FRONTHAUL MICROWAVE PLANNING FOR COMMUNICATION RADIO 4G NETWORK

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Abstract. At present the city of Bandung has an LTE access network, but there are still some areas that are still insufficient for LTE networks, so there is a need to design the right telecommunications network in order to get good communication services. At this time PT. Tri Indonesia has provided LTE network services for the Bandug city area. At this time PT. Tri Indonesia has provided LTE network services for the Bandug city area. Microwave frounthaul planning analysis using microwave communication. Fronthaul microwave is a transmission between BBU who is on eNodeB site existing to RRH who is on new site. To analyze the data access design that covers the planning area, design is carried out *microwave link*, *coverage planning* and *capacity planning* network LTE. Next is simulated using *software* pathloss 5.0 to microwave link and atoll for coverage planning.

Based on the results of calculations and simulations, with a large frequency of work 70 Ghz and spesifikasi the device used for antenna gain is as big as 40,6; 43,0 and 50,0 The minimum receipt field is equal to -75 dBm. Get results all over *link fronthaul microwave* reach *avaibility* as big as > 99,99 % equal to value fade margin value 28 dB to 45 dB , this is caused by the value of the value of each site is greater than the value of the minimum receiving power of the device. Then from the results of planning coverage. in one of the planning areas, it produces an average RSRP value of - 82.48 dBm and a SINR average of 6.07 dB thus the RSRP and SINR coverage parameter planning simulation is said to be successful because it is included in a fairly good condition.

Kata kunci :**RRH, BBU, *Fronthaul, Link Microwave*, received power value,RSRP, SINR.**

Introduction

The city of Bandung is in the geographical location of the plateau, so it is necessary to design the right telecommunications network in order to get good communication services [1]. At this time PT. Tri Indonesia has provided LTE network services for the city of Bandung, but there are still some areas that are still not covered for LTE networks. So it is necessary to design a new network to support services [2]. At present the solution that has been made to overcome this problem is with the existing site which is then reinforced by using repeaters equipped with sectoral antennas to service LTE services. With this solution, only increasing coverage coverage and capacity that has not been covered throughout the city of Bandung [3].

Based on these problems in this study a microwave analysis of fronthaul design was based on the existing site and added a new site to cover coverage and capacity planning on the LTE network. [4].

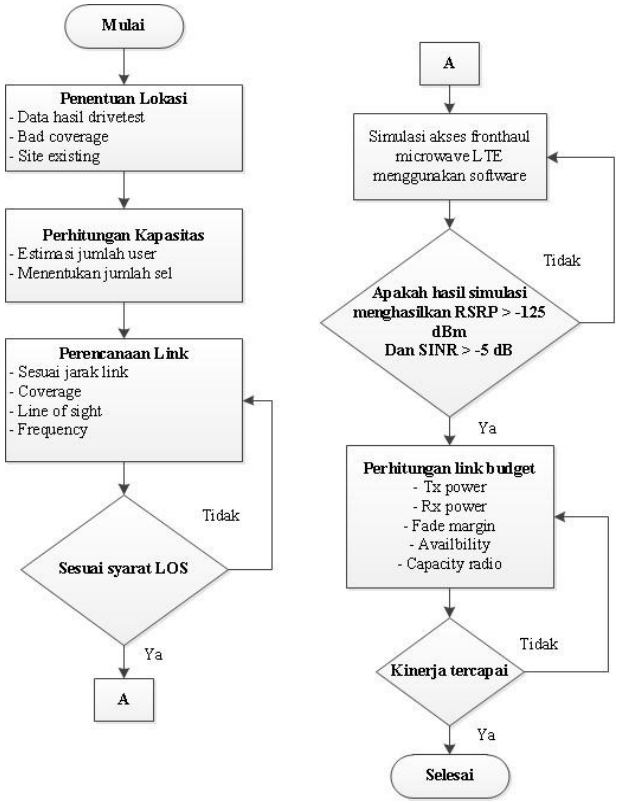
The transmission between BBU on the existing eNodeB site to RRH which is on the new site aims to expand coverage in the area. Then using the pathloss 5.0 software to simulate the microwave link between BBU towards RRH and atoll software to simulate area coverage and capacity in the area [5]. The parameters used for microwave links are: LOS (Line Of Sight) using a frequency of 70 Ghz [4] [6]. In accordance with the needs of fronthaul technology and based on the distance between sites, link budget and fade margin calculations were performed to obtain the efficacy parameters in the microwave link [7].

BBU (base band unit) is a port that is connected to all devices found in BTS (base transceiver station). In a BTS, BBU is a tool that is the center of the work of the BTS itself. BBU is a procecor that regulates data entry [8]. Radio Radio Head is a remote radio transceiver that is connected to the operator's radio control panel through an electric or wireless interface. In wireless system technology such as GSM, CDMA, UMTS, LTE, long-distance radio equipment to BTS / NodeB.eodeB, this equipment is used to expand the coverage of BTS / NodeB / eNodeB in environments such as urban or rural. RRH generally uses the Protocol Common Public Radio Interface [9].

Changes in communication networks must strengthen the influence of communication for business development in Indonesia. Providing communication networks must be balanced with the latest and updated communication tools. The emergence of the 4G network requires consumers to change their gadgets [10]. The purpose of this study is to identify the development of communication technology in the business world, and the benefits of 4G networks for communication technology.

Method

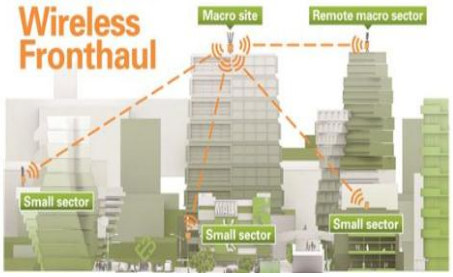
This study uses a description analysis method in the design of microwave fronthaul, and uses research that was previously related to the development of communication networks, which can analyze how much influence communication networks have in the business world. Systematic stages are needed to design the fronthaul so that this plan can be aligned as expected.



Picture 2.1 Flow Diagram

2.1. Fronthaul

Fronthaul is a function of separating base stations on components located at the cell location and the control function process located more centrally in the system. The radio function located in the cell location is called the Remote Radio Head (RRH) and the centralized processing function is called the Baseband Unit (BBU). Transmission between the Baseband Unit (BBU) and Remote Radio Head (RRH).



Picture 2.2 Fronthaul

2.2. Baseband Unit (BBU)

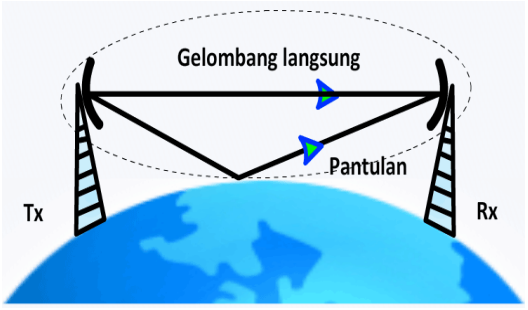
BBU (base band unit) is a port that is connected to all devices found in BTS (base transceiver station). In a BTS, BBU is a tool that is the center of the work of the BTS itself, BBU is a procecor that manages the entry of data.

2.3. Remote Radio Head (RRH)

2.4. Radio Radio head is a remote radio transceiver that is connected to the operator's radio control panel through an electric or wireless interface. In wireless system technology such as GSM, CDMA, UMTS, LTE, remote radio equipment to BTS / NodeB / eNodeB, this equipment is used to expand the coverage of BTS / NodeB / eNodeB in environments such as urban or rural. RRH is generally connected via fiber optic cable using the Common Public Radio Interface protocol.

2.5. Transmisi Microwave

Microwave is a form of radio emission that is transmitted through the air and received by using an antenna-like device that is round in a high building or tower. Microwave signals cannot be blocked by buildings or valleys. To make the current transmission avoid the presence of a barrier or slope of the earth. So if the position between buildings is blocked, then a tower is needed to place the antenna higher so that it stays in the Line of sight position.



Gambar 2.3 Sistem Transmisi Microwave

2.6. Performansi Jaringan LTE[15]

2.6.1 RSRP(*Receive Signal Received Power*)

RSRP or *Received Signal ReceivedPower* used to measure the signal strength received by UE (in units dBm). RSRP can be used to analyze *coverage*. Analogi RSRP together with RSCP on 3G. For standard value parameters RSRP can be seen in table 2.1 as follows:

Tabel 2.1 Value Standards RSRP[15]

Level Sinyal (dBm)	Signal Strength Category
Above -88	Good
≥ -104 to < -92	Enough
Below -125	Bad

2.6.2 SINR

SINR menunjukkan signal quality received by the EU and used to analyze *quality*. SINR is a comparison between the energy of each information signal against an interference signal or the noise signal that accompanies it. At its core is a comparison between the strength of the signal caused by the unwanted signal strength.

Tabel 2.2 Value Standards SINR[15]

Level Sinyal (dB)	Signal Strength Category
>25	Good
5>SINR< 18	Enough
SINR<-5	Bad

2.7 Perencanaan *Fronthaul*

2.7.1 To design a fronthaull microwave there are several steps needed, such as determining site information, fronthaul topology models, determining performance standards, frequency and polarization planning, achieving LOS, rain attenuation calculations to link budget calculations.

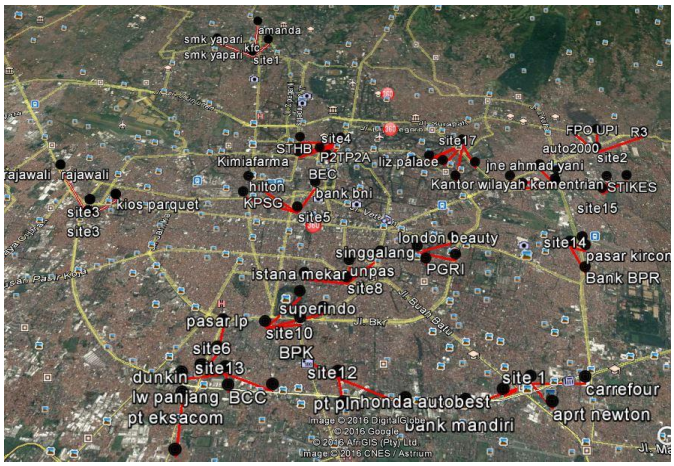
2.7.2 Informasi *Site*

To do fronthaul microwave planning, an assessment of the condition of the existing site is first carried out and then doing siteplanning. In this planning the fronthaul microwave uses an existing site as a donor bts that will emit signals to each new site that has been determined then the radio link is divided into hop-hop and create a path profile for each hop and determine the height of each antenna.

Table 1.1 Coordinate site planning

Site	latitude	longtitude	Type
Site1	-6.882096	107.595234	*Existing*
Kfc	-6.878562	107.59768	*New*
Smk Yapari	-6.878108	107.588518	*New*
Amanda	-6.873123	107.595299	*New*
Site4	-6.904294	107.611103	*Existing*
ISD	-6.904091	107.604791	*New*
STHB	-6.906552	107.604716	*New*
P2TP2A	-6.906607	107.607953	*New*
BEC	-6.908247	107.609216	*New*

Kimiafarma	-6.907521	107.604737	*New*
Site12	-6.946091	107.611753	*Existing*
PT LEN	-6.949618	107.619638	*New*
PT PLN	-6.950163	107.612469	*New*
BPK	-6.943313	107.607332	*New*



Picture 2.4 Planning *Site* Hop

2.7.3 Device Information

To support the design of the backhaul, a device is needed to suit the capacity requirements and supports the working frequency used, following the specifications of the antenna device and microwave radio

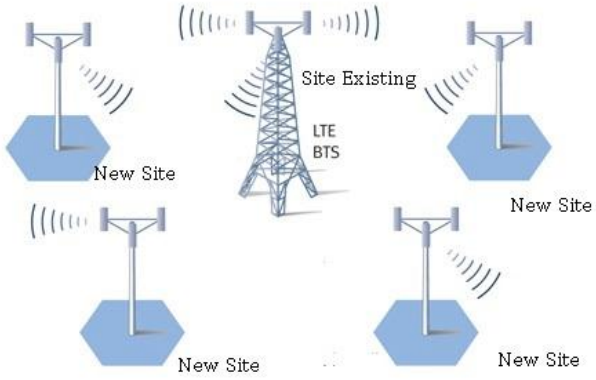
Tabel 2.2 Specifications of Radio Devices *Microwave*

Manufacturer	FUJITSU	
Model	GX4000	
Application Type	Adaptive Modulation Radio	
Frequency Range	70 GHz	76 GHz
Data Rate	37.72	
Radio Capacity	16	
Modulation	64 QAM	
Tx Power	13 dBm	
Rx Thrshold	-75 dBm	

Tabel 2.3 Antenna Device Specifications

Manufacture	COMMSCOPE		
Model	VHLP200-80	VHLP1-80	VHLP2-80
Diameter, nominal	0.2 m	0.3 m	0.6 m
Gain, Low Band	40.6 dBi	43.0 dBi	50.0 dBi
Gain, Mid Band	41.0 dBi	43.5 dBi	50.5 dBi
Gain, Top Band	41.4 dBi	44.0 dBi	51.0 dBi
Low Freq	71000 MHz		
High Freq	86000 MHz		
Beamwidth, Horizontal	1.4^0	0.9^0	0.5^0
Beamwidth, Vertical	1.4^0	0.9^0	0.5^0

2.7.4 Network Macro Fronthaul Microwave

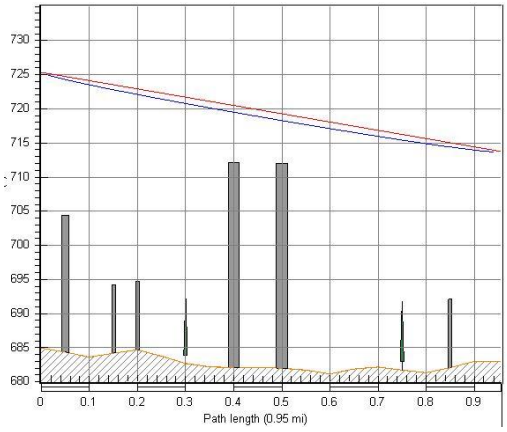


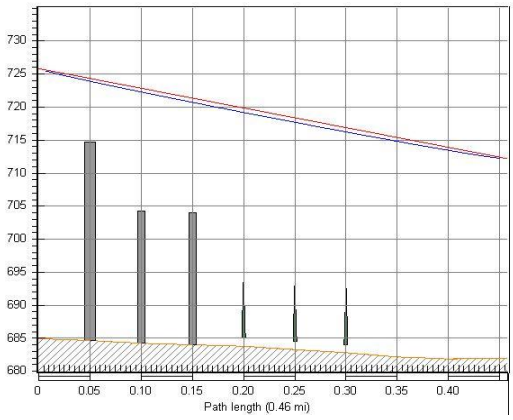
Picture 2.5 Microwave network fronthaul microwave

Fronthaul is a transmission between BBU which is on the side of the existing site with RRH which is on the side of the new site. BBU translates data flow originating from the network into a form that is suitable for airborne transmission which functions to retrieve data flow from RRH and convert it into a form that is suitable for transportation of its network. Odu has the duty to convert the IF (Intermediate Frequency) signal from a satellite modem which is 70 GHz to become an RF (Radio Frequency) signal received by RRH which functions to expand the coverage of BTS emitted by sector antennas to the user.

3 Planning Results

3.1 Fronthaul Planning Simulation Results





Picture3.1*Terrain Data site* 12 – site pt len **Picture 3.2***Terrain Data site* 12– site pt pln

3.2 Fronthaul Planning Results

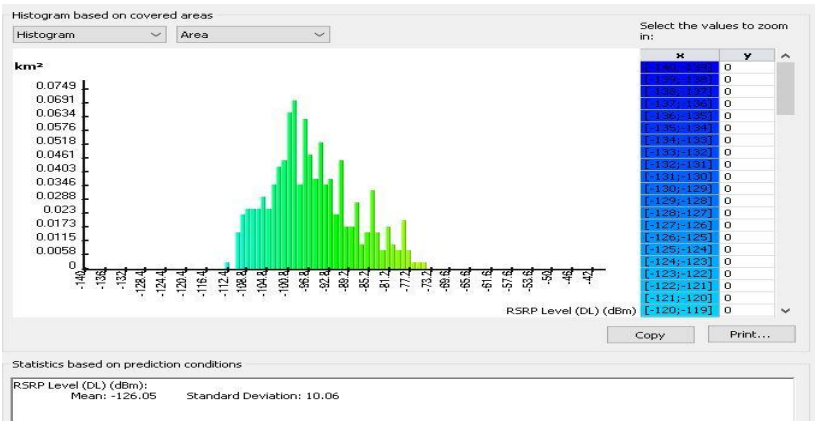
All fronthaul links have a value of receiving power greater than the minimum received power value of -75 dBm obtained from the device specifications. By calculating the link budget on the existing parameters, availability is also obtained at 99.99% on all fronthaul links and seen from the fade margin parameters that get 28 dB to 45 dB results. With the final results showing good performance and availability, it can be said that in this plan microwave fronthaul links are feasible to be applied to the city of Bandung in an optimal manner.

3.3 Analysis of the performance of the LTE access network

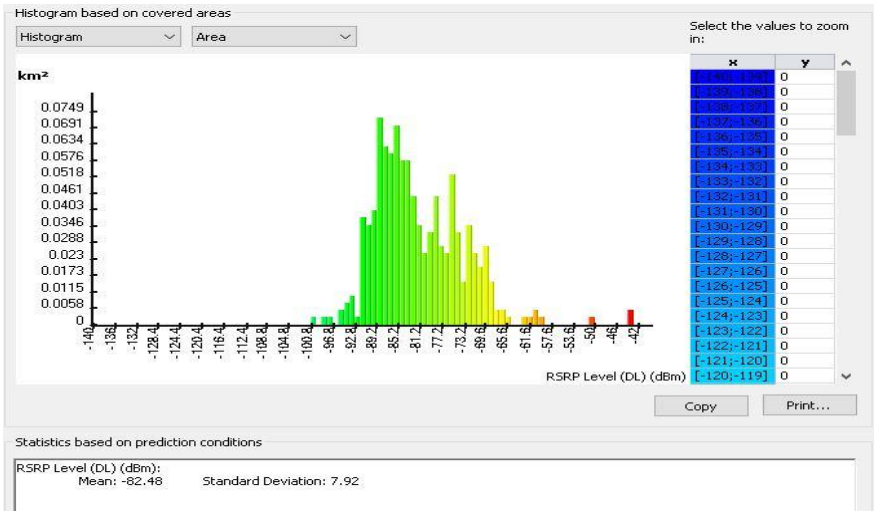
In the coverage planning simulation section carried out with 2 stages, namely:

1. Placing 4G BTS according to existing conditions.
2. Placing a new 4G base station from the existing conditions near the planning location.

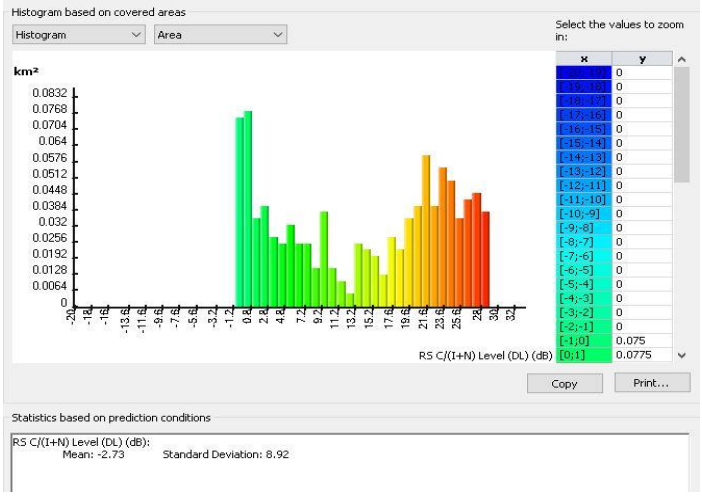
After the simulation is done by adjusting the location of each BTS that is used with existing conditions and also making new BTS using atoll software, then the value of the parameters sought is obtained. Graph percentage of RSRP kec. Bandung Kidul (after)



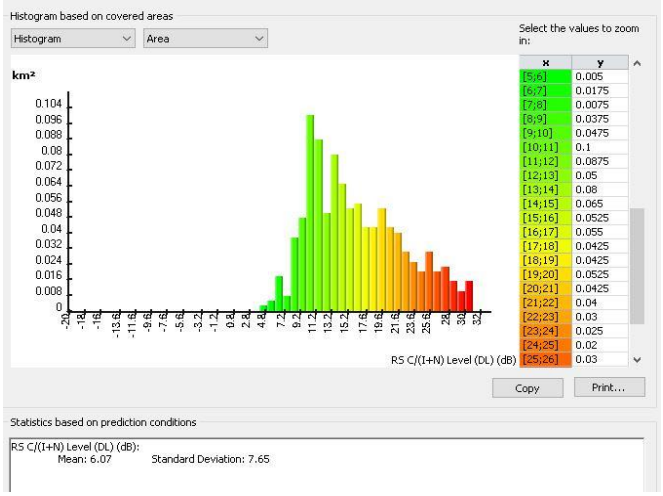
Grafik presentase RSRP kec. Bandung kidul (*before)*



Grafik presentase RSRP kec. Bandung kidul (*after)*



Gambar 3.5 Grafik presentasi SINR(*before*)



Gambar3.6Grafik presentasi SINR(*after*)

4. Conclusion

1. Capacity used by the existing site capacity is 30 Mbps by calculating the capacity of cells as many as 7 cells, so as to meet the required capacity.

2. From the scenario of designing the LTE network at the planning location of the bandung kidul sub-district it produces an average RSRP value of - 82.48 and an average SINR value of 6.07 dB, thus the RSRP and SINR coverage parameter planning simulations are said to be successful because they are included in good conditions for parameters RSRP and is quite good for SINR parameters and is feasible to be implemented in the field.

3. In the simulation results, all fronthaul microwave links reach avaibility of> 99.99% with a fade margin value of 28 dB to 45 dB, this is due to the value of the acceptance of each site is greater than the value of the minimum device power of -75 dBm .

4. Referring to the distance and coverage requirements and capacity requirements, the most suitable device for use in this planning is the GX-4000 radio device and uses 3 different antennas according to distance requirements.

• Model VHLP200-80, antenna gain specifications of 40.6 dBi

• VHLP1-80 model, antenna gain specifications of 43.0 dBi

• VHLP2-80 model, 50.5 dBi antenna gain specifications

5. For new sites antenna height ranges from 20-30 meters.

6. Planning of microwave fronthaul links is determined as many as 15 sites according to existing conditions that have transmission to each sectoral antenna on the new site with each site having 3-5 links.

7. Based on the results of calculations and simulations, with a working frequency of 70 Ghz based on site distance.

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