

# Unit Conversion Charts

dbm to dbw to Watts to Volts

Dbm	Dbw	Watts	Volts
60	30	1,000.0	223.61
59	29	794.3	199.29
58	28	631.0	177.62
57	27	501.2	158.30
56	26	398.1	141.09
55	25	316.2	125.74
54	24	251.2	112.07
53	23	199.5	99.88
52	22	158.5	89.02
51	21	125.9	79.34
50	20	100.0	70.71
49	19	79.4	63.02
48	18	63.1	56.17
47	17	50.1	50.06
46	16	39.8	44.62
45	15	31.6	39.76
44	14	25.1	35.44
43	13	20.0	31.59
42	12	15.8	28.15
41	11	12.6	25.09
40	10	10.0	22.36
39	9	7.9	19.93
38	8	6.3	17.76
37	7	5.0	15.83
36	6	4.0	14.11
35	5	3.2	12.57
34	4	2.5	11.21
33	3	2.0	9.99
32	2	1.6	8.90
31	1	1.3	7.93

Dbm	Dbw	Milliwatts	Volts
30	0	1,000.0	7.07
29	-1	794.3	6.30
28	-2	631.0	5.62
27	-3	501.2	5.01
26	-4	398.1	4.46
25	-5	316.2	3.98
24	-6	251.2	3.54
23	-7	199.5	3.16
22	-8	158.5	2.82
21	-9	125.9	2.51
20	-10	100.0	2.24
19	-11	79.4	1.99
18	-12	63.1	1.78
17	-13	50.1	1.58
16	-14	39.8	1.41
15	-15	31.6	1.26
14	-16	25.1	1.12
13	-17	20.0	1.00
12	-18	15.8	0.89
11	-19	12.6	0.79
10	-20	10.0	0.71
9	-21	7.9	0.63
8	-22	6.3	0.56
7	-23	5.0	0.50
6	-24	4.0	0.45
5	-25	3.2	0.40
4	-26	2.5	0.35
3	-27	2.0	0.32
2	-28	1.6	0.28
1	-29	1.3	0.25

Dbm	Dbw	Microwatts	Microvolts
0	-30	1,000.0	223,607
-1	-31	794.3	199,290
-2	-32	631.0	177,617
-3	-33	501.2	158,301
-4	-34	398.1	141,086
-5	-35	316.2	125,743
-6	-36	251.2	112,069
-7	-37	199.5	99,881
-8	-38	158.5	89,019
-9	-39	125.9	79,339
-10	-40	100.0	70,711
-11	-41	79.4	63,021
-12	-42	63.1	56,167
-13	-43	50.1	50,059
-14	-44	39.8	44,615
-15	-45	31.6	39,764
-16	-46	25.1	35,439
-17	-47	20.0	31,585
-18	-48	15.8	28,150
-19	-49	12.6	25,089
-20	-50	10.0	22,361
-21	-51	7.9	19,929
-22	-52	6.3	17,762
-23	-53	5.0	15,830
-24	-54	4.0	14,109
-25	-55	3.2	12,574
-26	-56	2.5	11,207
-27	-57	2.0	9,988
-28	-58	1.6	8,902
-29	-59	1.3	7,934

Insertion Loss	25	50
5.0	8.0	16.0
4.0	10.0	20.0
3.0	12.5	25.0
2.5	14.0	28.0
2.0	16.0	32.0
1.5	17.5	35.0
1.0	20.0	40.0
0.5	22.5	45.0

Frequency	0.25	0.5
In MHz		
150	-68db	-74db
220	-71db	-77db
460	-78db	-84db
860	-83db	-89db
940	-84db	-90db
1920	-90db	-96db

Free Space Loss = 36.6 + 20\*log(D)

Dbm	Dbw	Nanowatts	Microvolts
-30	-60	1,000.0	7,071.07
-31	-61	794.3	6,302.10
-32	-62	631.0	5,616.75
-33	-63	501.2	5,005.93
-34	-64	398.1	4,461.54
-35	-65	316.2	3,976.35
-36	-66	251.2	3,543.93
-37	-67	199.5	3,158.53

Dbm	Dbw	Picowatts	Microvolts
-60	-90	1,000.0	223.61
-61	-91	794.3	199.29
-62	-92	631.0	177.62
-63	-93	501.2	158.30
-64	-94	398.1	141.09
-65	-95	316.2	125.74
-66	-96	251.2	112.07
-67	-97	199.5	99.88

Dbm	Dbw	Picowatts	Microvolts
-90	-120	1.0000000	7.07
-91	-121	0.7943282	6.30
-92	-122	0.6309573	5.62
-93	-123	0.5011872	5.01
-94	-124	0.3981072	4.46
-95	-125	0.3162278	3.98
-96	-126	0.2511886	3.54
-97	-127	0.1995262	3.16

-38	-68	158.5	2,815.04
-39	-69	125.9	2,508.91
-40	-70	100.0	2,236.07
-41	-71	79.43	1,992.90
-42	-72	63.10	1,776.17
-43	-73	50.12	1,583.01
-44	-74	39.81	1,410.86
-45	-75	31.62	1,257.43
-46	-76	25.12	1,120.69
-47	-77	19.95	998.81
-48	-78	15.85	890.19
-49	-79	12.59	793.39
-50	-80	10.00	707.11
-51	-81	7.943	630.21
-52	-82	6.310	561.67
-53	-83	5.012	500.59
-54	-84	3.981	446.15
-55	-85	3.162	397.64
-56	-86	2.512	354.39
-57	-87	1.995	315.85
-58	-88	1.585	281.50
-59	-89	1.259	250.89

-68	-98	158.5	89.02
-69	-99	125.9	79.34
-70	-100	100.0	70.71
-71	-101	79.43	63.02
-72	-102	63.10	56.17
-73	-103	50.12	50.06
-74	-104	39.81	44.62
-75	-105	31.62	39.76
-76	-106	25.12	35.44
-77	-107	19.95	31.59
-78	-108	15.85	28.15
-79	-109	12.59	25.09
-80	-110	10.00	22.36
-81	-111	7.943	19.93
-82	-112	6.310	17.76
-83	-113	5.012	15.83
-84	-114	3.981	14.11
-85	-115	3.162	12.57
-86	-116	2.512	11.21
-87	-117	1.995	9.99
-88	-118	1.585	8.90
-89	-119	1.259	7.93

-98	-128	0.1584893	2.82
-99	-129	0.1258925	2.51
-100	-130	0.1000000	2.24
-101	-131	0.0794328	1.99
-102	-132	0.0630957	1.78
-103	-133	0.0501187	1.58
-104	-134	0.0398107	1.41
-105	-135	0.0316228	1.26
-106	-136	0.0251189	1.12
-107	-137	0.0199526	1.00
-108	-138	0.0158489	0.89
-109	-139	0.0125893	0.79
-110	-140	0.0100000	0.71
-111	-141	0.0079433	0.63
-112	-142	0.0063096	0.56
-113	-143	0.0050119	0.50
-114	-144	0.0039811	0.45
-115	-145	0.0031623	0.40
-116	-146	0.0025119	0.35
-117	-147	0.0019953	0.32
-118	-148	0.0015849	0.28
-119	-149	0.0012589	0.25

**Dbw = Dbm - 30**

**Watts = 10^(dbm/10)/1000**

**Volts = Square Root (dbm\*50)\***

**\* Assumes a 50 ohm circuit**

Dbm	Dbw	Picowatts	Microvolts
-120	-150	0.0010000	0.224
-121	-151	0.0007943	0.199
-122	-152	0.0006310	0.178
-123	-153	0.0005012	0.158
-124	-154	0.0003981	0.141
-125	-155	0.0003162	0.126
-126	-156	0.0002512	0.112
-127	-157	0.0001995	0.100
-128	-158	0.0001585	0.089
-129	-159	0.0001259	0.079
-130	-160	0.0001000	0.071
-131	-161	0.0000794	0.063
-132	-162	0.0000631	0.056
-133	-163	0.0000501	0.050
-134	-164	0.0000398	0.045
-135	-165	0.0000316	0.040
-136	-166	0.0000251	0.035
-137	-167	0.0000200	0.032
-138	-168	0.0000158	0.028
-139	-169	0.0000126	0.025
-140	-170	0.0000100	0.022
-141	-171	0.0000079	0.020

Return Loss	VSWR
30	1.06
25	1.11
20	1.20
19	1.25
18	1.28
17	1.33
16	1.37
15	1.43
14	1.50
13	1.57
12	1.67
11	1.78
10	1.92
9	2.10

Watts	dbm
300	54.8
200	54.0
200	53.0
150	51.8
100	50.0
75	48.8
50	47.0

-142	-172	0.0000063	0.018
-143	-173	0.0000050	0.016
-144	-174	0.0000040	0.014
-145	-175	0.0000032	0.013
-146	-176	0.0000025	0.011
-147	-177	0.0000020	0.010
-148	-178	0.0000016	0.009
-149	-179	0.0000013	0.008
-150	-180	0.0000010	0.007

25	44.0
20	43.0
15	41.8
10	40.0
5	37.0
4	36.0
3	34.8
2	33.0
1	30.0

**dbm = 10\*log(Power/1mW)**  
**Power is in Watts**

## Insertion Loss

Input Power In Watts						
75	100	125	150	200	250	300
24.3	32.0	40.3	48.0	64.0	80.0	96.0
30.4	40.0	50.4	60.0	80.0	100.0	120.0
38.0	50.0	63.0	75.0	100.0	125.0	150.0
42.0	56.0	70.0	84.0	112.0	141.0	169.0
47.0	63.0	79.0	95.0	126.0	158.0	189.0
53.0	71.0	88.0	106.0	142.0	177.0	212.0
60.0	79.0	99.0	119.0	159.0	199.0	238.0
67.0	89.0	111.0	134.0	178.0	223.0	267.0

## Free Space Path Loss

Distance in Miles						
0.75	1	2	5	10	15	20
-78db	-80db	-86db	-94db	-100db	-104db	-106db
-81db	-83db	-89db	-97db	-103db	-107db	-109db
-87db	-90db	-96db	-104db	-110db	-113db	-116db
-93db	-95db	-101db	-109db	-115db	-119db	-121db
-94db	-96db	-102db	-110db	-116db	-120db	-122db
-100db	-102db	-108db	-116db	-122db	-126db	-128db

) +  $20 \cdot \log(F)$  where D = distance in miles and F = frequency in MHz