

AT Commands

Meraj Alam

Syscom Corporation Limited

Abstract- In this paper, AT Command, which is used to instruct the modem, is discussed. AT Command as a Proactive Command (command that is being executed by SIM) will also be discussed in this paper. In addition, several applications that are being used to instruct the modem are discussed.

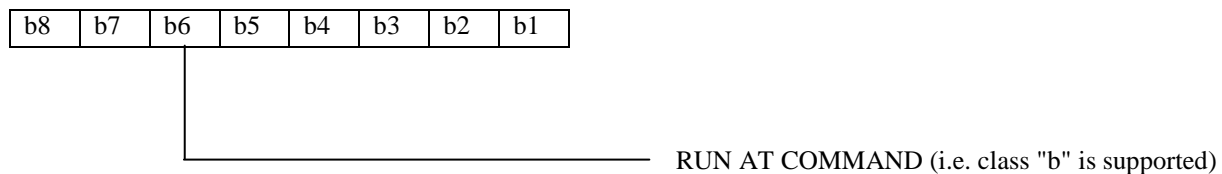
Index Terms- Attention (AT), General Packet Radio Service (GPRS), International Mobile Equipment Identity (IMEI), International Mobile Subscriber Identity (IMSI), Subscriber Identity Module (SIM), Short Message Service (SMS), 3rd Generation Partnership Project (3GPP), Protocol Data Unit (PDU), COMmunication Port (COM Port).

I. INTRODUCTION

The abbreviation for AT is “Attention”. AT Commands are basically the commands to instruct the Modem. Due to this reason, AT commands are also known as Modem Commands. The command line starts with “AT” or “at”. Now, we have variety of GSM/GPRS modems and the modem enabled mobile phones. So, with the help of AT Commands we can instruct/control the behavior or change few characteristics of mobile phones. In this paper, the various tasks that can be achieved using AT commands with a GPRS/GSM modem or Mobile Phones will be described. Remember one thing that Mobile Phone manufacturers usually do not implement all AT Commands, Command Parameters and Parameter Values in their Mobile Phones. Also, the behavior of the implemented AT Commands may be different from that defined in standard. In general, GSM/GPRS modems designed for wireless applications have better support of AT commands than ordinary mobile phones. In addition, some AT commands require the support of mobile network Operators for network related commands such as Send SMS, etc.

II. MOBILE PHONES AND AT COMMANDS

There are several kinds of mobile phones available in the market that supports AT commands. To know whether AT command is supported by the mobile phone, there is a need to understand the command known as Terminal Profile. Terminal Profile is issued by the mobile phones to inform SIM about what all capability the mobile phone has. The eighth byte in Terminal Profile command contains the information of AT command as shown below: (For in-depth knowledge of Terminal Profile command refer [2])



III. USE OF AT COMMAND

Here are some of the common tasks that can be performed using AT commands with a GSM/GPRS modem or modem enabled mobile phone which are as below:

1. Get basic information about the mobile phone. For example, name of manufacturer, model number, IMEI number and software version.
2. Get basic information about the subscriber. For example, MSISDN and IMSI number.
3. Get the current status of the mobile phone or GSM/GPRS modem. For example, mobile phone activity status, mobile network registration status, radio signal strength, battery charge level and battery charging status.

4. Data connection or Voice connection to a remote modem.
5. Read, Write, Delete and Send SMS and get the notifications on receiving the new SMS.
6. Read, Write and Search phonebook entries.
7. Get or change the configuration settings of the mobile phone or GSM/GPRS modem. For example, SMS center address and storage of SMS messages whether SIM or Phone.

Apart from the above tasks, there are lots of more tasks that can be performed using AT Commands. For Example, Security Related Tasks, Change the Display Screen of Mobile Phones (Where should Time, Operator Name get displayed), etc.

IV. TYPES OF AT COMMAND

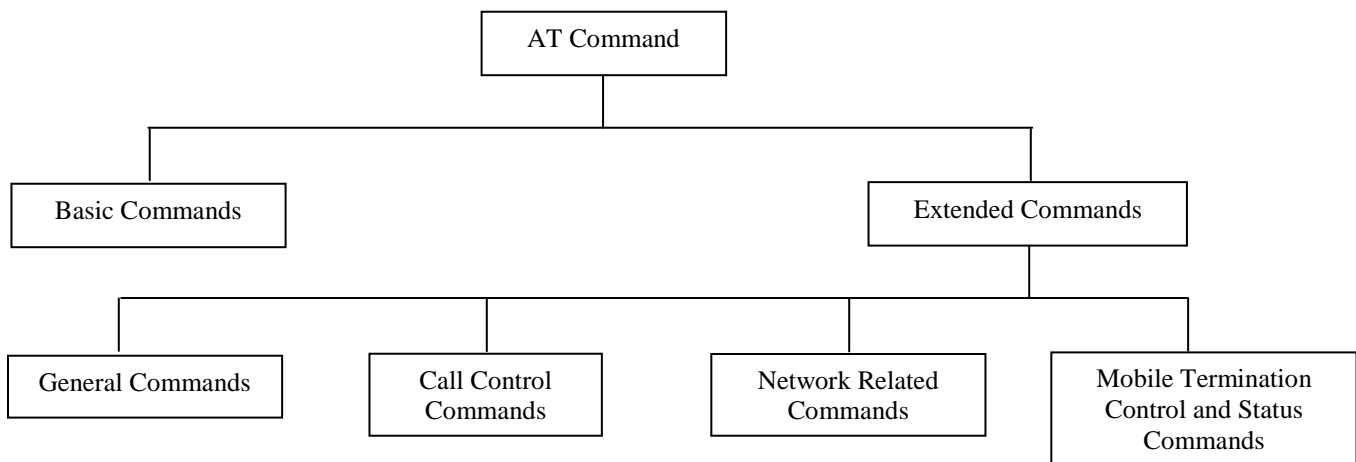
There are so many discrepancies in types of AT Command and their names. But if we analyze on broader end; AT Commands are broadly differentiated in two categories as below:

1. Basic Commands
2. Extended Commands

Basic Commands are those commands that do not start with '+'. For Example, ATD^{Note} (For Dial), ATA^{Note} (For Answer).

Extended Commands are those commands that starts with '+'. For Example, AT+CMGS^{Note} (For Send SMS). All GSM AT Commands are Extended Commands.

Further, Extended Commands are more classified in various categories that are described diagrammatically as below:



Note: “AT” Command Line Character is not the part of Command. It’s just to identify that these are AT commands. AT command line prefix is to notify the software that the commands to be executing is a set of AT commands or Modem Commands. Windows has provided the basic program to execute the AT commands i.e. Windows Hyper Terminal.

V. SYNTAX OF AT COMMAND

In 3GPP Specification of AT Command, all commands have been written in uppercase letters. However, many GSM/GPRS modems and mobile devices support uppercase or lowercase letters i.e. case insensitive. So, case sensitivity of AT Commands depends on the manufacturer of the mobile device.

The General syntax of AT Commands is as described below:

1. All command lines must start with “AT” and end with a carriage return (<CR>) character.
 - a. For Example: AT+CMGL<CR> (To list all unread message)
2. A command line can contain more than one AT command. Only the first AT command should be prefixed with “AT”. There should be semi colon to separate the two commands.
 - a. For Example: AT+CMGL;+CGMI<CR> (To list all unread message, get the manufacturer name of the mobile device)
3. String must be enclosed between double quotes.
 - a. For Example: AT+CMGL=“ALL” <CR> (To read all the SMS)
4. Information responses and result codes always start and end with a carriage return character and a linefeed character.
 - a. For Example: After sending the command line as AT+CGMI<CR>, the mobile device will send the response as
<CR><LF>Nokia<CR><LF>
<CR><LF>OK<CR><LF>

On any of the Hyper Terminal Program, it will look like as:

```
AT+CGMI -> Command Line
Nokia -> Information Response
OK -> Result Code
```

The result code “OK” treats as the end of the response. It indicates no more data will be send from the mobile device.

VI. ERROR CODES

Error Codes are the final result codes through which Mobile device informs the cause of failure of the commands. There is an AT Command through which you can bind any mobile device to throw the error code on occurrence of the failure of command.

There are two types of Error Codes are as follows:

1. CME Error Codes – GSM Device Error Codes
2. CMS Error Codes – GSM Network Related Codes

The Command which is used to set the error code output is AT+CMEE which comprise of three possible values as below:

1. 0, that means +CME Error shall not be used.
2. 1, that means Error will display as numeric value.
3. 2, that means Error will display as verbose (i.e. statement).

Below are the illustrations of different cases (Different values of +CMEE command) on +CGMI Command:

Case 0:

```
AT+CMEE=0
OK
AT+CGMI
ERROR
```

Case 1:

```
AT+CMEE=1
OK
AT+CGMI
+CME ERROR: 1
```

Case 2:

```
AT+CMEE=2
OK
AT+CGMI
+CME ERROR: no connection to phone
```

Below are the Error Codes and their meaning:

- CME ERROR: 0 Phone failures
- CME ERROR: 1 No connection to phone
- CME ERROR: 2 Phone adapter link reserved
- CME ERROR: 10 SIM not inserted
- CME ERROR: 11 SIM PIN required
- CME ERROR: 12 SIM PUK required
- CME ERROR: 13 SIM failures
- CME ERROR: 14 SIM busy
- CME ERROR: 15 SIM wrong

VII. AT COMMAND AS PROACTIVE COMMAND

AT Commands as Proactive Command are mentioned in 3GPP standard, refer [2] for the structure of proactive command. The “AT Command String” is exactly configured as discussed above and can be referenced from [1].

VIII. SEND SMS APPLICATION USING AT COMMAND

By default, Windows has provided software named as “Windows Hyper Terminal” through which you can send AT command to the Modem or Modem enabled device. You can also use your own application for Sending AT Command that will customize as per the requirement. I am going to show a sample application that will be used to broadcast SMS to the various subscribers.

This application has been developed in JAVA that will Send SMS to all of the numbers provided in an excel sheet as below:

	A	B	C	D
1	Contact Name	Contact Number		
2	Meraj Alam	1111111111		
3	Prem Kumar	2222222222		
4	Bharat Bhanjana	3333333333		
5				
6				
7				
8				

First of all, we need to import package “javax.comm” which is not available with JDK. This package contains several APIs that is used to interact with the COM port available in the system. This package can be downloaded from net as per the instructions given:

Next step is to get all the available ports on your system as:

```
Enumeration ports = CommPortIdentifier.getPortIdentifiers();  
while (ports.hasMoreElements()) { }
```

Get the serial port from the available port list and execute the commands on the port that your device has been connected as:

```
If (port.getPortType() == CommPortIdentifier.PORT_SERIAL )
```

Initialize the Serial Port Object as:

```
serialPort = (SerialPort) port.open(“AT Command App”, 2000);  
serialPort.setSerialPortParams(2400, SerialPort.DATABITS_8, SerialPort.STOPBITS_1, SerialPort.FLOWCONTROL_NONE);
```

Get the Output Stream object for writing to the port as:

```
outputStream = serialPort.getOutputStream();
```

Send the AT Command to output Stream as:

```
String data = “AT+CMGS=\\” + data + “\\”\r\n”;  
// data is the variable that contains phone number from excel sheet.  
outputStream.write(data.toString().getBytes());
```

```
String data = "Hello " + data + '\032';  
// data is the variable that contains name from excel sheet.  
// '\032' is the character code for CTRL-Z.  
outputStream.write(data.toString().getBytes());
```

After sending the AT Command as output stream, get the Input Stream Object to read the response from port that was given by mobile device. This application can be customized further to have the pre defined message column in excel sheet. This application can be used to send invitation across group of people in one click.

IX. CONCLUSION

So, we can implement various applications that can control the modem behavior, execute various functionalities related to GSM domain, Network, etc using AT Commands. Using AT as proactive command, we can also build various applications on SIM card that can instruct modem enabled phone to execute various tasks such as change the vibrator mode to ringer mode (this application is useful in case we forget where we have kept our handset and it is on vibrating mode), change the display characteristics of Handset, access all the messages that is stored on phone memory or SIM memory, etc. As it is evident from the above research that AT commands can be useful to built several applications and hence I recommend that Mobile manufacturers should consider more AT command set in the mobile terminals.

ACKNOWLEDGMENT

I would like to acknowledge my colleagues for supporting and encouraging me throughout the course work.

REFERENCES

- [1] 3GPP TS 27.007 V6.3.0 (2003-06) 3rd Generation Partnership Project; Technical Specification Group Terminals; AT command set for User Equipment (UE).
- [2] 3GPP TS 11.14 version 8.18.0; Digital cellular telecommunications system (Phase 2+); Specification of the SIM Application Toolkit (SAT) for the Subscriber Identity Module - Mobile Equipment (SIM-ME) interface.

AUTHORS

First Author – Meraj Alam, Experience: Currently working with Syscom Corporation Ltd, a leading telecom company dealing in SIM and SMART cards, **Email Address:** meraj.bpositive.alam1@gmail.com