



TECHNOLOGY

Low Profile F-Inverted Compact Antenna (FICA)

OVERVIEW

The antenna size is one of the major limitations in miniaturizing wireless communication equipment. Chip antennas and planar inverted F antennas (PIFAs) have already appeared on the market due to their low profile, small size and effective integration with transceiver chips on circuit boards. However these antennas perform well only if a ground plane of proper size is provided. This is because the ground plane acts as an effective radiating structure at the desired communication frequency. Generally one or more sides of the ground plane must be about $\lambda/4$ long. At 900 MHz, this length is 83 mm. Although it is acceptable for cell phone technology application, this size is impractical in low power wireless sensor networks (WSN), where the maximum size of the communication node is limited to 1cm to 3 cm. This is especially true for low frequency (433 MHz) applications, where the wave length (70 cm) is large. In addition, in order to maximize the battery life, the total power consumption of a communication module is about 1mW. It is essential that the antenna be very efficient if the power available is limited. Fortunately, in contrast to cell phone systems, WSN technology requires only a few meters of communication range.

Researchers at the University of Maryland have aimed at designing an electrically small antenna by carefully balancing the trade offs in terms of communication distance, stringent geometrical size limitations, bandwidth, and antenna efficiency. A prototype dielectric loaded FICA has been built and measured through the communication range of custom-integrated application-specific WSN elements at 916 MHz. The design is low profile, small volume and is suitable for WSN. The results indicate a promising potential for the effective use of the novel FICA in WSN where 3-dimensional integration and size reduction are vital requirements.

In some wireless sensor network systems, such as smartdust systems, the size of these sensors should not be noticeable. Ideally, these sensors should be as small as sand or dust. Therefore antennas with a large plane ground cannot be applied in these devices. The F-Inverted Compact Antenna (FICA) proposed by the inventors, successfully reduces the required ground plane size from a quarter wavelength to a few percent of the wavelength. The gain of the antenna has been measured and it is 5 dB less than a half wave dipole in the free space.

The mass production cost of the antenna is negligible compared to the CMOS circuits' part of the wireless sensor node. A large profit margin and market for these electrically small antennas is expected.

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Additional Information

INSTITUTION

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PATENT STATUS

Patent(s) pending

LICENSE STATUS

Contact OTC for licensing information

CATEGORIES

- Sensors/Monitors
- Microelectronics
- Power Electronics
- Devices

EXTERNAL RESOURCES

- [US Patent 8,040,291](#)

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