Mobile Phone. How it works?

A mobile phone is an electronic device used for mobile telecommunications over a cellular network of specialized base stations known as cell sites. A cell phone offers full Duplex Communication and transfer the link when the user moves from one cell to another. As the phone user moves from one cell area to another, the system automatically commands the mobile phone and a cell site with a stronger signal, to switch on to a new frequency in order to keep the link.

Mobile phone is primarily designed for Voice communication. In addition to the standard **voice function,** new generation mobile phones support many additional services, and accessories, such as SMS for text messaging, email, packet switching for access to the Internet, gaming, Bluetooth, camera with video recorder and MMS for sending and receiving photos and video, MP3 player, radio and GPS.

Signal Frequency in Cell Phone

The cellular system is the division of an area into **small cells**. This allows extensive frequency reuse across that area, so that many people can use cell phones simultaneously. **Cellular networks** has a number of advantages like increased capacity, reduced power usage, larger coverage area, reduced interference from other signals etc.

FDMA and CDMA Systems

Frequency Division Multiple Access (FDMA) and **Code Division Multiple Access** (CDMA) were developed to distinguish signals from several different transmitters. In FDMA, the transmitting and receiving frequencies used in each cell are different from the frequencies used in the neighboring cells. The principle of CDMA is more complex and the distributed transceivers can select one cell and listen to it. Other methods include **Polarization Division Multiple Access** (PDMA) and **Time Division Multiple Access** (TDMA). Time division multiple access is used in combination with either FDMA or CDMA to give multiple channels within the coverage area of a single cell.

Codes in the Mobile Phone

Mobile phones have special codes associated with them. These include

1. **Electronic Serial Number (ESN)** -Unique 32-bit number programmed in the phone
2. **Mobile Identification Number (MIN)** - 10 digit number derived from the phone's number.
3. **System Identification Code (SID)** – unique 5 digit number that is assigned to each carrier by the FCC.

ESN is a permanent part of the phone while MIN and SID codes are programmed in the phone when a service plan is selected and activated.

Mobile phone is a **Duplex device**. When we use one frequency for talking, a second separate frequency is used for listening. So that both the people on the call can talk at once. The Mobile phone can communicate on **1,664 channels** or more. The Mobile phones operate within the cells, so that it is easy to switch on to different cells as they move around. A person using a cell phone can drive hundreds of kilometers and can maintain a conversation during the entire time because of the cellular approach.

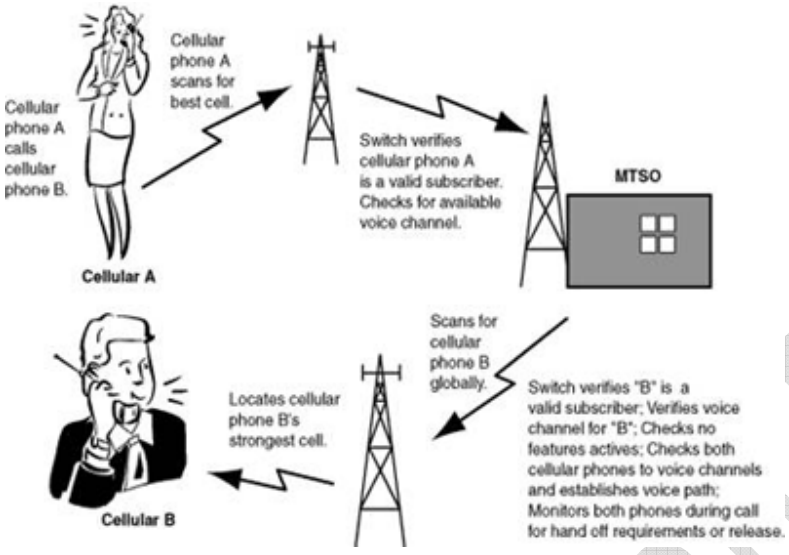
Activation of SIM Card

SIM card (Subscriber Identification Module (SIM)) is a type of **Smart card** used in mobile phone. The SIM is a detachable smart card containing the user's subscription information and phone book. This allows the user to retain

6. When the Mobile phone move toward the edge of the cell, the cell's base station will note that the signal strength is diminishing. At the same time, the base station in the cell in which the phone is moving will be able to see the phone's signal strength increasing.

7. The two base stations coordinate themselves through the MTSO. At some point, the Mobile phone gets a signal on a control channel and directs it to change frequencies. This will switch the phone to the new cell.

Mobile Network



The GSM System

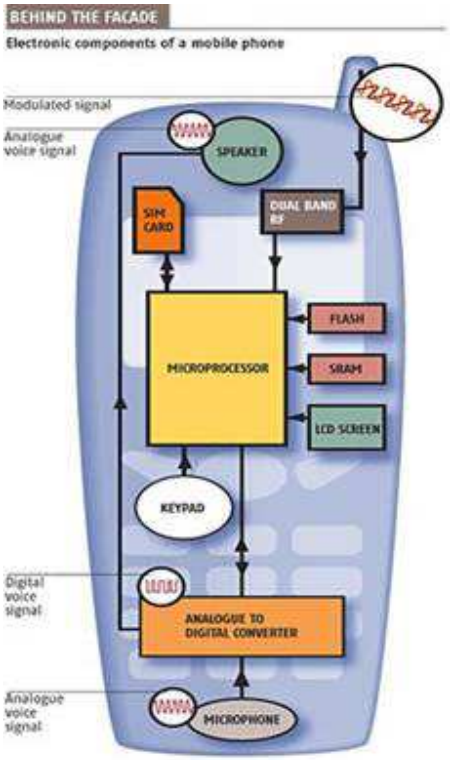
Global System for Mobile Communications is the standard for mobile telephone systems in the world. In GSM, the signaling and speech channels are **digital**, therefore GSM is considered a **2G** (Second Generation) system. This helps wide-spread implementation of data communication applications. There are five different cell sizes in a GSM network These are macro, micro, pico, femto and umbrella cells. Macro cells are cells where the base station antenna is installed on a mast above average roof top level. Micro cells are cells whose antenna height is under average roof top level. Pico cells are small cells whose coverage diameter is a few dozen metres. These are mainly used in indoors applications. Femto cells are cells designed for use in residential or small business environments and connect to the service provider's network via a broadband internet connection. Umbrella cells are used to cover shadowed regions of smaller cells and fill in gaps in coverage between those cells. Horizontal radius of the cell varies depending on the antenna height, antenna gain and propagation conditions. Maximum distance the **GSM supports** is 35 kilometers. Most 2G GSM networks operate in the **900 MHz or 1800 MHz bands** while 3G GSM in the 2100 MHz frequency band.

Time Sharing

Time Division Multiplexing technique is used to share eight full-rate or sixteen half-rate speech channels per radio frequency channel. There are eight radio time slots grouped into a TDMA frame.

Mobile Network

Mobile phone converts voice, text, multi-media messages or data calls into Radio Frequencies (RF). Mobile phone base stations transmit and receive these RF signals and connect callers to other phones and other networks. Mobile phone network is divided into thousands of overlapping, individual geographic areas or 'cells', each with a base station. The size of a cell depends on the area of coverage and the number of calls that are made in that area. The smallest cells



The circuit board is the heart of the Mobile phone. It has chips like **Analog-to-Digital and Digital-to-Analog** conversion chips that translate the outgoing audio signal from analog to digital and the incoming signal from digital back to analog.Following are the **Chips** present in Mobile phone.

1. **Digital signal processor**

It is generally rated as having 40 MIPS (millions of instructions per second) to conduct calculations of signal manipulation at high speed. This chip deals with both compression and decompression of the signals.

2. **Microprocessor**

It handles all the **housekeeping tasks** for the keyboard and display. It also deals with command and control signaling with the base station, and coordinates the rest of the functions on the board.

Precautions

Mobile phone is an **excellent communication device**. Mobile radiation defects occur only if it is used for **prolonged time**. Controlled use for communication purpose is always safe. Mobile phones emitting radiation **below 2 watts** is completely safe. Still, precautionary measures are always good, even though there are fewer case studies in this matter. Try to consider mobile phone as a **communication device** and not an **entertainment device**. Even if you are not talking, mobile phone is emitting strong signals to keep link with the base station having strongest signal.

Consider some of the precautionary measures :

1. Do not use mobile phones more than 10 minutes continuously. During conversation, mobile phone will release bursts of energy to keep link with the strongest base station.
2. Try to use the mobile phone maximum one hour per day. If you want to use it more than this , use Bluetooth or Head phones.
3. Keep mobile phone away from bed while sleeping. It may affect your sleep physiology.
4. Don't give mobile phone to children. Radiation hazard is more in children than adults.
5. Do not attend mobile phone while driving or operating machinery. It will increase the cognitive load and reduce the reaction time leading to accidents.
6. Do not use mobile phone near petrol outlet and LPG cylinder. The static electricity in the atmosphere may explode by accepting radiation from the mobile phone. This may cause fire.
7. Do not use mobile phone when it is connected to charger. Electricity problems may cause shock hazards.
8. Do not use mobile phone when there is lightning.
9. Do not over charge, mobile battery. It may reduce its life. Charge battery only when it's charge level reduces below 40 percent.
10. Do not send unwanted images or texts through sms or mms. It is an offence

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