A Report
On
Technical & Policy Consultation

FOCUS

Empowering rural communities of India through unlicensed (free) spectrum

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10 YEARS DEF
DIGITAL EMPOWERMENT foundation

Acknowledgement

Empowering rural communities is crucial for the development of rural India. Bringing rural communities into mainstream of the digital technologies is one of the major concern areas these days.

Indians constitute about 17 per cent of world population, nonetheless for about 35 per cent of the population is poor and 40 per cent of the illiterates in the world. Specifically when 70 percent of population is residing in villages, the agenda of achieving inclusive growth cannot be fulfilled unless access to information, media and communication infrastructure and resources are not channelized in properly manner.

In developing countries community networks and low-cost access technologies such as wireless networks allow for new communities based configurations to emerge, to be responsive to the broader development needs of the communities concerned and to operate sustainably.

On the other hand, there are existing provisions like free spectrum allocations as provided by the Government not being utilized to provision information and media infrastructure to reach out to unreached communities. Globally, and in India, frequency bands in 2.4 Ghz, 5.8 Ghz and 3.3 Ghz have been kept aside as free spectrum that can be used by anyone without taking a license or paying a fee to the Government.

Using the context of unlicensed spectrum, Digital Empowerment Foundation ideated project, Wireless for Communities (W4C) utilizing low-cost wireless technology and unlicensed band to create community-wide wireless communication networks in rural India with support from its project partners, the Internet Society (ISOC) and Ford Foundation. The project overall aims to provide internet connectivity at remotest regions of the country and enabled community members, who have been deprived of accessing information.

In an effort towards advocating how unlicensed spectrum can offer other advantages compared with licensed air waves, DEF organized technical and national-level consultations to bring challenges and share the best practices.

I take this opportunity to thank with all sincerity to our partners, the Internet Society and Ford Foundation for providing the timely support for this important project.

My special thanks and acknowledge to Ms. Anriette Esterhuysen, Executive Director of APC and Mr. Steve Song, Founder, Village Telco for participating at the short notice and sharing their invaluable experience with us.

The consultation would not have been achieved its objectives but for the invaluable presence of best practitioners, technologists, experts, speakers, delegates and participants who shared their inputs and thoughts with suggestions to seek for empowering rural and underserved communities of the country through unlicensed band.

The post consultation report gives you overall understanding of what the programme was about, session highlights and policy and regulatory framework in India. It comes out with key recommendation and suggestions as relevant for policy formulation and documentation towards achieving larger development and empowerment goals by providing equitable access to information to everybody.

The report has been prepared with all sincerity, care and focus. However, readers may forgive any errors and mistakes that may occurred unintentionally.

I wish thoughtful reading to all!

Warmest regards,

Osama Manzar
Founder & Director
Digital Empowerment Foundation

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Introduction

Technology can play a decisive role in determining how networks can be used, whether they will be centralized or decentralized, who can own them, who can set them up, and whether they can be adapted to the specific needs of individuals and communities. Certain technological developments can be decentralized and it can play vital role in shaping lives of local communities by providing affordable services and applications.

In developing countries, the wireless connectivity has been emerged as one of the inexpensive technologies to bridge the connectivity gap in remote areas. These wireless technologies have created much interest on the part of the international-development community. For example, in India, even with mobile penetration, the teledensity in rural areas is still less than 40 percent, and internet connectivity is a far cry. The reason has mostly been the issues around last mile connectivity. On the other hand, last mile wireless connectivity has the potential to resolve the issue of prohibitive cost of deploying conventional wired infrastructure in remotest areas of the country.

With an objective to address the issues of internet accessibility and connect remote and underserved regions of the country, in late 2010, Digital Empowerment Foundation (DEF) and Internet Society (ISOC) initiated a joint called "Wireless for Communities" (W4C) which utilizes low-cost Wi-Fi based equipment and unlicensed spectrum (free spectrum) to connect and empower rural and underserved communities. The motivation behind ideating for the project is twofold – firstly to democratize the availability of connectivity and enable internet accessibility to information in rural parts of the country, secondly to address the issue of lack of content product and services originating from rural areas which affects the economy from percolating to the bottom of the pyramid.

The project includes two factors – providing Training of Trainer (ToT) programme to community members on wireless technology and wireless mesh technology and deploying wireless mesh network in cluster-based environment to understand and observe the benefits and impact of the project over a period of time.

The first pilot project was launched in late 2011 in Chanderi cluster, highly populated with marginalized handloom weavers, located in Madhya Pradesh experimenting on the following key factors:

a) Addressing the issue of last mile connectivity;
b) Democratizing the availability of connectivity and enable internet accessibility and information decentralization;
c) Addressing the issue of content and services gap that obstructs local economy and pulls back social indicators; to address wireless technology skill gaps;

d) Initiating a dialogue and deliberation between stakeholders including public and private parties on the impact, need, scope, viability and sustainability of wireless deployment for community empowerment and meeting needs of underserved regions;

e) Initiating advocacy with the relevant public and private partners to propagate and adopt wireless technology as an unconventional solution to connect rural remote areas and communities with broadband connectivity and services on it.

The project has all key elements in such as network deployment, internet access, developing capacity of local human resource in wireless skills and empowers community with content and service.

The impact is overwhelming; stakeholders is not only connecting remotest regions such as Tura (Meghalaya), Guna & Shivpuri (Madhya Pradesh); Giridih (Bihar) and other regions of the country but also attracted the attention of stakeholders, including policy advocators, government and private players to adopt the wireless technology as an alternative solution towards connectivity and access.

Background

One of the core challenges in the country is to create equitable society where the citizens have universal access to information and knowledge to benefit. Specifically, when 70 percent of India's population is residing in villages, the inclusive growth agenda of the government can only be successfully realized after addressing the growth and developmental issues in rural India. Though it has been proven that information and communication technologies play an important role in rural development, however, provision of telecom services in rural areas is still a concern thrust area to attain the goal of accelerated electronic development and social change. Although the telecom network has grown rapidly in recent years, but a mere percentage of Indians have internet connection in their home.

With an objective to connect remotest regions of the country, the Broadband Policy was announced in Oct 2004 which in result broadband subscribers have grown from impacted 0.18 million to 10.34 million at the end of October 2010. To empower the common man in the rural/remote parts, the Department of Telecom has decided to provide broadband coverage to all 250,000 village panchayats by 2012 out of which 97426 have been stated to be provided. Despite this figures, the situation is far from encouraging given the country crossing a billion plus population across almost or more than 635,000 villages.

One of the objectives of the Dept. of Telecom (India) stated in the Results Framework Document of the Department for the year 2011-2012 is to work for rapid expansion of telecom infrastructure for voice, data & broadband with special emphasis in rural and remote areas of the country. This also includes increase in wireless broadband connection in villages of India. Thus, according to the 2010-2011 annual report of the Dept. of Telecom, broadband connectivity has been provided in 4044 cities, 5431 block headquarters, 613 district headquarters covering about 1,06,559 villages.

Citing optimism, the report projected broadband coverage will get boost with the setting up of 100,000 Common Service Centers (CSCs) covering all the villages in the country. As on October 2011, 97,121 CSCs have been rolled out in the country. These CSC are expected to provide internet access and e-governance service to the common citizen. Besides CSCs, there are over 9000 internet cyber cafes providing internet access enabling communication and interaction with other actors in e-governance through ICTs and wireless technologies such as, e-mail, audio or video chat etc.

However, India still faces technological as well as commercial challenges in penetration of broadband. The low PC penetration and affordability issue due to high cost are the main causes. With the lack of physical connectivity or telecommunication infrastructure, unaffordable cost and lack of ready accessibility to broadband technologies only few can use the Internet. Mostly rural India is lagging in development, education, health, entertainment services and the general living standard due to lack of Government support in creating ICT and Wireless infrastructure to reach rural masses.

Wireless broadband is likely to be the preferred route that operators would like to adopt in delivering broadband services to the masses of the country. Wireless technologies have capabilities to provide widespread broadband access and could drive inclusive growth by way of mobile banking, tele-education, E-governance, tele-medicine etc. However, there are not many wireless programmes that have been designed or deployed to cater needs of rural citizens.

Very few examples can cited which are working as rural wireless-based enterprises with aim of narrowing these digital gaps. AirJaldi is a wireless based social enterprise established in Dharamsala, India with aim of narrowing these gaps in 2005, and created the Dharamsala Community Wireless-Mesh Network in cooperation with the Tibetan Technology Center. DakNet provides extraordinarily low-cost digital communication, letting remote villages leapfrog past the expense of traditional connectivity solutions and begin development of a full-coverage broadband wireless infrastructure. In one such instance, Daknet has worked in Karnataka in providing point to point services. There is micro deployment & usage of wireless connectivity by Krishi Gram Vikash Kendra (KGVK) in Ranchi District of Jharkhand in India.

Another major effort has been continuously made by Delhi based NGO, Digital Empowerment Foundation (DEF) along with its partners ISOC and Ford Foundation to create equitable society by utilizing unlicensed band and low-cost wireless technology. In a desire to make several of such community oriented wireless networks to work on a sustainable basis which could be run, managed and implemented by the communities in different parts of the country in remote areas using open spectrum and providing access to remote communities, DEF is not only providing capacity-building programme to community members but also organizing national-level policy advocacy programmes.

Unlicensed Spectrum Policy & Regulatory Framework in India

The radio frequency (RF) spectrum is vital for wireless communications infrastructure.[1] Most operations on the RF spectrum require a license provided by a national regulatory body or the government. However, many countries have allocated some spectrum for unlicensed use. Unlicensed spectrum bands can be general purpose or application specific. As Robert Horvitz, one of the founding members of the Open Spectrum Alliance explains:

"*Essentially any equipment that does not violate the technical standards can be used for any means in general purpose unlicensed bands. There are other unlicensed bands where that is not the case. For example, there is a band for the control of modern airplanes. There is no license needed to operate in it, but you can only use it for the control of modern airplanes.*"[2]

Spectrum Policy Regulatory Environment in India

Regulation of spectrum licensing, allocation and management is characterized by two key regulatory structures:

- Policies and Laws
- Governmental Bodies

Laws and rules governing spectrum regulation and management in India are elements of several legislations and policies, namely:

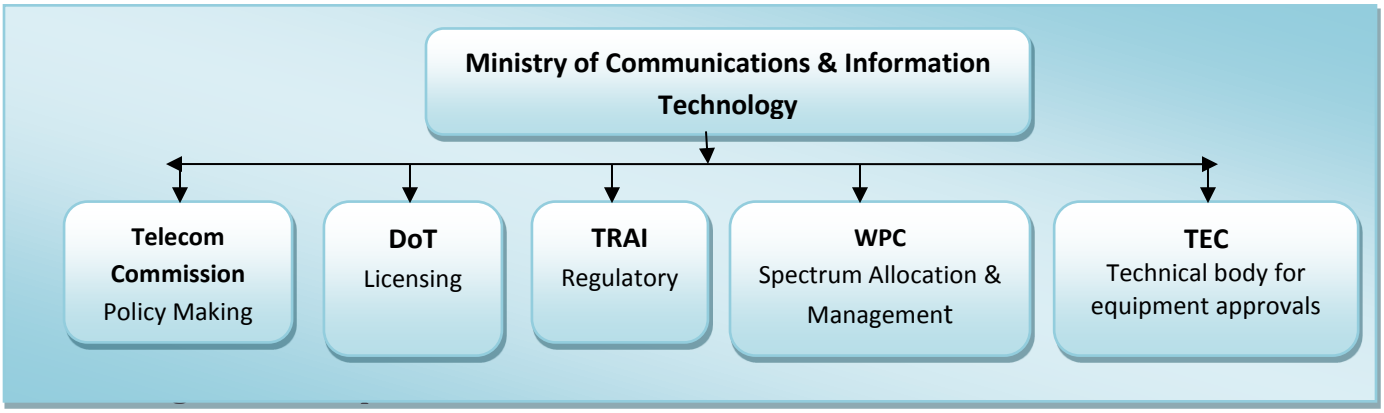
1. The Indian Telegraph Act, 1885[3]
2. Cable Television Networks (Regulation) Act, 1995[4]
3. The Indian Wireless Telegraphy Act, 1933[5]
4. The Telegraph Wires (Unlawful Possession) Act, 1950[6]
5. Telecom Regulatory Authority of India Act, 1997[7]
6. The Telecom Regulatory Authority of India (Amendment) Act, 2000[8]

[1]Ponappa, S. (2010) Understanding Spectrum.*Business Standard*. Retrieved November 21, 2011, from http://www.business-standard.com/india/news/shyam-ponappa-understanding-spectrum/387446/
[2] Horvitz, Robert. Personal Interview. 9 Sept. 2011
[3] Read full text athttp://www.dot.gov.in/Acts/telegraphact.htm (last visited on 31 July, 2012)
[4] Read full text at http://www.trai.gov.in/Content/cable_television.aspx
[5] Read full text at http://www.dot.gov.in/Acts/wirelessact.htm
[6] Read full text at http://www.indiankanoon.org/doc/980662/
[7] Read full text at http://www.trai.gov.in/Content/act_1997.aspx
[8] Read full text at http://www.trai.gov.in/Content/Act2001.aspx

Departments Involved in Spectrum Allocation

The key decision makers on spectrum allocation and assignment include the Wireless Planning and Coordination (WPC) Wing, the Department of Telecommunications (DoT), the Ministry for Communications and Information Technology (CIT) and ad hoc groups such as the Empowered Group of Ministers (EGoM) for third generation (3G) and Broadband Wireless Access (BWA) spectrum auctions.

Spectrum management and regulation is the collective responsibility of more than one body in India. There are different bodies handling spectrum licensing, regulation, pricing, and the levy of penalties; some bodies have only an advisory role.



The International Telecommunication Union (ITU) at the World Radio Communication Conference has identified that allocation of spectrum frequencies is necessary in order to ensure interference free operation for each radio service. RF spectrum allocation is harmonized on an international level through the Radio communication Sector within the International Telecommunication Union (ITU). During the World Telecommunication Conference (WRC) held by the ITU in 2003, spectrum in the 5-6 GHz range was allocated for unlicensed use.

Each frequency band is shared amongst various radio services but the sharing is possible only with the use of similar systems. Sharing is also possible by way of geographical separation, time-sharing and through technical solutions like smart antenna and intelligent radio system. Countries such as UK, U.S. and Canada have unlicensed these frequencies consistent with the decision made at the WRC. India has also done this, although only partially.

National Frequency Allocation Plan: 2002

The National Frequency Allocation Plan (NFAP) forms the basis for development and manufacturing of wireless equipment and spectrum utilization in the country. It contains the service options in various frequency bands for India and also provides the channeling plan in

different bands. Some of the typical frequency bands allocated for certain types of radio services in India are as given below:

S. No	Frequency (in MHz)	Usage
1.	0-87.5 MHz	Marine and aeronautical navigation, short and medium wave radio, amateur (ham) radio and cordless phones
2.	87.5-108	FM radio broadcasts
3.	109- 173	Satellite communication, aeronautical navigation and outdoor broadcast vans
4.	174-230	Not Allocated
5.	230—450	Satellite communication, aeronautical navigation and outdoor broadcast vans
6.	450- 585	Not allocated
7.	585-698	TV broadcast
8.	698-806	Not allocated
9.	806-960	GSM and CDMA mobile services
10.	960-1710	Aeronautical and space communication
11.	1710- 1930	GSM mobile services
12.	1930-2010	Defence forces
13.	2010-2025	Not allocated
14.	2025-2110	Satellite and space communications
15.	2110-2170	Not allocated
16.	2170-2300	Satellite and space communications
17.	2300-2400	Not allocated
18.	2400- 2483.5	Wi-Fi and Bluetooth short range services
19.	2483.5-3300	Space communications
20.	3300-3600	Not allocated
21.	3600-10000	Space research, radio navigation
22.	10000	Satellite downlink for broadcast and DTH services

Meaning of Unlicensed Spectrum in India

Unlicensed spectrum, by not requiring operators to obtain a costly license and special permission for its use is an inexpensive and barrier-free option for meeting communication requirements. Unlicensed spectrum simply means a spectrum band that has rules pre-defined for both the hardware and deployment methods of the radio in such a manner that interference is mitigated by the technical rules defined for the bands rather than it being restricted for use by only one entity through a spectrum licensing approach.

Standards Used for Unlicensed Band

The Institute of Electrical & Electronics Engineers (IEEE) has allocated IEEE 802 LAN/MAN group of standards that include the Ethernet standard “IEEE 802.3” and the Wireless Networking Standard “IEEE 802.11”. 802.11b and 802.11g standards use the 2.4 GHz ISM (Industrial, Scientific,

and Medical) frequency band. The 802.11a standard uses 5 GHz band UNII (Unlicensed-National Information Infrastructure).

The unlicensed 2.4 GHz band has lately become very noise in urban areas due to the high penetration of WLAN and other devices that are communicating in the same frequency range, such as microwave ovens, cordless phones and Bluetooth devices.

The 5 GHz band gives the advantage of less interference but faces other problems due to its nature. High frequency radio waves are more sensitive to absorption than low frequency waves. Waves in the range of 5 GHz are especially sensitive to water and surrounding buildings or other objects due to the higher adsorption rate in this range.

Summary of 802.11 amendments

Licensing of Unlicensed Bands: 2.4 GHz to 2.4835 GHz

According to WPC Wing of the Ministry of Communication & Information Technology:

"Notwithstanding anything contained in any law for the time being in force, no license shall be required by any person to establish, maintain, work, posses and deal in any wireless equipment, on non-interference, non-protection and shared (non-exclusive) basis, in the frequency band 2.4 GHz to 2.4835 GHz with the transmitter power, Effective Radiated Power and height of antenna as specified namely[9]:

Maximum out power of transmitter	Maximum Effective Radiated Power	Height of Antenna
(1)	(2)	(3)
1 W (30 dBm) in Spread of 10 MHz or higher	4 W (36 dBm)	Within 5 meters above the roof top of existing authorized building

[9] Ministry of Communications and Information Technology (Wireless Planning and Coordination Wing) NOTIFICATION on 28th January, 2005

Standard	Frequency	Max Data rate	Description
802.11a	5 GHz	54 Mbps	8 non-overlapping channels.
802.11b	2.4 GHz	11 Mbps	14 overlapping channels
802.11g	2.4 GHz	54 Mbps	– 14 overlapping channels. – Upward compatibility with the standard 802.11b
802.11n	2.4 GHz	360/540 Mbps	Builds upon previous 802.11 standards by adding MIMO that uses multiple transmitters and receiver antennas to allow increased data throughput through spatial multiplexing.

Licensing of Unlicensed Bands: 5.150 to 5.350 GHz and 5.725 to 5.875

The WPC Wing of the Ministry of Communications and Information Technology under its notification Jan 2005 has de-licensed 5.8 GHz Band[10]:

"Notwithstanding anything contained in any law for the time being in force, no license shall be required by any person to establish, maintain, work, possess or deal in any wireless equipment for the purpose of low power Wireless Access System, including Radio Local Area Networks, in the frequency band 5.150 to 5.350 GHz and 5.725 to 5.875 GHz with the Maximum Effective Isotropic Radiated Power, type of antenna and coverage area as specified in the Table below, namely:"

Frequency band (1)	**Maximum Effective Isotropic Radiated Power** (2)	**Type of antenna** (3)	**Coverage area** (4)
5.150 to 5.350 GHz and 5.725 to 5.875 GHz	Maximum mean Effective Isotropic Radiated Power of 200 mW and a maximum mean Effective Isotropic Radiated Power density of 10 mW/ MHz in any 1 MHz bandwidth	Built in or indoor antenna	Indoor usage which includes usage within the single contiguous campus of an individual, duly recognized organization or institution

[10] Ministry of Communications and Information Technology (Wireless Planning and Coordination Wing) NOTIFICATION on 28th January, 2005

Perspectives on Unlicensed Spectrums in India

India has unlicensed and license-exempt frequency bands available for use. However, there are no light-license frequency bands for use in India.

The Supreme Court of India in February 1995 declared airwaves to the public property. Justice P. B. Sawant and S. Mohan specified in their decision regarding the use of airwaves "has to be controlled and regulated by a public authority in the interests of the public and to prevent the invasion of their rights."[11]

In this context, P.K. Garg, the former wireless advisor to the Government of India, states that

"*The government had de-licensed the present bands for reasons that their de-licensing would provide a benefit to society, and the regulation of the bands through license issuance for such low power usage by common public would have been impractical normally. Hence to make the decision to de-license more bands, the spectrum regulator looks at the social benefit/ impact that it would make, and whether they can shift current licensed users to other frequencies if interference concerns are present*".[12]

"Spectrum could be considered for de-licensing for certain technical parameters which shall not cause interference to existing usages in the band." Stated Milind Deora, the Minister of State for Communications and Information Technology during a recent meeting held in Goa on International Mobile Communications.[13]

Moreover, the National Telecom Policy 2012 made the objective to:

- *De-license additional frequency bands for public use.*[14]

It is further specified under section 4.6 of the policy that the government will:

- *Identify additional frequency bands periodically, for exempting them from licensing requirements for operation of low power devices for public use.*[15]

Presently the government controls a large part of the RF spectrum, with only a minimal amount of frequencies being allocated for unlicensed use. However policy makers are beginning to recognize the importance of allocating more unlicensed spectrum.

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[11]The Airwaves are the People's Property. (2001) India Together. Retrieved November 30, 2011, from http://www.indiatogether.org/campaigns/freeinfo/sc95.htm

[12]Garg, P. K. Personal Interview. 8 Oct. 2011.

[13] Spectrum Audit and Pooling Under Consideration-MilindDeora. (2011),Voice&Data Online - Resource Center on Indian Telecom. Retrieved November 30, 2011, from http://voicendata.ciol.com/content/news1/111101401.asp

[14]Department of Telecommunications. National Telecom Policy 2012, objectives 22, 24.

[15] Department of Telecommunications, National Telecom Policy 2012, section 4.6.

Existing license-exempt bands in India

Unlicensed Frequency Ranges in India	Application/Specifications
50-200 kHz	Very low power devices
13553-13567 kHz	Very low power radio frequency devices, indoor only
26.957 MHz-27.283 MHz	Low power wireless equipment (max. Effective Radiated Power of 5 watts)
335 MHz	Low power wireless equipment for the remote control of cranes
402-405 MHz	Medical RF wireless devices (max. radiated power of 25 microwatt) with channel emission band width within 300 kHz
865-867 MHz	Low power wireless device (max. transmitter power of 1 watt-4 watts Effective Radiated Power) with 200 kHz carrier bandwidth
865 MHz - 867 MHz	Radio Frequency Identification Devices (RFID) (MTP of 1 watt-4 watts ERP) with 200 kHz carrier band width
2400 MHz-2483.5 MHz	Low power wireless equipment (e.g. Wi-Fi) (max. transmitter output power of 1 watt-4 watts ERP) with spectrum spread of 10 MHz or higher
5150 MHz-5350 MHz	Low power equipment for Wireless Access Systems (max. mean Effective Isotropic Radiated Power of 200 mW and max. mean Effective Isotropic Radiated Power density of 10 mW/MHz in any 1 MHz bandwidth) indoor only
5725 MHz-5825 MHz	Low power equipment for Wireless Access Systems (MMEIRP of 200 mW and MMEIRP density of 10 mW/MHz in any 1 MHz bandwidth) indoor only
5825 MHz- 5875 MHz	Low power equipment (MTOP of 1 watt-4 watts ERPower) with spectrum spread of 10 MHz or higher

The Indian Department of Telecommunications (DoT) requires operators to obtain a license before being granted the right to use radio spectrum. There are exceptions to this rule, such as the Citizens Band in the 27 MHz range and the Wi-Fi bands in the 2.4 GHz and 5.8 GHz ranges. India's National Telecom Policy 2012 recognizes the need to reserve more frequencies for unlicensed use.

However, the country is still behind when compared to unlicensed spectrum availability in the U.S. and UK, which have already integrated innovative spectrum management techniques in their telecom policies. These policies aim to create a flexible, market-driven approach to spectrum regulation and management through integrating spectrum sharing techniques and meeting the industry demand for unlicensed spectrum. India needs to follow suit in order to provide connectivity to remote/rural regions and encourage further innovation in the telecom domain.

Therefore, additional frequencies should be freed up for unlicensed use according to demands from community groups, industry bodies, and experts in the field, in line with international best practices.

Candidate License-exempt Spectrum Bands in India

Industry bodies in India such as the Internet Service Provider's Association of India (ISPAI), the DECT Forum, the Bidirectional Access Promotion Society (BAPSI), Google and Microsoft have been advocating for more unlicensed spectrum for low power wireless equipment based on international practices. These requests vary from being general purpose to being application specific. Presently, many industry bodies and advocacy groups in India have specific requests for unlicensed spectrum. The requests cover candidate bands including, 433-434 MHz, more bands in sub-1 GHz, more slots under 2.4 GHz, 1880-1900 MHz, 5.15-5.35 GHz, and 5.725-5.825 GHz.

The DECT Forum India, an industry association which represents suppliers, operators and users of DECT equipment, is advocating for the unlicensing of additional frequency ranges for low power cordless communication to meet the Residential and Enterprise Intra-Telecommunication Requirements. A consultation between TRAI and industry bodies is presently taking place on this issue. DECT Forum points to studies conducted by the CEPT, which found that the 3G technology in the adjacent band does not incur interference from low power, indoor use of cordless telephony.[16]

Bands requiring de-licensing in India

Requested Frequency Ranges for Unlicensing	Application	Current Allocation	Countries/Regions Where Exemption is in Place
433 MHz-434 MHz	Data telemetry[17]	Low power short range devices	Australia, Singapore, Malaysia, European Union and New Zealand[18]
902-928 MHz	Low power wireless equipment[19]	• 902.5-915 MHz: Additional requirements of cellular telephone systems, train control and mobile train radio systems • 900 MHz band: Micro cellular low powered telecommunication	U.S.[20]

[16](2011).Consultation Paper on Allocation of Spectrum Resources for Residential and Enterprise Intra-telecommunication Requirements/ cordless telecommunications system (CTS).*Telecom Regulatory Authority of India.*

[17] Ibid

[18] Ibid

[19]Jit Singh Chima. Raman (Google India), Personal Interview. 9 Dec. 2011.

[20](2002).Report of the Unlicensed Devices and Experimental Licenses Working Group, pg. 8.*Federal Communications Commission*. Retrieved November 25, 2011, from http://transition.fcc.gov/sptf/files/E&UWGFinalReport.pdf

		systems • 926-926.5: low power cordless telephone systems	
1880 MHz-1900 MHz	Low power cordless communication[21]	Micro cellular wireless access systems (fixed/mobile) based on TDD access techniques	Europe[22]
2483 -2500 MHz	Broadband Access[23]	_____	_____
5150- 5350 MHz	Broadband Access[24]	Low power equipments for wireless access systems indoor only	U.S.[25], UK[26]

Social & economic justification for open spectrum

Despite the number of growing technologies, many of communities, especially tribal communities and those who live in remotest region of the country suffer from non-availability of access to information and access to any kind of media. There are areas where one cannot access any media simply because it has never been facilitated or laid out.

In India, there are 250,000 panchayats in 635,000 villages through 3 million elected panchayat representatives. Though the government claims that under their scheme, State Wide Area Network (SWAN), the broadband connectivity has been provided up to block level, which is the first mile of the last mile in real terms. Connecting one panchayat has potential to connect 3-5 villages. Similarly, there are 1.4 million rural schools in remote regions of the country.

On the other hand, there are existing provisions like free (unlicensed) spectrum allocations as provided by government of India which is not being utilized to provision information and media infrastructure to reach out to unreached communities.

Considering that the entire last mile is disconnected, meaning all the villages under a block and panchayat are suffering from no information and media access, it is imperative to see how alternatively they could be provided network access and that too quickly and affordably. To connect

[21](2011).Consultation Paper on Allocation of Spectrum Resources for Residential and Enterprise Intra-telecommunication Requirements/ Cordless Telecommunications System (CTS).*Telecom Regulatory Authority of India.*

[22] Ibid pg. 6

[23]Jit Singh Chima. Raman (Google India), Personal Interview. 9 Dec. 2011.

[24] (2011). Response to the Draft National Telecom Policy 2011.*Internet Service Providers' Association of India*.

[25](2002).Report of the Unlicensed Devices and Experimental Licenses Working Group, pg. 10.*Federal Communications Commission*. Retrieved November 25, 2011, from http://transition.fcc.gov/sptf/files/E&UWGFinalReport.pdf

[26]Wireless Telegraphy (Exemption) Regulations 2003 SI No. 74 § 4 § (2011)

all institutional points such as panchayat offices, block offices, schools, there is need to aggressively adopt alternative solutions such as unlicensed wireless spectrum which can not only connect these institutions in remote areas where quality education is big question mark.

Globally, and in India, frequency bands in 2.4 GHz, 5.8 GHz and 3.3 GHz have been kept aside as free spectrum that can be used by anyone without taking a license or paying nominal fee to the Government.

There are very few social enterprises are working for designing or deploying wireless programmes to cater to citizen communities. Examples are very limited such as AirJaldi, which is providing community-based wireless mesh network in cooperation with the Tibetan Technology Center in Dharamshala. DakNet provides extraordinarily low-cost digital communication, letting remote villages leapfrog past the expense of traditional connectivity solutions and begin development of a full-coverage broadband wireless infrastructure. In one such instance, Daknet has worked in Karnataka in providing point to point services. There is micro deployment & usage of wireless connectivity by Krishi Gram Vikash Kendra (KGVK) in Ranchi District of Jharkhand in India. The Chanderi ICT for Weavers programme in Madhya Pradesh has deployed and using wireless to serve local user communities.

Understanding the advantages of unlicensed spectrum in the country, Digital Empowerment Foundation along with Ford Foundation decided to come forward and bring all stakeholders together to formulate and stipulate clear strategy as 'how to make community based ISPs' and to make several such community oriented wireless networks to work on a sustainable basis which could be run, managed and implemented by the communities in different parts of the country in remote areas using open spectrum and providing access to remote communities. The objective of this partnership is twofold – firstly to organize the technical consultation to understand how unlicensed wireless band/free spectrum can be used to connect isolated areas and communities of the country. Secondly to bring policy advocators, social ISP enterprises, experts, and government stakeholders together to have dialogue, debate and open discussion on the importance of open wireless spectrum and how it can be utilized as a means of access to information, rights and resources.

About the National Consultation Workshop

The national consultative workshop was a first kind effort to bring all stakeholders, stakeholders to deliberate, discuss, share, experience and emerge with a concrete set of recommendations as how unlicensed spectrum in India can be used to serving the last mile connectivity. The consultation saw stakeholders from the government departments, agencies, industry, civil society, academia, network implementers, policy advocators, wireless practitioners, and others to air views, opinions, inputs, concerns and suggestions on a wide area of topics. One unique approach was to present and share good practices and challenges in wireless network deployment and operations in India and other developing countries.

Workshop Objectives

Key objectives of the national consultation workshop identified were:

- Arrive at better understanding of unlicensed band, free spectrum and its importance to serve last mile connectivity
- To share good practices and challenges faced during the wireless network deployment and operations in India and other developing countries
- Deliberate on the need availability & challenges of appropriate wireless technologies to bridge access and connectivity divides
- To bring implications related to wireless, mobile & broadband technologies which help transcend traditional infrastructural bottlenecks in rural areas of India
- To emerge with working framework with necessary inputs, suggestions, comments, recommendations on ways to connect the government and business services that can reach the masses through the wireless and mobile networks in local languages and in oral medium

Workshop Broad Areas

In light of the above, the consultation discussed the following broad areas:

1. Discuss the importance of free spectrum for public good and advocacy towards utilizing it for social development
2. To understand the scope and opportunities of unlicensed spectrum in India and other developing countries
3. The magnitude and extent of unlicensed wireless band/free spectrum can be used to connect isolated areas and communities of the country.
4. Explore and understand the rights and ethics challenges and issues around unlicensed spectrum

Workshop Themes

The consultative workshop deliberated on the following themes:

1. Access, rights & ethics
2. Economic and social advancement of using wireless network
3. Developing uniform policy framework for unlicensed spectrum

Outcome

The national consultation workshop looked at the following key outcomes

1. Consolidate factors and inputs to uniform policy framework for unlicensed wireless spectrum;
2. Consolidate solutions towards issues related to media, access and rights, ownership of unlicensed spectrum, ownership of accessibility and exploring opportunities in terms of accessibility;
3. Building a roadmap towards a working framework on adopting cost-effective technologies to propagate the wireless network networks far and wide across the country for ensuring equality of access, digital equity and media access.
4. Consolidating scope of policy areas and suggest workable action steps;

Consultation Proceedings

The consultation was formed in discussion-oriented format sharing good practices, case studies and challenges in wireless network deployment and operations in India and other developing countries. The focus of the consultation is empower communities through open media access. The consultation also focused on understanding the importance of unlicensed band (free spectrum) to serve the last mile connectivity. The consultation was chaired by Executive Director of the Association for Progressive Communications (APC) and moderated by Subho Ray, President of Internet and Mobile Association of India (IAMAI). The consultation also focused on understanding the importance of unlicensed band (free spectrum) to serve the last mile connectivity.

Speakers

Guest of Honor & Chairperson

Ms. Anriette Esterhuysen, Executive Director, Association for Progressive Communications (APC), South Africa

Moderator

Mr. Subho Ray, President, Internet and Mobile Association of India (IAMAI)

Power Panel Speakers

1. Mr. Anoop Singh, Special Secretary, IT & Communication, Govt. of Andhra Pradesh
2. Dr. Ravina Aggarwal, Program Officer for Media Rights and Access, Ford Foundation
3. Mr. Rajnesh Singh, Regional Bureau Director for Asia, ISOC
4. Mr. Amitabh Singhal, Former CEO, NIXI

5. Mr. Mahabir Pun, Founder, Nepal Wireless
6. Mr. Michael Ginguld, Chief Executive Officer, AirJaldi
7. Mr. Mahesh Venkateswaran, CEO, KGVK Social Enterprises Limited

The Proceedings

The Consultation delegates and guests were welcomed by Mr. Subho Ray, President of Internet and Mobile Association of India (IAMAI). He outlined the reason and background to initiate the session dialogue through the consultation – scope and opportunities of unutilized spectrum to provide internet connectivity in rural areas. Sharing his ground experience, he quested to demonstrate the need for and importance of unlicensed spectrum as a medium for inexpensive connectivity in rural/remote areas and source of innovation by serving as a barrier-free and cost-effective platform for testing and implementing of new technologies.

Keynote address by Ms. Anriette Esterhuysen, Executive Director of APC

Executive Director of APC, Anriette Esterhuysen initiated the national consultation Summit asking key panelists to share their views on how the free spectrum (unlicensed spectrum) can be understood and utilized for benefitting the society. Raising the issue of approaching spectrum in two perspectives – policy and regulatory, she requested panelists to shed some light on how to approach spectrum, not only in terms of policy and regulatory issues, but also in terms of implementation and application.

Amitabh Singhal, Former CEO, NIXI

Mr. Amitabh Singhal initiated the discussion by sharing his industry experience, being a President at Internet Service Providers Association of India (ISPAI) enforced the government to follow global standards and exempt few frequencies from licensing process. In 2006, the Government of India exempted frequency 2.4 GHz band license-free. Referring to the draft of the National Telecom Policy-2011, he highlighted the government is trying to connect all the villages and households in the country through its various projects such as the National Optic Fibre Network (NOFN), which aims to provide broadband connectivity to Panchayats (village councils) and State Wide Area Network (SWAN), envisaged to create such a connectivity in each State / UT. He pointed out however; last mile connectivity is the real challenge in India because of geographical challenges, tropical challenges and accessibility issues in terms of physical infrastructure. Here free spectrum plays important role to resolve these challenges. According to ISPAI, most of internet service providers (ISPs) are using 2.4 GHz which is these days widely used spectrum to provide last mile connectivity. The government is also gearing up to launch range of new technologies such as WiMAX. Private companies are also coming up with new solutions and technologies to reach remotest regions of the country. Giving wider perspective, Mr. Singhal pointed that India is currently at various stages of using licensed & unlicensed band to create last mile connectivity and to reach end user.

Mr. Anoop Singh, Special Secretary - IT & Communication, Govt. of Andhra Pradesh

Mr. Anoop Singh initiated the discussion stating that revolution in the telecom industry is happening since 2001 with small revolutions happening in the country. Referring to Mr. Singhal's point, he stated that NOFN is one of the dreams that has come true in terms of connecting remotest regions of the country, however, the project has two challenges – firstly is the last mile connectivity, secondly is rendering of content on the free spectrum. Though, number of enormous and brilliant efforts is being undertaken by enterprises throughout the country, even in the remotest regions of the country, however, overall impact is yet not visible. At last, he concluded his points in a hope that soon the country will be able to witness the impact and revolutions that will boost the economic and social growth by leaps and bounds.

Dr. Ravina Aggarwal, Program Officer - Media Rights and Access, Ford Foundation

Dr. Ravina initiated her views by cautioning on using the word, 'revolution' as the word itself has innumerable optimism associated to it, however, there are two major issues related to the word in the context of mobile services. In accordance with the fact that the mobile services have enormous potential in India, she mentioned however, these services also face challenge of enormous inequity. According to Ms. Ravina though availability of content is important to deliver services, however, she recommended not to take service delivery provision models for granted. She also urged that there is need to invest in equitable solutions. According to Ms. Ravina more than 80 percent population does not have access to internet or means to access information. In the nutshell, she mentioned that though there is constant movement towards better technologies but the promise of scaling of the services has not been delivered yet in rural regions.

Raising the issue of accessing information, she also recommended that there is need of committed players such as non-profit organizations, small enterprises and individual players in the market to provide equitable solutions to rural citizens and those who are yet deprived of accessing information as big telcos might not be interested to cover in their big business models. In her conclusion, she recommended to have good partnerships between government and private stakeholders, small enterprises and big telcos and NGOs (non-profit organizations) and independent businesses which will help in serving end users. Thus, at last she welcomed opportunities for new ideas, policy advocators who would encourage small and medium enterprises to work altogether for the benefit society.

Mr. Michael Ginguld, Chief Executive Officer - AirJaldi

Mr. Michael initiated the discussion explaining 2.4 GHz and 5.8 GHz bandwidth are available as free (unlicensed) spectrum. Explaining about the science behind unlicensed spectrum, Mr. Ginguld further stated that radio waves or the spectrum is limited resource according to physics. Further explaining about spectrum utilization, he stated if all available bandwidth will be utilized, it will not solve the problem of delivering content. Thus, the problem could only be solved by using available spectrum efficiently.

Bestowing on the success of the Wi-Fi technology in the 5.8GHz, Mr. Ginguld added that success was partly due to cheap cost of equipment and partly due absence of license fee. Even if, lowering down

the license fee for 700 or 900 MHz, there is no equipment which is even close to the price range of 2.4GHz or 5.8 GHz range. At last, he concluded his points urging to use available spectrum effectively and efficiently.

Mr. Mahesh Venkateswaran, CEO - KGVK Social Enterprises Limited

Giving the background of the organization, Mr. Mahesh initiated the discussion that he has been working in Jharkhand from the last four years along with AirJaldi and struggling to expand the network in rural regions of the state. Being from the demand side, he further urged that there is need to use available spectrum wisely and effectively. Questioning on government's agenda thought-process for making digital-inclusive society through mobile phones or internet, he explained that stakeholders should not start their services from ultra-rural areas but they should start their services from semi-urban region because these regions are connected, however, the quality of connectivity is not up to the mark. These are the places with fluctuating connectivity and where existing operators could do a good job. In order to strengthen connectivity in these areas, there is a need to adopt cluster-based approach and the benefits could then be spread out to the grass root level.

Giving example of his organization, Mr. Mahesh stated that cost-factor that plays crucial role in spectrum India. He concluded his points that there is need to generate strong demand in terms of employability, educational and healthcare services within communities and later on there is possibility of creating rural broadband subsidies specifically designed for villagers. In result, it will help in spectrum utilization in a structured manner as well as further allocation of spectrum.

Mr. Mahabir Pun, Founder, Nepal Wireless

In the context of unlicensed spectrum utilization in Nepal, Mr. Mahabir stated that his organization, Nepal Wireless is working in the remote villages of Himalayas and trying them to connect with internet. Referring to the fact that over 80% population in Nepal is living in villages and they cannot afford internet, he commented no matter if telecom operators are introducing 3G or 4G technology in the country, if it will be highly priced, most of people cannot afford such technologies. Thus, open (free) spectrum is utmost important to provide connectivity in Nepal. He agreed that telecom companies are certainly unable to provide their services for free as they have to pay huge licensing fees, thus, there is requisite to understand the importance of open (free) spectrum. Like India, the Government of Nepal is also making its efforts to connect 75 district headquarters of the country with optic fibre network; he questioned what about the last mile connectivity in the country. According to Mr. Pun, connecting district headquarters or centres is not enough for last mile connectivity, there is not only need to connect to each and every villages but also make connectivity affordable to them. Giving an example of Nepal, he stated the government of Nepal has encouraged rural ISP to pay licensing fee of INR 100 in year. Further discussing about regulations, Mr. Pun recommended that regulations related to open spectrum is not important in developing countries like India or Nepal, but it is also important to motivate and encourage rural small enterprises to become ISP provider within their region through which rural ISPs can also earn some additional

income. Thus it is not only about opening up of spectrum but also creating resolutions for the better utilization of the spectrum.

Mr. Rajnesh Singh, Regional Bureau Director for Asia - ISOC

In the context of open spectrum, Mr. Rajnesh initiated the discussion with the utilization of white space in other countries. Giving examples of developed countries such as USA and Singapore where government has started approaching to use analog TV spectrum for their purpose, he proposed that there is need of utilization such spectrums in India as well. In a question of what kind of spectrums can be utilized, Mr. Singh stated there are number of organizations who have not really utilized that bandwidth allotted to them and in fact can be used. The underlying point, however is that how many of these frequencies are feasible and can be used at an affordable price. He further added though telcos buys spectrum in exorbitant rate, however, end of the day, cost needs to be paid by end users.

In a context to affordable resources available in the market, Mr. Rajnesh stated there are chipsets are available that can be used to effectively used the bandwidth of 700 or 900 MHz, while the 2.4 GHz chips can now fitted to almost any device. Thus, research and development (R&D) in this field has an important role to play so that mass production of chipsets for other frequencies can be done and at a very cheap price. He also prophesized the need of a balance in the government polices.

In the backdrop of cost-effective spectrum utilization, Mr. Rajnesh recommended to provide some kind of network access to the ones who certainly cannot afford the service of paid spectrum.

Recommendations

1. As the demand for bandwidth and connectivity is bound to grow in future. In a question of optimal utilization of available open spectrum, there is need of continuous experiment with the existing spectrum and looking for robust bandwidth solutions to provide the last mile connectivity.

2. In terms of the using new technologies, Wi-Fi is one of the most usable technologies as it doesn't have issue of the connectivity and stability.

3. In an effort to provide equitable access and increase internet penetration, there is need to explore all kind of spectrums, including open, white space and the existing spectrum.

4. One recommendation is to provide quality content in a channelized manner and develop sustainable business models to sustain small ISPs in India.

5. Regulations like using premium bandwidths on shared basis for both paid as well as non-paid spectrum can be initiated in India to solve the issues related to substandard quality of ISP service. Though there are issues like security, interference and even non-working of the business model, however, there is need to rework on sharing model of spectrum.

6. In an effort to provide last mile connectivity and come up with sharing spectrum model, there is need to open up free spectrum, so that end users living villages of the country can also be connected.

7. Another major recommendation is to develop sustainable social enterprises and to generate strong demand at the lowest price that could work for the poor. There is also need to understand the price-factor which has to be reduces before it reaches at grassroots level.

8. It must be mandatory to understand whether rural communities are able to harness the benefits of the existing bandwidth.

9. The necessity of more spectrums is required these days because if many people are using the same bandwidth which causes a problem, congestion. In result, it would lead to more severe problem of the congestion such as loss of speed, security, breaches, etc.

10. In terms of bringing digital literacy in real terms and to improve lives of the marginalized communities, it is important to use open spectrum and also provide devices which can harness the open spectrum. The rural population needs to be taught how to use computer, but not through text books but using computers in real life.

11. The word 'empowerment' should be clearly defined. It clearly describes how citizens can receive all kind of services using technology. Wireless communications and computers are means of empowerment and there is need to devise policy and methodology that will lead to actual empowerment. For the same, there is need to take immediate steps in redeveloping and redefining processes government policies and services.

12. The word, 'communities' also needs to be clearly identified and defined. For communities like NGOs, Panchayats and clusters; there is need to develop specific models which should be simple and realistic solution for such communities. Like DEF & PIR (Public Interest Registry) has addressed the needs of NGO communities and enabled them to use web and internet for community development. In a similar way, DEF & AirJaldi are working together to provide access to the internet to these NGOs. These kind of solutions need to be developed after identifying specific communities.

13. In terms of accessibility to the last mile users, there is a need to develop proper business opportunities. On the supply side of the spectrum, call needs to be taken for lowering down the spectrum. Presently in India, the cost of internet access is still highly-priced, thus there is need to work on ways which is logic.

14. Referring to the issue of physical infrastructure, government and BSNL have immense physical infrastructure in place which needs to be utilized in channelized manner.

15. In terms of new policies, policy makers and government needs to come forward and provide any kind of subsidy to internet users rather than internet service provider.

16. Being most of rural broadband is state controlled mostly (through BSNL) and this needs to change by opening up infrastructure for shared usage and subsidy depending on location of installation. On understanding the requirements of rural broadband networks, there is need to analyze ways and models which can fill in gap with provision some level of subsidy or tax exemption for ISPs.

17. Assessing the potential of open spectrum or rural broadband networks, first steps of bringing out sustainable models in semi-urban cities and towns, so that rural communities can also get inspired and look upon these models. In result, it will create an ecosystem and help rural regions to be connected with the mainstream.