APPENDICES
DETERRMINATION OF EFFECTIVE PIN LENGTH

From the transmission line theory reflection coefficient can be defined (equation 2.1.24),
Under limit \( \omega \to 0 \),

\[
\rho_{\omega} = \varepsilon - 1 = \frac{C}{i \omega d} \frac{P(\omega)}{q(\omega)}
\]

\[
= \frac{C}{i \omega d} \frac{\int_{\omega}^{\infty} p(t) \exp(i \omega t) \, dt}{1/\omega \int_{0}^{\omega} dq/dt \exp(i \omega t) \, dt}
\]

\[
= \frac{C}{d} \left( \frac{\text{area}_{p}}{q_{\omega} - q_{0}} \right)
\]

where \( \text{area}_{p} \) is a area under the \( p(t) \) curve, \( q_{\omega} \) and \( q_{0} \) are the values of \( q(t) \) at \( t = \omega \) and \( t = 0 \), respectively. These values can be determined experimentally by \( p(t) \) and \( q(t) \) curve as shown in figure (A.1).

The slope corresponding to plot of \( \text{area}_{p} / (q_{\omega} - q_{0}) \) vs. \( (\varepsilon - 1) \) [figure(A.1)], gives the value of \( c/d \). This determines the value of effective pin length 'd'.
Fig. A.1: Determination of "effective pin length" from p(t) and q(t) curve.

\[ \frac{p_{\text{area}}}{q_{\infty} - q_0} \]

\[ c/d \]

\[ \xi - \lambda \]

\[ d = \text{effective pin length} \]

\[ c = 3 \times 10^{-4} \text{ mm/sec} \]
Some liquids with known static dielectric constant $\varepsilon_0$ have to be used to determine effective pin length, which is greater than the actual pin length. In our experiment methanol, chlorobenzene, 1,2-dichloroethane and acetone were used as standard liquids for determination of effective pin length "d".