

A Performance Comparison of Recent GSM Handsets

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The first part, as presented as a poster session in IEEE APS2005, is a brief history of internal antennas in mobile phones, covering almost 40 GSM handsets, ranging from the first Hagenuk handset to the latest Nokia, Sony-Ericsson, Motorola, and Samsung handsets. In this presentation, we examine an addition 20 handsets and measure the antenna performance parameters of each handset (S-parameters, antenna 3D radiation, and antenna efficiency).

We examined different form factors--clamshell and candybar--as well as different antenna types and placements. As our survey demonstrates, there are several types of internal antennas currently used in mobile phones: 1. PIFA (planar inverted-F antennas), 2. Ungrounded internal antennas, 3. Semi-smart antennas, 4. Stacked antennas, 5. Grounded parasitics, etc. Single band and multi-band antennas were analyzed, including phones with separate antennas for separate frequencies. For handsets with separate antennas, we measured the S21 coupling between two antennas and examined its effect on the antenna efficiency. Most of the phones (95%) in this study use a passive antenna with an optional matching circuit comprised of 2 to 4 components. This study also analyzes and measures the performance of two examples of active antennas for GSM handsets on the market. One example uses a switches matching circuit and the second example uses a switched ground.

We calculate the effective antenna volume for every antenna and determine the average volume/space required for each antenna type and performance requirements. We conclude with an in-depth discussion of the different antenna parameters as a function of the handset performance. Some of the handsets are further simulated using CST Microwave studio and HFSS to examine current and electric field distributions.