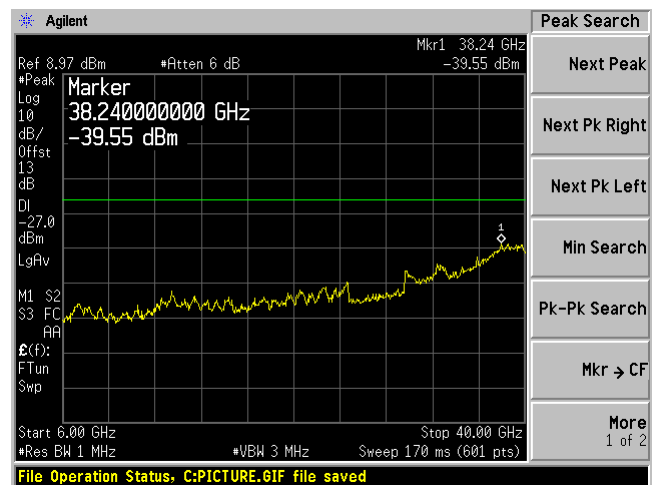
Low Channel 5745 MHz (6-40GHz)



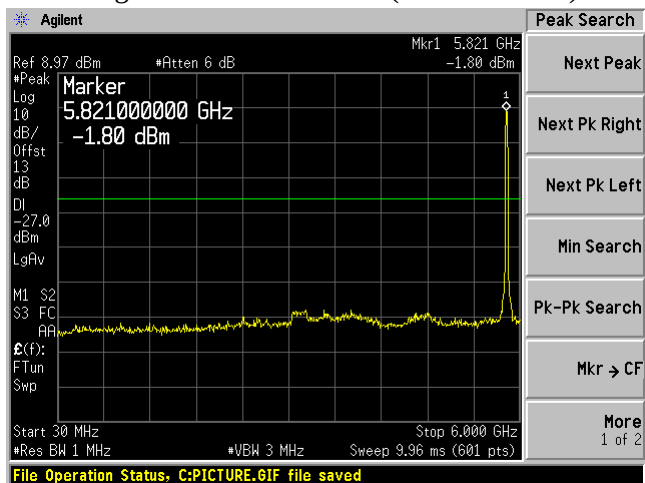
Middle Channel 5785 MHz (30MHz-6GHz)



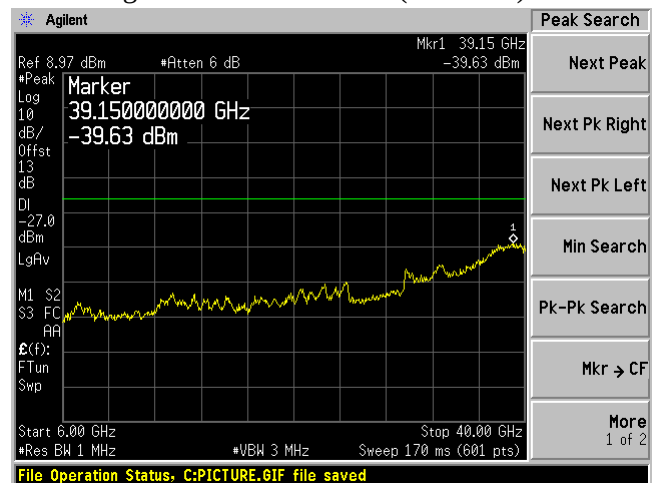
Middle Channel 5785 MHz (6-40GHz)



High Channel 5825 MHz (30MHz-6GHz)



High Channel 5825 MHz (6-40GHz)

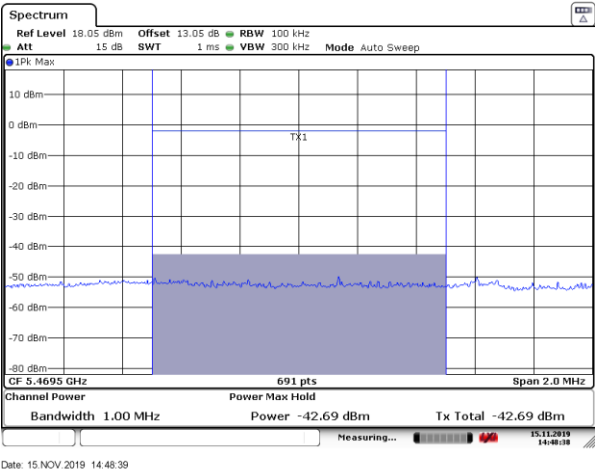


Band Edge Emissions

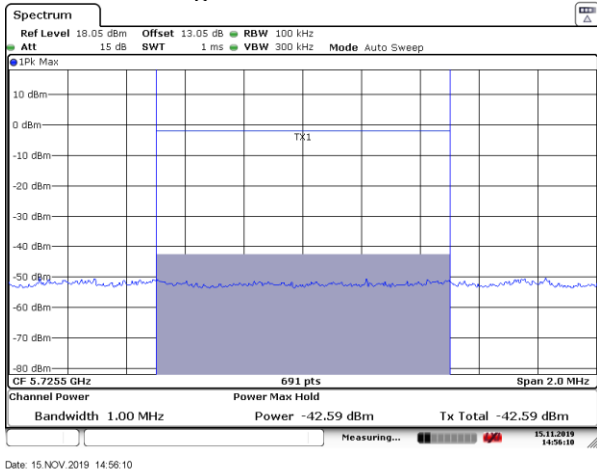
5470 - 5725 MHz

802.11a mode

Low Channel: 5500 MHz

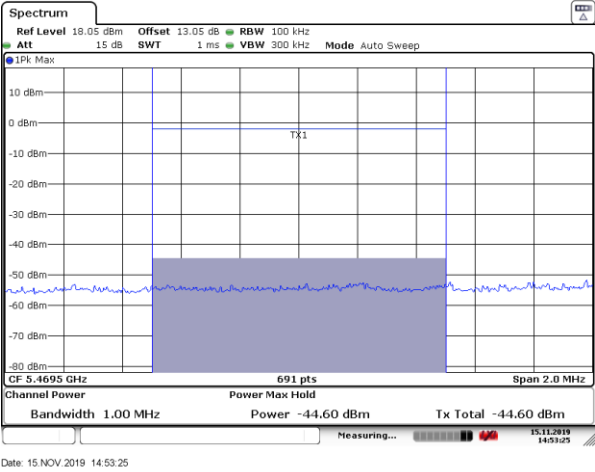


High channel: 5700 MHz

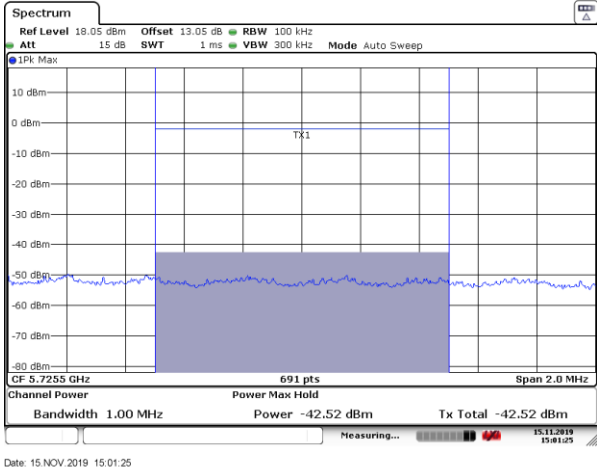


802.11n20 mode

Low Channel: 5500 MHz

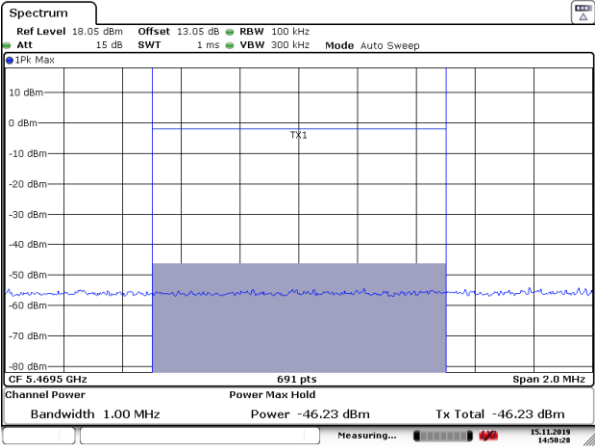


High channel: 5700 MHz



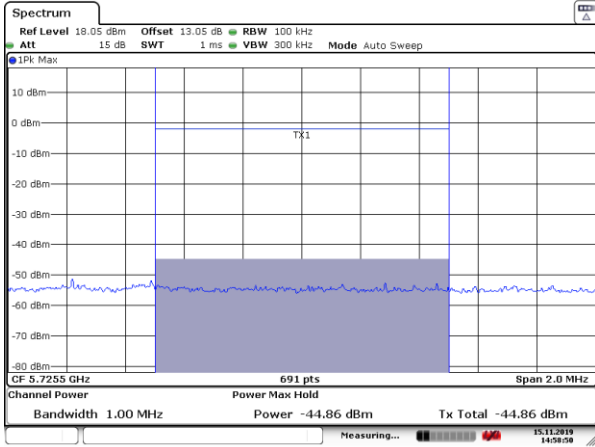
802.11ac20 mode

Low Channel: 5500 MHz



Date: 15 NOV 2019 14:50:29

High channel: 5700 MHz



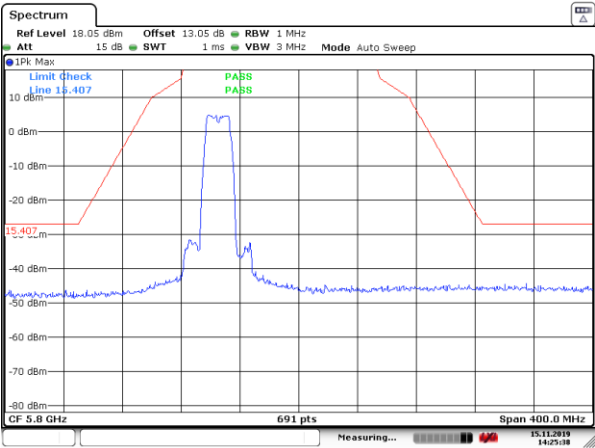
Date: 15 NOV 2019 14:58:51

5725 – 5850 MHz

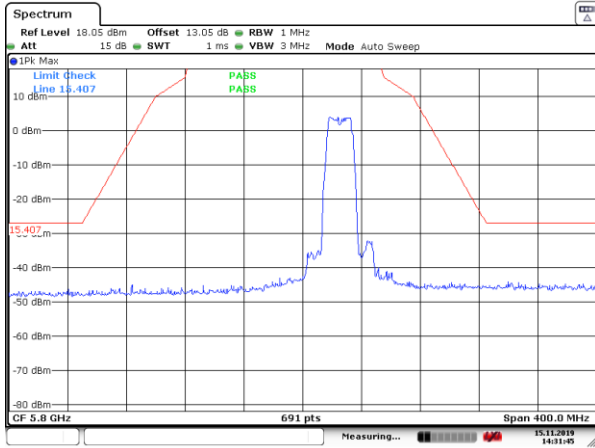
FCC Emission Mask

802.11a mode

5745 MHz

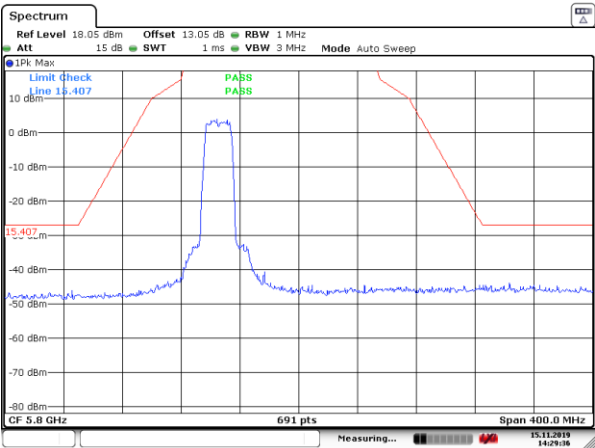


5825 MHz

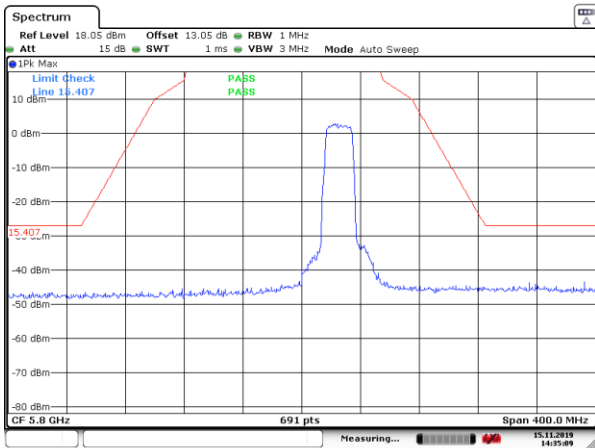


802.11n20 mode

5745 MHz

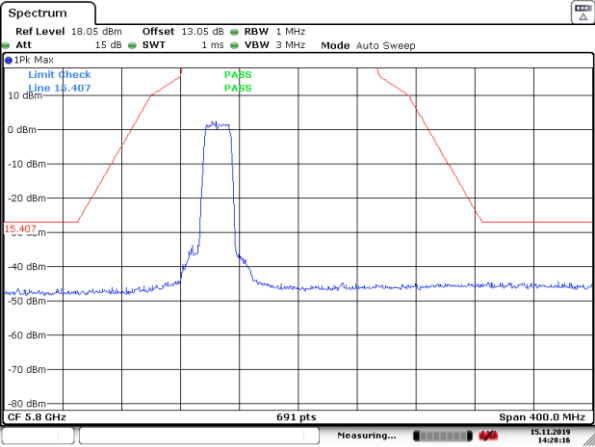


5825 MHz



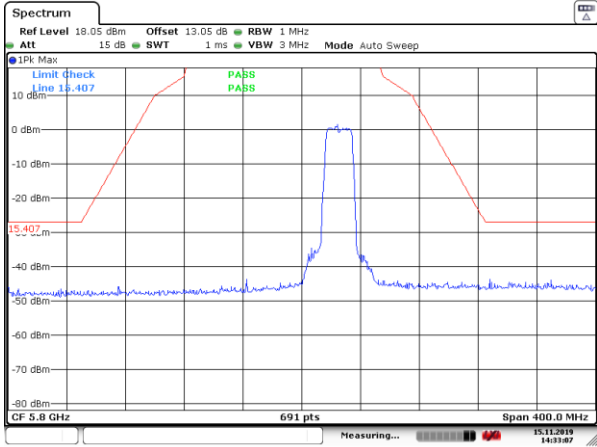
802.11ac20 mode

5745 MHz



Date: 15 NOV 2019 14:28:16

5825 MHz



Date: 15 NOV 2019 14:33:07

11 Annex A (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 ---