The Impact of Bangabandhu Satellite on Telecom Sector in Bangladesh

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APPROVAL CERTIFICATE

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DECLARATION

This is to certify that the work entitled "The Impact of Bangabandhu Satellite on Telecom Sector in Bangladesh" is the outcome of the research carried out by me under the supervision of DR. RAQIBUL MOSTAFA, Professor & Head of the Department, Department of Electrical and Electronic Engineering (EEE), United International University (UIU), Dhaka-1209, Bangladesh.

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ABSTRACT

Satellite communications is now the integral part of most major telecommunications systems. Satellite allows people with no access to physical connectivity to join roundtable discussion from thousands of miles away can join to others. Satellite made world becomes a very small places. Now a day's satellite communications is very attractive and powerful technology because one geostationary satellite can cover about forty two per cent of the earth. Because of these technological advantages, it will be needed only three geosynchronous orbital satellites to cover the whole world for communicating each other's.

As satellite technology dominates international telecommunications market, Bangladesh market is also dominated by Satellite Service during the last two decades. The whole telecom sector of Bangladesh is now using Satellite as their backup of capacity. Satellite can provide a good solution in terms of Service in remote places in Bangladesh. This paper will focus on to the Bangladesh own Satellite named as Bangabandhu Satellite which is targeted to launch very soon and discuss the relevant literature overview along with technical background including frequency allocations, band designations, satellite launching and regulatory perspectives of recent regulatory and licensing regime, present telecom sector related to Satellite, technical and economic impact on present telecom sector. Based on the analysis presented in this report it can be concluded that satellite will be the only way to communicate with the whole world without any interruption and satellite will be the true redundant of whole present telecommunication backbone in parallel of the present telecommunication infrastructure.

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The Project titled "The Impact of Bangabandhu Satellite on Telecom Sector in Bangladesh" has been chosen to accomplish the requirement of MSCSE degree. I am very happy that I have received sincere guidance, supervision and co-operation from various persons.

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Finally, I want to give my honour and deepest love to my parents for their support, encouragement and endless love.

TERMINOLOGY

A

AMSS	Aeronautical Mobile Satellite Service
ARSS	Aeronautical Radio Navigation Satellite Service
ASS	Amateur Satellite Service
AIT	Assembly Integration and Test
AP	Access Point
ANS	Access Network System

B

BSS	Broadcast Satellite Service
BSSR	Broadcast Satellite Service for Radio
BTRC	Bangladesh Telecommunication Regulatory Commission
BS-1	The Bangabandhu Satellite -1
BWA	Broadband Wireless Access
BUC	Block Up Converter

C

CDR	Critical Design Review
CMS	Carrier Monitoring System

D

DTH	Direct to Home
DGHS	Director General of Health Science

E

EIRP	Equivalent Isotropic Radiation Power
EESS	Earth Exploration Satellite Service

F

FSS	Fixed Satellite Services
FFWC	Flood Forecasting and warning Centre
FCCR	Foundation for Climate Change Refuges

G

GPS	Global Positioning System

GEO	Geostationary Earth Orbit Satellite
GDP	Gross domestic product
GSM	Global System for Mobile Communications

I

ISS	Inter-Satellite Service
ITC	International Terrestrial Cable
IP-TV	Internet Protocol Television
IP	Internet Protocol
IOT	InOrbit Test
IFL	Inter-Facility Link
ITU	International Telecommunications Union
ICT	Information and Communication Technology
ITJ	International Telecom Japan
IIG	International Internet Gateway
ILDC	International Long Distance Cable
ILDTS	International Long Distance Telecommunication Service
ICX	International Exchange
IGW	International Gateway
IPTSP	Internet Protocol Telephone Service Provider

L

LEOP	Launch in Early Orbit Phase
LMSS	Land Mobile Satellite Service
LEO	Low Earth Orbit Satellite

M

MEO	Medium Earth Orbit Satellite
MSS	Mobile Satellite Service
MMSS	Maritime Mobile Satellite Service
MRSS	Maritime Radio Navigation Satellite Service
MoPT&T	Ministry of Posts, Telecommunication and Information Technology

N

NASA	National Aeronautics and Space Administration

NOCC	Network Operation Control Centre
NGO	Non-Government Organization
NIX	National Internet Exchange

O

OCC	Outdoor Community Clinics
OHF	Outdoor Health Facilities

P

PFD	Power Flux Density (PFD)
PSA	Primary Service Area
PLMN	Public Land Mobile Network
PSTN	Public Switching Telephone Network

Q

QoS	Quality of Service

R

RFE	Radio Frequency Equipment
RDSS	Radio Determination Satellite Service
RNSS	Radio Navigation Satellite Service

S

SOCC	Satellite Operation Control Centre
SSA	Secondary Service Area
SCPC	Single Carrier Per Channel
SOS	Space Operation Service
SRS	Space Research Service
SOHO	Small Office Home Office
SAARC	South Asian Association for Regional Cooperation
SEA-ME-WE-4	South East Asia Middle East Western Europe 4
SC	Submarine Cable

T

TPE	Transponder Equivalent
TBD	To be decided

	TV	Television
U		
	UT	User Terminal
	UHC	Upazila Health Complexes
V		
	VSAT	Very small aperture terminal
	VoIP	Voice over Internet Protocol (VoIP)
W		
	WiMAX	Worldwide Interoperability for Microwave Access

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURE

CHAPTER-1

Theoretical background and literature review

1.1 Introduction

All the modern and economically developed nations have their own satellite in the orbit. A sovereign country like Bangladesh, in pursuit of sustainable development, needs its own satellite to reduce its dependency on outer nations who have its own satellite. Bangladesh as a developing country working with the dream to open new dimensions of possibility in the telecommunications sector by launching first ever satellite.

Bangladesh as its unique geographical location is highly exposed to natural disaster risk. Telecommunication infrastructure in Bangladesh has always been suffering from interrupting and problems as consistent disasters hit the country. During such emergency, satellite network can play an important role in ensuring uninterrupted telecommunication services in Bangladesh. It has significant advantages over terrestrial network because of several reasons. The important reasons are that satellite network is quite important in ensuring high-level of communications redundancy than the terrestrial network. Besides, by having its own satellite network, Bangladesh can save a significant amount of foreign currency paid as the transponder rental charge for communications and broadcasting.

Bangladesh currently does not own any satellite. Both the public and various other private sectors of the country meet the demand of a satellite by renting bandwidth from different satellite operators those have foot print over our territory. For lease of transponder for this purpose, every year Bangladesh spends about 14.0 million USD, which will increase over the years [25]. This puts pressure on foreign currency reserve of the country. The demand of usage of a satellite in telecommunication, broadcasting, meteorology, military, research & development is increasing. To meet the requirement of satellite usage of the country for ICT, Broadcasting and other purposes, Bangladesh requires launching of its own satellite as early as possible. Launching Bangladesh's own communication and broadcasting satellite in orbit will cater to the country's new value added services in several sectors. Excess capacity will be

leased to the Regional market that will generate revenues in USD and stop the drain of foreign currency.

1.2 Definition of Satellite

Generally, Satellite is an object that orbits something other object, for example, the moon orbits the earth. In a communications context, a satellite is a specialized wireless receiver or transmitter that is launched by a rocket and paced in orbit around the earth [2]. There are hundreds of satellites currently in operation. A satellite which used for such kind of diverse purposes as weather forecasting, global positioning system (GPS), television broadcasting, amateur radio communications and internet communications.

According to NASA satellite can be defined more specifically as "A Satellite is an object that moves around a larger object. Earth is a satellite because it moves around the sun. The moon is a satellite because it moves around Earth. Earth and the moon are called 'natural' satellite".

But usually when someone says "satellite", they are talking about a 'man made' satellite. Man-made satellite is machine made by people. These machines are launched into space and orbit earth or another body in space [1] [4].

There are thousands of man-made satellites. Some of this always takes pictures of our planet, the sun and other objects. These pictures help to gather scientist learn about earth, the solar systems and the universe. Other satellite sends TV signals and phone calls around the world.

Satellite communications are one of the major radio based communication systems where information/data can be transmitting from one place of the world to another place of the world. For this communication satellite is located twenty two thousand three hundred miles above from the equator which called the geostationary orbit. In this orbit the satellite rotates at the same speed with the rotation of the earth. Furthermore, it seems to earth stations that the satellite is stationary, for this reason communications more reliable and predictable.

The first commercial satellite which used for telecommunications was launched into space from Cape Kennedy in 1965. At the first time a satellite owned by Intelsat known as Early Bird which handles an average of two hundred and forty voice channels. From that time

various countries have deployed communications satellite in the orbit. For this reasons satellite communications are going to be a key factor of the telecommunications industry.

The key basics of the satellite operations is that information/data in the form of electromagnetic waves or microwave signal is transmitted (up-link) from one earth station to a device called transponder on board the satellite.

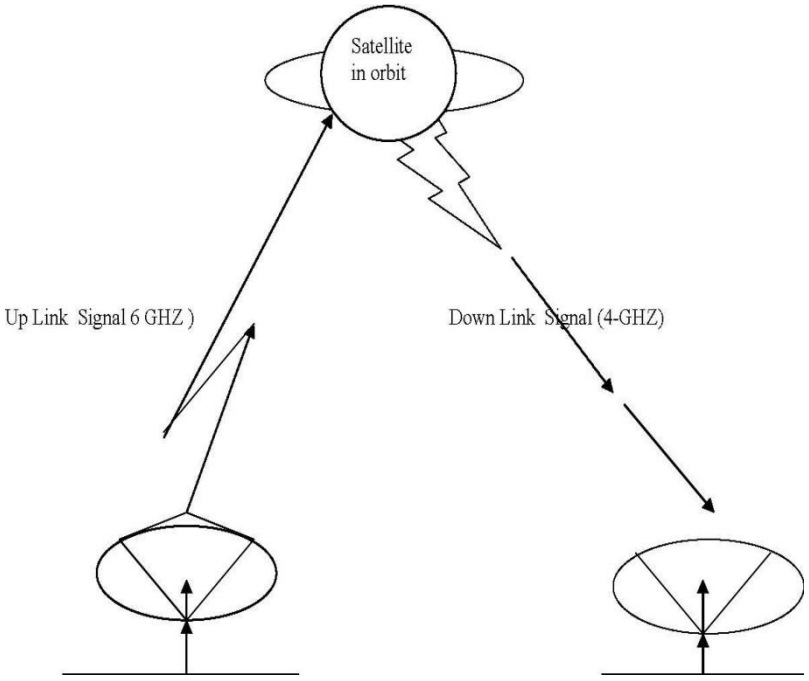

Figure 1.1: Satellite Communication

The transponder which receives comparatively weak microwave signal at a higher frequency from the earth and then amplifies those signals and transforms it into a frequency less than the one received and then retransmits (down-links) to a distant receiving earth station [7].

The setup in Figure 1.1 reflects the way how information or data can be transmitted through satellite in the orbit at around twenty three thousand miles from the earth. From the ground satellite station which located around twenty three thousand miles away from satellite cannot be seen properly. The speed of rotation of a satellite must be about six thousand and eight hundred miles per hour for staying in the orbit and its need twenty four hours to complete the cycle around the earth. As the same way earth is also rotates about the same speed like

satellite. For this reason one can see the satellite at this altitude from any location on earth, it seems to appear that it like standstill object.

1.3 Satellite Types

Generally three major types of satellite used:

1. **Geostationary Earth Orbit Satellite (GEOS)**
2. **Medium Earth Orbit Satellite (MEOS)**
3. **Low Earth Orbit Satellite (LEOS)**

Geostationary Earth Orbit Satellite (GEOS)

Geostationary Earth Orbit (GEO) Satellite is located exactly above the earth's equator and revolves around the earth in a circular orbit. Their revolving speed and direction which is west to east are exactly same as that of the earth, which makes it looks stationary from the earth surface. The exact altitude of these satellites above the equator is approximately 36,000 kilometres.

The term geostationary stems from the fact that this kind of satellite looks practically stationary in the sky when someone on the earth's surface observes it. A geostationary satellite's orbital path is called the Clarke Belt, in honour of the science fiction author Arthur C. Clarke. The uses of this type of satellite are all radio and TV broadcasting services.

Medium Earth Orbit Satellite (MEOS)

Medium Earth Orbit (MEO) Satellite which orbit the earth at an altitude above that of a low earth orbit satellite and above that of a geostationary earth orbit satellite. MEO, which is sometimes also called intermediate circular orbit (ICO), provides a vast range of options to those deploying satellites and strikes a balance between the costs of higher altitude constellations and the coverage of low orbit satellites. MEO satellites operate at altitudes between one thousand miles and twenty two thousand miles and orbit the earth at least twice a day. Some have perfectly circular orbits while others track elliptically, but all track the same orbit continuously once it has been established. The first satellite which was designed for high speed telephone signal and launched in the MEO is the Telstar and it was launched in the year 1962.

Low Earth Orbit Satellite (LEOS)

Low Earth Orbit (LEO) satellite means it extending from two hundred kilometer to one thousand and two hundred kilometer. LEO is still very close to the earth, especially when compared to other forms of satellite orbit including geostationary orbit. Orbit times are much less than for many others of orbit. The lower altitude means higher velocities are required to balance the earth's gravitational field. Typical velocities are very approximately around eight kilometer/second, with orbit times sometimes of the order of ninety minutes, although these figures vary considerably with the exact details of the orbit [5] [6].

1.4 Advantages

Satellites offer many advantages including:

1 Insensitivity of distances

Satellite transmission throughout a large geographical footprint means that operators incur no additional incremental costs to serve an additional point regardless of its distance from the program source. In terrestrial point-to-point networks, operators can attribute direct costs in extending a network to an additional point. Accordingly, satellites possess a comparative advantage relative to wire line networks for applications that require many connecting hopes in distributed geographical points.

2 Single-hop transmission

In satellite communication, a hop is a chunk of a signal's journey from earth station to satellite and vice versa. The transmission of a radio wave from the earth station to the satellite and back to the earth station. In routing, a hop is the step from one router to the next, on the path of a packet on any communications network.

3 Application for distance area and maritime uses

Satellite network provide rural satellite Internet for remote locations anywhere, but it allows business to be done anywhere. Stream video; make a phone call using VoIP (Voice over Internet Protocol) technology, and fax, all at the same time, for optimum productivity and profitability. Satellite based navigation helps all maritime applications, including

leisure boats, commercially run vessels and unregulated and safety of life at sea regulated ships.

4 Good error performance for data

As bandwidth demands increase and the tolerance for errors and latency decreases, designers of data-communication for satellite systems are looking for new ways to expand available bandwidth and improve the quality of transmission. Recent satellite technology has improved as such a way that performance increased in terms of correcting the error and data transmitting efficiency is satisfactory more than past years.

5 Broadcast technology

Satellite-based technology has become incredibly important to the broadcast industry, where the primary techniques of direct-to-home (DTH) and contribution/distribution (C&D) are employed throughout the world. In recent years, advances made in these methods have improved efficiency, and broadcasters are keen to move forward to use these technologies. However, there are issues, both financial and technical, that govern deployment.

6 Disaster recovery

Satellite is essentially microwave radio aimed upward. So, as it is based on wireless technology, it is not admitting to the infamous "backhoe fade" that often plagues today's communications-dependent organizations. Satellite is also independent of the terrestrial infrastructure. This could be significant since the communications systems in many third world countries may leave much to be desired. The diversification of the path or physical replication of this medium pays dividends during normal operation, particularly in areas prone to frequent circuit outages. In addition, the equipment is becoming increasingly compact, with truck-mounted transmitters, or "uplinks," becoming common place [29].

7 Large amounts of bandwidth

Satellites have more than a transponder with each of 36 MHz of bandwidth. Modern customer focused satellite oriented internet service is basically providing to individual customers through geostationary satellites that can be offered high data speeds with newer satellites using several band to achieve downstream data speeds up to 50 Mbps.

8 Ballistic missiles early warning systems

The radar based ballistic missile early warning systems which uses low earth orbit satellites, would be the basis for a cold war ballistic missile surveillance system and that would become in a way to complex and in capacity as the years went by. In the time of ballistic missile launches and if it create any threat, the decision to retaliate would mean the National Command Authority making the call to do so within half an hour, an act that could bring the end of humanity's reign on Earth, permanently.

9 Aviation industry

Both rotary and fixed wing aircraft currently use satellite based navigation to precise routes and reliably connect to air to ground logistics. The capabilities of Satellite based terrestrial network will introduce new type of services which improve emergency response time, reduce operational downtime and enable improvements in telemetry and logistics to better serve flight and maintenance crews. In the aviation industry many types of applications that can be optimized with the help of satellite based communications including passenger and freight identification, air to ground communications, location tracking, route optimization, monitoring and traffic detection and collision avoidance.

10 Weather forecasting

Satellites make it possible to observe wide areas in good temporal and spatial resolution. Web Images are probably the best-known satellite applications, but also other meteorological parameters also can be driven from satellite based measurements. These include temperature and humidity profiles, wind velocity and direction, as well as lightning.

11 No location restrictions

Location is independent in terms of using the satellite services. The altitude and the height of a satellite create this opportunity, as well as satellite service is independent of its uses in terms of locations.

1.5 Disadvantages

There are some drawbacks in terms of satellite communications which include the following:

1 **Propagation delay in one way (around 270 milliseconds to 540 milliseconds)**

A geostationary satellite is visible from a little less than one third of the earth's surface and if you are located at the edge of this area the satellite appears to be just above the horizon. The distance to the satellite is approx. 41756 km and the distance to the satellite is greater and for earth stations at the extreme edge of the coverage area. If you were to communicate with another similarly located site, the total distance is nearly 84,000 km so the end to end delay is almost two hundred and seventy milliseconds to five hundred and forty milliseconds.

2 **Delay increase due to multi hop and harmfully impacting voice**

On the commercial side, one of the interesting aspects of satellite communications is that the cost of a single-satellite-hop telephone call is almost independent of distance. Whether calling a next-door neighbour or someone on another continent, the amount of equipment involved in the process is almost the same. The application determines the type of satellite system required.

3 **Higher path loss in transmission to satellite**

In satellite communication, the free space path loss, also known as FSPL is the loss in signal strength that occurs when an electromagnetic wave travels satellite to earth or earth to satellite in free space.

4 **Rain absorption affects path loss**

The amount of rain absorption increases the fear to loss of data and as the wavelength of the electromagnetic wave approaches the size of a typical raindrop. The wavelength is equal to the speed of light (3 x 108 m/s) divided by the frequency, while the average diameter of a raindrop is about 1.5 mm. At the downlink, C-band frequency of 4 GHz, the wavelength is 75 mm. Generally the wavelength is 50 times the average diameter of a raindrop and without interaction the waves pass through the rain virtually.

5 **Congestion build-up**

Having a larger bandwidth means more data are being transferred at a given time making download faster. Internet speed refers to the bandwidth allocated to you. If you want to avoid congestion and want speed, you need to allocate your bandwidth well. Avoiding

traffic congestion and other impediments to your internet connection such as latency is easy. You simply need to be conscious about your internet usage and habits.

6 Risk during launching.

Risks during launching are categorized in ground risks and in orbit risks generally. There are various factors which need to be considered even before a launch. During their erection and operation, the various production sites and launch facilities are exposed to hazards such as natural catastrophes or fire. Great efforts must be made by the experts to assume safe procedures, as handled objects are at least delicate or, like explosive devices also dangerous [23].

1.6 Satellite Services

According to International Telecommunication Union (ITU), seventeen satellite services are generally used [18]. We can see the services [19]:

1. Maritime Mobile Satellite Service (MMSS)
2. Space Operation Service (SOS)
3. Inter Satellite Service (ISS) (also known as Inter Satellite Links (ISL))
4. Aeronautical Radio Navigation Satellite Service (ARSS)
5. Broadcast Satellite Service for Radio (BSSR)
6. Fixed Satellite Service (FSS)
7. Broadcast Satellite Service (BSS) (also known as Direct Broadcast Satellite Service (DBS) or Small Dish Television)
8. Space Research Service (SRS)
9. Metrological Satellite Service (MSS)
10. Earth Exploration Satellite Service (EESS)
11. Radio Determination Satellite Service (RDSS)
12. Radio Navigation Satellite Service (RNSS)
13. Mobile Satellite Service (MSS)
14. Aeronautical Mobile Satellite Service (AMSS)
15. Maritime Radio Navigation Satellite Service (MRNSS)
16. Land Mobile Satellite Service (LMSS)
17. Amateur Satellite Service (ASS)

1.7 Why Are Satellites Important?

Satellite is staying in the so high altitude from ground in the sky and also they can see larger area of the earth at one time and also have a clear view of the space. The distance covered by a satellite is larger than any other communications medium usually sued. Satellite flies above the earth cloud and air usually. TV signals didn't go so far in absence of satellites, since TV signals usually travel straight lines. So, these signals would go off into the space instead of following earth's curve. Sometimes, this signal would be blocked by mountains or tall building situated in the country.

Phone calls which come from so faraway places were also problems. Costs is increases and also it is hard to set up telephone network through wires over long distances or underwater. The TV signal and the phone calls can be sent up to a satellite and satellite can then send them back down to the earth in the different places or spots.

1.8 What Are the Parts of a Satellite?

Satellites come in many shapes and sizes. But most have at least two parts in common - an antenna and a power source. The antenna is used to send and receive information. The power source can be a solar panel or battery. Solar panels make power by turning sunlight into electricity. There are many satellite launched by NASA which carry cameras and scientific sensors. This type of satellite may gather information on earth surface and over air and water. At the same time this satellite may collect data from solar system and universe [7].

1.9 What Were the First Satellites in Space?

The first satellite into the space is called Sputnik 1 which launched by the Soviet Union. This satellite was launch in 1957.

There were many satellites in the space launched by NASA and the first one was Explorer 1 in 1958. This satellite was the first man made satellite by the American's. The first satellite was Explorer 6 which sends the picture from space to earth in 1959.

1.10 Organization of the report

This project report is organized in such a way where the theoretical review of literature builds your understanding then facts will be introduced. After that present situation of telecommunication is discussed and analysis the impact on it.

Chapter-1: Theoretical background and literature review

Chapter-2: Launching of Bangabandhu Satellite

Chapter-3: Structure of Present Telecommunication Sector

Chapter-4: Impact on Telecommunication Sector

Chapter-5: Conclusion

CHAPTER-2

Launching of Bangabandhu Satellite

2.1 Objective

Today's almost every modern and economically developed countries have their own satellite in the sky. A sovereign country, in a pursuit of sustainable development, needs its own satellite to reduce its dependency on other nations. Bangladesh started its work before almost five years with a theme to open new dimension of possibility in the telecommunication sector by launching its first ever satellite. A country like Bangladesh is highly exposed to natural disaster risk because of its unique geographical location. Telecommunications infrastructure in Bangladesh has been suffering from interruptions and problems as erratic disasters hit the country from long ago. During such emergency situation, satellite network can play an important role in ensuring uninterrupted telecommunication services in Bangladesh [27]. It has significant advantages over terrestrial network because of a number of reasons. One of the important reasons is that satellite network is more effective in ensuring high-level of communication redundancy than the terrestrial network. Besides, by having its own satellite network, Bangladesh can save a significant amount of foreign currency paid as the transponder rental charge for communications and broadcasting.

Both the public and various other private sectors of the country meet the demand of a satellite by renting bandwidth from different satellite operators those have foot print over our territory. Transponder leasing for this purpose, every year Bangladesh spends a huge foreign currency, which will increase over the years. This puts pressure on foreign currency reserve of the country. The demand of usage of a satellite in telecommunication, broadcasting, meteorology, military, research & development is increasing. To meet the requirement of satellite usage of the country for Broadcasting and other purposes and also information and technology, Bangladesh requires launching of its own satellite as early as possible. Launching Bangladesh's own communication and broadcasting satellite in orbit will cater to the country's new value added services in several sectors. Excess capacity will be leased to the regional market that will generate revenues and stop the drain of foreign currency.

2.2 History

The National ICT Policy 2009 (Strategic Theme No. 238 of Objective 8.2), gave the responsibility to Ministry of Posts, Telecommunication and Information Technology (MoPT&IT), Bangladesh Telecommunication Regulatory Commission (BTRC) and private sector to launch Bangladesh's own satellite in orbit. Pursuant to ICT Policy 2009, BTRC took initiative. As a result, "Preparatory Functions and Supervision in Launching a Communication and Broadcasting Satellite" Project was approved in January 2012. The main objective of this preparatory project is foreign consultancy services for preparatory works, including; frequency coordination, satellite design, tender document preparation & evaluation, LEOP, AIT, launch of Satellite and In Orbit Test (IOT). Digital Bangladesh concept through delivery of high quality multi-channel television and broadband Internet up to the village level government take this initiative.

At the same time the main reasons to take the initiative is as follows:

(i) Save money for existing national users of satellite services, Government and Enterprise alike

(ii) Create new services for Government, Enterprise and Consumers

(iii) Create jobs in country to operate the satellite and to manage the overall traffic through the satellite

(iv) Create social and community benefits for example first response communications in disaster areas.

(v) Revenue generation opportunity of the Government through national and international sales of bandwidth, and services, as well as license fees from new services.

(vi) Hosting 25 satellite TV channels on foreign owned satellites cost Bangladesh approximately 288,000 USD per channel per annum which equals 7.2 million USD in total per year. With the passage of time, more channels will be entering in the market, which would cost Bangladesh in excess of 100 million USD over the 15 years life time of a Satellite. By having its own satellite, Bangladesh will not only save in excess of 100 million USD, but also earn foreign currency by leasing out transponders to the neighbouring region.

(vii) During natural disasters, communication is vital. Destruction of terrestrial infrastructure due to annual disasters can be very costly. Having a dedicated satellite can mitigate the damages with advanced preparation using early warning systems and emergency disaster relief communications systems connecting critical support services.

(viii) One of the great side benefits for Bangladesh of launching its own satellite is having a knowledge based society of space generation. By availing themselves of this opportunity Bangladesh, in a short few years, open up new lines of high tech revenues and business opportunities. Similar experience can be found from the other new space operators.

(ix) Once Bangladesh has its own NOCC and SOCC, these can be outsourced to other countries/ satellite operators. There is a potential upside to the business plan by these opportunities.

2.3 Technical Characteristics

The Operational Satellite Network will provide service to the following Primary and Secondary Coverage areas:

Primary Coverage Area

- A dual polarized, high gain AP30/30A (BSS) and AP30B (FSS) Ku-Band spot beam covering Bangladesh and its territorial waters of the Bay of Bengal
- A dual polarized AP30/30A (BSS) and AP30B (FSS) Ku-Band regional beam covering India, Bangladesh and its territorial waters, Nepal, Bhutan, and Sri Lanka
- A regional C-Band beam covering Indonesia, The Philippines, Bangladesh, India, Myanmar, Bhutan, Nepal, Sri Lanka, Afghanistan, Pakistan, Tajikistan, Kyrgyzstan, Uzbekistan, Turkmenistan, and portions of Kazakhstan (with elevation angle equal or greater than 10 degrees to Bangabandhu)

Secondary Coverage Area

- A Ku-Band beam covering the Philippines
- A Ku-Band beam covering Indonesia

- Remainder of Kazakhstan (with elevation angle less than 10 degrees to Bangabandhu) in C-Band beam

Network Overview

The Bangabandhu Operational Satellite Network ("the Network") is a geosynchronous Fixed Satellite System (FSS) that has shaped beams over Bangladesh, India, Indonesia and the Philippines and surrounding regions, and a Broadcasting Satellite System (BSS) that is included in the beam over Bangladesh. The network architecture is shown in **Figure 2.1.**

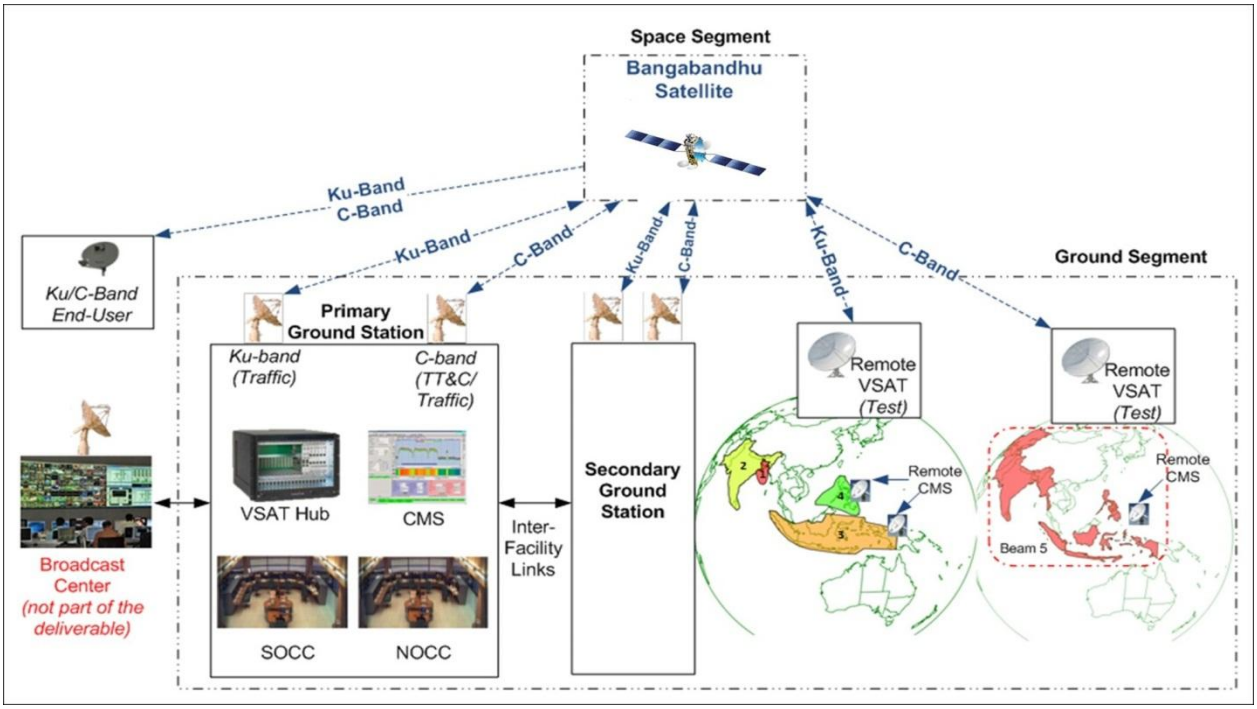

Figure 2.2: Bangabandhu Operational Satellite Network Concept

The Details of Network Concept

- The Primary and Secondary Ground Stations shall be in Bangladesh.
- An inter-facility link (IFL) to interconnect the Primary and Secondary Ground Stations, allowing the Satellite to be operated from either Ground Station. Purchaser will provide the administrative support to acquire the physical transport to interconnect the two ground stations.

- Each Ground Station shall include C-Band and Ku-Band RFE.
- The Primary Ground Station shall have a fully redundant NOCC and SOCC while the Secondary Ground Station shall have a non-redundant NOCC and SOCC.
- The Primary Ground Station shall have a VSAT Hub and CMS. These can be operated from the Secondary Ground Station by routing data through the IFL. The CMS shall monitor Ku-Band and C-Band satellite transponder operating levels in beams that can be seen from Bangladesh. Beams covering Indonesia and the Philippines shall require remote CMS stations. These remote stations shall have a data interface and be controlled from the NOCC.
- The Ground Stations shall provide the interfaces to connect to a future Broadcast centre(s). This station will perform the key role to control the satellite payloads and other components. There will be full duplex communication between the satellite and ground station. Every day the role of this ground station will be only for maximum of 60 minutes, when satellite will come in the field of view. For other time the simulations will be running in the background for doing the analysis of the past data collected.
- The Network shall further support VSAT and DTH hubs in other service areas and these other subsystems.

2.4 Frequency Allocation

As per the Radio Regulations (amended in 2016), which comprises the full set of documents regarding the radio regulations and it adopted by the World Radio communication Conference (WRC-95) (Geneva, 1995), subsequently amended and approved by the World Radio communication Conference (WRC-97) (Geneva, 1997), the World Radio communication Conference (WRC-2000) (Istanbul, 2000), the World Radio communication Conference (WRC-03) (Geneva, 2003), the World Radio communication Conference (WRC-07) (Geneva, 2007), the World Radio communication Conference (WRC-12) (Geneva, 2012) and the World Radio communication Conference (WRC-15) (Geneva, 2015), including all Appendices,

Resolutions, Recommendations and ITU-R Recommendations incorporated by reference. Available: November 2016, the Satellite payload and Ground Stations RFE shall operate in the AP30/30A Ku-Band BSS and the AP30B C and Ku-bands FSS, as specified below [20]:

- AP30/30A Ku-Band BSS (space-to-earth: 11700 – 12500 MHz, earth-to-space: 14500 – 14800 MHz and 17300 – 18100 MHz)
- AP30B C-Band FSS (space-to-earth: 4500 – 4800 MHz, earth-to-space: 6725 – 7025 MHz)
- AP30B Ku-Band FSS (space-to-earth: 10700 – 10950 MHz and 11200 – 11450 MHz, earth-to-space: 12750 –13250 MHz)

FSS Ku-Band Frequency Plan

A nominal FSS Ku-Band frequency plan, including the downlink beacon signal, is depicted in Figure 2.2 and Figure 2.3 with 36 MHz transponders and 40 MHz between transponder channel centres.

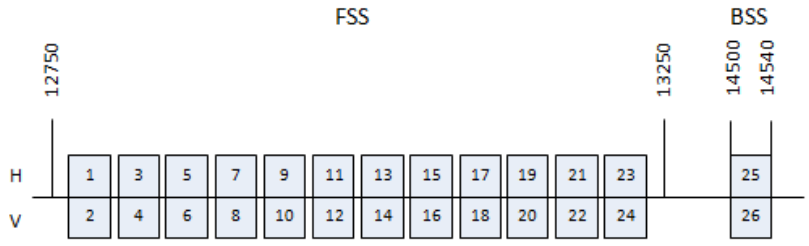

Figure 2.2: Nominal FSS Ku-Band Earth-to-Space Frequency Plan

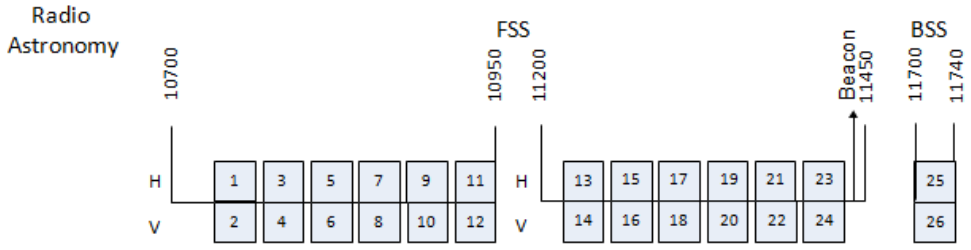

Figure 2.3: Nominal FSS Ku-Band Space-to-Earth Frequency Plan

It is intended that the 24 FSS transponders be assigned to the Ku-Band beams with sufficient switching to allow groups of transponders to be allocated to any.

C-Band Frequency Plan

A nominal C-Band frequency plan is depicted in Figure 2.4 and Figure 2.5 with a 14, 36-MHz transponders. TT&C operations will be conducted in the C-Band spectrum within the ranges shown below. The Bidder shall select the frequencies to be used.

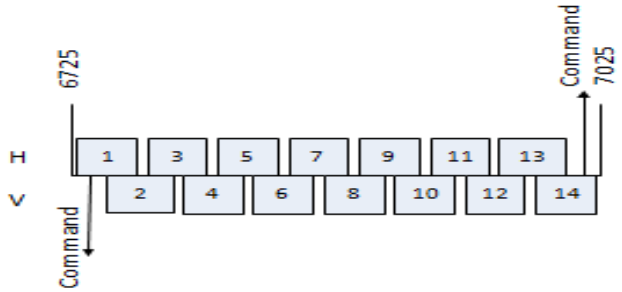

Figure 2.4: Nominal C-Band Earth-to-Space Frequency Plan

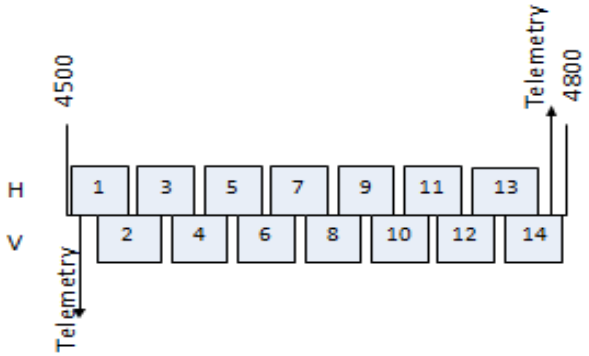

Figure 2.5: Nominal C-Band Space-to-Earth Frequency Plan

Dedicated BSS Ku-Band Transponder

The Ku-Band payload shall can operate in the BSS frequency bands. It is acceptable to add a BSS feed and use one of the planned Ku-Band reflectors. The design shall bring into use these BSS frequencies in Clear sky with no restriction on UT size. It is acceptable to make one of the 36-MHz BSS transponders tuneable if the Bidder can show that a test signal can be established.

Ku-Band Transmitted Power Flux Density

The Ku-Band FSS payload EIRP shall not exceed the Power Flux Density (PFD) limit produced at the Earth's surface per Table-2.1 below, as imposed by ITU Radio Regulations.

Table 2.1: Ku-Band PFD Limits

Frequency Band	Limit in dB(W/m^2) for angles of arrival (δ) above the horizontal plane			Reference Bandwidth
	0° - 5°	5° - 25°	25° - 90°	
10.7 – 11.7 GHz	-150	-150 + 0.5(δ – 5)	-140	4 kHz

Ku-Band EIRP

This section provides the minimum saturated EIRP requirements for each of the Ku-Band PSA and SSA beams. In addition, the EIRP outside of Ku-Band beams shall be less than the constraints in Table 3.2 and Table 3.3 for Ku-Band FSS and BSS frequencies respectively, within the indicated countries.

Table 2.2: Maximum EIRP Limits, Ku-Band FSS

Country	Max EIRP (dBW/36 MHz)
INDONESIA	57.9
MACAU	50.6
NORTH AND SOUTH KOREA	51.4
NEW CALEDONIA	60.7

Table 2.3: Maximum EIRP Limits, Ku-Band BSS

Country	Max EIRP (dBW/36 MHz)
MACAU AND HONG KONG	46.4
SOUTH KOREA	42.4
NORTHERN MARIANA ISLANDS	36.4

Beam 1 – Bangladesh EIRP

Beam 1 shall cover Bangladesh and its territorial waters with the maximum EIRP of 61.6 with considering the Reference G/T for Bangladesh coverage = 15.1dB/K

Figure 2.6 shows required coverage of Bay of Bengal. Performance in Bangladesh shall be maximized for the top four (4) population areas: Dhaka, Chittagong, Rajshahi, and Sylhet.

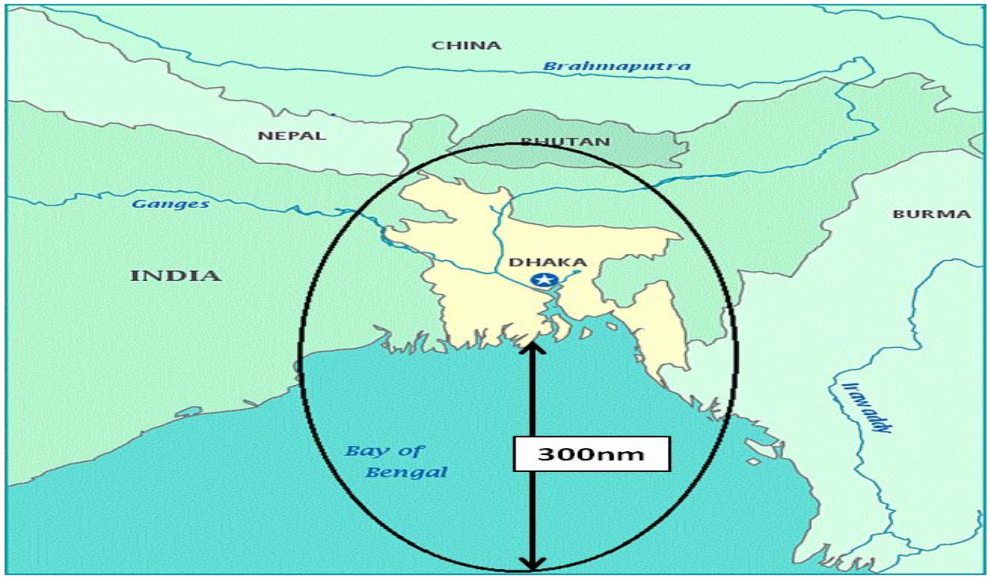

Figure 2.6: Bay of Bengal Coverage (up to 300 nautical miles from the port)

The minimum requirement for saturated EIRP specification, including satellite-pointing errors, in the space-to-earth direction, over the FSS frequency ranges 10.7 – 11.45 GHz and BSS frequency ranges11.7-11-74 GHz in Beam 1.

2.5 Covering Region

The Design shall provide coverage within two service areas: a Primary Service Area (PSA), and a Secondary Service Area (SSA).

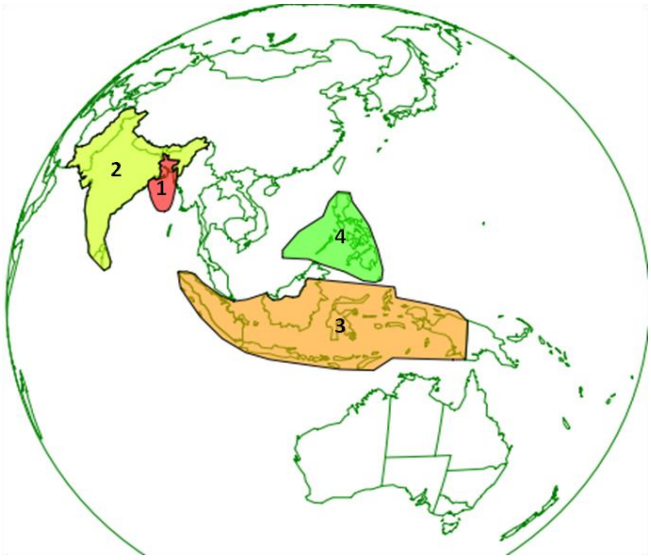

Figure 2.7: Ku-Band Service Areas

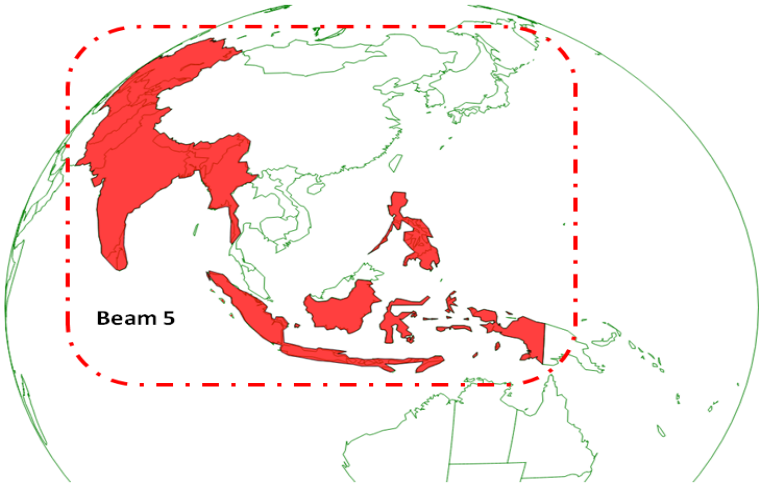

Figure 2.8: C-Band Service Areas (from Indonesia to Kazakhstan)

The PSA is defined by regions 1, 2 and 5 and includes:

- Region 1: Ku-Band Beam 1 over Bangladesh and its territorial waters in the Bay of Bengal
- Region 2: Ku-Band Beam 2, herein referred to as “India Plus” Beam, over India, Bangladesh (including its territorial waters, in the Bay of Bengal), Pakistan, Nepal, Bhutan, and Sri Lanka

- Region 5: C-Band Beam 5 covering Bangladesh (including its territorial waters in the Bay of Bengal), India, Sri Lanka, Nepal, Bhutan, Myanmar, Afghanistan, Pakistan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, portions of Kazakhstan, Indonesia and the Philippines, with elevation angle equal or greater than 10 degrees to Bangabandhu

2.6 Satellite launching

The first Bangladeshi geostationary communications satellite called the Bangabandhu Satellite -1 (BS-1), which is scheduled to launch in early 2018. This satellite as an expectation will be located at 119° East longitude geostationary slot. In the stage of its launching progress the Bangabandhu Satellite-1 project has successfully passed its Critical Design Review (CDR), which held in France in the premised to Thales Alenia Space at the end of 2016. The program will now begin the production phase with the integration of the communications module in Thales Alenia Space plant in Toulouse, France and the service module in Cannes, with the mating set for March 2017. At the same time, the ground team is kicking off factory acceptance tests and starting local work on the installation of ground antennas. It can be said that entirety, Bangabandhu Satellite-1 is a telecommunications system which comprises a satellite and the complete ground segment including satellite control, mission and user segments.

The turn-key contractor Thales Alenia Space is also responsible to build two ground facilities in Bangladesh for all support equipment needed to control the satellite and operate the telecom system. Thales Alenia Space Italy and Thales Alenia Space Spain are all involved in this project, as suppliers of various ground and satellite components. The launch service is also covered by the contract, and will be provided by a SpaceX Falcon 9 launch vehicle. The working progress of first Bangladeshi satellite called the Bangabandhu Satellite-1, is rapidly progressing with the target of launching it on March 2018, at the beginning of the next year. The Bangabandhu Satellite-1 will provide 40 different types of services once launched into orbit. The satellite with 1,600MHz capacity will have 40 transponders and the physical equipment of the space capsule that measures the capacity.

Half of the capacity will be reserved for Bangladesh while the other half will be rented out. In 2008, the Bangladesh Telecommunication and Regulatory Commission (BTRC) completed the primary work, including the submission of electronic filing to the International Telecommunication Union (ITU), to launch the satellite. It is the most technologically advanced project to have been undertaken by the Bangladesh government. The project is looking to finish work by this year so that the satellite can be launched on Victory Day. The construction work of two ground control stations in Gazipur and Betbunia are going on in full swing. The work on Bangabandhu Sattelite-1 is going on under the facility of Thales Alenia Space of Cannes and Toulouse. Thales Alenia Space oversees the design, production, testing and the delivery in orbit of the satellite. An agreement has already been signed between SpaceX, USA and Thales.

2.7 End-to-End Services

- Direct to Home (DTH)
    - Ku-band service consisting of multiplexed digital television, radio and associated data direct to very small antennas. Operators in the respective countries will package the content at their broadcast centre(s) and transmit them to the Bangabandhu Ground Station or another earth station facility for uplink to the Satellite.
- Video Distribution
    - C-band service of multiplexed digital television, radio and associated data services to medium-sized antennas anywhere in the Satellite's footprint. The users of this service are likely to be broadcasters distributing their content services to intermediaries like cable TV network operators, or re-broadcasters like DTH Operators in other countries.
- VSAT Private Networks
    - The Network shall support private networks consisting of voice, data, video and Internet services, to banks, gas stations, etc. with medium-sized antennas. The service will be delivered using Ku-Band in the Bangladesh and the IndiaPlus coverage regions and using C-Band beams. Typically, the

Purchaser's customers will be Satellite Service Providers offering end-to-end services for the user groups mentioned above.

- Broadband
    - This is a Ku-Band Broadband service that allows the end-user (individual, organization, corporation or Government) to remotely access the Internet at high speed with high quality of service. Small to medium-sized antennas will be required in Bangladesh and IndiaPlus with medium-sized antennas in Indonesia and the Philippines. The Purchaser's customers will typically be Satellite Service Providers and Internet Service Providers, which will retail the services to end-users.
- Communications Trunks
    - Ku-Band and C-Band wide band high data rate point-to-point services that require large antennas at both ends of the circuit. Typically, Telco's and GSM Operators use these services.

For DTH, which is a digital satellite service that provides television viewing services directly to subscribers through satellite transmission anywhere in the country and the User Terminal (UT) sizes shall apply to each of the key cities for Ku-Band beams over Bangladesh, India, Indonesia and the Philippines. These link budgets shall demonstrate the satisfactory performance of the Network in all beams and shall be tested operationally using the Bidder-supplied VSAT equipment. Over-the-air tests shall be performed in clear sky. Performance in rain shall be calculated analytically and it will match with calculation in link budget.

CHAPTER-3

Structure of Present Telecommunication Sector

3.1 Telecom sector related to Satellite

To establish the telecommunication with international community through International Long Distance Telecommunication Service (ILDTS), introduces a type of new generation technologies and advancement on the current field of telecommunication. Voice over Internet Protocol (VoIP) is one of such very popular technologies, which is being used universally for inexpensive voice communications through Internet all over the world. The technology based on Internet Protocol called the VoIP technology gradually successfully launched and create its huge popularity due to its low cost and compatibility with a host of different Internet Protocol (IP) based networks. VoIP has been the catchphrase in Bangladesh for quite some time. The National Telecommunications Policy created in 1998 and also Bangladesh Telecommunication Act, 2001, as its time of creation, this kind of newer topics has not been addressed in because the rapid emergence of the technology and its success could not be conceived at that time. There have been numerous studies, debates and discussions over opening of VoIP but unfortunately the adaptation of new technology was not taken in due course. The above raising confusion and delays by the implementation authorities, clandestine operation of VoIP services mushroomed, denying huge revenue opportunities for the government from this sector.

When an arbitrage opportunity has been identified and a technological means of exploiting it exists, it is difficult to restrict such activities. VoIP enabled telephony services for call termination and origination has grown uncontrolled in absence of proper policy framework and implementation. As the above contest, a big amount of revenue was lost from generating revenue and the government was deprived of its due share. Because of the detrimental effects of the institutionalization of these illegal actions and the rapid increase of demand from expatriate callers, local business entrepreneurs and multinational companies doing business in Bangladesh, the Government took the first step in 2007 to address the issue by presenting ILDTS Policy 2007.

The Government has the vision to materialize Digital Bangladesh to ensure socio economic changes in the society by introducing new technologies and by creating and facilitating an environment to connect the unconnected to the global network for their economic and social benefits. The government is also determined to make sure that information and communication technology and services are available at an affordable price to everyone in general and to rural areas.

The 2007 policy did not, however, fully succeed in achieving its laudable objectives. Illegal bypass of the international termination arrangements continued, even in the context of greatly increased legal traffic, depriving the government of legitimate revenue from the traffic itself and from taxes levied from the licensed operators, continuing an unhealthy environment of lawlessness and generation of black money, and endangering the legitimate interests of law abiding operators. The 2007 policy framework also fell short on delivering low cost international calls and of choice in terms of price quality configurations to residential and business customers. Despite active efforts to encourage job creation for Bangladesh youth and export promotion through business process outsourcing services (BPO), the results were meager. Therefore, the ministry of posts and telecommunications, acting under the power set out section 33 of the Bangladesh Telecommunications Act, No. 18 of 2001, carefully analyzed the experience of implementing the 2007 policy framework and its problems and hereby presents a revised ILDTS Policy Framework 2010 designed in consultation with BTRC to better achieve its objectives.

According to the ILDTS policy whole telecommunications sector are presently structured in a layered way which is depicted in Fig 3.1. This architecture is divided in two major parts, one is voice and another is data and both of this part have the primary route is Submarine cable (SC) and the secondary route is International Terrestrial Cable (ITC) in a true practical sense though both is shown through light green colour. Practically when any disruption or any maintenance or any other events occur in the SC then practically ITC is used as a backup media of communication. But the issues are if any events occur when both of this media is not working then what is the solution. Then answer is only satellite can serve in that kind of solution.

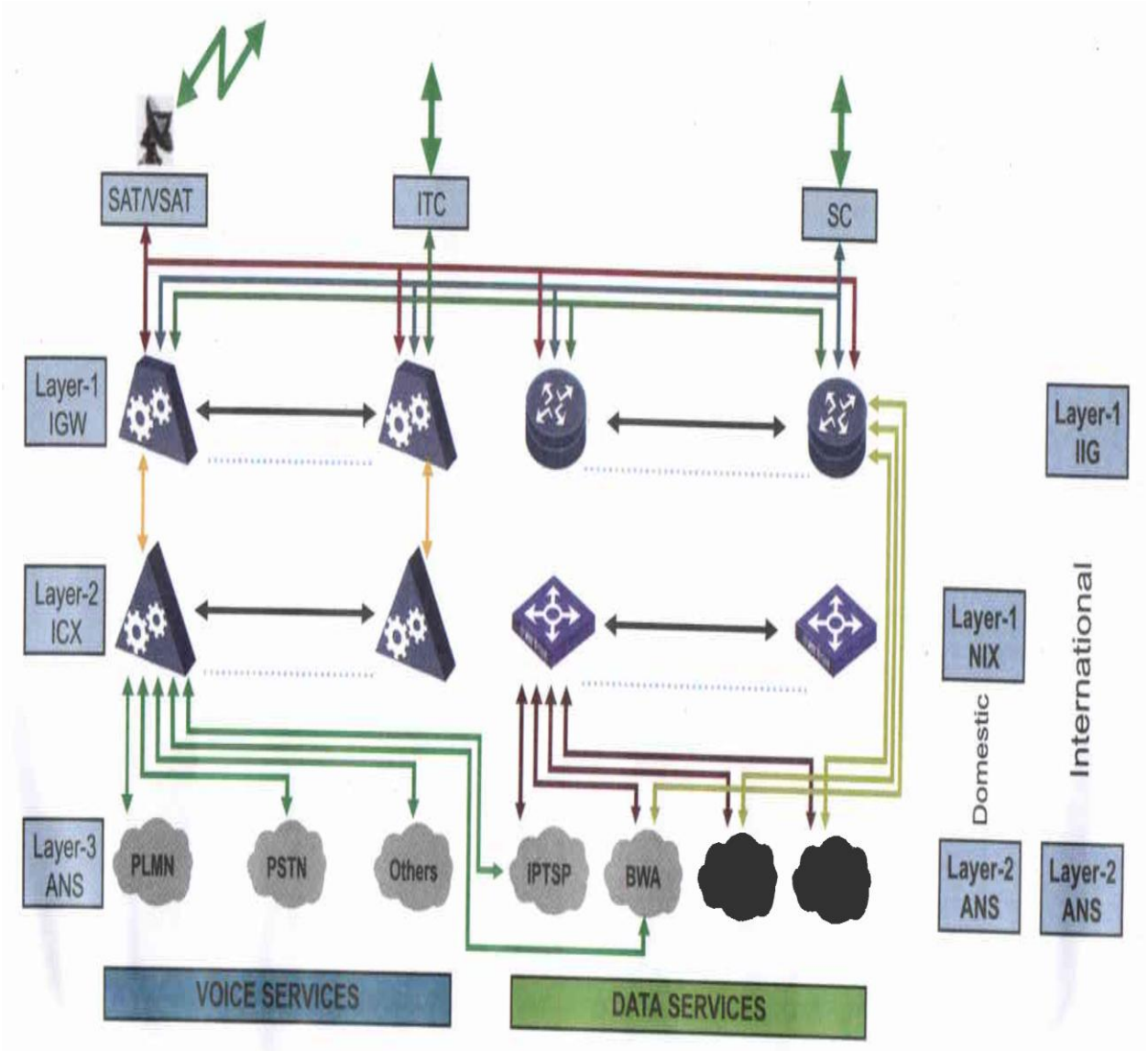

Figure 3.1: Schematic Diagram of Topology of Current Telecommunication Sector

In the revised policy framework, the objectives are unchanged. However, how the objectives are to be achieved have been modified to attain better coordination and to create a team spirit among the stakeholders, users and the regulators by liberalizing the existing policy that support law abiding behavior and induct energetic support for the government efforts to root out illegal activities while also yielding the desired good outcomes for the economy and users of international telecommunication services. For example, the number of operators for international voice and data termination in the 2007 ILDTS framework was limited wholly the

new policy aligns to unlock a new horizon liberalizing the number of operator as per requirements of our telecommunication sector.

Access network operators shall provide services to the respective subscribers. Network architecture shall be based on two layers with appropriate equipment's and technologies. The first layer is the International Internet Gateway (IIG), which will be connected to ILDC network and ANS operator. IIGs will have satellite earth station or VSAT as backup until the availability of alternative ILDC network or means the own satellite.

Submarine or international terrestrial cable will provide connectivity between the domestic and the international telecommunication network. To ensure uninterrupted telecommunication services and provide redundancy it is desirable to have operational one or more additional submarine or terrestrial cables in addition to the present SEA-ME-WE-4 submarine cable. The number of submarine or terrestrial cable operators will be determined by the government as per requirement of the telecommunication sector of Bangladesh. The number of cables, location of landing stations, cable route's, capacity etc. will be decided as per requirement of telecommunication sector of Bangladesh to be decided by the government.

The unregulated use of VSAT has been one of the means of conducting unauthorized VoIP call businesses. As such it is crucial to control unauthorized usages of VSAT. VSAT will not be allowed for voice services except that of IGWs, which will be used as backup. VSAT connected to IIGs will be allowed as backups for data communication only. Therefore, VSAT use will require till government approval.

All domestic VSAT hubs must be connected to the NIX's. From regulatory side there will be now new VSAT license will be issued and the existing VSAT's will remain operative until the NIX's ensure backup connectivity by VSAT. VSAT's other than the IX operator will gradually be withdrawn under the guideline of BTRC. The government will review existing VSAT hub licensing and issue additional license if necessary. The government will take strong measurement to curb unauthorized VoIP call business with VSAT.

The government will encourage introducing IP TV system through which TV programs and video on demand is delivered via IP protocol and digital streaming techniques to watch video

on the internet. The concerned ministries/ government agencies will issue incline and licenses for IP TV services.

The new ILDTS policy will help to transform the idea of Digital Bangladesh into a reality. For this reason, the government takes the initiative to launch the first satellite in the designated orbital slot to make a redundancy of the existing submarine cable or international terrestrial network.

In the Present Protocol, the Submarine Cable (SC) is the primary route of both data and voice to the international network and International Terrestrial Cable (ITC) is the secondary or backup route.

3.2 Current regulatory and licensing regime

The full and client centric regulatory and licensing regime in Bangladesh currently missing. But the service part of the satellite is currently under the jurisdiction of BTRC but it will consume long time. The internal process to authorizing filing procedures in the international telecommunication union for initiating the first steps to book an orbital slot. Filing procedures to seeks an orbital slot tot the ITU have and specialized set of procedures. But this kind of procedures may vary from country to country. In the USA there are some different regulatory criteria which can passes certain parameter.

Currently Bangladesh has no regulatory or licensing regime to explore the satellite services. Since, Bangladesh currently is going to launch its own satellite in the orbit very soon. To operate this satellite a new company already formed under the jurisdiction of the ministry of posts, telecommunications and information technology. The whole responsibility of the operation, marketing and sales is under this newly formed company. BTRC will be the regulator of this company. So, to create the regulatory and licensing environment which is currently missing, BTRC will take the initiative at first.

3.3 Regulatory Barrier for Satellite Service

DTH:

- ✓ DTH use in Bangladesh is currently limited to the illegal reception of foreign programming.

- ✓ The legalization of DTH is expected to result in significant and rapid take-up nationwide.
- ✓ Also, there are a considerable number of illegal cable TV networks as well and these need to become regulated or shut down. This way they can create more revenue for the Government.

VSAT:

- ✓ Service providers complain of steep license fees compared to terrestrial Counterparts; and
- ✓ They complain that prohibitions against using satellite for VoIP are stifling.

3.4 Current Satellite Demand

The Bangladesh Current Market Assessment shows that the following user segments will likely procure Fixed Satellite Services (FSS) and Broadcast Satellite Service (BSS) of the Bangabandhu satellite system once implemented [26] [28]:

- **Bangladesh Government**: Government agencies and administrative agencies, including 7 divisions, 64 districts and 1009 sub-districts (Upazila). Compatible government responsibilities include, but are not limited to, the nation's defence, health, education, safety, disaster preparedness and relief, infrastructure and economic development, as well as basic order suchas police, fire, medical, etc.
- **Bangladesh Enterprise Sector**: Including, but not limited to television and radio broadcasters, telecom operators, VSAT service providers, banks, insurance, energy, extraction and construction companies, etc., many of whom currentlypurchase satellite services from foreign operators.
- **Bangladeshi Consumers**: The pent-up consumer demand throughout Bangladesh (urban and rural) for Direct to Home (DTH) satellite broadcast services, with entertainment, information and educational programming uniquely tailored to Bangladeshi interests is enormous. The highly successful introduction to DTH in India over the past seven years is expected to be directly applicable to Bangladesh, with the added benefit that the regulatory environment in Bangladesh can be shaped to optimize the potential for success of this initiative.

- **National and International Organizations**: International NGOs, Finance, Emergency Services and National industry and professional organizations and associations for business, commerce, media, broadcast, news, textiles, science, health,etc.
- **Regional and International Customers**: Regional broadcasters, Telco's, airports, shipping companies, banks, foreign government Embassies, and others are also expected to purchase capacity on the system, with the added benefit that Bangladesh will be attracting significant revenues into the country from the provision of services to these entities.

This assessment overlooked within the spectrum requirements and technical and operational characteristics of the user terminals with the theme of providing high data rate access to the multiple satellite services at competitive prices. Satellite service types, applications, coverage areas, design characteristics used in this analysis are based on demand assessment, performance/ QoS requirements and competitive pricing benchmarks:

- This assessment chose Fixed Satellite Services (FSS) and Broadcast Satellite Services (BSS).
- Primary and secondary service areas determined by market demand analysis.
- Spectrum requirements and frequency bands which can be identified in the short, medium and long term for the provision of FSS and Broadcast Services.
- Payload arrangements and frequency bands that should provide consumer / SOHO access to the internet at transmit and receive data rates of the order of X Mbit/s.
- Technical and operational characteristics that could facilitate the mass production of simple Very Small Aperture Terminal (VSAT) equipment at competitive prices.

Business Requirements Per Service:

Service Areas:

- **Primary:** Bangladesh and SAARC Countries
- **Secondary:** Target Countries in S & SE Asia, Southern Russia and China (119Eslot) Number of Transponders:
- **Ku – Band:** 24 transponders in each of capacity is equal to 36 MHz
- **C – Band:** 16 transponders in each of capacity is equal to 34 MHz

Satellite Applications which gets Priority:

- Direct to Home (DTH)
- VSAT
- Backhaul & Trunking
- Network Restoration
- Disaster Preparedness and Relief

Market assumption:

- ✓ Target 55Mbps per transponder; seek few transponders with highest Availability.
- ✓ 60cm/99.5/55Mbps over the high population areas. At EOC 90cm/< 99.5/55 Mbps
- ✓ For Indonesia, no need to cover Papua New Guinea.
- ✓ Target 50Mbps per transponder; seek max transponders with highest Availability.
- ✓ Target max the throughput; repeat for 5.6m operator hub note 1
- ✓ Target max the throughput; repeat for 5.6m operator hub note 2
- ✓ Aim for max speed at 70cm to be 2Mbps by 512kbps
- ✓ Optimize BUC and availability to max throughput hope for 60Mbps plus per transponder

The market assumption depends on the whole market situations and the demand in future. There are few market demands where the high capacity of data rate is required and the interruption is not acceptable there, for accommodate those demands the 55Mbps data for transponder is anticipated. On the other hand, to assume for accommodating the lower capacity demanded customers, the 50 Mbps data rate is anticipated which shown Table 3.1. It shows that the transponder demand based on the data rate may vary from high availability to the low availability. The beams which is going to cover the Bangladesh and the surrounding region is the highest EIRP with high data rate of 55Mbps. This beam also covers the whole Bangladesh including the water territory of our country. The beams which is going to cover the Indonesia and Philippines and surrounding region is the moderate EIRP with high data rate of 50Mbps. This beam also covers the part of this two country. In this table, a block up converter (BUC) is used to converts a band of frequencies from a lower frequency to a higher frequency. In our case BUCs converts from the L band signal to Ku band and C band.

Table 3.1: Service comparison with several technical parameters

Service	Band	Hub Diameter	Hub Availability	Beam Coverage	Availability	User Terminal Diameter	BUC
DTH	Ku	TBD	99.95%	Bangladesh, India Plus (India, Nepal, Bhutan, Myanmar, Sri Lanka) All other beams Any Bangladesh	99.80%	50cm	N/A
DTH	Ku	TBD	99.95%		99.50%	60cm to 90+cm	N/A
DTH	Ku	TBD	99.95%		99.50%	60cm to 90+cm	N/A
Video distribution	C	TBD	99.95%		99.80%	1.8m	N/A
VSAT Closed User Group	Ku	TBD	99.95%		99.70%	1.2m	up to 4W
VSAT Closed	C	TBD	99.95%		99.80%	1.8m	up to 5W
Broadband	Ku	TBD	99.95%		99.50%	70cm to	½ to 1W
SCPC trunks	Ku	5.6m note 2	99.95%		99.50%	5.6m note 2	TBD
SCPC trunks	C	5.6m note 2	99.95%		99.70%	5.6m note 2	TBD
Service	Band	Hub Diameter	Hub Availability	Beam Coverage	Availability	User Diameter	BUC
DTH	Ku	TBD	99.95%	Bangladesh, India Plus (India, Nepal, Bhutan, Myanmar, Sri Lanka) All other beams Any Bangladesh	99.80%	50cm	N/A
DTH	Ku	TBD	99.95%		99.50%	60cm to	N/A
DTH	Ku	TBD	99.95%		99.50%	60cm to 90+cm	N/A
Video distribution	C	TBD	99.95%		99.80%	1.8m	N/A
VSAT Closed User Group	Ku	TBD	99.95%		99.70%	1.2m	up to 4W
VSAT Closed	C	TBD	99.95%		99.80%	1.8m	up to 5W
Broadband	Ku	TBD	99.95%		99.50%	70cm to	½ to 1W
SCPC trunks	Ku	5.6m note 2	99.95%		99.50%	5.6m note 2	TBD
SCPC trunks	C	5.6m note 2	99.95%		99.70%	5.6m note 2	TBD

Note 1: Can always use larger end-user terminals for more throughput or availability. BUC must allow operator own hub with say 5.6m Ø

Note 2: No problem for larger antenna, but will need to be careful about regulatory issues

Note 3: Sources of data: Bangladeshi, Indian and South East Asian service providers, Q4-2012

In the Table 3.1 the design of user terminal diameter is depend on the type of service which is going to be offered for user, the beam coverage and the availability.

Satellite services should be a critical component of Bangladesh's infrastructure to create seamless connectivity nationwide, which currently does not exist with respect to areas outside major cities.

- ✓ Urban Population 28%
- ✓ Rural Population 72%
- ✓ Literacy 56%
- ✓ Divisions 6
- ✓ Districts 64
- ✓ Sub-Districts (Upazila) 465
- ✓ Unions (Rural) 4484
- ✓ Villages (Rural) 87319
- ✓ Municipalities 223

The consistent nationwide GDP growth of 5-7% for the past few years, purchasing power parity in 2016 was estimated to be USD $1,800, 40% of population is between ages of 15 and 40, with great interest in adapting new technology. Mobile telecom growth is good indicator of demand for Voice, Data, and Internet. Approx. 80 million rural users spend significant % of consumption basket on mobile phone use. Telecom infrastructure and subscriber uptake still needs expansion in rural areas. Most rural areas lack fixed line communications and have very low mobile tele-density rural options for internet access are usually limited to current 3G mobile networks. Tremendous Pent-Up demand for Satellite Television.

- Bangladeshi Households with TV:
  - 53% of all (32 million) households in Bangladesh have TV, with %

increasing.

- 72% of the population lives in 87,000 villages, with TV in 34% of households
- 28% of the population lives in urban areas, with TV in 84% of households

- Demographics in Bangladesh are similar to India on relative scale
  - DTH in India has skyrocketed.
  - Despite illegal status, an increasing number of households purchase DTH from India
- Number of TV channels increasing:
  - 20 of 25 current channels using satellite for distribution
  - All local channels are currently Free To Air (FTA).
  - TV advertising is a USD $300 million business.
- Bangladesh Cable TV:
  - 1.9 million households pay monthly fee averaging 300 Taka ($3.50 USD)
  - Basic analogue package of about 60 channels with 15 o 16 national channels

3.5 Current Satellite Utilization

Satellite altimetry is typically used to measure the height of the ocean, but it can also be used to measure the heights of rivers and lakes. In areas that experience monsoonal rain this can provide life saving information. To forecast river heights, such as the Ganges River, up to 8 days ahead of time Bangladesh currently has implemented a system that uses Jason-2. This system was developed by Faisal Hossain, at University of Washington in collaboration with the Flood Forecasting and Warning Center (FFWC), the Institute of Water Modeling in Bangladesh and International Center for Integrated Mountain Development (ICIMOD). To make flood forecasts available for the public, the key government agency of Bangladesh with the national mandate uses FFWC functions. The development work was part of SERVIR, a joint program between NASA and USAID to use Earth observing satellite data to help developing countries make informed decisions on environmental matters.

Table 3.2: Current Estimated Satellite Utilization in Bangladesh

SL#	Service Type	Typical Customers	Frequency	Total Mhz	TPE	Future Potential
1.	VSAT Corporate Network	Banks, Corporations, Insurance Companies	Ku Band	25	0.7	High
2.	Backhaul for Fixed and Mobile Network	GO&O Entities and International Providers-BTCL, Teletalk, Singtel, International Telecom Japan (ITJ) for International Voice and Data. (a) Backhaul for GSM and terrestrial fixed wireless network.	C Band	144 36	4.0 1.0	High High
3.	VSAT Networks	Corporate Network, Foreign Embassies, Etc		72	2.0	Medium
4.	Video Distribution	20 out of 36 TV stations use 6 Mhz each SCPC transmission mode.		120	3.3	High
5.	Network Backup/Restoration	(a) IIG (International Internet Exchange) (b) IGW (International Gateway)		36 36	1.0 2.0	High High

1. Demand stifled by current regulatory environment and high transponder prices.
2. Wireless providers required backing up 10% of their capacity via Satellite but requirement isn't enforced.
3. Every embassy in Bangladesh has VSAT connectivity back to their country.
4. 30 out of 36 TV stations use APT-7 and other 6 use of AsiaSat-3.
5. BTRC regulations require Satellite backup of 10% of their capacity via SAT however isn't enforced.
6. The Transponder Equivalent (TPE) is the defined terms used for which amount of a transponder is consider for a service type and which customers is targeting for this type of services.

3.6 Demand After Launch

The government has made plans to earn foreign exchange by leasing out half the transponders of Bangabandhu Satellite-1, the maiden satellite of the country. The government will work to launch the satellite as well as seek out markets to lease out its transponders. With the technique of digital video data compression and multiplexing there are several video and audio channels can travel through a single transponder on a single wideband carrier. Bangabandhu-1 will go into operation from 2018 and is seeking out markets, keeping this timeline in view. Many neighbouring countries would be interested to buy the transponders of Bangabandhu Satellite-1. The price would be set in accordance with the global market rate, and emphasis would be placed on earning foreign exchange by selling the transponders. The country now meets the demand for bandwidth with the state-run Bangladesh Submarine Cable Company Limited (BSCCL) and six other International Terrestrial Cables (ITCs). It also gets services from very small aperture terminals (VSATs) and other internet service providers (ISPs). After launching the satellite, it will be the main source of bandwidth in the country, and the necessary demand will be met through the Bangladeshi launched own Satellite by its designed covering footprint.

3.6.1 Government Transponder Demand

The government transponder demand reflects in the table 3.3, where the total demand divided into the several types of applications or services. The consumer of the applications is several administrative organization of the government who serves the different kind of administrative purposes of the government. The transponder demand after Satellite launch is based on the current demand of the several government organization accumulated or forecasted based on their uses.

Table 3.3: Government Transponder Demand

Transponder Capacity Required (36 Mhz TPE)		C-Band		Ku-Band	
Functional Area of Use	Types of Application	Low	High	Low	High
Administrative/Coordination	Secure internet/Intra-agency network for voice and data				
Defense and Security	Military and Security voice and data services, fixed and mobile, encrypted				
Agriculture/Fisheries/Livestock	Monitoring, e-learning, etc				
Industries/Aviation/Tourism	Airport flight control, data				

Transportation/Infrastructure	Fleet management, monitoring/control of nationwide infrastructure	3.0	6.0	3.0	6.0
Posts and Telecommunication	Complements/back up terrestrial networks; advances Digital Bangladesh				
Education	E-learning and mentoring, direct to school/ multi-site campus connectivity				
Health and Welfare	Telemedicine, hospital/remote primary and emergency care connectivity				
Public Safety	Fixed /mobile communication for Police, Fire, Ambulance, National Guard, etc				
Environment / Disaster Management	Remote monitoring, data collection, early warning, disaster recovery				
Foreign Affairs	International Connectivity				
Science and Technology	Research and development, international cooperation				

3.6.2 Enterprise Transponder Demand

The enterprise transponder demand reflects in the table 3.4, where the total demand divided into the several types of applications or services. The consumer of the applications is several non-governmental organization of the country who serves the different kind of services which direct liked with the general people. The transponder demand after Satellite launch is based on the current demand of the several enterprise organization accumulated or forecasted based on their uses.

Table 3.4: Enterprise Transponder Demand

Transponder Capacity Required (36 Mhz TPE)		C-Band		Ku-Band	
Functional Area of Use	Types of Application	Low	High	Low	High
Financial Institutions	Secure data for online banking, ATM machines, brokerage and exchange				
Travel	Corporate networks, hotel internet, car rentals, travel agent bookings, etc				
Manufacturing	Resource automation, processes, supply chain management, inter-plant				

	communication	2.0	5.0	2.0	3.0
Commercial and SMB	Videoconferences, broadband direct small business, VPNs/ LAN/ WAN				
Transportation	Vehicle tracking and communications, fleet management, etc				
Healthcare	Telemedicine, remote data access, remote monitoring, emergency communication				
Energy	Solutions for expiration, production, distribution, sales				
Retail and POS	Sales, stock updates, ordering, credit card transactions, etc				
Industrial	Mining, agriculture, woodland, petroleum, food/beverage				
Carrier and Telephony	Fixed/mobile backhaul	5.0	7.0	0.0	2.0
	Backup/restoration	3.0	14.1	0.0	14.1

- Use capacity reserved for telecommunications infrastructure backup and disaster relief to advance e-Government, e-Learning and other public services when not needed for emergencies
- Price to be shared between Government and telecom operators

3.6.3 Consumer Transponder Demand

The consumer transponder demand reflects in the table 3.5, where the total demand divided into the several types of applications or services. The several applications are designed for the different types of functional areas. The transponder demand after Satellite launch is based on the current demand of the several consumers accumulated or forecasted based on their uses.

Table 3.5: Consumer Transponder Demand

Transponder Capacity Required (36 Mhz TPE)		C-Band		Ku-Band	
Functional Areas of Use	Types of Application	Low	High	Low	High
Video Contribution	Secure data for online banking, ATM machines, brokerage and exchange	2.0	5.0	2.0	3.0
DTH/Distribution	Direct to Home TV, distribution to cable head-ends, SMATV, broadband				
Broadband	Shared-hub service by ISP using high contention rations				

3.7 Utilization Forecast

3.7.1 Compatible Satellite Service Opportunities

Table 3.6: Compatible Satellite Service Opportunities

Target Users		Of Sites	Service Description
Government	Districts Sub-Districts (Upazilla) Kiosk Sites Post Offices Villages Total	65 493 8,500 87,000 96,058	Internet, Data, Voice Access Gov't to Gov't, Gov't to Corporate and Business to Corporate Service Family and Health Education Local Information Portal
Banks	Branches (State owned banks) Branches (Private banks) Potential ATM networks Total	949 5,135 5,600 11,684	Data Transmission Inter-branch communication Security Service
Education	Secondary Primary Universities Total	18,605 37,672 86 56,363	Internet, Data, Voice, Direct to School Multi-site campus connectivity Global eLearning and mentoring
Telemedicine	Secondary & Tertiary Hospitals & Health Cares Upazila Health Complexes (UHC) (run by DGHS) Outdoor Health Facilities (OHF) (run by DGHS) Outdoor Community Clinics (OCC) (functional) Total	121 424 1,449 9,772 11,766	Rural family health, viral outbreaks, emergencies, etc Distance Medical support for radiology, cardiology, urology, oncology, psychiatry & surgery Emergency field services, etc
Cellular	Villages	87,000	Increased

Backhaul	Major Mobile Operations-6 Three WiMAX Operators		availability for voice services Broadband services for internet data Coverage of difficult to reach areas
Network Restoration	Cable, Wireless Restoration Services		Back-up critical traffic on terrestrial networks To avoid outages resulting from natural disaster

3.7.2 Satellite For Terrestrial Network Backup

Five percent (5%) calculation for satellite backup assumes that a critical component of traffic should be protected in case of natural or manmade disasters affecting terrestrial infrastructure. Such events historically have been a common and regular occurrence in Bangladesh. Bangladesh's participation in SEA-ME-WE-4, the international sub-sea cable connecting Bangladesh, Indonesia, Malaysia, Singapore, Sri Lanka, India, Pakistan, UAE, Saudi Arabia, Egypt, Italy & France, should also be covered by satellite backup. BTRC regulations require 10% backup of IIC and IIG traffic, however this is not currently enforced.

Table 3.7: Satellite For Terrestrial Network Backup

Company	Length of Cable in KM	Capacity	District Covered	No. of Drop off point	Average Utilization (%)	Mbps used (STM-1=155 Mbps)[a]	Potential Satellite Back up (Mbps)[b]	TPE=(45 Mbps per TXP)
Bangladesh Railway (Leased by GP)	2,014	STM-16	34	66	52.0%	1,289.6	64.5	1.4
PGCB	3,727	STM-1, STM-4	Country wide	115	20.0%	124.0	6.2	0.1
Grameenphone	2,251	STM-16	36	49	51.0%	1,264.8	63.2	1.4
Banglalink	1,802	STM-16	23	43	39.0%	967.2	48.4	1.1

Robi	682	STM-64	11	21	44.0%	4,364.8	218.2	4.8
Citycell	1,134	STM-16, STM-64	17	33	32.0%	1,587.2	79.4	1.8
Teletalk	160	STM-16	9	8	20.0%	496.0	24.8	0.6
BTCL	1,806	STM-4	36	44	20.0%	124.0	6.2	0.1
	650	STM-64				1,984.0	99.2	2.2
Fiber@Home	1,200	n/a	23	90	20.0%	496.0	24.8	0.6
Total	15,426				-	12,697.6	634.9	14.1

[b] Potential Satellite Backup (Mbps) is the 5% backup of the [a]

3.7.3 Satellite Services for Disaster Relief

Floods, cyclones, storm surge, flash flood, drought, tornado, riverbank erosion and landslides upset people's lives in almost every year in some part of Bangladesh, due to the country's geography. The impact includes loss of human life, livestock, crops, destruction of roads, bridges, utilities, houses, and frequent outage / destruction of terrestrial communications infrastructure (fiber cables, wireless infrastructure (towers, etc.), etc. In the United States, Hurricane Sandy in 2012 damaged or destroyed 25% of the cell towers in eastern region of the United States and caused protracted outages of telecom services as a result [29].

CHAPTER-4

Impact on Telecommunication Sector

4.1 Technological Impact

To establishing the connectivity between international telecommunication network and domestic telecommunication network require submarine cable or terrestrial cable connection. It is require more than one submarine cable network or terrestrial cable network to establish the primary secure network or establishing the network with highly reliable with redundancy network in addition to the present submarine cable through SEA-ME-WE-4. Bangladesh will be connected to the long awaited second submarine cable SEA-ME-WE-5 from September 10. This two submarine cable is almost approx. twenty thousand kilometre long and it capable to provide broadband communications services with design capacity of twenty terabits per second between south east Asia, the India subcontinent, the middle east and Europe.

The government of Bangladesh determines the number of submarine cable operator or terrestrial cable operator depends on the current telecommunication sector demand requirements. The number of landing points for submarine cable or the number of pops for the terrestrial cable network will decided by the government depend on the demand of the current existing market.

The uses of satellite services currently in such a disorganized way which create the unauthorized uses of telecommunication services like the VSAT services in domestic business. So, it is very difficult to control the illegal usages of VSAT by using the satellite services. VSAT is not allowed to voice communication except through IGW's, which will be used as a backup.

At the same time the Submarine cable was the only primary route of telecommunication in Bangladesh. After that Terrestrial Cable was introduced as a secondary route for telecommunication. But the issues are both are land based communication and a chance to cut off or any short of disruption of the service. In that case of unavailability of the back bone of whole telecommunication the Satellite can a only solution.

4.2 Infrastructural Impact

The current infrastructure of Telecommunication Bangladesh is based on the ILDTS policy which incorporates the layering structure of incoming or outgoing voice or data. There is three layers on which the first layer deals with the international part directly, within that the middle layer is the only exchange layer between the gateway and the access level means the user level. On the other hand, the lower layer means the third layer or access layer is the user interaction layer.

Submarine or International Terrestrial Cable is the route which handshaking between the Bangladesh Gateway parts with the International Gateway Part and ensure to create connectivity between the domestic networks with the international telecommunication network. The details architectural overview describe in the previous chapter.

So, in that fact in mind need to established continuous telecommunication services and provide redundancy it is expected and wanted from the industry as well as to build the nation in the home of "Digital Bangladesh" to have Country Own operational Satellite in calculation to the present SEA-ME-WE-4 submarine cable or Terrestrial Cable.

The present layer structure will not be effective in terms of using the Satellite Service. Satellite will be directly communicating with the User Terminal (UT) without help of any exchange mediator. So, practically there will be two layer exist on the Satellite Communication one for Satellite and other for Access user of end user which describe below in Figure 4.1.

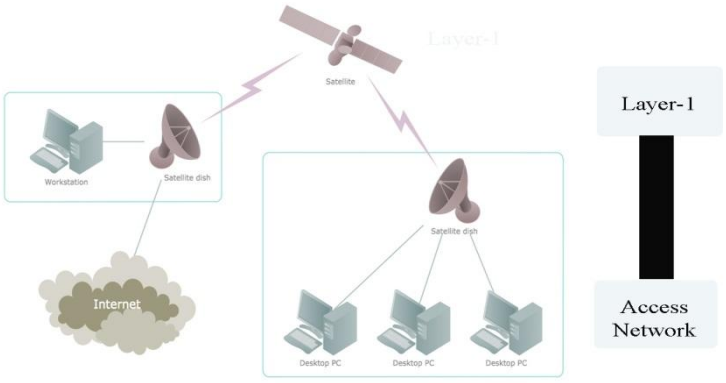

Figure 4.1: Infrastructural Impact to Launching of Satellite

Finally Launching the Country own Satellite will come to impact on the Telecommunication Sector as whole. Low expected charges and mobility can be coupled which provide satellite service will bring almost the pull factor in this industry, and where many people will have less usage for the physical fibre / copper connectivity. To providing the last mile connectivity will be not dependant over fibre optic backbone. Connectivity will be more diverse as well as usages of telecom backbone for opening new business will be seamless. So, Satellite will be the true redundant of whole present telecom backbone and in terms of Satellite Communication Layer will be less than present telecommunication infrastructure.

4.3 Financial Impact

After launching the first satellite of Bangladesh which is Bangabandhu Satellite-1, the financial impact can be considered as following:

a. Capture the majority of existing in country originated satellite business,

b. Create opportunity for NEW (pent-up) attractive and cost competitive services and networks in country as a result of the satellite and a "helpful" regulatory review, and

c. Capture a percentage of the demand growth in the targeted regions (with a competent and experienced team).

To considering the above strategies we can comes to a point about the financial impact which more lightly elaborately describe as follows:

- Current and projected satellite bandwidth requirements by the Bangladesh Government and Enterprise sectors (some of which are satisfied using foreign satellites) could

account for 30% or more of the total capacity of the Bangabandhu satellite, with significant commitments prior to launch.

- Therefore, Bangladesh is currently a captive market for its first national satellite system, with the BTRC able to provide a "protected opportunity" for the satellite to achieve critical mass in terms of transponder sales and revenue generation before later considering the prospect of opening the country to competition from other satellite systems.
- The Bangladesh Government's interest and participation in the system further enables it to enter into international cooperative agreements for satellite capacity utilization with other governments, such as India, and other neighbouring markets that might be more difficult for private satellite operators to enter.
- The ability to consider "lessons learned" from the industry in terms of sales and marketing strategies that work and those that don't, and strategically deploy a sales and marketing team well in advance of the satellite's in- service date to aggressively pre-sell the satellite system's capacity, with the objective of achieving a 50% fill rate at the time the satellite enters into service, and a 90% fill rate by the end of the fourth year of operation.

Considering the above financial impact there is other impact which also contributes to boosting the service based on Satellite and directly or indirectly impacted on revenue generation.

- **Direct Impact**

(i) Long term creation of more than 105 jobs in the country directly through wholesale operation of the system and many more directly and indirectly through value-added retail products and services including new TV and satellite radio programming, provision of transponders for DTH services and products and services, VSAT equipment and services etc.

(ii) Revenue generation by providing satellite connectivity to operator. At present Bangladesh is spending annually more than $14 million on satellite rent to ensure connectivity of television, radio, telephone and Internet. So, this satellite will make

Bangladesh self-contained & Bangladesh will also earn some foreign currency by broadcasting service [24].

(iii) Bangabandhu Satellite-1 will bring huge development & simless telecommunication System in Bangladesh especially in television, telephone & Internet service which Bangladesh usually purchase from overseas [25].

(iv) India & Pakistan have their own satellites; Sri-Lanka is in queue. So, Bangladesh rent service to Nepal, Myanmar or Bhutan & may earn more than $50 million per year [26].

(v) Finally, communication system of Bangladesh will get new progression of development. In terms of large scalability, global availability, reliability, versatility & super performance, satellite will give Bangladesh a long-term service to a [27].

(vi) Some sectors like telemedicine, e-learning, e-research's, video conference, defence & disaster management system will be improved for this satellite in Bangladesh.

- **Indirect Impact**

(i) E-learning, E-Government, Telemedicine, etc.

E-learning, Telemedicine and other Electronics services combined called Electronic-governance (e-governance in short) involves the use of Information and Communication Technology (ICT) and its numerous applications by the government for the provision of information and e-services (that is services by electronic means) to the citizens of the country. Broadly speaking, e-governance can be referred to as the uses and applications of ICT in public administration to conduct processes to effectively manage data and information to enhance public service delivery for empowerment of the citizens. Digital developments of recent years like online services, big data, social media, mobile apps, cloud computing etc. now influence people and the government tremendously. But the uses of this type of services mainly in the capital level. Current infrastructure without Satellite is almost impossible to distribute this service to the whole country level like in the rural level. In presence of Satellite means after launching the Bangabandhu Satellite-1, it will be possible to equally distribute this type of service in every single point of the country.

(ii) Disaster preparedness and relief

Every year floods, cyclones, storm surge, flash flood, drought, tornado, riverbank erosion and landslides upset people's live s in some part of Bangladesh, due to the country's geography. The impact includes loss of human life, livestock, crops, destruction of roads, bridges, utilities, houses, and frequent outage / destruction of terrestrial communications infrastructure (fiber cables, wireless infrastructure (towers, etc.), etc. After launching Bangabandhu Satellite-1, it will capable to provide reliable voice and data communication service in areas where terrestrial component permanently, or temporarily, collapses due to disaster. The terminal which will be used for Bangabandhu Satellie-1, have the attributes to be easily deployed and provide wide area coverage that is independent of local infrastructure, for providing immediate means of telecommunication to help in relief operations during natural disaster and emergency situations. It also can mitigate the impact of disasters and can be mitigated with advance preparation, using early warning and emergency communications systems connecting critical support services (food, shelter, medical, police, fire, security, etc.). Bangabandhu Satellite-1 have the multiple spot beam in design, which can be used for relief operations and have the capability of digital beam forming that allows re-configuration of the coverage and distribution of the system resources (spectrum and power) as and when needed.

(iii) International stature of being a national satellite operator.

There is an independent Satellite operating company in every country who have a national satellite. In that same way, Bangladesh already formed a satellite operating company recently to commercially operate the Bangabandhu Satellite-1. This initiative from government will be a positive impact on the whole telecommunication infrastructure to open an alternate route of communication successfully.

(iv) National reach for satellite delivered television and radio for virtually unlimited number of channels. Over the last decade, broadcast media, namely radio and television have experienced impressive operational advancement. But the policy decisions for the broadcast media sector have not always been consistent and timely. The launching of

Bangabandhu Satellite-1 will open a new era for the broadcasting TV channels and it will reduce the dependency over the foreign satellite operators.

(v) Additional services for Government and Enterprise, including delivery of high speed broadband Internet access.

(vi) Additional route for International Internet supply, possible back-up to optical fiber Full spectrum of support services, including CPE sales, distribution, installation, maintenance and repair, etc.

CHAPTER-5

Conclusion

5.1 Discussion on impact

Bangabandhu Satellite, after its successful launching will create an impact on Telecommunication sector of Bangladesh, this paper looked on this in depth. To find out the impact on present telecommunication sector, it requires analyzing the theoretical background of satellite, its advantages, disadvantages, the current market of Bangladesh and what will be the situation after satellite launching. At the same time this paper show some comparative analysis with present telecommunication structure with satellite into the basis of present and future demand forecast.

Satellite communication is a radio based wave guided communications, which means there will no physical connectivity. The relative advantages and disadvantages of satellite communications were discussed in this paper with combination of Bangabandhu Satellite. Satellite is a good solution for connecting the people in remote areas as well as over the sea or oceans means remote connectivity solution and maritime application is the good example of satellite service. At the same time propagation delay and the high risk of failure in the time of launching are the major disadvantages of satellite. Various uses of satellite after Bangabandhu Satellite launched is also discussed in this paper. The regulatory barrier to open a satellite services and also the licensing procedures for satellite operation is discussed here.

More people who lives around the world despites barriers of distances, geographical isolation or low income will have access to the latest information via satellite communication and for this reason satellite technology dominates international telecommunications market. As a same way for our national use more people eventually will be able to use satellite service in various sectors and communicate with outer country. There will be no need to travel thousands of miles and can capable to connect within a millisecond through satellite. Satellite communication gives such a diversification in terms of mobility and low costs that it will bring a pull factor in the telecommunication sector, where many people will have less usage for the physical fiber / copper connectivity.

The technological development in the field of telecommunication has always been a priority to the Government to make it available to the people. The present policy option is expected to take all technological facilities to the people and allow stakeholders to play an appropriate role in creating job opportunities and to contribute in the socio-economic development of the country. It will open the vast outer world to the mass for creating a knowledge-based society. The policy will augment healthy competition among the stakeholders and will also enhance access of domestic telecommunication system to the global network. It will further facilitate private sector investment and simplify existing procedure to promote growth in commercial and industrial arena. The Government is devoted and determined to deploy all its tools to protect and promote the promising sector for the interest of the country and its people. Implementation of this policy will minimize 'digital divide' and lead to increase broadband penetration and tale-density of the country. This will play a significant role in materializing the vision 'Digital Bangladesh'.

5.2 Findings

Satellite communication now a day's very attractive and powerful technology, because only one satellite can cover the almost one third of the whole world. So, it will be needed three geosynchronous orbital satellites to cover the whole world to communicate one people to another. This shows more satellite are needed at the LEO and MEO at its different altitude. Through satellite communication people have a better chance of being able to do the kinds of things that people in the developed country and it not possible through terrestrial network for its lack of physical connectivity. There are another area where satellite communication can made a great impact is the distance learning.

In Bangladesh there are so many places there people will be enjoying internet connectivity through satellite which currently not possible by using present telecommunication infrastructure. This kind of communication would be possible through satellite communications and communication between space station to earth or earth to space station will be very easy through satellite.

The current demand of satellite is goes high in terms of required time to establishing the connectivity between to places. At the same time modern technology continues to advance in

satellite technology, the total reliability of spacecraft now improve as well as cost goes less and risk to investment in satellite communications becomes less and as a result profit on this business goes high. So, satellite as a disaster prone county like Bangladesh will help to made the continuous communications in time of any emergency situation since satellite have no delay in terms of cut off the communication medium. At the same way security will be ensured in the time of communicating from one place to another since it will using encryption method.

The current situation discussed in the table 3.7 the present situation to uses of the satellite capacity as a backup of Submarine Cable (SC) or Terrestrial Cable (TC) telecommunication network can be demonstrated as on the following graph. The unit is Mbps in terms of the total capacity of the uses.

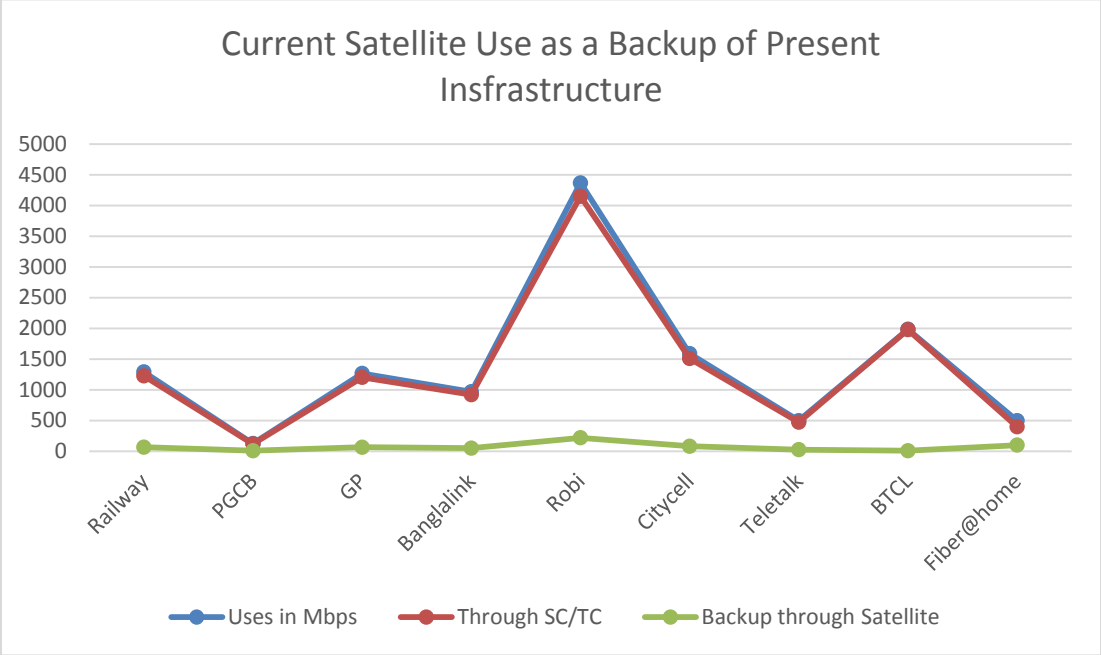

Figure 5.1: Current Uses of Satellite in terms of Backup

To formulate and determine the impact of launching the first Satellite of Bangladesh depend the complex and long-life-cycle of a satellite program and it demands a comprehensive multi-dimensional approach. As we have already known from the literature of the study that the present regulatory binding upon all the operator of telecommunication sector is to back up 5% of their total capacity through satellite. Considering the lifetime of the Bangabandhu Satellite-

1 will be 15 years. The baseline of the backup is 5% and increased it year by year up to 15% within first 5 years. After that within next 5 years it will be increased up to 30% and within next 5 years it will go to 50% as a backup of the whole capacity to the Satellite. Then the Bangabandhu Satellite-1 will be the true redundant compared to terrestrial network and it will be the only telecommunication network when the primary route (SEA-ME-WE-4 or SEA-ME-WE-5) is interrupted. This is displayed in the graphs shown in Figure 5.2. The second largest operator of Bangladesh, Robi uses the highest capacity over last twenty five years which is 4364.8 Mbps and considering the 5.3% increases of its uses capacity year by year over next fifteen years of the Bangabandhu Satellite-1 life time and it will be 80% increase of its previous uses means 7856.64 Mbps at the end of Satellite lifetime.

The present telecommunication infrastructure with the presence of Submarine Cable and Terrestrial Cable network plays and shows the key role of satellite communication in the Bangladesh. At the same time the lack of this two communication way Satellite will be the only way to communicating with the whole world in uninterrupted way with delay of switching from one medium to another. So, Satellite will be the true redundant of whole present telecom backbone and in terms of Satellite Communication Layer will be less than present telecommunication infrastructure.

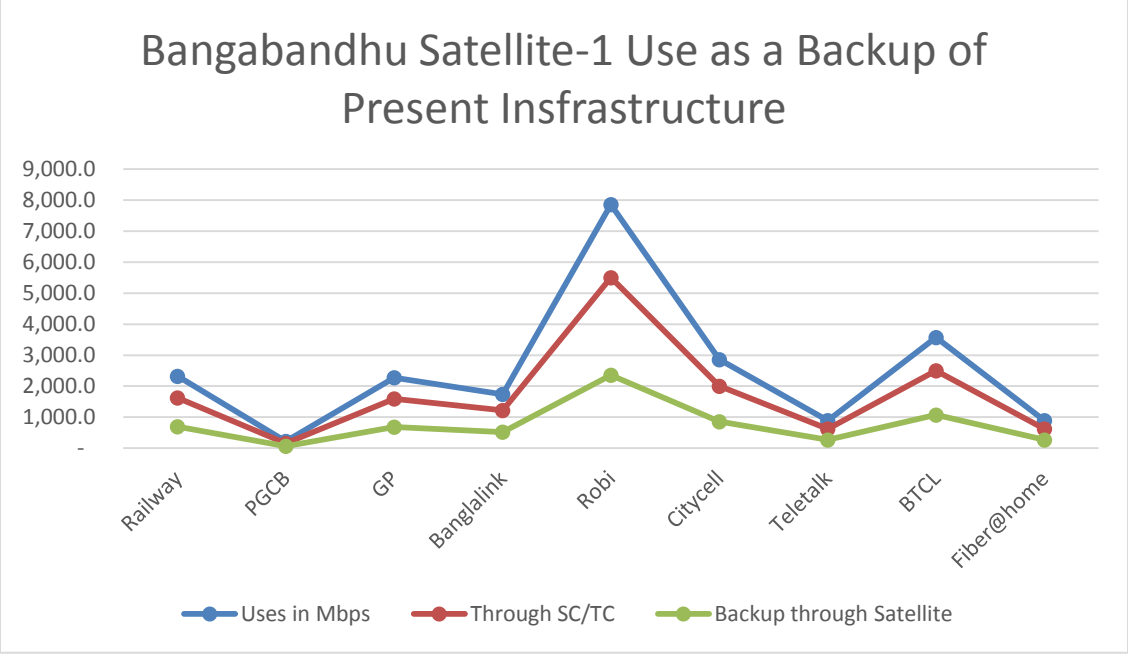

Figure 5.2: Uses after Bangabandhu Satellite-1 in terms of Backup

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