RF Exposure Evaluation Declaration

FCC ID:	2A64B-GPR11
Applicant:	Ecovacs Home Service Robotics Co., Ltd.
Product:	Lawn Mowing Robot
Model No.:	GPR12
Serial Model No.:	GPR11
FCC Rule Part(s):	FCC Part 2.1091
Result:	Complies
Received Date	2024-11-18
Evaluation Date:	2025-04-02

Reviewed By: Denise Zhou

Approved By: Robin Wu

Revision History

Report No.	Version	Description	Issue Date	Note
2411RSU033-U5	V01	Initial Report	2025-01-16	Invalid
2411RSU033-U5	V02	Update Product Information	2025-01-22	Invalid
2411RSU033-U5	V03	Update module information and reassess result of MPE	2025-04-03	Valid

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1. General Information

1.1. Applicant

Ecovacs Home Service Robotics Co., Ltd.
No.518 Songwei Road, Wusongjiang industry Park, Guoxiang Street, Wuzhong District, Suzhou, 215100 Jiangsu, P.R. China

1.2. Manufacturer

Ecovacs Home Service Robotics Co., Ltd.
No.518 Songwei Road, Wusongjiang industry Park, Guoxiang Street, Wuzhong District, Suzhou, 215100 Jiangsu, P.R. China

1.3. Testing Facility

☒	**Test Site – MRT Suzhou Laboratory**				
	Laboratory Location (Suzhou - Wuzhong) D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China **Laboratory Location (Suzhou - SIP)** 4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China **Laboratory Location (Suzhou - Wujiang)** Building 1, No.1 Xingdong Road, Wujiang, Suzhou, Jiangsu, People's Republic of China				
	Laboratory Accreditations				
	A2LA: 3628.01		CNAS: L10551		
	FCC: CN1166		ISED: CN0001		
	VCCI:	☐R-20025	☐G-20034	☐C-20020	☐T-20020
		☐R-20141	☐G-20134	☐C-20103	☐T-20104
☐	**Test Site – MRT Shenzhen Laboratory**				
	Laboratory Location (Shenzhen) 1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China				
	Laboratory Accreditations				
	A2LA: 3628.02		CNAS: L10551		
	FCC: CN1284		ISED: CN0105		
☐	**Test Site – MRT Taiwan Laboratory**				
	Laboratory Location (Taiwan) No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)				
	Laboratory Accreditations				
	TAF: 3261				
	FCC: 291082, TW3261		ISED: TW3261		

1.4. Product Information

Product Name	Lawn Mowing Robot
Model No.	GPR12
Serial Model No.	GPR11
Wi-Fi Specification	802.11b/g/n
Bluetooth Version	Bluetooth v5.2 BLE Only
3GPP Specification	WCDMA Band II/IV/V LTE Band 2/4/5/12/13/14/66/71
GNSS Specification	GPS, GLONASS, BDS, Galileo
Lora Specification	902.75 ~ 920.95MHz
Antenna Specification	Refer to Section 1.5
Power Type	By Battery
Contain Integrated Modular Information	
Cellular Modular Information	Modular Name: LTE Module Model Number: EC25-AFXD Brand Name: Quectel FCC ID: XMR202008EC25AFXD
Accessory	
Rechargeable Lithium-ion Battery Pack	Model: S34-LI-324-5000 Nominal Voltage: 32.4V Typical Capacity: 5000mAh Rated Capacity: 4600mAh

Remarks:

1. The information of EUT was provided by the manufacturer, and the accuracy of the information shall be the responsibility of the manufacturer.
2. The two models are the same except different models of charging station and different battery capacity. The charging station model of GPR12 is CH2491A, and battery capacity is 5Ah. The charging station model of GPR11 is CH2491, and battery capacity is 3Ah. Model GPR12 is selected for testing.

1.5. Antenna Details

Technology	Frequency Range (MHz)	Antenna Type	Max Peak Gain (dBi)
WCDMA Band II	1850 ~ 1910	PIFA Antenna	3.60
WCDMA Band IV	1710 ~ 1755		3.40
WCDMA Band V	824 ~ 849		-1.50
LTE Band 2	1850 ~ 1910		3.60
LTE Band 4	1710 ~ 1755		3.40
LTE Band 5	824 ~ 849		-1.50
LTE Band 12	699 ~ 716		1.30
LTE Band 13	777 ~ 787		-1.90
LTE Band 14	788 ~ 798		-3.40
LTE Band 66	1710 ~ 1780		3.40
LTE Band 71	663 ~ 698		0.70
Wi-Fi 2.4GHz	2400 ~ 2483.5		4.56
Bluetooth	2400 ~ 2483.5		4.56
Lora	902.75 ~ 920.95		0.50

Note 1: All antenna information (Antenna type and Peak Gain) is provided by the manufacturer.

Note 2: The typical antennas used to calculate the ERP (EIRP).

1.6. Device Classification

According to the user manual, this device is classified as a Mobile Device. So, the RF exposure evaluation requirements of § 2.1091 for mobile device exposure conditions subject to MPE limits.

1.7. Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 2.1091 & KDB 447498 D04 Interim General RF Exposure Guidance v01

2. RF Exposure Evaluation

2.1. Limits

According to FCC §1.1310: The criteria listed in the following table shall be used to evaluate the environment impact of human exposure to radio frequency (RF) radiation as specified in §1.1307(b)

Limits For Maximum Permissible Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (Minutes)
(A) Limits for Occupational/ Control Exposures				
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
(B) Limits for General Population/ Uncontrolled Exposures				
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.

2.2. MPE Exemptions

For single RF sources (i.e., any single fixed RF source, mobile device, or portable device, as defined in paragraph §1.1307(b)(2) of this section): A single RF source is exempt if:

(Option A) The available maximum time-averaged power is no more than 1 mW, regardless of separation distance. This exemption may not be used in conjunction with other exemption criteria other than those in paragraph §1.1307(b)(3)(ii)(A) of this section.
Medical implant devices may only use this exemption and that in paragraph §1.1307(b)(3)(ii)(A);

(Option B) Or the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P is given by:

$\mathrm{P\,th(mW)} = \{\mathrm{ERP_{20cm}(d\,/\,20cm)^{x}}$ d ≤ 20cm

$\mathrm{P\,th(mW)} = \{\mathrm{ERP_{20cm}}$ 20cm < d ≤ 40cm

Where

$\mathrm{x} = -\log_{10}\left(\frac{60}{\mathrm{ERP_{20cm}}\sqrt{\mathrm{f}}}\right)$ and f is in GHz;

and

$\mathrm{ERP_{20cm}(mW)} = \{2040\mathrm{f}$ 0.3GHz ≤ f < 1.5GHz

$\mathrm{ERP_{20cm}(mW)} = \{3060$ 1.5GHz ≤ f ≤ 6GHz

(Option C) Or using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least λ/2π, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of λ/4 or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 to §1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

RF Source Frequency (MHz)	Threshold ERP (watts)
0.3-1.34	$1920R^2$
1.34-30	$3450R^2/f^2$
30-300	$3.83R^2$
300-1,500	$0.0128R^2f$
1,500-100,000	$19.2R^2$

For multiple RF sources: Multiple RF sources are exempt if:

(A) The available maximum time-averaged power of each source is no more than 1 mW and there is a separation distance of two centimeters between any portion of a radiating structure operating and the nearest portion of any other radiating structure in the same device, except if the sum of multiple sources is less than 1 mW during the time-averaging period, in which case they may be treated as a single source (separation is not required). This exemption may not be used in conjunction with other exemption criteria other than those is paragraph §1.1307(b)(3)(i)(A) of this section. Medical implant devices may only use this exemption and that in paragraph §1.1307(b)(3)(i)(A).

(B) in the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation.

$$\sum_{i=1}^{a} \frac{P_i}{P_{th,i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{th,j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

Where:

a = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(B) of this section for P_{th}, including existing exempt transmitters and those being added.

b = number of fixed, mobile, or portable RF sources claiming exemption using paragraph §1.1307(b)(3)(i)(C) of this section for Threshold ERP, including existing exempt transmitters and those being added.

c = number of existing fixed, mobile, or portable RF sources with known evaluation for the specified minimum distance including existing evaluated transmitters.

$\boldsymbol{P_i}$ = the available maximum time-averaged power or the ERP, whichever is greater, for fixed, mobile, or portable RF source *i* at a distance between 0.5 cm and 40 cm (inclusive).

$\boldsymbol{P_{th,i}}$ = the exemption threshold power (P_{th}) according to paragraph §1.1307(b)(3)(i)(B) of this section for fixed, mobile, or portable RF source *i*.

$\boldsymbol{ERP_j}$ = the ERP of fixed, mobile, or portable RF source *j*.

ERP$_{th,j}$ = exemption threshold ERP for fixed, mobile, or portable RF source *j*, at a distance of at least λ/2π according to the applicable formula of paragraph §1.1307(b)(3)(i)(C) of this section.

Evaluated$_k$ = the maximum reported SAR or MPE of fixed, mobile, or portable RF source *k* either in the device or at the transmitter site from an existing evaluation at the location of exposure.

Exposure Limit$_k$ = either the general population/uncontrolled maximum permissible exposure (MPE) or specific absorption rate (SAR) limit for each fixed, mobile, or portable RF source *k*, as applicable from §1.1310 of this chapter.

2.3. Calculated Result

Product	Lawn Mowing Robot
Test Item	RF Exposure Evaluation

Test Mode	Frequency Band (MHz)	Maximum Conducted Power (dBm)	Max Antenna Gain (dBi)	Maximum ERP (dBm)	Maximum ERP or Conducted Power (dBm)
WCDMA Band II	1850 ~ 1910	25.00	3.60	26.45	26.45
WCDMA Band IV	1710 ~ 1755	25.00	3.40	26.25	26.25
WCDMA Band V	824 ~ 849	25.00	-1.50	21.35	25.00
LTE Band 2	1850 ~ 1910	25.00	3.60	26.45	26.45
LTE Band 4	1710 ~ 1755	25.00	3.40	26.25	26.25
LTE Band 5	824 ~ 849	25.00	-1.50	21.35	25.00
LTE Band 12	699 ~ 716	25.00	1.30	24.15	25.00
LTE Band 13	777 ~ 787	25.00	-1.90	20.95	25.00
LTE Band 14	788 ~ 798	25.00	-3.40	19.45	25.00
LTE Band 66	1710 ~ 1780	25.00	3.40	26.25	26.25
LTE Band 71	663 ~ 698	25.00	0.70	23.55	25.00
Wi-Fi 2.4GHz	2400 ~ 2483.5	17.00	4.56	19.41	19.41
Bluetooth	2400 ~ 2483.5	5.00	4.56	7.41	7.41
Lora	902.75 ~ 920.95	20.00	0.50	18.35	20.00

Notes:

1. Maximum Conducted Power is declared by the manufacturer.
2. Maximum ERP = Maximum Conducted Power + Antenna Gain - 2.15.

For multiple RF source, Option B

Test Mode	Frequency Band (MHz)	Maximum ERP or Conducted Power (dBm)	Maximum ERP or Conducted Power (mW)	Threshold Power at 20cm (mW)
WCDMA Band II	1850 ~ 1910	26.45	441.57	3060.0
WCDMA Band IV	1710 ~ 1755	26.25	421.70	3060.0
WCDMA Band V	824 ~ 849	25.00	316.23	1681.0
LTE Band 2	1850 ~ 1910	26.45	441.57	3060.0
LTE Band 4	1710 ~ 1755	26.25	421.70	3060.0
LTE Band 5	824 ~ 849	25.00	316.23	1681.0
LTE Band 12	699 ~ 716	25.00	316.23	1426.0
LTE Band 13	777 ~ 787	25.00	316.23	1585.1
LTE Band 14	788 ~ 798	25.00	316.23	1607.5
LTE Band 66	1710 ~ 1780	26.25	421.70	3060.0
LTE Band 71	663 ~ 698	25.00	316.23	1352.5
Wi-Fi 2.4GHz	2400 ~ 2483.5	19.41	87.30	3060.0
Bluetooth	2400 ~ 2483.5	7.41	5.51	3060.0
Lora	902.75 ~ 920.95	20.00	100.00	1841.61

Notes:

1. WCDMA/LTE Maximum Conducted Power comes from module reports (report No.: R2203A0238-R1, R2203A0238-R2, R2203A0238-R3, R2203A0238-R4);
   2.4GHz Wi-Fi Maximum Conducted Power comes from module report (report No.:2411RSU033-U2);
   Bluetooth Maximum Conducted Power comes from module report (report No.: 2411RSU033-U1).
   Lora Maximum Conducted Power comes from module report (report No.: 2411RSU033-U3).
2. Maximum ERP = Maximum Conducted Power + Antenna Gain – 2.15.

For multiple RF sources

The EUT supports WWAN + Wi-Fi 2.4GHz + BLE + Lora simultaneous transmissions. The worst-case combination is WWAN + Wi-Fi 2.4GHz + BLE + Lora.

So, the Max Simultaneous Transmission = 316.23/1426 (WWAN) + 87.30/3060 (DTS) + 5.51/3060 (BLE) + 100.00/1841.61(Lora)= 0.3064 < 1

CONCLUSION:

The device qualifies for RF exposure test exemption at 20cm distance.

The End