

Opportunities for India in sub-1GHz Spectrum and International Standardization

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Agenda

- **Global Situation of sub-1GHz frequency spectrum**
- **Sub-1GHz spectrum use in India**
- **What India should do?**

Global scenario for sub-1GHz bands

- **A major portion of the frequency band below 1GHz is allocated for analog TV broadcasting**
- **Transition from analog to digital television is resulting in a once-in-this-lifetime opportunity for reallocation of this very important spectrum**

	US	Europe	India
TV White Space (licensed)	698 – 806 MHz (Auctions completed [1])	790 – 862 MHz (auctions pending) [550 – 606 MHz] (under consultation) [2]	[585 – 698 MHz 698 – 806 MHz*] (status unknown)
TV White Space unlicensed (lightly licensed*)	Total of 282 MHz in 54 – 698 MHz range (ruling completed Sep'10 [3]) Note: Refer to reference for exact bands	[470 – 550 MHz 614 – 790 MHz] (under public consultation) [4]	Not available

* Lightly licensed bands will require unlicensed radios to adopt cognitive concepts to ascertain the presence of licensed or primary users of the band

**698 – 806MHz is largely unused in India (TRAI consultation report, Oct 2009 [5])

- **In the US and Europe, majority of the TV spectrum is being considered for lightly licensed operation [3,4]**

Global scenario for Public Safety

- **Several bands in sub-1GHz assigned to public safety communications**
- **Current systems are narrowband low data rate systems (example TETRA) which support primarily voice services**
- **Events like the 9/11 attacks in the US have triggered a series of reforms to promote broadband technology alternatives for public safety communications.**
 - Refer to [6] for some policy in this regard.
- **India has similar requirements**
 - Real time video surveillance of the 26/11 attack sites would have been precious for commandos from a strategic standpoint
 - Indian security agencies like police, paramilitary forces and anti terrorists suads need to deploy broadband public safety communications system

Global Spectrum licensing regimes

- **Licensed spectrum enables the deployment of large national infrastructures**
 - Commercial broadband deployments for urban areas
 - Public safety spectrum requires exclusive rights of use to ensure protection from interference
- **Lightly licensed spectrum enables innovative new devices and applications**
 - Radios to adopt cognitive and Self organizing concepts for adaptive interference management
 - Enable commercial broadband deployments for capex sensitive rural area deployments
 - Requires a regulatory framework for pricing spectrum
- **Unlicensed spectrum**
 - Continue to serve indoor users (home and office networks)
 - Low cost backhaul

Motivation for changes in India

Broadband services

- **Rural tele-density is at 26% [7]**
- **Broadband penetration is a mere 1% of the number of telephone connections**
 - 86% of Broadband connections use DSL implying that penetration is limited to urban areas with existing wireline infrastructure
- **ARPU is dropping (33% drop from 2009 to 2010) [8]**
- **High entry costs and low ROI are serious disincentives for operators to service rural India with current scenario**

Public safety communications

- **High cost of equipment for proprietary / customized solutions**
- **Interoperability issues**
- **A framework for Broadband public safety communications required in India too**

Sub-GHz spectrum allocation in India – NFAP 2008

- **890-960 MHz is allocated for cellular services**
- **368 – 380 MHz : Fixed Mobile band Note: could be considered for rural communications on a case-by-case basis**
- **470 – 520 MHz and 520 – 585 MHz: Fixed and Mobile services to be considered on a case-by-case basis**
- **585-806MHz: broadcasting services which include mobile TV**
 - IMT and Broadband Wireless Access (BWA) services in 698-806 MHz may be considered for coordination on case by case basis
- **Public Safety: Spot frequencies have been earmarked for public protection and disaster relief (PPDR)**
 - 380-400 MHz
 - 406.1-430 MHz
 - 440-470 MHz
 - 746-806 MHz
 - 806-824/851-869 MHz

Standardization

- **Both 3GPP LTE and WiMAX support sub-1GHz operation**
 - Several trials underway
- **IEEE 802.11af:**
 - Unlicensed operation in TV whitespace spectrum
 - Long range WiFi (referred to as ‘super WiFi’ by the FCC)
 - Candidate technology for ‘data offload’ to enable decongestion of cellular networks [10]

Standardization (contd)

- **IEEE 802.11ah:**
 - Targets unlicensed operation in non TV whitespace spectrum below 1GHz
 - Broadband deployments
 - Includes low data rate options to enable green initiatives such as smart grid and smart metering
- **IEEE 802.22:**
 - Standard completed recently in 2010
 - Targets unlicensed broadband deployments in TV whitespace spectrum

IIT Bombay participation in 802.11ah

- **Channel modeling in 400 MHz and 900 MHz for Indian rural and sub-urban**
- **Proposing MAC and PHY changes in 802.11ah**

Discussion

- **Categorize licensing of sub-1GHz spectrum into the following regimes:**
 - Licensed (may follow market dynamics and spectrum auction)
 - Lightly licensed
 - Unlicensed
- **Develop a Regulatory model based on the above licensing regimes**
- **Based on new evolving standards such as WiFi in 700MHz band (802.11af and 11ah) , India should facilitate deployments for low cost broadband technologies**
- **Identify requirements for enabling broadband public safety communications for national security agencies**
 - Security agency need to have broadband networks
- **Frequency harmonization with rest of the world**

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