Mm-Wave Antenna System

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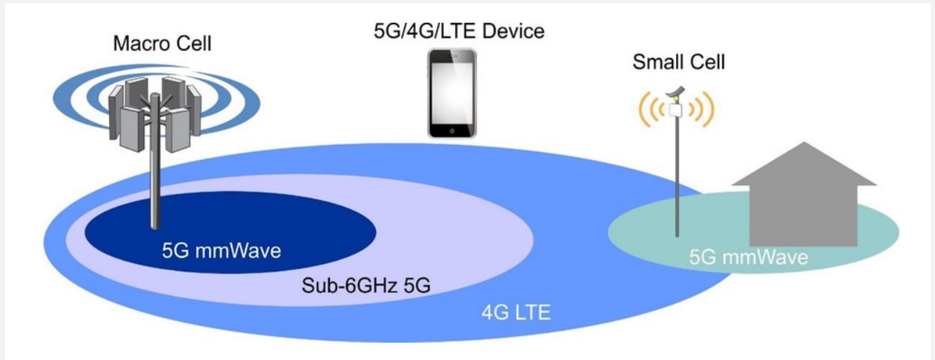
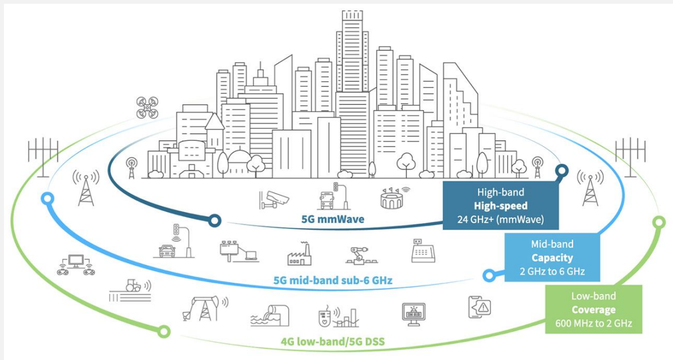
Abstract: Mobile communications are now evolving towards the sixth generation (6G). Data rates in mobile communication networks are increasing dramatically by excessive usage of data traffic and, thus, driving the tendency for use of higher frequencies as 26 GHz, 28 GHz, and 39 GHz bands for wireless communication. Millimeter-wave (mm-Wave) communication is one of the keys enabling technologies in 5G networks.

5G mm-Wave communication scenario :



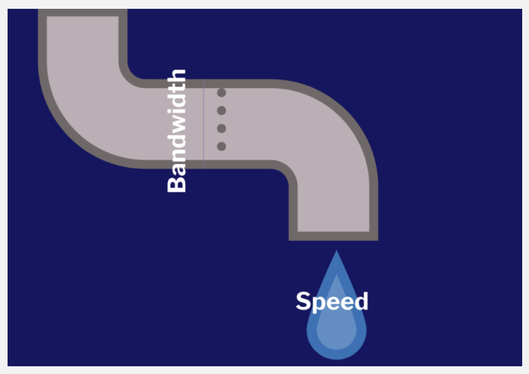


- The smaller cell sizes of 5G mm-Wave not only provides high throughput, but also allows for efficient use of spectrum as frequencies can be reused over relatively small distances. An important part of 5G mm-Wave performance is therefore dependent on line-of-sight (LOS) and non-line-of-sight (NLOS) propagation of signals and antenna design.

Communication path :

1. Base station antennas deployment
2. Base station to local access points (routers etc.)
3. Access points to communicating devices (vehicles, cctv etc.)

Importance of Bandwidth in mm-Wave



- The huge demand for bandwidth is a challenge and an opportunity for communications service providers. Millimeter wave, or mm-Wave, wireless technology will be able to achieve multi-gigabit speeds.

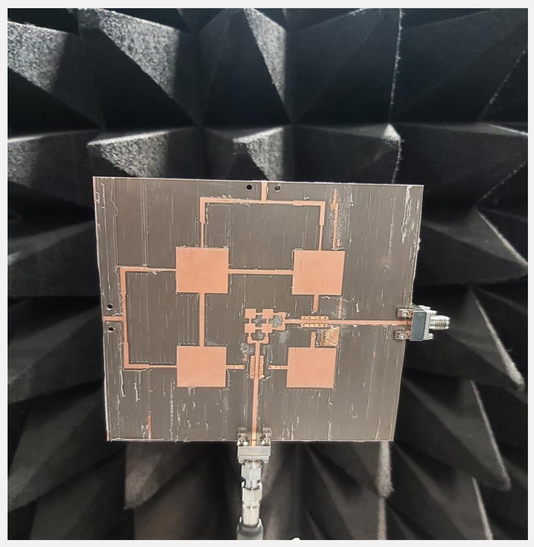
“Higher the bandwidth, higher the data rate”.

Mm-Wave Antenna system design

- Millimeter Wave Challenges
  - Atmospheric pathloss
  - Blockage (Shadowing effects)
  - Penetration losses
  - Scattering losses

- Millimeter Wave Opportunities
  - Larger bandwidth
  - Larger Antenna array in small form factor
  - Shorter TTI (Time transmission interval) and Reduced Latency
  - Higher Densification
  - Channel Reciprocity

a) mm-Wave crossover



b) mm-Wave Antenna array

- Millimeter wave use case
  - Enhanced mobile Broadband (Hotspots, General Broadband everywhere, public transport, Smart offices, Vehicle to person/vehicle communication etc.
  - Enhanced multimedia (High resolution mobile tv)
  - Massive Internet of things
  - Ultra-reliable Low Latency Applications (process automation , public safety , remote surgery etc.)

- This technology will help us to make cities inclusive, safe resilient and sustainable by building resilient infrastructure, promote sustainable industrialization and foster innovation.

References: Review of Aperture Coupled Microstrip Antennas: History, Operation, Development, and Applications, David M.Pozar

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