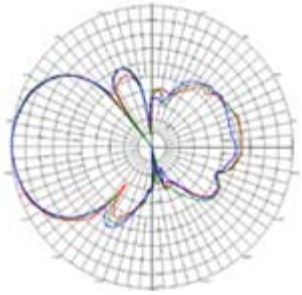

MOBILE AND FIXED WIRELESSES COMMUNICATION TECHNOLOGY IN NEPAL
A case study

By E.E. **Tikajit Rai**

CEO
Magnus Consulting Group Pvt. Ltd.

INTRODUCTION

Nepal is a land-locked country with a diverse topography located on the southern slopes of the Himalayan range. This Himalayan range runs from east-to-west constituting one third of the nation on the northern part. South from this mountainous belt, another one third, is the hilly region which also runs from east-to-west—parallel and along side its northern counterpart; the remaining southern most third is the flat land that slopes down from the foot hills and levels with India's northern plain.

The population of Nepal is estimated to be 25 million stemming from 113 major caste and ethnic groups [1]. Out of the 24 million, 86 % of population still in live in rural areas and is dependent on subsistence agriculture for the livelihood [2]. With no exposure to proper education, science and technology, their agricultural activities are still limited to conventional practices with little or no modern technologies. About 38% of the total population in the country is living below the income poverty line earning income of about a dollar per day [3]!

Overall literacy rate for male and female in Nepal are 65.1% and 42.5 %, respectively (total 53.7%) [4]. However, this statistic does not incorporate literacy in ICT. 14% of the population who live in metropolitan, city and urban areas are somewhat ICT literates and still, unlike western nations, personal computers and cell/mobile phones are not listed as day-to-day basic necessary items both in professional and personal lives.

MOBILE AND FIXED WIRELESSES COMMUNICATION TECHNOLOGY IN NEPAL

Considering geographic topography, to electronically reach-out to people in both rural and metropolitan areas and tap them on to the ICT hub, wireless technology is the right solution. To haul communication cable (Optical Fiber/ Coax/ Copper) through out the hilly and mountainous terrains is excruciatingly costly. Equally costly is to lay out additional underground cables in the cities that are densely crowded by residential and office buildings! Moreover, the maintenance costs will raise the consumable-cost cap even higher. Hypothetically, compared to this, cost of installing radio antennae and implementing wireless technology to setup communication is significantly less.

Compared to wire media, the newly developed broadband wireless technologies may not have equal bandwidth. However, the available wireless technologies have enough of this for transceiving both real-time voice and data.

With this realization, wireless technology, even though in a small scale, set its foot in the country five years ago in a form of mobile telephony, or mobile communication. Since then, the technology has steadily impressed many. Thus, it has achieved bringing in more government and private sector ICT enthusiasts, entrepreneurs, and policy makers mobile telephony, and as well as, the wireless technology itself.

By E. E. Tikajit Rai tika@magnus.com.np 9771 5546945 Magnus Consulting Group Pvt. Ltd.

MOBILE COMMUNICATION TECHNOLOGY IN NEPAL

There are two mobile cellular telephone operators in the country. Even though the second operator was granted license only recently, it has broken the monopoly trend of the other in the market. More importantly, because of competition, more innovation on the mobile communication technology and the reduced subscription rates are expected.

Nepal's first mobile cellular telephone system and service provider

Five years ago, in 1999, then state-owned company, Nepal Telecommunication Corporation (NTC) added mobile telephone service to its existing twenty-four years old landline telephone system. As it was the only company to have license (see more on license on the *Appendix*) for landline operation, it was also the first company to obtain 'Cellular Mobile Service' license from Ministry of Information and Communication (MoIC) to operate a wireless mobile communication system in 900-MHz band. As an international and domestic phone services provider, in the beginning, its service was limited only within the Kathmandu valley—the capital city—but now, the service is provided thorough out the country. There are currently 390,000 landline phone users [5].

Since the introduction of Global System for Mobile Communication (GSM), currently, the mobile subscribers have mushroomed to staggering 240,000 [6]. Out of total subscribers, 76,000 have post-paid accounts and rest have pre-paid. Right before initiation of GSM telephone service, Nepal's phone access statistic was 1.1 lines in every 100 people. Today, because of NTC and United Telecom (UTL)—another private wireless phone service provider, (*see Wireless telephony in Nepal, page 5*)—the number has doubled to 2.29 [7].

For the service, the Telecom has installed 27 Base Transceiver Stations (BTS) alone in the Kathmandu valley. There are 195,000 users with in the valley and rests of the 45,000 users are from out side the valley [8]. In the valley, there are 75,000 post- paid and 120,000 pre-paid accounts [9].

NTC's successful implementation of GSM, a **Second Generation**[1] (2G) system, has been a technological a giant-leap. It is because **First Generation**[2] (1G) wireless Network system was never introduced in the country. Consequently, the leap was directly from its **Public Switched Telephone Networks**[3] (PSTN) to 2G.

Note: Since April 13th, 2004, NTC has been privatized and the name has changed from Nepal Telecommunication Corporation to Nepal Telecom (NT). Thus, hereafter, it is referred as NT.

Nepal's second mobile cellular telephone service provider

On February 2004, His Majesty's Government of Nepal (HMGN) declared to open the telecom industry for private sectors. After five months from NT becoming a private organization, another private company, Spice Nepal Pvt. Ltd., was granted a license to operate 'Cellular Mobile Service' in both 900 and 1800 MHz bands. This makes two GSM operators in the country bringing NT's five-year long monopoly in wireless mobile market to end.

Why GSM?

GSM is the European standard for digital cellular systems operating at 900-MHz band. Its counterparts, American Personal Communication System (PCS) and United

Kingdom's Digital Cellular Systems (DCS), however operate in the 1900-MHz and 1800-MHz bands, respectively.

The GSM technology was developed and introduced in 1990 out of the need for increased service capacity due to the previous analog systems' limited growth. With this technology, subscribers can enjoy international roaming, high-speech quality, and increased security. On the other hand, in the beginning, GSM is utilized through out Europe as a single standard. Since its introduction, the then existing problem due to incompatibility of multiple different proprietary systems has been solved. Now, the technology has been so popular that it is the most widely used system in the world.

Frequency allocations for GSM in US, UK and Europe:

Uplink Frequencies	890-915 MHz (Europe GSM) 1850-1910 MHz (US PCS) 1710-1785 MHz (UK DCS/GSM1800)
Downlink Frequencies	935-960 (Europe) 1930-1990 (US PCS) 1805-1880 (UK DCS/GSM1800)

HMGN's frequency allocation for NT:

For Uplink	890-915 MHz (Shared with Spice Nepal)
For Downlink	935-960 MHz (Shared with Spice Nepal)

NT uses Nortel® GSM system. Lately, it has installed Huawei® sectoral antennae.

HMGN's frequency allocation for Spice Nepal:

For Uplink	890-915 MHz (Shared with NTC) 1710-1785 MHz
For Downlink	935-960 MHz (Shared with NTC) 1805-1880 MHz

Spice Nepal has not begun the installation of GSM system as of now.

Since GSM was developed from the scratch and was not an improvement on any previous wireless network systems, G1 infrastructure was not needed. Thus, NT's choice to adopt GSM was indeed a right decision. Also, it is important to note that, now, with 2G/GSM system matured, the stage is set for possible migration to **Third Generation**[3] (3G) Wideband Code Division Multiple Access[4] (WCDMA) in future. For technical information, please, visit http://www.gsmworld.com/about/index.shtml.

Note: Unlike other nations, there are not any unlicensed bands provided to general public. Thus, the licensees need to purchase both the service operation and frequency licenses.

FIXED WIRELESS COMMUNIATION TECHONOLOGY IN NEPAL

Besides wireless mobile communication services, other types of wireless services are also available in the market for consumers. However, till to this date, MoIC has only auctioned off two licenses (see A*ppendix* for more on license) under 'Basic Telecommunication Services' for telephone services.

Fixed wireless telephony in Nepal

The MoIC recently auctioned second 'Basic Telecommunication Services' based on Wireless Local Loop (WLL) technology. Twenty-nine years ago, first license was given to NT (then, it was state owned) and, again, since then, it had been enjoying the monopoly market in landline PSTN market as well. Even though PSTN and WLL technologies and operations are quite different, MoIC has listed both types of operators under same license category. Thus, this license allows licensees to operate wireless telephone system but prohibits the system to be mobile in nature.

Among other private companies, UTL was declared successful bidder. MoIC granted UTL the license on in October 2002 and within two years' span, it has already 18,000 subscribers [10]. From May 2004, UTL's own state-of-the-art International Gateway Switching link with INTELSAT was fully functional. With the launch of International Gateway, UTL customers can now get connected to each and every part of the world in a cheaper price. International Private Lease Circuit (IPLC) can also be provided through its Gateway.

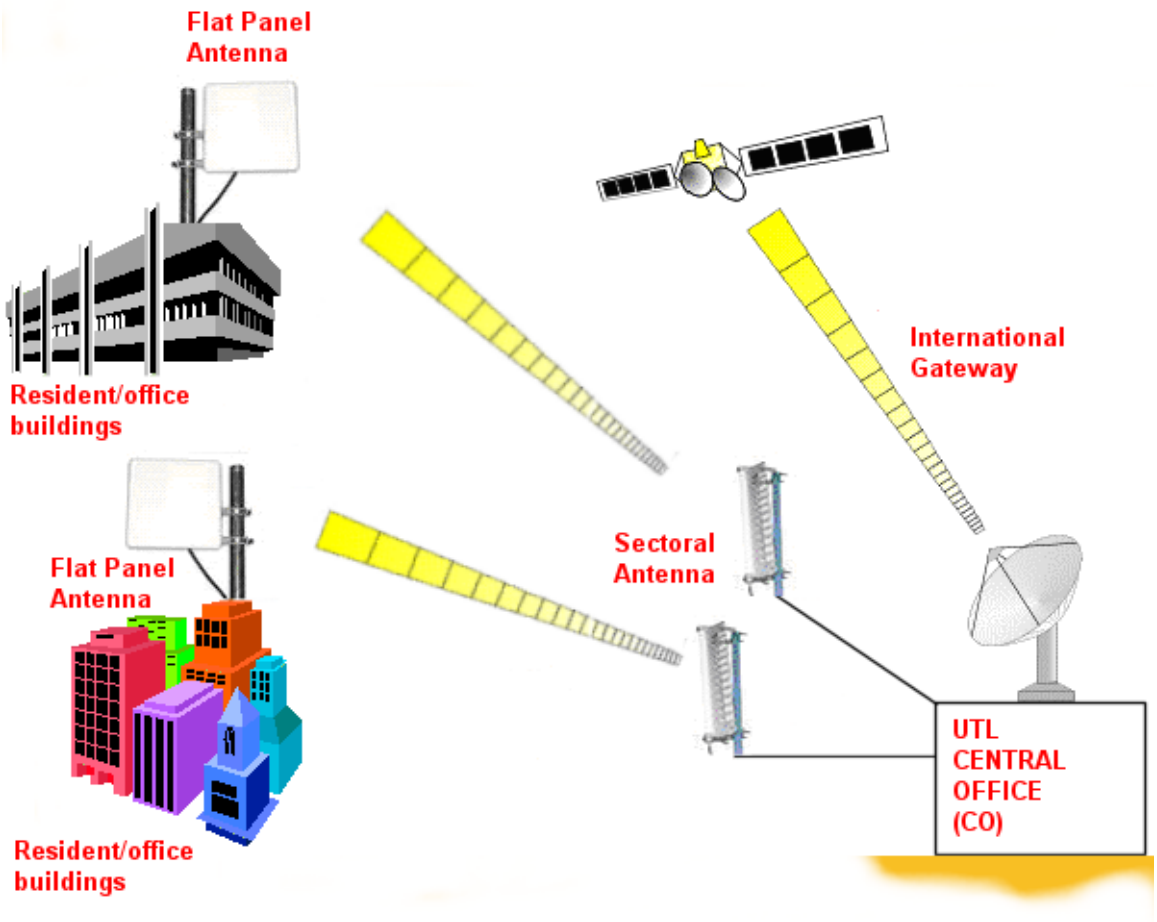

Figure 1

What is WLL?

Unlike mobile cellular telephone systems, fixed wireless communication systems are able to take advantage of the very well-defined, time-invariant nature of the propagation channel between the fixed transmitter and receiver. Microwaves wireless links can be used to create a WLL as shown in Figure 1 in previous page. These links can be thought of as the 'last mile' of the telecommunication network that resides between the Central Office (CO) and the individual residence or business in close proximity of CO. Prior to wireless technology, 'last mile' were connected through either copper or fiber optics cables.

Since, no cables are required to connect CO and Customer Premises Equipment (CPE), this technology could be potentially cheaper than wired landline phones. Moreover, the technology is also geared towards Local Multiple Distribution Service (LMDS) for broadband telecommunications access in the local exchange. Even though UTL is operating its service in MHz range, higher frequency band in GHz can be used for LMDS.

HMGN has allocated the frequency spectrum in the following bands for WLL connections:

For Uplink	1930-1940 MHz
For Downlink	1850-1860 MHz

Why WLL on CDMA?

UTL had selected Code Division Multiple Access (CDMA2000), a 2.5G[5] wireless technology, over other access and wireless technologies because of following reasons:

- This 2.5G allows the subscribers to have the instant data transfer/connectivity with high speeds up to 144 kbps.
- This technology enables easier/smooth migration to other higher EVDO/EVDV systems (i.e. data only and /or data with voice systems). In addition, migration to the future 3G systems (CDMA 2000 3X/ IMT-2000/NGN- Next Generation Network), which are likely to be popular in the coming decades, is possible.
- The proposed 2.5G 1X technology/ system allows easy and smooth Backward Compatibility to the IS-95A[6] and IS-95B[7]. It is, therefore, expected that this technology/state of art equipment will not obsolence for several decades.
- The system offers a wide range of supplementary services and has the capability to support Intelligence Network (IN) services.

FIXED WIRELESS INTERENT SERVICES THROUGH VSAT[8] TECHNOLOGY

The third type of license HMGN offers is for Internet and E-mail services (see *Appendix* for more on license). This particular service is provided to subscribers also through wireless media. For the fixed wireless network, all IEEE 802.11a[9], 802.11b[10], and 802.11g[11] technologies are deployed in the market. However, as mentioned earlier, both 2.4 GHz and 5.8 GHz frequency bands' licenses need to be purchased by the operator. There is not a formal standard for Radio Frequency (RF) systems for this service. Thus, different service provider uses different proprietary RF systems and access technologies.

However, even though different service provider deploys different means of technology for wireless Internet/e-mail services, since there is no physical cable connection between the country and rest of the world, all data needs to go through Very Small Aperture Terminal (VSAT) satellite technology. Additional 'VSAT user license' needs to be purchased from MoIC in order to operate this service.

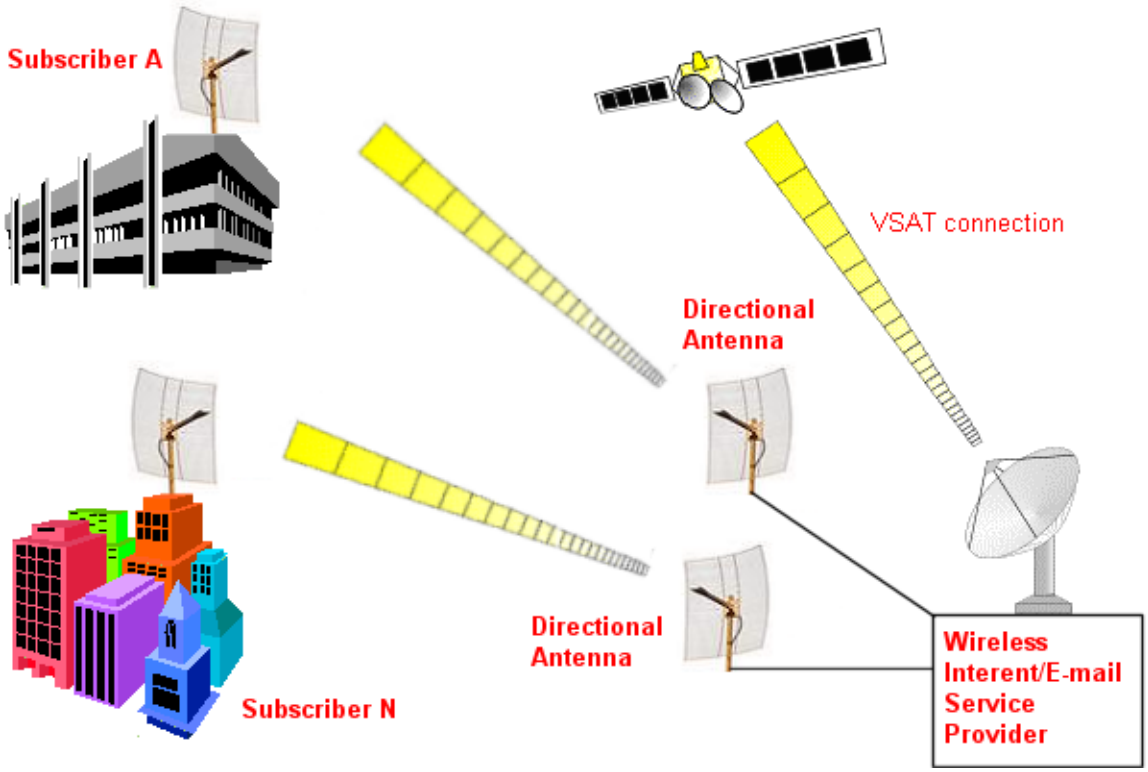

Figure 2

Just like UTL's, for the installation, this system does not require any cables between the service providers and customers. It is not only quick to install but also, often, depending on the distance, cheaper. The companies that provide this service is listed in the appendix.

AUTHOR'S COMMENT

It is apparent from the case-study that the wireless technology, both fixed and mobile, in Nepal has, even though in limited scale, taken off successfully. However, for private-sector entrepreneurs to get to the next level is a genuine challenge because of HMGN's inactive and retro-active role in IT policy/industry in the country.

HMGN has commissioned following governing bodies that are to play a vital role for the development, improvement, and nourishment of IT in Nepal:

1. Ministry of Science and Technology (MoST)
2. Ministry of Information and Communication (MoIC)
3. High Level Commission for Information Technology (HLCIT)
4. Nepal Telecommunications Authority (NTA)

Equally, there are handful of organizations that are involved in IT with the co-operation between HMGN and donor agencies. To name a few:

1. ICT for Development (UNDP)
2. Nepal Information and Technology Center

In the same manner, there are numerous registered private and academic organizations in the country. Some are:

1. Computer Association of Nepal (CAN)
2. Association of Computer Engineers in Nepal (ACEN)
3. Information Technology Professional Forum (ITPF)

With this many governmental and other organizations, if one extrapolates, the IT in Nepal should be in a good shape—if not equal to the western world. Unfortunately, but it is not. One should wonder then what are these governmental and other organizations do or have been doing.

From government's side, the ultimate goals need to be, development, improvement, and nourishment of IT in Nepal. To get there, government must gather and allocate needed resources. For example, for new IT entrepreneurs, the government should commission a program that provides them certain subsidies. Or, decrease in import/export taxes; or, other measures that would really assist IT entrepreneurs so that they can collectively contribute towards nation's IT industry.

Apparently, it has not happened.

Ironically, national annual budget hardly touched IT sector. NT pre-paid SIM card costs Rs. 1,700 (about 22 US Dollars) in Nepal. Indian rate is third of this. If you subscribe wireless Internet service of 1 Mbps, it costs you 3,000 US Dollars plus the equipment costs. How can government then narrow the so called 'Digital Divide' if it does not recognize its roles? Speaking of the government's role in IT, it let NT to retain is monopolistic stature for that many years! Way to go, isn't it?

NTA's objective reads following: "…is the telecommunications regulatory body of Nepal. It is an autonomous body established on Feb 1998 in accordance with Telecommunications Act, 1997 and Telecommunications Regulation, 1998. Its objective is to create a favorable and competitive environment for the development, expansion and operation of telecommunications services with the private sector participation in Nepal." If you go to NTA for any licenses, only license it provides is for 'Internet and E-

mail services'. If you need VSAT user or service provider licenses, you need to go to MoIC. Then why is NTA even there in existence? The IT policy 2000 was actually drafted by CAN, a private company. Is not this government's policy-makers' job to do it? Possibly, NTA's job if it tries to justify its existence?

In retrospect, government should also safeguard transparency among its own organizations; between itself and foreign-aided IT projects; between itself and private IT sector players. IT should pro-actively mend policies periodically while re-enforcing and policing it. Really, if it fails to do so, even in next ten years, I am afraid the digital-divide remains as wide as today and it will be even difficult to narrow it if we do not start doing the right thing from right now.

Much worse, with this impeded pace, think about where will Nepal be in a next decade when you put nation's IT domain in global context?

REFERENC E

[1], [2] Ministry of Population and Environment, Singhadurbar, Kathmandu, Nepal, 2004

[3], [4] Results of Population on census 2001, HMG/Nepal National Planning Commission Secretariat, Central Bureau of Statistics, Kathmandu, Nepal, 2001

[5], [6], [7] [8], [9] Sugat R Kasankar, Managing Director, Nepal Tecom, Kathmandu, Nepal

[10] N R Mokhariwale, CEO, UTL Pvt. Ltd.

ACRONYMS

[1] **Second Generation (2G)** 2G systems were, in essence, developed to improve the voice traffic throughput compared to existing analog system (see G1 below). The development also describes the advent of digital mobile communication for cellular mobile systems. 2Gs are defined as digital systems and are typically referred to as Interim Standard (IS1-36) or IS-95, or GSM.

[2] **First Generation (1G)** 1Gs are defined as analog systems and are typically referred to as an Advance Mobile Phone System (AMPS) or Total Access Communication Services (TACS) or Nordic Mobile Telephone (NMT) system. It is important to note that analog systems utilize digital signaling in many aspects of their network including the air interface. However, the analog reference applies to the method that the information content is transported over, that is, not CODEC is involved.

[3] **Third Generation (3G)** 3G systems enables deployment of high-speed data for wireless mobility. Specified by International Mobile Telecommunications-2000 (IMT-2000), these systems are to seamlessly integrate one or several radio channels with fixed network for delivering high-speed data/voice services. 3Gs are defined as digital systems and are typically referred to as Wideband Code Division Multiple Access (WCDMA) and CDMA2000 MX.

[4] **WCDMA** Wideband Code Division Multiple Access.

[5] **Second and half Generation (2.5G)** a2.5G systems were developed between 2G and 3G in order to make 2G systems easily migrate to 3G. These systerms are typically refereed to as Global Packet Radio System (GPRS) or Enhance Data Rate for Global Evolution (EDGE) or CDMA 1x **.**

[6] **IS-95A** A 2G system and Interim Standard for CDMA.

[7] **IS-95B** A 2G system and Interim Standard for CDMA. Compared to its couterpart IS-95A, it provides Integrated Service for Digital Network (ISDN)-like data rates.

[8] **VSAT** Stands for "Very Small Aperture Terminal" and refers to receive/transmit terminals installed at dispersed sites connecting to a central hub via satellite using small diameter antenna dishes (0.6 to 3.8 meter).

[9] **IEEE 802.11a** An IEEE specification for wireless networking that operates in the 5 GHz frequency range (5.725 GHz to 5.850 GHz) with a maximum 54 Mbps data transfer rate. The 5 GHz frequency band is not as crowded as the 2.4 GHz frequency, because the 802.11a specification offers more radio channels than the 802.11b. These additional channels can help avoid radio and microwave interference.

[10] **IEEE 802.11b** International standard for wireless networking that operates in the 2.4 GHz frequency range (2.4 GHz to 2.4835 GHz) and provides a throughput of up to 11 Mbps. This is a very commonly used frequency. Microwave ovens, cordless phones, medical and scientific equipment, as well as Bluetooth devices, all work within the 2.4 GHz frequency band.

[11] **IEEE802.11g** Similar to 802.11b, but this standard provides a throughput of up to 54 Mbps. It also operates in the 2.4 GHz frequency band but uses a different radio technology in order to boost overall bandwidth.

APPENDIX

LINCENSING POLICY OF HMGN:

1. Country's Telecom Act of 1997 allows only two licensed operators for Basic Telecommunication Services.
2. Similarly, the same Act allows only two licensed operators for Cellular Mobile Services.

Thus, following are the licensees in different wireless categories:

1. **Basic Telecommunication Services** licensees:
    a. Nepal Telecom (NT)—GSM900
    b. Spice Nepal Pvt. Ltd.—GSM900/1800
2. **Cellular Mobile Services** licensees:
    a. Nepal Telecom (NT)—even though its service is landline phones under this license, however, since UTL operates fixed wireless service under same, the company's name is included.
    b. United Telecom (UTL)—WLL on CDMA2000
3. **Internet and E-mail Services** licenses—companies that provide wireless service are listed :
    a. Worldlink Communication Pvt. Ltd.—proprietary radio system
    b. Mercantile Communication Pvt. Ltd.—proprietary radio system.
    c. Infocom Pvt. Ltd. —proprietary radio system
    d. Square Network Pvt. Ltd. —proprietary radio system
4. **GMPC Services**—since the scope of this case study does not include satellite telephone services it is not mentioned in the report. However, since it is actually a wireless technology, it is included in the appendix to let the readers know that this license category is part of HMGN licensing program:
    a. Constellation Pvt. Ltd
    b. AVCO International Pvt. Ltd