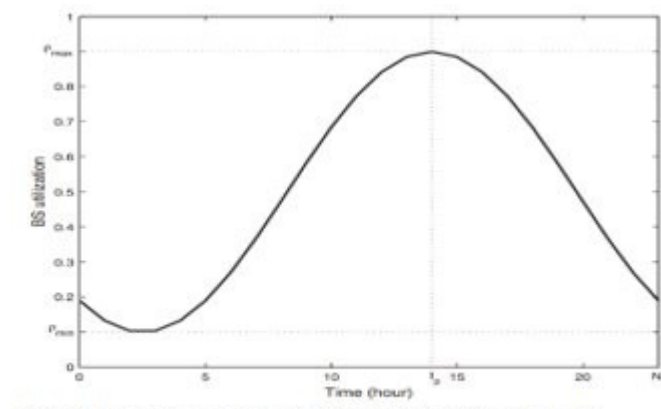


Energy Saving Use-Cases Operation

1. Energy saving with cell utilization:

by monitoring the Base Station (BS) utilization or traffic load over a 24-hour period, the graph illustrates the traffic's fluctuations throughout the day, highlighting periods of both high and low utilization.



This allows us to conserve network energy during periods of low cell utilization let show how can simulate this case in our RIC TaaP tester.

1. Make sure the FlexRIC is running in the background.
2. Set the simulation parameters as follow and press **Start new** :

IntersideDistanceUEs = 1000

IntersideDistanceCells = 500

N_UEs = 15

Connect to FlexRIC: (If true, FlexRIC need to be running) ☒

hoSinrDifference (dB): 3

IndicationPeriodicity (s): 0.1

Time (s): 30

e2TermIp: 127.0.0.1

KPM_E2functionID: 2

RC_E2functionID: 3

N_MmWaveEnbNodes: 4

N_UEs: 15

CenterFrequency (Hz): 3.5e9

Bandwidth (Hz): 20e6

IntersideDistanceUEs (m): 1000

IntersideDistanceCells (m): 500

Status: off

Start new

Stop

Reset

Warning: If there are no Cells/UEs on the grid after max 30s, please check if ns3 is running properly typing in terminal "ps -a" or "cat ns-3-mmwave-oran/ns3_run.log"

Cell energy states management:

ES status: off

Turn ES xApp on

Turn ES xApp off

Observe simulation grid

Observe KPIs

Observe ES

RIC TaaP Studio

1000 2000 3000 4000 5000 6000

UE Data

Cell Data

ue_id: 1

x_position: N/A

y_position: N/A

type: N/A

LTE_Cell: 1

ue_id: 2

x_position: N/A

y_position: N/A

type: N/A

LTE_Cell: 1

ue_id: 3

x_position: N/A

y_position: N/A

type: N/A

LTE_Cell: 1

cellId: 1

x_position: 2000

y_position: 2000

type: lte

es_state: 0

cellId: 2

x_position: 2000

y_position: 2000

type: mmwave

es_state: 0

cellId: 3

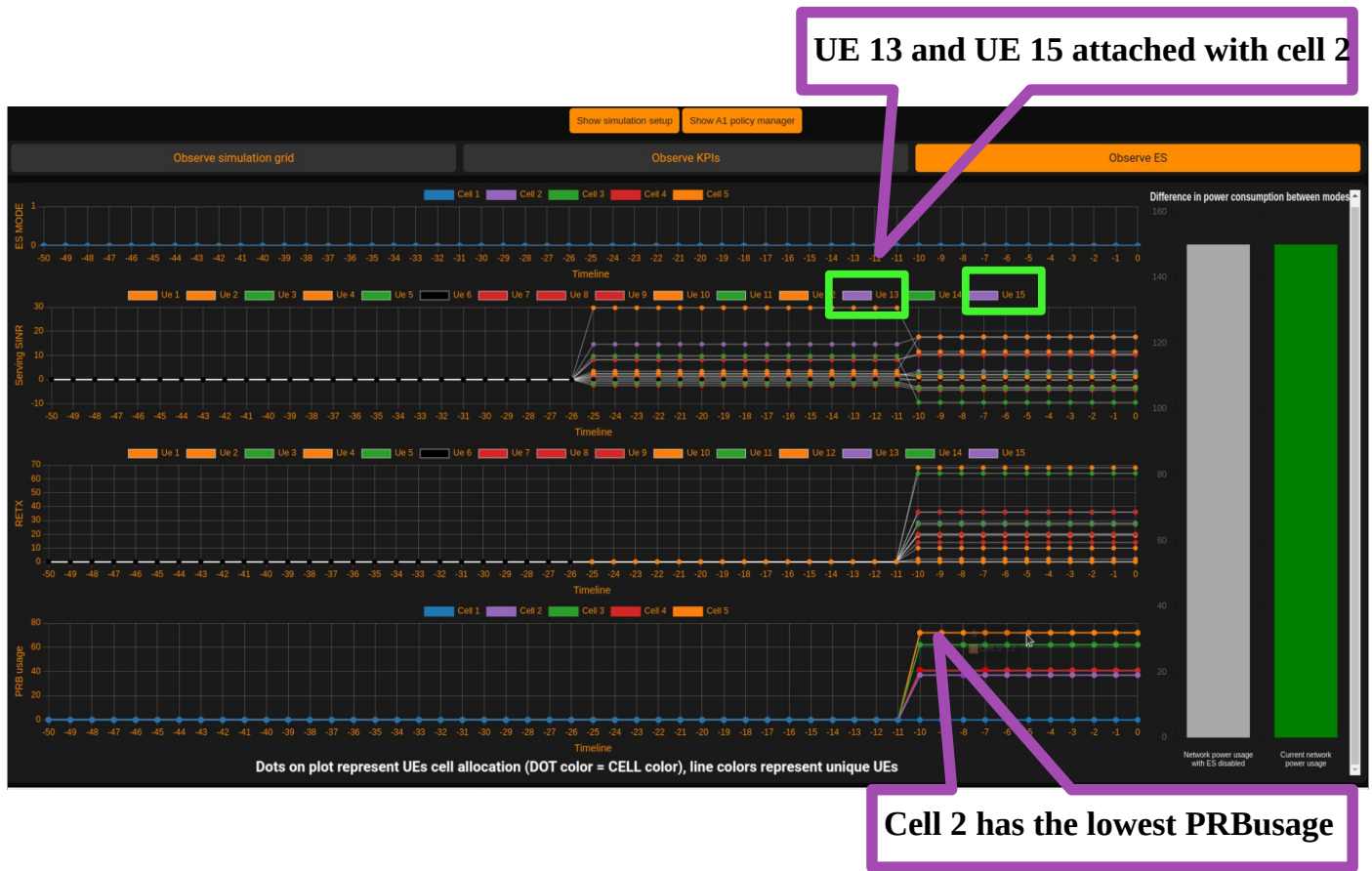
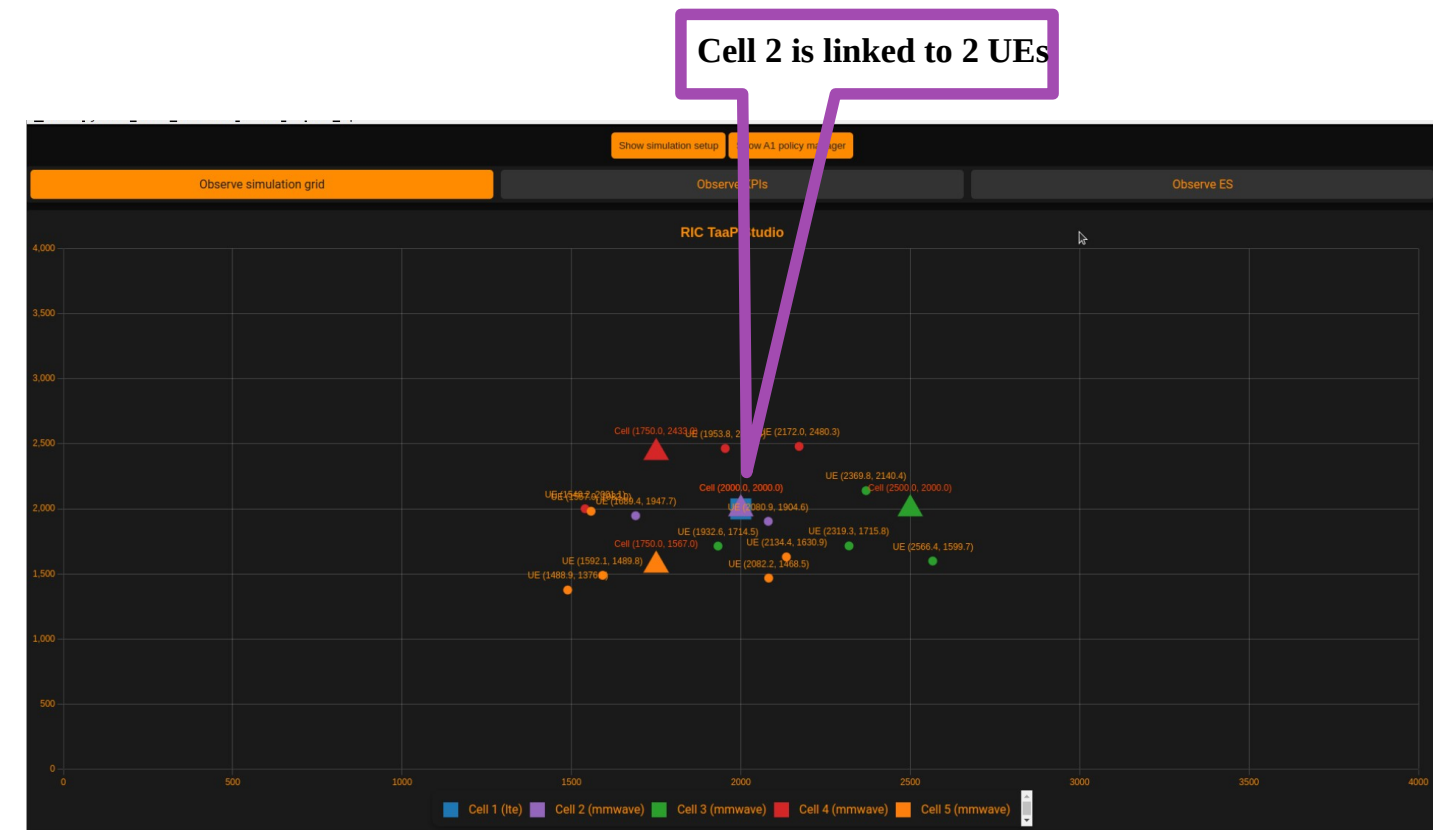
x_position: 2500

y_position: 2000

type: mmwave

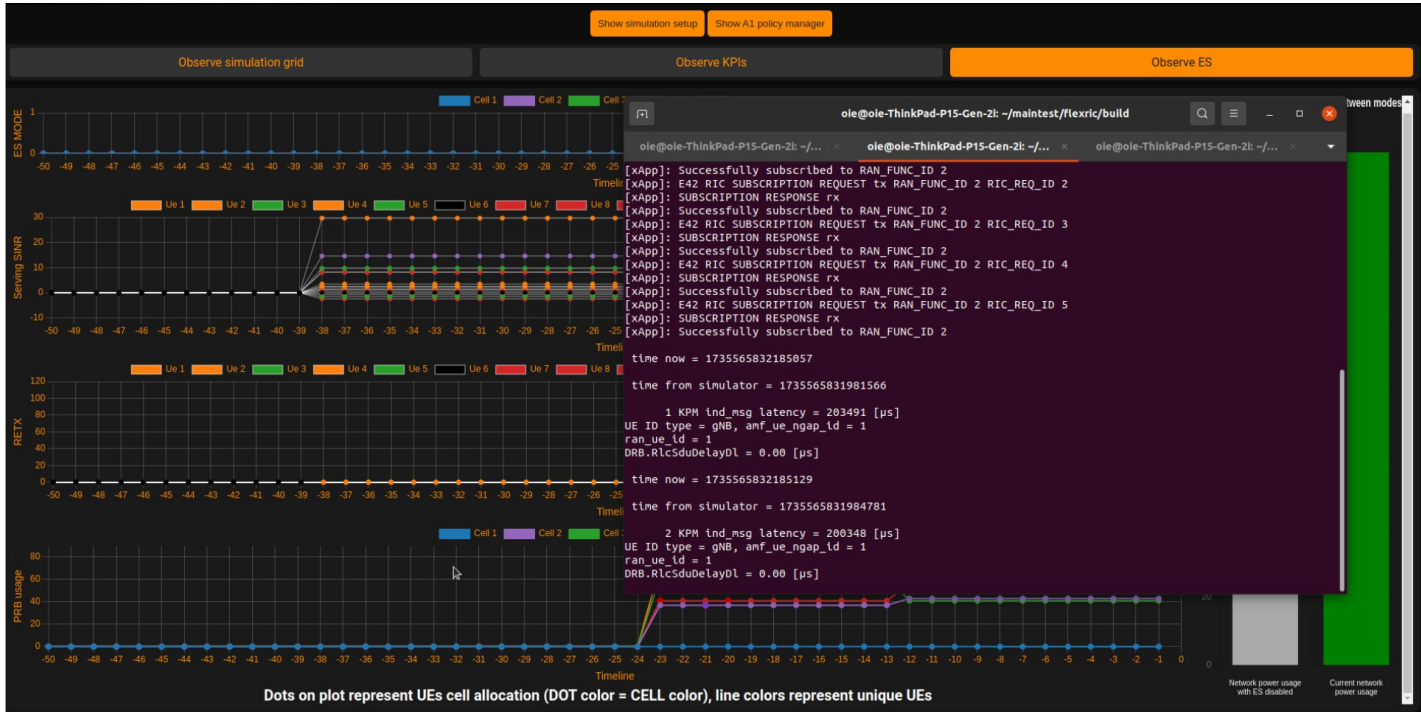
es_state: 0

after the nodes and UEs running and appear on the simulator we will notice the following:



3. run the xapp_energy_saving_with_CU by run this command on cmd

`./home/oie_project/flexric/build/example/xapp/c/ctrl/xapp_energy_saving_with_CU`



What is the action of xapp ?

The xApp will send a RIC control message to Cell 2, instructing it to move the two UEs attached to it to the nearest cells and then turn off it. Let us demonstrate this action in the following:

UE 15 attached with cell 5

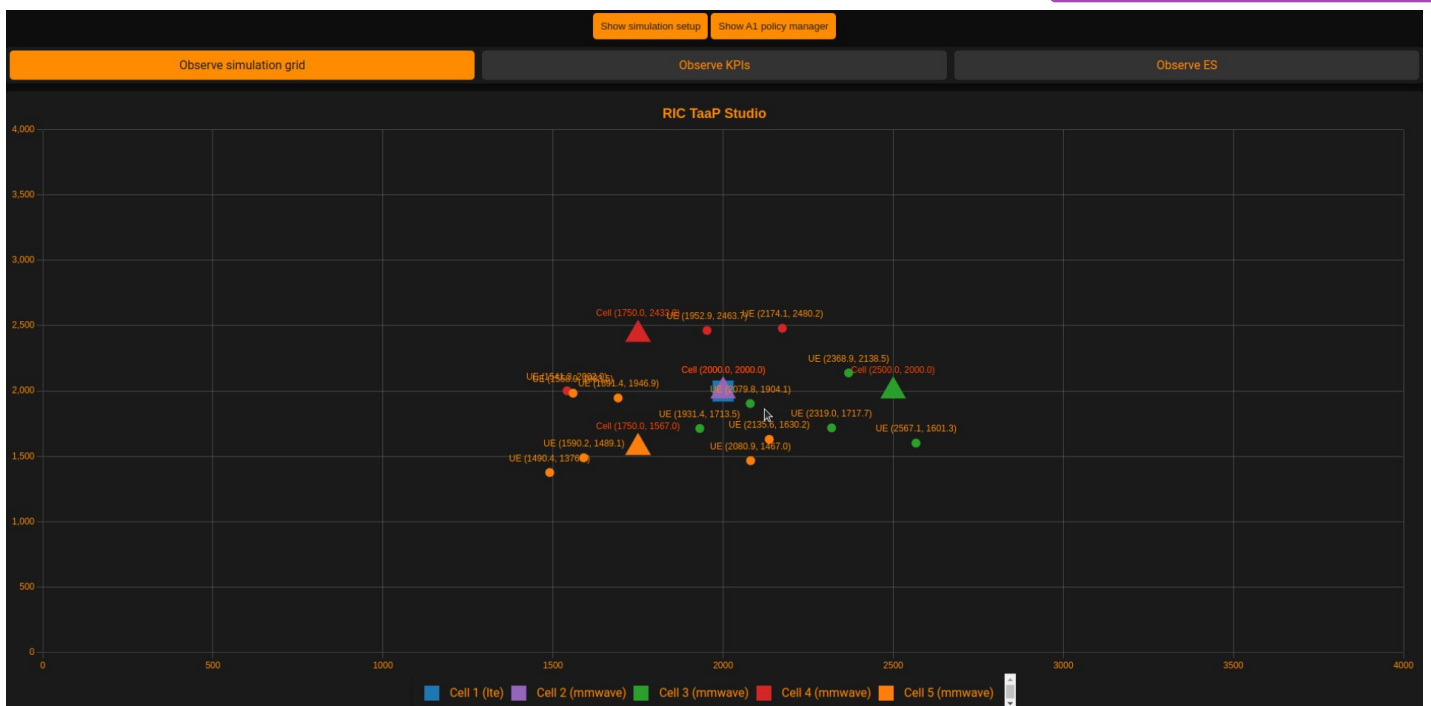
UE 13 attached with cell 3

Energy state flag for cell 2 =1
That means the cell 2 turned off



After handover the PRB usage of cell 2 equal zero

Current network power after Es operation

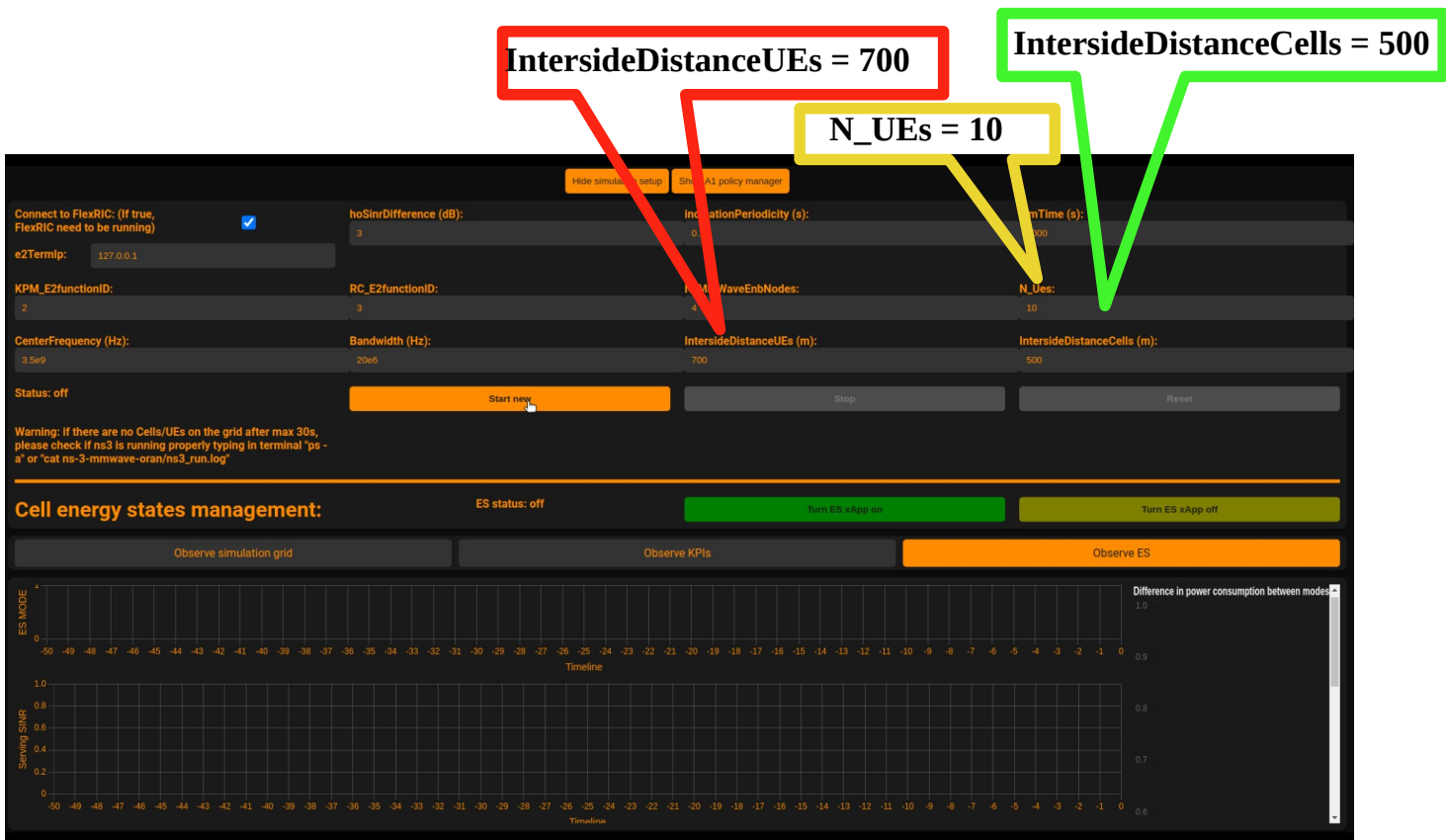


2. Energy saving with load balancing:

Energy Saving with Load Balancing focuses on optimizing network performance while minimizing energy usage through intelligent resource allocation and dynamic load redistribution.

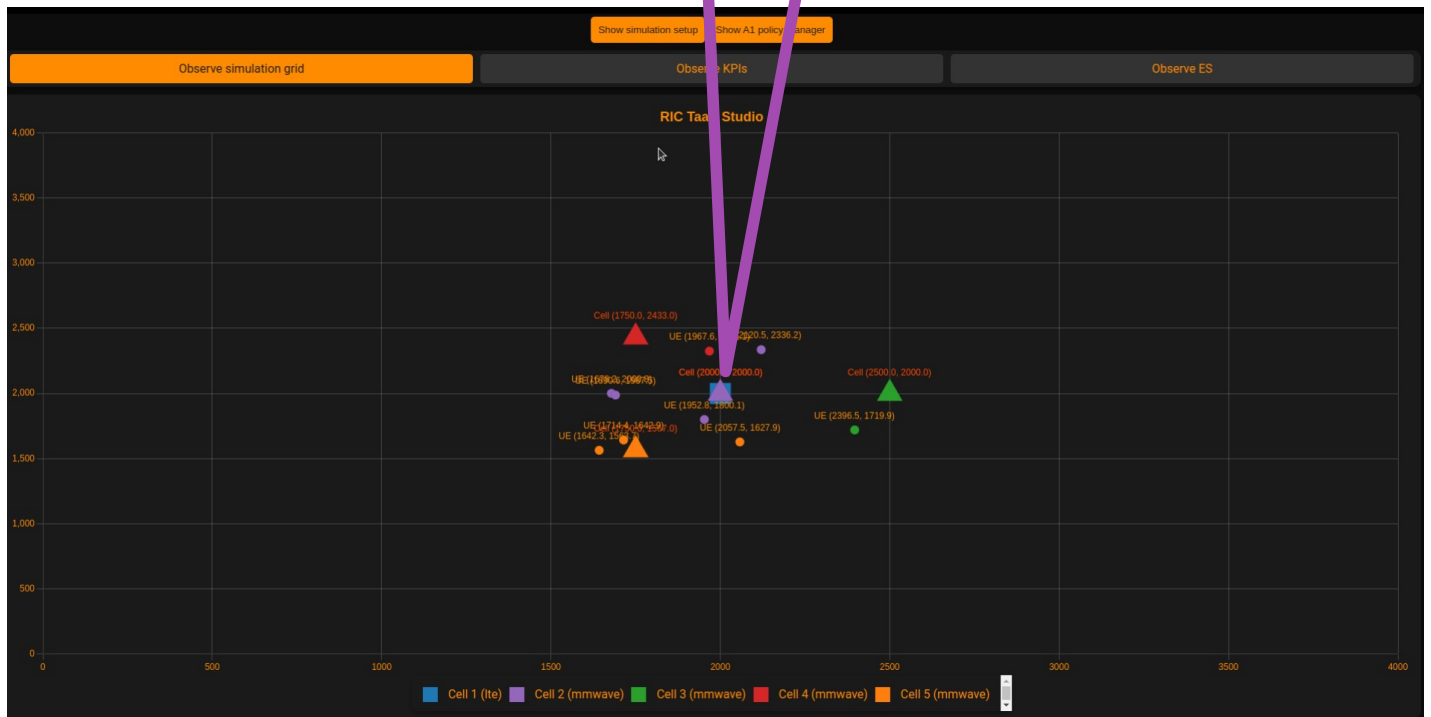
let show how can simulate this case in our RIC TaaP tester.

1. make sure the FlexRIC is running in the background.
2. Set the simulation parameters as follow and press **Start new** :



after the nodes and UEs running and appear on the simulator we will notice the following:

Cell 2 is linked to 4 UEs

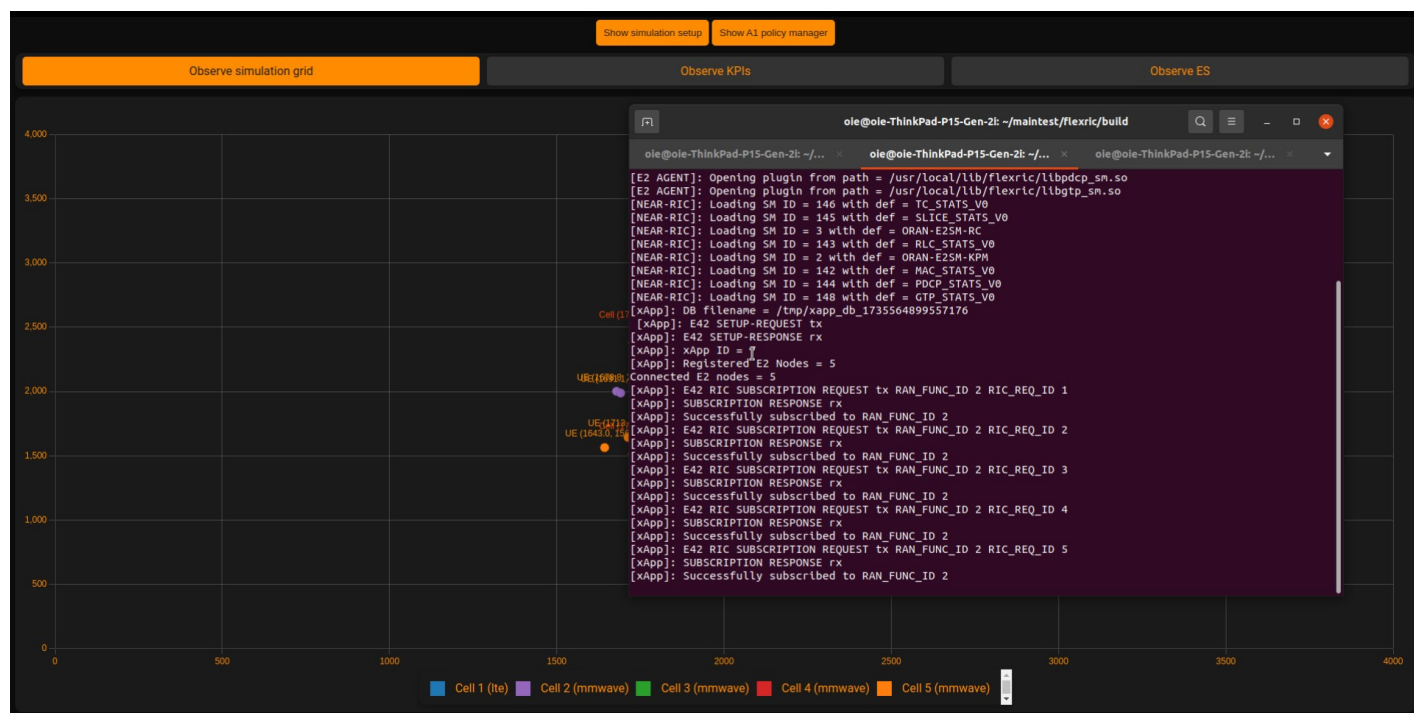


UE's 3,8,9 and 10 attached with cell 2



Cell 2 has the biggest PRB usage

3. run the xapp_energy_saving_with_LB by run this command on cmd
./home/oie_project/flexric/build/example/xapp/c/ctrl/xapp_energy_saving_with_LB



What is the action of xapp ?

The xApp will send a RIC control message to Cell 2, instructing it to move the a UEs attached to it to the nearest cells and then turn off it. Let us demonstrate this action in the following:



UE 10 attached with cell 5

UE 9 attached with cell 3

UE 8 attached with cell 4

UE 3 attached with cell 5

Energy state flag for cell 2 = 1
That means the cell 2 turned off

After handover the PRB usage of cell 2 equal zero

Current network power after Energy saving operation

