Spectrum Policy

An Internet Society Public Policy Brief

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Executive Summary

Community-centered connectivity (CCC) solutions—locally-owned, operated, and governed communication networks—have emerged as powerful vehicles for delivering meaningful connectivity to underserved communities. While there are various last-mile access technologies, wireless communication remains one of the most flexible and affordable technologies for delivering affordable connectivity. If CCC solutions are to live up to their transformative potential, these networks require equitable access to wireless radio spectrum. Without deliberate policy and regulatory measures to ensure spectrum availability for community-centered initiatives, efforts to expand inclusive digital access risk reinforcing existing inequalities rather than remedying them.

Radio spectrum is typically governed through national communication regulatory agencies that determine the functional use of radio frequency bands and who is given the rights to use specific frequencies. Regulatory agencies create rules for spectrum access to prevent interference among spectrum users.

To enable Community-Centered Connectivity solutions to reach their full potential, they require localized and affordable access to both licensed and unlicensed spectrum. Communications regulators can recognize the vital role these operators play by establishing spectrum regulations that focus on affordable, local access to radio spectrum.

Key Recommendations

- **Reflect diversity**: Regulators must consider the needs of all actors in the connectivity ecosystem, from large national operators to small, community-centered and not-for-profit providers.
- **Affordable access**: CCC providers should have access to both licensed and license-exempt spectrum.
- **Adopt flexibility**: Regulators should use a "toolbox" approach, offering a range of solutions tailored to different contexts and needs.
- **Promote inclusion**: Include small operators, community initiatives, civil society, and researchers in regulatory debates and decisions to ensure all citizens' needs are represented.

Key Issues

Most radio spectrum is allocated through spectrum licenses, which grant the licensee exclusive rights to use a specific frequency range. Often, this exclusivity is granted on a national level. As demand for radio spectrum has increased beyond available supply, licenses for popular frequencies are typically auctioned to the highest bidder. Auctions for such frequencies, like those for mobile broadband, can see bids of hundreds of millions of dollars.

While there is no denying that auctions have been successful in effectively freeing up large portions of spectrum for operators, they are not without issues. Nationally licensed spectrum is rarely used nationwide, leading to areas with limited or no coverage. The high prices paid for spectrum motivate operators to focus on the wealthiest, most densely populated regions. Additionally, spectrum auctions tend to exclude small operators from providing IMT services. (IMT stands for International Mobile Telecommunications. It is the term used by the ITU to describe mobile broadband services.)

In contrast to this, license-exempt spectrum has emerged as an alternative to traditional spectrum licensing regimes. By limiting the power output and enforcing rules regarding how radio transmitters behave in those frequencies, it is possible to allow access to the radio

spectrum without requiring the exclusivity granted through traditional license mechanisms. Wi-Fi[1] is the best-known use of license-exempt spectrum, and it has enabled a revolution in low-cost access technologies, empowering thousands of small Internet Service Providers and Community-Centered Connectivity solutions around the world. Wi-Fi is an affordable and accessible last-mile technology, but it also has its limitations. The low-power restrictions on Wi-Fi devices mean that an operator must deploy many Wi-Fi access points to cover an area that might be served by a single wireless base-station using licensed spectrum. This puts small operators at a disadvantage in competing with national network operators using licensed spectrum.

Affordable access to radio spectrum for small operators requires a variety of strategies to make spectrum more accessible. There is no single solution for the effective use of radio spectrum. Regulatory agencies should adopt a "toolbox" approach to spectrum management; that is, utilizing a wide range of techniques for spectrum availability and use. Some of the most promising innovations in spectrum management relevant to community-centered connectivity providers are outlined below.

License-Exempt Spectrum

As mentioned above, Wi-Fi technologies, using license-exempt frequencies, have enabled an entire industry of wireless Internet service providers. Wireless Internet service providers, both commercial and non-commercial, have built successful low-cost yet sustainable business models providing affordable access to underserved and unserved communities around the world. The amount of spectrum available for license-exempt use has remained largely unchanged for many years, with limited amounts of spectrum available in the 2.4GHz and 5GHz ranges. This changed dramatically in 2020 when the United States communication regulator opened 1200MHz of the 6GHz band for license-exempt use. This decision sparked a global debate on the use of the 6GHz band. Mobile technology manufacturers and operators argued that this band of spectrum is needed for additional IMT use[2], while the Wi-Fi industry supports the US decision[3]. Many countries have since followed the lead of the US, while others have taken more conservative steps and set aside only the lower half of the 6GHz band for license-exempt use. Expanding Wi-Fi

[1] Wi-Fi technology is based on the IEEE 802.11 series of wireless connectivity standards which have revolutionized how we communicate and access information. https://standards.ieee.org/wp-content/uploads/interactive/web/wi-fi-timeline/index.html

[2] GSMA, "A Balanced Approach to 6 GHz Is Needed," Connectivity for Good (Spectrum), August 3, 2020, accessed August 29, 2025, https://www.gsma.com/connectivity-for-good/spectrum/balanced-approach-to-6-ghz/

[3] Ing. Peter Kroon, Ilsa Godlovitch, and Dr. Thomas Plückebaum, Sustainability Benefits of 6 GHz Spectrum Policy, study for Wi-Fi Alliance, July 31, 2023, WIK-Consult GmbH, accessed August 29, 2025, https://www.wi-fi.org/system/files/SustainabilityBenefitsof6GHzSpectrumPolicy202307.pdf

into the 6GHz band is likely to increase the ability of wireless Internet Service Providers (ISPs) to deliver services more affordably and competitively.

Localized Spectrum Licenses

A growing number of countries around the world have begun to identify spectrum frequencies for mobile and fixed broadband to be assigned locally rather than auctioning the spectrum nationally. In many cases, applications can be made on a first-come, first-served basis, helping smaller operators access licensed spectrum affordably. This type of license is sometimes referred to as "Private LTE" or "Private 5G", making it clear that these frequencies are intended for broadband use but not as part of the public telephone network. Some countries that have introduced local spectrum licensing include the United Kingdom[4], Canada[5], Germany[6], and Finland[7]. As the OECD has recently recommended, priority access to spectrum for community-led networks and local spectrum licenses are playing an important role in fostering bottom-up approaches to close connectivity divides.[8]

Access to Licensed-but-Unused Spectrum

This approach, sometimes referred to as "use it or share it" licensing, requires the holders of national spectrum licenses, in regions where they have no stated intent of deploying infrastructure, to allow the regulator to re-assign that spectrum on a local, secondary basis. Thus, rather than a spectrum license granting guaranteed exclusive rights to a frequency throughout a country, license holders instead are guaranteed protection from interference wherever they deploy their networks. Under this framework, if a license holder has not deployed infrastructure

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[4] OFCOM, Shared Access Licence Guidance Document (PDF, updated 14 January 2025), published by OFCOM on its site, accessed August 29, 2025, https://www.ofcom.org.uk/siteassets/resources/documents/consultations/category-1-10-weeks/consultation-supporting-increased-use-of-shared-spectrum/associated-documents/shared-access-licence-guidance-document-2024.pdf

[5] Innovation, Science and Economic Development Canada, Decision on a Non-Competitive Local Licensing Framework, Including Spectrum in the 3900-3980 MHz Band and Portions of the 26, 28 and 38 GHz Bands (SPB-001-23) (PDF), May 2023, last modified March 19, 2025, accessed August 29, 2025, https://ised-isde.canada.ca/site/spectrum-management-telecommunications/en/spectrum-allocation/decision-non-competitive-local-licensing-framework-including-spectrum-3900-3980-mhz-band-and

[6] Bundesnetzagentur, Administrative Rules for Local Broadband Applications in the 3.7–3.8 GHz Band (PDF), published May 15, 2023, accessed August 29, 2025, https://www.bundesnetzagentur.de/SharedDocs/Downloads/EN/Areas/Telecommunications/Companies/TelecomRegulation/FrequencyManagement/FrequencyAssignment/LocalBroadband3,7GHz.pdf

[7] Finnish Transport and Communications Agency (Traficom), *Local 4G/5G Networks*, updated September 13, 2023, accessed August 29, 2025, https://www.traficom.fi/en/communications/communications-networks/local-4g5g-networks

[8] OECD report on Closing Broadband Connectivity Divides for All, published July 10, 2025 https://www.oecd.org/en/publications/closing-broadband-connectivity-divides-for-all_d5ea99b2-en.html

in a specific region and has not announced plans to do so, the regulator may choose to make that spectrum available for local licensing. Use-it-or-share-it spectrum license frameworks have been introduced in the United States[9], the United Kingdom[10], and Canada[11].

Dynamically Assigned Spectrum

The dynamic assignment of spectrum involves an automated system that uses a geo-location database with current information on local spectrum availability. It assigns spectrum according to preset rules and supports both use-it-or-share-it and local licensing models. Dynamic spectrum assignment represents a evolutionary shift in the management of radio spectrum, relying on advanced GIS database systems and spectrum monitoring to manage and prevent radio interference among spectrum license holders. Examples of Dynamic Spectrum Assignment include the Citizens Band Radio Service[12]; TV White Space regulation in [13], [14], and other countries. It is worth noting that the above approaches are sometimes used in combination. CBRS, for example, combines use-it-or-share-it principles with dynamic spectrum assignment.

Spectrum Set Asides

In some cases, regulators may deliberately set a range of radio spectrum aside to serve specific underserved regions or constituencies. In setting aside this spectrum, regulators may define constraints on how and where the spectrum may be used.

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[9] Federal Communications Commission (FCC), Citizens Broadband Radio Service (CBRS), Mobility Division, updated April 3, 2023, accessed August 29, 2025, https://www.fcc.gov/wireless/bureau-divisions/mobility-division/citizens-band-radio-service-cbrs

[10] OFCOM, Local Access Licence Guidance Document, published July 25, 2019, updated July 3, 2024, accessed August 29, 2025, https://www.ofcom.org.uk/siteassets/resources/documents/consultations/category-1-10-weeks/129951--enabling-opportunities-for-innovation/associated-documents/local-access-licence-guidance.pdf

[11] Innovation, Science and Economic Development Canada (ISED), Decision on New Access Licensing Framework, Changes to Subordinate Licensing and White Space to Support Rural and Remote Deployment (SPB-001-24), January 2024, last modified April 25, 2024, accessed August 29, 2025, https://ised-isde.canada.ca/site/spectrum-management-telecommunications/en/spectrum-allocation/decision-new-access-licensing-framework-changes-subordinate-licensing-and-white-space-support-rural

[12] FCC, *Citizens Broadband Radio Service (CBRS)*.

[13] Innovation, Science and Economic Development Canada (ISED), Framework for the Use of Certain Non-Broadcasting Applications in the Television Broadcasting Bands Below 698 MHz (SMSE-012-12), October 2012, accessed August 29, 2025, https://ised-isde.canada.ca/site/spectrum-management-telecommunications/en/framework-use-certain-non-broadcasting-applications-television-broadcasting-bands-below-698-mhz-0

[14] Independent Communications Authority of South Africa (ICASA), Regulations on the Use of Television White Spaces 2018, Government Gazette No. 41512, Notice 147 of 2018, published March 23, 2018, accessed August 29, 2025, https://www.icasa.org.za/legislation-and-regulations/regulations-on-the-use-of-television-white-spaces-2018

Mobile Virtual Network Operators

A Mobile Virtual Network Operator (MVNO) is a mobile operator that doesn't own the physical wireless infrastructure of the network through which it provides services, and therefore, it does not require spectrum to provide its services. An MVNO enters a relationship with a Mobile Network Operator (MNO), using their network and radio spectrum to provide services to their users. From a community-centered connectivity perspective, MVNOs have an inherent limitation in that they can only operate where an existing MNO has a network. Thus, MVNOs can provide access in underserved but not unserved regions.

Examples / Case Studies

Initiative	Rhizomatica / Tecnologías Indígenas Comunitarias (TIC)
Country	Mexico
Innovation	Spectrum Set-aside
Website	https://www.tic-ac.org/

In 2015, the Mexican communication regulator, IFETEL, set aside 2x5 MHz of 850 MHz spectrum in 7 regions and 2 x 2.54 MHz of spectrum in one other region. The spectrum was made available for use by non-profit, social benefit organizations with the provision that:

- Deployments must be in rural settlements with a population of less than 2,500 people; and,
    - The regulator reserves the right to assign the spectrum for commercial use in the future.

Tecnologías Indígenas Comunitarias (TIC), a non-profit organization based in Oaxaca, Mexico, holds a concession to that spectrum as a social telecommunications operator and currently serves 3,350 active daily users spread across 63 villages and communities in the state of Oaxaca with 2G voice and data services. These users are served by 14 community-owned and operated cellular sites.

Initiative	WikiKatat
Country	Mexico
Innovation	MVNO
Website	https://wikikatat.mx/

In 2022, Tosepan Titataniske, a network of cooperatives in Puebla, Mexico, launched WikiKatat: a community mobile virtual network operator (MVNO), offering affordable mobile phone and Internet services. This was made possible in part due to the existence of the Red Compartida, a shared wholesale wireless network in 700MHz established by the government of Mexico in late

2016. Operating an MVNO meant that the Tosepan Union of Cooperatives did not have to maintain any physical network infrastructure and was able to take advantage of the Red Compartida, which had been designed to extend network infrastructure into underserved and unserved regions.

Initiative	Tū Ātea
Country	New Zealand
Innovation	Spectrum Set-Aside
Website	https://www.tuatea.nz/

After many years of campaigning for indigenous spectrum rights, the Interim Māori Spectrum Commission (now Tū Ātea) was granted management rights to 100 MHz of 3.5GHz spectrum by the government of New Zealand. They are using the spectrum to build and operate Māori-owned 4G/5G infrastructure. Their approach focuses on neutral-host networks—shared infrastructure that allows multiple operators to extend coverage, especially in underserved and rural areas. Tū Ātea is investing in a platform to develop Māori skills, create R&D opportunities, and incubate Māori-led telecom solutions.

Initiative	Seattle Community Network
Country	United States
Innovation	Use-It-or-Share-It Spectrum & Dynamically Assigned Spectrum
Website	https://seattlecommunitynetwork.org/

The Seattle Community Network is a community-run cellular (4G LTE) Internet access network in Seattle, Washington, for expanding coverage in underserved neighborhoods. It was established in 2019 by Local Connectivity Lab (LCL), a non-profit that helps communities solve connectivity challenges with open-source mobile technologies. The network uses the Citizens' Broadband Radio Service (CBRS) spectrum band, at 3550–3700 MHz. CBRS allows for unassigned spectrum within the band to be made available under a general access tier (GAA), allowing unlicensed devices to receive dynamic spectrum assignments from a Spectrum Access System (SAS) database.

Challenges

Spectrum policy and regulation are complex, requiring elements of expertise in radio physics, network engineering, economics, competition, and law. For small operators, this makes engagement particularly challenging. The stakes are high: spectrum in high demand can be worth millions of dollars. Decisions about spectrum directly affect people. If operators cannot access

spectrum, they may struggle to provide reliable services. And when the spectrum is auctioned at high prices, those costs often pass through to consumers in the form of higher prices.

Lack of affordable, accessible radio spectrum for small operators can constrain the growth of the entire ISP sector. Small network operators play a critical role in delivering services in areas often deemed uneconomic by large-scale operators.

A balance needs to be struck in making spectrum available to both large and small operators.

Guiding Principles

A thriving connectivity ecosystem has a range of network service providers from national-scale operators to local, Community-Centered providers; from for-profit to not-for-profit. Spectrum regulation should reflect the needs of all actors.

Community-Centered Connectivity providers should have affordable and accessible access to both licensed and license-exempt spectrum.

There is no one-size-fits-all solution to spectrum access for Community-Centered Connectivity providers. Regulators should adopt a "toolbox" approach to spectrum regulation, implementing a range of spectrum access solutions to meet differing contexts and needs.

Regulators should make a particular effort to include small operators, Community-Centered Connectivity solutions, civil society, and researchers in regulatory debates, calls for input, and decisions to ensure that the needs of all citizens are represented in regulatory rulings.

Additional Resources

- Spectrum Allocation: There's Room for Everyone https://www.internetsociety.org/resources/advancing-community-connectivity/spectrum-allocation/
- Innovations in Spectrum Management (2019) https://www.internetsociety.org/resources/doc/2019/innovations-in-spectrum-management/
- Map of Wi-Fi 6 deployment in the world https://www.wi-fi.org/regulations-enabling-6-ghz-wi-fi