LAMPIRAN A

Hubungan S-Parameter dengan Parameter Z, Y, H dan ABCD

	S	z	y	h	ABCD
S	$\begin{bmatrix} b_1 \\ b_2 \end{bmatrix} = \begin{bmatrix} S_{11} & S_{12} \\ S_{21} & S_{22} \end{bmatrix} \begin{bmatrix} a_1 \\ a_2 \end{bmatrix}$	$S_{11} = \frac{(z_{11}-1)(z_{22}+1)-z_{12}z_{21}}{(z_{11}+1)(z_{22}+1)-z_{12}z_{21}}$ $S_{12} = \frac{2z_{12}}{(z_{11}+1)(z_{22}+1)-z_{12}z_{21}}$ $S_{21} = \frac{2z_{21}}{(z_{11}+1)(z_{22}+1)-z_{12}z_{21}}$ $S_{22} = \frac{(z_{11}+1)(z_{22}-1)-z_{12}z_{21}}{(z_{11}+1)(z_{22}+1)-z_{12}z_{21}}$	$S_{11} = \frac{(1-y_{11})(1+y_{22})+y_{12}y_{21}}{(1+y_{11})(1+y_{22})-y_{12}y_{21}}$ $S_{12} = \frac{-2y_{12}}{(1+y_{11})(1+y_{22})-y_{12}y_{21}}$ $S_{21} = \frac{-2y_{21}}{(1+y_{11})(1+y_{22})-y_{12}y_{21}}$ $S_{22} = \frac{(1+y_{11})(1-y_{22})+y_{12}y_{21}}{(1+y_{11})(1+y_{22})-y_{12}y_{21}}$	$S_{11} = \frac{(h_{11}-1)(h_{22}+1)-h_{12}h_{21}}{(h_{11}+1)(h_{22}+1)-h_{12}h_{21}}$ $S_{12} = \frac{2h_{12}}{(h_{11}+1)(h_{22}+1)-h_{12}h_{21}}$ $S_{21} = \frac{-2h_{21}}{(h_{11}+1)(h_{22}+1)-h_{12}h_{21}}$ $S_{22} = \frac{(1+h_{11})(1-h_{22})+h_{12}h_{21}}{(h_{11}+1)(h_{22}+1)-h_{12}h_{21}}$	$\frac{A+B-C-D}{A+B+C+D}$ $\frac{2(AD-BC)}{A+B+C+D}$ $\frac{2}{A+B+C+D}$ $\frac{-A+B-C+D}{A+B+C+D}$
z	$z_{11} = \frac{(1+S_{11})(1-S_{22})+S_{12}S_{21}}{(1-S_{11})(1-S_{22})-S_{12}S_{21}}$ $z_{12} = \frac{2S_{12}}{(1-S_{11})(1-S_{22})-S_{12}S_{21}}$ $z_{21} = \frac{2S_{21}}{(1-S_{11})(1-S_{22})-S_{12}S_{21}}$ $z_{22} = \frac{(1-S_{11})(1+S_{22})+S_{12}S_{21}}{(1-S_{11})(1-S_{22})-S_{12}S_{21}}$	$\begin{bmatrix} V_1 \\ V_2 \end{bmatrix} = \begin{bmatrix} z_{11} & z_{12} \\ z_{21} & z_{22} \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$	$\frac{y_{22}}{\Delta^y}$ $\frac{-y_{12}}{\Delta^y}$ $\frac{-y_{21}}{\Delta^y}$ $\frac{y_{11}}{\Delta^y}$	$\frac{\Delta^h}{h_{22}}$ $\frac{h_{12}}{h_{22}}$ $\frac{-h_{12}}{h_{22}}$ $\frac{1}{h_{22}}$	$\frac{A}{C}$ $\frac{\Delta^{ABCD}}{C}$ $\frac{1}{C}$ $\frac{D}{C}$
y	$y_{11} = \frac{(1-S_{11})(1+S_{22})+S_{12}S_{21}}{(1+S_{11})(1+S_{22})-S_{12}S_{21}}$ $y_{12} = \frac{-2S_{12}}{(1+S_{11})(1+S_{22})-S_{12}S_{21}}$ $y_{21} = \frac{-2S_{21}}{(1+S_{11})(1+S_{22})-S_{12}S_{21}}$ $y_{22} = \frac{(1+S_{11})(1-S_{22})+S_{12}S_{21}}{(1+S_{11})(1+S_{22})-S_{12}S_{21}}$	$\frac{z_{22}}{\Delta^z}$ $\frac{-z_{12}}{\Delta^z}$ $\frac{-z_{21}}{\Delta^z}$ $\frac{z_{11}}{\Delta^z}$	$\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} y_{11} & y_{12} \\ y_{21} & y_{22} \end{bmatrix} \begin{bmatrix} V_1 \\ V_2 \end{bmatrix}$	$\frac{1}{h_{11}}$ $\frac{-h_{12}}{h_{11}}$ $\frac{h_{21}}{h_{11}}$ $\frac{\Delta^h}{h_{11}}$	$\frac{D}{B}$ $\frac{-\Delta^{ABCD}}{B}$ $\frac{-1}{B}$ $\frac{A}{B}$
h	$h_{11} = \frac{(1+S_{11})(1+S_{22})-S_{12}S_{21}}{(1-S_{11})(1+S_{22})+S_{12}S_{21}}$ $h_{12} = \frac{2S_{12}}{(1-S_{11})(1+S_{22})+S_{12}S_{21}}$ $h_{21} = \frac{-2S_{21}}{(1-S_{11})(1+S_{22})+S_{12}S_{21}}$ $h_{22} = \frac{(1-S_{11})(1-S_{22})-S_{12}S_{21}}{(1-S_{11})(1+S_{22})+S_{12}S_{21}}$	$\frac{\Delta^z}{z_{22}}$ $\frac{z_{12}}{z_{22}}$ $\frac{-z_{21}}{z_{22}}$ $\frac{1}{z_{22}}$	$\frac{1}{y_{11}}$ $\frac{-y_{12}}{y_{11}}$ $\frac{y_{21}}{y_{11}}$ $\frac{\Delta^y}{y_{11}}$	$\begin{bmatrix} V_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} h_{11} & h_{12} \\ h_{21} & h_{22} \end{bmatrix} \begin{bmatrix} I_1 \\ V_2 \end{bmatrix}$	$\frac{B}{D}$ $\frac{\Delta^{ABCD}}{D}$ $\frac{-1}{D}$ $\frac{C}{D}$
A B C D	$A = \frac{(1+S_{11})(1-S_{22})+S_{12}S_{21}}{2S_{21}}$ $B = \frac{(1+S_{11})(1+S_{22})-S_{12}S_{21}}{2S_{21}}$ $C = \frac{(1-S_{11})(1-S_{22})-S_{12}S_{21}}{2S_{21}}$ $D = \frac{(1-S_{11})(1+S_{22})+S_{12}S_{21}}{2S_{21}}$	$\frac{z_{11}}{z_{21}}$ $\frac{\Delta^z}{z_{21}}$ $\frac{1}{z_{21}}$ $\frac{z_{22}}{z_{21}}$	$\frac{-y_{22}}{y_{21}}$ $\frac{-1}{y_{21}}$ $\frac{-\Delta^y}{y_{21}}$ $\frac{-y_{11}}{y_{21}}$	$\frac{-\Delta^h}{h_{21}}$ $\frac{-h_{11}}{h_{21}}$ $\frac{-h_{22}}{h_{21}}$ $\frac{-1}{h_{21}}$	$\begin{bmatrix} V_1 \\ I_1 \end{bmatrix} = \begin{bmatrix} A & B \\ C & D \end{bmatrix} \begin{bmatrix} V_2 \\ -I_2 \end{bmatrix}$

[5], Dimana nilai $\Delta^k = k_{11}k_{22} - k_{12}k_{21}$

LAMPIRAN B

Nilai S-Parameter dari transistor *microwave* dengan *range* frekuensi 1GHz sampai 12 GHz

[3], Niedert and Willing

Frequency (GHz)	$\|S_{11}\|\angle\theta^\circ$	$\|S_{21}\|\angle\theta^\circ$	$\|S_{12}\|\angle\theta^\circ$	$\|S_{22}\|\angle\theta^\circ$
1.0	0.970∠-46	3.232∠144	0.030∠61	0.784∠-16
2.0	0.886∠-85	2.618∠113	0.045∠35	0.728∠-31
3.0	0.874∠-113	2.379∠90	0.057∠18	0.709∠-38
4.0	0.821∠-155	1.988∠59	0.069∠-3	0.681∠-51
5.0	0.821∠-177	1.567∠36	0.064∠-22	0.615∠-77
6.0	0.815∠172	1.383∠18	0.064∠-28	0.694∠-88
7.0	0.812∠133	1.348∠-8	0.075∠-44	0.750∠-92
8.0	0.845∠111	1.049∠-27	0.063∠-70	0.544∠-121
9.0	0.894∠113	0.899∠-53	0.055∠-81	0.694∠-154
10.0	0.734∠106	0.752∠-67	0.059∠-92	0.784∠-162
11.0	0.810∠59	0.850∠-91	0.062∠-113	0.594∠-169
12.0	0.851∠45	0.653∠-127	0.058∠-139	0.707∠146
1.0	0.968∠-42	3.423∠145	0.029∠62	0.715∠-17
2.0	0.916∠-84	3.004∠112	0.048∠34	0.662∠-38
3.0	0.858∠-114	2.389∠85	0.055∠9	0.627∠-57
4.0	0.845∠-133	1.954∠64	0.060∠-10	0.631∠-70
5.0	0.786∠-153	1.721∠47	0.057∠-34	0.649∠-74
6.0	0.770∠-177	1.647∠28	0.046∠-51	0.662∠-76
7.0	0.835∠151	1.402∠6	0.055∠-51	0.627∠-91
8.0	0.792∠130	1.396∠-19	0.073∠-69	0.465∠-122
9.0	0.774∠113	1.217∠-46	0.079∠-87	0.501∠-155
10.0	0.722∠96	0.961∠-73	0.085∠-105	0.673∠-173
11.0	0.652∠82	0.673∠-86	0.074∠-118	0.746∠-178
12.0	0.635∠77	0.560∠-91	0.064∠-119	0.739∠-177

LAMPIRAN C

Test Set S-Parameter

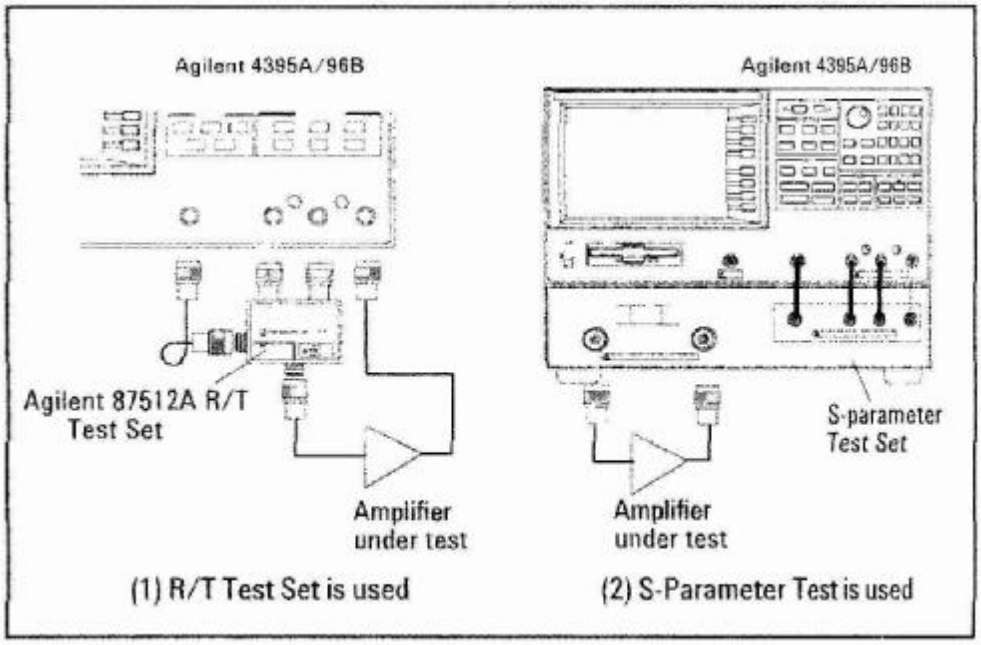

Figure 3. Measurement Configuration for Amplifier Network Analysis.

LAMPIRAN D

Smith Chart