

Acerca de unidades de medida EMC:

(Compatibilidad Electromagnética)

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Unidades:

E o V = Volts (puede utilizar cualquiera, según las normas de la Convención)
R = Ohms (impedancia/resistencia)
P = Power (Watts, dBm, mW, or W)
dB = decibel ratio (\log_{10}) - todos los registros serán a base 10
W = Watts = $(E \cdot E)/R$
u = micro = $10E-6$ (para todas las unidades - E, R, P, or V)
m = milli = $10E-3$ (para todas las unidades - E, R, P, or V)
dBm = relación de decibelios de vatios W a un milliwatt = $10\log_{10}(W/mW)$
dBuV = relación de decibelios de voltios a un microvoltio = $20\log_{10}\{V/uV\}$ o, por ejemplo, $\{E/uV\}$

Conversiones para sistemas de 50 ohmios:

1. Para convertir dBm a dBuV sumar 107 dB: $dBuV = dBm + 107 \text{ dB}$
2. Para convertir dBuV a dBm restar 107 dB: $dBm = dBuV - 107 \text{ dB}$

Recordar, 0 dBm = 1 mW (milliwatt) = 0.001 Watts

- a) E = Raíz cuadrada de $(W \times R)$ - asumir R = 50 Ohms Nota: para dBm nuestra referencia será 1 mW
- b) E = Raíz cuadrada de $(1mW \times 50 \text{ ohmios}) = 0,224 \text{ voltios}$
- c) $dBuV = 20 \log_{10}(0.224 \text{ Volts}/1uV^*) = 107 \text{ dBuV}$
- d) Por lo tanto, 107 dBuV = 0 dBm en un sistema de 50 Ohms
- e) Utilizando esto como el factor de escala: $dBm + 107 \text{ dB} = dBuV$
 - * Deben introducirse en vatios (0.001 or $1 \times 10^{-3} \text{ W} = 1 \text{ mW}$)
 - * Deben introducirse en Volts (0.000001 or $1 \times 10^{-6} \text{ V} = 1uV$)

Precaucion:

Uno error común observado en la utilización de las conversiones es la suma o resta.
Potencias (Watts) pueden sumarse, tensiones y valores \log_{10} no pueden sumarse o restarse.

Como ejemplo, en caso de un sistema de 50 ohmios:

$$\begin{aligned} 5 \text{ mW} &= 7 \text{ dBm} = 114 \text{ dBuV} = 501.2 \text{ mV} \\ + 8 \text{ mW} &= 9 \text{ dBm} = 116 \text{ dBuV} = 631.0 \text{ mV} \\ 13 \text{ mW} &= 11 \text{ dBm} = 118 \text{ dBuV} = 794.3 \text{ mV} \end{aligned}$$

Donde: uV es micro voltios
mV es milli voltios

Unidades de Medida de Radiación:

uV/m = microvolts por metro = Intensidad de Campo
dBuV/m = relación de decibelios referenciado a microvolt por metro = Intensidad de Campo
AF = Factor de antena = Pérdidas asociadas con la antena de recepción
CL = Pérdidas de Cable = Pérdida de la señal dentro del cable de transmisión.

Mediciones de fuerza de campo normalmente se miden y se calcula así:

$$FS(dBuV/m) = \text{Indica el nivel de señal (dBuV)} + AF(dB) + CL(dB)$$

Las intensidades de campo en microvoltios por metro (mV/m) pueden calcularse tomando el registro inverso de la intensidad del campo se mide en dBuV/m. Como ejemplo:

$$FS(uV/m) = 10 \text{ elevado a la potencia de } \{(dBuV/m)/20\}$$

FS = Fuerza del campo en decibelios por encima de un microvoltios por metro o en microvoltios por metro

Indicador nivel de señal = Nivel de señal en el receptor (analizador de espectro)

Nota: generalmente leer en dBuV, o en dBm y convierte en dBuV.

AF = Factor de Antena (pérdida de señal) en dB

CL = Pérdida de Cable (pérdida de señal) en dB

Unit Equivalent Cross-reference for 50 Ohm Systems

dBm	dBw	dBuV	Vrms	dBuA	Arms	W
-100	-130	6.9897	2.24E-06	-26.9897	4.47E-08	1E-13
-99	-129	7.9897	2.51E-06	-25.9897	5.02E-08	1.26E-13
-98	-128	8.9897	2.82E-06	-24.9897	5.63E-08	1.58E-13
-97	-127	9.9897	3.16E-06	-23.9897	6.32E-08	2E-13
-96	-126	10.9897	3.54E-06	-22.9897	7.09E-08	2.51E-13
-95	-125	11.9897	3.98E-06	-21.9897	7.95E-08	3.16E-13
-94	-124	12.9897	4.46E-06	-20.9897	8.92E-08	3.98E-13
-93	-123	13.9897	5.01E-06	-19.9897	1E-07	5.01E-13
-92	-122	14.9897	5.62E-06	-18.9897	1.12E-07	6.31E-13
-91	-121	15.9897	6.3E-06	-17.9897	1.26E-07	7.94E-13
-90	-120	16.9897	7.07E-06	-16.9897	1.41E-07	1E-12
-89	-119	17.9897	7.93E-06	-15.9897	1.59E-07	1.26E-12
-88	-118	18.9897	8.9E-06	-14.9897	1.78E-07	1.58E-12
-87	-117	19.9897	9.99E-06	-13.9897	2E-07	2E-12
-86	-116	20.9897	1.12E-05	-12.9897	2.24E-07	2.51E-12
-85	-115	21.9897	1.26E-05	-11.9897	2.51E-07	3.16E-12
-84	-114	22.9897	1.41E-05	-10.9897	2.82E-07	3.98E-12
-83	-113	23.9897	1.58E-05	-9.9897	3.17E-07	5.01E-12
-82	-112	24.9897	1.78E-05	-8.9897	3.55E-07	6.31E-12
-81	-111	25.9897	1.99E-05	-7.9897	3.99E-07	7.94E-12
-80	-110	26.9897	2.24E-05	-6.9897	4.47E-07	1E-11
-79	-109	27.9897	2.51E-05	-5.9897	5.02E-07	1.26E-11
-78	-108	28.9897	2.82E-05	-4.9897	5.63E-07	1.58E-11
-77	-107	29.9897	3.16E-05	-3.9897	6.32E-07	2E-11
-76	-106	30.9897	3.54E-05	-2.9897	7.09E-07	2.51E-11
-75	-105	31.9897	3.98E-05	-1.9897	7.95E-07	3.16E-11
-74	-104	32.9897	4.46E-05	-0.9897	8.92E-07	3.98E-11
-73	-103	33.9897	5.01E-05	0.0103	1E-06	5.01E-11
-72	-102	34.9897	5.62E-05	1.0103	1.12E-06	6.31E-11
-71	-101	35.9897	6.3E-05	2.0103	1.26E-06	7.94E-11
-70	-100	36.9897	7.07E-05	3.0103	1.41E-06	1E-10
-69	-99	37.9897	7.93E-05	4.0103	1.59E-06	1.26E-10
-68	-98	38.9897	8.9E-05	5.0103	1.78E-06	1.58E-10
-67	-97	39.9897	9.99E-05	6.0103	2E-06	2E-10
-66	-96	40.9897	0.000112	7.0103	2.24E-06	2.51E-10
-65	-95	41.9897	0.000126	8.0103	2.51E-06	3.16E-10
-64	-94	42.9897	0.000141	9.0103	2.82E-06	3.98E-10
-63	-93	43.9897	0.000158	10.0103	3.17E-06	5.01E-10
-62	-92	44.9897	0.000178	11.0103	3.55E-06	6.31E-10
-61	-91	45.9897	0.000199	12.0103	3.99E-06	7.94E-10
-60	-90	46.9897	0.000224	13.0103	4.47E-06	1E-09
-59	-89	47.9897	0.000251	14.0103	5.02E-06	1.26E-09
-58	-88	48.9897	0.000282	15.0103	5.63E-06	1.58E-09
-57	-87	49.9897	0.000316	16.0103	6.32E-06	2E-09
-56	-86	50.9897	0.000354	17.0103	7.09E-06	2.51E-09
-55	-85	51.9897	0.000398	18.0103	7.95E-06	3.16E-09
-54	-84	52.9897	0.000446	19.0103	8.92E-06	3.98E-09
-53	-83	53.9897	0.000501	20.0103	1E-05	5.01E-09
-52	-82	54.9897	0.000562	21.0103	1.12E-05	6.31E-09
-51	-81	55.9897	0.00063	22.0103	1.26E-05	7.94E-09
-50	-80	56.9897	0.000707	23.0103	1.41E-05	1E-08
-49	-79	57.9897	0.000793	24.0103	1.59E-05	1.26E-08
-48	-78	58.9897	0.00089	25.0103	1.78E-05	1.58E-08
-47	-77	59.9897	0.000999	26.0103	2E-05	2E-08
-46	-76	60.9897	0.001121	27.0103	2.24E-05	2.51E-08
-45	-75	61.9897	0.001257	28.0103	2.51E-05	3.16E-08
-44	-74	62.9897	0.001411	29.0103	2.82E-05	3.98E-08
-43	-73	63.9897	0.001583	30.0103	3.17E-05	5.01E-08
-42	-72	64.9897	0.001776	31.0103	3.55E-05	6.31E-08
-41	-71	65.9897	0.001993	32.0103	3.99E-05	7.94E-08
-40	-70	66.9897	0.002236	33.0103	4.47E-05	1E-07
-39	-69	67.9897	0.002509	34.0103	5.02E-05	1.26E-07
-38	-68	68.9897	0.002815	35.0103	5.63E-05	1.58E-07
-37	-67	69.9897	0.003159	36.0103	6.32E-05	2E-07
-36	-66	70.9897	0.003544	37.0103	7.09E-05	2.51E-07
-35	-65	71.9897	0.003976	38.0103	7.95E-05	3.16E-07

-34	-64	72.9897	0.004462	39.0103	8.92E-05	3.98E-07
-33	-63	73.9897	0.005006	40.0103	0.0001	5.01E-07
-32	-62	74.9897	0.005617	41.0103	0.000112	6.31E-07
-31	-61	75.9897	0.006302	42.0103	0.000126	7.94E-07
-30	-60	76.9897	0.007071	43.0103	0.000141	0.000001
-29	-59	77.9897	0.007934	44.0103	0.000159	1.26E-06
-28	-58	78.9897	0.008902	45.0103	0.000178	1.58E-06
-27	-57	79.9897	0.009988	46.0103	0.0002	2E-06
-26	-56	80.9897	0.011207	47.0103	0.000224	2.51E-06
-25	-55	81.9897	0.012574	48.0103	0.000251	3.16E-06
-24	-54	82.9897	0.014109	49.0103	0.000282	3.98E-06
-23	-53	83.9897	0.01583	50.0103	0.000317	5.01E-06
-22	-52	84.9897	0.017762	51.0103	0.000355	6.31E-06
-21	-51	85.9897	0.019929	52.0103	0.000399	7.94E-06
-20	-50	86.9897	0.022361	53.0103	0.000447	0.00001
-19	-49	87.9897	0.025089	54.0103	0.000502	1.26E-05
-18	-48	88.9897	0.02815	55.0103	0.000563	1.58E-05
-17	-47	89.9897	0.031585	56.0103	0.000632	2E-05
-16	-46	90.9897	0.035439	57.0103	0.000709	2.51E-05
-15	-45	91.9897	0.039764	58.0103	0.000795	3.16E-05
-14	-44	92.9897	0.044615	59.0103	0.000892	3.98E-05
-13	-43	93.9897	0.050059	60.0103	0.001001	5.01E-05
-12	-42	94.9897	0.056167	61.0103	0.001123	6.31E-05
-11	-41	95.9897	0.063021	62.0103	0.00126	7.94E-05
-10	-40	96.9897	0.070711	63.0103	0.001414	0.0001
-9	-39	97.9897	0.079339	64.0103	0.001587	0.000126
-8	-38	98.9897	0.089019	65.0103	0.00178	0.000158
-7	-37	99.9897	0.099881	66.0103	0.001998	0.0002
-6	-36	100.9897	0.112069	67.0103	0.002241	0.000251
-5	-35	101.9897	0.125743	68.0103	0.002515	0.000316
-4	-34	102.9897	0.141086	69.0103	0.002822	0.000398
-3	-33	103.9897	0.158301	70.0103	0.003166	0.000501
-2	-32	104.9897	0.177617	71.0103	0.003552	0.000631
-1	-31	105.9897	0.19929	72.0103	0.003986	0.000794
0	-30	106.9897	0.223607	73.0103	0.004472	0.001
1	-29	107.9897	0.250891	74.0103	0.005018	0.001259
2	-28	108.9897	0.281504	75.0103	0.00563	0.001585
3	-27	109.9897	0.315853	76.0103	0.006317	0.001995
4	-26	110.9897	0.354393	77.0103	0.007088	0.002512
5	-25	111.9897	0.397635	78.0103	0.007953	0.003162
6	-24	112.9897	0.446154	79.0103	0.008923	0.003981
7	-23	113.9897	0.500593	80.0103	0.010012	0.005012
8	-22	114.9897	0.561675	81.0103	0.011233	0.00631
9	-21	115.9897	0.63021	82.0103	0.012604	0.007943
10	-20	116.9897	0.707107	83.0103	0.014142	0.01
11	-19	117.9897	0.793387	84.0103	0.015868	0.012589
12	-18	118.9897	0.890195	85.0103	0.017804	0.015849
13	-17	119.9897	0.998815	86.0103	0.019976	0.019953
14	-16	120.9897	1.120689	87.0103	0.022414	0.025119
15	-15	121.9897	1.257433	88.0103	0.025149	0.031623
16	-14	122.9897	1.410864	89.0103	0.028217	0.039811
17	-13	123.9897	1.583015	90.0103	0.03166	0.050119
18	-12	124.9897	1.776172	91.0103	0.035523	0.063096
19	-11	125.9897	1.992898	92.0103	0.039858	0.079433
20	-10	126.9897	2.236068	93.0103	0.044721	0.1
21	-9	127.9897	2.50891	94.0103	0.050178	0.125893
22	-8	128.9897	2.815043	95.0103	0.056301	0.158489
23	-7	129.9897	3.15853	96.0103	0.063171	0.199526
24	-6	130.9897	3.543929	97.0103	0.070879	0.251189
25	-5	131.9897	3.976354	98.0103	0.079527	0.316228
26	-4	132.9897	4.461542	99.0103	0.089231	0.398107
27	-3	133.9897	5.005933	100.0103	0.100119	0.501187
28	-2	134.9897	5.616749	101.0103	0.112335	0.630957
29	-1	135.9897	6.302096	102.0103	0.126042	0.794328
30	0	136.9897	7.071068	103.0103	0.141421	1
31	1	137.9897	7.933869	104.0103	0.158677	1.258925
32	2	138.9897	8.901947	105.0103	0.178039	1.584893
33	3	139.9897	9.988149	106.0103	0.199763	1.995262
34	4	140.9897	11.20689	107.0103	0.224138	2.511886
35	5	141.9897	12.57433	108.0103	0.251487	3.162278

36	6	142.9897	14.10864	109.0103	0.282173	3.981072
37	7	143.9897	15.83015	110.0103	0.316603	5.011872
38	8	144.9897	17.76172	111.0103	0.355234	6.309573
39	9	145.9897	19.92898	112.0103	0.39858	7.943282
40	10	146.9897	22.36068	113.0103	0.447214	10
41	11	147.9897	25.0891	114.0103	0.501782	12.58925
42	12	148.9897	28.15043	115.0103	0.563009	15.84893
43	13	149.9897	31.5853	116.0103	0.631706	19.95262
44	14	150.9897	35.43929	117.0103	0.708786	25.11886
45	15	151.9897	39.76354	118.0103	0.795271	31.62278
46	16	152.9897	44.61542	119.0103	0.892308	39.81072
47	17	153.9897	50.05933	120.0103	1.001187	50.11872
48	18	154.9897	56.16749	121.0103	1.12335	63.09573
49	19	155.9897	63.02096	122.0103	1.260419	79.43282
50	20	156.9897	70.71068	123.0103	1.414214	100
51	21	157.9897	79.33869	124.0103	1.586774	125.8925
52	22	158.9897	89.01947	125.0103	1.780389	158.4893
53	23	159.9897	99.88149	126.0103	1.99763	199.5262
54	24	160.9897	112.0689	127.0103	2.241377	251.1886
55	25	161.9897	125.7433	128.0103	2.514867	316.2278
56	26	162.9897	141.0864	129.0103	2.821727	398.1072
57	27	163.9897	158.3015	130.0103	3.16603	501.1872
58	28	164.9897	177.6172	131.0103	3.552344	630.9573
59	29	165.9897	199.2898	132.0103	3.985795	794.3282
60	30	166.9897	223.6068	133.0103	4.472136	1000
61	31	167.9897	250.891	134.0103	5.017819	1258.925
62	32	168.9897	281.5043	135.0103	5.630086	1584.893
63	33	169.9897	315.853	136.0103	6.31706	1995.262
64	34	170.9897	354.3929	137.0103	7.087858	2511.886
65	35	171.9897	397.6354	138.0103	7.952707	3162.278
66	36	172.9897	446.1542	139.0103	8.923084	3981.072
67	37	173.9897	500.5933	140.0103	10.01187	5011.872
68	38	174.9897	561.6749	141.0103	11.2335	6309.573
69	39	175.9897	630.2096	142.0103	12.60419	7943.282
70	40	176.9897	707.1068	143.0103	14.14214	10000
71	41	177.9897	793.3869	144.0103	15.86774	12589.25
72	42	178.9897	890.1947	145.0103	17.80389	15848.93
73	43	179.9897	998.8149	146.0103	19.9763	19952.62
74	44	180.9897	1120.689	147.0103	22.41377	25118.86
75	45	181.9897	1257.433	148.0103	25.14867	31622.78
76	46	182.9897	1410.864	149.0103	28.21727	39810.72
77	47	183.9897	1583.015	150.0103	31.6603	50118.72
78	48	184.9897	1776.172	151.0103	35.52344	63095.73
79	49	185.9897	1992.898	152.0103	39.85795	79432.82
80	50	186.9897	2236.068	153.0103	44.72136	100000
81	51	187.9897	2508.91	154.0103	50.17819	125892.5
82	52	188.9897	2815.043	155.0103	56.30086	158489.3
83	53	189.9897	3158.53	156.0103	63.1706	199526.2
84	54	190.9897	3543.929	157.0103	70.87858	251188.6
85	55	191.9897	3976.354	158.0103	79.52707	316227.8
86	56	192.9897	4461.542	159.0103	89.23084	398107.2
87	57	193.9897	5005.933	160.0103	100.1187	501187.2
88	58	194.9897	5616.749	161.0103	112.335	630957.3
89	59	195.9897	6302.096	162.0103	126.0419	794328.2
90	60	196.9897	7071.068	163.0103	141.4214	1000000
91	61	197.9897	7933.869	164.0103	158.6774	1258925
92	62	198.9897	8901.947	165.0103	178.0389	1584893
93	63	199.9897	9988.149	166.0103	199.763	1995262
94	64	200.9897	11206.89	167.0103	224.1377	2511886
95	65	201.9897	12574.33	168.0103	251.4867	3162278
96	66	202.9897	14108.64	169.0103	282.1727	3981072
97	67	203.9897	15830.15	170.0103	316.603	5011872
98	68	204.9897	17761.72	171.0103	355.2344	6309573
99	69	205.9897	19928.98	172.0103	398.5795	7943282
100	70	206.9897	22360.68	173.0103	447.2136	10000000