

Europe's 6 GHz Crossroads Part I:

What the RSPG Decision Means for Wi-Fi and the EU Digital Economy

This article evaluates the recent Radio Spectrum Policy Group (RSPG) opinion regarding the 6 GHz band in Europe, which recommends prioritizing the upper portion of the spectrum for Mobile/Fixed Communication Networks (MFCN). The author contends that this approach risks creating inefficient spectrum silos and overlooks the critical role of Wi-Fi as the primary, energy-efficient, and cost-effective technology for indoor and local-area connectivity. By advocating for a "better together" strategy, the article demonstrates how shared spectrum models, utilizing Automated Frequency Coordination (AFC) and dynamic access mechanisms, can enable the coexistence of Wi-Fi and MFCN. Ultimately, the article argues that adopting such a collaborative, technology-neutral framework is essential for meeting Europe's Digital Decade goals, fostering innovation, and maintaining global competitiveness in the transition toward 6G.

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Introduction

With release of the final opinion of the European Commission's regulator advisory body, the Radio Spectrum Policy Group (RSPG), the long-running fight over the 6 GHz band in Europe has moved to a new phase. That recommendation urges the EC to prioritize most of the upper 6 GHz band for Mobile/Fixed Communication Network (MFCN) operations, i.e., 4G/5G, while preserving a portion of the band as a guard band for possible future use by license exempt services, depending on the outcome of WRC-27. The RSPG's opinion will now be taken up by the European Commission and its member states. Some observers have framed the RSPG opinion as an unqualified win for mobile operators, but those views ignore that the opinion leaves ample opportunities in the band for Wi-Fi and other license exempt technologies. Nevertheless, if adopted by the Commission, the RSPG opinion's focus on MFCN will diminish Europe's future ability to compete and innovate globally.

Certainly, the opinion prioritizes MFCN operations in most of the 6425–7125 MHz spectrum. Strictly followed, such a narrowly focused approach risks locking Europe into legacy-style spectrum policies that overlook the potential of shared spectrum as the foundation of a balanced, future-proof connectivity ecosystem. But a closer review of the opinion gives reason for hope. First, as noted above, it allows for the possible use by Wi-Fi and other license exempt technologies in the bottom 160 MHz of spectrum (6425 – 6585 MHz) post WRC-27. It also recommends that member states have the freedom to decide how much of the spectrum above 6585 MHz should be allocated for future IMT use and allows for other models to be investigated to enable the secondary use of Wi-Fi in the IMT-prioritized portion of the band.

While these are positive signs, a stronger approach and one that would have more closely conformed to related EC mandates would have refrained from focusing only on MFCN spectrum needs and embraced sharing solutions enabling co-existence between MFCN and Wi-Fi as the core European objective going forward. Spectrum is a finite resource, and shared use encourages multiple technologies and stakeholders to access it efficiently instead of creating inefficient silos.

Wi-Fi is a low-power, short-range technology with a small coverage radius and a correspondingly lower probability of harmful interference to other users. This makes contention-based access workable and explains Wi-Fi's success as a coexistence technology in homes, enterprises, and hotspots. By contrast, cellular macro networks operate at much higher power and over much larger radii; as the cell radius grows, the potential interference footprint grows non-linearly, which is why macro 5G/IMT layers must rely on planned, centrally coordinated spectrum use rather than Wi-Fi style contention.

Turning to the 6 GHz band specifically, the band is not as well suited to providing indoor coverage from higher power outdoor 5G/IMT base stations as other IMT bands lower in the spectrum. In this context, "sharing" in the upper 6 GHz spectrum could be provided in the future as opportunistic or coordinated sharing between Wi-Fi and MFCN (using appropriate tools such as geolocation databases, AFC and other dynamic spectrum access mechanisms where needed), so that low-power Wi-Fi can opportunistically reuse spectrum where it does not conflict with high-power macro-operations. As noted above, the RSPG opinion explicitly leaves room for EU Member States to adopt such sharing models in the band.

Extending this coordinated sharing philosophy across the 6 GHz range and beyond could make Europe a leader in efficient, equitable spectrum use that advances innovation and competitiveness, while respecting the different interference potential and sharing capabilities of Wi-Fi and MFCN technologies. As European policies may influence regulatory policies elsewhere, CEPT and the EU could inspire regulators in other regions with similar needs to adopt fair and future-proof spectrum frameworks that allow low-power Wi-Fi and high-power

MFCN macro to thrive side by side, each using sharing mechanisms appropriate to their technical profiles, rather than in strictly separated silos.

Wi-Fi as the Backbone of European Connectivity

While the EU just finished consulting [1] on the mid-term review of its Digital Decade Policy Programme [2], the EU's long term Digital Decade ambitions for 2030 are clear: every EU household should have access to gigabit connectivity, and all populated areas should be covered by high-performance wireless networks. These goals are technology-neutral by design; the Commission expects fiber, mobile, satellite, and Wi-Fi to contribute together to make Europe the world's most connected continent. All of these access technologies play a role, but it's clear that Wi-Fi already carries most of Europe's data traffic as the dominant "last-mile" technology in homes, offices, hospitals, and schools.

Modern MFCN networks deliver indoor services primarily by using massive MIMO in mid-band spectrum, complemented by carrier aggregation with lower-frequency bands that provide wider-area coverage. This innovative approach delivers excellent outdoor coverage and robust downlink throughput. However, it is not optimal for providing coverage in indoor environments such as offices, apartment buildings, and houses, where energy-efficient walls and reflective windows create high signal attenuation (also known as Building Entry/Exit Loss). For mobile operators relying exclusively on licensed spectrum, the cost and complexity of deploying dedicated in-building solutions are substantial.

Mobile operators are seeking additional spectrum primarily to increase capacity on their existing macro sites rather than investing in extensive new in-building infrastructure or network densification. Neutral-host networks based on "Distributed Antenna Systems" or "Small Cells" offer one potential path forward, allowing multiple operators to share common infrastructure, but they still entail significant real estate, CAPEX, and OPEX commitments. By contrast, Wi-Fi federations (leveraging existing Wi-Fi deployments that integrate SIM-based authentication, support seamless mobility, and deliver both Internet access and operator services such as voice or SMS) can provide high data-rate indoor connectivity at lower incremental cost than new MFCN builds. Europe would benefit from adopting a dedicated indoor coverage strategy that recognizes how the ample capacity of the 6 GHz band and Wi-Fi's proven role in shared spectrum environments can complement mobile networks to achieve universal gigabit coverage, while allowing MFCN to focus scarce spectrum resources on wide-area and mobility services rather than costly indoor MFCN densification.

Prioritizing MFCN use in most of the upper 6 GHz band ignores this reality. As Fiber-to-the-Home speeds grow and consumer demand for broadband intensifies, Wi-Fi will reliably and inexpensively deliver high-speed connectivity to devices such as XR headsets and smart TVs that MFCN will never serve at scale, because cellular has not been adopted as the default connectivity layer in the consumer electronics ecosystem. Furthermore, Wi-Fi infrastructure costs significantly less to build and operate, uses more affordable electronics elements, and typically consumes less power per delivered Gigabit, while offering substantially more aggregate bandwidth in indoor and local-area scenarios.

Adopting a shared spectrum model for the full upper 6 GHz band would better align with everyday usage and with Europe's goals of inclusion and innovation by allowing technologies like Wi-Fi to coexist dynamically with MFCN systems under fair and efficient rules. In this context, "shared" means that spectrum access is not granted exclusively to a single technology or service, but is coordinated so that multiple technologies can use the same frequencies in time, space, or power (through mechanisms such as low-power operation, listen-before-talk,

dynamic channel selection, or database/AFC-based coordination to protect incumbents and higher-power layers.

In the mid-band unlicensed spectrum, Wi-Fi already operates successfully alongside other technologies such as Ultra-Wide Band (UWB), Bluetooth, Zigbee, and Matter-based devices, using contention-based access and interference-mitigation techniques to share channels with a wide variety of radio profiles without centralized control. Extending this proven coexistence model, and complementing it with coordinated tools when appropriate, makes Wi-Fi fully capable of sharing spectrum with MFCN as well, provided that clear technical rules on power, deployment conditions, and protection criteria are defined so that low-power Wi-Fi and high-power macro systems can each fulfill their roles without causing harmful interference.

Efficiency, Innovation, and Economic Impact

Technically and economically, allocating the full 1200 MHz (5925–7125 MHz) of the 6 GHz band for shared, unlicensed use represents one of the most efficient paths to reach Europe’s gigabit connectivity targets. Wi-Fi 6E and Wi-Fi 7 demonstrate how contention-based CSMA/CA can deliver reliable multi-gigabit performance with low latency at minimal cost per bit – especially when paired with widespread fiber deployments. In dense indoor environments (such as apartment buildings, enterprise offices, and factories) this shared-access model avoids expensive over-engineering while maximizing real-world throughput.

The economics are particularly compelling when comparing deployment models for indoor connectivity for residential and enterprise scenarios:

Table 1 - Residential indoor models economics comparison¹

Residential indoor model	Typical incremental capex per dwelling (EUR, order-of-magnitude)	Typical deployment timeline	Relative energy per Gb (busy hour, order-of-magnitude)
Wi-Fi only (fiber/DSL + Wi-Fi 6/6E/7 CPE/APs)	€150-250	Days to a few weeks (CPE install / upgrade)	~0.01–0.05 Wh/Gb (most efficient, short-range Wi-Fi)
Indoor 4G/5G small cells (per dwelling or per small MDU zone)	€300-700	Weeks to a few months (RF design, provisioning)	~0.03–0.20 Wh/Gb (≈2–3× Wi-Fi at similar load)
Residential DAS / repeater system (shared across building)	€400-1,000+	Several months (design, cabling in MDU)	~0.10–0.30+ Wh/Gb for on-prem equipment (plus BTS energy)
MFCN “outdoor-in” macro coverage only (no indoor layer)	~€0–50 to the household (no dedicated indoor infra)	Immediate if macro exists; otherwise, operator-driven	~0.30–0.80+ Wh/Gb at network level (highest use for indoor traffic)

¹ **Residential methodology:**

- Capex per dwelling is derived by scaling the per-m² enterprise ranges in an indoor coverage analysis to typical residential footprints (e.g. ~60–120 m² per flat, ~120–200 m² per house) while preserving the same relative ratios between Wi-Fi, small cells, DAS, and outdoor-in.
- Wi-Fi costs cover CPE/router, additional Wi-Fi 6/6E/7 APs where needed, and basic wiring; small-cell and DAS figures reflect per-dwelling share of equipment and installation where dedicated licensed-spectrum indoor coverage is provided.
- Energy per Gb uses the same kWh per Gbps-hour framework as the enterprise study, Psystem/Cavg, with residential busy-hour loads applied to Wi-Fi CPE/APs, indoor small cells or repeaters, and macro-outdoor-in, maintaining the relative efficiency ordering: Wi-Fi < indoor small cells < DAS < outdoor-in macro.

Table 2 - Enterprise indoor model economics comparison²

Enterprise indoor model	Typical capex per m ² (EUR, order-of-magnitude)	Typical deployment timeline	Relative energy per Gb (busy hour)
Wi-Fi (Wi-Fi 6/6E/7 APs)	€5-15/m ²	Days to a few weeks	~0.01–0.05 Wh/Gb (most efficient)
4G/5G indoor small cells	€15-40/m ²	Weeks to a few months	~0.03–0.20 Wh/Gb (around 2–3× Wi-Fi at similar load)
DAS (multi-operator in-building)	€20-70+/m ²	Several months	~0.10–0.30+ Wh/Gb (plus feeding BTS/baseband energy)
MFCN “outdoor-in” macro coverage	€0-5/m ² to the enterprise	Immediate if macro exists; otherwise, operator-driven	~0.30–0.80+ Wh/Gb at network level (highest use)

These tables illustrate how a “better together” model in both enterprise and residential scenarios, where Wi-Fi carries most indoor traffic and MFCN focuses on wide-area mobility, delivers gigabit service faster, at substantially lower deployment cost, and with markedly better energy efficiency per gigabit than MFCN-only indoor strategies or outdoor-in coverage. The enterprise table shows that Wi-Fi and shared Wi-Fi + MFCN designs minimize capex per square meter and kWh/Gb compared with small-cell and DAS-centric builds, while the residential table mirrors this pattern at the dwelling level, with Wi-Fi-first architectures clearly outperforming indoor licensed-only or macro-only approaches on both affordability and sustainability.

Outdoors, shared spectrum can evolve beyond today’s approaches. Advanced signal processing techniques such as beam-forming and zero-forcing, combined with Automated Frequency Coordination (AFC) for 6 GHz Standard Power outdoor Wi-Fi, make it possible to manage interference intelligently and protect fixed links and satellite earth stations while still enabling cost-effective coverage in rural and hard-to-reach areas. Wi-Fi has already shown that coexistence works seamlessly with incumbents, and future shared spectrum models can extend this success to the benefit of both licensed and unlicensed systems.

The channelization figure below visualizes what this means in practice for 6 GHz band and beyond after the RSPG Final Opinion. In the lower part of the band (U-NII 5 and 6), wide 1 x 320 MHz and 1 x 480 MHz Wi-Fi channels are already available for Wi-Fi use today, while the proposed guard band around 6425–6585 MHz and the 540 MHz segment prioritized for IMT/5G above 6585 MHz still leave significant room for opportunistic or shared Wi-Fi operation. The diagram highlights in red how much mid-band spectrum could support wide Wi-Fi 6E/7 channels alongside MFCN carriers, underscoring that Europe’s choice is not “Wi-Fi or MFCN” but how to let both technologies use these spectrum blocks intelligently.

² Enterprise methodology:

- Values are indicative ranges based on an indoor coverage comparison analysis for medium/large enterprise buildings (10–50k m²), normalized from USD to EUR and expressed per square meter.
- Capex estimates aggregate radio equipment, cabling, and a proportional share of controllers, licenses, and installation for Wi-Fi, indoor small cells, and DAS; “MFCN outdoor-in” reflects minimal incremental cost to the enterprise where only existing macro coverage is used.
- Energy figures are derived by computing kWh per Gbps-hour as $P_{\text{system}}/C_{\text{avg}}$, where P_{system} is typical system power (radios, on-prem baseband/DAS elements, PoE/switching) and C_{avg} is busy-hour user throughput, then converting to Wh/Gb; ranges reflect realistic utilization for each technology (Wi-Fi, 4G/5G small cells, DAS, and macro outdoor-in).

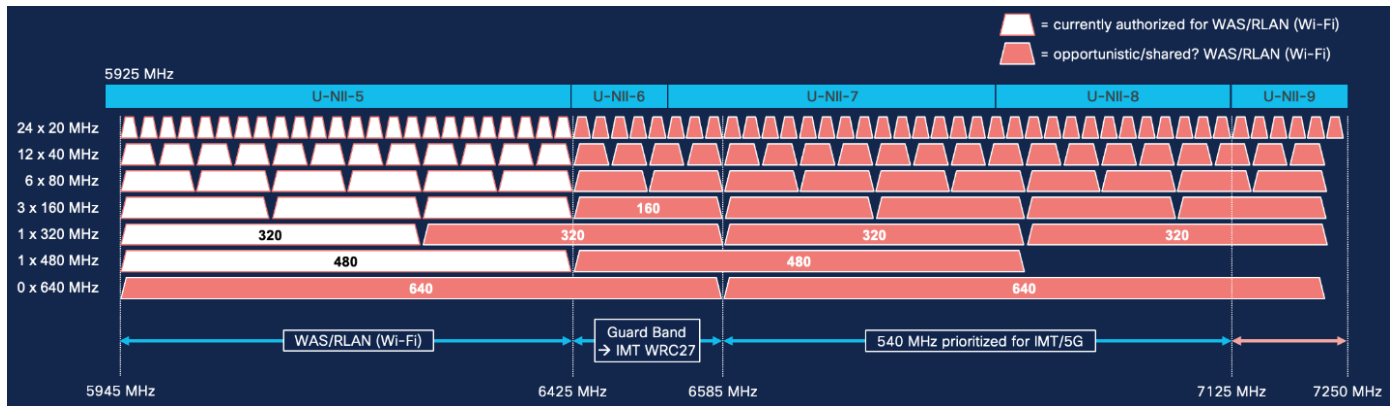


Figure 1 - Current 6 GHz and lower 7 GHz spectrum outlook in the light of the final RSPG Opinion illustrates the potential of a shared model where both MFCN and Wi-Fi can benefit from the ample mid-band spectrum

Technology Neutrality and European Principles

Prioritized MFCN allocation in the upper 6 GHz band diverges from the EU's long-standing principles of technology neutrality and competition. A healthy market requires room for both licensed and unlicensed innovation and importantly, for shared models that blend the two. Prioritizing nearly all mid-band spectrum for public MFCN tilts the market against shared access, neutral-host, and Wi-Fi-based networks that contribute directly to Europe's gigabit and industrial transformation goals.

By contrast, the shared spectrum approach fully aligns with the technology-neutral spirit of European policy. It allows innovation to decide which approach performs best in each environment, rather than regulatory exclusivity to pre-determine the winners. This is also consistent with recent RSPG work and the Digital Decade - Policy programme [3], which both underline that all capable technologies (fiber, MFCN, Wi-Fi and others) should be enabled to contribute fairly to gigabit connectivity.

Coexistence, Incumbent Protection, and Future-Proof Access

Protecting incumbent fixed and satellite services remains essential, and the RSPG Opinion rightly treats this as a precondition for any new use of the upper 6 GHz band. Yet these needs can be fully met under a shared-access approach that combines indoor low-power operation, dynamic power limits, indoor/outdoor restrictions, and AFC systems for outdoor standard power use. Wi-Fi's short range, CSMA/CA (listen-before-talk) mechanism, and proven interference management capabilities in dense deployments already limit its impact on neighboring systems, while AFC adds a geolocation-based protection layer for fixed incumbents such as cell towers and satellite links.

Emerging IEEE 802.11 and 3GPP work on multi-link operation, coordinated scheduling, and geolocation-based sharing shows how coexistence between MFCN, Wi-Fi and incumbents can scale further over time. This type of engineered sharing offers a more future-proof path than rigid segmentation of the important mid-band spectrum and would allow both MFCN and unlicensed innovation to thrive together in the same band.

Competitiveness, Innovation, and Sustainability

Wi-Fi is an open innovation platform that lowers barriers for startups, campus networks, municipalities, and public initiatives like WiFi4EU [4]. Europe's competitiveness in the digital era depends on open, innovation-driven connectivity. Shared spectrum with Wi-Fi as its proven foundation creates a level playing field where new players, startups, and community networks can thrive alongside established providers. Prioritizing MFCN use in much of the upper 6 GHz band risks limiting this open ecosystem while competing markets like the U.S., South Korea, and Saudi Arabia enable full-band shared access. That outcome could leave European devices, services, and research initiatives at a structural disadvantage.

Nearly 90% of Europeans believe that research and innovation are essential to stronger, more secure digital technologies. Unlicensed and shared spectrum provide an open environment where innovation flourishes, from secure campus networks to industrial automation and next-generation wireless services. Unlocking the full 6 GHz band for shared operations, including AFC-assisted standard-power operation for outdoor use, would accelerate Europe's Research & Development leadership and strengthen its digital sovereignty.

Sustainability forms the third pillar of this vision. The State of the Digital Decade 2025 report [5] warns that rising digital energy demand could become a major constraint on Europe's progress in reaching their sustainability goals. Studies show that when Wi-Fi bandwidth is limited and traffic shifts to mobile networks, both energy use and CO₂ emissions rise. On the contrary, fiber + Wi-Fi architectures deliver gigabit performance with far lower energy intensity. A robust, full-band shared spectrum framework therefore supports Europe's environmental, economic, and digital goals simultaneously by driving competitiveness, innovation, and sustainability together.

A “Better Together” Spectrum Strategy

Europe's real choice on the upper 6 GHz is not Wi-Fi versus 6G, it is collaboration versus constraint. Licensed 6G, unlicensed Wi-Fi, and emerging shared-spectrum technologies represent complementary layers of the same digital fabric that connects Europe's schools, hospitals, SMEs, industrial sites, and communities.

Treating the 6 GHz band as a shared asset aligns naturally with EU's Digital Decade vision of sustainable, inclusive, and innovation-driven connectivity. Through thoughtful engineering, hybrid access models, and spectrum-sharing innovation, MFCN, Wi-Fi, and incumbents can coexist while maximizing spectrum efficiency and societal benefits.

A shared, future-oriented approach would move Europe beyond zero-sum debates toward a more resilient and adaptive connectivity ecosystem. By leveraging coexistence mechanisms (such as AFC, coordinated scheduling, and dynamic spectrum access) Europe can unlock the full potential of this valuable mid-band spectrum across all usage environments. This “better together” path would strengthen Europe's global competitiveness, support sustainable gigabit connectivity, and uphold its principles of technology neutrality and digital sovereignty.

Summary

The RSPG's recent opinion on the upper 6 GHz band presents a critical juncture for European connectivity, proposing a prioritization of Mobile/Fixed Communication Network (MFCN) operations. While this approach risks creating inefficient spectrum silos, a "Better Together" strategy, leveraging shared spectrum models, offers a more effective path to meeting the EU's 2030 Digital Decade goals. By integrating coexistence mechanisms such as AFC and contention-based access, Europe can allow low-power Wi-Fi and high-power MFCN to thrive side-by-side, optimizing spectrum use for both indoor and wide-area environments.

This shared-access framework promotes technological neutrality, lowers deployment costs, and significantly improves energy efficiency, ensuring that European enterprises, homes, and public services benefit from high-speed, sustainable connectivity. By adopting a flexible, future-proof spectrum policy that avoids a binary choice between Wi-Fi and mobile, Europe can strengthen its digital sovereignty, foster open innovation, and maintain global competitiveness in the emerging 6G era.

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Citations and Bibliography

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