Small Cell 5G Use Case

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Mobile industry is evolving once again
5G enables very diverse services and use cases

Expanding the addressable Markets in three dimensions

**eMBB**
(1 Gbps everywhere)
- Infotainment
- Assisted driving
- Video Surveillance
- 50Mbps
- Everywhere
- Gaming
- Remote computing
- 50Mbps everywhere
- Video Surveillance
- Dense Urban Services
- Video Surveillance
- Remote
- Diagnostics

**mMTC**
(Massive sensors)
- UBI Insurance
- Remote Diagnostics
- Vehicle recovery
- Traffic Mgmt.
- Remote Sensors
- Indoor metering
- Fleet Mgmt.
- Asset Tracking
- Improved Comfort
- Home protection
- Remote Sensors
- Environment
- Fleet Mgmt.
- Asset Tracking
- Traffic mgmt.
- Wearables
- Patient Tracking
- Fleet Mgmt.
- Asset Tracking
- Wearables
- Disaster mgmt.

**URLLC**
(Ultra Reliability and low latency)
- Automated driving
- Collaborative Robots
- Public Safety
- Tele-protection
- AR/VR Gaming
- Remote Office
- Drone Surveillance
- Tactile Internet
- (AR/VR) for venues
- Patient Tracking
- VR diagnostics
- Disaster mgmt.

System requirements

- >10 Gbps peak data rates
- 10 000 x more traffic
- 100 Mbps whenever needed
- <1 ms radio latency
- 1 Million Connections/SqKm
- Connectivity on Demand
- Security on Demand
- Ultra reliability
- Unlimited experience
- Path to 5G
- For everything
- "Instant action"
- Extreme Mobile Broadband
- Critical machine communication
- Massice machine communication
5G offers higher capabilities, but with challenges

Strong Opportunity for Leveraging Small Cell Designs, Lessons Learned

**Physical Product Design**

- Compact implementations

**Radio Propagation**

- cm- and mmWave have high path loss and minimal wall penetration
- track and acquire users using narrow beams

**Small Cell Deployment**

- Higher Bandwidth, Spectrum increases small cell density

- Challenges

  - Macro Layer Co-existence
  - Backhaul Connectivity and EPC Impact
  - Performance
  - Security
  - Optimization
  - Ease of Installation
  - Backhaul/EPC Impact, Routing & Local Policy
  - Electrical Power
  - Quality of Services
  - Network Management

- **2.6GHz**
- **28GHz**
- **\(\lambda/2\)**

- **Outdoor 5G**
- **Indoor 5G**

- **Wall**

- **High Element Active Arrays**

- **2.6GHz**

- Integrated Active Antenna Array
- Increased Baseband Processing
- Wide Band RF Front-End
- Ultra Small Cell Densification
- Dedicated Outdoor and Indoor Deployments
- Narrow Beam Tracking Designs
- Ultra SON/No Touch
- Stealth Designs
- X-haul; 5G Backhaul
- Creative Deployments
Summary
Small Cell Synergy with evolution to 5G

• 5G addresses new Use Cases and Revenue Generating Opportunities
  – Enhanced Mobile Broadband
  – Massive Machine Type Communications
  – Ultra Reliable and Low Latency Services

• Small Cell and 5G Solutions highly synergetic-however scaling increased
  – Wider bandwidths; Increase Data Rate
  – Propagation Limitations leading to increase Small Cells

• Strong Opportunity for Leveraging Designs, Lessons Learned
  – Network Designs/Interconnect
  – Compact Design
  – Deployment