



**FCC PART 15.407**  
**ISED RSS-247, ISSUE 2, FEBRUARY 2017**



**TEST REPORT**

For

**Rajant Corporation**

200 Chesterfield Pkwy,  
Malvern, PA 19355, USA

**FCC ID: VJA-ES12450R**  
**IC: 7382A-ES12450R**

<b>Report Type:</b> Class II Permissive Change	<b>Product Type:</b> Wireless Node
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\* This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "\*" (Rev 1.2)

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**DOCUMENT REVISION HISTORY**

<b>Revision Number</b>	<b>Report Number</b>	<b>Description of Revision</b>	<b>Date of Revision</b>
0	R2203223-NII	Original Report	2022-06-17

# 1 General Description

## 1.1 Product Description for Equipment Under Test (EUT)

This test report was prepared on behalf of Rajant Corporation., and their product: ES1-2450IS, FCC ID: VJA-ES12450R, IC: 7382A-ES12450R, the “EUT” as referred to in this report. The EUT is a Wireless Node.

## 1.2 Mechanical Description

The EUT has two configurations: Aluminum Enclosure and Stainless Steel Enclosure.

The Aluminum Enclosure configuration measured approximately 32 cm (L) x 24 cm (W) x 11 cm (H) and weighs approximately 3 kg.

The Stainless Steel Enclosure configuration measured approximately 32 cm (L) x 24 cm (W) x 11 cm (H) and weighs approximately 5.65 kg.

*The test data gathered are from typical production sample with BACL assigned serial numbers: R2203223-1(Aluminum Enclosure) & R2203223-2 (Stainless Steel Enclosure).*

## 1.3 Objective

This report was prepared on behalf of *Rajant Corporation.* in accordance with FCC CFR47 §15.407 and ISEDC RSS-247 Issue 2, February 2017.

The objective is to determine compliance with FCC Part 15.407 and ISEDC RSS-247 for Output Power and Radiated Spurious Emissions testing.

This project is a Permissive Change II submission for the purpose of changing the enclosure (Model: ES1-2450IS), disabling one of the 2 2.4GHz Wifi ports and implementing software with lower power settings.

<b>Model Number</b>	ES1-2450IS (EUT)
<b>FCC ID</b>	VJA-ES12450R
<b>IC</b>	7382A-ES12450R
<b>Radio Type</b>	WLAN
Operating Frequency	2412MHz – 2462MHz 5180MHz – 5240MHz, 5745MHz – 5825MHz
Modulation	DSSS, OFDM (WLAN)
Channel Spacing	20MHz (2.4G); 40MHz (2.4G) 20MHz (5G); 40MHz (5G)
Omnidirectional Antenna Gain	5 dBi (2.4G), 7 dBi (UNII-1); 6 dBi (UNII-3)
Original RF Output Power	0.857W (2.4G WLAN); 0.198W (UNII-1); 0.314W (UNII-3)

## 1.4 Related Submittal(s)/Grant(s)

FCC Part 15, Subpart C, Equipment Class: DTS with FCC ID: VJA-ES12450R, IC: : 7382A-ES12450R

## 1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz, and FCC KDB 789033 D02 General UNII Test Procedure New Rules v02r01.

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

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

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

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

- For the USA (Federal Communications Commission):

- 1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
- 2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
- 3- All Telephone Terminal Equipment within FCC Scope C.

- For the Canada (Industry Canada):

- 1- All Scope 1-Licence-Exempt Radio Frequency Devices;
- 2- All Scope 2-Licensed Personal Mobile Radio Services;
- 3- All Scope 3-Licensed General Mobile & Fixed Radio Services;
- 4- All Scope 4-Licensed Maritime & Aviation Radio Services;
- 5- All Scope 5-Licensed Fixed Microwave Radio Services
- 6- All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.

- For Singapore (Info-Communications Development Authority (IDA)):

- 1- All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
- 2- All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2

- For the Hong Kong Special Administrative Region:

- 1- All Radio Equipment, per KHCA 10XX-series Specifications;
- 2- All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
- 3- All Fixed Network Equipment, per HKCA 20XX-series Specifications.

- For Japan:

- 1- MIC Telecommunication Business Law (Terminal Equipment):
  - All Scope A1 - Terminal Equipment for the Purpose of Calls;
  - All Scope A2 - Other Terminal Equipment
- 2- Radio Law (Radio Equipment):
  - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
  - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
  - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

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

- 1 Electronics and Office Equipment:
  - for Telephony (ver. 3.0)
  - for Audio/Video (ver. 3.0)
  - for Battery Charging Systems (ver. 1.1)
  - for Set-top Boxes & Cable Boxes (ver. 4.1)
  - for Televisions (ver. 6.1)
  - for Computers (ver. 6.0)
  - for Displays (ver. 6.0)
  - for Imaging Equipment (ver. 2.0)
  - for Computer Servers (ver. 2.0)
- 2 Commercial Food Service Equipment
  - for Commercial Dishwashers (ver. 2.0)
  - for Commercial Ice Machines (ver. 2.0)
  - for Commercial Ovens (ver. 2.1)
  - for Commercial Refrigerators and Freezers
- 3 Lighting Products
  - For Decorative Light Strings (ver. 1.5)
  - For Luminaires (including sub-components) and Lamps (ver. 1.2)
  - For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
  - For Integral LED Lamps (ver. 1.4)
- 4 Heating, Ventilation, and AC Products
  - for Residential Ceiling Fans (ver. 3.0)
  - for Residential Ventilating Fans (ver. 3.2)
- 5 Other
  - For Water Coolers (ver. 3.0)

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

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

Vietnam: APEC Tel MRA -Phase I;

## **2 System Test Configuration**

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### **2.1 Justification**

The EUT was configured for testing according to ANSI C63.10-2013 and FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

The EUT was tested in a testing mode to represent worst-case results during the final qualification test.

The worst-case configuration was selected based on the original test report, and verified to be lower than previous results at updated power setting by measuring the conducted output power or PSD.



## 2.2 EUT Exercise Software

The test utility used was the “BCCommander”, provided by *Rajant Corporation.*, the software is compliant with the standard requirements being tested against.

Radio	Modulation	Frequency (MHz)	Power Setting for Ports B&C
5 GHz Wi-Fi	802.11a	5180	13
		5200	13
		5220	13
		5240	13
		5745	13
		5765	13
		5785	13
		5805	13
		5825	13
	802.11n20	5180	13
		5200	13
		5220	13
		5240	13
		5745	13
		5765	13
		5785	13
		5805	13
		5825	13
	802.11n40	5190	13
		5230	13
		5755	13
		5795	13

\*Data rates tested:  
 802.11a mode: 6Mbps  
 802.11n HT20: MCS0

## 2.3 Equipment Modification

None.

## 2.4 Local Support Equipment

Manufacturer	Description	Model
Tycon Systems Inc.	POE	TP-POE-HP-24G

## 2.5 Remote Support Equipment

Manufacturer	Description	Model
HP	Laptop	Pro Book

## 2.6 Interface Ports and Cabling

Cable Descriptions	Length (m)	From	To
Ethernet	< 1	Laptop	POE
Ethernet	< 1	POE	EUT

### 3 Summary of Test Results

Results reported relate only to the product tested.

FCC & ISEDC Rules	Description of Test	Results
FCC §15.203 ISEDC RSS-Gen §6.8	Antenna Requirements	Compliant
FCC §2.1091, §15.407(f) ISED RSS-102	RF Exposure	Compliant
FCC §407(a) ISEDC RSS-247 §6.2	Output Power	Compliant
FCC §2.1053, §15.205, §15.209, 15.407(b) ISEDC RSS-247 §6.2	Radiated Spurious Emissions	Compliant

## 4 FCC §15.203 & ISEDC RSS-Gen §6.8 - Antenna Requirements

### 4.1 Applicable Standards

According to FCC §15.203:

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

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

According to ISEDC RSS-Gen §6.8: Transmitter Antenna

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

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

This radio transmitter has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

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

### 4.2 Antenna Description

External/Internal/ Integral	Part Number	Antenna Type	Frequency Range (MHz)	Maximum Antenna Gain (dBi)
External	KMA-5250-7-NM	Omni Directional	5150-5350 MHz	7
	KMA-5800-6-NM		5700-5900 MHz	6

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## 5 FCC §15.407(f) §2.1091 & ISED RSS-102 - RF Exposure

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### 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.<sup>8</sup> 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.<sup>9</sup>

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  $\lambda$  is the free-space operating wavelength in meters. The MPE-based test exemption condition is in terms of ERP, defined as the

<sup>8</sup> Specific test exemption thresholds for operations under occupational/controlled limits are not established.

<sup>9</sup> When SAR evaluation is required by the hotspot mode or UMPC mini-tablet procedures, that is, where an antenna is  $\leq 2.5$  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.

According to ISED RSS-102 Issue 5 Section 2.5.1 Exemption Limits for Routine Evaluation-SAR Evaluation:

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in table below,

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of $\leq 5$ mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
$\leq 300$	71	101	132	162	193
450	52	70	88	106	123
835	17	30	42	55	67
1900	7	10	18	34	60
2450	4	7	15	30	52
3500	2	6	16	32	55
5800	1	6	15	27	41

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of $\geq 50$ mm
$\leq 300$	223	254	284	315	345
450	141	159	177	195	213
835	80	92	105	117	130
1900	99	153	225	316	431
2450	83	123	173	235	309
3500	86	124	170	225	290
5800	56	71	85	97	106

According to ISSED RSS-102 Issue 5:

### 2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

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

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

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

## 5.2 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 <sup>2</sup>
1.34	-	30	35.6 m	-	1.6 m	3,450 R <sup>2</sup> /f <sup>2</sup>
30	-	300	1.6 m	-	159 mm	3.83 R <sup>2</sup>
300	-	1,500	159 mm	-	31.8 mm	0.0128 R <sup>2</sup> f
1,500	-	100,000	31.8 mm	-	0.5 mm	19.2 R <sup>2</sup>
Subscripts L and H are low and high; $\lambda$ 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 ERP<sub>20cm</sub> in Formula (B.1) [repeated from § 2.1091(c)(1) and § 1.1307(b)(1)(i)(B)].

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = 2040f \quad 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz}$$

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = 3060 \quad 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz}$$
(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).

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} (d/20 \text{ cm})^x \quad d \leq 20 \text{ cm}$$

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \quad 20 \text{ cm} < d \leq 40 \text{ cm}$$
(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  $EPR_{20\text{cm}}$  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

Prediction frequency (GHz)		5.745	
Maximum Output Power (dBm)		18.6	
Maximum ERP (dBm)		22.45	
Maximum ERP (mW)		175.79	
Prediction distance (cm)		20	
Maximum antenna gain (dBi)		6	
$0.3 \text{ GHz} \leq f < 1.5 \text{ GHz}$	ERP <sub>20 cm</sub> (mW)	$x$	SAR-based Exemption Threshold
	-	-	$d \leq 20 \text{ cm}$
			$P_{\text{th}}$ (mW)
			-
$1.5 \text{ GHz} \leq f \leq 6 \text{ GHz}$	ERP <sub>20 cm</sub> (mW)	$x$	SAR-based Exemption Threshold
	3060	-	$d \leq 20 \text{ cm}$
			$P_{\text{th}}$ (mW)
			-
$1.5 \text{ GHz} \leq f \leq 6 \text{ GHz}$	ERP <sub>20 cm</sub> (mW)	$x$	SAR-based Exemption Threshold
	3060	-	$d \leq 20 \text{ cm}$
			$P_{\text{th}}$ (mW)
			3060

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

### 5.4 RF exposure evaluation exemption for IC

Maximum EIRP = 18.6 dBm + 6 dBi = 24.6 dBm (288.4mW), which is less than  $1.31 \times 10^{-2} f^{0.6834} = 4.86 \text{ W} = 36.86 \text{ dBm}$

Therefore, the RF exposure Evaluation is not required.

## 6 FCC §15.209, §15.407(b) & ISEDC RSS-247 §6.2 - Spurious Radiated Emissions

### 6.1 Applicable Standard

As Per FCC §15.205(a) except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110	16.42 – 16.423	960 – 1240	4.5 – 5.15
0.495 – 0.505	16.69475 – 16.69525	1300 – 1427	5.35 – 5.46
2.1735 – 2.1905	25.5 – 25.67	1435 – 1626.5	7.25 – 7.75
4.125 – 4.128	37.5 – 38.25	1645.5 – 1646.5	8.025 – 8.5
4.17725 – 4.17775	73 – 74.6	1660 – 1710	9.0 – 9.2
4.20725 – 4.20775	74.8 – 75.2	1718.8 – 1722.2	9.3 – 9.5
6.215 – 6.218	108 – 121.94	2200 – 2300	10.6 – 12.7
6.26775 – 6.26825	123 – 138	2310 – 2390	13.25 – 13.4
6.31175 – 6.31225	149.9 – 150.05	2483.5 – 2500	14.47 – 14.5
8.291 – 8.294	156.52475 – 156.52525	2690 – 2900	15.35 – 16.2
8.362 – 8.366	156.7 – 156.9	3260 – 3267	17.7 – 21.4
8.37625 – 8.38675	162.0125 – 167.17	3.332 – 3.339	22.01 – 23.12
8.41425 – 8.41475	167.72 – 173.2	3.3458 – 3.358	23.6 – 24.0
12.29 – 12.293	240 – 285	3.600 – 4.400	31.2 – 31.8
12.51975 – 12.52025	322 – 335.4		36.43 – 36.5
12.57675 – 12.57725	399.9 – 410		Above 38.6
13.36 – 13.41	608 – 614		

As per FCC §15.209: 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 Note 1	3
88 - 216	150 Note 1	3
216 - 960	200 Note 1	3
Above 960	500	3

Note 1: 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 Part 15.407 (b)

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of -17 dBm/MHz; for

frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of -27 dBm/MHz.

(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.

(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

(7) The provisions of §15.205 apply to intentional radiators operating under this section.

As per ISERC RSS-247 §6.2

For transmitters operating in the band 5150-5250 MHz, all emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. However, any unwanted emissions that fall into the band 5250- 5350 MHz must be 26 dBc, when measured using a resolution bandwidth between 1 and 5% of the occupied bandwidth, above 5.25 GHz. Otherwise, the transmission is considered as intentional and the devices shall implement dynamic frequency selection (DFS) and transmitter power control (TPC) as per the requirements for the band 5250-5350 MHz

For devices with both operating frequencies and channel bandwidths contained within the band 5250-5350 MHz, the device shall comply with the following:

1. All emissions outside the band 5250-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. if the equipment is intended for outdoor use; or
2. All emissions outside the band 5150-5350 MHz shall not exceed -27 dBm/MHz e.i.r.p. and any emissions within the band 5150-5250 MHz shall meet the power spectral density limits of Section 6.2.1. The device shall be labelled "for indoor use only."

For devices with operating frequencies in the band 5250-5350 MHz but having a channel bandwidth that overlaps the band 5150-5250 MHz, the devices' unwanted emission shall not exceed -27 dBm/MHz e.i.r.p. outside the band 5150-5350 MHz and its power shall comply with the spectral power density for operation within the band 5150-5250 MHz. The device shall be labelled "for indoor use only."

For transmitters operating in the band 5470-5725 MHz, emissions outside the band shall not exceed -27 dBm/MHz e.i.r.p.

For the band 5725-5850 MHz, emissions at frequencies from the band edges to 10 MHz above or below the band edges shall not exceed -17 dBm/MHz e.i.r.p. For emissions at frequencies more than 10 MHz above or below the band edges, the emissions power shall not exceed -27 dBm/MHz.

## 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 15.407 and ISED RSS-247 limits.

The spacing between the peripherals was 10 centimeters.

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

## 6.3 Test Procedure

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

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

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter or 1.5 meter above ground plane, 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:

$$\text{RBW} = 100 \text{ kHz} / \text{VBW} = 300 \text{ kHz} / \text{Sweep} = \text{Auto}$$

Above 1000 MHz:

- (1) Peak:  $\text{RBW} = 1\text{MHz} / \text{VBW} = 3\text{MHz} / \text{Sweep} = 100\text{ms}$
- (2) Average:  $\text{RBW} = 1\text{MHz} / \text{VBW} = 10\text{Hz} \text{ or } 1/\text{T} / \text{Sweep} = \text{Auto}$

## 6.4 Corrected Amplitude and Margin Calculation

For emissions below 1 GHz,

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

$$\text{CA} = \text{S.A. Reading} + \text{Correction Factor}$$

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:

$$\text{Correction Factor} = \text{AF} + \text{CL} + \text{Atten} - \text{Ga}$$

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:

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

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:

$$\text{CA} = \text{Ai} + \text{AF} + \text{CL} + \text{Atten} - \text{Ga}$$

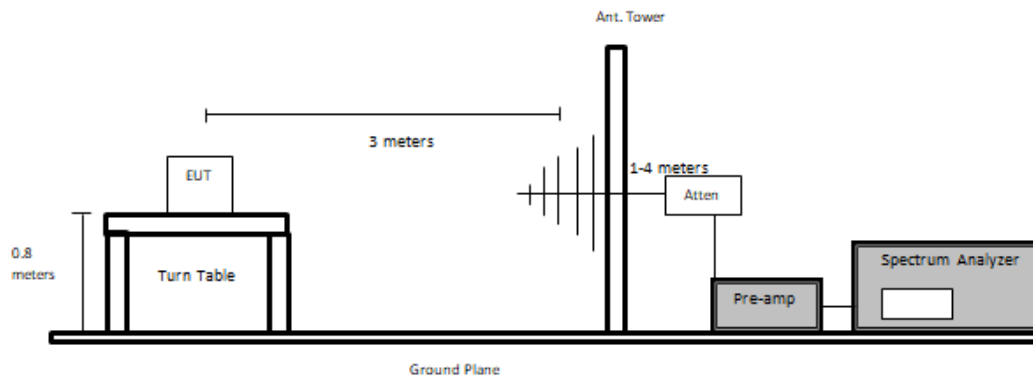
For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)

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

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

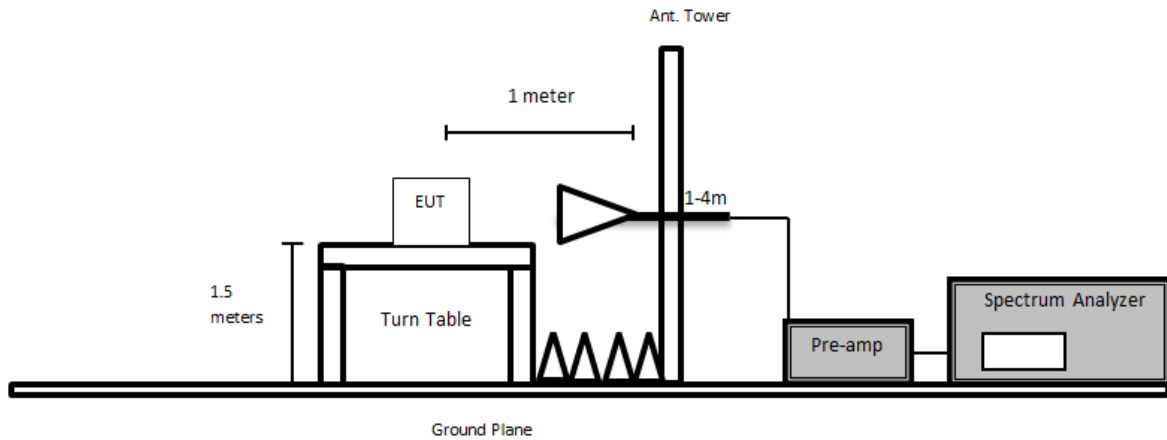
## 6.5 Test Setup Block Diagram

Below 1GHz:

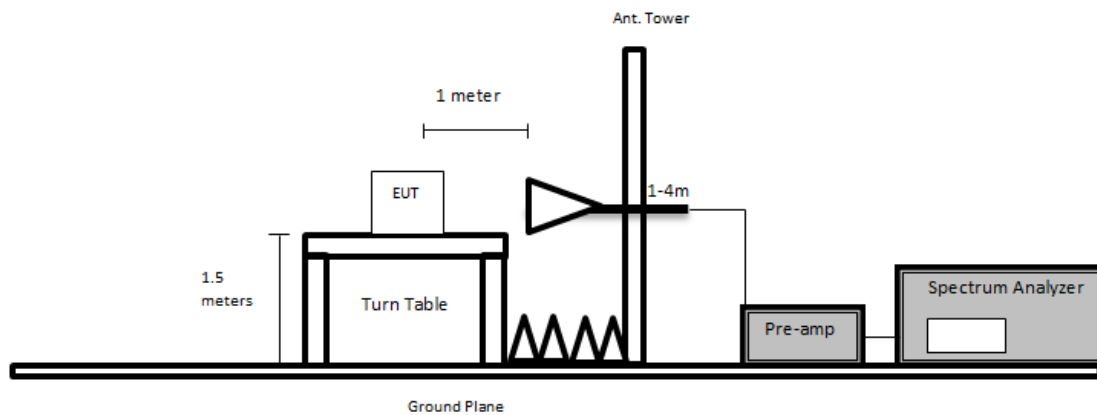


Above 1GHz:

1 GHz to 18 GHz (Asset #1192 Antenna used):



18 GHz to 40 GHz (Asset #91 and #230 Antennas used):





## 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	ESCI 1166.5950.03	100338	2021-11-18	1 year
624	Agilent	Analyzer, Spectrum	E4446A	MY48250238	2021-06-23	1 year
424	Agilent	Analyzer, Spectrum	E4440A	US45303156	2021-06-12	1 year
827	AH Systems	Preamplifier	PAM 1840 VH	170	2021-08-03	1 year
459	HP	Preamplifier	8447D	2443A04374	2021-11-02	1 year
N/A	Sunol Science Corp	System Controller	SC99V	011003-1	N/R	N/R
658	HP / Agilent	Pre-Amplifier	8449B OPT HO2	3008A0113	2022-05-06	1 year
321	Sunol Sciences	Biconilog Antenna	JB3	A020106-2	2021-11-22	2 years
1192	ETS Lindgren	Horn Antenna	3117	00218973	2021-09-14	2 years
91	Wisewave	Antenna, Horn 18-26.5GHz	ARH-4223-02	10555-02	2022-03-08	2 years
230	Wisewave	Antenna, Horn 26.5-40GHz	ARH-2823-02	10555-02	2022-03-08	2 years
1186	Pasternack	Coaxial Cable, RG214	PE3062-1050CM	1	2021-09-08	1 year
1077	Insulated Wire Corp.	KPS-1571AN-3960-KPS	KPS-1571AN-2400	DC 1917	2022-03-03	1 year
-	-	RF cable	-	-	Each time <sup>1</sup>	N/A
-	-	Notch filters	-	-	Each time <sup>1</sup>	N/A
N/A	Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

Note<sup>1</sup>: cable and notch filters 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

<b>Temperature:</b>	20-22 °C
<b>Relative Humidity:</b>	42-50 %
<b>ATM Pressure:</b>	102.7 kPa

The testing was performed by Marc Jean from 2022-05-09 to 2022-05-13 in 5m chamber 3.

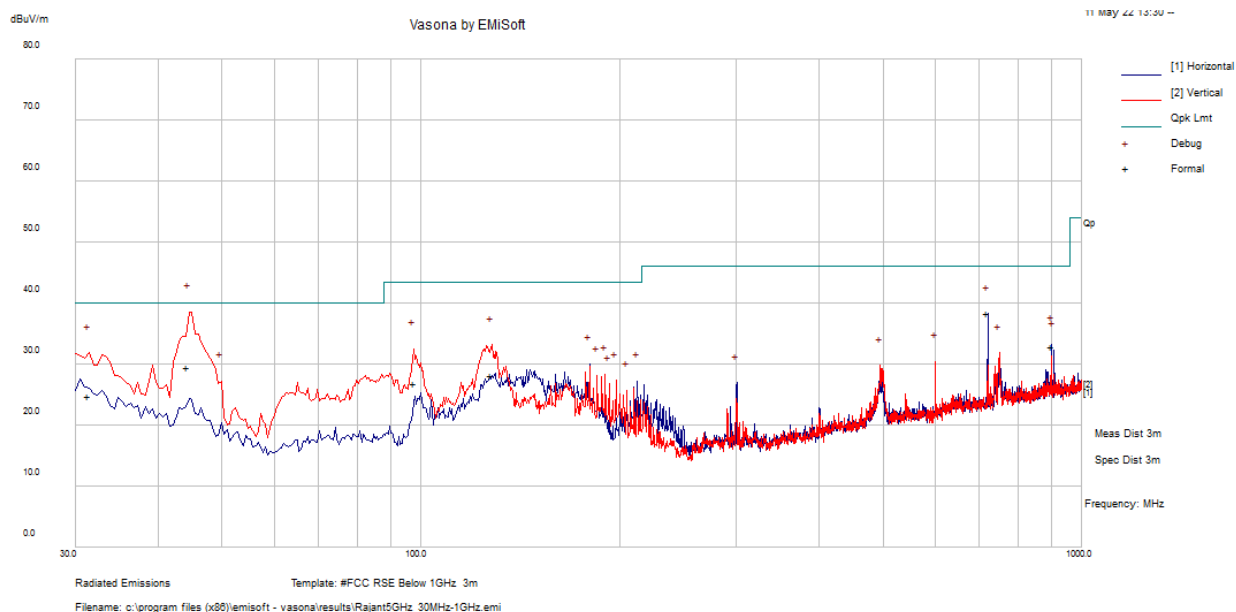
## 6.8 Summary of Test Results

According to the data hereinafter, the EUT complied with the FCC Part 15.407 and ISED RSS-247 standards' radiated emissions limits, and had the worst margin of:

Mode: Transmitting				
Margin (dB)	Frequency (GHz)	Polarization (Horizontal/Vertical)	Worst-case Configuration Tested	Model
-2.71	39662.505	V	802.11n20 mode, 5745 MHz	Aluminum Enclosure
-2.34	39596.468	V	802.11n20 mode, 5745 MHz	Stainless Steel Enclosure

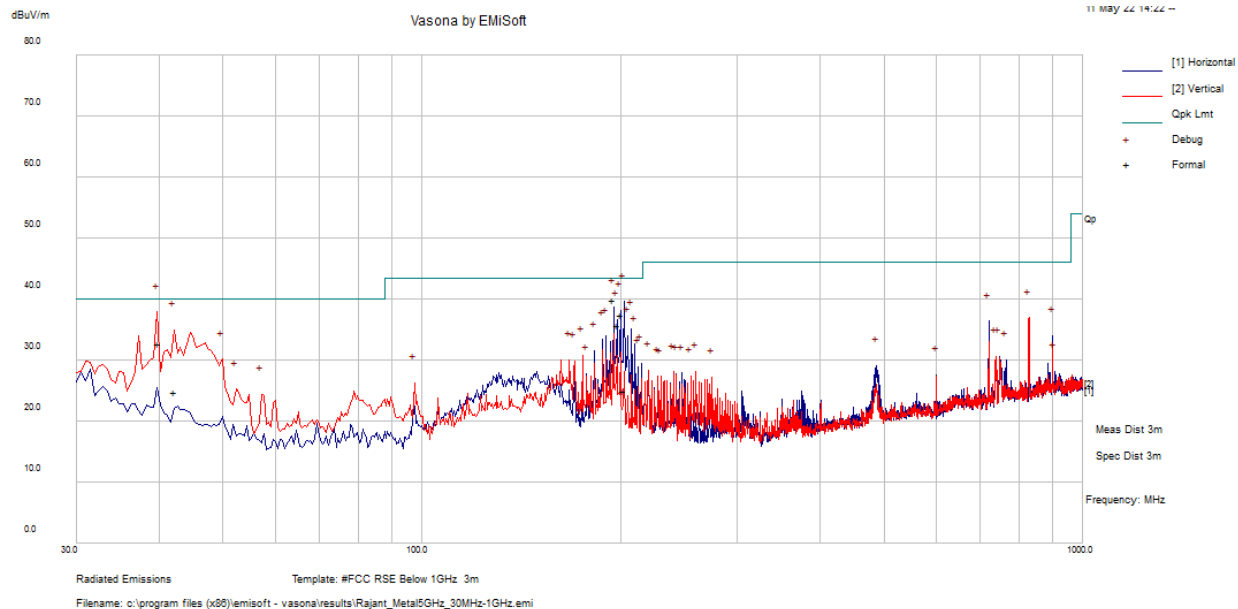
## 6.9 Radiated Emissions Test Result Data

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



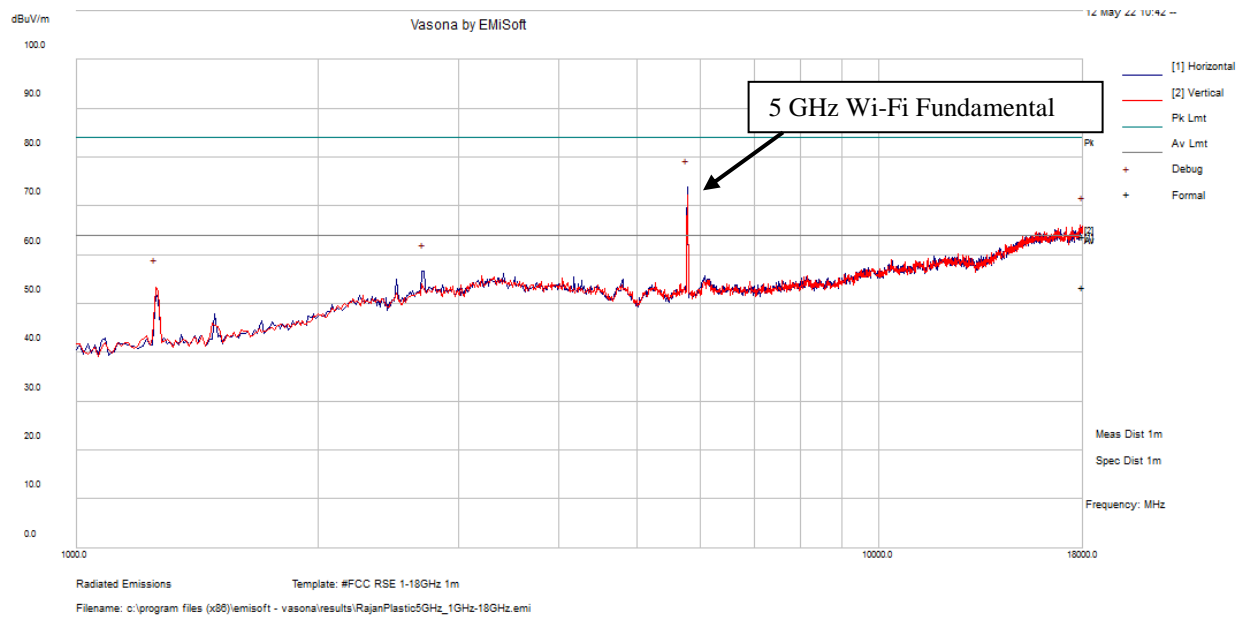
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBuV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBuV/m)	Margin (dB)	Comments (PK/QP/Ave.)
44.3715	38.15	-8.74	29.41	115	V	196	40	-10.59	QP
720.02175	35.92	2.49	38.41	102	H	296	46	-7.59	QP
31.3575	23.86	0.95	24.81	143	V	21	40	-15.19	QP
127.897	33.03	-4.81	28.21	156	V	161	43.5	-15.29	QP
97.654	35.98	-9.15	26.83	105	V	20	43.5	-16.67	QP
899.98675	28.7	4.23	32.92	152	H	304	46	-13.08	QP

## 2) 30 MHz – 1 GHz Worst Case, Measured at 3 meters, Stainless Steel Enclosure



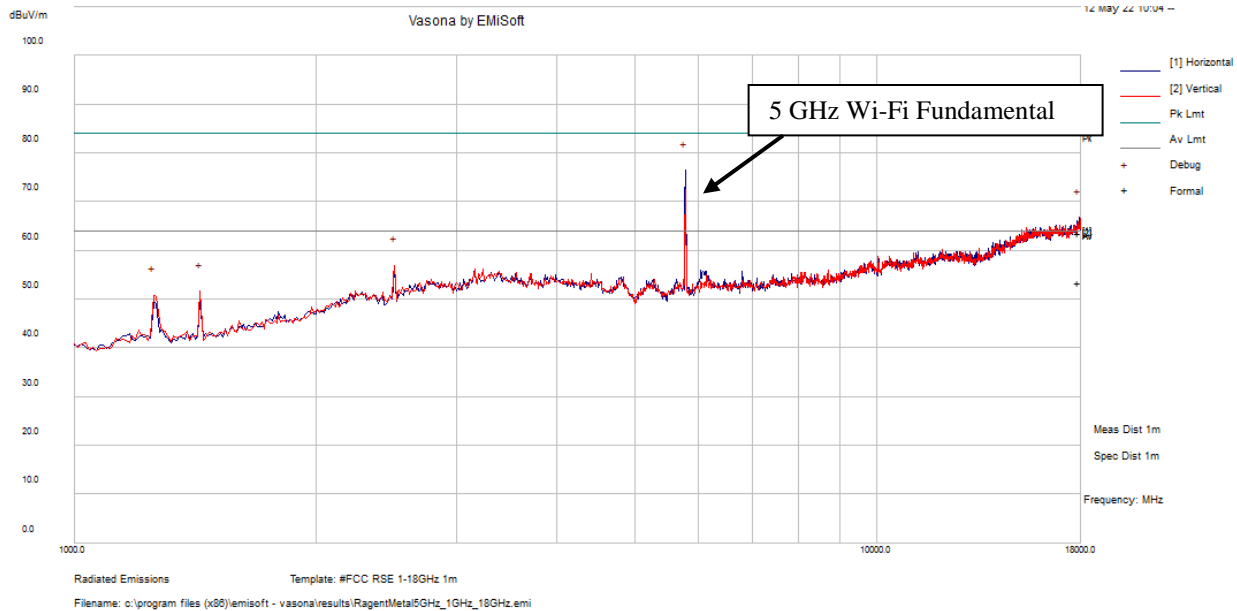
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBuV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBuV/m)	Margin (dB)	Comments (PK/QP/Ave.)
39.94	38.31	-5.68	32.63	100	V	305	40	-7.37	QP
202.00	31.73	-6.68	25.05	117	H	122	43.5	-18.45	QP
194.99	46.78	-6.98	39.8	172	H	94	43.5	-3.7	QP
42.17	32.10	-7.32	24.78	127	V	340	40	-15.22	QP
199.98	43.8	-6.38	37.42	130	H	83	43.5	-6.08	QP
197.49	42.23	-6.58	35.65	168	H	138	43.5	-7.85	QP

### 3) 1–18 GHz Worst Case, Measured at 1 meter, Aluminum Enclosure



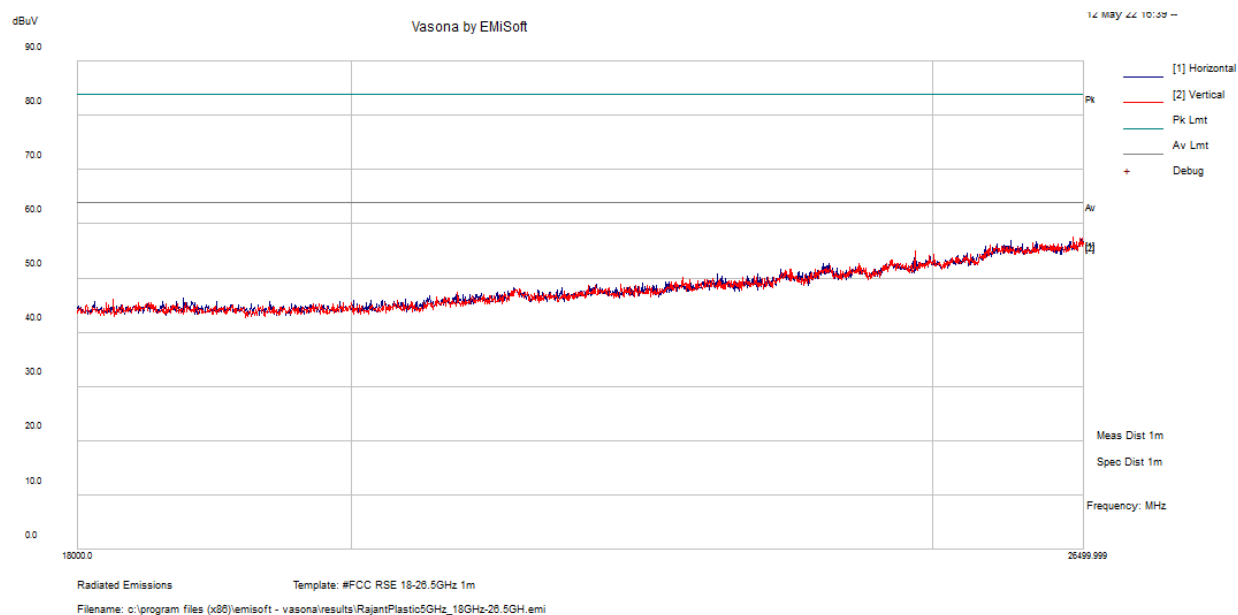
Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBμV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBμV/m)	Margin (dB)	Detector (Peak /Ave.)
17999.66	44.95	18.94	63.89	204	V	30	84	-20.11	Peak
17999.66	34.48	18.94	53.42	204	V	30	64	-10.58	Ave

#### 4) 1–18 GHz Worst Case, Measured at 1 meter, Stainless Steel Enclosure



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 (Peak /Ave.)
17895.438	44.77	19.05	63.51	245	H	221	84	-20.49	Peak
17895.438	34.69	19.05	53.43	245	H	221	64	-10.57	Ave

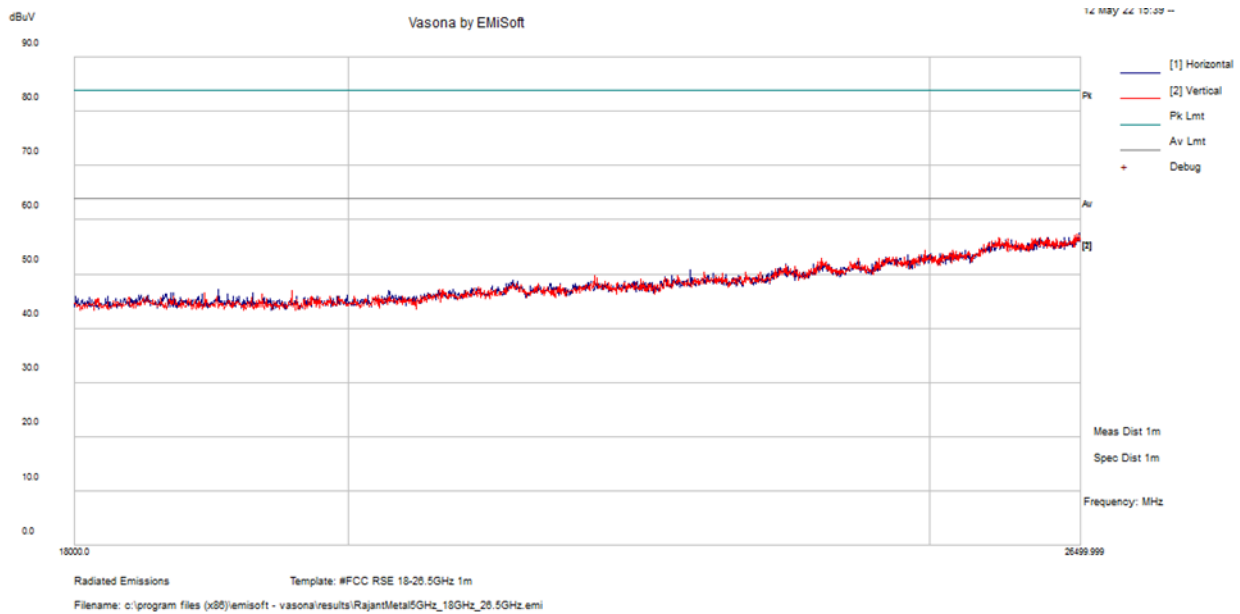
### 5) 18-26.5 GHz Worst Case, Measured at 1 meter, Aluminum Enclosure



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBμV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBμV/m)	Margin (dB)	Detector (Peak /Ave.)
26499.999	33.53	23.28	56.81	V	101	7	64	-7.19	Peak

Note: Peak measurement made on worst-case emission and compared to average limit to show compliance.

## 6) 18-26.5 GHz Worst Case, Measured at 1 meter, Stainless Steel Enclosure

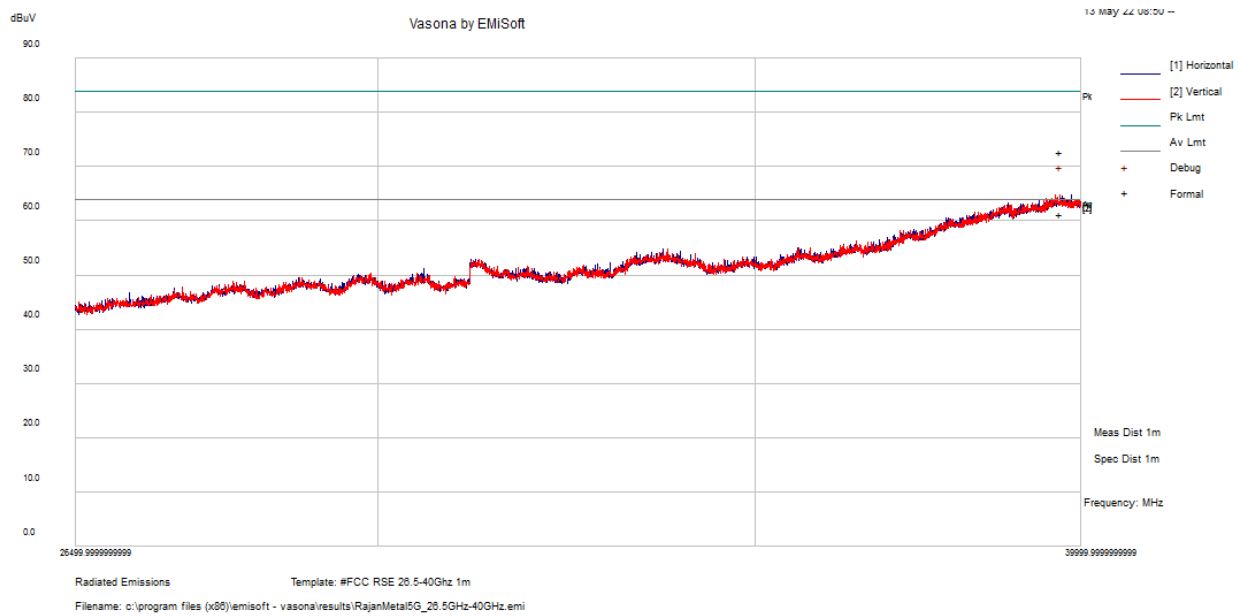


Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBμV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBμV/m)	Margin (dB)	Detector (Peak/Ave.)
26459.033	33.28	23.05	56.34	V	101	7	64	-7.66	Peak

Note: Peak measurement made on worst-case emission and compared to average limit to show compliance.

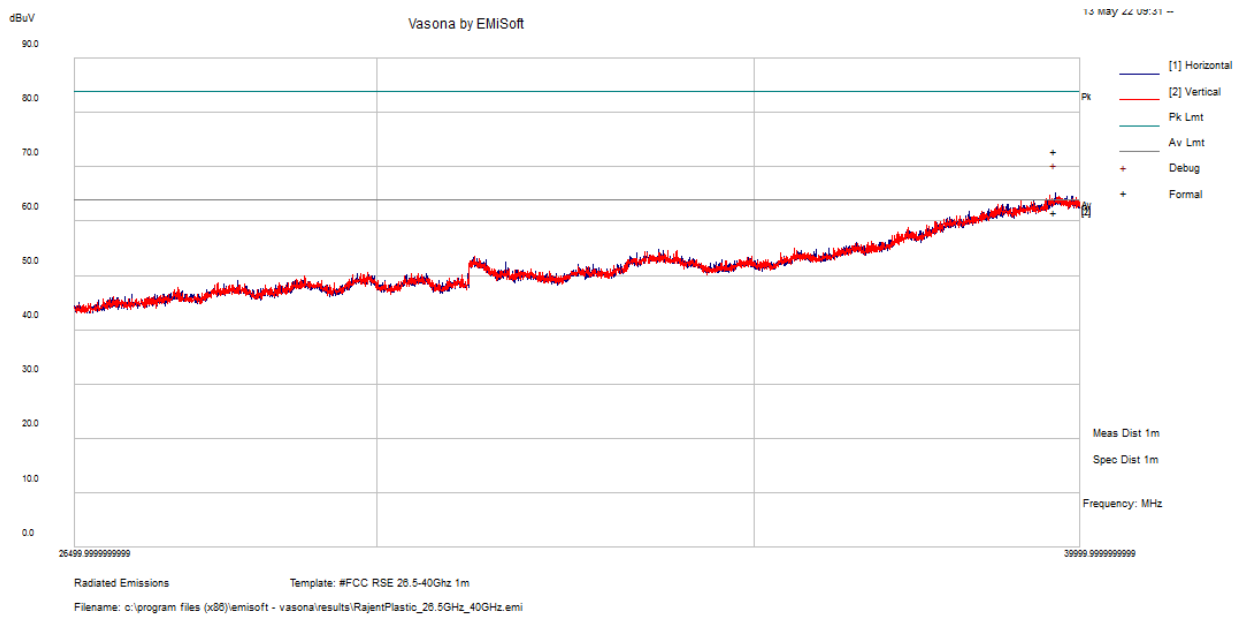


## 7) 26.5 – 40 GHz Worst Case, Measured at 1 meter, Aluminum Enclosure



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBμV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBμV/m)	Margin (dB)	Detector (Peak /Ave.)
39662.505	57.13	15.6	72.74	V	175	306	84	-11.26	Peak
39662.505	45.68	15.6	61.29	V	175	306	64	-2.71	Ave

### 8) 26.5 – 40 GHz Worst Case, Measured at 1 meter, Stainless Steel Enclosure



Frequency (MHz)	S.A. Reading (dBuV)	Correction Factor (dB/m)	Corrected Amplitude (dBμV/m)	Ant. Polarity (H/V)	Ant. Height (cm)	Turntable Azimuth (degrees)	Limit (dBμV/m)	Margin (dB)	Detector (Peak /Ave.)
39596.468	57.45	15.4	72.85	V	200	177	84	-11.15	Peak
39596.468	46.26	15.4	61.66	V	271	65	64	-2.34	Ave

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## 7 FCC §407(a) & ISEDC RSS-247 §6.2 - Output Power

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### 7.1 Applicable Standards

According to FCC §15.407(a):

For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

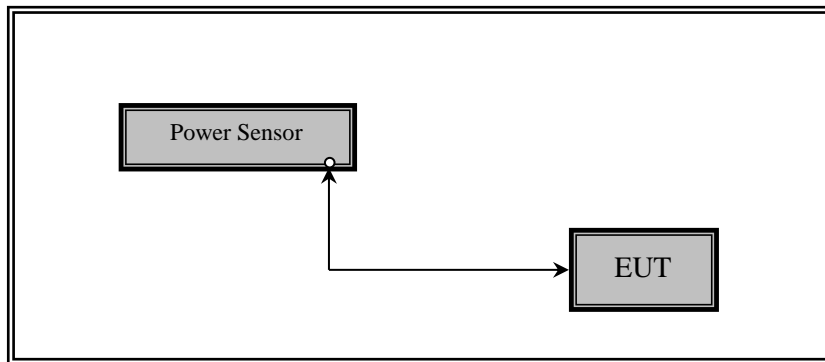
According to ISEDC RSS-247 §6.2.4 for frequency band 5725-5850 MHz:

The maximum conducted output power shall not exceed 1 W. The power spectral density shall not exceed 30 dBm in any 500 kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications and multiple collocated transmitters transmitting the same information.

### 7.2 Measurement Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to a power meter.

### 7.3 Test Setup Block Diagram



### 7.4 Test Equipment List and Details

Bacl No.	Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
697	ETS- Lingerin	Power Sensor	7002-006	160097	2021-02-21	2 years
-	-	RF cable	-	-	Each time <sup>1</sup>	N/A
-	-	10 dB attenuator	-	-	Each time <sup>1</sup>	N/A

Note<sup>1</sup>: cable and attenuator included in the test set-up will be checked each time before testing.

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

## 7.5 Test Environmental Conditions

<b>Temperature:</b>	23° C
<b>Relative Humidity:</b>	55 %
<b>ATM Pressure:</b>	102.2 KPa

The testing was performed by Marc Jean on 2022-06-13 in RF site.

## 7.6 Test Results

### 5150 - 5250 MHz

#### FCC Results:

#### Output Power:

Channel	Frequency (MHz)	Conducted Output Power Port B (dBm)	Conducted Output Power Port C (dBm)	Combined Output Power (dBm)	FCC Limit (dBm)
802.11a mode					
36	5180	14.00	14.73	-	29
40	5200	14.24	14.85	-	29
48	5240	14.30	14.72	-	29
802.11n20 mode					
36	5180	13.67	14.48	17.10	29
40	5200	13.77	14.82	17.34	29
48	5240	13.75	14.86	17.35	29
802.11n40 mode					
38	5190	13.88	14.87	17.41	29
46	5230	14.08	14.83	17.48	29

Note: Duty cycle correction factor has already been added to the measurements

Note: Limit reduced my amount amount in dB that that antenna gain exceeds 6 dBi

Note: Combined Output Power (dBm) =  $10 \cdot \log[\text{Port A(mW)} + \text{Port B(mW)}]$

**Max EIRP at any elevation angle > 30° from horizon**

Channel	Frequency (MHz)	EIRP Port B (dBm)	EIRP Port C (dBm)	Combined EIRP (dBm)	FCC Limit (dBm)
802.11a mode					
36	5180	11.90	12.63	-	21
40	5200	12.14	12.75	-	21
48	5240	12.20	12.62	-	21
802.11n20 mode					
36	5180	11.57	12.38	15.00	21
40	5200	11.67	12.72	15.24	21
48	5240	11.65	12.76	15.25	21
802.11n40 mode					
38	5190	11.78	12.77	15.31	21
46	5230	11.98	12.73	15.38	21

Note: Elevation angle above 30° Max Gain is -2.1dBi as declared by manufacturer.

Note: Combined EIRP (dBm) =  $10 \cdot \log[\text{Port A(mW)} + \text{Port B(mW)}]$

**5745- 5850 MHz****FCC/IC results**

Channel	Frequency (MHz)	Conducted Output Power Port B(dBm)	Conducted Output Power Port C (dBm)	Combined Output Power (dBm)	Limit (dBm)
802.11a mode					
149	5745	15.36	15.15	-	30
157	5785	15.30	14.85	-	30
165	5825	15.18	14.77	-	30
802.11n20 mode					
149	5745	15.58	15.60	18.60	30
157	5785	14.93	14.94	17.95	30
165	5825	14.89	14.61	17.76	30
802.11n40 mode					
151	5755	15.02	14.66	17.85	30
159	5795	14.51	14.43	17.48	30

Note: Duty cycle correction factor has already been added to the measurements

Note: Combined Output Power (dBm) =  $10 \cdot \log[\text{Port A(mW)} + \text{Port B(mW)}]$

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## **8 Annex A – EUT Test Setup Photographs**

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Please refer to the attachment.



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## **9 Annex B – Host Device External Photographs**

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Please refer to the attachment.

**10 Annex C (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 10<sup>th</sup> day of March 2021.

A blue ink signature of Trace McInturff.

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

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

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

<https://www.a2la.org/scopepdf/3297-02.pdf>**--- END OF REPORT ---**