White Spaces and Spectrum Sharing for Wireless Broadband

Office of Engineering and Technology
Wireless Telecommunications Bureau

FCC Open Agenda Meeting
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Overview

1. Spectrum Use Today: Licensed and Unlicensed
2. Emerging Spectrum Sharing Approaches
3. White Spaces: Progress to date and future directions
1. Spectrum Use Today
Wireless Broadband Ecosystem: Convergence

Licensed

Unlicensed
Unlicensed Spectrum

- Diversity of Uses: broadband, sensors, RF ID, baby monitors; cordless phones, vehicular radars, etc.
- Carries 30-40% of Internet traffic, expected to increase
- Enormous economic value
- Inherently shared spectrum
- Authorized in most bands, higher power in some
Licensed Spectrum

- Approximately 2 million FCC licenses
- Diversity of uses: broadband, broadcast, point-to-point, satellite, etc.
- $150 billion wireless industry
- Flexible use policy
Spectrum Management Today

Spectrum Allocations Are Silos

Silos Can Lead to Inefficiency
2. Spectrum Sharing Approaches
Multiple "Layers" of Sharing

- Services
  - Multiple users share same service, potentially multiple user types

- Network
  - Multiple service providers share network infrastructure, different spectrum

- Spectrum
  - Different radio systems share electromagnetic spectrum
Improving Efficiency: Sharing

- Much of the Spectrum Is Shared
- Several Ways to Share
  - Frequency
  - Space
  - Time
  - Accept Interference
  - Share Infrastructure
- Most Sharing is Static
  - Opportunity to share more
Basic Sharing Techniques

- Frequency (hopping, spread spectrum, coexistence)
- Geographical (exclusion zones, area licenses)
- Temporal (priority / scheduled access)

Modern sharing technologies (e.g., White Spaces) use these basic techniques, but more dynamically
Example 1: Coexistence Overlay

- Frequency coexistence using licensed spectrum
- LTE: designed to tolerate some interference
- Exploring this approach with federal @ 1755-1850 MHz
- Testing planned
Example 2: Small Cells

- Example of geographic sharing
- Licensed or unlicensed spectrum
- Dense networks = higher capacity
- Side benefit: short range = precise area targeting
- Stand-alone or combined with cognitive radio

Connect via Wi-Fi or licensed technology

Connect to Network over the Internet
Example 3: Dynamic Frequency Selection

DFS Enables Access to 5 GHz Spectrum for Unlicensed Devices

Radar operates only at certain Locations or intermittently

Device detects radar and moves to unoccupied channel

Medical Body Area Network detects and avoids flight testing and other signals
3. White Spaces: Update
White Spaces Paradigm

- Basic Concept:
  - Identify spectrum “White Space”
  - Device/Network adapts to use it – Dynamic Spectrum Access (DSA)
  - Technical standards protect services
- First Implementation: TV bands
  - Rules finalized September 2010
  - Slight modifications April 2012

Example: TV Ch. 25 Assignments / White Space
Sharing White Space in the TV Band

- Several TV channels are vacant at any given location
- Accessing the White Space
  - Device determines its location
  - Communicates with data base of protected services
  - Data base replies with permissible frequencies at that location
  - Device automatically adjusts to operate on permissible frequencies
- Services protected in the data base:
  - Digital TV, analog Class A, and low power TV, translator & booster stations
  - Wireless Microphones
  - Cable head-ends
  - Land mobile systems
U.S. Leads the World in White Space Technology

- Adopted final rules
- Approved the first devices
- Approved first databases
- Approved initial tests
- Approved first deployments
- Testing microphone registration
Spectrum Sharing: Beyond the TV Band

- Spectrum Innovation NOI: asked how dynamic access can provide more intensive and efficient use of spectrum
- Middle Class Tax Relief Act of 2012: Roadmap for exploring expansion of 5 GHz Wi-Fi
- President’s Council of Advisors on Science and Technology (PCAST): working on a report that will likely encourage shared spectrum model in federal government spectrum bands
- Potential Bands: 1.7 GHz, 3.5 GHz, 5 GHz – likely will require different approaches