FCC PART 15, SUBPART C

TEST AND MEASUREMENT REPORT

For

Silvus Technologies, Inc.

10990 Wilshire Blvd
Los Angeles, CA, 9002, USA

FCC ID: N2S-SL42-245-OEM

Report Type: Original Report	**Product Type:** StreamCaster Lite
Prepared By:	Libass Thiaw Test Engineer
Report Number:	R2402205-247
Report Date:	2024-04-04
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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	R2402205-247	Original Report	2024-04-04

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-O* with FCC ID: N2S-SL42-245-OEM. The device will be referred to as the "EUT" throughout this report. It is a StreamCaster Lite.

1.2 Mechanical Description of EUT

SL4210-235-O measures approximately 98 mm (Length), 54 mm (Width), and 55 mm (Height with heatsinks) and weighs 0.15 kg (with heatsinks)

The data gathered are from samples provided by Silvus Technologies, Inc. with their assigned S/N: SL42-00055875, X2

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	±1.48 dB
Unwanted Emissions, conducted	±1.57dB
All emissions, radiated	±4.0 dB
AC power line Conducted Emission	±2.0 dB
Temperature	±2ºC
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	55
2440	55
2462	55

Note: BPSK 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 frequency (MHz)	On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
2440	1.03	1.12	92	0.36

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

Please refer to Annex [F] for detailed test results.

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
Battery Adapter	< 1 m	Battery Packs	EUT
USB Extension	< 1 m	Laptop	EUT

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 §2.1091, §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 powered by Batteries.

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 (GHz)	Antenna Type	Maximum Antenna Gain (dBi)
External	2.40 ~ 2.48	Dipole	2.1

Antenna gain is information provided by customer.

*Note: directional gain is 2.1 dBi + 10*Log(number of antennas[2]) = 5.1 dBi*

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

5.1 Applicable Standards

As per FCC §1.1310(d) (3), At operating frequencies above 6 GHz, the MPE limits listed in Table 1 in paragraph (e)(1) of this section shall be used in all cases to evaluate the environmental impact of human exposure to RF radiation as specified in §1.1307(b) of this part.

TABLE 1 TO §1.1310(E)(1)—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(i) Limits for Occupational/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	≤6
3.0-30	1842/f	4.89/f	*($900/f^2$)	<6
30-300	61.4	0.163	1.0	<6
300-1,500			f/300	<6
1,500-100,000			5	<6
(ii) 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
300-1,500			f/1500	<30
1,500-100,000			1.0	<30

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

5.2 MPE Prediction

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

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

Where: S = power density
EIRP = Effective Isotropic Radiated Power
R = distance to the center of radiation of the antenna

5.3 RF exposure evaluation exemption for FCC

Frequency (MHz)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (mW)	Power Density at 20cm (mW/cm^2)	Limit (mW/cm^2)
2412	28.75	33.85	2426.61	0.48	1.0

Note 1: Maximum EIRP [dBm] = Maximum Power [dBm] + Directional Antenna Gain [dBi] = 28.75 + 5.1 = 33.85 dBm
Note 2: Maximum EIRP [mW] = 10 ^ (Maximum EIRP[dBm]/10) = 10 ^ 3.385 = 2426.61 mW

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

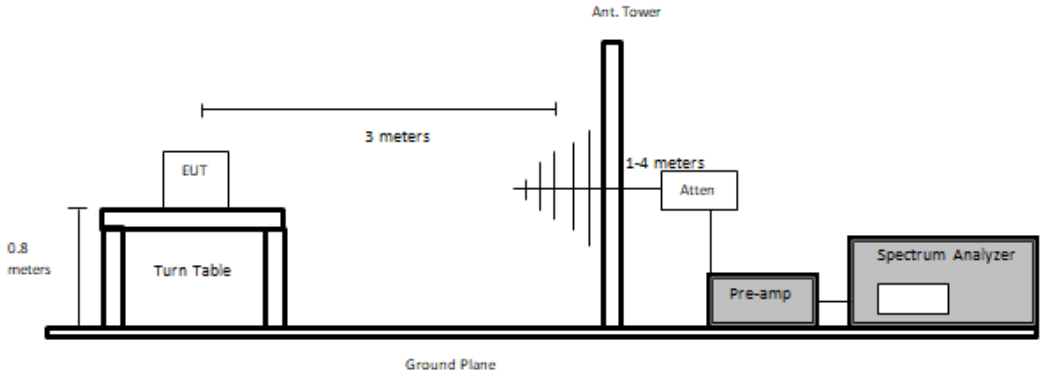
The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was the FCC 15 Subpart C limits.

The spacing between the peripherals was 10 centimeters.

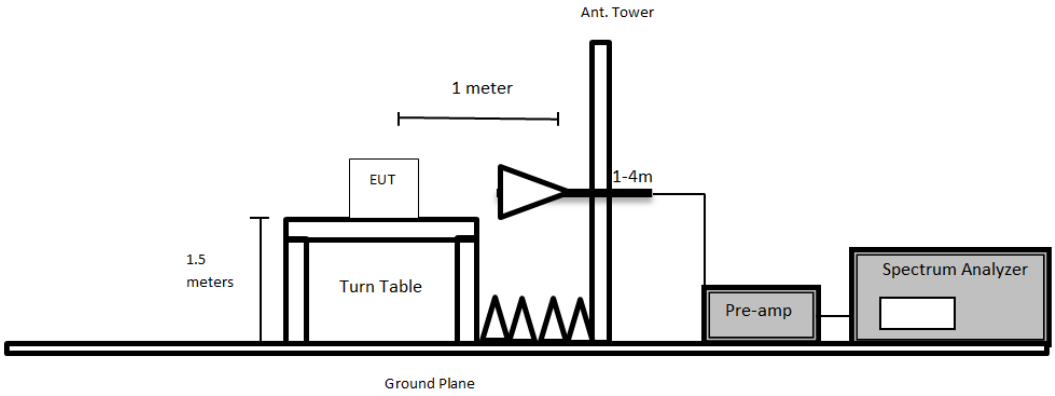
External I/O cables were draped along the edge of the test table and bundle when necessary.

6.3 Test Setup Block Diagrams

Below 1 GHz:



Above 1 GHz:



6.4 Test Procedure

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
310	Rohde & Schwarz	EMI test receiver 9 KHZ to 3 GHZ	ESCI 1166.5950. 03	100338	2023-05-11	1 year
316	Sonoma Instruments	Preamplifier 10 kHz - 2.5 GHz	317	260406	2023-09-26	6 months
321	Sunol Sciences	Biconilog Antenna	JB3	A020106-2; 1504	2023-12-18	2 years
1186	Pasternack	Coaxial Cable, RG214	PE3062-1050CM	-	2023-10-03	6 months
1245	-	6dB Attenuator	PE7390-6	01182018 A	2023-12-18	2 years
1246	Hewlet Packard	RF Limiter	11867A	01734	2023-04-13	1 year
1248	Pasternack	RG214 COAX Cable	PE3062	-	2023-10-04	6 months
1249	Time Microwave	LMR-400 Cable Dc-3 GHz	AE13684	2k80612-5 6fts	2023-10-09	6 months
624	Agilent	Spectrum Analyzer	E4446A	MY48250 238	2023-05-12	1 year
658	HP/ Agilant	Pre Amplifier 1-26.5 GHz	8449B OPT HO2	3008A011 03	2023-12-01	6 months
827	AH Systems	Pre-Amplifier 18-40 GHz	PAM 1840 VH	170	2023-11-08	6 months
90	Wisewave	Horn Antenna	ARH-4223-02	10555-01	2023-05-02	2 years
1192	ETS Lindgren	Horn Antenna	3117	00218973	2022-09-29	2 years
1247	Uti flex	Micro - Coax	-	-	2023-12-01	6 months
1329	Pasternack	2.92 mm short coaxial cable	PE360-12	-	2023-11-28	6 monhts
1353	RFMW	2.92 mm 10ft RF Cable DC to 40 GHz	P1CA-29M29M-F150-120	-	2024-01-24	1 year
672	Micro -Tronics	2.4-2.6 GHz Notch Filter	BRM50701	160	2024-03-06	1 year
327	Sunol Sciences	System Controller	SC110V	122303-1	NR	NR
1075	Sunol Sciences	Boresight Tower	TLT3	050119-7	NR	NR
1388	Sunol Sciences	Flush Mount Turntable	FM	112005-2	NR	NR

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 C
Relative Humidity:	34%
ATM Pressure:	102.2 kPa

The testing was performed by Arturo Reyes from 2024-03-01 to 2024-03-04 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)**
-3.72	34.8745	Vertical	2412 MHz

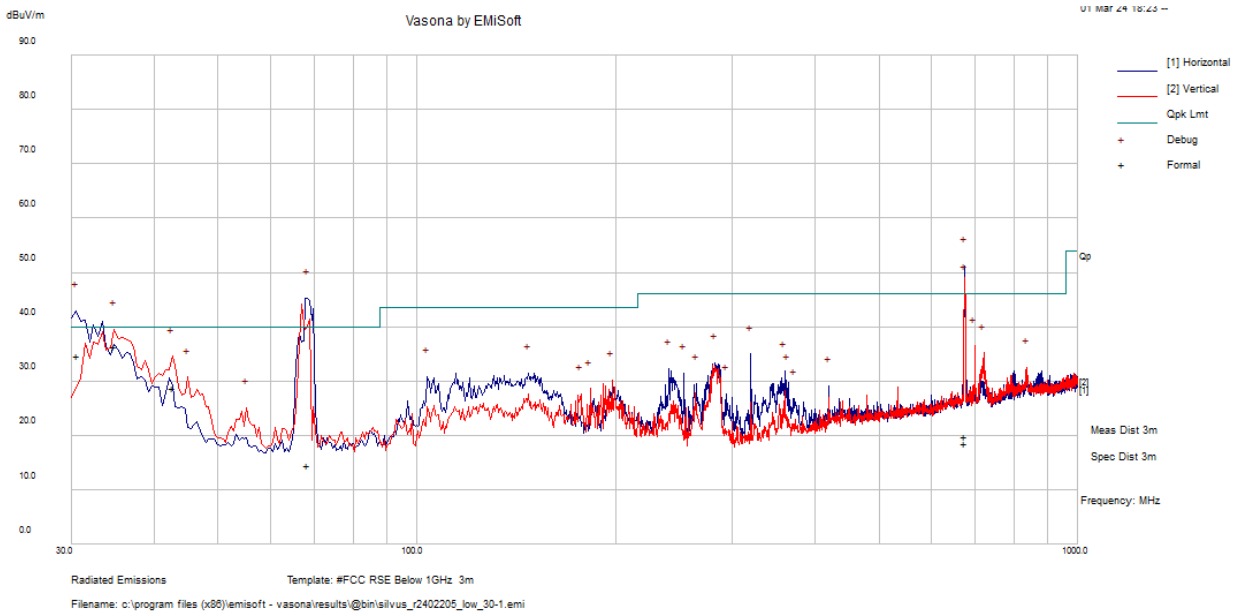
Please refer to the following table and plots for specific test result details.

6.9 Radiated Emissions Test Results

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

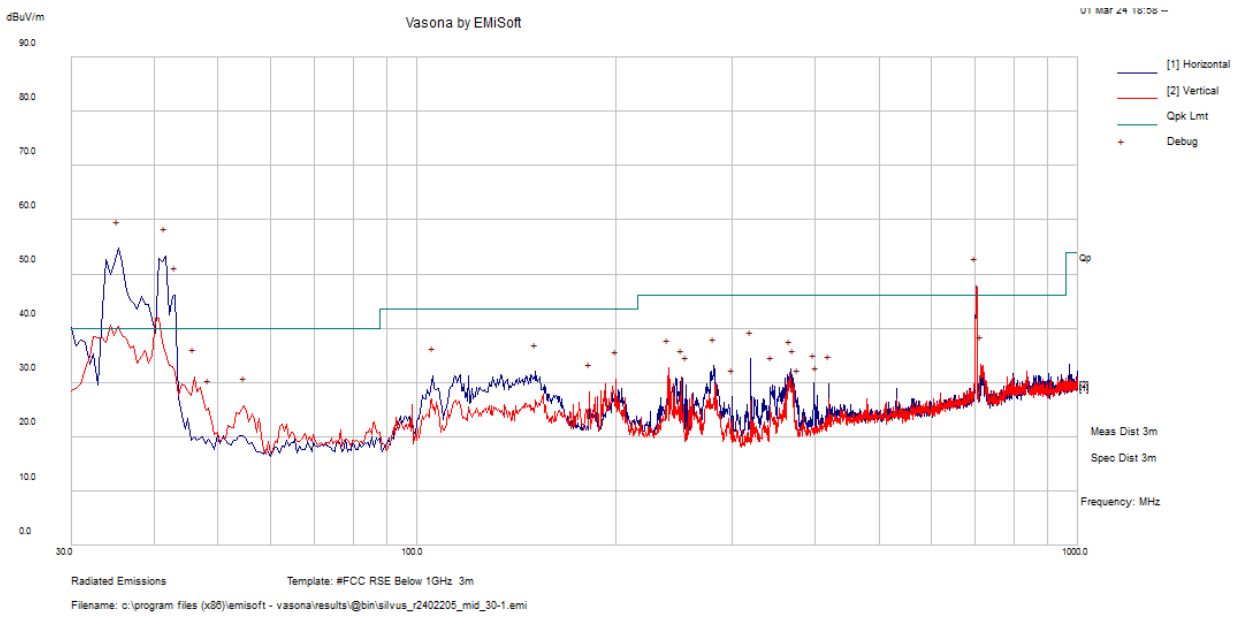
Note: *Pre-scans were performed on all shown configurations in order to determine worst-case results. Following this, a formal scan was performed on the worst-case detailed below*

2412 MHz



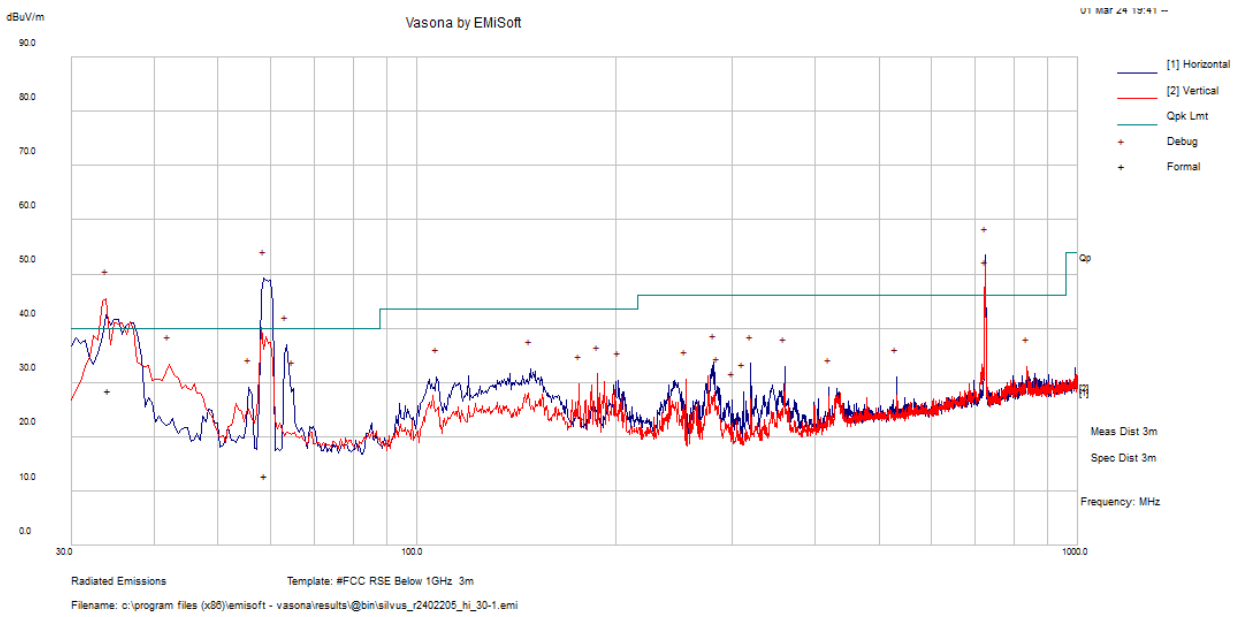
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector
68.2465	36.53	-22.05	14.48	151	H	194	40	-25.52	QP
674.0425	25.7	-7.24	18.46	146	H	251	46	-27.54	QP
30.709	44.86	-10.13	34.73	173	H	286	40	-5.27	QP
675.3285	26.98	-7.21	19.77	192	V	212	46	-26.23	QP
34.8745	49.21	-12.93	36.28	105	V	285	40	-3.72	QP
42.714	47.15	-18.39	28.76	125	V	7	40	-11.24	QP

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)	Detector
35.5585	37.05	-22.88	14.17	113	H	287	40	-25.83	QP
41.4915	36.92	-27.07	9.85	110	H	288	40	-30.15	QP
42.909	34.57	-28.08	6.49	286	H	285	40	-33.51	QP
700.9115	24.98	-16.22	8.76	264	H	90	46	-37.24	QP
45.94175	39.08	-30.04	9.04	147	V	352	40	-30.96	QP
151.31525	43.31	-26.52	16.79	195	H	235	43.5	-26.71	QP

2462 MHz



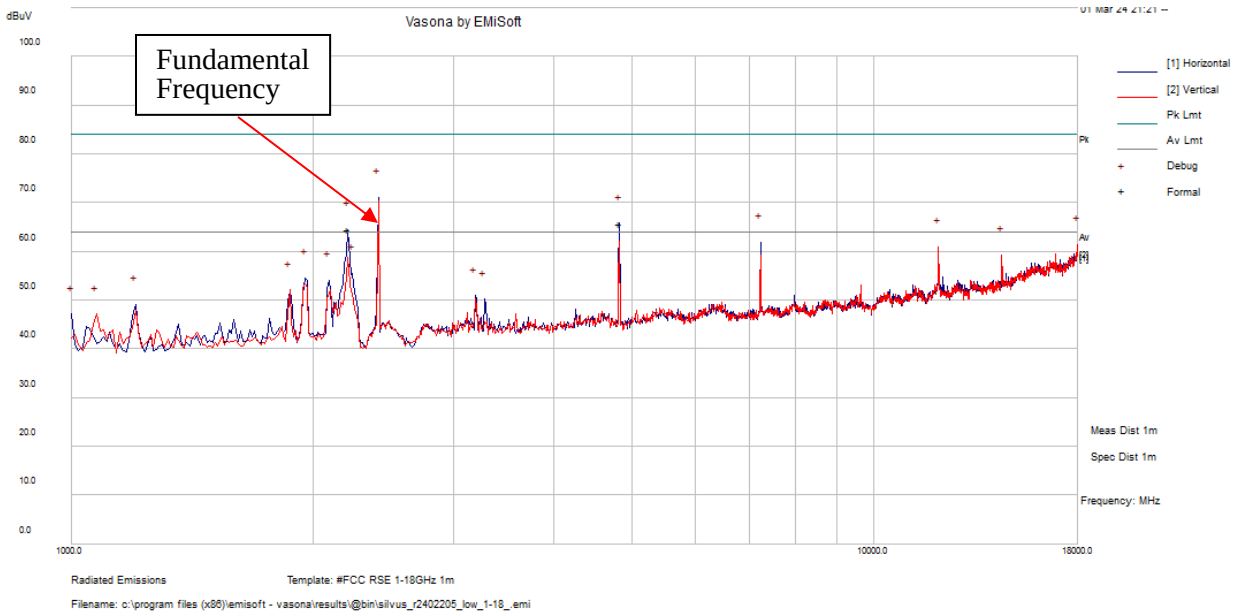
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Detector
58.82825	34.71	-32.3	2.41	210	H	165	40	-37.59	QP
723.96075	25.27	-16.16	9.11	140	H	133	46	-36.89	QP
33.9995	41	-22.01	18.99	101	V	234	40	-21.01	QP
725.25725	25.76	-16.15	9.61	277	H	135	46	-36.39	QP
63.40175	36.59	-31.9	4.69	121	H	197	40	-35.31	QP
42.3335	38.67	-27.66	11.01	168	V	23	40	-28.99	QP

2) 1 – 18 GHz Worst Case scan, Measured at 1 meter

FCC Limits for 1 GHz to 40 GHz				
Applicablity	**(dBm)**	**(uV/m at 3meters)**	**(dBuV/m at 3meters)**	**(dBuV/m at 1meter)[2]**
Restricted Band Average Limit	-	500	54	63.54
Restricted Band Peak Limit[1]	-	-	74	83.54

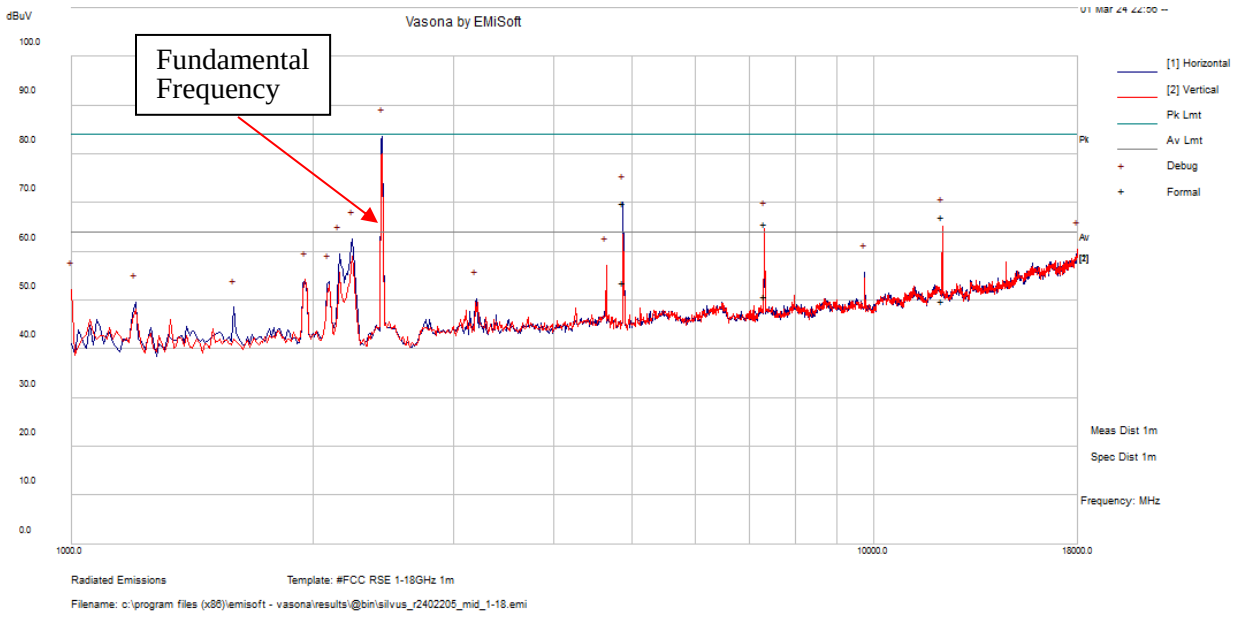
Note[1]: Restricted Band Peak Limit is defined to be 20dB higher than Average Limit.
Note[2]: Limits at 1 meter are determined by applying a Distance correction factor accounts for extrapolation from 1 meters to 3 meters. Formula used is as follows: 20*log(3meters/1meter) = 9.54 (According to ANSI C63.10-2013 Section 9.4)

2412 MHz



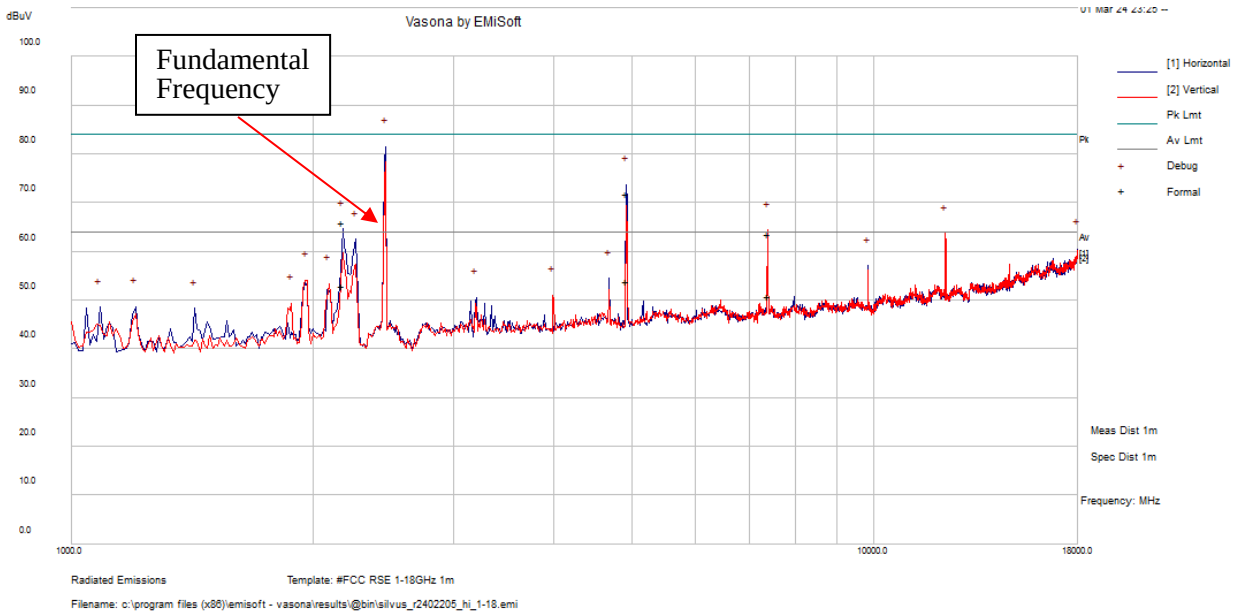
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
4822.91	63.23	-0.43	62.8	161	H	123	83.54	-20.74	Peak
4822.91	47.54	-0.43	47.11	161	H	123	63.54	-16.43	Average
2211.985	68.14	-5	63.14	225	V	352	83.54	-20.4	Peak
2211.985	54.19	-5	49.19	152	H	76	63.54	-14.35	Average

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
4878.8575	70.17	-0.34	69.83	140	H	154	83.54	-13.71	Peak
4878.8575	53.98	-0.34	53.64	140	H	154	63.54	-9.9	Average
12198.193	60.63	6.46	67.09	191	V	103	83.54	-16.45	Peak
12198.193	43.32	6.46	49.78	191	V	103	63.54	-13.76	Average
7318.875	63.06	2.61	65.67	110	V	168	83.54	-17.87	Peak
7318.875	48.26	2.61	50.87	172	H	156	63.54	-12.67	Average

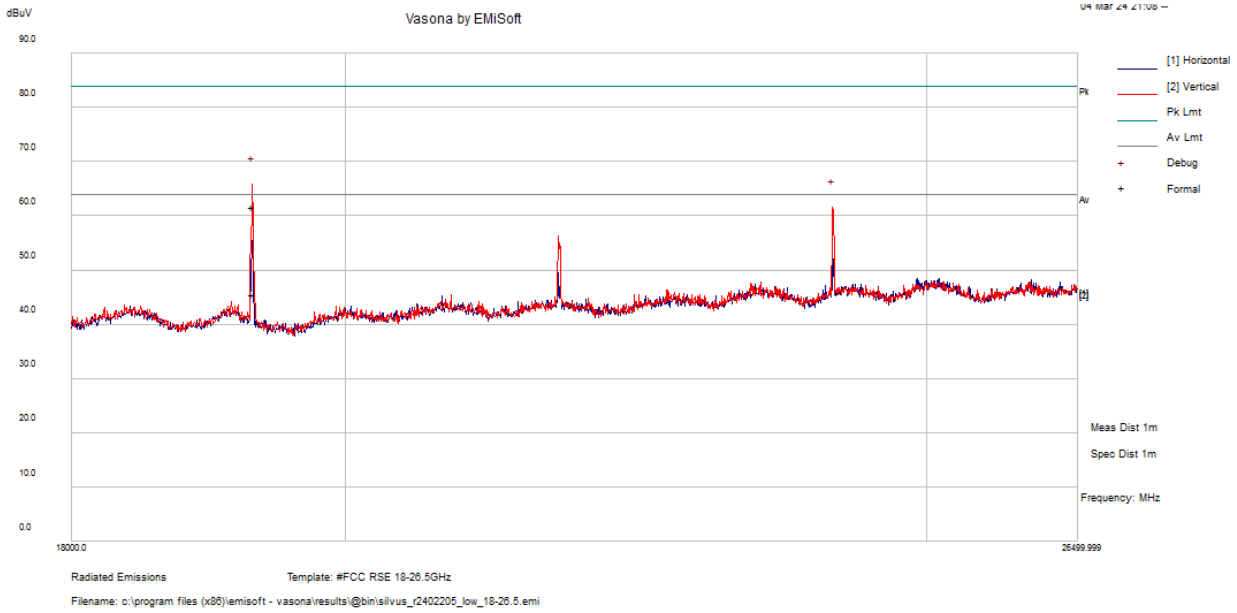
2462 MHz



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
4921.985	72.11	-0.27	71.84	152	H	155	83.54	-11.7	Peak
4921.985	54.1	-0.27	53.83	152	H	155	63.54	-9.71	Average
2180.465	70.96	-5.03	65.93	120	H	317	83.54	-17.61	Peak
2180.465	57.99	-5.03	52.96	120	H	317	63.54	-10.58	Average
7386.155	61.07	2.58	63.65	107	V	180	83.54	-19.89	Peak
7386.155	48.25	2.58	50.83	107	V	180	63.54	-12.71	Average

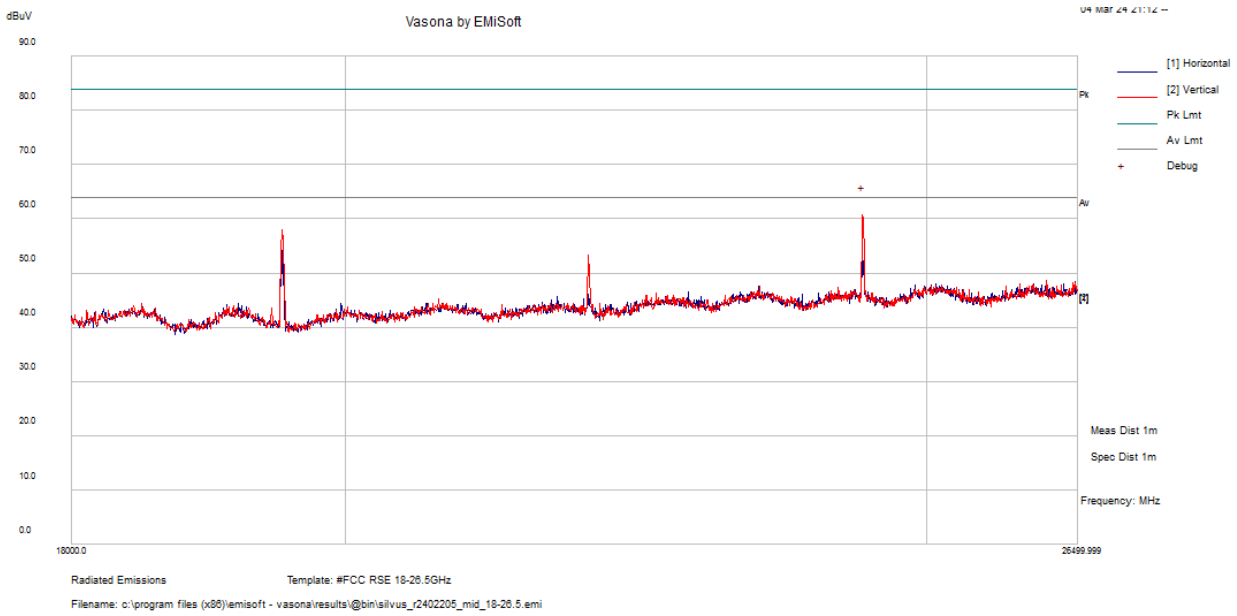
3) 18 – 26.5 GHz Worst Case scan, Measured at 1 meter

2412 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
19297.435	59.99	1.72	61.71	153	V	265	83.54	-21.83	Peak
19297.435	43.82	1.72	45.54	153	V	265	63.54	-18	Average

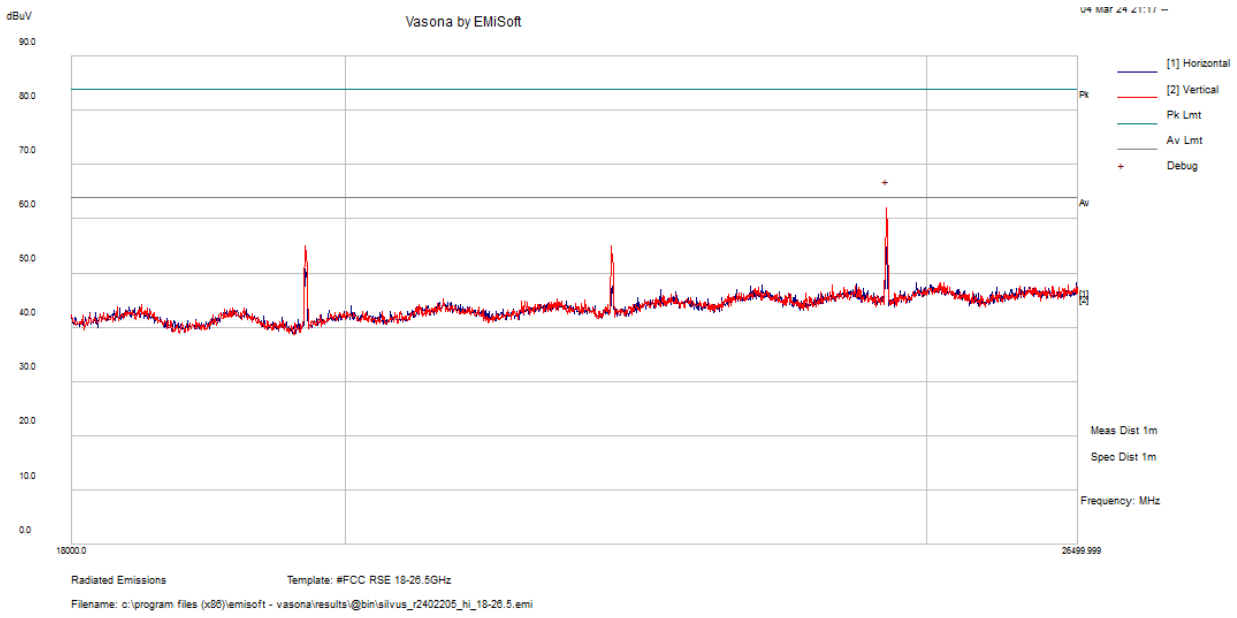
2440 MHz



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
24396.249	54.11	6.74	60.85	200	V	360	83.54	-22.69	Peak

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

2462 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
24624.687	55.34	6.62	61.96	200	V	360	83.54	-21.58	Peak

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

Please refer to Annex D for spurious emissions band edges.

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

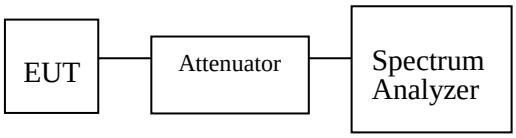
7.1 Applicable Standards

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
624	Agilent	Spectrum Analyzer	E4446A	MY48250238	05-15-2023	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:	23ºC
Relative Humidity:	49%
ATM Pressure:	101.6 kPa

The testing was performed by Libass Thiaw on 03-12-2024 at RF test site.

7.6 Test Results

Antenna 1

Channel	Frequency (MHz)	99% OBW (MHz)	6 dB OBW (MHz)	6 dB OBW Limit (kHz)
Low	2412	4.405	4.250	> 500
Middle	2440	4.413	4.248	> 500
High	2462	4.421	4.370	> 500

Antenna 2

Channel	Frequency (MHz)	99% OBW (MHz)	6 dB OBW (MHz)	6 dB OBW Limit (kHz)
Low	2412	4.415	4.241	> 500
Middle	2440	4.402	4.300	> 500
High	2462	4.435	4.309	> 500

Please refer to Annex A for detailed test results.

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

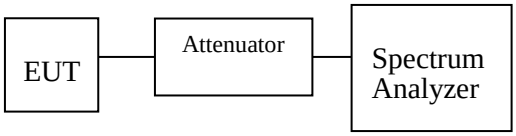
8.1 Applicable Standards

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
624	Agilent	Spectrum Analyzer	E4446A	MY48250238	05-15-2023	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:	22ºC
Relative Humidity:	53%
ATM Pressure:	101.5 kPa

The testing was performed by Libass Thiaw on 03-12-2024 at RF test site.

8.6 Test Results

Channel	Frequency (MHz)	Conducted Output Power (dBm)		Average Output Power (dBm)	FCC Limit (dBm)
		Antenna 1	Antenna 2		
Low	2412	25.63	25.84	28.75	< 30
Middle	2440	25.14	25.42	28.29	< 30
High	2462	24.81	25.07	27.95	< 30

*Note: Average Output Power (dBm)= 10*log(10^(Ant1/10) + 10^(Ant2/10))*
Note: DCCF was already added to Conducted Output Power measurements

Please refer to Annex B for detailed test results.

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

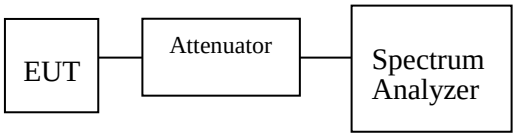
9.1 Applicable Standards

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
624	Agilent	Spectrum Analyzer	E4446A	MY48250238	05-15-2023	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:	22ºC
Relative Humidity:	53%
ATM Pressure:	101.5kPa

The testing was performed by Libass Thiaw on 03-12-2024 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	2412	1.538	1.767	4.664	< 8
Middle	2440	1.792	1.968	4.891	< 8
High	2462	2.017	1.629	4.838	< 8

*Note: Combined Conducted PSD (dBm/3kHz) = 10*log (10^ (Ant1/10) + 10^ (Ant2/10))*
Note: DCCF was already added to Conducted Output Power measurements

Please refer to Annex C for detailed test results.

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

10.1 Applicable Standards

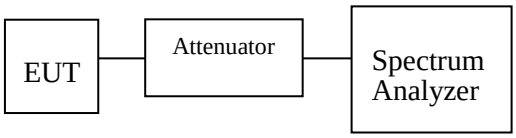
According to FCC §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, 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)).

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
624	Agilent	Spectrum Analyzer	E4446A	MY48250238	05-15-2023	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:	23ºC
Relative Humidity:	49%
ATM Pressure:	101.6 kPa

The testing was performed by Libass Thiaw on 03-12-2024 at RF test site.

10.6 Test Results

Please refer to Annex E for detailed test results.

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
624	Agilent	Spectrum Analyzer	E4446A	MY48250238	05-15-2023	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:	23ºC
Relative Humidity:	49%
ATM Pressure:	101.6 kPa

The testing was performed by Libass Thiaw on 03-12-2024 at RF test site.

11.6 Test Results

Please refer to Annex E for detailed test results.

12 Annex G (Normative) - Test Setup Photographs

Please refer to the attachment.

13 Annex H (Normative) - EUT External Photographs

Please refer to the attachment.

14 Annex I (Normative) - EUT Internal Photographs

Please refer to the attachment.

15 Annex J (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 ---