4G/5G Multiple Antennas for Future Multi-Mode

Smartphone Applications

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**4G/5G MULTIPLE ANTENNA FOR FUTURE MULTIMODE SMARTPHONE APPLICATION**

With the plethora of radio and wireless technologies, for communication, the network has become a mixture of different kinds of heterogeneous networks.As a result of which, the development and exploitation of multi-mode mobile terminals has aroused. Due to the limited volume size of mobile terminal devices (such as mobile handset) and miniaturized structure, strong mutual coupling among antenna elements is inevitable, which results in affecting the antenna efﬁciency and also inﬂuences the correlation. Therefore, it is vital to apply decoupling technique between antenna elements for MIMO system.

We have proposed a hybrid antenna comprising of 4G and 5G antenna array for the 4G/5G multiple input multiple output applications. The 4G antenna module comprises of two-antenna array capable of covering the GSM850/900/1800/190 0, UMTS2100, and LTE2300/2500 operating bands, whereas the 5G antenna module is an eight-antenna array that operates in the 3.5-GHz band capable of covering the *C*-band (3400\_3600 MHz), which could meet the demand of future 5G application. We analyzed the experimental results such as S-parameter, antenna efficiency and radiation pattern.

In this project, an antenna design for 4G applications has been developed with a combination of protruded ground and NL techniques. They are applied into this antenna, so that the enhanced isolation can be achieved along with reverse coupling can be excited in order to reduce the mutual coupling between antenna elements that are within very close proximity for this 4G antenna module.

**Designing**:

A substrate of 0.8mm thickness and of FR4 material along with relative permittivity 4.4 is used. The dimension of the system circuit board is 140mmx70mm, in which a 130 mm\_70 mm is ground plane. A 9.5 mm\_12 mm protruded ground plane is connected to the system ground for the purpose of decoupling and impedance matching. The two 4G antennas (Ant1 and Ant2) are placed at the bottom edge of the system ground plane and are separated by a

protruded ground, while the eight 5G antennas are printed along two long side edges.

**4G ANTENNA MODULE**

The 4G antenna module proposed design a version of antenna array that

covers WWAN/LTE operation bands. Each 4G antenna is comprises of a feeding strip fed by a 50ohm mini coaxial feeding line (with point A1 and A2 serving as the feeding point) and a bended shorting strip embedded with a 6.8 nH chip inductor (with point B1 and B2 serving as shorting point). A protruded ground plane is provided for the decoupling effects in the upper bands and for the improvement of the impedance matching in the lower bands. Thus, a neutralization line (NL) is being loaded between the two 4G antenna elements, so that the decoupling effects in the lower bands can be improved.

**5G ANTENNA MODULE**

The 5G antenna module is formed by eight identical antennas (Ant3 to Ant10). Eight rectangular clearance regions of 16 mm \_ 3 mm are reserved for accommodating the proposed 5G antennas. The adjacent two antennas are located on the same side edge has a spacing of 17 mm, and all the 5G antennas are arranged to have their open-end pointing toward the same direction.

The feeding strip and shorting strip can excite a fundamental resonant mode at 950MHz and 850MHz, Forming a combined dual response.

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