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Editorial

Advances in Low-Profile Antennas in Wireless Communications

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Antenna is a type of device that is adapted to transmit or receive electromagnetic energy. Numerous differing types of antenna structures have been developed, such as reflector antenna, helical antenna, notch antenna, cavity backed antenna, patch antenna, and line antenna. With rapid development of wireless communications, low-profile antenna is in great demand, especially in handheld radios, wireless USB, wireless sensors networks, high speed WPAN, and mobile devices. For the attractive characteristics such as light weight, good conformability, easy integration, and low cost fabrication, low-profile antennas have been extensively studied by researchers both in academia and industry. ISI indexed papers whose titles include the words "low-profile" and "antenna" in the past decades have been counted. From the results shown in Figure 1 it can be found that the research topic on low-profile antenna has become more and more popular.

One low-profile antenna is the patch antenna, which is usually elevated above a large metal plate. Dielectric substrate is used to support the elevated portion of the antenna above the large metal ground plate. The most popular type of patch antenna is microstrip patch antenna, which is manufactured by printed circuit board materials and process. The spacing between the top patch and the bottom metal ground plane is on the order of 1/15 wavelength and a low physical depth profile can be easily achieved. Main problems of patch antenna include a relatively narrow bandwidth, a high radiation angle above the horizon, and various manufacturing and fabrication difficulties. Its bandwidth can be increased by adding radiating surfaces and increasing the volume of the antenna, adding an impedance compensating network, placing selected impedance into the radiating surface, and introducing resistances into the radiating surface, thus lowering the Q of the antenna. Its radiation angle can be lowered by using a dielectric structure.

As a low-profile antenna, dipole antenna is also widely used in wireless communication for its vertically polarized radiation performance. The arm length of a dipole is about a half wavelength, which is too long for applications when it operates at a low frequency. Small size antennas such as planar inverted F antenna (PIFA), loop antenna, and table antenna have been presented. The PIFA is a variation of the patch antenna, whose one end of a radiating element disposed on a ground plane is bent so as to be connected to the ground plate. Its edge feeding structure is not easy to flush mounting. It also needs a grounded tuning wire separated from the metal sheet of the radiator. It also suffers from limitations of a narrow bandwidth and a high elevation radiation. A simple loop antenna is constructed by protruding the inner conductor of a coaxial line from one point of the ground plane and its end connects with the ground plane at the other point. A low-profile loop antenna is hard to match for its high capacitive impedance and low radiation resistance. A table antenna constructed by a radiating plate supported by four conductor posts was disposed on the ground plane. A coaxial feed is connected to the central part of the radiating

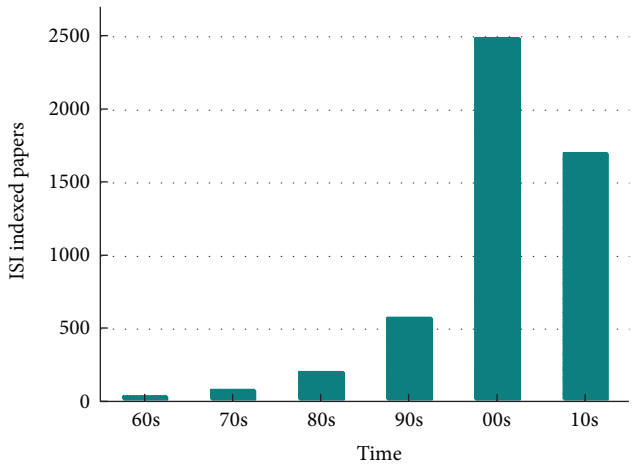

Figure 1: ISI indexed papers in the past decades.

element and a broad bandwidth can be achieved. If its height is reduced to get low-profile, the size of its radiating plate must be increased.

In modern wireless communication system, the design considerations of antenna include not only low-profile, high radiation performance, but also compactness, low cost, and easy integration. Recently antennas integrated on board, in package, and on chip have been extensively studied. This special issue presents novel antenna designs, antenna miniaturization and optimization techniques, antenna performance improvement techniques, feeding mechanisms and antenna arrays, and antenna applications.

We hope that through this special issue, the readers will find not only new designs about different low-profile antennas but also their valuable applications.

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