FCC PART 15, SUBPART C

TEST AND MEASUREMENT REPORT

For

Silvus Technologies, Inc.

10990 Wilshire Blvd #1500
Los Angeles, CA 90024, USA

FCC ID: N2S-SL42-245

Report Type: Original Report		**Product Type:** SteamCaster Lite MIMO Radio
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Report Number:	R2209302-247	
Report Date:	2022-10-18	
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ACCREDITED
CERTIFICATE #3297.02

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2209302-247	Original Report	2022-10-18

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test report was prepared on behalf of *Silvus Technologies, Inc.* and their product model: *SL4210-235-SB* with FCC ID: N2S-SL42-245 The device will be referred to as the "EUT" throughout this report. It is a SteamCaster Lite MIMO Radio.

1.2 Mechanical Description of EUT

SL4210-235-SB measures approximately 145 mm (Length), 72 mm (Width), and 20 mm (Height) and weighs 0.90 kg

The data gathered are from production samples provided by Silvus Technologies, Inc. with serial number: SL42-00055876

1.3 Objective

This report was prepared on behalf of *Silvus Technologies, Inc.* in accordance with Part 2, Subpart J, and Part 15, Subpart C of the Federal Communication Commission's rules.

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

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

1.6 Measurement Uncertainty

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

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

1.7 Test Facility Registrations

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

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

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

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

1.8 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2017 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 17025:2017 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report.

BACL's ISO/IEC 17025:2017 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 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 in accordance to ANSI C63.10.

2.2 EUT Exercise Software

Putty was used to interface with EUT to send transmit commands for all modulations. The software used are compliant with the standard requirements being tested against. The following channels and power settings were selected for testing.

Channel Frequency (MHz)	Power Settings Tested
2412	59
2440	60
2462	61

2.3 Duty Cycle Correction Factor

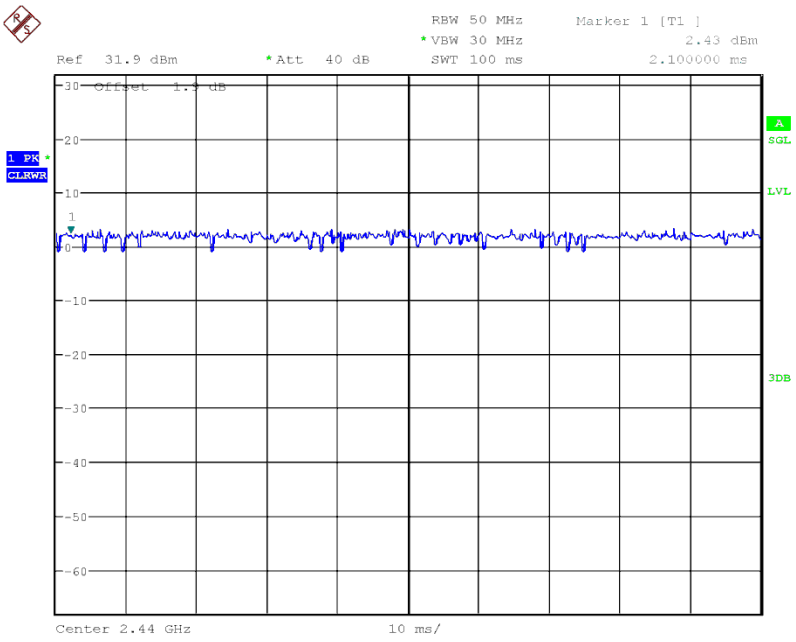
According to KDB 558074 D01 DTS Meas Guidance v05r02 section 6.0:

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 frequency (MHz)	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
2440	-	-	100	0

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

Please refer to the following plots.



2.4 Equipment Modifications

N/A

2.5 Local Support Equipment

N/A

2.6 Remote Support Equipment

Manufacturer	Description	Model
HP	Laptop	14-dq1037wm
Bren-Tronics, Inc.	Rechargeable Li-Ion Batteries	BT-70716BG

2.7 Interface Ports and Cabling

Cable Descriptions	Length (m)	From	To
SL42 Silvus Radio Hookup Cable	< 1 m	EUT	USB Extension and Battery Adapter
Battery Adapter	< 1 m	Battery Packs	SL42 Silvus Radio Hookup Cable
USB Extension	< 1 m	Laptop	SL42 Silvus Radio Hookup Cable

3 Summary of Test Results

Results reported relate only to the product tested.

FCC Rules	Description of Test	Results
FCC §15.203	Antenna Requirements	Compliant
FCC §2.1093, §15.247(i)	RF Exposure	Compliant
FCC §15.207	AC Line Conducted Emissions	N/A[1]
FCC §15.209, §15.247(d	Radiated Spurious Emissions	Compliant
FCC §15.247(a)(2)	6 dB & 99% Emission Bandwidth	Compliant
FCC §15.247(b)(3)	Maximum Output Power	Compliant
FCC §15.247(e)	Peak Power Spectral Density	Compliant
FCC §15.247(d)	100 kHz Bandwidth of Frequency Band Edge	Compliant
FCC §2.1051, §15.247 (d)	Spurious Emissions at Antenna Port	Compliant

Note[1]: Device is battery powered.

BACL is responsible for all the information provided in this report, except when information is provided by the customer as identified in this report. Information provided by the customer, e.g., antenna gain, can affect the validity of results.

4 FCC §15.203 - Antenna Requirements

4.1 Applicable Standards

According to FCC §15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

And according to FCC §15.247 (b) (4), if transmitting antennas of directional gain greater than 6 dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.2 Antenna Description

External/Internal/ Integral	Frequency Range (MHz)	Antenna Type	Maximum Antenna Gain (dBi)
External	2100-2500 MHz	Dipole	2.15
External	2100-2500 MHz	Dipole	2.15

Antenna gain is information provided by customer.

Antenna must be professionally installed (see customer's declaration in Annex D)

5 FCC §2.1091, §15.247(i) – RF Exposure

5.1 Applicable Standards

According to FCC KDB 447498 D04 Interim General RF Exposure Guidance v01, Section 2.1 RF Exposure Test Exemptions for Single Source,

2.1.1 General RF Exposure Test Exemption Considerations

RF exposure test exemptions provide means to obtain certification without the need of showing data (measurements, or analytical/numerical modeling) to demonstrate compliance. Hereafter, in this context, an RF source is referred to as "*exempt RF device*" in the sense that it is not required to show data demonstrating compliance to RF exposure limits.

Test exemptions apply for devices used in general population/uncontrolled exposure environments, according to the SAR-based, or MPE-based exemption thresholds.[8] However, it is always possible, especially when the potential for exposure cannot be easily determined, that an RF exposure evaluation may become required according §§ 1.1307(c) and (d).

As detailed in Section 2.1.2, the 1 mW and SAR-based test exemption conditions are in terms of source-based available maximum time-averaged (matched conducted) output power for all operating configurations, adjusted for tune-up tolerance, and at the minimum *test separation distance* required for the particular RF exposure scenario under consideration. This minimum *test separation distance* is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander. To qualify for SAR test exemption, the *test separation distances* applied must be fully explained and justified (typically in the SAR measurement, or SAR analysis report, according to KDB Pub. 865664) by showing the actual operating configurations and exposure conditions of the transmitter, and applicable host platform requirements (e.g., KDB Pubs. 648474, 616217, 941225)

When no other RF exposure testing or reporting is required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for SAR test exemption.

If RF exposure testing requirements for a specific device are covered in a KDB Publication, those requirements must be satisfied before applying any SAR test exemption provisions. For example, this is the case for handheld PTT two-way radios, handsets, laptops, and tablets, etc.[9]

Finally, when 10-g extremity SAR applies, SAR test exemption may be considered by applying a factor of 2.5 to the SAR-based exemption thresholds.

2.1.2 1-mW Test Exemption

Per §1.1307(b)(3)(i)(A), a single RF source is *exempt RF device* (from the requirement to show data demonstrating compliance to RF exposure limits, as previously mentioned) if the available maximum time-averaged power is no more than 1 mW, regardless of separation distance.

This exemption applies to all operating configurations and exposure conditions, for the frequency range 100 kHz to 100 GHz, regardless of fixed, mobile, or portable device exposure conditions. This is a standalone exemption, and it cannot be applied in conjunction with any other test exemption.

2.1.3 SAR-Based Exemption

A more comprehensive exemption, considering a variable power threshold that depends on both the *separation distance* and power, is provided in §1.1307(b)(3)(ii)(B). This exemption is applicable to the frequency range between 300 MHz and 6 GHz, with *test separation distances* between 0.5 cm and 40 cm, and for all RF sources in fixed, mobile, and portable device exposure conditions.

Accordingly, a RF source is considered an *RF exempt device* if its available maximum time-averaged (matched conducted) power or its effective radiated power (ERP), whichever is greater, are below a specified threshold. This exemption threshold was derived based on general population 1-g SAR requirements and is detailed in Appendix C.

2.1.4 MPE-Based Exemption

An alternative to the SAR-based exemption is provided in §1.1307(b)(3)(ii)(C), for a much wider frequency range, from 300 kHz to 100 GHz, applicable for separation distances greater or equal to $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. The MPE-based test exemption condition is in terms of ERP, defined as the

[8] Specific test exemption thresholds for operations under occupational/controlled limits are not established.
[9] When SAR evaluation is required by the hotspot mode or UMPC mini-tablet procedures, that is, where an antenna is ≤ 2.5 cm from a surface or edge, the *test separation distance* from the phantom to the antenna or device enclosure, as appropriate, should be applied to determine SAR test exemption for such configurations, according to the criteria in this document. For that case, the *test separation distance* cannot be determined from the distance of the antenna to the device surface or edge.

5.2 FCC RF Exposure Exemption Evaluation Procedures

According to FCC KDB 447498 D04 Interim General RF Exposure Guidance v01, Annex B Exemptions for Single Source,

B.1 General

This appendix provides the exemption criteria and summarizes relevant parameters and usage considerations based on descriptions in FCC 19-126.

B.2 Blanket 1 mW Blanket Exemption

The 1 mW Blanket Exemption of § 1.1307(b)(3)(i)(A) applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power of no more than 1 mW, regardless of separation distance. The 1 mW blanket exemption applies at separation distances less than 0.5 cm, including where there is no separation. This exemption shall not be used in conjunction with other exemption criteria other than those for multiple RF sources in paragraph § 1.1307(b)(3)(ii)(A). The 1 mW exemption is independent of service type and covers the full range of 100 kHz to 100 GHz, but it shall not be used in conjunction with other exemption criteria or in devices with higher-power transmitters operating in the same time-averaging period. Exposure from such higher-power transmitters would invalidate the underlying assumption that exposure from the lower-power transmitter is the only contributor to SAR in the relevant volume of tissue.

B.3 MPE-based Exemption

General frequency and separation-distance dependent MPE-based effective radiated power (ERP) thresholds are in Table B.1 [Table 1 of § 1.1307(b)(1)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

Table B.1 – THRESHOLD FOR SINGLE RF SOURCE SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

RF Source			Minimum Distance			Threshold ERP
f_L MHz		f_H MHz	$\lambda_L/2\pi$		$\lambda_H/2\pi$	W
0.3	-	1.34	159 m	-	35.6 m	1,920 R^2
1.34	-	30	35.6 m	-	1.6 m	3,450 R^2/f^2
30	-	300	1.6 m	-	159 mm	3.83 R^2
300	-	1,500	159 mm	-	31.8 mm	0.0128 $R^2 f$
1,500	-	100,000	31.8 mm	-	0.5 mm	19.2 R^2
Subscripts L and H are low and high; λ is wavelength. From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.						

The table applies to any RF source (i.e., single fixed, mobile, and portable transmitters) and specifies power and distance criteria for each of the five frequency ranges used for the MPE limits. These criteria apply at separation distances from any part of the radiating structure of at least $\lambda/2\pi$. The thresholds are based on the general population MPE limits with a single perfect reflection, outside of the reactive near-field, and in the main beam of the radiator.

For mobile devices that are not exempt per Table B.1 [Table 1 of § 1.1307(b)(1)(i)(C)] at distances from 20 cm to 40 cm and in 0.3 GHz to 6 GHz, evaluation of compliance with the exposure limits in § 1.1310 is necessary if the ERP of the device is greater than ERP20cm in Formula (B.1) [repeated from § 2.1091(c)(1) and § 1.1307(b)(1)(i)(B)].

$$P_{th}\,(\text{mW}) = ERP_{20\,\text{cm}}\,(\text{mW}) = 2040f \quad 0.3\ \text{GHz} \le f < 1.5\ \text{GHz}$$
$$P_{th}\,(\text{mW}) = ERP_{20\,\text{cm}}\,(\text{mW}) = 3060 \quad 1.5\ \text{GHz} \le f \le 6\ \text{GHz} \qquad \text{(B.1)}$$

If the ERP is not easily obtained, then the available maximum time-averaged power may be used (i.e., without consideration of ERP only if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole.

SAR-based exemptions are constant at separation distances between 20 cm and 40 cm to avoid discontinuities in the threshold when transitioning between SAR-based and MPE-based exemption criteria at 40 cm, considering the importance of reflections.

B.4 SAR-based Exemption

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the applicant may use the available maximum time-averaged power exclusively if the device antenna or radiating structure does not exceed an electrical length of $\lambda/4$.

As for devices with antennas of length greater than $\lambda/4$ where the gain is not well defined, but always less than that of a half-wave dipole (length $\lambda/2$), the available maximum time-averaged power generated by the device may be used in place of the maximum time-averaged ERP, where that value is not known.

The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.

The SAR-based exemption formula of § 1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by Formula (B.2).

$$P_{th}\ (\text{mW}) = ERP_{20\ \text{cm}}\,(d/20\ \text{cm})^{x} \quad d \leq 20\ \text{cm}$$
$$P_{th}\ (\text{mW}) = ERP_{20\ \text{cm}} \quad 20\ \text{cm} < d \leq 40\ \text{cm} \qquad \text{(B.2)}$$

Where

$$x = -\log_{10}\,(60/(ERP_{20\ \text{cm}}\sqrt{f}))$$

and f is in GHz, d is the separation distance (cm), and EPR20cm is per Formula (B.1).

The example values shown in Table B.2 are for illustration only.

Table B.2 – Example Power Thresholds (mW)

Frequency (MHz)	Distance (mm)										
		5	10	15	20	25	30	35	40	45	50
	300	39	65	88	110	129	148	166	184	201	217
	450	22	44	67	89	112	135	158	180	203	226
	835	9	25	44	66	90	116	145	175	207	240
	1900	3	12	26	44	66	92	122	157	195	236
	2450	3	10	22	38	59	83	111	143	179	219
	3600	2	8	18	32	49	71	96	125	158	195
	5800	1	6	14	25	40	58	80	106	136	169

5.3 RF exposure evaluation exemption for FCC

<table>
<tr><td colspan="2">Prediction frequency (GHz)</td><td colspan="3">2.462</td></tr>
<tr><td colspan="2">Maximum output power (dBm)</td><td colspan="3">29.86</td></tr>
<tr><td colspan="2">Maximum ERP (dBm)</td><td colspan="3">32.87</td></tr>
<tr><td colspan="2">Maximum ERP (mW)</td><td colspan="3">1936.42</td></tr>
<tr><td colspan="2">Prediction distance (cm)</td><td colspan="3">20</td></tr>
<tr><td colspan="2">Maximum antenna gain (dBi)</td><td colspan="3">5.16[1]</td></tr>
<tr><td rowspan="5">0.3 GHz ≤ f < 1.5 GHz</td><td>ERP_{20 cm} (mW)</td><td>x</td><td colspan="2">MPE-based Exemption Threshold</td></tr>
<tr><td rowspan="4">-</td><td rowspan="4">-</td><td rowspan="2">d ≤ 20 cm</td><td>P_{th} (mW)</td></tr>
<tr><td>-</td></tr>
<tr><td rowspan="2">20 cm < d ≤ 40 cm</td><td>P_{th} (mW)</td></tr>
<tr><td>-</td></tr>
<tr><td rowspan="5">1.5 GHz ≤ f ≤ 6 GHz</td><td>ERP_{20 cm} (mW)</td><td>X</td><td colspan="2"></td></tr>
<tr><td rowspan="4">3060</td><td rowspan="4">-</td><td rowspan="2">d ≤ 20 cm</td><td>P_{th} (mW)</td></tr>
<tr><td>-</td></tr>
<tr><td rowspan="2">20 cm < d ≤ 40 cm</td><td>P_{th} (mW)</td></tr>
<tr><td>3060</td></tr>
</table>

As shown in the table above, the EUT's Max ERP is lower than the MPE-based Exemption Threshold. SAR testing for this device is exempted.

Note[1]: Maximum Antenna Gain used is based on Combined Antenna Gain calculation for MIMO transmitting usage (i.e. Combined Antenna Gain(dBi) = Single Antenna Gain(dBi) + 10*log(Number of Antennas)). In this case the Combined Antenna Gain is 5.16 dBi = 2.15 dBi +10*log(2).

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

6.1 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), 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).

6.2 Test Setup

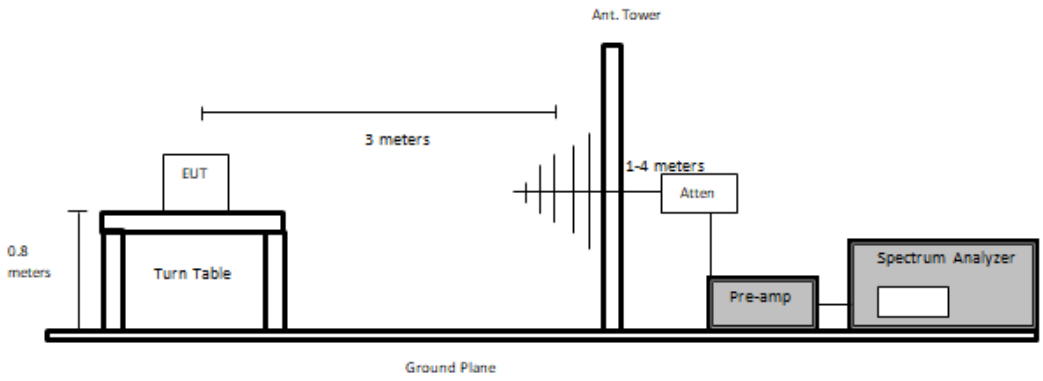
The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC 15 Subpart C limits.

The spacing between the peripherals was 10 centimeters.

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

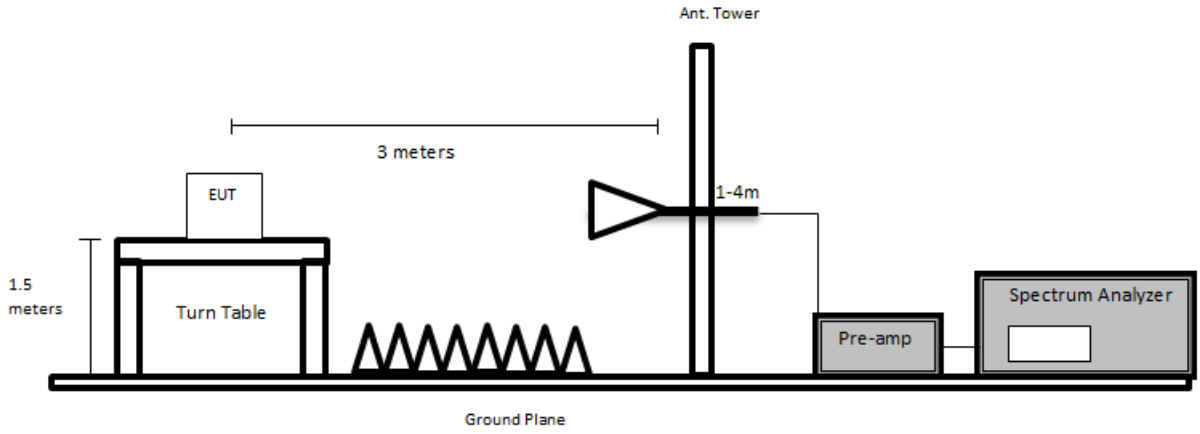
6.3 Test Setup Block Diagrams

Below 1 GHz:



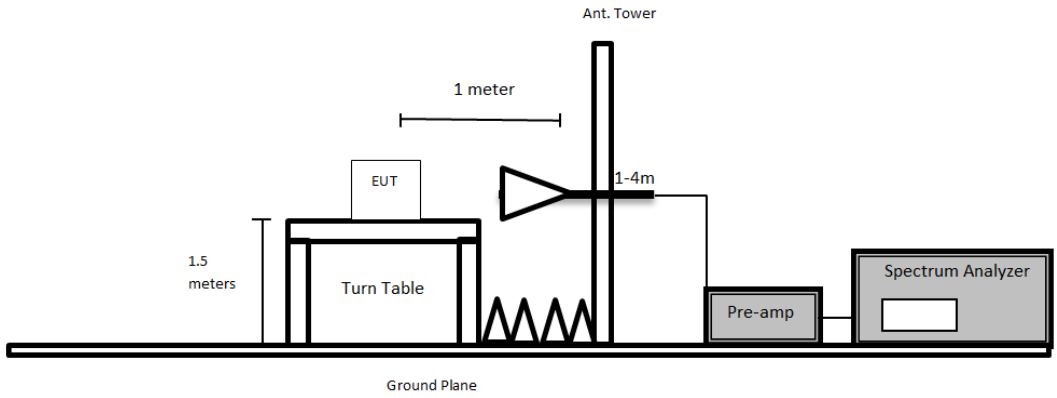
Above 1 GHz:

At 3 meters:

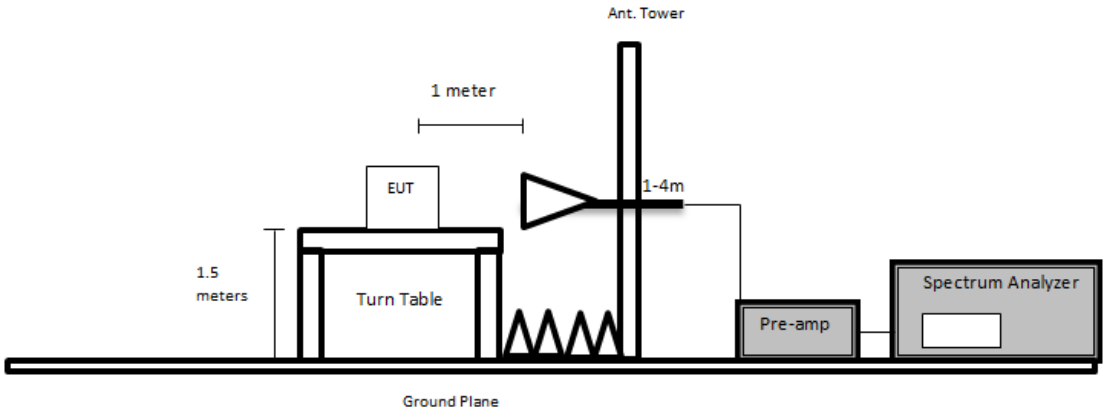


At 1 meter:

Using Asset#1192



Using Asset#91



6.4 Test Procedure

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

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

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

The spectrum analyzer or receiver is set as:

Below 1000 MHz:

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

Above 1000 MHz:

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

6.5 Corrected Amplitude & Margin Calculation

For emissions below 1 GHz,

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

CA = S.A. Reading + Correction Factor

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

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

Correction Factor = AF + CL + Atten – Ga

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

Margin = Corrected Amplitude – Limit

For emission above 1 GHz,

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

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

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

Margin = Corrected Amplitude – Limit

6.6 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
424	Agilent	Analyzer, Spectrum	E4440A	US45303156	2021-12-06	1 year
655	Rhode & Schwarz	Signal Analyzer	FSQ26	200749	2022-02-07	2 years
124	Rhode & Schwarz	EMI Test Receiver	ESCI 1166.5950 K03	100044	2021-05-14	2 years
327	Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
321	Sunol Sciences	Biconilog Antenna	JB3	A020106-2	2021-11-22	2 years
1192	ETS Lindgren	Horn Antenna	3117	00218973	2022-09-29	2 years
91	Wisewave	Antenna, Horn	ARH-4223-02	10555-02	2022-03-08	2 years
-	-	RF cable	-	-	Each time[1]	N/A
-	-	Notch Filter	-	-	Each time[1]	N/A
1228	Pasternack	Coaxial Cable, RG213	PE3496-800CM	2111301	2021-11-30	1 year
1248	Pasternack	RG214 COAX Cable	PE3062	-	Each time[1]	N/A
1249	time microwave	LMR-400 Cable Dc-3 Ghz	AE13684	2k80612-56fts	Each time[1]	N/A
1250	Florida RF Labs	1-18GHz, 26.5-40 GHz Coaxial cable	KMS-160-120.0-KMS	51	2022-05-10	1 year
316	Sonoma Instruments	Preamplifier 10 kHz - 2.5 GHz	317	260406	2022-05-12	1 year
658	Agilent	Pre-Amplifier	8449B	3008A01103	2022-05-05	1 year

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

6.7 Test Environmental Conditions

Temperature:	19 ºC
Relative Humidity:	34 %
ATM Pressure:	102.2 kPa

The testing was performed by Arturo Reyes from 2022-10-11 to 2022-10-12 and Deepak Mishra from 2022-10-10 to 2022-10-13 at 5 meter chamber 3.

6.8 Summary of Test Results

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

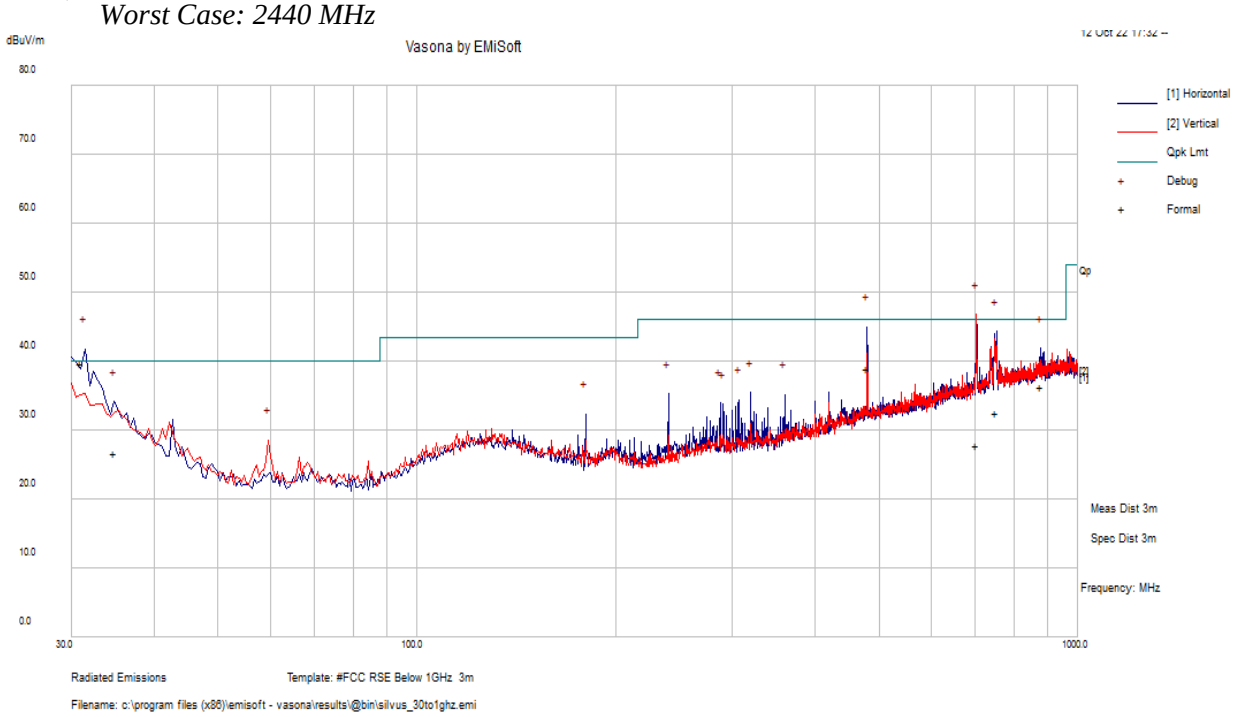
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Transmitting Channel (MHz)**
-0.34	30.97375	H	2440

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

6.9 Radiated Emissions Test Results

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

Worst Case: 2440 MHz

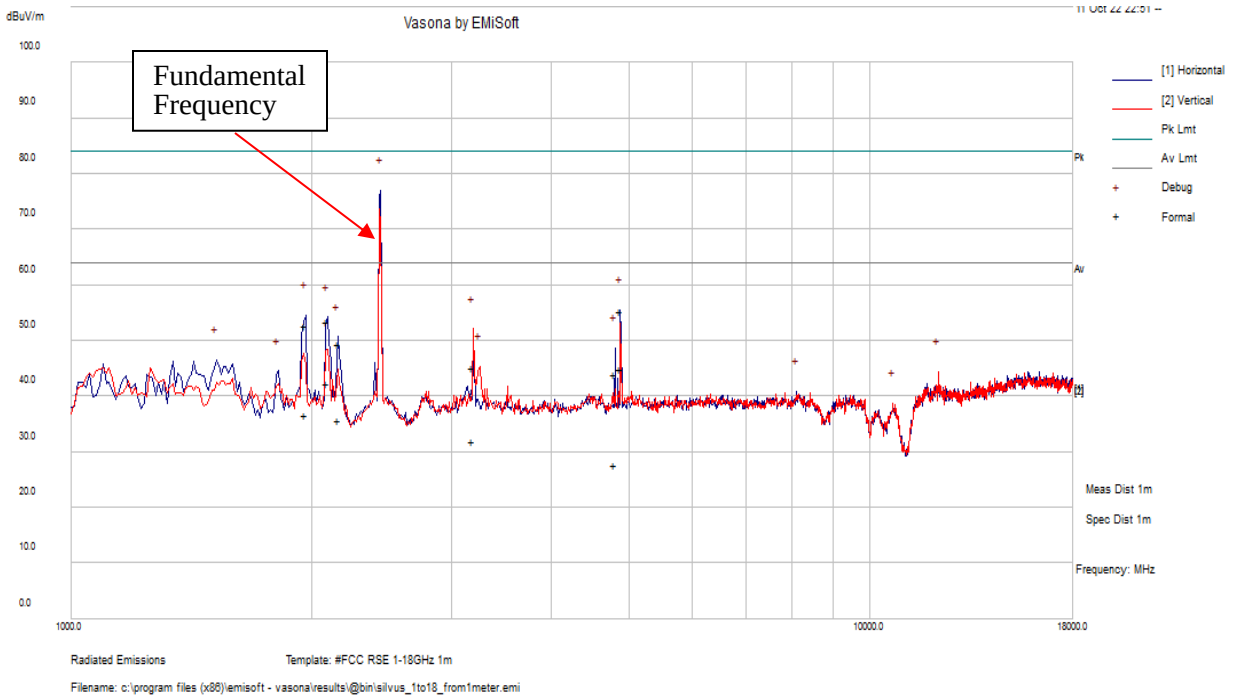


Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
30.97375	**41.12**	**-1.46**	**39.66**	**178**	**H**	**90**	**40**	**-0.34**	**Pass**
34.84125	30.51	-3.91	26.6	168	H	27	40	-13.4	Pass
479.8988	41.3	-2.42	38.88	199	H	251	46	-7.12	Pass
701.6398	26.67	1.06	27.73	273	V	125	46	-18.27	Pass
752.5318	30.63	1.85	32.48	201	H	77	46	-13.52	Pass
878.3438	33.09	3.25	36.34	283	H	352	46	-9.66	Pass

2) 1–26.5 GHz, Measured at 3 Meters

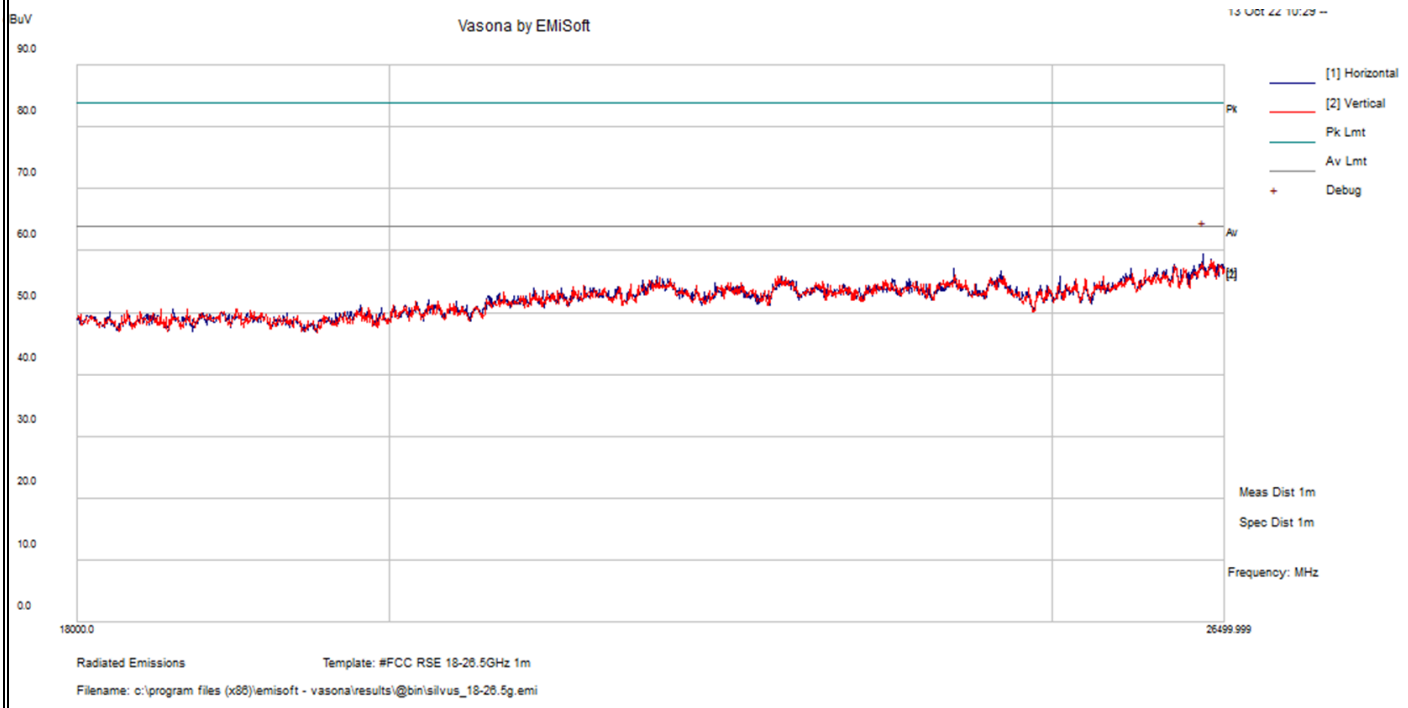
Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC		Note
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel Frequency: 2412 MHz											
2390	73.410	108	135	H	32.142	3.610	37.896	71.266	74	-2.734	Peak
2390	65.070	0	300	V	32.142	3.610	37.896	62.926	74	-11.074	Peak
2390	51.370	108	135	H	32.142	3.610	37.896	49.226	54	-4.774	Ave
2390	50.090	0	300	V	32.142	3.610	37.896	47.946	54	-6.054	Ave
4824	54.190	43	104	H	34.709	4.610	36.709	56.800	74	-17.200	Peak
4824	50.230	165	256	V	34.709	4.610	36.709	52.840	74	-21.160	Peak
4824	44.802	43	104	H	34.709	4.610	36.709	47.412	54	-6.588	Ave
4824	40.515	165	256	V	34.709	4.610	36.709	43.125	54	-10.875	Ave
7236	46.030	360	150	H	35.618	13.340	36.607	58.381	74	-15.619	Peak
7236	45.800	360	150	V	35.618	13.340	36.607	58.151	74	-15.849	Peak
7236	35.292	360	150	H	35.618	13.340	36.607	47.643	54	-6.357	Ave
7236	35.281	360	150	V	35.618	13.340	36.607	47.632	54	-6.368	Ave
Middle Channel Frequency: 2440 MHz											
4880	55.740	45	150	H	34.709	4.700	36.796	58.353	74	-15.647	Peak
4880	51.310	150	224	V	34.709	4.700	36.796	53.923	74	-20.077	Peak
4880	44.570	45	150	H	34.709	4.700	36.796	47.183	54	-6.817	Ave
4880	39.640	150	224	V	34.709	4.700	36.796	42.253	54	-11.747	Ave
7320	47.600	360	150	H	35.618	11.020	36.894	57.344	74	-16.656	Peak
7320	47.100	360	150	V	35.618	11.020	36.894	56.844	74	-17.156	Peak
7320	34.290	360	150	H	35.618	11.020	36.894	44.034	54	-9.966	Ave
7320	34.300	360	150	V	35.618	11.020	36.894	44.044	54	-9.956	Ave
High Channel Frequency: 2462 MHz											
2483.50	73.620	110	195	H	32.665	3.660	37.913	72.032	74	-1.968	Peak
2483.50	64.290	355	250	V	32.665	3.660	37.913	62.702	74	-11.298	Peak
2483.50	52.210	110	195	H	32.665	3.660	37.913	50.622	54	-3.378	Ave
2483.50	49.900	355	250	V	32.665	3.660	37.913	48.312	54	-5.688	Ave
4924.00	53.200	41	146	H	34.709	4.900	36.905	55.904	74	-18.096	Peak
4924.00	48.450	119	262	V	34.709	4.900	36.905	51.154	74	-22.846	Peak
4924.00	43.665	41	146	H	34.709	4.900	36.905	46.369	54	-7.631	Ave
4924.00	38.353	119	262	V	34.709	4.900	36.905	41.057	54	-12.943	Ave
7386.00	46.610	360	150	H	35.618	8.730	36.967	53.991	74	-20.009	Peak
7386.00	46.360	360	150	V	35.618	8.730	36.967	53.741	74	-20.259	Peak
7386.00	35.474	360	150	H	35.618	8.730	36.967	42.855	54	-11.145	Ave
7386.00	35.395	360	150	V	35.618	8.733	36.967	42.779	54	-11.221	Ave

3) 1 – 18 GHz Worst Case scan, Measured at 1 meter
Worst Case: 2440 MHz



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
1964.98	62.65	-6.48	52.63	104	H	133	84	-31.37	Peak Max
2093.08	63.34	-10.02	53.33	106	H	127	84	-30.67	Peak Max
2159.58	59.31	-10.01	49.38	100	H	254	84	-34.62	Peak Max
3188.05	53.63	-8.44	45.19	115	V	136	84	-38.81	Peak Max
4804.84	50.35	-9.93	43.9	114	H	252	84	-40.10	Peak Max
4879.48	61.73	-6.45	55.25	153	H	70	84	-28.75	Peak Max

4) 18 – 26.5 GHz Worst Case scan, Measured at 1 meter
Worst Case: 2440 MHz



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
26308.75	44.78	14.76	59.54	300	H	0	64	-4.46	Peak

Note: Worst case Peak emission was measured to be lower than average limit to show compliance.

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

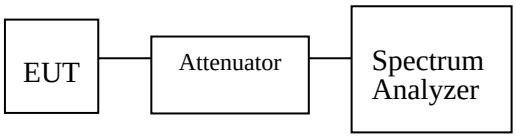
7.1 Applicable Standards

According to FCC §15.247(a) (2): the minimum 6 dB bandwidth shall be 500 kHz.

7.2 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.

7.3 Test Setup Diagram



7.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
912	Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008k39 -101203-UW	2022-05-05	1 year
-	-	RF cable	-	-	Each time[1]	N/A
-	-	20 dB Attenuator	-	-	Each time[1]	N/A

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

7.5 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	49 %
ATM Pressure:	101.6 kPa

The testing was performed by Christian Schwartz on 2022-10-12 at RF test site.

7.6 Test Results

Antenna 1

Channel	Frequency (MHz)	99% OBW (MHz)	6 dB BW (MHz)	6 dB BW Limit (kHz)
Low	2412	4.385	4.130	> 500
Middle	2440	4.384	4.052	> 500
High	2462	4.385	4.163	> 500

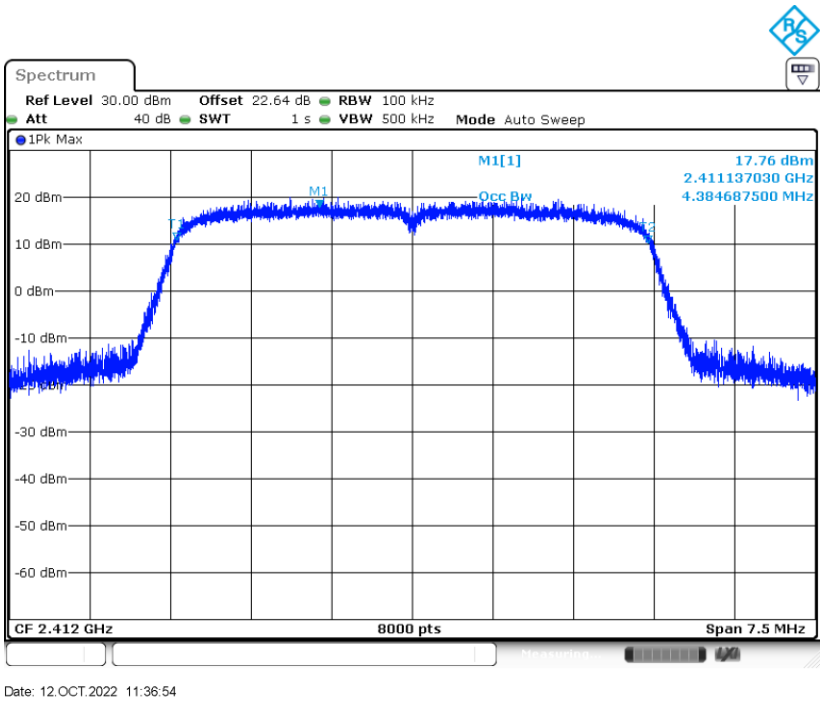
Antenna 2

Channel	Frequency (MHz)	99% OBW (MHz)	6 dB BW (MHz)	6 dB BW Limit (kHz)
Low	2412	4.386	4.197	> 500
Middle	2440	4.385	4.240	> 500
High	2462	4.385	4.138	> 500

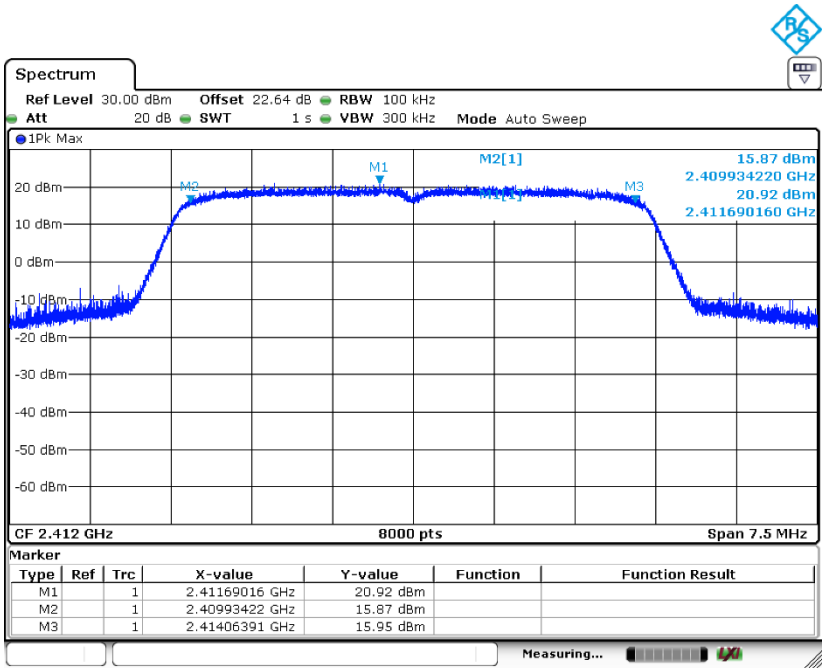
Please refer to the following plots for detailed test results.

Antenna 1:

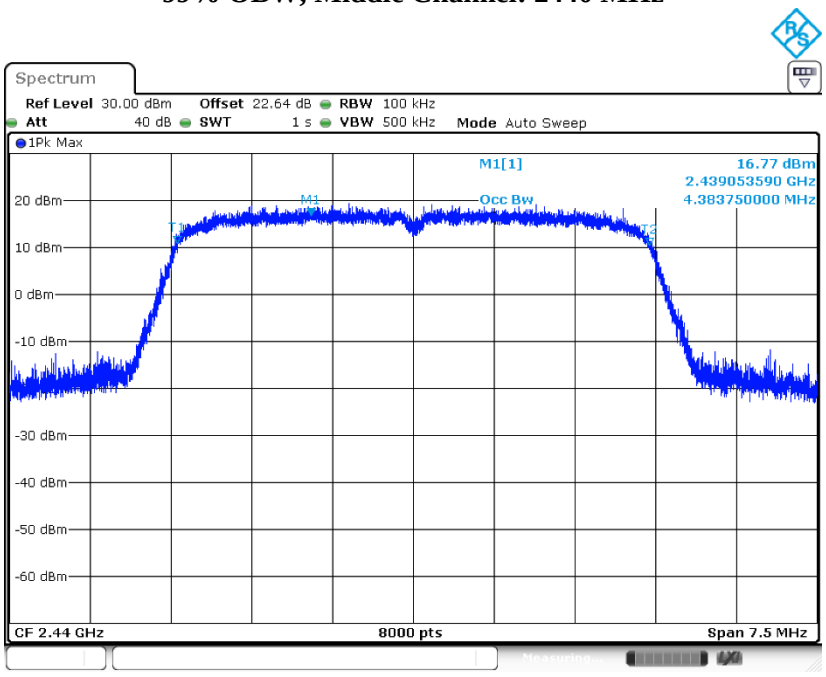
99% OBW, Low Channel: 2412 MHz



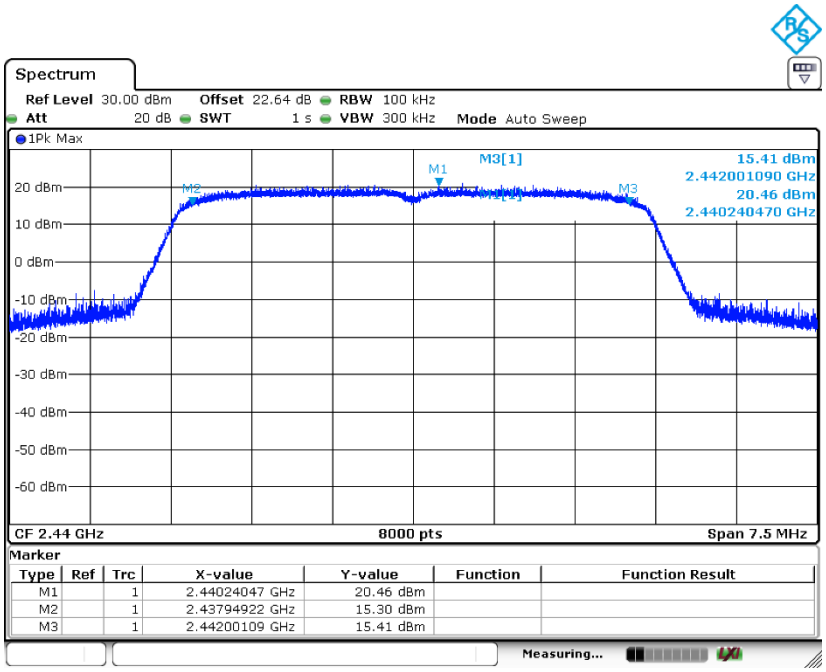
6dB BW, Low Channel: 2412 MHz



99% OBW, Middle Channel: 2440 MHz

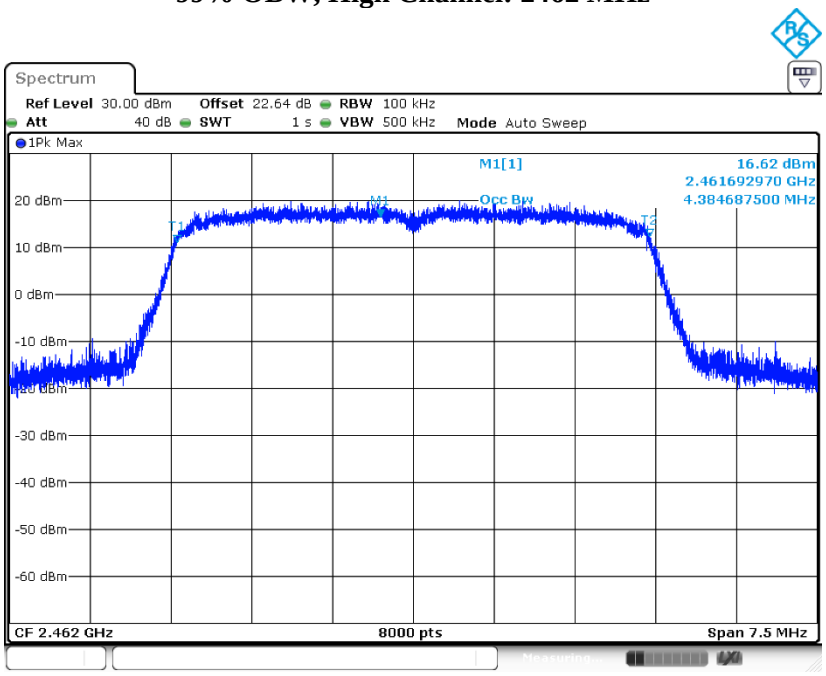


6dB BW, Middle Channel: 2440 MHz



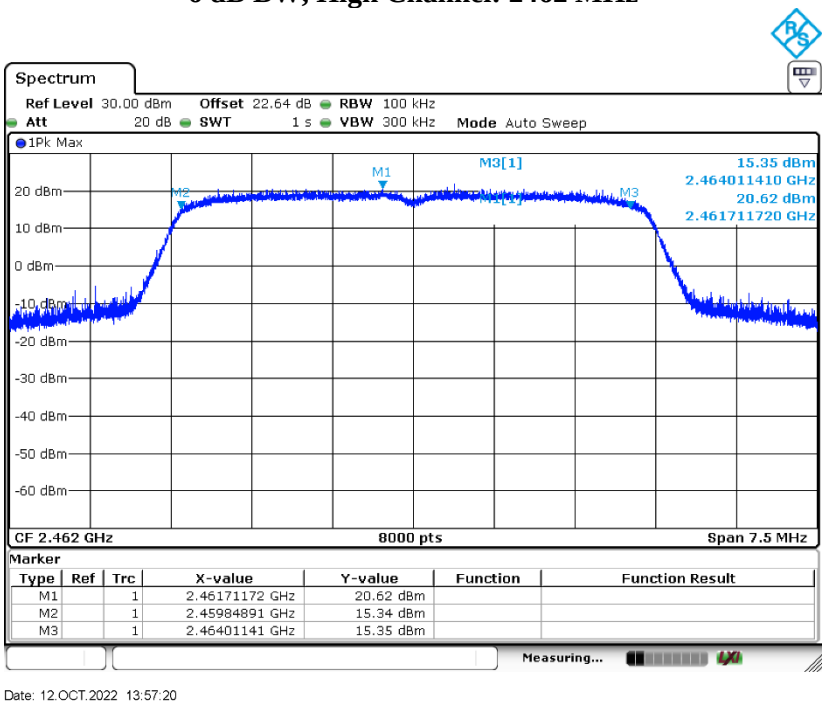
Date: 12.OCT.2022 13:53:58

99% OBW, High Channel: 2462 MHz



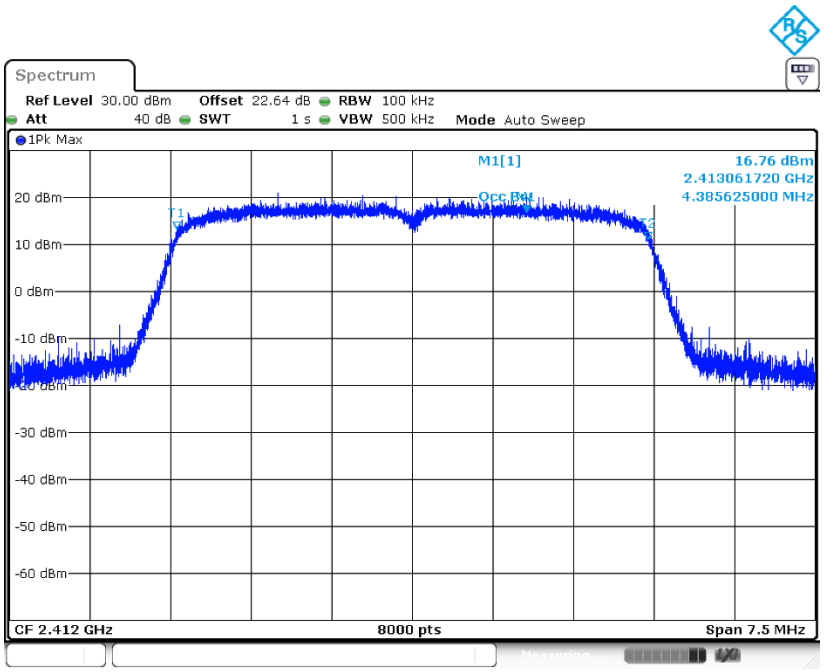
Date: 12.OCT.2022 11:47:19

6 dB BW, High Channel: 2462 MHz



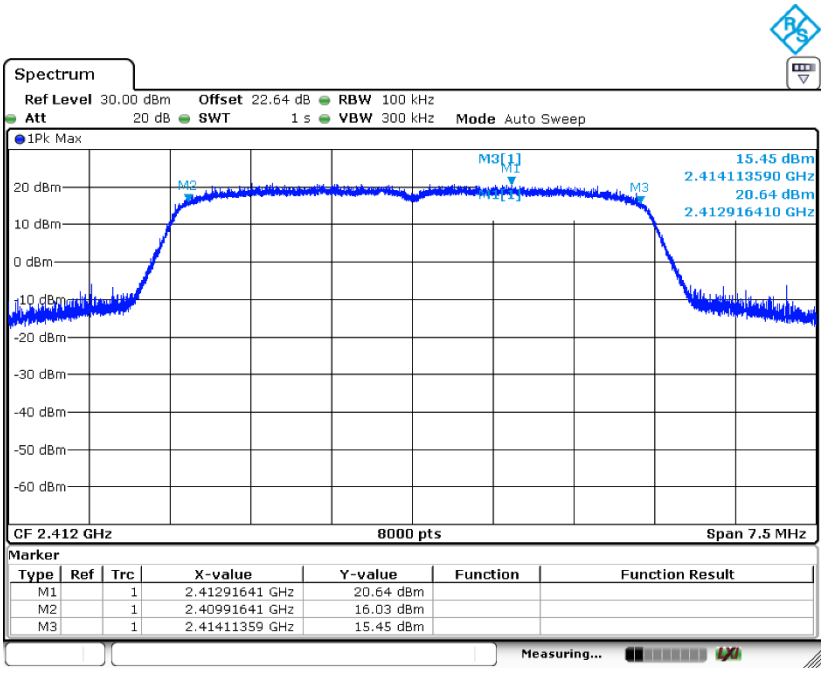
Antenna 2:

99% OBW, Low Channel: 2412 MHz



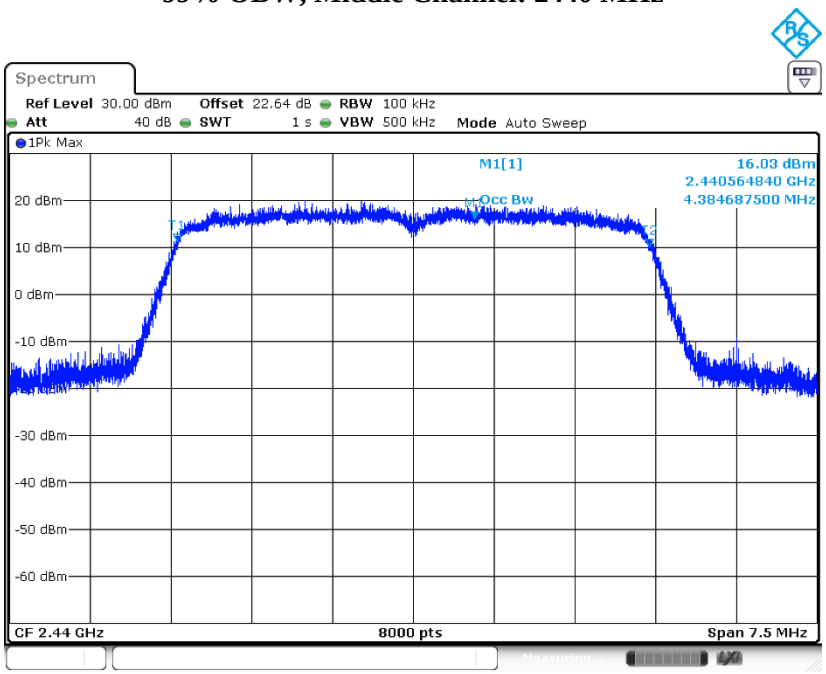
Date: 12.OCT.2022 11:52:45

6dB BW, Low Channel: 2412 MHz



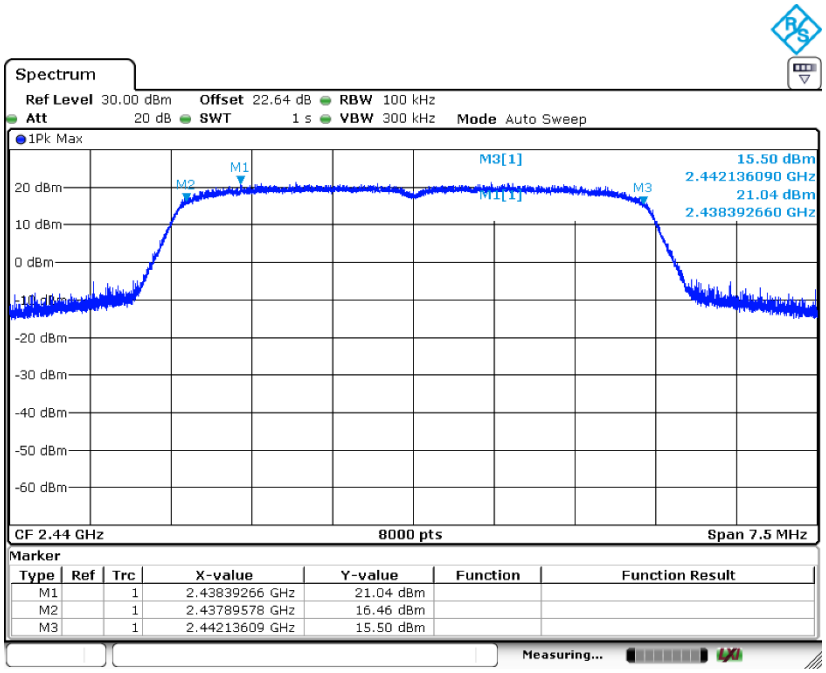
Date: 12.OCT.2022 13:47:09

99% OBW, Middle Channel: 2440 MHz



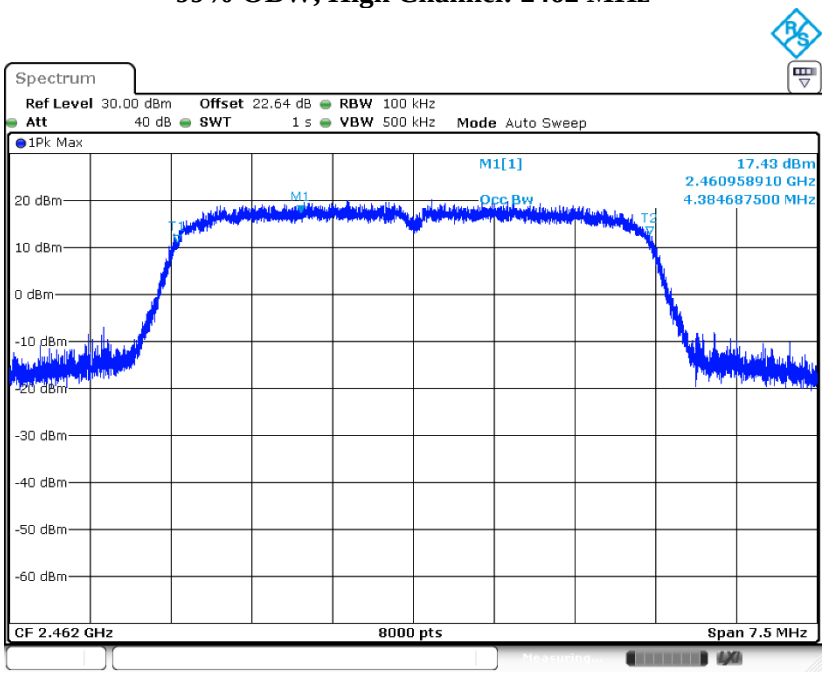
Date: 12.OCT.2022 11:54:25

6dB BW, Middle Channel: 2440 MHz



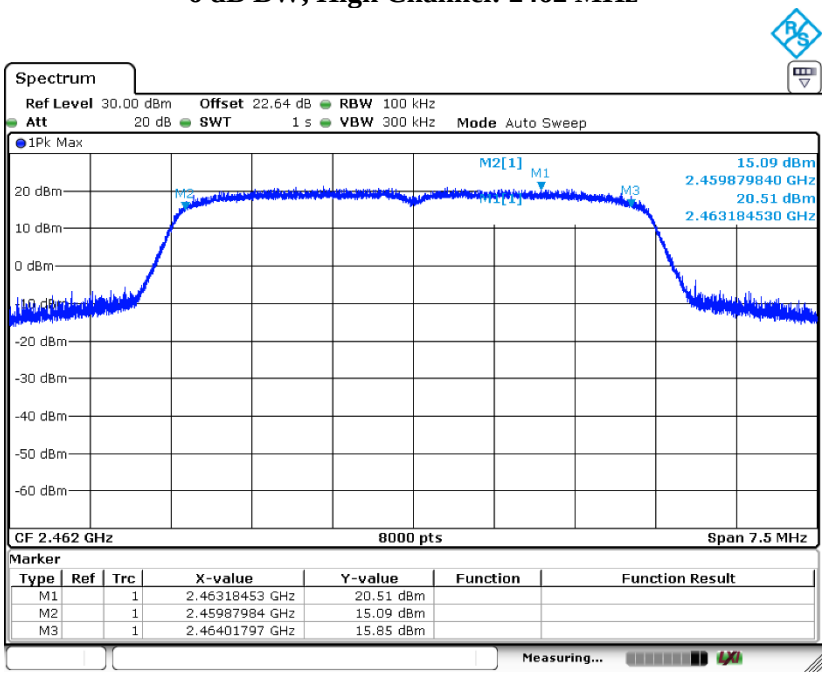
Date: 12.OCT.2022 13:41:12

99% OBW, High Channel: 2462 MHz



Date: 12.OCT.2022 11:57:41

6 dB BW, High Channel: 2462 MHz



Date: 12.OCT.2022 13:44:37

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

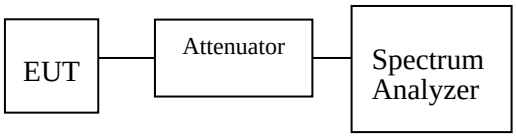
8.1 Applicable Standards

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

8.2 Measurement Procedure

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

8.3 Test Setup Diagram



8.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
912	Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008k39-101203-UW	2022-05-05	1 year
-	-	RF cable	-	-	Each time[1]	N/A
-	-	20 dB Attenuator	-	-	Each time[1]	N/A

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

8.5 Test Environmental Conditions

Temperature:	22º C
Relative Humidity:	53 %
ATM Pressure:	101.5 kPa

The testing was performed by Christian Schwartz on 2022-10-12 at RF test site.

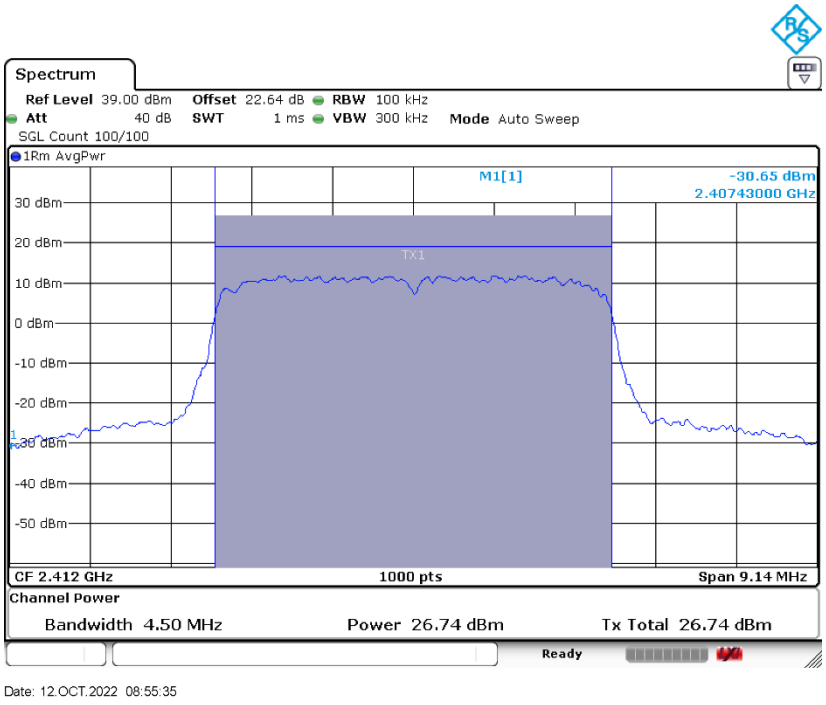
8.6 Test Results

Channel	Frequency (MHz)	Conducted Average Output Power (dBm)		Combined Conducted Average Output Power (dBm)	FCC Limit (dBm)
		Antenna 1	Antenna 2		
Low	2412	26.74	26.80	29.78	< 30
Middle	2440	26.30	26.39	29.36	< 30
High	2462	26.84	26.86	29.86	< 30

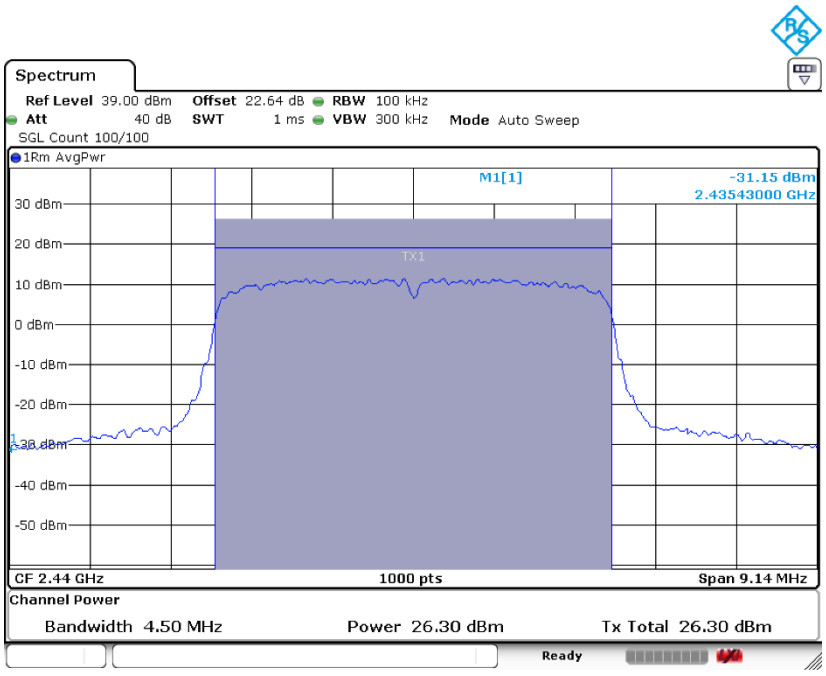
Note: Combined Conducted Average Output Power (dBm) = 10*log(Antenna 1(mW) + Antenna 2 (mW))

Antenna 1

Low Channel: 2412 MHz

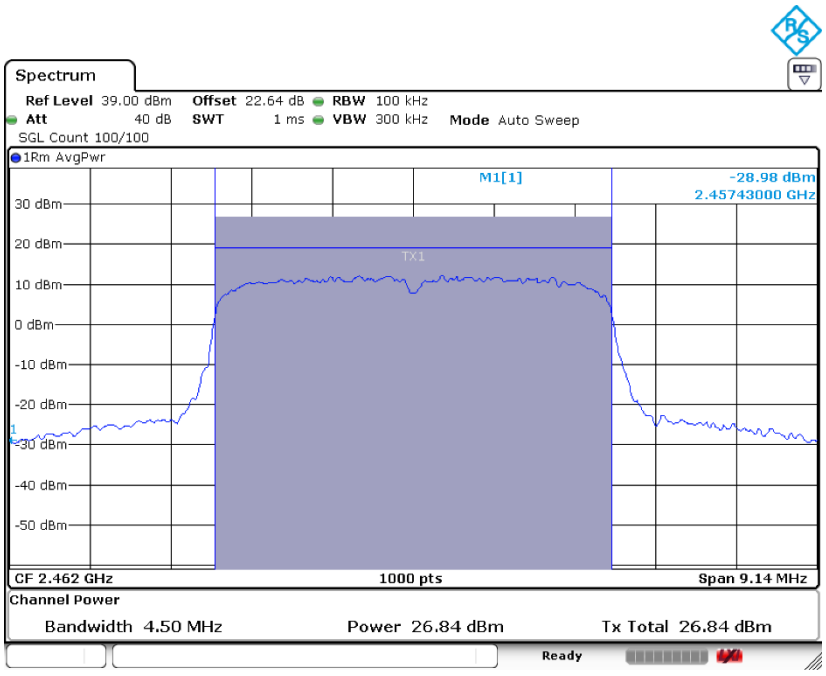


Middle Channel: 2440 MHz



Date: 12.OCT.2022 09:02:58

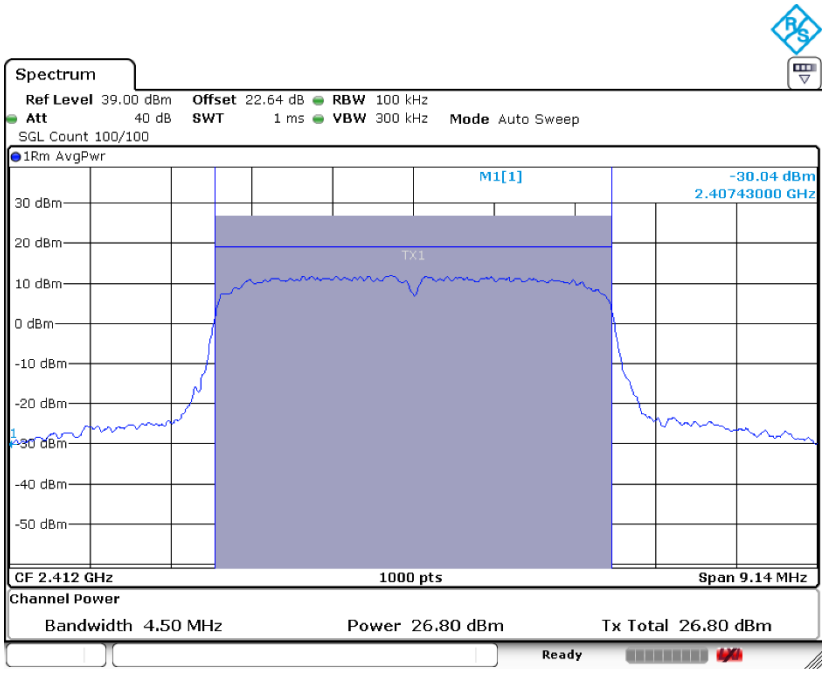
High Channel: 2462 MHz



Date: 12.OCT.2022 09:04:35

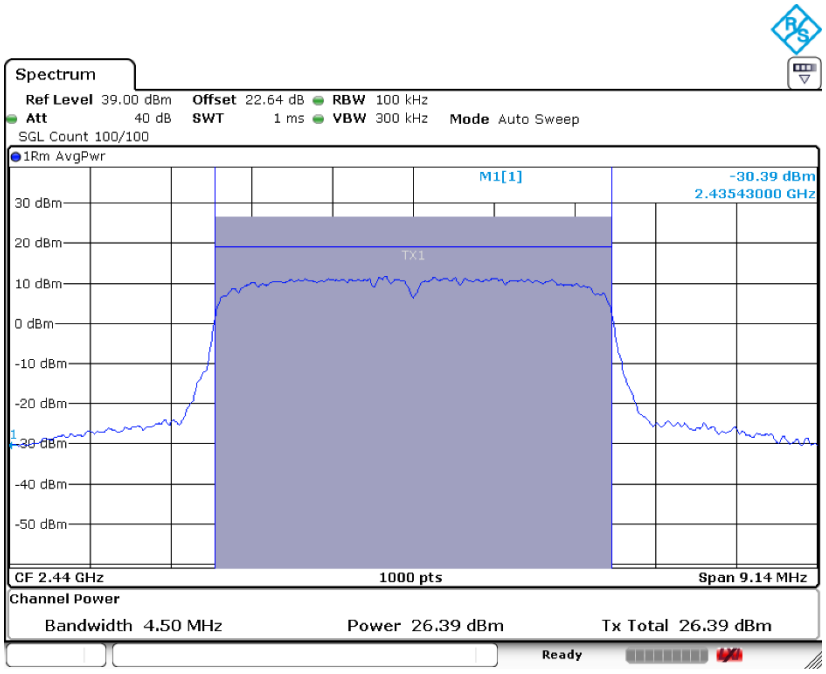
Antenna 2

Low Channel: 2412 MHz



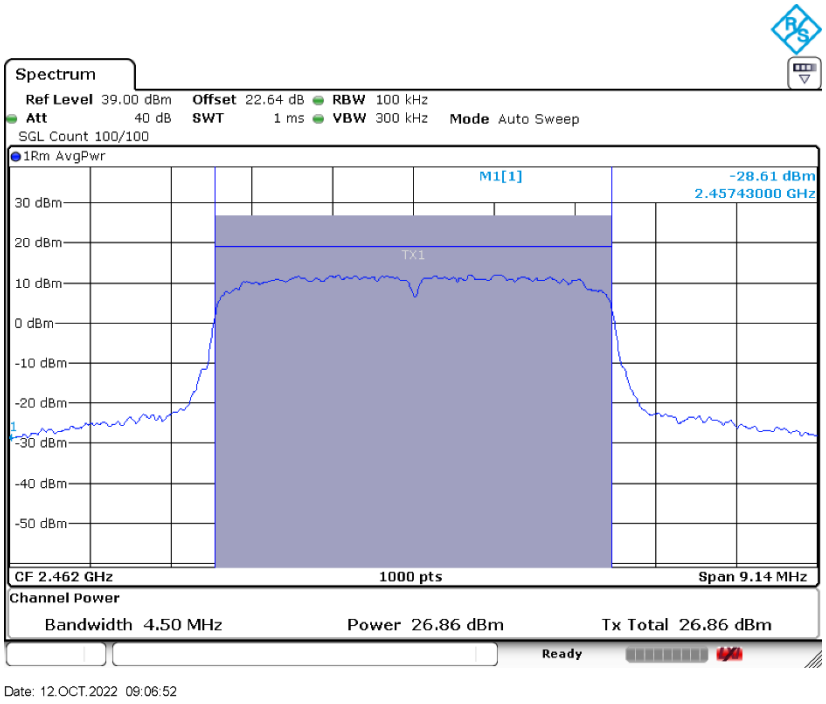
Date: 12.OCT.2022 08:59:08

Middle Channel: 2440 MHz



Date: 12.OCT.2022 09:01:44

High Channel: 2462 MHz



Date: 12.OCT.2022 09:06:52

9 FCC §15.247(e) - Peak Power Spectral Density

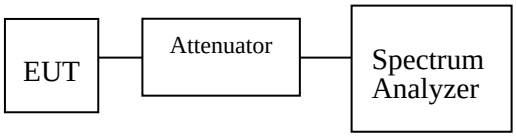
9.1 Applicable Standards

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

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 8.4: Maximum power spectral density level in the fundamental emission.

9.3 Test Setup Diagram



9.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
912	Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008k39-101203-UW	2022-05-05	1 year
-	-	RF cable	-	-	Each time[1]	N/A
-	-	20 dB Attenuator	-	-	Each time	N/A

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

9.5 Test Environmental Conditions

Temperature:	22º C
Relative Humidity:	53 %
ATM Pressure:	101.5kPa

The testing was performed by Christian Schwartz on 2022-10-12 at RF test site.

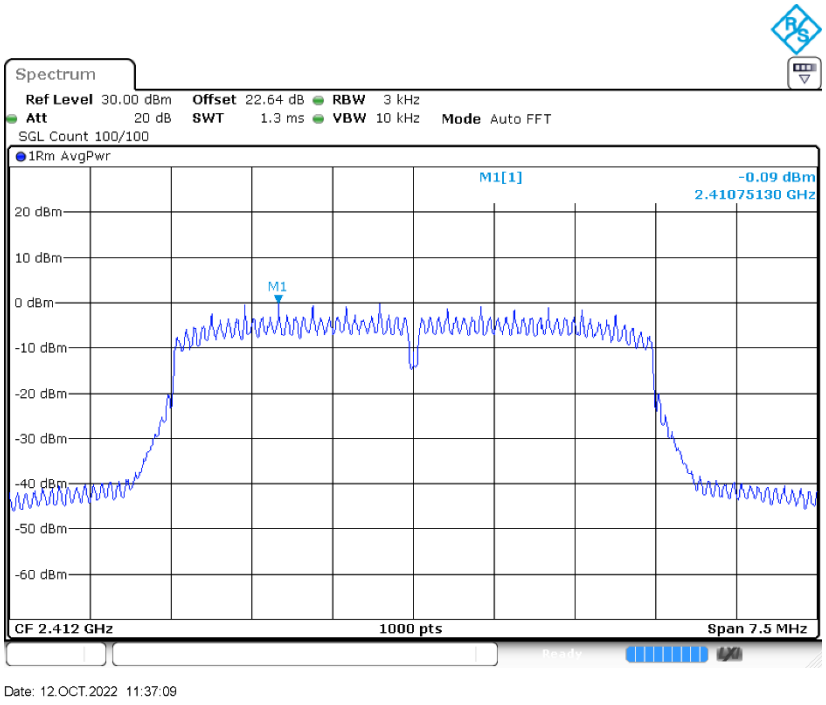
9.6 Test Results

Channel	Frequency (MHz)	Conducted PSD (dBm/3 kHz)		Combined Conducted PSD (dBm/3 kHz)	FCC Limit (dBm/3 kHz)
		Antenna 1	Antenna 2		
Low	2405	-0.09	-0.47	2.73	< 8
Middle	2445	-1.50	-1.66	1.43	< 8
High	2475	-0.38	-0.26	2.69	< 8

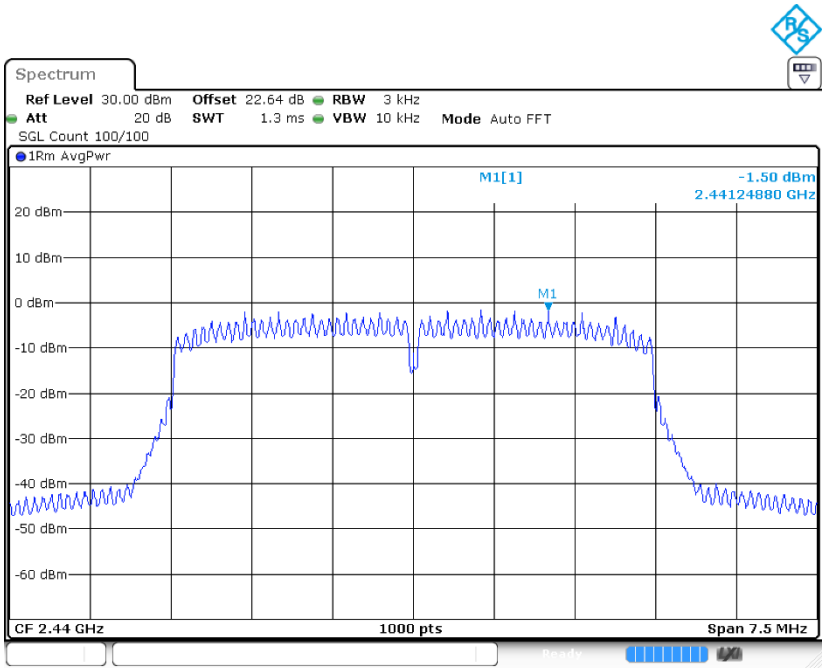
Note: Combined Conducted Average Output Power (dBm/3kHz) = 10*log(Antenna 1(mW) + Antenna 2 (mW))

Antenna 1

Low Channel: 2412 MHz

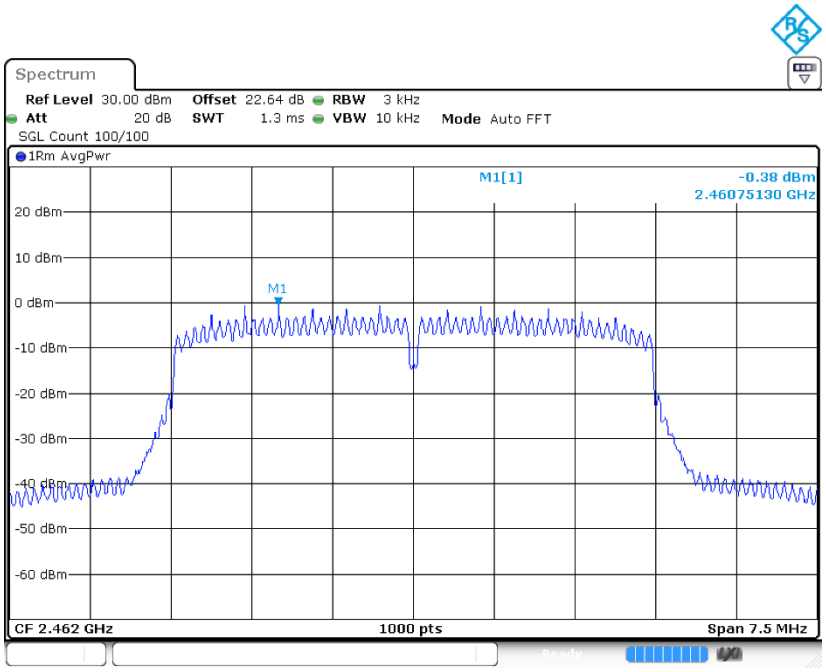


Middle Channel: 2440 MHz



Date: 12.OCT.2022 11:45:10

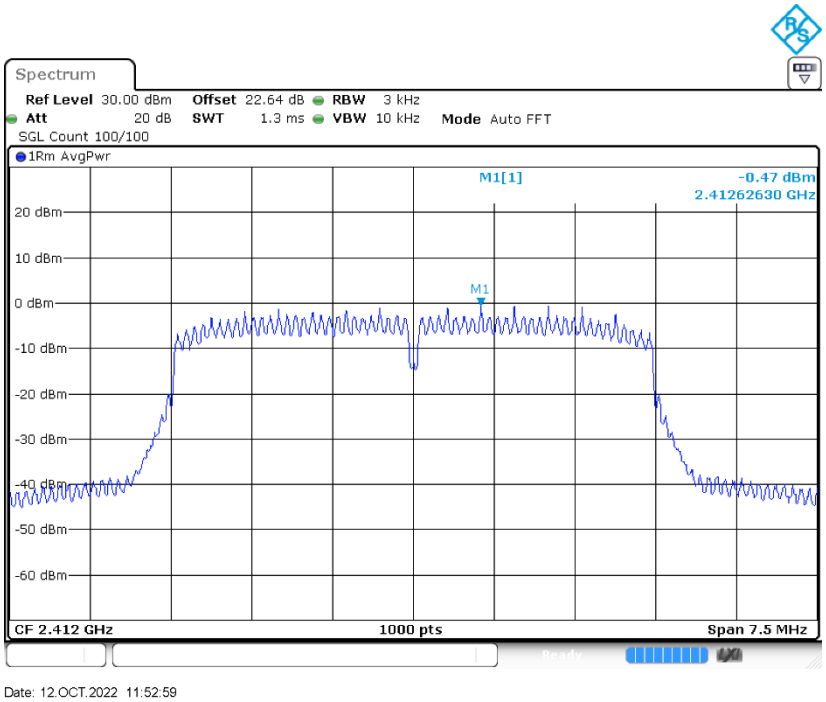
High Channel: 2462 MHz



Date: 12.OCT.2022 11:47:34

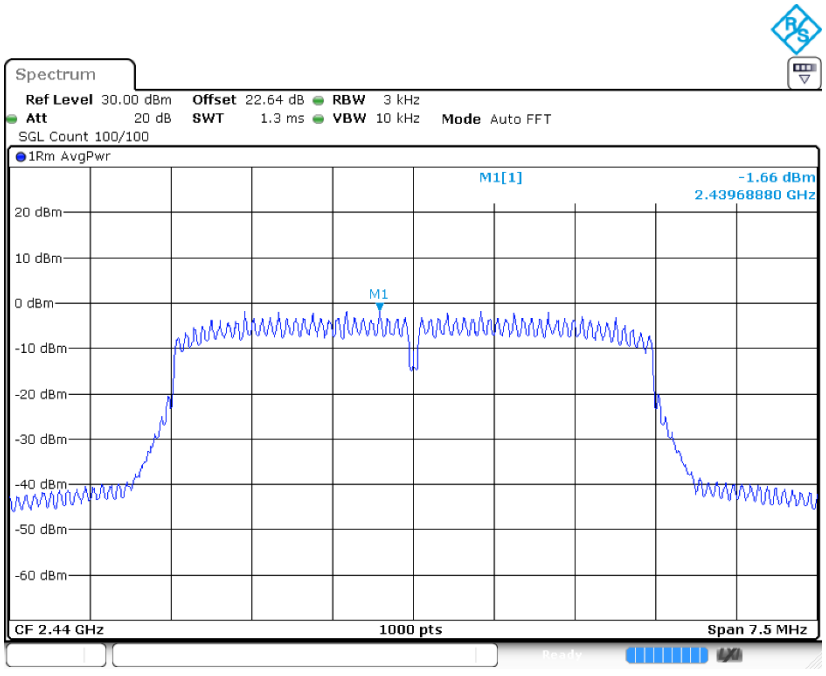
Antenna 2

Low Channel: 2412 MHz



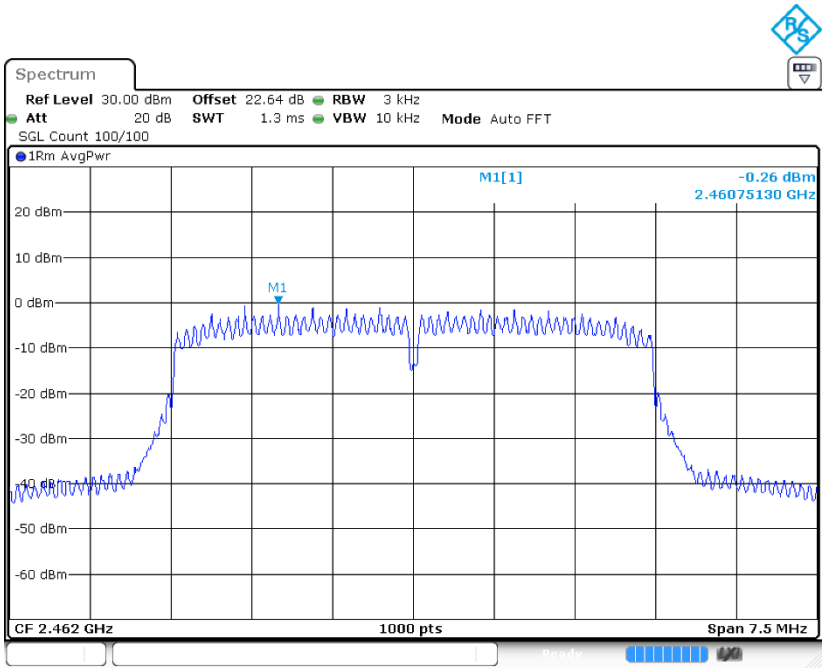
Date: 12.OCT.2022 11:52:59

Middle Channel: 2440 MHz



Date: 12.OCT.2022 11:54:40

High Channel: 2462 MHz



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

10.1 Applicable Standards

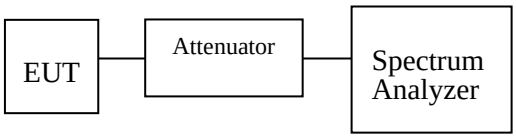
According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains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

10.2 Measurement Procedure

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

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

10.3 Test Setup Diagram



10.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
912	Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008k39-101203-UW	2022-05-05	1 year
-	-	RF cable	-	-	Each time[1]	N/A
-	-	20 dB Attenuator	-	-	Each time[1]	N/A

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

10.5 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	49 %
ATM Pressure:	101.6 kPa

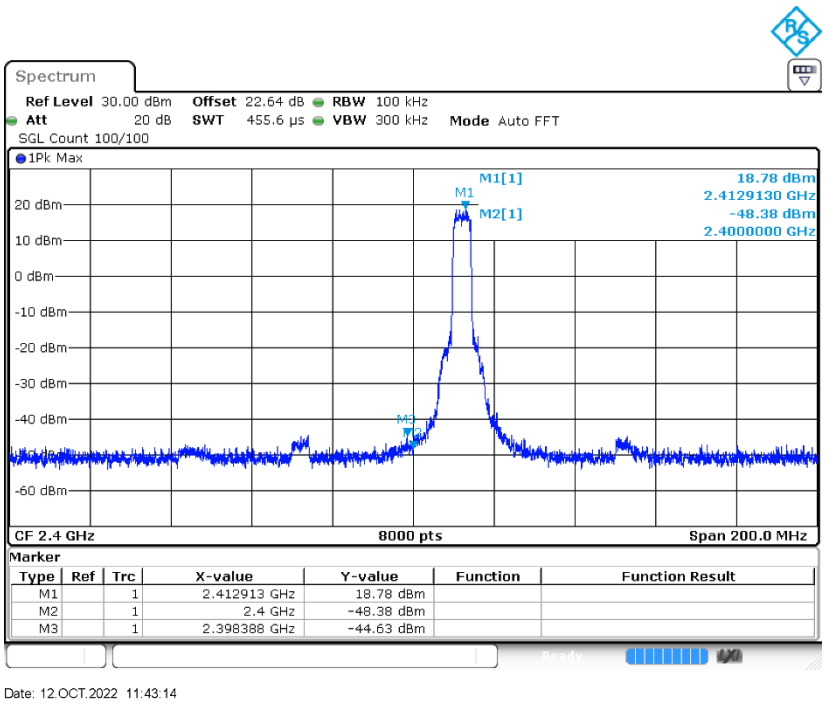
The testing was performed by Christian Schwartz on 2022-10-12 at RF test site.

10.6 Test Results

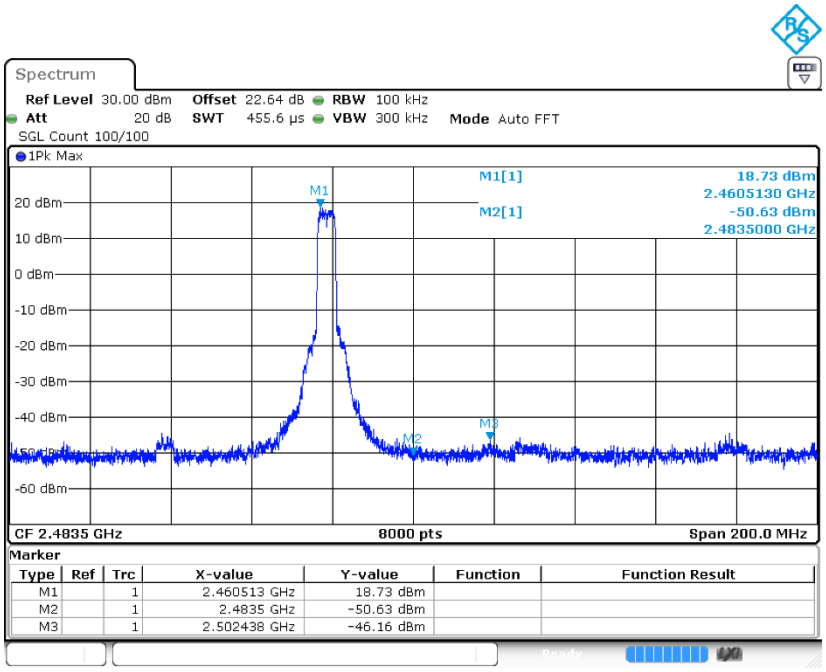
Please refer to the following plots.

Antenna 1

Low Channel: 2412 MHz



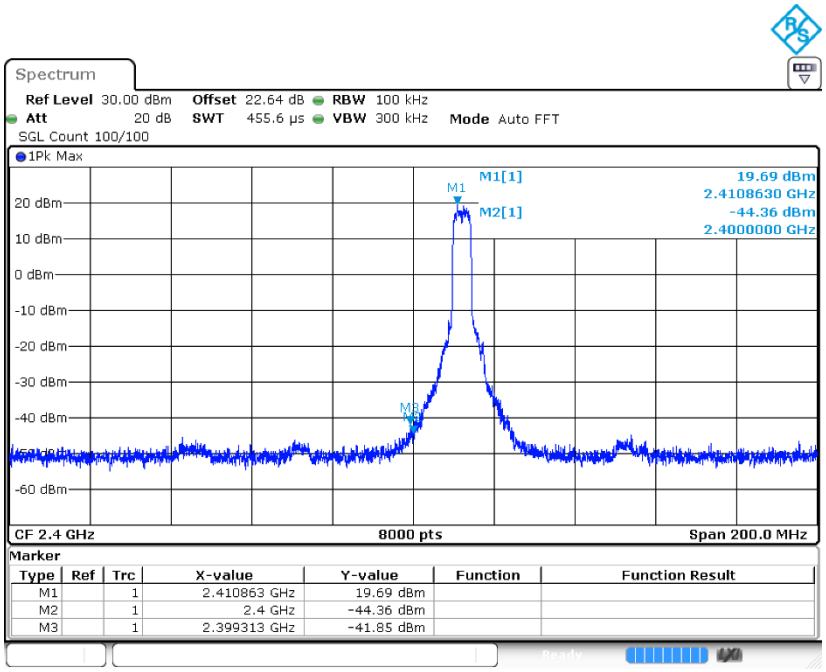
High Channel: 2462 MHz



Date: 12.OCT.2022 11:46:49

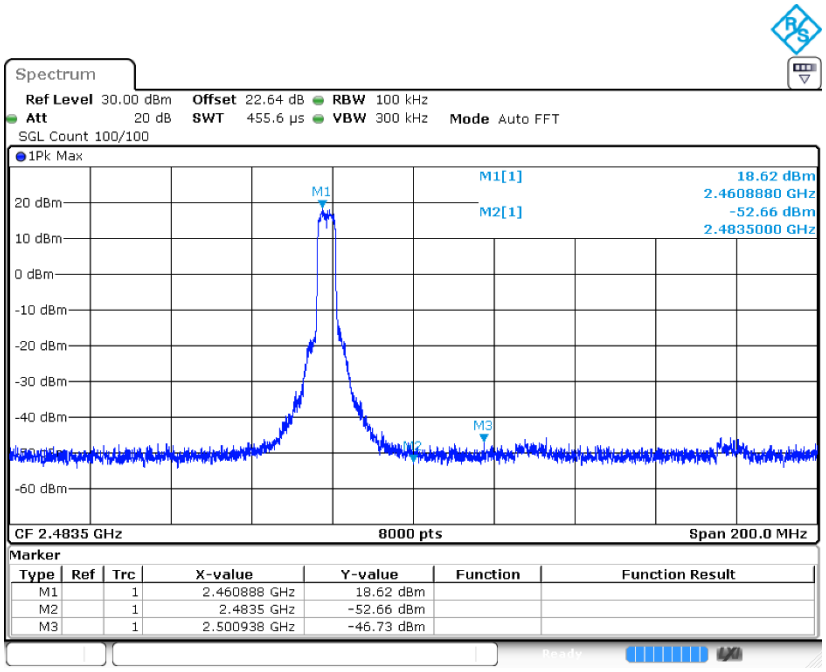
Antenna 2

Low Channel: 2412 MHz



Date: 12.OCT.2022 13:16:43

High Channel: 2462 MHz



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

11.1 Applicable Standards

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

11.2 Test Procedure

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

11.3 Test Setup Diagram

11.4 Test Equipment List and Details

BACL No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
912	Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008k39-101203-UW	2022-05-05	1 year
-	-	RF cable	-	-	Each time[1]	N/A
-	-	20 dB Attenuator	-	-	Each time[1]	N/A

Note[1]: equipment included in the test set-up will be checked each time before testing.

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

11.5 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	49 %
ATM Pressure:	101.6 kPa

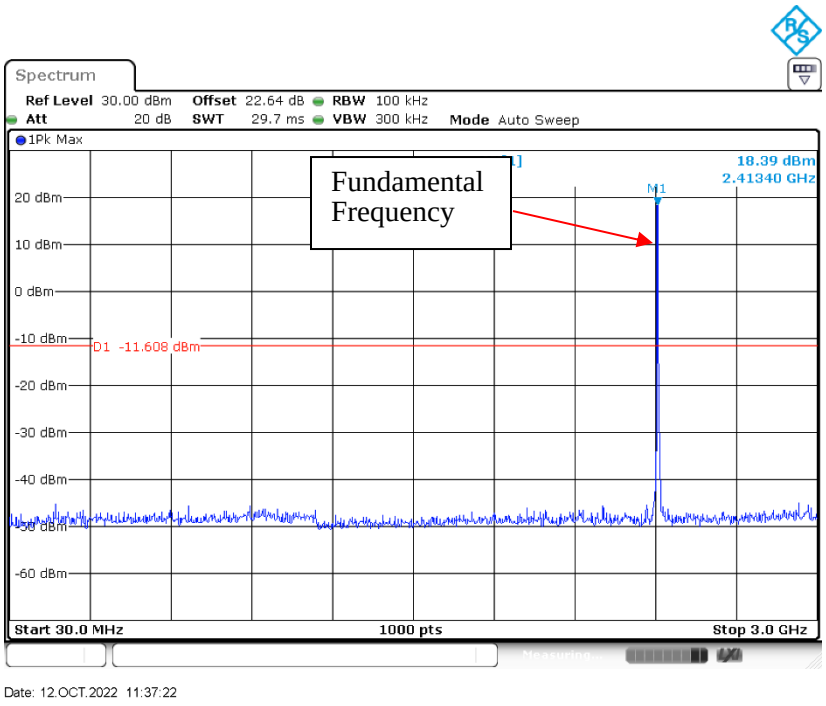
The testing was performed by Christian Schwartz on 2022-10-12 at RF test site.

11.6 Test Results

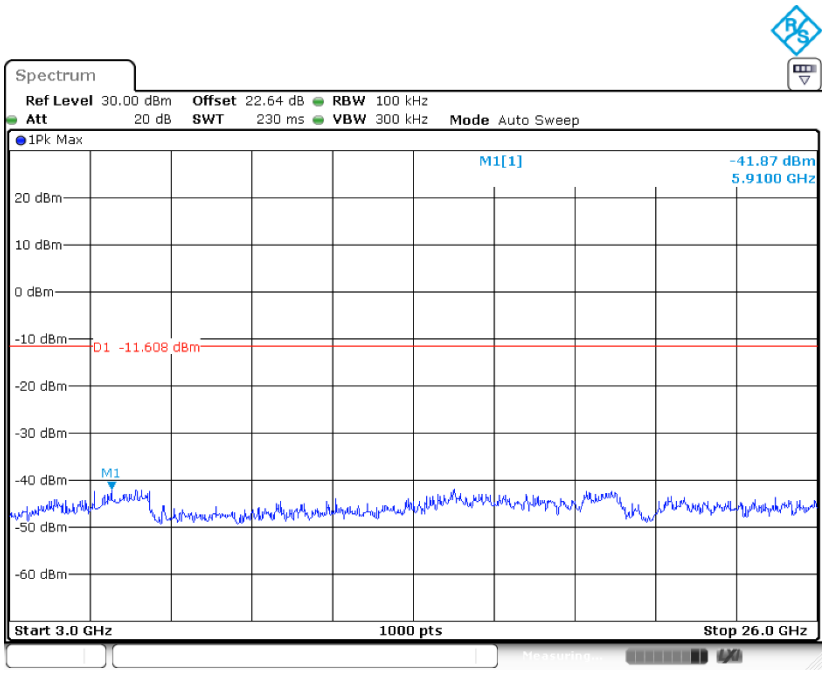
Please refer to the following plots.

Antenna 1

Low Channel: 2412 MHz
30 MHz – 3 GHz

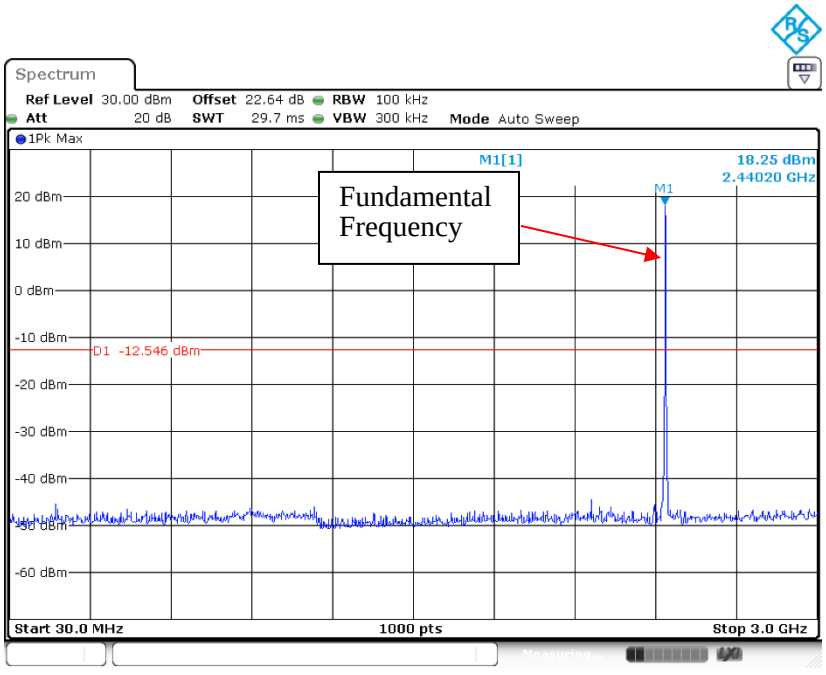


Low Channel: 2412 MHz
3 GHz – 26 GHz



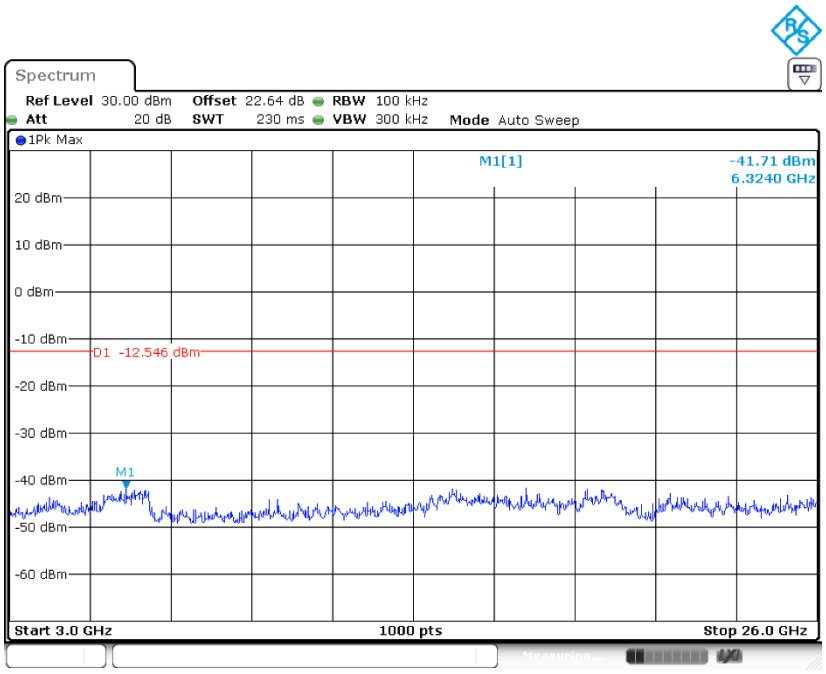
Date: 12.OCT.2022 11:37:32

Middle Channel: 2440 MHz
30 MHz – 3 GHz



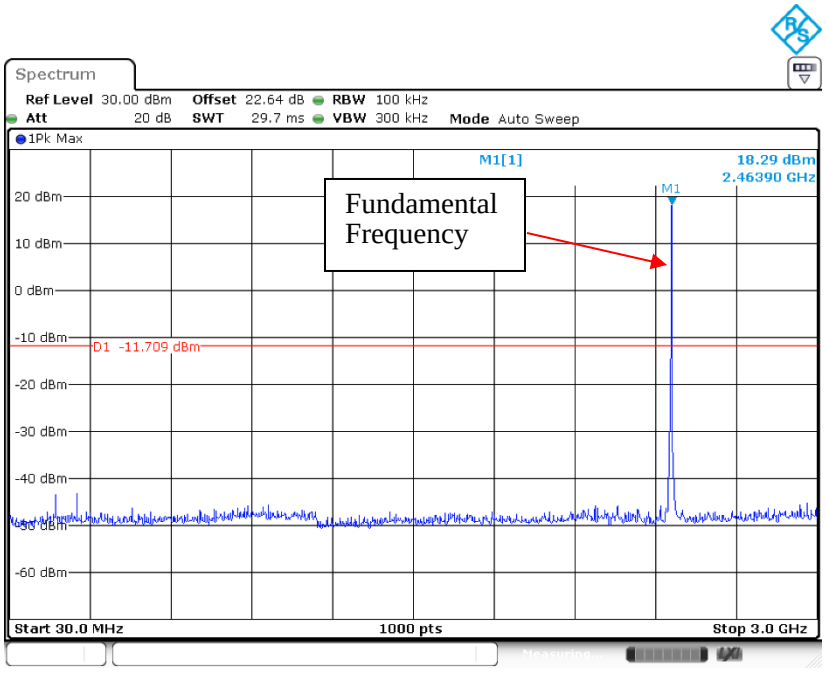
Date: 12.OCT.2022 11:45:23

Middle Channel: 2440 MHz
3 GHz – 26 GHz



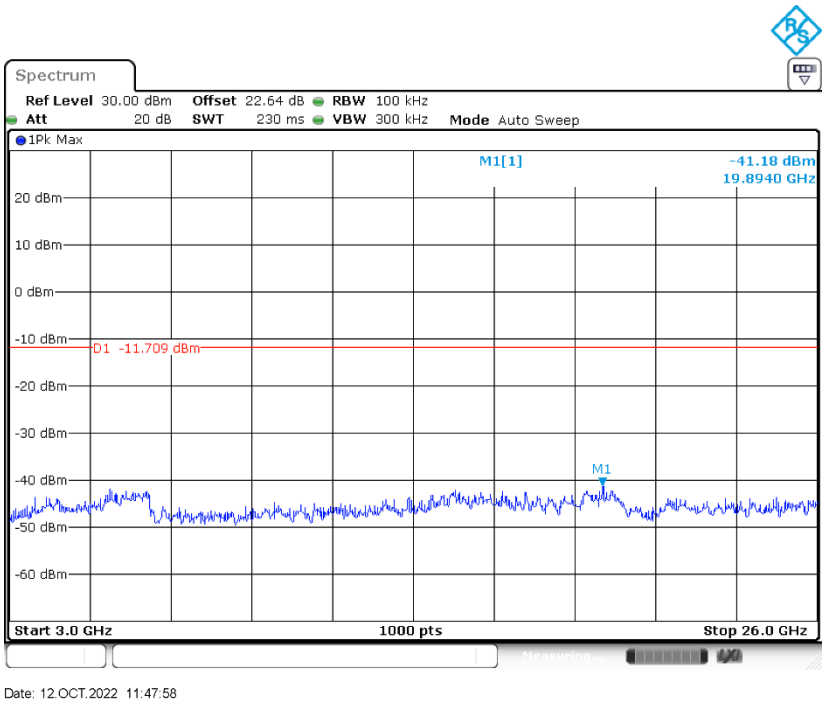
Date: 12.OCT.2022 11:45:34

High Channel: 2462 MHz
30 MHz – 3 GHz



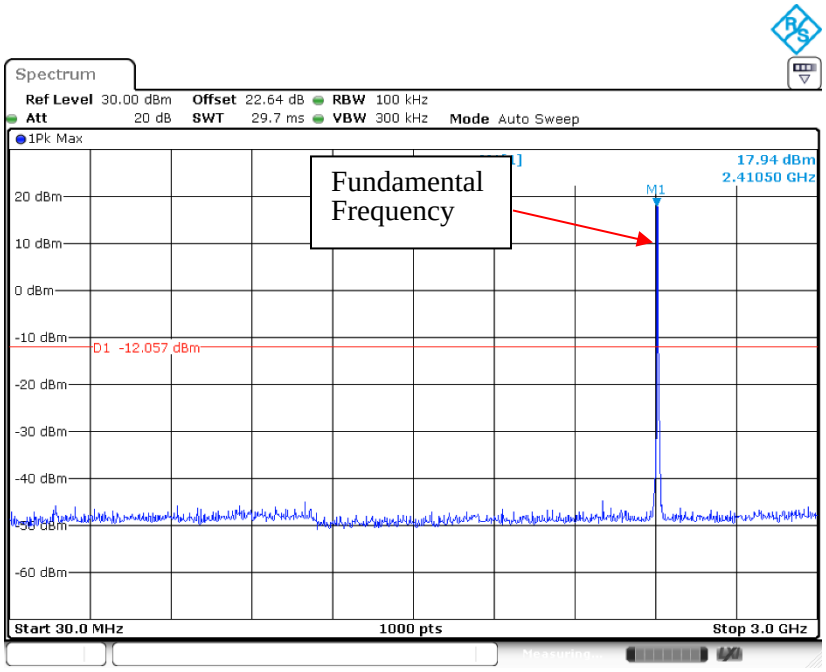
Date: 12.OCT.2022 11:47:47

High Channel: 2462 MHz
3 GHz – 26 GHz



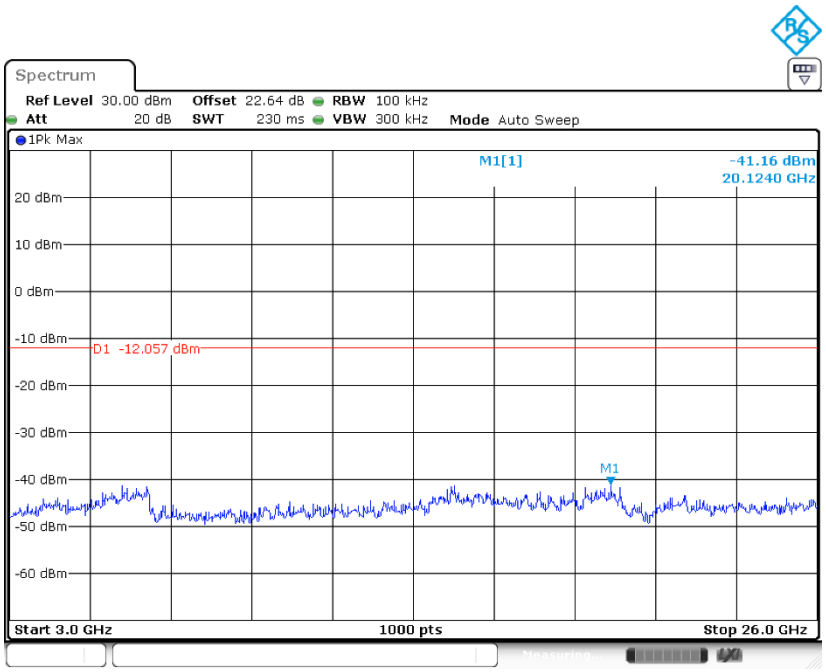
Antenna 2

Low Channel: 2412 MHz
30 MHz – 3 GHz



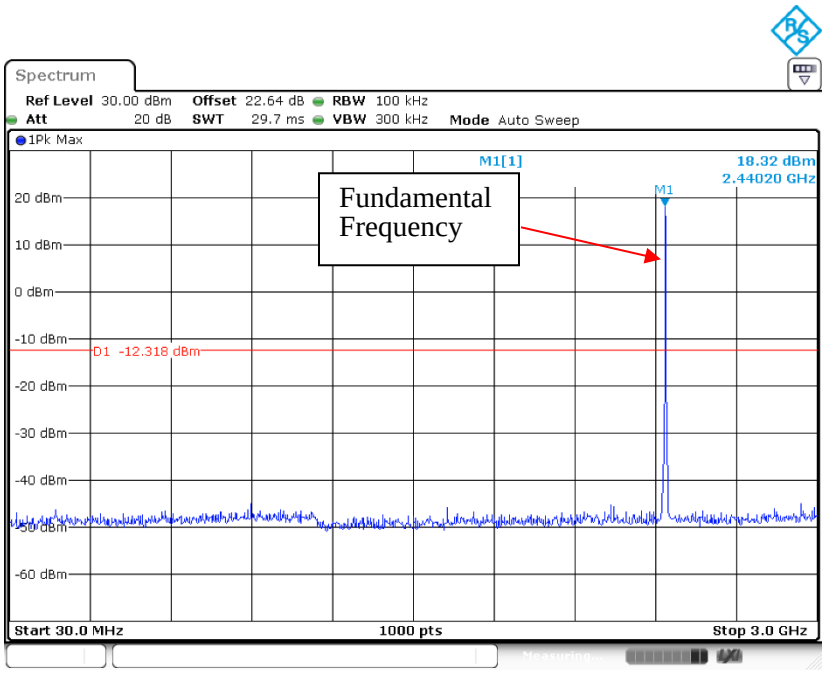
Date: 12.OCT.2022 11:53:12

Low Channel: 2412 MHz
3 GHz – 26 GHz



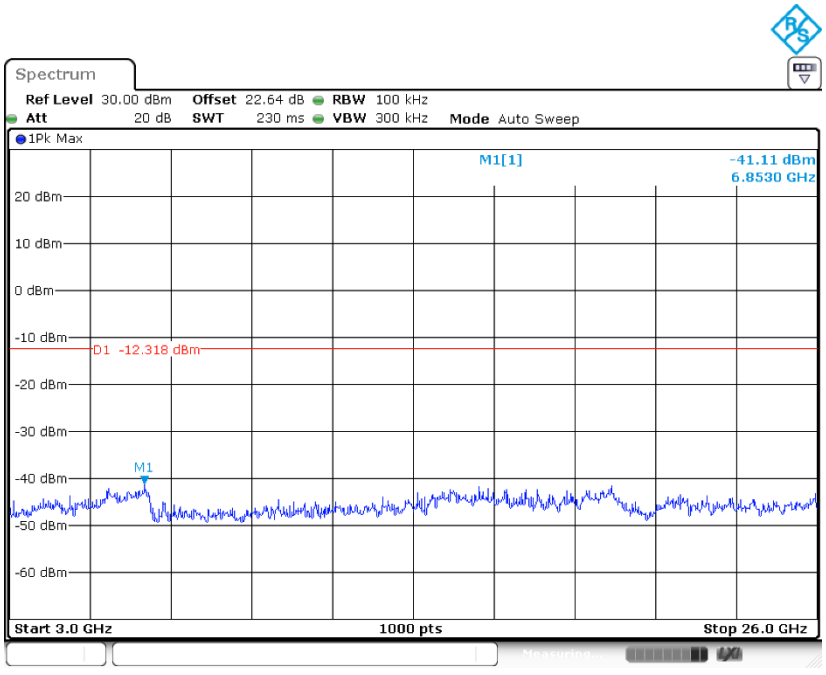
Date: 12.OCT.2022 11:53:23

Middle Channel: 2440 MHz
30 MHz – 3 GHz



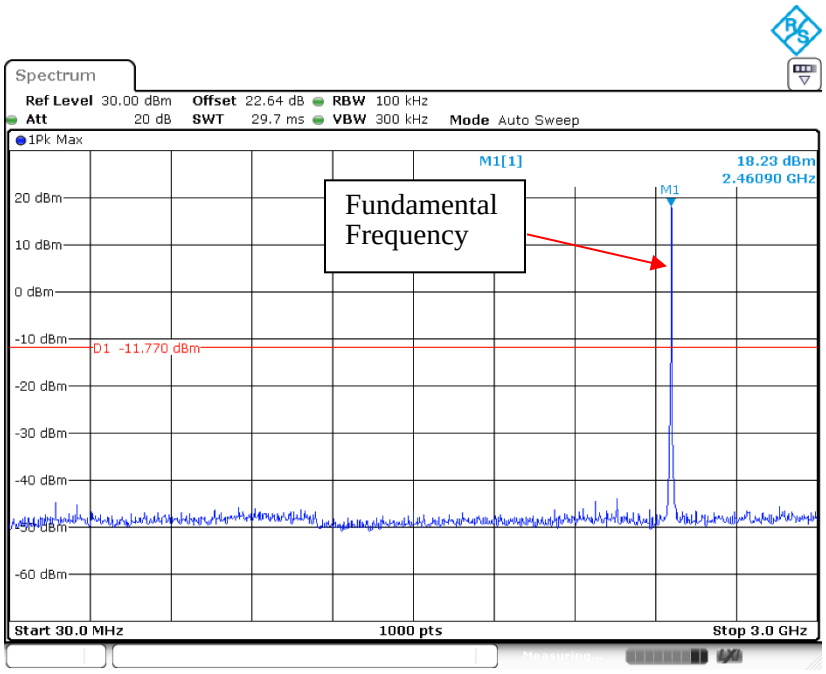
Date: 12.OCT.2022 11:54:53

Middle Channel: 2440 MHz
3 GHz – 26 GHz



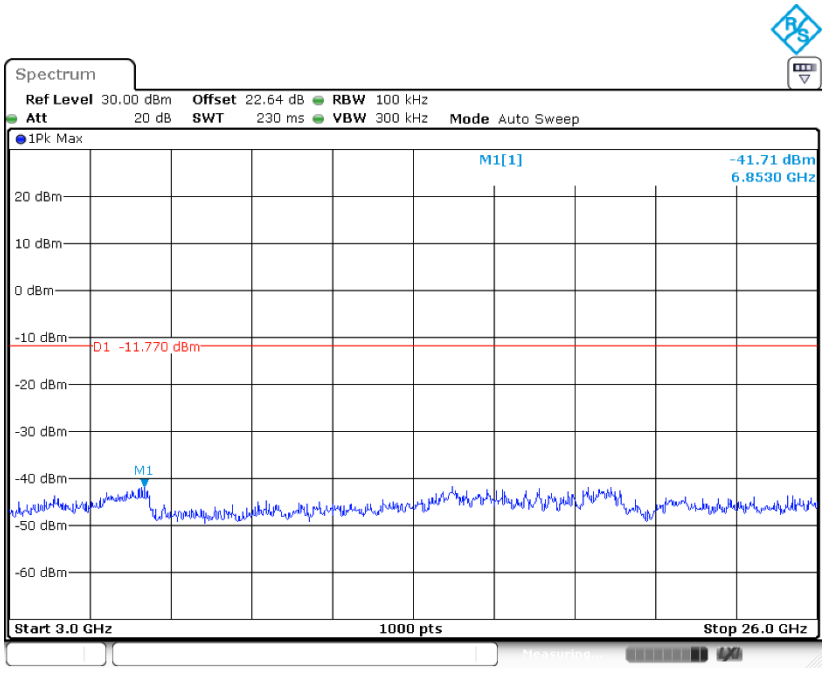
Date: 12.OCT.2022 11:55:03

High Channel: 2462 MHz
30 MHz – 3 GHz



Date: 12.OCT.2022 11:58:08

High Channel: 2462 MHz
3 GHz – 26 GHz



Date: 12.OCT.2022 11:58:19

12 Annex A (Normative) - Test Setup Photographs

Please refer to the attachment

13 Annex B (Normative) - EUT External Photographs

Please refer to the attachment

14 Annex C (Normative) - EUT Internal Photographs

Please refer to the attachment

15 Annex D (Normative) – Antenna Installation Declaration

SILVUS TECHNOLOGIES
Leading the MIMO Revolution

Silvus Technologies, Inc.
10990 Wilshire Blvd., Suite 1500
Los Angeles, California 90024
Ph 310-479-3333

December 7, 2022

RE: Professional Installation for Silvus Technologies Models SL4210.

To Whom It May Concern:

This product is design for outdoor point to multipoint wireless. It is available through special distribution channels worldwide serving systems integrators in military, homeland security and commercial air to ground video markets. A professional installer with experience in extended RF cable deployment, tower/vehicle mounting, and Silvus SL4210 system knowledge will be required to properly enable the equipment.

Please contact me if there is any information you may need.

Sincerely,

Cyrus Naim

Cyrus S. Naim
General Counsel
Cyrus.naim@silvustechnologies.com
Tel.: (310) 773-5490

16 Annex E (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 November 30, 2022
Revised September 16, 2022

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

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

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

--- END OF REPORT ---