

# Alpine Connectivity: How Mobile Networks Perform Across Europe's Premier Ski Resorts

Austria leads on the slopes, where Alpine-specific auction incentives, public co-funding, and deep low-band spectrum holdings drive superior outcomes in some of Europe's most challenging yet lucrative radio environments.



Europe's largest ski resorts are among the most demanding environments for mobile networks. Extreme terrain, steep changes in elevation between sites and users, seasonal demand spikes that can exceed baseline capacity by an order of magnitude, and remote power constraints all combine to make Alpine connectivity an infrastructure challenge that separates well-invested operators from the rest.

For the tens of millions of visitors who pass through the Alps' major ski resorts each winter, mobile connectivity is no longer a luxury. It underpins safety communications, real-time slope monitoring,

social media sharing from the chairlift, and the growing dependence on digital lift passes and resort apps.

*To understand how operators are meeting this challenge, we examined [Speedtest Intelligence](#)® data across 17 of Europe's top ski resorts in five Alpine nations (France, Switzerland, Austria, Italy, and Germany) over a 12-month period from March 2025 to March 2026. The analysis draws on consumer-initiated Speedtest results, background signal scans measuring 4G and 5G signal strength and quality, and quality of experience (QoE) metrics including web page load times.*

## Key Takeaways:

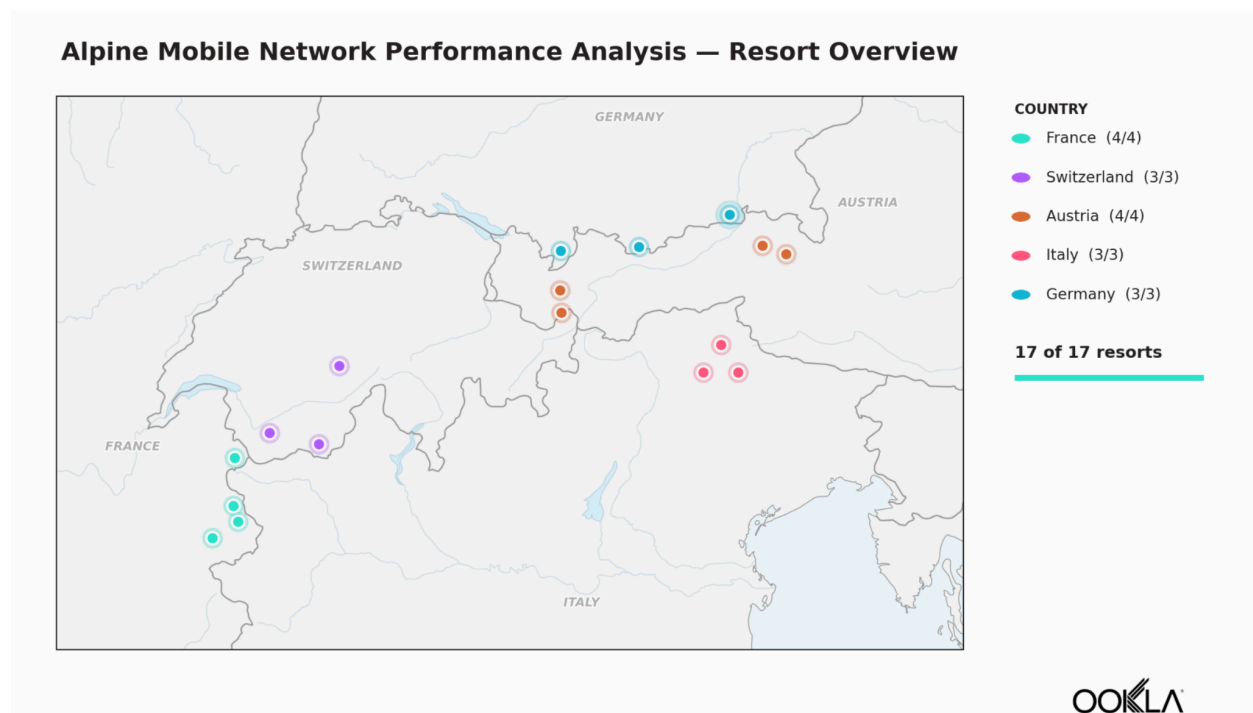
- **Austria leads its Alpine peers in median mobile download speeds at top ski resorts.** A1 delivered median download speeds of 144.21 Mbps and the strongest 10th percentile outcomes (20.97 Mbps) of all 17 studied operators. The combination of Breitbandstrategie 2030 co-funding, alpine-specific spectrum auction incentives, and deep low-band holdings (Magenta Telekom alone holds 120 MHz across 700 MHz, 800 MHz, and 900 MHz spectrum) has resulted in infrastructure density that sustains performance even in the worst 10% of network conditions.
- **Italy's mobile network outcomes at top ski resorts are the most competitively balanced of the five countries studied.** The country's four operators sit within just 16.66 Mbps of each other on median download speed (99.06 to 115.72 Mbps), and it is the only market where every operator exceeds 95 Mbps at the median. This reflects the broader national picture in a fiercely competitive and price-sensitive four-player market. The collective 700 MHz spectrum coverage obligation, which requires all operators to jointly reach 99.4% population coverage by June 2027, and the Milano Cortina 2026 Olympic 5G buildout, have driven competition across the Dolomites.
- **France has the widest within-country performance gap at resorts.** SFR leads with a median download speed of 165.32 Mbps while Free trails at 48.79 Mbps, a 116.53 Mbps spread that reflects divergent spectrum and technology strategies across French Alpine terrain. While ARCEP's New Deal Mobile has resulted in 3,200+ shared 4G sites and converging signal strength, shared infrastructure alone has not closed the throughput gap.
- **Germany's top resorts record the lowest median download speeds (66.43 Mbps) but the best latency and fastest web page loads, while Swisscom leads the pack in Switzerland.** Household-centric auction conditions tied to population coverage and transport corridors rather than tourism zones have left Bavarian resorts as a secondary priority in Germany. Without the geographic deployment mandates seen in France or the public co-funding of Austria, operator commercial strategy is the decisive variable, and Salt's -110 dBm 4G RSRP, the weakest of any operator across all five countries, shows what happens when that incentive is absent.

## The Alps poses a unique radio engineering challenge for mobile operators in tough mountain terrain

Providing cellular connectivity at ski resorts in the Alps is an order of magnitude more difficult than serving a comparable number of users in a lowland town. The physics, the logistics, and the economics all work against European operators.

Operators building remote mountain sites increasingly deploy hybrid solar-wind power systems that can supply as much as 80% of daily load from renewables, reducing diesel generator dependence by 70% to 80%, but the upfront engineering cost for a hardened Alpine installation can run 2.5 to 3.5 times that of an equivalent lowland site.

At 3,000 meters, base station equipment needs to operate in temperature ranges of -30 to +40 degrees Celsius across a single year. At -20 degrees Celsius, conventional lithium-ion batteries used for power backup retain roughly 50% of rated capacity, and charging rates must be throttled to prevent damage, meaning that a site designed for eight hours of backup power in summer may deliver fewer than four in winter.



Wet snow, which behaves like rain for signal propagation purposes, produces measurable attenuation on mid-band frequencies, while ice accumulation of even a quarter-inch on antenna radomes “changes the entire deployment scenario” according to [engineering guidance](#). Avalanche protection adds further cost. Steel and concrete snow sheds, flexible net barriers, and reinforced catching dams are standard protective infrastructure around mountain base stations, and in extreme cases operators rely on remote avalanche control systems to manage hazards without placing personnel at risk.

Backhaul is a major constraint. Fiber installation in Alpine terrain requires specialized ASU (Aerial Self-Supporting) cable rated for heavy snowfall and high wind, or trenching through rocky substrate that in many areas can only be excavated during summer months. Where fiber is uneconomical, satellite backhaul can be installed in one to two days at roughly a third of the cost of a microwave link, and A1 in Austria has adopted this approach to connect alpine huts and remote mountain refuges through a partnership with the Austrian and German Alpine associations.

Similarly, Swisscom's experience in the Ueschinen Valley in the Bernese Oberland illustrates the tradeoffs. When fiber was assessed for this mountain valley serving primarily summer-inhabited alpine huts, the cost-benefit case failed. Instead, [Swisscom deployed a 5G site in autumn 2021](#), providing the entire valley with broadband at a fraction of the fiber cost (and making use of pre-existing fiber for the site backhaul only rather than needing to deploy it to every home).

Equipment logistics present their own challenge. Helicopter delivery to high-altitude sites is standard practice across the Alps, but thin air at elevation reduces rotor lift capacity, and flight windows are constrained by weather. Deutsche Telekom [demonstrated one alternative](#) at the Jizerska 50 cross-country ski race in the Czech Jizera Mountains, deploying a drone-mounted base station at 2.3 kilometers altitude that provided connectivity to over 4,400 race participants. This solution provided measured speeds of 95 Mbps download and 34 Mbps upload, a proof-of-concept for temporary surge capacity at mountain events (noting though that drone usage is still at an early stage in the Alpine context and features severe constraints like short battery runtime).

## Austria's A1 sets the Alpine benchmark

Austria emerges as the strongest overall performer in ski resort connectivity in our analysis, combining the highest median download speeds with solid upload performance and latency. The country-level median download of 110.48 Mbps and upload of 17.69 Mbps both rank first among the five countries studied.

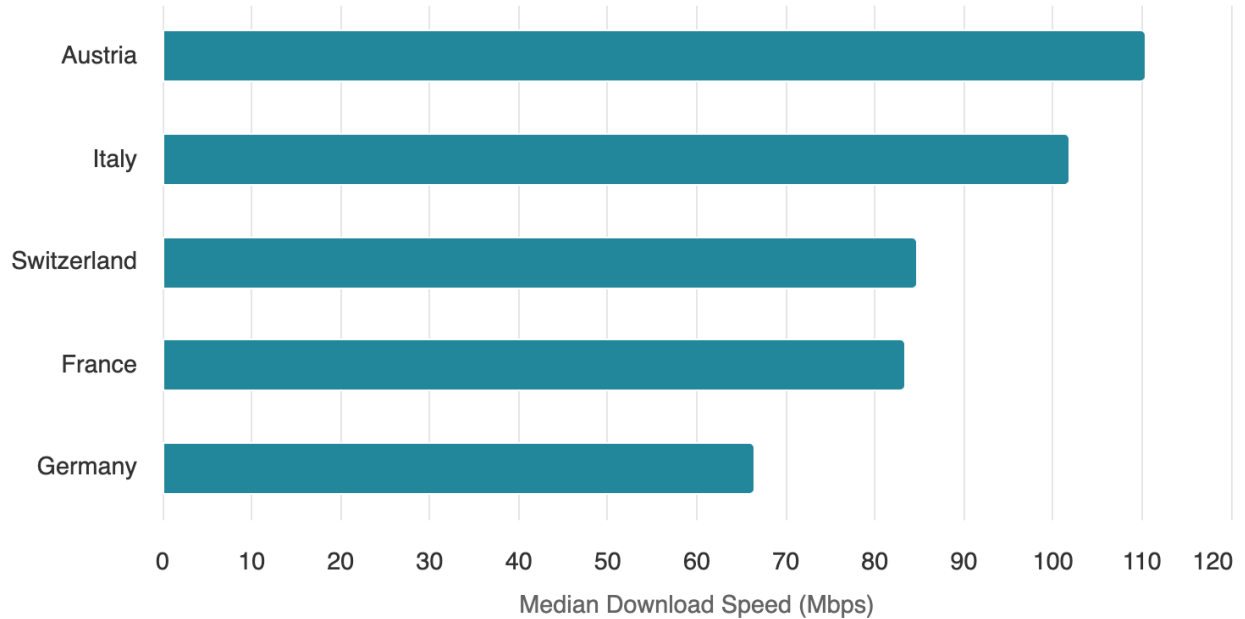
The four resorts studied (Ski Arlberg, Saalbach-Hinterglemm-Leogang-Fieberbrunn, Ischgl, and KitzSki) include Austria's highest-profile ski domains, and our data suggests these destinations benefit from deliberate investment in Alpine connectivity.

A1 drives much of this result. At 144.21 Mbps median download and 24.64 Mbps upload, A1 ranks second among all 17 operators on download and first on upload. Critically, A1 also delivers the strongest 10th percentile download performance of any operator at 20.97 Mbps, meaning that even users experiencing the worst 10% of conditions still receive a usable broadband-grade connection.

The gap between A1's median and 10th percentile download across top Austrian resorts (a ratio of roughly 7:1) is notably tighter than operators like Orange in France (24:1) or Sunrise in Switzerland (21:1), pointing to more consistent infrastructure density across Austrian resort terrain.

## Austria Leads European Ski Resort Download Speeds

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● Median Download Speed

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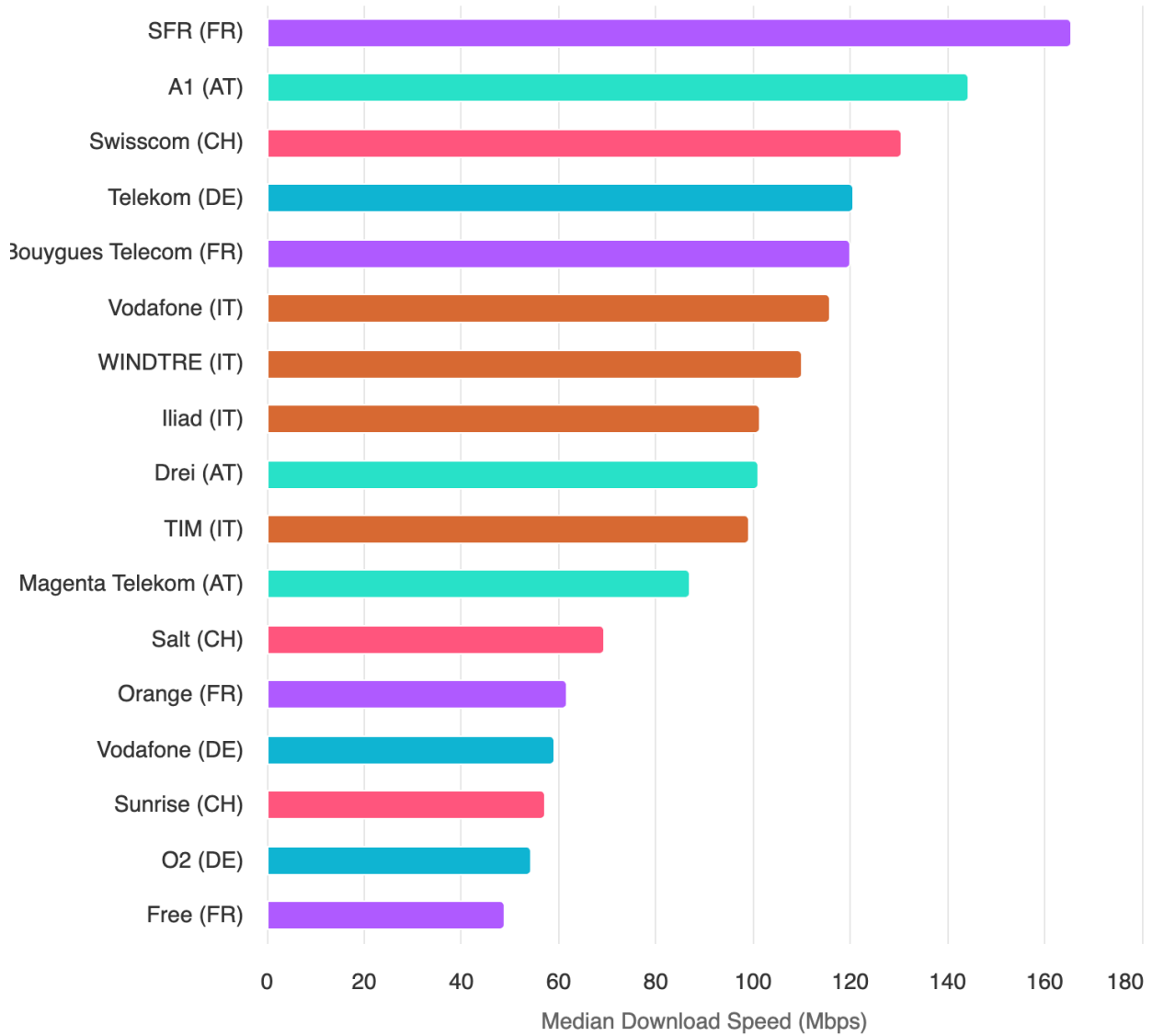
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Drei (3) follows at 100.89 Mbps median download, and Magenta Telekom sits at 86.85 Mbps. The 57.36 Mbps spread between A1 and Magenta is material but moderate by Alpine standards, and all three operators deliver acceptable performance for typical resort usage.

Analysis of signal strength data further supports A1's lead. Its median 4G signal strength (known as Reference Signal Received Power or RSRP) of -100 dBm is the strongest of any operator in our data, and its 4G signal quality (RSRQ) of -9 dB is among the best. Magenta Telekom's 5G signal stands out with a median RSRP of -95 dBm, the strongest 5G reading across all operators, likely reflecting the usage of its leading 120MHz-wide low-band allocation (prime spectrum for wide coverage that travels further in Alpine terrain) across the 700, 800, and 900 MHz bands.

# A1 and SFR Top the Operator Rankings at European Ski Resorts

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● Median Download Speed



Median web page load times at the top resorts in Austria cluster around 1.4 seconds across all three operators. The fact that A1's outcomes here are essentially equivalent to Drei despite its significantly higher download speeds illustrate the diminishing returns of raw speed on QoE metrics that are dominated by deeper factors like core interconnect, peering, and content delivery network (CDN) routing. These are the behind-the-scenes infrastructure elements that determine how efficiently data travels between servers and end users, rather than simply how fast the last mile connection can go.

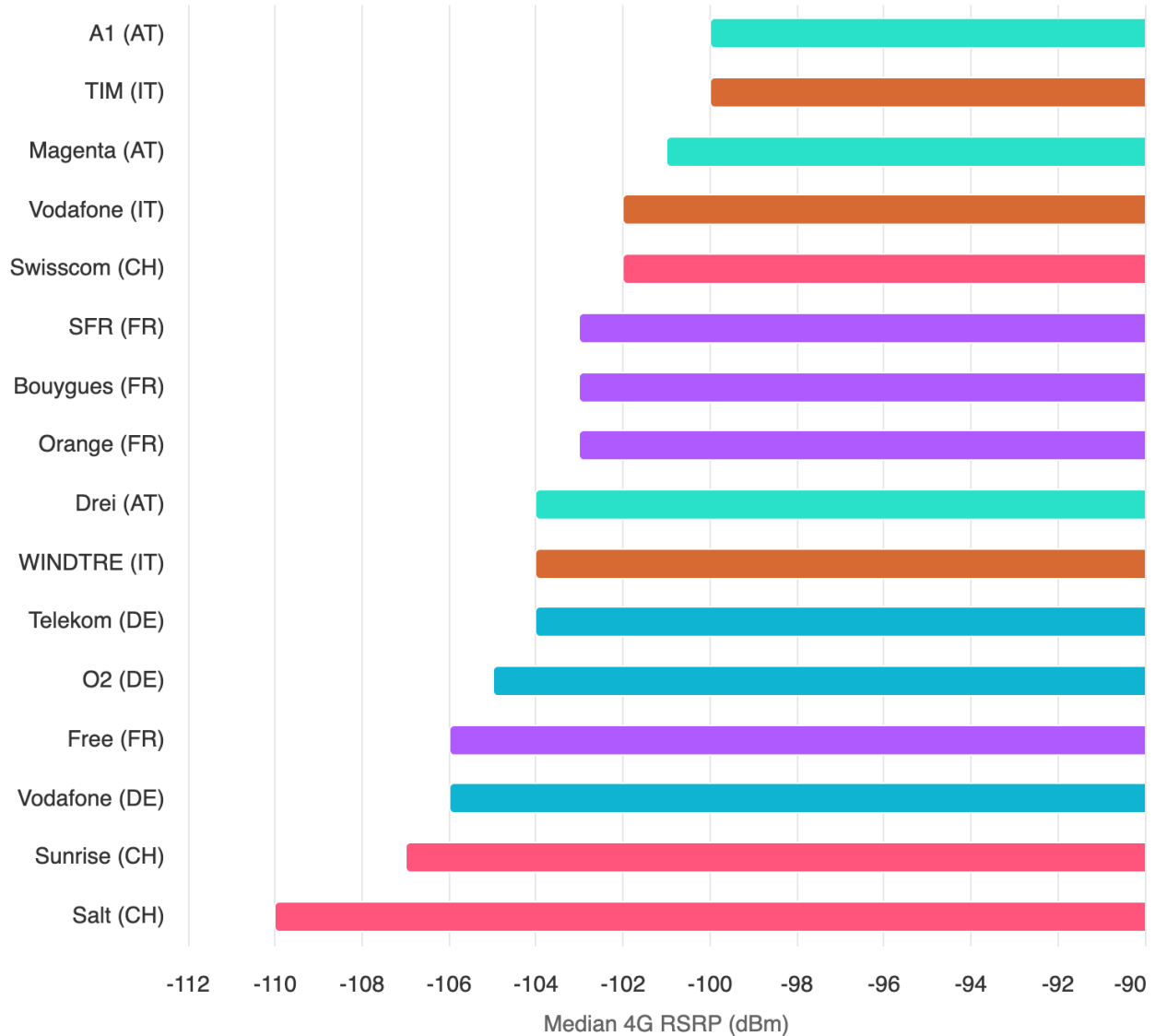
## Italy's tight operator spread points to competitive balance

Italy's ski resorts deliver the second-highest median download speeds (101.85 Mbps) and present the most balanced competitive picture of any country in the analysis. The three Italian resorts studied (Sella Ronda, Cortina d'Ampezzo, and Kronplatz) sit directly in the zone that received Olympic infrastructure investment, and the post-Games persistence of this network will be a critical test for long-term connectivity improvement in the Dolomites.

All four operators measured (Vodafone, WINDTRE, Iliad, and TIM) sit between 99.06 Mbps and 115.72 Mbps on median download, a total spread of just 16.66 Mbps or roughly 14% variance. The strong showing is somewhat surprising, as it runs counter to Italy's broader country-level mobile standing. In the latest edition of the [Speedtest Global Index™](#), Italy ranked 52nd globally and ahead of only Germany among the peer group.

## A1 and TIM Lead on 4G Signal Strength Across Alpine Resorts

Speedtest Intelligence® | Mar 2025 - Mar 2026 | Median 4G RSRP in dBm (closer to 0 = stronger signal)



SPEEDTEST

● Median 4G RSRP

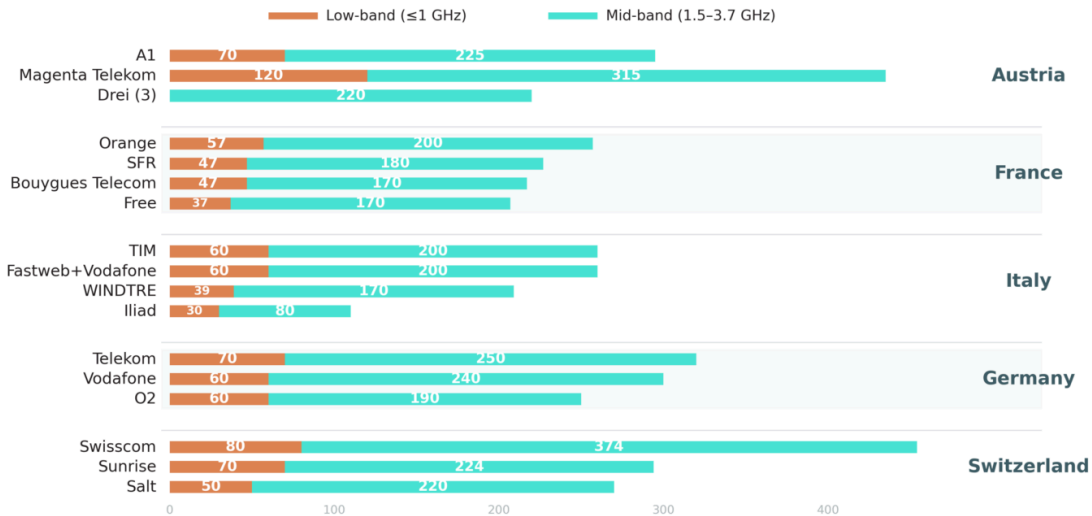
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Vodafone leads with a median download speed of 115.72 Mbps and with the lowest latency in the country (43 milliseconds). TIM, despite ranking last among Italian operators on median download speed at 99.06 Mbps, delivers the strongest 10th percentile download (12.51 Mbps) and the best 4G RSRP (-100 dBm), consistent with its position as the operator with the largest physical footprint in Italy. TIM's extensive 4G population coverage and 60 MHz of low-band spectrum give it deep reach that translates into more consistent mountain coverage, even if peak throughput is modestly lower.

WINDTRE deserves attention for upload performance. With a median of 17.98 Mbps, it delivers the highest upload speed of any Italian operator and one of the highest in the full five-country dataset, a finding that may reflect its 170 MHz of mid-band spectrum and capacity optimization choices.

### Spectrum Holdings Across Five Alpine Markets

Total assigned sub-6 GHz spectrum (MHz) by band group per operator | Source: GSMA Intelligence



Iliad, the newest entrant, delivers a competitive 101.40 Mbps median download speed, demonstrating that its national roaming and infrastructure-sharing arrangements provide reasonable resort coverage.

Italy features the poorest QoE outcomes among the five studied countries, with median web page load times ranging from 1.4 seconds (Vodafone) to 1.5 seconds (Iliad), roughly 0.1 to 0.2 seconds slower than the fastest country, Germany. This disconnect between relatively strong download speeds and slower page loads strongly suggests that network routing, CDN proximity, and peering arrangements, rather than raw throughput, may be the constraint on user experience in Italian resort areas.

## France features the widest operator divide in the Alps

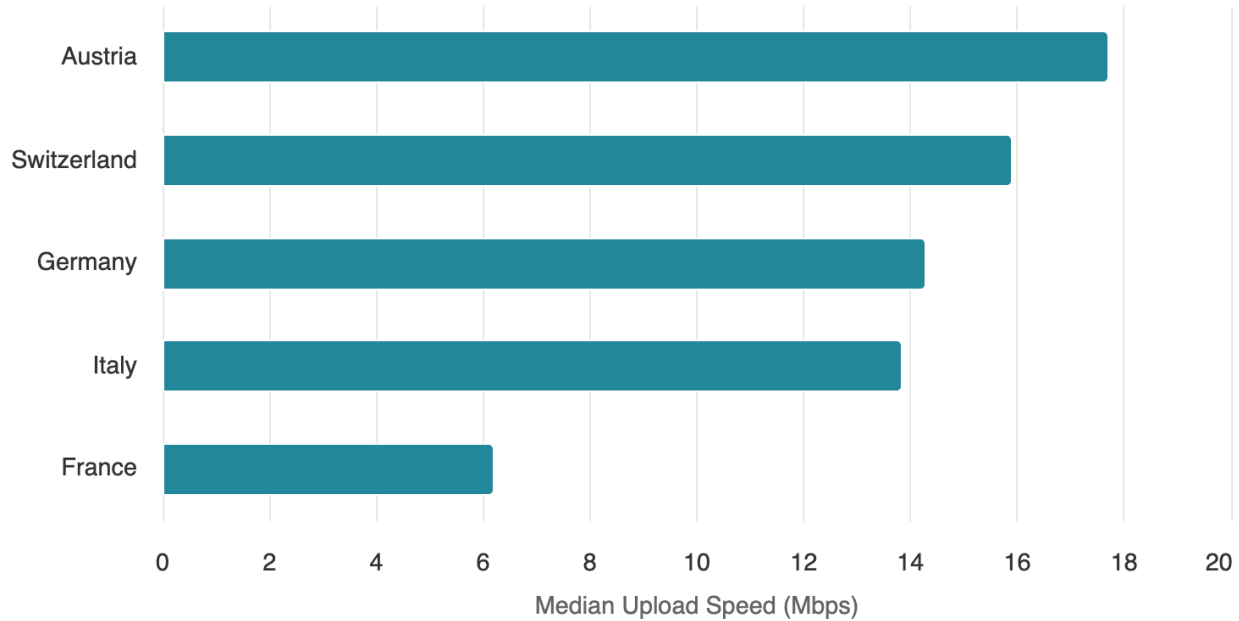
The four French resorts studied (Les 3 Vallees, Paradiski, Tignes-Val d’Isere, and Chamonix-Mont-Blanc) include the largest ski domains in the Alps and represent peak-demand environments where infrastructure sharing alone may not fully address congestion.

France’s overall median download speed of 83.44 Mbps across its top resorts place it fourth among the five studied countries, but this average masks a striking divergence between operators. SFR leads at 165.32 Mbps, the single highest median download of any operator across all five markets. Bouygues Telecom follows at 120.08 Mbps, while Orange sits at 61.62 Mbps and Free trails at 48.79 Mbps. The

116.53 Mbps spread between SFR and Free represents a 70% variance, the widest of any country in the study. It is also notable that this runs counter to the broader national pattern over recent quarters, where Orange leads on speed and consistency ahead of Bouygues, with both well ahead of SFR and Free.

## France's Upload Deficit at Ski Resorts Is Pronounced

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● Median Upload Speed

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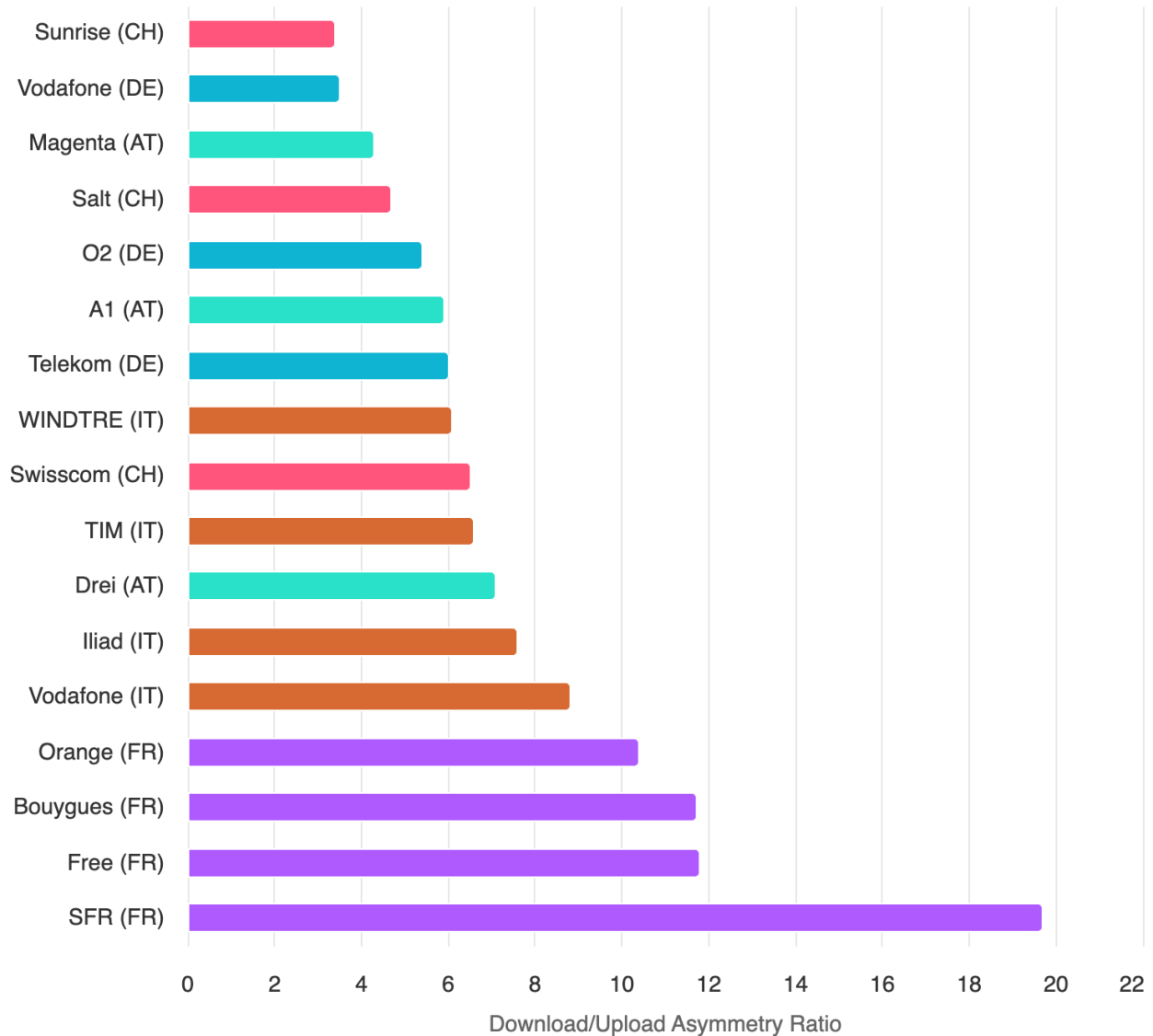
The French upload story at ski resorts is even more notable. With an overall median upload speed of 6.20 Mbps, France's upload speed is less than half the next-lowest country (Italy at 13.85 Mbps) and barely a third of Austria's 17.69 Mbps. Even SFR, France's fastest downlink operator, manages only 8.38 Mbps upload. Orange's 10th percentile upload speed drops to 0.35 Mbps, and Free's to 0.41 Mbps, levels that would render video calls and cloud uploads essentially nonfunctional. This upload deficit may reflect TDD configuration choices on mid-band spectrum, uplink resource allocation policies, or (most likely) backhaul constraints and seasonal congestion specific to French mountain infrastructure.

Deeper analysis of the 10th percentile outcomes expose an Alpine consistency problem across all French operators. Orange's 10th percentile download is just 2.59 Mbps, meaning the worst 10% of user experiences deliver less than 3 Mbps despite a median of 61.62 Mbps. This 24:1 ratio between median and 10th percentile is the highest in our data and points to potential severe congestion or coverage holes within the resort footprint. Free (16:1 ratio) and Bouygues (20:1) show similar patterns. SFR,

despite leading on median download, drops to 9.48 Mbps at 10th percentile (17:1) ratio.

## French Operators Show Extreme Download/Upload Imbalance at Ski Resorts

Speedtest Intelligence® | Mar 2025 - Mar 2026 | Ratio of median download to upload speed (lower = more balanced)



● DL/UL Asymmetry Ratio

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Median multi-sever latency performance in France (56 to 58 ms across all four operators) is tightly clustered, suggesting that latency is not the differentiating factor between French operators at ski resorts. The more impactful divergence is on signal. Three of four operators (Orange, SFR, and Bouygues Telecom) feature an identical 4G RSRP of -103 dBm, while Free registers -106 dBm, consistent with Free's smaller national site footprint and narrower low-band allocation (37 MHz total

vs.47 MHz to 57 MHz for its competitors).

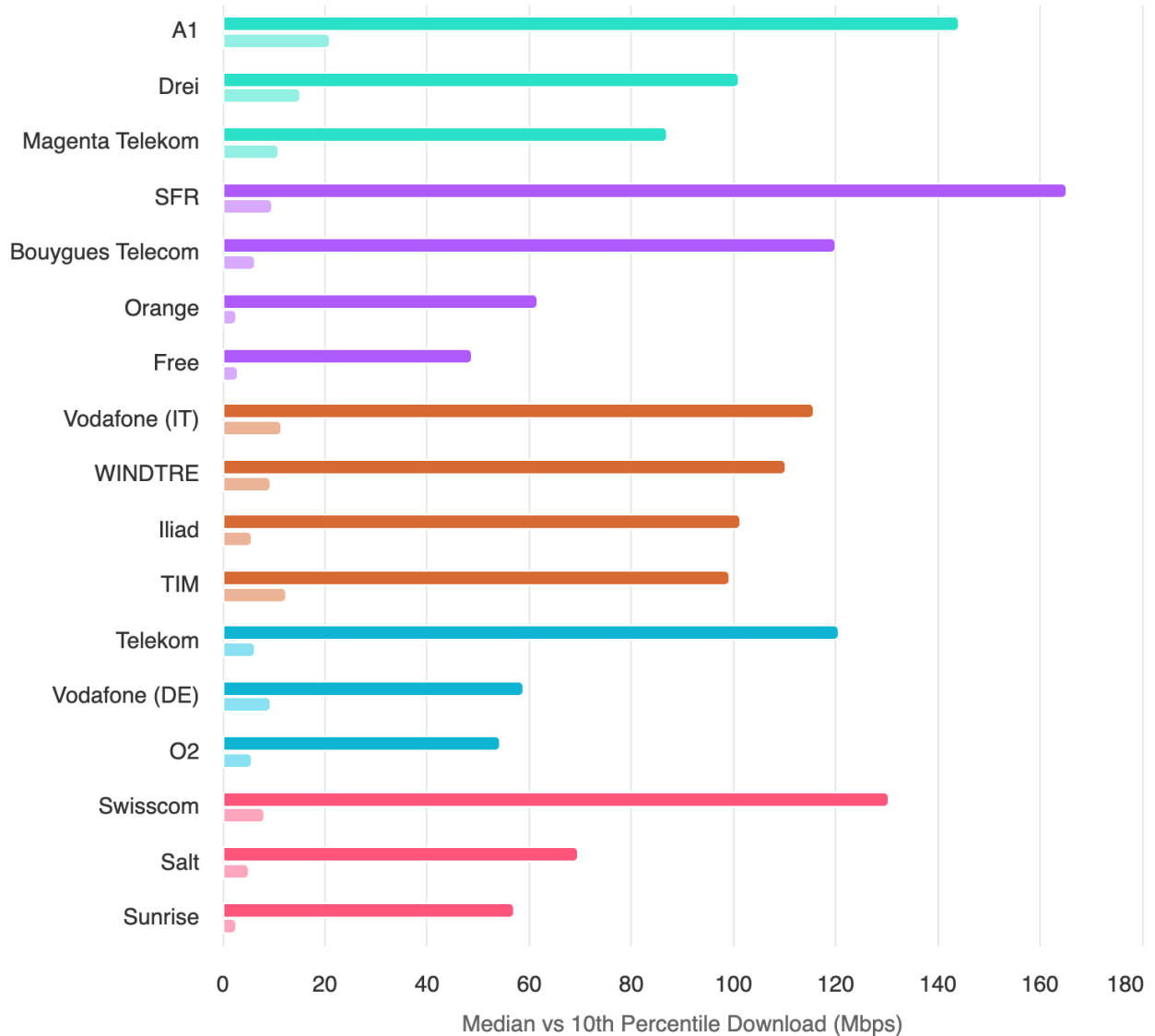
## Swisscom dominates, but Switzerland's overall position is middle of the Alpine pack

Switzerland's overall median download of 84.76 Mbps at resorts places it third, just above France, despite Swisscom delivering 130.40 Mbps, a figure that would rank among the top operators in any country. The gap reflects the sharp dropoff below Swisscom. Salt records 69.39 Mbps and Sunrise 57.13 Mbps, a 73.27 Mbps spread between top and bottom that represents a wide 56% variance.

On upload and latency, Switzerland is more competitive. Median upload speeds reach 15.91 Mbps overall (second only to Austria), and the median multi-server latency of 48 ms is the second-best, with Swisscom delivering the lowest single-operator latency in our entire dataset at 33 ms.

# Floor Performance Varies Dramatically Across Alpine Operators

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● Median Download (Mbps) ● 10th Percentile Download (Mbps)



Analysis of the 10th percentile outcomes highlights a consistency challenge. Sunrise's 10th percentile download speed is just 2.71 Mbps (a 21:1 ratio to its median) and Salt's is 4.93 Mbps (14:1). Even Swisscom's 10th percentile of 8.08 Mbps represents a 16:1 ratio. These floor-performance readings suggest that at peak times or in terrain-challenged areas of Zermatt, Verbier, and the Jungfrau Region, users on any operator can experience severe performance degradation (over and above what is observed in countries like Austria).

Signal data provides a partial explanation for these challenges. Swisscom's median 4G RSRP of -102 dBm is acceptable but not exceptional. Salt's median -110 dBm is the weakest 4G reading of any operator across all five countries, consistent with coverage limitations in peripheral Alpine valleys. Salt's 5G signal at -106 dBm tracks similarly weak.

Swisscom holds the largest low-band allocation in Switzerland (80 MHz across the 700, 800, and 900 MHz bands) and the deepest total spectrum portfolio at 454 MHz across all bands, vs. Sunrise at 294 MHz and Salt at 270 MHz. This spectrum depth, and the operator's status as the universal service licence holder, likely underpins Swisscom's clear Alpine advantage.

Switzerland's market-driven regulatory model, which lacks the kind of direct government co-funding seen in France (ARCEP New Deal Mobile) or Austria (Alpine Infrastructure Fund), places the burden of mountain investment on operator economics.

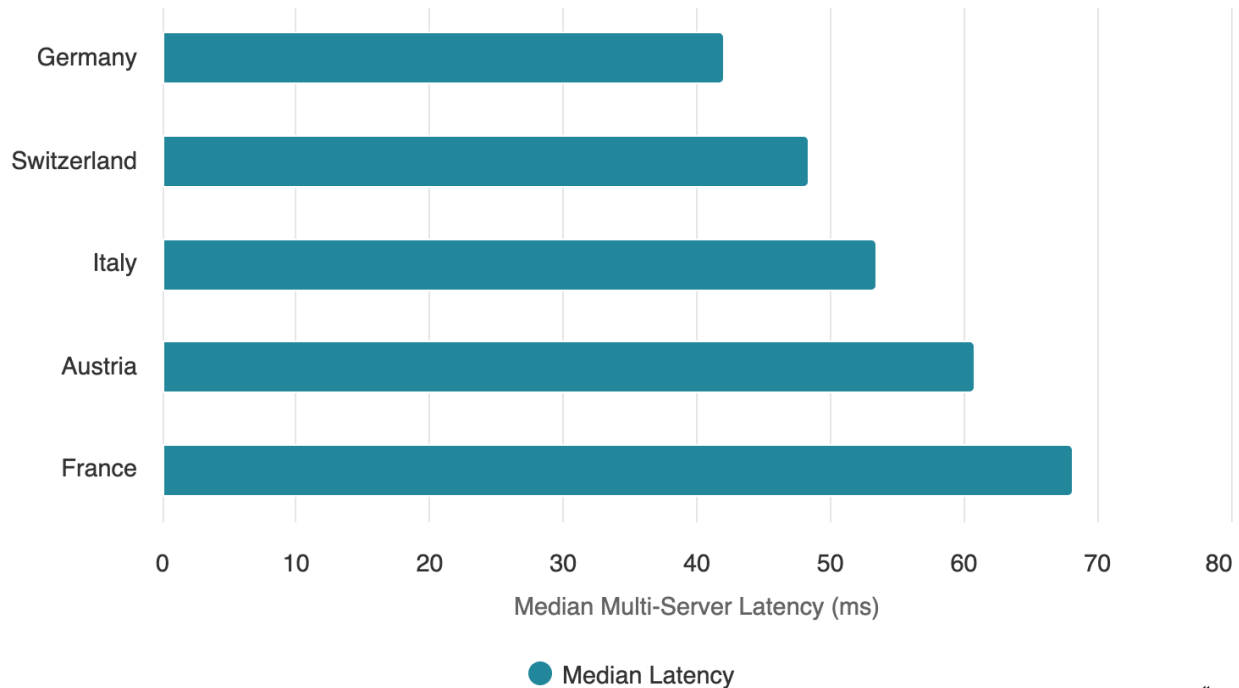
## Germany trades raw speed for latency and QoE

Germany's ski resort performance is unique. With a 66.43 Mbps median download speed, it ranks last among the five countries. But with a median latency of 42 ms, it delivers the best multi-server responsiveness, 6 ms faster than second-placed Switzerland and 26 ms better than France. Garmisch-Partenkirchen, Oberstdorf, and Sudelfeld are located in Bavaria but do not sit on priority transport corridors, creating a gap where commercial incentive alone drives investment.

Telekom dominates the German market on speed at resorts, recording a 120.58 Mbps median download, more than double its nearest domestic competitor (Vodafone at 58.95 Mbps, O2 at 54.39 Mbps). Telekom also leads on upload (20.22 Mbps) and latency (35 ms), the latter being the second-lowest single-operator figure in our entire dataset after Swisscom.

## Germany Leads on Latency and Web Page Load Times at Ski Resorts

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But Telekom's 10th percentile download drops to 6.14 Mbps (a 20:1 ratio), notably weaker than the consistency levels seen in Austria. Vodafone's 10th percentile download speed of 9.38 Mbps actually represents a tighter ratio (6:1), suggesting more even if lower-ceiling coverage. O2's 5.69 Mbps 10th percentile and modest signal readings (4G RSRP -105 dBm, 5G -103 dBm) likely reflect some rural coverage gaps.

The profile of results align closely with the relative spectrum position of each German operator. Telekom, with 70 MHz of low-band spectrum (the largest low-band allocation among German operators, spanning 700, 800, and 900 MHz), has the propagation advantage needed for mountain terrain. Vodafone and O2, with weaker low-band positions, therefore compete less effectively at altitude.

Overall, Germany delivers the best median web page load times of any country. Telekom records 1.2 seconds, the lowest figure across all 17 operators, while Vodafone and O2 also perform well at 1.3 seconds each. This QoE advantage aligns with Germany's latency leadership (and the inherent advantage that it features the highest density of hyperscale infrastructure in the DACH region) and suggests favorable CDN positioning, routing decisions and peering arrangements for German networks.

## Policy approaches to Alpine coverage vary widely from subsidized infrastructure sharing to targeted rollout obligations

The regulatory frameworks shaping Alpine connectivity differ materially across the five countries studied, and these differences can help to explain the performance patterns in our data.

France's policy approach is the most prescriptive. [ARCEP's New Deal Mobile program](#), announced in January 2018, replaced the traditional auction logic with a commitment-based framework in which operators accepted binding coverage obligations in exchange for administrative renewal of their spectrum rights. The targeted coverage mechanism requires each operator to cover up to 5,000 areas, with government orders issued at a rate of roughly 600 to 800 areas per year per operator and each designated location to be activated within at most 24 months.

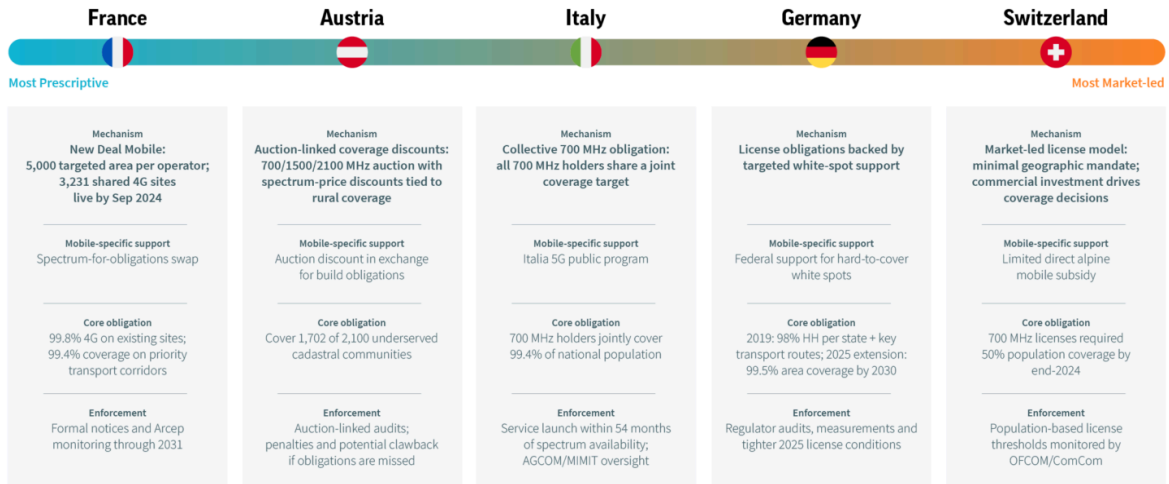
Infrastructure sharing is central, but more selectively than the original text implied. Of those 5,000 areas, [2,000 are explicitly intended for four-operator RAN sharing](#) in places where no operator provides "good coverage"; in the remaining areas operators must at least share passive infrastructure, and in some cases active sharing also applies. Separately, operators must reach 99.8% population "good coverage" for voice and SMS, with deadlines staggered between 2028 and 2031 depending on operator. Compliance is enforced with fines. Historically, SFR was penalized €380,000 for failing to cover 47 town centers by the January 2016 deadline, and Orange received a €27,000 penalty for missing five. Critically for ski areas, the [3.4 to 3.8 GHz obligations](#) require 25% of sites in the final two rollout phases to be located in sparsely populated areas.

Austria, meanwhile, has combined spectrum policy with direct public funding. The [Breitbandstrategie 2030](#) targets nationwide symmetric gigabit-capable connectivity by 2030, and the federal government has made €1.4 billion (US \$1.6 billion) available through 2026 under [Broadband Austria 2030](#). Coverage obligations from the 2020 multi-band auction (700, 1500, and 2100 MHz) require A1, Hutchison, and T-Mobile Austria to cover 1,702 of 2,100 underserved cadastral communities, roughly 81%, with first deadlines in summer 2022 and most remaining obligations falling in late 2023 and late 2025. Embedding rural buildout directly into the award process helps explain why operators with stronger

rural network positions perform relatively well in Alpine terrain.

## Five Countries, Five Regulatory Approaches to Rural and Mountain Mobile Coverage

From Prescriptive Site Mandates to Market-led Investment, Regulatory Design Shapes Coverage Outcomes



Note: Cards compare national mobile coverage instruments relevant to rural and hard-to-cover areas; not all measure are mountain specific

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By contrast, Switzerland takes the most market-driven approach. [Swisscom is the universal service licence holder for 2024 to 2031](#), but the obligation remains modest: basic telephony plus internet access at 10/1 Mbit/s, or 80/8 Mbit/s on request, with reduced rates permitted in exceptional cases. The February 2019 spectrum auction raised around €414 million (US\$477 million) and imposed mainly population-based obligations: licensees with 700 MHz spectrum had to reach at least 50% of the population with their own infrastructure by December 2024, while those without 700 MHz spectrum faced a 25% threshold. Those benchmarks can be met without specifically targeting remote Alpine terrain.

Italy's 700 MHz auction, concluded in October 2018, included a distinctive [collective coverage obligation](#). The 700 MHz licensees must jointly reach 99.4% of the population within 54 months of the band's July 2022 availability. This joint structure creates a cooperative incentive, since any single operator's shortfall affects the group, and it is consistent with infrastructure-sharing approaches. Earlier this year, [TIM and Fastweb+Vodafone](#) first announced a preliminary RAN-sharing agreement focused on municipalities with fewer than 35,000 inhabitants, and later announced a non-binding initiative to develop up to 6,000 new towers.

Italy's [Piano Italia 5G program](#) provides major public support for fiber backhaul to more than 10,000 existing mobile sites and for new 5G sites in underserved areas, with public funding covering up to 90% of project cost. The Milano Cortina 2026 Winter Olympics added a further layer, with TIM as [Official Telecommunications Partner](#) and FiberCop as [Fiber Infrastructure Partner](#) connecting venues to high-capacity fiber infrastructure.

Germany's regulatory model is the most explicitly focused on household and transport coverage. BNetzA's [2019 auction](#) required at least 100 Mbps for 98% of households in each federal state by the end of 2022, alongside obligations covering motorways, major federal roads, and rail routes. According to operators' submissions, all three incumbents met the household threshold, but BNetzA said gaps remained in some transport locations and tunnels. That structure is aimed at population density and corridors rather than tourism zones, leaving mountain coverage more dependent on commercial incentive.

Federal support exists, but execution has been slower than the headline ambition suggests. The [Mobilfunkstrategie](#) earmarked about €1.1 billion (US\$1.3 billion) from the Special Fund for Digital Infrastructure to support up to 5,000 additional masts, and by the end of 2024 the Mobilfunkinfrastrukturgesellschaft had funded 267 sites, with the first masts in operation and the remainder still in the realization phase. Updated obligations adopted in 2025 require at least 50 Mbps over 99.5% of Germany's land area from 2030, so German ski resorts are still likely to rely primarily on operator-led investment for the foreseeable future.

## Bars on the piste matter for competitive differentiation

For operators, the Alpine corridor is both a technical challenge and a strategic opportunity, a place where network quality is highly visible, directly experienced by affluent and digitally engaged visitors, and increasingly essential to resort operations.

The performance landscape across Europe's top ski resorts reveals a set of structural themes that extend beyond the mountains. Markets where regulation explicitly targets geographic coverage (e.g., France's ARCEP New Deal Mobile, Austria's Alpine investment incentives, Italy's joint coverage obligations) show stronger outcomes than markets where obligations are tied primarily to population thresholds and transport corridors. Germany's household-centric auction conditions, despite generating significant auction revenue, leave tourism-dependent mountain zones as a secondary priority.

Operator strategy matters as much as regulation. A1 in Austria and Swisscom in Switzerland have built measurable Alpine advantages that function as competitive differentiation. In markets where operator performance is more tightly clustered (Italy) or where infrastructure sharing dominates (France), the quality of the user experience can become more uniform or constrained by shared bottlenecks.

Emerging direct-to-device (D2D) satellite services from providers like SpaceX's Starlink and AST SpaceMobile represent a potential [complementary layer](#) for the highest-altitude and most remote Alpine terrain where terrestrial economics remain prohibitive. Switzerland's Salt, for example, was the first operator in Europe to report a successful (albeit non-commercial) Starlink direct-to-cell test, sending satellite-based text messages to a standard 4G smartphone over its mobile spectrum, touting

it as a future coverage extension and resilience layer in the most remote areas.