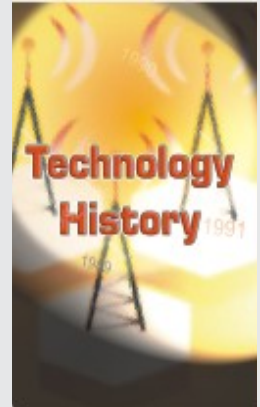## GSM (Global System for Mobile Communications)

GSM is an open, Digital Cellular Technology used for communication (voice and data) services. GSM differs form first generation wireless systems in that it uses digital technology and time division multiple access transmission methods. GSM is a circuit switched system. GSM operates in the 500MHz and 1800<Hz bands and the 1900MHz PCS band. GSM supports data transfer speeds of up to 9.6kbit/s, allowing the transmission of basic data services such as SMS (Short Message Service) Another major benefit is its international roaming capability, allowing users to access the same services when traveling as at home.

Technology History

In the beginning of the 1980s several different systems for mobile communications were developed in Europe.

The need for a common system that allowed roaming between countries was early recognized. In 1982 a number of European countries created a new standardization organization called "Group speciale Mobile" (GSM). The mandate of this group was to develop a standard to be common for the countries that created it. In 1988 te GSM was included in the European Telecommunication standards institute (ETS) and the standards developed by GSM thus became standards for all telecommunication administrations in Europe.

The radio interface

The radio interface in GSM uses a combination between Frequency (FDMA) and Time (TDMA) Division multiplexing. The frequency division in GSM 500 allocates 124 channels (frequencies) in each direction for GSM. The uplink (MS to BTS) frequencies are in the area 890-915MHz and the downlink (BTS to MS) frequencies are 95-960MHz. The carrier frequencies are separated with 200KHz on each side.

Each of the carrier frequencies are divided into 8 logical channels, and using TDMA.

A TDMA frame-contanis one time frame from each of the eight channels, and lasts 4.615 rms. The time frames from each channel lasts D.577ms. The total bit rate for all channels is 270.833 K bit/s, where as the bit rate for each channel is 22.8 bit/s.

GSM 900: 890-915MHz paired with 960MHz (124 Channels)
EGSM900: 880-915MHz paired with 925-960MHz (174 Channels)
GSM 1800: 1710-1785MHz paired with 1805-1880MHz (374Channels)
GSM 1900: 1850-1910MHz paired with 1930-1990MHz

Frequency & Channel list GSM900

CH	TX	RX
0	990	935
1	990.2	935.2
2	990.4	935.4
3	990.6	935.6
4	990.8	935.8
5	991	936
6	991.2	936.2
7	991.4	936.4
8	991.6	936.6
9	991.8	936.8
10	992	937

SMS

Short message service (SMS) are 160 character alphanumeric messages with a capacity of 640 b/s, when can be sent from any GSM mobile phone to another or to multi phone.

SMS is sent using SDCCH (Stand alone Dedicated Control Channel) This means they can be sent/received during on going call. The Short Message Service Center (SMSC) stores & forwards the SMS to the destination through the network.

Now a days SMS are more versatile means of indication of events such as email message, voice mail is switching applications.

To know, how to use SMS for switching, check our products.
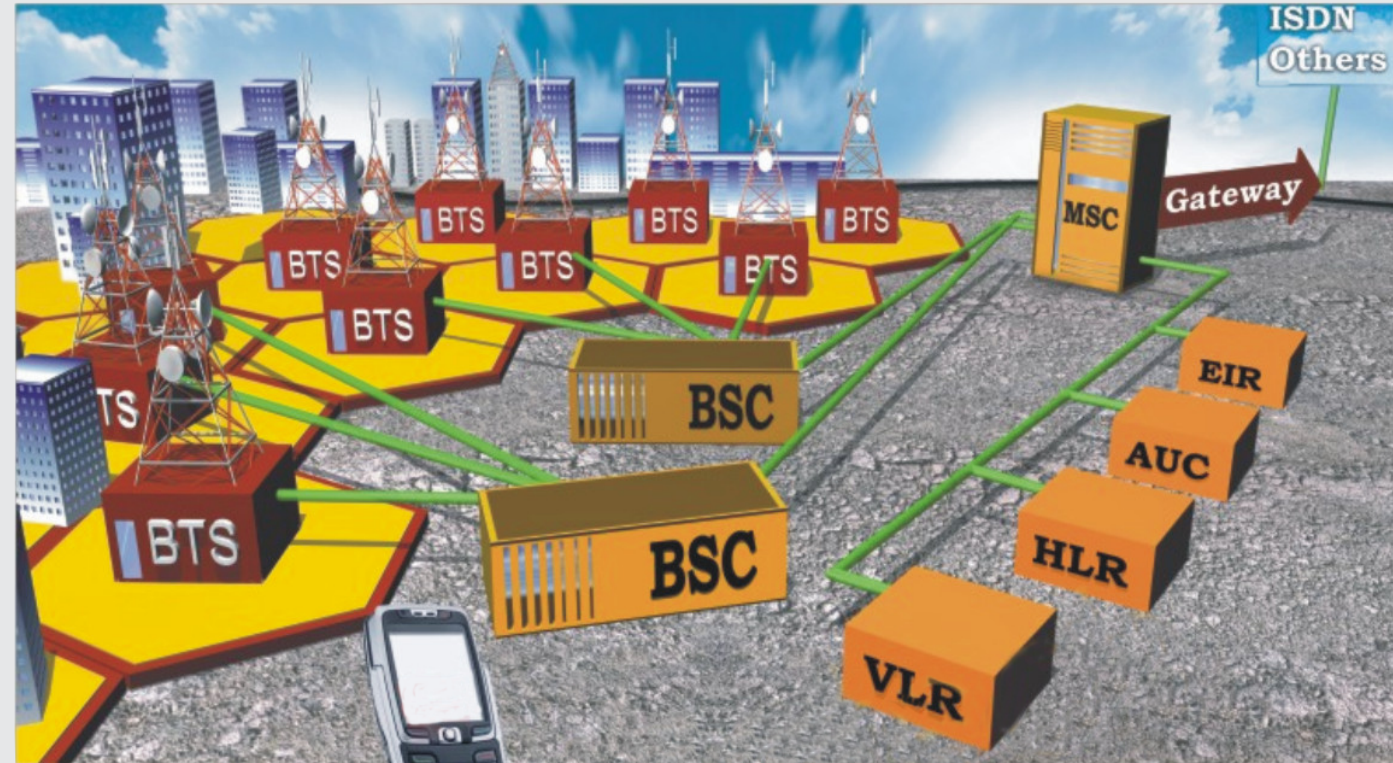
GSM Network Elements

! BTS : Base Transceiver Station
! BSC: Base Station Controller
! MSC: Mobile Switching Center
! HLR: Home Location Register
! VLR: Visitor Location Register
! ER: Epuipment Identity Register
! AUC: Authentication Center

Base Transceiver Station (BTS) Base Station

! Responsible for communication to and from Mobile statio
! BTS comprises radio transmission and reception devices including the antenna and signaling processing.
! BTS separates the speech and control signaling associated with a Mobile Station and sends them to the BSC on separate channels.

Base Station Controller (BSC)

! Monitor and control of BTS's change functions.
! Frequency administration, control of BTS exchange function
! Responsible for all the radio interface management.
! BSC is the interface between MCS and BTS

Mobile Switching Center (MSC)

! Retrieves data to manage subscribers form HLR, VLR, AUC
! Call Routing
! Billing Records
! Traffic & resource management with in the service area

Home Location Register (HLR)

! Man Database for subscriber information maintained on servers.
! Manages subscriber profiles, location & activity
! It can serve one or more MSC.

Visitor Location Register (VLR)

! Linked to MSC
! Stores temporary mobile station (mobile phones) information with in the area served by the MSC.
! MSC refers to VLR each time a mobule station

Equipment Identity Register (EIR)

! Ensures that all mobile equipments or mobile phones in the PLMN are authored to function.
! Maintains list of approved IMEI ranges & blocked

Authentication Center (AUC)

! Secured Database for authentication & encryption
! Generates & sends a random mobile number to the mobile equipment, which in turn performs calculate against it with a number stored in SIM card & sends back the result.

SIM

The SIM is a smart card. By inserting the SIM card into the mobile phone, the user have access to all the subscribed services. Without SIM card, the terminal is not operational. The SIM card is protected by a four digit Personal Intensification number (PIN). In order to intensify the subscriber to the system, the SIM card contains some parameters the user such as its international mobile Subscriber Identify (IMS). Another advantage of the

MCC   MNC   MSIN

MCC: Mobile Country Code
MNC: Mobile Network Code
MSIN: Mobile Station Identification Number

Each mobile subscriber is identified by an interactional Mobile Subscriber Identity. As shown in figure the IMSI is composed by a -digit Mobile Country Code (MCC) which intensifies the country, a 2-digit Mobile Network Code (MNC) which identifies the GSM network within that country and a MSIN of up 10 digits. The MSIN uniquely intensifies the subscriber within one network.

What happens when a GSM Mobile phone is switched on?

When a mobile first turns on, it searches all 124 channels in the downlink for signals. It will then order the channels by received signal strengths and check to determine it the channel was a BHC (Broadcast channel). Once it Mobile station/phone finds a BCH, it adjust internal frequency and timing from the frequency correction channel (FCH) and synchronization channel (SCH), then checks to determine if the BCH is from its public land mobile network (PLMN). This involves comparing the allowed network and country codes stored on the SIM card with the information encoded on the BCCH. The mobile repeats this cycle until a good broadcast channel is found. Once the mobile has synchronized to the BTS, determined that it's allowed to use the network. All BTS produce a broadcast channel (BCH) which is on all the time and can be viewed as a lighthouse beacon. The BCH signal is received by all mobile in the cell, whether they are on call or not, in order to.

1. Allow mobile to find the GSM network
2. Allow the network to identify which BTS is closest to a given mobile
3. Allow coded information like the network identify (e.g. Airtel, BSNL) to be known
4. Allow paging of message to any mobile needing to accept a phone call, and a variety of other information

The frequency channel used by the BCH is differnet in each cell.

10903A - Mobile Phone Trainer

Mobile Phone Trainer provides basic theory & working fundamentals of a 2G handset based on the most popular handset. It provides network power supply, charging & user interface circuit's for their detailed block wise study.

Features

* Real time mobile operation * Full explaination of mobile phone working * Frequency measurement and band verification * Provides study of all sections in mobile phone * TX/RX Frequency measurement * 2G technology & GMSK signals * GSM data rate * Detail study of User Interface Control signals * Detail study of SIM operation * Battery identification and charging study * Switched Faults

10939 - GSM Mobile Trainer Kit

GSM Mobile Trainer Kit is an easy medium of learning the fundamental concept of Mobile communication like GSM, GPRS. The main focus of MCLS is in opening up a whole new world for you, mobile communication concepts like Call setup,call forward, SMS, voice, data and other Network protocols are also experimented on vis-à-vis the existing environment.

Features

* Remote control by AT commands (GSM 07.07 and 7.05)
* Baud rate from 300 to 115,200 bits/s, Auto baud.
* Appropriate test points at various stages.
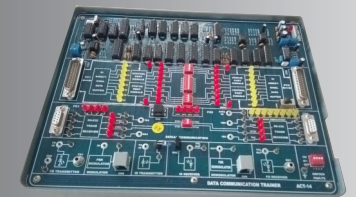
40628 - Data Communication Trainer

Accessories:

*Blue Short Links (10"): 8 Nos. * RS-232 Serial Cable: 02 Nos. * DB25 Parallel Port Cable: 2 No * RJ11-RJ11 Connector Cable : 02 Nos. * Plastic Fiber Cable Multimode: 01 Meter. * Experimental Manual: 01 No. * Power Supply Cable: 01 No.

List of Experiments:

l*Study of Serial and Parallel Port. *Study of Serial Communication. *Study of flow controls in Serial Communication. *Study of Protocols in Serial Communication. *Study of Fiber optic Communication. *Study of Modem Communication. *Study of Wire less Communication. *Study of Parallel Communication. *Study of Printer Interface using Parallel Port.

40501	40502	40516	40519	40536	40555A	40557	40625
Amplitude Modulation & Demodulation	Frequency Modulation & Demodulation	DSB / SSB Amplitude Modulationcation	Advanced Frequency Modulation & Demodulation	PAM-PPM-PWM Modulation & Demodulation	Local Area Network Trainer	Advanced Communication System	DPCM/ADPCM Modulation/Demdulation