**IMPEDANCE MATCHING USING SINGLE STUB TUNERS**

The load impedance $Z_L$ can be matched to the characteristic impedance of the transmission line $Z_O$ using either a specified length of single short or open circuit stub placed a specified distance from the load. A short circuit single stub tunner is shown in the Figure 1.

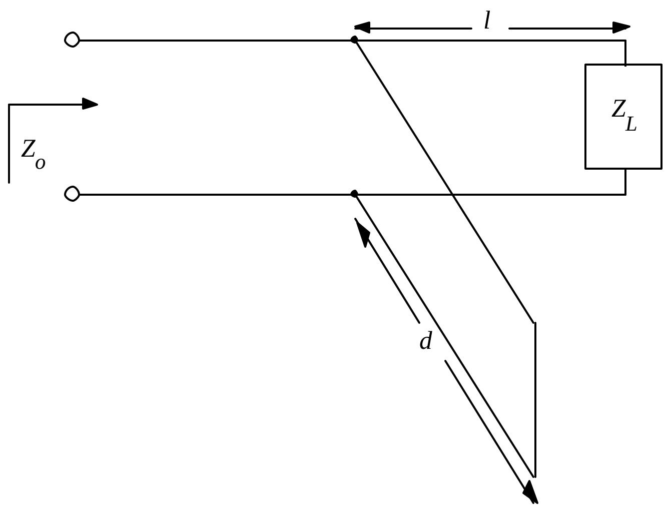


Figure 1. Short Circuit Single Stub Tuner

The Smith Chart is used to determine the lengths *l* and *d*. Figure 2(a) shows short circuit single stub matching design. The load impedance is normalized relative to such that $Z_{Ln} = Z_L / Z_O$ and plotted on the chart. The Smith Chart is used to add impedances or admittances. Since the stub is parallel to the load, $Z_{Ln}$ is converted to a normalized load admittance by reflecting the point through the normalized $Z_O$ at the center of the chart about a constant SWR circuit to the point $P_1$. The distance *l* between the load and the stub is determined by moving f from $P_1$ via a constant SWR circle to $P_2$ clockwise toward the generator until the circle $C_1$ intersects the unity conductance circle at $P_2$ . The distance traveled from $P_1$ to $P_2$ via constant SWR circuit $C_1$ in fractions of $\lambda$ is the length *l* from the load to the stub. At $P_2$ , the real part of the load is matched to $Z_O$ . To cancel out the reactive component at $P_2$ , a constant conductance arc is drawn from $P_2$ to the normalized $Z_O$ at the center of the chart. Note that traveling this arc corresponds to a movement in reactance of $-X_{P2}$ . For a short circuit stub, the stub length *d* is determined by the clockwise distance toward the generator in $\lambda$ from the right of the chart (indicating a short circuit conductance $= \infty$) to $-X_{P2}$ .

A similar design is used for an open circuit stub shown in Figure 2(b), except that the stub length *d* is determined by the clockwise distance toward the generator in $\lambda$ relative to left hand side of the chart corresponding to zero conductance.

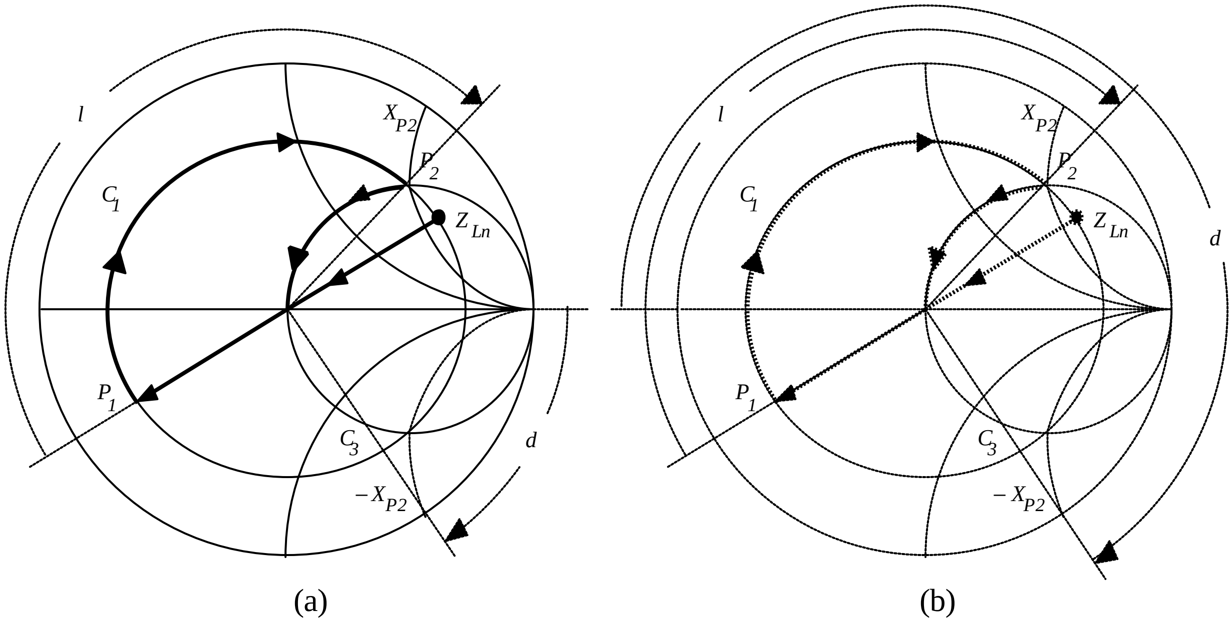


Figure 2. (a) Short and (b) Open Circuit Single Stub Tuner

Figure 3 shows an alternate length *l* that can be found for open circuit single stub tuner. In this case, the constant SWR arc of $C_1$ is extended to the lower half of the chart to intersect with the constant conductance circle. The lengths *l* and *d* are found as before, with both lengths being longer that the example in Figure 2(a).

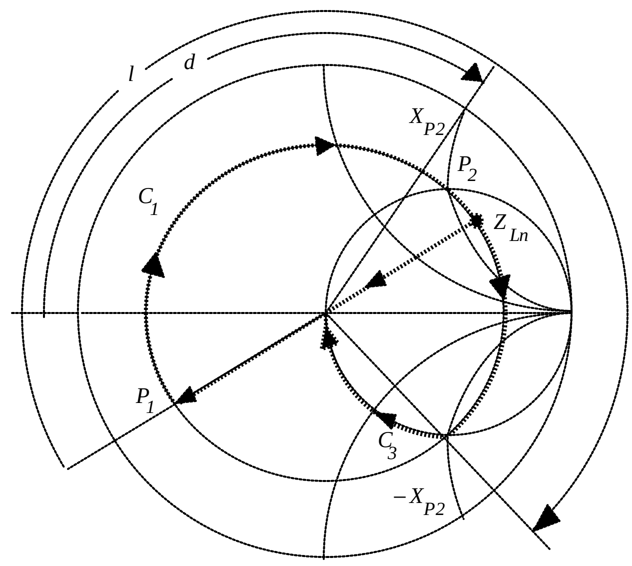


Figure 3. Alternate Open Circuit Single Stub Tuner