

RF Exposure for GMR18/GMR24

The GMR18/GMR24 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 270 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.

GMR18 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

		Output Power	dBd + 2.17 = dBi	Antenna Gain (dBi)	22.2
Tx Frequency (MHz)	9400	Average (Watts)	4.0000	dBi to dBd	2.17
				Antenna Gain (dBd)	20.03
Cable Loss (dB)	0.0	(dBm)	36.02	Antenna minus cable (dBi)	22.20
	Calculated ERP (mw)	402772.668		EIRP = Po(dBm) + Gain (dB)	
	Calculated EIRP (mw)	663834.763		Radiated (EIRP) dBm	58.221
				ERP = EIRP - 2.17 dB	
				Radiated (ERP) dBm	56.051

Occupational Limit	Power density (S)
5.00000 mW/cm ²	EIRP
	----- = mW/cm ²
General Public Limit	$4 \pi r^2$
1.00000 mW/cm ²	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
663834.763	1000.00	393.70	0.05283	32.808399
663834.763	900.00	354.33	0.06522	29.5275591
663834.763	800.00	314.96	0.08254	26.2467192
663834.763	700.00	275.59	0.10781	22.9658793
663834.763	600.00	236.22	0.14674	19.6850394
663834.763	500.00	196.85	0.21131	16.4041995
663834.763	400.00	157.48	0.33016	13.1233596
663834.763	375.00	147.64	0.37565	12.3031496
663834.763	370.00	145.67	0.38588	12.1391076
663834.763	365.00	143.70	0.39652	11.9750656
663834.763	360.00	141.73	0.40761	11.8110236
663834.763	350.00	137.80	0.43124	11.4829396
663834.763	325.00	127.95	0.50013	10.6627297
663834.763	300.00	118.11	0.58696	9.84251969
663834.763	275.00	108.27	0.69853	9.02230971
663834.763	250.00	98.43	0.84522	8.20209974
663834.763	230.00	90.55	0.99861	7.54593176
663834.763	220.00	86.61	1.09145	7.21784777
663834.763	215.00	84.65	1.14281	7.05380577
663834.763	212.00	83.46	1.17538	6.95538058
663834.763	210.00	82.68	1.19788	6.88976378
663834.763	200.00	78.74	1.32066	6.56167979
663834.763	190.00	74.80	1.46333	6.2335958
663834.763	180.00	70.87	1.63044	5.90551181
663834.763	160.00	62.99	2.06353	5.24934383
663834.763	150.00	59.06	2.34784	4.92125984
663834.763	140.00	55.12	2.69522	4.59317585
663834.763	130.00	51.18	3.12582	4.26509186
663834.763	110.00	43.31	4.36581	3.60892388
663834.763	105.00	41.34	4.79150	3.44488189
663834.763	100.00	39.37	5.28263	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	3.50	7.60

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

Garmin International, Inc.
 MODEL: GMR18/GMR24
 Test #: 061128
 Test to: FCC Parts 2, 80, RSS-138

IC: 1792A-GMR18
 FCCID#: IPH-GMR18
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GMR24 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) 23.7
 dBi to dBd 2.17
 Antenna Gain (dBd) 21.53
 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) 23.70
 Calculated ERP (mw) 568931.515
 Calculated EIRP (mw) 937691.526
 EIRP = Po(dBm) + Gain (dB)
 Radiated (EIRP) dBm 59.721
 ERP = EIRP - 2.17 dB
 Radiated (ERP) dBm 57.551

Occupational Limit	Power density (S)
5.00000 mW/cm²	EIRP
	----- = mW/cm ²
General Public Limit	4 π r ²
1.00000 mW/cm²	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
937691.526	1000.00	393.70	0.07462	32.80839895
937691.526	900.00	354.33	0.09212	29.52755906
937691.526	800.00	314.96	0.11659	26.24671916
937691.526	700.00	275.59	0.15228	22.96587927
937691.526	600.00	236.22	0.20728	19.68503937
937691.526	500.00	196.85	0.29848	16.40419948
937691.526	400.00	157.48	0.46637	13.12335958
937691.526	375.00	147.64	0.53062	12.30314961
937691.526	370.00	145.67	0.54506	12.13910761
937691.526	365.00	143.70	0.56010	11.97506562
937691.526	360.00	141.73	0.57576	11.81102362
937691.526	350.00	137.80	0.60914	11.48293963
937691.526	325.00	127.95	0.70645	10.66272966
937691.526	300.00	118.11	0.82910	9.842519685
937691.526	275.00	108.27	0.98670	9.022309711
937691.526	270.00	106.30	1.02358	8.858267717
937691.526	265.00	104.33	1.06257	8.694225722
937691.526	250.00	98.43	1.19391	8.202099738
937691.526	240.00	94.49	1.29547	7.874015748
937691.526	225.00	88.58	1.47396	7.381889764
937691.526	210.00	82.68	1.69204	6.88976378
937691.526	200.00	78.74	1.86548	6.56167979
937691.526	190.00	74.80	2.06701	6.233595801
937691.526	180.00	70.87	2.30306	5.905511811
937691.526	160.00	62.99	2.91481	5.249343832
937691.526	150.00	59.06	3.31641	4.921259843
937691.526	140.00	55.12	3.80710	4.593175853
937691.526	130.00	51.18	4.41533	4.265091864
937691.526	122.00	48.03	5.01338	4.002624672
937691.526	110.00	43.31	6.16687	3.608923885
937691.526	100.00	39.37	7.46191	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	4.00	8.90

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