

Artificial Intelligence Based LTE MIMO Antenna for 5th Generation Mobile Networks

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Abstract: Artificial intelligence based long term evolution multi in multi output antenna supporting the fifth generation mobile networks is put forth in the paper. The mechanism laid out in paper is devised using the monopole-antenna integrated with the switchable pattern. The long term evolution based multiple input and multiple output antenna is equipped with four antennas and capable of providing a four concurrent data streams quadrupling the theoretical maximum speed of data transfer allowing the base station to convey four diverse signals through four diverse transmit antennas for a single user equipment. The utilization of the long term evolution multiple input multiple output is capable of utilizing the multi-trial broadcasting to offer betterments in the signal performance as well as throughput and spectral efficiency when used along the fifth generation mobile networks. So the paper proposes the artificial intelligence based long term evolution multiple input multiple output four transmit antenna with four diverse signal transmission capacity that is operating in the frequency of 3.501 Gigahertz frequency. The laid out design is evaluated using the Multi-input Multi output signal analyzer to acquire the capacity of the passive conveyance of the various antennas with the diverse combination of patterns. The outcomes observed enables the artificial intelligence antenna to identify the choicest antenna to be integrated in the diverse environments for improving the throughput, signal performance and the data conveyance speed.

Keywords: Long Term Evolution, Multiple Input Multiple Output, Artificial Antennas, MIMO signal analyzer, Monopole Antenna

1. Introduction

Nowadays the smart phone and other portable devices users demand high data conveyance speeds along with the long lasting robust services. The fifth generation mobile radio platform assures to provide more than the demand laid by the customers. The multiple input multiple output antennas used in both the transmitter and the receiver side termed as MIMO are capable of sending multiple spatial data streams at the same time and operates antenna in smarter way by integrating the various data's at various streams that are flowing from various path at various times to effectively enhance the receiver signal capturing power. The multiple antennas fixed at every end of the conveyance device is connected together to reduce the errors and optimize the speed of the data.

The multiple input multiple output antennas are type of "smart antenna technology" unlike the conventional antennas the with single input and single output that is often affected by the multipath effects causing more errors in the data conveyance and limiting more the speed of conveyance, eludes the such problem caused by the multipath wave propagation and are prominently used in the multitudes of applications like "digital television, wireless local area networks and metropolitan area networks and mobile communications". The figure.1 shows the conventional and the MIMO Antennas capabilities.

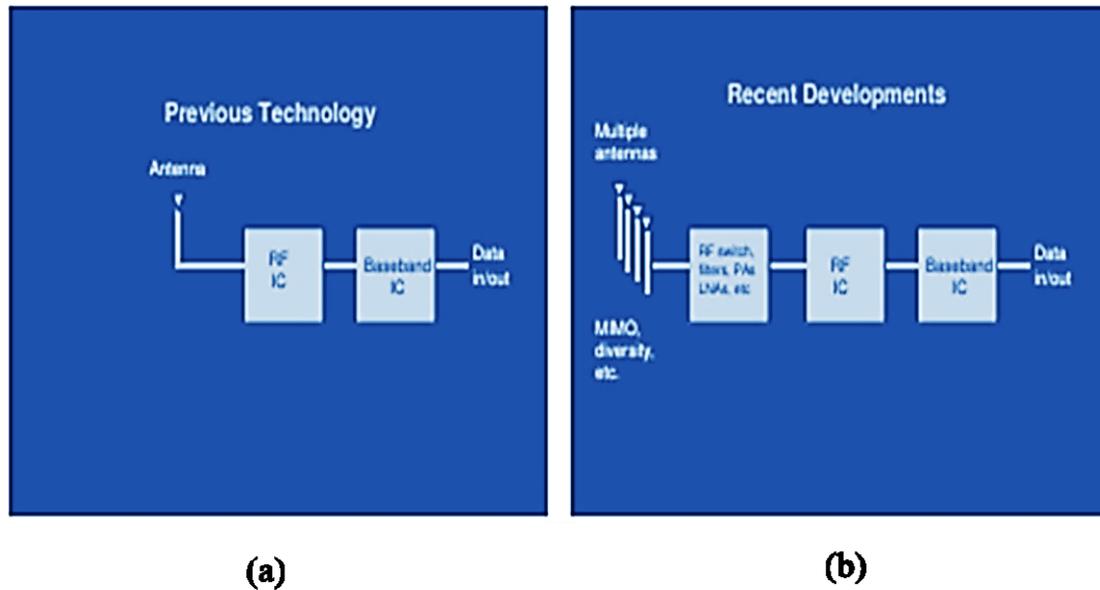


Figure.1 (a) Conventional (b) MIMO [1]

1.1. The Significance of multiple antennas

As the wireless platform that is embedded over the miniature electrical platforms are continuously changing. Till date the recent radios were utilized in isolation and were mostly linked to only single antenna. “But in today’s scenario there are more than single mode of wireless communication is utilized for.eg a mobile device is comprised with four cellular bands. WiFi, mobile data, Bluetooth etc. in few cases even wireless local area networks are also present. This makes clear that the RF filtering of signals becomes essential. “This becoming very common in the for every radio to use more than one antenna in order to create diversity or for multiple input multiple output applications”

“Though MMO system is complex compared to the diverse switching systems, yet its benefits are perceived as being worth the additional expense”. The utilization of the long term evolution multiple inputs multiple outputs is capable of utilizing the multi-trial broadcasting to offer betterments in the signal performance as well as throughput and spectral efficiency when used along the fifth generation mobile networks. So the paper proposes the artificial intelligence based long term evolution multiple input multiple output four transmit antenna with four diverse signal transmission capacities that is operating in the frequency of 3.501 Gigahertz frequencies. The laid out design is evaluated using the Multi-input Multi output signal analyzer to acquire the capacity of the passive conveyance of the various antennas with the diverse combination of patterns. The outcome observed enables the artificial intelligence antenna to identify the choicest antenna to be integrated in the diverse environments for improving the throughput, signal performance and the data conveyance speed. The mechanism laid out in paper is devised using the monopole-antenna integrated with the switchable pattern. The long term evolution based multiple inputs and multiple output antennas is equipped with four antennas and capable of providing a four concurrent data streams quadrupling the theoretical maximum speed of data transfer allowing the base station to convey four diverse signals through four diverse transmit antennas for a single user equipment.

The layout of the antenna put forward is organized with the literature survey in two, proposed antenna design in three, the analysis of performance in four and the conclusion in five.

2. Literature Survey

The swift progress in the internet of things as well as the 5th generation technology makes it necessary to select the choicest compatible conveyance frequency. “Yet the utilization of the fifth generation networks is utilized in the high frequency band, it is necessary to elude the problems such as the signal attenuation, faster easier obstruction and the coverage distance.”

The evolution of the MIMO utilized multiple antennas and receiver to send and receive signal so as to increase the conveyance capability and Yang, et al [2] in his paper devised a Four-element dual-band MIMO antenna system for mobile phones." Peng et al [3] devised an "An eight-port 5G/WLAN MIMO antenna array with hexa-band operation for mobile handsets."

Abdullah, et al [4] proposed an "Compact 4-port MIMO antenna system for 5G mobile terminal." Li et al [5] devised an "Compact quad-offset Loop/IFA hybrid antenna array for forming eight 3.5/5.8 GHz MIMO antennas in the future smartphone." Kim et al [6] has devised a "Spherical super wideband (SWB) monopole antenna with micromachined tapered feeding line."

Mehdipour et al [7] in his paper put forth an "A novel spherical bifurcated UWB antenna for ultra wideband communications." Hossein et al [8] elaborated the “Study of an UWB Spherical Monopole Antenna on the Dielectric Substrate." Sun et al [9] designed a "Design of planar antenna with bowtie shape for ultra-wideband (UWB) applications."

Valanarasu, et al [10] discusses the “Comprehensive Survey of Wireless Cognitive and 5G Networks”.Darney et al [11] has put forth the “Performance Enhancements of Cognitive Radio Networks Using the Improved Fuzzy Logic.”.Bashar, A et al [12] has laid out the “Secure And Cost Efficient Implementation Of The Mobile Computing Using Offloading Technique”.Chen et al [13] in his paper elaborates the "5G Technology and Advancements in Connected Living-Comprehensive Survey."

The paper is about to lay out an MIMO with four antennas that is capable of providing a four concurrent data streams quadrupling the theoretical maximum speed of data transfer allowing the base station to convey four diverse signals through four diverse transmit antennas for a single user equipment. This multi-input, multi-output antenna is an artificial intelligence based antenna that operates in long term evolution at a frequency of the 3.501 Giga hertz.

The antenna design is encompassed with monopole antenna along with a switching circuit with the amplification pattern. The laid out design is evaluated using the Multi-input Multi output signal analyzer to acquire the capacity of the passive conveyance of the various antennas with the diverse combination of patterns. The outcome observed enables the artificial intelligence antenna to identify the choicest antenna to be integrated in the diverse environments for improving the throughput, signal performance and the data conveyance speed. Thus enabling an optimization in the radiation of the field performance of the artificial intelligence to enjoy the benefit of the wireless conveyance

3. Proposed Antenna Design

The figure .2 below is the laid out geometry of the antenna design put forth in the paper. The laid out design is fabricated over the “NEMA grade designation for glass reinforced epoxy laminate material” commonly known as “FR4” where FR is abbreviated as flame retardant and the number 4 is to indicate the woven glass reinforced epoxy resin. The proposed antennas design is fabricated over printed circuit board structure consisting of a flame retardant woven glass reinforced epoxy in a thickness of .4 millimeter. The dimension of the designed antenna is composed with the length of forty five millimeter squared and breadth of twelve millimeter squared. The monopole structure are defined at a length of eight and the amplifying circuit that amplifies in the symmetrical pattern is equipped in the antenna and regulated using the switch to deliver a quadruple switching pattern.

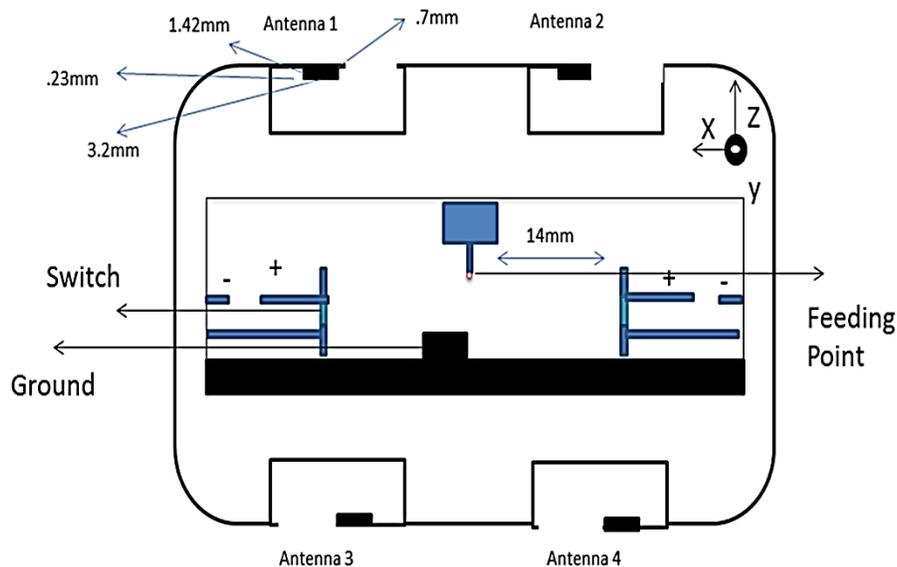


Figure .2 Antenna Geometry

The figure.3 shows the “S-parameters” observed on the proposed as the outcome of the switching across the various radiations pattern. The “S-parameters observed are very less than -10 decibel in the frequency ranging from the 3.53 gigahertz to 3.83gigahertz. On simulating the proposed antenna design with four antennas with the capability of transmitting four diverse signals is simulated on the 3.501gigahertz long term evolution. The efficiency of the antenna in all the four stages is higher than -4 decibel the figure.4 depicts the efficiency of the four antennas.

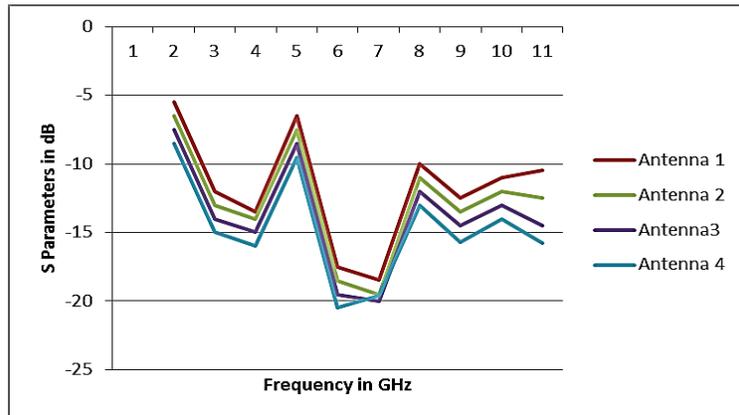


Figure.3 S-Parameters

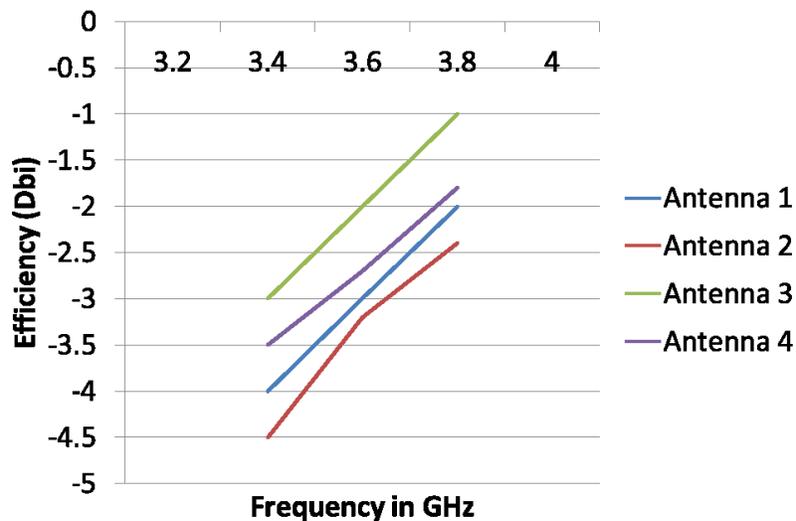


Figure.4 Measured Efficiency

4. Performance Measurement

The Multiple input multiple output signal evaluator, utilizes the wireless technology that is defined using the software in developing and implementing the innovative over the air multi input multi output evaluating device. The diverse transmission capability of the multiple antennas in the environment with multipath is measured using the evaluation system. The transmission capacity of each antenna could be distinguished using the evaluation system. The conditions termed as reference are listed below in the table.1

Signal to noise Ratio	SNR
Bit Error Rate	BER
Channel Matrix	CHM
Throughput	TPT

Table.1 Reference Sections

The laid out design is integrated with eight pairs of switching circuit is linked to the video graphic adapter signal sources. The two different coding principles are utilized to encode the data. “The measured data by the multi input multi output signal evaluator in the free space at 3.501 Giga hertz frequency for the reference conditions is listed below in figure.5 (a, b, c, d)

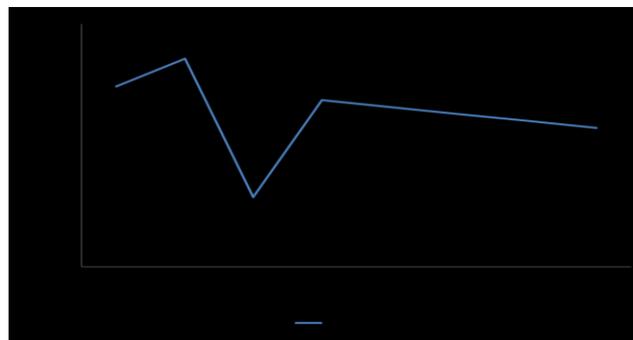


Figure. 5(a) Signal to Noise Ratio

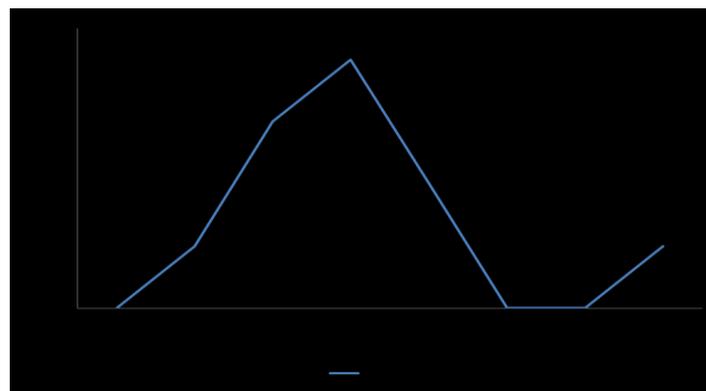


Figure. 5(b) Bit Error Rate

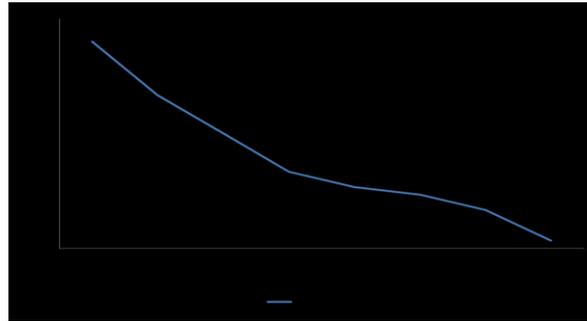


Figure. 5 (c) Channel Matrix

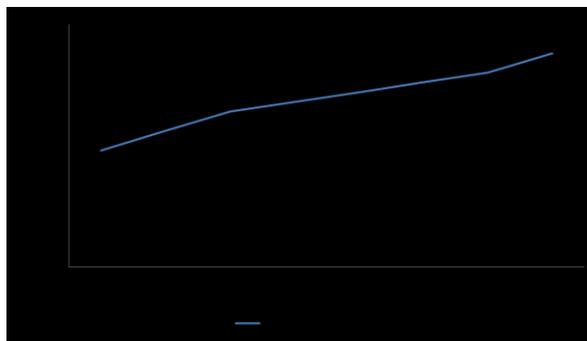


Figure.5 (d) Throughput

The output observed proves that the proposed antenna design provides betterments in the signal performance as well as throughput and spectral efficiency when used along the fifth generation mobile networks. The put forth design provides a difference of eighty megabits per second in the throughput under various patterns of switching conditions.

5. Conclusion

The artificial intelligence based long term evolution multiple input multiple output four transmit antenna with four diverse signal transmission capacity that is operating in the frequency of 3.501 Gigahertz frequency proposed in the paper is fabricated over printed circuit board structure consisting of a flame retardant woven glass reinforced epoxy in a thickness of .4 millimeter. The dimension of the designed antenna is composed with the length of forty five millimeter squared and breadth of twelve millimeter squared. The monopole structure are defined at a length of eight and the amplifying circuit that amplifies in the symmetrical pattern is equipped in the antenna and regulated using the switch to deliver a quadruple switching pattern. The laid out design is evaluated using the Multiple input multiple output signal evaluator, utilizes the wireless technology that is defined using the software in developing and implementing the innovative over the air multi input multi output evaluating device. The diverse transmission capability of the multiple antennas in the environment with multipath is measured using the evaluation system. The conveyance capacity of the all the antennas in multiple diverse path is also measured. Apart from the integration of the pattern to improve the conveyance capacity, according to the outcomes achieved in future the paper is to proceed with the evaluation of difference in the transmission capacity.

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Authors Biography

Dr. Abul Bashar is currently working as Assistant Professor at Prince Mohammad Bin Fahd University, Kingdom of Saudi Arabia in the College of Computer Engineering and Sciences. Earlier, he completed his PhD from the School of Computing and Information Engineering at the University of Ulster, Coleraine, UK in 2011. He received his B.E. degree in Electronics & Communication Engineering from Osmania University, Hyderabad, India in 1995. He has an M.S. degree in Electrical Engineering from King Fahd University of Petroleum & Minerals (K.F.U.P.M.), Dhahran, Kingdom of Saudi Arabia in 1999. Before joining his PhD research he was a Lecturer for 8 years in the Electrical Engineering department at K.F.U.P.M. He is a recipient of Osmania University Engineering Gold Medal in 1995, M.S. Research Scholarship from KFUPM (1996) and Vice Chancellors Research Scholarship from University of Ulster (2008). He is actively involved in the TPC/Review committees of renowned journals and conferences namely CSC IJCN, IEEE WCNC 2011, ISCI 2011, ICDIPC 2011, ICSECS 2011, DICTAP 2011 and NDT 2009/2010/2012