

The Untapped Promise of Wireless Spectrum



WIRELESS SPECTRUM—the airwaves used for wireless communication—facilitates such advances in technology as Wi-Fi, Bluetooth, and Smartphones like the iPhone. The value of the resource was highlighted in early 2008 when the Federal Communications Commission (FCC) announced that it had auctioned off a prime chunk of spectrum for a record \$19 billion. This amount is more than the combined proceeds of all the previous spectrum auctions in history. With demand soaring for wireless communications services, high-tech companies will continue to develop innovative products. Despite these developments, however, there is currently no transparent and efficient market through which spectrum rights can be traded so that spectrum is put to its most productive uses.

In a discussion paper for The Hamilton Project, Philip J. Weiser, professor of law and telecommunications at the University of Colorado, proposes a series of policies that would reform the regulation of wireless spectrum to better capture the potential of this resource. First, he proposes that the FCC be required to develop a searchable database of spectrum licenses and a program for identifying unused spectrum in order to facilitate a robust secondary market for spectrum. Second, he suggests that the FCC facilitate auctions of the highly valuable swath of spectrum currently occupied by broadcast television. Third, he proposes that the FCC be rechartered to create a regulatory system that better manages potential technical interference between adjacent spectrum licensees. These reforms would ultimately encourage more productive uses of spectrum and remove a barrier to growth in the U.S. economy.

THE CHALLENGE

Wireless spectrum can carry information using radio frequencies rather than wires. Only in the past century or so have scientists learned to harness more fully the capability of wireless spectrum. Some uses of wireless spectrum depend on the properties of the waves themselves, such as the ability of X-rays to penetrate soft tissue but not bone, for example. Other technologies, such as radio and television, exploit the varying amplitudes and frequencies of spectrum to carry signals over long distances. Radio frequencies between 30 MHz and 3 GHz are considered to be the most valuable for wireless communication. In recent decades, the uses of spectrum have exploded to include cellular telephone service, Smartphone technologies like the iPhone, mobile broadband, and other wireless technologies.

Although many companies are trying to meet the demand for wireless technologies, accessing wireless spectrum is a lengthy and onerous process. The current barriers to obtaining spectrum delay the development of new products, stifling innovation and weakening economic growth.

The first barrier is a system that restricts the supply of spectrum by protecting incumbent holders. The FCC allows licensees to hold on to their slice of spectrum no matter how much (or how little) they use it, creating a system in which vast swaths of spectrum go unused. One study found that for any part of a four-day period in New York City only 13 percent of the spectrum was in use.

Spectrum is wasted in a variety of ways. Current licensees, such as many government agencies, may hold a license to a particular part of the spectrum but use only a part of their available frequencies. Their license may entitle them to spectrum over a wide geographic area, even though they use it over a narrower one. Alternatively, waiting for some as-yet-nonexistent technology to exploit, they may leave

the spectrum untouched indefinitely. In the most common case, licensees use their spectrum only occasionally, leaving it dormant for long periods. Unfortunately spectrum, unlike other resources such as oil or minerals, cannot be saved for later use. If not used today, it is a loss to society.

The second barrier is that the FCC seems to err too much in favor of preventing technical interference between the signals of adjacent license holders at the expense of maximizing the value of spectrum. The FCC requires that large bands of spectrum between licensed bands in a geographic area go unused, out of fear that the signals generated by different users will interfere with each other. Weiser argues that this focus on before-the-fact interference prevention is highly inefficient. He compares this policy to a traffic congestion policy in which the government decides to severely limit the number of cars that are licensed to use the highways. To be sure, there would be no traffic jams, but many roads would go underused and many drivers—even those who value driving the most—might be left with their cars stuck in the driveway.

As a result of these inefficiencies in spectrum management, spectrum licenses are hard to come by and are not used as intensively as they should be. This system not only stifles technological innovation but also discourages competition among companies employing wireless technology. Consumers end up paying higher prices due to the lack of competition, and productivity is impaired by the inability of more companies to develop spectrum-based technologies.

One way to value spectrum is by looking at the example of the recent auction in which the FCC auctioned licenses for \$19 billion. That auction sold the spectrum used for UHF TV channels 61–69. The amount of spectrum currently being used for UHF TV stations 14–51 is about four times larger than the quantity previously auctioned, so it might be worth as much as \$80 billion. Even this figure may

underestimate the true value of spectrum, however, because it is difficult to predict the value of future innovations that rely on spectrum.

Conventional wisdom holds that little can be done to make more spectrum available for wireless technologies because there is a limited amount of it to go around. Weiser suggests that if policymakers resign themselves to that notion, however, they will miss important opportunities to facilitate better use of the spectrum.

A NEW APPROACH

With the right set of regulatory policies, argues Weiser, the government could make substantially more spectrum available for cutting-edge and still-unknown wireless technologies. He proposes three steps that the government can take to promote this outcome:

- The FCC should establish a database of all spectrum licenses, showing how licensees intend to use their swath of the spectrum, and it should encourage individuals and businesses to report unused spectrum.
- Congress should allow UHF TV broadcasters and others with spectrum licenses with excess capacity to auction off some or all of their licenses to users who would exploit them more vigorously.
- The FCC should be rechartered with a new mission: first to grant spectrum licenses more efficiently, and then to use after-the-fact oversight to mitigate problems of technical interference between licensees with adjacent bands of spectrum.

Database

Weiser proposes that the FCC develop an accessible database that identifies all licensed spectrum, lists a

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contact person for the license, and declares if and under what conditions the spectrum is available for leasing. This database would give policymakers and citizens the ability to evaluate the uses of spectrum. It could allow users to add and change content, similar to the way users can interact with crime maps of metropolitan areas to make them more informative to other users. Such a spectrum database would facilitate a market for spectrum by allowing entrepreneurs to find out whether there is dormant spectrum available for leasing.

The FCC should also develop a system by which unused spectrum can be reported. Under such a regime, anyone with spectrum monitoring equipment would have the ability to report to the FCC any bands not being used. The FCC would have a limited amount of time to decide if the claim of disuse was legitimate. If so, there would be an additional period during which the licensee could offer reasons for letting the spectrum lay fallow. If there were no justification, the spectrum would be returned to the government. Weiser notes that the time limits are very important because of the FCC's tendency to leave cases undecided for years.

Two rewards would provide the incentive for individuals or companies to participate in the identification of unused spectrum. First, if the FCC

Key Highlights

Problem

Wireless spectrum—the airwaves used for wireless communication—facilitates advances in technology such as Wi-Fi, Bluetooth, and Smartphones. The current regulatory system, however, does not foster the most efficient uses of bands of this spectrum for two principal reasons:

- No system of monitoring exists to ensure that licensees are using the spectrum that has been assigned to them.
- Spectrum is undersupplied because the FCC takes excessive measures to prevent possible technical interference by maintaining unused bands of spectrum as buffers between adjacent licensed masses.

Solution

Weiser proposes three policy reforms to foster better use of spectrum:

- Build a public database of licensed spectrum that indicates how spectrum is being used, and encourage reporting of unused spectrum. This would facilitate a market for spectrum and encourage better use of spectrum.
- Allow UHF television broadcasters to auction spectrum that is currently used for UHF television channels, while recapturing part of the revenue for the government.
- Recharter the FCC or another agency to assign spectrum licenses. The new regulatory system would not try to prevent every possible case of technical interference before assigning licenses. Instead, a more efficient front-end regulation process would be buttressed by after-the-fact oversight and bargaining between spectrum licensees.

finds disuse or underuse of the radio frequencies in question, the entity that identifies it might be granted a temporary license to that part of the spectrum. Second, if the FCC decided to auction off the underused spectrum, then those who brought the case would receive a bidding credit for the auction. Both the temporary license and the bidding credit would be transferable so that individuals who do not want to use spectrum could still profit by selling the license and credit to others.

Weiser notes that it could be difficult to prove disuse if the FCC requires that claims prove disuse across an entire area of a large mass of spectrum. Spectrum monitoring equipment is becoming less expensive, but monitoring a large area could still be prohibitively expensive and not worth the incentives offered. Weiser argues that those reporting disuse of spectrum should not be asked to meet such a burden of proof. Instead, he asserts that entities should be permitted to establish a case of disuse by simply showing a substantial amount of disuse. The burden would then shift to the licensee to demonstrate its use of the spectrum in question.

Voluntary Auction of UHF TV Licenses

The UHF segment of the spectrum currently used for television broadcasting could be put to much better use. The commitment of large swaths of wireless spectrum to transmit television signals reflects a policy decision made in the middle of the twentieth century when many households viewed television “over the air.” But today only 14 percent of Americans watch their TV through this type of broadcast, making it an inefficient use of spectrum. Most households get their television service through cable, satellite, or telephone wires.

Unfortunately, current law rules out the possibility that wireless companies could buy and use UHF spectrum, since this spectrum comes with the requirement to broadcast over-the-air signals. Weiser recommends that Congress facilitate the


sale of the remaining spectrum used for UHF broadcasting. He recognizes that the holders of UHF spectrum received this valuable asset from the government for free in order to provide broadcast services to the public, and they could thus reap windfall profits from such sales. He recommends that these sales be subject to a windfall tax—one that is large enough to prevent current licensees from making enormous profits from the sale, though not so large as to altogether discourage sales. He also would keep in place the must-carry rule to require cable or satellite providers serving a particular area to carry such UHF channels for a set period after auctions. This would give the UHF broadcasters an opportunity to prove the value of their stations in the hope that they may be picked up by cable companies.

Weiser notes that there is clear evidence that UHF television broadcasters would be willing to participate in this auction. Some holders of the UHF spectrum previously auctioned off have already requested to cease broadcasting—even though they could continue doing so until February 2009—because the cost of paying electricity bills is higher than the benefits of providing over-the-air television service.


Regulatory Mission

Using spectrum that it had purchased at auction, the technology firm Qualcomm petitioned the FCC several years ago for permission to offer video content to cellular phones. Qualcomm acknowledged a slight possibility that its service might cause technical interference with wireless services provided on adjacent wavelengths. That was enough to raise the FCC's eyebrows, and it took Qualcomm a full twenty months before it had permission to introduce its new product.

To Weiser, the FCC's protective rules did not reflect justifiable caution, but rather a mindset in which protecting today's spectrum users is more important



This proposal would free up spectrum for more valuable uses by improving transparency, facilitating more robust markets for spectrum, and reforming the regulatory process.



than encouraging tomorrow's. One outcome of this mindset is the use of so-called guard bands between different transmitters. The current system of regulation does not give incumbent spectrum holders an incentive to use the available technological solutions to avoid technical interference. Instead, licensees have an incentive to claim that their services cannot function at all without full protection against interference.

The current system also sets out too many rules as a condition for spectrum use. As the GAO reported, the FCC rules include limitations on the services licensees can offer and the technology and power levels that can be used. "These decisions can constrain users' ability to offer services and equipment of their choosing," reported the GAO.

Weiser suggests rechartering the FCC. Under the new charter, the FCC would implement a more efficient and less rigid front-end allocation of spectrum and then evaluate whether rights need to be modified. Within that process, the FCC should better balance the costs of potential interference against the benefits of fuller use of the spectrum. This procedural change would encourage newcomers to innovate instead of insulating existing license holders from competition. More-efficient front-end determination of spectrum rights, buttressed

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By encouraging more productive uses of wireless spectrum, this proposal would foster innovation and strengthen economic growth.”

by a system of after-the-fact oversight, would give licensees more flexibility in the services they offer and address interference between two licensees if and when interference occurred.

Weiser would also permit licensees to bargain with each other to reach a more efficient outcome that takes advantage of technology to overcome technical interference. Right now parties have no incentive to bargain with one another because they can each attempt to win favor with the FCC. Meanwhile, the spectrum that they are fighting over goes underused.

Questions and Concerns

What are the risks of a system that relies on private entities to identify unused spectrum?

The proposal to establish a database of spectrum licenses—and to award unused spectrum to the parties that identify spectrum disuse—could potentially lead competitors to harass leaseholders with unsubstantiated charges in hopes that one would stick. To mitigate this concern, Weiser would establish a penalty for those the FCC determines to have filed allegations frivolously.

Another concern is that the system will not work effectively because spectrum licensees can transmit what is known as “white noise.” That transmission would make it appear as if the spectrum were in use even though it is not being used productively. Weiser thinks this concern is overstated because companies would prefer to meet the requirement by leasing the spectrum and gaining revenue. If entities did choose to transmit white noise, the FCC would admittedly have little recourse: attempting to define real use of spectrum is not something Weiser would recommend.

Would the auction of UHF spectrum limit the number of small broadcast stations?

Some members of Congress worry about a loss of broadcast channels if UHF stations are allowed to auction off their spectrum. Weiser says Congress could tweak his proposal by ruling some stations ineligible for the auction program—those with more than a threshold level of broadcast viewers, for example, or public television stations. However, this approach could lead to the odd situation in which operators of the less successful stations would gain significant revenue from selling while operators of the more successful stations would be barred from this revenue source.

How does this proposal fit into the current “white spaces” debate?

The debate over the unused so-called white spaces between UHF channels has raged for more than four years. Some argue that these white spaces should be put to use on a licensed or unlicensed basis. Others argue that putting white spaces to use would create an unacceptable risk of technical interference. Weiser’s proposal would transform the white spaces debate by auctioning off entire swathes of UHF spectrum for more-productive uses. He argues that instead of focusing on better use of the small amount of white spaces in the UHF spectrum, it would be more efficient to make better use of the entire UHF spectrum, white spaces and all.

Are there concerns with how after-the-fact oversight would work in practice?

Weiser acknowledges that the FCC's new role would not be without complications. Advocates for after-the-fact oversight often point to the success of more flexible rules for cellular companies. Weiser cautions against generalizing from this unique example, since low-powered cellular technology creates minimal risk of technical interference and since players in this relatively small market have an incentive to resolve disputes on their own. In other contexts, Weiser warns, the FCC will have to weigh more seriously the trade-off between increasing private market flexibility and minimizing uncertainty about interference for adjacent users. Nonetheless, he argues, the benefits of flexible rules through more-efficient use of spectrum are likely to outweigh the costs of increased interference uncertainty.

CONCLUSION

The FCC says the record \$19 billion from its recent auction of UHF spectrum proves that it is headed in the right direction—toward opening the airwaves to all well-qualified newcomers. Weiser, in contrast, considers the success of the auction as a cause for concern. The impressive revenue from the auction, he argues, reflects the pent-up demand within the wireless industry for spectrum. The demand for spectrum has only reached this boiling point because the FCC has not licensed spectrum to maximize the use of the available space.

At stake, says Weiser, is not just consumer access to highly popular wireless devices and business opportunities to create new consumer products. More importantly, he argues, the United States is missing an opportunity to promote economic growth and is instead hindering the wireless industry with an outdated regulatory process.

Learn More About This Proposal

This policy brief is based on The Hamilton Project discussion paper, *The Untapped Promise of Wireless Spectrum*, which was authored by:

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Additional Hamilton Project Proposals

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This overview paper presents a comprehensive strategy for physical and telecommunications infrastructure policy in the United States. It emphasizes the need to use existing infrastructure more efficiently, improve the way in which infrastructure-related decisions are made, and promote infrastructure as a component of broadly shared growth.

Physical Infrastructure

Several new papers from The Hamilton Project discuss ways to make better use of physical infrastructure. These policies would encourage users to consider the full costs of their infrastructure use through better pricing mechanisms, while compensating low- and middle-income households with the revenue generated by these mechanisms. These papers include:

- *America's Traffic Congestion Problem: A Proposal for Nationwide Reform* by David Lewis
- *Pay-As-You-Drive Auto Insurance: A Simple Way to Reduce Driving-Related Harms and Increase Equity* by Jason E. Bordoff and Pascal J. Noel
- *Creating a Safer and More Reliable Air Traffic Control System* by Dorothy Robyn

Telecommunications Infrastructure

Two new Hamilton Project papers on telecommunications infrastructure aim to facilitate technological innovation and share the benefits of technology more broadly. Maximizing the value of telecommunications will require using wireless spectrum—the airwaves that allow devices to communicate—more efficiently and facilitating deployment of high-speed Internet access to rural areas. These papers include:

- *The Untapped Promise of Wireless Spectrum* by Philip J. Weiser
- *Bringing Broadband to Unserved Communities* by Jon M. Peha

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