



Advantage & Disadvantages of Electromagnetic Wave in Cell Phone

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Abstract:

In recent times, many people have expressed an interest in learning if the use of cell phones is associated with cancer. Many have heard or read about possible links between cell phones and cancer, but conclusions are rarely definitive. This paper will attempt to answer these questions, but first, we must develop a basic understanding of electromagnetic radiation (EMR)

Introduction

Cell phones represent a type of technology that has been around for little over fifty years. However, it has only been recently that many people began to use cell phones as a major part of their everyday life. In the past, cell phones were used by business people to conduct their business. In today's society, one member of every residence of the India owns a cell phone. Cell phones are interesting, useful and play a major role in our lives by bringing people closer together and keeping in constant touch with one another. However, most people do not understand the physics of a cell phone

Cell Phone

Cell phones are defined as sophisticated radios. They are a type of wireless

Communication device that uses many small cells with a base station and a cell phone tower at the center of each cell. These cells

have extensive frequencies that allow thousands of people to use cell phones at the same time. In this process, cellular calls are transferred from base station to base station as a user travels from cell to cell. For example, if you were traveling from New Haven to Rhode Island, your call would be transferred from several based stations along the way. Cellular phones use a short-wave analog or digital telecommunication in which a subscriber has a wireless connection from a mobile telephone to a relatively nearby transmitter and receiver in the base station.

Review literature of the Cell Phone

The basic concept of cellular phones began in 1947. Bell Laboratories introduced the idea of cellular communications in 1947 with the police car technology and Motorola was the first to incorporate the technology into portable device that was designed for use outside of an automobile. During that same year, AT&T proposed that the Federal Communications Commission (FCC) allocate a large number of radio-spectrum frequencies so that widespread mobile telephone service would become feasible and AT&T would have an incentive to research the new technology. However, broadcasting and sending a radio or television message out over the airwaves would come under (FCC) regulation. In 1968, the FCC changed its position by increasing, the frequencies allocation, freeing the airwaves for more mobile phones. AT&T and Bell Labs proposed a cellular system to the FCC of many small, low-powered, broadcast towers, each covering a 'cell' a few miles in radius



and collectively covering a larger area. Each tower was supposed to use only a few of the total frequencies allocated to the system. As the phones traveled across the area, calls would be passed from tower to tower.

Dr Martin Cooper, a former general manager for the systems division at Motorola, is considered the inventor of the first modern portable handset and made the first call on a portable cell phone in April 1973 to his rival, Joel Engel, Bell Labs head of research. In 1977, AT&T and Bell Labs constructed a prototype cellular system and a year later, public trials of the new system were started in Chicago with over 2000 trial customers. Two years later in 1979 a different undertaking, the first commercial cellular telephone system began operation in Tokyo. The seventies held great promise for cell phones.

In 1981, Motorola and American Radio Telephone started a second U.S. cellular radio-telephone system test in the Washington/Baltimore area. By 1982, the slow-moving FCC finally authorized commercial cellular service for the USA. Despite the incredible demand, it took cellular phone service 37 years to become commercially available in the United States. Consumer demand quickly outstripped the 1982 system standards and by 1987, cellular telephone subscribers exceeded one million and the airways were crowded. To stimulate the growth of new technology, the FCC declared during that year that cellular licensees could employ alternative cellular technologies in the 800 MHz band. In 1988, another group, the Cellular Technology Industry Association (CTIA) was established to work with the cellular service operators and researchers to identify new technology requirements and set goals to introduce a new

product by 1991. Shortly after, the Telecommunications Industry Association (TIA) created a standard specification based on the requirements the CTIA had recommended. The result was that wireless network divided them into time slots with each phone user having access to one time slot at regular intervals. These time slots will be discussed later in this unit.

How Cell Phones Work

The major component of the cell phone system is the cell. The cell phone system divides an area of service into a set of cells on what might look like a hexagonal grid. A phone tower or base station in the center of the cell covers an area of 2 or 3 square miles around the tower. Cell phones transmit to towers, which then connects you to the normal land based telephone system to route the call. In other words, a handoff has to happen when you move from one cell to another. A typical large city has hundreds of towers and each carrier in each city runs what is called a central office, known as the mobile telephone switching office (MTSO). For example, as you drive from one city to another every couple of miles, the system hands off to another cell. You don't realize that is happening because it is not noticeable. Let us look at what happens when someone calls you.

First, when you power up the phone, it listens for special frequencies (control channel) that the phone and tower use to talk to one another. If there are no control channels, the phone displays a message on service, because it knows it is out of range. Second, the phone transmits a registration request, so that the MTSO keeps track of your phone location in the data base. It is important for the MTSO to know which cell you are in



when it wants to ring your phone. Third, the MTSO gets the call, and it tries to find you by looking into the database to see which cell you are in. Fourth, the MTSO chooses a frequency pair that your phone will use in that cell to take the call. Fifth, the MTSO communicates with your phone over the control channel to tell it what frequencies to use and when your phone and the tower switch on those frequencies, you are connected and talking. And sixth, as you move toward the edge of the cell, the cell tower notes a diminishing signal. The diminishing signal indicates that it is time for the control channel to hands off you to the next cell.

Analog and Digital Signals

An analog signal has a base carrier's radio frequency signal, which is modified in some way to amplify the strength of the signal or vary the frequency to add information to the signal. An analog signal can be represented as a series signal to a signal carrier known as sine waves because carrier waves are analogous to the fluctuations of the human voice or other sound that is being transmitted.

Cell Access Technology

Cell phone networks use three common technologies: 1) Frequency-Division Multiple Access (FDMA); 2) Time-Division Multiple Access (TDMA) and Code-Division Multiple Access (CDMA).⁹

Frequency-Division Multiple Access (FDMA)

First the FDMA puts each call on a separate frequency. It separates the spectrum into distinct voice channels by splitting it into equal pieces of bandwidth and sending it out.

This is used mainly for analog and not considered to be effective.

TDMA assigns each cell a certain portion of time on a designated frequency. TDMA is a 30 MHz wide analog channel broken down into 6.7 millisecond time slices with each split into three time slots. Voice data is compressed to digital information with less transmission space than analog. TDMA is the access technology for the global communication system for mobile communication (GSM) and operates at 1.9 GHz in the U.S. It is used in digital cellular.

CDMA gives a unique code to each call and spreads it over the available frequencies by using spreading technology. Each phone will transmit on all the allotted frequencies. Each phone uses a different random number to decide which frequency. It will assign a code and will time stamp each signal. It uses the global positioning system (GPS) to get information.¹²

The Parts of a Cell Phone

If you take a cell phone apart, you find that it contains just a few individual parts, such as, an antenna, a liquid crystal display (LCD), a keyboard, a microphone, a speaker, and a battery. Inside the phone there is a circuit board. The circuit board is the heart of the system. Your journey through the computer chips on the circuit board would consist of three rooms. First you would enter in room analog-to-digital and digital-to-analog conversion chips which translate the outgoing audio signal from analog to digital and the incoming signal from digital back to analog. It can process millions of calculations per second in order to compress and decompress the voice stream. Then you would enter into the second room where the



digital signal processor (DSP) is located. Here in this room you would soon discover that the DSP is a highly customized processor designed to perform signal manipulation calculations at high speed. Next, you would enter the third room with the microprocessor. The microprocessor handles all the main functions for the keyboard and display, deals with command and control signaling with the base station (cell tower) and also coordinates the rest of the functions on the board. The read only memory (ROM) and Flash memory chips provide storage for the phone's operating system and customizable features, such as the phone directory. The radio frequency (RF) and power section handles power management and recharging, and also deals with the hundreds of FM channel. Finally, the RF amplifiers handle signals traveling to and from the antenna.

The Advantages and Disadvantages of Cell Phones

Advantages of Cell Phones

The cell phone is a wonderful invention and there are several advantages to cell phones. Cell phones have changed the way society thinks, operates and communicates. One advantage of cell phones is that it allows its users the advantage of a wider opportunity to communicate by a principle call frequency reuse. Through this principle the same frequency can be used by different cells without creating interference from other cells. Frequency can be used over and over. Cell phones operate within cells and can switch cells as the user moves around. Someone using a cell phone can drive hundreds of miles and maintain a conversation during the entire journey. In any cell, as many as fifty-six people can be talking on their cell phone at one time. This

seems to be a more efficient and effective way to communicate. A second advantage of cell phones is that they are small and easy to carry around.

Modern digital cell phones can process millions of calculations per second in order to compress and decompress the voice stream. Cell phones have full duplex. This means that you can use one frequency for talking and a second frequency, separate frequency for listening. Both people on a cell phone can talk at once. The cell phone can communicate on 1,664 channels or more. In addition, cell phones (TDMA) use a dual band. This means that it can operate in both 800 MHz and 1900 MHz bands.

Other advantages of us cell phones are that it gives you a wide variety of functions, for example, you can store information, make task or to-do lists, keep track of appointments and set reminders. Cell phones have a built-in calculator for math, you can send, receive calls, get information for a variety of sources, such as, news, entertainment, stock quotes, play simple games.

Cell phones have great influence in our everyday life and are convenient to have around. Cell phones are a faster and more effective way to transfer information. Some parents use cell phones to keep in contact with their children. Other uses it for business and to keep in contact with loved ones. Cell phones have played a vital role in bringing the world closer together. Indeed, it is an added resource that gives it user's great advantages.

Disadvantages of Cell Phones

There are some disadvantages of owning a cell phone. As mentioned earlier in this unit,



cell phones are those in which information is sent to one or more receiver by means of a modulated electromagnetic wave. Electromagnetic radiation can occur as a result of electromagnetic waves. The wavelength of electromagnetic wave determines its properties-rays, infrared microwaves, radio waves and light waves. The frequency of an electromagnetic wave is the number of cycle that occurs in one second.

There are concerns about cell phones like many other electronic devices. First, the cell phone physically has non-repairable internal parts that can corrode. For example if a cell phone gets wet, you may damage internal parts. Also, extreme heat in a car can damage the battery or the cell-phone electronics and extreme cold may cause a momentary loss of the screen display. Second, analog cell phones may have problems of cloning. Cloning means someone has stolen its ID numbers and makes long distance calls on the owner's account. Third, another disadvantage of cell phones is that it does not have the ability to provide the callers location like a land line telephone. If you do not know where you are, you can not be found, if in trouble, on a cell phone. The tower can be located, but the caller can not because cells use base stations and towers to hand off calls as the user moves from one location to another. Fourth, like all electromagnetic waves, radio waves contain vibrating, electric and magnetic fields. In free space, these electric and magnetic fields are constrained to be perpendicular to each other, and to the direction of propagation. The waves can also be polarized. For example, if the electric field vibrates only in the vertical direction, the wave is vertically polarized. This polarization will not change as the wave travels through free space. In urban areas,

radio waves are usually scattered by buildings and other large objects. This type of scattering effectively creates extra polarization states in all three spatial directions at a receiving antenna.

Sometimes cell phone calls in an area of tall buildings have a great deal of interference and dropped signals. The reason is because radio signals from the cell phones and towers all reflect back and forth between buildings around us. There echoes almost overlap at the antennas, but vary on points on the wave form from each reflection caused by the differing lengths the waves travel and the effect of reflection of various surfaces. This cause a great drop in signal strength and clarity and the signal may be dropped.

There are reasons to suspect that cell phone may cause cancer of the ear or brain tumors. The more individuals use cell phones and the greater the number of years used by them, the greater the risk of brain tumors. However, the mobile phone industry has long resisted any suggestion of a link to cancer, though it accepts that mobile phone radiation does affect the electrical activity in the brain. According to the Federal Drug Administration (FDA), who requires the manufactures of wireless phones to notify users of health hazards, there is not available evidence that show that any health problems are associated with using wireless phones. There is no proof, however, that wireless phones are absolutely safe.

Schools seem to be getting sick of cell phones interrupting the education of students. Many school districts are banning student's use of cell phones in school. School districts and law enforcement agencies say those electronic devices are used more often than not for drug related and gang related



activities. Students bringing cell phones to school have placed an awesome responsibility on teachers and other educators to provide a safe and orderly environment for students because of students' access to calls in schools and especially in classrooms. Students bringing cell phones to school can be faced with too many temptations that interfere with their schooling.

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