

# Comparative Analysis of Quality of Service (QoS) on 4G LTE and 5G Networks in Bekescsaba Hungary

Dery Adlil Karim<sup>a\*</sup>, Sri Yusnita<sup>b\*</sup>, Dikky Chandra<sup>c\*</sup>

<sup>a</sup> Csaba Metál ZRt. Békéscsaba, Kerek 63, Hungaria

<sup>bc</sup> Department of Telecommunication Engineering, Politeknik Negeri Padang, Padang, West Sumatra, Indonesia

<sup>a\*</sup> Corresponding author: [deryadlilkarim03@gmail.com](mailto:deryadlilkarim03@gmail.com)

**Abstract**— This research discusses the comparison of Quality of Service (QoS) performance on 4G LTE and 5G networks in the Bekescsaba region, Hungary. The analysis was conducted based on five main QoS parameters, namely download speed, upload speed, jitter, packet loss, and latency, with the RSRP (Reference Signal Received Power) measurement category. The results showed that 5G networks consistently outperformed 4G LTE in almost all categories. For example, in the Very Good category, 5G networks recorded download speeds of up to 196 Mbps, upload speeds of 91.5 Mbps, and latency of 25 ms, significantly better than 4G LTE. In the Good and Fair categories, the 5G network continued to show significant advantages in data speed and latency, although the jitter values were relatively comparable to 4G LTE. In addition, packet loss on both networks was recorded at 0%, indicating a high level of reliability. This study concludes that 5G networks provide a better experience in supporting modern connectivity needs than 4G LTE, even under less than optimal signal conditions. The findings are expected to serve as a reference for future telecommunications infrastructure development.

**Keywords**— QoS, 4G LTE, 5G, RSRP, Download Speed, Upload Speed, Jitter, Packet Loss, Latency, Bekescsaba, Hungary

Manuscript received 4 May. 2025; revised 20 Jun. 2025; accepted 22 Jun. 2025. Date of publication 23 Jun. 2025. International Journal of Wireless And Multimedia Communications is licensed under a Creative Commons Attribution-Share Alike 4.0 International License.



## I. INTRODUCTION

The rapid development of technology today is influenced by the increasing number of human needs or technology users for information that is always up to date and smooth communication. The more demand need for this, then humans as users began to create various new breakthroughs in the field of information and communication in order to help meet human needs for smooth access to information and communication especially in the field of communication.[1] Quality of service or Quality of Service (QoS) in a network is strongly influenced by various technical parameters such as jitter, packet loss, latency, upload and download speed. The comparison between 4G LTE and 5G networks is important to analyze because each has different characteristics in handling user needs. 5G is claimed to have advantages in speed and stability over 4G LTE, but its implementation is still in the stage of development in many regions. Therefore, an in-depth analysis is needed to find out whether 5G really provides a significant improvement over 4G LTE in real conditions.

One city that has seen significant growth in the use of mobile technology is the Hungarian city of Bekescsaba. Like many other cities in Europe, the people of Bekescsaba rely on mobile networks for various digital activities. However, the quality of service that users receive can vary depending on various technical factors and the condition of the network in use. QoS performance between 4G LTE and 5G networks in Bekescsaba City, as well as identify factors

Therefore, this study aims to analyze and compare the that affect the performance of both networks. With people's increasing reliance on mobile for communication, it is important to understand how these two types of networks affect the quality of service received by users.

The objectives of this research are Measuring the signal quality of 4G LT and 5G networks in Bekescsaba City, analyzing and comparing Quality Of Service (QoS) on 4G and 5G networks in Bekescsaba City and Identifying factors that affect Quality Of Service (QoS) on both types of networks.

The benefits obtained from this research are Providing data and insights that can be used to improve network quality in Bekescsaba Hungary, providing guidance for users in choosing the most suitable network for their needs and Adding to the literature related to Quality Of Service (QoS) performance on 4G LTE and 5G networks, especially in urban environments in Europe.

II. MATERIALS AND METHOD

1. Flowchart Drive Test

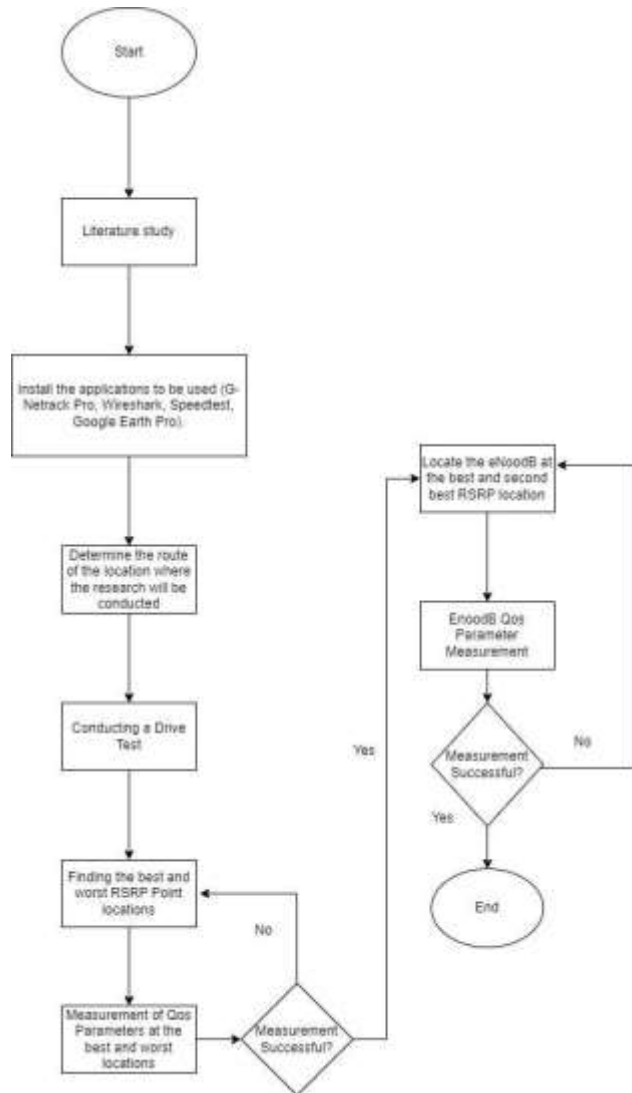


Figure 1 Flowchart Drive Test

2. Driver test Parameters

a. Reference Signal Received Power (RSRP)

Drivetest is a method for measuring the signal strength emitted by the nearest BTS and the data contained in the BTS network. This measurement is made in real time using specific software and hardware. Drivetest is a tool used to assess the network performance or condition of a network and to determine the throughput values (upload and download speeds) of a network in a specific area. [2]

Table 1 range RSRP value

Legend	Range
Excellent	$RSRP \geq -75$
Verry Good	$-85 \leq RSRP \leq -75$
Good	$-100 \leq RSRP \leq -85$
Fair	$-110 \leq RSRP \leq -100$
Poor	$RSRP \leq -110$

b. Reference Signal Receive Quality (RSRQ)

RSRQ (Reference Signal Receive Quality) is the ratio between RSRP and wideband power. RSRQ is the quality of the signal received by the UE.

Table 2 range RSRQ value

Kategori	Range Nilai RSRQ
Excellent	$RSRQ \geq -3$
Verry Good	$-3 \leq RSRQ \leq -9$
Good	$-9 \leq RSRQ \leq -14$
Fair	$-14 \leq RSRQ \leq -19,5$
Poor	$RSRQ \leq -19,5$

c. Signal to interference noise ratio (SINR)

SINR is the ratio between the main signal being transmitted and the interference and noise generated (mixed with the main signal).

Table 3 range SINR value

Legend	Range
Excellent	$SINR \geq 20$
Verry Good	$13 \leq SINR \leq 20$
Good	$0 \leq SINR \leq 13$
Poor	$SINR \leq 0$

d. Throughput

Throughput is the amount of data sent/transferred from the source (source) to the destination (destination) per unit time (bits per second/bps). The maximum throughput given will be different because the number of Resource Blocks (RB) is different.

Table 4 range throughput value

Legend	Range (kbps)
Excellent	$TPUT \geq 65.000$
Verry Good	$40.000 \leq = TPUT \leq 65.000$
Good	$10.000 \leq = TPUT \leq 40.000$
Fair	$5.000 \leq = TPUT \leq 10.000$
Poor	$TPUT \leq 2.000$

e. Google earth

Google Earth is a computer program that displays a 3D representation of the Earth based on satellite imagery. The program maps the Earth by superimposing satellite images, aerial photographs, and GIS data onto a 3D globe, allowing users to view cities and landscapes from different angles.

f. Speedtest

Speedtest is an App that provides speed testing

g. G-net track lite

G-Net Track Pro is software found on android-based mobile phones that is used to conduct drive tests. G-Net Track Lite can be used to measure indoor or outdoor network performance.

III. RESULTS AND DISCUSSION

A. Measurement and Analysis of Reference Signal Received Power (RSRP)

This measurement is carried out to see the ability of the existence of 4G LTE and 5G network BTS. when the Reference Signal Received Power (RSRP) value is getting bigger, the existence of BTS is getting farther and vice versa.

1. 4G LTE network

The results of Reference Signal Received Power (RSRP) reduction on 4G LTE networks that have been measured using the G-NetTrack application are as follows:

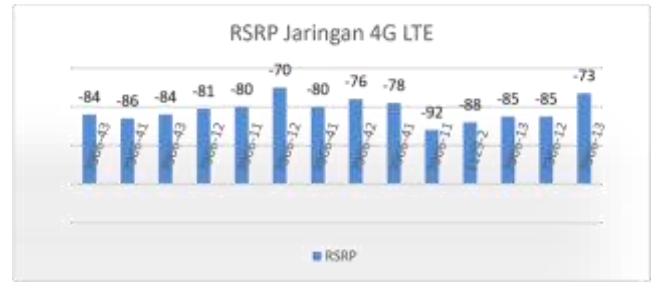


Figure 2 RSRP Graph of 4G LTE Network

2. 5G LTE network

The results of measuring Reference Signal Received Power (RSRP) on 5G networks that have been measured using the G-NetTrack application are as follows:

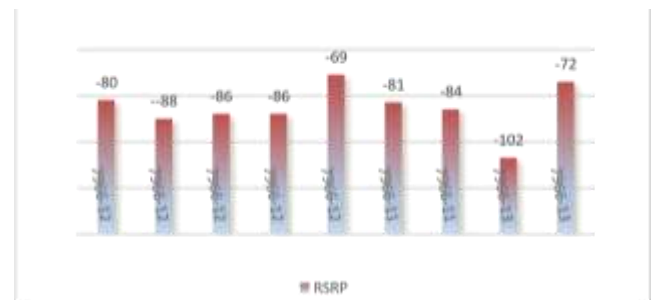


Figure 3 RSRP Graph of 5G LTE Network

B. Reference Signal Received Quality RSRQ Measurement

This measurement is carried out to see how much signal quality is received by the device.

1. Measurement RSRQ 4G LTE

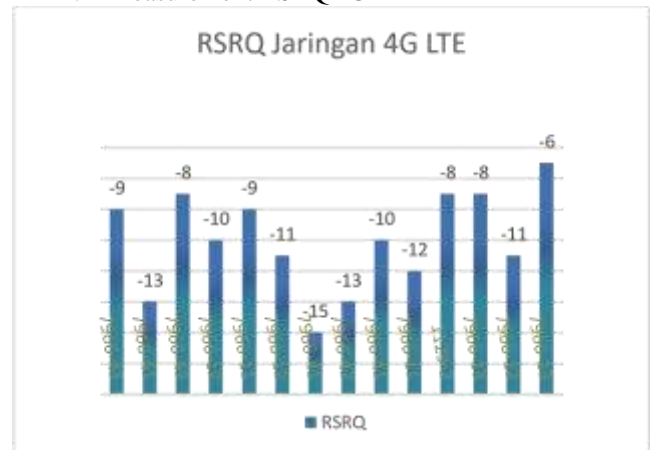


Figure 4 RSRQ Graph of 4G LTE Network

Cell ID 7966-13 has a more stable signal quality with good RSRQ values, while other cell

IDs show more variation with the dominance of RSRQ values at fair to poor levels. This shows that there are differences in network optimization in different areas. Therefore, network optimization efforts are needed to improve signal quality in areas with low RSRQ values to support a better user experience.

2. Measurement RSRQ 5G LTE

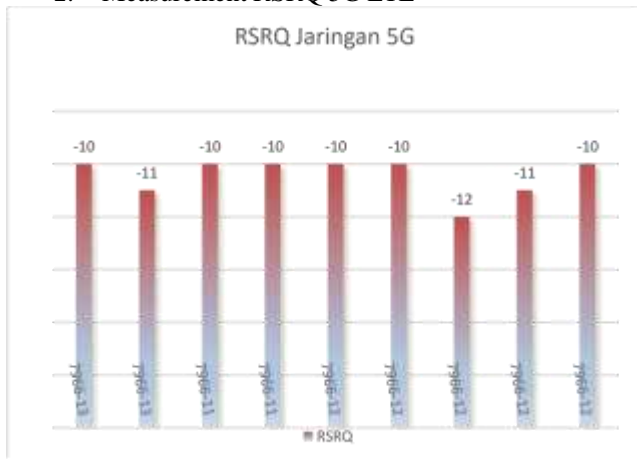


Figure 5 RSRQ Graph of 4G LTE Network

Certain cell IDs may be more stable than others, which could be due to location, distance from the BTS, or physical barrier conditions. Overall, while 5G networks provide relatively good signal quality, some areas require additional optimization to improve stability and reduce interference, especially in cell IDs with lower RSRQ values. This is important to ensure an optimal user experience when using 5G networks.

C. Determination of Quality of Service (QoS) Measurement Points

From the previous drive test measurements, the data needed to continue this Quality of Service (QoS) analysis was obtained, after obtaining the best 2 RSRP points.

1. Quality of service (QoS) measurement results

Tests are carried out in all conditions by conducting connection tests using the speedtest application which is directly connected to the 4G LTE and 5G Yettel providers based on 5 points according to the RSRP category in the previous drive test measurements.

Based on the measurement results of 4G LTE and 5G telecommunication networks in Bekescsaba, Hungary, the measurement results are as follows:

a. Quality of Service (QoS) Measurement RSRP Excellent Category

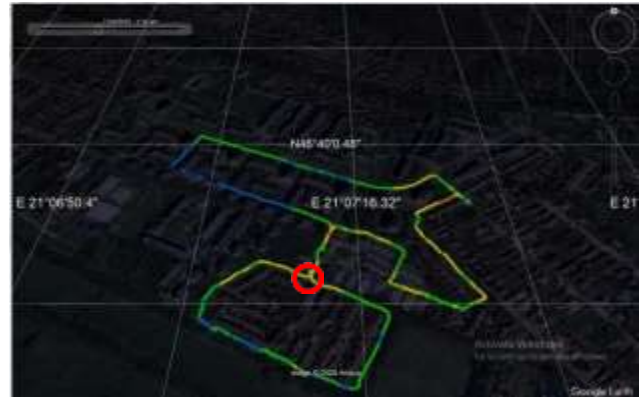


Figure 6 RSRP Excellent Quality of Service (QoS) Measurement Location

Table 5 RSRP Excellent Quality of Service (QoS) Measurement

Range Parameter	Parameter QoS	Jaringan 4G LTE	Jaringan 5G
<i>Excellent</i>	<i>Download</i>	108 Mbps	201 Mbps
	<i>Upload</i>	18,3 Mbps	62,1 Mbps
	<i>Jitter</i>	3 ms	6 ms
	<i>Packet Loss</i>	0,00 %	0,00 %
	<i>Latensi</i>	29 ms	30 ms

The results of QoS measurements in the RSRP Excellent category on 4G LTE and 5G networks in Bekescsaba, Hungary, show significant differences in the performance of the two networks. The download speed on the 5G network reached 201 Mbps, almost twice as high as the 4G LTE network which was only 108 Mbps. This demonstrates the ability of 5G networks to provide greater throughput, in accordance with the latest technology standards to support the increasing need for data transfer.

For the jitter parameter, the 5G network recorded a value of 6 ms, which is higher than the 3 ms on the 4G LTE network. However, this value is still in the excellent category and does not significantly affect the user experience, especially for applications such as voice or video communication. Both networks had a packet loss rate of 0.00%, indicating high reliability in data transmission without loss of information. The

latency of the 5G network was slightly higher (30 ms) than that of 4G LTE (29 ms).

b. Quality of Service (QoS) Measurement RSRP Very Good Category

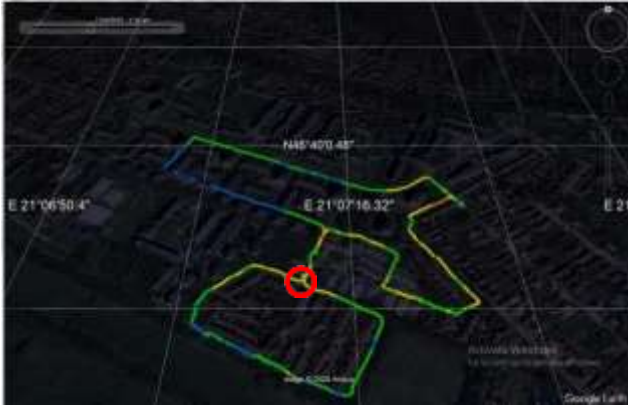


Figure 7 RSRP Very Good Quality of Service (QoS) Measurement Location

Table 6 RSRP Very Good Quality of Service (QoS) Measurement

Range	Parameter	4G LTE	5G
Very Good	Download	75,1 Mbps	196 Mbps
	Upload	43 Mbps	91,5 Mbps
	Jitter	24 ms	3 ms
	Packet Loss	0,00 %	0,00 %
	Latensi	33 ms	25 ms

Overall, the measurement results show that 5G networks have significant advantages over 4G LTE in all measured QoS parameters. These improvements indicate that 5G is capable of providing services with high speeds, better stability, as well as low latency, which are well suited to support modern applications and future technologies. These advantages position 5G as a network technology that is ready to meet the increasingly complex and dynamic needs of the digital era.

c. Quality of Service (QoS) Measurement RSRP Good Category

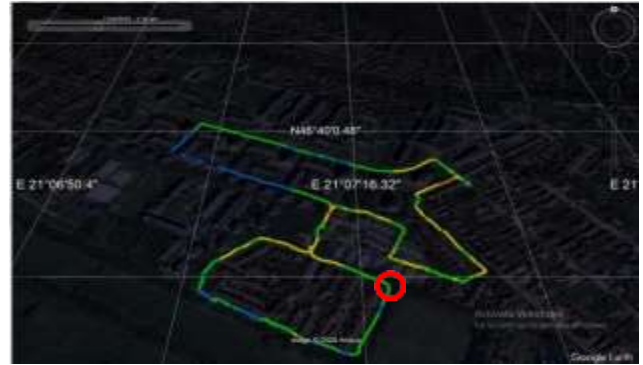


Figure 8 RSRP Good Quality of Service (QoS) Measurement Location

Table 7 RSRP Good Quality of Service (QoS) Measurement

Range	Parameter	4G LTE	5G
Good	Download	85,6 Mbps	185 Mbps
	Upload	28,8 Mbps	65,1 Mbps
	Jitter	6 ms	1 ms
	Packet Loss	0,00 %	0,00 %
	Latensi	53 ms	23 ms

Overall, 5G networks showed significant improvements over 4G LTE networks in all QoS parameters measured. With higher speeds, better connection stability and lower latency, 5G networks offer tremendous advantages in supporting the needs of modern applications that are increasingly complex and demand higher quality of service. This shows that 5G is ready to meet future needs with more reliable and efficient connections.

d. Quality of Service (QoS) Measurement RSRP Fair Category

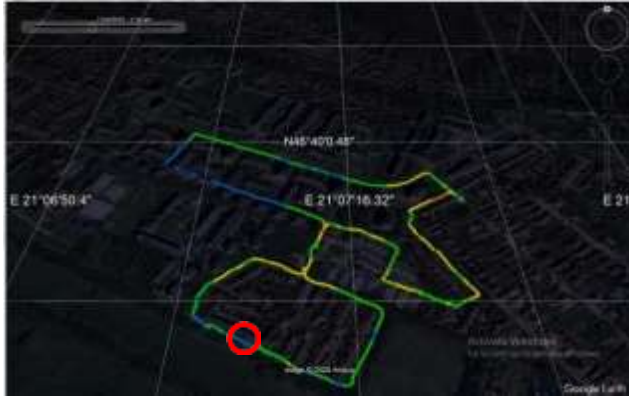


Figure 9 RSRP Fair Quality of Service (QoS) Measurement Location

Table 8 RSRP Fair Quality of Service (QoS) Measurement

Range	Parameter	4G LTE	5G
Parameter	QoS		
Fair	Download	67,9 Mbps	96,1 Mbps
	Upload	30,5 Mbps	46,6 Mbps
	Jitter	5 ms	5 ms
	Packet Loss	0,00 %	0,00 %
	Latensi	31 ms	26 ms

Overall, while both networks performed well in the RSRP Fair category, the 5G network still showed significant advantages in terms of download speed, upload speed, and lower latency. These advantages make 5G networks more efficient and responsive in supporting various modern application needs, even under non-ideal signal conditions.

e. Quality of Service (QoS) Measurement RSRP Poor Category



Figure 10 RSRP Poor Quality of Service (QoS) Measurement Location

Table 9 RSRP Poor Quality of Service (QoS) Measurement

Range	Parameter	4G LTE	5G
Parameter	QoS		
Poor	Download	50,5 Mbps	94,8 Mbps
	Upload	64,7 Mbps	107 Mbps
	Jitter	5 ms	2 ms
	Packet Loss	0,00 %	0,00 %
	Latensi	33 ms	23 ms

Overall, this analysis shows that 5G networks offer higher data speeds, better connection stability and faster response times than 4G LTE networks, even in "poor" signal conditions. This makes 5G networks superior in supporting the needs of modern applications that require fast and reliable connections.

D. Quality of Service (QoS) Analysis Based on Each Parameter with TIPHON Standards

Analysis of Quality of Service (QoS) Based on Each Parameter Based on the analysis of each measurement above, the following conclusions can be given, that this Quality of Service (QoS) measurement according to TIPHON standardization has achieved the desired results both on 4G LTE networks and 5G networks.

Table 10 average QoS analysis of 4G LTE and 5G networks

No	Titik	Latensi 4G	Latensi 5G	Jitter 4G	Jitter 5G	Packet Loss 4G	Packet Loss 5G
1.	<i>Excellent</i>	29 ms	30 ms	3 ms	6 ms	0.00 %	0.00 %
2.	<i>Very Good</i>	33 ms	25 ms	24 ms	3 ms	0.00 %	0.00 %
3.	<i>Good</i>	55 ms	23 ms	6 ms	1 ms	0.00 %	0.00 %
4.	<i>Fair</i>	31 ms	26 ms	5 ms	5 ms	0.00 %	0.00 %
5.	<i>Poor</i>	33 ms	23 ms	5 ms	2 ms	0.00 %	0.00 %
	<i>Rata-rata</i>	36,2 ms	25,4ms	8,6 ms	3,4 ms	0.00 %	0.00 %

Table 11 average QoS analysis of 4G LTE and 5G networks using TIPHON standardization

No	Network	Indeks Latensi	Indeks Jitter	Indeks Packet Loss	Indeks QoS	Category TIPHON
1	4G LTE	4	3	4	3,67	<i>Good</i>
2	5G	4	3	4	3,67	<i>Good</i>

In Bekescsaba, Hungary, the recapitulation of the Quality of Service (QoS) parameter index for 4G LTE and 5G networks shows results in the Good category with a low jitter index of 3, indicating minimal congestion opportunities. The Perfect category, with a packet loss index of 4, signifies no data loss during transfers, ensuring smooth voice communication, gaming, web browsing, and video conferencing experiences. Outdoor testing further reduces the likelihood of packet loss. The Excellent category, with a latency index of 4, indicates short delays in packet transmission, facilitating high data transfer rates that meet customer requirements effectively. Overall, these findings demonstrate that networks in Bekescsaba offer reliable performance for various activities without significant disruptions or quality issues.

Based on the average of each parameter, overall 4G LTE and 5G networks on measurements in Bekescsaba Hungary get a Quality of Service index worth 3.67 with the Good category. It can be interpreted that the comparison of these two Yettel networks, 4G LTE and 5G in Bekescsaba, Hungary, is almost not much different, only on the upload and download capabilities between 4G LTE and 5G, the 5G network is very favored. So overall it can be concluded that the 5G

network is superior to the 4G LTE network in Bekescsaba Hungary.

#### IV. CONCLUSION

The final project, which analyzed the quality of service performance of 4G and 5G networks in Bekescsaba, Hungary, revealed that signal quality factors such as RSRP and RSRQ are critical. It was observed that while 4G LTE networks need optimization for weak signal areas, 5G networks need improved infrastructure distribution for consistent performance. Comparing the networks in Bekescsaba, the average latency for 4G LTE was 36.2 ms and 25.4 ms for 5G, both in the "good" category. Similarly, the average jitter for 4G LTE was 8.6 ms and 3.4 ms for 5G, both considered good. In addition, both networks had a packet loss rate of 0.00%, which is considered perfect. The overall quality of service index for 4G LTE and 5G networks in Bekescsaba was 3.67, indicating 'Good' performance. Finally, 5G networks demonstrated superiority over 4G in terms of latency, jitter and packet loss, making them ideal for real-time applications such as VoIP and IoT.

#### V. REFERENCES

- [1] Azhar and M. Badrul, "Penerapan Voice Over Internet Protokol Untuk Optimalisasi Jaringan Pada Badan Kependudukan dan Keluarga Berencana Nasional," *Prosisko*, vol. 5, no. 1, pp. 1–17, 2018.
- [2] Belous, A., & Saladukha, V. (2019). Basic Components of Telecommunication Systems. *High-Speed Digital System Design* . [https://doi.org/10.1007/978-3030-25409-4\\_4](https://doi.org/10.1007/978-3030-25409-4_4).
- [3] S. Pemanfaatan, D. Dividend, U. Layanan, and S. Ariyanti, "Studi Pemanfaatan Digital Dividend Untuk Layanan Long Term Evolution (LTE) (Sri Ariyanti)," 2013.
- [4] Firdausi, R.S.V. Simbar, S. Hadi, "Pengenalan Teknologi 5G (Generasi Ke 5) Pada Sebuah Sistem Antena untuk Siswa/I SMA di Kembangan Utara", *Jurnal Abdi Masyarakat (JAM)*, Vol 5 No. 1, hlm. 6 – 10, September 2019,
- [5] Sutarti, Siswanto, and A. Subandi, "Implementasi Dan Analisis QoS (Quality of Service) Pada VoIP (Voice Over Internet Protocol) Berbasis Linux," *J. PROSISKO*, vol. 5, no. 2, pp. 92–101, 2018.
- [6] Tiphon. 1998. Telecommunications and Internet Protocol Harmonization Over Networks TIPHON) General Aspects of Quality of Service (QoS). E- book DTR/TIPHON-05006.
- [7] Liu, S., & Fu, L. (2023). Improving End-to-end Throughput in Multi-Hop Wireless Networks With Cut-Through Capability. *IEEE Transactions on mobile Computing*, 22, 1521-1535. <https://doi.org/10.1109/TMC.2021.3109901>

- [8] R. Nihayah, "Tugas Akhir Analisa Kualitas Jaringan 4G Lte Untuk Provider - Provider Di Surakarta Berdasarkan Parameter Drive Test," 2020.