

## Power Conversion Chart

dBm	mW	dBm	mW	dBm	mW
-20	0.010	-7	0.200	+6	3.98
-19	0.012	-6	0.250	+7	5.01
-18	0.016	-5	0.316	+8	6.30
-17	0.020	-4	0.398	+9	7.94
-16	0.025	-3	0.501	+10	10.0
-15	0.032	-2	0.630	+11	12.6
-14	0.040	-1	0.794	+12	15.8
-13	0.050	0	1.00	+13	19.9
-12	0.063	+1	1.25	+14	25.1
-11	0.079	+2	1.58	+15	31.6
-10	0.100	+3	2.00	+16	39.8
-9	0.130	+4	2.51	+17	50.1
-8	0.160	+5	3.16	+18	63.1

dBm	W	dBm	W	dBm	W
+19	0.079	+33	2.00	+47	50.1
+20	0.100	+34	2.55	+48	63.1
+21	0.120	+35	3.16	+49	79.4
+22	0.159	+36	3.91	+50	100.0
+23	0.200	+37	5.01	+52	126.0
+24	0.251	+38	6.31	+52	158.0
+25	0.316	+39	7.94	+53	200.0
+26	0.398	+40	10.0	+54	251.0
+27	0.501	+41	12.6	+55	316.0
+28	0.631	+42	15.8	+56	398.0
+29	0.794	+43	20.0	+57	501.0
+30	1.00	+44	25.1	+58	631.0
+31	1.26	+45	31.6	+59	794.0
+32	1.59	+46	39.8	+60	1000

## VSWR

$$VSWR = \frac{E_{max}}{E_{min}} = \frac{I_{max}}{I_{min}} = \frac{1 + \Gamma}{1 - \Gamma}$$

$\Gamma$  = reflection coefficient.  
Return loss =  $20 \log \frac{1}{\Gamma}$

## Multi-tone amplifier test

IP<sub>n</sub> = Intercept point of order n.

$$IP_n = P_o + \frac{\{P_o - P_i\}}{(n-1)}$$

P<sub>o</sub> = output level of each tone.

P<sub>i</sub> = output power of IMD product order n.

For 2-tone test:

$$TOI = \frac{CIM + P_o}{2}$$

TOI = third order intercept.

CIM = intermod level.

For the 2 tones F<sub>1</sub> and F<sub>2</sub>, the third order intermodulation products occur at:

$$2F_1 - F_2 \text{ and } 2F_2 - F_1$$

## For a FET, Power added efficiency

P<sub>1dB</sub> and P<sub>in</sub> are in watts.

$$\eta_{ADD} = \left\{ \frac{P_{1dB} - P_{in}}{V_{DS} - I_D} \right\} \times 100\%$$

Noise Figure (NF)

$$NF = 10 \log \left\{ \frac{T+1}{290} \right\}$$

T = noise temperature in °K

## Miscellaneous

$$dBm = 10 \times \log(W \times 1000)$$

## VSWR effect on power

VS WR	Ret. Loss dB	Trans. Loss dB	Volt Refl. Coeff.	Power Refl. %	Power Trans. %
1.00	0	.000	.00	.0	100.0
1.01	46.1	.000	.00	.0	100.0
1.02	40.1	.000	.01	.0	100.0
1.03	36.6	.001	.01	.0	100.0
1.04	34.2	.002	.02	.0	100.0
1.05	32.3	.003	.02	.1	99.9
1.06	30.7	.004	.03	.1	99.9
1.07	29.4	.005	.03	.1	99.9
1.08	28.3	.006	.04	.1	99.9
1.09	27.3	.008	.04	.2	99.8
1.10	26.4	.010	.05	.2	99.8
1.11	25.7	.012	.05	.2	99.7
1.12	24.9	.014	.06	.2	99.7
1.13	24.3	0.016	.06	.4	99.6
1.14	23.7	0.019	.07	.4	99.6
1.15	23.1	0.021	.07	.5	99.5
1.16	22.6	0.024	.07	.5	99.5
1.17	22.1	0.027	.08	.6	99.4
1.18	21.7	0.030	.08	.7	99.3
1.19	21.2	0.033	.09	.8	99.2
1.20	20.8	0.036	.09	.8	99.2
1.25	19.1	0.054	.11	1.2	98.8
1.30	17.7	0.075	.13	1.7	98.3
1.40	15.6	0.122	.17	2.8	97.2
1.50	14.0	0.177	.20	4.0	96.0
1.60	12.7	0.238	.23	5.3	94.7
1.70	11.7	0.302	.26	6.7	93.3
1.80	10.9	0.370	.29	8.2	91.8
1.90	10.2	0.440	.31	9.6	90.4
2.00	9.5	0.512	.33	11.1	88.9
3.00	6.0	1.24	.50	25.0	75.0
4.00	4.4	1.93	.60	36.0	64.0
5.00	3.5	2.55	.67	44.4	55.6
10.0	1.7	4.80	.82	66.9	33.1
20.0	0.9	7.41	.90	81.9	18.1



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