

ROGERS LABS, INC.

4405 West 259th Terrace
Louisburg, KS 66053
Phone / Fax (913) 837-3214

Test Report - Maximum Permissible Exposure, Radio Frequency (RF) Exposure Report 47CFR, PART 1.1310 / MPE and RSS-102 Issue 5

Models: A04676, B04676, C04676

9300-9500MHz

Radar

FCC ID: IPH-04676

IC: 1792A-04676

Garmin International, Inc.

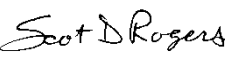
1200 East 151st Street
Olathe, KS 66062

FCC Designation: US5305

ISED Registration: 3041A

Test Report Number: 230213

Test Date: February 13, 2023

Authorized Signatory: 
Scot D. Rogers

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4405 West 259th Terrace
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Phone/Fax: (913) 837-3214
Revision 1

Garmin International, Inc.
Model: A04676, B04676, C04676
Test: 230213
Test to: 47CFR 1.1310, RSS-102
File: 04676 Garmin MPE TstRpt 230213

SN: 3435842142
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Date: March 14, 2023
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Revisions

Revision 1 Issued March 14, 2023

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Customer Information

Applicant: Garmin International, Inc.
 Address: 1200 East 151st Street
 Olathe, KS 66062

M/N: A04676, B04676, C04676 HVIN: A04676, B04676, C04676
 FCC ID: IPH-04676 IC: 1792A-04676
 Operating Frequency Range: 9300-9500 MHz

Equipment Tested

Models: A04676, B04676, C04676

Garmin International, Inc.
 1200 East 151st Street
 Olathe, KS 66062

<u>Equipment</u>	<u>Model / PN</u>	<u>Serial Number</u>
EUT (test sample, Power Load or antenna)	A04676 / 011-06162-01	3433643756
Power cable (0.2-meter)	Custom Cable (No P/N)	N/A
Power cable (14.7-meter)	320-00246-30	N/A
I/O cable (15-meter)	011-05671-00	N/A
Chart Plotter (GPSMap 8208)	011-02812-00	3855826969
Power cable (2-meter)	320-00354-20	N/A
DC Power Supply	BK 1745	209C13
Marine Battery (12Volt)	Duracell	N/A

Test results in this report relate only to the items tested. Worst-case configuration data recorded in this report.

Firmware: 4.13

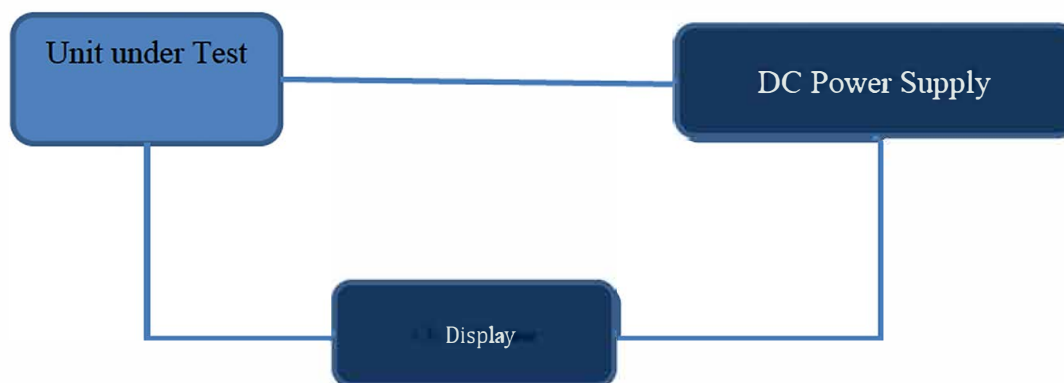
Antennas: 18": 5.2° horizontal & 25° vertical, with pk-21.3, ave-2.90 dBi gain
 24": 3.7° horizontal & 25° vertical, with pk-22.7, ave-2.82 dBi gain

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Equipment Function

The EUT is radar designed to provide bearing and distance information of ship and land targets located within the field of view (near the ship). As the radar sweeps through 360°, reflected signals are interpreted and displayed on the chart plotter as indication of potential above surface hazards. Test results in this report relate only to the products described in this report.

Equipment Configuration



Test Site Locations

Conducted EMI	AC line conducted emissions testing performed in a shielded screen room located at Rogers Labs, Inc., 4405 West 259 th Terrace, Louisburg, KS
Antenna port	Antenna port conducted emissions testing was performed in a shielded screen room located at Rogers Labs, Inc., 4405 West 259 th Terrace, Louisburg, KS
Radiated EMI	The radiated emissions tests were performed at the 3 meters, Open Area Test Site (OATS) located at Rogers Labs, Inc., 4405 West 259 th Terrace, Louisburg, KS
Registered Site information: FCC Site: US5305, ISED: 3041A, CAB Identifier: US0096	
NVLAP Accreditation	Lab code 200087-0

Environmental Conditions

Ambient Temperature	21.5° C
Relative Humidity	35 %
Atmospheric Pressure	1019.3 mb

Applicable Standards and Regulatory Limits

In accordance with Title 47 Code of Federal Regulations (47CFR), dated February 13, 2023, Parts 1 and 2 (2.1091 and 2.1093), and Innovation, Science and Economic Development, the following information is submitted. Test procedures used follow the guidance of FCC KDB 447498 D01 General RF Exposure Guidance v06 as per 47CFR 1.1310, and 2.1093, and Innovation, Science and Economic Development (ISED) RSS-102 Issue 5.

FCC Limits for Maximum Permissible Exposure

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.

**ISED RSS-102 RF Field Strength Limits for Devices Used by the General Public
(Uncontrolled Environment)**

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ₂₁	83	90	-	Instantaneous*
0.1-10	-	0.73/ f	-	6**
1.1-10	87/ $f^{0.5}$	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ $f^{0.25}$	0.1540/ $f^{0.25}$	8.944/ $f^{0.5}$	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 $f^{0.3417}$	0.008335 $f^{0.3417}$	0.02619 $f^{0.6834}$	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ $f^{1.2}$
150000-300000	0.158 $f^{0.5}$	4.21 x 10 ⁻⁴ $f^{0.5}$	6.67 x 10 ⁻⁵ f	616000/ $f^{1.2}$
Note: f is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

ISED RSS-102 RF Field Strength Limits for Controlled Use Devices (Controlled Environment)

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ₂₃	170	180	-	Instantaneous*
1-10	-	1.6/ f	-	6**
1.29-10	193/ $f^{0.5}$	-	-	6**
10-20	61.4	0.163	10	6
20-48	129.8/ $f^{0.25}$	0.3444/ $f^{0.25}$	44.72/ $f^{0.5}$	6
48-100	49.33	0.1309	6.455	6
100-6000	15.60 $f^{0.25}$	0.04138 $f^{0.25}$	0.6455 $f^{0.5}$	6
6000-15000	137	0.364	50	6
15000-150000	137	0.364	50	616000/ $f^{1.2}$
150000-300000	0.354 $f^{0.5}$	9.40 x 10 ⁻⁴ $f^{0.5}$	3.33 x 10 ⁻⁴ f	616000/ $f^{1.2}$
Note: f is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

Applicable information and equations

f = Transmit Frequency (MHz)

PT = Power Input to Antenna (mW)

Duty cycle (percentage of operation)

PA = Adjusted Power due to Duty cycle or Cable Loss (mW)

GN = Numeric Gain of the Antenna

S20 = Power Density of device at 20cm (mW/m²) $S20 = (PAGN) / (4\pi R20)^2$

RC = Minimum distance to the Radiating Element for Compliance (cm) FCC $RC = \sqrt{(PAGN / 4\pi SL)}$

SC = Power Density of the device at the Compliance Distance RC (W/m²) FCC $SC = (PAGN) / (4\pi RC)^2$

Power Density

$E(V/m) = \text{SQRT}(30 * P * G) / D$

$Pd(W/m^2) = E^2 / 377$

$S = \text{EIRP} / (4 * \pi * D^2)$

Where:

D = Separation Distance in cm

EIRP = Equivalent Isotropic Radiated Power, in mW

S = Power density in mW/cm²

Power density converted from units of mW/cm² to units of W/m² by multiplying by 10
mW/cm² by 10 => W/cm²

Distance

$D = \text{SQRT}[\text{EIRP} / (4 * \pi * S)]$

Where:

D = Separation Distance in cm

EIRP = Equivalent Isotropic Radiated Power, in mW

S = Power density in mW/cm²

Source-based time-average EIRP = (DC / 100) * EIRP

Where:

DC = Duty Cycle in percent as applicable

EIRP = Equivalent Isotropic Radiated Power, in mW

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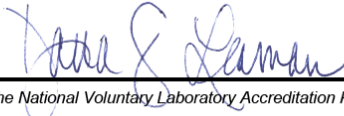
Summary: Standalone MPE Calculations and Summary					Public Limit		Public	
	Tx Duty Cycle (%)	Tx Frequency (MHz)	Power Total (mW)	Antenna Gain (numeric)	S _L (W/m²)	S ₂₀ (W/m²)	R _C (cm)	S _C (W/m²)
FCC	0.09904	9400	3,962	1.91	10.000	15.09	24.6	10.00
Canada	0.09904	9400	3,962	1.91	10.000	15.09	24.6	10.00
			Limit	Overall Minimum (cm)	Overall Minimum (inches)			
		Public	Occupational					
	FCC (cm)	24.6	11.0					
	FCC (inches)	10.0	5.0					
	Canada (cm)	24.6	11.0					
	Canada (inches)	10.0	5.0					
Overall Minimum Limit Public			Overall Minimum Limit Occupational					
25 cm			11 cm					
10 inches			5 inches					

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Annex

Laboratory Certificate of Accreditation

United States Department of Commerce National Institute of Standards and Technology NVLAP[®]  Certificate of Accreditation to ISO/IEC 17025:2017		
NVLAP LAB CODE: 200087-0		
Rogers Labs, Inc. Louisburg, KS		
<i>is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:</i>		
Electromagnetic Compatibility & Telecommunications		
<i>This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. 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 January 2009).</i>		
2022-03-22 through 2023-03-31 <i>Effective Dates</i>		 <i>For the National Voluntary Laboratory Accreditation Program</i>

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