

RF Exposure for GMR40X

The GMR40X 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 265 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.

GMR404 MPE 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) **28.5**
dBi to dBd **2.17**
Antenna Gain (dBd) **26.33**

Tx Frequency (MHz) **9400** Output Power Average (Watts) **4.0000** dBd + 2.17 = dBi

Cable Loss (dB) **0.0** (dBm) **36.02** Antenna minus cable (dBi) **28.50**

Calculated ERP (mw) 1718145.707
Calculated EIRP (mw) 2831783.138

EIRP = Po(dBm) + Gain (dB)
Radiated (EIRP) dBm **64.521**
ERP = EIRP - 2.17 dB
Radiated (ERP) dBm **62.351**

Occupational Limit
5.00000 mW/cm²

General Public Limit
1.00000 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	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	Distance
milliwatts	cm	inches	mW/cm ²	Feet
2831783.138	1000.00	393.70	0.22535	32.808399
2831783.138	900.00	354.33	0.27821	29.5275591
2831783.138	800.00	314.96	0.35210	26.2467192
2831783.138	700.00	275.59	0.45989	22.9658793
2831783.138	600.00	236.22	0.62596	19.6850394
2831783.138	500.00	196.85	0.90138	16.4041995
2831783.138	400.00	157.48	1.40841	13.1233596
2831783.138	375.00	147.64	1.60246	12.3031496
2831783.138	370.00	145.67	1.64606	12.1391076
2831783.138	365.00	143.70	1.69147	11.9750656
2831783.138	360.00	141.73	1.73878	11.8110236
2831783.138	350.00	137.80	1.83956	11.4829396
2831783.138	325.00	127.95	2.13345	10.6627297
2831783.138	300.00	118.11	2.50385	9.84251969
2831783.138	275.00	108.27	2.97978	9.02230971
2831783.138	250.00	98.43	3.60554	8.20209974
2831783.138	225.00	88.58	4.45128	7.38188976
2831783.138	220.00	86.61	4.65591	7.21784777
2831783.138	215.00	84.65	4.87498	7.05380577
2831783.138	212.00	83.46	5.01393	6.95538058
2831783.138	210.00	82.68	5.10989	6.88976378
2831783.138	200.00	78.74	5.63365	6.56167979
2831783.138	190.00	74.80	6.24228	6.2335958
2831783.138	180.00	70.87	6.95513	5.90551181
2831783.138	160.00	62.99	8.80258	5.24934383
2831783.138	150.00	59.06	10.01538	4.92125984
2831783.138	140.00	55.12	11.49725	4.59317585
2831783.138	130.00	51.18	13.33409	4.26509186
2831783.138	120.00	47.24	15.64904	3.93700787
2831783.138	110.00	43.31	18.62365	3.60892388
2831783.138	100.00	39.37	22.53461	3.2808399

Frequency (MHz)	Occupational Limit minimum Distance (feet)	Public Limit minimum distance (feetm)
300-1,500	N/A	N/A
1,500-10,000	7.00	16.40

ROGERS LABS, INC.
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Garmin International, Inc.
MODEL: GMR40X IC: 1792A-00991
Test #: 060406 FCCID#: IPH-00991
Test to: FCC Parts 2 and 80 Page 2 of 3

GMR406 MPE 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) **30.5**
 dBi to dBd 2.17
 Antenna Gain (dBd) **28.33**

Tx Frequency (MHz) **9400** Output Power Average (Watts) **4.0000** dBd + 2.17 = dBi

Cable Loss (dB) **0.0** (dBm) 36.02 Antenna minus cable (dBi) 30.50

Calculated ERP (mw) 2723077.435
 Calculated EIRP (mw) 4488073.817

EIRP = Po(dBm) + Gain (dB)
 Radiated (EIRP) dBm 66.521
 ERP = EIRP - 2.17 dB
 Radiated (ERP) dBm 64.351

Occupational Limit
5.00000 mW/cm²

General Public Limit
1.00000 mW/cm²

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

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	Distance
milliwatts	cm	inches	mW/cm ²	Feet
4488073.817	1000.00	393.70	0.35715	32.80839895
4488073.817	900.00	354.33	0.44093	29.52755906
4488073.817	800.00	314.96	0.55805	26.24671916
4488073.817	700.00	275.59	0.72888	22.96587927
4488073.817	600.00	236.22	0.99208	19.68503937
4488073.817	500.00	196.85	1.42860	16.40419948
4488073.817	400.00	157.48	2.23218	13.12335958
4488073.817	375.00	147.64	2.53973	12.30314961
4488073.817	370.00	145.67	2.60884	12.13910761
4488073.817	365.00	143.70	2.68080	11.97506562
4488073.817	360.00	141.73	2.75578	11.81102362
4488073.817	350.00	137.80	2.91551	11.48293963
4488073.817	325.00	127.95	3.38130	10.66272966
4488073.817	300.00	118.11	3.96833	9.842519685
4488073.817	275.00	108.27	4.72264	9.022309711
4488073.817	270.00	106.30	4.89917	8.858267717
4488073.817	265.00	104.33	5.08579	8.694225722
4488073.817	250.00	98.43	5.71439	8.202099738
4488073.817	240.00	94.49	6.20051	7.874015748
4488073.817	225.00	88.58	7.05481	7.381889764
4488073.817	210.00	82.68	8.09863	6.88976378
4488073.817	200.00	78.74	8.92874	6.56167979
4488073.817	190.00	74.80	9.89334	6.233595801
4488073.817	180.00	70.87	11.02313	5.905511811
4488073.817	160.00	62.99	13.95115	5.249343832
4488073.817	150.00	59.06	15.87331	4.921259843
4488073.817	140.00	55.12	18.22192	4.593175853
4488073.817	130.00	51.18	21.13311	4.265091864
4488073.817	120.00	47.24	24.80205	3.937007874
4488073.817	110.00	43.31	29.51649	3.608923885
4488073.817	100.00	39.37	35.71496	3.280839895

Frequency (MHz)	Occupational Limit minimum Distance (feet)	Public Limit minimum distance (feetm)
300-1,500	N/A	N/A
1,500-10,000	8.60	19.70

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