准确 计算 $t_{b\mu}$ 需用到 VNA

$$S=\begin{pmatrix} r_{\mu\mu} & t_{b\mu} \\ t_{b\mu} & r_{bb} \end{pmatrix}$$

$|t_{b\mu}|^2 = |S_{21}|^2$

$|t_{b\mu}|^2 = k_{eff}^2 \times$ 喇叭 Loss

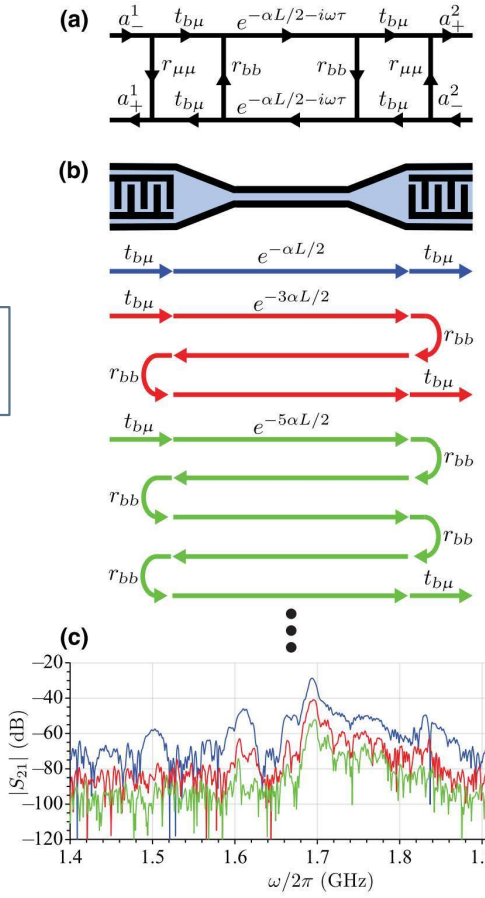
$$S=\begin{pmatrix} r_{\mu\mu} & t_{b\mu} \\ t_{b\mu} & r_{bb} \end{pmatrix}$$

$|t_{b\mu}|^2 = (1-|S_{11}|^2)(1-\text{Loss})$

$|t_{b\mu}|^2 < 1-|S_{11}|^2$

$$S=\begin{pmatrix} r_{\mu\mu} & t_{b\mu} \\ t_{b\mu} & r_{bb} \end{pmatrix}$$ — $|t_{b\mu}|^2 < 1-|S_{22}|^2$

$$S=\begin{pmatrix} r_{\mu\mu} & t_{b\mu} \\ t_{b\mu} & r_{bb} \end{pmatrix}$$ — $|t_{b\mu}|^2 < 1-|S_{11}|^2/2-|S_{22}|^2/2$



$$S=\begin{pmatrix} r_{\mu\mu} & t_{b\mu} \\ t_{b\mu} & r_{bb} \end{pmatrix}$$

$$S_{wg}=\begin{pmatrix} e^{-\alpha L/2-i\omega\tau} & 0 \\ 0 & e^{-\alpha L/2-i\omega\tau} \end{pmatrix}$$

2n 次 声波反射
2n+1 次 单程损耗

$$S_{11}=r_{\mu\mu}+\frac{t_{b\mu}^2 r_{bb} e^{-\alpha L-2i\omega\tau}}{1-r_{bb}^2 e^{-\alpha L-2i\omega\tau}}$$

$$S_{21}=\frac{t_{b\mu}^2 e^{-\alpha L/2-i\omega\tau}}{1-r_{bb}^2 e^{-\alpha L-2i\omega\tau}}$$