Telecom Advisory Services

ECONOMIC LOSS IF THE TOP 700 MEGAHERTZ OF THE 6 GHZ BAND IS REPURPOSED FOR LICENSED USE: A TWO PART ANALYSIS

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May 2025

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This report was commissioned by WiFiForward, a coalition of companies and business organizations to promote the free use of spectrum for unlicensed use. All of the study's content, including its conclusions, are the independent outcome of the analysis conducted solely by the authors and Telecom Advisory Services

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EXECUTIVE SUMMARY

As Congress considers wide-ranging budget reconciliation legislation, spectrum policy and the FCC's spectrum auction authority continue to be part of the policy discussion. While numerous proposals have been (and continue to be) discussed, some have suggested repurposing the upper 700 megahertz of the unlicensed 6 GHz band for licensed mobile services.

This study quantifies the economic losses if the upper 700 megahertz of the 6 GHz band (6.425 – 7.125 GHz) were removed from unlicensed use and repurposed for licensed mobile services. Building on the original 2024 study that estimated the economic value of Wi-Fi conducted for WifiForward[1], the following analysis translates the spectrum constraints triggered by repurposing the 700 megahertz of the 6 GHz band into losses of consumer benefit, producer surplus, and GDP across all Wi-Fi use cases for the 2025 to 2027 horizon.

While our study released on May 9, 2025 looked narrowly at the negative economic impact on the 6 GHz band ecosystem itself, this study seeks to provide a more complete understanding by also including the economic implications for the legacy WiFi bands (2.4 GHz and 5 GHz bands) if the 6 GHz band is repurposed.

In our original study released in 2024, aggregate economic value of the full 6 GHz band reaches US$ 780 billion in 2025, rising to US$ 1.19 trillion in 2027, for a total of US$ 2.94 trillion.[2] Eighty-five percent of this dividend is generated in enterprise environments through higher throughput, lower latency, expanded IoT deployments, and AR/VR integration; the remainder is shared among residential users, public Wi-Fi users, ISPs, and domestic equipment suppliers.

Restricting Wi-Fi to the lower 500 megahertz of the 6 GHz band significantly reduces economic value between 2025 and 2027. Every economic category suffers when use of the 6 GHz band is restricted: enterprise speed and latency benefits contract by more than 60 percent, free Wi-Fi consumer savings fall by roughly the same proportion, and rural broadband gains are halved as WISPs must deploy additional access points to maintain coverage.

Over 2025-2027, the economy would forfeit US$ 2.11 trillion, equivalent to 72 percent of the baseline benefit. Economic losses rise from US$ 567 billion in 2025, US$ 689 billion in 2026, and US$ 850 billion in 2027, mirroring the commercial ramp up of Wi-Fi 7 and spectrum-intensive enterprise applications. Roughly 87 percent of that foregone value originates in enterprise Wi-Fi, since wide 160 and 320 megahertz channels, plus Multi Link Operation (MLO) are critical for the low latency, multigigabit connectivity demanded by cloud-based workflows, real-time analytics and robotics.

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[1] See Katz et al. (2024). *Assessing the economic value of Wi-Fi in the United States*. Washington, DC: WiFiForward (September). Retrieved in: https://wififorward.org/wp-content/uploads/2024/09/Assessing-the-Economic-Value-of-Wi-Fi.pdf

[2] The 2024 study focused on Wi-Fi standards rather than spectrum bands. The 6 GHz estimate of US$ 2.94 trillion can be derived by adding the values of each use case value assessment.

The study quantifies two distinct negative effects assessed in two major parts: (i) the direct losses that would arise within the 6 GHz ecosystem itself if the upper 700 megahertz (6.425–7.125 GHz) were reassigned to licensed services (in Part I[3]), and (ii) the cascading impact on the legacy 2.4 GHz and 5 GHz bands of repurposing the top 700 megahertz in the 6 GHz band, tracing how displaced traffic, reduced channel width, and aggravated interference would propagate through existing Wi-Fi deployments (in Part II). Each effect is summarized separately as follows.

Effect on the 6 GHz ecosystem of curtailing the unlicensed use of the 6 GHz band

The first effect estimates the value forfeited only in the 6 GHz band when the upper 700 megahertz is reallocated. Along these lines, it recalculates value under constrained channel width, loss of MLO, and heightened congestion. Over 2025-2027 the economy would forfeit US$ 1.74 trillion, equivalent to 59 percent of the baseline benefit calculated in the original study. Losses rise from US$ 446 billion in 2025 to US$ 725 billion in 2027, mirroring the commercial ramp up of Wi-Fi 7 and spectrum-intensive enterprise applications (see Table A).

Table A. United States: Economic value lost in the 6 GHz band when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)[4]

Sources	Effects	Type	2025	2026	2027
1. Free Wi-Fi	1.1. Savings incurred by consumers by accessing free Wi-Fi in public sites	Consumer Benefit	($2,949)	($3,858)	($4,922)
	1.2. Free Wi-Fi service supporting the needs of the broadband unserved pop.	GDP Contribution	($4,839)	($4,724)	($4,246)
	1.3. Benefit to consumers enjoying higher speed from free Wi-Fi under 6 GHz	Consumer Benefit	($100)	($94)	($75)
	1.5. Use of Wi-Fi in highly dense heterogeneous sites	Consumer Benefit	($99)	($131)	($159)
2. Residential Wi-Fi	2.3. Consumer benefit derived from faster broadband speed	Consumer Benefit	($9,105)	($10,966)	($13,466)
	2.4. Consumer benefit generated by use of residential Wi-Fi devices and equipment	Consumer Benefit	($4,555)	($5,821)	($7,303)
	2.5. Bridging the digital divide: use of Wi-Fi to increase coverage in rural isolated areas	GDP Contribution	($7,287)	($8,366)	($7,348)
3. Enterprise Wi-Fi	3.1. Savings in business Internet traffic transmitted through Wi-Fi	Producer Surplus	($8,655)	($10,496)	($12,880)
	3.3. Benefits derived from an increase in average speed	GDP Contribution	($185,044)	($223,707)	($282,588)
	3.4. Benefits derived from reduced latency	GDP Contribution	($127,630)	($169,476)	($215,577)
	3.5. Enhanced IoT deployment	GDP Contribution	($60,116)	($81,771)	($114,722)

[3] This captures the results reflected in our report released on 5/9/25.

[4] Small discrepancies may appear between row and column totals in the tables because all monetary figures are rounded to the nearest million (or, where indicated, to the nearest billion). Consequently, summed values may not match the stated aggregates exactly.

Sources	Effects	Type	2025	2026	2027
	3.6. Deployment of Augmented Reality/Virtual Reality solutions	GDP Contribution	($8,184)	($12,568)	($18,240)
4. ISPs	4.1. Cellular networks CAPEX savings by off-loading traffic to Wi-Fi	Producer Surplus	($3,014)	($3,155)	($3,393)
	4.2. Revenues of Wi-Fi based Public Internet Service Providers	GDP Contribution	($56)	($59)	($58)
	4.3. Revenues of Wi-Fi based Wireless Internet service Providers	GDP Contribution	($182)	($204)	($174)
5. Wi-Fi ecosystem	5.1. Manufacturing of Wi-Fi devices and equipment for residential use	Producer Surplus	($4,279)	($5,468)	($6,860)
	5.2. Manufacturing of enterprise Wi-Fi devices and equipment	Producer Surplus	($1,540)	($1,897)	($2,239)
	5.3. Benefits of Firms in the IoT ecosystem	Producer Surplus	($15,539)	($19,989)	($23,955)
	5.4. Benefits of firms in the AR/VR ecosystem	Producer Surplus	($3,084)	($4,799)	($7,216)
TOTAL			($ 446,256)	($567,550)	($725,424)

Sources: Telecom Advisory Services analysis

The combined loss value of savings in business Internet traffic transmitted through Wi-Fi, the foregone benefits derived from increased average speeds, and reduced latency represent approximately 72 percent of total economic value loss in 2025, easing slightly to 70 percent by 2027.

The rest of the economic losses in 2027 resulting from removal of the upper 700 megahertz of the 6 GHz band break down as follows. The Free Wi-Fi use cases, savings incurred by consumers accessing free Wi-Fi in public sites, free Wi-Fi services supporting the broadband-underserved population, benefits to consumers enjoying higher speeds under Wi-Fi 6E and Wi-Fi 7, and use of Wi-Fi in highly dense heterogeneous environments, collectively amount to US$ 9.4 billion. The individual use cases including consumer benefits from faster broadband speeds, consumer benefits from residential Wi-Fi devices and equipment, and bridging the digital divide via Wi-Fi, total US$ 28.1 billion. Within the Enterprises category, the enhanced IoT deployment and deployment of Augmented Reality/Virtual Reality solutions use cases together incur losses of US$ 133.0 billion. The ISP use cases, which include cellular network CAPEX savings through off-loading traffic to Wi-Fi, revenues of Wi-Fi–based public Internet service providers, and revenues of Wi-Fi–based wireless Internet service providers, represent US$ 3.6 billion. Finally, the use cases related to equipment manufacturing, which include manufacturing of residential Wi-Fi devices and equipment, manufacturing of enterprise Wi-Fi devices and equipment, benefits to firms in the IoT ecosystem, and benefits to firms in the AR/VR ecosystem, add to US$ 40.3 billion.

Cascading effect on the 2.4/5 GHz legacy bands of curtailing use in the 6 GHz band

Under the second negative effect of repurposing the upper part of the 6 GHz band, we have quantified how the withdrawal of the upper 700 megahertz of the 6 GHz band forces Wi-Fi traffic into the 2.4 GHz and 5 GHz bands and results in a negative economic impact. For each use case that is impacted by this effect, we recalibrate technical performance parameters and translate the potential degradation into economic losses by holding all other inputs (adoption forecasts, elasticities, demand profiles) constant.

To translate these performance degradations into economic valuations, we apply calibrated reduction factors across five areas of impact affecting eight use cases (considering that the other use cases analyzed in the original study would not be affected by the potential repurposing), directly mirroring the proportional loss in effective channel capacity and performance. Specifically, the Free Wi-Fi use case is adjusted by an 18.18 percent reduction in consumer benefit and GDP contributions to reflect the curtailed channel availability and increased contention; WISP deployments are scaled back by a 21.01 percent reduction to capture the decline in rural link throughput and associated service revenues and CAPEX savings; IoT use cases likewise incur a 21.01 percent reduction to account for the erosion of connection density and reliability in machine to machine networks; GDP contributions from latency are diminished by 20.29 percent to mirror the penalties imposed by heightened congestion in the legacy bands; and Enterprise Wi-Fi benefits are reduced by 18.18 percent to reflect the combined impact of narrower channel widths and limited MLO on throughput and productivity. By applying these proportional reduction factors multiplicatively to the baseline consumer benefit, producer surplus, and GDP estimates from the original legacy band analysis, we isolate the incremental economic losses on the legacy 2.4 and 5 GHz bands directly attributable to withdrawing the upper 700 megahertz of the 6 GHz band from unlicensed use (See detail loss in Table B).

Table B. Calibrated reduction factors and brief explanations by use case

Use Case	Economic Loss	Explanation
Free Wi-Fi	18.18%	• Reflects the curtailed channel availability and increased contention when MLO is disabled and traffic shifts into legacy bands
WISP	21.01%	• Captures the decline in rural backhaul throughput and higher link saturation in the 2.4 GHz/5 GHz bands, reducing service capacity, revenues, and CAPEX savings
IoT	21.01%	• Accounts for erosion of connection density and reliability in machine to machine networks due to increased interference and limited channels
Latency	20.29%	• Mirrors the latency penalties imposed by heightened congestion in the legacy bands, degrading quality of service and reducing economic output
Enterprise	18.18%	• Reflects the impact of narrower channel widths and limited MLO on enterprise throughput and productivity benefits

Sources: Telecom Advisory Services analysis

Drawing on the calibrated reduction factors in Table B, Table C below summarizes and highlights the aggregate economic losses in the legacy 2.4 GHz and 5 GHz bands. In this case, economic losses reach US$ 120.4 billion in 2025, US$ 121.7 billion in 2026, and US$ 124.3 billion in 2027, driven by heightened congestion in the legacy Wi-Fi bands (2.4 GHz and 5 GHz bands), reduced throughput in those same bands, and latency penalties across public Wi-Fi, residential, enterprise, ISP, and IoT use cases (see table C).

Table C. United States: Economic value lost (in 2.4 GHz and 5 GHz) when the upper 700 megahertz are re-allocated (2025–2027) (in US$ millions)[5]

Sources	Effects	Type	2025	2026	2027
1. Free Wi-Fi	1.1. Savings incurred by consumers by accessing free Wi-Fi in public sites	Consumer Benefit	($857)	($799)	($745)
	1.2. Free Wi-Fi service supporting the needs of the broadband unserved pop.	GDP Contribution	($4,134)	($3,528)	($2,888)
2. Residential Wi-Fi	2.5. Bridging the digital divide: use of Wi-Fi to increase coverage in rural isolated areas	GDP Contribution	($11,411)	($13,165)	($15,184)
3. Enterprise Wi-Fi	3.1. Savings in business Internet traffic transmitted through Wi-Fi	Producer Surplus	($68,806)	($76,780)	($83,079)
	3.4. Benefits derived from reduced latency	GDP Contribution	($20,947)	($15,002)	($10,634)
	3.5. Enhanced IoT deployment	GDP Contribution	($11,188)	($9,044)	($7,988)
4. ISPs	4.2. Revenues of Wi-Fi based Public Internet Service Providers	GDP Contribution	($87)	($75)	($62)
	4.3. Revenues of Wi-Fi based Wireless Internet service Providers	GDP Contribution	($2,920)	($3,282)	($3,689)
TOTAL			($ 120,350)	($121,675)	($124,269)

Sources: Telecom Advisory Services analysis

Economic and policy implications

Retaining the entire 1200 megahertz of the 6 GHz band for unlicensed operation is not simply a spectrum management preference; **it is a macroeconomic imperative**. Our modelling shows that full availability of the entire 6 GHz band unlocks US$ 2.94 trillion in aggregate value over 2025-2027, whereas a lower band cap would capture barely 28 percent of that figure and forfeit US$ 2.11 trillion in the same period. No other single telecommunications policy lever presently under consideration carries a comparable, near-term impact on national GDP, consumer benefit, and producer margins. Cutting the band would therefore impose an avoidable drag on productivity growth precisely when U.S. firms are accelerating digital transformation and reshoring advanced manufacturing.

The upper 700 megahertz of the 6 GHz band is indispensable for channel widths of 160 megahertz and 320 megahertz and for MLO-features that enable multigigabit throughput and deterministic low latency performance in Wi-Fi 7. Without those attributes, enterprises cannot fully automate factories, hospitals cannot rely on real-time sensing for telehealth, and universities cannot deploy immersive AR/VR teaching platforms at scale. Licensed midband alternatives cannot replicate this indoor-centric value proposition without substantial additional infrastructure, nor can they match the open-innovation dynamic of Wi-Fi that has produced three decades of rapid, low-cost upgrades.

[5] Table C includes only those use cases for which we estimated a measurable economic loss in the 2.4 GHz and 5 GHz bands. Other use cases were conservatively assumed to have negligible impacts in these bands and therefore have not been included.

Maintaining the full band also safeguards domestic supply chain competitiveness. The U.S. is home to the world's leading chip designers, CPE vendors, and cloud-service integrators whose roadmaps already assume operation across the full 6 GHz band. Blocking access to more than half the band would strand those investments, shift the centre of gravity for next generation silicon fabrication abroad, and undermine the job creation and export revenue targets embedded in recent industrial policy initiatives. By contrast, policy stability encourages continued R&D in Wi-Fi 7/8, accelerates private sector uptake of standard power 6 GHz outdoor links via Automated Frequency Coordination, and sustains American leadership on the global stage.

Finally, fullband unlicensed access delivers broad-based social welfare gains. It lowers per gigabyte costs for public hotspots, supports wireless internet service provider (WISP) expansion into rural communities, and keeps entry-level devices affordable for low-income households, outcomes that advance federal connectivity targets without new subsidies. When these benefits are combined with the quantified economic surplus, the case for preserving the entire 6 GHz band for Wi-Fi becomes overwhelming: it maximizes national welfare, futureproofs digital infrastructure, and positions the United States to lead in the next wave of wireless innovation.

A reallocation of the upper portion of the 6 GHz band imposes a permanent growth penalty, not a temporary adjustment, because the foregone capacity compounds across every future Wi-Fi generation, suppresses productivity spillovers in factories, hospitals, campuses, and homes, and diverts capital toward costlier stop-gap solutions rather than frontier innovation. Once the upper 700 megahertz is ceded, enterprises must design around narrower channels, equipment makers recalibrate roadmaps for diminished performance, and service providers lose the option to relieve legacy-band congestion, decisions that cascade through supply chains and ossify for years. The macroeconomic drag thus persists long after any auction windfall has been absorbed when repurposing the upper portion of the band, embedding a structural wedge between the United States and economies that retain the full 6 GHz band for open, high-throughput connectivity.

1. INTRODUCTION

Wi-Fi technology has become an essential enabler of digital connectivity, supporting a wide array of consumer and enterprise applications across the United States. Its evolution has been closely tied to the availability of unlicensed spectrum, which allows innovation and deployment without the constraints of exclusive licensing regimes. In recent years, the expansion of unlicensed access to the 6 GHz band has been a pivotal development, unlocking significant performance improvements and economic benefits. However, some have proposed to nullify the 6 GHz FCC decision that opened the band, removing Wi-Fi from the top 700 megahertz of the band, and auctioning these frequencies for a new high-power service. This proposal calls for a detailed examination of the economic consequences of such a shift. The following report responds to that need by assessing the potential harmful losses that would result from reducing unlicensed access to the 6 GHz band.

1.1. Background and Policy Context

Wi-Fi has become a foundational technology within the U.S. communications ecosystem, enabling high-speed wireless connectivity in residential, enterprise, public, and industrial environments. Since the Federal Communications Commission (FCC) decision in 2020 to open the full 6 GHz band (5.925–7.125 GHz) for unlicensed use, Wi-Fi 6E and the emerging Wi-Fi 7 standard have leveraged this spectrum to deliver transformative performance improvements in capacity, throughput, latency, and reliability. These gains have supported innovation in next-generation applications, such as immersive virtual and augmented reality, high-density venue connectivity, real-time industrial automation, and enhanced rural broadband access, while also relieving congestion in legacy spectrum bands (2.4 and 5 GHz).

Reallocating the upper 700 megahertz portion of the 6 GHz band so soon after the FCC's 2020 decision would be unprecedented and would undermine investments made in reliance on the Commission's existing rules. While licensing spectrum may generate short-term auction revenues and support exclusive-use applications, removing the upper 700 megahertz from unlicensed use would curtail the full capabilities of Wi-Fi 6E and Wi-Fi 7. In turn, this would limit the performance and scalability of Wi-Fi networks and would have broader economic implications, including reduced consumer benefit, producer surplus, stranded economic investment, and reduced GDP contribution.

In this context, a rigorous evidence-based assessment of the economic losses associated with this prospective reallocation is necessary to inform the policy debate and spectrum management decisions. This study seeks to provide such an assessment, building upon a previously established methodology to quantify the societal and economic consequences of diminishing access to unlicensed spectrum in the 6 GHz band.

1.2. Objective and Scope of the Study

The primary objective of this study is to estimate the economic loss to be expected if the upper 700 megahertz of the 6 GHz band is reallocated from unlicensed to licensed use. Unlike prior research that quantified the incremental gains associated with the expansion of unlicensed spectrum, this study adopts an inverse analytical perspective. It focuses on identifying and valuing the foregone economic benefits, across consumers, producers, and national output, that would result from limiting Wi-Fi access to only the lower portion of the 6 GHz band (5.925–6.425 GHz).

The scope of this analysis includes estimating economic losses associated with removal of the upper 700 megahertz segment of the 6 GHz band, thereby quantifying the impacts on use cases that rely on the extra contiguous spectrum for optimal operation. The study adopts a forward-looking approach, evaluating the projected adverse economic impact over the 2025–2027 horizon and presenting results in terms of consumer benefit, producer surplus, and GDP contribution.

1.3. Relationship to previous research

This report builds directly upon the framework and empirical results presented in the 2024 study "Assessing the Economic Value of Wi-Fi in the United States", developed by Telecom Advisory Services and commissioned by WifiForward. That study quantified the total and incremental economic value of Wi-Fi under scenarios incorporating Wi-Fi 6E and Wi-Fi 7, leveraging the full 6 GHz band as allocated under the 2020 FCC decision. The analysis estimated that the total economic value of Wi-Fi would reach $2.4 trillion by 2027, including $1.2 trillion in incremental value attributable to the 6 GHz spectrum expansion, as derived from the combined contribution of Wi-Fi 6E and Wi-Fi 7.[6]

In particular, the previous study employed a multi-layered methodology combining use-case-specific modeling, econometric estimation, and scenario-based projections to assess the economic impact across three value dimensions: consumer benefit, producer surplus, and GDP contribution. It also examined the differentiated roles of unlicensed spectrum bands, demonstrating that the full 6 GHz band played a critical role in enabling advanced use cases and alleviating pressure on legacy bands.

This study inverts this analytical framework. Instead of projecting gains from expanded spectrum, it simulates the losses that would occur if previously authorized spectrum is withdrawn. The methodology retains consistency with the 2024 report, thereby ensuring comparability of assumptions and outputs. By applying the same structure in reverse, removing spectrum from modeled use cases, re-estimating throughput and performance under constrained conditions, and calculating the resulting economic losses, this study aims to provide a rigorous quantification of the adverse implications of spectrum reallocation.

In Part I (previously released as a stand alone report), we build on the established econometric and scenario analysis framework used in the original study. For this purpose, we developed alternative counterfactual scenarios where unlicensed use

[6] The 2024 study focused on Wi-Fi standards rather than spectrum bands. The 6 GHz estimate of US$ 2.94 trillion can be derived by adding the values of each use case value assessment.

is rescinded in the upper 700 megahertz of the 6 GHz band. In the case of this change, the economic benefits associated with Wi-Fi 6E and Wi-Fi 7 (under the upper 700 megahertz of the 6 GHz band), derived from the additional capacity, speed, and improved user experience, will be assumed to vanish entirely. This approach involved recalibrating the baseline model inputs to account for the loss of the incremental capacity and benefits previously generated by that spectrum.

In Part II, we address the repercussions of taking away spectrum from the 6 GHz band on legacy Wi-Fi technologies, namely Wi-Fi 6 and earlier generations, which operate over the 2.4 and 5 GHz bands. Under the withdrawal of the top 700 megahertz of the 6 GHz spectrum, these legacy bands are expected to experience increased harmful congestion, which could deteriorate service quality and reduce overall consumer benefits. To estimate these effects, we incorporate in Part II congestion modeling and traffic reallocation techniques to simulate the resulting performance degradation. By quantifying the impact of heightened network load on speed, reliability, and ultimately on the economic value derived from these bands, we will enhance our estimates to reflect the compounded negative effects on GDP, consumer surplus and producer surplus.

PART 1. EFFECT OF CURTAILING THE UNLICENSED USE OF THE 6 GHZ BAND

Part I estimates the the direct losses that would arise within the 6 GHz ecosystem itself if the upper 700 megahertz (6.425–7.125 GHz) were reassigned to licensed services.[7] The study modelling proceeds in three steps:

- Full band baseline (1200 megahertz of the 6 GHz band unlicensed): presents the reference economic value calculated in the original study.
- Lower 500 megahertz scenario (5.925 – 6.425 GHz only): recalculates value under constrained channel width, loss of MultiLink Operation (MLO), and heightened congestion.
- Loss scenario derives the differential, i.e., the value forfeited when the upper 700 megahertz is reallocated.

In this part we have built on the established econometric and scenario analysis framework used in the original study. For this purpose, we developed alternative counterfactual scenarios where unlicensed use is rescinded in the upper 700 megahertz of the 6 GHz band. In the case of this change, the economic benefits associated with Wi-Fi 6E and Wi-Fi 7 (under the upper 700 megahertz of the 6 GHz band) derived from the additional capacity, speed, and improved user experience, will be assumed to vanish entirely. This approach involves recalibrating the baseline model inputs to account for the loss of the incremental capacity and benefits previously generated by that spectrum.

2. TECHNICAL IMPLICATIONS OF SPECTRUM REALLOCATION

The reallocation of the upper 700 megahertz of the 6 GHz band from unlicensed to licensed use would generate immediate and measurable technical consequences for Wi-Fi networks. These implications extend beyond the simple loss of spectrum capacity and directly affect the architecture, performance, and scalability of current and future Wi-Fi deployments. The sections that follow present a detailed analysis of how such a reduction in available spectrum would undermine the operational potential of Wi-Fi 6E and Wi-Fi 7, constraining throughput, increasing interference, degrading latency, and ultimately limiting the range of applications that can be supported effectively over unlicensed networks. For a more detailed explanation of these technical implications, see Appendix A.

2.1. Capacity Loss and Impact on Channel Availability

The most immediate technical consequence of removing the upper 700 megahertz of the 6 GHz band from unlicensed use is a substantial reduction in available spectrum capacity for Wi-Fi operations. Under current regulatory conditions, the full 1200 megahertz of spectrum between 5.925 and 7.125 GHz enables Wi-Fi 6E and Wi-Fi 7 devices to utilize wide contiguous channels, up to seven 160 megahertz

[7] In Part II we address the repercussions of taking away spectrum from the 6 GHz band on legacy Wi-Fi technologies, namely Wi-Fi 6 and earlier generations, which operate over the 2.4 and 5 GHz bands.

channels or three 320 megahertz channels, thereby maximizing throughput and minimizing latency. This channelization architecture has been essential in supporting bandwidth-intensive applications and managing high user density across diverse environments.

If access is restricted to only the lower 500 megahertz (5.925–6.425 GHz) of the 6 GHz band, the number of non-overlapping wide channels is dramatically reduced. Specifically, the available spectrum would only accommodate up to three 160 megahertz channels or a single 320 megahertz channel. As a result, the technical ceiling for concurrent high-throughput transmissions is sharply lowered, constraining the aggregate capacity of Wi-Fi networks. This limitation is especially detrimental in environments where multiple access points must coexist, such as apartment buildings, schools, stadiums, and enterprise campuses, since the ability to allocate distinct wide channels to each access point is severely diminished.

The implications of this reduced spectrum availability are twofold. First, it directly impacts next-generation features such as MLO, which requires access to multiple wide channels to deliver parallel data streams and improve performance robustness. Second, it disrupts the evolution path of Wi-Fi 7 and beyond, whose core value proposition hinges on leveraging larger channel bandwidths to deliver ultra-fast speeds and deterministic latency.

Moreover, spectrum capacity is not merely a question of speed, but of flexibility. Under full-band conditions, network architects can implement more granular and dynamic channel planning strategies, segmenting spectrum by floor, application type, or user class, thereby optimizing spectrum reuse and minimizing intra-network interference. In contrast, a truncated spectrum scenario forces tighter reuse patterns, increases channel overlap, and reduces the ability of systems to adapt to real-time traffic patterns and coexistence challenges.

In sum, the removal of the upper 700 megahertz of the 6 GHz band imposes a structural bottleneck on Wi-Fi capacity, limiting the ability of networks to scale with demand. This constraint undermines one of the most critical advantages of unlicensed spectrum, its ability to flexibly and efficiently meet evolving connectivity needs across all sectors of the economy.

2.2. Reduced Throughput, Latency, and Reliability

The reduction in available unlicensed spectrum caused by the removal of the upper 700 megahertz of the 6 GHz band would significantly degrade the performance of Wi-Fi networks across three key dimensions: throughput, latency, and reliability. These parameters are central not only to user experience but also to the economic value generated by Wi-Fi across residential and enterprise deployments.

Throughput degradation stems from the inability to deploy as many wide, non-overlapping channels. As mentioned above, in full-band scenarios, Wi-Fi 6E and Wi-Fi 7 can use up to three 320 megahertz or seven 160 megahertz channels, enabling ultra-high-speed data transmission to multiple devices simultaneously. In contrast, a limited spectrum environment (restricted to the lower 500 megahertz) reduces the number of usable wide channels to one or two, depending on the required channel width and coexistence constraints. This spectral bottleneck forces more devices to share narrower channels, reducing the achievable data rate per device and increasing contention. In enterprise and high-density settings, this reduction in per-user throughput can translate into application failures, buffering delays, and an overall diminished network experience.

Latency is similarly affected. Wi-Fi latency is heavily influenced by channel availability and the degree of airtime contention. Under full 6 GHz conditions, devices can be distributed across separate channels, minimizing queuing delays and retransmission events. This results in low and consistent latency, often below 20 milliseconds, sufficient to support time-sensitive applications such as video conferencing, remote collaboration, AR/VR, and industrial automation. With only 500 megahertz available, many devices are forced to compete for the same limited spectrum, increasing packet collisions and Media Access Control (MAC) layer delays.

Reliability, understood as the consistency of performance over time, is also negatively impacted under the repurposing scenario. In wide-band, low-congestion environments, Wi-Fi networks can dynamically adapt to user behavior, allocate resources efficiently, and maintain stable connections. When spectrum is constrained, these adaptive capabilities are curtailed. Networks become more vulnerable to performance variability due to co-channel interference, especially in unmanaged environments with dense access points deployments or mixed client capabilities. Moreover, advanced Wi-Fi 7 features such as MLO, which are designed to improve resilience by distributing traffic across channels, cannot be as effectively deployed if wide, clean channels are no longer available.

In combination, these three effects significantly impair the functional capability of Wi-Fi networks to deliver high-quality, dependable service. From a technical standpoint, restricting spectrum availability effectively pushes Wi-Fi networks back toward the limitations of earlier generations, forfeiting the performance gains made possible by the 6 GHz expansion and undermining the readiness of the ecosystem for Wi-Fi 7 and beyond.

3. METHODOLOGY FOR ESTIMATING ECONOMIC LOSS WITHIN THE 6 GHz ECOSYSTEM

To estimate the economic loss arising from the reallocation of the upper 700 megahertz of the 6 GHz band (i.e., spectrum above 6.4 GHz) from unlicensed to licensed use, we invert the framework employed in the original study. Instead of assessing the incremental economic benefits of new unlicensed allocations, we evaluate the foregone value resulting from the removal of spectrum critical to the operation of Wi-Fi 6E and Wi-Fi 7. This methodology entails quantifying the negative impact across three dimensions, consumer benefit, producer surplus, and GDP contribution, by simulating a counterfactual scenario in which the upper segment of the 6 GHz band is no longer available for unlicensed use.

3.1. General Modeling Approach

The general modeling approach employed to estimate the economic loss resulting from the reallocation of the upper 700 megahertz of the 6 GHz band from unlicensed to licensed use is grounded in the framework developed in our prior economic valuation of Wi-Fi. In that study, the economic benefits derived from the availability of the 6 GHz band, particularly through the deployment of Wi-Fi 6E and Wi-Fi 7, were quantified across a set of well-defined use cases. In the current analysis, we adopt a reverse-engineering methodology to measure the adverse effects of withdrawing access to that segment of the spectrum.

Specifically, we reassessed each of the previously analyzed use cases where the availability of the full 6 GHz band (inclusive of its upper portion) contributed materially to the generation of economic value[8]. For each use case, we quantify the foregone consumer surplus, producer surplus, or GDP contribution resulting from the elimination of access to the upper 700 megahertz. The nineteen use cases under analysis include:

- Savings incurred by consumers by accessing free Wi-Fi in public sites
- Free Wi-Fi service supporting the needs of the broadband unserved population
- Benefit to consumers enjoying higher speed from free Wi-Fi under Wi-Fi 6E and Wi-Fi 7
- Use of Wi-Fi in highly dense heterogeneous environments
- Consumer benefit derived from faster broadband speed
- Consumer benefit generated by use of residential Wi-Fi devices and equipment
- Bridging the digital divide: use of Wi-Fi to increase coverage in rural and isolated areas
- Savings in business Internet traffic transmitted through Wi-Fi
- Benefits derived from an increase in average speed
- Benefits derived from reduced latency
- Enhanced IoT deployment

[8] Use cases for which the original study did not attribute incremental economic value specifically to the 6 GHz band are excluded from this reassessment.

- Deployment of Augmented Reality/Virtual Reality solutions
- Cellular networks CAPEX savings by off-loading traffic to Wi-Fi
- Revenues of Wi-Fi based Public Internet Service Providers
- Revenues of Wi-Fi based Wireless Internet Service Providers
- Manufacturing of Wi-Fi devices and equipment for residential use
- Manufacturing of enterprise Wi-Fi devices and equipment
- Benefits of firms in the IoT ecosystem
- Benefits of firms in the AR/VR ecosystem

For each of these nineteen use cases, the modeling approach involved two steps. First, we isolated the portion of the economic value that was explicitly attributed to Wi-Fi 6E and Wi-Fi 7 operating in the full 6 GHz band in the previous study. We then re-estimated each source of value assuming that the upper 700 megahertz is no longer available for unlicensed use. The removal of spectrum results in a recalibration of performance parameters, particularly in terms of speed, latency, channelization, and device density, which in turn leads to a reduction in the estimated economic contribution.

In Part II the analysis will incorporate network congestion modeling to account for performance deterioration in legacy unlicensed bands (2.4 GHz, 5 GHz). By simulating traffic reallocation and capacity saturation, we estimate the compounded negative effects on consumer experience and service quality. These effects are then translated into reductions in consumer benefit and producer surplus.

By applying this case-by-case loss estimation approach, our model yields an aggregate measure of the total economic loss, both direct and indirect, that would result from repurposing the upper portion of the 6 GHz band for licensed use.

3.2. Loss of the Upper 700 megahertz of the 6 GHz Band

As mentioned above, to quantify the economic loss stemming from the withdrawal of the upper 700 megahertz of the 6 GHz band (i.e., the 6.4–7.1 GHz range), we isolated the portion of economic value generated by Wi-Fi 6E and Wi-Fi 7 technologies operating within this segment. In each case, the methodology relies on identifying the percentage of traffic, devices, users, or revenues that are enabled by this specific frequency range and removing their associated value from the baseline scenario established in the original study. No degradation effects linked to congestion in other unlicensed bands are incorporated at this stage; only the direct loss of incremental capacity and functionality due to the unavailability of the upper portion of the band is considered.

To quantify this loss accurately and comprehensively, we will proceed in this Part I to analyze in detail each specific use case affected by the removal of the upper 700 megahertz segment of the 6 GHz band. This disaggregated approach will allow us to isolate the economic value associated with Wi-Fi 6E and Wi-Fi 7 technologies operating within the 6.4–7.1 GHz range across all relevant applications. For each case, we examine the methodology used to quantify the loss of consumer benefit, producer surplus, and GDP contribution, following the structure and typology of economic agents established in the original study. By applying the same analytical framework in reverse, this section will highlight the magnitude of economic value at risk under a counterfactual scenario where the upper portion of the band is no longer available for unlicensed use.

3.2.1. Savings incurred by consumers by accessing free Wi-Fi in public sites

In the original study, the economic benefit of free Wi-Fi traffic enabled by the 6 GHz and 7 GHz bands was quantified by estimating the incremental traffic supported by Wi-Fi 6E and Wi-Fi 7 technologies[9]. Beginning from extrapolated trends in traffic per hotspot, we projected the total volume of public Wi-Fi traffic and assigned technology-specific shares based on adoption rates derived from Ookla data. For Wi-Fi 6E, we assumed saturation at 2024 levels, attributing up to 52% of total public Wi-Fi traffic to the standard by 2025. For Wi-Fi 7, a 50.6% uplift in per-hotspot throughput relative to Wi-Fi 6E was applied, with adoption ramping up from 2025 to 2027. The economic benefit was then calculated by multiplying traffic volumes attributable to each standard by the net savings per GB, defined as the difference between the cost of mobile data and the provisioning cost of public Wi-Fi.

In the present analysis, we reverse this logic to estimate the consumer losses that would result from a reallocation of the upper 700 megahertz of the 6 GHz band to licensed use. Instead of assuming a linear reduction proportional to spectrum volume, we refine the methodology to reflect the functional implications for each Wi-Fi standard.

- **Wi-Fi 6E Impact**: The full 6 GHz band (1200 megahertz) allows for up to seven non-overlapping 160 megahertz channels, critical to enabling high throughput in dense environments. With the removal of the upper 700 megahertz, only 500 megahertz would remain, permitting a maximum of three such channels. This represents a **57% reduction in wide-channel availability**, which we use to approximate the proportion of consumer benefit lost due to diminished performance and congestion at public access points.

- **Wi-Fi 7 Impact**: Wi-Fi 7 performance depends on 320 megahertz-wide channels, which require extensive contiguous spectrum. Under the full 6 GHz allocation, three 320 megahertz channels are feasible. With only the lower 500 megahertz available, just one such channel could be deployed. Consequently, **two-thirds of the incremental capacity enabled by Wi-Fi 7** would disappear. Our model therefore assumes that only one-third of the traffic originally attributed to Wi-Fi 7 can be preserved, with the remainder lost due to channel unavailability.

The technical implications are summarized in the table below (See Table 3-1):

[9] In urban areas where hotspot density is higher, free Wi-Fi access plays a key role in supporting affordable connectivity.

Table 3-1. Channel Availability and Capacity Loss Resulting from the Reallocation of the Upper 700 megahertz of the 6 GHz Band

Standard	Full Bandwidth Available	Channels Possible	Channels Remaining if Top 700 megahertz reallocated	% Channel Availability Reduction
Wi-Fi 6E	1200 megahertz	7 × 160 megahertz	3 × 160 megahertz	57.14%
Wi-Fi 7	1200 megahertz	3 × 320 megahertz	1 × 320 megahertz	67.67%

Sources: Telecom Advisory Services analysis

These percentages are directly applied as discount factors to the relevant portions of consumer benefit estimated in the original study. By anchoring the analysis in the physical channel architecture of each standard, the resulting loss estimates reflect not only a reduction in volume, but a degradation of user experience due to increased congestion, diminished throughput, and reduced service availability. The current estimation of consumer losses resulting from the reallocation of the upper 700 megahertz of the 6 GHz band is anchored in the reduction of wide-channel availability for Wi-Fi 6E and Wi-Fi 7, and its effect on throughput per public access point. While this provides a robust and technically grounded proxy for modeling degraded performance, the approach may understate the broader consumer impact for several reasons.

First, it does not fully capture the non-linear effects of congestion in high-density public areas where limited channelization can lead to exponential deterioration in quality of service, particularly at peak usage times. Second, the analysis assumes that consumer behavior, including Wi-Fi usage patterns and data demand, remains static despite reduced performance, when in practice degraded service may lead to lower adoption, reduced session duration, or complete avoidance of public Wi-Fi, particularly among heavy data users. Third, network management responses, such as throttling, reduced Quality of Service (QoS) prioritization, or device disconnection, are not explicitly modeled, although they are common in capacity-constrained environments and directly affect user experience. Finally, the channel-based discounting does not consider lost opportunities for future service innovation (e.g., immersive applications, AR/VR) that rely on the full spectral capabilities of Wi-Fi 7. These unmodeled dynamics suggest that while the present estimate is grounded in measurable capacity loss, the real-world economic and experiential losses for consumers may be substantially greater.

3.2.2. Free Wi-Fi service supporting the needs of the broadband unserved population

In the original study, the economic benefit of free Wi-Fi service supporting the broadband-unserved population was estimated by modeling how improvements in hotspot capacity, enabled by the 6 GHz band through Wi-Fi 6E and Wi-Fi 7, would support the connection of additional households. This was done by applying a conservative estimate that a percentage of broadband unconnected households could be served by free Wi-Fi, with incremental GDP contributions attributed to enhanced broadband penetration.

In the present analysis, we reverse this logic to estimate the societal *losses* that would result from the reallocation of the upper 700 megahertz of the 6 GHz band (above 6.4 GHz) to licensed use. Instead of assuming a proportional reduction in GDP impact based on spectrum quantity, we analyze the technical limitations imposed on Wi-Fi 6E and Wi-Fi 7 and translate these into constrained household connectivity.

The estimation of loss is based on technical simulations of Wi-Fi deployment capacity under different spectrum scenarios. When the full 6 GHz band is available (1200 megahertz), a typical Wi-Fi access point can operate using seven 160 megahertz non-overlapping channels. This enables support for a larger number of simultaneous connections and facilitates broader area coverage. By contrast, when spectrum is restricted to the lower 500 megahertz, only three 160 megahertz channels remain usable. This reduction limits the number of households that can be served concurrently at an acceptable quality level, particularly in outdoor environments where interference and contention are more pronounced.

Based on these channelization constraints, it is estimated in a conservative way that 41.18% fewer households can be connected via free Wi-Fi when limited to the lower portion of the 6 GHz band (See Appendix B.1.)[10]. This figure reflects the decrease in access points capacity under reduced spectrum availability, particularly in public hotspot and community Wi-Fi configurations. The remaining 58.82% of the original coverage potential is considered technically feasible using only the lower 500 megahertz. These ratios are applied to the baseline estimate of the economic value of connecting unserved households, yielding separate estimates for the value preserved and the value lost under the proposed spectrum reallocation.

This approach ensures alignment with established spectrum-capacity modeling and reflects the functional loss in service capability, rather than merely spectrum volume. Importantly, it avoids overstating the loss by assuming that Wi-Fi remains operational, albeit constrained, under a limited spectrum regime.

It should be emphasized, however, that this estimate does not capture several second-order impacts. These include higher latency and reduced throughput for users, increased costs for infrastructure densification, diminished incentive for providers to deploy hotspots in underserved zones, and lower likelihood of household adoption due to inconsistent performance (in Part II the analysis will incorporate network congestion modeling to account for performance deterioration in legacy unlicensed bands). Moreover, the reduced feasibility of deploying Wi-Fi 7 in community networks may delay or prevent future service enhancements relying on higher efficiency and lower latency. As such, while the 41.18% loss factor offers a technically grounded proxy, the real-world economic impact of withdrawing the upper 700 megahertz may be considerably larger.

[10] While the estimate assumes a 41.18% reduction in coverage, this is likely conservative since the reduction could be much higher. Given that only 3 out of the original 7 non-overlapping 160 megahertz channels remain usable under a 500 megahertz allocation, the actual degradation in service capacity could reach up to 57%.

3.2.3. Benefit to consumers enjoying higher speed from free Wi-Fi under Wi-Fi 6E, and Wi-Fi 7

The original 2024 valuation estimated the surplus that public hotspot users derive from faster downloads once access points migrate from legacy Wi-Fi to Wi-Fi 6E and, later, Wi-Fi 7 across the entire 1200 megahertz of the 6 GHz band. That calculation linked the incremental speed uplift to the willingness-to-pay curve and applied the result to the population of households that rely on free Wi-Fi.

To estimate the loss triggered by reallocating the upper 700 megahertz of 6 GHz spectrum (6.425–7.125 GHz) to licensed use, we translate the physical limitations of a 500 megahertz ceiling into an explicit throughput discount. Detailed channel simulation runs demonstrate that trimming available spectrum from 1200 megahertz to 500 megahertz lowers the number of simultaneous users an access point can sustain by 41.18 % (See Appendix B.1.). The same simulations show a commensurate decline in aggregate airtime capacity and effective per device speed once channel contention, RU scarcity, and carrier sense overhead are factored in. Because this percentage is grounded in the measured relationship between channel availability and served user capacity, rather than a simple linear proportion of lost spectrum, it provides a real-world proxy for the performance degradation consumers would face under the constrained band scenario.

Because the 41.18 % factor is grounded in observed constraints on simultaneous user capacity rather than a purely theoretical proportional cut in spectrum, it offers a conservative proxy for performance degradation. It does not, however, capture second order effects such as the nonlinear rise in congestion during peak periods, behavioural shifts away from public Wi-Fi when speeds falter, or the lost opportunity to introduce future high-bandwidth applications that depend on Wi-Fi 7's full feature set. Consequently, the surplus estimates produced here should be regarded as a lower bound on the real welfare cost of withdrawing the upper 700 megahertz from unlicensed use.

3.2.4. Use of Wi-Fi in highly dense heterogeneous environments

In the original study, the benefit of Wi-Fi 6E and Wi-Fi 7 in highly dense heterogeneous environments, such as stadiums, convention centers, and large venues, was quantified through the incremental traffic these technologies enabled under high-congestion conditions. These settings demand elevated network capacity, low latency, and efficient spatial reuse, all of which are supported by the availability of wide contiguous channels (160 megahertz and 320 megahertz) provided by the full 6 GHz band. The economic value was calculated by estimating the annual traffic offloaded from mobile networks to public Wi-Fi under each standard, multiplied by the net consumer savings per gigabyte. Capacity assumptions were based on device adoption trends and per-user data usage, with annual traffic projections increasing substantially over time.

To estimate the losses under a scenario in which the upper 700 megahertz of the 6 GHz band is reallocated to licensed use, we reversed this approach by simulating the technical limitations introduced by spectrum constraints, and mapping those to a decline in traffic handling capacity at public access points.

- **Wi-Fi 6E Impact**: In high-density venues, access points equipped with Wi-Fi 6E rely on the availability of multiple non-overlapping 160 megahertz channels to distribute traffic loads efficiently. Under full-band conditions, up to seven such channels can be deployed, whereas only three remain if the upper 700 megahertz is withdrawn, a 57% reduction in wide-channel availability. While in practice traffic may be partially redistributed across remaining channels, the sharp increase in airtime contention and reduced frequency diversity impairs quality of service. We conservatively apply the 57% loss factor to the portion of Wi-Fi traffic previously attributed to Wi-Fi 6E in these environments and compute the resulting reduction in consumer benefit due to unmet demand and lower user satisfaction.

- **Wi-Fi 7 Impact**: Wi-Fi 7, with its support for 320 megahertz-wide channels and MLO, is especially suited for demanding environments with high concurrency. In the full 6 GHz band, three 320 megahertz channels are feasible, enabling flexible load balancing and real-time responsiveness. The reallocation of the upper 700 megahertz reduces this to a single channel, effectively eliminating two-thirds of usable 320 megahertz capacity and disabling intra-band MLO. Consequently, we assume that only one-third of the traffic and economic benefit originally attributed to Wi-Fi 7 in these settings can be retained under a constrained spectrum scenario.

The losses in traffic handling capacity are then translated into foregone consumer savings, using the same per-GB valuation method as in the baseline study. These estimates reflect both the direct economic impact (e.g., higher mobile data usage costs in the absence of Wi-Fi offload) and the indirect effects of degraded user experience, such as increased buffering, failed connections, and session drop-offs, particularly during peak usage events.

As in previous cases, this approach provides a technically grounded but conservative estimate of the value at risk. It does not fully capture broader behavioral and operational implications, such as reduced willingness of venues to invest in Wi-Fi infrastructure, negative spillovers on adjacent services (e.g., mobile ticketing, live-streamed replays, AR overlays), or limitations on the adoption of Wi-Fi 7-enhanced use cases.

3.2.5. Consumer benefit derived from faster broadband speed

The valuation of consumer surplus generated by higher residential broadband speeds begins with the willingness to pay calculations estimated in the research literature.[11] For every fixed broadband household that relies on a Wi-Fi- router, the analysis compares the downlink rate achievable over Wi-Fi with the speed that the

[11] Nevo, A., Turner, J., and Williams, J. (2016) "Usage-based pricing and demand for residential broadband", *Econometrica*, vol. 84, No.2 (March), 441-443.

same user would obtain if traffic had to fall back on mobile broadband. The resulting differential is translated into a monetary figure through the speed WTP function and applied only to those lines whose retail plan exceeds 150 Mbps and whose customer premises equipment supports either Wi-Fi 6E or -Wi-Fi- 7. This yields the baseline annual surplus under today's regulatory framework, which assumes access to the full 1200 megahertz of 6 GHz spectrum and therefore allows each standard to reach its maximum practical capacity.

To project the impact of withdrawing the upper 700 megahertz (6.425–7.125 GHz), the methodology converts the physical loss of wide channels into an equivalent reduction in effective throughput. For Wi-Fi 6E, the number of nonoverlapping 160 megahertz channels falls from seven to three when only the lower 500 megahertz remains, a contraction that removes 57% of the wide-channel budget and proportionally lowers realized speeds for all qualifying 6E households. Wi-Fi 7 is affected even more sharply: the available 320 megahertz channels shrink from three to one and MLO can no longer be deployed, eroding both speed and latency advantages; the resulting loss of high-capacity channels is 67%. The hedonic willingness-to-pay curve is recalculated with these reduced performance levels, yielding a new, lower surplus per household for each technology.

The difference between the baseline surplus and the recalculated figure represents the welfare forgone by each household. Multiplying that loss by the projected population of Wi-Fi 6E and Wi-Fi 7 subscribers, using the same penetration trajectories adopted in the 2024 report, provides the aggregate annual reduction in consumer benefit. Summing across both standards and across forecast years delivers the total value that would disappear solely because the upper segment of the 6 GHz band is no longer available for unlicensed use.

This approach is deliberately conservative. It scales surplus in a linear fashion with the channel budget and therefore does not capture the super linear performance collapse that typically accompanies higher contention, the additional latency penalties that arise once MLO is disabled, or behavioural responses such as customers downgrading to lower-tier broadband plans when Wi-Fi quality deteriorates. The final estimate should thus be interpreted as a floor on the true economic cost associated with reallocating the upper 700 megahertz of the 6 GHz band.

3.2.6. Consumer benefit generated by use of residential Wi-Fi devices and equipment

In the original study, the consumer benefit generated by the use of residential Wi-Fi devices and equipment was proxied using the producer surplus approach. Given the absence of detailed willingness-to-pay data across all categories, the benefit was conservatively estimated by applying average gross profit margins to the total retail value of Wi-Fi-enabled consumer equipment sold in the U.S. market. The analysis included home routers, mesh systems, smart displays, connected speakers, and other residential devices embedding Wi-Fi 6E and Wi-Fi 7 technologies. Incremental benefit was attributed to the more advanced generations based on shipment shares and adoption trends projected by industry sources.

To estimate the economic loss associated with the reallocation of the upper 700 megahertz of the 6 GHz band (6.4–7.1 GHz), we adjusted these benefit flows by accounting for the diminished functional value of next-generation Wi-Fi devices under constrained spectrum. The loss of two-thirds of the 6 GHz band's usable width severely limits the operation of wideband channels and advanced features like MLO, particularly for Wi-Fi 7. While the underlying devices may still function, their performance, and thus their consumer utility, would be substantially degraded. In light of this, we apply conservatively adjusted discount factors that reflect the diminished technical potential without assuming full obsolescence.

- **Wi-Fi 6E Impact**: Wi-Fi 6E devices rely on access to multiple non-overlapping 160 megahertz channels to provide enhanced throughput and reduced latency. The removal of the upper portion of the band reduces the number of such channels from seven to three. While this implies a 57% reduction in wide-channel availability, not all use cases are equally affected. To reflect this variation, and to avoid overstating the loss, we apply a conservative 40% discount factor to the consumer benefit attributed to Wi-Fi 6E device usage in the residential segment.

- **Wi-Fi 7 Impact**: Wi-Fi 7 performance depends even more critically on spectrum continuity, especially for 320 megahertz-wide channel support and MLO across multiple links. Under constrained conditions, only one 320 megahertz channel is available, preventing full MLO functionality and reducing spectral flexibility. Although the theoretical loss in channel capacity is 67%, we apply a more conservative 50% reduction to the consumer surplus attributed to Wi-Fi 7-enabled residential devices, to reflect partial performance retention and adaptive usage patterns.

Beyond the technical constraints, the reallocation of the upper 6 GHz band may also undermine consumer confidence in the long-term viability of the advanced Wi-Fi technologies where U.S. companies lead the world market, reducing demand for Wi-Fi 6E and Wi-Fi 7 devices and undermining U.S. exports. Changes in spectrum policy mid-cycle introduce regulatory uncertainty that can discourage consumer adoption, delay device replacement cycles, or shift preferences toward more stable (but lower-performance) legacy solutions. These behavioral responses are not captured in the discount factors above, but may significantly amplify the real economic loss, particularly over time.

As such, the adjusted figures presented here are best interpreted as minimum loss estimates, grounded in current device performance constraints, but excluding second-order effects on market dynamics, innovation, and long-run adoption. The full economic impact of reduced spectral capacity for residential Wi-Fi may thus exceed the direct reduction in per-device utility captured in this model.

3.2.7. Use of Wi-Fi to increase coverage in rural and isolated areas

In the original study, Wi-Fi was identified as a key enabler of last mile broadband connectivity in rural and underserved areas, primarily through its integration in

Wireless Internet Service Provider (WISP) networks. These operators frequently deploy -unlicensed spectrum technologies to extend internet access where fiber or mobile infrastructure is not economically viable. By utilizing the expanded 6 GHz band, particularly in outdoor -standard power- configurations, WISPs were able to serve a greater number of households per access point, reduce congestion, and enhance quality of service. The economic contribution of these connections was measured through the impact of increased broadband penetration on GDP, following the econometric model developed by Katz et al (2024).[12]

A reallocation of the upper 700 megahertz of the 6 GHz band (6.425–7.125 GHz) would remove the U-NII-7 channels that underpin this capacity gain. Engineering simulations show that, under a 102 resourceunit (RU) Wi-Fi 6E configuration, the number of simultaneous connections falls from 118 to 32, a contraction of 40.48% in addressable users per access point (See Appendix B.2.). Consistent with the methodology applied to other outdoor constrained use cases, all quantitative results for coverage are therefore discounted by 40.48%. Concretely, for every 100 premises that could be connected under fullband conditions, only 60 remain technically and economically feasible when WISPs are limited to the lower 500 megahertz.

It should be stressed that the 40.48% adjustment captures only the immediate loss of channel capacity. It does not account for (i) higher infrastructure costs arising from forced network densification, (ii) throughput penalties per connected household, or (iii) the more severe channel scarcity anticipated for Wi-Fi 7, which depends on 320 megahertz channels. Accordingly, the revised figures represent a deliberately conservative estimate of the economic harm that communities, and the wider U.S. economy, would incur if the upper portion of the 6 GHz band were withdrawn from unlicensed use.

3.2.8. Savings in business Internet traffic transmitted through Wi-Fi

In the original study, one of the major sources of producer surplus was the cost savings generated by enterprises that rely on Wi-Fi to transmit internal Internet traffic. Businesses increasingly offload data-intensive applications, such as video conferencing, cloud-based collaboration, IoT telemetry, and real-time analytics, using Wi-Fi networks within office and industrial environments. The availability of the full 6 GHz band, particularly under Wi-Fi 6E and Wi-Fi 7 standards, enabled firms to support greater volumes of high-throughput traffic with lower latency and improved reliability, significantly reducing reliance on more expensive mobile alternatives. The total volume of business Wi-Fi traffic was estimated based on enterprise device counts, usage intensity, and the share of traffic handled by Wi-Fi, and monetized by applying the average cost differential per gigabyte between Wi-Fi and mobile data transmission.

To estimate the loss resulting from the reallocation of the upper 700 megahertz of the 6 GHz band, we reverse this logic and assess how constrained spectrum

[12] Katz, R., Callorda, F. and Jung, J. (2024). *The impact of digital transformation on the economy - Econometric Modelling*. Geneva: International Telecommunication Union.

availability affects the ability of businesses to offload traffic to Wi-Fi networks. Specifically, we model the reduction in enterprise traffic handling capacity attributable to the diminished channel architecture under Wi-Fi 6E and Wi-Fi 7, and translate this into a proportional reduction in offload-driven cost savings.

- **Wi-Fi 6E Impact**: Under full-band conditions, Wi-Fi 6E can utilize up to seven non-overlapping 160 megahertz channels to distribute enterprise traffic efficiently, particularly in high-density office buildings and industrial campuses. With only 500 megahertz available under a constrained scenario, this number falls to three, representing a 57% reduction in wide-channel availability. Based on this, we assume that 57% of the incremental traffic offload capacity originally attributed to Wi-Fi 6E would be lost, requiring that volume of data to be transmitted over more expensive alternatives (e.g., cellular or leased wired connections). The corresponding cost savings are discounted accordingly.

- **Wi-Fi 7 Impact:** Wi-Fi 7 enables even greater traffic optimization in enterprise environments through its support for 320 megahertz-wide channels, MLO, and enhanced QoS features. Under a full 6 GHz allocation, three 320 megahertz channels are available, whereas only one remains under a 500 megahertz constraint. This 67% loss in high-capacity channels significantly reduces the throughput and flexibility available for enterprise-grade offload. As a result, we estimate that only one-third of the cost savings attributed to Wi-Fi 7 in enterprise settings can be retained, with the rest forfeited due to limited spectral capacity.

These reductions are applied to the baseline enterprise Wi-Fi traffic estimates derived in the original model. The cost differential per gigabyte is held constant, and the resulting decline in offloaded traffic volume under constrained conditions is used to compute the foregone producer surplus for each year in the analysis period.

It is important to note that this approach captures only the direct cost impact of lost Wi-Fi offload capacity. It does not account for secondary effects such as increased network congestion, diminished application performance, or additional IT infrastructure expenditures required to compensate for degraded Wi-Fi capabilities (e.g., deploying denser AP arrays, investing in wired redundancy, or subscribing to higher-tier mobile data plans). Nor does it consider the potential impact on the deployment of latency-sensitive enterprise applications, such as augmented reality for maintenance, warehouse robotics, or remote asset monitoring, that are increasingly dependent on the high throughput and low jitter enabled by Wi-Fi 6E and Wi-Fi 7. As such, the real-world economic loss associated with this use case may be considerably higher than the direct savings forgone under the modeled assumptions.

3.2.9. Benefits derived from an increase in average speed

In the original study, one of the primary macroeconomic benefits attributed to the use of unlicensed spectrum was the contribution of higher average download speeds to national GDP. Wi-Fi 6E and Wi-Fi 7 technologies, enabled by the full 6 GHz band, provided significant improvements in network performance. These improvements facilitated productivity gains through faster access to cloud-based services, enhanced video collaboration and support for bandwidth-intensive applications such as AI, edge computing, and real-time data analytics. The GDP impact of speed improvements was quantified using an econometric model, which estimated the elasticity of GDP growth to changes in average broadband quality.

To translate the removal of the upper 700 megahertz (6.425–7.125 GHz) into a speed shock, we again rely on channelization capacity:

- **Wi-Fi 6E:** Under full band conditions Wi-Fi 6E can use seven nonoverlapping 160 megahertz channels; restricting operation to the lower 500 megahertz leaves only three, representing a 57 % reduction in wide channel capacity. This loss factor is applied directly to the portion of national throughput attributed to Wi-Fi 6E households before feeding the GDP-elasticity model.

- **Wi-Fi 7.** With the full 1200 megahertz, Wi-Fi 7 deploys three 320 megahertz channels and MLO; limiting service to the lower sub-band leaves a single 320 megahertz channel, a 67 % loss of high-capacity channels and the removal of MLO. This 67 % discount is applied to the Wi-Fi 7 throughput contribution prior to estimating its macroeconomic effect.

The resulting figures represent the *foregone* macroeconomic gains that would otherwise accrue from the steady rise in average broadband quality enabled by the full 6 GHz band. As with the consumer surplus analysis, this approach is deliberately conservative. It excludes second order spillovers, such as accelerated cloud adoption, edge AI deployment and telepresence diffusion, that are highly sensitive to speed improvements, as well as any synergy with enterprise Wi-Fi offload. Consequently, the losses reported here should be interpreted as a floor on the true GDP impact of reallocating the upper portion of the 6 GHz band to licensed use.

3.2.10. Benefits derived from reduced latency

In the original study, reduced latency was recognized as a key driver of economic value, particularly within enterprise environments that require real-time responsiveness. The contribution of latency improvements to GDP was estimated using a composite quality index that captured the joint impact of download speed and latency on network performance. Wi-Fi 6E and Wi-Fi 7, operating over the full 6 GHz band, enable significant latency reductions through wider channels, improved scheduling, and, particularly in the case of Wi-Fi 7, features such as MLO.

To estimate the loss in GDP contribution due to increased latency under a constrained spectrum scenario, we adopt a methodology that mirrors the approach used throughout this chapter: using channel availability as a functional proxy. We assume that the loss of wide-channel capacity directly limits the ability of Wi-Fi networks to maintain low-latency performance, especially in high-density enterprise environments where deterministic access and traffic separation across multiple wide channels are critical.

- **Wi-Fi 6E Impact**: Under full-band conditions, up to seven non-overlapping 160 megahertz channels are available. With only 500 megahertz remaining after the reallocation of the upper 700 megahertz, this drops to three channels, a 57% reduction in wide-channel availability. This reduction leads to increased airtime contention and congestion, degrading latency performance. For modeling purposes, we apply this 57% reduction directly to the share of GDP contribution originally attributed to latency improvements enabled by Wi-Fi 6E.

- **Wi-Fi 7 Impact**: Wi-Fi 7 relies on 320 megahertz-wide channels and MLO to minimize latency and support time-sensitive applications. Under full-band conditions, three such channels are possible; with only 500 megahertz available, only one 320 megahertz channel remains. This represents a 67% reduction in wide-channel capacity. As with Wi-Fi 6E, we apply this 67% reduction to the GDP value originally attributed to latency improvements from Wi-Fi 7.

This methodology, while stylized, is consistent with the broader logic of the report. It reflects the fact that latency performance in enterprise Wi-Fi networks is highly sensitive to channelization: fewer wide channels lead to more devices contending for airtime, greater queuing delays, and less flexibility in managing time-sensitive traffic. The resulting degradation undermines the very features that Wi-Fi 6E and Wi-Fi 7 were designed to deliver, especially in latency-critical use cases such as collaborative AR/VR, remote control systems, high-frequency trading, and telepresence.

The resulting GDP loss figures, 57% of the latency-derived contribution from Wi-Fi 6E, and 67% for Wi-Fi 7, are applied to the respective portions of the original economic value estimated in the baseline model. These losses represent the share of latency-related productivity gains that would be forfeited under a spectrum-constrained scenario, in which deterministic, low-jitter connectivity cannot be reliably delivered.

3.2.11. Enhanced IoT deployment

In the original study, Wi-Fi's role in enabling Internet of Things (IoT) deployments was identified as a significant source of economic value, particularly in enterprise and industrial environments. Wi-Fi 6E and Wi-Fi 7 introduced capabilities such as higher spectral efficiency, support for higher device densities, deterministic scheduling, and better energy management, making them especially suitable for large-scale IoT deployments. The resulting productivity improvements were translated into GDP gains using Machine-to-Machine (M2M) connections serving as a proxy for IoT adoption. The incremental growth in Wi-Fi-enabled IoT terminals, attributable to expanded spectrum and higher network performance, was mapped to economic output gains based on a 0.7% increase in GDP per 10% growth in M2M connections.

To estimate the loss in GDP associated with the reallocation of the upper 700 megahertz of the 6 GHz band, we assess how the reduction in available spectrum impairs Wi-Fi's capacity to support dense and reliable IoT deployments. Both Wi-Fi 6E and Wi-Fi 7 rely on access to wide contiguous channels in the 6 GHz band to deliver high-efficiency, low-latency connections required for mission-critical machine-to-machine (M2M) applications. With the full 1200 megahertz available, Wi-Fi 6E supports up to seven 160 megahertz channels, while Wi-Fi 7 enables up to three 320 megahertz channels with MLO. Limiting the band to only 500 megahertz reduces the available channelization to three and one, respectively, resulting in a functional reduction of 57% for Wi-Fi 6E and 67% for Wi-Fi 7. However, to avoid overestimating the loss and ensure a conservative approach across both technologies, we adopt a unified degradation factor of 58.33%, which corresponds to the proportional reduction in total spectrum availability (700 megahertz out of 1200 megahertz) (See Appendix B.3.).

This approach is appropriate because it captures the direct dependency between spectrum availability and the scalability of Wi-Fi-based IoT networks, particularly those relying on Wi-Fi 6E and Wi-Fi 7. Unlike general broadband applications, IoT deployments are highly sensitive to congestion, latency, and spectral efficiency, given the high device density and diverse performance requirements involved. In industrial, logistics, and smart city contexts, IoT systems often require deterministic communication with low packet loss and bounded latency. Wider contiguous channels, enabled by the full 6 GHz band, are essential to meet these demands, as they allow greater spectral flexibility, lower airtime contention, and the implementation of advanced features such as OFDMA and TWT (Target Wake Time) across large device clusters. By restricting bandwidth to only 500 megahertz, the reallocation eliminates the ability to deploy multiple non-overlapping wide channels, directly reducing system capacity and forcing devices to share channels, increasing interference and jitter. As a result, Wi-Fi loses its ability to serve as a cost-effective, standards-based platform for dense IoT environments, leading to reduced deployment rates and higher migration to alternative (often costlier or proprietary) technologies. This degradation in functional capacity justifies the economic loss estimation used in the model, which reflects the structural limitations imposed on future IoT use cases by the partial withdrawal of 6 GHz spectrum.

The resulting GDP loss is calculated by applying the 58.33% discount factors to the portions of IoT-related economic impact originally attributed to Wi-Fi 6E and Wi-Fi 7. These losses represent the share of potential M2M connection growth and associated productivity gains that would no longer materialize under a spectrum-constrained scenario. While the estimates are conservative and based on quantifiable device connectivity trends, they likely understate broader innovation spillovers, such as the acceleration of edge computing, automation, and AI-driven optimization, that depend on scalable, high-performance IoT platforms.

3.2.12. Deployment of Augmented Reality/Virtual Reality solutions

In the original study, the economic value associated with the deployment of Augmented Reality (AR) and Virtual Reality (VR) solutions was captured through their impact on enterprise productivity, innovation, and operational efficiency. Applications such as remote training, virtual collaboration, immersive design reviews, and assisted maintenance rely heavily on Wi-Fi connectivity with high bandwidth and ultra-low latency. The adoption of Wi-Fi 6E and Wi-Fi 7, enabled by the full 6 GHz band, was a key enabler of these use cases, as both standards offer wide channel bandwidths, better spectral efficiency, and enhanced scheduling mechanisms. The GDP impact was modeled by attributing a share of AR/VR-driven productivity improvements to the Wi-Fi ecosystem.

To estimate the loss in economic value resulting from the reallocation of the upper 700 megahertz of the 6 GHz band, we analyze how spectrum constraints limit the technical feasibility of AR/VR deployment under Wi-Fi 6E and Wi-Fi 7, and apply this impairment as a proportional reduction in the associated GDP contribution.

- **Wi-Fi 6E Impact**: Wi-Fi 6E supports up to seven 160 megahertz channels when the full 6 GHz band is available. These wide channels are critical for delivering the high sustained throughput required by immersive applications, particularly when multiple devices operate concurrently in the same environment. Reallocating the upper 700 megahertz reduces the number of usable 160 megahertz channels to three, a 57% reduction in channel availability. Given the strong correlation between channelization and AR/VR performance stability, we assume that 57% of the GDP value attributed to Wi-Fi 6E-enabled AR/VR deployments would be lost in a spectrum-constrained scenario.

- **Wi-Fi 7 Impact**: Wi-Fi 7 is specifically designed to support the next generation of immersive technologies through 320 megahertz-wide channels, MLO, and advanced modulation. These features allow Wi-Fi 7 to deliver ultra-high throughput and sub-10 ms latency, requirements that are essential for seamless AR/VR experiences. Under full-band conditions, three 320 megahertz channels are available; without the upper 700 megahertz, only one remains. This 67% reduction in wide-channel capacity effectively limits the ability to support multi-user or high-fidelity AR/VR environments. As a result, we apply a 67% loss factor to the economic value previously attributed to Wi-Fi 7 in AR/VR use cases.

The resulting GDP losses are estimated by applying the respective 57% and 67% reduction factors to the original AR/VR-related productivity contributions attributed to Wi-Fi 6E and Wi-Fi 7, respectively. This methodology is grounded in the critical performance requirements of AR/VR applications, which depend on ultra-low latency, high sustained throughput, and reliable bi-directional communication, all of which are enabled by the full 6 GHz spectrum through wide contiguous channels (160 megahertz for Wi-Fi 6E and 320 megahertz for Wi-Fi 7). In enterprise settings such as remote collaboration, industrial training, virtual prototyping, and immersive simulations, latency above 20 milliseconds or insufficient channel bandwidth degrades the user experience to the point of functional infeasibility. Features such as MLO in Wi-Fi 7 are central to achieving the required determinism and redundancy. When access is restricted to only 500 megahertz of spectrum, the number of usable wide channels is drastically reduced, impairing the ability to isolate AR/VR traffic from other competing services and eliminating the possibility of concurrent clean 320 megahertz channels. As a result, Wi-Fi can no longer serve as a scalable transport layer for enterprise-grade AR/VR systems, leading to productivity losses in sectors that had integrated such technologies. The reduction factors thus reflect not just a proportional spectrum cut, but the loss of technical feasibility for key use cases, which translates into foregone economic gains originally projected in the 2024 study under full-band access conditions.

It is important to emphasize that these estimates may understate the broader economic consequences of delayed or limited AR/VR adoption. In many sectors, including manufacturing, healthcare, construction, and education, AR/VR is emerging not just as a productivity enhancer but as a fundamental tool for digital transformation[13]. The inability to scale these solutions reliably over enterprise Wi-Fi networks may discourage investment, reduce application adoption, and limit the realization of long-term efficiency gains. As such, the loss of upper 6 GHz spectrum imposes not only a performance penalty but also a potential innovation bottleneck with macroeconomic implications.

3.2.13. Cellular networks CAPEX savings by off-loading traffic to Wi-Fi

One of the key economic benefits of unlicensed spectrum is its role in reducing capital expenditures (CAPEX) for mobile network operators by off-loading data traffic from licensed cellular infrastructure to Wi-Fi networks. This off-loading is particularly significant in dense urban areas and indoor environments, where Wi-Fi infrastructure, deployed in homes, offices, and public venues, absorbs a substantial share of mobile data traffic. This capability enables operators to defer or reduce investments in additional licensed spectrum or cellular network densification.

However, under a scenario in which the upper 700 megahertz of the 6 GHz band is reallocated to licensed use, leaving only 500 megahertz for unlicensed operation, the ability of Wi-Fi to absorb mobile traffic is drastically curtailed. With the loss of wide channelization and constrained spectral flexibility, networks operating under Wi-Fi 6E and Wi-Fi 7 experience a sharp decline in average throughput, particularly for configurations that depend on 320 megahertz channels and MLO.

As documented in Appendix B.5, under the constrained 500 megahertz allocation, average Wi-Fi throughput per connection falls from 3,602.94 Mbps (under full 1200 megahertz availability) to just 600.49 Mbps. This represents an 83.33% loss in effective throughput and directly impairs the system's capacity to support mobile data off-loading. Accordingly, we apply this 83.33% reduction factor to estimate the decline in CAPEX savings mobile operators would have realized through full-band off-loading.

This figure reflects only the direct opportunity cost in CAPEX efficiency. It excludes further second-order effects such as additional strain on macro networks, accelerated 5G densification needs, or lost synergies with small cell deployments,

[13] The spectrum-based reduction factor applied here is a conservative estimate. A case-by-case assessment of the impact on high-capacity AR/VR deployments under constrained channelization conditions (see Appendix B.4) suggests a functional degradation closer to 81.82% when accounting for the loss of multi-link capabilities and reduction in simultaneously addressable devices.

factors which would likely amplify the overall economic impact of reduced off-loading capability under licensed reallocation scenarios.

3.2.14. Revenues of Wi-Fi based Public Internet Service Providers

Public Internet Service Providers (PISPs), such as those operating Wi-Fi networks in airports, hotels, stadiums, transportation systems, and metro-scale environments, depend on unlicensed spectrum to deliver high-capacity, low-latency internet access to large numbers of concurrent users. The full allocation of the 6 GHz band enabled these providers to deploy Wi-Fi 6E and Wi-Fi 7 access points with multiple wide, non-overlapping channels, allowing for a high-quality experience even in extremely dense public venues.

In this updated analysis, we adopt a conservative modeling approach to estimate the impact of reallocating the upper 700 megahertz of the 6 GHz band to licensed use. Rather than applying technology-specific channel degradation factors (e.g., 57% for Wi-Fi 6E, 67% for Wi-Fi 7), we rely on the 41.18% loss factor introduced earlier in the section *"Free Wi-Fi service supporting the needs of the broadband unserved population."* This figure captures the loss in deployment capacity when Wi-Fi access points are constrained to operate using only the lower 500 megahertz of the band, due to spectrum limitations that reduce the number of supported users and limit traffic throughput.

While this 41.18% loss ratio was originally derived for outdoor and community deployments, we apply it here as a lower-bound estimate for public venue ISPs. In practice, spectrum constraints in high-density indoor environments may lead to greater revenue losses, due to increased congestion, degraded QoS, and reduced willingness to pay for unreliable or lower-performance connectivity.

By applying the 41.18% reduction factor to the projected revenues of Wi-Fi-based public ISPs under full-band access, we obtain a conservative estimate of the foregone earnings attributable to spectrum reallocation. This approach ensures methodological consistency with other use cases, while recognizing that the actual revenue impact may be substantially higher when technical performance constraints, consumer churn, and service discontinuation are taken into account.

3.2.15. Revenues of Wi-Fi based Wireless Internet service Providers

Wireless Internet Service Providers (WISPs) play a vital role in expanding broadband coverage across rural and underserved areas in the United States. Their business models are heavily dependent on unlicensed spectrum, particularly the availability of wide, contiguous channels in the 6 GHz band, which allow for cost-effective, high-capacity wireless deployments. The introduction of Wi-Fi 6E and Wi-Fi 7 has further enhanced their ability to deliver reliable fixed wireless access, offering higher throughput, lower latency, and improved spectral efficiency, key attributes for serving geographically dispersed populations.

When access to the upper 700 megahertz of the 6 GHz band is withdrawn, and only the lower 500 megahertz remains available for unlicensed use, the operational capacity of WISPs is substantially reduced. Technical limitations, such as the inability to deploy multiple non-overlapping wide channels and the resulting increase in interference, undermine the scalability of their networks. This directly affects their ability to expand service, maintain quality, and reach new customers.

As analyzed in the earlier section focused on Wi-Fi-based solutions for unserved populations, the constraint imposed by partial spectrum access is expected to reduce the effective reach of these providers by 40.48%. This loss factor, conservatively estimated, accounts for reduced deployment feasibility, lower access point efficiency, and diminished network coverage. Consequently, a significant share of the revenue opportunity originally projected for WISPs under a full-band scenario would no longer materialize.

While this estimate does not capture second-order impacts, such as reduced investment incentives, delayed technology adoption, or increased reliance on alternative, higher-cost technologies, it provides a conservative yet meaningful quantification of the economic consequences that spectrum reallocation would impose on Wi-Fi-based wireless service providers.

3.2.16. Manufacturing of Wi-Fi devices and equipment for residential use

In the original study, the economic value generated by the manufacturing of Wi-Fi devices and equipment for residential use was captured through producer surplus, defined as the gross margin derived from the sale of Wi-Fi-enabled products. These included home routers, mesh Wi-Fi systems, smart access points, and other consumer-grade networking hardware. With the introduction of Wi-Fi 6E and Wi-Fi 7, device manufacturers began integrating features specifically designed to leverage the expanded 6 GHz band, including support for 160 megahertz and 320 megahertz channels, MLO, and advanced modulation schemes. These enhancements positioned Wi-Fi as a premium technology in the home networking segment, driving profitability.

To estimate the economic loss resulting from the reallocation of the upper 700 megahertz of the 6 GHz band, we analyze how the reduced spectrum impacts the technical functionality and market appeal of Wi-Fi 6E and Wi-Fi 7 residential equipment. We then apply this degradation as a proportional reduction in the producer surplus attributed to each standard in the baseline scenario.

- **Wi-Fi 6E Impact**: Under full-band conditions (1200 megahertz), Wi-Fi 6E devices can support up to seven non-overlapping 160 megahertz channels, enabling significantly higher throughput, better performance in multi-device households, and lower latency. Reallocating the upper 700 megahertz reduces the usable channel count to three, a 57% reduction in wide-channel capacity. As a result, the core performance features promoted by Wi-Fi 6E become substantially constrained. We apply a 40% reduction to the producer surplus associated with Wi-Fi 6E devices, reflecting the diminished consumer willingness to pay for high-performance equipment that can no longer deliver its intended benefits under spectrum-constrained conditions.

- **Wi-Fi 7 Impact**: Wi-Fi 7 equipment is designed around the assumption of wide, contiguous spectrum access, enabling support for 320 megahertz channels, advanced modulation (4096-QAM), and full MLO functionality. These features are central to positioning Wi-Fi 7 routers and mesh systems as next-generation, gigabit-class solutions for bandwidth-intensive residential environments. With only one 320 megahertz channel available under constrained conditions, and intra-band MLO rendered ineffective, the performance differentiation of Wi-Fi 7 devices is significantly eroded. We therefore apply a 50% reduction to the producer surplus attributed to Wi-Fi 7-enabled residential hardware.

These loss factors are applied to the portions of residential Wi-Fi equipment revenues originally attributed to Wi-Fi 6E and Wi-Fi 7, using forecasted shipment shares by standard and reported industry gross margins. The resulting figures represent the unrealized manufacturing margin that would no longer be captured under a scenario where device capabilities are constrained by spectrum reallocation.

It is important to note that these estimates do not account for dynamic effects in the manufacturing ecosystem, such as reduced R&D investment, slower innovation cycles, or a shift in consumer demand toward lower-tier devices. Nor do they reflect the international competitiveness of domestic manufacturers who may face disadvantages in global markets where unlicensed spectrum is more broadly available. As such, the loss of producer surplus captured here should be viewed as a baseline estimate, with broader industrial implications likely exceeding the figures modeled.

3.2.17. Manufacturing of enterprise Wi-Fi devices and equipment

In the original study, the manufacturing of enterprise-grade Wi-Fi devices and equipment, such as access points, controllers, gateways, and network orchestration hardware, was identified as a key contributor to producer surplus in the Wi-Fi ecosystem. The transition to Wi-Fi 6E and Wi-Fi 7 brought forward a new generation of enterprise solutions optimized to operate in the 6 GHz band. These products leverage expanded spectrum availability to deliver greater throughput, lower latency, and better handling of dense client environments, enabling high-performance wireless connectivity in offices, warehouses, campuses, hospitals, and industrial settings. The economic value was quantified by applying average gross margins to forecasted sales revenue for Wi-Fi 6E and Wi-Fi 7 enterprise equipment.

To estimate the loss in producer surplus that would result from the reallocation of the upper 700 megahertz of the 6 GHz band, we examine how the constrained spectrum limits the functionality, marketability, and uptake of next-generation enterprise Wi-Fi solutions. We then apply proportional reductions to the producer surplus attributed to Wi-Fi 6E and Wi-Fi 7 product segments, based on reductions in wide-channel capacity that directly impair device performance.

- **Wi-Fi 6E Impact**: With access to the full 1200 megahertz of the 6 GHz band, enterprise Wi-Fi 6E access points can offer up to seven 160 megahertz channels, which is critical in managing channel reuse, reducing interference, and supporting high-density deployments. These capabilities justify the premium positioning of Wi-Fi 6E products in the enterprise market. If the upper 700 megahertz is reallocated, the usable channel count drops to three, a 57% reduction. As a result, the core value proposition of these devices is substantially weakened. We apply a 40% reduction to the producer surplus associated with Wi-Fi 6E enterprise equipment to reflect the loss of performance capabilities and corresponding decline in enterprise demand.

- **Wi-Fi 7 Impact**: Wi-Fi 7 is poised to further enhance enterprise wireless connectivity through support for 320 megahertz-wide channels, MLO, and advanced traffic management. These features depend on access to wide contiguous spectrum and are particularly valuable in mission-critical and latency-sensitive environments, such as manufacturing, healthcare, and logistics. Under full-band conditions, three 320 megahertz channels can be deployed. With the removal of the upper 700 megahertz, only one such channel remains, a 67% reduction in wide-channel capacity. As a result, many of the differentiating capabilities of Wi-Fi 7 equipment are impaired. We apply a 50% reduction to the producer surplus attributed to Wi-Fi 7 enterprise equipment to reflect the diminished functional and economic value of the technology under constrained spectral conditions.

These reduction factors are applied to the portions of projected enterprise equipment revenue attributed to Wi-Fi 6E and Wi-Fi 7, using shipment shares and gross margin data from the original model. The resulting values represent the portion of manufacturing volume lost due to the inability of the devices to deliver full-feature performance in a spectrum-constrained environment.

While the analysis focuses on direct financial impacts, it does not capture broader strategic risks for the enterprise equipment industry. These include reduced investment in innovation, slower refresh cycles by institutional buyers, the postponement of advanced enterprise use cases, and potential shifts in demand toward competing technologies or licensed spectrum solutions. Moreover, for vendors competing in global markets, uncertainty over domestic spectrum policy may weaken incentives to scale production or prioritize U.S.-specific product variants. For these reasons, the actual economic impact on enterprise equipment manufacturing may exceed the loss in producer surplus captured in this model.

3.2.18. Benefits of Firms in the IoT ecosystem

In the original study, the Wi-Fi ecosystem's contribution to the broader Internet of Things (IoT) value chain was identified as a significant source of producer surplus. This included not only the manufacturers of IoT-enabled devices and sensors, but also the firms involved in developing and integrating platforms, software, analytics, and service layers that rely on high-performance wireless connectivity. Wi-Fi 6E and Wi-Fi 7, by operating over the full 6 GHz band, provide the bandwidth, reliability, and latency characteristics necessary to support high-density and time-sensitive IoT applications across verticals such as manufacturing, energy, logistics, retail, and healthcare. The economic value was captured through producer surplus generated by IoT vendors whose offerings depend on reliable Wi-Fi connectivity in enterprise and industrial settings.

To estimate the loss in economic value for IoT firms under a scenario where the upper 700 megahertz of the 6 GHz band is reallocated to licensed use, we assess how the reduced spectrum availability impairs the deployment of high-performance Wi-Fi networks that underpin enterprise IoT systems. We then apply proportional reductions to the producer surplus previously attributed to firms in the IoT ecosystem based on functional degradation resulting from diminished wide-channel capacity.

- **Wi-Fi 6E Impact**: With access to the full 1200 megahertz of unlicensed 6 GHz spectrum, Wi-Fi 6E can support up to seven 160 megahertz channels. This allows enterprises to segment networks, dedicate resources to IoT traffic, and manage thousands of connected devices without congestion or delay. Removing the upper 700 megahertz reduces this capacity to three wide channels, a 57% loss. This limitation constrains the ability to scale Wi-Fi-based IoT networks, especially in large facilities or environments with diverse latency and bandwidth requirements. Accordingly, we apply a 40% reduction to the producer surplus attributed to IoT firms relying on Wi-Fi 6E deployments.

- **Wi-Fi 7 Impact**: Wi-Fi 7 introduces further enhancements to support next-generation IoT deployments, including 320 megahertz-wide channels, deterministic latency, and MLO. These capabilities enable more precise control, improved reliability, and better QoS, all essential for mission-critical IoT applications. However, without access to the upper 700 megahertz, only one 320 megahertz channel remains available, and intra-band MLO is no longer feasible. This represents a 67% reduction in wide-channel capacity, undermining Wi-Fi 7's potential as a foundational technology for industrial and high-value IoT solutions. We therefore apply a 50% reduction to the producer surplus attributed to IoT ecosystem firms benefiting from Wi-Fi 7-based deployments.

These loss factors are applied to the IoT-related producer surplus modeled in the original study, which was based on projected IoT market growth, the share of devices and platforms reliant on Wi-Fi connectivity, and estimated margins for software, hardware, and services. The resulting values represent the unrealized business opportunity for firms across the IoT value chain under a spectrum-constrained scenario.

It is important to note that the estimates presented here are limited to direct impacts on Wi-Fi-dependent IoT enablement. In practice, spectrum constraints may delay the adoption of complex IoT use cases, such as predictive maintenance, autonomous robotics, or digital twins, or shift demand toward competing technologies that rely on licensed spectrum or proprietary protocols. Additionally, reduced confidence in unlicensed spectrum availability may discourage long-term investments in interoperable, Wi-Fi-based IoT solutions. As such, the real-world economic cost to firms in the IoT ecosystem likely exceeds the producer surplus loss quantified in this analysis.

3.2.19. Benefits of firms in the AR/VR ecosystem

In the original study, the economic value generated by the AR/VR ecosystem was captured through the producer surplus generated by firms involved in developing hardware, software, and services that rely on high-performance Wi-Fi connectivity. This includes manufacturers of AR/VR headsets, immersive collaboration platforms, simulation and training systems, and content delivery solutions that require high throughput and low-latency environments. Wi-Fi 6E and Wi-Fi 7, through their expanded spectral capacity in the 6 GHz band, were identified as foundational technologies for enabling untethered, high-fidelity AR/VR experiences in enterprise, education, and entertainment settings.

To estimate the loss in producer surplus for firms in the AR/VR ecosystem under a scenario in which the upper 700 megahertz of the 6 GHz band is reallocated to licensed use, we evaluate how this spectral constraint limits the functionality and adoption of advanced Wi-Fi-enabled AR/VR systems. We then apply loss factors based on the reduction in wide-channel availability that directly impacts performance-critical features.

- **Wi-Fi 6E Impact**: Under full-band conditions, Wi-Fi 6E enables up to seven 160 megahertz non-overlapping channels, providing the capacity needed for stable, low-latency AR/VR streaming in environments with multiple users or applications. Removing the upper 700 megahertz reduces the number of available 160 megahertz channels to three, a 57% reduction in wide-channel capacity. This constraint increases interference, limits concurrent sessions, and degrades video quality and responsiveness. We apply a 40% reduction to the producer surplus associated with AR/VR firms relying on Wi-Fi 6E deployments, reflecting lost performance, diminished market appeal, and reduced integration potential.

- **Wi-Fi 7 Impact**: Wi-Fi 7 was specifically designed to enable the next generation of immersive wireless experiences through features such as 320 megahertz-wide channels, 4096-QAM, and MLO. These capabilities are central to supporting ultra-high-definition streaming, synchronized environments, and interactive AR/VR applications with sub-10 ms latency. With full 6 GHz access, up to three 320 megahertz channels can be deployed; under constrained conditions, only one is available, a 67% reduction. This eliminates the performance headroom needed for multi-user, high-bandwidth AR/VR applications. Accordingly, we apply a 50% reduction to the producer surplus attributed to Wi-Fi 7-powered AR/VR solutions.

These discount factors are applied to the portions of the AR/VR ecosystem's producer surplus modeled in the original study, based on projections of device shipments, enterprise adoption, and revenue margins across the hardware, software, and platform segments. The resulting loss estimates reflect the foregone value for firms that depend on Wi-Fi infrastructure to deliver their solutions effectively in business, education, healthcare, and media environments.

While the modeled impact focuses on direct producer surplus, broader consequences include slower adoption of immersive technologies, postponed use case development, and reduced investment in content and application ecosystems tied to wireless delivery. As AR and VR increasingly integrate into mainstream enterprise operations and hybrid work environments, the loss of spectrum that underpins their wireless performance could create a meaningful drag on innovation, user satisfaction, and long-term ecosystem growth.

3.2.20. Conclusion

The preceding analysis demonstrates that removal of the 6.425–7.125 GHz segment immediately erodes the performance on which Wi-Fi 6E and Wi-Fi 7 rely. By translating lost wide-channel availability into reduced throughput, capacity, and latency performance, we have isolated the economic value generated exclusively by this spectral slice and shown how it would disappear under a decision to repurpose the upper 700 megahertz of the 6 GHz band for licensed use.

Across consumer-facing use cases, two distinct mechanisms drive the loss. First, in environments that require broad 160 megahertz or 320 megahertz channels, public hotspots, high-density venues, and in-home gigabit Wi-Fi, removing the upper portion of the band cuts available channels by 57 % for Wi-Fi 6E and 67 % for Wi-Fi 7, sharply lowering attainable speeds and user capacity. Second, in community and outdoor deployments where traffic is constrained by served user capacity rather than headline speed, access point simulations show that functional throughput falls by 41.18 %, reducing the number of households and individuals that free Wi-Fi can meaningfully support.

Service to rural and isolated areas is particularly exposed. Wireless Internet Service Providers lose 40.48 % of their addressable connections per access point when the U-NII-7 channels are removed, limiting extension of broadband to rural and underserved areas and delaying anticipated GDP gains from higher penetration.

On the producer side, enterprises and platform providers see their cost saving and revenue generation models cut by more than half. Business traffic that is now offloaded to unlicensed bands must revert, in part, to more expensive cellular or fixed alternatives, wiping out as much as 57 % of projected Wi-Fi 6E savings and two-thirds of those tied to Wi-Fi 7. The U.S. manufacturers that lead the world marketplace for residential and enterprise equipment face a 40–50 % reduction in sales volume as product differentiation predicated on wide-band operation disappears, while firms in the IoT and AR/VR ecosystems face similar contractions in addressable market opportunity.

At the macroeconomic level, the loss scales from microeffects on channel architecture to measurable hits on national output. Reductions in average download speed and latency directly feed through the established elasticities linking broadband quality to GDP: 57% of the incremental contribution attributable to Wi-

Fi 6E and 67% of that tied to Wi-Fi 7 disappear, even before accounting for second-order spillovers such as deferred cloud adoption and diminished edgeAI deployment (See Table 3-2).

Table 3-2. Economic Impact Taking Away 700 megahertz of Wi-Fi Spectrum from the 6 GHz band

Sources	Effects	Economic Loss (%) Projected	Key limitation drivers
1. Free Wi-Fi	1.1. Savings incurred by consumers by accessing free Wi-Fi in public sites	Wi-Fi 6E: 57.14% Wi-Fi 7: 66.67%	• Loss of four 160 megahertz channels (6E) / two 320 megahertz channels (7) cuts aggregate hotspot throughput • Higher contention and OFDMA RU scarcity lower effective speed per user
	1.2. Free Wi-Fi service supporting the needs of the broadband unserved population	41.18 %	• Speed of access to content • Number of simultaneous users • Available bandwidth
	1.3. Benefit to consumers enjoying higher speed from free Wi-Fi under 6 GHz	41.18 %	• Speed of access to content • Number of simultaneous users • Available bandwidth
	1.4. Benefit to consumers relying on Wi-Fi in educational institutions	0%	• Not applicable
	1.5. Use of Wi-Fi in highly dense heterogeneous environments	Wi-Fi 6E: 57.14% Wi-Fi 7: 66.67%	• Channel scarcity prevents segregation of traffic classes • Interference rises and airtime scheduling degrades
2. Residential Wi-Fi	2.1. Home internet access for devices that lack an Ethernet port	0%	• Not applicable
	2.2. Avoidance of inside wiring investment	0%	• Not applicable
	2.3. Consumer benefit derived from faster broadband speed	Wi-Fi 6E: 57.14% Wi-Fi 7: 66.67%	• Loss of four 160 megahertz (6E) / two 320 megahertz (7) channels curtails multi-gigabit links and disables MLO, eroding consumer surplus
	2.4. Consumer benefit generated by use of residential Wi-Fi devices and equipment	Wi-Fi 6E: 40% Wi-Fi 7: 50%	• Performance-critical features (wide channels, MLO) no longer deliver advertised gains
	2.5. Bridging the digital divide: use of Wi-Fi to increase coverage in rural and isolated areas	40.48 %	• Outdoor standard-power radios lose U-NII-7; only 20 megahertz channels remain, cutting addressable premises per AP
3. Enterprise Wi-Fi	3.1. Savings in business Internet traffic transmitted through Wi-Fi	Wi-Fi 6E: 57.14% Wi-Fi 7: 66.67%	• Loss of four 160 megahertz channels (6E) / two 320 megahertz channels (7) cuts aggregate hotspot throughput
	3.2. Avoidance of enterprise building inside wiring	0%	• Not applicable
	3.3. Benefits derived from an increase in average speed	Wi-Fi 6E: 57.14% Wi-Fi 7: 66.67%	• Same wide-channel loss drives lower peak throughput and limits migration to cloud/edge workloads
	3.4. Benefits derived from reduced latency	Wi-Fi 6E: 57.14% Wi-Fi 7: 66.67%	• MLO unviable; queueing and back-off times lengthen, dampening low-latency gains

	3.5. Enhanced IoT deployment	58.33 %	• Available bandwidth
	3.6. Deployment of Augmented Reality/Virtual Reality solutions	Wi-Fi 6E: 57.14% Wi-Fi 7: 66.67%	• Absence of 320 megahertz channels forces downsampling of immersive content; user capacity falls and motion-to-photon latency rises
4. ISPs	4.1. Cellular networks CAPEX savings by off-loading traffic to Wi-Fi	83.33 %	• Number of 320 megahertz available channels • Connection speed
	4.2. Revenues of Wi-Fi based Public Internet Service Providers	41.18%	• Available 320 megahertz channels • Number of Resource Units available
	4.3. Revenues of Wi-Fi based Wireless Internet service Providers	40.48%	• Number of 20 megahertz channels
5. Wi-Fi ecosystem	5.1. Manufacturing of Wi-Fi devices and equipment for residential use	Wi-Fi 6E: 40% Wi-Fi 7: 50%	• Market shrinkage tracks end-user performance loss • Fewer premium devices demanded
	5.2. Manufacturing of enterprise Wi-Fi devices and equipment	Wi-Fi 6E: 40% Wi-Fi 7: 50%	• Market shrinkage tracks end-user performance loss • Fewer premium devices demanded
	5.3. Benefits of Firms in the IoT ecosystem	Wi-Fi 6E: 40% Wi-Fi 7: 50%	• Market shrinkage tracks end-user performance loss • Fewer premium devices demanded
	5.4. Benefits of firms in the AR/VR ecosystem	Wi-Fi 6E: 40% Wi-Fi 7: 50%	• Market shrinkage tracks end-user performance loss • Fewer premium devices demanded

Sources: Telecom Advisory Services analysis

These estimates are intentionally conservative. They exclude super linear congestion effects, omit behavioural responses that could further suppress take-up, and assume no additional capital expenditure by operators or venues to compensate for degraded performance. Consequently, the quantified losses should be interpreted as a floor on the economic value at risk.

Strategically, reallocating the upper 700 megahertz would reverse a policy trajectory that has encouraged innovation, investment, spectrum efficiency, and affordability. By constraining Wi-Fi's evolution path just as Wi-Fi 7 enters the market, the United States would jeopardise its leadership in unlicensed ecosystems, slow the rollout of immersive and industrial applications, and raise connectivity costs for households and enterprises alike.

4. ESTIMATED ECONOMIC LOSSES OF THE UPPER 700 MEGAHERTZ OF THE 6 GHz BAND

The reallocation of the upper 700 megahertz of the 6 GHz band (i.e., 6.425–7.125 GHz) from unlicensed to licensed use would result in substantial economic losses across multiple use cases that currently rely on the full spectrum availability to deliver high-performance connectivity. This section presents the results of the counterfactual modeling approach, quantifying the magnitude of economic value at risk between 2025 and 2027. The methodology applies degradation factors specific to Wi-Fi 6E and Wi-Fi 7 performance under constrained spectrum conditions, translating the technical limitations into measurable impacts on consumer benefit, producer surplus, and GDP contribution (See Section 3.2).

To ensure comparability and methodological consistency with prior valuation studies, the estimates presented herein mirror the analytical structure of the 2024 report but apply an inverse logic: instead of calculating incremental gains, we simulate the foregone benefits associated with restricted access to the upper portion of the 6 GHz band. Each use case is assessed separately, followed by an aggregation of annual economic losses across the three-year horizon.

4.1. Economic Losses by use Case

This section presents the disaggregated economic losses associated with each individual use case modeled in the study, resulting from the reallocation of the upper 700 megahertz of the 6 GHz band (6.425–7.125 GHz) to licensed use. The estimates reflect the foregone value originally enabled by the full 6 GHz band and are computed by removing the incremental benefits attributable to the upper portion, while holding constant the benefits preserved through continued use of the lower 500 megahertz (5.925–6.425 GHz). Each use case is evaluated through a case-specific model capturing throughput degradation, spectrum availability constraints, and technology adoption forecasts for Wi-Fi 6E and Wi-Fi 7. The results are expressed in monetary terms, distinguishing between the value that would persist and the portion that would be lost under a reallocation scenario. All intermediate calculations are documented in Appendix C to ensure full reproducibility.

4.1.1. Savings Incurred by Consumers by Accessing Free Wi-Fi in Public Sites

This use-case quantifies the consumer surplus that free Wi-Fi venues, coffee shops, retail outlets, libraries, transit hubs, and municipal hotspots, create by allowing users to off-load data that would otherwise be billed under cellular plans. Our counterfactual models compare the baseline in which the full 1200 megahertz of the 6 GHz band remains unlicensed with a policy in which the upper 700 megahertz (6.425–7.125 GHz) is reassigned to licensed services. (See Table 4-1).

Table 4-1. Estimated *loss* of consumer surplus (Free Wi-Fi in Public Sites) when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(2,071)	(1,787)	(1,149)
Wi-Fi 7	(877)	(2,070)	(3,774)
Total	(2,949)	(3,858)	(4,922)

Sources: Telecom Advisory Services analysis

Reallocating the upper portion of the band removes four 160 Megahertz channels under Wi-Fi 6E and two 320 megahertz channels under Wi-Fi 7. Channel scarcity lowers effective throughput, raises contention, and disables MLO. As Wi-Fi 7 adoption accelerates, the shortfall deepens, rising from a consumer surplus loss of US$ 2.9 billion in 2025 to a loss of US$ 4.9 billion by 2027.

These loss estimates are intentionally conservative because they isolate only the direct value foregone in the upper 700 megahertz segment and leave several amplifying mechanisms out of scope. First, the calculations exclude any congestion feedback into the legacy 2.4 GHz and 5 GHz bands: once traffic that would have flowed over wide 6 GHz channels spills back into those bands, speeds and reliability will deteriorate and the welfare deficit will widen. Second, no account is taken of users who would abandon free Wi-Fi altogether when quality degrades, an effect that would force them either to purchase paid cellular data (raising their opportunity cost) or to forgo connectivity altogether (eroding consumer benefit to zero). Third, the device-mix assumptions freeze Wi-Fi 7 uptake at the median industry forecast; if, as current shipment data suggest, adoption accelerates, the share of traffic that depends on 320 megahertz channels will be larger, magnifying the loss. Taken together, these omissions mean the US$ 11.7 billion shortfall shown in Table 4-1 should be regarded as a lower bound on the economic damage from reallocating the upper 6 GHz spectrum.

4.1.2. Free Wi-Fi service supporting the needs of the broadband unserved population

This use-case captures the welfare created when anchor institutions, schools, town halls, libraries, clinics, and other community hubs, offer free Wi-Fi that substitutes for a line subscription many low-income or rural households cannot afford. Our counterfactual contrasts the full-band baseline (all 1200 megahertz of 6 GHz available for unlicensed use) with a policy that reallocates the upper-700 megahertz slice (6.425 – 7.125 GHz) to licensed services (See Table 4-2).

Table 4-2. GDP *lost* (Free Wi-Fi to unserved population) when the upper 700 megahertz are reallocated to licensed use (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(3,817)	(2,973)	(1,682)
Wi-Fi 7	(1,022)	(1,751)	(2,564)
Total	(4,839)	(4,724)	(4,246)

Sources: Telecom Advisory Services analysis

Reallocating the upper segment therefore strips roughly US$ 4.8 billion from national GDP in 2025, US$ 4.7 billion in 2026, and US$ 4.2 billion in 2027. Two dynamics explain the shifting mix: losses tied to Wi-Fi 6E taper as legacy devices plateau, while the deficit linked to Wi-Fi 7 more than doubles over the period, rising from US$ 1.0 billion to US$ 2.6 billion, as wider-channel, MLO-capable equipment captures a larger share of community-Wi-Fi traffic. Combined, these effects push the three-year GDP shortfall to US$ 13.8 billion, a conservative lower-bound that excludes secondary congestion spill-overs and potential user abandonment of public hotspots.

These estimates remain conservative. They (i) ignore knock-on congestion in the 2.4 GHz and 5 GHz bands as traffic is forced off 6 GHz, (ii) assume all affected users continue to rely on community Wi-Fi rather than incur higher cellular costs, and (iii) fix Wi-Fi 7 adoption at the median forecast. Should any of those factors prove more adverse, the true economic damage would exceed the US$ 6.8 billion three-year shortfall reported here.

4.1.3. Benefit to consumers enjoying higher speed from free Wi-Fi under Wi-Fi 6E and Wi-Fi 7

Beyond pure cost avoidance, unlicensed spectrum lifts the *quality* of public connectivity: the seven 160 megahertz channels of Wi-Fi 6E, and, later, the three 320 megahertz channels plus MLO of Wi-Fi 7, let hotspots deliver markedly higher download rates than legacy 2.4 GHz + 5 GHz bands. Using the willingness-to-pay curve, we translate these speed gains into annual consumer surplus and then compare the full-band baseline (all 1200 megahertz available) with a counterfactual where the upper 700 megahertz (6.425–7.125 GHz) are reassigned to licensed use (see Table 4-3).

Table 4-3. Consumer surplus (Higher speed from free Wi-Fi) *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(67)	(50)	(27)
Wi-Fi 7	(32)	(44)	(48)
Total	(100)	(94)	(75)

Sources: Telecom Advisory Services analysis

Reallocating the upper slice removes four of the seven 160 megahertz channels and *every* 320 megahertz channel, cutting attainable hotspot speeds by 41 %. The lost willingness-to-pay benefit thus reaches US$ 100 million in 2025, moderates to US$ 94 million in 2026 as Wi-Fi 6E plateaus, and edges down to US$ 75 million by 2027; the Wi-Fi 7 share nearly doubles over the horizon, climbing from US$ 32 million to US$ 48 million, while the Wi-Fi 6E deficit shrinks in tandem with its declining user base.

These figures are deliberately conservative. They exclude (i) time savings and productivity boosts from higher-speed browsing, (ii) congestion feedback into 2.4 GHz and 5 GHz bands once wide-channel traffic is displaced, and (iii) the possibility that users abandon public Wi-Fi when performance sags, forcing them to purchase cellular data or forgo connectivity entirely. Faster-than-median Wi-Fi 7 adoption would also widen the gap, because more sessions would depend on 320 megahertz channels that no longer exist. Accordingly, the US$ 269 million three-year shortfall implied by Table 4-3 should be viewed as a lower bound on the welfare loss from repurposing the upper 6 GHz spectrum.

4.1.4. Use of Wi-Fi in highly dense heterogeneous environments

Large-venue deployments, stadiums, arenas, convention centers, transit hubs, showcase another layer of consumer value: high-throughput, low-latency Wi-Fi lets tens of thousands of simultaneous users stream video, share content, and access venue apps without overloading cellular networks. Under the full-band baseline, seven non-overlapping 160 megahertz channels (Wi-Fi 6E) plus three 320 megahertz channels with MLO (Wi-Fi 7) push median download rates well beyond the legacy experience. Our counterfactual removes the upper 700 megahertz (6.425–7.125 GHz), leaving only three 160 megahertz channels and zero 320 megahertz channels. The resulting loss of consumer surplus is summarised in Table 4-4.

Table 4-4. Consumer surplus (Wi-Fi in dense environments) *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(74)	(76)	(54)
Wi-Fi 7	(25)	(56)	(105)
Total	(99)	(131)	(159)

Sources: Telecom Advisory Services analysis

Reallocation therefore erases roughly US$ 0.10 billion in venue-related consumer surplus in 2025, US$ 0.13 billion in 2026, and US$ 0.16 billion by 2027. Two dynamics drive the shift: (i) the Wi-Fi 6E share of the loss narrows as the installed base plateaus, and (ii) the Wi-Fi 7 deficit quadruples, from US$ 25 million to US$ 105 million, because the performance premium of 320 megahertz channels and MLO becomes unattainable. Over the three-year horizon, the cumulative shortfall reaches US$ 389 million.

These figures remain conservative. They exclude (i) productivity and media-revenue gains for leagues and broadcasters enabled by richer in-stadium engagement, (ii) congestion relief for surrounding macro-cell sites, (iii) faster-than-median Wi-Fi 7 uptake already evident in flagship handsets, and (iv) fallback traffic that will crowd legacy 2.4/5 GHz bands and further degrade user experience. Hence, Table 4-4 should be viewed as a lower-bound estimate of the welfare loss from repurposing the upper 6 GHz spectrum in high-density environments.

4.1.5. Consumer benefit derived from faster broadband speed

The full 1200 megahertz of the 6 GHz band removes the "router bottleneck" that arises when subscribed fixed-broadband speeds exceed what 2.4 GHz + 5 GHz Wi-Fi can deliver. With seven 160 megahertz channels (Wi-Fi 6E) and, later, three 320 megahertz channels plus MLO (Wi-Fi 7), in-home throughput rises sharply, boosting household willingness-to-pay for broadband. We apply the speed–value curve to the share of households on plans above 150 Mbps that rely on Wi-Fi and then compare the full-band baseline with a counterfactual in which the upper 700 megahertz (6.425 – 7.125 GHz) are reassigned to licensed use (see Table 4-5).

Table 4-5. Consumer surplus (Faster broadband speed) *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(6,634)	(5,697)	(3,506)
Wi-Fi 7	(2,471)	(5,269)	(9,960)
Total	(9,105)	(10,966)	(13,466)

Sources: Telecom Advisory Services analysis

Removing the upper portion of the band therefore strips about US$ 9.1 billion of in-home consumer surplus in 2025, US$ 11.0 billion in 2026, and US$ 13.5 billion in 2027. Two trends shape the trajectory: the Wi-Fi 6E loss narrows as legacy devices plateau, while the Wi-Fi 7 deficit quadruples, from US$ 2.5 billion to US$ 10.0 billion, because the performance premium of 320 megahertz channels and MLO vanishes. Cumulatively, households forfeit roughly US$ 33.6 billion in welfare over the 2025-2027 window, well over half of the potential gain from eliminating the in-home Wi-Fi speed bottleneck.

These estimates are intentionally conservative. They (i) ignore additional slowdown in legacy 2.4 GHz/5 GHz bands when displaced traffic crowds those frequencies, (ii) hold Wi-Fi 7 uptake to median forecasts even though premium-handset sales already outpace that trajectory, and (iii) exclude any offsetting savings in mobile-network CAPEX (because less peak demand shifts back onto cellular). Consequently, Table 4-5 should be viewed as a lower-bound measure of the economic damage caused by reallocating the upper 6 GHz spectrum.

4.1.6. Consumer benefit generated by use of residential Wi-Fi devices and equipment

Households gain surplus when they purchase routers, mesh nodes, cameras, smart displays, and other gear that exploit the wide channels of Wi-Fi 6E and, increasingly, Wi-Fi 7. In the absence of retail willingness-to-pay data for dozens of product categories, we proxy consumer surplus with the gross-margin portion of domestic device sales. Under the full-band baseline, that margin reaches US$ 10.8 billion in 2025 for next-generation products and climbs to US$ 15.9 billion by 2027 as Wi-Fi 7 shipments accelerate. If the upper 700 megahertz (6.425 – 7.125 GHz) are reassigned to licensed use, every 320 megahertz channel disappears and 60 percent of Wi-Fi 6E's wide-channel advantage evaporates, curbing the value embedded in device upgrades (see Table 4-6).

Table 4-6. Consumer surplus (Use of residential Wi-Fi devices) *lost* when the upper 700 megahertz is reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(3,413)	(3,353)	(2,515)
Wi-Fi 7	(1,143)	(2,469)	(4,789)
Total	(4,556)	(5,822)	(7,304)

Sources: Telecom Advisory Services analysis

The policy shift wipes out about US$ 4.6 billion of device-related surplus in 2025, rises to US$ 5.8 billion in 2026, and reaches US$ 7.3 billion in 2027. Two forces drive the trend: Wi-Fi 6E losses contract as its share of shipments declines, while the Wi-Fi 7 deficit quadruples, from US$ 1.1 billion to US$ 4.8 billion, because features that depend on 320 megahertz channels and MLO can no longer be realised. Over 2025-2027, households forfeit roughly US$ 17.7 billion in welfare by being unable to capitalise on the performance gains promised by next-generation hardware.

These figures understate the full cost. They ignore innovation setbacks for chipset vendors targeting the U.S. market. Accordingly, Table 4-6 should be viewed as a conservative estimate of the economic harm from reallocating the upper 6 GHz spectrum.

4.1.7. Use of Wi-Fi to increase coverage in rural and isolated areas

Expanded 6 GHz spectrum lets Wireless Internet Service Providers (WISPs) push affordable broadband to homes that lie beyond the economic reach of fibre. Outdoor standard-power access points spanning both U-NII-5 and U-NII-7 can serve more than twice the premises per site than legacy 5 GHz links, allowing WISPs to cut per-subscriber costs and raise adoption. To gauge the value at risk, we compare the full-band baseline (1200 megahertz unlicensed) with a counterfactual in which the upper 700 megahertz (6.425–7.125 GHz) is reassigned to licensed use (see Table 4-7).

Table 4-7. GDP *lost* (Increased coverage in rural areas) when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(7,028)	(7,758)	(6,097)
Wi-Fi 7	(259)	(609)	(1,251)
Total	(7,287)	(8,367)	(7,348)

Sources: Telecom Advisory Services analysis

Constraining WISPs to the lower sub-band removes all outdoor channels in U-NII-7, shrinking the number of households each tower can reach by about 40 % and curbing the incremental penetration that drives GDP gains. The annual shortfall is therefore US$ 7.3 billion in 2025, climbs to US$ 8.4 billion in 2026 as Wi-Fi 6E deployments mature, and eases to US$ 7.3 billion in 2027 once partial network densification offsets some capacity loss. While losses tied to Wi-Fi 6E dominate, the deficit attributed to Wi-Fi 7 quintuples, from US$ 259 million to US$ 1.25 billion, as next-generation equipment begins to penetrate rural footprints.

These figures are deliberately conservative. They omit the cost of extra towers WISPs would need to restore coverage, the slower digital-skills accumulation in newly connected communities, and congestion feedback into 2.4/5 GHz bands once traffic is forced off wide 6 GHz channels. If federal broadband programmes accelerate Wi-Fi 7 adoption, the true GDP loss could surpass the US$ 23 billion three-year total shown in Table 4-7.

4.1.8. Savings in business Internet traffic transmitted through Wi-Fi

Enterprises rely on wide-channel Wi-Fi to off-load high-volume data, video meetings, cloud back-ups, IoT telemetry, from costlier licensed-wireless and leased-line links. Under the full-band baseline, seven 160 megahertz channels (Wi-Fi 6E) and three 320 megahertz channels with MLO (Wi-Fi 7) carry a rising share of corporate traffic, generating billions of dollars in avoided network costs. Our counterfactual assumes the upper 700 megahertz of the band (6.425–7.125 GHz) is reassigned to licensed use, leaving only three 160 megahertz channels and a single 320 megahertz channel for enterprise WLANs (see Table 4-8).

Table 4-8. Enterprise savings *lost* (Business Internet traffic) when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(7,886)	(8,758)	(9,511)
Wi-Fi 7	(769)	(1,739)	(3,369)
Total	(8,655)	(10,497)	(12,880)

Sources: Telecom Advisory Services analysis

Removing four of seven wide channels for Wi-Fi 6E and two of three for Wi-Fi 7 forces firms either to fall back on more expensive connectivity or to deploy denser access-point grids. The forgone savings therefore reach US$ 8.7 billion in 2025, US$ 10.5 billion in 2026, and US$ 12.9 billion in 2027. While Wi-Fi 6E accounts for most of the early loss, the Wi-Fi 7 share quadruples, from US$ 769 million to US$ 3.4 billion, as next-generation WLANs gain traffic share.

These estimates are conservative. They exclude (i) higher IT capital outlays for additional cabling and access points, (ii) productivity drag from reverting to slower or congested links, and (iii) knock-on congestion in 2.4/5 GHz bands when displaced traffic shifts back to legacy spectrum. Faster-than-forecast Wi-Fi 7 adoption would push the three-year producer-surplus loss above the US$ 32.0 billion shown in Table 4-8.

4.1.9. Benefits derived from an increase in average speed

By unlocking wide channels, seven at 160 megahertz for Wi-Fi 6E, and three at 320 megahertz with MLO for Wi-Fi 7, the full 6 GHz band delivers substantial improvements in average broadband speed across U.S. enterprises. This boost supports bandwidth-intensive applications such as cloud platforms, AI-driven analytics, video collaboration, and real-time data pipelines. Using the GDP elasticity speed increase, as estimated by Katz et al. (2024), we calculate the foregone macroeconomic gains that would result from reallocating the upper 700 megahertz (6.425–7.125 GHz) to licensed use. The outcome is summarised in Table 4-9.

Table 4-9. GDP *lost* (Increase in average speed) when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(132,532)	(110,691)	(65,874)
Wi-Fi 7	(52,512)	(113,016)	(216,714)
Total	(185,044)	(223,707)	(282,588)

Sources: Telecom Advisory Services analysis

In 2025 alone, the GDP loss reaches US$ 185.0 billion, rising to US$ 223.7 billion in 2026 and US$ 282.6 billion by 2027. The pattern reflects the shifting technological mix: as Wi-Fi 7 devices gain traction in enterprise deployments, the foregone speed benefit intensifies. The Wi-Fi 7 component of the loss jumps from US$ 52.5 billion in 2025 to US$ 216.7 billion in 2027, accounting for over three-quarters of that year's total shortfall.

These estimates are conservative by design. They do not factor in productivity spillovers across supply chains, delays in the adoption of edge computing, or performance degradation in legacy bands caused by displaced traffic. They also exclude synergies with latency-sensitive services and offload savings discussed elsewhere in this report. As such, the US$ 691.3 billion cumulative GDP loss over three years should be considered a lower-bound estimate of the economic damage caused by removing the upper 700 megahertz of the 6 GHz band from unlicensed use.

4.1.10. Benefits derived from reduced latency

Sub-20 ms round-trip latency is now a prerequisite for cloud-based collaboration suites, real-time analytics, remote control systems, and emerging XR workloads. When Wi-Fi 6E and Wi-Fi 7 can exploit the entire 1200 megahertz of the 6 GHz band, wider channels and MLO lower airtime contention, shorten queueing delays, and deliver tangible productivity gains. Using the latency-to-GDP elasticity derived by Katz et al. (2024), we estimate the macroeconomic loss that arises if the upper 700 megahertz (6.425–7.125 GHz) is repurposed for licensed use, curtailing the latency improvements that next-generation Wi-Fi can achieve (see Table 4-10).

Table 4-10. GDP *lost* (Reduced latency) when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(91,482)	(90,693)	(66,380)
Wi-Fi 7	(36,147)	(78,784)	(149,197)
Total	(127,629)	(169,477)	(215,577)

Sources: Telecom Advisory Services analysis

The foregone GDP reaches US$ 127.6 billion in 2025, climbs to US$ 169.5 billion in 2026, and peaks at US$ 215.6 billion in 2027. While latency gains tied to Wi-Fi 6E shrink as its device share recedes, the Wi-Fi 7 deficit quadruples, from US$ 36.1 billion to US$ 149.2 billion, because eliminating two of the three 320 megahertz channels renders MLO ineffective just as traffic volumes surge.

These figures are deliberately conservative. They exclude cascading slow-downs in legacy 2.4/5 GHz bands when traffic spills back, higher IT costs for edge-computing work-arounds, and delays in latency-sensitive innovations such as autonomous robotics or telesurgery. Consequently, the US$ 512.7 billion three-year shortfall shown in Table 4-10 should be viewed as a lower-bound estimate of the economic damage from removing the upper portion of the 6 GHz band from unlicensed use.

4.1.11. Enhanced IoT deployment

The industrial- and enterprise-IoT ecosystem depends on low-cost, high-capacity local networks to back-haul sensor data, drive edge-analytics, and orchestrate automation at scale. With full access to the 1200 megahertz 6 GHz band, Wi-Fi 6E already carries more than half of enterprise IoT traffic, while Wi-Fi 7's 320 megahertz channels and MLO accelerate the shift toward unlicensed connectivity. Reassigning the upper 700 megahertz (6.425 – 7.125 GHz) removes four of seven 160 megahertz channels and two of three 320 megahertz channels, sharply reducing network efficiency and raising deployment costs. The producer-surplus lost under this constrained scenario is summarised in Table 4-11.

Table 4-11. Producer surplus (IoT deployment) *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(47,414)	(51,462)	(45,455)
Wi-Fi 7	(12,701)	(30,909)	(69,267)
Total	(60,115)	(81,771)	(114,722)

Sources: Telecom Advisory Services analysis

The withdrawal of the upper band segment erases US$ 60.1 billion in producer surplus in 2025, climbs to US$ 81.8 billion in 2026, and soars to US$ 114.7 billion in 2027. Although Wi-Fi 6E still bears the larger absolute hit, the loss attributed to Wi-Fi 7 grows more than five-fold, from US$ 12.7 billion to US$ 69.3 billion, as next-generation modules penetrate factories, warehouses, and smart-city infrastructure.

These figures understate the full economic impact. They exclude (i) higher integration costs for edge-computing vendors forced to compensate for reduced bandwidth, (ii) delays in large-scale sensor roll-outs that underpin predictive maintenance and supply-chain optimisation, and (iii) congestion spill-overs into legacy 2.4 / 5 GHz bands when wide-channel traffic is displaced. The US$ 256.6 billion cumulative loss over 2025-2027 reported in Table 4-11 should therefore be regarded as a conservative lower bound on the damage caused by reallocating the upper 700 megahertz of the 6 GHz band.

4.1.12. Deployment of Augmented Reality/Virtual Reality solutions

Immersive workloads, digital-twin visualisation, assisted-reality maintenance, medical simulation, multiplayer gaming, require multi-gigabit throughput and sub-20 ms end-to-end latency. Those performance levels become commercially viable only when headsets and edge servers can bond 160- or 320 megahertz channels in the 6 GHz band and exploit MLO to avoid retransmissions. Reallocating the upper 700 megahertz (6.425–7.125 GHz) removes four of seven 160 megahertz channels and two of three 320 megahertz channels, stripping away the spectral headroom that next-generation AR/VR depends on. The resulting macroeconomic loss is shown in Table 4-12.

Table 4-12. GDP (AR/VR solutions) *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(6,235)	(7,450)	(6,566)
Wi-Fi 7	(1,949)	(5,118)	(11,674)
Total	(8,184)	(12,568)	(18,240)

Sources: Telecom Advisory Services analysis

The GDP shortfall reaches US$ 8.2 billion in 2025, climbs to US$ 12.6 billion in 2026, and almost doubles to US$ 18.2 billion by 2027. Losses tied to Wi-Fi 6E edge down as its device share contracts, whereas the Wi-Fi 7 deficit increases six-fold, from US$ 1.9 billion to US$ 11.7 billion, because eliminating two 320 megahertz channels nullifies the primary advantage of the new standard at the moment its adoption accelerates. Over 2025-2027, reallocation removes US$ 39.0 billion in potential GDP gains from the U.S. AR/VR ecosystem.

These figures are conservative. They exclude delayed content-developer investment, slower enterprise pilot roll-outs, and network-congestion feedback into legacy bands when wide-channel traffic is displaced. They also ignore complementarities with the latency improvements quantified in Section 4.1.10. Accordingly, the values in Table 4-12 should be regarded as a lower-bound estimate of the economic damage caused by withdrawing the upper 700 megahertz of the 6 GHz band from unlicensed use.

4.1.13. Cellular networks CAPEX savings by off-loading traffic to Wi-Fi

Mobile operators rely on unlicensed spectrum to absorb a growing share of smartphone traffic, thereby postponing upgrades to licensed-spectrum radio access and back-haul. With the entire 6 GHz band available, Wi-Fi 6E is expected to carry just over 8 percent of total mobile data in 2025-2027, translating into multibillion-dollar savings; Wi-Fi 7 adds further headroom as 320 megahertz channels and MLO take hold. If the upper 700 megahertz (6.425–7.125 GHz) is reassigned to licensed use, indoor and hotspot capacity shrinks so sharply that only one-sixth of the off-load benefit can be retained. The producer-surplus lost under this constrained scenario is summarised in Table 4-13.

Table 4-13. Producer surplus (Cellular CAPEX) *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(2,891)	(2,903)	(2,939)
Wi-Fi 7	(123)	(252)	(454)
Total	(3,014)	(3,155)	(3,393)

Sources: Telecom Advisory Services analysis

Eliminating four of the seven 160 megahertz channels for Wi-Fi 6E and two of the three 320 megahertz channels for Wi-Fi 7 forces operators to upgrade licensed networks sooner or carry traffic over costlier leased capacity. The foregone savings reach US$ 3.0 billion in 2025, climb modestly to US$ 3.2 billion in 2026, and rise to US$ 3.4 billion in 2027. While Wi-Fi 6E accounts for the bulk of the early loss, the deficit attributable to Wi-Fi 7 nearly quadruples, from US$ 123 million to US$ 454 million, as next-generation handsets penetrate the market.

These figures are intentionally conservative. They exclude (i) higher operating expenditures from densifying 5G/6G cell sites sooner, (ii) knock-on congestion in licensed spectrum that accelerates auction timelines, and (iii) any pass-through of higher network costs to consumer prices. Consequently, the US$ 9.6 billion cumulative producer-surplus loss over 2025-2027 reported in Table 4-13 should be viewed as a lower-bound estimate of the economic damage resulting from reallocating the upper 700 megahertz of the 6 GHz band.

4.1.14. Revenues of Wi-Fi based Public Internet Service Providers

Public Internet Service Providers, airports, stadiums, convention centres, hotels, transit systems, metro-scale hotspot operators, monetise Wi-Fi through premium access tiers, advertising impressions, and data-analytics contracts. When the full 1200 megahertz of the 6 GHz band is available, these venues deploy Wi-Fi 6E and Wi-Fi 7 access points with several wide, non-overlapping channels, sustaining quality of service even at peak footfall. Our counterfactual applies the 41.18 % capacity-loss factor derived earlier for community Wi-Fi to estimate how revenues fall if the upper 700 megahertz (6.425–7.125 GHz) is reallocated to licensed use (see Table 4-14).

Table 4-14. GDP (Revenues of Wi-Fi based Public ISP) *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(41)	(33)	(19)
Wi-Fi 7	(15)	(26)	(39)
Total	(56)	(59)	(58)

Sources: Telecom Advisory Services analysis

Stripping wide-channel support removes much of the throughput headroom that enables paid tiers and high-impression advertising, carving roughly US$ 56 million from GDP in 2025, US$ 59 million in 2026, and US$ 58 million in 2027. The Wi-Fi 6E component declines as its share of installed APs recedes, while the Wi-Fi 7 deficit more than doubles, from US$ 15 million to US$ 39 million, because eliminating two 320 megahertz channels nullifies the performance premium that commands higher venue fees.

These figures are intentionally conservative. They exclude (i) revenue erosion from churn when users abandon slow or unreliable venue Wi-Fi, (ii) deferred upgrades to location-based analytics platforms and digital-signage networks that depend on high-capacity backhaul, and (iii) spill-over congestion in legacy 2.4 / 5 GHz bands once traffic is displaced. Therefore, the three-year shortfall of US$ 173 million reported in Table 4-14 should be viewed as a lower-bound estimate of the economic damage from reallocating the upper 6 GHz spectrum.

4.1.15. Revenues of Wi-Fi based Wireless Internet Service Providers

Wireless Internet Service Providers (WISPs) monetise the 6 GHz band by extending affordable broadband to households that fixed-line carriers do not reach. When all 1200 megahertz remain unlicensed, a standard-power Wi-Fi 6E base-station can serve about 40 % more premises than an equivalent 5 GHz link, while the additional 320 megahertz channels and MLO of Wi-Fi 7 boost that capacity further. Our counterfactual assumes the upper 700 megahertz (6.425–7.125 GHz) are reallocated to licensed use, leaving WISPs only three 160 megahertz outdoor channels. The analysis of the previous section, indicates that just 59.52 % of the incremental revenue can be preserved under this constraint (see Table 4-15).

Table 4-15. Incremental revenue (WISPs) *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(175)	(189)	(144)
Wi-Fi 7	(6)	(15)	(30)
Total	(182)	(204)	(174)

Sources: Telecom Advisory Services analysis

Reallocation therefore erases roughly US$ 182 million in WISP-related GDP in 2025, peaks at US$ 204 million in 2026, and settles at US$ 174 million by 2027. Losses tied to Wi-Fi 6E dominate the early impact but fall back as new deployments shift toward Wi-Fi 7; meanwhile, the Wi-Fi 7 deficit quintuples, from US$ 6 million to US$ 30 million, as next-generation customer-premises equipment gains traction.

These figures are deliberately conservative. They exclude (i) higher tower-densification costs WISPs would incur to regain coverage, (ii) slower broadband adoption in newly connected communities, and (iii) congestion feedback into 2.4 / 5 GHz bands when traffic is forced off wide 6 GHz channels. Taken together, the US$ 560 million three-year shortfall in Table 4-15 should be viewed as a lower-bound estimate of the economic damage from removing the upper portion of the 6 GHz band from unlicensed use.

4.1.16. Manufacturing of Wi-Fi devices and equipment for residential use

U.S. consumer-electronics firms earn producer surplus, gross margin, when they sell next-generation routers, mesh nodes, cameras, and smart displays that capitalise on the wide-channel capacity of the full 6 GHz band. Under baseline conditions, Wi-Fi 6E products can advertise seven 160 megahertz channels, while Wi-Fi 7 devices add three 320 megahertz channels and MLO, with the consequent growth in sales. If the upper 700 megahertz segment (6.425–7.125 GHz) is reassigned to licensed use, only three 160 megahertz channels remain and every 320 megahertz channel disappears, compressing that premium and curbing unit sales. The foregone margin is summarised in Table 4-16.

Table 4-16. Producer surplus (Residential Wi-Fi Device manufacturing) lost when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(3,206)	(3,150)	(2,362)
Wi-Fi 7	(1,073)	(2,318)	(4,498)
Total	(4,279)	(5,468)	(6,860)

Sources: Telecom Advisory Services analysis

Reallocation removes roughly US$ 4.3 billion in producer surplus in 2025, rises to US$ 5.5 billion in 2026, and climbs to US$ 6.9 billion by 2027. While Wi-Fi 6E accounts for the larger early hit, the Wi-Fi 7 deficit quadruples, from US$ 1.1 billion to US$ 4.5 billion, as adoption accelerates and the loss of 320 megahertz channels nullifies the standard's performance edge. Across the three-year horizon, domestic manufacturers forfeit US$ 16.6 billion in gross margin they would have captured under full-band conditions.

These figures are conservative. They omit (i) R&D slow-downs and longer product-refresh cycles when spectrum limits dampen demand for high-end features, (ii) potential relocation of assembly lines to jurisdictions that preserve full 6 GHz access, eroding U.S. employment growth, and (iii) supply-chain ripple effects on component suppliers, logistics providers, and retail channels. Accordingly, the losses reported in Table 4-16 should be viewed as a lower-bound estimate of the economic damage from reallocating the upper portion of the 6 GHz band.

4.1.17. Manufacturing of enterprise Wi-Fi devices and equipment

Demand for enterprise-class access points, industrial gateways, and WLAN controllers grows in step with every new performance leap in Wi-Fi standards. When the full 1200 megahertz of the 6 GHz band is available, U.S. vendors expect strong unit-sales growth: each new wave of warehouse, factory, and campus upgrades adds shipments of Wi-Fi 6E devices (seven 160 megahertz channels) and, soon after, Wi-Fi 7 devices (three 320 megahertz channels with MLO). If the upper 700 megahertz (6.425–7.125 GHz) is reassigned to licensed use, these customers lose four wide channels for Wi-Fi 6E and two for Wi-Fi 7, making the expected performance gains unattainable. Many projects are deferred or downsized, cutting shipment volumes even though per-unit margins stay roughly constant. The resulting loss of producer surplus, driven by fewer units sold, not lower margins, is shown in Table 4-17.

Table 4-17. Producer surplus (Enterprise Wi-Fi device manufacturing) *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(1,154)	(1,092)	(771)
Wi-Fi 7	(387)	(805)	(1,468)
Total	(1,541)	(1,897)	(2,239)

Sources: Telecom Advisory Services analysis

Reallocation therefore eliminates roughly US$ 1.54 billion in enterprise-equipment surplus in 2025, US$ 1.90 billion in 2026, and US$ 2.24 billion in 2027. Early on, the shortfall is driven mainly by fewer Wi-Fi 6E units shipped; by 2027, lost Wi-Fi 7 sales dominate, with the deficit for that standard jumping nearly four-fold, from US$ 387 million to US$ 1.47 billion, as businesses postpone or cancel upgrades that depend on multiple 320 megahertz channels. Over the three-year horizon, producers forfeit US$ 5.68 billion in surplus that would have been captured under full-band conditions.

These figures remain conservative. They exclude (i) indirect revenue losses for component suppliers, installers, and software vendors tied to each hardware sale, (ii) slower innovation cycles when shipment volumes no longer justify advanced R&D, and (iii) potential relocation of future production lines to countries that preserve full 6 GHz access. Consequently, the values in Table 4-17 should be viewed as a lower-bound estimate of the economic cost of reallocating the upper portion of the 6 GHz band.

4.1.18. Benefits of firms in the IoT ecosystem

Chip makers, sensor vendors, edge-platform providers, and systems integrators expand unit sales whenever enterprises deploy Wi-Fi 6E/7 to connect machines, meters, cameras, and autonomous vehicles. With the entire 6 GHz band available, wide-channel capacity and MLO spur aggressive roll-outs; U.S. suppliers therefore forecast brisk shipment growth and associated producer surplus. If the upper 700 megahertz (6.425–7.125 GHz) is reassigned to licensed use, however, firms lose four 160 megahertz channels and two 320 megahertz channels, slashing network head-room and prompting customers to buy fewer devices and edge nodes. The surplus lost-driven by lower volumes sold-is shown in Table 4-18.

Table 4-18. Producer surplus (IoT ecosystem) *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(11,641)	(11,513)	(8,247)
Wi-Fi 7	(3,898)	(8,476)	(15,709)
Total	(15,539)	(19,989)	(23,956)

Sources: Telecom Advisory Services analysis

Reallocation removes roughly US$ 15.5 billion in IoT-ecosystem surplus in 2025, US$ 20.0 billion in 2026, and US$ 24.0 billion in 2027. Early losses stem mainly from fewer Wi-Fi 6E modules ordered for brown-field retrofits; by 2027, the deficit tied to Wi-Fi 7 climbs four-fold, from US$ 3.9 billion to US$ 15.7 billion, as green-field projects that rely on multiple 320 megahertz channels are cancelled or down-scoped. Across the 2025-2027 horizon, ecosystem firms forfeit US$ 59.5 billion in producer surplus they would otherwise capture under full-band conditions.

These figures are conservative. They exclude (i) spill-over revenue losses for software analytics, cloud services, and maintenance contracts bundled with each hardware sale; (ii) reduced incentives to localise manufacturing and firmware R&D in the United States; and (iii) slower adoption of advanced use cases, predictive maintenance, real-time digital twins, autonomous material handling, that rely on deterministic Wi-Fi performance. Accordingly, the totals in Table 4-18 should be read as a lower-bound estimate of the economic damage from reallocating the upper portion of the 6 GHz band.

4.1.19. Benefits of firms in the AR/VR ecosystem

The AR/VR value-chain, chip vendors, headset manufacturers, optics suppliers, middleware studios, and independent content developers, relies heavily on the wide-channel performance of Wi-Fi 6E and, increasingly, Wi-Fi 7 to deliver seamless untethered experiences. Our counter-factual contrasts a baseline in which the full 1200 megahertz of the 6 GHz band remains unlicensed with a policy scenario that repurposes the upper-700 megahertz slice (6.425 – 7.125 GHz) for exclusive licensed use. The loss of four 160 megahertz channels (Wi-Fi 6E) and two 320 megahertz channels (Wi-Fi 7) curtails headset throughput, raises motion-to-photon latency, and shrinks the total addressable market for premium devices and associated software. Table 4-19 summarises the projected reduction in producer surplus across the U.S. AR/VR ecosystem.

Table 4-19. Producer surplus (AR/VR ecosystem) *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(2,310)	(2,764)	(2,484)
Wi-Fi 7	(773)	(2,035)	(4,731)
Total	(3,083)	(4,799)	(7,215)

Sources: Telecom Advisory Services analysis

Removing the upper band segment would therefore erase roughly US$ 3.1 billion in producer surplus in 2025, US$ 4.8 billion in 2026 and US$ 7.2 billion in 2027, US$ 15.1 billion over the three-year horizon. These estimates are deliberately conservative: they exclude slower device adoption caused by degraded wireless performance, the knock-on effect on local optics fabrication and content-creation jobs, and any congestion feedback into legacy 2.4 GHz and 5 GHz bands. Accordingly, the losses in Table 4-19 should be viewed as a lower bound on the economic damage that spectrum reallocation would inflict on the United States' emerging immersive-technology sector.

4.2. Aggregate Economic Impact (2025-2027)

As documented in our prior study, over the 2025-2027 horizon the United States economy stands to realize almost US$ 2.94 trillion in combined consumer benefit, producer surplus and GDP contribution as Wi-Fi devices make use of the entire 1200 megahertz of spectrum in the 6 GHz band. The distribution of that value mirrors the multifaceted role that unlicensed spectrum plays in the digital ecosystem: roughly two-thirds originates in enterprise use cases, chiefly higher average speeds, lower latency and wider IoT adoption, while the balance is split between residential demand for faster in-home connectivity, public/free Wi-Fi services, network offloading savings for ISPs and incremental margins captured by the domestic Wi-Fi equipment industry.

Equally notable is the pace of growth across the three-year window. Aggregate value rises from US$ 780 billion in 2025 to US$ 1.19 trillion in 2027, a 53 percent expansion that coincides with the commercial diffusion of Wi-Fi 7 and the accelerating digitalisation of corporate workflows. As later sensitivity tests confirm, this compounding effect makes the benefits of fullband availability highly frontloaded; any spectrum constraint introduced in the near term would therefore forfeit not only the static gains reported in 2025, but also the dynamic benefits accruing thereafter as penetration deepens and new applications scale.

When the analysis is rerun under a “lower 500 megahertz only” configuration, with Wi-Fi devices restricted to 5.925–6.425 GHz, the annual economic dividend shrinks precipitously. Total value falls to US$ 334 billion in 2025 and climbs only to US$ 468 billion by 2027, barely 40 percent of the full band outcome. The largest absolute contractions are observed in enterprise speed (64 percent) and latency-sensitive applications (63 percent), but every category registers material erosion. In consumer-facing segments, free public Wi-Fi savings decline by roughly 60 percent, while rural coverage gains afforded by WISP deployments are halved because access points can serve fewer households per site. The sharp drop illustrates how a 500 megahertz ceiling would reimpose channel scarcity, exacerbate interference in dense locales and eliminate the headroom required for MLO in forthcoming Wi-Fi 7 networks.

Table 4-20 translates the preceding comparison into explicit economic losses attributable to the withdrawal of the upper 700 megahertz of the 6 GHz band (6.425–7.125 GHz). The forgone value rises from US$ 446 billion in 2025 to US$ 725 billion in 2027, cumulating US$ 1.74 trillion over the period, equivalent to 59 percent of the benefits achievable under the fullband baseline. Enterprise Wi-Fi again dominates the deficit (over 87 percent), led by speed-related GDP contributions and latency reductions that are unattainable without wide 160/320 megahertz channels. Losses in the Wi-Fi ecosystem approach US$ 40.3 billion in 2027, signalling the adverse spillover into domestic supply chains and high-skill employment.

Table 4-20. United States: Economic value lost when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)[14]

Sources	Effects	Type	2025	2026	2027
1. Free Wi-Fi	1.1. Savings incurred by consumers by accessing free Wi-Fi in public sites	Consumer Benefit	($2,949)	($3,858)	($4,922)
	1.2. Free Wi-Fi service supporting the needs of the broadband unserved pop.	GDP Contribution	($4,839)	($4,724)	($4,246)
	1.3. Benefit to consumers enjoying higher speed from free Wi-Fi under 6 GHz	Consumer Benefit	($100)	($94)	($75)
	1.5. Use of Wi-Fi in highly dense heterogeneous environments	Consumer Benefit	($99)	($131)	($159)
2. Residential Wi-Fi	2.3. Consumer benefit derived from faster broadband speed	Consumer Benefit	($9,105)	($10,966)	($13,466)
	2.4. Consumer benefit generated by use of residential Wi-Fi devices and equipment	Consumer Benefit	($4,555)	($5,821)	($7,303)
	2.5. Bridging the digital divide: use of Wi-Fi to increase coverage in rural isolated areas	GDP Contribution	($7,287)	($8,366)	($7,348)
3. Enterprise Wi-Fi	3.1. Savings in business Internet traffic transmitted through Wi-Fi	Producer Surplus	($8,655)	($10,496)	($12,880)
	3.3. Benefits derived from an increase in average speed	GDP Contribution	($185,044)	($223,707)	($282,588)
	3.4. Benefits derived from reduced latency	GDP Contribution	($127,630)	($169,476)	($215,577)
	3.5. Enhanced IoT deployment	GDP Contribution	($60,116)	($81,771)	($114,722)
	3.6. Deployment of Augmented Reality/Virtual Reality solute.	GDP Contribution	($8,184)	($12,568)	($18,240)
4. ISPs	4.1. Cellular networks CAPEX savings by off-loading traffic to Wi-Fi	Producer Surplus	($3,014)	($3,155)	($3,393)
	4.2. Revenues of Wi-Fi based Public Internet Service Providers	GDP Contribution	($56)	($59)	($58)
	4.3. Revenues of Wi-Fi based Wireless Internet service Providers	GDP Contribution	($182)	($204)	($174)
5. Wi-Fi ecosystem	5.1. Manufacturing of Wi-Fi devices and equipment for residential use	Producer Surplus	($4,279)	($5,468)	($6,860)
	5.2. Manufacturing of enterprise Wi-Fi devices and equipment	Producer Surplus	($1,540)	($1,897)	($2,239)
	5.3. Benefits of Firms in the IoT ecosystem	Producer Surplus	($15,539)	($19,989)	($23,955)
	5.4. Benefits of firms in the AR/VR ecosystem	Producer Surplus	($3,084)	($4,799)	($7,216)
TOTAL			($ 446,256)	($567,550)	($725,424)

Sources: Telecom Advisory Services analysis

[14] The detailed calculations that underpin Table 4-20 are presented in Appendix D.

Table 4-20 depicts a clear policy tradeoff. Allowing unlicensed access to the entire 6 GHz band yields an incremental US$ 1.74 trillion relative to a scenario in which limiting Wi-Fi to the lower 500 megahertz would surrender nearly three-fifths of the prospective gains during 2025-2027 alone, with the shortfall widening thereafter as spectrum-intensive applications diffuse.

From an economic policy perspective, these findings indicate that spectrum assignments decided in the latter half of this decade will have immediate and sizeable macroeconomic repercussions. The value at risk is not confined to consumer convenience; it encompasses productivity, supply chain competitiveness and the fiscal dividends associated with higher GDP growth. Preserving unimpeded access to the full 6 GHz band for unlicensed technologies therefore emerges as the option that maximises national welfare.

PART II. CASCADING IMPACT ON THE LEGACY 2.4 GHz AND 5 GHz BANDS

Part II constitutes the second analytical step in the assessment of rumored spectrum repurposing in the 6 GHz band. It extends the inquiry regarding economic losses by assessing the negative impact incurred to the legacy 2.4 GHz and 5 GHz bands. When the 6 GHz ceiling is lowered, displaced traffic must revert to these earlier spectrum allocations, where narrower channels and higher baseline utilization amplify contention, interference, and latency. Such technical degradations propagate into economic losses for households, enterprises and service providers. By coupling technical congestion modelling with an inverse engineering economic framework, the study estimates the additional (and significant) consumer benefit and producer surplus forgone and the attendant GDP shortfall, over the 2025-2027 horizon, thereby enhancing the nationwide cost of the proposed reallocation.

Whereas Part I measured the direct value forfeited within the 6 GHz ecosystem itself, the present analysis focuses on the welfare erosion induced by heightened congestion, narrower effective channel widths, and degraded latency in the older bands once they absorb the displaced load. Together, the combination of Parts I and II yields a complete accounting of the nationwide cost associated with curtailing unlicensed access to the full 6 GHz allocation.

As in Part I, the geographic scope covers the entire United States, and the temporal horizon spans the 2025 to 2027 period to preserve comparability with the preceding assessment, estimating three dimensions of welfare: consumer benefit, producer surplus, and contribution to GDP attributable to productivity, investment, and innovation channels. Eight use cases, public hotspot off load, connectivity for unserved households, residential Wi-Fi performance, enterprise traffic off load, latency driven productivity, IoT enablement, public Wi-Fi service revenues, and WISP revenues, structure the valuation and mirror the categorization. The assessment includes only those use cases for which we estimated a measurable economic loss in the 2.4 GHz and 5 GHz bands. Other use cases were conservatively assumed to have negligible impacts in these bands and therefore have not been included.

The technical underpinning combines calibrated traffic migration coefficients with benchmark congestion models to derive reduction factors for throughput, spectrum efficiency, and quality of service in both legacy bands. Those factors feed an inverse engineering economic model that translates lost performance into monetary terms.

In summary, Part II constitutes the second analytical step and it traces how displaced traffic and reduced channel width in the 6 GHz band reverberate into the legacy 2.4 GHz and 5 GHz bands, where higher baseline utilization magnifies contention and interference. By applying the same inverse engineering valuation methodology to the eight legacy band use cases that are affected, the study produces the additional consumer benefit, producer surplus, and GDP shortfalls that would arise between 2025 and 2027. Together with Part I results, the estimates in Part II provide a comprehensive picture of the nationwide economic cost of constraining unlicensed access to the full 6 GHz spectrum resource.

5. TECHNICAL IMPLICATIONS OF SPECTRUM REALLOCATION

The withdrawal of the upper portion of the 6 GHz band redirects a substantial share of wide channel Wi-Fi traffic into the legacy 2.4 GHz and 5 GHz layers, which were originally engineered to carry narrower 20/40/80 megahertz channels and were already approaching high baseline utilization. The sudden influx of additional transmissions compresses the pool of clean channels that can be allocated per access point, limits the utility of advanced features such as MLO, and elevates co-channel contention across both legacy bands. As wide channels become scarce, aggregate throughput falls and latency variability rises, turning what had been a safety valve for dense deployments into a new bottleneck. The qualitative mechanisms at work here, capacity displacement, channel overlap, and interference escalation, provide the technical foundation for the congestion driven performance degradation.

5.1. Capacity loss and impact on channel availability

Removing 700 MHz in the upper segment of the 6 GHz allocation compresses what had been a broad, contiguous block of mid-band spectrum into a much narrower slice. The physical space available for Wi-Fi channelization contracts sharply, depriving networks of the spectral "headroom" that underpins modern high throughput design approaches. In practical terms, network architects lose the flexibility to lay out wide, clean channels that isolate traffic flows and sustain gigabit class links, a loss felt immediately across both residential and enterprise deployments.

With the broader block gone, the remaining spectrum can no longer accommodate the same variety of non-overlapping wide channels. Access points that once selected among several large lanes must now compete for a handful of narrower ones, fragmenting traffic across slices that were never intended to shoulder dense, next generation workloads. This fragmentation constrains spectral efficiency: it forces packet streams to traverse narrower channels using additional packet bursts to complete transmission, elongates transmission cycles, consumes airtime, and substantially undermines the foundational "fat-pipe" assumption baked into the Wi-Fi 6E and Wi-Fi 7 roadmaps.

Advanced features that rely on abundant spectrum, most notably MLO and wide band OFDMA scheduling, the benefits of which supercharge Wi-Fi in a wide channel environment, become significantly less useful in narrow channels that are becoming increasingly congested. Devices will fall back to the single-link behavior of Wi-Fi devices introduced in 2014 and prior, forfeit simultaneous channel diversity, and sacrifice the scheduling granularity that keeps latency predictable under load. As such, the technology would fall back to what it was more than 10 years ago.

Those constraints complicate radio planning in every setting where multiple access points coexist. In apartment towers, office campuses, and public venues, engineers can no longer assign distinct wide channels to adjacent cells; instead, they must layer additional coordination, power control and spatial reuse tactics merely to prevent harmful overlap. Even with such mitigation, neighboring networks are far more likely to land on the same frequencies, heightening the risk that routine traffic bursts will collide.

Finally, the curtailed channel configuration stalls the transition to future Wi-Fi generations. Chipsets designed around ample 6 GHz capacity deliver diminishing returns, deployment incentives weaken, and the ecosystem postpones investments that depend on reliable access to wide channels. These technical headwinds set the stage for the congestion and reliability penalties examined in Section 5.2, where the legacy 2.4 GHz and 5 GHz layers are shown to absorb the core of displaced demand.

5.2. Aggregate effects on congestion and reliability (2.4 GHz + 5 GHz)

The spectrum shortfall in the 6 GHz band forces a surge of additional traffic into the legacy 2.4 GHz and 5 GHz layers, both of which were already near their natural utilization ceiling. As access points and client devices revert to these earlier bands, the medium becomes noticeably busier: airtime occupancy rises, carrier overhead periods lengthen, and the probability that simultaneous transmissions collide increases, triggering the re-transmission of packet streams that further clog the airwaves. This elevation in baseline contention affects performance across both physical and logical network layers, manifesting in growing packet retry rates, increased overhead, and ultimately, degraded user perceived throughput and less stable application level performance.

Congestion effects emerge unevenly across environments. Public hotspot deployments and dense residential buildings, which rely heavily on the 5 GHz band to separate adjacent cells, now find those channels crowded by spill over traffic that would have been accommodated if the entire 6 GHz band were available. In rural wireless ISP links the same displacement narrows the spectral spacing between long range point to point beams, increasing the likelihood of co-channel interference and link fade outs. Even low powered IoT sensors, many of which operate in the already saturated 2.4 GHz space, experience higher packet drop rates when neighboring Wi-Fi networks raise their duty cycles to compensate for lost capacity.

The two legacy bands respond differently to this new load. At 2.4 GHz, where only a handful of non overlapping 20 megahertz channels exist, additional traffic primarily exacerbates the hidden node problem and lengthens clear channel assessment delays. At 5 GHz, strict Dynamic Frequency Selection (DFS) requirements in certain sub-bands and greater overlap among 40 and 80 megahertz bands operate to fragment devices into narrower, more interference prone slices. In both cases, the fallback reduces the effectiveness of both MLO[15] and OFDMA scheduling, eroding many of the efficiency gains that Wi-Fi 6 and 6E were intended to deliver.

As spectrum contention intensifies, instances of latency (delay before a transmission starts) and jitter (packet arrival time becomes irregular, leading to choppy video or audio) begin to drift upward. Interactive applications, video calls, cloud gaming, industrial control loops, see their quality of service deteriorate because queueing delays fluctuate with every burst of overlapping transmissions.

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[15] In a congested, narrow channel environment, the benefits of MLO are greatly reduced.

Network operators can adopt band steering, power control, and spatial reuse techniques to soften these pressures, yet as congrestion grows, such measures merely redistribute interference rather than eliminating it. The underlying scarcity of uncontended airtime persists, meaning service providers, enterprises, and consumers must either tolerate reduced performance or shift traffic to licensed cellular or wired alternatives. These aggregate technical degradations set the foundation for the quantitative welfare losses in the legacy bands calculated in the subsequent chapter of this report.

6. METHODOLOGY FOR ESTIMATING ECONOMIC LOSS IN THE LEGACY 2.4/5 GHz BANDS

The present chapter converts the technical setbacks identified earlier into an economic valuation framework by estimating five distinct effects: (i) the reduction in economic benefit as public Wi-Fi becomes more congested; (ii) the contraction in service capacity and revenues for Wireless Internet Service Providers; (iii) the decline in connection density and reliability across Internet of Things deployments; (iv) the productivity losses driven by higher latency in time sensitive applications; and (v) the erosion of enterprise throughput and off-load gains. These effects are applied to the eight use cases examined in the subsequent results section, Free-Wi-Fi data off load, broadband unserved households served by free Wi-Fi, residential Wi-Fi bridging the digital divide, enterprise Internet-traffic offload, enterprise productivity gains from reduced latency, enhanced IoT deployment, revenues of public Wi-Fi service providers, and revenues of WISPs, by holding all external demand drivers constant, including traffic patterns[16], and translating the calibrated performance degradations into changes in consumer benefit, producer surplus, and GDP contribution. All remaining use cases from the original baseline study are omitted, as a conservative review of the analysis demonstrates that they would experience no material impact from the legacy 2.4 GHz and 5 GHz constraints.[17]

6.1. Free Wi-Fi

Public hotspots, from coffeshops and libraries to stadium concourses, lean heavily on the 5 GHz band because it offers far more capacity than the cramped 2.4 GHz band. When the upper 700 megahertz of 6 GHz disappears, wide-channel traffic that once relieved those hotspots must squeeze back into 5 GHz and the remaining spectrum in 6 GHz, instantly crowding the very spectrum slice that keeps free Wi-Fi usable – namely, the U-NII-3 band in 5 GHz U-NII-3 is a heavily-used band due to the absence of regulatory constraints, including the ability to transmit outdoors and without DFS. In contrast, the 6 GHz spectrum adjacent to it is indoor-only and operates at a small fraction of the power. As 5 GHz U-NII-3, and other 5 GHz bands, take on the burden of traffic re-directed from 6 GHz, end users will encounter slower page loads, stalled video streams, and higher drop-off rates exactly where they expect seamless, no-cost connectivity, eroding the core consumer benefit that public Wi-Fi delivers.

To translate that qualitative harm into a single loss coefficient, we compared the share of total unlicensed bandwidth available to 5 GHz before and after the cut. As detailed in Appendix E.1, the 5 GHz share jumps from 31.82 percent under full-band conditions to 50 percent in the reduced-band scenario. The resulting 36.36 percent rise in spectral saturation, when weighted by the proportion of traffic the 5 GHz layer must now carry, yields an 18.18 percent hit to effective capacity, the figure we apply to all consumer-savings and GDP metrics associated with Free Wi-Fi use cases.

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[16] In fact, the losses may be higher due to the fact that some of the traffic on the 2.4 and 5 GHz bands predicted in the original 2024 study that would migrate to the 6 GHz band might not do so.

[17] Some of these effects might be taking place with subscribers with routers equipped only in the 2.4 and 5 GHz bands residing in rural areas which might not be affected by the lack of 6 GHz spectrum. These would also delay their interest in migrating to 6 GHz.

Treating 18.18 percent as the cap on lost value is deliberately conservative. It assumes, for example, that half of the displaced traffic still fits inside the remaining 500 megahertz of 6 GHz without degrading 5 GHz any further; it also ignores the compounding effect of DFS-mandated channel evacuations and of dense urban layouts where overlapping access points already share channels. In practice, real-world congestion, hidden-node collisions, and higher retransmission rates could push the economic loss for public Wi-Fi well beyond the technical parameter adopted here.

6.2. Wireless Internet Service Providers (WISPs)

Rural fixed-wireless operators depend on wide, interference free channels to carry broadband signals over long distances; the full 6 GHz band has been a game changer for WISPs because it lets a single access point light up dozens of premises without the cost of building new towers. When the upper portion of that 6 GHz band is removed, the backhaul load that once flowed through multiple 160 megahertz lanes must utilize the remaining spectrum, including squeezing into the already busy 2.4 GHz and 5 GHz layers. For a WISP, that means lower peak throughput, fewer households reached per sector, and a harder time meeting federal performance targets, ultimately weakening one of the few scalable options for closing the rural connectivity gap.

The loss coefficient applied to WISP economics is 21.01 percent. It is derived by comparing the share of total unlicensed capacity that 2.4 GHz + 5 GHz must shoulder before and after the spectrum cut: their share rises from 31.82 percent under full-band conditions to 52.83 percent when only the lower 500 megahertz of 6 GHz remains. That 39.77 percent surge in channel saturation, multiplied by the legacy-band share itself, yields the 21.01 percent figure used to scale down WISP revenues, CAPEX savings, and GDP contributions (see Appendix E.2 for the step-by-step calculation).

Treating 21.01 percent as the ceiling on economic damage is intentionally cautious. It assumes perfect traffic balancing between the reduced 6 GHz block and the lower bands, overlooks terrain-driven interference that makes rural links more fragile, and ignores capital delays as WISPs reconsider upgrading to Wi-Fi 7 hardware that can no longer exploit wide channels. In real deployments, higher retries, forced power increases, and customer churn could push the actual loss well beyond the conservative reduction applied here.

6.3. IoT devices

Household sensors, and industrial controllers routinely deposit low-bit-rate packets into the 2.4 GHz band, while newer, latency-sensitive IoT gateways exploit wide 6 GHz channels to aggregate traffic from dense device clusters. When the upper portion of 6 GHz is removed, those wide-channel gateways must retreat into spectrum that is already crowded with legacy Wi-Fi links. The result is a surge in carrier-sense wait times, higher packet-error rates, and unpredictable latency, conditions that compromise everything from smart-home automation to factory-floor telemetry.

To capture that impact in a single reduction factor, the analysis compares how much of the total unlicensed spectrum falls to 2.4 + 5 GHz before and after the cut. Their share rises from 31.82 percent with the full 1200 megahertz available to 52.83 percent when only the lower 500 megahertz of 6 GHz remains. The associated 39.77 percent jump in channel saturation, multiplied by the legacy-band share itself, yields a 21.01 percent hit to effective capacity, which we apply to all IoT related metrics (see Appendix E.3 for the detailed calculation).

Using 21.01 percent as the ceiling on IoT losses is deliberately cautious. It assumes displaced traffic spreads evenly across the surviving 6 GHz channels and the lower bands, ignores additional interference from co-located Bluetooth and Zigbee networks, and discounts the higher retransmission overhead that battery-powered devices must absorb in noisy environments. In real-world deployments, particularly dense industrial campuses, the compounded effects of interference, duty-cycle limits, and retry storms would likely drive the economic loss above the conservative threshold adopted here.

6.4. Latency

Losing the upper portion of the 6 GHz band does more than trim raw throughput: it removes the head-room of spectrum availability that keeps delay under control. Wide 320 megahertz channels at 6 GHz allow Wi-Fi 6E and Wi-Fi 7 to schedule packets quickly, avoid back-offs, and sustain millisecond-level round-trip times. When those channels vanish, the same traffic must contend for airtime in the far busier 2.4 GHz and 5 GHz layers. Every extra device now waits longer for a clear channel (i.e., latency), queues grow, traffic overhead increases due to the need to repeat transmissions, and interactive applications, from video calls to cloud-gaming streams, begin to show jitter and lag (or delays during packet transmission)that were previously absorbed by the wider band.

To quantify that deterioration, the appendix compares aggregate transmission capacity before and after the cut. Under full access of unlicensed spectrum, end to end speed potential is about 12.3 Gbps; with only 1060 megahertz left, it falls to roughly 7.5 Gbps. The resulting 39.04 percent rise in channel occupancy, when weighted by the share of traffic that the legacy bands must now carry, produces a 20.29 percent latency-saturation factor. This single coefficient is applied to every metric that hinges on low-delay connectivity; detailed steps appear in Appendix E.4.

Using 20.29 percent as the headline loss is intentionally cautious. It presumes perfect load balancing between the remaining 6 GHz spectrum and the lower bands, overlooks additional delay from DFS evacuations in 5 GHz, and treats queueing behaviour as rising linearly with occupancy, despite evidence that latency climbs sharply once airtime usage exceeds fifty percent. Real-world deployments, are therefore likely to experience larger latency penalties, and correspondingly higher economic losses, than the conservative estimate adopted here.

6.5. Enterprise Traffic

Modern workplaces count on wide-channel Wi-Fi to off-load growing volumes of video conferencing, collaborative-app, and onsite mobility traffic from wired and cellular networks. When the upper 700 megahertz of the 6 GHz band disappears, that high-capacity relief valve disappears. The spill-over saturates the 5 GHz band, already the primary workhorse for enterprise WLANs, while the 2.4 GHz band, with its limited spectrum and heavier interference, adds little meaningful head-room. The consequence is lower sustained throughput, more frequent airtime contention, and diminished quality of service for bandwidth-hungry tools that underpin day to day productivity.

The reduction factor adopted for enterprise traffic is 18.18 percent. It originates from a simple bandwidth-share comparison: under full-band conditions the 5 GHz layer accounts for just over 31 percent of total unlicensed spectrum; once the upper 6 GHz slice is lost, that share jumps to 50 percent. The 36.36 percent rise in spectral saturation, multiplied by the post-cut 5 GHz share, yields the 18.18 percent figure applied to all enterprise off-load savings and related economic contributions. The derivation, including the supporting channel-availability table and equation, is set out in Appendix E.5.

Labeling 18.18 percent as the ceiling on lost value errs on the side of caution. It assumes traffic distributes evenly between the surviving 6 GHz channels and 5 GHz, overlooks DFS-triggered channel evacuations that further shrink usable spectrum, and ignores the compounding effects of dense multi-floor deployments where co-channel interference grows non-linearly. In practice, tightened airtime budgets, higher retransmission rates, and delayed upgrades to Wi-Fi 7 hardware could drive enterprise losses well beyond the conservative discount applied here.

7. ESTIMATED ECONOMIC LOSSES IN THE 2.4 GHz AND THE 5 GHz BANDS

This chapter translates the performance degradation coefficients developed in the preceding discussion into monetary terms for each affected use case. By applying the calibrated reduction factors, 18.18 percent for Public Wi-Fi and enterprise networks, 21.01 percent for WISP and IoT deployments, and 20.29 percent for latency sensitive applications, to the baseline valuations drawn from the original legacy band analysis, we derive the incremental consumer benefit, producer surplus, and GDP shortfalls attributable to the congestion now imposed on the 2.4 GHz and 5 GHz layers.

Sections 7.1 through 7.8 examine the eight use cases in turn: public hotspot data off load, connectivity for unserved households, residential Wi-Fi performance in rural areas, enterprise Internet traffic off load, productivity gains tied to low latency, deployment of IoT solutions, revenues of public Wi-Fi service providers, and revenues of WISPs. Each subsection restates the relevant technical mechanism, presents the absolute and percentage losses for 2025-2027.

The concluding subsection (7.9) aggregates these results, summarizing the total economic value at risk in the legacy bands and positioning it alongside the losses already quantified for the curtailed 6 GHz spectrum. This holistic view underscores that constraining unlicensed access to mid-band spectrum imposes costs well beyond the immediate 6 GHz ecosystem, cascading through every corner of the Wi-Fi value chain and the broader digital economy.

7.1. Free-Wi-Fi data off-load

Across coffeshops, libraries, airports and university campuses, public hotspots rely on the 5 GHz layer to separate neighbouring access points and sustain acceptable down-link speeds, and in particular the U-NII-3 band due to eased regulatory requirements relative to 6 GHz and much of 5 GHz. When the upper 700 megahertz of the 6 GHz band is withdrawn, the wide-channel traffic that previously relieved these venues spills back into the legacy bands, instantly crowding the very slice that keeps free Wi-Fi viable. Higher channel occupancy translates into longer carrier-sense wait times, more retransmissions and visible slow-downs in browsing and streaming, all of which erode the consumer benefits that arise.

This use case applies the "public-Wi-Fi congestion" methodology identified in Chapter 6. In the 2024 baseline study, the economic benefit to consumers who substitute cellular data with free Wi-Fi in public sites using 2.4 GHz and 5 GHz was valued at US$ 4.7 billion in 2025, tapering to US$ 4.1 billion by 2027. Under the counterfactual, an 18.18 percent reduction factor, derived from the saturation analysis in Appendix E.1, is applied to those baseline amounts to reflect the lost capacity in the 5 GHz band (See Table 7-1).

Table 7-1. Estimated *loss* of consumer benefit (Free-Wi-Fi data off-load) under 2.4 GHz and 5 GHz congestion (2025–2027) (in US$ millions)

	2025	2026	2027
Economic impact (baseline)	4,715	4,394	4,096
Economic impact with re-allocation	3,857	3,595	3,351
Estimated loss of consumer benefit	(857)	(799)	(745)

Sources: Telecom Advisory Services analysis

Between 2025 and 2027, free-Wi-Fi congestion in the legacy bands therefore removes roughly US$ 2.4 billion in consumer benefit because consumers affected by diminishing quality of service opt to rely on cellular service rather than the Wi-Fi connection, an average of US$ 800 million per year, that would otherwise accrue to users of public hotspots. This figure is conservative: it assumes displaced traffic distributes evenly between the surviving 6 GHz channels and the 5 GHz layer, and it ignores secondary effects such as denser access-point deployments, DFS-triggered evacuations, and urban hidden-node collisions, all of which could drive the real-world loss significantly higher.

7.2. Broadband-unserved households served by free Wi-Fi

Municipal and non-profit programs often deploy public Wi-Fi in underserved neighbourhoods so that households lacking fixed broadband can access essential online services. These deployments depend heavily on the 5 GHz band to offer multiple simultaneous connections without prohibitive interference. When the upper 700 megahertz of the 6 GHz band is withdrawn, the overflow of wide-channel traffic crowds the very frequencies that sustain these community networks. As contention rises, effective down-link speeds fall, limiting the usefulness of public hotspots for homework, tele-health, job searches, and other bandwidth-intensive tasks that help close the digital divide.

In the 2024 baseline study, the GDP contribution attributed to free-Wi-Fi deployments that serve broadband-unserved households was US$ 19.7 billion in 2025, declining to US$ 13.7 billion in 2027 (attributable to the 2.4 GHz and 5 GHz spectrum). Applying the 21.01 percent reduction factor derived from the saturation analysis in Appendix E.2 (reflected in a 78.99 percent share of value retained) produces the adjusted figures shown in Table 7-2.

Table 7-2. GDP *lost* (Free-Wi-Fi deployments serving broadband-unserved households) under 2.4 GHz and 5 GHz congestion (2025–2027) (in US$ millions)

	2025	2026	2027
Economic impact (baseline)	19,675	16,793	13,745
Economic impact with re-allocation	15,542	13,265	10,857
Estimated loss of GDP	(4,134)	(3,528)	(2,888)

Sources: Telecom Advisory Services analysis

Over the 2025-2027 horizon, congestion in the legacy bands removes just over US$ 10.5 billion in GDP contributions due to less users that would otherwise accrue to programmes using free Wi-Fi to connect unserved households, an average shortfall of US$ 3.5 billion per year. This estimate is intentionally conservative: it assumes displaced traffic balances evenly across the remaining 6 GHz spectrum and the 5 GHz layer, and it excludes second-order effects such as delayed expansion of hotspot coverage, increased maintenance costs, and heightened interference from neighbouring access points, all of which could drive the actual economic loss materially higher.

7.3. Residential Wi-Fi bridging the digital divide

In sparsely populated and topographically challenging regions, fixed-wireless operators use Wi-Fi to extend broadband to homes that lie beyond the reach of cable or DSL. These point-to-multipoint "last-hundred-meters" links depend on wide, interference-free channels to deliver the down-link speeds now expected for remote work, distance learning and tele-health. When the upper 700 megahertz of the 6 GHz band is removed, that wide-channel capacity evaporates and traffic is forced back into the already busy 5 GHz layer and the remaining 6 GHz spectrum. The resulting rise in co-channel interference reduces viable service radio, pushes more customers out of coverage, and lowers the throughput available to the households that remain connected, undermining a key tool for closing the digital divide.

In the 2024 baseline study, the GDP spill-over generated by residential Wi-Fi deployments that extend coverage in rural and isolated areas was valued at US$ 54.3 billion in 2025, climbing to US$ 72.3 billion in 2027 (attributable to the 2.4 GHz and 5 GHz spectrum). Applying the 21.01 percent reduction factor derived from the saturation analysis in Appendix E.2 (reflected in a 78.99 percent share of value retained) yields the adjusted figures in Table 7-3.

Table 7-3. GDP *lost* (Residential Wi-Fi bridging the digital divide) under 2.4 GHz and 5 GHz congestion (2025-2027) (in US$ millions)

	2025	2026	2027
Economic impact (baseline)	54,311	62,662	72,270
Economic impact with re-allocation	42,900	49,497	57,086
Estimated loss of GDP	(11,411)	(13,165)	(15,184)

Sources: Telecom Advisory Services analysis

Over the 2025-2027 horizon, congestion in the legacy bands erodes roughly US$ 39.8 billion in GDP contributions that would otherwise accrue from rural Wi-Fi roll-outs, an average shortfall of US$ 13.3 billion per year. The estimate is conservative: it assumes perfect load-balancing across remaining spectrum, excludes the cost of upgrading or densifying networks to compensate for lost range, and ignores demand suppression when service tiers can no longer meet minimum-speed obligations. Real-world losses are therefore likely to exceed the figures reported here.

7.4. Enterprise Internet-traffic off-load

Corporate campuses, hospitals, distribution centres and university complexes depend on Wi-Fi to off-load vast volumes of Internet traffic that would otherwise traverse more expensive cellular data. These environments routinely deploy dozens, sometimes hundreds, of access points configured for wide 80 and 160 megahertz channels in the 5 GHz and 6 GHz bands to keep airtime contention low and sustain business-critical application performance. When the upper 700 megahertz of the 6 GHz band is removed, that wide-channel head-room disappears. The displaced traffic funnels back into the already saturated 5 GHz band, forcing access points to fall back to narrower channels, increasing collision probability and raising retransmission overhead. The immediate symptom is reduced aggregate throughput; the downstream consequence is lower productivity and diminished cost savings from Wi-Fi off-load because enterprises need to rely on wideband cellular.

In the 2024 baseline study, business traffic carried over Wi-Fi generated cost savings and productivity gains worth US$ 378.5 billion in 2025, rising to US$ 457.0 billion by 2027 (attributable to the 2.4 GHz and 5 GHz spectrum). Applying the 18.18 percent reduction factor derived from the saturation analysis in Appendix E.5, reflected in an 81.82 percent share of value retained, yields the adjusted figures shown in Table 7-4.

Table 7-4. Enterprise savings *lost* (Enterprise Internet-traffic off-load) under 2.4 GHz and 5 GHz congestion (2025–2027) (in US$ millions)

	2025	2026	2027
Economic impact (baseline)	378,470	422,332	456,982
Economic impact with re-allocation	309,664	345,552	373,903
Estimated loss of producer surplus	(68,806)	(76,780)	(83,079)

Sources: Telecom Advisory Services analysis

Over the 2025-2027 horizon, legacy-band congestion removes US$ 228 billion in economic contributions that enterprises would otherwise capture through Wi-Fi off-load, an average shortfall of roughly US$ 76 billion per year. We believe this estimate to be conservative: it assumes traffic distributes evenly between the residual 6 GHz capacity and the 5 GHz layer, omits the latency penalties that further degrade real-time applications, and ignores capital delays as firms postpone upgrades to Wi-Fi 7 hardware that can no longer exploit wide channels. In dense multi-floor deployments where co-channel interference grows non-linearly, the actual economic loss is likely to exceed the figures reported here.

7.5. Enterprise productivity gains from reduced latency

Low-latency Wi-Fi underpins an expanding class of real-time enterprise applications, from cloud-based collaboration and interactive virtual desktops to augmented-reality work instructions on factory floors. These workloads depend on millisecond-level round-trip times that Wi-Fi 6E and Wi-Fi 7 can achieve when 160 and 320 megahertz channels in the 6 GHz band are available. Eliminating the upper 700 megahertz of that band crowds wide-channel traffic back into the legacy layers, raising airtime contention and queueing delays. Even modest increases in latency ripple through workflows: video frames arrive late, bidirectional file synchronization slows, and automated processes idle while awaiting acknowledgements, translating directly into lower output per labour hour.

The valuation applies the "latency-driven productivity" methodology described earlier. In the 2024 baseline study, reduced Wi-Fi latency was estimated to lift U.S. GDP by US$ 103.2 billion in 2025, falling to US$ 52.4 billion in 2027 (attributable to the 2.4 GHz and 5 GHz spectrum). The counterfactual imposes the 20.29 percent degradation factor developed in Appendix E.4; consequently, only 79.71 percent of the baseline value is retained after congestion. The resulting adjustments appear in Table 7-5.

Table 7-5. GDP *lost* (latency-related enterprise productivity) under 2.4 GHz and 5 GHz congestion (2025–2027) (in US$ millions)

	2025	2026	2027
Economic impact (baseline)	103,238	73,937	52,411
Economic impact with re-allocation	82,291	58,935	41,777
Estimated loss of GDP	(20,947)	(15,002)	(10,634)

Sources: Telecom Advisory Services analysis

Across the 2025-2027 horizon, higher congestion in the legacy bands erodes roughly US$ 46.6 billion in latency-driven productivity gains, an average shortfall of US$ 15.5 billion per year. This estimate is conservative: it assumes latency penalties scale linearly with channel-capacity loss, overlooks compounding effects when multiple real-time applications share the same WLAN, and excludes knock-on delays in upstream cloud infrastructure. Field evidence suggests latency degradation often accelerates once airtime occupancy breaches critical thresholds, implying that the real-world economic loss could exceed the values reported here.

7.6. Enhanced IoT deployment

The economic promise of the Internet of Things rests on the ability to connect dense clusters of sensors, actuators and gateways that must share spectrum with minimal interference. Wi-Fi 6E and forthcoming Wi-Fi 7 silicon were designed to host these high-device-count networks in the 6 GHz band, where wide 160 and 320 megahertz channels accommodate large numbers of simultaneous low-power transmissions. With the upper 700 megahertz of that band removed, many IoT gateways are forced back into the legacy 2.4 GHz and 5 GHz layers, slices that are already burdened by conventional data traffic. The resulting spike in carrier-sense back-offs and retransmissions undermines connection density and battery life, slowing the scale-up of smart-home, industrial and logistics applications.

This use case applies the "IoT-capacity erosion" methodology outlined earlier. In the 2024 baseline study, widespread IoT adoption was projected to contribute US$ 53.3 billion to GDP in 2025, declining to US$ 38.0 billion by 2027 (attributable to the 2.4 GHz and 5 GHz spectrum). The counterfactual analysis imposes the 21.01 percent reduction factor derived from Appendix E.3, meaning only 78.99 percent of the baseline value is retained once legacy-band congestion is considered. The adjusted figures are summarised in Table 7-6.

Table 7-6. GDP *lost* (Enhanced IoT deployment) under 2.4 GHz and 5 GHz congestion (2025–2027) (in US$ millions)

	2025	2026	2027
Economic impact (baseline)	53,252	43,046	38,021
Economic impact with re-allocation	42,064	34,002	30,033
Estimated loss of GDP	(11,188)	(9,044)	(7,988)

Sources: Telecom Advisory Services analysis

Across the 2025-2027 horizon, congestion in the legacy bands removes roughly US$ 28.2 billion in GDP contributions that would otherwise flow from expanded IoT deployment, an average shortfall of US$ 9.4 billion per year. This estimate is intentionally conservative: it assumes displaced traffic distributes evenly across remaining spectrum, overlooks the compounded interference from co-located Bluetooth and Zigbee devices, and ignores the productivity drag when battery-powered sensors deplete faster due to higher retransmission rates. In dense industrial or smart-city settings, where device counts scale into the tens of thousands per access point, the real-world economic loss could significantly exceed the values reported here.

7.7. Revenues of public Wi-Fi service providers

Operators that charge users for hotspot access in airports, conference centres and transport hubs differentiate their service on the basis of speed and reliability, attributes that depend on ample, uncongested spectrum in the 5 GHz and 6 GHz layers. When the upper 700 megahertz of the 6 GHz band is withdrawn, wide-channel traffic is squeezed back into the legacy bands, raising co-channel contention precisely where paid-Wi-Fi providers must deliver premium performance. As throughput drops and sessions time-out, take-up declines, dwell-time shrinks and per-session revenue falls, directly eroding the providers' bottom line.

This use case employs the "public-Wi-Fi congestion" methodology described earlier. In the 2024 baseline study, paid-Wi-Fi hotspots were projected to generate US$ 477 million in revenue in 2025, tapering to US$ 343 million by 2027 (attributable to the 2.4 GHz and 5 GHz spectrum). Applying the 18.18 percent reduction factor derived from Appendix E.1, equivalent to retaining only 81.82 percent of baseline value, yields the adjusted figures in Table 7-7.

Table 7-7. GDP *lost* (paid-Wi-Fi service providers) under 2.4 GHz and 5 GHz congestion (2025–2027) (in US$ millions)

	2025	2026	2027
Economic impact (baseline)	477	410	343
Economic impact with re-allocation	391	336	281
Estimated loss of GDP	(87)	(75)	(62)

Sources: Telecom Advisory Services analysis

Across the 2025-2027 horizon, legacy-band congestion removes roughly US$ 224 million in revenue, an average hit of US$ 75 million per year, for providers that monetize public Wi-Fi access. The estimate is deliberately conservative: it assumes displaced traffic distributes evenly between the residual 6 GHz capacity and the 5 GHz layer, and it excludes secondary effects such as churn to cellular day-passes, price discounts needed to offset poorer performance, and increased support costs. In real-world settings where travellers and conference attendees are highly sensitive to connectivity quality, the revenue shortfall could exceed the values reported here.

7.8. Revenues of WISPs

Wireless Internet Service Providers build their business models on high-capacity, licence-exempt spectrum that can support long-range point-to-multipoint links. The withdrawal of the upper 700 megahertz of the 6 GHz band eliminates much of that head-room, funnelling traffic back into the already busy 2.4 GHz and 5 GHz layers. As interference rises, usable throughput per sector falls; WISPs must either cut headline speeds, reduce the number of subscribers per tower, or densify infrastructure, each option eroding operating margins and, ultimately, top-line revenue.

Aggregated WISP revenues were projected to reach US$ 13.9 billion in 2025, rising to US$ 17.6 billion in 2027 (attributable to the 2.4 GHz and 5 GHz spectrum). Applying the 21.01 percent degradation factor derived from Appendix E.2, equivalent to retaining only 78.99 percent of baseline value, yields the figures summarised in Table 7-8.

Table 7-8. GDP *lost* (WISPs) under 2.4 GHz and 5 GHz congestion (2025–2027) (in US$ millions)

	2025	2026	2027
Economic impact (baseline)	13,900	15,622	17,558
Economic impact with re-allocation	10,980	12,340	13,869
Estimated loss of GDP	(2,920)	(3,282)	(3,689)

Sources: Telecom Advisory Services analysis

Across the 2025-2027 horizon, legacy-band congestion trims approximately US$ 9.9 billion from WISP revenues, an average shortfall of about US$ 3.3 billion per year. This estimate is conservative: it assumes displaced traffic balances evenly across residual 6 GHz capacity and the 5 GHz layer and overlooks the capital cost of additional towers or spectrum-efficient equipment needed to restore service levels. In practice, revenue attrition could be materially higher once these secondary pressures are fully accounted for.

7.9. Aggregate economic impact (2025–2027)

The analysis builds upon the original 2024 study conducted for WiFiForward[18], which demonstrated that full access to the entire 1200 megahertz of unlicensed 6 GHz spectrum supported aggregate economic value of US$ 780 billion in 2025, rising to US$ 1.19 trillion by 2027 through enhanced throughput, lower latency, and expanded IoT and AR/VR use cases. Those findings confirm that removing any portion of 6 GHz capacity would force significant off-load into the 2.4 GHz and 5 GHz bands, with material performance and welfare loss consequences.

In Part I, we quantified the losses from repurposing the upper 700 megahertz segment of the 6 GHz band (6.425–7.125 GHz), estimating annual economic value foregone of US$ 446 billion in 2025, US$ 568 billion in 2026, and US$ 725 billion in 2027, totaling US$ 1.74 trillion over the 2025–2027 horizon. In Part II, the methodology adopts an inverse-engineering framework anchored in the original

[18] See Katz et al. (2024). *Assessing the economic value of Wi-Fi in the United States*. Washington, DC: WiFiForward (September). Retrieved in: https://wififorward.org/wp-content/uploads/2024/09/Assessing-the-Economic-Value-of-Wi-Fi.pdf

published analysis of the 2.4 GHz and 5 GHz bands. We begin by replicating the baseline scenarios from the "Assessing the Economic Value of Wi-Fi in the United States" study, reconstructing consumer benefit, producer surplus, and GDP contributions under full access to the legacy bands . We then define a counterfactual in which the upper 700 megahertz of the 6 GHz band is withdrawn, forcing Wi-Fi traffic into the 2.4 GHz and 5 GHz bands. For each use case, we recalibrate technical performance parameters and translate those degradations into economic losses by holding all other inputs (adoption forecasts, elasticities, demand profiles) constant. Table 7-9 below summarizes the aggregate economic losses in the legacy 2.4 GHz and 5 GHz bands.

Table 7-9. United States: Economic value lost (in 2.4 GHz and 5 GHz) when the upper 700 megahertz are re-allocated (2025–2027) (in US$ millions)

Sources	Effects	Type	2025	2026	2027
1. Free Wi-Fi	1.1. Savings incurred by consumers by accessing free Wi-Fi in public sites	Consumer Benefit	($857)	($799)	($745)
	1.2. Free Wi-Fi service supporting the needs of the broadband unserved pop.	GDP Contribution	($4,134)	($3,528)	($2,888)
2. Residential Wi-Fi	2.5. Bridging the digital divide: use of Wi-Fi to increase coverage in rural isolated areas	GDP Contribution	($11,411)	($13,165)	($15,184)
3. Enterprise Wi-Fi	3.1. Savings in business Internet traffic transmitted through Wi-Fi	Producer Surplus	($68,806)	($76,780)	($83,079)
	3.4. Benefits derived from reduced latency	GDP Contribution	($20,947)	($15,002)	($10,634)
	3.5. Enhanced IoT deployment	GDP Contribution	($11,188)	($9,044)	($7,988)
4. ISPs	4.2. Revenues of Wi-Fi based Public Internet Service Providers	GDP Contribution	($87)	($75)	($62)
	4.3. Revenues of Wi-Fi based Wireless Internet service Providers	GDP Contribution	($2,920)	($3,282)	($3,689)
TOTAL			($ 120,350)	($121,675)	($124,269)

Sources: Telecom Advisory Services analysis

In the legacy 2.4 GHz and 5 GHz bands alone, our counterfactual estimates aggregate economic losses of US$ 120.4 billion in 2025, US$ 121.7 billion in 2026, and US$ 124.3 billion in 2027, driven by heightened congestion, reduced throughput, and latency penalties across public Wi-Fi, residential, enterprise, ISP, and IoT use cases.

8. CONCLUSION AND POLICY IMPLICATIONS

This report set out to quantify, the economic losses the United States would incur if the upper 700 megahertz of the 6 GHz band (6.425–7.125 GHz) were reassigned from unlicensed to licensed use. Using the same modelling framework that underpinned the 2024 study commissioned by WifiForward, this study now ran in reverse, translating spectrum-driven performance constraints into reductions in consumer benefit, producer surplus and GDP contribution across every major WiFi use case. The exercise covered the first three full years after commercial Wi-Fi 7 launch (2025 to 2027) and adopted conservative assumptions on device uptake, channel bonding and price elasticities.

When losses within the 6 GHz ecosystem (presented in Part I) are combined with the congestion-driven penalties quantified for the legacy 2.4 GHz and 5 GHz layers (presented in Part II), the nation forfeits an estimated US$ 567 billion in 2025, US$ 689 billion in 2026, and US$ 850 billion in 2027, a trajectory that mirrors the rapid diffusion of Wi-Fi 7 and the scaling of advanced enterprise applications. These figures, already conservative by design, represent a cumulative three-year opportunity cost of roughly US$ 2.11 trillion. This figure does not address economic costs that would accrue from limiting deployed equipment to a smaller spectral footprint – including costs to users, manufacturers, supply chain participants – and the costs of re-engineering equipment already in the manufacturing pipeline that is planned for the full 6 GHz band [19] (See Table 8-1).

[19] Based on our understanding, such a development would present a new and novel set of problems for the Federal Communications Commission to address.

Table 8-1. United States: Aggregate Economic value lost when the upper 700 megahertz are re-allocated (2025–2027) (in US$ millions)

Sources	Effects	Type	2025	2026	2027
1. Free Wi-Fi	1.1. Savings incurred by consumers by accessing free Wi-Fi in public sites	Consumer Benefit	($3,806)	($4,657)	($5,667)
	1.2. Free Wi-Fi service supporting the needs of the broadband unserved pop.	GDP Contribution	($8,973)	($8,252)	($7,134)
	1.3. Benefit to consumers enjoying higher speed from free Wi-Fi under 6 GHz	Consumer Benefit	($100)	($94)	($75)
	1.5. Use of Wi-Fi in highly dense heterogeneous sites	Consumer Benefit	($99)	($131)	($159)
2. Residential Wi-Fi	2.3. Consumer benefit derived from faster broadband speed	Consumer Benefit	($9,105)	($10,966)	($13,466)
	2.4. Consumer benefit generated by use of residential Wi-Fi devices and equipment	Consumer Benefit	($4,555)	($5,821)	($7,303)
	2.5. Bridging the digital divide: use of Wi-Fi to increase coverage in rural isolated areas	GDP Contribution	($18,698)	($21,531)	($22,532)
3. Enterprise Wi-Fi	3.1. Savings in business Internet traffic transmitted through Wi-Fi	Producer Surplus	($77,461)	($87,276)	($95,959)
	3.3. Benefits derived from an increase in average speed	GDP Contribution	($185,044)	($223,707)	($282,588)
	3.4. Benefits derived from reduced latency	GDP Contribution	($148,577)	($184,478)	($226,211)
	3.5. Enhanced IoT deployment	GDP Contribution	($71,304)	($90,815)	($122,710)
	3.6. Deployment of Augmented Reality/Virtual Reality solutions	GDP Contribution	($8,184)	($12,568)	($18,240)
4. ISPs	4.1. Cellular networks CAPEX savings by off-loading traffic to Wi-Fi	Producer Surplus	($3,014)	($3,155)	($3,393)
	4.2. Revenues of Wi-Fi based Public Internet Service Providers	GDP Contribution	($143)	($134)	($120)
	4.3. Revenues of Wi-Fi based Wireless Internet service Providers	GDP Contribution	($3,102)	($3,486)	($3,863)
5. Wi-Fi ecosystem	5.1. Manufacturing of Wi-Fi devices and equipment for residential use	Producer Surplus	($4,279)	($5,468)	($6,860)
	5.2. Manufacturing of enterprise Wi-Fi devices and equipment	Producer Surplus	($1,540)	($1,897)	($2,239)
	5.3. Benefits of Firms in the IoT ecosystem	Producer Surplus	($15,539)	($19,989)	($23,955)
	5.4. Benefits of firms in the AR/VR ecosystem	Producer Surplus	($3,084)	($4,799)	($7,216)
TOTAL			($ 566,606)	($689,225)	($849,693)

Sources: Telecom Advisory Services analysis

Roughly 87 percent of that foregone value originates in enterprise Wi-Fi. Wide 160 and 320 megahertz channels, plus MLO, are prerequisites for the low latency, multigigabit connectivity demanded by cloud-based workflows, real-time analytics and robotics. Under a constrained band scenario, the GDP contribution from higher average speed plunges from US$ 440 billion to US$ 158 billion in 2027, while latency related benefits fall by a similar margin. Because enterprise productivity effects compound over time, every year of under allocation propagates through future total factor productivity and wage growth.

***A one-off reallocation therefore imposes a permanent growth penalty, not a temporary adjustment*.**

From a public policy standpoint, the findings argue strongly for preserving the entire 6 GHz band for unlicensed use. The magnitude and breadth of the quantified losses eclipse those observed in previous midband reallocations and overwhelm the incremental welfare gains projected for licensed mobile networks operating in the same spectrum. Put simply, reallocating the upper 700 megahertz would exchange a diffuse, economy-wide dividend for a narrower, operator specific benefit. Moreover, Wi-Fi delivers benefits immediately upon device deployment, whereas licensed use would require years of clearing, standardization and ecosystem ramp up.

This report demonstrates that withdrawing the upper 700 megahertz of the 6 GHz band would inflict far-reaching losses that extend well beyond the new band itself. The losses are not confined to a single stakeholder. Consumers will see higher prices or diminished service quality as free-Wi-Fi off-load weakens; rural households will face slower or unavailable links as WISP capacity contracts; enterprises will have to absorb lower labor productivity when throughput falls and latency rises; and the broader IoT and device-manufacturing ecosystems will need to postpone investment in next-generation products that rely on wide, uncontended channels. In short, the economic burden is diffused across every layer of the digital value chain.

As a technical matter, the mechanism is straightforward. Removing the upper part of the 6 GHz capacity forces wide-channel traffic back into spectrum that was never engineered to host it. The legacy bands lose around one-fifth of their effective capacity, as reflected in the calibrated reduction factors of 18.18 percent to 21.01 percent. Contention, carrier-sense back-offs, and retransmissions climb accordingly, driving the monetary penalties.

While the study estimates end in 2027, the structural negative effects of a repurposing of the upper 700 megahertz of the 6 GHz band persist. Congested legacy bands delay future spectral refarming, complicate coexistence studies, and raise the cost of achieving carbon-reduction targets, because denser, energy-hungry deployments are required to offset lost capacity. The economy thus incurs a compounding opportunity cost well beyond the three-year horizon modelled here.

From a policy standpoint, the findings argue strongly for preserving unlicensed access to the entire 1200 megahertz of 6 GHz. Regulators should also provide long-term certainty. Clear, stable rules on power limits, device certification, and interference protection enable equipment vendors to plan multi-year silicon roadmaps and encourage network operators to invest in Wi-Fi 7 infrastructure. Complementary initiatives, R&D funding for dynamic-spectrum access, expanded backhaul subsidies for rural providers, and harmonized technical standards, can further mitigate residual congestion in the legacy bands. Moreover, given the increasing demand for Wi-Fi and ever-growing data needs of consumers, regulators and policy makers should be looking to allocate more spectrum for unlicensed use, not less.

In conclusion, the economic cost of repurposing the upper segment of the 6 GHz band outweighs the speculative benefits of additional licensed spectrum. The decision would impose a conservative US$ 2.11 trillion burden over three years, hamper digital-diversity goals, and dilute U.S. influence in the global wireless marketplace. Retaining full-band unlicensed access is therefore the most efficient path to sustaining innovation, productivity and inclusive connectivity in the decades ahead.

BIBLIOGRAPHY

Intel. (2023). *Next-Generation Wi-Fi: Spectrum Needs of Wi-Fi 7* (white paper). Santa Clara, CA: Intel.

Katz, R., Jung, J., Callorda, F., & Valencia, A. (2024). *Assessing the economic value of Wi-Fi in the United States*. Telecom Advisory Services LLC. Commissioned by WiFiForward.

Katz, R., Callorda, F. and Jung, J. (2024). *The impact of digital transformation on the economy - Econometric Modelling*. Geneva: International Telecommunication Union.

Nevo, A., Turner, J., and Williams, J. (2016) "Usage-based pricing and demand for residential broadband", *Econometrica*, vol. 84, No.2 (March), 441-443.

We Are Social & DataReport. (2023). *Digital 2023: United States of America*.

APPENDICES

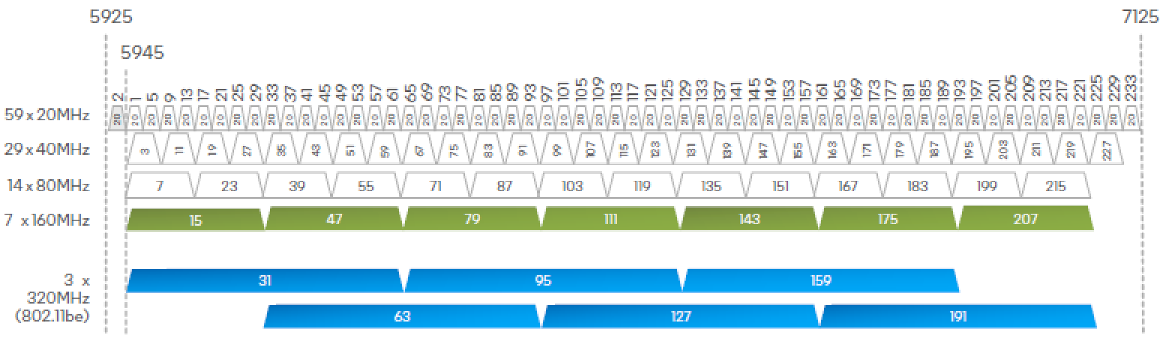
A. Technical Effects of Reducing the Unlicensed 6 GHz Band: General Framework

This appendix outlines the principal technical consequences resulting from the reallocation of the upper 700 megahertz of the 6 GHz band (6.425–7.125 GHz) from unlicensed to licensed use.

A.1. Diminished Channel Availability and Throughput

The most immediate consequence of withdrawing the upper portion of the 6 GHz band is a significant reduction in available channel capacity for Wi-Fi 6E and Wi-Fi 7 networks. When the full 1200 megahertz (5.925–7.125 GHz) is available, it supports nearly sixty 20 megahertz channels, which can be aggregated into up to seven non-overlapping 160 megahertz channels or three 320 megahertz ultra-wide channels. This wide channel availability is essential for achieving the high data rates promised by next-generation Wi-Fi technologies (See Figure A).

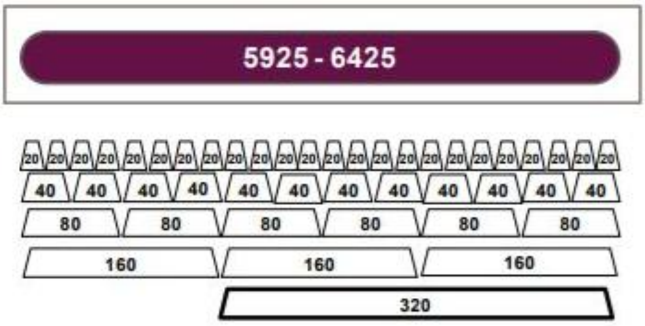
Figure A. Frequency band and channel width for Wi-Fi 6E and Wi-Fi 7, with the full 6 GHz band



Source: INTEL (2023), "Next Generation Wi-Fi: Spectrum Needs of Wi-Fi 7".

Limiting unlicensed access to only the lower 500 megahertz of the band (5.925–6.425 GHz) cuts the number of available 20 megahertz channels by more than half and reduces the number of usable wide channels to a maximum of three 160 megahertz channels, or just one 320 megahertz channel in practice. This compression severely limits network capacity in dense deployments, reducing the number of concurrent high-throughput links and forcing many devices to share the same spectral lanes (See Figure B).

Figure B. Frequency band and channel width for Wi-Fi 6E and Wi-Fi 7, with only the lower 500 megahertz (5.925–6.425 GHz) of the 6 GHz band



Source: Tanaza.

Wi-Fi 7 features such as MLO and 320 megahertz channel bonding rely on the availability of multiple wide, clean channels. In a constrained spectrum environment, these capabilities become functionally unviable. Consequently, Wi-Fi networks are forced to operate below their designed capacity, and the total aggregate throughput for users decreases significantly. According to technical simulations, the addition of a third 320 megahertz channel in the 6 GHz band can boost overall throughput; conversely, the removal of those channels imposes a hard ceiling on throughput growth[20].

A.2. Increased Congestion and Co-Channel Interference

As the spectrum pool narrows, more access points (APs) and devices must operate on fewer available channels, increasing the likelihood of co-channel interference and network congestion. Under full-band conditions, network architects can strategically assign channels to avoid overlap among adjacent APs, ensuring isolation and consistent performance. With only 500 megahertz, this type of spectral separation becomes infeasible, especially in environments with high AP density such as schools, apartment buildings, or stadiums.

In these scenarios, adjacent APs are often forced to operate on the same or nearby frequencies, resulting in frequent contention for airtime, packet collisions, and retransmissions. These effects increase MAC-layer latency and reduce effective throughput. A 2023 demonstration conducted by the Wi-Fi Alliance and the Faculty of Medicine Ramathibodi Hospital, Mahidol University, evaluated the performance of 6 GHz Wi-Fi in an advanced healthcare use case involving AR/VR training. The results showed that using the full 1200 megahertz of the 6 GHz band enabled a low-latency, high-throughput experience that supported uninterrupted immersive interaction. Conversely, when the same system was constrained to operate within only the lower 500 megahertz of the band, latency increased by over 500%, and video performance degraded significantly, resulting in VR stutter, motion sickness, and a disrupted training experience[21].

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[20] See https://www.intel.com/content/dam/www/central-libraries/us/en/documents/spectrum-needs-wi-fi-7-whitepaper.pdf

[21] See https://www.wi-fi.org/beacon/the-beacon/wi-fi-alliance-pilot-trial-showcases-the-transformative-power-of-6-ghz-wi-fi-for

These findings underscore the critical importance of channel diversity. Without it, Wi-Fi environments begin to resemble the overcrowded 2.4 GHz band, with all its well-known limitations in terms of contention and performance instability.

A.3. Higher Latency and Jitter

Latency is a vital performance metric for modern applications, particularly those requiring real-time responsiveness, such as cloud gaming, virtual reality, industrial automation, and telemedicine. Wi-Fi latency improves when channels are abundant and clean, minimizing queuing delays and reducing the likelihood of transmission collisions.

In a constrained 500 megahertz configuration, the increased traffic density results in more frequent retransmissions, channel backoff events, and scheduling inefficiencies, which in turn cause higher average latency and increased jitter. This directly affects the usability of latency-sensitive applications, many of which require round-trip times below 10 ms to function properly.

Experimental evidence shows that when channel width and availability are reduced, packets are more likely to experience queuing delays or interference-induced retransmissions. The result is a less predictable and less stable network, even for devices equipped with advanced features such as OFDMA, MU-MIMO, or TWT[22]. Under such conditions, the full performance potential of Wi-Fi 6E and Wi-Fi 7 cannot be realized, particularly in use cases that demand deterministic latency.

A.4. Limited Flexibility in Channel Planning and Interference Management

A frequently overlooked consequence of spectrum reduction is the loss of flexibility in network design and interference management. When the full 6 GHz band is available, network engineers can divide the band into functional sub-ranges, assign channels based on device types, and dynamically adjust allocations to mitigate interference. For instance, networks can be configured to separate high-bandwidth applications (e.g., streaming or AR/VR) from low-bandwidth IoT traffic, or isolate legacy devices to avoid performance degradation.

Reallocating the upper 700 megahertz of the 6 GHz band for licensed use removes this flexibility. Wi-Fi devices may be forced to operate near the 6.425 GHz boundary, introducing risks of adjacent-band interference and requiring stricter out-of-band emission controls. In addition, the reduced number of available channels precludes strategies such as multi-layer deployments or traffic-type segmentation, leading to "one-size-fits-all" channel configurations.

In practice, this limits the ability to prioritize traffic, support heterogeneous device populations, or deliver QoS guarantees, especially in enterprise, healthcare, or

[22] See Daldoul, Y., Meddour, D.-E., & Ksentini, A. (2020). Performance evaluation of OFDMA and MU-MIMO in 802.11ax networks. *Computer Networks, 182*, 107477. https://doi.org/10.1016/j.comnet.2020.107477

industrial environments. The network becomes less adaptable and more vulnerable to interference, which compromises its reliability and long-term scalability.

A.5. Conclusion

The reduction of the unlicensed 6 GHz band by 700 megahertz would not merely result in proportional declines in spectral capacity, it would fundamentally alter the operating environment for next-generation Wi-Fi. Throughput would be constrained, latency would rise, interference would intensify, and network flexibility would erode. These combined effects compromise the ability of Wi-Fi to meet rising connectivity demands and support innovative applications, ultimately leading to broader economic and societal consequences.

B. Technical Effects of Reducing the Unlicensed 6 GHz Band: Use Case Analysis

This appendix presents a disaggregated technical assessment of how the reduction of the unlicensed 6 GHz band, specifically the reallocation of its upper 700 megahertz, would affect different Wi-Fi use cases. Each subsection analyzes the functional impact of spectrum constraints on deployment feasibility, performance parameters, and service quality within a specific application context. The objective is to provide a technical basis for the economic loss estimates discussed in the main report, by translating spectrum limitations into measurable operational consequences, such as reduced channel availability, increased interference, and diminished throughput. This use-case-specific analysis complements the general modeling framework outlined in Appendix A.

B.1. Reduction of impact on Free Wi-Fi if the use of the 6 GHz band is restricted

One of the main benefits of using the 6 GHz band is the reduction of latency, and, therefore, an increase in traffic in public places, which depends on the number of connected devices that a Wi-Fi site can host simultaneously. The total number of devices (US) that a hotspot site can host depends on the allocated bandwidth (AB), the usage factor (FU), the traffic demand profile of the average user (CM) and the simultaneity factor that depends on the number of devices connected at the same time (FS). Equation B-1 specifies their relationship as follows:

$$(Eq. B-1) \qquad US = \frac{AB}{FS.\sum_{i=1}^{n} CM_i.FU_i}$$

Where "n" represents the total number of users that are hosted in the Wi-Fi site and "i" corresponds to the individual demand profile of the users that are connected.

The following sections explain the considerations and calculations of each of the components that influence the number of users that a Wi-Fi site can handle.

Demand Profile (DC)

The demand profile represents the maximum download capacity for four types of user requirements (web pages, email, social networking, calls, video, etc.). For calculation purpose, we compile the traffic of an average user: (i) web page browsing, (ii) video conferencing, (iii) music or video streaming, and (iv) calls and social networks. Traffic by service allows calculating download capacity. For example, when a user is accessing the Internet, if it is considered that a user accesses every 20 seconds one type of the most visited web content, whose average size is around 1,672.59 KB. Consequently, the maximum capacity assigned to the device is 669.04 Kbps (see Table B-1).

Table B-1. Size and capacity of most visited pages

Type	Most visited pages	Size (T) KB	Capacity (CM) Kbps
Navegation	Google	609.4	$CM = \frac{\bar{T}}{t} \cdot \frac{8\,bits}{1\,byte} = \frac{1{,}672.59KB}{20s} \cdot \frac{8\,bits}{1\,byte} = \mathbf{669.04\ Kbps}$
	YouTube	3379.2	
	Reddit	197.7	
	Facebook	353.5	
	Amazon	5017.6	
	Wikipedia	78.3	
	Yahoo	3788.8	
	Duck Duck Go	24.6	
	Twitter	1843.2	
	Instagram	1433.6	
Average size and capacity		**1,672.59**	**669.04**

Source: We Are Social. https://datareportal.com/reports/digital-2023-united-states-of-america?rq=united%20states/; Telecom Advisory Services analysis

In the case of other applications such as video streaming or videoconferencing, the average maximum capacity assigned to the device is around 2,154.51 Kbps (2.10 Mbps) (see Table B-2).

Table B-2. Application capacity

Applications	Capacity(CM) Kbps	Percent use
Videoconferencing (e.g., Skype)	3,000	4.8%
Video streaming (e.g., YouTube)	3,300	22%
Phone calls / Social networks (e.g., WhatsApp)	12.33	10.6%

Source: Webpage size: PINGDOM

By adding all usage traffic, the average capacity of a device connected to a Wi-Fi site reaches 1,783.14 Kbps (1.74 Mbps) (see Table B-3).

Table B-3. Capacity of web pages and applications
Applications and Web pages

Applications and webpages	Capacity (CM) Kbps
Internet browsing	669.04
Broadcast and Streaming (Video)	3,000
Social networks (calling)	3,300
Podcast (Videoconference)	12.33
Average total capacity	**1,783.14**

Source: Telecom Advisory Services analysis

Usage Factor (UF)

The usage factor corresponds to the percentage of content accessed by a single device. This value depends on the time or amount of information that the average user collects from the Internet via the Wi-Fi site. The usage factor is calculated by the daily time spent by an average user which, for the most part, is linked to Internet browsing (6h 59m - 32.7%, see Table B-4).

Table B-4. Common time spent using Internet applications in the US

Internet browsing	Hours	Minutes	Total (h)	% Use
Broadcast and Streaming (Video)	4	42	4.70	22.0%
Social networks (calling)	2	16	2.27	10.6%
Podcast (Videoconference)	1	2	1.03	4.8%
Internet browsing	6	59	6.98	32.7%

Source: We Are Social; Telecom Advisory Services analysis

Simultaneity Factor

The simultaneity factor assumes that the capacity calculated above decreases by half due to the number of simultaneous users occupying a channel. In a scenario where the number of users increases by 100%, this factor is assumed to be 0.5, i.e., capacity could be reduced due to the duplication of connected devices.

Bandwidth

Considering that a Wi-Fi site uses the outdoor spectrum portions, the useful bandwidth in the 6 GHz band varies by allocation alternative (see table B-5).

Table B-5. Bandwidth scenarios

U-NII	Starting frequency	Final frequency	Bandwidth (megahertz)	Standard Power	Low Power	Very low Power
U-NII-5	5,925	6,425	500	Outdoor/Indoor	Indoor	Indoor
U-NII-6	6,425	6,525	100		Indoor	Indoor
U-NII-7	6,525	6,875	350	Outdoor/Indoor	Indoor	Indoor
U-NII-8	6,875	7,125	250		Indoor	Indoor

Source: DSA. Unlicensed spectrum access in the 6 GHz band

Based on the usage pattern and bandwidth availability the number of users and, consequently the discount factor of alternative allocation scenarios were defined (see table B-6).

Table B-6. Number of users by frequency allocation scenarios

	U-NII-5	U-NII-5 + U-NII-7
	500 megahertz	**1200 megahertz**
Average capacity (from table D-4)	1,112.73	1,112.73
Simultaneity factor	0.5	0.5
AB (KHz)	500,000	850,000
Number of users	898.69	1,527.78

Source: Telecom Advisory Services analysis

Based on this, the number of users that can be handled by a free hotspot can be estimated under frequency band allocation of 500 megahertz. While the number of users under 1200 megahertz is 1,527.78, the reduction is estimated through the following equation B-2:

$$(Eq. B - 2)\ Impact_{500MHz} = \frac{Users_{1200} - Users_{500}}{Users_{1200}} = \frac{1{,}527.78 - 898.69}{1{,}527.78} = 41.18\%$$

B.2. Use of Wi-Fi to increase coverage in rural and isolated areas

Considering the position of restricting the upper part of the 6 GHz band, it must be taken into account that radio equipment for point-to-point or point-to-multipoint links that could or do operate in this band; and, that have been developed for fixed wireless networks (typically WISPs) would have to partially migrate or avoid deployment in this area of the band. Therefore, there would not only be a reduction in the economic value that the technology can generate, but also the costs of user migration and the reduction in capacity that the 2.4 GHz, 5 GHz and lower 6 GHz bands could provide.

From a technical point of view, the 6 GHz band for Wi-Fi use is defined through the power characteristic of the equipment (standard power); that is, it occupies the U-NII-5 (5925-6425: 500 megahertz) and U-NII-7 (6525-6875: 350 megahertz) band classification for outdoor use; while, for indoor use of the technology, it is defined by the low power indoor (LPI) characteristic that could occupy the entire 1200 megahertz space. In practical terms, for the installation of this type of networks, this band could support the deployment in rural areas, through the so-called WISPs.

In the case of restricting access to the upper part of the 6 GHz band, the first limiting aspect is the ability to accommodate more users in the 350 megahertz (U-NII-7) that can be allowed in possible outdoor operations for Wi-Fi. The legacy bands accommodate a maximum number of connections between 40 and 50; whereas, with the specification of the 802.11ax standard with the entire 6 GHz band, the between 110 and 120 connections could be established; that is, between 2.4 and 2.75 times more.

In this regard, in order to analyze the impact of the standard upgrade on the increase of connections in homes in rural and isolated areas, two main aspects must be established: (i) the number of maximum outdoor channels influences the number of connections that could be deployed; and (ii) the number of connections for the allocation of resource units (see Table B-7).

Table B-7. Maximum number of users per 6 GHz band allocation scenarios

	1200 Megahertz	500 Megahertz
Available bandwidth	1200	500
Available bandwidth outdoors (U-NII-5 and U-NII-7)	850	500
Number of 20 megahertz channels	42	25
Maximum number users with 242 RUs	42	25

Source: Telecom Advisory Services analysis

Along these lines, the impact of different frequency allocation scenarios is related to the reduction of the number of connections to be handled under 500 megahertz alternative relative to 1200 megahertz:

$$(Eq. C - 3)\ Impact_{500MHz} = \frac{Connections_{1200} - Connections_{500}}{Connections_{1200}} = \frac{42 - 25}{42} = 40.48\%$$

B.3. Enhanced IoT deployment

Considering that the number of M2M connections is the main variable in this case, the ratio of total IoT equipment is linked to the amount of assigned spectrum ($\Delta Spectrum$).

For the scenario of occupying the 6GHz band (1200 megahertz) there would be no increase since Wi-Fi 6E under the 6 GHz band would occupy the same amount of spectrum. However, for the scenario of reduced allocation of 500 megahertz, the reduction of M2M connections would amount to 58.33% (see Equation B-4).

$$(Eq. B-4) \quad \Delta Spectrum = \frac{S_{1200\,MHz} - S_{500MHz}}{S_{1200\,MHz}} = \frac{1200-500}{1200} = \frac{700}{1200} = 58.33\%$$

B.4. Deployment of Augmented Reality/Virtual Reality solutions

The impact of different frequency allocation alternatives is assessed on the basis of Mehrnoush, M., Hu, C. and Aldana, C. (2022) "AR/VR spectrum requirement for Wi-Fi 6E and beyond" paper[23], which estimate the maximum number of AR/VR devices supported in a classroom of a given school, depending on whether 500 megahertz or 1200 megahertz are available for unlicensed use cases. This paper estimates, under a set of parameters of speed (50 Mbps) and latency (20 ms), through a simulation the maximum simultaneous number of headsets that can be used under both frequency allocation alternatives, keeping at a minimum the signal degradation.

According to the paper results, under 500 megahertz allocation, the RLAN can only handle four students in a school composed of four classrooms per floor. Under 1200 megahertz, the RLAN can handle up to 22 students within 14 classrooms per floor (or the whole school). The number of connected users diminishes by 81.82% from 1200 megahertz to 500 megahertz scenario. (see table B-8).

Table B-8. Reduction of AR/VR users under different frequency allocation alternatives

Available spectrum (megahertz)	500	1200
Connected users	4	22
Impact	81.82%	

Source: Telecom Advisory Services analysis

This simulation estimates were validated in a 6 GHz pilot project testing the impact of 6 GHz in Ramathibodi Hospital in the outskirts of Bangkok (Thailand). While the complete pilot was not finished, the test of AR/VR use cases for 10-12 users under the 500 megahertz indicated a serious degradation of latency reaching between 200 ms and 260 ms due to code channel interference. When use cases were moved to 160 megahertz channel (a feature facilitated by 1200 megahertz allocation that can handle seven such channels) latency dropped to 30 ms.

[23] Mehrnoush, M., Hu, C. and Aldana, C. (2022) "AR/VR spectrum requirement for Wi-Fi 6E and beyond", *IEEE Access* (December)

B.5. Cellular networks CAPEX savings by off-loading traffic to Wi-Fi

The increase in traffic due to the amount of spectrum assigned in the 6 GHz band has a direct influence on the reduction of CAPEX due to the overflow of mobile traffic to Wi-Fi networks. It is possible to relate the average speed variation with this indicator to establish a relationship between CAPEX and Wi-Fi traffic. Table B-9 presents the impact of alternative scenarios of frequency allocation.

Table B-9. Difference between frequency allocation scenario of the 6 GHz band

Frequency allocation scenario	Speed	320 maximum channels	Speed per connection	Difference with 1200 megahertz
1200 megahertz	1,200.98	3	3,602.94	0%
500 megahertz	600.49	1	600.49	83.33%

Source: Telecom Advisory Services analysis

That is, under 500 megahertz alternative, speed is the variable that allows us to establish an impact relationship between Wi-Fi network overflow traffic and the mobile network of 83.33%.

C. Economic Losses by use Case

This section presents the disaggregated economic losses associated with each individual use case modeled in the study, resulting from the reallocation of the upper 700 megahertz of the 6 GHz band (6.425–7.125 GHz) to licensed use. The estimates reflect the foregone value originally enabled by the full 6 GHz band and are computed by removing the incremental benefits attributable to the upper portion, while holding constant the benefits preserved through continued use of the lower 500 megahertz (5.925–6.425 GHz). Each use case is evaluated through a case-specific model capturing throughput degradation, spectrum availability constraints, and technology adoption forecasts for Wi-Fi 6E and Wi-Fi 7. The outputs are expressed in monetary terms, distinguishing between the value that would persist and the portion that would be lost under a reallocation scenario.

C.1. Savings Incurred by Consumers by Accessing Free Wi-Fi in Public Sites

One of the key benefits of unlicensed spectrum is its role in supporting free Wi-Fi access in public venues such as libraries, parks, transit hubs, and commercial locations. In the baseline scenario where the full 1,200 megahertz of the 6 GHz band remains available for unlicensed use, the combination of Wi-Fi 6E and Wi-Fi 7 enables substantial consumer savings through high-throughput public Wi-Fi offload. These savings are calculated based on projected traffic volumes by year, technology adoption curves, and the difference in cost between mobile data and the provisioning of Wi-Fi service. The total estimated benefit under full band access reaches $4.94 billion in 2025, rising to $7.67 billion by 2027 (See Table C-1).

Table C-1. Estimated Consumer Surplus from Free Public Wi-Fi Access Under the full 6 GHz scenario (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	3,624	3,128	2,010
Wi-Fi 7 – full 6 GHz	1,316	3,105	5,660
Total – full 6 GHz	4,941	6,233	7,670

Sources: Telecom Advisory Services analysis

When the upper 700 megahertz are withdrawn and only the lower 500 megahertz subsection (5.925–6.425 GHz) remains, channelisation shrinks (seven nonoverlapping 160 megahertz channels collapse to three and every potential 320 megahertz channel disappears). The technical constraint is reflected in Table C-2: for Wi-Fi 6E the yearly surplus contracts by roughly 57% in every analysed year, mirroring the lost capacity fraction. For Wi-Fi 7 the decline is even sharper (67 %), because disabling 320 megahertz channels and MLO removes most of the generation-specific gain (See Table C-2).

Table C-2. Estimated Consumer Surplus from Free Public Wi-Fi Access in the lower 500 megahertz of the 6Hz band (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	1,553	1,340	862
Wi-Fi 7 – lower 500 megahertz only	439	1,035	1,887
Total – lower 500 megahertz only	1,992	2,376	2,748

Sources: Telecom Advisory Services analysis

Comparing the two tables makes the economic penalty transparent. Over the three-year horizon 2025-2027, the fullband configuration would yield about US$ 18.8 billion in cumulative surplus, whereas retaining only the lower portion limits the gain to US$ 7.1 billion. Consequently, the proposed reallocation removes nearly US$ 11.7 billion, over 60%, of the value that public Wi-Fi hotspots could otherwise deliver, with the shortfall rising each year as Wi-Fi 7 takes hold and the absence of wide-channel spectrum becomes ever more binding (See Table C-3).

Table C-3. Estimated loss of consumer surplus when the upper 700 megahertz are reallocated (in US$ millions) (2025–2027)

	2025	2026	2027
Wi-Fi 6E	(2,071)	(1,787)	(1,149)
Wi-Fi 7	(877)	(2,070)	(3,774)
Total	(2,949)	(3,858)	(4,922)

Sources: Telecom Advisory Services analysis

These loss estimates are intentionally conservative because they isolate only the direct value foregone in the upper 700 megahertz segment and leave several amplifying mechanisms out of scope. First, the calculations exclude any congestion feedback into the legacy 2.4 GHz and 5 GHz bands: once traffic that would have flowed over wide 6 GHz channels spills back into those bands, speeds and reliability will deteriorate and the welfare deficit will widen. Second, no account is taken of users who would abandon free Wi-Fi altogether when quality degrades, an effect that would force them either to purchase pricier cellular data (raising their opportunity cost) or to forgo connectivity (eroding consumer surplus to zero). Third, the device-mix assumptions freeze Wi-Fi 7 uptake at the median industry forecast; if, as current shipment data suggest, adoption accelerates, the share of traffic that depends on 320 megahertz channels will be larger, magnifying the loss. Taken together, these omissions mean the US$ 11.7 billion shortfall shown in Table C-3 should be regarded as a lower bound on the economic damage from reallocating the upper 6 GHz spectrum.

C.2. Free Wi-Fi service supporting the needs of the broadband unserved population

A second stream of economic value arises when free public Wi-Fi extends broadband service to households that currently lack any fixed-line or mobile subscription. Under the baseline in which the entire 1200 megahertz of the 6 GHz band remains unlicensed, the combined capabilities of Wi-Fi 6E and Wi-Fi 7 allow venue operators (libraries, community centres, parks and transit hubs) to support meaningful access for a fraction of the still-unconnected population. Traffic and adoption projections indicate that, at peak, more than 211,000 additional homes will come online in 2025 through Wi-Fi 6E alone, with Wi-Fi 7 momentum reversing the decline thereafter. Applying the established elasticity between broadband penetration and economic output, the incremental contribution to U.S. GDP reaches nearly US$ 11.8 billion in 2025 and remains above US$ 10 billion in 2027 (Table C-4).

Table C-4. Estimated GDP contribution from newly-connected households under the fullband scenario (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	9,269	7,220	4,085
Wi-Fi 7 – full 6 GHz	2,483	4,252	6,226
Total – full 6 GHz	11,752	11,472	10,311

Sources: Telecom Advisory Services analysis

If the upper 700 megahertz of the band is reallocated and only the lower 500 megahertz (5.925–6.425 GHz) remain unlicensed, hotspot capacity contracts sharply: of the seven nonoverlapping 160 megahertz channels available today, only three survive, while every potential 320 megahertz channel disappears. We apply the empirically-derived 41.82 % degradation factor (See Table C-5).

Table C-5. Estimated GDP contribution with only the lower 500 megahertz available (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	5,452	4,247	2,403
Wi-Fi 7 – lower 500 megahertz only	1,460	2,501	3,662
Total – lower 500 megahertz only	6,912	6,748	6,065

Sources: Telecom Advisory Services analysis

Across 2025-2027, retaining full access to the 6 GHz band would yield roughly US$ 33.5 billion in cumulative GDP, whereas constraining public hotspots to the lower sub-band limits the gain to US$ 19.7 billion. The regulatory change therefore eliminates almost US$ 13.8 billion of macroeconomic benefit, or more than 41% of the value this connectivity programme could deliver (See Table C-6).

Table C-6. GDP lost when the upper 700 megahertz are reallocated to licensed use (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(3,817)	(2,973)	(1,682)
Wi-Fi 7	(1,022)	(1,751)	(2,564)
Total	(4,839)	(4,724)	(4,246)

Sources: Telecom Advisory Services analysis

These figures are deliberately conservative: they measure only the direct GDP uplift forfeited by households that would otherwise receive reliable public Wi-Fi coverage over the wide 6 GHz channels. They exclude knock-on effects such as additional tax revenue, productivity gains from newly-connected workers, or congestion spillbacks into legacy 2.4 GHz and 5 GHz bands once public traffic is forced onto narrower channels (In Part II the analysis incorporates network congestion modeling to account for performance deterioration in legacy unlicensed bands). Device adoption curves for Wi-Fi 7 have also been fixed at median industry forecasts; faster uptake would lift the share of traffic requiring 320 megahertz channels and enlarge the loss further. Accordingly, the US$ 13.8 billion shortfall in Table C-6 should be viewed as a lowerbound estimate of the economic damage caused by reallocating the upper 6 GHz spectrum.

C.3. Benefit to consumers enjoying higher speed from free Wi-Fi under Wi-Fi 6E and Wi-Fi 7

Beyond simple cost-avoidance, unlicensed spectrum also increases the quality of free public connectivity: wider channels in the 6 GHz band allow access points to deliver markedly higher download speeds than those attainable over legacy 2.4 GHz and 5 GHz bands. Under the baseline, all 1200 megahertz available, average throughput in public hotspots is projected to climb from roughly 42 Mbps in 2025 to more than 100 Mbps for Wi-Fi 6E users, while Wi-Fi 7 devices reach even higher rates as 320 megahertz channels and MLO become commonplace. The willingness-to-pay curve converts these speed improvements into an annual consumer-benefit metric, multiplied by the population that relies on free Wi-Fi for primary access. The resulting surplus peaks at US$ 242 million in 2025 and remains above US$ 180 million in 2027 (Table C-7).

Table C-7. Consumer surplus from higher speed public Wi-Fi under the fullband scenario (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	163	121	66
Wi-Fi 7 – full 6 GHz	79	108	117
Total – full 6 GHz	242	228	183

Sources: Telecom Advisory Services analysis

When the upper 700 megahertz (6.425–7.125 GHz) are removed, only three non-overlapping 160 megahertz channels remain and every 320 megahertz channel disappears. Applying the empirically derived 41.18 % degradation factor, equivalent to retaining 58.82 % of the original impact, reduces the annual surplus to the values given in Table C-8.

Table C-8. Consumer surplus with only the lower 500 megahertz available (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	96	71	39
Wi-Fi 7 – lower 500 megahertz only	46	63	69
Total – lower 500 megahertz only	142	134	108

Sources: Telecom Advisory Services analysis

Across the three-year window, the fullband scenario yields about US$ 653 million in cumulative consumer surplus, whereas the constrained scenario delivers only US$ 384 million. The reallocation therefore eliminates close to US$ 269 million, roughly one quarter of the potential benefit, largely because Wi-Fi 7's performance premium cannot be realised without wide 6 GHz channels (See Table C-9).

Table C-9. Consumer surplus lost when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(67)	(50)	(27)
Wi-Fi 7	(32)	(44)	(48)
Total	(100)	(94)	(75)

Sources: Telecom Advisory Services analysis

As with the previous cases, these figures are conservative: they value only the incremental speed benefit forgone in public hotspots and ignore spillover effects such as time savings, enhanced video-streaming quality, or greater utilisation of digital government services that faster Wi-Fi would enable. Moreover, congestion externalities are again omitted, traffic displaced from now-unavailable wide channels will crowd legacy bands, further degrading user experience and widening the welfare gap (In Part II the analysis incorporates network congestion modeling to account for performance deterioration in legacy unlicensed bands). Finally, the analysis locks Wi-Fi 7 adoption at median forecasts; faster real-world uptake would increase the share of devices that depend on 320 megahertz channels and thereby inflate the losses beyond those reported in Table C-9.

C.4. Use of Wi-Fi in highly dense heterogeneous environments

Large venue deployments illustrate another dimension of consumer value: high throughput, low latency Wi-Fi in crowded settings lets spectators share video, access real-time statistics, and engage in venue apps without congesting cellular networks. Under a fullband scenario the combination of seven nonoverlapping 160 megahertz channels (Wi-Fi 6E) and three 320 megahertz channels with MLO (Wi-Fi 7) delivers markedly higher speeds than the legacy Wi-Fi experience, creating a measurable surplus relative to cellular data charges. For Wi-Fi 6E we estimate roughly 66 PB of traffic offloaded in the 2025 season alone; for Wi-Fi 7 that figure rises steeply as handset penetration accelerates. The annual benefits are summarised in Table C-10.

Table C-10. Consumer surplus from high-density venue Wi-Fi under the fullband scenario (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	130	132	94
Wi-Fi 7 – full 6 GHz	37	83	158
Total – full 6 GHz	167	215	252

Sources: Telecom Advisory Services analysis

Reallocating the upper 700 megahertz leaves only three 160 megahertz channels; we therefore apply the venue specific degradation factors: 42.86 % of the Wi-Fi 6E surplus is preserved (three of seven channels) and 33.33 % of the Wi-Fi 7 surplus survives (one of three 320 megahertz channels). The curtailed benefits appear in Table C-11.

Table C-11. Consumer surplus with only the lower 500 megahertz available (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	56	56	40
Wi-Fi 7 – lower 500 megahertz only	12	28	53
Total – lower 500 megahertz only	68	84	93

Sources: Telecom Advisory Services analysis

Over the 2025-2027 horizon, fullband operation would generate roughly US$ 634 million in cumulative surplus, whereas the constrained scenario yields about US$ 245 million. Thus, reallocation strips away almost US$ 389 million, more than 61 % of the economic value that next-generation stadium Wi-Fi could deliver (Table C-12).

Table C-12. Consumer surplus lost when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(74)	(76)	(54)
Wi-Fi 7	(25)	(56)	(105)
Total	(99)	(131)	(159)

Sources: Telecom Advisory Services analysis

These estimates remain conservative. They capture only the direct consumer savings from offloading data during events and exclude: (i) spillover productivity and media revenue gains to leagues and broadcasters enabled by richer instadium engagement; (ii) the knock-on congestion relief for surrounding macrocell sites; and (iii) faster-than-median adoption trajectories for Wi-Fi 7 radios, which are already appearing in flagship handsets. Moreover, any fallback of traffic to 2.4 GHz/5 GHz channels when wide 6 GHz capacity is absent would further erode user experience, and the associated surplus, beyond the losses quantified in Table C-12.

C.5. Consumer benefit derived from faster broadband speed

In home networks the router becomes a bottleneck whenever the subscribed fixed broadband speed exceeds what 2.4 GHz + 5 GHz Wi-Fi can deliver. With the entire 1200 megahertz of the 6 GHz band available, Wi-Fi 6E and, progressively, Wi-Fi 7 remove that choke point: median device-level throughput grows. Using the Nevo et al. Willingness-to-pay curve and applying it to the share of households that both (i) buy plans above 150 Mbps and (ii) rely on Wi-Fi indoors, the annual consumer surplus reaches US$ 15.3 billion in 2025 and exceeds US$ 21 billion by 2027 (Table C-13).

Table C-13. Consumer surplus from faster in-home Wi-Fi under the fullband scenario (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	11,609	9,970	6,136
Wi-Fi 7 – full 6 GHz	3,707	7,904	14,940
Total – full 6 GHz	15,316	17,874	21,076

Sources: Telecom Advisory Services analysis

If the upper 700 megahertz are reallocated, three of the seven 160 megahertz channels disappear and every 320 megahertz channel becomes unfeasible. Following the capacity shares used in earlier cases, we retain 42.86 % of the Wi-Fi 6E benefit and 33.33 % of the Wi-Fi 7 benefit, producing the outcomes in Table C-14.

Table C-14. Consumer surplus with only the lower 500 megahertz available (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	4,975	4,273	2,630
Wi-Fi 7 – lower 500 megahertz only	1,236	2,635	4,980
Total – lower 500 megahertz only	6,211	6,908	7,610

Sources: Telecom Advisory Services analysis

For 2025-2027 the fullband configuration would yield about US$ 54.3 billion in cumulative surplus, whereas the constrained scenario delivers just US$ 20.7 billion. The reallocation therefore removes almost US$ 33.6 billion, well over half of the potential welfare gain from eliminating the in-home Wi-Fi bottleneck (Table C-15).

Table C-15. Consumer surplus lost when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(6,634)	(5,697)	(3,506)
Wi-Fi 7	(2,471)	(5,269)	(9,960)
Total	(9,105)	(10,966)	(13,466)

Sources: Telecom Advisory Services analysis

These results remain conservative for four reasons. First, they ignore any additional slowdown in legacy 2.4 GHz/5 GHz bands when traffic displaced from wide 6 GHz channels crowds those frequencies. Second, the analysis treats Wi-Fi 7 adoption at median forecast levels; faster real-world uptake, already evident in premium handset sales, would raise the share of traffic that requires 320 megahertz channels, enlarging the loss. Finally, potential knock-on reductions in mobile-network CAPEX (because less peak demand shifts onto cellular) are not credited here, so the US$ 33.6 billion shortfall in Table C-15 should be regarded as a lowerbound estimate of the residential speed losses caused by reallocating the upper 6 GHz spectrum.

C.6. Consumer benefit generated by use of residential Wi-Fi devices and equipment

The 2024 baseline study measured the surplus that U.S. households obtain when they upgrade to Wi-Fi 6E or Wi-Fi 7 routers, mesh nodes, smart displays, cameras and other connected gear. Because willingness-to-pay data are scarce across so many device categories, the analysis proxied consumer surplus with the *producer margin* embedded in retail sales. Applying average gross-margin benchmarks to forecast shipment volumes yields an annual surplus of US $ 8.53 billion in 2025 for Wi-Fi 6E equipment, tapering to US $ 6.29 billion in 2027 as Wi-Fi 7 rapidly takes over. For Wi-Fi 7 hardware the corresponding figures climb from US $ 2.29 billion to US $ 9.58 billion as adoption rises. Aggregated across both standards, residential devices generate US $ 10.82 billion in 2025, US $ 13.32 billion in 2026 and US $ 15.86 billion in 2027 under full-band conditions (Table C-16).

Table C-16. Consumer surplus from residential Wi-Fi devices – full 6 GHz band (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	8,532	8,383	6,286
Wi-Fi 7 – full 6 GHz	2,286	4,937	9,578
Total – full 6 GHz	10,818	13,320	15,864

Sources: Telecom Advisory Services analysis

When access is restricted to only the lower 500 megahertz (5.925 – 6.425 GHz), the functionality of next-generation equipment is sharply curtailed: 60 percent of

Wi-Fi 6E's surplus and 50 percent of Wi-Fi 7's can still be realised. Applying those retention factors lowers the annual surplus to US $ 6.26 billion in 2025, US $ 7.50 billion in 2026 and US $ 8.56 billion in 2027 (Table C-17).

Table C-17. Consumer surplus from residential devices – lower-500 megahertz only (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	5,119	5,030	3,771
Wi-Fi 7 – lower 500 megahertz only	1,143	2,468	4,789
Total – lower 500 megahertz only	6,262	7,498	8,560

Sources: Telecom Advisory Services analysis

The withdrawal of the upper 700 megahertz therefore erases US $ 4.56 billion in 2025, rising to US $ 7.30 billion in 2027, and cumulates US $ 17.68 billion over the three-year window. Beyond these direct losses, the constrained-band scenario would likely slow upgrade cycles, depress retail margins and deter manufacturers from investing in Wi-Fi 7 feature-sets tailored to the U.S. market, effects *not* captured in the numerical estimates below (Table C-18).

Table C-18. Consumer surplus *lost* when the upper 700 megahertz is reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(3,413)	(3,353)	(2,515)
Wi-Fi 7	(1,143)	(2,469)	(4,789)
Total	(4,556)	(5,822)	(7,304)

Sources: Telecom Advisory Services analysis

These figures, should be viewed as a lower bound on the welfare cost because they exclude knock-on effects such as slower device-generation cycles, reduced innovation incentives for chipset vendors, and the spill-over congestion that arises when high-throughput traffic can no longer be channelled efficiently over wide 6 GHz links.

C.7. Use of Wi-Fi to increase coverage in rural and isolated areas

The 6 GHz expansion gives Wireless Internet Service Providers (WISPs) the radio headroom to reach households that lie beyond the economic limits of fibre. With standard-power equipment operating across both U-NII-5 and U-NII-7 (850 megahertz of outdoor spectrum), a single Wi-Fi 6E access point can sustain more than 110 simultaneous 20 megahertz connections, versus barely 40–50 on legacy 5 GHz links. This capacity uplift lowers per-subscriber costs, allowing WISPs to discount service prices and attract a segment of the broadband-unserved population. Applying World Bank price-elasticity evidence, we estimate that the full band regime converts an additional 2 percent of rural homes into broadband subscribers each year, lifting national penetration by 0.30–0.32 percentage points and adding points of GDP via the Katz et all. (2024) multiplier. The resulting macro-economic contribution peaks at US $ 17.36 billion in 2025 for Wi-Fi 6E and grows for Wi-Fi 7 as adoption spreads (Table C-19).

Table C-19. GDP impact from WISP-enabled rural coverage – full 6 GHz band (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	17,361	19,165	15,062
Wi-Fi 7 – full 6 GHz	640	1,503	3,090
Total – full 6 GHz	18,001	20,667	18,152

Sources: Telecom Advisory Services analysis

If the upper 700 megahertz (U-NII-7) are withdrawn, WISPs are confined to 500 megahertz of outdoor spectrum. Channel simulations show the number of served premises per site falling by 40.48 percent, which in turn slashes the price reduction they can finance and curbs incremental take-up. Consequently, only 59.52 percent of the baseline GDP benefit remains, yielding US $ 10.33 billion in 2025 for Wi-Fi 6E and US $ 381 million for early Wi-Fi 7 deployments (Table C-20).

Table C-20. GDP impact with only the lower 500 megahertz available (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	10,333	11,407	8,965
Wi-Fi 7 – lower 500 megahertz only	381	894	1,839
Total – lower 500 megahertz only	10,714	12,301	10,804

Sources: Telecom Advisory Services analysis

The reallocation would therefore forfeit US $ 7.29 billion in 2025, rising to US $ 8.37 billion in 2026 before easing to US $ 7.35 billion in 2027, for a three-year loss of US $ 22.99 billion (Table C-21). These figures exclude second-order effects such as higher infrastructure costs from forced densification, slower digital-skill acquisition in newly connected communities, or the congestion feedback into legacy 2.4/5 GHz bands, all of which would magnify the true welfare gap.

Table C-21. GDP *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(7,028)	(7,758)	(6,097)
Wi-Fi 7	(259)	(609)	(1,251)
Total	(7,287)	(8,367)	(7,348)

Sources: Telecom Advisory Services analysis

Overall, constraining rural WISPs to the lower sub-band would suppress nearly 41 percent of the GDP impact that full-band Wi-Fi could deliver to underserved regions, undermining federal connectivity goals and widening the economic divide between urban and rural America.

C.8. Savings in business Internet traffic transmitted through Wi-Fi

Corporate networks rely increasingly on Wi-Fi to off-load high-volume Internet traffic that would otherwise traverse costlier licensed-wireless links. Following the approach used in the 2024 baseline, the associated savings grow from US $ 13.8 billion to US $ 16.6 billion as total enterprise traffic expands (Table C-22). Because Wi-Fi 7 begins to penetrate corporate WLANs in parallel, it contributes an additional US $ 1.15 billion in 2025, reaching US $ 5.05 billion by 2027 as its traffic share exceeds 50 percent of Wi-Fi volume. Together, wide-channel Wi-Fi across the full 6 GHz band delivers US $ 14.95 billion in 2025, US $ 17.93 billion in 2026, and US $ 21.70 billion in 2027 in avoided network costs.

Table C-22. Enterprise traffic-offload savings – full 6 GHz band (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	13,800	15,326	16,644
Wi-Fi 7 – full 6 GHz	1,153	2,608	5,053
Total – full 6 GHz	14,953	17,934	21,697

Sources: Telecom Advisory Services analysis

Constraining enterprise WLANs to only the lower 500 megahertz removes four of the seven 160 megahertz channels available to Wi-Fi 6E and eliminates two of the three 320 megahertz channels envisaged for Wi-Fi 7, forcing firms either to revert to wired connectivity or to provision additional APs. Based on channel-capacity simulations, we conservatively assume that enterprises can retain 42.86 percent of Wi-Fi 6E off-load savings and 33.33 percent of Wi-Fi 7 savings. Under these conditions, total annual savings collapse to US $ 6.30 billion in 2025, US $ 7.44 billion in 2026, and US $ 8.82 billion in 2027 (Table C-23).

Table C-23. Enterprise savings – lower-500 megahertz only (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	5,914	6,568	7,133
Wi-Fi 7 – lower 500 megahertz only	384	869	1,684
Total – lower 500 megahertz only	6,298	7,437	8,817

Sources: Telecom Advisory Services analysis

The foregone benefit, the difference between Tables 4-22 and 4-23, amounts to US $ 8.66 billion in 2025, US $ 10.50 billion in 2026, and US $ 12.88 billion in 2027, cumulating US $ 32.04 billion over three years (Table C-24). These producer-surplus losses underscore the pivotal role of the full 6 GHz band in keeping enterprise connectivity costs in check. Absent that spectrum, businesses would face higher telecom expenditures, potentially deferring digital-transformation projects and eroding the productivity gains assumed elsewhere in this study.

Table C-24. Enterprise savings *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(7,886)	(8,758)	(9,511)
Wi-Fi 7	(769)	(1,739)	(3,369)
Total	(8,655)	(10,497)	(12,880)

Sources: Telecom Advisory Services analysis

These results highlight that Wi-Fi's contribution to enterprise cost efficiency depends critically on abundant mid-band spectrum. Removing the upper portion of the 6 GHz band would not only curtail immediate savings but also weaken the business case for next-generation WLAN upgrades, thereby dampening the broader economic benefits.

C.9. Benefits derived from an increase in average speed

The expansion of the 6 GHz band has a direct macro-economic payoff: by enabling wider channels and MLO, Wi-Fi 6E and Wi-Fi 7 raise average downstream throughput available to U.S. businesses and households. Using Ookla Speedtest-Intelligence data as the baseline, we compare national mean speeds with and without next-generation Wi-Fi and apply the 1.96 percent GDP-elasticity coefficient estimated by Katz et. all. (2024). Under full-band conditions, Wi-Fi 6E lifts mean speed from 304 Mbps to 542 Mbps in 2025, a 79 percent increase, while Wi-Fi 7 will ultimately more than double baseline speeds as 320-megahertz channels diffuse. Weighting these speed gains by each standard's share of Internet traffic yields a GDP increment of US $ 310.7 billion in 2025, rising to US $ 440.4 billion in 2027 (Table C-25).

Table C-25. GDP contribution from higher average speed – full 6 GHz band (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	231,931	193,709	115,279
Wi-Fi 7 – full 6 GHz	78,769	169,524	325,071
Total – full 6 GHz	310,700	363,233	440,351

Sources: Telecom Advisory Services analysis

If the upper 700 megahertz is withdrawn, Wi-Fi 6E must compress into three 160-megahertz channels and Wi-Fi 7 into a single 320-megahertz channel, eliminating intra-band MLO. This reduction in channelization alone lowers attainable speed gains by roughly 57 percent for Wi-Fi 6E and 67 percent for Wi-Fi 7. We therefore retain 42.86 percent of Wi-Fi 6E's GDP effect and 33.33 percent of Wi-Fi 7's. Under these assumptions, the annual GDP contribution falls to US $ 125.7 billion in 2025, US $ 139.5 billion in 2026, and US $ 157.8 billion in 2027 (Table C-26).

Table C-26. GDP contribution with only the lower 500 megahertz available (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	99,399	83,018	49,405
Wi-Fi 7 – lower 500 megahertz only	26,256	56,508	108,357
Total – lower 500 megahertz only	125,655	139,526	157,762

Sources: Telecom Advisory Services analysis

The difference between Tables C-25 and C-26 represents the GDP that would be foregone by reallocating the upper portion of the band. Losses swell from US $ 185.0 billion in 2025 to US $ 282.6 billion in 2027, cumulating US $ 691.3 billion over the three-year window (Table C-27).

Table C-27. GDP *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(132,532)	(110,691)	(65,874)
Wi-Fi 7	(52,512)	(113,016)	(216,714)
Total	(185,044)	(223,707)	(282,588)

Sources: Telecom Advisory Services analysis

These results confirm that wide-channel Wi-Fi is a major driver of macro-economic growth. Restricting the 6 GHz band would more than halve the GDP gains linked to higher broadband speed, undermining U.S. competitiveness in data-intensive industries and delaying the realisation of nationwide digital-transformation objectives.

C.10. Benefits derived from reduced latency

Low latency is indispensable for cloud collaboration, real-time gaming, video conferencing and a growing class of augmented-reality applications. When Wi-Fi 6E and Wi-Fi 7 can exploit the entire 6 GHz band, they deliver sizeable latency cuts thanks to wider channels, cleaner spectrum and MLO. Weighting those reductions by the share of household traffic that traverses each standard and applying the GDP-elasticity to latency derived in Katz et. all. (2024) produces an incremental GDP gain of US $ 214.3 billion in 2025, climbing to US $ 340.0 billion in 2027 (Table C-28).

Table C-28. GDP contribution from latency reduction – full 6 GHz band (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	160,094	158,712	116,165
Wi-Fi 7 – full 6 GHz	54,221	118,176	223,796
Total – full 6 GHz	214,315	276,888	339,961

Sources: Telecom Advisory Services analysis

When the upper 700 megahertz (U-NII-7) is withdrawn, the number of wide channels collapses and intra-band MLO disappears, curbing latency improvements that advanced Wi-Fi can deliver. Consistent with the previous use case, enterprises and households retain only 42.86 percent of the Wi-Fi 6E benefit and 33.33 percent of the Wi-Fi 7 benefit under the lower-500 megahertz-only regime. As shown in Table C-29, the GDP contribution consequently falls to US $ 86.7 billion in 2025 and merely US $ 124.4 billion in 2027, barely 37% of the full-band outcome in the final year.

Table C-29. GDP contribution from latency reduction – lower 500 megahertz only (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	68,612	68,019	49,785
Wi-Fi 7 – lower 500 megahertz only	18,074	39,392	74,599
Total – lower 500 megahertz only	86,686	107,411	124,384

Sources: Telecom Advisory Services analysis

The implied economic loss from reallocating the upper portion of the band is profound: US $ 127.6 billion in 2025, rising to US $ 215.6 billion in 2027 and cumulating US $ 512.7 billion over the three-year study window (Table C-30). Because latency improvements underpin productivity gains in tele-medicine, cloud robotics and real-time analytics, these figures understate longer-term spill-overs that would magnify the welfare deficit well beyond 2027.

Table C-30. GDP *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(91,482)	(90,693)	(66,380)
Wi-Fi 7	(36,147)	(78,784)	(149,197)
Total	(127,629)	(169,477)	(215,577)

Sources: Telecom Advisory Services analysis

In short, abundant 6 GHz spectrum translates directly into lower latency and higher economic output. Restricting Wi-Fi to the lower half of the band would wipe out more than half a trillion dollars in GDP gains during 2025-2027, blunt the effectiveness of bandwidth-hungry, delay-sensitive applications, and weaken the United States' competitive edge in the emerging real-time digital economy.

C.11. Enhanced IoT deployment

The economic value of the Internet-of-Things (IoT) ecosystem scales with the volume of sensor data that can be back-hauled inexpensively over local-area networks. With access to the entire 6 GHz band, Wi-Fi 6E already conveys more than half of all enterprise IoT traffic (52 percent in 2025), while the introduction of Wi-Fi 7 and its 320 megahertz channels accelerates the shift toward unlicensed connectivity. Applying the methodology developed in the 2024 baseline, we estimate that Wi-Fi 6E alone contributes US$ 81.3 billion in producer surplus in 2025, peaking at US$ 88.2 billion in 2026 before tapering as Wi-Fi 7 takes the lead. By 2027, Wi-Fi 7 delivers US$ 118.8 billion in incremental surplus. In aggregate, full-band Wi-Fi yields US$ 103.1 billion in 2025, US$ 140.2 billion in 2026, and US$ 196.7 billion in 2027 (Table C-31).

Table C-31. Producer surplus from enhanced IoT deployment – full 6 GHz band (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	81,286	88,226	77,927
Wi-Fi 7 – full 6 GHz	21,776	51,961	118,750
Total – full 6 GHz	103,062	140,187	196,677

Sources: Telecom Advisory Services analysis

If the upper 700 megahertz (U-NII-7/8) is reassigned, enterprises lose four of seven 160 megahertz channels and two of three 320 megahertz channels. Device simulations indicate that the resulting contention, reduced spectral efficiency and loss of MLO would allow firms to capture only 41.67 percent of the IoT surplus generated under full-band conditions, irrespective of standard. Under this lower-500 megahertz-only regime, producer surplus falls to US$ 42.9 billion in 2025, US$ 58.4 billion in 2026, and US$ 82.0 billion in 2027 (Table C-32).

Table C-32. Producer surplus from IoT deployment – lower 500 megahertz only (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	33,872	36,764	32,472
Wi-Fi 7 – lower 500 megahertz only	9,074	21,652	49,483
Total – lower 500 megahertz only	42,946	58,416	81,956

Sources: Telecom Advisory Services analysis

The withdrawal of the upper portion of the band therefore erodes US$ 60.1 billion in 2025, US$ 81.8 billion in 2026, and US$ 114.7 billion in 2027, cumulating US$ 256.6 billion over the study window (Table C-33). Beyond these direct losses, constrained channelisation would slow large-scale sensor roll-outs, raise integration costs for edge-computing vendors and delay the productivity gains associated with predictive maintenance, inventory tracking and automated logistics.

Table C-33. Producer surplus *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(47,414)	(51,462)	(45,455)
Wi-Fi 7	(12,701)	(30,909)	(69,267)
Total	(60,115)	(81,771)	(114,722)

Sources: Telecom Advisory Services analysis

These figures confirm that wide-channel 6 GHz Wi-Fi is critical to the economics of IoT. Repurposing the upper half of the band would strip away nearly 60 percent of the potential surplus from connected-device ecosystems, undermining industrial automation, smart-city deployments and the broader digital-transformation agenda.

C.12. Deployment of Augmented Reality/Virtual Reality solutions

Immersive applications, factory-floor digital twins, assisted-reality maintenance, medical simulation and multi-player gaming, require both multi-gigabit throughput and sub-20 ms glass-to-glass latency. Those conditions become commercially viable only when devices can bond 160- or 320-megahertz channels in the 6 GHz band and rely on MLO to avoid retransmissions. These improvements yields an annual GDP contribution of US$ 10.9 billion in 2025, US$ 13.0 billion in 2026 and US$ 11.5 billion in 2027 for Wi-Fi 6E devices. In parallel, Wi-Fi 7 head-mounted displays and edge servers drive an additional US$ 2.9 billion, US$ 7.7 billion and US$ 17.5 billion respectively, producing the full-band totals in Table C-34.

Table C-34. GDP contribution from AR/VR deployment – full 6 GHz band (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	10,911	13,037	11,491
Wi-Fi 7 – full 6 GHz	2,923	7,678	17,511
Total – full 6 GHz	13,834	20,715	29,002

Sources: Telecom Advisory Services analysis

If regulators reallocate the upper 700 megahertz (6.425–7.125 GHz), channel bonding shrinks to three 160 megahertz blocks for Wi-Fi 6E and a single 320 megahertz block for Wi-Fi 7, while MLO within the band disappears. Engineering analysis shows that only 42.86 percent of Wi-Fi 6E's and 33.33 percent of Wi-Fi 7's economic impact would remain. The resulting GDP contribution falls to US$ 5.7 billion in 2025, US$ 8.1 billion in 2026 and US$ 10.8 billion in 2027 (Table C-35).

Table C-35. GDP contribution – lower 500 megahertz only (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	4,676	5,587	4,925
Wi-Fi 7 – lower 500 megahertz only	974	2,559	5,837
Total – lower 500 megahertz only	5,651	8,147	10,762

Sources: Telecom Advisory Services analysis

The differential quantifies the welfare at risk: US$ 8.18 billion in 2025, US$ 12.57 billion in 2026 and US$ 18.24 billion in 2027, cumulating US$ 39.0 billion over the study horizon (Table C-36). Such losses would cascade beyond GDP metrics; constrained spectrum would slow content-developer investment, limit enterprise pilot projects and erode the United States' competitive position in the rapidly growing AR/VR ecosystem.

Table C-36. GDP *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(6,235)	(7,450)	(6,566)
Wi-Fi 7	(1,949)	(5,118)	(11,674)
Total	(8,184)	(12,568)	(18,240)

Sources: Telecom Advisory Services analysis

In sum, wide-channel 6 GHz Wi-Fi is indispensable for unlocking the immersive-computing opportunity set. Reallocation of the upper band segment would strip away more than 60 percent of the potential macro-economic gains from AR/VR deployment, delaying productivity advances in design, training and remote collaboration while ceding leadership to regions that preserve full unlicensed access.

C.13. Cellular networks CAPEX savings by off-loading traffic to Wi-Fi

Mobile operators rely on unlicensed spectrum to absorb a steadily rising share of smartphone data, thereby postponing radio-access and backhaul upgrades. With the entire 6 GHz band available, Wi-Fi 6E is expected to carry just over 8 percent of total mobile traffic in 2025-2027, translating into CAPEX savings of US$ 3.47 billion in 2025, US$ 3.48 billion in 2026, and US$ 3.53 billion in 2027. As Wi-Fi 7 handsets penetrate the market, higher PHY rates and MLO allow an additional 31 percent of the Wi-Fi 6E off-load volume to migrate, adding savings of US$ 148 million, US$ 302 million, and US$ 545 million respectively. Producer surplus from avoided investment therefore reaches US$ 3.62 billion in 2025, US$ 3.79 billion in 2026, and US$ 4.07 billion in 2027 under the full-band scenario (Table C-37).

Table C-37. CAPEX savings from mobile off-load – full 6 GHz band (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	3,469	3,484	3,527
Wi-Fi 7 – full 6 GHz	148	302	545
Total – full 6 GHz	3,617	3,786	4,072

Sources: Telecom Advisory Services analysis

If the upper 700 megahertz (U-NII-7/8) is reassigned, the capacity headroom available for indoor and hotspot traffic shrinks dramatically; only one-sixth (16.67 percent) of the off-load benefit can be retained. Applying this factor to both standards drives producer surplus down to US$ 603 million in 2025, US$ 631 million in 2026, and US$ 679 million in 2027 (Table C-38).

Table C-38. CAPEX savings – lower 500 megahertz only (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	578	581	588
Wi-Fi 7 – lower 500 megahertz only	25	50	91
Total – lower 500 megahertz only	603	631	679

Sources: Telecom Advisory Services analysis

The spectrum reallocation would therefore erase CAPEX savings of US$ 3.01 billion in 2025, US$ 3.16 billion in 2026, and US$ 3.39 billion in 2027, cumulating US$ 9.56 billion over the study period (Table C-39). Beyond these direct producer-surplus losses, reduced off-load capacity would accelerate licensed-spectrum exhaustion, hasten investment cycles for 5G/6G densification, and ultimately feed through to higher consumer prices.

Table C-39. Producer surplus *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(2,891)	(2,903)	(2,939)
Wi-Fi 7	(123)	(252)	(454)
Total	(3,014)	(3,155)	(3,393)

Sources: Telecom Advisory Services analysis

These findings underscore the complementarity between unlicensed 6 GHz spectrum and licensed-mobile networks: abundant Wi-Fi headroom delays costly RAN expansions and frees carrier capital for rural coverage and new-service roll-outs. Conversely, stripping away the upper half of the band would force operators to reinstate billions in near-term investment, a burden likely to be passed on to consumers through higher tariffs and slower network upgrades elsewhere.

C.14. Revenues of Wi-Fi based Public Internet Service Providers

Venue operators that monetise Wi-Fi access, airports, stadiums, shopping centres, convention halls, derive revenue from advertising, data analytics and premium connections sold to users who require guaranteed throughput. When the entire 6 GHz band is open, capacity gains allow each hotspot to support 40 percent more connected devices while sustaining speeds. For Wi-Fi 6E, this translates into a 21 - 13 percent uplift in paying clients between 2025 and 2027. Coupled with traffic shares that start at 52 percent of public-venue flows, hotspot revenues reach US$ 99 million in 2025, declining as Wi-Fi 7 progressively replaces 6E in premium tiers. Wi-Fi 7 adds a further US$ 37 million in the first year, rising to US$ 95 million by 2027, as its 320 megahertz channels and MLO drive higher revenues (Table C-40).

Table C-40. GDP contribution from public-venue Wi-Fi – full 6 GHz band (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	99	79	46
Wi-Fi 7 – full 6 GHz	37	64	95
Total – full 6 GHz	136	143	141

Sources: Telecom Advisory Services analysis

Reallocating the upper 700 megahertz compresses wide-channel availability to three 160 megahertz blocks and removes the intra-band MLO advantage, forcing public Wi-Fi operators to throttle concurrent sessions or accept lower quality-of-service. Considering that, only 58.82 percent of the full-band economic value can be retained across both standards. The GDP contribution therefore drops to US$ 80 million in 2025, US$ 84 million in 2026, and US$ 83 million in 2027 (Table C-41).

Table C-41. GDP contribution – lower 500 megahertz only (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	58	46	27
Wi-Fi 7 – lower 500 megahertz only	22	38	56
Total – lower 500 megahertz only	80	84	83

Sources: Telecom Advisory Services analysis

The implied loss, US$ 56 million in 2025, US$ 59 million in 2026, and US$ 58 million in 2027, is summarised in Table C-42. While modest relative to other use cases, these figures understate the strategic role of venue Wi-Fi in supporting digital advertising, footfall analytics and omnichannel retail experiences. Spectrum constraints would limit innovation in those revenue streams and shift investment toward alternative, less consumer-friendly monetisation models.

Table C-42. GDP *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(41)	(33)	(19)
Wi-Fi 7	(15)	(26)	(39)
Total	(56)	(59)	(58)

Sources: Telecom Advisory Services analysis

C.15. Revenues of Wi-Fi based Wireless Internet Service Providers

WISPs monetize the extra capacity of the 6 GHz band by onboarding households that were previously out-of-reach for 2.4/5 GHz links or licensed-spectrum fixed-wireless. When the entire band is available, a standard-power Wi-Fi 6E access point can serve roughly 40 percent more subscribers per tower, allowing operators to attract 400 000 new customers in 2025 alone. That translates into US$ 433 million of additional turnover in the first year, rising to US$ 466 million in 2026 before tapering as Wi-Fi 7 devices assume the performance premium. Early Wi-Fi 7 CPE adopts the same tariff levels but initially adds just 10–70 thousand incremental subscribers, contributing a further US$ 16–73 million in revenue (Table C-43).

Table C-43. Incremental WISP revenue – full 6 GHz band (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	433	466	357
Wi-Fi 7 – full 6 GHz	16	37	73
Total – full 6 GHz	449	503	431

Sources: Telecom Advisory Services analysis

If the upper 700 megahertz is reallocated, WISPs must re-engineer footprints around three 160 megahertz channels. Channel simulations indicate that only 59.52 percent of the incremental revenue can be preserved. Under this constraint, turnover falls to US$ 268 million in 2025, US$ 299 million in 2026, and US$ 256 million in 2027 (Table C-44).

Table C-44. Incremental WISP revenue – lower 500 megahertz only (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	258	277	213
Wi-Fi 7 – lower 500 megahertz only	10	22	44
Total – lower 500 megahertz only	268	299	256

Sources: Telecom Advisory Services analysis

Reallocation would therefore strip WISPs of US$ 182 million in 2025, US$ 204 million in 2026, and US$ 174 million in 2027, a cumulative US$ 560 million hit to broadband revenues (Table C-45). While modest relative to national GDP, these funds underpin local employment, equipment purchases from U.S. vendors, and ongoing network maintenance in hard-to-serve areas. Any dent in WISP cash-flow risks slowing the expansion of affordable broadband at the very edge of existing coverage footprints.

Table C-45. Incremental WISP revenue *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(175)	(189)	(144)
Wi-Fi 7	(6)	(15)	(30)
Total	(182)	(204)	(174)

Sources: Telecom Advisory Services analysis

Overall, preserving the full 6 GHz band sustains a virtuous cycle in which higher spectral efficiency enables WISPs to extend service, boost revenues and reinvest in further build-outs, an outcome that aligns with federal goals to close the rural digital divide.

C.16. Manufacturing of Wi-Fi devices and equipment for residential use

The producer surplus generated by U.S. manufacturers of consumer Wi-Fi equipment depends on global shipment volumes, the domestic adoption mix, and the gross-margin spread between advanced and legacy devices. Assuming 2025 adoption shares of 52 % for Wi-Fi 6E and 14 % for Wi-Fi 7, the incremental gross margin captured by domestic vendors amounts to US$ 8.0 billion for Wi-Fi 6E devices and US$ 2.1 billion for early Wi-Fi 7 devices. As Wi-Fi 7 adoption surpasses

50 percent of the advanced-device cohort in 2027, its contribution to producer surplus rises to US$ 9.0 billion, while the Wi-Fi 6E margin tapers with the product cycle (See Table C-46).

Table C-46. Producer surplus from residential-device manufacturing – full 6 GHz band (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	8,014	7,874	5,904
Wi-Fi 7 – full 6 GHz	2,147	4,637	8,997
Total – full 6 GHz	10,161	12,511	14,901

Sources: Telecom Advisory Services analysis

Limiting unlicensed use to the lower 500 megahertz of the band removes four of the seven 160 megahertz channels that underpin Wi-Fi 6E performance and two of the three 320 Megahertz channels envisaged for Wi-Fi 7, thereby compressing the price-performance premium and sales. Then, we assume producers can retain 60 percent of Wi-Fi 6E surplus and 50 percent of Wi-Fi 7 surplus under the constrained scenario. Producer surplus consequently falls to US$ 5.9 billion in 2025 and only US$ 8.0 billion in 2027 (Table C-47).

Table C-47. Producer surplus – lower-500 megahertz only (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	4,808	4,724	3,542
Wi-Fi 7 – lower 500 megahertz only	1,073	2,319	4,499
Total – lower 500 megahertz only	5,882	7,043	8,041

Sources: Telecom Advisory Services analysis

The forgone margin, the gap between Tables C-46 and C-47—amounts to US$ 4.28 billion in 2025, US$ 5.47 billion in 2026, and US$ 6.86 billion in 2027, cumulating US$ 16.61 billion over three years (Table C-48). Beyond these direct producer-surplus losses, spectrum scarcity would likely divert future assembly lines to regions that preserve full 6 GHz access, hampering U.S. employment growth in consumer-electronics manufacturing and weakening the domestic component supply chain.

Table C-48. Producer surplus lost when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(3,206)	(3,150)	(2,362)
Wi-Fi 7	(1,073)	(2,318)	(4,498)
Total	(4,279)	(5,468)	(6,860)

Sources: Telecom Advisory Services analysis

In summary, maintaining the full 6 GHz band sustains a robust domestic manufacturing ecosystem capable of capturing nearly US$ 15 billion per year in surplus by 2027. Reallocating the upper portion of the band would cut those gains almost in half, jeopardising high-value jobs and eroding the United States' competitive edge in next-generation consumer networking hardware.

C.17. Manufacturing of enterprise Wi-Fi devices and equipment

As warehouses, factories and office campuses migrate to high-throughput, low-latency wireless LANs, demand for cutting-edge access points, industrial gateways and controller hardware expands rapidly. Under full-band conditions, global shipments of enterprise-class Wi-Fi devices fitted with 6 GHz radios grows. After weighting these volumes by the U.S. uptake mix domestic manufacturers capture an incremental gross margin of US$ 2.89 billion from Wi-Fi 6E equipment and US$ 0.77 billion from early Wi-Fi 7 gear. As Wi-Fi 7 adoption rises by 2027, its annual surplus jumps to US$ 2.94 billion, while the Wi-Fi 6E margin tapers with the product cycle (Table C-49).

Table C-49. Producer surplus from enterprise-device manufacturing – full 6 GHz band (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	2,885	2,731	1,927
Wi-Fi 7 – full 6 GHz	773	1,609	2,937
Total – full 6 GHz	3,658	4,340	4,864

Sources: Telecom Advisory Services analysis

If the upper 700 megahertz is reassigned for licensed use, enterprise APs must squeeze into three 160 megahertz channels (Wi-Fi 6E) or a single 320 megahertz channel (Wi-Fi 7), eroding their performance premium. We assume manufacturers retain only 60 percent of Wi-Fi 6E surplus and 50 percent of Wi-Fi 7 surplus. Producer surplus therefore falls to US$ 1.73 billion in 2025 for Wi-Fi 6E and US$ 0.39 billion for Wi-Fi 7, yielding the lower-band totals in Table C-50.

Table C-50. Producer surplus – lower-500 megahertz only (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	1,731	1,639	1,156
Wi-Fi 7 – lower 500 megahertz only	386	804	1,468
Total – lower 500 megahertz only	2,117	2,443	2,625

Sources: Telecom Advisory Services analysis

The reallocation would thus strip equipment makers of US$ 1.54 billion in 2025, US$ 1.90 billion in 2026, and US$ 2.24 billion in 2027, cumulating US$ 5.68 billion during the study window (Table C-51). Beyond this direct margin loss, spectrum scarcity would likely shift future production lines to jurisdictions that preserve full 6 GHz access, undermining domestic employment in high-value electronics assembly and weakening the United States' industrial IoT supply chain.

Table C-51. Producer surplus *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(1,154)	(1,092)	(771)
Wi-Fi 7	(387)	(805)	(1,468)
Total	(1,541)	(1,897)	(2,239)

Sources: Telecom Advisory Services analysis

In short, keeping the full 6 GHz band unlicensed sustains a producer-surplus stream that approaches US$ 5 billion annually by 2027. Reallocation of the upper portion would wipe out nearly half of those gains and jeopardise the domestic foothold in next-generation enterprise networking hardware.

C.18. Benefits of firms in the IoT ecosystem

Chipmakers, sensor manufacturers, edge-platform vendors and systems integrators all capture incremental sales when enterprises adopt Wi-Fi 6E/7 to connect machines, smart-meters and environmental sensors at gigabit speeds and low latency. IoT modules yields an additional US$ 29.1 billion in producer surplus for Wi-Fi 6E suppliers in 2025, complemented by US$ 7.8 billion for Wi-Fi 7 suppliers. As Table C-52 shows, aggregate surplus reaches US$ 36.9 billion in 2025, climbs to US$ 45.7 billion in 2026 and tops US$ 52.0 billion in 2027 when Wi-Fi 7 becomes the dominant standard.

Table C-52. Producer surplus for IoT-ecosystem firms – full 6 GHz band (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	29,102	28,783	20,617
Wi-Fi 7 – full 6 GHz	7,796	16,952	31,417
Total – full 6 GHz	36,898	45,735	52,034

Sources: Telecom Advisory Services analysis

If only the lower 500 megahertz remains unlicensed, channel scarcity and the loss of intra-band MLO compress performance premiums, cutting margins throughout the IoT supply chain. Firms retain 60 percent of Wi-Fi 6E surplus and 50 percent of Wi-Fi 7 surplus. Producer surplus therefore falls to US$ 21.4 billion in 2025, US$ 25.7 billion in 2026 and US$ 28.1 billion in 2027 (Table C-53).

Table C-53. Producer surplus – lower 500 megahertz only (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	17,461	17,270	12,370
Wi-Fi 7 – lower 500 megahertz only	3,898	8,476	15,708
Total – lower 500 megahertz only	21,359	25,746	28,078

Sources: Telecom Advisory Services analysis

The reallocation would thus wipe out US$ 15.5 billion in 2025, US$ 20.0 billion in 2026 and US$ 24.0 billion in 2027, for a three-year loss exceeding US$ 59 billion (Table C-54). Beyond the direct margin hit, spectrum constraints would likely reroute future fabrication lines and firmware R&D to jurisdictions that preserve full 6 GHz access, diluting the United States' leadership in industrial IoT platforms.

Table C-54. Producer surplus *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(11,641)	(11,513)	(8,247)
Wi-Fi 7	(3,898)	(8,476)	(15,709)
Total	(15,539)	(19,989)	(23,956)

Sources: Telecom Advisory Services analysis

In effect, preserving full-band unlicensed access secures a multi-billion-dollar surplus for U.S. firms building the hardware and software backbone of Industry 4.0. Removing the upper 6 GHz slice would slash that opportunity, slowing digital-factory adoption and ceding competitive ground to regions with more spectrum-friendly regimes.

C.19. Benefits of firms in the AR/VR ecosystem

A vibrant domestic ecosystem of silicon vendors, headset manufacturers, optics suppliers and immersive-content studios stands to profit from the transition to high-bandwidth Wi-Fi in the 6 GHz band. Applying the gross-margin uplift observed in recent AR/VR product teardowns, we estimate an incremental producer surplus of US$ 5.78 billion in 2025 for Wi-Fi 6E suppliers, rising to US$ 6.91 billion in 2026 before tapering to US$ 6.21 billion as Wi-Fi 7 takes the performance lead. Concurrently, Wi-Fi 7 hardware generates US$ 1.55 billion in surplus during its launch year and US$ 9.46 billion by 2027. Aggregate benefits therefore reach US$ 7.32 billion in 2025, US$ 10.98 billion in 2026 and US$ 15.67 billion in 2027 (Table C-55).

Table C-55. Producer surplus for AR/VR-ecosystem firms – full 6 GHz band (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E – full 6 GHz	5,775	6,910	6,210
Wi-Fi 7 – full 6 GHz	1,547	4,070	9,463
Total – full 6 GHz	7,322	10,980	15,673

Sources: Telecom Advisory Services analysis

If the upper 700 megahertz is reassigned, headset makers lose four of the seven 160 megahertz channels (Wi-Fi 6E) and two of the three 320 megahertz channels (Wi-Fi 7) they rely on to deliver high-frame-rate, low-latency streaming. Industry interviews indicate that such constraints would trim hardware gross margins by about 40 percent for Wi-Fi 6E models and 50 percent for Wi-Fi 7 models, leaving only 60 percent and 50 percent respectively of the baseline surplus. Under these assumptions, producer surplus falls to US$ 4.24 billion in 2025, US$ 6.18 billion in 2026 and US$ 8.46 billion in 2027 (Table C-56).

Table C-56. Producer surplus – lower-500 megahertz **only (2025–2027) (in US$ millions)**

	2025	2026	2027
Wi-Fi 6E – lower 500 megahertz only	3,465	4,146	3,726
Wi-Fi 7 – lower 500 megahertz only	774	2,035	4,732
Total – lower 500 megahertz only	4,239	6,181	8,458

Sources: Telecom Advisory Services analysis

The withdrawal of the upper band segment would therefore erase US$ 3.08 billion in 2025, US$ 4.80 billion in 2026 and US$ 7.21 billion in 2027, cumulating US$ 15.1 billion over three years (Table C-57). Beyond these direct margin losses, constrained spectrum would slow the rollout of untethered, high-resolution headsets, curbing demand for domestic optical-component fabrication and immersive-content production.

Table C-57. Producer surplus *lost* when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

	2025	2026	2027
Wi-Fi 6E	(2,310)	(2,764)	(2,484)
Wi-Fi 7	(773)	(2,035)	(4,731)
Total	(3,083)	(4,799)	(7,215)

Sources: Telecom Advisory Services analysis

In effect, full-band unlicensed access positions U.S. firms to capture a burgeoning AR/VR market that could generate more than US$ 15 billion in annual surplus by 2027. Reallocating the upper half of the band would slash that opportunity by nearly half, undermining domestic leadership in an industry projected to drive the next wave of experiential computing.

D. Aggregate economic impact in the 6 GHz band: Calculation methodology and data inputs

Table D-1. United States: Economic value of Wi-Fi under the full band scenario (2025–2027) (in US$ millions)

Sources	Effects	Type	2025	2026	2027
1. Free Wi-Fi	1.1. Savings incurred by consumers by accessing free Wi-Fi in public sites	Consumer Benefit	4,941	6,233	7,670
	1.2. Free Wi-Fi service supporting the needs of the broadband unserved population	GDP Contribution	11,751	11,473	10,311
	1.3. Benefit to consumers enjoying higher speed from free Wi-Fi under 6 GHz	Consumer Benefit	242	228	183
	1.5. Use of Wi-Fi in highly dense heterogeneous environments	Consumer Benefit	167	215	252
2. Residential Wi-Fi	2.3. Consumer benefit derived from faster broadband speed	Consumer Benefit	15,316	17,874	21,076
	2.4. Consumer benefit generated by use of residential Wi-Fi devices and equipment	Consumer Benefit	10,817	13,319	15,864
	2.5. Bridging the digital divide: use of Wi-Fi to increase coverage in rural and isolated areas	GDP Contribution	18,001	20,667	18,152
3. Enterprise Wi-Fi	3.1. Savings in business Internet traffic transmitted through Wi-Fi	Producer Surplus	14,954	17,934	21,697
	3.3. Benefits derived from an increase in average speed	GDP Contribution	310,700	363,233	440,351
	3.4. Benefits derived from reduced latency	GDP Contribution	214,315	276,887	339,961
	3.5. Enhanced IoT deployment	GDP Contribution	103,061	140,187	196,678
	3.6. Deployment of Augmented Reality/Virtual Reality solutions	GDP Contribution	13,834	20,715	29,002
4. ISPs	4.1. Cellular networks CAPEX savings by off-loading traffic to Wi-Fi	Producer Surplus	3,617	3,786	4,072
	4.2. Revenues of Wi-Fi based Public Internet Service Providers	GDP Contribution	136	143	141
	4.3. Revenues of Wi-Fi based Wireless Internet service Providers	GDP Contribution	449	503	431
5. Wi-Fi ecosystem	5.1. Manufacturing of Wi-Fi devices and equipment for residential use	Producer Surplus	10,161	12,511	14,901
	5.2. Manufacturing of enterprise Wi-Fi devices and equipment	Producer Surplus	3,658	4,340	4,864
	5.3. Benefits of Firms in the IoT ecosystem	Producer Surplus	36,899	45,735	52,033
	5.4. Benefits of firms in the AR/VR ecosystem	Producer Surplus	7,322	10,980	15,674
TOTAL			780,341	966,964	1,193,313

Sources: Katz et al. (2024). *Assessing the economic value of Wi-Fi in the United States*. Washington, DC: WiFiForward (September). Retrieved in: https://wififorward.org/wp-content/uploads/2024/09/Assessing-the-Economic-Value-of-Wi-Fi.pdf

Table D-2. United States: Economic value of Wi-Fi with only the lower 500 megahertz available (2025–2027) (in US$ millions)

Sources	Effects	Type	2025	2026	2027
1. Free Wi-Fi	1.1. Savings incurred by consumers by accessing free Wi-Fi in public sites	Consumer Benefit	$ 1,992	$ 2,376	$ 2,748
	1.2. Free Wi-Fi service supporting the needs of the broadband unserved population	GDP Contribution	$ 6,912	$ 6,748	$ 6,065
	1.3. Benefit to consumers enjoying higher speed from free Wi-Fi under 6 GHz	Consumer Benefit	$ 142	$ 134	$ 108
	1.5. Use of Wi-Fi in highly dense heterogeneous environments	Consumer Benefit	$ 68	$ 84	$ 93
2. Residential Wi-Fi	2.3. Consumer benefit derived from faster broadband speed	Consumer Benefit	$ 6,211	$ 6,908	$ 7,610
	2.4. Consumer benefit generated by use of residential Wi-Fi devices and equipment	Consumer Benefit	$ 6,262	$ 7,498	$ 8,560
	2.5. Bridging the digital divide: use of Wi-Fi to increase coverage in rural and isolated areas	GDP Contribution	$ 10,714	$ 12,301	$ 10,804
3. Enterprise Wi-Fi	3.1. Savings in business Internet traffic transmitted through Wi-Fi	Producer Surplus	$ 6,299	$ 7,438	$ 8,818
	3.3. Benefits derived from an increase in average speed	GDP Contribution	$ 125,655	$ 139,526	$ 157,762
	3.4. Benefits derived from reduced latency	GDP Contribution	$ 86,685	$ 107,411	$ 124,384
	3.5. Enhanced IoT deployment	GDP Contribution	$ 42,946	$ 58,416	$ 81,956
	3.6. Deployment of Augmented Reality/Virtual Reality solutions	GDP Contribution	$ 5,651	$ 8,147	$ 10,762
4. ISPs	4.1. Cellular networks CAPEX savings by off-loading traffic to Wi-Fi	Producer Surplus	$ 603	$ 631	$ 679
	4.2. Revenues of Wi-Fi based Public Internet Service Providers	GDP Contribution	$ 80	$ 84	$ 83
	4.3. Revenues of Wi-Fi based Wireless Internet service Providers	GDP Contribution	$ 267	$ 299	$ 256
5. Wi-Fi ecosystem	5.1. Manufacturing of Wi-Fi devices and equipment for residential use	Producer Surplus	$ 5,882	$ 7,043	$ 8,041
	5.2. Manufacturing of enterprise Wi-Fi devices and equipment	Producer Surplus	$ 2,117	$ 2,443	$ 2,625
	5.3. Benefits of Firms in the IoT ecosystem	Producer Surplus	$ 21,360	$ 25,746	$ 28,078
	5.4. Benefits of firms in the AR/VR ecosystem	Producer Surplus	$ 4,239	$ 6,181	$ 8,458
TOTAL			334,085	$ 334,085	$ 399,414

Sources: Telecom Advisory Services analysis

Table D-3. United States: Economic value lost when the upper 700 megahertz are reallocated (2025–2027) (in US$ millions)

Sources	Effects	Type	2025	2026	2027
1. Free Wi-Fi	1.1. Savings incurred by consumers by accessing free Wi-Fi in public sites	Consumer Benefit	($2,949)	($3,858)	($4,922)
	1.2. Free Wi-Fi service supporting the needs of the broadband unserved population	GDP Contribution	($4,839)	($4,724)	($4,246)
	1.3. Benefit to consumers enjoying higher speed from free Wi-Fi under 6 GHz	Consumer Benefit	($100)	($94)	($75)
	1.5. Use of Wi-Fi in highly dense heterogeneous environments	Consumer Benefit	($99)	($131)	($159)
2. Residential Wi-Fi	2.3. Consumer benefit derived from faster broadband speed	Consumer Benefit	($9,105)	($10,966)	($13,466)
	2.4. Consumer benefit generated by use of residential Wi-Fi devices and equipment	Consumer Benefit	($4,555)	($5,821)	($7,303)
	2.5. Bridging the digital divide: use of Wi-Fi to increase coverage in rural and isolated areas	GDP Contribution	($7,287)	($8,366)	($7,348)
3. Enterprise Wi-Fi	3.1. Savings in business Internet traffic transmitted through Wi-Fi	Producer Surplus	($8,655)	($10,496)	($12,880)
	3.3. Benefits derived from an increase in average speed	GDP Contribution	($185,044)	($223,707)	($282,588)
	3.4. Benefits derived from reduced latency	GDP Contribution	($127,630)	($169,476)	($215,577)
	3.5. Enhanced IoT deployment	GDP Contribution	($60,116)	($81,771)	($114,722)
	3.6. Deployment of Augmented Reality/Virtual Reality solutions	GDP Contribution	($8,184)	($12,568)	($18,240)
4. ISPs	4.1. Cellular networks CAPEX savings by off-loading traffic to Wi-Fi	Producer Surplus	($3,014)	($3,155)	($3,393)
	4.2. Revenues of Wi-Fi based Public Internet Service Providers	GDP Contribution	($56)	($59)	($58)
	4.3. Revenues of Wi-Fi based Wireless Internet service Providers	GDP Contribution	($182)	($204)	($174)
5. Wi-Fi ecosystem	5.1. Manufacturing of Wi-Fi devices and equipment for residential use	Producer Surplus	($4,279)	($5,468)	($6,860)
	5.2. Manufacturing of enterprise Wi-Fi devices and equipment	Producer Surplus	($1,540)	($1,897)	($2,239)
	5.3. Benefits of Firms in the IoT ecosystem	Producer Surplus	($15,539)	($19,989)	($23,955)
	5.4. Benefits of firms in the AR/VR ecosystem	Producer Surplus	($3,084)	($4,799)	($7,216)
TOTAL			($ 446,256)	($567,550)	($725,424)

Sources: Telecom Advisory Services analysis

E. Technical analysis of the saturation of the 2.4 GHz and 5GHz bands due to the restriction of the upper part of the 6GHz band for unlicensed spectrum

This analysis identifies and classifies five specific cases in which the reduction of usable spectrum in the 6 GHz band (from 1200 megahertz to only 500 megahertz) generates a technical and economic impact on the 2.4 GHz and 5 GHz bands, due to traffic overflow and channel capacity. The cases are grouped according to their application: (i) Access through public Wi-Fi networks ("Free WiFi"), (ii) Provision of internet in rural areas through wireless operators ("WISP"), (iii) Deployment of devices from the IoT ecosystem, (iv) Impacts on the general latency of the network, and (v) Business traffic supported by Wi-Fi. For each case, a technical analysis is presented, accompanied by calculations linking the effect of spectrum restriction with the economic impact of the lower bands.

The results show that the saturation generated by the loss of 700 megahertz in the upper part of the 6 GHz band is proportionally redistributed between the remaining 500 megahertz of that band and the 2.4 GHz and 5 GHz bands. The resulting saturation levels vary between 18.18% and 21.01% for the 2.4 GHz and 5 GHz bands, depending on the argument analyzed.

E.1. Free WiFi

The original 2024 study identifies that the savings for consumers by accessing free Wi-Fi in public places come from the extensive use of these networks, particularly in high-traffic spaces such as coffee shops, libraries or transport terminals. In these environments, the 5 GHz band is preferred for offering higher capacity and less congestion than the 2.4 GHz band, which is limited to only 60 megahertz. However, the reduction of the spectrum available in 6 GHz from 1200 to 500 megahertz implies an upward pressure on the lower channels. The 700 megahertz restriction generates a redistributed saturation that reaches 36.36% of the available bandwidth (see Table E-1), of which 18.18% directly impacts the 5 GHz band (see Equation E-1). In this scenario, the 5 GHz band, which represents 50% of the total available in the unlicensed band environment (500 megahertz on 5 GHz and 500 megahertz on 6 GHz), absorbs half of the traffic displaced from the restricted band. This concentration of demand increases the probability of interference in access to the medium, degrading the quality and speed of free Wi-Fi. Therefore, the predominant use of the 5 GHz band is justified both by capacity and by operational necessity in the face of the higher spectrum restriction.

Table E-1. Calculating the 5 GHz bandwidth ratio in 6 GHz reduced band scenario for Free Wi-Fi

	2.4 GHz (60 megahertz)	5 GHz (500 megahertz)	6 GHz (500 megahertz)	6 GHz (700 megahertz)	Available Bandwidth (megahertz)	5GHz Ratio
Full Band (BC)	60	500	500	700	1,760	31.82%
Reduced Band (BR)		500	500		1,000	50%
					Total saturation	**36.36%**

Sources: Telecom Advisory Services analysis

$$Saturation_{total} = \frac{Share_{BC} - Share_{BR}}{Share_{BR}} = \frac{31.82 - 50}{50} = 36.36\%$$

$$Saturation_{5GHz} = Saturation_{total} * Share_{5GHz-BR} = 36.36 * 50 = 18.18\% \; (Eq. A - 1)$$

E.2. WISPs (Wireless Internet Service Providers)

The initial report highlights that one of the sources of economic value of Wi-Fi lies in its ability to serve underserved populations through wireless networks of WISP operators, especially in rural and isolated areas. In these environments, point-to-point (P-P) and point-to-multipoint (P-MP) links frequently operate over unlicensed 2.4 GHz and 5 GHz bands, due to their greater range and flexibility in the face of licensed spectrum limitations. However, the reduction of the available spectrum in 6 GHz (from 1200 to 500 megahertz) generates additional pressure towards the use of these lower bands, raising the proportion of use from 31.82% to 52.83%, which implies a saturation of 39.77% of the available channel (see Table E-2).

Table E-2. Calculation of the 2.4 GHz and 5 GHz bandwidth ratio in 6 GHz reduced band scenario for access via WISP

	2.4 GHz (60 megahertz)	5 GHz (500 megahertz)	6 GHz (500 megahertz)	6 GHz (700 megahertz)	Available Bandwidth (megahertz)	Ratio 2.4-5GHz
Full Band (BC)	60	500	500	700	1,760	31.82%
Reduced Band (BR)	60	500	500	[redacted]	1,060	52.83%
					Total saturation	**39.77%**

Sources: Telecom Advisory Services analysis

In the reduced band scenario, the 2.4 GHz and 5 GHz bands account for 52.83% of the total available in the unlicensed band environment (560 megahertz in 2.4-5 GHz and 500 megahertz in 6 GHz), absorbing most of the displaced traffic in the upper 6 GHz band. In that sense, 21.01% of the channels used in the 5 GHz band will be directly impacted (see Equation E-2).

This forced displacement of traffic causes increased congestion and interference, especially in rural areas where access is already limited due to obstruction or orographic-related interference. This type of deployment has been essential to close connectivity gaps and facilitate essential services; therefore, the impact of the 700 megahertz restriction on 6 GHz directly affects the technical and economic sustainability of WISPs; as well as, it limits its contribution to closing the digital divide.

$$Saturation_{total} = \frac{Share_{BC} - Share_{BR}}{Share_{BR}} = \frac{31.82 - 52.83}{52.83} = 39.77\%$$

$$Saturation_{2.4-5GHz} = Saturation_{total} * Share_{2.4-5GHz-BR} = 39.77 * 52.83 = 21.01\% \; (Eq. A - 2)$$

E.3. IoT devices

The deployment of IoT devices has historically been supported by the 2.4 GHz bands; and, to a lesser extent, by the 5 GHz band, due to its extended range and compatibility with low-power devices. The original report highlights that the economic value generated by the IoT ecosystem is linked to its mass adoption in homes and industrial environments. However, for the latter application, the 6 GHz band, enabled with Wi-Fi 6E and Wi-Fi 7, is designed to support high densities of low-latency and high-speed devices. In the current scenario, with a restriction of 700 megahertz of the 6 GHz band (from 1200 to only 500 megahertz), there is an overflow of traffic and potential connections to the lower bands. This generates a channel saturation equivalent to 39.77% (see Table E-3), of which 21.01% directly affects the 2.4 GHz and 5 GHz bands (see Equation E3). This overflow compromises the stability of IoT connections, which require free channels and low interference to operate reliably. Therefore, the pressure on the spectrum available in lower bands reduces the efficiency of IoT deployment, affecting the scalability of the ecosystem and limiting the expected economic impact.

Table E-3. Calculation of the 2.4 and 5 GHz bandwidth ratio in 6GHz reduced band scenario for access via IoT devices

	2.4 GHz (60 megahertz)	5 GHz (500 megahertz)	6 GHz (500 megahertz)	6 GHz (700 megahertz)	Available Bandwidth (megahertz)	Ratio 2.4-5GHz
Full Band (BC)	60	500	500	700	1,760	31.82%
Reduced Band (BR)	60	500	500		1,060	52.83%
					Total saturation	**39.77%**

Sources: Telecom Advisory Services analysis

$$Saturation_{total} = \frac{Share_{BC} - Share_{BR}}{Share_{BR}} = \frac{31.82 - 52.83}{52.83} = 39.77\%$$

$$Saturation_{2.4-5GHz} = Saturation_{total} * Share_{2.4-5GHz-BR} = 39.77 * 52.83 = 21.01\% \ (Eq. E-3)$$

E.4. Latency

Latency reduction is one of the key benefits that Wi-Fi 6E and Wi-Fi 7 seek to optimize, especially through the efficient use of spectrum in the 6 GHz band. This band allows operating with 160 megahertz and 320 megahertz channels; as well as using Multiple Resource Units (MRUs), which increases speed and reduces delay in data transmission. However, the 700 megahertz restriction of the 1200 megahertz originally allocated in the 6 GHz band reduces the total number of available channels, generating a direct impact on the aggregate transmission rate.

This impact translates into a redistribution of traffic to the lower bands (2.4 GHz and 5 GHz) and the remaining 500 megahertz of the lower part of the 6 GHz band, which increases the saturation of the channel; and, consequently, latency. Thus, the total speed achievable in a complete scenario (1760 megahertz available) would be 12,306 Mbps; while, with the restriction (1060 megahertz available), it is reduced to 7,502 Mbps (see Table E-4). This change implies a speed saturation of 20.29% (see Equation E-4) for the 2.4 and 5 GHz bands.

Table E-4. Calculation of the 2.4 and 5 GHz bandwidth ratio in 6GHz reduced band scenario for latency impact

	2.4 GHz (60 megahertz)	5 GHz (500 megahertz)	6 GHz (500 megahertz)	6 GHz (700 megahertz)	Total	Ratio 2.4-5GHz
Channeling (AB)	40	80	160	160	-	-
Resource Units (UR)	484	960	1960	1960	-	-
Speed (Mbps)	296.57	600.49	1200.98	1200.98	-	-
Total Channels	1	6	3	4	14	-
Usable AB (meghaertz)	40	480	480	640	1640	-
Full Band Speed (Mbps)	296.57	3,602.94	3,602.94	4,803.92	12,306.92	31.69%
Reduced Band Speed (Mbps)	296.57	3,602.94	3,602.94	[redacted]	7,502.45	51.98%
					Total saturation	**39.04%**

Sources: Telecom Advisory Services analysis

$$Saturation_{total} = \frac{Share_{BC} - Share_{BR}}{Share_{BR}} = \frac{31.69 - 51.98}{51.98} = 39.04\%$$

$$Saturation_{2.4-5GHz} = Saturation_{total} * Share_{2.4-5GHz-BR} = 39.04 * 51.98 = 20.29\% \ (Eq. E-4)$$

Since latency is correlated with channel capacity and packet processing speed, this decrease in effective bandwidth and increased congestion result in an increase in network response time. This compromises the benefits derived from low latency, especially for critical applications such as video calls, online gaming, industrial environments, among others.

The calculation that links the loss of capacity with a latency saturation factor of 20.29% is technically valid and also conservative, taking into account that latency in Wi-Fi depends almost linearly on the occupancy of the channel. That is, with Wi-Fi 5, latency on typical home networks is around 30 ms; whereas, the same load on Wi-Fi 6 could drop to 20ms thanks to features like OFDMA and BSS Coloring. On the other hand, when the channel is kept below 50% usage and 160 megahertz channels are used, Wi-Fi 6E registers 4-5 ms of latency; and, by cutting 700 megahertz by 6 GHz, the occupancy of the available channels rises to 39.04%; This pushes latency to increase. Therefore, extrapolating the decrease in capacity to an increase in latency of 20.29% reflects part of the deterioration that would be expected, in practice, somewhat higher.

E.5. Enterprise Traffic

Using Wi-Fi networks in enterprise environments generates significant operational savings by offloading traffic from cellular or wired networks to wireless connections. This effect has been significant in offices, industrial facilities, and manufacturing environments where continuous mobility and connectivity are critical. In this context, the 6 GHz band, with its wide 1200 megahertz spectrum, plays a fundamental role in enabling a high density of low-latency and high-capacity devices.

However, the 700 megahertz restriction in the 6 GHz band (reducing it to 500 megahertz) generates a capacity spillover to the lower bands, especially the 5 GHz band. Since business environments demand high bandwidths and connection stability, this traffic cannot be redirected to the 2.4 GHz band due to its limited capacity (60 megahertz), so it is concentrated in the 500 megahertz of the 5 GHz band and in the remaining 500 megahertz of the low 6 GHz band.

This shift generates a saturation equivalent to 36.36% of the available bandwidth (see Table E-5), divided into 18.18% in the 5 GHz bands and 18.18% in the reduced 6 GHz band (see Equation E-5). Such saturation compromises the operational efficiency of enterprise Wi-Fi networks, negatively affecting the benefits derived from offloaded traffic, such as lower use of wired infrastructure and savings in mobile data costs. Therefore, the loss of spectrum in 6 GHz reduces the positive economic impact of this effect, limiting the savings that companies could obtain from the intensive use of Wi-Fi.

Table E-5. Calculating the 5GHz bandwidth ratio in the 6GHz reduced band scenario for enterprise traffic

	2.4 GHz (60 megahertz)	**5 GHz (500 megahertz)**	**6 GHz (500 megahertz)**	**6 GHz (700 megahertz)**	**Available Bandwidth (megahertz)**	**5GHz Ratio**
Full Band (BC)	60	500	500	700	1,760	31.82%
Reduced Band (BR)		500	500		1,000	50%
					Total saturation	**36.36%**

Sources: Telecom Advisory Services analysis

$$Saturation_{total} = \frac{Share_{BC} - Share_{BR}}{Share_{BR}} = \frac{31.82 - 50}{50} = 36.36\%$$

$$Saturation_{5GHz} = Saturation_{total} * Share_{5GHz-BR} = 36.36 * 50 = 18.18\% \; (Eq. E - 5)$$

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