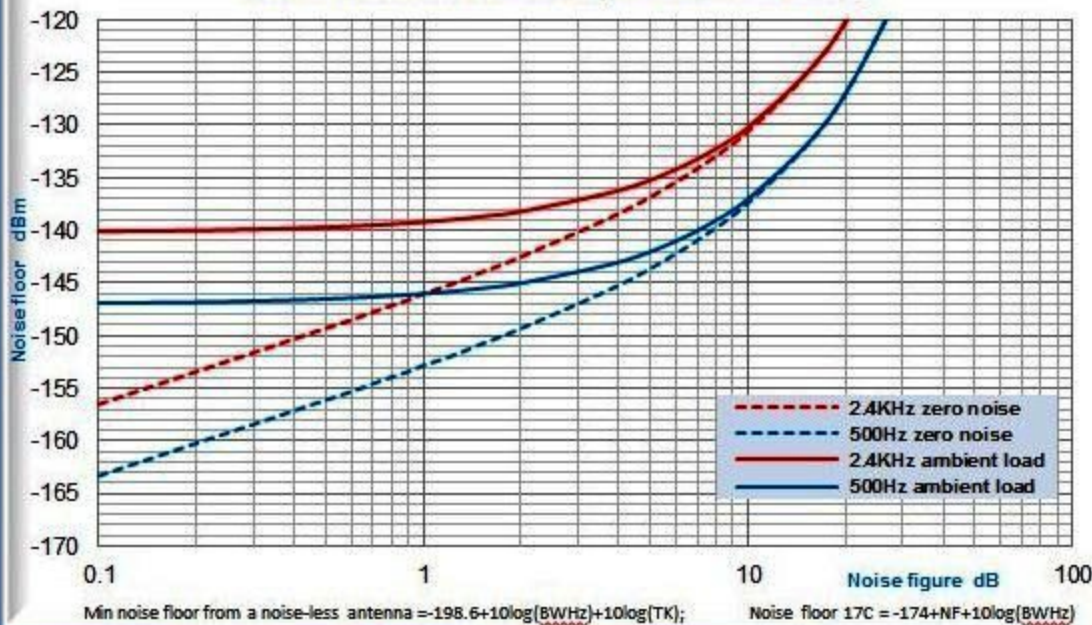
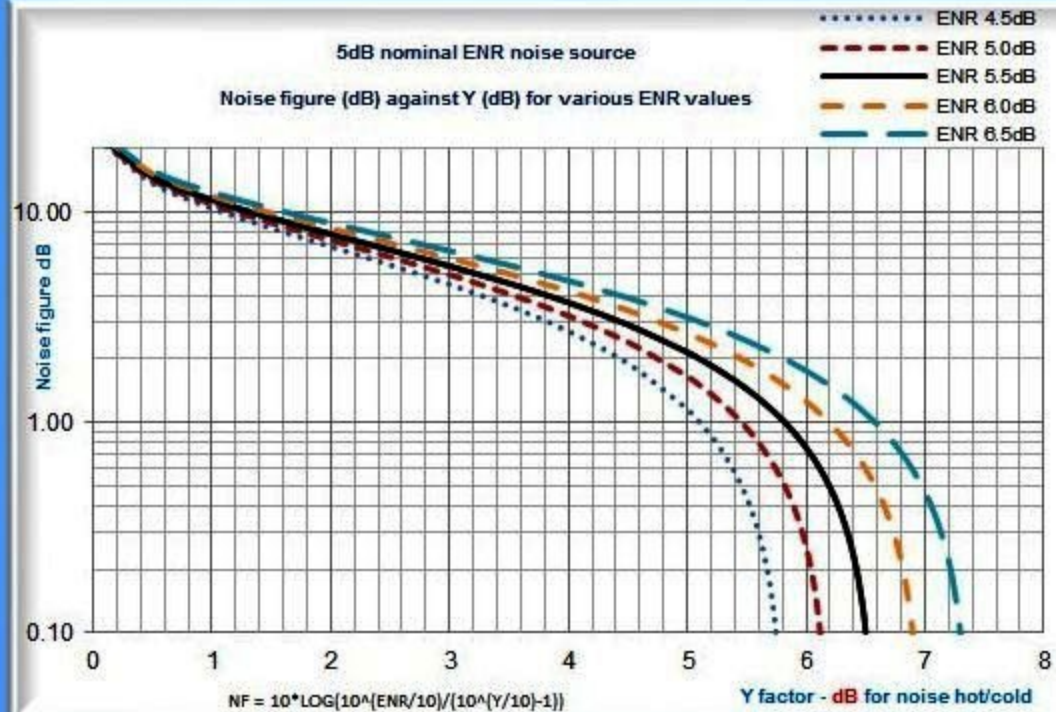


Receiver noise figure and resulting noise floors in SSB and CW bandwidths.  
Minimum discernible signal from an ambient temperature load (e.g. signal generator)  
& the minimum noise floor available (from a 'zero noise' antenna)



5dB nominal ENR noise source



Half wave 0dB dipole K factor

MHz	K (dB)
1	-31.9
10	-11.9
39	0
50	2.1
70	5.0
100	8.1
144	11.3
220	15.0
432	20.8
1000	28.1

$K = 20\log(\text{MHz}) - 31.9$   
Field strength  $\mu\text{V/m} = \text{dB}\mu\text{V}(\text{50R}) + K$

Half wave dipole rod length

MHz	cm
30	237
50	143
70	102
100	71.3
144	49.5
220	32.4
312	22.8
433	16.5
500	14.3
600	11.9
700	10.2
868	8.2
1000	7.1

$Cm = 95\% \text{ of } \lambda/4$

Noise figure / N temp

NF (dB)	T (Kelvin)
0.1	6.8
0.2	13.6
0.3	20.7
0.4	28.0
0.5	35.4
0.6	43.0
0.7	50.7
0.8	58.7
0.9	66.8
1.0	75.1
1.1	83.6
1.2	92.3
1.3	101
1.4	110
1.5	120
1.6	129
1.7	139
1.8	149
1.9	159
2.0	170
2.1	180
2.2	191
2.3	203
2.4	214
2.5	226
2.7	250
3.0	289 (16C)

# Wireless engineers bench buddy

50 OHM T PAD

dB	R series-shunt-series
1	2.9 432 2.9
2	5.8 215 5.8
3	8.5 143 8.5
4	11.3 105 11.3
5	14 82.5 14
6	16.5 66.5 16.5
7	19.1 56.2 19.1
8	21.5 47.5 21.5
9	23.7 40.2 23.7
10	26.1 34.8 26.1
11	28.0 30.9 28.0
12	30.1 26.7 30.1
13	31.6 23.7 31.6
14	33.2 21.0 33.2
15	34.8 18.2 34.8
20	41.2 10.2 41.2

VSWR Return Loss rho

VSWR	Return Loss	rho
1.01	46.1dB	0.005
1.02	40.1dB	0.010
1.03	36.6dB	0.015
1.04	34.2dB	0.020
1.05	32.3dB	0.024
1.06	30.7dB	0.029
1.07	29.4dB	0.034
1.08	28.3dB	0.039
1.09	27.3dB	0.043
1.10	26.5dB	0.048
1.15	23.1dB	0.070
1.20	20.8dB	0.091
1.25	19.1dB	0.111
1.30	17.7dB	0.130
1.50	14.0dB	0.200
1.75	11.3dB	0.273
2.00	9.55dB	0.333

50 OHM Pi PAD

dB	R shunt-series-shunt
1	866 5.8 866
2	432 11.5 432
3	294 17.8 294
4	221 23.7 221
5	178 30.1 178
6	150 37.4 150
7	130 45.3 130
8	115 52.3 115
9	105 61.9 105
10	95.3 71.5 95.3
11	88.7 82.5 88.7
12	84.5 93.1 84.5
13	78.7 107 78.7
14	75.0 121 75
15	71.5 137 71.5
20	60.4 249 60.4

VSWR from reflected power

Pw ref %	VSWR
50%	5.8:1
40%	4.4:1
30%	3.4:1
20%	2.6:1
10%	1.9:1
5%	1.6:1
2%	1.3:1
1%	1.2:1

Friss free space path loss between two 0dB antennas at 100MHz

Distance	Loss (dB)
1m	12
10m	32
100m	52
1km	72
10km	92
100km	112

For higher frequencies: +20dB / decade  
For lower frequencies: -20dB / decade  
For greater distance: +20dB / decade

This data is presented without warranty and Continental Compliance Limited shall not be held liable for the accuracy of the information provided or the consequences of its application.

Mismatch errors due to VSWR of the source and load. Data is +/- dB uncertainty in power measurement or noise source ENR.

VSWR	1.00	1.02	1.05	1.10	1.50	2.00	5.00	10.00	20.00
1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.02	0.00	0.00	0.00	0.00	0.02	0.03	0.06	0.07	0.08
1.05	0.00	0.00	0.01	0.01	0.04	0.07	0.14	0.18	0.19
1.10	0.00	0.00	0.01	0.02	0.08	0.14	0.28	0.35	0.38
1.50	0.00	0.02	0.04	0.08	0.36	0.60	1.24	1.55	1.74
2.00	0.00	0.03	0.07	0.14	0.60	1.02	2.18	2.77	3.12



dBm	power	unit	voltage	unit	dBuV
-140	10.0	aW	22.36	nV	-33
-139	12.6	aW	25.09	nV	-32
-138	15.8	aW	28.15	nV	-31
-137	20.0	aW	31.59	nV	-30
-136	25.1	aW	35.44	nV	-29
-135	31.6	aW	39.76	nV	-28
-134	39.8	aW	44.62	nV	-27
-133	50.1	aW	50.06	nV	-26
-132	63.1	aW	56.17	nV	-25
-131	79.4	aW	63.02	nV	-24
-130	100.0	aW	70.71	nV	-23
-129	125.9	aW	79.34	nV	-22
-128	158.5	aW	89.02	nV	-21
-127	199.5	aW	0.10	uV	-20
-126	251.2	aW	0.11	uV	-19
-125	316.2	aW	0.13	uV	-18
-124	398.1	aW	0.14	uV	-17
-123	501.2	aW	0.16	uV	-16
-122	631.0	aW	0.18	uV	-15
-121	794.3	aW	0.20	uV	-14
-120	1.0	fW	0.22	uV	-13
-119	1.3	fW	0.25	uV	-12
-118	1.6	fW	0.28	uV	-11
-117	2.0	fW	0.32	uV	-10
-116	2.5	fW	0.35	uV	-9
-115	3.2	fW	0.40	uV	-8
-114	4.0	fW	0.45	uV	-7
-113	5.0	fW	0.50	uV	-6
-112	6.3	fW	0.56	uV	-5
-111	7.9	fW	0.63	uV	-4
-110	10.0	fW	0.71	uV	-3
-109	12.6	fW	0.8	uV	-2
-108	15.8	fW	0.9	uV	-1
-107	20.0	fW	1.0	uV	0
-106	25.1	fW	1.1	uV	1
-105	31.6	fW	1.3	uV	2
-104	39.8	fW	1.4	uV	3
-103	50.1	fW	1.6	uV	4
-102	63.1	fW	1.8	uV	5
-101	79.4	fW	2.0	uV	6
-100	100.0	fW	2.2	uV	7
-99	125.9	fW	2.5	uV	8
-98	158.5	fW	2.8	uV	9
-97	199.5	fW	3.2	uV	10
-96	251.2	fW	3.5	uV	11
-95	316.2	fW	4.0	uV	12
-94	398.1	fW	4.5	uV	13
-93	501.2	fW	5.0	uV	14
-92	631.0	fW	5.6	uV	15
-91	794.3	fW	6.3	uV	16

dBm	power	unit	voltage	unit	dBuV
-90	1.0	pW	7.1	uV	17
-89	1.3	pW	7.9	uV	18
-88	1.6	pW	8.9	uV	19
-87	2.0	pW	10.0	uV	20
-86	2.5	pW	11.2	uV	21
-85	3.2	pW	12.6	uV	22
-84	4.0	pW	14.1	uV	23
-83	5.0	pW	15.8	uV	24
-82	6.3	pW	17.8	uV	25
-81	7.9	pW	19.9	uV	26
-80	10.0	pW	22.4	uV	27
-79	12.6	pW	25.1	uV	28
-78	15.8	pW	28.2	uV	29
-77	20.0	pW	31.6	uV	30
-76	25.1	pW	35.4	uV	31
-75	31.6	pW	39.8	uV	32
-74	39.8	pW	44.6	uV	33
-73	50.1	pW	50.1	uV	34
-72	63.1	pW	56.2	uV	35
-71	79.4	pW	63.0	uV	36
-70	100.0	pW	70.7	uV	37
-69	125.9	pW	79.3	uV	38
-68	158.5	pW	89.0	uV	39
-67	199.5	pW	99.9	uV	40
-66	251.2	pW	112.1	uV	41
-65	316.2	pW	125.7	uV	42
-64	398.1	pW	141.1	uV	43
-63	501.2	pW	158.3	uV	44
-62	631.0	pW	177.6	uV	45
-61	794.3	pW	199.3	uV	46
-60	1.0	nW	223.6	uV	47
-59	1.3	nW	250.9	uV	48
-58	1.6	nW	281.5	uV	49
-57	2.0	nW	315.9	uV	50
-56	2.5	nW	354.4	uV	51
-55	3.2	nW	397.6	uV	52
-54	4.0	nW	446.2	uV	53
-53	5.0	nW	500.6	uV	54
-52	6.3	nW	561.7	uV	55
-51	7.9	nW	630.2	uV	56
-50	10.0	nW	707.1	uV	57
-49	12.6	nW	793.4	uV	58
-48	15.8	nW	890.2	uV	59
-47	20.0	nW	998.8	uV	60
-46	25.1	nW	1.1	mV	61
-45	31.6	nW	1.3	mV	62
-44	39.8	nW	1.4	mV	63
-43	50.1	nW	1.6	mV	64
-42	63.1	nW	1.8	mV	65
-41	79.4	nW	2.0	mV	66

dBm	power	unit	voltage	unit	dBuV
-40	100.0	nW	2.2	mV	67
-39	125.9	nW	2.5	mV	68
-38	158.5	nW	2.8	mV	69
-37	199.5	nW	3.2	mV	70
-36	251.2	nW	3.5	mV	71
-35	316.2	nW	4.0	mV	72
-34	398.1	nW	4.5	mV	73
-33	501.2	nW	5.0	mV	74
-32	631.0	nW	5.6	mV	75
-31	794.3	nW	6.3	mV	76
-30	1.0	uW	7.1	mV	77
-29	1.3	uW	7.9	mV	78
-28	1.6	uW	8.9	mV	79
-27	2.0	uW	10.0	mV	80
-26	2.5	uW	11.2	mV	81
-25	3.2	uW	12.6	mV	82
-24	4.0	uW	14.1	mV	83
-23	5.0	uW	15.8	mV	84
-22	6.3	uW	17.8	mV	85
-21	7.9	uW	19.9	mV	86
-20	10.0	uW	22.4	mV	87
-19	12.6	uW	25.1	mV	88
-18	15.8	uW	28.2	mV	89
-17	20.0	uW	31.6	mV	90
-16	25.1	uW	35.4	mV	91
-15	31.6	uW	39.8	mV	92
-14	39.8	uW	44.6	mV	93
-13	50.1	uW	50.1	mV	94
-12	63.1	uW	56.2	mV	95
-11	79.4	uW	63.0	mV	96
-10	100.0	uW	70.7	mV	97
-9	125.9	uW	79.3	mV	98
-8	158.5	uW	89.0	mV	99
-7	199.5	uW	99.9	mV	100
-6	251.2	uW	112.1	mV	101
-5	316.2	uW	125.7	mV	102
-4	398.1	uW	141.1	mV	103
-3	501.2	uW	158.3	mV	104
-2	631.0	uW	177.6	mV	105
-1	794.3	uW	199.3	mV	106
0	1.0	mW	223.6	mV	107
1	1.3	mW	250.9	mV	108
2	1.6	mW	281.5	mV	109
3	2.0	mW	315.9	mV	110
4	2.5	mW	354.4	mV	111
5	3.2	mW	397.6	mV	112
6	4.0	mW	446.2	mV	113
7	5.0	mW	500.6	mV	114
8	6.3	mW	561.7	mV	115
9	7.9	mW	630.2	mV	116

dBm	power	unit	voltage	unit	dBuV
10	10.0	mW	707.1	mV	117
11	12.6	mW	793.4	mV	118
12	15.8	mW	890.2	mV	119
13	20.0	mW	998.8	mV	120
14	25.1	mW	1.1	V	121
15	31.6	mW	1.3	V	122
16	39.8	mW	1.4	V	123
17	50.1	mW	1.6	V	124
18	63.1	mW	1.8	V	125
19	79.4	mW	2.0	V	126
20	100.0	mW	2.2	V	127
21	125.9	mW	2.5	V	128
22	158.5	mW	2.8	V	129
23	199.5	mW	3.2	V	130
24	251.2	mW	3.5	V	131
25	316.2	mW	4.0	V	132
26	398.1	mW	4.5	V	133
27	501.2	mW	5.0	V	134
28	631.0	mW	5.6	V	135
29	794.3	mW	6.3	V	136
30	1.0	W	7.1	V	137

Continental Compliance Limited v1.0

Jotter. You'll need a marker pen plus some IPA