

Tutorial Session 4

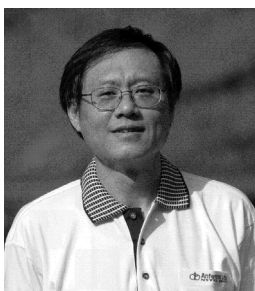
Small Antennas for Multiband Wireless Communication Devices

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Abstract

Small antennas including using the printed (monopole, PIFA, loop, slot) antennas, patch antennas, chip antennas, and the like for applications in the wireless communication devices are introduced. They are generally flat in appearance and have a low profile. They are very suitable for the LTE700/2300/2500, WWAN (850/900/ 1800/1900/2050 MHz bands), WLAN (2.4/5.2/5.8 GHz bands), WiMAX (2.5/3.5/5.5 GHz bands), UWB (3.1~10.6 GHz band) operation. Many promising small multiband antennas have found applications as internal antennas in the wireless devices including the mobile phones and laptop computers. These antennas have the attractive features of small size and wideband operation. The techniques for achieving smaller size yet wider bandwidth for the antenna are addressed in this tutorial. The topics include:

- (1) **WWAN handset/laptop antennas**, including using the printed monopole ($\lambda/4$ and $\lambda/8$ mode excitation), PIFA ($\lambda/4$ and $\lambda/8$ mode excitation), loop (1λ , $\lambda/2$ and $\lambda/4$ mode excitation) and slot ($\lambda/2$ and $\lambda/4$ mode excitation) antennas. These small-size yet wideband antennas are suitable to be directly printed on the system circuit board of the mobile device, very promising for applications in the slim mobile device. The SAR and HAC results of some promising internal handset antennas are discussed.
- (2) **WLAN/WiMAX antennas**, including dual-band and/or diversity operation for mobile devices; promising antennas with broadband CP (broadside and omnidirectional) radiation, high-gain omnidirectional radiation and diversity operation for access points are presented;
- (3) **UWB antennas for mobile devices and access points**, including the design techniques for impedance matching, improved omnidirectionality, pattern stability, polarization purity and band-notching over the ultra-wide band.



Kin-Lu Wong is with the Electrical Engineering Department, National Sun Yat-sen University (NSYSU), Kaohsiung, Taiwan. Dr. Wong has published more than 450 refereed journal papers and 230 conference articles and has personally supervised 47 graduated PhDs. He also holds over 100 patents, including the U.S., Taiwan, China and European patents, and has many patents pending. He is the author of *Design of Nonplanar Microstrip Antennas and Transmission Lines* (New York: Wiley, 1999), *Compact and Broadband Microstrip Antennas* (New York: Wiley, 2002), and *Planar Antennas for Wireless Communications* (New York: Wiley, 2003). Dr. Wong is an IEEE Fellow and Sun Yat-sen Chair Professor of NSYSU.