

# 5G Cellular Analysis in Klang, Selangor, Malaysia

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**Abstract:** Nowadays, 5G communication is becoming latest technology used for mobile connection. The technology is widely implemented in Malaysia country especially at urban area. However, there are different speed being measured at different locations. For the research analysis, Wifi analyzer and speedtest applications that can measure parameters related to cellular communication have been used as a measurement tool. At the end, the results show the connection speed for downloading and uploading process.

**Keywords:** 5G Communication; Wifi Analyzer; Cellular Communication; Speedtest; Connection Speed

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## 1. INTRODUCTION

In this world wide today 5G is an important thing to make sure people around the world can get access to faster internet connection. Hence there are the following elements must be taken into account in order to comply with 5G connectivity requirements. The first one is network infrastructure and it used to accommodate the higher data speeds and capacity, 5G networks need a sophisticated infrastructure. This entails putting in place brand-new base stations, tiny cells, and antennas that can handle the high-frequency bands needed for 5G connection [1].

Spectrum 5G networks require enough available spectrum resources. Governments and regulatory organisations designate particular frequency bands for use with 5G. These bands vary between various nations and areas. To deploy 5G services, network operators must get the required spectrum licences. Technology to deliver high-speed data, low latency, and improved network efficiency, 5G relies on cutting-edge technologies including millimetre waves (mmWave), massive MIMO (Multiple-Input Multiple-Output), and beamforming. upgrading current network hardware or implementing new technology support for these functionalities is required.

Backhaul capacity used to accommodate the increasing data flow, 5G networks need a strong backhaul infrastructure. The link between the base stations and the core network is referred to as backhaul. For 5G backhaul, fiber-optic cables and powerful microwave links are frequently used. Devices which are in order for customers to access 5G services, 5G-compatible devices such as smartphones, tablets, and other connected devices are required. These gadgets must be compatible with the specific 5G network's required frequency bands and technological infrastructure.

Security is needed to preserve data privacy and stop unauthorised access, 5G networks need strong security measures. For 5G communications to be secure and private, network operators must use encryption, authentication protocols, and other security measures. The development of 5G networks that can deliver higher speeds, ultra-low latency, expanded capacity, and support for a variety of connected devices and applications is made possible by meeting these standards.

### 1.1 5G Features

In comparison to earlier wireless technology generations, 5G networks offer a number of essential advantages. The

following are some salient characteristics of 5G such as quicker rates compared to earlier generations, 5G offers data rates that are noticeably quicker. It provides upload speeds of up to 1 Gbps and peak download speeds of up to 10 Gbps. Faster data transfers, smooth streaming of high-definition entertainment, and speedy file downloads are all made possible by this. Lower latency, the time between sending a command and receiving a response, or "latency," is extremely low in 5G networks [2]. Real-time communications and time-sensitive applications like driverless vehicles, remote surgery, and virtual reality gaming are supported by 5G's low latency of 1 millisecond (ms).

Greater capacity 5G networks are capable of handling a greater number of linked devices in a specific location. In densely populated areas and for Internet of Things (IoT) deployments, 5G networks may support a higher density of devices at once thanks to enhanced spectral efficiency and cutting-edge technology like massive MIMO (Multiple-Input Multiple-Output). Greater bandwidth, compared to earlier wireless technologies, 5G uses wider frequency bands, including higher frequency millimetre waves (mmWave). With more data being transferred simultaneously due to the increased bandwidth, more sophisticated streaming, video conferencing, and data-intensive applications are now possible.

Network slicing is a permit for the construction of several virtual networks on a common physical infrastructure, is a notion that 5G introduces. Service providers can dedicate portions of the network resources to particular apps or use cases by using network slicing assuring optimised performance and services that are customised depending on individual needs. Improved energy efficiency, a 5G networks are made to use less energy overall, both in terms of network infrastructure and device battery life. This is made possible by cutting-edge technology like beamforming, which enables for more targeted and effective signal transmission while consuming less power [3].

Massive connectivity, the IoT ecosystem's backbone, 5G seeks to connect a huge number of devices. It enables seamless communication and data exchange between a wide variety of devices, including smartphones, tablets, wearables, sensors, smart home appliances, and industrial equipment. These 5G capabilities offer game-changing services and applications in a range of industries, including automated vehicles, smart cities, remote healthcare, augmented reality,

and more [4]. The capabilities of 5G open up paving the path for a future with advanced technology and strong connectivity.

## 1.2 5G Developments in Malaysia

In Malaysia, the development of 5G technology has been a key focus for the government and telecommunications industry. Here are some key developments and initiatives related to 5G in Malaysia. Firstly, National 5G Task Force in 2018, the Malaysian government established the National 5G Task Force to drive the development and adoption of 5G technology in the country. The task force comprises representatives from the government, regulatory bodies, industry players, and academia.

The Malaysian Communications and Multimedia Commission (MCMC) initiated the 5G Demonstration Projects in 2019. These projects aim to test and showcase various 5G use cases and applications across different sectors, including healthcare, agriculture, smart cities, and tourism. Spectrum Allocation, in July 2020, the Malaysian government allocated the 700 MHz, 3.5 GHz, and 26/28 GHz frequency bands for 5G usage. This spectrum allocation enables network operators to deploy 5G services across the country.

5G deployment and testing, several telecommunication companies in Malaysia, such as Telekom Malaysia, Maxis, Digi, and Celcom, have conducted 5G network trials and tests in various locations [5]. These trials aim to assess network performance, coverage, and feasibility of 5G deployment. Regulatory framework, the Malaysian government has been working on developing a regulatory framework for 5G. The framework includes guidelines for spectrum assignment, licensing, infrastructure sharing, and cybersecurity to ensure a smooth and secure deployment of 5G networks.

Industry collaboration, the government encourages collaboration between industry players, academic institutions, and research organizations to drive 5G innovation and development. The development of 5G technology in Malaysia is expected to bring about various benefits, including enhanced connectivity, digital transformation across industries, and the ability to leverage advanced technologies like IoT, artificial intelligence, and automation. The government's focus on 5G development aims to position Malaysia as a regional leader in telecommunications and digital innovation.

## 2. METHODOLOGY

### 2.1 WIFI Analyzer

Choose a software application that is suitable for analyzing telecommunication signals in the group's nearest area. Download and install the "WIFI Analyzer" application from the Play Store on mobile device. Enable mobile data on your phone to ensure that you are connected to the 5G network. Select two different locations within the specific area where you will conduct the Wi-Fi speed tests. These locations should represent different environments or conditions that may affect network performance.

Analyze the data collected during the speed tests to evaluate the current state of the 5G network's performance and coverage in the selected areas [6]. Identify any shortcomings, challenges, or areas for improvement based on the obtained results. Capture screenshots of the results obtained during the Wi-Fi speed tests and perform a detailed analysis of the captured data. Examine the screenshots to assess various parameters such as signal strength, download/upload speeds,

latency, and any other relevant metrics provided by the WIFI Analyzer application.

Compare and analyze the results from different locations to identify patterns, variations, or inconsistencies in the 5G network performance and coverage. Interpret the data to gain insights into the strengths and weaknesses of the 5G network in the specific areas tested. Identify any potential factors that may be influencing the network performance, such as obstacles, interference sources, or signal attenuation. Analyze the screenshots and the accompanying data to identify potential areas for improvement or optimization in order to enhance the 5G network's performance and coverage. Another application that has been used is Speedtest application.

## 3. RESULTS

The Wi-Fi speed tests were conducted in two different locations which are indoor and outdoor. The results revealed certain shortcomings, challenges, and areas for improvement in the 5G network's performance and coverage. Additionally, potential factors influencing the network performance, such as obstacles, interference sources, and signal attenuation, were identified.

**Indoor Speeds:** The indoor location exhibited lower download speed of 82.2 Mbps and upload speed of 3.9 Mbps compared to the outdoor location, which recorded a download speed of 375.9 Mbps and upload speed of 76.3 Mbps. This indicates that there are challenges or limitations in providing consistent high-speed connectivity indoors. **Latency (Ping):** The ping values for the indoor and outdoor locations were 21ms and 13ms, respectively. Lower ping values indicate lower latency, which is desirable for real-time applications such as online gaming or video conferencing. However, it's important to note that the difference in ping values between the two locations was not significant.

**Obstacles:** Physical obstacles like walls, floors, or furniture in indoor environments can obstruct the propagation of wireless signals, leading to signal attenuation and a decrease in network performance. **Signal Attenuation:** Different building materials, such as concrete, metal, or dense structures, can attenuate or weaken 5G signals, resulting in reduced signal strength and lower data transfer speeds.

**Interference Sources:** Nearby electronic devices or wireless networks operating in the vicinity can cause interference, degrading the overall network performance and impacting both signal quality and speed. **Indoor Signal Boosting:** To address the indoor coverage limitation, consider installing indoor signal boosters or repeaters to amplify the 5G signal within buildings. This will improve coverage and provide better download and upload speeds.

**Network Optimization:** Conduct a comprehensive analysis of the indoor environment to identify potential obstacles and interference sources. By strategically placing access points and minimizing signal obstructions, the signal strength and overall performance can be optimized. **Interference Mitigation:** Implement measures to mitigate interference from neighboring networks or devices. This can include selecting optimal wireless channels, utilizing advanced interference avoidance techniques, or deploying advanced networking equipment capable of handling interference more effectively.

By addressing these areas for improvement and considering the potential factors influencing network performance, the 5G network's overall performance and coverage can be enhanced. This will result in faster and more reliable connectivity both indoors and outdoors, providing an improved user experience.

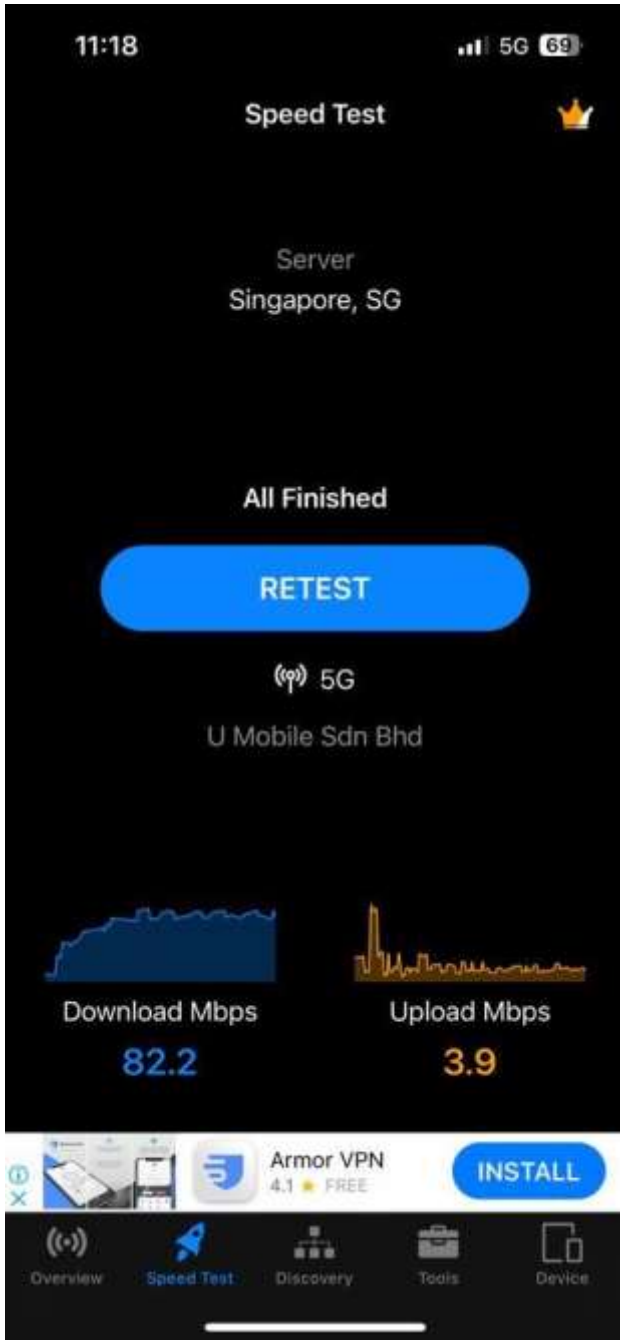


Figure 1 Result from Wifi Analyzer application.

The Figure 1 shows the result of download and upload analysis of cellular connection between a personal phone and telecommunication tower using Wifi Analyzer application. The connection is based on 5G communication from the user phone. It was recorded in indoor environment. While, the Figure 2 shows the analysis result using Speedtest application indicating download and uploading speed for data connection. The result was recorded at outdoor surrounding environment.



Figure 2. Result from Speedtest application.

#### 4. CONCLUSION

In conclusion, 5G technology has revolutionized the telecommunications industry, and its implementation is driven by various requirements, features, and advantages. 5G technology fulfills key requirements such as high data rates, low latency, massive connectivity, and reliable communication, enabling a wide range of applications. With its significantly higher data transfer speeds, 5G enables seamless streaming of high-definition content, ultra-fast downloads, and real-time communication. The low latency offered by 5G enhances applications like autonomous vehicles, remote surgery, and Internet of Things (IoT) devices, allowing for near-instantaneous response times.

The advantages of 5G technology extend beyond speed and latency. Its increased capacity and improved efficiency enable the connection of a massive number of devices, facilitating the growth of smart cities, smart homes, and industrial automation. Moreover, 5G offers enhanced network reliability and security, making it suitable for critical applications that demand uninterrupted connectivity and data protection [7].

In Malaysia, the development of 5G technology is a national priority. The government, in collaboration with industry players, is actively driving initiatives to accelerate 5G deployment. Malaysia aims to leverage 5G technology to boost economic growth, drive digital transformation across industries, and enhance the overall quality of life for its citizens. The focus areas for 5G applications in Malaysia include smart cities, e-healthcare, agriculture, transportation, and education.

In the project, it has achieved the objectives whereby gain a thorough understanding of concept of 5G and perform an analysis of it to identify and explore the potential use and application of 5G technology. For instance, the 5G technology still need to be improved in terms of indoor coverage as the 5G offers remarkable speeds and capabilities, but its connectivity inside buildings is still cannot be considered as reliable. Factors such as building materials, interference, and signal propagation need to be carefully addressed to provide seamless 5G coverage indoors. There are some strategies to improve the 5G performance, where it can be done by deploying small cells, utilizing the high-frequency bands, and optimizing the antenna placement to overcome the indoor coverage limitations. By applying these strategies, the indoor coverage effectiveness will be ensured, hence the full potential of 5G applications and services is able to be experienced by the users.

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