East West University

Department of CSE

Lab Report 02

CSE 453

Wireless Networking

Submitted To:

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Planning Terrestrial Radio Networks

Part 2

Providing my solutions:

1. **Antenna height, type and orientation for each transmitter and receiver.**

   Ans: Here, A, B = transmitter & C, D = receiver
   Antenna gain: 13dBi for all.

   For A, antenna type: yagi.ant
   Antenna height: 100 meters
   Orientation: A to D

   For B, antenna type: yagi.ant
   Antenna height: 100 meters
   Orientation: B to C

   For C, antenna type: yagi.ant
   Antenna height: 25 meters
   Orientation: C to B

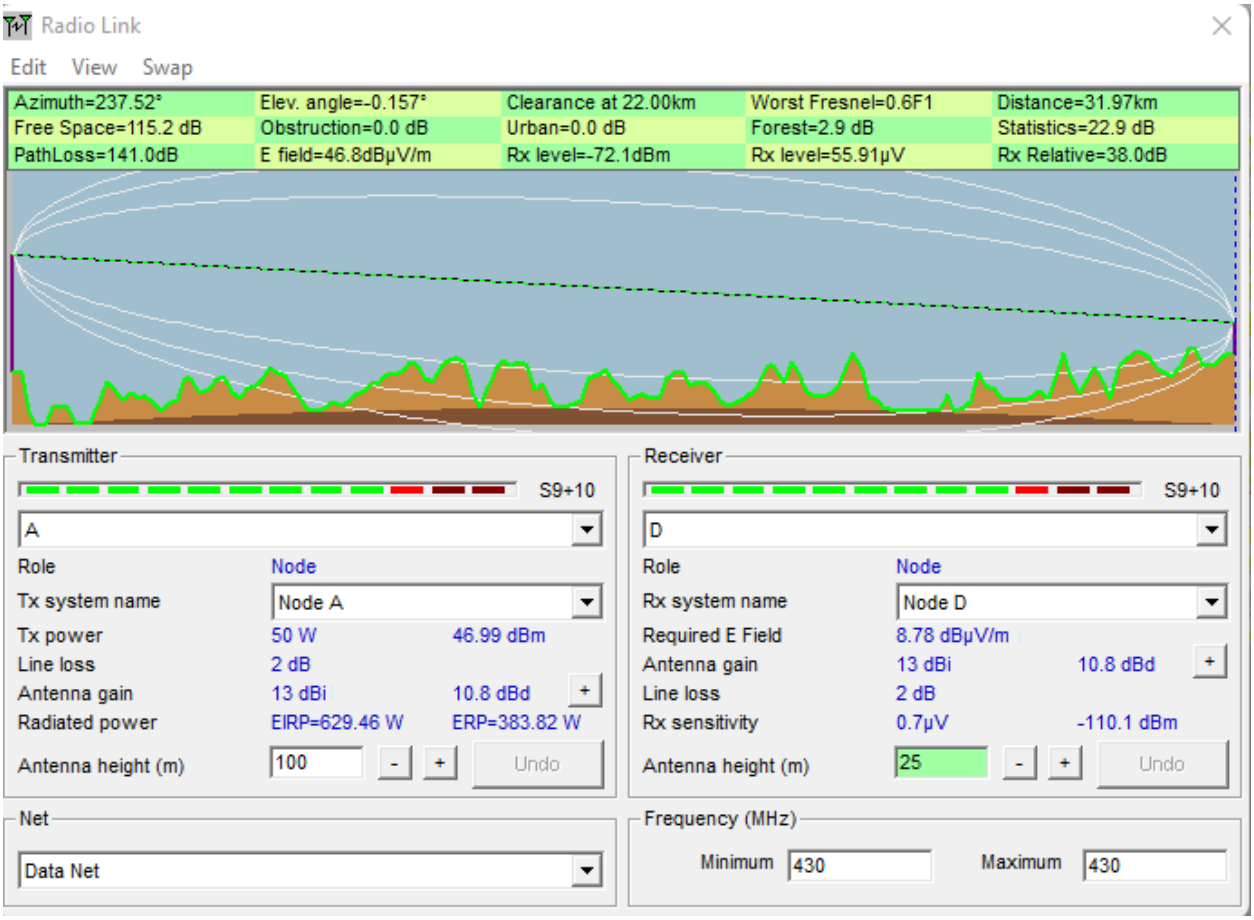
   For D, antenna type: yagi.ant
   Antenna height: 25 meters
   Orientation: D to A

2. **EIRP for each transmitter.**

   Ans: A & B is transmitter.
   We know, EIRP= P_t- L_C +G_A
   Pt= transmitted power
   Lc= Line loss
   Ga= Antenna gain
   For A,
   $EIRP_A$ (dBm)= P_t- L_C +G_A
   = 46.99-2+13
   = 57.99 dBm = 58 dBm

   $EIRP_A$ (KW) = (10^ (58/10))/1000 W = 630.957 W
   = 0.630 KW

Which is same as the result we saw from the output EIRP screenshot below.



For B,

$EIRP_B$ (dBm)= P_t- L_C +G_A

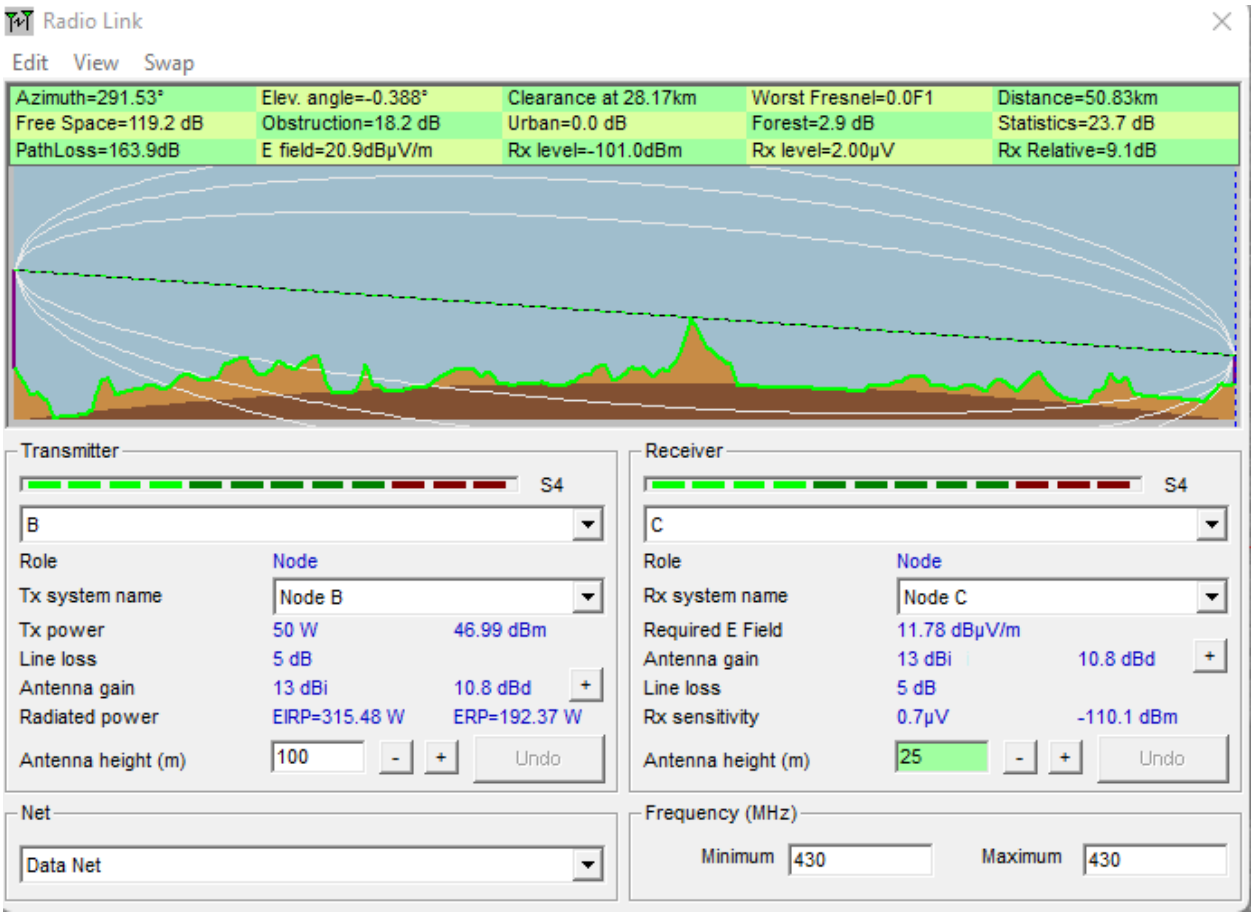
= 46.99-5+13

= 54.99 dBm = 55 dBm

$EIRP_B$ (KW)= (10^ (55/10))/1000 W = 316.227 W

= 0.316 KW

Which is same as the result we saw from the output EIRP screenshot below.



3. **Numerically show that SIR is greater than 10dB at both receivers. Note that you do not need to calculate the received powers analytically in order to do this task. Simply use the signal and interference levels that you obtained in your simulation results. Also, be careful about the units when you calculate the signal-to-interference ratio.**

Ans:
From our results of radio link we saw,
From A to D Rx level is: -72 dBm
And B to D Rx level is: -93 dBm
B is interference on AD.
AD= AD-BD= -72.1-(93.7) =21.6 >10

Again,
From B to C Rx level is: -101 dBm
And A to C Rx level is: -112.3 dBm

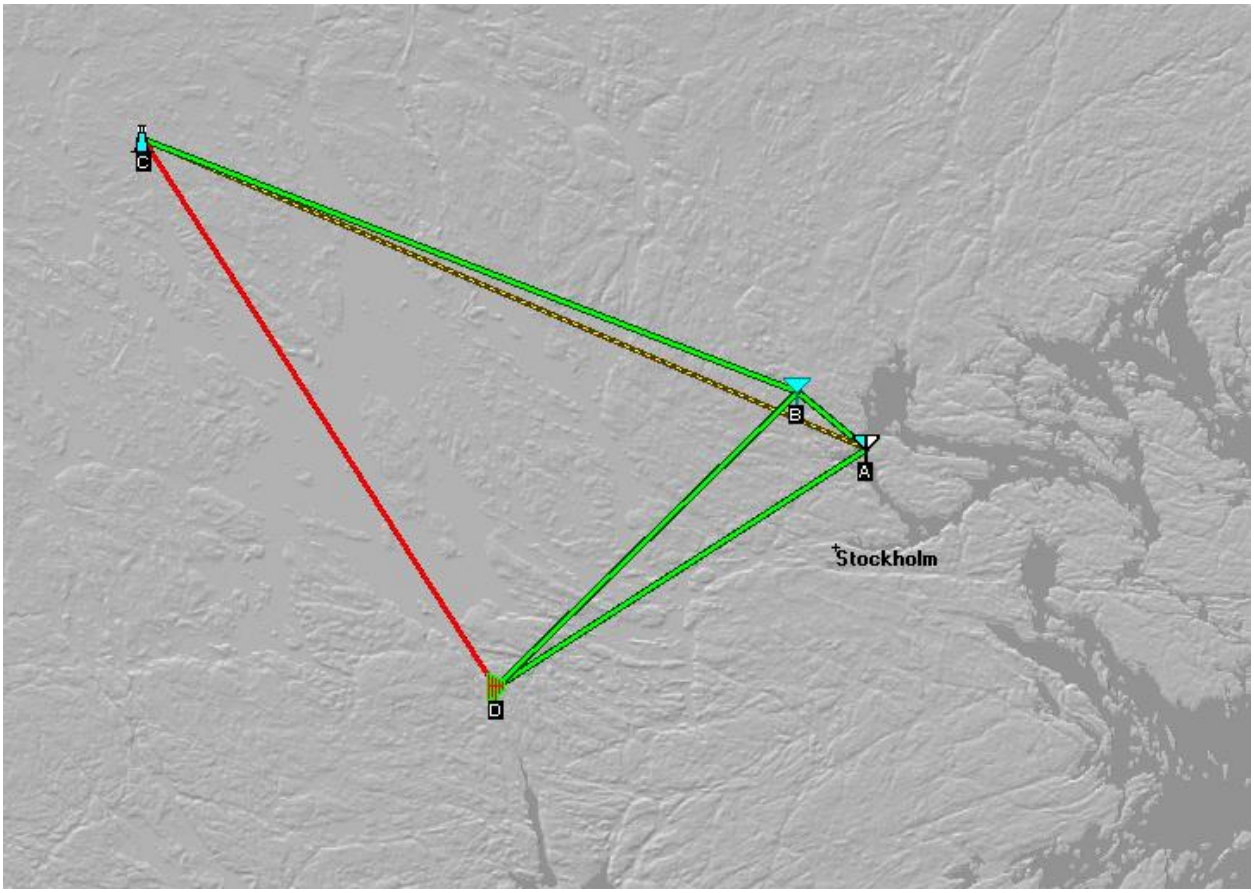
A is interference on BC.
BC= BC-AC= -101-(-112.3) =11.3 >10

So, we see the signal to interference ratio, SIR for both AD and BC is 21.6 dB and 11.3 which is greater than 10dB. [showed]

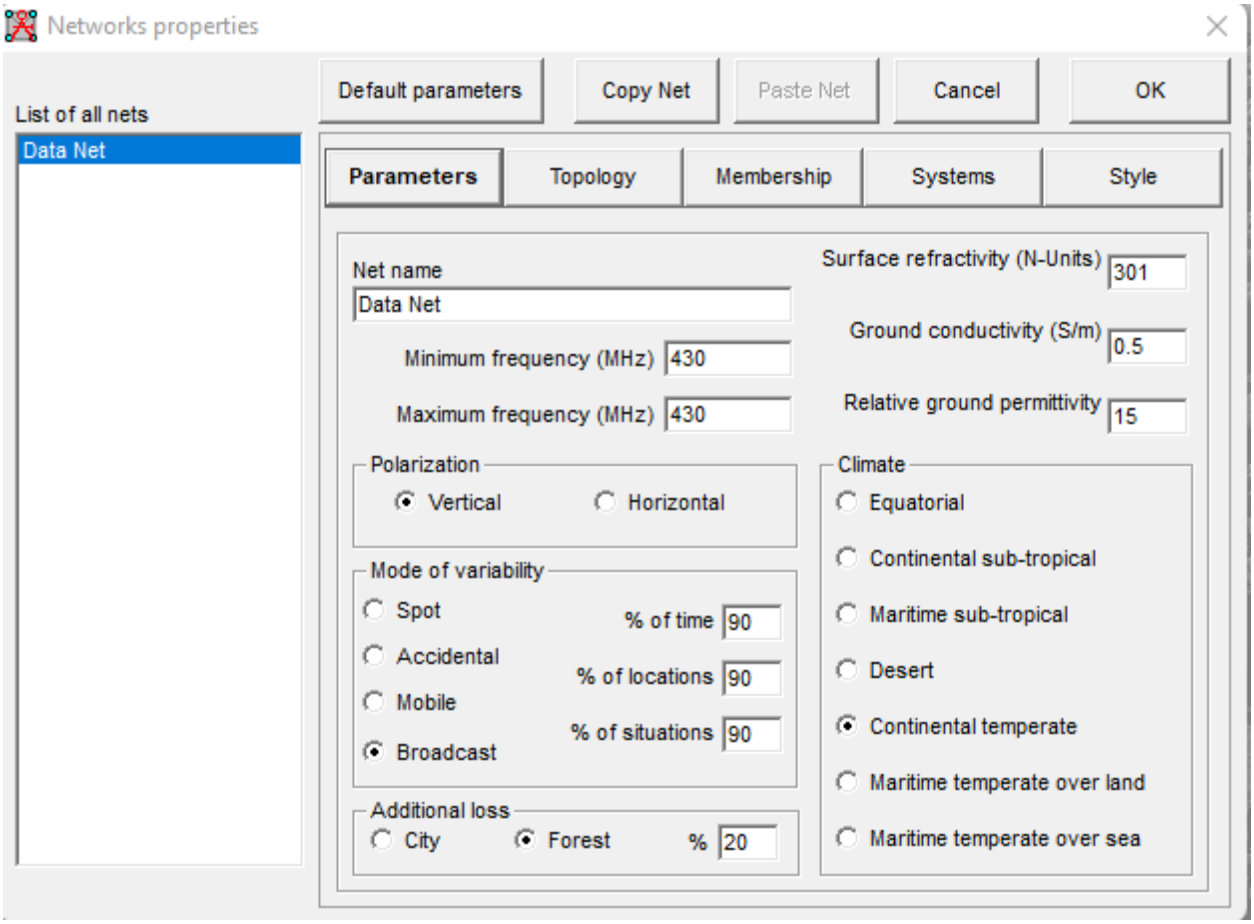
4. **Briefly explain your solution method and results. In your explanation, use the screenshots of Radio Link profiles of both links and Interference plots at both receivers.**

Ans: Solution method steps are given below:

- First open network-ex-interf.net
- Then go to new picture, click on grayscale slope and draw
- Check show network—all

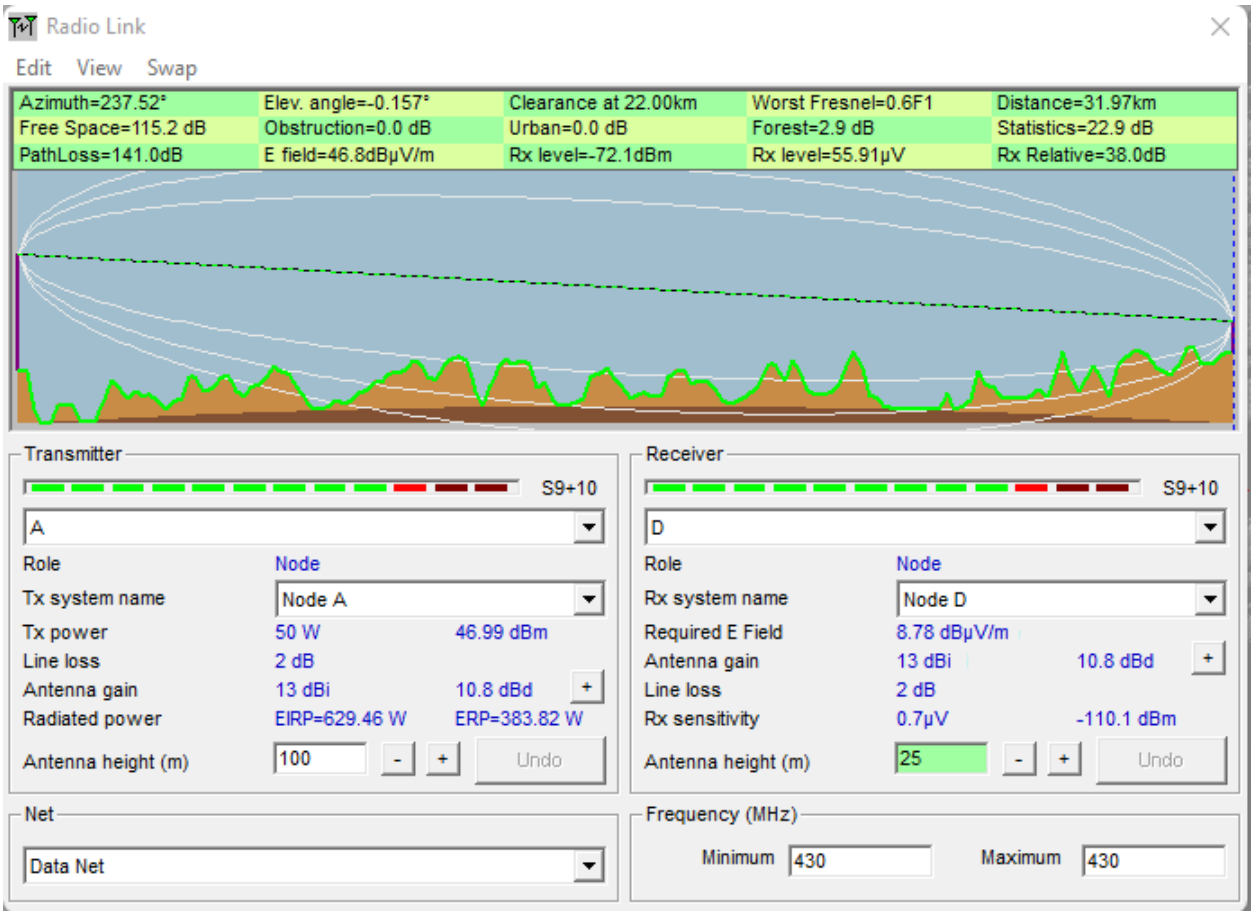


- Then go to the network properties and parameters.
- Make net name: data net, polarization: vertical, mode of variability: broadcast, additional loss, forest: 20%



- Now go to the systems & make 4 nodes named: node A, node B (for transmitter), node C, node D (for receiver)
- Here, some default parameters for all nodes:
  Transmit power= 50 Watt
  Receiver threshold= 0.7 uV
  Line loss= 2dB
  Antenna type= yagi.ant
- Now make some changes on antenna height.
  Make node A, B height 100 meter
  & C, D height 25 meter.
- Then go to the membership & click list of all units: A, B, C, D.
- Set the orientations for each nodes means change the antenna direction.
- Then go to the tools--- radio link.
- Check A to D, A to C, B to C, B to D. Here we can see some solutions like: Tx and Rx power, line loss, antenna gain, EIRP.

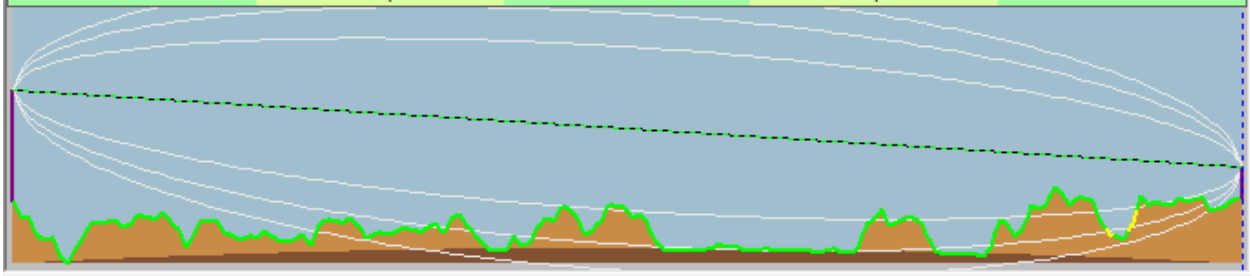
Radio link profiles screenshots are given:


Radio Link
Edit View Swap
Azimuth=237.52°
Elev. angle=-0.157°
Clearance at 22.00km
Worst Fresnel=0.6F1
Distance=31.97km
Free Space=115.2 dB
Obstruction=0.0 dB
Urban=0.0 dB
Forest=2.9 dB
Statistics=22.9 dB
PathLoss=141.0dB
E field=46.8dBµV/m
Rx level=-72.1dBm
Rx level=55.91µV
Rx Relative=38.0dB
Transmitter
S9+10
A
Role
Node
Tx system name
Node A
Tx power
50 W
46.99 dBm
Line loss
2 dB
Antenna gain
13 dBi
10.8 dBd
Radiated power
EIRP=629.46 W
ERP=383.82 W
Antenna height (m)
100
Undo
Receiver
S9+10
D
Role
Node
Rx system name
Node D
Required E Field
8.78 dBµV/m
Antenna gain
13 dBi
10.8 dBd
Line loss
2 dB
Rx sensitivity
0.7µV
-110.1 dBm
Antenna height (m)
25
Undo
Net
Data Net
Frequency (MHz)
Minimum
430
Maximum
430

Radio Link

Edit View Swap

Azimuth=225.82°	Elev. angle=-0.150°	Clearance at 25.94km	Worst Fresnel=0.5F1	Distance=30.62km
Free Space=114.8 dB	Obstruction=2.8 dB	Urban=0.0 dB	Forest=2.9 dB	Statistics=23.0 dB
PathLoss=143.4dB	E field=26.9dBµV/m	Rx level=-93.7dBm	Rx level=4.64µV	Rx Relative=16.4dB



Transmitter

S6

B

Role	Node	
Tx system name	Node B	
Tx power	50 W	46.99 dBm
Line loss	5 dB	
Antenna gain	-1.5 dBi	-3.6 dBd +
Radiated power	EIRP=11.19 W	ERP=6.83 W
Antenna height (m)	100 - +	Undo

Receiver

S6

D

Role	Node	
Rx system name	Node D	
Required E Field	10.5 dBµV/m	
Antenna gain	11.3 dBi	9.1 dBd +
Line loss	2 dB	
Rx sensitivity	0.7µV	-110.1 dBm
Antenna height (m)	25 - +	Undo

Net

Data Net

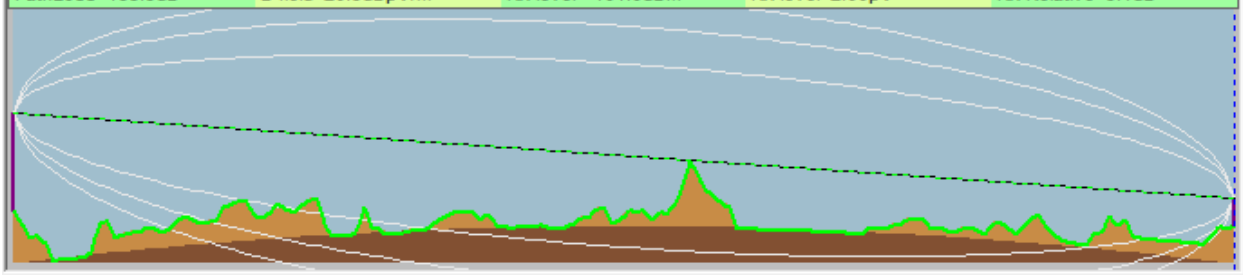
Frequency (MHz)

Minimum 430 Maximum 430

Radio Link

Edit View Swap

Azimuth=291.53°	Elev. angle=-0.388°	Clearance at 28.17km	Worst Fresnel=0.0F1	Distance=50.83km
Free Space=119.2 dB	Obstruction=18.2 dB	Urban=0.0 dB	Forest=2.9 dB	Statistics=23.7 dB
PathLoss=163.9dB	E field=20.9dBµV/m	Rx level=-101.0dBm	Rx level=2.00µV	Rx Relative=9.1dB



Transmitter

S4

B

Role	Node	
Tx system name	Node B	
Tx power	50 W	46.99 dBm
Line loss	5 dB	
Antenna gain	13 dBi	10.8 dBd +
Radiated power	EIRP=315.48 W	ERP=192.37 W
Antenna height (m)	100 - +	Undo

Receiver

S4

C

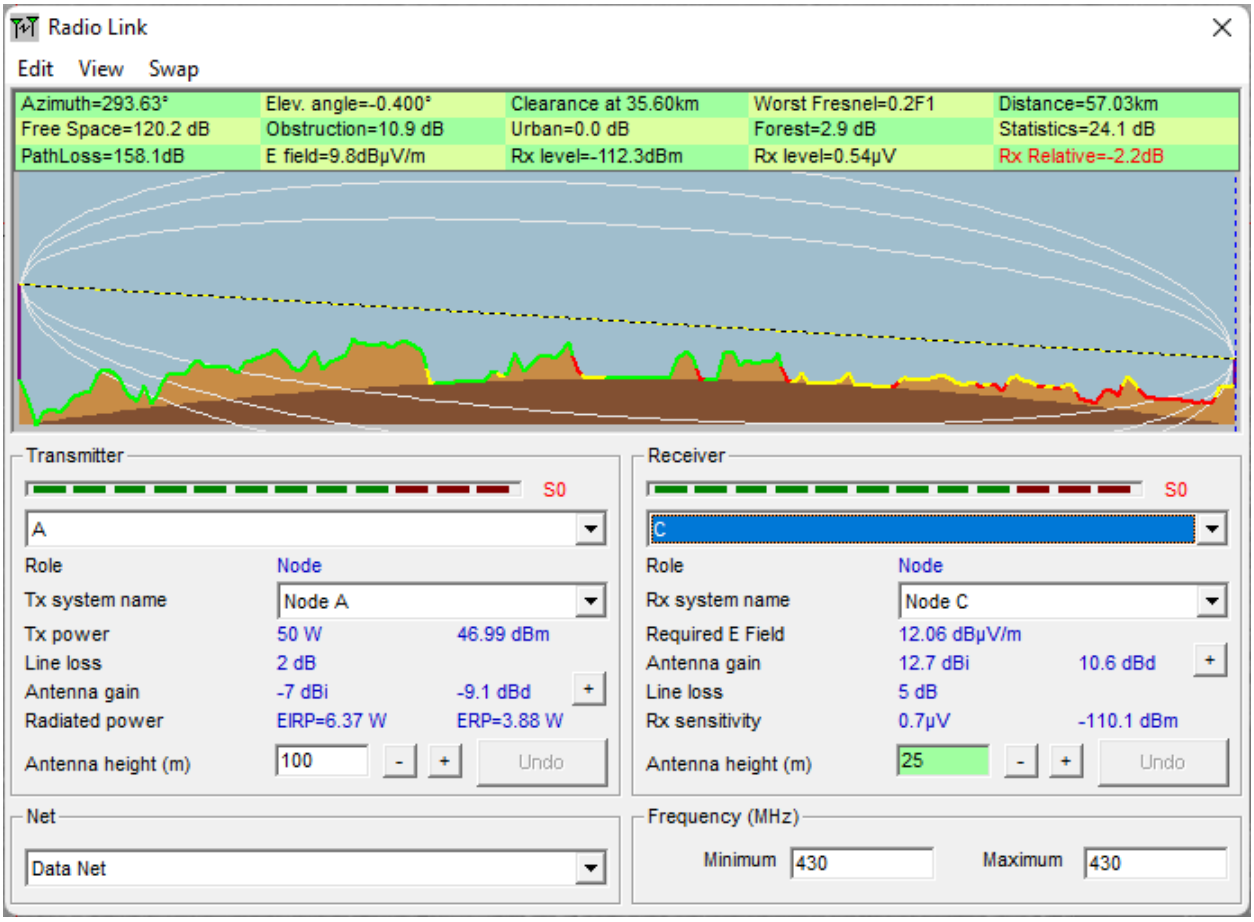
Role	Node	
Rx system name	Node C	
Required E Field	11.78 dBµV/m	
Antenna gain	13 dBi	10.8 dBd +
Line loss	5 dB	
Rx sensitivity	0.7µV	-110.1 dBm
Antenna height (m)	25 - +	Undo

Net

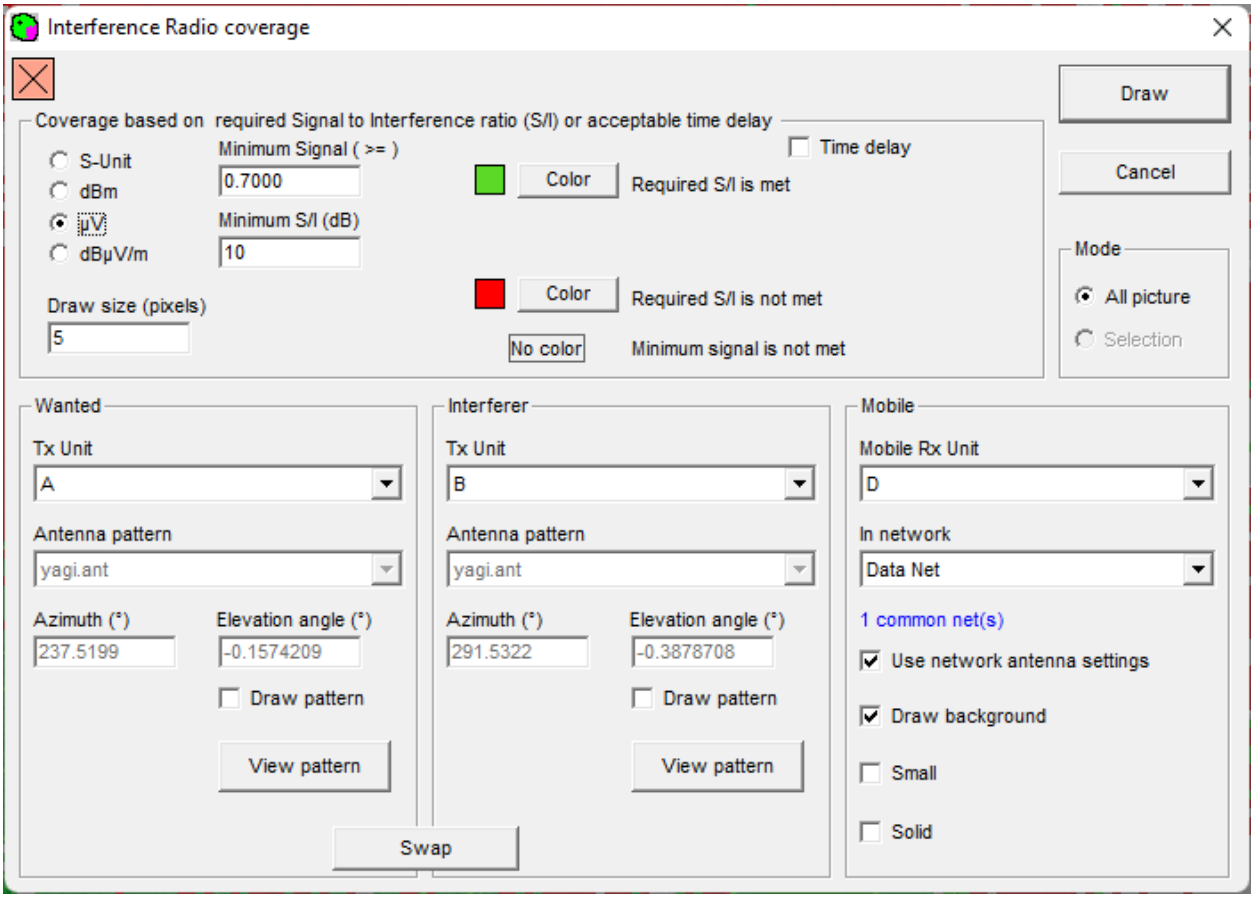
Data Net

Frequency (MHz)

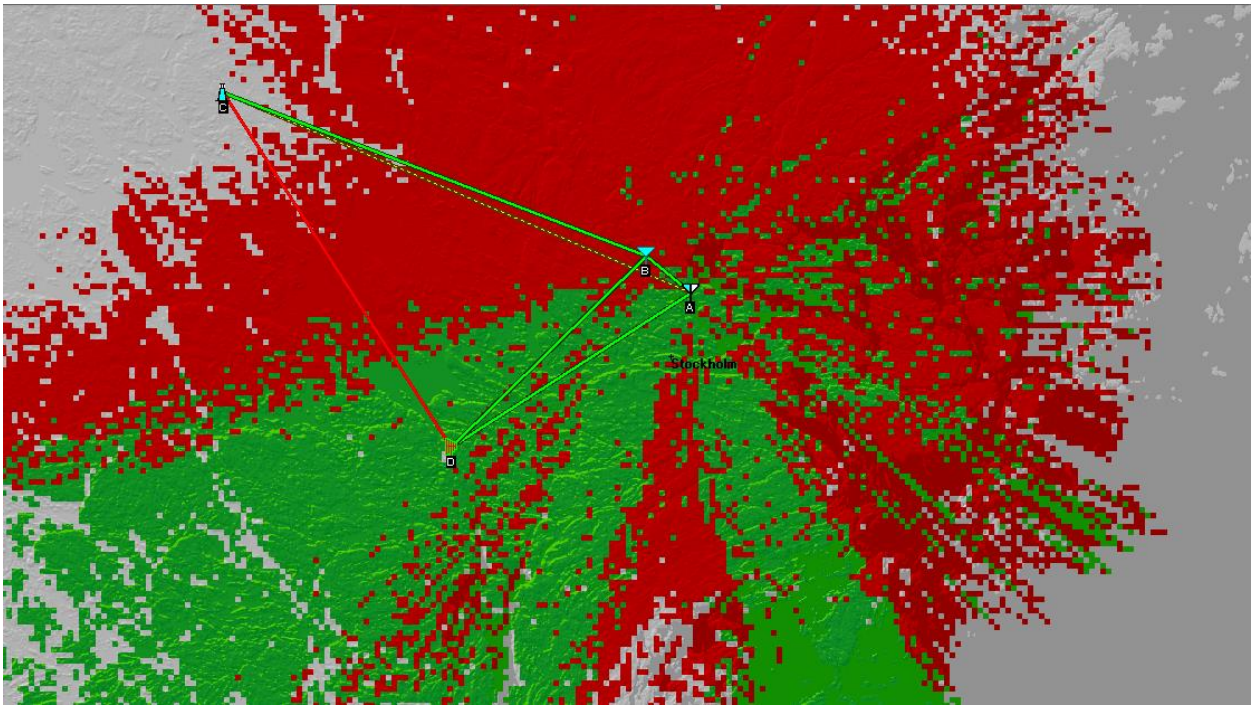
Minimum 430 Maximum 430



- Then go to tools—radio coverage—interference
- Here, first draw for Tx unit A and Rx unit D. Between A and D interference is Tx unit B. Then draw the plot.

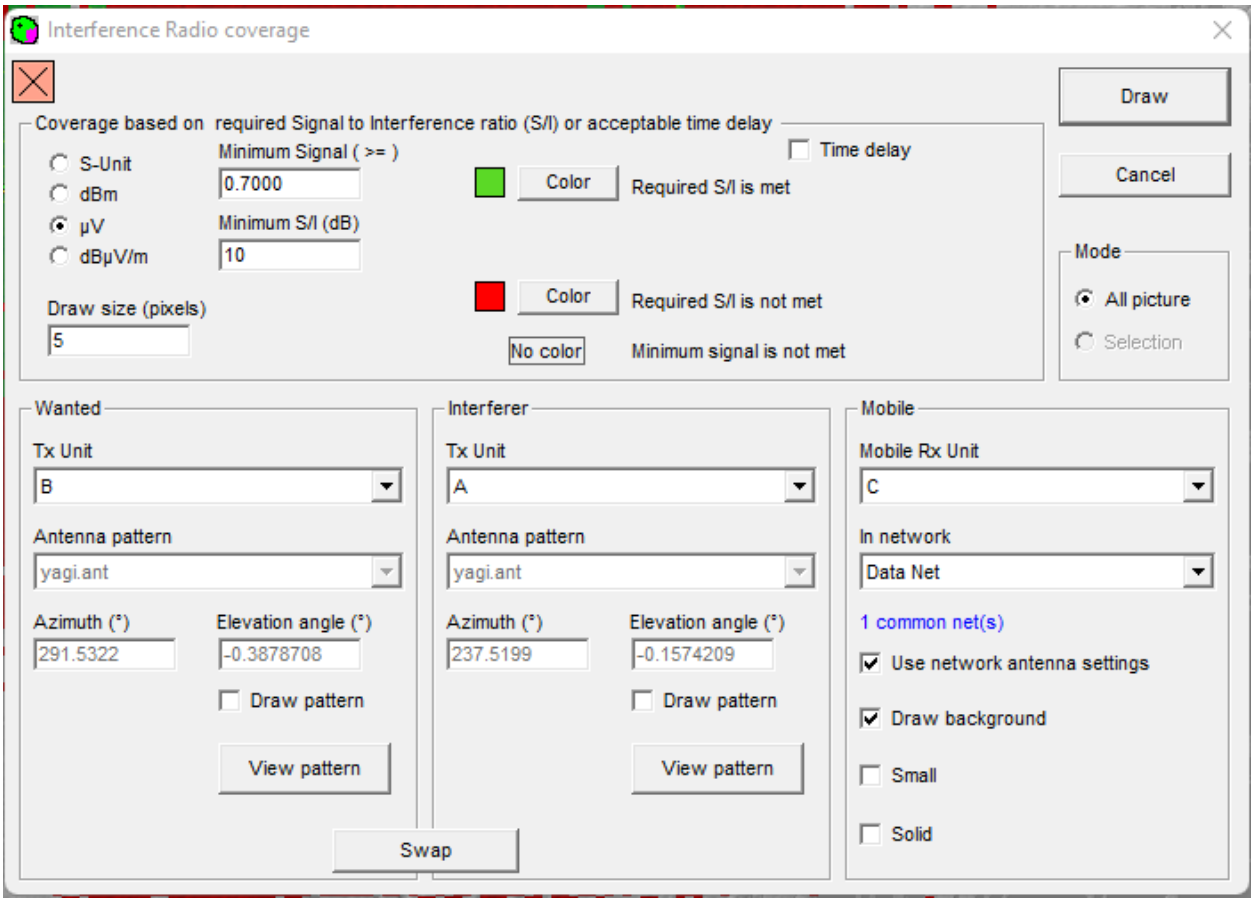


Resulting plot:

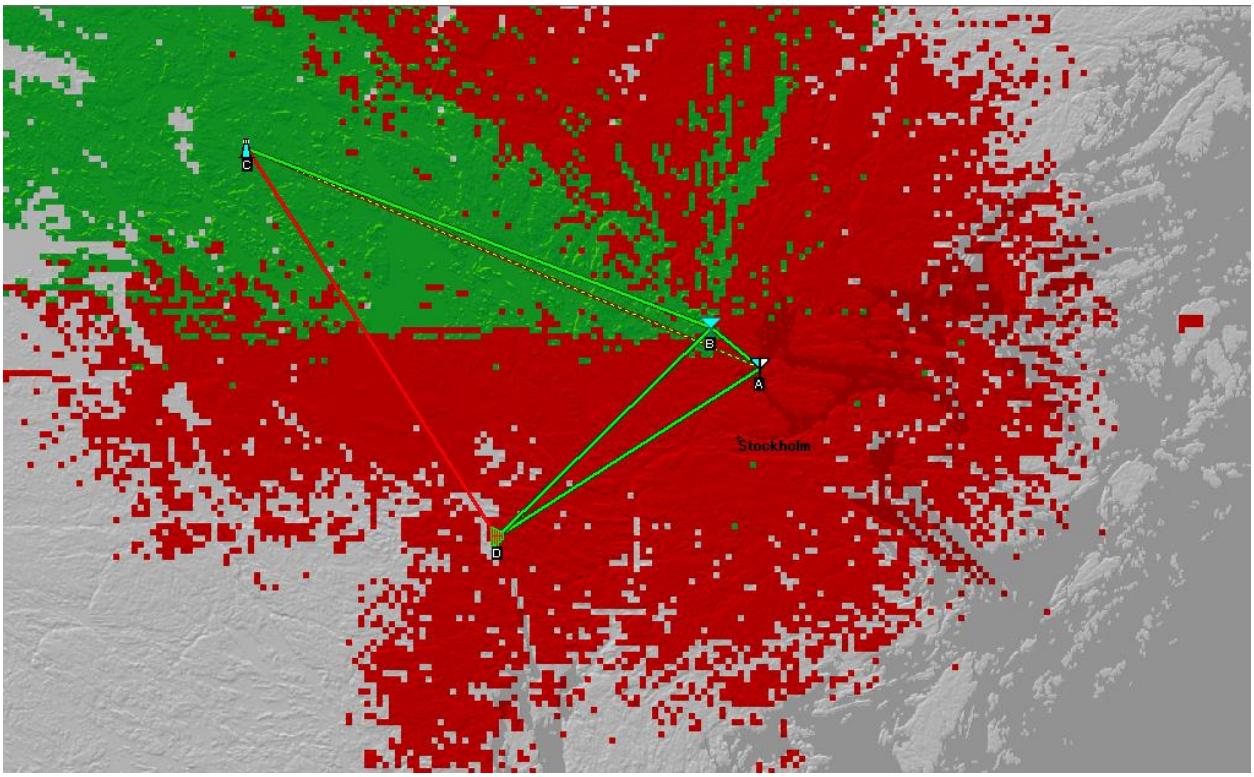


We see A to D there is green plot shows that required S/I has met.

- Now again draw new picture and go to interference radio coverage.
- Draw for Tx unit B and Rx unit C. Between B and C interference is Tx unit A. Then draw the plot.



Resulting plot:



We see B to C the green plot is the coverage area shows that required S/I has met.