Documents for the Record – 03.18.26

1. A September 17, 2025, letter to the Secretaries of State, Commerce, and War.
2. A March 17, 2026, letter from NCTA to Committee leadership.
3. A March 16, 2026, blog post from Michael Mullinix at CTIA.
4. A study titled, “China’s Management of Electro Magnetic Spectrum Resources.
5. A March 9, 2026, letter from Brett Guthrie and Frank Pallone, Jr. to the President of the United States.

# Congress of the United States
## House of Representatives
## Washington, DC 20515-3605

September 17, 2025

The Honorable Marco Rubio
Secretary of State
U.S. Department of State
2201 C Street NW
Washington, DC 20520

The Honorable Howard Lutnick
Secretary of Commerce
U.S. Department of Commerce
1401 Constitution Ave NW
Washington, DC 20230

The Honorable Pete Hegseth
Secretary of War
U.S. Department of War
1000 Defense Pentagon
Washington, DC 20301

Dear Secretary Rubio, Secretary Lutnick, and Secretary Hegseth:

I am/We are writing to express my grave concerns about China hosting the 2027 World Radiocommunications Conference (WRC-27).

President Trump has consistently been a strong leader for advancing an America First telecommunications agenda. President Trump's leadership has helped advance the most significant spectrum pipeline deal in recent history that also balances national security priorities. In his first term, he issued several executive orders promoting supply chain resiliency, critical infrastructure security, and prohibiting U.S. investments in CCP telecommunications companies. Internationally and domestically, he fought to combat the influence of Huawei and ZTE in telecommunications networks, signing the Secure and Trusted Communications Networks Act to remove Chinese equipment from the U.S. that posed a national security risk. President Trump's consistent leadership and support of an America First agenda to counter China is important now, more than ever.

It is no secret that our foreign adversaries leverage international standard-setting bodies, such as the International Telecommunication Union (ITU), to advance their interests at the expense of U.S. national and economic security. China's coordinated strategy has involved shaping technical standards early on through active participation in international standards organizations like 3rd

Generation Partnership Project (3GPP) and Institute of Electrical and Electronics Engineers (IEEE) before the WRC, utilizing Belt and Road partner countries in support of China's telecommunications policies, and assuming leadership roles in international bodies such as the ITU and WRC to formalize these positions globally. This coordinated approach allows China to influence global technology standards and restrict the free flow of information domestically and internationally.

Hosting the WRC provides several significant advantages, including setting the agenda, guiding discussions, and influencing themes, thereby enabling the host country to exert substantial "soft" influence over global telecommunications standards and policies. China's role as host thus raises concerns about potential impacts on U.S. leadership in innovation and open, secure communications. This, combined with the threat of espionage against government officials and participants, raises significant data security and national security concerns.

Several key decisions will be made at WRC-27 that will shape the global telecommunications landscape for years to come and impact U.S. dominance on the world stage. Among the most consequential agenda items are:

- **Allocating New Spectrum bands for Mobile Broadband in the 4.4–4.8 GHz, 7.125–8.4 GHz, and 14.8–15.35 GHz:** If China is allowed to dominate these negotiations, it could set technical and regulatory conditions that disadvantage U.S. companies, national security operations, undermine our global competitiveness, and affect international use and create interference risks to U.S. military and federal agency operations globally. For example, the One Big Beautiful Bill included protections of the 7.4-8.4 GHz band through 2034, and protection of this band and its users from harmful interference should be a part of the U.S. policy position.

- **Expanding new allocations and regulations for satellite communications, including Earth Stations in Motion, non-geostationary satellite systems, and mobile-satellite services:** The ITU's regulatory decisions and management of frequencies, orbital slots, and coordination, planning, and deployment of new satellite systems are critical for the future of broadband connectivity, space-based internet, and the protection of U.S. interests in low Earth orbit (LEO). If adversarial interests prevail, U.S. commercial and national security satellites could face harmful interference or regulatory barriers, limiting our ability to innovate, operate freely in space, or restrict communications services to foreign nations.

- **Considering new rules for direct-to-device (D2D) communications:** The U.S. is a leader in D2D satellite services technology, which promises to close connectivity gaps. Decisions made at WRC-27 could enable or delay these services globally. U.S. companies are already providing these services, and our presence and leadership in D2D could spur new technologies, services, jobs, and revenue. Poorly crafted or a lack of international rules could delay the development and application of this technology.

- **Deciding on measures to protect existing services, including aviation, defense, and radio astronomy, from harmful interference caused by new entrants in shared or**

**adjacent spectrum bands:** Failure to secure robust protections could put critical U.S. operations and infrastructure at risk.

Robust, effective, coordinated, and purposeful participation in WRC-27 and the working groups that precede it is an absolute necessity. If the United States does not engage with clear, unified positions, we risk being overtaken by our adversaries. Our leadership in technology and innovation is at risk, and our allies may increasingly turn to China for telecommunications solutions, eroding our influence and compromising shared security interests.

The United States is the world leader in innovation. Whether it be American-led spectrum sharing models which have opened new bands for service and brought in vast economic benefits, our leadership in deploying exclusive mobile 5G and beyond wireless solutions to our ever-increasing interconnected world, or pioneering low earth orbit (LEO) and D2D space-based connectivity that can bring broadband to anyone anywhere in the world, all of that is at risk if we fail to act decisively.

I ask the Administration to utilize the full authorities of the federal government to reach a unified position early, coordinate across all federal agencies involved, advocate for support in the Inter-American Telecommunication Commission (CITEL), and amongst our allies, and promote an America-first approach to WRC-27.

To accomplish the above, it is imperative that the Administration take three immediate steps. First, senior political leadership needs to be placed at the State Department's Bureau of Cyberspace and Digital Policy, which includes nominating a Senate-confirmed Ambassador to lead the group. Second, appoint a senior political leader as the campaign manager for the re-election of American Doreen Bogdan-Martin as ITU Secretary General, which will require a whole-of-government campaign to ensure American leadership continues in this vital role. And third, deliberations begin immediately to identify the WRC-27 Ambassador. The identified person should assume the role as soon as possible to ensure the U.S. is equipped to build the necessary coalitions to achieve the desired outcome.

We must use every tool at our disposal to counter China's influence and ensure the United States remains at the forefront of global telecommunications leadership. As Members of Congress, we stand ready to provide the necessary support to assist the Administration in accomplishing these goals.

Sincerely,

Sincerely,

August Pfluger
Member of Congress

Michael V. Lawler
Member of Congress

Troy Balderson
Member of Congress

Earl L. "Buddy" Carter
Member of Congress

Keith Self
Member of Congress

Christopher H. Smith
Member of Congress

Sheri Biggs
Member of Congress

Erin Houchin
Member of Congress

Kat Cammack
Member of Congress

Mariannette J. Miller-Meeks, M.D.
Member of Congress

Thomas H. Kean, Jr.
Member of Congress

H. Morgan Griffith
Member of Congress

CC: The Honorable Brendan Carr, FCC Chairman
The Honorable Arielle Roth, Assistant Secretary of Commerce for Communications and Information
The Honorable Anna M. Gomez, FCC Commissioner
The Honorable Olivia Trusty, FCC Commissioner

ncta
THE INTERNET & TELEVISION ASSOCIATION

March 17, 2026

The Honorable Brett Guthrie
Chairman
Committee on Energy and Commerce
U.S. House of Representatives

The Honorable Frank Pallone
Ranking Member
Committee on Energy and Commerce
U.S. House of Representatives

The Honorable Richard Hudson
Chairman
Subcommittee on Communications and Technology
Committee on Energy and Commerce
U.S. House of Representatives

The Honorable Doris Matsui
Ranking Member
Subcommittee on Communications and Technology
Committee on Energy and Commerce
U.S. House of Representatives

**Re: Hearing on U.S. Leadership at the World Radiocommunication Conference 2027 (WRC-27): Strategy and Challenges Ahead of Shanghai**

Dear Chairman Guthrie, Ranking Member Pallone, Subcommittee Chair Hudson, Subcommittee Ranking Member Matsui and Members of the Subcommittee:

Decisions made at the World Radiocommunication Conference (WRC) shape the global market for a wide range of communications technologies, from satellite services to Wi-Fi to commercial mobile services. Ensuring that the marketplace remains flexible and open to innovation will require a whole-of-government approach, as well as consistent engagement with both industry and our international partners.



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A well-coordinated campaign to promote U.S. priorities has never been more important. During the next year and a half, the United States will prepare for WRC-27, set to take place in Shanghai in October-November of 2027, against a backdrop of heightened global competition for technological leadership. Other nations, particularly the People's Republic of China and their subsidiary Huawei, are investing significantly in attempts to dominate international standards, proliferate untrustworthy technologies, and lock U.S. companies out of key international markets. Sustained and robust U.S. engagement will help ensure that international spectrum policies reflect principles of open markets, free speech, technical rigor, and innovation-driven growth—not authoritarian values. We are encouraged that United States' preparations for WRC-27 are already underway through the Federal Communications Commission's (FCC's) World Radiocommunication Conference Advisory Committee (WAC) process and interagency coordination led by the FCC, the National Telecommunications and Information Administration (NTIA), and the Department of State. We also appreciate the engagement from the leaders of this Committee with their letter on March 9th and the hearing being held today.

In support of that engagement, NCTA recommends that Congress and the Administration (1) prioritize WRC-27 advocacy that reinforces U.S. technological leadership and captures all aspects of our telecommunications marketplace, (2) invest in robust public- and private-sector participation in the WRC-27 preparation process, and (3) work to ensure the conditions necessary for full and secure stakeholder participation in Shanghai.

First, Congress and the Administration should prioritize efforts that maximize our nation's leadership and competitive advantage. Unlicensed technologies are one important example. For decades, Americans have benefited from a spectrum policy framework that encourages innovation, promotes investment, and supports an "all of the above" wireless ecosystem. That environment has helped make shared and unlicensed spectrum critical economic drivers and consistent sources of U.S. wireless leadership. Much of the technology ecosystem supporting Wi-Fi and related platforms—including chipsets, networking equipment, software, and services—has been developed by American companies and continues to support high-skilled jobs, research, and manufacturing in the United States. Wi-Fi, in turn, supports a large and growing U.S. innovation ecosystem that drives investment, high-skilled employment, and global leadership in networking equipment, semiconductor design, and connectivity services. All that and it is loved by consumers. As NTIA Administrator Arielle Roth put it,

"American companies lead the world in unlicensed device technologies using the 6 GHz band. No one does it better, and the world knows it." The United States has made clear that it is firmly committed to Wi-Fi operations across the entire 6 GHz band and it is not revisiting this decision. NCTA encourages the U.S. delegation to rally nations around the world to resist pressure from China, adopt 6 GHz Wi-Fi, and share in the immediate innovation and economic benefits of 6 GHz.

Second, NCTA recommends that Administration leaders promote sustained participation by U.S. government and private-sector experts to ensure that the conference's decisions are informed by the experience of the world's most dynamic communications ecosystem. NCTA recognizes that WRC preparation is a multi-year process that, when done right, requires significant investments of time and resources. Making that long-term commitment may be particularly challenging when Congress, under the One Big Beautiful Bill Act, has also charged the FCC and NTIA with strict timeline benchmarks for allocating our nations spectrum airwaves.

Third, NCTA urges the Administration to help remove obstacles to broad public- and private-sector participation in Shanghai. The U.S. approach is strengthened by our nation's commitment to a transparent, collaborative partnership between the public and private sectors. Alongside government experts, participation by American private-sector leaders has consistently advanced technically sound and forward-looking proposals that reflect the cutting edge of technology. Industry partners also help government negotiators fully understand the commercial consequences of each proposal and serve as force multipliers in formal negotiations and informal engagements around the world. A significant American presence at preparatory events and on the ground at WRC-27 is essential.

Without careful planning, the location of the conference in Shanghai could deter some stakeholders from undertaking this important work. Potential participants have raised concerns about data security, safety, privacy, and rule-of-law protections. The U.S. government can promote participation by encouraging the International Telecommunication Union to ensure the host country offers protections and conditions consistent with international norms. These should include guarantees of timely entry and exit for registered delegates; access to consular services; secure communications capabilities at the conference site, including reliable encrypted Wi-Fi connectivity; appropriate privacy safeguards in meeting spaces and lodgings;


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and assurances that all registered participants may freely conduct official conference business consistent with the rules of the conference.

In short, maintaining leadership at WRC-27 will help ensure that international spectrum frameworks continue to support innovation, investment, and the development of advanced communications technologies that benefit consumers and businesses both domestically and around the world.

We thank you for your leadership on this issue and for holding such an important hearing regarding America's continued emphasis of our technologies and innovation on the global stage. Our nation faces a critical moment in Shanghai in 2027. Your attention to the upcoming conference will help further drive key stakeholder involvement in the process, helping the U.S. meet this pivotal moment in the global competition for technology leadership.

Respectfully,

Hon. Cory Gardner
President and CEO
NCTA – The Internet & Television Association

Cc: The Honorable Brett Guthrie, Chairman, Committee on Energy and Commerce
The Honorable Frank Pallone, Ranking Member, Committee on Energy and Commerce

Blog March 16, 2026

# Spectrum Priorities For WRC-27.

**Michael Mullinix**
Vice President, Regulatory Affairs

The future of America's AI and 6G leadership centers in large part on America's ability to leverage economies of scale for a secure and trusted innovation economy both domestically and abroad. That's a core message of President Trump's vision for U.S. wireless leadership too—one that CTIA applauds and that the wireless industry is working tirelessly to advance.

Licensed wireless networks form the essential infrastructure supporting next-generation AI applications, delivering high-capacity, low-latency, secure connectivity at scale for mission-critical applications, while also driving AI-powered integration within networks—enabling optimization, efficiency, and enhanced security. As the President correctly highlighted, a central element of achieving America's AI and 6G leadership is "identifying a significant volume of radiofrequency spectrum that can be harmonized" with networks internationally. Other nations have secured their pathway to large blocks of spectrum to support next-generation

applications and innovations; now is the time for the U.S. to secure its and provide allies a future roadmap.

The United States government is currently working to advance this goal in its preparations for the 2027 World Radiocommunication Conference (WRC-27), a convening of technical expertise from countries across the globe that provides a generational opportunity for the U.S. to define the course of global technological development.  As part of that work, the U.S. must focus on building global consensus around American priorities for future commercial use of the 7/8 GHz and 4 GHz bands.

**Spectrum Leadership Is an Essential Driver of Wireless and AI Innovation.** To preserve and extend U.S. AI leadership, American technology companies must remain competitive on all fronts. Domestically, the United States must reduce barriers that slow innovation and maintain its technological edge to support the bandwidth-intensive AI applications expected to operate across networks in the coming decade. Globally, the nation must strengthen its ability to export trusted technologies to counter foreign adversaries seeking dominance in AI and next-generation wireless.

Securing additional mid-band spectrum is essential to steering these competitive dynamics. A shortage of spectrum could throttle the U.S. AI industry both by impairing consumer and enterprise use of AI applications and limiting access to next-generation wireless capabilities for nascent AI applications like physical AI. Without additional licensed spectrum, a third of data traffic from AI-enabled devices is projected to go unmet by 2029. Fortunately, Congress has defined a clear path for U.S. spectrum leadership, enacting the landmark spectrum pipeline legislation

that will bring 800 megahertz of licensed spectrum to the marketplace by 2034 to fuel our AI and 6G ambitions.

**Harmonizing Our Domestic Spectrum Pipeline Is Imperative.** The President made clear that the United States' continued leadership in AI and 6G depends on leveraging global scale with secure, reliable systems built on internationally harmonized spectrum. In other words, harmonizing spectrum is a priority for our domestic agenda, not an afterthought. A concerted, whole-of-government effort to ensure that spectrum that is opened up in the United States is made available in globally used frequency bands for licensed, full-power wireless use best positions America to leverage the free-market dynamism that made it a global technological leader. Among other things, harmonization:

***Boosts America's Economic Opportunity,*** adding up to $200 billion to America's economy.

***Benefits Consumers,*** because consumers see even lower prices and better quality at faster speeds with global scale.

***Promotes National Security Interests,*** as U.S. leadership in the global transport layer for AI helps to minimize the threat from other countries that are seeking to dominate in AI and 6G.

**The U.S. Has an Opportunity to Lead Global Harmonization at WRC-27.** WRC-27 will identify new spectrum bands for International Telecommunications (IMT) that facilitate the next generations of wireless connectivity. The conference is an opportunity to advance wireless technologies in the United States, which would benefit consumers in addition to a

multitude of industries, such as agriculture, energy, healthcare, manufacturing, and transportation.

The United States must seize the international harmonization opportunities presented for the 4 GHz and 7 GHz bands—which are among the targets for global harmonization at WRC-27 and are centerpieces of the Working Families Tax Cut Act's spectrum pipeline. The United States must lead the WRC-27 process with a unified domestic position to maximize the economic opportunities of these bands and ensure that the U.S. leads the way for 6G, AI, and other emerging technologies in these bands.

**7 GHz:** Making spectrum available across the 7 GHz band for commercial wireless use would be a valuable opportunity to align U.S. spectrum policy with our partners and allies. This band if part of a broader "tuning range" segment that has long been targeted for next-generation commercial wireless use thanks to its ability to support high-capacity wireless services and to be used alongside other spectrum that is available for licensed use in other nations. The President directed the U.S. to auction this spectrum swiftly for full-power use, and America's delegation should enter WRC-27 with a strong, unified position in support of IMT in this band.

**4 GHz:** The 4 GHz band is a clear focus of America's spectrum pipeline and a key target for nations across the globe, making it an important opportunity for the United States to promote harmonized use of frequencies across a contiguous block of spectrum for high-capacity, high-bandwidth next-generation wireless and AI growth. The United States should be a clear leader for an IMT allocation in this band this WRC cycle

so that, when the near-term spectrum studies are completed, the spectrum can be allocated and auctioned for wireless use domestically and put to work quickly for next-generation wireless and AI applications.

While the last WRC showed that the rest of the world was putting significant emphasis on making mid-band spectrum available for full-power wireless use, WRC-27 gives the U.S. the first-mover advantage to define the ecosystems for these new technologies to the benefit of the domestic economy, national security, and American consumers. The practical reality is that our rivals like China have already identified a significant amount of 6 GHz spectrum for next-generation wireless. Europe has similarly indicated its intent to support both 6G and Wi-Fi in the 6 GHz band. It is now incumbent on the United States to give the world an alternative with the hundreds of megahertz needed to meet our AI and 6G ambitions.

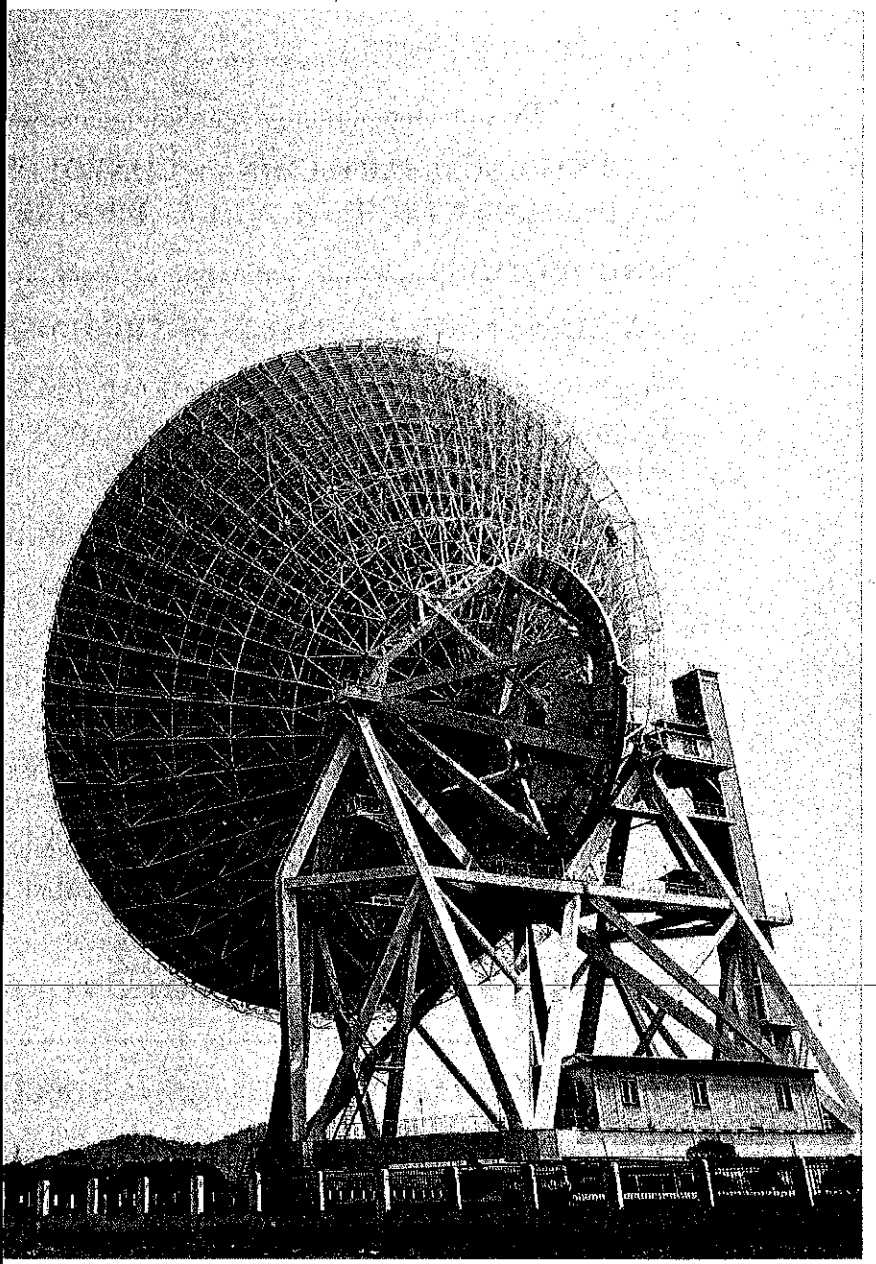
To realize the potential of transformational AI applications, American innovators and entrepreneurs need resilient, secure, and reliable wireless networks built on a foundation of licensed, full-power spectrum in globally harmonized bands. The U.S. has a generational opportunity at WRC-27 to define the ecosystems for these new technologies — securing America's economic dominance, protecting national security, and delivering better, faster, cheaper connectivity to consumers. The wireless industry stands ready to build that future. Now, the U.S. government must act with the urgency our economy and national security demand.

# China's Management of Electromagnetic Spectrum Resources

Eric Hundman, Ph.D.

Supported by Matt Bruzzese, Devon Johannesen, John van Oudenaren, and Linda Yang

March 2026



*Radio telescope scene at dusk in China.*
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# Acronyms

| | |
|---|---|
| AI | Artificial intelligence |
| ASPI | Australian Strategic Policy Institute |
| CAS | Chinese Academy of Sciences |
| CBN | China Broadnet |
| CETC | China Electronics Technology Corporation |
| D2D | Direct-to-device |
| EDD | Equipment Development Department |
| CMC | Central Military Commission |
| CSSC | China State Shipbuilding Corporation |
| EM | Electromagnetic |
| EMSM | Electromagnetic spectrum management |
| FCC | Federal Communications Commission |
| ICT | Information and communications technology |
| IEEE | Institute of Electrical and Electronics Engineers |
| GDP | Gross domestic product |
| GPS | Global Positioning System |
| GNSS | Global navigation satellite system |
| IoT | Internet of things |
| IT | Information technology |
| ITU | International Telecommunication Union |
| JSD | Joint Staff Department |
| MIIT | Ministry of Industry and Information Technology |
| MOST | Ministry of Science and Technology |
| MR | Military Region |
| NDRC | National Development and Reform Commission |
| NTIA | National Telecommunications and Information Association |
| NUDT | National University of Defense Technology |
| PLA | People's Liberation Army |
| PRC | People's Republic of China |
| RF | Radio frequency |
| SEP | Standard essential patent |
| SOE | State-owned enterprise |
| SRRC | State Radio Regulation of China |
| TC | Theater Command |
| UAV | Unmanned aerial vehicle |
| UESTC | University of Electronic Science and Technology of China |
| U.S. | United States |
| WRC | World Radiocommunication Conference |

# Executive Summary: China's Convoluted Management System Is Driving Rapid Technological Progress

China seeks to lead the development of future generations of spectrum management technology. The use of wireless technologies has exploded in recent decades, and technological development is expanding the possibilities for use of the electromagnetic spectrum. As competition between the United States and China intensifies, interest has sharpened in finding better ways to manage the use of spectrum to support critical applications in areas such as warfighting, mobile communications, and remote sensing. Beijing's approach to spectrum management has been poorly understood, but it offers important lessons regarding the benefits and drawbacks of a relatively centralized, civilian-led approach. This report therefore investigates how China manages its electromagnetic spectrum, how that spectrum is used, how China's approach to spectrum management is impacting global standards, and what benefits (and costs) China's approach has offered.

China's approach to managing its electromagnetic spectrum resources has generated a number of benefits, including rapid deployment of 5G technologies, a highly active spectrum research field, and expanded influence in international markets. The relative centralization of its spectrum management authorities is also likely to improve the People's Liberation Army's joint warfighting capabilities in the future. However, its approach has also generated a complex, opaque bureaucratic process, high barriers to entry for smaller companies, and possibly lower efficiency in allocating and utilizing spectrum resources.

- China has four **primary spectrum objectives** that shape its approach to managing electromagnetic spectrum resources:
    - Increasing the efficiency of spectrum allocation and utilization;
    - Improving coordination on spectrum issues between the government, the military, and the commercial sector;
    - Supporting the development of priority technology areas, especially 5G and 6G mobile communications, the Internet of Things (in a wide variety of sectors including smart manufacturing, agriculture, transportation, and healthcare), and the integration of satellite communications into a comprehensive mobile communications network; and
    - Promoting the adoption of Chinese standards for managing the electromagnetic spectrum at international organizations.

- The approach China uses to pursue these goals has six key characteristics:
    - **Centralized decision-making processes**: the People's Republic of China (PRC) Ministry of Industry and Information Technology is the sole authority responsible for allocating spectrum bands in China.

- **Labor-intensive coordination between military and civilian stakeholders**: while civilian authorities take precedence, civilian and military users who need to share spectrum must engage in time-consuming processes of deconfliction.
- **Support for national priorities**: Spectrum management in China aligns with clear economic and technological goals set by policymakers.
- **Close relationships between regulators and providers**: PRC authorities not only set detailed national industrial priorities in cooperation with large state-owned telecommunications providers, they also actively reshape, merge, or eliminate providers when necessary to achieve their goals. Chinese regulators also, unusually, encourage cooperation among large telecommunications providers.
- **Adherence to international standards**: While China actively promotes its preferred international standards in spectrum use, it also generally appears interested in adhering to standards that are adopted, even if they were not China's preferred approach.
- **Secrecy surrounding government and military spectrum allocations**: China does not appear to delineate dedicated bands for either government or military use.

These findings point to three recommendations for Congressional action:

1) **Direct the Federal Communications Commission and the National Telecommunications and Information Administration to jointly lead a study investigating how the United States' process for re-allocating and licensing spectrum bands could be streamlined, with input from other stakeholders in government, academia, and the private sector.** One key advantage China's approach to electromagnetic spectrum management has displayed in recent years is speed: it issued 5G licenses to its three primary telecommunications providers within months of the international 5G standard being finalized. The United States moved more slowly to allocate spectrum to 5G for several reasons, including an unforeseen legal complication, an unplanned lapse in the FCC's authority to auction frequency, and the time needed to prepare and conduct auctions. Any such studies should, however, attempt to identify how to preserve the benefits of incorporating market-based incentives and information. While the PRC system can move quickly when it makes up its mind, it is often slow to change its mind when it has put so many resources behind an initial decision. The U.S. system for electromagnetic spectrum management has an advantage in its more effective incorporation of market dynamics (though auctions, for instance) that should be preserved.
2) **Increase funding for foundational research on advanced technologies such as cognitive radio and radar, dynamic approaches to spectrum allocation, and spectrum sharing.** As a consequence of its high-level prioritization of spectrum

management in the 13th Five-Year Plan and continuing prioritization of basic research in mobile communications and remote sensing, China's research in cutting-edge approaches to increasing the efficiency and utility of electromagnetic spectrum use in general appears to be proceeding much more rapidly than that of the United States.

3) **Encourage U.S. entities – both government agencies and corporations – to participate more actively in the international standards-setting process**. The United States is a major funder of the ITU, but U.S. participation in its standards-setting processes is substantially lower than China's. Directly encouraging U.S. government agencies and offices working in spectrum management to participate in international standard setting could involve increased travel subsidies, expanded research budgets, or the creation of new organizations directly focused on researching and contributing to international wireless technology standards. Encouraging corporate participation should be pursued on multiple fronts, because the reasons U.S. corporate participation at the ITU has been lower than China's are complex and poorly understood. Tax incentives or grants for companies pursuing research relevant to the ITU's work would help develop a larger pool of expertise for contributing to ITU decision-making processes. Offering streamlined regulatory pathways to commercializing new technologies for companies that succeed in shaping ITU standards for those technologies could strengthen existing market-driven incentives to shape and adopt global standards. In addition, the National Science Foundation could be directed to fund research into views of the ITU and the reasons for low participation within U.S corporations, which would help identify the most effective methods for policymakers to incentivize increased participation.

# Introduction

Electromagnetic (EM) waves, such as radio waves or microwaves, are essential for a range of technologies involving wireless information transmission, remote sensing, and wireless energy transfer. The spectrum of EM waves available for such uses, however, is finite. As the use of wireless technology expands, it has become necessary for governments and international organizations to more carefully manage the use of EM spectrum. EM spectrum management (EMSM) is the process of managing multiple entities' use of spectrum for wireless technologies in order to minimize interference (see below for definitions of key terms), maximize efficiency, and ideally, promote economic development.[1] Broadly speaking, today such management involves both national and international organizations licensing spectrum to specific use cases such as "maritime navigation" or "radio astronomy" and/or users such as T-Mobile or China Mobile, monitoring those uses of spectrum, identifying and resolving cases of interference and unlicensed use, and researching more effective policies and technologies for managing spectrum use in the future.

## Key Terms

***Electromagnetic (EM) field:*** A physical field representing the influences of electricity and magnetism.

***EM wave / radiation:*** A wave in the electromagnetic field that carries momentum and energy through space.

***EM spectrum:*** A description of the full range of electromagnetic radiation, classified by frequency or wavelength. Components include radio, visible light, and gamma rays.

***EM spectrum band / frequency band:*** A specific range of frequencies in the EM spectrum. The physical properties of different bands determine the applications they are best suited to.

***EM spectrum management:*** The scientific, political, and bureaucratic processes of managing the use of EM spectrum in order to minimize interference, maximize efficiency, and maximize benefits.

***EM interference:*** Disruption or degradation of the performance of an electronic device by an external source of EM radiation. For example, two radio operators broadcasting on the same frequency in the same location will each interfere with the others' signal, causing interference in both broadcasts.

***Spectrum allocation:*** The component of EM spectrum management dealing with the designation of the EM spectrum into bands that can be regulated and assigned to particular purposes or users.

# How China Manages the Electromagnetic Spectrum

The PRC manages use of the EM spectrum under a joint decision-making structure based on consensus between the relevant civilian and military organizations. The PRC's overarching national EM spectrum regulations, the Radio Regulations of the People's Republic of China [中华人民共和国无线电管理条例], are jointly issued by the State Council (the highest state administrative organ in the country) and the Central Military Commission (CMC, the highest military leadership organ in the country), most recently in 2016. As is typical in many areas of PRC governance, those Regulations serve as guiding documents for lower-level administrative bodies to issue more specific regulations in their areas of authority. In the case of EMSM, that involves cooperation between civilian and military organizations at all levels, although military involvement has reportedly deepened in recent years.[2] A schematic of the organization of EMSM in China is depicted in Figure 1 on page 10.

Beyond the general EMSM needs of assigning and monitoring spectrum use while addressing cases of interference, the PRC's objectives for spectrum management currently include: 1) increasing the efficiency of spectrum use; 2) improving coordination between the government, the military, and the commercial sector; 3) supporting the development of priority technologies such as 5G, 6G, and the Internet of Things (IoT); and 4) promoting the adoption of PRC standards for international EMSM.

This section focuses on how China and its EMSM bureaucracy pursue these four goals at a high level: what EMSM policy looks like, the structure of EMSM organizations, and how policymakers and the bureaucracy broadly attempt to incentivize markets to pursue these goals. The ensuing sections go into more detail on the specific economic and technological impacts of China's choices about how to manage EMSM, the global implications of China's interest in setting international standards for spectrum use, and China's leaders in developing the use of its spectrum resources.

## Pursuing Efficiency and Coordination in EM Spectrum Management

China is pursuing increased efficiency in EM spectrum use through a combination of policy, organizational, and technological approaches.

### Policy

PRC policymakers have responded to surges in demand for spectrum resources by regularly updating spectrum allocations, improving frameworks for coordination between military and civilian stakeholders, and devoting additional resources to research aimed at both increasing

efficiency and developing new spectrum resources.* For example, in 2010 the State Council and CMC issued a major revision of the Radio Regulations aimed at developing additional spectrum resources, increasing support for EM scientific and technological research, and improving coordination between military and civilian stakeholders in line with the PRC's "military-civil fusion" strategy. The latter focus reflects PRC decisionmakers' awareness that military personnel and equipment were rapidly becoming more dependent on wireless information technologies, including both land- and space-based capabilities.[3]

**Organization and Regulatory Authorities**

Only one agency in China holds responsibility for allocating spectrum, a setup that has streamlined processes of reallocation and coordination with other national policies, but also generated a need for labor-intensive coordination with other stakeholders. Within the framework established by the Radio Regulations, the agency officially responsible for allocating spectrum in the PRC is the Ministry of Industry and Information Technology (MIIT).† In addition to allocating and reallocating spectrum bands to specific use cases (*e.g.*, "aeronautical mobile" [航空移动], "radionavigation" [无线电导航], or "mobile" [移动]), MIIT also licenses spectrum bands to specific service providers for those use cases. It also uses a variety of other mechanisms to manage the markets involved in spectrum use, for instance by adjusting access regulations for the satellite internet business in order to encourage competition.[4]

Somewhat paradoxically, while regulatory authority within China's spectrum management bureaucracy is highly centralized, the process of managing spectrum involves extensive consultation with other stakeholders that appears to be quite labor-intensive. The subordinate office in MIIT responsible for the work of spectrum allocation and licensing is the State Radio Regulation of China [中国无线电管理] (SRRC).‡ In order to conduct this work, however, the

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* For example, terahertz (THz) frequency bands are thought to have a number of advantages for remote sensing, but until recently they were prohibitively difficult to use and detect. S.S. Dhillon et al, "The 2017 Terahertz Science and Technology Roadmap," *Journal of Physics D: Applied Physics*, 50 (2017): 1-50, https://iopscience.iop.org/article/10.1088/1361-6463/50/4/043001/pdf.

† MIIT is the "issuing authority" [发文机关] for spectrum allocations, whereas the SRRC develops them as its subordinate office. Miao Wei [苗圩], "Order of the Ministry of Industry and Information Technology of the People's Republic of China" [中华人民共和国工业和信息化部令], *People's Republic of China Central People's Government* [中华人民共和国中央人民政府], February 7, 2018, https://www.gov.cn/zhengce/zhengceku/2018-12/31/content_5439640.htm.

‡ In MIIT documentation, the SRRC is described as the Bureau of Radio Regulation (State Radio Office) [无线电管理局（国家无线电办公室）]. "Department and Bureaus" [机关司局], *Ministry of Industry and Information Technology* [中华人民共和国工业和信息化部], accessed September 15, 2025, https://www.miit.gov.cn/zzjg/index.html; Kan Runtian, "Radio Spectrum Management in China," *International Telecommunication Union presentation by Director General Bureau of Radio Regulation, MIIT,* September 11, 2017, https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/Events/2017/Sep-SECB/Presentations/D1-2-Kan%20Runtian-Radio%20Spectrum%20Management%20Strategies%20in%20China.pdf; "Radio Administration Bureau (State Radio Office)" [无线电管理局（国家无线电办公室）], *Ministry of Industry and Information Technology of the*

SRRC solicits input from the military and other stakeholders and develops EMSM principles and other policies, for instance relating to management of radio stations and equipment, radio monitoring, investigation of spectrum interference, management of satellite orbits, and management of international radio issues.[5] Similar to other PRC bureaucracies, the SRRC supervises a system of local radio management agencies in China's provinces, autonomous regions, and lower-level administrative divisions.[6] Again in what appears to be a labor-intensive set of processes, those local agencies cooperate with their military counterparts as needed to license frequency use in their jurisdictions, review construction locations and plans for radio stations, issue licenses to radio stations, and investigate cases of interference.

**Technology**

Spectrum management also requires extensive technical monitoring capabilities, which in the PRC are operated separately in MIIT's State Radio Monitoring Center [国家无线电监测中心].* Under the guidance of the SRRC, that Center monitors spectrum usage, locates sources of interference, blocks illegal transmissions, conducts research in EMSM, manages data, calibrates equipment, conducts compatibility analyses, and provides technical support for coordinating the use of spectrum resources, both in China and abroad.[7] It also oversees nine monitoring stations

*People's Republic of China* [中华人民共和国工业和信息化部], February 22, 2024, https://www.miit.gov.cn/jgsj/wgj/jgzz/art/2024/art_f9ad02cc6a3f4a52b9aad6a666c55458.html.

* Also known as the National Radio Spectrum Management Center [国家无线电频谱管理中心].

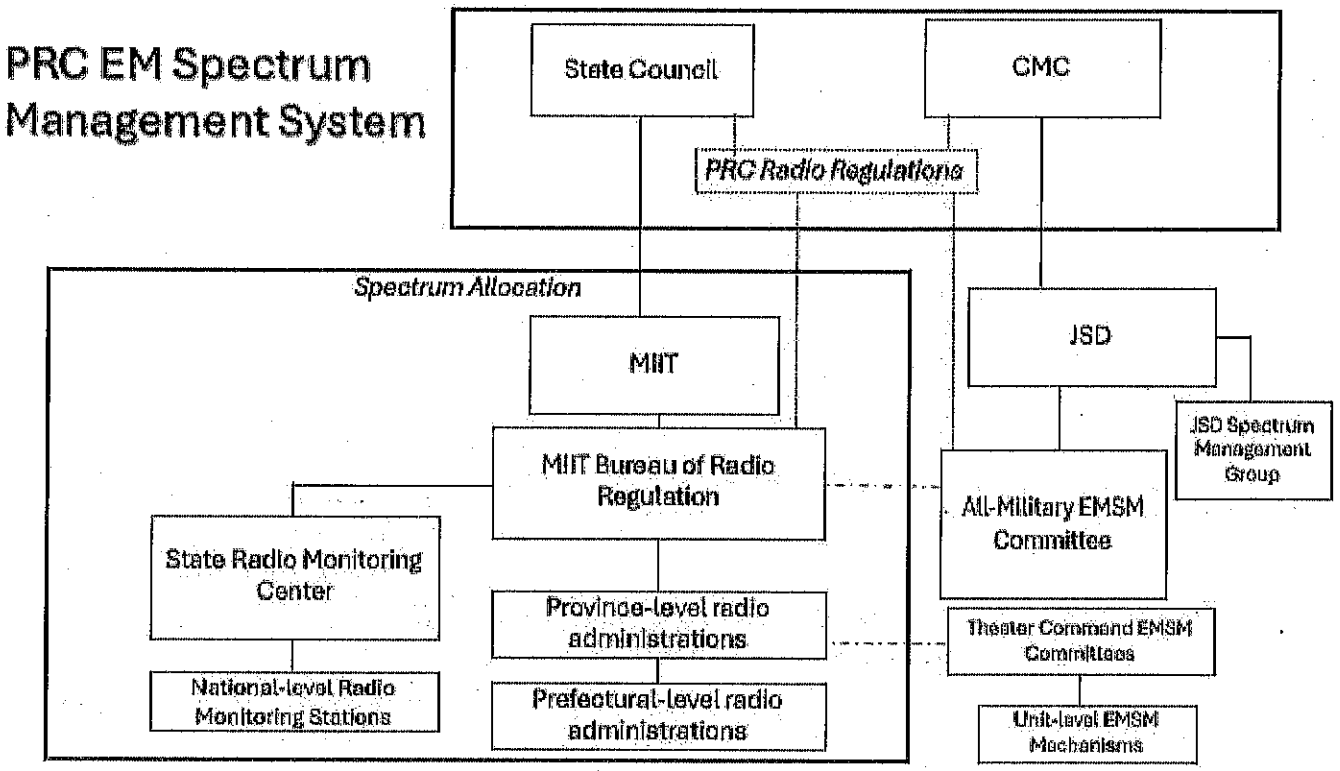


*Figure 1: Overview of the PRC's EM spectrum management bureaucracy*

spread across China, in addition to operating the Beijing Oriental Botai Radio Spectrum Technology Research Institute [北京东方波泰无线电频谱技术研究所] and the National Radio Monitoring Center's Test Center [国家无线电监测中心检测中心].[8]

The organizations involved in military EMSM in China are publicly known, but the processes of military EMSM are largely unknown. While secrecy about the specifics of such processes is common in other countries, it is unusual that the PRC's national table of frequency allocations does not even identify which frequency bands are reserved for government use, much less any details on military use. Official media has confirmed that management of the military's spectrum use falls to the All-Military Electromagnetic Spectrum Management Committee [全军电磁频谱管理委员会],* which is likely subordinate to the CMC's Joint Staff Department (JSD).[9] While little has been made public about the workings of this committee, it supervises the regional

* Referred to generically in the PRC Radio Management Regulations as the PLA Electromagnetic Spectrum Authority [电磁频谱管理机构]. "Delegation of the PLA Frequency Management Office visited CCBN2012" [全军频管办参观团参观 CCBN2012], *CCBN* [CCBN 官网 ] , March 23, 2012, http://kejiao.cntv.cn/program/ccbn/20120323/100337.shtml; "Radio Management Regulations of the People's Republic of China" [中华人民共和国无线电管理条例], Gov.cn [中华人民共和国中央政府], November 11, 2016, https://www.gov.cn/zhengce/content/2016-11/25/content_5137687.htm.

military spectrum management conducted by the PLA's geographic Theater Commands (TCs), each of which likely operates its own EMSM committee.[10]

## China Seeks to Support Priority Technologies through Spectrum Policy

China has aligned its priorities for wireless spectrum usage with its broader national industrial policy focus on the digitization of the Chinese economy, giving funders, corporations, and researchers direction and support in developing the next generation of key technologies. China has a long and well-documented history of using both broad and highly targeted industrial policies to achieve its technological goals. In the case of spectrum management, the PRC's 13th Five-Year Plan (FYP), which guided national development from 2016-2020, was issued with a National Information Technology Plan [十三五国家信息化规划] that laid out specific guidelines for the "development of application infrastructure and spectrum resource allocation," including in "power grids, railways, highways, and water conservancy systems." It also directed the planning of satellite frequency bands such that they could "meet the spectrum needs of major national strategies and relevant industries."[11] This kind of national-level plan opened the way for government funding of research into spectrum management technologies, for instance in high-precision spectrum sensing technologies needed for IoT applications. The Chinese Academy of Sciences (CAS) has been working on this technology for years with financial support from the National Natural Science Foundation of China, the Ministry of Science and Technology (MOST), and the municipal governments of both Beijing and Shanghai.[12] More recently, a 2024 plan issued by MIIT in cooperation with 11 other national-level agencies specifically called for "scientifically coordinating existing spectrum resources and steadily increasing 5G frequency allocations" and conducting "research on 5G industrial dedicated frequency requirements."[13]

Whereas the 13th FYP for National Informatization discussed above was explicit about the PRC's goals for spectrum and wireless technologies, the current plan instead focuses on digitizing the economy more broadly, including by integrating the use of the EM spectrum. The 14th FYP for National Informatization (issued in December 2021 and intended to guide China's development in this area through 2025) focuses on "the development of broad, mutually reinforcing, organically evolving systems" that will encourage the digitization of the PRC's industry, cities, and agriculture.[14] This plan specifically expresses satisfaction about China becoming a world leader in 5G use. The lesser focus on spectrum itself may imply that Beijing is satisfied with the results of its current approach to spectrum management.

Even though improving the allocation of spectrum resources and developing wireless technologies are no longer explicit foci of China's industrial policy, MIIT continues to refine and clarify policies for EMSM and establish new research institutes focused on it.[15] The 14th FYP for National Informatization highlights eighteen cross-cutting areas in which spectrum-reliant technologies like 5G and 6G wireless communications, as well as satellite communications and geolocation, should be prioritized through 2025. The full list of these goals is provided in Appendix A; they include indicators such as 5G user adoption rate, enterprise industrial

equipment cloud usage, and the number of high- and new-technology enterprises in the country.[16]

As the regulating entity in charge of spectrum management, MIIT translates these broad industrial policy priorities into practice by, in part, reallocating spectrum bands in support of Beijing's preferred sectors. In the case of encouraging the adoption of 5G mobile communications, for example, MIIT reallocated spectrum in the 700 MHz band from analog broadcasting to 5G mobile communications.[17] In 2023, MIIT announced its plan to reallocate much of the 6 GHz band from fixed-satellite services [卫星固定] to 5G mobile communications, and in late 2024, MIIT permitted China's largest telecommunications state-owned enterprise (SOE) to reclaim frequency resources in multiple bands below 3000 MHz from other uses for 5G public mobile communications. As of the end of 2024, MIIT had licensed a total of 1109 MHz of spectrum to China's four main telecommunications operators for use in public mobile communications.[18] PRC reporting has stated that 86.5 percent of this is bandwidth suitable for 5G use.[19]

Policymakers are prioritizing primary applications for future wireless communications technology in three specific areas: wireless communications (currently 5G and 6G), the IoT, and the integration of space-based capabilities into both. Targeted applications for mobile communications technologies include categories like smart homes, smart power, and smart geological mines, in addition to specifics such as glasses-free 3D systems and extended reality business systems (a more complete list of priority areas is provided in Appendix B).[20] IoT priorities, based on MIIT documentation, are largely focused on expanding capacity and setting standards in order to facilitate that expansion.[21] Satellite technology appears to be primarily viewed as communications infrastructure in public PRC planning, with MIIT calling for satellite internet and direct satellite connections for mobile phones in order to "build a new type of digital infrastructure that is high-speed, ubiquitous, integrated, interconnected, intelligent, green, safe, and efficient."*[22] Given these priorities, it is easy to understand why China's recent spectrum allocation decisions have been focused on optimizing bandwidth for 5G, as well as why one of its priorities for the 2027 World Radiocommunication Conference (WRC) is securing bandwidth for satellite-to-mobile communications.

**Case Study: Reallocating the "Golden Frequency"**

The case of the 2019-2021 reallocation of the "Golden Frequency" in the 700 MHz band to 5G applications helps illustrate some of the specific dynamics involved in China's pursuit of efficiency, technological development, and improved coordination in managing uses of the EM spectrum. This case also highlights two general aspects of China's approach to spectrum

* China is, however, actively pursuing a range of military uses for space assets that are not included in these public-facing plans. See, *e.g.,* Kevin Pollpeter, Elizabeth Barrett, and April Herlevi, "Deterring China's Use of Force in the Space Domain," CNA, May 2025, https://www.cna.org/reports/2025/05/Deterring-China-Use-of-Force-in-the-Space-Domain.pdf.

management. First, MIIT does not necessarily directly dictate all allocation and uses of spectrum licenses. Providers can and do cooperate to share spectrum on their own initiative (although such agreements probably need to be approved by MIIT), or MIIT can allocate spectrum jointly to multiple users and allow them to work out a specific framework for cooperation. Second, MIIT is carefully managing China's telecoms market, not only by encouraging cooperation in the name of efficiency and accelerated technological development, but also by fostering competition.[23]

Many analysts view the "Golden Frequency" in the 700 MHz band as offering a prime balance of long-range propagation capabilities and bandwidth for data-hungry 5G mobile communications. Prior to its reallocation in China, that bandwidth had long been used for analog television and radio broadcasting by the China Broadcasting Network (CBN).[24] The process of reallocation began on June 6, 2019, when MIIT issued a license allowing the commercialization of 5G technology to CBN.*[25] In March of 2020, MIIT released the 700 MHz Migration Frequency Assignment Plan [700MHz 迁移频率指配方案], which was reportedly focused on 5G for radio and television, which were CBN's traditional remit (although its previous experience was in analog broadcasting, not digital).[26]

In the following months, MIIT issued several other approvals necessary for CBN to develop 5G capabilities in this band. In April of 2020, it issued the "Notice on Adjusting the Frequency Use Plan of the 700 MHz Band" [关于调整 700MHz 频段频率使用规划的通知], which formally switched the band's allocation from analog radio and television to mobile communication systems (including digital radio and television services). In May, MIIT approved CBN's application for a frequency use license, allowing it to use the 703-733 MHz and 758-788 MHz frequency bands to deploy a nationwide 5G network.[27]

CBN, however, did not have the same depth of experience with wireless communications technology that other operators did—it only received a license to operate in that sector in 2016, almost two decades after China Mobile was established—and the company ultimately decided to partner with China Mobile in developing a 5G network.[28] The two companies publicly announced signing a "cooperation framework agreement" [合作框架协议] in May 2020.[29] That agreement was finalized on January 26, 2021.[30] The process of migrating the 700 MHz band and deploying a nationwide 5G network on that basis was reportedly completed around the end of 2023.[31]

* An MIIT commercial license [商用牌照] is required for operators in the PRC to use 5G in commercial applications. These are distinct licenses from those that allow PRC entities to use spectrum bands. Xinhua News Agency [新华社], "Xinhua News Agency: China Officially Issues 5G Commercial Licenses" [新华社：我国正式发放 5G 商用牌照], *State-Owned Assets Supervision and Administration Commission of the State Council* [国务院国有资产监督管理委员会], June 6, 2019, http://www.sasac.gov.cn/n2588025/n2588139/c11432389/content.html.

## Promoting International Adoption of PRC Standards

China expends considerable resources working to influence international standards and typically adopts internationally promulgated standards as domestic policy. China's spectrum allocations, along with the processes for assigning allocations, are broadly aligned with international standards. That alignment is expressly required in China's spectrum regulations, and this law appears to be generally obeyed.[32] Beijing's interest in adopting international standards for spectrum technologies in China also helps explain its sustained interest in influencing which international standards are adopted.

Beijing has maintained a high-level interest in setting international standards in many sectors (not just spectrum management) since at least 2015.[33] More recently, the PRC's 2021 National Standardization Development Outline [国家标准化发展纲要] explicitly calls for a focus on shaping international standards.[34] Chinese agencies reportedly support China's influence in international standards through direct subsidies to companies or other organizations that successfully have their proposed standards adopted in international fora. This support is likely an important reason why the number of Chinese entities participating in the ITU grew from 16 in 2012 to 106 in 2022 (compared to 114 and 118 for U.S. entities, respectively).[35] This report discusses China's promotion of homegrown standards for EM spectrum management abroad in greater detail in the section "Global Implications of China's Spectrum Management" below.

# How China Leverages the Electromagnetic Spectrum

While national policy as laid out above determines the processes through which China manages its EM spectrum, the specific implications of that management structure flow from a complex combination of decisions about allocating spectrum, resolution of competing interests in spectrum use, and dynamic deconfliction of overlapping allocations (for instance between commercial and military users sharing the same band). This section of the report first outlines the specifics of how spectrum is allocated and developed as a resource in China, then goes on to highlight how those choices impact the development of China's economic, technological, and military capabilities.

## Strategic Spectrum Allocations: Competition and Cooperation among Four Telecommunications Providers

MIIT has strategically allocated spectrum across China's four major mobile telecommunications companies— China Mobile, China Telecom, China Unicom, and CBN—in a manner that has led to faster deployment of 5G capabilities while also encouraging competition, leading to better service and lower costs for consumers. While China Mobile holds the most spectrum for mobile telecommunications (along with the most subscribers among China's telecommunications companies), MIIT has allocated generally similar amounts of bandwidth across its other three

primary telecommunications providers, much of which is shared either among all four or in two-party cooperative agreements (see Table 1 below).*

*Table 1: PRC 5G Carriers and their assigned frequencies*[36]

| Carrier | Frequencies | Total Bandwidth |
|---|---|---|
| China Mobile | 700 MHz (shared)<br>2.6 GHz (2515-2675) (shared)<br>4.9 GHz (4800-4900) | 200+ MHz 5G,<br>60 MHz 4G |
| China Telecom | 3.5 GHz (3400-3500)<br>3.5 GHz (3500-3600) (shared) | 100 MHz 5G |
| China Unicom | 3.5 GHz (3500-3600)<br>3.5 GHz (3400-3500) (shared) | 100 MHz 5G |
| China Broadnet | 700 MHz (703-33; 758-788) (shared)<br>4.9 GHz (4900-5000) | 160 MHz 5G |
| Shared by all | 2.6 GHz (2515-2675)<br>3.3 GHz (3300-3400) | 100 MHz 5G |

*Note:* Recently reassigned 6 GHz and high-band frequencies are not included here, as the process of reallocation has not concluded and they do not appear to have been licensed yet (they are likely in the process of being migrated away from their previous allocation to fixed-satellite services).† Few details on the specifics of the reallocation process have been made available, but it reportedly involves study and solicitation of advice by the SRRC.[37]

The initial creation of China Mobile, China Telecom, and China Unicom in 2008 from five previous state-owned providers was not only intended to maintain competition in the sector, but also to facilitate the deployment of 3G mobile communications.‡ Each new entity was issued a 3G license as part of the restructuring, with the hope that they would each eventually generate broadly comparable capabilities and compete directly in the others' markets.[38] As detailed in the

* The larger spectrum allocation for China Mobile may reflect the fact that the spectrum bands it controls are relatively fragmented, making them more challenging to develop. China Mobile has licenses for spectrum in the 700 MHz, 2.6 GHz, and 4.9 GHz bands, while China Telecom and China Unicom control a contiguous band of spectrum near 3.5 GHz. Zhang Weijia [张维佳], "Analysis of the Development Status of China's Operators' 5G Private Network Communication Services in 2024: The Three Major Operators' 5G Private Network Deployments Have Their Own Characteristics" [2024年中国运营商5G专网通信业务发展现状分析 三大运营商5G专网部署各有特色], *Qianzhan Industrial Research Institute* [前瞻产业研究院], July 1, 2024, https://www.qianzhan.com/analyst/detail/220/240701-3d966545.html.

† While the reallocation has been officially announced by MIIT and state media, the most recent version of China's frequency allocation tables does not yet list the 6 GHz band as reallocated to mobile use. "Radio Frequency Allocation Regulations of the People's Republic of China" [中华人民共和国无线电频率划分规定], *State Radio Regulation of China* [中国无线电管理], November 8, 2023, https://www.srrc.org.cn/kindeditor/attached/file/20231108/20231108162331_5223.pdf.

‡ Notably, China did not adhere to international standards for 3G developed at the Third Generation Partnership Project (3GPP). Instead, Chinese authorities promoted a standard unique to their home market, the Time Division Synchronous Code Division Multiple Access (TD-SCDMA). That standard did not gain traction internationally, and Chinese scholars have since criticized it as a mistake that hindered innovation and led to wasteful spending. Hosuk Lee-Makiyama, "Subsidizing Balkanization: What China's 3G Subsidies Teach Us about 5G Open RAN," *European Centre for International Political Economy*, May 2021, https://ecipe.org/publications/china-3g-subsidies-and-5g-open-ran/.

case study above, this interest in encouraging competition in mobile telecommunications was also likely an important reason that MIIT chose to issue a 5G license to CBN.

MIIT's interest in encouraging cooperation among China's telecommunications providers appears to have been driven by Beijing's industrial policies identifying development and deployment of 5G technology as a national priority. In November 2013, for instance, MIIT, in cooperation with MOST and China's economic planning agency, the National Development and Reform Commission (NDRC), established the IMT-2020 (5G) promotion group as a "foundational platform for China's 5G R&D," which included representatives from both domestic and international companies* as well as academic and other research organizations.[39] As the development of 5G technology progressed, policymakers began calling for industry-wide "collaboration in building, operating, and maintaining the fifth-generation wireless networks to reduce costs."[40]

That high-level pressure to cooperate has led to a constellation of agreements that today govern resource sharing and partnerships among China's four largest telecommunications operators. China Telecom and China Unicom have built a close partnership in order to compete with China's largest mobile provider, China Mobile.[41] That partnership has reportedly significantly decreased redundancies in infrastructure investment, and state media proclaimed that it had enabled "rapid development of 5G service capabilities, enhancing network efficiency and asset operational effectiveness."[42] A report from the Beijing municipal government's news outlet claimed this partnership had saved the two companies RMB 270 billion (~$38 billion) in capital expenditures and RMB 30 billion (~$4.2 billion) in operational expenditures as of early 2023.[43]

The cooperation between China Mobile and CBN has also resulted in substantial savings for the corporations and their customers. In addition to sharing CBN's license to the "Golden Spectrum" for 5G (detailed in the case study above),[44] China Mobile has contributed its experience and expertise in building 5G infrastructure such as base stations, and the two companies continue to explore new models for product development and operations, customer service, and channel management.[45] The partnership has also reportedly allowed CBN to decrease its prices for customers.[46]

China's cooperative approach to frequency assignments is relatively rare, although interest in shared access arrangements like this is increasing. In the United States, for example, the director of the Federal Communications Commission (FCC) in April 2025 announced the agency's interest in establishing sharing rules for the lower 37 GHz band,† and the UK is experimenting with shared access and local access licenses.[47]

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* No membership lists are publicly available, but it is highly probable that all of the state-owned domestic telecommunications companies were members.

† While not identical to China's sharing arrangements between specific licensees, the United States also operates the Citizens Broadband Radio Service (CBRS), which the FCC established in 2012 with the express purpose of encouraging advances in spectrum sharing. "Notice of Proposed Rulemaking and Order: In the Matter of

## Extensive Consultations: Resolving Conflicting Interests in PRC Spectrum Allocation

China's approach to allocating spectrum bands requires military and civilian users to engage in extensive manual deconfliction. PRC regulations do not assign dedicated spectrum bands to military or government use, and they broadly distinguish between military and civilian needs, rather than between government/public service and commercial needs like in Canada, the United States, and Japan.[48*] China's approach is not unique; both Germany and the UK have adopted a similar distinction.[49] More unusually, however, China does not assign dedicated bands of spectrum to either government or military use, and there are no gaps between frequency assignments that might hint at military allocations.[50†]

In lieu of dedicated military or government allocations, the PRC appears to resolve conflicts between civilian and military needs on a case-by-case basis. At the highest level, that involves MIIT and the SRRC soliciting input from stakeholders including the military, then building consensus on the best approach.[51‡] MIIT also regularly updates the PRC's Radio Frequency Allocation Regulations, most recently in 2023, to address changing spectrum needs. The allocations in these regulations assign bands for categories such as aerial navigation, radio astronomy, wireless navigation, and maritime mobile communications. The same frequency band can be assigned to multiple categories of use, in which case they either operate with equal status or are ranked into primary and secondary allocations. The Regulations govern potential conflict between users in three ways:[52]

1) When multiple allocations share the same frequency band, they have equal status unless otherwise specified.

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Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz band," *Federal Communications Commission*, December 12, 2012, https://docs.fcc.gov/public/attachments/FCC-12-148A1.pdf.

* The ITU guidance on preparing national frequency allocation tables also recommends distinguishing between government and non-government use in allocations. "Guidelines for the Preparation of a National Table of Frequency Allocations (NTFA)," International Telecommunication Union, 2015, https://www.itu.int/en/ITU-D/Spectrum-Broadcasting/Documents/Publications/Guidelines-NTFA-E.pdf.

† The only clear exception to this is the 156.4875—156.5625 band, which is allocated in line with international standards to "maritime mobile (distress and safety calls using DSC)," referring to digital selective calling. The PRC's frequency allocation table also contains brief references to "safety services" [安全业务] and "special services" [特别业务] that may refer to government and defense needs, but it does not identify bands that are dedicated specifically to these uses.

‡ At the subnational level, the PRC Radio Regulations require the establishment of radio management coordination mechanisms involving both civilian and military authorities. These mechanisms, probably intended to mirror the process at the national level, were directed by the MIIT National Radio Management Plan (2016-2020) to maximize cooperation between People's Liberation Army Theater Command spectrum management organs and provincial radio administrations. "Notice of the Ministry of Industry and Information Technology on Issuing the National Radio Management Plan (2016-2020)" [工业和信息化部关于印发国家无线电管理规划（2016－2020年）的通知], *Cyberspace Administration of China* [中华人民共和国国家互联网信息办公室], August 29, 2016, https://www.cac.gov.cn/2016-08/31/c_1119487645.htm.

2) In the event that interference occurs, the last user to begin using the contested frequency should be the first to stop, and unplanned frequency use should yield to planned frequency use.
3) When a primary allocation is subject to harmful interference from a secondary allocation, the relevant authorities or users of the secondary service should work to eliminate the interference.

In contrast to widespread acceptance outside of China that auctioning of spectrum allocations helps maximize efficiency in developing spectrum resources, MIIT has never held a spectrum auction despite having legal authority to do so. Instead, it pursues a mix of top-down spectrum reallocations every four to ten years and encouragement of market-based mechanisms for reallocation.* This choice reflects an ongoing debate in China over the relative merits of auction-based spectrum allocation like that in the United States and direct allocation like China's. Scholars at the Chinese Academy of Social Sciences, for instance, have criticized the U.S. approach as "costly in terms of administration and time."[53]

## Labor-Intensive Coordination: Deconflicting Dynamic Spectrum Sharing

Deconflicting spectrum use by military and civilian actors in China is often ad hoc and labor-intensive, which will slow the PLA's development of true joint-force expeditionary capabilities. It appears to remain so labor-intensive, in part, because civilian uses take precedence over military uses: given that the military does not have any spectrum bands dedicated to it, it cannot simply use specific bands to easily avoid interference with civilian needs.† Deconfliction is also labor-intensive because the processes for it do not appear to be standardized at the brigade level or below in the PLA. That lack of standardization squares with other analyses of the PLA that highlight how PRC authorities see some success in reforming the top levels of the military organization, but still think more work needs to be done to push those reforms all the way down to the bottom of the organization.[54]

Beyond those generalities, the specifics available about these deconfliction processes indicate that China is still exploring how best to make them less onerous—this process will be worth

* In February 2020, for example, MIIT jointly allocated the 3300-3400 MHz band for indoor 5G coverage to China Telecom, China Unicom, and CBN. This was the first time MIIT had ever licensed frequency to multiple companies for joint use. Zhang Xiaobao [张晓宝], "Review: Core 700MHz! "Missed" China Broadcasting and Television's 5G in 2020!" [复盘‖核心 700MHz! "错付"2020 年的中国广电 5G! ] *DVBCN* [DVBCN 广电网], January 13, 2021, https://www.c114.com.cn/topic/5890/a1150311.html.

† While users of spectrum allocations can work together via bespoke spectrum-sharing agreements or shared spectrum licenses, as detailed above, PRC scholars have noted that the legal framework for spectrum sharing in China remains both poorly understood and underdeveloped in general. Ma Zhiguo [马治国] and Wang Xueqi [王雪琪], "Legal Issues Facing Key Core Technologies in Spectrum Sharing in China's Communications Sector" [我国通信领域频谱共享关键核心技术面临的法律问题], *China Legal Innovation Network* [中国法学创新网], November 10, 2023, http://www.fxcxw.org.cn/html/105/2023-11/content-26374.html.

observing closely for insights that may be applicable in future U.S. regulatory adjustments. One unverified report claims that China is pursuing a spectrum sharing model in the 3 GHz band that layers home 5G "Wi-Fi" hotspot systems (which do not typically penetrate outdoors) on top of older military communications systems.[55] The PLA has also publicly made clear its substantial interest in the use of 5G communications, but there is very little open discussion about technical solutions to deconfliction such as spectrum sharing or spectrum slicing.[56] Research into those techniques at defense SOEs and defense-linked academic institutions is, however, ongoing.[57]

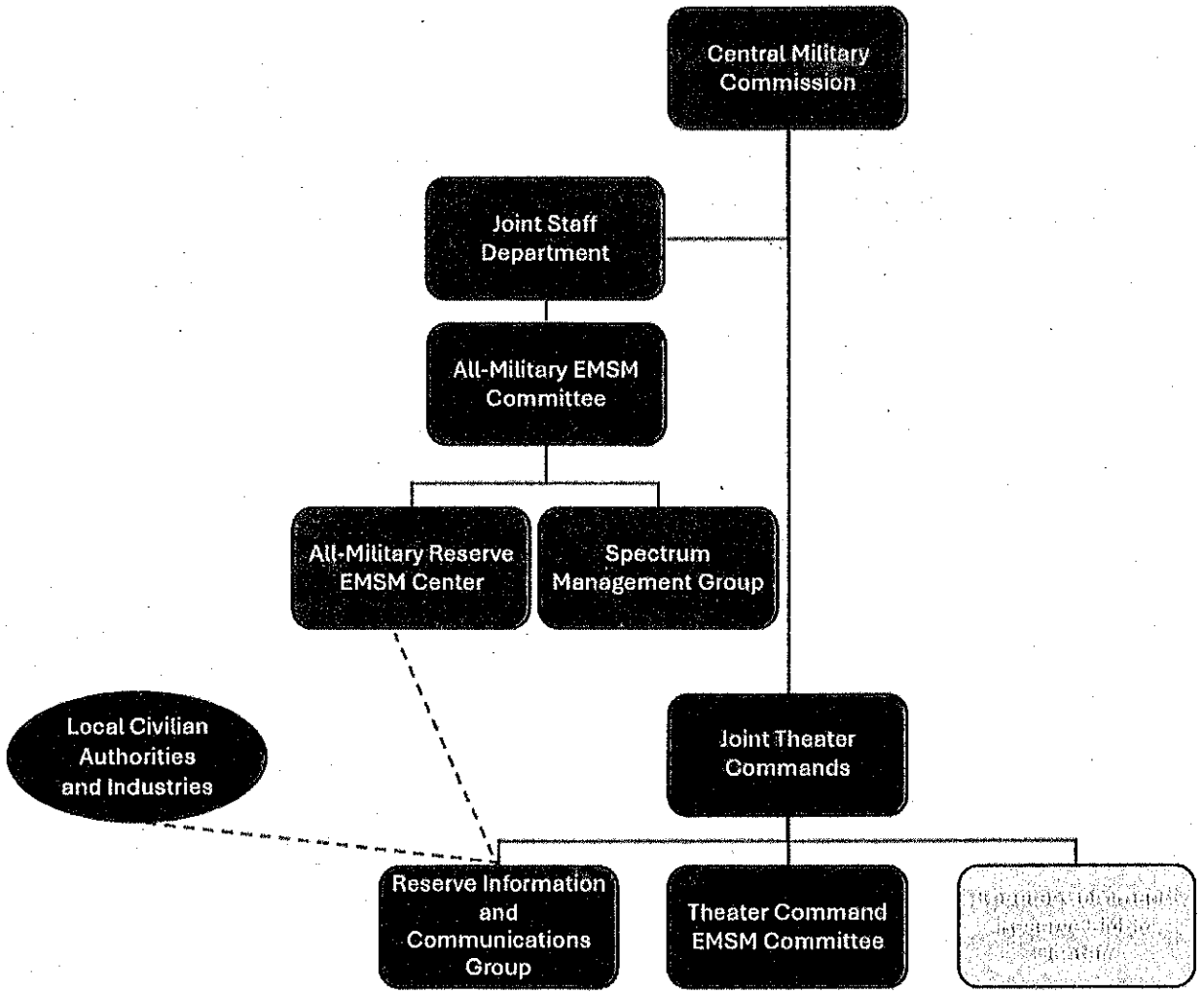


*Figure 2: PLA organizations involved in electromagnetic spectrum management*

At least two levels of bureaucracy are involved in the military's spectrum management, and both must coordinate with civilian authorities in order to achieve successful deconfliction. The top level is housed within the CMC, while the next level resides within the Theater Commands. The specific organizations involved in the PRC's current deconfliction process are displayed in Figure 2. As discussed above, at the national level, the CMC JSD operates the All-Military Electromagnetic Spectrum Management Committee, which appears to be focused on high-level coordination and policymaking, for instance by representing the PLA's interests to MIIT in

spectrum allocation decisions. That Committee supervises two other organizations: the JSD Spectrum Management Group [频谱管理大队], which is the only spectrum management and control unit in the PLA and is focused on spectrum research and operations;[58] and the All-Military Reserve Electromagnetic Spectrum Management Center [全军预备役电磁频谱管理中心], which interfaces with civilian organizations to manage spectrum use, draws on expertise from reservists who hold senior positions in the civilian sector, and supplements active-duty spectrum management capabilities.[59]

The top level of this bureaucratic structure has three responsibilities: (1) managing internal PLA spectrum use, for instance by ensuring compatibility across PLA systems; (2) working with international counterparts to deconflict spectrum use when the PLA is operating abroad; and (3) working with civilian agencies and other stakeholders within China to deconflict military and civilian spectrum needs.[60]

The JSD's Spectrum Management Group handles the first two tasks. For example, in 2016, a PLA Air Force radar brigade reported that one of its radars was facing constant interference from an unknown source. The JSD Spectrum Management Group dispatched five personnel to the radar site, and after three days of work they were able to find the source of the problem and deconflict the uses of spectrum.[61]

The CMC JSD's All-Military Reserve Electromagnetic Spectrum Management Center primarily takes on the third task. Its personnel are engineers and technicians drawn from civilian spectrum research organizations, factories, and commercial enterprises who are provided with military training – sometimes at PLA educational institutions – and then train regularly with active-duty forces.[62] Despite their part-time, heavily civilian nature, this Center's personnel appear to play a leading role in EMSM for the PLA.[63] For example, in a major 2018 military exercise, 16 reservists from this Center monitored more than 2,000 frequency points in a challenging mountainous area for over 80 days.[64] It is also heavily involved with, and may help supervise, the lower-level reserve EMSM groups, which also have responsibility for coordinating with civilians in their localities to deconflict spectrum needs.[65]

At the next level down in this bureaucracy, each of the five joint Theater Commands* operates an EMSM bureaucracy similar to the CMC's, with each hosting an EMSM committee and a reserve information and communications group (the latter fulfilling a similar role as the CMC JSD's Spectrum Management Group).[66] The details of these lower-level military spectrum management processes are provided in Appendix C.

* Since the major reforms to the PLA that were initiated in late 2015, the five joint Theater Commands—similar to U.S. combatant commands and the successors to China's previous Military Regions (MRs)—have formed the geographic basis for the PLA's organization. They were created with the explicit goal of encouraging cooperation among service branches and improving the ability of the force to conduct joint-force operations.

## Faster but Less Efficient and Innovative: Economic and Technological Impacts of China's Approach to EM Spectrum Management

China's relatively centralized system for spectrum allocation coupled with its choice to eschew auctions allows it to move quickly once a decision has been made, but that very centralization and the associated choice to avoid a market-driven approach to spectrum allocation also leaves Chinese policymakers vulnerable to making the wrong bet on future standards or wireless technologies. Centralization also allows easier coordination with national industrial policy, but the opacity of MIIT's decision-making processes and the larger bureaucracy may stifle innovation and favor large, state-owned businesses. The remainder of this section explores the advantages and disadvantages of China's approach to EMSM in more detail.

**Advantages**

The clearest advantage China's approach to EMSM has generated, China's lead in 5G technology, results from a combination of the PRC's prioritization of civilian needs in spectrum allocation, its centralized spectrum management and allocation system, and its industrial policies that made the pursuit of 5G and the IoT national-level priorities as early as 2015. The centralization of spectrum allocation decisions under MIIT—which is also responsible for developing many of those industrial policies—offers further advantages in coordinating spectrum management with national priorities for technological development.

A comparison of the timelines for 5G rollout in China and the United States illustrates how China was able to leverage the benefits of its EMSM approach to its economic and technological advantage. Shortly after the international finalization of the 5G standard in 2018, which opened the way for commercial technologies using it, MIIT allocated large portions of the crucial mid-band spectrum to China's three biggest telecommunications providers for 5G use.* That enabled the providers to begin developing and deploying infrastructure and equipment using the allocated bands, a process that typically takes eight to ten months.[67]

In the United States, allocation of mid-band spectrum was delayed by the FCC's initial decision to prioritize allocation of high-band spectrum for 5G use. While those frequencies offer excellent speed, they do not propagate as effectively as mid-band frequencies and require a higher density of base stations to operate effectively if they are not coupled with other bands. The FCC began auctioning licenses in the high band for 5G use in November 2018, but it did so in smaller allocations than China had, which initially limited the total spectrum available to carriers.[68] Between 2020 and 2022, for example, the United States had only licensed 270 MHz of mid-band spectrum for 5G uses, as opposed to 460 MHz for China, putting the PRC in an advantageous position to compete for dominance in the development of cutting-edge mobile technology.[69] While delays in deployment due to the duration of the auction processes are obvious, some

* As noted above, the mid-band is widely considered the best balance of speed and propagation capabilities for 5G wireless communication.

researchers have also found that assigning non-ideal spectrum bands can also delay network deployment for wireless technologies.[70] Legal disputes, the complexity of FCC rulemaking and auction processes, and concern about assigning commercial uses to mid-band spectrum currently allocated to the military all delayed 5G spectrum allocations and deployment in the United States, as well.[71]

In part as a result of its spectrum management decisions, the PRC has already become the most prominent market in the world in 5G deployment and consumer take-up.[72] 95 percent of China's population is covered by 5G networks, it is the first country in the world to open the entire 6 GHz band for 5G and 6G applications, and the 5G speeds it is able to offer are considerably ahead of those in the United States.[73] Some analysts expect the PRC to ultimately allocate around three times more mid-band spectrum to 5G commercial use than the United States.[74]

The economic benefits of rapidly deploying 5G will be substantial. In China, where mobile services already account for $1.2 trillion of the economy (6.2 percent of GDP), current estimates project that number will rise to $2 trillion by the end of the decade. China has also already deployed more 5G-enabled technologies than the United States.[75] In the United States, in contrast, the Boston Consulting Group estimates that by the end of the decade, 5G could contribute $1.4-$1.7 trillion to the U.S. economy if it is deployed quickly. Analysts at Charles River Associates found that each six-month delay in the deployment of 5G networks would decrease U.S. GDP by $104 billion,[76] and an Accenture analysis found that the U.S. GDP will forfeit $300 billion in potential economic gains annually through 2035 if more mid-band spectrum is not licensed for 5G use.[77] U.S. deployment appears unlikely to catch up quickly, given that China and a number of other countries have already licensed more than twice the amount of mid-band spectrum the United States has for 5G.[78]

China's centralized spectrum management structure and coordination with national industrial policy is also likely supporting a broader range of research into advanced radio frequency communications, including the development of infrastructure for new spectrum allocations and use cases (see below for more on China's leaders in EMSM research). On the future uses of spectrum, for instance, researchers at China Unicom Research Institute [中国联合网络通信有限公司研究院] are investigating potential 6G network architectures with state support via the National Key Research and Development Program of China, China's most prominent funding vehicle for supporting national scientific and technological priorities.[79]

Furthermore, as discussed above, centralization of spectrum allocation within MIIT effectively results in a civilian-first approach to spectrum use. While the military in China jointly issues national spectrum use regulations and has input into MIIT's specific decisions about allocations, it has no publicly identified dedicated spectrum allocations of its own and must work within the framework MIIT devises when its uses of spectrum come into conflict with civilian needs. This civilian dominance in EMSM is explicitly laid out in the 2016 Radio Management Regulations:[80]

> *The national radio management authority [MIIT] shall be responsible for formulating regulations on radio frequency allocation and publishing them to the public. In formulating such regulations, opinions shall be solicited from relevant departments of the State Council and relevant military units, and full consideration shall be given to national security, economic and social development, scientific and technological advancement, and the need for effective utilization of spectrum resources.*

Internal PLA publications on EMSM also highlight this civilian dominance, with one reference work by PLA experts complaining that civilians hold a relatively large share of spectrum resources, that the military's spectrum resources had decreased in recent years, and furthermore that, compared to the civilian sector, the military's EMSM capabilities are relatively limited.[81]

China may also be able to secure benefits in terms of global market access due to its willingness to both align itself with and work to influence international standards via the International Telecommunication Union (ITU) and the WRC, among other standards bodies. In addition to its allocation of mid-band spectrum to 5G uses as detailed above, a good example of this dynamic is the global debate over the best use for the 6 GHz band (specifically, 5.925-7.125 GHz).[82] In the initial debate about this band that came to a head at the 2023 WRC, China and the United States maintained competing positions. The United States preferred a "WiFi-first" approach to this band, while China preferred a "mobile communications-first" approach. To date, the United States has allocated the entire band to WiFi and seen some success in arguing for this use case: Europe and India, among others, have decided to split the difference and allocate the lower half of the band to unlicensed use for WiFi signals, and are continuing to study whether the top half should be allocated to mobile communications.[83] Had China's preferred approach won out, its WiFi producers would have been in a better competitive position for global sales, but because those producers' standards at home do not use this band, U.S. producers have been able to take advantage of this new market for WiFi devices.

**Disadvantages**

China's approach to EM spectrum management allows rapid adoption and scaling of new wireless technologies, but it can also limit innovation, efficiency, and experimentation. The combination of carefully managed market dynamics, centralized allocations, and secrecy about government and military use of spectrum means that many actors hoping to leverage spectrum resources often find themselves uncertain how to do so. While this is less of a problem for large state-owned or state-supported companies like Huawei and China Mobile—in part because they are so deeply enmeshed in MIIT's pursuit of national priorities*—smaller, less favored, or

* For example, Huawei and China Mobile collaborated with MIIT to submit a proposal for "strategic transformation" of some parts of the ITU. Hascall Sharp and Olaf Kolkman, "Discussion Paper: An Analysis of the 'New IP' Proposal to the ITU-T," *Internet Society*, April 24, 2020, https://www.internetsociety.org/resources/doc/2020/discussion-paper-an-analysis-of-the-new-ip-proposal-to-the-itu-t/.

unusual Chinese aspirants to spectrum licenses often find entering this sector very challenging. As interviews with satellite communications companies revealed in a 2019 study, for instance, "companies are not very aware of the public regulations on spectrum licensing; obtaining spectrum often involves negotiations with many different agencies and entities."[84]

This dynamic favoring larger companies means that China's approach to EMSM also has the potential to generally limit innovation and efficiency in spectrum technology. One of the success stories in the U.S. use of spectrum, for instance, is how surprisingly effective the commercial sector has been in making increasingly efficient use of what most analysts and industry groups argue is a woefully insufficient allocation of spectrum.[85] Many analysts also argue that auctions have helped drive U.S. companies to greater efficiency in this area.[86] Conversely, China's choice to forego auction mechanisms is widely thought to limit the efficiency of spectrum use in the country, with some PRC legal scholars, for instance, calling for marketization of spectrum use rights since at least 2015.[87] Other researchers are less critical, but still note areas for potential improvement. For example, in 2021 researchers from the State Radio Monitoring Center note that China's fee-based pricing structure "insufficiently reflects" the real-world use value of some commercial frequencies.[88]

MIIT's mission to manage China's telecommunications and information services markets, including markets reliant on spectrum, may also slow the development of spectrum resources.* Researchers at the State Radio Monitoring Center raised this issue in general in 2015, noting that "in China, due to a late start and long-term influence from the planned economy model of management, radio spectrum resource management remains subordinate to and supportive of sector-specific regulations like telecommunications, broadcasting, and other industry management."[89] Similarly, in 2018 the Radio Association of China noted that competitive allocation of spectrum resources could be more "timely and stable," arguing that a move away from a fully administrative model of approval to incorporate more market involvement would be ideal.[90] SRMC researchers also noted in 2020 that even though valuation of spectrum resources was improving, "for some commercial radio frequencies, their use value is [still] not fully reflected."[91]

* This mission was laid out explicitly in the 2008 State Council document elaborating MIIT's responsibilities, one of which is to: "supervise and manage the telecommunications and information services market in accordance with the law…promote universal telecommunications services, and ensure important communications." General Office of the State Council [国务院办公厅], "Responsibilities, Internal Structure, and Staffing Regulations of the Ministry of Industry and Information Technology (Full Text)" [工业和信息化部职责、内设机构和编制规定(全文)], *Central People's Government of the People's Republic of China* [中华人民共和国中央人民政府], July 17, 2008, https://web.archive.org/web/20100819030711/http://www.gov.cn/zfjs/2008-07/17/content_1048292.htm.

## Integrating Disparate Capabilities: Spectrum Management and Joint Warfighting in the PLA

China's leaders view denying adversary use of the EM spectrum as "necessary to seize and maintain the strategic initiative in a conflict" and see it as a warfighting domain on the same footing as air, space and cyberspace.[92] Remote sensing and communications technologies, in particular, are crucial to effective joint force operations, and will likely become more so as unmanned platforms proliferate.*[93] EMSM is therefore absolutely critical to ensure that PLA capabilities as diverse as radar, communications jamming, geolocation, autonomous weaponry, and satellite imaging operate to their highest potential in challenging conflict environments.

In order to understand how EMSM is likely to impact China's joint warfighting capabilities, it is important to note that the PLA is currently, in many ways, in upheaval. It has seen repeated rounds of reform since late 2015 with the goal of enhancing joint capabilities, an important component of which has been "informatizing" [信息化] the force by unifying information technology and communications standards and improving personnel skill levels when using new information and communications technology (ICT) platforms.[94] And while scholars of the PLA mostly agree that its reforms could ultimately result in improved battlefield performance, there is also general agreement that they have created a certain degree of chaos as restructuring interrupts career paths, new roles require learning new skills, and new bureaucracies need to be navigated.[95]

China's approach to EMSM could help the PLA by offering personnel experience with other service branches, but also hinder it by requiring onerous, labor-intensive processes for dynamic spectrum deconfliction. As laid out above, one important characteristic of China's EMSM system is its close coordination at multiple levels of the military with numerous civilian stakeholders at each level. That could both enhance and limit joint warfighting capabilities. First, while it is not clear what the service branch composition of the reserve EMSM groups in the TCs is, TCs themselves are designed as inherently joint organizations. It is therefore likely that this EMSM structure, all else equal, will give the PLA's EMSM personnel at multiple levels of the PLA numerous opportunities to work directly with individuals from other service branches, better understand force-wide processes, and identify problems with EMSM that may be inhibiting joint operations. The counterpoint, of course, is that the PLA's system for deconflicting spectrum use still appears to be largely manual and labor-intensive, which implies that progress is likely to be slow.

The increasing centralization of the PRC's military spectrum management is also likely to assist the PLA in unifying information technology (IT) standards, a prerequisite for the effective force-

* One of China's motivations for pursuing rapid improvement in its remote sensing capabilities was the ability of U.S. forces to use such capabilities in support of extensive joint force strikes in the first Gulf War. See, *e.g.*, Tate Nurkin et al, "China's Remote Sensing," *U.S-China Economic and Security Review Commission*, December 2024, https://www.uscc.gov/sites/default/files/2024-12/Chinas_Remote_Sensing.pdf.

wide communication and information sharing that would underpin effective joint operations. The 1994 PRC Radio Regulations devolved many aspects of military spectrum management down to individual service branches, which is part of the reason the PLA still has so many problems with interoperability today.[96] As a result, the PLA began to move toward an "all-military" model of shared control. For example, a precursor of the current reserve EMSM groups was created in 2008, in part because the PLA's lack of proper spectrum deconfliction led to embarrassment in an international exercise.[97] By 2013, the PLA was reporting that high-level military exercises in northeast China and in the Chengdu MR were able utilize a single, multi-service joint EMSM system for the first time.[98] This centralization has continued with the creation of the TCs, and the PLA continues to announce progress in integrating spectrum technologies in larger joint forces in major exercises.[99]

By 2018, the PLA was able to deconflict spectrum use within a large joint force using a modular deployment of EMSM personnel from multiple organizations within the military bureaucracy. During the "Peace Mission" exercise in Russia that year, the PLA deployed a modular force made up of EMSM personnel from the CMC, the TCs, and the service branches that was able to deconflict not only a complex joint force on the PRC side made up of aircraft, unmanned aerial vehicles (UAVs), ground vehicles, and radars, but between PRC and Russian forces as well. When spectrum conflicts arose between ground navigation and air command forces -- which made it difficult for aircraft to communicate among themselves and with their foreign partners – the PLA's modular EMSM detachment successfully discovered the root of the problem and corrected it, allowing the exercise to proceed. This was reportedly the first case in which PRC spectrum control forces operated outside the country under the new force structure.[100]

As standards for spectrum use and deconfliction increasingly align across the PLA's service branches, at least four impacts on its military capabilities are likely. First, one key area of interest for military radar development is networking radars of multiple types, ranges, and frequencies to create the most comprehensive possible picture of the battlefield. While the PRC has claimed success in networking all PLA radars at the brigade level, work on expanding the size of such networks appears to continue.[101] EMSM and standards alignment will be crucial to enabling progress toward that goal.

Second, the PLA's increasing ability to deconflict spectrum use and share information in large international exercises will make partnering with other nations – and learning from their experiences – easier for China.

Third, China's approach to spectrum management and the PLA's work to improve EMSM across the force may make it better able to adapt and upgrade its electronic warfare (EW) and intelligence, surveillance, and reconnaissance (ISR) capabilities by drawing on commercial developments, in line with the PRC's broad strategy of military-civil fusion.[102] The PRC's prioritization of civilian needs for spectrum use, counterintuitively, probably makes it easier for the PLA to adapt to changing standards and updated equipment, because the PLA's lack of

dedicated spectrum allocations implies it is more likely to be using modified commercial capabilities in these areas than militaries that have long had their own dedicated spectrum allocations. Many of China's military-capable radars, for instance, are marketed as suitable for use at civilian airports, and researchers at China Electronics Technology Corporation (CETC) have indicated that commercial 4G LTE cellular networks have been adapted to create localized high-speed broadband mobile networks for PLA units.[103] It is worth noting, however, that while this approach may make the PLA more adaptable in EW and ISR, commercially-developed equipment is also generally less secure.

Fourth, China's approach to spectrum management is likely to allow relatively rapid expansion and incorporation of the PLA's space-based military capabilities. In line with its prioritization of civilian capabilities, for instance, the PLA has long utilized commercial satellite imagery, and similar to the U.S. Global Positioning System (GPS), China's Beidou satellite positioning system offers both civilian and military capabilities.[104] Centralized management of spectrum use is also likely to ease the integration of space-based capabilities into the PLA's larger communications network and sensing capabilities.[105] Between 2019 and 2024, for instance, China has doubled the number of PLA ISR satellites in geosynchronous orbit and tripled the number in low-earth orbit.[106] Furthermore, China's relative secrecy surrounding military use of spectrum will make it more difficult for opponents to counter the PLA's uses of satellite communications and harder to identify which satellites appear civilian but are actually dual-use. The Yaogan series of earth-observation satellites, for instance, while presented as civilian, are widely thought to be military imaging satellites owned and operated by the PLA.[107]

# China's International Promotion of its Spectrum Management Priorities

Beijing has been keenly interested in setting global standards for over a decade due to the potential financial, geopolitical, and intelligence benefits. First, being a leader in global standards can lead to substantial revenue streams for holders of "standard essential patents" (SEPs), which regulate technologies crucial to utilizing a particular standard.* Second, if China succeeds in having enough of its proposed spectrum standards adopted, not only will it have access to a larger global market for its products, having a head start with those standards will give it a significant leg up in competition in that market. Third, if China gains control of global standards for wireless technologies, that also gives it greater control over access to its domestic market. Fourth, China would have substantial opportunities for intelligence gathering if it succeeds in

* China currently claims to be the world leader in applications for SEPs related to 5G technology. One estimate put the global royalty income in 2020 on 5G-related SEPs at $20 billion, with large increases expected. Brett D. Shaefer and Danielle Pletka, "Countering China's Growing Influence at the International Telecommunication Union," *The Heritage Foundation*, March 7, 2022, http://aei.org/research-products/report/countering-chinas-growing-influence-at-the-international-telecommunication-union/.

placing its standards and hardware at the core of the most widely used international telecommunications technologies.

Beijing has therefore implemented a coherent national strategy for influencing standards in a wide range of next-generation technologies, in hopes of "surpassing" other nations.[108] The China Standards 2035 [中国标准 2035] initiative directs Chinese entities—government and commercial alike—to increase their influence in international standard-setting for emerging technologies Beijing sees as critical.

According to a leading engineer at MIIT, China is particularly interested in setting standards for wireless technologies through the ITU* and related global standards bodies such as the WRCs and the 3rd Generation Partnership Project (3GPP).[109] In order to achieve its objectives in these

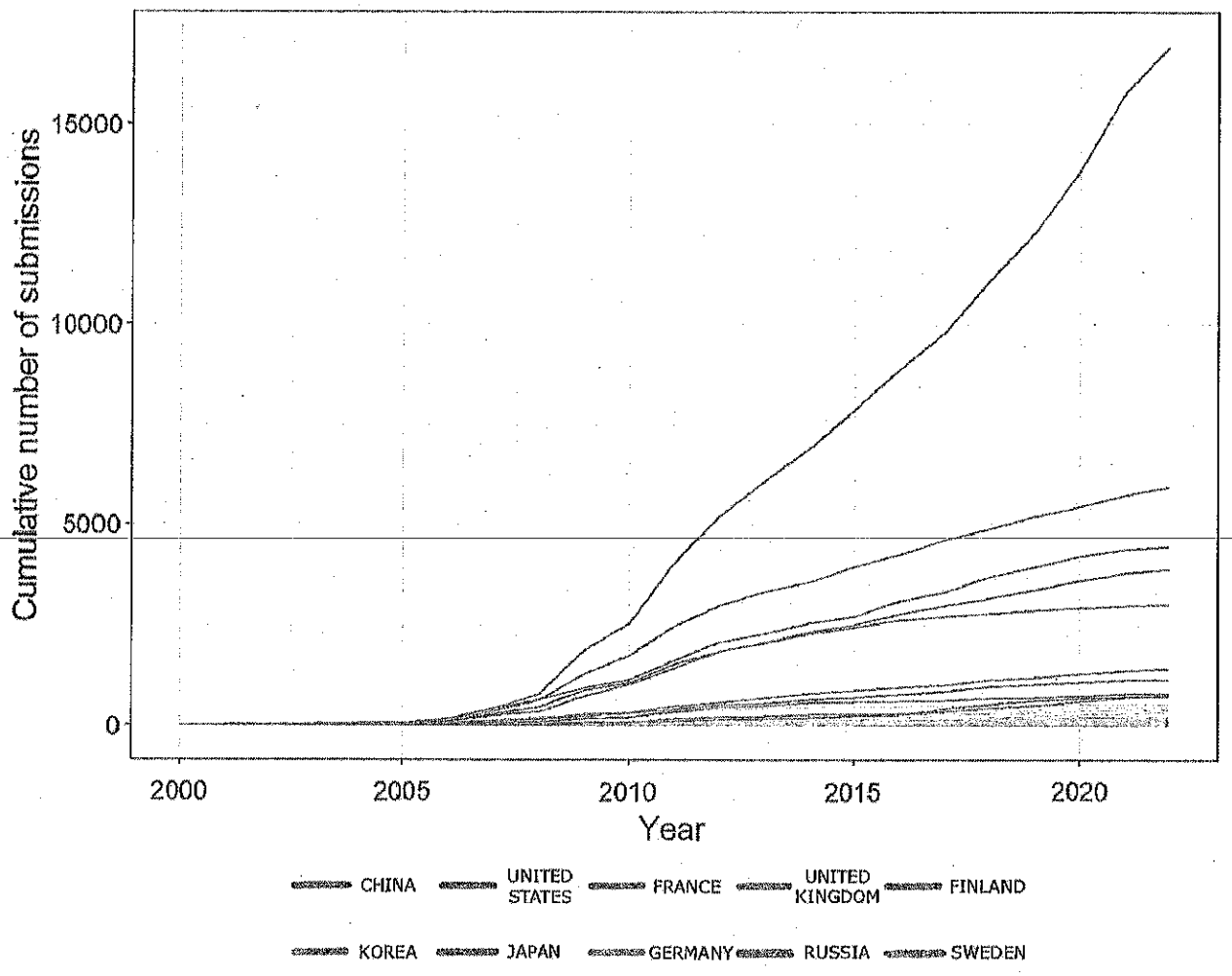


*Figure 3: Cumulative number of submissions to the ITU for top ten submitters, 2000-2022; reproduced with permission of the author.*

* Relevant bodies within the ITU include ITU-T, responsible for setting international standards, and ITU-R, responsible for allocation of spectrum.

fora, China is engaging broadly: it places Chinese experts in a large proportion of ITU leadership positions (one fifth as of late 2021); it produces a huge number of standards proposals for consideration by ITU committees (see Figure 3 above);[110] it is one of the ITU's leading funders; and it competed for and won a bid to host the WRC in 2027.[111]

China's incentives for its representatives—both government and corporate representatives can represent China at the ITU—to propose standards have helped it achieve a striking lead in its cumulative number of submissions at the ITU.* Chinese representatives submitted over 16,000 proposals between 2000 and 2022; the next-largest submitter in that time period was the United States, with around 6,000 (see Figure 3).[112] Huawei, ZTE, China Mobile, China Unicom, and China Telecom alone account for almost a quarter of total contributions received during this time period.[113]

While the ITU does not report comprehensive data on which countries proposed recommendations that were ultimately adopted, and many proposals are adopted without opposition, it is clear that China sees value in any of its proposals being adopted. MIIT regularly issues press releases describing Chinese proposals that were adopted as recommendations at ITU fora. For instance, China hosted a meeting of ITU's terrestrial services study group from April 23 to May 16, 2025, where it submitted 38 proposals on topics such as the satellite IoT and revisions to space service procedures. MIIT reported that all 38 were adopted.[114] While it is difficult to forecast which proposals will turn out to be the most important in the future, one likely example of an important standard is the newly adopted rules for the incorporation of AI into 6G networks, which are aimed at supporting the development of immersive virtual environments. These rules, adopted at the ITU in 2024, were jointly developed by the state-run Chinese Academy of Sciences and China Telecom.[115] While national-level adoption of these standards is voluntary, and they can be contested at higher levels of the ITU if members object after adoption, they nonetheless represent an international consensus that many countries are interested in adopting for the sake of efficiency and access to a larger international market for their products.

In addition to what some analysts have called "flooding the zone" with standards proposals, China has pursued influence in the ITU by pushing for leadership that will pursue PRC interests.[116] American diplomats broadly viewed the PRC's Houlin Zhao, the prior secretary general, as "using his position to bend the ITU toward Beijing."[117] While the Trump administration is pushing for American diplomat Doreen Bogdan-Martin to be voted in to a second term as secretary general, reportedly in part due to concerns about China's expanding influence with the organization, China is likely to push hard for its own candidate once selected.

* These proposals—referred to as "recommendations" in ITU parlance—are "standards that define how telecommunication networks operate and interwork." They are proposed and adopted at numerous smaller ITU meetings and study sessions around the world in the four years between each WRC. "ITU-T Recommendations and Other Publications," *International Telecommunication Union*, n.d., accessed October 1, 2025, https://www.itu.int/en/ITU-T/publications/Pages/default.aspx.

The PRC is also highly active in other standard-setting bodies associated with the ITU, such as the WRC. WRC conferences are held every three to four years and are focused on resolving high-level issues at a global scale.[118] The agenda for each ensuing WRC conference is finalized at the previous one in order to enable an interim cycle of preparatory studies and discussions. Two prominent items on the agenda for the upcoming WRC 2027 are the potential for new bands to be used for international mobile telecommunication, and direct connectivity between satellites and mobile devices, referred to as "direct-to-device" (D2D) satellite communications (including potential spectrum allocations for this service).[119*] It is likely that China and the United States will put forward competing approaches to both of these key problems, in order to minimize the potential costs to their providers of adjusting to new standards and to maximize market access.

China is already preparing its domestic spectrum users and reaching out to international partners about its preferred approaches in advance of the upcoming 2027 WRC. In the case of D2D satellite communications, while studies are ongoing in preparation for the conference and specific proposals have not yet been put forward, MIIT has already issued domestic licenses for satellite mobile phone service to China Mobile, China Telecom, and China Unicom so that they can provide the service, initially, in remote regions, for emergencies, and for maritime traffic.[120] The announcements of these licenses did not specify any spectrum reallocation, so it is likely the initial deployments of this technology will use the spectrum China has already allocated for "mobile-satellite service" [卫星移动业务].[†] Further, Beijing is engaging with Germany, France, Japan, and Brazil to coordinate satellite network usage, and in preparatory meetings PRC experts from China Satellite Corporation [中国卫通集团股份有限公], China Mobile, MIIT, and the National Radio Monitoring Center have been elected into planning roles for the Asia-Pacific regional preparatory meeting for WRC 2027.[121‡] The U.S. proposals for this use case are still in development, but so far seem likely to emphasize protection of incumbent allocations in both the bands under consideration for reallocation and in adjacent bands.[122]

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* This latter service is typically referred to as "direct-to-device" (D2D) satellite communications, mobile satellite service, or in Chinese-language discussions, mobile-satellite service [卫星移动业务] or satellite mobile communications systems [卫星移动通信系统]. China's regulations place satellite-to-mobile (D2D) communications in the same category as other forms of satellite-to-ground communications, including not just mobile phones but also fixed terminals and dedicated mobile terminals in aircraft and vehicles. Ministry of Industry and Information Technology [工业和信息化部], "Regulations for the Management of Satellite Mobile Communication System Terminal Earth Stations" [卫星移动通信系统终端地球站管理办法], *Central People's Government of the People's Republic of China* [中华人民共和国中央人民政府], April 21, 2011, https://www.gov.cn/zhengce/2022-08/23/content_5722701.htm.

† Thirty-one separate frequency bands ranging from 137 MHz to 265 GHz are currently allocated to this use case. "Radio Frequency Allocation Regulations of the People's Republic of China" [中华人民共和国无线电频率划分规定], *State Radio Regulation of China* [中国无线电管理], November 8, 2023, https://www.srrc.org.cn/kindeditor/attached/file/20231108/20231108162331_5223.pdf.

‡ Not all planning roles have been assigned yet, so it is not yet clear how much influence these assignments will offer the PRC.

China's expanding influence with the ITU and the WRC have generated concern, both in the United States and in some partner nations. Researchers at MERICS in Germany, for instance, argued that the Chinese-developed IPv6+ internet protocol being promoted by, among others, Huawei, "threatens the fair and equal treatment of traffic on the internet."[123] More recently, in the summer of 2025, the ITU Council decided that Shanghai would host the 2027 WRC.[124] Some U.S. observers—including 12 members of the U.S. Congress—have expressed concern that the choice of locale cedes too much agenda-setting power to China and may pose security risks.[125] Given continuing geopolitical tensions and prior controversies over China's proposals, that concern seems likely to persist.

# Leadership in Developing China's Spectrum Resources

China is pursuing a comprehensive slate of research into the next generation of spectrum management technologies. Supported by state resources and centrally-led industrial policies and conducted at many different institutions, this research focuses on technological approaches to increasing efficiency and reliability in the use of EM spectrum and on learning from how other countries and international organizations manage their spectrum. By many metrics, China's researchers are much more active in this area than those of the United States.

The technologies addressed in this report and described below focus on management of the EM spectrum, which are distinct from those needed to develop wireless applications. Spectrum management technologies include sensors for monitoring spectrum use, tools for testing equipment for compatibility, algorithms and hardware for dynamic spectrum allocation, hardware to reduce interference, fingerprinting tools for identifying sources of interference, and software for managing data collected by monitoring equipment. The remainder of this section identifies the PRC's top companies, laboratories, and universities producing cutting-edge research in spectrum management technology based on patent registrations and Chinese-language journal publications, summarizes the areas of research they are focusing on, and identifies potential implications for the United States. It excludes organizations focused primarily on component production for technologies that use the EM spectrum and the provision of wireless technologies. For a comparison of spectrum technology types, see Figure 4 below.

The areas currently of most interest for the top PRC organizations researching spectrum management are:

- "Cognitive" approaches to wireless communication and sensing such as cognitive radio and cognitive radar, in which the equipment senses the EM environment in which it is operating and dynamically adjusts its spectrum use and/or processing algorithms to maximize performance.[126]
- Dynamic spectrum allocation and management, in which available frequency resources are assigned to users or devices in real time, based on changes in network conditions and demand.[127]

- Monitoring technologies, both to feed into dynamic approaches like cognitive radar and to monitor allowed use and identify cases of impermissible interference. Especially in military contexts, this can include fingerprinting to identify a particular source or transmission platform.
- Foreign policies, especially ITU policy, other countries' spectrum management approaches, and other countries' military uses of spectrum.

| Category | Examples | PRC Leaders |
|---|---|---|
| Spectrum management | • Monitoring sensors<br>• Tools for testing compatibility<br>• Software for managing sensor data | • CETC Network and Communications Institute<br>• Chengdu DG Broadtrum Information Technology Company<br>• Chengdu Huari Communication Technology Company<br>• CSSC 701st Research Institute<br>• Guangzhou Institute of Communications<br>• National University of Defense Technology<br>• PLA Units 31437, 31638, 91977<br>• University of Electronic Science and Technology of China<br>• Xidian University |
| Component producers | • RF chip manufacturers<br>• Radar transmitter manufacturers | • Lansus<br>• Maxscend<br>• OnMicro<br>• Vanchip[128] |
| Wireless providers | • Mobile phone providers<br>• Wi-Fi providers<br>• Satellite operators | • Alibaba<br>• Huawei<br>• Tencent<br>• Xiaomi<br>• ZTE[129] |

*Figure 4: Categories of spectrum use technologies*

Research in these areas is distributed across universities, military units, defense SOEs, and commercial organizations. The most prominent organizations developing EMSM technology are subsidiaries of the major state-owned defense conglomerates. CETC is one such electronics and information technology company, and it has extensive, longstanding ties to the PLA.[130] CETC operates two research institutes that focus on EMSM and related spectrum technologies:

- CETC Network and Communications Institute [中国电科网络通信研究院]
- Guangzhou Institute of Communications [广州通信研究所][131]

The Guangzhou Institute* advertises EMSM as one of its primary research areas, with its researchers publishing on dynamic spectrum allocation technology, spectrum sensing for cognitive radio applications, and the U.S. military's approach to EMSM.[132] It most likely

* Also known as the 7th Research Institute of CETC.

provides EM environment testing for some components of the PLA, and works closely with the CMC's Equipment Development Department (EDD).[133]

The Network and Communications Institute* manages a similar research portfolio.† Notable examples of its work include developing a "big data management system" for EM data on naval battlefields and cognitive approaches aimed at using software-defined networks to increase efficiency in spectrum use, for instance through dynamic allocation.[134] Finding ways to better manage data about highly complex battlefield EM environments is a prerequisite to managing friendly uses of spectrum such that any system that relies on friendly sensor or communication networks is able to operate effectively. It is also necessary to conduct EW and jamming operations against one's opponent. As the authors from the Network and Communications Institute put it in their cited article, "[w]ith the rapid development of battlefield perception, data processing, and transmission technologies, the introduction of big data technology into naval electromagnetic spectrum management is imperative." Dynamic allocation, in turn, is needed on the battlefield to take advantage of the clearer understanding of the EM environment that such a big data management system could produce.

Another defense SOE, the China State Shipbuilding Corporation (CSSC), is also active in EMSM research via its 701st Research Institute, which oversees the nationally-funded Defense Science and Technology Key Laboratory of Electromagnetic Compatibility [电磁兼容性国防科技重点实验室].[135] This laboratory focuses on electromagnetic compatibility in naval warfare platforms, but it also works in a range of other sectors, including space and radar.[136] This kind of research will be crucial to support the PLA's efforts to more effectively standardize its EMSM processes and improve joint-force interoperability.

The military itself is also engaged in EM spectrum technology research. Perhaps the most prominent military institution doing so is the National University of Defense Technology [国防科技呆鹅] (NUDT), the PRC's largest comprehensive degree-granting military university. It operates the NUDT 63rd Research Institute that hosts a dedicated EM spectrum research office and a PLA Electromagnetic Spectrum Technology Research Center [全军电磁频谱技术研究中心].‡[137] This organization's research has focused on EMSM, spectrum security, ITU policy, and foreign military spectrum intelligence.[138]

Operational military units also occasionally publish research into EM spectrum technology. PLA Army Unit 31437 [31437 部队] has been noted taking an interest in EMSM topics, particularly in protecting radio, radar, and 5G performance in diverse environments; cognitive radio

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* Also known as the 54th Research Institute of CETC.

† Many of the defense-related SOE research institutes maintain overlapping research portfolios, likely because they were historically subordinate to different companies that have since been merged in the waves of consolidation that have occurred in the PRC's defense industry.

‡ Publicly available sources were unclear as to how these two organizations are different, but the former may have more of a research management role.

technology to maintain EM bandwidth for radio, radar, and 5G during peak demand periods in diverse environments;[139] training in EM spectrum monitoring;[140] and EM signal fingerprint recognition on the battlefield.[141] Improved monitoring and signal fingerprint recognition together would enable the PLA to better operate in unfamiliar environments and identify opponents, while improved cognitive EM capabilities would enhance operations by enabling more consistent communication and higher-resolution imaging. PLA Unit 91977 [91977 部队] is the PLA Navy's primary research institute for network information systems. It has helped design an intelligent EM spectrum-assisted decision-making system for improved EMSM and spectrum sensing capabilities to support cognitive radio.[142] PLA Unit 31638 [31638 部队]* also carries out prominent research on EMSM, including on cognitive radio, intelligent resource scheduling in radar networks, and GNSS/GPS spoofing and interference.[143] Radar networking has been a particular area of interest to PLA planners and researchers, because while U.S. government analysts have concluded that China's newest individual radar platforms are cutting-edge, the PLA's ability to knit them together beyond individual brigades is still somewhat limited.[144] Integrating diverse and geographically separated radar systems can improve battlefield awareness by offering better detection of stealthy targets, more geographical coverage, and improved resistance to interference and countermeasures.

Spectrum technology research is also conducted at public universities, which in China often host important state-funded laboratories.[145] The University of Electronic Science and Technology of China [电子科技大学] (UESTC) is one of the more prolific institutions publishing on spectrum sensing and intelligent spectrum management.[146] Its School of Information and Communication Engineering [信息与通信工程学院] is particularly prominent in this field, and it also hosts related expertise in electronic countermeasures.[147] Xidian University [西安电子科技大学] affiliates in this area broadly seem to focus on electronic warfare or other highly contested EM environments. They hold several patents for EMSM and spectrum control methods, including, for example, concepts for intelligent countermeasures focused on maintaining system control in contested EM environments and blockchain-based approaches for maintaining spectrum security when a wireless network is under attack.[148] Similar to the cognitive systems described above, this kind of research helps ensure that PRC actors using spectrum in contested or otherwise challenging environments are best able to maintain secure communications, radar visibility, and network integrity.

Finally, two private-sector entities are also active in EMSM research and spectrum technology. While well-known companies like Huawei are world leaders in, for instance, patenting 5G technology applications, they do not typically appear to be leaders in the narrower area of EMSM. On that front, Chengdu DG Broadtrum Information Technology Company [成都大公博

* The specifics of this unit's composition are unclear, but it may be a PLA Army unit under the 75th Group Army in the Southern Theater Command.

创信息技术有限公司][*] is one leader. A manufacturer of EMSM equipment and a primary supplier to the PLA, it integrates research, development, production, and services in this sector.[149] Its products include fixed, mobile, quick-deployment, and portable systems for EM spectrum monitoring and direction finding; systems for monitoring aviation assets and high-speed rail; and phased-array antennas for a variety of applications.[150] Like most of the other research organizations highlighted here, it is also pursuing intelligent approaches to spectrum management, for instance in a signal source for radio training and drills that can simulate a wide range of complex EM environments.[151]

Chengdu Huari Communication Technology Company [成都华日通讯技术股份有限公司] operates similarly but focuses on civilian applications more than DG Broadtrum. Its primary range of products reportedly targets the National Radio Office's regulations[†] on technical requirements for radio monitoring facilities.[152] Those products include both fixed and mobile "spectrum management stations," monitoring equipment, and direction-finding antennas.[153] It has been a key provider to multiple national-level projects aimed at improving spectrum management, including a spectrum monitoring system along the border in Guanxi Province and Heilongjiang Province, the 3D spectrum monitoring system around Beijing, and the drone detection and control system around Beijing's airport.[154] Products like these will be crucial to EMSM organizations across the country as MIIT and the CMC JSD work to standardize mechanisms for allocating, monitoring, and deconflicting spectrum use at lower levels of organization.

By some measures, China is moving more rapidly in spectrum management research than the United States. In the case of cognitive radar, for instance, U.S. and PRC publication rates have been roughly similar in the last decade, but the PRC has published over three times as many research papers on intelligent radar.[155] With regard to cognitive radio, China appears to be producing far more research than the United States. Statistics from the Institute of Electrical and Electronics Engineers (IEEE) journal focused on cognitive communications technologies in 2024 indicated that China-based researchers submitted more than six times as many manuscripts as U.S.-based researchers, with more than five times as many ultimately published.[156] In terms of general competition in research into spectrum-reliant technologies, the Australian Strategic Policy Institute (ASPI) rates the risk of China monopolizing advanced radio frequency communications technologies as medium, but ranks that risk as high in other critical applications

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[*] Also known as DG Broadtrum or Chengdu Dagong Bochuang Information Technology Company.

[†] Specifically, the Provincial Radio Monitoring Facilities Construction Specifications and Technical Requirements (Trial) [省级无线电监测设施建设规范和技术要求（试行）] issued in 2019. Radio Management Bureau of the Ministry of Industry and Information Technology [工业和信息化部无线电管理局], "The State Radio and Television Administration Issued the 'Provincial Radio Monitoring Facility Construction Specifications and Technical Requirements (Trial)'" [国家无线电办公室印发《省级无线电监测设施建设规范和技术要求（试行）》], *Hunan Radio Administration* [湖南无线电管理], July 9, 2019, https://gxt.hunan.gov.cn/gxt/wxd_ycl/gldt_ycl/w_gzdd_ycl/201907/t20190709_5393453.html.

relying on the EM spectrum such as electronic warfare, multispectral and hyperspectral imaging sensors, and radar.[157]

# Conclusion

China's approach to managing the electromagnetic spectrum blends a willingness to adhere to international standards and an interest in influencing them with a relatively centralized, but opaque and sometimes slow-moving system for allocating spectrum bands. It has gained some benefits from this approach, in particular its ability to leap ahead in 5G deployment, but it is not clear whether the approach will continue to be as beneficial in the future. Some disadvantages, such as discouraging smaller players from entering the market and potentially limiting innovation, are already apparent. Regardless of those problems, China is clearly pursuing global dominance in both military and civilian spectrum management technologies, which if successful would generate severe challenges for the development of wireless technology in the United States, for American companies' market access and competitiveness, and in U.S. military operations and procurement.

# Appendix A: Main Targets for 14th FYP Informatization Development

| No. | Category | Indicator | 2020 | 2025 | Nature |
|---|---|---|---|---|---|
| | General development levels | Digital China Development Index | 85 | 95 | Expected |
| 1 | Digital infrastructure | Scale of netizens (million) | 989 | 1,200 | Expected |
| 2 | | 5G user adoption rate (%) | 15 | 56 | Expected |
| 3 | | 1000M and higher-speed optical fiber access users (1000 households) | 6400 | 60,000 | Expected |
| 4 | | IPv6 active user number (million) | 462 | 800 | Expected |
| 5 | Innovative capabilities | New-generation information technology industry invention patent holding per 10000 inhabitants | 2.7 | 5.2 | Expected |
| 6 | | IT project investment proportion of all social fixed asset investment (%) | 3.5* | 5.8 | Expected |
| 7 | | Strength of R&D investment in the computer, telecommunications and other electronic equipment manufacturing sector (%) | 2.35 | 3.2 | Expected |
| 8 | | Nationwide number of high and new technology enterprises (1000) | 275 | 450 | Expected |
| 9 | Industrial transformation | Core digital economy industries' added value proportion of GDP | 7.8 | 10 | Expected |
| 10 | | Proportion of completely digitized enterprises in critical operational segments (%) | 48.3 | 60 | Expected |
| 11 | | Enterprise industrial equipment cloud usage rate (%) | 13.1 | 30 | Expected |
| 12 | | Online retail value (trillion Yuan) | 11.76 | 17 | Expected |
| 13 | | Information consumption scale (trillion Yuan) | 5.8 | 7.5 | Expected |
| 14 | Governmental services | Provincial-level administrative licensing online handling rate (%) | 80 | 90 | Expected |
| 15 | | Online governmental service real-name usage scale (million) | 400 | 800 | Expected |
| 16 | | E-social security card application rate (%) | 25 | 67 | Expected |
| 17 | | E-litigation proportion (%) | 18 | 30 | Expected |

Source: Central Cyberspace Affairs Commission of the Chinese Communist Party.[158]

# Appendix B: China's Priorities for Mobile Communications

Selected from MIIT's 5G Large-Scale Application 'Setting Sail' Plan; this is a representative sample rather than a complete listing of every priority, some of which are very vague.[159]

| | |
|---|---|
| **Broadcasting** | **Large-scale AI models** |
| **Cloud devices** | **Smart agriculture** |
| **Extended reality business systems** | **Smart homes** |
| **Glasses-free 3D** | **Smart mines** (remote tunneling, remote fully mechanized mining, unmanned mining trucks) |
| **Industrial internet** (manufacturing, mining, railways, defense) | **Smart mobile terminals** |
| **Intelligent connected vehicles** (with smart cabins) | **Smart oceanic applications** |
| **Intelligent oil and gas applications** (unmanned inspections, environmental information collection) | **Smart power** (intelligent inspection and distributed energy management) |
| **Intelligent robots** | **Smart transportation** (advanced autonomous driving, remote control of port machinery) |
| **Interactive video with AI integration** | **Smart wearables** |

# Appendix C: Military Spectrum Management in and below the Theater Commands

The EMSM committees in the TCs operate much as the JSD version does, by managing the TC's own EMSM and coordinating with the relevant civilian organizations to deconflict the use of shared spectrum. For example, the predecessor to the Northern TC, the Shenyang MR, conducted an exercise in 2013 that required spectrum use deconfliction across the jurisdictions of multiple cities and counties. Public reports highlight how the EMSM committee established a "Military-Civil Electromagnetic Spectrum Joint Management and Control Mechanism" [军地电磁频谱联管联控机制], which they credited as being responsible for reducing needed planning time down from two weeks or more in previous exercises.[160] In that case, deconfliction reportedly involved intensive cooperation between military and civilian authorities in eleven jurisdictions to monitor the relevant frequencies and address any interference issues. Notably, that cooperation mechanism was developed based on a higher-level regional spectrum cooperation agreement, which called for the establishment of a high-level organization dedicated to coordination of resources, a joint command mechanism, and regular meetings to discuss coordination needs.* That agreement ultimately led to the deployment of hundreds of monitoring stations, both fixed and mobile, which greatly eased spectrum deconfliction during ensuing exercises in the region.[161]

Available evidence about the TC-level equivalents of the CMC JSD's All-Military Reserve Electromagnetic Spectrum Management Center, which are called the Reserve Information and Communications Groups [备役信息通信大队],[162] indicates that they perform broadly similar tasks focused on engaging with civilian stakeholders to deconflict spectrum usage when problems arise.[163] For instance, in 2024 the Northern TC Reserve Information and Communication Group participated in Shandong Province's annual radio monitoring technology drill, a competition held between twenty-seven teams that included government, military, and private sector specialists.[164] The likely predecessors to these groups, which were housed in provincial military reserves, pursued a similar mission.† For example, in 2018, the Guangdong

* This agreement was titled "Interim Measures for Coordination of Electromagnetic Spectrum Management in the Northeast Military Region" [东北地区军地电磁频谱管理协调暂行办法].

† Recent references to provincial military reserve EMSM spectrum management units have all but disappeared. That is likely due to the substantial reorganization of the PLA's reserve forces between 2016 and 2021. The most important of those changes were the removal of reserve units from local provincial command and placing them directly under CMC supervision, the near disappearance of references to specific named reserve brigades, and the reorganization of at least some of the reserves into bases subordinate to the TCs. As Figure 2 in this report shows, while historical data would suggest the existence of TC reserve EMSM centers, no public evidence of such centers is available. They may exist and no longer be publicly discussed, or they may have been combined with the reserve EMSM groups in the TCs. On reserve reforms, see Joshua M. Arostegui, "China's Next Step in Modernizing the People's Liberation Army: A New Reserve Service System," *U.S. Army War College Strategic Studies Institute,* December 5, 2024, https://ssi.armywarcollege.edu/SSI-Media/Recent-Publications/Article/3986350/chinas-next-step-in-modernizing-the-peoples-liberation-army-a-new-reserve-servi/.

Province Reserve EMSM Group [广东预备役电磁频谱管理大队] ran a drill with five municipal radio management agencies, four district radio management agencies, four mobile service providers, and an unspecified number of amateur radio operators in order to practice management of emergencies, securing radio communications, and identifying sources of interference.[165]

Even though each Reserve Information and Communications Group is a component of, and subordinate to, the leadership of its TC, they are likely also subordinate to other authorities. The CMC JSD's All-Military Reserve Electromagnetic Spectrum Center is one such authority. It has reportedly been heavily involved in organizing training drills and exercises for lower-level reserve groups. Local party committees and some form of industry supervision also likely help oversee the activities of these groups.[166]

Below the TC level, processes do not appear to be standardized. In 2018, for example, when a brigade in the Southern TC was struggling to identify a source of EM interference, it responded by establishing a Military-Civilian Cooperative Mechanism for EM Spectrum Control [电磁频谱管控军地协作机制] with local authorities. The reporting on this mechanism suggests that it persisted past the initial need, working on an ongoing basis to discuss and resolve local spectrum issues.[167] Both the fact that this mechanism reportedly emerged as a response to one specific event and its unconventional naming indicate that such organizations and processes are not yet likely to be standardized across brigades.

# Notes

[1] See, *e.g.*, "What is Spectrum Management?" *U.S. Department of Transportation*, October 18, 2019, https://www.transportation.gov/pnt/what-spectrum-management.

[2] In 2014, for example, one priority for spectrum management was strengthening coordination between the PLA and local governments. "All-Army Reserve EMSM Center Director Yin Tiehua Arrives to Inspect and Guide Work in Ji'an" [全军预备役频管中心尹铁华主任一行莅临吉安局视察并指导工作], *Ji'an City (Jiangxi Province) Radio Management Bureau*, November 28, 2014, https://web.archive.org/web/20191222045620/http://jxciit_www.jxciit.gov.cn/(S(wwhfwp55srj5dbvgt0ztax55))/Item.aspx?id=35519.

[3] "Rationally Developing Radio Resources to Promote the Development of National Defense, Civil Aviation, and the Information and Communication Technology Industry — Interpretation of the Radio Management Regulations of the People's Republic of China" [合理开发无线电资源　促进国防、民航与信息通信技术产业发展——《中华人民共和国无线电管理条例》解读 ], *Xinhua News Agency* [新华社], November 26, 2016, https://www.gov.cn/zhengce/2016-11/26/content_5137920.htm.

[4] "China to Encourage More Private Enterprises to Participate in Telecommunications Sector," *Global Times*, October 7, 2023, https://www.globaltimes.cn/page/202310/1299382.shtml.

[5] "Radio Management Regulations of the People's Republic of China" [中华人民共和国无线电管理条例], *Central People's Government of the People's Republic of China* [中华人民共和国中央政府], November 11, 2016, https://www.gov.cn/zhengce/content/2016-11/25/content_5137687.htm.

[6] "Radio Management Regulations of the People's Republic of China" [中华人民共和国无线电管理条例], *Central People's Government of the People's Republic of China* [中华人民共和国中央政府], November 11, 2016, https://www.gov.cn/zhengce/content/2016-11/25/content_5137687.htm.

[7] "Center Introduction" [ 中心介绍], *State Radio Regulation of China* [中国无线电管理 ], accessed September 13, 2025, https://www.srrc.org.cn/about.aspx; Kan Runtian, "Radio Spectrum Management in China," *International Telecommunication Union presentation by Director General Bureau of Radio Regulation*, MIIT, September 11, 2017, https://www.itu.int/en/ITU-D/Regional-Presence/AsiaPacific/Documents/Events/2017/Sep-SECB/Presentations/D1-2-Kan%20Runtian-Radio%20Spectrum%20Management%20Strategies%20in%20China.pdf; "Responsibilities of China's Radio Regulatory Agency" [中国无线电管理机构职责], *State Radio Regulation of China* [中国无线电管理], August 16, 2010, https://www.srrc.org.cn/article2011.aspx.

[8] "Responsibilities of China's Radio Regulatory Agency" [中国无线电管理机构职责], *State Radio Regulation of China* [中国无线电管理], August 16, 2010, https://www.srrc.org.cn/article2011.aspx.

[9] "Delegation of the PLA Frequency Management Office visited CCBN2012" [全军频管办参观团参观CCBN2012], *CCBN* [CCBN 官网 ] , March 23, 2012, http://kejiao.cntv.cn/program/ccbn/20120323/100337.shtml.

[10] Marcus Clay, "To Rule the Invisible Battlefield: The Electromagnetic Spectrum and Chinese Military Power," *War on the Rocks,* January 22, 2021, https://warontherocks.com/2021/01/to-rule-the-invisible-battlefield-the-electromagnetic-spectrum-and-chinese-military-power/; "Notice of the Ministry of Industry and Information Technology on Issuing the National Radio Management Plan (2016-2020)" [工业和信息化部关于印发国家无线电管理规划（2016－2020年）的通知], *Cyberspace Administration of China* [中华人民共和国互联网信息办公室], August 29, 2016, https://www.cac.gov.cn/2016-08/31/c_1119487645.htm.

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[13] "Notice of the Ministry of Industry and Information Technology and 11 Departments on the Issuance of the 'Upgraded Plan for the "Sailing" Initiative on Large-Scale 5G Applications'" [工业和信息化部等十二部门关于印

发《5G 规模化应用"扬帆"行动升级方案》的通知], *Central People's Government of the People's Republic of China* [中华人民共和国中央人民政府], November 22, 2024, https://www.gov.cn/zhengce/zhengceku/202411/content_6989412.htm.

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[15] "Ten Major Events in China's Radio Management 2024" [2024 年度中国无线电管理十件大事], *State Radio Regulation of China* [中国无线电管理], January 10, 2025, https://web.archive.org/web/20250815044748/https://www.srrc.org.cn/article34268.aspx; Wang Wenjie [王文捷], "Electromagnetic Spectrum Research Institute Recruitment Announcement" [电磁频谱研究院招聘启事], *Nanjing University of Aeronautics and Astronautics* [南京航空航天大学], July 28, 2024, https://cog.nuaa.edu.cn/2024/0728/c757a351316/page.htm.

[16] Rogier Creemers et al, "Translation: 14th Five-Year Plan for National Informatization – Dec. 2021," *DigiChina*, January 24, 2022, https://digichina.stanford.edu/work/translation-14th-five-year-plan-for-national-informatization-dec-2021/.

[17] "The Ministry of Industry and Information Technology (MIIT) has Adjusted the 700MHz Frequency Band Usage Plan to Provide Frequency Support for the Development of Low-Frequency 5G in China (with Interpretation)." [工信部调整 700MHz 频段频率使用规划 为我国低频段 5G 发展提供频率保障（附解读）], *MIIT Radio Management Bureau* [工信部无线电管理局] via the Hunan Radio Administration [湖南无线电管理], April 2, 2020, https://gxt.hunan.gov.cn/gxt/wxd_ycl/hyzx_ycl/hyzx_ycl_1/202004/t20200402_11870300.html.

[18] "Ten Major Events in China's Radio Management 2024" [2024 年度中国无线电管理十件大事], *State Radio Regulation of China* [中国无线电管理], January 10, 2025, https://web.archive.org/web/20250815044748/https://www.srrc.org.cn/article34268.aspx.

[19] "Ten Major Events in China's Radio Management 2024" [2024 年度中国无线电管理十件大事], *State Radio Regulation of China* [中国无线电管理], January 10, 2025, https://web.archive.org/web/20250815044748/https://www.srrc.org.cn/article34268.aspx.

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March 9, 2026

President Donald J. Trump
The White House
1600 Pennsylvania Avenue NW
Washington, DC 20500

Dear President Trump:

It is with great pride that the United States remains at the forefront of technological innovation. We continue to lead in the development of digital devices and services that people around the world rely on in their daily lives, while also adding billions of dollars to our economy. But this dominance, as well as our economic and national security, is being threatened by the People's Republic of China (PRC), under the rule of the Chinese Communist Party (CCP). Under CCP leadership, the PRC has made significant strides in their quest to overtake the United States as the world's technology leader by subsidizing and stealing technology across a wide range of industries, including communications technologies, all of which puts Americans at risk.

The PRC also seeks to sideline the United States in international telecommunication and technology standards bodies. If successful, our allies and partners around the world may increasingly turn to CCP-backed entities for telecommunications solutions and digital services, eroding the influence of our world-class American and allied information and communications technology industries and compromising our shared economic and security interests.

With this in mind, we write about upcoming international engagements at the International Telecommunication Union (ITU). The ITU is responsible for international coordination of communications services, including global spectrum allocations and satellite orbits. U.S. participation in the ITU is essential to maintaining our competitive edge in the global economy.

The ITU's Plenipotentiary Conference takes place later this year and will oversee the election of multiple positions within the organization, including Secretary-General, the 48-seat Council that governs the ITU, and 12 Radio Regulations Board members. It is imperative that the U.S. government give its full support to those Americans being considered for these positions, including the re-election of current Secretary-General Doreen Bogdan-Martin. Secretary-General

Bogdan-Martin has demonstrated clear leadership and experience throughout her tenure at the ITU and should be reelected.

Additionally, the ITU announced last year that it would hold the 2027 World Radiocommunications Conference (WRC-27) in Shanghai, China. We appreciate that, despite the location and the inevitable challenges that come with it, your Administration recognizes that the United States should remain an active participant in this conference. Participants will make key decisions that will establish the spectrum bands and technical rules for next-generation communications technology, including 6G, for the satellite and commercial mobile radio industries. It will also be an important opportunity to promote our nation's prior policy position of utilizing the entire 6 gigahertz (GHz) band for Wi-Fi and other unlicensed uses.

To ensure our best opportunity for success at WRC-27, it is essential that our nation coordinates across all federal agencies and with the private sector to establish clear, unified positions for WRC-27. This should include defending the U.S. position on the 6 GHz band for unlicensed use as well as identifying additional bands for International Mobile Telecommunications (IMT) service. Failing to establish clear national positions on these matters risks undercutting our own advocacy and giving the PRC the upper hand.

We also appreciate your recent nomination of Adam Cassady as Ambassador at Large for Cyberspace and Digital Policy to lead these efforts as it is an important step forward. Nevertheless, we respectfully request a briefing on your Administration's efforts to prepare for these upcoming engagements, including efforts to support the candidacies of Secretary-General Bogdan-Martin and other Americans, the timelines for developing consensus positions and working with partners and allies in our region and beyond, as well as the status of negotiations of the Host Country Agreement with the PRC.

We look forward to continuing our partnership with you and your Administration to ensure the United States continues to be a global technology leader.

Sincerely,

Brett Guthrie
Chairman
Committee on Energy and Commerce

Frank Pallone, Jr.
Ranking Member
Committee on Energy and Commerce

cc:
Marco Rubio, Secretary, Department of State
Howard Lutnick, Secretary, Department of Commerce

Arielle Roth, Assistant Secretary of Commerce for Communications and Information, National Telecommunications and Information Administration
Brendan Carr, Chairman, Federal Communications Commission