Pillar chip antennas

Ground clearance and PCB dimensions are no longer a concern

Unictron, the manufacturer and the designer of world-class miniature antennas, introduced a new product called pillar antenna. Pillar antennas are patented SMD type chip antennas that don't require ground clearance area and their performance is independent of the dimensions of the ground plane of circuit board.

Small wearable devices normally have challenging installation environment for the antenna designers to design a satisfactory antenna. Miniature antenna on small PCB size may often result in rather poor performance, like occasional lags when listening to music, or problems in connecting to a Wi-Fi network. Furthermore, standard antennas made from FPC, or monopole chip antennas, show large shift of frequency when the device is worn on a human body. Such shift of the frequency, caused by the change of installation environment, may make antenna lose its signal receiving capability.

In general, there are two approaches to minimize the frequency shift of antennas and make wearable devices achieve higher RF connection capability:

1. Use loop-type antennas whose near field reactance is dominated by magnetic field,
   such as Unictron's TELA antennas; or

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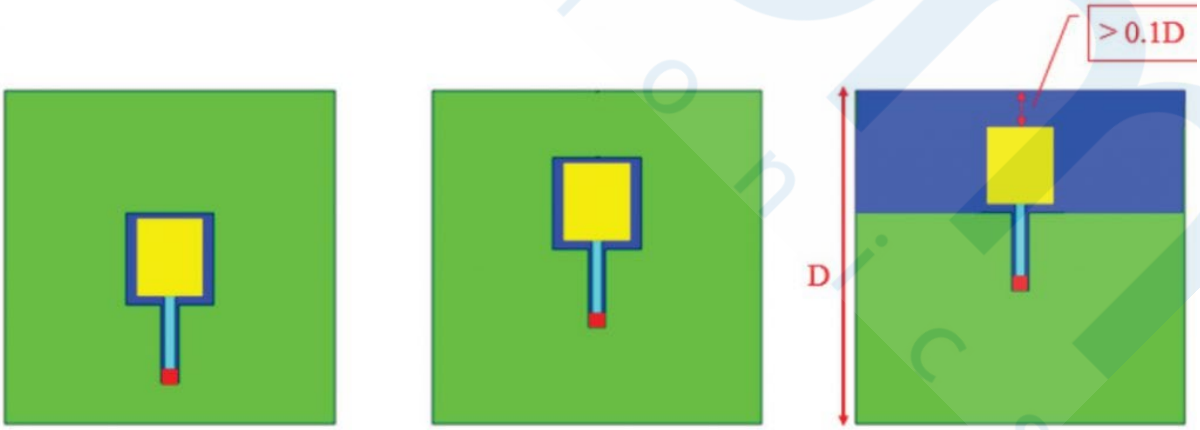
2. Use PILLAR antennas that are vertically polarized and don't require ground clearance and antenna performance is not as sensitive to surrounding environment.

From the viewpoint of antenna design, a ground plane on printed circuit board (PCB) not only behaves as a metal layer to reflect RF wave but also allows antenna to induce image current on the ground plane which may degenerate the performance of the antenna. That is why in designing an antenna, no metal layers are allowed above or below antenna, which is so called the ground clearance (area without metal). However, a ground plane can minimize the influence of human body on the impedance of the antenna, therefore minimize or eliminate the frequency shift and therefore can avoid deterioration of antenna performance.

It is always a challenge for an antenna designer of wearable devices to design an antenna with ground plane underneath the antenna to minimize the influence of human body and in the meantime also avoid the negative impact of image current which may be induced on ground plane. Unictron's antenna developing team has being devoted to resolve this challenge and come out with a patented chip antenna called Pillar Antenna. Unictron's first pillar antenna bares a model name CW337. This high performance chip antenna works at 2.4GHz ISM band to support all miniature portable devices, such as: ear phone, for Bluetooth and Wi-Fi connections. Unictron's CW337 pillar chip antennas offer the best from both worlds: a miniature chip antenna on ground plane for wearable devices with little negative impact of image current and frequency shift.

The pictures below show several versions of installation locations of CW337 on a circuit board. Green color represents the metal layer while the blue color represents the area without metal layer. The yellow area is the metal pad for antenna installation. Some no metal area around installation site of antenna is needed on the top metal layer to separate the antenna from ground plane.



Placement A Placement B Placement C

Please note that the above pictures represent a top view of the PCB. When implementing CW337, it is always recommended to have a full metal layer on the bottom side of the PCB to reduce the influence of human body on antenna performance.

Antenna installation

Since there is no need for ground clearance, CW337 can be installed virtually anywhere on the PCB. However, as shown in placement C, when installing CW337 at the edge of circuit board, in order to achieve better performance, it is preferred to keep CW337 away from the edge with a distance of at least 10% of the width of the PCB. When placing CW337 close to the center of the PCB, vertical polarization will be predominant. While moving the pillar antenna from the center to the edge of the PCB, more and more horizontal polarization will be obtained.
The pillar antennas installed at placement C from the above picture provide a mixture of horizontal and vertical polarization and enable the antenna to receive signal from all direction with various polarization. Such unique characteristics is desired for applications such as high performance true wireless stereo (TWS) earphones*.

Typical applications

The ever popular TWS earphones often suffered low performance and frequency shift of antennas caused by user's unique shape of the ear, impedance variations of the skin (e.g. dry skin versus oily skin) or indefinite direction of signal source. These difficulties are now worries of the past with the introduction of Unictron's CW337 chip antenna!
Compared to regular monopole chip antenna, CW337 provides longer working distance as well as good quality of signal reception from all directions. User of TWS earphones can enjoy continuous stream of music no matter which direction of the connected smartphone even during extensive exercise and jogging.
* True wireless stereo earphone (or ear buds) refer to earphones that have no cable connecting left and right part. Conventional wireless earphones have a cable connecting left and right ear buds, and may have the antenna hidden inside the volume control module that is part of the cable.