Ethiopian TVET-System

ELECTRONIC COMMUNICATION AND MULTIMEDIA EQUIPMENT SERVICING Level II

Based on May 2011 Occupational Standards

October, 2019

Module Title: Servicing and repairing mobile phones

TTLM Code: EEL CMS2TTLM 1019 v1

This module includes the following Learning Guides

LG22: Prepare Unit and Workplace

LG Code: EEL CMS2MO7 LG22

LG23: Diagnose Faults of Cellular Phone Unit

LG Code: EEL CMS2Mo7 LG23

LG24: Service/repair cellular phone unit

LG Code: EEL BEC2 M07 LG24

LG25: Test Repaired Unit

LG Code: EEL BEC2 MO7 LG25

LG26: Install additional/ enhancement features

LG Code: EEL BEC2 MO7 LO5LG26

Instruction Sheet	LG22: Prepare Unit and Workplace

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Prepare unit and workplace
- Diagnose faults of cellular phone unit
- Service/repair cellular phone unit
- Test repaired unit
- Install additional/ enhancement features

Install additional/ enhancement features. This guide will also assist you to attain the learning outcome stated in the above. Specifically, upon completion of this Learning Guide, first learning outcome you will be able to –

- Workplace is set/arranged for repair job in line with the company requirements and standards
- Necessary tools, test instruments and personal protective equipment are made ready in line with job requirements
- Service manuals and service information required for repair/maintenance are acquired   at commencement of activities
- Repair/maintenance history of the unit is properly verifie

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described below
3. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the "Self-checks" in each information sheets.
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
6. If you earned a satisfactory evaluation proceed to "Operation sheets and LAP Tests if any". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity.
7. After you accomplish Operation sheets and LAP Tests, ensure you have a formative assessment and get a satisfactory result;
8. Then proceed to the next Learning guide.

| Information Sheet #1	set/arrange workplace for repair job in line with the company requirements and standard

INTRODUCTION

1.1. **Mobile Phones**

1.1.1 Types of mobile phone

a. Mobile Phone Vs Cell Phone – What is the Difference?

A cell phone can be a mobile phone but a mobile phone may not necessarily be a cell phone. For *e.g.* a satellite phone is a mobile phone but not a cell phone. Let us understand in detail.
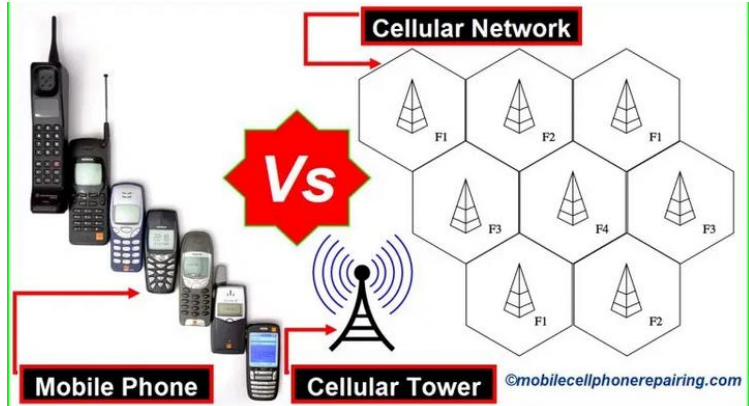
Before we discuss the types of mobile phones, let us first look at the meaning of a mobile phone.

b. What is a mobile phone?

I. *A mobile phone* is a portable telephone to make and receive wireless phone calls. This can be done either by using radio frequency transmitting towers called base station or cell site. Phone calls over a mobile phone can also be done using satellite. These phones can be Mobile (*Portable*) or Fixed Site Satellite Phones.

II. *A mobile phone* is a handheld device that allows you to make and receive telephone calls while you move around a wide geographical area. A mobile phone also supports several other functions, such as text messaging, email and internet access, photography, money transfer, banking, and so on.

c. What is a Cell Phone?

A cell phone is a mobile phone (*not satellite mobile phone*) that works on radio frequency transmitted from one cell to another and is controlled by antenna systems on cell phone towers. It will be much clear when you read the below chapter on cellular network.

fig1.1

d. What is a Cellular Network?

A cellular network is a network of wireless links. An area on Earth is divided into cells. Shape of these cells can be hexagonal, square, rectangular, circular or any other shapes. But hexagonal shape is most preferred to create cells of a cellular network. Each of these cells has their own base transceiver stations. These base stations provide wireless network coverage to the cell. These wireless frequencies can be used for transmission of voice, data, FM radio content etc. Different set of frequencies are used by each cell to avoid conflict with the neighboring cells.

When a number of cells are joined together, they provide wireless radio frequency coverage to a large area. This is how wireless devices or transceivers (*Transmitter and Receiver*) like mobile phone, tablets, smartphones, modem etc work.
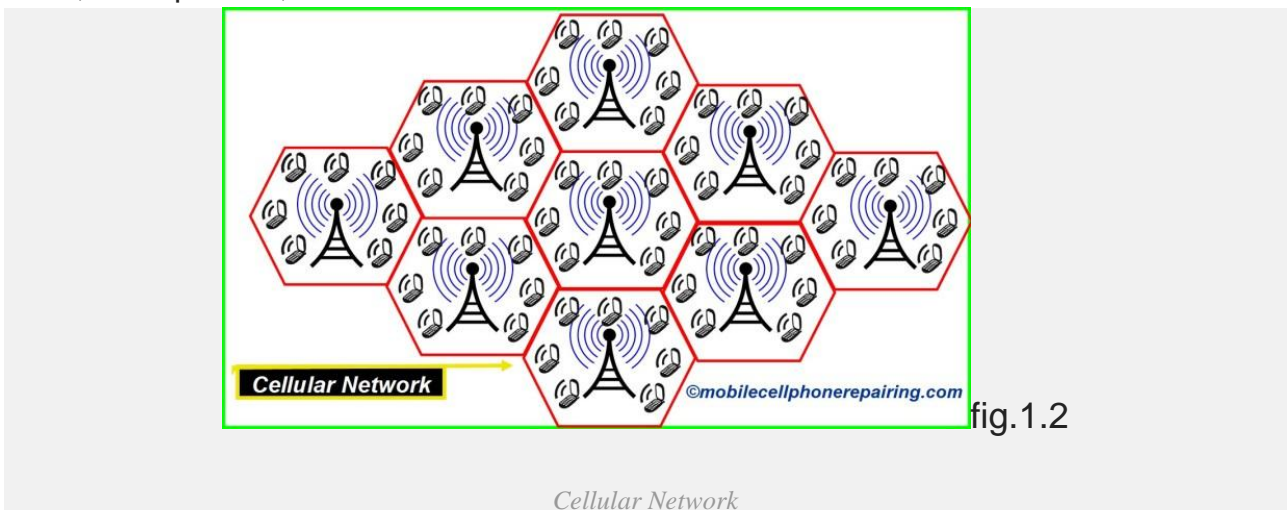

fig.1.2

Cellular Network

1.1.2 Mobile Phone Vs Cell Phone – What is the Difference?

Well, the British people call it a Mobile Phone while the Americans call it a Cell Phone. I named

this site "*Mobile Cell Phone*". Look at the URL.
To avoid the conflict, now we have Smartphone. Mobile phone and cell phone are gone now, so no more conflict.

a. What is a Satellite Phone – Mobile Phone or Cell Phone?

A satellite phone can be either a portable mobile phone or a Fixed Site Satellite Phone. But it is not a cell phone because it does not work using any cellular network. It transmits and receives radio frequency directly from satellites orbiting around Earth.

fig1.3

1.1.3 Types of Mobile Phones

There are many different types of mobile phones available in the market

Fig1.4

. Which ones do you know? Take 2 minutes to think about it and then complete the following activity.

> ## What is a form factor?

A **form factor** refers to the size, style, and shape of a mobile phone, as well as to the layout and position of the phone's major components. There are four major forms of mobile phones, namely:

- The bar phone,
- The touch screen phone
- The flip phone, and
- The slider phone.

Let us look at each form in further detail starting with the bar phone

b. The Bar Phone

A bar phone is also known as the slab, block, or slate phone. It takes the shape of a cuboid, usually with rounded corners and/or edges. The name is derived from the rough resemblance to a candy bar in size and shape, see Figure 1 below.

Figure 1: 5A bar phone

c. The Flip Phone

A flip or clamshell phone consists of two or more sections that are connected by hinges, as shown in figure 3. The hinges allow the phone to flip open and fold to close in order to become more compact. When flipped open, the phone's speaker and microphone are placed closer to the operator's ear and mouth, thereby improving usability.

Figure 1.6A flip phone

d. The Touch screen Phone

A touch screen, or slate phone is a subset of the bar form. Like the tablet computer, a touchscreen phone has minimal buttons and instead relies on an electronic visual display known as a touch screen. It also has an onscreen QWERTY keyboard.

Figure 1.7 Touch screen phone

1.2 Parts of a Conventional Mobile Phone

A mobile phone has several parts or components. It is important for you to know the parts and understand their functions so that you can easily diagnose and solve problems. How many parts of a mobile phone do you know? Take a minute to think about it and then complete the following activity

Table 1.1: Parts of a mobile phone and their functions

Parts of a mobile cell phone	Functions
Keypad	Used for inputting or entering data into the phone. It is connected directly to the CPU
Ear piece	Converts the electric signal to a sound signal
Mouth piece	Transmits sound from one phone to another
Battery	Source of power supply to a mobile phone
Power switch	Switches the phone on and off
Power IC	It takes power from the battery and supplies to all other parts of a mobile phone
Oscillator	It creates frequency during outgoing calls
Screen or display	Displays data. It is connected to the CPU to receive following signals : LCD Data Signal,

	LCD Reset Signal, LCD WR Signal, LCD RD Signal, LCD FLM Signal, LCD HSYN Signal etc.
Flash IC	Stores the software and other programs installed in the mobile phone
Charging IC	Takes the current from the charger and charges the battery
CPU	Controls all sections of a mobile phone
Antenna	Receives and transmit radio frequencies and helps the phone to connect to the cellular network

Figure 5 below shows a printed circuit board (PCB) of a mobile phone showing the different internal parts. As you can see from this diagram the PCB is divided into two parts, the network section and the power section. The network section controls the incoming and outgoing phone calls, while the power section controls the memory and power related functions of the phone.
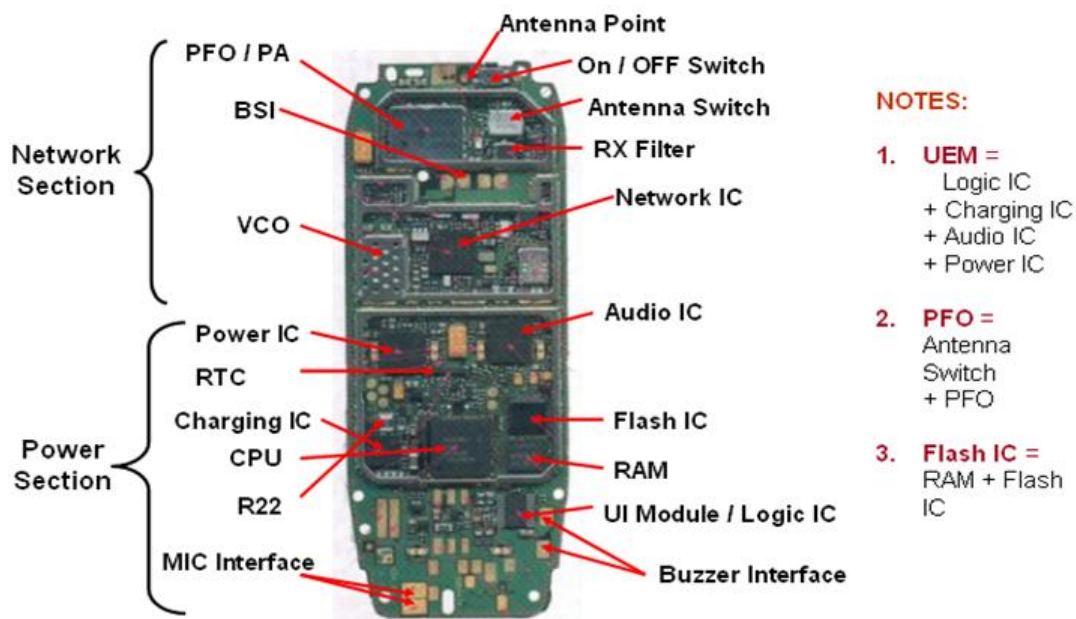

fig1.8

1.2.1 Big Parts of a Mobile Cell Phone and Their Function
1. Antenna Switch
It is found in the Network Section of a mobile phone and is made up of metal and non-metal. In GSM sets it is found in white color and in CDMA sets it is found in golden metal.
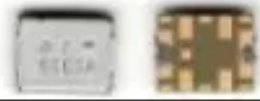
Antenna Switch

fig1.9

Work / Function: It searches network and passes forward after tuning.

Faults: If the Antenna Switch is faulty then there will be no network in the mobile phone

2. P.F.O

It is found near the Antenna Switch in the Network Section of the PCB of Mobile Phone. It is also called P.A (Power Amplifier) and Band Pass Filter.

PFO

Fig 1.10

Work / Function: It filters and amplifies network frequency and selects the home network.

Faults: If the PFO is faulty then there will be no network in the mobile phone. If it gets short then the mobile phone will get dead.

3. RF IC / Hagar / Network IC

This electronic component found near the PFO in the Network Section of a Mobile Phone. It is also called RF signal processor.
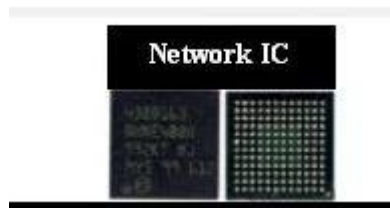

Network IC

fig1.11

Work / Function: It works as transmitter and receiver of audio and radio waves according to the instruction from the CPU.

Faults: If the RF IC is faulty then there will be problem with network in the mobile phone. Sometime s the mobile phone can even get dead.

4. 26 MHz Crystal Oscillator

It is found near the PFO in the Network Section of a Mobile Phone. It is also called Network Crystal. It is made up of metal.
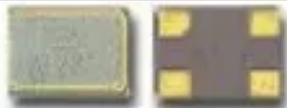

fig1.12

Work / Function: It creates frequency during outgoing calls.

Faults: If this crystal is faulty then there will be no outgoing call and no network in the mobile phone.

5. VCO

It is found near the Network IC in the Network Section of a Mobile Phone.

fig1.13

Work / Function: It sends time, date and voltage to the RF IC / Hager and the CPU. It also creates frequency after taking command from the CPU.

Faults: If it is faulty, then there will be no network in the mobile phone and it will display "Call End" or "Call Failed".

6. RX Filter

It is found in the Network Section of a Mobile Phone.

fig1.14

Work / Function: It filters frequency during incoming calls.

Faults: If it is faulty then there will network problem during incoming calls.

7. TX Filter
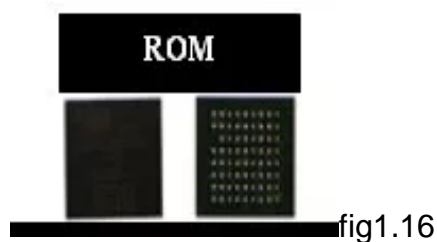
It is found in the Network Section of a Mobile Phone.

fig1.15

Work / Function: It filters frequency during outgoing calls.

  Faults: If it is faulty then there will network problem during outgoing calls.

8. ROM

It is found in the Power Section of a Mobile Phone.

fig1.16

Work / Function: It loads current operating program in a Mobile Phone.

Faults: If ROM is faulty then there will software problem in the mobile phone and the set will get dead.

9. RAM

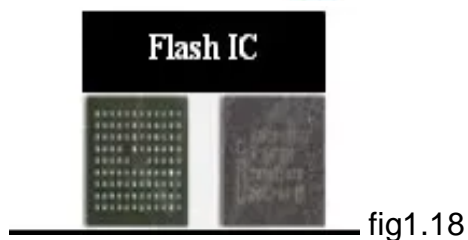It is found in the Power Section of a Mobile Phone.

fig1.17

Work / Function: It sends and receives commands of the operating program in a mobile phone.

Faults: If RAM is faulty then there will be software problem in the mobile phone and it will get frequently get hanged and the set can even get dead.

10. Flash IC

It is found in the Power Section of a Mobile Phone. It is also called EEPROM IC, Memory IC, RAM IC and ROM IC.

fig1.18

Work / Function: Software and IMEI Number of the mobile phone is installed in the Flash IC.

Faults: If Flash IC is faulty then the mobile phone will not work properly and it can even get dead.

11. Power IC

It is found in the Power Section of a Mobile Phone. There are many small components mainly SMD capacitor around this IC. RTC is near the Power IC.
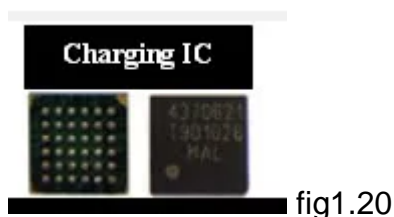

fig1.19

Work / Function: It takes power from the battery and supplies to all other parts of a mobile phone.

Faults: If Power IC is faulty then the set will get dead.

12. Charging IC

It is found in the Power Section near R22.

fig1.20

Work / Function: It takes current from the charger and charges the battery.

Faults: If Charging IC is faulty then there will be battery not charging problem and the set will not get charged. If the Charging IC is short then the set will get dead.

13. RTC (Simple Silicon Crystal)

It is Real Time Clock and is found in the Power Section near Power IC. It is made up of either metal or non-metal. It is of long shape.

fig1.21

Work / Function: It helps to run the date and time in a mobile phone.

Faults: If RTC is faulty then there will be no date or time in the mobile phone and the set can even get dead.

14. CPU

It is Central Procession Unit of the Phone and is found in the Power Section. It is also called MAD IC, RAP IC and UPP. It is the largest IC on the PCB of a Mobile Phone and it looks different from all other ICs.
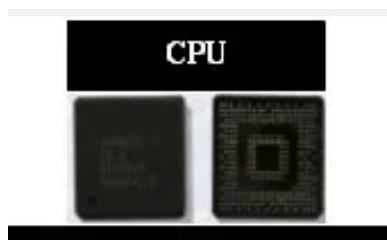

fig1.22

Work / Function: It controls all sections of a mobile phone.

Faults: If CPU is faulty then the mobile phone will get dead

15. Logic IC / UI IC

It is found in any section of a mobile phone. It has 20 pins or legs. It is also called UI IC and Interface IC.

fig1.23

Work / Function: It controls Ringer, Vibrator and LED of a mobile phone.

Faults: If Logic IC / UI IC is faulty then Ringer, Vibrator and LED of mobile phone will nor work properly.

16. Audio IC

It is found in Power Section of a mobile phone. It is also called Cobba IC and Melody IC.

fig1.24

Work / Function: It controls Speaker and Microphone of a mobile phone.

Faults: If Audio IC is faulty then Speaker and Microphone of a mobile phone will not work and the set can even get dead.

1.3 Identification of Small Part

a) **Diode**: Diodes are of 4 types:-

• Rectifier Diode: It is found in black color and converts AC Current to DC Current. Itpasses current in one direction. It does not pass current in reverse direction.

• LED: It is found in white or light yellow color and emits light.

• Zener Diode: It is found in charging section. It filters and minimize current and passes forward. It acts as voltage regulator. Zenor diode has fixed capacity like 4V, 6V, 8V etc.

Photo Diode: It is used for Infrared. It captures Infrared Rays.

B) Network Capacitor: It is found in any section of a mobile phone.
It is made from 2 or more Non-Electrolytic Capacitors

C) Coil: It is found in any section of a mobile phone. It is found inmany shapes and sizes. Coils are found in 2 colours:

(i) Black and white; and
(ii) Blue and white.
It has binding of copper coil inside. It filters and decreases Current and Voltage.

Boost Coil: It's size is little bigger than coil. It is found in black colour and look like button. It increases current. If this coil gets damaged then it has to be changed

d) IC &Counting

IC (Integrated Circuit): IC is an electronic component that is made up of many other small electronic components like resistance, capacitor, coil, diode, transistor etc. There are 2 types of ICs – (i) Leg-Type IC; and (ii) Ball- Type IC.

Counting: Leg-Type IC: Counting of leg-type IC starts in Numerical Digit in Anticlockwise Direction starting from the Nose Point or Cut Point
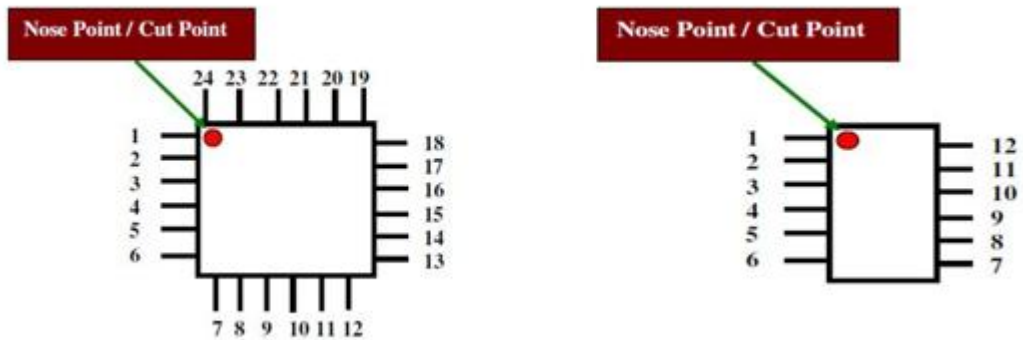
Counting: Ball-Type IC: Counting of Ball-type IC is done in Both Clockwise and Anti-Clockwise Direction. Rows are counted in Digit Numbers (1,2,3,4…) in Clockwise Direction. Columns are Counted in Alphabet (A,B,C,D…) in Anti-Clockwise Direction.

NOTE: When counting Columns, "I" and "O" are omitted because they look like "1" and "0".
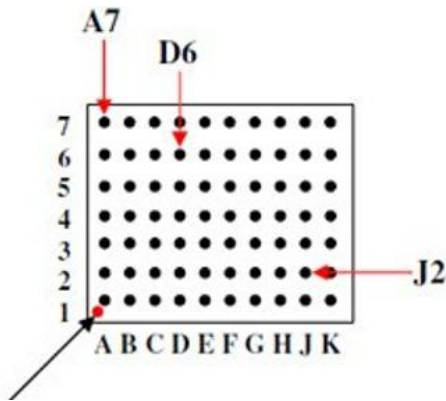
1.4 What are the features of a mobile phone?

Feature of **mobile phones**. The main purpose of the **mobile phone** is to be able to make and receive **telephone** calls. In addition, text messaging is a basic function, officially called SMS (Short Message Service). All **phones**, even the cheapest ones are able to perform these basic functions.

- **What a cell phone is made of?**

Cell phones can be made up of **plastics**, rechargeable batteries, and **metals**. The types of **metals** found in cell phones can vary. **Metals** that have been recovered from cell phones in the recycling process have included **gold**, silver, **platinum**, palladium, **copper**, tin, and zinc!

- **What is a mobile handset?**

A cordless telephone uses a radio transceiver as its **handset**, and a radio transceiver, wired to the telephone line, as a base station. In a **mobile** telephone, the entire unit is usually a radio transceiver that communicates through an outdoor base station located at a cell site.

1.4.1 What is a code of practice in the workplace?

An approved **code of practice** is a practical guide to assist you in complying with your health and safety duties under the WHS Act and Regulations.

1.4.2 Is a code of practice a legal requirement?

A **Code of practice** can be a document that complements occupational health and safety laws and **regulations** to provide detailed practical guidance on how to comply with **legal** obligations, and should be followed unless another solution with the same or better health and safety standard is in place, or may be a document ..

1.4.3 What does a code of practice include?

What a **code of conduct should include**. The most common sections to **include** in a **code of conduct** are: ethical principles - **includes** workplace behaviour and respect for all people. values - **includes** an honest, unbiased and unprejudiced work environment.

1.4.4 What is the purpose of the codes of practice?

By setting clear standards of professional **practice** and behaviour, the **Codes** are an important part of regulating and improving the quality of care for people who use services. The **Codes** let you know what you can expect from social service workers.

. 1.4.5 What are workplace policies?

I.   A **workplace** policy is a set of rules and principles that aims to guide managers and workers in how to behave in the **workplace**. You can have them in place for numerous different issues – bullying, harassment, internet use, health and safety, and social media are just a few.

II.   **What are the OHS policies and procedures?**

The purpose of the Health and Safety **policies and procedures** is to guide and direct all employees to work safely and prevent injury, to themselves and others. All employees are encouraged to participate in developing, implementing, and enforcing Health and Safety **policies and procedures**.

iii. What should be included in a workplace health and safety policy?

It **must** include a statement regarding the responsibilities of the employer, supervisors and other workers. A **policy** states clearly what the employer intends to do about commitment and support for **health and safety** in the **workplace**. ... A **policy** commits the entire organization to maintaining a **safe workplace**.

1.5 occupational health and safety (OH&S) program

A health and safety program is a definite plan of action designed to prevent accidents and occupational diseases. Some form of a program is required under occupational health and safety legislation in most Country. A health and safety program must include the elements required by the health and safety legislation as a minimum.

Because organizations differ, a program developed for one organization cannot necessarily be expected to meet the needs of another. This document summarizes the general elements of a health and safety program. This approach should help smaller organizations to develop programs to deal with their specific needs.

An organization's occupational health and safety policy is a statement of principles and general rules that serve as guides for action. Senior management must be committed to ensuring that the policy is carried out with no exceptions. The health and safety policy should have the same importance as the other policies of the organization.

The policy statement can be brief, but it should mention:

- Management's commitment to protect the safety and health of employees.
- The objectives of the program.
- The organization's basic health and safety philosophy.
- Who is accountable for occupational health and safety programs.
- The general responsibilities of all employees.
- That health and safety shall not be sacrificed for expediency.
- That unacceptable performance of health and safety duties will not be tolerated.
  ### 1.5.1The policy should be:

- Stated in clear, unambiguous, and unequivocal terms.
- Signed by the incumbent Chief Executive Officer.
- Kept up-to-date.
- Communicated to each employee.
- Adhered to in all work activities.

1.program elements?

While organizations will have different needs and scope for specific elements required in their health and safety program, the following basic items should be considered in each case:

- Individual responsibility.
- Joint occupational health and safety committee.
- Health and safety rules.
- Correct work procedures.
- Employee orientation.

Training.
- Workplace inspections.
- Reporting and investigating accidents/incidents.
- Emergency procedures.
- Medical and first aid.
- Health and safety promotion.
- Workplace specific items.

2. Responsibilities of workers

Examples of responsibilities of workers include:

- Using personal protection and safety equipment as required by the employer.
- Following safe work procedures.
- Knowing and complying with all regulations.
- Reporting any injury or illness immediately.
- Reporting unsafe acts and unsafe conditions.
- Participating in joint health and safety committees or as the representative.

3.What are individual OH&S responsibilities

Health and safety is the joint responsibility of management and workers. Management is accountable for non-compliance to health and safety legislation.

Responsibility may be defined as an individual's obligation to carry out assigned duties. Authority implies the right to make decisions and the power to direct others. Responsibility and authority can be delegated to subordinates, giving them the right to act for superiors. It is important to note that, while some responsibilities can be delegated, the superior remains accountable for seeing that they are carried out.

Individual responsibilities apply to every employee in the workplace, including the Chief Executive Officer. All employees will then know exactly what is expected of each individual in health and safety terms.

To fulfill their individual responsibilities, the people must:

- Know what these responsibilities are (communication required).
- Have sufficient authority to carry them out (organizational issue).
- Have the required ability and competence (training or certification required).

Once all these criteria have been met, each individual's supervisor on an equal basis with other key job elements can assess safety performance. Health and safety is not just an extra part of an employee's job: it is an integral, full-time component of each individual's responsibilities.

4. Responsibilities of safety coordinators

Examples of responsibilities of safety coordinators include:

- Advising all employees on health and safety matters.
- Coordinating interdepartmental health and safety activities.
- Collecting and analyzing health and safety statistics.
- Providing health and safety training.
- Conducting research on special problems.
- Attending joint health and safety committee meetings as a resource person.

5. What are workplace inspections?

Workplace inspections help to identify existing hazards so that appropriate corrective action can be taken. Health and safety legislation requires workplace inspections as a proactive action to ensure workplace health and safety.

Supervisors and workers are responsible for reporting and taking action on unsafe conditions and acts as they are encountered. The frequency of planned formal inspections may be set out in legislation. Records of previous accidents and the potential for serious accidents and injuries are factors to be included when determining if more frequent inspections are needed.

Joint health and safety committee members are obvious choices of personnel to carry out formal inspections, especially if they have received training or certification. Other criteria for selecting the inspection team are:

- Knowledge of regulations and procedures.
- Knowledge of the hazards in the workplace.
- Experience with work processes involved.

Pre-planning any inspection is always worthwhile. Documents, such as previous inspections, accident investigations, maintenance reports, and committee minutes, should be consulted. If a checklist is to be used, it should be reviewed and changed to meet specific needs of the workplace.

Checklists are useful aids in that they help ensure that no items are overlooked in an inspection. One type of checklist is the "critical parts inventory". This inventory itemizes parts and items that may result in a serious accident if they fail. While many ready-made checklists are available in safety literature, it is best to adapt these to local conditions. The joint health and safety committee should participate in the preparation of these tailor-made checklists.

6.Sample Inspection List

Date: _____

Location/Department: _____

Yes = Satisfactory
No = Unsatisfactory, needs attention

Yes	No	Safe Work Practices	Yes	No	Fire Protection
		Use of machine guards Proper manual lifting Smoking only in safe, designated areas Proper use of air hoses No horseplay Other: _____			Fire extinguishers Proper type/location Storage of flammable materials Other: _____
		Use of Personal Protective Equipment			Tools and Machinery
		Eye/face protection Footwear Gloves Protective clothing Head protection Aprons			Lawn mowers Power tools Hand tools Snow blowers Machine guarding Belts, pulleys, gears, shafts

		Respirators Other: _____		Oiling, cleaning, adjusting Maintenance, oil leakage Other: _____
		Housekeeping		First aid
		Proper storage areas Proper storage of flammable material (oily/greasy rags, etc.) Proper disposal of waste Floors (clean, dry, uncluttered) Maintenance of yards, parking lots Other: _____		First aid kits in rooms/vehicles Trained first aid providers Emergency numbers posted All injuries reported Other: _____
		Electrical Safety		Other: _____
		Machines grounding/GFI Electrical cords Electrical outlets Other: _____		SDS/Labels Dust/vapour/fume control Safe use of ladders/scaffolds New processes or procedures carried out Other: _____

Table 1.2

Notes:

_____

_____

_____

During the actual inspection, both work conditions and procedures should be observed. If a hazard that poses an immediate threat is discovered, preventive action must be taken right away, not after the inspection. Notes are made, specifying details of the hazard, including its exact location. When completing the inspection report, it is a good idea to classify each hazard by degree of possible consequences (for example: A = major, B = serious, C = minor). In this way, priorities for remedial action are established.

7. Workplace Inspection Report

Location:_____

Department/Areas covered: _____

Date of Inspection: _____

Time of Inspection: _____

Item (Location)	Hazards Observed	Repeat item Yes/No	Priority	Recommended Action	Responsible Person	Action Taken	Date
Analysis and comments:							

Table 1.3

Priority Codes: A - do immediately; B - do within 3 days; C - do within 2 weeks; D - other

Inspections serve a useful purpose only if remedial action is taken to correct shortcomings. Causes, not symptoms alone, must be rectified. Corrective action should be taken immediately, with the emphasis on engineering controls, management failures, or need for worker education, whatever applies.

8.What are emergency procedures and how are they established?

Emergency procedures are plans for dealing with emergencies such as fires, explosions, major releases of hazardous materials, violent occurrences, or natural hazards. When such events occur, the urgent need for rapid decisions, shortage of time, lack of resources, and trained personnel can lead to chaos.

The objective of the plan is to prevent or minimize fatalities, injuries, and damage. The organization and procedures for handling these sudden and unexpected situations must be clearly defined.

 The development of the plan follows a logical sequence.

- Compile a list of possible hazards or scenarios (for example: fires, explosions, floods).
- Identify the possible major consequences of each (for example: casualties, damage).
- Determine the required countermeasures (for example: evacuation, rescue, firefighting).

- Inventory the resources needed to carry out the planned actions (for example: medical supplies, rescue equipment, training personnel).
- Based on these considerations, establish the necessary emergency organization and procedures.

Communication, training, and periodic drills are required to ensure adequate performance when the plan must be implemented.

9.how do you establish medical aid and first aid programs?

First aid facilities and the provision of medical aid is generally prescribed under health and safety legislation or workers' compensation legislation. The OSH program must include the following information:

- Location of first aid stations and medical facilities.
- Identification of first aid attendants.
- Identification of other staff trained in first aid.
- Policy on pre-employment and follow-up medical examinations.
- Procedures for transporting injured employees to outside medical facilities.
- Provision of first aid training.
- Procedure for recording injuries and illnesses.

A policy on return to work after a lost-time accident might appropriately be included in this section of the program.

In general, if injured workers are offered alternative employment:

- The work should be suitable and productive.
- The worker's physician must agree that such employment will not harm the worker or slow down the recovery.
- The worker will pose no threat to other workers.
- The policy is applied to off-the-job injuries as well.

Under no circumstances should the reduction of severity ratings be a reason for initiating a "modified work" program.

10.Should workplace specific items be included in occupational health and safety programs

The elements of OH&S programs discussed so far apply to all basic health and safety programs. In addition, specific items may be needed to address workplace specific activities. Examples of such items are:

- Workplace Hazardous Materials Information System (WHMIS).
- Lock out procedures.
- Confined space procedures.
- Hot-work permits.
- Material handling rules.
- Plant maintenance.

- Fire safeguards.
- Vehicle safety rules.
- Off-the-job safety.
- Working alone guidelines.
- Personal protective equipment requirements.
- Engineering standards.
- Purchasing standards.
- Preventive maintenance.

1.5.2 how do you implement occupational health and safety programs?

A good health and safety program provides a clear set of guidelines for activities that, if followed rigorously, will reduce accidents and cases of occupational disease. The key to success is the manner in which the program is implemented and maintained.

Senior management must demonstrate commitment and support the program by:

- Providing resources such as time, money, and personnel.
- Ensuring that employees receive training or certification as required.
- Making all applicable health and safety information available to all employees.
- Including health and safety performance as part of employee performances appraisals at all levels.
- Attending health and safety meetings.

The program must be communicated to all employees. Special emphasis should be given to new workers, newly appointed supervisors, and new members of the joint health and safety committee. Revisions to policies and procedures should be publicized. The program should be available in a single written document. However, if separate manuals have been developed for various elements, such as accident/incident investigation procedures, their use should be referred to in the main document.

1.5.3How is the effectiveness of OH&S programs evaluated

Accident frequency and severity rates are not always the only measures to use for evaluating the effectiveness of a health and safety program. Cases of occupational disease are often under-reported in these statistics. The emphasis is usually on injury-producing accidents, not all events. Since accidents/incidents are rare events, in small organizations the basis for comparison may be limited.

It is desirable to use an audit as a before-the-fact measure of the effectiveness of an OH&S program. An audit uses a checklist in which each element is subdivided into a series of questions. Each question is given a weighting factor depending on its importance. Records, observations, interviews, and questionnaires are used to evaluate performance for each sub-element.

A number of audit systems are available.

Annual audits appear to be more common, but reviewing critical elements in the program more frequently may be advisable. The audit team, which should include representation from the joint health and safety committee, must receive appropriate training in audit procedures.

The audit identifies weaknesses in the health and safety program. Little is achieved unless a procedure is established to ensure prompt follow-up on deficiencies. This procedure should include provision for target dates for remedial action and checks to confirm completion.

1.6 Occupational Health and Safety In Workplaces Duties of Workers
1.6.1Occupational Health and Safety and You

One of your most important responsibilities is to protect your Health and Safety as well as that of your co-workers. This booklet will discuss some of your duties under the occupational Health and Safety legislation and help you to make your workplace safer and healthier.

I. What the law requires

Workplaces under the jurisdiction are governed by your provincial legislation. The legislation places duties on owners, employers, workers, suppliers, the self-employed and contractors, to establish and maintain safe and healthy working conditions. The legislation is administered by your provincial legislation. Your officials are responsible for monitoring compliance.

.

II. Responsibilities of trainees

You must also comply with the legislation.

You have responsibilities to:
- protect your own Health and Safety and that of your co-workers;
- not initiate or participate in the harassment of another worker; and
- co-operate with your supervisor and anyone else with duties under the legislation

1.6.2Potential Hazards Associatedwith Mobile Phone Repair

Your physical wellbeing is important not only to yourself, but also to others.

Therefore, as you embark on mobile phone repair, you should be aware of all the

Potential hazards and how to prevent them.

What is a hazard?

A hazard is anything that has the potential to cause harm to yourself or those Around you. Before you learn the different types of hazards, let's start by definingSome of the terms associated with hazards.

Table 1.4

Hazard	Preventive Actions
Burns	Use of well insulated tools Use of gloves Keeping the soldering iron in the right place Unplugging equipment when not in use
Pricks by sharp objects	Appropriate storage of equipment Proper disposal of sharp objects Use of appropriate tools and equipment
Environmental pollution	Proper disposal of electronic wastes
Trailing electrical cables	Make sure electrical equipment is unplugged while not in use Safe storage of cables
Falls	Keep all tools, bins etc. in the right place

Self-check 1	choose

Name: _____Date:_____

Time Start: _____

Time Finish_____

1._____help to identify existing hazard so that appropriate corrective action can be taken

    A. work place   b. safety

    C. workplace inspection   d .all

2._____portable telephone to make and receive call.

        A. bell   c. buzzer

        B antenna   d. mobile phone

3_____refers to the size, style and shape of mobile phone.

        A. Bar phone   c. touch screen

        B. Form factor   d. battery

4._____used for inputting or interring data to the phone

        A .mic   c. speaker

        B .keypad   D. battery

Answer   **score**

1. _____
2. _____
3. _____
4. _____

Information sheet 2	Make necessary *tools*, *test instruments* and *personal protective equipment* are ready with job requirements

2.1 Mobile Phone Repairing Tools & Equipment Tools to Repair Mobile Cell Phone

When selecting tools and equipment for repairing mobile cell phones, it is important to select the best tools. Cheap or inexpensive tools and equipment may not be handy when repairing a mobile phone. On the other hand, best quality little expensive tools and equipment will help you to repair a mobile phone easily and comfortable. I am personally trained in mobile cell phone repairing and my personal experience says that we must always select and buy the best tools available in the market or online. These good quality tools may cost a little more but in the long term, you will be happy that you bought the best tools.

There are hundreds of tools for mobile phone repairing available in the market. It is important to select the best brand. Below all the tools and equipment needed for mobile cell phone repairing:

1. **Soldering Iron**:

Fig. 2.1 Shows Soldering Iron

It is used to solder small components like capacitor, resistor, diode, transistor, regulator, speaker, microphone, display etc. A 50 watt soldering iron is good enough for most mobile phone repairing job. When buying a soldering iron, select the one that is easy to hold and does not burn your hand. The soldering iron must have option to choose and select different types and shapes of soldering tips or bits. These tips or bits must be replaceable. It must also be ESD-Safe (Antistatic) because most electronic components in a mobile phone are very sensitive and can get damaged due to static charge or static electricity. Hakko and Weller are two world renowned brands who manufacture, sell and export world class soldering irons and other soldering tools and equipments.

2. **Soldering Station**: A soldering station has 2 units – a station and an

Soldering Station

Fig. 2.2 Shows Soldering Station equipments

Soldering Station Iron: It has option to control temperature depending on the heat requirement of the soldering job being done. The soldering iron is attached with the soldering station. It is better and more convenient than traditional soldering iron. It makes soldering work much easier and faster. When buying a soldering station for mobile phone repairing one must always select an ESD-Safe (Antistatic) model. Hakko and Weller are two world renowned brands who manufacture, sell and export world class soldering irons and other soldering tools and equipments.

3.**PCB Holder / PCB Stand**: A PCB (Printed Circuit Board) holder or PCB

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PCB Holder

Fig.2.3 Shows PCB holder

PCB Holder stand: is used to old the PCB of a mobile phone while soldering or repairing. It holds the PCB very strongly and doesn't allows it to move thus helping in repairing. Again, it is important and wise to select a good quality PCB holder rather than a cheaper and inexpensive one.

4 **Solder Wire**: Solder wire is used to solder electronic components, ICs

Solder Wire

Fig. 2.4 Shows Solder wire or Jumper

Solder Wire or jumper: Composition of most solder wire is Tin / Lead in the ratio 60:40 or 63:37. Since the introduction of RoHS (Restriction of Hazardous Substances) from electronics, more and more companies are using lead-free solder. Lead-free solder wire is available in many compositions but the most common composition is Tin / Silver / Copper in the Ratio 96.5:3.0:0.5. Solder wire is available in different diameters such 2.0mm, 1.5mm, 1.0mm, 0.5mm, 0.2mm etc. For mobile phone repairing 0.5mm solder wire is best suitable. Kester is a world renowned manufacturer and supplier of solder wire and other soldering material.

5. **Thinner or PCB Cleaner:** Thinner or PCB cleaner is used to clean the PCB of a mobile phone. The most common PCB cleaner used in mobile phone repairing is IPA or Isopropyl Alcohol. It is important to buy only good quality PCB cleaner as poor quality PCB cleaners can damage the board.

Fig.2.5 Shows PCB Cleaner

6. **Jumper Wire:** This is a thin laminated or coated copper wire used to jumper from one point to another on the track of a mobile phone while repairing. Most people doing the work of mobile repairing do jumper to solve many problems.
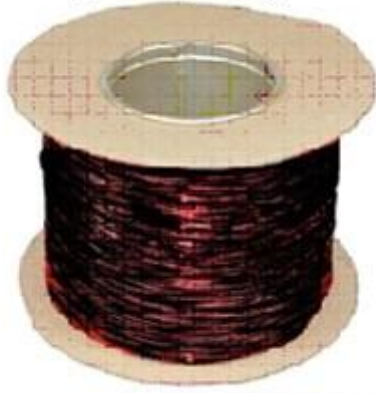
Fig.2.6 Shows Jumper Wire

7 **Blade Cutter**: This is used to remove lamination from jumper wire. It can also be used for several other purposes.

Fig.2.7 Shows Blade Cutter

8 **Point Cutter**: It is used for cutting.

Fig.2.8 Shows Point Cutter

9**Nose Cutter**: It is used for cutting.

Nose Cutter

Fig.2.9 Shows Nose Cutter

10. **Precision Screwdriver**: It is used to remove and tighten screws while assembling and dissembling a mobile phone. Precision screwdrivers of sizes T4, T5, T6 and forehead are good for most mobile repairing job.

Fig.2.10 Shows Screwdriver for Mobile Phone Repairing

11. **Tweezers**: These are needed to hold electronic components, ICs, jumper wire etc while soldering and Disordering.

Tweezers

Fig.2.11 Shows Tweezers

12.**Brush**: These are used for cleaning the PCB of a mobile phone while repairing. It is important to buy only ESD-Safe cleaning brushes.

Fig.2.12 Shows ESD-Safe Brush for Mobile Repairing

13. **Multi Meter**: Used to find faults, check track and components. Always buy a good quality reliable ESD-Safe digital Multi meter for mobile repairing works.

Fig..13 Shows Multi meter

14.**Hot Air Blower**: It is also called SMD (Surface Mount Device) rework system and SMD repair system. It has control to regulate or manage temperature and flow or hot air. Always buy a good quality ESD-Safe hot air blower.

Fig.2.14 Shows Hot Air Blower

15.**Battery Booster**: It is used to boost the power of battery of a mobile phone.

Fig.2.15 Shows Mobile Phone Battery Booster 16. **Ultrasonic Cleaner**: Used to clean PCB of a mobile phone and electronic components.

Fig.2.16 Shows Ultrasonic Cleaner for Mobile Repairing

17.**BGA Kit**: Used to Re ball and repair ball-type ICs. BGA stands for Ball Grid Array.

Fig.2.17 Shows BGA Kit for Mobile Repairing

18. Magnifying Lamp: It is used to see the magnified view of the PCB of a mobile phone. Most magnifying lamps also have light. Magnifying lamps are available in different magnification such as 3x, 4x, 5x, 10x, 50x etc.

Fig.2.18 Shows Magnifying Lamp to Repair Mobile Phone

19. **Mobile Opener**: These are used to open the housing or body of a mobile phone.

Fig.2.19 Shows Mobile Phone Opener

20.**DC Power Supply**: Regulated DC (Direct Current) power supply is used to supply DC current to a mobile phone. Most repair person used DC power supply to switch ON a mobile phone without battery.

Fig.2.20 Shows DC Power Supply for Mobile Phone Repairing

21. **Liquid Flux**: It is used to clean PCB track and legs or pins of electronic components while soldering. Liquid flux improves quality of soldering. Kester flux is world renowned for good quality.

Fig.2.21 Shows Liquid Flux for Mobile Phone Repairing

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22.**Paste Flux**: This is also used while soldering.

Fig..22 Shows Paste Flux

23. Solder Paste: This is solder in molted semi-solid form. It looks like paste. Solder paste is mainly used for Rebelling of ICs.

Fig.2.23 Shows Solder Paste

24.**Cleaning Sponge**: This is used to clean tip of soldering iron while soldering.

Fig.2.24 Shows Cleaning Sponge to Clean Tip of Soldering Iron

25. **Disordering Wire**: Disordering wire or De solder wire is used to remove excess solder from track of PCB. Chemtronics is world renowned manufacturer and supplier of De soldering wire.
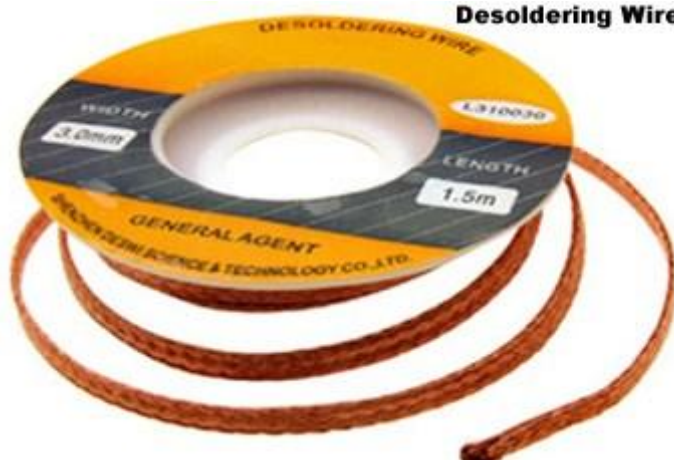
Fig.1.25 Shows De soldering Wire

26. **Screw driver Kit**: It has several screwdrivers of different shapes and sizes to dissemble and assemble a mobile phone. Tool is a world renowned manufacturer, exporter and supplier of all kinds of tools and tool kits.

Fig.2.26 Shows Screwdriver Kit

27.**IRDA or Infrared Workstation**: This machine is similar to hot air blower. Only difference is that it gives heat through infrared. It is very precise and give heat only where it is needed thus preventing any damage to nearby electronic components on a PCB.

Fig.2.27 Shows Infrared Workstation

28 **LCD Tester**: Used to check whether LCD screen of a mobile phone is faulty or not.

LCD Tester

Fig.2.28 Shows LCD Tester

29. **Microscope**: It is used to see a magnified view of PCB or electronic components. These are available in different zoom options. Many microscopes can also be connected to a computer or a monitor.

Fig.2.29 Shows Microscope for Mobile Repairing

30. **Test JIG Box**: This device is used to diagnose and find fault or problem in a mobile phone. It helps the mobile phone to work and function normally outside its case. This helps to test and check voltage and other test points on the PCB. It simple words it helps a mobile phone to work without battery.
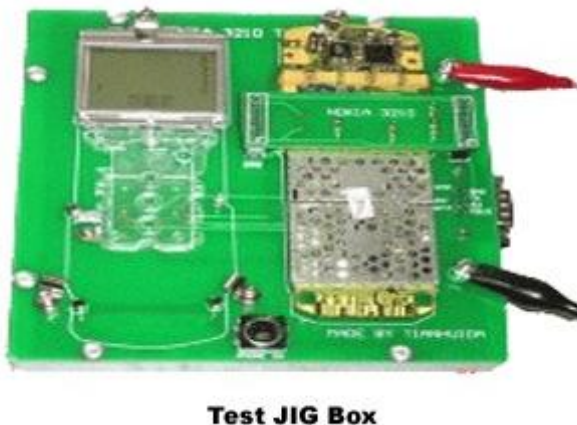
Test JIG Box

Fig.2.30 Shows Test JIG Box

31. **Wrist Strap**: It is work in the wrist of the person who is repairing a mobile phone. It helps to discharge or ground static charge thus preventing the PCB or electronic components from any damage.

Wrist Strap

Fig.2.31 Shows Wrist Strap

32**Antistatic Hand Gloves**: It is important to wear ESD-Safe hand gloves while repairing a mobile phone to prevent PCB and electronic components from static charge.

Antistatic Hand Gloves

Fig.1.32 Shows Antistatic Hand Gloves

33. **Antistatic Mat**: It is laid or placed on the table or workbench where mobile repairing is done. The mat is grounded using a grounding cord or normal grounding wire. This also prevents damage from static electricity.

Fig.2.33 Shows Antistatic Mat

34. Antistatic Apron: It is a dress work by people who repair mobile phones. This also helps to discharge static electricity.

Fig.2.34 Shows Antistatic Apron

35. **Smoke Absorber**: This is like an exhaust fan that helps to filter smoke that comes out while soldering and de soldering.

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Fig.2.35 Shows Smoke Absorber

36. **Battery Tester**: This device is used to test and analyze status or condition of battery of a mobile cell phone.

Fig.2.36 Shows Battery Tester

Self-Check 2	matching

Name: _____Date: _____

Time Start: _____Time Finish: _____

1	Pcb holder
2	Battery tester
3	Hot Air Blower
4	Soldering iron
5	Wrist rap

Answer Sheet

1. _____

2. _____

3. _____

4. _____

5. _____

Operation sheet 1	Select appropriate tools and material for mobile maintenance

PURPOSE: - identify each component and knowing their function

PROCEDURE:-
- ➢ Follow safety procedure and rule
- ➢ Select the appropriate tool
- ➢ Identify the appropriate tools
- ➢ Write their function of each selected tools

PRECAUTIONS:-
You should not forget to wear your PPEs.

QUALITY CRITERIA:-
Set each tools on safe areas

Information sheet 3	Service manuals and service information required for repair/maintenance are acquired at commencement of activities

3.1 Service manuals and service information required for repair/maintenance are acquired at commencement of activities

3.1.1 What is maintenance manual.

The **Maintenance Manual** provides maintenance personnel with the information necessary to maintain the system effectively. ... Appendices to document various maintenance procedures standards, or other essential information may he added to this document as needed.

3.1.2 What is standard maintenance procedure.

A **Standard Maintenance Procedure**, or SMP, is a written set of instructions that specifies how a maintenance procedure is to be performed. .

3.1.3 What is an O&M manual.

The operation and maintenance manual (O&M Manual) defines the requirements and procedures for the effective operation, maintenance, decommissioning and demolition of the building.

3.1.4 What is repair manual.

Factory service manuals (FSM) are the manuals provided by manufacturers, which cover the servicing, maintenance and repair of their products. They were not originally offered to the public as they were developed for the dealerships so that their mechanics were able to fix their own products.

3.1.5 What is the service manual.

Factory service manuals (FSM) are the manuals provided by manufacturers which cover the servicing, maintenance and repair of their products. They were not originally offered to the public as they were developed for the dealerships so that their mechanics were able to fix their own products.

Self-cheak3

Name:_____Date:_____

Time Start: _____Time Finish: _____

1. .What is service manual?.

2. What is repair manual?

Information sheet 4	**repair/maintenance history of the unit is properly verified**

4.1 Repair/maintenance history of the unit is properly verified

4.1.1 What is mobile maintenance?
Mobile technology is opening up a world of possibilities, and that includes new advances for the maintenance industry. One good example is mobile maintenance software which allows maintenance staff to enjoy the perks of a computerized maintenance management system (CMMS) anywhere via their mobile devices.

4.1.2 What is a mobile service?
A **mobile service** provider (MSP) is a company that offers transmission **services** to users of **wireless** devices (smartphones and tablet PCs) through radio frequency (RF) signals rather than through end-to-end wire communication.

Types of Mobile Services

➢ The Mobile Internet. Mobile phones today are equipped with Internet browsers and large colour screens. ...

- ➢ Mobile Instant Messaging Services. ...
- ➢ Mobile Chat Rooms. ...
- ➢ Premium Rate Mobile Content Services. ...
- ➢ Examples of mobile phone subscription services. ...
- ➢ Mobile Dating Services.

Step by Step Mobile Phone Repairing

Step-1: Take admission in a well-known and trusted mobile phone repairing training institute. You can never learn mobile phone repairing on your own. It may look simple and easy and you may also be able to do some easy repairing yourself by reading or watching online videos but you will never be perfect.

Try to do some bargaining and get some discount on the admission fee. Most such institutes provide offers for discount. Like most of them will ask you to bring few more students to their institute and you will get some discount per student on your own fee.

Step-2:

1. – Start from the basic. Try to learn some of the Most Common Terms Used in Telecommunication.
2. Next, learn about tools and equipment needed for mobile phone repairing.
3. Next, Learn how to disassemble and open a mobile phone and again assemble it back.
4. The PCB of a mobile phone is divided into different sections and contains different parts. Learn about different sections in a mobile phone and parts.
5. Next, Learn about Mobile Software Problem and Solution and then learn mobile phone hardware problem and solution.
6. Once you are done with learning how to repair basic mobile phone, you can move onto the second stage and learn how to repair modern smartphone, Apple iPhone and Android-Based smartphones.
7. Read Other Useful Articles on Mobile Phone Repairing.
8. Download for Free: Mobile Phone Repairing PDF Book
9. Learn Electronics Tutorial

   - ➢ **We have to discuss in detail in next learnnring outcome**

Self-check 4	Choose

Name:_____Date:_____

Time Start: _____Time Finish: _____

1._____is opening up world of possibility and that include new advance for the maintenance industry
  A. Mobile maintenance
  B. Soldering /disoldering
  C. Safety
  D. Workplace policy

Answer

1._____

Operation sheet 2	Identify internal mobile parts

PROCEDURE:-

Step 1: Try to cheak your nsafety

Step2: Select the required cell phone

Step3: Selection is personal

Step 4: Select appropriate tools for did assembling

Step5: Use appropriate ESD material

PRECAUTIONS:-

You should not forget to wear your PPEs. You should take care of not to contact any bare part of your body whenever you assemble & disassemble cell phone. Use instruments properly according to manufacturer specification.

QUALITY CRITERIA:-

Perform safely and properly when assemble & disassemble cell phone, identified quickly, efficiently, economically and safely.

LAP TEST #1	Identify mobile tools

Name: _____Date:_____

Timestarted_____Timefinished:_____

Instructions: You are required to perform the following individually with the presence of your teacher

Task 1: identify tools and material

LAP TEST #2	Identify internal mobile phone part

Name_____Date: _____

Time started: _____ Time finished: _____

Instructions: You are required to perform the following individually with the presence of your teacher

   Task: dis assemble mobile phone

   Task: identify each mobile part

Instruction Sheet	LG23: Diagnose Faults of Cellular Phone Unit

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- ↓ Service manuals
- ↓ Systematic pre-testing procedure
- ↓ Identify the working principles of cell phone
- ↓ Identify types of mobile boards
- ↓ Identify system defect/fault symptoms

This guide will also assist you to attain the learning outcome stated in the above. Specifically, upon completion of this Learning outcome, you will be able to –

- Observe systematic **pre-testing procedure** in accordance with manufacturer's instructions
- Identify system defects/fault symptoms using appropriate tools and equipment
- Use test instruments for the job in accordance with user manuals
- Check and isolate circuits using specified testing procedures
- Explain to the **responsible person** the Identified defects and faults in accordance with company policy and procedures

- Check control settings/adjustments in conformity with service-manual specifications
- Documenting results of diagnosis and testing accurately and completely within the specified time
- Advise or inform customers regarding the status and serviceability of the unit according to company procedures

Learning Instructions:

9. Read the specific objectives of this Learning Guide.

10. Follow the instructions described below

11. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.

12. Accomplish the "Self-checks" in each information sheets.

13. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

14. If you earned a satisfactory evaluation proceed to "Operation sheets and LAP Tests if any". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity.

15. After you accomplish Operation sheets and LAP Tests, ensure you have a formative assessment and get a satisfactory result;

.

Information sheet: 1	Complete check-up of cellular phone is conducted and defects are identified, verified and documented against customer description

1.1Mobile Phone Fault Finding for Mobile Cell Phone Repairing

2.1Complete check-up of cellular phone is conducted and defects are identified, verified and documented against customer description

Mobile Phone Fault Finding for Mobile Cell Phone Repairing – In order to repair any mobile cell phone, we must find and know fault or problem present in Different Sections of Mobile Phone, Parts and Components. If we know about problems of different parts and components present in different sections inside a mobile cell phone then we can easily repair the fault by checking the component.

FIG 1.1Mobile Phone Fault Finding

1.2Mobile Phone Fault Finding Method – Problems Identification & Troubleshooting

➢ While doing mobile phone repairing, we can do fault finding if we know different sections inside a mobile cell .2. For Example – If there is Network Problem in a mobile phone then we can easily repair the phone if we know different parts, components and their function in the Network Section.

NOTE: This Lesson is on Fault Identification and Troubleshooting of Problems. It is Not about Testing Methods. For Component Testing Methods, Please **Read**: Mobile Phone Repairing Testing Methods

Following are different electronic parts and components in different sections inside a mobile cell phone**:**

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1. Network Fault

Antenna Switch, PFO, FEM, RF IC, VCO, RX-Filter, TX-Filter, RF Antenna, RF Crystal, External Antenna Socket, Network Signal and Supply Control and Interface Section.

If we know about the parts and Electronic Components present in the Network section and their function then we can easily repair the fault by looking at the code number of the faulty component in the Circuit Diagram and Different PCB Layout Diagram.

In this way, we can easily make good use of circuit diagram for mobile cell phone repairing.

2. Power ON Fault

Battery (*3.7 V*), Battery Connector Jack, Power IC, CPU, Flash IC, S-RAM IC, RF Crystal, RF Clock Section Component, RF IC, Power ON / OFF Trigger Components.

3. Charging Fault

Charger (*5-6 V*), Battery (*3.7 V*), Charger Connector, Charger Volt Fuse, Coil, Charger Over Volt Protector, Charging IC, Power IC, Charging Regulator, Charging Volt Output Components, Charger and Charger Volt Detector Components.

4. SIM Fault

SIM Card, SIM Socket, SIM Signal and Supply Interface Components, Resistance, Coil, Power IC, CPU etc.

5. Ringer Fault

Ringer, Ringer Signal Input and Output Components, Audio Amplifier IC, Power IC, CPU etc.

6. Ear Speaker Fault

Ear Speaker, Ear Speaker Signal Components, Audio Amplifier IC, CPU, Power IC etc.

7. Micro SD Card Fault / MMC Fault

Micro SD Card, Micro Card Connector, Micro Card Detector Switch, Micro Card Detector Signal Components, CPU etc.

8. USB and Bottom Connector fault

USB and Bottom Connector, USB and Signal Interface Connector Components, USB Signal Interface IC, USB Driver IC, CPU etc.

9. Keypad Fault

Key Tip, Key Pad Dot Sheet, Key Signal Filters, Key Signal Varactors, Key Board to Key Connector, CPU etc.

10. Display Fault

LCD, LCD Connector, LCD Supply Components, LCD Signal Interface Filter IC, CPU, LCD Signal Interface Resistance etc.

11. MIC Sound Fault

   MIC, MIC Interface Connection, MIC Signal and Supply Components, Power IC, CPU etc.

12. Backlight (LED) Fault

   LED, Backlight Driver IC, Backlight Driver Section Components, Power IC, CPU etc.

13. Bluetooth Fault

   Bluetooth Antenna, Bluetooth Driver IC, Bluetooth Section Crystal, CPU etc.

14. FM Radio Fault

   Hands Free Lead, Hands Free Connector, FM and Bluetooth IC, FM Driver IC, CPU etc.

15. Vibrator Fault

   Vibrator Motor, Vibration Supply Components, Power IC, Vibrator Driver IC etc.

16. Touch Screen Fault

1.3 Repair of Common Mobile Phone Faults/defect

What is a fault?

A fault is a defect (a failure in a circuit) or an electronic device.

What causes faults or failures in mobile phones?

Failures can be caused by any of the following:

- Excess temperature,
- Excess current or voltage,
- Mechanical shock,
- Stress or impact,
- Mechanical stress,
- Short circuits,
- Imperfect connections,
- Poor insulation or wiring caused by grounding.

There are three types of mobile phone faults:

i. **Hardware faults**: occur due to hardware malfunctioning

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ii. **Software faults**: occur due to problems with software

iii. **Settings faults**: occur due to wrong/invalid setting

Let us discuss each type of faults and how they can be repaired.

i.Hardware Faults

Many hardware faults can occur in a mobile phone, such as:

a) Battery charging faults/problems

b) Mobile phone battery problem (faults)

c) Network not working problem

d) Overheating problem

e) Sound faults

f) Ear piece, ringer and microphone problem

g) Display problems

h) Lighting or LED problems

i) Touchscreen problems

j) Keypad problems

k) SIM faults

l) WiFi problem and internet connectivity problems

a) Battery Charging Faults/Problems

Battery charging faults manifest in a number of ways:

- The battery is not charge at all,

- There is a sign of battery charging but the battery does not get charged.

- When the charger is inserted, it shows 'Not Charging'.

- When the charger is connected it shows 'Bad Connecting Charging'.

- When the charger is inserted the mobile phone gets hot.

Solutions to Battery charging fault

1. Change the charger and check. The voltage must be between 5 and 7 Volts.

2. Clean, resold or change the charger Connector.

3. If the phone shows "FALSE CHARGING" then use a 3.6 Volt Zenor Diode and

      do direct charging.

4. If the problem is not solved then change the battery and check again

5. Check the voltage of the battery connector using a Multimeter. The voltage should be between 1.5 and 3.7 Volts.

6. If there is no voltage in the connector check the track of the charging section.

Refer to the diagram of the particular model of the mobile phone(fig1).

7. If the problem persists, check the fuse, coil and regulator one by one and change the faulty part.

8. If the problem is still not solved then heat or change the charging IC.

9. Finally heat, re-ball or change the Power IC.

Charging Connector   *Battery Connect*
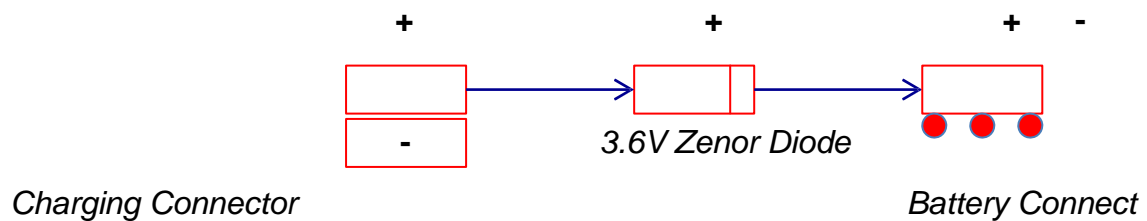
fig1.2: charging block diagram

B) Mobile Phone Battery problem

A mobile cell phone can have any of the following battery problems:

- Low Battery
- Battery Drains Fast
- Battery Backup Low,
- Battery Not chargin

- ### Solutions to Battery faults

1. Check the battery connector and charger plug to see if there is any problem.

2. Check if there is any dust or corrosion in the connector or any broken pin. Clean the points using IPA or cleaning swabs.

3. Check the Interface Connector to see if there is any dust. If there is dust clean or replace the interfaceconnector.

4. If the battery problem is not solved then upgrade the software or operating system to latest version

5. If the problem is still not solved then check the Mobile Phone PBA current consumption.

6. Check for any short circuit.

7. If there is serious problem at the board level then it is better to replace the whole Logic Board of the Mobile Cell Phone.

C.Network Not Working Problem

The common issues related to this problem include the following:

- There is no network in the mobile phone
- There is less or weak network signal
- Sometimes there is a signal and sometimes there is no network signal.

- ### Solutions to Network fault

1. Manually search for the network. If the 'no network problem' persists, then

There is a problem with the Antenna Switch. Repair or replace it.

2. If the network resumes after manual search but the home network cannot be selected, then there is a problem with the PFO. Repair or change the PFO.

3. If the Network gets disconnected during phone calls then you should repair or change the Network IC.

4. Clean the antenna tips and point.

5. If the network problem persists, heat or change the 26MHz Crystal Oscillator.

6.   If the problem is still not solved then heat or change the Antenna Switch. You can also jumper if the Antenna Switch is not available.

7. Heat, Change or Jumper the PFO if the problem persists.

8. Heat, re-ball or change the Network IC.

9. Heat, re-ball or change the Power IC.

10. Heat, re-ball or change the CPU.

D.Network Signal and Call Drop Problem

If a mobile phone is having network problems and dropping calls, then you should use the f ollowing steps to solve it:

1. Check the SIM Card. Insert the SIM card in other mobile phone and see if the network problem or the 'call drop' problem is still there.
2. Alternatively, try to insert another SIM card inside the mobile phone that has the network problem. If the SIM card causes the problem, then you should change or replace it.
3. If the problem is still not resolved then upgrade the operating system to the latest version. You can also rewrite the IMEI Number of the mobile cell phone.
4. If the problem is not solved then you may have to change the mobile phone.

E.Mobile Phone Overheating

A mobile phone may overheat either inside or on the body. To solve this problem you should proceed as follows:

1.Check if the mobile phone overheats when a particular application is running or if the overheating happens all the time.
2.Upgrade the mobile phone software operating system to the latest version. This may solve the overheating problem.
3.Smartphone's overheat if too many applications are running at the same time. Close all the applications and try to run 1 application at a time
4. If overheating persists, then there is some internal hardware problem. Change the PCB or Logic Board to solve the heating problem.

F. Sound Faults

We shall consider the following types of sound faults:

- Earpiece or ear speaker problem
- Mobile phone speaker problem
- Ringer problem

- Vibration problem
- Microphone problem

i). *Earpiece or Ear Speaker Problem*

The Earpiece or speaker is the electronic component or part that helps us to listen to sound during a phone call. It is controlled by Audio IC or Power IC (UEM). See Figure 27 for a picture of an ear speaker.

Figure 1.3

The common problems associated with the ear speaker are:

- No sound during phone call
- Low sound during phone call
- Sound has interruptions.

> ### *How to Solve Earpiece or Speaker Fault*

1. Check the speaker volume during a phone call.
2. If speaker volume is fine, then check the earpiece by keeping the multimeter in buzzer mode. The value must be between 25~35 Ohm. If the value is not between 25,~35 Ohm then change the earpiece.
3. If the problem is not solved then check the Circuit Track of the earpiece section. Do jumper wherever required.
4. If the problem persists heat, reball of change the UEM/Audio IC.
5. If the problem is still not solved then heat, reball or change the CPU.

ii. Ringer Problem

A Ringer is any type of electronic component that rings or plays a loud sound.   It is also called the I.H.F Speaker, buzzer, melody, etc. Figure 28 shows a picture of a ringer.
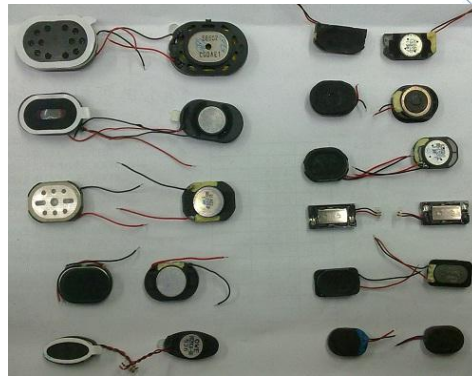
Figure 1.4   ringer /buzzer... Source (www.mobile reparing.com)

The following are the types of problems associated with the ringer:

- Ringer not working
- Low sound from the Ringer
- Sound coming from Ringer but with interruption
- Sound not clear

➢ ***How to Solve Ringer Faults***

1. Check the ringer settings in the mobile phone. Check Ringer volume and silent mode. Adjust or change the volume and /or mode if required.
2. If the problem is not solved then open the mobile phone and clean the ringer point and ringer connector.
3. If the problem is not solved then check the ringer by keeping the multimeter in buzzer mode. The value must be between 8 ~ 10 Ohm. If the value is not between 8~10 Ohm then change the Ringer.
4. If the problem is not solved then check the track of ringer section. Do jumper wherever required.
5. If the problem is not solved then check the Ringer IC. Heat or change the IC.
6. If the problem is not solved then heat, reball or change the UEM / Logic IC.
7. If the problem is still not solved then heat, reball or change the CPU.

iii. Vibration Problem

The vibrator is an electronic device that generates vibrations. It is controlled by the Logic IC or Power IC.

Different Types of Mobile Phone Vibrator / Motor

@mobilecellphonerepairing.com
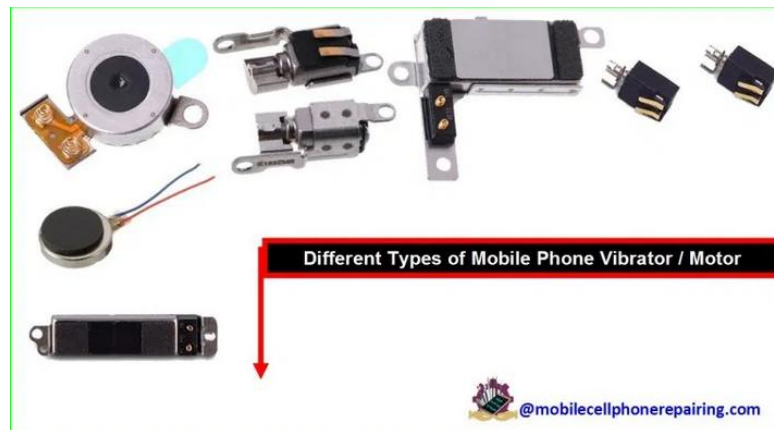
Fig 1.5

The common types of faults associated with the vibrator are:

- Vibrator not working
- Vibration has an interruption
- Vibration Hangs.

➢ *How to solve Mobile Vibrator faults*

1. Check the Vibrator settings in the mobile phone. Check if the Vibrator is ON or OFF.
2. If the problem is not solved, then open the mobile cell phone and clean the vibrator tips and connector.
3. If the problem is not solved then check the vibrator with the multimeter in Buzzer Mode. The value must be between 8~16 Ohm. If the value is not between 8, ~16 Ohm then change the Vibrator or Motor.
4. If the problem is not solved then check the track of the vibrator section. Do jumper wherever required.
5. If the problem is not solved then heat, reball or change the UEM/Logic IC /Power IC.
6. If the problem is still not solved then heat, reball or change the CPU.

iv. Microphone Problem

The Microphone is an electronic component that helps to transmit sound during phone call. A microphone is controlled by Audio IC or Power IC (UEM).

The common types of problems associated with the microphone are:

- Low sound during phone call
- Sound has interruption
- Change in sound.

How to Solve Microphone Fault

1. Check the Microphone settings.

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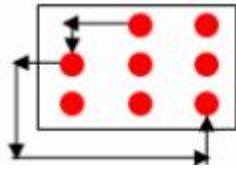
Figure 1.6: Jumper Setting For Microphone

2. If all the settings are normal, then check and clean the Microphone tips and connector.
3. If the problem is not solved then check the Microphone with the multimeter in Buzzer Mode. The value must be between 600~1800 Ohm. If the value is not in between that range, then change the Microphone. Note that only one side will give a value.
4. If the problem is not solved then check the track of the Microphone section. Do Jumper wherever required.
5. If the problem is not solved then heat or change the Microphone IC.
6. If the problem is not solved then heat, reball, or change the UEM / Audio IC /Power IC.
7. If the problem is still not solved then heat, reball or change the CPU.

g) Display Not Working

This part displays information in a mobile phone. The CPU controls it. In some cell phones there is an Interface IC called the Display IC situated between the Display and the CPU.

The following are the common types of problems associated with the display:

- Display is blank.
- Display not working properly.
- Only half the display works.
- White display.
- Display is upside down.
- Display is broken.
- When the mobile phone is switched ON, the Logo appears and then the display disappears

How to Solve Display Faults in a Mobile Cell Phone

1. Clean the display tips and display connector.
2. Resold the display connector
3. Change the display
4. Check the display Track.
5. Resold or change the display IC.

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6. Heat, reball or change the CPU.

h) Mobile Light or LED Problem and Solution

The LED is the electronic component that generates light in the mobile phone. There are 2 types of connections in the light section of a mobile phone:

- Series Connection;
- Parallel Connection.

Figure 36 shows a diagram of series and parallel connections.

Series Connection   *Parallel Connection*
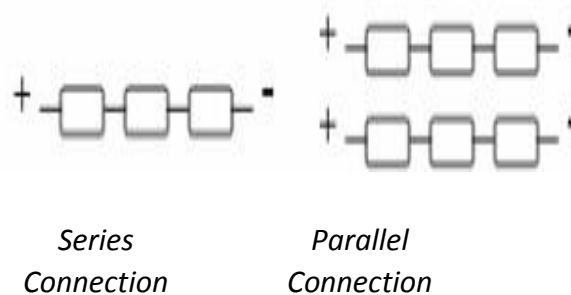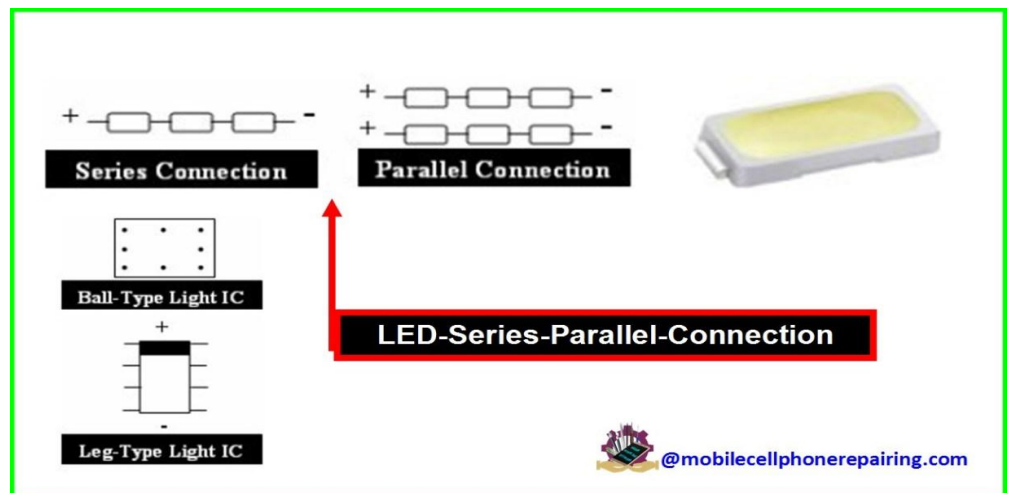
Figure 1.7: Diagram Showing Series and Parallel Connections

The common symptoms of LED problems are:

- No Light.
- Light only in the Keypad or Display.

- Some lights not working

How to Solve a LED problem

1. Check the light settings.
2. If the settings are normal then resold all the LED.
3. If the problem is not solved then change the display or the screen.
4. Next, check all the LEDs with the multimeter on Buzzer mode. If the LED is good then it will glow. If the LED is faulty then it will not glow.
5. Change the LED or jumper if required.
6. If the problem is not solved then check the Track of the light section of the PCB and jumper if required.
7. Next check the Boosting Coil and change if required.
8. If the problem is not solved then heat or change the Light IC.
9. If the problem is still not solved then heat, reball or change the Power IC.

i) Phone Touch Screen (PDA) fault

A Touch Screen (PDA) is an electronic component that allows you to input data or control your mobile phone by touching the screen. It normally has 4 Points namely:

- (+),
- (-),
- (RX),
- (TX).

The CPU normally controls the touch screen. In some mobile phones there is an Interface IC called PDA IC or Screen Touch IC.

The following are the faults associated with the Touch Screen

- Touch Screen not working.
- Only half the Touch Screen works.
- When one key is pressed, another key works.

How to Solve Touch Screen (PDA) Faults

1. Check the settings if the mobile phone has both a keypad and a touch screen.
2. Clean and resold the PDA Tips and PDA connector.
3. Change the PDA.
4. Check the Track of the PDA section and Jumper if required.
5. Heat or change the PDA IC
6. Heat, reball or change the CPU
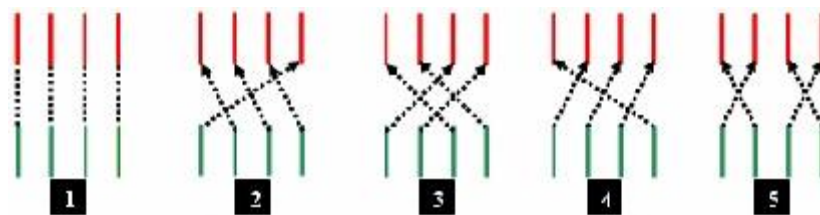
5 Types of PDA jumper solution

Figure1.8: Jumper settings for PDA

(h) Keypad Problems

The keypad enables you to enter data, such as, phone numbers and names in your mobile phone.

The main types of problems associated with the keypad are:

- Some keys not working.
- Keys need more pressure to work.
- When a key is pressed it works continuously.
- When one key is pressed, some other key works
- When one key is pressed, some other key works simultaneously.

How to Solve a Keypad Faults

1. Check the facial of the keypad.
2. Clean the keypad and keypad points shown in Figure 38 below.
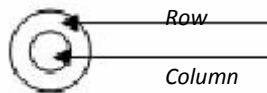
Figure 1.9: Keypads and keypad points

3. Using the multimeter in Buzzer Mode and check the Row and Column of the Keypad. If there is a beeping sound then the keypad is working.
4. If there is no improvement, heat or change the Keypad IC or the Interface IC.
5. If still no change, heat, reball or change the CPU.

(i) Mobile Phone SIM faults

A Subscriber Identify Module (SIM) card is an integrated circuit that securely stores information about the number of the cell phone line, password, and information related to your local network service. It has a unique serial number.
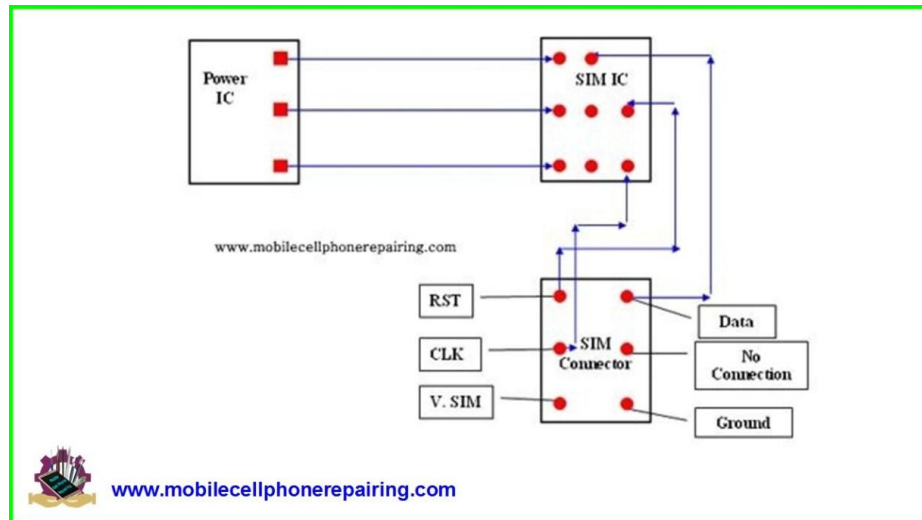
Fig 1.10 sim connection block diagram

The following are the common problems associated with the SIM card:

- SIM is inserted but still there is a message saying "Insert SIM".
- The mobile phone goes OFFLINE when the SIM card is inserted.
- The SIM works for sometime and then stops working.
- There is a message that says "Invalid SIM"

How to Solve SIM Card Fault

1. Check settings and see if the mobile phone is in Flight Mode. If it is in "Flight Mode" then change it to Normal mode.
2. Clean the SIM Card Tips and SIM Connector.
3. If the problem is not solved then change the SIM card and check.
4. If the problem still persists then change the SIM connector.
5. If you still do not find a solution to the problem, check the Track of the SIM section.
6. If the problem is still not solved then heat or change the SIM IC.
7. Finally, if there is no change, heat, reball or change the Power IC.

(j) Mobile Wi-Fi Wireless Internet Connection Problem:

This problem may present in the following ways:

- No internet
- Low Wi-Fi signal
- Wi-Fi cannot be enabled

How to Solve Wi-Fi problem

1. Enable Wi-Fi and check if it is working or not. Make sure you are connected to a wireless network. Make sure the password is correct.
2. If the Wi-Fi cannot be enabled and you are not able to use or access the internet, then there could be problem with the mobile phone PCB and you may have to replace it.
3. If the Wi-Fi can be enabled then there is no problem with the PCB. Just upgrade the software of the mobile phone to the latest version.

You now know the common hardware problems found in mobile cell phones. Next let us discuss the software problems and how to solve them.

1.4 Other common mobile phone problems

fig1.11

Technology issues are some of the most aggravating problems we face on a regular basis. Whether it's a server crashing, our favorite website being down or a hard drive getting wiped out, tech issues take time and money to resolve, which is plenty of cause for frustration.

Mobile phone problems can sometimes feel the most invasive and solutions aren't always easy to come by. We rely on our cell phones more and more every day, so when we encounter difficulty with them and have to take them somewhere to get them fixed, it can be a real pain. Fortunately, many common cell phone problems are easy to resolve if you know how.

Check out our guide on how to fix the most common smartphone problems below. Keep in mind that some cell phone solutions will require professional repair assistance.

1. Your Phone is Responding Slowly

By far, the issue that plagues most smartphone users is a device that appears to slow down over time. New updates to the operating system, especially on aging phones, along with apps that run when not in use seem to be what triggers slow responses the most. As

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long as it isn't your phone's age that is causing it to lag, there are a few things you can do.

Solution: Clear the Cache and Make Some Room

Start by closing apps that you aren't using, and alter your settings to keep unimportant apps from running in the background at all times. These eat up valuable RAM space. Feel free to delete apps and software that you don't need and free up storage space by moving photos and other content to a cloud service.

If your problem is with slow internet speeds rather than phone speeds, try alternating between data and Wi-Fi to see which has a stronger signal, and close other apps or location services that may be taking up bandwidth. Just be careful not to go over your data limit if you opt to go with data over Wi-Fi. If you are experiencing lag as a result of a weak network, there may not be much you can do. If it's because you are using an old phone that is incompatible with new updates, you may want to consider selling your phone for cash and upgrading.

2. Your Battery Doesn't Seem to Hold Up

PROBLEM:
Your Battery Doesn't Seem to Hold Up

SOLUTION:
Maximize Your Standby Time

fig 1.12

How can you use your phone if it doesn't stay alive long enough? Battery problems are one of the most common phone frustrations, usually caused by user abuse. Next time you find that your phone is taking forever to charge to 100 percent or that it seems to die on you way too fast, try changing a few of the following settings and clearing apps that can drain your battery.

Solution: Maximize Your Standby Time

First, make sure the charger you are using is optimized for your battery. Then, shorten your screen timeout setting so that your phone will fall asleep sooner when not in use,

and reduce your brightness when possible. If your phone has a battery saving mode, initiate it whenever you need your phone to be accessible without plugging it in for several hours. Finally, and maybe most importantly, alter your settings so that system-hogging apps and updates don't run in the background.

3. Your Screen Is Cracked

Since our phone screens are made of glass, it's no surprise that sometimes a heavy impact with the ground can cause them to break. Cracks may lead to problems with your touchscreen responses or let in moisture over time, so it's important to have your phone repaired after the screen gets damaged.

Solution: Repair for Now, Prevent for Later

If your screen has already cracked, you will want to have it replaced as soon as you can. After that, the best course of action — as with most smartphone problems and solutions — is all about prevention. Invest in a reliable case and screen protector or keep your phone in a padded pouch or wallet — something that will cushion the fall should it slip from your grasp.

4. Your Device Got Wet

Accidents happen to the best of us. It's frightening when your phone gets submerged in water, especially if the display starts flashing or looking abnormal. You may think your cell phone is history, and it's true that water damage is perhaps one of the trickiest phone problems to deal with, but there's always still a sliver of hope. Your best bet is to get some professional help.

Solution: Take It to the Repair Shop

Rather than panicking, turn off your device, maybe throw it in some rice if you have any on hand to help absorb some of the moisture and head to your nearest phone repair place. Don't plug your phone in or attempt to fix it on your own. The technician will be able to determine the extent of the damage, take the device apart to dry out the pieces, and repair or replace specific parts as necessary.

5. Your Phone Is Overheating

fig1.13

Holding a strangely warm phone can be a weird experience, and it can be hard to know the best way to fix it without tossing the device in the freezer. Overheating can severely damage your battery and screen life — and so would the moisture and cold from the icebox, we should mention — so if you notice your phone is way too hot, here are some better ways to cool it down.

Solution: Keep It Cool and Inactive

For starters, your phone should be kept out of direct sunlight and stored in a dry, shaded bag or pocket that won't transfer the sun's heat. After removing outside heat sources, take some time to relax your busy phone by reducing brightness, closing apps, abstaining from overbearing Wi-Fi or data use, and making sure to postpone downloads or updates until you're in more ideal circumstances, like when you plug your phone in at night.

6. You've Filled up Your Storage Space

People are taking pictures and videos more now than ever before, so storage space has become a real issue for a lot of smartphone users. Apps, downloads and new operating system features also contribute to the cramped space within your phone's memory. Fortunately, there are a few simple ways to clear some room.

Solution: Expand Your Storage Options Beyond Your Phone's Memory

In the same way that homeowners still invest in storage units to hold extra belongings, you can find other devices for your data and pictures. You can embrace a variety of cloud-based options, like iCloud or Google Drive, or you can transfer your content to external hard-drives or a computer to remove miscellaneous archives from your mobile device. A third possibility would be to purchase a microSD card to give your phone itself some extra memory. You could, of course, also go through the old process of printing out

your photos and deleting them from your device once you have a physical copy you're happy with.

7. Your Screen Keeps Freezing

When your phone is frozen, and the home button doesn't even work, the only thing you can do is force the device to shut down and restart. But what if it seems like it's constantly happening? If your phone is freezing frequently, it can be pretty inconvenient, and it's usually caused by low storage space, excessive app use and, occasionally, malware infection.

Solution: Clean up Your Phone

Some form of housekeeping is likely in order. Close apps that are running, clear the cache, delete programs you don't need, move some of your stuff over to an external hard-drive or get an app that literally cleans up the trash on your phone for you. Your phone will likely begin running much more smoothly after some of that extra data and activity is wiped away. You can also take some steps to protect your phone from viruses in the future.

8. A Particular App Is Constantly Crashing

Every once in a while, your favorite app may decide to give you some unwanted trouble by freezing or crashing a lot. If it's just one app that's giving you issues, it may have to do with the app not being optimized for your operating system or that the latest version of the program simply has a lot of bugs. It can be hard to know what to do when this keeps happening.

Solution: Troubleshoot and Check With the App Developer

Start by quitting the problematic app, perhaps even deleting and re downloading it to clear some unnecessary data. If you want to preserve your data on the app, try restarting your phone. If it continues to crash, head over to your app store and see if other people have left reviews that communicate similar problems.

Next, look up the app developer on social media sites and see if they've released a statement or tips for resolving the issue. From there, of course, you can always contact the developer directly about what you're experiencing. It may be a problem they haven't yet heard about.

PROBLEM:
Your Entire Phone is
Constantly Crashing

SOLUTION:
Restart and Reset

fig1.14

If it's more than one specific app that is having issues and your phone sometimes shuts down or restarts on its own, you may have an entirely different problem on your hands. Bugs are common with new operating system updates, but if you haven't downloaded anything new recently, diagnosing the problem becomes a bit tricky. There may even be some hardware kinks involved. Take a few initial steps to clean up your system, then see if there are other measures that you need to consider.

Solution: Restart and Reset

Begin by simply restarting your device to clear temporary memory and active app data. If the phone is frozen, you'll need to force the device to shut down. Then, check to see if you can widen your available storage space by deleting some unnecessary data.

In the end, if you're still having trouble, a factory reset may be the best thing you can do to give your phone a clean slate. If the problem lies with malfunctioning or aging hardware, you may need to visit the repair shop and go from there.

10. You Have Bad Reception

While more than likely your phone is not at fault for networking issues or poor cell signal, it is worth including this common problem in this list. For the most part, changing settings on your phone is not going to solve your connectivity dilemma. However, there are times when it is your hardware that is causing the problem, and, in those cases, there are a few steps you can take, but it may require seeking outside help.

Solution: Try Some At-Home Fixes, Then Call the Experts

Before you do anything else, make sure that you're not just experiencing normal, unavoidable network problems like a dead spot where no one can get signal. If other

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devices are having trouble connecting, it's probably your network as a whole and not your phone that you need to address. In this case, try calling your carrier or Internet service provider for some assistance.

If your phone truly is the culprit, try restarting it first. Then, make sure you have the latest version of your operating system installed. At that point, if you still have difficulty connecting, you may need to do some web searching or call your phone manufacturer to help out.

11. You're Having Trouble With Bluetooth

fig1.15

While fewer cables might seem like fewer problems, that is not always the case with Bluetooth devices. If a device isn't pairing, it can even be more frustrating because you literally can't see where the problem is. The issue might not be visible, but if you try a few of these fixes, you should be able to figure out how to solve it.

Solution: Do Some Troubleshooting

For starters, is that Bluetooth device compatible with your phone? The device might not be universal for all phones. You can also try placing the devices right next to each other to make sure that no obstruction is causing the issue. Once you have attempted that and checked to make sure Bluetooth is turned on, you can always try turning both your phone and the device off and back on again.

12. Your Charging Port Stopped Working

Just as with phone batteries, over time your charging cables and port will wear down. On your phone, the little metal tabs around the opening where you plug in your charger can get damaged or dirty, which can complicate or slow down its charging capabilities. It's not

always the charging port that is causing charger problems though, so feel free to do a little troubleshooting before admitting defeat and shelling out for a phone repair.

Solution: Do What You Can, Then Have It Fixed Professionally

If you just need to brush away some debris from the port, try using an unused toothbrush or cotton swab to clean out the gunk that's preventing a good connection to your charging cable. If it's the cable or wall adapter that's faulty, swap them out. Unfortunately, if the issue is really related to a broken charging port, you'll need to head to the repair shop.

Other Smartphone Issues and Their Solutions

If the problem you're experiencing isn't explicitly addressed in this list, you may be able to search for solutions online. Do some web searches using your phone's make and model and the particular difficulty you are having. You can also contact us for some additional assistance if the tips in this post don't seem to fix the problem. We are here to help!

If your phone is ultimately beyond repair, consider selling your phone to The Whiz Cells to get cash to put towards a new one. We accept a wide variety of devices, pay our sellers faster than anyone else in the business and offer free shipping. So even if your mobile phone problem can't be fixed with the steps we've listed, you can be on your way to a new, problem-free phone in no time.

Self-check 1	MATCHING

Name: _____Date: _____

Time Start: _____Time Finish: _____

Match the cell phone problems or fault in Column A with the correct solutions in Column B.

Cell Phone Problem	Solutions
Display not working	Clean and resolder the PDA tips
Faulty ear piece	Check the speaker volume
Phone is overheating	Close all the applications and run one at a time
Network problem	Change the charger
Vibrator is not working	Repair the antenna
Phone dropping calls	Rewrite the IMEI number of the phone
Touch screen problem	Check if phone is in vibrate mode
Battery problem	Resold the display connector

Operation Sheet #1	Solve Earpiece or Speaker Fault

Purpose: The following statements describe Solve Earpiece or Speaker Fault

Procedure

1. Follow saftry rule and procedure
2. Check the speaker volume during a phone call.
3. . If speaker volume is fine, then check the earpiece by keeping the multimeter in buzzer mode. The value must be between 25~35 Ohm. If the value is not between 25,~35 Ohm then change the earpiece.
4. If the problem is not solved then check the Circuit Track of the earpiece section. Do jumper wherever required.
5. If the problem persists heat, reball of change the UEM/Audio IC.
6. If the problem is still not solved then heat, reball or change the CPU.

PRECAUTIONS:-

You should not forget to wear your PPEs. You should take care of not to contact any bare part of your body

Operation Sheet #2	**Mobile Phone SIM faults repairing**

Purpose: The following statements describe How to Solve SIM Card Fault

PROCEDURE:-

1. Follow safety rule and procedure
2. Check settings and see if the mobile phone is in Flight Mode. If it is in "Flight Mode" then change it to Normal mode.
3. Clean the SIM Card Tips and SIM Connector.
4. If the problem is not solved then change the SIM card and check.
5. If the problem persists then change the SIM connector.
6. If you still do not find a solution to the problem, check the Track of the SIM section.
7. If the problem is still not solved then heat or change the SIM IC.
8. Finally, if there is no change, heat, reball or change the Power

PRECAUTIONS:-

You should not forget to wear your PPEs. You should take care of not to contact any bare part of your body

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Information Sheet #2	Systematic pre-testing procedure is followed in accordance with manufacturer's instructions

2.1 pre testing procedures

❖ **What is the purpose of pretesting?**

Pretesting your survey is an important way to pinpoint problem areas, reduce measurement error, reduce respondent burden, determine whether or not respondents are interpreting questions correctly, and ensure that the order of questions is not influencing the way a respondent answers.

❖ **What are pre-test procedures?**

The **Pre**/Post-**test** method is designed to measure trainee's growth in knowledge and/or skill over the course of a unit of study or grading period. The **Pre**/Post-**test** method can be helpful to trainers in determining growth toward the achievement on specific standards .

❖ **Why is pretesting of a questionnaire important?**

Pretesting can help you determine the strengths and weaknesses of your **survey** or **questionnaire**. By making your main concern for your **pretest** to have a reliable question format and also a good wording and order. By establishing a correct **pertest**, your **questionnaire** will yield better results

❖ **What is pretesting of a questionnaire?**

Pretesting is done on a small sample of respondents from the target population. After the pilot test, both the interviewer(s) and respondents are asked a series of questions regarding the survey as well as the process of data collection during the debriefing session.

2.2 Mobile Phone Repairing Testing Methods

Mobile Phone Repairing Testing Methods – Fault Finding, Testing and Checking of Mobile Phone Parts, Components and Section of a Mobile Cell Phone can be done using following 2 methods at the time of repairing mobile cell phone. These methods can also be used for Fault Finding or Testing and Checking Mobile Components.

Fig 2.1

2.2 Mobile Phone Repairing Testing Methods for Fault Finding of Mobile Components

Let us Understand these 2 Main Mobile Phone Repairing Testing Methods in Detail.

1. Cold Testing Method

When we check the value of Resistance Using a Multimeter at the time of mobile repairing and fault finding, it is called cold testing. There is no need to give any power supply to the faulty mobile phone from any equipment such as DC Power Supply or Battery during Cold Testing.

Diode Range and Beep Sound from the Multimeter is used to find fault in a mobile cell phone using the cold testing method of mobile phone repairing. In this testing method, the **RED Probe** of the multimeter is connected to the **Ground** of the Mobile Phone PCB and the **BLACK Probe** is touched at the **Testing Points** of the Mobile Phone.

During the fault finding and repairing process of each part, SMD Electronic Component or Mobile Phone Section, following correct values will be received:

- ☐ Ear Phone Connector Tip (+ , -): .500 to .700
- ☐ Loud Speaker / Ringer Connector Tip (+,-): .300 to .600
- ☐ Battery Connector Tip (+): .400 to .500
- ☐ Battery Connector Tip (*Sense*): above .800
- ☐ Display Connector Supply Pins: .250 to .400
- ☐ Display Connector Signal Pins: .500 to .800
- ☐ Camera Connector Supply Pins: .250 to .400
- ☐ Camera Connector Signal Pins: .600 to .900
- ☐ Key Tip (Row and Column): .400 to .800

☐ Charger Connector Tip: .600 to .700
☐ Vibrator Motor Connector: .40 to .500
☐ Power ON / OFF Switch Point (+): .600 to .900
☐ MIC Connector Tip (Analog MIC) (+,-): .700 to .900
☐ Battery Charging Out Point (+,-): .300 to .400
☐ SIM Card Connector Pin 1 (VSim): .500 to .700
☐ SIM Card Connector Pin 2,3,6: .400 to .800
☐ SIM Card Connector Pin 4 (GND): .00 (Beep)
☐ Micro SD Card Connector Pin 4: .500 to .600
☐ Micro Card Connector Pin 6 (GND): .00 (Beep)
☐ Micro Card Connector Pin 1,2,3,5,7,8: .600 to .800
☐ RTC: .400 to .500
☐ Data RX and TX Pins: .600 to .700

2. Hot Testing Method

This is the second method of fault finding and repairing any mobile cell phone. Hot testing method is used when the fault cannot be found or when the phone cannot be repaired using the Cold Testing Method.

In this Process, VOLTAGE of damaged part, component or section of a mobile phone is checked. The fault is found by giving Power Supply to the mobile phone with a Battery OR DC Power Supply.in this method, DC V (*DC Volt*) range of the Multimeter is selected. The BLACK Probe of the multimeter is connected with the Ground of the Mobile Phone PCB and the RED Probe is touched at the Testing Points**.**

During Hot Testing method, Voltage of different part or sections should be as follows (*All Values in Volt*):

1. Ear Phone Connector Tip (+ , -) during working: .0 to 2.5
2. Loud Speaker / Ringer Connector Tip (+,-) during working: .0 to 2.5
3. Battery Connector Tip (+): 3.7
4. Display Connector Supply Pins: 1.8 to 2.9
5. Display Connector Signal Pins During Working: .0 to 1.8
6. Camera Connector Supply Pins: 1.8 to 2.9
7. Camera Connector Signal Pins During Working: .0 to 1.8
8. Key Tip (Row and Column) One Side: 1.8 to 2.8
9. Charger Connector Tip: 5 to 6
10. Vibrator Motor Connector Tip During Working: 1.9 to 3.6
11. Power ON / OFF Switch Point (+): 3 to 3.6
12. MIC Connector Tip (Analog MIC) (+,-): 1.8 to 3.0

13. Battery Charging Out Point (+,-): 3.7 to 4.2
14. SIM Card Connector Pin 1 (VSim) When SIM Connected: 1.8 to 3.0
15. SIM Card Connector Pin 2,3,6 During Working: 0 to 2.8
16. Micro SD Card Connector Pin: 2.8
17. Micro Card Connector Pin 1,2,3,5,7,8: 0 to 2.8
18. Data RX and TX Pins: 1.8 to 2.8

2.3 Disassembling and Assembling a Mobile Cell Phone

❖ **What is to disassemble?**

To disassemble is to take something apart or to break it down into pieces.

❖ **What is to assemble?**

To assemble is to fit together all the separate pieces in order to form one whole.

Before you continue reading, complete the following activity.
❖ **Disassembling a Mobile Phone**

The following are the steps that you should take when disassembling a mobile
Phone:

1. Switch off the phone
2. Remove the battery cover
3. Remove the battery, SIM card memory card (if any)
4. Remove all the screws from the phone
5. Lift back the cover with the help of a flat screwdriver
6. Remove the strips (buzzer strip, display, camera, volume and speaker button Strips)
7. Remove the antennae wire from the outside
8. Remove the motherboard and vibrator.

To successfully disassemble a phone, you need to understand the various internal
Sections of a mobile phone and how they are connected to the CPU. Let us look at
that next.

➢ **Internal Parts of a Mobile Phone**

Table below outlines the main sections and how they are connected.

Internal Section	Connections
SIM card section	SIM Card Interface section is directly connected with the CPU in most mobile cell phones. If there is no power supply in a mobile phone then the SIM section is connected with the CPU through the Power IC.
Memory card section	In most phones the micro SD card holder is connected through a 8-pin socket. The memory card section is found inside the CPU
Ear Speaker Section	In modern mobile cell phones which have a separate ear speaker, the speaker is directly connected to the CPU. It receives sound via signals directly from the CPU of from the audio section inbuilt within the CPU. In some mobile phones, these sound signals are received via coil / resistance. Some mobile phones have audio IC in the audio section, while others have audio amplifier.
Speaker/Ringer Section	The ringer, buzzer or speaker in most mobile phones are connected to the audio amplifier IC to obtain loud sound. The amplifier IC amplifies the sound or audio signal received from the CPU of the audio section.

Table 1: Internal parts of
a mobile phone

b.Assembling a Mobile Phone

The following are the steps that you should take when assembling a mobile phone:

1. Fix the vibrator strips of speaker and volume button
2. Fix the motherboard
3. Connect the antenna with wire
4. Place the camera and connect it
5. Place the buzzer
6. Put the camera cover

7. Make sure that the LCD is working before you place the screen
8. Put battery and battery cover

2.3.1 Diagnosing and Repairing Mobile

Phone Fault

The correct diagnosis of mobile cell phone faults is the key to successful and cost effective repair of the phone. Let us start by looking at the skills that you need to have to be able to diagnose and repair a mobile phone.

1. Skills Needed to Diagnose and Repair a Mobile Phone

Before you can diagnose and repair a phone, there are some skills that you need to learn. These skills are:

- Soldering

- Desoldering

- Testing using a multimeter

- Jumper setting

Let us briefly discuss each skill in turn.

a. Soldering

Soldering is a process in which two or more metal items are joined together by melting and flowing a filler metal into the joint. The filler metal has a relatively lower melting point.

Fig2.2. *Picture showing A technician Soldering*

Steps In Soldering

1. Prepare the following materials:

   - Soldering Iron,

   - Solder paste

   - Long Nose Pliers,

   - PCB holder,

   - Electronic Components (Resistors, Diode etc.)

2. Plug and pre-heat the soldering iron.

3. Heat both items at the same time by applying the soldering iron to the copper pad and the component lead.

4. Continue heating and apply a few millimeters of solder. Remove the iron and allow the solder joint to cool naturally.

5. It only takes a second or two to make the perfect joint, which should appear shiny.

b.Desoldering

Desoldering is the removal of solder and components from a printed circuit board for troubleshooting, repair, replacement, and salvage.

Fig 2. *2.desoldering*

Steps in desoldering

1.   Use a solder   wick (finely braided copper) to wick away excess solder from a de- soldered connection.

2.   Apply the solder wick and use the soldering iron to the de-soldered connection. The solder wick will draw the excess solder off the PCB pad.

3. Service manuals

Meaning of Terms used in Mobile Phone Repairing

Before you learn how to repair a mobile phone, it is very important to understand meanings of some of the important terms used during mobile phone repairing. Read and understand these terms and their meaning. This will help you later during the course of mobile cell phone repairing.

- ✓ **1G**: 1st Generation in Mobile Telephony.
- ✓ **2G**: 2nd Generation in Mobile Telephony.
- ✓ **3G**: 3rd Generation in Mobile Telephony.
- ✓ **4G**: 4th Generation in Mobile Telephony.
- ✓ **AC**: Alternate Current.
- ✓ **BGA**: Ball Grid Array.
- ✓ **BSI**: Battery Status Indicator.
- ✓ **CDMA**: Code Division Multiple Access.
- ✓ **CPU**: Central Processing Unit.
- ✓ **DCT**: Digital Core Technology.
- ✓ **DC**: Direct Current.
- ✓ **GSM**: Global System for Mobile Communications.
- ✓ **IMEI**: International Mobile Equipment Identity.
- ✓ **IC**: Integrated Circuit.
- ✓ **LED**: Light Emitting Diode.
- ✓ **PDA**: Personal Digital Assistant.
- ✓ **PFO**: Power Frequency Oscillator.
- ✓ **PCB**: Printed Circuit Board.
- ✓ **RAM**: Random Access Memory.
- ✓ **RF**: Radio Frequency.
- ✓ **ROM**: Read Only Memory.
- ✓ **RTC**: Real Time Clock.
- ✓ **RX**: Receive / Receiver (Receiving Section).
- ✓ **SMD**: Surface Mount Device.
- ✓ **TX**: Transmit (Transmitting Section).
- ✓ **UEM**: Universal Energy Manager
- ✓ **VCO**: Voltage-Controlled Oscillator.

Any mobile phone [PCB] has several IC or Integrated Circuit. These are SMD or Surface Mount Electronic Components. Before understanding how to count legs or pins of any IC, let us learn about IC.

What is an IC?

An IC is an [electronic component] made up of combination or integration of several other electronic components like resistor, capacitor, coil, diode, transistor etc.

How Many Types of IC are their?

There are mainly 2 types of ICs:

1. **Leg-Type IC**: This type of IC has legs or pins. These types of ICs are again divided into different categories but we will not discuss it here because it has nothing to do with mobile repairing.
2. **Ball-Type IC**: This type of IC has BGA (Ball Grid Array) underneath the IC. These types of ICs are again divided into different categories but we will not discuss it here because it has nothing to do with mobile repairing.

How to Count Legs or Pins of Leg-Type IC?

Counting of leg-type IC starts in Numerical Digit in Anticlockwise Direction starting from the Nose Point or Cut Point. Have a look at the photo below to understand it clearly.
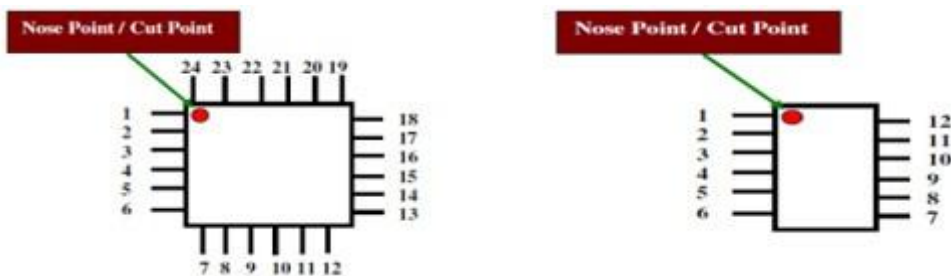
Fig. 2.1 Shows ICs leg Identification

How to Count Legs or Pins of Leg-Type IC

How to Count Balls of Ball-Type IC?

Counting of Ball-type IC is done in Both Clockwise and Anti-Clockwise Direction. Rows are counted in Digit Numbers (1, 2, 3, 4…) in Clockwise Direction. Columns are counted in Alphabet (A, B, C, D…) in Anti-Clockwise Direction.

NOTE: When counting Columns, "I" and "O" are omitted because they look like "1" and "0".

Fig. 2.2 Shows How to Count Balls of Ball-Type IC

How to Check Mobile Cell Phone Settings

When repairing any mobile cell phone, you will often come across problems when you will need to start with by checking the settings before proceeding to open and repair the mobile phone. Such problems could include any of the following:

Ringer or Loudspeaker of the Mobile Phone Not Working: To solve this problem, before you open the mobile cell phone to check if the ringer is faulty or not, you need to first check the ringer or loudspeaker settings (If ringer settings is present in the set). Check ringer volume settings and see if the phone is on silent mode or not. Set the required settings. If everything is ok the open the mobile phone and check the ringer using a Multi meter. If the ringer is not faulty then it will give a buzz or beep sound and the value must be in the range of 8 to 10 Ohm. If the ringer is faulty then replace it with a new one.

Vibrator of Mobile Cell Phone Not Working: To solve the problem, start by checking the vibrator settings. Check if it is ON or OFF.

Earpiece or Speaker Problem: There can be several problems with the speaker or the earpiece of a mobile phone. These can be less or no sound or there can be problem with sound. The first thing to do to solve the problem is to check settings. Go to settings and check speaker or earpiece volume. It can also be checked during incoming phone calls. If the volume is less then increase the volume to desired level.

Microphone Problems: If there is problem with the Mic or microphone then there will be problems during phone call. The person you are talking to will not be able to listen to your voice. To solve the problem, start by checking microphone setting if any such setting is present. In most cases, changing or replacing the old faulty microphone with a new one solves the problem.

Light Problem: If there is less light or some of the LED lights are not working or if there is no light at all, then start by checking the light and display settings. Adjust the light settings according to your requirement. If everything is OK and

the problem is not solved then open the mobile phone and check all the LEDs. Change LED if it is faulty.

Headphone Problem: If headphone is not working or there is less sound in the headphone then you need to check headphone settings first.

Display or Screen Problem: To solve any problem related to screen or display, the first thing to do is to check settings and adjusts according to requirement. If the problem is not solved the move on to hardware solution. If the problem is still now solved then move on to software solution.

SIM Problem: If you are not able to make or receive a phone call with a valid SIM card and your mobile phone is OK, the check settings first. See if the phone is on Flight Mode or not. If it is on Flight Mode then change the setting.

Network Problem: If, your mobile cell phone has less, week or no network then, check Network Settings. Manually search for available networks and select the desired network provider. If the problem is not solved then there is problem with the Network Section of the Phone.

Camera, Bluetooth, FM Radio: If there is any problem with any of these the check their settings first.

NOTE: There are several other settings in a mobile cell phone. These include – Mode, Wi-Fi, VPN, Tethering and Portable Hotspot, Mobile Networks, Data Usage, Call Settings, Sound and Display Settings, Power Saving Settings, Storage Setting, Battery Setting, Settings for Applications, Accounts and Sync or Syncing, Location or GPS Services, Security Settings, Language and Input Setting, Back Up and Reset, Dock or Docking, Date and Time Settings, Accessibility, Motion Settings etc.

How to Check Mobile Cell Phone Settings

Most people using a mobile cell phone know *How to Check Mobile Cell Phone Settings*. Different Models and Phones like Nokia, Samsung, Motorola, LG, iPhone, Android Phone, China Mobile Phones, they all have different phone setting options. Most phones have separate settings menu. Just go to MENU and select SETTINGS. Once you have reached SETTINGS, select the setting you are looking for and change or adjust whatever you need.

fig2.4

How to Open and Disassemble a Mobile Cell Phone

How to **open and disassemble any mobile cell phone** including Nokia, Samsung, Motorola, China Mobile Phones or any other brand of cell phone from any mobile cell phone manufacturer is basically same with slight change in the process. Before proceeding to open and disassemble a mobile cell phone, make sure you have all the required *tools for mobile repairing*. *The tools you will need are:*

1. T5, T6 and Forehead Precision Screwdriver. A screwdriver set or kit can be very useful. These screwdrivers must have magnetic tip.
2. Mobil Phone Opener

3. Tweezers
4. Antistatic Wrist Strap
5. Antistatic Hand Gloves
6. Antistatic or ESD-Safe Mat
7. ESD-Safe Apron
8. ESD-Safe Footwear

NOTE: It is very important to use only Antistatic or ESD-Safe tools to open **and disassemble a mobile cell phone** because parts inside a mobile phone are very sensitive to static electricity and can get damaged if precaution is not taken to prevent static electricity.

How to Open and Disassemble a Mobile Cell Phone: Step by Step Instructions

1. Take OFF and remove the battery cover and back facial of the mobile phone. You should use a mobile opener tool to remove the back Facia.
2. Remove the battery, SIM card and memory card.
3. You will find several small screws at the back. Using suitable screwdriver, unscrew and remove all the screws and keep them in a safe box. These screws must be kept very carefully so that they do not get lost.
4. Once all the screws are open, remove the front cover or the front Facia of the mobile phone.
5. Now you have the internal Facia or skeleton of the mobile phone. It is attached to the mobile phone PCB with screws. Unscrew and open all the screws.
6. Remove connectors for display and camera and pull the display and the camera out.

How to Disassemble a Mobile Phone fig2.5

Fig. 2.3 Shows Mobile Phone Parts

Multi meters are of two types – Analog Multi meter and Digital Multi meter.
How to use Multi meter to check voltage, Ohms, battery, continuity etc is more or less the same. The only difference is that a digital Multi meter has a digital display of all the readings. An analog Multi meter has a needle-type pointer that moves to a reading while testing any device or electronic component.

Fig2.6 DMM

Most Multi meters, often spelt as Multi Meter, will have following:

1. **Function and Range Switch**: This switch is used to select the function and desired range as well as to turn the instrument. In order to extend the life of the battery of the Multi meter, this switch must be kept in the "OFF" position when the instrument is not in use.
2. **Display or LCD**: To display all the readings.
3. **Common Jack**: Plug in connector for black (negative) test lead or probe.
4. **V? mA Jack**: Plug in connector for red (positive) test lead or probe for all voltage, resistance and current (except 10A) measurements.
5. **10A Jack**: Plug in connector for red (positive) test lead or probe for 10A measurement.
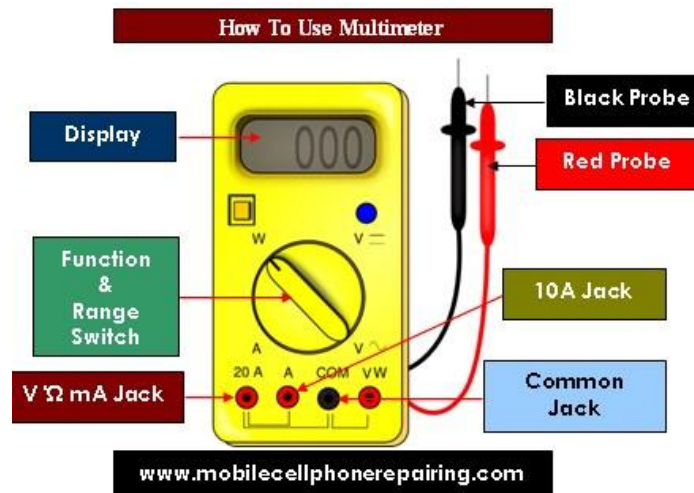
fig2.7 Shows How to Use Multi meter

Packing List or Items that come with a New Multi meter:

1. Multi meter.
2. Set or red and black test leads or probes.
3. Battery.
4. Thermoelectric couple.
5. Operator Instruction Manual.

How to Use a Multi meter (Analog and Digital): Instruction:

How to Measure DC (Direct Current) Voltage / DC Voltage Measurement:

1. Connect the red Test Lead to "**V ? mA Jack**" and the black lead to

DC   Current   Circuit   Symbol

"**COM**" jack.

2. Set the "**Range Switch**" to desired DC V position. If the voltage to be measured is not known then set the Switch to the highest range and reduce it until satisfactory reading is obtained.
3. Connect Test Leads to device or circuit being measured.
4. Turn ON Power of the device, instrument or component being measured. Voltage will appear on the Digital Display of a Digital Multi meter along with voltage polarity.

How to Measure AC (Alternating Current) Voltage Using a Multi meter / AC Voltage Measurement:

1. Connect the red Test Lead to "**V ? mA Jack**" and the black lead to

AC Current Circuit Symbol

"**COM**" jack.

2. Set the "**Range Switch**" to desired AC V position.
3. Connect Test Leads to device, electronic component or circuit being measured.
4. Voltage value will appear on the Digital or Analog Display the Multi meter.

How to Measure DC (Alternating Current) Current Using a Multi meter / DC Current Measurement:

1. Connect the red probe to "**V ? mA Jack**" and the black probe to "**COM**" jack. To measure DC current between 200mA and 10A, connect the Red probe to "**10A**" jack with fully depressed.
2. Set the "**Range Switch**" to desired AC A position.
3. Open the circuit to be measured and connect probes **in series** with the load in which current is to be measured.
4. Read value on display.

How to Measure Resistance Using a Multi meter / Resistance Measurement:

1. Connect the red probe to "**V ? mA Jack**" and the black probe to

Resistance Circuit Symbol

"**COM**" jack.

2. Set the "**Range Switch**" to desired **Ohms (?)** position.
3. If the resistor to be measured is connected to a circuit then TURN OFF POWER and discharge all capacitors before measurement.
4. Connect probes to circuit being measured.
5. Read resistance value on display.

How to Measure Diode / Diode Measurement:

1. Connect the red Test Lead to "**V? mA Jack**" and the black lead to

Diode Circuit Symbol

"**COM**" jack.

2. Set the "**Range Switch**" to **diode position**.
3. Connect Red Test Leads to Anode of the Diode and Black Test Lead to Cathode.
4. The forward voltage drop in mV will be displayed in the screen or display. If the diode is reversed, figure "1" will be displayed.

How to Measure Transistor hFE / Diode Measurement:

1. Set the "**Range Switch**" to **hFE** position.

Transistor Circuit Symbol

2. Determine whether the transistor is **NPN** or **PNP** type and locate the **Emitter, Base and Collector Leads**. Insert the leads into the proper holes of the **hFE Socket** on the Front Panel of the Multi meter.
3. The Multi meter will display the approximate hFE value at the condition of base current 10 µA and VCD 2.8V.

How to Measure Continuity / **Audible Buzzer Continuity measurement:**

1. Connect the red Test Lead to "**V ? mA Jack**" and the black lead to "**COM**" jack.
2. Set the "**Range Switch**" to **Buzzer**.
3. Connect test leads to the two points to be tested. If the resistance is lower than 100 Ohm then there will be buzzer sound which means that continuity is OK.

Test Signal Use:

1. Set the "**Range Switch**" to **Signal Symbol**.
2. A test signal appears between "**V ? mA Jack**" and "**COM**" jacks. The output voltage is approx 5V p⁻p with 50 k ohm impedance.

How to Measure Temperature / Temperature Measurement:

1. Connect the k-type thermoelectric couple to "**V ? mA Jack**" and "**COM**" jacks.
2. Set the "**Range Switch**" to "**Temperature Position**".
3. The display will read the temperature value in Celsius or Fahrenheit.

How to Measure Room Temperature / Room Temperature Measurement:

Most Multi meters can easily measure room temperature from 0 to 35 degree Celsius. Just set the "**Range Switch**" to RT Position and the present room temperature will be displayed.

Warning:

1. To avoid electrical shock, hazard or damage, do not measure voltage exceeding 1000V or 750V above earth ground. Different Multi meters may have different measurement range. Read the instruction manual carefully before operating the Multi meter.
2. Before using the Multi meter, inspect Test Leads, Connectors and Probes for cracks, breaks or crazes in the insulation.
3. Before attempting to open the case of the Multi meter, be sure to disconnect test leads or probes from any energized electronic circuit to avoid electrical shock.

How to Take Care of your Multi meter

When you are using a Multi meter, it is your responsibility to its proper care and prevent it from any damage:

1. **Replacing Fuse**: Fuse of a Multi meter rarely blow or need replacement. If it happens, it is because of operator error or mistake. If required just replace the old fuse with a new one with proper polarity.
2. **Battery Replacement**: If the symbol of battery appears on the display, it indicates that the battery has to be replaced.

2.4 How to use Jumper in Mobile Phone Repairing

Most *mobile phone repairing* is done by doing jumper. Different *parts of a mobile cell phone* like display, keypad, speaker, microphone, LED lights, different ICs, different small parts and electronic components, all have different jumper settings. It is important to first track the fault or missing track and then do the jumper.

How to Jumper use:

1. Disassemble mobile phone and place it on a PCB holder.
2. Using a multi meter, check track and find the fault or the missing track that need jumper.
3. Apply liquid soldering flux to the points where you need to solder jumper wire.
4. Cut jumper wire to desired length and remove its lamination using blade cutter.
5. Hold one end of the jumper wire and solder it to one point of the faulty circuit track. Use a good quality tweezers to hold the wire and good quality of soldering iron and solder wire to solder.
6. Now hold the other end of the jumper wire and solder to the other point of the track
7. Using a multi meter check the jumper.

2.4.1 Systematic *pre-testing procedure* is followed in accordance with manufacturer's instructions
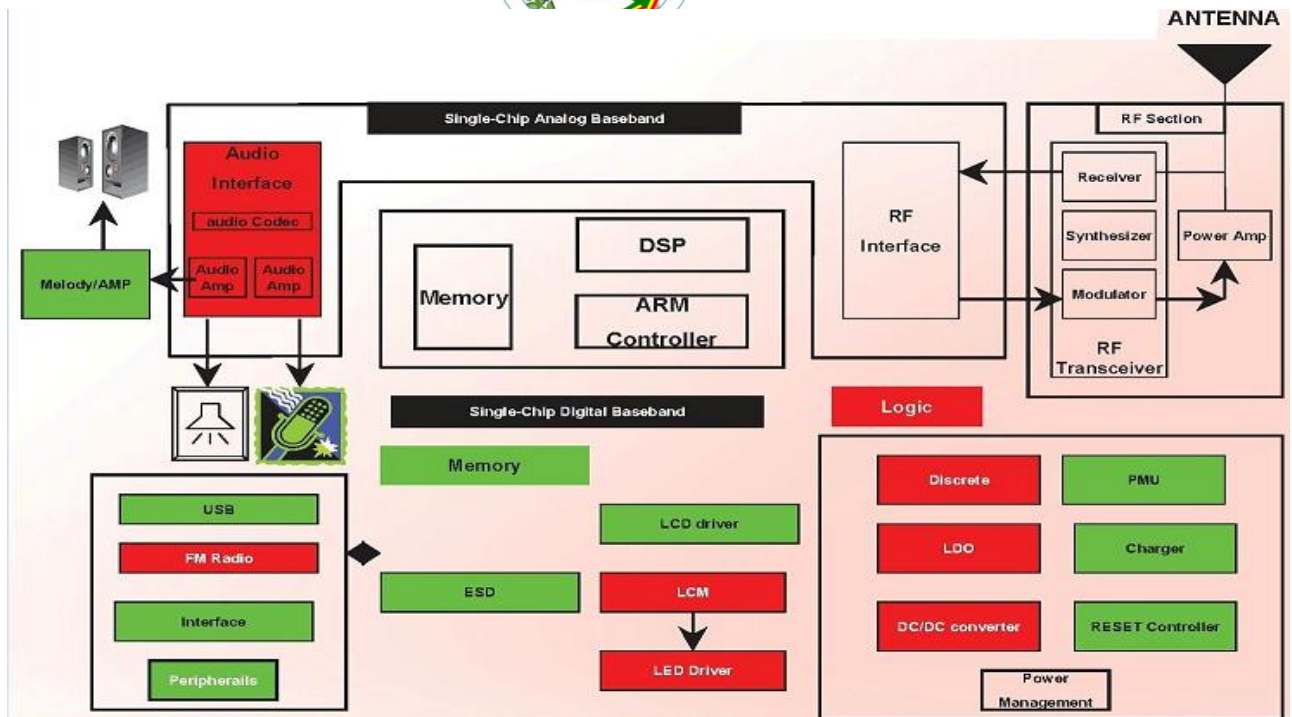
Fig. 2.8 Shows Mobile Phone Block Diagram

Okay, that's it for a while, for there are lots of techniques we are going to tackle sooner, hope you do understand a little bit with this method.
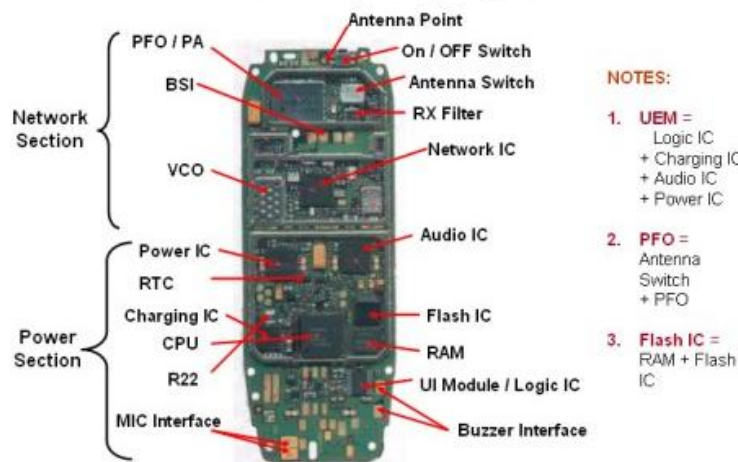
Fig.2.9 Phone PCB   *Shows   Mobile Diagram*

NOTES:

1. **UEM (Universal Energy Manager)** = Logic IC + Charging IC + Audio IC + Power IC
2. **PFO (Power Frequency Oscillator)** = Antenna Switch + PFO
3. **Flash IC**= RAM + Flash IC

1. **Antenna Switch**: It is found in the Network Section of a mobile phone and is made up of metal and non-metal. In GSM sets it is found in white color and in CDMA sets it is found in golden metal.

Fig.2.10 Shows Cell Phone Antenna Switch

Work: It searches network and passes forward after tuning.

Faults: If the Antenna Switch is faulty then there will be no network in the mobile phone.

2. **P.F.O**: It is found near the Antenna Switch in the Network Section of the

Fig. 2.11 Shows Cell Phone PFO

PCB of Mobile Phone: It is also called P.A (Power Amplifier) and Band Pass Filter.

Work: It filters and amplifies network frequency and selects the home network.

Faults: If the PFO is faulty then there will be no network in the mobile phone. If it gets short then the mobile phone will get dead.

3. **RF IC / Hagar / Network IC**: This electronic component found near

Fig. 2.12 Cell Phone Network IC / RF IC

The PFO in the Network Section of a Mobile Phone: It is also called RF signal processor.

Work: It works as transmitter and receiver of audio and radio waves according to the instruction from the CPU.

Faults: If the RF IC is faulty then there will be problem with network in the mobile phone. Sometimes the mobile phone can even get dead.

4. **26 MHz Crystal Oscillator**: It is found near the PFO in the Network

Fig. 2.13 Shows Mobile Phone 26 MHz Crystal Oscillator

Section of a Mobile Phone: It is also called Network Crystal. It is made up of metal.

Work: It creates frequency during outgoing calls.

Faults: If this crystal is faulty then there will be no outgoing call and no network in the mobile phone.

5. **VCO**: It is found near the Network IC in the Network Section of a Mobile
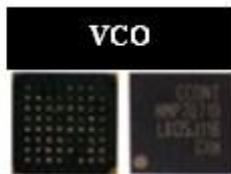
Fig. 2.14 Shows Mobile Phone VCO Phone.

Work: It sends time, date and voltage to the RF IC / Hager and the CPU. It also creates frequency after taking command from the CPU.

Faults: If it is faulty then there will be no network in the mobile phone and it will display "Call End" or "Call Failed".

6. **RX Filter**: It is found in the Network Section of a Mobile Phone.

Fig.2.15Shows   Mobile   Phone RX Filter

Work: It filters frequency during incoming calls.

Faults: If it is faulty then there will network problem during incoming calls.

7. **TX Filter**: It is found in the Network Section of a Mobile Phone.

Fig. 2.16Shows Mobile Phone TX Filter

Work: It filters frequency during outgoing calls.

Faults: If it is faulty then there will network problem during outgoing calls.

8. **ROM**: It is found in the Power Section of a Mobile Phone.

Fig. 2.17 Shows Mobile Phone ROM

Work: It loads current operating program in a Mobile Phone.

Faults: If ROM is faulty then there will software problem in the mobile phone and the set will get dead.

9. **RAM**: It is found in the Power Section of a Mobile Phone.

Fig. 2.18 Shows Mobile Phone RAM

Work: It sends and receives commands of the operating program in a mobile phone.

Faults: If RAM is faulty then there will be software problem in the mobile phone and it will get frequently get hanged and the set can even get dead.

10. **Flash IC**: It is found in the Power Section of a Mobile Phone. It is also Called EEPROM IC, Memory IC, RAM IC and ROM IC.

Fig. 2.19 Shows Cell Phone Flash IC

Work: Software of the mobile phone is installed in the Flash IC.

Faults: If Flash IC is faulty then the mobile phone will not work properly and it can even get dead.

11. **Power IC**: It is found in the Power Section of a Mobile Phone. There are Many small components mainly capacitor around this IC. RTC is near the Power IC.

Fig. 2.20 Shows Cell Phone Power IC

Work: It takes power from the battery and supplies to all other parts of a mobile phone.

Faults: If Power IC is faulty then the set will get dead.

12. **Charging IC**: It is found in the Power Section near R22.

Fig. 2.21 Shows Cell Phone Charging IC

Work: It takes current from the charger and charges the battery.

Faults: If Charging IC is faulty then the set will not get charged. If the Charging IC is short then the set will get dead.

13. **RTC (Simple Silicon Crystal)**: It is Real Time Clock and is found in

Fig.2.22Shows Mobile Phone RTC (Real Time Clock)

The Power Section near Power IC. It is made up of either metal or non-metal. It is of long shape.

Work: It helps to run the date and time in a mobile phone.

Faults: If RTC is faulty then there will be no date or time in the mobile phone and the set can even get dead.

14. **CPU**: It is found in the Power Section. It is also called MAD IC, RAP IC

Fig. 2.23 Shows Cell Phone CPU and UPP

It is the largest IC on the PCB of a Mobile Phone and it looks different from all other ICs.

Work: It controls all sections of a mobile phone.

Faults: If CPU is faulty then the mobile phone will get dead.

15. **Logic IC / UI IC**: It is found in any section of a mobile phone. It has 20 legs (pins)

Fig. 2.24Shows Cell Phone Logic IC pins or legs

It is also called UI IC and Interface IC.

Work: It controls Ringer, Vibrator and LED of a mobile phone.

Faults: If Logic IC / UI IC is faulty then Ringer, Vibrator and LED of mobile phone will not work properly.

16. **Audio IC**: It is found in Power Section of a mobile phone. It is also

Fig. 2.22 Shows Cell Phone Audio IC Called Cobba IC and Melody IC.

Work: It controls Speaker and Microphone of a mobile phone.

The PCB of any mobile phone of any brand namely Nokia, Samsung, Motorola, China Mobile Phones etc is divided into 2 Parts namely: (1) Network Section; and (2) Power Section. When identifying parts, electronic components and ICs on the PCB of a mobile cell phone, it is important to keep these two sections in mind.

1. **Antenna Point**: The point where antenna is connected is called antenna point. It is normally located at the top of the PCB of a mobile phone.

Network Section: The section below antenna point and above power section is called network section.

2. **Antenna Switch**: It is found in the network section. It is made from metal and non-metal. It has 16 points or legs. In some mobile phones, the antenna switch is merged with PFO.

Fig. 2.25Shows Antenna Switch of Mobile Phone

3. **PFO**: Power Frequency Oscillator. It is present beside the antenna switch.

Fig. 2.26Shows PFO of a Mobile Phone

4. **Network IC**: It is below or beside the antenna switch and PFO. In some mobile phones, the Network IC is merged with the CPU. E.g.: Nokia 1200, 1650, 1208, 1209 etc.

Fig. 2.28Shows Network IC of a Mobile Phone

Power Section: This section is below the Network Section.

5. **Power IC**: In the Power Section, the IC around which there are several brown-colored capacitors is called Power IC. In some mobile phones there are 2 Power ICs.

Fig. 2.29Shows Power IC of a Mobile Phone

6. **CPU**: Central Processing Unit. In the power section, the largest IC is the CPU. In some sets there are 2 CPU.
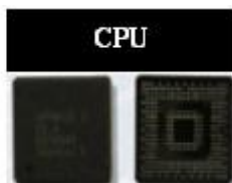
Fig. 2.30 Shows CPU of a Mobile Phone

7. **Flash IC**: This IC is found beside the CPU.

Fig. 2.31Shows Flash IC of a Mobile Phone

8. **Logic IC**: The IC with 20 legs is the Logic IC.

Fig. 2.32 Shows Logic IC of a Mobile Phone

9. **Charging IC**: In the Power Section, the IC beside R22 is the Charging IC.

Fig. 2.33 Shows Charging IC of a Mobile Phone

10. **Audio IC**: The IC parallel to Power IC is the Audio IC.

Fig. 2.34 Shows Audio IC of a Mobile Phone

1. **Keyboard or Keypad Section**: The keyboard section of any mobile cell phone is directly connected with the CPU. This means that rows and columns of keys are directly connected with the CPU. Protector IC or Interface IC or Varactor diode is connected in the row or column line for the protection of key section. In modern mobile cell phones, which have QWERTY keys, a separate control IC is connected with the CPU for extra protection to the keys.

2. **Display Section**: The display section is directly connected with the CPU to receive following signals – LCD Data Signal, LCD Reset Signal, LCD WR Signal, LCD RD Signal, LCD FLM Signal, LCD HSYN Signal etc. These signals are given to the LCD Module through the CPU. 2.8V power supply or 1.8V power supply is given to the LCD for functioning. LCD signal interface filter are connected in many mobile cell phones for interfacing these signals of LCD Module.

3. **SIM Card Section**: The SIM Card Interface section is directly connected with the CPU in most mobile cell phones. If there is no power supply in a mobile phone then the SIM section is connected with the CPU through the Power IC. Mainly V-SIM (3.0V), SIM-RST (2.85V), SIM CLK, SIM-Data (2.5V), and SIM GND are made in the SIM Section. These four pins (Beside (SIM GND) are directly connected with the SIM interface / control

section and V-SIM volt are given to the SIM data pin from V-SIM pin through the 10-18 Kilo Ohms Resistance.

4. **Memory Card Section**: Now mostly Micro SC Card is connected in most mobile cell phones which is connected with micro card section through a 8 pin socket. Memory card section is made inside the CPU. Description of these 8 pins are as follows:
    1. MMC-Data-2
    2. MMC Data
    3. MMC CMD (Command)
    4. VMMC / VSD (Positive Supply Pin)
    5. MMC-CLK
    6. GND
    7. MMC-Dta0
    8. MMC Data-1

Volt Power is supplied to Pin Number 4 from Power Supply for functioning of the MMC Card and connection the 50 tp 100 Kilo Ohms resistance in this power supply. This power supply is given to Pin Numbers – 1,2,3,7,8 of MMC Socket. One MMC detector switch or pin is made in MMC socket at which, if there is no MMC Card then 1.8 V power is continuously received and after the MMC is connected, it becomes zero.

5. **MIC Interface Section**: MIC interface section is directly connected with the CPU inmost mobile phones. Working voltage (MIC Bios) (1.8 to 2.8 V) is supplied from the CPU or the Power Supply Section for functioning of the MIC and MIC Positive and Negative Volt are input through two capacitors.
6. **Ear Speaker Section**: In most modern mobile cell phones, in which there is a separate ear speaker, it is directly to the CPU. It receives sound via signals directly from the CPU of from the audio section inbuilt within the CPU. In some mobile phones, these sound signals are received via coil / resistance. Some mobile phones have audio IC in the audio section. Some mobile phones have audio amplifier.
7. **Speaker / Ringer Section**: Ringer, Buzzer or Speaker in most mobile phones are connected with the audio amplifier IC to obtain loud sound. The amplifier IC amplifies the sound or audio signal received from the CPU of the audio section.
8. **Key Backlight Section**: LED Lights are connected according to the parallel circuit in the key backlight section. Anode ends of all the LEDS are connected to each other and all the cathode ends are to each other. 3 to 3.3 V is supplied for the functioning of these Key LED Lights. This power supply is given to the cathode ends of LEDs from the ground ends. Power

supply to the anode ends of LED Lights is controlled bu using LED-Driver or PNR IC.

9. **LCD Backlight Section**: LCD Backlight in mobile cell phones is made according to the series circuit. A Boost Voltage Generator Section is built for the supply of high voltage (10 to 18V) for the functioning of the LCD LED. Boost coil, Boost Volt Driver IC, Rectifier Diode etc are present in this section.

10. **Vibrator Motor Section**: Positive power supply is given to this section directly from the positive end of the battery. Negative power supply is given through a NPN transistor or from the ground of any circuit.

11. **Network Section**: Antenna, External Antenna Socket, RX-Band Pass Filter, RF Crystal, FEM, PFO, TX-Band Pass Filter, RF IC, and CPU are connected in the Network Section. Signal received at the antenna during the RX is given to the antenna switch or FEM through the antenna socket where the next processing is completed by selecting a frequency of proper band and is passed on to the RF IC through RX-Band Pass Filter. RF Signal out from the RF IC during TX is given to the FEM or PFO to amplify the signal. After the Band Selection Process the signal is passed through the antenna.

12. **Battery Charging Section**: Charger and system interface connector is made together in most modern mobile cell phones. Regulator section is made separately for the battery charging section. In some mobile phones, the battery charging section is made inside the Power IC.

13. **FM Radio Section**: FM Radio Driver IC, FM Antenna, Signal and Supply Components are made in the FM Radio Section.

14. **Bluetooth Section**: Bluetooth Antenna, Bluetooth RF Signal Filter, Bluetooth Driver IC, Supply and Signal Components are made in this section. The Bluetooth sections functions like the Network Section. RF-CLK signal is given to the Bluetooth driver IC during signal processing.

15. **Set Power ON**: Power IC, CPU (UCP), Flash IC, RF-CLK, Crystal, RF-IF, PWR Ket etc components are present this section. Battery positive supply is given to the power IC and connecting the battery (3.7V) from 2.87 to 3.0 Power ON Volts are received at one tip of the Power Key. Supply is given to the CPU, Flash IC, RF-CLK, Generator Section (RF Crystal, RF IC) by which the mobile phone gets switched ON.

16. **Hands free (Earphone Section)**: Mainly hands free jack, hands free MIC, speaker signal component and hands free audio amplifier are present in this section. Hands free symbol is displayed after connection the Hands free jack.

Self Check #1	Written Test

Name: _____Date: _____

Time Start: _____Time Finish: _____

Instruction: Answer all the questions provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

Part I. Choose the correct answer from the alternatives (2 points each)

1. If there is less light or some of the LED lights are not working?
  A. Screen Problem   C. Light Problem
  B. Headphone Problem   D. All

2. If your mobile cell phone has less or week or no network?
  A. Bluetooth   C. SIM Problem
  B. Network Problem   D. All

3. If the person you are talking to will not be able to listen to your voice?
   A. Screen Problem   C. Headphone Problem
   B. Light Problem   D. Microphone Problems

4. If the symbol of battery appears on the display
   A. Battery Replacement   C. Bluetooth
   B. Replacing Fuse   D. Network Problem

5. _____is found in the Network Section of a mobile phone and is made up of metal and non-metal.

  A. Antenna Switch   C. Work

  B. Faults   D.PCB of Mobile Phone

Note: **Satisfactory rating –5 points**   **Unsatisfactory - below 5 points**

   You can ask your teacher for the copy of the correct answers.

Answer Sheet

                   scored Points [   ]

Part I

    1. _____
    2. _____
    3. _____
    4. _____
    5. _____

Operation Sheet #1	Assemble & disassemble cell phone

OPERATION TITLE: Perform Assembling & disassembling of cell phone

PURPOSE: To assemble & disassemble cell phone properly, to identify the external and internal parts of the cell phone.

CONDITIONS OR SITUATIONS FOR THE OPERATIONS:-Clean, safe working area and equipped workshop with sufficient electrical/electronic components & measuring instrument, materials of cell phones, hand tools.

Equipments and Tools

Tools	Equipments
Set of Flat and Philips screw driver, **Kit Mobile Phone Opener, Tweezers,** side cutting plier	Digital Multi-meter PPEs Clean and ESD free work bench

PROCEDURE:-

Select the required cell phone

Select the required tools
Open the cell phone properly
Clean the internal parts of cell phone.
Identify the external & internal parts of cell phone.
PRECAUTIONS:-
You should not forget to wear your PPEs. You should take care of not to contact any bare part of your body whenever you assemble & disassemble cell phone. Use instruments properly according to manufacturer specification.
QUALITY CRITERIA:-
Perform safely and properly when assemble & disassemble cell phone, identified quickly, efficiently, economically and safely.

Operation Sheet #2	the cold testing or hot testing methods

Purpose: The following statements describe either the cold testing or hot testing methods used for diagnosing mobile phone problems

Description of diagnosis method	Name of Diagnosis method
1 Checks the value of resistance using a multimeter to diagnose a problem	Cold Testing
2 Checks the voltage of damaged part	Hot testing
3 The phone is not powered during testing	Cold testing
4 Fault is found by powering the mobile phone with a battery	Hot testing

PROCEDURE:-
1. Follow safty rule and procedure
2. Select the required cell phone
3. Select the required tools
4. Select the correct DMM
5. Open the cell phone properly
6. Clean the internal parts of cell phone.

7. Start measuring and test

PRECAUTIONS:-

You should not forget to wear your PPEs. You should take care of not to contact any bare part of your body

Operation Sheet #3	Diagnosis faulted cell phone

OPERATION TITLE:-perform Diagnosing faulted cell phone.

PURPOSE:- To identify where is the fault, What type of fault, and what is the cause of fault that makes the cell phone parts

CONDITIONS OR SITUATIONS FOR THE OPERATIONS:-Clean, safe working area and equipped workshop with sufficient electrical/electronic components & measuring instrument

Equipment and Tools for cell phone repair

Tools	Equipment
Flat and Philips screwdriver kit Soldering Iron, Soldering Station equipment's, PCB holder, PCB Cleaner, Tweezers, Hot Air Blower, side cutting plier	Digital Multi-meter Faulted cell-phone PPEs Clean and ESD free work bench

PROCEDURE:-

Follow the following steps to investigate the fault systematically.

1. Folloew safty rule and procedure
2. Receive (collect) necessary information about the fault nature and symptom of the fault from the user or operator

3. Wear   PPEs   (apron,   Glove, Safety shoe)
4. Verify the information that the cell phone is really mal-function by visual inspection and output voltage measurement by DC power supply. If the output voltage is 0, bellow the rated value:
5. Check the speaker and the micro phone (continuity test)
6. Measure DC voltage/Battery and compare with its rating
7. Test each component of cell phone and dingoes the faults.

PRECAUTIONS:-You should not forget to wear your PPEs. You should take care of not to contact any bare part of your body whenever you test and digamous the cell phone . Use instruments properly according to manufacturer specification.

Information sheet 3	System defects/fault symptoms are identified using appropriate diagnostic software,

3.1How to Diagnose Mobile Phone Problem – Diagnostic Codes

Here we Learn How to Diagnose Mobile Phone Problems with Diagnostic Codes. Learn How to Diagnose Common Mobile Phone Problems with Secret Diagnostic Codes.

fig 3.1

3.1.1What are Secret Diagnostic Codes to Test & Check Phone Hardware Condition

Diagnostic codes, also called, secret codes, help to get a closer look at the inner functionality of a phone. Most mobile phone repairing technicians use these diagnostic codes to troubleshoot Feature Mobile Phones, Android Smartphone. and Apple iPhone.

There are a list of these diagnostic codes for Android phones, iPhone, China phones and other phones. Most manufacturers provide such list with their manual that comes with a new phone.

Below you will find a list of Codes to Diagnose Mobile Phone Hardware Problem. Make sure to use them with caution. Read carefully what each diagnostic code

does before entering them in your phone. Some codes can wipe OFF the firmware or delete the vendor-specific updates from the OS. So, be extra careful.

3.1.2How to Diagnose Mobile Phone Problem

There could be times when you may need to troubleshoot / diagnose your mobile phone or Android Smartphone when there are problems such as Slow Performance, Audio Problems, Touchscreen or Display Problems or any other such Hardware or Software Problem.

There are in-built Diagnostic Tools and Downloadable Apps that can help you easily and quickly diagnose your mobile cell phone and troubleshoot and fix the problem.

Mobile Phone Secret Diagnostic Codes

- **iPhone** – 3001#12345# * – This will display "*Field Test*" on your iPhone where you can easily test each part of the phone's functions.
- **BlackBerry**: TEST
- **HTC**: *#*#3423#*#*
- **LG**: 2945#*# or 2945*#01*#
- **Motorola**: ##7764726
- **Nokia**: ##3282
- **Samsung**: * #0011#
- **Sony**: 904059+>

The above codes will help you identify software or hardware problem and then it becomes easier to find the solution. Please note that the above codes may not work on all models

List of Useful Secret Codes for Android Mobile Phones

Code	Function
##0*#*#*	LCD Test
##0673#*#* OR *#*#0289#*#*	Melody Test
##0283#*#*	Packet Loop Back
##0842#*#*	Vibrator and Back light Test
##2663#*#*	Touch Screen Version

##2664#*#*	Touch Screen Test
*#*0588#*#*	Proximity Sensor Test
##3264#*#*	RAM Version

3.3.3 What are Secret Diagnostic Codes to Test & Check Phone Hardware Condition

Diagnostic codes, also called, secret codes, help to get a closer look at the inner functionality of a phone. Most mobile phone repairing technicians use these diagnostic codes to troubleshoot Feature Mobile Phones, Android Smartphone. And Apple iPhone.

You may remember that whenever you go to a technician or any service center, the first thing they do is enter some code with **#** symbol and some numbers and few other symbols. These are nothing but Diagnostic Codes that help the technician to know about the exact problem. They have a list of such codes and they use them as and when required.

If you've never run a diagnostics test on your own smartphone, it's worth doing— especially as your phone starts to show its age, or if you purchased a "new" smartphone second-hand and want to get a feel for its condition.

Diagnostic tools are also helpful for when your device becomes less efficient, but you cannot quite pin down why. Instead of using guesswork to troubleshoot the various features on your phone until you stumble on a solution, a diagnostics scan can highlight exactly what is wrong with your phone, or at least provide enough data to point you in the right direction.

Unfortunately, finding the built-in diagnostics tools on Android smartphones and iPhones can be difficult, and some devices don't even have very good diagnostic options to begin with (if at all). But you can always turn to third-party apps for help.

Built-in diagnostics tools

Android

Most Android phones have a few simple diagnostics tools hidden in the OS, but they vary between devices. The tools are found by typing codes into your phone

app's dialer—kinda like inputting cheat codes in a video game. Type in the codes below, and the menus should automatically open.
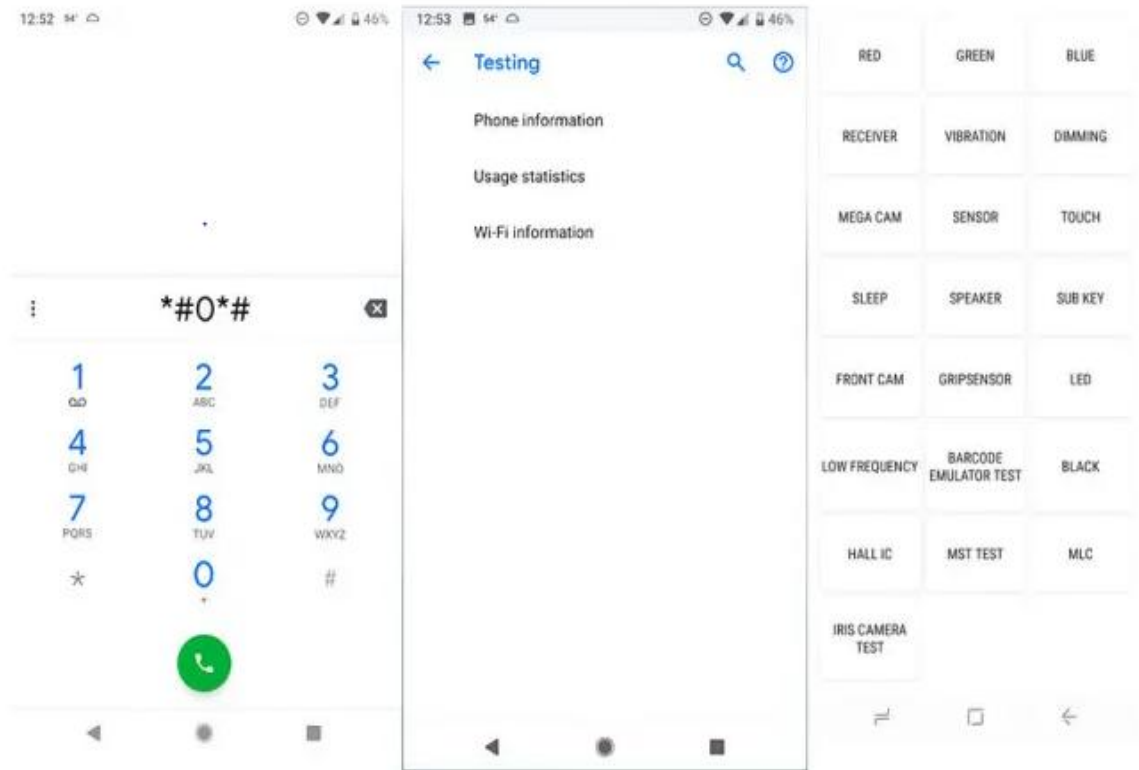
Fig.3.2

Here are the two main codes usable on most Android devices:

- ***#0*# hidden diagnostics menu**: Some Android phones come with a full diagnostics menu. You'll be able to run a check-up for at least some of the phone's hardware. However, this code isn't available on all phones—nothing happened when I tried the code on a Pixel XL, for example, though the menu appeared on a Samsung Galaxy S9. For those that do have access, it's a handy trick. The menu offers a number of standalone tests to check the performance of your phone's various parts, such as your screen (touch recognition, color accuracy), your cameras, sensor, and physical buttons like the power and volume controls.
- ***#*#4636#*#* usage information menu**: This menu will show up on more devices than the hidden diagnostics menu, but the information shared will

be different between   devices. At the very
least, you should be able to see app usage history; real-time wifi and
cellular network connection stats; and basic phone information like the
current service carrier, phone number, et cetera.
- You don't have to press the call button or anything else to open the hidden
  menus, they'll just open automatically. If nothing happens when you type
  in the code, then your phone doesn't have the feature. Similarly, some
  devices don't provide very helpful information, like the aforementioned
  Google Pixel (which relies on Google collecting diagnostic information
  from your phone in the background). If that's the case, then jump on down
  to the next section for some recommendations for third-party diagnostics
  apps.

- **iPhone**

fig3.3

3.3.4Running diagnostics scans with third-party apps

With limited options available in iOS, the only real option for running diagnostics
on your iPhone or iPad is to use a third-party app. These apps are also helpful
for Android phones that do not have built-in diagnostics tools—or if you want a
more detailed (and less cumbersome) way to test your phone's hardware.

Test (Android and iOS)

This app lets you run both quick appraisals and full hardware diagnostics on iPhone and Android devices. The full scan performs simple actions that test each of your phone's major hardware functions, including the cameras; battery and charging; onboard sensors; and the performance of location, Bluetooth, and cellular connections.

Each test is simple, and the results are easy to read. If the scan detects something wrong, the app can give you recommendations for nearby repair shops. The only major downside to TestM is that it plays ads between each test, which is annoying.

Phone Check and Test (Android)
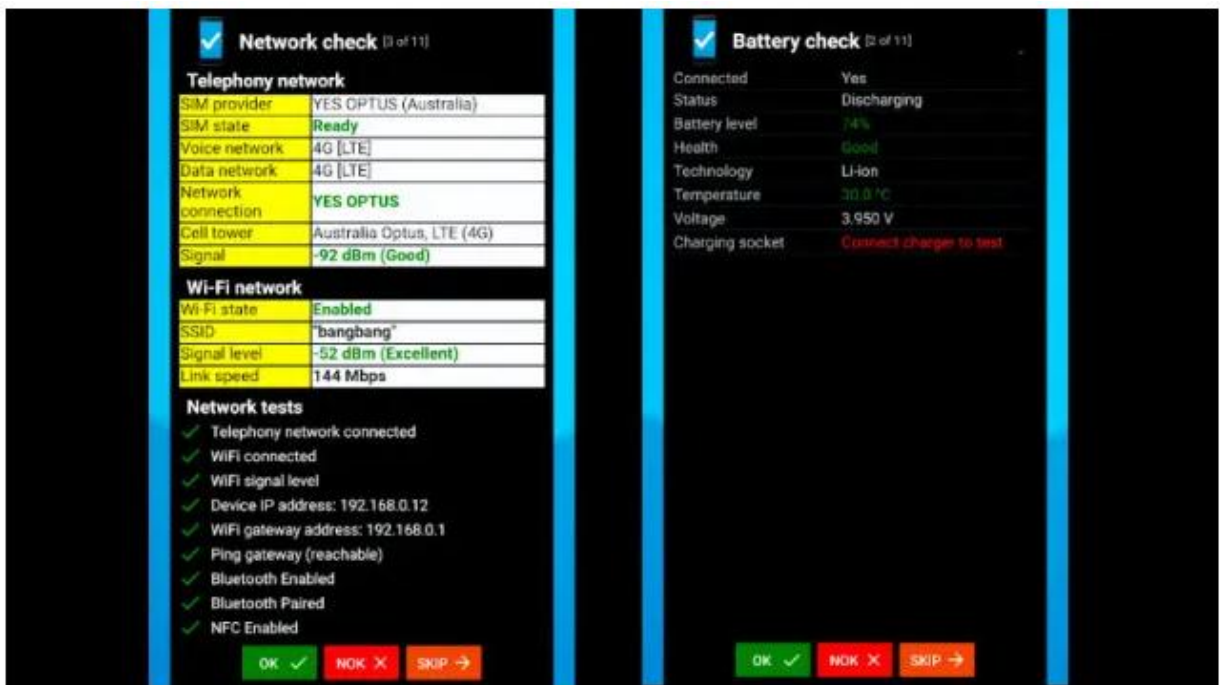
Fig 3.4

Phone Check and Test is a plain-looking app, but it's capable of much more than just checking that your phone's hardware "works." A full scan includes deep CPU, storage, and battery diagnostics, and the test readouts are highly detailed. This makes Phone Check and Test a little less user-friendly than TestM, but it's an excellent troubleshooting tool that provides you with tons of data.

While the free version does contain ads, they're minimal, and you can upgrade to Plus for just $2 to remove them. The Plus version also adds a few more testing

tools and lets you run standalone tests for each piece of hardware separately, which saves you time over a full system scan.

Phone Diagnostics (iOS)

Like the TestM app for Android phone, Phone Diagnostics can be an ad-ridden mess at times, but hidden behind all that is a reliable set of hardware function tests. The full test takes you through all the major hardware features based on the iPhone model you're using.

Unlike the other apps we've listed, Phone Diagnostics allows users to perform immediate standalone tests of any hardware function your iPhone carries without requiring a paid upgrade

Diagnostics

DIGITIZER	MULTI TOUCH
LCD	CAMERA
VIDEO RECORD	SPEAKER + MIC
FLASH	BUTTONS
TOUCH ID	WI-FI
3G/4G	CALL
PROXIMITY	MOTION
COMPASS	GPS

grade.

Fig,3.5

Software Tools for Mobile Phone Repairing

With These Software Tools for Mobile Phone Repairing, you can Flash Software of all Android Smartphone and iPhone. You Can Flash ROM (OS), IMEI, Unlock Forgotten Lock Pattern or Password, Repair Smartphone that Hangs at Logo.

Here are all the Software Tools for Mobile Phone Repairing. With these Software Tools you can do fix all software relates problems of all iPhone and Android

Smartphones of any Brand and ![logo] Model including – Samsung, Apple iPhone, All China Mobile Phone (*Vivo, Oppo, Honor, Huawei, Xiaomi, Meizu, OnePlus, Lenovo, Qiku 360, Smartisan*), Micromax, Lava etc.

Miracle Thunder Box (Software Tool for China Android Smartphones)
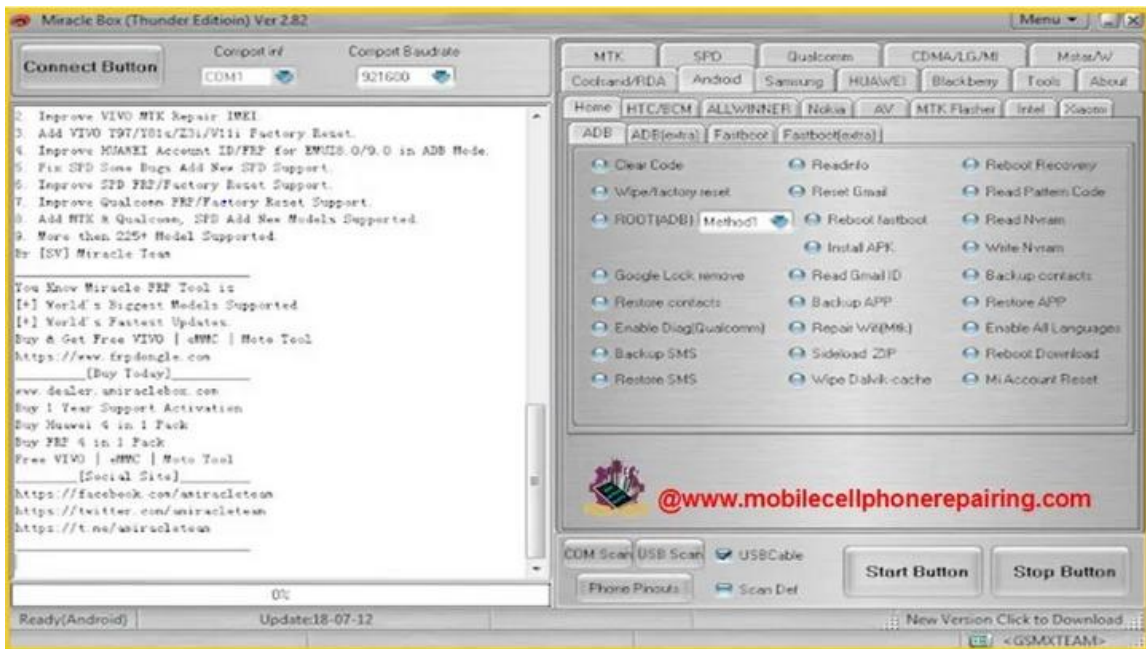
Fig 3.6

Miracle Thunder Box is is the Software Tool for All China Made Android Smartphones of all Brands and Models using any CPU (*MTK (Mediatek), Qualcomm, Spreadtrum etc*). With this tool you can Flash Software (OS), Flash IMEI Number, Unlock Forgotten Lock Pattern or Password, Repair Mobile phones that Hangs at the Logo and Fix any Software Related Issues.

Your can repair Android Smartphones of Following Brands – Alcatel, Asus, Motorola, Samsung, ZTE, Vivo, Oppo, Honor, Huawei, Xiaomi, Meizu, OnePlus, Lenovo, Qiku 360, Smartisan, Coolpad, Fly, Gionee, Infocus, Intex, Infinex, Karbonn, Lyf, Micromax, Qmobile, Tecno, Wiko, Zopo.

No Flashing Box is Needed for ![logo] to use this software. Just Download to your PC and start using with its easy Software Flashing GUI. It is Universal Mobile Phone Flashing Software for all China Made Android Mobile Phones.

fig3.7

SP Flash Tool (Software Tools for Mobile Phone Repairing using MTK Processor)
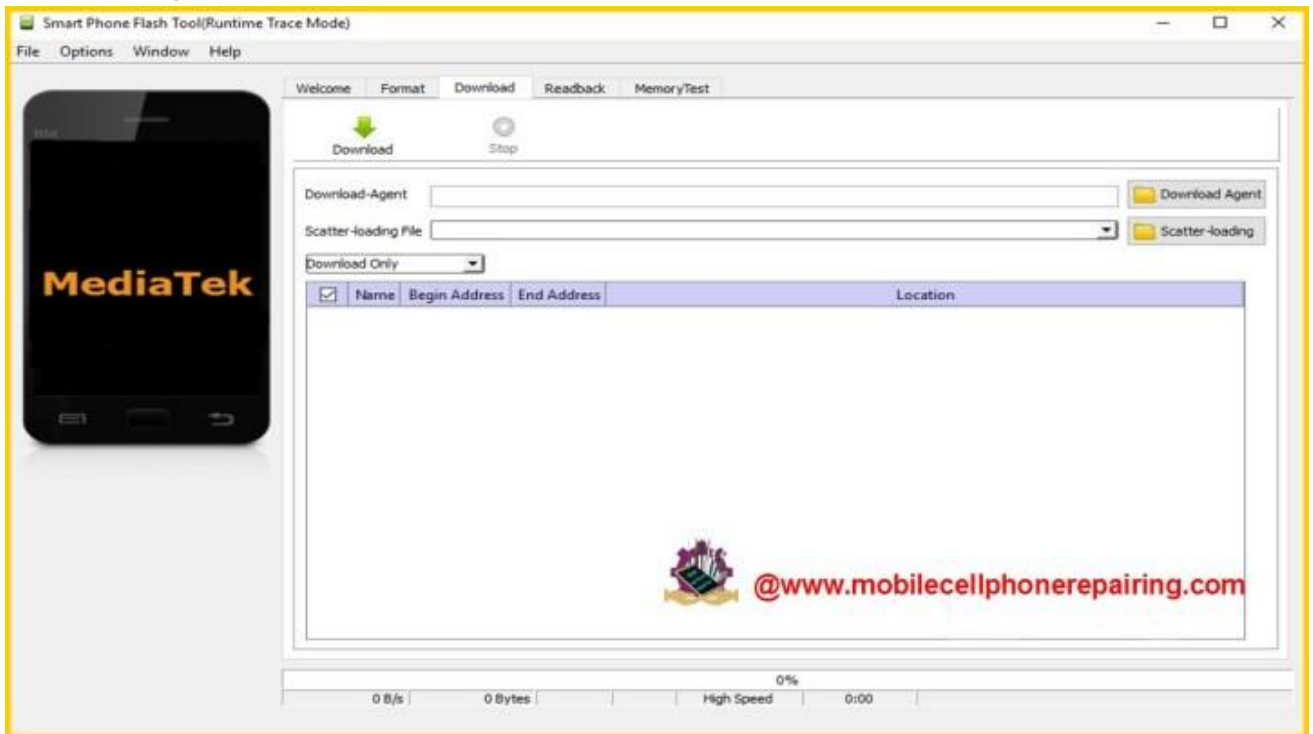
fig3.9

SP Flash Tool

SP Flash Tool (*Smart Phone* *Flash Tool*) is a small-sized Easy to Use Software to flash Stock ROM, Custom Recovery, Upgrade or Downgrade Firmware Version, Unlock Forgotten Lock Pattern or Password and for Fixing all Software Related Issues of Android Smartphones using MTK (*Mediatek*) Processor.

REMEMBER SP Flash Tool is completely FREE and is used to Repair of Android Mobile Phones using MTK (Mediatek) Processors ONLY.

What You can do with SP Flash Tool

With this easy to use tool, you can do following:

- Flashing of Android Stock-ROM
- Flash Custom ROM
- Fix Bricked Devices
- Perform Memory Test
- Format / Reset Android Smartphones using MTK Processor

Requirements to use SP Flash Tool

You need following to use this Tool:

- Laptop of Desktop PC
- USB Data Cable to Connect Smartphone with the PC
- MediaTek USB-VCOM Drivers (*Available as a Bundle with the Software when you Download. No need to Download Separately*)
- Scatter File
- Software Files to be Flashed (Download **Here**)

PS: All instructions to Download, Install and Use the Tool is clearly mentioned on the Above Site.

Other Software Tools for Mobile Phone Repairing

Processor	Software Tool
SpreadTrum	SPD Flash Tool
Qualcomm	QFlash Tool
Samsung	Odin Flash Tool
Apple iPhone	iTune Tool

- Apple is notorious for its products being "walled gardens," which makes it hard for users to perform check-ups and DIY fixes for their devices. Unsurprisingly, you won't find any built-in diagnostics tests that you can run on an iPhone.
- That said, the iPhone settings *do* include detailed readouts on battery performance and history. To find this data, go to **Settings > Battery.**
- You'll find a number of different options and categories that contain your device's [battery performance data](—)but nothing else beyond that, unfortunately.

How to Flash IMEI Number in Android Mobile Phone

You will need to flash IMEI Number in your Android Mobile Phone after flashing Stock ROM (Firmware). **You have to flash the Stock ROM (Firmware) in your Android Mobile Phone for any of the following reasons:**

- Your mobile phone gets hanged too often.
- Your phone gets hanged at company logo and doesn't boot.
- You want to update the latest software / operating system in your phone.
- You have forgotten the lock pattern or password and want to unlock the phone.
- Your Android Mobile phone or tablet is dead because of software issues.

After you Flash the Stock ROM, you will also have to Flash the IMEI Number and Restore it back. Otherwise you may get following error messages: **Invalid IMEI Number**

So, in order to fix this Invalid IMEI Problem and Restore the IMEI Number on Android Smartphone you have to Flash IMEI Number in you Android Mobile Phone.

This tutorial to flash IMEI Number on Android Mobile Phone works on most Brands including – *Alcatel, BLU, Celkon, Coolpad, FLY, Gionee, Huawei, Intex, Carbonn, LAVA, Lenovo, Micromax, Oppo, Panasonic, Samsung, Vivo, Xiaomi, ZTE, etc.*

Software and Hardware Needed to Flash IMEI Number in Android Mobile Phone

You will need following Software and hardware to flash or Rewrite IMEI Number on Android Mobile Phone and Tablet:

Hardware Needed

1. The Android Phone to Flash the IMEI Number.
2. A USB Data Cable to Connect Your Phone to the Computer or Laptop.

Software Needed

1. **Stock ROM / Firmware**: of the Model of the Phone in which Flashing of IMEI Number is to be done. (*Why is this needed will be clear later in this Tutorial*)
2. **SN Write Tool**: SN Write Tool allows you to read and write IMEI on any Mediatek Feature Phone, Android Smartphone and Tablets.
3. **AP BP Base for SN Write Tool**: in .zip file (*You need this if you do not have the .zip file of the Stock ROM*)
4. **Read&Write Tool**: Read&Write Tool allows you to read and write IMEI on any Qualcomm, MTK or SpreadTrum Smartphone and Tablet
5. **AP BP Base for Read&Write Tool**: in .zip file (*You need this if you do not have the .zip file of the Stock ROM*)
6. **IMEI Number of your Phone**: You will also find the IMEI Number of your Phone at the Back after you remove the Back Cover and also on the Packet of the Phone.

➡ **PS:** In this tutorial, I will explain **how to use SN Write Tool to Flash IMEI Number in any Android Smartphone or Tablet having Mediatek Chipset**. If you want to flash IMEI Number in any **Qualcomm, MTK** or **SpreadTrum** device then download and use Read&Write Tool ➡ []. Process is very Similar for BOTH and you will not face any difficulty.

How to Flash IMEI Number in Android Mobile Phone and Restore IMEI Number and Fix Invalid IMEI Number Problem

Step-1

Download SN Write Tool on your computer from Here ➡ [https://snwritetool.com/download/sn-write-tool-v1-1828]. Extract the .zip File. You will see following files in the Extracted Fold

SN Write Tool Extracted Folder

fig3.10

Step-2

In the Extracted Folder, you will find – SN Writer.exe File. Open this .exe file (*Double Click or Right Click and Run as Administrator*)

fig3.11

Step-3

Now you will see following screen. Click on **ComPort** and Select **USB VCOM**. In the "*Target Type*" you will get Options to Select Feature Phone, Smartphone and Other Android Devices. Select **Smartphone** if you are flashing the IMEI Number to an Android Phone.
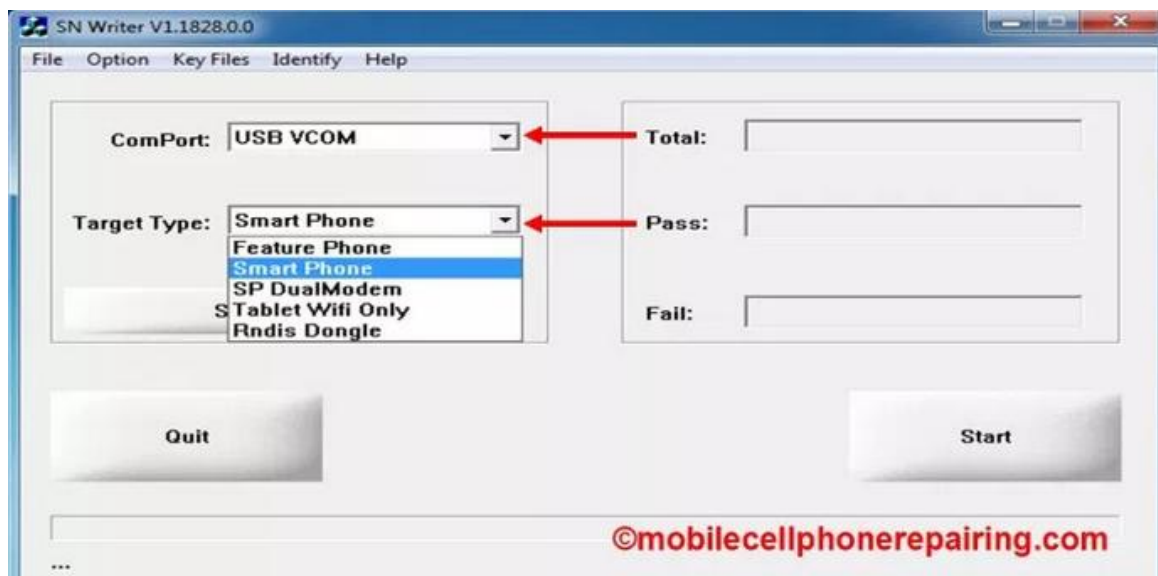
 fig3.12

Step-4

Now select System Config Button.

fig3.13

Step-5

Once you click onto the Config Button, you will see the following Screen. Select Following Options – **IMEI, BT Address** and **WiFi Address**. You also get the Option to select Dual IMEI, 3 IMEI and 4 IMEI. Select the Required Option.

Under Database File Option select the Path of **MD1_DB** and **AP_DB**. Remember that BOTH these Files come with the *.zip* File of the Custom ROM Firmware. Otherwise, you have to download the **AP BP Base for SN Write Tool** (➞ *https://androiddatahost.com/yhaz9*)

Select all the Required Options and Click **SAVE**

 fig3.14

Step-6

Now click **Start** Button on the Next Screen.

fig3.15

Step-7

Under Scan Data, Enter the **15 Digit IMEI Number**. You will also find the IMEI Number of your Phone at the Back after you remove the Back Cover and also on the Packet of the Phone.

Once you have entered all the required Data, **SWITCH OFF** your Phone and Take out the Battery. If there is Non-Removable Battery then just switch OFF the Phone and Connect the Phone to your Computer with USB Data Cable. Now Click **OK**.

The Process will take just few minutes. Once the IMEI Number writing is Done, you will see **Green Pass** Message.

fig3.16

Self Check	choose

Name: _____Date: _____

Time Start: _____Time Finish: _____

Instruction: Answer all the questions provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

1_____also called secret code.help to get acloser look innrer fauilt of the problem

> A. Mobile phone
> B. Volcano box
> C. Diagnose code
> D. All

2._____soft eare tool for all android

> A. Soldering iron
> B. App sortware
> C. Miracle thunder box
> D. Scew drive

3,which one of the following is not flashing tool

> A. ,useb data cabel
> B. Screw driver
> C. Pc
> D. sotware

Operation Sheet #1	System defects/fault symptoms are identified using appropriate diagnostic software, tools and equipment

OPERATION TITLE: Perform System defects/fault symptoms are identified using appropriate diagnostic software, tools and equipment

PURPOSE: TO Perform System defects/fault symptoms are identified using appropriate diagnostic software, tools and equipment

SITUATIONS FOR THE OPERATIONS:-Clean, safe working area and equipped workshop with sufficient electrical/electronic components & measuring instrument, materials of cell phones, hand tools.

Equipments and Tools

Tools	Equipments
• Laptop of Desktop PC • USB Data Cable to Connect Smartphone with the PC • Mediate USB-VCOM Drivers (*Available as a Bundle with the Software when you Download. No need to Download Separately*) • Scatter File Software Files to be Flashed • Flashing of Android Stock-ROM • Flash Custom ROM • Fix Bricked Devices • Perform Memory Test • Format / Reset Android Smartphones using MTK Processor	Digital Multi-meter PPEs Clean and ESD free work bench

Operation sheet 3	Flash mobile phone

PROCEDURE:-

Step1: Follow safety rule and procedure

Step2:.Select the required cell phone

Step3: Download the the required software

Step 4Install the software correctly

Step5: Select the required tools

Step6:the cell phone properly

Step7: Clean the internal parts of cell phone.

Step8: Identify the external & internal parts of cell phone.

Step9: Connect the phone with pc and start the installation

safely.

LAP TEST #2	Practical Demonstration (flashing a mobile phone)

Name: _____**Date:** _____

Time started: _____**Time finished:** _____

Instructions: You are required to perform the following individually with the presence of your teacher.

Task 1: flashing a mobile a phon

4.1 Checking and isolating chips using specified testing procedures

♣ SIM Circuit Works & Schematic Diagram

Now here's a brief explanation on how does SIM Circuit Works on a mobile phones circuit.
A SIM Card has six pads that also corresponds to the six SIM connectors pins, but only five has totally have connection on the entire layout.

SIM DATA - this is a digital data that being stored on a SIM memory
SIM Clock - this is a clock frequency signal that being synchronize to the digital data to create data signal in order transfer or sends and receive data information.
SIM Reset - this is also a frequency signal that triggers or reset all synchronization process.
VSIM B+ Supply Voltage- This a power supply voltage used to activated the SIM circuit.

SIM Ground - a ground line voltage

The other one is not connected
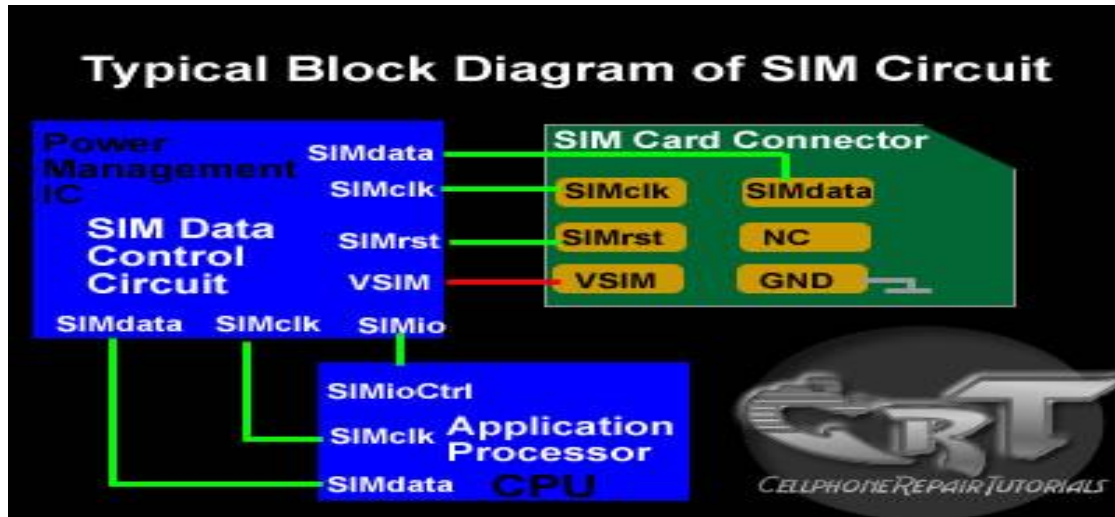
fig4.1

A Typical block Diagram above shows on how SIM Circuit Works on a Cellular phones circuits.
In the layout the **SIM Interface Connector** connected directly to SIM Control Circuit. The SIM Control Circuit is the one that generates Clock frequency that triggers the SIM data storage, once the SIM is now being triggered, it is then now

sends data information to the application processor to begin the process with. The application processor is the one that gathered all data information from the SIM memory, initiate and activate it, if all information is in desired status.

Those three particular lines of signal flows associated in the circuit shows how the synchronization is being applied. If one of those lines is being cut off the sending and receiving process will breakdown, and will result to SIM problem issues. The Power Supply Voltage through the SIM is also remaining stable otherwise a lack of voltage will not activate the SIM to work.
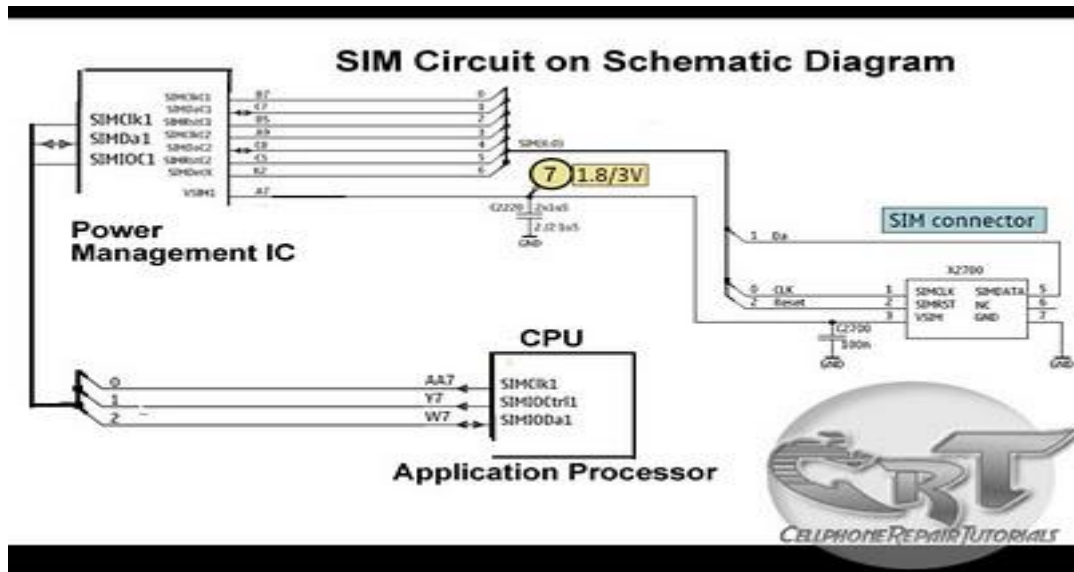
fig4.2

In a picture below, an <u>EMI-ESD</u> Filter has been added to protect the circuit to an Electro-static Discharge and Electro-magnetic Interference disorders. This type of SIM connection circuit is an advantage to mobile phone technician for troubleshooting SIM related problem issues. Thus, type of particular EMI filter is very vulnerable and mostly create breakdown to the entire SIM connection.
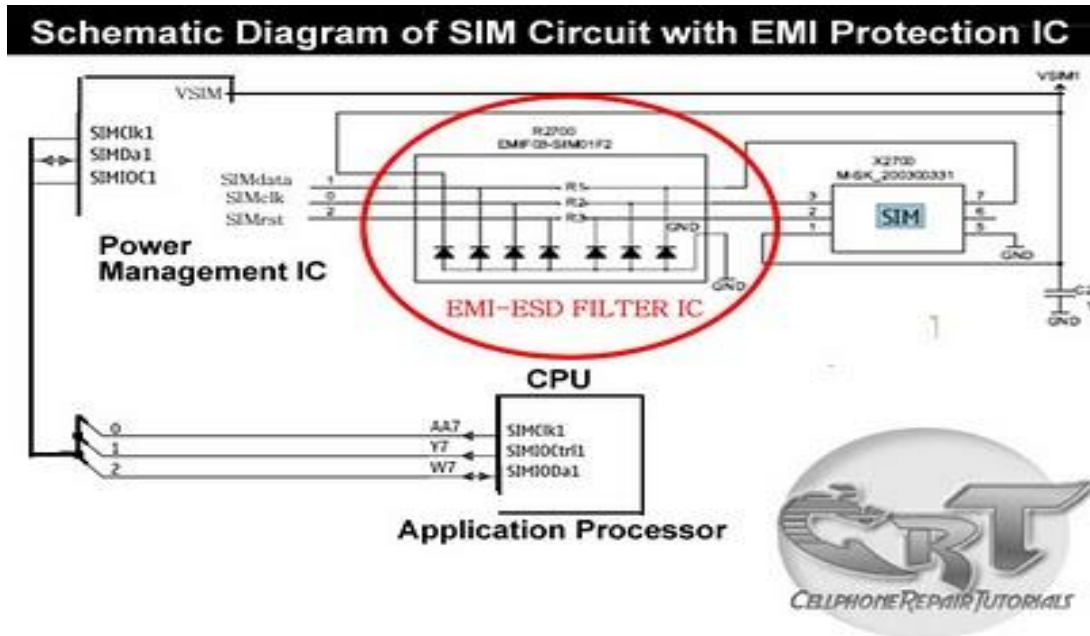
Fig4.3

The picture below is an equivalent layout of an EMI filter and its internal circuitry, only both frequency and data lines is being filtered.
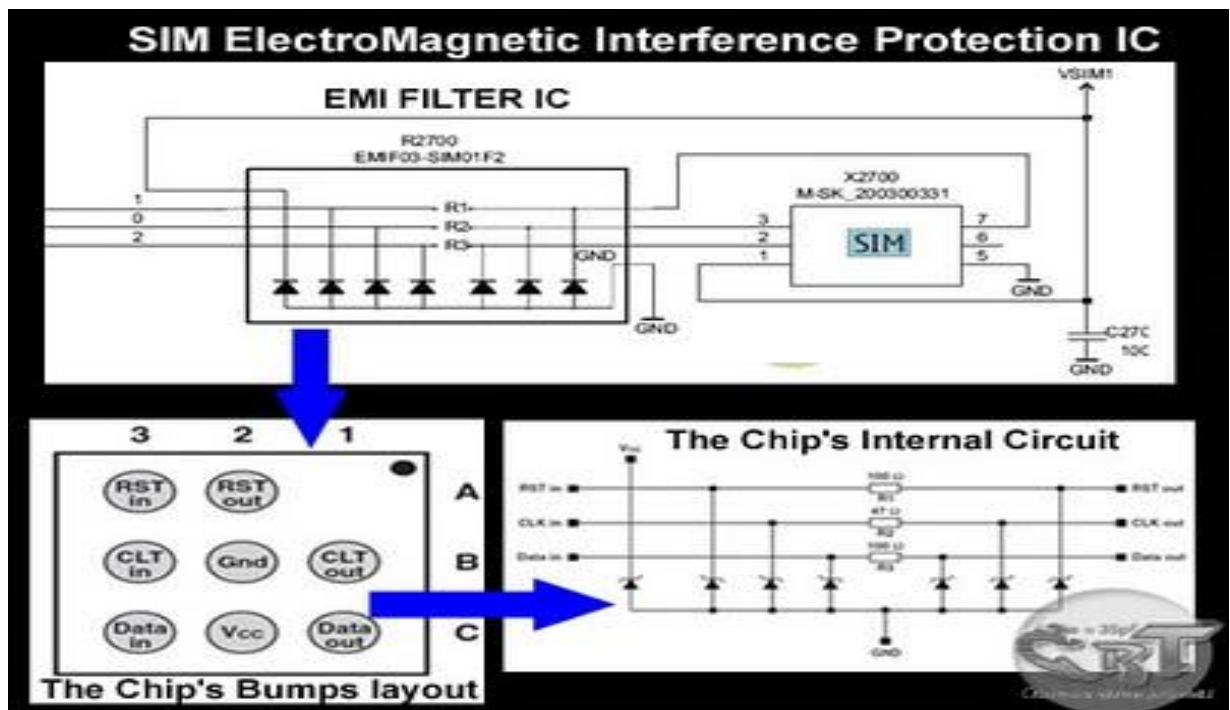
Fig 4.4

The **EMI Filter** is a tiny chip designed to protect SIM DATA, SIM Clock and SIM Reset data signals that flow across trough the SIM connector.
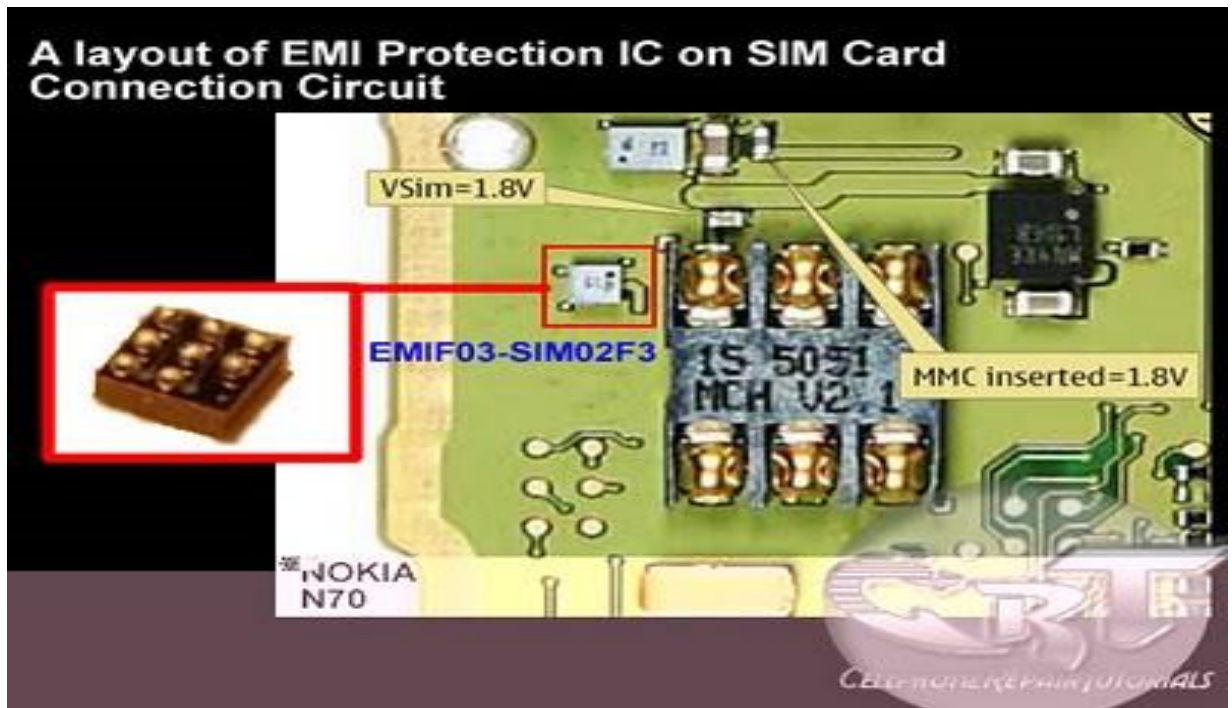
Fig 4.5

The EMI-ESD Filter is a highly integrated device designed to suppress EMI (Electromagnetic Interference) and RFI (Radio frequency Interference) in a circuit. This filter includes ESD protection circuitry which prevents damaging the mobile phone application when subject to ESD (Electrostatic Discharge) surges up to 15 kV.

Here's an example of how the **SIM data signal flow across the printed circuit board.**

Note: this is only shows where the signal flows from component to component connections.
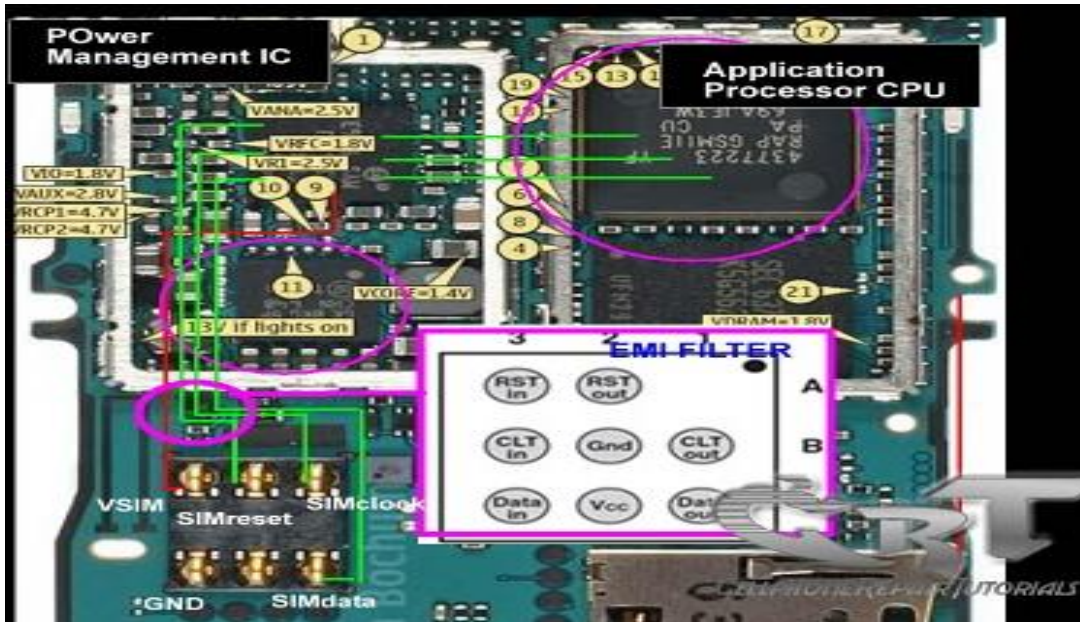
Fig4.6

A picture above is an alternative way by many mobile phone technicians dealing with SIM problem issues on most Nokia Mobile Phones.

Understanding the Keypad circuit may help and boost your knowledge on fixing keypad problem issues on mobile phones. Keypads is a part of user interface being used to navigate or enter numbers, letters and characters, browse application, sends information and etc.

A **schematic diagram** below will help us understand how keypad circuits works and which components or parts did this circuit is being connected.

In this diagram the each and every key switching pads is being divided and grouped into rows and columns. Each rows and columns were group into 2 -5 keypads switch. This rows and columns have each corresponding lines according to each and every group of switching pads.
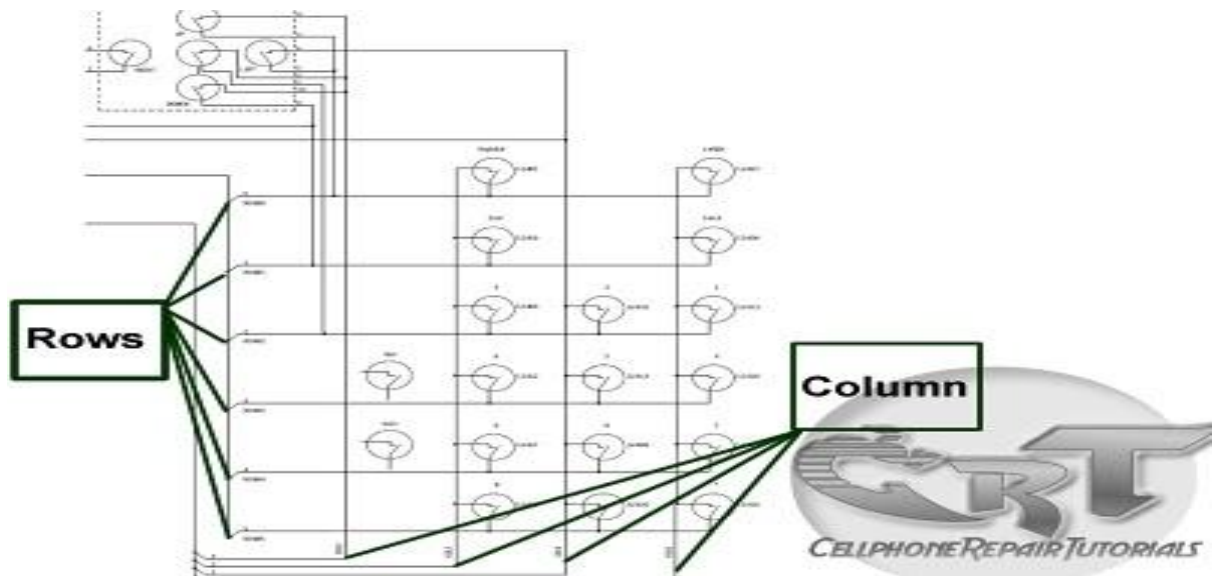
Fig 4.7

This lines of rows and columns is being filtered for EMI and ESD protection the EMI filter is made of tiny chip that used to protect such EMI and ESD interference.
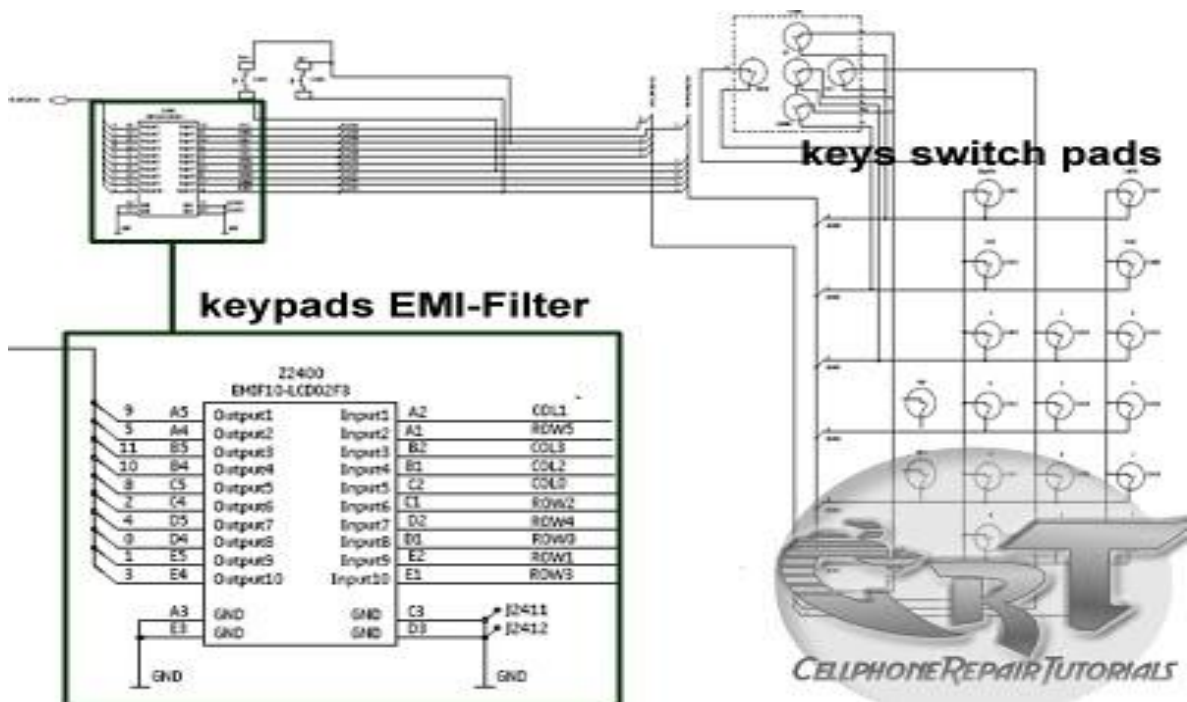
Fig4.8

This rows and columns lines are digital switching signals generated by the application processor to trigger or activate every corresponding digital data's that is being stored and programmed within the mobile phone system memory. This diagram below is an Application Processor that generates and feeds then receives digital data switching signals.

Keypads Rows and Column Lines on EMI Filter
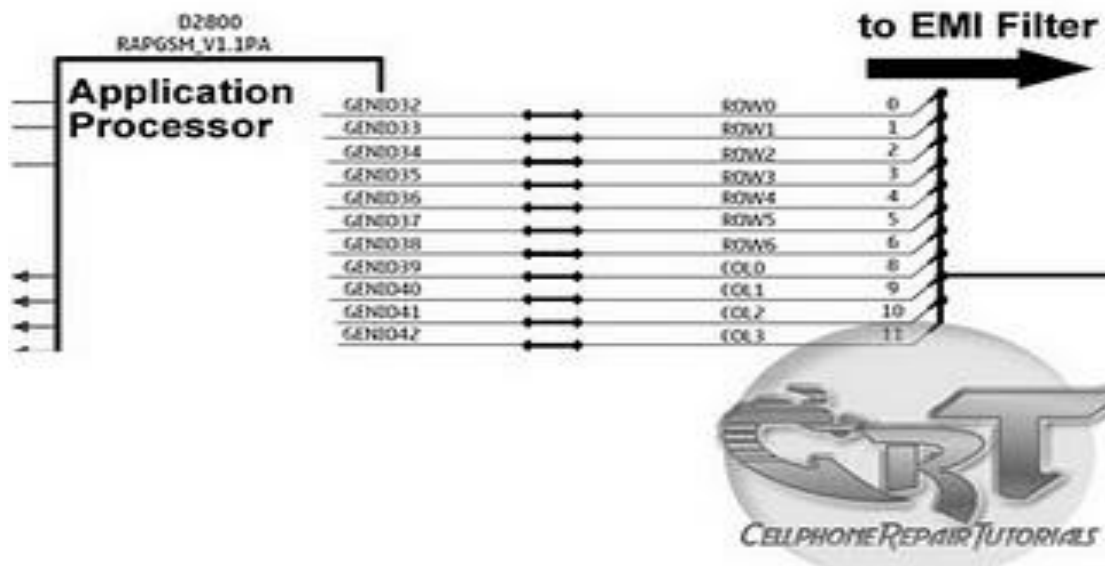
Fig4.9

This digital data frequency signals corresponds and interpreted to each key characters that are marked on each keypads. Like for example a combination of row 2 and column 3 will triggered the number 3 when hitting on it.

This block diagram below shows how the switching signal is being triggered to process a command data.
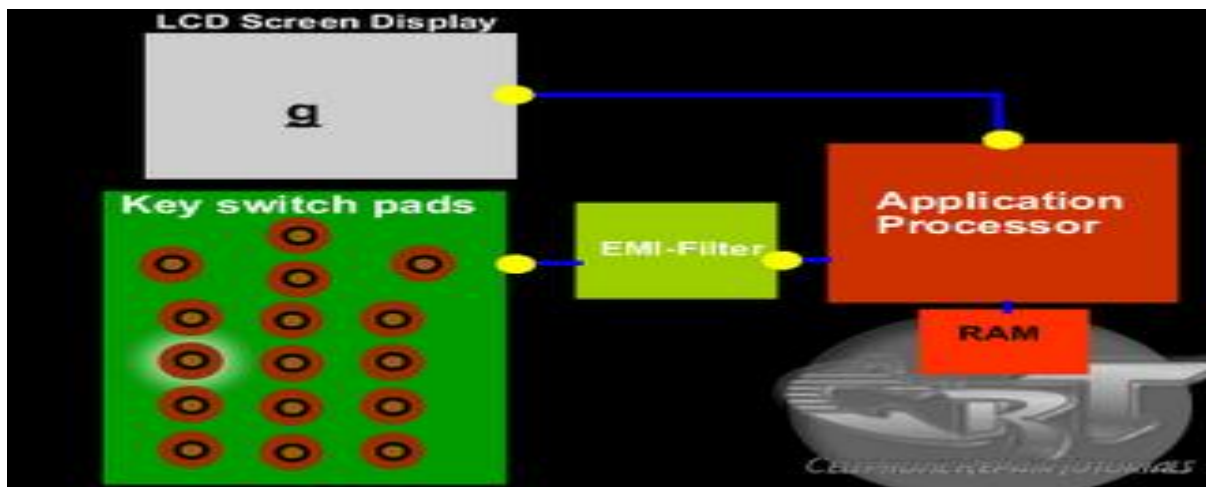
Fig4.10

Various mobile phones have different keypads layouts and specification. A joystick and a volume switch is also parts of keypads switching circuits. Some keypads module designs are made into a flexible wire like those Slide Type package of mobile phones. Some flexible wires are very vulnerable and common cause of keypad malfunction.

There are few methods in tracing and mapping the keypad layout on a mobile phones keypads on printed circuit board. One of these quick and very easy methods is by using an schematic diagram, if that certain mobile phones have available unto it. Schematic diagram is very useful guide in every aspects of hardware   troubleshooting.
Now assuming that you already have knowledge how to use and read it, follow these simple steps below.

 Browse to bottom of the pages where yo can locate and find like the picture below. it is the keypad circuit section. In that schematic layout you will notice that each corresponding key characters is being group into lines. This group of keypad switch lines is being marked with rows and columns.
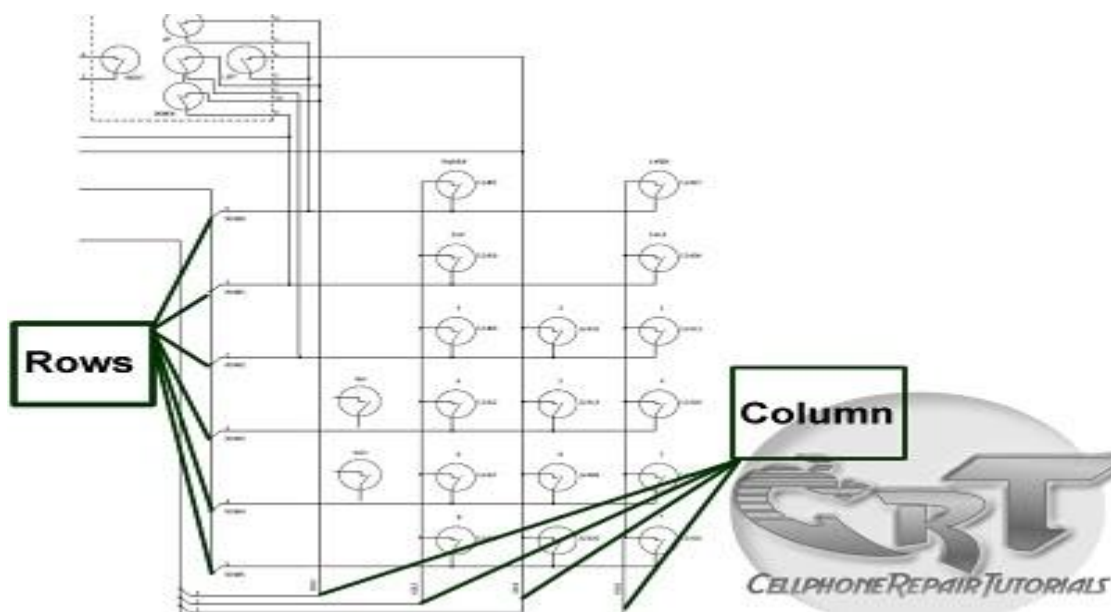
fig4.11

Trace each and every lines where those keypads switch symbols is being connected, once you been manage to trace it. Configure and trace it on the printed circuit board by using an analog or digital multi-meter, just set it the resistance value X1 and attach both probes to corresponding keypads groups in every rows and column

Keypad Mapping is a way of tracing each switch pads lines

col0= * 7 4 1 send leftsoft
col1= 0 8 5 2 right left
col2= # 9 6 3 rightsoft
col3= down up

Row0= left up rightSK leftSK
Row1= right down end send
Row2= 3 2 1
Row3= 6 5 4
Row4= 9 8 7
Row5= # 0 *
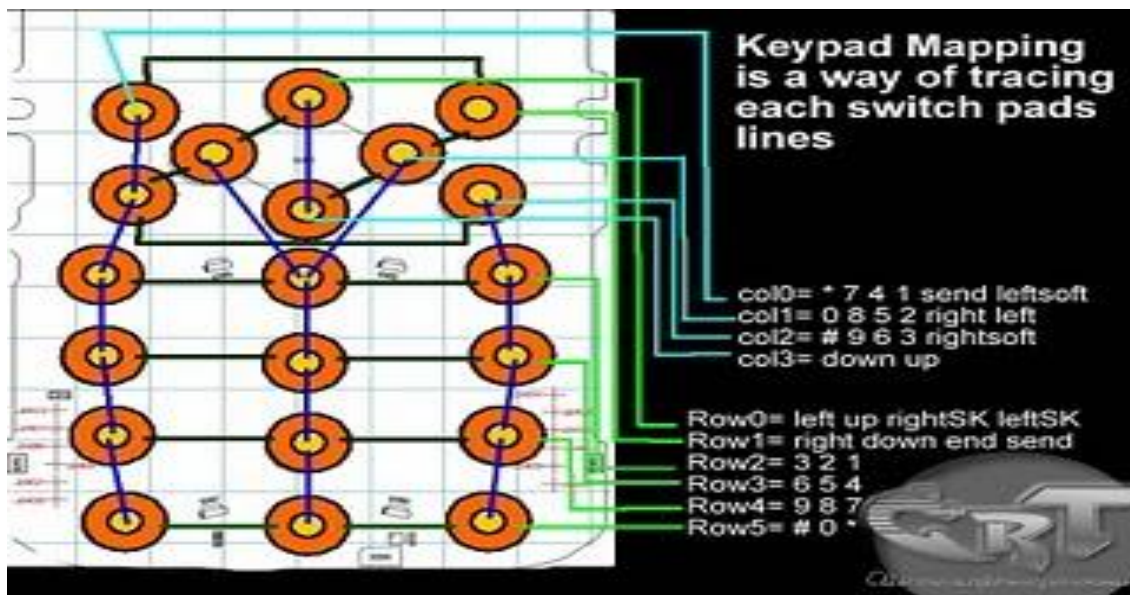
Fig4.12

Practice this kind of method with an aide of schematic diagram, in this way if you're skills grows further, you can then trace any other mobile phones without any schematic diagram available at first hand.

An **LED - light emitting diode** is used to illuminate keypads keys and LCD screen displays on all mobile phones handsets. It is being controlled by a voltage or current draws on its terminal led's.

A picture below is an Schematic Diagram that tells us how does the LED circuit works on cellular phone whole circuitry.

Schematic Diagram of a LED Driver Circuit

Figure 1.
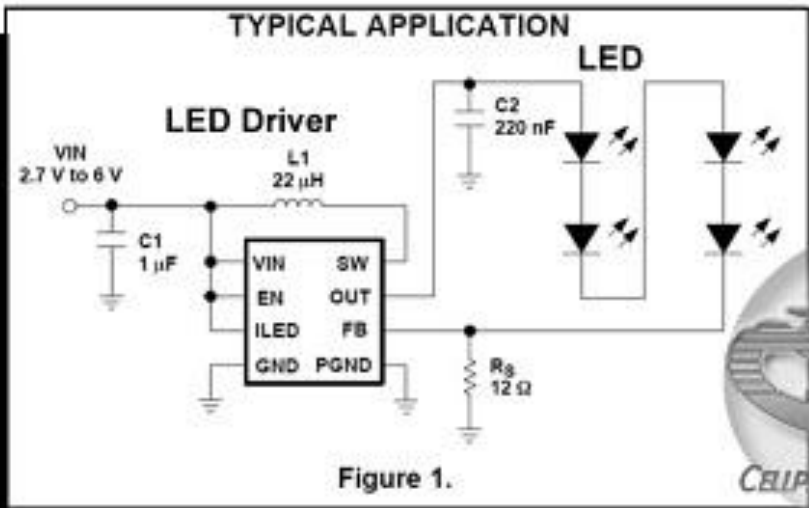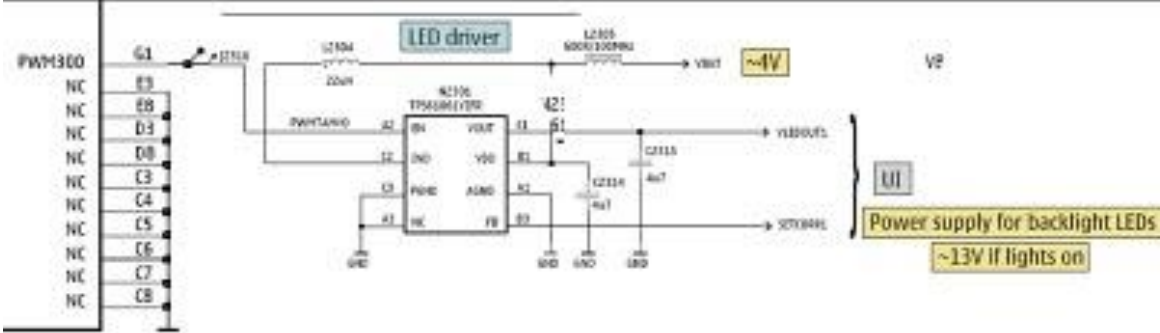
Fig4.13

On schematic diagram we notice that the LEDs is driven by an LED driver chips, and an Switching Control circuit that also being packed in a chip. The LED driver is being used to stabilized the voltage and current and do take control on engaging ON and OFF status of an LEDs to light up or not.

It also drives the amount of brightness or dimming status of the LEDs by applying Pulse Width Modulation signal from the Switching control circuit.

The block diagram below interpreted a component and section or parts of an LED circuit to work during application process.

The Switching control circuit feeds and release a Pulse Width Modulation Signal (PWM) to switch and light up the LEDs light bulbs. A pulse width modulation signal is a type of digital frequency signal range up to 1 kHz to enable and implement to take control of LED brightness.

Once that certain signal is being received by the LED driver, the LED driver now will engage and release the voltage or current that being feeds up from the mobile phones battery supply voltage;

The output voltage release by the LED driver is the one that draws the LED light bulbs to light up.
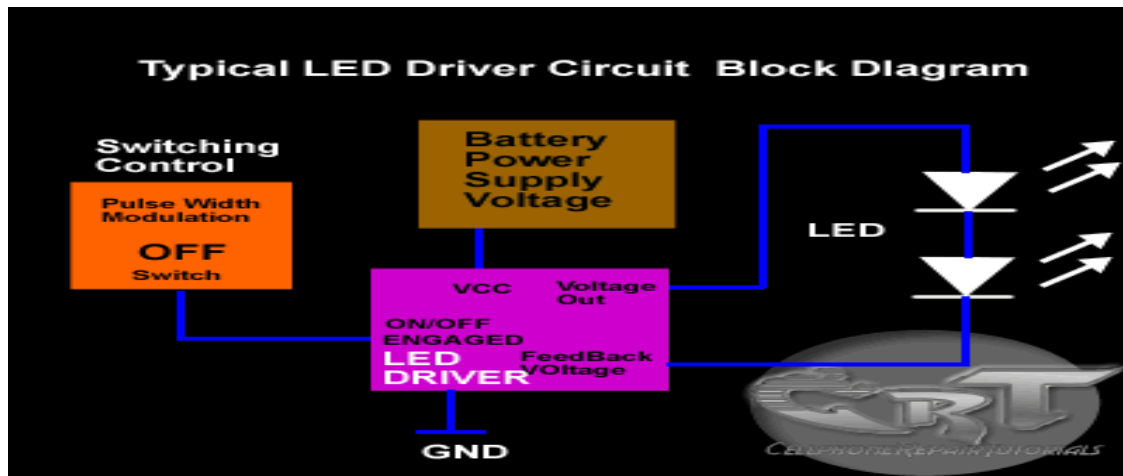
Fig4.14

LED drivers are a high frequency, synchronous boost converter with constant current output to drive up to 5 white LEDs. This device circuit is designed for maximum safety, it integrates overvoltage and short circuit protection when the

output is being shorted to the ground. Meaning this chips circuitry will not easily breakdown for it is designed to protect when short circuit happens.

For example, the two LED light bulbs commits short circuit to its terminal In mobile phones application methods; the switching control circuit that release pulse switching signal is also being synchronized programmed by the application processor (CPU) to engaged a full control on how and which proper situation that the LED will be switch to light up or not.

Like for example the LED will only switch and light up, if the handset is being in used and remain off if the handset is not in used.
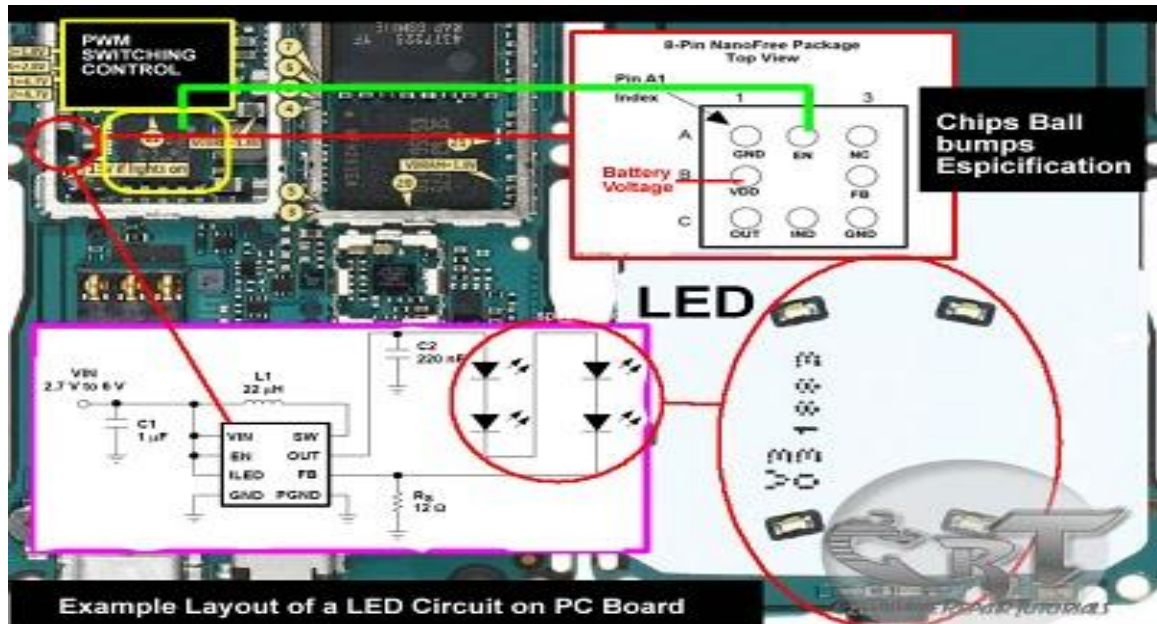
Fig4.15

The above image is an example of the LED circuit, how those particular stages and components being mounted on phones circuits. Note that the LED driver and switching control circuits is being packed into an Integrated Circuit or ICs. To all beginners: A bunch of simplified STEP By STEP Procedures On Troubleshooting LED Problem issues on various mobile phones product will be Posted Here Later.. Just keep on visiting this blog more often.

The Audio Codec is a circuit that controls sound signals in a cell phone circuits. It acts like an audio amplifier or an audio mixer or a sound booster.

Audio codec is the main area in a mobile phone where all audio properties is being process, during transmission and reception. It converts the sound signal into radio frequency signal, and also converts radio frequency signal into a sound signals.

Like for example a microphone's sound signal is being amplified then converts and feeds to radio frequency before it send to the network airwaves. Opposite to that process is the conversion of radio frequency into an audible or understandable sound, and that sound is that what we hear on the earpiece speaker.

A typical block diagram below show how audio interfaces being connected to an audio codec circuit.
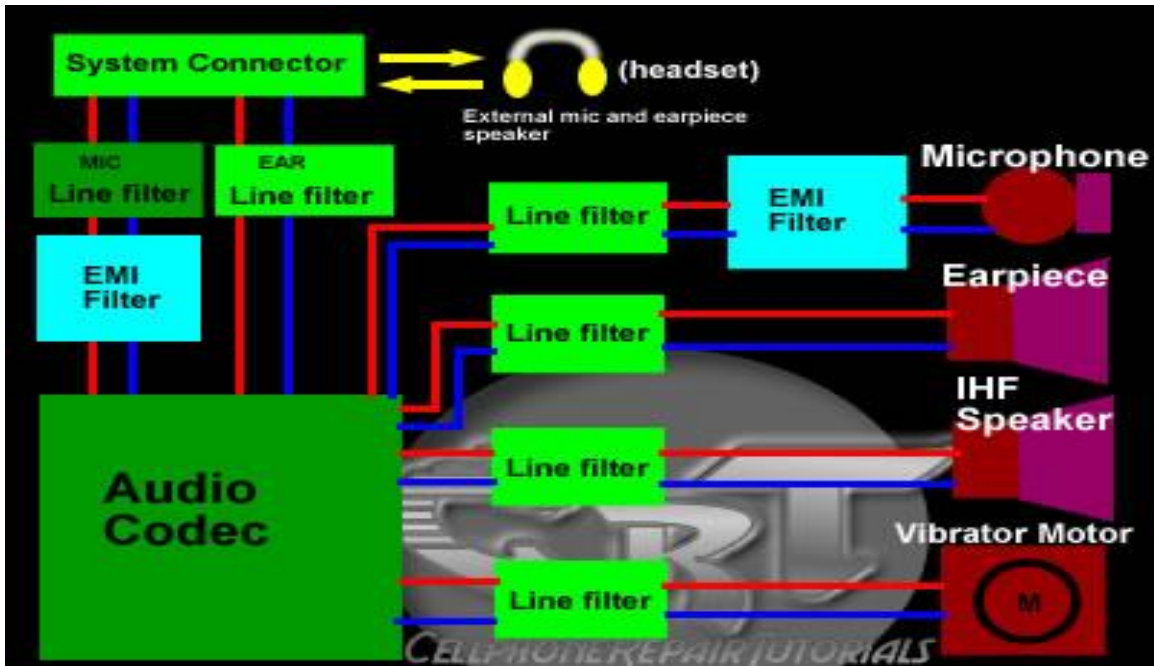
Fig4.16

The **Audio codec** is the main part which **controls all audio properties from all audio interfaces** like the microphone, earpiece, IHF (integrated hands free) speaker or a buzzer, ringer, head set and vibrator motor. A typical audio circuit is being filtered from any sound interference signal to avoid sound interruptions.

A mobile phones microphone or mouthpiece is a component used to convert sound signal into an electrical signal. The earpiece speaker is the one that converts electrical signal into a sound signal, likewise also the IHF , buzzer or ringer speaker do.
These certain parts works as a user interfaces components on a mobile phone. And controlled by an Audio Codec Circuit which is the part that relatively controls and converts all audio frequency signal. *See picture below*
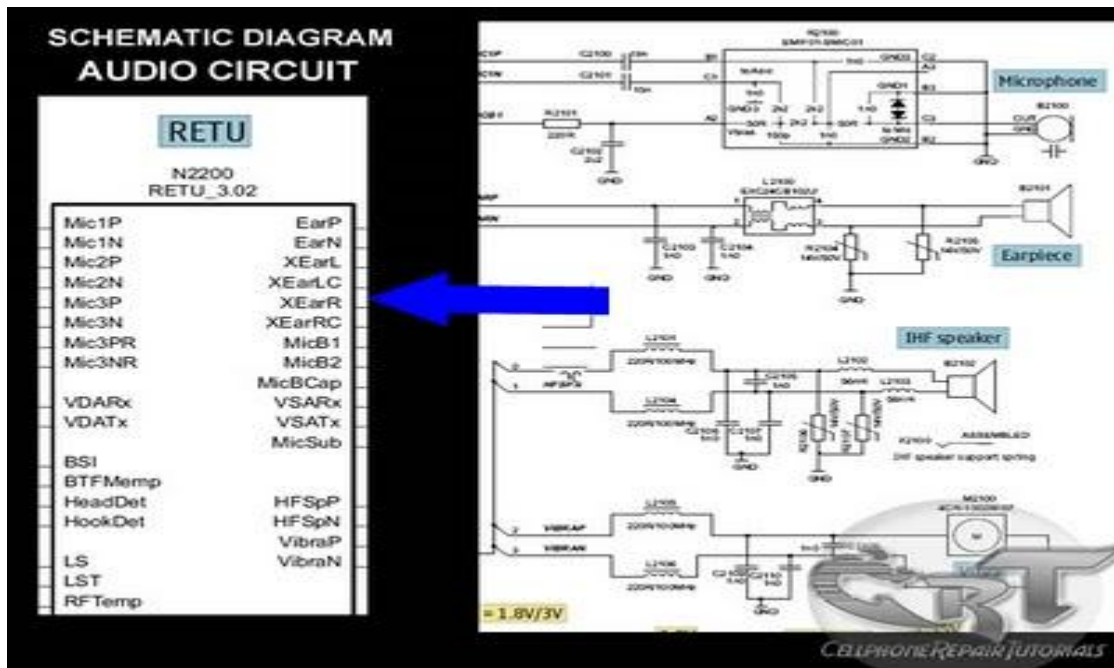
Fig4.17

A picture below is an schematic diagram microphone or mouthpiece circuit, A typical and modern designed of mouthpiece circuit is being protected by an EMI- Filter to prevent sound interruption, before it then feeds the audio signal to the audio codec circuit. Some microphone circuit other mobile phones have no EMI Filter like the one showed below. The microphone line signal is being presented into positive and negative polarity, and those two polarity lines is being filtered again by two capacitor after being pass by from an EMI-Filter, in order to remove the DC (direct current) coming from the EMI-filter.
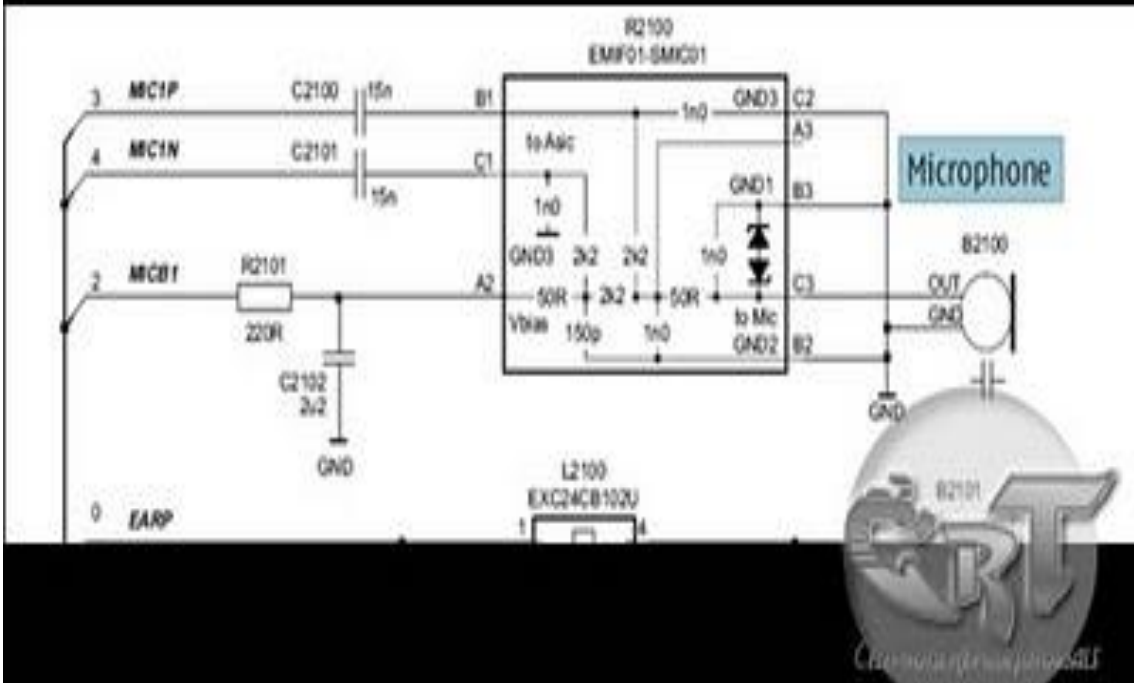
Fig4.18

The earpiece circuit is also filtered by inductor coil to reduce sound saturation cause by any radio frequency interruption.
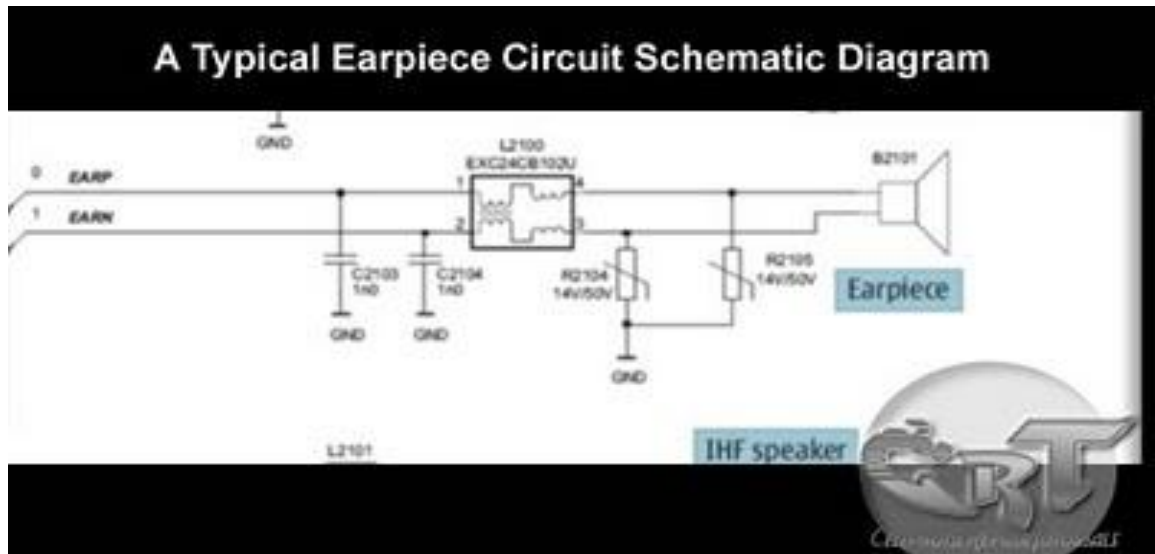
Fig4.19

And same also in an IHF speaker circuit. The IHF speaker also has two lines which is positive and negative line.
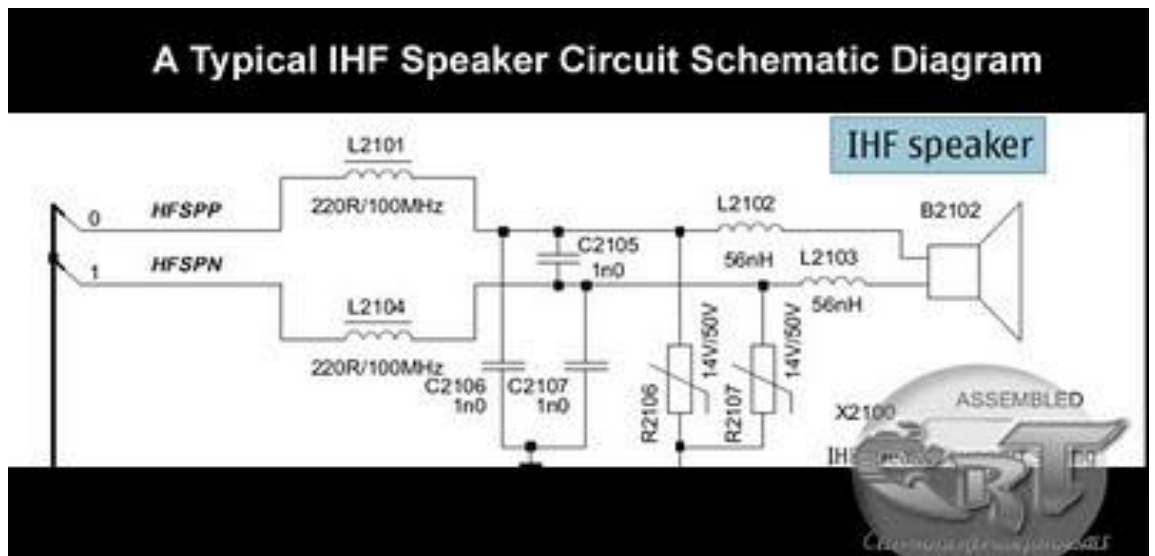
Fig4.20

A vibrator motor although this is not a sound converting device but it generates a vibration which generates sounds, this one is also included in audio circuitry.

A Typical Vibrator Circuit Schematic Diagram
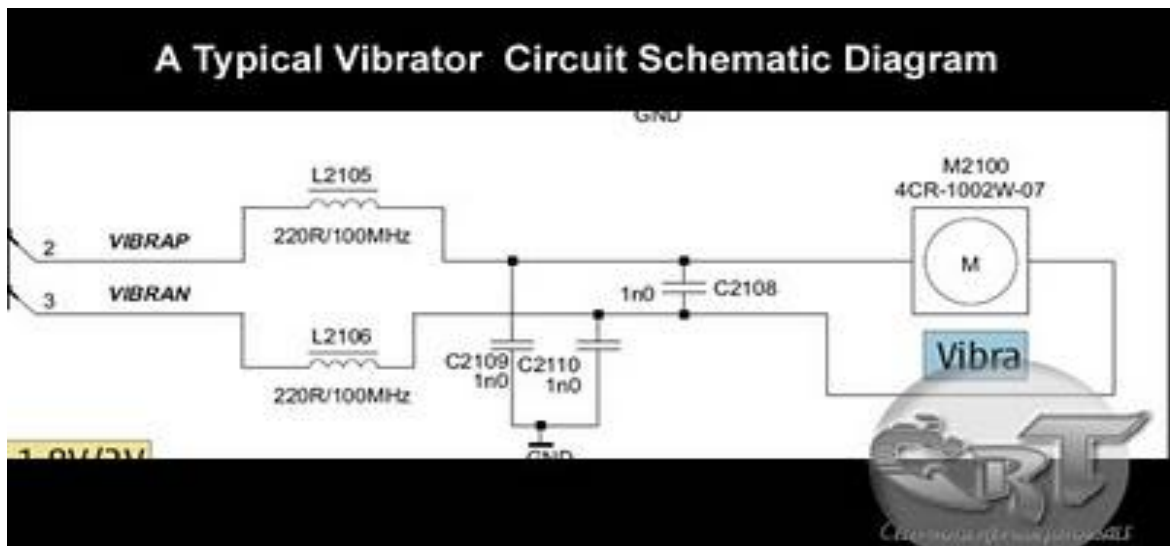
Fig4.21

Here's an example mapping layout of a Microphone, Earpiece, IHF speakers and Vibrator motor connections on a mobile phones printed circuit board. Each connection were both separated and apart from each other but all of each line is being pointed towards in audio codec circuit.
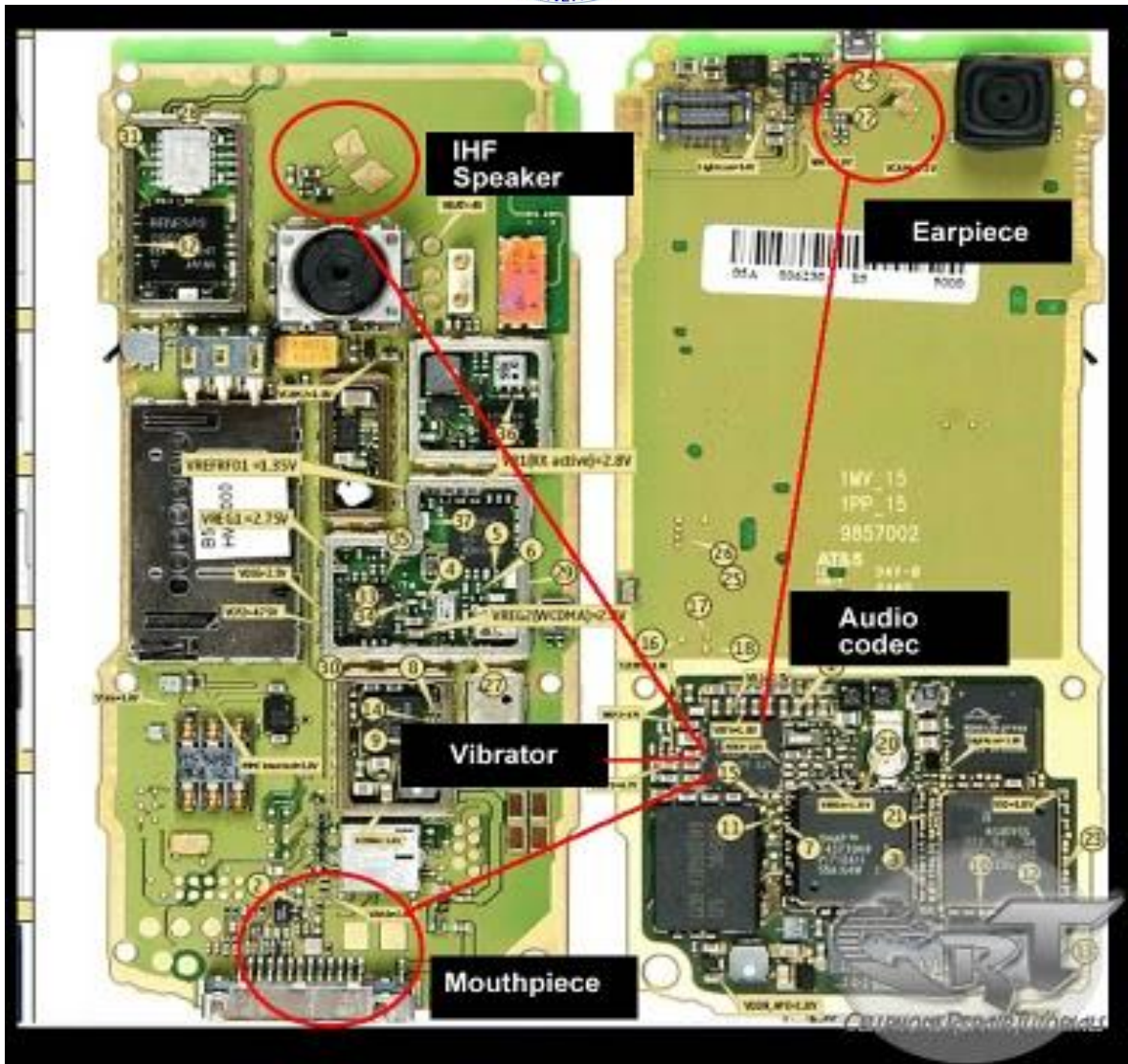
Fig4.22

The above picture is only an interpretation of how audio circuit is being connected or mounted in a mobile phones printed circuit board.

A mobile phones **microphone or mouthpiece** is a component used to convert sound signal into an electrical signal. The earpiece speaker is the one that converts electrical signal into a sound signal, likewise also the IHF, buzzer or ringer speaker do.

Monochrome
It can be optimized for static text, detailed still images, or dynamic, fast-changing, video content.

Old type of LCD are monochrome types which only display one certain color while the modern types are colored ones that can display rich text and images. LCD's resolution of display depends on the amount of pixels into it, the highest amount designed looks and displays best.

Now, LCD won't work without a light source and a reflector to drive it pixels to form image information.

This typical block diagram below will help us a brief explanation oh how the LCD can produce a text and images on mobile phones handsets.

The block diagram shows the LCD gets a data source from the application processor, so therefore LCD is being controlled by the application processor to produce a detail images, LED is a light emitting diode that can produce light, this light source of an LED is the one that reflect at the back of an LCD, without this LED light reflection on the back of an LCD it will result a black or dark screen displays.

LCD also needs a power supply voltage to activate its liquid crystal arrays inside of it, so that is why a voltage supply is also very important for that matter.
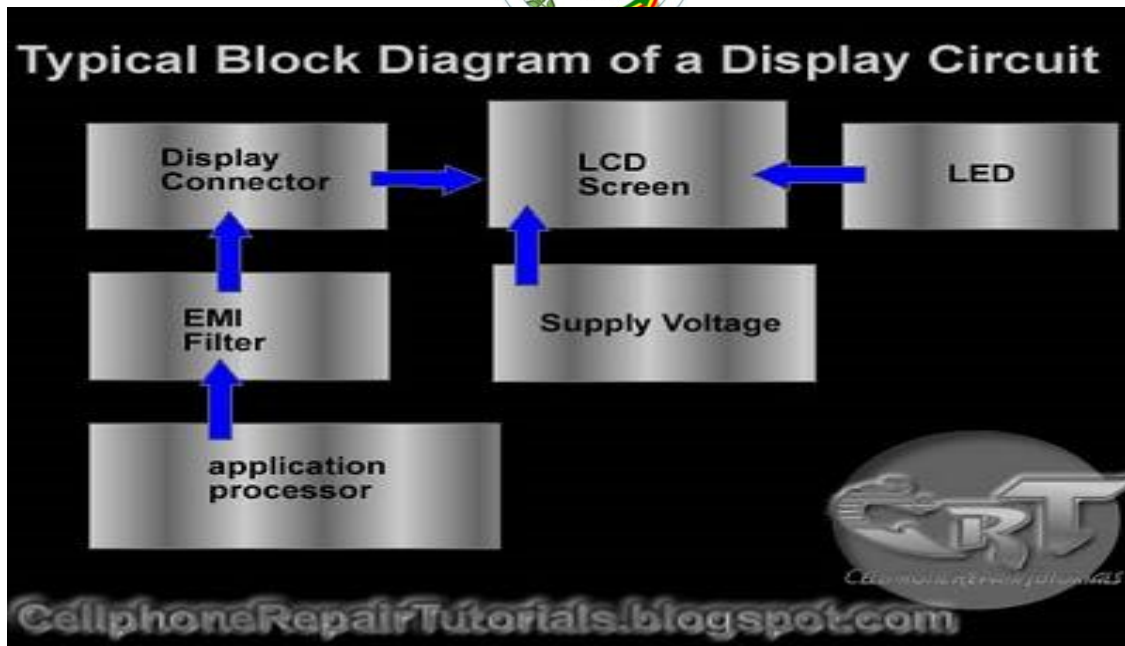
Fig4.23

An LCD Display Circuit Schematic diagram of a mobile phones below interprets how the whole circuitry of an LCD being connected and designed. A circuit start from an application processor that controls and sends data to LCD connector which where the LCD is being connected. Before the data reach to the LCD connector it is being filtered for Electromagnet Interference protection. The LED light circuit and a power supply voltage is also provided for it is also work an important part on LCD circuit.
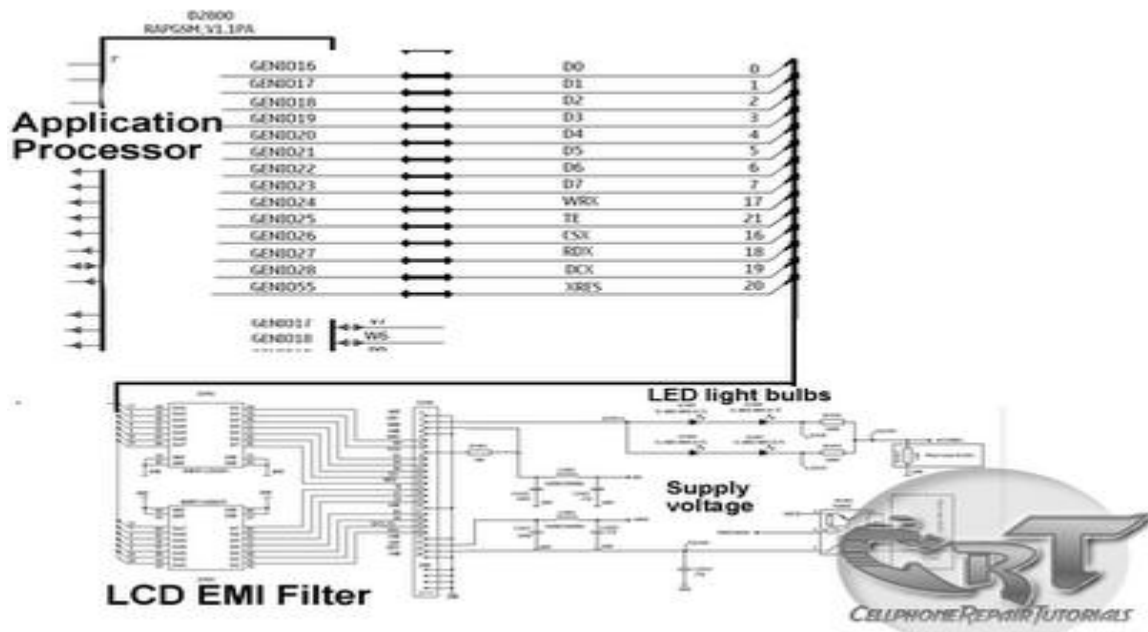
Fig4.24

The picture below interprets the schematic diagram above on how each components layout are being mounted on a particular mobile phones printed circuit board.
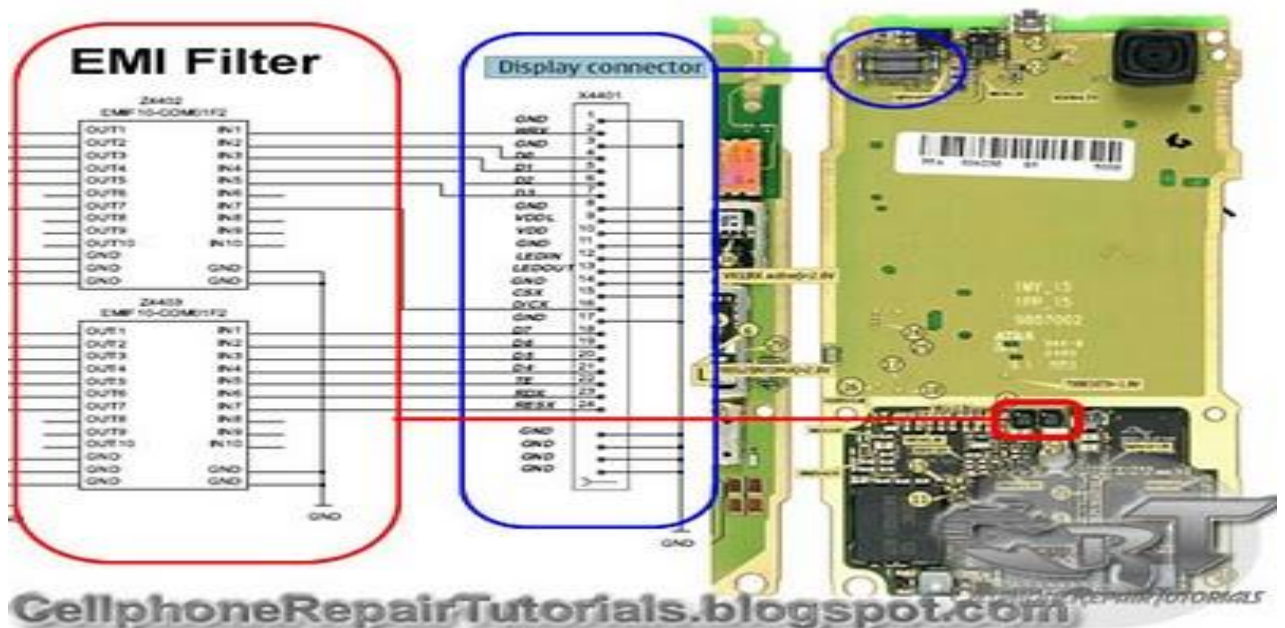
Fig4.25

Always keep in mind that LCD needs the following sources to make it work completely,

1. Data control signal from the application processor
2. LED light that reflects on it back so that display will reveal completely.
3. A power supply voltage to turn the LCD activated.
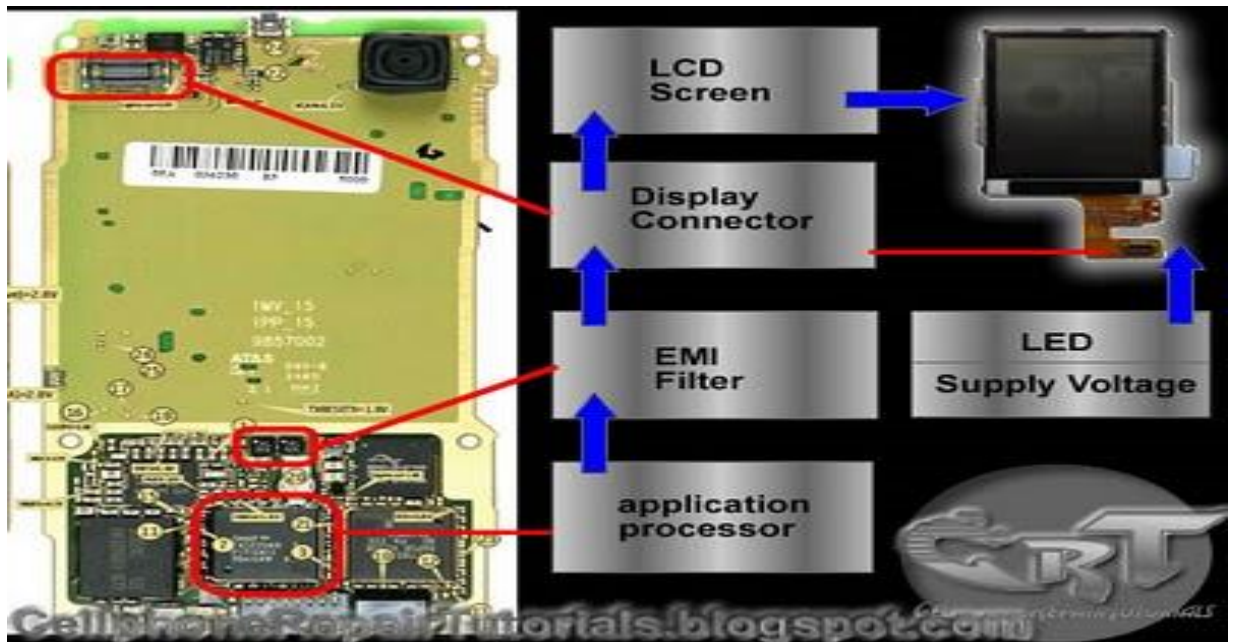
Fig4.26

A failure of these three sources will result on display problem issues.
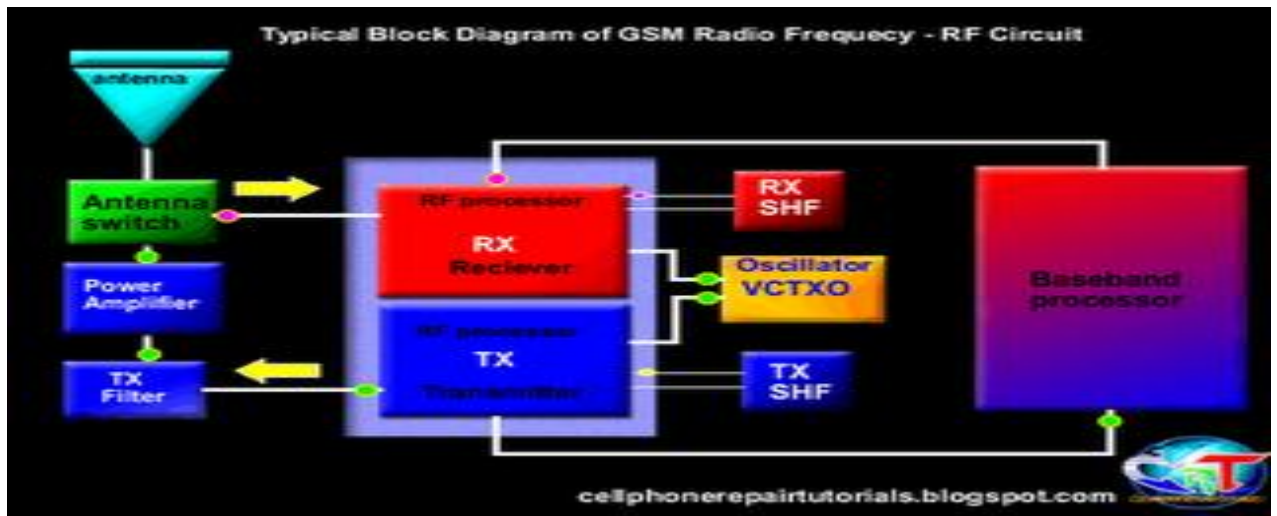
fig4.27

In cell phone repair it is very helpful to understand how the RF circuits works, for this is a big help when troubleshooting No signal problem issues.

RF stands for radio frequency, this frequency is used to transmit and receive the data signals from a mobile phone.

Here's a brief explanation on how does RF circuit works on mobile phones. This is for GSM RF circuit only, although the WCDMA circuit and WI-FI circuit have similarity on this but I will try to explain both of it hereafter.

See the block diagram below. Observe how the frequency data signal feeds from a certain parts of an RF circuit design.

A breakdown or failure of each certain part will result to signal loss and the capability to generate, amplify, control, process, send and receive the desired radio   frequency   during   transmission   process.
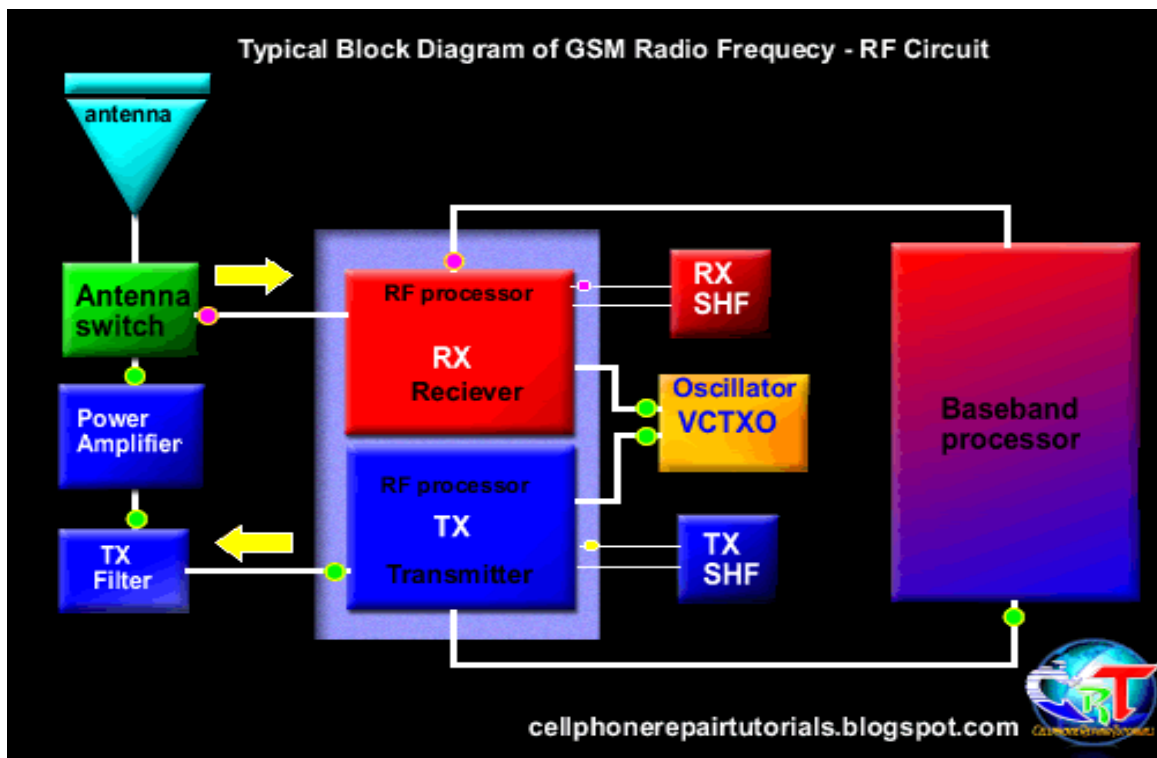
Fig4.28

In mobile phones transmission there are two types of operation took place, the receiving operation and the transmitting operation.

In normal mode, **RX** part is always active in receiving operation the antenna switch is always open its gateway through to the RX circuit, It is always ready to receive and intercepts the radio waves and wait for the desired frequency signal to catch up.

During transmission like making a call or sending a text message the antenna switch will close the gateway of the RX and open the gateway of the TX in order not to interfere the data signal during transmission.

All data that has been receive and before to transmit or send, all this data signals are feeds to the baseband processor.

An explanation of an RF Circuit Parts and what possible problems if a certain pare are damaged.
RF Receiver - (RX radio receiver) . The **rf** receiver are called RX, this circuit is design to receives, and process the data signals from the airwaves during transmission process. A failure of this circuit will result to unable to receive data signal during transmission.
RF Transmitter - (TX radio transmitter). The **rf** transmitter are called TX which is the one that process, amplify the data signals from a mobile phone.

Once failed to initiate a failure to transmit radio frequency signal, this will result to unable to send data signal during transmission.

Power amplifier - RF amplifier.

The power amplifier is used to amplify, boost up the radio frequency signal before it feeds to the antenna before it thrown over the air waves during transmission. If damaged will result to signal loss, a dropping signal indication on the display.
The **Antenna** is used to intercepts and thrown the radio frequency in the air during transmission.
When electricity is "thrown" into the metal of an antenna, the metal reacts to the electricity at an atomic level in the form of a wave.

If damaged or due to a corroded terminal pads, will indicate and show a poor signal or low level frequency signal.

Antenna switch

The antenna switch is used as a gateway that controls and manage the frequency to pass through, it switch the RX frequency signal and TX frequency signal during transmission process. Literally the antenna is the signal catcher and likewise the signal thrower. If damaged the gateway to the antenna will be closed and result to network signal indication.

It generates a desired frequency that feeds to the RX and TX circuits. In mobile phones a Voltage controlled Oscillator (VCO) and Voltage Controlled Temperature Compensated Crystal Oscillator (VCTXO) is used in RF circuit.

If damaged the RX and TX will not work and the RF circuit is at full failure.

SAW filter

Surface Acoustic Wave filter used as an rf synthesizer to purify a desired level of frequency. If damaged result also to no network signal indication.

An example of the RF circuit components layout on a PCB board.
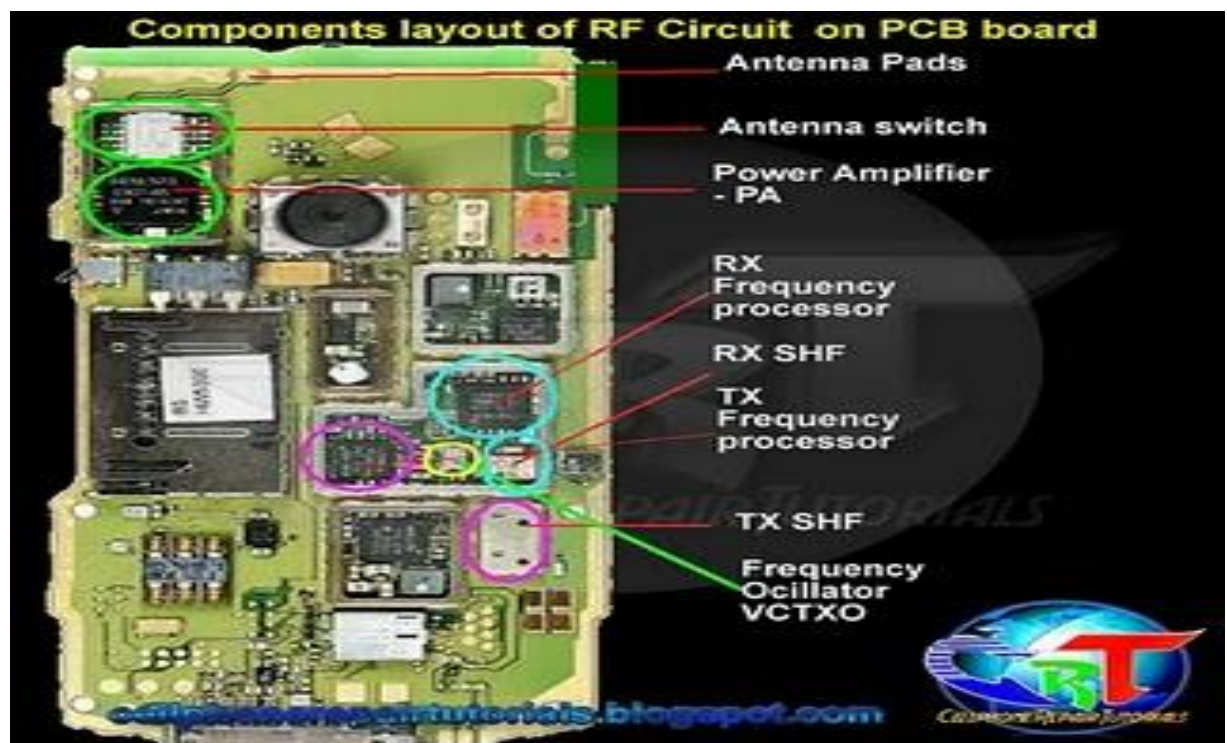
Fig4.29

The RF circuit components are often covered with shielding metal case unlike the baseband processor parts which is oftentimes not. This is because frequency is very vulnerable with unwanted radio waves interference and destroys data signals. Using the shielding metal will minimize the radio waves interference. Fixing hardware problems is not been easy and takes a lot of time to consume rather than software problems, it is because when it comes to software handling you don't really need to open or dismantle a mobile phone handset, because only

few of them really need to. In most cases like this, many among mobile phones technician focus on software handling like especially unlocking, for it less time consuming and more flexible to do with. This is been true that mobile phone technicians were separated into two specialties, like Hardware expert and Software expert, that is what the term they called it; It because mobile phones is a combination of software and hardware mechanism.

But there are also many mobile phones masters that can manage and do both hardware and software specialty and skills. They gained this knowledge by years of experience, and not only that they also earned much more income rather than to those staying at one particular specialty.

Now, here is the basic step by step repair procedure on hardware troubleshooting on mobile phones. Various mobile phones have different circuits and components or parts layouts and designs. First thing you must learn and be familiar with is how each circuit components or parts is being mounted, connected, assembled or designed.

An example here is Nokia 6300, now assuming that this handset having a faulty microphone or mouthpiece.

Fig4.30

Do the basic procedures mentioned above, assuming that you are familiar with the Mouthpiece or microphone circuit, and already know how to check a microphone or mouthpiece component.

You can now do this step below;

1. Find any available schematic diagram and locate the microphone circuit layout on it. Remember where each parts and components location and do a mapping like this.
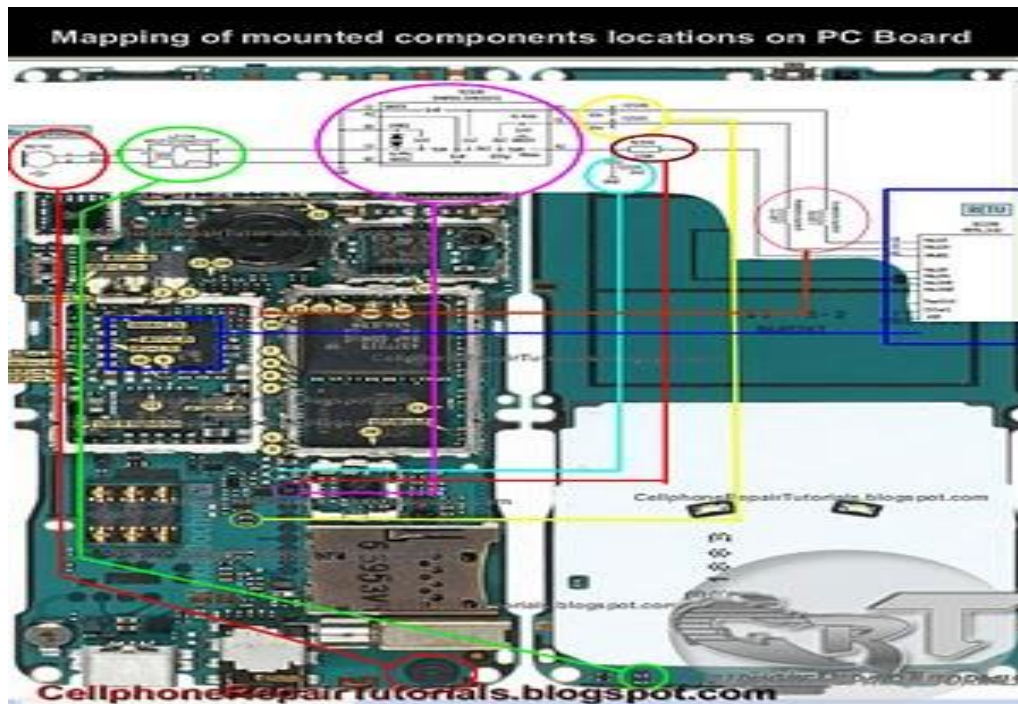
Fig4.31

2. Use a multi-tester and check the pads for a short circuit, this is not always happen but it is also unpredictable to a mobile phones short circuit might occurs, you are not checking the outer mounted components but the internal lines with it. Just set the tester to x1 resistance value, I preferred analog multitester in this lesson for it is cheaper to purchase rather than the digital. Now connect both test

probe to the inner and outer layer of the mouthpiece terminal pads, then do it again in opposite manner, a short circuit have both readings closer to zero ohms.
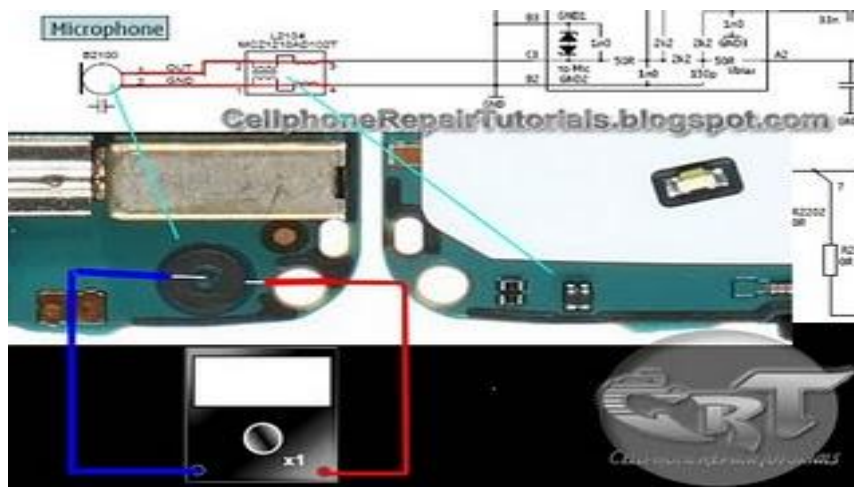

Fig4.32

3. Trace the line paths between the first or the closest component connected to each terminal pads.

The circuit diagram shows that there are coil filter in both lines, connect the tester across each coil terminal leds, your not just checking the lines here but also checking the the coil as well.
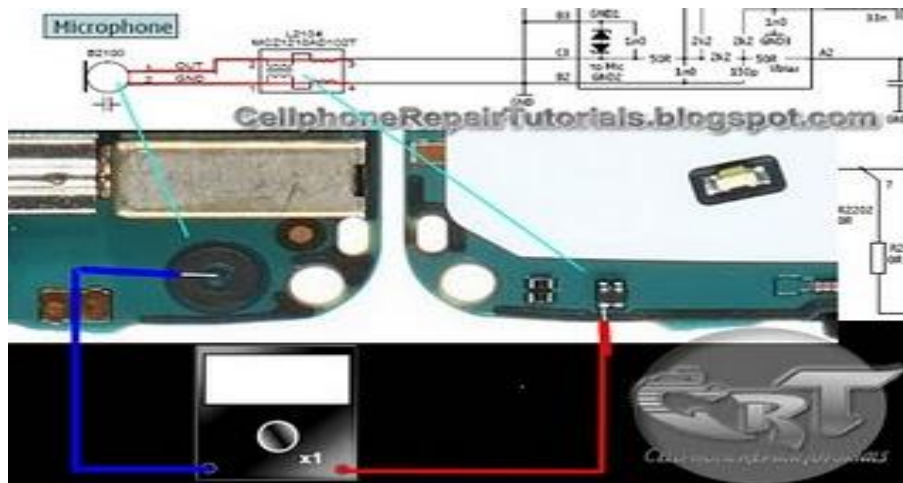

Fig4.33

4. Now the next step is to leave behind the line paths between the coil to the EMI-Filter for it is uncheck able beyond that paths for the EMI- filter is an IC. You need to remove it first before you can check on those lines, which will be done later at the last steps of procedures. Now next to move on to the opening lines and component where the test probe can connect with, the two filter capacitors

and both coils which are an open path where you can connect the test probe on it. now connect or attach both probes at the end of each line indicated in red.
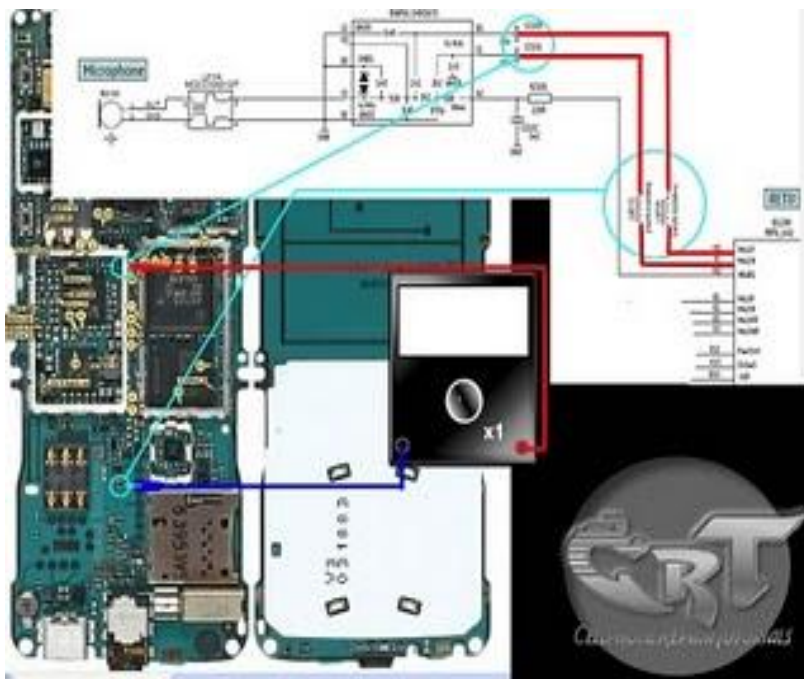

Fig4.34

5. Now check the remaining open path which is the Resistor, you can't check the line paths on those area for it ends up connected to Retu IC. So just then proceed to check its resistance value instead.
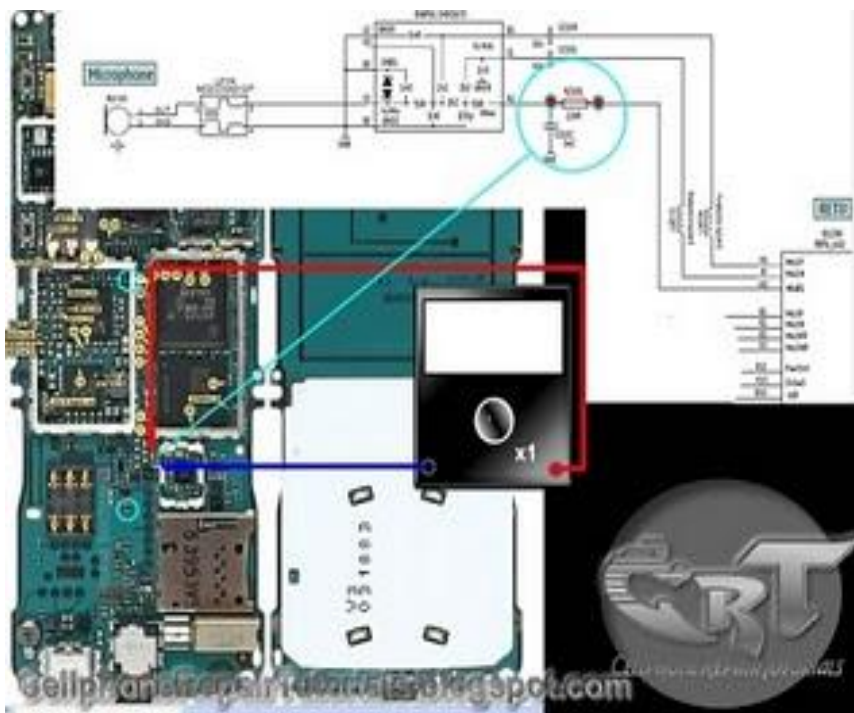
Fig4.35

6. If all those mentioned lines above are all in good condition you may now proceed to suspect the EMI-Fiter is having a problem or faulty. You then now remove it from the Printed circuit board then does a line check up from the mouthpiece terminal to those EMI-filter terminal bumps where it is being connected.
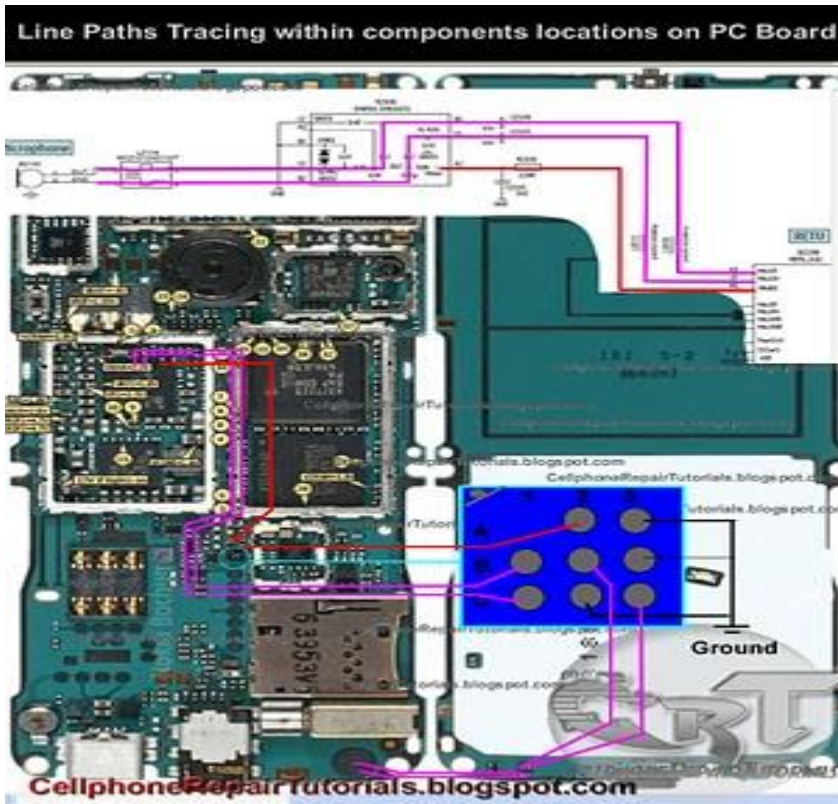

Fig4.36

You can refer to the schematic diagram for each terminal specification. You may now can check the IC itself by analyzing the internal circuitry inside it. I advice just replace a good and working one if not so sure about.
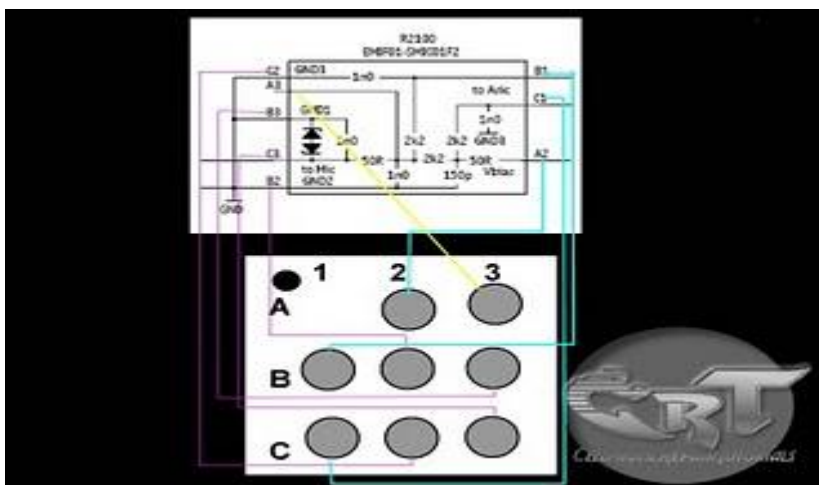
Fig4.37

8. It this step is most complicated job to do with, especially for beginners. This is one of advance troubleshooter's skills. If found all of those line paths and components above were in good conditions. The last part is to work a power management IC itself for the audio codec circuit is also within that chips.

Now, if the last and final suspected parts is the chips, you must need to rework it, Reheating it the first will do and might as well also work. But if the problem still remain, Reworking it is the best advice that suites out.

But also do not forget to check the line paths between the mouthpiece circuit area, while the chips is being remove and out on the PCB layout, it is a proper time to check the ball bumps terminal where that certain microphone is being connected. An example of tracing the ball bumps terminals below.
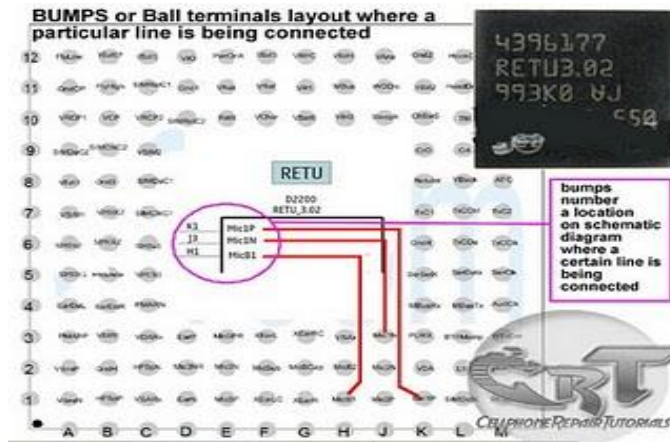
Fig4 .38

Name: _____Date: _____

Time Start: _____Time Finish: _____

1. Describe sim data

2. Describe EMI-ESD filter

3. Write the use of LED

Information sheet 5	Proper troubleshooting procedures are implemented

5.1basic Troubleshooting Steps for your Cell Phone

   Troubleshooting is a skill used by almost everyone in many different parts of our working and personal lives.To be able to troubleshoot an issue quickly and effectively, you need to have a theory of how to approach the issue Yous hould be   able to apply this processto and problem or fault you encounter.

What are the 6 steps of troubleshooting?
The six steps are:

- Identify the problem.
- Establish a theory of probable cause.
- Test the theory to determine cause.
- Establish a plan of action to resolve the problem and implement the solution.
- Verify full system functionality and if applicable implement preventative measures.
- Document findings, actions, and outcomes.

What are the basic steps of troubleshooting?
- You are systematic approach to **troubleshooting** should involve five **basic steps**; Information Gathering. Analysis and Planning. Implementation of a solution.

5.3 The Five Steps of Troubleshooting

You're systematic approach to troubleshooting should involve five basic steps;

1. Information Gathering
2. Analysis and Planning
3. Implementation of a solution
4. Assessment of the effectiveness of the solution
5. Documentation of the incident

Below we will address these steps individually.

Information Gathering Before we can determine how to address a problem--or even assess what the problem is--we must gather information. Gathering information can be particularly challenging when the problem manifests itself at the client side. You might have to formulate your questions carefully in order to get meaningful information. Log files contain great information you should consult during the data-gathering stage. Both the Windows logs and the AIRA logs should be consulted. Also check to see if all Services are running properly.

Analysis Once we have gathered the data (including attempting to reproduce the problem), it's time to analyze the data. The primary task in this phase is to look for patterns. An important part of the analysis phase involves prioritizing. This

includes prioritizing the problems, if there are multiple problems. Performance problems are generally less urgent than access problems.

Solution Implementation Although there could be several possible solutions to a problem, you should always implement one change at a time. Assess the results of that change before trying something else. This will save you time in the long run.

Assessment It is vital that you assess the results of your actions and determine whether the "fix" worked, whether it was a temporary work around, or whether it caused additional problems.

Documentation After completing your assessment, you should develop a summarization of the problem, which should include the reported and observed symptoms, the corrective actions taken, and the results of those actions.

> ### What is the basic troubleshooting?
Troubleshooting is a form of problem solving, often applied to repair failed products or processes on a machine or a system. It is a logical, systematic search for the source of a problem in order to solve it, and make the product or process operational again. Troubleshooting is needed to identify the symptoms.

> ### How to Troubleshoot your Cell Phone

Technology should be seamless, but you will find that your cell phone doesn't always perform as flawlessly as you want. A list of solutions for ordinary problems with these devices can be found in the tips and tricks listed below. However, if you still can't find the answer, you might want to contact your authorized cell phone provider. Whatever you do, don't take apart the phone yourself. Trying to fix your phone by taking it apart will void the warranty.

- If your phone does turn on, your battery might be out of charge. This is a fairly elementary fix. Charge your battery like you usually do, but make sure it is fully plugged in the phone or the computer or wall charger. You should also remove the battery from the phone and use a rag to brush away dirt. Although cell phones are supposedly sealed, dirt and debris can clog up the connections. Reconnect, make sure the battery is correctly re-installed and try again.

- If your battery is not charging, you might try plugging another electrical device into the outlet to verify this outlet works. Replace your charger or battery if necessary.

- If your phone gets wet, remove the battery from the phone and allow both the phone and the battery to thoroughly dry. If you find rust or corrosion on

the battery, wipe it off with a stiff brush. Try out the phone and if it still does not work, you might need to replace your battery.

- If your display is not working, it may be due to extreme temperatures. Let your phone come to room temperature. Your display should come back up.

- If the keys on your cell phone don't work, look for a symbol on your display screen that looks like a lock. You may have inadvertently locked your keypad. The display should tell you how to unlock your phone. If you do not have these instructions, check out the owner's manual or the phone's website.

- If you have problems while talking, you might check to make sure the battery is not low. Move toward a window if you are inside or go outside to get better reception. Basements, elevators, and basements interfere with cell phone reception. Storms can also be the cause of interference. If you get continually static, you may need to change phones.

- Check your volume if you cannot hear the other person. It is easy to forget that there is a volume control on your phone. Having your volume control turned down low is a very common mistake.

- It is so annoying to not receive calls when you know they are coming in. Confirm that your call forwarding or automatic voice control is not activated. Check the ringer volume and confirm that your rings are not in the silent mode.

If your cell phone is not working due to problems with your service provider, call their customer service and register a complaint. You can also work with a representative to solve any problems you are experiencing. If all else fails contact FCC, Consumer Information Bureau Customer Services Network Division, 445 12th Street SW Washington, DC 20554 to get your complaints aired.

How do you troubleshoot a mobile phone?
General troubleshooting tips for Android devices

1. Restart your device. It might sound simple, but sometimes that's all it takes to fix a bad connection.
2. If restarting doesn't work, switch between Wi-Fi and mobile data: Open your Settings app "Wireless & networks" or "Connections". ...
3. Try the troubleshooting steps below.

    https://www.youtube.com/watch?v=f1W_gORf66I

3.2 MAIN CONCERN

The effective & efficient working condition of a certain laboratory equipment depends on the following four features:

- Maintenance
- Servicing
- Troubleshooting
- Repair

MAINTENANCE

- Maintenance is a continuous process.
- Must include both the Hardware and the Software.
- Hardware:
- Cleaning/Dusting
- Maintaining prescribe levels of parameters such as electrical, environmental, and others.
- Software:
- Reinstallation/Uninstallation
- Upgrade

SERVICING

- Mainly associated with the hardware parts of the equipment.
- It Includes:
- Check-ups,
- Repairs, and
- Updating of all physical components

SERVICING

- **STEPS:**

1. Uninstall all physical components starting from power connections.
2. Clean dust from the components.
3. Perform a visual check or electronic check as required.
4. Reinstall all components carefully and properly.

SERVICING (cont.)

5. Check for loose wiring or crack cables.
6. Check if any jumper is missing, if required replace it with a new one.
7. Check for physical damages of peripherals and replace them if needed.
8. Tighten all internal and external connections.
9. Switch on the power supply and observe.

TROUBLESHOOTING

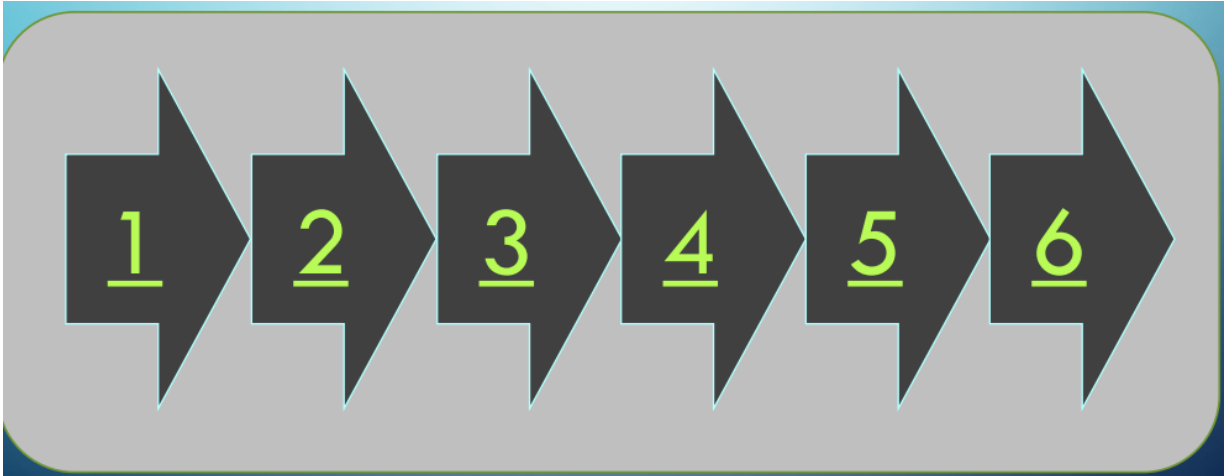- Detection and rectification of faults in the equipment.Repairing

means to rectify the problem in the hardware or software.It is an essential part of troubleshooting.Repairing may also include replacement of a component.

REPAIRING

SIX-STEP PROCEDURE

•A standardized approach toward electronic troubleshooting and maintenance:

SYMPTOM RECOGNITION

• Determine if the equipment is functioning as design.
• A trouble symptom is an indicator of malfunction.
• Use your senses of **SIGHT** and **HEARING**

SYMPTOM ELABORATION

• What fault is probably causing the specific symptoms?
• Symptom elaboration requires an evaluation of all observed displays.
• Indications must be evaluated in relation to each other as well as the overall operation.
• Record information observed! For example: How did each control affect an associated meter or other indicator?
• "Think" about the information before jumping to a conclusion

LISTING PROBABLE FAULTY FUNCTIONS

• Dividing the equipment into functional areas can save numerous trouble shooting steps.
• Use **FUNCTIONAL BLOCK DIAGRAM (FBD)**

FBD shows the functional areas of an equipment, as well the detailed functions, levels of input and output parameters (voltage and current).

FUNCTION
* **Isolating the functional area** that
has an indication of *malfunction*. :
* **Knowledge, skill, and proper
test equipment** should now be
used to isolate the faulty functional
area.

LOCALIZING THE TROUBLE TO THE CIRCUIT
•Isolating the circuits within the faulty unit.
•More extensive troubleshooting is now
required within the identified faulty unit.
•Look for improper voltages, improper
waveforms, obvious component overheating.
•Isolate the defective circuit group.

FAILURE ANALYSIS
• **Steps 1 and 2** were used to *recognize, verify, and
obtain descriptive information*
• **Step 3** allowed you to *make a logical selection* of the
logical faulty unit
• **Step 4** provided for simple input-output *tests and
localized the faulty functions*
• **Step 5** *localized the fault to the circuit* within the faulty
unit
• **Step 6** will involve the *actual replacement or repair of
faulty circuit components*

> ➢ **What are the most common troubleshooting techniques and
> strategies?**

Here are my five common-sense techniques and strategies to solve common
computer hardware problems.

- Swap Components (Trial-and-Error) Personal computers by design are
  highly modular. ...
- Check the cables. Almost 80% of all PC problems are related to cabling
  and connections. ...
- Do not get frustrated. ...
- Take down notes. ...
- Look inside.

Self-check 5	Written test

Name: _____Date:

_____

Time Start: _____Time Finish:

_____

1. Describe troubleshooting.

2. Write 5 steps of troubleshooting

3. What are the most common troubleshooting techniques and strategies?

Answer
score

1_____
_____
_____
_____

2_____
_____
_____

3_____
_____
_____

6.1 identify Mobile Phone Fault Finding for Mobile Cell Phone Repairing

Mobile Phone Fault Finding for Mobile Cell Phone Repairing – In order to repair any mobile cell phone, we must find and know fault or problem present in Different Sections of Mobile Phone, Parts and Components. If we know about problems of different parts and components present in different sections inside a mobile cell phone then we can easily repair the fault by checking the component.

A cell phone can get various faults and problems when using it. So cell phone repair technicians should know what are all the faults they have to repair and fix when they open a repair center.They should know how to diagnose and troubleshoot them easily.

> ➢ **Basically, there are 3 types of faults in cell phones**

1. Settings Faults
2. Software Faults
3. Hardware Faults

The list of all faults in cell phone are:

1. Dead: If a phone doesn't switch-on, it is called a dead phone.

2. Insert Sim Card: In this fault, the SIM card does not detected.

3. Hanging Problem: In this fault, the handset freezes frequently.

4. Network Problem: No signal and network or low network

5. Microphone Problem: No out-going sound.

6. Ringer Problem: No ring tone, music and loud speaker will not work.

7. Speaker Problem: No incoming sound.

8. Vibrator Problem: No vibration.

9. Display Problem: No graphics on LCD or broken LCD.

10. Auto Switch Off: Phone switches off automatically even if not switched-off.

11. Restart Problem: Phone restarts automatically.

12. Call Cut Off: Call gets disconnected or cuts off.

13. Charging Problem: No charging or very slow charging.

14. Keypad Problem: Keypad doesn't work or some keys do not function. Home button or volume buttons do not work

15: Touch Problem: Touch doesn't work or slow touch.

16. Battery Discharge Problem: Battery gets drained very fast even when fully charged.

17. Bluetooth Problem: Bluetooth does not work.

18. Camera Problem: Camera does not work.

19. FM Radio: Radio does not work or no tuning.

20. LED Problem: Not light on LCD.

21. Memory Card Problem: MMC does not get detected.

22. No Internet

23 WiFi Problem: WiFi does not function

These are the most common faults that arise in cell phones as well as smartphones and tablets. Sometimes unlocking is required if your device is locked. There are many more strange problems other than the ones mentioned above. Some of these are easy to repair while others are difficult and sometimes are beyond repair.

Self-check 6	Written test

Name: _____Date: _____

Time Start: _____Time Finish: _____

1. Write down types of fault

2. List out some common mobile phone fault.

Answer   **score**

1. _____
   _____
   _____
   _____
   _____
   _____

2. _____
   _____
   _____
   _____
   _____
   _____
   _____

Information sheet 7	Documenting and completing results of diagnosis and testing within the specified time

7.1 Documentation

Documentation is about documents, which communicate information. Those documents provide information for and about a certain object, process or topic. Documentation can be published in digital (CD, DVD, bluray disc, memory stick, download, as a web site,...) or in analog (book, paper, poster, photo...) form. Further more, digital documentation can be presented in an interactive manner, which increases ease of use. Examples for interactive features are, among others, cross references, search, tip-of-the-day features,
contextual information, wizards or knowledge based help systems.
Another important characteristic of documentation is the level of detail. There may exist several documents describing the same aspect, but are intended for a different audience (with varying domain knowledge) and thus serve a different purpose. Software system underlie continuous changes throughout their whole life cycle. As a consequence,
also the amount of information grows continually. For international software systems, the documentation has to be available in multiple languages. All these aspects contribute
to the problems of documentation: Keeping up with changes during the development, propagating changes in requirements documents, design documents to the development
and keeping documents on the desired level of quality.
The above already indicates, that most documentation artifacts also underlie frequent and sometimes fundamental changes and the task of maintaining them require additional
effort in personnel, time and thus money.

About technical documentation and user documentation
In this section, we will define technical and user documentation and investigate both subjects from different perspectives. Understanding the different aspects of

documentation helps to deduce requirements for maintenance.

2.1 Technical documentation

Among all the recommended practices in software engineering, software documentation has a special place. It is one of the oldest recommended practices and yet has been renowned for its absence. There is no end to the stories of software systems, especially legacy software, lacking documentation or with outdated documentation. For the last decade, the importance of technical documentation (and documentation in general), has been stressed by educators, software development processes, standards, etc. and despite

of this, it is still discussed why documentation is not generally created and maintained. In recent years, this topic gained new interest (from [6]):

• Agile methods question the importance of documentation as a development aid

• The growing gap between *traditional* (e.g. COBOL) and up-to-date technologies

(e.g. OO or web-oriented) increased the pressure to re-document legacy software.

Typical examples of technical software documentation include: requirement specifications, design (architectural) documents, source code comments, test documents and

defect (bug) reports. The authors of [9] summarize benefits of technical documentation from other articles. Figure 1 shows the result. The benefits have been classified into four categories: (1) maintenance aid, (2) development aid, (3) management decision aid,

and (4) other.

Self-check 7	Written

Name:_____Date:_____

Time Start: _____Time Finish: _____

1. What is documentation?.

Information sheet 8	Advising or informing customers regarding the status and serviceability of the unit

8.1 CUSTOMER SATISFACTION AND CUSTOMER LOYALTY

Customer satisfaction Customer satisfaction has been one of the top tools for a successful business. Customer satisfaction is defined as an overall evaluation based on the total purchase and consumption experience with the good or service over time (Fornell, Johnson, Anderson, Cha & Bryant 1996). With marketing, customer satisfaction also comes along with it, which means it ascertains the expectation of the customer on how the goods and services are being facilitated by the companies. Actionable information on how to make customers further satisfied is therefore, a crucial outcome (Oliver 1999.)

Customer satisfaction is dynamic and relative. Only the idea "customer-centric" can help companies improve satisfaction and keep customer truly, conversely, if competitors improve customer satisfaction, then it may loss corporate customers.

Specific product or service features and perceptions of quality influence customer satisfaction. Satisfaction is also influenced by customer's emotional responses, their attibutions natheir perception of equity.

Customer relationship management triangle law describes Customer satisfaction = customer expectations customer satisfaction. In the given figure, customer satisfaction can be seen negatively correlated with customer expectations. The figure clear difference between the customer experience and customer expectation. Therefore, it is divided into five intervals (very dissatisfied, relatively dissatisfied, general satisfaction, relatively satisfied and very satisfied). When the customer experience essential flats with customer expectation, the customer satisfaction become higher. On the contrary, compared with the expectations, the worse customer experience brings lower customer satisfaction. There are two ways to improve customer satisfaction for companies.

Customer Satisfaction

Customer Satisfaction

High

Very Satisfaction

Relatively satisfaction

Experienced expectation

General satisfaction

Low

Relatively Dissatisfaction

Very Dissatisfaction

Self-check 8	Written
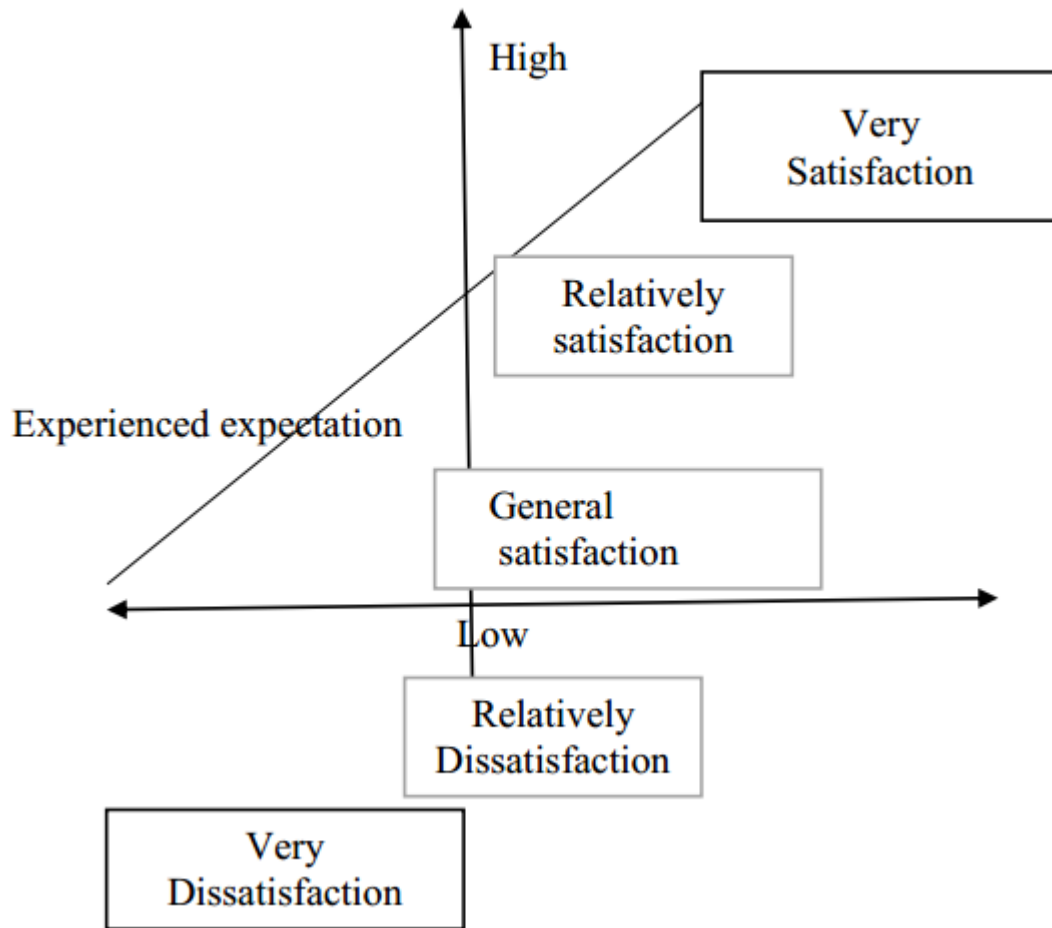
Name:_____Date:_____

Time Start: _____Time Finish: _____

1. What is customer satisfaction?

LAP TEST #2	Complete check-up of *cellular phone*

Name: _____   Date: _____

Time started: _____Time finished _____

Instructions: You are required to perform the following individually with the presence of your teacher.

1. Diagnose, Troubleshoot and repair the Mobile Phone Unit given by your teacher. If you have some clarification, ask your teacher.

2. Observe Safety Procedures in Dis-assembling the unit.

➢ *Your teacher will evaluate your output either satisfactory or unsatisfactory. If*

unsatisfactory, your teacher shall advice you on additional work. But if satisfactory, you can proceed to the next topic.

LAP TEST #1	Mobile Phone SIM faults repairing

Time   started: _____**Time   finished:**
_____

Instructions: You are required to perform the following individually with the presence of your teacher.

Task 1.Mobile Phone SIM faults repairing

LAP TEST #3	Diagnose mobile phone

Name: _____**Date:**

_____

Time   started: _____**Time   finished:**
_____

Instructions: You are required to perform the following individually with the presence of your teacher.

- A. Tools & Materials
    1. Nokia 3310 board or any motherboard
    2. Maintenance Plate Board
    3. Maintenance Plate Stand
    4. Hot Air & Soldering Station
   5. Tweezers
    6. Soldering Flux

- B. Procedure

    1. Dismantle Nokia 3310 Unit

    2. Prepare hot air soldering iron station. Plug into outlet. Turn the station on. Set operational air and heat combination and wait for few minutes for the heat to stabilize before using.
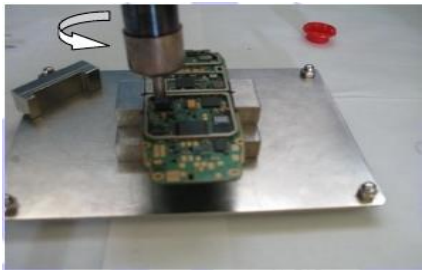   (Air = 4.0, Heat = 4.0)

AIR   HEAT
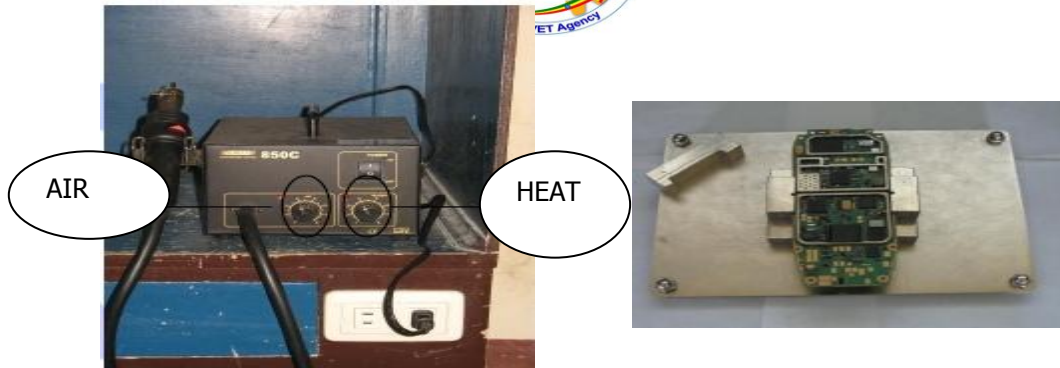
3. Place the unit board to the maintenance plate stand as shown below.
4. Place a soldering flux to the SMD to be extracted, i.e. CCONT BGA IC of Nokia 3310.

CCONT
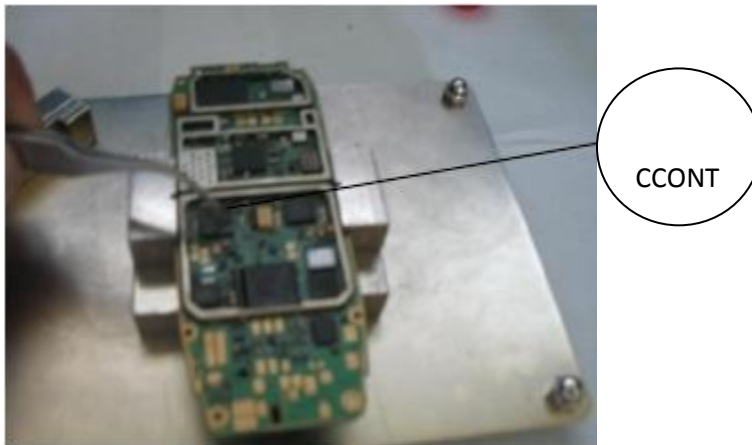
5. Apply the hot air station nozzle over the SMD at about 1 cm and start to move the nozzle counterclockwise according to the SMD to be removed.
6. Occasionally check for the SMD if it loosens before removing it from board.

Has your Instructor Check your work?

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- OH&S procedures
- application software
- Defective parts/components are replaced
- Solder/ mount Repaired or replaced parts/components

This guide will also assist you to attain the learning outcome stated in the above. Specifically, upon completion of this Learning Guide, you will be able to –

- Replacing defective parts or components with correct soldering techniques and procedures with application of OHS.
- Installing application software.

Learning Instructions:

16. Read the specific objectives of this Learning Guide.
17. Follow the instructions described below
18. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
19. Accomplish the "Self-checks" in each information sheets.
20. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
21. If you earned a satisfactory evaluation proceed to "Operation sheets and LAP Tests if any". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity.
22. After you accomplish Operation sheets and LAP Tests, ensure you have a formative assessment and get a satisfactory result;
23. Then proceed to the next Learning guide.

Information Sheet #1	Using personal protective equipment's in accordance with Occupational Health and Safety practices

1.1 PPE Safety

Personal Protective Equipment (PPE) is clothing or equipment designed to protect workers from physical hazards when on a worksite. PPE should only be considered as a last line of defence between a hazard and the worker. Attempts to control workplace risks and hazards should always be addressed first.

Workplace safety should begin with a hazard assessment. Once the hazards and risks have been identified, a plan can be put forward to prioritize and reduce risk of injury. Useful systems and tools to perform hazard assessments include performing a Risk Assessment and a Job Safety Analysis.

1.1.1 Workplace Hazards and Risks Involved

Workplace hazards caused 5,190 workplace deaths in 2016 according to the US Bureau of Labor Statistics, which is an average of 99 weekly deaths or more than 14 fatalities per day. Employers, managers, and safety officials can help prevent these deaths by establishing adequate safety protocols, hazard identification procedures, and conducting regular hazard assessments in the workplace.

> ### What are Common Workplace Hazards?

OSHA identifies the 6 most common hazards in the workplace as follows:

1. Safety hazards
2. Biological hazards
3. Chemical and dust hazards
4. Ergonomic hazards
5. Work organization hazards
6. Physical hazards

1.1.2 What is a JSA and Why is it Important?

Job Safety Analysis (JSA) also known as Job Hazard Analysis (JHA) is a process of looking at a work task and considering what is the safest way to complete it. The process typically involves 1) Breaking a job down into smaller tasks and observing a worker performing it, 2) Identifying the potential hazards for each task and, 3) Determining preventive measures and controls to overcome these hazards.

Dangerous jobs benefit the most from a JSA because it can reduce or eliminate hazards that cause serious injuries or fatalities. A JSA increases job knowledge,

establishes teamwork, serves as a health and safety standard and teaching aid, and supports accident investigations at work. A JSA template is used when performing a JSA procedure and is used to generate a safety and recommendation report.

➤ **What Jobs are Appropriate for a JSA?**

A JSA can be conducted on many jobs in your workplace but priority should go to the types of jobs that have:

1. Highest injury or illness rates;
2. Potential to cause severe or disabling injuries or illness, even if there is no history of previous accidents;
3. Simple human error which could lead to a severe accident or injury;
4. Undergone changes in processes and procedures; and
5. Complexity enough to require written instructions

1.1.3 What is a Risk Assessment?

A risk assessment is a systematic examination of your workplace to: 1) identify significant hazards; 2) assess injury severity and likelihood; and 3) implement control measures to reduce workplace risks

Beyond complying with legislative requirements, the purpose of risk assessments are to improve the overall health and safety of your workers.

Risk assessments are often confused with a Job Safety Analysis (JSA) or Job Hazard Analysis (JHA). The key difference between a risk assessment and a JSA is scope. Risk assessments assess safety hazards across the entire workplace and are oftentimes accompanied with a risk matrix to prioritize hazards and controls. Whereas a JSA focuses on job-specific risks and are typically performed for a single task, assessing each step of the job.

➤ **How to Perform a Risk Assessment?**

Competent persons who are experienced in assessing hazard injury severity, likelihood and control measures should carry out risk assessments. A new risk assessment should be carried out when there are new machines, substances and procedures which could lead to new hazards. They should be reviewed regularly and kept up to date.

Here are 5 steps to follow when performing a risk assessment in your workplace:

1. Identify hazards: Survey the workplace and look at what could reasonably be expected to cause harm. Identify [common workplace hazards](). Check manufacturers or suppliers instructions or data sheets for any obvious hazards. Review previous accident and near-miss reports.
2. Decide who might be harmed and how: Identify which group and demographic of workers might be harmed. Ask workers if they can think of anyone else who could be harmed by the hazard.
3. Evaluate the risks and decide on control measures: Look for existing controls in place. Follow the hierarchy of controls in prioritizing implementation of controls.
4. Record your findings and implement them: Use a risk assessment template to document your findings. Get started with iAuditor's [free risk assessment templates]() that you can use on your mobile device while on-site. Share your report and findings with key parties who can implement changes.
5. Review your assessment and update if necessary: Follow up with your assessments to check if controls have been put in place or if any new hazards have resulted

1.1.4 Basic Types of PPE

However, even the strictest controls will not necessarily eliminate all the risks associated with most job tasks and this is where the need for PPE must be evaluated. A hazard assessment can help identify which specialized PPE will be required. However, the following basic types of PPE should be made available in every worksite.

1. Head Protection

PPE includes hard hats and headgears and should be required for tasks than can cause any force or object falling to the head. When performing head protection safety checks, ensure that there are no dents or deformities on the shell and connections are tightened inside. Do not store in direct sunlight and always replace a hard hat if it was used for any kind of impact, even if damage is unnoticeable.

2. Face and Eye Protection

PPE includes safety goggles and face shields and should be used for tasks that can cause loss of vision and an eye, burns, splashes, sprays of toxic liquids etc. When conducting equipment safety checks, ensure that there are no cracks or deformities on the lenses, ensure the strap is in good working order and is firmly sealed to the cheek and forehead.

3. Foot Protection

PPE includes knee pads and safety boots and should **be used for tasks that can cause serious foot and leg injuries from falling or rolling objects, hot substances, electrical hazards and slippery surfaces. Use boots with slip-resistant soles that protect against compression and impact.**

4.   Hands Protection

PPE includes safety gloves and should be used for tasks that can cause hand and skin burns, absorption of harmful substances, cuts, fractures or amputations. When inspecting hand protection equipment, ensure that they fit perfectly with no spaces and are free from cuts, burns and chemical residue. Always replace them if any sign of contamination was observed.

5.   Body Protection

PPE includes safety vests and suits and should be used for tasks that can cause body injuries from extreme temperatures, flames and sparks, toxic chemicals, insect bites and radiation. Ensure that they are clean and free from cuts and burns. Always get a good fit to ensure full body protection.

6. Hearing Protection

PPE includes ear muffs and plugs and should be used for tasks than can cause hearing problems and loss of hearing. When ensuring hearing safety, the equipment must fit the ear canal perfectly. Recommended types include formable earplugs to fit on different sizes of ear canals.

7. Fall Protection

PPE includes safety harnesses and lanyards and should be strictly used for task that can cause falling from heights and serious injury or death. When inspecting equipment, ensure that the straps are free from tears, deformities and burn marks and buckles are connected securely and tightly. It is very important to dispose them if used after a falling incident.

8. Respiratory Protection

PPE includes respirators and should be used for task that can cause inhalation of harmful materials to enter the body. When conducting respiratory protection safety, ensure that the equipment is fit-tested and the employee has undergone proper training before wearing one.

1.1.5 PPE Safety Checklists

Safety officials and supervisors to help identify tasks that require PPE, ensure staff is using the right equipment and reduce overall harm use personal Protective Equipment (PPE) Safety Checklists. This page features the most downloaded PPE checklists from OSHA and other best practice checklists. Use iAuditor, the most powerful inspection app, to conduct regular PPE self-inspections, identify tasks that require PPE and ensure staff is using the right equipment. Get started with these free customizable PPE checklists to find out how you can prevent accidents at work.

➢ What are PPE Safety Checklists?

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Follow these 5 steps to start performing mobile inspections

1. Create a free I Auditor account to get started
2. Download a template above and modify it for your workplace or browse other checklist topics
3. Install the iAuditor app on your mobile or tablet and perform an inspection
4. Take photos, create actions and generate reports on your device
5. Invite your teammates. Save time, save lives

➢ Top 3 PPE Safety Checklists

PPE Safety Checklist

Managers and safety officials to select the appropriate equipment to reduce hazards identified at work can use this free PPE checklist. Start by recording nature of work and potential hazards that may be in contact with body parts. The template then prompts the inspector to describe the hazard, state the required PPE and check the condition of the PPE by capturing photo evidence. Lastly, it summarizes the inspection by providing recommendations. Use iAuditor to perform more efficient PPE inspections by taking photos of defects and generate quality reports on-site.

What are the 4 types of PPE?
Types of personal protective equipment

- Respiratory protection - for example, disposable, cartridge, air line, half or full face.
- Eye protection – for example, spectacles/goggles, shields, visors.
- Hearing protection – for example, ear muffs and plugs.
- Hand protection – for example, gloves and barrier creams.

Why is PPE used?

The Importance of **Personal Protective Equipment**. ... **PPE** is equipment that will protect workers against health or safety risks on the job. The purpose is to reduce employee exposure to hazards when engineering and administrative controls are not feasible or effective to reduce these risks to acceptable levels.

1.1.16   Tips on Cell Phone Safety and Privacy

As cell phones become smarter, they're more like mini computers that contain lots of personal information about us. Here are 12 easy steps to take to manage your privacy and safety when using your cell phone.

1. Put a passcode on your phone.

The easiest thing for you to do is to put a passcode on your phone. Having a passcode will make it harder for someone to pick up your phone to scroll through, access your accounts, or install something malicious. In the event that your phone gets stolen or you lose it, it'll make it a bit harder for others to get into your phone. Most phones just ask for a 4-digit passcode, but some phones will allow you to use a more complex passcode.

2. Turn off location sharing.

Most phones have a GPS that can pinpoint your general or exact location. With this capability, many applications may collect and share your location information. However, many smartphones give you the option of managing your location sharing under the "settings." You can pick and choose which applications may access your location or you can opt to turn off the location setting altogether. Minimizing the location access can also help increase the battery life on your phone. If your phone doesn't offer specific location-sharing settings, choose carefully when downloading new apps so you're not sharing your location unknowingly.

3. Turn off Bluetooth when not using.

Bluetooth allows your phone to communicate with other devices, such as the hands-free option in your car or your printer. If accessed by someone else though, they could misuse it to access your information or intercept your calls. Turn off the Bluetooth on your phone and turn it on only when you need to connect with other device. Many phones also allow users to set passcodes or additional security levels on their Bluetooth as well. Use all available options to increase your privacy.

4. Check your privacy & security settings.

Most smartphones have settings that will help you manage your privacy and safety. You can find these controls through the settings on your phone or through the settings of a specific app. These settings may allow you to limit an application's access to the data on your phone, including access to your location, pictures, contacts, notes, etc. You may even be able to block cookies and limit what data your mobile browser collects.

5. What online accounts are you automatically logged into?

One of the convenient features of having a smartphone is to quickly access email or social media accounts with just a tap of a finger. However, this also means that you are always connected to accounts that may contain sensitive information. Consider logging out of certain accounts if you can so that others can't access those accounts if they are using your phone. Keep in mind that depending on the type of phone you have, you might not be able to log out of some accounts, such as email accounts, but may have to remove the entire account from your phone. In this case, make your decision based on your own privacy and safety risk. While it may be inconvenient to access the account through the browser instead, it may be safer.

6. Review the apps you download.

Know the apps that are on your phone, and if you have an unfamiliar app, delete it. Apps are easy to download and easy to forget, but depending on the app, it could be accessing private information or could be a monitoring program that someone surreptitiously installed.

7. Put a password on your wireless carrier account to keep others from accessing your account.

If you're worried that someone might be contacting your wireless carrier to obtain information about you and your account, you can ask your wireless carrier to put

additional security on your   account, such as a password. Only someone with this password will be allowed to make changes to your account.

8. Lock down your online phone account.

Keep in mind that even if someone doesn't have access to your phone, it might be possible for them to access your online account. Online accounts can include your wireless carrier account, call logs, your email or social media accounts, your Google Play/Apple AppStore, or iCloud account. Update the passwords and security questions for those accounts to ensure someone else can't get access.

9. Use virtual phone numbers (such as Google Voice) to keep your number private.

To further maximize your privacy, consider using a virtual number, such as Google Voice or a throw away number, so you don't have to give out your actual phone number. A virtual phone number will also allow you to screen calls and make calls/send texts from the virtual number.

10. Try not to store sensitive information on your phone.

Finally, although it may be tempting to store information such as passwords, account numbers, or personal information on your phone, the less sensitive information you have, the less likely someone else can access it. You might even want to consider deleting sensitive text messages or voicemails so they're not stored on your phone.

11. Use anti-virus and anti-spyware software on your phone.

After years of warnings, we are fairly used to ensuring we have anti-spyware, anti-malware, and anti-virus programs on our computers. This software should also be used on our smartphones as well. Search for programs in the app stores and discuss them with your wireless provider. Some phones come with built-in software that you won't want to override.

12. Take care when using safety apps.

There are many "personal safety apps" available for download that offer to increase the users' personal safety – immediately connecting them with 911 or select trusted individuals. Several of these apps are designed and marketed specifically to survivors of violence. Before relying on any safety app in an emergency, be sure to test it out with friends and family to be sure that it works correctly for you. Your

trusted friend may not receive your location with your emergency call or may not receive your call for help at all. Always know the quickest way to access 911 on your phone in case of an emergency. Many phones have a quick emergency call button that you can even dial without entering the phone's passcode.

Self-Check #1	Written Test

Name: _____Date: _____

Time Start: _____Time Finish: _____

1. _____clothing or equipment design to protect workers

   A. Safety
   B. PPE
   C. DMM
   D. All

2. Which one of the following is not common workplace hazard?

   A. PPE
   B. Biological hazard
   C. Ergonomic hazard
   D. All

Answer   score

   1_____

   2_____

Information sheet 2	Following electro-static discharge (ESD) procedure in accordance with industry standards

2.1 ESD (Electrostatic Discharge) – Static Electricity and Anti Static Protection

2.1.1 What is ESD Electrostatic Discharge?

ESD Electrostatic Discharge or Static electricity is an electrical charge that is at rest. This is mainly created by an imbalance of electrons that stay on a specific surface, or in the environmental air. The imbalance of electrons (in all cases, is caused by absence or surplus of electrons) thus causes an electrical field that is capable of influencing other objects at a distance.

https://www.youtube.com/watch?v=y5FswkQ4bi0

The level of charge is affected by material type, speed of contact and separation, humidity, and several other factors. The ESD effect can be seen easily in everyday life, while it could always been hardly detected. The electronics industry is badly affected by ESD or Electrostatic Discharge. Let us discuss ESD in detail.

fig 2.1symbol of esd

Static charge is an unbalanced electrical charge at rest. Typically, it is created by insulator surfaces rubbing together or pulling apart. One surface gains electrons, while the other surface loses electrons.This results in an unbalanced electrical condition known as static charge. When a static charge moves from one surface to another, it becomes ESD. ESD is a miniature lightning bolt of charge that movesbetween two surfaces that have different potentials. It can occur only when the voltage differential between the two surfaces is sufficiently high to break down the dielectric strength of the medium separating the two surfaces. When a static charge moves, it becomes a current that damages or destroys gate oxide, metallization, and junctions. ESD can occur in any one of four different ways: a charged body can touch an IC, a charged IC can touch a grounded surface, a charged machine can touch an IC, or an electrostatic field can induce a voltage across a dielectric sufficient to break it down.

2.1.1ESD Stress Models

ESD can have serious detrimental effects on all semiconductor ICs and the system that contains them. Standards are developed to enhance the quality and reliability of ICs by ensuring all devices employed have undergone proper ESD design and testing, thereby, minimizing the detrimental effects of ESD. Three major stress methods are widely used in the industry today to describe uniform methods for establishing ESD withstand thresholds (highest passing level).

2.1.2Human Body Model (HBM)
The HBM is a component level stress developed to simulate the action of a human body discharging
accumulated static charge through a device to ground, and employs a series RC network consisting of a
100 pF capacitor and a 1500 Ω resistor.
2.1 .3Charged Device Model (CDM)
The CDM is a component level stress that simulates charging and discharging events that occur in production equipment and processes. Potential for CDM ESD events occur when there is metal-to-metal contact in manufacturing. One of many examples is a

device sliding down a shipping tube and hitting ametal surface. The CDM addresses the possibility that charge may reside on a lead frame or package (for example, from shipping) and discharge through a pin that subsequently is grounded, causing damage to sensitive devices in the path. The discharge current is limited only by the parasitic impedance and capacitance of the device. CDM testing consists of charging a package to a specified voltage, then this voltage through the relevant package leads. At TI, the CDM testing is conducted using a field-induced CDM (FCDM) simulator.

2.1.4 System Level ESD (International Electrotechnical Commission - IEC)

The IEC system level ESD is a widely accepted European standard which defines an ESD event that is meant to be tested on actual end equipment to simulate a charged person or object discharging into electronic systems. The IEC standard defines an ESD stress that is much stronger than the component level ESD stresses defined by HBM and CDM.

2.1.5 What are the common sources of static electricity?

The following table shows a sample list of sources of static electricity

Object or process	Material or activity
Work surfaces	Waxed, painted or plastic surfaces.
Floors	Waxed, common vinyl tiles, sealed concrete
Clothes	Common smocks, non-conductive shoes, synthetic materials (e.g. nylon)
Chairs	Vinyl, fiber-glass, finished wood
Packaging	Common plastic bags, foam, trays, tote boxes
Assembly area	Spray cleaners, heat guns, blowers, plastic tools (e.g. solder suckers, brushes) cathode ray tubes.

> **What are typical examples of static charge inducing situations? Does humidity have any effect on the induced static charge?**

The following table shows some typical situations. Please note that humidity has a significant effect on the induced charge. It is not recommended to have relative humidity (RH) that is too low, say, below 30%. ESD control becomes especially challenging at low RH levels. A relative humidity between 40% to 60% is recommended for the typical assembly area.

Means of static generation	RH 10-20%	RH 65-90%
Walking across a carpet	35,000 V	1,500 V
Walking on a vinyl tile floor	12,000 V	250 V
Vinyl envelopes for work instructions	7,000 V	600 V
Worker at bench	6,000 V	100 V

2.1.6How does damage from ESD happen?

When a statically charged person or object touches an electrostatic discharge sensitive (ESDS) device, there is a possibility that the electrostatic charge could be drained through sensitive circuitry in the device. If the electrostatic discharge possesses sufficient energy, damage could occur in the device due to localized overheating. Generally, devices with finer geometries are more susceptible to damage from ESD. The modes in which ESD damage occurs are:

(a) Discharge to the device

(b) Discharge from the device

(c) Field-induced discharge.

2.1.7The Prevention and Control ofElectrostatic Discharge (ESD)
what damage does ESD cause in an electronic device?

There are basically two categories of damage from ESD:

(a) Catastrophic damage – the electronic device is rendered inoperable immediately after the ESD event. A semiconductor junction or a connecting metallization could have been damaged by the electrostatic discharge.

(b) Latent damage – the electronic device appears to be working fine following the ESD event. However, the sensitive circuitry has been damaged and could fail to operate properly at some time in the future.

What are the classifications of ESD sensitivity? Electrostatic discharge sensitive (ESDS) parts are commonly characterized to three defined models:

• Human Body Model (HBM)

• Machine Model (MM)

• Charged Device Model (CDM) Based on the models used, the ESDS parts can be classified in accordance with the following table (per MIL-STD-1686C, with HBM subgroups per ESD STM5.1-2001). It should be noted that the HBM, MM and CDM voltage levels do not correlate with each other.

ESD Model	ESD Class
Human Body Model (HBM)	0
	1A
	1B
	1C
	2
	3A
	3B
Machine Model (MM)	M1
	M2
	M3
	M4
	M5
Charged Device Model (CDM)	C1
	C2
	C3
	C4
	C5
	C6
	C7

2.1.8 Causes / Sources of Electrostatic Discharge or Static Electricity

1. Triboelectric Charging (Primary Cause)

Triboelectric charging occurs when two materials are separated after coming into contact with each other or any rubbing activities. The charging thus takes place during the transfer of electrons from one material to another. Triboelectric charging can happen between any materials such as solids, liquids and air particles.

2. Field Induction

Whenever an object is electrostatically charged, an electrical field associated with that charge is created around it. Once an ungrounded sensitive device enters the electrical field, a charge is induced on the device, causing a surging transfer of charges between the two bodies. This transfer of charges thus results in catastrophic failures, which leaves the device destroyed permanently.

2.1.9 Damage Caused by ESD Electrostatic Discharge

Electrostatic discharge can change, degrade or destroy the electrical characteristics of electronic devices such as integrated circuits and electronic components, mainly SMD Electronic Components and even Different Types of PCB. Therefore effective static control and protection / prevention is crucial, in order to protect products from undesirable damages.

In mobile cell phone manufacturing and repairing industry, ESD-Safety is a must because SMD <u>Electronic Components used in Mobile Phones</u> are very sensitive to static charge and can get easily damaged if they come in contact with static electricity.

2.2 ESD Electrostatic Discharge Protection / Prevention

On many instances, people at work are one of the key generators of static electricity. The simple act of walking or repairing a Printed Circuit Assembly is sufficient to generate thousands volts on the body. It is obvious that personal grounding is the first step to effective static control. Following <u>ESD Protection Materials</u> can be used.

1. Anti-Static Packaging Material for ESD Protection

Packaging materials such as Static Shielding bags, Conductive bags, ESD containers and boxes / bins provide direct protection to devices and components from electrostatic discharge. The principal use of these packaging materials is to protect the product when it leaves the ESD protected facility. The main function of these ESD packaging materials is to eliminate or minimize the possible impact of electrostatic discharge created from triboelectric charging, direct discharge, and electrostatic induction fields.

https://www.youtube.com/watch?v=imdtXcnywb8

fig 2.2 Anti-Static Packaging Material for ESD Protection

2. ESD Safe Wrist Strap and Heal Strap for ESD Protection

When properly worn and grounded, a functioning wrist strap and heal strap keeps the human body near ground potential, thus preventing hazardous discharge between bodies and objects. Wrist straps and heal straps allow safe dissipation of charges from the body to ground.

fig 2.3 esd strap

3. ESD Safe Flooring and ESD-Safe Footwear

A good combination of ESD floor materials (ESD Mat or ESD Tiles or ESD Paint) and proper footwear provides a grounding path for dissipating electrostatic charges generated during walking.The use of ESD floor materials is particularly appropriate in those areas where increased personnel mobility is essential.

Fig2.4 ESD-Safe Footwear

4. ESD-Safe Garments

Anti-Static Clothing such as ESD Apron is an important consideration in most ESD protective areas, particularly in dry environments. Grounded static control garments are recommended to minimize the effects of electrostatic fields or charges that may exist on a person's clothing.

ESD-Safe Apron

fig2,5

5. ESD-Safe Workstation

Proper ground of workstation plays an important role in protecting devices from electrostatically induced damages. ESD tablemats, grounding cords and awareness signs are key elements in an electrostatic protective workstation.

ESD-Safe Workstation

fig2.6

6. Ionizers

Air ionization can neutralize the static charges on insulated and isolated objects by charging the molecules of the gases in the surrounding air. Static charges that exist on any surface can be neutralized by attracting opposite polarity charges from the air.

www.mobilecellphonerepairing.com

Ionizer

fig2.7

> **An example of a static-safe workbench (at Electrical Test).**

The picture below shows an example of a static-safe workbench. It is vitally important that the wrist-strap and the tablemat are securely grounded (through the 1 Meg-ohm safety resistor). In addition, all other materials with which the products come into contact must also be static-safe. The use of an antistatic floor further enhances the protective capabilities of a static-safe work environment. The worker should also wear an antistatic smock.
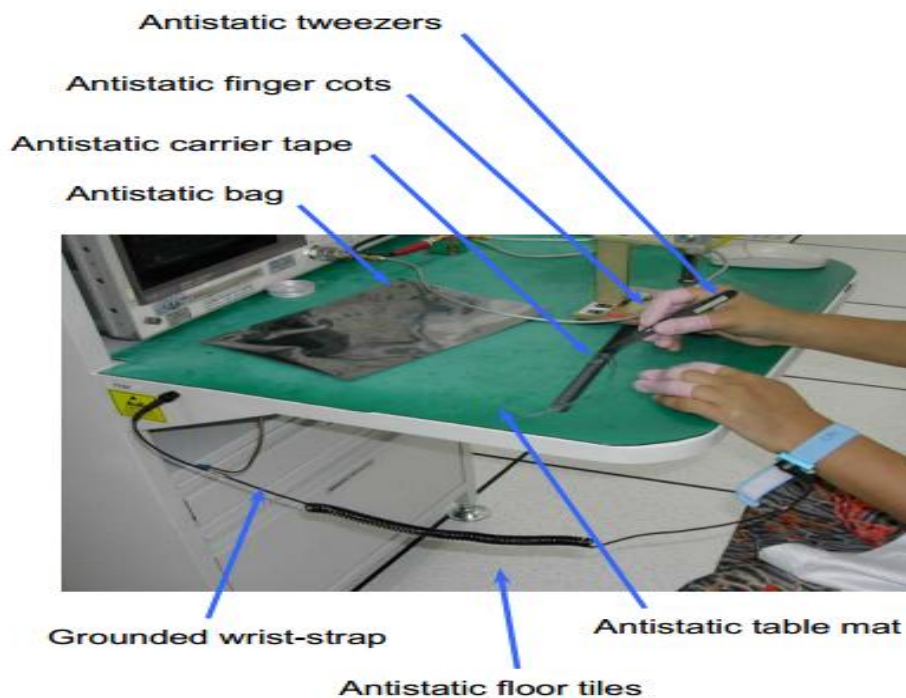
Antistatic tweezers
Antistatic finger cots
Antistatic carrier tape
Antistatic bag
Grounded wrist-strap
Antistatic table mat
Antistatic floor tiles

fig2.8

> **Static-safe work bench.**

The diagram below shows a typical static-safe work bench. The table top is covered by a static dissipative mat which is grounded through a 1 Meg-ohm resistor. This resistor is required in order to protect the users of the static-safe work bench – in the event that the ground becomes electrically live, the resistor will prevent electrical shock at the work bench. The same safety requirement holds true for the antistatic wrist-strap as well.
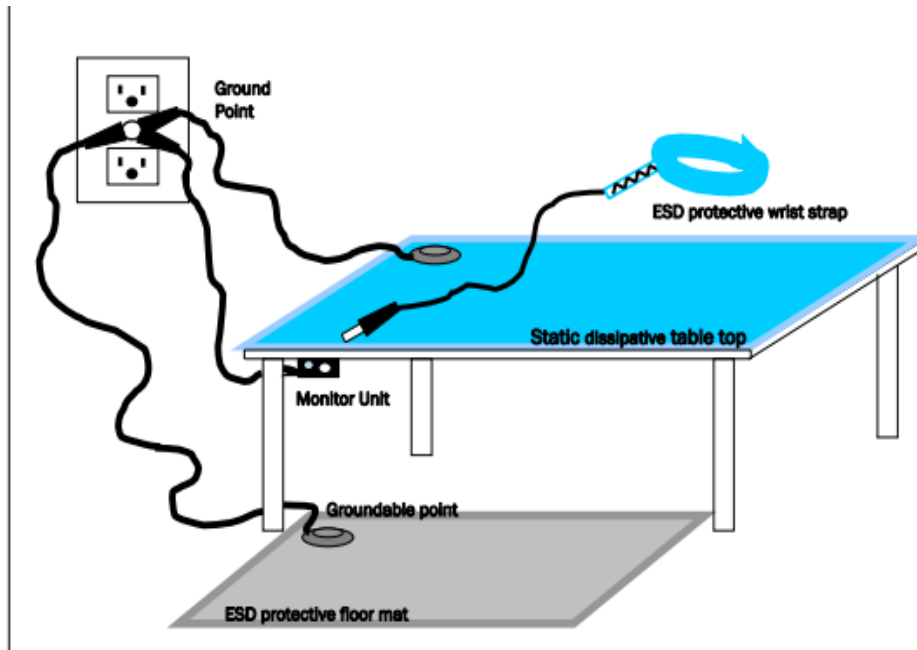

fig2.9

An example of a Static Control Test Station.

The picture shows an example of a test station used to determine whether antistatic wrist-straps or antistatic shoes are working properly

A green test indicator light means the wrist-strap is worn properly and is working as intended. This picture shows the configuration for testing wrist-straps. The test station can also be configured to test antistatic footwear.

Antistatic footwear.

Where a wrist-strap is impractical, e.g. the job requires the worker to walk from one location to another, it is recommended that antistatic footwear such as antistatic shoes or heel-straps are worn. The picture on the right shows an example of an antistatic heel-strap with the grounding cord running into the socks to make contact with the skin. It is also necessary to use an antistatic floor (e.g. conductive floor tiles) to work together with the antistatic footwear.

Labels to identify electrostatic discharge sensitive (ESDS) devices.

The following labels are commonly used on containers and packaging to alert anyone who handles the ESDS devices on the need to use static-safe procedures before handling the devices. The one on the left is preferred.

The following verbiage should be placed beside the label:

CAUTION
Contains parts and
assemblies susceptible to damage by
Electrostatic Discharge (ESD)

Self cheak	Written/choose

Name: _____Date: _____

Time Start: _____Time Finish: _____

1._____ is an important consideration in most ESD protective areas, particularly in dry environments.

      A. CMD

      B. SMD

      C. ESD

      D. None

2._____the electronic device id rendered in operable immediately after the esd evenet

      A. Catastrophic damage

B. Latent damage

C. Human body model

D. all

Information sheet 3	Replacing or swap defective parts or components with original part

3.1 Replacing or swap defective parts or components with original part

3.1.1 Service/repair cellular phone unit

When learning how to repair a mobile cell phone, it is important to identify parts of a mobile phone. There are hundreds of parts and electronic components in mobile phone. These parts and components can be classified into different groups such as card level parts, big parts and small parts. In this article, I will explain and teach you about card level parts of a mobile phone. Big parts, small parts, and electronic components will be covered in future articles.

3.1.2Card Level Parts of a Mobile Cell Phone

➢ **Front Facial or Facial**:

This is the front cover or housing of any mobile phone. These are of different shapes and sizes depending upon brand and model.

Fig.3.1. Shows Mobile Phone Front Facia

➤ **Back Facia or Facial**:

This is the Back cover or housing of any mobile phone. These are of different shapes and sizes depending upon brand and model.

f**ig.3.2** Shows Mobile Phone Back Facia

➤ **Internal Facia or Facial**:

This is the internal skeleton of a mobile phone.

Fig.3.3 Shows Internal Facia or Skeleton of a Mobile Phone

☐ **Ringer:** This part of component in a mobile phone is also called loudspeaker. It plays loud sound and music in mobile phone.

Fig.3.4 Shows Mobile Phone Ringer

☐ **Speaker:** This part or component is also called earpiece. It helps to listen to sound during phone call when the loudspeaker or headphone is NOT ON.

Fig.3.5 Shows Mobile Phone Speaker

☐ **Microphone:** It is also called Mic in short. It transmits sound of the speaker during phone call. It also helps to record sound in a mobile phone. It other words, microphone is a sound input device.

Fig.3.6 Shows Mobile Phone Microphone   Fig.3.7 Shows Vibrator of Mobile Phone

 Vibrator: It is also called motor.

It creates vibration in a cell phone when vibration mode setting is turned ON.

Vibrator
it is made of a tiny motor that conduct vibration when in active mode. It has been attach an unbalance tiny metal on its tip that is why it creates vibration when the motor rotates. .   It creates vibration in a cell phone when Vibration mode setting is turned ON**Fig.3.8 Shows Buzzers and Ringers**

Also these speakers can generate high audible sound louder than Earpiece speakers can. It amplifies the ringtones, voice, or music more audibly.

☐ **LED:** Light Emitting Diode. These components

Produce light in a mobile cell phone.
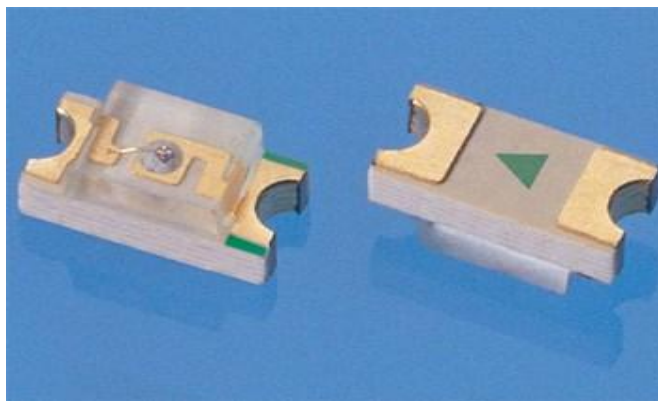
Fig.3.9 Shows LED of Mobile Phone

3.1.3 Plug-in Connectors

Plug in connectors is interfaces used in charging or by charger plugging, USB and data cables. Various mobile products also have different plug-in connector's designs.

 Charging Connector: It helps to connect the charger to the PCB of a mobile phone to charge or recharge the battery.
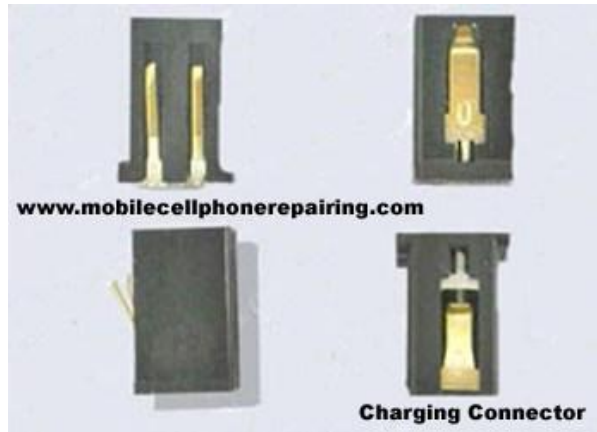
Fig.3.10 Shows Mobile Phone Charging Connector

 Headphone Connector: It is also called Earphone Connector. It helps to connect the headphone to the mobile phone via jack.

Fig.3.11 Shows Mobile Phone Headphone Connector

Data Cable Connector: It helps to connect the mobile to another device such as a computer, laptop, table etc using a data cable.

Fig.3.12 Shows Data Cable Connector of Mobile Phone

Battery: It supplies power or DC current to the mobile phone.

Fig.3.13 Shows Battery of Mobile Phone

Battery Connector: It connects the battery to the internal circuit tracks of the PCB of a mobile phone.

Fig.3.14 Shows Mobile Phone Battery Connector

☐ **SIM Card**: Subscriber Identification Module. This is a small rectangular chip with circuit and information of user of the card. A SIM card is necessary to make or receive phone calls with a mobile phone.

Fig.3.15 Shows SIM Card

☐ **SIM Card Connector**: It connects the SIM card to the Circuit or PCB of a mobile phone.

Fig.3.16 Shows SIM Connector

☐ **Memory Card**: It is used to store data like document, music, videos etc. These are available in different capacities like 1GB, 2GB, 4GB, 8GB, 16GB, 32 GB etc.

Fig.3.16 Shows Memory Card

 Memory Card Connector or MMC Connector: It connects the memory card to the PCB of a mobile phone.
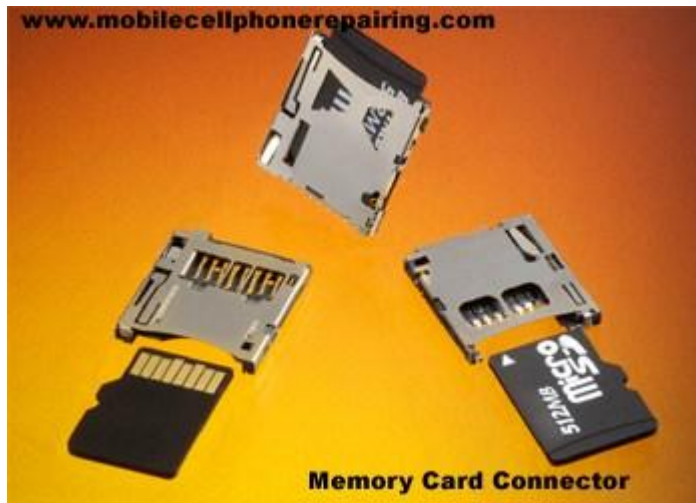
Fig.3.17 Shows Mobile Phone Memory Card Connector

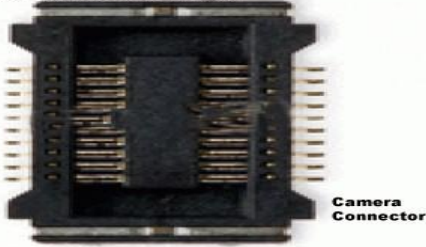 **Camera:** It is used to capture still images or record videos. These are available in different megapixel.

Fig.3.18 Shows Camera of Mobile Phone

 Camera Connector: It connects the camera to the PCB of the mobile phone.

Fig.3.19 Shows Mobile Phone Camera Connector

 Keypad Button: It is connected to the keypad carbon to enter numbers to make phone calls and other data.

Fig.3.20 Shows Mobile Phone Keypad

☐ **Keypad Carbon**: It is present in between keypad button and the PCB. It connects the keypad buttons to the PCB of a mobile phone.

☐ **Keypad Connector**: It connects the keypad to the PCB of the cell phone.

> ➢ **Keypads Membrane**

This are made of tiny round metals that acts as a switch in a row of letters and numbers characters on keypads mattress.

Fig.3.21 Shows Mobile Phone Keypad Connector

ON and OFF Switch

It is made of tiny metal that conducts connectivity when press. It is being used as a power on and off, Volume control switch and camera shutter switch on various mobile phones.
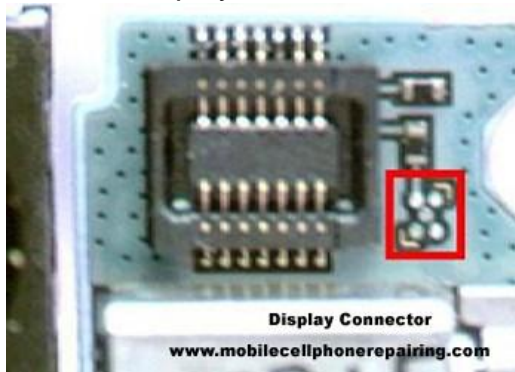
□ **Display**: It is screen of the mobile phone.

Fig.3.22 Shows Mobile Phone ON-OFF Switch

□ **Display Connector**: It connects display of screen to the PCB of a Mobile Phone.

Fig.3.23 Shows Mobile Phone Display Connector

□ **Internal Antenna**: It helps to capture network frequency.

Fig.3.24 Shows Internal Antenna of Mobile Phone

☐ **PCB**: Printed Circuit Board of the Mobile Phone.

Fig.3.25 Shows Mobile Phone PCB

☐ **PDA**: Display or Screen of a touch screen mobile phone.

fig 3.26

Name:

_____Date: _____

Time   Start: _____Time   Finish:

_____

Instruction: Answer all the questions provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher

A	**B**
1. Display or Screen of a touch screen mobile phone	A. camera
2. Capture still images or record videos.	B. Internal Antenna
3. It helps to capture network frequency.	C, PDA
4. It connects the keypad to the PCB of the cell phone.	D. Keypad Connector

Answer   score

1. _____
2. _____
3. _____
4. _____

Information sheet 4	Replacing or swap defective parts or components with original part

4.1 Replacing or swap defective parts

a.Surface Mount Device (SMD)

Surface Mount Device (SMD) are Chip-Type electronic components for SMT. Surface Mount Device do not have leads like thru-hole. They are mounted on the PCB

Surface Mount Device (SMD) are Chip-Type electronic components for SMT. Surface Mount Device do not have leads like thru-hole. They are mounted directly on the PCB. Learn all about Surface Mount Device (SMD).

Fig3.27

- **Surface Mount Device (SMD)**

Circuit of a mobile phone looks like general circuit but the parts in printed circuit boards (PCB) of mobile phone are different from normal thru-hole electronic components. These electronic components are known as surface mount device or surface mount electronic components.

These SMD electronic components on the PCB of a mobile cell phone generally do not have any leads. Components that have leads are bent in a manner that they can be mounted only on the surface of the PCB and hence the name "Surface Mount Device". Most of the electronic components on the PCB of a Mobile Cell Phone are BGA or Ball grid Array Packages. The whole technology is called Surface Mount Technology (SMT)

SMD Components of Mobile Phone PCB

Fig3.28

- **What is SMD or Surface Mount Device or Surface Mount Electronic Component?**

Surface mount devices of SMD are electronic components that are easily soldered or mountable on the surface on the PCB. Most of these PCBs are multilayered PCB which means these PCB have more than one layer. The technique of soldering or utilizing SMD components is called SMT (Surface Mount Technology).

- **What are Advantages of SMD?**

SMD type electronic components offer many advantages. The main advantage is that they are space saving. The size of mobile phones has been significantly reduced because of the use of SMD components. SMD components use less electricity and voltage loss is also very less.

- **Uses of SMD Electronic Components?**

Presently SMD of Surface Mount Devices are used in ultra-modern electronic equipment's like mobile phones, smartphone, computers, laptops tablets etc. all the components used in Surface Mount Technology are mostly in the form of chips or IC (Integrated Circuit). These chips or ICs are classified into different categories depending of the type of legs or leads they have and their function. These components are mounted directly at the specified location on the copper track of the Printed Circuit Board using Surface Mount Soldering Technology.

b.Surface Mount Transistor in Mobile Phone and Their Function

Surface Mount Transistor in Mobile Phone – SMT Transistor is SMD part made of semiconductors like silicon or germanium. Types of SMD Transistors: NPN, PNPSurface Mount Transistor or SMT Transistor is an SMD electronic component made up of semiconductor material like silicon or germanium. There are 2 types of Surface Mount Transistors:
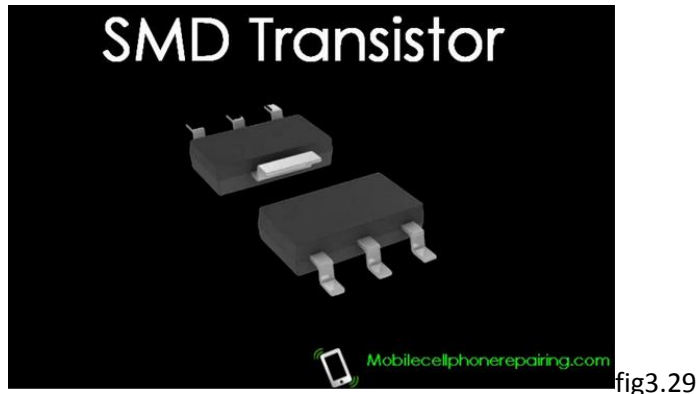
1. NPN Type
2. PNP Type

fig3.29

- **Terminals of a Transistor**

There are three terminals of a surface mount transistor or thru-hole transistor:

1. **Ammeter (E)** – Flows current on receipt of forward bias. Electrons are emitted in NPN transistors whereas PNP transistors emit 'holes'.
2. **Collector (C)** – The terminal of the transistor which receives the emitted electrons or holes. Collector always works or reverse bias mode.
3. **Base (B)** – The layer between ammeter and collector is called base. Base displays the property of showing low resistance in ammeter junction forward bias and high in collector junction reverse bias.

Facts about Transistor

1. **Indicating Character**: Q or V, TR
2. **Function**: Switching, Amplification, Regulating Voltage.
3. **Unit**: Transistors are identified according to the code.

Digital Surface Mount Transistor

In digital transistor, resistance in built in the base and ammeter. This transistor is also called RET (Resistance Equipped Transistor). This type of transistor is used in mobile phones for reducing the current consumption.

Field Effect Transistor (FET)

This type of transistor is controlled by voltage instead of current. Flow of working current through a semiconductor channel is switched and regulated by the effect of electrical charge in the area near channel, which is called gate. This is called unipolar transistor. FET can be P-Channel type or N-Channel Type.

Metal Oxide Semiconductor (MOSFET)

MOSFET is active semiconductor components. MOSFET has 3 terminals – source, drain and gate. There are 2 types of MOSFET:

1. P-Channel MOSFET (*PMOS*)
2. N-Channel MOSFET (*NMOS*)

How to Read SMD Transistor Code

All SMD Transistors are Marked with Codes to denote the type of semiconductor used and use of transistor.

Here I explain How to Read SMD Transistor Code:

First Alphabet:

- **A**= Germanium
- **B** = Silicon
- **C** = Gallium Arsenide
- **D** = Indium Antimide

Second Alphabet:

- **C** = Audio Frequency Amplifier
- **D** = Audio Frequency Power Amplifier
- **F** = Low Power Radio Frequency Amplifier
- **P** = High Power Radio Frequency Amplifier

Therefore, Identification of a Transistor Marked with the Code – BC486 will be:

- B = Silicon
- C = Audio Frequency Amplifier
- The Transistor = Silicon Audio Frequency Amplifier

More Examples:

- BD 187 = B for Silicon, D for Audio Frequency Power Amplifier

- AD 486 = A for Germanium, D for Audio Frequency Power Amplifier
- AC 140 = A for Germanium, C for Audio Frequency Amplifie

3.3 Mobile Phone Dead Problem and Solution

Mobile Phone Dead Problem and Solution –How to Repair a Dead Mobile Cell Phone. These problem and solution apply to all brands and make of Android Smartphone or Feature Mobile Phone including Nokia, Samsung, iPhone, China Mobile Phones, Motorola, HTC, Sony, Blackberry, Alcatel, Apple, AudioVox, Benefone, Danger, FIC, Hagenuk, Palm, Kyocera, LG, Xiaomi, Huawei, Oppo, Panasonic, Huawei, ZTE, Spice, Lava, Sony Ericsson, Micromax etc.

fig3.30

What is a Dead Mobile Phone?

A Dead Mobile Phone is a Cell Phone that does not get switched ON. It won't turn ON and won't Charge.

How a Mobile Cell Phone Does Gets Dead?

A mobile phone can get dead for several reasons:

1. If the mobile phone gets dropped down on the floor or on some hard surface.
2. If the mobile phone gets wet or is dropped in rain or water.
3. If there is any kind of short (in **+** and **−**) or shorting in the Mobile Phone PCB

3.3.1 Mobile Phone Dead Problem and Solution – How to Repair a Dead Mobile Cell Phone

1. Remove the battery and see if it gets charged or not. Check voltage <u>using a Multimeter</u>. Voltage must be 3.7-4.2 Volt DC. Use a <u>Battery Booster</u> to Boost the Power of the Battery and Charge it again.
2. Check Battery Point and Battery Connector. <u>Clean Battery Point and Battery Connector</u> to remove any carbon deposits.
3. Resold or change the Battery Connector.
4. Insert charger and se if the "*Battery Charging*" appears or not. If there is icon of "*Battery Charging*" but the mobile phone does not gets switched ON then check ON / OFF Switch. Voltage of ON / OFF Switch must be 2.5 to 3.5 Volt (*DC*). Clean or change the ON / OFF Switch. Check track of ON / OFF Switch and <u>Jumper</u> if required.
5. If the charging icon is not there then check voltage of ON / OFF Switch. If the voltage is between 2.5 to 3.7 Volts DC, then RELOAD Software in the Phone (*Software Flashing*).
6. If the phone won't get switched ON even after reloading software then Heat the C.P.U, Power IC and Flash IC.
7. If there is no voltage on the ON / OFF Switch then check track of the ON / OFF Switch. Jumper if required.
8. If the problem is not solved then heat, Reball or change the Power IC and CPU to fix the problem.
9. Keep the Multimeter on Buzzer Mode and Check **+** and **–** of the Battery Connector. If there is Buzzer Sound then the Phone is short. If there is short at the Battery Connector then clean the PCB with thinner. Apply Flux and Heat the <u>PCB</u>.
10. If this does not fix the Mobile Phone Dead problem then remove the PFO and check for short. If there is short then replace the PFO.
11. Remove the charging connector and check for shorting. If there is short then change the connector.
12. Remove the charging IC and check for shorting. Change if required.
13. Remove the Bluetooth IC and check for shorting. Replace if required.
14. Remove the Power IC and check for shorting. Replace with a new one if required.
15. Remove the CPU and check for shorting. Replace if required.
16. Remove all the Big Electrolytic <u>Capacitors</u> and check one by one. Replace capacitors if required.

Important Note

- Some mobile phone gets dead if the RTC (*Real Time Clock*) is faulty. This happens mostly in China Mobile Phones. Change the RTC to fix the problem.
- If the mobile phone gets hang after reloading software then change the RTC.

- If the phone is still dead   then check by replacing the 26 MHz Crystal Oscillator.

Ringer Problem

A Ringer is any type of electronic component that rings or plays a loud sound.   It is also called the I.H.F Speaker, buzzer, melody, etc. Figure 28 shows a picture of a ringer.
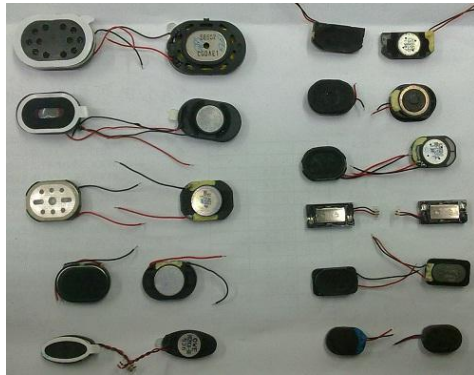

fig 3.31

➢ *How to Solve Ringer Faults*

8. Check the ringer settings in the mobile phone. Check Ringer volume and silent mode. Adjust or change the volume and /or mode if required.
9. If the problem is not solved then open the mobile phone and clean the ringer point and ringer connector.
10. If the problem is not solved then check the ringer by keeping the multimeter in buzzer mode. The value must be between 8 ~ 10 Ohm. If the value is not between 8~10 Ohm then change the Ringer.
11. If the problem is not solved then check the track of ringer section. Do jumper wherever required.
12. If the problem is not solved then check the Ringer IC. Heat or change the IC.
13. If the problem is not solved then heat, reball or change the UEM / Logic IC.
14. If the problem is still not solved then heat, reball or change the CPU.

Display Not Working

This part displays information in a mobile phone. The CPU controls it. In some cell phones there is an Interface IC called the Display IC situated between the Display and the CPU.

The following are the common types of problems associated with the display:

- Display is blank.

- Display not working properly.
- Only half the display works.
- White display.
- Display is upside down.
- Display is broken.
- When the mobile phone is switched ON, the Logo appears and then the display disappears

How to Solve Display Faults in a Mobile Cell Phone

7. Clean the display tips and display connector.
8. Resold the display connector
9. Change the display
10. Check the display Track.
11. Resold or change the display IC.
12. Heat, reball or change the CPU.

Phone Touch Screen (PDA) fault

A Touch Screen (PDA) is an electronic component that allows you to input data or control your mobile phone by touching the screen. It normally has 4 Points namely:

- (+),
- (-),
- (RX),
- (TX).

The CPU normally controls the touch screen. In some mobile phones there is an Interface IC called PDA IC or Screen Touch IC.

The following are the faults associated with the Touch Screen

- Touch Screen not working.
- Only half the Touch Screen works.
- When one key is pressed, another key works.

How to Solve Touch Screen (PDA) Faults

7. Check the settings if the mobile phone has both a keypad and a touch screen.
8. Clean and resold the PDA Tips and PDA connector.
9. Change the PDA.
10. Check the Track of the PDA section and Jumper if required.
11. Heat or change the PDA IC
12. Heat, reball or change the CPU
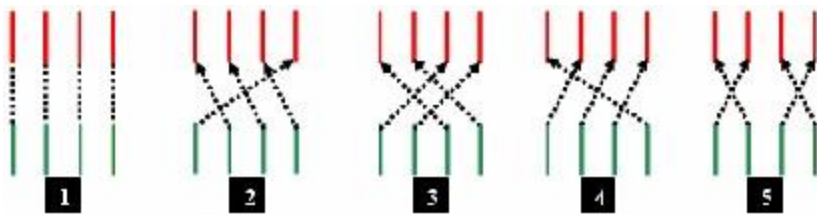
5 Types of PDA jumper solution

3.4 How to Solder

How to Solder with Flux and Solder Wire – Learn how to solder circuit boards and wires to metal.
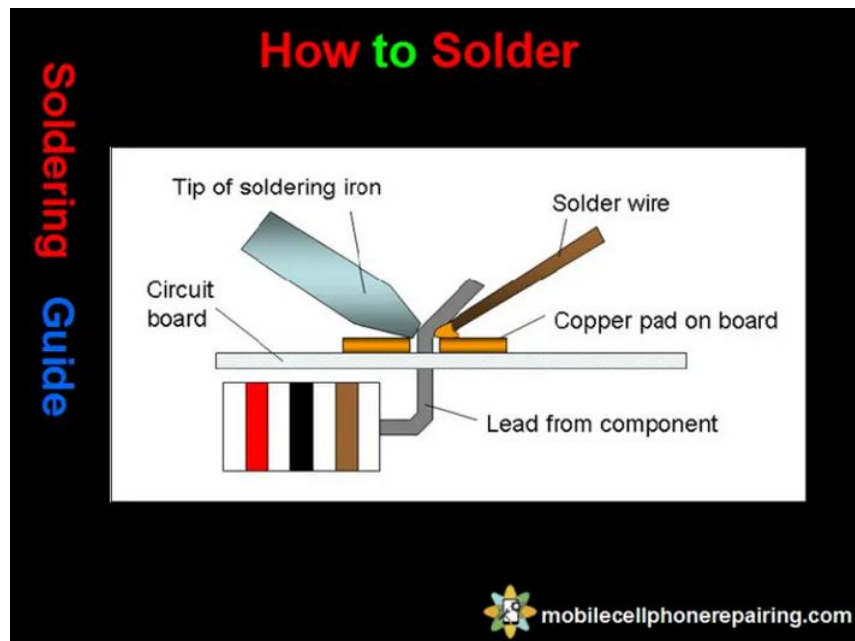

fig3.32

What is Hand Soldering?

Soldering electronic components by hand is a very important part of mobile phone repairing or repairing and rework of any PCB (Printed Circuit Board). Good soldering can increase the life and performance of any PCB. Poor soldering can lead to failure of the PCB. This basic hand soldering guide is a tutorial on how to do hand soldering like a professional.

https://youtu.be/OLdh4OrCl9c

fig3.33

Tools and Consumables Needed for Hand Soldering

You will need following tools and equipment:

1. <u>Soldering Iron</u> – Always try to buy a good <u>ESD-Safe</u> soldering iron. A 50 watt soldering iron is good for soldering any electronic component to a PCB.
2. <u>Soldering Station</u> – If you are a professional, try to get a good quality branded ESD-Safe soldering station. It will have a separate unit (*Station*) to control temperature and a soldering iron plugged into the station. <u>Goot Soldering Station</u> is One of the Best.
3. <u>Flux Cored Solder Wire</u>: It is always better to use flux cored solder wire. Flux will help to remove any oxide and contamination from the surface of the PCB and leads of the electronic components. This will help better soldering. <u>Cookson Solder Wire</u> is One of the Best.
4. No Clean Liquid Solder Flux: This will help to remove any oxide from the surface of the Board and the Leads of electronic components.
5. Other consumables that may be needed are Desoldering wick, desoldering pump, PCB holder, conductive pen, flux pen, cleaning sponge etc.

Self Check	choose

Name: _____Date: _____

Time   Start: _____Time   Finish: _____

Instruction: Answer all the questions provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

Part I. Choose the best answer for the following question

1---------Is made of a tiny motor that conduct vibration when in active mode.

    A. Vibrator   C. Ringer

    B. Microphone   D. Back Facial

2. ------- Is connects the battery to the internal circuit tracks of the PCB of a mobile phone.

      A. SIM Card   C. SIM Card Connector

      B. Memory Card   D. Battery Connector

3.--------Is connects the SIM card to the Circuit or PCB of a mobile phone.

    A. SIM Card Connector   C. Ringer

    B. Microphone   D. Back Facial

4.--------Is connected to the keypad carbon to enter numbers to make phone calls and other data.

      A. Display   C. Camera Connector

      B. Keypad Button   D. Memory Card

5.--------Is connects display of screen to the PCB of a Mobile Phone

      A. Display Connector   C. Camera Connector

      B. Keypad Button   D. Memory Card

Note: **Satisfactory rating –5 points**   **Unsatisfactory - below 5 points**

Answer Sheet   **Scored Poin**

Part I

      6. _____

      7. _____

      8. _____

      9. _____

      10. _____

Operation Sheet #1	Practical Demonstration (Re-solder SMD)

OPERATION TITLE: Perform Re-soldering SMD in cell phone.

PURPOSE:- To Re-solder SMD Cell phone properly and without damage the cell phone board.

CONDITIONS OR SITUATIONS FOR THE OPERATIONS:-Clean, safe working area and equipped workshop with sufficient electrical/electronic components & measuring instrument

Equipment and Tools for cell phone Re-solder SMD.

Tools	Equipment
Flat and Philips screwdriver kit	Digital Multi-meter
Soldering Iron, Soldering Station equipments, PCB holder, PCB Cleaner,	Faulted cell phone
	PPEs
Tweezers, Hot Air Blower,	Clean and ESD free work bench
side cutting plier	

PROCEDURE:-

Follow the following steps to Re -solder the cellp hone SMD.

Step1 .Select the required cell phone to Re solder.

Step2 Paint the Paste Flux to the surface.

Step3 Heat up Hot Air Blower

Step 4 Adjust the balance of the temperature

Step5. Use Tweezers to avoid the movement of the parts

PRECAUTIONS:-You should not forget to wear your PPEs. You should take care of not to contact any bare part of your body whenever you Re solder cell phone parts . Use instruments properly according to manufacturer specification.
QUALITY CRITERIA:-
Not use more power to your cell phone because of the cell phone components are very sensitive apply proper heat.

Information sheet 4	Flashing or repair unit using appropriate application software based o
	manufacturers' requirement

4.1Software Faults

A software is a set of programs, routines and symbolic language that control thefunctions of hardware and directs its operations.

The common software problems are:
- Display problems
- No signal message
- Dead phone set
- Phone on test mode
Phone not charging
- Phone has message to contact service provider
- Phone hangs, goes off, freezes or has slow processing

How to solve these problem:

1. Check the downloaded applications and note when the problem happened.
2. Note whether the problem is happening when a certain application is running.
3. Remove the application that is causing the problem
4. If the problem is still not solved then reset the factory settings of the mobile phone and update the software.
You have now come to the end of our topic on common mobile phone problems or faults. Before you move on, do the following activity to evaluate your understanding of this section.

4.1.1 What is the software for flashing phone?

Here are the best flash tools almost for all phones: Samsung- Odin, Kies,Smart switch. Mediatek based phones -like Huawei, Lenovo, Xiaomi, Karbonn, Lava,Gionee,Micromax,ZTE etc- Sp flash tool. Sony- Sony pc companion, Xperia flash tool (by androxyde

4.1.2 What is mobile phone flashing?

Flashing a cell phone means reprogramming the cell phone to work with a carrier other than the intended provider. One advantage of flashing a cell phone is that you need not to invest in a brand new phone.

4.1.3 What is a flasher box?

Flasher boxes are also known as flashers or clips and they are mobile phone service devices used by mobile phone service providers and shops. They are mainly used to recover user data from dead or faulty mobile phones that otherwise will not provide access to data stored on their internal memory

4.2 How to flash a phone with a computer

If you want to use your smartphone with a new data storage, you will have to flash it first. Flashing means the same as reprogramming. You can choose to take the gadget to an authorized phone dealer and have a flashing procedure done. However, this will not be free. You may want to learn how to flash a phone by yourself! Read the article to know how to do it for Android and IPhone. Read more: https://www.legit.ng/1140556-how-flash-a-phone-a-computer.html

4.2.1 How to flash Android phone from PC with USB cable?

First, you have to ensure you have at least 50% level of battery. Check your firmware compatibility as well. The Stock Firmware or Custom ROM can be downloaded from appropriate websites. Systematic guide: Upload an Android USB Driver into the Hard Drive Disc of your computer. If you already have one, just skip this step. Remove your phone battery. Google and download Stock ROM or Custom ROM that need to be flashed on your device. Extract the installation files on your PC. Download and install the Smartphone Flash software to your PC. Start the installed program. After you open it, you will see this interface: Read more: https://www.legit.ng/1140556-how-flash-a-phone-a-computer.html
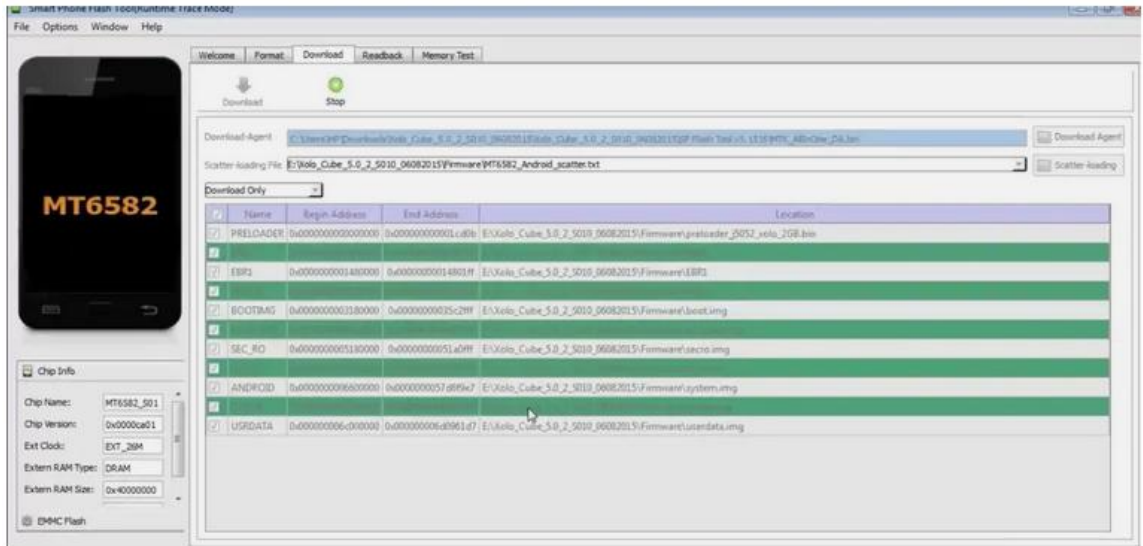
Fig 4.1 flasher software

When all the required firmware programes are downloaded,
You can start the second stage of the flashing process. As soon as you launch your Smart Phone Flash Software, you can start Download. Afterwards click on the Scatter-Loading icon. Search for the Scatter File. It will be stored in the extracted Stock ROM folder. Start the Download process by clicking on the corresponding button. It will launch Flashing procedure as well. Connect your Android phone to PC with USB cord (if the battery is portable, you need to remove it). After you connect both devices, press Volume Down or Up button. It will help your PC to automatically identify your smartphone. As soon as flashing process is done, you will see a Green Ring on your screen. Now you can close the Flashing software and disconnect your phone. Read more: https://www.legit.ng/1140556-how-flash-a-phone-a-computer.html

Everything is ready! Now your Android device is operating on the Stock ROM basis you uploaded in it. Read more: https://www.legit.ng/1140556-how-flash-a-phone-a-computer.html

4.2.2 How to flash an iPhone?

The process here is very similar to the Android method. It involves the update of the firmware just like in the above. Basically, all you have to do is to upload the newer version of the device system. You will find a lot of new features of the OS that increase the iPhone's performance and level of compatibility. This process

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	Copyright: Ethiopia Federal TVET Agency	

will also require attaching your ⬡ device to PC and starting iTunes device management program. Read more: https://www.legit.ng/

Fig4.2 iPhone flashing

Tutorial:
1. Connect your iPhone to PC.
2. Start iTunes.
3. Click on the icon with name of your device.
4. Choose "Check for Updates" option. If there are any updating softwares to be installed to your device, you will get a notice about it. However, if there are no updates available, it will not be possible to flash your smartphone for now.
5. Choose "Download and Install" option in the section of available updates in iTunes. Please, do not use your smartphone when the update is being performed. Also, do not try to disconnect your device from the PC, as it will ruin all the updating installation. All the required firmware updates will be downloaded to one of your PC folders from iTunes. That means you will be ready to flash your device.
6. Flashing will erase the firmware that was already installed to your iPhone. Do not worry! The new one will take its place instead. All the data and files from the phone's memory stock will synchronize with the device as soon as flashing is completed. Read more: https://www.legit.ng/1140556-how-flash-a-phone-a-computer.html

4.3 How to Flash IMEI Number in Android Mobile Phone

Learn How to Flash IMEI Number in Android Mobile Phone / Smartphone & Fix Invalid IMEI Number Problem. You will need to flash IMEI Number in your Android Mobile Phone after flashing Stock ROM (Firmware). You have to flash the Stock ROM (Firmware) in your Android Mobile Phone for any of the following reasons:

- Your mobile phone gets hanged too often.
- Your phone is hanged at company logo and doesn't boot.
- You want to update the latest software / operating system in your phone.

- You have forgotten the lock pattern or password and want to unlock the phone.
- Your Android Mobile phone or tablet is dead because of software issues.

After you flash the Stock ROM, you will also have to Flash the IMEI Number and Restore it back. Otherwise, you may get following error messages: Invalid IMEI Number

So, in order to fix this Invalid IMEI Problem and Restore the IMEI Number on Android Smartphone you have to Flash IMEI Number in you Android Mobile Phone.

💡 PS: This tutorial to flash IMEI Number on Android Mobile Phone works on most Brands including – Alcatel, BLU, Celkon, Coolpad, FLY, Gionee, Huawei, Intex, Carbonn, LAVA, Lenovo, Micromax, Oppo, Panasonic, Samsung, Vivo, Xiaomi, ZTE, etc.

4.4 Software and Hardware Needed to Flash IMEI Number in Android Mobile Phone

You will need following Software and hardware to flash or Rewrite IMEI Number on Android Mobile Phone and Tablet:

Hardware Needed

1. The Android Phone to Flash the IMEI Number.
2. A USB Data Cable to Connect Your Phone to the Computer or Laptop.

Software Needed

1. Stock ROM / Firmware: of the Model of the Phone in which Flashing of IMEI Number is to be done. (Why is this needed will be clear later in this Tutorial)
2. SN Write Tool: SN Write Tool allows you to read and write IMEI on any Mediatek Feature Phone, Android Smartphone and Tablets.
3. AP BP Base for SN Write Tool: in .zip file (You need this if you do not have the .zip file of the Stock ROM)
4. Read&Write Tool: Read&Write Tool allows you to read and write IMEI on any Qualcomm, MTK or SpreadTrum Smartphone and Tablet
5. AP BP Base for Read&Write Tool: in .zip file (You need this if you do not have the .zip file of the Stock ROM)
6. IMEI Number of your Phone: You will also find the IMEI Number of your Phone at the Back after you remove the Back Cover and on the Packet of the Phone.

➜ PS: In this tutorial, I will explain how to use SN Write Tool to Flash IMEI Number in any Android Smartphone or Tablet having Mediatek Chipset. If you want to flash IMEI Number in any Qualcomm, MTK or SpreadTrum device then download and use Read&Write Tool ➜ []. Process is very similar for BOTH and you will not face any difficulty.

4.4.1How to Flash IMEI Number in Android Mobile Phone and Restore IMEI Number and Fix Invalid IMEI Number Problem

Step-1

Download SN Write Tool on your computer from Here ➜ [https://snwritetool.com/download/sn-write-tool-v1-1828]. Extract the .zip File. You will see following files in the Extracted Folder.

Step-2

In the Extracted Folder, you will find – **SN Writer.exe** File. Open this .exe file (Double Click or Right Click and Run as Administrator)

Refer lo2………

Step-3

Now you will see following screen. Click on ComPort **and Select** USB VCOM**. In the** *"Target Type"*, **you will get Options to Select Feature Phone, Smartphone and Other Android Devices. Select** Smartphone **if you are flashing the IMEI Number to an Android Phone.**

Refer lo2………

Step-4

Now select System Config Button.

Step-5

Once you click onto the Config Button, you will see the following Screen. Select Following Options – IMEI, BT Address and WiFi Address. You also get the Option to select Dual IMEI, 3 IMEI and 4 IMEI. Select the Required Option.

Under Database File Option, select the Path of MD1_DB and AP_DB. Remember that BOTH these Files come with the **.zip** File of the Custom ROM

Firmware. Otherwise, you have [logo] to download the AP BP Base for SN Write Tool (→ https://androiddatahost.com/yhaz9*)*

Select all the Required Options and Click **SAVE**

Step-6

Now click Start **Button on the Next Screen.**

Step-7

Under Scan Data, Enter the 15 Digit IMEI Number. You will also find the IMEI Number of your Phone at the Back after you remove the Back Cover and on the Packet of the Phone.Once you have entered all the required Data, SWITCH OFF your Phone and Take out the Battery. If there is Non-Removable Battery then just switch OFF the Phone and Connect the Phone to your Computer with USB Data Cable. Now Click OK**.The Process will take just few minutes. Once the IMEI Number writing is Done, you will see** Green Pass **Message.**

4.5ABOUT FLASHERS AND THEIR MOBILE SERVICE USES

Flasher boxes are also known as flashers or clips and they are mobile phone service devices used by mobile phone service providers and shops. They are mainly used to recover user data from dead or faulty mobile phones that otherwise will not provide access to data stored on their internal memory. They can also be used to update
or replace software that is stored in the mobile phone's Read Only Memory (ROM). This software is commonly referred to as "firmware" and is usually pre-installed on phones by either the manufacturer of the phone such as Nokia and Sony-Ericsson or phone service providers such as Three Mobile or Telstra. Flashers are also used to add language support and set regional settings for mobile phones. Changing regionalsettings can enable a user that bought a mobile phone device from Australia with Telstra-based firmware for example and did not have Arabic language support by default in the firmware to re-flash it with an Arabicsupported firmware supplied by Nokia in the Middle East. Therefore, he or she will have a mobile phone that now supports the Arabic language and will therefore be able to send and receive Arabic Short Message Service(SMS) messages Other uses for flasher boxes include removing or changing carrier settings and unlocking SIM restrictions or carrier based locks or call restrictions. Even though Subscriber Identity Module (SIM) unlocking is legal insome countries such as Australia, it can be illegal in some other countries.

4.5.1 IMEI AND THE ILLEGAL   USE OF FLASHERS

International Mobile Equipment Identity (IMEI) is a unique 15 digit international serial number used to identify a mobile phone handset to a mobile phone network. This number can used to identify illegal mobile phone handsets. Each time a mobile phone is switched on or a call is made on it, the network provider checks the IMEI number of the handset, then it cross references it with a blacklist register such as the Central Equipment Identity

Register (CIER) used in the United Kingdom. If it is on the blacklist then the network will either refuse to send a signal to the phone or will supply a signal but will not allow any outgoing or incoming calls (UnlockMe 2007). Flashers can be illegally used to change the IMEI number of some mobile phone devices. This in effect enables criminals to illegally re-enable stolen or lost mobile phones that won't be otherwise usable on a certain mobile

phone network Figure below is a screen shot of the flasher software for UFS3 by SarasSoft that shows the option to change

(rebuild) the IMEI number of the mobile device under the Aux features box within the DCTL group of devices

options for the Nokia mobile phone brand flashing. It is worth noting that for Nokia, only DCT3 and DCTL

group of devices allow for IMEI modification. Newer Nokia mobile phone devices embed the IMEI number in a

non-re-writable chip and therefore are not subject to IMEI rebuilding.
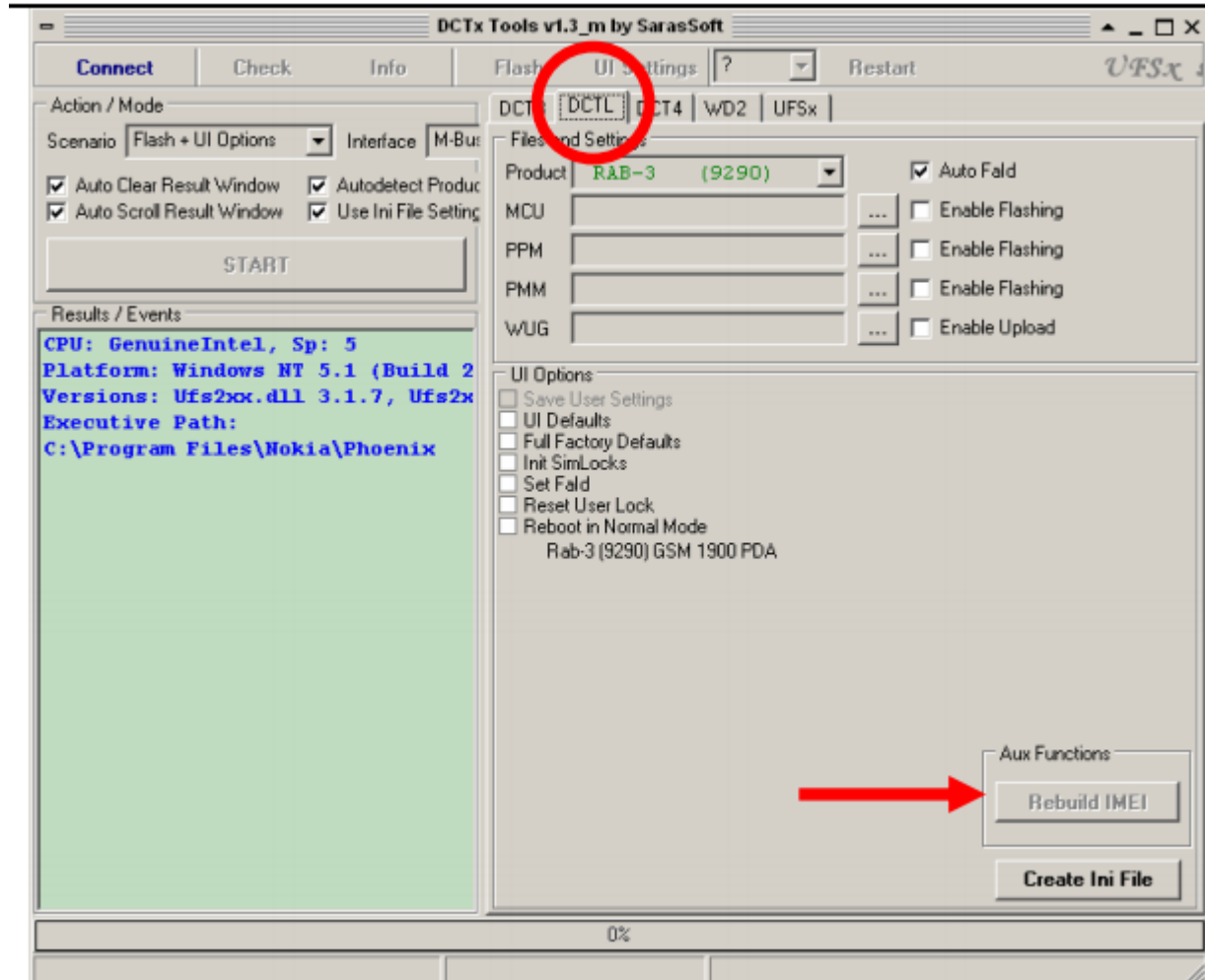
Fig 4.3 Rebuild IMEI option for DCTL range of Nokia mobile phones

`FLASHER BOX COMPONENTS AND VARIETIES

Flashers are a combination of software, hardware and drivers. There are many varieties of flasher boxes covering a wide variety of mobile phones. Therefore, choosing the correct box for a type of mobile phone
device or phone model or mobile phone manufacturer can be a daunting task.
There are two main categories offlasher boxes:
• Branded Boxes. The features of which include:
• They are more expensive than their proprietary counterparts.
• They have well-known names and model numbers.
• They have unique serial numbers.
• Some boxes need activation. Software, updates and support is provided for these boxes.
The level of support varies depending on manufacturer of box.
• They are widely used by service technicians.
• They are sold by recognized suppliers and an "approved supplier list" is often

found on   the manufacturer's website.

• Easier to get support for them in forums and on other support websites.

• Some boxes come with a large amount of cables and can cover both GSM and CDMA phones.

• They do not usually require an external power supply to function. They rely on the

USB interface as a power source.

• Unbranded (Proprietary) Boxes:

• Much cheaper than branded boxes

• Sometimes match the original flasher boxes in components and functionality.

• Sometimes combine the functionality and phone support of more than one branded

flasher box.

• Sometimes support the addition of a smartcard from branded flasher boxes.

• Do not usually come with any software and/or drivers and put the onus on the buyer to

come up with the software from other Internet sources.

• Some boxes come with phone flashing/servicing cables while others do not.

• Some require an external power supply that is not usually provided with the purchase

(IPMart 2007).

Fig4.4I-Smart2 In 1 Flasher Box With Smart Card Holder (IPMart 2007)

It is worth mentioning that none of the flasher boxes, branded or unbranded, are supported or indorsed by the manufacturers of mobile phones such as Nokia, Sony-Ericsson and others. The top selling branded boxes for the Nokia brand of mobile phone devices include:

• Universal box (UniversalBox 2007).

• JAF box (Odeon 2007).

• MT-Box for Nokia. There is a separate MT-Box for Sony-Ericsson. Even though both boxes are

exactly the same and come with a 10 uses trial for the opposite brand (MT-Box 2007).

• UFS 3 tornado: The original flasher box and most widely recommended and used (UFSxSupport 2007).

Fig4.5 UFS 3 Tornado Flasher Box

Widely used flasher boxes with support for multiple brands of mobile phones include:
• Smart Clip: Motorola, Sendo and others (Smart-Clip 2007).
• GTS Box: Nokia, Motorola, Samsung, Sharp, LG, Sony Ericsson and Siemens (GTS 2007).
• Vygis: LG, Sharp, Sanyo, NEC, BenQ, Alcatel, and Toshiba (Vygis 2007).
There are paid service sites and free phone repair communities that provide the following:
• Video tutorials on setup and use of boxes (FoneFunShop 2007).
• Constantly updated raw ROM images and language packs to flash mobile phone memory with.
• Service manuals and updates for software to cover a wide variety of mobile phones and flasher boxes.
USB flasher dongles that can be used for mobile phone servicing often offer less functionality than USB flasher
boxes but may offer other added services such as:
• Remote unlocking and de-branding of phones.
• Credit points that can be used to do things such as IMEI change or unlocking of devices from a service provider.
An example of a product that needs pre-paid credit to unlock and de-brand mobile phones is the JAF device for
Windows Mobile Phones (GSMServer 2007). It should be noted however that the JAF device will not work with all phone models running Windows Mobile software. While it supports some phones made by the Taiwanese HTC manufacturer, the do not support devices made by Palm which run Windows Mobile software.

Fig 4.6 *JAF WM software and USB Dongle (Polyphone 2006)*

4.6 ISSUES WITH COMMAND BASED FORENSICS SOFTWARE TOOLS

There are a wide range of software applications and mobile forensic toolkits that claim to acquire data from mobile phones in a forensically sound manner without altering any content in the mobile phone's memory. Such claims however cannot be verified. The basic flaw in these forensic software tools is in the way they gain access to data in the phone's memory. They usecommand and response protocols that provide indirect access to memory (McCarthy 2005).

Command and response protocols such as AT Commands (AT is short for attention) are commands that were originally developed to control modems to do things like dial, hang up, switch modes, and other modem commands. These commands are utilized by current command based forensic software to communicate with the mobile phone and query it about certain data held in the phone's memory. This means that the forensic software

does not have direct access or low level access to data within the phone's memory and in effect treats every mobile phone as a black box. This also means that the software is dependant on the phone's operating system based command to retrieve data in the phone's memory. This could also mean that by querying the operating system, the device could be creating changes to the memory of the device. Because of this dependency on the operating system, such forensic toolkits cannot recover data from dead or faulty mobile phones.Another flaw with these forensic software applications is that they cannot recover deleted data. This is because they access data at a high level or logical level which means that when a file is deleted, the pointer to that file within the operating system is erased which means that the file is no longer accessible by the operating system or visible to the phone's software. In addition, some mobile phone devices do not respond to AT commands making acquiring them

with command based tools impossible (Purdue 2007). Some command based mobile forensics software were not originally developed for forensic purposes and therefore they could unexpectedly write to the mobile phone device's memory (Horenbeeck 2007). Some forensic software suits such as MOBILedit Forensic 2.2 sometimes require the investigator to install additional software on the target mobile device (MOBILedit 2007). This is in direct violation of the principles of electronic mevidence as published by the United Kingdom's Association of Chief Police Officers (ACPO) Good Practice

Guide for Computer based Electronic Evidence (ACPO 2003). The guide states the following:

"No action taken by law enforcement agencies or their agents should change data held on a computer or storage media which may subsequently be relied upon in court."

It is also in violation of the Guidelines for Best Practice in the Forensic Examination of Digital Technology published by the European Network of Forensic Science Institutes (ENFSI) which states (ENFSI 2006): "Upon seizing digital evidence, actions taken should not change that evidence." and "Wherever possible no actions taken during the seizing of any evidential material should cause that material to be changed and this is of particular importance when dealing with digital evidence which could be seen as prone to accidental 'tampering'. Where actions have been taken that change the data, this should be fully documented." Therefore, new ways to gain direct access to data held on mobile phones without resorting to the operating system software or hardware command and response protocols must be utilized in mobile phone forensics. Flasher boxes can provide this direct low-level access and therefore they can be considered as a future pathway on the quest for a more optimal acquisition of mobile phones.

Moreover, flasher software present the user with both the memory reading and writing buttons on the same screen which can lead to accidental pressing or the wrong button on the flasher software which could lead to the total loss of evidence from the phone's memory. Figure 6 below shows some of the dangerous buttons that should be avoided by forensic investigators:
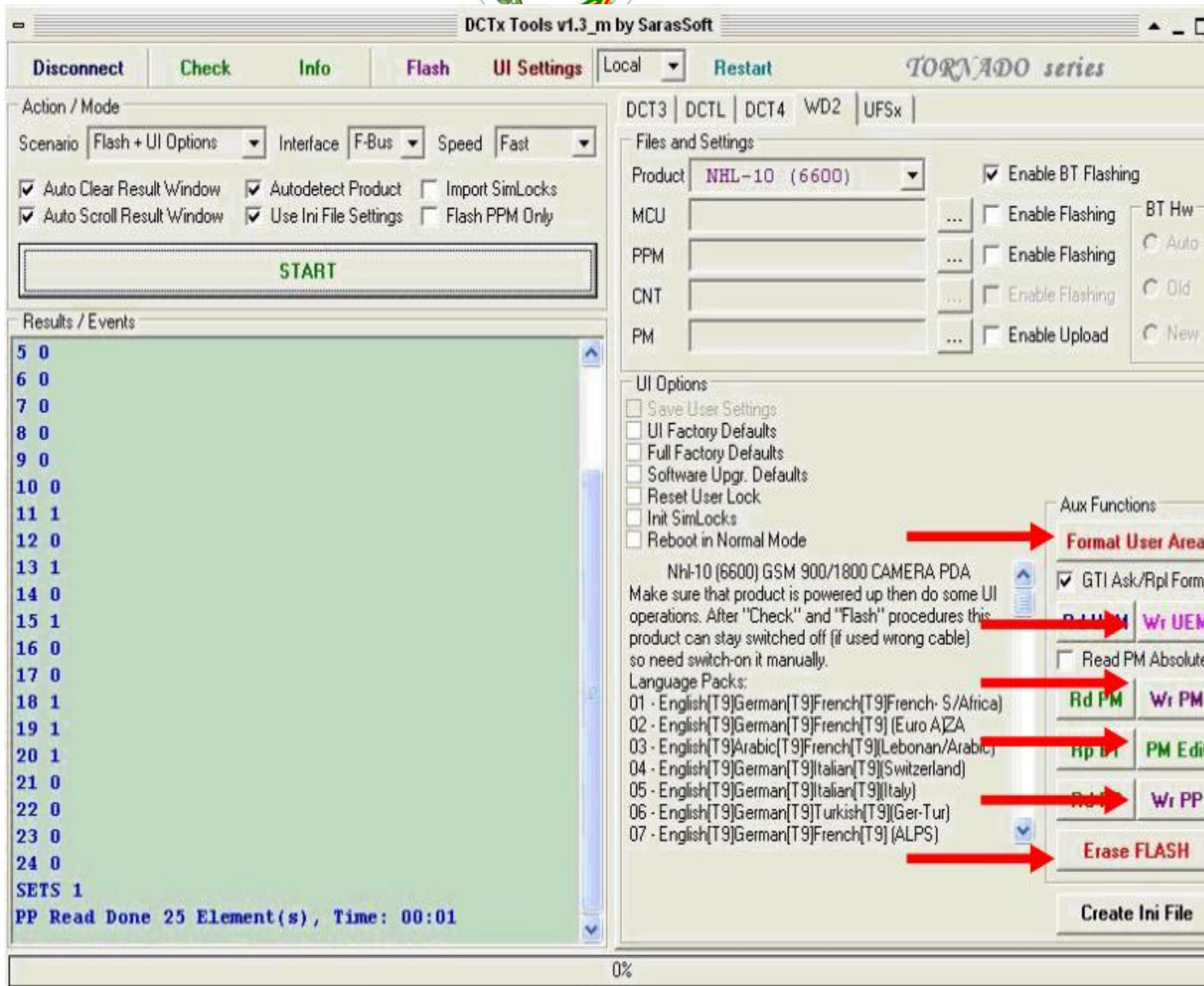
Fig 4.7 *Some of the buttons that should be avoided.*

4.7 FLASHER CABLES AND INTERFACES

The flasher box typically connects to the mobile device via a special cable made for that phone model. One side of the cable is the RJ-45 standard Ethernet networking cable interface. The other side usually contains a number of pins that contact the mobile phone's service ports through the Joint Test Action Group (JTAG) connection or the Mbus/Fbus connections (Harrington 2007). Figure 7 below shows a Nokia 6600 cable for the UFS3 Tornado
Box.

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Fig4.8 Connectors on the UFS3 cable for Nokia 6600

4.8 Software Installation Precautions

The appropriate software for each type of flasher box is usually made available through the official support site for the flasher box manufacturer. A username and password are given to each customer once they purchase a flasher box. Each flasher box is has a unique serial number that is displayed in the software's dialog box after it's installed. Choosing the right driver for the type of mobile device can be confusing at times. This is because the support sites usually update the drivers frequently. Sometimes an older version of a USB driver and software bundle will run perfectly with some mobile phone models while a newer USB driver and software bundle will not work withthe same device. Information about the best version of driver for each type of device or device range can be found in phone service forums as well as the support site itself. USB drivers for the flasher box hardware in addition to the phone servicing software should always be installed3BEFORE connecting the USB cable to the flasher box. If a certain version of software does not work properly with a mobile phone model or phone range then both the flasher servicing software and the USB drivers

associated with it should be completely uninstalled. After restarting the machine after the un-installation, the investigator can try another USB driver and software bundle

until the appropriate driver and software combination is found.
The following section of the paper describes some further considerations when using flasher boxes

> ➢ **CONSIDERATIONS WHEN USING FLASHER BOXES**

Some phones are accessible through service ports located on the bottom of the phone as with some Nokia models such as the 3220 shown below:

Fig 4.9 *Nokia 3220 Fbus connections (Harrington 2007)*

Some phones such as the Nokia N95 require an external 9V battery to be connected to the cable to power the phone while operating it with the flasher box. The investigators must always make sure that the battery is fully charged to insure consistent operation and results.
One of the biggest concerns when it comes to acquisitions through the use of flashers is the loss of volatile data. This is because, in the some cases, the phone needs to be turned off and the battery for the phone needs to be removed to allow for access to the phone's service ports which are pin contact points on the back of the phone that enable the acquisition of the mobile phone device. These points can be located under the battery of the phone, underneath the SIM card or just below the phone itself without the need to remove the battery of the phone. The location of the service ports is highly dependent on the model of the mobile phone. Investigators should be careful when they deal with mobile phones with service ports under the SIM card. This is because when SIM cards are removed, some phones tend to loose information associated with them and this information might not be recoverable again. The pictures below show a connection cable with contact pins, a mobile phone with the pin contact points under the battery but not under the SIM card, and another mobile phone where the contact points are located beneath the SIM card (Nokia 6600)**.**
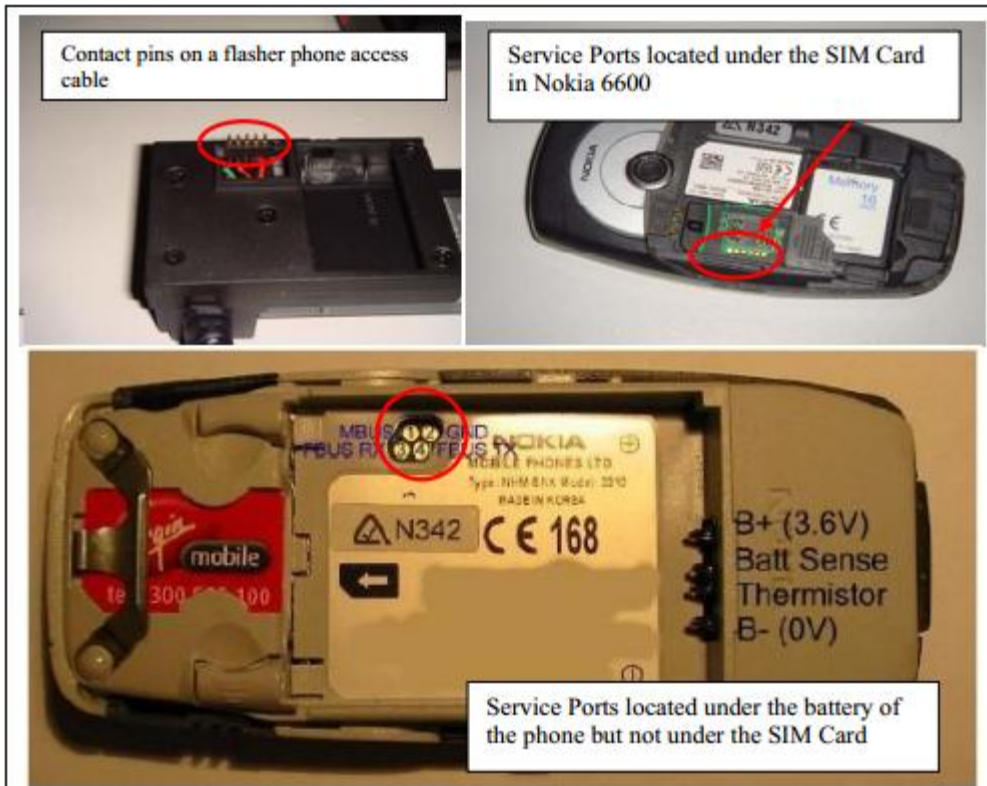
Fig4.10 Contact pins that the cable from the flasher device connects to can be either under   the SIM card or not depending on the device model (Embed Tronics 2005).

On the other hand, if a phone to be investigated has no SIM card inserted in its SIM card slot, it is recommended that a flasher box is used before any other command based tools. This is because if another SIM card is inserted in the phone, or if the phone is powered up normally without a SIM card inserted, it might lose important information about the SIM card previously inserted into it. Some mobile phones require a SIM card to be inserted into them before allowing access to the phone, this means that command based software will not be able to acquire the phone without a SIM card present. Therefore, through testing of flasher boxes with each phone model is essential before using them for the forensic acquisition of mobile phones. Scenarios such as the ones described above, with and without SIM cards with AT

commands first then flashers and vice versa should also be tested. Additional in depth testing considerations andsuggestions are listed hereafter.

5.9TESTING AND VERIFYING FLASHER ACQUISITIONS

One of the ways to verify the functionality of flasher boxes it to disassemble the flasher's code and track its behaviour with a logical analyser to understand its effect on the handset. This is not always easy to do and sometimes not possible at all and depends on the competence of the investigators and their knowledge in the practical use of logical analysers (Gratzer and Naccache 2007)

Another way to verify the use of the flasher device is to test it with a large number of mobile phone devices ofthe same model investigated in a particular case. One study into the use of flashers in mobile forensics suggests that some of these devices be used to develop an experimental protocol or acquisition procedure (Breeuwsma et al. 2007). The protocol is then fine-tuned and made more stable and the procedures modified until they produce desired results. The device investigated is then examined using the tested procedure. Another study takes this further and suggests that the finalized protocol should not be applied to the investigated device after testing the protocols or procedures but rather it should be tested on another set of mobile phones and the occurrences of the following six possible outcomes are then calculated: {information extracted, information not extracted} X {device unaltered, device altered, device destroyed}. This is then carefully documented and all the results are presented to the investigating judge to make a decision on whether to allow the use of flashers in the investigation (Gratzer and Naccache 2007).

5.9.1PHYSICAL IMAGE ANALYSIS TOOLS

There are many tools that have surfaced in the last couple of years that address the need for the analysis of physical memory dumps from mobile phone devices. The tools range from easy to use tools to tools that require extensive forensics and hex editing and decoding expertise. The following is a rundown some of the tools and their features.

• FTS Hex: The first forensic tool that was developed for the purpose of low level examination of hex dumps from mobile phone memory. It is very basic and mainly sold to law enforcement officers (Knijff 2007, FTS 2007).

• BK forensics' Cell Phone Analyzer: The tool is a simple to use Windows based program that cananalyse physical dumps from the following phone manufacturer devices: Sony-Ericsson, Nokia, Blackberry, Motorola and Samsung. The tool does not give the investigator great flexibility to examine the raw data in the dumped image but rather attempts to decode and display phone records, SMS data, pictures and other forms of data to the examiner. An evaluation copy is available to investigators for evaluation purposes from the developer's website (Forensics 2007).

• Pandora's Box: A new tool developed by Mike Harrington. It recently passed beta testing and is now available in a full retail version. This tool is a very affordable

alternative to BK Forensics' Cell Phone Analyzer and offers the investigator with more control over the hex decoding process. It can retrieve data such as power down time and date on Series 30 Nokia phones (MFC 2007).

• Neutrino: A mobile phone acquisition device by Guidance Software to be used with Encase version 6. Extracted mobile device data is stored in an Encase® Logical Evidence File (LEF) format and can be examined via EnCase v6 only (Guidance Software 2007).

Conventional hex editors, decoder software and file comparison tools can also be used to examine the physical
dump image and provide the investigator with more flexibility in examining the hex dump but require good
knowledge in hex editing, some decoding skills and an eye for recognizing patterns and oddities

Self Check #1	

Name: _____Date: _____

Time   Start: _____Time   Finish: _____

1._____set of program, routine and symbolic language that control the function of hardware and direct its operation

     A. flash   b. Software

     C. IC   d. volcano box

2_____are also known as flasher box

     A.charger   C. Flasher box

     B. transistor   D .all

3, flasher box typically connect to mobile device via a special cable

     A.RJ_45   B .fiber optics

     B. Coax cable   D. all

Answer   score ☐

       1_____

       2_____

       3_____

Operation sheet 2	Flash IMEI Number in Android Mobile

Purpose: How to Flash IMEI Number in Android Mobile

Procedures: first try to check your safety

Step-1

Download SN Write Tool on your computer from Here ➡ [https://snwritetool.com/download/sn-write-tool-v1-1828]. Extract the .zip File. You will see following files in the Extracted Folder.

Step-2

In the Extracted Folder, you will find – *SN Writer.exe* File. Open this .exe file (Double Click or Right Click and Run as Administrator

Step-3

Now you will see following screen. Click on ComPort **and Select** USB VCOM**. In the *"Target Type", you will get Options to Select Feature Phone, Smartphone and Other Android Devices. Select** Smartphone **if you are flashing the IMEI Number to an Android Phone.**

Step-4

Now select System Config Button.

Step-5

Once you click onto the Config Button, you will see the following Screen. Select Following Options – IMEI, BT Address and WiFi

Address. You also get the   **Option to select Dual IMEI, 3 IMEI and 4 IMEI. Select the Required Option.**

Under Database File Option, select the Path of MD1_DB and AP_DB. Remember that BOTH these Files come with the *.zip* File of the Custom ROM Firmware. Otherwise, you have to download the AP BP Base for SN Write Tool (➡ https://androiddatahost.com/yhaz9*)* Select all the Required Options and Click **SAVE**

Step-6   Now click **Start** Button on the Next Screen.

Step-7 Under Scan Data, Enter the 15 Digit IMEI Number. You will also find the IMEI Number of your Phone at the Back after you remove the Back Cover and on the Packet of the Phone.Once you have entered all the required Data, SWITCH OFF your Phone and Take out the Battery. If there is Non-Removable Battery then just switch OFF the Phone and Connect the Phone to your Computer with USB Data Cable. Now Click **OK**.The Process will take just few minutes. Once the IMEI Number writing is Done, you will see **Green Pass** Message.

Information sheet 5	Soldering or mounting repaired, replaced parts or components

5.1 Soldering /DEsoldering techniques

a.Soldering

Soldering is a process in which two or more metal items are joined together by melting and flowing a filler metal into the joint. The filler metal has a relatively lower melting point.

Fig5.1 *Picture showing A technician Soldering*

Steps In Soldering

1. Prepare the following materials:

   - Soldering Iron,

   - Solder paste

   - Long Nose Pliers,

- PCB holder,

- Electronic Components (Resistors, Diode etc.)

2. Plug and pre-heat the soldering iron.

3. Heat both items at the same time by applying the soldering iron to the copper pad and the component lead.

4. Continue heating and apply a few millimeters of solder. Remove the iron and allow the solder joint to cool naturally.

5. It only takes a second or two to make the perfect joint, which should appear shiny.

b.Desoldering

Desoldering is the removal of solder and components from a printed circuit board for troubleshooting, repair, replacement, and salvage.

Fig 5. *2.desoldering*

Steps in desoldering

1. Use a solder wick (finely braided copper) to wick away excess solder from a de- soldered connection.

2. Apply the solder wick and use the soldering iron to the de-soldered connection. The solder wick will draw the excess solder off the PCB pad.

5.2 Testing a phone using a multimeter

We hope you still remember that a multimeter is a device that is used to measure the voltage, current and resistance of various components of a mobile phone. Figure 29 below shows the various parts of a multimeter
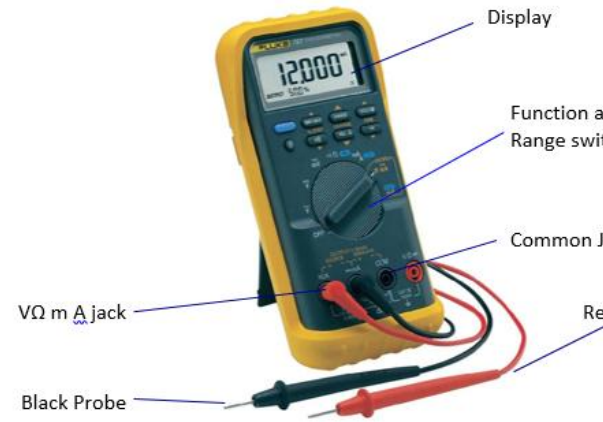
Fig5.3

a) Measuring Resistance

To measure resistance follow these steps:

1. Plug your red and black probes into the appropriate sockets on your multimeter.
2. Choose the appropriate resistance measurement setting on your millimeter's
3. Hold the probes against the resistor.

Check the resistor value on the display.

Fig5.4

b) Measuring voltage

Testing for proper supply voltage is usually the first step when troubleshooting a circuit. To measure voltage you should follow these steps:

1. Select V~ (ac) or V (dc), as desired.

2. Plug the black test probe into the COM input jack. Plug the red test probe into the V input jack.
3. If the DMM has a manual range only, select the highest range so as not to overload the input.
4. Touch the circuit with the tips of the probes
5. Read the number in the display window and take note of the unit of measurement.

c) Measuring Current

1. Turn off power to the circuit.
2. Cut or unsolder the circuit, creating a place where the meter probes can be inserted.
3. Select A~ (ac) or A (dc) as desired.
4. Plug the black test probe into the COM input jack. Plug the red test probe into the amp or milliamp input jack, depending on the expected value of the reading.
5. Connect the probe tips to the circuit across the break so that all current will flow through the DMM (a series connection).
6. Turn the circuit power back on.

d. Jumper setting

Jumpering means to temporarily complete a circuit or to bypass a break in a circuit by making a connection from one point to another.A good conductor wire is used to make a jumper which by-passes the components and passes on a signal or supply line for further uses. When wire is used as a jumper, it must have some special specifications as required. These jumper wires can mainly be of two types i.e. insulated and non-insulated. In the mobile phone, insulated wires are used for jumpers. The length of a jumper depends on the two points connected in between.

Why do Jumpering

While repairing mobile phones, we find that certain faulty components are very difficult to get from the market. To repair such mobile phones the only immediate option is the use of jumpers. By use of jumpers, we will bypass the faulty components specifically.

How to Jumper

1. Disassemble mobile phone and place it on a PCB holder.
2. Using a multimeter, check track and find the fault or the missing track that need jumper.
3. Apply liquid soldering flux to the points where you need to solder jumper wire.
4. Cut jumper wire to desired length and remove its lamination using blade cutter.

5. Hold one end of the jumper wire and solder it to one point of the faulty circuit track. Use a good quality tweezers to hold the wire and good quality of soldering iron and solder wire to solder.
6. Now hold the other end of the jumper wire and solder to the other point of the track
7. Using a multimeter check the jumper.

The **Figure 5.5** Below shows jumper settings in of the jumpers may look like on your motherboard. In this example, the jumper is the white block covering two of the three gold pins. Also, next to the pins is a silkscreen description of what the pins do, in this case when pins 1-2 are jumped the computer is operating normal, when 2-3 are jumped it is set into configuration mode, and when open the computer will be in recovery mode.
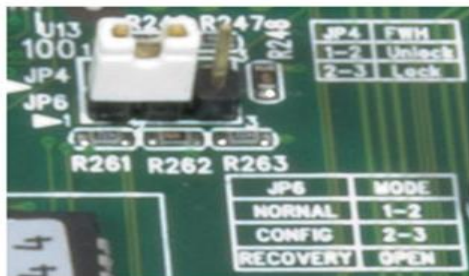
 fig 5.5

Why is SMT used in industry?

 SMT has several important benefits over though hole technology. They are :

- Faster for automatic machines to place
- Have a smaller physical size for the same electrical function
- Less parasitic (unwanted) effect
- Cheaper in terms of raw material cost

SMT: It is a type of electronic component
package. Most electronic components can be divided into two categories - through hole (TH)
and surface mount (SM). Through-hole components have been used for many years and are
designed to be loaded on one side of a printed circuit board (PCB) and soldered on the other.
SM components are designed to be loaded and soldered on the same side of the PCB.

Why should you care about   **Surface Mount Technology?**

"Black Box Operators" aside, SMT is increasingly effecting people involved in the repair,
modification or development of electronics. Through hole components are being replaced by
their SMT equivalents at a rapid rate as manufacturers increase their investment in SMT
production equipment to cash in on the benefits.

Whilst there are exceptions, it is rare to see the use of leaded resistors, capacitors, transistors
or integrated circuits in modern consumer electronics. Since the demand for these types   of
leaded parts is low and decreasing, their cost will rise over the next few years and sourcing
them will become difficult. Eventually, supplies will dry up and leaded components will   join
the domain of valves. Those of you who doubt these warnings should spend some time and have a look at modern mobile phone, computer motherboard or amateur radio. An alert observer will note is mainly because connectors often rely on their leads for mechanical strength and electrolytic capacitors have a shape that does not lend itself towards easy implementation as a surface mount device (SMD). Eventually the solutions to these problems will become cheaper and they too will disappear from electronic equipment in their leaded form.

- **SMT Myths**
  Many new facets of amateur radio and experimentation with electronics in general are
  hampered by the myths that surround them. Some of these myths are :

    SMT needs special and expensive equipment
    SMT components are hard to find
    SMT requires professional PCBs
    SMT requires special training and skill
- To use SMT and not get too stressed about it does require the following :

    To have a steady hand
    To practice your technique
    To be invest in a good pair of tweezers
    To have reasonable eyesight or use magnification

Unfortunately, there is not much you can do about the steadiness of your hand, but all the
other obstacles can be easily overcome. The main emphasis of this article, is to

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explain how you can work with SMT with the smallest possible investment of special equipment

Common SMT Packages

There are three popular package styles used for most passive components. Their names
refer to their size (in thousands of an inch or just thou). They are :

- 0603 (60 thou long, 30 thou wide)
- 0805 (80 thou long, 50 thou wide)
- 1206 (120 thou long, 60 thou wide)

RESISTOR   MELF

CAPACITOR   SOT

Fig 5.6 - Common discrete SMT components

The common discrete SMT packages. Diodes, Transistors and IC's all use the SOT package and often measurement with a multi-meter and the two or three character marking on the top of the package is the only way to guess what the component is. Some IC's use larger packages as shown in Fig 2. Several good web sites exist for determining SMT parts from their markings and these are detailed on the VK3EM website.

SOIC

- Common SOIC package

Fig 5.7

For the purposes of illustration, only a very small selection of SMT packages have been shown in this article. A more detailed listing including colour pictures can be found on the VK3EM website (See end of article). This may be useful for those who you who recycle parts from junk equipment that uses SMT.

How can SMT help you?
SMT has many benefits over leaded components.

These are:
1. Where component value tweaking (i.e. : small changes) are needed. SMT capacitors and
resistors are easy to parallel together and quick to solder and de-solder. The chances of
"lifting" circuit board tracks are reduced and so is the frustration of trying to work on both
sides of a PCB at the same time.
2. Where RF signals are being used. Unwanted (ie:parasitic) effects in SMT parts are smaller
when compared to leaded parts, which results in better predictability of component characteristics. Leaded packages do no lend themselves to microwave use.
However, there are exceptions.
3. A significant number of modern components are only available in SMT form. If you want to
play with them, then you have no choice but to use SMT!
4. Where space is limited. This is dependent on the circuit type and layout, but SMT parts like
decoupling capacitors and pull up resistors can be used to reduce the space required on
the PCB. SMT parts fit neatly across the gaps on VERO board and can be mixed with
designs using leaded parts.
5. Where drilling holes is a problem. Anyone who has made a PCB understands the frustration
of trying to work on two sides at once. SMT simplifies this because you load and solder all
on the same side. Components can be used on both sides of the PCB without interference, or a solid ground plane can be used on one side with holes drilled only for
ground connections.
6. Where a preexisting circuit needs modification. Forgot to add that series capacitor, diode or resistor. Cut the track, insert a SMT. the solution is simple, small, and tidy (no holes)**!**

Self cheak	Written/choose

Name: _____Date: _____

Time Start: _____Time Finish: _____

1_____ means to temporarily complete a circuit or to bypass a break in a circuit by making a connection from one point to another

        A. Fleshing
        B. PpE
        C. Jumpring
        D. Sucker

2_____ It is a type of electronic component package. Most electronic components can be divided into two categories - through hole (TH)and surface mount

        A. SMT
        B. Smd

C. PPE

D. All

Answer   **score**

1_____

2_____

Operation sheet 3	Measuring Current

Purpose: Measuring Current

Procedure: first try to check your safet

Step1: Turn off power to the circuit.

Step2: Cut or unsolder the circuit, creating a place where the meter probes can be inserted.

Step3: Select A~ (ac) or A (dc) as desired.

Step4: Plug the black test probe into the COM input jack. Plug the red test probe into the amp or milliamp input jack, depending on the expected value of the reading.

Step5: Connect the probe tips to the circuit across the break so that all current will flow through the DMM (a series connection).

Step6 Turn the circuit power back on.

Information sheet 6	Performing repair activity within required timeframe

6.1 What is maintenance schedule?
Maintenances schedule

Planned or scheduled maintenance is a list of predetermined maintenance actions carried out at regular time intervals that are aimed at the prevention of breakdowns. ... The primary goal of scheduled maintenance is to prevent equipment failure before it actually occurs.

What is maintenance effectiveness?

They are the higher-level indicators of long-term success when maintenance is viewed as a business. The maintenance manager must remember to: Emphasize the need to manage maintenance incrementally. Watch those things that constitute the end result that is used to judge maintenance effectiveness

How do you prepare a preventive maintenance schedule?

Here are the steps in creating an effective preventative equipment maintenance plan:

1. Step 1: Create a Plan. ..
2. Step 2: Inventory Facility Equipment/Assets. ...
3. Step 3: Create Preventive Maintenance Procedures. ...
4. Step 4: Create Preventive Maintenance Schedules. ...
5. Step 5: Train Your Maintenance Team.

6.1.2 Maintenance work process

The Maintenance Work Process
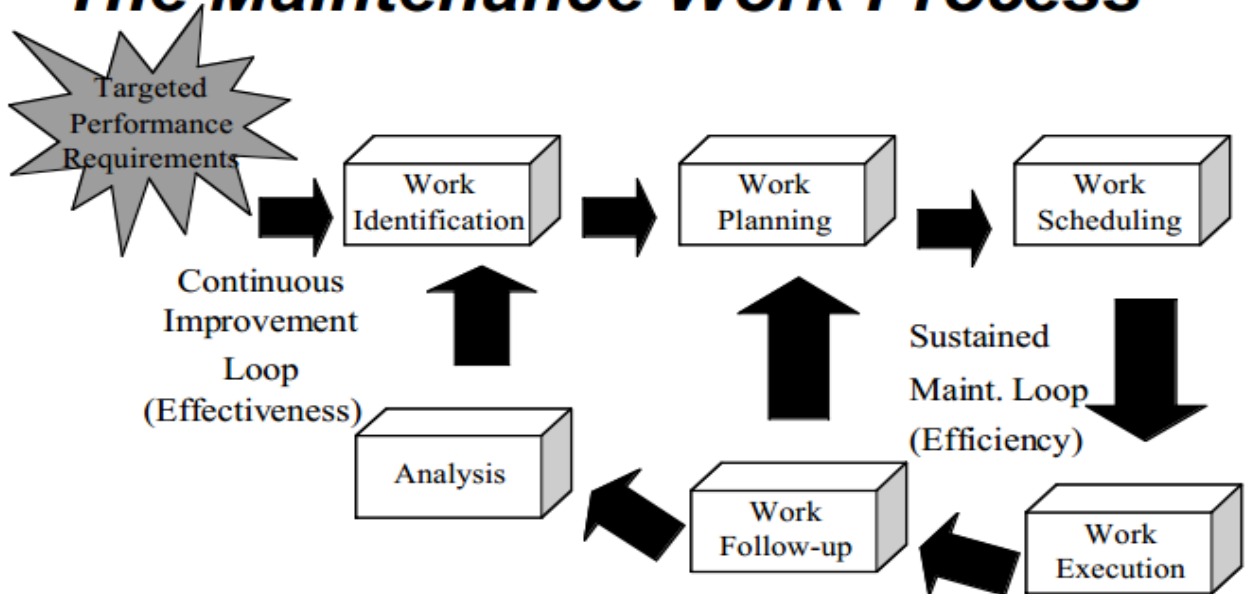
Work Flow
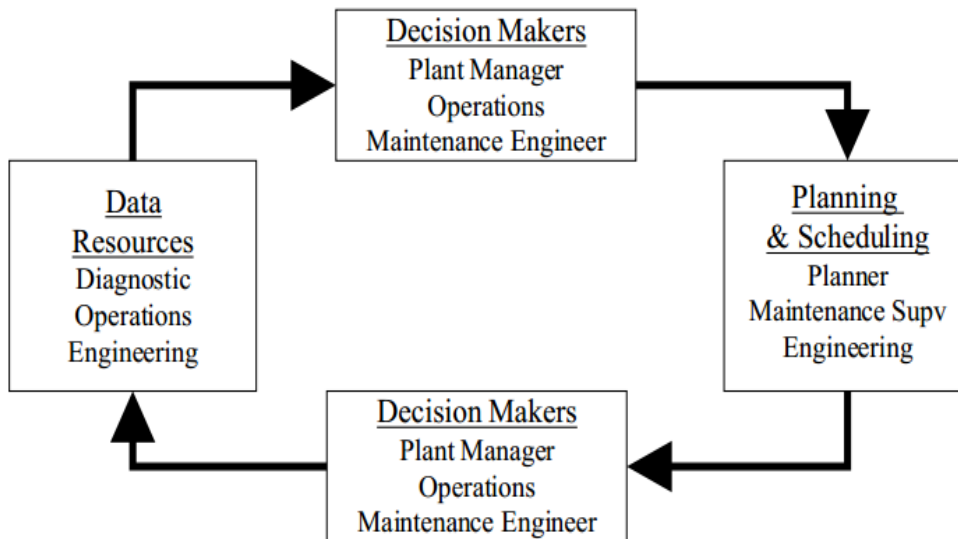
6.2 Elements of a Planned Maintenance System

• A work order system to make assignments to craftsmen/technicians and to accumulate maintenance data

• Maintenance personnel dedicated to the task of planned and scheduled maintenance including preventive and predictive activities

• Methods of formal planning and scheduling that achieve the following:

– Effective allocation of maintenance resources
– Prioritized work tasks
– Effective supply of materials
– Positive impact on equipment availability/reliability

Measurement of planning and scheduling results (performance measurements should deal with level of planned work, scheduling effectiveness, level of unscheduled work, backlog, etc.)
• A means of sharing/planning and scheduling information with production personnel.
• Regulated inspections and repairs. Documentation of feedback from regulated repairs and inspections should be formalized.
• Systematic review, revision and refinement of the planned maintenance system

6.3 Maintenance Planning

• Scope of the job
– What job is to be done? - What is the scope of the work?
What is the priority of this job? - What are the work steps?
– Is engineering required?
• Details have to be ironed out about each of the five elements:
– Mechanic(s), Techs, helper: What skills, how much craft coordination, time per step, crew size, contractor needed, back-up plan if scope of work isn't adequate and job doubles in size.
– Tools: What tools, where to procure, how to ensure availability.
– Materials/Parts/Supplies: What parts, how many, availability, in stock, lead time, vendor.
– Availability of the unit to be serviced: Best time to do the job.
– Authorizations/Permits/Statuary Permissions: Hot permit, open line permit, tank entry, lock-out/tag-out, EPA involvement, etc.

Work Requests Generated by the Different Types of Maintenance

Location

Spare Par
List

Equipmen
number

Description
Of Work

Work Order S

Priority

Charge
Code

Title

Work Order
Number

Re
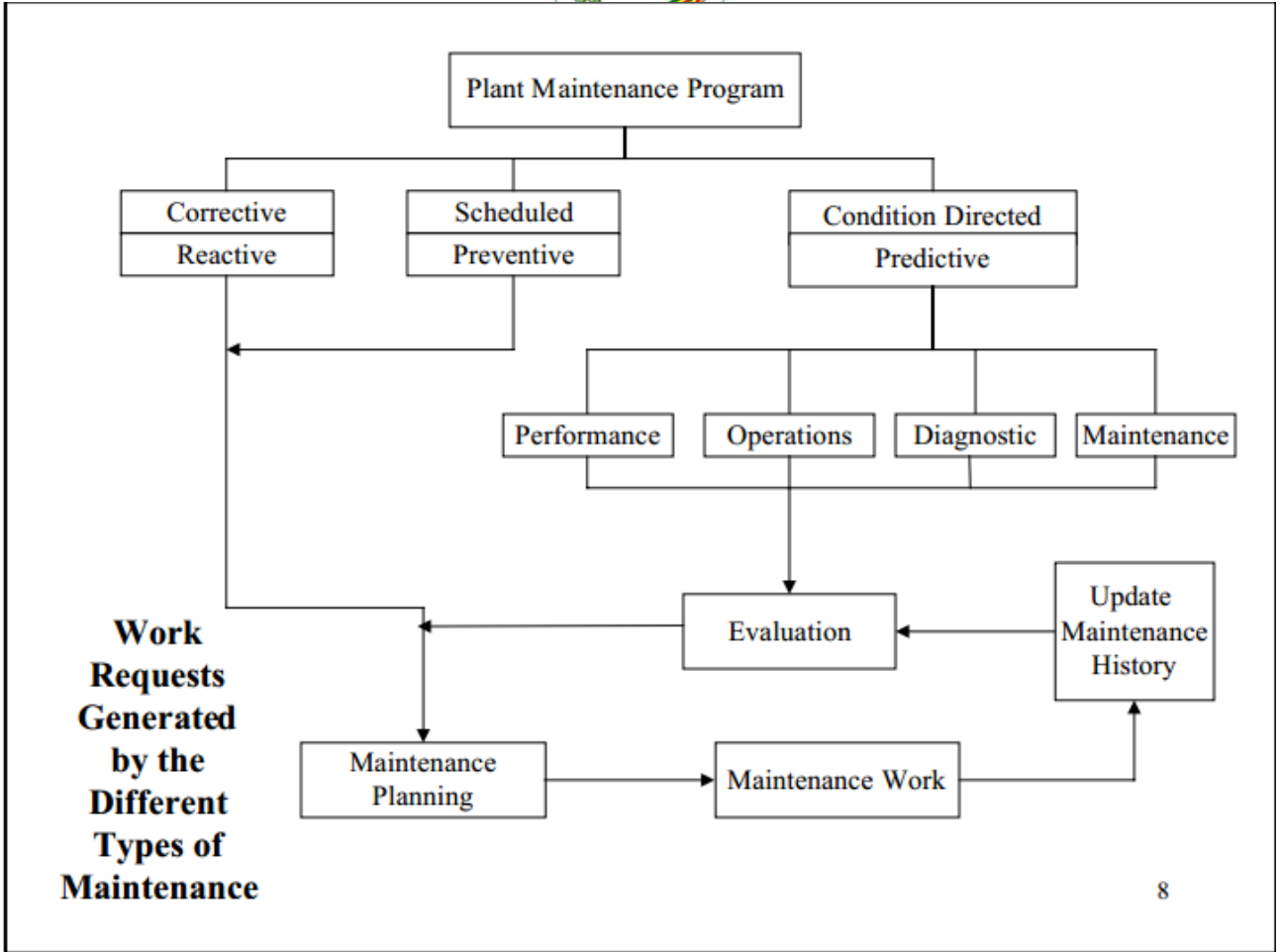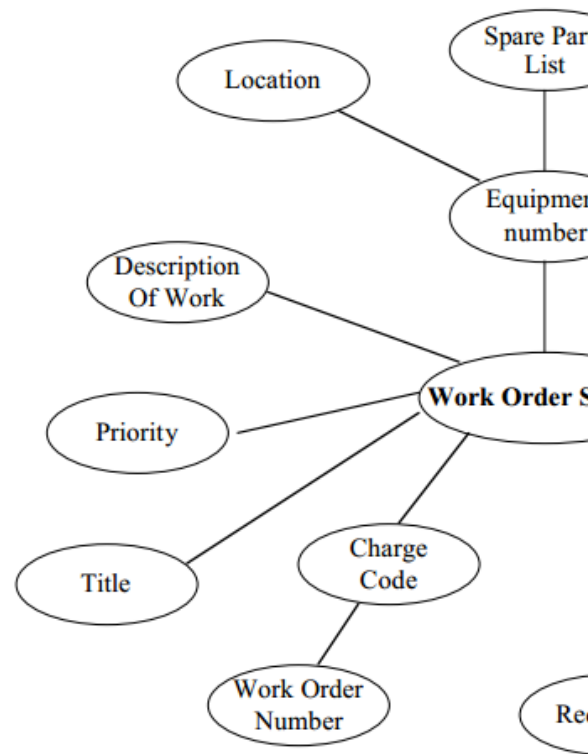
6.4 Functions of the Work Order

It is a:

• Planning and scheduling mechanism for complex jobs (also determine the
resources needed and estimates the manpower and cost).

• A contract between maintenance and the equipment owner.

• Means to authorize the work and denote priority.

• Cost collection mechanism for labor, stores requisitions, purchase
orders, and services to charge against a piece of equipment or
production cost center.

• Way to capture delays and measure productivity

Tool to determine and manage backlogs.

• Guides supervision in execution.

• Means to register acceptance of completed work.

• Provides a means to record equipment history.

• Input data for the Management Information System.

• Means to analyze failure and effectiveness of preventive/predictiveefforts.

• Used for reporting status of jobs, costs by department and type of work,versus
budget, actual versus estimated cost comparison, open work
orders, etc.

6.5 Types of Work Orders

• Planned and scheduled:

These work orders are requested and screened by a planner, resources are planned, work is scheduled, and the work information is entered in the computer and the work order is filed.

• Standing or blanket: Used for (1) repetitive small jobs where the cost

of processing the paperwork exceeds the cost of doing the job; (2)

Fixed or routine assignments where it is unnecessary to write a workorder.

• Emergency: Usually written after the job is performed.

• Shutdown or outage: Are for work that is going to be performed as a project or when the equipment is down for an extended period.

Sample templets

#SWO	STANDING WORK ORDER				DATE OPENED			DATE CLOSED		
	USER: PHONE:				LOCATION				**SPECIAL** LOCK-OUT	
PRIORITY:	70 SAFETY OR CODE VIOLATION	60 PM DAMAG	50 EFFIC. IMPROV	40 COMFOR					PERMIT REQUIRED	

REASON FOR WRITE-UP	PM	CM	RM	UMR	CL	GN	OTHER	DOWNTIME REQUIRED: Y N	CONFINED SPACE OTHER

SYSTEM:		CHARGE-BACK ACCOUNT?:		REQUESTED BY:

DESCRIPTION OF WORK REQUESTED:

SKILL LEVEL	UNSKILLED	MAINTENANCE PERSON	LICENSED TRADES	ENGINEER OR OTHER	CONTRACTOR:
LABOR ESTIMATE:			MATERIAL REQUIREMENTS		

ESTIMATED BY:

DATE	INIT	TIME	DOWN TIME	MATERIAL	DATE	INIT	TIME	DOWN TIME	MATERIAL

TOTAL DOWN TIME					TOTAL DOWNTIME			14
TOTAL (HRS1	+HRS2) *CHGRT			+ (MAT'L	MAT'L		=	

Repair Reasons

Code	Description
SCHEDULED ACTIVITY	
PM	PM (Preventive maintenance) task list activ... adjustment, and survey (an initial PM insp...
CM	Corrective maintenance (also called Reactive... maintenance known 1 - 2 days in advance, w... or impending problem.
UM-R	User maintenance ---Routine work or stand... done every week)
UM-P	User maintenance --- Project work requeste... jobs, can be planned). Larger projects are c...
RM	Rehabilitation maintenance, rebuild, capital... decision
RM-M	Modernize equipment to shop spec.
RM-I	Installation of new equipment
RM-E	Efficiency improvement
RM-U	User initiated modification
CL	Cleaning machines and shop, sweeping up, et...
GN	Grounds, including cleaning, mowing, exteri...
NONSCHEDULED ACTIVITY	
UM-B	User maintenance ---- Breakdown (requiri... could be a jam-up, slow down, leak, quality... danger, etc.
PS	Personal service, errands, minor jobs aroun...
D-R	Reported damage (someone made a mistake a...
D-U	Unreported damage, no report, includes vand...
MU	Misapplied use, wrong component for job.
OB	Other breakdown, including code violation, sa... inspector finds imminent danger or breakdow...

Name: _____Date: _____

Time   Start: _____Time   Finish: _____

1_____ Planned or scheduled maintenance is a list of predetermined maintenance actions carried out at regular time intervals that are aimed at the prevention of breakdowns

- A. Maintenance report
- B. Documentation
- C. Research
- D. Maintenances schedule

2.draw the block diagram of work order

7.1 What does the word precaution?

A precaution is a careful action you make in advance. You might want to take the precaution of bringing lots of water and sunblock if you are going on a desert hike. Precaution means exactly what it sounds like. The prefix pre- means before, and caution means carefulness in the face of danger

7.1.1 What is the difference between caution and precaution?

As nouns the difference between precaution and cautionis that precaution is previous caution or care; caution previously employed to prevent mischief or secure good; as, his life was saved by precaution while caution is precept or warning against evil or danger of any kind; exhortation to wariness; advice; injunction.

What is the safety precaution?

An action taken in advance to protect against possible danger, failure, or injury; a safeguard: followed safety precautions when using heavy machinery. 2. Caution practiced in advance; forethought or circumspection: a need for precaution when planning a vacation.

7.2 Mobile Phone Repairing Safety Tips

Mobile Phone Repairing Safety Tips, Guidelines and Precautionary Measures is a must not only while repairing mobile phone but also while handling or repairing any electronic device or gadget. The parts inside a mobile phone or smartphone are very sensitive especially to ESD or Electrostatic Discharge. By adopting safety measures and maintaining precaution, you can avoid any unwanted damage to the PCB of Mobile Phone.If you are into mobile phone repairing business and follow these Mobile Phone Repairing Safety Tips, then people get to know that you are well organized and well equipped. Remember, first impression is the last impression. By being well equipped and well informed, you will always get more satisfied customers that your competitors. Modern smartphone are expensive and no one would like to hand it over for repairing to someone how is not well equipped or well organized.

fig7.1

Here are some tried and tested Mobile Phone Repairing Safety Tips for Safety and Precaution. Follow these guidelines and you will see the difference in your business very soon.

7.3 Mobile Phone Repairing Safety Tips and Precaution: Guidelines and Instructions

1. Use ESD-Safe Work Station / Work Bench / Table

Yes, repairing of any <u>brand of mobile phone</u>, tablet, laptop or any other such electronic gadget must always be done on an ESD-Safe Workbench. An <u>ESD-Safe</u> work bench is nothing but a table made up of ESD-Safe material with ESD-Safe Mat on the area where actual repairing is done. The whole table including the ESD Mat and the person doing the repairing job are all grounded properly. This prevents the gadget or mobile phone from any potential damage due to static electricity.Now, <u>static electricity</u> is unwanted electricity or flow or electrons from one body to another. These negatively charged electrons can cause damage to sensitive <u>electronic components</u> mainly SMD (<u>Surface Mount Devices</u>). Such work stations are well equipped so that all your tools of regular use are within your arms reach and at appropriate place.

2. Use Right ESD-Safe Tools

Professionals always with professional and good quality <u>Mobile Phone Repairing Tools</u>. Do not use alternative tools or cheap tools. Use only professional tools for particular device you want to repair and fix.

Many technicians use their thumb nail to open the front or back cover of a mobile phone or smartphone. This is not correct. For this job, low-cost mobile opening tools made of hard plastic (ESD-Safe) are easily available.

Similarly, you will always need <u>T4, T5 and T6 screwdrivers</u> for such repairing jobs. T4 or Philips head screwdriver is most common. 90% of your job will get done using a Philips (+) screwdriver. So, always keep ESD-Safe Philips screwdriver near you. With such organized workstation and tools, your job will become easier and very comfortable and your customers will be highly impressed.

Check: <u>Buy Mobile Phone Repairing Tools Online</u>

3. ESD Safety and Protection

ESD (Electro Static Discharge) is the sudden flow of electricity between two electrically charged objects caused by any contact between them. For ESD protection, you need to wear <u>ESD-Safe Apron</u>, ESD-Safe Slippers, ESD-Safe Hand Gloves and Anti-static wrist strap. You must also work on a well-grounded <u>ESD Mat</u>.

Combination of these three will make sure that no unwanted static electricity from your body is transferred to the gadget you are repairing. Remember that ESD protection is not required for your personal safety. It is for the safety of the electronic components on the logic board or the motherboard.

PS: I am into this field for over 15 years now and I know most technicians do not use ESD protection. Most of them don't even know about ESD. I always prefer better to be on the safer side. What do you say?

Video: What is ESD and ESD Protection

https://youtu.be/PNztxW2yb0Q

4. USE ESD-Safe Tray

These are readily available and don't cost much. Whenever you disassemble any mobile phone handset, place all the part in separate compartments of the tray. This will make your life much easier when you reassemble the mobile phone because you don't have to remember where you placed the part. All of them are already well organized in different compartments of the tray. Remember smartphone and mobile phone have number of tiny screws and these are the ones that get lost most of the time. Using a tray with different compartments for different part will your life easy.

5. Handle Delicate Parts Carefully for Safety

Most of the parts in a mobile phone or smartphone are very delicate. Take care about them. For example make sure the LCD does not get any scratches. Make sure to handle connectors and connecting cables carefully as they are very delicate.

6. Handle Hot Air Blower and Soldering Iron with Care for Safety

Hot air machine and soldering iron or soldering station must be used and handled carefully. They can damage the gadget and even harm you. Hot air machine produces hot air with very high temperature. Make sure the direction of the nozzle is where it should be. Switch it OFF when not in use.

Similarly use a hot soldering iron with care. Always place the iron in a iron stand and do not put it on the table. Such repairing jobs also need use of highly inflammable liquid such as IPA. They need to be placed at the right place to avoid high heat.

7. Take Care of Customer's Data

Many times you need to perform hard reset or factory reset or reinstall the operating system or Flash IMEI in a Mobile Phone. During the process, data stored in the mobile phone memory and even external SD card might get deleted. This data can be very

important for some customers. So, make sure to backup all data before performing and factory reset.

7.4   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 are.

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

Self cheak7	True/false

Name: _____Date: _____

Time Start: _____Time Finish: _____

Part 1:Say true or false

1. A precaution is a careless action you make in advance

2. Professionals always with professional and good quality <u>Mobile Phone Repairing Tools</u>. Do not use alternative tools or cheap tools. Use only professional tools for particular device you want to repair and fix.

3. Use mobile phone near petrol outlet and LPG cylinder. The static electricity in the atmosphere may not explode.

Answer   **score**

1_____

2_____

3_____

Information sheet 8	Performing cleaning of unit in accordance with safety standard procedures

8.1 Performing cleaning of unit in accordance with safety standard procedures

With the rapid development of the era, improvements have been made, not just to people's living standards, but also to science and technology. We have increasingly frequent access to a wide variety of electronic products, such as mobile phones. However, it is important to pay attention to maintenance of such items to ensure they can be used safely and effectively. Read on to maximize your phone's potential, while maintaining its value.

Steps

Avoid exposing your mobile phone to too much sun or rain. This is especially important for smartphones with LCD screens

- o If the phone was immersed in water or used in heavy rain, wipe it dry as soon as possible. Should the phone have gotten seriously wet, it is advisable not to turn it on immediately. This avoids the electrical burn out of internal parts. Instead, send for repairs as soon as possible.
- o If the mobile phone has sat idle for a long time, it may need special moisture treatment. In humid areas, the internal moisture of the mobile phone could cause harm to the parts. When using your mobile phone has been idle for a reasonable amount of time, it will have attained a certain internal temperature. This can cause the accumulated water to evaporate at ordinary times. To avoid harm to the body, do not touch the antenna.

To prevent damage to your mobile phone or **deteriorating the quality of phone calls, do not install modified parts.**

Some useful tips to prolong the service life of your mobile phone are:

- Keep your mobile phone and its accessories in a place where children can't reach.

- Keep your mobile phone dry. Rain, moisture, and liquids all contain minerals that can corrode sensitive electronic circuit boards.
- Do not use or store your mobile phone in dusty or dirty places, as this could undermine its circuitry or essential components
- Do not store your phone where it could overheat. High temperatures can shorten the life of electronic devices by damaging batteries or melting some of the plastic parts, causing deformation. Also, when the temperature rises high enough, the moisture will form inside of your phone, and this can damage electronic circuit boards

Do not attempt to open your phone. This can cause damage and can be dangerous if you do not know much about phones and how they work.

Do not throw, knock, or shake your mobile phone. Rough handling can break internal circuit boards, or the screen.

Self-Check #8	Written Test

Name: _____Date: _____

Time   Start: _____Time   Finish: _____

Instruction: Answer all the questions provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

1. List the steps on Performing cleaning of unit in accordance with safety standard procedures

Answer   score [   ]

1._____
_____
_____
_____

LAP TEST #1	Practical Demonstration (Rework BGA IC)

Name: _____**Date:** _____

Time started: _____ **Time finished:** _____

Instructions: You are required to perform the following individually with the presence of your teacher.

A. Tools & Materials

1. Nokia 3310 board or any motherboard
2. Maintenance Plate Board

3. Maintenance   Plate Stand
4. Hot Air & Soldering Station
5. Tweezers
6. Soldering Flux

B. Procedure

1. Extract a BGA IC from cell phone unit board.
2. Clean terminals of BGA IC and place on the maintenance plate underside.
3. Choose a ball perform from perform sheets that matches the grid array on the BGA and apply BGA paste on the underside of the performer.
4. Place weight on the perform sheet and start hovering the hot air nozzle to melt the paste until the balls are formed on the underside of the BGA.
5. Separate the BGA IC from the perform sheet.

Has your Instructor Check your work?

➢ *Your teacher will evaluate your output either satisfactory or unsatisfactory. If*

 unsatisfactory, your teacher shall advice you on additional work. But if satisfactory, you can proceed to the next topic.

LAP TEST #2	Flash IMEI Number in Android Mobile

Name:
_____Date: _____
Time started: _____ Time finished:
_____

Instructions: You are required to perform the following individually with the presence of your teacher.

Task 1: Flash IMEI Number in Android Mobile

Instruction Sheet	LG25: Test Repaired Unit

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Visual inspection of the unit with power off
- Operate the appliance according to manual to confirm defects
- Check the functionalities of mobile units.

This guide will also assist you to attain the learning outcome stated in the above. Specifically, upon completion of this Learning Guide, you will be able to –

- Operating the appliance according to manual to confirm defects.
- Checking the functionalities of mobile units.

Learning Instructions:

24. Read the specific objectives of this Learning Guide.

25. Follow the instructions described below

26. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.

27. Accomplish the "Self-checks" in each information sheets.

28. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

29. If you earned a satisfactory evaluation proceed to "Operation sheets and LAP Tests if any". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity.

30. After you accomplish Operation sheets and LAP Tests, ensure you have a formative assessment and get a satisfactory result;

31. Then proceed to the next Learning guide.

1.1 How to Open and Disassemble a Mobile Cell Phone

Here we will learn How to open and disassemble any mobile cell phone (Feature Phone and Android Smartphone and iPhone) including Samsung, iPhone, Huawei, Xiaomi, Oppo, LG, Motorola, Mobicel, Lenovo, Nokia, China Mobile Phones or any other brand of cell phone from any mobile cell phone manufacturer. The process and steps are basically same with slight change in the process. To open and disassemble a feature phone is rather easy than to open and disassemble an Android Smartphone or iPhone.

Fig1.1

Tools to Open and Disassemble Mobile Phone

Before proceeding to open and disassemble a mobile cell phone, make sure you have all the required tools for mobile phone repairing. The tools you will need are:

1. T4, T5 and T6 Precision Screwdriver. A screwdriver set or kit can be very useful. These screwdrivers must have magnetic tip to hold the screws so that you don't lose them.
2. Mobil Phone Opener
3. Tweezers
4. Antistatic Wrist Strap

5. Antistatic Hand Gloves
6. Antistatic or ESD-Safe Mat
7. <u>ESD-Safe Apron</u>
8. ESD-Safe Footwear

NOTE: It is very important to use only Antistatic or ESD-Safe tools to open and disassemble a mobile cell phone because small parts inside a mobile phone and SMD Components are very sensitive to ESD or static electricity and can get damaged if precaution is not taken to prevent static electricity.

1. Take OFF, remove the battery cover, and back facial of the mobile phone. You should use a mobile opener tool to remove the back Facia.
2. Remove the battery, SIM card and memory card.
3. You will find several small screws at the back. Using suitable precision screwdriver, unscrew and remove all the screws and keep them in a safe box. These screws must be kept very carefully so that they do not get lost.
4. Once all the screws are open, remove the front cover or the front Facia of the mobile phone.
5. Now you have the internal Facia or skeleton of the mobile phone. It is attached to the <u>mobile phone PCB</u> with screws. Unscrew and open all the screws.
6. Remove connectors for display and camera and pull the display and the camera out.

Video: How to Disassemble a Feature Mobile Phone

Fig 1.2

How to Open and Disassemble Android Smartphone: Step by Step Instructions

https://youtu.be/cxcgJ_9Hj2c

How to Open and Disassemble Android Smartphone

1. Remove the back cover carefully. Most people use their nails for this but you should always use a mobile phone opening tool. Modern smartphones have

Fingerprint sensor and Antenna Connector attached to the back cover. So, be careful or you will damage these connectors.

2. Remove the Battery. Removable batteries are easy to remove. But if your Android Smartphone has a Non-Removable Battery then it is connected to the Board with a Connector. Remove this connector first. The non-removable batteries are glued at the bottom with a double-sided tape. Carefully remove this tape and the battery will easily come out.

3. Remove the SIM card and memory card.

4. You will find several small screws at the back. Using suitable precision screwdriver, unscrew and remove all the screws and keep them in a safe box. These screws must be kept very carefully so that they do not get lost.

5. Once all the screws are open, remove the front cover or the front Facia of the smartphone.

6. Now you have the internal Facia or skeleton of the mobile phone. It is attached to the mobile phone PCB with screws. Modern Android Smartphone and iPhone have 2 to 3 PCBs connected to each other using connectors. These PCBs are from <u>Different Sections of Mobile Phone</u> – Network Section, Power Section and Audio Section. Unscrew and open all the screws.

7. Remove connectors for display and camera and pull the display and the camera out.

   NOTE: Modern smartphones have too many connectors that can break or get damaged very easily. So, be very careful when opening and disassembling them.

1.2 Assembling a Mobile Phone

the following are the steps that you should take when assembling a mobile phone:
1. Fix the vibrator strips of speaker and volume button
2. Fix the motherboard
3. Connect the antenna with wire
4. Place the camera and connect it
5. Place the buzzer
6. Put the camera cover
7. Make sure that the LCD is working before you place the screen
8. Put battery and battery cover

So far you have learnt about the hazards of mobile phone repair, the parts of a mobile phone, the tools to use and how to assemble and disassemble a mobile phone. Now let us look at how to diagnose and repair a mobile phone

Self-check 1	Written test

Name: _____Date: _____

Time Start: _____Time Finish: _____

1, list the tool and material for assemble and disassemble mobile phone

Operation sheet 1	Assembling/disassemble a Mobile Phone

Purpose: Assembling a Mobile Phone

Procedure:

. **Step   1.** Fix the vibrator strips of speaker and volume button

step   2. Fix the motherboard

step 3. Connect the antenna with wire

step 4. Place the camera and connect it

step 5. Place the buzzer

step   6. Put the camera cover

step   7. Make sure that the LCD is working before you place the screen

step 8. Put battery and battery cover

Information sheet 2	Subjecting to final testing reassembled units and cleaning in conformity with manufacturer's specifications

2.1 Test repaired unit

First step in handling troubleshooting procedure:

2.1.1.Visualization Checkup-

Before proceeding to anything always considers the fact that a mobile phones handset is fragile object. Check and have take a look around every inch of the handsets package and layout, In this manner you can identify if the handset is in repairable condition, something like checking the whole printed circuit board components and parts, if it is free from dust, corrosion, bended, breakage etc.

1.Know the Phones Status - Ask the user or the costumer about the phones history before the problem occurs. Letting know the phones history like accidentally soaked into a liquids or water, dropped, and thrown etc.

In this manner you can get an idea where to start or begin with.

2. **Doing Software check up** - Use a certain flashing device for that particular handset product to be able to read logs, logs is a reading of mobile phones firmware programmed and installed unto it. This is a big help for most advance mobile technician this days, A logs reading can help you where the faulty line or parts occurs. If you are not familiar about how to read logs you can ask to that certain flashing device product supporters and creator.

    You can do flash, reformat at first hand if found something wrong with the mobile phones firmware. If all methods of software already done and nothing happen, proceed to hardware troubleshooting.

3. **Analyze The Circuit** - After dismantling and do visualization check up,be patient and take your time to analyze the whole circuits layout, and think of a step by step plan procedure in your mind where or how to begin with. A Special Operation Procedure is good way and a reliable source of idea within yourself, not only by enhancing your skills but you are also practicing a self discipline   method.

    Now let's take one example of basic hardware troubleshooting methods in one particular mobile phone handsets. In this simple way you can then

manage how to troubleshoot or been able on finding faulty parts or components within a mobile phone circuitry.

Troubleshooting Mobile Phone Guides:

FAULT	REMEDY
No Audio	Speaker 1. Clean up speaker terminals. 2. Check speaker. If bad, replace. 3. Circuit trace for open circuit connection. 4. Check coupling resistors/capacitors connected to speaker. COBBA 1. Reheat COBBA IC 2. If problem still remains, rework COBBA IC. 3. If problem still remains, replace COBBA IC. CPU 1. Reheat CPU IC if it is not sealed. 2. If problem still remains, replace CPU. 3. If problem still remains, replace entire board.
No Ringtone	Buzzer 1. Clean up buzzer terminals. 2. Check buzzer. If bad, replace. 3. Circuit trace for open circuit connection. 4. Check coupling resistors/capacitors connected to speaker. UI Control IC 1. Reheat UI Control IC 2. If problem still remains, replace UI Control IC. CPU 1. Reheat CPU IC if it is not sealed. 2. If problem still remains, replace CPU.

	3. If problem still remains, replace entire board.

No Backlights	**LED**
	   1. Check LEDs. If bad, replace.
	   2. Circuit trace for open circuit connection.
	   3. Check coupling resistors/capacitors connected to LEDs.
	UI Control IC
	   1. Reheat UI Control IC
	   2. If problem still remains, replace COBBA IC.
	CPU
	   1. Reheat CPU IC if it is not sealed.
	   2. If problem still remains, replace CPU.
	   3. If problem still remains, replace entire board.

Keypad Malfunction	**Membrane**
	   1. Check and clean up membrane.
	   2. Replace membrane
	Keypad
	   1. Check keypad and clean terminals.
	   2. Circuit traces connections.
	CPU
	   1. Reheat CPU IC if it is not sealed.
	   2. If problem still remains, replace CPU.
	   3. If problem still remains, replace entire board.

Insert Sim Card	**SIM Card**
	   1. Check SIM card and clean up terminals
	   2. Replace with working SIM Card.
	SIM Card Holder
	   1. Clean up terminals.
	CCONT
	   1. Reheat CCONT IC.
	   2. If problem still remains, rework CCONT IC.

	3. If problem still remains, replace CCONT IC.
	CPU
	1. Reheat CPU IC if it is not sealed.
	2. If problem still remains, replace CPU.
	3. If problem still remains, replace entire board.
Not Charging	**Charger**
	1. Check charger. Measure voltage output.
	Battery
	1. Check battery voltage
	Battery terminals
	1. Clean up battery terminals.
	Charger holder
	1. Clean up terminals
	Fuse
	1. Check fuse.
	2. Circuit trace for possible open circuit.
	CHAPS
	1. Reheat CHAPS IC.
	2. If problem still remains, rework CHAPS.
	9. If problem still remains, replace CHAPS.
	CCONT
	1. Reheat CCONT IC.
	2. If problem still remains, rework CCONT IC.
	3. If problem still remains, replace CCONT IC.
	CPU
	1. Reheat CPU IC if it is not sealed.
	2. If problem still remains, replace CPU.
	3. If problem still remains, replace entire board.
No Power	**Battery**
	1. Check and measure battery voltage.
	Battery terminals

	1. Clean up battery terminals.
	Power switch
	1. Check switch.
	2. Circuit trace switch connections
	RF power amplifier
	1. Check B+ and ground terminals for shortage and leakage
	2. Remove power amplifier
	CCONT
	1. Reheat CCONT IC
	2. If problem still remains, rework CCONT IC.
	3. If problem still remains, replace CCONT IC.
	RAM
	1. Reheat RAM IC.
	2. If problem still remains, rework RAM IC.
	3. If problem still remians, replace RAM IC.
	FLASH IC
	1. Reheat FLASH IC.
	2. If problem still remains, rework FLASH IC.
	3. If problem still remains, replace FLASH IC.
	CPU
	1. Reheat CPU IC if it is not sealed.
	2. If problem still remains, replace CPU.
	3. If problem still remains, replace entire board.
Vibrator Problem	**Vibrator**
	1. Clean up vibrator terminal
	2. Check vibrator, if bad replace
	3. Circuit trace for open connection
	4. Check coupling resistors/capacitor connected to vibrator
	UI control IC

	1. Reheat UI control IC
	2. If problem still remain, replace UI control IC
	CPU
	1. Reheat CPU IC , if it is not sealed
	2. If problem still remain, replace CPU
	3. If problem still remain, replace the board

No Signal Problem

GSM Frequencies

Single band – 900 MHz

Dual band – 900 MHz/1800 MHz

Tri band – 900 MHz/1800 MHz/1900 MHz

Quad band – 850 MHz/900 MHz/1800 MHz/1900 MHz

No Network	Antenna
	1. Clean antenna terminals.
	Antenna switch
	1. Reheat antenna switch
	2. Check if bad, replace.
	RX(receiver) filter
	1. Reheat RX filter.
	2. Check if bad, replace.
	GSM/DCS HF Amplifier
	1. Reheat IC
	2. Check If bad , replace.
	RX Coupler
	1. Reheat mutual coupler.
	2. Check if bad, replace.
	HAGAR
	1. Reheat HAGAR
	2. If problem still remains, rework HAGAR.
	3. If problem still remains, replace HAGAR.
	COBBA

	1. Reheat COBBA
	2. If problem still remains, rework COBBA.
	3. If problem still remains, replace COBBA.
	CCONT
	1. Reheat CCONT
	2. If problem still remains, rework CCONT.
	3. If problem still remains, replace CCONT.
	VCO
	1. Reheat VCO
	2. Check if bad, replace
	CPU
	1. Reheat CPU if it is not sealed.
	2. If problem still remains, replace CPU.
	3. If problem still remains, replace entire board.
No Access	Antenna switch
	1. Reheat antenna switch.
	2. Check if bad, replace.
	TX(Transmit) coupler
	1. Reheat TX coupler
	2. Check if bad, replace.
	TX filter
	1. Reheat TX filter
	2. Check if bad, replace.
	Pre amplifier transistor
	1. Reheat transistor.
	2. Check if bad, replace.
	3. Circuit trace for open circuit connections to transistor.
	RF power amplifier
	1. Reheat power amplifier
	2. Check if bad, replace/

	3. Circuit trace for open circuit connections to power amplifier.
	HAGAR
	1. Reheat HAGAR
	2. If problem still remains, rework HAGAR.
	3. If problem still remains, replace HAGAR.
	COBBA
	1. Reheat COBBA
	2. If problem still remains, rework COBBA.
	3. If problem still remains, replace COBBA.
	CCONT
	1. Reheat CCONT
	2. If problem still remains, rework CCONT.
	3. If problem still remains, replace CCONT.
	CPU
	1. Reheat CPU if it is not sealed
	2. If problem still remains, replace CPU.
	3. If problem still remains, replace entire board.
Wet Unit	Clean stained board with solvent(lacquer thinner) for 1 to 2 minutes. Test circuit board for open connection. Troubleshoot same with no power.
Contact Service	Most BGA IC contribute to this problem 1. CCONT 2. COBBA 3. RAM (Random Access Memory) 4. FLASH IC 5. EEPROM IC (Electronically Erasable Programmable Read Only Memory) 6. CPU (Central Processing Unit)

	COBBA
Hang	1. Reheat COBBA.
	2. If problem still remains, rework COBBA.
	3. If problem still remains, replace COBBA.
	EEPROM
	1. Reheat EEPROM IC
	2. If problem still remains, replace EEPROM IC
	CPU
	1. Reheat CPU it is not sealed
	2. If problem still remains, replace CPU
	3. If problem still remains, replace entire board.

Self-check 2	Written test

Name: _____Date: _____

Time Start: _____Time Finish: _____

Instruction: Answer all the questions provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher

Part I. Give the best answer for the following questions (3 points each)

1. If the fault is No Audio in cell phone what is its Remedy?

Answer Sheet

Scored Point ⬜

Part I

11. _____

_____

_____

12. _____

_____

_____

13. _____

_____

_____

14. _____

_____

_____

15. _____

_____

_____

Information sheet 3	Complying service completion procedures and documentation based on manual

3.1 Complying service completion procedures and documentation based on manual

Templates for policy and procedure documents.

Components of Policy Documents.

Campus policy documents should use a paragraph numbering system that permits them to be cited easily and they should include each of the following components:

a. Best Practices for Documenting Your Project

1. Include A README file that contains. ...
2. Allow issue tracker for others.
3. Write an API documentation. ...
4. Document your code.
5. Apply coding conventions, such as file organization, comments, naming conventions, programming practices, etc.
6. Include information for contributors.

b. What are maintenance documents?

Maintenance planning documents. ... Aircraft maintenance includes the tasks that are required to restore or maintain the systems, components, and structures of an aircraft in a safe and airworthy condition.

c.What are examples of documentation?

Documentation is a set of documents provided on paper, or online, or on digital or analog media, such as audio tape or CDs. Examples are user guides, white papers, on-line help, quick-reference guides. It is becoming less common to see paper (hard copy) documentation

d.What is the difference between Document and documentation?

The word 'Documentation' is non-countable noun and is a collection of or body of material of any subject/topic. "This is just one report, where is the documentation for the whole project?" Document is a form of information that means record,or a capture of things and events so information will not be lost.

Templet

1.	**Headline banner**	*UC Santa Cruz Policy*, the policy title, issuing date, and an identification block which includes: Policy number, Page Number, Effective Date, "Supersedes" notification, Office of Origin, and Policy Approval Authority. The Policy Number and Page Number would appear on all subsequent pages; the footer of each page should repeat the Issuing Date and the Policy Title. *Note*: The policy title should be carefully selected so that it is simple and clearly conveys the policy's content.
2.	**Purpose of the policy/ Policy statement**	A *concise* statement of the rationale for the policy, including if appropriate, reference to external regulations, further policy discussion, etc. Summary (one paragraph) clearly stating the important policy content.
3.	**Detailed policy statement**	Complete policy statement. If the effective date is different from the issuing date in the headline banner, and then an appropriate discussion of when the policy applies should be included with the policy statement.
4.	**Applicability**	Exactly who the policy applies to and the consequences for non-compliance, if applicable.
5.	**Definitions**	Definitions of terms (as needed).
6.	**Cognizant office(s)/ Getting Help**	The office and specific individual position title (with telephone number and electronic mail address, as appropriate) that should be contacted for interpretations, resolution of problems, and special situations.
7.	**Policy authority**	The highest administrative or academic officer or group authorizing the policy. If appropriate, one might also note the next required review date.
8.	**Related policies/ References for more information**	Information about related policies or procedures, guidelines, forms, etc. Give complete references and ensure that documents cited are readily available (i.e., either as widely distributed manuals such as the Business and Finance Bulletins, Accounting Manual, Contracts and Grants Manual; or available in the on-line campus Policies and Procedure Manuals). If needed, provide additional background discussion here.
9.	**Implementation procedures**	Reference to detailed procedures that are recommended in order to carry out the intent of the policy.

3.1.1 What is the main purpose of documentation?

The purpose of documentation is to: Describe the use, operation, maintenance, or design of software or hardware through the use of manuals, listings, diagrams, and other hard- or soft-copy written and graphic materials

Why proper documentation is so important?

The purpose of complete and accurate patient record documentation is to foster quality and continuity of care. It creates a means of communication between providers and between providers and members about health status, preventive health services, treatment, planning, and delivery of care.

3.2 MAINTENANCE MANUAL

Overview

The Maintenance Manual provides maintenance personnel with the information necessary to maintain the system effectively. The manual provides the definition of the software support environment, the roles and responsibilities of maintenance personnel, and the regular activities essential to the support and maintenance of program modules, job streams, and database structures.

In addition to the items identified for inclusion in the Maintenance Manual, additional information may he provided to facilitate the maintenance and modification of the system. Appendices to document various maintenance procedures standards, or other essential information may he added to this document as needed.

INTRODUCTION

This section provides general reference information regarding the Maintenance Manual. Whenever appropriate, additional information may be added to this section.

Purpose

In this section, describe the purpose of the manual and reference the system name and identifying information about the system and its programs.

Points of Contact

This section identifies the organization(s) responsible for system development maintenance, and use. This section also identifies points of contact (and alternate if appropriate) for the system within each organization.

Project Reference

This section provides a bibliography of key project references and deliverables produced during the information system development life cycle.

Glossary

Provide a glossary with definitions of all terms, abbreviations, and acronyms used in the manual. If the glossary is several pages in length, place it as an appendix.

SYSTEM DESCRIPTION

The subsequent sections provide an overview of the system to be maintained.

System Application

This section provides a brief description of the purpose of the system, the functions it performs, and the business processes that the system is intended to support. If the system is a database or an information system, include a general description of the type of data maintained, and the operational sources and uses of those data.

System Organization

In this section, provide a brief description of the system structure, major system components, and the functions of each major system component. Include charts, diagrams, and graphics as necessary.

Security

This section provides an overview of the system's security controls and the need for security and protection of sensitive data. For example, include information regarding procedures to log on/off of the system, provisions for the use of special passwords, access verification, and access statuses as appropriate.

System Requirements Cross-Reference

This section contains an exhibit that cross-references the detailed system requirements with the system design document and test plan. This document, also referred to as a trace ability matrix in other documents, assists maintenance personnel by tracing how the user requirements developed in the FRD are met in other products of the life cycle. Because this information is provided in the system design document, it may he appropriate to repeat or enhance that information in this section.

SUPPORT ENVIRONMENT

This section describes the operating and support environment for the system and program(s). Include a discussion of the equipment, support software, database characteristics, and personnel requirements for supporting maintenance of the system and its programs.

Equipment Environment

> This section describes the equipment support environment including the development, maintenance, and target host computer environments. Describe telecommunications and facility requirements, if any.

> ➢ **Example**

Computer Hardware

> This section discusses the computer configuration on which the software is hosted and its general characteristics. The section should also identify the specific computer equipment required to support software maintenance if that equipment differs from the host computer. For example, if software development and maintenance are performed on a platform that differs from the target host environment, describe both environments. Describe any miscellaneous computer equipment required in this section, such as hardware probe boards that perform hardware-based monitoring and debugging of software. Include any telecommunications equipment.

Facilities

> This section describes the special facility requirements, if any, for system and program maintenance and includes any telecommunications facilities required to test the software.

Support Software

> This section lists all support software - such as operating systems, transaction processing systems, and database management systems (DBMSs) - as well as software used for the maintenance and testing of the system. Include the appropriate version or release numbers, along with their documentation references, with the support software lists.

Database Characteristics

> This section contains an overview of the nature and content of each database used by the system. Reference other documents for a detailed description, including the system design document as appropriate.

Personnel

> This section describes the special skills required for the maintenance personnel. These skills may include knowledge of specific versions of

operating systems, transaction processing systems, high-level languages, screen and display generators, DBMSs, testing tools, and computer-aided system engineering tools.

SYSTEM MAINTENANCE PROCEDURES

This section contains information on the procedures necessary for programmers to maintain the software.

Conventions

This section describes all rules, schemes, and conventions used within the system. Examples of this type of information include the following:

- System-wide labeling, tagging, and naming conventions for programs, units, modules, procedures, routines, records, files, and data element fields
- Procedures and standards for charts and listings
- Standards for including comments in programs to annotate maintenance modifications and changes
- Abbreviations and symbols used in charts, listings, and comments sections of programs

If the conventions follow standard programming practices and a standards document, that document may be referenced, provided that it is available to the maintenance team.

Verification Procedures

This section includes requirements and procedures necessary to check the performance of the system following modification or maintenance of the system's software components. Address the verification of the system-wide correctness and performance.

Present in detail, system-wide testing procedures. Reference the original development test plan if the testing replicates development testing. Describe the types and source(s) of test data in detail.

Error Conditions

This section describes all system-wide error conditions that may be encountered within the system, including an explanation of the source(s) of each error and recommended methods to correct each error.

Maintenance Software

This section references any special maintenance software and its supporting documentation used to maintain the system.

Maintenance Procedure

This section describes step-by-step, system-wide maintenance procedures, such as procedures for setting up and sequencing inputs for testing. In addition, present standards for documenting modifications to the system.

SOFTWARE UNIT MAINTENANCE PROCEDURES

For each software unit within the system, provide the information requested. If the information is identical for each of the software units it is not necessary to repeat it for each software unit. If the information in ally of the areas discussed below is identical to information provided in Section 4, System Maintenance Procedures, for the system maintenance procedures, then reference that area. This section should contain the following:

- Unit Name And Identification—Provide the name or identification of each software unit that is a component of the system. Repeat the following information for each unit name.
- Description—Provide a brief narrative description of the software unit. Reference other sections within the life cycle that contains more detailed descriptive material.
- Requirements Cross-Reference—Include the detailed user requirements satisfied by this particular software unit. It may he a matrix that traces the system requirements from the FRU) through the system design document and test plan for the specific software units. Other life cycle documentation may be referenced as appropriate.
- Conventions—Describe all rules, schemes, and conventions used within the program. If this information is program-specific, provide that information here. If the conventions are all system-wide, discuss them Section 4. If the conventions follow standard programming practices and a standards document, that document may be referenced here.
- Verification Procedures—Include the requirements and procedures necessary to check the performance of the program following modification or maintenance and addresses the verification of program correctness, performance and detailed testing procedures. If the testing replicates development testing, it may be appropriate to reference the original development test plan.
- Error Conditions— Describe all program-specific error conditions that may be encountered provide an explanation of the source(s) of each error, and recommend methods to correct each error. If these error conditions are the same as the system-wide error conditions described in Section 4.3, Error Conditions. that section may be referenced here.

Listings—Provide a reference to the location of the program listings.

Self-check 3	choose

Name: _____Date: _____

Time Start: _____Time Finish: _____

Instruction: Answer all the questions provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

1_____ includes the tasks that are required to restore or maintain the systems, components, and structures of an aircraft in a safe and airworthy condition.

       A. maintenance documents

       B. CMD

       C. SMD

       D. all

2._____ is a set of documents provided on paper, or online, or on digital or analog media, such as audio tape or CDs.

       A. Research

       B. Documentation

       C. Report writing

       D. all

answer   score

1._____

2_____

Information sheet 4	Disposing waste materials in accordance with environmental requirements

4.1 How do you dispose of waste materials?
1. How to Dispose of Garbage Properly

1. Sort your garbage into a few different bins. ...
2. Bring any garbage that can be reused, such as toys or clothing, to a second-hand store to be resold.
3. Take recyclables such as glass, plastics and paper to a local recycling canter. ...
4. Turn food and garden waste into compost.

2. What should be considered when disposing of waste?
When waste is generated, it must be disposed of properly. Sink disposal may not always be appropriate and may end contaminating drinking water. Alternative methods of disposal should be considered including incineration, treatment, and land disposal.

When waste is generated, it must be disposed of properly. Sink disposal may not always be appropriate and may end contaminating drinking water. Alternative methods of disposal should be considered including incineration, treatment, and land disposal

The methods of waste management involve proper dumping, recycling, transportation and collection, and the creation of awareness.

- Dumping methods. The most common waste dumping methods include landfill and incineration. ...
- Recycling methods. ...
- Collection and transportation. ...
- Creation of awareness.

The most important reason for proper waste management is to protect the environment and for the health and safety of the population.Reduce the volume of the solid waste stream through the implementation of waste reduction and recycling programs.

As a result of the Environmental Protection Act (EPA) 1990, the Environmental Protection (Duty of Care) Regulations 1991 & the Environment Act 1995 the University has a 'Duty of Care' with regards to waste.

This Duty of Care places responsibility on producers of waste to store, transport and dispose of waste legally and in a way that doesn't harm the environment. The person/company who collects the waste from our site is the Waste Carrier and all Waste Carriers are required to be registered. For approved suppliers these checks have been made and the records are held centrally with the Environmental Manager.

As a producer we must ensure any waste carriers we use are authorised and that any waste transfers must be accompanied by a written description of the waste (i.e. via a Waste Transfer Note – WTN or Consignment Note for Hazardous Wastes).

For scheduled collections of general waste and recyclables collected by our approved suppliers we operate under an annual Duty of Care WTN and no further paperwork is required. However for adhoc and special waste collections a WTN or Consignment note is required.

These notes must be completed for every load of waste we pass to others (i.e. that leaves our site/campus to go to a contractor). They show details of the carriers and site operators who handle our waste what they are dealing with – it ensures safe and legal management. They also ensure a clear audit trail from when the waste is produced until it is disposed of.

These notes must be completed and signed by both the person sending the waste and the person collecting the waste. The information on the WTN must include:

- A description of the waste – including the appropriate EWC Code
- How the waste is contained or packaged
- The quantity of the waste
- The place, date and time of transfer
- The name and address of both parties (producer and receiver)
- Details of the permit, license or exemption of the person receiving the waste
- Pre-treatment declaration?

The University is required to keep copies of all WTN's and Consignment Notes for two and three years respectively and must be able to produce them on demand to our environmental regulator or local council. As a result departments are required to scan in any documentation received and email this to waste@lboro.ac.uk for central archives but also to keep the documentation for the required period of time.

Name: _____Date: _____

Time Start: _____Time Finish: _____

1. How do you dispose of waste materials?

Answer   score

1._____
_____
_____

Operation Sheet 2	Practical Demonstration (Extracting an SMD)

PURPOSE: To **Extract** SMD Cell phone properly and without damage the cell phone board.

Equipment and Tools for cell phone **Extract** SMD.

Tools	Equipment
Flat and Philips screwdriver kit	Digital Multi-meter
Soldering Iron, Soldering Station equipment's, PCB holder, PCB Cleaner, Tweezers, Hot Air Blower,	Faulted cell phone
	PPEs
	Clean and ESD free work bench
side cutting plier	

PROCEDURE:-first try to check your safety

Follow the following steps to the cell phone Extract.

step1. Select the required cell phone to Extract.

Step 2. Paint the Paste Flux to the surface.

Step 3. Heat up Hot Air Blower

Step 4. Adjust the balance of the temperature

Step 5. Use Tweezers to avoid the movement of the parts

LAP TEST #1	Practical Demonstration (Re-solder SMD)

Instructions: You are required to perform the following individually with the presence of your teacher.

A. Tools & Materials

1. Nokia 3310 board or any motherboard
2. Maintenance Plate Board
3. Maintenance Plate Stand
4. Hot Air & Soldering Station
5. Tweezers
6. Soldering Flux

B. Procedure

Prepare SMD. If it is a BGA IC, rework it.

Step 1.Prepare hot air soldering iron station. Plug into outlet. Turn the station on. Set operational air and heat combination and wait for few minutes for the heat to stabilize before using.

(Air = 4.0, Heat = 4.0)

Step2. Place soldering flux on the SMD, i.e. CCONT BGA IC of Nokia 3310.

Step. 3Apply the hot air station nozzle over the SMD at about 1 cm and start to move the nozzle counterclockwise. Try to move the BGA IC occasionally until the BGA IC is lodge in its place.
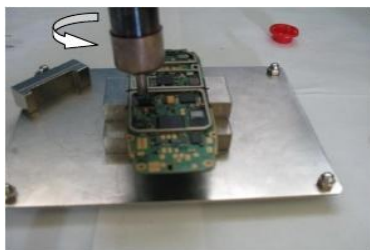
Instruction Sheet	LG26: Install additional/ enhancement features

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- ↓ Enhancements and applications
- ↓ Advise/orient Customers' on the operation of additional operator services

This guide will also assist you to attain the learning outcome stated in the above. Specifically, upon completion of this Learning Guide, you will be able to –

- Install additional enhancement features and special application.

Learning Instructions:

32. Read the specific objectives of this Learning Guide.

33. Follow the instructions described below

34. Read the information written in the "Information Sheets". Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.

35. Accomplish the "Self-checks" in each information sheets.

36. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-checks).

37. If you earned a satisfactory evaluation, proceed to "Operation sheets and LAP Tests if any". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity.

38. After you accomplish Operation sheets and LAP Tests, ensure you have a formative assessment and get a satisfactory result;

39. Then proceed to the next Learning guide.

1.1 Installing enhancements and applications to the unit based on customers' request and manufacturers' recommendation

1.1.1 Install software from outside the Android Market on your Android phone

Even though there are thousands of titles in the Android Market, there's still a lot of great software that isn't available in the Market. Here's how to install a non-Market application on your Android device.

If you find must-have software that is not available in the Android Market, you can install it on your Android phone without going through the Market. Here's a walk-through of the simple process. **Note:** The AT&T Samsung line of phones does not allow installation from unknown sources. I think this is an unfortunate mistake on the part of AT&T/Samsung.

Step 1: Configure your smartphone

You have to enable a non-Market application installation on your phone before you will be able to install third-party software. To do this, follow these steps:

1. Tap Menu.
2. Tap Settings.
3. Tap Applications.
4. Check the box labeled Unknown Sources.

Your Android phone is ready to accept the installation of software from outside the Android Market.

Step 2: Locate the software

There are a number of good sites that allow you to download Android apps. One such site is AndAppStore, where you can download a number of apps you won't find in the Android Market. The file will have to be in the format .APK (Android Package).

Step 3: Install a file manager

You will need to be able to locate and install the file from within the file manager. The file manager you install doesn't really matter, as long as you can navigate around both internal and external storage. I highly recommend the Astro File Manager (there is both a free version and a paid version), which you can install from the Android Market.

Step 4: Download the software

Download the software from your Android phone's browser. You could also download the software to your PC and then copy the .APK file to your external storage (as long as your file manager can see the external storage).

Regardless of the method you use, remember to make note of the location where you saved the file; otherwise, you will have to spend some time hunting around the file structure of your phone in order to install the software.

Step 5: Install the software

Open your file manager and navigate to where you saved the .APK file. (This is why it's so important to remember where you saved the file.) Tap that file, and you should have the option to open the AppManager (**Figure**). **Figure**
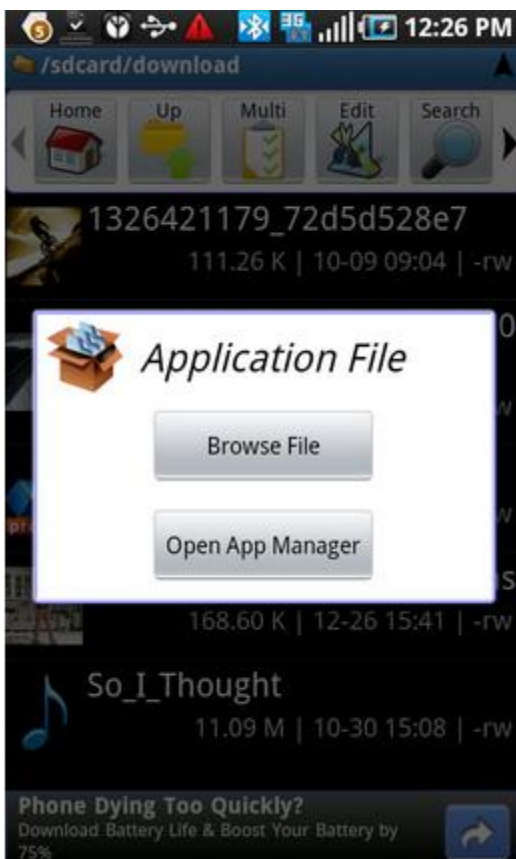
Fig 1.1

When you select Open App Manager, the Application Manager will open (**Figure B**). This tool allows you to see information about the application. From here, click a single button and the application will install. Once the installation is complete, go back to your application drawer, and you should see it listed among the installed applications. **Figure B**
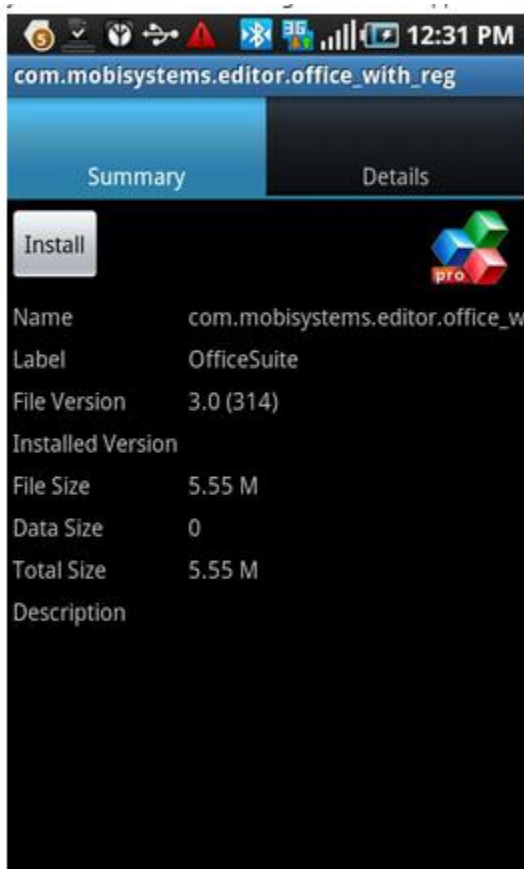
 fig 2.2

Step 6: Disable Unknown Sources

1. Tap Menu.
2. Tap Settings.
3. Tap Applications.
4. Uncheck the box labeled Unknown Sources.

If you leave this option enabled, your Android phone could be vulnerable to the installation of malicious software. Although this is a hassle, it's a precaution you should take.

Use caution

You always want to make sure the third party, non-market applications you are installing are safe to install. If you download the software from a known, reliable source, you should be fine, but use caution when doing so to avoid the installation of software that could be malicious.

- **How to install the mobile software?**

A short generic description of the options available for installing the mobile software on your mobile device.

From the Downloads page, you need to get the **GS-911 Downloader** utility. This is a Windows utility and should be run on any Windows PC/Laptop. See the F.A.Q.: "What does the GS-911 Downloader do?"

When you press the "Download Options" button on the GS-911 Downloader window, a web page will open in your web browser that shows all the download links available for your GS-911 device. Browse down to the Mobile Software section and select the type of software that is appropriate for your device... i.e. the Android app for an Android device and the Blackberry app for a Blackberry device, etc. You should be seeing something similar to the following (versions and dates might change):

You basically have 2 options, highlighted as "1" and "2" on the screenshot above. My preference is definitely Option 1. Here is a brief description of the options:

Option 1: Email download link to phone

When you click on this link, it will open the default email client on your PC with the link already populated in the body of the email... you simply add the email address that you want to send it to. Make sure this is an email that you can access on your mobile device... If you don't have one (highly unlikely), you can register on gmail.com for free.

Once you open the email on your mobile device, simply click on the link and this will install the software. You might also have to enable 'install from unknown sources' in your phone settings.

Option 2: Download the install package and manually install it on your mobile device

As the heading suggests, you download the install package (typically: right-click, save-as...). This will now be somewhere on your PC... and it is not our responsibility to teach you how to install a package on YOUR mobile device ;-) Manual installation procedures differ from device to device, manufacturer to manufacturer and are even different (or prohibited) for various Operators (AT&T etc.)... if you need help on the manual install... Google is your friend!

1.2Smartphone Repair

Smartphone repairing business is flourishing in the same speed as the smart phone market. With more and more people now using smart phones like Android, iPhone, Blackberry, China made Smartphone etc, the smart phone repair business is bound to grow since these smart phones are electronic devices and they will never last for ever. There are online tutorial and course available that can provide you some training on how to repair smart phones. But one can master the business only with practice. Practice makes a man perfect. Initially you may make some mistakes or even damage some smart phone but eventually anyone can learn how to repair smart phone.

For someone who want to do simple DIY (Do it yourself) repairing, online videos and tutorials or Guides in PDF format is enough. But for people who are looking for deep knowledge on smart phone repairing from business point of view, it is important to learn few of the basic theory and the do some practical training.

Following are some of the basics that one must learn to master the art of smart phone repairing:

2.1.1The Basics of Smartphone Repairing

- Assembling & disassembling of different types of smart phones.
- Knowledge of different parts of smart phone and their function.
- How to use Multi meter.

Understanding Hardware of Smartphone

- Understanding of Circuit Board / Motherboard / Logic Board.
- How to check faulty parts and how to replace them.
- Fault finding & troubleshooting.

- How to repair different hardware problems.

Understanding Software of Smartphone

- Proper understanding of smart phone operating system including Android and iOS.
- Understanding types of software faults.
- Flashing smart phones.
- Upgrading operating system.
- Unlocking of handsets through codes and software.

Tools to Repair Smartphone

Before you start repairing any smart phone, it is important to have the right tools and took kit. Modern smart phones are very delicate and sensitive to ESD (Electrostatic Discharge). Hence it is important to have the right and ESD-Safe tools.

Following are some the must-have tools that you will need to repair and brand and any model of smart phone:

- A workbench or work table with layer of ESD-Safe mat that is properly grounded. Remember that without proper grounding, ESD-Safe mat is good for nothing.
- T4, T5 and T6 precision screwdriver. These three screwdrivers is sufficient for most repairing jobs.
- Suction Cup – Used to remove glass panel of a smart phone.
- SIM Card Eject Tool – Used to safely remove the SIM card from iPhones.
- Spudger – Used to disconnect connectors, remove thermal paste, pry off components etc.
- Opening Tool – Used to safely pry open smart phones without scratching the case, glass, or internal components.
- ESD-Safe Tweezers – Used for picking up and handling screws and other small components.
- Opening Pick – Can be used for prying, sliding, separating etc.
- Soldering Iron or Soldering Station.
- Hot Air SMD Rework Station.

1.2.2There is Complete List of Tools to Repair Mobile Cell Phone

Most Common Smartphone Repairs

While there can be different problems with a smart phone, studies and observations have shown following major problems:

- **Screen cracked or smashed** – 60 to 65%
- **Water damage** – 20 to 30%
- **Charging connector damaged** – 10 to 15%

Other problems include:

- Broken LCD Screen or Touch screen.
- Broken or Faulty PDA or External Touch screen (glass / digitizer).
- Cracked, Broken or Faulty Internal LCD Display.
- Charging connector / USB connector / dock broken or faulty
- Damage due to Water or any other Liquid.
- Unlock a Locked phone.
- No Network Signal.
- No Wi-Fi
- Bluetooth Problem.
- Data retrieval from dead phone.
- Not powering / not charging / no signs of life or Dead.
- Speaker / Microphone / Loudspeaker / Ringer / No Sound problem.
- Keypad buttons not working.
- Home button problem.
- Broken volume / power / camera button problems.
- SIM card / SD card problems.
- Camera problems.
- Phone is freezes / crashing / won't start up
- Replacement of housing.
- Headphone Socket problem.

Self-check 1	choose

Name: _____Date: _____

Time Start: _____Time Finish: _____

1. One of the following is not the step for configuration of smart phones

   A. Tap menu
   B. Tap setting
   C. Speaker setting
   D. Tap application

2. Which one of the following is not basic principle for smart mobile maintenance?

   A. Assembling & disassembling of different types of smart phones

   B. Knowledge of different parts of smart phone and their function

   C. How to use Multi meter
   D. none

Answer   **score**

   1._____
   2._____

Operation sheet 1	Configure your smartphone

PURPOSE: Configure your smartphone

Required tool/equipment: smart mobile phone

Procedure: first try to check your   safety

      Step1.Tap Menu.

      Step2.Tap Settings.

      Step3. Tap Applications.

Operation sheet 2	Install software from outside the Android Market on your Android phone

PURPOSE: Install software from outside the Android Market on your Android phone

Required tool/equipment:

Procedure: first try to check your safety

      Step1: Configure your smartphone/from operation sheet 1

      Step2: locate the software from trusted site

      Step 3:install the afile manager

      Step 4 :donload the software

      Step5:install the softwa

Information sheet 2	Advising or orienting customers' on the operation of additional operator

2.1What is Operation strategy?

A plan specifying how an organization will allocate resources in order to support infrastructure and production. An operations strategy is typically driven by the overall business strategy of the organization, and is designed to maximize the effectiveness of production and support elements while minimizing costs.

Customer Relationship Management
In its purest and most literal form CRM stands for Customer Relationship Management. A system or strategy for managing client interactions, dealing with future and current customers, optimising and systematising relationships.

What is the CRM process?
CRM process involves the activities and strategies that companies use to manage their interaction with current and potential customers. ... Harness that relationship even with prospects and they'll be converted into actual customers.

Why is CRM important to your business?

CRM or Customer Relationship Management may be a strategy for managing associate organization's relationships and interactions with customers and potential customers. A CRM system helps many firms to keep connected to customers, contour processes, and improve profits

A CRM system consists of a historical view and analysis of all the acquired or to be acquired customers. This helps in reduced searching and correlating customers and to foresee customer needs effectively and increase business. ... The strongest aspect of Customer Relationship Management is that it is very cost-effective.

Customer relationship management (CRM) is an approach to manage a company's interaction with current and potential customers. It uses data analysis about customers' history with a company to improve business relationships with customers, specifically focusing on customer retention and ultimately driving sales growth.

Self-Check #2	Choose and T/F

Name: _____Date: _____

Time Start: _____Time Finish: _____

Instruction: Answer all the questions provided correctly, if you have some clarification regarding the test just raise your hand and ask the assistance of the teacher.

Part I. Give your Answer for the Following Questions

1. _____ Process involves the activities and strategies that companies use to manage their interaction with current and potential customers.

    A. ESD

    B. PPE

    C. CRM

    D. SMD

Part I. Say true or false

2. Customer relationship management (CRM) is an approach to manage only a company's interaction

3. A CRM system consists of a historical view and analysis of all the acquired or to be acquired customers.

Note: **Satisfactory rating –5 points**　　　　　**Unsatisfactory - below 5 points**

You can ask your teacher for the copy of the correct answers.

Answer　　　　　　　　　　**score**

1_____

2._____

3._____

Prepared by:-

No	Name	Edu. Background	Experience in TVET	Addresses
1	Alemseged Getachew	MA in vocational management	17Years	getachewalemseged@yahoo.com alemsegedabt@gmail.com
2	Abel Molla	Bsc in Cont.En	9 Years	Molla1@gmail.com
3	Gashaw Mamo	Msc in Cont.En	16 years	gashawshalom2010@gmail.com
4	Engida Tefera	Msc in Com.Technology	7 Years	Tefera.engida@gmail.com
5	Nardos Daniel	Bsc in Cont.En	4 years	Leulmoke45@gmail.com
6	Tamirat	Msc in El.Comm.En	12 Years	
7	Zewdu	Msc in El.Comm.En	12 Years	

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