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

TEST REPORT

For

Roku, Inc.

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

FCC ID: TC2-R1040
IC: 5959A-R1037

Report Type:	**Product Type:**
Original Report	Set-top-box

Prepared By:	Vang Lee Test Technician
Report Number:	R2101064-DTS
Report Date:	2021-03-23
Reviewed By:	Christian McCaig RF Project Engineer

Bay Area Compliance Laboratories Corp.
1274 Anvilwood Avenue,
Sunnyvale, CA 94089, USA
Tel: +1 (408) 732-9162, Fax: +1 (408) 732-9164

ACCREDITED
CERTIFICATE #3297.02

TABLE OF CONTENTS

DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2101064-DTS	Original Report	2021-03-23

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: *3940X* and a similar model *3941X*, FCC ID: *TC2-R1040*; IC: *5959A-R1037* or the "EUT" as referred to in this report. It is a Set-top-box with 2.4 GHz and 5 GHz Wi-Fi. 2.4 GHz and 5 GHz Wi-Fi cannot transmit simultaneously.

1.2 Objective

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

The objective was to determine compliance with FCC Part 15.247 and ISEDC RSS-247 rules for Output Power, Antenna Requirements, 6 dB Bandwidth, Power Spectral Density, 100 kHz Bandwidth of Band Edges Measurement, Conducted and Radiated Spurious Emissions.

1.3 Related Submittal(s)/Grant(s)

FCC Part 15, Subpart E, Equipment NII with FCC ID: TC2-R1040; IC: 5959A-R1037

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

1.6 Test Facility Registrations

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

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

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

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

1.7 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 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 Teraterm. The software is compliant with the standard requirements being tested against.

Please refer to the following power setting table.

Modulation	Frequency (MHz)	Power Setting	
		Ant A	Ant B
802.11b	2412	44	40
	2437	64	59
	2462	52	48
802.11g	2412	44	44
	2437	64	64
	2462	49	46
802.11n20	2412	47	44
	2437	64	64
	2462	48	44
802.11n40	2422	46	42
	2437	64	64
	2452	42	42

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:

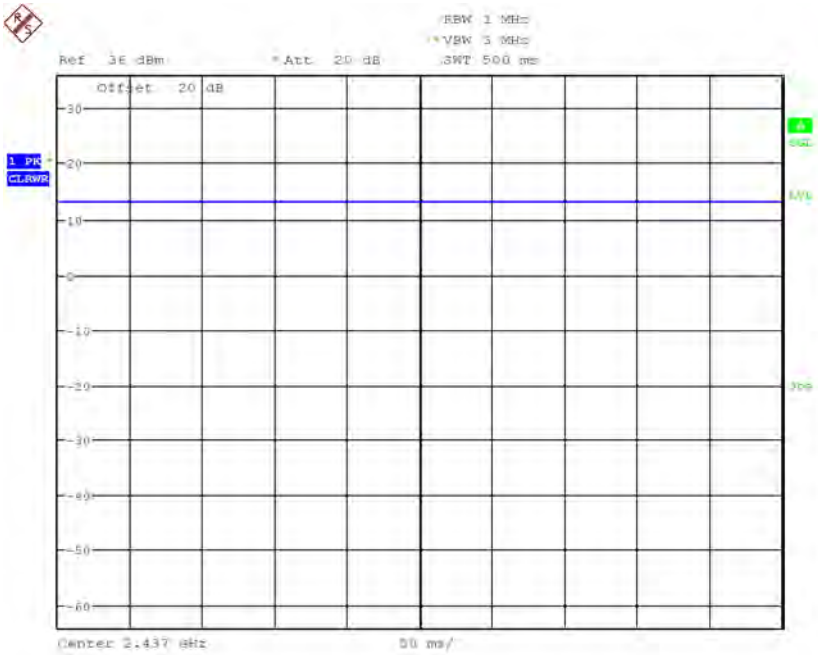
Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be utilized 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	-	-	100	0
802.11g	-	-	100	0
802.11n20	-	-	100	0
802.11n40	-	-	100	0

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

Please refer to the following plots.

802.11b mode



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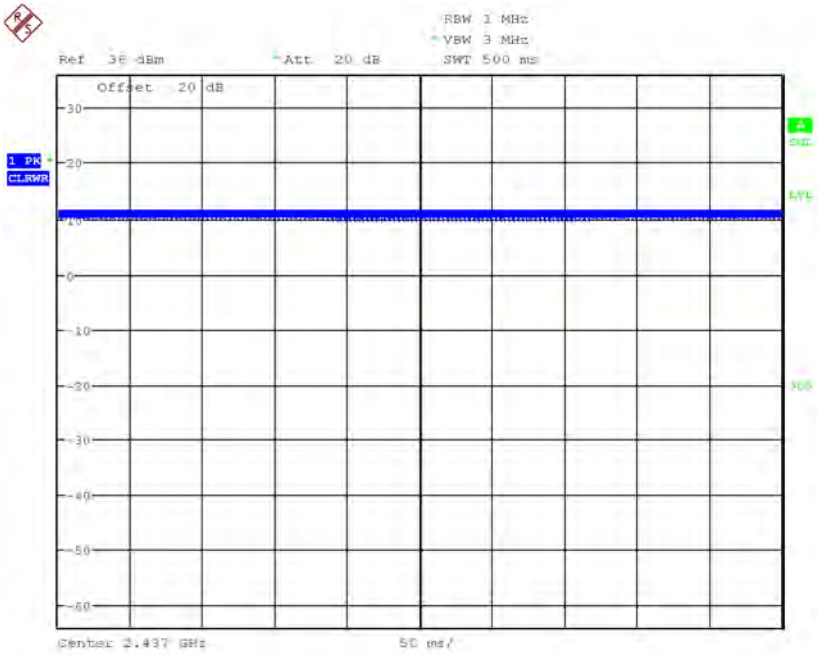
802.11g mode



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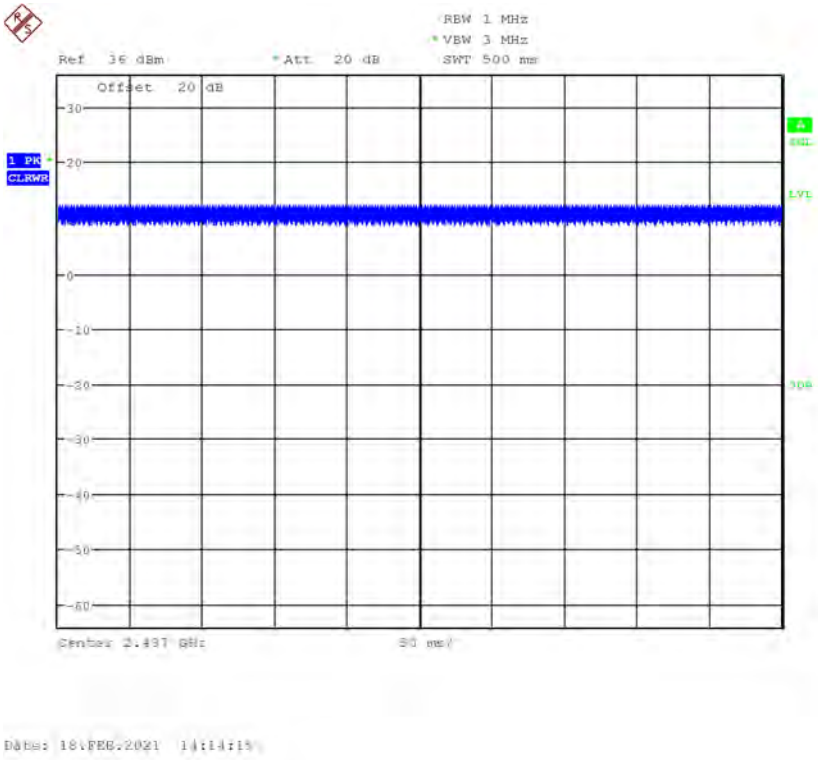
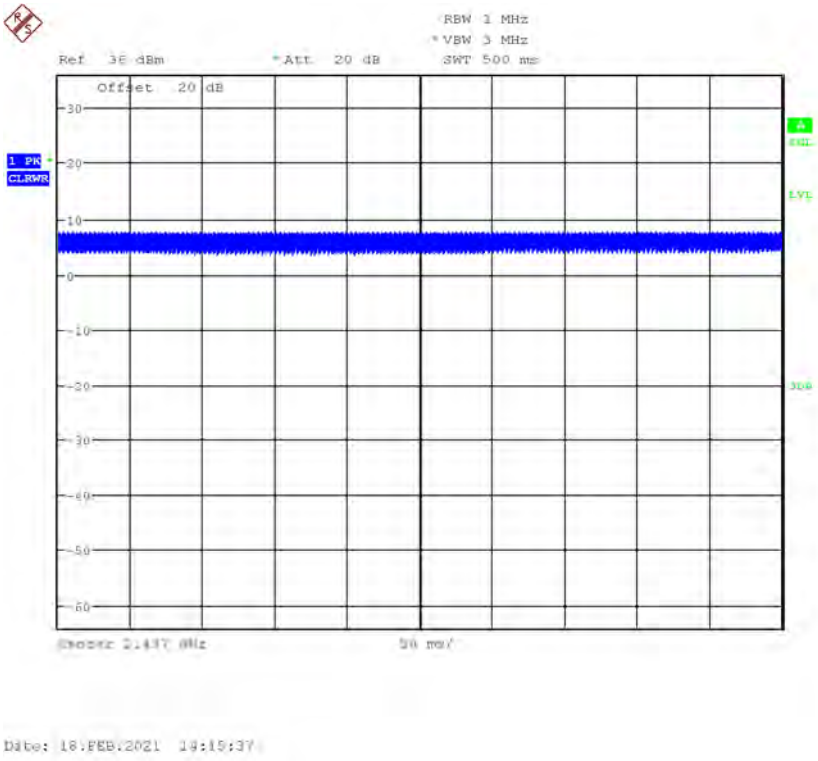
802.11n20 mode



802.11n40 mode



2.4 Equipment Modifications

N/A

2.5 Local Support Equipment

Manufacturer	Description	Model
Dell	Laptop	Latitude E6410

2.6 Remote Support Equipment

None

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 and ISEDC Rules	Description of Test	Results
FCC §15.203 ISEDC RSS-Gen §6.8	Antenna Requirement	Compliant
FCC §15.207 ISEDC RSS-Gen §8.8	AC Line Conducted Emissions	Compliant
FCC §2.1091, §15.247(i) ISEDC RSS-102	RF Exposure	Compliant
FCC §2.1051, §15.247 (d) ISEDC RSS-247 §5.5	Spurious Emissions at Antenna Port	Compliant
FCC §2.1053, §15.205, §15.209, §15.247 (d) ISEDC RSS-247 §5.5 ISEDC RSS-Gen §8.9 and §8.10	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(2) ISEDC RSS-247 §5.2 (1)	6 dB and 99% Emission Bandwidth	Compliant
FCC §15.247(b)(3) ISEDC RSS-247 §5.4 (4)	Maximum Peak Output Power	Compliant
FCC §15.247(d) ISEDC RSS-247 §5.5	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §15.247(e) ISEDC RSS-247 §5.2 (2)	Power Spectral Density	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 isotopically 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 [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

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

4.2 Antenna Description

The antennas used by the EUT are permanent attached antennas.
Antenna used is a Chip Antenna.

Radio	Frequency Range (MHz)	Maximum Antenna Gain (dBi)
2.4 GHz Wi-Fi (Ant A)	2400-2483.5	0
2.4 GHz Wi-Fi (Ant B)		2.9
5.2 GHz Wi-Fi (Ant A)	5150-5250	3
5.2 GHz Wi-Fi (Ant B)		2.2
5.8 GHz Wi-Fi (Ant A)	5725-5850	3
5.8 GHz Wi-Fi (Ant B)		4

Note: antenna gain is provided by the manufacturer.

5 FCC §2.1091, §15.247(i) & 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

5.3 MPE Results

2.4 Wi-Fi

Worst Case: Antenna A, 802.11b, Mid Channel 2437 MHz

Maximum output power at antenna input terminal (dBm):	21.23
Maximum output power at antenna input terminal (mW):	132.7394
Prediction distance (cm):	20
Prediction frequency (MHz):	2437
Maximum Antenna Gain, typical (dBi):	2.9
Maximum Antenna Gain (numeric):	1.95
Power density of prediction frequency at 20.0 cm (mW/cm^2):	0.0515
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	1.0

The device is compliant with the requirement MPE limit for uncontrolled exposure. The maximum power density at the distance of 20 cm is 0.0515 mW/cm^2. Limit is 1.0 mW/cm^2.

5.4 RF exposure evaluation exemption for IC

2.4 Wi-Fi

Worst Case: Antenna A, 802.11b, Mid Channel 2437 MHz

Maximum EIRP power = 21.23 dBm + 2.9 dBi = 24.13 dBm which is less than $1.31\times10^{-2}f^{0.6834}$ = 2.70 W = 34.31 dBm

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

6.1 Applicable Standards

As per FCC §15.207 and ISEDC RSS-Gen §8.8 Conducted limits:

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 were FCC §15.207 and ISEDC RSS-Gen §8.8 limits.

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 were 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 Corrected Amplitude and Margin Calculation

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 = S.A. Reading (32.5 dBuV) + Correction Factor (7.8 dB)

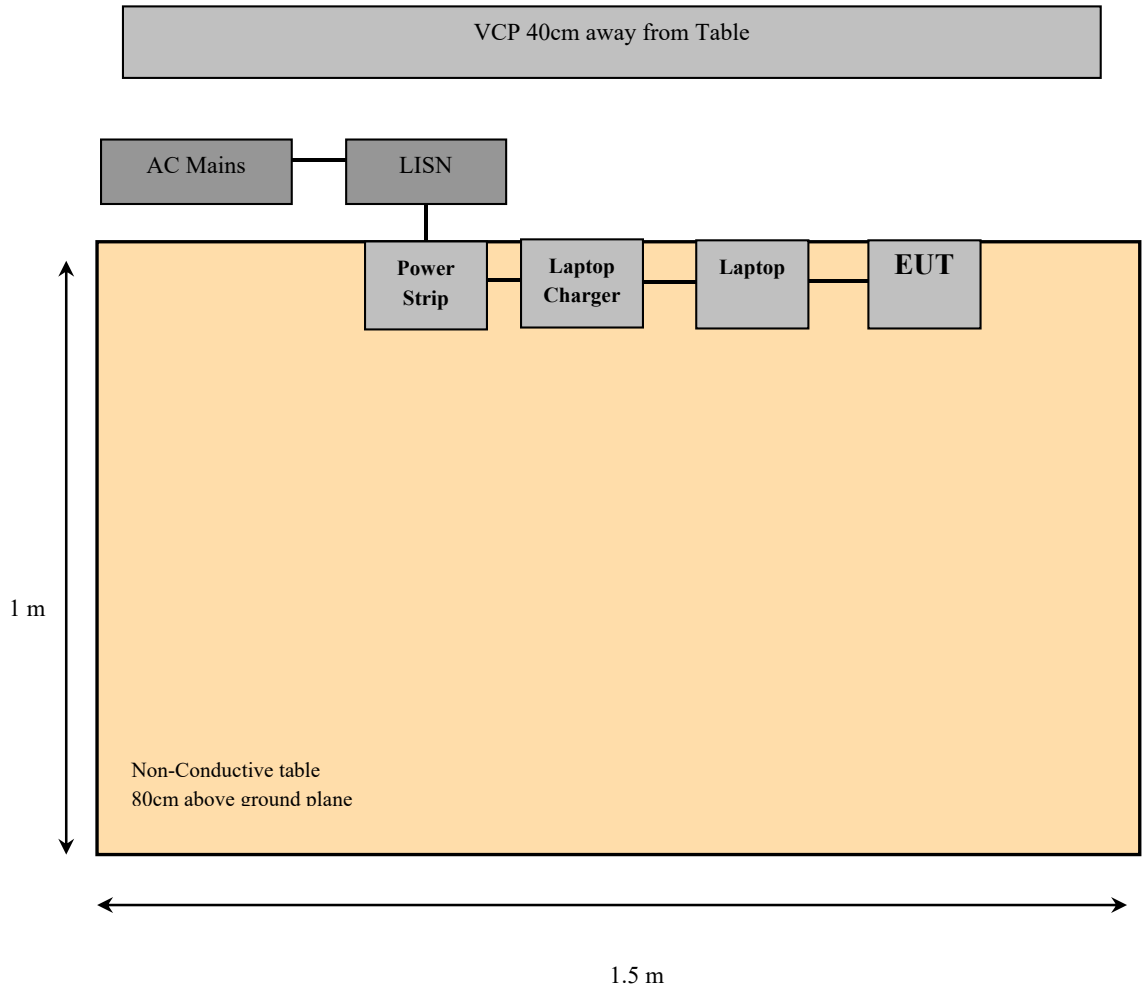
The Correction Factor is calculated by adding the Cable Loss (CL) and the Attenuator Factor (Atten) together. This calculation is done in the measurement software, and reported in the test result section. The basic equation is as follows:

Correction Factor = CL + Atten

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

6.5 Test Setup Block Diagram



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	18 months
Rohde and Schwarz	Impulse Limiter	ESH3-Z2	101964	2020-07-01	1 year
Solar Electronics Company	High Pass Filter	Type 7930-100	7930150204	2020-11-12	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 2021-02-18 in the Ground Plane test site.

6.8 Summary of Test Results

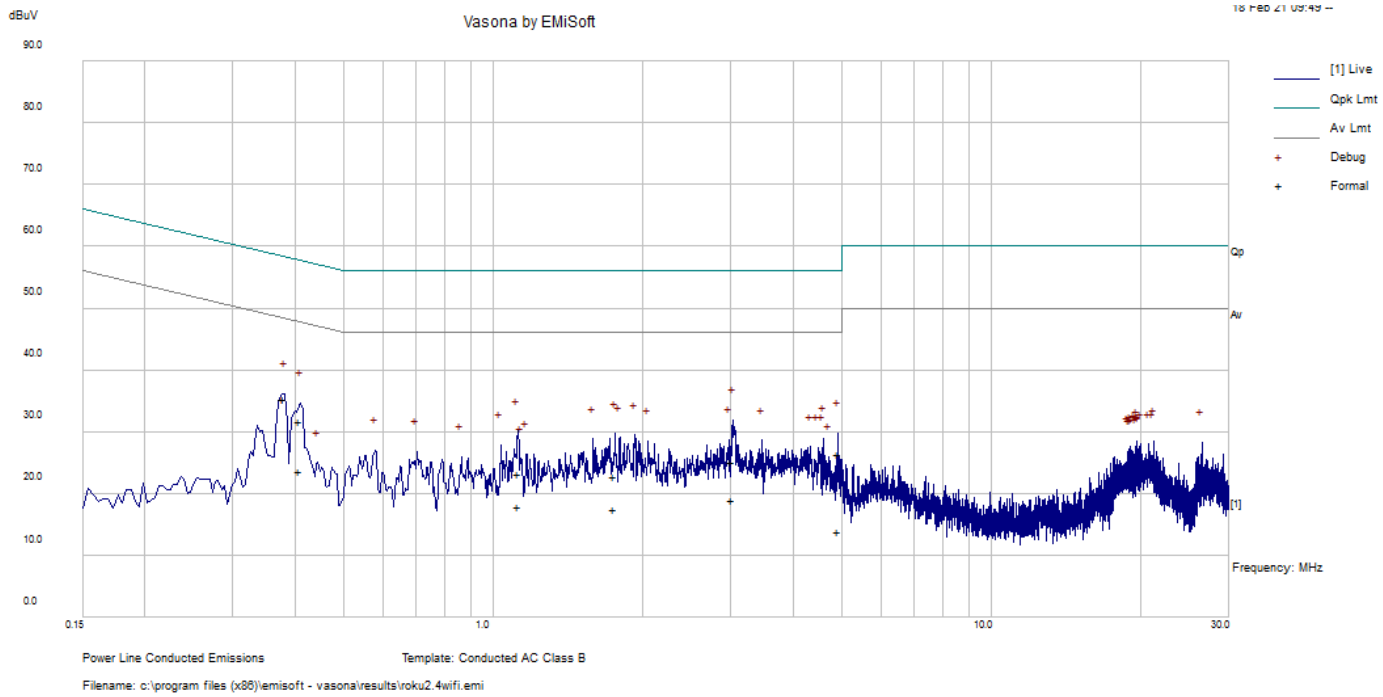
According to the recorded data in following table, the EUT complied with the FCC 15C and ISEDC RSS-Gen standard's conducted emissions limits, with the margin reading of:

Connection: AC/DC adapter connected to 120 V/60 Hz, AC			
Margin (dB)	**Frequency (MHz)**	**Conductor Mode (Line/Neutral)**	**Range (MHz)**
-12.65	0.380736	Neutral	0.15-30

6.9 Conducted Emissions Test Plots and Data

Worst Case: Antenna B, 802.11b mode Mid Channel

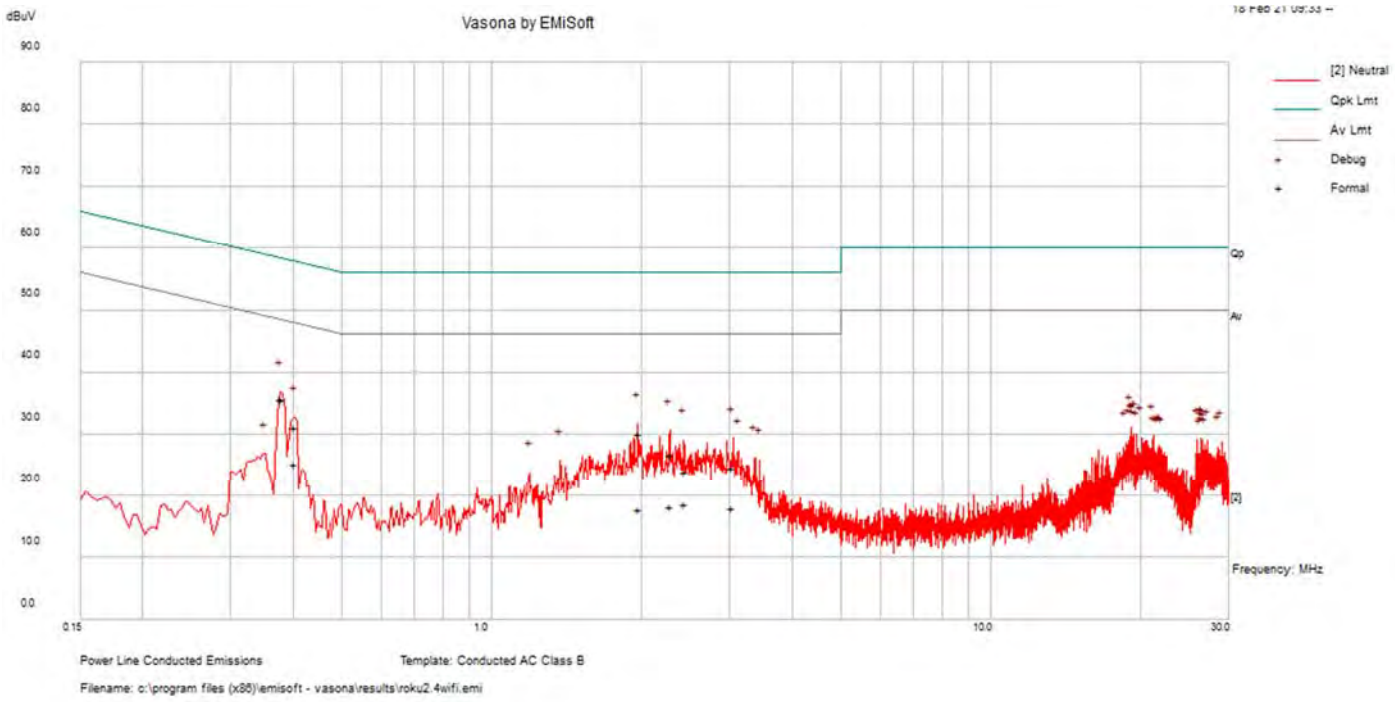
120 V, 60 Hz – Line



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB)	Corrected Amplitude (dBuV)	Conductor (Line/ Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.380075	25.59	9.78	35.37	Line	58.28	-22.91	QP
0.409711	21.94	9.78	31.73	Line	57.65	-25.92	QP
3.020255	15.25	9.93	25.18	Line	56	-30.82	QP
1.12145	13.3	9.86	23.16	Line	56	-32.84	QP
4.931414	16.4	9.97	26.37	Line	56	-29.63	QP
1.753339	12.79	9.89	22.68	Line	56	-33.32	QP

Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB)	Corrected Amplitude (dBuV)	Conductor (Line/ Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.380075	25.44	9.78	35.22	Line	48.28	-13.06	Ave.
0.409711	13.73	9.78	23.51	Line	47.65	-24.14	Ave.
3.020255	9.09	9.93	19.02	Line	46	-26.98	Ave.
1.12145	8.08	9.86	17.94	Line	46	-28.06	Ave.
4.931414	3.77	9.97	13.74	Line	46	-32.26	Ave.
1.753339	7.54	9.89	17.43	Line	46	-28.57	Ave.

120 V, 60 Hz – Neutral



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB)	Corrected Amplitude (dBuV)	Conductor (Line/ Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.380736	26.02	9.78	35.8	Neutral	58.26	-22.46	QP
1.969462	20.06	9.9	29.96	Neutral	56	-26.04	QP
0.404732	21.36	9.78	31.15	Neutral	57.76	-26.61	QP
2.2864	16.76	9.91	26.67	Neutral	56	-29.33	QP
3.038853	14.65	9.93	24.58	Neutral	56	-31.42	QP
2.438095	13.92	9.92	23.84	Neutral	56	-32.16	QP

Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB)	Corrected Amplitude (dBuV)	Conductor (Line/ Neutral)	Limit (dBuV)	Margin (dB)	Detector (QP/Ave.)
0.380736	25.83	9.78	35.61	Neutral	48.26	-12.65	Ave.
1.969462	7.87	9.9	17.77	Neutral	46	-28.23	Ave.
0.404732	15.29	9.78	25.07	Neutral	47.76	-22.68	Ave.
2.2864	8.28	9.91	18.19	Neutral	46	-27.81	Ave.
3.038853	8.04	9.93	17.97	Neutral	46	-28.03	Ave.
2.438095	8.6	9.92	18.52	Neutral	46	-27.48	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, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 or Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 4 – General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Above 30 MHz

Frequency (MHz)	Field Strength (µv/m at 3 metres)
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 license-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 were connected to the AC floor outlet.

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

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

The spectrum analyzer or receiver was set as:

Below 1000 MHz:

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

Above 1000 MHz:

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

7.4 Corrected Amplitude and 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 Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
HP	Spectrum Analyzer 46 GHz	E4446A	US44300386	2019-08-24	18 Months
Rohde and Schwarz	Receiver, EMI Test	ESCI 1166.5950.03	100338	2020-03-17	18 months
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	10555-01	2020-02-27	2 years
-	SMA cable	-	-	Each time[1]	N/A
Insulted Wire Corp.	157 Series 2.92 SM (x2) Armored 33 ft. Cable	KPS-1571AN-3960-KPS	DC 1917	2020-02-28	1 year
MDP Digital	Times Microwave LMR 400 UltraFex Coaxial Cable 35\'	LMR400UF	BACL1904161	2020-05-20	1 year
AH Systems	Preamplifier	PAM 1840 VH	170	2020-11-09	1 year
Agilent	Preamplifier	8449B	3147A00400	2020-02-27	1 year
HP	Pre Amplifier	8447D	2944A07030	2020-08-17	1 year
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

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".*

7.6 Test Environmental Conditions

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

The testing was performed by Tri Pham and Allen Huang from 2021-01-29 to 2021-02-24 in 5m chamber 3.

7.7 Summary of Test Results

According to the data hereinafter, the EUT complied with FCC Title 47, Part 15C and ISEDC RSS-247 standard's radiated emissions limits, and had the worst margin of:

2.4 GHz Wi-Fi

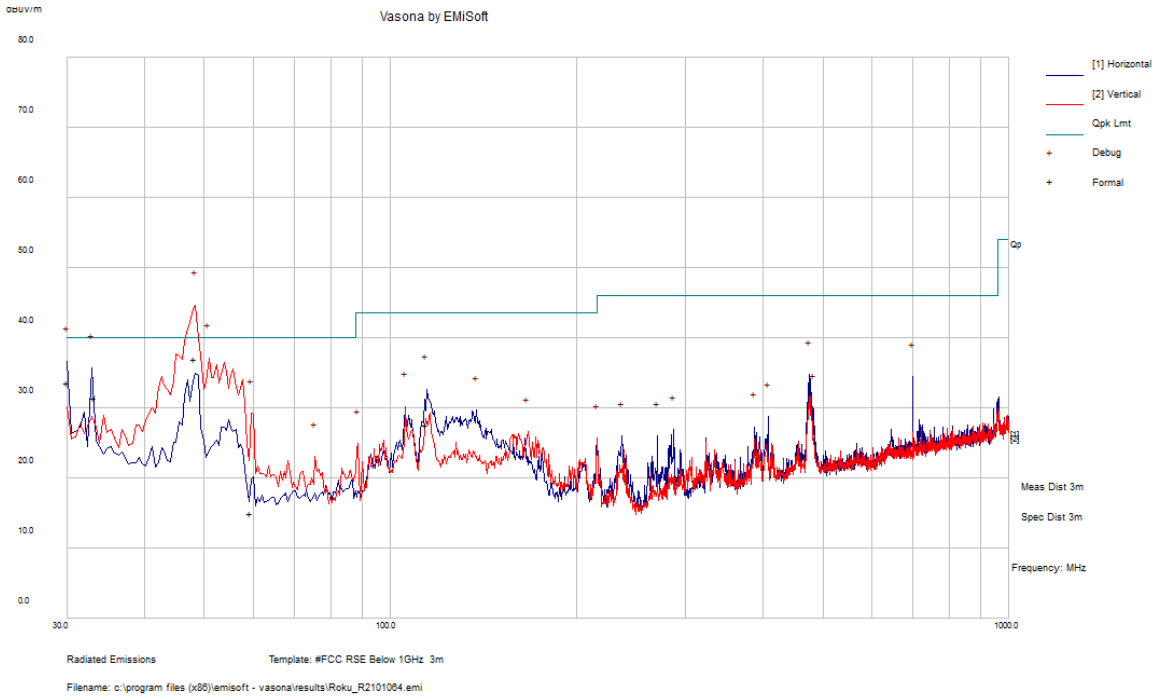
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Radio, Mode, channel**
-0.297	2390	Horizontal	Antenna B, b mode, low channel

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

7.8 Radiated Emissions Test Results

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

Worst Case: Antenna B, 802.11b mode Mid Channel, 2437 MHz



Frequency (MHz)	S.A. Reading (dBµV)	Correction Factor (dB)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
48.3095	52.01	-14.93	37.08	102	V	298	40	-2.92	QP
50.82375	45.51	-15.67	29.84	110	V	298	40	-10.16	QP
30	35.75	-2.11	33.64	101	H	50	40	-6.36	QP
33.2285	36.17	-4.65	31.52	136	H	63	40	-8.48	QP
59.41325	31.11	-16.01	15.1	219	V	34	40	-24.9	QP
114.3963	37.61	-10.02	27.58	121	H	80	43.5	-15.92	QP

2) 1–18 GHz Measured at 1 meter

2400-2483.5 MHz

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/ISEDC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2390	31.15	148	152	V	32.6	4.8	0	68.55	84	-15.45	Peak
2390	33.27	194	145	H	32.6	4.8	0	70.67	84	-13.33	Peak
2390	22.52	148	152	V	32.6	4.8	0	59.92	64	-4.08	Ave
2390	**26.303**	**194**	**145**	**H**	**32.6**	**4.8**	**0**	**63.703**	**64**	**-0.297**	**Ave**
4824	46.64	0	105	V	35	9.57	35.43	55.78	84	-28.22	Peak
4824	49.38	290	120	H	35	9.57	35.43	58.52	84	-25.48	Peak
4824	38.67	0	105	V	35	9.57	35.43	47.81	64	-16.19	Ave
4824	44.41	290	120	H	35	9.57	35.43	53.55	64	-10.45	Ave
7236	46.69	0	100	V	36.1	11.1	35.82	58.07	84	-25.93	Peak
7236	47.09	0	100	H	36.1	11.1	35.82	58.47	84	-25.53	Peak
7236	35.24	0	100	V	36.1	11.1	35.82	46.62	64	-17.38	Ave
7236	35.53	0	100	H	36.1	11.1	35.82	46.91	64	-17.09	Ave
Middle Channel 2437 MHz											
4874	51.22	79	185	V	35.2	9.78	35.43	60.77	84	-23.23	Peak
4874	54.95	319	130	H	35.2	9.78	35.43	64.5	84	-19.5	Peak
4874	47.7	79	185	V	35.2	9.78	35.43	57.25	64	-6.75	Ave
4874	52.16	319	130	H	35.2	9.78	35.43	61.71	64	-2.29	Ave
7311	45.96	79	185	V	36.1	11.86	35.82	58.1	84	-25.9	Peak
7311	48	84	120	H	36.1	11.86	35.82	60.14	84	-23.86	Peak
7311	37.01	79	185	V	36.1	11.86	35.82	49.15	64	-14.85	Ave
7311	40.32	84	120	H	36.1	11.86	35.82	52.46	64	-11.54	Ave
High Channel 2462 MHz											
2483.5	31.15	141	148	V	33	4.8	0	68.95	84	-15.05	Peak
2483.5	33.28	208	125	H	33	4.8	0	71.08	84	-12.92	Peak
2483.5	21.65	141	148	V	33	4.8	0	59.45	64	-4.55	Ave
2483.5	25.31	208	125	H	33	4.8	0	63.11	64	-0.89	Ave
4924	48.44	6	285	V	35.4	9.78	35.43	58.19	84	-25.81	Peak
4924	51.8	290	120	H	35.4	9.78	35.43	61.55	84	-22.45	Peak
4924	43.84	6	285	V	35.4	9.78	35.43	53.59	64	-10.41	Ave
4924	47.27	290	120	120	35.4	9.78	35.43	57.02	64	-6.98	Ave
7386	45.61	0	100	V	36.1	11.86	35.9	57.67	84	-26.33	Peak
7386	45.89	85	120	H	36.1	11.86	35.9	57.95	84	-26.05	Peak
7386	34.62	0	100	V	36.1	11.86	35.9	46.68	64	-17.32	Ave
7386	35.72	85	120	H	36.1	11.86	35.9	47.78	64	-16.22	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/ISEDC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2390	30.29	150	230	V	32.6	4.8	0	67.69	84	-16.31	Peak
2390	34.46	44	145	H	32.6	4.8	0	71.86	84	-12.14	Peak
2390	20.81	150	230	V	32.6	4.8	0	58.21	64	-5.79	Ave
2390	25.8	44	145	H	32.6	4.8	0	63.2	64	-0.8	Ave
4824	46.47	155	142	V	35	9.57	35.43	55.61	84	-28.39	Peak
4824	47.18	50	130	H	35	9.57	35.43	56.32	84	-27.68	Peak
4824	38.16	155	142	V	35	9.57	35.43	47.3	64	-16.7	Ave
4824	40.19	50	130	H	35	9.57	35.43	49.33	64	-14.67	Ave
7236	46.8	0	100	V	36.1	11.1	35.82	58.18	84	-25.82	Peak
7236	46.11	0	100	H	36.1	11.1	35.82	57.49	84	-26.51	Peak
7236	36.03	0	100	V	36.1	11.1	35.82	47.41	64	-16.59	Ave
7236	35.08	0	100	H	36.1	11.1	35.82	46.46	64	-17.54	Ave
Middle Channel 2437 MHz											
4874	52.56	50	105	V	35.2	9.78	35.43	62.11	84	-21.89	Peak
4874	54.89	50	130	H	35.2	9.78	35.43	64.44	84	-19.56	Peak
4874	49.62	50	105	V	35.2	9.78	35.43	59.17	64	-4.83	Ave
4874	52.578	50	130	H	35.2	9.78	35.43	62.128	64	-1.872	Ave
7311	45.85	8	269	V	36.1	11.86	35.82	57.99	84	-26.01	Peak
7311	47.11	319	132	H	36.1	11.86	35.82	59.25	84	-24.75	Peak
7311	37.74	8	269	V	36.1	11.86	35.82	49.88	64	-14.12	Ave
7311	39.65	319	132	H	36.1	11.86	35.82	51.79	64	-12.21	Ave
High Channel 2462 MHz											
2483.5	31.11	83	260	V	33	4.8	0	68.91	84	-15.09	Peak
2483.5	33.13	48	137	H	33	4.8	0	70.93	84	-13.07	Peak
2483.5	21.65	83	260	V	33	4.8	0	59.45	64	-4.55	Ave
2483.5	25.47	48	137	H	33	4.8	0	63.27	64	-0.73	Ave
4924	49.18	50	115	V	35.4	9.78	35.43	58.93	84	-25.07	Peak
4924	48.25	50	132	H	35.4	9.78	35.43	58	84	-26	Peak
4924	43.24	50	115	V	35.4	9.78	35.43	52.99	64	-11.01	Ave
4924	42.94	50	132	H	35.4	9.78	35.43	52.69	64	-11.31	Ave
7386	45.73	0	100	V	36.1	11.86	35.9	57.79	84	-26.21	Peak
7386	45.13	0	100	H	36.1	11.86	35.9	57.19	84	-26.81	Peak
7386	34.94	0	100	V	36.1	11.86	35.9	47	64	-17	Ave
7386	33.92	0	100	H	36.1	11.86	35.9	45.98	64	-18.02	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/ISEDC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2390	35.23	148	152	V	32.6	4.8	0	72.63	84	-11.37	Peak
2390	38.61	194	145	H	32.6	4.8	0	76.01	84	-7.99	Peak
2390	21.93	148	152	V	32.6	4.8	0	59.33	64	-4.67	Ave
2390	25.304	194	145	H	32.6	4.8	0	62.704	64	-1.296	Ave
4824	45.95	0	100	V	35	9.57	35.43	55.09	84	-28.91	Peak
4824	46.29	0	100	H	35	9.57	35.43	55.43	84	-28.57	Peak
4824	35.68	0	100	V	35	9.57	35.43	44.82	64	-19.18	Ave
4824	35.17	0	100	H	35	9.57	35.43	44.31	64	-19.69	Ave
7236	45.11	0	100	V	36.1	11.1	35.82	56.49	84	-27.51	Peak
7236	45.88	0	100	H	36.1	11.1	35.82	57.26	84	-26.74	Peak
7236	34.99	0	100	V	36.1	11.1	35.82	46.37	64	-17.63	Ave
7236	35.21	0	100	H	36.1	11.1	35.82	46.59	64	-17.41	Ave
Middle Channel 2437 MHz											
4874	47.14	79	185	V	35.2	9.78	35.43	56.69	84	-27.31	Peak
4874	47.32	319	130	H	35.2	9.78	35.43	56.87	84	-27.13	Peak
4874	36.1	79	185	V	35.2	9.78	35.43	45.65	64	-18.35	Ave
4874	36.28	319	130	H	35.2	9.78	35.43	45.83	64	-18.17	Ave
7311	45.41	79	185	V	36.1	11.86	35.82	57.55	84	-26.45	Peak
7311	45.76	84	120	H	36.1	11.86	35.82	57.9	84	-26.1	Peak
7311	34.87	79	185	V	36.1	11.86	35.82	47.01	64	-16.99	Ave
7311	34.92	84	120	H	36.1	11.86	35.82	47.06	64	-16.94	Ave
High Channel 2462 MHz											
2483.5	37.91	141	148	V	33	4.8	0	75.71	84	-8.29	Peak
2483.5	37.89	208	125	H	33	4.8	0	75.69	84	-8.31	Peak
2483.5	22.41	141	148	V	33	4.8	0	60.21	64	-3.79	Ave
2483.5	24.92	208	125	H	33	4.8	0	62.72	64	-1.28	Ave
4924	45.82	0	100	V	35.4	9.78	35.43	55.57	84	-28.43	Peak
4924	46.09	85	120	H	35.4	9.78	35.43	55.84	84	-28.16	Peak
4924	35.18	0	100	V	35.4	9.78	35.43	44.93	64	-19.07	Ave
4924	35.31	85	120	H	35.4	9.78	35.43	45.06	64	-18.94	Ave
7386	44.68	0	100	V	36.1	11.86	35.9	56.74	84	-27.26	Peak
7386	44.57	85	120	H	36.1	11.86	35.9	56.63	84	-27.37	Peak
7386	34.47	0	100	V	36.1	11.86	35.9	46.53	64	-17.47	Ave
7386	34.67	85	120	H	36.1	11.86	35.9	46.73	64	-17.27	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/ISEDC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2390	33.43	124	230	V	32.6	4.8	0	70.83	84	-13.17	Peak
2390	37.14	44	145	H	32.6	4.8	0	74.54	84	-9.46	Peak
2390	19.97	124	230	V	32.6	4.8	0	57.37	64	-6.63	Ave
2390	24.652	44	145	H	32.6	4.8	0	62.052	64	-1.948	Ave
4824	46.53	0	100	V	35	9.57	35.43	55.67	84	-28.33	Peak
4824	46.27	0	100	H	35	9.57	35.43	55.41	84	-28.59	Peak
4824	35.55	0	100	V	35	9.57	35.43	44.69	64	-19.31	Ave
4824	35.24	0	100	H	35	9.57	35.43	44.38	64	-19.62	Ave
7236	46.31	0	100	V	36.1	11.1	35.82	57.69	84	-26.31	Peak
7236	46.04	0	100	H	36.1	11.1	35.82	57.42	84	-26.58	Peak
7236	35.88	0	100	V	36.1	11.1	35.82	47.26	64	-16.74	Ave
7236	34.94	0	100	H	36.1	11.1	35.82	46.32	64	-17.68	Ave
Middle Channel 2437 MHz											
4874	46.43	127	230	V	35.2	9.78	35.43	55.98	84	-28.02	Peak
4874	48.82	50	130	H	35.2	9.78	35.43	58.37	84	-25.63	Peak
4874	36.93	127	230	V	35.2	9.78	35.43	46.48	64	-17.52	Ave
4874	37.54	50	130	H	35.2	9.78	35.43	47.09	64	-16.91	Ave
7311	46.42	127	230	V	36.1	11.86	35.82	58.56	84	-25.44	Peak
7311	46.28	319	132	H	36.1	11.86	35.82	58.42	84	-25.58	Peak
7311	35.24	127	230	V	36.1	11.86	35.82	47.38	64	-16.62	Ave
7311	35.31	319	132	H	36.1	11.86	35.82	47.45	64	-16.55	Ave
High Channel 2462 MHz											
2483.5	36.21	83	260	V	33	4.8	0	74.01	84	-9.99	Peak
2483.5	38.77	48	137	H	33	4.8	0	76.57	84	-7.43	Peak
2483.5	21.05	83	260	V	33	4.8	0	58.85	64	-5.15	Ave
2483.5	25.18	48	137	H	33	4.8	0	62.98	64	-1.02	Ave
4924	45.65	0	100	V	35.4	9.78	35.43	55.4	84	-28.6	Peak
4924	45.41	0	100	H	35.4	9.78	35.43	55.16	84	-28.84	Peak
4924	35.77	0	100	V	35.4	9.78	35.43	45.52	64	-18.48	Ave
4924	35.63	0	100	H	35.4	9.78	35.43	45.38	64	-18.62	Ave
7386	44.97	0	100	V	36.1	11.86	35.9	57.03	84	-26.97	Peak
7386	43.78	0	100	H	36.1	11.86	35.9	55.84	84	-28.16	Peak
7386	34.87	0	100	V	36.1	11.86	35.9	46.93	64	-17.07	Ave
7386	34.13	0	100	H	36.1	11.86	35.9	46.19	64	-17.81	Ave

802.11n20 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/ISEDC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2390	40.36	148	152	V	32.6	4.8	0	77.76	84	-6.24	Peak
2390	43.1	194	145	H	32.6	4.8	0	80.5	84	-3.5	Peak
2390	22.06	148	152	V	32.6	4.8	0	59.46	64	-4.54	Ave
2390	25.25	194	145	H	32.6	4.8	0	62.65	64	-1.35	Ave
4824	45.33	0	100	V	35	9.57	35.43	54.47	84	-29.53	Peak
4824	45.53	0	100	H	35	9.57	35.43	54.67	84	-29.33	Peak
4824	34.76	0	100	V	35	9.57	35.43	43.9	64	-20.1	Ave
4824	35.14	0	100	H	35	9.57	35.43	44.28	64	-19.72	Ave
7236	47.01	0	100	V	36.1	11.1	35.82	58.39	84	-25.61	Peak
7236	47.2	0	100	H	36.1	11.1	35.82	58.58	84	-25.42	Peak
7236	35.44	0	100	V	36.1	11.1	35.82	46.82	64	-17.18	Ave
7236	35.38	0	100	H	36.1	11.1	35.82	46.76	64	-17.24	Ave
Middle Channel 2437 MHz											
4874	46.97	79	185	V	35.2	9.78	35.43	56.52	84	-27.48	Peak
4874	47.63	319	130	H	35.2	9.78	35.43	57.18	84	-26.82	Peak
4874	35.51	79	185	V	35.2	9.78	35.43	45.06	64	-18.94	Ave
4874	35.99	319	130	H	35.2	9.78	35.43	45.54	64	-18.46	Ave
7311	45.63	79	185	V	36.1	11.86	35.82	57.77	84	-26.23	Peak
7311	45.03	84	120	H	36.1	11.86	35.82	57.17	84	-26.83	Peak
7311	34.97	79	185	V	36.1	11.86	35.82	47.11	64	-16.89	Ave
7311	35.12	84	120	H	36.1	11.86	35.82	47.26	64	-16.74	Ave
High Channel 2462 MHz											
2483.5	38.99	141	148	V	33	4.8	0	76.79	84	-7.21	Peak
2483.5	41.43	208	125	H	33	4.8	0	79.23	84	-4.77	Peak
2483.5	22.98	141	148	V	33	4.8	0	60.78	64	-3.22	Ave
2483.5	25.23	208	125	H	33	4.8	0	63.03	64	-0.97	Ave
4924	45.66	0	100	V	35.4	9.78	35.43	55.41	84	-28.59	Peak
4924	45.74	85	120	H	35.4	9.78	35.43	55.49	84	-28.51	Peak
4924	35.17	0	100	V	35.4	9.78	35.43	44.92	64	-19.08	Ave
4924	35.44	85	120	H	35.4	9.78	35.43	45.19	64	-18.81	Ave
7386	45.23	0	100	V	36.1	11.86	35.9	57.29	84	-26.71	Peak
7386	45.82	85	120	H	36.1	11.86	35.9	57.88	84	-26.12	Peak
7386	34.49	0	100	V	36.1	11.86	35.9	46.55	64	-17.45	Ave
7386	34.65	85	120	H	36.1	11.86	35.9	46.71	64	-17.29	Ave

802.11n20 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/ISEDC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2412 MHz											
2390	38.59	124	230	V	32.6	4.8	0	75.99	84	-8.01	Peak
2390	42.84	44	145	H	32.6	4.8	0	80.24	84	-3.76	Peak
2390	20.86	124	230	V	32.6	4.8	0	58.26	64	-5.74	Ave
2390	25.45	44	145	H	32.6	4.8	0	62.85	64	-1.15	Ave
4824	46.12	0	100	V	35	9.57	35.43	55.26	84	-28.74	Peak
4824	45.14	0	100	H	35	9.57	35.43	54.28	84	-29.72	Peak
4824	35.66	0	100	V	35	9.57	35.43	44.8	64	-19.2	Ave
4824	34.58	0	100	H	35	9.57	35.43	43.72	64	-20.28	Ave
7236	46.44	0	100	V	36.1	11.1	35.82	57.82	84	-26.18	Peak
7236	45.69	0	100	H	36.1	11.1	35.82	57.07	84	-26.93	Peak
7236	35.67	0	100	V	36.1	11.1	35.82	47.05	64	-16.95	Ave
7236	34.81	0	100	H	36.1	11.1	35.82	46.19	64	-17.81	Ave
Middle Channel 2437 MHz											
4874	46.56	127	230	V	35.2	9.78	35.43	56.11	84	-27.89	Peak
4874	49.11	50	130	H	35.2	9.78	35.43	58.66	84	-25.34	Peak
4874	36.87	127	230	V	35.2	9.78	35.43	46.42	64	-17.58	Ave
4874	37.28	50	130	H	35.2	9.78	35.43	46.83	64	-17.17	Ave
7311	46.77	127	230	V	36.1	11.86	35.82	58.91	84	-25.09	Peak
7311	46.92	319	132	H	36.1	11.86	35.82	59.06	84	-24.94	Peak
7311	35.41	127	230	V	36.1	11.86	35.82	47.55	64	-16.45	Ave
7311	35.25	319	132	H	36.1	11.86	35.82	47.39	64	-16.61	Ave
High Channel 2462 MHz											
2483.5	35.84	83	260	V	33	4.8	0	73.64	84	-10.36	Peak
2483.5	39.56	48	137	H	33	4.8	0	77.36	84	-6.64	Peak
2483.5	20.73	83	260	V	33	4.8	0	58.53	64	-5.47	Ave
2483.5	25.38	48	137	H	33	4.8	0	63.18	64	-0.82	Ave
4924	45.95	0	100	V	35.4	9.78	35.43	55.7	84	-28.3	Peak
4924	46.17	0	100	H	35.4	9.78	35.43	55.92	84	-28.08	Peak
4924	35.35	0	100	V	35.4	9.78	35.43	45.1	64	-18.9	Ave
4924	35.22	0	100	H	35.4	9.78	35.43	44.97	64	-19.03	Ave
7386	45.02	0	100	V	36.1	11.86	35.9	57.08	84	-26.92	Peak
7386	44.61	0	100	H	36.1	11.86	35.9	56.67	84	-27.33	Peak
7386	34.94	0	100	V	36.1	11.86	35.9	47	64	-17	Ave
7386	34.29	0	100	H	36.1	11.86	35.9	46.35	64	-17.65	Ave

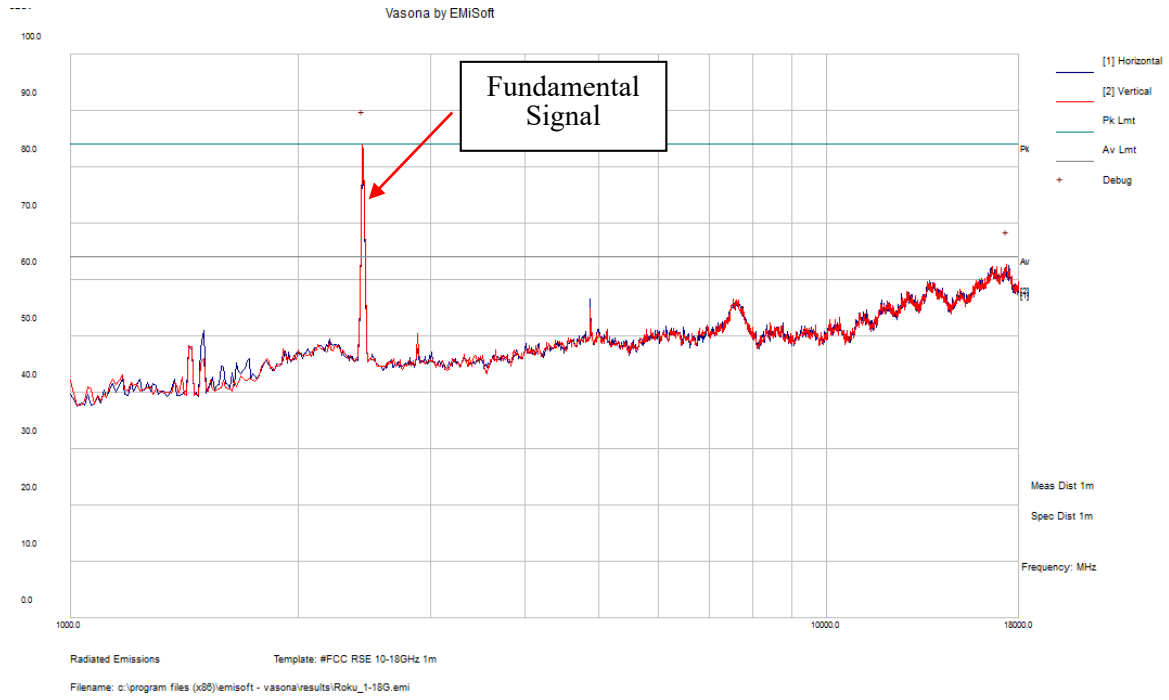
802.11n40 mode Antenna A

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISEDC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2422 MHz											
2390	38.97	148	152	V	32.6	4.8	0	76.37	84	-7.63	Peak
2390	41.12	194	145	H	32.6	4.8	0	78.52	84	-5.48	Peak
2390	24.12	148	152	V	32.6	4.8	0	61.52	64	-2.48	Ave
2390	25.806	194	145	H	32.6	4.8	0	63.206	64	-0.794	Ave
4844	45.67	0	100	V	35.2	9.57	35.43	55.01	84	-28.99	Peak
4844	45.92	0	100	H	35.2	9.57	35.43	55.26	84	-28.74	Peak
4844	35.01	0	100	V	35.2	9.57	35.43	44.35	64	-19.65	Ave
4844	34.89	0	100	H	35.2	9.57	35.43	44.23	64	-19.77	Ave
7266	45.58	0	100	V	36.1	11.1	35.82	56.96	84	-27.04	Peak
7266	45.73	0	100	H	36.1	11.1	35.82	57.11	84	-26.89	Peak
7266	34.61	0	100	V	36.1	11.1	35.82	45.99	64	-18.01	Ave
7266	34.76	0	100	H	36.1	11.1	35.82	46.14	64	-17.86	Ave
Middle Channel 2437 MHz											
4874	46.23	79	185	V	35.2	9.78	35.43	55.78	84	-28.22	Peak
4874	46.68	319	130	H	35.2	9.78	35.43	56.23	84	-27.77	Peak
4874	35.47	79	185	V	35.2	9.78	35.43	45.02	64	-18.98	Ave
4874	35.64	319	130	H	35.2	9.78	35.43	45.19	64	-18.81	Ave
7311	46.21	79	185	V	36.1	11.86	35.82	58.35	84	-25.65	Peak
7311	46.06	84	120	H	36.1	11.86	35.82	58.2	84	-25.8	Peak
7311	35.19	79	185	V	36.1	11.86	35.82	47.33	64	-16.67	Ave
7311	35.26	84	120	H	36.1	11.86	35.82	47.4	64	-16.6	Ave
High Channel 2452 MHz											
2483.5	32.84	141	148	V	33	4.8	0	70.64	84	-13.36	Peak
2483.5	37.45	208	125	H	33	4.8	0	75.25	84	-8.75	Peak
2483.5	19.95	141	148	V	33	4.8	0	57.75	64	-6.25	Ave
2483.5	25.38	208	125	H	33	4.8	0	63.18	64	-0.82	Ave
4904	45.14	0	100	V	35.3	9.78	35.43	54.79	84	-29.21	Peak
4904	45.44	85	120	H	35.3	9.78	35.43	55.09	84	-28.91	Peak
4904	34.47	0	100	V	35.3	9.78	35.43	44.12	64	-19.88	Ave
4904	34.65	85	120	H	35.3	9.78	35.43	44.3	64	-19.7	Ave
7356	44.82	0	100	V	36.1	11.86	35.9	56.88	84	-27.12	Peak
7356	44.62	85	120	H	36.1	11.86	35.9	56.68	84	-27.32	Peak
7356	35.02	0	100	V	36.1	11.86	35.9	47.08	64	-16.92	Ave
7356	34.73	85	120	H	36.1	11.86	35.9	46.79	64	-17.21	Ave

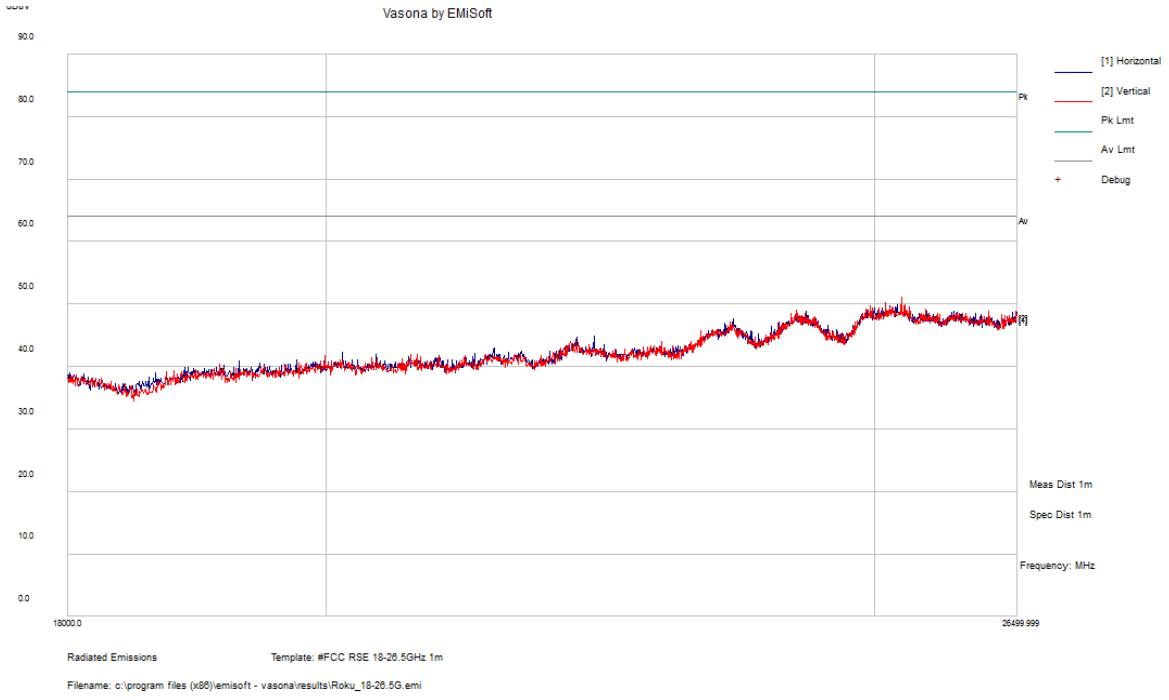
802.11n40 mode Antenna B

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/ISEDC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel 2422 MHz											
2390	35.34	124	230	V	32.6	4.8	0	72.74	84	-11.26	Peak
2390	40.52	41	145	H	32.6	4.8	0	77.92	84	-6.08	Peak
2390	21.25	124	230	V	32.6	4.8	0	58.65	64	-5.35	Ave
2390	25.933	41	145	H	32.6	4.8	0	63.333	64	-0.667	Ave
4844	46.08	0	100	V	35.2	9.57	35.43	55.42	84	-28.58	Peak
4844	46.21	0	100	H	35.2	9.57	35.43	55.55	84	-28.45	Peak
4844	35.22	0	100	V	35.2	9.57	35.43	44.56	64	-19.44	Ave
4844	34.81	0	100	H	35.2	9.57	35.43	44.15	64	-19.85	Ave
7266	45.97	0	100	V	36.1	11.1	35.82	57.35	84	-26.65	Peak
7266	44.91	0	100	H	36.1	11.1	35.82	56.29	84	-27.71	Peak
7266	35.42	0	100	V	36.1	11.1	35.82	46.8	64	-17.2	Ave
7266	34.73	0	100	H	36.1	11.1	35.82	46.11	64	-17.89	Ave
Middle Channel 2437 MHz											
4874	46.07	127	230	V	35.2	9.78	35.43	55.62	84	-28.38	Peak
4874	46.33	50	130	H	35.2	9.78	35.43	55.88	84	-28.12	Peak
4874	36.11	127	230	V	35.2	9.78	35.43	45.66	64	-18.34	Ave
4874	36.209	50	130	H	35.2	9.78	35.43	45.759	64	-18.241	Ave
7311	46.67	127	230	V	36.1	11.86	35.82	58.81	84	-25.19	Peak
7311	46.53	319	132	H	36.1	11.86	35.82	58.67	84	-25.33	Peak
7311	35.09	127	230	V	36.1	11.86	35.82	47.23	64	-16.77	Ave
7311	34.92	319	132	H	36.1	11.86	35.82	47.06	64	-16.94	Ave
High Channel 2452 MHz											
2483.5	33.94	83	260	V	33	4.8	0	71.74	84	-12.26	Peak
2483.5	38.62	48	150	H	33	4.8	0	76.42	84	-7.58	Peak
2483.5	21.43	83	260	V	33	4.8	0	59.23	64	-4.77	Ave
2483.5	25.58	48	150	H	33	4.8	0	63.38	64	-0.62	Ave
4904	45.47	0	100	V	35.3	9.78	35.43	55.12	84	-28.88	Peak
4904	45.53	0	100	H	35.3	9.78	35.43	55.18	84	-28.82	Peak
4904	34.91	0	100	V	35.3	9.78	35.43	44.56	64	-19.44	Ave
4904	34.83	0	100	H	35.3	9.78	35.43	44.48	64	-19.52	Ave
7356	44.58	0	100	V	36.1	11.86	35.9	56.64	84	-27.36	Peak
7356	43.69	0	100	H	36.1	11.86	35.9	55.75	84	-28.25	Peak
7356	34.75	0	100	V	36.1	11.86	35.9	46.81	64	-17.19	Ave
7356	33.71	0	100	H	36.1	11.86	35.9	45.77	64	-18.23	Ave

1 GHz – 18 GHz Worst Case Scan at 1 Meter



18 GHz – 26.5 GHz Worst Case Scan at 1 Meter



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

8.1 Applicable Standards

According to ECFR §15.247(a) (2) and ISEDC RSS-247 §5.2, systems using digital modulation techniques may operate in the 902~928 MHz, 2400~2483.5 MHz, and 5725~5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz

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 Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008K39 -101203-UW	2019-08-06	2 years
Rhode & Schwarz	Signal Analyzer	FSQ26	200749	2019-11-07	2 years
-	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".*

8.4 Test Environmental Conditions

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

The testing was performed by Vang Lee from 2021-01-28 to 2021-02-18 at RF site.

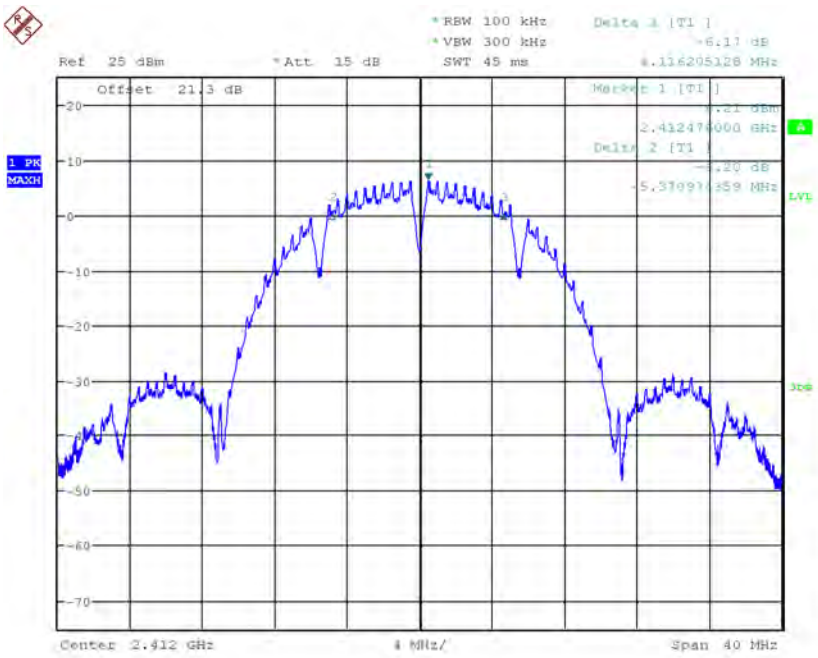
8.5 Test Results

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	9.487	10.000	15.500	15.202	≥ 500	Pass
Middle	2437	8.423	9.937	27.261	18.182	≥ 500	Pass
High	2462	9.936	9.936	16.162	15.698	≥ 500	Pass
802.11g							
Low	2412	16.508	16.538	17.350	17.342	≥ 500	Pass
Middle	2437	16.538	16.538	25.857	26.661	≥ 500	Pass
High	2462	16.475	16.539	17.474	17.378	≥ 500	Pass
802.11n20							
Low	2412	17.693	17.692	18.322	18.262	≥ 500	Pass
Middle	2437	17.693	17.756	31.524	31.497	≥ 500	Pass
High	2462	17.627	17.693	18.378	18.234	≥ 500	Pass
802.11n40							
Low	2422	36.411	36.499	36.548	36.500	≥ 500	Pass
Middle	2437	36.275	36.448	54.642	54.427	≥ 500	Pass
High	2452	36.539	36.497	36.532	36.500	≥ 500	Pass

Please refer to the following plots for detailed test results:

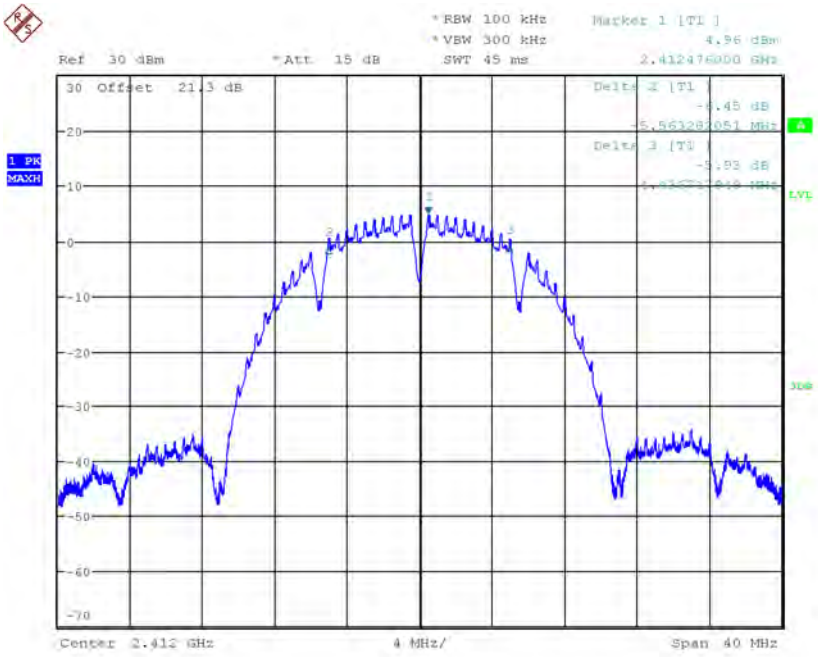
802.11b mode

Low Channel, 2412 MHz Antenna A, 6 dB OBW



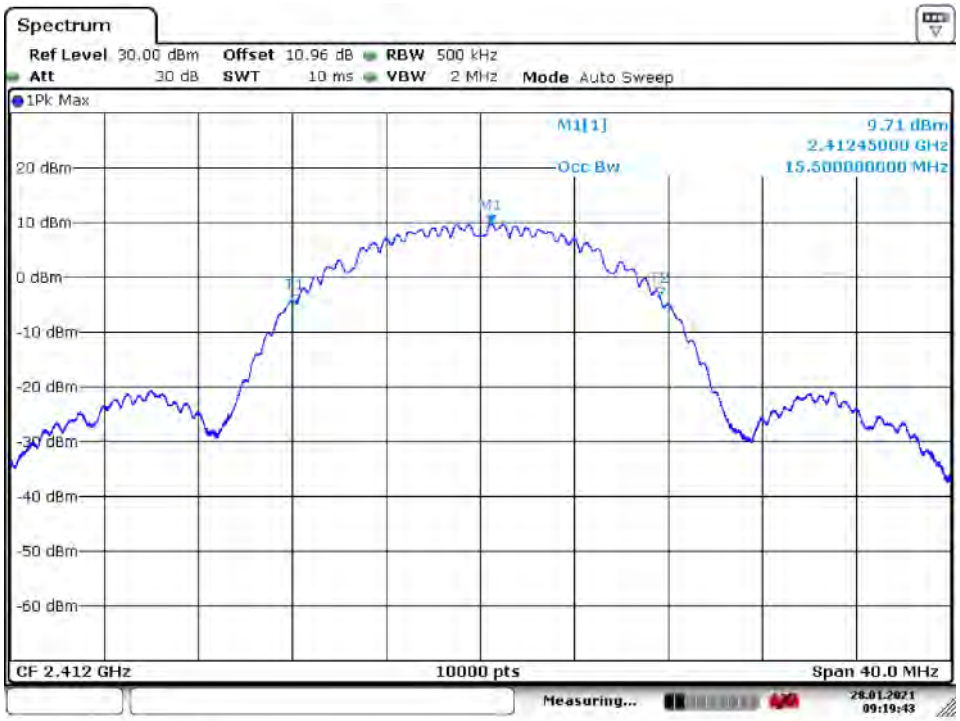
Date: 18.FEB.2021 10:19:21

Low Channel, 2412 MHz Antenna B, 6 dB OBW



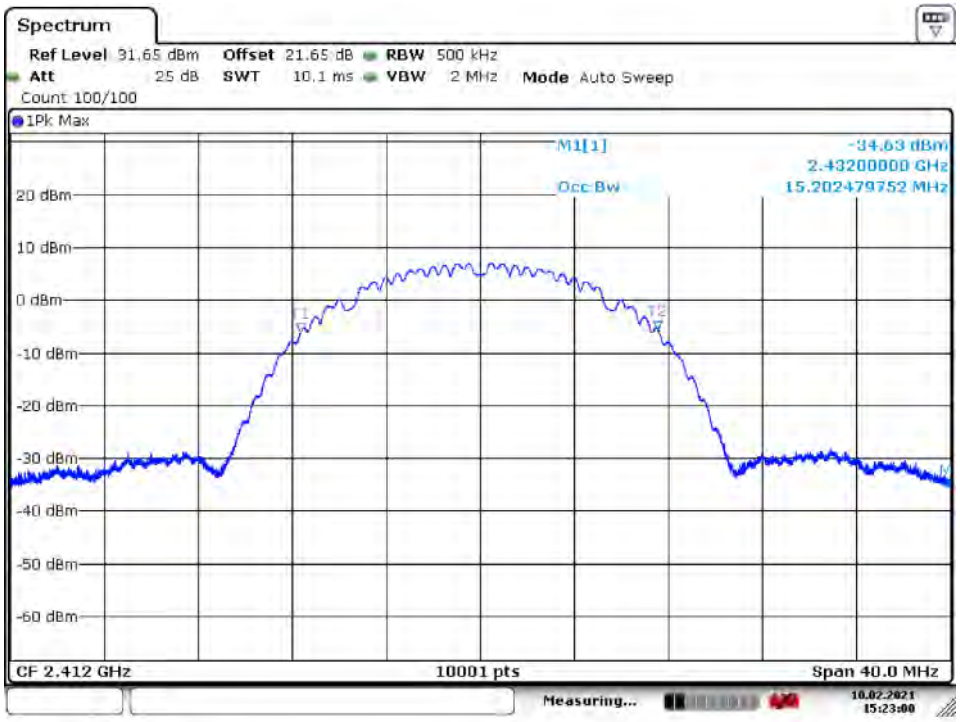
Date: 18.FEB.2021 11:28:09

Low Channel, 2412 MHz Antenna A, 99% dB OBW



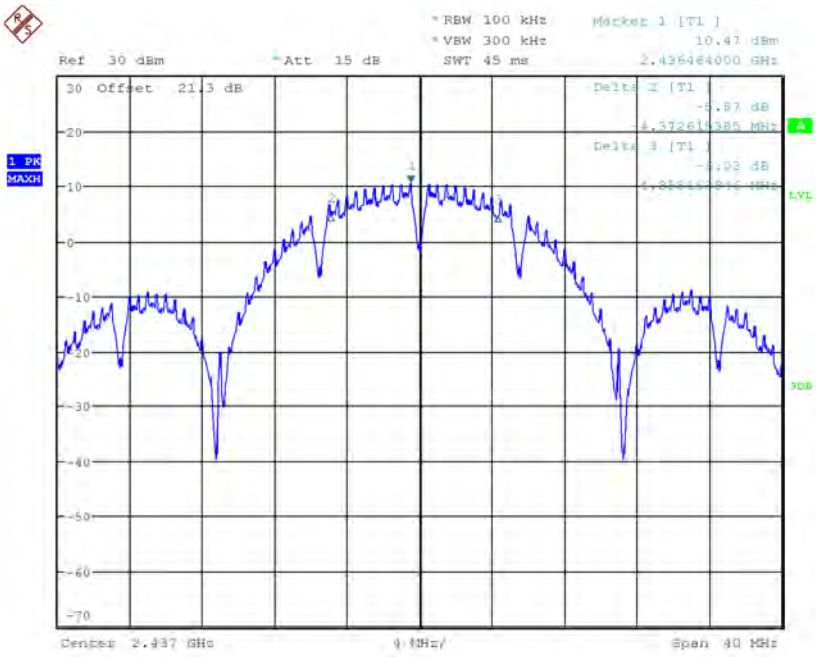
Date: 28.JAN.2021 09:19:43

Low Channel Low Channel, 2412 MHz Antenna B, 99% dB OBW

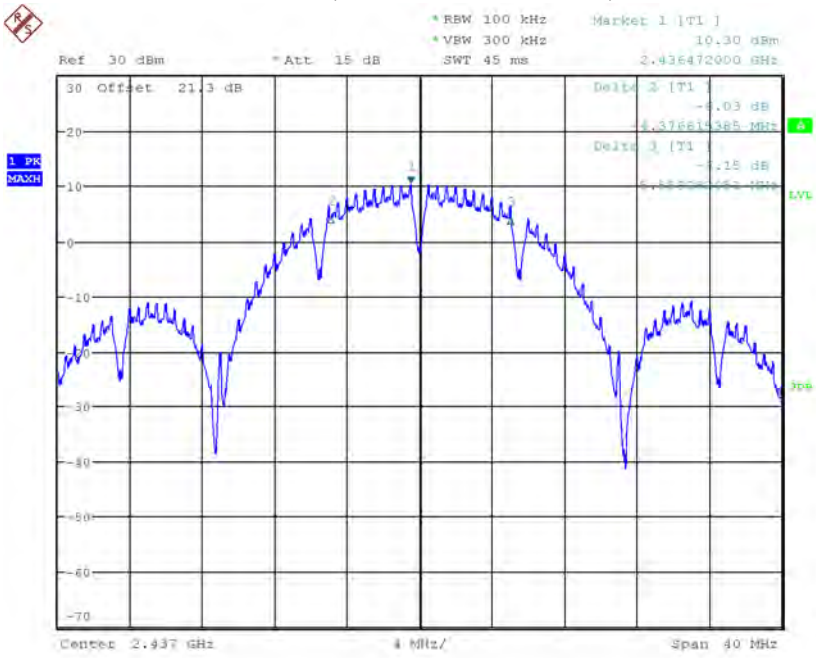


Date: 10.FEB.2021 15:23:00

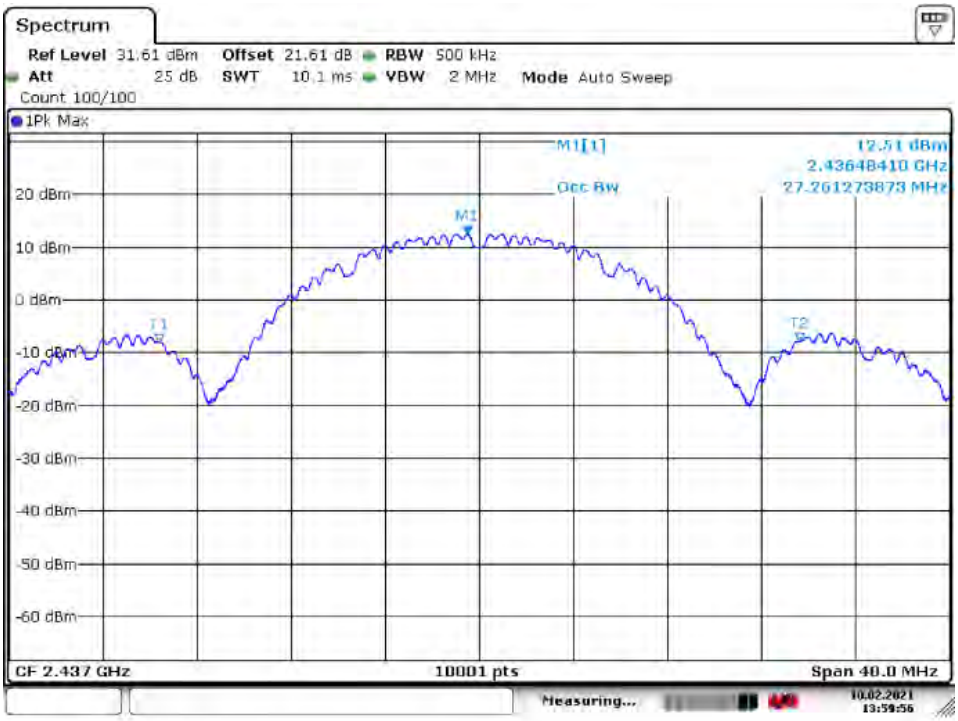
Mid Channel, 2437 MHz Antenna A, 6 dB OBW



Mid Channel, 2437 MHz Antenna B, 6 dB OBW

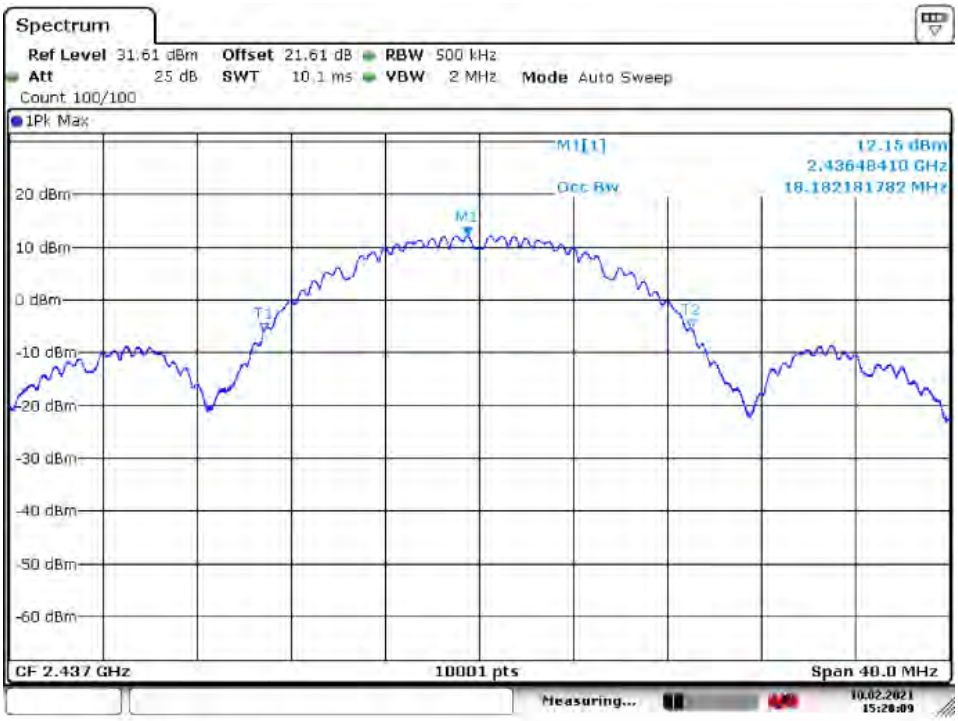


Mid Channel, 2437 MHz Antenna A, 99% dB OBW



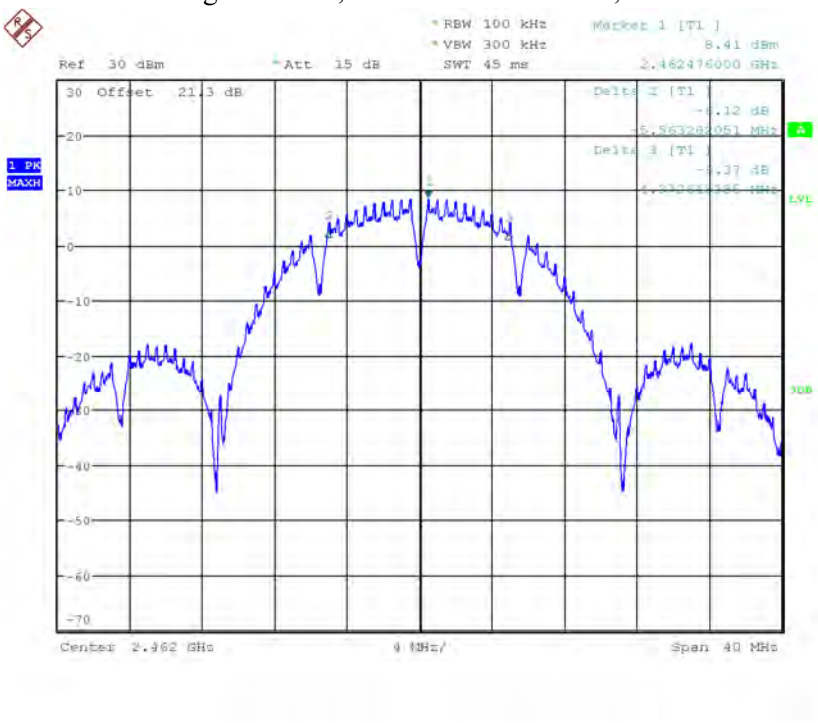
Date: 10.FEB.2021 13:59:57

Mid Channel, 2437 MHz Antenna B, 99% dB OBW

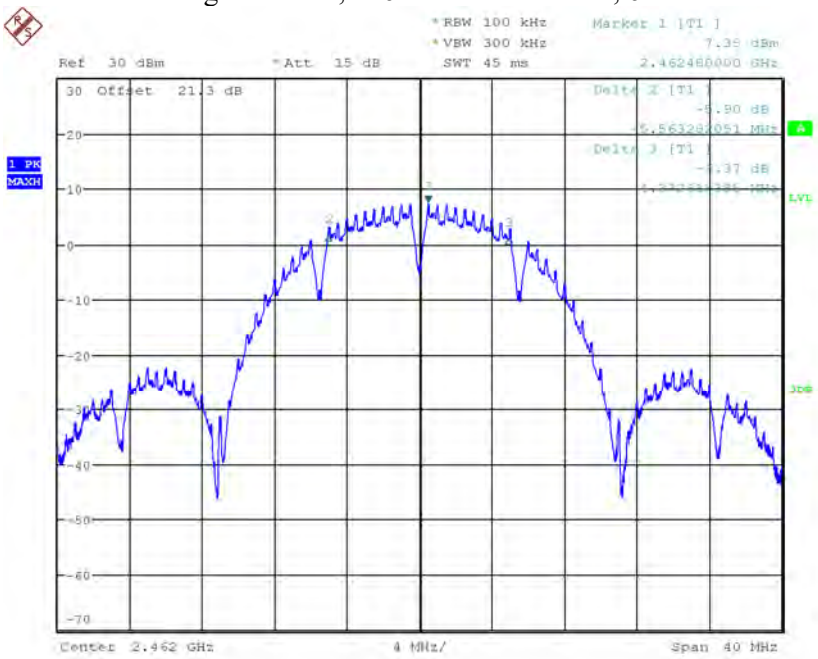


Date: 10.FEB.2021 15:28:09

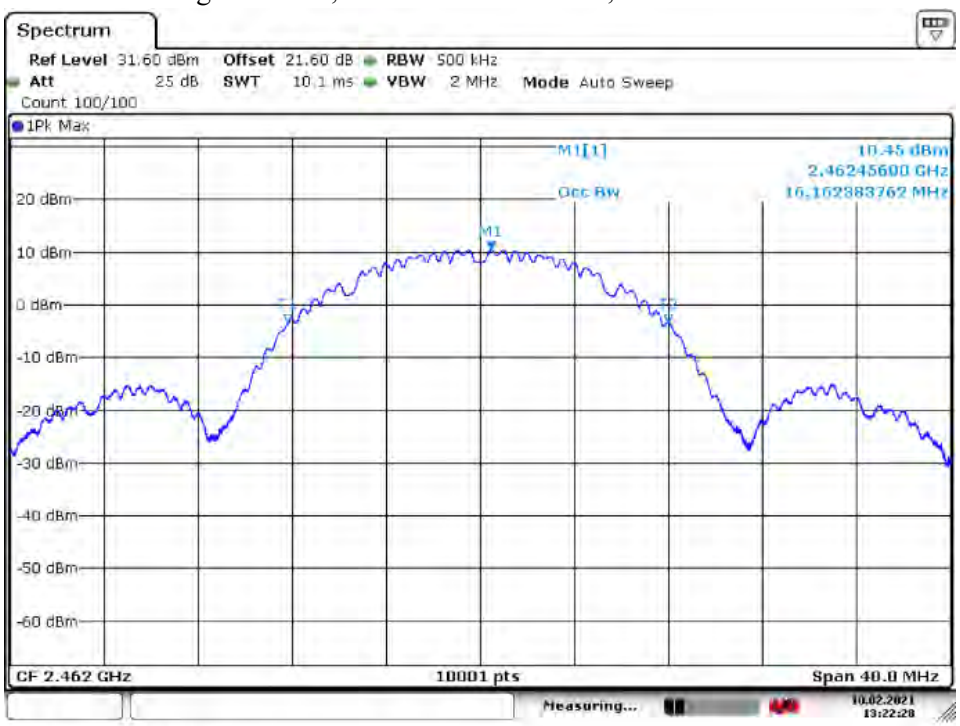
High Channel, 2462 MHz Antenna A, 6 dB OBW



High Channel, 2462 MHz Antenna B, 6 dB OBW

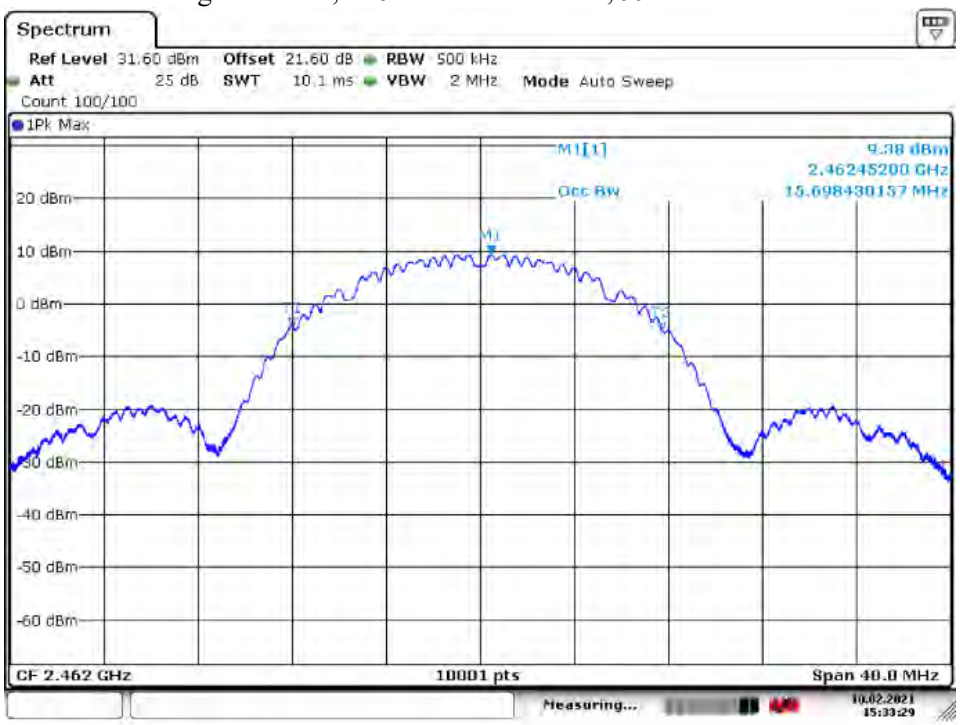


High Channel, 2462 MHz Antenna A, 99% dB OBW



Date: 10.FEB.2021 13:22:28

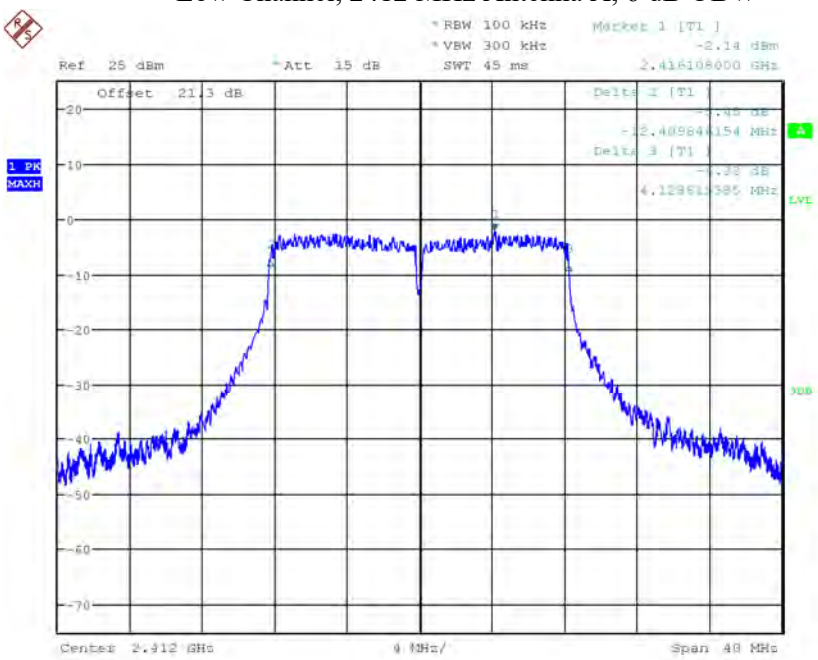
High Channel, 2462 MHz Antenna B, 99% dB OBW



Date: 10.FEB.2021 15:33:29

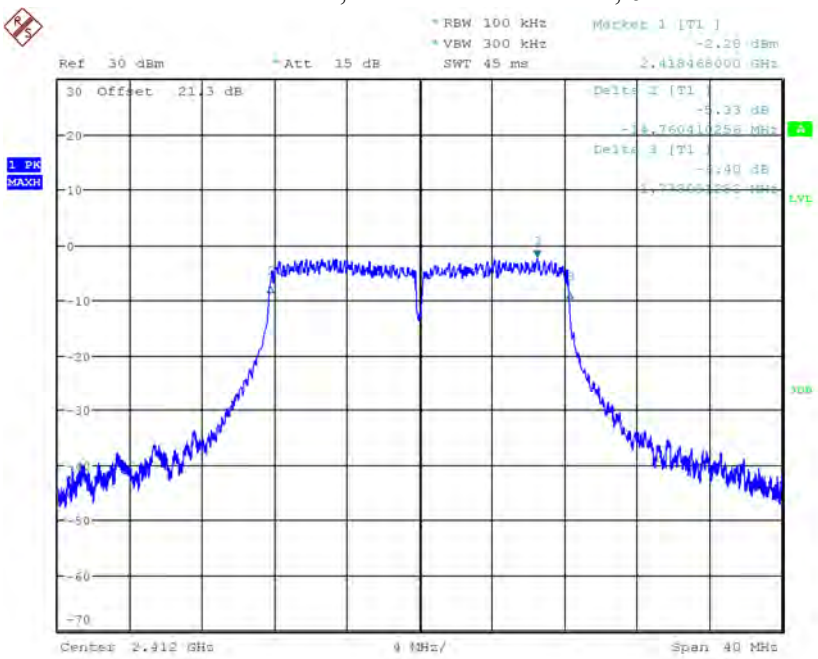
802.11g mode

Low Channel, 2412 MHz Antenna A, 6 dB OBW



Date: 18.FEB.2021 10:24:27

Low Channel, 2412 MHz Antenna B, 6 dB OBW

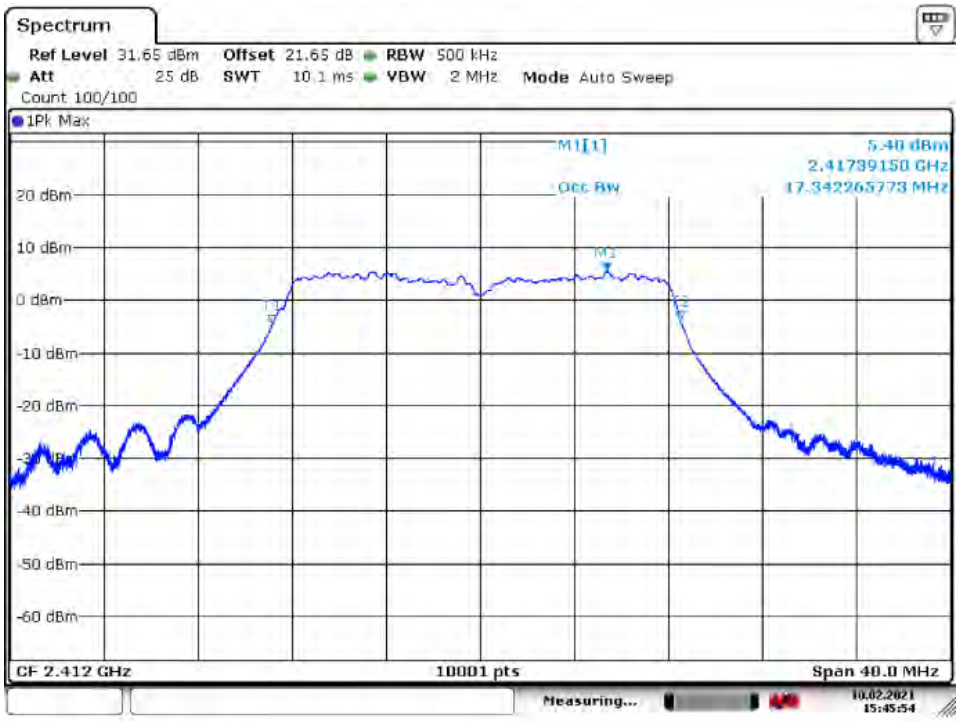


Date: 18.FEB.2021 11:30:46

Low Channel, 2412 MHz Antenna A, 99% dB OBW

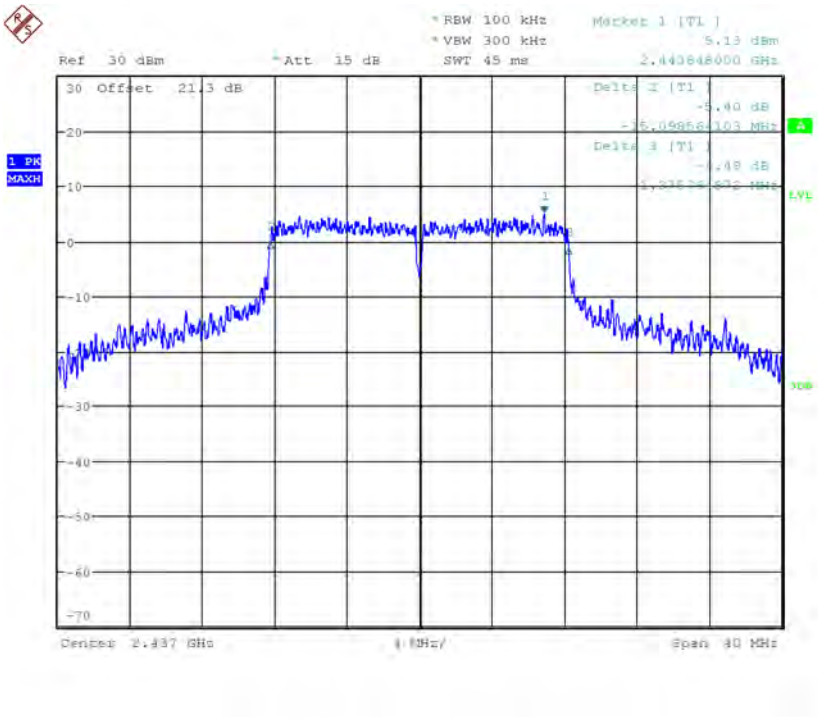
Date: 11.FEB.2021 09:32:21

Low Channel, 2412 MHz Antenna B, 99% dB OBW

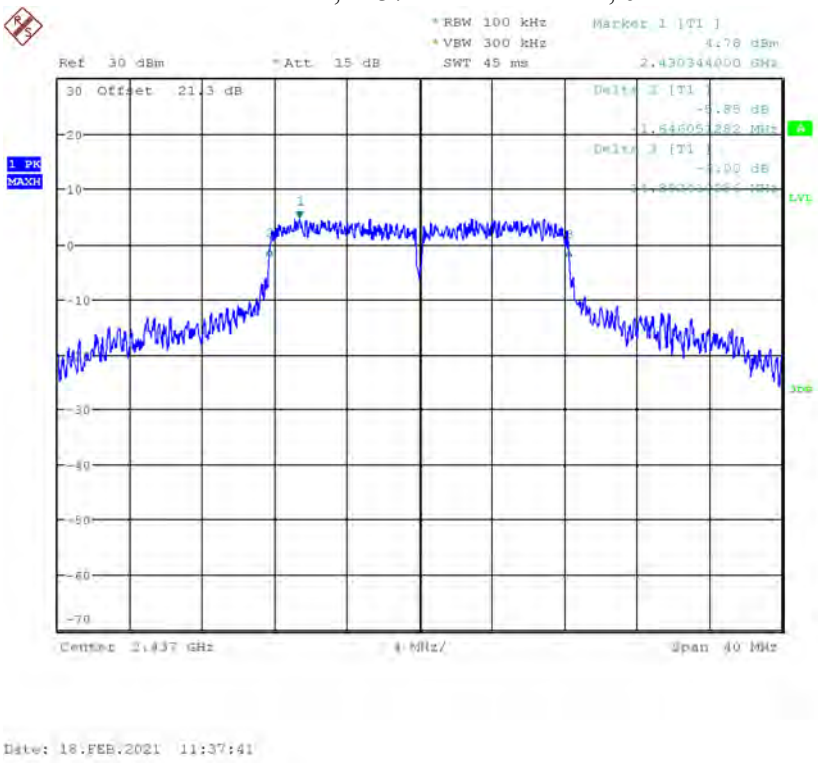


Date: 10.FEB.2021 15:45:55

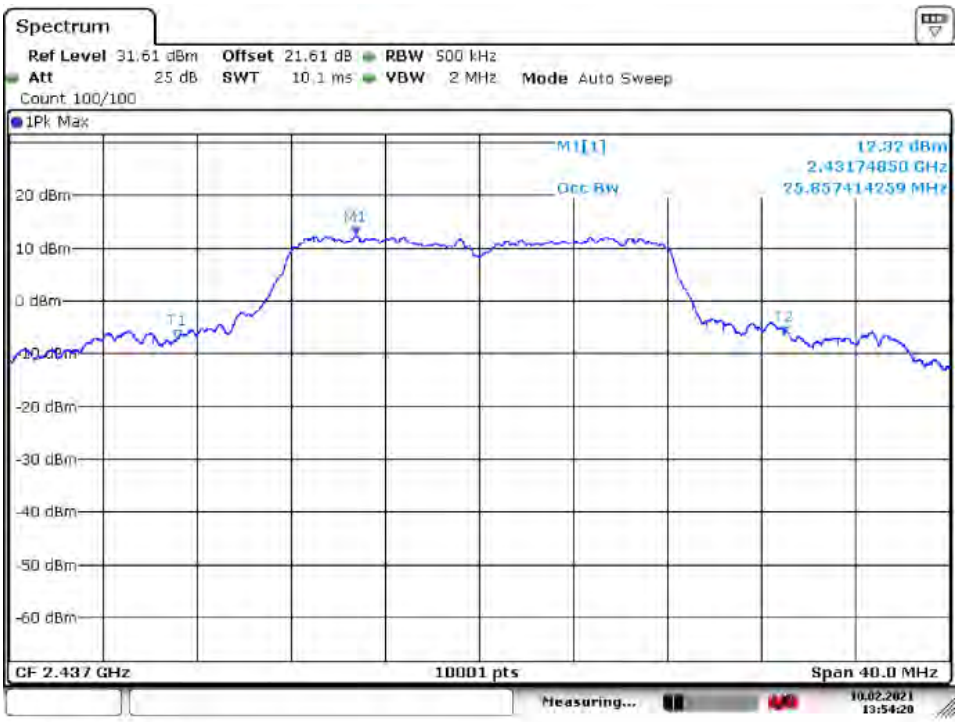
Mid Channel, 2437 MHz Antenna A, 6 dB OBW



Mid Channel, 2437 MHz Antenna B, 6 dB OBW

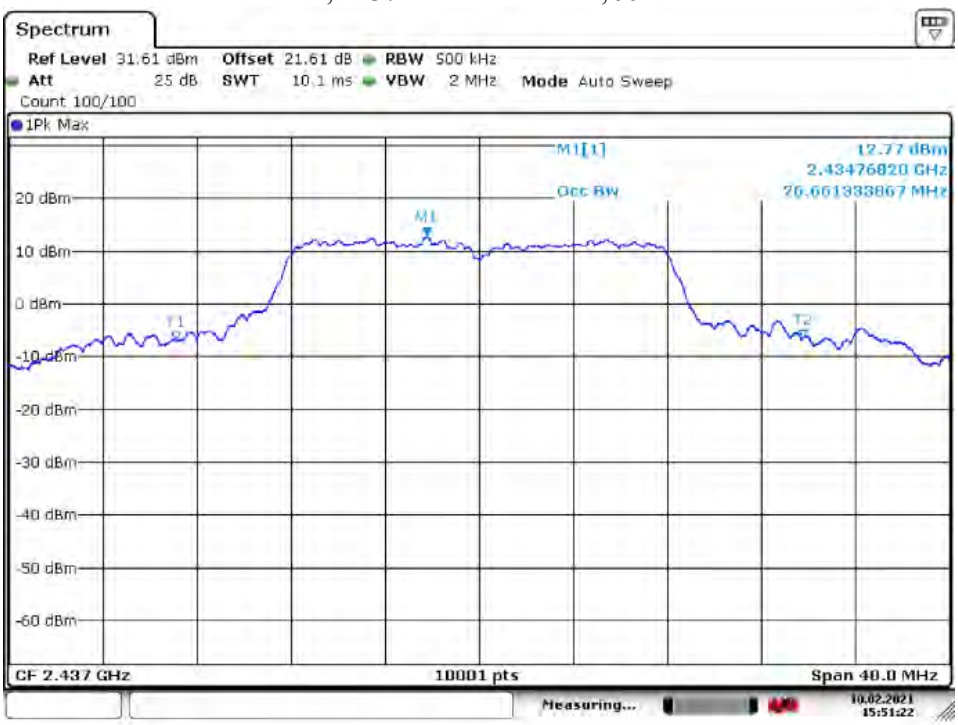


Mid Channel, 2437 MHz Antenna A, 99% dB OBW



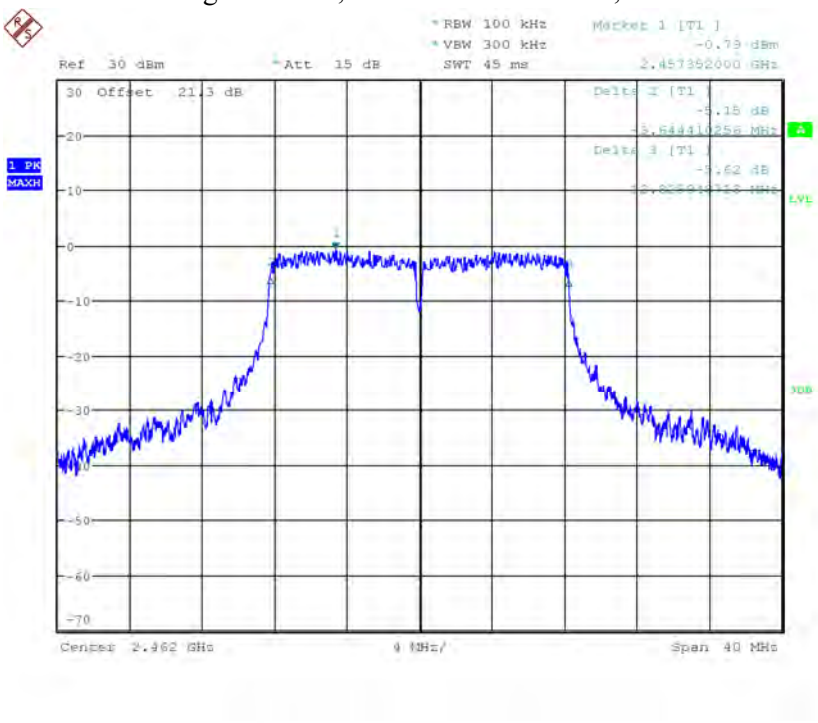
Date: 10.FEB.2021 13:54:20

Mid Channel, 2437 MHz Antenna B, 99% dB OBW



Date: 10.FEB.2021 15:51:21

High Channel, 2462 MHz Antenna A, 6 dB OBW

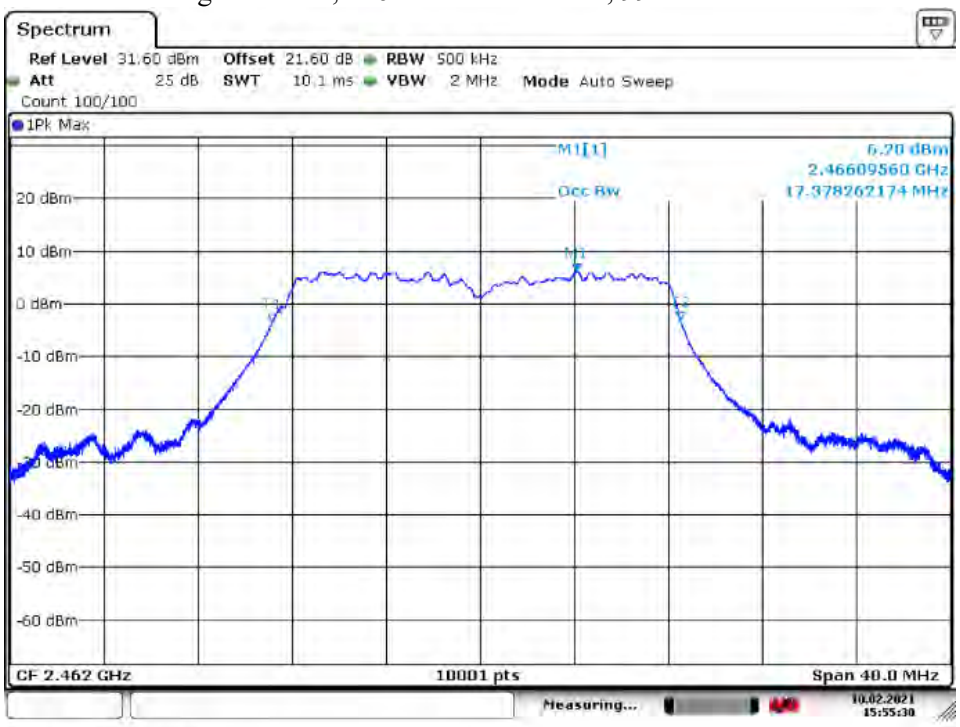


High Channel, 2462 MHz Antenna B, 6 dB OBW

High Channel, 2462 MHz Antenna A, 99% dB OBW

Date: 10.FEB.2021 15:09:36

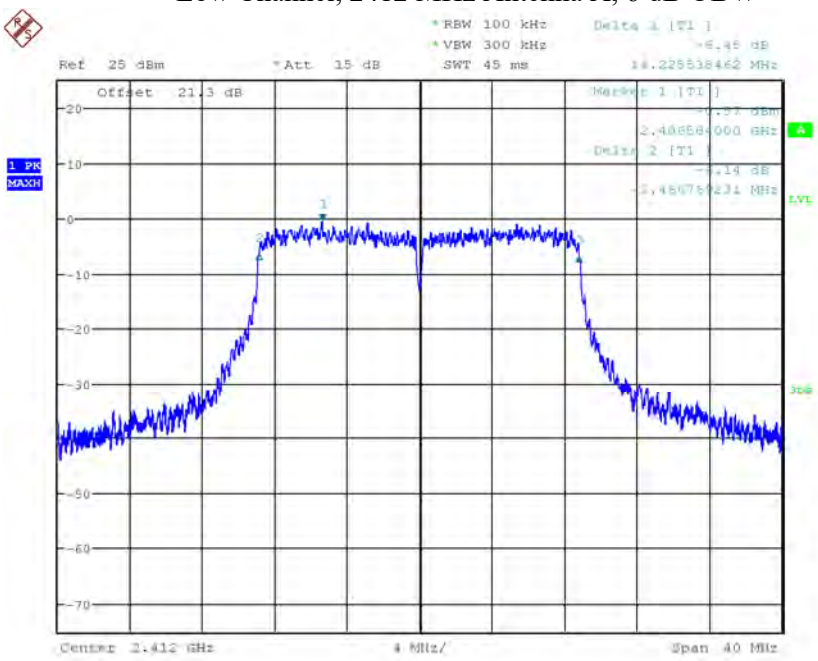
High Channel, 2462 MHz Antenna B, 99% dB OBW



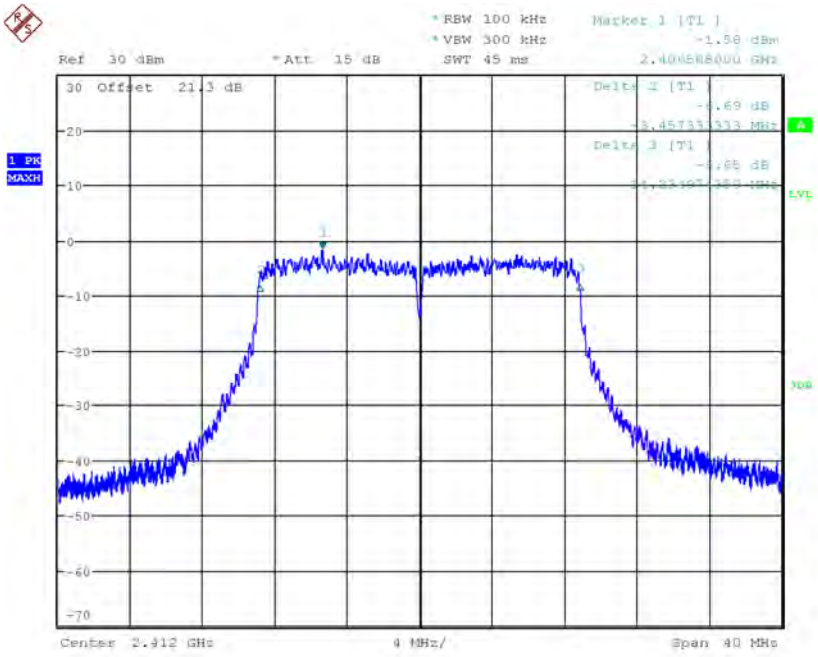
Date: 10.FEB.2021 15:55:31

802.11n20 mode

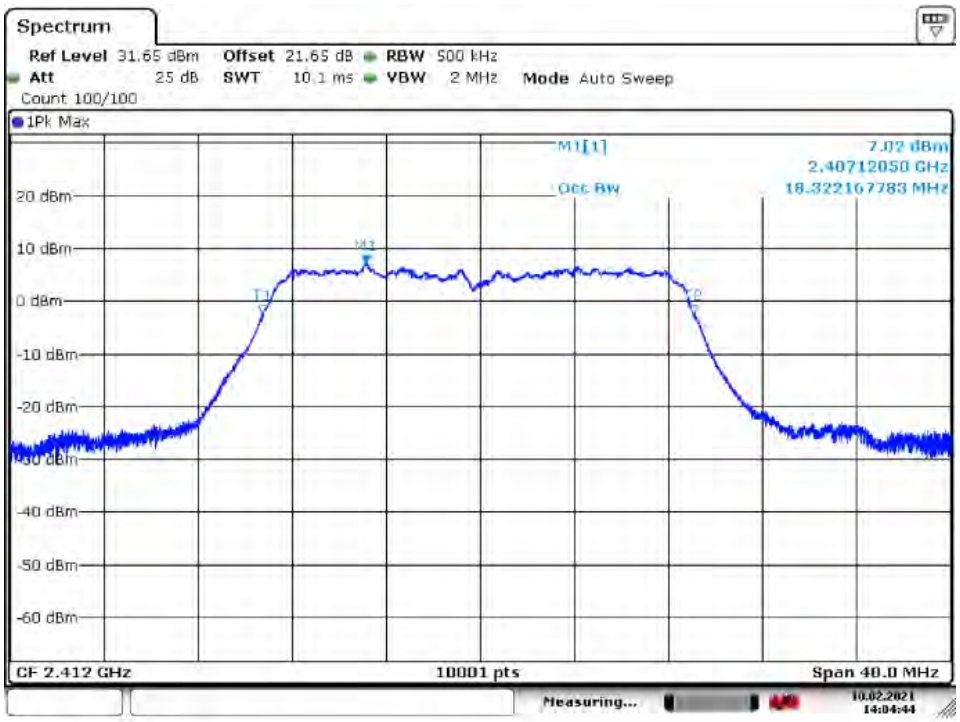
Low Channel, 2412 MHz Antenna A, 6 dB OBW



Low Channel, 2412 MHz Antenna B, 6 dB OBW

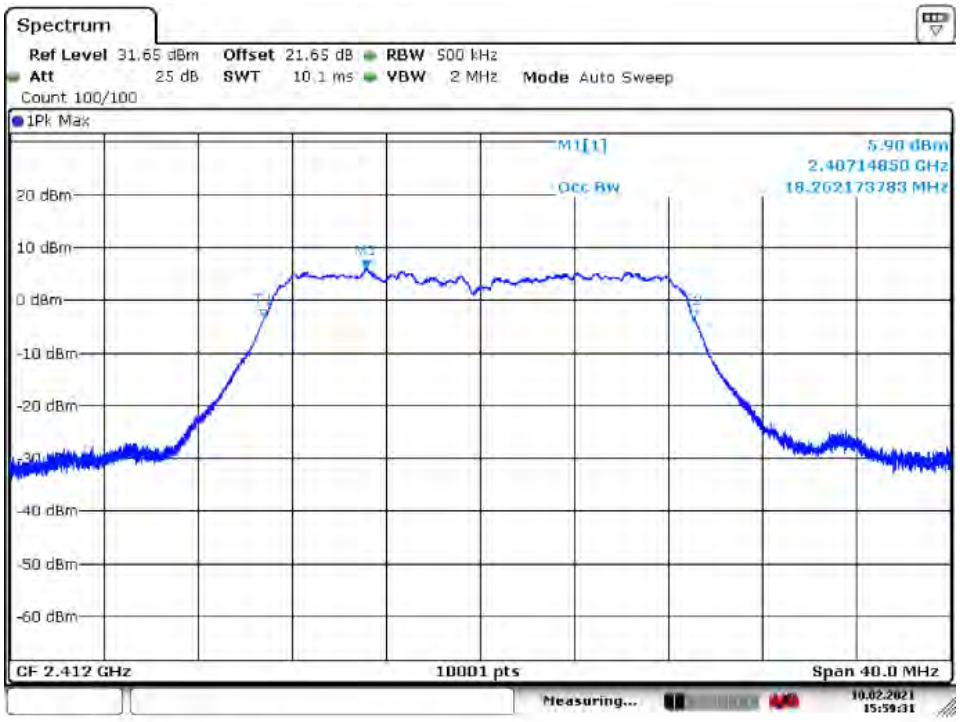


Low Channel, 2412 MHz Antenna A, 99% dB OBW



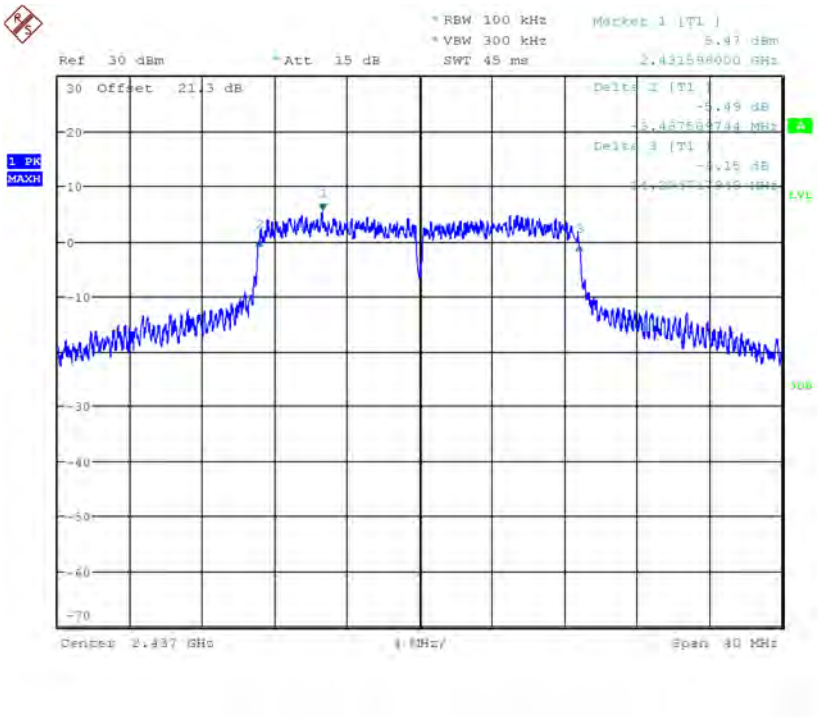
Date: 10.FEB.2021 14:04:45

Low Channel, 2412 MHz Antenna B, 99% dB OBW

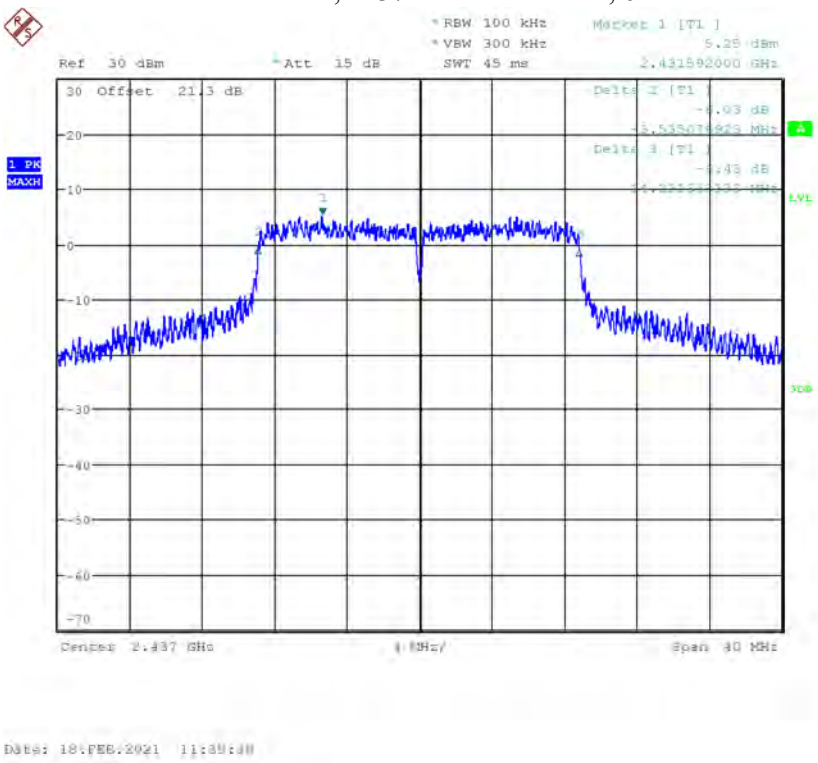


Date: 10.FEB.2021 15:59:32

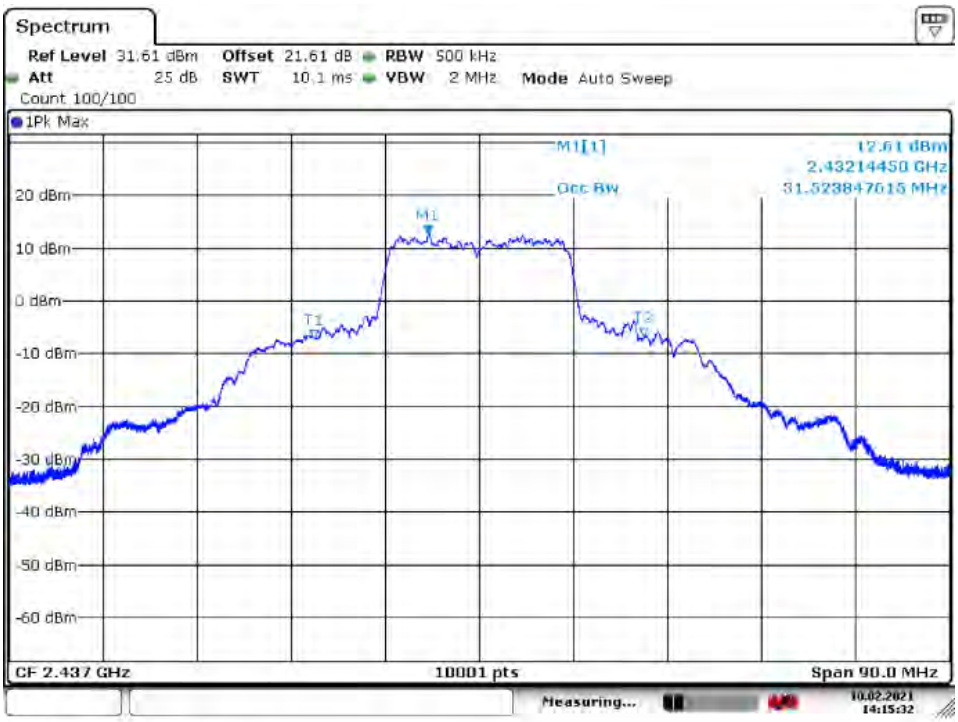
Mid Channel, 2437 MHz Antenna A, 6 dB OBW



Mid Channel, 2437 MHz Antenna B, 6 dB OBW

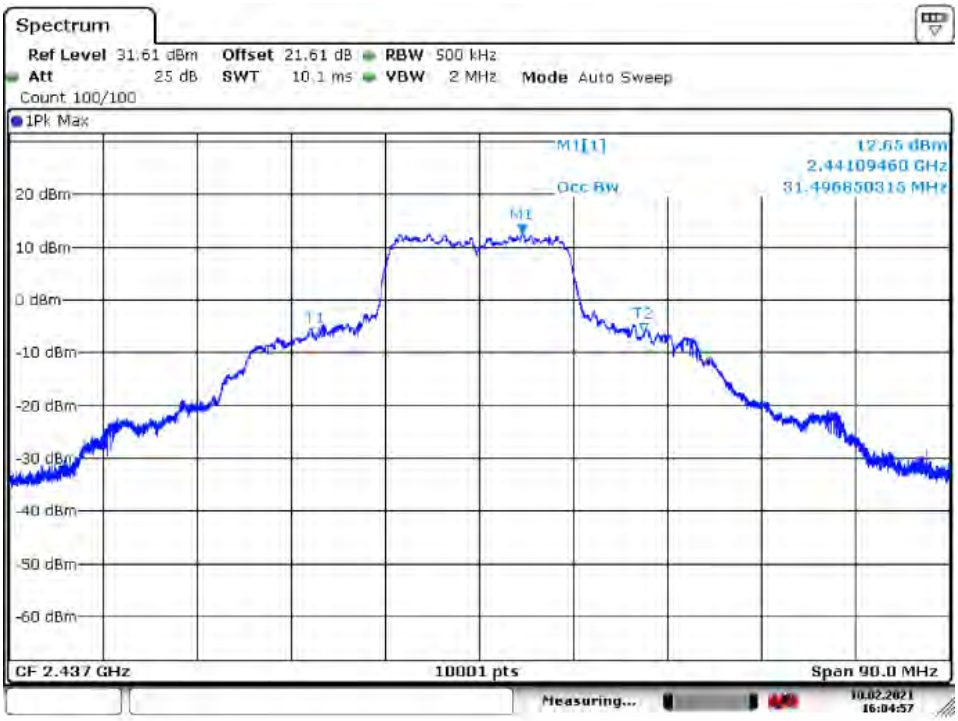


Mid Channel, 2437 MHz Antenna A, 99% dB OBW



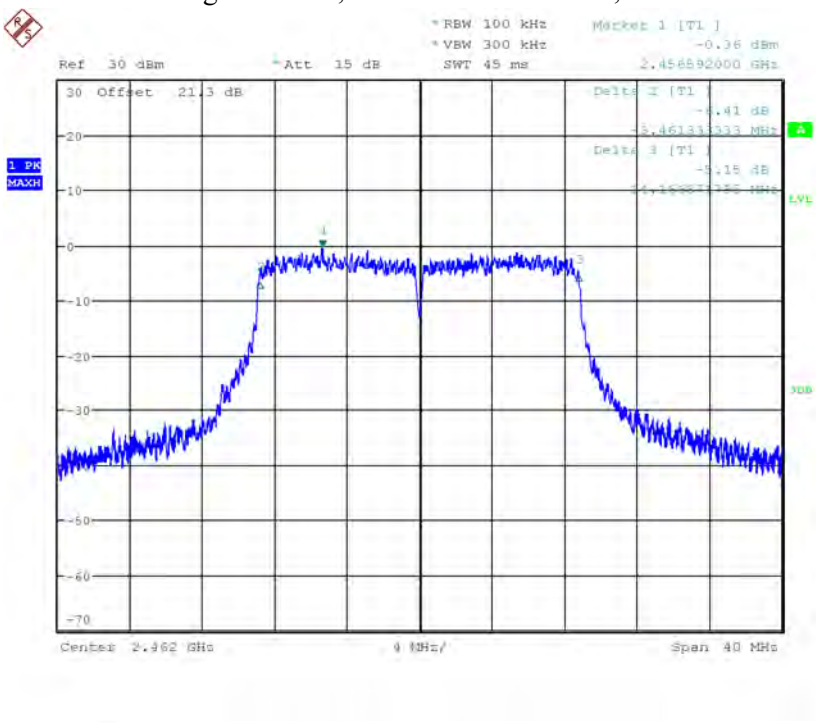
Date: 10.FEB.2021 14:15:32

Mid Channel, 2437 MHz Antenna B, 99% dB OBW

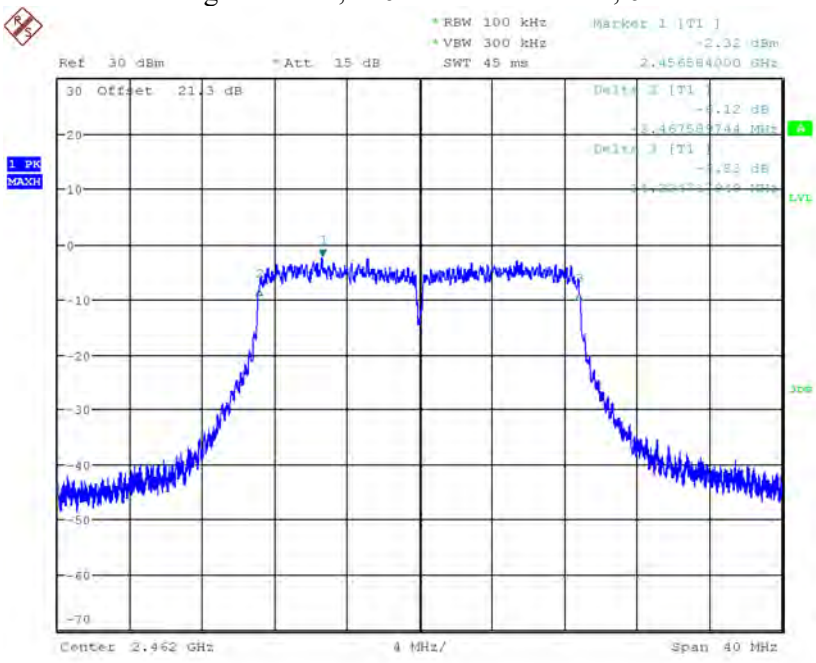


Date: 10.FEB.2021 16:04:57

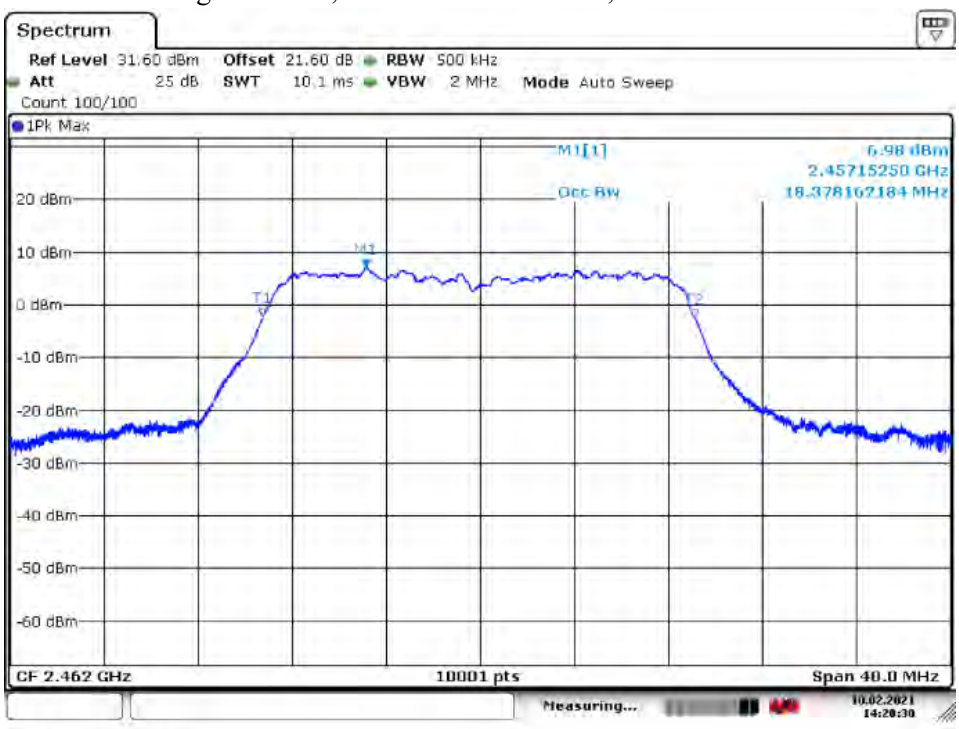
High Channel, 2462 MHz Antenna A, 6 dB OBW



High Channel, 2462 MHz Antenna B, 6 dB OBW

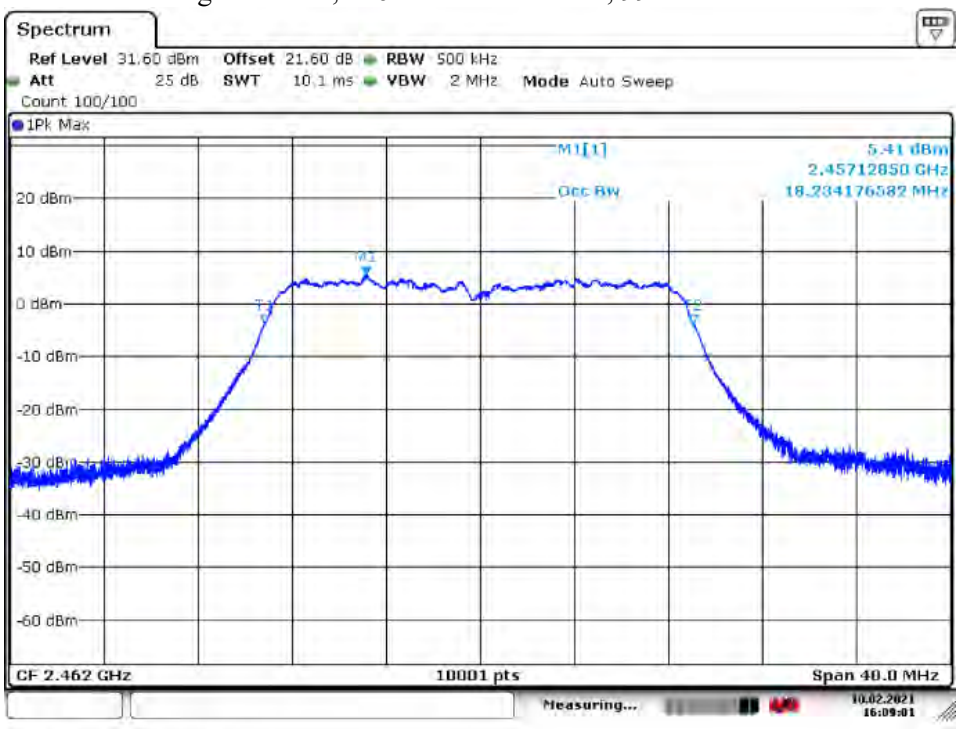


High Channel, 2462 MHz Antenna A, 99% dB OBW



Date: 10.FEB.2021 14:20:31

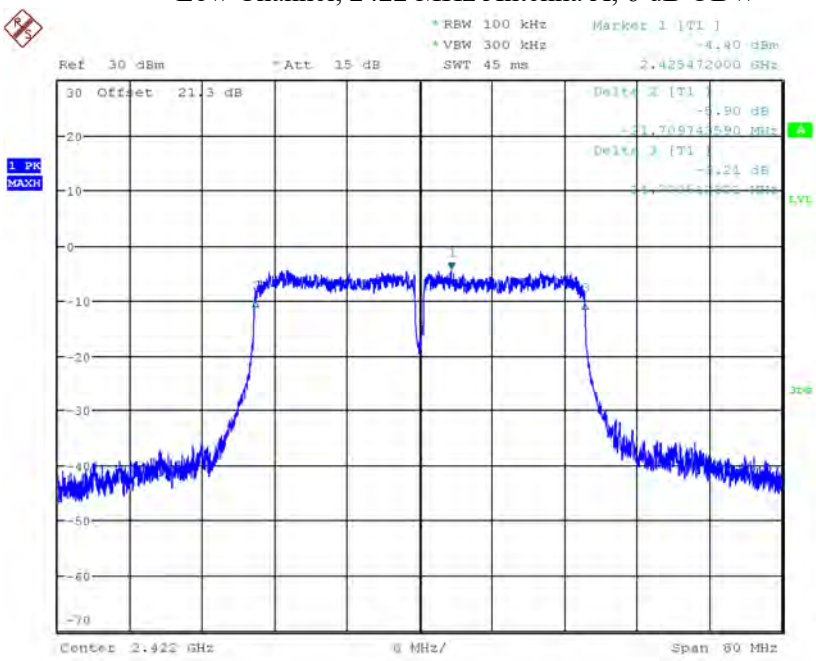
High Channel, 2462 MHz Antenna B, 99% dB OBW



Date: 10.FEB.2021 16:09:02

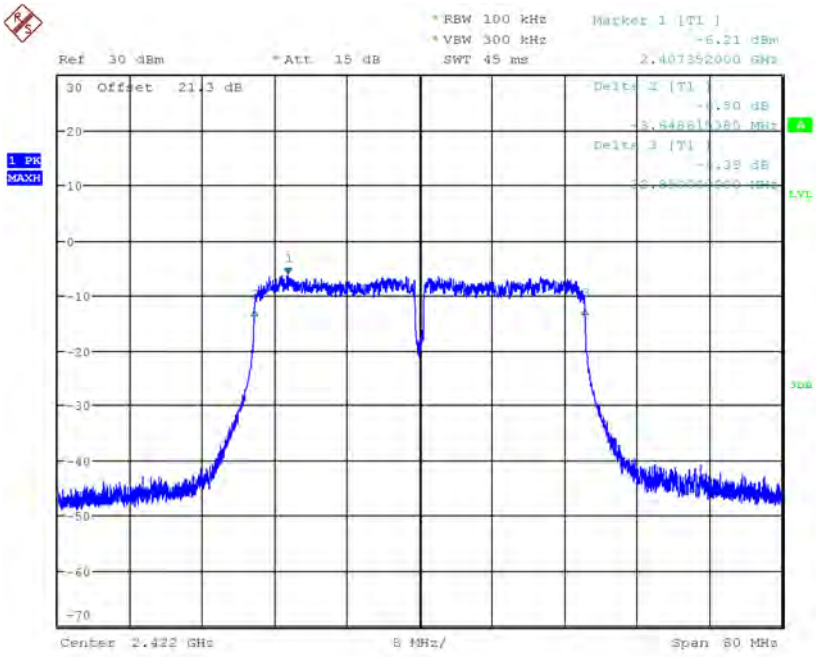
802.11n40 mode

Low Channel, 2422 MHz Antenna A, 6 dB OBW



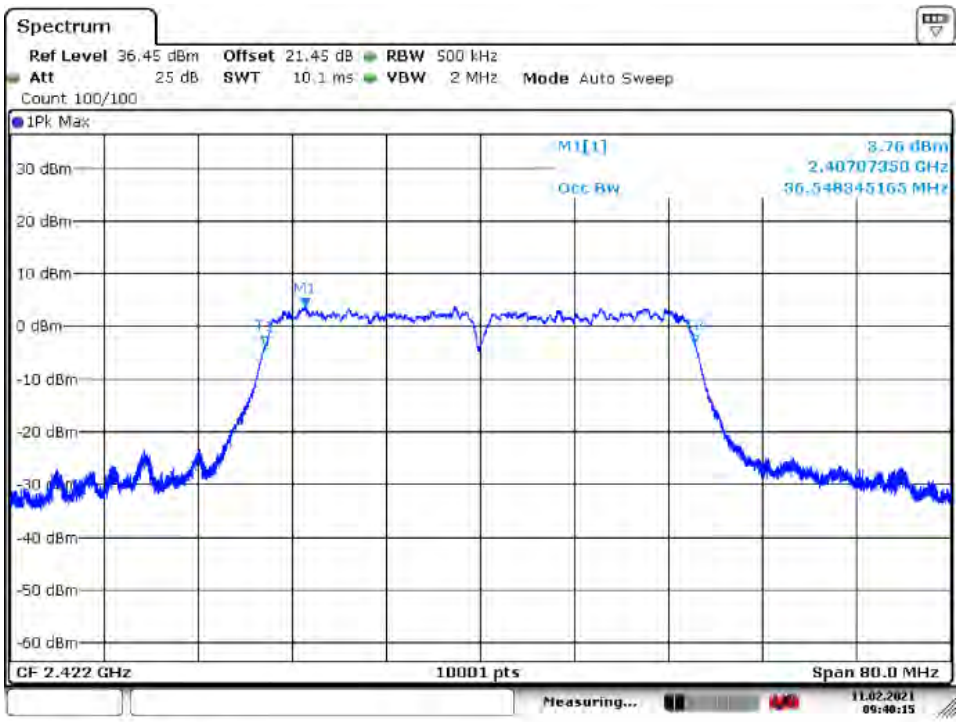
Date: 18.FEB.2021 10:59:57

Low Channel, 2422 MHz Antenna B, 6 dB OBW



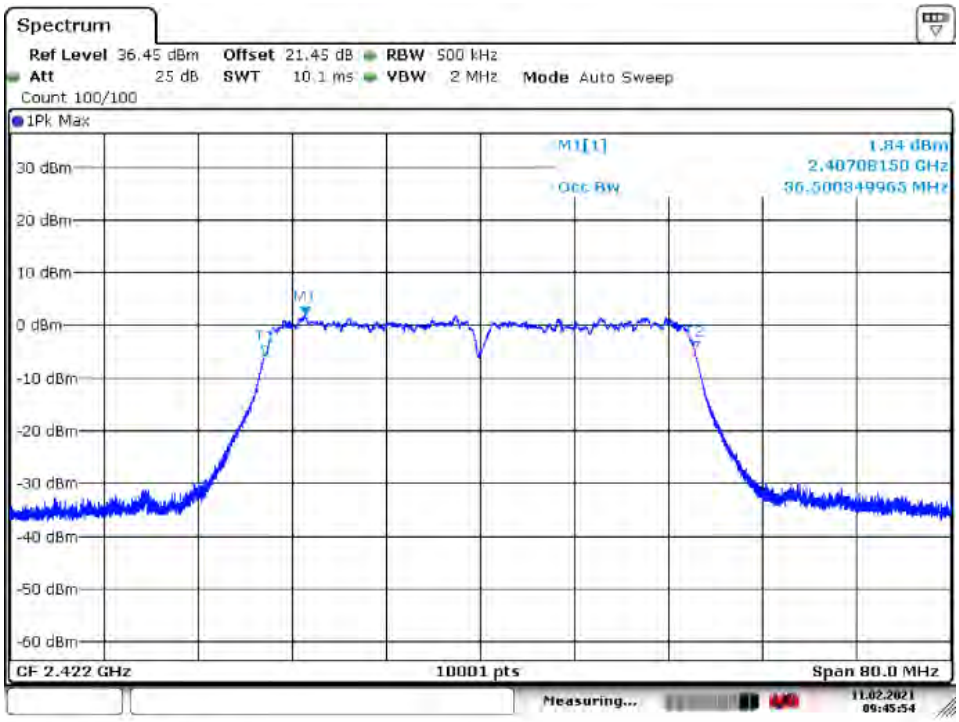
Date: 18.FEB.2021 13:51:32

Low Channel, 2422 MHz Antenna A, 99% dB OBW



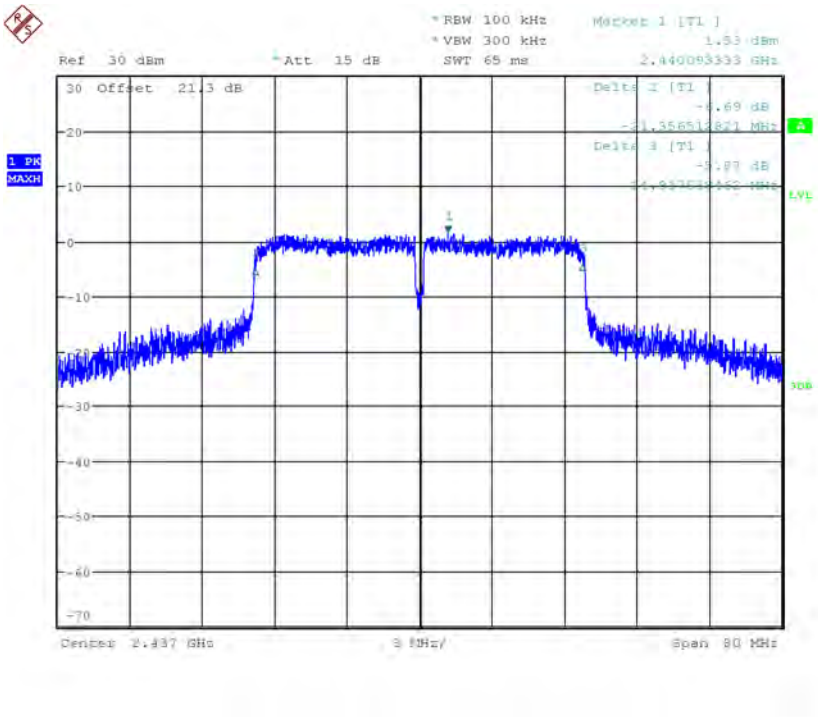
Date: 11.FEB.2021 09:40:15

Low Channel, 2422 MHz Antenna B, 99% dB OBW



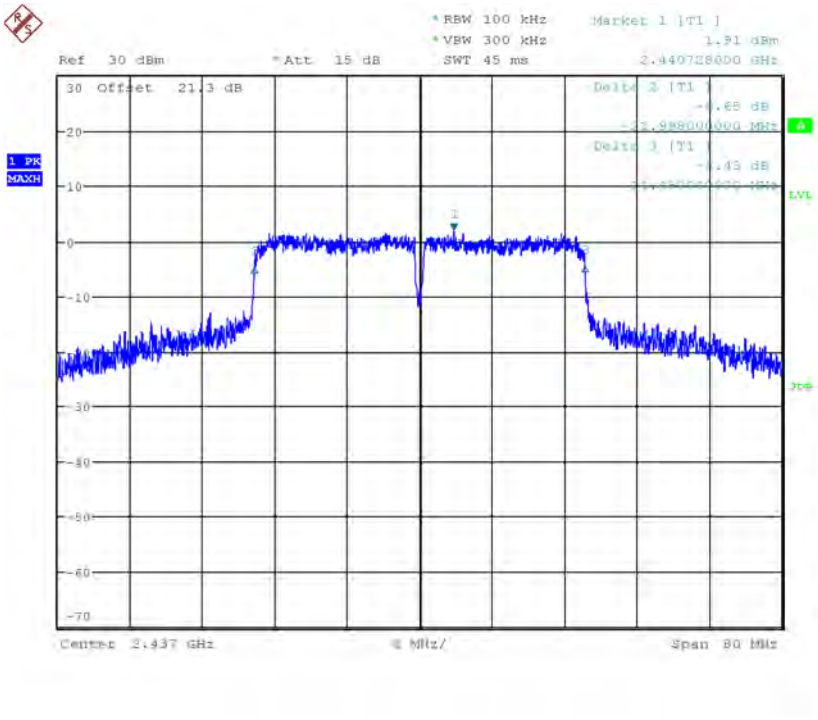
Date: 11.FEB.2021 09:45:54

Mid Channel, 2437 MHz Antenna A, 6 dB OBW



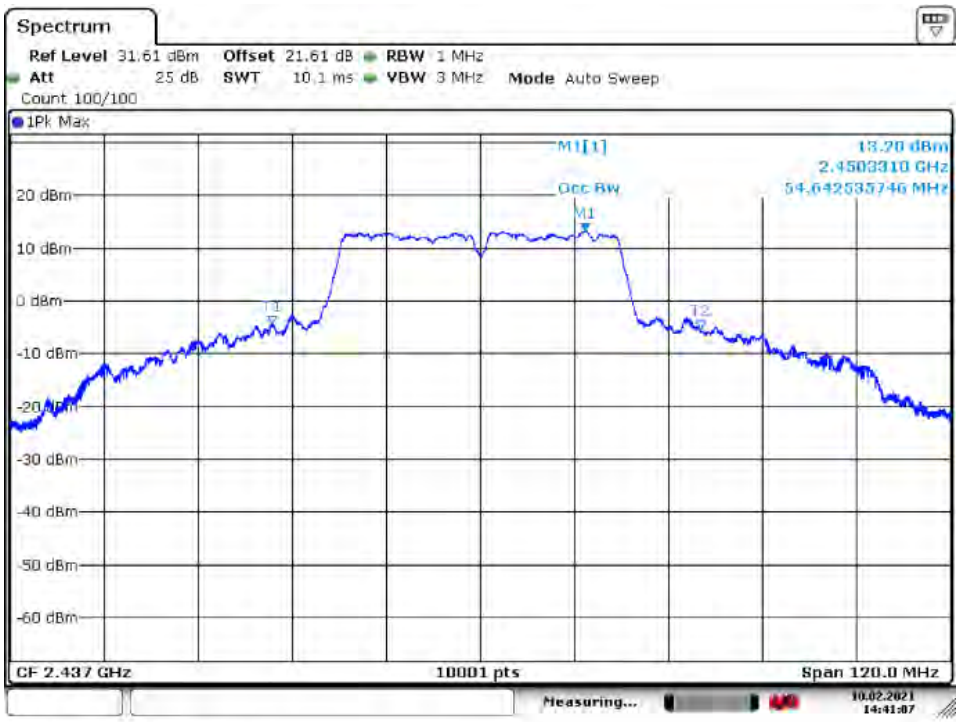
Date: 18.FEB.2021 11:08:40

Mid Channel, 2437 MHz Antenna B, 6 dB OBW



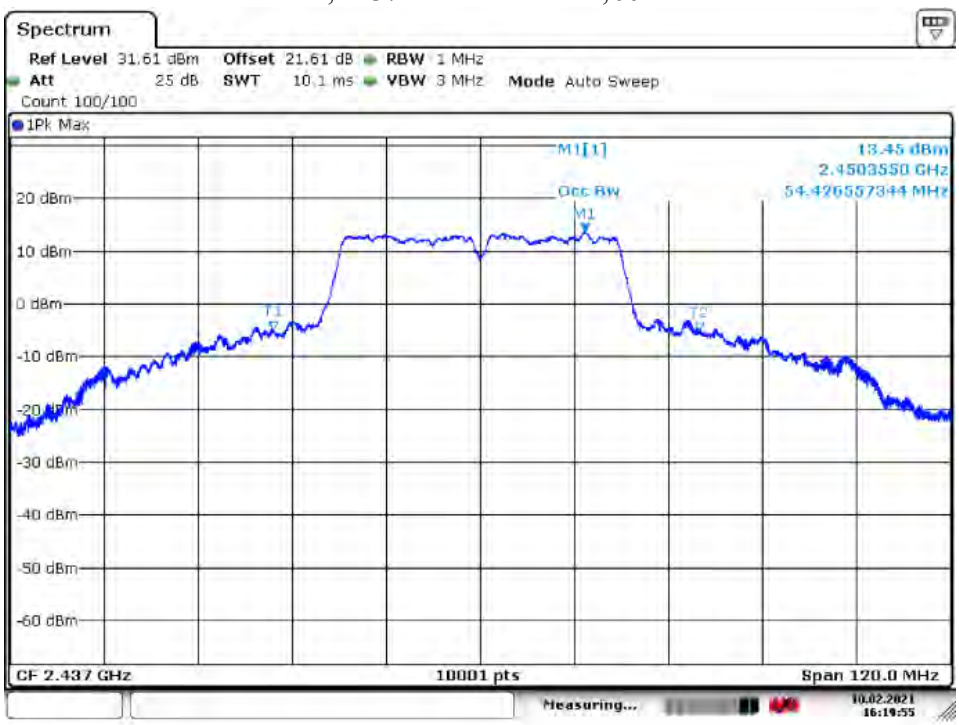
Date: 18.FEB.2021 13:43:38

Mid Channel, 2437 MHz Antenna A, 99% dB OBW



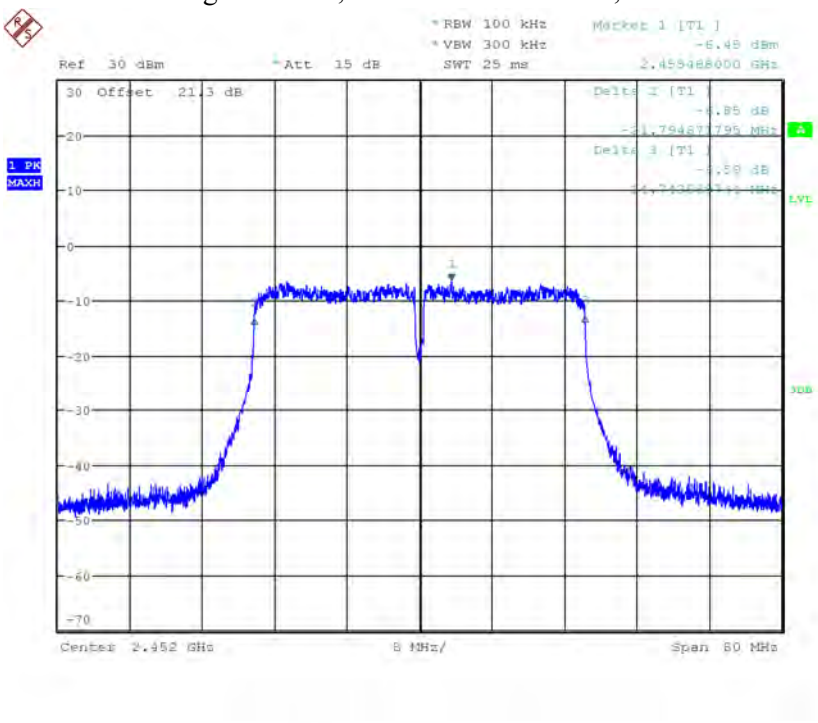
Date: 10.FEB.2021 14:41:08

Mid Channel, 2437 MHz Antenna B, 99% dB OBW



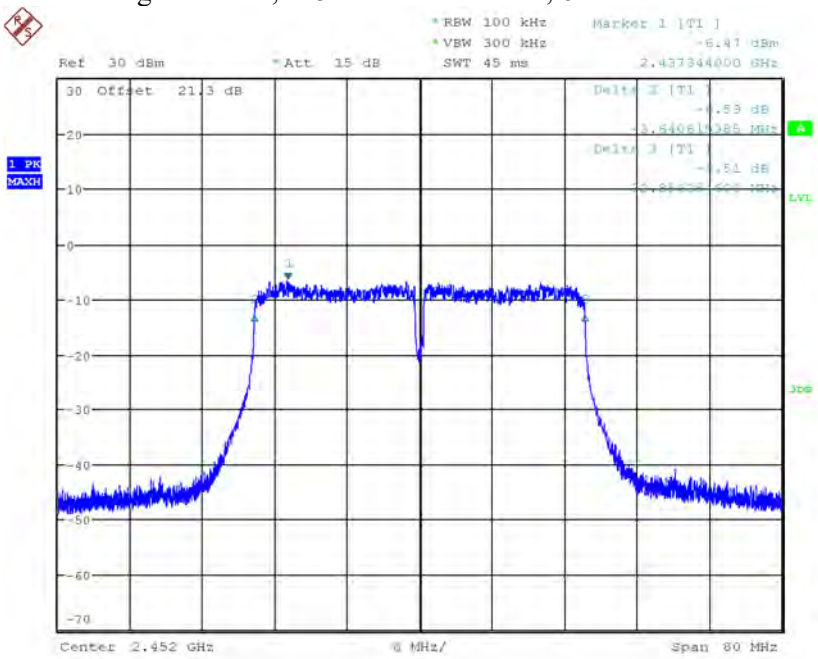
Date: 10.FEB.2021 16:19:56

High Channel, 2452 MHz Antenna A, 6 dB OBW



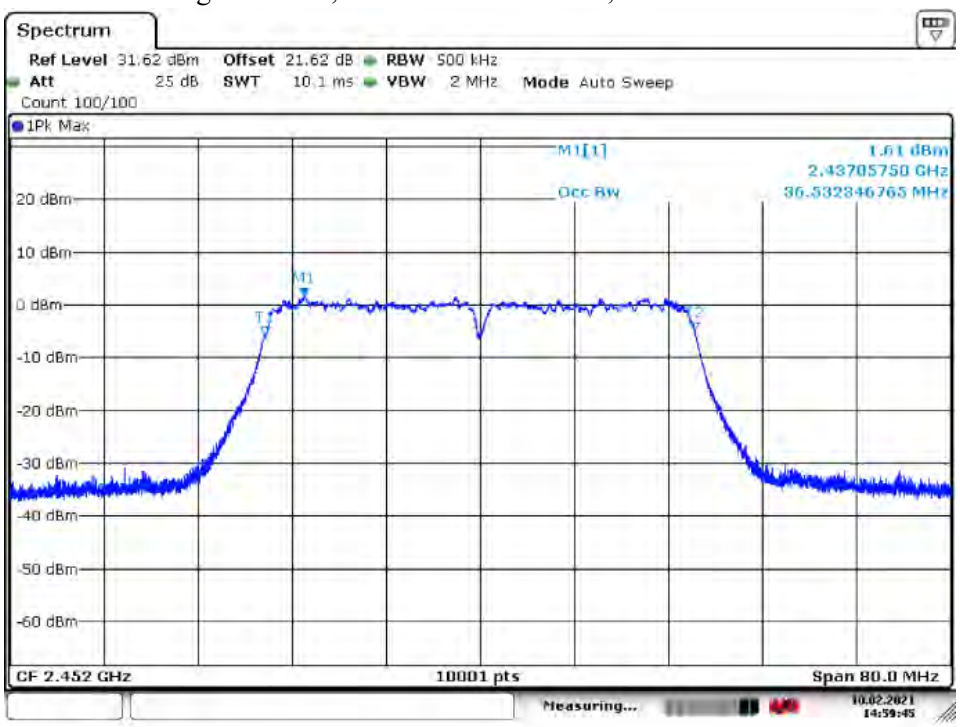
Date: 18.FEB.2021 11:21:1

High Channel, 2452 MHz Antenna B, 6 dB OBW Antenna B



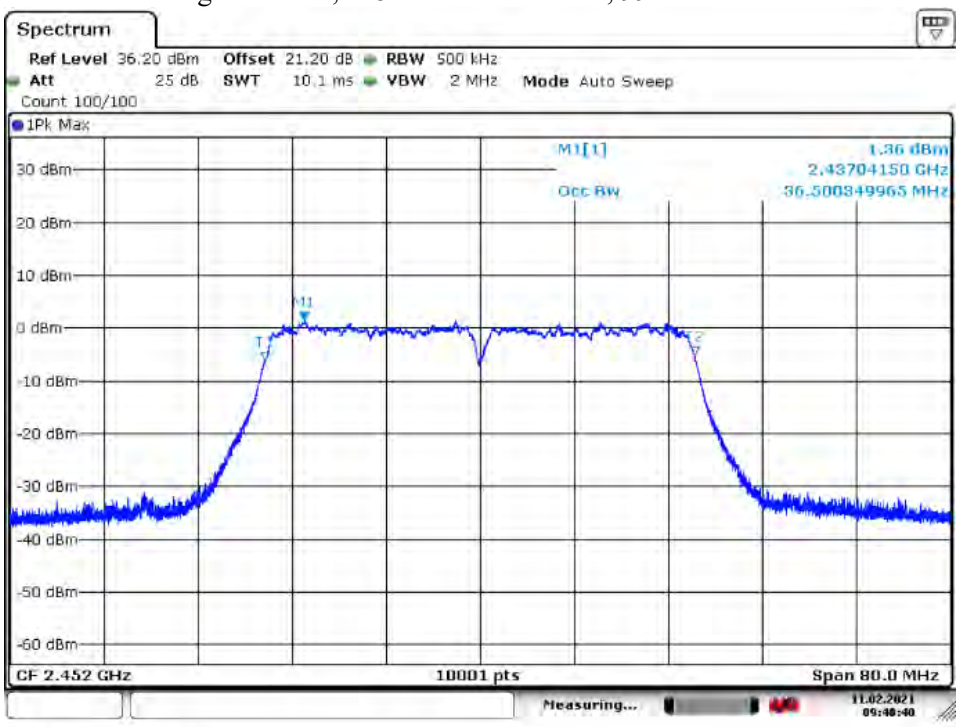
Date: 18.FEB.2021 13:47:09

High Channel, 2452 MHz Antenna A, 99% dB OBW



Date: 10.FEB.2021 14:59:46

High Channel, 2452 MHz Antenna B, 99% dB OBW



Date: 11.FEB.2021 09:48:41

9 FCC §15.247(b) (3) & ISEDC RSS-247 §5.4 (4) - Output Power Measurement

9.1 Applicable Standards

According to ECFR §15.247(b) (3) and ISEDC RSS-247 §5.4 (4) for systems using digital modulation in the 902~928 MHz, 2400~2483.5 MHz, and 5725~5850 MHz bands: 1 Watt.

9.2 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 9: Fundamental emission output power

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008K39 -101203-UW	2019-08-06	2 years
-	RF cable	-	-	Each time[1]	N/A
-	20 dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all 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".*

9.4 Test Environmental Conditions

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

The testing was performed by Vang Lee from 2021-02-10 to 2021-02-11 in RF site.

9.5 Test Results

Average Output Power

Channel	Frequency (MHz)	Conducted Output Power (dBm)		Output Power Limit (dBm)	Result
		ANT A	ANT B		
802.11b					
Low	2412	17.58	15.44	30	Pass
Middle	2437	21.60	21.23	30	Pass
High	2462	19.26	18.04	30	Pass
802.11g					
Low	2412	12.28	12.31	30	Pass
Middle	2437	19.07	19.14	30	Pass
High	2462	14.09	12.79	30	Pass
802.11n20					
Low	2422	13.43	12.33	30	Pass
Middle	2437	19.03	19.15	30	Pass
High	2462	13.46	11.82	30	Pass
802.11n40					
Low	2422	13.31	11.47	30	Pass
Middle	2437	19.27	19.29	30	Pass
High	2452	11.26	10.98	30	Pass

Note: the device does not support MIMO operation.

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

10.1 Applicable Standards

According to ECFR §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

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 13: Band-edge measurements

10.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008K39 -101203-UW	2019-08-06	2 years
-	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".*

10.4 Test Environmental Conditions

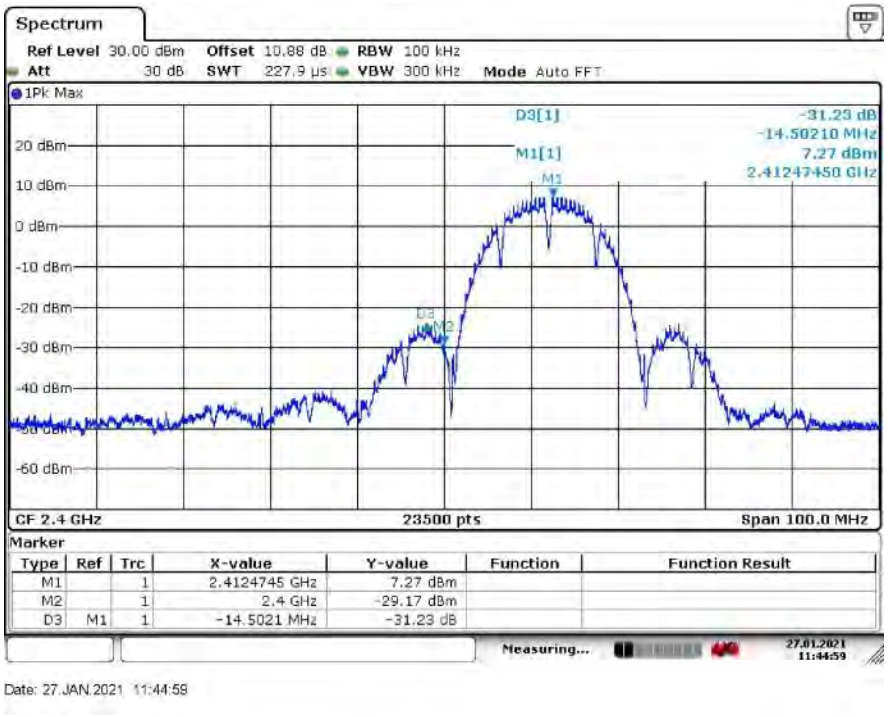
Temperature:	23º C
Relative Humidity:	42 %
ATM Pressure:	102.7 kPa

The testing was performed by Vang Lee on 2021-01-27at RF site.

10.5 Test Results

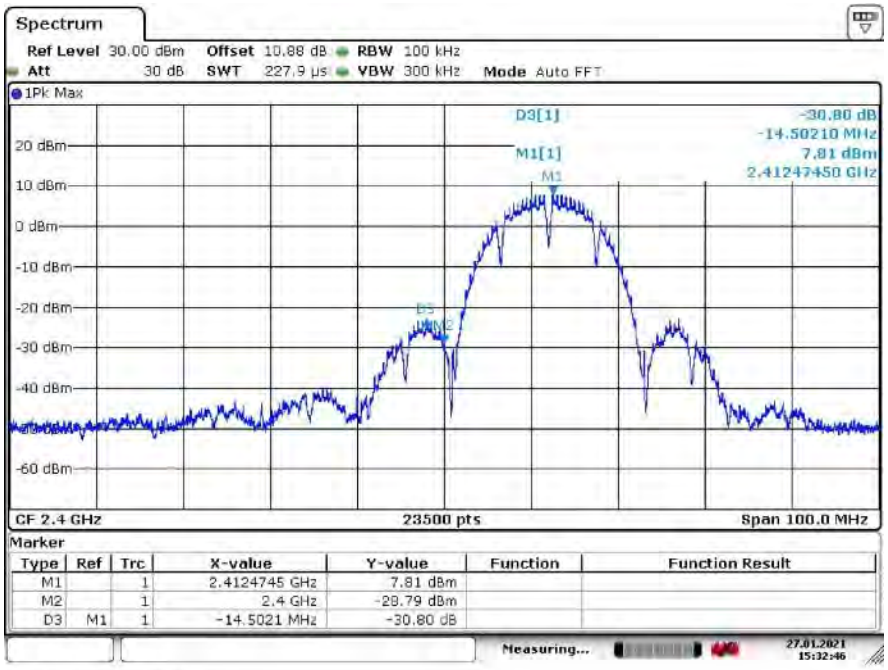
802.11 b mode

Low Channel, 2142 MHz Antenna A



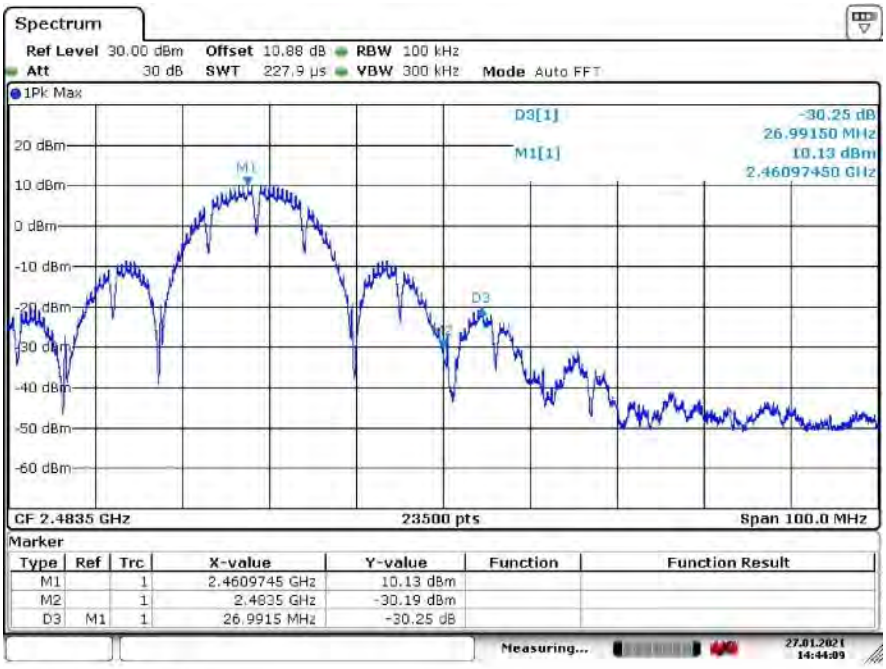
Date: 27.JAN.2021 11:44:59

Low Channel, 2142 MHz Antenna B



Date: 27.JAN.2021 15:32:47

High Channel, 2462 MHz Antenna A



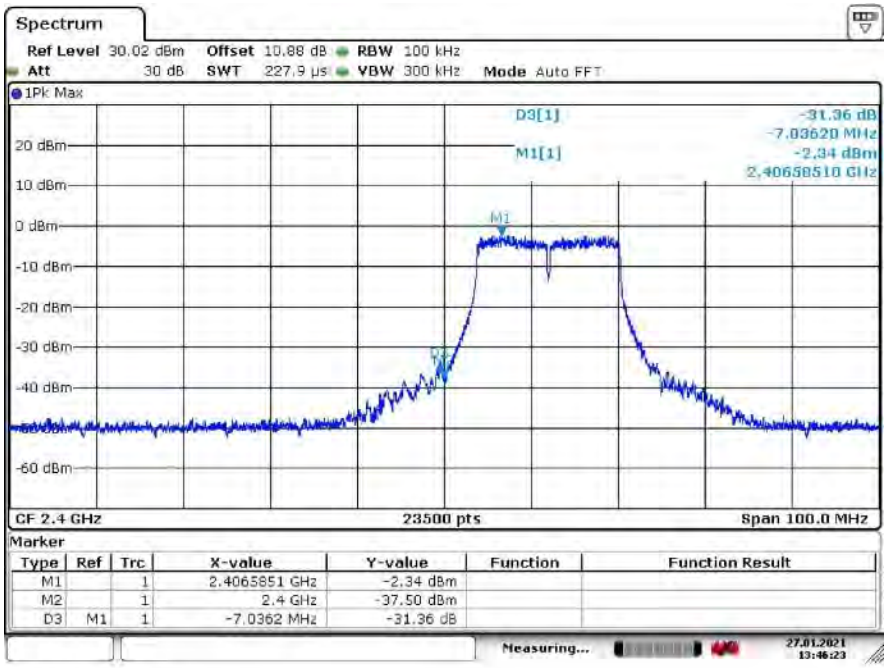
Date: 27.JAN.2021 14:44:09

High Channel, 2462 MHz Antenna B

Date: 27.JAN.2021 15:59:17

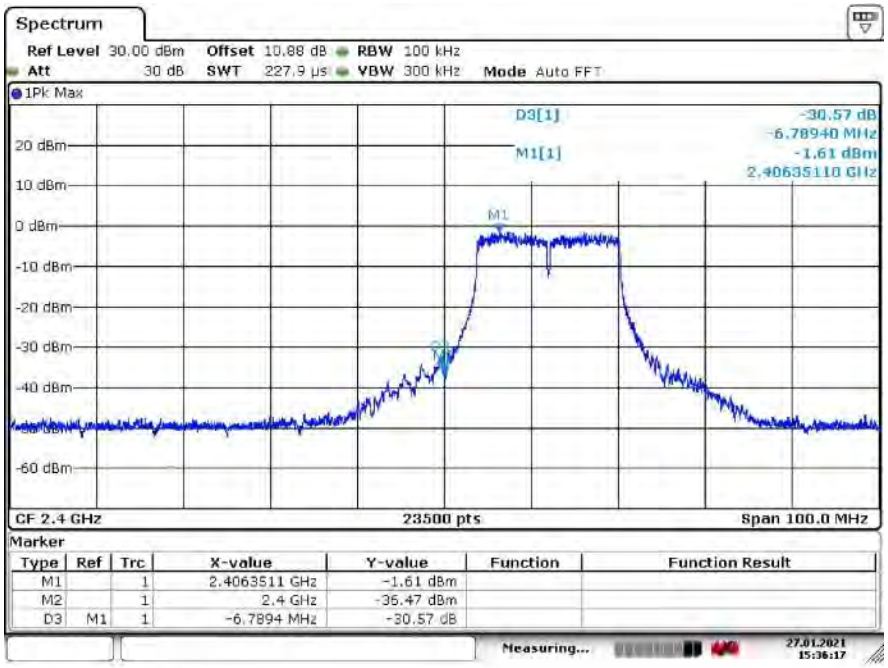
802.11 g mode

Low Channel, 2412 MHz Antenna A



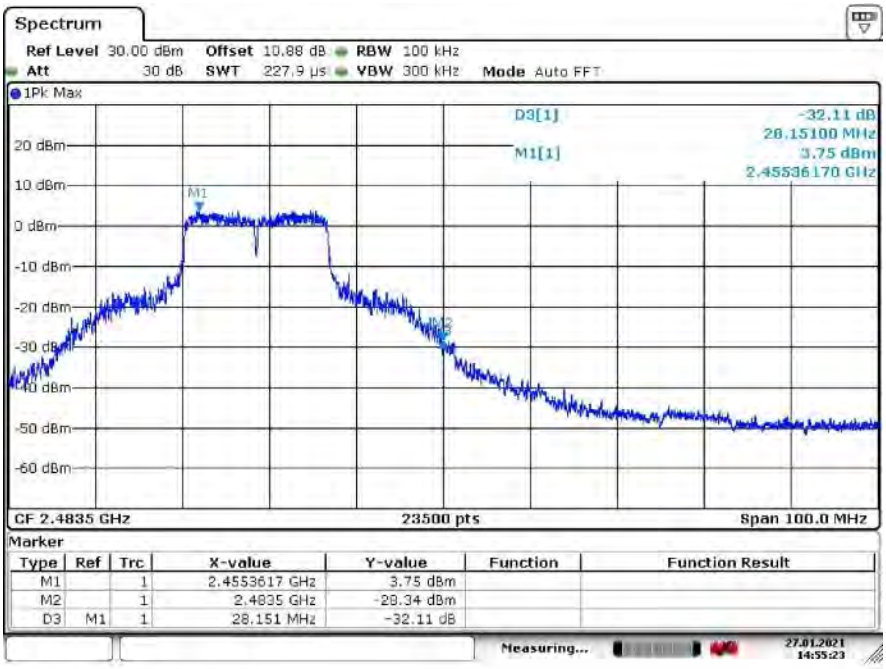
Date: 27.JAN.2021 13:46:23

Low Channel, 2412 MHz Antenna B



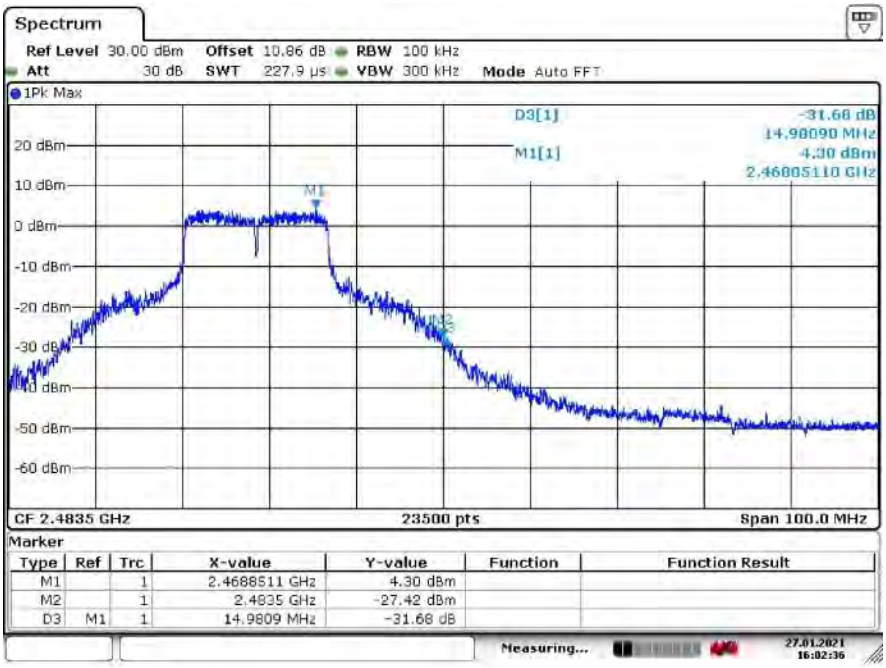
Date: 27.JAN.2021 15:36:18

High Channel, 2462 MHz Antenna A



Date: 27.JAN.2021 14:55:23

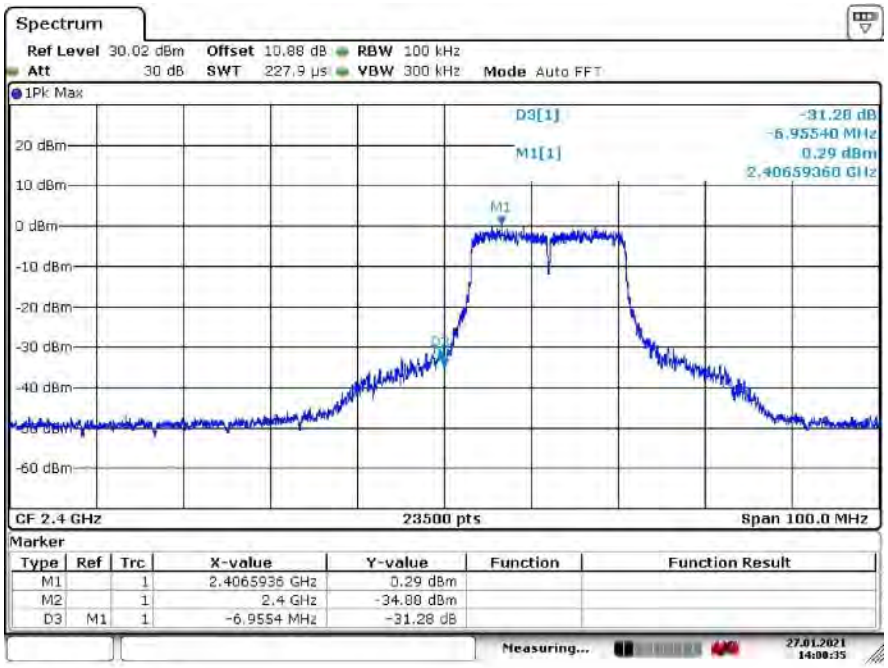
High Channel, 2462 MHz Antenna B



Date: 27.JAN.2021 16:02:36

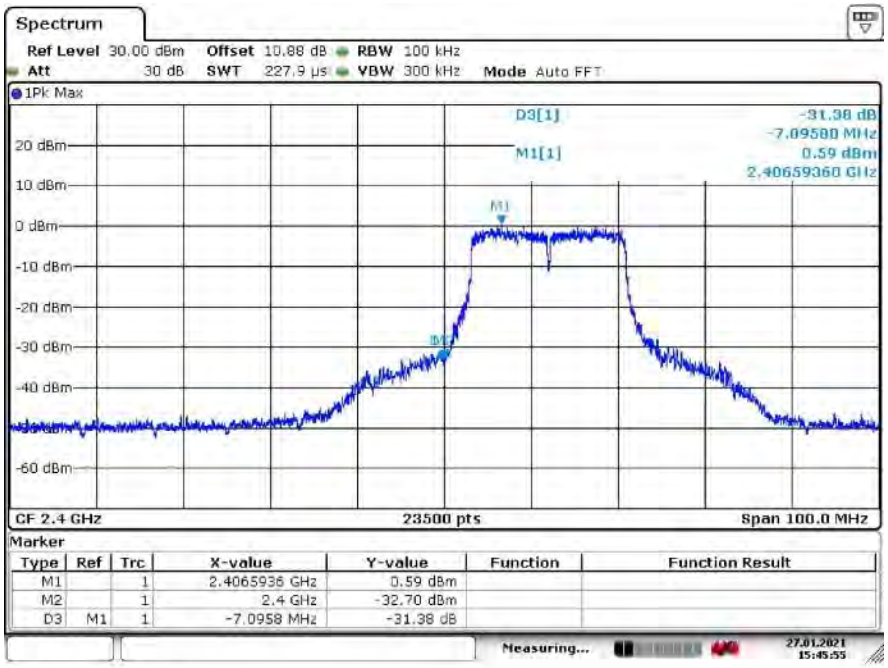
802.11 n20 mode

Low Channel, 2412 MHz Antenna A



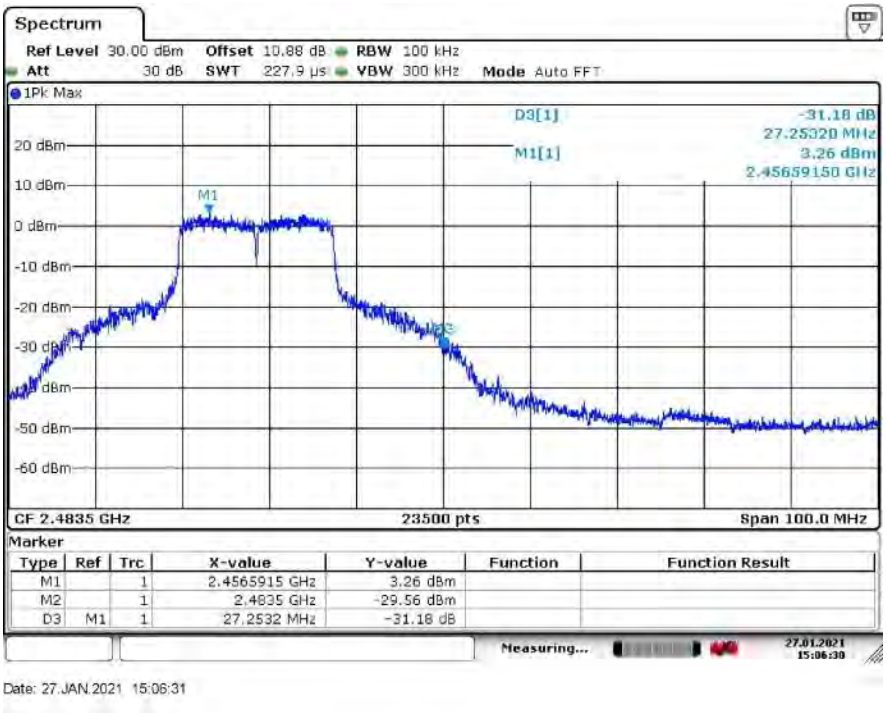
Date: 27.JAN.2021 14:00:35

Low Channel, 2412 MHz Antenna B

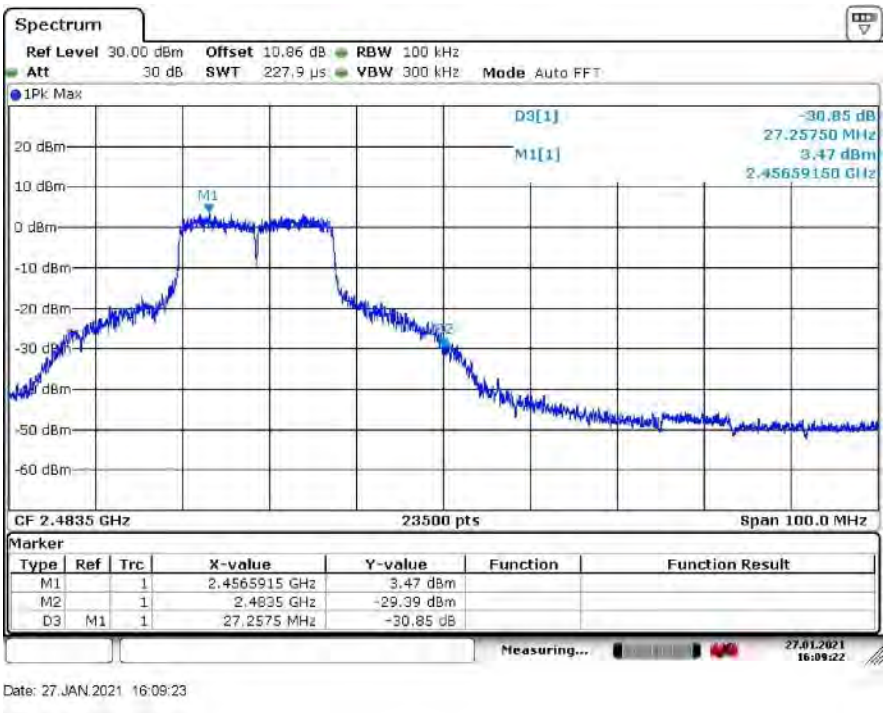


Date: 27.JAN.2021 15:45:56

High Channel, 2462 MHz Antenna A

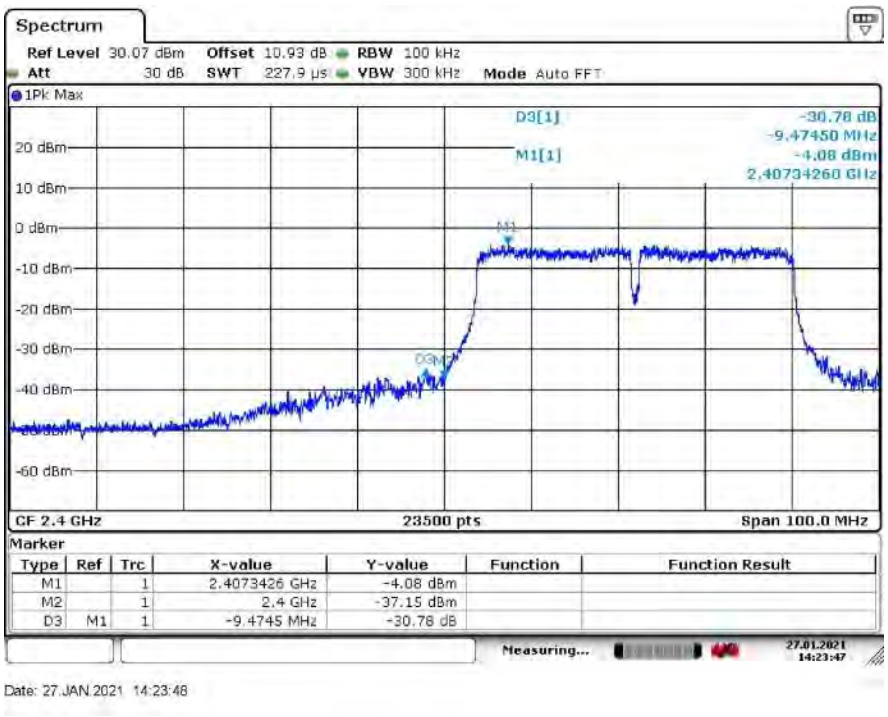


High Channel, 2462 MHz Antenna B

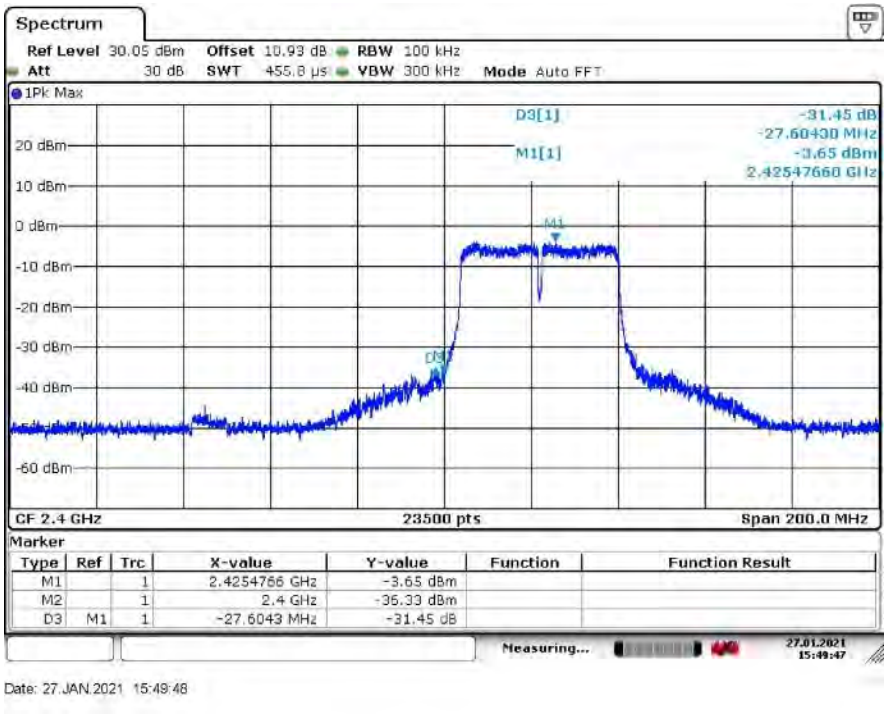


802.11 n40 mode

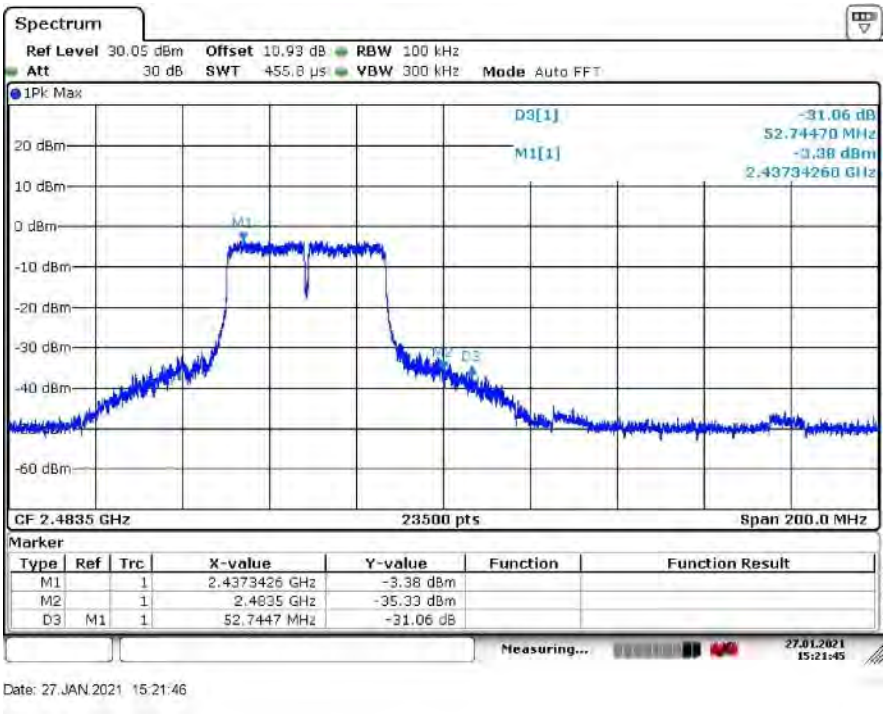
Low Channel, 2412 MHz Antenna A



Low Channel, 2412 MHz Antenna B

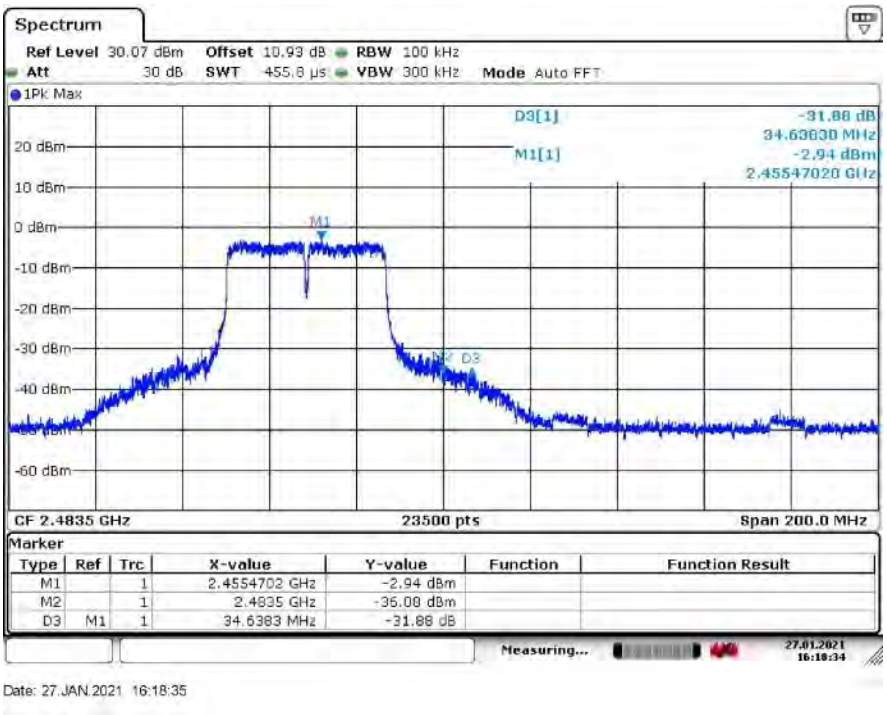


High Channel, 2462 MHz Antenna A



Date: 27.JAN.2021 15:21:46

High Channel, 2462 MHz Antenna B



Date: 27.JAN.2021 16:18:35

11 FCC §15.247(e) & ISEDC RSS-247 §5.2(2) - 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 Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode & Schwarz	Signal Analyzer	FSQ26	200749	2019-11-07	2 years
-	RF cable	-	-	Each time[1]	N/A
-	20 dB attenuator	-	-	Each time[1]	N/A

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all 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".*

11.4 Test Environmental Conditions

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

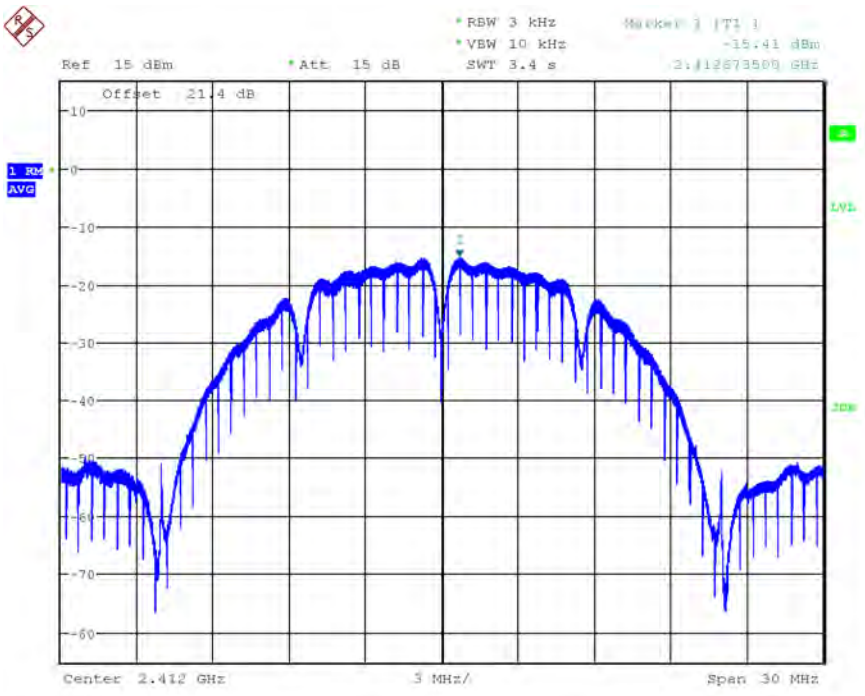
The testing was performed by Vang Lee on 2021-02-12 in RF site.

11.5 Test Results

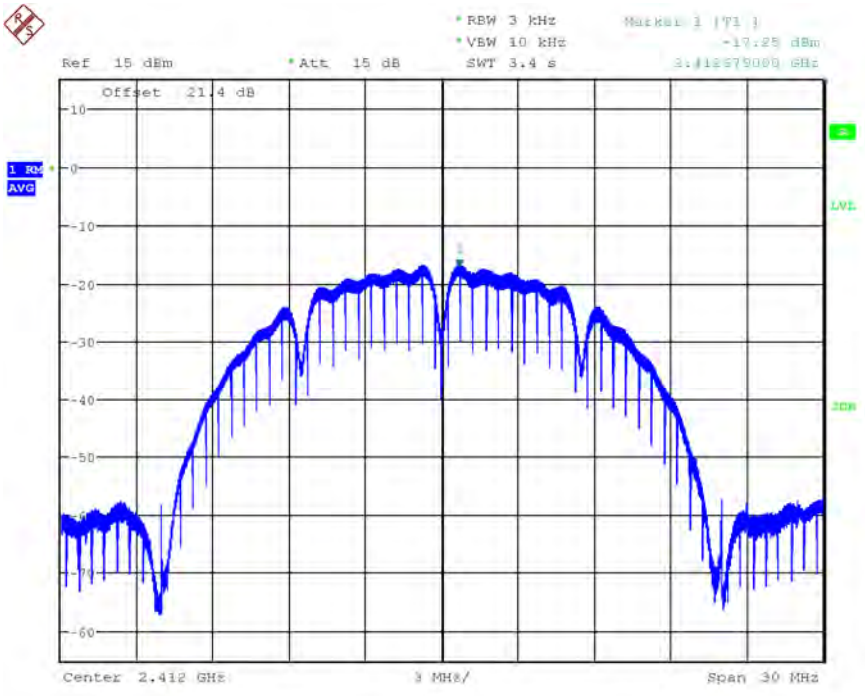
Channel	Frequency (MHz)	PSD (dBm/3kHz)		Limit (dBm/3kHz)
		Antenna A	Antenna B	
802.11b mode				
Low	2412	-15.41	-17.25	8
Middle	2437	-11.19	-11.63	8
High	2462	-13.45	-14.48	8
802.11g mode				
Low	2412	-19.53	-19.92	8
Middle	2437	-12.76	-12.85	8
High	2462	-18.63	-18.86	8
802.11n20 mode				
Low	2412	-18.98	-21.11	8
Middle	2437	-13.26	-13.37	8
High	2462	-19.05	-20.70	8
802.11n40 mode				
Low	2422	-21.83	-24.50	8
Middle	2437	-16.12	-14.96	8
High	2452	-23.86	-23.00	8

802.11b mode

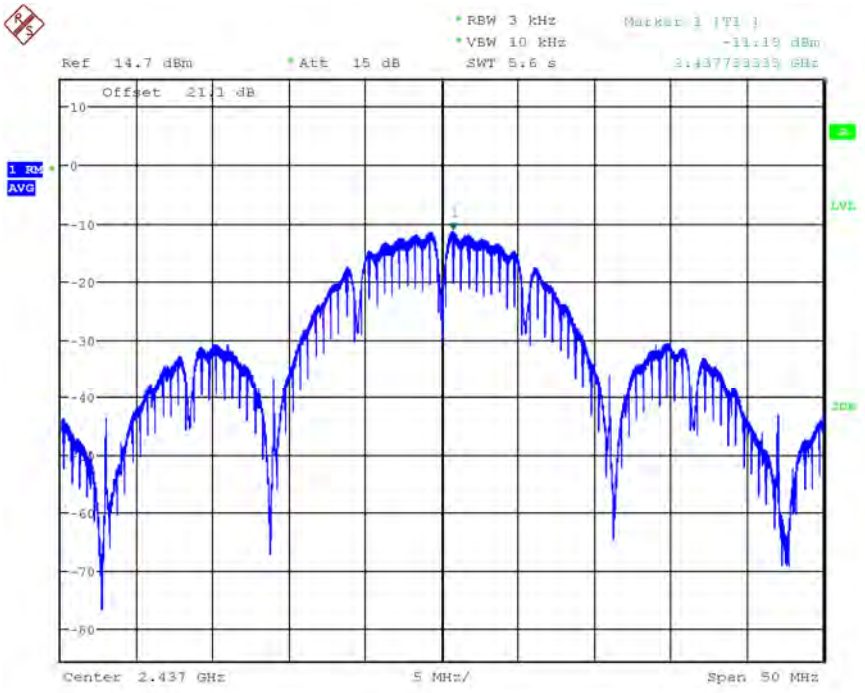
Low Channel, 2412 MHz Antenna A



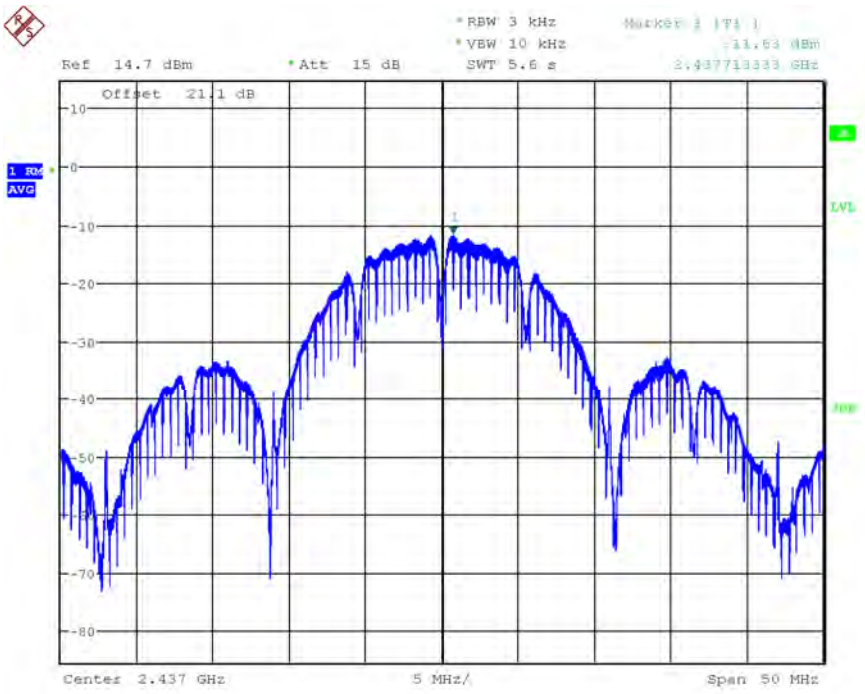
Low Channel, 2412 MHz Antenna B



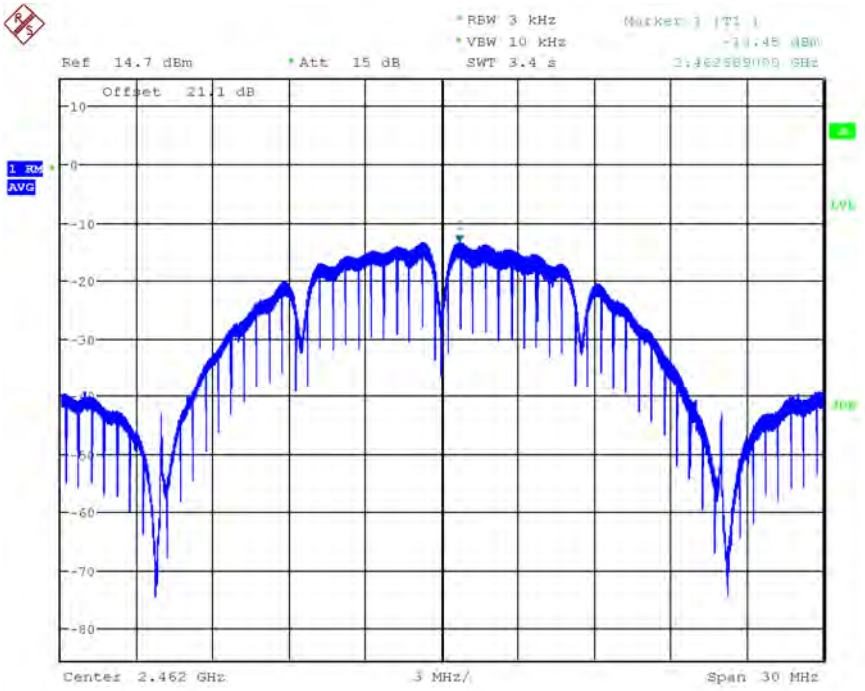
Mid Channel, 2437 MHz Antenna A



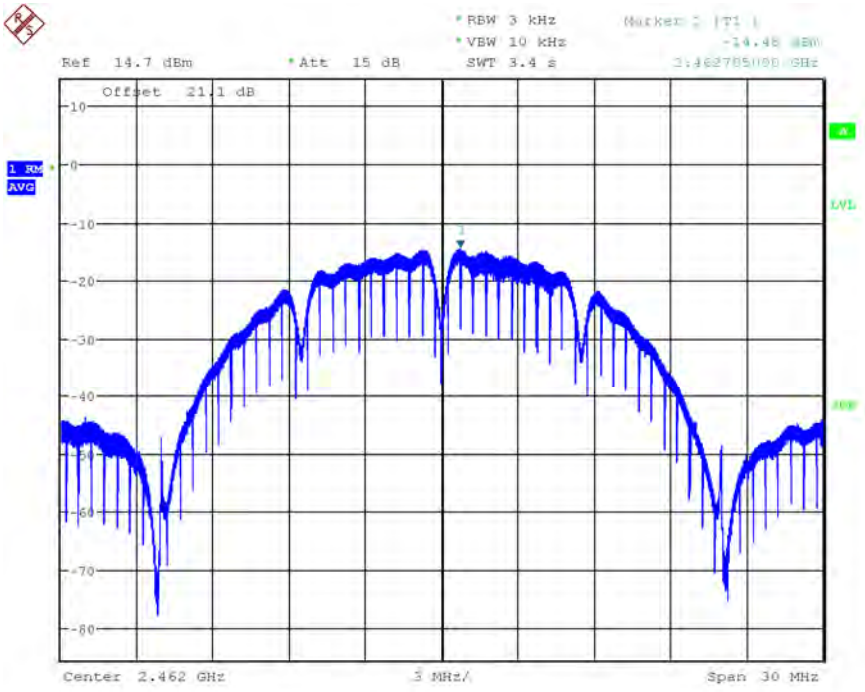
Mid Channel, 2437 MHz Antenna B



High Channel, 2462 MHz Antenna A

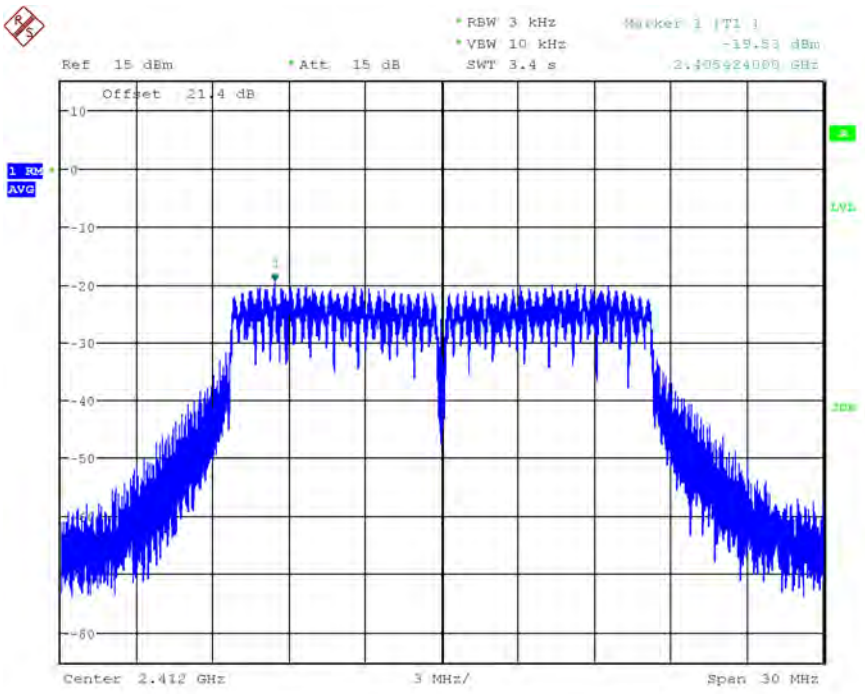


High Channel, 2462 MHz Antenna B

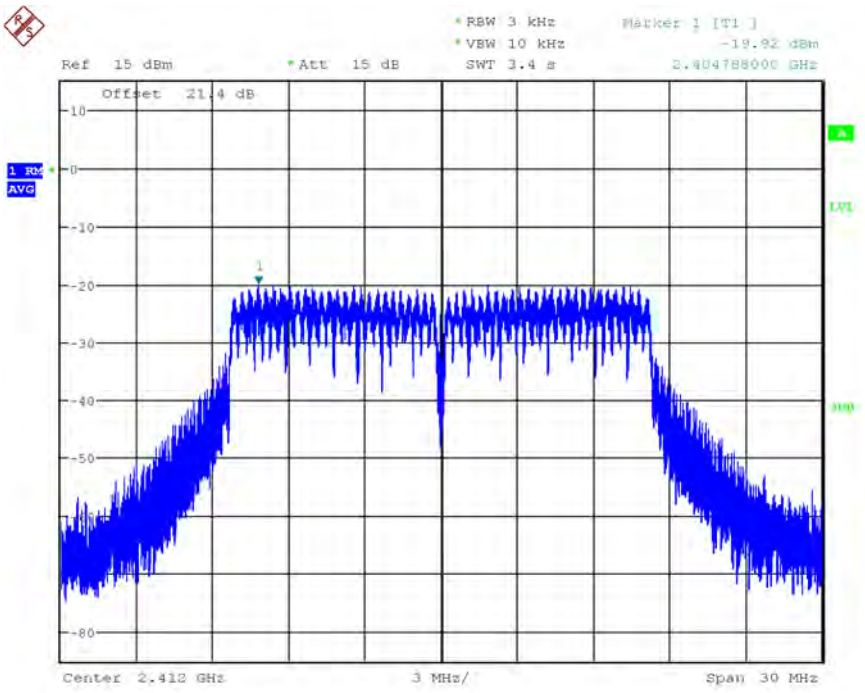


802.11g mode

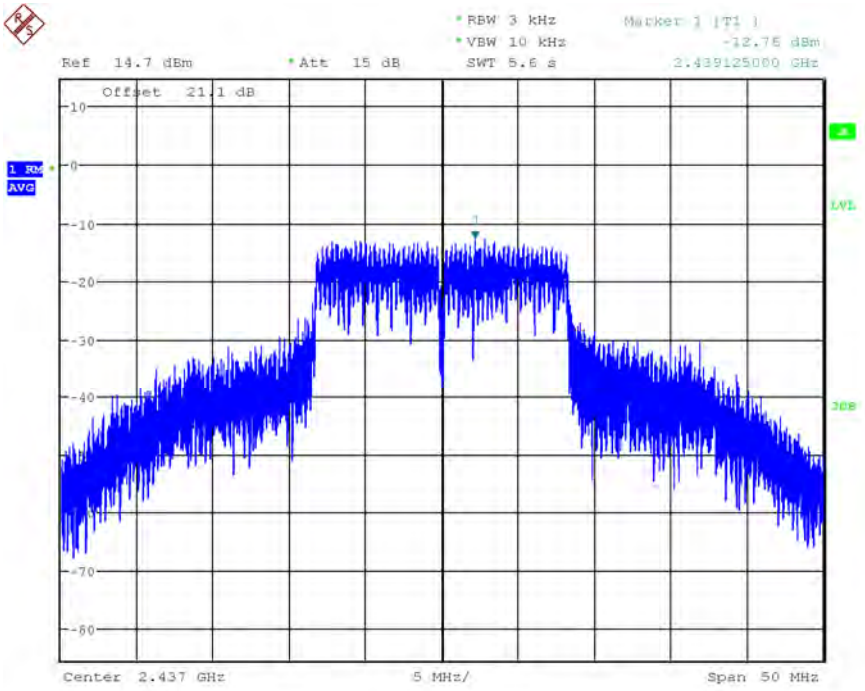
Low Channel, 2412 MHz Antenna A



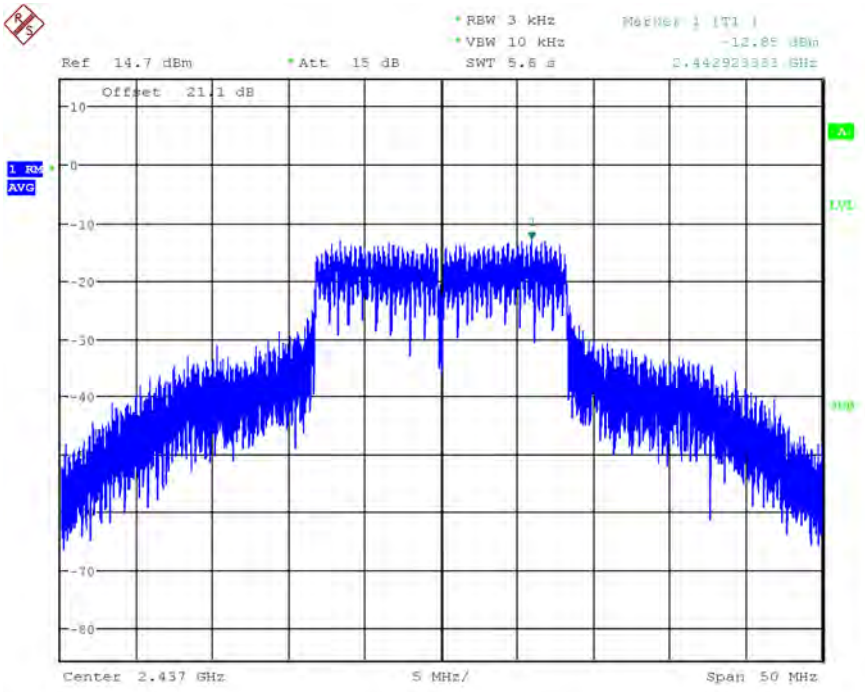
Low Channel, 2412 MHz Antenna B



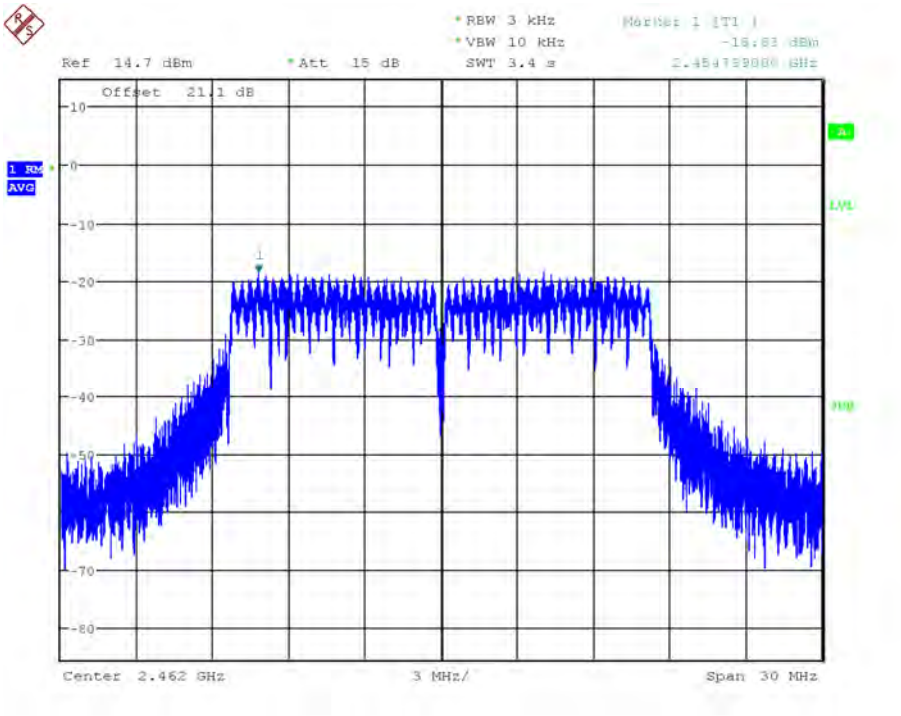
Mid Channel, 2437 MHz Antenna A



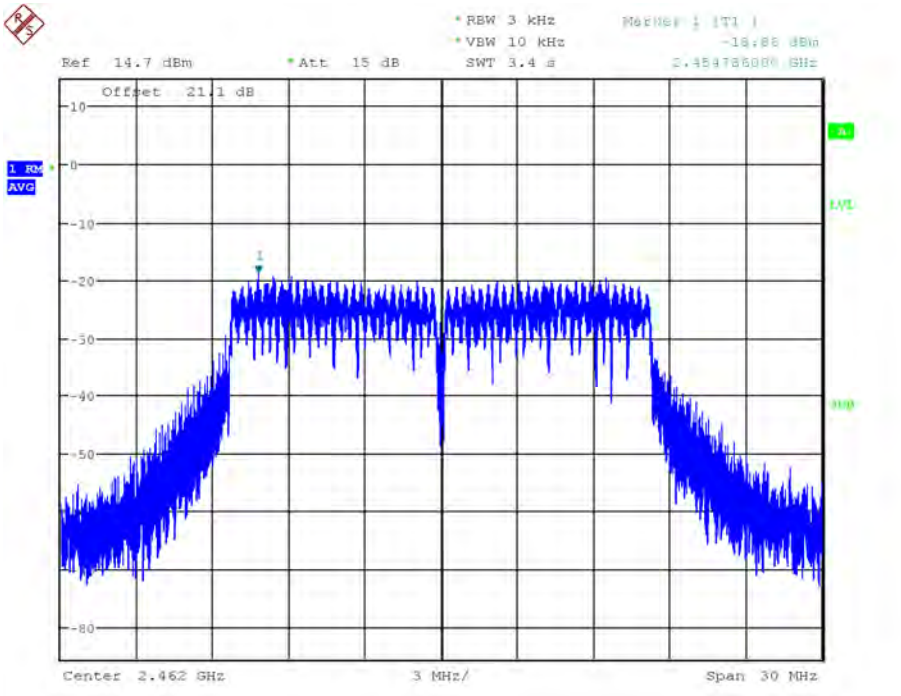
Mid Channel, 2437 MHz Antenna B



High Channel, 2462 MHz Antenna A

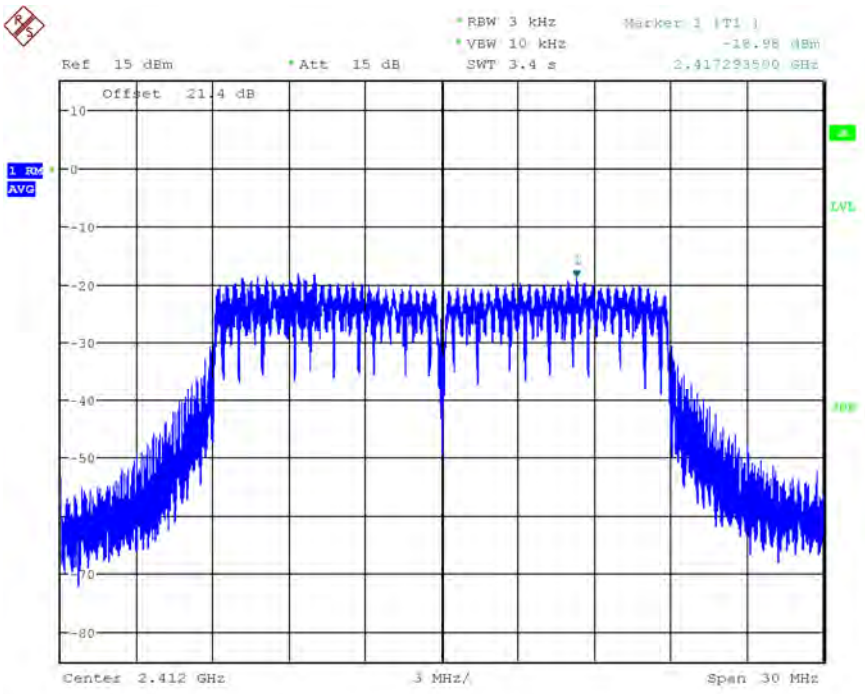


High Channel, 2462 MHz Antenna B

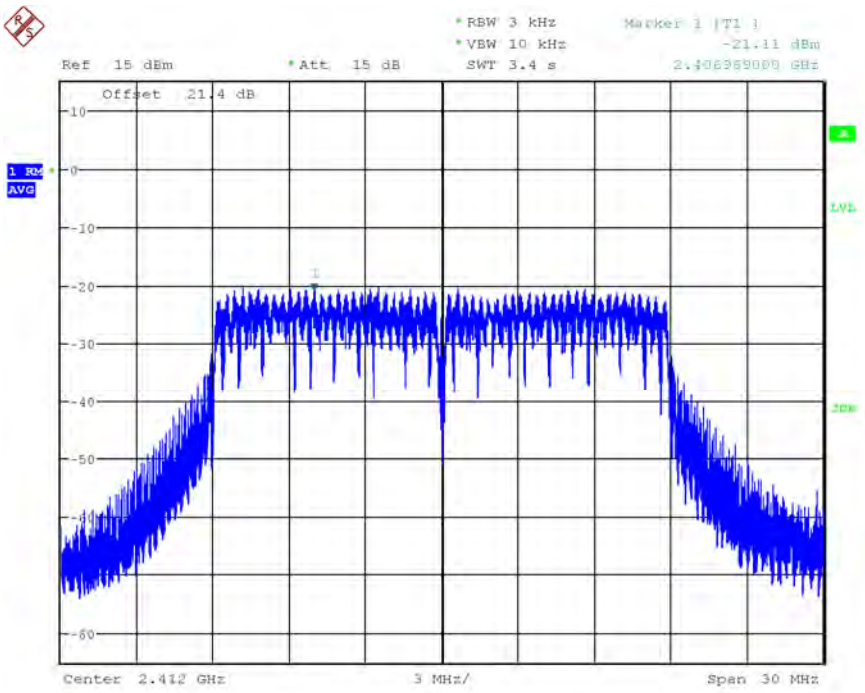


802.11n20 mode

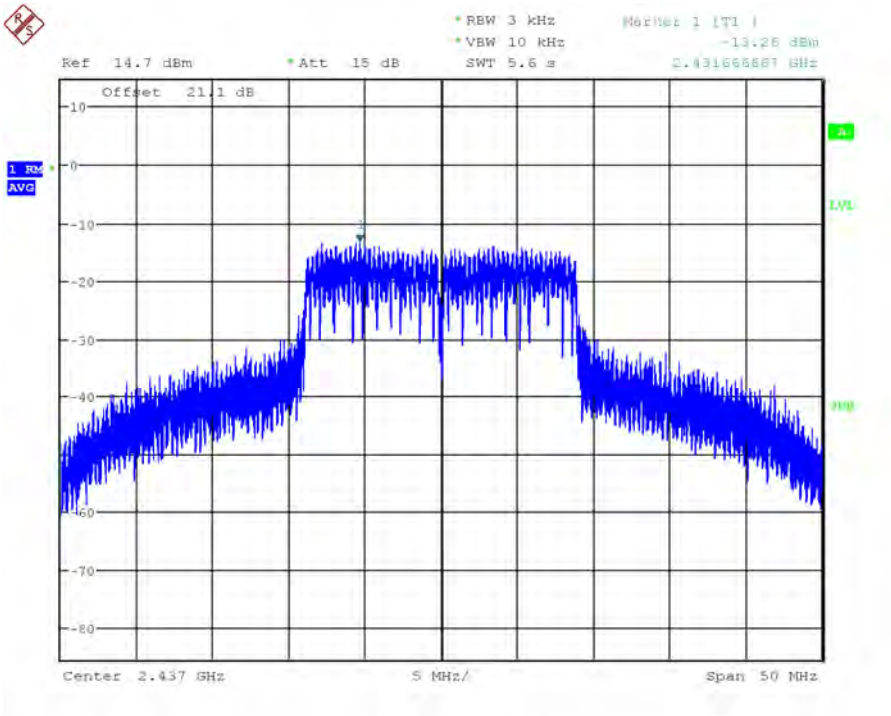
Low Channel, 2412 MHz Antenna A



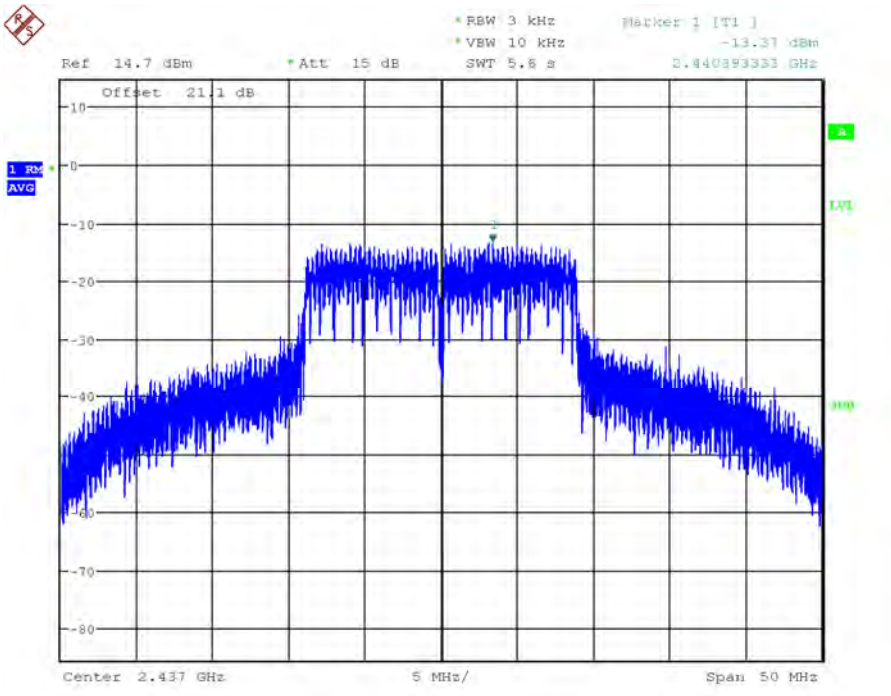
Low Channel, 2412 MHz Antenna B



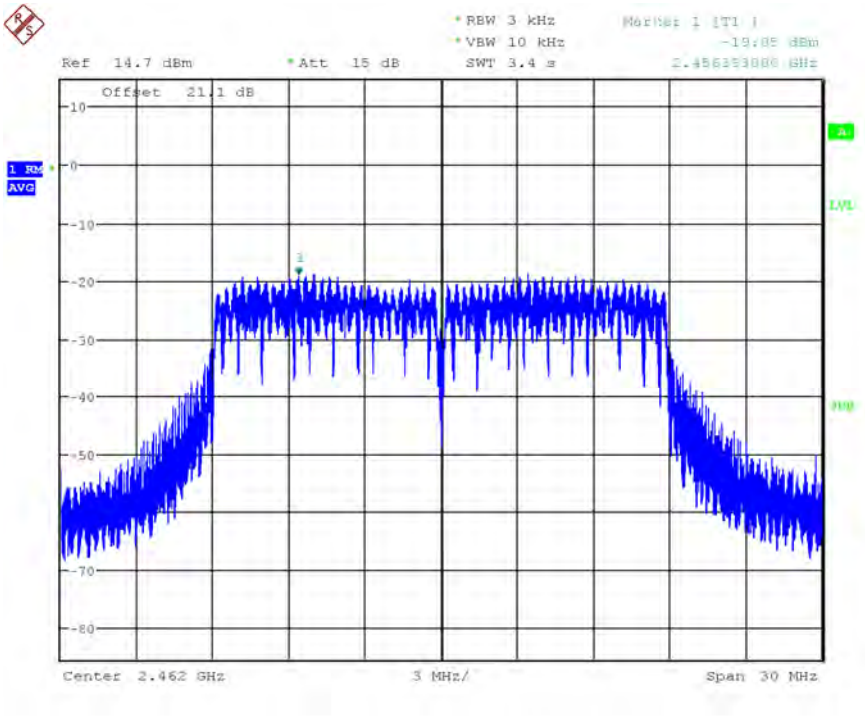
Mid Channel, 2437 MHz Antenna A



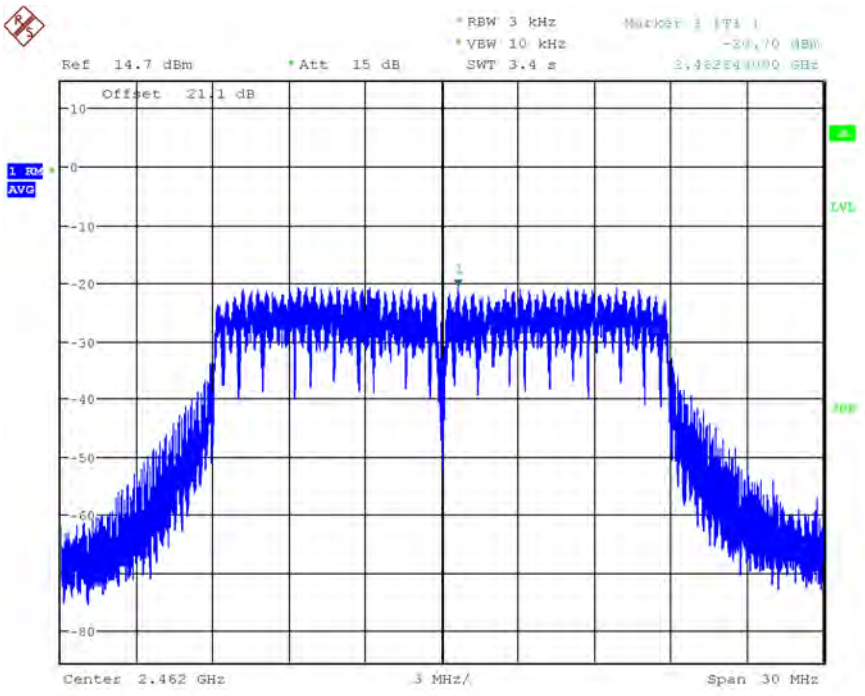
Mid Channel, 2437 MHz Antenna B



High Channel, 2462 MHz Antenna A

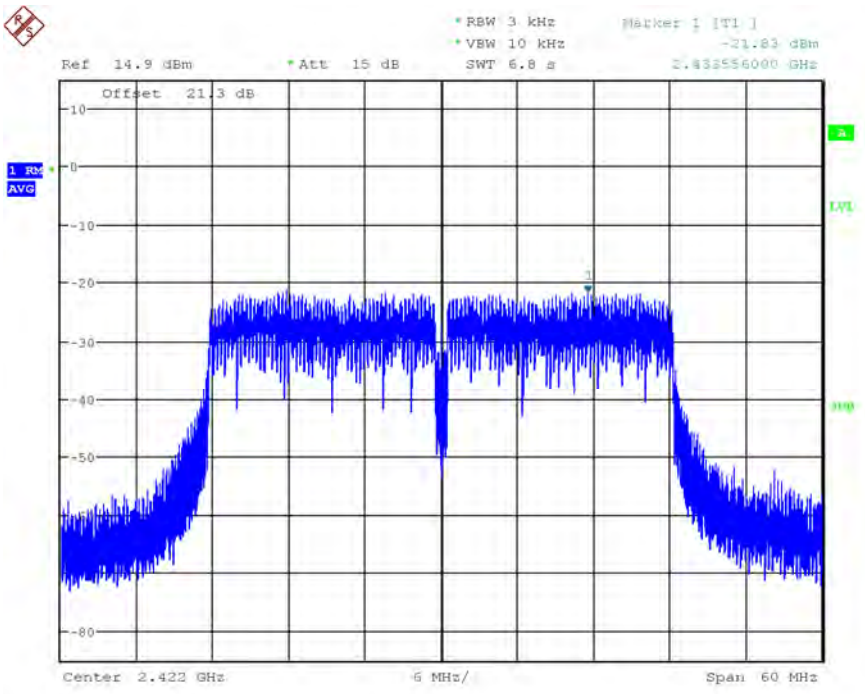


High Channel, 2462 MHz Antenna B

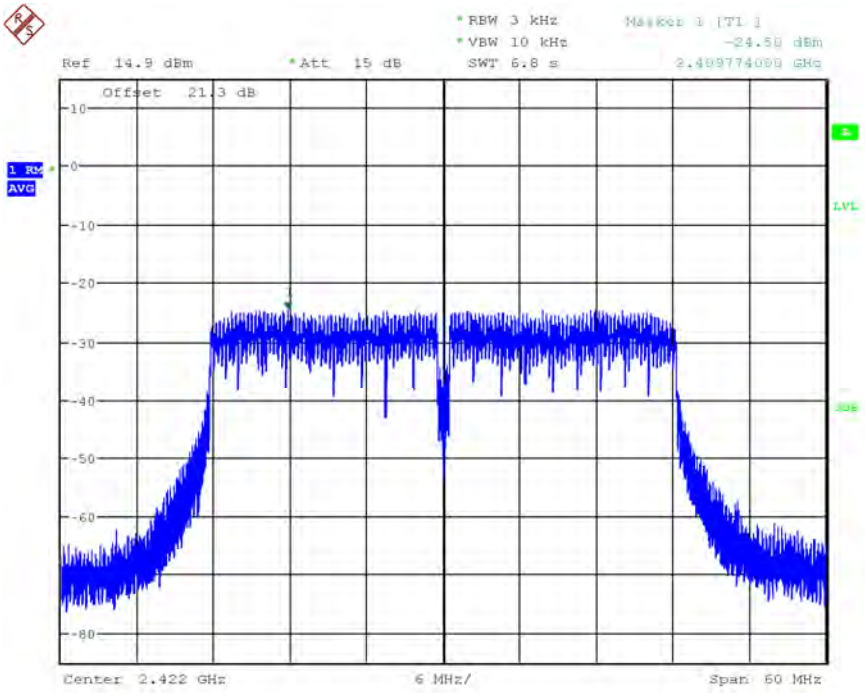


802.11n40 mode

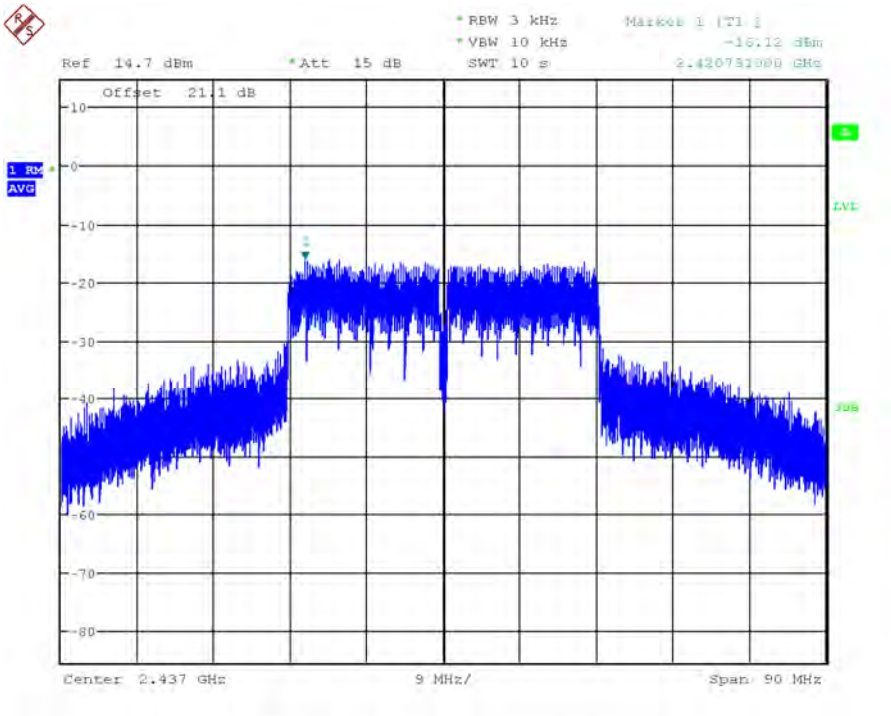
Low Channel, 2422 MHz Antenna A



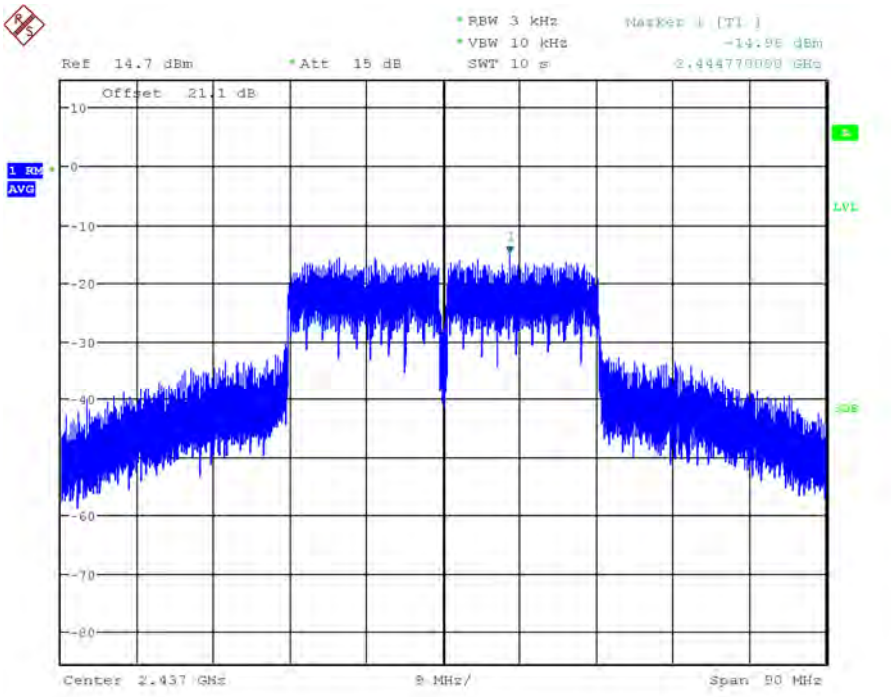
Low Channel, 2422 MHz Antenna B



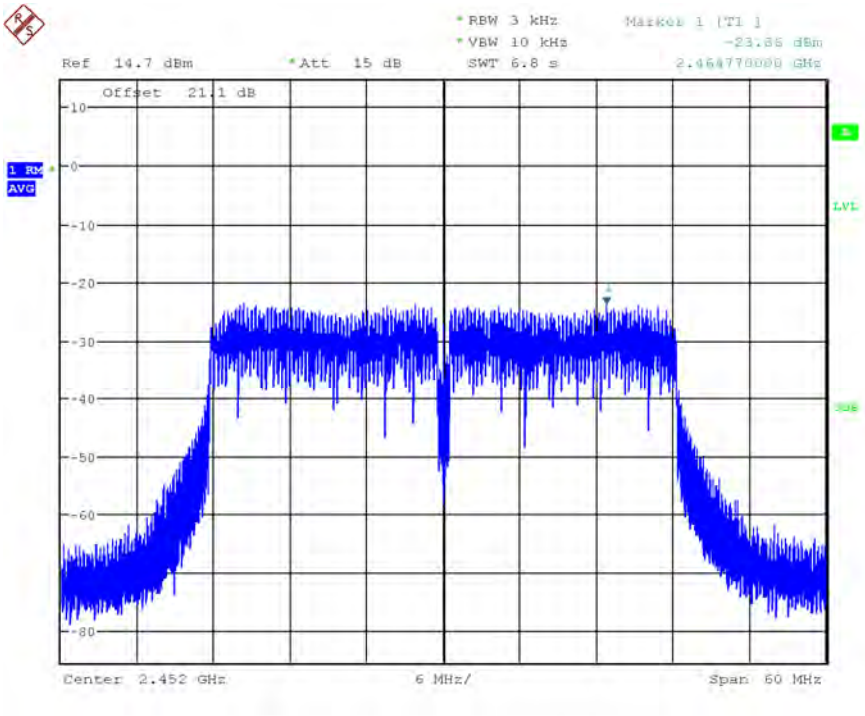
Mid Channel, 2437 MHz Antenna A



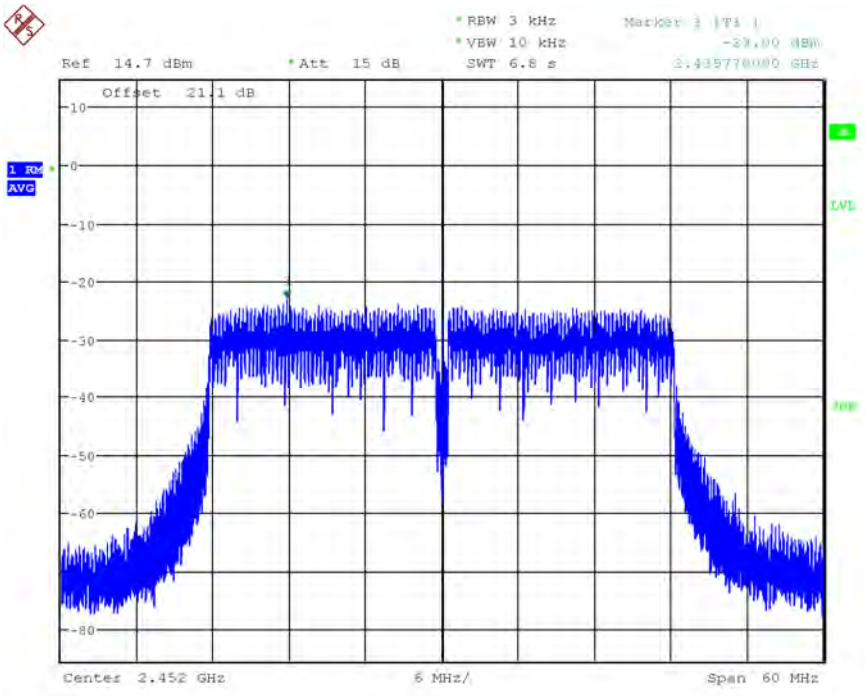
Mid Channel, 2437 MHz Antenna B



High Channel, 2452 MHz Antenna A



High Channel, 2452 MHz Antenna B



12 FCC §15.247(d) & ISEDC RSS-247 §5.5, RSS-GEN §8.9 - Spurious Emissions at Antenna Terminals

12.1 Applicable Standards

For ECFR §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-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.

12.2 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.

12.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008K39 -101203-UW	2019-08-06	2 years
-	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".*

12.4 Test Environmental Conditions

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

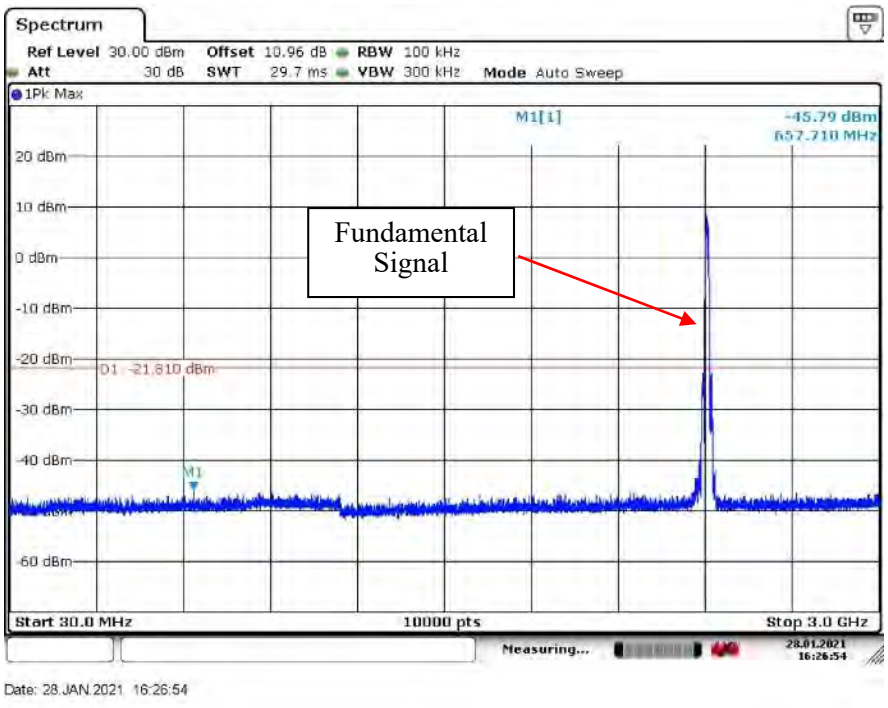
The testing was performed by Vang Lee from 2021-01-28 to 2021-01-29 at RF site.

12.5 Test Results

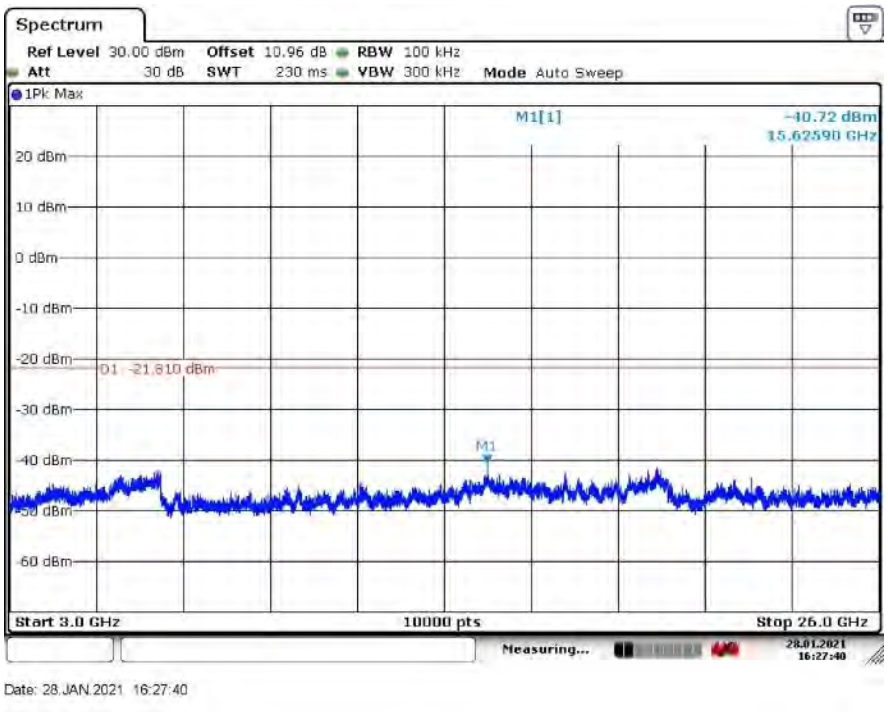
802.11b mode

Low Channel, 2412 MHz Antenna A

30MHz – 3GHz

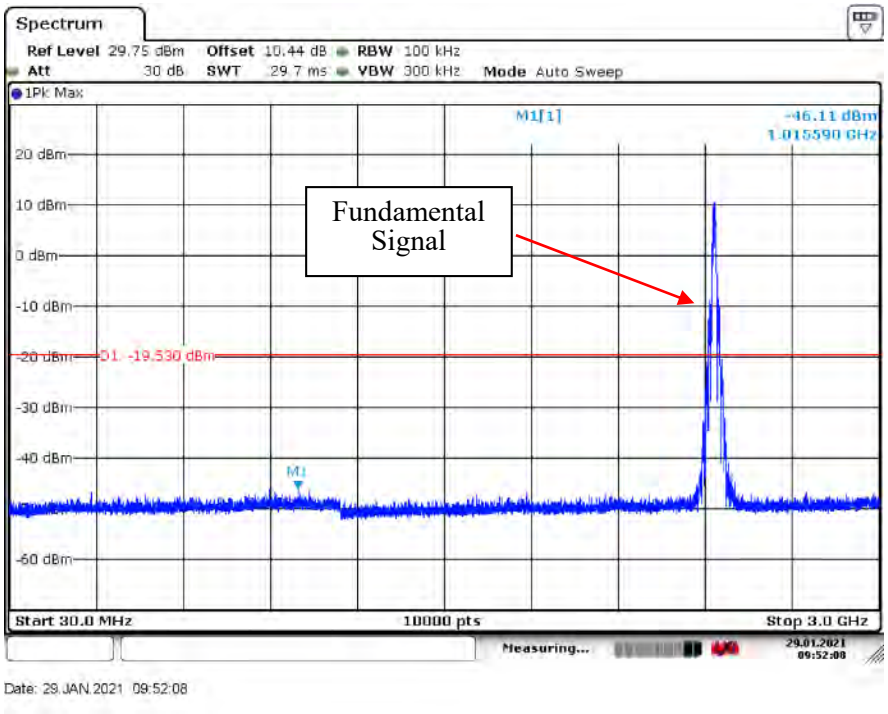


3GHz – 26GHz

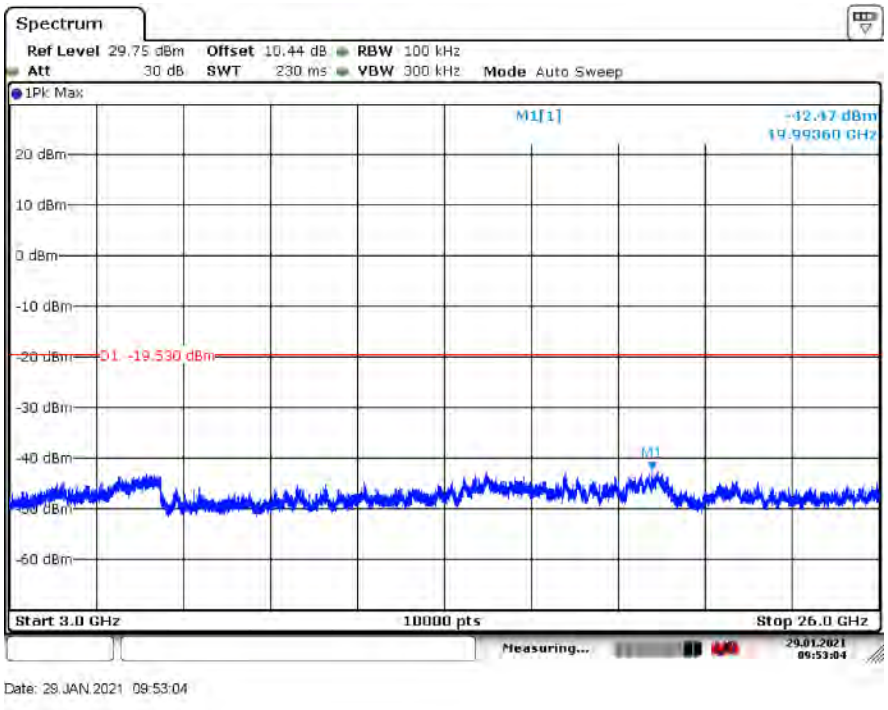


Mid Channel, 2437 MHz Antenna A

30MHz – 3GHz

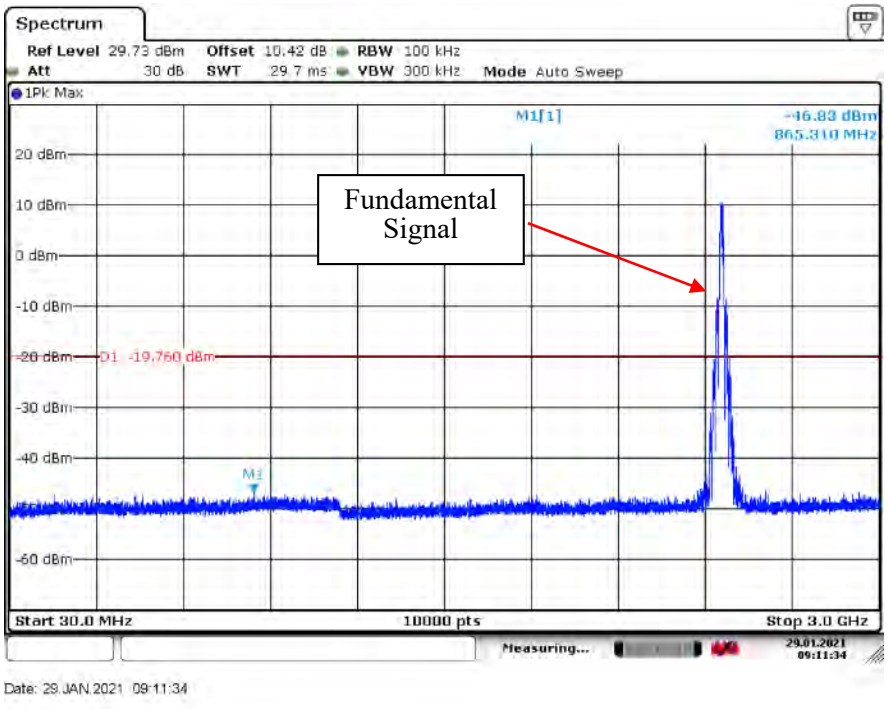


3GHz – 26GHz

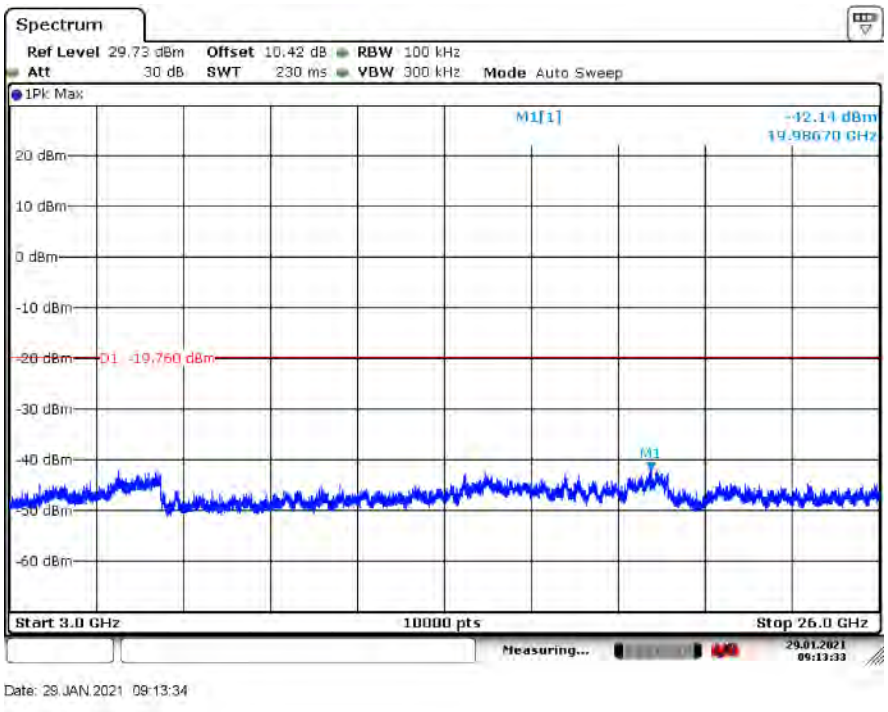


High Channel, 2462 MHz Antenna A

30MHz – 3GHz

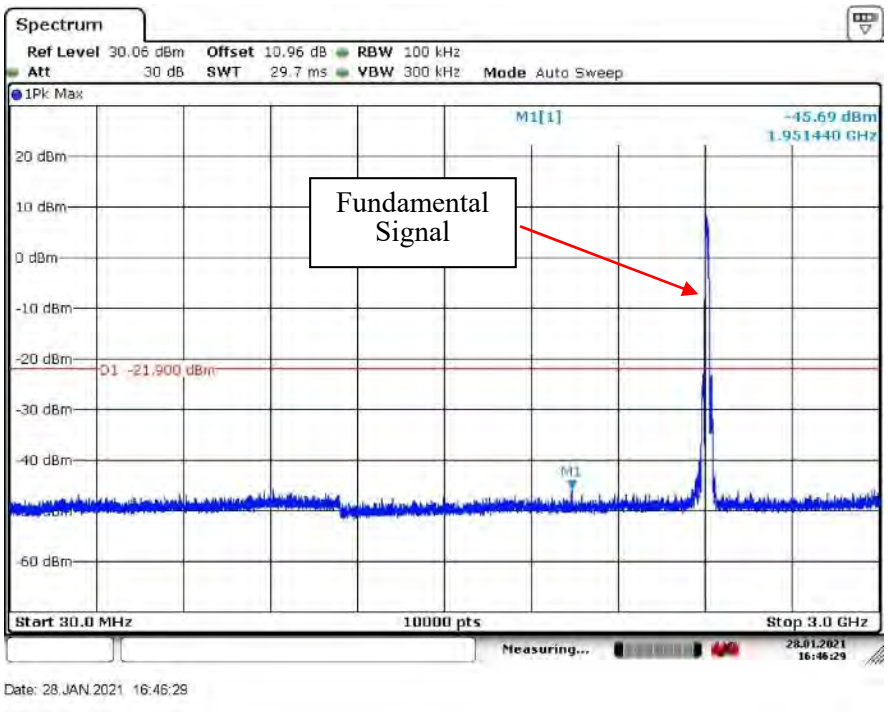


3GHz – 26GHz

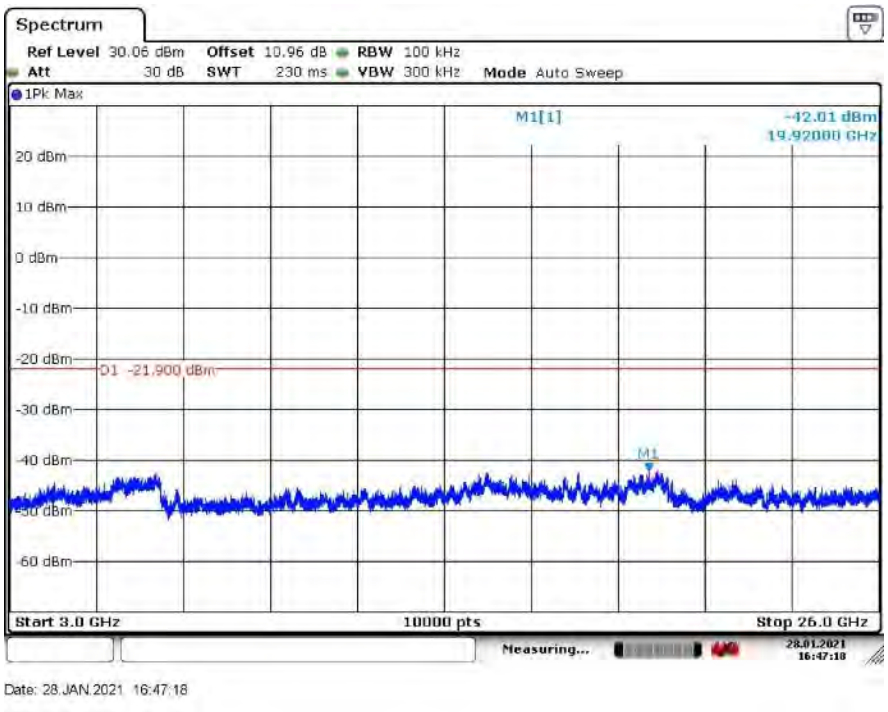


Low Channel, 2412 MHz Antenna B

30MHz – 3GHz

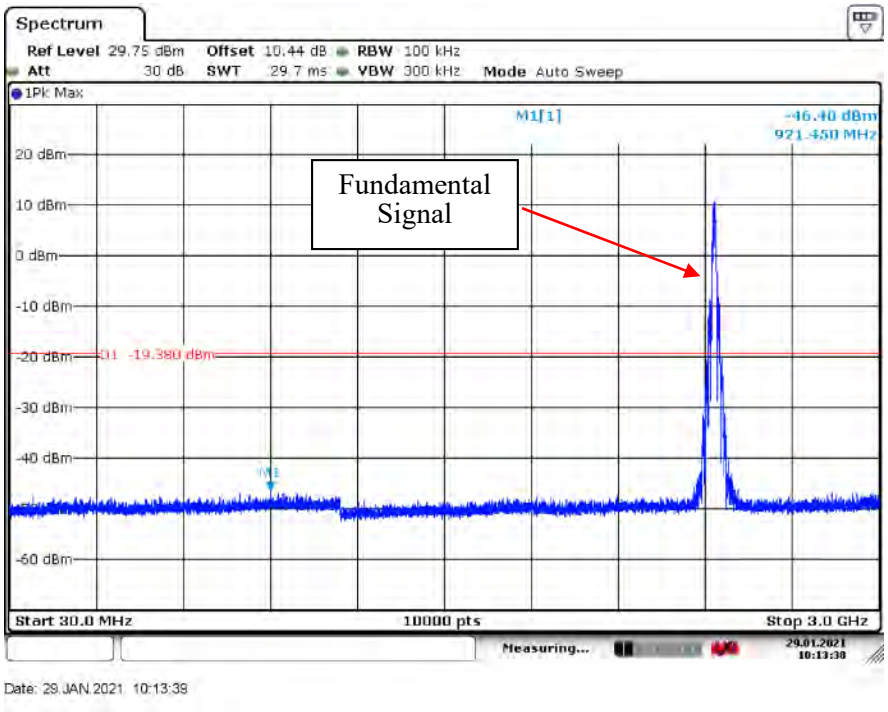


3GHz – 26GHz

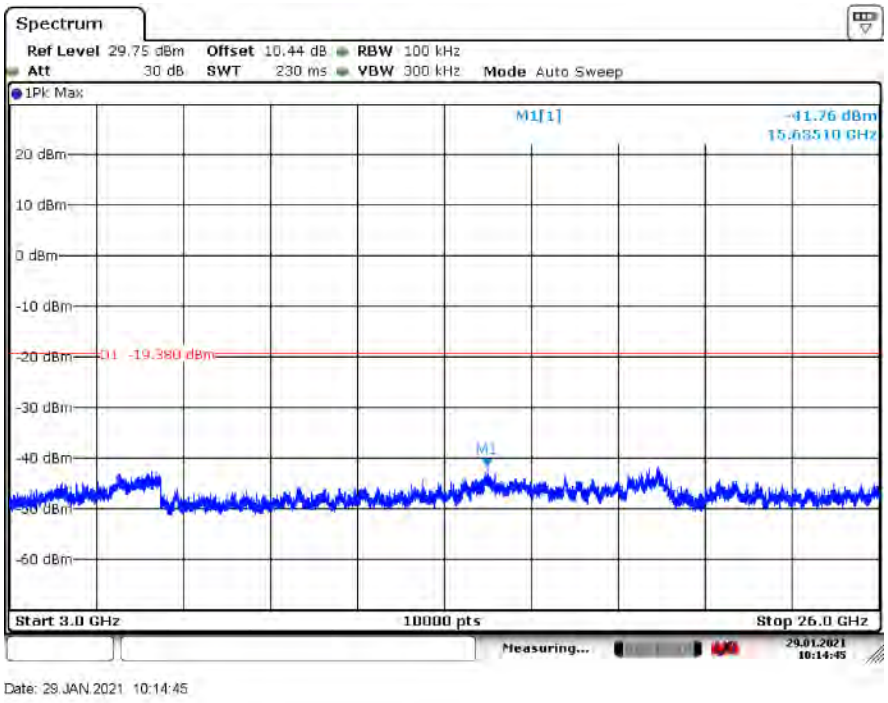


Mid Channel, 2437 MHz Antenna B

30MHz – 3GHz

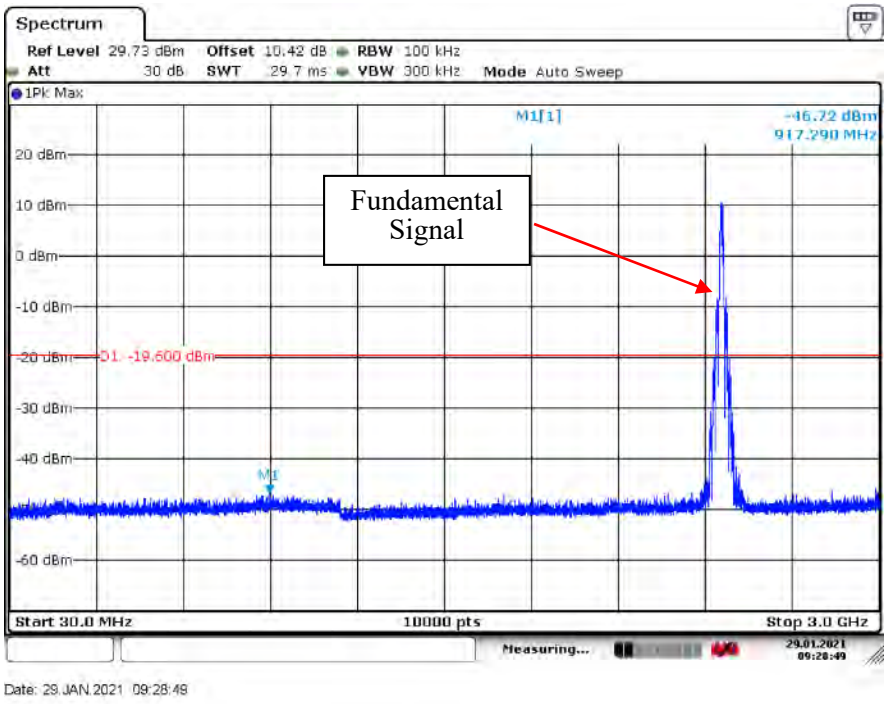


3GHz – 26GHz

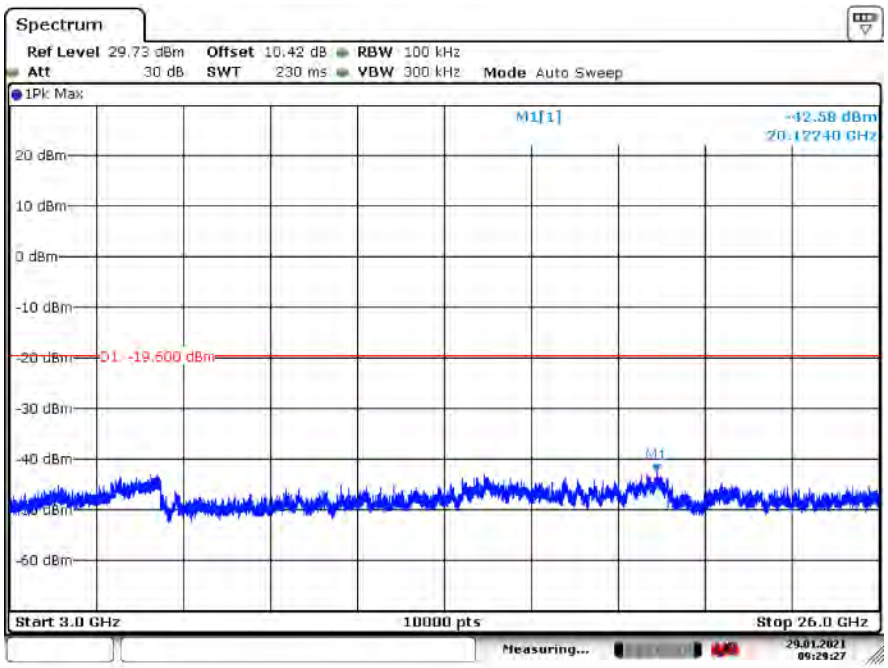


High Channel, 2462 MHz Antenna B

30MHz – 3GHz



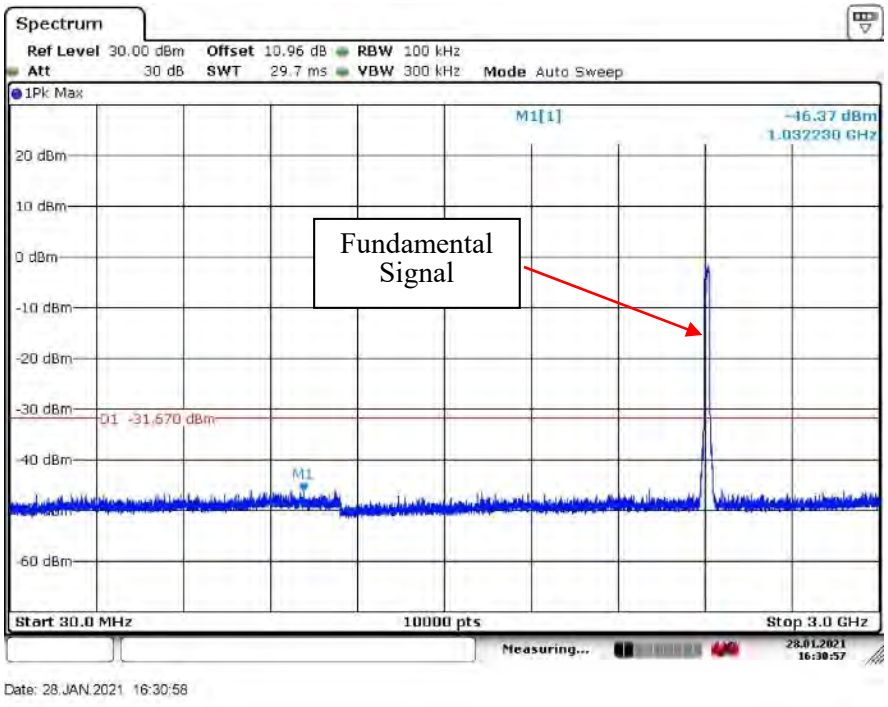
3GHz – 26GHz



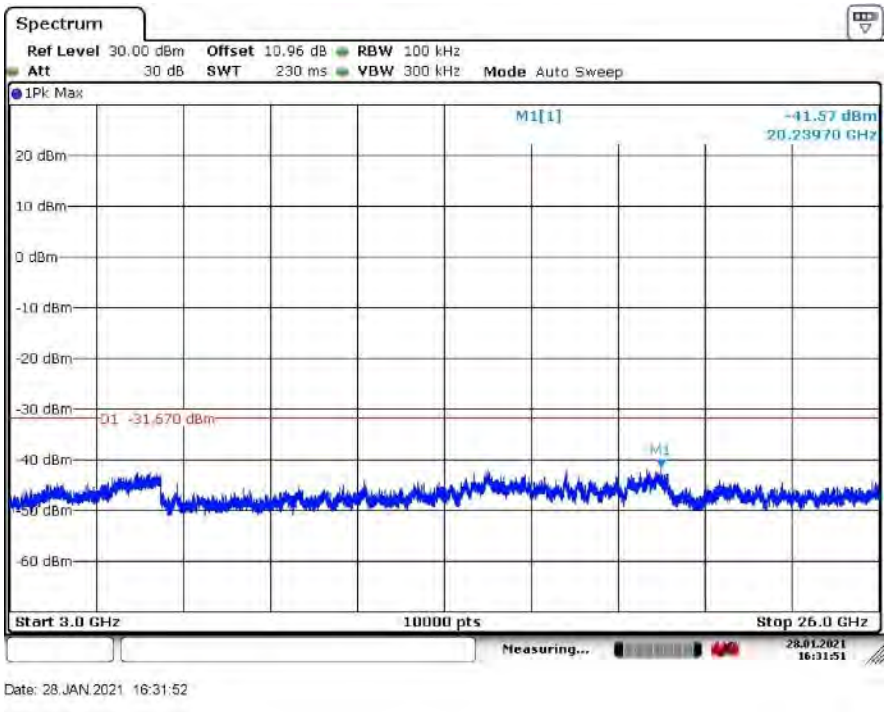
802.11g mode

Low Channel, 2412 MHz Antenna A

30MHz – 3GHz

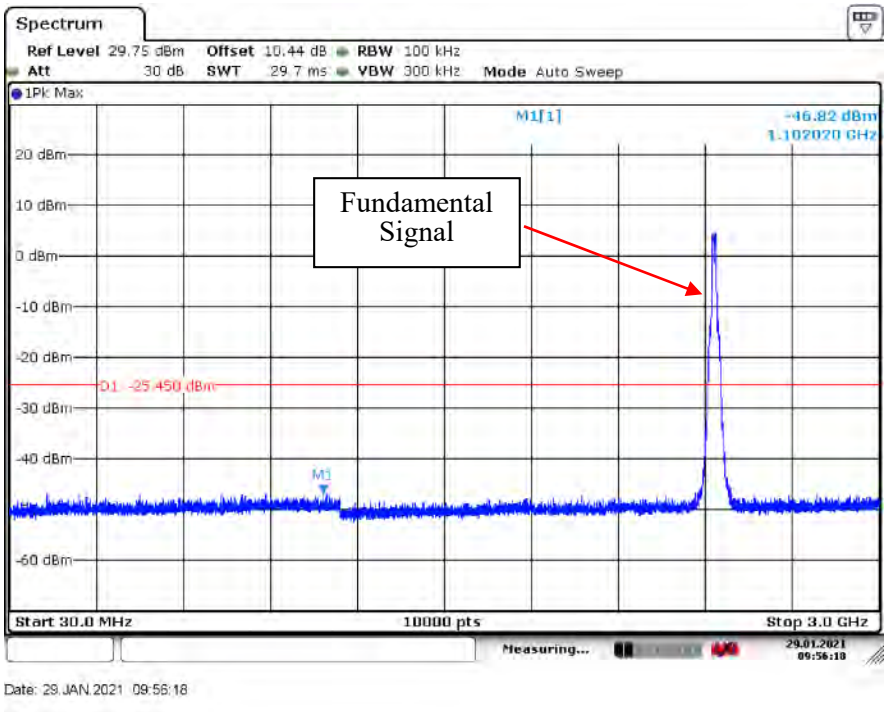


3GHz – 26GHz

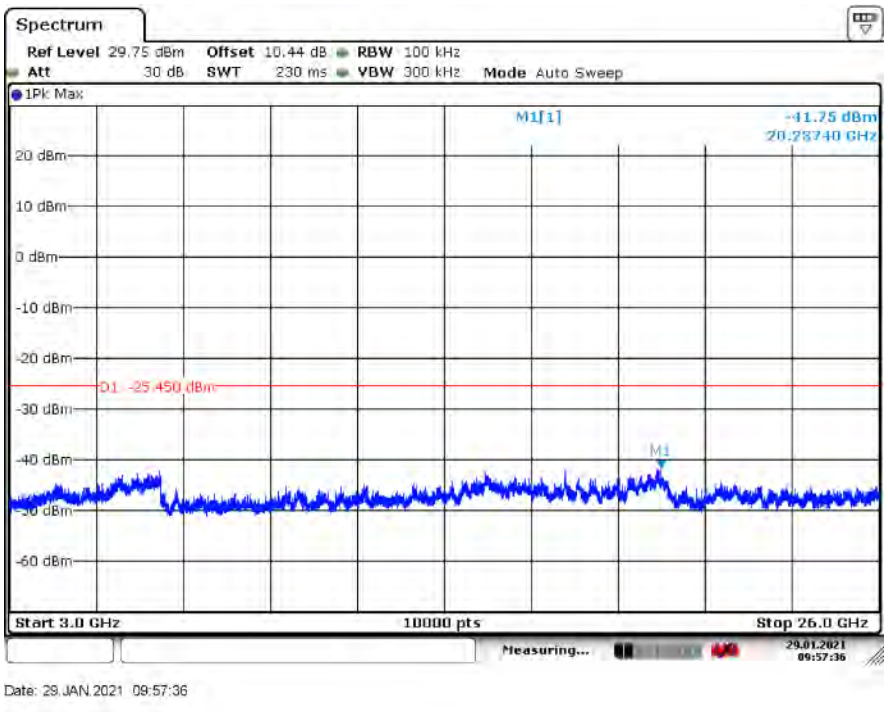


Mid Channel, 2437 MHz Antenna A

30MHz – 3GHz

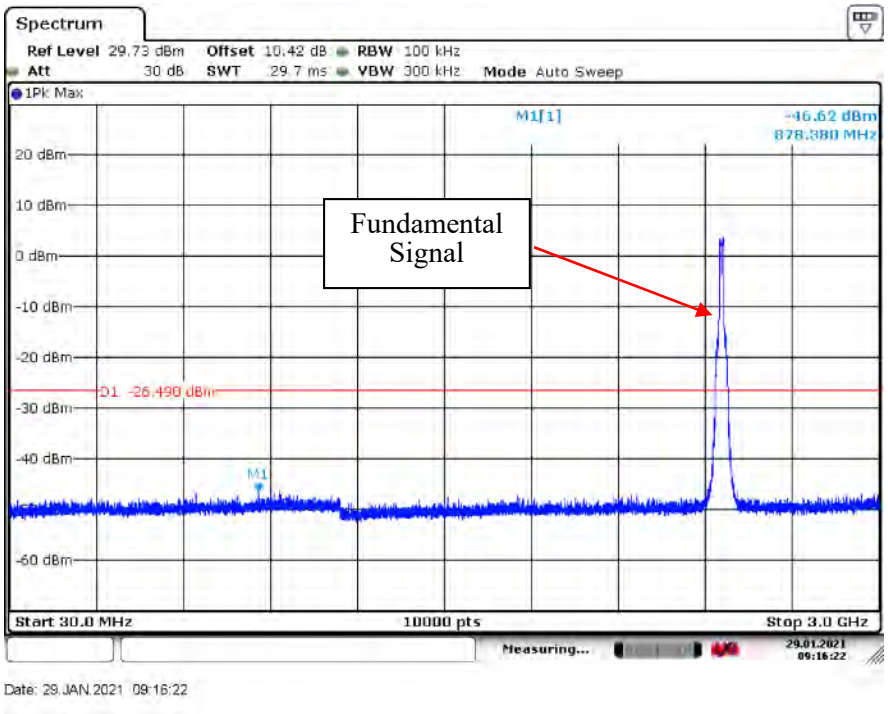


3GHz – 26GHz

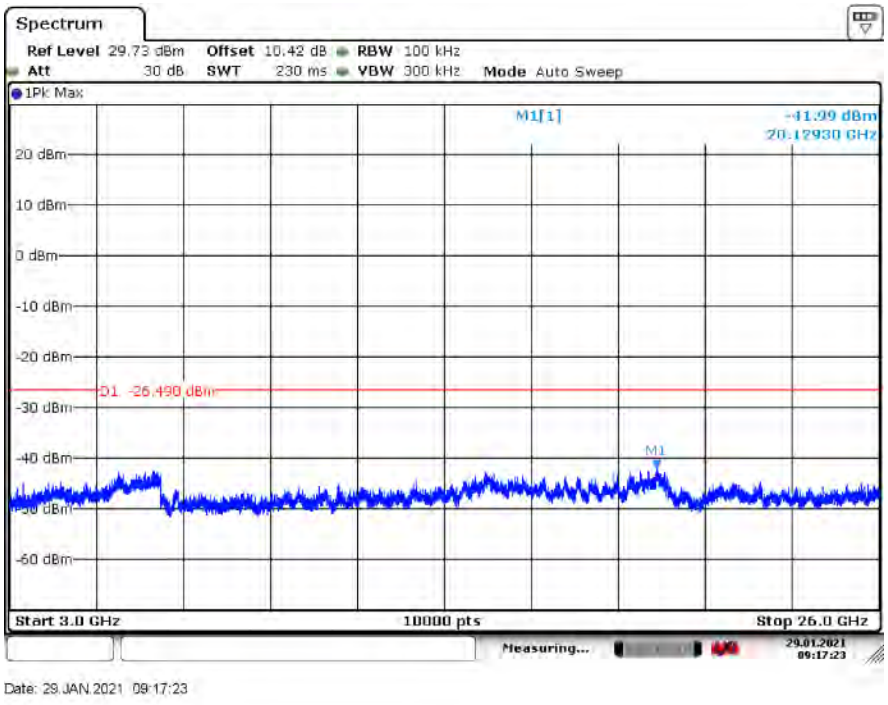


High Channel, 2462 MHz Antenna A

30MHz – 3GHz

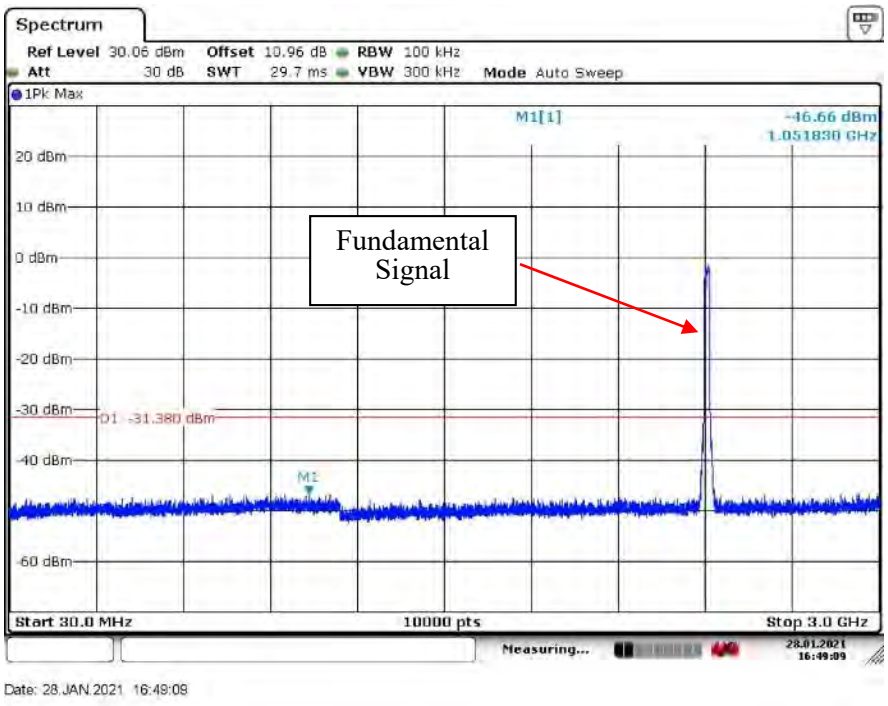


3GHz – 26GHz

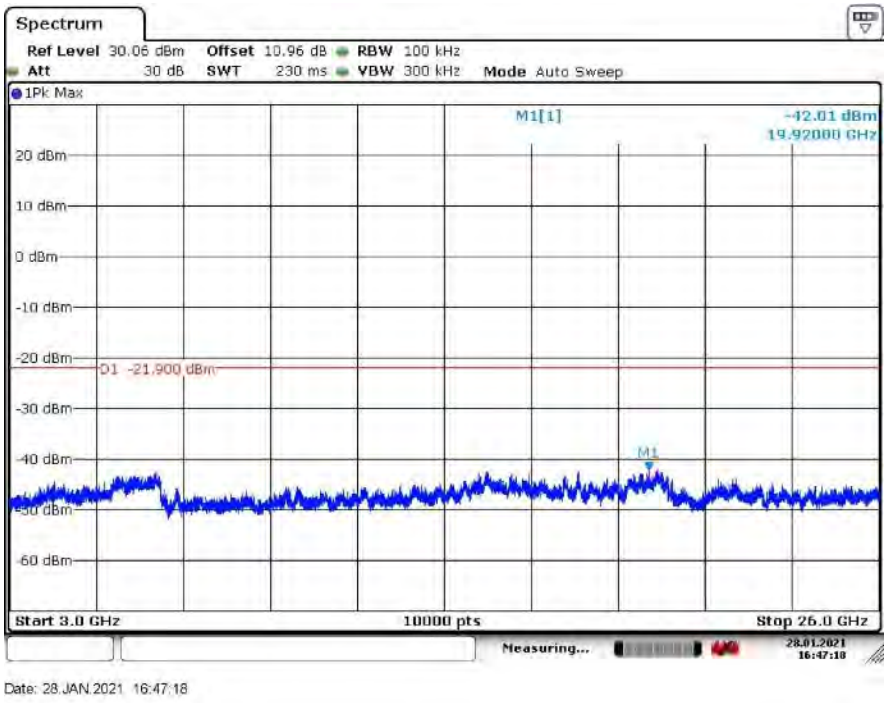


Low Channel, 2412 MHz Antenna B

30MHz – 3GHz

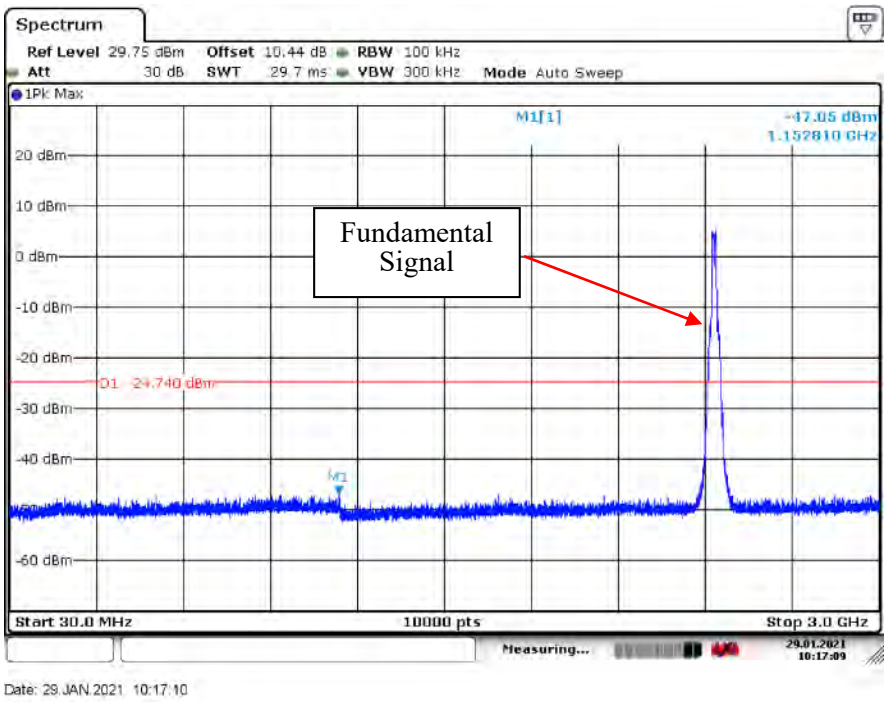


3GHz – 26GHz

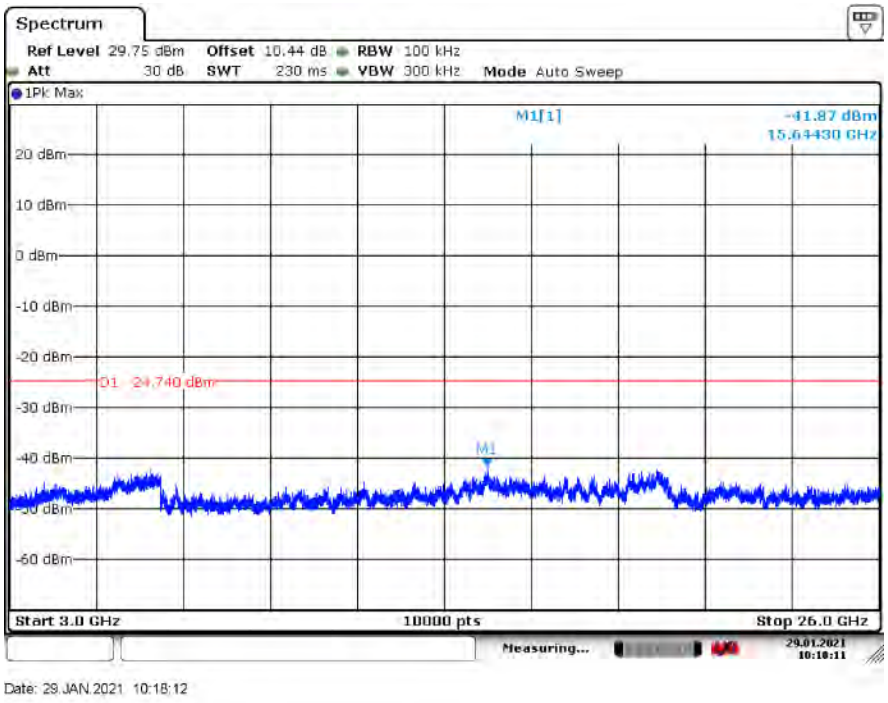


Mid Channel, 2437 MHz Antenna B

30MHz – 3GHz

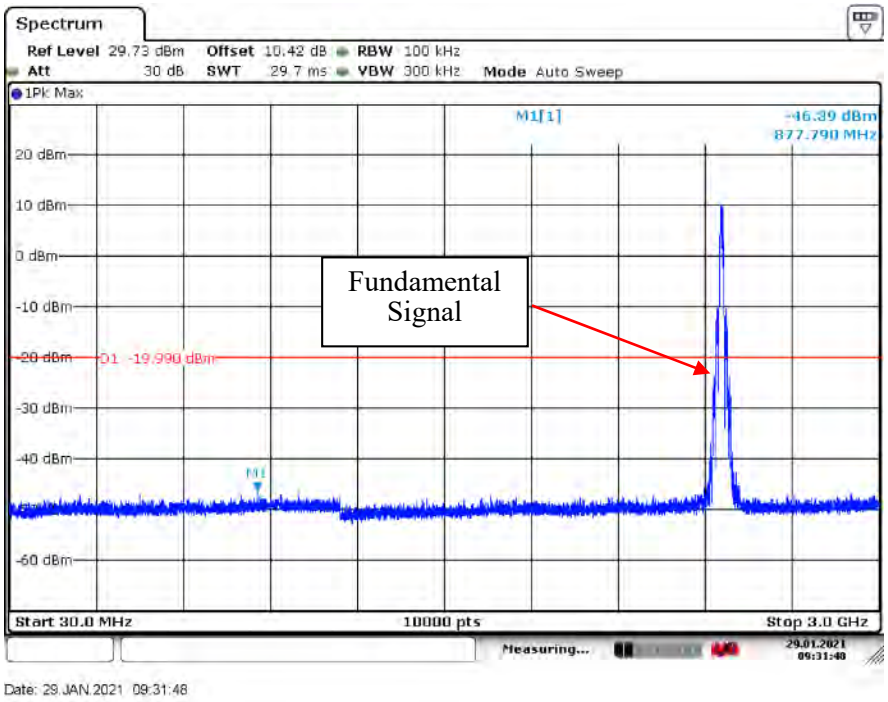


3GHz – 26GHz

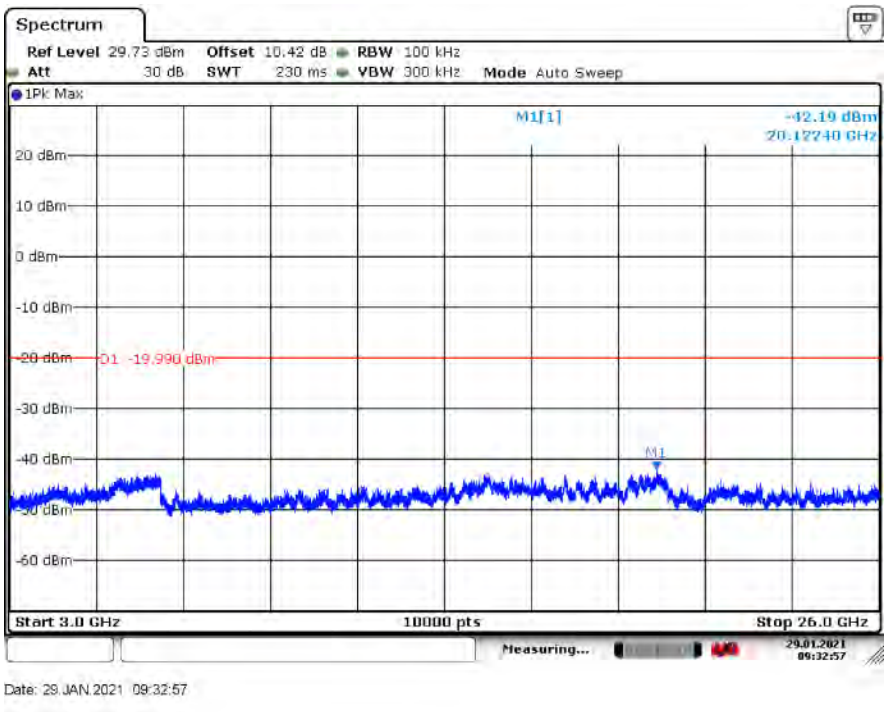


High Channel, 2462 MHz Antenna B

30MHz – 3GHz



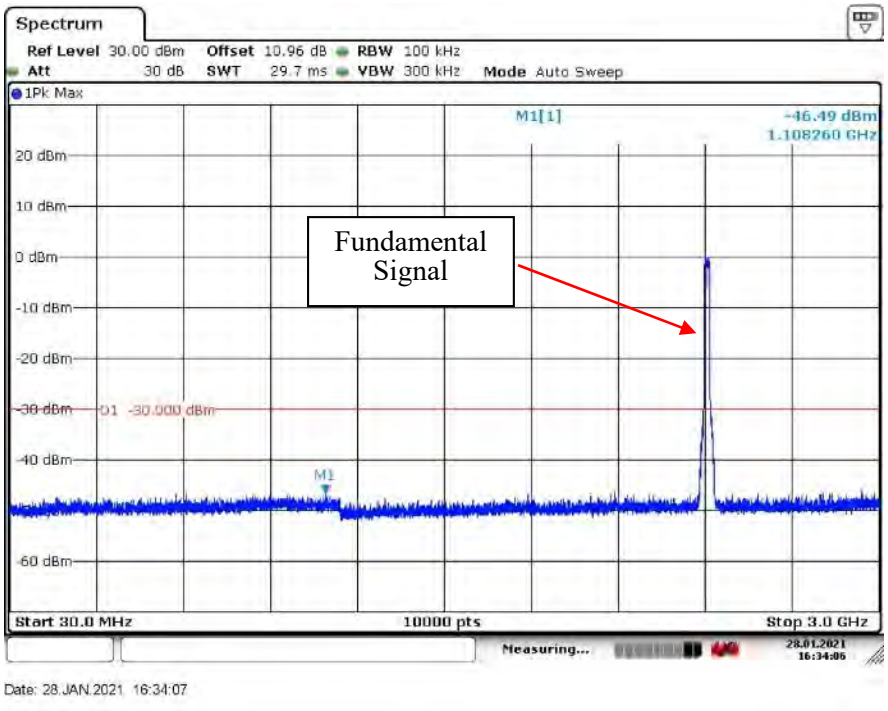
3GHz – 26GHz



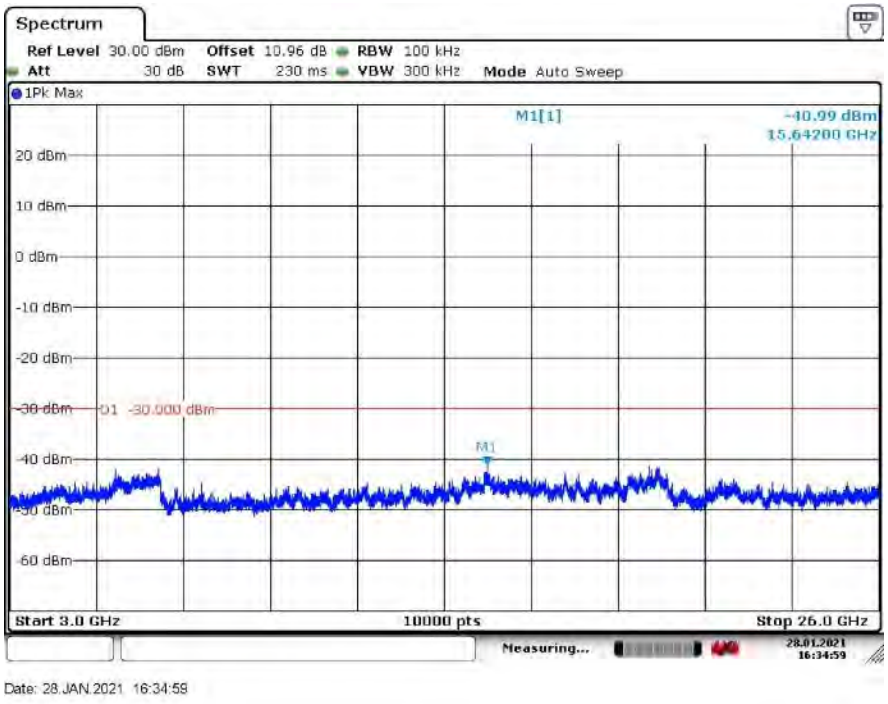
802.11 n20 mode

Low Channel, 2412 MHz Antenna A

30MHz – 3GHz

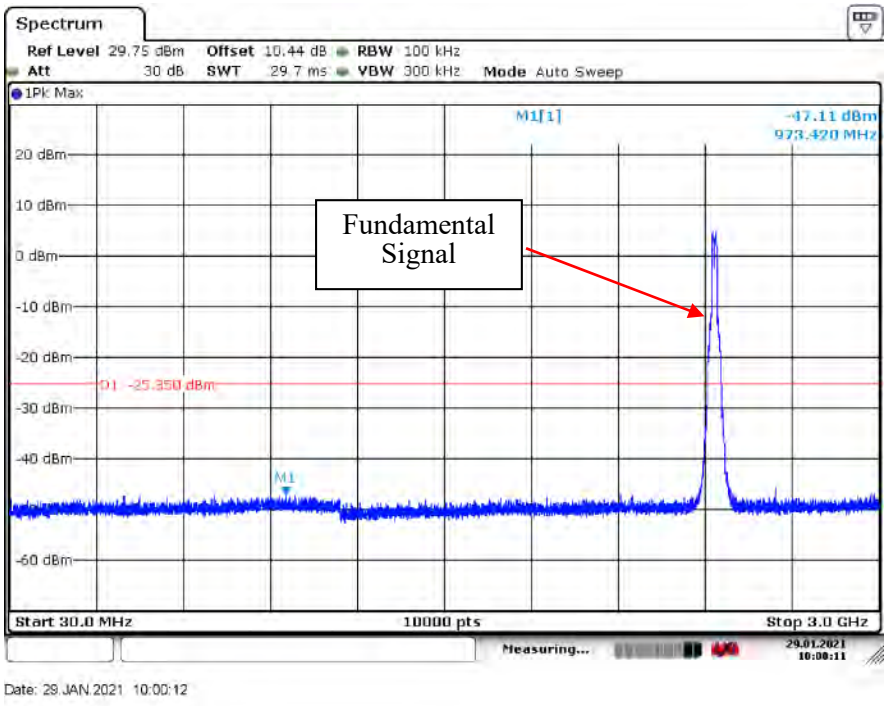


3GHz – 26GHz

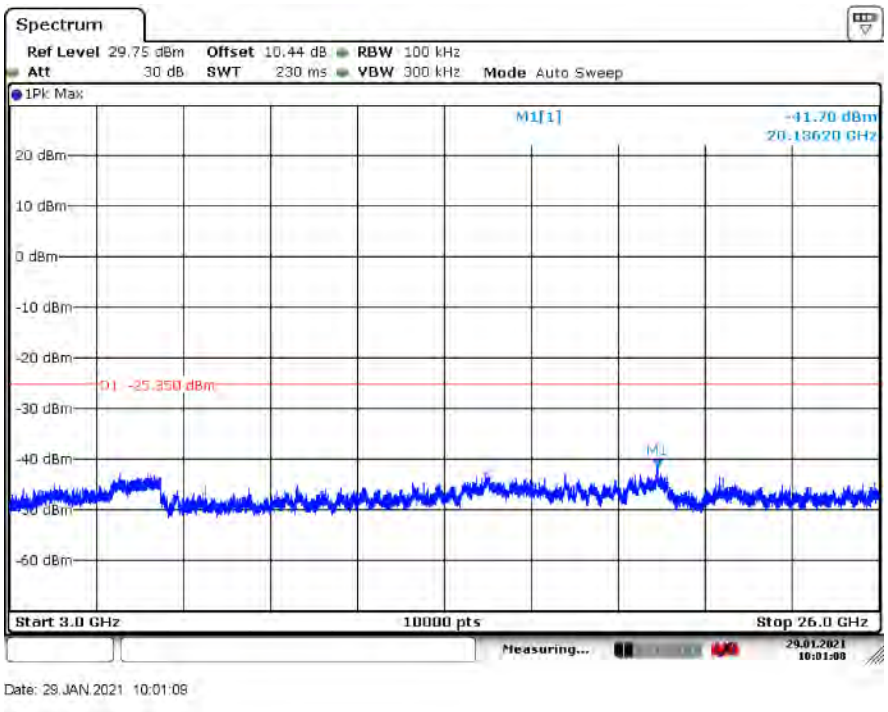


Mid Channel, 2437 MHz Antenna A

30MHz – 3GHz

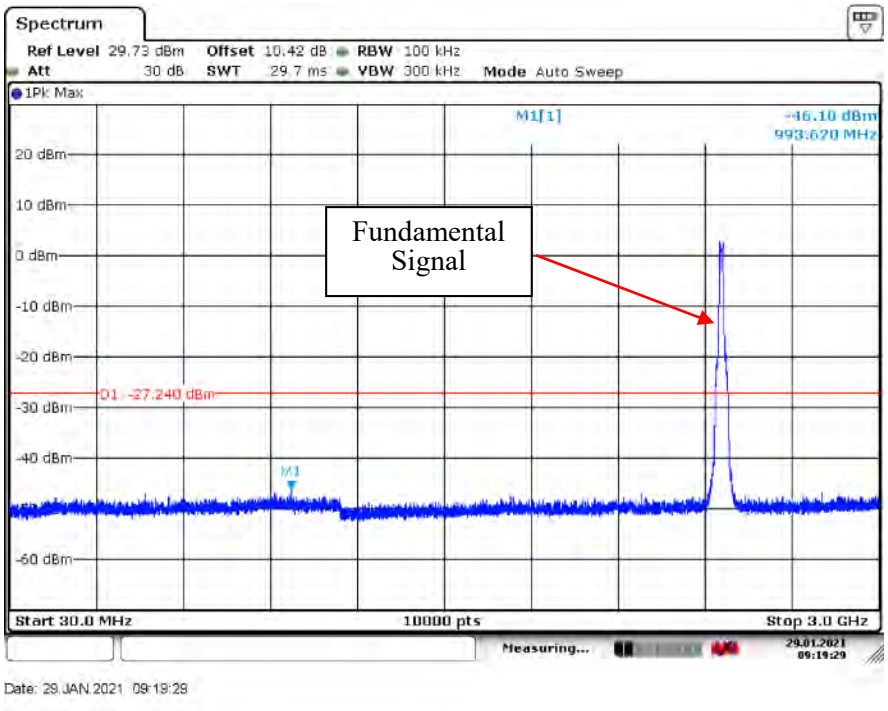


3GHz – 26GHz

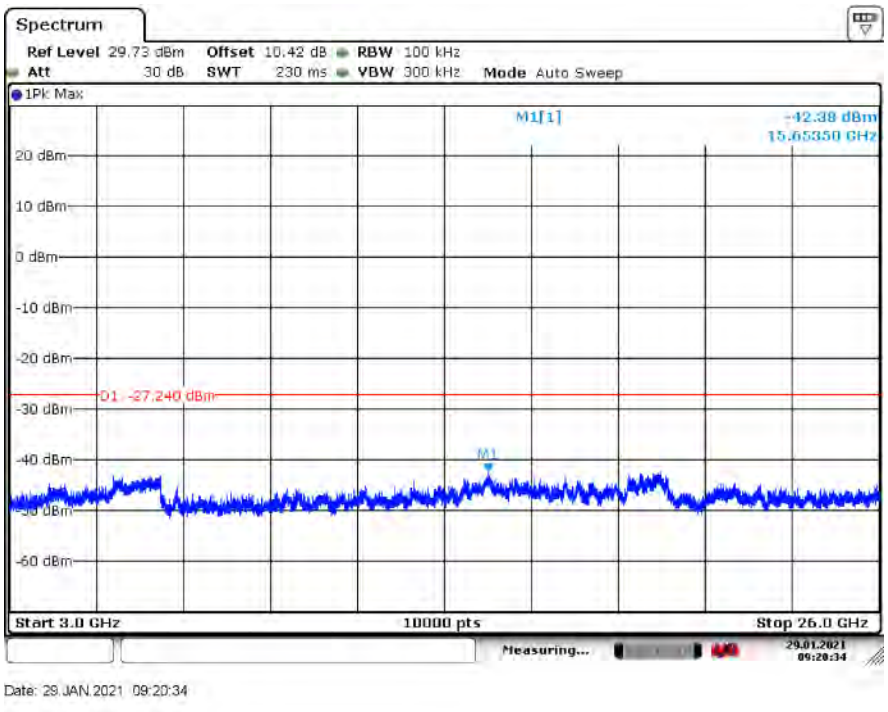


High Channel, 2462 MHz Antenna A

30MHz – 3GHz

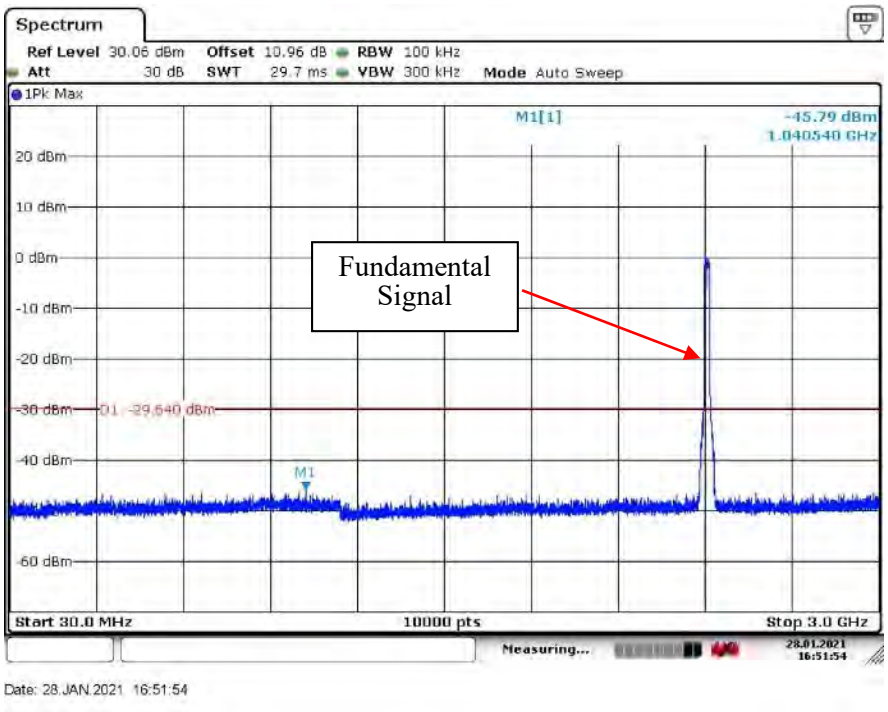


3GHz – 26GHz

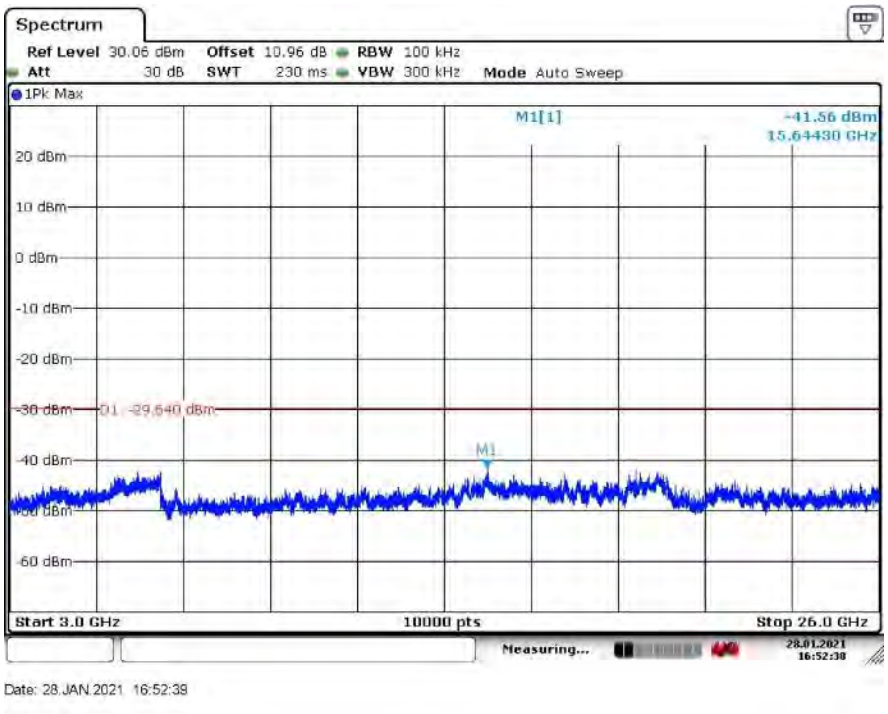


Low Channel, 2412 MHz Antenna B

30MHz – 3GHz

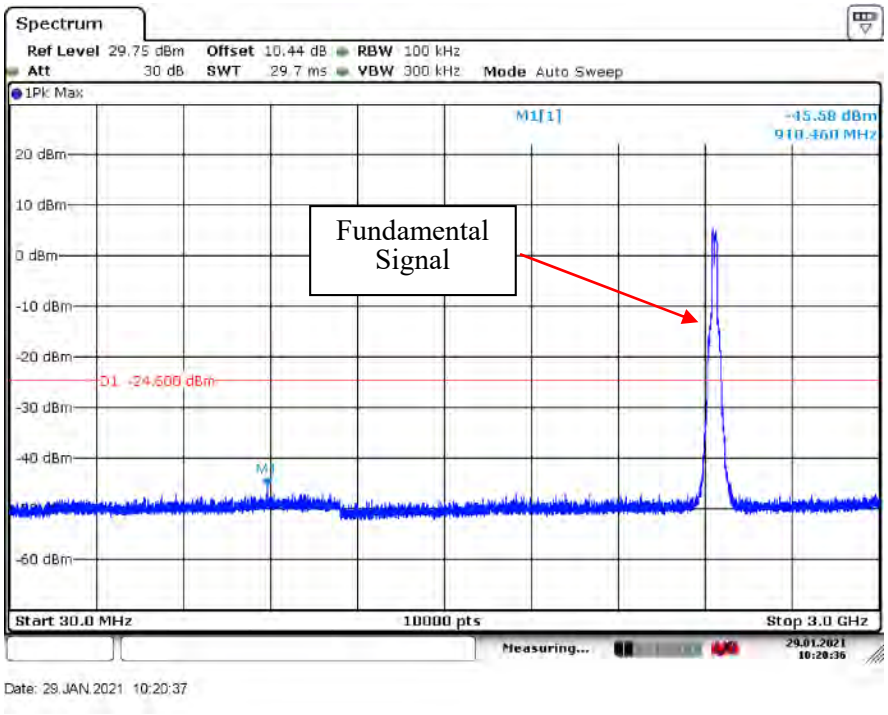


3GHz – 26GHz

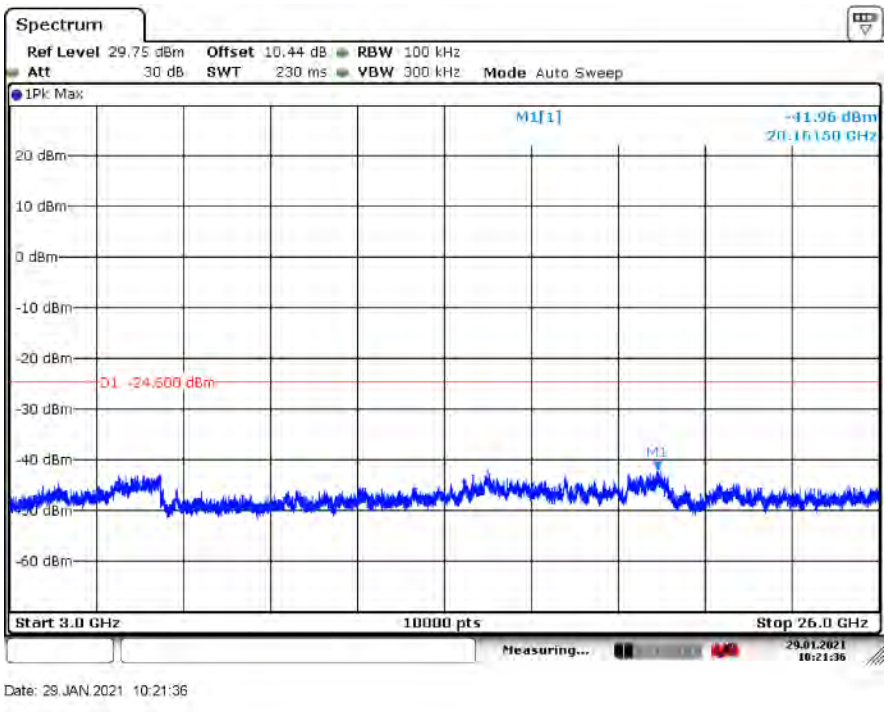


Mid Channel, 2437 MHz Antenna B

30MHz – 3GHz

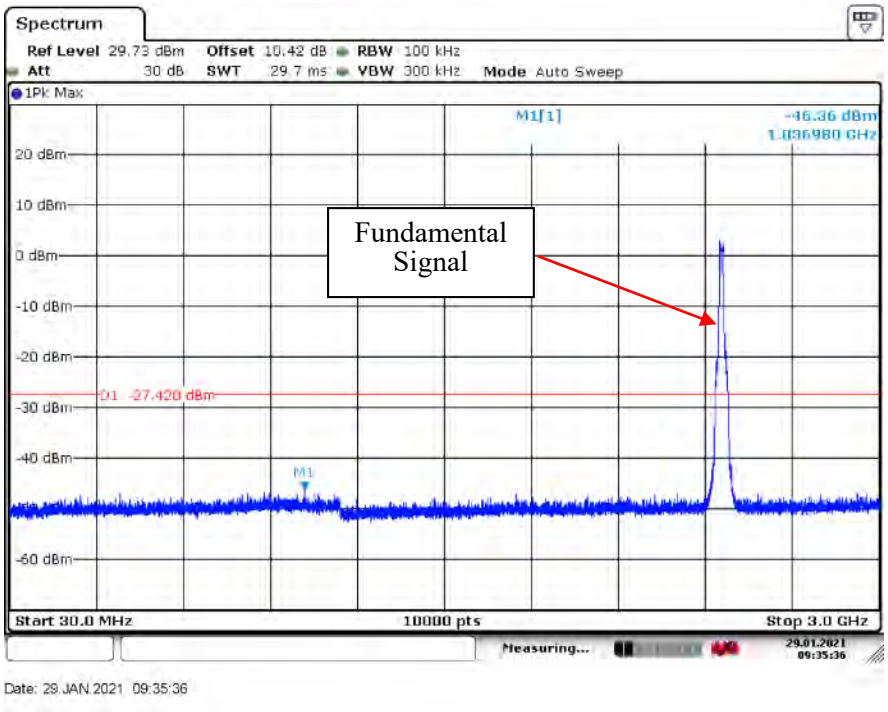


3GHz – 26GHz

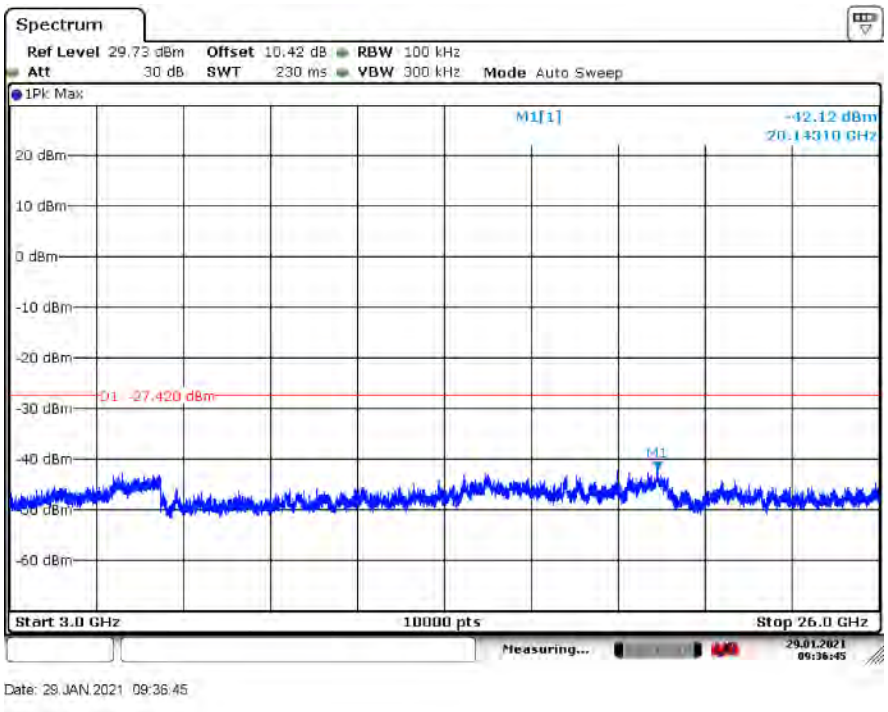


High Channel, 2462 MHz Antenna B

30MHz – 3GHz



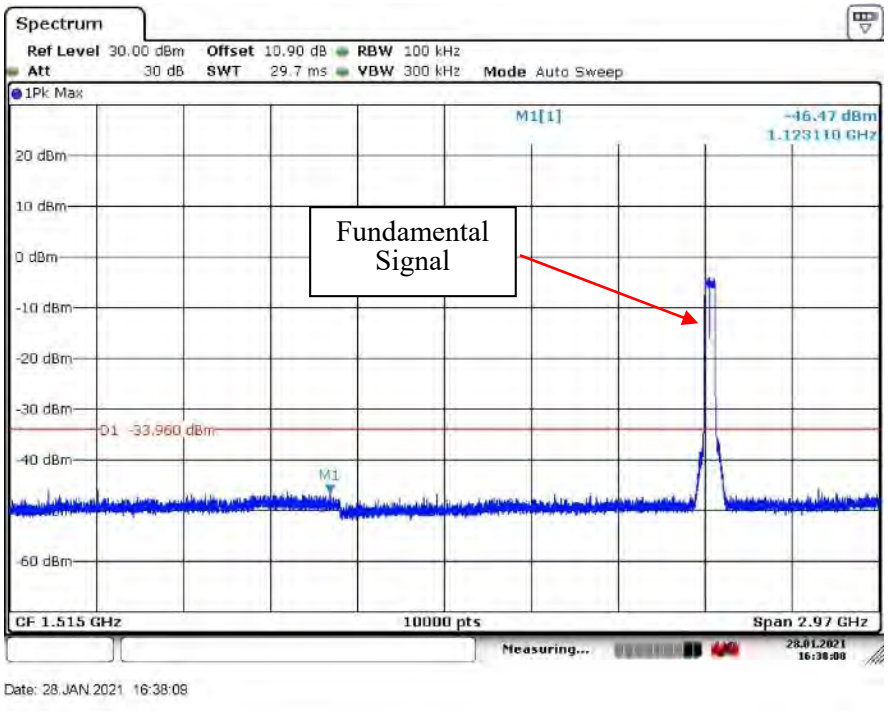
3GHz – 26GHz



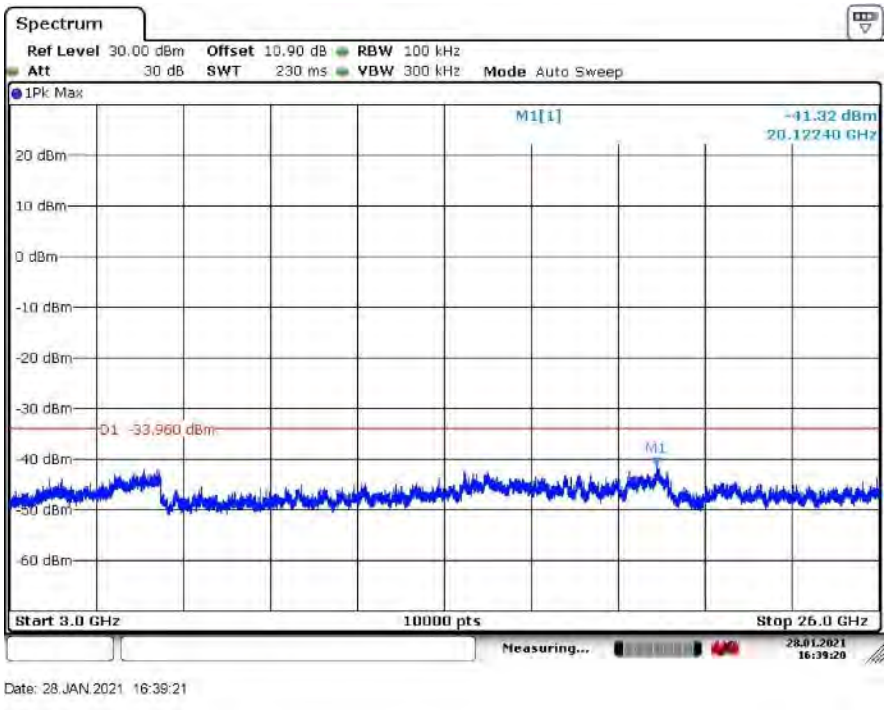
802.11 n40 mode

Low Channel, 2422 MHz Antenna A

30MHz – 3GHz

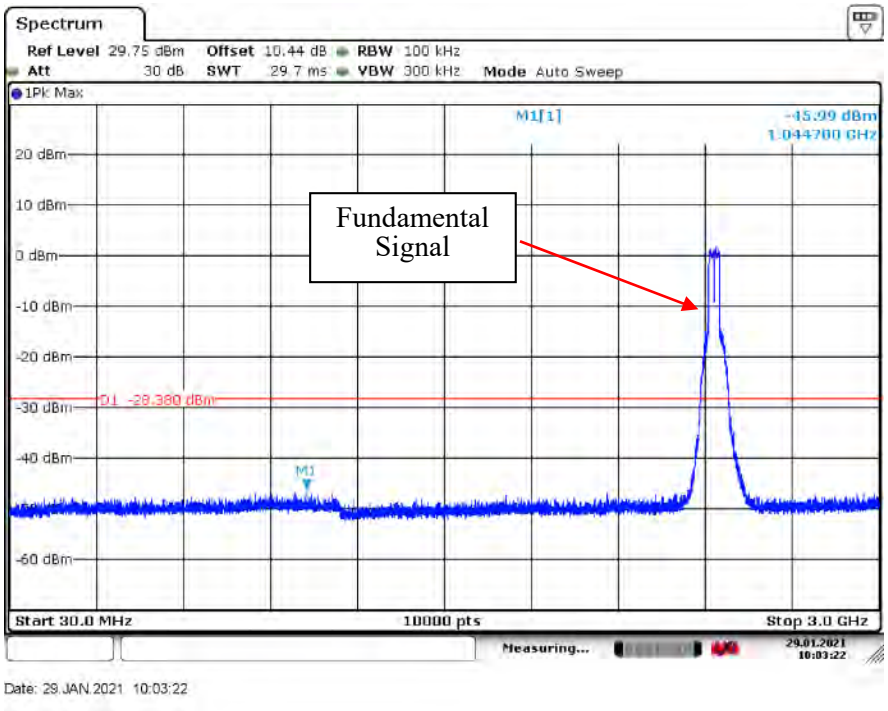


3GHz – 26GHz

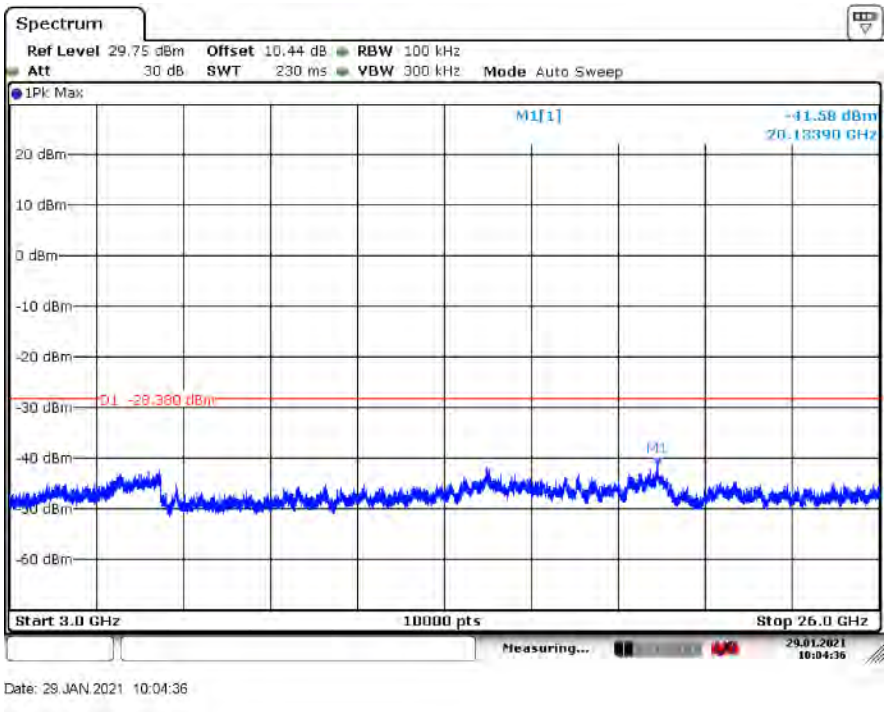


Mid Channel, 2437 MHz Antenna A

30MHz – 3GHz

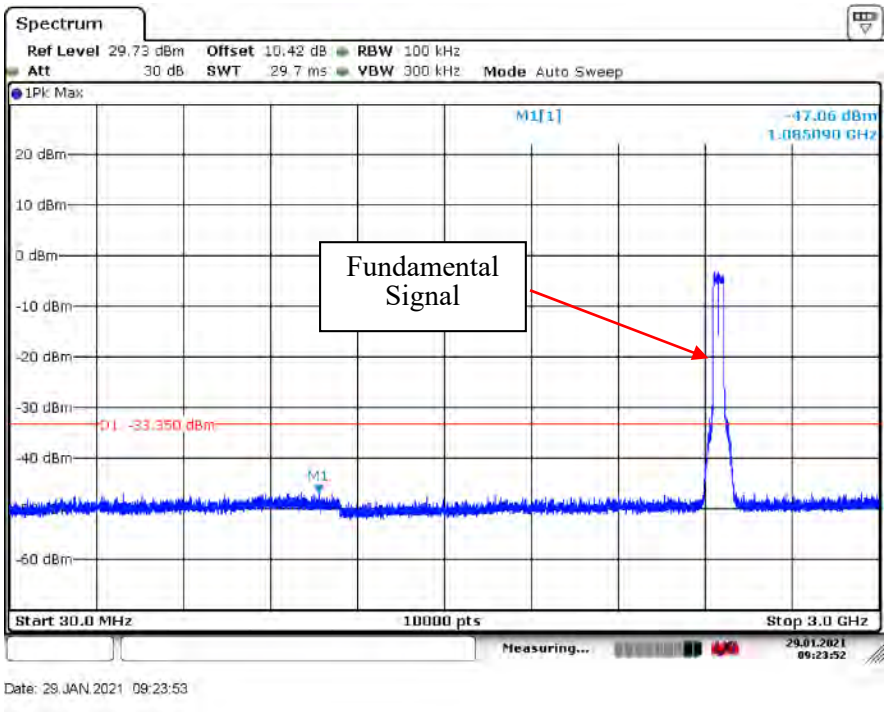


3GHz – 26GHz

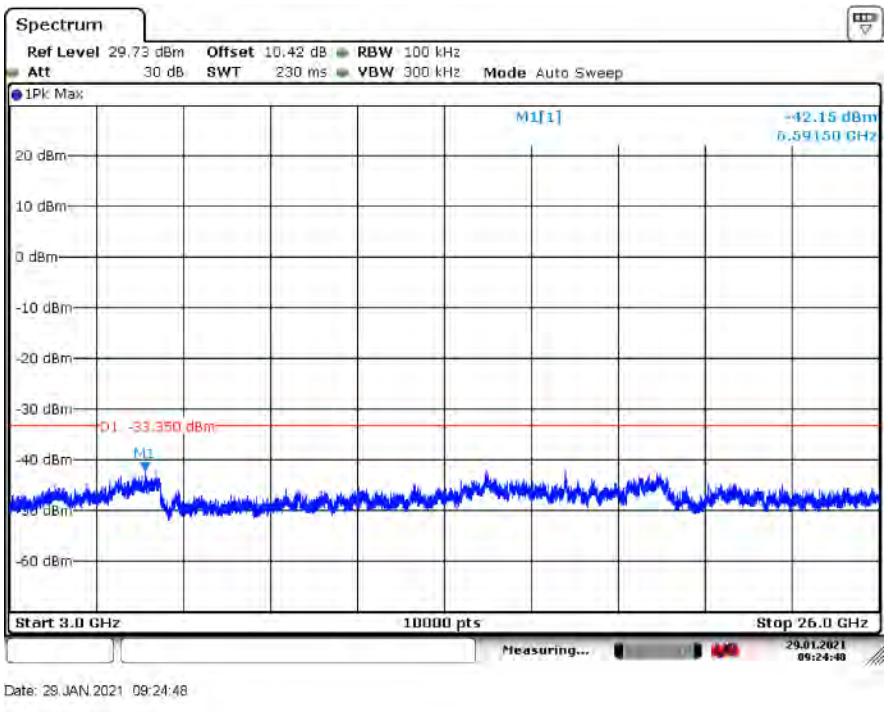


High Channel, 2452 MHz Antenna A

30MHz – 3GHz

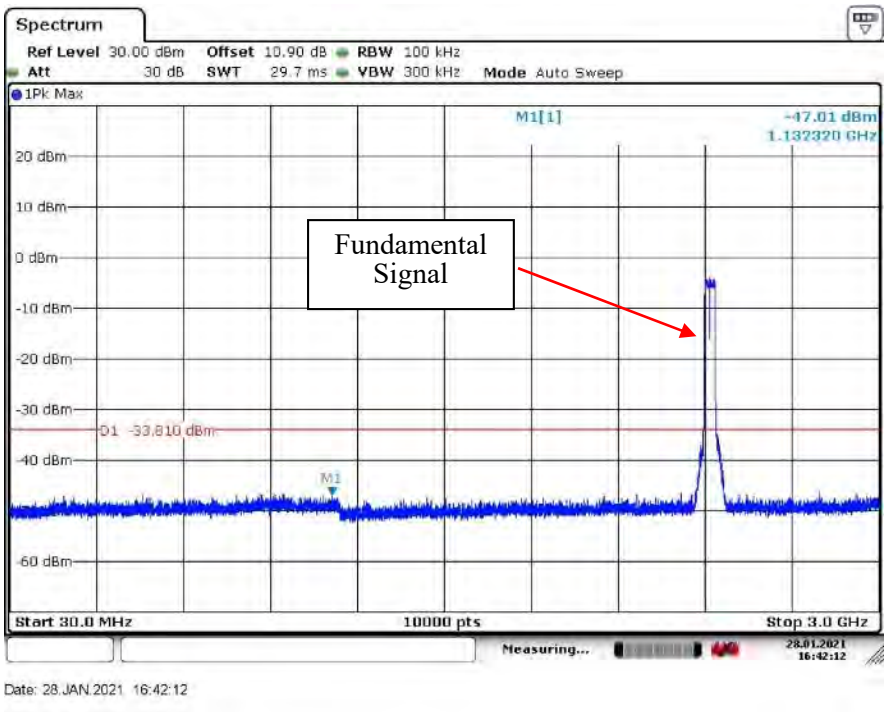


3GHz – 26GHz

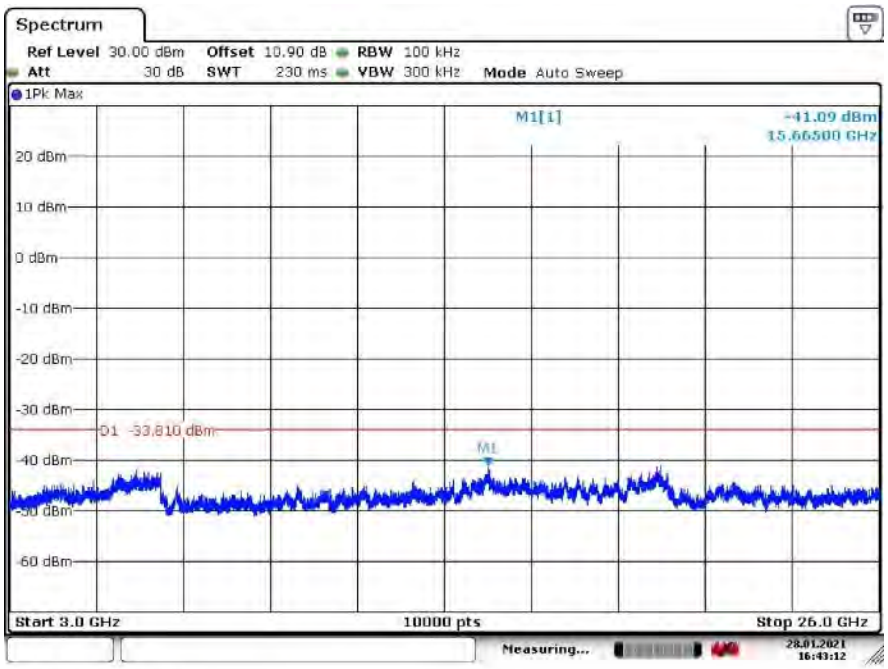


Low Channel, 2422 MHz Antenna B

30MHz – 3GHz

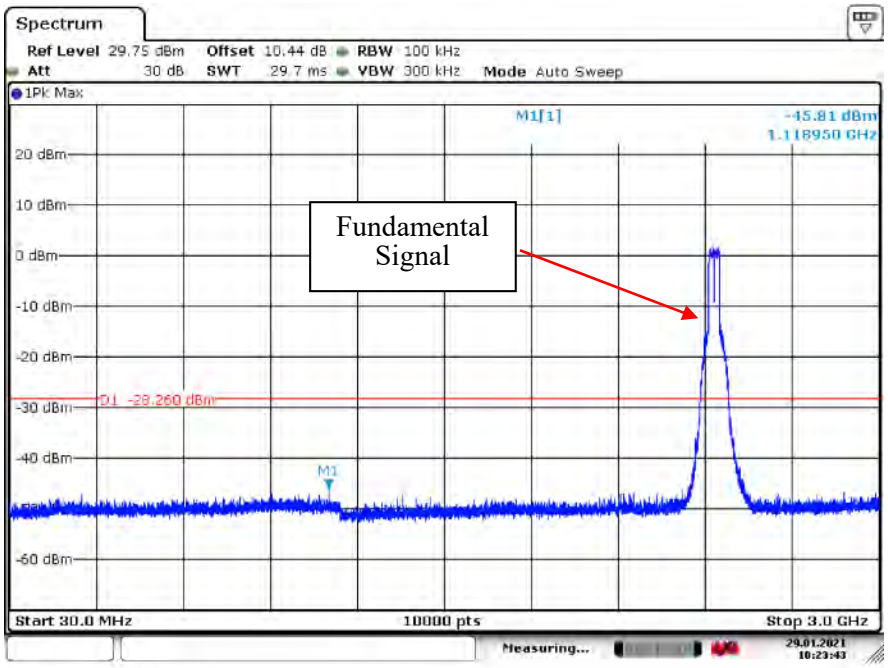


3GHz – 26GHz

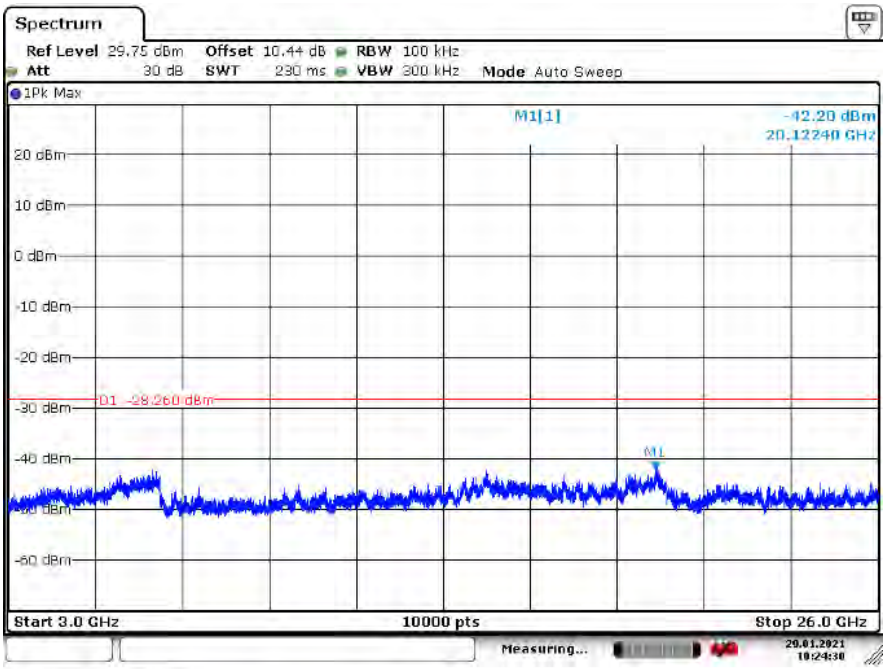


Mid Channel, 2437 MHz Antenna B

30MHz – 3GHz

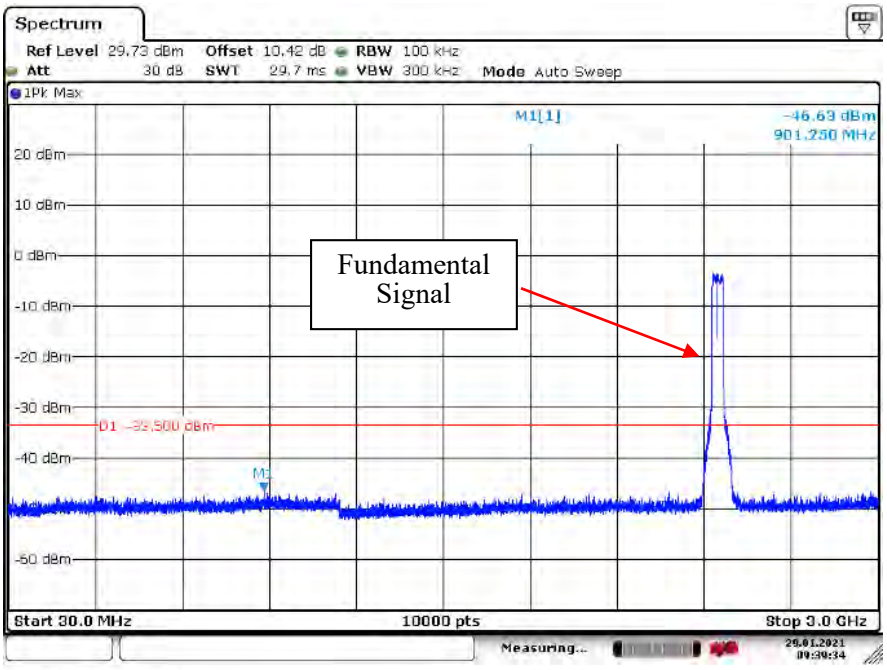


3GHz – 26GHz

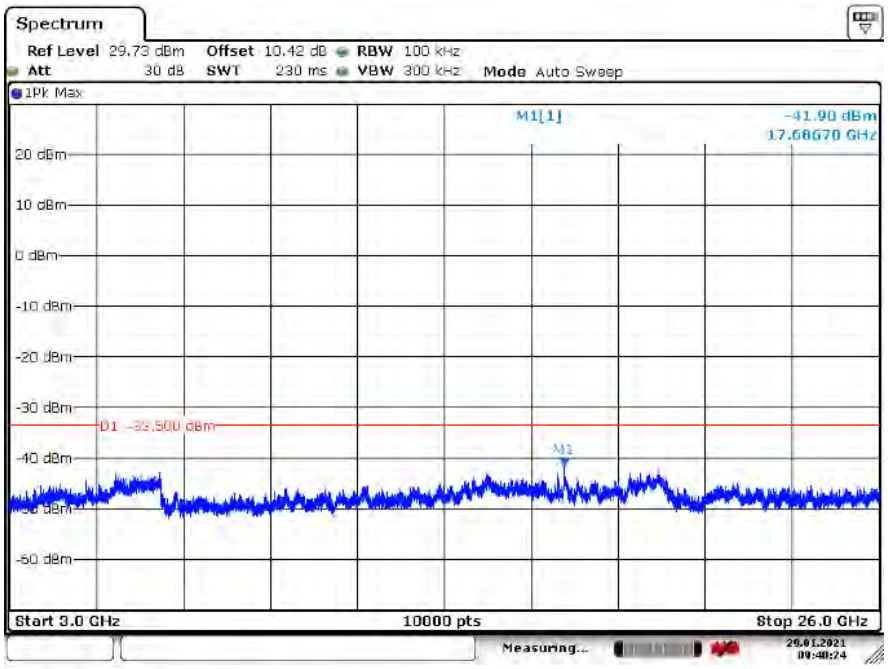


High Channel, 2452 MHz Antenna B

30MHz – 3GHz



3GHz – 26GHz


Spectrum
Ref Level 29.73 dBm Offset 10.42 dB RBW 100 kHz
Att 30 dB SWT 230 ms VBW 300 kHz Mode Auto Sweep
1Pk Max
M1[1] -41.90 dBm
17.68670 GHz
20 dBm
10 dBm
0 dBm
-10 dBm
-20 dBm
-30 dBm
D1 -32.500 dBm
-40 dBm
-50 dBm
M1
Start 3.0 GHz
10000 pts
Stop 26.0 GHz
Measuring...
29.01.2021
09:40:24
Date: 29.JAN.2021 09:40:24

13 Annex A (Normative) - EUT Test Setup Photographs

Please refer to the attachment.

14 Annex B (Normative) - EUT External Photographs

Please refer to the attachment.

15 Annex C (Normative) - EUT Internal Photographs

Please refer to the attachment.

16 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

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