Friis's Formula:

$$NF_{DUT} = NF_{TOT} - \frac{NF_{REC} - 1}{G_{av.DUT}}$$

Y-Factor (hot/cold):

$$NF = \frac{\frac{T_{Hot}}{T_{Cold}} - 1}{Y - 1} = \frac{ENR}{Y - 1}$$

Cold-Noise Source:

$$NF = \frac{P_N}{T_0 KBG} \cdot \frac{\left|1 - S_{11}.\Gamma_S\right|^2 . \left|1 - \Gamma_{REC}.\Gamma_{OUT}\right|^2}{(1 - \left|\Gamma_S\right|^2).\left|S_{21}\right|^2} - \frac{T_C}{T_0} + 1$$

Where

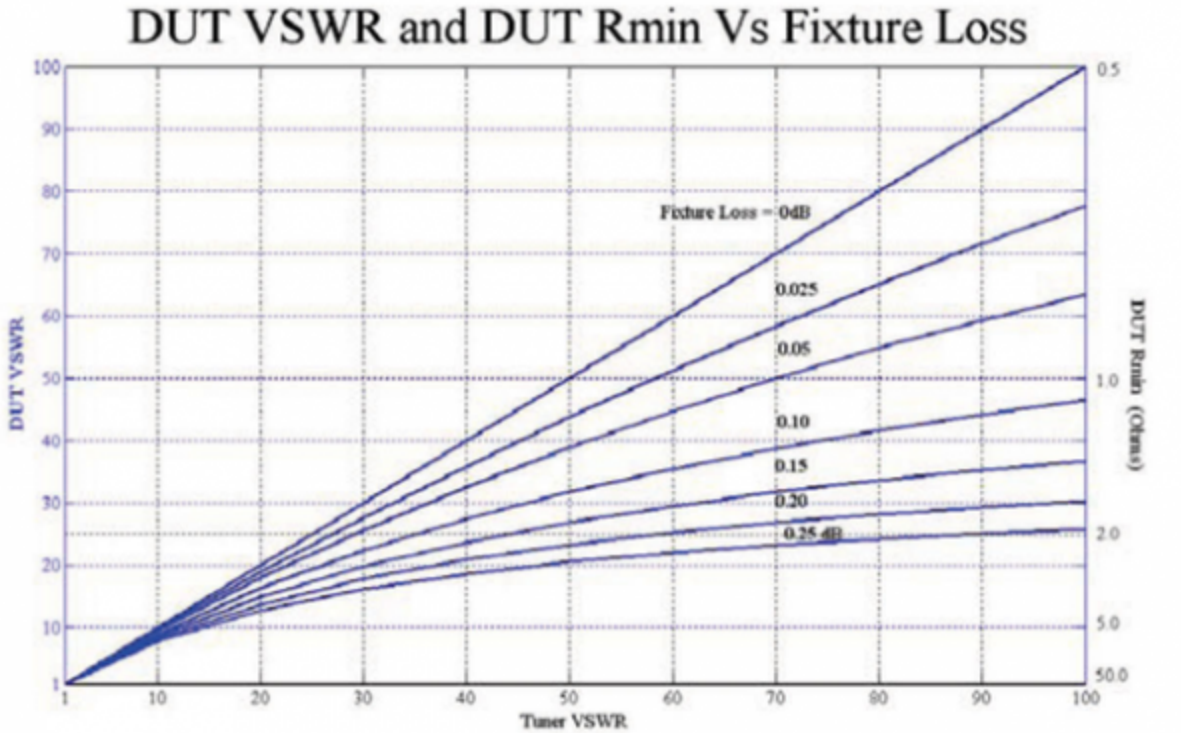
- P_N : Noise Power
- Γ_S : Source reflection coefficient (seen by DUT)
- Γ_{OUT} : reflection coefficient (seen by RECEIVER)
- Γ_{REC} : input reflection coefficient of receiver
- KBG : gain-bandwidth constant of receiver
- T_C : actual temperature
- T_0: standard temperature (290K)
- S_{ij} : "S"- parameter of DUT

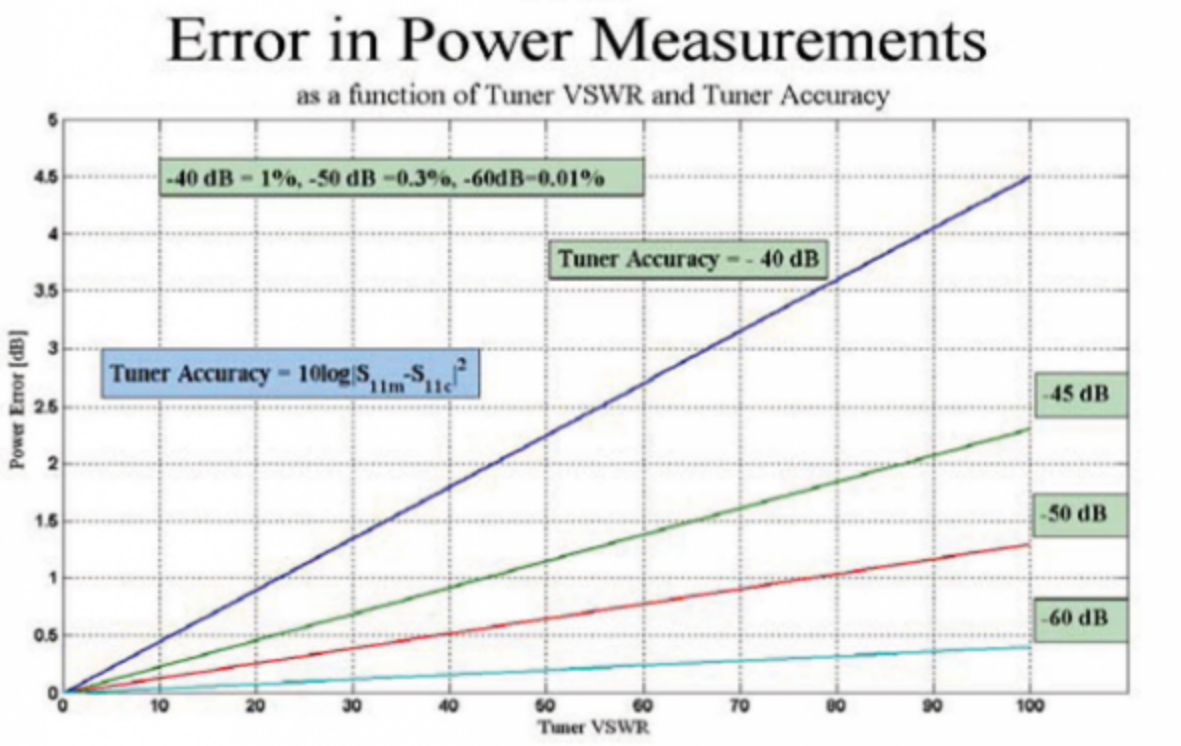
Noise Circles:

$$NF = NF_{\min} + \frac{R_n}{G_S}\left|Y_S - Y_{opt}\right|^2$$

Recommended Sensitivity of Noise Receiver:

$$NF_{REC} \leq NF_{DUT} + G_{av.DUT} - 5dB$$


DUT VSWR and DUT Rmin Vs Fixture Loss
DUT VSWR
DUT Rmin (Ohms)
Tuner VSWR
Fixture Loss = 0dB
0.025
0.05
0.10
0.15
0.20
0.25 dB


Error in Power Measurements
as a function of Tuner VSWR and Tuner Accuracy
-40 dB = 1%, -50 dB =0.3%, -60dB=0.01%
Tuner Accuracy = - 40 dB
Tuner Accuracy = 10log|S11m-S11c|2
-45 dB
-50 dB
-60 dB
Power Error [dB]
Tuner VSWR

RL[dB]	|Γ|	VSWR	Rmin(Ω)
0,05	0,994	347.44:1	0,14
0,10	0,989	173,71:1	0,29
0,15	0,983	115,81:1	0,43
0,20	0,977	86,86:1	0,58
0,25	0,972	69,49:1	0,72
0,30	0,966	57,91:1	0,86
0,35	0,961	49,64:1	1,01
0,40	0,955	43,44:1	1,15
0,45	0,950	38,61:1	1,29
0,50	0,944	34,75:1	1,44
0,55	0,939	31,60:1	1,58
0,60	0,933	28,96:1	1,73
0,65	0,928	26,74:1	1,87
0,70	0,923	24,83:1	2,01
0,75	0,917	23,18:1	2,16
0,80	0,912	21,73:1	2,30
0,85	0,907	20,45:1	2,44
0,90	0,902	19,32:1	2,59
0,95	0,896	18,30:1	2,73
1,00	0,891	17,39:1	2,88
1,05	0,886	16,56:1	3,02
1,10	0,881	15,81:1	3,16
1,15	0,876	15,13:1	3,31
1,20	0,871	14,50:1	3,45
1,25	0,866	13,92:1	3,59
1,30	0,861	13,39:1	3,73
1,35	0,856	12,89:1	3,88
1,40	0,851	12,43:1	4,02
1,45	0,846	12,01:1	4,16
1,50	0,841	11,60:1	4,31
1,55	0,837	11,24:1	4,45
1,60	0,832	10,89:1	4,59
1,65	0,827	10,56:1	4,73
1,70	0,822	10,25:1	4,88