$$b_1 = S_{11}a_1 + S_{12}a_2$$

$$b_2 = S_{21}a_1 + S_{22}a_2$$

$$b_L = \Gamma_L a_L \implies a_2 = \Gamma_L b_2$$

$$a_S = V_S + \Gamma_L b_S$$

$$V_S = a_1 - \Gamma_L b_1 \quad - \quad \textcircled{1}$$

$$b_1 = S_{11}a_1 + S_{12}\Gamma_L b_2 \quad - \quad \textcircled{2}$$

$$b_2 = S_{21}a_1 + S_{22}\Gamma_L b_2$$

$$a_1 = \frac{(1 - S_{22}\Gamma_L)b_2}{S_{21}} \quad \textcircled{3}$$

$\textcircled{1}$ and $\textcircled{2}$

$$V_S = a_1 - \Gamma_S \left[S_{11}a_1 + S_{12}\Gamma_L b_2 \right]$$

$$V_S = a_1 \left[1 - \Gamma_S S_{11} \right] - S_{12}\Gamma_L \Gamma_S b_2$$

Subst ③

$$V_S = \frac{[1 - \Gamma_S S_{11}][1 - \Gamma_L S_{22}] b_2}{S_{21}}$$

$$- S_{12} \Gamma_L \Gamma_S b_2$$

$$\frac{b_2}{V_S} = \frac{S_{21}}{(1 - S_{11}\Gamma_L)(1 - S_{22}\Gamma_S) - S_{12} S_{21} \Gamma_L \Gamma_S}$$