

FINAL PROJECT
AKTEL CONTACT CENTER

Prepared For

S I Nusrat A Chaudhury
Associate Professor
Department of Business Administration
Head, Career Counseling Center

Prepared By

Saima Malek Lovely

ID # 2004-2-10-270

25th April, 2009



AKTEL Milestones

timeline

2007

Financial Express- Standard Chartered
CSR Award 2006
Deshor Kagaj Business Award 2006



2006

Established more than 5 million customer base
Establishment of more than 3500 BTS in 451
upazillas, covering 90% Thanas.
Successful completion of Back Bones in
Dhaka-Ctg, Dhaka-Sylhet, Dhaka-Bogura,
Dhaka -Khulna



2004

All 61 Districts covered
Established 1 million customer base
Established inter-operator SMS
Launched International Roaming



2002

Launch of SMS service



2000

Dhaka Chittagong Backbone connectivity



1997

Official launch in Dhaka



2005

Established 2 million customer base
Independent unit for Corporate Care
First to launch e-fill
First to launch 1 second pulse on Postpaid
First to launch 10 second pulse on Prepaid
International SMS with 500 operators
Established customer base of 3 million
First telecom operator to receive ISO
9001:2000 certification



2003

First to launch Prepaid Mobile Standard



2001

Launch of One Prepaid



1999

First to launch Mobile plus BTTB incoming



1996

AKTEL received
the license





Table of Contents

Topics	Page No
Acknowledgement.....	i
Letter of Transmittal.....	ii
Executive Summary.....	iii
Introduction.....	iv
1. Origin of the report.....	iv
2. Objectives of the report.....	iv
3. Scope of the report.....	iv
4. Methodology.....	v
5. Limitations.....	v
My Project.....	vi
About AKTEL.....	vii
Introduction to TMIB.....	viii
 PART I 	
1 AKTEL Contact Center.....	1-2
1.1. Steps to follow when answering calls (as in August 2005).....	2-3
1.2. Questionnaire regarding customer Satisfaction.....	3-4
1.3. Questions Regarding the Betterment of AKTEL Contact Center.....	4-5
1.4. Recommendations.....	5-6
 PART II 	
2. Major Value Added Services (VAS)	7
2.1 AKTEL GoonGoon: The Marvel of GSM Technology.....	7
2.2 Friends & Family (FnF).....	8
2.3 Recharge AKTEL Prepaid Account.....	8
2.4 FAQ Regarding International Roaming (AIRS).....	9-11
2.5. Bill Payment for Postpaid.....	12
3. Some of the Latest Promotional Offers	13
3.1 AKTEL Directory Service.....	14
3.2 Balance Transfer (New).....	14-15
3.3 AKTEL Call Block (new).....	16
3.4 AKTEL Phone Book Backup.....	16
3.5 AKTEL Instant News.....	17-18
3.6 AKTEL Café8000.....	19
3.7 AKTEL GPRS (Spice).....	20
3.8.AKTEL Opener.....	21
3.9 Call Waiting / Holding / Divert / Forward.....	21
3.10 Call Conferencing.....	22
3.11 AKTEL Voice SMS.....	23
3.12 AKTEL GopShop.....	24
3.13 AKTEL Missed Call Alert.....	24

3.14 International Voice SMS.....	24
3.15 SMS Banking.....	25-26
3.16 SMS2EMAIL.....	27
3.17 Voice Mail Service.....	27
3.18 Voice Greetings Service.....	27
3.19. Incoming Bonus.....	28

PART III

4 Global System for Mobile Communication (GSM).....	29
4.1 Definition.....	30
4.2 Overview.....	30
4.3 Topics.....	30
4.3.1 A. Introduction: The Evolution of Mobile Telephone Systems.....	31
4.3.2 B. GSM.....	32
4.3.3 C. The GSM Network.....	33
4.3.3.1 The Switching System.....	33
4.3.3.2 The Base Station System (BSS).....	34
4.3.3.3 The Operation and Support System.....	35
4.3.3.4 Additional Functional Elements.....	35
4.3.4 D. GSM Network Areas.....	36-37
4.3.5 E. GSM Specifications.....	38
4.3.6 F. GSM Subscriber Services.....	39
4.4 The Transition from Analog to Digital Technology.....	40
4.4.1 The capacity of the system.....	40
4.4.2 Compatibility with other systems such as ISDN.....	40
4.4.3 Aspects of quality.....	40
4.5 The GSM network.....	41
4.5.1 Architecture of the GSM network.....	41
4.5.2 Mobile Station.....	41
4.5.3 The Terminal.....	42
4.5.4 The SIM.....	42
4.5.5 The Base Station Subsystem.....	42
4.5.6 The Base Transceiver Station.....	42
4.5.7 The Base Station Controller.....	42
4.5.8. The Network and Switching Subsystem.....	42
4.5.9. The Mobile services Switching Center (MSC).....	43
4.5.10 The Gateway Mobile services Switching Center (GMSC).....	43
4.5.11 Home Location Register (HLR).....	43
4.5.12 Visitor Location Register (VLR).....	43
4.5.13 The Authentication Center (AuC).....	43
4.5.14 The Equipment Identity Register (EIR).....	43

4.5.15 The GSM Interworking Unit (GIWU)	44
4.5.16 The Operation and Support Subsystem (OSS)	44
4.5.17 The GSM functions	44
4.5.18 Transmission	44
4.5.19 Radio Resources management (RR).....	44
4.5.20 Handover.....	45
4.5.21 Mobility Management.....	45
4.5.22 Location management.....	46
4.5.23 Authentication and security	46
4.5.24 Communication Management (CM)	46
4.5.25 Call Control (CC)	46
4.5.26 Supplementary Services management.....	47
4.5.27 Short Message Services management	47
4.5.28 Operation, Administration and Maintenance (OAM)	47
4.6 GSM services	48
4.6.1 Teleservices.....	48
4.6.2 Bearer services	49
4.6.4 Supplementary Services	49-50
5. Conclusion	50
6. Acronyms	51-53
7. Bibliography	53

Acknowledgement

In preparing this report I have got the assistance of some respectful individuals. Without the co-operation of them it would be not possible for me to prepare this project report.

In the very beginning, I would like to express my profound gratitude to the God Almighty for giving me the strength and the ability to finish the task within the scheduled time.

I also thank and express my gratitude to my Project Supervisor S I Nusrat A Choudhury, Associate professor and head of career counseling department of East West University. Without his guidance and valuable suggestion it was very difficult for me to prepare this report.

Then I would like to thank the Career Counseling Center, East West University for allowing me to do the final Project.

I also want to thank Mrs. Barna Ahmad (Manager of Contact centre), Mr. Ariful Aziz, Ms. Hazera Khatun (Executive of Contact Centre) and very special thanks to Md. Ali Ershad Mithun (Part Time Executive of Contact Centre and student of EWU). During my project I have enjoyed the company of them. My heartiest gratitude goes to every one of AKTEL Contact Center Executives for their friendly attitude.

Letter of Transmittal

25th April, 2009

To

S I Nusrat A Chaudhury
Associate Professor
Department of Business Administration
Head of career counseling Department
East West University
43, Mohakhali
Dhaka -1212

Subject: Submission of Project Report.

Dear Sir,

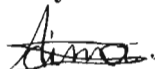
It is my great honor to submit the project report on “AKTEL Contact Center” as full time of my BBA degree requirement. I have tried my level best to fulfill the requirement of the course.

Doing project on AKTEL Contact Center you helped me to fulfill the requirement of preparing the project report & subsequent of this report is a very valuable experience for me as it helps to combine practical & theoretical knowledge.

I am much obliged to you because of your consideration regarding my report, which provided me the opportunity to do this project report.

Please notify me if you have any query on this project.

Sincerely Yours



.....
Saima Malek Lovely

Executive Summary

This is the era of science and technology. Almost all the sector of life is being inclined by it. Business and economic sector also have the strong blow of it. As far as the present perspective is concerned, people want faster service to cope up with the modern life and hence the various forms of service provides by the telecommunication industry as well as their Contact Centers, with the help of Global System for Mobile Communication (GSM)

Technology provides our life with a spectacular pace. Even 10 years back it was merely a luxury to use the cellular technology but soon people came to realize its necessity. So cellular technology in addition to the contact center becomes the demand of the people. Now everybody concentrates on improved, smart and fastest service from the mobile operator. As contact center gives all facilities, instant service as well as faster solutions of various problems the demand for this service is gradually increasing. Every single person of this planet is much aware of the services offered by the operators. The following description, documents and pictorial representation will help us to realize the necessity of the various services provided by the mobile operator and also the function of contact center, implemented by GSM Technology.



Introduction

Origin of the report

Project Report of East West University is a graduation requirement for the BBA students. This report is a partial requirement of the Final Project. Assigned by the institutional supervisor, this report is prepared for Final project and placement committee, based on the project assigned by Market Research and Development department, Sales and Marketing Division of TM International (AKTEL).

Objective

The broad and over all objective of this report is to provide with an over view of the learning as an employee at AKTEL during the organizational attachment period so that the theoretical learning can be related with the real life business situation.

This report aims to achieve the following specific objectives:

- ⊕ Extensively describe AKTEL as an organization providing cellular phone service in Bangladesh, its products and services.
- ⊕ To portray the Global System for Mobile Technology i.e. GSM as the brain and life blood of the cellular technology.
- ⊕ Make a projection of the future development and potentials.
- ⊕ To identify the plethora of bottlenecks faced by the Contact Center and ways to remove all those hindrances.

Scope of the study

This report renders a close view at AKTEL Company with main focus and emphasis on the Contact Center, its functions since its inception. It also sheds light on the Products and services its potentials. The report is written from the point of view of AKTEL, as this report is expected to give a clear link in between the Contact Center and the product and service provided by AKTEL with the ultimate relationship with the Global System for Mobile Technology

Methodology

Type of business research used in this report is of descriptive nature. Through this descriptive research this report seeks to determine the answers to who, what, where and how questions of the Contact Center of AKTEL.

Secondary data analysis was selected as the basic research method.

Data Collection

Data for this report has been extracted from secondary sources, as the descriptive nature of the study to prepare this report calls in for existing facts and information compilation.

Source of Secondary Data

Majority of the secondary data was obtained from the Contact Center and IT Department of AKTEL Ltd. Annual reports of other Mobile operators, their official web sites, reports done on the telecommunication sectors and information obtained from the Internet, augmented this report to take a comprehensive shape.

Limitations

The major limitation factor for this report was primarily the reluctance and strict adherence to confidentiality maintenance attitude shown by the officials of Contact Center. Most of the relevant literature and study materials on the technical function were not updated, and no comprehensive in-depth study on the GSM could be found. Failed to access more information on the Contact Center as there are some limitations, imposed by the authority. Due to some hindrances I was not allowed to use the detail information about the Value Added Service although the information about VAS is the newest. Furthermore, some information was withheld to retain confidentiality of the companies. So appropriate verifications of some information could not be made.

My Project

Those who are working in the AKTEL contact Center where their main responsibility is to answer the subscriber calls. There are more than 100 million customers of AKTEL throughout the country. Customers may face different types of problems, they may have various queries regarding products and services, or they may have some complaints regarding the same issues. Responsibilities of executives in the CC is to answer their queries, take their complaints, inform them regarding the new products or services and above all ensure the customer's satisfaction.

When any subscriber has any kind of complaint executives take the relevant information from the individual and log the complaint in the Complaint Management System (CMS) to make the complaint available to the relevant department to fix it. To serve the customers they have to obtain information regarding the customer and his connection. Among the software AKTEL uses BSCS for the Post-paid subscriber and Websmap for the Pre-paid customers. There are also some other software which help executives to obtain information regarding different value Added Services (VAS) like: Share A Fill (Balance Transfer), Pretups (Easy Load), Voucher (Refill Card Detail) etc. Executives also use the Intranet of Aktel to obtain information regarding different products and services. Another major responsibility of executives is to respond 8123. 8123 is the sms based help line for the Aktel subscribers. Customers send sms to 8123 regarding their queries, complaints and for other services like: GPRS, Refill Bar etc. Executives have to take necessary actions according to the subject matter of the sms and provide them necessary feedback. Executives have to perform all these activities simultaneously. Customers also do fax in the fax lines regarding different complaints or request like: Bar/Unbar a line, executives also monitor the fax lines and take necessary actions and provide feedback to the customers. Just because of the link between the Product and The Service and the Technical, my project comprises of 3 parts: PART I: The Contact Center; PART II: Product & Services; PART III: GSM Technology.

Executives have to be very sincere and quick responding in all these duties and responsibilities because the company's reputation and customer's satisfaction lies with our services. So executives have to be very careful in providing information and logging complaints. Our main intention is to satisfy, retain and expand the customer base of their company.

About AKTEL

AKTEL is a dynamic and leading countrywide GSM communication solutions provider. It is a joint venture company between Axiata and NTT DoCoMo, Japan. When it has started its journey then it was also join ventured between Telecom Malaysia and AK Khan. AKTEL was officially commenced its operations in 1997 among the pioneers GSM mobile telecommunications provider in Bangladesh.

Covering all 64 districts of the country, AKTEL has become the first mobile operator to connect Tetulia and Teknaf, the northern and southern most points of Bangladesh and the first to provide seamless coverage along the Dhaka-Chittagong highway. AKTEL supports 2G voice, CAMEL phase 2 and GPRS/EDGE service with high speed internet connectivity. It has the widest International Roaming coverage in Bangladesh connecting 440 operators across 203 countries.

AKTEL's GSM service is based on a robust network architecture and cutting edge technology such as Intelligent Network (IN), which provides peace-of-mind solutions in terms of voice clarity, extensive nationwide network coverage, and multiple global partners for international roaming. AKTEL customer centric solution includes value added services (VAS), quality customer care, easy access call centers, digital network security, and flexible tariff rates.

With its strengths and competencies developed over the years, AKTEL aims to provide the best quality service experience in terms of coverage and connectivity to its customers all over Bangladesh.

Introduction to TMIB

TMIB (Telekom Malaysia International Bangladesh) is a joint venture company formed between Telekom Malaysia Berhad and M/S A K Khan Group.

TMIB started its commercial operation in Dhaka, Bangladesh as a GSM cellular operator on the 900 MHz frequency on 15th November 1997. TMIB expanded its operation to Chittagong in March 1998.

TMIB uses the GSM (Global System for Mobile Communication) system as the digital cellular system (running on the 900 MHz frequency). Throughout the years, the network has expanded its coverage to cover all major districts (with the exception of high terrain areas due to government regulation).

The network has also expanded its services to offer some VAS (Value Added Services) such as Call Hold, Call Wait, Voice Mail, Call Forwarding, SMS (Short Message Service), CLIP (Caller Line Identification Presentation), SMS-based Infotainment Services and GPRS.

AKTEL's 24-hour Call Center can be contacted as follows (from December 30, 2006):

From an Aktel mobile: 123 (Tk. 2.3 per minute, VAT inclusive, 30-sec pulse for Prepaid and 10-sec pulse for Postpaid) - from 16.3.07

124 (No longer available since December 30, 2006)

(All Zones, all subscribers – Toll-free for post-paid and Tk. 0.20 per 10-sec. pulse for pre-paid callers)

From other numbers: 01819 400400

Dhaka: 9885467-8 Fax: 9885232 or 9887113

AKTEL Contact Centre fax nos. - 01819234329 - 333 & 8832503 (NEW)
Chittagong: 721411-2

Fax: 724704 (Not available at the moment - confirm by Ctg, Office on 2.7.06)

Customers can e-mail to the call center at: 123@aktel.com

Customers can SMS their queries and complaints to: 8123

Official web site: www.aktel.com

Address of H/O: BRAC Centre, 9th floor, 75 Mohakhali C/A, Dhaka 1212. Tel: 9887149 – 53, Fax: 9885463



PART I

1. AKTEL Contact Center

AKTEL understands that for customer's versatile range of demands for new and innovative products, providing instant information is a must. Which is why 123 provides the customer with both automated assistance as well as direct assistance from AKTEL's trained staff.

A Quick Guide to 123:

For language options -

- For Bengali, press 1.
- For English, press 2.

For Postpaid customers

- For account information (usage, billing and Friends & Family numbers), press 1.
- For information on latest packages, press 2.
- For information on value added services, press 4.
- For information on special services for Postpaid connections, press 5.
- To leave a Voice Message, press 7.
- For direct assistance from Customer Service Executive, press 0.

For Prepaid customers

- For account information (usage, balance and Friends & Family numbers), press 1.
- For information on latest packages, press 2.
- For information on value added services, press 4.
- For information on special services for Prepaid connections, press 5.
- To leave a Voice Message, press 7.
- For direct assistance from Customer Service Executive, press 0.

For General Information (through 01819 400400)

- If the customers do not have an AKTEL number, press # (hash).
- For information on latest packages, press 1.

- For information on value added services, press 3.
- For information on special services for Prepaid & Postpaid connections, press 4.
- For AKTEL address and contact details, press 5.
- To leave a Voice Message, press 6.
- For direct assistance from Customer Service Executive, press 0.

Other 24/7 Customer Support & Assistance Points:

- SMS to 8123 (from your AKTEL number) – (Standard SMS charge and VAT applicable)
- Call to 01819 400400 (from any number)
- Fax to +88 01819 234329 – 333, 02 8832503
- Email to 123@aktel.com

1.1. Steps to follow when answering calls (as in August 2005):

- Greet the customer
- Ass'lamu Alaikum. Aktel Call Centre. xxx speaking. How may I help you?
- Enquiry Reconfirmation
- Use this soon after the customer has stated the complaint/query (there is no need to reconfirm the enquiry if it is a short query such as bill amount).
- Human Touch (depends on the call)
- Use together with Enquiry Reconfirmation, only when the customer displays emotion.
- Be attentive
- Note down all-important information. Do not get the customer to repeat.
- Get & use the customer's name
- Should be done in every call. Remember to use the customer's name at least twice during the conversation. If the customer does not want to give the name or if the name is difficult to pronounce, switch to Sir/ Madam.
- (Note – in case of post paid, refer the customer's name from the cti application and greet the customer by saying "Is this Mr/Mrs XYZ?" Or "Am I speak with Mr/Mrs XYZ?")
- Control
- Take control of the call by asking smart questions. Ask for permission before doing so... "In order to assist you better, may I ask you a few questions?"
- Solution (All 3 steps to be followed based on type)
- Product & Service Solution – Why get it, How to get it, How to use it
- Problem solving solution – Fix it, teach it, Close it
- Order taking – Recap it, Track it, Agree it

- You should deliver the following elements in all calls:
 - Respect
 - Expertise
 - Solution
 - Other standards to be maintained depending on the call
 - Proper Hold Technique
 - No interruption
 - Small Talk
 - Alive & breathing
 - Use of positive words
 - Close the call
 - Mr./Ms. XYZ or Sir/Madam, is there anything else I could do for you?... Thank you for calling Aktel. Have a nice day/evening

1.2. Questionnaire Regarding Customer Satisfaction:

1. How often do you call to Aktel helpline or visit our CCC?

a. Everyday, b. once a week, c. twice a week, d. once every two weeks

2. How has been your experience with Aktel's Customer Care Service?

a. Highly Satisfied, b. More than Satisfied, c. Satisfied, d. Indifferent, e. Dissatisfied.

3. What are the qualities you want to see while you are being attended by a customer care executive?

4. How would you rate your experience with Aktel Helpline service?

a. Highly Satisfied, b. More than Satisfied, c. Satisfied, d. Indifferent, e. Dissatisfied.

5. Do you think the customer care executives at Aktel are highly professional & efficient?

a. Yes, b. No, c. Indifferent

6. Please rank the following Mobile phone operators in terms of Customer Service

7. Please mention some of the positive sides of Aktel's Customer Service

8. Please mention some the negative sides of Aktel's Customer Service

Aktel, Grameen, Banglalink, Warid, Citycell, Teletalk

9. How would you rate the product & service knowledge of Aktel's customer care executives?

Excellent, b. Very good, c. Good, d. Moderate, e. Below standard

10. How would you rate the behavioral aspect of Aktel's customer care executives ?

Highly professional, b. Cordial and professional, c. Not highly professional, d. Discourteous.

11. Please rank the following qualities in order of importance to you as customer while receiving service from Customer service

Prompt service, adequate & accurate information, proper attention, professionalism, confidence & problem solving capabilities.

12. What will be your suggestions as a well wisher of our customer service to better improve our customer service?

13. What is the main reason behind customers accessing Customer service?

a. To know about new product & services, b. Problem solving, c. To enhance their product & service knowledge, d. Make comparison with rival companies

14. Has our customer service been a major reason for your tenure with Aktel?

a. Yes, b. No, c. Indifferent, d. Strongly yes.

1.3. Questions Regarding the Betterment of AKTEL Contact Center:

- To you what is the key to ensuring constant customer satisfaction?
- What is Aktel's motto in ensuing customer satisfaction?
- What are the requirements to be a good customer care executive?
- How would you rate Aktel's customer care service standard?
- What incentives you would like to implement in coming months to make Aktel customer care service a supreme one?
- Where to you want to see Aktel's customer care service in 5 years?
- What is the year-end target of yours in terms of customer care service of Aktel?
- What initiative you think should Aktel take to retain loyal customers?
- What are the challenges & obstacles you have to deal with to ensure quality customer service in a market like Bangladesh?
- What qualities do you think one needs to have as a leader to maintain such a diversified division?

- What motivational tools you would like to implement especially for our Call Centre to get the best out of our Call Center Employees?
- Do you think Aktel's customer service is the best among all mobile operators operating in Bangladesh & why?
- What incentives you would like to take to improve the working environment of our Contact Center?
- How many Customer Care Centers Aktel plans to have at the end of this year?
- What trainings & incentives you think should be given to our Channel members to better ensure quality customer service?
- What initiatives you think should be taken from Management part to reduce the discrepancy between Customer Care Center & Contact Center?
- How important is the motivational level of a customer care executive to perform his job efficiently?
- How are the customers' feedback incorporated in improving customer service standard in Aktel?
- Do you think job rotation among Customer care division will bring better output for the company?
- What has been the real success point of your tenure as "Head of Customer Care" at Aktel?
- What is your immediate goal in relation to Aktel Customer Service?

1.4. Recommendations:

- Increase the number of Customer Care Centers
- Have Customer Care Centers in all cities of Bangladesh
- Reduce helpline call charge
- Have separate hot line numbers for postpaid & prepaid
- 24 hours of IT personnel to solve customer problems
- Involvement of Customer Care Personnel on Product design, launching and pretesting of the product on employee level
- Reduce log in hours at contact center to ensure better service
- Distribute diversified works among executives to increase their enthusiasm for work and efficiency
- Cross Functional activity among Customer Care Centers like people from Contact Center working 2-3 days a week at Customer Care centers and people from Customer Care centers working at contact center to give all the executives exposure to all types of customer service (both wings of practical knowledge)
- Focus at contact Center should be on providing correct information & customer service rather than on giving too much focus on handling, clerical & log in duration
- Work environment at Contact Center needs to be improved immediately to provide employees with at least a tolerable working environment to cope with.
- People at Contact Center need to be given special briefings on product planning, bulk sms that going to customers before hand.

- ATP's needs to be given re-initialization facility, sim change timing needs to be reduced; postpaid sim change should also be allowed from ATP's
- For Erased Scratch cards, ATP's or dealer point should be able to provide the support & solution rather than asking customers to go to customer cares
- For lost case, no GD should be there; also sim change fee should not be more than TK 50. Also if the customer can provide adequate information over phone, then fax won't be required for blocking any line
- We need to have full profile of the customer along with photograph, finger prints and signature to reduce scope of frauds
- Every month, there should be a customer day where the customers can share their opinions and feedbacks to better improve our customer service
- A dedicated hotline number for accessing IT and Technical personnel should be there where customer care executives can contact immediately to solve any customer problem.
- Executives need to undergo training session related to their nature of job from time to time to better perform their jobs
- Management of Contact Center should take into account the results found from surveys seriously and arrange necessary training and briefing sessions to reduce the level of dissatisfaction of customers and management
- Customer Retention program should be more focused on and executives from both Customer Care and Contact Center should be utilized to retain our valued customers
- No employ should be kept in the customer care department for more than 3 years and there needs to be divisional switching based on the person's educational and professional qualification.
- Employees should be given full 2 days day offs without any forceful work assignments.
- Work timing at Contact Center needs to be changed
- Like Club Magnate of Postpaid, there needs to be an exclusive group for Prepaid also who have been using our Aktel connection for more than 3 years and generating a certain percentage of revenue
- Special Customer care service corners will be there for exclusive & elder customers
- To enhance sim sell & customer retention, every month the current customer who recommends most new customers will be honored & rewarded

PART II: Product & Services

2. Major Value Added Services (VAS)

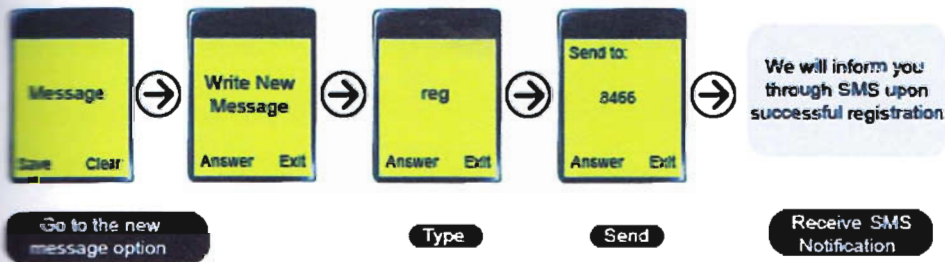
2.1. AKTEL GoonGoon: The Marvel of GSM Technology

Registration for Goongoon:

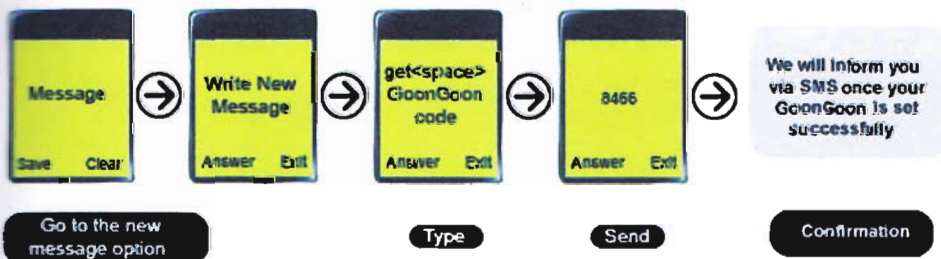
Dial *140*1# and follow the instruction to get registered to AKTEL GoonGoon service.

Via SMS:

Registration:



Download & Set GoonGoon :



Though IVR: Dial 8466 and follow the instructions.

CHARGES (EXCLUDING VAT):

Monthly Subscription**	TK. 25.00
GoonGoon Download	Tk. 15.00
IVR Browsing	TK. 4 per minute (Tk. 2 per 30 sec)
SMS	Tk. 2 per SMS
AKTEL GoonGoon web portal	No charges on web browsing

2.2. Friends & Family (FnF)

TO	SMS FORMAT	EXAMPLE
Add FnF numbers	add<space>FnF numbers **(if you want to enter multiple numbers leave space between them)	add 018xxxxxxxx 017xxxxxxxx 019xxxxxxxx
Add Partner number	P<space>Partner Number	P 018xxxxxxxx
Delete FnF and Partner number	del<space>number to be deleted	del 018xxxxxxxx
To see current FnF and Partner list and status	FnF	
To know about the whole process	Help	

2.3. Recharge AKTEL Prepaid Account

With **EasyLoad** no PIN is required for any prepaid recharge or postpaid bill payment. Customers can now enjoy the greatest flexibility for meeting their day to day to mobile needs.



**Recharge has
never been
so easy**

Scratch Card Refill:

Type *111* then type 13 or 14 digit PIN number then press # and press the send button. he will receive a confirmation message.

The refill facility of his account will be temporarily barred following three consecutive wrong attempts in refilling the card.

2.4. FAQ Regarding International Roaming (AIRS)

01. Which Credit Card can be used to avail airs?

Only International Credit Card has to be used which are Mastercard & VISA.

02. Can other person's International Credit Card be used ?

No. The card must be against the subscribers name and therefore any other persons credit card may not be used.

03. Is there any monthly access fee for airs?

Additional monthly access fee to avail airs is not required.

04. Is Caller ID facility available during roaming?

Depending on the operator in the roaming country Caller ID may be displayed on the Handset.

05. Which is the appropriate handset for airs?

A proper network-compatible handset is a must for using the airs facility while visiting abroad. Globally, operators are using GSM 900, 1800 and 1900 MHz frequency/bandwidth; the handset must be compatible with the frequency of the visiting network. In general, a customer may use a dual band (GSM 900/1800) handset while roaming abroad. But particularly while roaming in North America i.e. in USA and Canada, use a tri-band (GSM 900/1800/1900) handset.

For example: in Thailand, the operator ORANGE is using GSM 1800 and in Canada Microcell is using GSM 1900. Single band (GSM 900) handset will not work in these networks; a dual band and tri-band handset respectively should be used in order to avail airs with those operators in Thailand and Canada. Roamers visiting Japan will have to rent/buy special 3G compatible handsets (Nokia 6620, etc) available at Narita Airport,

Tokyo, Japan. For roaming with Nextel USA, Roamers will have to use special handsets, (e.g. Motorola i30x).

06. How will the customers be charged?

While in a country other than Bangladesh, for example, if the roamer is in Germany with his/her air mobile phone:

- **For making a call to a German phone**

German Operator's charge (Local/NWD) + AKTEL service charge (Home Charge) + applicable Taxes, Levies, other charges, if any

- **For a call to Bangladesh or any other country**

German Operator's charge + International Call charge (from Germany to Bangladesh or any other called country) + AKTEL service charge (Home Charge) + applicable Taxes, Levies, other charges, if any

- **Receiving any call**

International Call charge (from Bangladesh to Visiting Country) + Visiting Country's Operator charge for incoming calls (if any) + AKTEL service charge (Home Charge) + applicable Taxes, Levies, other charges, if any

07. How are roaming charges reflected in the air bill & local bill ?

All your bills regarding usage while roaming will be captured in the Roaming bill and will not be reflected in the local bill. Local bills will only capture all your usages while in Bangladesh.

08. How to make calls while Roaming?

- To make a call to a mobile phone of the visiting country, simply dial the desired number
- To make a local call to a land phone (in the visiting country), dial the area code and then the desired number
- To make an International call, dial the International Access Code ("00" or "+") + country code + phone number (omitting 0 as first digit). If the roamer is making a call to Bangladesh from a visiting country, then the roamer will make an international call (by dialing 00880 or +880).

Destination Number	Country Code (+ Area Code)	Desired Number
BTTB in Dhaka	+8802 or 008802	xxxxxxx

BTTB in Chittagong	+88031 or 0088031	xxxxxxx
AKTEL	+88018 or 0088018	Xxxxxxx
GP	+88017 or 0088017	Xxxxxxx
Banglalink	+88019 or 0088019	Xxxxxxx
CityCell	+88011 or 0088011	Xxxxxxx
Warid	+88016 or 0088016	Xxxxxxx

09. How to send SMS while Roaming?

While on roaming you can enjoy all the AKTEL SMS services. In order to send an SMS to AKTEL number, please enter the recipient's mobile number in the following format: 018xxxxxxx or +88018xxxxxxx. Check SMSC Service Center Number +8801801000004

SMS Charges : The charge for SMS while roaming will be as per the visited operator's charge.

Note: Please do not change SMS Service Center number. Desired Service Center number will be automatically selected.

10. How to select the network manually while roaming?

AKTEL has agreements with operator worldwide that forms the base of its wide coverage. Therefore the network updates its location within a few minutes of the roamers landing in overseas airport. However, some times due to unavoidable circumstances the roamer may have to select the network manually.

While selecting the network manually the roamer will have to go to the airs menu that will be added in the handset menu option when the customer is roaming. In the airs menu, the customer will have to select "Select IMSI/Side" and then there will be two options: "AKTEL" and "ABROAD". When the outbound roamer is roaming in a country with which AKTEL has bilateral agreement, the roamer must select "AKTEL". Whereas, while roaming in a country with which AKTEL has proxy agreement, the roamer must select "ABROAD" *.

2.5. Bill Payment for Postpaid

The steps below:

Step 1: Go to the 'Message' option of the handset.

Step 2: Type **PAY** then type **13/14 digit secret number** of Pre-Paid Scratch Card or E-fill voucher then give space, and then type the **11-digit AKTEL Post-Paid mobile number** whose bill he wants to pay.

For Example: PAY1234567890123 01810000000

Step 3: Send the SMS to 8PAY (i.e. 8729 on his number pad)

Reply: He will receive a confirmation message - "Thank you. Tk. 600 has been successfully adjusted against 01810000000."

Bill Payment

He can pay your post paid bill amount at any AKTEL Customer Care Center through

- Bank booth / counter (available at the Center)
- Refill Cards
- Easy Load
- Auto-credit facility (for AIRS)

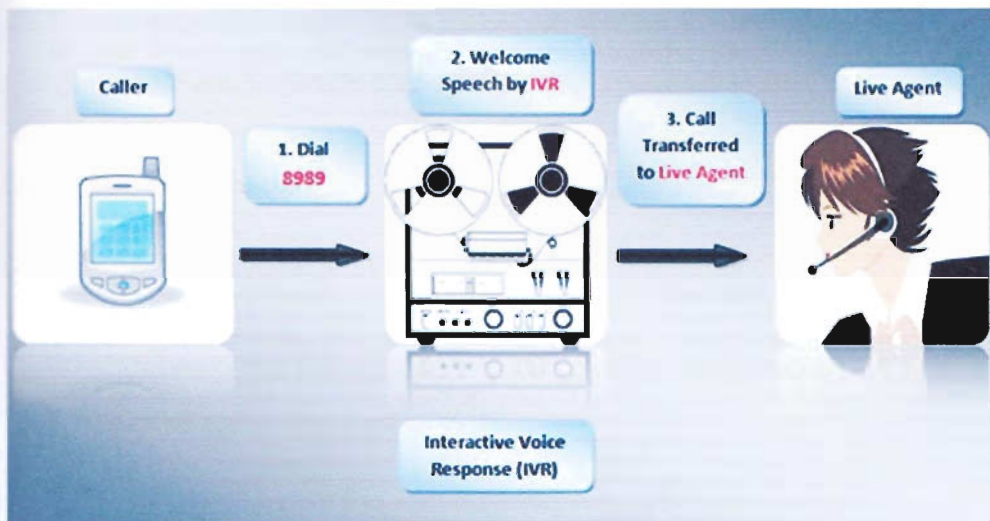


3. Some of the Latest Promotional offers

AKTEL Directory Service

AKTEL introduces a new service, **AKTEL-Directory Service** for both its Pre-Paid and Post-Paid customers to make any information available for them from anywhere anytime.

AKTEL-Directory Service, a service which will help its clients to access and obtain their desired information, starting from household needs to life saving information.



Key benefits for the user:

- Get (almost) any information on one touch.
- Saves time as you do not need to go through pages after pages.
- Get (almost) any information any time (24 hrs service).
- Provide great value to high end corporate customers of an operator.

3.1. Balance Transfer (New)

AKTEL introduces a new Balance Transfer service where both the Prepaid and Postpaid customers are able to transfer balance to any AKTEL prepaid account whenever required.

To transfer balance:

- Now you don't have to register for using the balance transfer service.
- To transfer, just type the amount (For example, 20) in a text message body and send SMS to **1212018XXXXXXX** (where 018XXXXXXX is the balance recipient's number).



- You will be auto registered for the service after the first transaction.
- You will also get a PIN code after successful transfer. Please use the PIN for future transactions. To disable the PIN, SMS **off < Your PIN >** to 1210.

To request for balance:

- The customer needs to have only 58 Paisa in your account to request.
- Just type the request amount (for example, 25) a text message body and send SMS to 1211018YYYYYYY (where 018YYYYYYY is the balance donor's number).
- Donor will receive the request as an SMS.



3.2. AKTEL Call Block (new)

AKTEL introduces for the first time in Bangladesh “AKTEL CALL BLOCK” service, – an easy-to-use and simple service to get rid all of unwanted incoming calls instantly.

AKTEL also offer:

- ‘**White list**’ option- when you want to allow only your preferred callers to reach you
- List of **FREE** announcements to set for your blocked callers

- 5 FREE number additions after registration
- SMS notification to inform you blocked caller's number and time of call
- Unlimited addition to black/white list

To activate this great service just **dial 8181** and follow the instructions. You can activate it SMS by typing "**reg**" and send it to **8181**.

SMS Keywords:

SL	TYPE OF COMMAND	KEYWORDS (TO SEND TO 8181)
1	To register	reg
2	To add number to black list	addb < space > number Example: addb 018XXXXXXXX
3	To see current black list	bl
4	To delete number from black list	delb < space > number Example: delb 018XXXXXXXX
5	To add number to white list	addw < space > number Example: addw 018XXXXXXXX
6	To see current white list	wl
7	To delete a number from white list	delw < space > number Example: delw 018XXXXXXXX
8	Switch to white list	swl
9	Switch to black list	sbl
10	To unregister	unreg
11	To know keywords	help

3.3. AKTEL Phone Book Backup

With Phone Backup Service the customer can store valuable data from their mobile handset to a secured storage and easily recover it whenever they want.

With this service, they can save the contacts (phone book), text message (SMS) and calendar items (task note) stored on your handset memory and can retrieve instantly.

3.4. AKTEL Instant News

AKTEL brings you latest news from -

ATN Bangla		The first satellite channel in Bangladesh
Channel I		The first digital Bangla channel
BDnews24.com		The first online Newspaper of Bangladesh
AccuWeather		One-stop shop for your weather needs
AFP		The world's oldest established news agency

To get Voice update:





bdnews24.com

AKTEL brings you daily news updates from **bdnews24.com** - Bangladesh's first web-based news agency.

For LATEST NEWS, just type **news** and SMS to **2324** or call **2324** anytime and get news wherever you are.

Want to get DAILY morning news update? SMS **m** to **2324**, to subscribe.

To subscribe for BREAKING NEWS, type **b** and send to **2324**. You will get breaking news alert, as and when happens.

3.5. AKTEL Café8000

The customers can get this complete package from "AKTEL Café8000". It is basically a package of voice based service introduced for the 1st time in Bangladesh for all AKTEL customers.

In Café8000, voice based services such as News, Information, Entertainment, Religion, International Roaming etc. will be available.

Services can also be accessed by dialing the respective short codes directly:

SUB MENU

MENU ITEMS

NEWS(8010)	Latest News
	Newspaper Headlines
	Current Sport
	Weather
	Business
	International
INFORMATION (8020)	Emergency Services
	Jobs (available hot jobs from BDjobs)
	Exchange Rate

	Yellow Pages
ENTERTAINMENT	Music World
	Voice Blog
	Jokes
	Horoscope
	Fashion & Care
	Audio Streaming of LIVE Concert
CRICKET WORLD (8274)	Daily Cricket News headlines
	Live score
	Today's Match Schedule
	Live commentary of current match
	Automated daily Cricket News Update
AKTEL PRODUCTS (8050)	Latest ICC team and player rankings
	VAS
ROAMING (8060)	Customer wish list
	Exchange Rate
	Airlines
	Embassy
	Hotels
	Restaurants
	Taxi
	Shopping Malls
Travel	
RELIGION (8070)	Daily Surah (with Tarjama)
	Daily Doa

Daily Hadith
Names of Allah
Important Ayat
Azan
Awdu

3.6. AKTEL GPRS (Spice)

WAP

In order to enjoy the following services the customers must surf <http://aktelspice.mobi/> from their handset:

- List of top mobile downloads
- Other WAP sites to download more fun stuff
- Read latest local and international news
- Daily cricket, football and other sports news
- Check yahoo, hotmail and gmail from your phone
- Other Services

MMS

The customers can send photos, videos, sounds and other multimedia through the MMS (multimedia messaging). They can also send their MMS to any email address in the world.

How to start (WAP/MMS/INTERNET)

1. The customers need a handset which supports their required service(GPRS/WAP/MMS)
2. To get WAP/MMS/Internet settings dial *140*7# or visit <http://gprs.aktel.com/> and follow the instructions.
3. Connect any GPRS enabled handset to your PC/laptop to start browsing
4. They can use an electronic organizer,hand-held PDA (Palm Pilot, Psion, Windows Mobile or other smart phones) to enjoy these services.

3.7. AKTEL Opener

" AKTEL Opener " is a groundbreaking service under which by dialing only a single number *140# - the customer can browse & avail the Value Added Services like AKTEL GoonGoon, AKTEL P.A., Cricket Update (8CRI), Post-Paid bill information (8PST) and many other infotainment based services.

That means the customer no longer have to take the trouble of memorizing the different registration number & short code applicable for each of AKTEL's Value Added Services.

Step 1: Dial *140#

Below menu will appear on the screen displaying the **Value Added Services** & their respective service number.

AKTEL OPENER MENU:

1. GoonGoon
2. Missed Call Alert
3. Sports
4. Postpaid Bill
5. FnF & Partner
6. Balance Transfer
7. GPRS
8. Infotainment
9. SMS Reg Status

Step 2: Choose the service number of your desired Value Added Service.

Step 3: Press **Answer/select** and type the service number of your desired Value Added Service & send it.

Step 4: You will receive a sub-menu. Then type your required information number & send it.

Reply: You'll receive a reply SMS notification with the required information.

3.8. Call Waiting / Holding / Divert / Forward

Call Waiting/Call Holding

Call Waiting lets the customer know when they are on a call and someone else is trying to get through to them. They will hear a tone that alerts them to the incoming call. On the other hand, the Call Holding Service allows them to put your current call on hold and either deal with the incoming call, or make a new call. It is also possible to switch alternatively from one call to the other without terminating either of the calls.

Call Divert/Forwarding

It might not always be convenient to answer the phone. So if you're already busy on a call, cannot answer phone or just don't want to be disturbed, you can divert your calls to your voice mail or any other number

Call Forwarding allows an AKTEL Postpaid user to divert incoming calls to another AKTEL or any other BTTB number (accept an international number).

How to divert calls to your voice mail or AKTEL number?

Select one or more divert options and press the following keys to activate or cancel divert from your handset:

3.9. Call Conferencing

As a valued AKTEL Post-Paid customer, the customers can now call up to 4 persons at a time with AKTEL Call Conferencing. To initiate a Conference Call on your mobile phone (for example in case of NOKIA Handset), they need to follow steps given below:

Step 1:

Make a call

Step 2:

While the first call is on the line, dial second number

Step 3:

After connecting to the second number you can join both numbers together by doing the following: a) Press Options, choose Conference and press Select

Step 4:

To add additional numbers to your conference call, follow steps 2 to 3. Customer will be able to make conversation with up to 5 persons (including him/her) at a time under call conferencing.

3.10. AKTEL Voice SMS

The customers can send SMS with their own voice to any AKTEL or other mobile number with AKTEL - KOTHAR CHITHI.

IF YOU WANT TO...	THEN YOU HAVE TO...	
Send a Voice SMS	Dial * followed by your desired mobile number	Record your message after the beep and disconnect. The Voice SMS will be automatically sent to the recipient.
Listen to a new Voice SMS	When you receive an SMS notification for the Voice SMS, dial *01 to retrieve.	No charge is applicable!
Listen to your old Voice SMS	Dial *02	Old and unsaved Voice SMS will be stored for maximum 3 days.
Listen to your saved Voice SMS	Dial *03	
Listen to the saved Voice SMS of a particular number	Dial *03 followed by the mobile number	
Send a surprise Voice SMS	Dial *04 followed by recipient's mobile number	Record your message after the beep and disconnect. The Voice SMS will be automatically sent to the recipient.
Save a new or old Voice SMS	Press 1 while listening to the Voice SMS	
Delete a new or old Voice SMS	Press 2 while listening to the Voice SMS	
Skip listening a Voice SMS	Press 3 while listening to the Voice SMS	

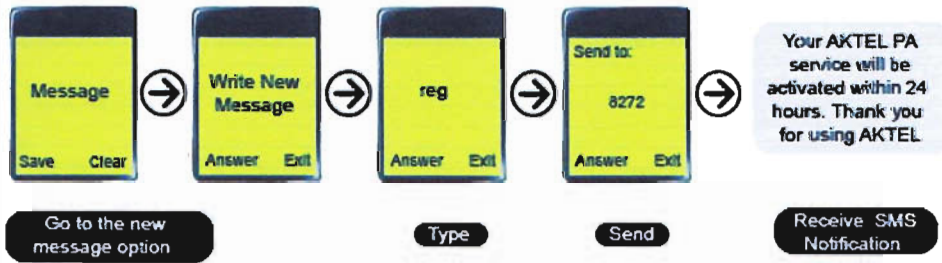
3.11. AKTEL GopShop

Chat with a group of people and post your messages in large number of chat rooms with the help of SMS Chat "GopShop" service. The customers must go through the following steps in order to enjoy the service:

To sign in SMS Chat	signinnickname e.g. signinlanny
To register the nickname	regnickname e.g. reglanny
To unregister the nickname	unreg
Change Registered nickname	regnew nickname e.g. regrodrigues
To know the available chat room names	list
To join a chat room	goroom name e.g. gomusic
To know available people in that particular chat room	show
To send message to a particular nick	sendnicknamemessage e.g. sendkarimhello
To send message to all the members of the chat room	sendchat roommessage e.g. sendmusichello everyone!
To invite other people in the chat room	inviteMobile Number e.g. invite0181900000
To leave the chat room	bye
To sign out from SMS chat	out
To sign in SMS Chat	signinnickname e.g. signinlanny

3.12. AKTEL Missed Call Alert

AKTEL Missed Call Alert (MCA) will get all incoming call details send to the subscribers through SMS after turning their set on. Just like a personal assistant, MCA will track all your missed calls. Through AKTEL Missed Call Alert Service, AKTEL users will be notified about all the missed calls (i.e. calls attempted but unsuccessful) when the called party (user) was not reachable (switched off or out of coverage or busy).



3.13. International Voice SMS

Service Details:

To send an International Voice SMS:

- Just dial **"*8359** with country code>" ['+' or '00' before the country code is not required]

To listen to the reply:

- Dial **"*8360"**

3.14. SMS Banking

The customers can become a client of any of AKTEL's SMS baking partners they can check their account balance, transactions details, credit card details etc. through SMS.

Bank Asia

SEND SMS TO 2929

TYPE OF SERVICE	SMS FORMAT
-----------------	------------

Account balance inquiry	<#> full a/c no. or the last 4 digit of the a/c no.>
-------------------------	--

Example: Acc1234#2365

Pre-Paid refill or Post-Paid bill
to own number <#>amount

Example: Pay1234#300

Pre-Paid refill or Post-Paid bill
other mobile <#>

Example: Pay1234#300#018XXXXXXXX

BRAC Bank

SEND SMS TO 3939

TYPE OF SERVICE	SMS FORMAT
To know account balance	Type : a and send to 3939
To know last few transaction	Type : t and send to 3939

Standard Chartered Bank

SEND SMS TO 2727

TYPE OF SERVICE	SMS FORMAT
To access Credit Card's previous day's outstanding amount	Type : CARDPIN No Example: CARD 2365
To access Account's previous day's balance	Type : ACCPIN No

3.15. SMS2EMAIL

Main Features of the Service:

1. Send email in maximum 160 characters
2. Receive email in maximum 320 characters
3. Email address can be added in the auto notification email list and automated email notification will be generated on email arrival from anyone of the list
4. Set Sender Name for outgoing email address

address book

Reply Email

repe mail no.reply message

Delete Email

Delete all email from inbox

delall

Delete nth email from the inbox

delemail no.

3.16. Voice Mail Service

The customers are capable to get the messages of their callers even when they cannot receive their call.

Voice Mail Service (VMS) is an easy to use personal answering service. The customers' unanswered calls are forwarded to voicemail. Caller will hear a welcome greeting requesting them to leave a message. They may retrieve these messages later.

Voice Mail Service works when

- Their line is busy or
- The call is unanswered or
- They are unreachable

3.17. Voice Greetings Service

AKTEL is offering the customers a complete solution of Voice Greetings for various occasions. In AKTEL Voice Greetings Service, they are getting special voice greetings for Love, Birthday, Fun, Sorry, etc. according to their desire. They can also choose and dedicate songs from different categories like English, Bangla, Hindi, Love, birthday, Instrumental etc.

3.18. AKTEL Radio Nationwide

Radio Nationwide is just like a pocket FM radio with the added convenience to choose from what one wants to hear, and that too whenever & wherever. This is a personal, customized radio station which provides

- A plethora of songs of about every emotion and every genre
- allows listeners to

- listen to full tracks
- create your own playlist
- dedicate songs to loved ones
- set favorite song as GoonGoon
- Download ringtones
- know about favorite celebrities through “ **Celebrity Adda**”

This service has launched on February 17, 09.

Service Charges

PARTICULARS	CHARGES
Monthly Subscription / Rental	BDT 20
IVR menu browsing	BDT 0.68/ min (60 sec. pulse)
Ringtone Download	BDT 10
Song Dedication	BDT 10
SMS	BDT 2

** All tariffs are excluding vat

3.19. Incoming Bonus

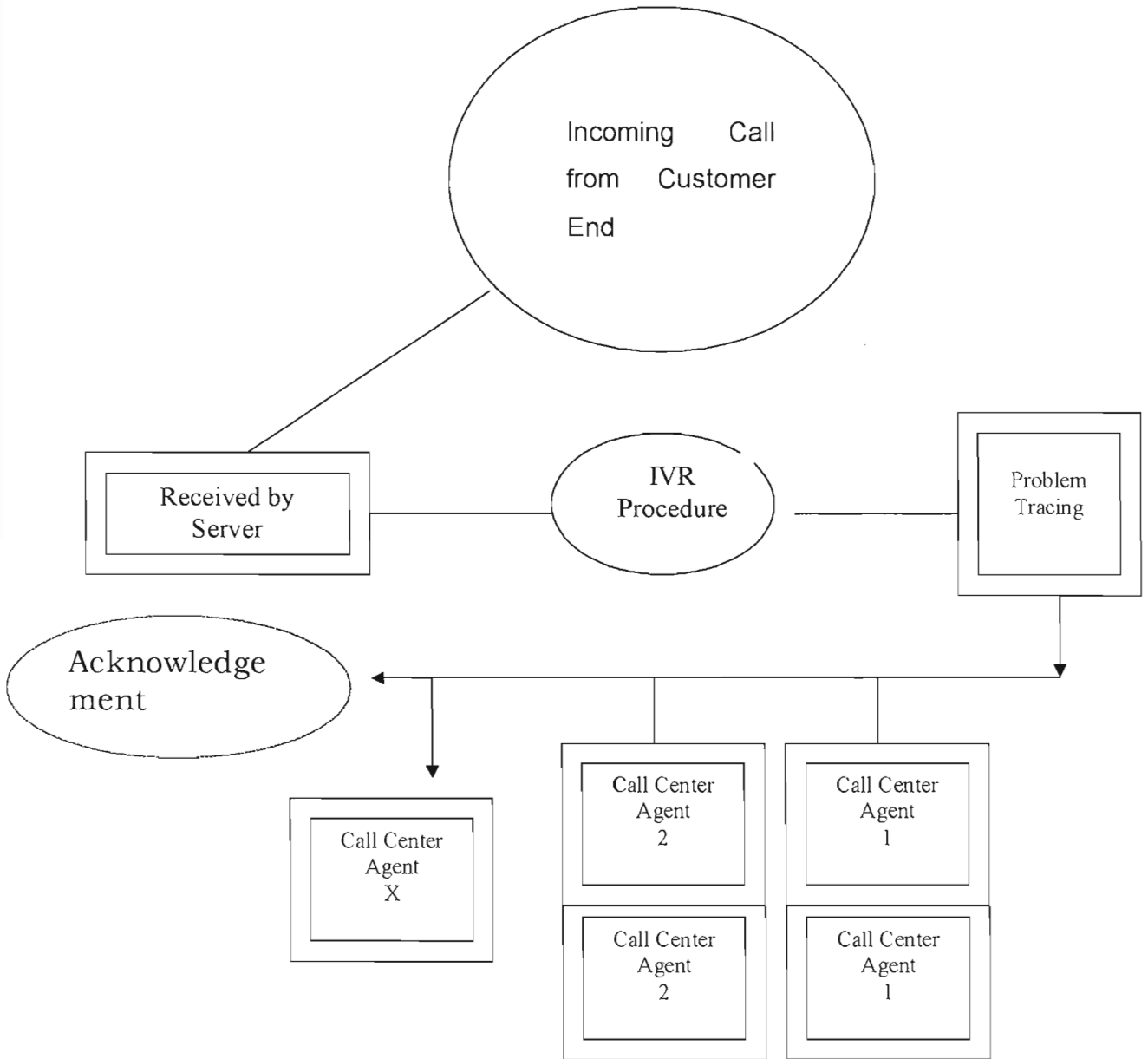
AKTEL is offering incoming bonus which will activate upon registration, customers will get bonus on their monthly total **Incoming Calls** (minutes) from other mobile operators only. It has launched on 13th of February 09. PSTN, International call and AKTEL incoming call not considered in this regards. Customer will get 25% free minutes of incoming call from other operators’, 3days will validity period of using this bonus to only AKTEL number in Bangladesh.

Service Charges

PARTICULARS	USSD	CHARGES
Registration	*140*9*1#	TK10+VAT
Deregistration	*140*9*2#	TK2+VAT
Status Query	*140*9*3#	TK2+VAT

PART III

Global System for Mobile Communication (GSM)



4. Global System for Mobile Communication (GSM)

4.1. Definition

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group established in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz. It is estimated that many countries outside of Europe will join the GSM partnership.

4.2. Overview

This tutorial provides an introduction to basic GSM concepts, specifications, networks, and services. A short history of network evolution is provided in order set the context for understanding GSM.

4.3. Topics

1. Introduction: The Evolution of Mobile Telephone Systems
2. GSM
3. The GSM Network
4. GSM Network Areas
5. GSM Specifications
6. GSM Subscriber Services

4.3.1. A. Introduction: The Evolution of Mobile Telephone Systems

Cellular is one of the fastest growing and most demanding telecommunications applications. Today, it represents a continuously increasing percentage of all new telephone subscriptions around the world. Currently there are more than 45 million cellular subscribers worldwide, and nearly 50 percent of those subscribers are located in the United States. It is forecasted that cellular systems using a digital technology will become the universal method of telecommunications. By the year 2005, forecasters predict that there will be more than 100 million cellular subscribers worldwide. It has even been estimated that some countries may have more mobile phones than fixed phones by the year 2000 (see Figure 1).

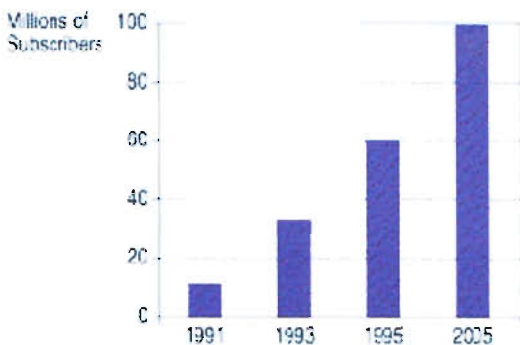


Figure 1. Cellular Subscriber Growth Worldwide

The concept of cellular service is the use of low-power transmitters where frequencies can be reused within a geographic area. The idea of cell-based mobile radio service was formulated in the United States at Bell Labs in the early 1970s.

However, the Nordic countries were the first to introduce cellular services for commercial use with the introduction of the Nordic Mobile Telephone (NMT) in 1981. Cellular systems began in the United States with the release of the advanced mobile phone service (AMPS) system in 1983. The AMPS standard was adopted by Asia, Latin America, and Oceanic countries, creating the largest potential market in the world for cellular.

In the early 1980s, most mobile telephone systems were analog rather than digital, like today's newer systems. One challenge facing analog systems was the inability to handle the growing capacity needs in a cost-efficient manner. As a result, digital technology was welcomed. The advantages of digital systems over analog systems include ease of signaling, lower levels of interference, integration of transmission and switching, and increased ability to meet capacity demands. Table 1 charts the worldwide development of mobile telephone systems.

Table 1. The Development of Mobile Telephone Systems
Year Mobile System

1981	Nordic Mobile Telephone (NMT) 450
1983	American Mobile Phone System (AMPS)
1985	Total Access Communication System (TACS)
1986	Nordic Mobile Telephony (NMT) 900
1991	American Digital Cellular (ADC)
1991	Global System for Mobile Communication (GSM)
1992	Digital Cellular System (DCS) 1800
1994	Personal Digital Cellular (PDC)
1995	PCS 1900—Canada
1996	PCS—United States



4.3.2. B. GSM

Throughout the evolution of cellular telecommunications, various systems have been developed without the benefit of standardized specifications. This presented many problems directly related to compatibility, especially with the development of digital radio technology. The GSM standard is intended to address these problems. From 1982 to 1985 discussions were held to decide between building an analog or digital system. After multiple field tests, a digital system was adopted for GSM. The next task was to decide between a narrow or broadband solution. In May 1987, the narrowband time division multiple access (TDMA) solution was chosen. A summary of GSM milestones is given in Table 2.

Table 2. GSM Milestones

Year	Milestone
1982	GSM formed
1986	field test
1987	TDMA chosen as access method
1988	memorandum of understanding signed
1989	validation of GSM system
1990	preparation system
1991	commercial system start-up
1992	coverage of larger cities/airports
1993	coverage of main roads

4.3.3. C. The GSM Network

GSM provides recommendations, not requirements. The GSM specifications define the functions and interface requirements in detail but do not address the hardware. The reason for this is to limit the designers as little as possible but still to make it possible for the operators to buy equipment from different suppliers.

The GSM network is divided into three major systems: the switching system (SS), the base station system (BSS), and the operation and support system (OSS). The basic GSM network elements are shown in Figure 2.

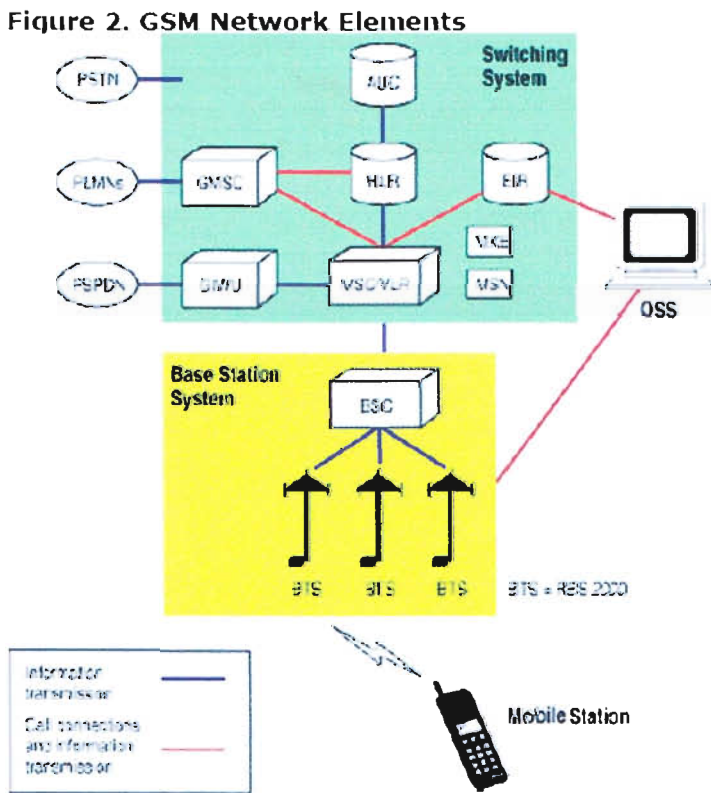


Figure 2. GSM Network Elements

4.3.3.1. The Switching System

The switching system (SS) is responsible for performing call processing and

subscriber-related functions. The switching system includes the following functional units:

□home location register (HLR)—The HLR is a database used for storage and management of subscriptions. The HLR is considered the most important database, as it stores permanent data about subscribers, including a subscriber's service profile, location information, and activity status. When an individual buys a subscription from one of the PCS operators, he or she is registered in the HLR of that operator.

□mobile services switching center (MSC)—The MSC performs the telephony switching functions of the system. It controls calls to and from other telephone and data systems. It also performs such functions as toll ticketing, network interfacing, common channel signaling, and others.

□visitor location register (VLR)—The VLR is a database that contains temporary information about subscribers that is needed by the MSC in order to service visiting subscribers. The VLR is always integrated with the MSC. When a mobile station roams into a new MSC area, the VLR connected to that MSC will request data about the mobile station from the HLR. Later, if the mobile station makes a call, the VLR will have the information needed for call setup without having to interrogate the HLR each time.

□authentication center (AUC)—A unit called the AUC provides authentication and encryption parameters that verify the user's identity and ensure the confidentiality of each call. The AUC protects network operators from different types of fraud found in today's cellular world.

□equipment identity register (EIR)—The EIR is a database that contains information about the identity of mobile equipment that prevents calls from stolen, unauthorized, or defective mobile stations. The AUC and EIR are implemented as stand-alone nodes or as a combined AUC/EIR node.

4.3.3.2. The Base Station System (BSS)

All radio-related functions are performed in the BSS, which consists of base station controllers (BSCs) and the base transceiver stations (BTSs).

□BSC—The BSC provides all the control functions and physical links between the MSC and BTS. It is a high-capacity switch that provides functions such as handover, cell configuration data, and control of radio frequency (RF) power levels in base transceiver stations. A

number of BSCs are served by an MSC.

-7

□BTS—The BTS handles the radio interface to the mobile station. The BTS is the radio equipment (transceivers and antennas) needed to service each cell in the network. A group of BTSs are controlled by a BSC.

4.3.3.3. The Operation and Support System

The operations and maintenance center (OMC) is connected to all equipment in the switching system and to the BSC. The implementation of OMC is called the operation and support system (OSS). The OSS is the functional entity from which the network operator monitors and controls the system. The purpose of OSS is to offer the customer cost-effective support for centralized, regional, and local operational and maintenance activities that are required for a GSM network. An important function of OSS is to provide a network overview and support the maintenance activities of different operation and maintenance organizations.

4.3.3.4. Additional Functional Elements

Other functional elements shown in Figure 2 are as follows:

□message center (MXE)—The MXE is a node that provides integrated voice, fax, and data messaging. Specifically, the MXE handles short message service, cell broadcast, voice mail, fax mail, email, and notification.

□mobile service node (MSN)—The MSN is the node that handles the mobile intelligent network (IN) services.

□gateway mobile services switching center (GMSC)—A gateway is a node used to interconnect two networks. The gateway is often implemented in an MSC. The MSC is then referred to as the GMSC.

□GSM interworking unit (GIWU)—The GIWU consists of both hardware and software that provides an interface to various networks for data communications. Through the GIWU, users can alternate between speech and data during the same call. The GIWU hardware equipment is physically located at the MSC/VLR.

4.3.4. D. GSM Network Areas

The GSM network is made up of geographic areas. As shown in Figure 3, these areas include cells, location areas (LAs), MSC/VLR service areas, and public land mobile network (PLMN) areas.

Figure 3. Network Areas

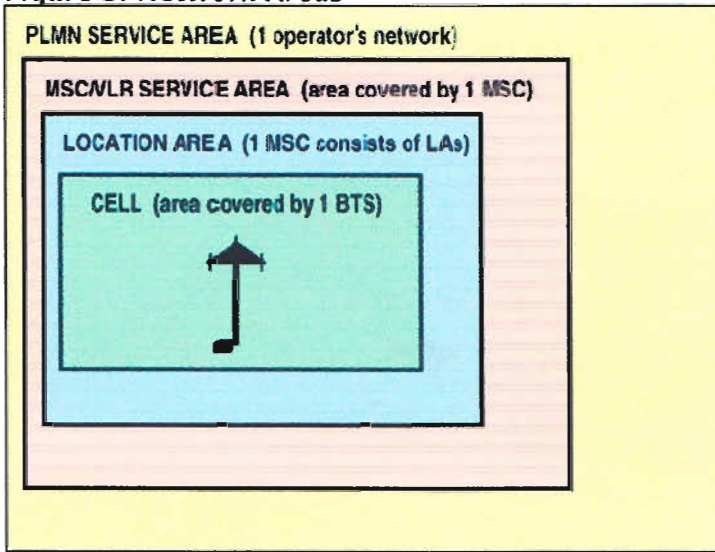


Figure 3. Network Areas

The cell is the area given radio coverage by one base transceiver station. The GSM network identifies each cell via the cell global identity (CGI) number assigned to each cell. The location area is a group of cells. It is the area in which the subscriber is paged. Each LA is served by one or more base station controllers, yet only by a single MSC (see Figure 4). Each LA is assigned a location area identity (LAI) number.

Figure 4. Location Areas

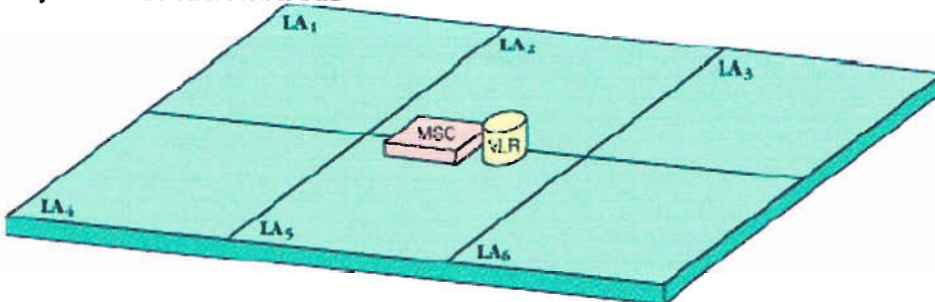


Figure 4. Location Areas

An MSC/VLR service area represents the part of the GSM network that is covered by one MSC and which is reachable, as it is registered in the VLR of the MSC (see

Figure 5).

Figure 5. MSC/VLR Service Areas

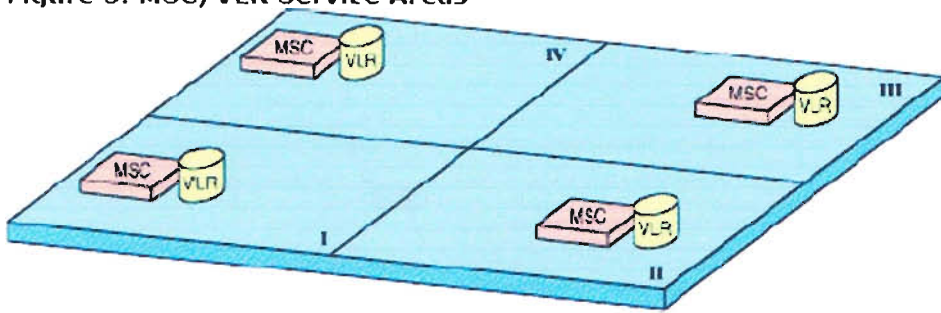


Figure 5. MSC/VLR Service Areas

The PLMN service area is an area served by one network operator (see Figure 6).

Figure 6. PLMN Network Areas



4.3.5. E. GSM Specifications

Before looking at the GSM specifications, it is important to understand the following basic terms:

□ bandwidth—the range of a channel's limits; the broader the bandwidth, the faster data can be sent

□ bits per second (bps)—a single on-off pulse of data; eight bits are equivalent to one byte

□ frequency—the number of cycles per unit of time; frequency is measured in hertz (Hz)

□ kilo (k)—kilo is the designation for 1,000; the abbreviation kbps represents 1,000 bits per second

□ megahertz (MHz)—1,000,000 hertz (cycles per second)

□ milliseconds (ms)—one-thousandth of a second

□ watt (W)—a measure of power of a transmitter. Specifications for different personal communication services (PCS) systems vary among the different PCS networks. Listed below is a description of the specifications and characteristics for GSM.

□ frequency band—The frequency range specified for GSM is 1,850 to 1,990 MHz (mobile station to base station).

□ duplex distance—The duplex distance is 80 MHz. Duplex distance is the distance between the uplink and downlink frequencies. A channel has two frequencies, 80 MHz apart.

□ channel separation—The separation between adjacent carrier frequencies. In GSM, this is 200 kHz.

□ modulation—Modulation is the process of sending a signal by changing the characteristics of a carrier frequency. This is done in GSM via Gaussian minimum shift keying (GMSK).

□ transmission rate—GSM is a digital system with an over-the-air bit rate of 270 kbps.

□ access method—GSM utilizes the time division multiple access

(TDMA) concept. TDMA is a technique in which several different calls may share the same carrier. Each call is assigned a particular time slot.

□ speech coder—GSM uses linear predictive coding (LPC). The purpose of LPC is to reduce the bit rate. The LPC provides parameters for a filter that mimics the vocal tract. The signal passes through this filter, leaving behind a residual signal. Speech is encoded at 13 kbps.

4.3.6. F. GSM Subscriber Services

There are two basic types of services offered through GSM: telephony (also referred to as teleservices) and data (also referred to as bearer services). Telephony services are mainly voice services that provide subscribers with the complete capability (including necessary terminal equipment) to communicate with other subscribers. Data services provide the capacity necessary to transmit appropriate data signals between two access points creating an interface to the network. In addition to normal telephony and emergency calling, the following subscriber services are supported by GSM:

□ dual-tone multifrequency (DTMF)—DTMF is a tone signaling scheme often used for various control purposes via the telephone network, such as remote control of an answering machine. GSM supports full-originating DTMF.

□ facsimile group III—GSM supports CCITT Group 3 facsimile. As standard fax machines are designed to be connected to a telephone using analog signals, a special fax converter connected to the exchange is used in the GSM system. This enables a GSM-connected fax to communicate with any analog fax in the network.

□ short message services—A convenient facility of the GSM network is the short message service. A message consisting of a maximum of 160 alphanumeric characters can be sent to or from a mobile station. This service can be viewed as an advanced form of alphanumeric paging with a number of advantages. If the subscriber's mobile unit is powered off or has left the coverage area, the message is stored and offered back to the subscriber when the mobile is powered on or has reentered the coverage area of the network. This function ensures that the message will be received.

□ cell broadcast—A variation of the short message service is the cell broadcast facility. A message of a maximum of 93 characters can be broadcast to all mobile subscribers in a certain geographic area. Typical applications include traffic congestion warnings and reports on accidents.

□voice mail—This service is actually an answering machine within the network, which is controlled by the subscriber. Calls can be forwarded to the subscriber's voice-mail box and the subscriber checks for messages via a personal security code.

□fax mail—With this service, the subscriber can receive fax messages at any fax machine. The messages are stored in a service center from which they can be retrieved by the subscriber via a personal security code to the desired fax number.

4.4. The Transition from Analog to Digital Technology

In the 1980s most mobile cellular systems were based on analog systems. The GSM system can be considered as the first digital cellular system. The different reasons that explain this transition from analog to digital technology are presented in this section.

4.4.1. The capacity of the system

As it is explained in section 1, cellular systems have experienced a very important growth. Analog systems were not able to cope with this increasing demand. In order to overcome this problem, new frequency bands and new technologies were proposed. But the possibility of using new frequency bands was rejected by a big number of countries because of the restricted spectrum (even if later on, other frequency bands have been allocated for the development of mobile cellular radio). The new analog technologies proposed were able to overcome the problem to a certain degree but the costs were too important.

The digital radio was, therefore, the best option (but not the perfect one) to handle the capacity needs in a cost-efficiency way.

4.4.2. Compatibility with other systems such as ISDN

The decision of adopting a digital technology for GSM was made in the course of developing the standard. During the development of GSM, the telecommunications industry converted to digital methods. The ISDN network is an example of this evolution. In order to make GSM compatible with the services offered by ISDN, it was decided that the digital technology was the best option.

Additionally, a digital system allows, easily than an analog one, the implementation of future improvements and the change of its own characteristics.

4.4.3. Aspects of quality

The quality of the service can be considerably improved using a digital technology rather than an analog one. In fact, analog systems pass the physical disturbances in radio transmission (such as fades, multipath reception, spurious signals or interferences) to the receiver. These disturbances decrease the quality of the communication because they produce effects such as fadeouts, crosstalks, hisses, etc. On the other hand, digital

systems avoid these effects transforming the signal into bits. This transformation combined with other techniques, such as digital coding, improve the quality of the transmission. The improvement of digital systems comparing to analog systems is more noticeable under difficult reception conditions than under good reception conditions.

4.5. The GSM Network

4.5.1 Architecture of the GSM network

The GSM technical specifications define the different entities that form the GSM network by defining their functions and interface requirements.

The GSM network can be divided into four main parts:

The Mobile Station (MS).

The Base Station Subsystem (BSS).

The Network and Switching Subsystem (NSS).

The Operation and Support Subsystem (OSS).

The architecture of the GSM network is presented in figure 1.

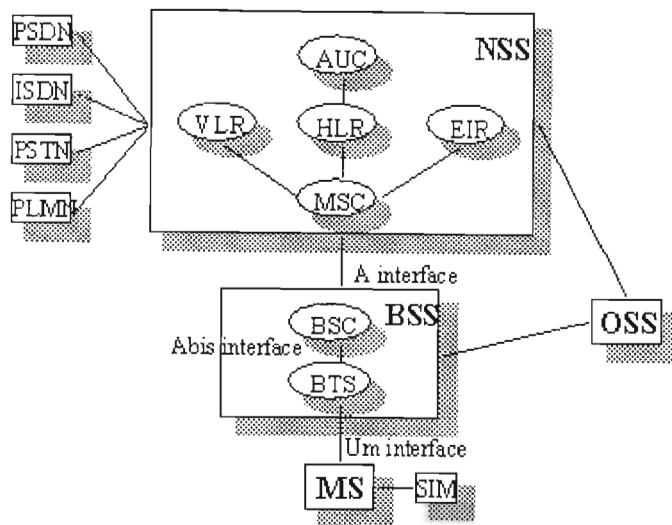


figure 1: Architecture of the GSM network

4.5.2. Mobile Station

A Mobile Station consists of two main elements:

The mobile equipment or terminal.

The Subscriber Identity Module (SIM).



4.5.3. The Terminal

There are different types of terminals distinguished principally by their power and application: The 'fixed' terminals are the ones installed in cars. Their maximum allowed output power is 20 W. The GSM portable terminals can also be installed in vehicles. Their maximum allowed output power is 8W. The handheld terminals have experienced the biggest success thanks to their weight and volume, which are continuously decreasing. These terminals can emit up to 2 W. The evolution of technologies allows to decrease the maximum allowed power to 0.8 W.

4.5.4. The SIM

The SIM is a smart card that identifies the terminal. By inserting the SIM card into the terminal, the user can have access to all the subscribed services. Without the SIM card, the terminal is not operational.

The SIM card is protected by a four-digit Personal Identification Number (PIN). In order to identify the subscriber to the system, the SIM card contains some parameters of the user such as its International Mobile Subscriber Identity (IMSI).

Another advantage of the SIM card is the mobility of the users. In fact, the only element that personalizes a terminal is the SIM card. Therefore, the user can have access to its subscribed services in any terminal using its SIM card.

4.5.5. The Base Station Subsystem

The BSS connects the Mobile Station and the NSS. It is in charge of the transmission and reception. The BSS can be divided into two parts:

The Base Transceiver Station (BTS) or Base Station.

The Base Station Controller (BSC).

4.5.6. The Base Transceiver Station

The BTS corresponds to the transceivers and antennas used in each cell of the network. A BTS is usually placed in the center of a cell. Its transmitting power defines the size of a cell. Each BTS has between one and sixteen transceivers depending on the density of users in the cell.

4.5.7. The Base Station Controller

The BSC controls a group of BTS and manages their radio resources. A BSC is principally in charge of handovers, frequency hopping, exchange functions and control of the radio frequency power levels of the BTSs.

4.5.8. The Network and Switching Subsystem

Its main role is to manage the communications between the mobile users and other users, such as mobile users, ISDN users, fixed telephony users, etc. It also includes data bases

needed in order to store information about the subscribers and to manage their mobility. The different components of the NSS are described below.

4.5.9. The Mobile services Switching Center (MSC)

It is the central component of the NSS. The MSC performs the switching functions of the network. It also provides connection to other networks.

4.5.10. The Gateway Mobile services Switching Center (GMSC)

A gateway is a node interconnecting two networks. The GMSC is the interface between the mobile cellular network and the PSTN. It is in charge of routing calls from the fixed network towards a GSM user. The GMSC is often implemented in the same machines as the MSC.

4.5.11. Home Location Register (HLR)

The HLR is considered as a very important database that stores information of the subscribers belonging to the covering area of a MSC. It also stores the current location of these subscribers and the services to which they have access. The location of the subscriber corresponds to the SS7 address of the Visitor Location Register (VLR) associated to the terminal.

4.5.12. Visitor Location Register (VLR)

The VLR contains information from a subscriber's HLR necessary in order to provide the subscribed services to visiting users. When a subscriber enters the covering area of a new MSC, the VLR associated to this MSC will request information about the new subscriber to its corresponding HLR. The VLR will then have enough information in order to assure the subscribed services without needing to ask the HLR each time a communication is established.

The VLR is always implemented together with a MSC; so the area under control of the MSC is also the area under control of the VLR.

4.5.13. The Authentication Center (AuC)

The AuC register is used for security purposes. It provides the parameters needed for authentication and encryption functions. These parameters help to verify the user's identity.

4.5.14. The Equipment Identity Register (EIR)

The EIR is also used for security purposes. It is a register containing information about the mobile equipments. More particularly, it contains a list of all valid terminals. A terminal is identified by its International Mobile Equipment Identity (IMEI). The EIR

allows then to forbid calls from stolen or unauthorized terminals (e.g, a terminal which does not respect the specifications concerning the output RF power).

4.5.15. The GSM Interworking Unit (GIWU)

The GIWU corresponds to an interface to various networks for data communications. During these communications, the transmission of speech and data can be alternated.

4.5.16. The Operation and Support Subsystem (OSS)

The OSS is connected to the different components of the NSS and to the BSC, in order to control and monitor the GSM system. It is also in charge of controlling the traffic load of the BSS.

However, the increasing number of base stations, due to the development of cellular radio networks, has provoked that some of the maintenance tasks are transferred to the BTS. This transfer decreases considerably the costs of the maintenance of the system.

4.5.17. The GSM functions

In this paragraph, the description of the GSM network is focused on the different functions to fulfil by the network and not on its physical components. In GSM, five main functions can be defined:

- Transmission.
- Radio Resources management (RR).
- Mobility Management (MM).
- Communication Management (CM).
- Operation, Administration and Maintenance (OAM).

4.5.18. Transmission

The transmission function includes two sub-functions:

The first one is related to the means needed for the transmission of user information.

The second one is related to the means needed for the transmission of signaling information.

Not all the components of the GSM network are strongly related with the transmission functions. The MS, the BTS and the BSC, among others, are deeply concerned with transmission. But other components, such as the registers HLR, VLR or EIR, are only concerned with the transmission for their signaling needs with other components of the GSM network. Some of the most important aspects of the transmission are described in section 5.

4.5.19. Radio Resources management (RR)

The role of the RR function is to establish, maintain and release communication links between mobile stations and the MSC. The elements that are mainly concerned with the RR function are the mobile station and the base station. However, as the RR function is

also in charge of maintaining a connection even if the user moves from one cell to another, the MSC, in charge of handovers, is also concerned with the RR functions.

The RR is also responsible for the management of the frequency spectrum and the reaction of the network to changing radio environment conditions. Some of the main RR procedures that assure its responsibilities are:

Channel assignment, change and release.

Handover.

Frequency hopping.

Power-level control.

Discontinuous transmission and reception.

Timing advance.

Some of these procedures are described in section 5. In this paragraph only the handover, which represents one of the most important responsibilities of the RR, is described.

4.5.20. Handover

The user movements can produce the need to change the channel or cell, specially when the quality of the communication is decreasing. This procedure of changing the resources is called handover. Four different types of handovers can be distinguished:

Handover of channels in the same cell.

Handover of cells controlled by the same BSC.

Handover of cells belonging to the same MSC but controlled by different BSCs.

Handover of cells controlled by different MSCs.

Handovers are mainly controlled by the MSC. However in order to avoid unnecessary signaling information, the first two types of handovers are managed by the concerned BSC (in this case, the MSC is only notified of the handover).

The mobile station is the active participant in this procedure. In order to perform the handover, the mobile station controls continuously its own signal strength and the signal strength of the neighboring cells. The list of cells that must be monitored by the mobile station is given by the base station. The power measurements allow to decide which is the best cell in order to maintain the quality of the communication link. Two basic algorithms are used for the handover:

The 'minimum acceptable performance' algorithm. When the quality of the transmission decreases (i.e the signal is deteriorated), the power level of the mobile is increased. This is done until the increase of the power level has no effect on the quality of the signal. When this happens, a handover is performed.

The 'power budget' algorithm. This algorithm performs a handover, instead of continuously increasing the power level, in order to obtain a good communication quality.

4.5.21. Mobility Management

The MM function is in charge of all the aspects related with the mobility of the user, specially the location management and the authentication and security.

4.5.22. Location management

When a mobile station is powered on, it performs a location update procedure by indicating its IMSI to the network. The first location update procedure is called the IMSI attach procedure.

The mobile station also performs location updating, in order to indicate its current location, when it moves to a new Location Area or a different PLMN. This location updating message is sent to the new MSC/VLR, which gives the location information to the subscriber's HLR. If the mobile station is authorized in the new MSC/VLR, the subscriber's HLR cancels the registration of the mobile station with the old MSC/VLR.

A location updating is also performed periodically. If after the updating time period, the mobile station has not registered, it is then deregistered.

When a mobile station is powered off, it performs an IMSI detach procedure in order to tell the network that it is no longer connected.

4.5.23. Authentication and security

The authentication procedure involves the SIM card and the Authentication Center. A secret key, stored in the SIM card and the AuC, and a ciphering algorithm called A3 are used in order to verify the authenticity of the user. The mobile station and the AuC compute a SRES using the secret key, the algorithm A3 and a random number generated by the AuC. If the two computed SRES are the same, the subscriber is authenticated. The different services to which the subscriber has access are also checked.

Another security procedure is to check the equipment identity. If the IMEI number of the mobile is authorized in the EIR, the mobile station is allowed to connect the network.

In order to assure user confidentiality, the user is registered with a Temporary Mobile Subscriber Identity (TMSI) after its first location update procedure.

Enciphering is another option to guarantee a very strong security but this procedure is going to be described in section 5.

4.5.24. Communication Management (CM)

The CM function is responsible for:

Call control.

Supplementary Services management.

Short Message Services management.

4.5.25. Call Control (CC)

The CC is responsible for call establishing, maintaining and releasing as well as for selecting the type of service. One of the most important functions of the CC is the call routing. In order to reach a mobile subscriber, a user dials the Mobile Subscriber ISDN (MSISDN) number which includes:

a country code

a national destination code identifying the subscriber's operator;
a code corresponding to the subscriber's HLR

The call is then passed to the GMSC (if the call is originated from a fixed network) which knows the HLR corresponding to a certain MSISDN number. The GMSC asks the HLR for information helping to the call routing. The HLR requests this information from the subscriber's current VLR. This VLR allocates temporarily a Mobile Station Roaming Number (MSRN) for the call. The MSRN number is the information returned by the HLR to the GMSC. Thanks to the MSRN number, the call is routed to subscriber's current MSC/VLR. In the subscriber's current LA, the mobile is paged.

4.5.26. Supplementary Services management

The mobile station and the HLR are the only components of the GSM network involved with this function. The different Supplementary Services (SS) to which the users have access are presented in section 6.3.

4.5.27. Short Message Services management

In order to support these services, a GSM network is in contact with a Short Message Service Center through the two following interfaces:

- The SMS-GMSC for Mobile Terminating Short Messages (SMS-MT/PP). It has the same role as the GMSC.
- The SMS-IW MSC for Mobile Originating Short Messages (SMS-MO/PP).

4.5.28. Operation, Administration and Maintenance (OAM)

The OAM function allows the operator to monitor and control the system as well as to modify the configuration of the elements of the system. Not only the OSS is part of the OAM, also the BSS and NSS participate in its functions as it is shown in the following examples:

- The components of the BSS and NSS provide the operator with all the information it needs. This information is then passed to the OSS which is in charge of analyze it and control the network.
- The self test tasks, usually incorporated in the components of the BSS and NSS, also contribute to the OAM functions.
- The BSC, in charge of controlling several BTSs, is another example of an OAM function performed outside the OSS.

4.6. GSM Services

It is important to note that all the GSM services were not introduced since the appearance of GSM but they have been introduced in a regular way. The GSM Memorandum of Understanding (MoU) defined four classes for the introduction of the different GSM services:

- E1: introduced at the start of the service.
- E2: introduced at the end of 1991.
- Eh: introduced on availability of half-rate channels.
- A: these services are optional.

Three categories of services can be distinguished:

- Teleservices.
- Bearer services.
- Supplementary Services.

4.6.1. Tele services

- Telephony (E1® Eh).

- Facsimile group 3 (E1).

- Emergency calls (E1® Eh).

- Teletex.

- Short Message Services (E1, E2, A). Using these services, a message of a maximum of 160 alphanumeric characters can be sent to or from a mobile station. If the mobile is powered off, the message is stored. With the SMS Cell Broadcast (SMS-CB), a message of a maximum of 93 characters can be broadcast to all mobiles in a certain geographical area.

- Fax mail. Thanks to this service, the subscriber can receive fax messages at any fax machine.

- Voice mail. This service corresponds to an answering machine.

4.6.2. Bearer services

A bearer service is used for transporting user data. Some of the bearer services are listed below:

- Asynchronous and synchronous data, 300-9600 bps (E1).
- Alternate speech and data, 300-9600 bps (E1).
- Asynchronous PAD (packet-switched, packet assembler/disassembler) access, 300-9600 bps (E1).
- Synchronous dedicated packet data access, 2400-9600 bps (E2).

4.6.3. Supplementary Services

- Call Forwarding (E1). The subscriber can forward incoming calls to another number if the called mobile is busy (CFB), unreachable (CFNRc) or if there is no reply (CFNRy). Call forwarding can also be applied unconditionally (CFU).

- Call Barring. There are different types of 'call barring' services:

- Barring of All Outgoing Calls, BAOC (E1).
- Barring of Outgoing International Calls, BOIC (E1).
- Barring of Outgoing International Calls except those directed toward the Home PLMN Country, BOIC-exHC (E1).
- Barring of All Incoming Calls, BAIC (E1)
- Barring of incoming calls when roaming (A).

- Call hold (E2). Puts an active call on hold.

- Call Waiting, CW (E2). Informs the user, during a conversation, about another incoming call. The user can answer, reject or ignore this incoming call.

- Advice of Charge, AoC (E2). Provides the user with an online charge information.

- Multiparty service (E2). Possibility of establishing a multiparty conversation.

- Closed User Group, CUG (A). It corresponds to a group of users with limited possibilities of calling (only the people of the group and certain numbers).

- Calling Line Identification Presentation, CLIP (A). It supplies the called user with the ISDN of the calling user.

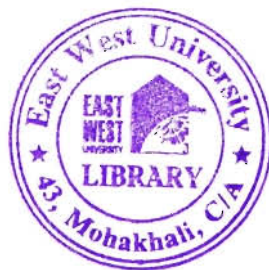
- Calling Line Identification Restriction, CLIR (A). It enables the calling user to restrict the presentation.

- Connected Line identification Presentation, CoLP (A). It supplies the calling user with the directory number he gets if his call is forwarded.
- Connected Line identification Restriction, CoLR (A). It enables the called user to restrict the presentation.
- Operator determined barring (A). Restriction of different services and call types by the operator.

5. Conclusion

The aim of this paper was to give an overview of the AKTEL's Contact Center, its Product and services with the GSM system and not to provide a complete and exhaustive guide.

As it is shown in this chapter, GSM is a very complex standard. It can be considered as the first serious attempt to fulfil the requirements for a universal personal communication system. GSM is then used as a basis for the development of the Universal Mobile Telecommunication System (UMTS).



6. Acronyms

A3	Authentication algorithm
A5	Ciphering algorithm
A8	Ciphering key computation
AGCH	Access Grant CHannel
AMPS	Advanced Mobile Phone Service
AoC	Advice of Charge
ARQ	Automatic Repeat reQuest mechanism
AUC	Authentication Center
BAIC	Barring of All Incoming Calls
BAOC	Barring of All Outgoing Calls
BOIC	Barring of Outgoing International Calls
BOIC-exHC	Barring of Outgoing International Calls except those directed toward the Home PLMN Country
BCCH	Broadcast Control CHannel
BCH	Broadcast CHannel
BER	Bit Error Rate
bps	bits per second
BSC	Base Station Controller
BSS	Base Station Subsystem
BTS	Base Transceiver Station
CC	Call Control
CCCH	Common Control CHannel
CDMA	Code Division Multiple Access
CEPT	Conference of European Posts and Telecommunications
CFB	Call Forwarding on mobile subscriber Busy
CFNRc	Call Forwarding on mobile subscriber Not Reachable
CFNRy	Call Forwarding on No Reply
CFU	Call Forwarding Unconditional
CGI	Cell Global Identity
C/I	Carrier-to-Interference ratio
C/I	Carrier-to-Interference ratio
CLIP	Calling Line Identification Presentation
CLIR	Calling Line Identification Restriction
CM	Communication Management
CoLP	Connected Line identification Presentation
CoLR	Connected Line identification Restriction
CUG	Closed User Group
CW	Call Waiting
DCS	Digital Cellular System
DCCH	Dedicated Control CHannel
DTX	Discontinuous transmission
EIR	Equipment Identity Register
ETSI	European Telecommunications Standards Institute
FACCH	Fast Associated Control CHannel
FCCH	Frequency-Correction CHannel

FDMA	Frequency Division Multiple Access
FEC	Forward Error Correction code
FER	Frame Erasure Rate
GIWU	GSM Interworking Unit
GMSC	GSM Mobile services Switching Center
GMSK	Gaussian Minimum Shift Keying
GP	Guard Period
GSM	Global System for Mobile communications
HLR	Home Location Register
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
ISDN	Integrated Services Digital Network
JDC	Japanese Digital Cellular
LA	Location Area
LAI	Location Area Identity
LOS	Line-Of-Sight
MM	Mobility Management
MoU	Memorandum of Understanding
MS	Mobile Station
MSC	Mobile services Switching Center
MSISDN	Mobile Station ISDN number
MSRN	Mobile Station Roaming Number
NADC	North American Digital Cellular
NMT	Nordic Mobile Telephone
NSS	Network and Switching Subsystem
OAM	Operation, Administration and Maintenance
OSS	Operation and Support Subsystem
PAD	Packet Assembler Disassembler
PCH	Paging CHannel
PCS	Personal Communications Services
PDC	Personal Digital Cellular
PIN	Personal Identification Number
PLMN	Public Land Mobile Network
PSPDN	Packet Switched Public Data Network
PSTN	Public Switched Telephone Network
RACH	Random Access CHannel
RF	Radio Frequency
RPE-LTP	Regular Pulse Excitation Long-Term Prediction
RR	Radio Resources management
S	Stealing flags
SACCH	Slow Associated Control CHannel
SCH	Synchronisation CHannel
SDCCH	Standalone Dedicated Control CHannel
SDCCH	Standalone Dedicated Control CHannel
SIM	Subscriber Identity Module
SMS	Short Message Services

SMS-CB	Short Message Services Cell Broadcast
SMS-MO/PP	Short Message Services Mobile Originating/Point-to-Point
SMS-MT/PP	Short Message Services Mobile Terminating/Point-to-Point
SNR	Signal to Noise Ratio
SRES	Signed RESult
SS	Supplementary Services
T	Tail bits
TACS	Total Access Communication System
TCH	Traffic CHannel
TCH/F	Traffic CHannel/Full rate
TCH/H	Traffic CHannel/Half rate
TDMA	Time Division Multiple Access
TMSI	Temporary Mobile Subscriber Identity
UMTS	Universal Mobile Telecommunications System
VAD	Voice Activity Detection
VLR	Visitor Location Register

7. Bibliography:

- # The data of product and services have been obtained from www.aktel.com.
- # The technical division provided me with the data of GSM from the intranet.
- # I have got the rest of the data from the internal portal of the Contact Center.

