The following observation has been made in the Consultation paper on National Broad Band Plan issued by the Telecom Regulatory Authority of India.

5.7 What network topology do you perceive to support high speed Broadband using evolving wireless technologies? (Reference Para 3.22)

Presently, availability of optical fibre from major service providers is largely restricted up to the district headquarters and in some cases up to block headquarters

3.27 Non availability of connectivity in rural areas has already impacted Existing schemes to provide broadband in rural areas. Department of Information technology (DIT) in May 2006 planned to deploy Community Service Centres in rural areas all over the country under National e-Governance Plan (NeGP) in order to deliver e-governance Services. Presently the project has targeted to deploy 123181 CSC all over the country. The project was started with an estimated cost of Rs. 5,742 crores to roll out these CSCs in 4 years i.e. by June 2010. However, till April 2010 only 77,338 CSCs have been provided. Connectivity to most of these CSCs has been provided by one service provider who has highest optical fibre presence in rural areas. The project has been delayed for want of transmission connectivity in the rural and remote areas. As a result, DIT has now decided to utilize satellite connectivity for CSCs in the unconnected areas and so far approximately 7000 CSCs have been established using satellite connectivity. The low bandwidth support, higher cost of connectivity through satellite and limited availability of satellite transponders are some of the issues of concern.

The time has come when we have to work out alternative plans to lay optical Fibre network up to villages on priority basis.

With reference to the above TRAI observations, I offer my comments as follows:
One of the major impediments in implementing wireless net works in the rural areas of the country is “terrain factor”. The wireless Broad Band systems operate in the Microwave frequencies which require clear “Line of Sight” (LOS) conditions which mean that both the transmitting antenna and Receiver antenna should be able to see each other without any obstruction in between. But most of the regions in the country are interposed with hill regions that make LOS difficult. Even in regions with out hills, the terrain is not flat but with ups and downs (earth bulge) as one can observe while driving along the high way. To get LOS in such situation, the straight forward solution will be to use tall towers. But the cost of the tower increases exponentially with height which is a critical component in the project cost. Hence for rural connectivity the selection of minimum tower height and provide LOS has to be ensured to keep the capital cost as minimum as possible. For this, each and every radio link needs a rigorous planning of technical feasibility study, link budget calculation and system engineering as is done for Microwave Radio links.

This process involves

(1) Collection of terrain data between station A and station B from survey of India topographic map.
(2) Plot ground elevation (MSL) Vs distance in the Path profile map with scale K=4/3. India being in temperate zone, K=4/3 used.
(3) Confirm as to whether the data plotted in the profile map confirms as to whether LOS is available between the two stations.
(4) In the map plotted possible obstruction / earth bulge that may not fully block the signal path but cause reflection of the signal and introduce noise in the radio link to be identified.
(5) The Fresnel zone radius of the RF signal at the obstruction point is calculated which depends upon the distance of the obstruction point from station A and station B and the frequency of the radio link.
(6) The height of the antenna at both the ends is determined by ensuring that at the point of obstruction, the height of the radio link is above the radius of the Fresnel zone.
(7) Path loss is calculated based on the frequency and distance
(8) Link budget calculated based on path loss, Tx power, Rx sensitivity, cable and connector loss and antenna gain so that receive power is at least 20 db above the receiver threshold to withstand severe signal fading that might introduce noise in the radio path. This is also known as Fade Margin.

Once the above procedure is followed while planning the radio links, there will not be any technical issue while the link is commissioned.

TECHNOLOGY: In my opinion, Wireless Broad Band will be the ideal solution for connectivity in rural areas since they are technically feasible and cost effective. They are

(a) Wimax – Point to point and point to multi point.
(b) WIFI – Point to Pont and Point to Multi point.
(c) Broad Band Cor-DECT with BSD option to have CBS in villages where 512 Kbps will be sufficient, through E1 links using point to point WIFI links.

DEPLOYMENT: (a) In small towns and villages where 2 MB or more required, point to multipoint Wimax may be deployed. Back haul connectivity from POP may be by Point to point WIFI/Wimax.

(b) For 512 Mbps to 2 Mbps, WIFI in Point to multi point may be by suitable. Back haul connectivity from POP may be point to point WIFI.

(d) Up to 512 Mbps, Broad Band Cor-DECT may be ideal. Connectivity from DIU (exchange) to the BSD in the villages may be E1 through WIFI point to point links. Simultaneous telephony is an advantage.

Before the advent of OFC, BSNL deployed wide band MW systems through out the country using tall microwave towers in cities, rural areas and many on hill tops with buildings, all amenities and approach roads. Many of these towers on hill tops and rural areas remain not fully utilised after the advent of OFC. Also have put up small towers in rural villages for MARR project. These towers and infrastructure will be ideally suitable for Broad Band Wireless Connectivity in the rural areas. The BSNL microwave survey divisions are fully equipped for planning such networks. With modern technology gadgets such as GPS, software packages for feasibility study using digital maps and "on line" calculators, technical feasibility study and system engineering can be done faster and accurately.

As a Telecom engineer, I have over 35 years professional experience in planning and executing analogue/digital multichannel UHF radio links, analogue/digital multichannel MW radio links, Digital point to multipoint radio systems linking district headquarters with state capital- Chennai in Tamilnadu Police as head of the telecommunication wing. Also I have planned and installed 31 cor-DECT systems in the rural areas of Tamilnadu, AP, Karnataka, Maharashtra, Gujarat, MP and Rajasthan after map study and extensive field survey while serving as VP Technical, n-Logue Communications Pvt Ltd, a rural ISP incubated by IIT, Madras. I have gained considerable experience in setting up wireless network in rural areas.

Now I have done an exploratory study of Line-of-Sight (LOS) conditions in the hilly region of Waynad district, Kerala. I selected 22 villages adjacent to Waynad Wildlife Sanctuary, Bandipur national Park, Mudumalai National Park and Nagarhole National Park . The NH 212, Calicut – Bangalore National Highway passes through this region. Out of these 22 villages/towns, Vythiri (Taluk Hq), Chundale, Kalpetta and Sultan Bathery are located on NH 212. My first attempt was to check LOS from kalpetta, which is an urban town with the rest of 21 villages. Only 5 villages have LOS with Kalpetta. Second attempt was to check LOS from Sultan Bathery. 9 villages have LOS with Sultan Bathery. Finally I checked up with Thariyode in Vythiri Taluka, smallest village in Waynad district with 396 house holds and a population of 1859 as per the census 2001. From Thariyode, 14 villages have LOS. I have drawn the path profile map for each link, Fresnel zone calculation and fixed the tower height at each place required for 100% Fresnel zone clearance. With a 45 mtrs tower at Thariyode, 12 places require 21 mtrs towers and 2 places require 30 mtrs towers. The technical feasibility study details such as Mean Sea Level (MSL) of these 22 stations, Distance, Orientation angle, Antenna height required at each site and whether 100% Fresnel zone clearance is available are tabulated in Excel sheet. For NON-LOS links, the obstruction point with MSL and the distance from Thariyode is furnished. The excel sheet, connectivity diagrams from Kalpetta, Sultan Bathtery and Thariyode are attached here with.

However I feel that the exploratory work done may not be 100% accurate. Since I do not have the exact Latitude and Longitude of the tower points, I have fixed the tower points approximately at the centre of the village which may not be the actual location of the tower. Shifting the location a few meters away may make a lot of difference in LOS since it is a hilly region. In actual practice, for fixing the tower locations in the villages, the exact Latitude and Longitude of the tower location is required. This could be done using a GPS and noting down the coordinates at the tower site. This input will help in doing Technical feasibility study and connectivity plan for all the 49 villages in Waynad district. Once the connectivity plan with tower heights finalised, based on the technical specifications of the

radio equipments and antennas, deployment plan could be arrived at based on system engineering calculation.

I am sure that all the 49 villages could be provided with wireless broadband connectivity and it is technically feasible.

I am willing to offer my assistance in planning such network as an honorary consultant to the operator who may be planning to provide Wireless broad band connectivity in Waynad district, Kerala.

M.Samuel chandrakumar
Director – Police Telecommunication (Rtd)
Chennai.

E-mail: samuel_ckumar@yahoo.co.in

Mobile: 9444913729
Phone: 044-22582058