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An Analysis of 4G Lite Signal Quality on Telkomsel XL Provider and Hutchison 3 Indonesia Using G-Nettrack Pro Application Via Android at State Polytechnic of Sriwijaya

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Abstract

The use of providers can increase customer satisfaction and the development of various future features. Performing network performance is the main thing that must be considered in network management. Sriwijaya State Polytechnic has several buildings, and many students, lecturers and academic staff. Each individual uses a provider on a mobile phone to communicate. The reason researchers measured the signal quality of Telkomsel, XL and H3I providers using the G-Nettrack Pro application is based on the parameters measured to determine the service's quality. The best RSRP measurement results from XL providers on the first day, with a consequence of -77.5 dBm. The lowest RSRQ value measurement was found on the first day of the H3I provider, with a value of -37.25 dB. The highest SNR value measurement was found on the first day, with a result of 7.56 dB.
Keywords: 4G LTE, RSRP, RSRQ, SNR, G-Nettrack pro, Walk test

Abstrak

Penggunaan provider dapat meningkatkan kepuasan pelanggan dan pengembangan berbagai fitur kedepannya. Performa jaringan merupakan hal utama yang harus diperhatikan dalam manajemen jaringan. Politeknik Negeri Sriwijaya memiliki beberapa gedung dan terdiri dari banyak mahasiswa, dosen dan tenaga kependidikan, masing-masing menggunakan provider di handphone untuk berkomunikasi. Alasan peneliti mengukur kualitas sinyal provider Telkomsel, XL dan H3I menggunakan aplikasi G-Nettrack Pro berdasarkan parameter yang diukur untuk mengetahui kualitas layanan tersebut. Hasil pengukuran RSRP terbaik dari provider XL pada hari pertama, dengan hasil -77,5 dBm. Pengukuran nilai RSRQ terendah didapatkan pada hari pertama pemberian H3I provider dengan nilai -37,25 dB. Pengukuran nilai SNR tertinggi didapatkan pada hari pertama dengan hasil sebesar 7,56 dB.
***Kata-kata kunci**: 4G LTE, RSRP, RSRQ, SNR, G-Nettrack pro, Tes Berjalan*

1. Introduction

The wireless communication relationship commonly referred to as wireless starts with the 1G, 2G, and 3G generations. So far, the majority of users have implemented the 4G generation called Long Term Evolution (LTE), which has an internet signal quality speed 500 times faster than 3G and can deliver speeds of up to 10 Mbps and 100 Mbps [1][2]. 4G LTE provides a better service than the progress of existing information. However, it also shares a higher speed of information so that the network monitoring process ensures that operators and users are satisfied with network facilities [3].

Sriwijaya State Polytechnic has several buildings and consists of many students, lecturers and academic staff, where each individual uses a provider on a mobile phone to communicate. The use of providers can increase customer satisfaction and the development of various future features. It is the reason for researchers to carry out the wireless network monitoring process as an analysis of signal quality using the G-NetTrack Pro application, which aims at whether the quality of the service is good or not. Similar research carried out previously leads to measurements in high-rise buildings. Moreover, in the measured field area, the application of previous methods, namely the Drive Test and Walk Test methods, is to observe and optimize so those network performance criteria are produced or can produce signal quality results that have been measured.

Based on this background, in writing this article, an analysis of the Signal Quality of Telkomsel, XL and Hutchison 3 Indonesia Providers was carried out, which is widely used by users. However, of the 3 providers, there are problems with the signal quality generated at the route point at the Sriwijaya State Polytechnic campus. The data was collected using the G-NetTrack Pro Application Via Android. The comparison measured in this study is the RSRQ, RSRP and SNR parameters using the Walk Test method.

2. Method

a. Material

1) Basic Concepts of Cellular Telecommunications

The basic concept of a mobile system is to divide telecommunications services into smaller areas called cells. The goal is to allow customers to communicate freely within the service area uninterruptedly [4].

2) Long-Term Evolution (LTE)

Long-Term Evolution (LTE) is a long-time radio channel communication relationship developed by the 3rd Generation Partnership Project (GPP). LTE is a continuation of WDCMA-UMTS 3G. Information advancements are already expected to be as profitable since 2009. An evolutionary standard for mobile broadband data communication over the next decade. Since December 2007, 3GGP has issued Release-7 to demonstrate the LTE concept. Thus, the LTE plan began in 2008, along with the release of the 8th Release **[5].**

3) LTE Network Architecture

4G is a term for 4th generation mobile communication technology. Designed to represent 3G, 4G neutralizes communication through smoothness more advanced than ever. According to the theory, the transmission speed of a 4G signal is 100 Mbit/s to 1 Gbit/s. With a 4G network, it can enjoy 13 voice, data/internet services, chat, network, games, video and other functions more than a 3G network. 4G speed is excellent for users marketed through smartphones, as users do not support it too. There are two criteria for commercial 4G signals in the environment: WiMax signs in South Korea and the LTE standard in Sweden **[6].**

4) LTE Network Performance Comparison

Measurement of signal quality helps know the performance of a network on a cellular, indicating the highest power quality based on the data obtained. Comparison of LTE signal performance, i.e. **[5].**

a) Reference Signal Received Power (RSRP)

Reference Signal Received Power is the power that the user gets at the frequency. The further the website is away from the user, the lower the RSRP the user will receive. RS is a reference signal or RSRP at each coverage point. The range of RSRP values is generally divided into Good, Normal, and Bad **[7][8].**

b) Reference Signal Received Quality (RSRQ)

Reference Signal Received Quality is a comparison of Reference Signal Received Power to broadband power known for signal quality captured from User and noise **[9].**

c) Signal Noise Ratio (SNR)

Signal to Noise Ratio is the equation of network strength obtained with network strength that is not obtained and shows the network results captured by the transmission speed **[2].**

Table 1. Values of LTE KPI Standards [9]

Category	RSRP (dBm)	RSRQ (dB)	SNR (dB)
Very Good	(-80) ≤ x dBm	(-9) ≤ dB	(30) ≤ x (15) dB
Good	(≤ -90) x < (-80) dBm	(-10) ≤ x < (-9) dB	(15) ≤ x (0) dB
Good Enough Bad	(≤-100) x < (-90) dBm	(-15) ≤ x < (-10) dB	(0) ≤ x (-5) dB
Very Bad	(≤-120) x < (-100) dBm	(-19) ≤ x < (-15) dB	(-11) ≤ x (-20) dB
	(< -120) x dBm	(-20) < dB	≤ -11 s/d ≥ -20

5) G-NetTrack Pro

G-NetTrack Pro is an application that can be downloaded to Android phones through the Play Store application which helps monitor 4G signal performance via mobile phones **[5].** This app is to see if RSRP, RSRQ, and SNR are rated well in the environment to determine the signal quality area **[1][10].**

b. Material

The method at this research stage is carried out as a whole on a system that can function in **Figure 1** of the research framework.

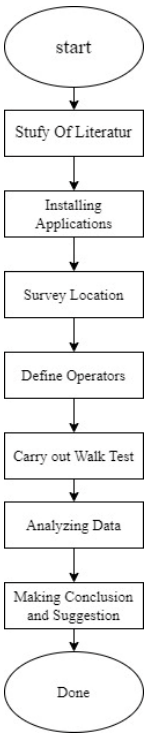

Figure 1. Research Framework

1. Conducting Literature Studies, namely conducting research and data documentation related to the problems in this final project, articles, references, journals, or other sources related to discussions about Telkomsel, XL and Hutchison 3 Indonesia networks, parameters used as well as the G-NetTrack Pro application and others.
2. Installing Applications, namely installing software applications, G-NetTrack Pro as supporting software in this study.
3. Conducting a Location Survey, which is a research location at the Sriwijaya State Polytechnic.
4. Determine the operators widely used by users, namely Telkomsel, XL and Hutchison 3 Indonesia operators. However, from these 3 providers, there are problems with the signal quality generated at the route point on the Sriwijaya State Polytechnic campus.
5. Doing a Walk Test, that is, a walk test is a measurement taken while walking with a drive test device.
6. Conducting analysis is analyzing the results of data from walk test research.
7. Conclusions and Suggestions are to briefly explain the results that have been achieved, along with suggestions for the development of further research, as for the preparation of devices, both hardware and software, supporting the implementation of signal measurements and the implementation of data analysis. The devices used are shown in **Figure 2.** Device Preparation Flowchart.

Figure 2. Device Preparation Flowchart

The hardware equipment in the study is android phones and laptops with specifications as stated in **Table 2.** HP specifications and **Table 3.** Laptop specifications.

Table 2. HP Specifications

Product Name	*Processor*	RAM
Vivo Y91	1,95 GHz Snapdragon 439 Octa-core	2 GB

Table 3. Laptop Specifications

Product Name	*Processor*	RAM
Acer	Intell CoreI i7-10510U CPU @ 1.80GHz 2.30 GHz	8,00 GB (7,80 GB usable)

1) Software Equipment

Software equipment uses a supporting application, namely the G-NetTrack Pro application. The following **Figure 3** shows the appearance of the application on an Android phone.

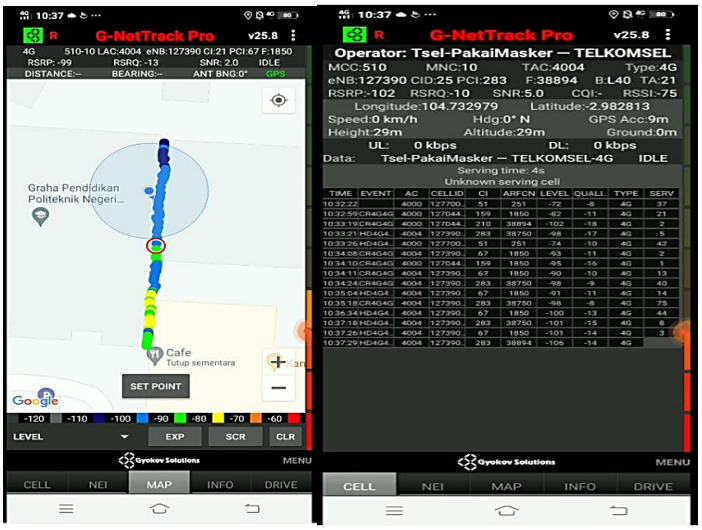

Figure 3. G-NetTrack Pro App

3. Results and Discussion

a. Data analysis of walk test measurement results

1) 4G LTE Performance Measurement Data Results

The walk test measurement data results can be seen in table 3. RSRP telkomsel the first day and table 4.RSRP telkomsel day two. The signal quality category is outstanding; there are measurements on the first day at points 4-1 on route 1 with a value of -76 dBm. Moreover, on the second day on route 1, points 3-4 with a value of -76 dBm. Then for the lousy category, there are on the second-day measurements at points 2-3 on route 2 with a value of -105 dBm.

Table 4. RSRP Telkomsel first day

Point	Rute 1	Rute 2	Rute 3
1-2	-95	-92	-97
2-3	-82	-91	-82
3-4	-90	-89	-80
4-1	-76	-85	-83
Average	-85.75	-89.25	-83

Table 5. RSRP Telkomsel second day

Point	Rute 1	Rute 2	Rute 3
1-2	-99	-90	-92
2-3	-93	-105	-87
3-4	-76	-96	-99
4-1	-90	-81	-81
Average	-89.5	-93	-89.75

The results of the RSRQ walk test measurement data can be seen in the table 5 Telkomsel the first day and table 6 Telkomsel day two. The signal quality category is very Good. There are first-day measurements at points 2-3 on route 1 with a value of -6 dB and 3-4 points obtained by -8 dB, and for the bad category found in the second day of measurements at points 2-3 on route 3 with a value of -15 dB.

Table 6. RSRQ Telkomsel first day

Point	Rute 1	Rute 2	Rute 3
1-2	-13	-9	-11
2-3	-6	-14	-9
3-4	-10	-15	-8
4-1	-11	-14	-10
Average	-10	-13	-9.5

Table 6. RSRQ Telkomsel second day

Point	Rute 1	Rute 2	Rute 3
1-2	-14	-12	-12
2-3	-14	-11	-15
3-4	-7	-13	-14
4-1	-13	-10	-10
Average	-12	-11.5	-12.75

The results of the walk test measurement data can be seen in table 7. SNR day one and table 8. SNR on the second day. The signal quality category is good. There are first-day measurements at points 2-3, 3-4 on route 1 with values of 14.6 dB and 16.4 dB and dotted 4-1 on route 3 with values obtained of 11.6 dB, and for the bad category; there are on the second-day measurements at points 2-3 on route 3 with values of -6.6 dB.

Table 7. SNR Telkomsel first day

Point	Rute 1	Rute 2	Rute 3
1-2	5.6	5.0	7.4
2-3	14.6	2.8	3.4
3-4	16.4	1.8	6.8
4-1	8.4	7.0	11.6
Average	11.25	4.15	7.3

Table 8. SNR Telkomsel second day

Point	Rute 1	Rute 2	Rute 3
1-2	0.2	6.0	7.0
2-3	0.2	9.0	-6.6
3-4	13.6	6.0	12.8
4-1	-2.2	3.4	4.8
Average	2.95	7	4.5

The results of the RSRP walk test measurement data can be seen in table 9. RSRP XL day one and table 10. RSRP XL day two. The signal quality category is very good. There are measurements on the first day at points 3-4 on route 1 with a value of -80 dBm and the second day on route 1 points 3-4 with a value of -80 dBm; for the wrong category, there are on the first-day measurements on route 2 at points 3-4 with values of -107 dBm, route 3 at points 3-4 and 4-1 with values of -100 dBm and -101 dBm. and measurements on the second day on route 2 in dots 3-4 with a value of -105 dBm.

Table 9. RSRP XL first day

Point	Rute 1	Rute 2	Rute 3
1-2	-99	-92	-90
2-3	-81	-98	-87
3-4	-80	-107	-100
4-1	-90	-95	-101
Average	-87.5	-50.5	-94.5

Table 10. RSRP XL second day

Point	Rute 1	Rute 2	Rute 3
1-2	-99	-99	-90
2-3	-84	-84	-85
3-4	-80	-80	-95
4-1	-88	-88	-97
Average	-87.75	-95.5	-91.75

The results of the RSRQ walk test measurement data can be seen in table 1. RSRQ XL day one and table 12. RSRQ XL day two. The signal quality category is good on the second day of measurement on route 1 at points 4-1, route 2 at points 1-2, 2-3 and route 3 at points 2-3 with values obtained of -8.0 dB to -10 dB. The category is a good dominant on the first-day measurement, and there is a wrong measurement category on the second day.

Table 11. RSRQ XL first day

Point	Rute 1	Rute 2	Rute 3
1-2	-18	-11	-14
2-3	-9	-9	-9
3-4	-12	-13	-12
4-1	-10	-10	-15
Average	-12.25	-10.75	-12.5

Table 12. RSRQ XL second day

Point	Rute 1	Rute 2	Rute 3
1-2	-17	-10	-2.4
2-3	-10	-9	-8.0
3-4	-12	-18	-10.6
4-1	-9	-11	-12.4
Average	-12	-12	-8.35

The results of the SNR walk test measurement data can be seen in table 13. SNR XL day one and table 14.SNR XL day two. Good signal quality there were first-day measurements at points 2-3, 3-4 on route 1 with values of 12.6 dB and 10.6 dB, and there was one lousy category found at points 3-4 on route 3 with values of -3.8 dB. The second dominant measurement with good categorized results with values of 6.8 dB to 12.4 dB, and there are 3 points categorized as bad, namely at points 1-2, 3-4 with values of -2.4 dB to -1.2 dB

Table 13. SNR XL first day

Point	Rute 1	Rute 2	Rute 3
1-2	5.6	6.4	7.2
2-3	12.6	3.0	7.6
3-4	10.6	6.2	-3.8
4-1	5.4	1.0	7.4
Average	8.55	4.15	4.6

Table 14. SNR XL second day

Point	Rute 1	Rute 2	Rute 3
1-2	-2.4	1.6	9.6
2-3	8.0	7.4	6.8
3-4	10.6	-5.4	-1.2
4-1	12.4	0.6	0.2
Average	7.15	1.05	3.85

The results of the walk test measurement data table 15. RSRP H3I the first day and table 16. RSRP H3I the second day. The signal quality category was excellent; there were first-day measurements at points 4-1 on route 1 with values of -76 dBm, points 3-4 and 4-1 on route 2 with values of -76 dB and -68 dB, and measurements on the second day on routes 1 point 1-2 and 4-1 on route 1 with values of -80 dBm and -65 dBm. The wrong category was found in the first day's measurements at points 3-4 and 4-1 on route 3 with values of -100 dBm and the second day's measurements at points 1-2, 2-3 and 4-1 on route 3 with values obtained of -100 dBm to -105 dBm.

Table 15. RSRP H3I first day

Point	Rute 1	Rute 2	Rute 3
1-2	-91	-88	-98
2-3	-84	-82	-99
3-4	-81	-76	-100
4-1	-72	-68	-110
Average	-82	-78.5	-101.75

Table 16. RSRP H3I in the second-day

Point	Rute 1	Rute 2	Rute 3
1-2	-80	-91	-100
2-3	-92	-93	-105
3-4	-86	-92	-95
4-1	-65	-66	-100
Average	-80.75	-85.5	-100

The results of the RSRQ walk test measurement data can be seen in table 17. RSRQ H3I day one and table 18. RSRQ H3I day two results of the first and second-day measurements of the signal quality obtained are predominantly categorized as poor, excluding the Target Key Performance Indicator (KPI). Because the weather is drizzling, rain during the measurement and strong winds weaken the RSRQ signal quality.

Table 17. RSRQ H3I first day

Point	Rute 1	Rute 2	Rute 3
1-2	-9	-15	-16
2-3	-15	-10	-16
3-4	-15	-9	-15
4-1	-9	-5	-15
Average	-12	-9.75	-15.5

Table 18. RSRQ H3I second day

Point	Rute 1	Rute 2	Rute 3
1-2	-10	-15	-16
2-3	-9	-16	-17
3-4	-13	-8	-18
4-1	-6	-9	-18
Average	-9.5	-12	-17.25

The results of the SNR walk test measurement data can be seen in table 19. SNR H3I day one and table 20.SNR H3I day two. Good category with values of 2.0 dB to 11.0 dB, Excellent category is found in the measurements on the first day at points 4-1 route 1 and route 2 with values of 16.0 dB and 15.0 dB. The category was quite good in the second-day measurements of points 1-2 and 2-3 with values of -3.0 dB, and the bad categories were found in the second-day

measurements at points 3-4 of route 2 and points 4-1 of route 3 with values of -5.0 dB and -10.0 dB.

Table 19. SNR H3I first day

Point	Rute 1	Rute 2	Rute 3
1-2	3.0	3.0	2.0
2-3	2.0	6.0	3.0
3-4	3.0	6.0	9.0
4-1	11.0	16.0	15.0
Average	4.75	7.75	7.25

Table 20. SNR H3I second day

Point	Rute 1	Rute 2	Rute 3
1-2	5.0	1.0	-3.0
2-3	4.0	1.0	-3.0
3-4	6.0	-5.0	4.0
4-1	8.0	10.0	-10.0
Average	5.75	1.75	-3

b. Comparison of Telkomsel, XL, Hutchison 3 Indonesia Providers

The results of comprehensive measurement data of RSRP RSRQ and SNR parameters with 3 providers. **Figure 4** is graph of the average values of the first and second-day measurements.

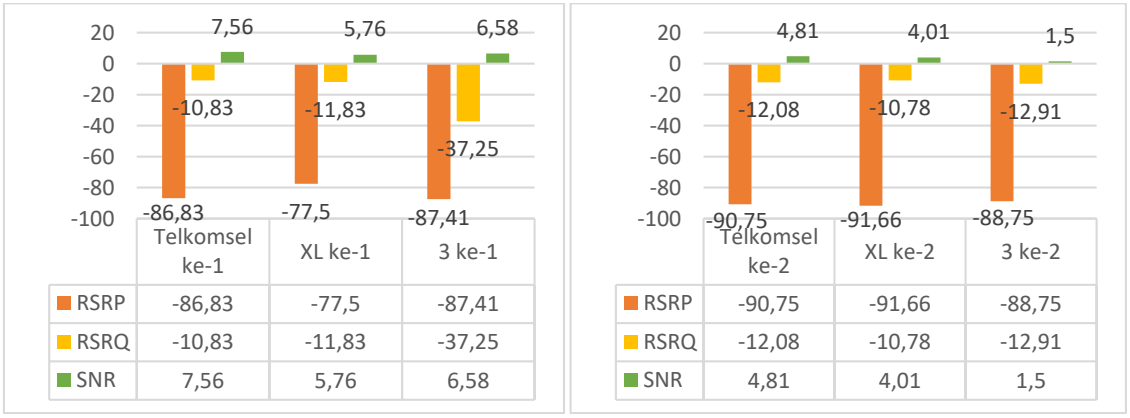

Figure 4. First and Second Day Measurement Average Graph

4. Conclusion

Based on the analysis of the network quality of Telkomsel, XL and Hutchison 3 Indonesia Providers, it can be concluded that the quality of the 4G LTE network at the highest RSRP average value measurement against the comparison of the first and second measurements is found in the first day XL provider with the results obtained of -77.5 dBm, there is no lowest RSRP value. However, it is included in the category is quite good. The measurement of the highest RSRQ value was found at the Telkomsel provider on the first day with a result of -10.83 dB, and the lowest RSRQ value was found at the Hutchison 3 Indonesia provider on the first day with a value

of -37.25 dB. The highest SNR value measurement was found in the first-day Telkomsel provider with a result of 7.56 dB, including the good category. There is a signal quality that needs to reach the KPI standard. Due to the presence of places that do not support the measurement of the Hutchison 3 Indonesia provider, weather conditions at that time were cloudy and rainy. So the signal quality deteriorated, and the area did not cover the BTS.

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