



Radio Spectrum

The Oxygen for Our Everyday Lives

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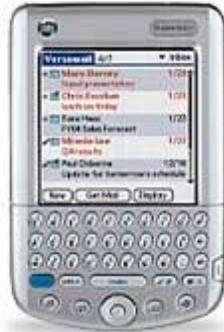
Office of Spectrum Management

National Telecommunications and
Information Administration

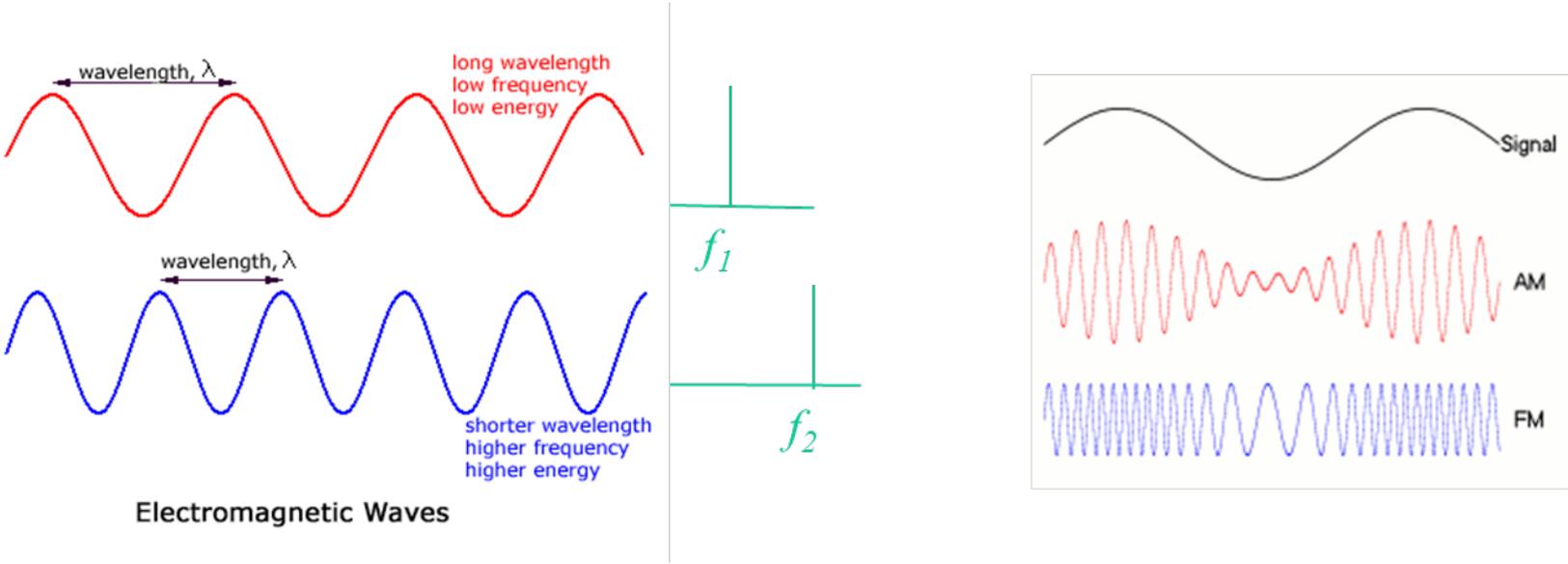
Overview

- Spectrum – what is it?
- Spectrum Management
- Spectrum for New Services
- Spectrum Sharing

Wireless Systems *Require* Spectrum



Radio Signal Basics

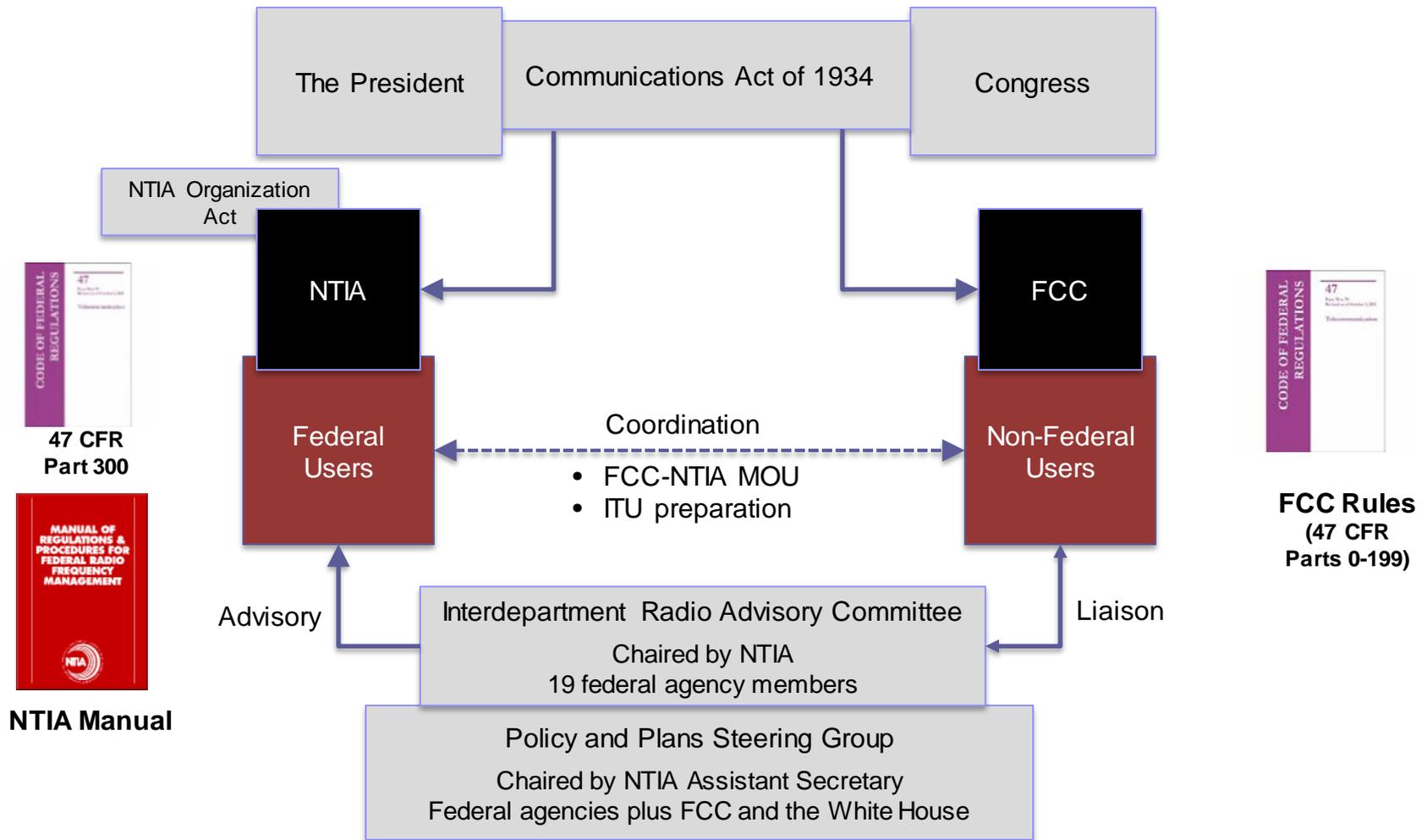


What is Spectrum?

- **Radio frequencies – 10 kHz to 300 GHz**
- **A finite but renewable public resource**
- **Not confined within national borders**
- **Used and managed by international treaties and national policies**
- **Vital to economic, social and cultural life**
- **Critical for essential government missions and public services**

Spectrum must be managed to ensure efficient, equitable and optimum access for the services that use it

National Spectrum Management



Spectrum Allocations 101

International Allocations (ITU/WRC)

Domestic Allocations (FCC & NTIA)

Table of Frequency Allocations			941-1525 MHz (UHF)		Page 31
International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
(See previous page)	(See previous page)	(See previous page)	941-944 FIXED	941-944 FIXED	Public Mobile (22) Aural Broadcast Auxiliary (74E) Fixed Microwave (101)
942-960 FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322	942-960 FIXED MOBILE 5.317A	942-960 FIXED MOBILE 5.317A BROADCASTING	US268 US301 G2 944-960	US268 US301 NG30 NG120 944-960 FIXED	Public Mobile (22) Aural Broadcast Auxiliary (74E) Low Power Auxiliary (74H) Fixed Microwave (101)
5.323		5.320		NG120	
960-1164 AERONAUTICAL MOBILE (R) 5.327A AERONAUTICAL RADIONAVIGATION 5.328			960-1164 AERONAUTICAL RADIONAVIGATION 5.328 US224 US400		Aviation (87)
1164-1215 AERONAUTICAL RADIONAVIGATION 5.328 RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328B			1164-1215 AERONAUTICAL RADIONAVIGATION 5.328 RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328A US224		
5.328A			1215-1240 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328B 5.329 5.329A SPACE RESEARCH (active)	1215-1240 Earth exploration-satellite (active) Space research (active)	
5.330 5.331 5.332 1240-1300 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328B 5.329 5.329A SPACE RESEARCH (active) Amateur			5.332 1240-1300 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G56 SPACE RESEARCH (active) AERONAUTICAL RADIONAVIGATION	1240-1300 AERONAUTICAL RADIONAVIGATION Amateur Earth exploration-satellite (active) Space research (active)	Amateur Radio (97)
5.282 5.330 5.331 5.332 5.335 5.335A 1300-1350 RADIOLOCATION AERONAUTICAL RADIONAVIGATION 5.337 RADIONAVIGATION-SATELLITE (Earth-to-space)			5.332 5.335 1300-1350 AERONAUTICAL RADIONAVIGATION 5.337 Radiolocation G2	5.282 1300-1350 AERONAUTICAL RADIONAVIGATION	Aviation (87)
5.149 5.337A			US342	US342	
1350-1400 FIXED MOBILE RADIOLOCATION	1350-1400 RADIOLOCATION 5.338A		1350-1390 FIXED MOBILE RADIOLOCATION G2		
			5.334 5.339 US342 US385 G27 G114	5.334 5.339 US342 US385	

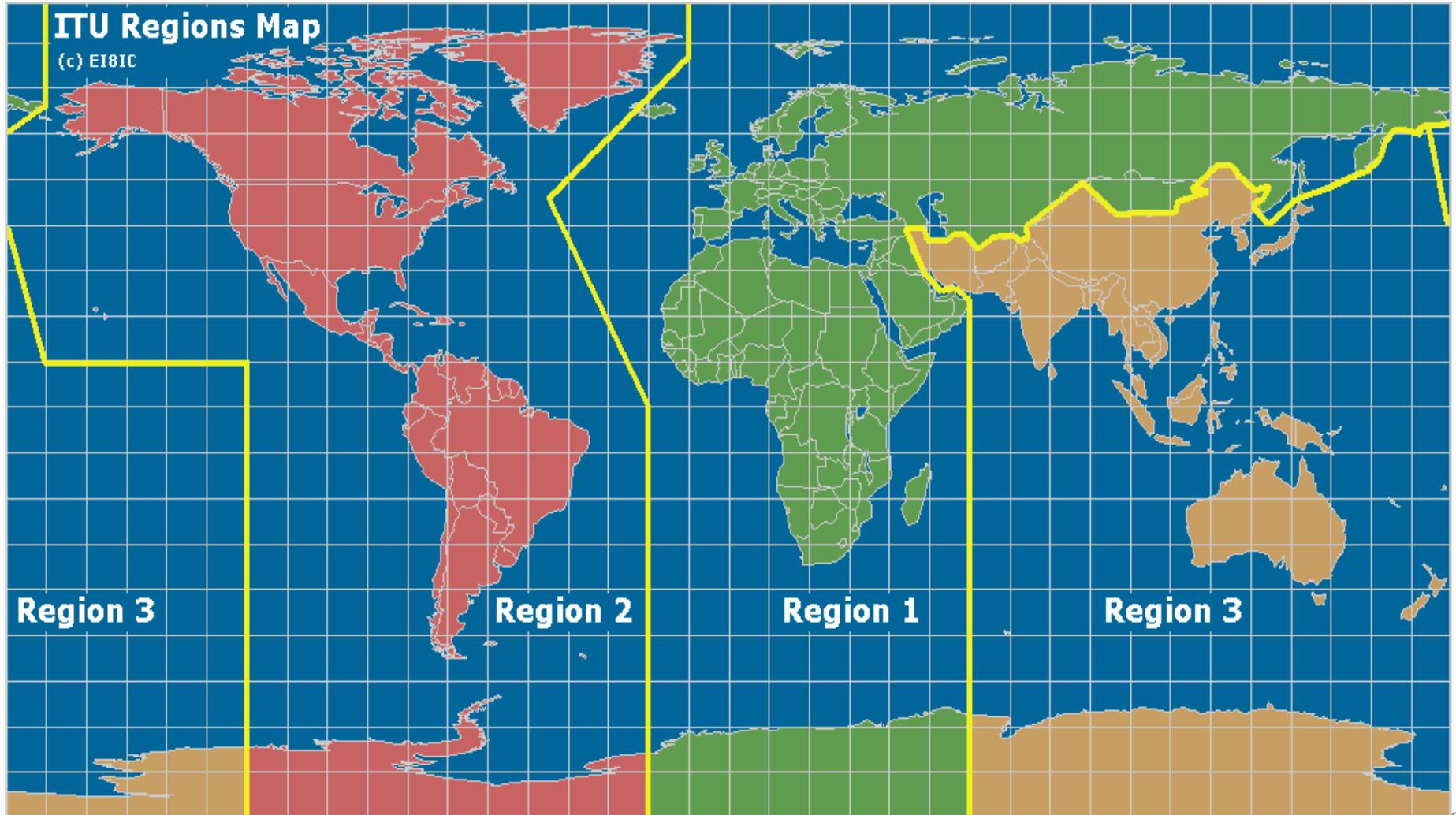
International Footnotes

Domestic Footnotes

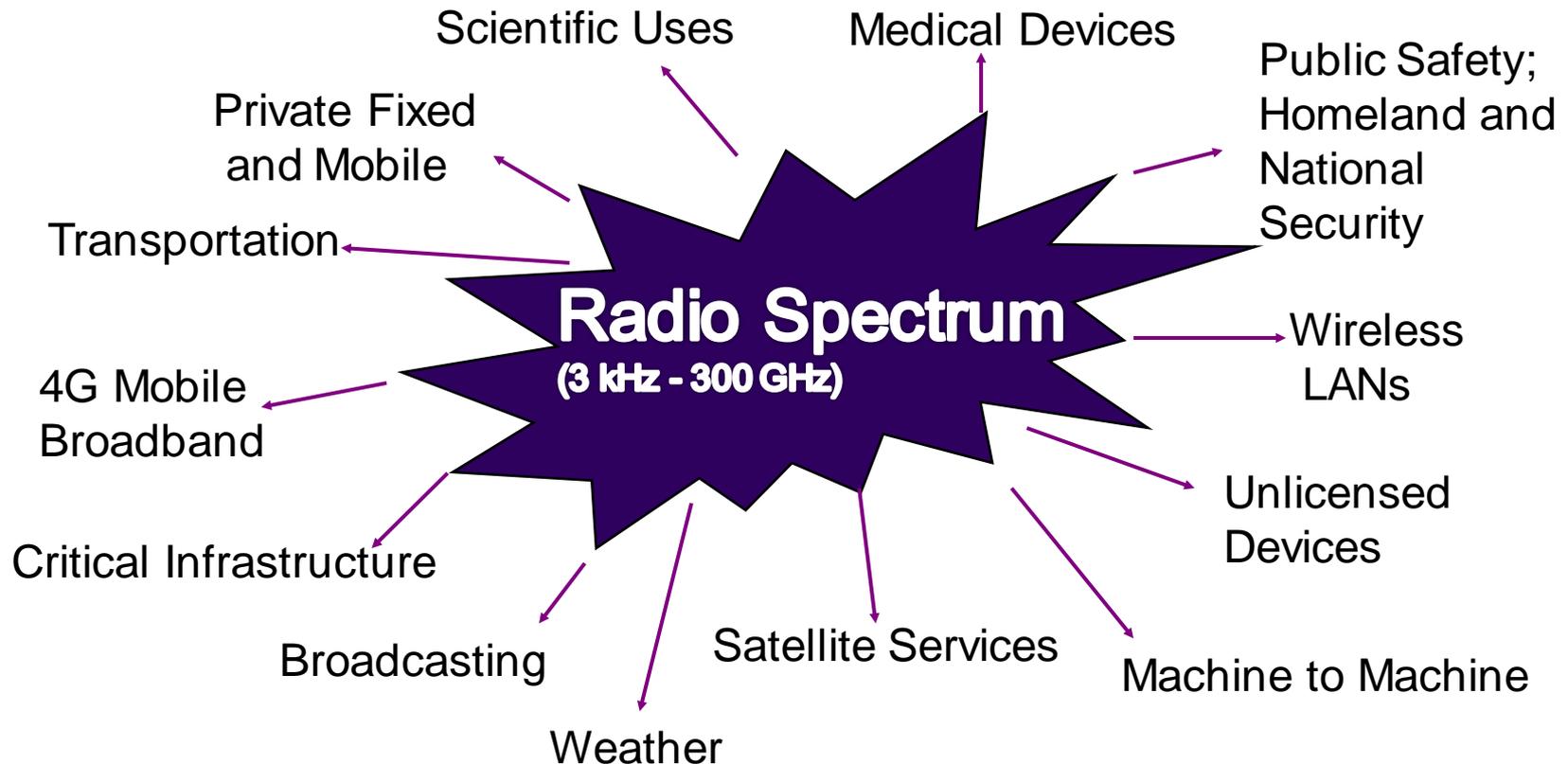
International Spectrum Management

- **International Telecommunications Union (ITU)**
- **Harmonization and economies of scale**
- **U.S. Government international operations**
- **International operations and commitments for space communications and science, aviation, maritime, weather prediction**
- **National sovereignty of member states**

ITU Regions



High Demand for Spectrum Access



***Driven by demand for mobility, digital, and new services.
The “beachfront property below 3 GHz is already used heavily.***

Demand for Mobile Continues to Grow



24/7



24X



120X

Data-Hungry Devices

- The global mobile economy totals \$1.6 trillion, or about 2% of the world's GDP. Mobile technology is a significant contributor to annual global economic growth, adding up to 0.39% to GDP and hundreds of thousands of new jobs.
- Mobile data traffic in the U.S. is projected to grow seven-fold from 2014 to 2019, a compound annual growth rate of 47%.

The Internet of Things (M2M) is In Its Infancy

- LTE connected vehicles; smart grid; health care; appliance control; connected advertising, etc.



Operate your garage door opener or view baby monitor on you smart phone or pad

Spectrum is key to growth and innovation in a wide range of industries and government applications

Advanced Wireless Services-3

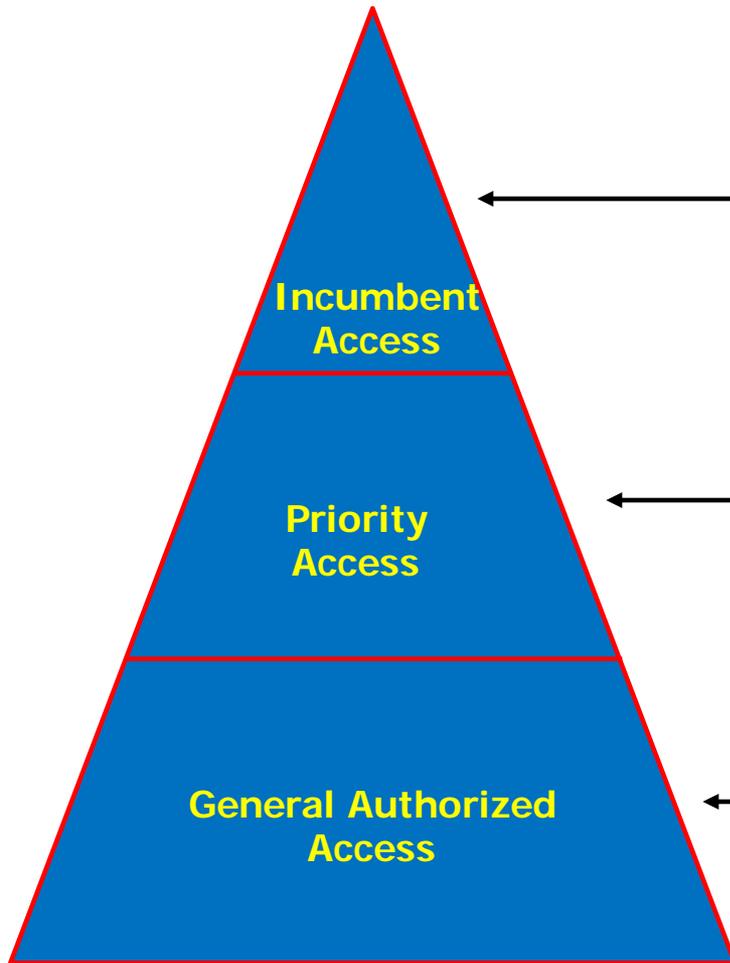
- Recently concluded AWS-3 auction:
 - Paired 2110 MHz - 2155 MHz with 1755 - 1780 MHz;
 - Unpaired 1695 – 1710 MHz
- Relocation or sharing with numerous federal operations
- “Heavy Duty” engineering
 - Identify relocation bands
 - Sharing: realistic vs. worst case
- Required close collaboration

Federal Incumbent Systems:

- Fixed Point-to Point Microwave
- Military Tactical Radio relay
- Air Combat Training System
- Precision Guided Munitions
- Tracking, Telemetry & Commanding
- Aeronautical Mobile Telemetry
- Video Surveillance
- Unmanned Aerial Systems
- Other Systems

**Over \$41B in net bids funding key
Administration priorities**

New Sharing Frameworks



Incumbent Access: Includes authorized federal and grandfathered Fixed Satellite Service (FSS) users currently operating in the 3.5 GHz Band.

Priority Access: Authorize certain users to operate with some interference protection in portions of the 3.5 GHz Band at specific locations

General Authorized Access: Users would be authorized to use the 3.5 GHz Band opportunistically within designated geographic areas. GAA users would be required to accept interference from Incumbent and Priority Access tier users.

Sharing Enabled by Technology

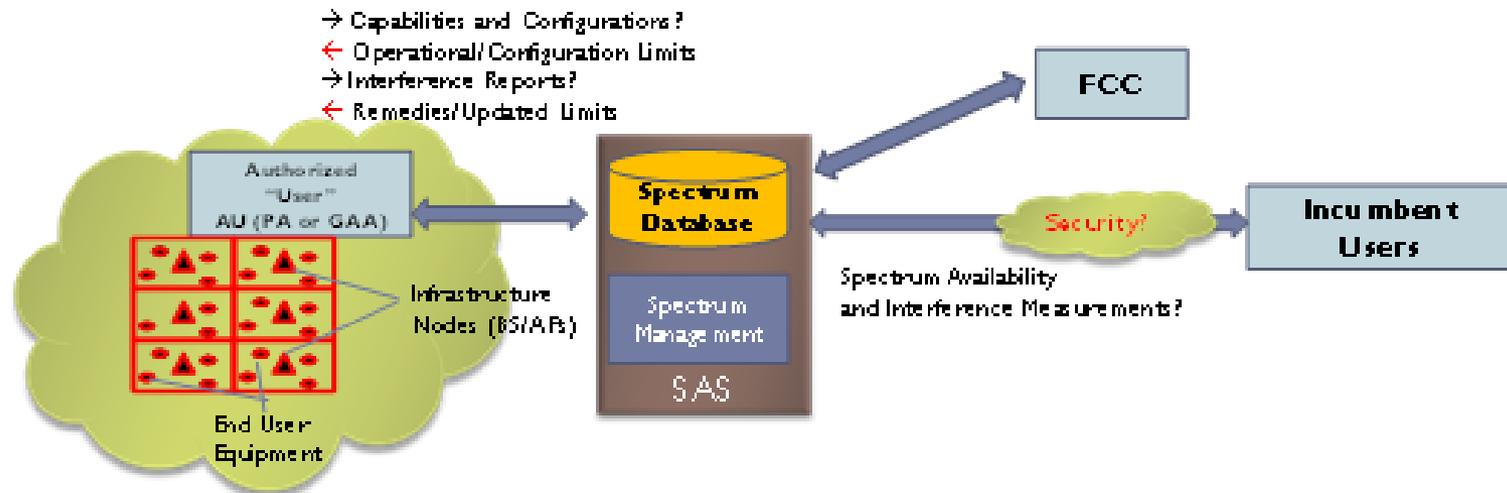
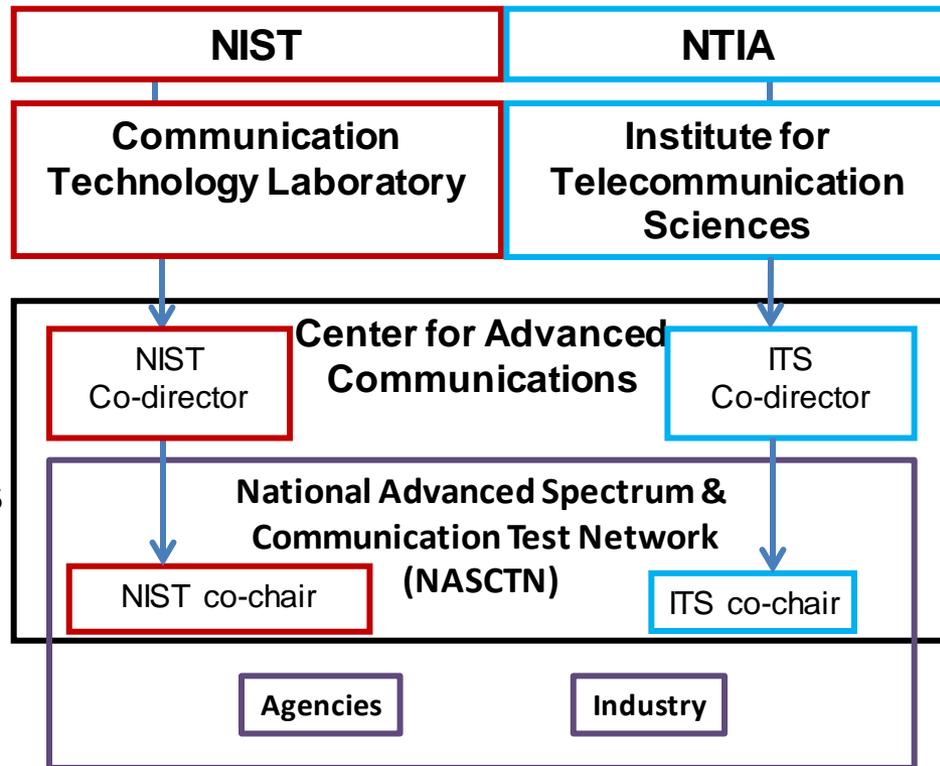


Figure 1: Spectrum Access System

Sharing is critical to improving spectrum access

Center for Advanced Communications (CAC)

- Focal point for accelerating the development and deployment of spectrum sharing technologies that increase both Federal and commercial spectrum access
- Impartial testing and evaluation of new spectrum sharing technologies
- One-stop shop for coordinating access to federally owned, operated or funded spectrum test facilities
- Enables sound policy changes driven by scientifically sound tests and evaluations



Spectrum Management



Questions?



Website: NTIA.DOC.GOV

Twitter: [@NTIAgov](https://twitter.com/NTIAgov)

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