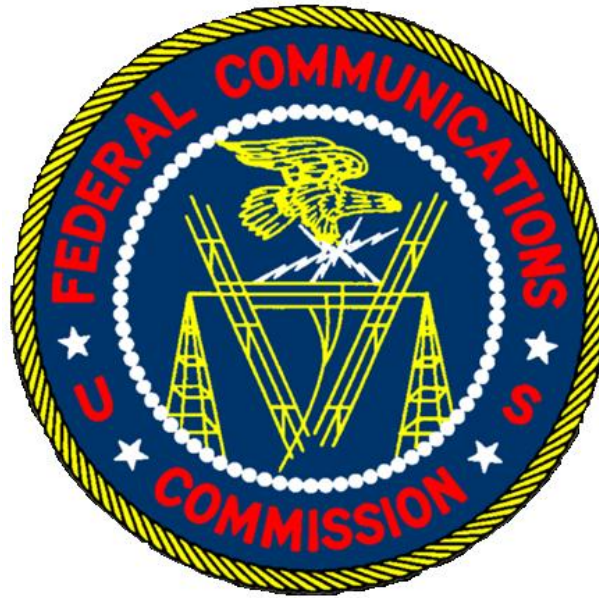


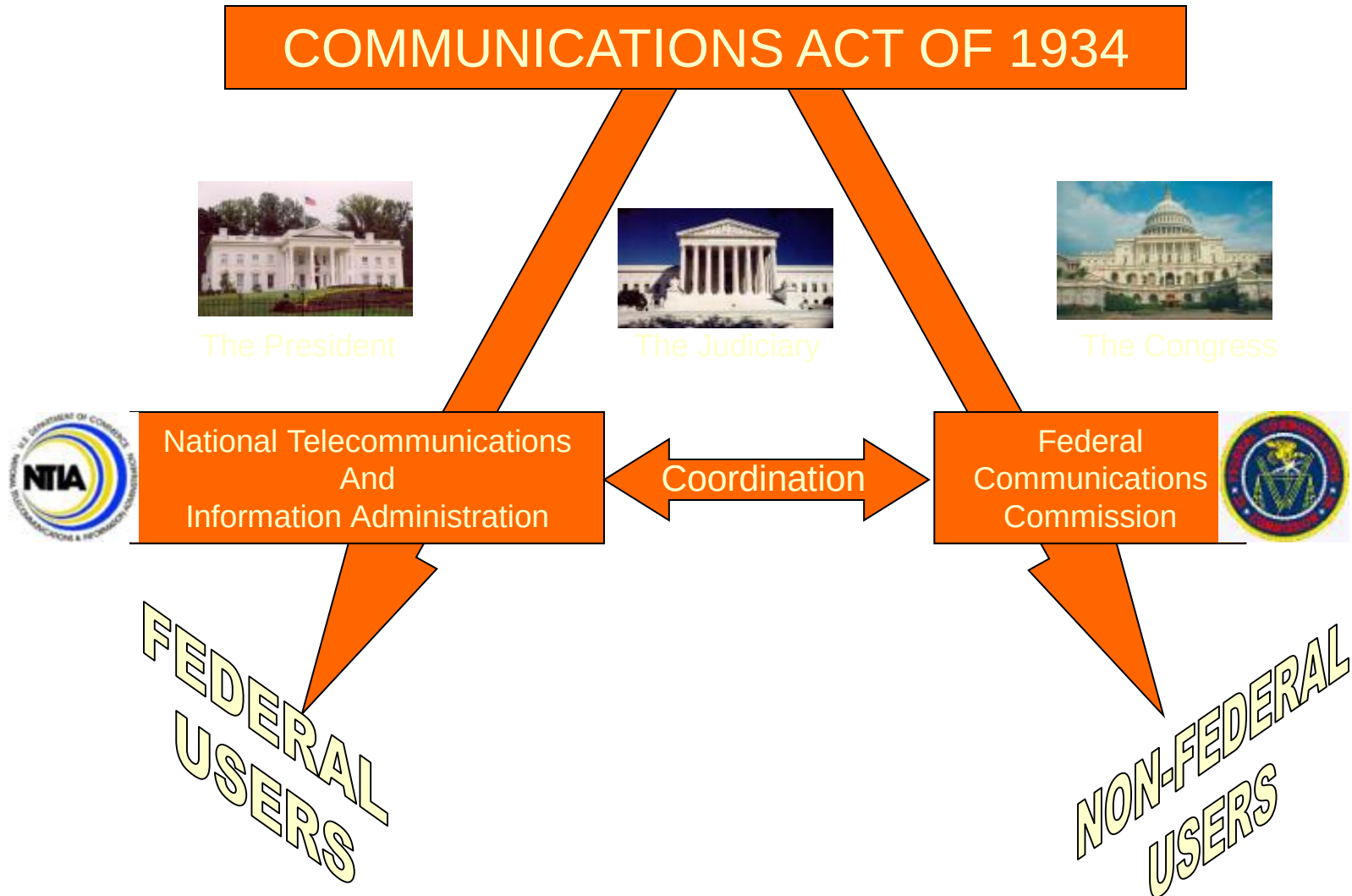
Spectrum Management at the Federal Communications Commission



Mark Settle
Office of Engineering and Technology

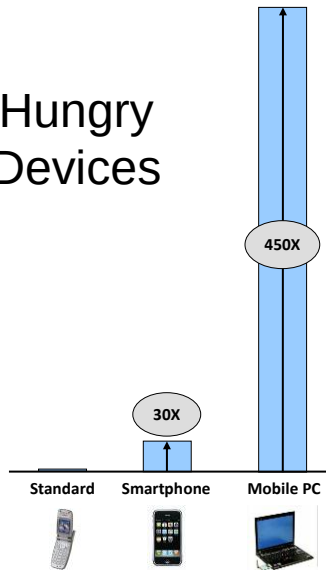
December 2012

Background



Wireless Broadband Spectrum Demands

Hungry Devices



Source: Cisco

National Purposes



Civic Engagement



Public Safety



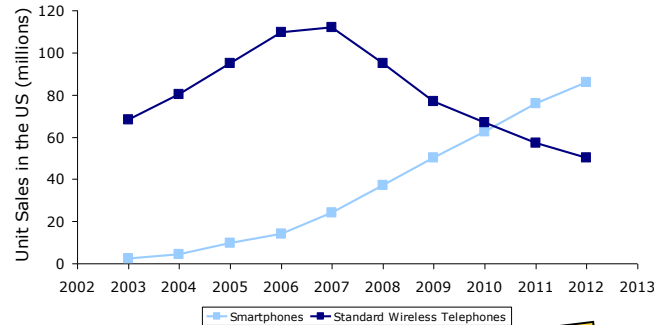
Telemedicine



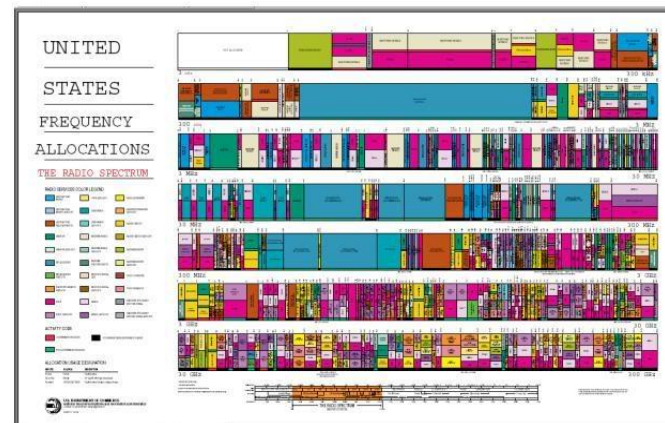
Smart Grid

Smartphone sales to overtake standard phones by 2011

Source: TIA, Wilkofsky Gruen Associates from "TIA's 2009 ICT Market Review and Forecast".



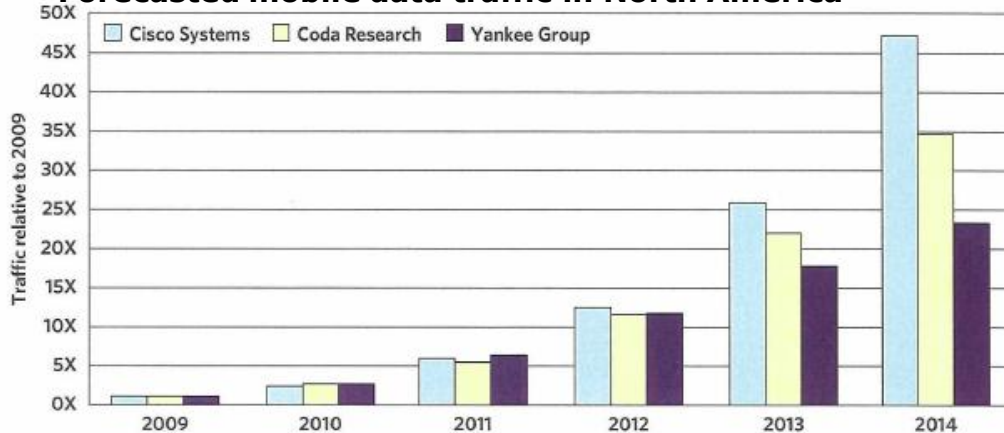
Consumer Apps



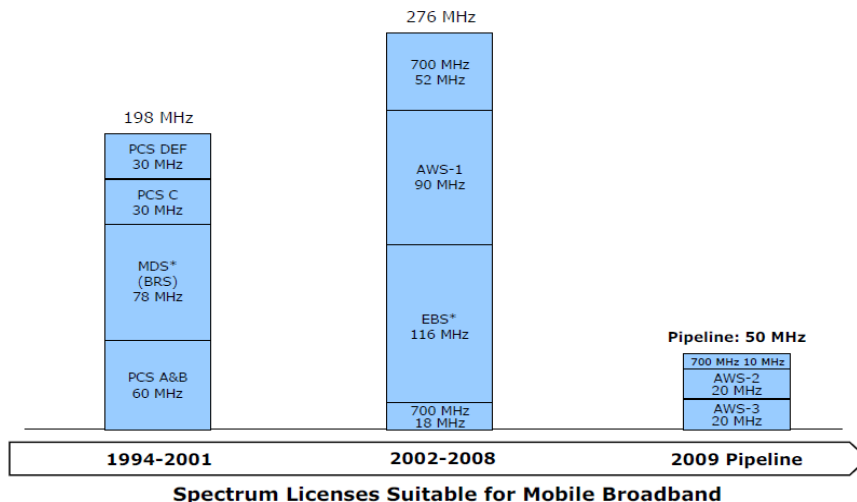
Available at: <http://www.ntia.doc.gov/page/2011/united-states-frequency-allocation-chart> (last visited, October, 2011).

Wireless Broadband Spectrum Supply

Forecasted mobile data traffic in North America



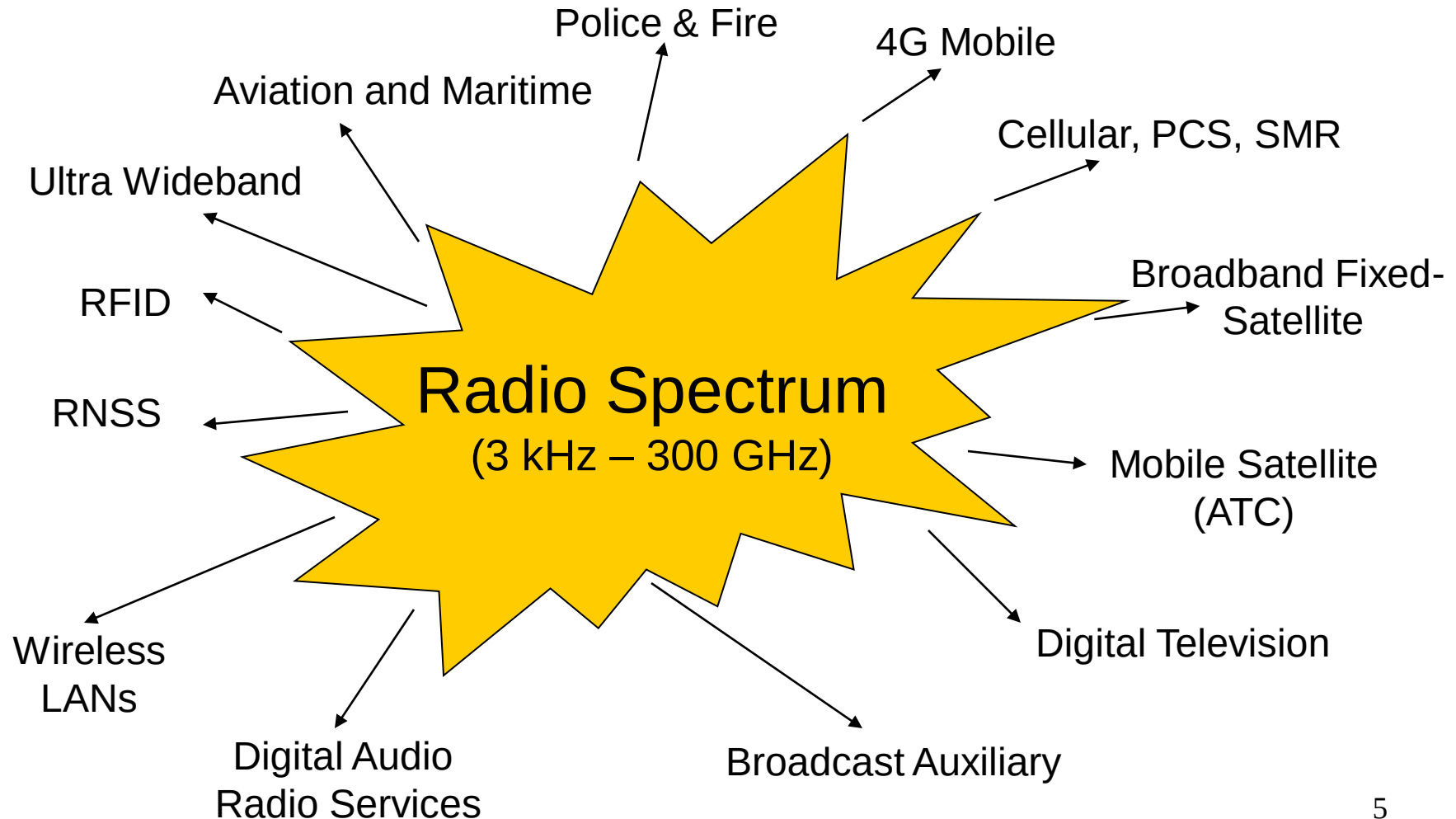
Mobile broadband spectrum pipeline



Need to transform spectrum policy to meet wireless broadband demands

*In 2004 MDS/ITFS was rebanded to create the EBS/BRS band

Spectrum Demand Among Services



Spectrum is a Shared Resource



- ⌘ Large amount of spectrum is co-allocated in the U.S. for federal and non-federal purposes
 - ☒ 93.8% between 9 kHz and 300 GHz
 - ☒ 54.2% of the spectrum below 3 GHz is shared,
 - ☒ 14.1% is federal exclusive and 31.7% is non-Federal exclusive

Spectrum Management Functions

⌘ Four major functions in managing radio spectrum

☒ Allocate Spectrum to various radio services

☒ Develop Service Rules to provide administrative procedures, technical standards, and other operational requirements for shared intra- and inter-service use of the spectrum

☒ Assign Frequencies to individual systems or authorize specific equipment use, assignments coordinated domestically and internationally

☒ Enforce Rules to ensure compliance of radio equipment and systems and resolve interference

Principal Spectrum Management Models

⌘ Dedicated Service Model (sometimes called command-and-control)

- ⏏ Spectrum uses are limited and conform to detailed service rules (AM and FM Radio, TV broadcasting, public safety)

⌘ Exclusive Use Model

- ⏏ Flexible use rights for specified spectrum within defined geographic area (Cellular, PCS , AWS, BRS)
- ⏏ Rights governed by technical rules to protect against interference

⌘ Commons Model

- ⏏ Spectrum is shared with multiple users (TVBDs, UNII, Wi-Fi, Cordless phone, UWB)
- ⏏ Technical and operational rules to protect licensed services
- ⏏ No right to protection from interference received from licensed services

Allocations

ITU Radio Regulations

Federal government use
controlled by NTIA

Non-Government
Use controlled
by FCC

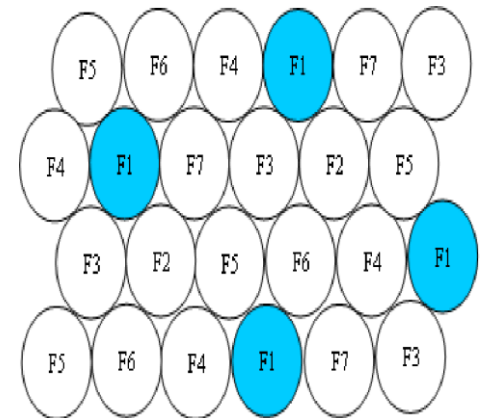
941-1430 MHz (UHF)					Page 41
International Table			United States Table		FCC Rule Part(s)
Region 1	Region 2	Region 3	Federal Government	Non-Federal Government	
See previous page for 890-942 MHz			941-944 FIXED US268 US301 US302 G2	941-944 FIXED US268 US301 US302 NG120	Public Mobile (22) Fixed Microwave (101)
942-960 FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322 5.323	942-960 FIXED MOBILE 5.317A	942-960 FIXED MOBILE 5.317A BROADCASTING 5.320	944-960	944-960 FIXED NG120	Public Mobile (22) Auxiliary Broadcast (74) Fixed Microwave (101)
960-1215 AERONAUTICAL RADIONAVIGATION 5.328 5.328A			960-1215 AERONAUTICAL RADIONAVIGATION 5.328 US224		Aviation (87)
1215-1240 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.329 5.329A SPACE RESEARCH (active) 5.330 5.331 5.332			1215-1240 RADIOLOCATION 5.333 G56 RADIONAVIGATION- SATELLITE (space-to- Earth)	1215-1240 5.333	Rule Explanations
1300-1350 AERONAUTICAL RADIONAVIGATION 5.337 RADIOLOCATION RADIONAVIGATION-SATELLITE (Earth-to-space) 5.149 5.337A			1300-1350 AERONAUTICAL RADIO- NAVIGATION 5.337 Radiolocation G2 5.149	1300-1350 AERONAUTICAL RADIO- NAVIGATION 5.337 5.149	

Table of Frequency Allocations, 47 C.F.R. §2.106, Sample, ref.: <http://www.fcc.gov/oet/spectrum/table/fcctable.pdf>

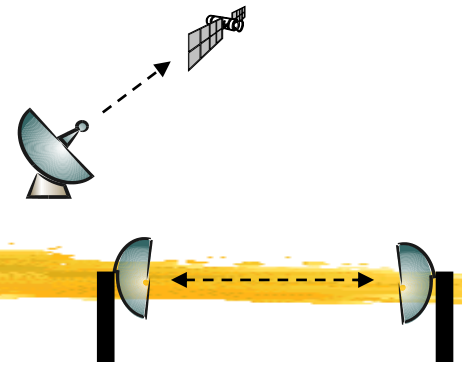
Service Rules

⌘ Promote spectrum efficiency by

- ☒ Increasing information throughput in channels already authorized (by promoting higher order modulation, coding and signal processing)
- ☒ Exploiting frequency reuse (small cells, antenna directivity, satellite spot-beams)
- ☒ Promote State of the Art Technologies (use of dynamic frequency sensing and automatic transmitter power control)
- ☒ Re-purpose spectrum (transitioning from incumbent technologies to broadband technologies)



Service Rules



- ⌘ Promote Intra-service and inter-service spectrum sharing where risk of interference is minimal
 - ☑ Co-coverage, frequency separation (manage in-band and out-of-band interference)
 - ☑ Co-frequency, geographic separation (exclusion or coordination zones)
 - ☑ Co-frequency, co-coverage sharing
 - ☒ Time sharing (automated, real-time database access, sensing)
 - ☒ Low power, NIB uses in non-restricted bands

Frequency Assignments, Authorizations



- ⌘ First-received, First-licensed
- ⌘ Market oriented approach to licensing
 - ☑ Exclusive licensees receive interference protection
 - ☑ Have flexibility to offer new applications
- ⌘ Licensed-exempt use in non-restricted bands
 - ☑ No protection from interference
 - ☑ Low cost barrier to entry
- ⌘ Hybrid licenses
 - ☑ Capitalize on benefits non-exclusive, nationwide licenses
 - ☑ Licensees cooperate to avoid mutual interference

Frequency Assignments, Authorizations

⌘ Special Temporary Authority (STAs)

- ☑ Case-by-case, extraordinary circumstances, limited time duration

⌘ Waivers

- ☑ Case-by-case, rules may not yet be established, granted when risk of interference is low

⌘ Equipment Authorizations

- ☑ Including License-exempt devices

⌘ Experimental Authorizations, Part 5

- ☑ Non-interference basis only (Section 5.85(c))
- ☑ to test and demonstrate equipment

National Broadband Plan



⌘ The National Broadband Plan recommends that the FCC:

- ☑ make 500 MHz of spectrum newly available for broadband use within the next ten years,
- ☑ of which 300 MHz of spectrum between 225 MHz and 3.7 GHz should be made newly available for mobile use within five years

National Broadband Plan Implementation

Service	Frequencies (MHz)	Amount (Megahertz)
WCS	2305-2320, 2345-2360	30
MSS (L-band)	1525-1559, 1626.5-1660.5	40
MSS (L/S-band)	1610-1626.5, 2483.5-2500	10
MSS (S-band)	2000-2020, 2180-2200	40
Broadcast TV	572-698	120
AWS 3	2155-2175	20
AWS 2 (J-Block)	2020-2025, 2175-2180	10
AWS 2 (H-Block)	1915-1920, 1995-2000	10
D-Block	758-763, 788-793	10

Summary



Transparency
Flexibility
Competition

“The Dynamic Regulatory Environment” 16

Backup Slides

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Decision Making Process

- ⌘ Laws such as the Communications Act and Administrative Procedures Act govern FCC's interactions with the public and the management of public resources (e.g. Spectrum)
- ⌘ Notice to Public
 - ☒ Public Notices (PN), Notice of Inquiry (NOI), Notice of Proposed Rulemaking (NPRM or Further NPRM), Federal Register Publication
- ⌘ Decision based on Public Comment
 - ☒ Report and Order (R&O), Memorandum Opinion and Order (MO&O)
- ⌘ Authorization Orders issued with operating conditions



Useful Websites and Addresses

⌘ Main FCC Website

📄 www.fcc.gov

⌘ FCC Online Table

📄 <http://www.fcc.gov/oet/spectrum/table/fcctable.pdf>

⌘ Electronic Documents Management Site For finding Rulemakings, public notices and news release information

📄 http://hraunfoss.fcc.gov/edocs_public/SilverStream/Pages/edocs.html

⌘ Experimental Licensing System

📄 <https://apps.fcc.gov/oetcf/els/reports/GenericSearch.cfm>

⌘ Equipment Authorization Database

📄 <http://www.fcc.gov/oet/ea/fccid/>

⌘ Title 47 of the Code of Federal Regulations (CFR) – GPO

📄 <http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=%2Findex.tpl>