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PERBANDINGAN SOFTWARE DRIVE TEST DALAM UJI KUALITAS JARINGAN 3G MENGGUNAKAN PROVIDER TELKOMSEL

COMPARISON OF SOFTWARE DRIVE TEST IN 3G NETWORK QUALITY TEST USING TELKOMSEL PROVIDER

Hana Graceila Sitindjak[1], Ridwan Satrio Hadikusuma[2], Yuliarman Saragih[3]

[1, 2, 3]Program Studi Teknik Elektro, Fakultas Teknik, Universitas Singaperbangsa Karawang
[1]hanagraceila2001@gmail.com, [2]ridwansatrio2@gmail.com, [3]yuliarman@staff.unsika.ac.id

Abstrak

Peningkatan jumlah infratsruktur telekomunikasi di Indonesia sesuai dengan kebutuhan pelanggan pada kestabilan dan kecepatan akses jaringan. Diperlukan pengukuran jaringan menggunakan metode *drive test* guna menjamin kualitas jaringan didalam area layanan. Untuk melakukan *drive test* diperlukan *software* seperti *Net Monitor Lite, Nemo Handy, G-Net Track Lite* dan masih banyak lagi. Diperlukan perbandingan *performance* untuk mengetahui kualitas dari *software* yang digunakan ketika melakukan pengukuran. Maka pengukuran yang didapat menggunakan *Net Monitor Lite, Nemo Handy* dan *G-Net Track Lite* untuk parameter *RSCP, RSSI, RSRP, RSRQ* dan *SNR* memerlukan perbandingan *performance*. Hasil perbandingan menunjukkan bahwa nilai *RSCP* antara pengukuran dengan teoritis memperlihatkan hasil pengukuran *Net Monitor Lite* hampir serupa dibandingkan dengan *Nemo Handy* maupun *G-Net Track Lite*. Untuk pemisalan selisih *RSCP* pada *eNodeB* untuk *Net Monitor Lite* diperoleh sebesar 3,50 dBm sedangkan pada *Nemo Handy* diperoleh selisih sebesar 4,15 dBm dan 5,56 dBm untuk *software G-Net Track Lite*. Hal ini dikarenakan keterbatasan menu pada *software G-Net Track Lite* yang tidak memiliki menu penguncian *PCI* sehingga pada bagian-bagian tertentu pengukuran tidak dapat dibandingkan.

Kata kunci: ***Drive test, G-Net Track Lite, Nemo Handy, Net Monitor Lite,*** **Operator**

Abstract

Increasing the number of telecommunication infrastructure in Indonesia in accordance with customer needs on the stability and speed of network access. Network measurement is required using the drive test method to ensure network quality within the service area. To do a drive test, you need software such as Net Monitor Lite, Nemo Handy, G-Net Track Lite and many more. Performance comparisons are needed to determine the quality of the software used when measuring. So the measurements obtained using Net Monitor Lite, Nemo Handy and G-Net Track Lite for parameters RSCP, RSSI, RSRP, RSRQ and SNR require performance comparisons. The comparison results show that the RSCP value between the theoretical measurements shows that the Net Monitor Lite measurement results are almost similar compared to Nemo Handy and G-Net Track Lite. For example, the RSCP difference on eNodeB for Net Monitor Lite is 3.50 dBm, while for Nemo Handy, the difference is 4.15 dBm and 5.56 dBm for G-Net Track Lite software. This is due to the limited menu in the G-Net Track Lite software which does not have a PCI lock menu so that in certain parts the measurements cannot be compared.

Keywords: Drive test, G-Net Track Lite, Nemo Handy, Net Monitor Lite, Operator

1. INTRODUCTION

In Indonesia until now the need for 3G technology is still very much needed even in rural areas, it is necessary to test the quality of the 3G network in rural areas. The operator's efforts to ensure the quality of the internet network can be done by testing the network quality with the drive test method. By conducting a drive test, cellular operators can perform network analysis to

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improve network performance to increase customer satisfaction. Besides that, drive tests are also carried out for benchmarking or comparing network performance between cellular operators [1] [2].

In this paper, the author focuses on the comparison of the software drive test in testing the quality of the 3G network using the Telkomsel provider. The comparison is done to find out the differences in terms of features, measurement results and other differences. Generally, the purpose of this Drive Test activity is to collect radio frequency network data in real time in the field [3]. By collecting data from a software drive test comparison on a 3G network quality test using Telkomsel provider, the authors can find out whether or not a software drive test is accurate when used in a network quality test and compare the measurement results with theoretical results.

Many factors affect the difference in measurement results between the test drive software used when conducting network quality tests such as differences in feature availability, differences in antenna frequencies on smartphones used when measuring and many other differences. It is because of these differences that research is carried out regarding differences in software drive tests to identify and recommend software whose measurement results are close to theoretical results. Because in the signal quality test using a drive test it is necessary to get all the necessary data related to the range, signal quality, and performance of a site to help Radio Planning and Optimization of cellular networks to solve problems and to improve the KPI that has been determined [4] [5] [6].

Several studies regarding the measurement of network quality test with the drive test method have been carried out before. Among them are "Analysis of Drive Test Results Using G-Net and Nemo Handy Software on the Denpasar Area LTE Network" by I Gede Made Yogi Priyadana Adi Saputra, Pande Ketut Sudiarta and Gede Sukadarmika. In this study, it was found that the results of measuring the signal level of the RSRP parameter using the Nemo Handy were generally closer to the results of the theoretical calculations using the theory of the Cost Hatta 231 Method [7].

There is also a study on "Analysis of GSM Network Signal Quality on Rooftop Towers" by Yanuari R. According to this research, the results of measuring GSM network signals on the rooftop using the drive test method using G-Net Track Pro are as good as using Nemo Handy [8]. Based on the above problems, for the first time, a study was conducted regarding the Comparison of Software Drive Tests in 3G Network Quality Testing Using Telkomsel Providers. The author raises the comparison of measurement results using the drive test method between Net Monitor Lite, Nemo Handy and G-Net Track Lite software on a 3G network using the Telkomsel provider in Tambun Utara District, Bekasi.

2. METHOD AND BASIC THEORY

2.1 Research Method

This research was initially conducted by conducting a literature study using relevant reference books, journals and articles on the internet. KPI (Key Performance Indicator) data collection from Telkomsel provider. Next, prepare measuring instruments that will be used in both hardware and software research, such as installing Net Monitor Lite, Nemo Handy and G-Net Track Lite software. The user equipment used when measuring is the Samsung Galaxy S5. The flow of the research can be seen in Figure 1.

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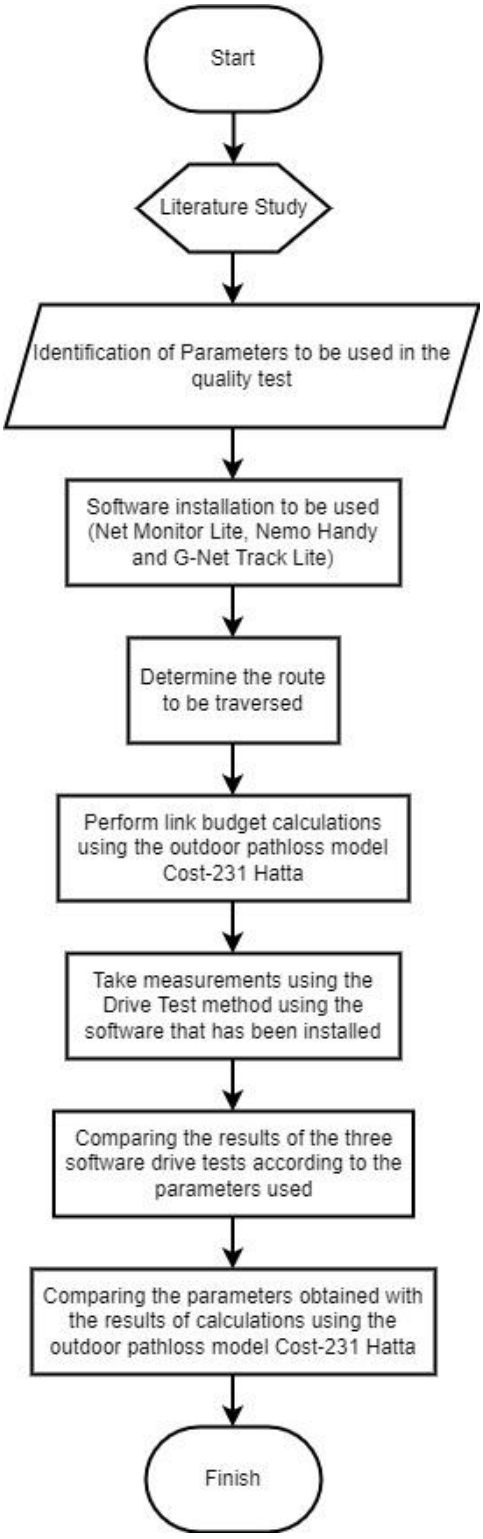

Figure 1. Flowchart research

The process of retrieving information and data uses the drive test method and is carried out by SSV (Single Site Verification) which produces a logfile containing measurement results when finished measuring 3G network quality tests using the Telkomsel provider. Then proceed with analyzing and comparing the logfile of each software in line with the parameters used in the study.

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2.2 Basic Theory

2.2.1 Drive Test

The drive test can be identified by the measurement method carried out to observe, collect cellular network data and perform optimization so that the results of network performance criteria are obtained [8]. The drive test itself can be done using a laptop or mobile phone (HP) with a note that you must use an active provider. Drive tests are usually carried out after the installation of a new device on a cellular network or to collect signal data for analysis and benchmarking purposes. The devices used during the drive test include: laptops / cell phones, drive test software, modems, SIM cards, GPS, and data engineer parameters or cell files containing the site name, antenna type and coordinates (longitude and latitude). In general, the test drive requires a laptop with the drive test software installed, a cellphone and its data cable, a dongle and a USB GPS.

To be able to carry out a drive test and obtain the desired network optimization data, users must also know what devices are used to support the implementation of the drive test. Some of the tools are good drive test software, namely TEMS from ASCOM, Genex Probe from Huawei, CNT from ZTE, and others. The laptop or software used for the test drive must also meet the minimum system requirements of the software used.

2.2.2 Net Monitor Lite

Net Monitor Lite is one of the drive test software that can be run using a smartphone that is able to take measurements using the drive test method on 2G to 5G networks. Net Monitor Lite also has a feature to read measurements taken using other software. Net Monitor Lite can be accessed for free by anyone without having to buy a license first. However, of course there are some differences in features with the paid version. The Net Monitor Lite display can be seen in Figure 2.

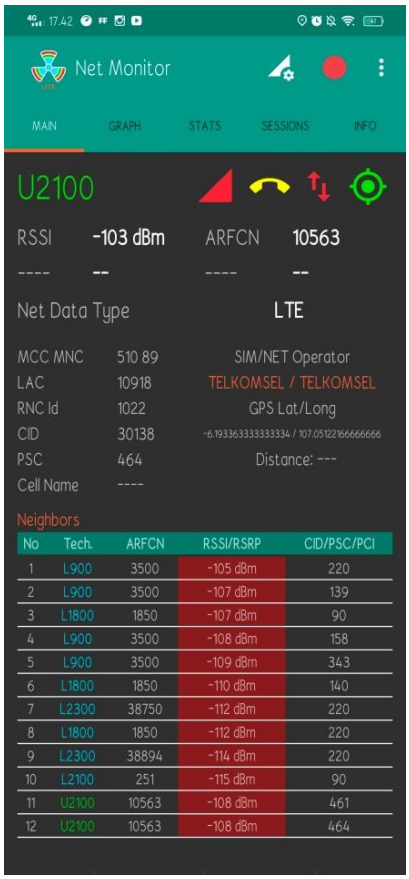

Figure 2. Display of net monitor lite software

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2.2.3 Nemo Handy

Nemo Handy can be defined as the most frequently used drive test software in the telecommunications industry in Indonesia. This software is very suitable for measuring and checking outside and inside the room. When doing a drive test, Nemo Handy can monitor network technologies such as EVDO (Evolution-Data Optimized), GSM, CDMA, HSPA, WCDMA, HSPA+, LTE to wireless networks. Nemo Handy is also able to perform mobile applications for QoS analysis [9]. Nemo Handy software display can be seen in Figure 3.

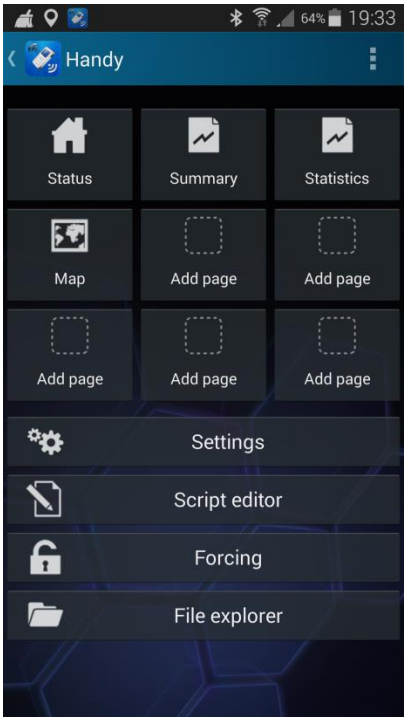

Figure 3. Display of nemo handy software

2.2.4 G-Net Track Lite

G-Net Track Lite is an Android-based drive test software that functions to monitor UMTS, GSM, LTE, CDMA and EVDO networks. This software monitors services from Cell ID, Level, Qual, MCC, MNC, LAC, TAC, cell time, near cell service and level [4]. Just like Net Monitor Lite, G-Net Track Lite software can also be accessed for free by anyone without having to buy a license but with limited features. Unlike the paid version which provides complete features. The display of G-Net Track Lite can be seen in Figure 4.

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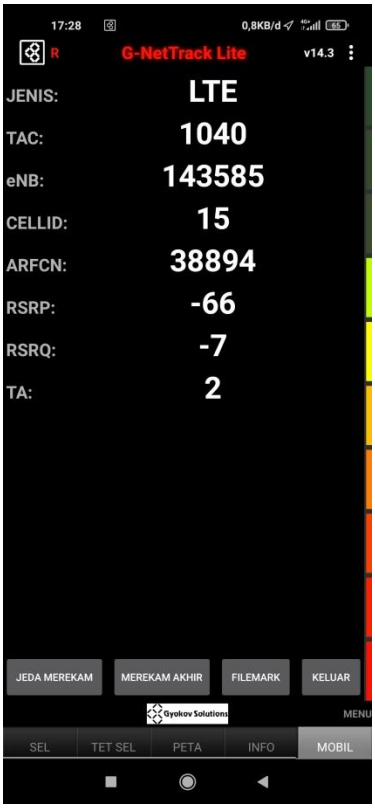

Figure 4. Display of G-Net Track Lite

2.2.5 RSSI (Received Signal Strength Indicator)

RSSI can be defined as the power signal received by the user in a certain frequency range plus noise and interference. RSSI can be calculated by the following formula :

$$RSSI = P1 + P2 + P3 \quad (1)$$

Or

$$RSSI = 12N \times RSRP \quad (2)$$

Where P1 as noise power, P2 as signal power and P3 as interference power. N in the equation indicates the Number of Resource Block in the modulation used. The RSSI parameters can be seen in Table 1.

Table 1 Parameter RSSI

Quality	Parameter (dB)
Exclent	>-65
Good	-65 to -75
Fair	-75 to -85
Poor	<-85

2.2.6 RSRP (Reference Signal Received Power)

RSRP is the strength of the reference signal or the received signal strength and is expressed in dBm units. This parameter is commonly used to determine the point of the handhover [10]. RSRP can be expressed in the following formula :

$$RSRP = RSSI - 10\,Log(12 \times N) \quad (3)$$

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Where N is the number of resource block used by OFDMA [2]. RSRP parameters can be seen in Table 2.

Table 2 Parameter RSRP

Quality	Parameter (dB)
Exclent	>-84
Good	-85 to -102
Fair	-103 to -111
Poor	<-111

2.2.7 RSCP (Received Signal Code Power)

RSCP is used to measure signal power received by user equipment and is expressed in dBm units. RSCP can be used to analyze the range of services provided by the operator at the site where the drive test is carried out. RSCP can be calculated by the following formula :

$$RSCP = \frac{RSSI}{EC/NO} \quad (4)$$

Where EC/NO is the ratio between the energy per chip of the information signal in the signal interference or accompanying noise. RSCP parameters can be seen in Table 3.

Table 3 Parameter RSCP

Quality	Parameter (dB)
Exclent	>-60
Good	-75 to -60
Fair	-75 to -85
Poor	<-85

2.2.8 RSRQ(Received Signal Reference Quality)

RSRQ is the signal power received by user equipment and is expressed in dBm units. RSRQ is calculated using the following formula:

$$RSRQ = \frac{(RSRP\ X\ N)}{RSSI} \quad (5)$$

Where N indicates the value of the number of resources used by OFDMA. RSRQ parameters can be seen in Table 4.

Table 4 Parameter RSRQ

Quality	Parameter (dB)
Exclent	>-5
Good	-9 to -5
Fair	-12 to -9
Poor	<-12

2.2.9 SNR (Signal to Noise Ratio)

SNR is a measure to determine the quality of the signal disturbed by noise and is expressed in decibels (dB). SNR can be calculated using the following formula:

$$SNR = 10Log\ 10\frac{\rho}{1-\rho} \quad (6)$$

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Where ρ is the correlation coefficient between the information signal and the noise.

2.2.10 Cost Propagation Model 231 Hatta

Cost 231 Hatta is a development of the Hatta Model which was initiated by The European Coorperative for Scientific and Technical Resreach for PCS (Personality Communication System) in urban areas [3]. The calculation of the cost-231 hatta propagation model in urban areas can use the following equation:

$Lp = 49{,}3 + 33{,}9\ Log\ fc - 13{,}82 Loghb - a(hm) + (44{,}9 - 6{,}55 Loghb) \log d + CM$ (7)

Mobile antenna correction factor for sub-urban and rural areas,

$a(hm) = (1{,}1\ Log\ fc - 0{,}7)$hm-(1,56 Log fc – 0,8) (8)

Correction factor for mobile antennas for urban areas,

$a(hm) = -4{,}97 + 3{,}2(Log\ 11{,}75hm)^2$ (9)

Information :

Lp = Average Path Loss(dB)
Fc = Frequency from 1500-2000MHz
Hb = Height of base station antenna starting from 4-50m
Hm = Height of base station antenna from 1-3m
d = Distance between MS and BS ranging from 0.02-20km

3. RESULT

This study was conducted to determine the comparison of the software used when measuring the signal using the drive test method. The output of this research is to collect comparative data on 3G network quality tests using Net Monitor Lite, G-Net Track Lite and Nemo Handy software. The data collected are eNB, RSSI, RSRP, RSRQ, SNR and TAC.

Measurements were carried out using the Telkomsel provider by following a predetermined route around the Tambun Utara sub-district at 16.00-17.15 for 7 trials on each software using user equipment from the Samsung S5. In the three softwares used in total there are 1330 signal strength measurement points and 7 eNodeB serving. Then the user equipment used during the measurement is locked on the 3G network with U2100 band. The route traversed during the measurement can be seen in Figure 5 below.

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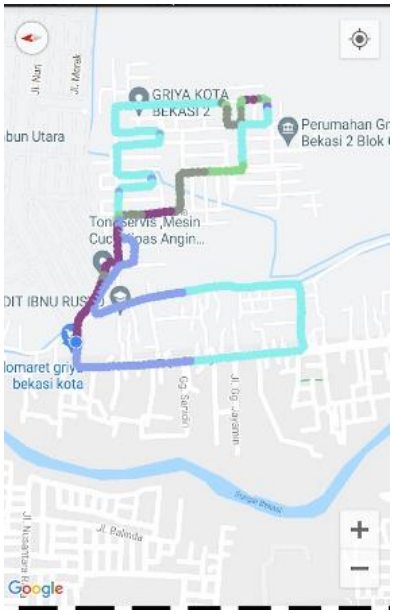

Figure 5. Map traversed during data collection

The Net Monitor Lite software has similar measurement results to the Nemo Handy software. Unlike the G-Net Track Lite software, which has features that are not as complete as the Net Monitor Lite and Nemo Handy software. The comparison of the average measurement results of the three software can be seen in Table 5.

Table 5 Measurement results

Parameters Measured	Net Monitor Lite	Nemo Handy	G-net Track Lite	Cost-231 Hatta
RSSI (dB)	-60	-58,2	N.A	-59,4
RSRP (dBm)	-66	-66	-90	-66
RSRQ (dB)	-14	-14	-16	-14
SNR (dB)	N.A	14,7	19	16

From Table 5 above, it can be seen that there are similarities in the average measurements on the Net Monitor software with Nemo Handy as in the RSRP and RSRQ parameters. While the G-Net Track Lite software displays a significant difference in the RSRP and RSRQ parameters. The measurement results on the three softwares also show good signal quality test results, considering the average RSRP results in the range of -85dBm to -102dBm.

In terms of available features, Nemo Handy software has the most complete features compared to the other two softwares. For example, the Net Monitor Lite software does not have a feature to display the readings from the SNR so it cannot be analyzed to find out what is disturbed by noise. Also in the G-Net Track Lite software, which cannot display the readings from RSSI, this causes it to be unable to determine the received signal strength within a certain frequency difference, including noise and interference.

Even so, the Net Monitor Lite and G-Net Track Lite software can be used for free and are compatible with various user equipment. It's different from Nemo Handy software, which has to buy a license and only supports some user equipment, one of which is the Samsung S5. The difference in the average measurement results is clearly visible on the graph in Figure 6. From the picture, it is known that the Net Monitor Lite software has similarities with the Nemo Handy software in conducting network quality tests using the drive test method.

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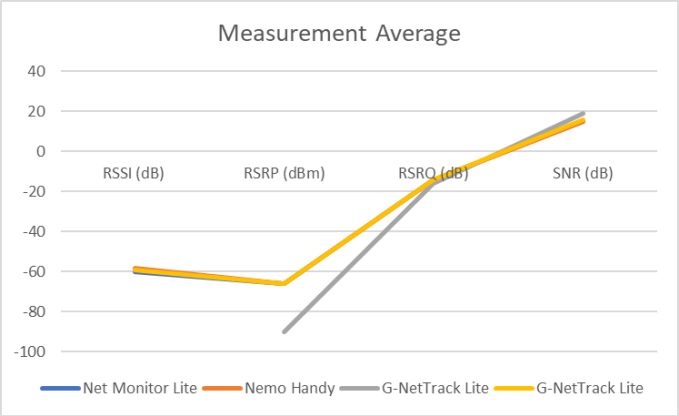

Figure 6. Graph of the average measurement results

The results of the received signal strength test or RSCP to show the acceptance of measurements from user equipment using the three software can be seen in Figure 6.

3.1 Measurement using the G-Net Track Lite software

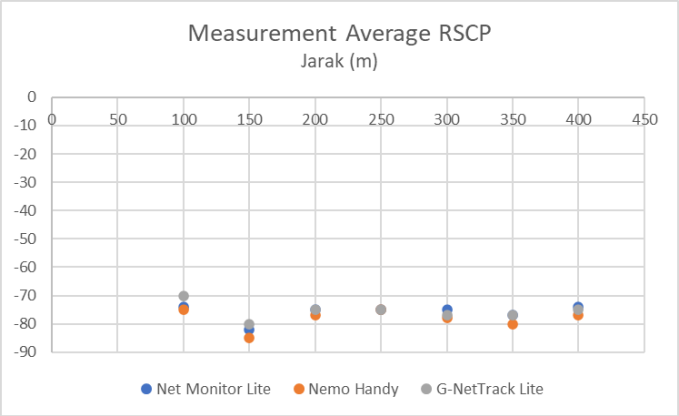

Figure 7. Comparison of rscp values on enodeb

It can be seen in Figure 7 the G-Net Track Lite software from a distance of 250 m to 300 m cannot be displayed and compared. This is due to the limited features in the software used due to the absence of PCI locking features such as those found in the Net Monitor Lite and Nemo Handy software, causing the user equipment to look for the largest RSCP value in the service area traversed when taking measurements using the drive test method. The difference in the average RSCP measurement value using the Net Monitor Lite software, which is closer to the result of the calculation using Cost-231 Hatta.

3.2 Measurement Results of Net Monitor Lite, Nemo Handy and G-Net Track Lite

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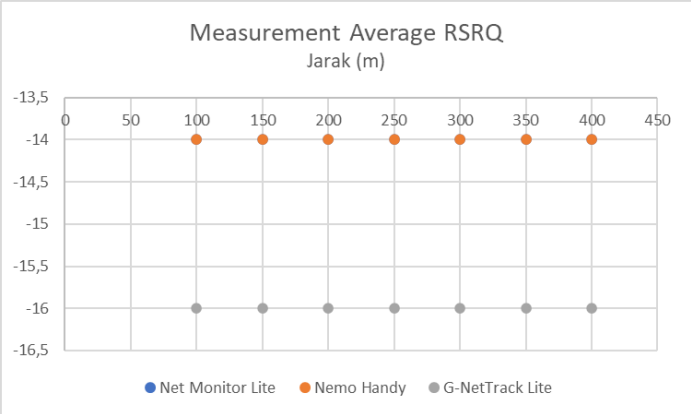

Figure 8. Comparison of rsrq values on enodeb

The difference between the RSRQ parameters and the measurement results of Net Monitor Lite, Nemo Handy and G-Net Track Lite with KPI on eNodeB as shown in Figure 8. The results of measuring the quality of the RSRQ signal using the three software show that the quality of the RSRQ signal is in the poor category according to the KPI operator Telkomsel (-12 <= RSRQ (dB) < -9). It is evident from the average measurement results of the three software with a result of -14 dB on the Net Monitor Lite and Nemo Handy, while on the G-Net Track Lite software the average result is 16 dB.

3.3 Signal Quality Measurement Results with Nemo Handy software and G-Net Track Lite

Then for the comparison of SNR parameters on eNodeB can be seen in Figure 9.

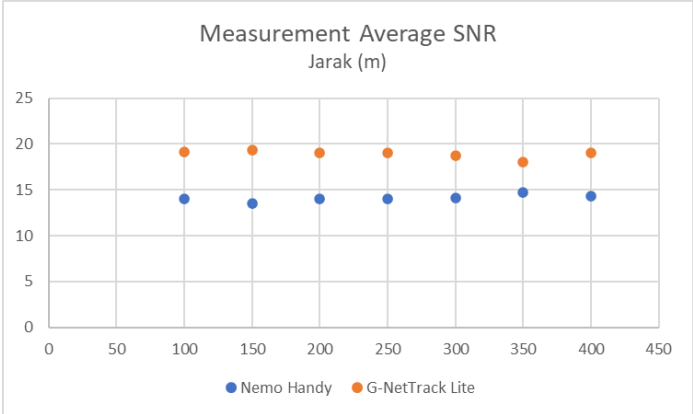

Figure 9. Comparison of snr values on the enodeb

As can be seen in Figure 9, the results of measuring signal quality using Nemo Handy and G-Net Track Lite software on eNodeB show good results according to Telkomsel operator KPI (0 <= SNR(dB) < 10). While the Net Monitor Lite software does not have a feature to display SNR measurement results.

4. CONCLUSION

Results Based on research in comparing 3 software drive tests between Net Monitor Lite, Nemo Handy and G-Net Track Lite in conducting a 3G network quality test using the Telkomsel provider, the conclusions are:

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1 Results of measuring the signal quality of the RSCP and SNR parameters from the three software on eNodeB, Tambun Utara sub-district, compared to Telkomsel's KPI, showed that the quality of RSCP and SNR in the signal category was quite good.
2 The three drive test software have something in common, namely that each software can be run on a smartphone without having to connect to an External GPS and each can display RSCP, RSRQ and SNR parameters. However, there are several measurement points that cannot be compared due to weaknesses in the Net Monitor Lite and G-Net Track Lite software, namely the limitations of using the feature to display some parameters due to having to upgrade to a paid version such as the PCI lock feature in the G-Net Track Lite software and features to display SNR in Net Monitor Lite software.
3 The results of measuring the signal level of RSCP parameters using Net Monitor Lite software are generally closer to the results of calculations using Cost 231-Hatta.

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