Millimeter-wave overlay HetNet for 5G

Mobile traffic grows exponentially every year and current cellular network cannot deal with this traffic explosion. In order to overcome this problem, many researchers try to achieve more than 1000x higher system rate by using ultra wideband millimeter wave technologies.

Millimeter-wave HetNet architecture
- C-plane/U-plane splitting
- Next generation CPRI interface
- C-RAN (Cloud RAN) driven network
- Ultra high speed mmW smallcell basestation

Which band in mm-wave frequency is suitable for 5G?

Spectrum allocation status in US, EU and JP

Pathloss model for mm-wave bands

Pathloss model is generated by using frequency domain interpolation

NYU 28GHz: \[ P_{L_{28GHz}} = 72.0 + 29.2 \log_{10} (d) \]

MWEBA 60GHz: \[ P_{L_{60GHz}} = 82.02 + 23.6 \log_{10} (d) \]

NYU 73GHz: \[ P_{L_{73GHz}} = 82.7 + 26.9 \log_{10} (d) \]

From the point of view of this allocation status, \(1 \) 31.8-33.4, \(2 \) 45.5-47.0, \(3 \) 47.2-50.2, \(4 \) 55.78-57.0, \(5 \) 81.0-86.0 are useful bands.

System level simulation

By using our developed system level simulator, we assessed each candidates from two aspects

1. System rate gain vs Number of smallcell BSs
2. System rate gain vs Average traffic demand

Although coverage becomes narrower as carrier frequency increases, the difference of total bandwidth is dominant in the result of comparison with number of smallcells. Additionally, the difference of the system rate gain is very big in high traffic case. Therefore 66GHz band \(4\) which has 20GHz bandwidth should be selected for the future 5G cellular network.