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NEAR-FIELD-FOCUSED MICROWAVE ANTENNAS AND NEAR-FIELD SHAPING OF SPECTRUM USING DIFFERENT ANTENNAS

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ABSTRACT

The huge development of the mobile phones have grown up rapidly in the last years, frequency bands have come up and the market is asking for smaller mobile phones with more services which give the user the ability to use the mobile phone with good signal performance and helps to use the mobile phone around the all world. On top of that it is important to reduce the risks affecting in the human body because of the antenna radiation. In the past the mobile phone was so heavy, big and had external antenna on the top of the phone which effect badly on the human head and most of the signal radiate is reflected and absorbed by the human head which lead to bad efficiency. Nowadays the internal antenna has been using instead of the external antenna the main reason of that is the internal antenna has a good relation with SAR rate, on the other hand the size of the phone became smaller. Recently there are many types of the internal antennas for example PIFA antenna (Planar Inverted- F Antenna), fractal antenna and monopole antenna. Those kinds of antennas can cover a single band, dual band, wideband and multiband based on the design of the antenna.

In 1997, Motorola produced a mobile device Motorola mr601 which was the first dual band GSM phone, it supported GSM900 and GSM1800 dual band and its antenna consists of two antennas helix antenna which has travelling wave in the shape of corkscrew with circularly polarized and whip antenna which can be consider as dipole antenna and it is Omni-directional radiation pattern. That's model phone offered the ability to access network in over 70 countries by the end 1997. In the first dual band PIFA operating at GSM900 and GSM1800, invented by Prof. Peter Hall in 1996 U.K, the first dual band PIFA a slot with a certain geometric dimensions, lead to support two different bands.

In 1999, Prof. Peter Hall comes back with the first Triple Band PIFA which operates at GSM800/1800/1900. He designed Triple Band PIFA with two slots in the ground plane of the PIFA antenna, that's let the antenna to transmit and receive different band of frequencies.

Cordless phones navigation systems and multichannel access systems have contributed dramatically to the development of antennas design, while the personalization of mobile terminals raised the needs of small antennas. Other needs for small antennas are hybrid systems, the handset of multiband GSM combined with DECT (Digital Enhanced Cordless Telecommunications) for example. The specifications of the handset small

antennas are low profile, compact and lightweight, which has led to modify and develop the antennas. One of the antennas is a modified PIFA, which has changed that it is difficult to recognize it as an original PIFA. The modified PIFA was first used in GSM handsets and has become more common in several different mobile terminals. Other modified antennas such as monopole were used in PDC (Personal Digital Cellular) with a normal mode helical antenna.

Printed antenna has been used in mobile terminals; also Printed antennas have the smallest dimensions comparing with other installed small antennas. Chip antennas or a printed antenna consists of dielectric material and a ground plane which is a part of the antenna. Chip antennas offer a high gain, appropriate radiation pattern, and high efficiency.

Radiation pattern can be described by power radiated through the antenna, which depends on the direction, and it can be represented as graphical or mathematical function of the radiation properties. There are two common types of antenna pattern , the first one is a power pattern and the second is field pattern , the first type is considering the power radiated and the position of the spherical coordinate and the second type which depend on the field if we have electrical field or magnetic field with the position of spherical coordinate.

One of the characteristics for any types of antennas is the direction of the electrical field vector of the electromagnetic wave. The polarizations of electromagnetic wave depend on the electrical field, which is perpendicular with the magnetic field.

II STATEMENT OF THE PROBLEM

The current study is done to analyze the near-field-focused microwave antennas and near-field shaping of spectrum using different antennas.

II DELIMITATIONS

1. The study was delimited to analyze the GSM antenna radiation pattern.
2. The study was also de-limited to GSM antenna radiation pattern.

III LIMITATION

The facts discussed in this study were based entirely on the responses to the questionnaire therefore, ascertaining the genuineness of the responses was identified as the limitation of the study.

IV HYPOTHESIS

On the basis of research finding, literature reviews, expert opinion and scholar's own understanding of the problem, it was hypothesized that the GSM antenna radiation pattern is efficient.

V DEFINITIONS AND EXPLANATION TERMS

Impedance

The impedance of the antenna mainly depends on the input voltage and current for the power losses equal to the power transmission of the antenna. The benefits of knowing the input impedance it is lead you that to choose the suitable transmission line.

Antenna gain

One of the antenna properties to describe the value of the power transmission to the peak radiation direction. The efficiency of the antenna always relate with the antenna gain so if the efficiency is perfect 100% that's mean the gain and the directivity are equal to each other.

VI SIGNIFICANCE OF THE STUDY

If the voltage standing wave has a small value that means the value of the power transmission will deliver to the antenna better but does not necessarily mean the power delivered sometimes also radiated. The value of the ideal VSWR is 1 and that's will happen if the voltage of the transmission wave matched in this situation we will not have a return losses on the other hand if the voltage in the transmission waves haven't matched with the antenna that's mean there is some losses.

VSWR is a measure of how much power is delivered by a voltage source to an antenna. Which means that's an antenna dose not radiate all the received power; there is always amount of reflection voltage due to mismatching network. Based on the VSWR concept we find that an antenna with VSWR less than 2 that's good enough to have a good impedance matching, on the other hand the transmission of more power to the radio can be lead to damage the radio.

VII OBJECTIVES OF THE STUDY

The objectives of the current research work are as follows:

1. To study the GSM antenna radiation pattern.
2. To study the near-field-focused microwave antennas and near-field shaping of spectrum using different antennas.
3. To study the significance of GSM antenna radiation pattern.

VIII REVIEW OF RELATED LITERATURE

Ahlfeld et al. (2012)[1] described that the directivity is the ability of an antenna to focus energy in a particular direction. The definition of the directivity according to IEEE Standard 145-1983: "Directivity (of an antenna) (in a given direction) is the ratio of the radiation intensity in a given direction from the antenna to the radiation intensity averaged over all directions".

Barlow et al. (2010)[2] described that the directive gain (according to IEEE Std 145-1983) is "the ratio of the radiation intensity, in a given direction to the radiation intensity that would be obtained if the power accepted by the antenna were radiated isotropically".

Mulligan et al. (2010)[3] described that the Gain is always less than directivity because efficiency is between 0 and 1. The directivity increases with increase in substrate thickness h and patch width W. Conversely the beamwidth is expected to decrease with increasing of h & W.

Mulvey et al. (2012)[4] described that the theory of maximum power transfer states that for the transfer of maximum power from a source with fixed internal impedance to the load, the impedance of the load must be the same of the source.

Peralta et al. (2011)[5] described that the for a microstrip patch antenna, efficiency can be defined as the power radiated from the microstrip element divided by the power received by the input to the element.

Becker et al. (2012)[6] described that the factors that affect the efficiency of the antenna and make it high or low are the dielectric loss, the conductor loss, the reflected power (Voltage Standing Wave Ratio VSWR), the crosspolarized loss, and power dissipated in any loads in the element.

Chang et al. (2012)[7] described that for a microstrip antenna, the electric field E within the patch is normal to the patch and the ground plane, and the magnetic field H is parallel to the strip edge.

Culver et al. (2010)[8] described that Polarization of a rectangular patch antenna for the dominant mode is linear and directed along the patch dimensions.

Dougherty et al. (2011)[9] described that the width W of the patch must be less than the wavelength in the dielectric substrate material so that higher – order modes will not be excited.

Duran et al. (2013)[10] described that as a part of the antenna, the ground plane should be infinite in size as for a monopole antenna but in reality this is not easy to apply besides a small size of ground plane is desired.

Fletcher et al. (2013)[11] described that length of ground plane should be at least one wavelength, it means as the length of the patch is equal or less than half wavelength.

Goldberg et al. (2009)[12] described that the repulsive force is between the like charges tends to push the charges from the bottom of the patch around the edge of the patch to the top of the patch, this will create the current density.

Gorelick et al. (2013)[13] described that when the microstrip antenna is connected to a microwave source, the charge distribution will be established on the upper and the lower planes of the antenna

Mehta et al. (2010)[14] described that the charge distribution is controlled by two mechanisms; attractive and repulsive. The attractive force is between the opposite charges on the patch and on the ground plane, it creates a current density inside the dielectric.

Agarwal et al. (2010)[15] described that the cavity model in analyzing the microstrip antennas is based on the assumption that the region between the microstrip patch and ground plane is a resonance cavity bounded by ceiling and floor of electric conductors and magnetic walls along the edge of the conductor.

Mehra et al. (2010)[16] described that working in high frequencies makes the microstrip line behave more homogeneous line as it is only one dielectric (one substrate under and above the transmission line), and the effective dielectric constant is closer to the actual dielectric constant.

IX PROCEDURE

Procedure & Statistical Analysis

This study will cover title of the study, significance of the study, aims and objectives of the study, research hypothesis and research design. This research has designed based upon descriptive study as it aims to identify and elaborate the objectives of work.

The research design contains the following steps:

- Literature review
- Theoretical and experimental analysis.

This study combines both primary and secondary research methods. Thus, gathering and analyzing the data will be done on the basis of existing research.

SPSS statistical package of data analysis will employ to analyze the quantitative data.