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# My Kingdom for a Hertz: Can Washington Keep the Mobile Revolution Going?

**Panel Discussion on Capitol Hill**

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## ■ Our Sponsor

- Heinrich Hertz, 1857-1894.
- Built the first radio at Karlsruhe in 1886 to test Maxwell's equations
- Cycle per second is known as Hertz (Hz) in his honor.
- "In bulk, Hertz' experiments explain reflection, refraction, polarization, interference, and velocity of electric waves."  
- Wikipedia



## ■ The Panel

- John Leibovitz, Deputy Chief  
Wireless Telecommunications Bureau, FCC
- Karl Nebbia, Deputy Associate Administrator  
NTIA Office of Spectrum Management
- Neil Fried, Chief Counsel,  
House Committee on Energy and Commerce
- Shawn Chang, Senior Democratic Counsel  
House Committee on Energy and Commerce
- Neeta A. Bidwai, Senior Policy Advisor, Senator Mark Warner
- Matthew Hussey, Legislative Assistant, Senator Olympia Snowe

# ■ The Mobile Revolution

- The Mobile Revolution marks a new era in computing.



- This revolution is powered by spectrum, microelectronics, and software.

# ■ Spectrum

- “Spectrum” is the range of Electromagnetic Radiation or Energy.
  - Radiation is charged particle energy moving in waves
  - These waves range in frequency from very small to very large
- Modulating pure sine waves enables them to carry information
  - These modifications – distortions – have to be intelligible by a receiver
  - Intelligible distortions are signal, others are noise
- Noise comes from natural sources and from reflections of signals off natural surfaces
  - Frequency determines whether a signal passes through or bounces off a given obstacle

# ■ Spectrum of Visible Light Refracted



# ■ Spectrum Propagation

- Propagation of EMR is a function of power, not frequency
- Power drops off with distance depending on propagation pattern or antenna directionality
  - Omni-directional antennas lose energy most rapidly
- Waves are reflected by barriers larger than the wavelength
  - Windows pass frequencies above ~500 MHz
  - Foliage scatters frequencies above ~4 GHz
- Modern cellular architecture is hierarchical
  - Large cells for coverage
  - Small cells within large cells for performance

# FCC and NTIA Control Spectrum Rights

## UNITED STATES FREQUENCY ALLOCATIONS THE RADIO SPECTRUM

### RADIO SERVICES COLOR LEGEND

- AERONAUTICAL MOBILE
- INTERSATELLITE
- RADIOASTRONOMY
- AERONAUTICAL MOBILE SATELLITE
- LAND MOBILE
- RADIOCELESTION
- AERONAUTICAL RADIOAGIGATION
- LAND MOBILE SATELLITE
- RADIOLOGATION
- MARITIME
- MARITIME MOBILE
- RADIOLOGATION SATELLITE
- MARITIME SATELLITE
- MARITIME MOBILE SATELLITE
- BROADCASTING
- MARITIME RADIOAGIGATION
- RADIOAGIGATION SATELLITE
- BROADCASTING SATELLITE
- METEOROLOGICAL MOBILE
- SPACE OPERATION
- DATA EXPLORATION SATELLITE
- METEOROLOGICAL SATELLITE
- SPACE RESEARCH
- FIXED
- MOBILE
- STANDBY FREQUENCY AND THE SIGNAL
- FIXED SATELLITE
- MOBILE SATELLITE
- STANDBY FREQUENCY AND THE SIGNAL SATELLITE

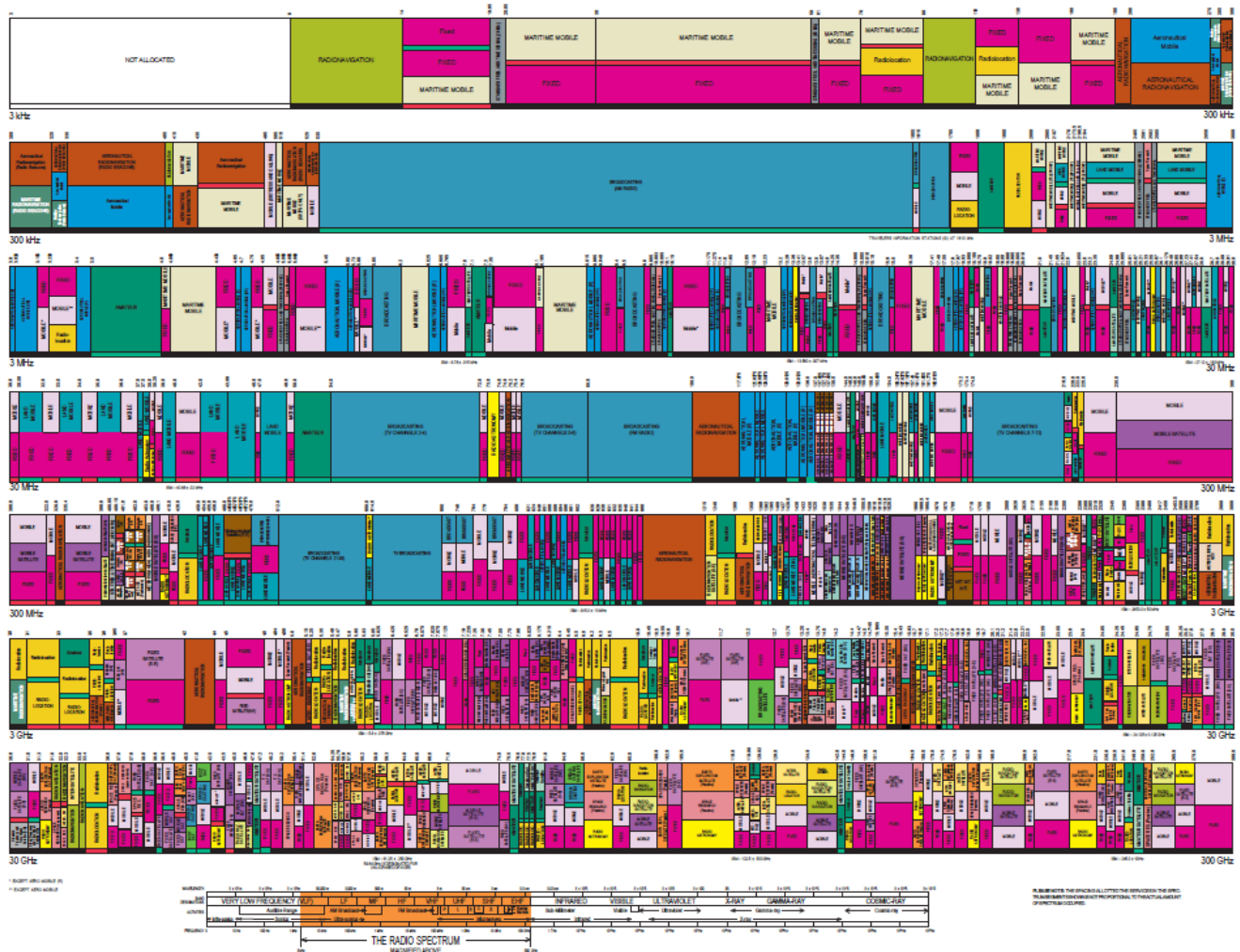
### ACTIVITY CODE

- GOVERNMENT EXCLUSIVE
- GOVERNMENT/GOVERNMENT SHARED
- NON-GOVERNMENT EXCLUSIVE

### ALLOCATION USAGE DESIGNATION

- |           |         |                                     |
|-----------|---------|-------------------------------------|
| SERVICE   | EXAMPLE | DESCRIPTION                         |
| Primary   | FIXED   | Capital Letters                     |
| Secondary | MOBILE  | 1st Capital with lower case letters |

This chart is a graphic representation of the portion of the Table of Frequency Allocations used by the FCC and NTIA for the United States. It is not intended to be a substitute for the Table of Frequency Allocations. The table of Frequency Allocations is the official document of the FCC and NTIA. It is available on the FCC website at [www.fcc.gov](http://www.fcc.gov).





## ■ Sharing Spectrum

- Commercial networks share “cooked” spectrum by user and application:
  - Very efficient sharing that allows > 95% utilization
  - Scheduling, CDMA, SDMA, and MIMO
  - Common coordination function makes it happen
- Shared use of “raw” spectrum is much more difficult
  - Management functions in various networks have to coordinate with each other before doing what commercial networks do
  - Commercial model works in this space too: Sharing by Contract
- Research will simplify sharing:
  - Medium term: Dynamic Sharing (LTE, Wi-Fi, White Spaces)
  - Long term: Simultaneous Sharing (SDMA, MU-MIMO and beyond)

Thank you!



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