Conference Paper

Performance Analysis 4G LTE Network Operator X and Y in the District of North Balikpapan

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Abstract

The level of user mobility which is growing every time can cause the technology of communication increased, especially cellular communication. Every user want the high service of data access and also the strength signal. This also become a challenge for operator to fix and give the best service for consumer. There is a technology is Long Term Evolution (LTE) that is a solution to overcome the higher service need. This research analyze about the comparison of service quality in the net between x operator and y operator. Drive test is the method that is used in this research. The parameter which is analyze is RSRP for data test plan (http page and video play). The result from this research that is in test plan (http page) x operator has a RSRP value in the amount of -93.1315159 dBm and y operator -99.38692563 dBm which is x operator more superior than y operator. In test plan (video play) x operator more superior because x has a value of RSRP higher -94.2734738 dBm and y operator -99.24648903 dBm.

Keywords: LTE, RSRP, 4G, E Node B

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Received: 18 January 2019
Accepted: 24 March 2019
Published: 31 March 2019

Publishing services provided by Knowledge E

Selection and Peer-review under the responsibility of the ICEST 2018 Conference Committee.

1. Introduction

The development of telecommunication networks is now growing rapidly. Which initially only carried analogue technology or better known as 1G or Advanced Mobile Phone Service (AMPS), then developed again to the technology using the first digital technology (2G) [1] then 2G technology previously developed again so that data transfer speed is faster known as third generation (3G) digital technology [2]. And until finally found the communication technology with a very high speed of previous generations known as 4G / LTE (Long Term Evolution) [3]

LTE is a continuation of third generation (3G) WDCMA-UMTS technology. LTE bandwidth is from 1.4 MHz to 20 MHz network operator can choose different bandwidth and

provide different services based on spectrum. It is also the design goal of LTE that is to improve the spectrum efficiency of the network, enabling the operator to provide more packets of data on a bandwidth [4]

Telecommunication service providers should be aware that consumers want high data access and strong signals. The level of customer satisfaction creates new challenges for telecommunication service providers (operators) to improve and provide the best service for consumers. The quality of a network can be done with a real observation in the field through the measurement of signal quality of a regional 4G LTE service. The method that many do is drive test. Therefore it is very important to test drive on e Node B sites that have implemented 4G LTE technology in North Balikpapan.

1.1. 4G LTE technology

The LTE architecture consists of two main parts namely the E-UTRAN (Envolved Universal Terrestrial Radio Access Network) and SAE (System Architecture Evolution) which is the heart of the LTE system

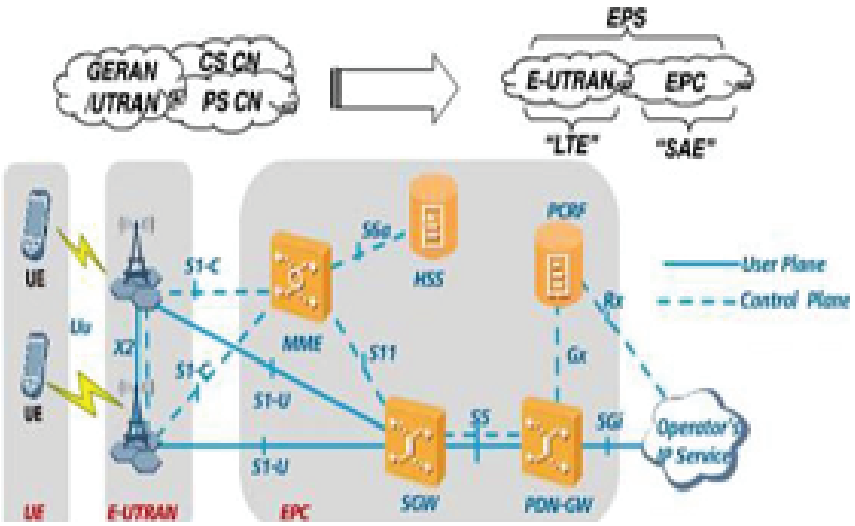

Figure 1: LTE 4G LTE ARCHITECTURE.

e Node B (envolved Node B) is a network interface (LTE) with the user. its ability to perform connection and handover control functions [5]

1.2. Operator X

In 1993 Operator X began to explore GSM wireless technology, in the next year, in 1994 PT. Palapa Indonesia satellite is the first GSM network operator in Indonesia to issue SIM cards. Operator X became the largest mobile telecommunications operator in Indonesia

with 139.3 million subscribers as of December 31, 2014. The X operator network has covered 288 international roaming networks in 155 countries by the end of 2007

Operator X has become the world's sixth mobile operator with more than 100 million subscribers in one country as of May 2011. Operator X officially launches the first 4G LTE mobile commercial service in Indonesia. Service operator X 4G LTE has data access speed reaching 36 Mbps.

Currently X operators are deploying more than 100,000 BTSs that cover about 98% of the population in Indonesia. As the number 6 mobile operator in the world in terms of number of subscribers. Operator X is the market leader of the telecommunication industry in Indonesia which is now believed to serve more than 143 million subscribers in 2015-2016. In an effort to guide the development of the telecommunications industry in Indonesia into a new era of mobile broadband services, X operators consistently implement 3G, HDSPA, HSPA + technology roadmaps, and Long Term Evolution (LTE) network development. Now operator X develops broadband network in 100 big cities in Indonesia[6]

1.3. Operator Y

Operator Y was established in 1967 as the first foreign investment company in Indonesia that provides international telecommunications services via international satellite. Over time, Operator Y evolved into the first international telecommunications company purchased and 100% owned by the Government of Indonesia. In 1994 the Y operator became a public company listed on the Indonesia Stock Exchange and the New York Stock Exchange, the Government of Indonesia 65% and the public 35%

Operator Y gets a 3G network license and introduces 3.5G services in Jakarta and Surabaya. In 2009 Qtel purchased 24.19% of B series shares from the public to become a majority shareholder of Y operator with 65% ownership. In the same year operator Y obtained an additional 3G frequency license from the Ministry of Communications and Informatics and won a tender for a government-run WIMAX license.

In 2013, operator Y held commercialization of 3G network at 900 MHz frequency. The following year Indosat launched 4G service launch and service at 900 MHz with speeds up to 42 Mbps in some major cities in Indonesia.[7]

2. Methodology

2.1. Drive test mechanism

Drive Test is a measurement process of mobile communication system on the radio waves side in the air, from the direction of base stations to MS or from MS to BTS by using mobile phones specially designed for measurement. The purpose of the implementation of Drive Test is to measure signal quality and fixes problems associated with the signal.

Drive test also has a special purpose within network optimization:

1. Knowing whether coverage at the time of planning or planning the same as the actual situation in the field.
2. To look for poor coverage or areas that have power receive low signal.
3. Find out whether the network parameters in the field are appropriate with the reality at the time of planning and optimization.
4. Knowing network performance after the changes are made, such as the addition or reduction of BTS (Base Transceiver Station).
5. To know the performance of other carrier networks or Benchmarking.
6. Know if there is interference from neighboring cells.
7. To search for RF (Radio Frequency) issues related to the Drop Call or Block Call [8].

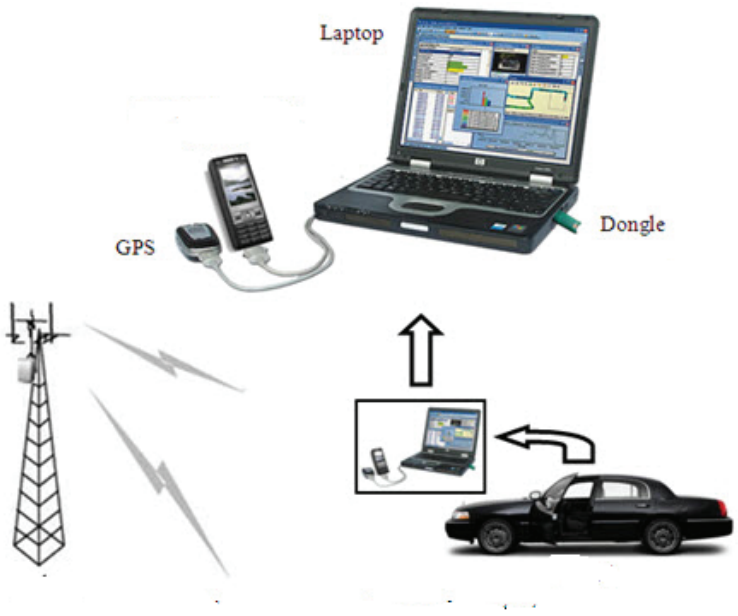

Figure 2: DRIVE TEST ILLUSTRATION [9].

2.2. Reference signal received quality (RSRP)

RSRP is the average power on the resource element that carries the reference signal in the subcarrier. UE (User Equipment) measures the power of many resource elements used to carry the reference signal and then calculated the mean in one bandwidth.

TABLE 1: RSRP Signal Strength [10].

RSRP Value	Signal Strength
-80 dBm	Excellent
-80 dBm to -90 dBm	Good
-90 to 100 dBm	Mid Cell
<= - 100 dBm	Cell Edge

2.3. Pilot pioneer

Pioneer is a flexible laptop-based diagnostic tool for indoor and outdoor assessment of all major wireless networking technologies (GSM/CDMA/UMTS/TD SCDMA/HSDPA/Wi-Fi/WIMAX/LTE). It is a user-friendly, highly-scalable solution that accelerates returns on your network investment. Pioneer can display map-based data in real time and simultaneously export said information to a server for further analysis. The data it collects reflects user perceptions, enabling engineers to maximize subscriber satisfaction and your bottom line.

Below, features of Pilot Pioneer:

1. Runs a wide range of network tests to improve and maintain network coverage and quality.
2. Compatible with a variety of terminals, from engineering test mobiles to standard handsets.
3. Employs multiple devices for voice and data benchmarking of multiple networks.
4. Can simultaneously test virtually any desired number or independent networks.
5. Displays sites geographically in various map formats.
6. Supports MOS testing, based on the PESO algorithm, for GSM, CDMA, UMTS & TD-SCDMA; compatible w/ITU-P862.
7. Supports FTP, HTTP, E-mail, PING & VOIP testing for LTE.

8. Configures test plans for looping, parallel & simultaneous testing.
9. Automatic alarms indicate device connection failure; system prompts indicate possible solutions.
10. Logs data in real time; automatically saves data by time and/or file size.
11. Carries out test plans according to customized plans or predefined templates.[11].

The following general display pilot pioneer

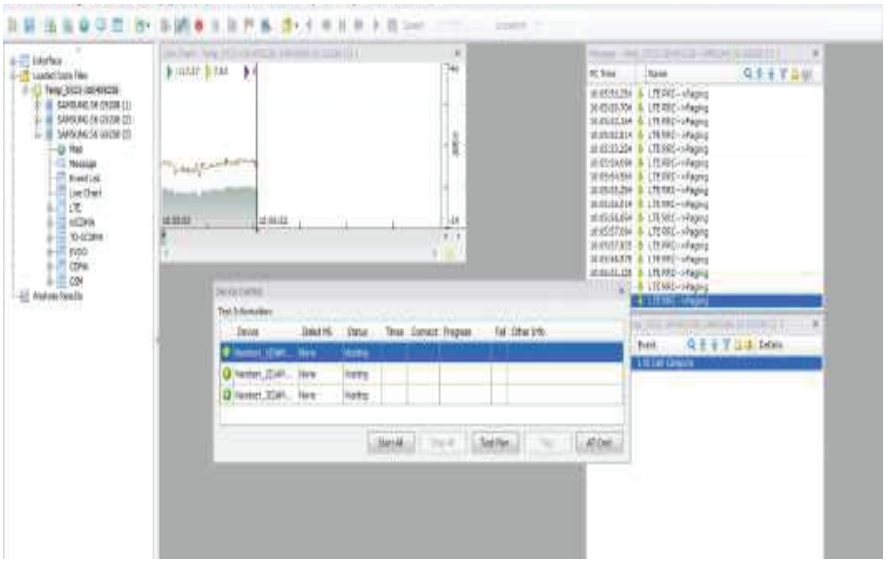

Figure 3: PILOT PIONEER.

2.4. Research flowchart

Below is a flow chart of the study:

3. Result and Discussion

The data retrieval of 4G LTE network of X and Y Operator is done 3 times in different days, along the road of Soekarno Hatta Km. 1-5 North Balikpapan. And then will be taken average value of each RSRP value to classified

3.1. Result drive test operator X

Below HTTP page drive test result

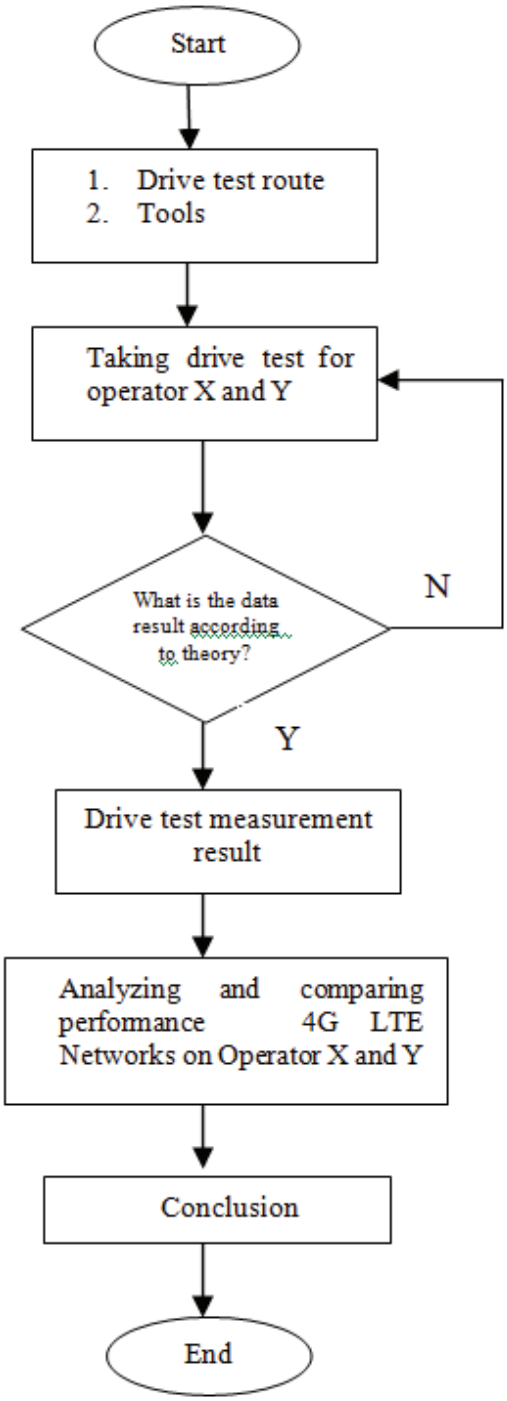

Figure 4: FLOWCHART.

Table 2: HTTP Page Service Result.

Testing Time(hh:mm)	Initial info of LTE Cell			
	EARFCN	**Cell ID**	**PCI**	**RSRP**
11:50	1875(804);	-1295372971(1); -1295371681(2); -1295371671(1); -1295371351(1); -1295369881(3); -1295369871(1); -1295369861(1); -1295362361(2); -1295360871(2); -1295356981(1); -1295344581(3); -1295344571(1); -1295327681(2);	3(47); 4(85); 9(73); 10(41); 11(53); 99(19); 207(85); 264(52); 265(69); 273(41); 274(34); 280(32); 324(163); 335(10);	-95.4840026
9:55	1875(1018);	-1295372971(3); -1295371671(1); -1295371351(1); -1295369881(2); -1295369871(1); -1295369861(1); -1295362661(1); -1295362361(2); -1295360881(4); -1295360871(1); -1295360861(1); -1295357261(1); -1295356981(4); -1295327681(1);	3(180); 4(96); 5(32); 8(24); 9(79); 10(27); 11(45); 99(6); 273(90); 274(30); 280(41); 324(101); 331(111); 332(23); 335(44);	-94.452404
9:33	1875(765);	-1295373681(1); -1295373661(1); -1295373581(2); -1295371681(2); -1295371671(1); -1295371351(1); -1295370581(1); -1295369881(1); -1295369861(3); -1295362361(1); -1295358981(2); -1295357881(4); -1295357871(1); -1295356971(2); -1295356961(1); -1295344581(1); -1295327681(1); -1295282471(1);	3(8); 6(130); 8(13); 9(44); 11(55); 99(4); 208(46); 209(59); 210(20); 264(9); 273(40); 274(37); 324(74); 335(23); 348(52); 384(69); 385(34); 502(48);	-89.4581411

From the results of testing the http page on the entire site sampling then obtained the results of operator x has the best RSRP value on the third test drive that is with -89.4581411 dBm.

Below Video Play drive test result

TABLE 3: Video Play Service Result.

Testing Time (hh:mm)	Initial info of LTE Cell			
	EARFCN	**Cell ID**	**PCI**	**RSRP**
11:50	1875(678);	-1295372971(2); -1295371681(2); -1295371671(1); -1295371351(1); -1295369881(2); -1295369871(1); -1295369861(1); -1295362361(2); -1295360871(2); -1295356981(1); -1295327681(1); -1295327671(2);	3(46); 4(86); 9(67); 10(44); 11(45); 99(20); 207(88); 273(34); 274(31); 280(10); 324(121); 325(52); 335(34);	-96.16
9:55	1875(993);	-1295372981(1); -1295372971(4); -1295371681(1); -1295371671(2); -1295371661(1); -1295371351(1); -1295370471(2); -1295369881(1); -1295369871(1); -1295369861(1); -1295362681(1); -1295362661(1); -1295362361(2); -1295360881(4); -1295360871(1); -1295360861(1); -1295358971(1); -1295357271(1); -1295357261(1); -1295356981(2); -1295327681(2);	3(102); 4(94); 5(14); 6(4); 8(11); 9(50); 10(31); 11(47); 99(6); 207(72); 273(94); 274(53); 275(11); 279(9); 280(47); 324(152); 331(104); 332(28); 335(50);	-95.952
9:33	1875(748);	-1295373681(1); -1295372971(1); -1295371681(2); -1295371671(1); -1295370581(1); -1295369881(1); -1295369871(1); -1295369861(1); -1295362661(1); -1295357881(4); -1295357871(1); -1295356981(1); -1295356971(1); -1295356961(1); -1295327681(1); -1295282471(1);	6(124); 8(16); 9(44); 10(33); 11(46); 207(19); 208(11); 209(59); 273(41); 274(31); 280(4); 324(91); 348(53); 384(91); 385(37); 502(48);	-90.707

From the results of testing the video play service on the entire site sampling then obtained the results of operator X has the best RSRP value on the third test drive that is with -90.707 dBm

3.2. Result drive test operator Y

Below HTTP page drive test result

TABLE 4: HTTP Page Service Result.

Testing Time(hh:mm)	Initial info of LTE Cell			
	EARFCN	**Cell ID**	**PCI**	**RSRP**
15:22	1625(1583);	-1735939977(5); -1735939929(2); -1735939928(1); -1735939898(2); -1735939829(1); -1735939789(2); -1735939788(1); -1735939737(1); -1735939689(6); -1735939477(1); -1735939319(1); -1735939317(3);	9(80); 30(158); 31(116); 46(175); 47(38); 57(147); 67(498); 105(28); 130(131); 136(73); 216(47); 217(92);	-103.147978
11:50	1625(1017);	-1735939977(3); -1735939929(1); -1735939928(2); -1735939898(2); -1735939829(3); -1735939789(1); -1735939788(1); -1735939737(3); -1735939689(4); -1735939477(2);	9(153); 30(106); 31(86); 46(115); 47(35); 57(57); 67(171); 105(52); 130(131); 136(111);	-100.848785
14:36	1625(1164);	-1735939929(1); -1735939928(2); -1735939919(1); -1735939918(1); -1735939898(1); -1735939829(2); -1735939827(1); -1735939789(1); -1735939788(1); -1735939477(1); - 1735939259(1); -1735939257(1);	30(173); 31(111); 46(139); 47(40); 82(34); 83(52); 105(37); 107(27); 130(154); 136(82); 399(71); 400(244);	-94.1640139

From the results of testing the HTTP Page service on the entire site sampling then obtained the results of operator Y has the best RSRP value on the third test drive that is with -94.1640139 dBm

Below Video Play drive test result

TABLE 5: Video Play Service Result.

Testing Time (hh:mm)	Initial info of LTE Cell			
	EARFCN	**Cell ID**	**PCI**	**RSRP**
11:50	1625(832);	-1735939977(3); -1735939929(1); -1735939928(2); -1735939898(2); -1735939829(2); -1735939789(1); -1735939788(1); -1735939737(1); -1735939689(6); -1735939527(3); -1735939477(1);	9(40); 30(100); 31(100); 46(133); 47(32); 57(12); 61(18); 67(104); 105(43); 130(139); 136(111);	-99.8738319
15:22	1625(1520);	-1735939977(4); -1735939929(2); -1735939928(1); -1735939898(2); -1735939829(1); -1735939789(1); -1735939788(1); -1735939737(2); -1735939689(5); -1735939477(1); -1735939329(1); -1735939317(2);	9(98); 30(151); 31(117); 46(175); 47(34); 57(226); 67(405); 105(25); 130(146); 136(73); 217(64); 311(6);	-104.137283
14:36	1625(1166);	-1735939929(2); -1735939928(2); -1735939919(1); -1735939918(2); -1735939898(2); -1735939829(2); -1735939827(2); -1735939789(1); -1735939788(1); -1735939689(1); -1735939477(2); -1735939259(1); -1735939257(1);	30(169); 31(120); 46(142); 47(37); 67(20); 82(13); 83(74); 105(31); 107(38); 130(136); 136(71); 399(72); 400(243);	-93.7283522

From the results of testing the Video Play service on the entire site sampling then obtained the results of operator Y has the best RSRP value on the third test drive that is with -93.7283522 dBm.

3.3. Average value of HTTP page and video play services

Below the average value of each services for Operator X and Operator Y

TABLE 6: Average Value of HTTP Page and Video Play Services.

Operator	RSRP Parameter	Value (dBm)	Condition
X	HTTP Page	-93.1315159	Good
Y		-99.3869256	Good
X	Video Play	-94.27334738	Good
Y		-99.24648903	Good

From the measurement result for operator X the RSRP (http page) parameter value, the average RSRP value for is -93.1315159 dBm which means that the signal quality is good, while for RSRP average (video play) is -94.2734738 dBm which means that the signal quality at still in good condition or normal

The measurement result for operator Y the RSRP (http page) parameter value, the average RSRP value for is -99.3869256 dBm which means that the signal quality is good, while for RSRP average (video play) is -99.24648903 dBm which means that the signal quality at still in good condition or normal.

4. Conclusion

Measurement performance of 4G LTE network operator X and Y operator located in North Balikpapan was done 3 times including http page and video play services focused on RSRP parameter observation. From the results of 3 times of data retrieval on operator X for HTTP service page has the best value of -89.4581411 dBm while for Operator Y of -94.1640139 dBm.

As for the measurement for video play services Operator X has the best value of -90.7076818 dBm and while for operator Y -93.7283522 dBm. From the average result for each operator and for each service all its can be concluded in either category or normal. Such as the average RSRP value of operator X for HTTP service Page -93.1315159 dBm and video Play -94.27334738 dBm. As for Operator Y mean RSRP value for HTTP Page -99.3869256 dBm and Video Play -99.24648903 dBm

Acknowledgement

Acknowledgment to Politeknik Negeri Balikpapan majoring in Electronics Engineering for the help of drive test device in this research

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