Model Based Federal and Commercial Spectrum Sharing Solutions

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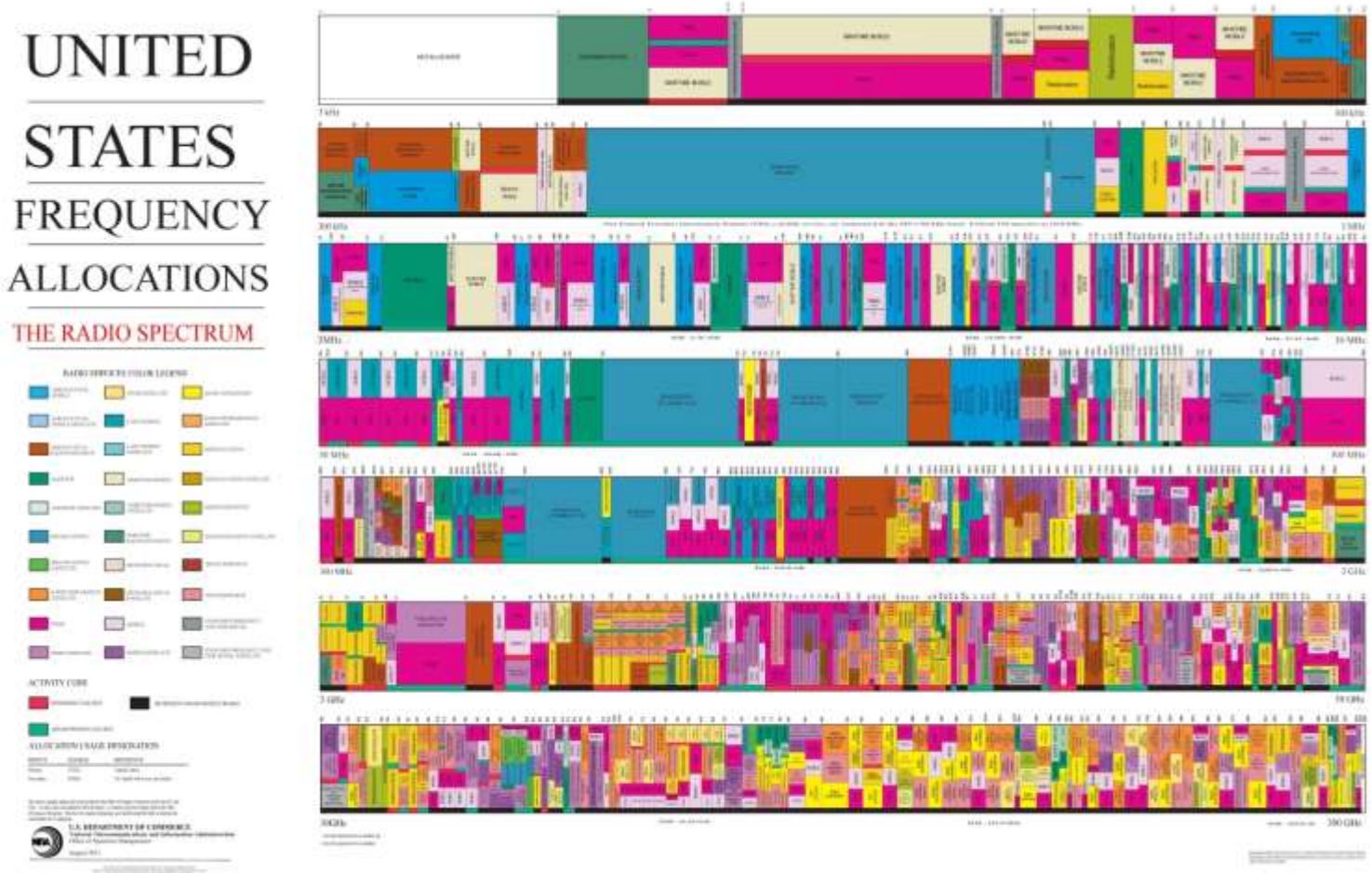
Increasing Demands on Spectrum



- The demands for access to spectrum by federal agencies to perform their missions and commercial users to provide new commercial services is increasing dramatically.

New Paradigm for Spectrum Access

- The days of clearing frequency bands of federal operations to make them available for commercial services is not possible as a long-term solution.

- Given the exploding demand for spectrum, NTIA proposed spectrum sharing as a new paradigm for repurposing spectrum that meets the needs of commercial and federal users.

> *"To achieve the President's goal, we need to move beyond the traditional approach of clearing government-held spectrum of federal users in order to auction it off to the private sector for exclusive use. Too often, relocating incumbent operations is too costly, too time-consuming and too disruptive to federal missions. The future lies in sharing spectrum – across government agencies and commercial services, and across time, geography and other dimensions in the future."*

NTIA Blog Post - Promoting Spectrum Sharing
In the Wireless Broadband Era
January 9, 2015

Spectrum Sharing Analysis Models

- NTIA develops analysis models that:
  - are tailored to the specific federal and commercial sharing scenarios;
  - allow greater flexibility in examining diverse spectrum sharing proposals; and
  - allow parametric evaluation of different spectrum sharing options.
- The models employ statistical "link budget" analysis techniques to more realistically simulate the potential effects of aggregate interference to federal systems.
- The models can be used to establish:
  - sharing conditions between federal and commercial systems (*e.g.*, frequency or geographic constraints);
  - service rules for compatible operation (*e.g.*, transmitter power and out-of-band emission limits); and
  - receiver filter requirements for compatible operation.

Categories of Spectrum Sharing Models

- General spectrum sharing models are used to develop:
  - service rules based on technical and deployment parameters considered in the sharing analysis;
  - service rules that are technology neutral; and
  - service rules before the service/technology is fully defined.

- Specific spectrum sharing models can:
  - benefit from direct dialogue between federal agency and commercial service provider;
  - take into account specific technical and deployment parameters of commercial systems; and
  - employ additional constraints to protect federal systems (*e.g.*, sector blanking of base station antenna).

Challenges in Spectrum Sharing Analysis Models

- Technical and deployment parameters for new commercial service:
  - transmitter in-band and out-of-band power levels, transmitter power control, antenna gain pattern; and
  - distribution of transmitters (*e.g.*, transmitter density, indoor and outdoor use, antenna heights)

- Selection of propagation loss, building loss, and clutter loss models.

- Use cases for federal systems:
  - most federal bands support many types of diverse systems so defining a single use case is difficult; and
  - new commercial service must be compatible with all federal systems.

- Receiver interference thresholds are necessary to protect current and future federal operations.

Summary

- Sharing is not a new concept in spectrum management:
  - common place in most frequency bands allocated for exclusive federal use; and
  - sharing between federal and commercial users does occur.
- It is imperative that federal agencies and the commercial users continue to find innovative ways to improve the analysis models to promote greater spectrum access through sharing.