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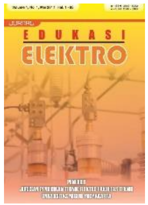

New site Power Transmitter Analysis of 4G LTE FDD 1800 MHz Using Cell Splitting Method

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Abstract—The advancement of cellular telecommunications is growing day by day. Some theories, including 4G LTE FDD 1800 MHz, are becoming irrelevant to the current technology. The theory of power reduction by the cell splitting method is unsuitable for the actual conditions in the field. Theoretically, the cell splitting method is carried out on a new site with half of the main site's coverage, in which the transmitter power at the split site is reduced by 12 dB from the main site. This results in the power generated from the calculation being small so that service coverage is limited. This study aimed to test the theory of transmitter power reduction in the cell splitting method (scenario 1) and compare it with other power reduction scenarios (Scenario 1: reduced by 15 dB, and Scenario 2: reduced by half from the main site power). The analysis is done by conducting simulations using Atoll RF Planning software. The study results revealed that in Scenario 3, the value of Key Performance Indicators is better than in other scenarios. The average throughput is 11045 kbps, the RSRP value is -108.58dBm, the range is 1.045 Km, and the average SINR is reduced to 8.52 dB. In addition, the data revealed that the coverage and signal quality of the site cell splitting is better when the transmitter power is 43 dBm (scenario 3). In conclusion, a site with higher transmitter power tends to have better signal strength, quality, and speed, as well as a wider coverage area. Reducing the transmitter cell splitting power will be more effective by reducing the new power site to half of the main site.

Keywords: atoll, **c**ell splitting**,** LTE, power, transmitter

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1 Introduction

Internet use has become a basic need in all social, economic, and educational sectors. The internet emerged due to advances in telecommunications technology; one of the extensively used technologies that support the availability of mobile internet services is Long Term Evolution (LTE) FDD 1800 MHz technology or commonly known as 4G [1]. Third Generations Partnership Project (3GPP), which has a maximum throughput of 300 Mbps to 1 Gbps, uses Internet Protocol (IP) based technology that makes 4G network capable of fast data transmission [2],[3]. Several strategies are used to support 4G technology in optimizing data transmission speed during initial network planning, one of which is the cell splitting method [4].

Cell splitting is an optimization method by splitting a large cell (macro) into small cells (micro) [5], which aims to increase capacity and throughput within the area covered by the 4G network [6]. The cell splitting method is carried out on a new site with half of the main site's coverage. The transmitter power at the split site is reduced by 12 dB from the transmitter power of the main site, and the antenna height is limited to no more than 20 meters above ground level [7].

Power is one of the elements considered when optimizing a 4G network using the cell splitting method [8]. A power reduction of 12 dB from the main site transmitter can cause the power intended for the new site to be inadequate to cover the entire area as expected to get additional services from the new site. This is because the largest power that can be operated by LTE macro power site is at 40W or about 46dBm [9], while theoretically, macro sites have effective power at around 2.5 W or 34 dBm [10]. Therefore, the limited power will make it difficult for the split cell to perform optimal service.

In this study, experiments and analysis using simulations from RF planning software atoll were conducted to test the theory of transmitter power reduction in the cell splitting method and compare it with other power reduction scenarios. The results of this experiment are expected to replace or support the existing cell splitting theory and positively contribute to the field of 4G LTE FDD 1800 MHz cellular telecommunications technology.

2 Research Method

The method used in this research is to collect data from the main site to determine the site point, then calculate and plan the power cell splitting. The next step is to test the theory of power reduction in the cell splitting method, analyze its impact on the established site's quality and capacity, and compare it with other powering scenarios that are more effective than the pre-existing theory by simulating and analyzing cellular networks in Atoll software.

2.1 Main Site Data

The main site data is needed as information and initial reference for carrying out calculations from the cell splitting method [11]. The data of the main site which the cell splitting method was conducted is shown in Table 1.

Table 1. Main Site Data

Data	Value
Site name	032290_0_4G
Maximum power	46 dBm (40W)
Radius	2100 m
Coverage area	22,48 Km²
Maximum throughput interface	170000 kbps
Longitude	100.402
Latitude	-0.90219
Azimuth	0, 95, 255
Technology	FDD 1800 MHz
Bandwidth	10 MHz (band 3)
Propagation type	Cost-hatta
Cell Type	Macro cell
Total traffic	58 GB (464 Gb)

2.2 Calculation of area and radius

The new cell area and radius with the cell splitting method is calculated using the equation (1) and (2): [12]

$$\text{New cell area} = \frac{\text{previous cell area}}{4} \quad (1)$$

$$\text{New cell radius} = \frac{\text{previous cell radius}}{2} \quad (2)$$

2.3 Calculation of power

The main site power is calculated using the equation (3): [12]
PowerO = previous enB power

$$\text{PowerO} = 10^{\frac{\text{dBm}}{10}} \quad (3)$$

Scenario 1 according to theory is reduced by 12 dB (16)

$$\text{Power1} = \frac{\text{PowerO}}{16}$$

Scenario 2 is reduced by 15 dB (32)

$$\text{Power2} = \frac{\text{PowerO}}{32}$$

Scenario 3 is reduced by half from the main site power

$$\text{Power3} = \frac{\text{PowerO}}{2}$$

For power use the conversion to dBm:

$$\text{PowerdBm} = 10 \text{ x} \log(\text{ power mW })$$

2.4 Calculation of antenna height

To determine the height of the antenna, the trigonometry formula as in the equation (4) is used.

$$\tan x = \frac{y}{z} \quad (4)$$

x = MDT; y = antenna height; z = new cell radius
The effective antenna height can be calculated from y + hre; which hre is the height of user equipment position.

2.5 Calculation of traffic load

The Traffic Load (TL) is calculated using the equation (5): [12]

$$\text{New TL} = 4 \text{ x previous TL x } \frac{\text{previous area}}{\text{new area}} \quad (5)$$

Then it can be calculated how many new cells (n) can be formed through the cell splitting method using the equation (6).

$$\text{New TL} = 4^{n} \text{ x previous TL} \quad (6)$$

2.6 Determination of site point

Selection of a new site point by placing the site in an area with a Timing Advance and high traffic [13], marked by the number of residential and office buildings in the area. Besides, the selected area must be in the service coverage of the main site and cannot be built if it is already out of the service area of the main site. If the main site has a coverage of 2 km, then the new site must be within the coverage of the main site.

2.7 Planning of cell splitting

Atoll is an RF planning software that has the function of calculating and simulating cellular network models to be built or optimized. Atoll can display information about cellular network quality and coverage [12],[14]. In addition, the Atoll has several features, such as network radio planning, site analysis and simulation, and UMTS/GSM/LTE planning. Atoll software can also calculate KPI values such as Throughput, SINR, and RSRP obtained from new sites built using the cell splitting method using the prediction features available in the software [12].

2.8 Stages of cell splitting optimization ACP method 1800MHz frequency using Atoll

In optimizing cell splitting, Automatic Cell Planning (ACP) was conducted through several stages, which are:

a. Prepare the existing site data of the operator used in the research (XL). This data contains longitude, latitude, frequency, bandwidth, azimuth, tilt, mechanical tilt, antenna power, antenna height, and Cost Hatta propagation model.
b. Set the projection used, in this case done in the Sumatra area, so set the UTM zone 48s coordinate properties, WGS 84 display, and degree format to -xx.xxxx
c. Perform Atoll configuration by inputting Sumatra map data, such as clutter classes, clutter height, altitude, and vector.
d. Activate the online map on the Geo Tab.
e. Input Atoll parameter data, such as site, transmitter, and cell.
f. Create a focus zone using polygons on the map according to the area to be optimized.
g. Initiating the calculation of RSRP and SINR parameter predictions according to the prediction template in Atoll and setting the legend according to the XL operator's Key Performance Indicator (KPI).
h. Calculating existing data to see coverage and quality before optimizing.
i. Perform ACP method optimization by setting the RSRP target zone parameter to 100% for RSRP quality ≥ -105, and SINR target zone to 100% for quality ≥ -3 in the objective on the ACP setup.
j. The optimization results will appear in optimization, to apply it click commit.
k. Recalculate the predicted SINR and RSRP parameters to display the results after optimization.
l. Perform further analysis by generating prediction reports on each parameter, the selected data are % of covered area, %focus zone, site, antenna, height (m), and surface (km).
m. Export the optimization result data to excel.

2.9 Key Performance Indicators

KPIs, or key performance indicators, are tools used to evaluate the quality and effectiveness of cellular network services [15]. Several KPIs used for measuring the LTE network quality are:

a. Throughput

Throughput shows the average rate at which a node obtains data during a particular observation period [16]. Throughput is the effective data transfer rate measured during a period in a day, utilizing a certain internet path to download files [17]. The range for the Throughput values can be seen in Table 2.

Table 2. Range of throughput value

Throughput	Color	Strength (kbps)
Excellent	Purple	≥ 14000
Good	Blue	7000 – 14000
Low	Green	1000 – 7000
Very Low	Yellow	512 – 1000
Bad	Red	< 512

b. RSRP

Reference Signal Receive Power (RSRP) is the power signal on LTE captured by the user at a particular frequency. As the distance between the site and the user increases, the RSRP received by the user decreases. Reference Signal (RS) is the RSRP at each point of coverage. LTE services will not be available to users out of range [18],[19]. Table 3 shows the range of RSRP values.

Table 3. Range of RSRP value

RSRP	Color	Strength (kbps)
Excellent	Blue	≥ -80
Good	Green	-95 – -80
Low	Yellow	-110 – -95
Bad	Red	< -110

c. SINR

Signal to Interference Noise Ratio (SINR) shows the proportion of received standard power to standard interference and noise. A higher SINR value indicates superior signal quality, while a lower value indicates lower quality [20]. The SINR values range is provided in Table 4.

Table 4. Range of SINR value

Throughput	Color	Strength (kbps)
Excellent	Blue	≥ 20
Good	Green	13 – 20
Low	Yellow	0 – 13
Bad	Red	< 0

3 Results and Discussion

3.1 The results of cell splitting calculation

a. Calculation of area and radius

$\text{Previous cell area} = 1{,}95 \text{ x } 2{,}6 \text{ x } d^2$

d = previous cell to the UE

$\text{Previous cell area} = 1{,}95 \text{ x } 2{,}6 \text{ x } 2{,}1^2$

$\text{Previous cell area} = 1{,}95 \text{ x } 2{,}6 \text{ x } 4{,}41$

$\text{Previous cell area} = 22{,}36 \text{ Km}^2$

Then the new cell area can be calculated as follow:

$\text{New cell area} = \frac{\text{Previous cell area}}{4}$

$\text{New cell area} = \frac{22{,}3 \text{ Km}^2}{4}$

$\text{New cell area} = 5{,}58 \text{ Km}^2$

$\text{Previous cell radius} = 2{,}1 \text{ Km}$

$\text{New cell radius} = \frac{2{,}1 \text{ Km}}{2}$

$\text{New cell radius} = 1{,}05 \text{ Km}$

$\text{New cell radius} = 1 \text{ Km}$

b. Calculation of main site power

$\text{PowerO} = \text{previous enB power enB}$

$\text{PowerO} = 46 \text{ dBm}$

$\text{PowerO} = 10^{\frac{\text{dBm}}{10}}$

$\text{PowerO} = 10^{\frac{46}{10}}$

$\text{PowerO} = 39810 \text{ mW}$

$\text{PowerO} = 39{,}8 \text{ W}$

$\text{PowerO} = 40 \text{ W}$

Scenario 1 according to theory is reduced by 12 dB (16)

$\text{Power1} = \frac{\text{Power0}}{16}$

$\text{Power1} = \frac{40\text{ W}}{16}$

$\text{Power1} = 2{,}5\text{ W}$

$\text{Power1} = 2500\text{ mW}$

Conversion to dBm,

$\text{Power1} = 10 \text{ x} \log(2500)$

$\text{Power1} = 33{,}9$

$\text{Power1} = 34\text{ dBm}$

Scenario 2 is reduced by 15 dB (32)

$\text{Power2} = \frac{\text{Power0}}{32}$

$\text{Power2} = \frac{40\text{ W}}{32}$

$\text{Power2} = 1{,}25\text{ W}$

$\text{Power2} = 1250\text{ mW}$

Conversion to dBm,

$\text{Power2} = 10 \text{ x} \log(1250)$

$\text{Power2} = 31\text{ dBm}$

Scenario 3 is reduced by half from the main site power

$\text{Power3} = \frac{\text{Power0}}{2}$

$\text{Power3} = \frac{40\text{ W}}{2}$

$\text{Power3} = 20\text{ W}$

$\text{Power3} = 20000\text{ mW}$

Conversion to dBm,

$\text{Power3} = 10 \text{ x} \log(20000)$

$\text{Power3} = 43\text{ dBm}$

c. Calculation of antenna height

$\tan(1°) = \frac{y}{1000\text{ meter}}$

$y = 0{,}017 \text{ x } 1000$

$y = 17\text{ meter}$

Effective antenna height = y + hre

Effective antenna height = y + 1,5

Effective enB antenna height = 18,5 meter

d. Calculation of traffic load

$\text{Previous TL} = 58\ GB$ (464Gb)

$\text{New TL} = 4 \text{ x Previous TL x } \frac{\text{Previous area}}{\text{New area}}$

$\text{New TL} = 4 \text{ x } 464 \text{ x } \frac{22{,}3}{5{,}58}$

$\text{New TL} = 928\ GB$ (7424 Gb)

The number of new cells (n) formed through the cell splitting method:

$\text{New TL} = 4^n \text{ x Previous TL}$

$7424 = 4^n \text{ x } 464$

$$\frac{7424}{464} = 4^n$$

$$16 = 4^n$$

$$4^2 = 4^n$$

$$n = 2$$

So, the previous cell can be split into 2 new cells.

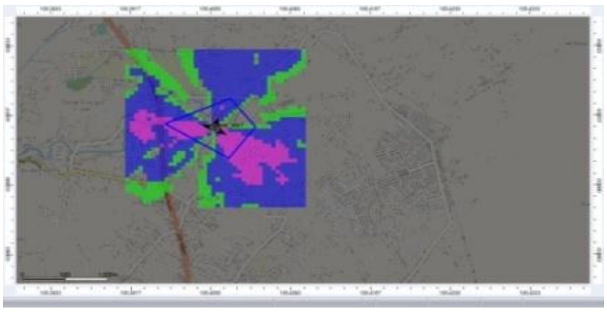
e. Determination of site point

The new site cell splitting position is at longitude 100.400395° and altitude -0.893210°. This position was chosen as a simulation area because it is located within the radius of the main site and is a settlement area.

3.2 The results of Atoll simulation

a. Throughput

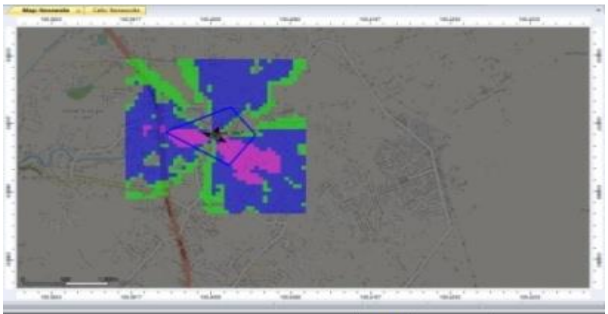
Fig. 1 shows the throughput of the site cell splitting with a transmitter power of 34 dBm. The download throughput value on the site cell splitting scenario one is quite good. It can be seen from the Fig. that the site is dominated by blue (good), which means that the download speed is at the level of 7000 to 14000 kbps, with an average speed of 10041 kbps. Cells in sectors 2 and 3 have better throughput, marked in purple, indicating the download speed is above 14000 kbps.



Legend	Zone surface (km^2)	Surface (km^2)	% of Covered Area
	-	**3.5**	**100**
0 <=Application Channel Throughput (DL) (kbps) <512	-	0	0
512 <=Application Channel Throughput (DL) (kbps) <1,000	-	0	0
1,000 <=Application Channel Throughput (DL) (kbps) <7,000	-	0.805	23
7,000 <=Application Channel Throughput (DL) (kbps) <14,000	-	2.105	60.143
14,000 <=Application Channel Throughput (DL) (kbps) <100,000	-	0.59	16.857

Fig. 1. The result of the throughput simulation1

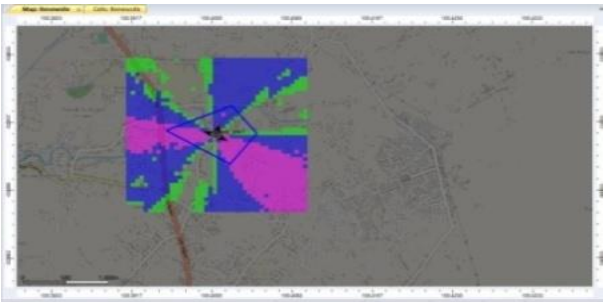
Fig. 2 depicts the throughput of the site cell splitting with a transmitter power of 31 dBm. The download throughput value of the cell splitting site scenario two is quite good. The site is dominated by blue, meaning that the download speed is at 7000 to 14000 kbps, with an average speed of 9348 kbps. In sectors 2 and 3, the cells have a better throughput, marked in purple, indicating the download speed is above 14000 kbps. However, more blank spot areas appear in this second scenario.



Legend	Zone surface (km²)	Surface (km²)	% of Covered Area
	-	**3.365**	**100**
0 <=Application Channel Throughput (DL) (kbps) <512	-	0	0
512 <=Application Channel Throughput (DL) (kbps) <1,000	-	0	0
1,000 <=Application Channel Throughput (DL) (kbps) <7,000	-	0.883	26.241
7,000 <=Application Channel Throughput (DL) (kbps) <14,000	-	2.09	62.11
14,000 <=Application Channel Throughput (DL) (kbps) <100,000	-	0.393	11.679

Fig. 2. The result of the throughput simulation 2

Fig. 3 displays the throughput of the site cell splitting with a transmitter power of 43 dBm. The download throughput value for the third scenario cell splitting site is quite good, dominated by the blue color, which indicates the download speed is average at 7000 to 14000 kbps with an average speed is 11045 kbps. In sectors 2 and 3, the cells have better throughput, which mainly the download speed is above 14000 kbps. Compared to other scenarios, in scenario 3, the green area is increasing. Overall, this scenario has the highest throughput value with a transmitter power of 43 dBm with a speed of 11045 kbps.

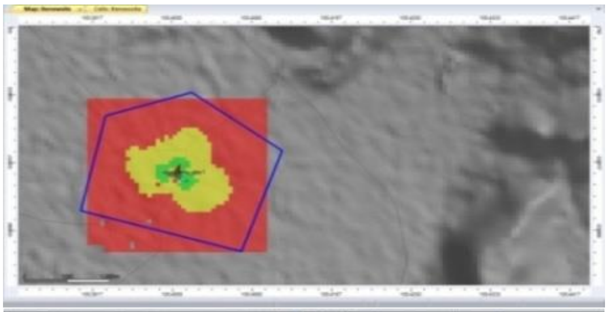


Legend	Zone surface (km²)	Surface (km²)	% of Covered Area
	-	**3.403**	**100**
0 <=Application Channel Throughput (DL) (kbps) <512	-	0	0
512 <=Application Channel Throughput (DL) (kbps) <1,000	-	0	0
1,000 <=Application Channel Throughput (DL) (kbps) <7,000	-	0.61	17.925
7,000 <=Application Channel Throughput (DL) (kbps) <14,000	-	1.77	52.013
14,000 <=Application Channel Throughput (DL) (kbps) <100,000	-	1.023	30.062

Fig. 3. The result of the throughput simulation 3

b. RSRP

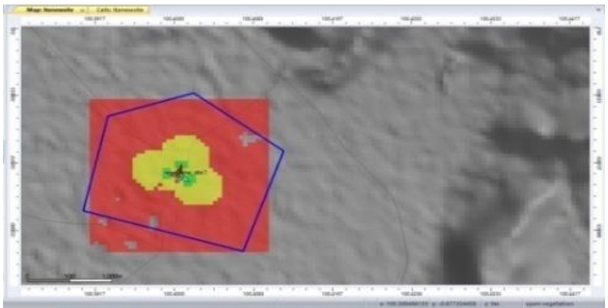
Fig. 4 shows the RSRP value of the cell splitting site with a transmitter power of 34 dBm. The area receiving the signal from the site cell splitting scenario one is dominated by red. Still, around 600 meters from the site, it is dominated by yellow (low), indicating the signal strength is not very good, which is between -110 to -95 dBm. Meanwhile, good areas are only 100 meters from the site, with the average signal strength is -116.88 dBm.



Legend	Zone surface (km^2)	Surface (km^2)	% of Covered Area
	-	**4.378**	**100**
-140 <=RSRP Level (DL) (dBm) <-110	-	3.465	79.146
-110 <=RSRP Level (DL) (dBm) <-95	-	0.795	18.159
-95 <=RSRP Level (DL) (dBm) <-80	-	0.118	2.695
-80 <=RSRP Level (DL) (dBm) <0	-	0	0

Fig. 4. The result of the RSRP simulation 1

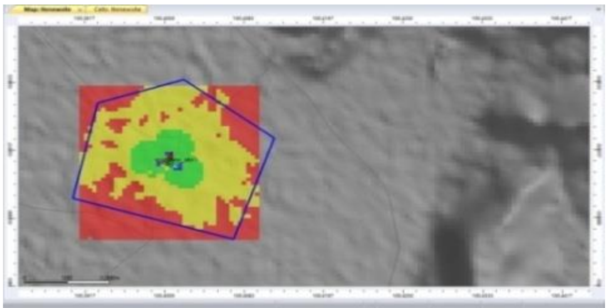
Fig. 5 illustrates the RSRP of the site cell splitting with a transmitter power of 31 dBm. The area that receives the signal from the site cell splitting scenario two is dominated by red color, and there are blank spot areas within the cell coverage. Meanwhile, the area around 500 meters from the site is still dominated by yellow, indicating the signal strength is low or between -110 and -95 dBm. However, the total yellow area for the RSRP parameter in this second scenario is fewer than in the first scenario. Yet, the green area also decreases to under 100 meters from the site, with the average signal strength is -119.58 dBm.



Legend	Zone surface (km^2)	Surface (km^2)	% of Covered Area
	-	**4.318**	**100**
-140 <=RSRP Level (DL) (dBm) <-110	-	3.638	84.252
-110 <=RSRP Level (DL) (dBm) <-95	-	0.623	14.428
-95 <=RSRP Level (DL) (dBm) <-80	-	0.058	1.343
-80 <=RSRP Level (DL) (dBm) <0	-	0	0

Fig. 5. The result of the RSRP simulation 2

Fig. 6 displays the RSRP of site cell splitting with a transmitter power of 43 dBm. The area obtaining the signal from the site cell splitting in the third scenario is still dominated by yellow. In this scenario, there is an increase in the radius of the yellow area to 1000 m and a reduction in the red area. The green (good) RSRP area also increases with a radius of about 400 meters from the site, indicating an improvement in the RSRP parameter in this scenario. Based on the comparison of the three scenarios, it can be concluded that the highest RSRP is produced from the third scenario with a transmitter power of 43 dBm and an RSRP value of -108.58 dBm.



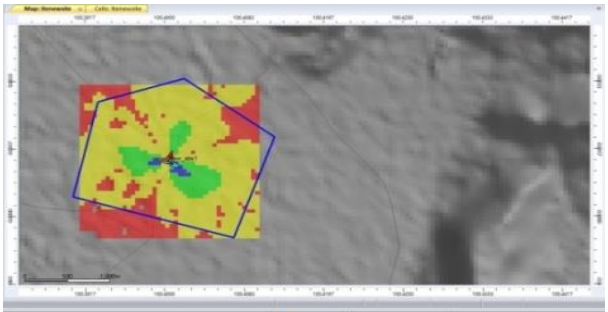
Legend	Zone surface (km²)	Surface (km²)	% of Covered Area
	-	**4.408**	**100**
-140 <=RSRP Level (DL) (dBm) <-110	-	1.91	43.33
-110 <=RSRP Level (DL) (dBm) <-95	-	2.033	46.121
-95 <=RSRP Level (DL) (dBm) <-80	-	0.445	10.095
-80 <=RSRP Level (DL) (dBm) <0	-	0.02	0.454

Fig. 6. The result of the RSRP simulation 3

c. SINR

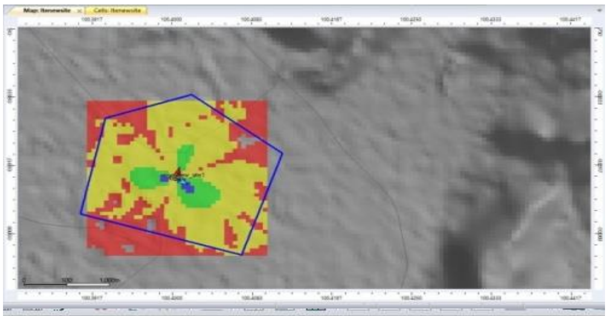
The SINR of site cell splitting with a transmitter power of 34 dBm is shown in Fig. 7. The signal quality generated from site cell splitting in scenario one is dominated by yellow colored area (low) with a total of 2,838 Km² and a green area (good) of 0.403 Km². Meanwhile, the area with red color with bad SINR value covers an area of 1.095 Km², and areas with blue color with excellent SINR cover an area of 0.043 Km². Overall, the SINR value is quite good, as it has an average SINR value of 4.08 dB.

Fig. 8 displays the SINR of site cell splitting with a transmitter power of 31 dBm. This Fig. revealed that the signal quality generated from site cell splitting in scenario two is dominated by a yellow area of 2,443 Km² and a green area of 0.295 Km². In contrast, areas with red color or bad SINR value is 1.545 Km² and areas with blue color or excellent SINR value only cover an area of 0.035 Km². Compared to the first scenario, a wider red area in this second scenario indicates worse quality. However, the SINR in scenario two can be concluded as good with an average of 2.28 dB.



Legend	Zone surface (km²)	Surface (km²)	% of Covered Area
	-	**4.378**	**100**
-20 <=RS C/(I+N) Level (DL) (dB) <0	-	1.095	25.011
0 <=RS C/(I+N) Level (DL) (dB) <13	-	2.838	64.824
13 <=RS C/(I+N) Level (DL) (dB) <20	-	0.403	9.205
20 <=RS C/(I+N) Level (DL) (dB) <40	-	0.043	0.982

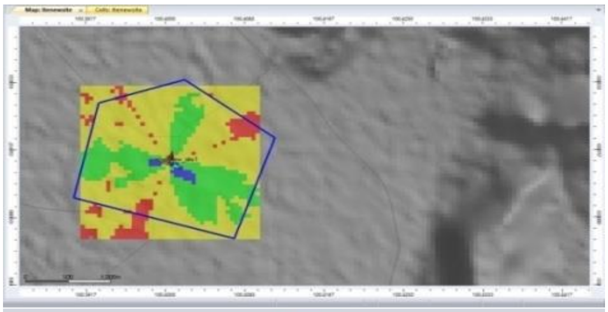
Fig. 7. The result of the SINR simulation 1



Legend	Zone surface (km²)	Surface (km²)	% of Covered Area
	-	**4.318**	**100**
-20 <=RS C/(I+N) Level (DL) (dB) <0	-	1.545	35.78
0 <=RS C/(I+N) Level (DL) (dB) <13	-	2.443	56.577
13 <=RS C/(I+N) Level (DL) (dB) <20	-	0.295	6.832
20 <=RS C/(I+N) Level (DL) (dB) <40	-	0.035	0.811

Fig. 8. The result of the SINR simulation 2

The SINR of site cell splitting with a transmitter power of 43 dBm is illustrated in Fig. 9. It can be seen that the signal quality generated from site cell splitting in the third scenario is dominated by yellow color with an area of 2,853 Km² and green color with an area of 1.1 Km². Meanwhile, the red area covers an area of 0.393 Km² and the blue area of 0.063 Km². Compared to the other scenarios, the SINR value in scenario three is better, with an average SINR value is 8.52 dB, although it is still dominated by yellow.

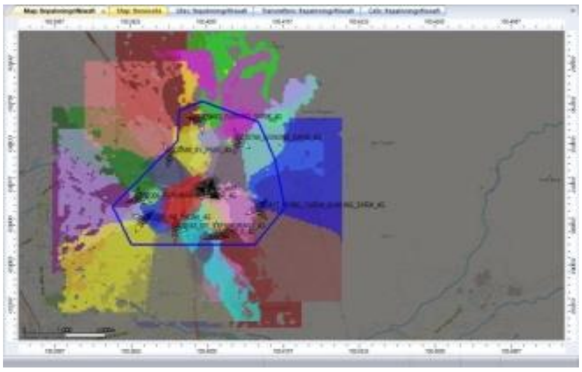


Legend	Zone surface (km²)	Surface (km²)	% of Covered Area
	-	**4.408**	**100**
-20 <=RS C/(I+N) Level (DL) (dB) <0	-	0.393	8.916
0 <=RS C/(I+N) Level (DL) (dB) <13	-	2.853	64.723
13 <=RS C/(I+N) Level (DL) (dB) <20	-	1.1	24.955
20 <=RS C/(I+N) Level (DL) (dB) <40	-	0.063	1.429

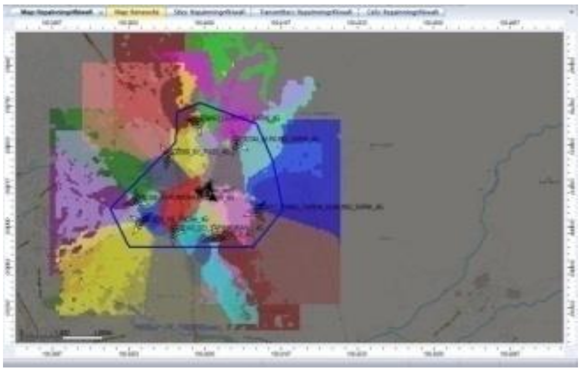
Fig. 9. The result of the SINR simulation 3

d. Cell Coverage

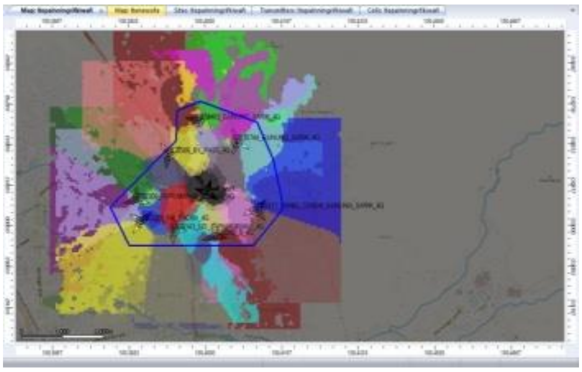
The comparison of the coverage area and signal strength based on the transmitter from the site cell splitting for each scenario is illustrated in Fig. 10. The first scenario with 34 dBm according to the theory is presented in Fig. 10 (a), the second scenario with 31 dBm (scaled down by 15 dB) in Fig. 10 (b), and the third scenario with 43 dBm (half the main power site) in Fig. 10 (c). The data revealed that the coverage and signal quality of the site cell splitting is better when the transmitter power is 43 dBm (scenario 3). The coverage aligns with the expected cell splitting area, which reaches a radius of 1 km from the site. Also, the signal is not too reduced as it can compete with interference from the main and neighbor sites. Meanwhile, scenarios 1 and 2 can only cover half of the area where the cell signal is reduced. This condition can be caused by the small power provided, so it is reduced by interference from the main and neighbors site, which have higher power values.



(a)



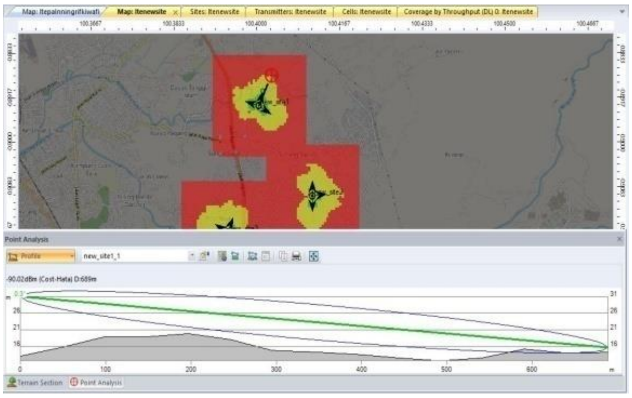
(b)



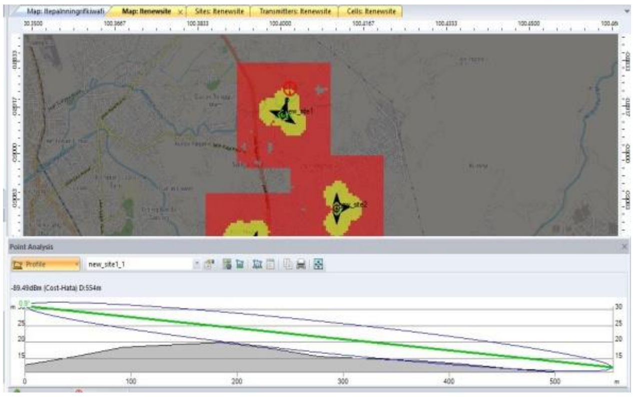
(c)

Fig. 10. Comparison of the coverage of transmitter signal strength in (a) simulation 1, (b) simulation 2, (c) simulation 3

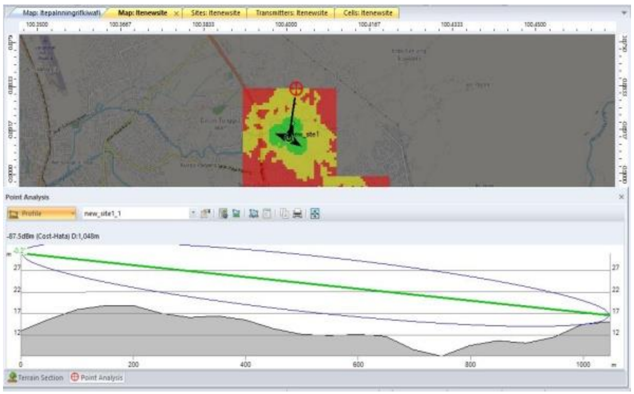
This result is similar to the comparison of the radius of each scenario, in which the site cell splitting with a power of 43 dBm has a broader coverage as far as 1 km, as displayed in Fig. 11. The Fig. shows that the coverage profile of site cell splitting scenario 1 can reach a radius of 726 meters from the site (a), while scenario 2 is only able to reach a radius of 689 meters (b), and scenario 3 (c) is able to reach up to a radius of 1048 meters from the site. So, it can be concluded that scenario three, with a power of 43 dBm, has a broader coverage capability than scenarios 1 and 2.



(a)



(b)



(c)

Fig. 11. Comparison of the pathloss coverage in (a) simulation 1, (b) simulation 2, (c) simulation 3

4 Conclusion

The research found that the higher the transmitter power value of a site, the better the strength, quality, and speed of the signal and the wider the coverage area. Cell splitting transmitter power reduction will be more effective with a new site power reduction equal to half of the parent site power. Reduced power transmitter cell splitting still produces good signal quality and speed but considers the real conditions in the field. However, this research only discusses coverage for the 1800 MHz frequency which will be different if using a power transmitter for the 900MHz and 2300 MHz frequencies, so the determination of the transmitter power value can be further analyzed by adding the interference value.

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