



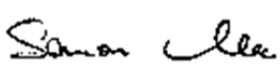
FCC PART 15, SUBPART C TEST REPORT

For

Roku, Inc.

1155 Coleman Ave., San Jose, CA 95110, USA

FCC ID: TC2-R1037

Report Type: Original Report	Model: RC-EL2 & RC-EL3
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Report Number: R2005185-247	
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* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "*" Rev.01

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2005185-247	Original Report	2020-06-22

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test report was prepared on behalf of *Roku, Inc.*, and their product model: RC-EL3 and a similar model RC-EL2, FCC ID: TC2-R1037 or the “EUT” as referred to in this report. It is a remote control. The two models are electrically identical; RC-EL3 was selected for testing. Please refer to the declaration letter submitted by the manufacturer.

1.2 Mechanical Description of EUT

The Remote Control measures approximately 140 mm (L) x 43m (W) x 25 mm (H) and weighs approximately 0.05 kg.

The data gathered are from the typical production sample provided by Roku, Inc. with serial number: R2005185-1, assigned by BACL.

1.3 Objective

This report was prepared on behalf of *Roku, Inc.* in accordance with Part 2, Subpart J, and Part 15, Subparts B and C of the Federal Communication Commission’s rules.

The objective was to determine compliance with FCC Part 15.247 rules for: Antenna Requirements, RF Exposure, 6 dB and 99% Bandwidth, Output Power, Power Spectral Density, 100 kHz Bandwidth of Band Edges Measurement, Conducted TX Spurious Emissions and Radiated Spurious Emissions.

1.4 Related Submittal(s)/Grant(s)

Equipment Class: NII, FCC ID: TC2-R1037

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and FCC KDB 558074 D01 DTS Meas Guidance v04: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

1.6 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 %

1.7 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.

1.8 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3297.02), in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment

[including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.03) to certify

- For the USA (Federal Communications Commission):
 - 1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
 - 2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
 - 3- All Telephone Terminal Equipment within FCC Scope C.
- For the Canada (Industry Canada):
 - 1 All Scope 1-Licence-Exempt Radio Frequency Devices;
 - 2 All Scope 2-Licensed Personal Mobile Radio Services;
 - 3 All Scope 3-Licensed General Mobile & Fixed Radio Services;
 - 4 All Scope 4-Licensed Maritime & Aviation Radio Services;
 - 5 All Scope 5-Licensed Fixed Microwave Radio Services
 - 6 All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.
- For Singapore (Info-Communications Development Authority (IDA)):
 - 1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
 - 2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2
- For the Hong Kong Special Administrative Region:
 - 1 All Radio Equipment, per KHCA 10XX-series Specifications;
 - 2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
 - 3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
 - 1 MIC Telecommunication Business Law (Terminal Equipment):
 - All Scope A1 - Terminal Equipment for the Purpose of Calls;
 - All Scope A2 - Other Terminal Equipment
 - 2 Radio Law (Radio Equipment):
 - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
 - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
 - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.01) to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

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

- for Computer Servers (ver. 2.0)
- 2 Commercial Food Service Equipment
 - for Commercial Dishwashers (ver. 2.0)
 - for Commercial Ice Machines (ver. 2.0)
 - for Commercial Ovens (ver. 2.1)
 - for Commercial Refrigerators and Freezers
- 3 Lighting Products
 - For Decorative Light Strings (ver. 1.5)
 - For Luminaires (including sub-components) and Lamps (ver. 1.2)
 - For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
 - For Integral LED Lamps (ver. 1.4)
- 4 Heating, Ventilation, and AC Products
 - for Residential Ceiling Fans (ver. 3.0)
 - for Residential Ventilating Fans (ver. 3.2)
- 5 Other
 - For Water Coolers (ver. 3.0)

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

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Innovation, Science and Economic development Canada - ISED) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
 - o BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
 - o NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
 - o EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
 - o Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
 - o Low Voltage Directive (LVD) 2014/35/EU
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Media Development Authority - IMDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
 - o ENERGY STAR Recognized Test Laboratory – US EPA
 - o Telecommunications Certification Body (TCB) – US FCC;
 - o Nationally Recognized Test Laboratory (NRTL) – US OSHA
- Vietnam: APEC Tel MRA -Phase I;

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.10-2013 and FCC KDB 558074 D01 DTS Meas Guidance v04.

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 to be as follows for each mode based upon investigation 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 UI_mptool, the EUT firmware is compliant with the standard requirements being tested against.

Modulation	Frequency (MHz)	Power Setting
802.11b	2412	99
	2437	100
	2462	101
802.11g	2412	89
	2437	96
	2462	96
802.11n20	2412	87
	2437	96
	2462	92

2.3 Duty Cycle Correction Factor

According to KDB 558074 D01 DTS Meas Guidance v04 section 6.0:

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be utilized to ensure that measurements are made only during transmissions at the maximum power control level. Such sweep triggering/signal gating techniques will require knowledge of the minimum transmission duration (T) over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Sweep triggering/signal gating techniques can then be used if the measurement/sweep time of the analyzer can be set such that it does not exceed T at any time that data is being acquired (i.e., no transmitter off-time is to be considered).

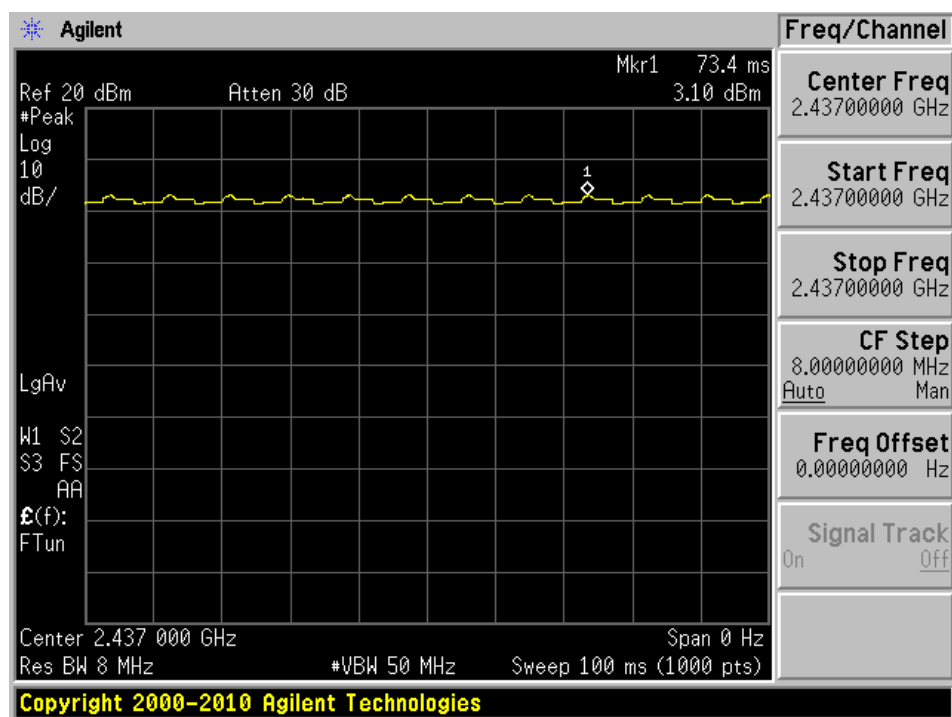
Radio Mode	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
802.11b	100	100	100	0
802.11g	100	100	100	0
802.11n20	100	100	100	0

Duty Cycle = On Time (ms)/ Period (ms)

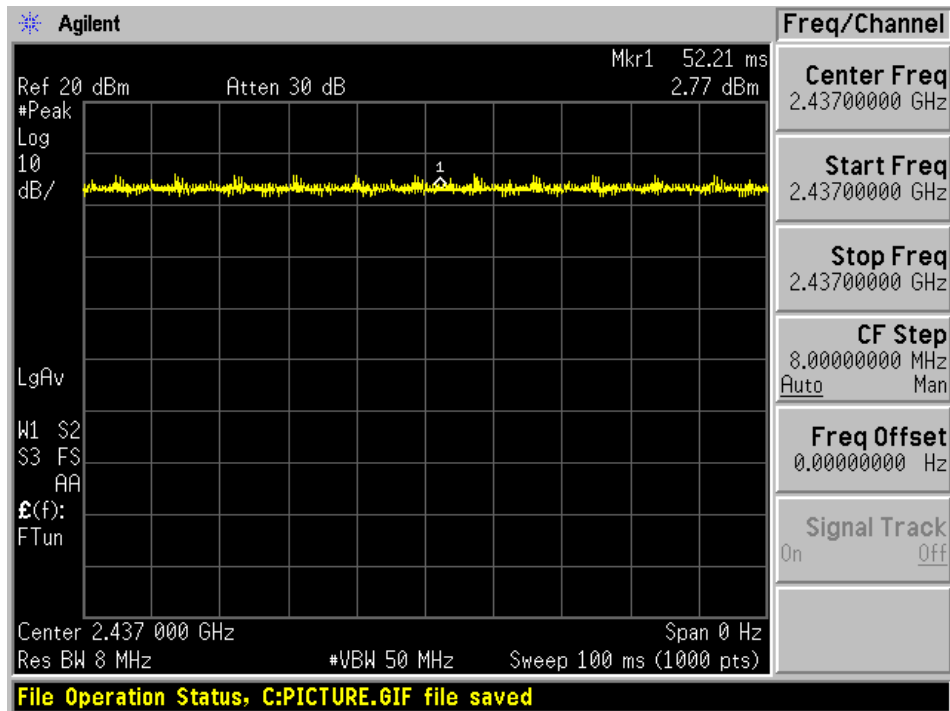
Duty Cycle Correction Factor (dB) = $10 \cdot \log(1/\text{Duty Cycle})$

Please refer to the following plots.

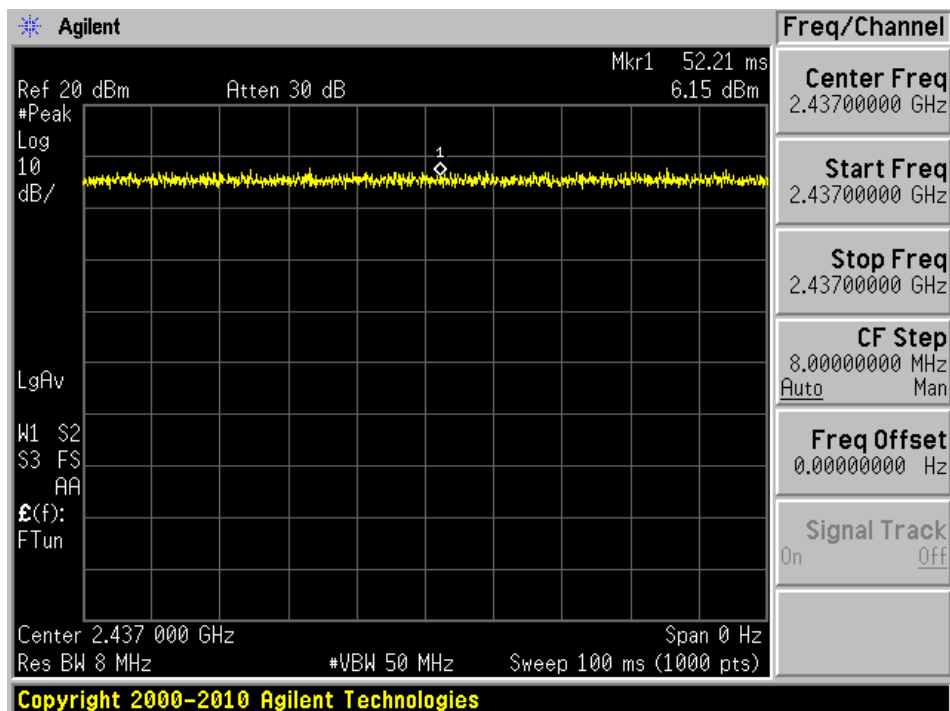
802.11b mode



802.11g mode



802.11n20 mode



2.4 Equipment Modifications

None

2.5 Local Support Equipment

Manufacturer	Description	Model
Dell	Laptop	Latitude E7450

2.6 Support Equipment

Manufacturer	Description	Model
Roku	Debug Board	-

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
RF Cable (WFL-SMA)	< 1 m	EUT	PSA
Standard USB Adapter (A-Male to B-Male)	< 1m	Laptop	EUT
Ribbon Cable	< 1m	EUT	Dubug/Programmer Board

3 Summary of Test Results

FCC Rules	Description of Test	Results
§15.203, §15.247	Antenna Requirement	Compliant
§2.1093, §15.247(i)	RF Exposure	Compliant
§15.207	AC Power Line Conducted Emissions	N/A *
§2.1051, §15.247(a)(2),(d)	Spurious Emissions at Antenna Port	Compliant
§2.1053, §15.35(b), §15.205, §15.209, §15.247(d)	Radiated Spurious Emissions	Compliant
§15.247(a)(2)	6 dB and 99% Emission Bandwidth	Compliant
§15.247(b)(3)	Output Power	Compliant
§15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
§15.247(e)	Power Spectral Density	Compliant

Note: The EUT is powered by two AA batteries only, AC Power Line Conducted Emissions test does not apply.

4 FCC §15.203 & §15.247 - Antenna Requirements

4.1 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.

4.2 Antenna Description

The antennas used by the EUT are permanent attached antennas.

	Antenna Usage	Frequency Range (MHz)	Antenna Type	Antenna Gain (dBi)
Antenna 1	Wi-Fi	2400-2483.5	Dual-band Chip Antenna	0.1
Antenna 2	Wi-Fi	2400-2483.5	Dual-band Chip Antenna	-0.8

5 FCC §2.1093 & §15.247(i) - RF Exposure

5.1 Applicable Standards

According to FCC KDB 447498 D01 General RF Exposure Guidance v05r02 Section 4.3.1, Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition, listed below, is satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions. The minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander (see 5) of section 4.1). To qualify for SAR test exclusion, the test separation distances applied must be fully explained and justified by the operating configurations and exposure conditions of the transmitter and applicable host platform requirements, typically in the SAR measurement or SAR analysis report, according to the required published RF exposure KDB procedures. When no other RF exposure testing or reporting is required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for the SAR test exclusion. When required, the device specific conditions described in the other published RF exposure KDB procedures must be satisfied before applying these SAR test exclusion provisions; for example, handheld PTT two-way radios, handsets, laptops & tablets etc.

- 1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

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

- $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

- 2) At 100 MHz to 6 GHz and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following, and as illustrated in Appendix B:
- a) $[\text{Power allowed at numeric threshold for 50 mm in step 1}) + (\text{test separation distance} - 50 \text{ mm}) \cdot (f(\text{MHz})/150)] \text{ mW}$, at 100 MHz to 1500 MHz
 - b) $[\text{Power allowed at numeric threshold for 50 mm in step 1}) + (\text{test separation distance} - 50 \text{ mm}) \cdot 10] \text{ mW}$ at > 1500 MHz and ≤ 6 GHz
- 3) At frequencies below 100 MHz, the following may be considered for SAR test exclusion, and as illustrated in Appendix C:
- a) The power threshold at the corresponding test separation distance at 100 MHz in step 2) is multiplied by $[1 + \log(100/f(\text{MHz}))]$ for test separation distances > 50 mm and < 200 mm
 - b) The power threshold determined by the equation in a) for 50 mm and 100 MHz is multiplied by $\frac{1}{2}$ for test separation distances ≤ 50 mm
 - c) SAR measurement procedures are not established below 100 MHz. When SAR test exclusion cannot be applied, a KDB inquiry is required to determine SAR evaluation requirements for any test results to be acceptable.

5.2 RF Exposure Evaluation Results

Customer declares the separation distance between antenna and user's hand is 10mm.

The turn-up conducted power report is 11.4 dBm (13.8 mW).

According to KDB 447498D01, [(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [$\sqrt{f}$ (GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR.

$(13.8/10) \cdot \sqrt{2.412} = 2.143$ which is less than 7.5

SAR testing for this device is excluded.

6 FCC §15.205, §15.209 & §15.247(d) - Spurious Radiated Emissions

6.1 Applicable Standards

As per FCC §15.35(b): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

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	3332 – 3339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3345.8 – 3358	23.6 – 24.0
12.29 – 12.293	240 – 285	3600 – 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(a): Except as provided elsewhere in this Subpart, 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**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** 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 §15.247 (d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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 Subpart C 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

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

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

The EUT was set 3 meter away from the testing antenna, which was varied from 1-4 meter, and the EUT was placed on a turntable, which was 0.8 meter and 1.5 meter above the ground plane for below and above 1000 MHz measurements, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna's polarity should be changed between horizontal and vertical.

The spectrum analyzer or receiver was set as:

Below 1000 MHz:

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

Above 1000 MHz:

(1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto

(2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = 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:

$$CA = Ai + AF + CL + Atten - Ga$$

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. The equation for margin calculation is as follows:

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

6.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde and Schwarz	Receiver, EMI Test	ESCI 1166.5950K03	100338	2018-07-05	2 years
Agilent	Analyzer, Spectrum	E4446A	US44300386	2019-08-24	1 year
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
Sunol Sciences	Antenna, Biconi-Log	JB3	A020106-2	2019-11-20	2 years
ETS Lindgren	Horn Antenna	3117	00218973	2019-02-13	2 years
HP	Amplifier, Pre	8447D	2443A04374	2019-08-13	1 year
Agilent	Preamplifier	8449B	3147A00400	2020-02-27	1 year
Wisewave	Antenna, Horn	ARH-4223-02	10555-02	2020-02-05	2 years
Wisewave	Antenna, Horn	ARH-2823-02	10555-01	2020-02-05	2 years
AH Systems	Preamplifier	PAM 1840 VH	170	2019-09-24	1 year
IW Microwave	150 Series 2.92mm Cable	KPS1501AN-3780-KPS	DC 1925	2019-09-11	1 year
MDP Digital	Times Microwave LMR 400 UltraFlex Coaxial Cable 35'	LMR400UF	BACL1904161	2020-05-20	1 year
-	SMA cable	-	C0002	Each time ¹	N/A
-	N-Type Cable	-	C00012	Each time ¹	N/A
-	N-Type Cable	-	C00014	Each time ¹	N/A
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

Note¹: cable and attenuator 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.

6.6 Test Environmental Conditions

Temperature:	20-22 °C
Relative Humidity:	42-45 %
ATM Pressure:	101.5 kPa

The testing was performed by Zhao Zhao and Matthew Riego de Dios 2020-06-10 to 2020-06-12 in 5m chamber 3.

6.7 Summary of Test Results

According to the data hereinafter, the EUT complied with FCC Title 47, Part 15C standard's radiated emissions limits, and had the worst margin of:

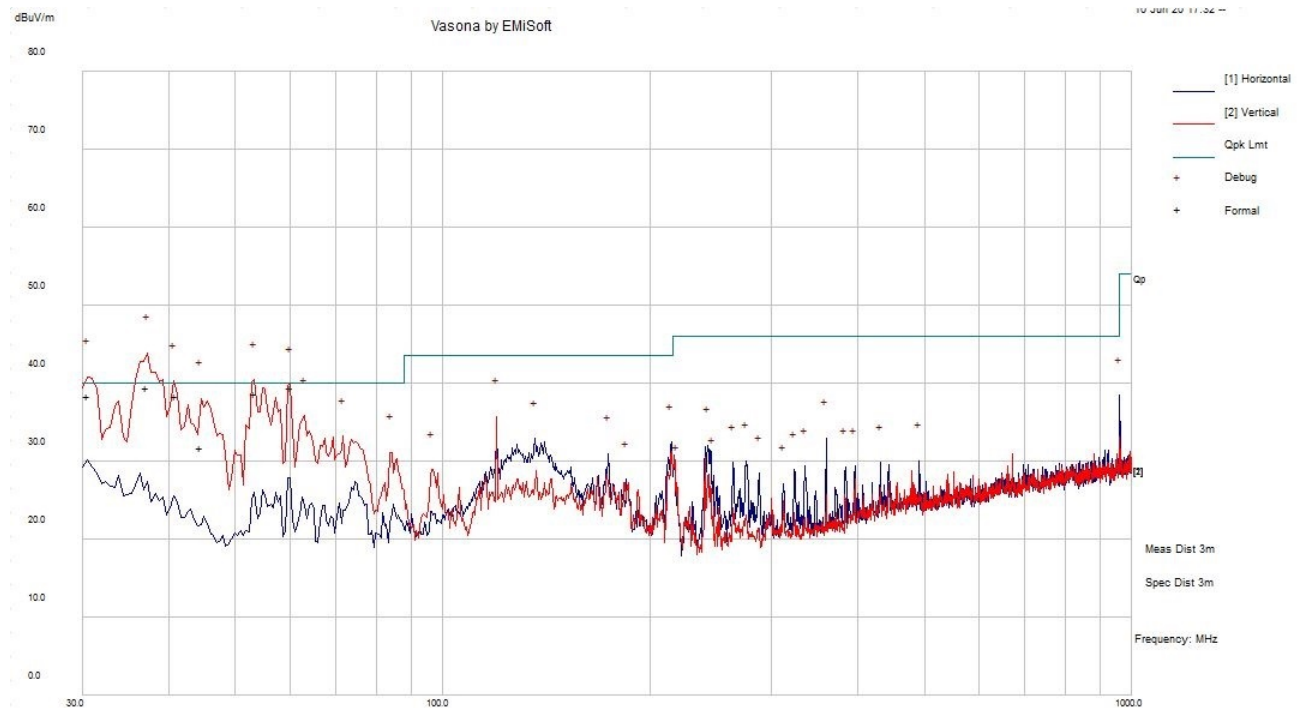
Mode: Transmitting			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Mode, channel
-0.36	2390	Horizontal	g mode, low channel

Please refer to the following table and plots for specific test result details

6.8 Radiated Emissions Test Results

1) 30 MHz – 1 GHz Worst Case, Measured at 3 meters

Worst case



Frequency (MHz)	Corrected Amplitude (dBμV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBμV/m)	Margin (dB)	Comment
37.2185	39.6	103	V	105	40	-0.4	QP
30.5125	38.44	143	V	44	40	-1.56	QP
53.2725	38.7	134	V	316	40	-1.3	QP
40.8605	38.4	101	V	79	40	-1.6	QP
60	39.54	179	V	57	40	-0.46	QP
44.48875	31.72	159	V	214	40	-8.28	QP

2) 1–25 GHz Measured at 3 meters

802.11b mode

Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Low Channel 2412 MHz											
2390	55.36	226	148	H	32.60	6.20	36.34	57.82	74.00	-16.18	PK
2390	43.62	226	148	H	32.60	6.20	36.34	46.08	54.00	-7.92	AV
2390	51.77	242	128	V	32.60	6.20	36.34	54.23	74.00	-19.77	PK
2390	37.15	242	128	V	32.60	6.20	36.34	39.61	54.00	-14.39	AV
4824	44.86	0	100	H	35.00	8.40	35.43	52.83	74.00	-21.17	PK
4824	33.54	0	100	H	35.00	8.40	35.43	41.51	54.00	-12.49	AV
4824	45.98	0	100	V	35.00	8.40	35.43	53.95	74.00	-20.05	PK
4824	33.42	0	100	V	35.00	8.40	35.43	41.39	54.00	-12.61	AV
7236	45.61	0	100	H	36.10	10.56	37.67	54.60	74.00	-19.40	PK
7236	33.82	0	100	H	36.10	10.56	37.67	42.81	54.00	-11.19	AV
7236	45.39	0	100	V	36.10	10.56	37.67	54.38	74.00	-19.62	PK
7236	33.78	0	100	V	36.10	10.56	37.67	42.77	54.00	-11.23	AV
Middle Channel 2437 MHz											
4874	46.25	0	100	H	35.20	8.40	35.43	54.42	74.00	-19.58	PK
4874	34.33	0	100	H	35.20	8.40	35.43	42.50	54.00	-11.50	AV
4874	45.97	0	100	V	35.20	8.40	35.43	54.14	74.00	-19.86	PK
4874	34.28	0	100	V	35.20	8.40	35.43	42.45	54.00	-11.55	AV
7311	45.39	0	100	H	36.10	10.56	37.67	54.38	74.00	-19.62	PK
7311	33.64	0	100	H	36.10	10.56	37.67	42.63	54.00	-11.37	AV
7311	45.9	0	100	V	36.10	10.56	37.67	54.89	74.00	-19.11	PK
7311	33.27	0	100	V	36.10	10.56	37.67	42.26	54.00	-11.74	AV
High Channel 2462 MHz											
2483.5	49.51	198	140	H	33.00	6.20	36.34	52.37	74.00	-21.63	PK
2483.5	38.90	198	140	H	33.00	6.20	36.34	41.76	54.00	-12.24	AV
2483.5	48.29	226	222	V	33.00	6.20	36.34	51.15	74.00	-22.85	PK
2483.5	36.28	226	222	V	33.00	6.20	36.34	39.14	54.00	-14.86	AV
4924	46.07	0	100	H	35.30	8.40	35.43	54.34	74.00	-19.66	PK
4924	34.45	0	100	H	35.30	8.40	35.43	42.72	54.00	-11.28	AV
4924	46.37	0	100	V	35.30	8.40	35.43	54.64	74.00	-19.36	PK
4924	34.38	0	100	V	35.30	8.40	35.43	42.65	54.00	-11.35	AV
7386	45.6	0	100	H	36.10	10.56	37.67	54.59	74.00	-19.41	PK
7386	33.56	0	100	H	36.10	10.56	37.67	42.55	54.00	-11.45	AV
7386	46.09	0	100	V	36.10	10.56	37.67	55.08	74.00	-18.92	PK
7386	33.78	0	100	V	36.10	10.56	37.67	42.77	54.00	-11.23	AV

802.11g mode

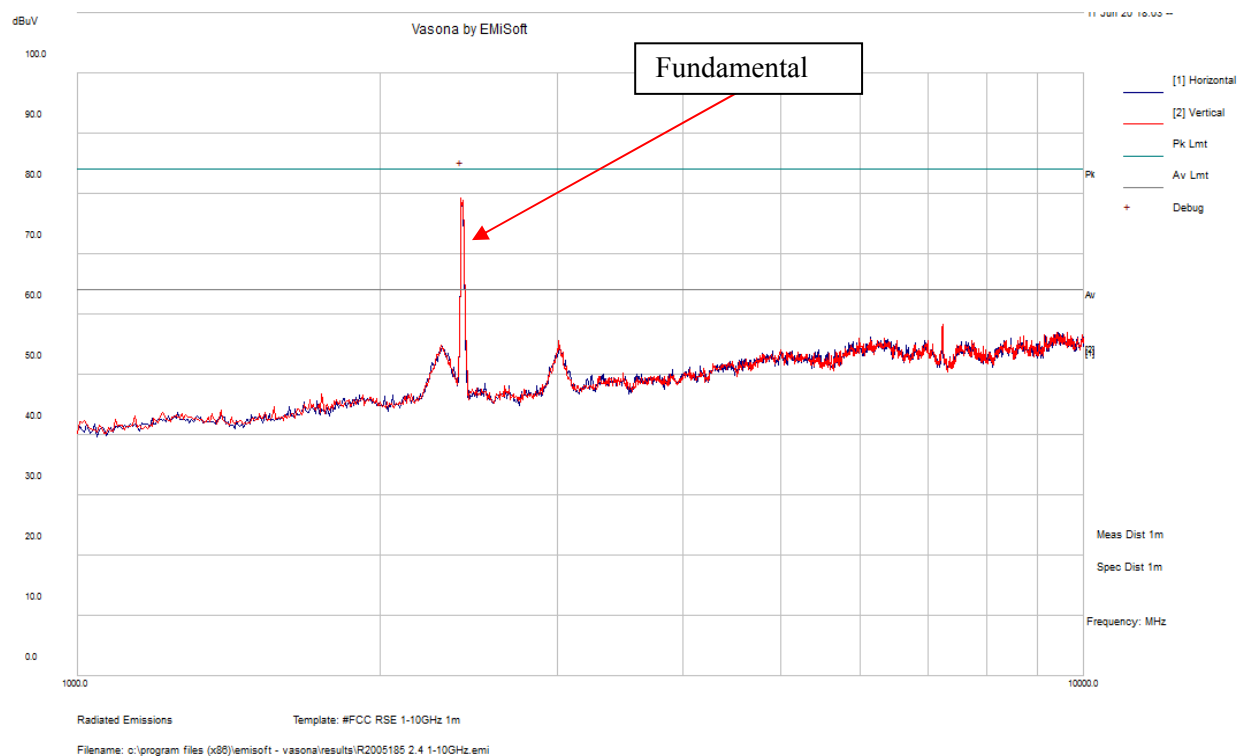
Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Low Channel 2412 MHz											
2390	65.61	226	148	H	32.60	6.20	36.34	68.07	74.00	-5.93	PK
2390	51.18	226	148	H	32.60	6.20	36.34	53.64	54.00	-0.36	AV
2390	58.43	242	128	V	32.60	6.20	36.34	60.89	74.00	-13.11	PK
2390	42.70	242	128	V	32.60	6.20	36.34	45.16	54.00	-8.84	AV
4824	45.39	0	100	H	35.00	8.40	35.43	53.36	74.00	-20.64	PK
4824	33.57	0	100	H	35.00	8.40	35.43	41.54	54.00	-12.46	AV
4824	44.69	0	100	V	35.00	8.40	35.43	52.66	74.00	-21.34	PK
4824	33.36	0	100	V	35.00	8.40	35.43	41.33	54.00	-12.67	AV
7236	45.12	0	100	H	36.10	10.56	37.67	54.11	74.00	-19.89	PK
7236	33.83	0	100	H	36.10	10.56	37.67	42.82	54.00	-11.18	AV
7236	46.418	0	100	V	36.10	10.56	37.67	55.41	74.00	-18.59	PK
7236	33.93	0	100	V	36.10	10.56	37.67	42.92	54.00	-11.08	AV
Middle Channel 2437 MHz											
4874	46.91	0	100	H	35.20	8.40	35.43	55.08	74.00	-18.92	PK
4874	45.06	0	100	H	35.20	8.40	35.43	53.23	54.00	-0.77	AV
4874	45.33	0	100	V	35.20	8.40	35.43	53.50	74.00	-20.50	PK
4874	34.94	0	100	V	35.20	8.40	35.43	43.11	54.00	-10.89	AV
7311	45.09	0	100	H	36.10	10.56	37.67	54.08	74.00	-19.92	PK
7311	33.2	0	100	H	36.10	10.56	37.67	42.19	54.00	-11.81	AV
7311	45.18	0	100	V	36.10	10.56	37.67	54.17	74.00	-19.83	PK
7311	32.87	0	100	V	36.10	10.56	37.67	41.86	54.00	-12.14	AV
High Channel 2462 MHz											
2483.5	65.50	198	140	H	33.00	6.20	36.34	68.36	74.00	-5.64	PK
2483.5	50.75	198	140	H	33.00	6.20	36.34	53.61	54.00	-0.39	AV
2483.5	60.31	212	250	V	33.00	6.20	36.34	63.17	74.00	-10.83	PK
2483.5	45.43	212	250	V	33.00	6.20	36.34	48.29	54.00	-5.71	AV
4924	46.27	0	100	H	35.30	8.40	35.43	54.54	74.00	-19.46	PK
4924	34.11	0	100	H	35.30	8.40	35.43	42.38	54.00	-11.62	AV
4924	45.44	0	100	V	35.30	8.40	35.43	53.71	74.00	-20.29	PK
4924	34.21	0	100	V	35.30	8.40	35.43	42.48	54.00	-11.52	AV
7386	44.57	0	100	H	36.10	10.56	37.67	53.56	74.00	-20.44	PK
7386	33.51	0	100	H	36.10	10.56	37.67	42.50	54.00	-11.50	AV
7386	44.38	0	100	V	36.10	10.56	37.67	53.37	74.00	-20.63	PK
7386	33.63	0	100	V	36.10	10.56	37.67	42.62	54.00	-11.38	AV

802.11n20 mode

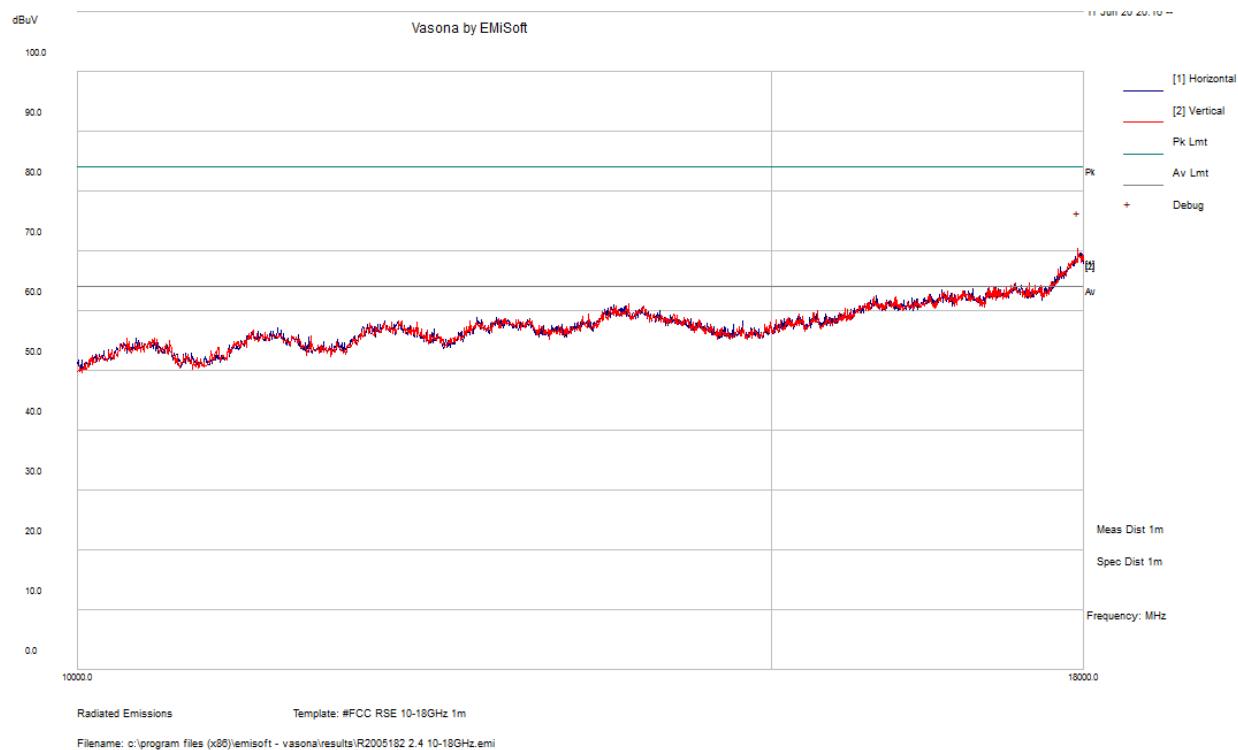
Frequency (MHz)	S.A. Reading (dBμV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre- Amp. (dB)	Cord. Reading (dBμV/m)	FCC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBμV/m)	Margin (dB)	
Low Channel 2412 MHz											
2390	70.45	226	148	H	32.60	6.20	36.34	72.91	74.00	-1.09	PK
2390	51.15	226	148	H	32.60	6.20	36.34	53.61	54.00	-0.39	AV
2390	64.75	242	128	V	32.60	6.20	36.34	67.21	74.00	-6.79	PK
2390	45.03	242	128	V	32.60	6.20	36.34	47.49	54.00	-6.51	AV
4824	44.81	0	100	H	35.00	8.40	35.43	52.78	74.00	-21.22	PK
4824	33.39	0	100	H	35.00	8.40	35.43	41.36	54.00	-12.64	AV
4824	45.05	0	100	V	35.00	8.40	35.43	53.02	74.00	-20.98	PK
4824	33.92	0	100	V	35.00	8.40	35.43	41.89	54.00	-12.11	AV
7236	46.21	0	100	H	36.10	10.56	37.67	55.20	74.00	-18.80	PK
7236	33.12	0	100	H	36.10	10.56	37.67	42.11	54.00	-11.89	AV
7236	45.91	0	100	V	36.10	10.56	37.67	54.90	74.00	-19.10	PK
7236	33.31	0	100	V	36.10	10.56	37.67	42.30	54.00	-11.70	AV
Middle Channel 2437 MHz											
4874	55.89	0	100	H	35.20	8.40	35.43	64.06	74.00	-9.94	PK
4874	42.60	0	100	H	35.20	8.40	35.43	50.77	54.00	-3.23	AV
4874	57.41	0	100	V	35.20	8.40	35.43	65.58	74.00	-8.42	PK
4874	43.62	0	100	V	35.20	8.40	35.43	51.79	54.00	-2.21	AV
7311	44.9	0	100	H	36.10	10.56	37.67	53.89	74.00	-20.11	PK
7311	33.51	0	100	H	36.10	10.56	37.67	42.50	54.00	-11.50	AV
7311	45.68	0	100	V	36.10	10.56	37.67	54.67	74.00	-19.33	PK
7311	33.91	0	100	V	36.10	10.56	37.67	42.90	54.00	-11.10	AV
High Channel 2462 MHz											
2483.5	70.12	198	140	H	33.00	6.20	36.34	72.98	74.00	-1.02	PK
2483.5	50.28	198	140	H	33.00	6.20	36.34	53.14	54.00	-0.86	AV
2483.5	62.69	212	250	V	33.00	6.20	36.34	65.55	74.00	-8.45	PK
2483.5	45.20	212	250	V	33.00	6.20	36.34	48.06	54.00	-5.94	AV
4924	45.38	0	100	H	35.30	8.40	35.43	53.65	74.00	-20.35	PK
4924	34.23	0	100	H	35.30	8.40	35.43	42.50	54.00	-11.50	AV
4924	45.08	0	100	V	35.30	8.40	35.43	53.35	74.00	-20.65	PK
4924	33.29	0	100	V	35.30	8.40	35.43	41.56	54.00	-12.44	AV
7386	45.48	0	100	H	36.10	10.56	37.67	54.47	74.00	-19.53	PK
7386	33.64	0	100	H	36.10	10.56	37.67	42.63	54.00	-11.37	AV
7386	44.72	0	100	V	36.10	10.56	37.67	53.71	74.00	-20.29	PK
7386	33.19	0	100	V	36.10	10.56	37.67	42.18	54.00	-11.82	AV

Note 1: pre-scanned each antenna and the final testing were done on the worst case antenna.

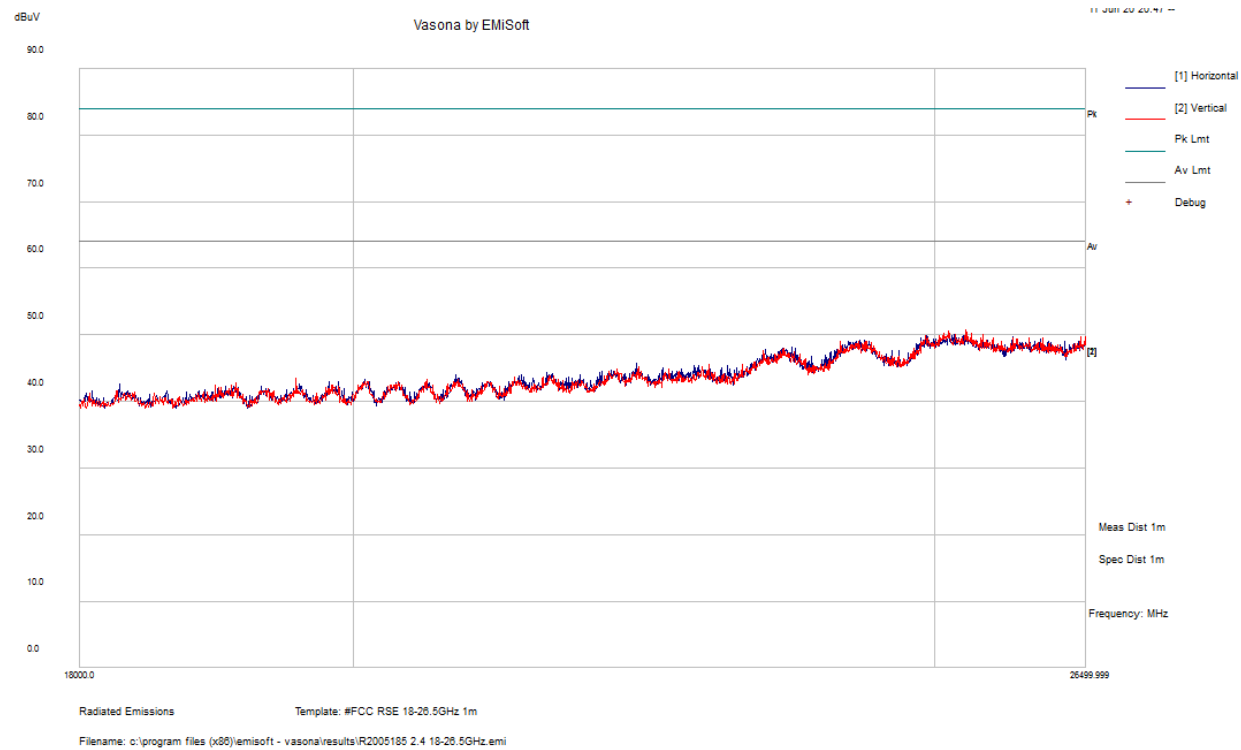
3) 1 – 10 GHz graph at 1 meter



3) 10 – 18 GHz graph at 1 meter



3) 18 – 26.5 GHz graph at 1 meter



7 FCC §15.247(a) (2) - Emission Bandwidth

7.1 Applicable Standards

According to ECFR §15.247(a) (2), systems using digital modulation techniques may operate in the 902~928 MHz, 2400~2483.5 MHz, and 5725~5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz

7.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v04: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 8: DTS bandwidth

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2020-04-29	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.

7.4 Test Environmental Conditions

Temperature:	23° C
Relative Humidity:	42 %
ATM Pressure:	101.5 KPa

The testing was performed by Zhao Zhao on 2020-06-02 in RF site.

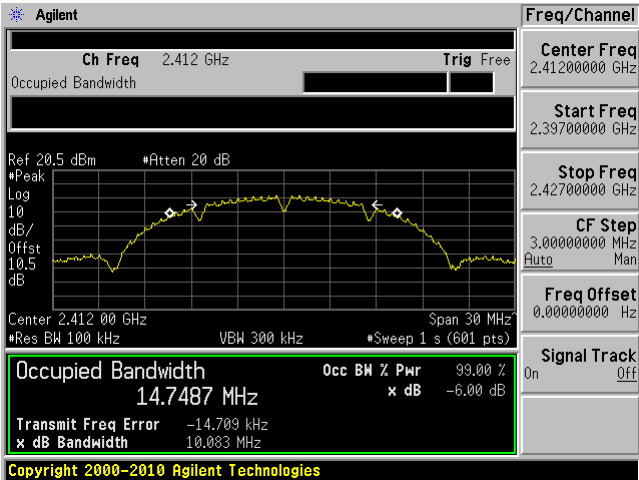
7.5 Test Results

Channel	Frequency (MHz)	99% OBW (kHz)	6 dB OBW (kHz)	6 dB OBW limit (kHz)
802.11b mode				
Low	2412	14776.8	10083	≥ 500
Middle	2437	14699.6	10077	≥ 500
High	2462	14712.0	10079	≥ 500
802.11g mode				
Low	2412	16536.0	16504	≥ 500
Middle	2437	16566.5	16502	≥ 500
High	2462	16566.5	16504	≥ 500
802.11n20 mode				
Low	2412	17761.4	17656	≥ 500
Middle	2437	17696.2	17662	≥ 500
High	2462	17685.2	17636	≥ 500

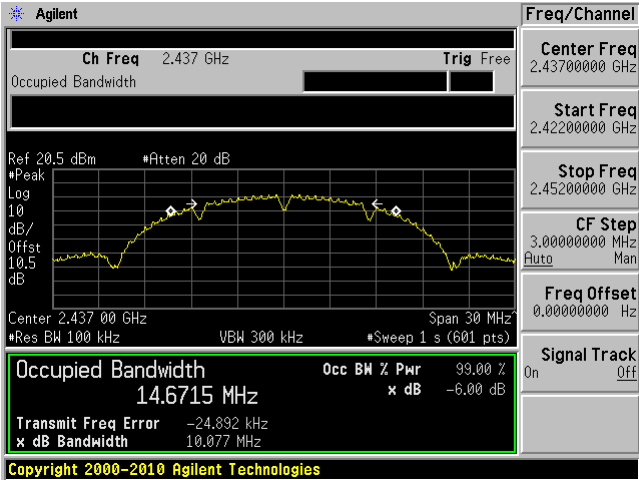
Please refer to the following plots for detailed test results

6 dB Occupied Bandwidth
802.11b mode

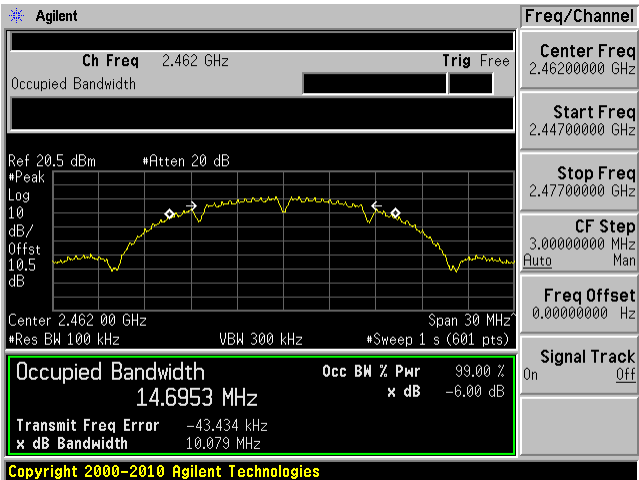
Low Channel 2412 MHz



Middle Channel 2437 MHz

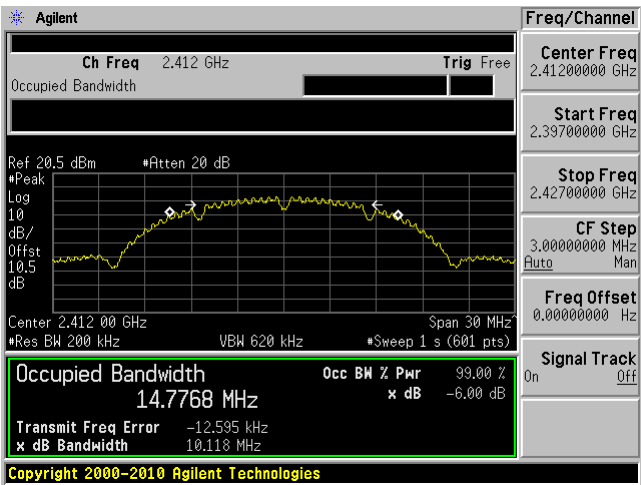


High Channel 2462 MHz

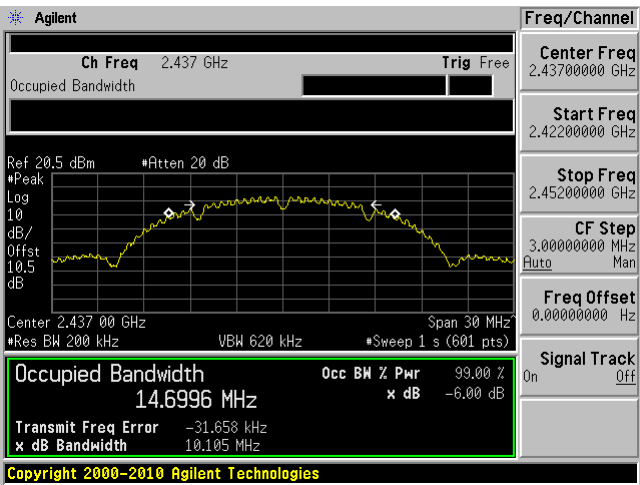


99% Occupied Bandwidth
802.11b mode

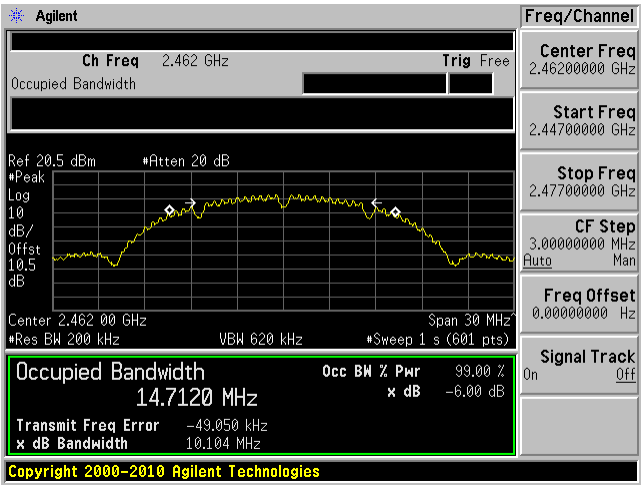
Low Channel 2412 MHz



Middle Channel 2437 MHz



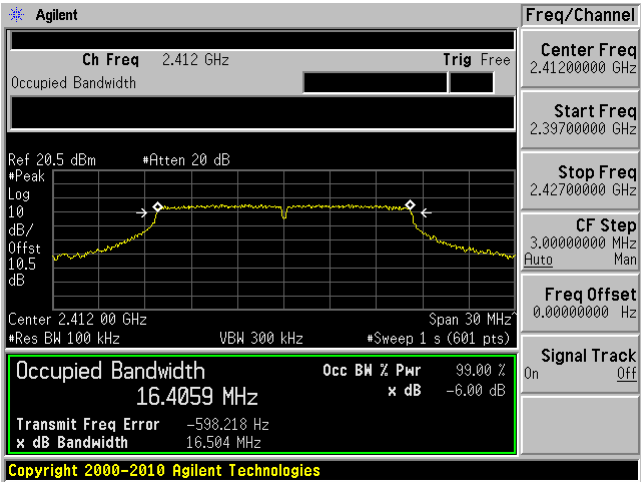
High Channel 2462 MHz



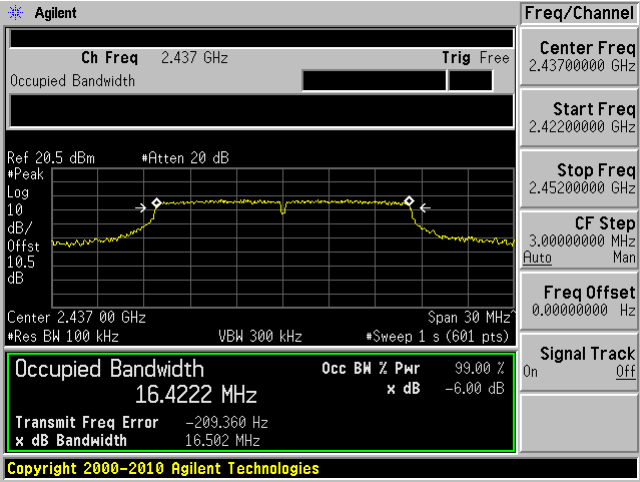
6 dB Occupied Bandwidth

802.11g mode

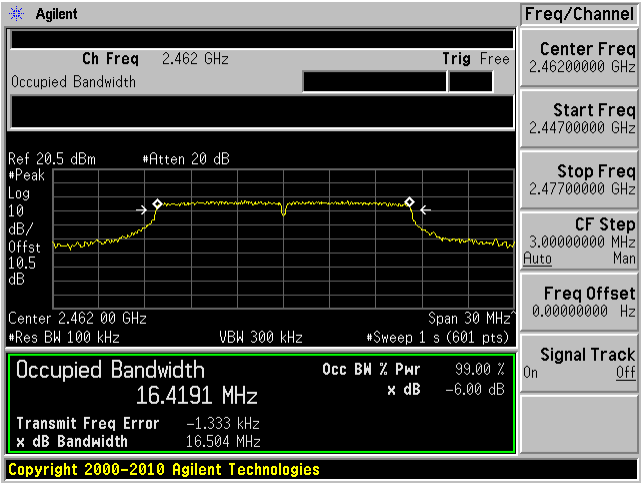
Low Channel 2412 MHz



Middle Channel 2437 MHz

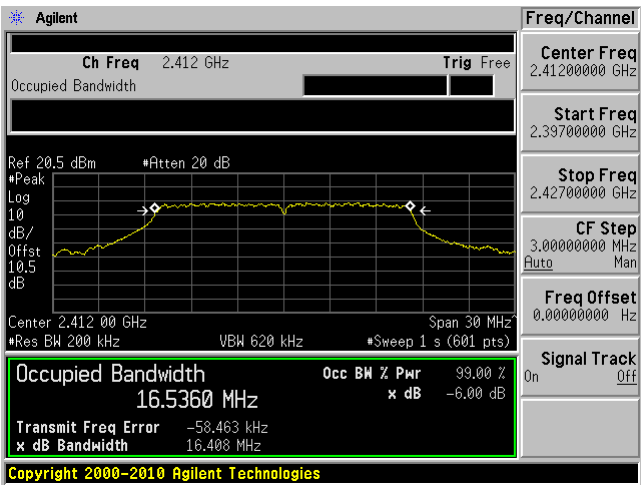


High Channel 2462 MHz

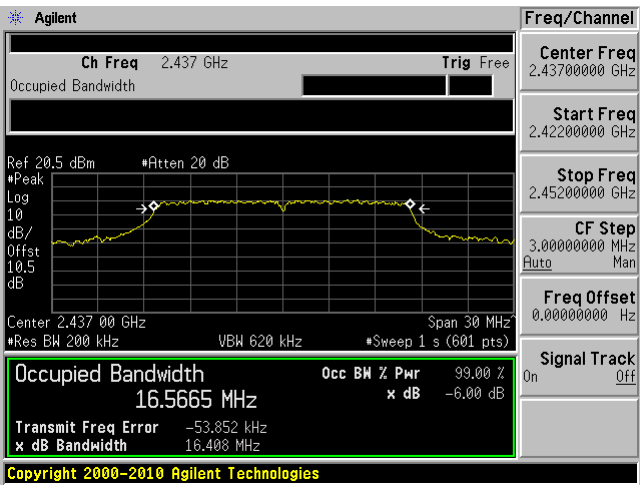


99% Occupied Bandwidth
802.11g mode

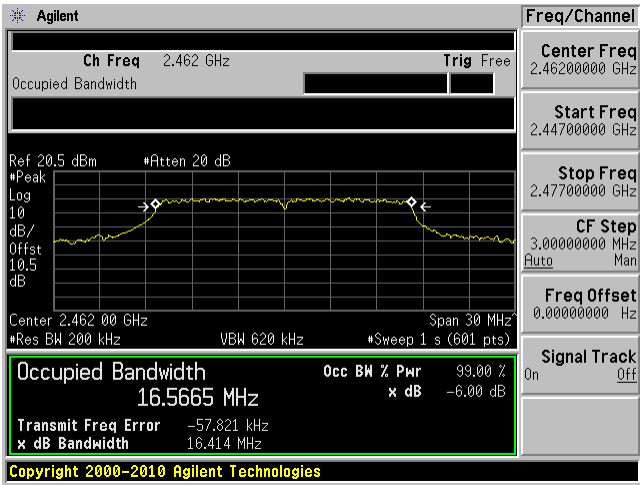
Low Channel 2412 MHz



Middle Channel 2437 MHz



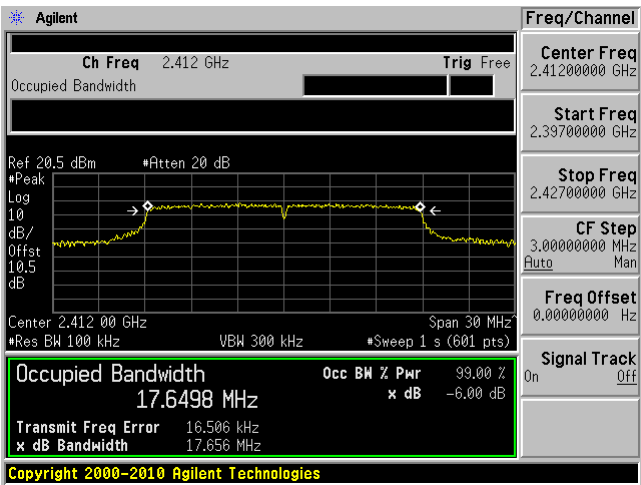
High Channel 2462 MHz



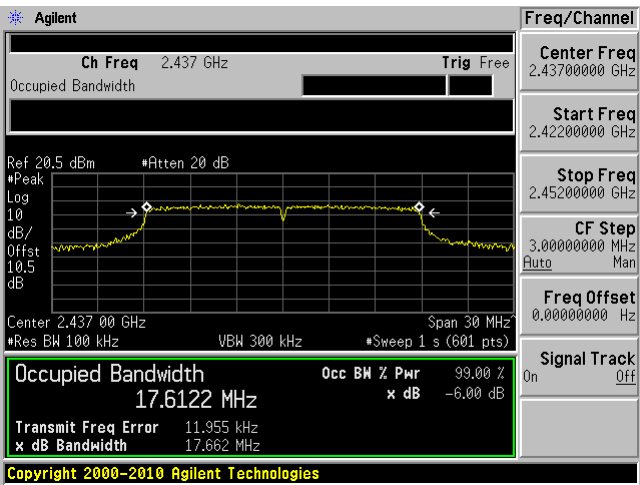
6 dB Occupied Bandwidth

802.11n20 mode

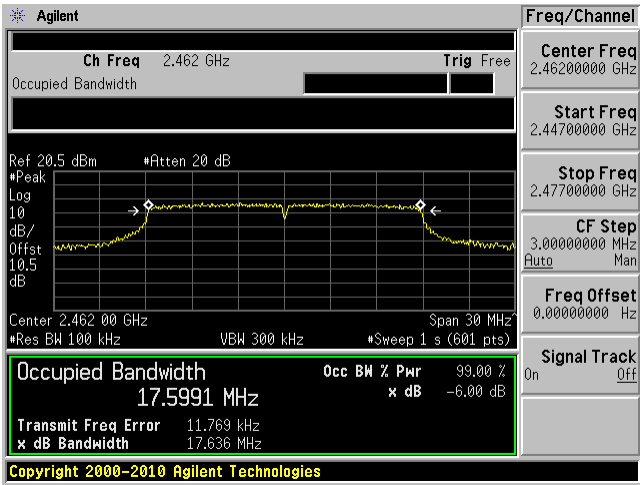
Low Channel 2412 MHz



Middle Channel 2437 MHz



High Channel 2462 MHz

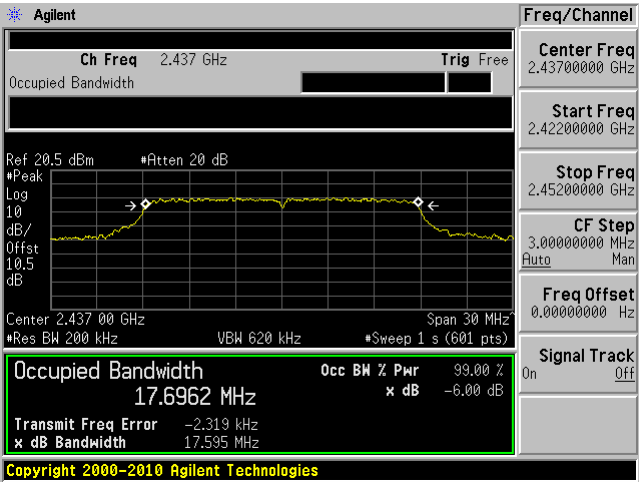
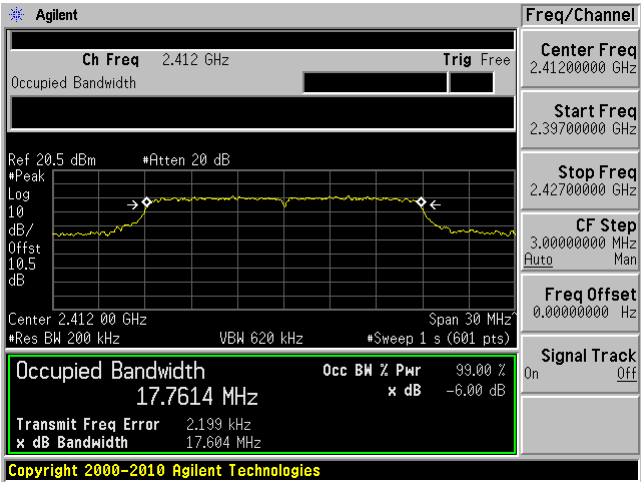


99% Occupied Bandwidth

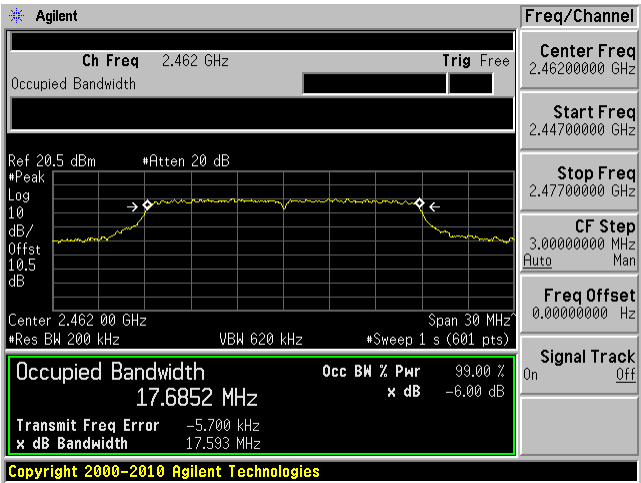
802.11n20 mode

Low Channel 2412 MHz

Middle Channel 2437 MHz



High Channel 2462 MHz



8 FCC §15.247(b) (3) - Output Power Measurement

8.1 Applicable Standards

According to ECFR §15.247(b) (3) for systems using digital modulation in the 902~928 MHz, 2400~2483.5 MHz, and 5725~5850 MHz bands: 1 Watt.

8.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v04: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 9: Fundamental emission output power

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008K39-101203-UW	2019-08-06	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.

8.4 Test Environmental Conditions

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

The testing was performed by Christopher Casteel from 2020-05-26 to 2020-06-16 in RF site.

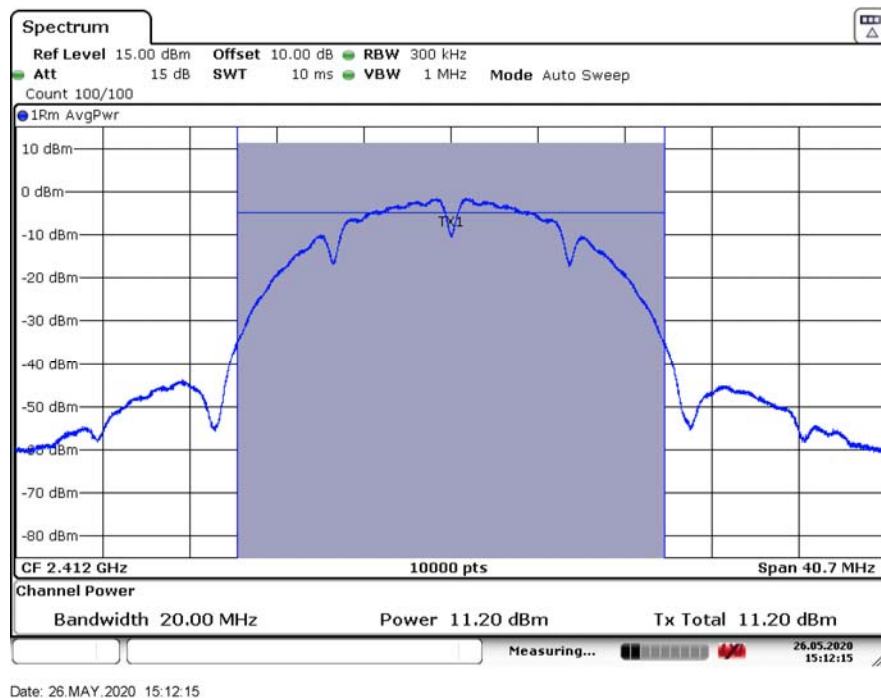
8.5 Test Results

Average Output Power

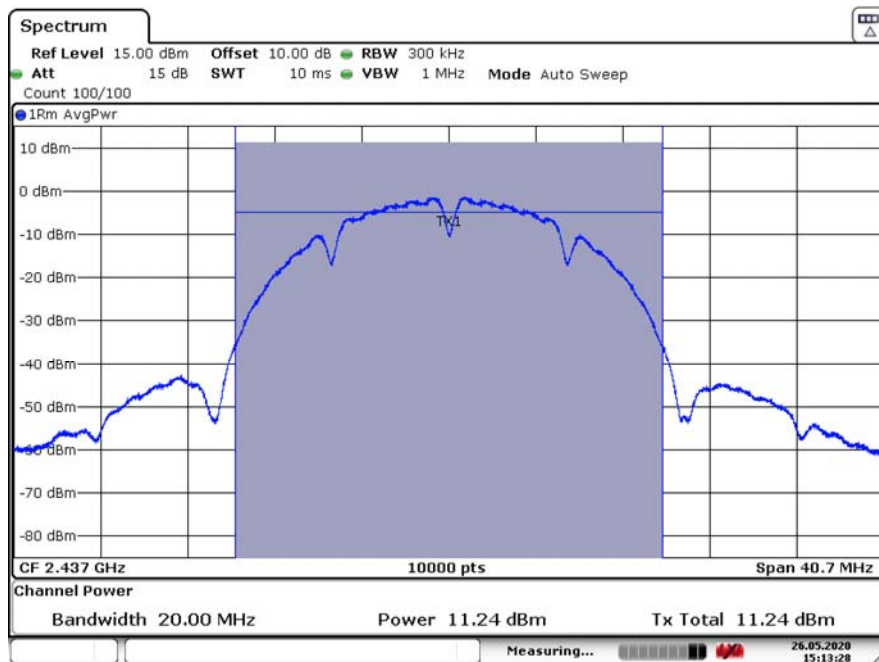
Channel	Frequency (MHz)	Conducted Average Power (dBm)	Limit (dBm)
802.11b mode			
Low	2412	11.2	30
Middle	2437	11.24	30
High	2462	11.18	30
802.11g mode			
Low	2412	9.60	30
Middle	2437	11.25	30
High	2462	11.13	30
802.11n20 mode			
Low	2412	9.12	30
Middle	2437	11.21	30
High	2462	10.16	30

Please refer to the following plots for detailed test results

2412 MHz, 802.11b mode

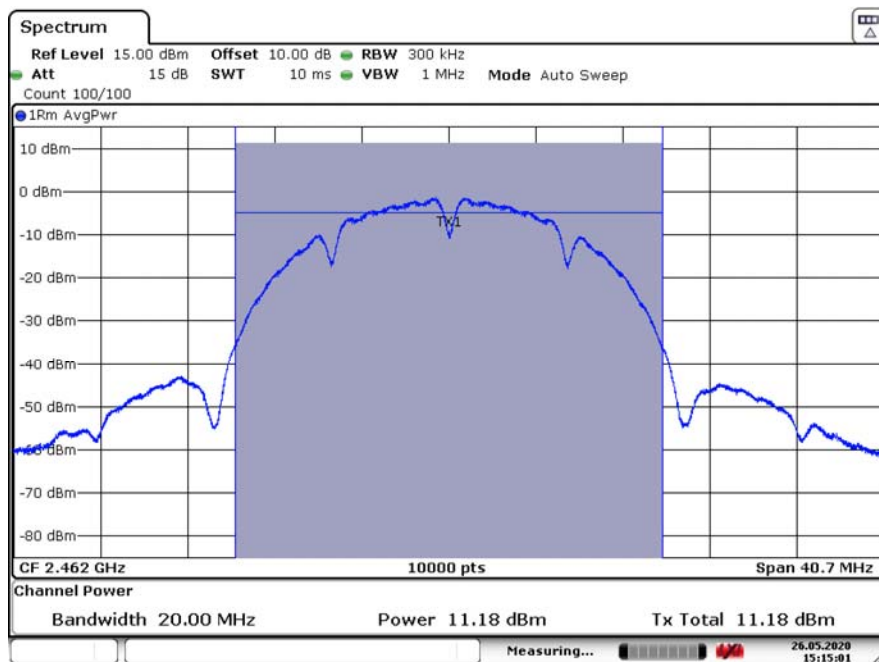


2437 MHz, 802.11b mode



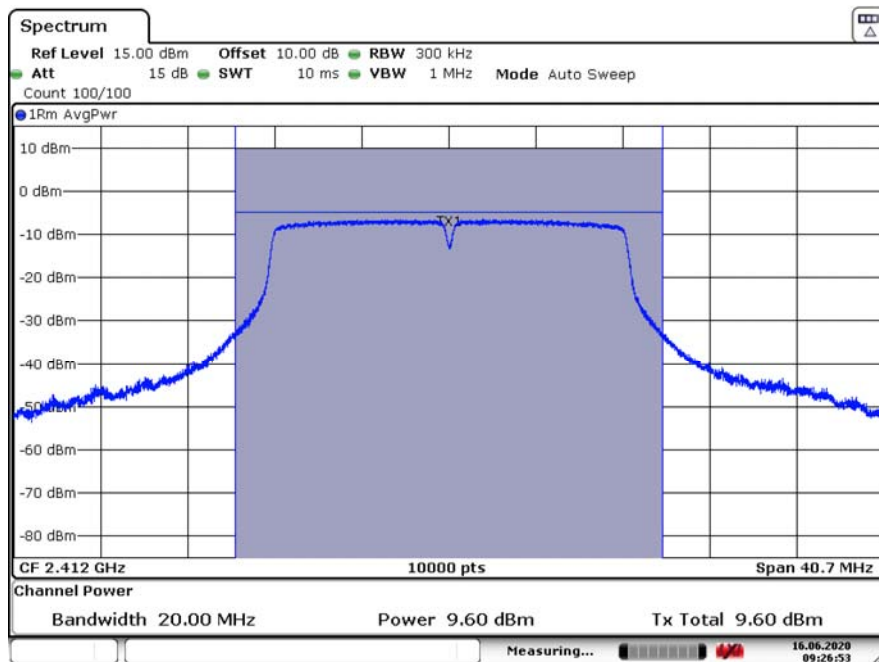
Date: 26 MAY 2020 15:13:28

2462 MHz, 802.11b mode



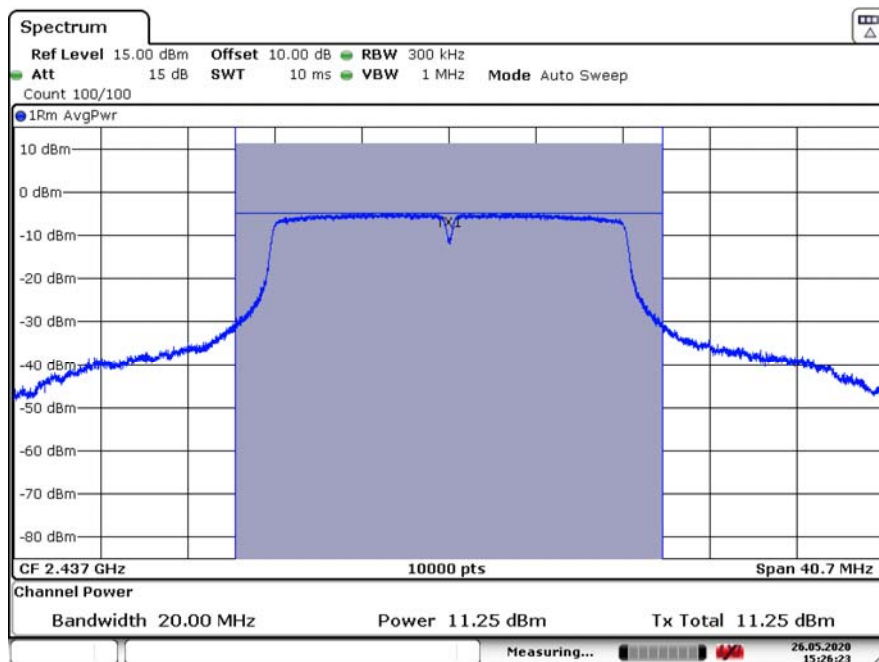
Date: 26 MAY 2020 15:15:02

2412 MHz, 802.11g mode

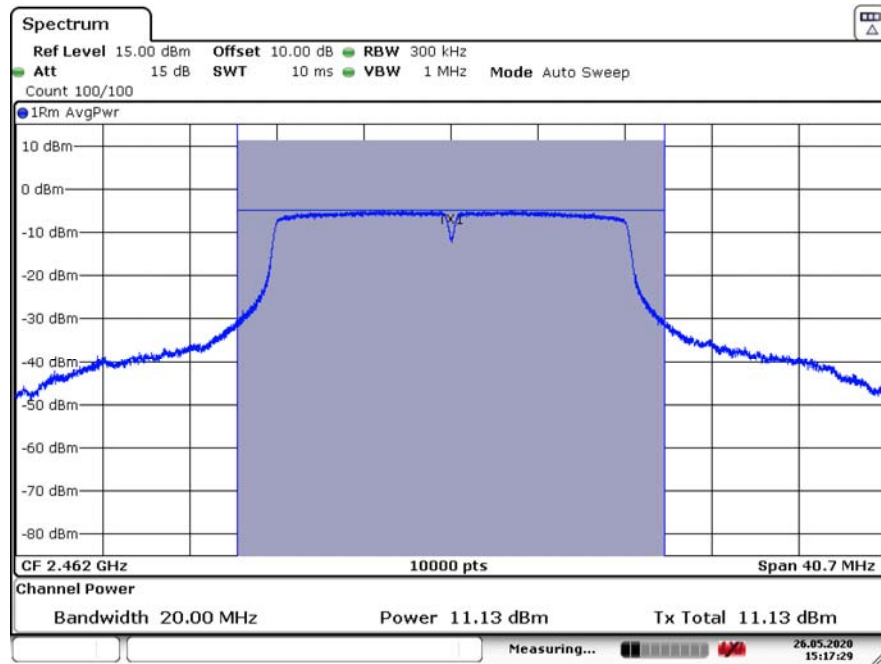


Date: 16 JUN 2020 09:26:53

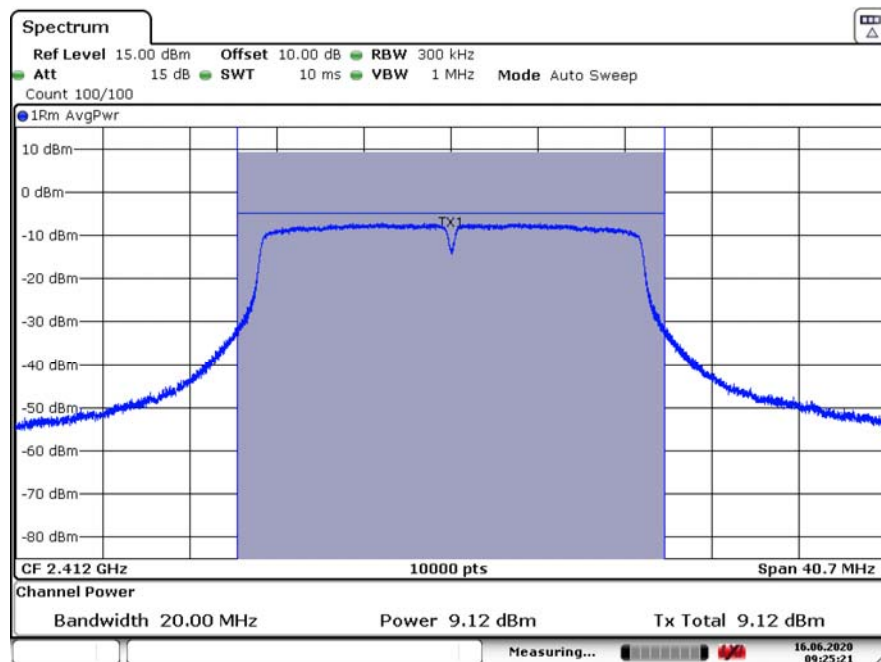
2437 MHz, 802.11g mode



Date: 26 MAY 2020 15:26:23

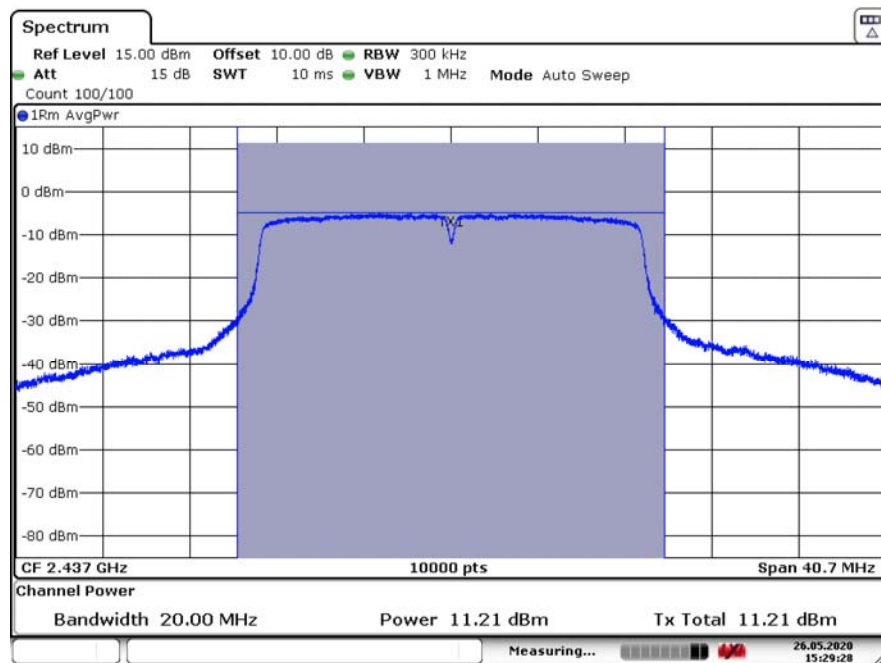
2462 MHz, 802.11g mode

Date: 26.MAY.2020 15:17:29

2412 MHz, 802.11n20 mode

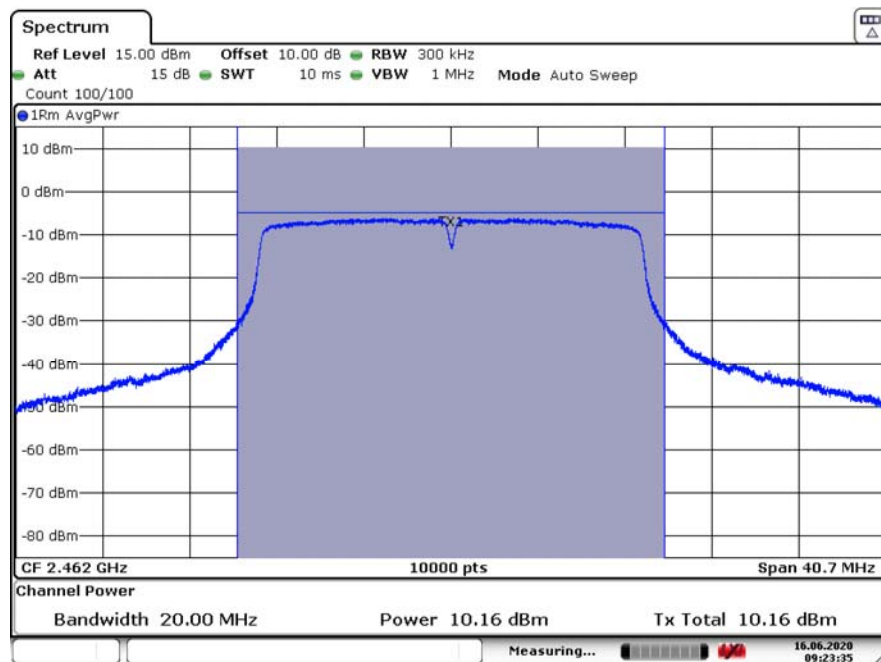
Date: 16.JUN.2020 09:25:22

2437 MHz, 802.11n20 mode



Date: 26 MAY 2020 15:29:29

2462 MHz, 802.11n20 mode



Date: 16 JUN 2020 09:23:35

9 FCC §15.247(d) - 100 kHz Bandwidth of Band Edges

9.1 Applicable Standards

According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emissions limits specified in §15.209(a) see §15.205(c).

9.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v04: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 13: Band-edge measurements

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2020-04-29	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

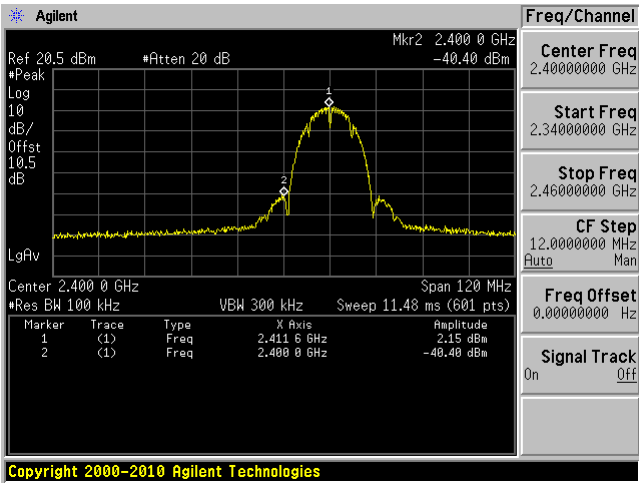
Temperature:	23° C
Relative Humidity:	42 %
ATM Pressure:	101.5 KPa

The testing was performed by Zhao Zhao on 2020-06-02 in RF site.

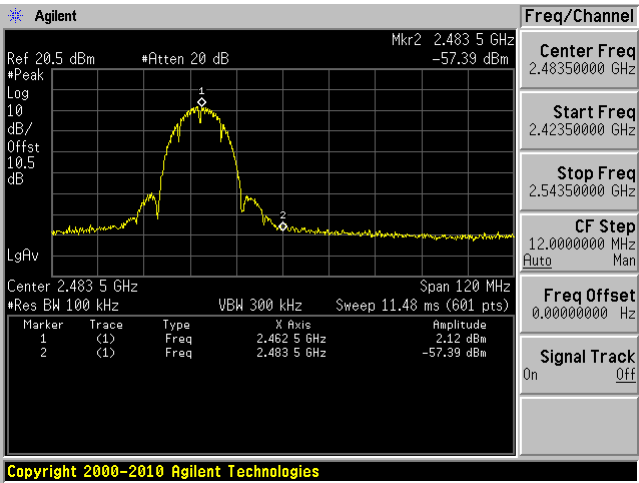
9.5 Test Results

802.11b mode

Low Channel 2412 MHz

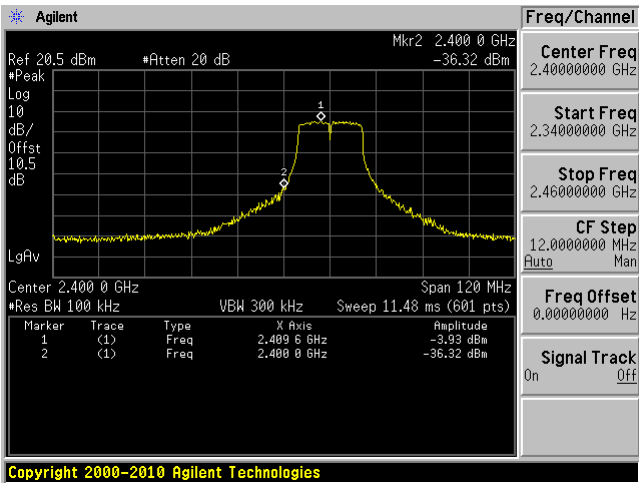


High Channel 2462 MHz

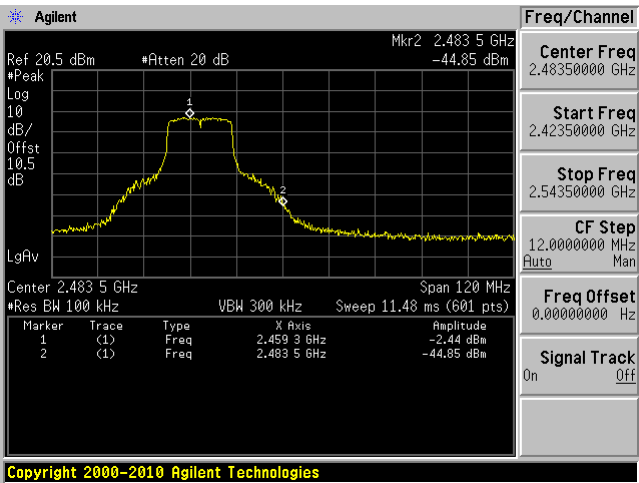


802.11g mode

Low Channel 2412 MHz

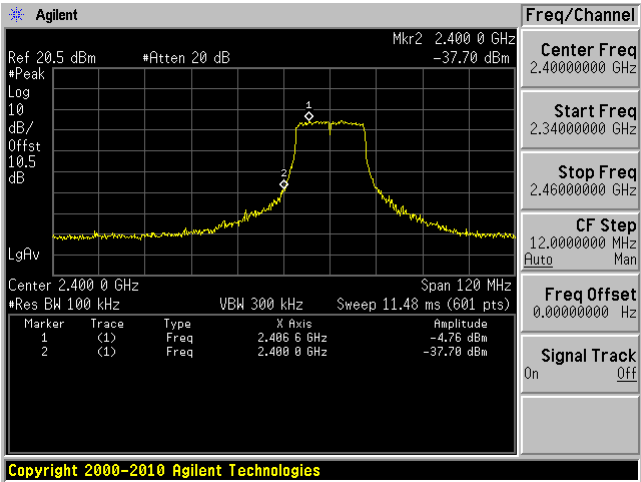


High Channel 2462 MHz

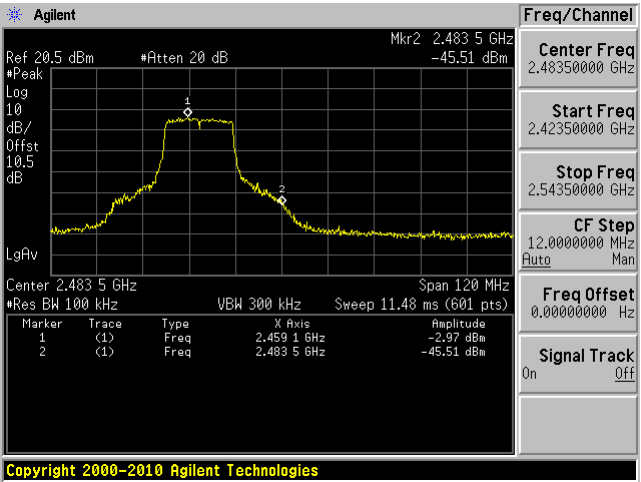


802.11 n20 mode

Low Channel 2412 MHz



High Channel 2462 MHz



10 FCC §15.247(e) - Power Spectral Density

10.1 Applicable Standards

According to ECFR §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

10.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v04: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 10: Maximum power spectral density level in the fundamental emission.

10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2020-04-29	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:	23° C
Relative Humidity:	42 %
ATM Pressure:	101.5 KPa

The testing was performed by Zhao Zhao on 2020-06-02 in RF site.

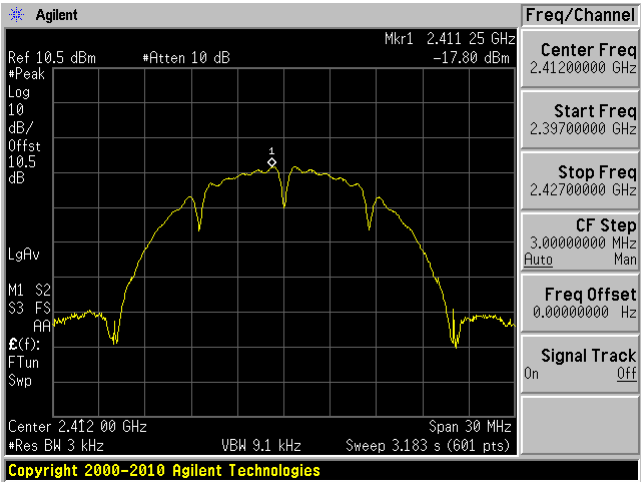
10.5 Test Results

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
802.11b mode			
Low	2412	-17.80	8
Middle	2437	-17.73	8
High	2462	-17.79	8
802.11g mode			
Low	2412	-18.56	8
Middle	2437	-16.38	8
High	2462	-16.71	8
802.11n20 mode			
Low	2412	-18.65	8
Middle	2437	-16.47	8
High	2462	-17.68	8

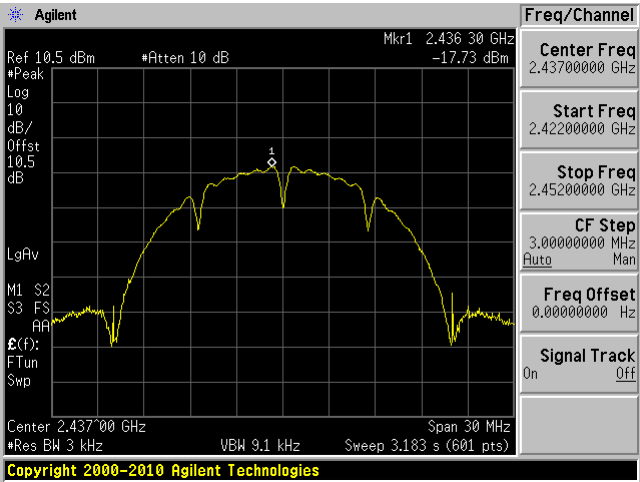
Please refer to the following plots for detailed test results

802.11b mode

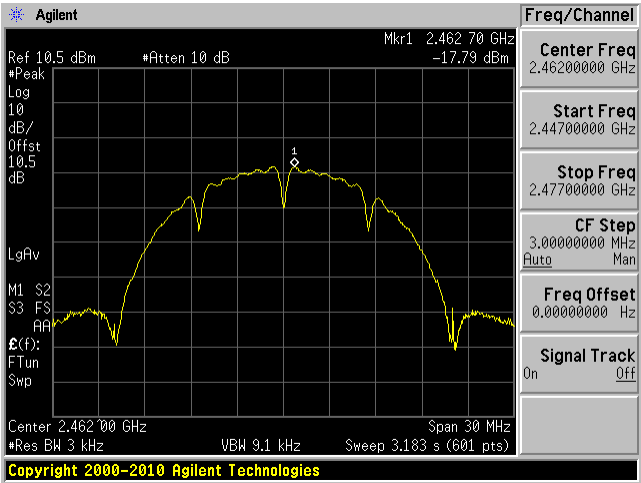
Low Channel 2412 MHz



Middle Channel 2437 MHz

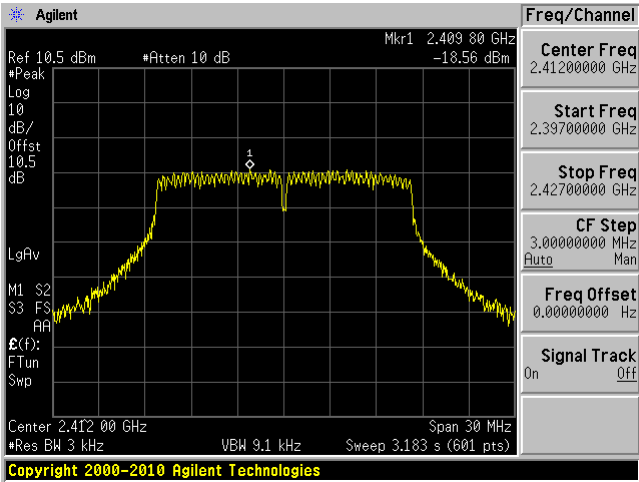


High Channel 2462 MHz

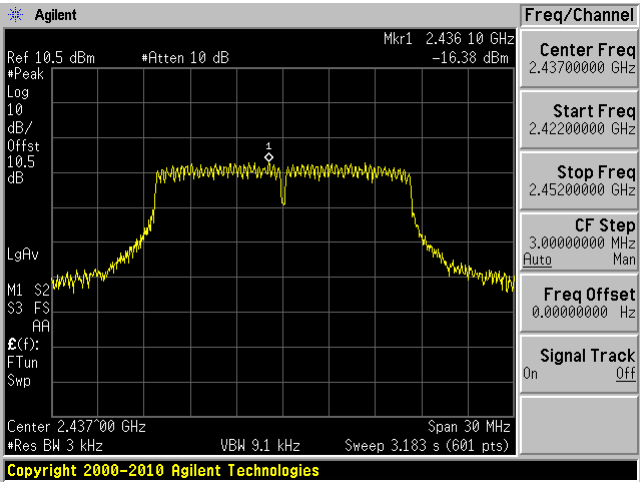


802.11g mode

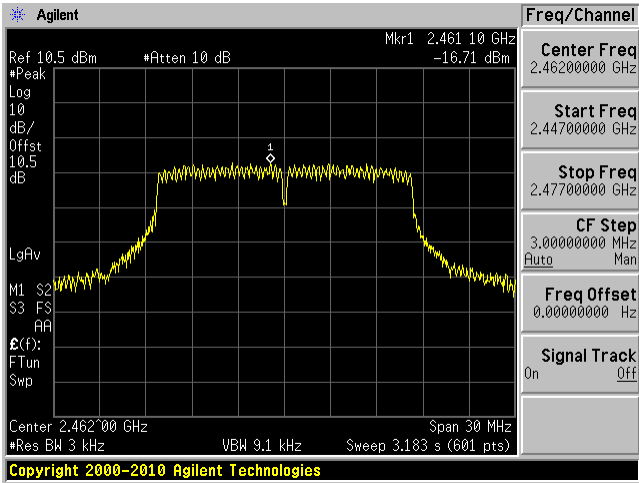
Low Channel 2412 MHz



Middle Channel 2437 MHz

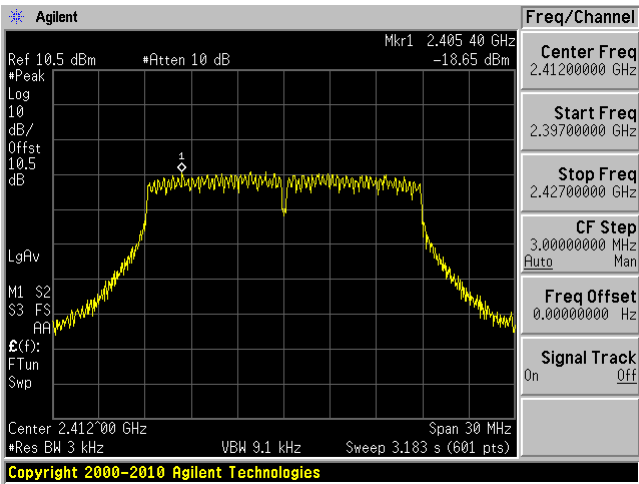


High Channel 2462 MHz

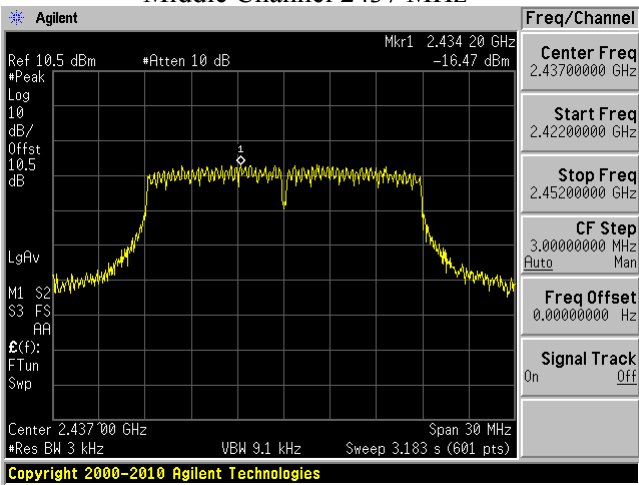


802.11n20 mode

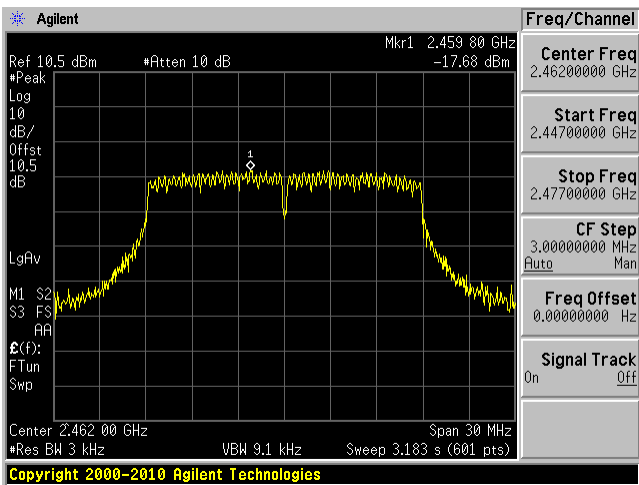
Low Channel 2412 MHz



Middle Channel 2437 MHz



High Channel 2462 MHz



11 FCC §15.247(d) - Spurious Emissions at Antenna Terminals

11.1 Applicable Standards

For FCC §15.247(d) in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

11.2 Test Procedure

The RF output of the EUT was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

11.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4440A	US45303156	2020-04-29	1 year
-	RF Cable	-	-	Each time ¹	N/A
-	10dB attenuator	-	-	Each time ¹	N/A

Note¹: cable and attenuator included in the test set-up will be checked each time before testing.

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

11.4 Test Environmental Conditions

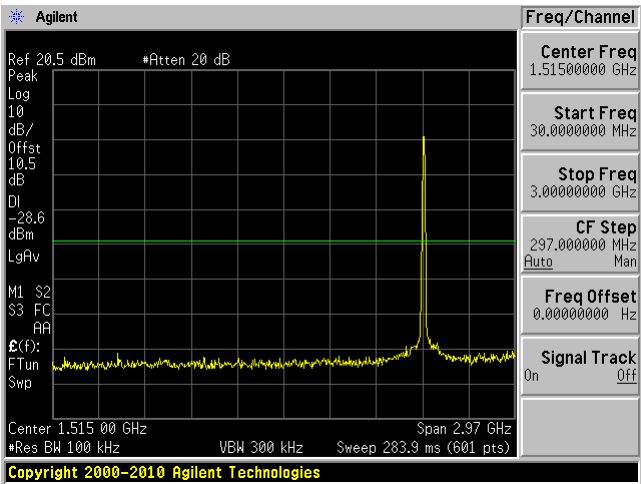
Temperature:	23° C
Relative Humidity:	42 %
ATM Pressure:	101.5 KPa

The testing was performed by Zhao Zhao on 2020-06-02 in RF site.

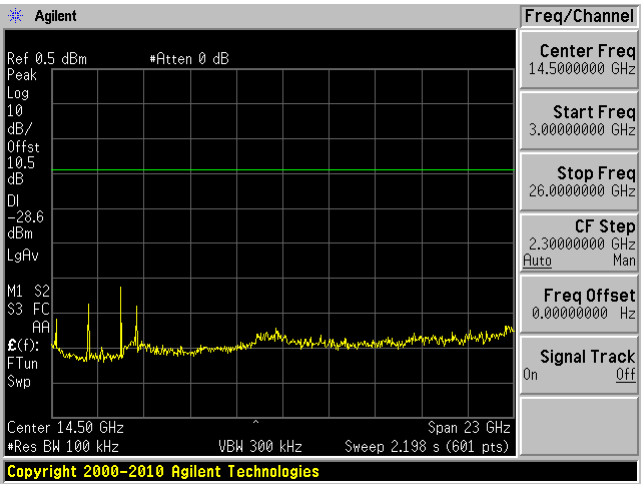
11.5 Test Results

802.11b mode

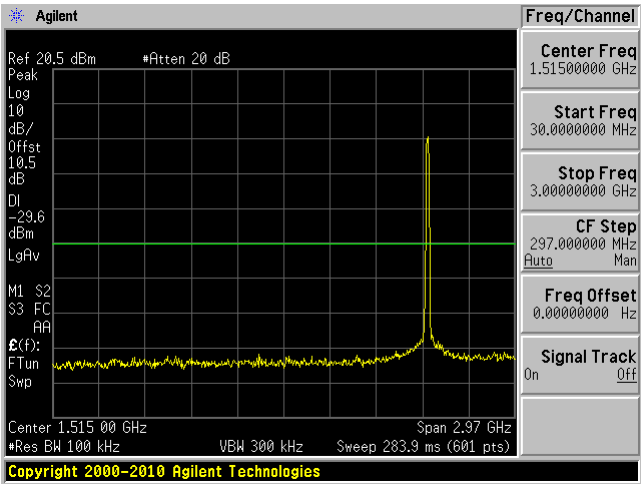
Low Channel 30 MHz – 3 GHz



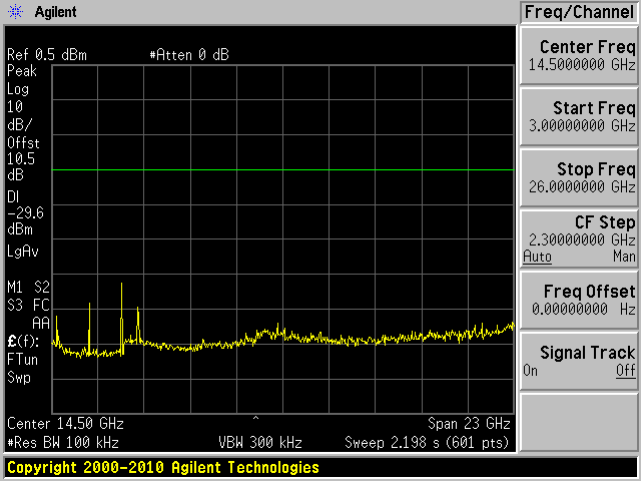
Low Channel 3 GHz – 26 GHz



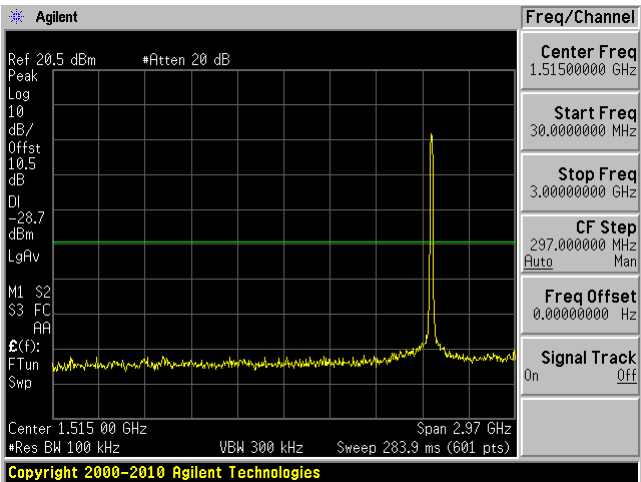
Middle Channel 30 MHz – 3 GHz



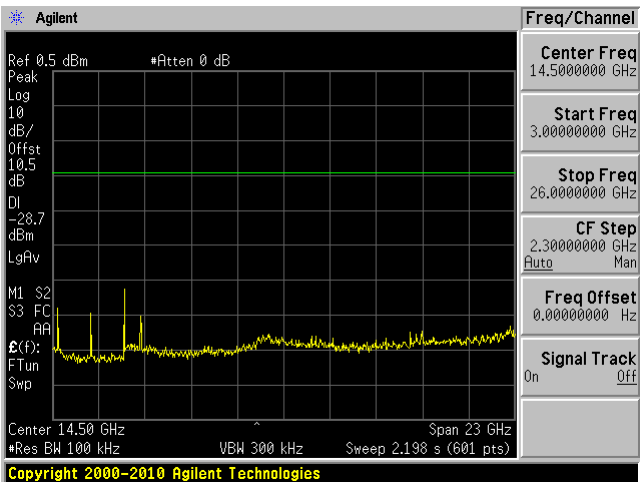
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz

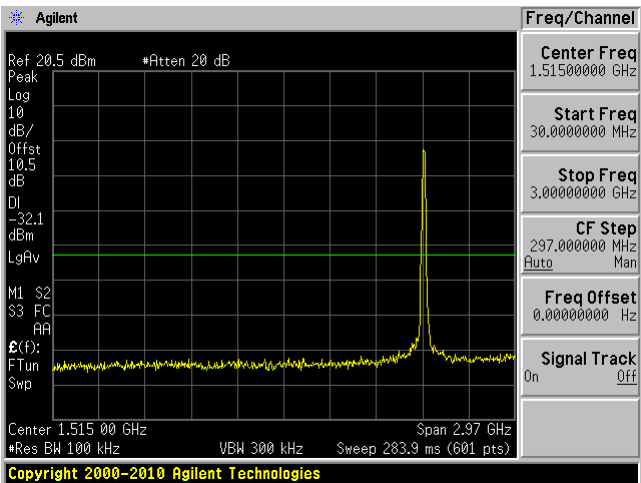


High Channel 3 GHz – 26 GHz

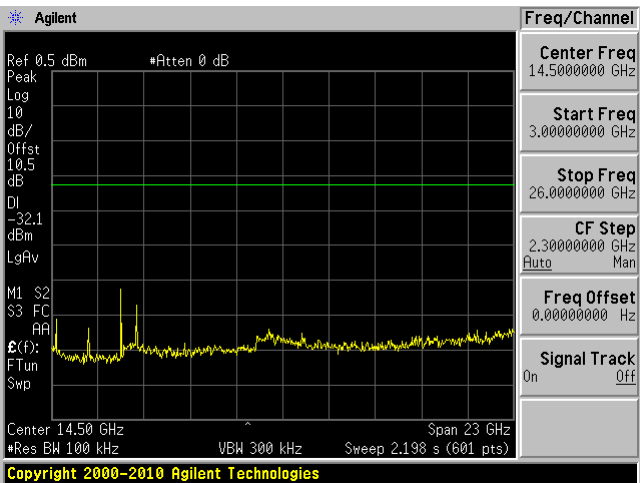


802.11g mode

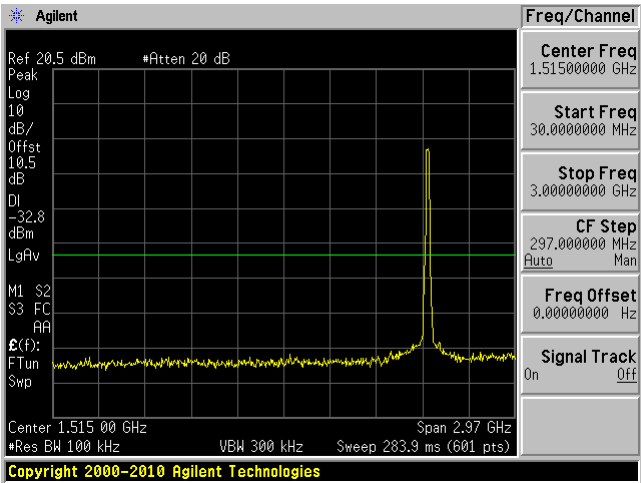
Low Channel 30 MHz – 3 GHz



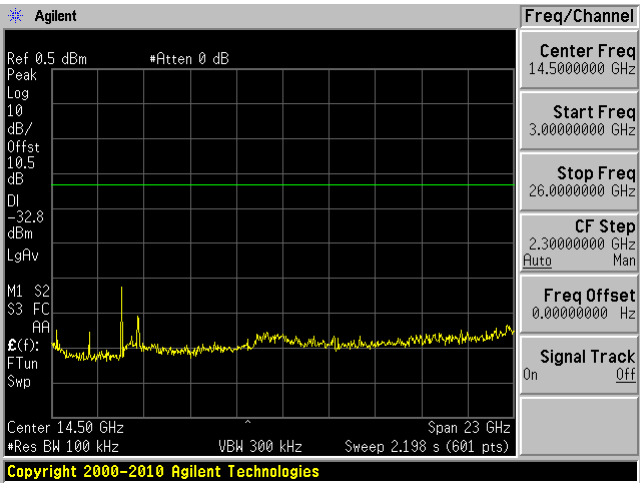
Low Channel 3 GHz – 26 GHz



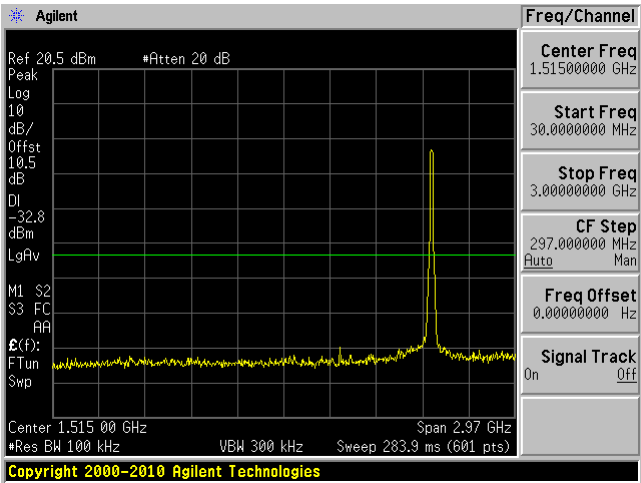
Middle Channel 30 MHz – 3 GHz



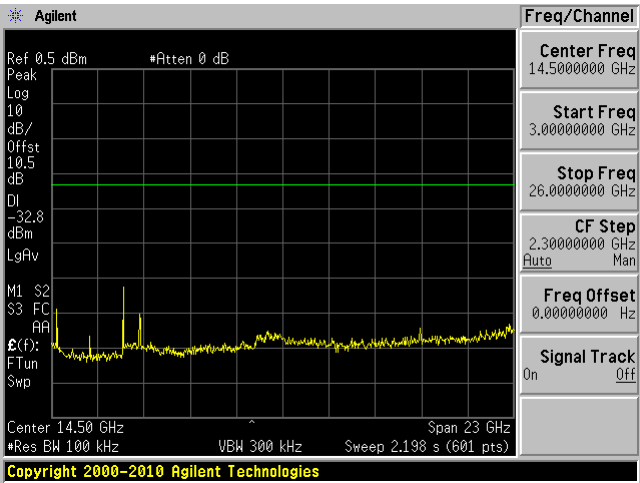
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz

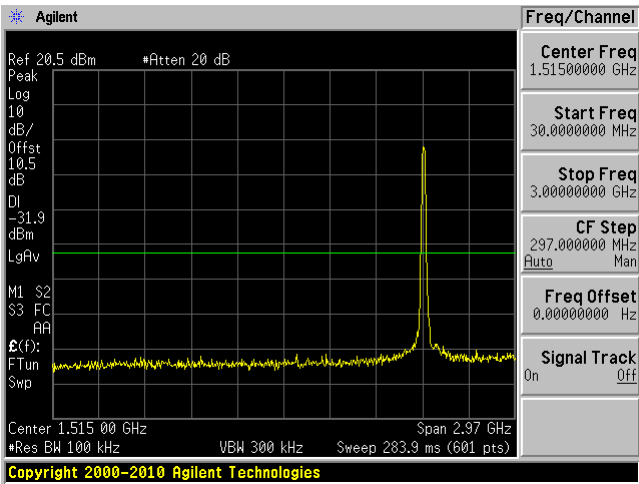


High Channel 3 GHz – 26 GHz

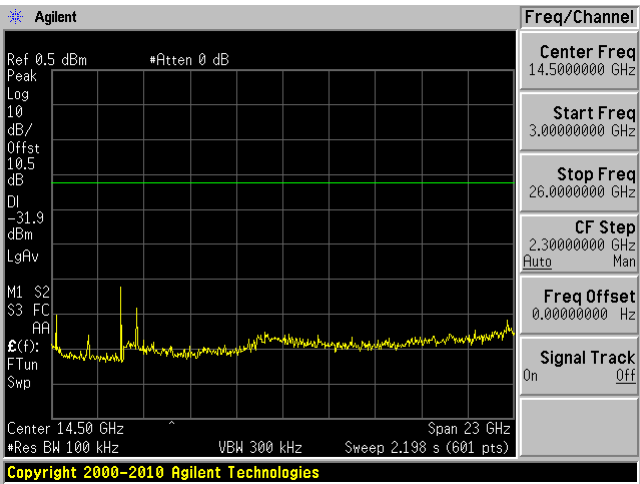


802.11n20 mode

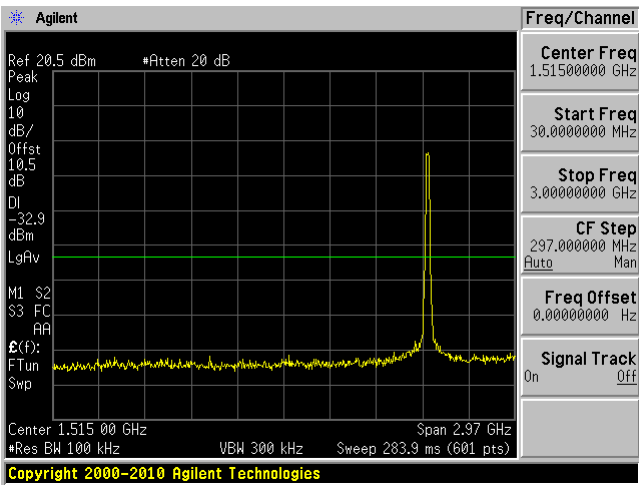
Low Channel 30 MHz – 3 GHz



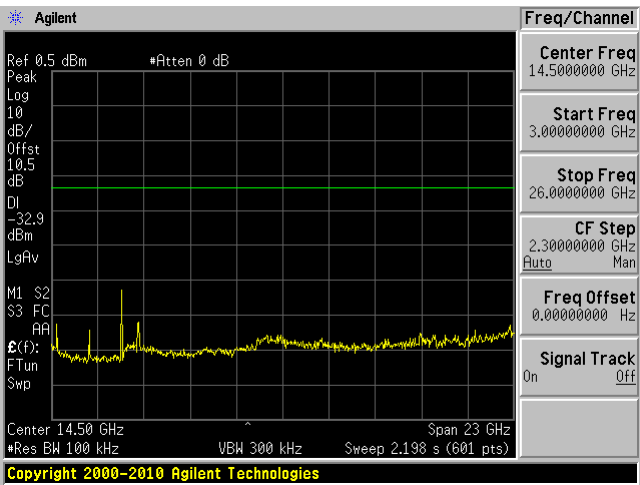
Low Channel 3 GHz – 26 GHz



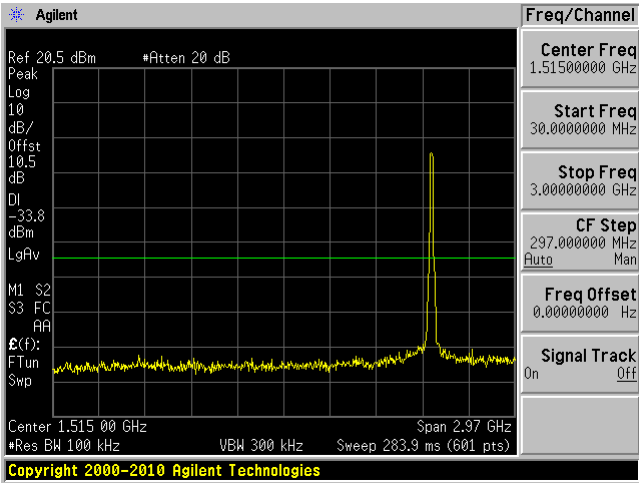
Middle Channel 30 MHz – 3 GHz



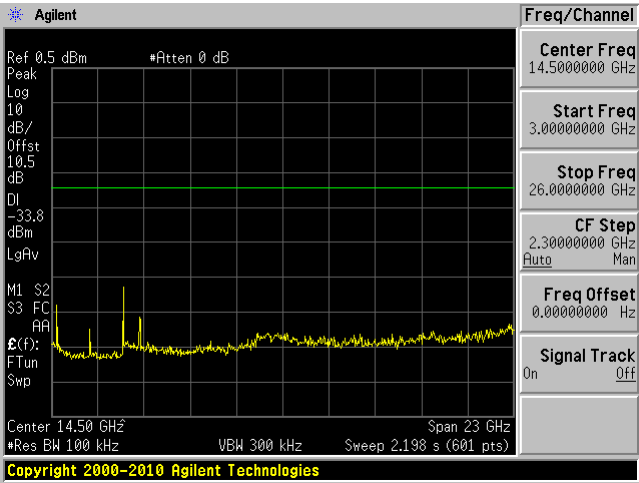
Middle Channel 3 GHz – 26 GHz



High Channel 30 MHz – 3 GHz



High Channel 3 GHz – 26 GHz



12 Annex A - EUT Test Setup Photographs

Please refer to the attachment.

13 Annex B - EUT External Photographs

Please refer to the attachment.

14 Annex C - EUT Internal Photographs

Please refer to the attachment.

15 Annex D (Normative) - A2LA Electrical Testing Certificate



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

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

--- END OF REPORT ---