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Developing Economically Viable Antenna Systems to Ensure Dependable Long-Range Communication in Rural Areas of Iraq

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Abstract*. The objective of this project is to develop cost-effective antenna systems. The study utilized AutoCAD 2006 for data analysis and visualization. This article provides a detailed examination of various antenna systems, including cable/wire, log-periodic, array, helical, and aperture antennas. The research also explores several parameters related to antenna systems, such as effective length, antenna gain and directivity, active aperture, bandwidth, polarization, input impedance, power gain, radiation efficiency, radiation pattern, and radiation intensity. The main goal is to identify the challenges in designing cost-effective antenna systems for reliable communication. These challenges include design issues, contract management difficulties, fluctuating material prices, inaccurate estimations, limited wireless communication technology, and financial constraints. The study examines a wavelength range from 16.7 to 120, corresponding to distances from 10,000 km to 120,000 km. The findings show that at a frequency of 600 MHz, a wavelength of 16.7 units covered a distance of 10,000 km. Similarly, at 750 MHz, a wavelength of 53.3 units covered 40,000 km, and at 850 MHz, a wavelength of 94.1 units spanned 80 km. At 1000 MHz, a wavelength of 120 units covered 120,000 km. This study offers valuable insights into the design of cost-effective antenna systems and provides an understanding of the factors that influence their performance in practical communication scenarios.*

Keywords*: Antenna System,Communication,Long Distance,Reliable,Wireless Communication.*

Abstrak.Tujuan dari proyek ini adalah untuk mengembangkan sistem antena yang hemat biaya. Penelitian ini menggunakan AutoCAD 2006 untuk analisis data dan visualisasi. Artikel ini memberikan pemeriksaan mendalam mengenai berbagai sistem antena, termasuk antena kabel/tembaga, log-periodik, array, helikal, dan aperture. Penelitian ini juga mengeksplorasi berbagai parameter yang terkait dengan sistem antena, seperti panjang efektif, gain dan directivity antena, aperture aktif, bandwidth, polarisasi, impedansi input, gain daya, efisiensi radiasi, pola radiasi, dan intensitas radiasi. Tujuan utama penelitian ini adalah untuk mengidentifikasi tantangan dalam merancang sistem antena yang hemat biaya untuk komunikasi yang andal. Tantangan-tantangan tersebut mencakup masalah dalam desain, manajemen kontrak, fluktuasi harga material, estimasi yang tidak akurat, keterbatasan teknologi komunikasi nirkabel, dan keterbatasan keuangan. Penelitian ini memeriksa rentang panjang gelombang dari 16,7 hingga 120, yang berkaitan dengan jarak dari 10.000 km hingga 120.000 km. Temuan menunjukkan bahwa pada frekuensi 600 MHz, panjang gelombang 16,7 unit mencakup jarak 10.000 km. Demikian juga, pada 750 MHz, panjang gelombang 53,3 unit mencakup 40.000 km, dan pada 850 MHz, panjang gelombang 94,1 unit mencakup 80 km. Pada 1000 MHz, panjang gelombang 120 unit mencakup 120.000 km. Penelitian ini memberikan wawasan berharga dalam desain sistem antena yang hemat biaya dan memberikan pemahaman tentang faktor-faktor yang memengaruhi kinerja sistem tersebut dalam skenario komunikasi praktis.

Kata Kunci: Andal, Jarak Jauh, Komunikasi Nirkabel,Komunikasi,Sistem Antena

1. INTRODUCTION

Over the decades, achieving consistent and reliable long-distance communication has been one of the major challenges in Iraq, particularly in the rural regions. The lack of reliable communication infrastructures in these areas has hindered various sectors, including healthcare, transportation, and public safety, where effective communication is critical. Rural communities often struggle to maintain contact with urban centers, making it difficult to coordinate emergency responses or facilitate vital services. As a result, the need for dependable

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long-range communication solutions has become more pressing, highlighting the importance of advancing infrastructure in these regions.

In most rural areas in Iraq, long-range communication is expected to play a significant role in various essential sectors. These sectors, such as energy distribution, healthcare delivery, and public safety, all depend on efficient communication systems to function optimally. For example, in rural healthcare facilities, reliable communication with central hospitals can facilitate consultations, patient referrals, and the quick transmission of medical data. Similarly, in the energy sector, long-distance communication ensures that the transmission of power and control signals remains uninterrupted. Therefore, addressing the communication gap is not only an economic necessity but also a matter of life and death in some situations.

To achieve reliable communication in these remote areas, the best solution is to design robust on-demand communication infrastructures. Such infrastructures are particularly useful in regions where fixed or traditional communication systems are unavailable or where existing systems have been damaged due to conflict or environmental factors. On-demand communication systems provide flexibility and scalability, allowing them to be rapidly deployed when needed. These systems can be essential for maintaining communication during natural disasters or other emergencies when fixed infrastructure is disrupted.

However, building and maintaining strong on-demand communication infrastructures in rural Iraq presents significant challenges. The difficulty lies not only in the physical setup of such systems but also in the computational complexity required to ensure reliable performance. The design process must consider factors such as power supply, signal range, cost-effectiveness, and system resilience. Additionally, the systems must be designed to adapt to the unique challenges posed by rural terrain, climate, and infrastructure limitations. These complexities make the development of such communication solutions a difficult and resource-intensive task.

Despite the challenges, addressing the communication gap in rural Iraq is critical for the country's overall development. To overcome these obstacles, it is essential to focus on building long-distance, on-demand communication capabilities that can serve the needs of rural communities. Research and innovation in communication technologies must continue to focus on cost-effective and efficient solutions that can be easily implemented in remote areas. By doing so, Iraq can enhance its ability to respond to emergencies, improve public services, and promote economic development in rural regions.

2. BACKGROUND

Nowadays in the era of wireless communication, wireless technologies played a prominent role in long-range communication. With the introduction of wireless communication, many people in the rural region are showing interest in long distance communication, but this requires a cost effective antenna system, electromagnetic radioactivity, as well as all forms of phenomena associated with transmission, etc. An antenna system plays a vital role in converting and transmitting electrical signals to electromagnetic waves effectively. According to [6], "Antenna is a mechanized and automated device used for discharging and emitting electromagnetic signals and waves from one point to another [6]. However, in the wireless communication systems, antennas serve as the main mechanism of any electrical circuit because most of the antenna systems make available a communicating links between the decoder and the encoder.

Moreover, in the wireless communication system, an antenna system is one of the long-distance on-demand communication capabilities and a leading solution in attaining effective long distance communication [5]. There are several antenna systems that can be used in improving long distance communication; some of these antenna systems includes Omni-directional antenna, directional antennas, etc. All these antenna systems cover frequencies from a long distance. The characteristics of an antenna system used for a reliable communication system in a long range distance include; reduction in power usage, wide-ranging bandwidth, as well as interfering rejection [5]. The difference between the types of antennas are vary. Generally, omnidirectional antennas discharge radio frequency consistently and equally to every direction, with the power reducing from elevations above or below the plane to decrease power waste and at the same time increase transmission distance. Directional antennas on the other hand, are aimed to spread and transmit radio waves in a particular direction with a great concentration. These are tremendous and excellent for direct communication between two points. Actually, not all the antenna systems are completely directional or omnidirectional. In the wireless communication system, using directional antennas typically enables the energy to emphasize and concentrate on a certain direction, and therefore, facilitates a lot of advantages such as extending the communication distance as well as reducing communication interference.

A good wireless communication system requires a consistent and effective communication between a moveable and immovable station in most of the rural region. However, in order to achieve a consistent, reliable, and effective communications in a wireless communication system, an electrical signal must be perfectly produced and transmitted through a transducer called an "Antenna System". The main purpose of the antenna system in a wireless

communication system is to captures and transmits radio electromagnetic waves during the communication process. In a communication process, the main objective of transmitting, and receiving a radio waves is to disseminate and communicate information at the speed of light.

Generally, the antenna system applied in a wireless communication system serves as one of the main components that enable and facilitate the communication system. In a communication system, the antenna usually serves as the interface between the radio system and the external communication environment. Communication systems need an antenna system to makes the transmitter and the receiver to function perfectly and accurately. Mostly, antennas are employed in the wireless communication system to establish and maintain the communication link. According to [1], in wireless communication system, a lot of antennas types are available, and each of them perform various functions based on the available application. Numerous studies have been conducted on design and implementation of aerial communication using directional antennas learning control in unknown communication environments [1, 5], but not much for designing cost-effective antenna systems for reliable long-distance communication in Iraqi rural regions. This paper therefore intended to design cost-effective antenna systems for reliable long-distance communication in Iraqi rural regions.

3. LITERATURE REVIEW

Overview of an Antenna System

Antenna system can be defined as mechanized mechanisms that interact with transistor waves roaming between two space [7]. According to [7], most of these mechanisms have been in existence a long time ago. Also, these systems are generally applied in electrical and electronic devices that require the conduction of electrical signals through electromagnetic signals such as radar or sensor systems, radio, as well as television [7]. Antennas are computerized and mechanized devices that transmit or accept radio frequency signals. In the process of transmission, an oscillating radio frequency electrical current is usually fed within the antenna's system terminals, whereby the channel discharges the signal as electromagnetic waves. In receiving the signal, an antenna system usually captures some of the original signal to create a voltage upon its stations' which is then improved and amplified.

According to [5], in a wireless communication system, an antenna is used in every instance of radio frequency communication, such as radio and TV transmissions, Smart and mobile phones, sensor and detector systems, handheld transceivers, Wi-Fi networks, remote controls as well as satellite communications. An antenna usually encompasses metallic conductors, that are electrically attached to the receiver or transmitter.

In the wireless communication system, an antenna system plays a crucial role in transmitting and receiving electromagnetic energy and radioactivity [5]. In an antenna system, during transmission, an antenna obtains electrical signals from a transmission line then modifies them into a radio waves. On the other hand, in receiving antenna, it is quite opposite because it enables electromagnetic signals from space and modifies the electromagnetic signals to electrical signals and transfers the signals to a transmission line. Typically, there are many parameters in an antenna such parameters include bandwidth, gain, radioactivity configuration, separation, impedance as well as the beam width. Generally, there are many reasons for using antenna system in the wireless communication system. The main reason for using antenna system in a wireless communication is to provide an easy way to transmit signals when other techniques are not available [5].

Types of Antenna

Generally, most of the antennas come in a wide range of patterns, sizes as well as configurations which is applicable to their functions [7]. There are many antennas used in the wireless communication system. Nowadays, different forms of antenna are generally employed in modern applications and they can be used to increase directionality. Some of these antennas are as follows:

- The log-periodic antennas
- The aperture antennas
- The helical antennas
- The cable or wire antennas
- An array antenna

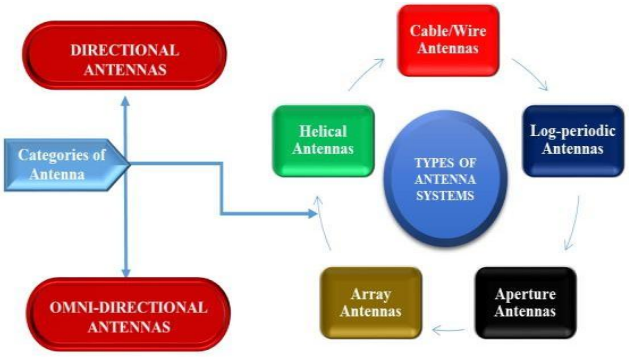

Figure 1. Types of Antenna System.

a. **Log-periodic antennas:** According to [7], log-periodic antennas are antenna types that are generally categorize under directional antenna. Log-periodic antennas are composed of multiple components. These types of antenna transfer signals across a wide range of frequencies. Also, these types of antennas are classically dipoles and set along their axis. Log-periodic antennas are mostly used in applications that need flexible bandwidths, directivity of the antenna as well as antenna gain. According to [8], Log-periodic antennas are multi-element, unidirectional, narrow- beam antennas. The length and spacing of the components of log periodic antennas escalates logarithmically from one point to another. These types of antennas are usually employed in broadband applications [8].

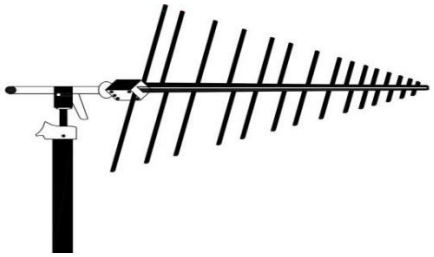

Figure 2. Log-Periodic Antenna.

b. **Aperture Antennas:** Aperture Antennas is one of the types of antennas that are basically reformed and change dipole the antennas housed in a particular pattern. These kinds of antennas transmit a radio waves and signals in a fixed or stable direction [7].

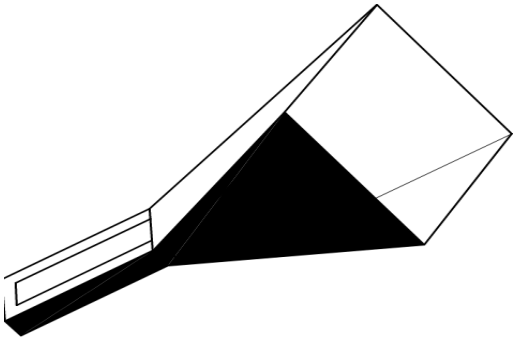

Figure 3. Aperture Antenna.

c. **The helical Antennas:** A helical antenna is one of the antennas that consist of a single metal conductor looped. Generally, helical antennas are polarized circularly. It is a kind of antenna that have both perpendicular and parallel radio wave patterns (Circular Polarization) [7].

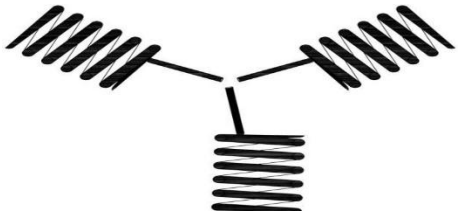

Figure 4. Helical Antenna.

d. The cable or wire antennas: The cable or wire antennas are the best and the most common forms of the antennas that are utilized in various applications. In an automobile industry, residential and commercial buildings, sea and aircraft, wire antennas are the most commonly used among others [7]. These types of antenna system are referred to as "linear or curved antennas". Naturally, the cable antennas are simple and inexpensive. These kinds of antennas are generally utilized in long-range applications. The cable antennas can be divided into four types. The four types of wire antenna include; short dipole, dipole, monopole, as well as loop antenna.

e. Array Antennas: Array Antennas is another form of the antennas. A Yangi antenna is one of the most common types of array antenna; it is a form of antenna with directional operation using dipoles to produce and radiate the radio waves [7].

BASICS PARAMETERS AN ANTENNA System

Active or Effective Length

According to [7], the active length of a fictional linear antenna is the extent to which a consistently circulated current is flowing [7]. The active length also known as "effective length" is one of the antenna system parameters that characterizes the adeptness and effectiveness of an antenna system when discharging and receiving radio waves. The active length is usually in both transmitting and receiving antennas. Below is the mathematical formula used in expressing the active length of an antenna

$$\text{Active Length} = \frac{(\text{An Area under non}-\text{uniform current distribution})}{(\text{An Area under uniform current distribution})}$$

Antenna Gain

An antenna gain is one of the antenna system parameter which helps to measures and evaluates the total amount of directivity of the antenna's radiated configuration and pattern. Antenna gain in an antenna system is one of the crucial and basic parameter that combines the directivity of the antenna's as well as the radiation efficiency [7]. In wireless communication system, an antenna with a greater gain is more effective and active in its radioactivity structure. Generally, most of the antenna system is constructed in a manner that enables power to increase in a required direction as well as reduces such power in unrequired directions. Below is the mathematical formula used in expressing the gain of an antenna

$$\text{Antenna Gain (G)} = \frac{(\textbf{power radiated by an antenna})}{\textbf{power radiated by reference antenna}}$$

The Active Aperture

Active Aperture is one of the features of antenna system used to describe a receiving antenna. An active aperture is one of the antenna parameters that helps to measure antennas proficiency in the extraction of appropriate signals from the electromagnetic waves [7]. The active aperture otherwise regarded as the "effective aperture" is another antenna parameter that actively play a crucial role when transmitting and receiving an electromagnetic wave. During the process, the power acquired by the antenna system is linked with the collective area. Mathematically, active aperture can be expressed using the following formula:

$$Pr = Pd*A \text{ watts}$$

$$A = \frac{pr}{pd\ m2}$$

The Bandwidth

According to [7], an antenna bandwidth may be regarded to as a fixed set of frequencies through which an antenna features are retained and maintained at a definite effective value [7]. When designing an antenna, the bandwidth is one of the preferred parameters to put into consideration. Generally, an antenna bandwidth is usually seen as the series of frequencies through which an antenna system accurately discharges and receives energy.

The Polarization of the Antenna

Generally, the electromagnetic signal established by antenna system may be polarized parallel and perpendicularly. Vertically, when the wave gets separated, the electromagnetic vector is in perpendicular direction then it demands a vertical antenna. On the other hand, when an electromagnetic vector is in a horizontal direction, then it required a horizontal antenna to launch the electromagnetic wave. Conversely, circular polarization is the combination of both horizontal and vertical polarization [7].

Input Impedance

In general, the input impedance of the antenna system may be defined as the degree of resistance attached and placed against the flow of current through its conductive material [7]. However, there is a need for antenna system to have an input impedance that is well-adjusted to its input transmission line so as to remain effective and efficient.

The Power Gain and Radiation Effectiveness

According to [7], the effectiveness of an antenna system generally reduce by the conductor material it is composed of. Since, antennas are made of materials with flawed and inconsistent conductivity, their effectiveness is less than hundred per cent. The radioactivity effectiveness of an antenna is the total proportion of power discharged to the input power.

The radiation and radioactivity pattern of the Antenna System

According to [7], in some circumstances, an antenna may not be able to discharge the same amounts of energy in every direction. Most of the antennas system generally radiate radio signals extremely in a specific direction. On the other hand, the energy radiated in other areas remains insignificant [7]. The radioactivity structure of an antenna system is usually characterized by the use of Quantity Field Strength (QFS). Generally, the quantity field strength can be calculated at a distance or space from the antenna system using the following formula:

$$\text{Field Strength (FS)} = \frac{\text{volts}}{\text{meters}}$$

The strength and intensity of Radioactivity

According to [7], the strength and intensity of radioactivity of a specific antenna can be defined as the power per unit angle. The strength and intensity of radioactivity can be calculated using:

Watts per steradian = (W/Sr).

Applications Of Antenna System

Nowadays, many of the available antenna system can be applied in the transmission of reliable information in a long range distances. The transmitter and the receivers' required, many antennas to attain electromagnetic wave transmissions. Antennas can be applied in the following applications [7].

High & Ultra High-Frequency Transmission

Generally, broadcast station usually transmit their programs with the help of very high frequency as well as the ultra-high frequency antenna systems. The applications of High & Ultra High-Frequency Transmission allow Information and communication to reach audience

at long distances [7]. Generally, most of the distinctive transmission frequencies used by High & Ultra High-Frequency ranged between 3MHz to 300MHz.

Television and Radio

In broadcast industry, Yagi array antennas are the most to receive VHF and UHF waves discharged by broadcasting bases. However, most of these antennas are directional and they are generally placed at the front of the source of the radio signals so as to effectively capture and decrypt the discharged signals [7].

Research Gaps

Numerous studies have been conducted on the "design and implementation of aerial communication using directional antennas learning control in unknown communication environments [1, 5], but not much for designing cost-effective antenna systems for reliable long-distance communication in Iraqi rural regions.

Poor Cost-effective Design

Most of the existing papers focuses more on the designing of antenna system. The existing paper failed to addressed the problems associated with the designing of a cost-effective antenna system for reliable communication in the rural area. There are many problems associated with the designing of cost-effective antenna system for reliable communication this includes the problems in the design process, contract management problems, fluctuations in materials price, inadequate design skills, incorrect estimation, lack of proper planning, lack of wireless communication technology, as well as financial problems.

The Causes of the Increased in Wear and Tear of the Antenna System

The existing papers also failed to examine the main reason why there is increased in the wear and tear of the antenna system. There are many factors that lead to the increased in the wear and tear of an antenna system. In the process of the design, the Exposure to radiation, and ultraviolet light was identified as the major causes of the increased in the wear and tear of the antenna system.

Existing Research Analysis

According to [1], in their study, "Long-Range and Broadband Aerial Communication using Directional Antennas (ACDA): Design and Implementation". The study designed a long-

range and broadband aerial communication system with the help of directional antennas. The study incorporates Wi-Fi and aerial systems to rapidly launch a Wireless facility in the air, and this enables real-time communication ability for a remote area where a stable communication facility is inexistence. According to [1] ACDA uses unmanned aerial vehicle (UAV)-carried directional antennas to spread range of the information to be communicate, improve output, and decrease interfering. In the paper, GPS-based control algorithm was designed and implemented so as to discard wind disruption and align the antennas directions based on the UAV movement. A Received Signal Strength Indicator (RSSI)- based decentralized an initial scan algorithm was also designed and implemented. This helps to speedily launch an initial connection between the UAVs.

Simulation studies has proved that the effectiveness of heading control as well as the initial scan algorithm. Also in the paper, a field tests were carried out in order to measure the performance of the entire system based on the output and delay in reverence to the increases in the communication range. In the paper, the result shows that the Aerial Communication using Directional Antennas model system attains 48Mbps output at a distance which range between 300m - 2Mbps at 5000m, and this shows the favorable usage of directional antennas for long-range distance Wi-Fi aerial communication.

[5] in their study, “Design and implementation of aerial communication using directional antennas: learning control in unknown communication environments” [9]. The study designed and implemented a new Aerial Communication using Directional Antennas system, with the middleware, platform, computing, control, as well as the interface components. In the paper, the practical execution issues for the emergency response application was also put into consideration. The Aerial Communication using Directional Antennas system was verified by simulation studies, disaster drills as well as the field tests.

4. METHODOLOGY

In this paper, Computer Aided Software AutoCAD 2006 was used to design the cost-effective antenna systems for reliable long-distance communication in Iraqi rural regions. In the process of the design, a frequency was chosen, then a conductor was developed, the wire length was determined, then the wire was cut to various size and the ground plane was formed.

5. RESULTS

Table 1: The length of the Antenna Using 150 Bandwidth.

BANDWIDTH	FREQUENCY (MHz)	Kilometer	Wavelength
150	**600**	**10,000**	**16.7**
	750	**40,000**	**53.3**
	850	**80,000**	**94.1**
	1000	**120,000**	**120**

In this paper, the antenna system designed for a reliable communication range within 10,000km-120,000km using 150 bandwidths. In attaining the total wavelength, the total wavelength/meters is calculated as thus:

Total wavelength (TW) = km/MHz

Where

TW= km/frequency

TW = total wavelength

Km = kilometer

F= frequency

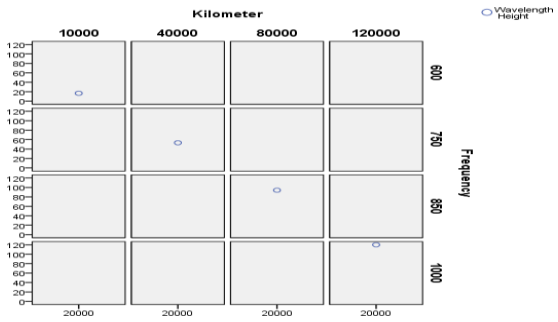

Figure 5. Antenna Length of the Designed Antenna using 150 Bandwidth.

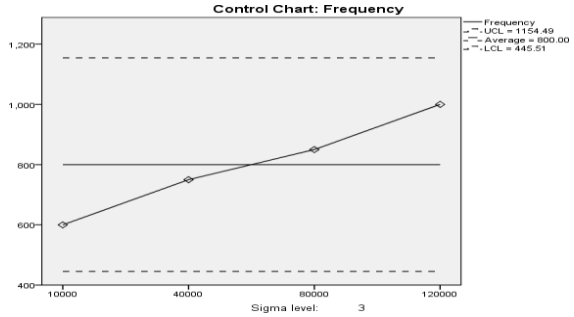

Figure 6. The control chart of the Antenna Length using 150 bandwidth.

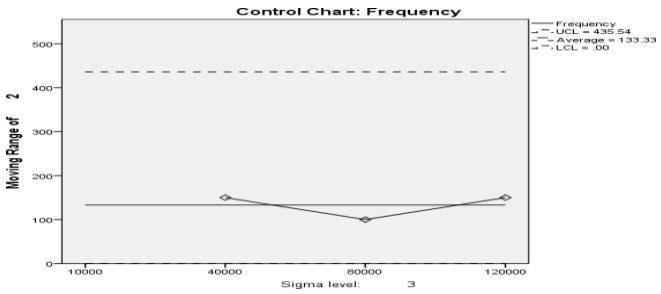

Figure 7. The control chart of the Antenna Length using 150 bandwidth.

Table 2. The length of the Antenna Using 75 Bandwidth.

BANDWIDTH	FREQUENCY (MHz)	Kilometer	Wavelength
75	1200	160,000	13.3
	1400	200,000	142.9
	1600	240,000	150
	1800	300,000	166.7

In this paper, the antenna system designed for a reliable communication range within 160,000km-300,000km using 75 bandwidths. In attaining the total wavelength, the total wavelength/meters is calculated as thus:

Total wavelength (TW) = km/MHz

Where

TW= km/frequency

TW = total wavelength

Km = kilometer

F = frequency

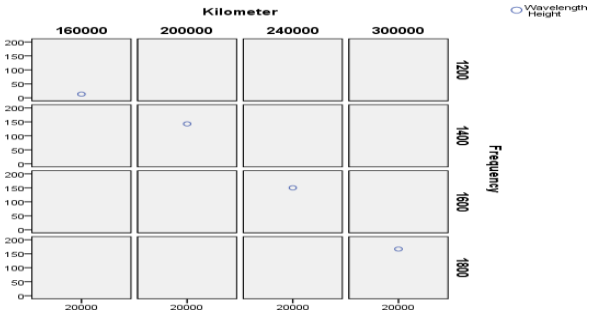

Figure 8. Antenna Length of the Designed Antenna using 75 Bandwidth.

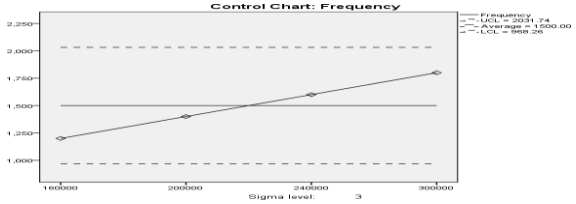

Figure 9. The control chart of the Antenna Length using 75 bandwidth.

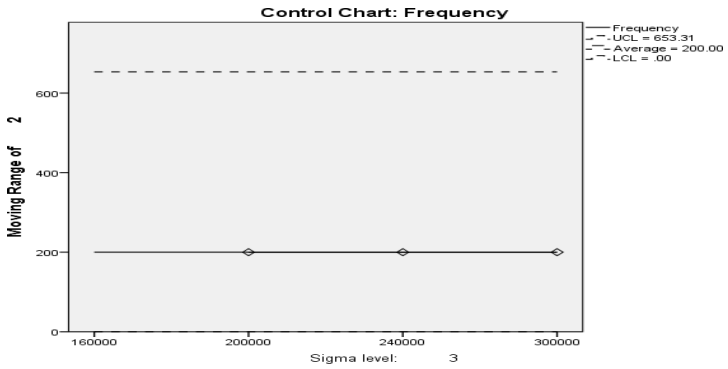

Figure 10. The control chart of the Antenna Length using 75 bandwidth.

6. DISCUSSION

The paper designed a cost-effective antenna system for reliable long-distance communication in Iraqi Rural Regions. Table 1 shows the length of the Antenna using 150 bandwidths. From the table, the wavelength ranged from 16.7-120 for 10,000km-120,000km, respectively. From the results, with 600MHz, the wavelength (16.7) covered 10,000km, with 750MHz, the wavelength (53.3) covered 40,000km, with 850MHz, the wavelength (94.1) covered 80km, the with 1000MHz, the wavelengths (120) covered 120,000km. Table 2 shows the length of the Antenna using 75 bandwidths. From the table, the wavelength ranged from 13.3-166.7 for 160,000km-300,000km, respectively. From the results, with 1200MHz, the wavelength (13.3) covered 160,000km, with 1400MHz, the wavelength (142.9) covered 200,000km, with 1600MHz, the wavelength (150) covered 80km, the with 1800MHz, the wavelengths (166.7) covered 300,000km.

The application of the Cost-Effective Antenna System

The antenna system in this paper is cost-effective in nature and it has been designed in such a way to enhanced long distance communications for reliable communication among the rural regions in Iraq. The designed antenna can be applied in many areas most especially in long-distance communication in the rural regions of Iraqi. In the field of engineering such as electrical and electronics engineering, computer engineering, the antenna system designed can contribute to the enhancement and the improvement of previous antenna systems. The cost-effective antenna system designed in this paper can help in the discovery of new solutions to frequent glitches and problems in the previous antenna system. On the other hand, the antenna systems may be generally used in a wireless communication system among the dwellers in the rural regions of Iraq.

Problems associated with the designing of a cost-effective antenna system for reliable communication There are many problems associated with the designing of cost-effective antenna system for reliable communication this includes the

- Problems in the design process
- Contract management problems
- Materials price fluctuations
- Inadequate design skills
- Incorrect estimation
- Lack of the proper planning
- Lack of a wireless communication technology, and
- Financial issues

CONCLUSION

The study designed cost-effective antenna systems for reliable long-distance communication in Iraqi rural regions. In most of the rural regions in Iraq, long range communication is expected to play a vital role in many application areas like transportation, energy, health care, and public safety. However, to achieve this, designing strong on-demand communication infrastructures is the best choice. An on-demand communication infrastructure plays a crucial role in a situation where secure and fixed communication infrastructures are not in existence, or whereby the communication infrastructures are damaged. In most of the rural regions in Iraq, long-distance communication facilities are necessary to communicate and send information in long distance communication. One of the main phenomena of achieving reliable communication is due to the growth and increase in size, application as well as the complexity of communication

system infrastructure. In some rural region of Iraq, developing and designing antenna systems in a cost-effective is a difficult and computationally challenging task. However, to tackle most of these challenges facing the rural dwellers in long distance communication, it is important to build long-distance on-demand communication capabilities.

In this paper, the types of antenna systems were reviewed, some of the antenna types discussed in this paper are cable/wire antenna system, log-periodic antenna system, array antenna system, helical antenna system and aperture antenna system. The study also reviews the parameters of an antenna system which includes active or effective length, the antenna gains and the directivity, the active aperture, the bandwidth, the polarization of the antenna,

input impedance, the Power gain and radiation effectiveness, the radiation and radioactivity pattern of the Antenna System as well as the strength and intensity of Radiation. This paper identified the problems associated with the designing of cost- effective antenna system for reliable communication this includes the problems in the design process, contract management problems, fluctuations in materials price, inadequate design skills, incorrect estimation, lack of proper planning, lack of wireless communication technology, as well as financial problems. However, to tackle most of these challenges facing the rural dwellers in long distance communication, it is important to build long-distance on-demand communication capabilities.

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