


ANOKIWAVE INDUSTRY'S TRUSTED CHOICE FOR mmW 5G INNOVATIVE
SOLUTIONS THAT MAKE OUR CUSTOMERS SUCCESSFUL

mmW 5G for EVERYONE

A new ecosystem for global technology



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 **Anokiwave**
mmW Solutions. Enabling a new world

Executive Summary

5G is changing our world.

It represents a sea change in telecommunications and whole new ecosystem that will lay the foundations for global technological progress moving forward.

It will break new boundaries, act as a central pillar of global innovation, and fundamentally change our world in ways that we couldn't have thought possible just a few years ago.

It is not another typical step forward in terms of speed. Rather, 5G is the flagbearer of the complete transformation of technological capabilities globally.

Anokiwave has been leading the game since before 5G standards existed and has been actively solving the challenges associated with mmW 5G in collaboration with our customers and partners to reach new, exciting products that make mmW 5G easy for OEMs to adopt.

This whitepaper provides a holistic view of the mmW 5G market, its benefits, and its future, followed by technical discussion of various tools and resources available to succeed in this market and how Anokiwave is enabling the mmW 5G radio market as a trusted supplier and partner for OEMs and ODMs.



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Contents

Executive SummaryII

5G is changing our world 1

 An introduction to mmW 5G 2

 Benefits of 5G mmW..... 2

 Applications where mmW coverage is critical 5

 Global 5G mmW: Current Situation and Expected Future..... 10

Tools to help 12

 Anokiwave Array Calculator..... 13

 Algorithm to Antenna Characterization Tool 15

 Successful Array Designs 16

Anokiwave as Part of the 5G mmW Ecosystem 18

 Why Choose Anokiwave? 18

Addressing the Future of 5G mmW 20

"The success of mmW 5G is dependent on the right combination of innovation and cost effectiveness. A successful company will therefore have four key characteristics: it will be an innovator and a visionary; it will have a reputation as a reliable supplier; it will be easy to do business with; and deliver attractive pricing." Bob Donahue, Anokiwave CEO

5G is changing our world

5G is paving a path of extraordinary opportunity.

While its predecessors (2G, 3G, 4G) were brownfield developments entailing upgrades or additions to existing network infrastructure, 5G is a greenfield deployment comprising the installation and configuration of a brand-new network.

It is a whole new ecosystem that will lay the foundations for global technological progress moving forward.

So, how do network operators, end-users, and entire industries stand to benefit enormously from the rollout of this next generation telecommunications technology?

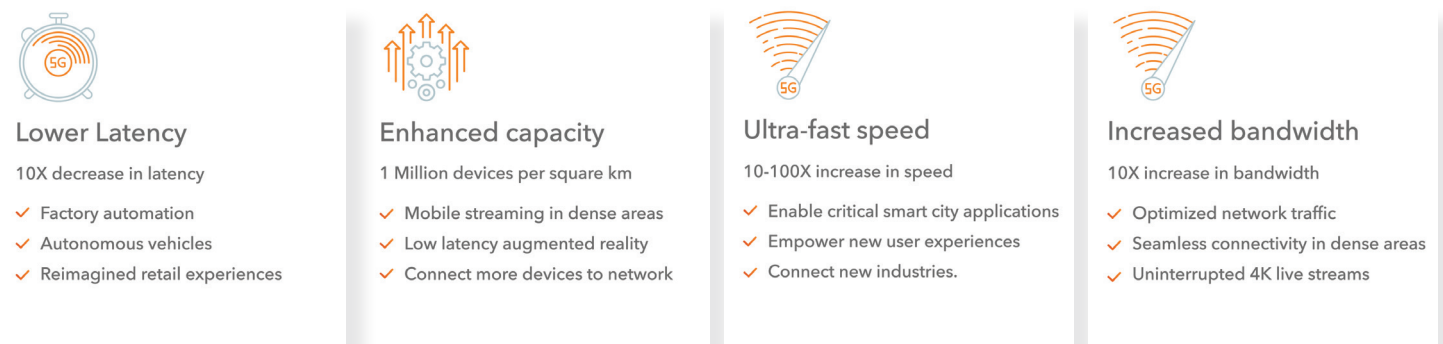


Figure 1: 5G sets the stage for large scale disruption by providing the infrastructure for tomorrow's connected technologies offering low latency, better capacity, ultra fast speed, and increased bandwidth^{1,2}

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An introduction to mmW 5G

The millimeter wave (mmW) spectrum has a highly promising role to play in helping operators, enterprises, and end-users to unlock some of these highly desirable benefits.

So, what is 5G mmW?

Defined as the band of spectrum between 24.25 GHz and 52.5 GHz (FR2 bands), 5G mmW is incredibly useful for high-speed wireless communications, capable of relieving mounting pressures in relation to data usage and bandwidth.

mmW phased arrays, an established technology used by aerospace and defense applications to overcome high path loss associated with mmW bands, were not a viable option for commercial application in years gone by. But now, thanks to sustained innovation, they are on the brink of being an integral part of the next-generation network.

In this white paper, we will consider the 5G mmW opportunity - the challenges, benefits, use cases, and how operators and enterprises should look to capitalize.

Benefits of 5G mmW

By the end of 2020, more than 200 million 5G connections had already been adopted - a figure that is expected to balloon to 1 billion by the end of 2023 and nearly 2 billion by the end of 2025.

This sharp spike is anticipated for good reason. 5G can deliver data rates 10 times faster and with 100 times more capacity, at latencies up to 10 times shorter compared to 4G networks, enabling it to handle growing data traffic.

Anokiwave is dedicated to enabling OEMs succeed in the mmW 5G market with key 5G FR2 innovations that provide critical market solutions:

- *IC platform that supports intelligent, scalable antenna arrays*
- *Antenna array calculator to create antenna proof of concepts*
- *Algorithm to antenna analysis tool for real-time signal chain characterization*
- *Antenna innovator kits and example array designs to enable customers to successfully build antennas quickly at a mass scale*

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It is sometimes less well known that 5G is not one-size-fits-all, and can be implemented at three different bands:

- Low band: Typically covers hundreds of square miles with 5G service that ranges in speed from 30 to 250 megabits per second (Mbps).
- Mid-band: Typically covers a several-mile radius with 5G that currently ranges from 100 to 900Mbps.
- mmW band: Typically covers a one-mile or lower radius while delivering roughly 1-3Gbps speeds.

Low band has emerged as the most common market, statistics from the Global Mobile Suppliers Association showing that 396 operators in 158 countries/territories were known to have launched LTE or 5G networks using low-band spectrum as of May 2021.

On the other end of the spectrum, we anticipate mmW to truly take off come 2024, presenting immense commercial opportunity.

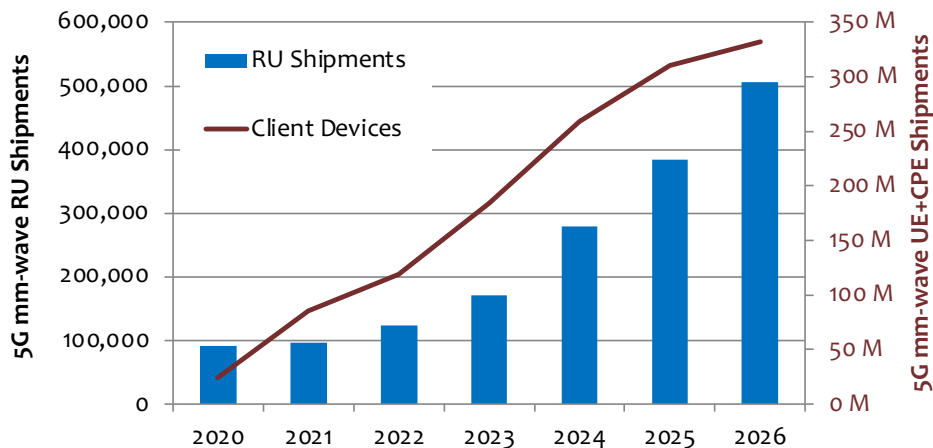


Figure 2: mmW 5G equipment forecast showing significant growth and potential in the coming years³

The significant mmW opportunity in Asia

- China's Ministry of Industry and Information Technology (MIIT) plans to triple the number of 5G base stations, targeting 3.64 million by the end of 2025.
- It aims to increase the number of sites supporting 10,000 people from five in 2020 to 26 in the same period.
- Cumulative investment in telecoms infrastructure nationwide is expected to grow from CNY2.5 trillion (\$391.7 billion) in 2020 to CNY3.7 trillion (\$579.4 billion) in 2025.

Moving forward, mmW will make the most profound impact on user experience with its incredibly high-speed wireless communication capabilities, while also unlocking a far greater range of benefits for telcos.

As mmW 5G grows, network operators, consumers, and enterprise and governments pose to gain the greatest benefits:

Benefits for the network operator

- Supports **global sustainability** and **net zero emissions ambitions** of operators, with an improved bits per DC power delivering a more efficient use of energy versus 4G.
- Drives down **network costs to provide competitive advantages**.
- Last mile solutions offer the opportunity to seamlessly **bring high-capacity connectivity** to busy urban environments.
- Allows operators to provide a **more diverse set of 5G networks** for differing and demanding needs.
- Enables telco providers to **leverage one network to serve multiple use cases** such as mobile user, fixed wireless access (FWA) and private enterprise without throughput bottle necks.

Benefits for the consumer

- Meets **high traffic demand by drastically upscaling spectrum resource** while maintaining the performance and quality required of 5G services.
- Key to **serving new demanding applications and relieving network congestion** – a need that mmW is perfectly suited to meet, through its ability to accommodate greater capacity than any other band.
- The **dramatic reduction in latency** will help to further technological experiences. The motion sickness associated with VR today, for example, will be reduced and/or eliminated.
- Retail experiences could be reimaged. Powered by artificial intelligence, computer vision and other cutting-edge solutions, cashierless, ‘just walk out’ models could become the norm.

Benefits for enterprise and governments

- A key enabler to **improving productivity and efficiency** by leveraging digital transformation projects.
- An explosion of IoT devices will **enhance technological capabilities across public and private industries** from new healthcare models to the remote monitoring of physical workflows in warehouses.
- Low latency characteristics of 5G mmW **allows enterprises to tap into 5G at the edge**, powering the next generation of industries, such as the smart factory.
- Supports **global sustainability** and **net zero emissions** ambitions of governments and enterprises, with an improved bits per DC power delivering a more efficient use of energy versus 4G.

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Applications where mmW coverage is critical

There are multiple ways in which mmW can offer superior value over traditional telco networks. Some scenarios include:

- Fixed Wireless Access
- Converged Fixed Mobile (CFW)
- Cloud Edge Computing
- Crowded arenas and stadiums
- Transportation hubs such as subway stations and airports
- Smart factories, warehouses and office complexes
- Next generation vehicle connectivity
- Urban centers and tourist hotspots

The following sections will highlight these scenarios with a look into a section of a mmW 5G connected urban area starting with the carrier side of the network and building out to the user and edge access.

Anokiwave enables every step of this scenario with our family of mmW 5G ICs that deliver the maximum number of options for performance, cost, and functionality enabling the total cost of ownership for base-stations and small cells to resemble Wi-Fi access points.



The low-latency of mmW 5G enables increased bandwidth for autonomous vehicles and interconnection of billions of IoT sensors for control, monitoring, and automation in homes, offices, medical facilities, and factories.

Infrastructure Carrier Segment

This segment includes gNodeB (gNb) devices, small cell devices, and integrated backhaul nodes (IAB). When a 5G network is developed, this is the first step in building the network.

- **gNb:** gNb nodes are a 3GPP-compliant implementation of the 5G new radio (NR) base station that provides 60-70 dBm of effective isotropic radiated power (EIRP) and features Software Defined Radio (SDR) with various MIMO options including 2x2, 4x4, 8x8 and Massive MIMO options for higher capacities. gNb devices are implemented on towers, rooftops, or street poles. gNb connects to the 5G core with fiber.
- **Small Cell:** Small cell nodes are also a 3GPP-compliant implementation of the 5G NR basestation designed to enhance network coverage and capacity in areas such as densely populated city centers where use demands are the highest. Small cells typically provide 43-54 dBm of EIRP and are typically mounted on utility poles. Small cells also connect to the 5G core with fiber.
- **IAB nodes:** IAB nodes wirelessly provide network access to end users, leveraging the spectral efficiencies of 5G NR and the increased capacity afforded by mmW bands to deliver enhanced backhaul solutions. It is a bridge between two Infrastructure site/nodes and does not connect to the 5G core. IAB nodes typically provide 43-54 dBm of EIRP and are also mounted on utility poles.

Carrier Side

Install gNB tower

Add rooftop gNb for coverage over urban areas

Extend coverage with small cell/IAB

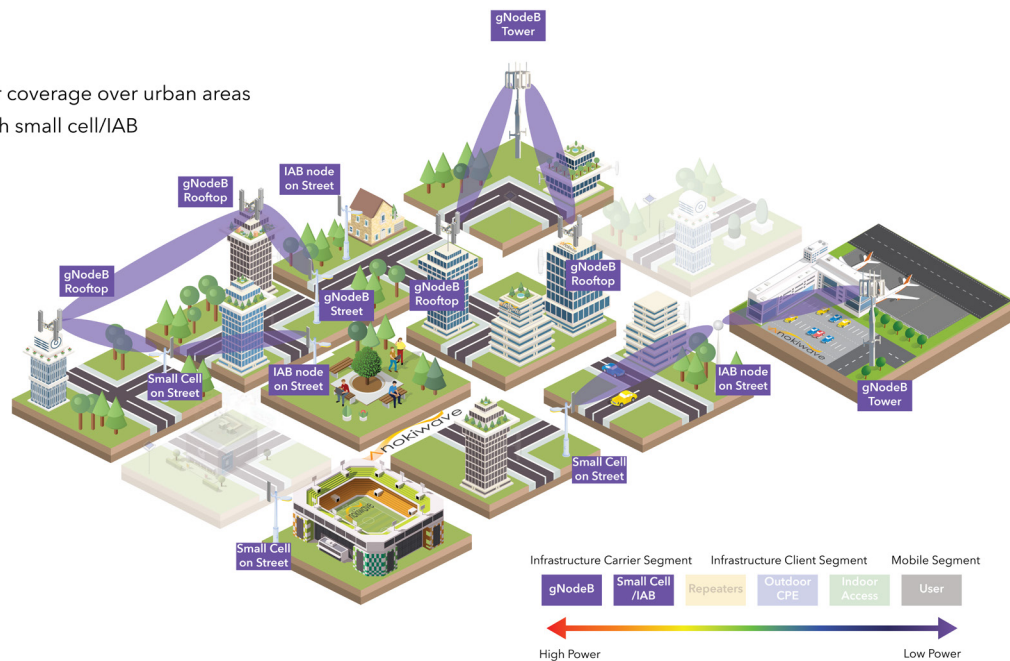


Figure 3: Carrier side of a mmW 5G ecosystem enabled by Anokiwave ICs that support intelligent, scalable antenna arrays that can be configured for different power levels and frequency bands.

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Infrastructure Client Segment

This segment builds out the 5G network by adding coverage to areas needing additional capacity or coverage.

- **Outdoor Client Premise Equipment (CPE) for FWA:** Outdoor CPE equipment is designed to work in densely populated environments and are designed to deliver ultra-high-speed internet access to the end-users via the 5G network. Outdoor CPE units are mounted on a building and provides 40-43 dBm of EIRP.
- **Outdoor Network Repeaters:** Repeaters are used to offset the need for new base station buildouts by amplifying signals from nearby cell sites and retransmitting them to underserved areas. They are pole mounted and provide 50-54 dBm of EIRP.
- **Indoor Small Cell/Access Point:** Indoor small cells are devices that create a wireless local area network, or WLAN, usually in an office or large, highly populated building like a stadium or airport. These devices are mounted inside a building and provide 40-43 dBm of EIRP.
- **Indoor Distributed Antenna System (DAS):** A DAS is used in large or complex venues and buildings to improve coverage. They amplify the original carrier sources throughout a property through strategic antenna placement. The systems are mounted inside a building and provide 40-43 dBm of EIRP.
- **Indoor CPE:** The indoor CPE will transform a 5G signal to WIFI hotspot. Users can access the CPE through the external network to access the 5G network and achieve carrier-class security and achieve standby Internet calls through the external network channel, which is no different from accessing the network through the operator's base station. Indoor CPE units are placed inside a building to provide residential FWA and provide 40-43 dBm of EIRP.

Client Side

Add range and coverage for blockage with Network Repeaters

Provide FWA to urban centers and residential with CPE

Build indoor networks with access points

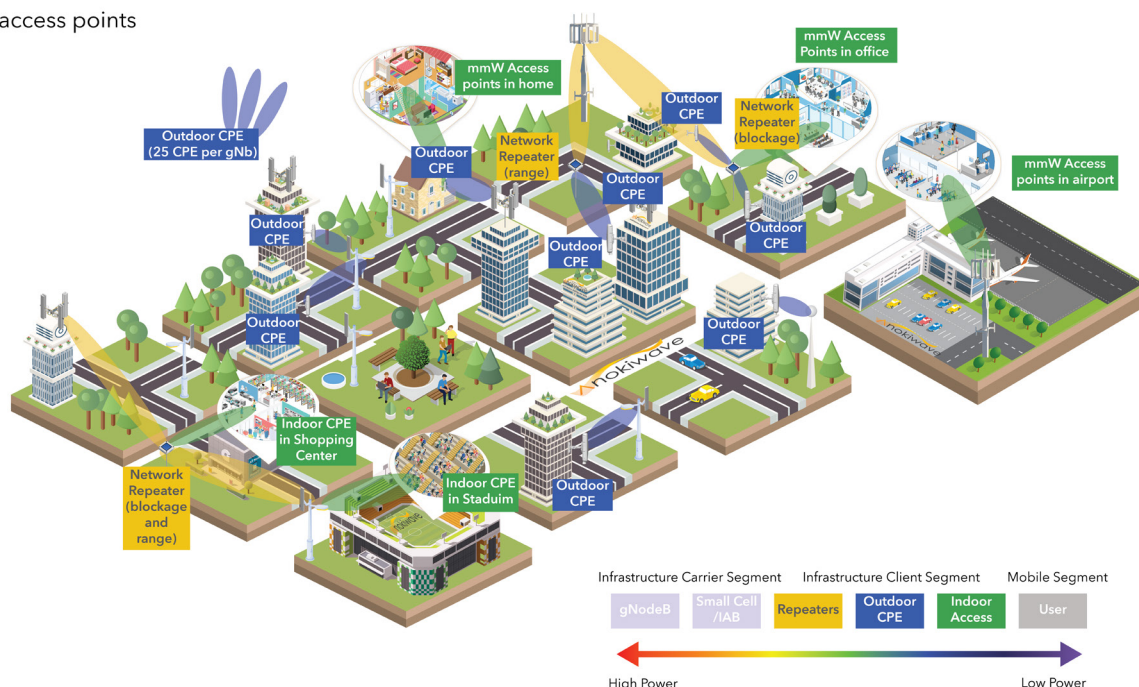


Figure 4: Client side of a mmW 5G ecosystem enabled by Anokiwave ICs that provide flexibility to optimize systems for different use cases -small cells, CPE, repeaters - and is important as the needs vary from application to application.

Mobile and Edge Access

This segment completes the 5G network by adding coverage users both indoor and outdoor.

- **Mobile edge devices:** These devices are used in laptops, MiFi, handsets and other edge devices. These devices provide 23-25 dBm of EIRP.
- **Handset:** 5G mmW enabled handsets, such as flagship smartphones, provide users with high data throughput on the go. These devices also provide 23-25 dBm of EIRP.
- **Auto:** Technologically advanced vehicles today can transfer 1-2GB of data per data through cellular networks, while cellular V2X capabilities will soon demand larger data exchanges to support platooning, extended sensors, automated and remote driving and other advanced capabilities. Here, mmW can play a critical role thanks to a drastic decrease in latency and huge expansion in capacity. Devices used on the vehicle permanently for vehicle connection provide 40-43 dBm of EIRP, while single trip portable auto devices provide 20-30 dBm of EIRP.

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Mobile and Edge Access

Handset, notebook, auto users



Figure 5: Mobile and Edge Access of a mmW 5G ecosystem

Carrier Side

Install gNB tower

Add rooftop gNb for coverage over urban areas

Extend coverage with small cell/IAB

Client Side

Add range and coverage for blockage with Network Repeaters

Provide FWA to urban centers and residential with CPE

Build indoor networks with access points

Mobile and Edge Access

Handset, notebook, auto users

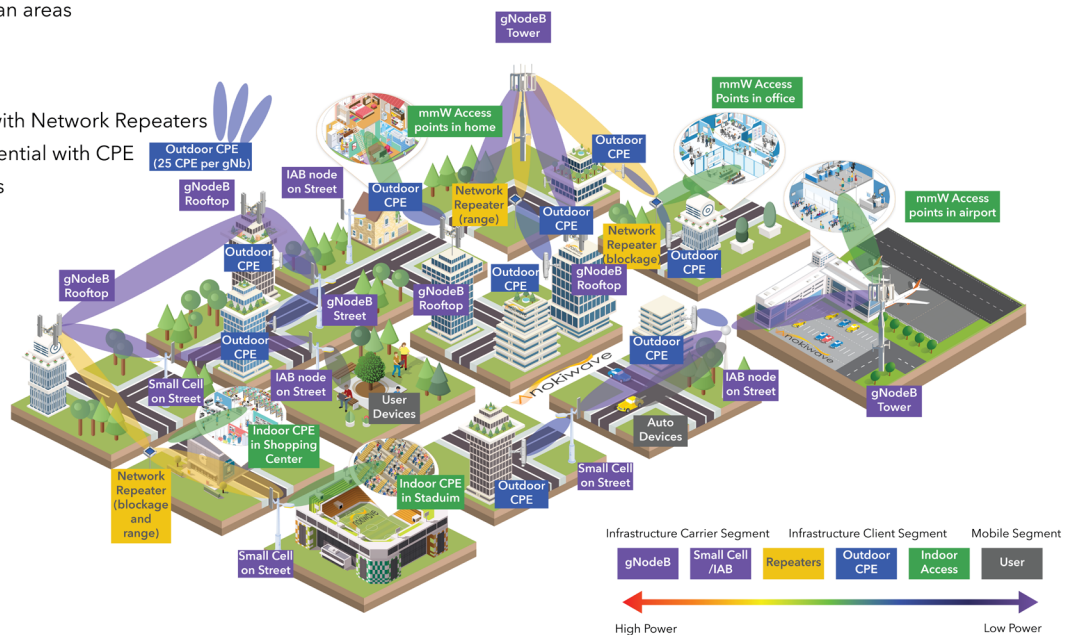


Figure 6: A mmW 5G connected urban area enabled by Anokiwave

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Global 5G mmW: Current Situation and Expected Future

The commercial deployment of 5G mmW began in 2019 and has moved at a rapid pace ever since.

While telcos, operators, and private organizations are already tapping into 100,000 mmW new base stations to mobilize, it is anticipated that both rising demand and the increasing deployment of base stations and critical infrastructure will see the 5G mmW arena begin to boom in the coming years.

The tipping point

In 2022-2023, it is forecasted that mmW will reach a crucial tipping point where market demand will begin to exponentially rise, owing to several factors:

- The US currently has 20 million 5G phones with mmW capabilities enabled, a figure that will continue to expand with the release of new models and broader uptake among the population.
- Multi-band will be launched in the near future, adding to existing momentum.
- The international market will begin to pick up, as similar deployment trajectories emerge in countries across Europe and Asia, from the United Kingdom to South Korea.
- The number of mmW use cases will grow, from mobility and connected vehicles to fixed wireless access.
- Enterprises will increasingly turn to private 5G networks, recognizing their benefits in supporting functions of smart factories, large offices, and other key hubs.
- There will be a rise in the adoption of edge-computing in cases where networks must ensure uninterrupted connectivity. Examples include autonomous vehicles, enterprise laptops, and the use of devices in crowded places such as sports stadiums.

mmW 5G will reach a crucial point where market demand will begin to exponentially rise and a tipping point will be reached where demand will balloon, creating a continual, upward curve.

To support this influx in demand and surge in 5G use cases, critical mmW infrastructure will be required in abundance.

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As each of these variables simultaneously place extra pressure onto the mmW ecosystem, a tipping point will be reached where demand will balloon, creating a continual, upward curve.

5G market analyst group, Mobile Experts, believes operators expect traffic demand to grow faster than their ability to add capacity below 6 GHz. They further state that economically, adding sub 6 GHz capacity will not be the best choice in many areas because the cost of renting space on a tower could be staggering where deployment of mmW small cells will actually be cheaper than another round of small-cell densification and widespread use of giant massive MIMO antennas.

To support this influx in demand and surge in 5G use cases, critical mmW infrastructure will be required in abundance.



Mobile traffic demand has already grown faster than available sub-6 GHz capacity. Operators will use mmW small cell antennas to add tremendous capacity at a reasonable cost

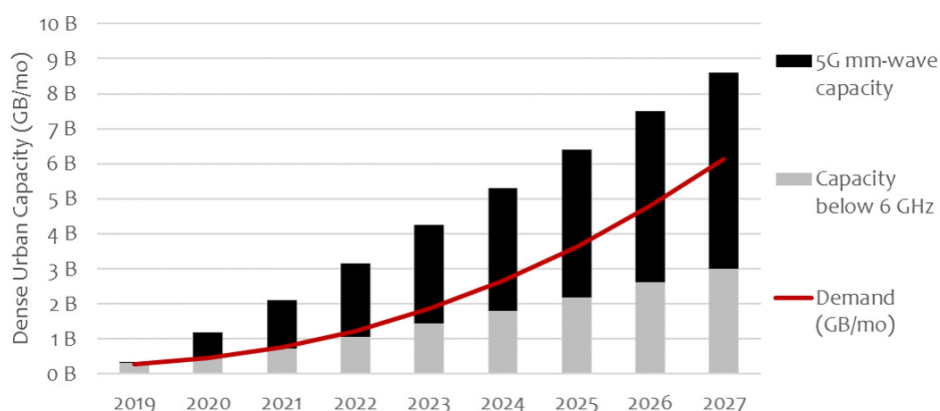


Figure 7: Mobile Experts prediction of mmW and sub-6 GHz capacity. Operators expect traffic demand to grow faster than the ability to add sub-6 GHz capacity.

Tools to help

Anokiwave is dedicated to enabling OEMs stay one step ahead, using key 5G FR2 innovations to provide critical market solutions.

Our goal is to make our customers successful in the market. By Anokiwave undertaking much of the heavy lifting associated with mmW in a simple, high quality, and reliable manner, our clients are freed up to focus on refining their solutions and achieving a faster time to market.

Our 5G portfolio offers a complete RF signal chain solution for 5G mmW arrays with system level performance optimized for each 5G use case. This enables our customers to rapidly design arrays in relation to any given use case within a scalable platform, offering proven capabilities in handling use cases with different EIRP requirements, from low to the maximum allowed under the FCC.

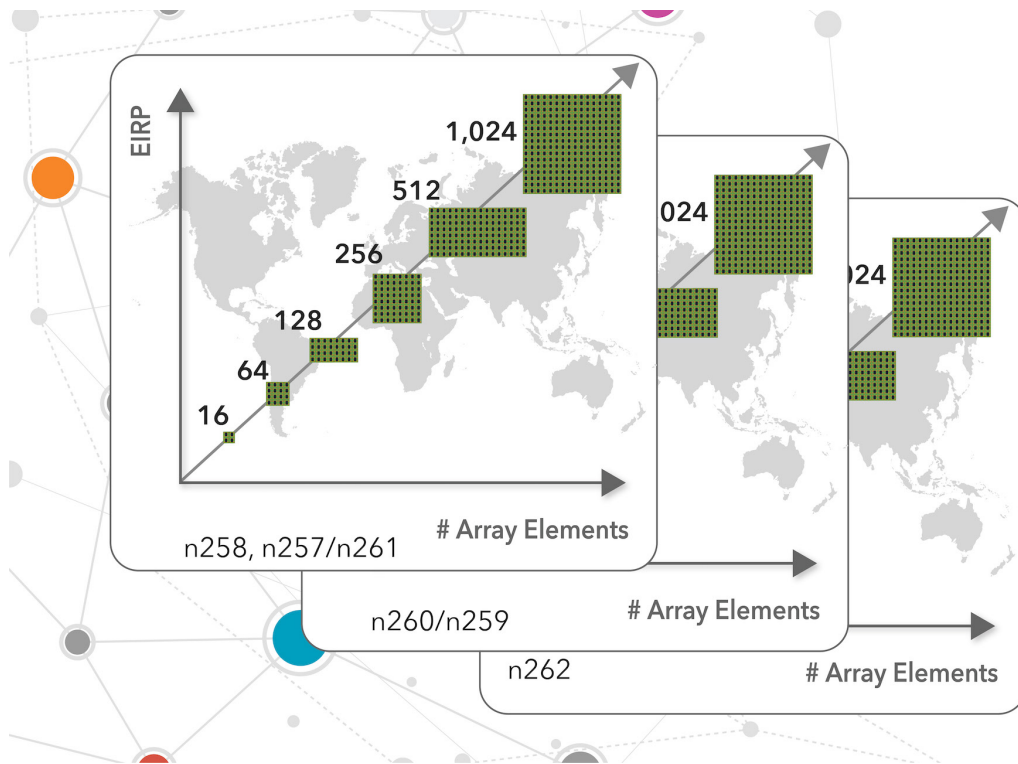


Figure 8: Anokiwave's feature rich, low cost 5G platform enables scalable arrays in EIRP and frequency to address multiple use cases in multi-region markets

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A critical issue for OEMs lies in the need to model and optimize systems from the digital baseband to antenna. This requires unique, multidisciplinary skills spanning the antenna, radio frequency, digital semiconductor, thermal and system requirements.

Anokiwave solves this problem for our customers with advanced roadmaps and rapid generational learning curves.

Anokiwave Array Calculator

A key part of our ability to support array manufacturers in creating proof-of-concepts with reliable, informed calculations is the Anokiwave array calculator.

Active antenna design is a complex and novel skill that many OEMs are not yet familiar. That's why we introduced the array calculator - to rapidly develop effective solutions at speed.

The intent of the calculator is to accelerate time-to-market for manufacturers by selecting the right combination of components to build the most effective arrays possible. Tapping into data from almost 2,000 use cases, it offers key advice in relation to desirable frequency bands, antenna sizes, scan volumes, and more.

Our success is determined by the success of our customers. That's why we work closely with them by providing sound and logical calculations in relation to EIRP, beam widths, and other important data that provides an indication as to how effective proposed systems and solutions might be.

By selecting data from specified options, the array calculator will guide you through the IC array selection process for your 5G application and show how Anokiwave ICs support many 5G use cases.

Over the last 5 years, Anokiwave has delivered millions of ICs with more than 95% cost reduction and 70% form factor reduction.

With the newest fourth generation family, Anokiwave now provides one of the industry's most integrated and complete mmW to IF solution, including frequency synthesizers and option for antenna level support

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Anokiwave Array Calculator

- Provides 'what if' analysis, allowing users to decipher what works for them.
- Shows customers expected end solutions.
- Explore design trade-offs quickly
- Customize the array design for specific requirements, such as set frequency bands or desired beam performance
- Evaluates key performance metrics including linear power, efficiency, receiver sensitivity/linearity and cost.
- Delivers printouts of key physical parameters of array design concepts.

[Home](#) / [5G](#) / [Array Selection Guide](#)

Array Selection Guide

Welcome to the Anokiwave Selection Guide for Active Phased Array Antennas.

By selecting data from the following options, we will guide you through the IC array selection process for your 5G application and show how Anokiwave ICs support many 5G use cases.

Frequency:

- ☐ 24/26 GHz
- ☐ 28 GHz
- ☐ 37/39 GHz

Use Case:

- ☐ CPE (33-53 dBm)
- ☐ Small Cell/Repeater (37-58 dBm)
- ☐ Infrastructure (56-67 dBm)

Polarization:

- ☐ Single
- ☐ Dual

EI Scan Angle: (Assume AZ Scan Angle = 60°)

- ☐ 0°
- ☐ 20°
- ☐ 60°

Submit

Figure 9: The array calculator guides customers through the IC selection process for a specific use case. Tapping into data from over 2000 use cases, it offers key advice in relation to desirable frequency bands, antenna sizes, scan volumes and more.

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Algorithm to Antenna Characterization Tool

Once a customer has an array concept in mind, our Algorithm to Antenna Characterization tool allows the customer an early look at the systemic antenna performance in a test environment that ultimately results in a faster time to market by ensuring first pass design success of complex, full signal chain, high power antennas.

We work closely with our customers to perform a comprehensive signal chain characterization using measured data from all our ICs used in the antenna line-up, including gain, linearity, and temperature under optimized performance settings. Innerconnect loss and passive component losses are indicative of what the customer expects in their system and are based on measured test structures and lab characterization.

The final line up is then refined with our customers allowing them to optimize their antenna settings in situ. By providing an excellent prediction of what the customer will achieve when they build the integrated antenna, this tool allows first pass design success while minimizing time to market.

Algorithm to Antenna Characterization Tool Benefits:

- Measured and optimized lineup ensuring first pass design success and ultimately fast time to market
- Ability to analyze and test various multi-pol applications, antenna configurations, EIRP, and out-of-band emission requirements
- Real time performance trade off analysis with measured data



Figure 10: Anokiwave's algorithm to antenna characterization tool allows customer to perform a signal chain characterization in a true test environment

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Successful Array Designs

To reiterate, Anokiwave's success is determined by the success of our customers. It's a philosophy engrained in our history.

Having started out focusing exclusively on mmW, becoming the first commercial vendor to supply ICs for fielded FCC qualified radios, we then took the strategic decision to invest beyond simply selling ICs. It was an expensive and time-consuming process, but today we're able to go the extra mile for our customers, acting as an innovator for those with whom we do business.

Anokiwave's goal is to enable radio manufacturers and antenna manufacturers to successfully build active antennas in a quickly and cost-effective way at a mass scale by providing insights, knowledge, expertise, and tools to our customers.

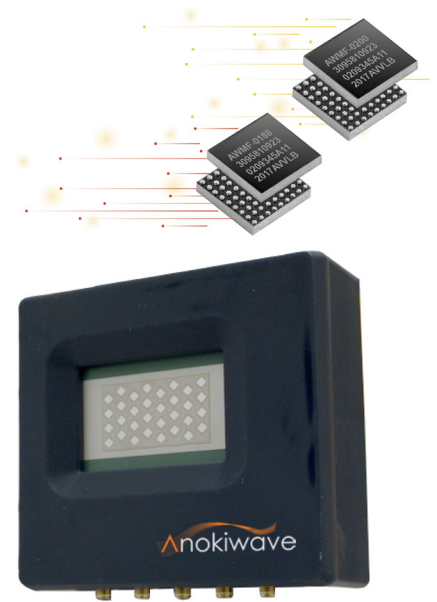
This approach has allowed us to evolve. We've learned and sophistically advanced our products through various generations to address anticipated customer needs. Our active antenna innovations have helped progress modern IC developments, for example.

This unique take is underpinned by the example array designs we share, capable of demonstrating how to achieve optimal performance that can be used as either templates, or for general inspiration.

Despite being an IC specialist, we have an in-house antenna team to offer customers industry-leading knowledge and insights for both building arrays and maximizing the performance of ICs in the overall system.

Innovator Kits

The innovator kits enable manufacturers to quickly prototype, develop, and introduce mmW 5G radios. The kits allow equipment manufacturers to easily evaluate array level performance of Anokiwave's ICs, develop new mmW 5G NR radio front ends and, ultimately, accelerate their radio developments. It provides real working evidence of the near ideal performance achievable using Anokiwave's ICs, and a starting platform to scale the design to meet each specific use case.




Anokiwave has a dedicated team and detailed process focused on supporting customers to develop and commercialize mmW 5G active antennas

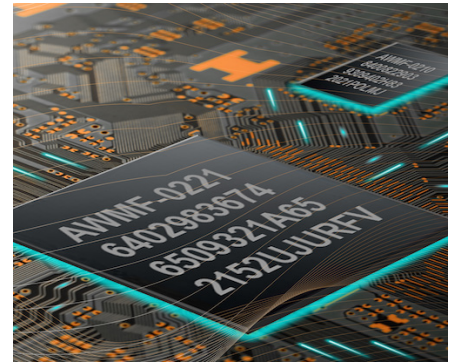
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Features and Functions of the 5G IC Family

Anokiwave's all Silicon-based smart antenna solutions provide the lowest cost and highest performance to meet commercial market demand. These products, which have been optimized through multiple generations since their initial release, leverage state-of-the-art, unique architecture allowing manufacturers to build scalable arrays with EIRP ranging from 30 dBm to 70 dBm.

Some of the unique features we bring to the manufacturers through our innovations include:

-  Kinetic Green™: Lowers energy consumption by >33% through dynamic array control and fast attenuator control, turning off elements and rows to shape beams and reduce DC power - supporting the industry's sustainability goals.
- ZERO-CAL® (Patented): Enables each IC to self-align to prescribed performance levels while eliminating the need for array calibration.
- Digital pre distortion (DPD): Improves system efficiency through a higher linear EIRP, lower DC power, minimized heat sink and other innovative methods.
- 3D Beamforming: Future-proof innovation for 3GPP, minimizing DC power consumption by using smaller radios with smaller heat sinks.
- Ultra Fast Beam Steering (Patented): Enables the antenna to quickly change beam direction consistent with 5G timing protocol.
- Variable Maximum Linear Power (vMLP): Ability to flexibly adapt the amount of power that you can have in a system while avoiding interference for different requirements.
- Smart Arrays: Digital core included in ICs allows users to monitor IC performance in array operation and apply critical corrections real-time.



Over the 20+ years of delivering commercially deployed beamformer ICs, Anokiwave has the experience and understanding of nuances of commercially deployable mmW phased array antennas, unlike any other company, and is proven by the unique features of the ICs that make our customers successful.

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Anokiwave as Part of the 5G mmW Ecosystem

5G mmW presents an incredibly exciting opportunity with vast potential, capable of embedding itself within the new hyperconnected foundations of the telecommunications industry globally.

The convergence of an unprecedented demand for bandwidth and the continuing advancements being made in the silicon industry is driving a disruptive and refreshing change to the industry, creating a cocktail of innovation.

It's a space that has attracted a significant amount of noise as a result – so, how can manufacturers be sure they're picking the right solutions and finding the right support for their needs?

At Anokiwave, we look at things simply, getting the basics right before anything else.

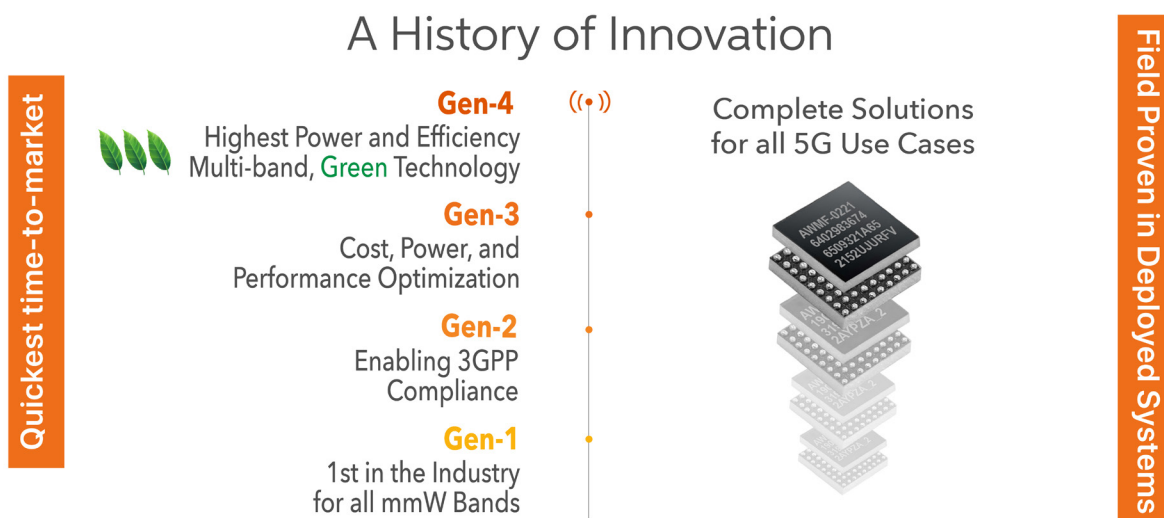
Why Choose Anokiwave?

Because customers care about success. We enable customer success with our proven track record of delivering performance over multiple generations of ICs and we have a clear road map that shows continued generational improvements in power and efficiency for commercial deployment.

*Leadership,
pioneering,
scalability,
innovation,
compatibility,
cost.*

*Choose Anokiwave
when you must
succeed.*

*Choose Anokiwave
when failure is not an
option.*



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Leadership

- Focused exclusively on mmW for the last decade and were the first third party vendor to field FCC qualified 5G radios.
- History of successfully delivering for our customers, spearheading industry innovation.
- Fielded products from the dawn of the commercial mmW network thanks to extensive experience in aerospace and defense antennas.
- First IC for 5G was introduced in 2016, before standards even existed and now home to the largest mmW 5G player in the market today.
- A rich portfolio of easy to use, quality and reliable solutions that make mmW easy for end users.

Pioneering the mmW Revolution

- Successful cost reduction through classic generational development over multiple years.
- Home to the largest mmW IC development team in the industry.
- Working as a partner, not just a manufacturer.

Scalable Solutions

- Scalable ICs capable of supporting small and large arrays and all global 5G bands using the same platform.
- Adhering to varied requirements in a flexible manner.
- Offering a family of beamformer ICs as well as Integrated Up/Down Converters for a complete RF solution.

Innovation

- Solving a range of problems to allow 5G mmW to deploy as effectively as possible.
- Multiple generations of ICs, released and deployed in the field.
- Delivered more than a 95% cost reduction to our customers over three generations.
- Linear power supplied by our products has increased 10-fold.
- A rich digital core enabling functions such as Zero-Cal®, Kinetic Green™ and Fast Beam steering.
- Driven down product size to meet thermal constraints thanks to generational learning curve.
- 4th and 5th generational products in development with aggressive targets, deploying in 2022.

Cost

- Optimizing technology over four generations for best performance and lowest cost.
- Using the highly cost-effective silicon SOI-based CMOS 12" wafer.
- Delivered 95% cost reduction over 3 generations and will continue to do so with our 4th and 5th generation ICs.
- Innovating to shrink our parts to deliver significant cost reductions for end manufacturers in their processes over time.
- Handset and mobile technology for infrastructure

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Addressing the Future of 5G mmW

It's been more than two decades since a new greenfield wireless technology emerged, the last being Wi-Fi.

5G mmW presents a series of novel challenges. Using our various platforms, technologies, insights, and tools, Anokiwave has actively been solving these in collaboration with our customers and partners to reach new, exciting outcomes across all use cases and cost structures.

To date, we have:

- Introduced common product platforms across all major mmW frequency bands.
- Pioneered highly efficient green product solutions.
- Successfully deployed 4 generations of ICs for mmW 5G resulting in a 70% form factor reduction and 81% DC power reduction per W of RF developed.
- Developed low-cost antenna active array aperture solutions.

And we continue to focus on delivering a high-volume manufacturing platform, employing handset technology for infrastructure.

For many, the viability of mmW is a question of cost, knowhow, and technical expertise, spanning everything from waveforms and frequency bands to antenna power, sensitivity, and the size of arrays.

Anokiwave is bridging these gaps.

Through cutting-edge solutions and co-innovation with customers, we continue to make mmW easy for OEMs as the trusted source of innovative mmW solutions.



About Anokiwave

Anokiwave is a fabless semiconductor company providing highly integrated mmW silicon ICs to enable large scale commercialization of phased array active antennas for 5G, SATCOM, and A&D markets. Anokiwave brings unique, industry-leading, Silicon IC technology and system level support to help companies develop high performance and cost effective phased arrays with first pass-success.

- mmW Silicon ICs
- Intelligent Array IC Solutions™
- mmW Algorithms to Antennas™

www.anokiwave.com/5g

Endnotes

- 1 Ericsson website 5G vs. 4g: <https://www.ericsson.com/en/5g/5g-vs-4g>
- 2 CNet: <https://www.cnet.com/tech/mobile/5g-from-galaxy-s21-to-new-apps-heres-what-you-need-to-know/>
- 3 Mobile Experts 5G mmW forecast dated 3 December, 2021 www.mobileexperts.net