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LAMPIRAN

Lampiran 1. Faktor Pertumbuhan Penduduk Kampus Tamalanrea UNHAS 2015-2020

SDM Tahun 2015 (P_0)	SDM Tahun 2020 (P_t)
29658	30724

$$r = \left(\frac{P_t}{P_0}\right)^{\frac{1}{t}} - 1$$

$$r = \left(\frac{30724}{29658}\right)^{\frac{1}{5}} - 1$$

$$r = (1,035)^{0,2} - 1$$

$$r = 1,006 - 1$$

$$r = 0,006$$

$$r = 0,6\%$$

Lampiran 2. Faktor Pertumbuhan Penduduk Kampus Gowa UNHAS 2015- 2020

SDM Tahun 2015 (P_0)	SDM Tahun 2020 (P_t)
4998	5184

$$r = \left(\frac{P_t}{P_0}\right)^{\frac{1}{t}} - 1$$

$$r = \left(\frac{5184}{4998}\right)^{\frac{1}{5}} - 1$$

$$r = (1,037)^{0,2} - 1$$

$$r = 1,007 - 1$$

$$r = 0,007$$

$$r = 0,7\%$$

Lampiran 3. *Traffic Forecasting* Kampus Tamalanrea UNHAS 2015-2020

Jumlah SDM (U_0)	Faktor Pertumbuhan (F_p)	Tahun Perencanaan (n)
30724	0,6 %	5 tahun

$$U_n = U_0 (1 + F_p)^n$$

$$U_n = 30724 (1 + 0,6\%)^5$$

$$U_n = 30724 (1,0303)$$

$$U_n = 31654,9$$

$$U_n = 31655 \text{ jiwa}$$

Lampiran 4. *Traffic Forecasting* Kampus Gowa UNHAS 2015-2020

Jumlah SDM (U_0)	Faktor Pertumbuhan (F_p)	Tahun Perencanaan (n)
5184	0,7 %	5 tahun

$$U_n = U_0 (1 + F_p)^n$$

$$U_n = 5184 (1 + 0,7\%)^5$$

$$U_n = 5184 (1,0354)$$

$$U_n = 5367,5$$

$$U_n = 5368 \text{ jiwa}$$

Lampiran 5. Prediksi Jumlah Total Pelanggan Kampus Tamalanrea UNHAS

2015-2020

Jumlah Penduduk Tahun ke-n (U_n)	Penetrasi Pengguna Seluler (P_p)	Market Share (M_s)	Penetrasi Layanan (PNT)
31655	100%	30%	90%

$$C_f = U_n \times P_p \times M_s \times PNT$$

$$C_f = 31655 \times 100\% \times 30\% \times 90\%$$

$$C_f = 8546 \text{ pelanggan}$$

Lampiran 6. Prediksi Jumlah Total Pelanggan Kampus Gowa UNHAS 2014-

2019

Jumlah Penduduk Tahun ke-n (U_n)	Penetrasi Pengguna Seluler (P_p)	Market Share (M_s)	Penetrasi Layanan (PNT)
5368	100%	30%	90%

$$C_f = U_n \times P_p \times M_s \times PNT$$

$$C_f = 5368 \times 100\% \times 30\% \times 90\%$$

$$C_f = 1449,3$$

$$C_f = 1449 \text{ pelanggan}$$

Lampiran 7. Service Model LTE

<i>Traffic Parameters</i>	<i>Uplink</i>				<i>Downlink</i>			
	<i>Bearer Rate (Kbps)</i>	<i>PPP Session Time (s)</i>	<i>PPP Session Duty Ratio</i>	<i>BLER (%)</i>	<i>Bearer Rate (Kbps)</i>	<i>PPP Session Time (s)</i>	<i>PPP Session Duty Ratio</i>	<i>BLER (%)</i>
VoIP	26,9	108	0,6	1	26,9	108	0,6	1
Video Phone	62,53	36	1	1	62,53	36	1	1
Video Conference	62,53	1800	1	1	62,53	1800	1	1
Real Time Gaming	31,26	1800	0,2	1	125,06	1800	0,4	1
Streaming Media	31,26	3600	0,05	1	250	3600	0,05	1
IMS Signalling	15,63	7	0,2	1	15,63	7	0,2	1
Web Browsing	62,53	1800	0,05	1	250,11	1800	0,05	1
File Transfer	140,69	600	1	1	750,34	600	1	1
Email	140,69	50	1	1	750,34	15	1	1
P2P File Sharing	250,11	1200	1	1	750,34	1200	1	1

Tabel Parameter Service Model

a. Uplink Throughput

1. VoIP

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 26,9 \text{ Kbps} \times 108 \text{ s} \times 0,6 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 1743,12 \times (1/0,99) \text{ Kbit}$$

$$\text{Throughput} = 1760,73 \text{ Kbit}$$

2. *Video Phone*

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times \frac{1}{1 - \text{BLER}}$$

$$\text{Throughput} = 62,53 \text{ Kbps} \times 36 \text{ s} \times 1 \times \frac{1}{1 - 1\%}$$

$$\text{Throughput} = 2251,08 \times (1/0,99) \text{ Kbit}$$

$$\text{Throughput} = 2273,82 \text{ Kbit}$$

3. *Video Conference*

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times \frac{1}{1 - \text{BLER}}$$

$$\text{Throughput} = 62,53 \text{ Kbps} \times 1800 \text{ s} \times 1 \times \frac{1}{1 - 1\%}$$

$$\text{Throughput} = 112554 \times (1/0,99) \text{ Kbit}$$

$$\text{Throughput} = 113690,91 \text{ Kbit}$$

4. *Real Time Gaming*

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times \frac{1}{1 - \text{BLER}}$$

$$\text{Throughput} = 31,26 \text{ Kbps} \times 1800 \text{ s} \times 0,2 \times \frac{1}{1 - 1\%}$$

$$\text{Throughput} = 11253,6 \times (1/0,99) \text{ Kbit}$$

$$\text{Throughput} = 11367,27 \text{ Kbit}$$

5. *Streaming Media*

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 31,26 \text{ Kbps} \times 3600 \text{ s} \times 0,05 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 5626,8 \times (1/0,99) \text{ Kbit}$$

$$\text{Throughput} = 5683,64 \text{ Kbit}$$

6. *IMS Signalling*

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 15,63 \text{ Kbps} \times 7 \text{ s} \times 0,2 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 21,882 \times (1/0,99) \text{ Kbit}$$

$$\text{Throughput} = 22,10 \text{ Kbit}$$

7. *Web Browsing*

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 62,53 \text{ Kbps} \times 1800 \text{ s} \times 0,05 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 5627,7 \times (1/0,99) \text{ Kbit}$$

$$\text{Throughput} = 5684,55 \text{ Kbit}$$

8. *File Transfer*

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 140,69 \text{ Kbps} \times 600 \text{ s} \times 1 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 84414 \times (1/0,99) \text{Kbit}$$

$$\text{Throughput} = 85266,67 \text{ Kbit}$$

9. Email

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 140,69 \text{ Kbps} \times 50 \text{ s} \times 1 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 7034,5 \times (1/0,99) \text{Kbit}$$

$$\text{Throughput} = 7105,56 \text{ Kbit}$$

10. P2P File Sharing

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 26,9 \text{ Kbps} \times 108 \text{ s} \times 0,6 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 300132 \times (1/0,99) \text{Kbit}$$

$$\text{Throughput} = 303163,64 \text{ Kbit}$$

b. Downlink Throughput

1. VoIP

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 26,9 \text{ Kbps} \times 108 \text{ s} \times 0,6 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 1743,12 \times (1/0,99) \text{Kbit}$$

$$\text{Throughput} = 1760,73 \text{ Kbit}$$

2. *Video Phone*

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 62,53 \text{ Kbps} \times 36 \text{ s} \times 1 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 2251,08 \times (1/0,99) \text{ Kbit}$$

$$\text{Throughput} = 2273,82 \text{ Kbit}$$

3. *Video Conference*

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 62,53 \text{ Kbps} \times 1800 \text{ s} \times 1 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 112554 \times (1/0,99) \text{ Kbit}$$

$$\text{Throughput} = 113690,91 \text{ Kbit}$$

4. *Real Time Gaming*

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 125,06 \text{ Kbps} \times 1800 \text{ s} \times 0,4 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 90043,2 \times (1/0,99) \text{ Kbit}$$

$$\text{Throughput} = 90952,73 \text{ Kbit}$$

5. *Streaming Media*

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 250 \text{ Kbps} \times 3600 \text{ s} \times 0,05 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 45000 \times (1/0,99) \text{Kbit}$$

$$\text{Throughput} = 45454,55 \text{ Kbit}$$

6. *IMS Signalling*

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 15,63 \text{ Kbps} \times 7 \text{ s} \times 0,2 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 21,882 \times (1/0,99) \text{Kbit}$$

$$\text{Throughput} = 22,10 \text{ Kbit}$$

7. *Web Browsing*

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 250,11 \text{ Kbps} \times 1800 \text{ s} \times 0,05 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 22509,9 \times (1/0,99) \text{Kbit}$$

$$\text{Throughput} = 22737,27 \text{ Kbit}$$

8. *File Transfer*

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 750,34 \text{ Kbps} \times 600 \text{ s} \times 1 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 450204 \times (1/0,99) \text{Kbit}$$

$$\text{Throughput} = 454751,52 \text{ Kbit}$$

9. Email

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 750,34 \text{ Kbps} \times 15 \text{ s} \times 1 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 11255,1 \times (1/0,99) \text{ Kbit}$$

$$\text{Throughput} = 11368,79 \text{ Kbit}$$

10. P2P File Sharing

$$\text{Throughput} = \text{Bearer Rate} \times \text{Session Time} \times \text{Session Duty Ratio} \times [1/(1 - \text{BLER})]$$

$$\text{Throughput} = 750,34 \text{ Kbps} \times 1200 \text{ s} \times 1 \times [1/(1 - 1\%)]$$

$$\text{Throughput} = 900408 \times (1/0,99) \text{ Kbit}$$

$$\text{Throughput} = 909503,03 \text{ Kbit}$$

Lampiran 8. Single User Throughput

Tabel Parameter Single User Throughput

Traffic Parameters	Uplink Throughput (Kbit)	Downlink Throughput (Kbit)	Uplink dan Downlink		
			BHCA	Penetration Ratio (PR) %	Peak to Average Ratio (%)
VoIP	1760,73	1760,73	1,4	100	20
Video Phone	2273,82	2273,82	0,2	20	20
Video Conference	113690,91	113690,91	0,2	20	20
Real Time Gaming	11367,27	90952,73	0,2	30	20
Streaming Media	5683,64	45454,55	0,2	15	20
IMS Signalling	22,10	22,10	5	40	20
Web Browsing	5684,55	22737,27	0,4	100	20

<i>File Transfer</i>	85266,67	454751,52	0,2	20	20
<i>Email</i>	7105,56	11368,79	0,2	10	20
<i>P2P File Sharing</i>	303163,64	909503,03	0,4	20	20

a. Uplink Single User Throughput

1. VoIP

$$Throughput_{SU} = \frac{\left[\left(\frac{Throughput}{Session} \right) \times BHCA \times PR \times (1 + Peak\ to\ Average\ Ratio) \right]}{3600\ s}$$

$$Throughput_{SU} = \frac{[1760,73\ Kbit \times 1,4 \times 1 \times (1 + 0,2)]}{3600\ s}$$

$$Throughput_{SU} = \frac{2958,0264}{3600\ s}$$

$$Throughput_{SU} = 0,821674\ Kbps$$

2. Video Phone

$$Throughput_{SU} = \frac{\left[\left(\frac{Throughput}{Session} \right) \times BHCA \times PR \times (1 + Peak\ to\ Average\ Ratio) \right]}{3600\ s}$$

$$Throughput_{SU} = \frac{[2273,82\ Kbit \times 0,2 \times 0,2 \times (1 + 0,2)]}{3600\ s}$$

$$Throughput_{SU} = \frac{109,14336}{3600\ s}$$

$$Throughput_{SU} = 0,0303176\ Kbps$$

3. Video Conference

$$Throughput_{SU} = \frac{\left[\left(\frac{Throughput}{Session} \right) \times BHCA \times PR \times (1 + Peak\ to\ Average\ Ratio) \right]}{3600\ s}$$

$$Throughput_{SU} = \frac{[113690,91\ Kbit \times 0,2 \times 0,2 \times (1 + 0,2)]}{3600\ s}$$

$$Throughput_{SU} = \frac{5457,16368}{3600\ s}$$

$$\text{Throughput}_{SU} = 1,5158788 \text{ Kbps}$$

4. Real Time Gaming

$$\text{Throughput}_{SU} = \frac{\left[\left(\frac{\text{Throughput}}{\text{Session}} \right) \times \text{BHCA} \times \text{PR} \times (1 + \text{Peak to Average Ratio}) \right]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{[11367,27 \text{ Kbit} \times 0,2 \times 0,3 \times (1+0,2)]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{818,44344}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = 0,2273454 \text{ Kbps}$$

5. Streaming Media

$$\text{Throughput}_{SU} = \frac{\left[\left(\frac{\text{Throughput}}{\text{Session}} \right) \times \text{BHCA} \times \text{PR} \times (1 + \text{Peak to Average Ratio}) \right]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{[5683,64 \text{ Kbit} \times 0,2 \times 0,15 \times (1+0,2)]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{204,61104}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = 0,0568364 \text{ Kbps}$$

6. IMS Signalling

$$\text{Throughput}_{SU} = \frac{\left[\left(\frac{\text{Throughput}}{\text{Session}} \right) \times \text{BHCA} \times \text{PR} \times (1 + \text{Peak to Average Ratio}) \right]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{[22,10 \text{ Kbit} \times 5 \times 0,4 \times (1+0,2)]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{53,04}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = 0,01473333 \text{ Kbps}$$

7. *Web Browsing*

$$\text{Throughput}_{SU} = \frac{\left[\left(\frac{\text{Throughput}}{\text{Session}} \right) \times \text{BHCA} \times \text{PR} \times (1 + \text{Peak to Average Ratio}) \right]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{[5684,55 \text{ Kbit} \times 0,4 \times 1 \times (1+0,2)]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{2728,584}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = 0,75794 \text{ Kbps}$$

8. *File Transfer*

$$\text{Throughput}_{SU} = \frac{\left[\left(\frac{\text{Throughput}}{\text{Session}} \right) \times \text{BHCA} \times \text{PR} \times (1 + \text{Peak to Average Ratio}) \right]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{[85266,67 \text{ Kbit} \times 0,2 \times 0,2 \times (1+0,2)]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{4092,80016}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = 1,13688893 \text{ Kbps}$$

9. *Email*

$$\text{Throughput}_{SU} = \frac{\left[\left(\frac{\text{Throughput}}{\text{Session}} \right) \times \text{BHCA} \times \text{PR} \times (1 + \text{Peak to Average Ratio}) \right]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{[7015,56 \text{ Kbit} \times 0,2 \times 0,1 \times (1+0,2)]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{170,53344}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = 0,0473704 \text{ Kbps}$$

10. *P2P File Sharing*

$$\text{Throughput}_{SU} = \frac{\left[\left(\frac{\text{Throughput}}{\text{Session}} \right) \times \text{BHCA} \times \text{PR} \times (1 + \text{Peak to Average Ratio}) \right]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{[303163,64 \text{ Kbit} \times 0,4 \times 0,2 \times (1+0,2)]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{29103,7094}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = 8,08436373 \text{ Kbps}$$

b. *Downlink Single User Throughput*

1. *VoIP*

$$\text{Throughput}_{SU} = \frac{\left[\left(\frac{\text{Throughput}}{\text{Session}} \right) \times \text{BHCA} \times \text{PR} \times (1 + \text{Peak to Average Ratio}) \right]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{[1760,73 \text{ Kbit} \times 1,4 \times 1 \times (1+0,2)]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{2958,0264}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = 0,821674 \text{ Kbps}$$

2. *Video Phone*

$$\text{Throughput}_{SU} = \frac{\left[\left(\frac{\text{Throughput}}{\text{Session}} \right) \times \text{BHCA} \times \text{PR} \times (1 + \text{Peak to Average Ratio}) \right]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{[2273,82 \text{ Kbit} \times 0,2 \times 0,2 \times (1+0,2)]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{109,14336}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = 0,0303176 \text{ Kbps}$$

3. *Video Conference*

$$\text{Throughput}_{SU} = \frac{\left[\left(\frac{\text{Throughput}}{\text{Session}} \right) \times \text{BHCA} \times \text{PR} \times (1 + \text{Peak to Average Ratio}) \right]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{[113690,91 \text{ Kbit} \times 0,2 \times 0,2 \times (1+0,2)]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{5457,16368}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = 1,5158788 \text{ Kbps}$$

4. Real Time Gaming

$$\text{Throughput}_{SU} = \frac{\left[\left(\frac{\text{Throughput}}{\text{Session}} \right) \times \text{BHCA} \times \text{PR} \times (1 + \text{Peak to Average Ratio}) \right]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{[90952,73 \text{ Kbit} \times 0,2 \times 0,3 \times (1+0,2)]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{6548,59656}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = 1,8190546 \text{ Kbps}$$

5. Streaming Media

$$\text{Throughput}_{SU} = \frac{\left[\left(\frac{\text{Throughput}}{\text{Session}} \right) \times \text{BHCA} \times \text{PR} \times (1 + \text{Peak to Average Ratio}) \right]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{[45454,55 \text{ Kbit} \times 0,2 \times 0,15 \times (1+0,2)]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{1639,6398}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = 0,4554555 \text{ Kbps}$$

6. IMS Signalling

$$\text{Throughput}_{SU} = \frac{\left[\left(\frac{\text{Throughput}}{\text{Session}} \right) \times \text{BHCA} \times \text{PR} \times (1 + \text{Peak to Average Ratio}) \right]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{[22,10 \text{ Kbit} \times 5 \times 0,4 \times (1+0,2)]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{53,04}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = 0,01473333 \text{ Kbps}$$

7. *Web Browsing*

$$\text{Throughput}_{SU} = \frac{\left[\left(\frac{\text{Throughput}}{\text{Session}} \right) \times \text{BHCA} \times \text{PR} \times (1 + \text{Peak to Average Ratio}) \right]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{[22737,27 \text{ Kbit} \times 0,4 \times 1 \times (1+0,2)]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{10913,8896}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = 3,031636 \text{ Kbps}$$

8. *File Transfer*

$$\text{Throughput}_{SU} = \frac{\left[\left(\frac{\text{Throughput}}{\text{Session}} \right) \times \text{BHCA} \times \text{PR} \times (1 + \text{Peak to Average Ratio}) \right]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{[454751,52 \text{ Kbit} \times 0,2 \times 0,2 \times (1+0,2)]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{21828,073}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = 6,0633536 \text{ Kbps}$$

9. *Email*

$$\text{Throughput}_{SU} = \frac{\left[\left(\frac{\text{Throughput}}{\text{Session}} \right) \times \text{BHCA} \times \text{PR} \times (1 + \text{Peak to Average Ratio}) \right]}{3600 \text{ s}}$$

$$\text{Throughput}_{SU} = \frac{[11368,79 \text{ Kbit} \times 0,2 \times 0,1 \times (1+0,2)]}{3600 \text{ s}}$$

$$Throughput_{SU} = \frac{272,85096}{3600 \text{ s}}$$

$$Throughput_{SU} = 0,07579193 \text{ Kbps}$$

10. P2P File Sharing

$$Throughput_{SU} = \frac{\left[\left(\frac{Throughput}{Session} \right) \times BHCA \times PR \times (1 + Peak \text{ to Average Ratio}) \right]}{3600 \text{ s}}$$

$$Throughput_{SU} = \frac{[909503,03 \text{ Kbit} \times 0,4 \times 0,2 \times (1+0,2)]}{3600 \text{ s}}$$

$$Throughput_{SU} = \frac{87312,2909}{3600 \text{ s}}$$

$$Throughput_{SU} = 24,2534141 \text{ Kbps}$$

c. Total Uplink Single Throughput

$$\Sigma Throughput_{SU} =$$

$$0,821674 \text{ Kbps} + 0,0303176 \text{ Kbps} + \\ 1,5158788 \text{ Kbps} + 0,2273454 \text{ Kbps} + \\ 0,0568364 \text{ Kbps} + 0,01473333 \text{ Kbps} + \\ 0,75794 \text{ Kbps} + 1,13688893 \text{ Kbps} + \\ 0,0473704 \text{ Kbps} + 8,08436373 \text{ Kbps}$$

$$\Sigma Throughput_{SU} = 12,6933486 \text{ Kbps}$$

d. Total Downlink Single Throughput

$$\Sigma \text{Throughput}_{SU} =$$

$$0,821674 \text{ Kbps} + 0,0303176 \text{ Kbps} + \\ 1,5158788 \text{ Kbps} + 1,8190546 \text{ Kbps} + \\ 0,4554555 \text{ Kbps} + 0,01473333 \text{ Kbps} + \\ 3,031636 \text{ Kbps} + 6,0633536 \text{ Kbps} + \\ 0,07579193 \text{ Kbps} + 24,2534141 \text{ Kbps}$$

$$\Sigma \text{Throughput}_{SU} = 38,0813095 \text{ Kbps}$$

Lampiran 9. Network Throughput Kampus Tamalanrea UNHAS

Total Pelanggan	Uplink Single User Throughput	Downlink Single User Throughput
8546	12,6933486 Kbps	38,0813095 Kbps

1. Uplink Network Throughput

$$\text{UL Network Throughput} = \text{Total Pelanggan} \times \text{Uplink Throughput}_{SU}$$

$$\text{UL Network Throughput} = 8546 \times 12,6933486 \text{ Kbps}$$

$$\text{UL Network Throughput} = 108477,357 \text{ Kbps}$$

$$\text{UL Network Throughput} = 108,477357 \text{ Mbps}$$

2. Downlink Network Throughput

$$\text{DL Network Throughput} = \text{Total Pelanggan} \times \text{Uplink Throughput}_{SU}$$

$$\text{DL Network Throughput} = 8546 \times 38,0813095 \text{ Kbps}$$

$$\text{DL Network Throughput} = 325442,871 \text{ Kbps}$$

$$\text{DL Network Throughput} = 325,442871 \text{ Mbps}$$

Lampiran 10. Network Throughput Kampus Gowa UNHAS

Total Pelanggan	<i>Uplink Single User Throughput</i>	<i>Downlink Single User Throughput</i>
1449	12,6933486 Kbps	38,0813095 Kbps

1. Uplink Network Throughput

$$\text{UL Network Throughput} = \text{Total Pelanggan} \times \text{Uplink Throughput}_{SU}$$

$$\text{UL Network Throughput} = 1449 \times 12,6933486 \text{ Kbps}$$

$$\text{UL Network Throughput} = 18392,6621 \text{ Kbps}$$

$$\text{UL Network Throughput} = 18,3926621 \text{ Mbps}$$

2. Downlink Network Throughput

$$\text{DL Network Throughput} = \text{Total Pelanggan} \times \text{Downlink Throughput}_{SU}$$

$$\text{DL Network Throughput} = 1449 \times 38,0813095 \text{ Kbps}$$

$$\text{DL Network Throughput} = 55179,8175 \text{ Kbps}$$

$$\text{DL Network Throughput} = 55,1798175 \text{ Mbps}$$

Lampiran 11. Cell Throughput

a. Uplink Cell Throughput

<i>Code Bit</i>	<i>Code Rate</i>	<i>Number of Resource Block (Nrb)</i>	<i>Antena Mode</i>	<i>1 Resource Element (CRC)</i>
4 bit	0,5 per sekon	25	2	24

$$\text{UL Cell Throughput} = ((168 - 24) \times \text{Code Bit} \times \text{Code Rate} \times \text{Nrb} \times C \times 1000) - 24$$

$$\text{UL Cell Throughput} = (144 \times 4 \times 0,5 \times 25 \times 2 \times 1000) - 24$$

$$\text{UL Cell Throughput} = 14400000 - 24$$

$$UL \text{ Cell Throughput} = 14399976 \text{ bps}$$

$$UL \text{ Cell Throughput} = 14,399976 \text{ Mbps}$$

b. Downlink Cell Throughput

Tabel 12. Parameter *Downlink Cell Throughput*

<i>Code Bit</i>	<i>Code Rate</i>	<i>Number of Resource Block (Nrb)</i>	<i>Antena Mode</i>	<i>1 Resource Element (CRC)</i>
6 bit	0,67 per sekon	25	2	24

$$UL \text{ Cell Throughput} = ((168 - 36 - 12) \times \text{Code Bit} \times \text{Code Rate} \times \text{Nrb} \times C \times 1000) - 24$$

$$UL \text{ Cell Throughput} = (120 \times 6 \times 0,67 \times 25 \times 2 \times 1000) - 24$$

$$UL \text{ Cell Throughput} = 24120000 - 24$$

$$UL \text{ Cell Throughput} = 24119976 \text{ bps}$$

$$UL \text{ Cell Throughput} = 24,119976 \text{ Mbps}$$

Lampiran 12. Jumlah Sel Kampus Tamalanrea UNHAS

Parameter	<i>Uplink (Mbps)</i>	<i>Downlink (Mbps)</i>
<i>Network Throughput</i>	108,477357	325,442871
<i>Cell Throughput</i>	14,399976	24,119976

1. Jumlah Sel *Uplink*

$$\text{Jumlah Sel} = \frac{\text{Network Throughput}}{\text{Cell Throughput}}$$

$$\text{Jumlah Sel} = \frac{108,477357 \text{ Mbps}}{14,399976 \text{ Mbps}}$$

Jumlah Sel = 7,5331

Jumlah Sel = 8

2. Jumlah Sel *Downlink*

$$\text{Jumlah Sel} = \frac{\text{Network Throughput}}{\text{Cell Throughput}}$$

$$\text{Jumlah Sel} = \frac{325,442871 \text{ Mbps}}{24,119976 \text{ Mbps}}$$

Jumlah Sel = 13,4926698

Jumlah Sel = 14

3. Jumlah Site

$$\text{Jumlah Site} = |\text{Jumlah Sel Downlink} - \text{Jumlah Sel Uplink}|$$

$$\text{Jumlah Site} = |14 - 8|$$

$$\text{Jumlah Site} = |6|$$

$$\text{Jumlah Site} = 6$$

Lampiran 13. Jumlah Sel Kampus Gowa UNHAS

Parameter	<i>Uplink</i> (Mbps)	<i>Downlink</i> (Mbps)
<i>Network Throughput</i>	18,3926621	55,1798175
<i>Cell Throughput</i>	14,399976	24,119976

1. Jumlah Sel *Uplink*

$$\text{Jumlah Sel} = \frac{\text{Network Throughput}}{\text{Cell Throughput}}$$

$$\text{Jumlah Sel} = \frac{18,3926621 \text{ Mbps}}{14,399976 \text{ Mbps}}$$

$$\text{Jumlah Sel} = 1,27727033$$

$$\text{Jumlah Sel} = 1$$

2. Jumlah Sel *Downlink*

$$\text{Jumlah Sel} = \frac{\text{Network Throughput}}{\text{Cell Throughput}}$$

$$\text{Jumlah Sel} = \frac{55,1798175 \text{ Mbps}}{24,119976 \text{ Mbps}}$$

$$\text{Jumlah Sel} = 2,2877274$$

$$\text{Jumlah Sel} = 2$$

3. Jumlah *Site*

$$\text{Jumlah Site} = |\text{Jumlah Sel Downlink} - \text{Jumlah Sel Uplink}|$$

$$\text{Jumlah Site} = |2 - 1|$$

$$\text{Jumlah Site} = |1|$$

$$\text{Jumlah Site} = 1$$

Lampiran 14. Jumlah *User Per Site* Kampus Tamalanrea UNHAS

$$\text{Jumlah User Per Site} = \frac{\text{Total Target user}}{\text{Jumlah site}}$$

$$\text{Jumlah User Per Site} = \frac{8546 \text{ user}}{6 \text{ site}}$$

$$\text{Jumlah User Per Site} = 1424 \text{ user/site}$$

Lampiran 14. Jumlah *User Per Site* Kampus Gowa UNHAS

$$\text{Jumlah User Per Site} = \frac{\text{Total Target user}}{\text{Jumlah site}}$$

$$\text{Jumlah User Per Site} = \frac{1449 \text{ user}}{1 \text{ site}}$$

$$\text{Jumlah User Per Site} = 1449 \text{ user/site}$$

Lampiran 15. Luas Cakupan Sel dan Radius Sel Kampus Tamalanrea UNHAS

Luas Wilayah	Jumlah <i>Site</i>
2,2 km ²	6

1. Luas Sel

$$\text{Luas Cakupan Sel} = \frac{\text{Luas Wilayah}}{\text{Jumlah Site}}$$

$$\text{Luas Cakupan Sel} = \frac{2,2 \text{ km}^2}{6 \text{ site}}$$

$$\text{Luas Cakupan Sel} = 0,37 \text{ km}^2/\text{site}$$

2. Radius Sel

$$\text{Radius Sel} = \sqrt{\frac{\text{Luas Cakupan Sel}}{1,95 \times 2,6}}$$

$$\text{Radius Sel} = \sqrt{\frac{0,37 \text{ km}^2}{1,95 \times 2,6}}$$

$$\text{Radius Sel} = \sqrt{0,0729 \text{ km}^2}$$

$$\text{Radius Sel} = 0,27 \text{ km}$$

Lampiran 16. Luas Cakupan Sel dan Radius Sel Kampus Gowa UNHAS

Luas Wilayah	Jumlah <i>Site</i>
0,4 km ²	1

1. Luas Sel

$$\text{Luas Cakupan Sel} = \frac{\text{Luas Wilayah}}{\text{Jumlah Site}}$$

$$\text{Luas Cakupan Sel} = \frac{0,4 \text{ km}^2}{1 \text{ site}}$$

$$\text{Luas Cakupan Sel} = 0,4 \text{ km}^2/\text{site}$$

2. Radius Sel

$$\text{Radius Sel} = \sqrt{\frac{\text{Luas Cakupan Sel}}{1.95 \times 2.6}}$$

$$\text{Radius Sel} = \sqrt{\frac{0,4 \text{ km}^2}{1.95 \times 2.6}}$$

$$\text{Radius Sel} = \sqrt{0,0789 \text{ km}^2}$$

$$\text{Radius Sel} = 0,281 \text{ km}$$

Lampiran 17. MAPL *Uplink* LTE

1. EIRP

<i>Max.Tx Power</i> (P_{Max-Tx})	<i>Tx.Antenna Gain</i> ($G_{Antenna-Tx}$)	<i>Line Loss</i> (L_{Cable})
23 dBm	0 dBi	0 dBi

$$EIRP_{UL} = P_{Max-Tx} + G_{Antenna-Tx} - L_{Cable}$$

$$\text{EIRP}_{\text{UL}} = 23 + 0 - 0$$

$$\text{EIRP}_{\text{UL}} = 23 \text{ dBm}$$

2. Receiver Noise Floor

Noise Figure (NF)	Thermal Noise (Pn)
4 dB	-132,2

$$Nf_{\text{Rx}} = \text{NF} + \text{Pn}$$

$$Nf_{\text{Rx}} = 4 + (-132,2)$$

$$Nf_{\text{Rx}} = -128,2 \text{ dBm}$$

3. Receiver Sensitivity

Receiver Noise Floor (NF)	SINR
-128,2 dB	11

$$S_{\text{Rx}} = Nf_{\text{Rx}} + \text{SINR}$$

$$S_{\text{Rx}} = -128,2 + 11$$

$$S_{\text{Rx}} = -117,2 \text{ dBm}$$

4. MAPL

Parameter	Nilai
EIRP	23 dBm
Receiver Sensitivity (S_{Rx})	-117,2 dBm
Interference Margin (IM)	4 dB
Rx. Antenna Gain ($G_{\text{Antenna-Rx}}$)	18 dBi
Rx. Line Loss (L_{Body})	2 dB

$$\text{MAPL}_{\text{UL-LTE}} = \text{EIRP}_{\text{UL}} - S_{\text{Rx}} - \text{IM} - G_{\text{Antenna-Rx}} + L_{\text{Body}}$$

$$\text{MAPL}_{\text{UL-LTE}} = 23 - (-117,2) - 4 - 18 + 2$$

$$\text{MAPL}_{\text{UL-LTE}} = 120,2 \text{ dB}$$

Lampiran 18. MAPL *Downlink* LTE

a. Frekuensi 1800 MHz

1. EIRP

<i>Max.Tx Power</i> ($P_{\text{Max-Tx}}$)	<i>Tx.Antenna Gain</i> ($G_{\text{Antenna-Tx}}$)	<i>Line Loss</i> (L_{Cable})
44,04 dBm	18 dBi	1,8 dBi

$$\text{EIRP}_{\text{UL}} = P_{\text{Max-Tx}} + G_{\text{Antenna-Tx}} - L_{\text{Cable}}$$

$$\text{EIRP}_{\text{UL}} = 44,04 + 18 - 1,8$$

$$\text{EIRP}_{\text{UL}} = 60,24 \text{ dBm}$$

2. *Receiver Noise Floor*

<i>Noise Figure</i> (NF)	<i>Thermal Noise</i> (Pn)
8 dB	-132,2

$$Nf_{\text{Rx}} = \text{NF} + Pn$$

$$Nf_{\text{Rx}} = 8 + (-132,2)$$

$$Nf_{\text{Rx}} = -124,2 \text{ dBm}$$

3. *Receiver Sensitivity*

<i>Receiver Noise Floor</i> (NF)	SINR
-124,2 dB	20

$$S_{Rx} = Nf_{Rx} + SINR$$

$$S_{Rx} = -124,2 + 20$$

$$S_{Rx} = -104,2 \text{ dBm}$$

4. MAPL

Parameter	Nilai
EIRP	60,24dBm
<i>Receiver Sensitivity</i> (S_{Rx})	-104,2 dBm
Interference Margin (IM)	4 dB
Rx. <i>Antenna Gain</i> ($G_{Antenna-Rx}$)	0 dBi
Rx. <i>Line Loss</i> (L_{Body})	0 dB

$$MAPL_{DL-LTE} = EIRP_{DL} - S_{Rx} - IM - G_{Antenna-Rx} + L_{Body}$$

$$MAPL_{DL-LTE} = 60,24 - (-104,2) - 4 - 0 + 0$$

$$MAPL_{DL-LTE} = 160,44 \text{ dB}$$

Lampiran 19. Propagasi Cost-231 Frekuensi 1800 MHz Kampus Tamalanrea

UNHAS

1. Propagasi Arah *Uplink*

Total Path Loss (L_P)	Tinggi Transmitter (h_{te})	Tinggi Receiver (h_{re})
120,2 dB	20 m	1,5 m

$$\log(f) = \log(1800) = 3,2553$$

$$\log(h_{te}) = \log(20) = 1,3010$$

$$A(h_{re}) = 3,2 (\log(11,75h_{re}))^2 - 4,97 \text{ dB}$$

$$A(h_{re}) = 3,2 (\log(11,75 \times 1,5))^2 - 4,97 \text{ dB}$$

$$A(h_{re}) = 3,2 (\log(17,625))^2 - 4,97 \text{ dB}$$

$$A(h_{re}) = 4,96896 - 4,97$$

$$A(h_{re}) = -0,00104$$

$$L_p = 46,3 + 33,9 \log (f) - 13,82 \log (h_{te}) - A(h_{re}) + [(44,9 - 6,55 \log (h_{te})) \log (d)] + C_M$$

$$120,2 = 46,3 + (33,9 \times 3,2553) - (13,82 \times 1,3010) - (-0,00104) + [(44,9 - (6,55 \times 1,3010)) \log (d)] + 3$$

$$120,2 = 46,3 + 110,3547 - 17,9798 + (0,00104) + [(44,9 - 8,52155) \log (d)] + 3$$

$$120,2 = 141,6728 + 36,3785 \log (d)$$

$$120,2 - 141,6728 = 36,3785 \log (d)$$

$$-21,4728 = 36,3785 \log (d)$$

$$\log (d) = \frac{-21,4728}{36,3785}$$

$$\log (d) = -0,5903$$

$$d = 10^{-0,5903}$$

$$d = 0,257 \text{ km}$$

$$d = 257 \text{ m}$$

2. Propagasi Arah *Downlink*

Total Path Loss (L_P)	Tinggi Transmitter (h_{te})	Tinggi Receiver (h_{re})
160,44 dB	20 m	1,5 m

$$\log (f) = \log (1800) = 3,2553$$

$$\log \left(h_{te}\right) = \log (20) = 1,3010$$

$$A\left(h_{re}\right) = 3,2\left(\log \left(11,75 h_{re}\right)\right)^2 - 4,97 \text{ dB}$$

$$A\left(h_{re}\right) = 3,2\left(\log \left(11,75 \times 1,5\right)\right)^2 - 4,97 \text{ dB}$$

$$A\left(h_{re}\right) = 3,2\left(\log (17,625)\right)^2 - 4,97 \text{ dB}$$

$$A\left(h_{re}\right) = 4,96896 - 4,97$$

$$A\left(h_{re}\right) = -0,00104$$

$$L_p = 46,3 + 33,9 \log (f) - 13,82 \log \left(h_{te}\right) - A\left(h_{re}\right) + [(44,9 - 6,55 \log \left(h_{te}\right)) \log (d)] + C_M$$

$$160,44 = 46,3 + (33,9 \times 3,2553) - (13,82 \times 1,3010) - (-0,00104) + [(44,9 - (6,55 \times 1,3010)) \log (d)] + 3$$

$$160,44 = 46,3 + 110,3547 - 17,9798 + (0,00104) + [(44,9 - 8,52155) \log (d)] + 3$$

$$160,44 = 141,6759 + 36,3785 \log (d)$$

$$160,44 - 141,6759 = 36,3785 \log (d)$$

$$18,7641 = 36,3785 \log (d)$$

$$\log (d) = \frac{18,7641}{36,3785}$$

$$\log (d) = 0,5158$$

$$d = 10^{0,5158}$$

$$d = 3,279 \text{ km}$$

$$d = 3279 \text{ m}$$

Lampiran 20. Propagasi Cost-231 Frekuensi 1800 MHz Kampus Gowa UNHAS

1. Propagasi Arah Uplink

Total Path Loss (L_p)	Tinggi Transmitter (h_{te})	Tinggi Receiver (h_{re})
120,2 dB	20 m	1,5 m

$$\log (f) = \log (1800) = 3,2553$$

$$\log (h_{te}) = \log (20) = 1,3010$$

$$A(h_{re}) = 3,2 (\log (11,75 h_{re}))^2 - 4,97 \text{ dB}$$

$$A(h_{re}) = 3,2 (\log(11,75 \times 1,5))^2 - 4,97 \text{ dB}$$

$$A(h_{re}) = 3,2 (\log(17,625))^2 - 4,97 \text{ dB}$$

$$A(h_{re}) = 4,96896 - 4,97$$

$$A(h_{re}) = -0,00104$$

$$L_p = 46,3 + 33,9 \log (f) - 13,82 \log (h_{te}) - A(h_{re}) + [(44,9 - 6,55 \log (h_{te})) \log (d)] + C_M$$

$$120,2 = 46,3 + (33,9 \times 3,2553) - (13,82 \times 1,3010) - (-0,00104) + [(44,9 - (6,55 \times 1,3010)) \log (d)] + 0$$

$$120,2 = 46,3 + 110,35467 - 17,97982 + (0,00104) + [(44,9 - 8,52155) \log (d)]$$

$$120,2 = 138,67589 + 36,3785 \log (d)$$

$$120,2 - 138,6759 = 36,3785 \log (d)$$

$$-18,4759 = 36,3785 \log (d)$$

$$\log (d) = \frac{-18,4759}{36,3785}$$

$$\log (d) = -0,5079$$

$$d = 10^{-0,5079}$$

$$d = 0,3105 \text{ km}$$

$$d = 310,5 \text{ m}$$

2. Propagasi Arah *Downlink*

Total Path Loss (L_p)	Tinggi Transmitter (h_{te})	Tinggi Receiver (h_{re})
160,44 dB	20 m	1,5 m

$$\log (f) = \log (1800) = 3,2553$$

$$\log (h_{te}) = \log (20) = 1,3010$$

$$A(h_{re}) = 3,2 (\log (11,75 h_{re}))^2 - 4,97 \text{ dB}$$

$$A(h_{re}) = 3,2 (\log(11,75 \times 1,5))^2 - 4,97 \text{ dB}$$

$$A(h_{re}) = 3,2 (\log(17,625))^2 - 4,97 \text{ dB}$$

$$A(h_{re}) = 4,96896 - 4,97$$

$$A(h_{re}) = -0,00104$$

$$L_p = 46,3 + 33,9 \log (f) - 13,82 \log (h_{te}) - A(h_{re}) + [(44,9 - 6,55 \log (h_{te})) \log (d)] + C_M$$

$$160,44 = 46,3 + (33,9 \times 3,2553) - (13,82 \times 1,3010) - (-0,00104) + [(44,9 - (6,55 \times 1,3010)) \log (d)] + 0$$

$$160,44 = 46,3 + 110,35467 - 17,97982 + (0,00104) + [(44,9 - 8,52155) \log (d)]$$

$$160,44 = 138,67589 + 36,3785 \log (d)$$

$$160,44 - 138,6759 = 36,3785 \log (d)$$

$$21,7641 = 36,3785 \log (d)$$

$$\log (d) = \frac{21,7641}{36,3785}$$

$$\log (d) = -0,5983$$

$$d = 10^{-0,5983}$$

$$d = 3,965 \text{ km}$$

$$d = 3965 \text{ m}$$

Lampiran 21. Jumlah Pole Kampus Tamalanrea UNHAS

1. Luas Sel

$$\text{Luas Sel} = 0,257$$

$$\text{Luas Sel} = 2,6 \times 1,95 \times d^2$$

$$\text{Luas Sel} = 2,6 \times 1,95 \times (0,257)^2$$

$$\text{Luas Sel} = 2,6 \times 1,95 \times 0,0660$$

$$\text{Luas Sel} = 0,33462$$

$$\text{Luas Sel} = 0,335 \text{ km}^2$$

2. Jumlah Pole

Luas Area	Luas Sel
2,2 km ²	0,335 km ²

$$\text{Jumlah Sel} = \frac{\text{Luas Area Perencanaan}}{\text{Luas Cakupan Sel Coverage}}$$

$$\text{Jumlah Sel} = \frac{2,2 \text{ km}^2}{0,335 \text{ km}^2}$$

$$\text{Jumlah Sel} = 6,567$$

$$\text{Jumlah Sel} = 7$$

Lampiran 22. Jumlah Pole Kampus Gowa UNHAS

1. Luas Sel

$$\text{Luas Sel} = 0,310$$

$$\text{Luas Sel} = 2,6 \times 1,95 \times d^2$$

$$\text{Luas Sel} = 2,6 \times 1,95 \times (0,310)^2$$

$$\text{Luas Sel} = 2,6 \times 1,95 \times 0,096$$

$$\text{Luas Sel} = 0,48762$$

$$\text{Luas Sel} = 0,487 \text{ km}^2$$

2. Jumlah Pole

Luas Area	Luas Sel
0,4 km ²	0,487 km ²

$$\text{Jumlah Sel} = \frac{\text{Luas Area Perencanaan}}{\text{Luas Cakupan Sel Coverage}}$$

$$\text{Jumlah Sel} = \frac{0,4 \text{ km}^2}{0,487 \text{ km}^2}$$

$$\text{Jumlah Sel} = 0,82$$

$$\text{Jumlah Sel} = 1$$

Lampiran 23. Kualitas Sinyal Hasil Perencanaan

a. EIRP

<i>Max. Tx Power</i> (P_{Max-Tx})	<i>Tx. Antenna Gain</i> ($G_{Antenna-Tx}$)	<i>Line Loss</i> (L_{Cable})
44,04 dBm	18 dBi	1,8 dBi

$$EIRP = P_{Max-Tx} + G_{Antenna-Tx} - L_{Cable}$$

$$EIRP = 44,04 + 18 - 1,8$$

$$EIRP = 60,24 \text{ dBm}$$

b. RSRP 4G

EIRP	Max. Path Loss	Shadowing Margin
60,24 dBm	160,44 dB	5,36 dB

$$RSRP = EIRP - \textit{path loss} - \textit{shadowing margin}$$

$$RSRP = 60,24 \text{ dBm} - 160,44 \text{ dB} - 5,36 \text{ dB}$$

$$RSRP = -105,56 \text{ dBm}$$