DEVELOPMENT OF SMART PLASMA ANTENNA BY USING FLUORESCENT TUBE FOR WIRELESS COMMUNICATION APPLICATION

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4. REPORT

4.1 PROPOSED EXECUTIVE SUMMARY

The industrial potential of plasma technology is well known and excellent demonstrated in several processes of microwave technology, which incorporate some use of an ionized medium. In vast majority of approaches, the plasma, or ionized volume, simply replaced a solid conductor. Highly ionized plasma is essentially a good conductor, and therefore plasma filaments can serve as transmission line elements for guiding waves, or antenna surfaces for radiation. Plasma antenna is a kind of antenna that radiate electromagnetic wave (EM) energy based on ionized gas instead of metallic conductor in antenna design. Differ from its metal or copper counterparts; the plasma requires an initial step which is plasma excitation for it to create electrical conductivity so that it can imitate the metallic materials. By having the conductivity, surface wave can propagate along plasma column so that it can be radiated. One of the most important advantages of plasma antenna over metallic antenna is that, plasma antenna can be turn off in microseconds [1]. Thus the plasma antenna exhibits stealth ability because it can be considered not exists in the eyes of radars.

This research will study the performance of plasma antenna using a single fluorescent tube and reviews the antenna performance as a transmitter and receiver. The main objective in this research is to design plasma antenna based on plasma medium by using commercially available fluorescent tube for wireless communication application. A typical fluorescent lamp consists of a glass tube with its inner surface coated with fluorescent powder. It is filled with mixture of argon gas and mercury vapour. When the gas inside the tube is energize by RF signal, the gas inside the tube will convert into plasma state and capable to transmit and receive radio signal with the help of coupling sleeve.

It is expected that this research will recommented a new models and novel design rules to construct a plasma based radiating element. Conventional metal antenna is made from metal element while this invention use plasma element as its source of material. Conventional antenna will only functioned to transmit and receive radio frequency but this invention can allow user to not only as transmitting and receiving radio frequency signal but as lighting devices as well. Moreover, this invention can also be effectively used in military operation.

4.2 ENHANCED EXECUTIVE SUMMARY

Plasma antenna is a general term that represents the use of ionized gas as a conducting medium instead of a metal to either transmit or reflect a signal to achieve radar [2-3], or stealth or communication purpose [4]. There are many ways to generate plasma medium as a conductor element such as UV laser irradiation, or by laser initiated pre-ionization or by simply using commercial fluorescent lamp as a plasma antenna. In this work the commercial fluorescent lamp was chosen because it was low cost to produce plasma element.

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As a comparison to the plasma antenna proposed in the literature review previously, the plasma antenna in this study was made from cylindrical shaped fluorescent lamp that functioned as a radiating element with target frequency at 2.4 GHz for Wi-Fi application. In this project using plasma antennas instead of metallic elements. When a plasma element is not energized (OFF), the tube will convert the plasma back to a normal gas state, which significantly reduced its radar cross section. Even when it is energized (ON), it is transparent to the transmission above the plasma frequency, which falls in the microwave region. Plasma elements can energize and de-energized in seconds which is can prevent from radar detection. So the possibility to switch on and off the plasma makes plasma antennas suitable for the production of time varying radar cross section elements. Conventional metal antennas are unable to hide from enemy radar even if turned off, since they are still conductors which reflect electromagnetic waves.

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