DESIGN AND DEVELOPMENT OF MICROSTRIP ARRAY ANTENNA AT 28 GHz

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Tajuk Projek : **Design and Development of Microstrip Array Antenna at 28 GHz**

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"I hereby declare that the work in this project is my own except for summaries and quotations which have been duly acknowledge."

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Date : 15th June 2016

DEDICATION

I dedicate this thesis to my beloved Father

Abd Rahim Bin Mohd

And

To the loving memory of my Mother

Noormah binti Hj. Hussien

You have successfully made me the person I am now

And

will always be remembered

ACKNOWLEDGEMENT

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ABSTRACT

5G technologies undergo a huge research to meet the fast growing wireless communication whereby the high frequency is required to fulfil the high data capacity demands. Mircostrip antenna is preferred due to its low profile, easy in feeding and array configurations. The natural low gain of this antenna can be overcome by constructing patch array antenna. In this project, configurations of patch array antennas are designed by following the specification from ETSI EN 301 215 part 1-4, to investigate their radiation patterns with different orientation ,excitation phase and gain at 28 GHz for 5G application. Simulated Retur loss, VSWR and simulated radiation patterns are presented. In future work, this project will be more focus on antenna array because to achived the higher gain.

ABSTRAK

Teknologi 5G telah dijalankan kajian secara menyeluruh untuk mengatasi perkembangan yang pesat pada teknologi komunikasi tanpa wayar dimana frequensi tinggi diperlukan untuk memenuhi sistem muatan data yang tinggi. Antena microstrip dipilih disebabkan susuk rendah, dan kemudahan pengeluaran serta kemudahan konfigurasi array. Keuntungan rendah pada antena ini boleh diatasi dengan konfigurasi array. Di dalam project ini, konfigurasi tampal array antena direkabentuk, simulasi dan fabrikasi untuk menganalisa mengikut spesifikasi daripada ETSI EN 301 215 bahagian 1-4 pada frekuensi 28 GHz. Pengukuran dan simulasi pekali pantulan, VSWR telah dipaparkan adalah untuk mecapai spesifikasi yg ditentukan. Pada masa hadapan, projek ini akan lebih fokus kepada antena tampal susunan.

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INTRODUCTION

1.0 Introduction

In this project we are designing and develop the antenna of 28 GHz Mircostrip Antenna Array. The problem statement of the project, is the compact of the previous service provider. Other than that, there are so many type Antenna but to fiind the cheaper antenna that follow the specification are hard to had . The main objective of the antenna is to understand the 5G oprate on 28 GHz antenna, to design the antenna and fabricate the design on selected substrate. The scope of the project, is to design antenna on many type on difference type of substrate to see the result of the parameters. This project will be divide into 2 categories that is simulation and hardware. The design will undergo by CST. The expectation of the project is, the operating frequency (28 GHz) with specification can be achieved in the simulation and also on the hardware.

1.1 Background study of 5G

5G is the next step in the evolution of mobile communication. It will be a key component of the Networked Society and will help realize the vision of essentially unlimited access to information and sharing of data anywhere and anytime for anyone and anything [1]. 5G will therefore not only be about mobile connectivity for people. Rather, the aim of 5G is to provide ubiquitous connectivity for any kind of device and any kind of application that may benefit from being connected.

Mobile broadband will continue to be important and will drive the need for higher system capacity and higher data rates. But 5G will also provide wireless connectivity for a wide range of new applications and use cases, including wearables, smart homes, traffic safety/control, and critical infrastructure and industry applications, as well as for very-high-speed media delivery.

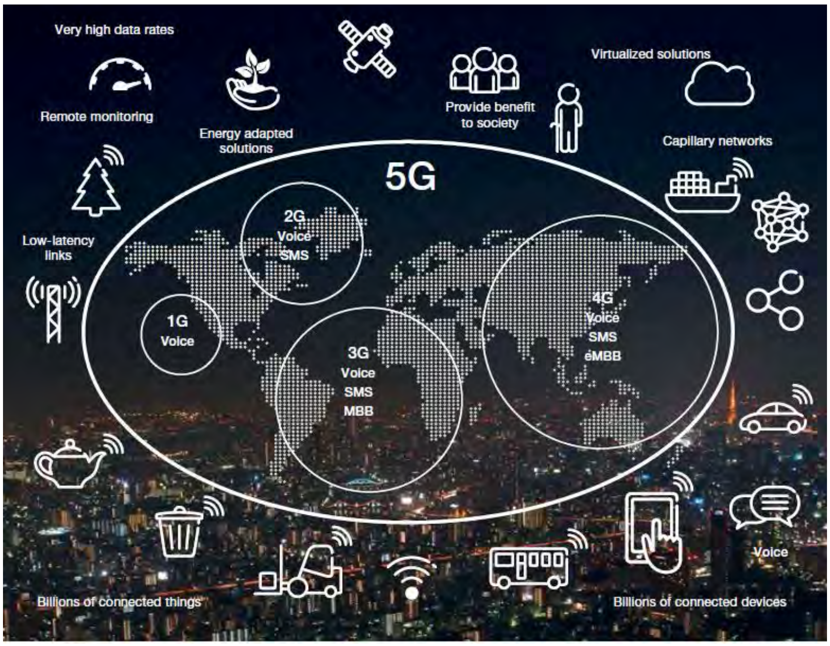

Figure 1.1 5G contain all communication

In contrast to earlier generations, 5G wireless access should not be seen as a specific radio-access technology. Rather, it is an overall wireless-access solution addressing the demands and requirements of mobile communication beyond 2020.

LTE will continue to develop in a backwards-compatible way and will be an important part of the 5G wireless-access solution for frequency bands below 6GHz. Around 2020, there will be massive deployments of LTE providing services to an enormous number of devices in these bands. For operators with limited spectrum resources, the possibility to introduce 5G capabilities in a backwards-compatible way, thereby allowing legacy devices to continue to be served on the same carrier, is highly beneficial and, in some cases, even vital.

In parallel, new radio-access technology (RAT) without backwards-compatibility requirements will emerge, at least initially targeting new spectrum for which backwards compatibility is not relevant. In the longer-term perspective, the new non-backwards-compatible technology may also migrate into existing spectrum

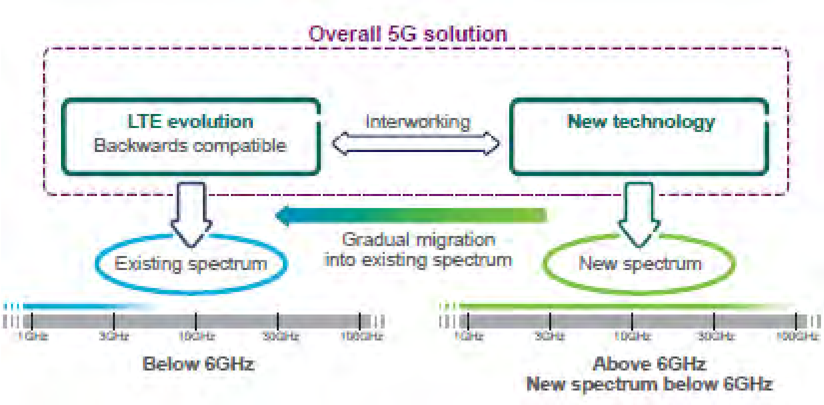

Figure 1.2 The figure 5G wireless-access solution consisting of LTE evolution and new technology

Although the overall 5G wireless-access solution will consist of different components, including the evolution of LTE as well as new technology, the different components should be highly integrated with the possibility for tight interworking between them. This includes dual-connectivity between LTE operating on lower frequencies and new technology on higher frequencies. It should also include the possibility for user-plane aggregation, that is, joint delivery of data via both LTE and a new RAT

.

1.2 Spectrum for 5G

In order to further extend traffic capacity and to enable the transmission bandwidths needed to support very high data rates, 5G will extend the range of frequencies used for mobile communication. This includes new spectrum below 6GHz, expected to be allocated for mobile communication at the World Radio Conference (WRC) 2015, as well as spectrum in higher frequency bands, expected to be on the agenda for WRC 2019.

It is still unclear what spectrum in higher frequency bands will be made available for mobile communication, and the entire frequency range up to approximately 100GHz is considered at this stage. The lower part of this frequency range, below 30GHz, is preferred from the point of view of propagation properties. At the same time, very large amounts of spectrum and the possibility of very wide transmission bandwidths, in the order of 1GHz or even more, will only be available in frequency bands above 30GHz.

Thus, spectrum relevant for 5G wireless access ranges from below 1GHz up to in the order of 100GHz, as Figure 2 shows.

Figure 1.3 Frequency spectrum for 5G

It is important to understand that high frequencies, especially those above 10GHz, can only serve as a complement, providing additional system capacity and very wide transmission bandwidths for extreme data rates in dense deployments. Lower frequencies will remain the backbone for mobile-communication networks in the 5G era, providing ubiquitous wide-area connectivity.

1.3 Why do we need 5G?

One of the main benefits of 5G technology over 4G will not be its speed of delivery – which admittedly could be between 10Gbps and 100Gbps – but the latency. At present, 4G is capable of between 40ms and 60ms, which is low-latency but not enough to provide real-time response. Multiplayer gaming, for example, requires a lower latency than that to ensure that when you hit a button, the remote server responds instantly. Another example was given to us by EE's Sutton, who said that 5G's prospective ultra-low-latency could range between 1ms and 10ms. This would allow, he said, a spectator in a football stadium to watch a live stream of an alternative camera angle of the action that matches what is going on the pitch ahead with no perceivable delay.

The capacity is an important factor too. With the Internet of Things becoming more and more important over time, where gadgets and objects employ smart, connected features that they have never had before, the strain on bandwidth will continue to grow. Initial ideas behind 5G is that an infrastructure will be in place to avoid that. It will be more adaptive to user's needs and demands and therefore able to allocate more or less bandwidth based on the application.

Table 1.1 Comparison of all generations of mobile technologies

Technology Features	1G	2G	3G	4G	5G
Deployment	1970-1980	1990-2004	2004-2010	2010 >>	2020
Data Bandwidth	2Kbps	64Kbps	2Mbps	100Mbps	>1Gbps
Technology	Analog Cellular	Digital Cellular	CDMA 2000 (1xRTT, EVDO)	Wi-Max LTE Wi-Fi	WWWW
Multiplexing	FDMA	TDMA CDMA	CDMA	CDMA	CDMA

1.3.1 The Internet of Things.

By the year 2020, it is predicted by analysts that each person in the UK will own and use 27 internet connected devices[2][3] . There will be 50 billion connected devices worldwide. These can range from existing technology, such as smartphones, tablets and smartwatches, to fridges, cars, augmented reality specs and even smart clothes. Some of these will require significant data to be shifted back and forth, while others might just need tiny packets of information sent and received. The 5G system itself will understand and recognise this and allocate bandwidth respectively, thereby not putting unnecessary strain on individual connection points.

The work has already begun for 4G implementation, but will become even more vital to a 5G future. As part of a “heterogeneous network", the points, or cells, will be used for LTE-A and the technology will be increased and refined to adapt to 5G too. Cells will automatically talk to each device to provide the best and most efficient service no matter where the user is. Larger cells will be used in the same way as they are now, with broad coverage, but urban areas, for example, will also be covered by multiple smaller cells, fitted in lampposts, on the roofs of shops and homes, and even inside bricks in new buildings. Each of these will ensure that the connection will be regulated and seemingly standard across the board.

Algorithms will even know how fast a device is travelling, so can adapt to which cell it is connected to. For example, a connected car might require connection to a macro-cell, such as a large network mast, in order to maintain its connection without having to re-establish continuously over distance, while a person’s smartphone can connect to smaller cells with less area coverage as the next cell can be picked up easily and automatically in enough time to prevent the user noticing.

Figure 1.4 Every 60 second happens in the Internet