

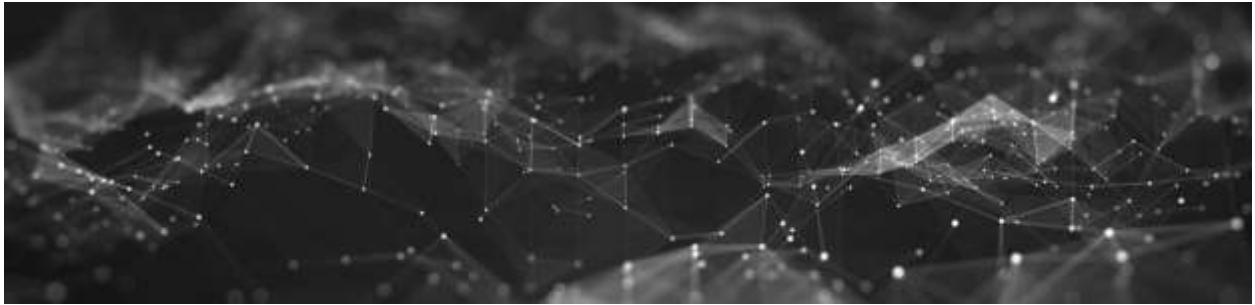


WI - FI 8

A Quantum Leap in
Connectivity

A whitepaper by
iCuerious Research Services

October 14, 2023



Introduction

As the 802.11be (Wi-Fi 7) task group nears completion of its standardization efforts, the IEEE 802.11 working group has shifted its focus towards shaping the next-generation Wi-Fi standard.

A newly established initiative, the Ultra High Reliability (UHR) study group, is actively engaged in formulating a Project Authorization Request (PAR) for the forthcoming major Wi-Fi release, Wi-Fi 8.

Within this paper, we provide an overview of the prospective technologies and application scenarios currently under consideration within the UHR study group.

Additionally, we have presented a preliminary overview of the current intellectual property (IP) landscape, which is still in its infancy with respect to Wi-Fi 8 technologies.

“In contrast to 802.11be (Wi-Fi 7), which primarily centres on enhancing throughput, known as Extremely High Throughput Wi-Fi, the UHR initiative places a strong emphasis on enhancing reliability.”

IEEE 802.11 Ultra High Reliability (UHR) SG

Created:
July 2022

First
meeting:
September
2022

Finalized
PAR and CSD
Documents:
March 2023

Ultra-High Reliability is a new Study Group within the IEEE 802.11 working group that will investigate PHY and MAC technologies to improve reliability of WLAN connectivity, reduce latencies, increase manageability, increase throughput including at different SNR levels and reduce device level power consumption.

Wi-Fi 8 Timeline

2023

March: PAR Approved

May: First Task Group Meeting

2025

May: Draft 1.0

2026

March: Draft 2.0

Nov: Draft 3.0

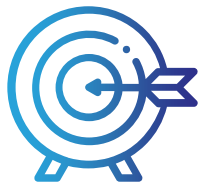
2028

Final 802.11 WG
approval

What is Wi-Fi 8?

IEEE 802.11bn is the formal technical designation for the standard that is currently in development. This standard will eventually transition into what is commonly known and marketed as "Wi-Fi 8" when it becomes commercially available.

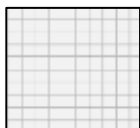
Highlighting features: Wi-Fi 8



Peak Rate
100 Gbps



Frequency band
2.4, 5, 6 GHz and mm-Wave



Modulation
8K-QAM



“8192-QAM OFDMA means higher data transfer rate of 100 Gbps.”

“mm-wave spectrum can provide gigabits per second (Gbps) data rates, which is much faster than traditional microwave and radio frequency (RF) spectrum.”

Why there is a need for Wi-Fi 8?

The field of wireless communication and technology has witnessed continuous advancement and evolution since its inception. These developments have consistently been driven by the specific demands and requirements of the market. The same principle applies to the upcoming generation of wireless technology, where the primary focus is on enhancing the reliability of wireless networks.

In other words, the wireless industry has a history of responding to market needs by improving its technologies, and the next generation of wireless technology is no exception. The central goal of this evolution is to ensure that wireless networks become more dependable and robust in meeting the communication needs of users and businesses.

Market
Trends
Envisioned
by the
Members
of the
Task
Groups

More and more
P2P links by
2028-2030:



IEEE presentation- UHR- Jan 2022

Focusing on how to better
manage P2P infrastructure links.

Increased device
sharing experiences:



IEEE presentation- UHR- Jan 2022

Summary of
Key Metrics and
Market
Requirements
Evaluated by
Task Group
Members for
the Next
Generation of
Wireless
Communication

Metric	Market Requirements
Reduced latency	Gaming, AR/ VR, Interactive video (latency<01.ms)
Range extension	Wireless video doorbells and wireless home security surveillance cameras requires Wi-Fi to extend its range.
Scalability	Scalable for different market segments, different power consumption requirements
Enhanced 6GHz utilization	Home office, AR/VR, 4k/8k, video streaming

Applications and use cases



Gaming
Online Gaming (e.g., FPS) with smartphone, console, or PC. Requires quick response to the user's inputs.



XR/ Metaverse
Immersive VR, enjoying virtual world life. Requires quick response to the user's inputs.



Remote work/ education
Conference, classes, or diagnostics via video.



Robotics
Machine control, autonomous vehicles. Requires communication between machines, sensors, and cameras.



e-Health for all
Providing remote medical surgery in areas where doctors and infrastructure are lacking.

As highlighted in the previous pages, various stakeholders, including chip vendors, network operators, and service providers, have envisioned and presented numerous potential use cases for Next-Gen Wi-Fi during the 2022 IEEE 802.11 interim (January and May) and plenary (March) meetings,

While Wi-Fi 7 holds promise in handling industry use cases with demanding requirements, it also presents numerous unresolved technical challenges that Next-Gen Wi-Fi 8 aims to address.

Next-Generation Wi-Fi is poised to deliver substantial improvements in several key performance indicators (KPIs), including throughput and latency, when compared to the current Wi-Fi standards based on IEEE 802.11 WLAN.

This technological advancement will empower the growing demand for the Internet of Things (IoT), high-resolution video streaming, and low-latency wireless services, among others.

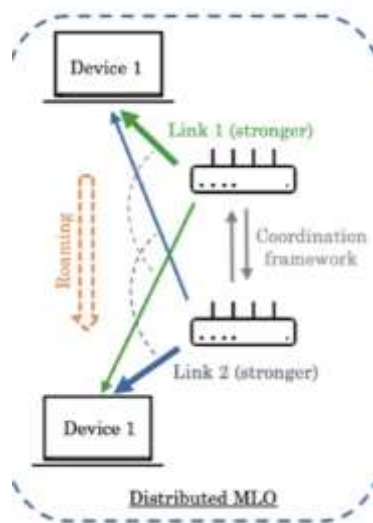
“It is now time to explore the potential key features that will enable the realization of advanced use cases in this next generation of wireless communication discussed thus far, ultimately ensuring the higher reliability in this next generation.”

Wi-Fi 8 potential features

As the standardization process for UHR (Ultra-High Reliability) is still in its very early stages, it is hard to predict the exact technologies that will be adopted to achieve UHR's goals.

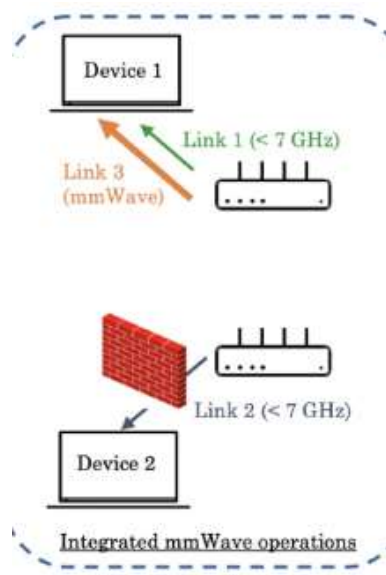
In this paper, we conduct a comprehensive review of several technologies with the potential to be incorporated into the UHR standardization. These insights are derived from early UHR SG (Study Group) discussions held over the last one year.

Highlighting features: Wi-Fi 8



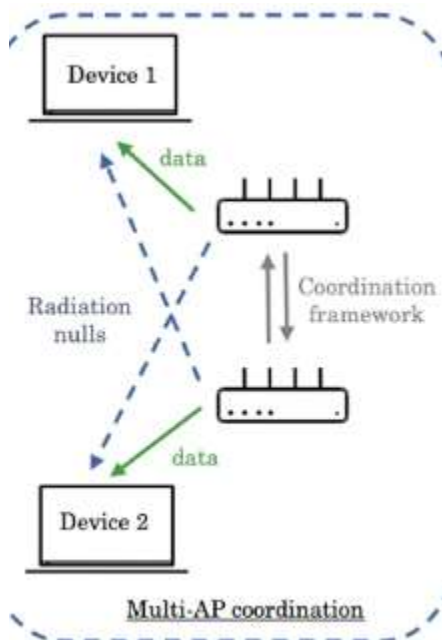
Distributed MLO

Seamless Connectivity via Distributed Multi-link Operation (MLO)



Integrated mm-Wave Operations

Abundant Spectrum via Integrated mm-Wave Operations



Multi-AP coordination

Controlled Worst-Case Delay via AP Coordination

Wi-Fi 7

Wi-Fi 8

Peak Rate

30 Gbps

100 Gbps

Frequency
band

2.4 GHz, 5 GHz, 6
GHz

2.4 GHz, 5 GHz, 6
GHz, mm-Wave

Channel
bandwidth

Up to 320 MHz

Up to 320 MHz or
Above

Modulation
Mode

4096-QAM
OFDMA

8192-QAM OFDMA

MIMO

16X16 UL/DL
MU-MIMO

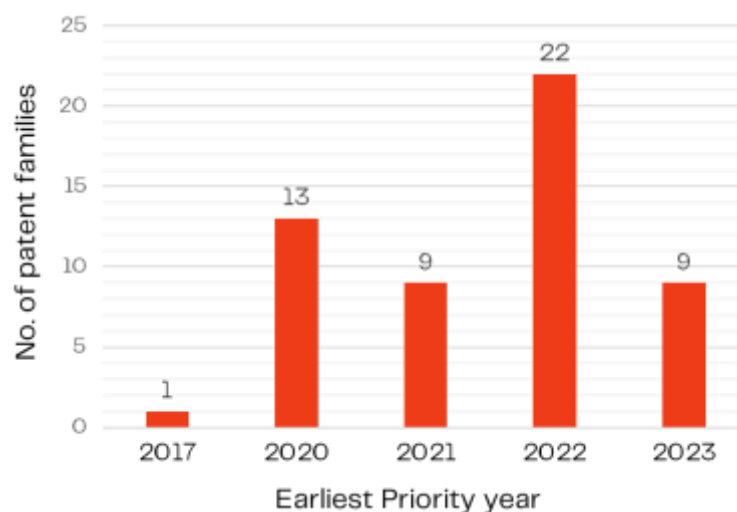
16X16 UL/DL MU-
MIMO

Has any innovation been initiated in the Wi-Fi 8 domain?

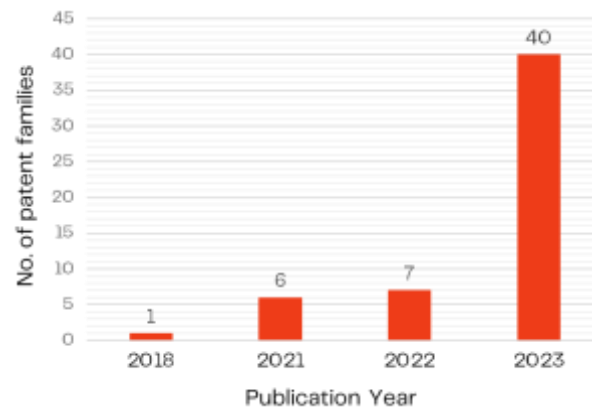
While Wi-Fi 8 is still in its early stages of development, with the first draft of candidate features expected to be released in 2025 and final approval scheduled in 2028, it has already captured the attention of innovators.

Even at this early stage, dominant industry players have started filing patents related to this next generation highly reliable network or addressing the concept of Wi-Fi 8.

This demonstrates the forward-thinking nature of the technology and the industry's eagerness to participate in its development.

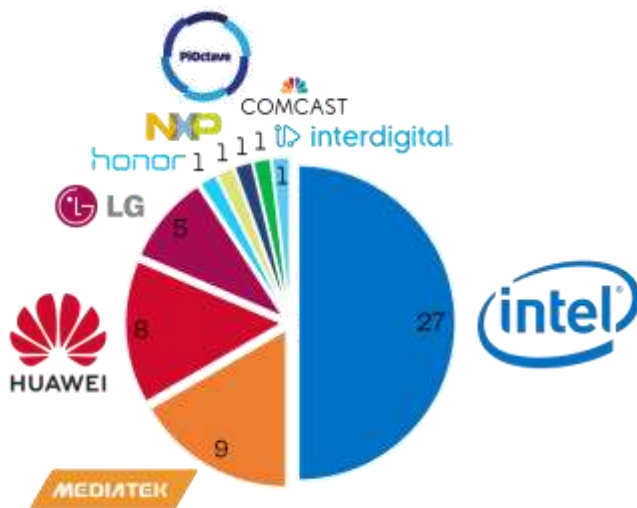


Note: The count presented here signifies the number of patent families that exclusively focus and address the Wi-Fi 8 concept, with respect to their earliest priority year.



The publication trend of Wi-Fi 8 patents has experienced a significant surge, with a remarkable increase of approximately 500% in publications in 2023 alone. This upward trend is anticipated to persist in the upcoming years as Wi-Fi 8 innovations continue to gain momentum.

Players actively innovating in this domain:



The chart adjacent showcases the current participants who have initiated patent filings related to Wi-Fi 8 technology. Presently, Intel holds a substantial portion of the patents in comparison to other players within this domain.

Major contributors on Wi-Fi 8 concept:

The pie chart above displays the players for which we have identified patents relevant to Wi-Fi 8. Intel is at the forefront with approximately 27 relevant patent families in this field, followed by MediaTek and Huawei.

Furthermore, we have also compiled lists of key inventors from our set of Wi-Fi 8 patents to recognize the primary contributors to Wi-Fi 8.

	Company	Wi-Fi 8
LAURENT CARIOU	Intel	18
KENNEY THOMAS J	Intel	14
LI QINGHUA	Intel	9
YEE JAMES CHI H-SHI	MediaTek	8
FANG JUAN	Intel	8
SEOK YONGHO	Intel	8
HUANG PO-KAI	Intel	6
CHEON, JIN YOUNG	LG Electronics	5
CHOE, JIN-SU	LG Electronics	5
CHUNG, IN-SIK	LG Electronics	5
PARK, EUNSUNG	LG Electronics	5
LU KAI YING	MediaTek	5
GAN, MING	Huawei	5
LIM, DONGGUK	LG Electronics	5

Do you know:

LAURENT CARIOU serves as the chairperson of the Ultra High Reliability study group dedicated to the development of the Wi-Fi 8 concept.

IEEE P802.11 - ULTRA HIGH RELIABILITY (UHR) STUDY GROUP (SG) - MEETING UPDATE

Status of IEEE 802.11 Ultra High Reliability (UHR) SG

Laurent Cariou, Chair

Page Contents

[Background](#)
[Goals](#)
[September 2022](#)
[November 2022](#)
[January 2023](#)
[March 2023](#)
[May 2023](#)
[July 2023](#)
[September 2023 plan](#)

Background

Ultra High Reliability is a new Study Group within the IEEE 802.11 working group that will investigate PHY and MAC technologies to improve reliability of WLAN connectivity, reduce latencies, increase manageable throughput including at different SNR levels and reduce device level power consumption. The intention is to lead to the creation of a task group with a target start in May 2023.

The study group has been created in July 2022 and first meeting will happen in September 2022.

Goals

The goal of the IEEE 802.11 UHR Study Group is to produce a PAR and a CSD document for the creation of a task group.

Focused areas of innovations:

While it's too early to discuss the features of Wi-Fi 8 since we're far from the release of the first draft, some key features are anticipated based on discussions among study group members.

These features are expected to set Wi-Fi 8 apart from its predecessor, making it significantly superior.

Wi-Fi 8 Key Features

Distributed MLO

Integrated mm-Wave Operations

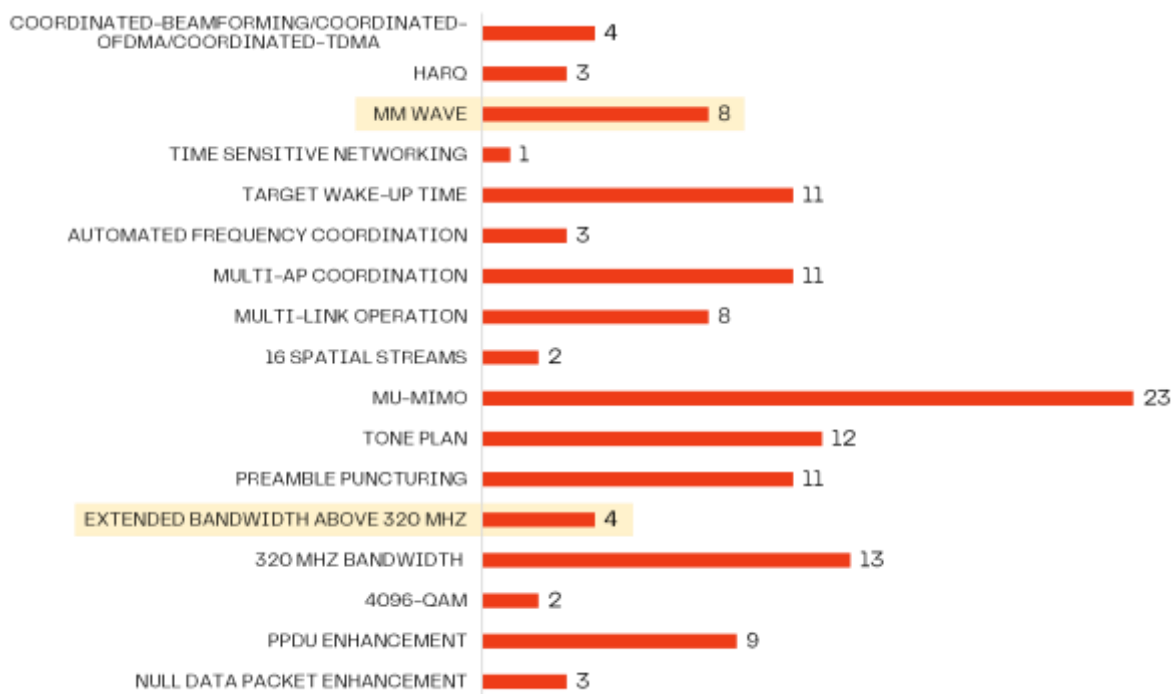
Multi-AP coordination

Channel Bandwidth:
Up to 320 MHz or Above

8K-QAM

Any patents on these features?

After examining all the relevant patents that we identified for the Wi-Fi 8 concept, it is apparent that the majority of these patents are aimed at further improving the Wi-Fi 7 candidate features that will be incorporated into Wi-Fi 8 technology. Nonetheless, there are a few patents that specifically target Wi-Fi 8 features, including integrated mm Wave operation and expanded bandwidth exceeding 320 MHz.



Note: The chart above has been compiled through a manual review of patents considered relevant to the Wi-Fi 8 domain.

The integrated mm-Wave operations and extending the bandwidth above 320 MHz are presently the sole two features directly linked to Wi-Fi 8, as also discussed in the patents.

The remaining patents related to Wi-Fi 8 primarily focus on Wi-Fi 7 or earlier wireless generation features that will see further improvement or enhancement in Wi-Fi 8.

Players owning patents on features unique to Wi-Fi 8 concept:



mm-wave

Currently, all patents related to mm-wave operations in the context of Wi-Fi 8 have been filed by Intel Corporation.

Moreover, LAURENT CARIOU, the current chairperson of the UHR group, has collaborated with other inventors on these patents.

This underscores the significance of these patents and the associated feature in the context of their potential inclusion in Wi-Fi 8 technology.



Expanded bandwidth beyond 320 MHz

LG Electronics and Huawei have filed patents aimed at extending the bandwidth beyond 320 MHz.

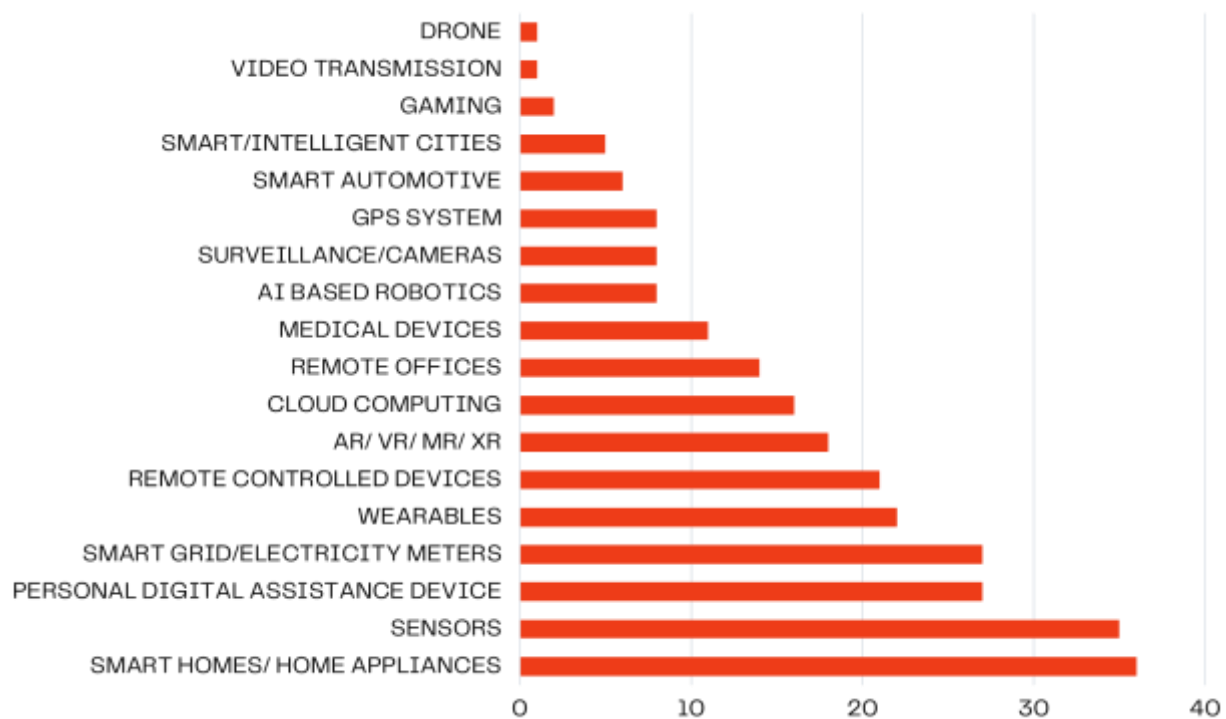
Application areas targeted:

Wi-Fi 7 witnessed a strong emphasis on applications such as AR/XR/VR, smart home appliances, and gaming.



As most of the patents related to the Wi-Fi 8 concept directed to enhance Wi-Fi 7 features, the applications identified in these patents largely overlap with those of Wi-Fi 7.

Focused applications on Wi-Fi 8:



Note: The chart above has been compiled through a manual review of patents considered relevant to the Wi-Fi 8 domain. The applications listed have been extracted from each patent (based on manual review) to emphasize the applications focused by the applicants innovating in the Wi-Fi 8 domain.

Similar to the application trends observed in Wi-Fi 7, Wi-Fi 8 patents continue to emphasize the significance of smart home appliances. Additionally, other notable application areas include PDAs, smart grid/electricity meters, wearables, AR/VR/XR, cloud computing, and medical devices.

The one common factor among all these areas is the necessity for a highly reliable network infrastructure.



Building the Future: Where Communication Meets Reliability.

In the future landscape of manufacturing, high-speed Gbps communication among robots, sensors, and industrial equipment will place an unprecedented demand on reliability.

For instance, the prospect of undergoing robotic-assisted surgery with an unreliable Wi-Fi connection – a notion that's far from reassuring.

Even in applications as crucial as holographic communications, which are pivotal for the emerging Metaverse, minor delays experienced by a mere 0.01% of data packets can induce discomfort and distress in users.

As technology ventures into increasingly ambitious domains like industrial automation, digital twinning, and telepresence, **the next-generation Wi-Fi will have to move beyond its conventional boundaries and prioritize reliability as its foremost concern**

Are you engaged in innovation within the wireless communication domain?

If yes, you might find our other publications on various wireless communication domains of interest:

S. No	Reports
1	Technology Landscape- Wi-Fi 6/6E
2	Technology Landscape- Wi-Fi 7
3	SEPs evaluation- Wi-Fi 7
4	Litigation scenario- Wi-Fi 5 and Wi-Fi 6

About us

ICUERIOUS is an intellectual property (IP) consulting firm providing full-service technology support for the entire stage of the IP process, with a focus on patents. We work closely with a diverse set of clients, including Fortune 500 companies, premier IP law firms, patent monetization and brokerage firms, independent inventors, and universities and focus on creating valuable IP ecosystems and patent monetization strategies via litigation and/or licensing. Our main services include prior art and invalidation searches, target scouting, evidence-of-use charting and detailed infringement analyses, patent drafting, open-source and proprietary source code review, competitor benchmarking and business/IP intelligence, technology landscaping and whitespace analysis reports, patent monitoring and market research.

Contact us: info@icuerious.com

Address: iCuerious Research Services LLP,
Unit 501 & 502, 5th Floor, Tower B,
Bestech Business Towers.

+91-(988)-873-2426 | +1-(339)-237-3075 (USA)