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Geographic Analysis of The Distribution of Asia cell Telecommunication Network Services in Misan Governorate and its environmental Impacts Using (GIS)

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Abstract

The study aims to reveal the reality of geographical analysis of the services of the Asiacell communication network in Misan Governorate and its potential environmental and health effects and determine its spatial suitability in accordance with the approved planning standards, as well as the analysis of cadastral and population coverage levels through the use of geographic information systems programs, the research has concluded that the percentage of area serviced by the network has reached about (68.7) while the deficit rate is about (31.3) for the unserviced area throughout the province, and the distribution of the current towers depends on Random system in different areas of the governorate .

Keywords: Network Services, GIS, Spatial Distribution, Misan

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الملخص :
تهدف الدراسة إلى الكشف عن واقع التحليل الجغرافي لخدمات شبكة اتصالات آسياسيل في محافظة ميسان وآثارها البيئية والصحية المحتملة وتحديد ملاءمتها المكانية وفق المعايير التخطيطية المعتمدة وكذلك التحليل المساحي والسكاني مستويات التغطية من خلال استخدام برامج نظم المعلومات الجغرافية، وخلص البحث إلى أن نسبة المساحة المخدومة بالشبكة قد بلغت حوالي (68.7) في حين بلغ معدل العجز حوالي (31.3) للمنطقة غير المخدومة في عموم المحافظة، وتوزيعها تعتمد الأبراج الحالية على النظام العشوائي في مناطق مختلفة من المحافظة.
الكلمات المفتاحية: خدمات الشبكات، نظم المعلومات الجغرافية، التوزيع المكاني، ميسان

1. Introduction

Our contemporary world is witnessing a huge revolution in information and communication technologies and this revolution is accompanied by a rapid expansion in the use of technological systems that emit electromagnetic radiation such as radio broadcasting stations, satellite broadcasting, industrial and medical applications, including the mobile phone,(5. Obaid H. Almusawi M. 2023).) which invaded the lives of millions in a way that is no longer possible to abandon it despite warnings of some of the risks caused by these modern technologies in the means of wireless communication and entered this type of communication to Iraq in 2003 after it was dismantled The government monopoly of telecommunications and the participation of the private sector in it through operating companies, whether Iraqi or Arab, and achieved rapid development in the number of lines and users and a wide spread throughout the country from the far north to the far south

1.1 Statement of the Problem

- What is the reality of the spatial distribution of Asia cell mobile phone towers in Misan Governorate?

- Is there some kind of balance in its geographical distribution and between population density and area?

1.2 Hypothesis

The spatial distribution of Asia cell mobile phone towers in Misan Governorate takes a random pattern, and GIS technology can determine the efficiency of the geographical distribution of Asia cell mobile phone towers in Misan Governorate.

1.3 importance of research

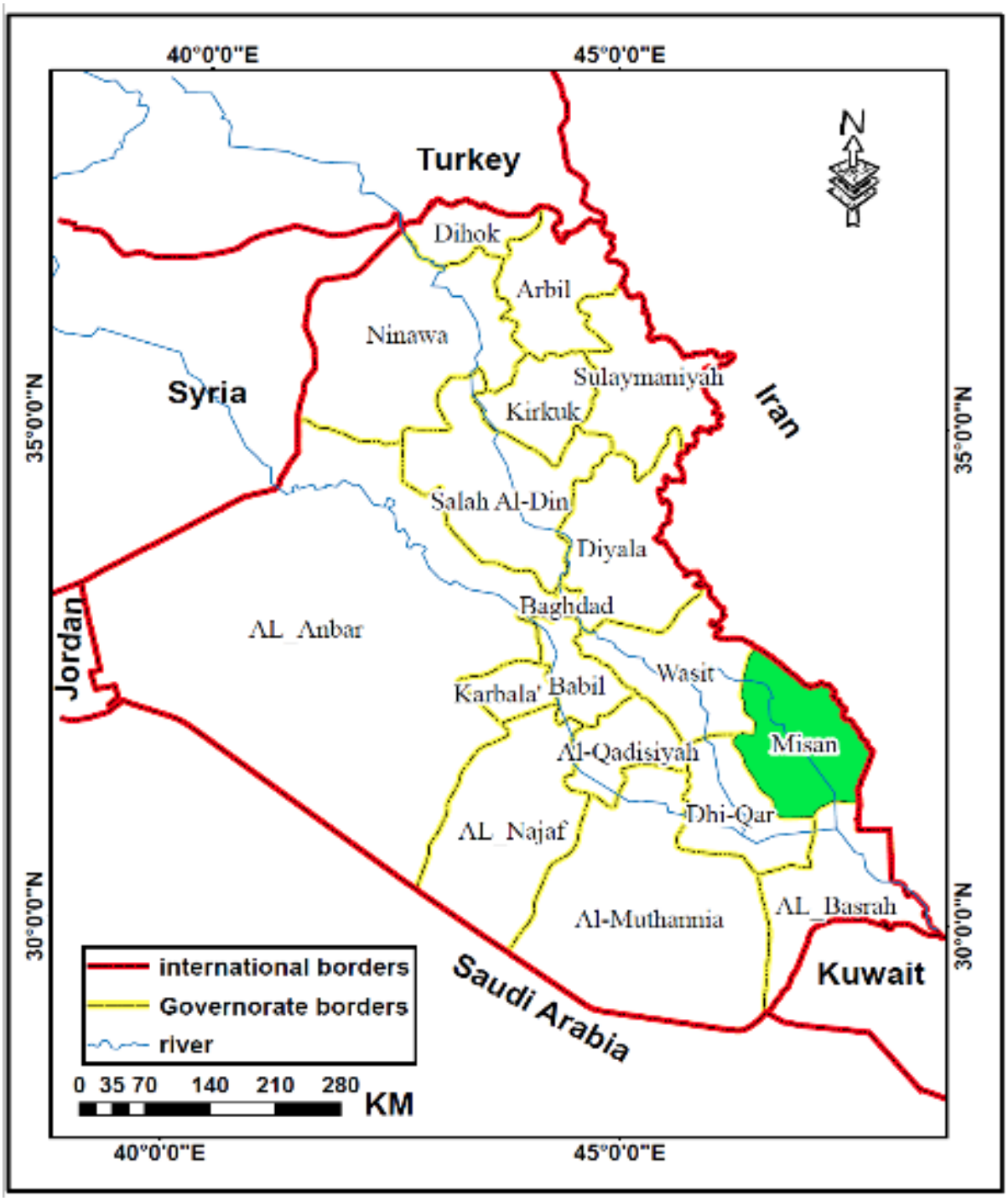
The research aims to reveal the nature of the spatial distribution of Asia cell mobile network towers in Misan Governorate based on GIS technology

1.4 spatial boundaries

The boundaries of the spatial study are represented in Misan Governorate, which is located between two latitudes (31.15 32.56) north and arc length (46.15 47.50) east, as it is located in the southeastern part of Iraq, map (1,2) and is bordered on the north and northwest by Wasit Governorate and Dhi Qar Governorate on the west and on the south by Basra Governorate, and it also has international borders with the Republic of Iran, which extends from the east and northeast.

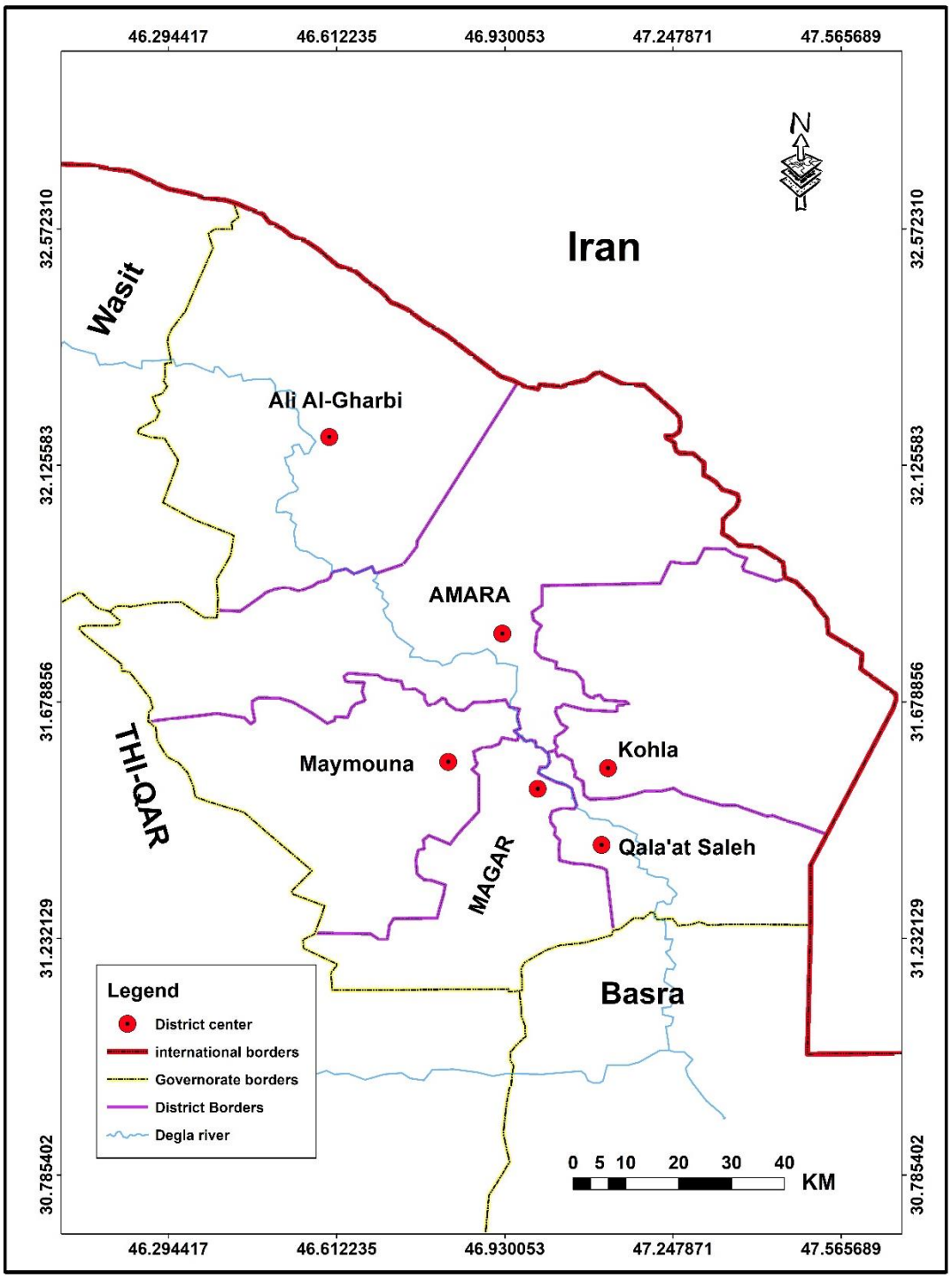
Map (1)

Location of Misan Governorate from Iraq



Source: Republic of Iraq, Ministry of Water Resources, Directorate of Public Survey, Administrative Map of Iraq, Scale 1:1,000,000, for the year 2010

Map (2)
Administrative divisions in Misan Governorate



Source: - work of the researcher based on, Ministry of Water Resources, Directorate of Public Survey,

Map Misan Governorate Administrative ,2010.

2. Terminology used in the study

Mobile phone: A small device for exchanging radio signals with the service center in the central exchange through the main stations and works at a very low power, and consists of a receiving and transmitting circuit, a central and sub-processing unit and a memory to store information (Musa 2005, p. 211)

Communication: It is the process or method by which information, needs, knowledge and experiences are transmitted from one person to another until they become common between them and lead to understanding between these two people.

Mobile phone towers: It consists of major or secondary towers, which are 3 groups of transmitters and receivers for radio waves and therefore they form the backbone of mobile phone networks because they are linked to each other, and they consist of interconnected network iron supports installed on an independent ground base and existing without any supports from another facility and are used to install radio frequency transmitting and receiving devices and consist of heights of up to (90) or (70) or (35) m (Al-Hamdani 2017, p. 56)

Coverage: It is the largest distance within which the user can transmit the signal of the appropriate level to the base station.

2.1 Planning and Environmental Standards for the Signing of Mobile Telecom Company Towers[(3)]: (Environment 2010 , p. 6)

Article (2) of the Iraqi Ministry of Environment Law No. (37) of 2008 states that the main objective of setting controls and standards for the establishment of mobile phone towers is to protect humans and the environment in general

from the potential biological effects of non-ionizing radiation resulting from mobile phone systems in order to achieve the minimum technical and environmental conditions that must be met to grant licenses for the operation of these towers.

Article (3) of the aforementioned law specifies many technical specifications that must be available at the sites of mobile phone systems, which stipulated the following:

- According to the principles of environmental classification of pollution sources according to polluting activities approved by the Ministry of Environment, it has been classified into three categories, namely (a) highly polluted and (b) less polluted and (c) low pollution, as the central exchanges were counted within class (b) and the main stations (main and secondary towers) for mobile phones were classified within class (c) and the two classes mentioned are the least polluted and affect humans and the surrounding environment from the effects of the first class (a), These towers can be erected inside or outside the boundaries of the basic designs of cities, as well as villages and kasbahs nominated for development, taking into account the technical specifications and environmental requirements when erecting the sites of the towers.
- Not to establish mobile phone towers within the following buildings: (hospitals, schools, kindergartens and roofs that are used for partial housing purposes such as sleeping, guarding, work, storage or animal husbandry).
- C- It is forbidden to construct and erect towers on the floor of residential floors (such as gardens and external courtyards) and the floor of the regular abandonment of buildings, floors and street sidewalks.
- It is forbidden to construct towers on roofs that are not constructed with reinforced concrete.
- The minimum horizontal distance between one tower and another should be (50) meters for small primary towers (secondary) and (300) meters for large primary towers (main).

- The level of human exposure to the intensity of the magnetic radiation power resulting from the components of the mobile phone system should not exceed (0.4) milliwatt / cm2.
- The beams of fine rays resulting from mobile phone towers should not be directed towards the buildings and constructions surrounding the towers and in which the human being is present, and that the level of vertical distance between the connecting antennas and the highest point in those buildings and constructions that correspond to the direction of those antennas should not be less than (2) meters for any distance.

3. Geographical Distribution of Asia cell Network Subscribers in Misan Governorate

The number of subscribers of the Asia cell network reached about (464324) thousand subscribers for the year 2021 throughout the governorate, and they were distributed over the districts, so the largest share of the number of subscribers for the (Amarah) district was about (373717) subscribers, while the district of (Hungary) came by (29694) subscribers, and the district of (Qal'at Saleh) came third in terms of the number of subscribers, who reached about (19459) subscribers, then comes each of the districts of (Al-Maymouna - Al-Kahla - Ali Al-Gharbi) with a number of subscribers amounting to about (17712, 13173), 10569) subscribers respectively due to the decrease in their population, as shown in Table 1 and Map 3.

3.1.The districts of the governorate can also be classified according to telephone density into four levels as follows:

Level 1: Low telephone density ranging between (13.6 – 15.7)

100 people, which includes each of the districts of Kahla and Maymouna, as their telephone density reached about (13.6-15.7) 100 / person respectively, and this decrease is due to the intensification of competition among mobile phone companies to attract customers in those districts.

The second level: medium telephone density ranging between (15.8 – 18.4) 100 / person This level included the districts of Qal'at Saleh and Ali al-Gharbi with a telephone density of about (16.6 – 18.8) 100 / people each respectively.

Level III: High telephone density, ranging from

(18.5 – 57.7) 100 / person

This level included the district of Amara only with a telephone density of about (57.7) 100 / person, and this increase is due to the spread of Asia cell towers heavily within the district And the small number of towers for (Zain Iraq and Korek) in the district, which encouraged its residents to participate heavily in Asia cell lines

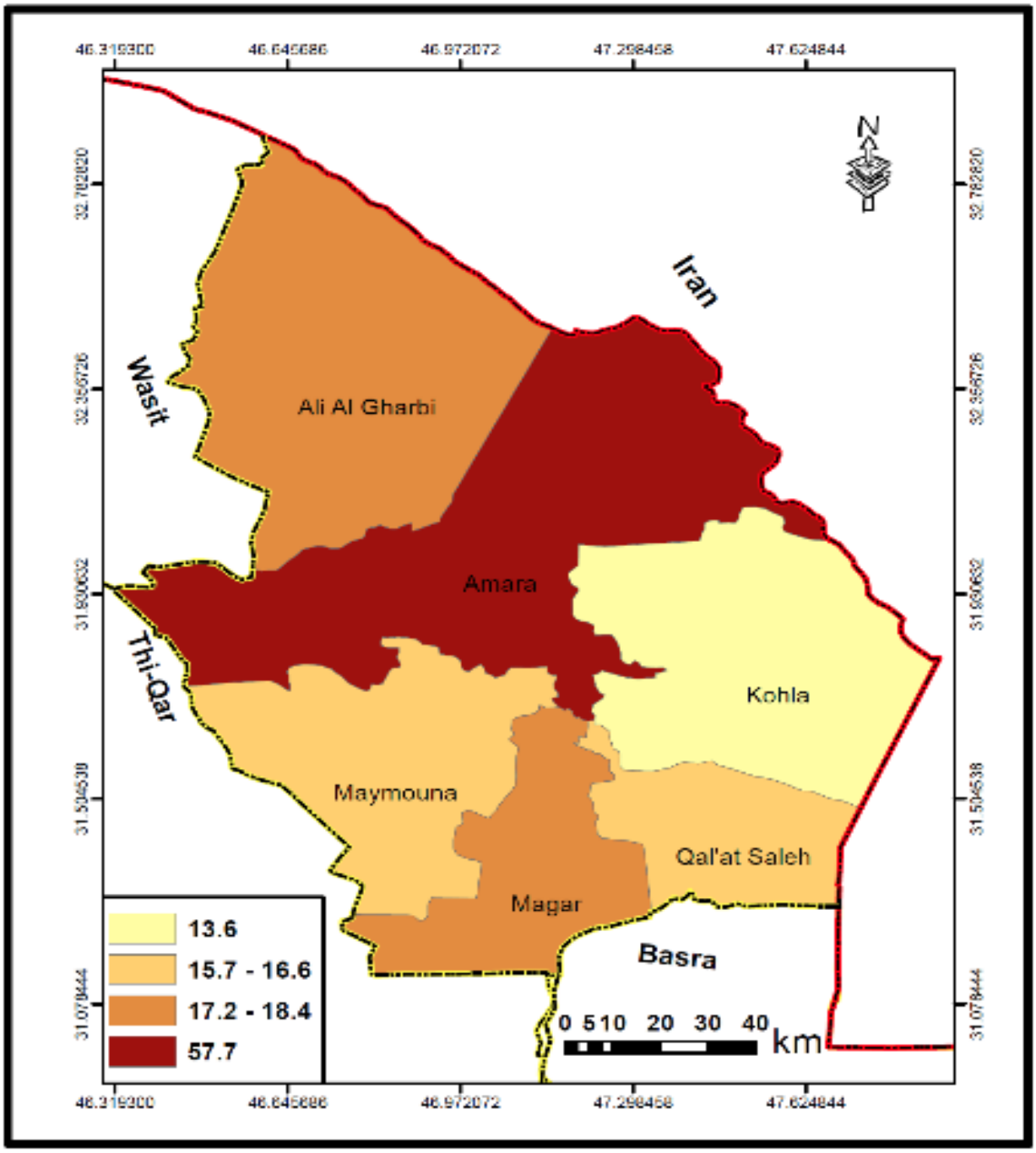
Table (1) Number of Asia cell Network Subscribers by Districts of Misan Governorate for the year 2021

district	Population	Number of subscribers	Telephone density
Amara	647,435	373717	57.7
Ali Al Gharbi	57,418	10569	18.4
Maymouna	112,273	17712	15.7
Qal'at Saleh	116,759	19459	16.6
Magar	172,116	29694	17.2
Kohla	96,173	13173	13.6
Total Governorate	1,202,175	464324	

1- Republic of Iraq, Ministry of Planning, Central Bureau of Statistics, Misan Governorate Statistics Directorate 2021

2- Asia cell Company, Marketing Department, unpublished data

levels of telephone density in the districts of Misan Governorate for the year 2021



Source: From the researcher's work based on Table (1)

4.Geographical distribution of mobile towers

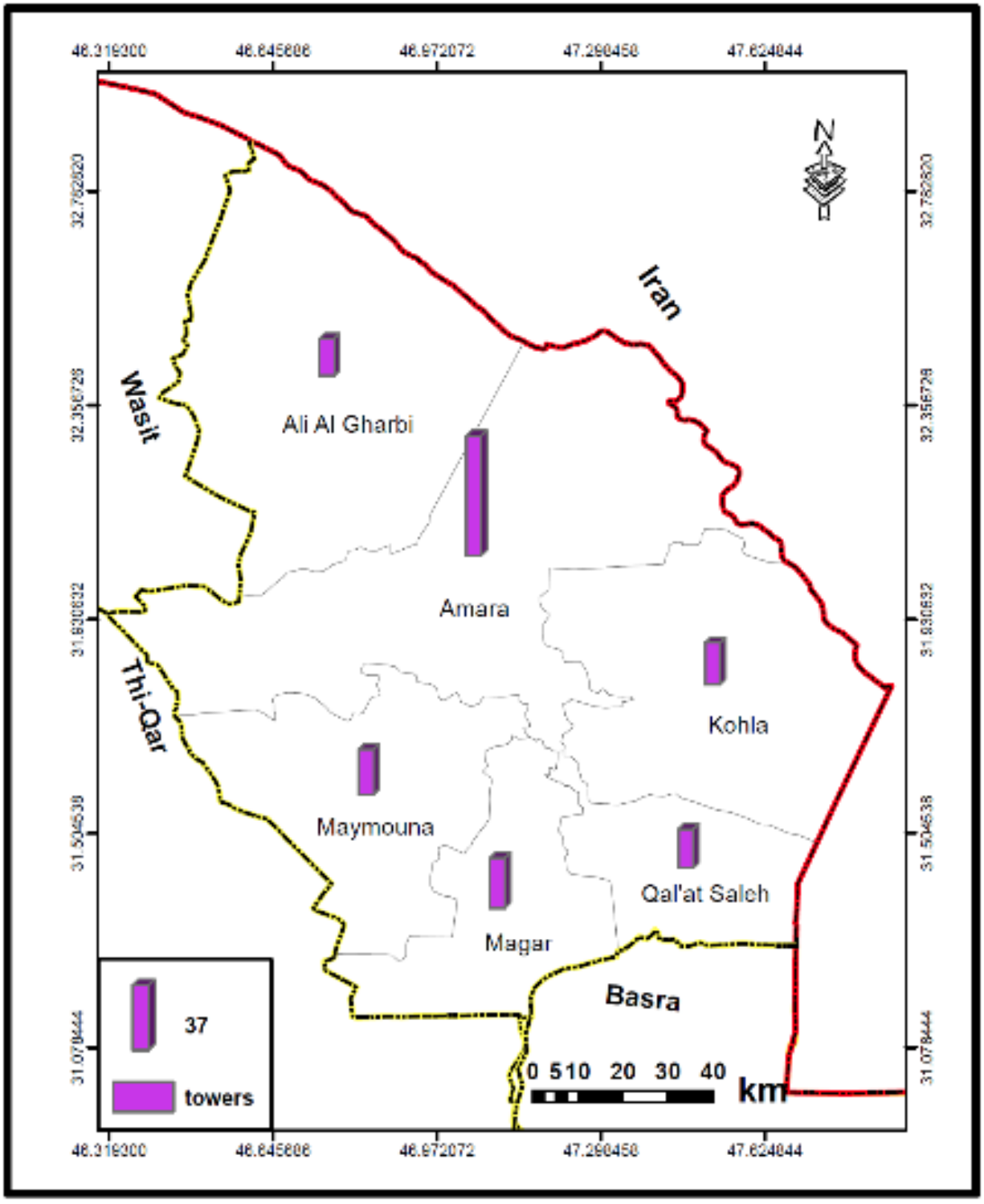
The geographical distribution of any geographical phenomenon reflects the nature of the relationship between the elements of this phenomenon and the geographical place in which they are distributed, so the geographical distribution of mobile phone towers reflects the nature of the relationship between the number of towers on the one hand and between the number of population and their density and the area of neighborhoods on the other hand in the study area and through Table (2) and map (4) We note that the district of Amara has come in first place by (35.9%) and the district of Magar ranked second by (15%) The district of Maymouna came in third place by (13.5%) while the districts of Kahla, Qal'at Saleh and Ali Al-Gharbi came in last place with percentages of (12.6 - 12 - 11%) respectively.

Table (2) Distribution of Asia Network towers according to the districts of Misan Governorate for the year 2021

district	Number of towers	Standard Grade	Category	%
Amara	74	0.124611	medium	35.9
Ali Al Gharbi	23	-0.03427	Very weak	11
Maymouna	28	-0.01869	Weak	13.5
Qal'at Saleh	24	-0.03115	Very weak	12
Magar	31	-0.00935	Weak	15
Kohla	26	-0.02492	Very weak	12.6
Total Governorate				

Asia cell Company, unpublished data

map (4) Distribution of Asia Network towers according to the districts of Misan Governorate for the year 2021



Source: From the researcher's work based on Table (2)

4.1. Efficiency of population coverage of Asiacell towers in Misan Governorate

Through Table (3), which shows the average of the service of one tower of the population, we can analyze the efficiency of the network in terms of its coverage of the population in the districts of Maysan Governorate by dividing it into four levels as follows:

- **The first level (high efficiency less than 2500 people)**

This level is represented by the western district of Ali Al Gharbi
, which comes in the first place in terms of high efficiency to accommodate one tower of the population, as one tower serves about (2496) people, and this high efficiency came as a result of the low population in it, where the population reached (57418) people and a population density of (60.3) people / km2 compared to its area, which amounted to (359685) km2.

- **The second level (medium efficiency of 2500-5000 people)**

This level includes the districts of Kahla - Maymouna - Qal'at Saleh, as the average of what one tower serves from the population within those districts by about (3698 - 4009 - 4864) people respectively, and the reasons for the low efficiency of accommodating one tower in the districts (Kahla and Maymouna and Qal'at Saleh) are due to the high number of their population, who reached about (90137 - 112273 - 116759) people with a population density of (101.1 - 118 - 122.8) people / km 2 compared to the number of towers as they reached about (26) - (28) - (24) telecommunications towers on Straight

- **Level III (low efficiency from 5000 to 8000 people)**

This level included the district of Magar, as it amounts to 5552 average of what one tower serves from the population within this district by about (172116) people, and the reasons for this decrease in the efficiency of accommodating one tower for the number of residents are attributed to the high number of residents within this district, where its population density reached about (181) people / km 2 compared to the number of towers distributed within the district, amounting to (31) communication towers

- **Fourth level (low efficiency 8000 people and more)**

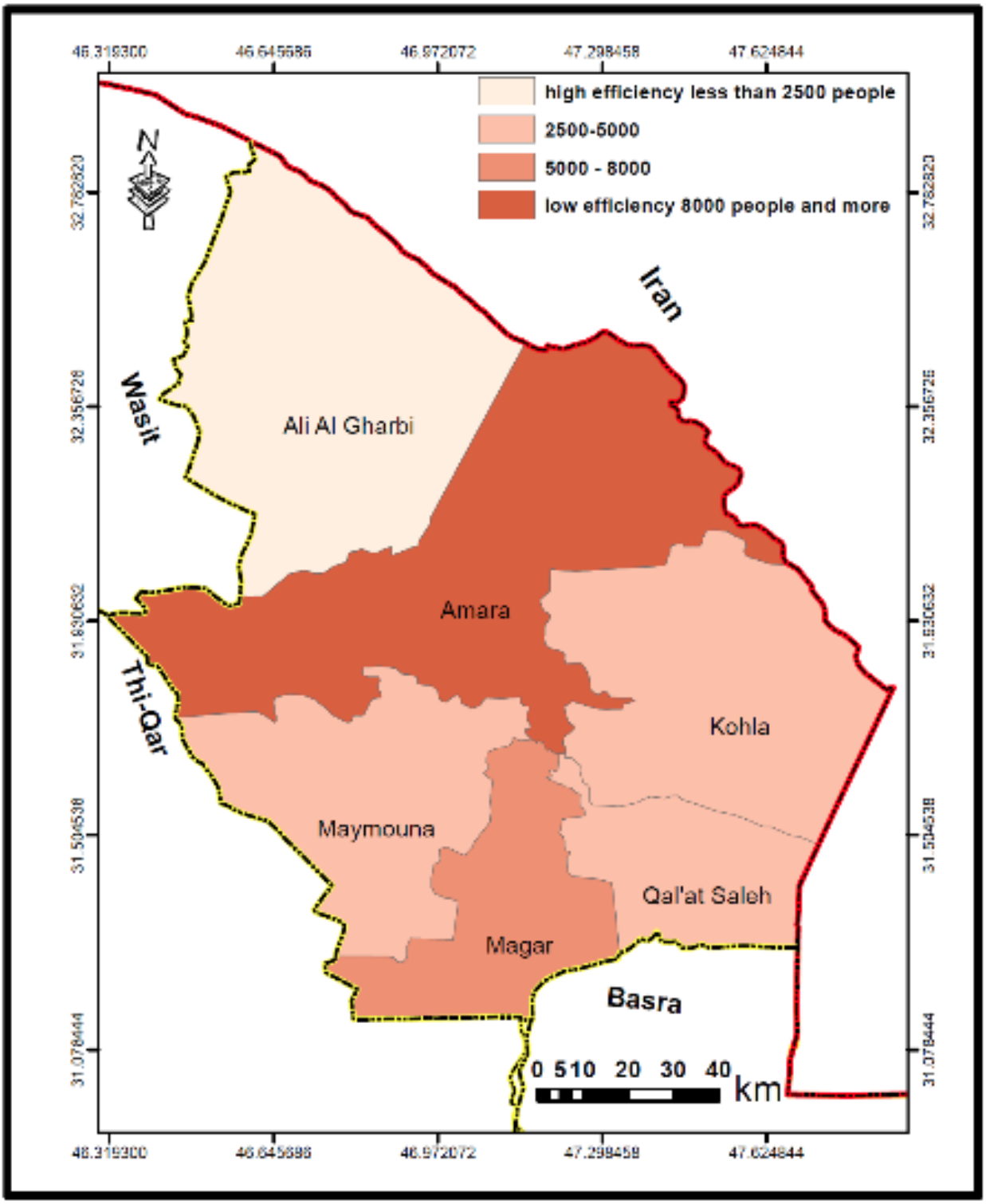
This level included the district of Amara because one tower within these districts serves an average of (8749) people, and the reasons for this low efficiency of accommodating one tower for the number of residents in the district of Amara to the high number of residents of the district, as it reached about (647435) people and a population density of (680.9) people / km 2 compared to the number of towers within the district, where it reached (74) towers for the Asiacell network Map (5)

Table (3) Average service per tower according to the number of residents in the Asia cell network by district of Misan Governorate for the year 2021

district	Population	district Area	Population density	Number of towers	Average of what serves one tower of inhabitants Nesma / tower
Amara	647,435	6287,07	680,9	74	8749
Ali Al Gharbi	57,418	3596,85	60,3	23	2496
Maymouna	112,273	2081,49	118	28	4009
Qal'at Saleh	116,759	1434,92	122,8	24	4864
Magar	172,116	1381,87	181	31	5552
Kohla	96,173	1289,80	101,1	26	3698
Total Governorate	1,202,175	16072	74.7	206	5835

Source: From the work of the researcher based on
Republic of Iraq, Ministry of Planning, Central Bureau of Statistics, Misan Governorate Statistics Directorate 2021

Map (5) Average service per tower according to the number of residents in the Asia cell network by district of Misan Governorate for the year 2021



Source: From the researcher's work based on Table (3)

5.Geographical distribution of cadastral coverage (serviced and unserved)

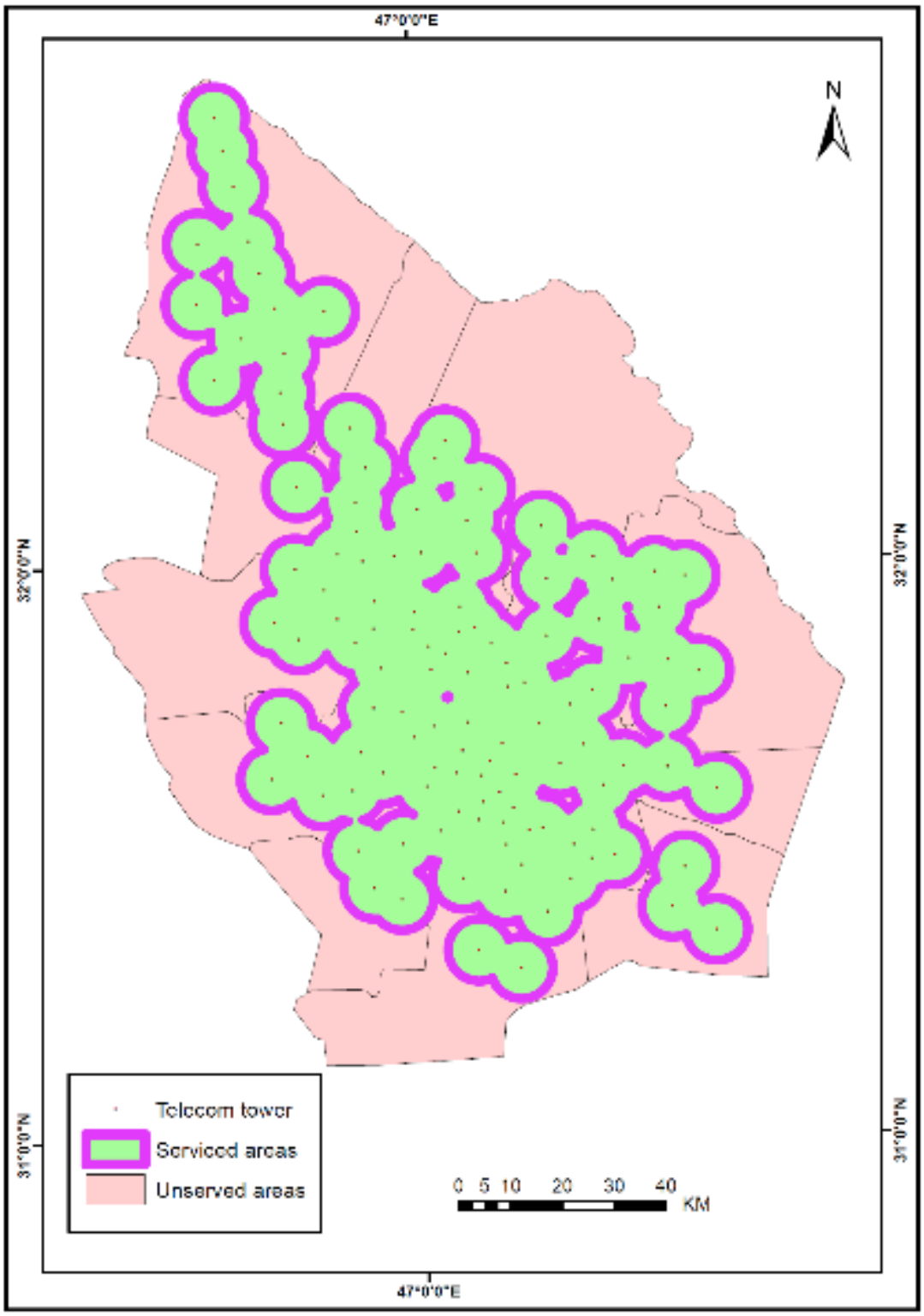
Through the analysis of the data of Table (4) and the map (6) we note that the area served throughout the province amounted to (11519) km 2, which occupied a percentage of (71.7) while the unserved area reached (4553) km 2, which occupied (28.3) of the total area of the governorate, either at the level of districts, the district of Qal'at Saleh ranked first by (88.85), while the second place was for the Magar district by (76.4), while the districts of Kahla and Maymouna ranked third by (75.9 - 75.5) on respectively, and came in last place the judges of Amara and Ali Al-Gharbi, as the percentage of their coverage in the network was about (67.3-66.6) respectively, has been the process of extracting and calculating the area of spatial coverage of the Asia cell communication towers at the level of the province as a whole and at the level of each district of its districts on the map using geographic information systems (GIS) through the program 10.8 Arc Map and relying on the analysis tool (Tools Analysis), which is the basis of spatial analysis of databases and for its multiple possibilities in analysis and through proximity analysis (Analysis Proximity) In particular, which includes several tools that are used to clarify the proximity of spatial phenomena to other spatial phenomena absolutely or proportionally according to the criterion of the specified distance, by knowing the distance around the phenomenon based on the special window to represent the spatial campus (Buffer) for one tower within the software environment, which helps us clarify the serviced spaces and the spaces that need towers to cover them, and the distribution of towers takes a different form in urban areas than rural areas in terms of the area of service provided to users Because urban areas have a small area that witnesses the concentration of the population, their high density and the diversity of land uses, and therefore we find that the coverage area served by one tower in urban areas ranges from (1-3) km2 and a larger area in rural areas where the coverage area reaches (10-15) km2

Table (4) Spatial distribution of the area covered and not covered by the network in Misan Governorate

district	district Area km2	covered Area km2	%	not covered Area	%
Amara	6287	4237	67.393	2050	32.607
Ali Al Gharbi	3597	2399	66.694	1198	33.306
Maymouna	2082	1572	75.504	510	24.496
Qal'at Saleh	1435	1275	88.85	160	11.15
Magar	1382	1057	76.483	325	23.517
Kohla	1289	979	75.95	310	24.05
Total Governorate	16072	11519	71.671	4553	28.329

Source: The work of the researcher based on a program Arc map 10.8

Map (6) shows the spatial coverage area of Asia cell telephone network towers in Misan Governorate 2021



Source: From the researcher's work based on Table (4)

6.Environmental impacts

Communication towers in the study area pose a problem for residents and the environment by installing them inside housing and government institutions, as environmental reports and studies revealed the environmental and health risks of towers erected on the roofs of residential houses in the middle of neighborhoods. It is a source of radiation that may cause certain types of cancer associated with increased electromagnetic sensitivity in some individuals. According to technical experts, the electromagnetic fields constitute a form of radiation harmful to the public health of humans and animals and the environment in general, and the impact of these fields on the health of the individual occurs when the individual is exposed to them, as the electromagnetic fields directly affect the tissues, as scientific research has found that this energy is absorbed by parts of the human body that use it, especially the face, and the rate of this absorption has been studied, as researchers pointed to the possibility of tumors in the brain in a way General, and the possibility of acoustic neuromas in particular, which result from the absorption of radio frequency waves by the head. The researchers confirm that health damage caused by cell phone towers and their impact can be divided as follows:

1- Electromagnetic emissions: Telecommunication towers emit mobile phone signals and other wireless communications, and these signals consist of electromagnetic emissions. There may be concerns about the impact of these emissions on public health and the environment, and electromagnetic radiation is divided into ionizing and non-ionizing radiation.

A. Ionizing rays are rays that have sufficient energy to cause the ionization process, which is a physical process to convert an atom or molecule into ions

by adding or removing charged particles such as electrons or other ions, which leads to changes in the reactions that occur inside the body, including DNA (Jabbara 2019, p. 80)

B. non-ionizing radiation (Non Aonizing Radiation is the rays that do not have enough energy to cause the ionization process, but they cause some thermal effects and there are four sources of them, which are natural sources and broadcast centers, such as mobile phone towers, electricity facilities and laser devices. It is also known as that part of the electromagnetic spectrum that is located within frequencies less than (10x3) 15 Hz, which has a photon energy so weak that it is not able to break atomic bonds. The mobile operates within the frequency range of (872-096) Megahertz and (1710 - 1875) Megahertz and (1920-2170) (Dhiyab 2012, p. 3) Megahertz This part of the spectrum includes both ultraviolet rays, infrared rays and visible light, as well as includes radio or radio frequency and microwave fields, and this part of the spectrum also contains very weak frequency fields as well as electric and magnetic static fields

2- Infrastructure and energy consumption: Telecom towers require certain infrastructure, including towers, wires, fans and other equipment. The construction and maintenance of this infrastructure may result in the consumption of natural resources such as energy and raw materials.

3. Wildlife: The wildlife surrounding communication towers may be affected as a result of changes in landscape and infrastructure, but this impact is usually limited. However, some large towers found in sensitive areas may affect the habitats of migratory birds or other animals that depend on these areas as migratory corridors.

7.Conclusions:

1- The number of mobile phone connection towers for Asia Cell Company in Maysan Governorate reached (206) towers, most of which were concentrated in the Amara district

2- Electromagnetic radiation has environmental risks and health effects that can be exposed to the population in the governorate, especially those near those towers, as a result of some diseases shown by some studies.

3- The need for communication services increases with the increase in the number of populations, and the concentration of the population in specific areas without others increases the pressure on those services, which leads to a decrease in their efficiency and adequacy for the population

8.Recommendations

1- Urging telecommunications companies to use alternative energy in operating towers and preserving the environment.

2- Close follow-up by the authorities responsible for monitoring the performance of mobile phone networks

3- The need for full compliance by mobile phone companies with environmental laws, standards and controls stipulated in the establishment and installation of towers and maintaining the reduction of electromagnetic radiation emission levels, and we also find that there is an extreme need to monitor and measure these radiations by the Ministry of Environment and its formations in the governorates periodically and hold violating companies accountable to reduce the health and environmental effects of those radiations.

4- Holding seminars and conferences related to educating the community about the harms of modern technologies, including mobile phone towers

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