FCC PART 15, SUBPART C
ISEDC RSS-247, ISSUE 2, FEBRUARY 2017

TEST REPORT

For

Roku, Inc.

1155 Coleman Avenue, San Jose, CA 95110, USA

FCC ID: TC2-R1042
IC: 5959A-R1039

Report Type:	**Model:**
Original Report	WR002

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Report Number:	R2106181-247
Report Date:	2021-08-26
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ACCREDITED
CERTIFICATE #3297.02

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2106181-247	Original Report	2021-08-26

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: *WR002, FCC ID: TC2-R1042, IC: 5959A-R1039*, or the "EUT" as referred to in this report. The EUT has 2.4 GHz/5 GHz Wi-Fi capabilities.

The EUT was evaluated as a complete unit, which consist of models 3820X and WR002. In order for the device to function, both sub-devices must be connected to each other (refer to the User Manual for more information) and are always packaged together for the market. The sub-devices are not intended for sale separately.

1.2 Objective

This report was prepared on behalf of *Roku, Inc.* in accordance with Part 2, Subpart J, and Part 15, Subpart C of the Federal Communication Commission's rules and ISEDC RSS-247 Issue 2, February 2017.

The objective was to determine compliance with FCC Part 15.247 and ISEDC RSS-247 for Antenna Requirement, RF Exposure, AC Line Conducted Emissions, Emission Bandwidth, Radiated & Conducted Spurious Emissions, 100 kHz Band Edges, Maximum Output Power, and Peak Power Spectrum Density

1.3 Related Submittal(s)/Grant(s)

Equipment Class: NII, FCC ID: TC2-R1042, IC: 5959A-R1039

1.4 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 v05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247.

1.5 Measurement Uncertainty

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

Parameter	Measurement uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.86 dB
Power Spectral Density, conducted	±0.86 dB
Unwanted Emissions, conducted	±2.76 dB
All emissions, radiated	±4.94 dB
AC power line Conducted Emission	±2.0 dB
Temperature	±2 º C
Humidity	±5 %
DC and low frequency voltages	±1.0 %
Time	±2 %
Duty Cycle	±3 %

1.6 Test Facility Registrations

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

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

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

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

1.7 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 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 - ISEDC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
  - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
  - NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
  - EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
  - Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
  - 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:
  - ENERGY STAR Recognized Test Laboratory – US EPA
  - Telecommunications Certification Body (TCB) – US FCC;
  - 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 v05r02.

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 PuTTy. The software is compliant with the standard requirements being tested against.

FCC/IC power settings:

Modulation	Frequency (MHz)	Power Setting	
		Ant A	Ant B
802.11b	2412	97	97
	2437	97	115
	2462	97	97
8002.11g	2412	62	67
	2437	100	115
	2462	67	72
802.11n20	2412	58	58
	2437	110	110
	2462	60	60
802.11n40	2422	41	41
	2437	115	115
	2452	43	43

Data Rates Tested:
802.11b mode: 1Mbps
802.11g mode: 6Mbps
802.11n HT20 mode: MCS0
802.11n HT40 mode: MCS0

2.3 Duty Cycle Correction Factor

According to KDB 558074 D01 DTS Meas Guidance v05r02 section 6.0:

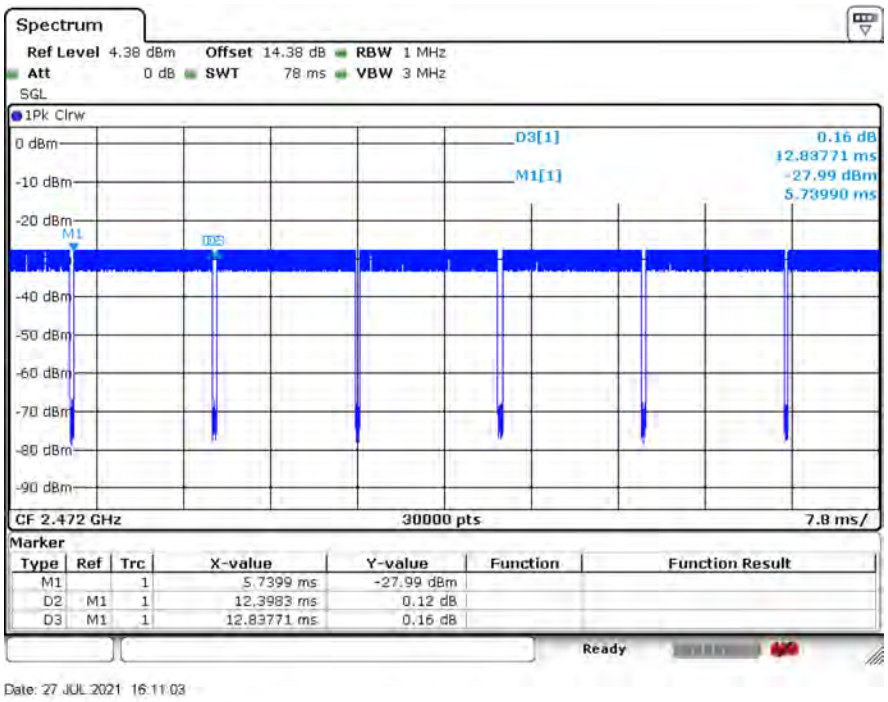
Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be utilized 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	12.40	12.84	96.58	0.15
802.11g	2.03	2.20	92.50	0.34
802.11n20	1.90	2.06	91.34	0.35
802.11n40	0.94	1.17	80.73	0.93

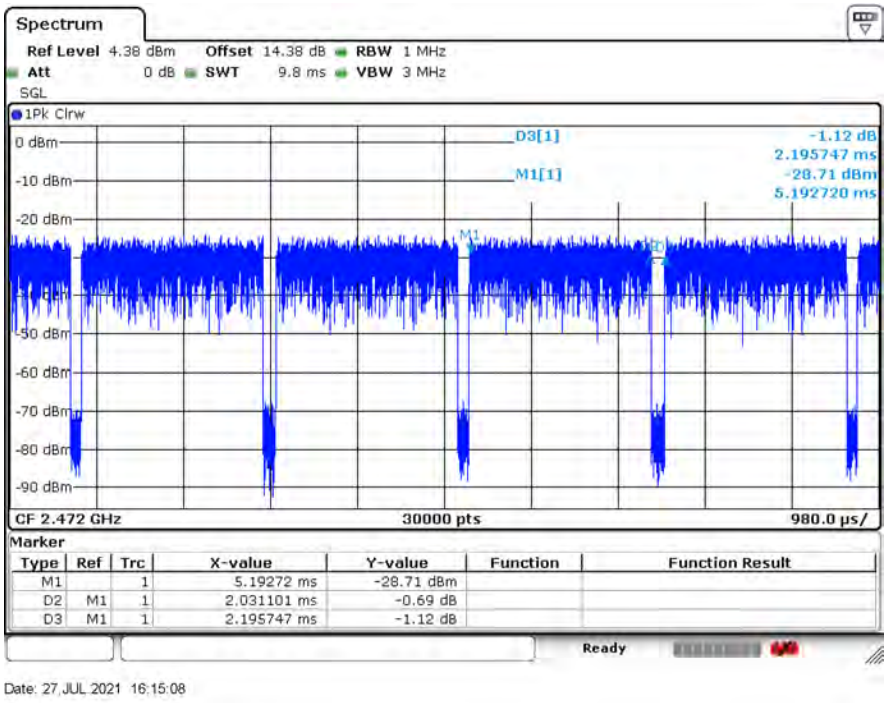
Duty Cycle = On Time (ms)/ Period (ms)
Duty Cycle Correction Factor (dB) = 10*log(1/Duty Cycle)

Please refer to the following plots.

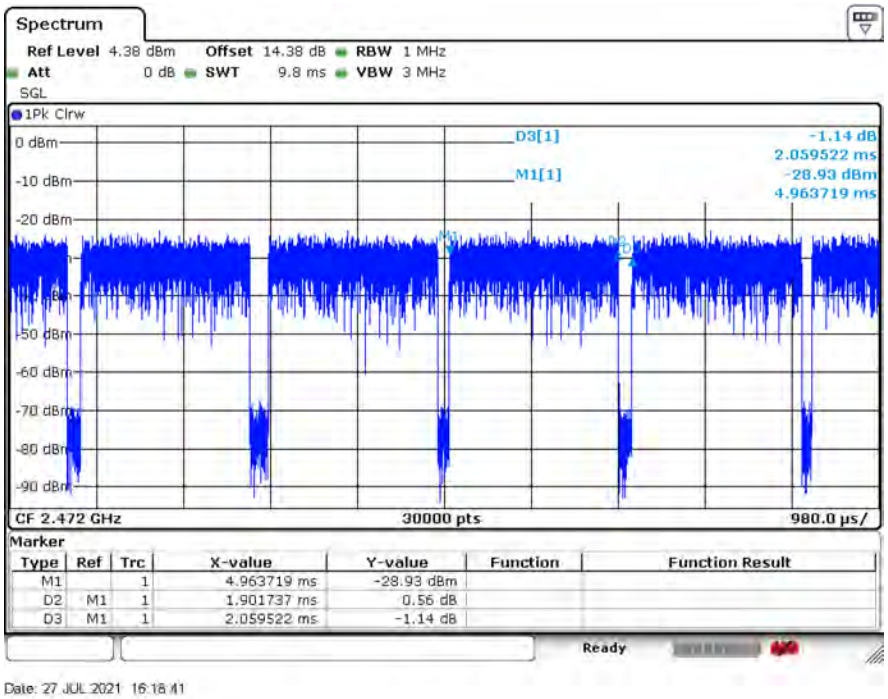
802.11b mode



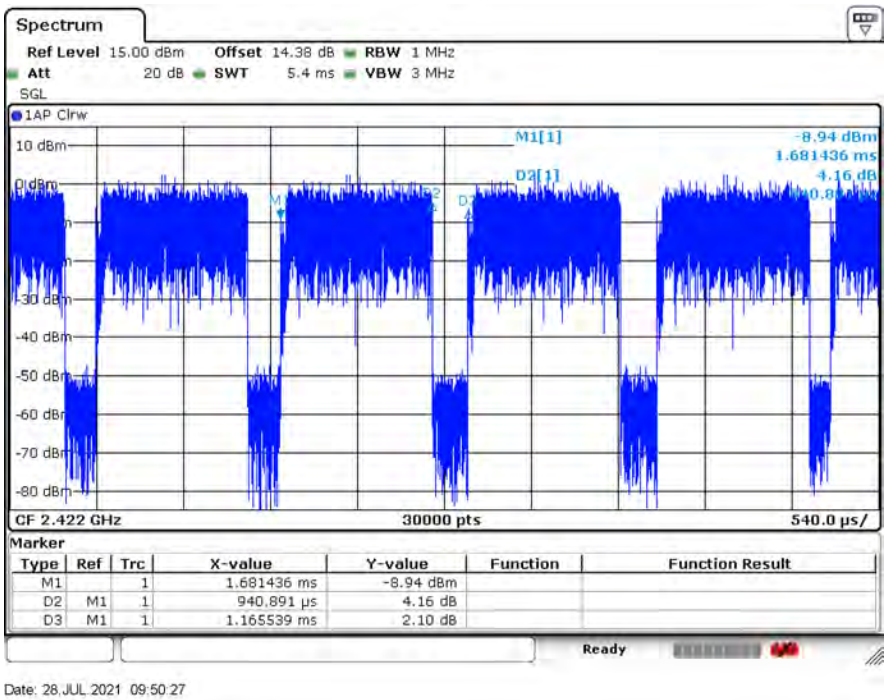
802.11g mode



802.11n20 mode



802.11n40 mode



2.4 Equipment Modifications

N/A

2.5 Local Support Equipment

Manufacturer	Description	Model
Dell	Laptop	Latitude E6410

2.6 Support Equipment

Manufacturer	Description	Model
Roku, Inc.	Debug Board	-

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

Results reported relate only to the product tested.

FCC/ISEDC Rules	Description of Test	Results
FCC §15.203 ISEDC RSS-Gen §6.8	Antenna Requirements	Compliant
FCC §2.1093, §15.247(i) ISEDC RSS-102	RF Exposure	Compliant
FCC §15.207 ISEDC RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
FCC §15.209, §15.247(d) ISEDC RSS-247 §5.5 RSS-Gen §8.9, §8.10	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(2) ISEDC RSS-247 §5.2 RSS-Gen §6.7	6 dB & 99% Emission Bandwidth	Compliant
FCC §15.247(b)(3) ISEDC RSS-247 §5.4	Maximum Output Power	Compliant
FCC §15.247(e) ISEDC RSS-247 §5.2(2)	Peak Power Spectral Density	Compliant
FCC §15.247(d) ISEDC RSS-247 §5.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §2.1051, §15.247 (d) ISEDC RSS-247 §5.5	Spurious Emissions at Antenna Port	Compliant

4 FCC §15.203 & ISEDC RSS-Gen §6.8 - 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.

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

This radio transmitter 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.

4.2 Antenna Description

Antenna usage	Frequency Range (MHz)	Maximum Antenna Gain (dBi)	Antenna Type
2.4GHz Wi-Fi	2400-2483.5	2.3	Chip

Note: The antennas used by the EUT are permanent attached antennas.
Note: Antenna info is information provided by customer.

5 FCC §2.1091, §15.407(f) & ISEDC RSS-102 - RF Exposure

5.1 Applicable Standards

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

According to KDB 447 498 Section (7.2), "simultaneous transmission of MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on calculated or measured field strengths or power density, is ≤ 1.0. The MPE ratio of each antenna is determined at the minimum *test separation distance* required by the operating configurations and exposure conditions of the host device, according to the ratio of field strengths or power density to MPE limit, at the test frequency.

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

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

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

According to ISED RSS-102 Issue 5:

2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

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

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

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

5.2 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

Note: According to MIMOFCC KDB 662911 D02 MIMO with Cross Polarized Antenna v01, Where an FCC rule specifies limits in radiated terms such as EIRP or ERP, the limits apply to the maximum emission that would be observed by a linearly polarized measurement antenna. Therefore, the highest output power from single antenna power was selected to calculate in this section.

5.3 MPE Results

Worst Case: 802.11n40, 2437 MHz

Maximum peak output power at antenna input terminal (dBm):	26.58
Maximum peak output power at antenna input terminal (mW):	454.99
Prediction distance (cm):	20
Prediction frequency (MHz):	2437
Maximum Directional Antenna Gain, typical (dBi):	5.3
Maximum Antenna Gain (numeric):	3.39
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.307
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement FCC MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.307 mW/cm^2. Limit is 1.0 mW/cm^2.

Radio Co-location

2.4 GHz Wi-Fi and 5 GHz Wi-Fi simultaneous transmission is not supported.

5.4 RF exposure evaluation exemption for IC

Worst Case: 802.11n40, 2437 MHz

Maximum EIRP power = 26.58dBm + 5.3 dBi = 31.88 dBm which is less than $1.31\times10^{-2}f^{0.6834}$ = 2.703 W = 34.32 dBm

Therefore the RF exposure Evaluation is not required.

Note: Maximum Antenna Gain used is based on Combined Antenna Gain calculation for MIMO transmitting usage (i.e. Combined Antenna Gain(dBi) = Single Antenna Gain(dBi) + 10*log(Number of Antennas)). In this case the Combined Antenna Gain is 5.3 dBi = 2.3 dBi +10*log(2).

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

6.1 Applicable Standards

As per FCC §15.207 and ISEDC RSS GEN §8.8

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

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

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

6.2 Test Setup

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

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

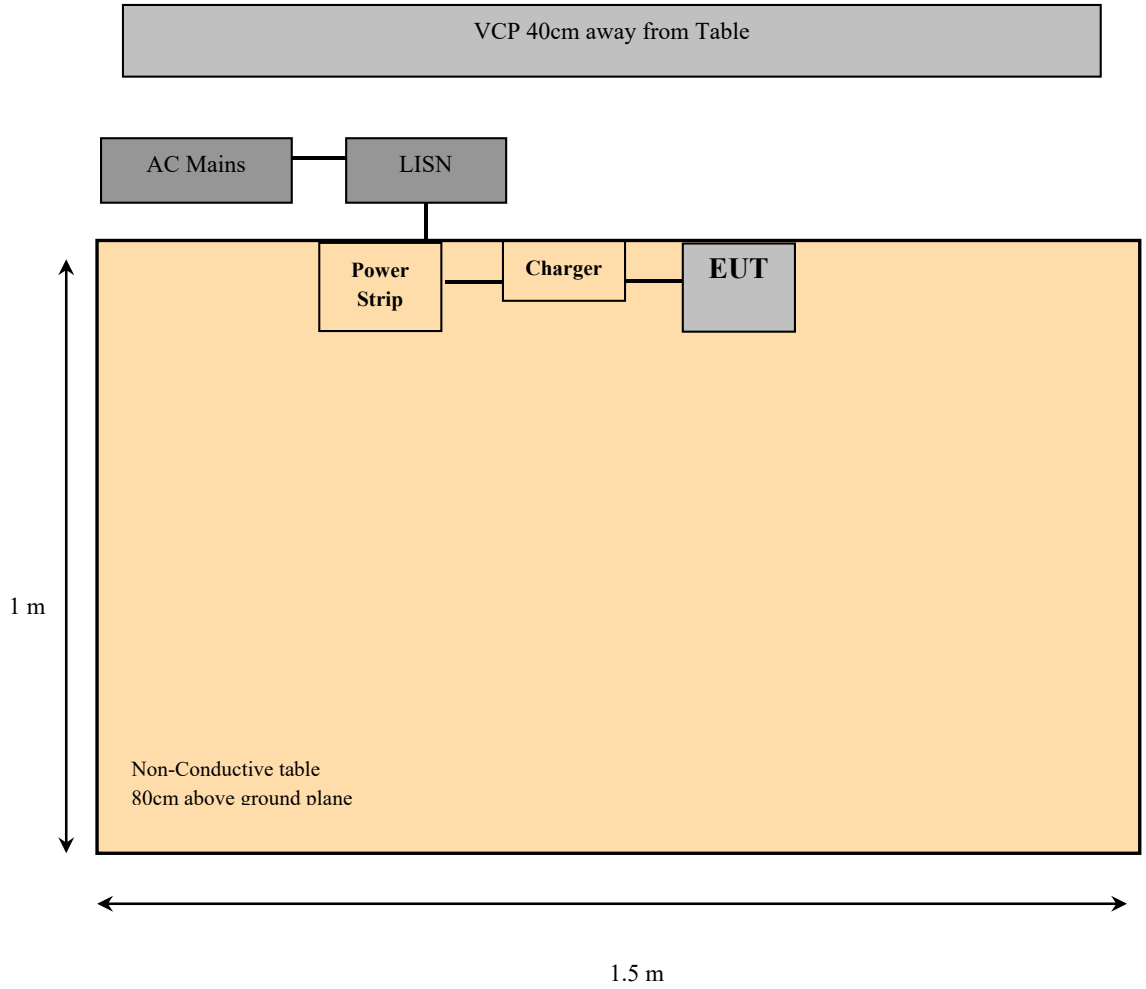
6.3 Test Procedure

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

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

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

6.4 Test Setup Block Diagram



6.5 Corrected Amplitude and Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Correction Factor (CF) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + CF

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Correction Factor (13.7 dB)

The Correction Factor is calculated by adding Cable loss (CL), LISN calibration factor, and attenuation of the impulse limiter and the high pass filter. The basic equation is as follows:

CF= CL + LISN calibration factor + Attenuation

For example, a corrected amplitude of 46.2 dBuV = Indicated Reading (32.5 dBuV) + Cable Loss (3.5 dB) + LISN calibration factor (0.2 dB) + Attenuator (10 dB)

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

Margin = Corrected Amplitude – Limit

6.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde and Schwarz	Receiver, EMI Test	ESCI 1166.5950.03	100338	2020-03-17	1.5 years
Rohde and Schwarz	Impulse Limiter	ESH3-Z2	101964	2021-07-07	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150202	2021-03-02	1 year
Suirong	30 ft conductive emission cable	LMR 400	-	N/R	N/A
FCC	LISN	FCC-LISN-50-25-2-10-CISPR16	160129	2020-10-13	1 year
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

6.7 Test Environmental Conditions

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

The testing was performed by Allen Huang on 2021-08-03 in the Ground Plane test site.

6.8 Summary of Test Results

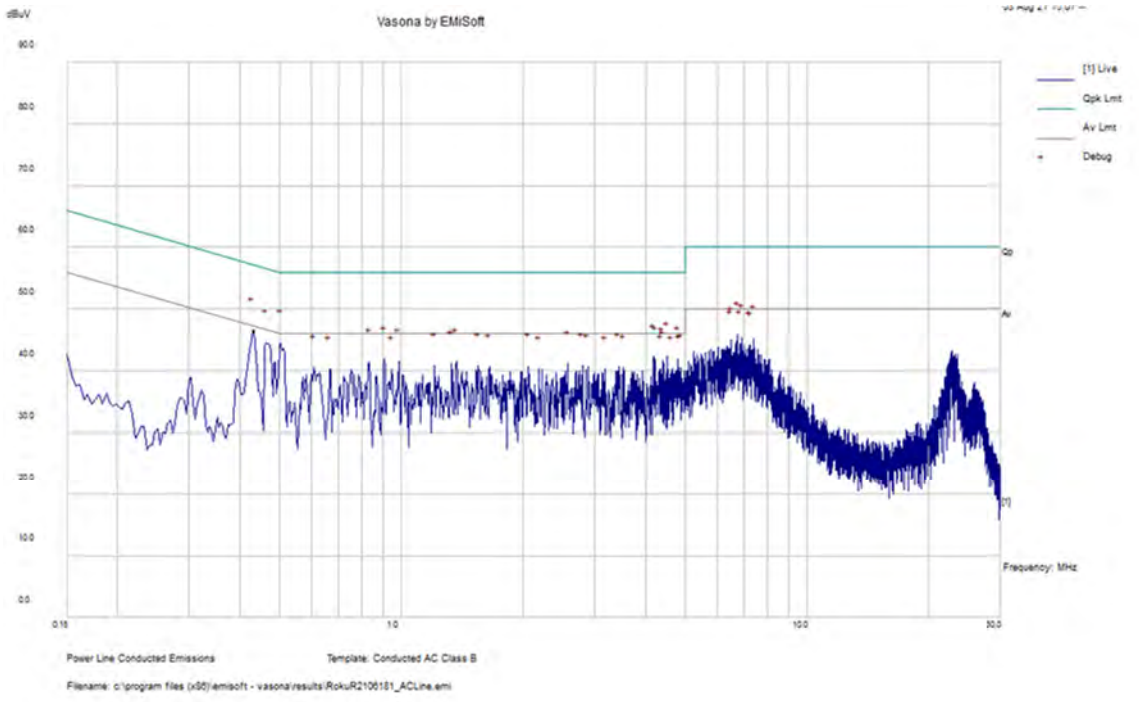
According to the recorded data in following table, the EUT complied with the FCC 15C & ISEDC standard's conducted emissions limits, with the margin reading of:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-12.96	0.433733	Line	0.15-30

6.9 Conducted Emissions Test Plots and Data

Worst Case: 802.11n40 mode – 2437 MHz

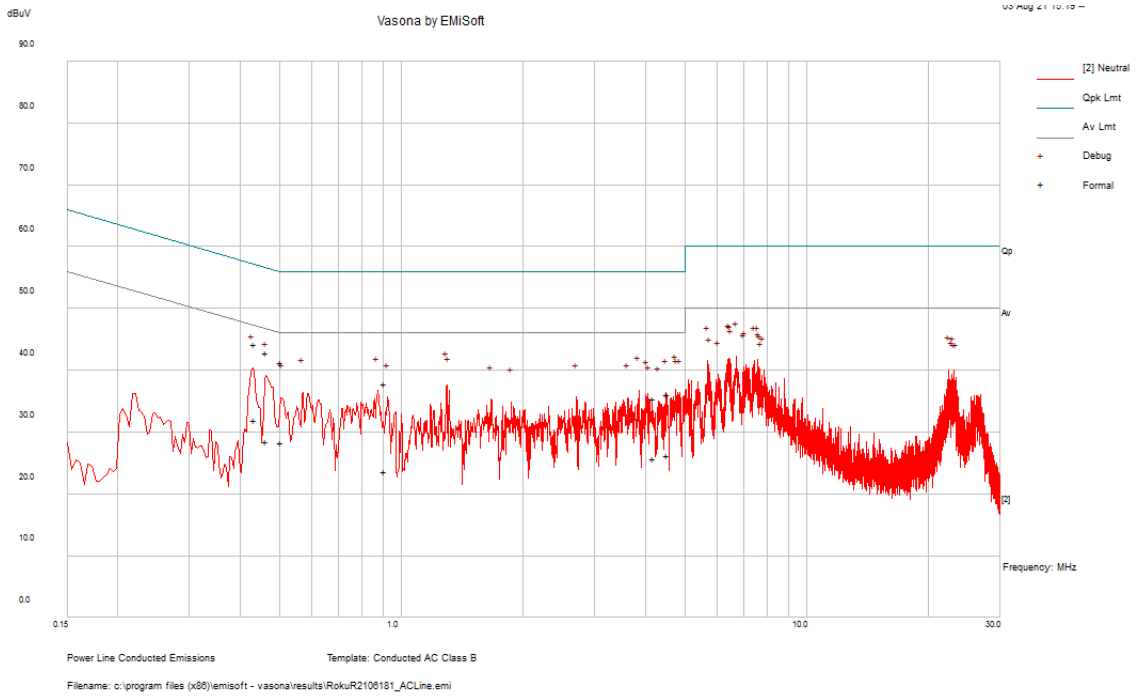
120 V, 60 Hz – Line



Frequency (MHz)	Ai Reading (dBuV)	Correction Factor (dB)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.433733	**33.84**	**10.38**	**44.22**	**Line**	**57.18**	**-12.96**	**QP**
0.505267	30.98	10.31	41.29	Line	56	-14.71	QP
0.464652	32.45	10.35	42.8	Line	56.61	-13.81	QP
4.516118	26.14	9.99	36.13	Line	56	-19.87	QP
4.181471	25.37	9.98	35.35	Line	56	-20.65	QP
0.909637	27.69	10.15	37.84	Line	56	-18.16	QP

Frequency (MHz)	Ai Reading (dBuV)	Correction Factor (dB)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.433733	21.53	10.38	31.91	Line	47.18	-15.27	Ave.
0.505267	18	10.31	28.31	Line	46	-17.69	Ave.
0.464652	18.09	10.35	28.44	Line	46.61	-18.17	Ave.
4.516118	16.31	9.99	26.3	Line	46	-19.7	Ave.
4.181471	15.81	9.98	25.79	Line	46	-20.21	Ave.
0.909637	13.49	10.15	23.64	Line	46	-22.36	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	Ai Reading (dBuV)	Correction Factor (dB)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.436469	26.78	10.38	37.16	Neutral	57.13	-19.97	QP
0.47709	27.62	10.34	37.96	Neutral	56.39	-18.43	QP
6.715233	26.8	10.03	36.83	Neutral	60	-23.17	QP
6.430522	26.14	10.02	36.16	Neutral	60	-23.84	QP
6.463841	26.43	10.02	36.45	Neutral	60	-23.55	QP
7.594987	25.43	10.05	35.48	Neutral	60	-24.52	QP

Frequency (MHz)	Ai Reading (dBuV)	Correction Factor (dB)	Corrected Amplitude (dBuV)	Conductor (Line/Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.436469	17.09	10.38	27.47	Neutral	47.13	-19.66	Ave.
0.47709	17.56	10.33	27.89	Neutral	46.39	-18.5	Ave.
6.715233	19.44	10.03	29.47	Neutral	50	-20.53	Ave.
6.430522	18.68	10.03	28.71	Neutral	50	-21.29	Ave.
6.463841	18.87	10.02	28.89	Neutral	50	-21.11	Ave.
7.594987	18.33	10.05	28.38	Neutral	50	-21.62	Ave.

7 FCC §15.209, §15.247(d) & ISEDC RSS-247 §5.5, RSS-Gen §8.9, §8.10 - Spurious Radiated Emissions

7.1 Applicable Standards

As per FCC §15.35(d): 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) and RSS-Gen 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 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

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).

As per ISEDC RSS-Gen 8.9,

Except when the requirements applicable to a given device state otherwise, emission from licence-exempt transmitters shall company with the field strength limits shown in the table below. Additional, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

General Field Strength Limits for Licence-Exemption Transmitters at Frequencies above 30 MHz

Frequency (MHz)	Field Strength (µv/m at 3 meters)
30-88	100
88-216	150
216-960	200
Above 960*	500

* Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

Note: Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the specific RSS.

As per ISEDC RSS-247 §5.5, in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

7.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC 15 Subpart C and ISEDC RSS-247 limits.

The spacing between the peripherals was 10 centimeters.

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

7.3 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords was 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 should be changed the polarization both of horizontal and vertical.

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

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

Above 1000 MHz:

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

7.4 Corrected Amplitude & Margin Calculation

For emissions below 1 GHz,

The Corrected Amplitude (CA) is calculated by adding the Correction Factor to the S.A. Reading. The basic equation is as follows:

CA = S.A. Reading + Correction Factor

For example, a corrected amplitude of 40.3 dBuV/m = S.A. Reading (32.5 dBuV) + Correction Factor (7.8 dB/m)

The Correction Factor is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) together. This calculation is done in the measurement software, and reported in the test result section. The basic equation is as follows:

Correction Factor = AF + CL + Atten – Ga

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

Margin = Corrected Amplitude – Limit

For emission above 1 GHz,

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

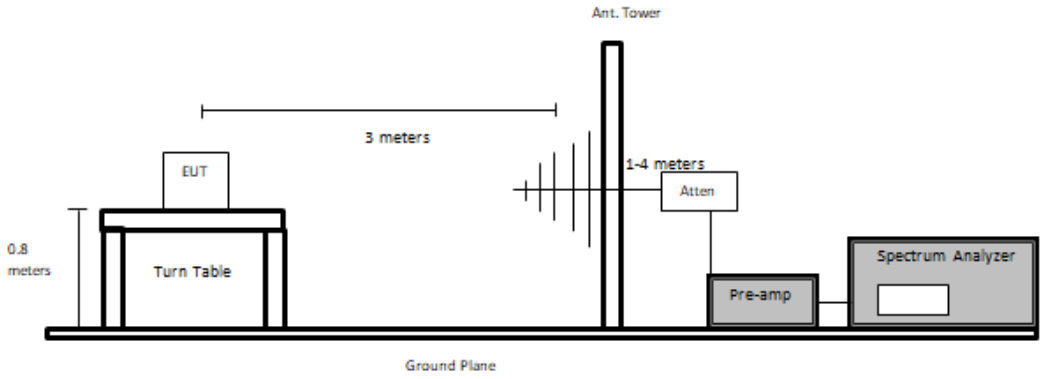
For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

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:

Margin = Corrected Amplitude – Limit

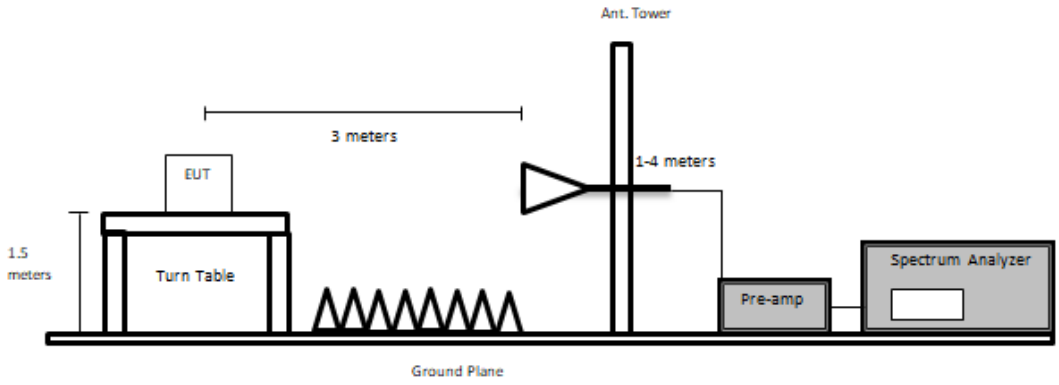
7.5 Test Setup Block Diagram

Below 1GHz:

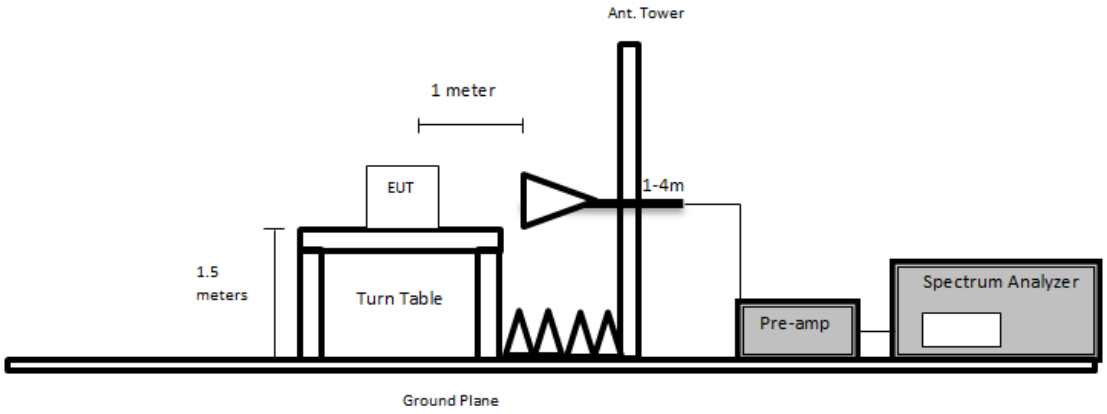


Above 1GHz:

At 3 meters:



At 1 meter:


Ant. Tower
1 meter
EUT
1-4m
1.5
meters
Turn Table
Pre-amp
Spectrum Analyzer
Ground Plane

7.6 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode&Schwarz	Signal Analyzer	FSV40	101203	2021-04-26	1 year
Rhode & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100044	2021-05-14	2 years
BACL	5m3 Sensitivity Box	1	2	2020-10-27	1 year
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
Sunol Sciences	Biconilog Antenna	JB3	A020106-2	2019-11-20	2 years
ETS Lindgren	Horn Antenna	3117	00218973	2019-02-13	2.5 years
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
-	SMA cable	-	-	Each time[1]	N/A
-	Notch Filter	-	-	Each time[1]	N/A
Fairview Microwave	Times Microwave LMR 400 UltraFex Coaxial Cable 35'	FMC0101405-420	BACL1904161	2021-06-18	1 year
Insulted Wire Corp.	157 Series 2.92 SM (x2) Armored 33 ft. Cable	KPS-1571AN-3960-KPS	DC 1917	2021-03-03	1 year
IW Microwave	157 Series Cable Armored with 2.92mm Male Plugs on Both Sides	KPS-1571AN-2400	DC 1922	2021-07-06	1 year
AH Systems	Preamplifier	PAM 1840 VH	170	2021-08-03	1 year
Agilent	Preamplifier	8449B	3147A00400	2021-03-27	1 year
HP	Pre Amplifier	8447D	2443A04374	2020-08-17	1 year
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

Note[1]: equipment included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

7.7 Test Environmental Conditions

Temperature:	20-22 ºC
Relative Humidity:	42-50 %
ATM Pressure:	102.7 kPa

The testing was performed by Rita Yang and Allen Huang from 2021-07-09 to 2021-08-09 in 5m chamber 3.

7.8 Summary of Test Results

According to the data hereinafter, the EUT complied with FCC Part 15C and ISEDC RSS-247 standard's radiated emissions limits, and had the worst margin of:

2.4 GHz Wi-Fi

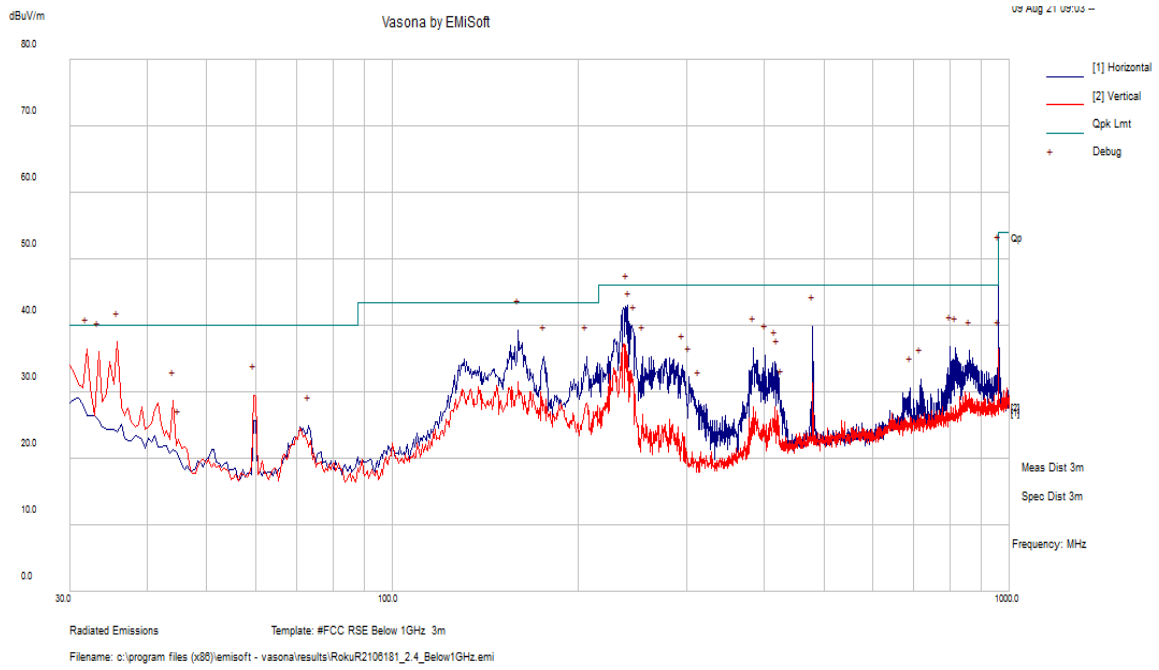
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Configuration**
-1.54	7311	V	G mode, 2437 MHz, Ant B

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

7.9 Radiated Emissions Test Results

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

Worst Case: 2437 MHz, n40 mode



Frequency (MHz)	S.A. Reading (dBµV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
36.01825	26.1	-2.12	23.98	134	V	314	40	-16.02	QP
240.0118	49.3	-6.4	42.9	122	H	127	46	-3.1	QP
31.61525	21.18	1.2	22.38	129	V	284	40	-17.62	QP
33.2515	21.32	-0.06	21.26	191	V	155	40	-18.74	QP
160.0178	42.52	-5.89	36.63	236	H	294	43.5	-6.87	QP
960.0105	40.32	5.67	45.99	143	H	129	54	-8.01	QP

2) 1–18 GHz Measured at 1 meter

802.11b mode Antenna A

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2412	119.46	112	145	H	32.6	4.913	36.863	120.11	-	-	-
2412	120.42	123	125	V	32.6	4.913	36.863	121.07	-	-	-
2390	67.02	95	150	H	32.6	4.913	36.863	67.67	84	-16.33	Peak
2390	68.11	70	115	V	32.6	4.913	36.863	68.76	84	-15.24	Peak
2390	60.01	95	150	H	32.6	4.913	36.863	60.66	64	-3.34	Ave
2390	59.63	70	115	V	32.6	4.913	36.863	60.28	64	-3.72	Ave
4824	51.81	25	160	H	35	9.826	35.707	60.93	84	-23.07	Peak
4824	49.4	75	140	V	35	9.826	35.707	58.52	84	-25.48	Peak
4824	46.94	25	160	H	35	9.826	35.707	56.06	64	-7.94	Ave
4824	42.61	75	140	V	35	9.826	35.707	51.73	64	-12.27	Ave
7236	53.55	90	235	H	36.1	13.549	36.388	66.81	90.11	-23.30	Peak[1]
7236	55.29	75	130	V	36.1	13.549	36.388	68.55	91.07	-22.52	Peak[1]
Middle Channel 2437 MHz											
4874	53.53	315	150	H	35.3	8.336	35.707	61.46	84	-22.54	Peak
4874	51.35	65	150	V	35.3	8.336	35.707	59.28	84	-24.72	Peak
4874	49.78	315	150	H	35.3	8.336	35.707	57.71	64	-6.29	Ave
4874	45.17	65	150	V	35.3	8.336	35.707	53.10	64	-10.90	Ave
7311	52.02	35	150	H	36.1	10.531	36.388	62.26	84	-21.74	Peak
7311	55.7	310	135	V	36.1	10.531	36.388	65.94	84	-18.06	Peak
7311	45.69	35	150	H	36.1	10.531	36.388	55.93	64	-8.07	Ave
7311	51.50	310	135	V	36.1	10.531	36.388	61.74	64	-2.26	Ave
High Channel 2462 MHz											
2483.5	68.88	85	125	H	33	4.913	36.863	69.93	84	-14.07	Peak
2483.5	68.15	115	150	V	33	4.913	36.863	69.20	84	-14.80	Peak
2483.5	58.95	85	125	H	33	4.913	36.863	60.00	64	-4.00	Ave
2483.5	54.20	115	150	V	33	4.913	36.863	55.25	64	-8.75	Ave
4924	53.58	315	160	H	35.3	8.336	35.707	61.51	84	-22.49	Peak
4924	50.29	65	150	V	35.3	8.336	35.707	58.22	84	-25.78	Peak
4924	50.06	315	160	H	35.3	8.336	35.707	57.99	64	-6.01	Ave
4924	44.49	65	150	V	35.3	8.336	35.707	52.42	64	-11.58	Ave
7386	53.56	100	165	H	36.1	10.531	36.388	63.80	84	-20.20	Peak
7386	55.78	330	130	V	36.1	10.531	36.388	66.02	84	-17.98	Peak
7386	47.35	100	165	H	36.1	10.531	36.388	57.59	64	-6.41	Ave
7386	51.07	330	130	V	36.1	10.531	36.388	61.31	64	-2.69	Ave

802.11b mode Antenna B

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2412	117.66	110	125	H	32.6	4.913	36.863	118.31	-	-	-
2412	119.95	100	115	V	32.6	4.913	36.863	120.60	-	-	-
2390	69.07	80	130	H	32.6	4.913	36.863	69.72	84	-14.28	Peak
2390	64.95	115	150	V	32.6	4.913	36.863	65.60	84	-18.40	Peak
2390	60.00	80	130	H	32.6	4.913	36.863	60.65	64	-3.35	Ave
2390	55.62	115	150	V	32.6	4.913	36.863	56.27	64	-7.73	Ave
4824	51.49	100	130	H	35	9.826	35.707	60.61	84	-23.39	Peak
4824	52.84	240	150	V	35	9.826	35.707	61.96	84	-22.04	Peak
4824	48.47	100	130	H	35	9.826	35.707	57.59	64	-6.41	Ave
4824	48.99	240	150	V	35	9.826	35.707	58.11	64	-5.89	Ave
7236	52.52	355	200	H	36.1	13.549	36.388	65.78	88.31	-22.53	Peak[1]
7236	50.96	320	145	V	36.1	13.549	36.388	64.22	90.60	-26.38	Peak[1]
Middle Channel 2437 MHz											
4874	55.13	80	135	H	35.3	8.336	35.707	63.06	84	-20.94	Peak
4874	57.34	280	110	V	35.3	8.336	35.707	65.27	84	-18.73	Peak
4874	52.59	80	135	H	35.3	8.336	35.707	60.52	64	-3.48	Ave
4874	54.59	280	110	V	35.3	8.336	35.707	62.52	64	-1.48	Ave
7311	54.46	25	110	H	36.1	10.531	36.388	64.70	84	-19.30	Peak
7311	52.08	335	150	V	36.1	10.531	36.388	62.32	84	-21.68	Peak
7311	50.09	25	110	H	36.1	10.531	36.388	60.33	64	-3.67	Ave
7311	47.79	335	150	V	36.1	10.531	36.388	58.04	64	-5.96	Ave
High Channel 2462 MHz											
2483.5	69.18	85	130	H	33	4.913	36.863	70.23	84	-13.77	Peak
2483.5	63.13	90	130	V	33	4.913	36.863	64.18	84	-19.82	Peak
2483.5	58.71	85	130	H	33	4.913	36.863	59.76	64	-4.24	Ave
2483.5	52.65	90	130	V	33	4.913	36.863	53.70	64	-10.30	Ave
4924	50.23	285	150	H	35.3	8.336	35.707	58.16	84	-25.84	Peak
4924	52.76	250	125	V	35.3	8.336	35.707	60.69	84	-23.31	Peak
4924	45.62	285	150	H	35.3	8.336	35.707	53.55	64	-10.45	Ave
4924	48.83	250	125	V	35.3	8.336	35.707	56.76	64	-7.24	Ave
7386	51.34	345	150	H	36.1	10.531	36.388	61.58	84	-22.42	Peak
7386	50.88	45	150	V	36.1	10.531	36.388	61.12	84	-22.88	Peak
7386	45.16	345	150	H	36.1	10.531	36.388	55.40	64	-8.60	Ave
7386	43.70	45	150	V	36.1	10.531	36.388	53.94	64	-10.06	Ave

802.11g mode Antenna A

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2412	80.95	70	155	H	32.6	4.913	36.863	118.46	-	-	-
2412	79.11	55	150	V	32.6	4.913	36.863	116.62	-	-	-
2390	78.75	95	150	H	32.6	4.913	36.863	79.40	84	-4.60	Peak
2390	70.70	130	190	V	32.6	4.913	36.863	71.35	84	-12.65	Peak
2390	60.89	95	150	H	32.6	4.913	36.863	61.54	64	-2.46	Ave
2390	55.61	130	190	V	32.6	4.913	36.863	56.26	64	-7.74	Ave
4824	46.99	360	235	H	35	9.826	35.707	56.11	84	-27.89	Peak
4824	46.67	105	150	V	35	9.826	35.707	55.79	84	-28.21	Peak
4824	36.01	360	235	H	35	9.826	35.707	45.13	64	-18.87	Ave
4824	35.77	105	150	V	35	9.826	35.707	44.89	64	-19.11	Ave
7236	52.1	40	155	H	36.1	13.549	36.388	65.36	88.46	-23.10	Peak[1]
7236	54	330	150	V	36.1	13.549	36.388	67.26	86.62	-19.36	Peak[1]
Middle Channel 2437 MHz											
4874	53.46	270	150	H	35.3	8.336	35.707	61.39	84	-22.61	Peak
4874	50.40	70	110	V	35.3	8.336	35.707	58.33	84	-25.67	Peak
4874	41.95	270	150	H	35.3	8.336	35.707	49.88	64	-14.12	Ave
4874	39.55	70	110	V	35.3	8.336	35.707	47.48	64	-16.52	Ave
7311	57.77	115	150	H	36.1	10.531	36.388	68.01	84	-15.99	Peak
7311	59.95	310	130	V	36.1	10.531	36.388	70.19	84	-13.81	Peak
7311	46.57	115	150	H	36.1	10.531	36.388	56.82	64	-7.18	Ave
7311	50.54	310	130	V	36.1	10.531	36.388	60.79	64	-3.21	Ave
High Channel 2462 MHz											
2483.5	75.72	80	115	H	33	4.913	36.863	76.77	84	-7.23	Peak
2483.5	76.39	125	120	V	33	4.913	36.863	77.44	84	-6.56	Peak
2483.5	60.09	95	150	H	33	4.913	36.863	61.14	64	-2.86	Ave
2483.5	60.01	125	120	V	33	4.913	36.863	61.06	64	-2.94	Ave
4924	48.42	20	190	H	35.3	8.336	35.707	56.35	84	-27.65	Peak
4924	47.89	335	150	V	35.3	8.336	35.707	55.82	84	-28.18	Peak
4924	37.95	20	190	H	35.3	8.336	35.707	45.88	64	-18.12	Ave
4924	36.17	335	150	V	35.3	8.336	35.707	44.10	64	-19.90	Ave
7386	52.43	120	210	H	36.1	10.531	36.388	62.67	84	-21.33	Peak
7386	54.41	75	145	V	36.1	10.531	36.388	64.65	84	-19.35	Peak
7386	40.41	120	210	H	36.1	10.531	36.388	50.66	64	-13.34	Ave
7386	43.00	75	145	V	36.1	10.531	36.388	53.24	64	-10.76	Ave

802.11g mode Antenna B

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2412	117.45	135	165	H	32.6	4.913	36.863	118.10	-	-	-
2412	115.13	95	135	V	32.6	4.913	36.863	115.78	-	-	-
2390	77.61	95	150	H	32.6	4.913	36.863	78.26	84	-5.74	Peak
2390	72.70	125	175	V	32.6	4.913	36.863	73.35	84	-10.65	Peak
2390	58.98	95	150	H	32.6	4.913	36.863	59.63	64	-4.37	Ave
2390	56.48	125	175	V	32.6	4.913	36.863	57.13	64	-6.87	Ave
4824	46.14	230	150	H	35	9.826	35.707	55.26	84	-28.74	Peak
4824	48.96	280	205	V	35	9.826	35.707	58.08	84	-25.92	Peak
4824	35.12	230	150	H	35	9.826	35.707	44.24	64	-19.76	Ave
4824	37.50	280	205	V	35	9.826	35.707	46.62	64	-17.38	Ave
7236	50.24	350	150	H	36.1	13.549	36.388	63.50	88.10	-24.60	Peak[1]
7236	49.65	325	150	V	36.1	13.549	36.388	62.91	85.78	-22.87	Peak[1]
Middle Channel 2437 MHz											
4874	58.34	95	135	H	35.3	8.336	35.707	66.27	84	-17.73	Peak
4874	60.50	265	120	V	35.3	8.336	35.707	68.43	84	-15.57	Peak
4874	47.98	95	135	H	35.3	8.336	35.707	55.91	64	-8.09	Ave
4874	49.21	265	120	V	35.3	8.336	35.707	57.14	64	-6.86	Ave
7311	59.71	25	130	H	36.1	10.531	36.388	69.95	84	-14.05	Peak
7311	63.87	80	150	V	36.1	10.531	36.388	74.11	84	-9.89	Peak
7311	50.42	25	130	H	36.1	10.531	36.388	60.67	64	-3.33	Ave
7311	52.21	80	150	V	36.1	10.531	36.388	62.46	64	-1.54	Ave
High Channel 2462 MHz											
2483.5	77.62	225	150	H	33	4.913	36.863	78.67	84	-5.33	Peak
2483.5	73.10	105	115	V	33	4.913	36.863	74.15	84	-9.85	Peak
2483.5	59.87	225	150	H	33	4.913	36.863	60.92	64	-3.08	Ave
2483.5	58.43	105	115	V	33	4.913	36.863	59.48	64	-4.52	Ave
4924	48.81	100	125	H	35.3	8.336	35.707	56.74	84	-27.26	Peak
4924	51.57	295	120	V	35.3	8.336	35.707	59.50	84	-24.50	Peak
4924	38.67	100	125	H	35.3	8.336	35.707	46.60	64	-17.40	Ave
4924	40.69	295	120	V	35.3	8.336	35.707	48.62	64	-15.38	Ave
7386	52.83	355	150	H	36.1	10.531	36.388	63.07	84	-20.93	Peak
7386	52.01	80	145	V	36.1	10.531	36.388	62.25	84	-21.75	Peak
7386	40.20	355	150	H	36.1	10.531	36.388	50.45	64	-13.55	Ave
7386	40.82	80	145	V	36.1	10.531	36.388	51.07	64	-12.93	Ave

802.11n20 mode Antenna A+B

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2412	82.04	70	135	H	32.6	4.913	36.863	119.55	-	-	-
2412	84.05	75	115	V	32.6	4.913	36.863	121.56	-	-	-
2390	77.02	105	125	H	32.6	4.913	36.863	77.67	84	-6.33	Peak
2390	76.65	75	115	V	32.6	4.913	36.863	77.30	84	-6.70	Peak
2390	61.30	105	125	H	32.6	4.913	36.863	61.95	64	-2.05	Ave
2390	56.50	75	115	V	32.6	4.913	36.863	57.15	64	-6.85	Ave
4824	45.48	315	150	H	35	9.826	35.707	54.60	84	-29.40	Peak
4824	45.54	65	150	V	35	9.826	35.707	54.66	84	-29.34	Peak
4824	33.67	315	150	H	35	9.826	35.707	42.79	64	-21.21	Ave
4824	33.94	65	150	V	35	9.826	35.707	43.06	64	-20.94	Ave
7236	49.84	80	150	H	36.1	13.549	36.388	63.10	89.55	-26.45	Peak[1]
7236	49.67	330	150	V	36.1	13.549	36.388	62.93	91.56	-28.63	Peak[1]
Middle Channel 2437 MHz											
4874	52.68	250	150	H	35.3	8.336	35.707	60.61	84	-23.39	Peak
4874	54.09	105	125	V	35.3	8.336	35.707	62.02	84	-21.98	Peak
4874	39.91	250	150	H	35.3	8.336	35.707	47.84	64	-16.16	Ave
4874	39.48	105	125	V	35.3	8.336	35.707	47.41	64	-16.59	Ave
7311	60.90	305	130	H	36.1	10.531	36.388	71.14	84	-12.86	Peak
7311	60.11	320	150	V	36.1	10.531	36.388	70.35	84	-13.65	Peak
7311	46.83	305	130	H	36.1	10.531	36.388	57.07	64	-6.93	Ave
7311	50.33	320	150	V	36.1	10.531	36.388	60.57	64	-3.43	Ave
High Channel 2462 MHz											
2483.5	80.53	85	130	H	33	4.913	36.863	81.58	84	-2.42	Peak
2483.5	69.34	60	100	V	33	4.913	36.863	70.39	84	-13.61	Peak
2483.5	59.83	85	130	H	33	4.913	36.863	60.88	64	-3.12	Ave
2483.5	50.94	60	100	V	33	4.913	36.863	51.99	64	-12.01	Ave
4924	46.81	325	120	H	35.3	8.336	35.707	54.74	84	-29.26	Peak
4924	46.18	345	150	V	35.3	8.336	35.707	54.11	84	-29.89	Peak
4924	35.70	325	120	H	35.3	8.336	35.707	43.63	64	-20.37	Ave
4924	35.05	345	150	V	35.3	8.336	35.707	42.98	64	-21.02	Ave
7386	48.76	0	230	H	36.1	10.531	36.388	59.00	84	-25.00	Peak
7386	52.24	330	120	V	36.1	10.531	36.388	62.48	84	-21.52	Peak
7386	36.79	0	230	H	36.1	10.531	36.388	47.03	64	-16.97	Ave
7386	39.78	330	120	V	36.1	10.531	36.388	50.02	64	-13.98	Ave

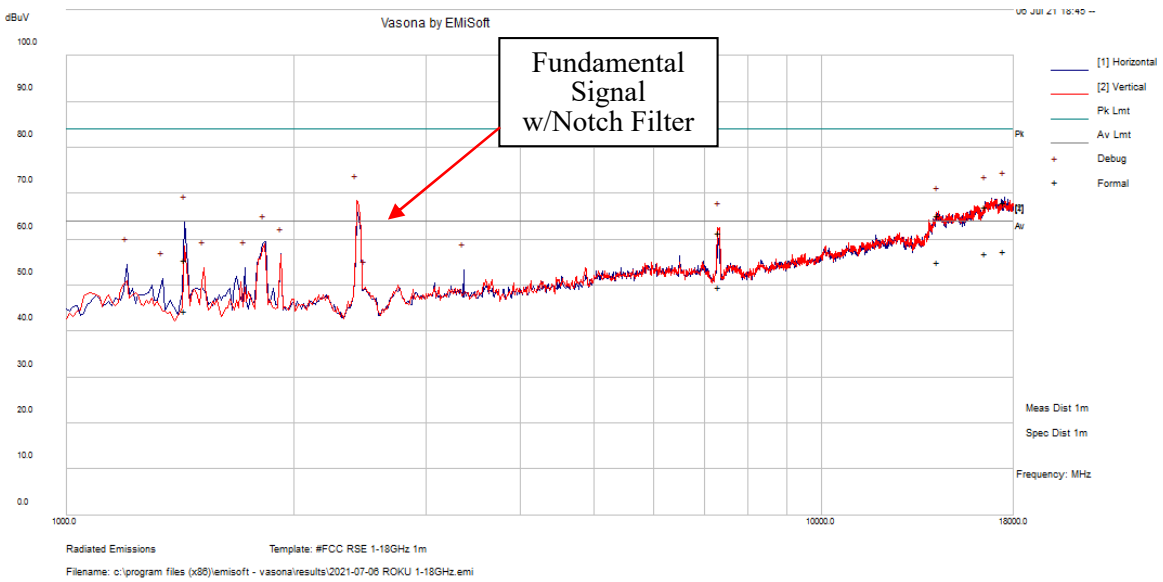
802.11n40 mode Antenna A+B

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2422 MHz											
2390	75.93	90	150	H	32.6	4.913	36.863	76.58	84	-7.42	Peak
2390	69.46	75	115	V	32.6	4.913	36.863	70.11	84	-13.89	Peak
2390	60.12	90	150	H	32.6	4.913	36.863	60.77	64	-3.23	Ave
2390	53.93	75	115	V	32.6	4.913	36.863	54.58	64	-9.42	Ave
4844	45.41	290	150	H	35	9.826	35.707	54.53	84	-29.47	Peak
4844	46.01	340	230	V	35	9.826	35.707	55.13	84	-28.87	Peak
4844	35.39	290	150	H	35	9.826	35.707	44.51	64	-19.49	Ave
4844	35.37	340	230	V	35	9.826	35.707	44.49	64	-19.51	Ave
7266	47.46	360	150	H	36.1	13.549	36.388	60.72	84	-23.28	Peak
7266	46.52	185	165	V	36.1	13.549	36.388	59.78	84	-24.22	Peak
7266	35.83	360	150	H	36.1	13.549	36.388	49.09	64	-14.91	Ave
7266	35.77	185	165	V	36.1	13.549	36.388	49.03	64	-14.97	Ave
Middle Channel 2437 MHz											
4874	51.86	310	120	H	35.3	8.336	35.707	59.79	84	-24.21	Peak
4874	51.80	105	120	V	35.3	8.336	35.707	59.73	84	-24.27	Peak
4874	40.74	310	120	H	35.3	8.336	35.707	48.67	64	-15.33	Ave
4874	40.80	105	120	V	35.3	8.336	35.707	48.73	64	-15.27	Ave
7311	55.25	360	125	H	36.1	10.531	36.388	65.49	84	-18.51	Peak
7311	59.12	310	130	V	36.1	10.531	36.388	69.36	84	-14.64	Peak
7311	43.42	360	125	H	36.1	10.531	36.388	53.66	64	-10.34	Ave
7311	49.44	310	130	V	36.1	10.531	36.388	59.68	64	-4.32	Ave
High Channel 2452 MHz											
2483.5	74.95	95	170	H	33	4.913	36.863	76.00	84	-8.00	Peak
2483.5	66.34	55	145	V	33	4.913	36.863	67.39	84	-16.61	Peak
2483.5	59.46	95	170	H	33	4.913	36.863	60.51	64	-3.49	Ave
2483.5	51.73	55	145	V	33	4.913	36.863	52.78	64	-11.22	Ave
4924	46.05	305	150	H	35.3	8.336	35.707	53.98	84	-30.02	Peak
4924	45.78	150	150	V	35.3	8.336	35.707	53.71	84	-30.29	Peak
4924	35.69	305	150	H	35.3	8.336	35.707	43.62	64	-20.38	Ave
4924	35.43	150	150	V	35.3	8.336	35.707	43.36	64	-20.64	Ave
7386	45.88	310	210	H	36.1	10.531	36.388	56.12	84	-27.88	Peak
7386	45.77	50	190	V	36.1	10.531	36.388	56.01	84	-27.99	Peak
7386	35.61	310	210	H	36.1	10.531	36.388	45.85	64	-18.15	Ave
7386	35.21	50	190	V	36.1	10.531	36.388	45.45	64	-18.55	Ave

Note[1]: Emission is outside Restricted Bands, therefore limit is based on 30dB below fundamental per standard.

1 GHz – 18 GHz Worst Case Scan at 1 Meter

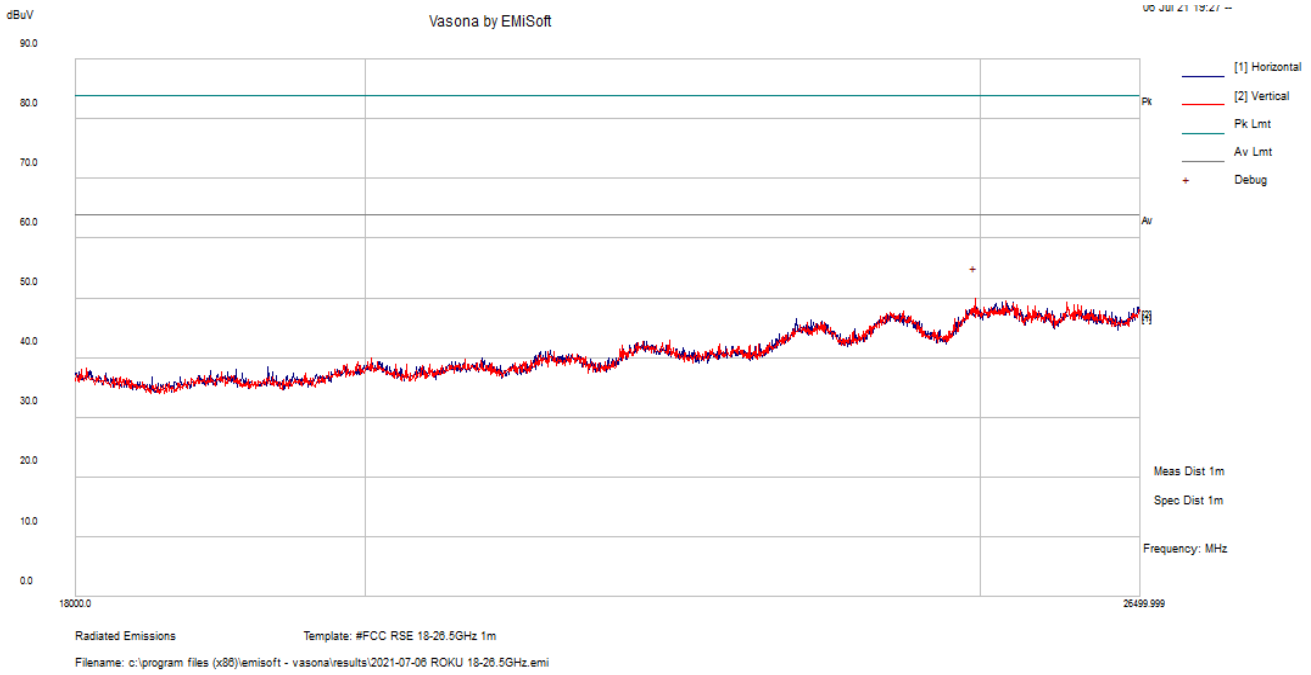
Worst Case: 2437 MHz, n40 mode



Frequency (MHz)	S.A. Reading (dBµV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
17480.878	44.11	23.9	68.01	155	H	214	84	-15.99	Peak
16503.562	44.3	22.9	67.2	250	H	167	84	-16.8	Peak
14270.051	43	22.24	65.24	113	H	173	84	-18.76	Peak
1437.5225	61.13	-5.54	55.59	117	H	238	84	-28.41	Peak
7332.2925	53.07	8.44	61.51	130	V	279	84	-22.49	Peak
17480.878	33.58	23.9	57.48	155	H	214	64	-6.52	Average
16503.562	34.06	22.9	56.96	250	H	167	64	-7.04	Average
14270.051	32.91	22.23	55.14	113	H	173	64	-8.86	Average
1437.5225	50.06	-5.54	44.52	117	H	238	64	-19.48	Average
7332.2925	41.11	8.44	49.55	130	V	279	64	-14.45	Average

18 GHz – 26.5 GHz Worst Case Scan at 1 Meter

Worst Case: 2437 MHz, n40 mode



8 FCC §15.247(a) (2) & ISEDC RSS-247 §5.2, RSS-Gen §6.7 - Emission Bandwidth

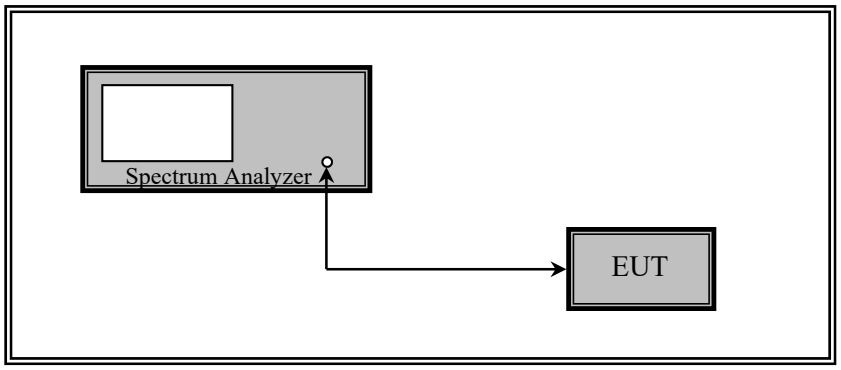
8.1 Applicable Standards

According to FCC §15.247(a) (2) and ISEDC RSS-247 §5.2: the minimum 6 dB bandwidth shall be 500 kHz.

8.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v05r02: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 section 8: DTS bandwidth.

8.3 Test Setup Block Diagram



8.4 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode & Schwarz	Signal Analyzer	FSV40	101203	2021-04-26	1 year
-	RF cable	-	-	Each time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A
-	20 dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

8.5 Test Environmental Conditions

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

The testing was performed by Rita Yang from 2021-06-26 to 2021-07-06 in RF site.

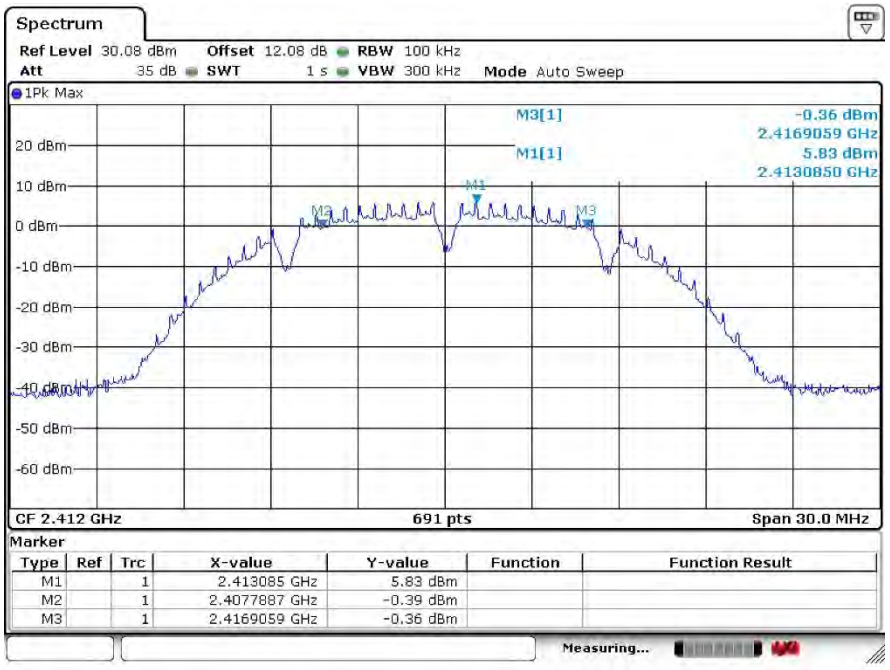
8.6 Test Results

Channel	Frequency (MHz)	6 dB OBW (MHz)		99% OBW (MHz)		6 dB OBW Limit (kHz)	Result
		Antenna A	Antenna B	Antenna A	Antenna B		
802.11b							
Low	2412	9.11	9.03	14.98	14.67	≥ 500	Pass
Middle	2437	10.42	8.94	14.89	14.76	≥ 500	Pass
High	2462	8.42	8.38	14.89	14.76	≥ 500	Pass
802.11g							
Low	2412	15.72	15.89	17.06	16.45	≥ 500	Pass
Middle	2437	15.24	16.15	17.50	19.84	≥ 500	Pass
High	2462	15.76	15.93	17.06	16.76	≥ 500	Pass
802.11n20							
Low	2412	16.89	16.194	18.23	17.67	≥ 500	Pass
Middle	2437	16.50	16.28	22.32	18.58	≥ 500	Pass
High	2462	16.76	16.11	18.10	18.23	≥ 500	Pass
802.11n40							
Low	2422	34.82	31.70	36.73	36.82	≥ 500	Pass
Middle	2437	34.65	35.14	42.55	40.12	≥ 500	Pass
High	2452	32.73	34.73	36.38	36.73	≥ 500	Pass

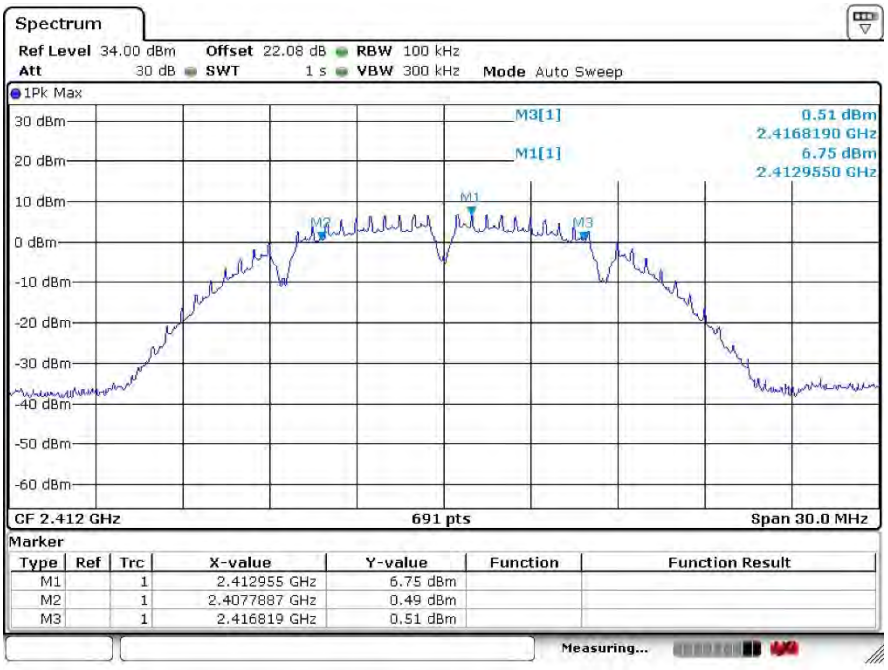
Please refer to the following plots for detailed test results:

802.11b mode

Low Channel 6 dB OBW Antenna A

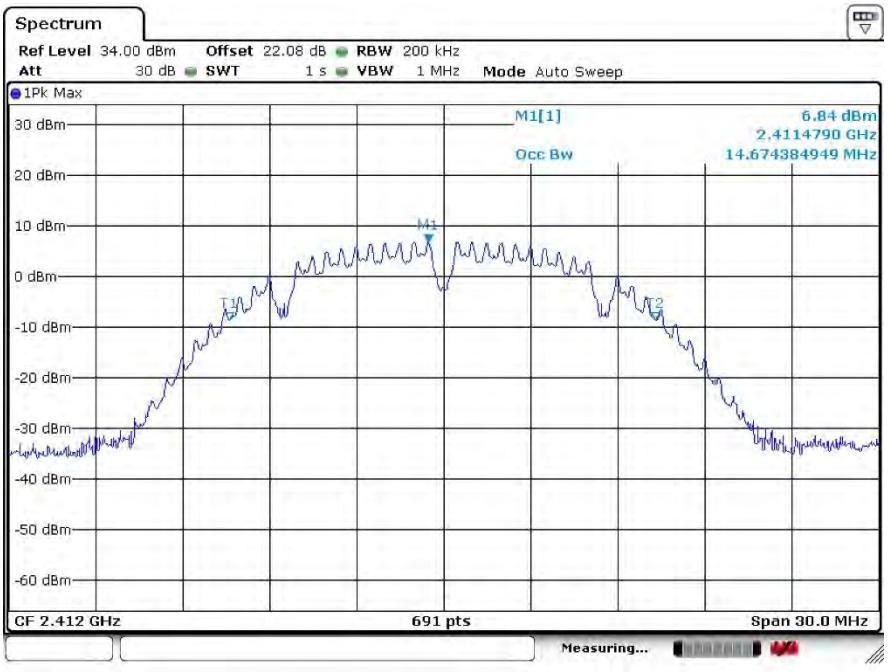


Low Channel 6 dB OBW Antenna B

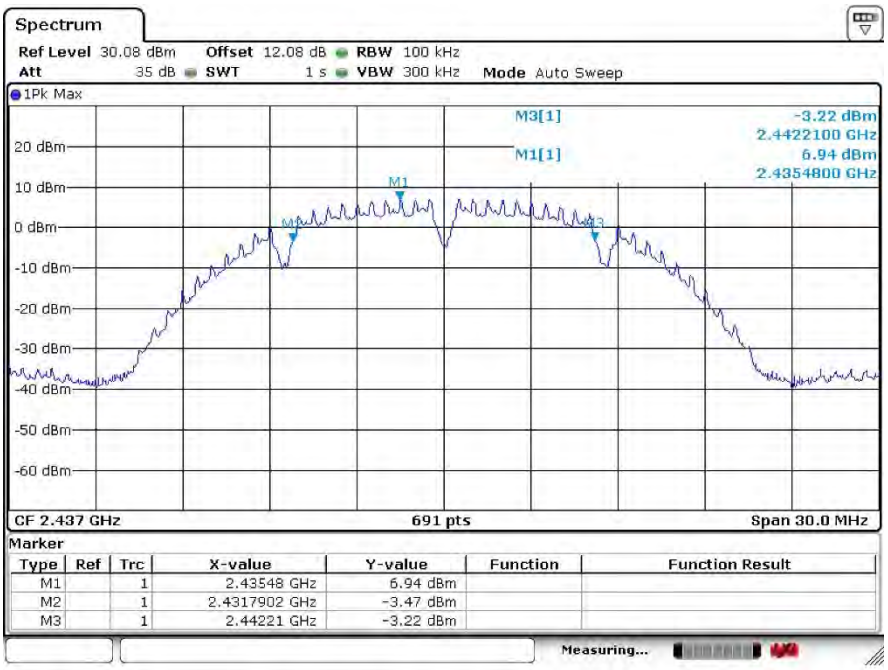


Low Channel 99% OBW Antenna A

Low Channel 99% OBW Antenna B

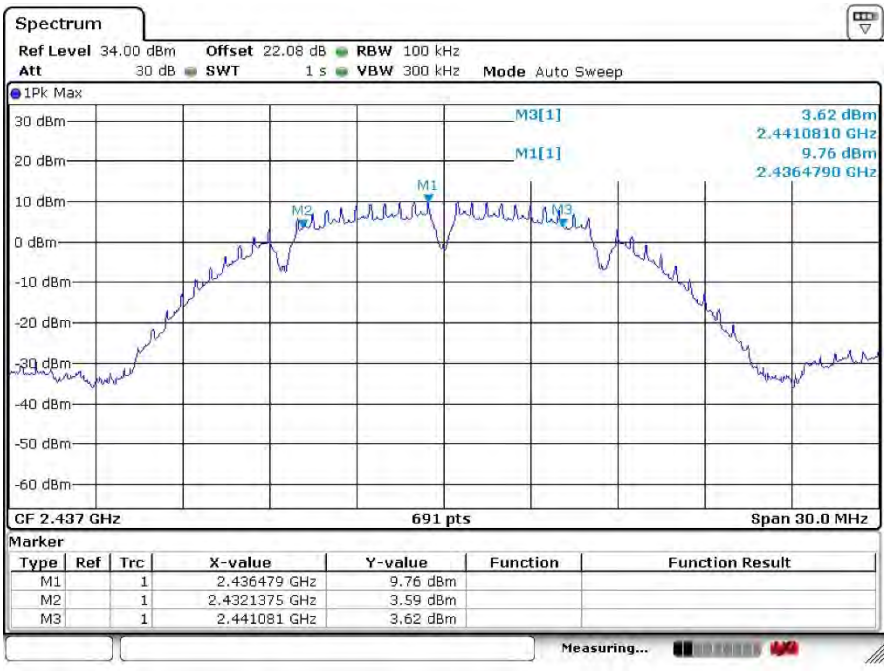


Mid Channel 6 dB OBW Antenna A



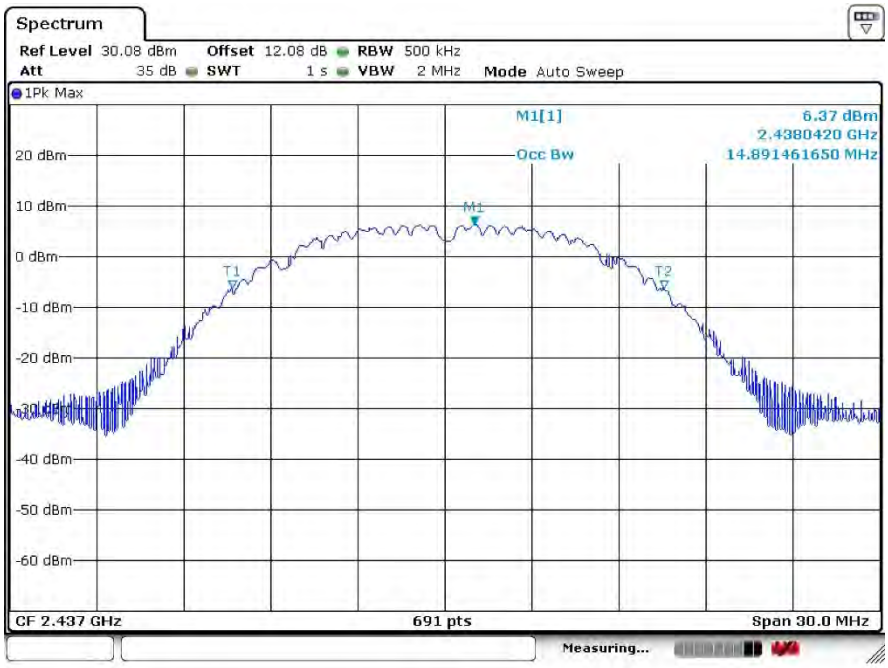
Date: 2.JUL.2021 16:18:50

Mid Channel 6 dB OBW Antenna B

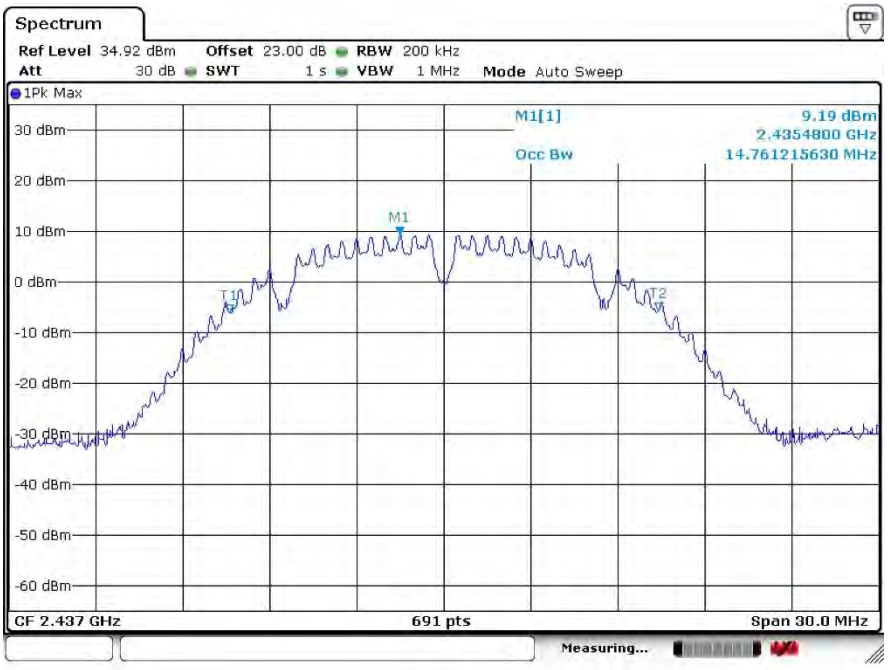


Date: 29.JUN.2021 10:30:32

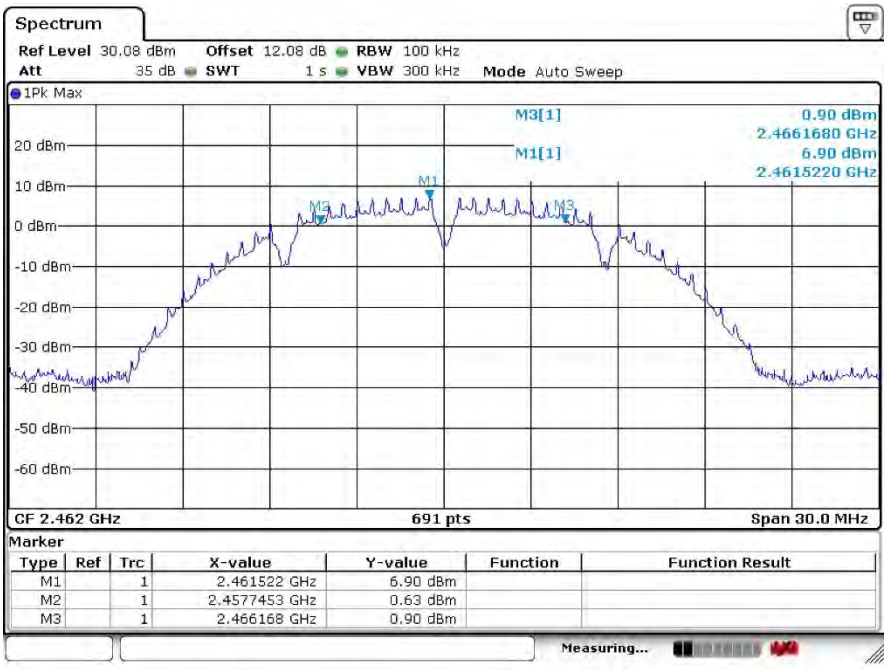
Mid Channel 99% OBW Antenna A



Mid Channel 99% BW Antenna B

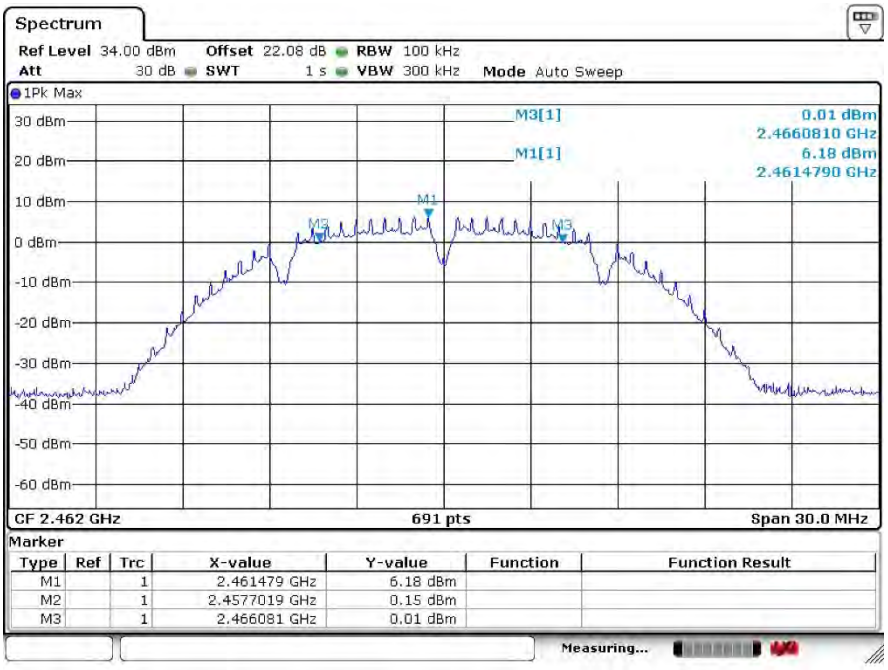


High Channel 6 dB OBW Antenna A



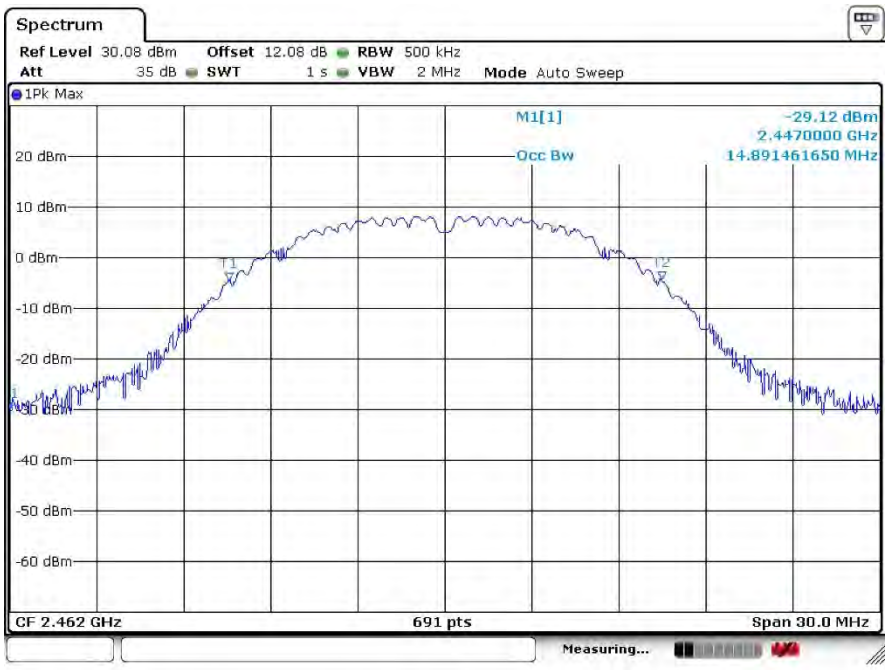
Date: 2.JUL.2021 16:23:18

High Channel 6 dB OBW Antenna B

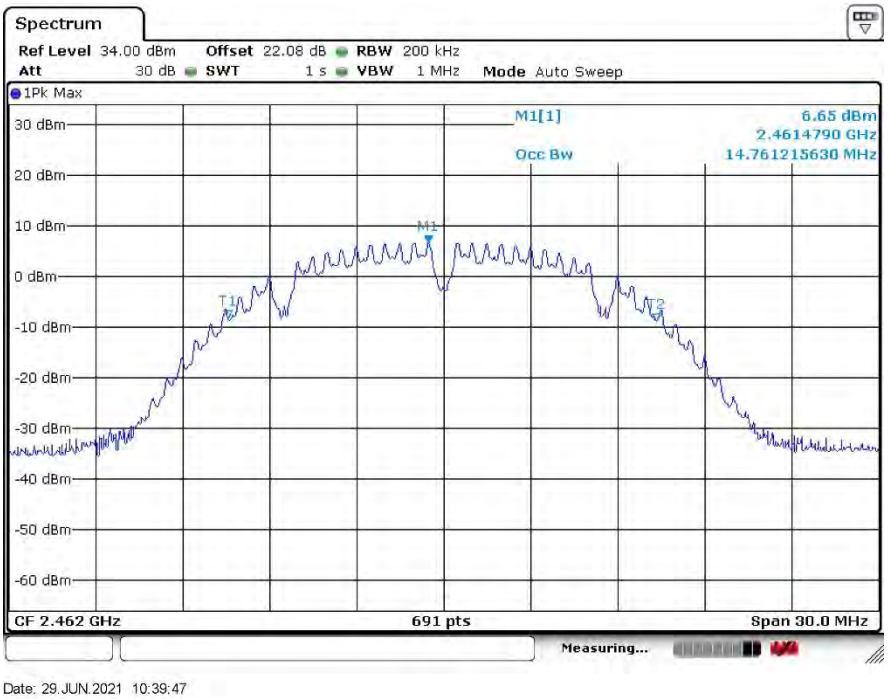


Date: 29.JUN.2021 10:41:16

High Channel 99% OBW Antenna A

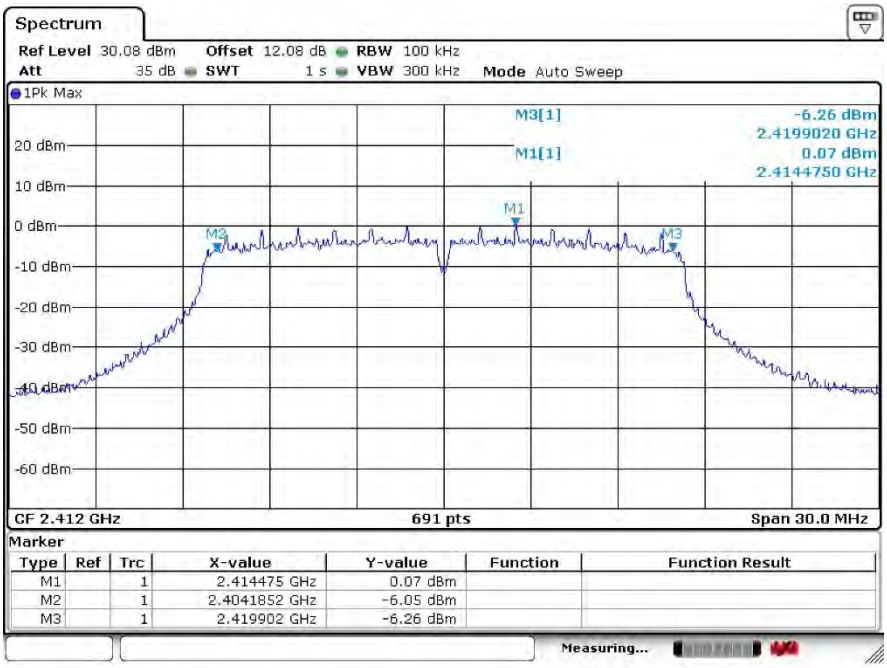


High Channel 99% OBW Antenna B

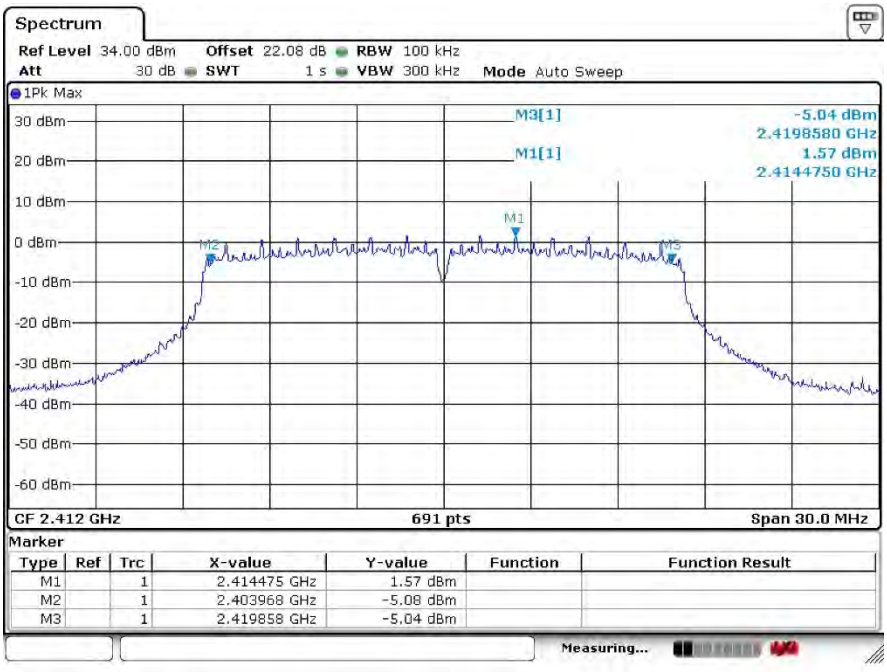


802.11g mode

Low Channel 6 dB OBW Antenna A



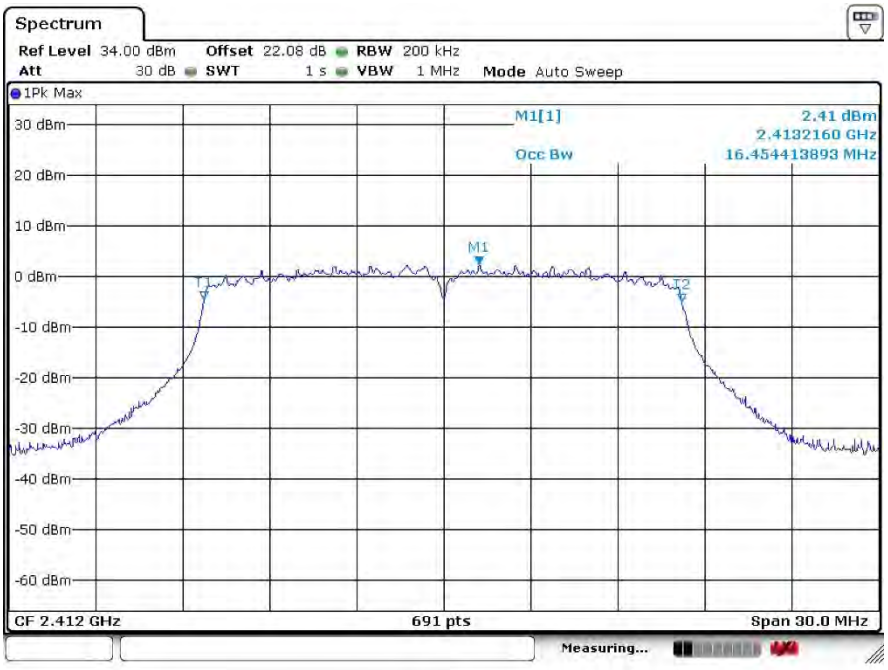
Low Channel 6 dB OBW Antenna B



Low Channel 99% OBW Antenna A

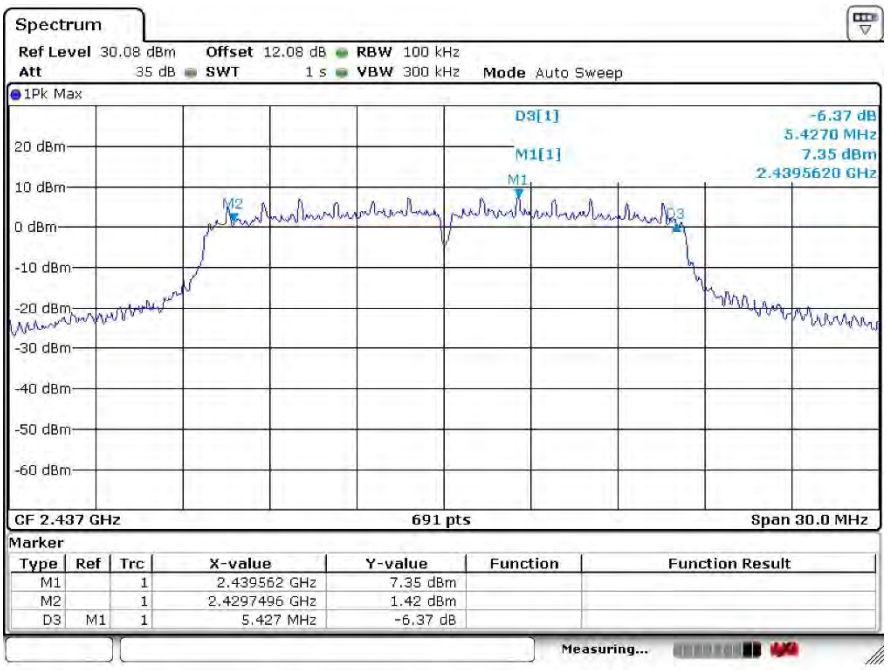
Date: 2.JUL.2021 16:37:02

Low Channel 99% OBW Antenna B



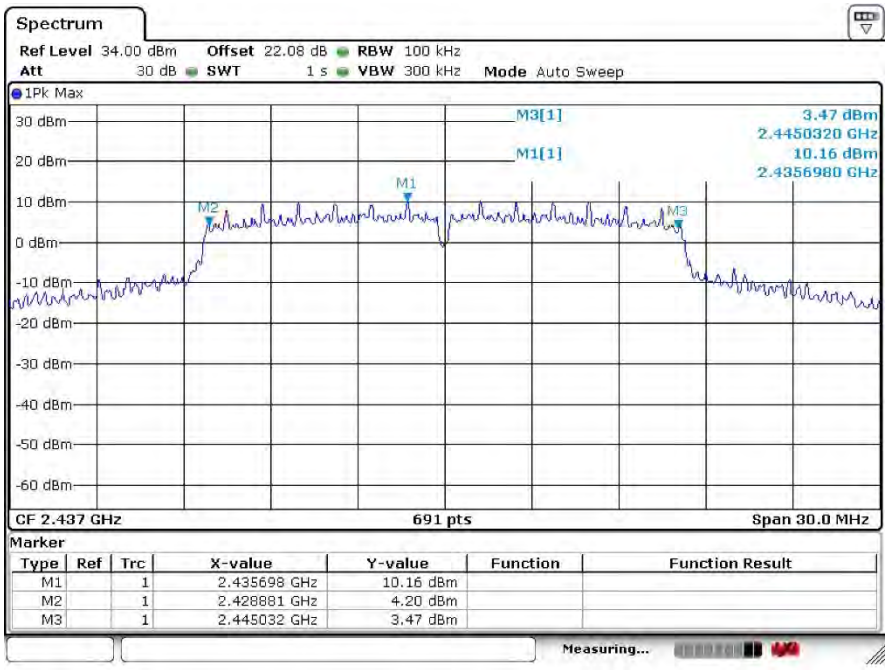
Date: 29.JUN.2021 11:01:02

Mid Channel 6 dB OBW Antenna A



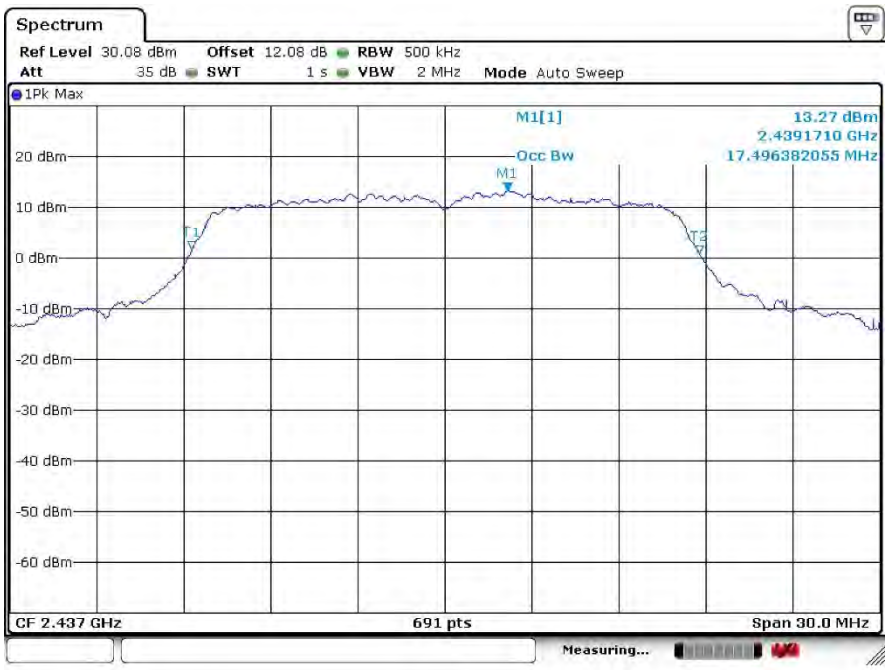
Date: 2.JUL.2021 16:30:40

Mid Channel 6 dB OBW Antenna B

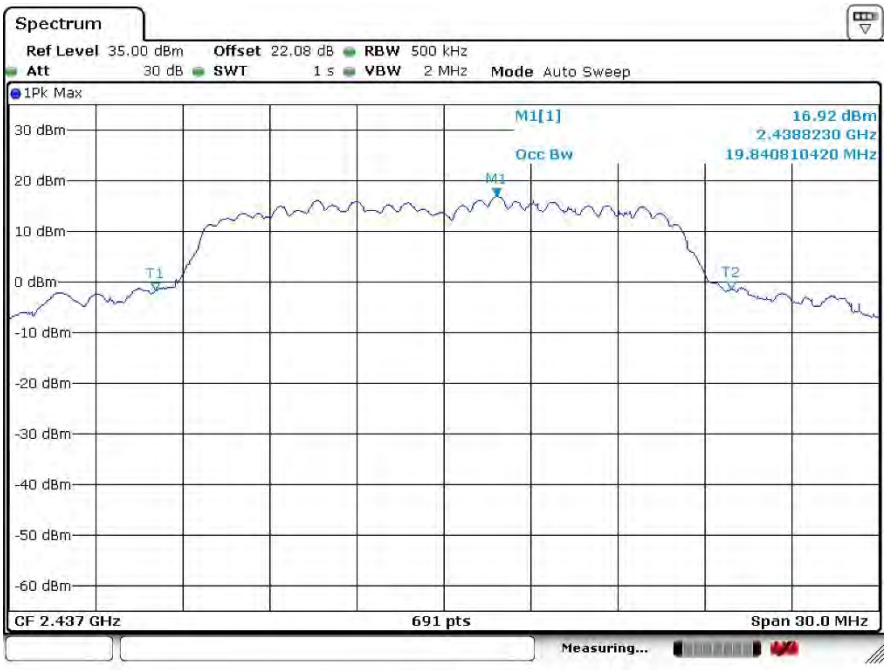


Date: 29.JUN.2021 10:51:46

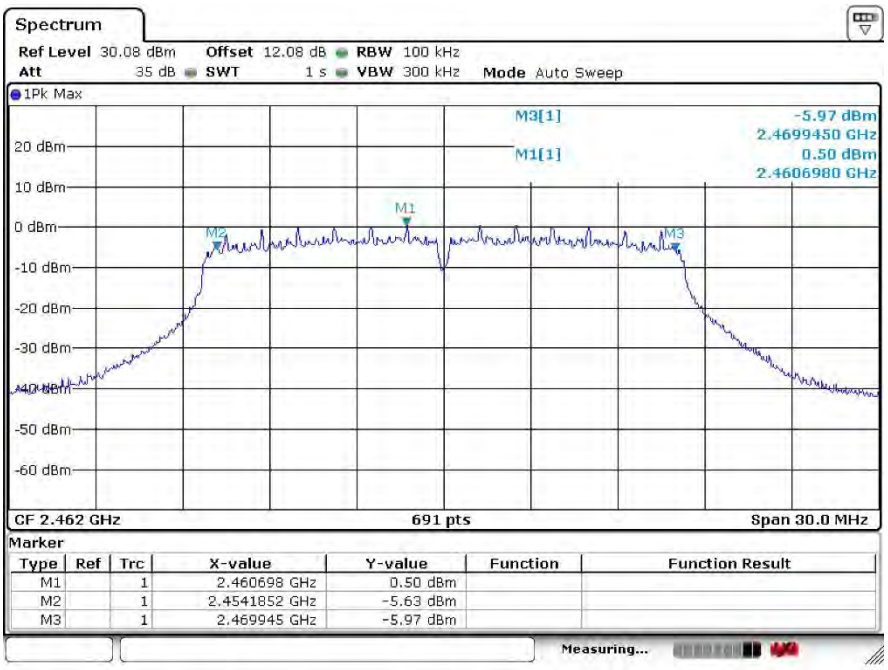
Mid Channel 99% OBW Antenna A



Mid Channel 99% OBW Antenna B

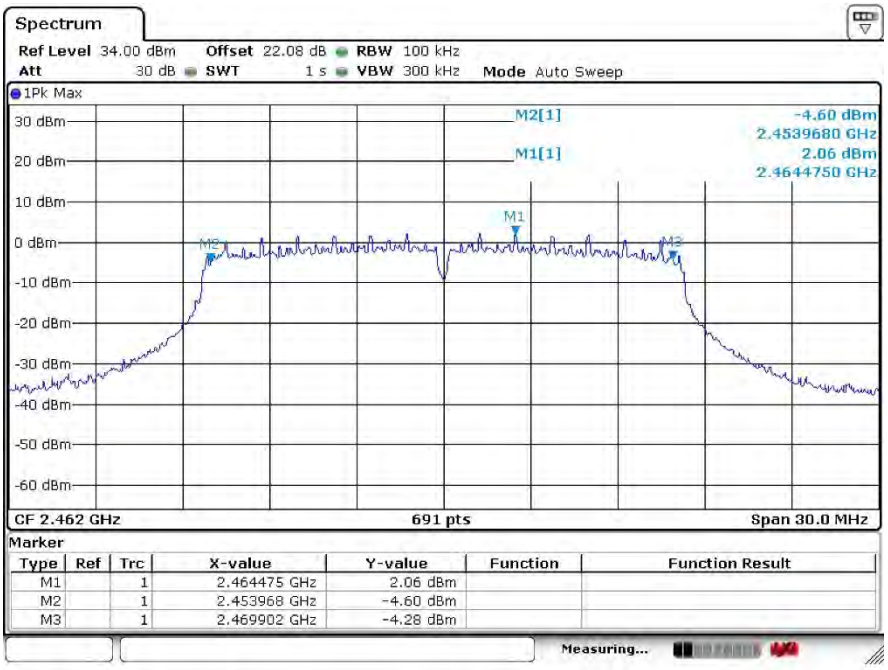


High Channel 6 dB OBW Antenna A



Date: 2.JUL.2021 16:26:19

High Channel 6 dB OBW Antenna B

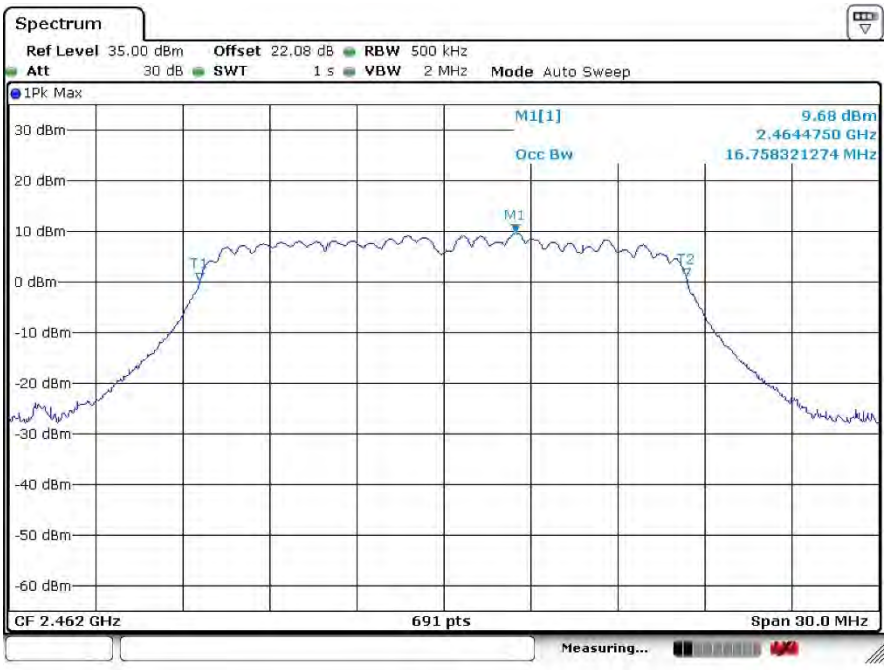


Date: 29.JUN.2021 10:45:38

High Channel 99% OBW Antenna A

Date: 2.JUL.2021 16:27:13

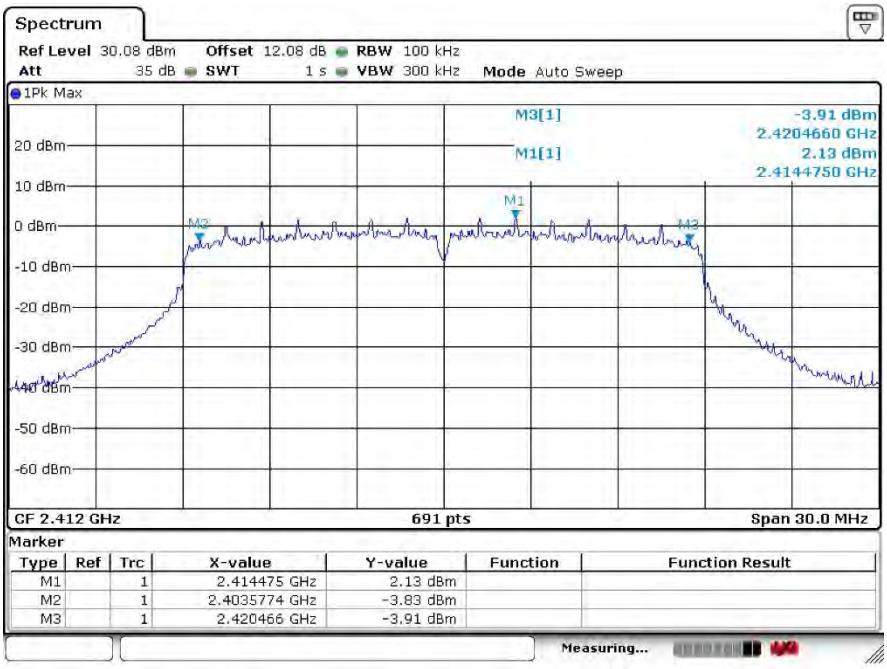
High Channel 99% OBW Antenna B



Date: 1.JUL.2021 10:28:24

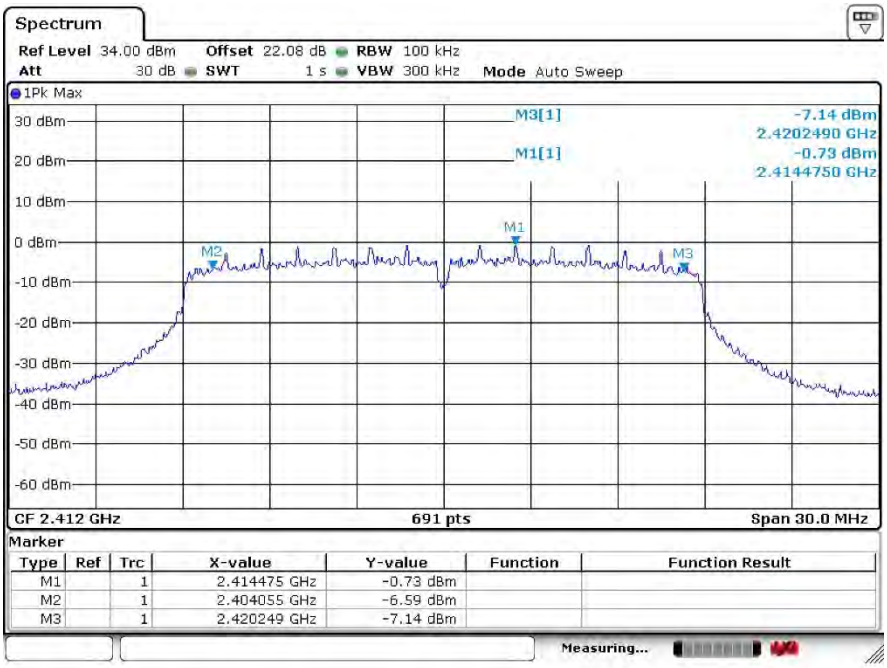
802.11n20 mode

Low Channel 6 dB OBW Antenna A



Date: 6.JUL.2021 08:25:00

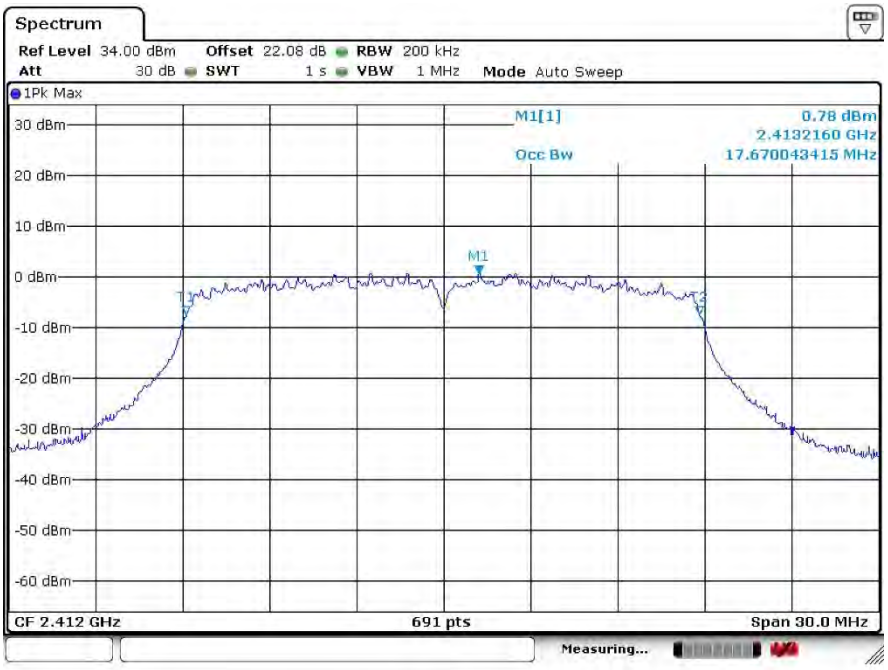
Low Channel 6 dB OBW Antenna B



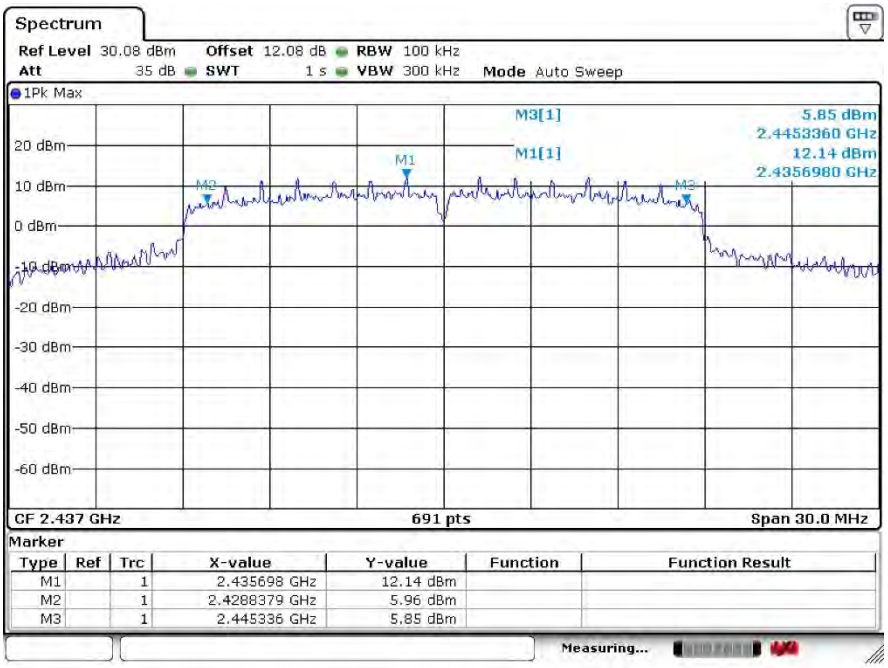
Date: 29.JUN.2021 11:04:42

Low Channel 99% OBW Antenna A

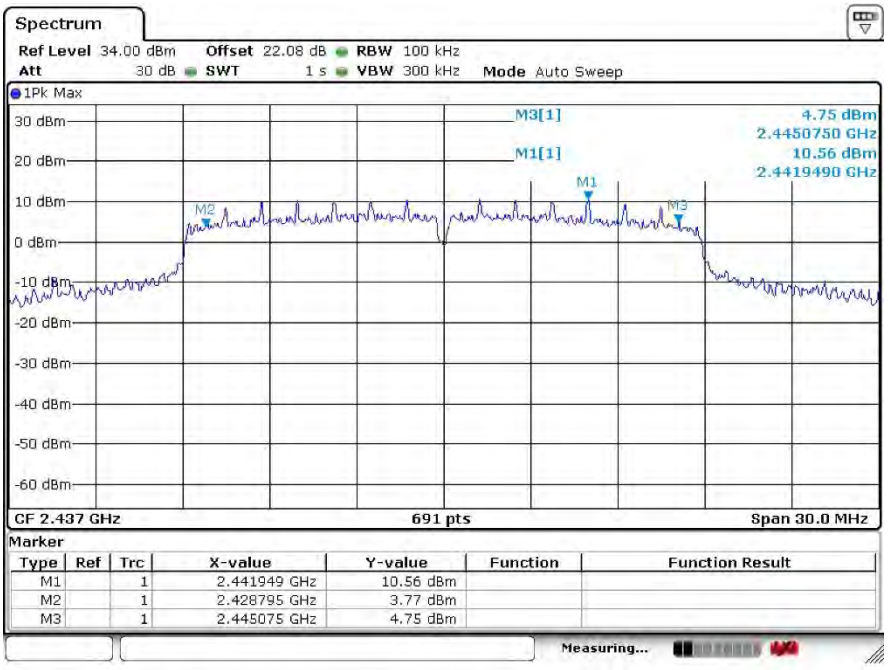
Low Channel 99% OBW Antenna B



Mid Channel 6 dB OBW Antenna A



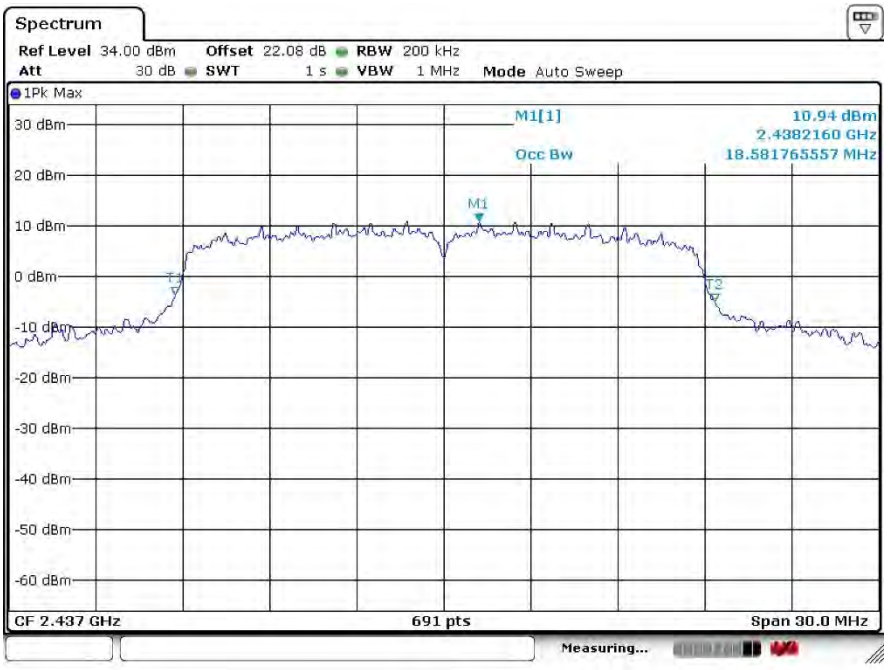
Mid Channel 6 dB OBW Antenna B



Mid Channel 99% OBW Antenna A

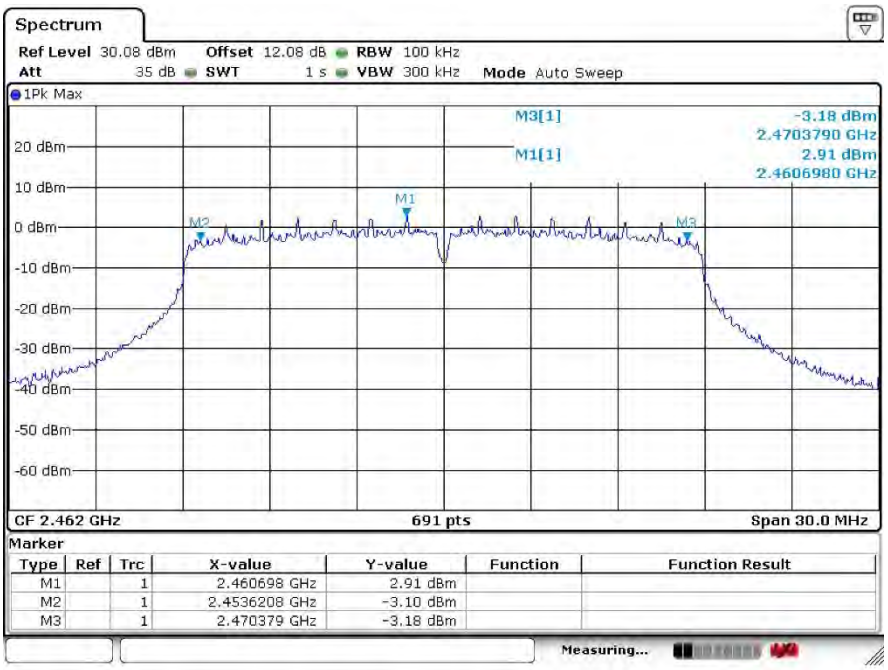
Date: 6.JUL.2021 08:29:01

Mid Channel 99% OBW Antenna B



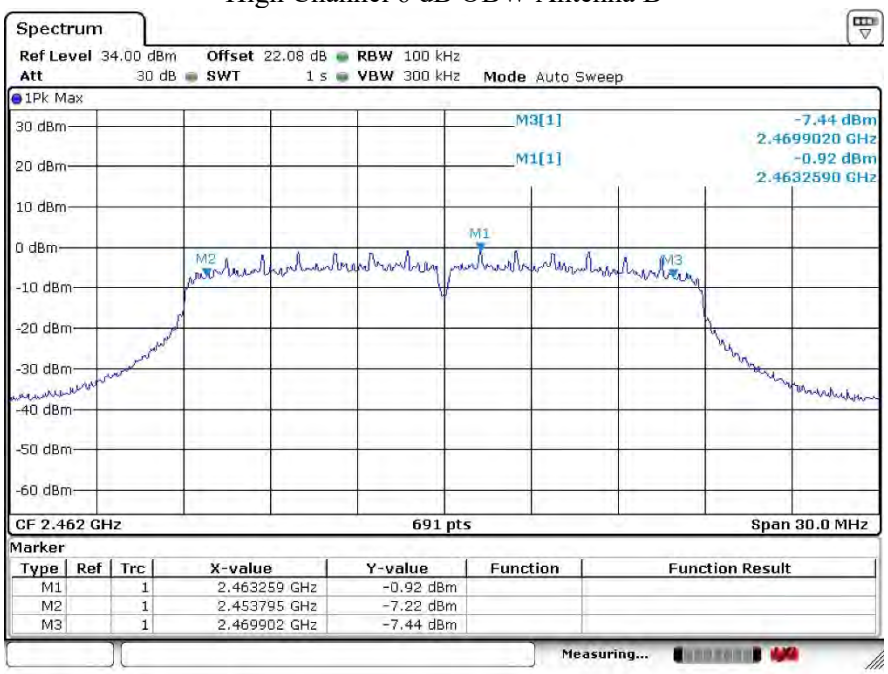
Date: 29.JUN.2021 11:08:29

High Channel 6 dB OBW Antenna A



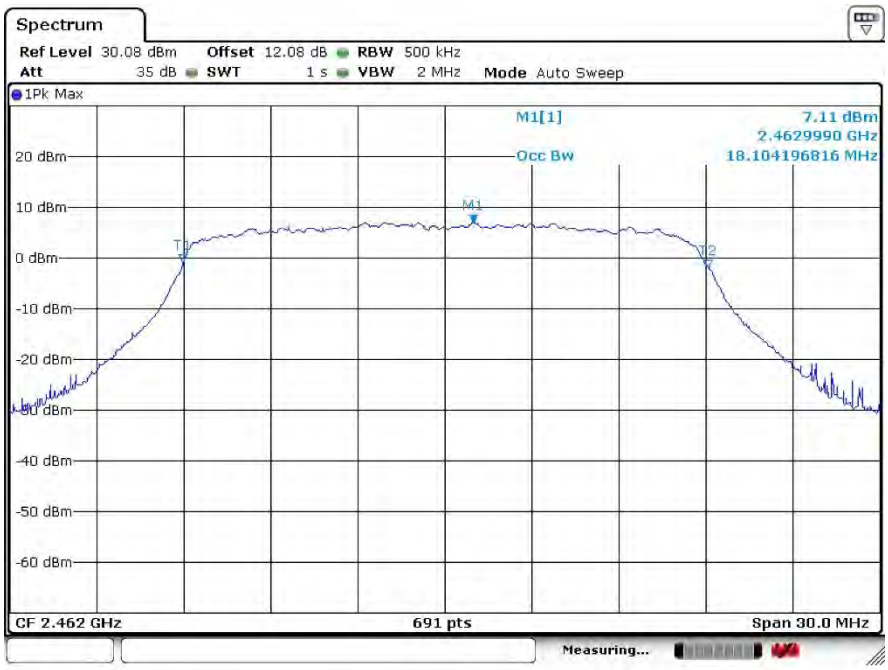
Date: 6.JUL.2021 08:35:42

High Channel 6 dB OBW Antenna B

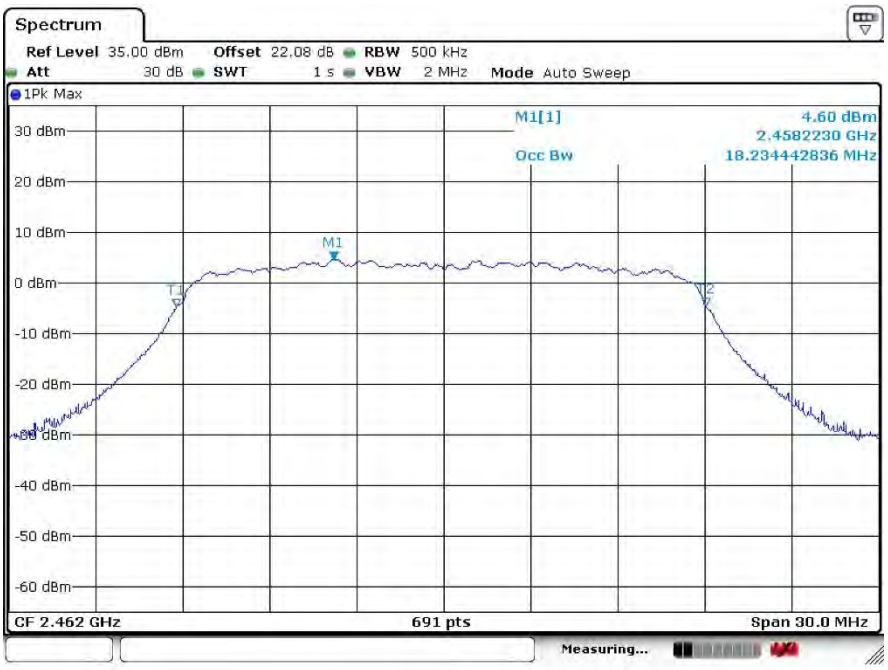


Date: 29.JUN.2021 11:12:53

High Channel 99% OBW Antenna A

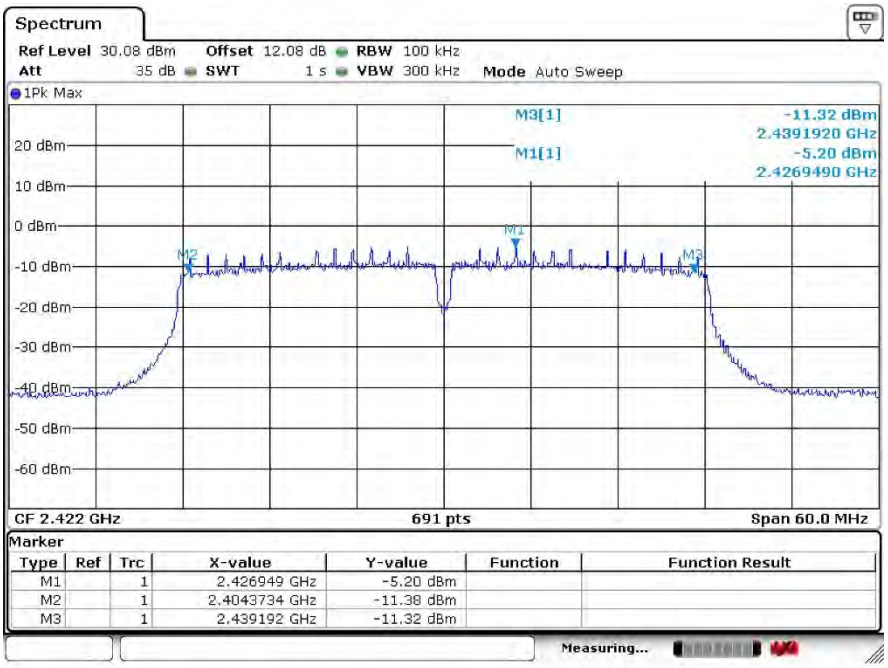


High Channel 99% OBW Antenna B

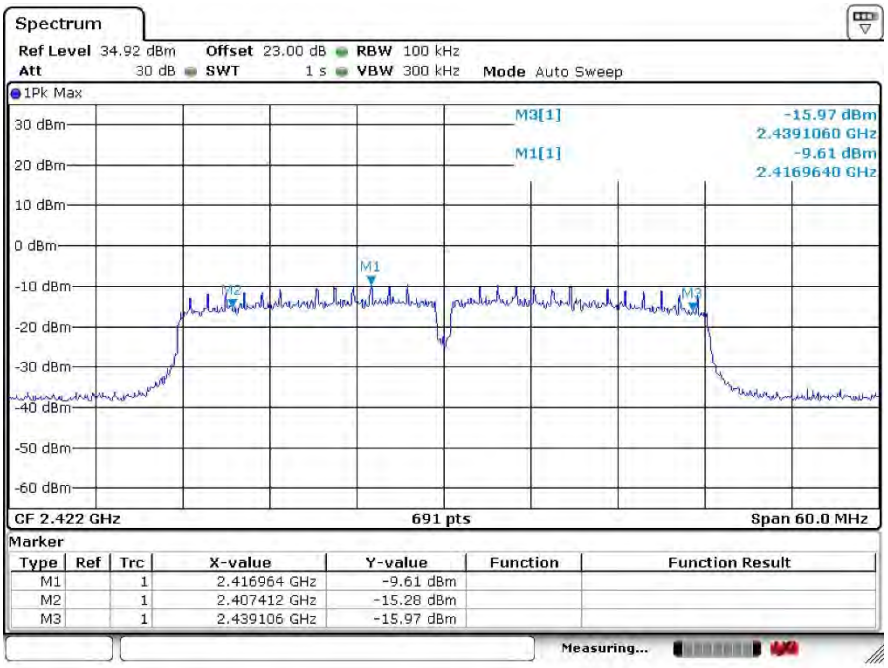


802.11n40 mode

Low Channel 6 dB OBW Antenna A



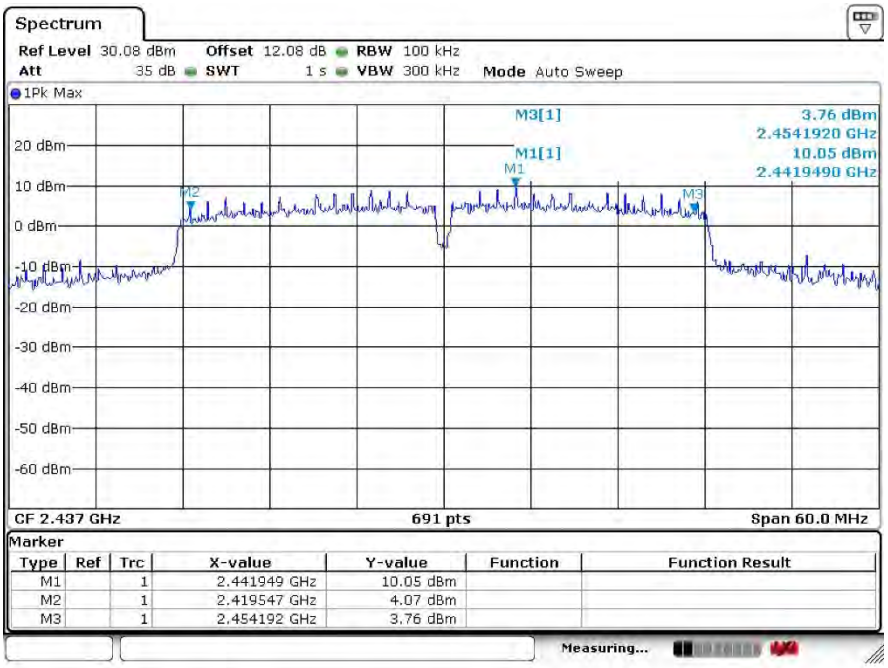
Low Channel 6 dB OBW Antenna B



Low Channel 99% OBW Antenna A

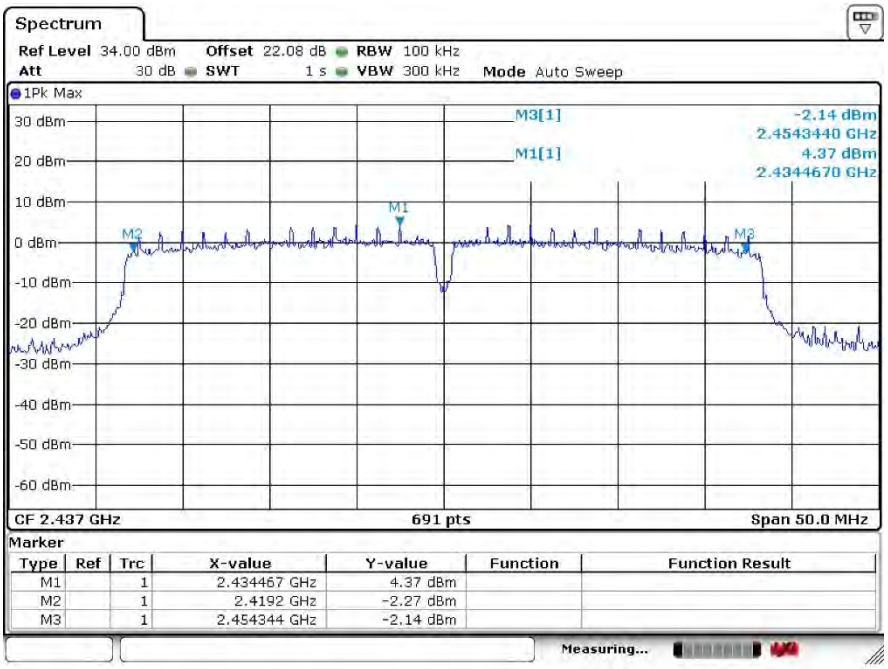
Low Channel 99% OBW Antenna B

Middle Channel 6 dB OBW Antenna A



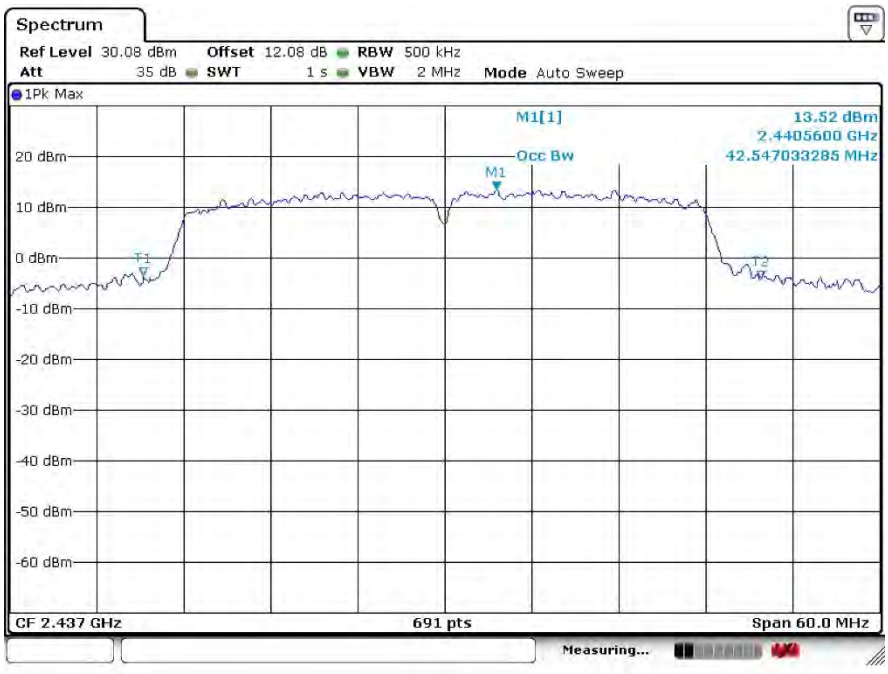
Date: 6.JUL.2021 08:54:06

Middle Channel 6 dB OBW Antenna B



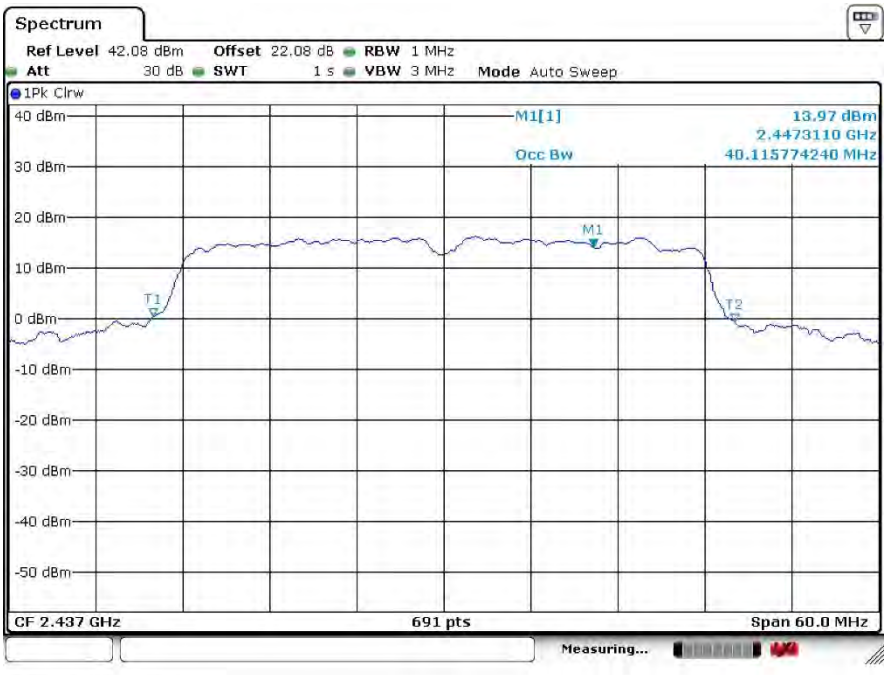
Date: 29.JUN.2021 11:28:10

Middle Channel 99% OBW Antenna A



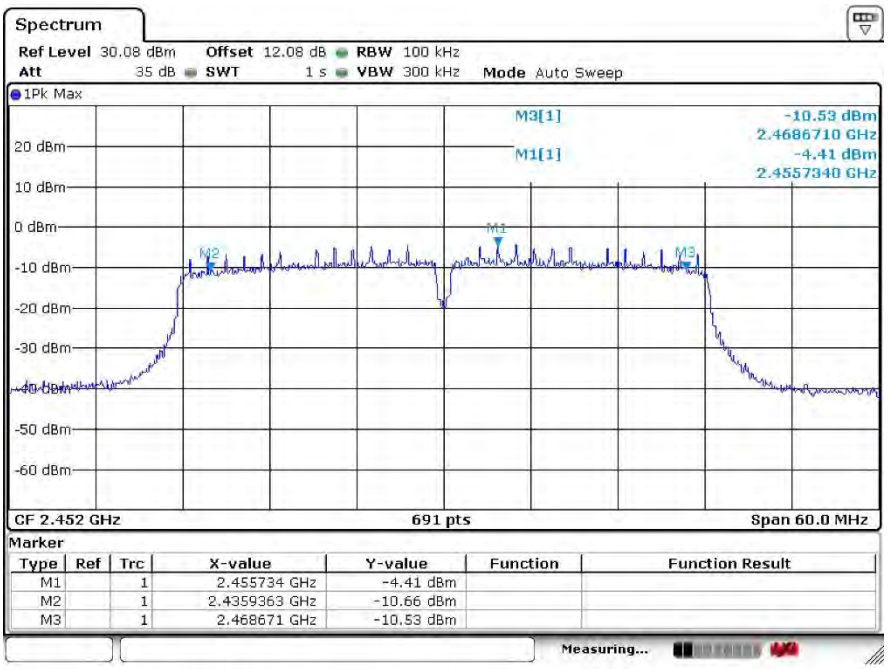
Date: 6.JUL.2021 08:55:55

Middle Channel 99% OBW Antenna B



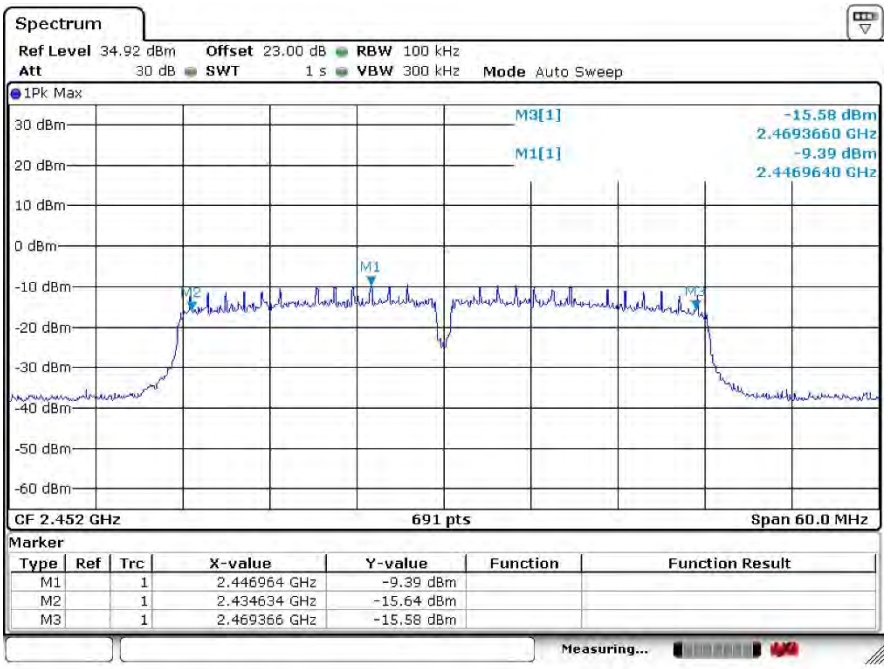
Date: 1.JUL.2021 11:18:05

High Channel 6 dB OBW Antenna A



Date: 6.JUL.2021 09:01:22

High Channel 6 dB OBW Antenna B



Date: 29.JUN.2021 15:50:14

High Channel 99% OBW Antenna A

High Channel 99% OBW Antenna B

9 FCC §15.247(b) (3) & ISEDC RSS-247 §5.4 - Maximum Output Power

9.1 Applicable Standards

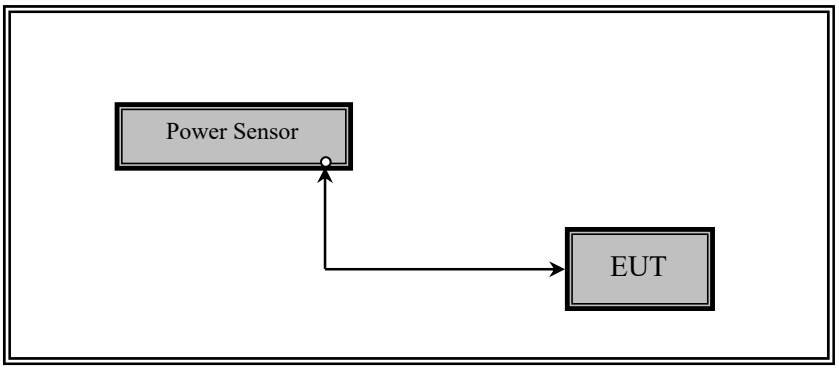
According to FCC §15.247(b) (3): For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

According to RSS-247 §5.4: For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e).

9.2 Measurement Procedure

The measurements are based on ANSI C63.10-2013, Section 11.9.2.2.2.

9.3 Test Setup Block Diagram



9.4 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
-	RF cable	-	-	Each time[1]	N/A
-	20 dB attenuator	-	-	Each time[1]	N/A
ETS- Lingerin	Power Sensor	7002-006	160097	2021-02-21	2 years

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

9.5 Test Environmental Conditions

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

The testing was performed by Rita Yang on 2021-07-15 in RF site.

9.6 Test Results

Channel	Frequency (MHz)	Conducted Output Power (dBm)			Output Power Limit (dBm)	Result
		Antenna A	Antenna B	Total		
802.11b						
Low	2412	20.23	17.6	-	30	Pass
Middle	2437	19.57	21.13	-	30	Pass
High	2462	20.27	16.47	-	30	Pass
802.11g						
Low	2412	14.57	13.73	-	30	Pass
Middle	2437	22.09	22.31	-	30	Pass
High	2462	15.75	14.37	-	30	Pass
802.11 n20						
Low	2412	13.46	11.16	15.47	30	Pass
Middle	2437	23.92	22.27	26.18	30	Pass
High	2462	14.09	11.07	15.85	30	Pass
802.11 n40						
Low	2422	8.92	7.61	11.32	30	Pass
Middle	2437	23.87	23.25	26.58	30	Pass
High	2452	8.94	7.05	11.10	30	Pass

Note: Duty Cycle correction factor has already been added to the measurement.

10 FCC §15.247(d) & ISEDC RSS-247 §5.5 - 100 kHz Bandwidth of Band Edges

10.1 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).

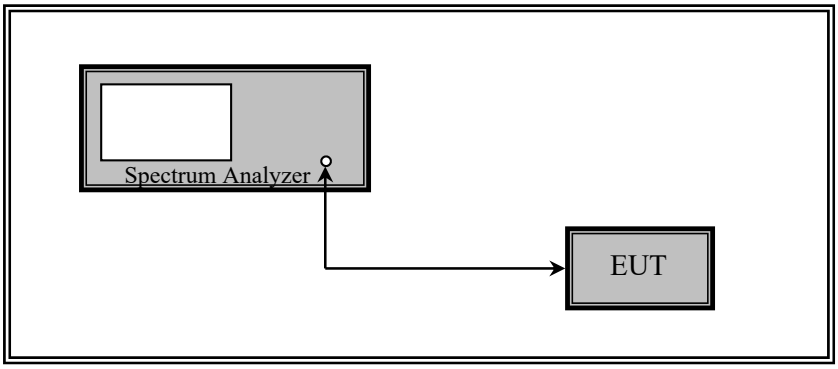
According to ISEDC RSS-247 §5.5.In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

10.2 Measurement Procedure

Span = wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation

RBW = 100 kHz
VBW = 300 kHz
Sweep = coupled
Detector function = peak
Trace = max hold

10.3 Test Setup Block Diagram



10.4 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode & Schwarz	Signal Analyzer	FSV40	101203	2021-04-26	1 year
-	RF cable	-	-	Each time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

10.5 Test Environmental Conditions

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

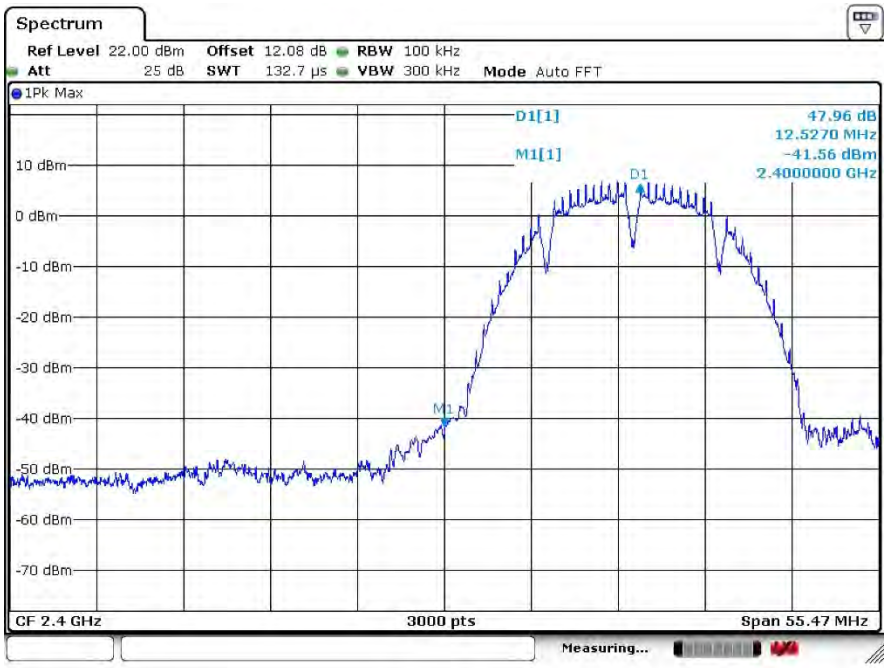
The testing was performed by Rita Yang on 2021-07-06 in RF site.

10.6 Test Results

Please refer to the following plots for detailed test results

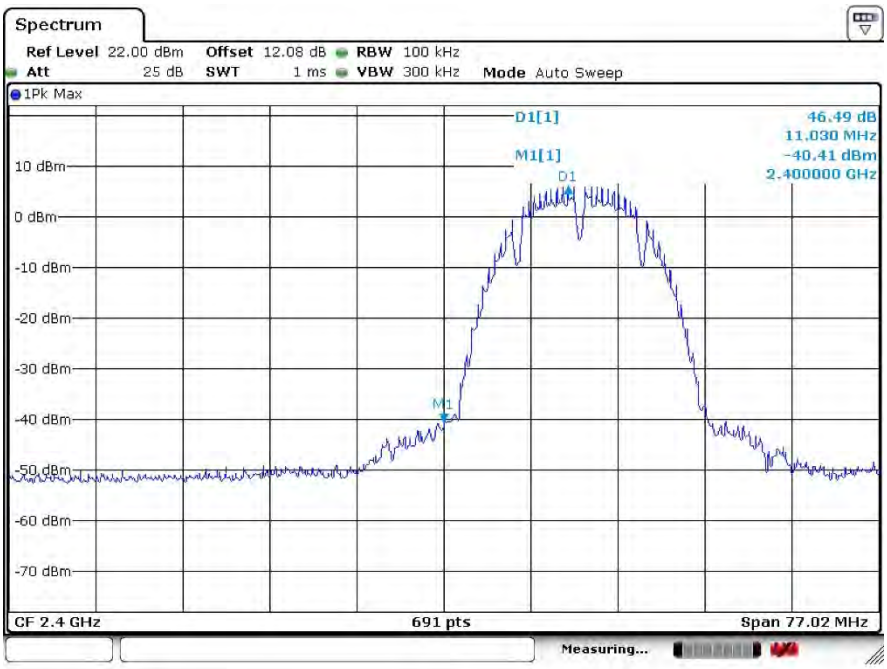
802.11 b mode

Low Channel Antenna A



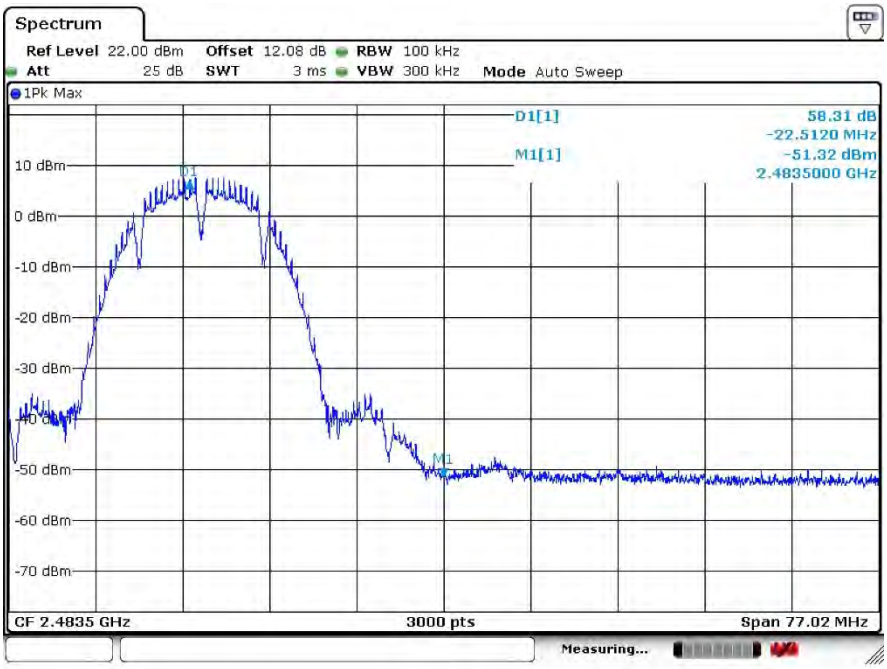
Date: 6.JUL.2021 15:05:58

Low Channel Antenna B



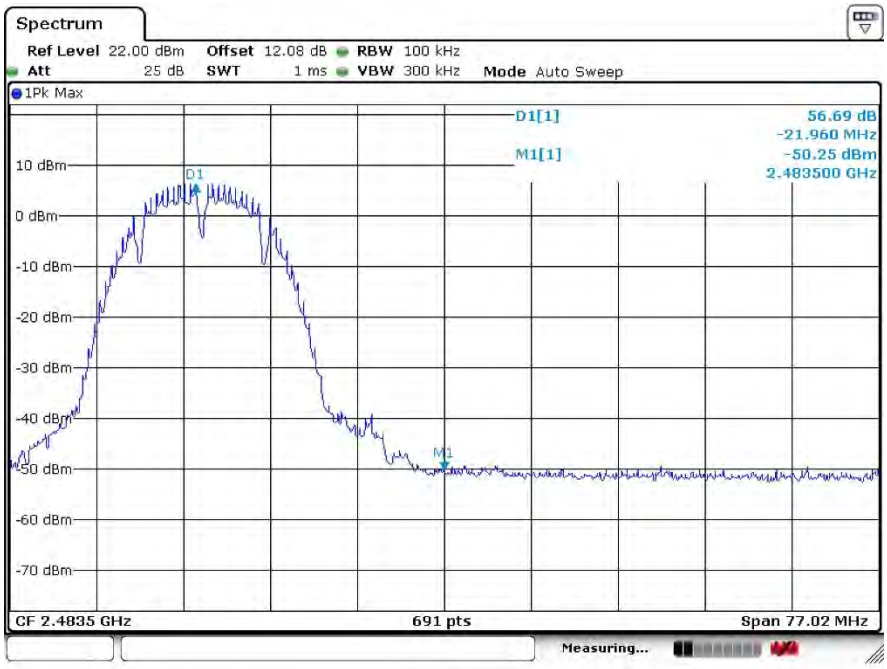
Date: 6.JUL.2021 16:22:10

High Channel Antenna A



Date: 6.JUL.2021 15:12:21

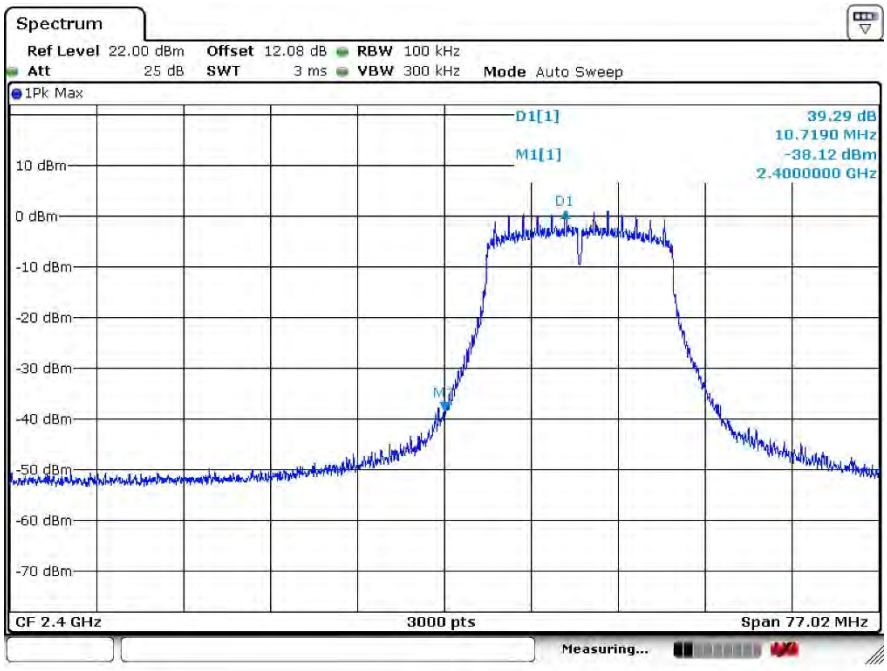
High Channel Antenna B



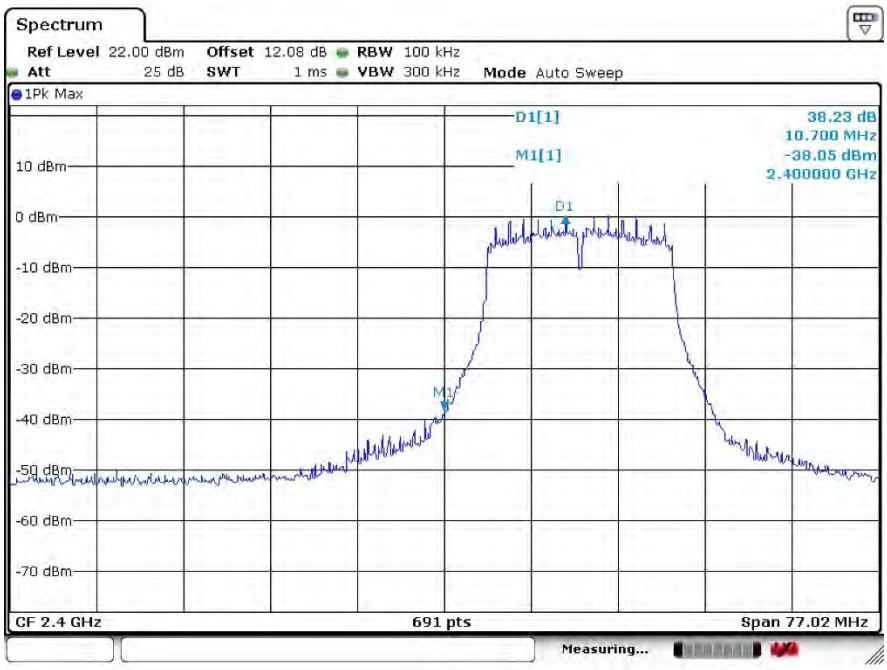
Date: 6.JUL.2021 16:25:35

802.11 g mode

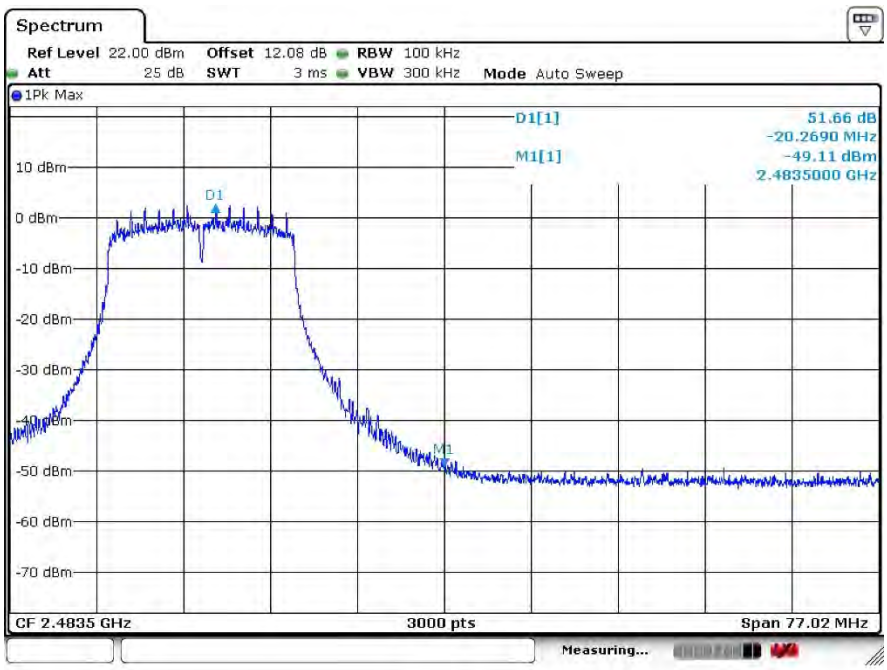
Low Channel Antenna A



Low Channel Antenna B

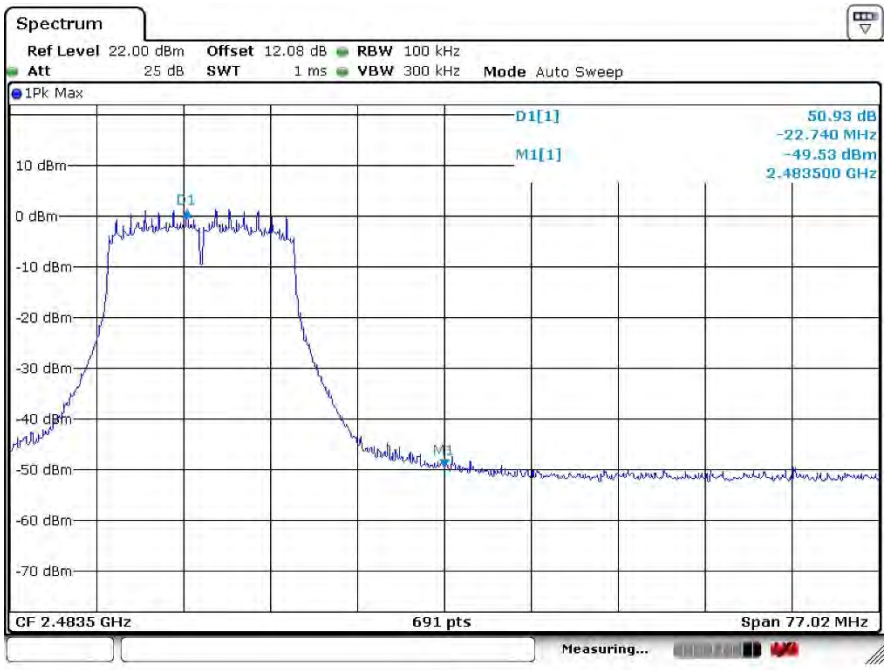


High Channel Antenna A



Date: 6.JUL.2021 15:17:30

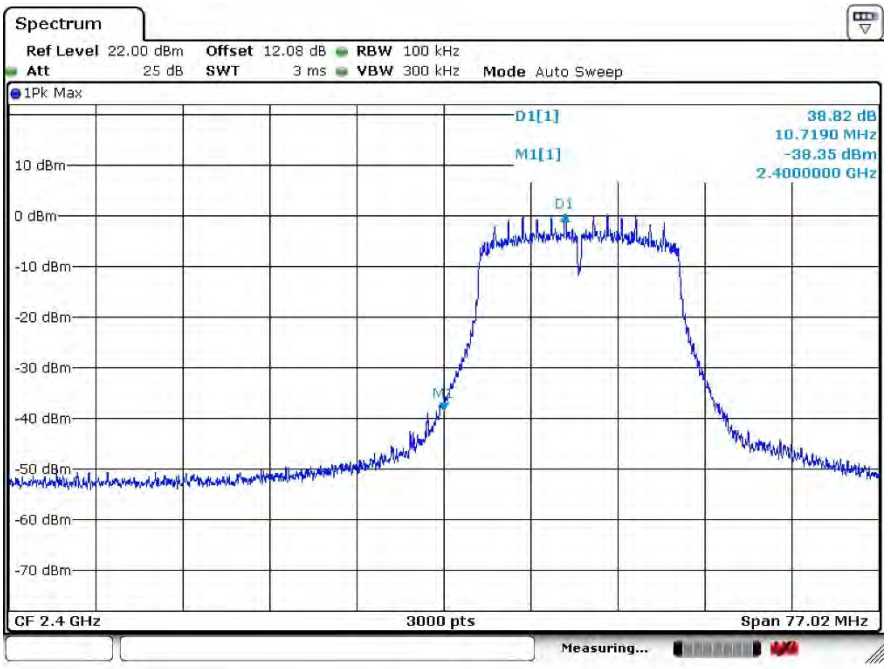
High Channel Antenna B



Date: 6.JUL.2021 16:29:32

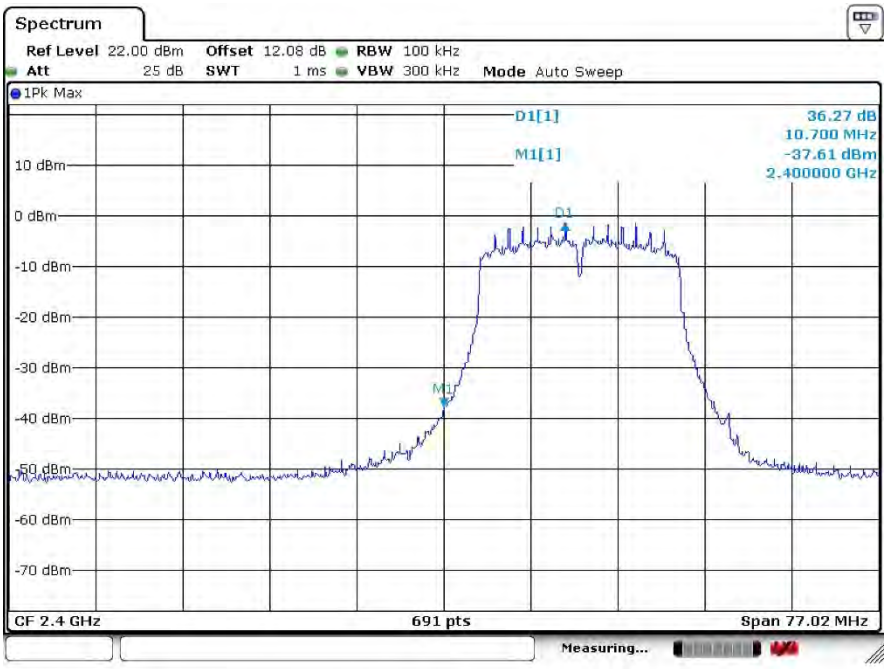
802.11 n20 mode

Low Channel Antenna A



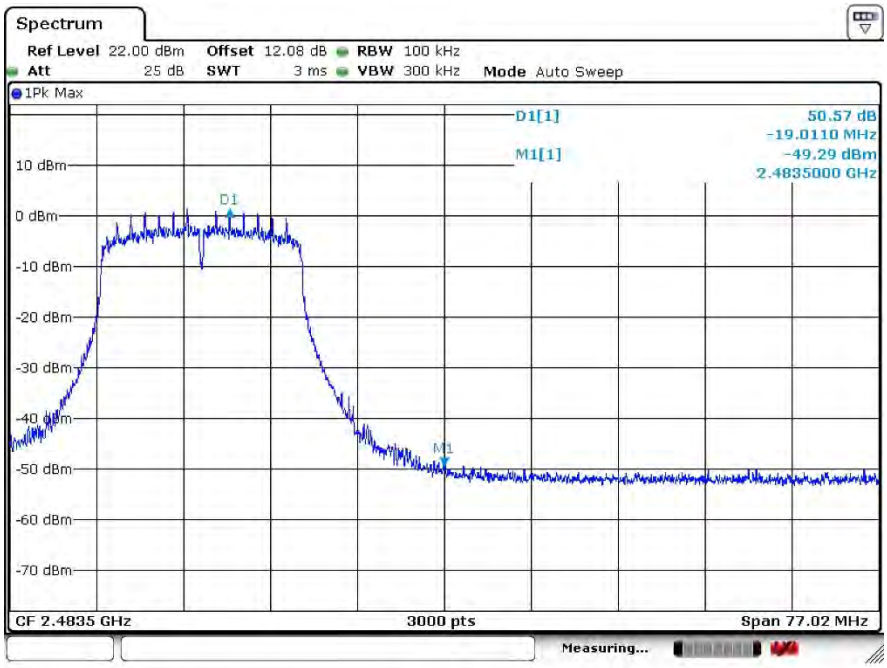
Date: 6.JUL.2021 15:19:28

Low Channel Antenna B



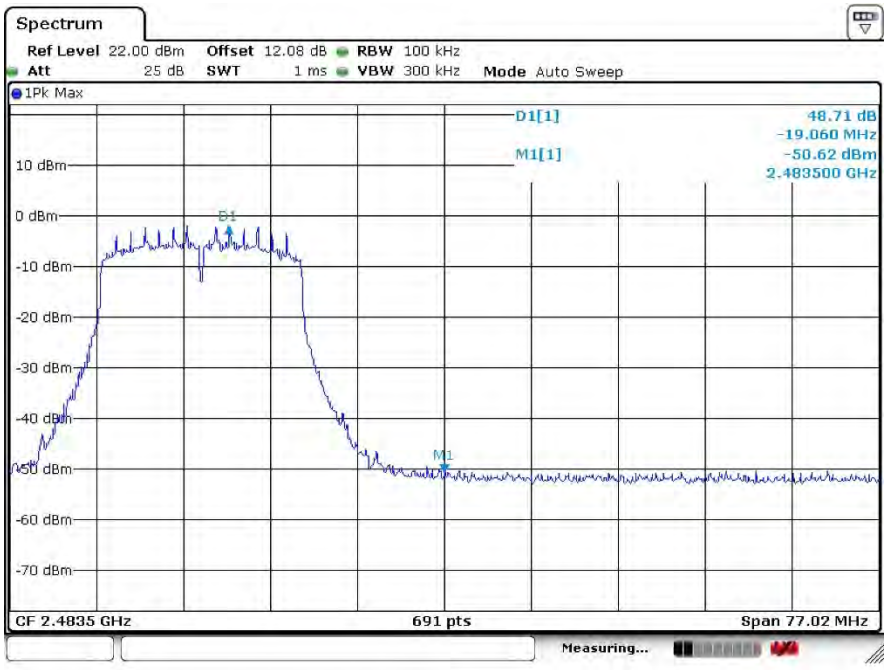
Date: 6.JUL.2021 16:31:32

High Channel Antenna A



Date: 6.JUL.2021 15:21:56

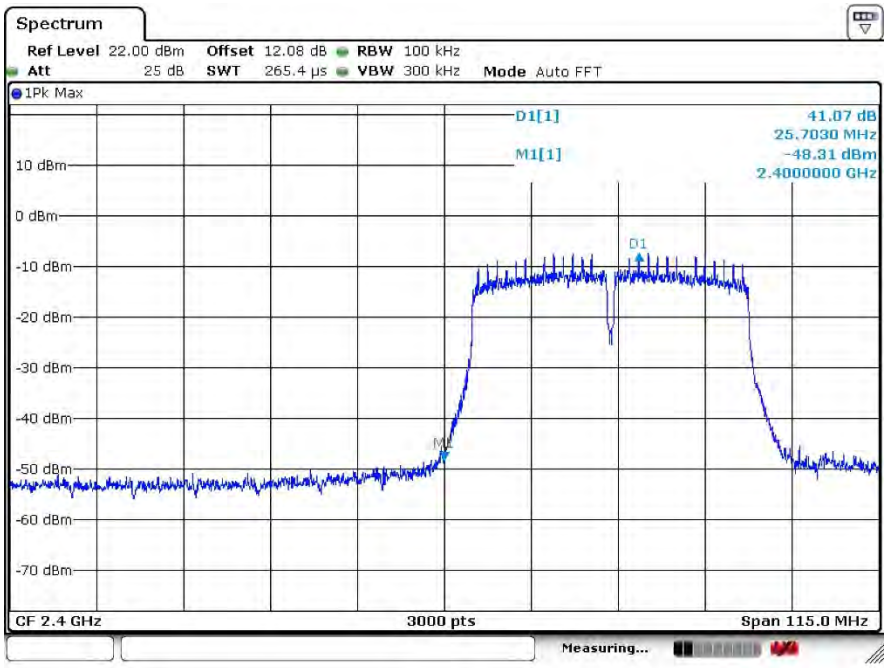
High Channel Antenna B



Date: 6.JUL.2021 16:33:35

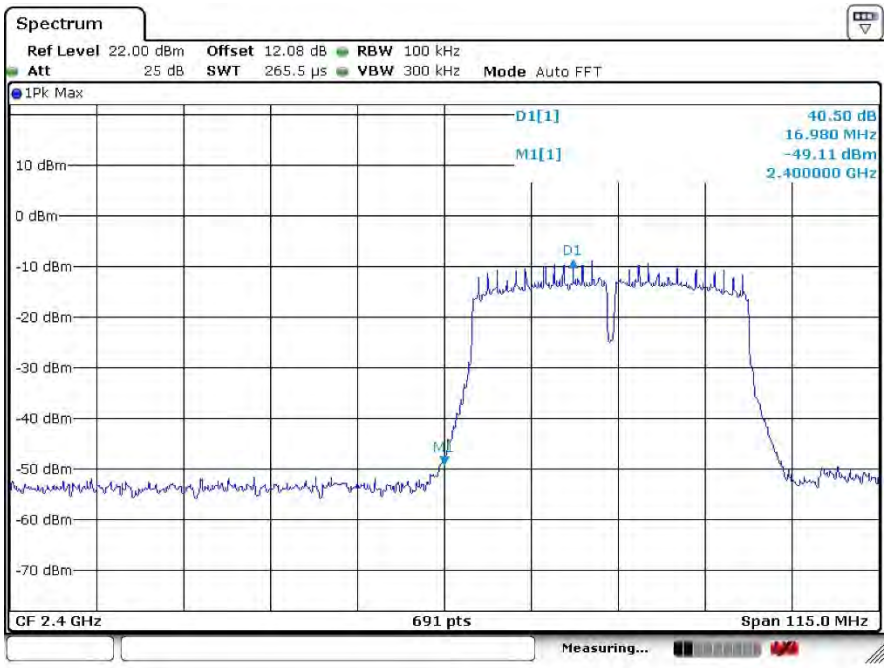
802.11 n40 mode

Low Channel Antenna A



Date: 6.JUL.2021 15:25:24

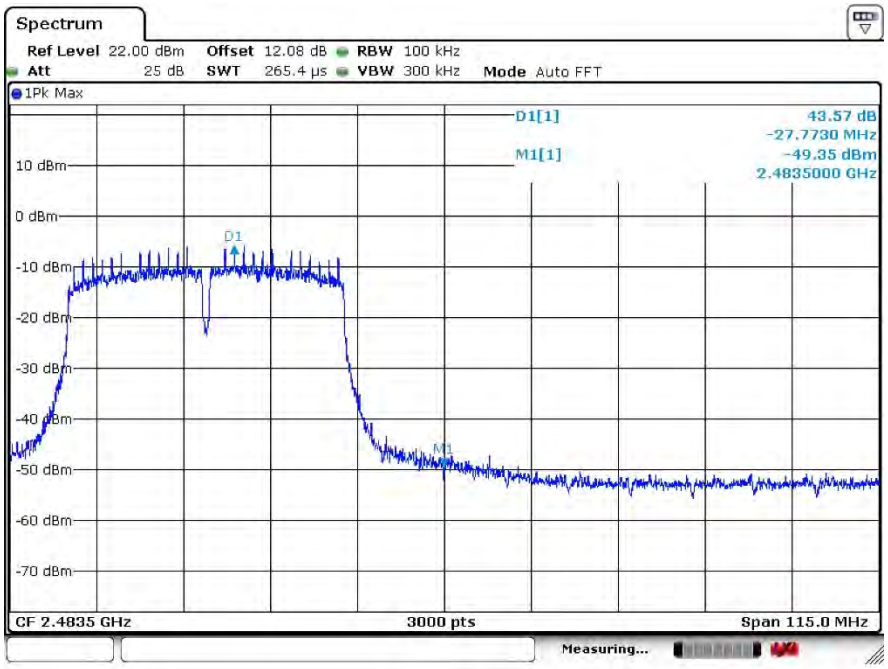
Low Channel Antenna B



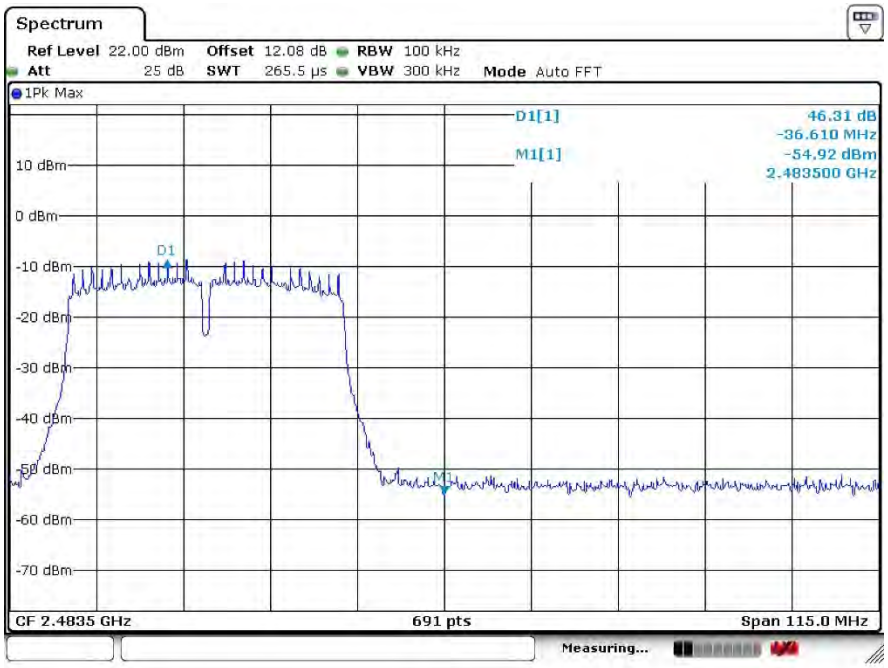
Date: 6.JUL.2021 16:35:46

802.11 n40 mode

High Channel Antenna A



High Channel Antenna B



11 FCC §15.247(e) & ISEDC RSS-247 §5.2(2) – Peak Power Spectral Density

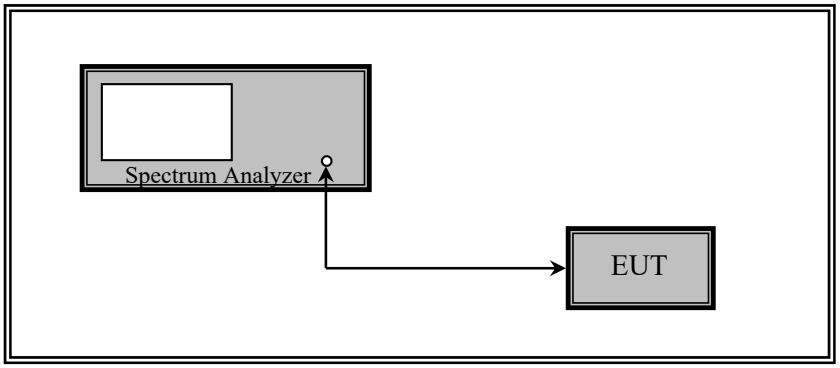
11.1 Applicable Standards

According to ECFR §15.247(e) and RSS-247 §5.2 (2) , 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.

11.2 Measurement Procedure

The measurements are based on FCC KDB 558074 D01 DTS Meas Guidance v05r02: 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.

11.3 Test Setup Block Diagram



11.4 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode & Schwarz	Signal Analyzer	FSV40	101203	2021-04-26	1 year
-	RF cable	-	-	Each time[1]	N/A
-	20 dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

11.5 Test Environmental Conditions

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

The testing was performed by Rita Yang on 2021-07-14 in RF site.

11.6 Test Results

Channel	Frequency (MHz)	PSD (dBm/3kHz)		Corrected PSD (dBm/3kHz)		Limit (dBm/3kHz)
		Antenna A	Antenna B	Antenna A	Antenna B	
802.11b mode						
Low	2412	-5.27	-4.36	-5.12	-4.21	8
Middle	2437	-4.30	-1.78	-4.15	-1.63	8
High	2462	-3.97	-6.09	-3.82	-5.94	8
802.11g mode						
Low	2412	-11.87	-11.95	-11.53	-11.61	8
Middle	2437	-3.60	-2.26	-3.26	-1.92	8
High	2462	-10.27	-10.98	-9.93	-10.64	8
802.11n20 mode						
Low	2412	-13.37	-14.22	-10.41		8
Middle	2437	-3.07	-3.43	0.1140		8
High	2462	-12.37	-15.00	-10.13		8
802.11n40 mode PSD (dBm/30kHz)[1]						
Low	2422	-13.37	-14.22	-9.83		18 dBm/30kHz
Middle	2437	-3.07	-3.43	0.69		18 dBm/30kHz
High	2452	-12.37	-15.00	-9.55		18 dBm/30kHz

*Note: Corrected PSD (dBm/3kHz) = PSD(dBm/3kHz) +10*log(1/x), where x is duty cycle
Note[1]: n40 mode PSD was measured using 30kHz RBW. The limit was updated to reflect this different RBW. (i.e. added 10*log(30kHz/3kHz) = 10)

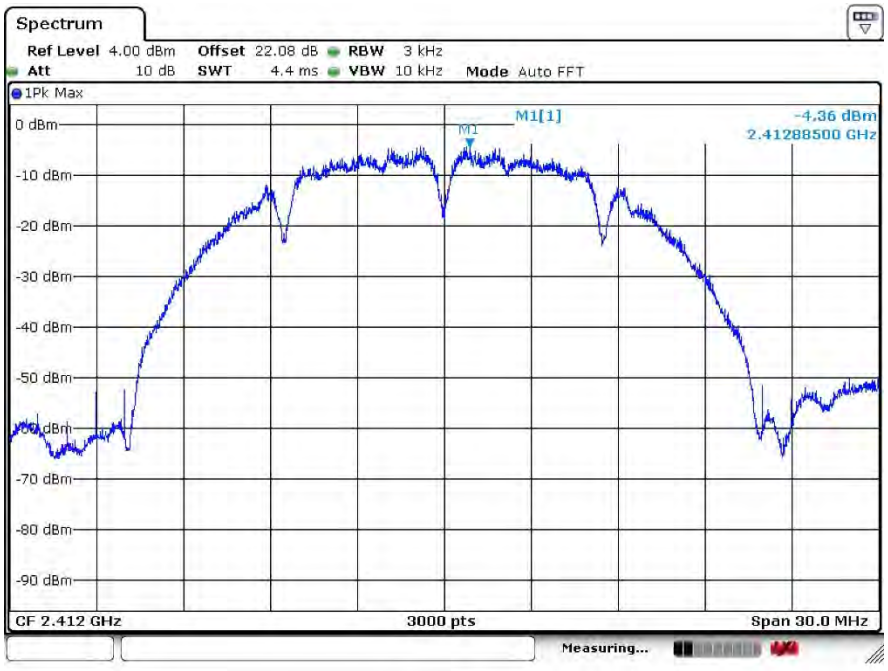
Please refer to the following plots for detailed test results

802.11b mode

Low Channel Antenna A

Date: 14.JUL.2021 09:01:28

Low Channel Antenna B

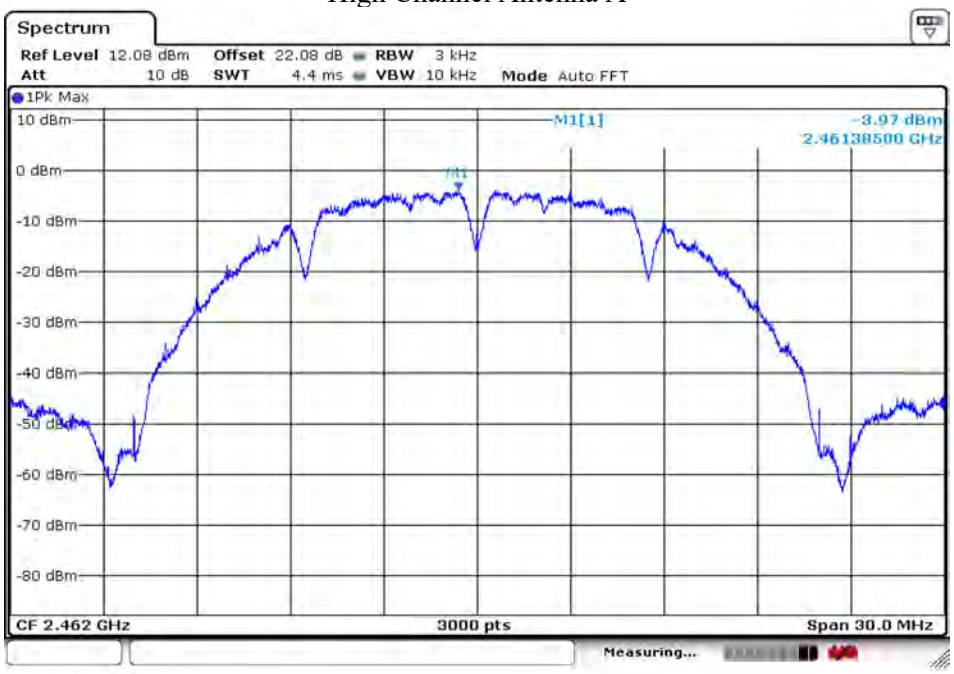


Date: 14.JUL.2021 10:18:12

Mid Channel Antenna A

Mid Channel Antenna B

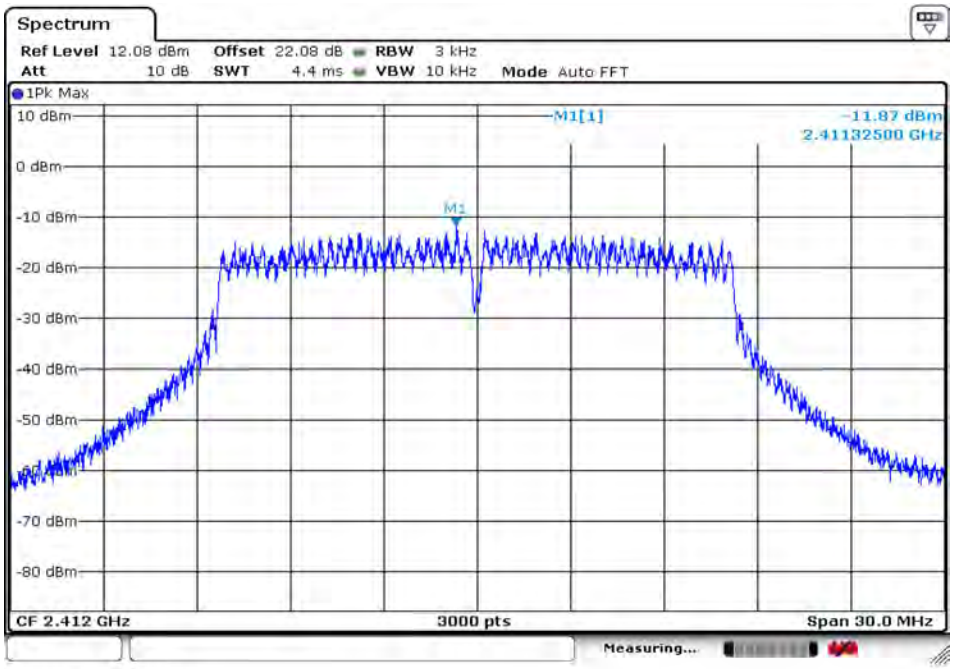
High Channel Antenna A



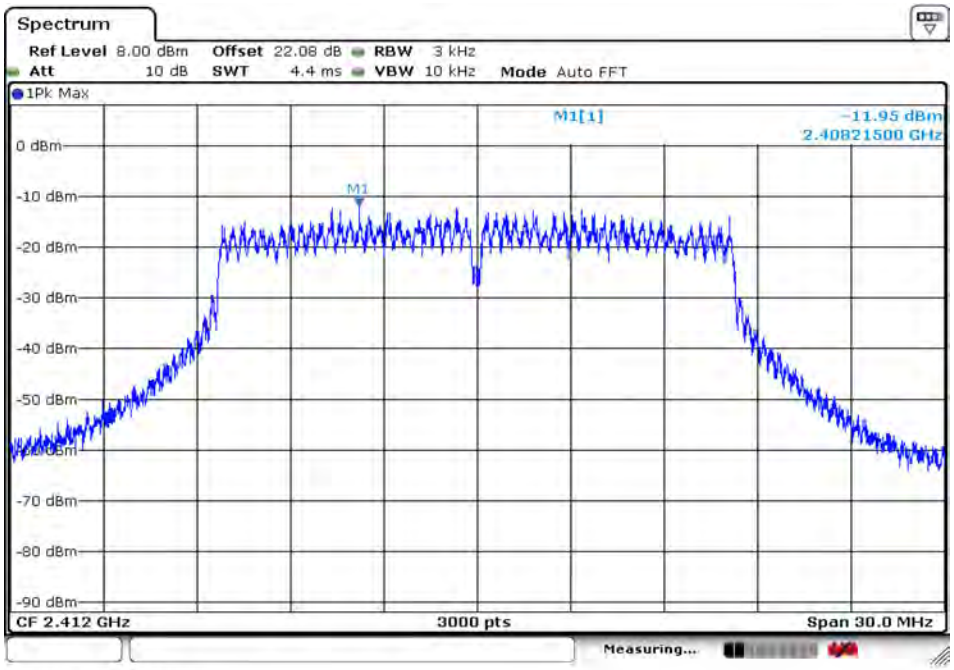
High Channel Antenna B

802.11g mode

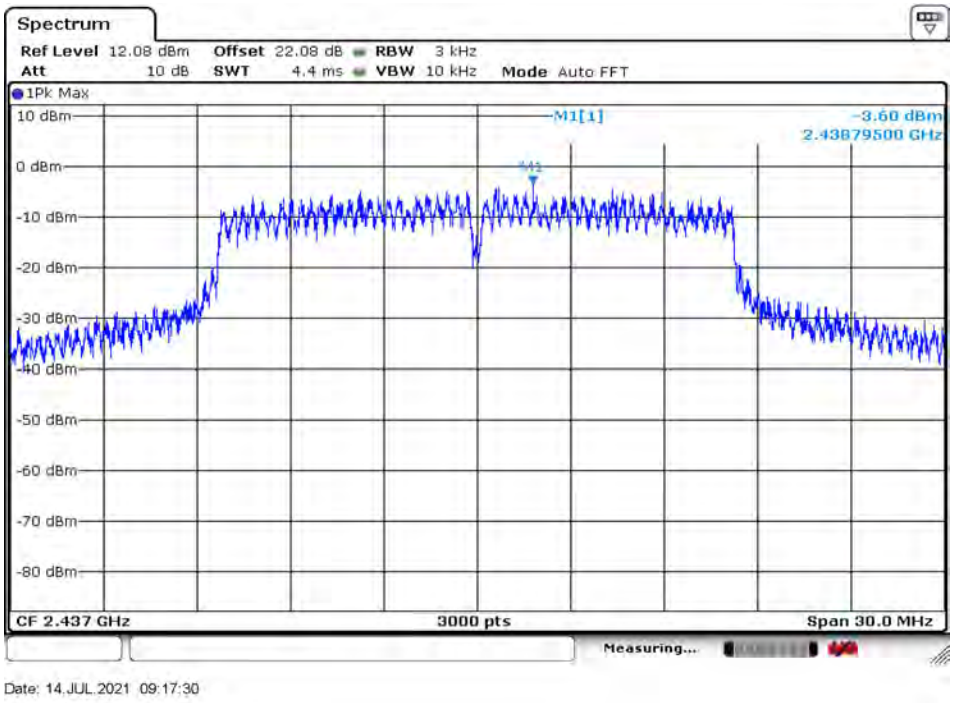
Low Channel Antenna A



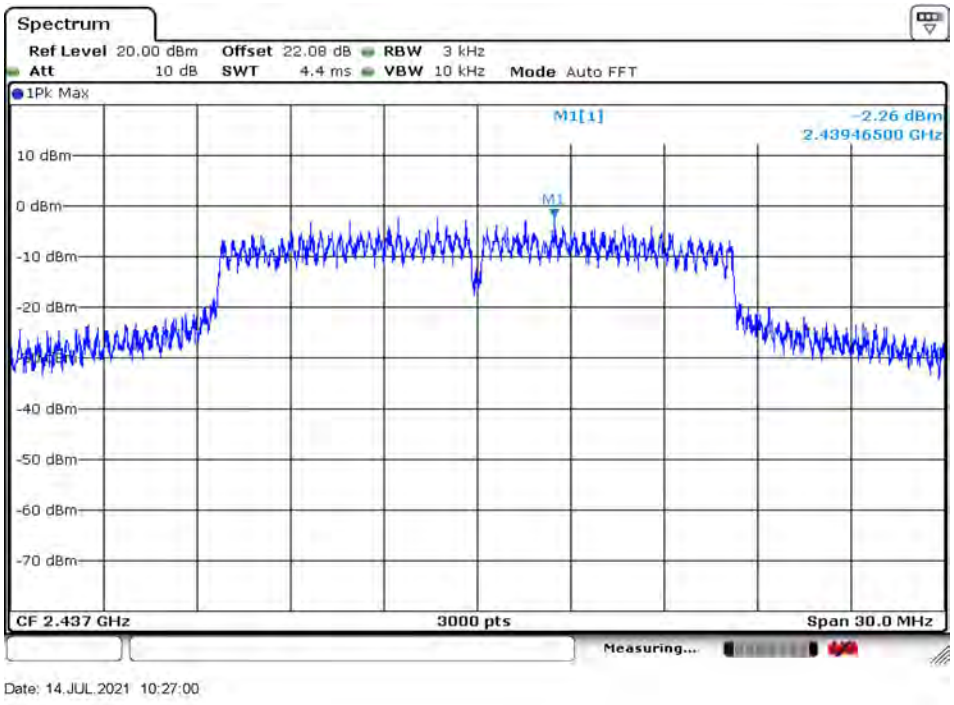
Low Channel Antenna B



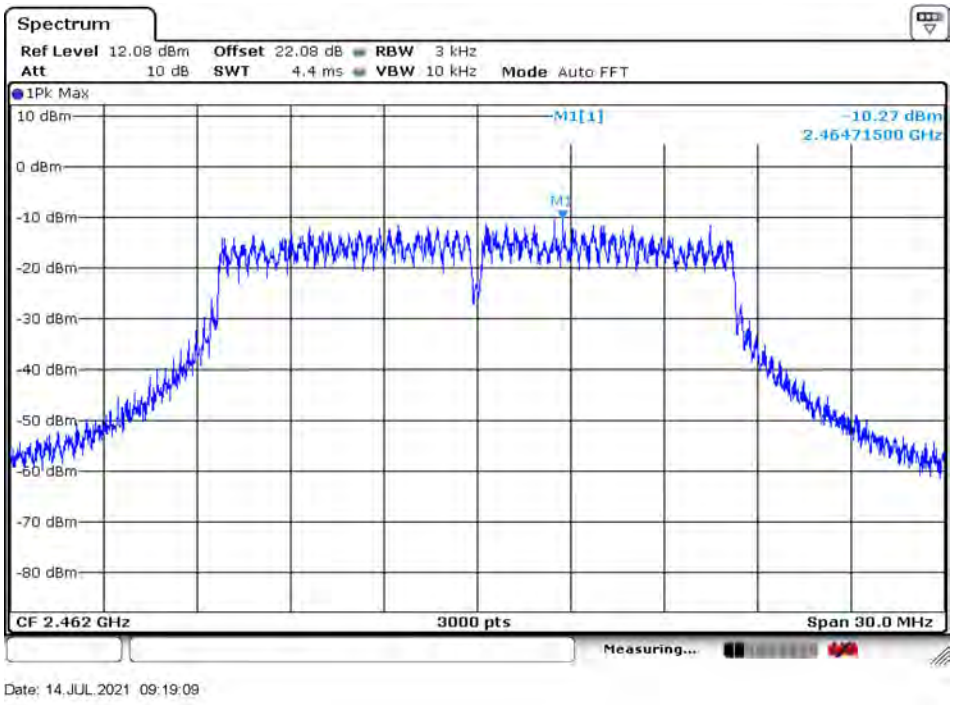
Mid Channel Antenna A



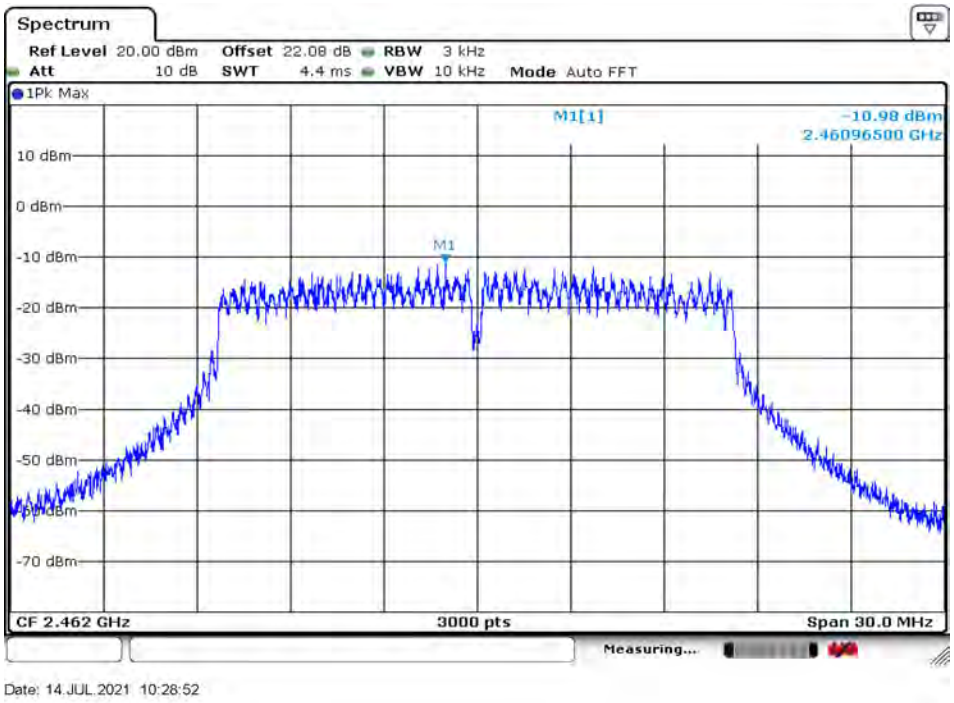
Mid Channel Antenna B



High Channel Antenna A

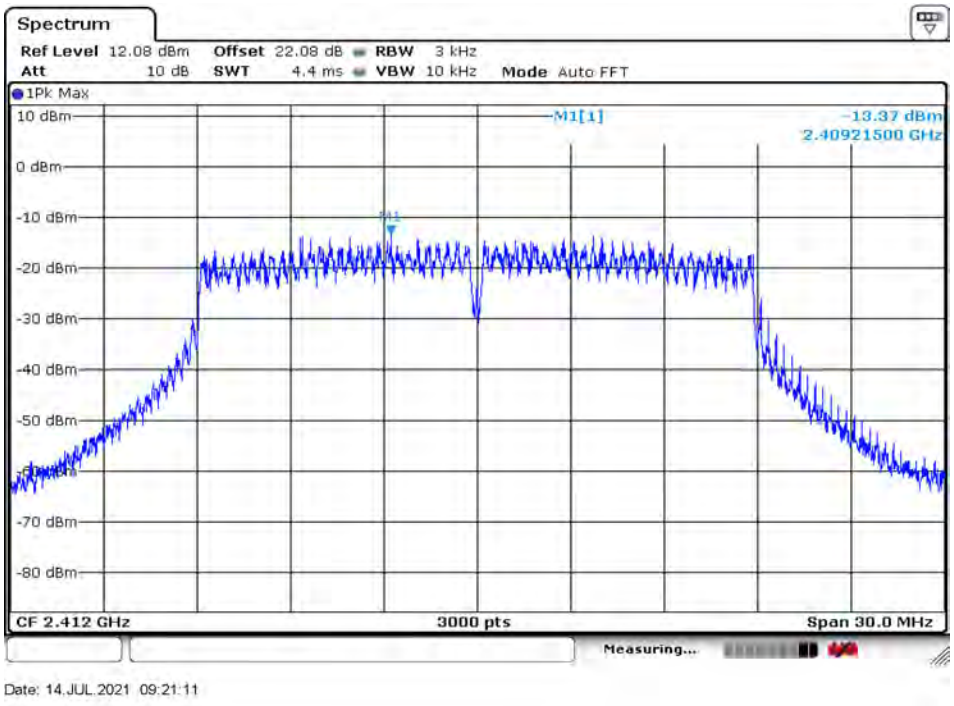


High Channel Antenna B

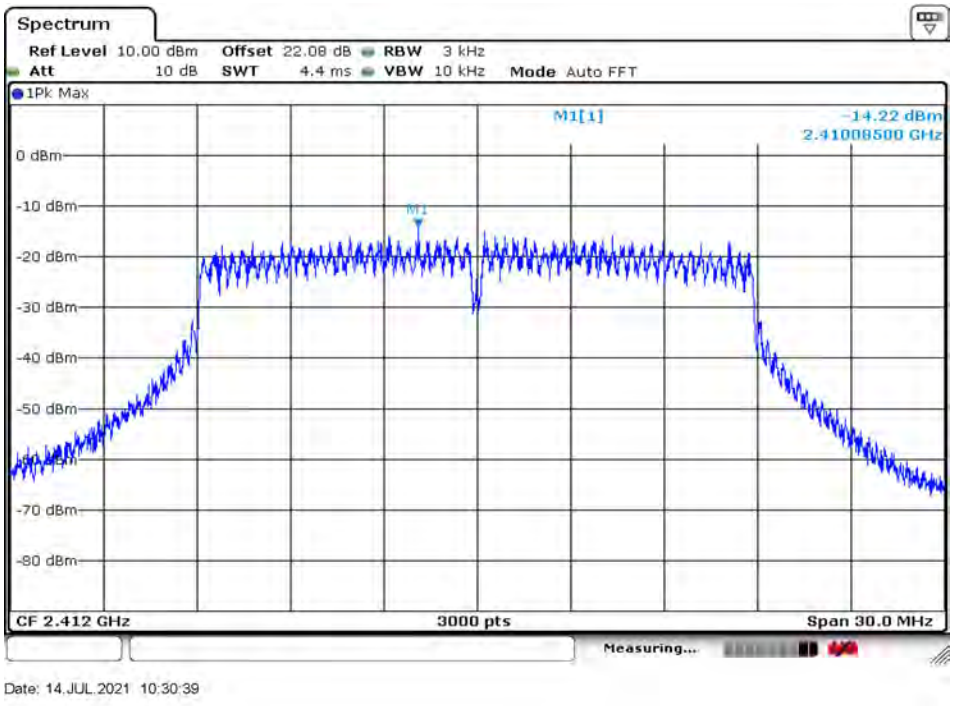


802.11n20 mode

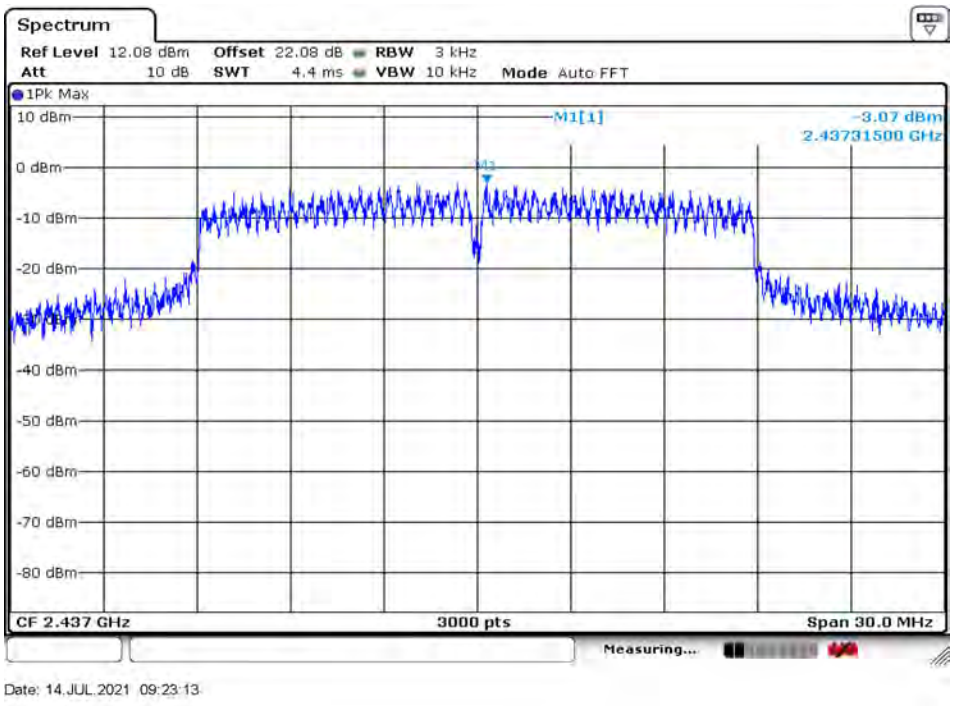
Low Channel Antenna A



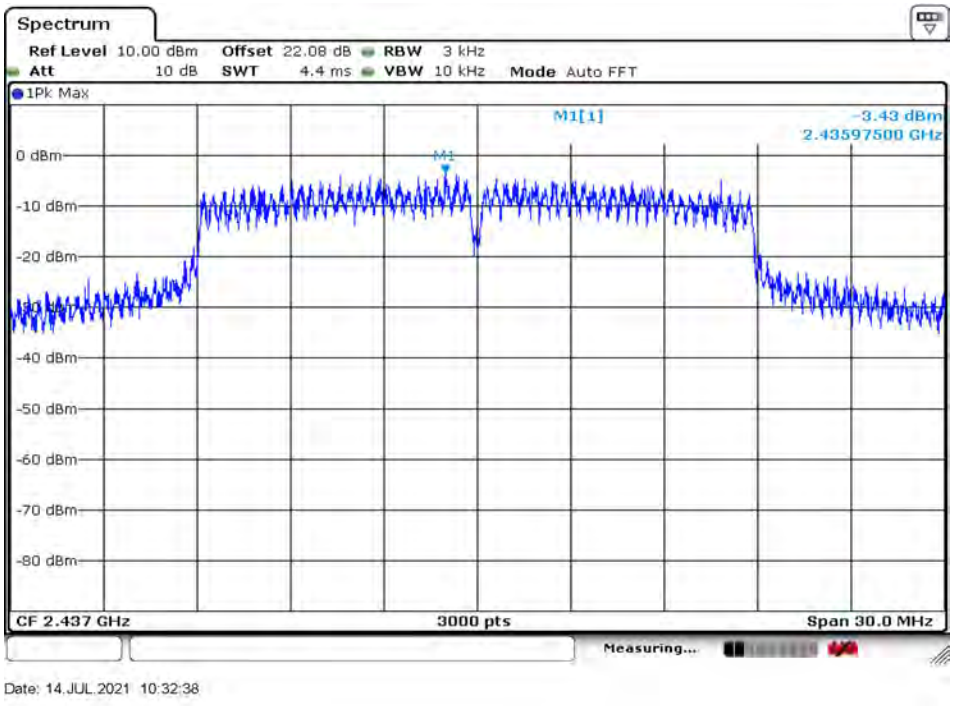
Low Channel Antenna B



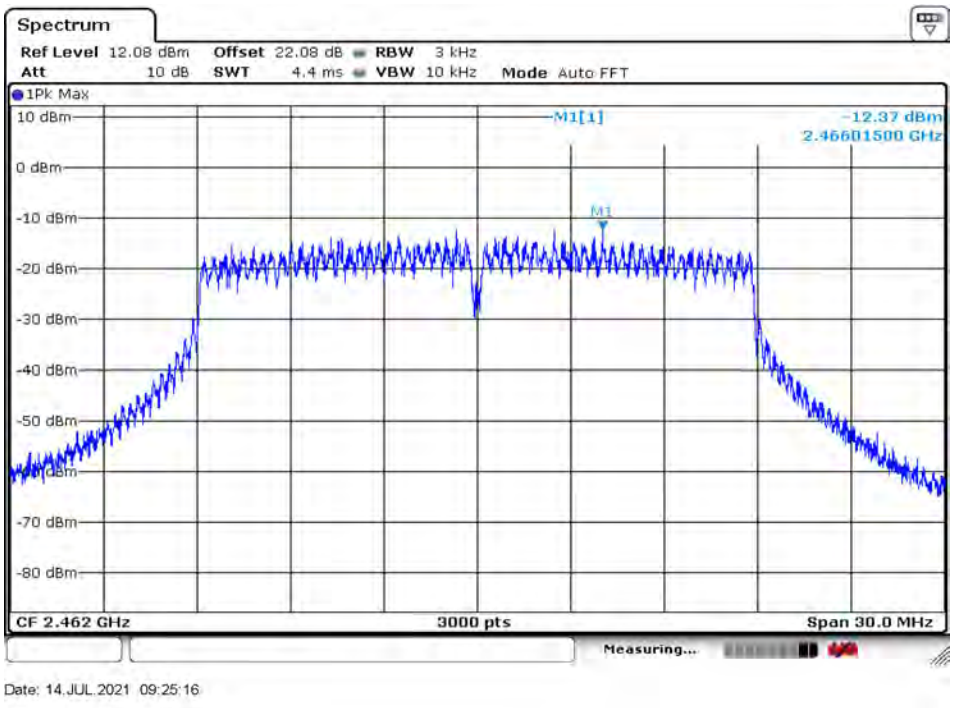
Mid Channel Antenna A



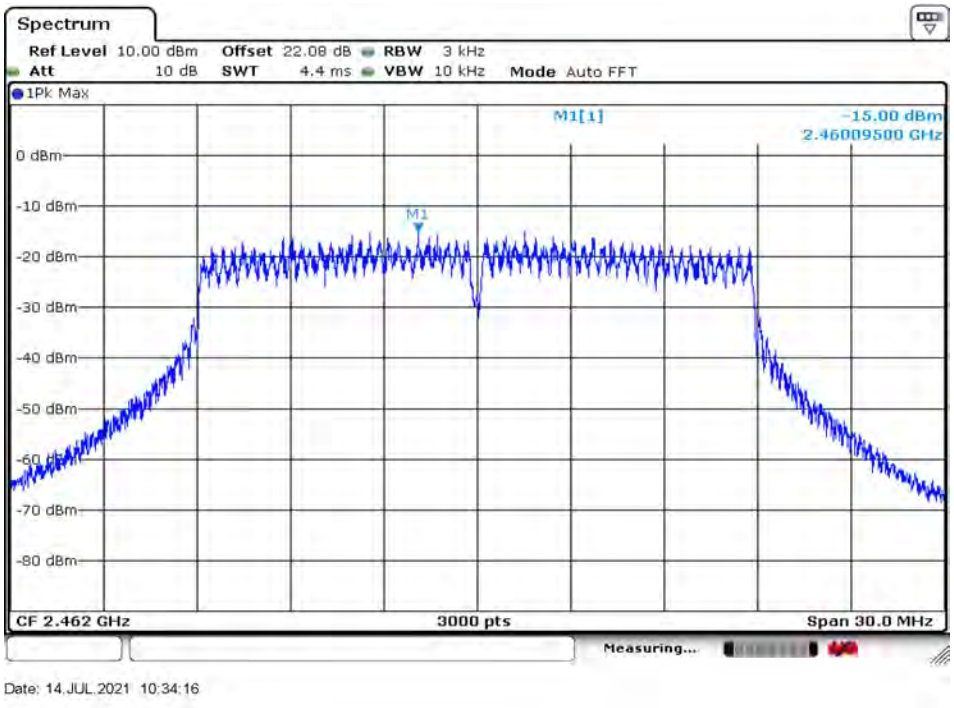
Mid Channel Antenna B



High Channel Antenna A

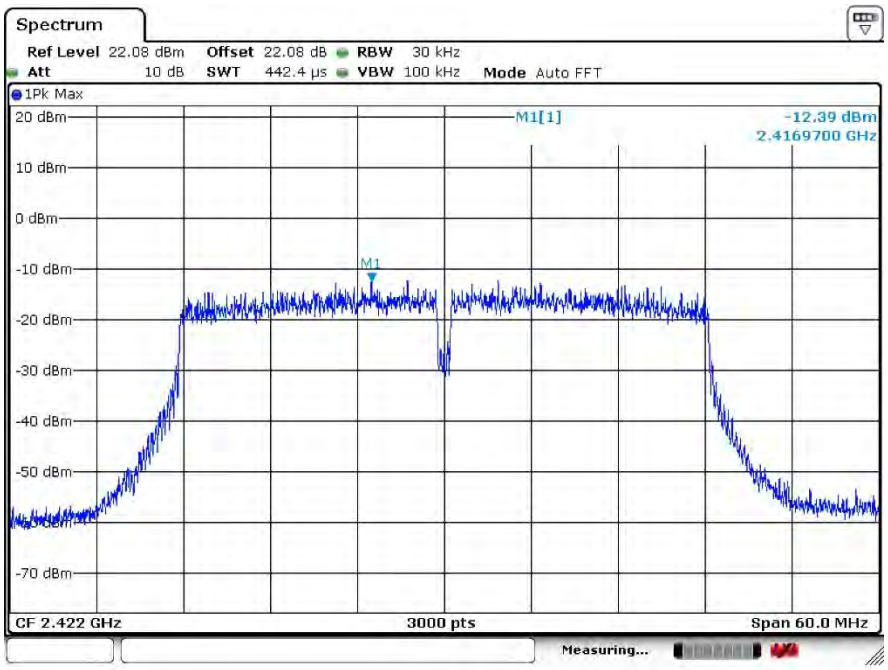


High Channel Antenna B



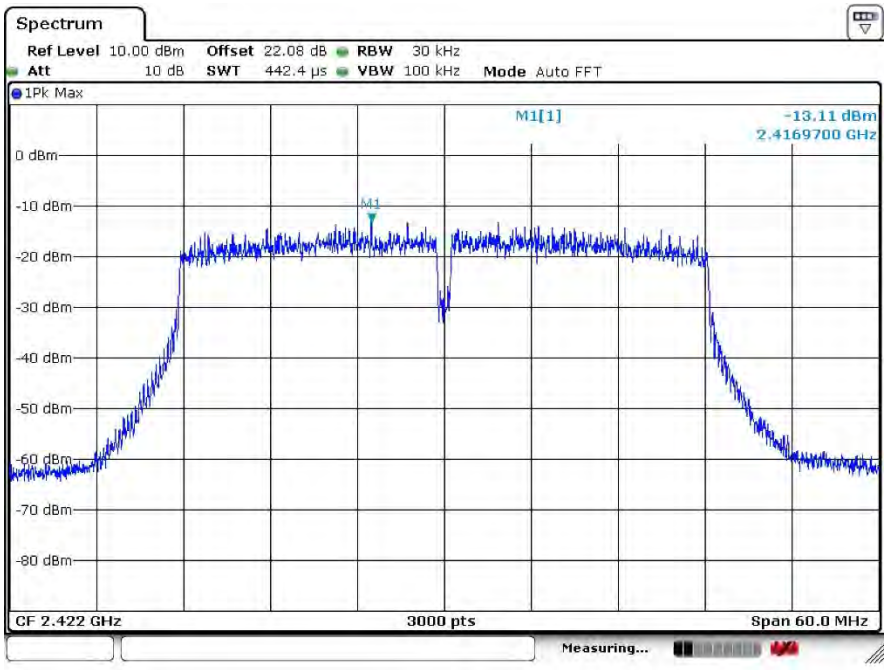
802.11n40 mode

Low Channel Antenna A



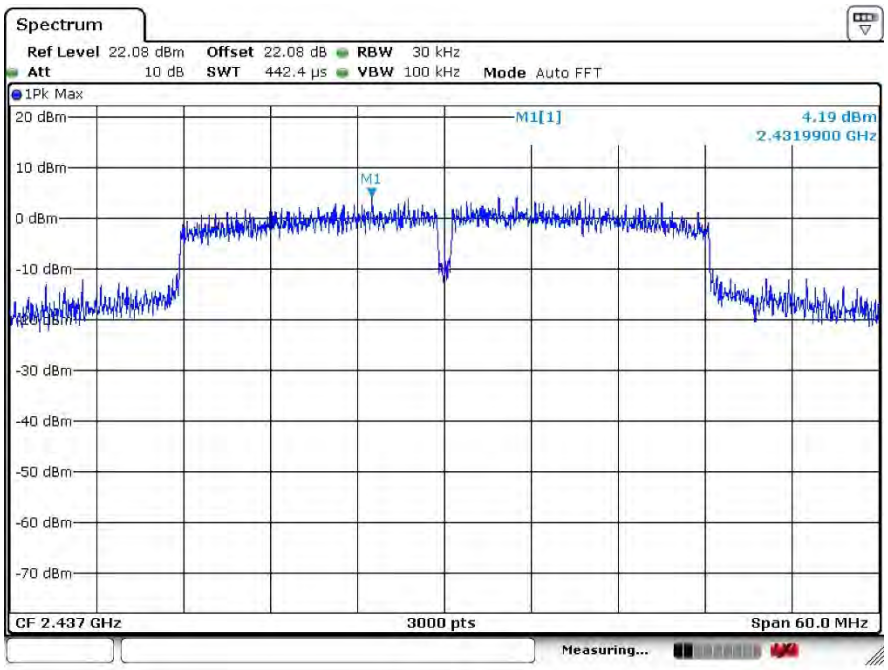
Date: 14.JUL.2021 09:45:34

Low Channel Antenna B



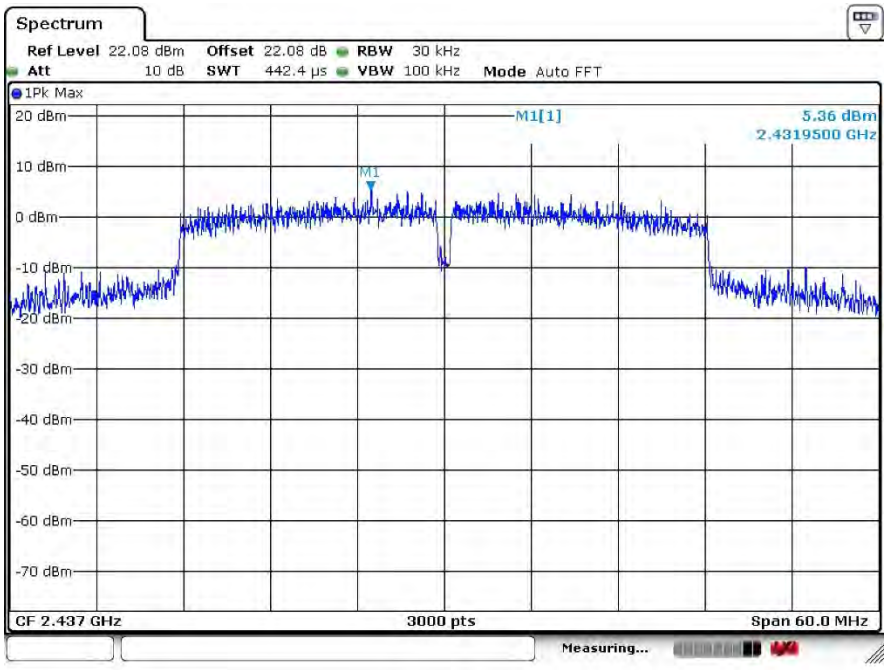
Date: 14.JUL.2021 10:37:02

Middle Channel Antenna A



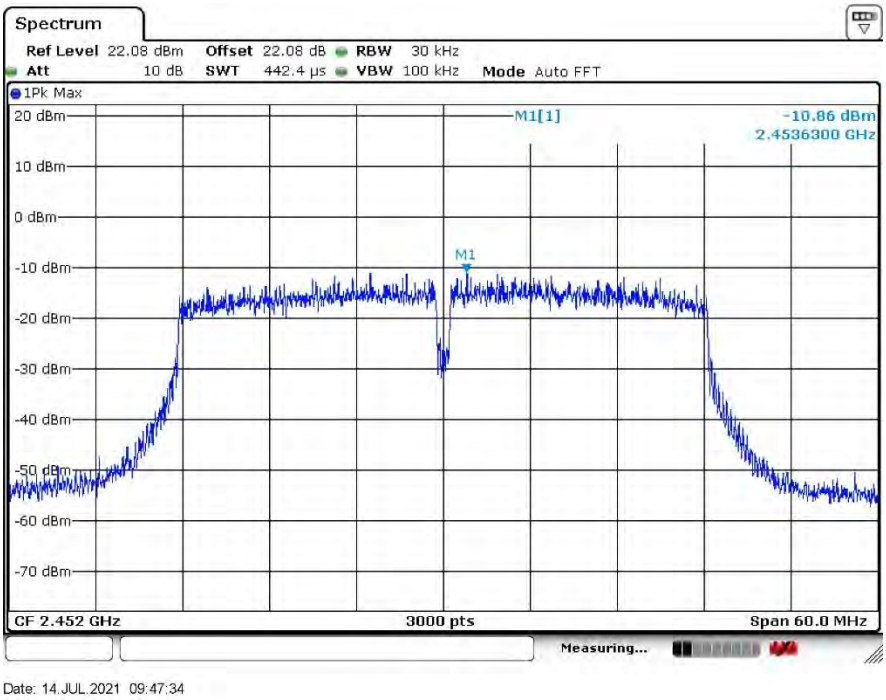
Date: 14.JUL.2021 09:43:39

Middle Channel Antenna B



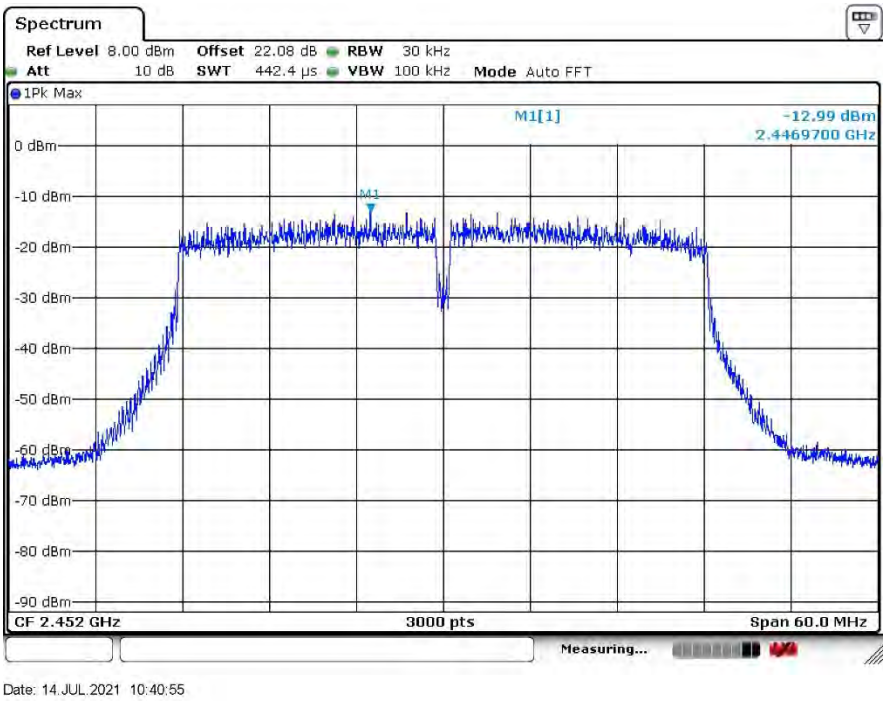
Date: 14.JUL.2021 10:39:04

High Channel Antenna A



802.11n40 mode

High Channel Antenna B



13 FCC §15.247(d) & ISEDC RSS-247 §5.5 - Spurious Emissions at Antenna Terminals

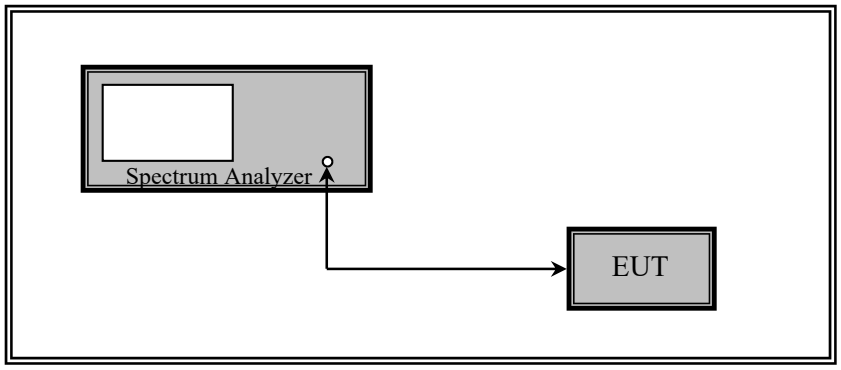
13.1 Applicable Standards

For FCC §15.247(d) and ISEDC RSS-247 §5.5, 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)).

13.2 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.

13.3 Test Setup Block Diagram



13.4 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4446A	MY48250238	2019-06-26	18 Months
-	RF cable	-	-	Each time[1]	N/A
-	10 dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with the latest version of A2LA policy P102 "A2LA Policy on Metrological Traceability".*

13.5 Test Environmental Conditions

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

The testing was performed by Rita Yang on 2021-07-06 in RF site.

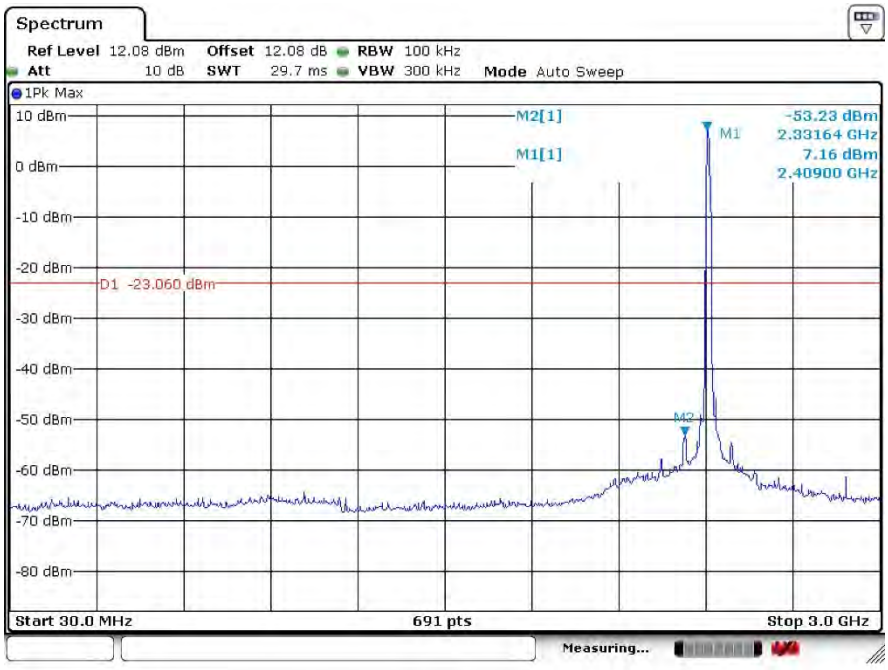
13.6 Test Results

Please refer to following plots.

802.11b mode

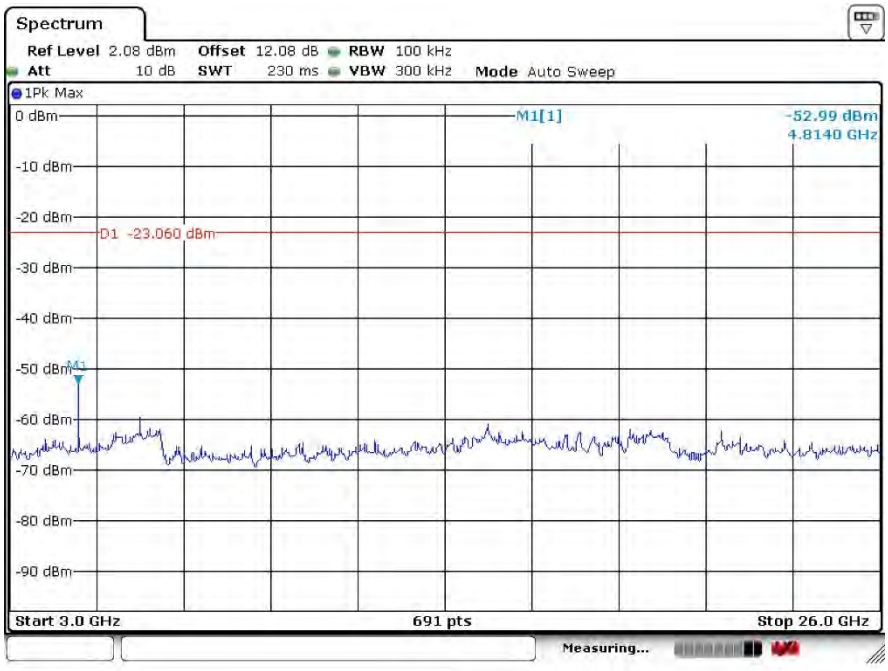
Antenna A Low Channel 2412MHz

30MHz – 3GHz



Date: 6.JUL.2021 13:26:29

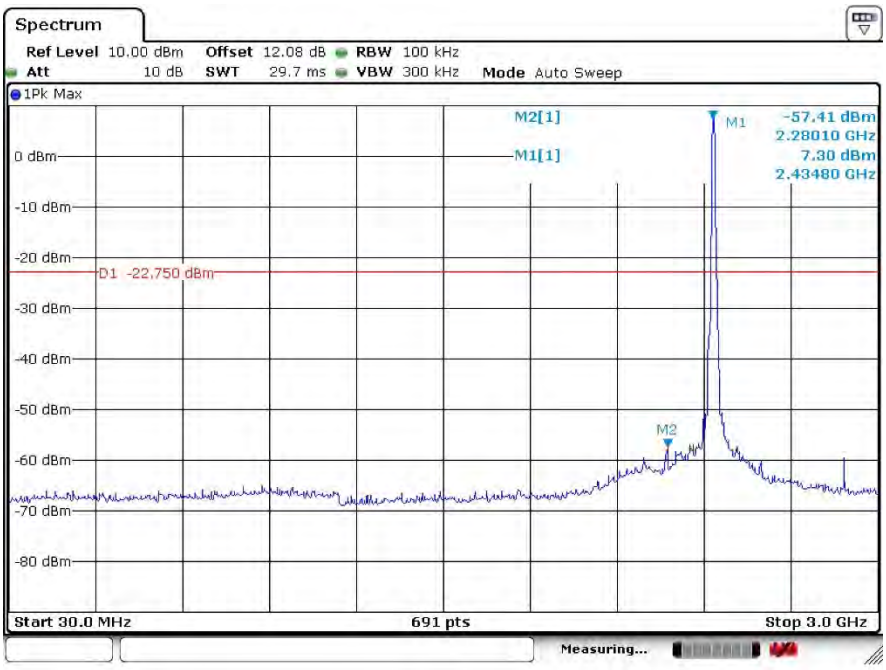
3GHz – 26GHz



Date: 6.JUL.2021 13:29:34

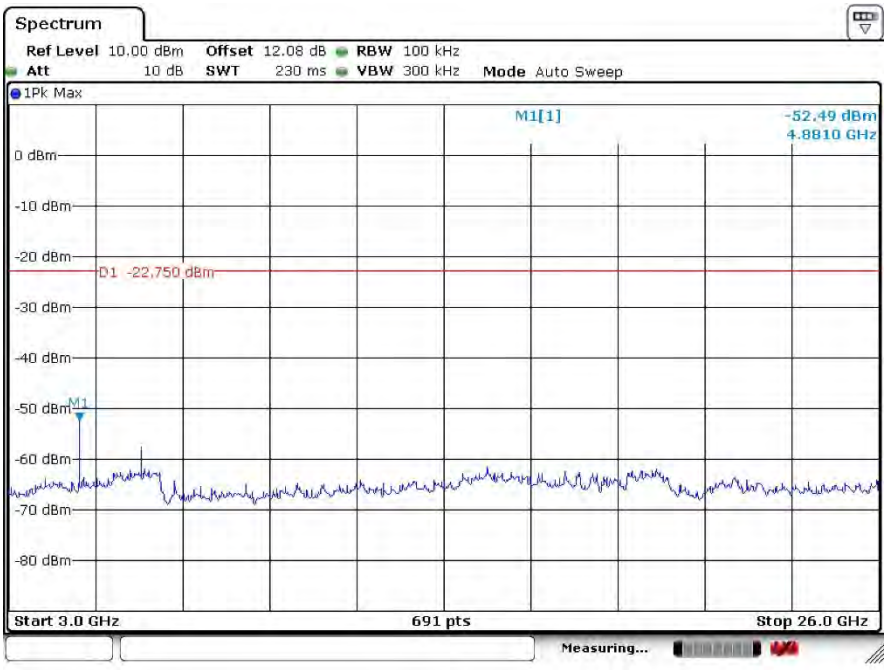
Antenna A Mid Channel 2437MHz

30MHz – 3GHz



Date: 6.JUL.2021 13:34:17

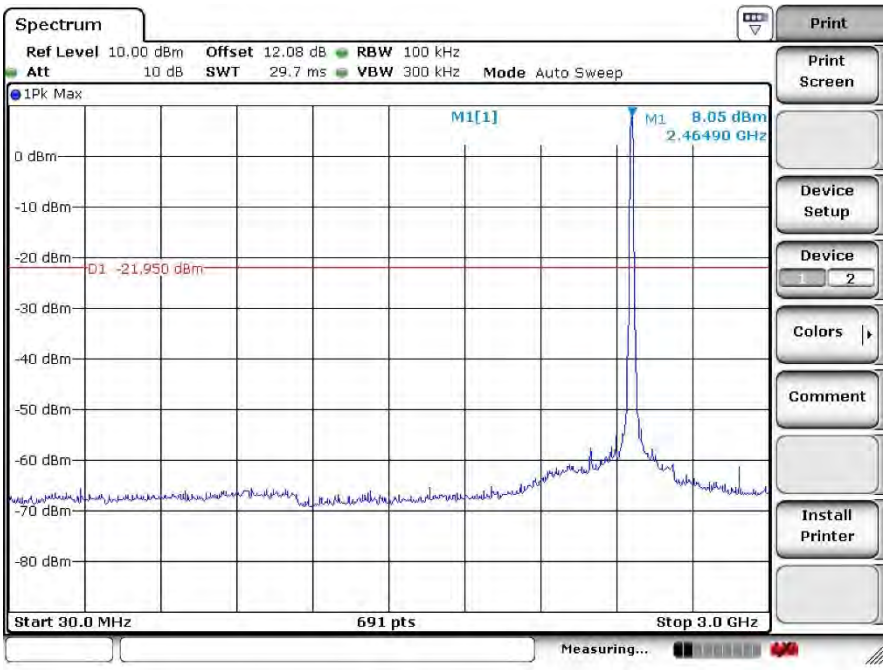
3GHz – 26GHz



Date: 6.JUL.2021 13:35:16

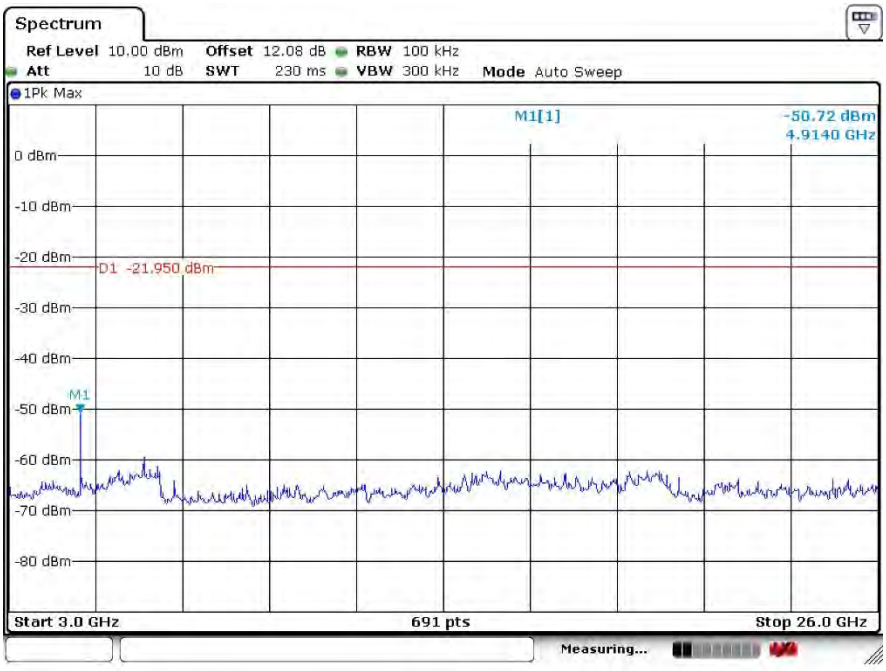
Antenna A High Channel 2462MHz

30MHz – 3GHz



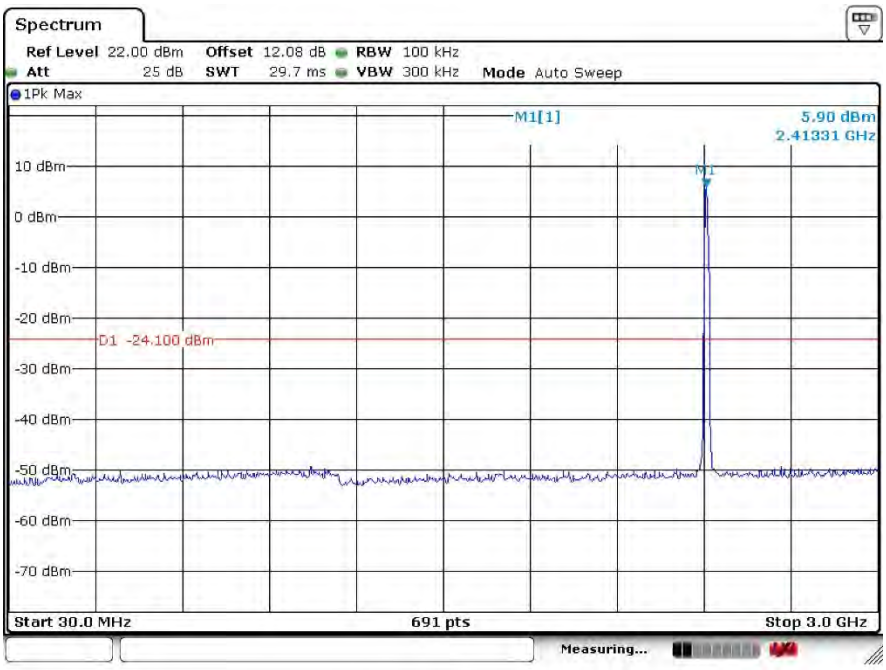
Date: 6.JUL.2021 13:38:14

3GHz – 26GHz



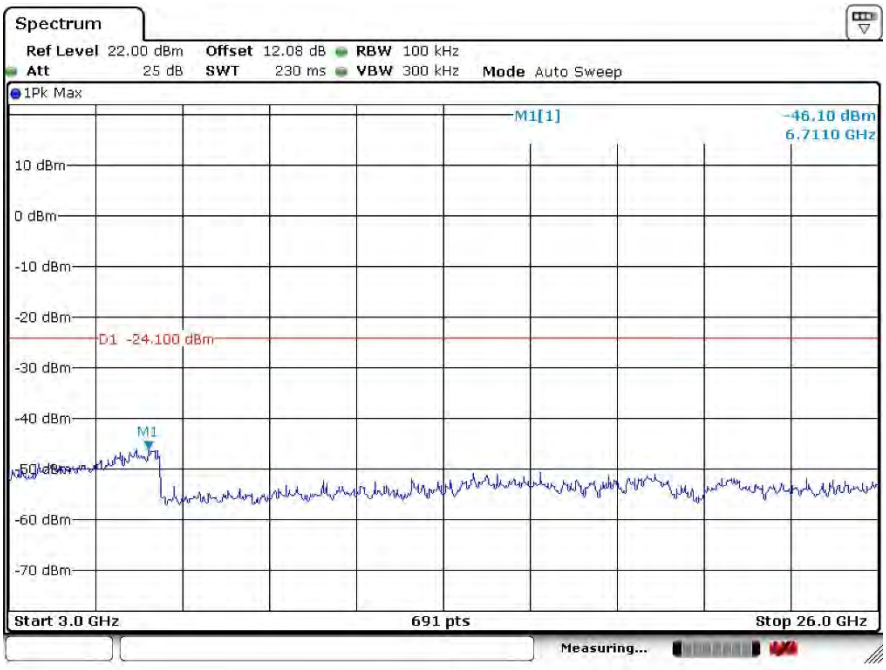
Date: 6.JUL.2021 13:39:10

Antenna B Low Channel 2412MHz



Date: 6.JUL.2021 15:46:42

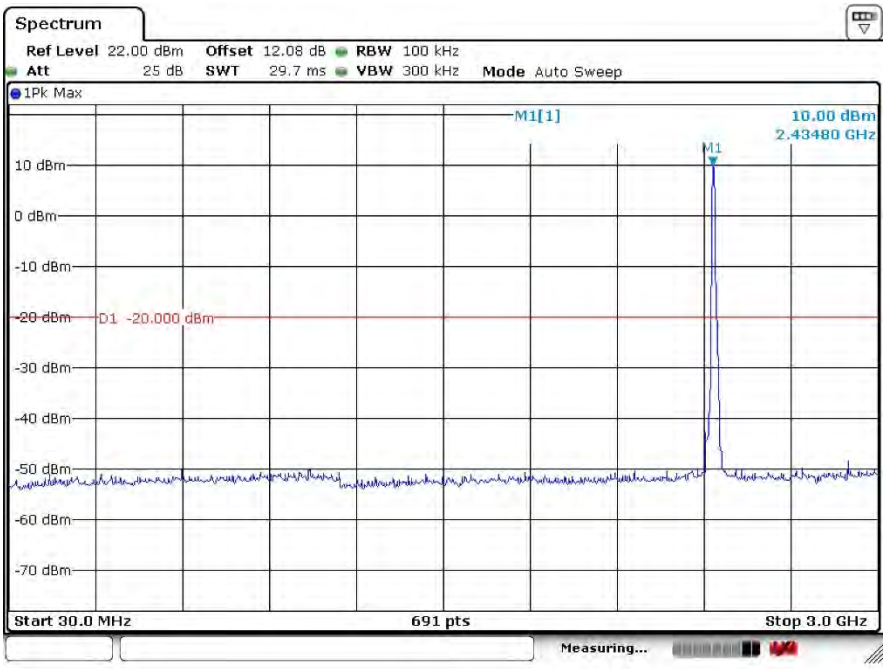
3GHz – 26GHz



Date: 6.JUL.2021 15:47:40

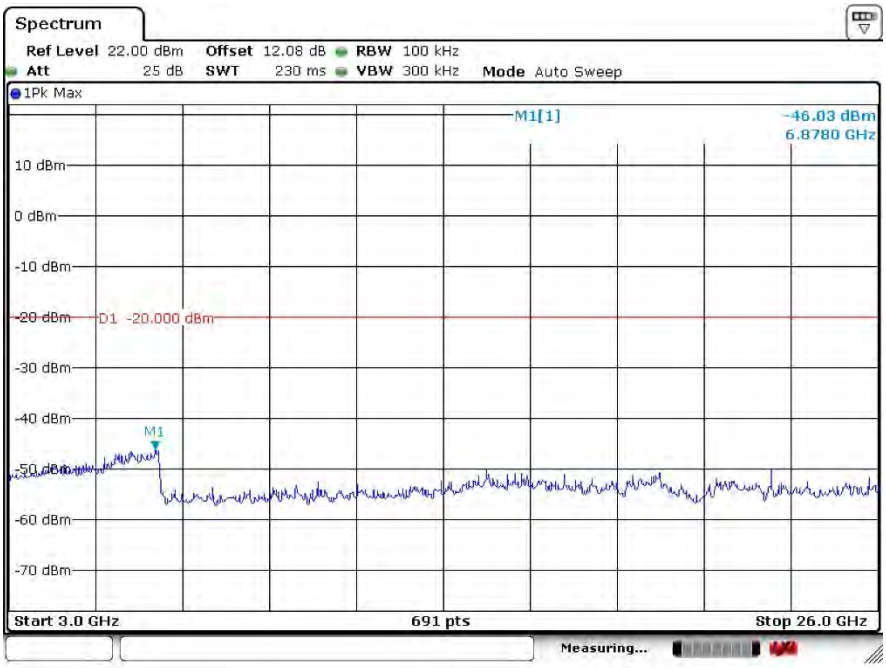
Antenna B Mid Channel 2437MHz

30MHz – 3GHz



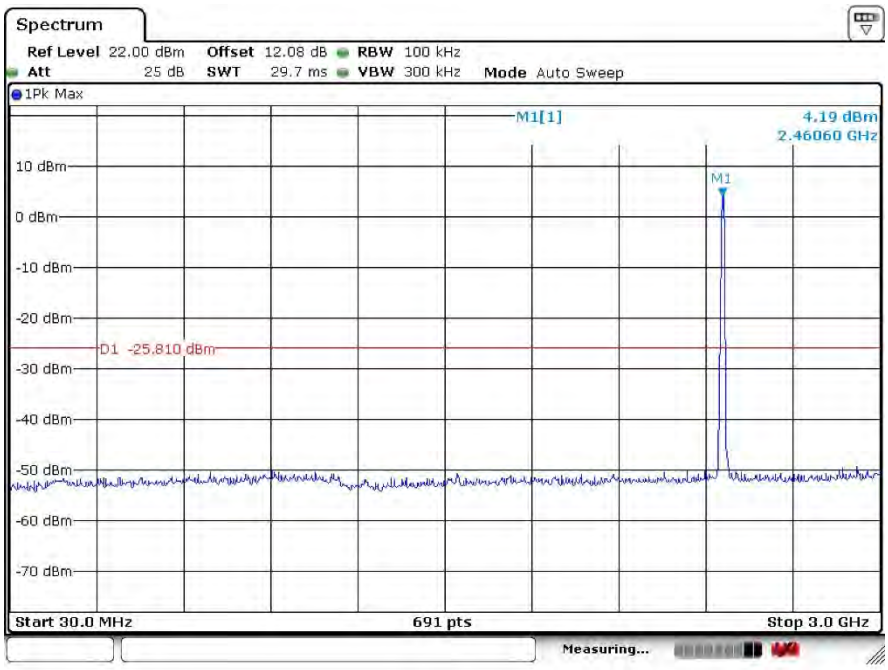
Date: 6.JUL.2021 15:49:53

3GHz – 26GHz

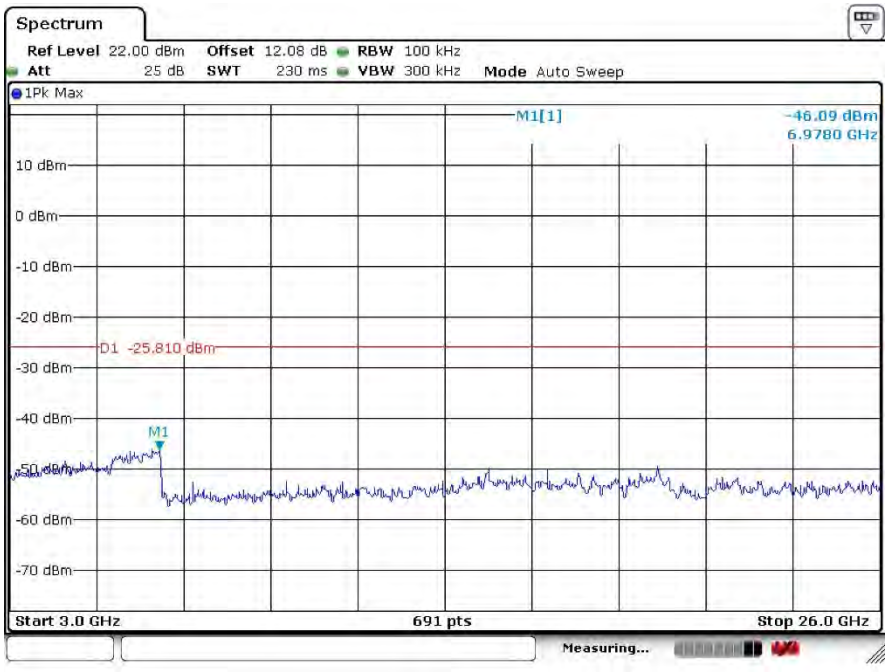


Date: 6.JUL.2021 15:50:20

Antenna B High Channel 2462MHz

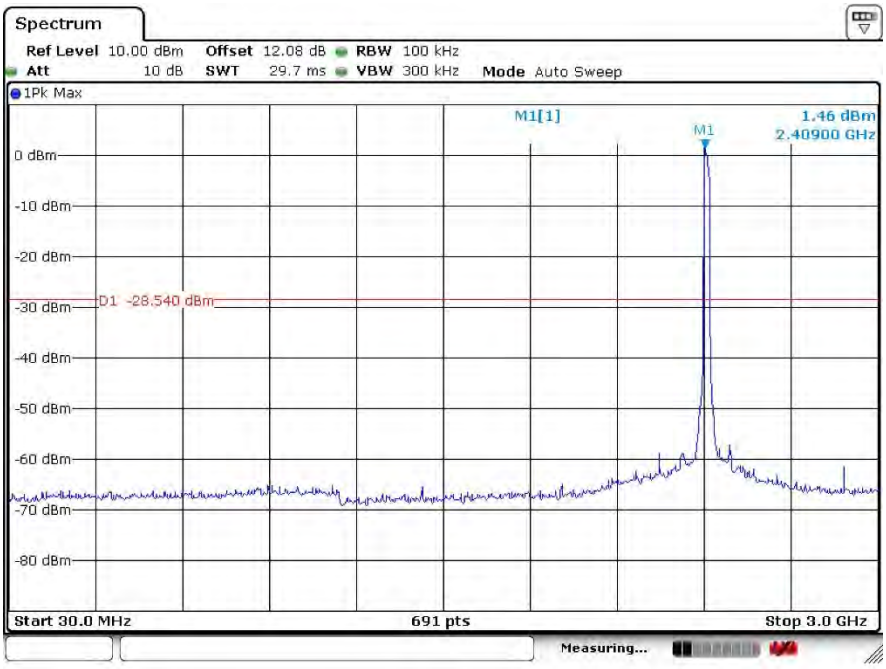


3GHz – 26GHz



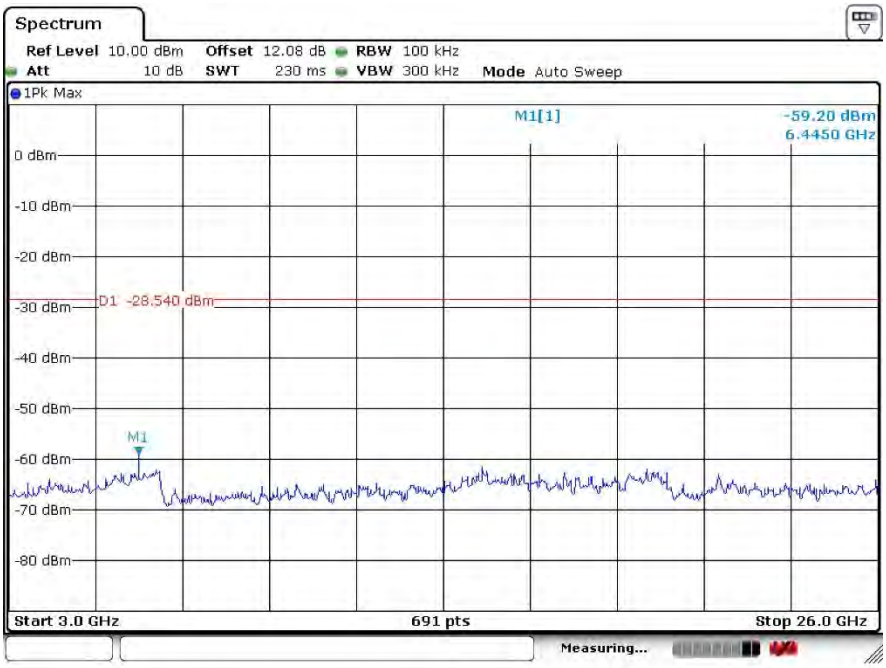
802.11g mode

Antenna A Low Channel 2412MHz



Date: 6.JUL.2021 13:46:46

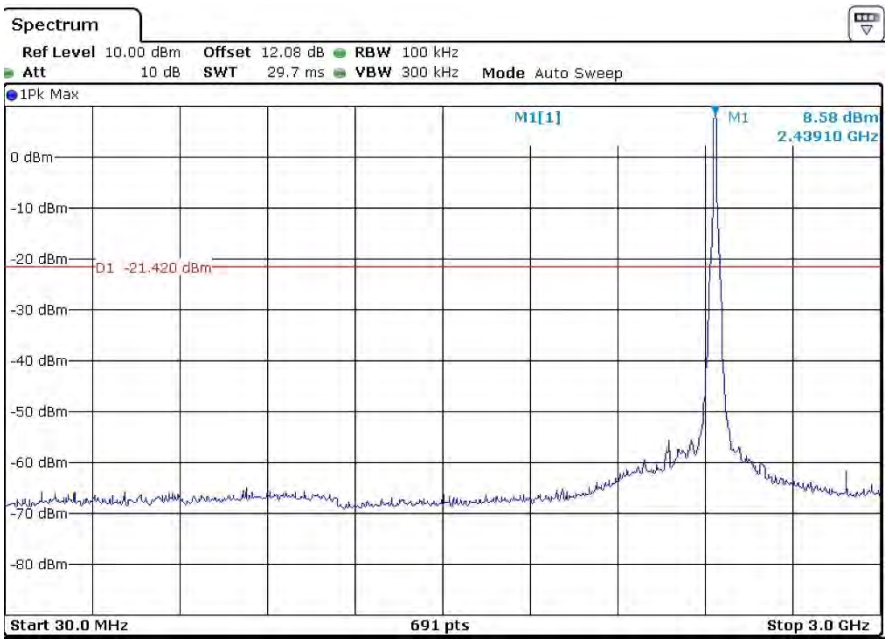
3GHz – 26GHz

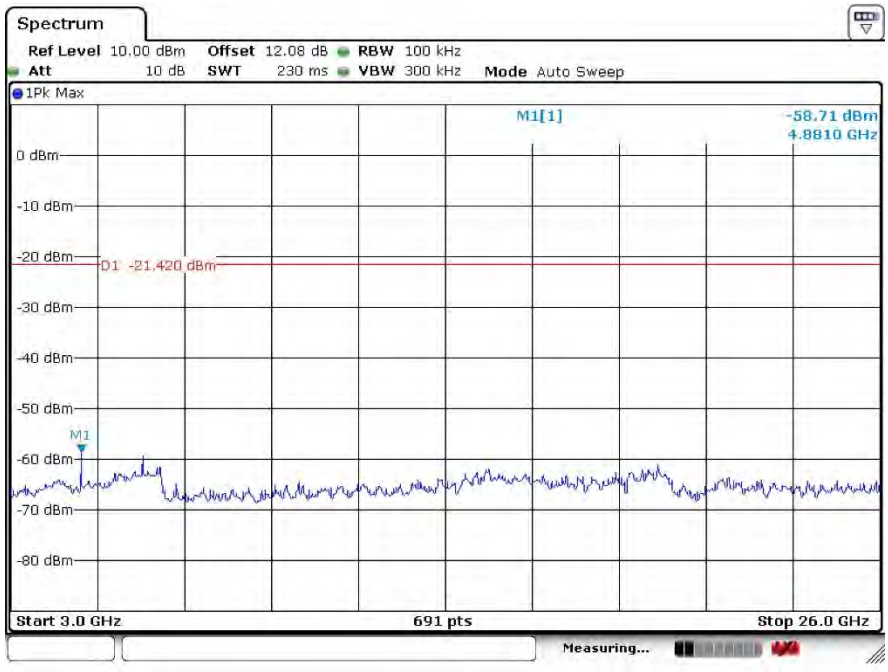


Date: 6.JUL.2021 13:48:06

Antenna A Mid Channel 2437MHz

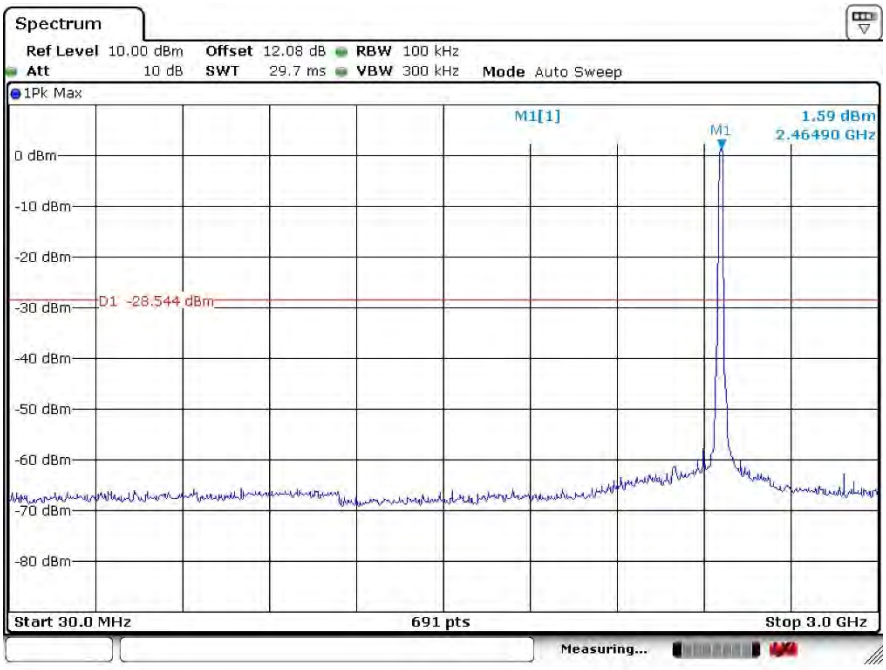
30MHz – 3GHz





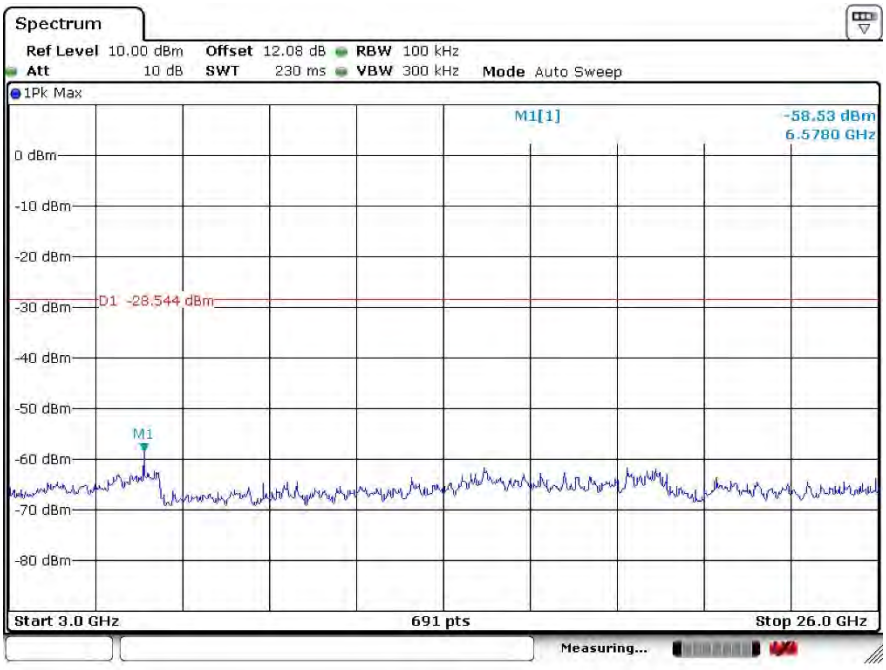
Antenna A High Channel 2462MHz

30MHz – 3GHz



Date: 6.JUL.2021 13:55:16

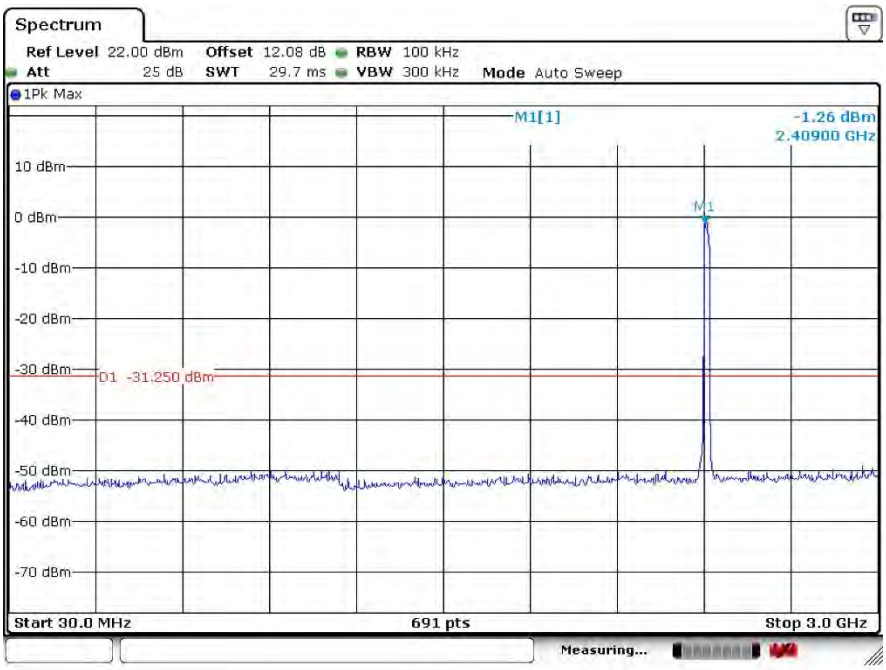
3GHz – 26GHz



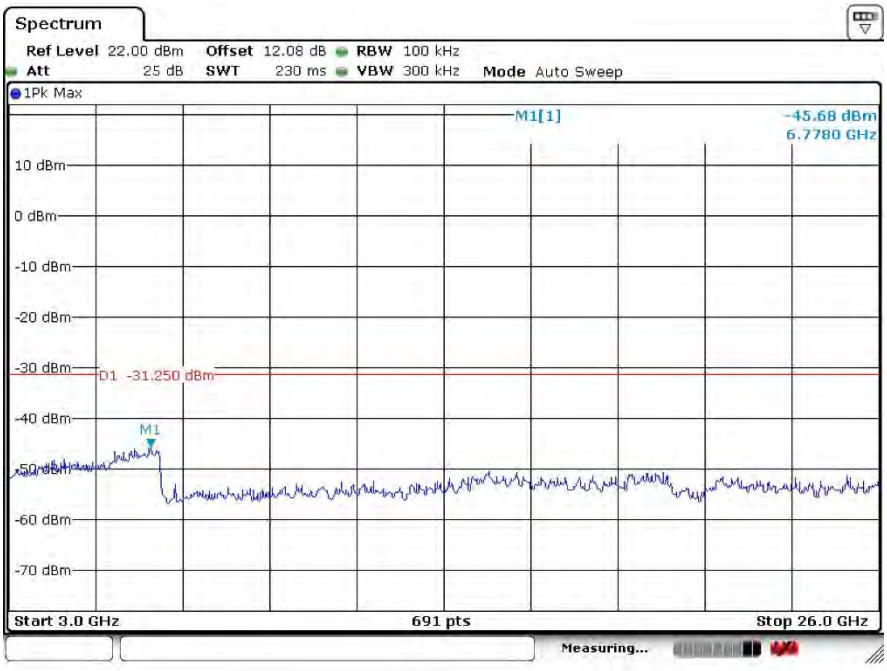
Date: 6.JUL.2021 13:56:11

802.11 g mode
Antenna B Low Channel 2412MHz

30MHz – 3GHz

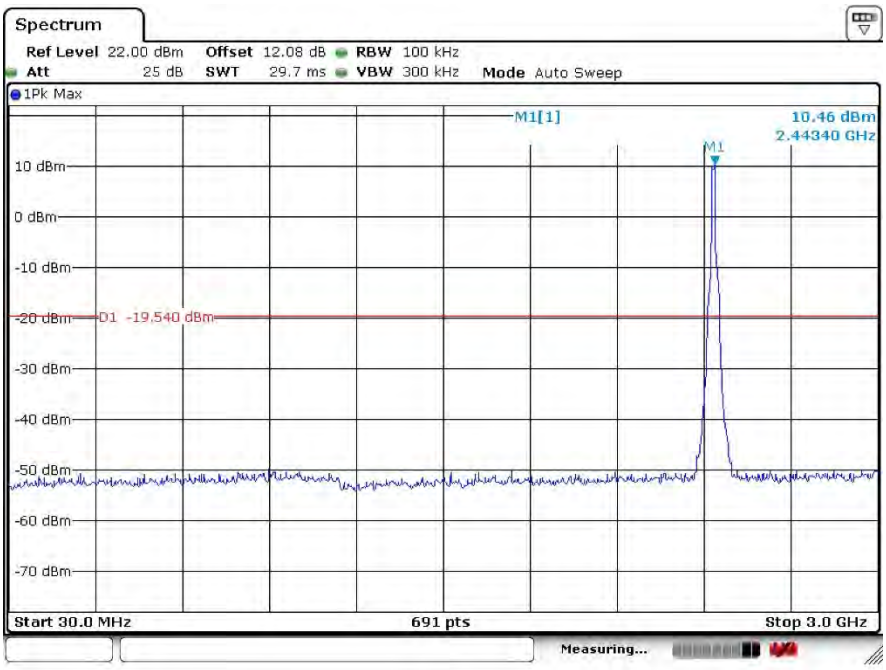


3GHz – 26GHz



Antenna B Mid Channel 2437MHz

30MHz – 3GHz



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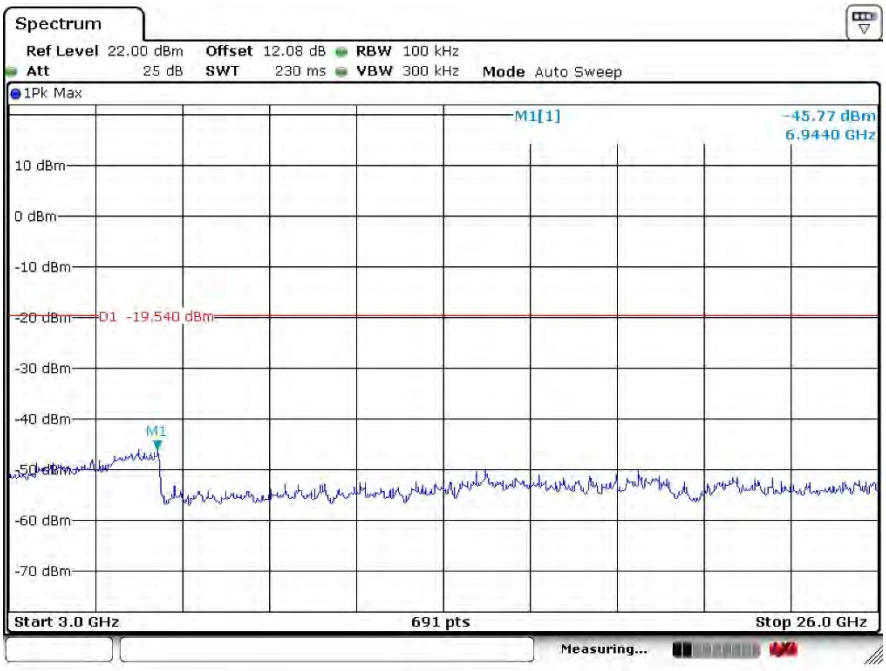
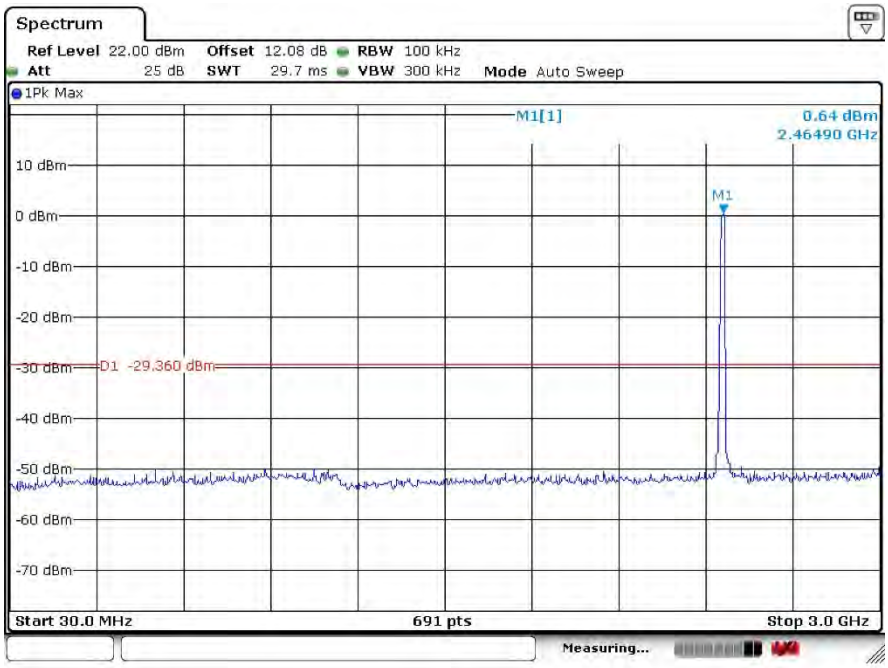
3GHz – 26GHz



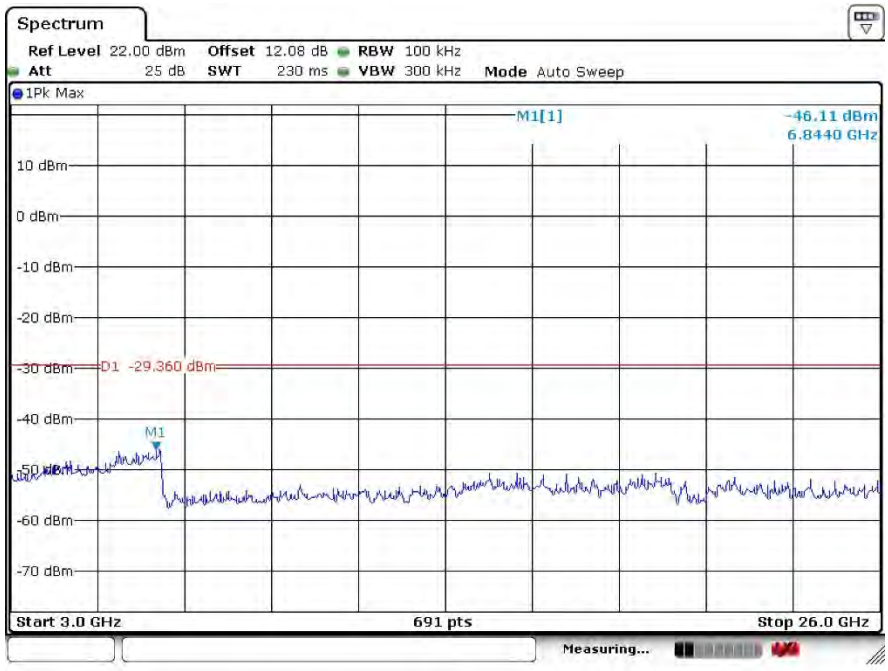
Date: 6.JUL.2021 15:58:20

Antenna B High Channel 2462MHz

30MHz – 3GHz



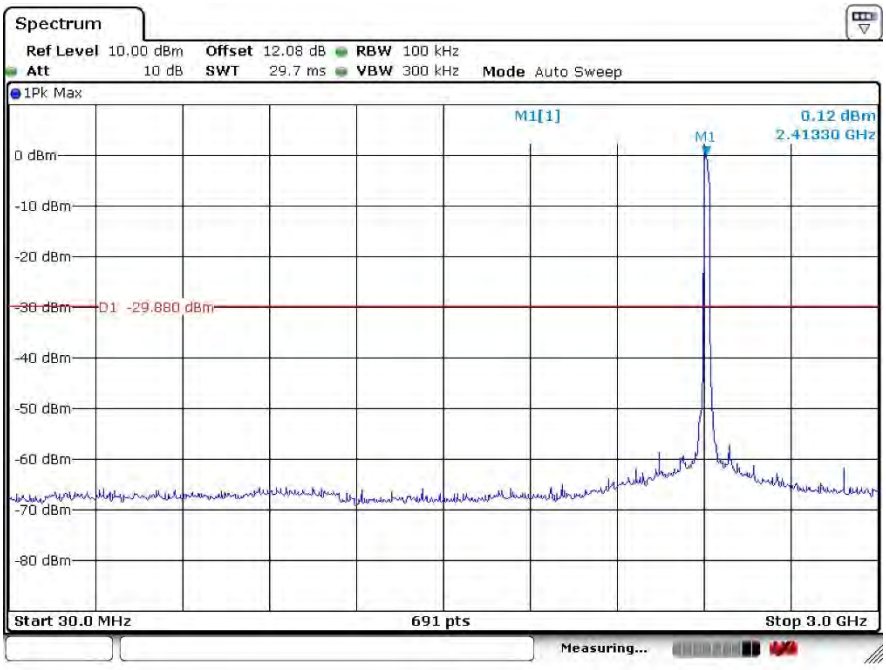
3GHz – 26GHz



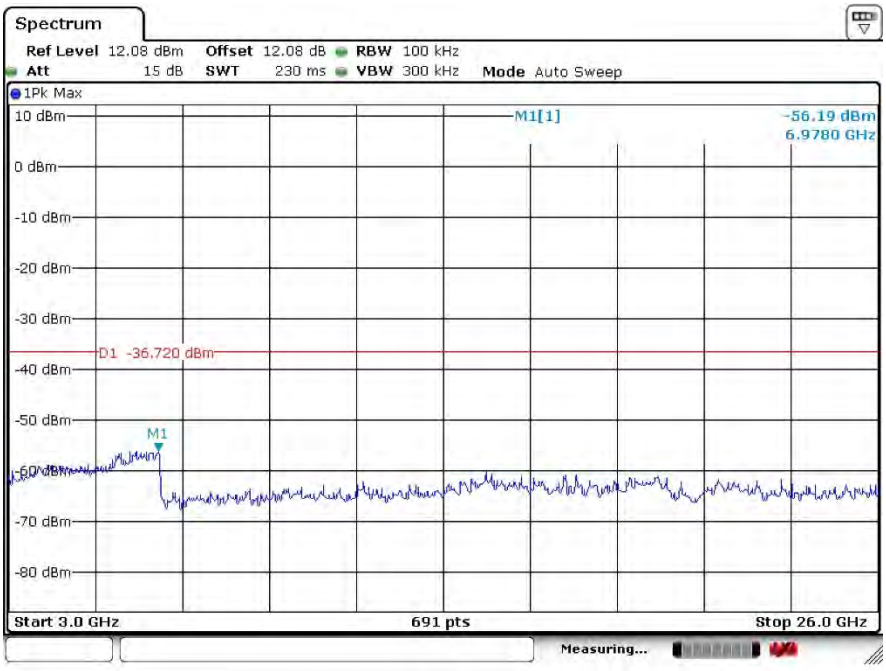
802.11 n20 mode

Antenna A Low Channel 2412MHz

30MHz – 3GHz

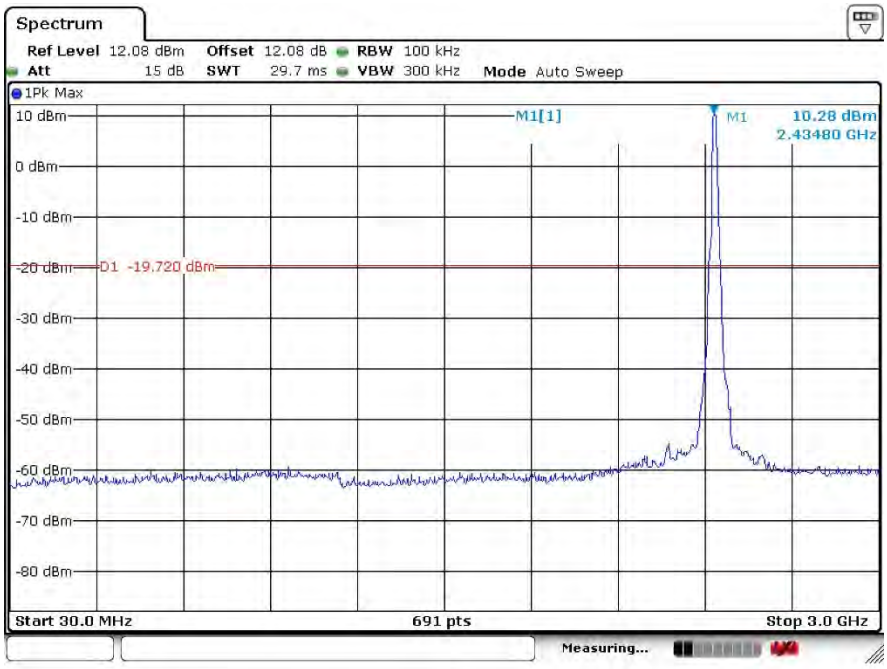


3GHz – 26GHz

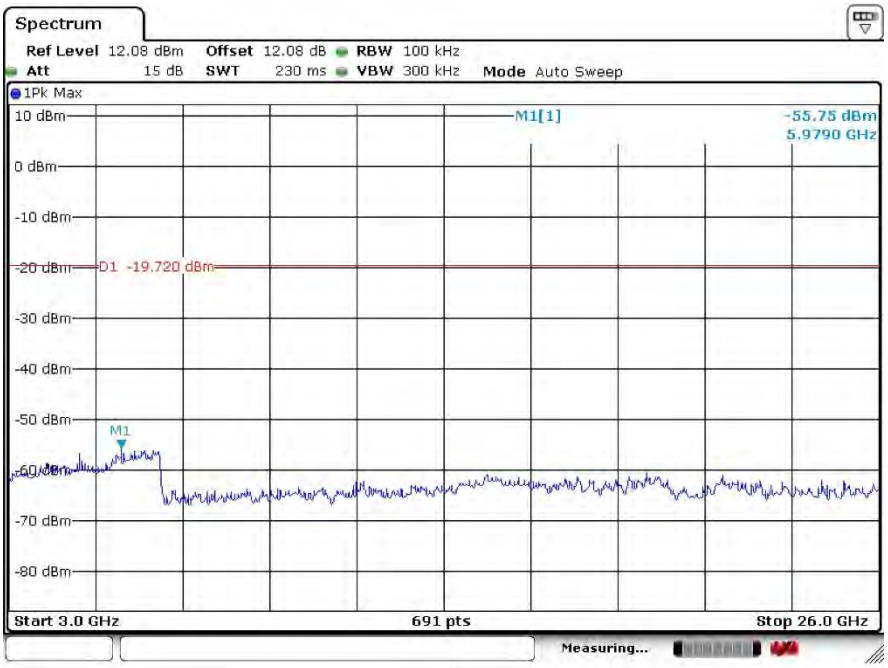


Antenna A Mid Channel 2437MHz

30MHz – 3GHz

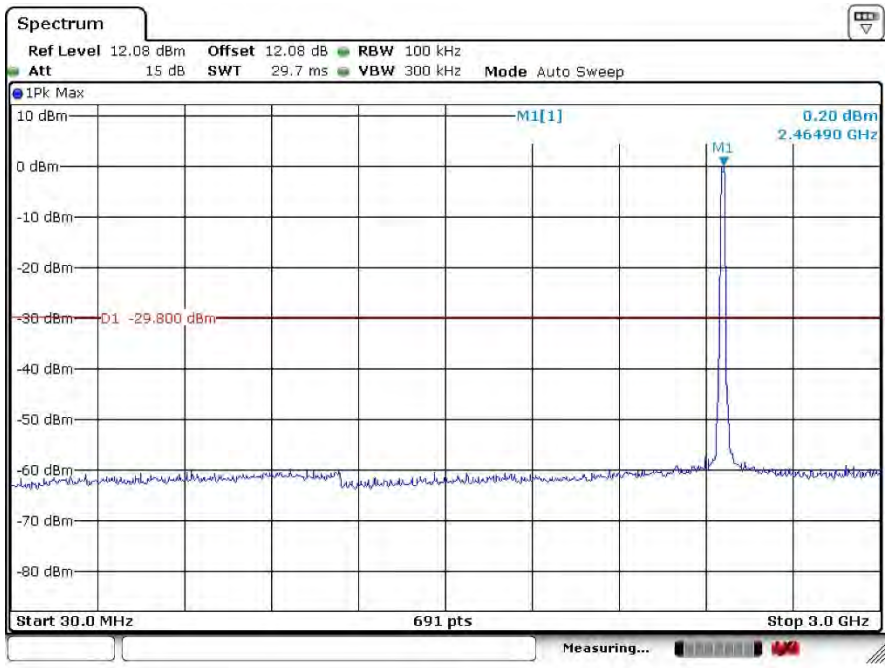


3GHz – 26GHz



Antenna A High Channel 2462MHz

30MHz – 3GHz



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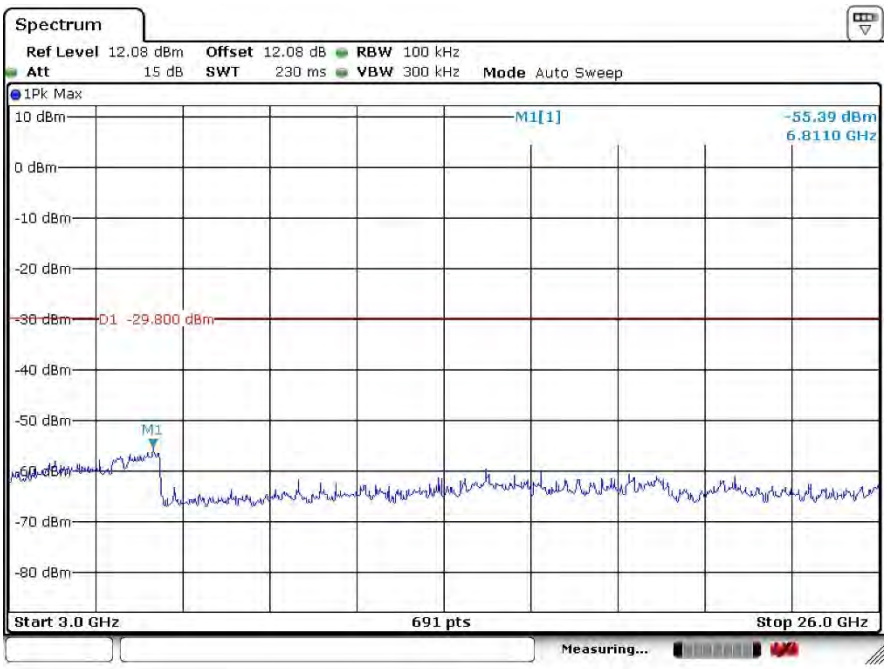
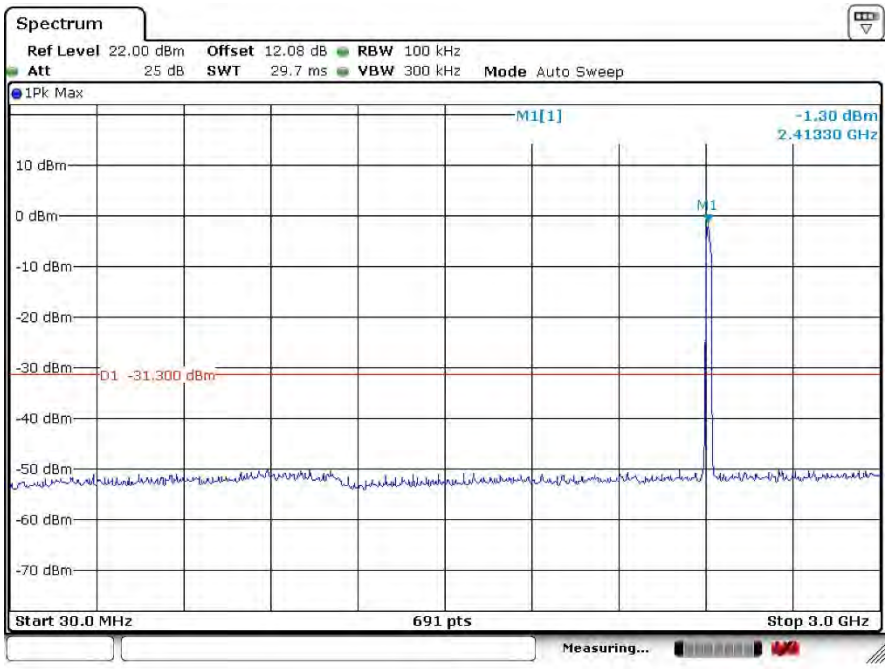
3GHz – 26GHz



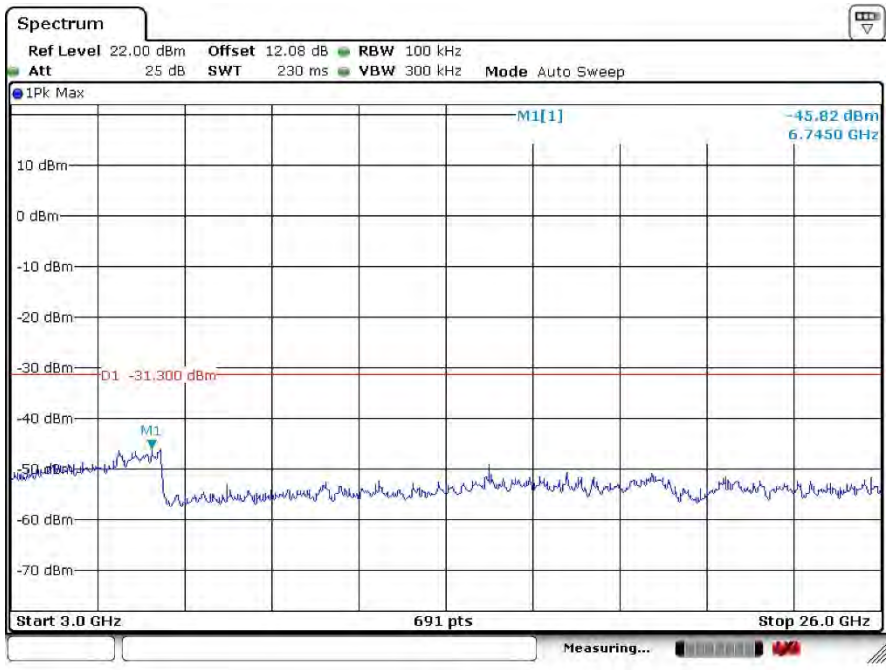
Date: 6.JUL.2021 14:08:39

Antenna B Low Channel 2412MHz

30MHz – 3GHz

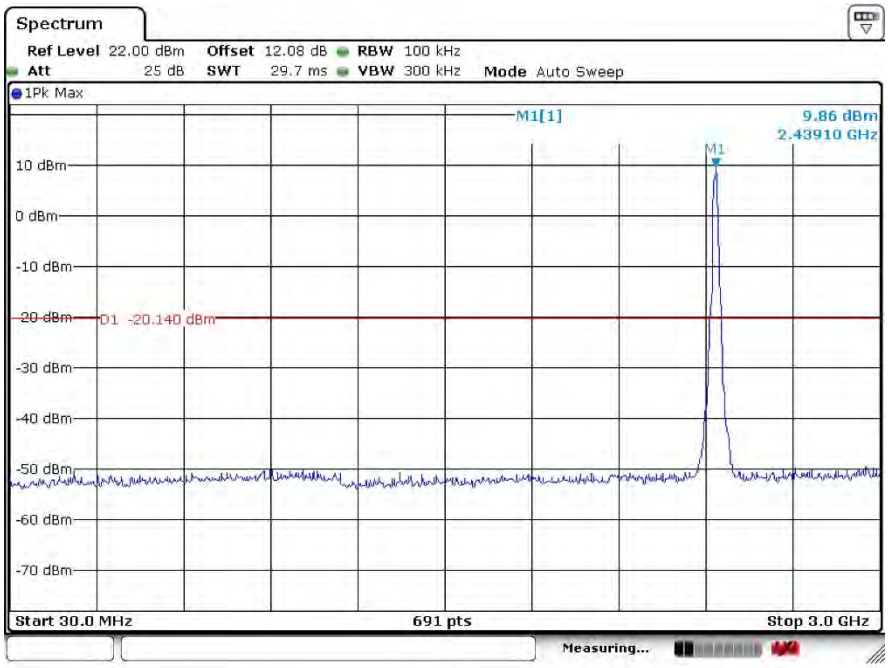


3GHz – 26GHz



Antenna B Mid Channel 2437MHz

30MHz – 3GHz



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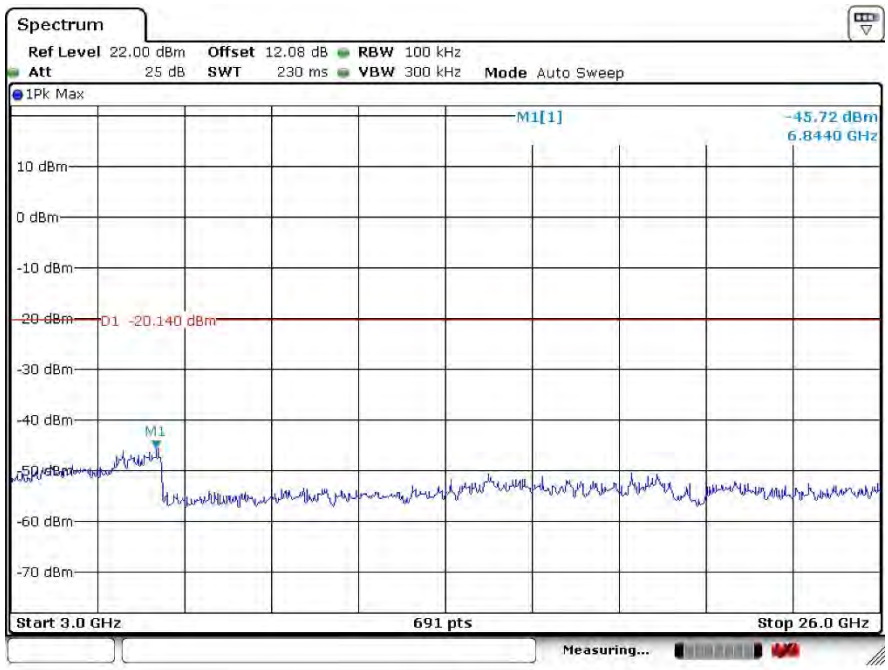
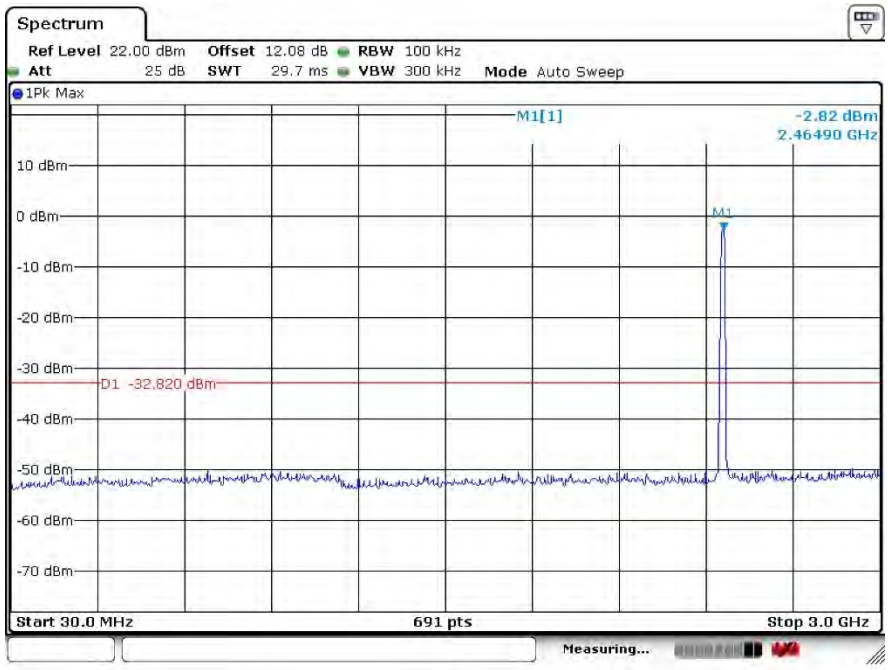
3GHz – 26GHz



Date: 6.JUL.2021 16:05:53

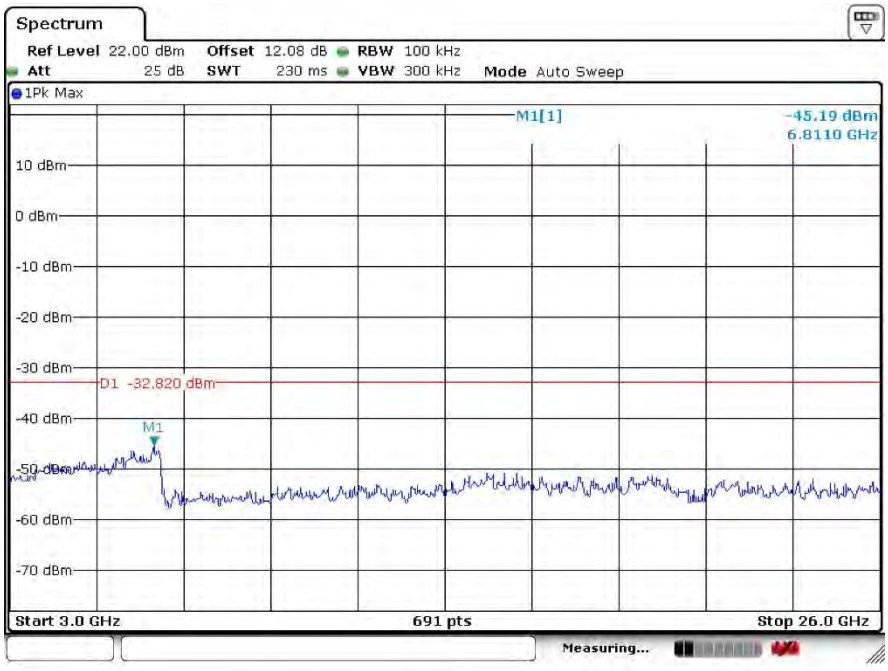
Antenna B High Channel 2462MHz

30MHz – 3GHz



Date: 6.JUL.2021 16:07:58

3GHz – 26GHz



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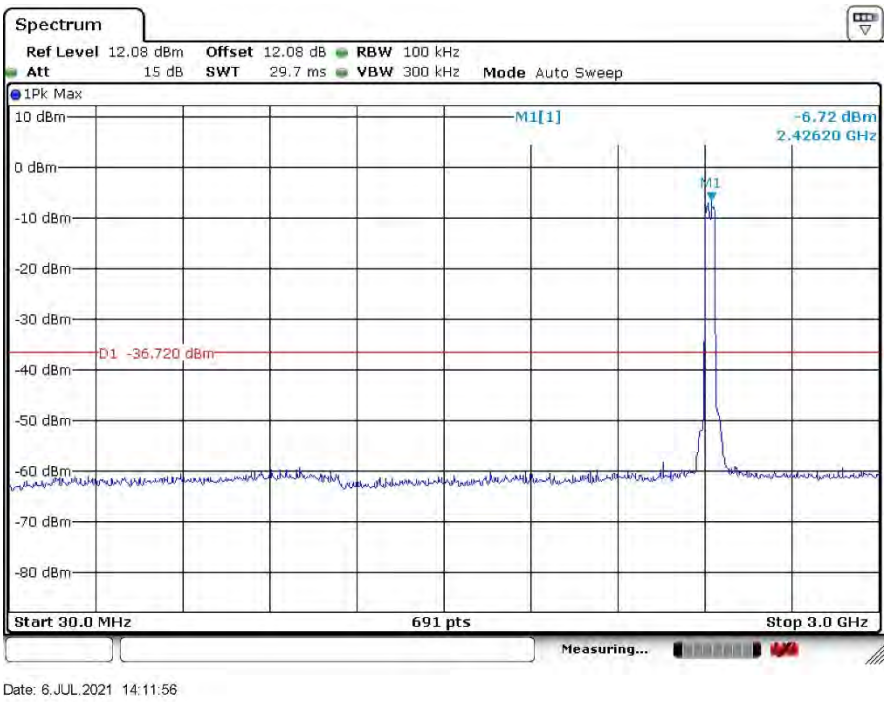
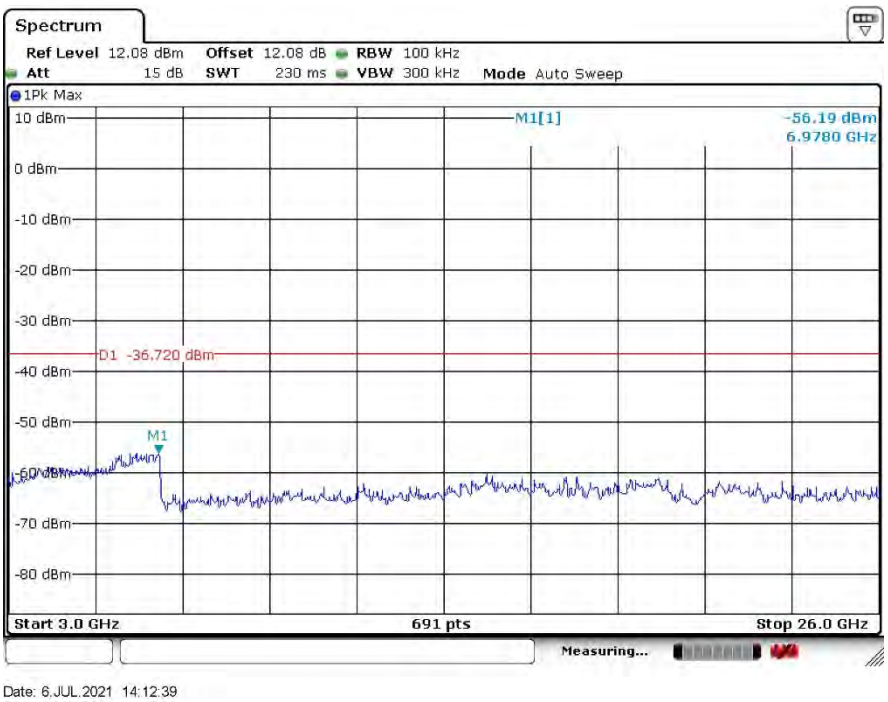
802.11 n40 mode

Antenna A Low Channel 242 2MHz

30MHz – 3GHz

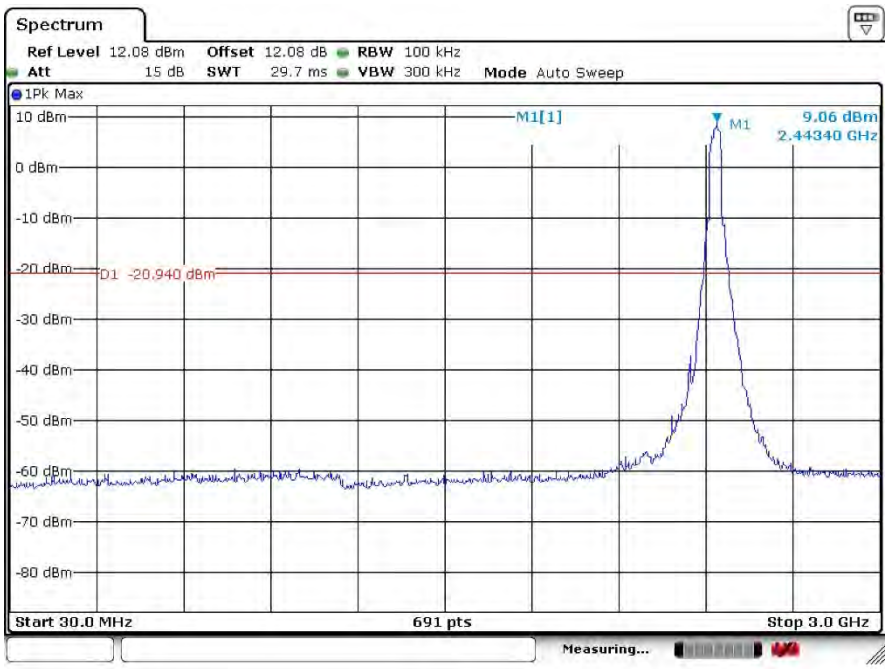


3GHz – 26GHz

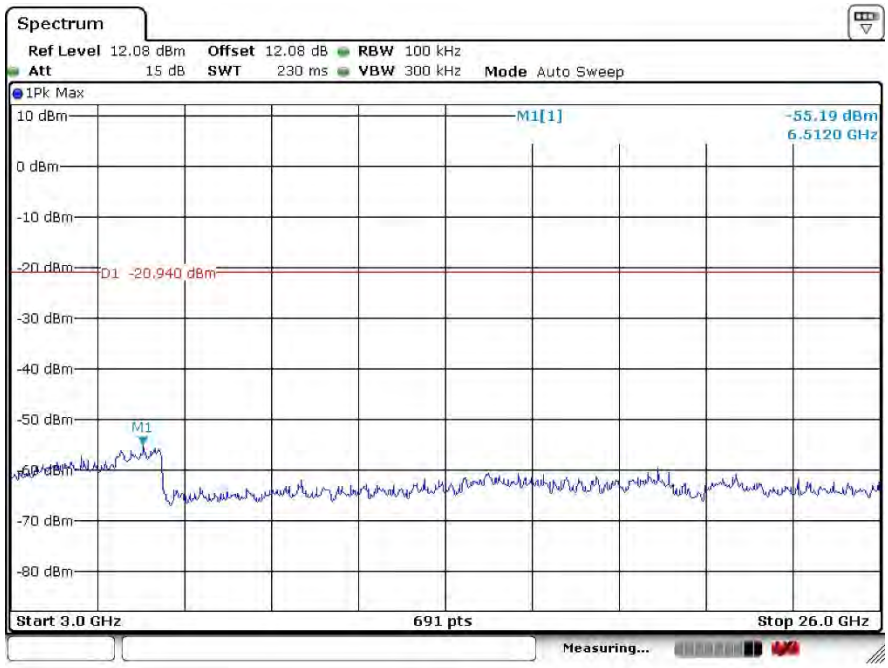


Antenna A Mid Channel 2437MHz

30MHz – 3GHz

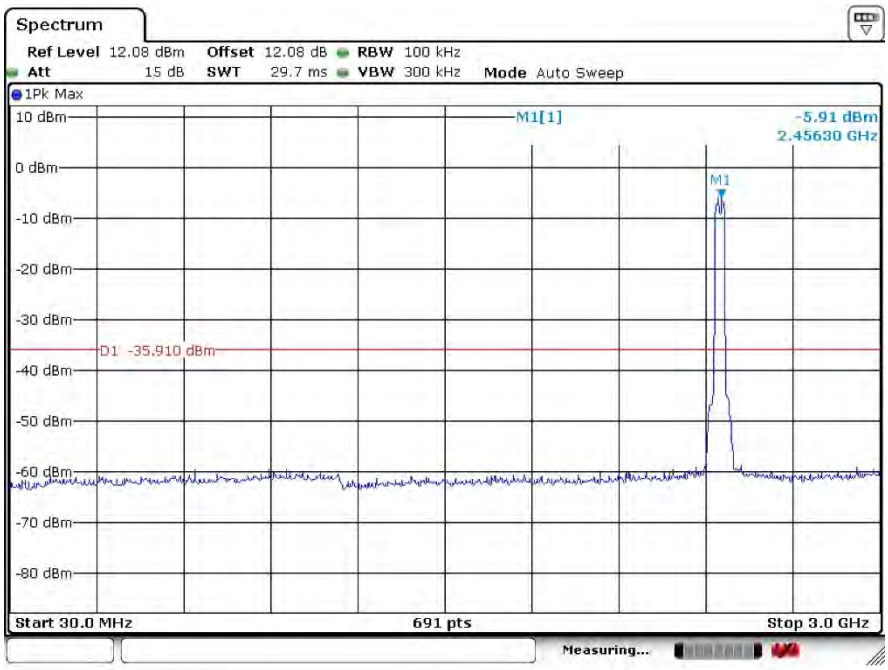


3GHz – 26GHz

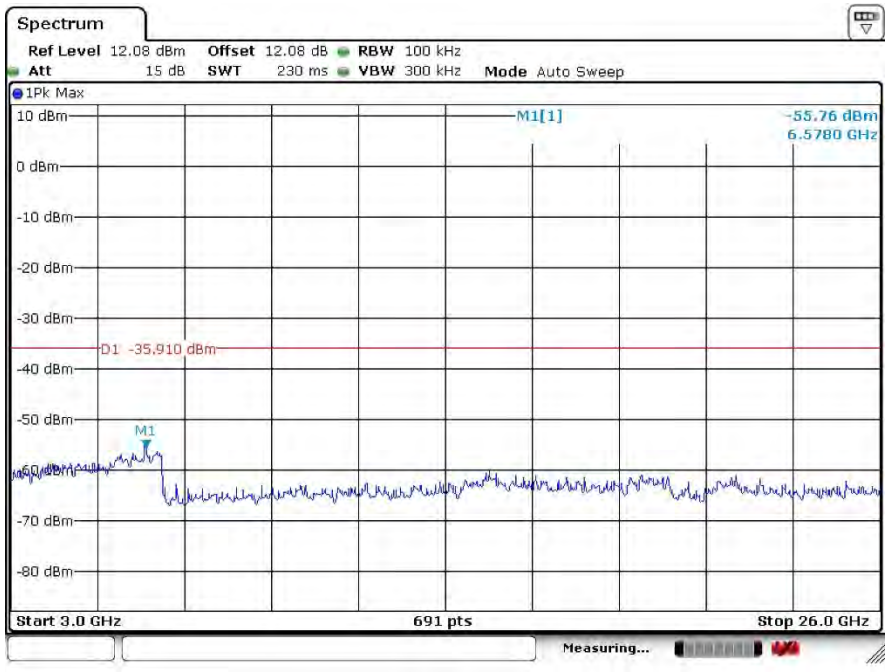


Antenna A High Channel 245 2MHz

30MHz – 3GHz



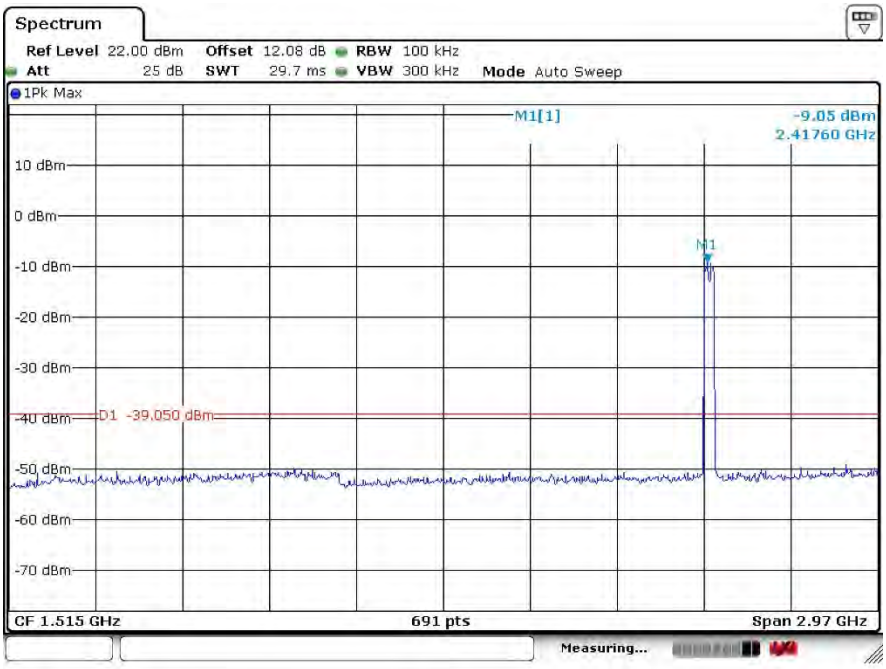
3GHz – 26GHz



802.11 n40 mode

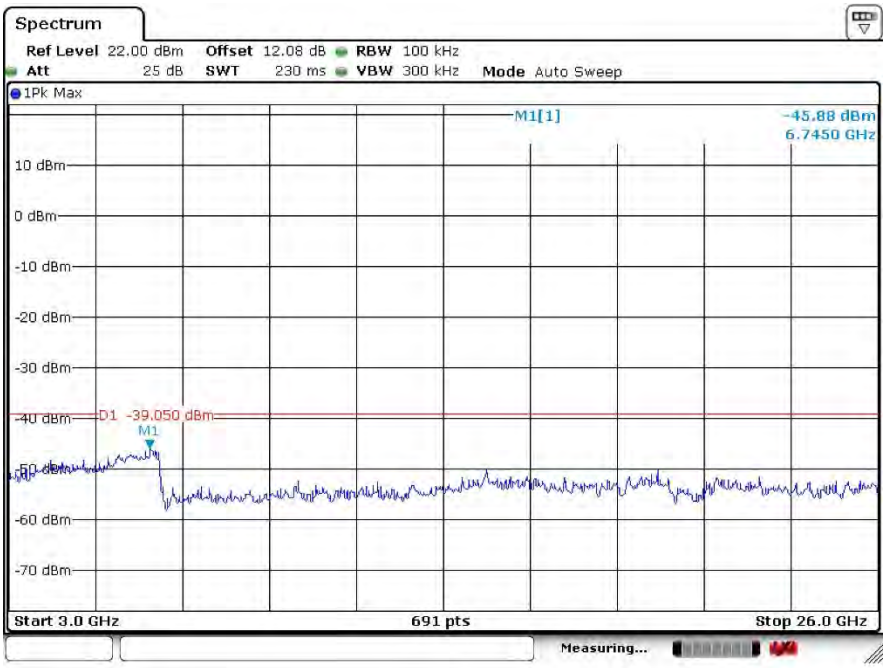
Antenna B Low Channel 2422MHz

30MHz – 3GHz



Date: 6.JUL.2021 16:11:33

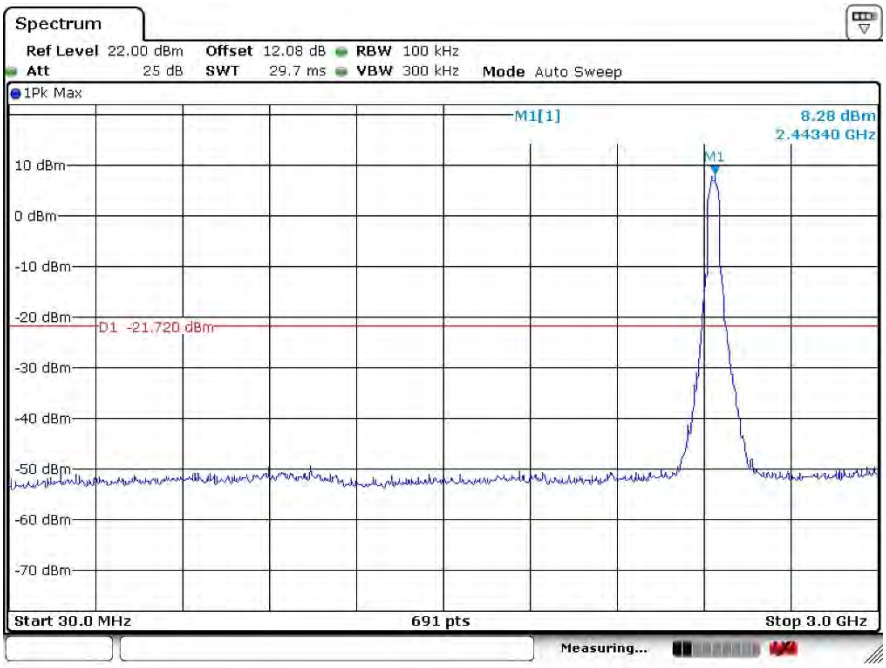
3GHz – 26GHz



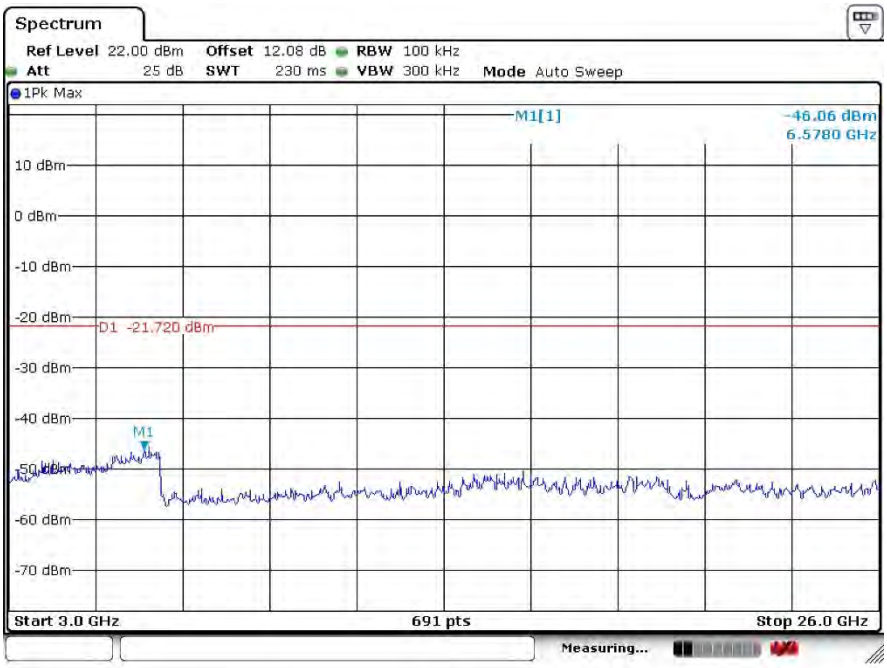
Date: 6.JUL.2021 16:12:00

Antenna B Mid Channel 2437MHz

30MHz – 3GHz

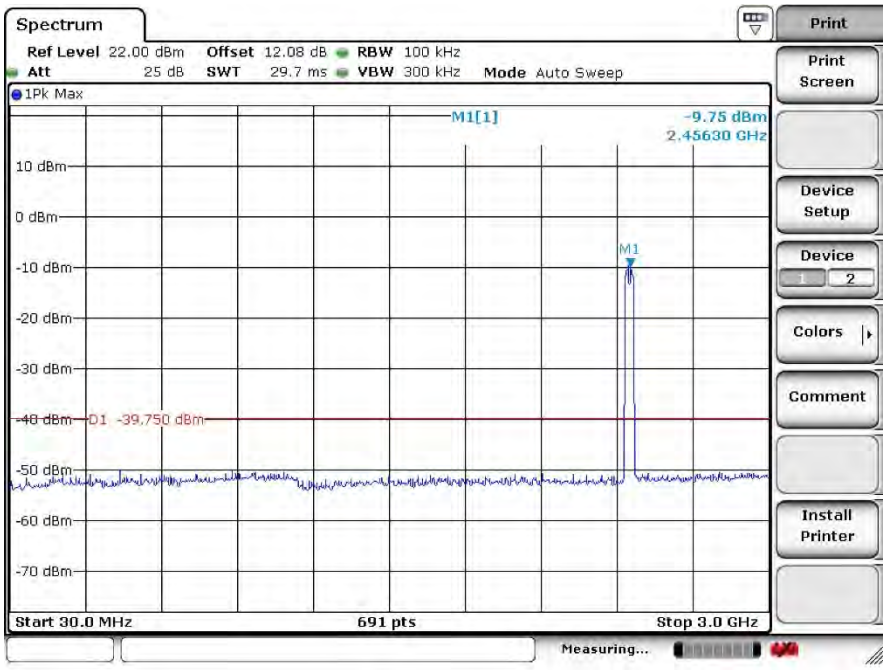


3GHz – 26GHz



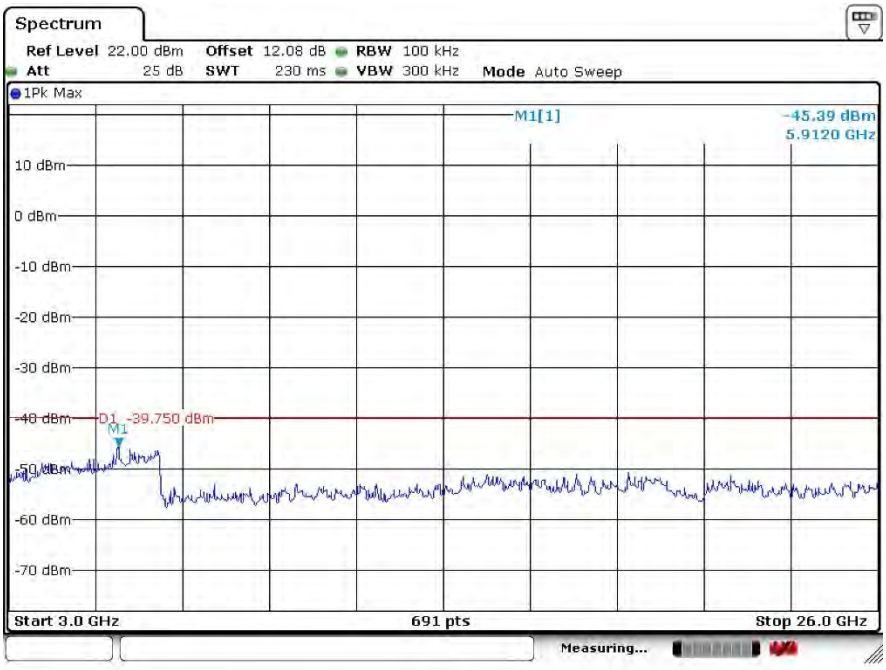
Antenna B High Channel 2452MHz

30MHz – 3GHz



Date: 6.JUL.2021 16:16:59

3GHz – 26GHz



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14 Annex A (Normative) – EUT Test Setup Photographs

Please refer to the attachment.

15 Annex B (Normative) – EUT External Photographs

Please refer to the attachment.

16 Annex C (Normative) – EUT Internal Photographs

Please refer to the attachment.

17 Annex D (Normative) - A2LA Electrical Testing Certificate

Accredited Laboratory

A2LA has accredited

BAY AREA COMPLIANCE LABORATORIES CORP.

Sunnyvale, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets A2LA *R222 - Specific Requirements EPA ENERGY STAR Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 10th day of March 2021.

Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2022

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

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

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

--- END OF REPORT ---