TDRA

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TELECOMMUNICATIONS AND DIGITAL GOVERNMENT REGULATORY AUTHORITY

e& etisalat and

The Golden 6 GHz Band

NYU ABU DHABI

How the UAE is Pioneering the **Road to 6G with Upper 6 GHz**

The world's first commercial U6GHz 256TRX Giga-MIMO network — turning 6G research into deployed reality.

TDRA | e& UAE | Khalifa University | NYU Abu Dhabi

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Executive Summary

The UAE has switched on the world's first commercial mobile network in the Upper 6 GHz (U6GHz) band. e& UAE has awarded a contract to a strategic infrastructure partner to roll out a commercial network built on U6GHz 256TRX Giga-MIMO technology, with commercial launch planned for the second half of 2026. The deployment uses the U6GHz band— paired with a 256-transceiver Giga-MIMO antenna system, and is designed to deliver peak speeds of up to 10 Gbps.

This is more than a network upgrade. It is the first time the global industry has taken U6GHz – widely regarded as the "Golden Band" for the 6G era – from the laboratory into live commercial service. Because WRC-23 already identified this band for IMT across ITU Region 1, it is also the leading candidate to carry 6G (IMT-2030) here: the regulatory decision is made, the harmonization exists, and the network is live years before the standard is frozen. It positions the UAE at the forefront of 5G-Advanced evolution while laying the architectural foundations for 6G, and it directly supports the national 6G roadmap led by the **Telecommunications and Digital Government Regulatory Authority (TDRA)** and the country's ambition to become a "10 Giga intelligent nation."

This white paper explains, in plain terms, **why U6GHz works, what it delivers, and what it unlocks**. It draws on a detailed engineering study conducted jointly by e& UAE, Khalifa University, and NYU Abu Dhabi comparing 6G centimeter-wave operation at U6GHz against today's 5G C-band at 3.5 GHz. With the right antenna technology, a higher-frequency band can match the coverage of today's networks while delivering 1.5× the spectral efficiency on the same spectrum – a capacity gain that comes from the Giga-MIMO radio system rather than extra bandwidth, and entirely from existing cell sites – with the device, chipset, and standards ecosystem to support it ready now.

350 MHz	10 Gbps	1.5x	~0%
contiguous spectrum (6425–6775 MHz)	peak downlink speed	spectral efficiency vs. 5G, same spectrum	new sites required

The bottom line for decision-makers

U6GHz lets operators deliver **fiber-like wireless speed and 1.5× the spectral efficiency** of 5G on the same occupied spectrum – a capacity gain delivered by the 256TRX Giga-MIMO radio system – the array together with its beamforming, MU-MIMO pairing, and scheduling – with comparable coverage and no millimeter-wave-style site densification. The UAE is the first market in the world to prove this commercially, with a use case roadmap spanning homes, enterprises, and consumers.

1. Why Upper 6 GHz Matters

The next decade of mobile connectivity will be shaped by a fundamentally different demand profile than the one that drove previous network generations.

While 4G and 5G were largely built to support human-generated traffic such as video streaming, social media, and cloud applications, future networks will increasingly serve artificial intelligence agents, immersive digital experiences, connected machines, autonomous systems, digital twins, and intelligent infrastructure. These emerging services require not only higher throughput, but also greater network capacity, enhanced uplink performance, and more deterministic user experiences.

Meeting these requirements presents a growing challenge for mobile operators worldwide. Low-band spectrum remains essential for coverage but offers limited capacity. Existing mid-band resources provide a strong balance between coverage and performance but are increasingly constrained by rising traffic demand. At the other end of the spectrum range, millimeter-wave frequencies offer abundant bandwidth but require significant network densification and are challenging to deploy at scale.

Upper 6 GHz occupies a unique position within the spectrum landscape. It combines access to large contiguous bandwidth blocks with propagation characteristics that remain compatible with wide-area macro-cell deployment. This balance enables operators to significantly increase network capacity while leveraging existing infrastructure investments.

For this reason, Upper 6 GHz is increasingly recognized across the industry as the most strategic spectrum resource for the evolution of 5G-Advanced and the foundation of future IMT-2030 and 6G systems.

1.1 A National First, A Global Signal

In the global race to 6G, most of the world is still running trials. The UAE has moved from validation to commercial readiness. By awarding the rollout of the first commercial U6GHz 256TRX Giga-MIMO network, e& UAE has turned a research-grade concept into deployed infrastructure that customers will use in everyday life.

The significance is best understood through three lenses. For **customers**, it means fiber-like speeds over the air with the headroom to absorb the data growth that AI, immersive media, and connected services will bring. For the **industry**, it demonstrates that the Upper 6 GHz band — long debated in standards bodies — is commercially viable today. For the **nation**, it cements the UAE's standing as a hub for advanced digital infrastructure and a credible voice in shaping the 6G standards now being written.

1.2 Why "Upper 6 GHz" — and why "Golden"?

Mobile spectrum involves a permanent trade-off. Low bands travel far but carry little data. Very high bands (millimeter-wave) carry enormous data but barely penetrate walls and need cell sites on almost every corner. The Upper 6 GHz band sits in a rare sweet spot: wide, contiguous bandwidth for capacity, while remaining low enough in frequency that — with modern antennas — it can cover an area similarly to today's mainstream 5G. That balance is why the industry calls 6 GHz the "Golden Band" for the next decade.

Upper 6 GHz is both a new capacity band for 5G-Advanced and, at the lower edge of FR3, the natural entry point to the 7–24 GHz range that 6G will use. It is the only part of FR3 that is already IMT-identified in Region 1 and commercially available today, which makes it the practical place for 6G to begin rather than a waypoint on the way to somewhere else. Commercial deployment in this band gives operators, vendors, and regulators early experience with the radio architectures, massive MIMO techniques, beamforming strategies, and deployment models that the rest of FR3 will later depend on — experience that accrues to whichever additional bands are identified in future.

Broadband connectivity is now a direct engine of national economic output. Research consistently demonstrates that a 10-percentage point increase in broadband penetration drives between 0.26% to 0.92% growth in GDP and that effect is amplified significantly when network speeds improve. Studies cited by GSMA Intelligence confirm that a doubling of broadband speed alone can deliver a 0.3% increase in GDP, as faster connectivity unlocks productivity gains across industries, reduces information friction and enables new digital services that were previously constrained by throughput limitations. The introduction of up to 350 MHz of new contiguous bandwidth in Upper 6 GHz enables substantial higher user throughput from existing site infrastructure and this capacity overlay directly translates into the speed improvements that economic models identify as GDP-positive, serving more users at higher data rates while lowering cost per bit for operators.

Figure 1. Economic benefits of Licensed 6GHz mobile allocation as a proportion of expected GDP in 2035. Source: GSMA Intelligence

What "U6GHz 256TRX Giga-MIMO" actually means

U6GHz — the Upper 6 GHz spectrum (3GPP band n104, 6425–7125 MHz). The e& UAE allocation is 6425–6775 MHz, offering up to 350 MHz of contiguous bandwidth.

Giga-MIMO / 256TRX — an antenna with 256 transceivers versus 64 transceivers in standard 5G. More transceivers mean sharper, more precise beams that focus energy exactly where users are, compensating for the higher frequency.

The combined effect — higher capacity, more accurate beamforming, better interference control, and coverage comparable to existing 3.5 GHz C-band sites.

2. A Layered Spectrum Strategy

Every spectrum band plays a distinct role within a mobile network.

Low-band spectrum provides wide-area coverage but limited capacity. Traditional mid-band spectrum delivers a balance between coverage and throughput. Millimeter-wave spectrum provides very high capacity but often requires dense site deployments and dedicated coverage planning.

Upper 6 GHz occupies a unique middle ground. It offers significantly larger contiguous bandwidth than traditional mobile bands while retaining propagation characteristics that allow deployment on existing macro-cell infrastructure. Combined with advances in massive-MIMO and Extremely Large Antenna Array (ELAA) technologies, Upper 6 GHz enables operators to unlock substantial capacity gains without adopting the dense deployment model typically associated with millimeter-wave networks.

This combination of bandwidth availability, coverage performance, infrastructure reuse, and ecosystem scalability is what distinguishes Upper 6 GHz from alternative spectrum expansion options and underpins its growing importance in future mobile-network evolution.

U6GHz is not a replacement for existing bands — it is a new layer added on top of them. A modern operator runs several frequency layers at once, each with a distinct role. This is also the essence of multi-band network design, where different spectrum layers are combined to deliver the right balance of coverage, capacity, and user experience. Low bands (600–900 MHz) provide ubiquitous coverage and the in-building base; mid bands (1.8–2.6 GHz) add wide-area performance; 3.5 GHz is today's mainstream 5G coverage-and-capacity anchor. U6GHz now sits at the top as a super-capacity layer, absorbing the heaviest traffic while the lower layers continue to do their jobs.

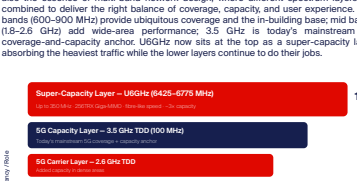
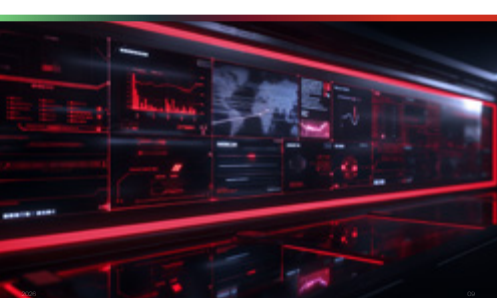


Figure 2. The layered spectrum strategy. U6GHz is added as a super-capacity layer on top of existing bands — not instead of them.

This layering is what makes the economics work. By steering the most demanding traffic – such as fixed-wireless and heavy data users – onto the wide U6GHz layer, the operator **frees up the 3.5 GHz and 2.6 GHz layers** for everyone else, improving the experience across the whole network. It is a strategy of user and service stratification: the right traffic on the right layer, dynamically.

Figure 3. The UAE collaboration model – industry, regulator, and academia aligned around a single national objective.



3. A Model of Collaboration: Industry, Regulator, Academia

World firsts are rarely the work of a single organization. The U6GHz milestone reflects a deliberate alignment of forces that often operate in isolation — a national operator, the regulator, and two leading universities — whose coordination is itself a competitive advantage for the UAE.

Partner	Role	Contribution
TDRA	Regulator	National 6G roadmap, spectrum strategy for the Golden Band, and the "10 Giga intelligent nation" vision.
e& UAE	Industry	Commercial deployment, network engineering, and real-world operation of the first U6GHz Giga-MIMO network.
Khalifa University	Academia	Engineering analysis, link-budget modeling, and peer-reviewed validation of coverage and capacity.
NYU Abu Dhabi (NYUAD)	Academia	Advanced channel modeling, MU-MIMO and ELAA analysis, and wireless–systems research (NYUAD Wireless Center).

The UAE's leadership in Upper 6 GHz began well before commercial deployment. During the preparatory studies leading to the **World Radiocommunication Conference 2023 (WRC-23), the Telecommunications and Digital Government Regulatory Authority (TDRA)**, leading the UAE National Team together with national stakeholders — including e& UAE — played an active role in regional and international discussions shaping the future of upper mid-band spectrum for International Mobile Telecommunications (IMT).

The outcomes of WRC-23, reflected in **ITU-R Resolution 220 (WRC-23)**, marked a pivotal milestone by recognizing the **6425–7125 MHz** frequency range for future IMT development and establishing the technical basis for continued international harmonization. Critically, WRC-23 did more than study the band: through footnote 5.457E of the Radio Regulations it **identified** 6425–7125 MHz for the terrestrial component of IMT throughout ITU Region 1, which includes the UAE. That identification is already in force, and it is what allows the UAE to license and deploy the band today rather than wait for a future world conference. The Upper 6 GHz band offers a unique combination of wide contiguous bandwidth, macro-cell coverage, and viable indoor performance, making it one of the most strategically important spectrum resources for the evolution of **5G-Advanced** and future **6G** network.

While many administrations entered the WRC-23 study cycle with differing positions on the future use of Upper 6 GHz, the UAE consistently recognized its strategic importance and adopted a clear long-term vision for the band. Building on this direction, TDRA became one of the first regulators globally to identify the entire **700 MHz Upper 6 GHz band** for IMT within the UAE National Frequency Plan, providing the certainty needed to accelerate ecosystem development, commercial investment, and large-scale deployment.

This early regulatory leadership created the foundation upon which industry, academia, and ecosystem partners could work together to transform international spectrum policy into commercial reality.

This white paper is one tangible output of that collaboration: the technical claims behind the deployment are not marketing assertions but the result of a rigorous, operator-oriented engineering study that quantifies exactly how U6GHz coverage and capacity compare against today's 5G.

It also builds on a growing body of UAE national 6G work. TDRA has set out the country's strategic 6G roadmap in "6G: Next-Generation Connectivity in the UAE". e& UAE and NYUAD have published the joint white paper "Building the Fabric of 6G: Spectrum Frontiers and Enabling Technologies" that highlights the strategic importance of layered spectrum strategy and multi-band network design. e& UAE and Khalifa University have jointly published "6G AI-Native Networks: Architecture, Intelligence, and the Path to Autonomous Connectivity," a blueprint for embedding intelligence into the 6G standard that feeds directly into ITU IMT-2030 and 3GPP Release 21+ discussions.

Together, these efforts position the UAE as an active contributor to how the world's next generation of connectivity is defined — and U6GHz is the spectrum layer that turns that vision into deployed reality.

"The Upper 6 GHz band is central to the UAE's 6G ambition. Having identified this spectrum for IMT ahead of the field, the TDRA is now working with industry and academia to turn that regulatory foundation into commercial reality, and to position the band as the platform for IMT-2030 in the UAE."

– TDRA Executive Director Spectrum Affairs

"The commercial deployment of U6GHz 256TRX Giga-MIMO is a major step in e& UAE's network evolution. It will enhance the 5G-Advanced experience for customers today while preparing the architecture needed for 6G."

– e& UAE CTO

4. The Engineering Story

Higher-frequency spectrum has always carried a reputation for poor coverage. Signals at U6GHz lose roughly 5.5 dB more power traveling through the air than signals at 3.5 GHz in free space, and somewhat more in dense, non-line-of-sight urban settings — a real, fixed penalty. The central question the joint study set out to answer was simple: can modern antenna technology fully offset that penalty? The answer is yes.

4.1 Four mechanisms that close the gap

The study isolates four compensating mechanisms, each derived from first principles:

- A bigger, smarter antenna (+8 dB). The 256-transceiver array focuses energy into a narrow, high-gain beam — about 33 dBi versus 25 dBi for standard 5G. This alone more than covers the 5.5 dB air-loss penalty; combined with cleaner interference below, the array delivers a total link-budget advantage of roughly 12–13 dB.
- Cleaner interference (+4 to 5 dB). Narrow beams (roughly 1.5° wide versus 6°) spill far less energy into neighboring cells, freeing up link budget that would otherwise be lost to interference.
- Signal boosting for cell discovery (+6 to 10 dB). The broadcast signal used to find and join the network can be selectively boosted, extending reach at the cell edge.
- Serving two users at once (MU-MIMO). Because beams are so narrow, the network can serve two spatially separated users on the same airwaves simultaneously — adding capacity without adding spectrum.

Together, the first three mechanisms restore coverage; the fourth multiplies capacity. The result is a band that behaves like a capacity powerhouse while keeping the footprint of today's network.

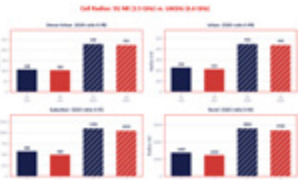


Figure 4. Cell radius across deployment types. U6GHz (red) tracks within a few percent of 5G C-band (blue) in outdoor scenarios — coverage parity despite the higher frequency.

4.2 Coverage holds — the numbers

Modeled across four real-world environments — dense urban, urban, suburban, and rural — the U6GHz cell stays remarkably close to the 5G cell in reach. Outdoors, where signals don't have to fight through walls, the coverage gap is just 2–5%. In the most demanding dense-urban indoor case, U6GHz reaches 105 m versus 108 m for 5G — within 3%.

Environment	5G reach	U6GHz reach	Coverage ratio
Dense urban (outdoor)	230 m	225 m	0.98
Urban (outdoor)	450 m	440 m	0.98
Suburban (outdoor)	1100 m	1050 m	0.95
Rural (outdoor)	2800 m	2700 m	0.96

Table 1. Outdoor coverage parity — U6GHz stays within 2–5% of 5G C-band reach across all environments.

4.3 The role of building materials

The single biggest factor in indoor coverage is not the air — it is the walls. Standard glass and wood are almost transparent to U6GHz signals (less than 1 dB of extra loss versus 3.5 GHz). Concrete is the challenge, adding meaningfully more loss at the higher frequency. This is excellent news for the UAE: the glass-and-steel construction that defines modern districts in Abu Dhabi and Dubai is close to ideal for U6GHz, allowing it to serve indoor users with little or no extra infrastructure.

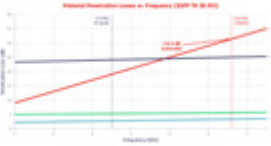


Figure 5. Penetration loss by material. Glass and wood barely change with frequency; concrete is the main consideration — making building-material mix a first-order planning input.

Why this favors the UAE

In glass-dominant markets like the UAE, the extra indoor penetration loss at U6GHz is only 1–2 dB. Combined with the antenna gain advantage, U6GHz can act as a full coverage-and-capacity layer co-sited with existing 5G — indoors and out — without supplementary indoor systems in most modern glass-dominant buildings, though selected areas may warrant an indoor system later to meet deep-coverage requirements.

5. The Payoff: More Capacity From the Same Sites

5.1 Engineering the Gain

Coverage parity is the enabler; capacity is the prize. It is important to be precise about where the capacity comes from, because two different effects are at work and they should not be conflated.

The first — and the one that holds regardless of how much spectrum an operator owns — is the gain from the radio system itself. On the same amount of spectrum, the 256TRX Giga-MIMO array raises cell-average spectral efficiency by about **1.5×** versus 5G. This breaks into two analytically-derived steps: a **+12.5% per-user gain** from the sharper, higher-quality ELAA beams (3.2 → 3.6 bps/Hz), followed by a **×1.35** gain from MU-MIMO pairing, where two spatially separated users share the same time–frequency resource on orthogonal beams (3.6 → 4.8 bps/Hz cell-average). This 1.5× is the honest, bandwidth-independent headline. It should be attributed to the Giga-MIMO radio system as a whole rather than to the antenna alone. The 256TRX aperture is what makes the narrow beams and the spatial separation between users possible, but the gain is realized only through the beamforming and precoding applied to that aperture, the MU-MIMO user-pairing and scheduling decisions, and the accuracy and freshness of the channel-state information those decisions rest on. Where channel information ages at speed, or where users cannot be cleanly separated, the achievable gain falls below the modeled figure. The 1.5× should therefore be read as a well-conditioned system result rather than an unconditional property of the array.

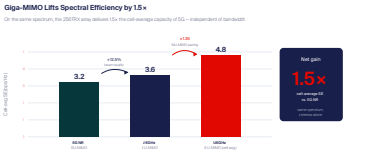


Figure 6. The spectral-efficiency gain from Giga-MIMO. On the same spectrum, sharper beams (+12.5%) and MU-MIMO pairing (×1.35) combine for a 1.5× cell-average lift — attributable to the Giga-MIMO radio system — array, beamforming, and MU-MIMO scheduling — not to bandwidth.

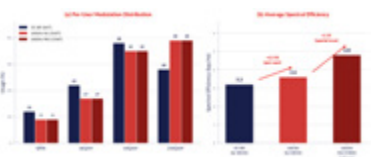


Figure 7. The same result from the study's modulation and spectral-efficiency analysis: 3.2 → 3.6 → 4.8 bps/Hz cell-average.

The second effect is bandwidth, and it depends entirely on the channel an operator deploys. Where U6GHz is configured with wider channels than the C-band layer it is compared against, the per-Hz gain above is multiplied by the bandwidth ratio. For the e& UAE deployment this is not hypothetical: its licensed allocation is 6425–6775 MHz, giving 350 MHz of contiguous spectrum against a 100 MHz C-band carrier. On that basis the 1.5× efficiency gain combines with a 3.5× bandwidth ratio to give about a 5.2× cell-average capacity uplift and, on the same basis, roughly 80% fewer sites to meet a given area-capacity target. The multiplier is a property of the bandwidth actually held, not of the band itself.

Configuration (study scenario)	□ ell-peak throughput	Subscribers per site	□ apacity gain
5G NR, 100 MHz (baseline)	1.2 Gbps	336	1× (baseline)
J6GHz, 100 MHz (SU-MIMO)	1.4 Gbps	—	1.1×
J6GHz, 350 MHz + MU-MIMO	5.3 Gbps	1,764	5.2×

Table 2. Cell-peak throughput for the e& UAE allocation (U6GHz 350 MHz vs. 5G 100 MHz). The 5.2× figure combines the bandwidth-independent 1.5× efficiency gain with the 3.5× bandwidth ratio of this specific allocation; the efficiency gain alone holds on any spectrum. These are cell-aggregate peak figures: MU-MIMO raises the total throughput a cell can deliver by serving paired users simultaneously, rather than the peak rate seen by any single user. Subscribers per site scale with cell capacity on the same basis.

Reading the numbers correctly

Always true (bandwidth-independent): ~1.5× cell-average spectral efficiency from the Giga-MIMO radio system (array, beamforming, and MU-MIMO scheduling) — the figure to lead with.
Scenario-dependent: the 5.2× capacity and 80%-fewer-sites results assume wider U6GHz channels than the C-band reference; the multiplier scales with the actual bandwidth ratio an operator deploys.

The strategic implication is clear either way. Because the efficiency gain is delivered by the radio rather than by new civil works, an operator can lift the capacity of an existing site simply by adding a U6GHz Giga-MIMO radio — and where wider U6GHz channels are available, that gain compounds with bandwidth. This is the opposite of the millimeter-wave model, which requires 3–5× more sites for comparable reach.

Independently corroborated

These findings align with the wider industry. Major-vendor system analyses reach the same conclusion: adding ~200 MHz of U6GHz spectrum to an existing macro deployment can **roughly triple downlink capacity on existing sites without densification**, with the larger antenna's beamforming gain compensating for the higher-frequency propagation. The capacity gains in this white paper are therefore consistent with independent third-party studies.

Figure 8. Throughput vs. distance (dense urban). The U6GHz 350 MHz curve (dashed) sits far above 5G everywhere, approaching multi-gigabit rates close in and roughly triple 5G at the cell edge.

5.2 Proving the Gain: Field Trial Results

Recognizing the strategic importance of the **Upper 6 GHz (U6GHz)** spectrum from the outset, **e& UAE** actively contributed to the studies and technical discussions. Moving beyond theoretical studies, e& pioneered early field validation to quantify the practical benefits of U6GHz, successfully completing the **Middle East and North Africa's (MENA) first Upper 6 GHz field trial in 2022** using vendor prototypes, before progressing to comprehensive testing of **pre-commercial solutions by 2025.**

These trials were completed using **pre-commercial solutions from the world's three leading telecommunications infrastructure vendors**. The primary objective was to maximize cell throughput using **Giga-MIMO Active Antenna Units (AAUs)** while benchmarking performance directly against the established **3.5 GHz** band. The trials evaluated how advanced antenna technologies enhance **Multi-User MIMO (MU-MIMO)** performance and high-precision beamforming to improve coverage. The results demonstrated that antenna evolution effectively compensates for the additional propagation loss associated with higher frequencies, bringing Upper **6 GHz coverage to a level closely comparable with the 3.5 GHz band.**

These trials achieved an **aggregated downlink throughput exceeding 10 Gbps** by aggregating multiple U6GHz-capable **Customer Premises Equipment (CPE)** devices and maximizing MU-MIMO performance through advanced antenna directivity. The results demonstrate the ability of Upper 6 GHz to significantly increase network capacity while enabling operators to support substantially more users in dense urban environments.

To validate real-world performance, e& conducted extensive field measurements using a prototype device powered by the commercial MediaTek M90 chipset, providing native support for the U6GHz band. The measurements confirmed that the real-world coverage profile of Upper 6 GHz closely matches that of today's **3.5 GHz** macro layer, demonstrating that the benefits of U6GHz extend beyond theoretical modeling and can be consistently achieved using commercially representative network infrastructure and devices.

6. The Complete Picture

A single comparison captures the full story across six dimensions — from the raw propagation penalty (panel a) through coverage and efficiency, to the business-case conclusion of dramatically fewer sites (panel f). U6GHz is not a marginal improvement on 5G; it is a qualitatively different network layer that trades a modest, fully-compensated coverage penalty for transformative capacity.

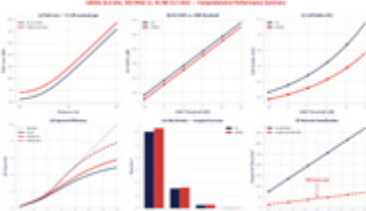


Figure 9. Comprehensive comparison of U6GHz versus 5G C-band (3.5 GHz) across six performance dimensions.

Key takeaways at a glance

Coverage. The 5.5 dB propagation penalty is fully offset by Giga-MIMO; outdoor coverage parity within 2–5%.
Capacity. ~1.5× cell-average spectral efficiency from Giga-MIMO on the same spectrum, compounding with bandwidth where wider U6GHz channels are deployed — with no new sites.
Resilience. Narrow beams cut interference by ~50%, so U6GHz cells degrade more gracefully under heavy load.
Economics. On e& UAE's 350 MHz allocation versus a 100 MHz C-band carrier, about 80% fewer sites are needed for the same capacity target — a highly efficient path to scaling.

7. The Operator Perspective

The figures in the previous sections matter because of the decisions they enable. For a network operator, U6GHz is not an abstract technology choice — it is a set of concrete levers across deployment strategy, capital spend, traffic management, and quality of experience. This section translates the engineering into the operator's playbook.

7.1 A capacity overlay, not a new network

The single most important deployment decision is also the simplest: U6GHz is best deployed as a capacity overlay co-sited with the existing C-band macro grid, not as a standalone network. Because coverage is at parity (Section 4), the U6GHz radio can be added to the antenna positions an operator already owns — reusing towers, power, transport, and site leases. The C-band layer remains the coverage anchor and the indoor fallback for the hardest concrete buildings; the U6GHz layer carries the bulk of the traffic with its far wider bandwidth.

This mirrors the proven multi-band playbook operators already run — a low-band coverage layer paired with higher-band capacity layers — and means U6GHz can be introduced incrementally, site by site, starting with the highest-traffic clusters, without re-architecting the network or disrupting existing services.

What an operator actually adds

Reused: tower and rooftop positions, civil works, power, fiber backhaul, site leases, and the C-band coverage anchor.

New: the 256TRX Giga-MIMO radio unit and, where needed, a backhaul upgrade to carry the higher peak throughput (multi-gigabit per cell on the 350 MHz allocation, approaching the 10 Gbps peak-throughput target with carrier aggregation across the full allocation).

7.2 The economics: fewer sites, lower cost-per-bit

Capacity growth has traditionally meant one of two expensive paths: densifying C-band by building more sites, or overlaying millimeter-wave at 3–5× the site density. U6GHz offers a third path that avoids both. The Giga-MIMO radio system raises spectral efficiency by ~1.5× on any spectrum, and where wider U6GHz channels are deployed that gain compounds with bandwidth: on e& UAE's 350 MHz allocation against a 100 MHz C-band reference, a U6GHz site delivers roughly five times the cell-average capacity, requiring about 80% fewer sites to meet the same area-capacity target.

The Operator Economics: Fewer Sites, More Capacity

Study scenario (U6GHz 200 MHz vs. C-band 100 MHz) to meet the same area-capacity target, U6GHz needs far fewer sites.

Figure 10. Three paths to the same area-capacity target. U6GHz reuses the existing grid, avoiding the site-acquisition cost of C-band densification and the dense small-cell burden of mmWave.

The cost implications compound across the budget. Site acquisition — often the slowest and most contested part of network expansion — is largely avoided. Because capacity scales with the U6GHz radio rather than with new civil works, the **cost-per-bit falls sharply**, and capacity can be turned up by widening the carrier (100 → 200 → 400 MHz) rather than by building. On the energy side, while a 256TRX array draws more power than a 64TRX unit, the capacity gain outpaces the power increase — yielding a net improvement in energy-per-bit, an increasingly important operating-cost and sustainability metric.

Capacity path	Relative sites	In-building	Time-to-deploy	Cost driver
C-band densification	~3×	Good	Slow	Site acquisition + civil works
mmWave overlay	~3–5×	Weak	Slow	Dense small-cell estate
U6GHz overlay	1×	Strong*	Fast	Radio unit on existing site

*Table 3. Comparing the three capacity-growth strategies. *In glass-dominant markets such as the UAE; concrete-heavy buildings retain the C-band anchor.*

7.3 Traffic steering and service stratification

The wide U6GHz layer is also a powerful traffic-management tool. By steering the heaviest users — particularly fixed-wireless access (FWA) homes and high-demand data users — onto U6GHz, the operator relieves load on the 2.6 and 3.5 GHz layers, improving the mobile experience for everyone else. This is service stratification: the right traffic on the right layer.

It is also a monetization lever. As multi-carrier devices mature, operators can build **differentiated experience tiers** — reserving higher carrier-aggregation tiers (and therefore higher peak speeds) for premium and VIP subscribers, while standard users are served on fewer carriers. The network can enforce this either through device capability or through base-station control, allowing the operator to package experience — not just data allowance — as a product. High-value users, high-value services (video, gaming, live), and high-value scenarios (events, transport hubs) can each be assured the experience they are paying for.

7.4 Loading resilience: a dimensioning advantage

A subtle but operationally significant benefit is how gracefully U6GHz cells behave under load. The narrow Giga-MIMO beams cut inter-cell interference by roughly 50% at every loading level, which means the link budget erodes far less as the cell fills up.

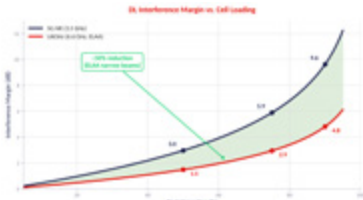


Figure 11. Interference margin vs. cell loading. The U6GHz curve (red) sits at roughly half the 5G value across all loading levels — preserving coverage headroom under heavy traffic.

In practical terms, a U6GHz cell loses only about 9% of its radius from unloaded to fully loaded, versus roughly 14% for a 5G C-band cell. This lets operators dimension cells at a higher target load (for example 80% rather than 70%) with smaller coverage-degradation margins — squeezing more usable capacity from each site — and makes the network more robust to traffic spikes from stadiums, concerts, and transport hubs, where a single cell can momentarily surge to near-full load.

7.5 Key dependencies to manage

An honest operator view also names the dependencies. None is a blocker, but each should be tracked through the rollout:

- **Device power class.** The uplink coverage parity assumes a higher UE transmit power class (Power Class 1). If devices are limited to the lower class, dense-urban indoor reach shrinks meaningfully — so device power class should be tracked as a key requirement in procurement and standards.
- **Carrier-component maturity.** The full speed and stratification benefits depend on devices that aggregate multiple carriers; clear, early commercial-use requirements to chipset and device vendors accelerate this (Section 9).
- **Building material in concrete-heavy areas.** Glass-dominant districts are ideal; concrete-heavy buildings retain the C-band anchor and may need selective indoor solutions. U6GHz is still deployed across these areas to provide continuous outdoor and shallow-indoor coverage, with indoor systems added later where deep coverage is required. A building material survey should be a first-order planning input.
- **Backhaul.** Multi-gigabit per-site throughput requires fiber backhaul; transport upgrades may need to run in parallel with the radio rollout. The UAE proudly maintains the world's highest FTTH (Fiber-to-the-Home) penetration for the 11th consecutive year, as ranked by the FTTH Council Europe, with a 99.7% penetration rate.

7.6 A market-by-market planning playbook

Because building material is the dominant indoor variable, the optimal deployment posture differs by market type. The study distills this into three deployment profiles operators can apply directly:

Market profile	Indoor penalty	Recommended posture	Design load
Glass-dominant (UAE, modern CBDs)	+1–2 dB	Full coverage + capacity overlay; no extra indoor systems	80%
Mixed glass/concrete	+3–4 dB	Strong outdoor + glass-building; selective indoor cells for concrete	75%
Concrete-dominant	+5 dB	Outdoor/glass capacity layer; C-band remains indoor anchor	70%

Table 4. Deployment profiles by market type. The UAE's glass-dominant urban fabric places it in the most favorable category.

The operator takeaway

U6GHz lets an operator **add capacity by adding a radio, not a tower** — a ~1.5× spectral-efficiency gain from Giga-MIMO on any spectrum, compounding with bandwidth where wider channels are deployed, plus comparable coverage, better loading resilience, and a built-in lever to steer traffic and monetize premium experience. For the UAE's glass-dominant cities, it is close to an ideal capacity layer, deployable today on the existing grid.

8. What U6GHz Unlocks: Use Cases

Capacity at this scale is a means to an end — the services that define a leading digital economy. The use case roadmap unfolds in two phases: in 2026, U6GHz delivers giga-connectivity to homes, enterprises, and consumers; from 2027, it becomes the platform for intelligent, AI-native applications everywhere. The cases below are organized around three domains: Connect Home, Connect Industry, and Connect Consumer & Vehicle.

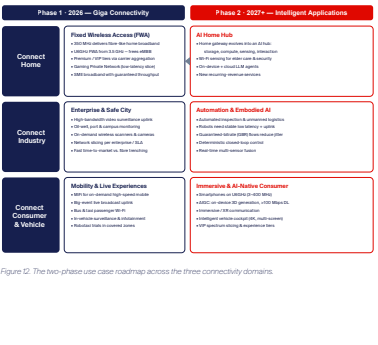


Figure 12. The two-phase use case roadmap across the three connectivity domains.

8.1 Connect Home

Home broadband is the most immediate and highest-value U6GHz opportunity. With 350 MHz of bandwidth and Giga-MIMO, fixed wireless access (FWA) finally delivers a genuine fiber-like experience over the air — to complement the fiber connectivity.

Fixed Wireless Access — fiber-like, wireless

The fastest path to premium home broadband.

- **Giga speeds at home.** U6GHz CPEs deliver multi-gigabit downlink, turning FWA into a true fiber alternative for new homes, rented and nomadic households, and second properties.
- **Traffic offload that lifts everyone.** Steering FWA users onto U6GHz removes their load from the 2.6 and 3.5 GHz layers — so mobile (eMBB) users on those layers get a faster, less congested experience too.
- **Premium and VIP tiers.** As multi-carrier devices mature, operators can offer differentiated packages — higher carrier-aggregation tiers for VIP users, standard tiers for others — monetizing experience, not just data volume.
- **Low-latency gaming.** A dedicated gaming private-network slice over U6GHz gives serious gamers guaranteed responsiveness.

The AI Hub — the gateway becomes a platform

From a connectivity box to the revenue center of the AI at home.

- **More than connectivity.** The home gateway evolves into an AI hub that combines storage, computing, sensing, and interaction — a foundation for new recurring-revenue services.
- **Wi-Fi sensing.** The same radio that carries data can sense presence and motion — enabling whole-home intrusion monitoring and care for elderly people living alone, without cameras.
- **On-device AI agents.** Local and cloud language models power natural-language interaction, home data management, and emotional-companionship agents — keeping family data private at the edge.

SME Broadband — enterprise-grade, fast to deploy

Bringing Enterprise-level reliability to small and medium businesses.

- **Fast time-to-market.** A wireless CPE can light up a shop or office in days, not the weeks or months a fiber dig requires — ideal for street-side retail and pop-up locations.
- **Dual-APN and slicing.** Separate secure and public service profiles (for example, payment terminals versus guest Wi-Fi) with guaranteed-throughput slices per business.
- **Hybrid resilience.** U6GHz FWA as an active layer or backup alongside fixed lines raises uptime and can roughly double small-shop ARPU through bundled CCTV, payment, and cloud services.

8.2 Connect Industry

Enterprises and public agencies increasingly depend on high-bandwidth uplink and deterministic performance — needs that U6GHz, with its large bandwidth and Giga-MIMO uplink capability, is well placed to serve.

Safe City & Enterprise Video

Large-bandwidth uplink for an explosion of cameras and sensors.

- **Surveillance at scale.** Public-safety and operational monitoring — traffic intersections, ports, campuses, oil-well sites — generate heavy uplink video that U6GHz's large bandwidth absorbs comfortably.
- **On-demand industrial devices.** Wireless scanners and cameras can be deployed where and when needed, without cabling.
- **Per-enterprise slicing.** Dedicated network slices give each enterprise its own assured performance and security posture.

Automation & Embodied Intelligence

The connectivity backbone for robots and autonomous systems.

- **A fast-growing market.** Embodied intelligence — robots that sense and act in the physical world — is moving rapidly from pilots into commercial use across inspection, logistics, security, and fire patrol.
- **Deterministic, low-latency links.** Robots need a quick, reliable, closed-loop connection. Guaranteed-bitrate flows reduce jitter and hold latency stable, which is what makes real-time control and obstacle avoidance safe.
- **Uplink-heavy and sensor-rich.** Multi-sensor fusion (vision, radar, positioning) demands sustained uplink — again playing to U6GHz's bandwidth strength.

8.3 Connect Consumer & Vehicle

As U6GHz smartphones and modules arrive, the band extends from fixed and enterprise use into mobile and in-vehicle experiences — the domain of immersive media, AI-generated content, and the connected car.

Immersive & AI-Native Consumer

When the phone joins the Golden Band.

- **Smartphones on U6GHz.** With 300–400 MHz available to a handset, U6GHz brings fiber-class mobile speed to flagship devices as the ecosystem matures.
- **AI-generated 3D and XR.** On-device 3D content generation and immersive communication need sustained downlink above 100 Mbps with second-level interactivity — a profile U6GHz serves naturally.
- **Experience tiers.** VIP spectrum slicing lets operators guarantee a premium experience for high-value users and high-value moments.

Connected & Intelligent Vehicles

Cars are becoming large, always-on terminals.

- **The intelligent cockpit.** Multi-screen displays, 4K projection, mobile cinema, and in-car gaming turn connectivity into a core differentiator for modern vehicles.
- **Passenger Wi-Fi for fleets.** U6GHz provides high-capacity access for bus and taxi passengers, with unified authentication for security and reliability — and a new advertising and services channel for operators.
- **Mobility & live events.** On-demand MiFi, big-event live-broadcast uplink, and robotaxi trials in covered zones all benefit from the capacity layer.

9. An Ecosystem That Is Ready Now

The industry's momentum behind Upper 6 GHz extends well beyond individual technology developments. Across multiple regions, regulators, operators, equipment vendors, chipset manufacturers, and standards organizations increasingly recognize that future mobile networks will require additional harmonized upper mid-band spectrum to sustain long-term traffic growth and enable the transition toward AI-native communications.

This momentum reflects more than spectrum availability alone. Global harmonization has historically accelerated mobile innovation by creating economies of scale, reducing device costs, simplifying international roaming, and enabling faster commercialization of new technologies. Upper 6 GHz presents one of the most significant remaining opportunities to achieve these benefits while providing the capacity required for future IMT-2030 systems.

The UAE's commercial deployment therefore represents more than a national milestone. It provides an early operational proof point for the global ecosystem, demonstrating that Upper 6 GHz has progressed beyond technical feasibility into commercial readiness. The world-first deployment is only credible if the whole value chain is ready — not just the network. The U6GHz ecosystem has moved decisively from trials to commercial readiness across every layer, from spectrum and standards through chipsets, devices, and radios.

An End-to-End Ecosystem That Is Ready Now

From spectrum harmonization through chipsets, devices and radios — the building blocks for commercial U6GHz are in place.

Figure 13: The end-to-end U6GHz ecosystem — spectrum, standards, chipsets, devices, and network — is commercially ready.

The industry's confidence is increasingly reflected in coordinated actions across the ecosystem. At the 2026 Mobile World Congress, the GSMA and major industry partners issued a U6GHz readiness statement affirming that **the mobile industry is ready to provide equipment so that Upper 6 GHz can deliver the critical capacity needed for growing data demand.** This commitment was further reinforced at MWC Shanghai 2026, where the GSMA and a broad coalition of ecosystem partners, including e&, co-signed the **"Upper 6 GHz Readiness and the Future of Mobile"** statement, reaffirming global industry readiness and calling for timely spectrum assignments to accelerate commercial deployment of Upper 6 GHz networks. More than 60 mobile operators, network-equipment vendors, chipset providers, and device manufacturers have already signed the statement, demonstrating strong industry confidence that the ecosystem is ready to support commercial deployments. Multiple silicon vendors now offer U6GHz chipsets with carrier-aggregation support; commercial CPEs are shipping at multi-gigabit speeds; smartphone prototypes are in test; and commercial-grade 256TRX Giga-MIMO radios with 1,536 antenna elements, 30+ dBi gain, and up to 400 MHz of bandwidth are available.

9.1 Accelerating the device curve

The one dependency that determines how fast customers feel the full benefit is device capability — specifically, how many carrier components (chunks of bandwidth) a device can combine at once. The hardware exists; what accelerates it into customers' hands is clear, early commercial-use requirements from operators to chipset and device makers. This is exactly the kind of demand signal the UAE deployment provides, and it shortens the time-to-market for higher-tier CPEs and smartphones.

The TDRA plans to include U6GHz (n104) band requirements in the "Telecommunication Equipment Type Approval Specifications," encouraging terminal devices such as smartphones and CPEs — particularly high-end devices — to support the U6GHz (n104) band. This requirement also encourages devices to support U6GHz (n104) carrier aggregation with the existing bands in the UAE, for a total bandwidth of 300–400 MHz.

The UAE's role in maturing the ecosystem

By committing to commercial deployment ahead of the field, the UAE does more than serve its own customers — it sends a **demand signal** that pulls the global device and chipset ecosystem forward, helping make U6GHz devices available sooner and at scale everywhere.

10. The Commercial Roadmap

The UAE deployment follows a clear path through 2026, from planning and site survey to a commercial launch in the second half of the year, with commercial device availability from September 2026.

Road to Commercial Launch — 2026

Figure 14. The 2026 path to commercial launch.

Beyond 2026, U6GHz sits on a longer evolutionary path toward **IMT-2030 and 6G**. Crucially, this is not a bet on a future decision. WRC-23 already identified 6425–7125 MHz for the terrestrial component of IMT across ITU Region 1, which includes the UAE, under footnote 5.457E and the technical conditions of Resolution 220 (WRC-23). The regulatory foundation for U6GHz is therefore in place today, giving the band a harmonized footprint that spans a large majority of the world's population. The 7.125–8.4 GHz range, immediately above U6GHz, remains a study item under Resolution 256 (WRC-23) and is on the agenda for possible IMT identification at WRC-27 in 2027; any outcome there would be additive, extending the upper mid-band rather than replacing the band already identified. In parallel, 3GPP has set the Release 21 functional freeze for December 2028, with the first commercial 6G systems expected from around 2030. U6GHz therefore carries 5G-Advanced traffic now and becomes a native 6G capacity layer as IMT-2030 equipment arrives — the same band, the same grid, the same sites. By establishing commercial operation now, the UAE is helping to define the future rather than waiting for it, with a live network that informs standards and gives its customers a multi-year head start.

Horizon	Milestone	What it delivers
Today	5G-Advanced + U6GHz (IMT-identified, WRC-23)	Enhanced experience, multi-fold capacity headroom
H2 2026	Commercial U6GHz launch	World-first live Golden-Band network
2027	WRC-27 spectrum decision	Possible IMT identification of 7.125–8.4 GHz — complementary to U6GHz, already identified
2030+	IMT-2030 / 6G	AI-native, sensing-capable 6G services

10.1 U6GHz as the Candidate Band for IMT-2030

As the industry converges on IMT-2030, attention has turned to which upper mid-band spectrum will carry 6G. For the UAE and the wider ITU Region 1, the question is already substantially settled. U6GHz is the only upper mid-band spectrum that is identified for IMT today, harmonized regionally today, and supported by commercial-grade equipment today. Every other candidate under discussion depends on a decision that has not yet been taken.

Regulatory certainty already exists: WRC-23 identified 6425–7125 MHz for the terrestrial component of IMT throughout Region 1 under footnote 5.457E, with the technical and protection conditions set out in Resolution 220 (WRC-23). No further world-conference decision is required for an administration in Region 1 to license and deploy the band. The 7.125–8.4 GHz range, by contrast, is a study item: WRC-27 will consider whether to identify it for IMT, on a regional or global basis, and that outcome will not be known until the conference concludes in late 2027. Building a national 6G plan on a band that is already identified is a matter of prudence rather than preference.

Incumbent protection is a first-order consideration: Upper mid-band spectrum is attractive to mobile precisely because it is attractive to everyone else. The bands above 7.125 GHz host dense fixed-satellite, earth-exploration, meteorological, space-research, and other critical services, and the administrations proposing them acknowledge that these incumbents must be protected. Where such services are nationally significant — as they are in the UAE — the practical path to clearing or sharing that spectrum is longer and less certain than for a band where the sharing framework has already been negotiated and codified. Resolution 220 (WRC-23) gives U6GHz that framework now, including the agreed e.i.r.p. conditions that protect fixed-satellite reception.

Different starting points explain different positions: National positions on upper mid-band spectrum are shaped by decisions already taken at home. Markets that assigned the entire 6 GHz range to license-exempt use have no licensed capacity remaining in the band, and their interest naturally moves higher up the spectrum. Markets that retained the upper 6 GHz for licensed mobile, as the UAE did, can act on the identification that already exists. Neither approach is wrong in the abstract; each follows from prior national policy. What matters for the UAE is that its own choice preserves both options: Wi-Fi continues to operate in the lower 6 GHz (5925–6425 MHz), while licensed mobile uses the upper 6 GHz, so the two technologies evolve side by side rather than at each other's expense.

The timeline fits, not conflicts: 3GPP has fixed the Release 21 functional freeze at December 2028, with final code freeze in March 2029 and the first commercial 6G systems expected from around 2030. Today's U6GHz deployment is therefore a 5G-Advanced network by design, and deliberately so: it establishes the spectrum, the sites, the antenna technology, and the device ecosystem that 6G will inherit. When IMT-2030 equipment arrives at the end of the decade, the band, the grid, and the radios are already in place, and the transition is a software and device-generation step rather than a new spectrum campaign. Limited deployment now is not a hedge against 6G — it is how a market arrives at 6G early.

Complementary, not competing: None of this argues against the higher ranges. If WRC-27 identifies 7.125–8.4 GHz, that spectrum would extend the upper mid-band and add capacity on top of U6GHz, much as U6GHz today adds capacity on top of 3.5 GHz. The layered logic of Section 2 applies to spectrum policy as much as to network design. The UAE's position is simply that the layer which is identified, harmonized, and commercially proven should be the foundation on which IMT-2030 is built, and that later additions should be evaluated on their own merits when the studies are complete.

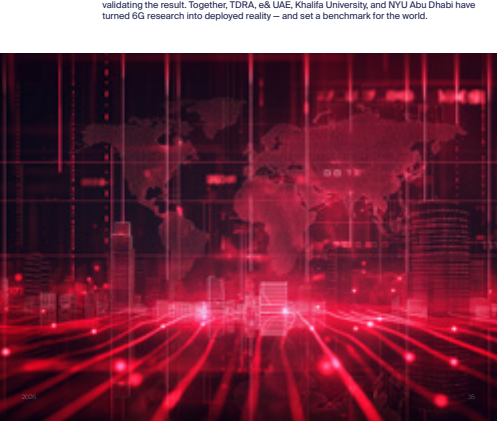
A role model for the world

The UAE's U6GHz milestone shows what is possible when a regulator sets a clear roadmap, an operator invests ahead of the curve, and a university grounds the ambition in rigorous engineering. The result is a **repeatable model** — not just a network — that other markets can learn from as the industry moves toward 6G.

11. Conclusion

The Upper 6 GHz band has long been described as the Golden Band for 6G. The UAE has now proven it is golden in practice, not just in theory — deploying the world's first commercial U6GHz 256TRX Giga-MIMO network and demonstrating, with peer-reviewed engineering, that it delivers fiber-like speed and about 1.5× the spectral efficiency of today's 5G on the same spectrum — a gain from the Giga-MIMO radio system rather than from bandwidth — while keeping comparable coverage and reusing existing sites. It has done so in a band that WRC-23 already identified for IMT across Region 1 — which is why U6GHz is not only today's capacity layer but the strongest candidate to carry IMT-2030 in this region: identified, harmonized, and commercially proven ahead of the 6G standard itself.

Just as importantly, the use cases are real and the ecosystem is ready — from fiber-like home broadband and enterprise video to the AI home, connected vehicles, and the intelligent applications of the 6G era. This is what national digital leadership looks like: a regulator charting the course, an operator with the conviction to build first, and academia validating the result. Together, TDRA, e& UAE, Khalifa University, and NYU Abu Dhabi have turned 6G research into deployed reality — and set a benchmark for the world.



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The findings and context in this white paper draw on the joint TDRA, e& UAE – Khalifa University, NYU Abu Dhabi engineering study, e& UAE's commercial announcements, and the work of international standards and regulatory bodies (ITU, 3GPP) and the GSMA. Key sources are listed below by category.

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