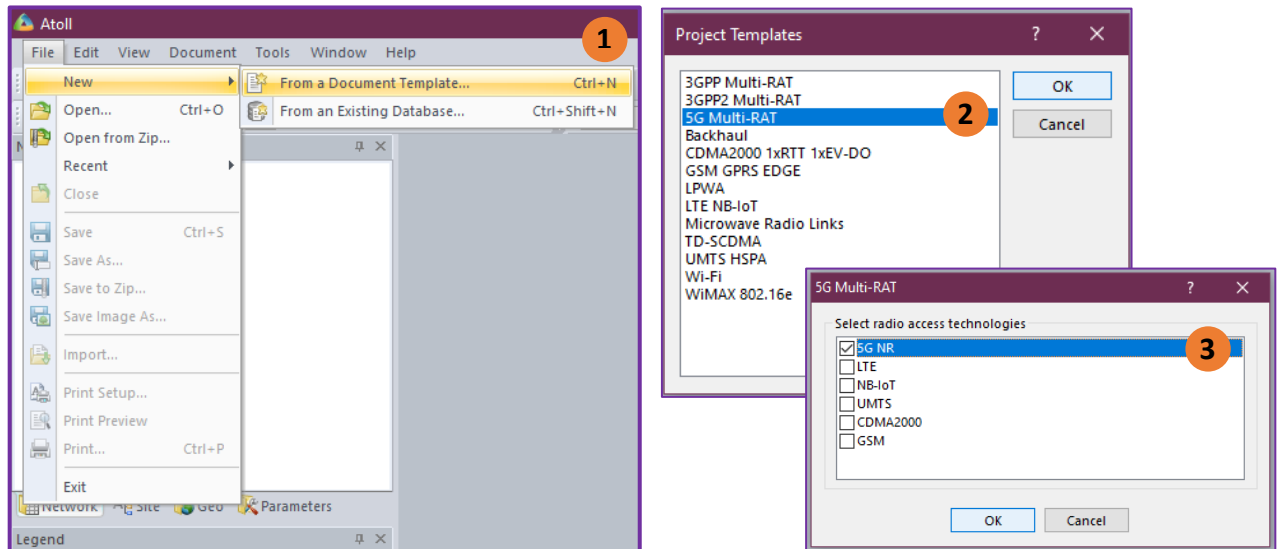


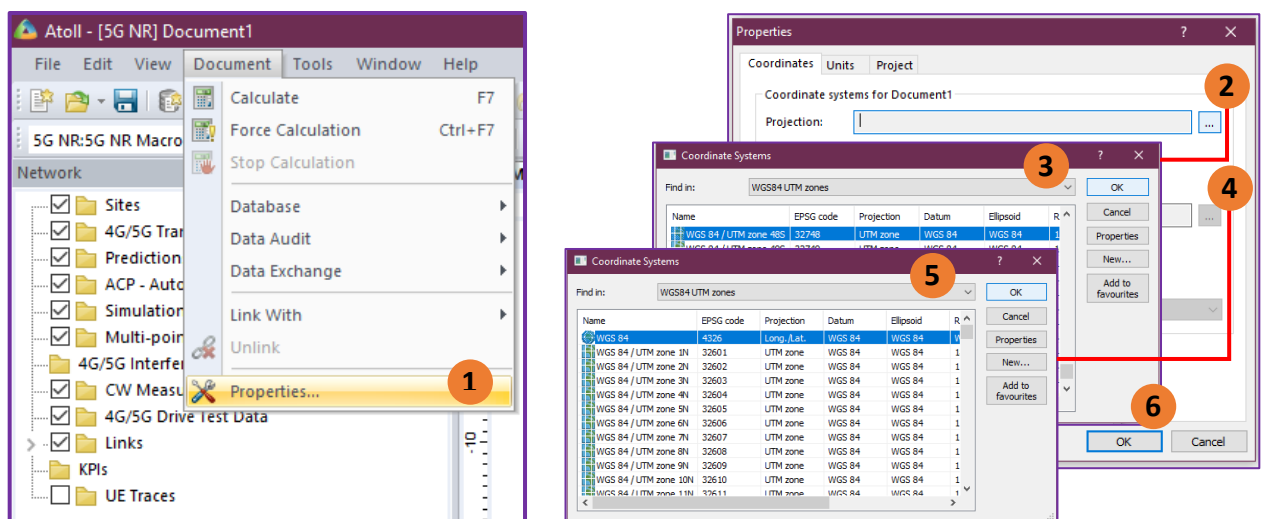
## PRAKTIKUM MODUL 5G RADIO PLANNING

### MENGUNAKAN *SOFTWARE* ATOLL 3.4

1. Buka *software* Atoll 3.4.
2. *Create New Project*

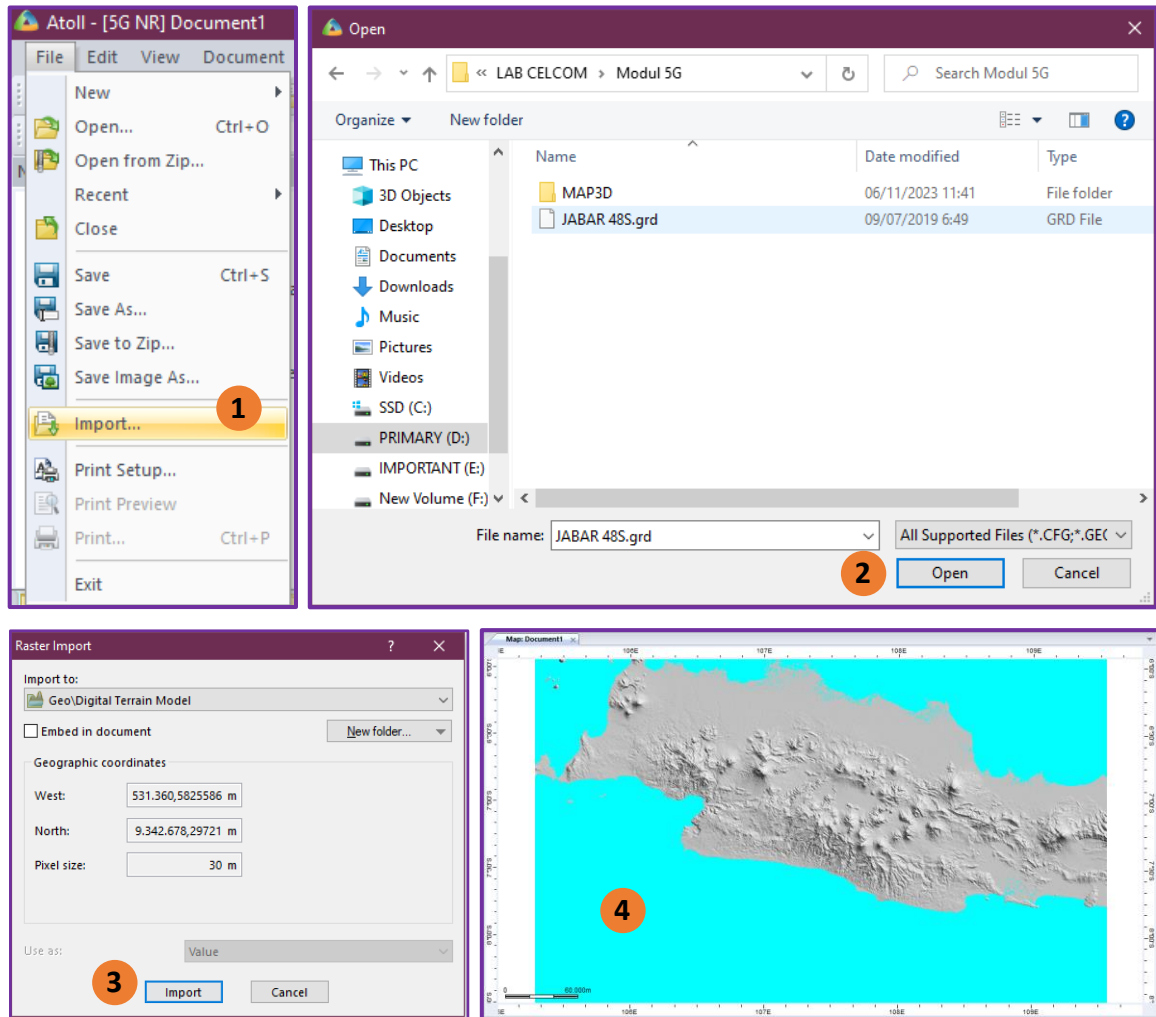


- 1) *File* > *New* > *From a Document Template*
- 2) Pilih *Project Templates* “5G Multi-RAT” > OK
- 3) Pilih *Radio Access Technologies* “5G NR” > OK
3. *Setting Project Area*



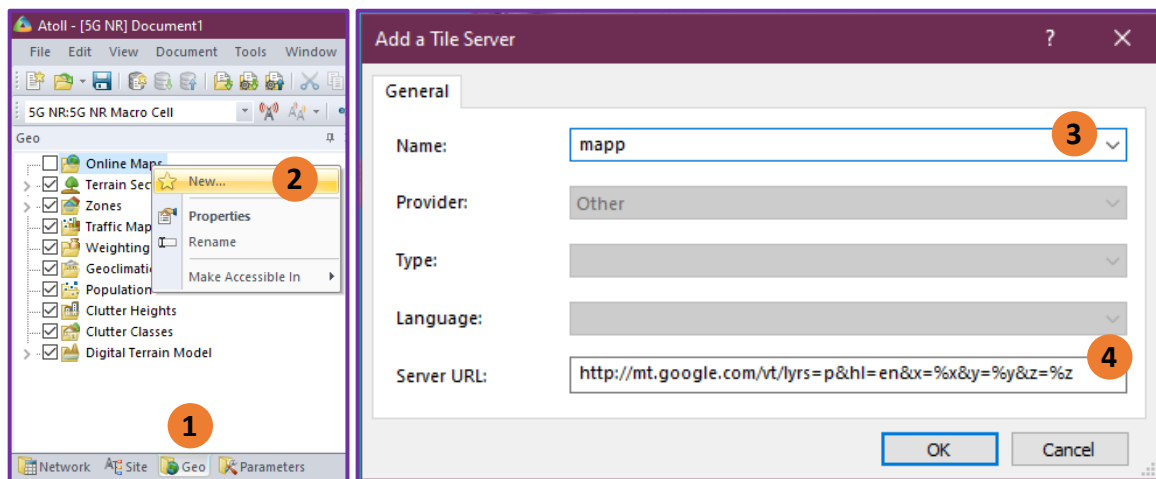
- 1) *Document* > *Properties*
- 2) Telusuri proyeksi peta Anda
- 3) Pilih proyeksi peta Anda > OK
- 4) Telusuri tampilan peta Anda
- 5) Pilih tampilan peta Anda > OK
- 6) Klik OK

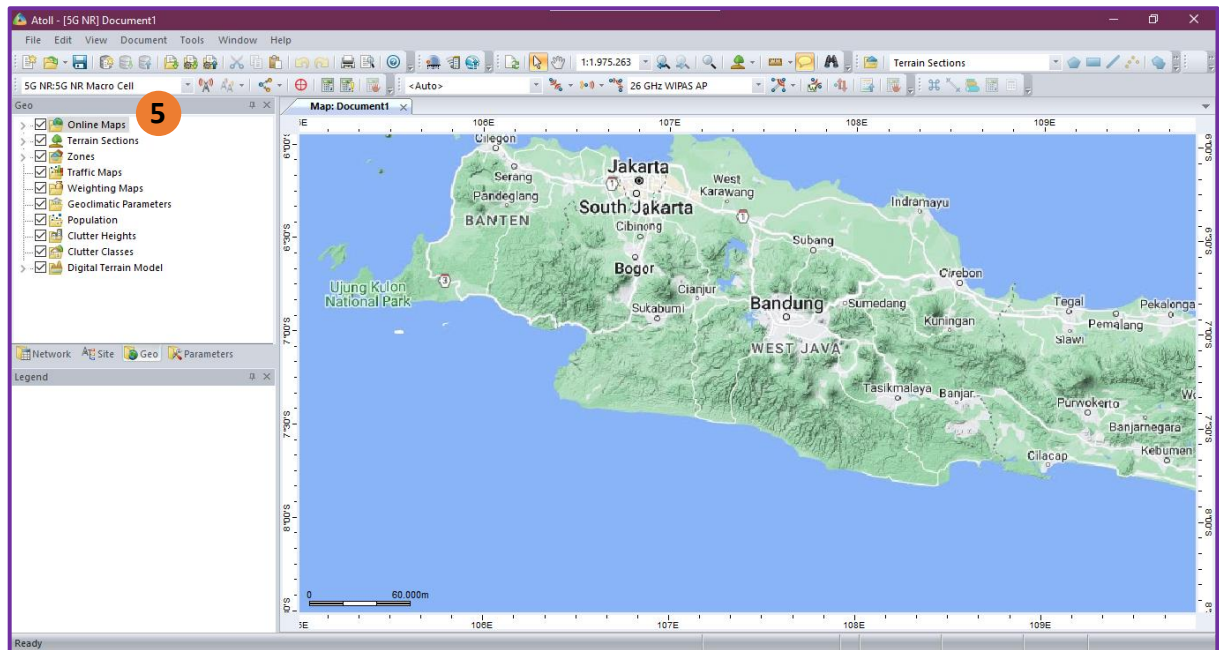
#### 4. Import Map



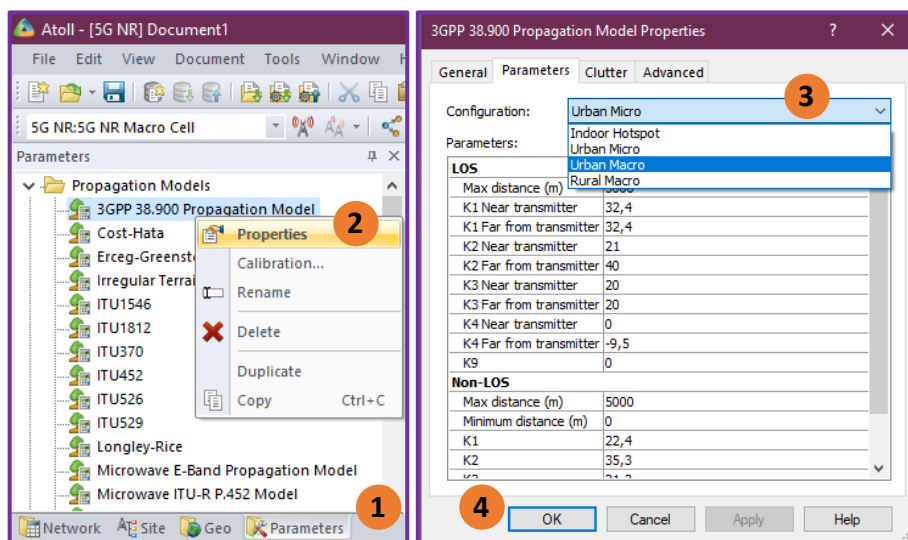
- 1) *File > Import*
- 2) Pilih file peta yang ingin Anda impor > *Open*
- 3) Di *Raster Import* > Klik *import*
- 4) Hasil

#### 5. Online Maps



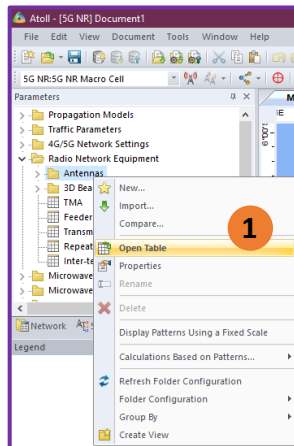


- 1) Pilih tab Geo
- 2) Klik kanan *Online Maps* > *New*
- 3) Isi bagian *Name*
- 4) Masukkan Server URL:  
<http://mt.google.com/vt/lyrs=p&hl=en&x=%x&y=%y&z=%z> > OK
- 5) Centang *Online Maps* dan muncul hasil *Online Maps*
6. *Propagation Model*



- 1) Pilih tab *Parameters*
- 2) Klik kanan pada salah satu model propagasi > *Properties*
- 3) Pilih kategori pada tab *Configuration*
- 4) Klik *Apply* > OK

## 7. Setting equipment (1)



Map: Document1

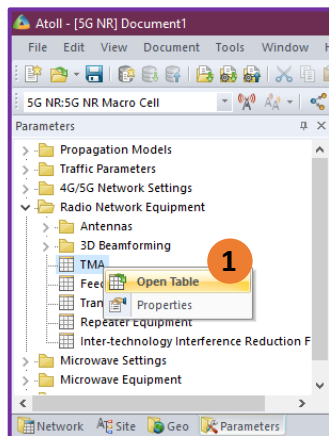
Antennas: Document1

Name	Gain (dBi)	Manufacturer	Comments	Pattern	Pattern Electrical Tilt (°)	Physical Antenna	Half-power Beamwidth	Min Frequency (MHz)	Max Frequency (MHz)
110deg 15dBi 0Tilt 1900MHz	15,72	Comba	Smart antenna element pattern	0	Comba Dua	110	1.880	1.92	
30deg 18dBi 0Tilt 1800MHz	18	Kathrein	1800 MHz	0	30deg 18dB	30	1.710	1.90	
30deg 18dBi 0Tilt 850/900MHz	18	Kathrein	850/900 MHz	0	30deg 18dB	30	870	96	
33deg 21dBi 2Tilt 1900/2100MHz	21	Kathrein	1900/2100 MHz	2	33deg 21dB	33	1.920	2.17	
3GPP Antenna Radiation Pattern	8			0	3GPP Anten	65			
60deg 16dBi 0Tilt 2600MHz	16,4	Kathrein	2600 MHz	0	60deg 16dB	60	2.620	2.69	
60deg 16dBi 2Tilt 2600MHz	16,6	Kathrein	2600 MHz	2	60deg 16dB	60	2.620	2.69	
60deg 16dBi 4Tilt 2600MHz	16,7	Kathrein	2600 MHz	4	60deg 16dB	60	2.620	2.69	
60deg 16dBi 6Tilt 2600MHz	16,7	Kathrein	2600 MHz	6	60deg 16dB	60	2.620	2.69	
60deg 16dBi 8Tilt 2600MHz	16,5	Kathrein	2600 MHz	8	60deg 16dB	60	2.620	2.69	
65deg 17dBi 0Tilt 700/800MHz	17,2	Kathrein	700/800 MHz	0	65deg 17-1	65	698	89	
65deg 17dBi 2Tilt 700/800MHz	16,8	Kathrein	700/800 MHz	2	65deg 17-1	65	698	89	
65deg 17dBi 4Tilt 700/800MHz	16,8	Kathrein	700/800 MHz	4	65deg 17-1	65	698	89	
65deg 17dBi 6Tilt 700/800MHz	16,7	Kathrein	700/800 MHz	6	65deg 17-1	65	698	89	
65deg 17dBi 8Tilt 700/800MHz	16,5	Kathrein	700/800 MHz	8	65deg 17-1	65	698	89	
65deg 17dBi 0Tilt 1800MHz	17,15	Kathrein	1800 MHz	0	65deg 17-1	65	1.710	1.90	
65deg 17dBi 0Tilt 2600MHz	17,62	Comba	Smart antenna element pattern	0	Comba Dua	65	2.555	2.63	
65deg 17dBi 0Tilt 850/900MHz	17	Kathrein	850/900 MHz	0	65deg 17-1	65	870	96	
65deg 17dBi 2Tilt 1800MHz	17	Kathrein	1800 MHz	2	65deg 17-1	65	1.710	1.90	
65deg 17dBi 2Tilt 850/900MHz	17	Kathrein	850/900 MHz	2	65deg 17-1	65	870	96	
65deg 17dBi 4Tilt 850/900MHz	17	Kathrein	850/900 MHz	4	65deg 17-1	65	870	96	
65deg 17dBi 6Tilt 1800MHz	17,5	Kathrein	1800 MHz	6	65deg 17-1	65	1.710	1.90	
65deg 18dBi 0Tilt 1900/2100MHz	18	Kathrein	1900/2100 MHz	0	65deg 17-1	65	1.920	2.17	
65deg 18dBi 2Tilt 1900/2100MHz	18	Kathrein	1900/2100 MHz	2	65deg 17-1	65	1.920	2.17	
65deg 18dBi 4Tilt 1900/2100MHz	18	Kathrein	1900/2100 MHz	4	65deg 17-1	65	1.920	2.17	
70deg 17dBi 3Tilt (SA Broadcast)	17	None	Smart antenna broadcast pattern	3	Smart Ante	70			
90deg 14.5dBi 3Tilt (SA Element)	14,5	None	Smart antenna element pattern	3	Smart Ante	90			
Omni 11dBi 0Tilt 1800MHz	11	Kathrein	1800 MHz	0	Omni 11dBi	360	1.710	1.90	
Omni 11dBi 0Tilt 1900/2100MHz	11	Kathrein	1900/2100 MHz	0	Omni 11dBi	360	1.920	2.17	
Omni 11dBi 0Tilt 850/900MHz	11,15	Kathrein	850/900 MHz	0	Omni 11dBi	360	870	96	
Omni 5.7dBi 2100MHz	5,7	Kathrein	2100 MHz	0	Kathrein 5m	360	1.425	3.80	
Omni 5.8dBi 2600MHz	5,8	Kathrein	2600 MHz	0	Kathrein 5m	360	1.425	3.80	

1) Pilih tab *Parameters* > Klik kanan pada *Antennas* > *Open Table*

2) Tetapkan nilai parameter pada Antena

## 8. Setting equipment (2)

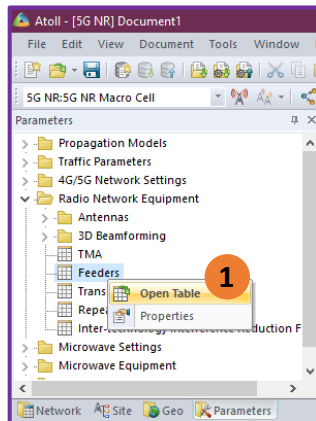


Name	Noise Figure (dB)	Reception gain (dB)	Transmission losses (dB)
Default TMA Equipment	1,5	12	0,5

1) Klik kanan pada TMA > *Open Table*

2) Tetapkan nilai parameter pada TMA Equipment

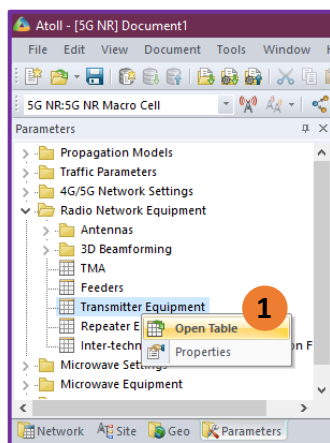
## 9. Setting equipment (3)



Feeder: Document1				
Name	Loss per meter (dB/m)	Connector reception losses (dB)	Connector transmission losses (dB)	Linear losses by frequency (dB/m)
Default 1/2" Feeder	0,103	0,5	0,5	
Default 1-5/8" Feeder	0,04	0,5	0,5	
Default 7/8" Feeder	0,06	0,5	0,5	

- 1) Klik kanan pada *Feeder* > *Open Table*
- 2) Tetapkan nilai parameter pada *Feeder Equipment*

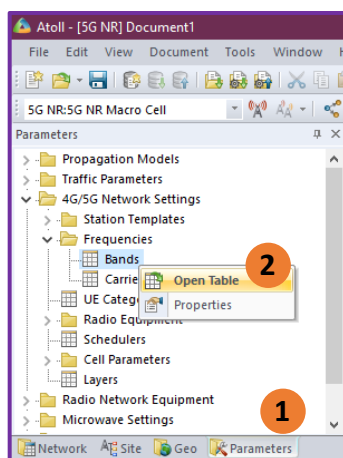
## 10. Setting equipment (4)



Transmitter Equipment: Document1			
Name	Noise Figure (dB)	DL Losses due to the configuration (dB)	UL Losses due to the configuration (dB)
Default eNode-B Equipment	4	0	0

- 1) Klik kanan pada *Transmitter Equipment* > *Open Table*
- 2) Tetapkan nilai parameter pada *Transmitter Equipment*

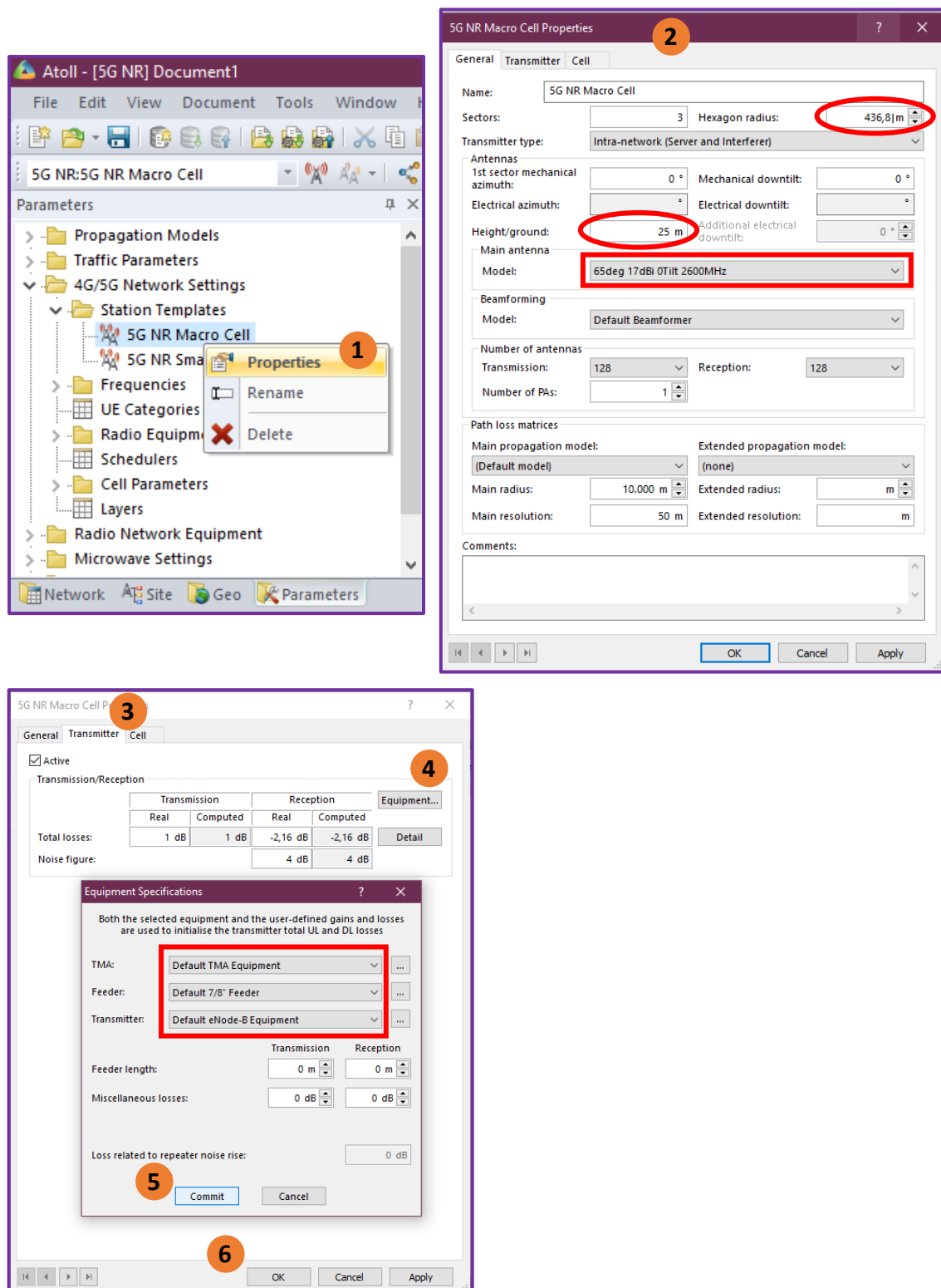
## 11. Frequency Band



Frequency Bands: Document1	
Name	Reference Frequency (MHz)
n1 / E-UTRA 1	2.110
n2 / E-UTRA 2	1.930
n20 / E-UTRA 20	791
n257	26.500
n258	24.250
n260	37.000
n28 / E-UTRA 28	758
n3 / E-UTRA 3	1.805
n41 / E-UTRA 41	2.496
n5 / E-UTRA 5	869
n66 / E-UTRA 66	2.110
n7 / E-UTRA 7	2.620
n78	3.300
n8 / E-UTRA 8	925

- 1) Pilih tab *Parameters*
- 2) Klik kanan pada *Bands* > *Open Table*
- 3) Tetapkan nilai parameter pada *Frequency Bands*

## 12. Setting Station Template

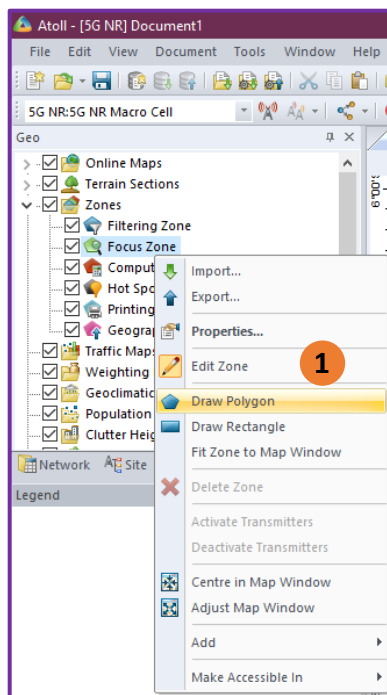


- 1) Pilih tab *Parameters* > Klik kanan *5G NR Macro Cell* > *Properties*
- 2) Isi data pada Tab *General*
- 3) Klik Tab *Transmitter* > *Equipment*
- 4) Isi spesifikasi pada *Equipment*
- 5) Klik *Commit*
- 6) Klik *Apply* > OK



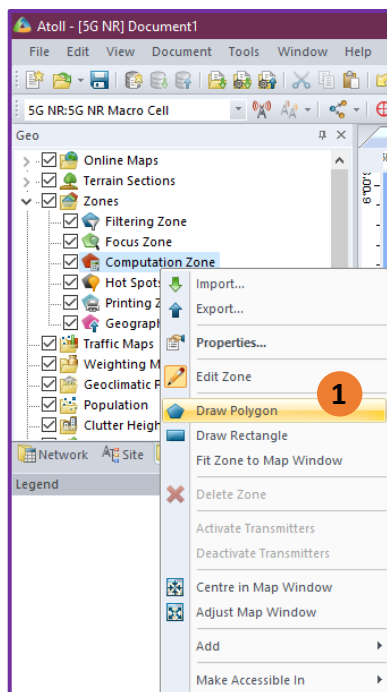
### 13. Drawing Polygon Zone

#### 1) Focus Zone



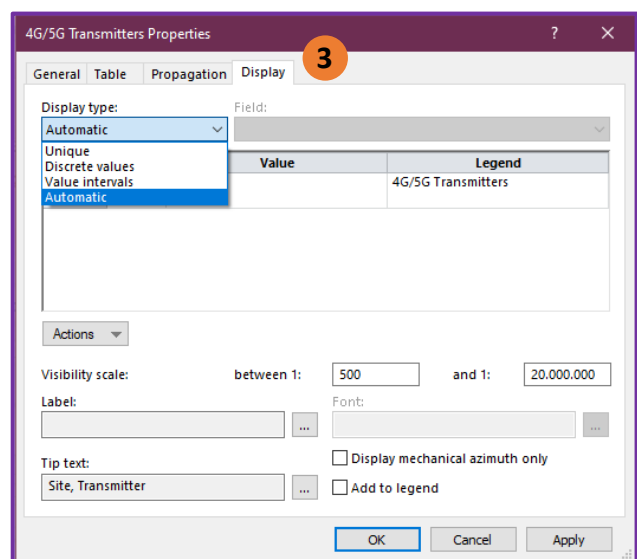
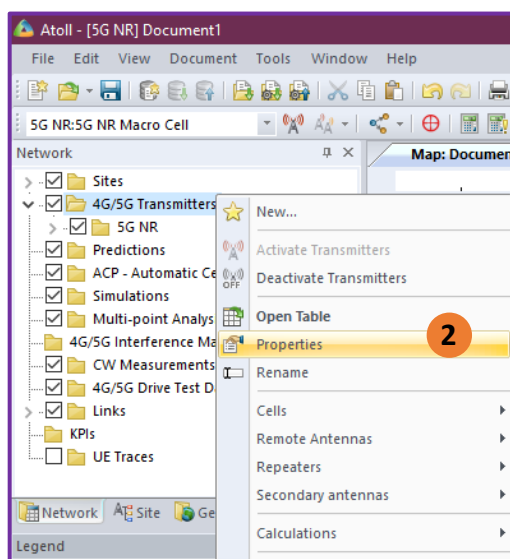
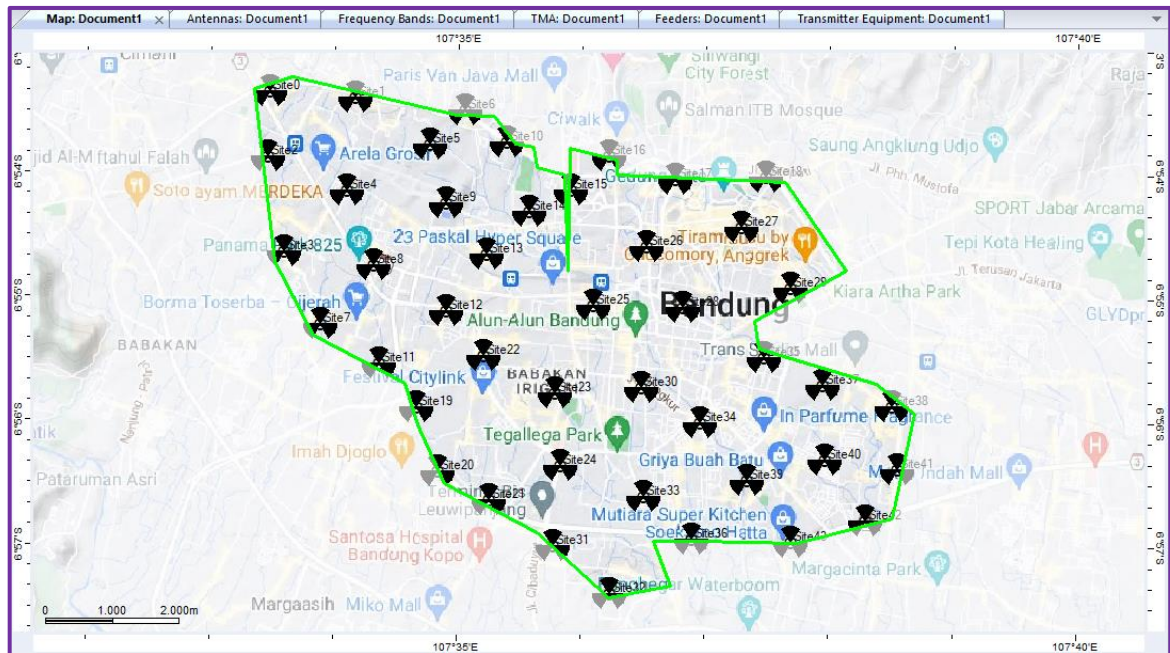
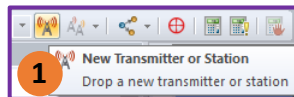
Pilih Tab Geo > Klik kanan pada *Focus Zone* > Pilih *Draw Polygon* > Gambar *Focus Zone* di map.

#### 2) Computation Zone

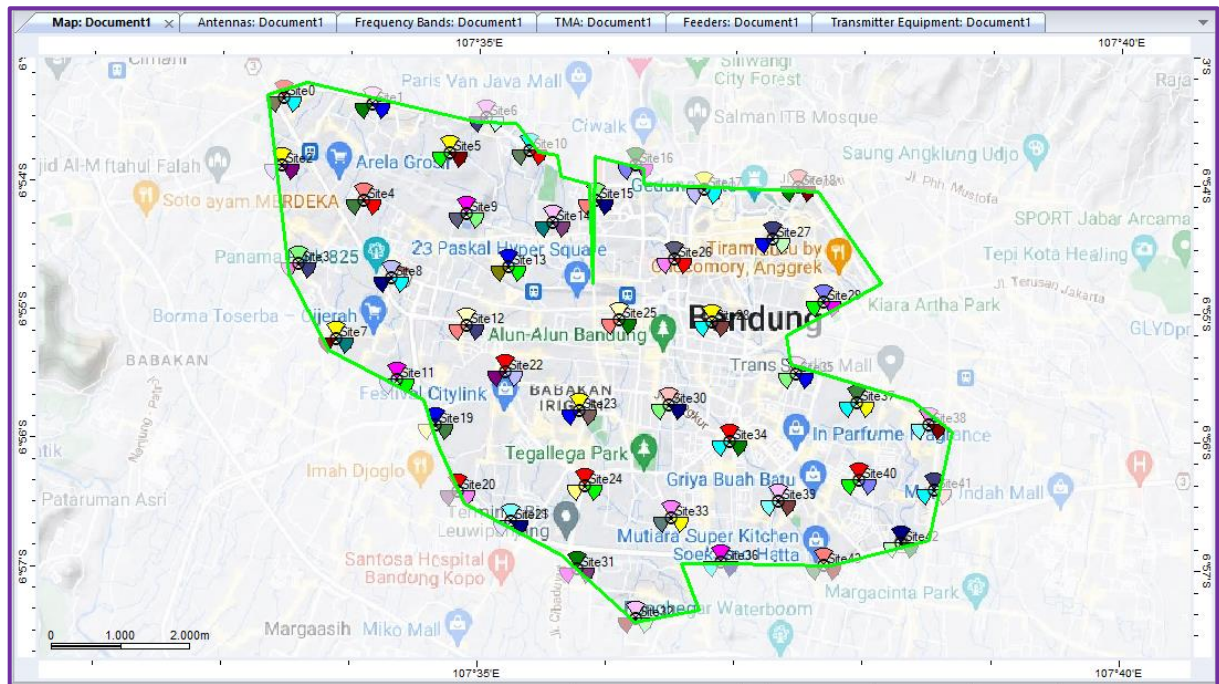


Pilih Tab Geo > Klik kanan pada *Computation Zone* > Pilih *Draw Polygon* > Gambar *Computation Zone* di map.

## 14. Plotting Site

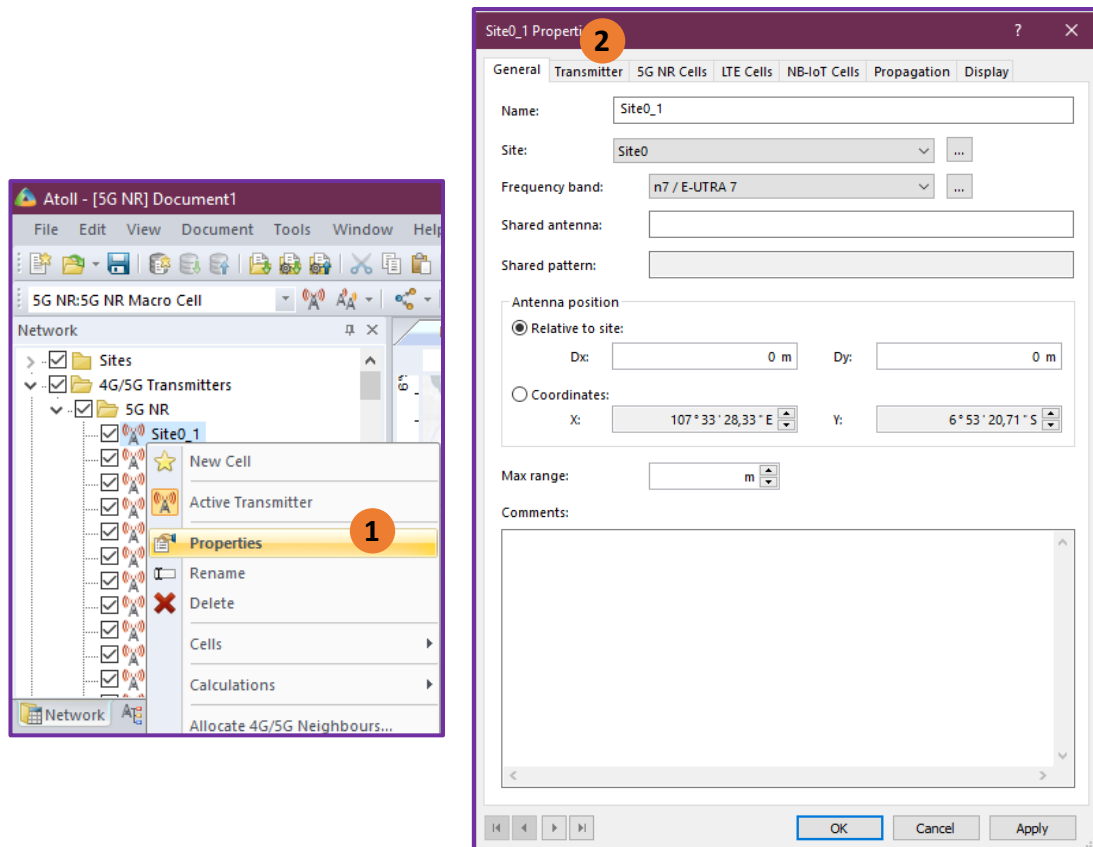






- 1) Klik *New Transmitter or Station* > Plot di peta wilayah yang akan direncanakan
- 2) Berikan beberapa warna > Klik kanan pada 4G/5G Transmitters > *Properties* > *Display* > *Display type*
- 3) Klik OK

## 15. Transmitter



Site0\_1 Properties **3**

General Transmitter 5G NR Cells LTE Cells NB-IoT Cells Propagation Display

☒ Active Transmitter type: Intra-network (Server and Interferer)

Transmission/Reception

	Transmission		Reception		Equipment...
	Real	Computed	Real	Computed	
Total losses:	2,5 dB	2,5 dB	-1,96 dB	-1,96 dB	Detail
Noise figure:			4 dB	4 dB	

Antennas

Height/ground: 25 m

Antenna model and parameters

Broadcast: 65deg 17dBi OTilt 2600MHz

Beamforming:

Mechanical azimuth: 0° Mechanical downtilt: 0°

Electrical azimuth: 0° Electrical downtilt: 0°

Additional electrical downtilt: 0°

Number of antennas

Transmission: 64 Reception: 64

Number of PAs: 1

Secondary antennas

Antenna	Azimuth (°)	Mechanical Downtilt (°)	Additional Electrical Downtilt (°)
*			

OK Cancel Apply

1) Klik kanan pada jenis *site* > *Properties*

2) Klik Tab *General*

3) Klik Tab *Transmitter*

## 16. Transmitter

Equipment Specifications **1**

Both the selected equipment and the user-defined gains and losses are used to initialise the transmitter total UL and DL losses

TMA: Default TMA Equipment

Feeder: Default 7/8" Feeder

Transmitter: Default eNode-B Equipment

Feeder length:

Transmission	Reception
25 m	25 m

Miscellaneous losses:

Transmission	Reception
0 dB	0 dB

Loss related to repeater noise rise: 0 dB

Commit Cancel

Site0\_1 Properties **2**

General Transmitter 5G NR Cells LTE Cells NB-IoT Cells Propagation Display

Main matrix

Propagation model: (Default model)

Radius: 4,000 m

Resolution: 50 m

Extended matrix

Propagation model: (none)

Radius: m

Resolution: m

Available results:

Locked: ☐

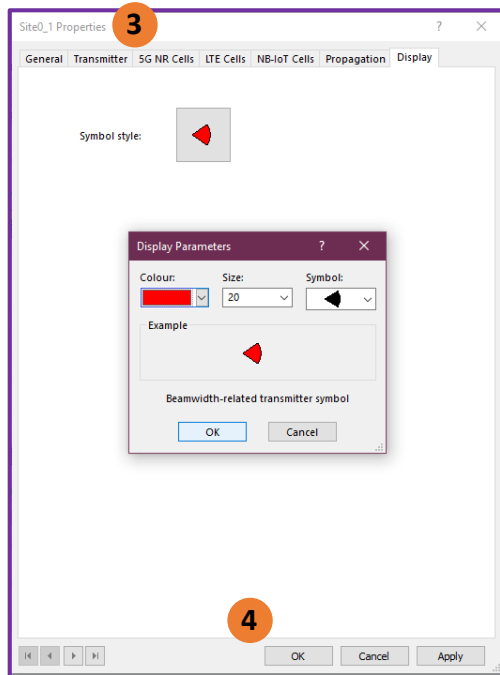
Valid: No

Reason for invalidity:

Size:

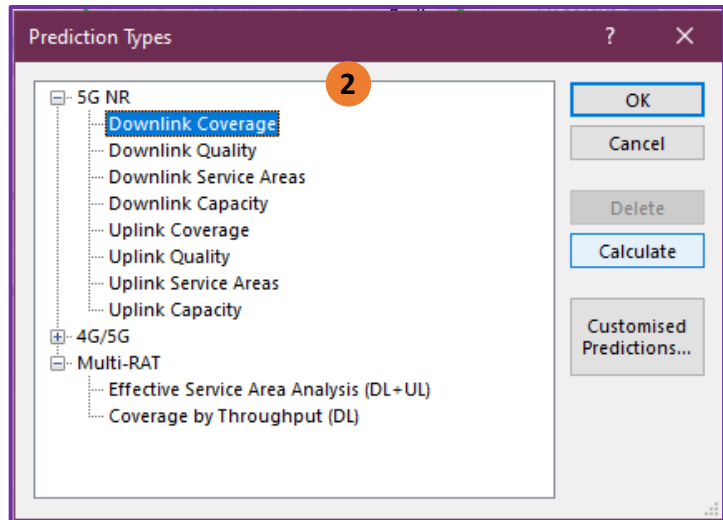
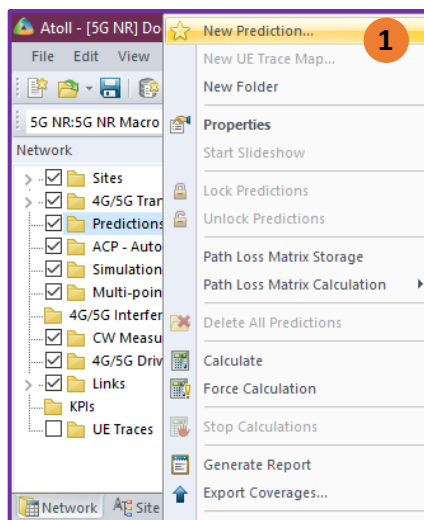
File: No available result

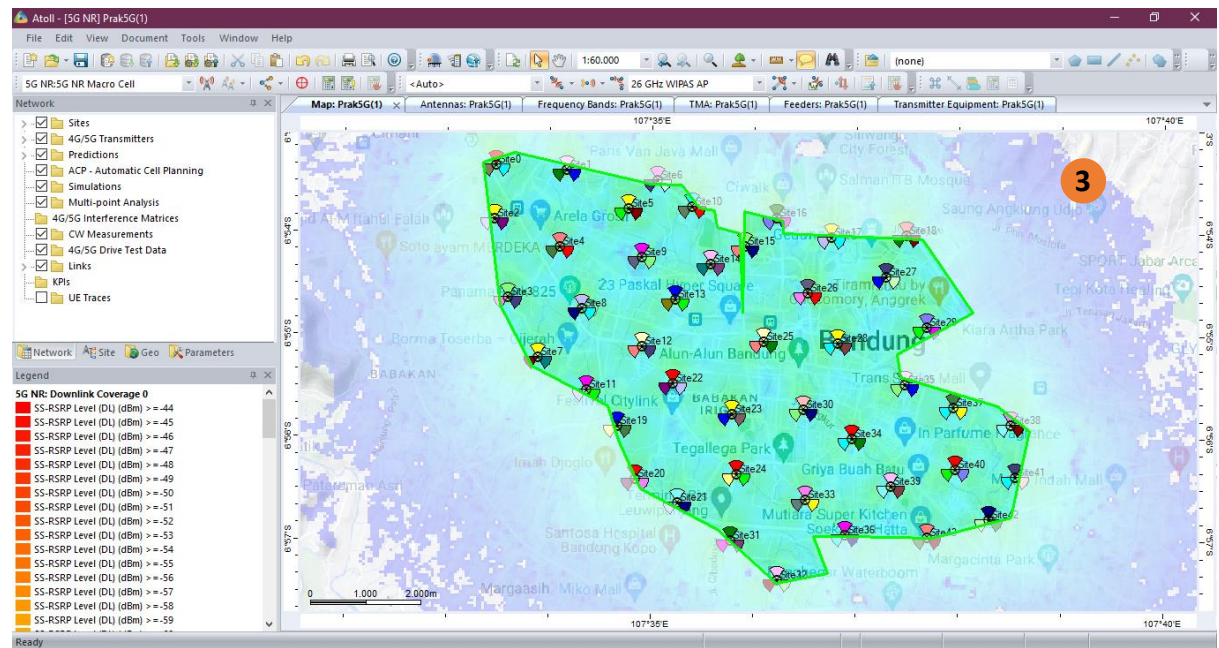
OK Cancel Apply



- 1) Klik *Equipment* pada Tab *Transmitter* > Isi spesifikasi pada *Equipment* > *Commit*
- 2) Klik Tab *Propagation* > Pilih *Propagation Model*
- 3) Klik Tab *Display* > Simbol > OK
- 4) *Apply* > OK

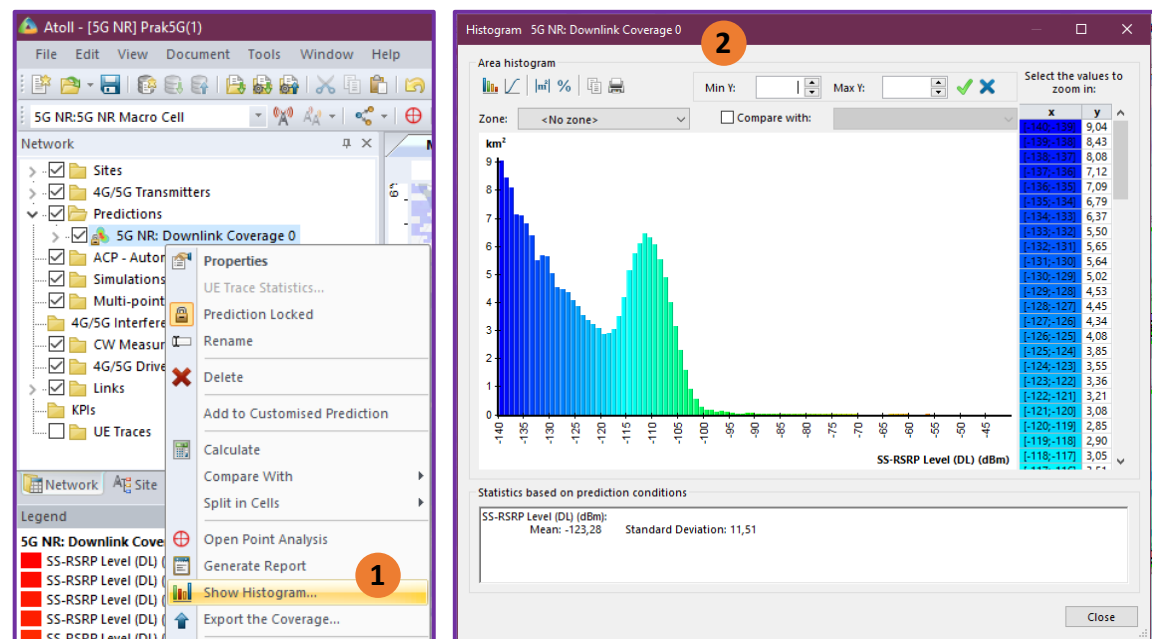
#### 17. Make a Prediction (SS-RSRP)





- 1) Klik kanan *Prediction* > *New Prediction*
- 2) Choose *Prediction* > *Calculate* > OK
- 3) Hasil

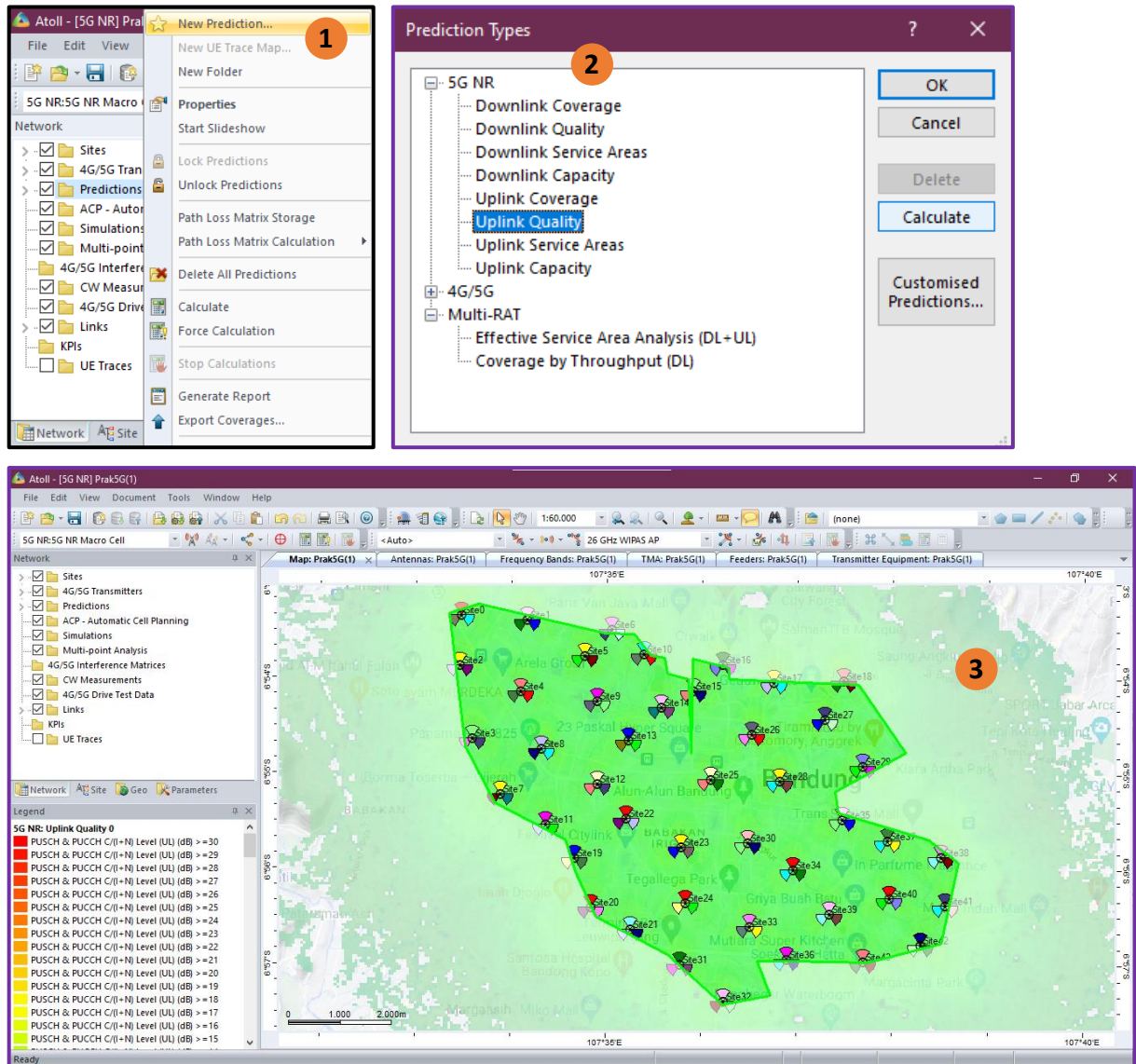
## 18. Make a Prediction (SS-RSRP)



- 1) Klik kanan *Downlink Coverage* > *Show Histogram*
- 2) Hasil

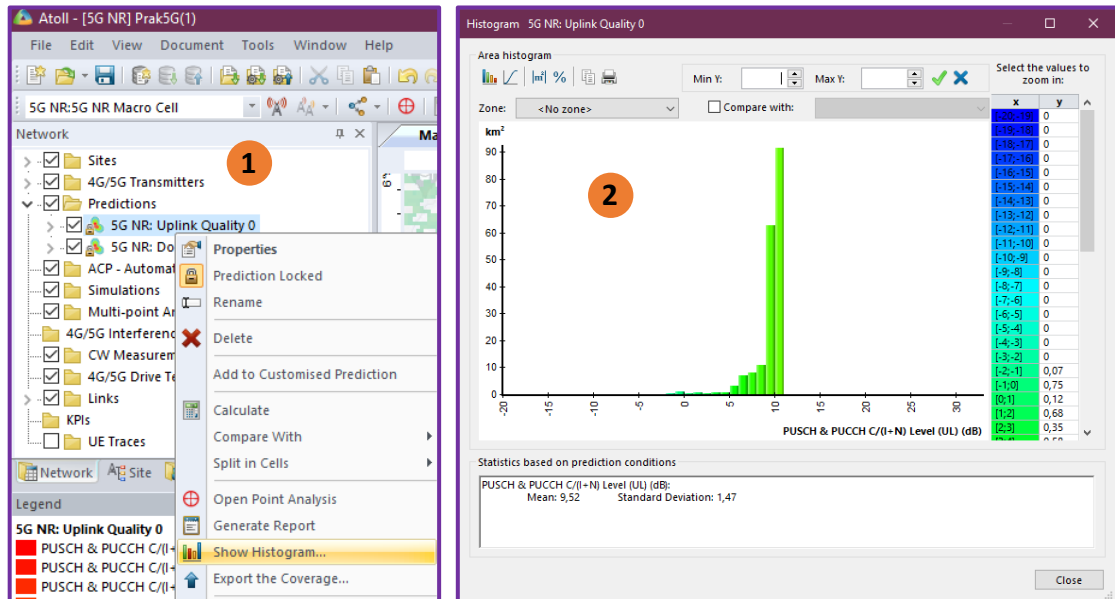


## 19. Make a Prediction (SS-SINR)



- 1) Klik kanan *Prediction* > *New Prediction*
- 2) *Choose Prediction* > *Calculate* > OK
- 3) Hasil

## 20. Make a Prediction (SS-SINR)



1) Klik kanan *Uplink Quality* > *Show Histogram*

2) Hasil

## 21. KPI

SS-RSRP	Grade
$x < -115$ dBm	<i>Unusable</i>
$-100 > x \geq -115$ dBm	<i>Fair to Poor</i>
$-80 > x \geq -100$ dBm	<i>Good</i>
$x \geq -80$ dBm	<i>Excellent</i>

SS-SINR	Grade
$x < 0$ dB	<i>Unusable</i>
$0 < x \leq 13$ dB	<i>Fair to Poor</i>
$13 < x \leq 20$ dB	<i>Good</i>
$x > 20$ dB	<i>Excellent</i>