5G networks will adopt a heterogeneous network (HetNet) architecture, where 4G/5G macro cells are used to provide coverage with 5G small cells, providing enhanced services. Low/Mid/High frequency bands are used together.

Keywords:
- 5G, Heterogeneous network, HetNet, Small Cell, mmWave, HetNet reference design, EN-DC, ANR, SUL, CLI, RF frontend, beam forming, beam management, PHY, L1, dynamic UL/DL operation, NSA, SA, EPC

Problems addressed

- Data throughput improvement over existing 4G network
- Coverage/performance limitation in new 5G network
- Manual management of small cells
- Uplink (UL) coverage limitation

To accommodate 5G's wide variety of coverage zones and service requirements, 5G networks will adopt a heterogenous architecture, where 4G/5G macro cells are used to provide coverage with 5G small cells providing enhanced services, whereas low-, mid-, and high-frequency spectrum bands are used together to achieve wide coverage and/or high throughput. LTE-5G NR dual connectivity (EN-DC) technology will be developed to enable the use of existing long term evolution (LTE) radio access and core network as anchor for mobility management and coverage to add 5G radio access. As such, mobile operators can provide 5G services with shorter time and lower cost.

Innovations

**Innovative features are introduced to HetNet architecture.**

The innovation outline:
- LTE-5G NR Dual Connectivity (EN-DC) – Implement signaling procedures and control algorithm
- Automatic Neighbor Relations (ANR) – PHY processing and procedures for ANR
- Supplementary Uplink (SUL) – UL coverage extension
- Cross Link Interference (CLI) handling – mitigate interference from dynamic uplink/downlink (UL/DL) assignment
- mmWave radio frequency (RF) frontend supporting analog beamforming

Key impact

- Support Hong Kong Government Smart City Blueprint for 5G networks
- Mobile operators can provide 5G services with shorter time and lower cost
- Enable flexible deployment of 5G UL/DL network
- Enable different 5G use cases

Innovation snapshot
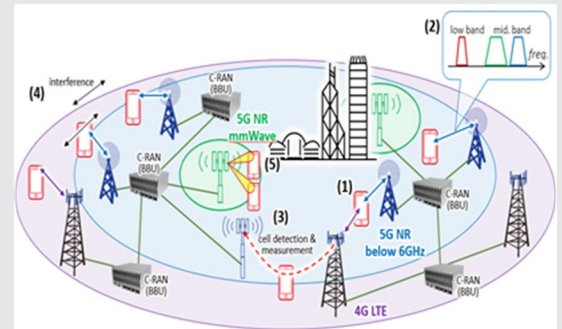
Project completed

- 15 March 2022

Applications

- Heterogeneous network
- Small cell management
- UL coverage extension
- Customizable UL/DL for 5G use case

Patent(s)

- US App. No. 17/171,190;
  CN App. No. 202180000592.5 and
  HK App. No. 62021037958.7
- US App. No. 17/482,831 and
  CN App. No. 202180003285.2

ASTRI Patent Search

Commercialisation opportunities

- IP licensing
- Technology co-development