

RF Exposure for GMR20, GMR 40

The GMR20/40 is a marine mount radar system operating in the marine services authorized under part 80 of CFR 47. Per 2.1091(c) of CFR 47, the equipment is categorically excluded from routine environmental evaluation for RF exposure prior to equipment authorization or use. The radiating structure for the device is typically mounted more than 200 centimeters away and located outside the crafts helm. Due to the location of the antenna, normal operating conditions, and use the unit will satisfy the requirements for RF Exposure per CFR rule 1.1311. MPE calculations are shown below demonstrating compliance.

GMR20 MPR calculations.

MPE Calculator MPE uses EIRP for calculation. EIRP is based on TX power added to the antenna gain in dBi.
dBi = dB gain compared to an isotropic radiator.
S = power density in mW/cm²

				Antenna Gain (dBi)	24
		Output Power	dBd + 2.17 = dBi	dBi to dBd	2.17
Tx Frequency (MHz)	9400	Average (Watts)	0.7258	Antenna Gain (dBd)	21.83
Cable Loss (dB)	0.0	(dBm)	28.61	Antenna minus cable (dBi)	24.00
Calculated ERP (mw)		110609.653		EIRP = Po(dBm) + Gain (dB)	
Calculated EIRP (mw)		182302.670		Radiated (EIRP) dBm	
				ERP = EIRP - 2.17 dB	
				Radiated (ERP) dBm	
Occupational Limit		Power density (S)		52.608	
31.33333		EIRP		50.438	
		----- = mW/cm²			
		4 π r²			
General Public Limit		r (cm) EIRP (mW)			
6.26667					

FCC radio frequency radiation exposure limits per 1.1310		
Frequency (MHz)	Occupational Limit	Public Limit
300-1,500	f/300	f/1500
1,500-10,000	5	1

FCC radio frequency radiation exposure limits per 1.1310		
Frequency (MHz)	Occupational Limit @ Tx Freq (mW/cm ²)	Public Limit @ Tx Freq (mW/cm ²)
300-1,500	31.33333333	6.266666667
1,500-10,000	5	1

EIRP	Distance	Distance	S
milliwatts	cm	inches	mW/cm ²
182302.670	250.00	98.43	0.23211
182302.670	200.00	78.74	0.36268
182302.670	195.00	76.77	0.38152
182302.670	190.00	74.80	0.40186
182302.670	185.00	72.83	0.42388
182302.670	180.00	70.87	0.44775
182302.670	175.00	68.90	0.47370
182302.670	170.00	66.93	0.50198
182302.670	160.00	62.99	0.56669
182302.670	150.00	59.06	0.64476
182302.670	140.00	55.12	0.74016
182302.670	130.00	51.18	0.85841
182302.670	120.00	47.24	1.00744
182302.670	110.00	43.31	1.19894
182302.670	100.00	39.37	1.45072
182302.670	90.00	35.43	1.79101
182302.670	85.00	33.46	2.00791
182302.670	80.00	31.50	2.26675
182302.670	79.00	31.10	2.32450
182302.670	78.00	30.71	2.38448
182302.670	77.00	30.31	2.44682
182302.670	76.00	29.92	2.51163
182302.670	75.00	29.53	2.57906
182302.670	70.00	27.56	2.96065
182302.670	60.00	23.62	4.02977
182302.670	55.00	21.65	4.79576
182302.670	54.00	21.26	4.97503
182302.670	53.00	20.87	5.16454
182302.670	50.00	19.69	5.80287
182302.670	40.00	15.75	9.06699
182302.670	30.00	11.81	16.11910

Frequency (MHz)	Occupational Limit minimum Distance (cm)	Public Limit minimum distance (cm)
300-1,500	N/A	N/A
1,500-10,000	120.00	54.00

ROGERS LABS, INC.
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Phone/Fax: (913) 837-3214

Garmin International, Inc.
MODEL: GMR20, GMR40
Test #: 040428
Test to: FCC Parts 2 and 80

FCCID#: IPH-00610

Page 2 of 3

IPH00610 RFExp.doc 9/8/2004

GMR40 MPR calculations.

MPE Calculator MPE uses EIRP for calculation. EIRP is based on TX power added to the antenna gain in dBi.
dBi = dB gain compared to an isotropic radiator.
S = power density in mW/cm²

Antenna Gain (dBi) **24**
dBi + 2.17 = dBi dBi to dBd 2.17
Tx Frequency (MHz) **9400** Output Power Average (Watts) **1.5322** Antenna Gain (dBd) **21.83**
Cable Loss (dB) **0.0** (dBm) 31.85 Antenna minus cable (dBi) 24.00
Calculated ERP (mw) 233509.267 EIRP = Po(dBm) + Gain (dB)
Calculated EIRP (mw) 384861.191 Radiated (EIRP) dBm 55.853
ERP = EIRP - 2.17 dB
Radiated (ERP) dBm 53.683

Occupational Limit
31.33333 mW/cm²
General Public Limit
6.26667 mW/cm²

Power density (S)
EIRP
----- = mW/cm²
4 π r²
r (cm) EIRP (mW)

FCC radio frequency radiation exposure limits per 1.1310		
Frequency (MHz)	Occupational Limit	Public Limit
300-1,500	1/300	1/1500
1,500-10,000	5	1

FCC radio frequency radiation exposure limits per 1.1310		
Frequency (MHz)	Occupational Limit @ Tx Freq (mW/cm ²)	Public Limit @ Tx Freq (mW/cm ²)
300-1,500	31.33333333	6.26666667
1,500-10,000	5	1

EIRP	Distance	Distance	S
milliwatts	cm	inches	mW/cm ²
384861.191	250.00	98.43	0.49002
384861.191	200.00	78.74	0.76566
384861.191	195.00	76.77	0.80542
384861.191	190.00	74.80	0.84837
384861.191	185.00	72.83	0.89485
384861.191	180.00	70.87	0.94526
384861.191	175.00	68.90	1.00004
384861.191	170.00	66.93	1.05973
384861.191	160.00	62.99	1.19634
384861.191	150.00	59.06	1.36117
384861.191	140.00	55.12	1.56257
384861.191	130.00	51.18	1.81221
384861.191	120.00	47.24	2.12683
384861.191	110.00	43.31	2.53110
384861.191	100.00	39.37	3.06263
384861.191	90.00	35.43	3.78102
384861.191	85.00	33.46	4.23893
384861.191	80.00	31.50	4.78536
384861.191	79.00	31.10	4.90727
384861.191	78.00	30.71	5.03391
384861.191	77.00	30.31	5.16551
384861.191	76.00	29.92	5.30233
384861.191	75.00	29.53	5.44467
384861.191	70.00	27.56	6.25026
384861.191	60.00	23.62	8.50730
384861.191	50.00	19.69	12.25051
384861.191	40.00	15.75	19.14143
384861.191	30.00	11.81	34.02920
384861.191	20.00	7.87	76.56570
384861.191	10.00	3.94	306.26281
384861.191	5.00	1.97	1225.05122

Frequency (MHz)	Occupational Limit minimum Distance (cm)	Public Limit minimum distance (cm)
300-1,500	N/A	N/A
1,500-10,000	79.00	175.00

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Page 3 of 3

IPH00610 RFExp.doc 9/8/2004