



# Spectrum Sharing Implications for 5G

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# Spectrum and 5G



- A number of the proposed design principles of 5G are focused on addressing spectrum constraints, not the air Interface
  - Move to millimeter wave
  - Beam-forming
  - Spatial Management
- If spectrum opportunities change, then 5G views should consider changes
- Internalizing these is not trivial
  - Will Discuss 2 areas where changes in spectrum view could impact our view of 5G

# User Experience and Bandwidth Capacity



- Near term opportunities for spectrum sharing largely supports capacity networks, not coverage nets
  - Support very dense, small/femto cell deployments
  - Less/no capital investment, no relocation of incumbents, ...
  - Reasonable bands
- Handset bandwidth is key to user experience – Two Strategies:
  - Conventional – Increase the PHY layer Speed
  - Emerging – Decrease users per eNodeB/sector
  - No coupling of handset bandwidth and PHY bandwidth

# Early Technology Opportunities



- Migration from exclusive use to shared use bands have technology opportunities
- Many commonalities with those needed for 5G performance
  - Beam forming to avoid incumbents, rather than “internal” spectrum reuse and gain
  - Dense spatial/beam management to reflect excluded areas/directions due to incumbent protection
  - Ability to manage a “Federation” of access points in the same spectrum – collaboration across domains

# Converging Future #1



- Spectrum sharing offers capacity bands that potentially delays need to immediately migrate to microwave
  - Keep cellular safe for low cost CMOS!
  - Focus on service architectures that leverage/share backhaul/installation/power
    - Look how successful Wi-Fi has been!
  - Backhaul/installation/power is going to be the constraint anyway, as towers not too attractive at 20 GHz
- New PHY does not address these: So Need to think of 5G as sharing more than just spectrum
  - Once you make the leap to a more local view of CMRS deployment, then spectrum may not be the constraint

# Converging Future #2



- No Need to Wait – Many 5G Technologies Needed Now to Maximize Spectrum Sharing
  - AWS Auction shows value that increased access to spectrum can have – Justifies new Technology in 4G
  - Immediate market to create revenue for innovators, prove technology, and drive costs down
  - Massive capacity increase through more spectrum, and tens of times more spectrum reuse than macros
- Should not walk away from 4G as target for new technology; create a ramp from 4G, to 4 ½G, to 5G