



designing a wideband antenna which has the bandwidth wider than 300Mhz. Wider bandwidth usually means that the antenna has more tolerance for Dielectric Constants varying, board by board and batch by batch.

## 2. Hands

For handheld devices, the human hand is another factor which may affect the RF performance. As similar as the plastic casing, the human hand can also cause the resonant frequency shifts to a lower frequency, but the situation here is slightly different than the plastic. The plastic structure can be modeled accurately, but the human hands cannot. We even could not assume how the product be held by human hand. The only possible solution I have is designing a wideband antenna which has more higher frequency bandwidth. More details can be found in Part IV.

## 3. PCB

Understanding the PCB's Dielectric Constant is the foundation stone for the successful high frequency design. However, the Dielectric Constant of PCB is a complex topic as you can easily find thousands research papers on this topic, but the Dielectric Constant control for the high frequency design especially the RF design is still considered as "black magic" of engineering in industry. I think this happens due to many factors affecting the PCB's Dielectric Constant.

The factors may affect PCB's Dielectric Constant:

- a. The Dielectric Constant can be dependent on the substrate thickness, the testing frequency, the operation temperature, the type of copper used and the microwave structure.
- b. Two different microwave circuits using the exact same material will experience two different Dielectric Constant due to how the