
Re: review Alvin Jurna TELE

3 pesan

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13 Juli 2016 pukul 14.51

Kepada: Muhammad Anif <muhammad.anif@gmail.com>, edwardihani@gmail.com, Muhammad Anif <muhammadanif@gmail.com>

Cc: Alfin Hikmaturokhman <alfin@st3telkom.ac.id>

Asswrwb

Selamat Siang Pak Muh Anif dan Bu Eni W, terlampir revisi dari saya berkaitan tentang Jurnal yang kemarin saya kirimkan., atas perhatian dan kerjasamanya, saya ucapkan terima kasih
Wassalam

Best Regard

Alfin Hikmaturokhman.,ST.,MT

2G-3G-4G Trainer and ST3 Telkom Purwokerto Lecturer

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Pada 27 Juni 2016 09.24, Muhammad Anif <muhammad.anif@gmail.com> menulis:

fyi prof..

Muhammad Anif, M.Eng.Kepala UPT Teknologi Informasi dan Komunikasi
Politeknik Negeri Semarang

----- Forwarded message -----

From: **Eni Wardihani** <edwardihani@gmail.com>

Date: 2016-06-27 8:51 GMT+07:00

Subject: review Alvin

To: Muhammad Anif <muhammad.anif@gmail.com>, Muhammad Anif <m_anif@yahoo.com>

Kepada Yth.

Bapak Alfin

Selamat dan Terima kasih, kami ucapkan atas diterimanya paper saudara.
Berikut kami kirimkan hasil review paper saudara dengan judul "Analysis Cost 231 MultiWall Model on 4G LTE FDD 1800 and 900 Mhz Femtocell Network Planning ".
kami tunggu hasil revisinya dalam waktu 3 minggu.

Hormat kami,
redaksi jurnal TELE

**Alfin_Revision for Polines 13 Juli 2016.docx**

2169K

Eni Wardihani <edwardihani@gmail.com>

18 Juli 2016 pukul 15.22

Kepada: Alfin Hikmaturokhman <alfin@st3telkom.ac.id>

Terima Kasih Bapak Alfin,
kami sudah menerima artikel Bapak yang sudah diperbaiki.
sekarang lagi proses editing dan layout dari tim TELE.
Terima kasih

Eni

[Kutipan teks disembunyikan]

Alfin Hikmaturokhman <alfin@st3telkom.ac.id>
Kepada: Eni Wardihani <edwardihani@gmail.com>

18 Juli 2016 pukul 20.20

Terima kasih Bu atas bantuanya
Jurnal TELE terbitan yg sekarang ini sdh menjadi Jurnal Internasional yah Bu?

Best Regard

Alfin Hikmaturokhman.,ST.,MT

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Analysis Cost 231 MultiWall Model on 4G LTE FDD 1800 and 900 Mhz Femtocell Network Planning

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^{1,2,3}Sekolah Tinggi Teknologi Telematika Telkom Purwokerto

Abstrak -Indoor cellular network system is one solution to overcome weak signals transmitted by eNodeB. Building with high cellular communication traffic levels, requiring indoor network system to maintain continuity of communication by all users. Therefore, it is necessary to plan an indoor network using Femtocell Access Point (FAP). This research is based on network design indoor propagation COST 231-Multiwall Model using the software Radiowave Propagation Simulator (RPS) and conducted at Telkom Office. The collection of data obtained is used to perform calculations on research variables include the calculation of capacity and coverage. The research showed the number of FAP for capacity and coverage is 3 FAP. The Coverage Results for scenario 2 is the best result compared with the other scenarios, with the following results, the frequency of 1800 MHz at Building 1 of -19.86 dBm, Building 2 at -21.34 dBm, and Building 3 at -28, 07 dBm. While the scenario 2 for the 900 MHz frequency in Building 1 at -13.38 dBm, Building 2 at -14.52 dBm, and building 3 of -20.39 dBm

Index Terms— :Femtocell, RPS, COST 231Multiwall,4G LTE,FDD

Commented [POL1]: Cek grammar....

I. Introduction

Requirement for data and voice communication is very necessary, not only outdoor users, but also necessary for indoor users eg offices, schools, shopping centers, etc. Indoor Building Coverage is a system with a transmitter and receiver are installed in the building.

LTE is a technology development of GSM (Global System for Mobile Communications) and UMTS (Universal Mobile Telecommunication System) with a speed higher datarate.

LTE Femtocell technology can improve indoors signal coverage because of the placement of femtocell base station placed in the room. The signal quality indoors is better because of the reduced distance between FAP (Femtocell Access Point) with the user. Based on this background, the authors took the research on the topic "Analysis Cost 231 MultiWall Model on 4G LTE FDD 1800 and 900 Mhz Femtocell Network Planning".

into small areas called cells.

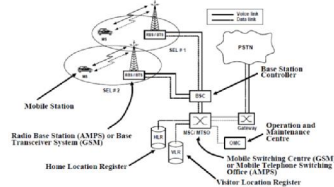


Fig 1. Cellular Communication System Architecture [1]

Commented [POL2]: Sitasi?

B. LTE (Long Term Evolution)[3]

LTE (Long Term Evolution) is the development of third generation technology (3G) WCDMA-UMTS from the 3rd Generation Partnership Project (3GPP).

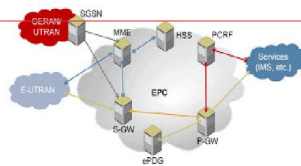


Fig 2. LTEArchitecture [1]

Commented [POL3]: Sitasi?

II. Basic Theory

A. Mobile Communication System [1]

Mobile communication system is a wireless telecommunications system that delivers good mobility to the user. The service area is divided

C. Indoor Building Solution (IBS)

Indoor Building Solution is a solution to overcome the problem of weak signal in the room or building, expanding the coverage area of the cell, and overcome high customer inside the building.[5]

D. Femtocell

Femtocell is a micro base station technology that use low power level as a solution for customers who are in the room or building.

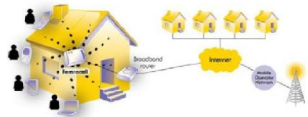


Fig 3. Femtocell Concept [5]

Femtocell architecture consists of three main things:

- a. Femtocell Access Point (FAP) is a major node in the network-based femtocell.
- b. Security Gateway (SeGW) is a network node that acts to secure the Internet connection between the femtocell users on the service provider's core network.
- c. Femtocell Device Management System (FMS) is the part that ensures scalability femtocell network to multiple devices.

E. Indoor Propagation Network

Indoor network propagation model are:

- a. One Slope Model is a model that takes into account propagation parameters that affect the calculation of pathloss exponent.
- b. Keenan Motley indoor propagation model is a model that takes into account the entire wall in the vertical plane between the transmitter and receiver.
- c. Cost 231 Multi-Wall Model is a propagation model where all the walls in the vertical plane and properties of materials between transmitter and receiver included in the calculation

$$LT = LFSL + LC \quad (1)[9]$$

Information :

- LFSL = free space loss
- $LFSL = 20 + 10 \log f \text{ Mhz} + 20 \log d \text{ (km)} + 32.5$
- LC = constant loss = 37 dB
- NWI = the value of the type penetrated wall (partition wall material)
- LWI = wall type of loss
- LW1 = L Light Wall
- Lw2 = L Heavy Wall
- Lf = loss between floors adjacent to each other.
- b = empirical parameter (0.46)
- M = Number of wall type :
- LFSL = free space loss
- $LFSL = 20 \log f \text{ Mhz} + 20 \log d \text{ (km)} + 32.5$
- LC = constant loss = 37 dB
- nwi = partition wall materials
- Lwi = wall type loss

- Lw1 = L Light Wall
- Lw2 = L Heavy Wall
- L_f = loss between floors adjacent to each other.
- b = empirical parameter (0.46)
- M = Number of wall type
- nf = value from penetrated floors

G. Link Budget Calculation

a. Propagation Line of Sight (LOS) is a power drop during the radio waves propagating in free space. (Sitasi)

$$FSL = 32,45 + 20 \log f \text{ (MHz)} + 20 \log d \text{ (km)} \quad (2)[3]$$

b. Effective Isotropic Radiated Power (EIRP). (Sitasi)

$$EIRP = P_{tx} + G_{tx} - L_{tx} \quad (3)[3]$$

c. Receive Signal Level (RSL)

RSL: received signal level at the receiver side.
 $RSL = EIRP - L_{propagasi} + GRX - L_{RX} \quad (4)[1]$

d. SensitivitasReceiver (SR)

$$= + + + \quad (5)[1]$$

H. Determining the Number of FAP

- 1. Based on Capacity,
 - a. Calculating Future Population

$$\text{Future Population} = [+] \quad (6)[9]$$

b. Calculating Throughput

$$\text{Throughput} = \text{Bearer rate} \times \text{Session time} \times \text{Session duty ratio} \times [1/(1-BLER)] \quad (7)[9]$$

c. Calculating Single User Throughput

$$\text{Single User Throughput} = \frac{1}{\dots} \quad (8)[9]$$

d. Uplink Network Throughput (IP)

$$\text{Uplink Network Throughput (IP)} = \text{Total User Number} \times \text{UL Single Throughput} \quad (9)[9]$$

Information :

e. Downlink Network Throughput (IP)

$$\text{Downlink Network Throughput (IP)} = \text{Total User Number} \times \text{DL Single User Throughput} \quad (10)[9]$$

f. Total FAP

$$\text{FAP Amount} = \dots \quad (11)[9]$$

Commented [POL4]: Tempatkan di akhir kalimat yang menyebutkan rumus tersebut

- 2. Based on Coverage
 - a. COST 231 Multiwall Model

$$L_T = L_{FSL} + \dots + \dots \quad (12)[9]$$

- b. The covered area
 - = , (13)[9]

- c. Jumlah Femtocell
 - FAP Amount = $\frac{(\dots)}{(\dots)}$ (14)[9]

II. RESEARCH METHODOLOGY

A. Research Instruments

The research instrument required is a laptop that already installed Radiowave Propagation Simulator (RPS), a site plan of research, and the type of building materials.

B. Research Methods

The research methodology used was simulated. By creating a design that uses Radiowave Propagation Simulator version 5.4.

C. Data Collection

Collecting data in this research is to design and data preparation design results. Data preparation for designing the required data before you can design the indoor LTE network. Sample data is as follows building that will be analyzed, indoor base stations, and partition materials. The data is a result of design data associated with the design form of the calculation result. The data obtained through testing by using a calculation formula.

D. Planning Area Description

Planning area carried at Telkom Office located at Jalan Pemuda No. 74, a total area of 508.15 meter² with a height of 3.5 meters from the ground which is divided into 3 separate buildings, namely plasa telecoms with an area of 85.62 meter², DCS building with an area of 85.93 meter², and building division access to the building area of 189.62 meter²

II. DESIGN ANALYSIS AND SIMULATION RESULTS

A. RESULTS CALCULATION

A. The following describes the calculation of the indoor network planning.

1. Link Budget

Table 2. MAPL Uplink Calculation

Transmitter	Value	Calculation
A Max TX Power (dBm)	23	
B TX Antena Gain (dBi)	0	
C Body Loss (dB)	0	
D EIRP (dBm)	23	d=a+b-c
Receiver		
Value	Calculation	
E Noise Fig (dB)	2	
F Thermal Noise (dBm)	-137.445	KTB
G Receiver Noise Floor (dBm)	-135.445	g=e+f
H SINR (dB)	-7	
I Receiver Sensitivity (dBm)	-142.445	i=g+h
J Load Factor	0.7	70%
K Interference Margin (dB)	1	
L Cable Loss (dB)	0	
M RX Antena Gain (dBi)	0	
N Fast Fade Margin (dB)	0	
O Maximum Path Loss	157.445	o=d-g-k+m-n

Table 3. MAPL Downlink Calculation

Transmitter	Value	Calculation
A Max TX Power (dBm)	34	
B TX Antena Gain (dBi)	0	
C Cable Loss (dB)	2	
D EIRP (dBm)	32	d=a+b-c
Receiver		
Value	Calculation	
E UE Noise Fig (dB)	7	
F Thermal Noise (dBm)	-137.445	KTB
G Receiver Noise Floor (dBm)	-130.445	g=e+f
H SINR (dB)	-9	
I Receiver Sensitivity (dBm)	-139.445	i=g+h
J Load Factor	0.7	
K Interference Margin (dB)	4	
L Control Channel overhead (%)	0.1	10%
M RX Antena Gain (dBi)	0	
N Body Loss (dB)	0	
O Maximum Path Loss	158.445	o=d-g-k+m-n

Uplink MAPL Calculation acquired 157.445 dB and downlink MAPL calculations obtained 158.445 dB.

2. Indoor Attenuation

Indoor loss calculation is done to get how big a result of loss of material such as the type of walls, floors, insulation, glass, etc.

Table 4. Building 1 Obstacle Total Loss

Obstacle Type	dB	Amount	Total (dB)
Glass	0.8	9	7.2
Concrete	4	6	24
Wood Door	4	1	4
Obstacle Total Loss			35.2

Table 5. Building 2 Obstacle Total Loss

Obstacle Type	dB	Amount	Total (dB)
Glass	0.8	8	6.4
Concrete	4	6	24
Wood Door	4	2	8
Obstacle Total Loss			38.4

Table 6. Building 3 Obstacle Total Loss

Obstacle Type	dB	Amount	Total (dB)
Glass	0.8	8	6.4
Concrete	4	10	40
Wood Door	4	4	16
Obstacle Total Loss			62.4

After getting the total value of the indoor attenuation of each building, then take into account the propagation permitted after passing loss.

Table 7. Propagation losses in Building 1

A	Max Path Loss (dB)	158,445.104
B	Soft Handoff Gain	0
C	Obstacle Total Loss	35.2
D	Allowed Propagation Loss for cell range (dB) / LT	123,245104

Table 8. Propagation losses in Building 2

A	Max Path Loss (dB)	158,445
B	Soft Handoff Gain	0
C	Obstacle Total Loss	38.4
D	Allowed Propagation Loss for cell range (dB) / LT	120,045104

Table 9. Propagation losses in Building 3

a	Max Path Loss (dB)	158,445
b	Soft Handoff Gain	0
c	Obstacle Total Loss	62.4
d	Allowed Propagation Loss for cell range (dB) / LT	96,045

B. ANALYSIS OF TOTAL FEMTOCELL ACCESS POINT (FAP)

1. Coverage Based Analysis

Coverage based analysis is carried out to determine the area that can be covered by FAP.

Table 10. Number of FAP Coverage Based on 1800 MHz

	1800 MHz		
	Building 1	Building 2	Building 3
The area planned	85,62 m ²	81,96 m ²	189,62 m ²
Coverage Cells	189540 m ²	91092 m ²	362,647 m ²
FAP Number	1	1	1

Table 11. Number of FAP Coverage Based on 900 MHz

	900 MHz		
	Building 1	Building 2	Building 3
The area planned	85,62 m ²	81,96 m ²	189,62 m ²
Coverage Cells	758160 m ²	364320,6 m ²	1450,38 m ²
FAP Number	1	1	1

2. Capacity Based Analysis

Capacity based analysis used to estimate the number of users that can be served by a single cell.

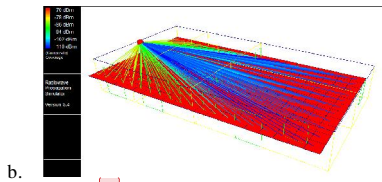
Table 12. Number of FAP Capacity Based

Item	UL	DL
Area	508,15 m ²	
User	50	
Network Throughput (Mbps)	2,400182	20,92775
Site Capacity (Mbps)	10,10878	8,423976
FAP Number	1	3
FAP User Number	50	16,66667

C. RADIOWAVE PROPAGATION SIMULATOR ANALYSIS

1. Building 1

- a. FAP is placed on the left side of the room..Fig 16 shows.....



b. Fig 16. FAP display Simulation

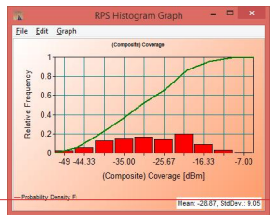


Fig 21. Composite Coverage Result

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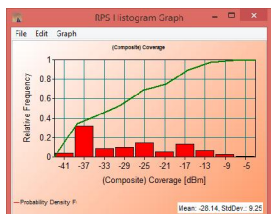


Fig 17. Composite Coverage Result

2. Building 2

a. FAP is placed on the left side of the room

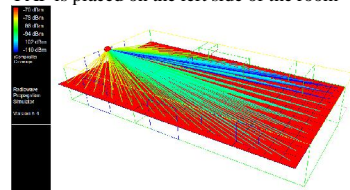


Fig 22. FAP display Simulation

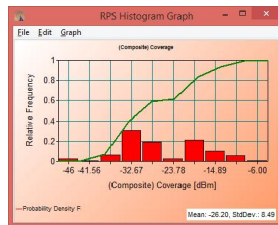


Fig 23. Composite Coverage Result

c. FAP is placed in the middle of the room

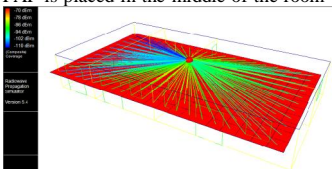


Fig 18. FAP display Simulation

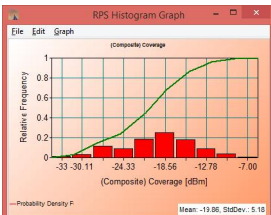


Fig 19. Composite Coverage Result

b. FAP is placed in the middle of the room

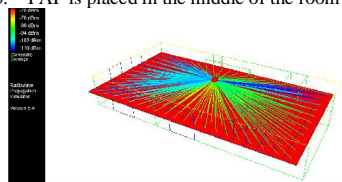


Fig 24. FAP display Simulation

d. FAP is placed on the right side of the room

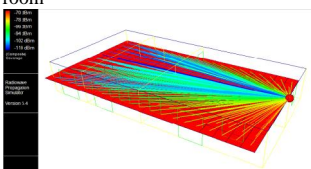


Fig 20. FAP display Simulation

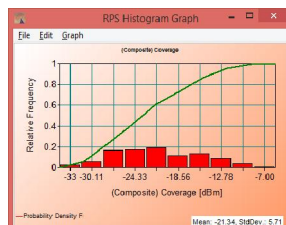


Fig 25. Composite Coverage Result

c. FAP is placed on the right side of the room

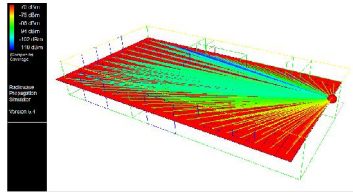


Fig 26. FAP display Simulation

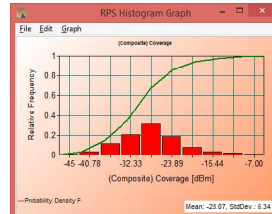


Fig 31. Composite Coverage Result

a. FAP diletakkan di sisi kanan ruangan

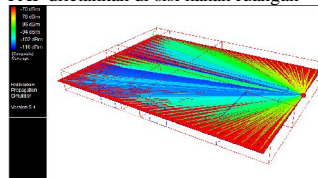


Fig 32. FAP display Simulation

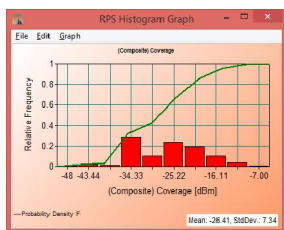


Fig 27. Composite Coverage Result

3. Building 3

a. FAP is placed on the left side of the room

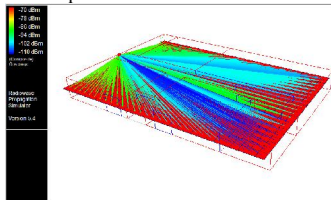


Fig 28. FAP display Simulation

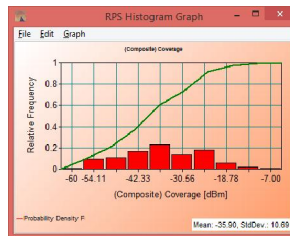


Fig 33. Composite Coverage Result

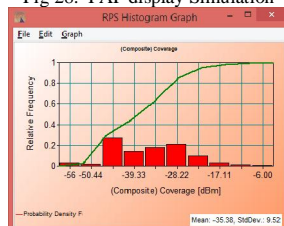


Fig 29. Composite Coverage Result

b. FAP is placed in the middle of the room

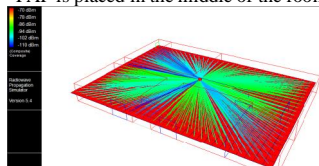


Fig 30. FAP display Simulation

FAP placement of the whole scenario already have an indicator of average power levels below -70 dBm. However, the most appropriate to be implemented is scenario 2, the beam has the smallest attenuation compared to scenario 1 and scenario 3.

D. PHYSICAL CELL IDENTITY (PCI) ALLOCATION

PCI is naming that is used to identify cells in LTE. Number of PCI on LTE at 504 units consisting of 168 (Secondary Synchronization Signal (SSS) ID group and 3 Primary Synchronization Signal (PSS) ID per group. PCI allocation in this research are 492-501 (located at 164-167 SSS). While the rest of the PCI numbering used for macro cell.

Table 13. PCI Allocation

FAP Number	PCI Number
1	492
2	495
3	498

III. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusion

Based on the research results, it can be concluded that:

1. Maximum Allowable Path Loss is 157.445 dB for uplink and 158.445 dB for downlink
2. The second scenario is selected in this reserach. The second scenario resulting composite value coverage for the 1800 MHz frequency in Building 1 at -19.86 dBm, in Building 2 at -21.34 dBm, and at Building 3 of -28.07 dBm. While the value of the second scenario composite coverage for the 900 MHz frequency in Building 1 at -13.38 dBm, in Building 2 at -14.52 dBm, and the Building 3 at -20.39 dBm.
3. The allocation of numbering PCI is 3 PCI ie 492, 495, and 498. This corresponds to the number of FAP because there is no division of sectors in each FAP.

B. Recommendations

1. Not only use the 1800 MHz and 900 MHz but also 2300 Mhz or 850 Mhz. Bandwidth variation not only uses 5 MHz.
2. Selection of partition and building materials more varied so that the simulation results will design more in line with real conditions.

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Commented [POL6]: Ref no 11 tidak ada. Nomor loncat

Revisi:

1. Ref. No. 2,4,6,7,8,10,12 tidak disebut di dalam teks. Hanya ref yang disebut di teks yang ditulis di daftar ref.
2. Ref loncat dari no. 10 ke No. 12
3. Penempatan sitasi untuk rumus ditempatkan di kalimat
4. Sebutkan gambar di dalam teks