

Policy Issues Relating to the Implementation of Gigabit Wireless: Emerging Technologies and FCC Spectrum Policy

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How is Spectrum Policy Relevant to CENIC?

- CENIC has not yet formulated its position on spectrum policy
- Spectrum reform is critical for the Gigabit Initiative to succeed via wireless means

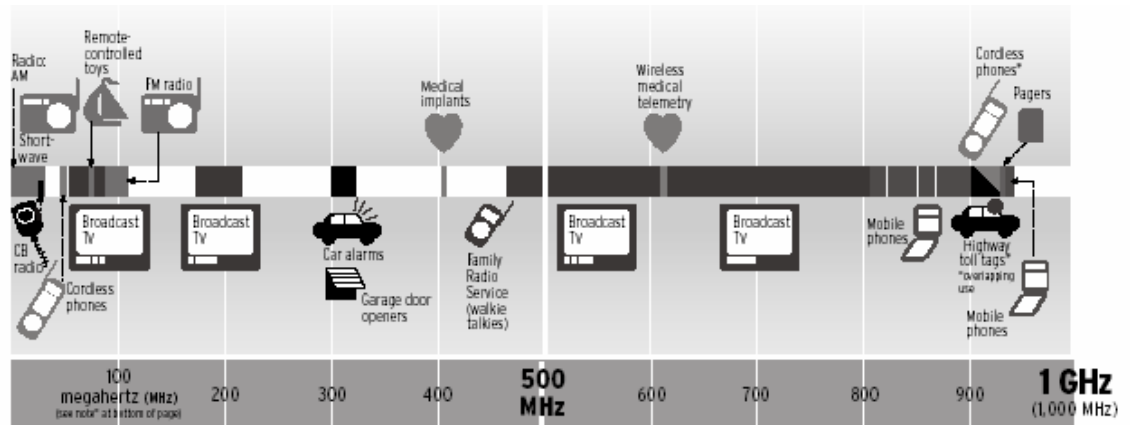
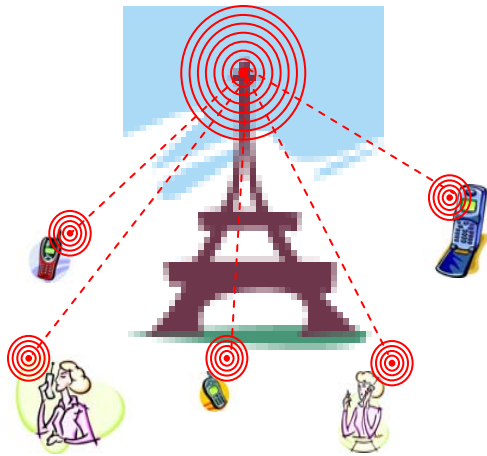
Policy Question

What strategy should spectrum reform advocates pursue in achieving spectrum policy that effectively incorporates emerging technologies to facilitate efficient spectrum allocation?

What is Spectrum?

- Safe radiation that serves as a *wireless connection* between *transmitters*, such as cell towers and *receivers*, such as cell phones

- Separated into *frequency bands*, where different wireless devices operate
- Lower frequency bands are more valuable than higher bands because superior propagation characteristics



FREQUENCY ASSIGNMENTS USED BY EVERYDAY DEVICES

The Value of Spectrum

US radio spectrum has been estimated to be worth **\$782 billion***...
McDonald's and Bill Gates are together worth under \$90 billion.

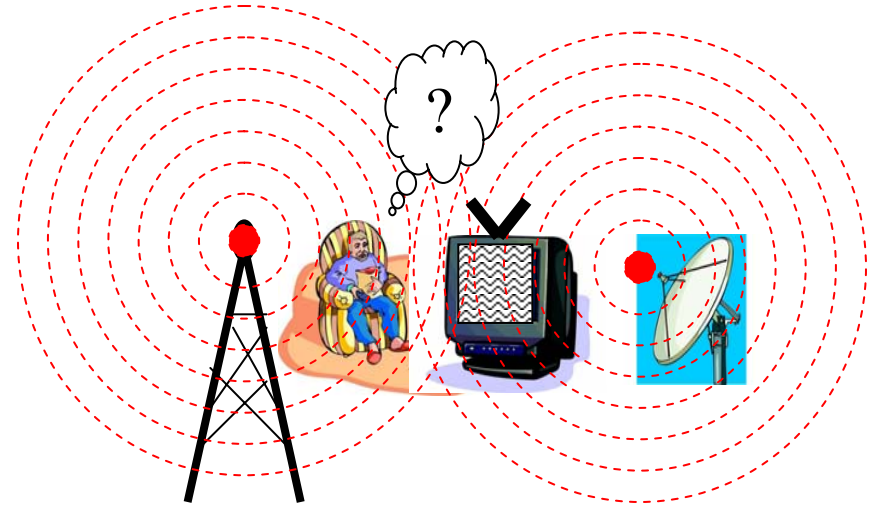


“The radio spectrum is to the information age what oil and steel were to the industrial age.” – Sen. Pressler, Former Chair, Senate Commerce Committee

*estimates by New America Foundation, 2002

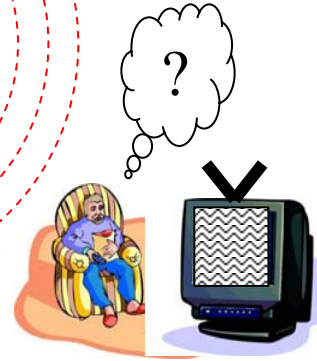
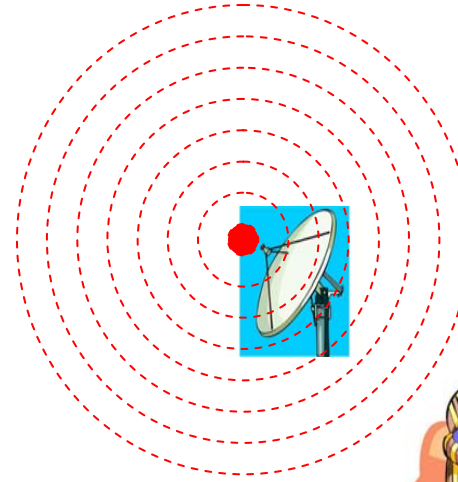
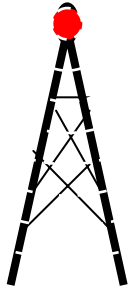
U.S. Government's Role

- The 1934 Communications Act sought to protect wireless (radio) communication from *interference*
- The FCC regulates spectrum for commercial use, and issues *licenses* of frequency bands for exclusive use



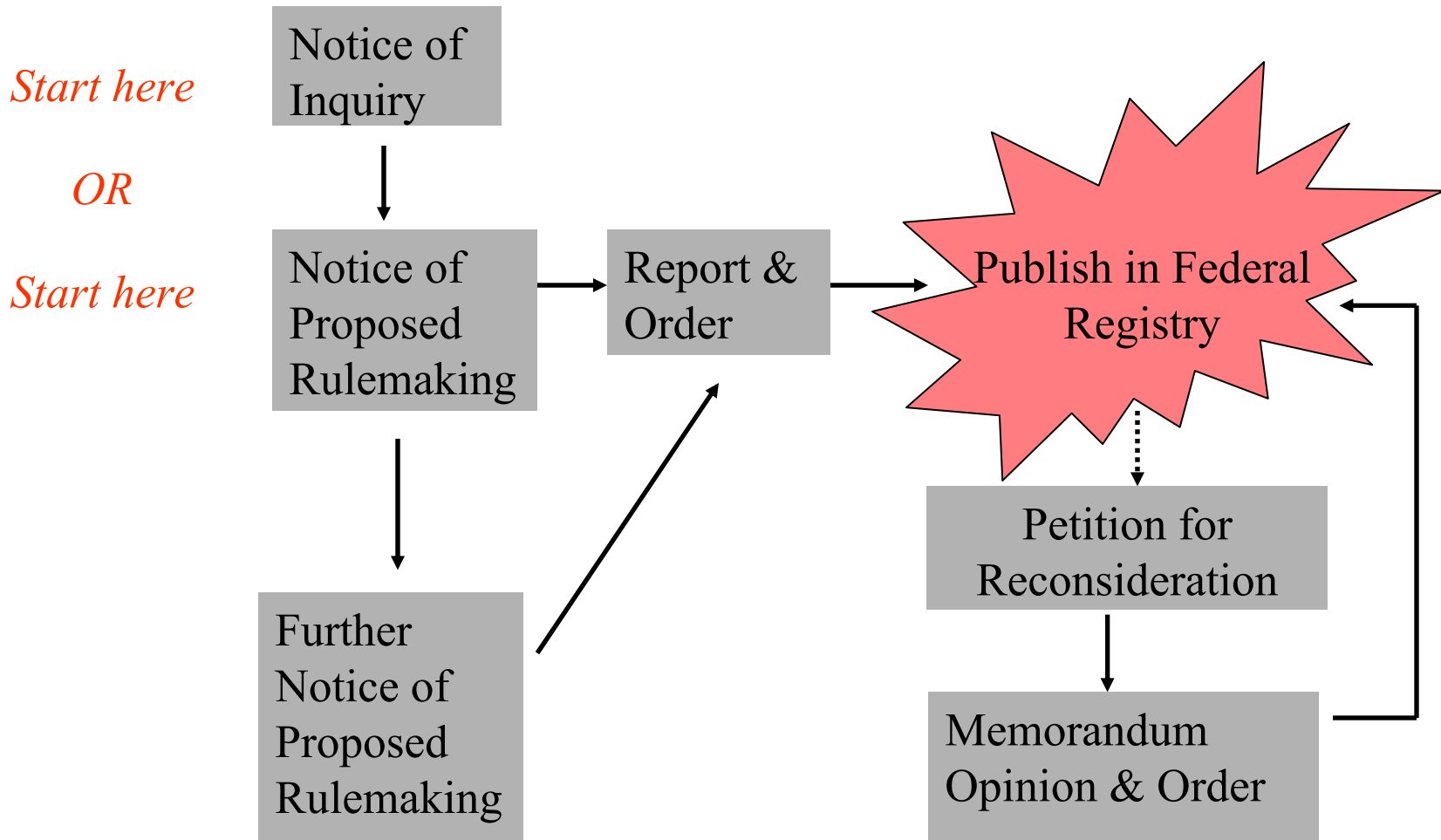
Using Licensed Spectrum	Using Unlicensed Spectrum
<i>Broadcast TV, Cell phones, AM/FM radio</i>	<i>Remote Controls, Cordless phones, Wi-Fi networks, walkie-talkies, E-Z pass tolls, security systems</i>

- 2% of spectrum is *unlicensed*, which means that anyone can use those frequencies, but with no guarantee of protection from interference



FCC Rulemaking Process

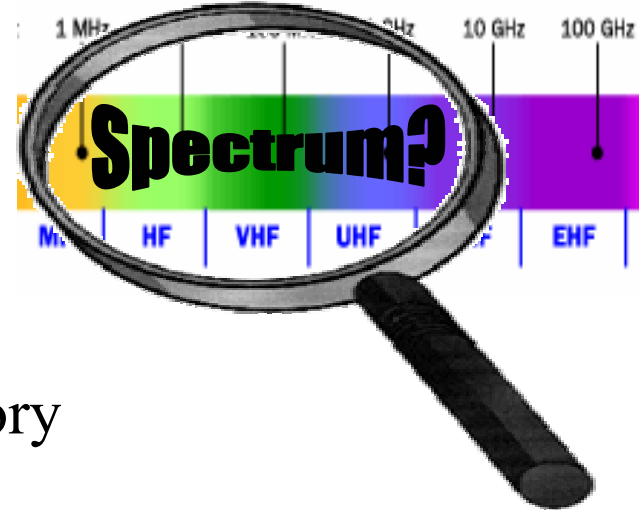
- Rule changes can be initiated from the public, from FCC staff, or the Chairman.
- CENIC and others in the public could initiate a rulemaking change, by filing a “*petition for rulemaking*”, which will lead to a *Notice of Inquiry* or a *Notice of Proposed Rulemaking*



FCC Investigates New Technologies for Spectrum Management

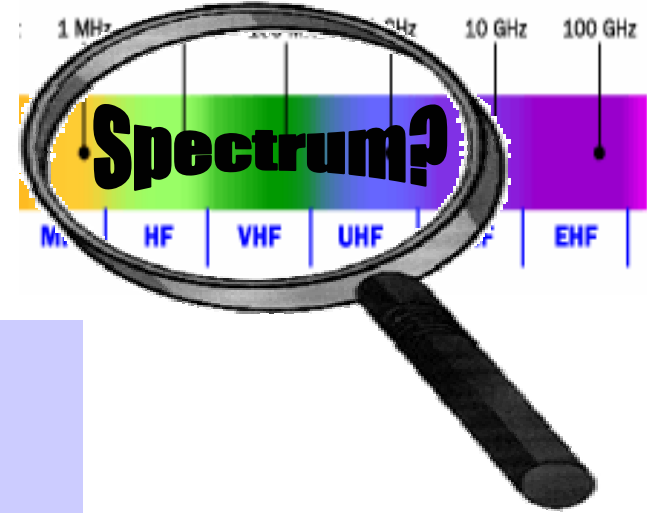
- The Spectrum Policy Task Force (SPTF) found that new innovations which help mitigate device interference can lead to drastic spectrum policy reforms
- Stemming from SPTF recommendations, the FCC issued 3 *Notices* for public comment regarding *spectrum sharing mechanisms*
 1. Notice for *Additional Spectrum for Unlicensed Devices*
 2. Notice for *Interference Temperature*, a metric to measure interference
 3. Notice for “*Smart*” *Radio Technologies* that uses software to automatically avoid interference

Additional Spectrum for Unlicensed Devices



- Unlicensed Spectrum has no regulatory guarantee for interference protection
- “Spread spectrum” technologies such as Wi-Fi and blue-tooth have thrived in the unlicensed environment.
- Where does additional unlicensed spectrum come from
 - Unused or underutilized bands held by licensees
 - Broadcast Guard bands and “White spaces”
 - Transition from analog to digital will free up more licensed spectrum

Additional Spectrum for Unlicensed Devices



Summary of Comments

- PRO: Additional unlicensed spectrum, particularly at low frequencies will spur innovation
- CON: Licensees resistant to give up ANY of their spectrum

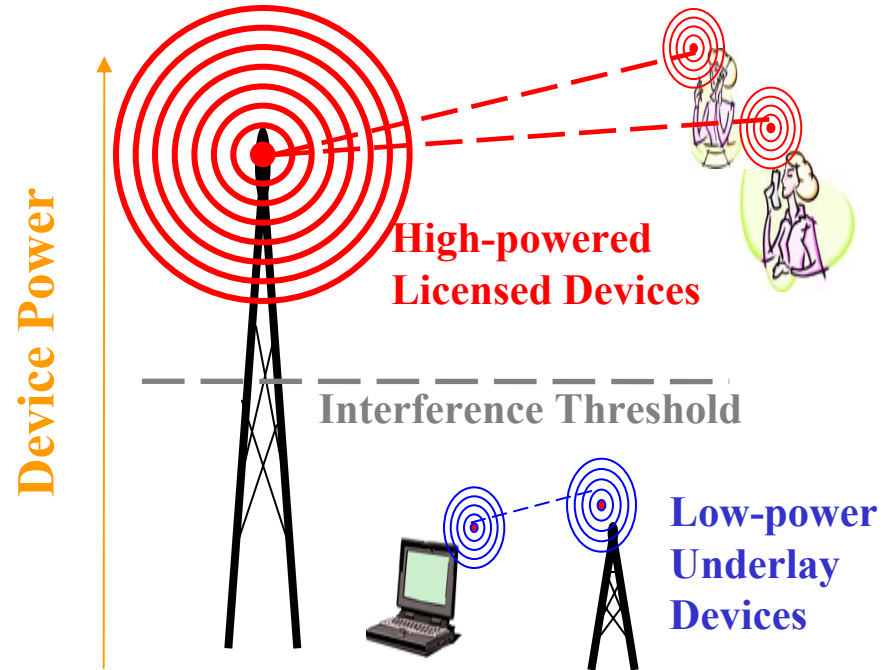
Analysis

- Allocating spectrum from the broadcast band will be the most politically contentious
- While the FCC tries to allocate these difficult to obtain bands, the FCC should target bands viewed as less valuable. These less valuable bands will be subject to less political friction, yet will still foster innovation.



Interference Temperature

- A metric for measuring interference in an area.
- Particularly useful for “*Underlay sharing*”
- “*Underlay*” employs low - powered signal devices that operate below the *Interference Threshold*, where high-powered licensed devices are not sensitive enough to detect or interfere





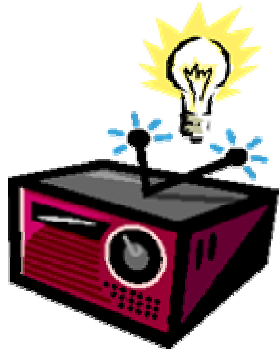
Interference Temperature

Summary of Comments

- PRO: Will allow more underlay devices to be implemented in licensed bands
- CON: Licensees don't believe the metric works

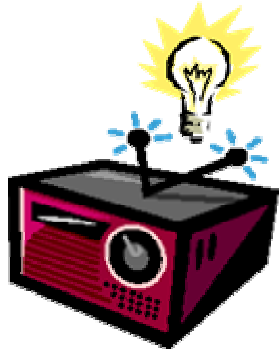
Analysis

- Separate the development of interference metrics from spectrum management.
- Development of an interference metric is paramount for spectrum reform



“Smart” Cognitive Radio Technology

- Software-enabled *Smart Radio* technology automatically detects unused frequencies within bands
- Advanced Smart Radio varies its signals over time, space, and power level to avoid interference with other devices
- This will allow for the “opportunistic spectrum sharing”



“Smart” Cognitive Radio Technology

Summary of Comments

- PRO: Key spectrum sharing mechanism which may allow unlicensed devices to operate in licensed bands
- CON: License holders don't believe it works. And if it does, robust interference metrics are required to protect them from interference.

Analysis

Maturation of Smart Radio technology is needed to convince naysayers

The Political Environment

- In order for Cenic to achieve its One Gigabit initiative wirelessly, spectrum sharing devices must be allowed to operate in currently licensed broadcast frequency bands.
- Spectrum license holders politically overpower advocates of spectrum management reform
- A broader political base to counter spectrum reform opponents will come from new users of wireless devices operating on unlicensed spectrum, and the companies that provide those services and technologies.

Recommendations Spectrum Policy Reform

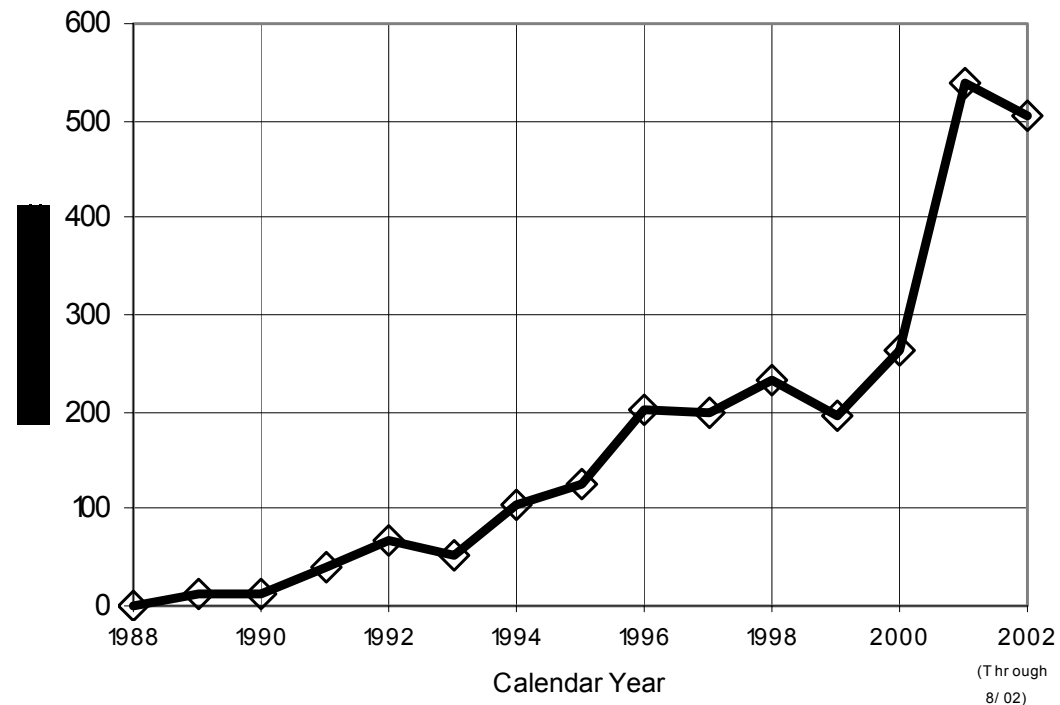
Phased Implementation Plan

- **Phase 1:** Continue to increase unlicensed spectrum in order to help facilitate emerging spectrum-using technology innovations. And focus overseeing the development of a robust interference metric, to prove that new Spectrum Sharing Technologies work.
- **Phase 2:** Once interference metrics and standards are developed, pursue avenues to test Spectrum Sharing Technologies in the valuable lower frequency Licensed Bands. Avenues may include FCC mandates, or secondary markets for spectrum use leases.

Phase I: Increasing Unlicensed Spectrum

- *Spread Spectrum* technologies such as Wi-Fi, Bluetooth, and other computer networking applications have thrived in recent years within unlicensed spectrum
- Though incremental increases in unlicensed spectrum will not answer CENIC's goal, the new technologies and broader public support that arise will benefit ultimate spectrum reform

Part 15 Spread Spectrum Equipment Authorizations



Phase I: Create Interference Metric

- An interference metric will set acceptable guidelines for interference
- Set metrics will help evaluate underlay and opportunistic sharing technologies
- Will be able to refute opposition to spectrum management reform
- Caution should be used in linking the development of an interference metric with the development of spectrum sharing technologies

Phase II: Implement Spectrum Sharing Technologies in Licensed Bands

- This phase is contingent upon the development of robust interference metrics that will mollify the objections of license holders
- Both Underlay Sharing and Opportunistic Sharing have documented proof that the technology works!