

Spectrum Licensing Policy Section
Australian Communications and Media Authority
PO Box 78
Belconnen ACT 2616

Re: Tarana Wireless response to Automatic Frequency Coordination-assisted spectrum sharing in the 6 GHz band Discussion paper

Dear Sir/Madam

Tarana Wireless, Inc. ("Tarana") is a U.S. company whose mission is to accelerate the deployment of fast, affordable internet access around the world. Through more than \$400M of R&D investment over a decade, Tarana has created a unique Next Generation Fixed Wireless Access ("ngFWA") technology. The core innovation relies on novel, antenna-array enabled radio architectures and unique spatial processing and interference cancellation methodologies, with a focus on delivering a) extended range and high non-line-of-sight (NLoS) performance, b) very high spectral efficiency at the link, sector, tower and network level, and c) highly reliable service even in high interference environments.

Tarana Wireless appreciates the opportunity to provide its comments to the Australian Communications and Media Authority of Australia's ("ACMA") 'Views on 6 GHz band spectrum sharing for Automatic Frequency Coordination' Public Consultation and is looking forward to the success of the 6 GHz Standard Power operation with AFC in Australia.

Sincerely,

Sergiu Nedevschi
CSO & Co-Founder
Tarana Wireless, Inc.

1. Do you support the adoption of an AFC framework in Australia to enable outdoor standard-power operation in the 6 GHz band? What are the key benefits and concerns? In particular, who would the main beneficiaries be, and what would be the implications for consumers in the telecommunications market?

Yes. We strongly support the adoption of an Automated Frequency Coordination (AFC) framework in Australia to enable outdoor standard-power operation in the 6 GHz band.

AFC is an established and effective mechanism for enabling higher-power unlicensed operation while protecting incumbent services through deterministic, location-aware coordination. It has been adopted or is in the process of being adopted in multiple jurisdictions, including by the Federal Communications Commission in the United States, Innovation, Science and Economic Development Canada, and, more recently, Ofcom in the United Kingdom. This growing international experience demonstrates that AFC is a mature and scalable approach that provides regulatory certainty while enabling efficient use of mid-band spectrum.

The principal beneficiaries of AFC-enabled standard-power operation would be consumers, communities, and broadband service providers across urban, suburban, and regional Australia. In particular, AFC would support the deployment of high-performance fixed wireless broadband services by a wide range of providers, increasing competition and improving service quality. Standard-power unlicensed operation can complement both the National Broadband Network and licensed mobile network investments by enabling cost-effective fixed broadband offerings, particularly in underserved or hard-to-reach areas.

For consumers, these outcomes translate into greater choice, improved broadband performance, and increased competitive pressure in the telecommunications market. While implementation details such as database governance and compliance require careful consideration, these challenges are well understood and have been successfully addressed in other jurisdictions. Overall, the benefits of adopting an AFC framework to enable standard-power 6 GHz operation substantially outweigh the associated risks, and AFC represents an appropriate and forward-looking regulatory approach for Australia.

2. How might AFC change the way WISPs and other communications service providers operate, particularly in terms of supporting greater spectrum efficiency or service innovation?

An AFC framework would materially change how WISPs and other communications service providers operate by enabling more predictable, higher-power outdoor use of the 6 GHz band, thereby supporting significantly greater spectrum efficiency and service innovation.

By providing deterministic, location-aware coordination, AFC allows service providers to move away from conservative, low-power designs driven by uncertainty around incumbent protection. This enables the deployment of highly directional antennas, wider channels, and advanced radio techniques such as MU-MIMO, spatial multiplexing, and interference cancellation. The result is higher capacity per site, improved reliability, and more efficient spatial reuse of spectrum compared to low-power or indoor-only operation.

AFC would also accelerate the adoption of **new high-performance fixed wireless access (FWA) technologies** emerging in the unlicensed ecosystem. These include both standards-based solutions (such as advanced Wi-Fi platforms adapted for outdoor fixed broadband use) and proprietary systems specifically optimized for fixed wireless operation in unlicensed bands. Examples include next-generation fixed wireless architectures that combine beamforming, spatial interference sensing, and adaptive nulling — such as the ngFWA (Next Generation Fixed Wireless Access) solutions developed by Tarana — which are designed to deliver fiber-like performance in challenging interference environments.

For WISPs in particular, AFC would support more scalable and resilient network architectures, enabling operators to serve more customers per access point and extend coverage with fewer sites. This improves deployment economics, especially in regional and rural areas, and allows providers to offer higher-performance broadband services that were previously difficult to achieve using unlicensed spectrum.

More broadly, AFC would support service innovation by giving providers the confidence to invest in advanced fixed wireless offerings, hybrid access models, and complementary services alongside fiber and mobile networks. By enabling efficient

standard-power use of the 6 GHz band, AFC supports innovation not only in radio technology but also in broadband service delivery, ultimately benefiting consumers through improved performance, greater choice, and stronger competition.

3. Are there any alternatives to AFC that could support dynamic and efficient frequency assignments in the 6 GHz band?

Tarana believes that Automated Frequency Coordination (AFC) is the most efficient, mature, and practical approach for supporting dynamic and efficient frequency assignment for standard-power operation in the 6 GHz band.

Alternative approaches, such as static exclusion zones, tower height limitations, or uniformly lower power limits, can provide a baseline level of protection for incumbents but are significantly inferior in terms of spectrum efficiency and flexibility. These static measures tend to be overly conservative, limiting capacity and coverage even in locations where higher power operation could safely be permitted.

In contrast, AFC enables location-aware, dynamic coordination that maximizes the use of available spectrum while providing predictable incumbent protection. As a result, AFC offers a more scalable and future-proof framework than static regulatory constraints and is better suited to supporting innovation and efficient spectrum use in the 6 GHz band.

4. Would established models in other jurisdictions, such as the US and Canada, or aspects of these models, be appropriate for the Australian radiocommunications environment?

Yes. Established models in other jurisdictions, particularly the United States and Canada, provide a strong and appropriate reference point for the Australian radiocommunications environment, subject to local adaptation.

Both jurisdictions have adopted Automated Frequency Coordination (AFC) frameworks to enable standard-power operation in the 6 GHz band while protecting incumbent services. These frameworks demonstrate that database-driven, location-

aware coordination can be implemented at a national scale and can support efficient spectrum use across a wide range of deployment scenarios. The experience of the Federal Communications Commission and Innovation, Science and Economic Development Canada provides valuable practical guidance for Australia.

Importantly, these international models distinguish between different device classes. In both the United States and Canada, **listen-before-talk (LBT)** requirements apply to very low power (VLP) and low power indoor (LPI) devices, where short-range, contention-based operation is expected. In contrast, LBT is **not required** for standard-power access points and fixed client devices operating under AFC control. This reflects a recognition that LBT is poorly suited to long-range, highly directional, and centrally scheduled systems, and that its application to standard-power fixed wireless would be detrimental to performance and spectrum efficiency.

While Australia's incumbent landscape and regulatory settings differ in detail, the core principles underlying these approaches — differentiated rules by power class, deterministic incumbent protection via AFC, and avoidance of unnecessary constraints on standard-power operation — are directly applicable. Adopting a similar framework, with parameters tailored to Australian conditions, would allow ACMA to leverage proven international practice while addressing local requirements. Further discussion of the technical limitations of LBT for standard-power 6 GHz operation is provided in the accompanying Appendix.

5. How much spectrum should be made available under AFC, and what bandwidths should be allocated to support individual AFC service offerings? Should part or all of the 6 GHz spectrum available for RLAN use be made available for AFC-enabled access by standard power devices, or is there a case for arrangements supporting a range of power levels above VLP/LPI and below/including standard power?

The entire 6 GHz band made available for RLAN use should be eligible for AFC-enabled access by standard-power devices. Limiting the AFC to only a subset of the band would unnecessarily constrain spectrum efficiency and reduce the overall public benefit that can be derived from this unique mid-band resource.

Supporting AFC across the full band enables the use of a wide range of **channel bandwidths, from 40 MHz up to 320 MHz**, which is critical for delivering higher speeds, increased network capacity, and efficient support for high-density deployments. Wide contiguous channels are particularly important for modern fixed wireless and advanced broadband services that rely on high spectral efficiency and predictable performance.

A tiered framework remains appropriate, with VLP and LPI operation continuing across the band for short-range and indoor use cases, **alongside standard-power operation under AFC** for outdoor and fixed deployments. This approach allows each device class to operate under coexistence mechanisms suited to its characteristics, rather than fragmenting the band or introducing artificial constraints.

Introducing additional intermediate power classes above VLP/LPI but below standard power is unlikely to provide material benefits relative to the added regulatory complexity. AFC-enabled standard-power operation already allows power levels to be dynamically tailored based on location and incumbent protection requirements, making it the most flexible and efficient mechanism.

Overall, enabling AFC-supported standard-power operation across the full 6 GHz band, with support for wide channel bandwidths, would maximize efficient spectrum use, enable high-performance broadband services, and align with proven international practice and the policy objectives of the Australian Communications and Media Authority.

6. What degrees of geographic and spectrum segmentation should be considered when planning for individual AFC system deployments? For example, would planning for localized, self-contained areas or multiple sub-bands foster competition in the market for the provision of AFC services, or would that come at too much of a cost to spectrum efficiency (through the need for guard bands/spaces)?

Geographic and spectrum segmentation for AFC system deployments should be kept to a minimum to maximize spectrum efficiency and preserve the benefits of wide, contiguous channel access in the 6 GHz band.

Fragmenting the band into multiple sub-bands or planning for localized, self-contained geographic AFC areas would introduce guard bands or coordination boundaries that reduce usable spectrum and constrain the availability of wide channel bandwidths. This would directly undermine key use cases for standard-power operation, including high-capacity fixed wireless and dense broadband deployments, which benefit from large contiguous channels.

Experience in other jurisdictions suggests that competition in the provision of AFC services is better supported through **multiple AFC operators accessing the same spectrum and geographic areas**, operating under common technical and governance rules, rather than through spectrum or geographic partitioning. This approach allows service providers to choose among AFC administrators while preserving full-spectrum flexibility for device operation.

Accordingly, AFC deployment models should prioritize nationwide or broadly consistent geographic coverage and access to the full AFC-enabled spectrum, avoiding unnecessary segmentation. This approach maximizes spectrum efficiency, supports advanced services, and enables competition among AFC service providers without imposing artificial constraints on spectrum use.

7. What are the respective roles and responsibilities for industry and government in realising an AFC regime? Should AFC be operated by the industry under government-set rules, or should the government play a more direct role in providing AFC services?

No Comments.

8. What role should databases such as the ACMA's RRL or other coordination mechanisms, such as those administered by the ACMA but used by accredited assigners, play in the process?

No Comments.

9. What is the need for, and potential structure of, a tiered access model for incorporating standard power RLAN devices in the 6 GHz band?

A tiered access model is both necessary and appropriate for incorporating standard-power RLAN devices in the 6 GHz band, as it allows different use cases to coexist under access conditions that reflect their distinct technical characteristics and interference potential.

At a minimum, the tiered model should distinguish between:

- **Very Low Power (VLP) and Low Power Indoor (LPI)** devices, which are suited to short-range, indoor, or personal-area use cases. These devices operate in dense, contention-based environments and appropriately rely on contention-based access protocols to manage coexistence; and
- **Standard-power devices**, which support outdoor and fixed deployments, and should operate under an Automated Frequency Coordination (AFC) framework to ensure deterministic protection of incumbent services.

This differentiated approach enables efficient spectrum use by applying the least restrictive rules necessary for low-risk, short-range devices, while allowing higher-power operation where it can be safely managed through location-aware coordination. Importantly, it avoids imposing contention-based access requirements on standard-power devices, for which such mechanisms are poorly suited and would materially degrade performance and spectrum efficiency. Further discussion of the technical limitations of contention-based protocols for standard-power operation is provided in the accompanying Appendix.

Overall, a clear two-tier framework — contention-based low-power operation without AFC, and AFC-enabled standard-power operation without mandatory contention-based protocols — reflects the very different propagation, range, and deployment characteristics involved and aligns with established international practice.

10. With respect to licensing, should individual AFC-coordinated devices be registered on the RRL or covered by broader system-wide licensing

arrangements, or are there other authorisation models that we should consider?

No Comments.

11. What processes and safeguards would need to be established to accredit, audit and ensure ongoing compliance of industry-led AFC operators? What type of rules should be imposed on prospective AFC operators and how should those rules be codified?

No Comments.

12. What technical or administrative features (e.g., real-time geolocation, exclusion zones, device registration, database accuracy and latency) will be critical to the successful implementation of AFC?

No Comments.

13. How should data integrity, ownership, and update mechanisms be managed in AFC systems? Are ACMA's existing systems (such as the RRL) sufficient, or would changes or new systems be required to support real-time coordination?

No Comments.

14. What is the expected market for the provision of AFC services in Australia?

No Comments.

15. What standards or other mandatory specifications should be prescribed to ensure AFC-enabled devices comply with operational rules (for example, GPS accuracy, firmware requirements, revalidation intervals)? What are the implications for manufacturers and operators?

Mandatory specifications for AFC-enabled devices should be limited, outcomes-focused, and aligned with established international frameworks. In particular, ACMA should recognize the specifications developed by the **Wireless Innovation Forum (WINNF)**, which are widely referenced internationally and have proven effective in supporting secure, interoperable AFC operation.

WINNF specifications already address key requirements such as device location accuracy, secure communication with AFC systems, firmware integrity, revalidation intervals, and fail-safe behavior. Leveraging these specifications would avoid unnecessary reinvention and promote consistency with global equipment ecosystems.

ACMA should also recognize standard-power unlicensed devices that are certified under **FCC Part 15 Subpart E** and **Innovation, Science and Economic Development Canada (ISED) RSS-248**, as these certification regimes already incorporate AFC-related operational and compliance requirements.

Aligning Australian requirements with these established standards would maximize additional cost and complexity for manufacturers and operators, accelerate the availability of compliant equipment, and support the efficient implementation of AFC-enabled standard-power operation in the 6 GHz band.

APPENDIX

Executive summary

Fixed wireless broadband is becoming an increasingly important use case for outdoor standard-power operation in unlicensed mid-band spectrum. Recent advances in beamforming, multi-user MIMO (MU-MIMO), spatial multiplexing, and interference cancellation have transformed fixed wireless access (FWA) from a niche solution into a high-performance broadband platform capable of delivering reliable, high-throughput services with very high spectral efficiency.

In this context, the introduction of mandatory listen-before-talk (LBT) requirements for standard-power operation in the 6 GHz band warrants careful consideration. LBT was originally developed for short-range, largely omnidirectional, contention-based systems. Its underlying assumptions do not align well with the characteristics of modern long-range, highly directional, and centrally scheduled fixed wireless systems — particularly point-to-multi-point (PtMP) architectures employing MU-MIMO.

In this Appendix we argue that mandating LBT for standard-power operation would materially reduce capacity, increase latency and deployment cost, impede spatial reuse, and ultimately limit the effectiveness of the 6 GHz band for broadband delivery. International experience, notably in the United States, indicates that a regulatory framework which does not impose LBT on standard-power outdoor fixed wireless has supported large-scale deployment of high-performance FWA services by Wireless Internet Service Providers (WISPs).

Importantly, alternative coexistence mechanisms are available that are better aligned with modern fixed wireless architectures, including Automated Frequency Coordination (AFC), regulatory encouragement of directional transmission, and advanced interference-aware beamforming techniques. These approaches can protect incumbents and other users while preserving the efficiency gains enabled by contemporary antenna and signal-processing technologies.

1. Fixed wireless broadband as a key use case for unlicensed standard-power spectrum

Fixed wireless access plays a significant and growing role in broadband delivery, particularly in suburban, regional, and rural areas where fiber deployment may be slow or uneconomic. Unlicensed spectrum has historically been important to this role because it enables:

- rapid deployment without the delays associated with exclusive licensing
- cost-effective scaling by small and medium-sized operators
- competitive market entry and ongoing innovation

Modern fixed wireless systems are no longer best-effort or low-capacity solutions. Using advanced antenna systems and centrally scheduled MAC architectures, they routinely deliver hundreds of megabits per second per sector with high reliability. These performance gains are enabled by:

- highly directional beamforming
- MU-MIMO and spatial multiplexing
- advanced interference suppression and cancellation
- coordinated and scheduled transmission rather than contention-based access

Outdoor standard-power operation in the 6 GHz band is particularly well suited to these techniques due to the availability of wide channels and favorable propagation characteristics relative to higher-frequency bands.

2. International experience without mandatory LBT

In the United States, unlicensed regulatory settings that do not mandate LBT for standard-power outdoor fixed wireless have supported the development of a substantial FWA ecosystem. Thousands of WISPs have deployed millions of fixed broadband connections using unlicensed spectrum and advanced directional technologies, particularly in underserved and rural areas.

This outcome reflects a regulatory approach that:

- recognizes the deterministic and scheduled nature of fixed wireless systems
- relies on coordination mechanisms (including AFC in the 6 GHz band) rather than local probabilistic carrier sensing
- allows operators to fully exploit beamforming and spatial reuse

The resulting improvements in broadband availability, cost efficiency, and competition are consistent with broader public-interest objectives relevant to spectrum policy.

3. Applicability of LBT assumptions to directional fixed wireless systems

LBT is based on the premise that a device can assess whether it is safe to transmit by sensing channel energy and deferring transmission if the channel appears busy. This model implicitly assumes:

- omnidirectional or near-omnidirectional radiation patterns
- short transmission ranges with relatively symmetric interference relationships
- a binary concept of channel occupancy

These assumptions do not hold for long-range fixed wireless systems. Directional antennas and beamforming create highly asymmetric and spatially selective interference footprints. In such environments, the presence or absence of detectable energy at the transmitter is often poorly correlated with whether harmful interference would occur at a distant receiver.

As a result, LBT can systematically produce both exposed-node behavior (unnecessary deferral of otherwise compatible transmissions) and hidden-node behavior (failure to prevent interference at the receiver).

4. Impact of LBT on reliability and latency

Fixed wireless networks are typically centrally scheduled and engineered to deliver predictable performance. Introducing LBT into these systems adds random backoff and deferral behavior that:

- disrupts scheduled transmissions
- increases latency and jitter
- undermines the ability to offer a consistent quality of service

These effects are particularly relevant for broadband access services, where stable throughput and latency are increasingly important for common applications such as video conferencing, cloud-based services, and interactive workloads.

5. Incompatibility between LBT and MU-MIMO spatial multiplexing

Modern PtMP fixed wireless systems rely heavily on MU-MIMO and spatial multiplexing to achieve high spectral efficiency. In these systems:

- Multiple independent data streams are transmitted simultaneously using the same time-frequency resources
- Streams are separated spatially through beamforming and/or precoding
- Channel occupancy is inherently spatial rather than binary

LBT cannot readily represent this spatial heterogeneity. A single energy-based sensing decision forces the channel to be treated as globally busy if any energy is detected, even where multiple beams could transmit concurrently without mutual interference. This leads to artificial serialization of transmissions and erosion of MU-MIMO capacity gains.

As the number of beams and served users increases, the likelihood that LBT blocks at least one beam — and consequently all beams — increases significantly, resulting in a substantial reduction in delivered capacity.

6. Economic and deployment impacts

By limiting spatial reuse, mandatory LBT can:

- reduce sector capacity
- lower per-user throughput
- require denser site deployments to achieve equivalent coverage

These effects increase the cost per connection and reduce the economic viability of fixed wireless deployments, particularly in regional and rural areas where FWA often provides the greatest marginal benefit.

7. Regulatory complexity and implementation uncertainty

Applying LBT to advanced multi-beam systems raises a number of unresolved implementation questions, including:

- How “listening” should be defined for transmitters with multiple simultaneous beams
- Which antenna patterns and gains apply during sensing
- How detection thresholds should be specified and tested across beams

These uncertainties increase certification complexity and regulatory risk for vendors and operators, potentially slowing innovation and deployment without delivering commensurate coexistence benefits.

8. Alternative coexistence mechanisms better aligned with modern systems

There are alternative coexistence approaches that are more compatible with standard-power fixed wireless operation than mandatory LBT:

a) Automated Frequency Coordination (AFC)

AFC provides deterministic, location-aware coordination by controlling permitted frequencies and power levels for standard-power devices. This enables predictable

protection of incumbents while allowing fixed wireless systems to operate continuously and efficiently within approved parameters, without undermining MU-MIMO or spatial reuse.

b) Encouragement of directional transmission

Regulatory settings that require conducted transmit power to be significantly lower than the radiated power effectively necessitate the use of directional antennas. This approach:

- discourages omnidirectional outdoor transmissions that create broad-area interference
- promotes spatial containment of emissions
- improves coexistence through natural beam isolation

Directional operation is inherently more spectrum-efficient and better suited to outdoor standard-power use than omnidirectional contention-based models.

c) Advanced interference-aware beamforming and nulling

Contemporary fixed wireless systems increasingly employ techniques such as retro-directive beamforming, spatial sensing, and adaptive nulling. These techniques allow radios to:

- detect the direction of arrival of interference
- dynamically place deep transmit nulls toward interferers
- protect other users while maintaining service to intended receivers

Commercial implementations, including those developed by Tarana, demonstrate that such approaches are practical and effective in unlicensed environments. These techniques address interference where it actually manifests — at the receiver — rather than relying on pre-transmission deferral based on incomplete local sensing.

Conclusion

Fixed wireless broadband is a proven and increasingly important use case for unlicensed standard-power spectrum, enabled by beamforming, MU-MIMO, and advanced spatial interference management. International experience suggests that regulatory frameworks which avoid mandatory LBT can support large-scale, high-quality broadband deployment using unlicensed spectrum.

Introducing mandatory LBT for standard-power operation, as proposed in the ACMA consultation framework, would apply a legacy contention-based access model that is poorly aligned with modern fixed wireless architectures. Such a requirement risks reducing spectral efficiency, degrading performance, increasing deployment costs, and limiting broadband availability. A regulatory approach that emphasizes deterministic, location-aware coordination, directional transmission, and advanced interference-management techniques would better align with contemporary multi-beam network design and spectrum-efficiency objectives.