Preface

We have been fortunate to witness and be part of the advances in communications technology over the last two decades. In particular, mobile communications which have drastically changed the lifestyles of people through the widespread use of wireless personal terminals for both voice and data services. Connecting people anytime and anywhere has become a reality, be it talking to friends on a mobile phone while on a train, or chatting with a stranger at an internet café. As antenna engineers, we are able to contribute to this wireless revolution by designing high performance antennas for fixed base-stations and mobile portable terminals. The demands placed on mobile communication systems have increased remarkably, so antenna designers face many challenges: small or tiny size, low- or ultra-low-profile features, wide- or ultra-wide operating bandwidth, multiple functions, pure polarization, low cost, etc. As a result, antenna research and development has become a hot topic in both academia and industry, as demonstrated by the increasing number of publications and start-up companies.

One of the authors (Zhi Ning Chen) started his research into antennas for mobile communication systems at the Centre for Wireless Communication, Singapore, in 1999, with particular emphasis on broadband technology. Planar structures were selected as the broadband solution because of their lower profile, broader bandwidth, more design degrees, and ease of manufacture by virtue of the simpler geometry. They include antennas with planar radiators such as microstrip antennas, suspended plate antennas, planar inverted L/F antennas, and planar monopole antennas. Applications have covered cellular phone systems, global positioning systems, wireless local area networks, vehicle mobile communication systems, and ultra-wideband-based wireless personal area networks. The aim in writing this book was to introduce readers systematically to the latest progress in planar broadband antennas with the review of conventional bandwidth techniques, information on which is scattered in countless journals, conference proceedings and books. All the results shown in this book have been verified by experiment or simulation or both. This book will therefore be an invaluable design aid for all 'ants' (antenna researchers, engineers and students).

Broadband Planar Antennas is organized into five chapters. Chapter 1 introduces the concepts, with a brief look at the radiation characteristics of planar radiators with different heights. Roughly, planar radiators can be categorized into (a) microstrip patch antennas with very thin dielectric substrates, (b) suspended plate antennas with thick and low-permittivity
dielectric substrates, (c) planar monopole antennas, a variation of the thin-wire monopole, and (d) inverted-L/F antennas, situated between suspended plate antennas and planar monopole antennas.

Chapter 2 reviews techniques to broaden the bandwidth of a microstrip patch antenna. The methods include lowering the $Q$, using a matching network, and introducing multiple resonances.

Chapter 3 covers three aspects of suspended plate antennas (SPAs). First, broadband techniques based on the concept of low antenna $Q$ are considered. With the various techniques, impedance bandwidths of the SPAs reach up to 60%. Second, there is a discussion of techniques to enhance the radiation performance of broadband SPAs. Balanced excitation and symmetrical configurations are considered as the basic ideas to improve radiation performance. The final section of Chapter 3 describes design techniques for SAP arrays. The design goal is to suppress mutual couplings and reduce the lateral size of the broadband arrays with suspended elements.

Chapter 4 looks at techniques for broadening the impedance bandwidth of planar inverted-L/F antennas (PIFAs), especially when used in portable devices such as handphones, PDAs and laptops. In particular, planar inverted-F antennas with a small system ground plane in handphones are described.

Chapter 5 covers broadband planar monopole antennas, and explores their application in emerging ultra-wideband (UWB) systems.

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