

## Outline of an OFDM Based PHY Proposal for 802.16.3

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Purpose:

Outline of an OFDM based PHY proposal, using TDD and adaptive multibeam base station.

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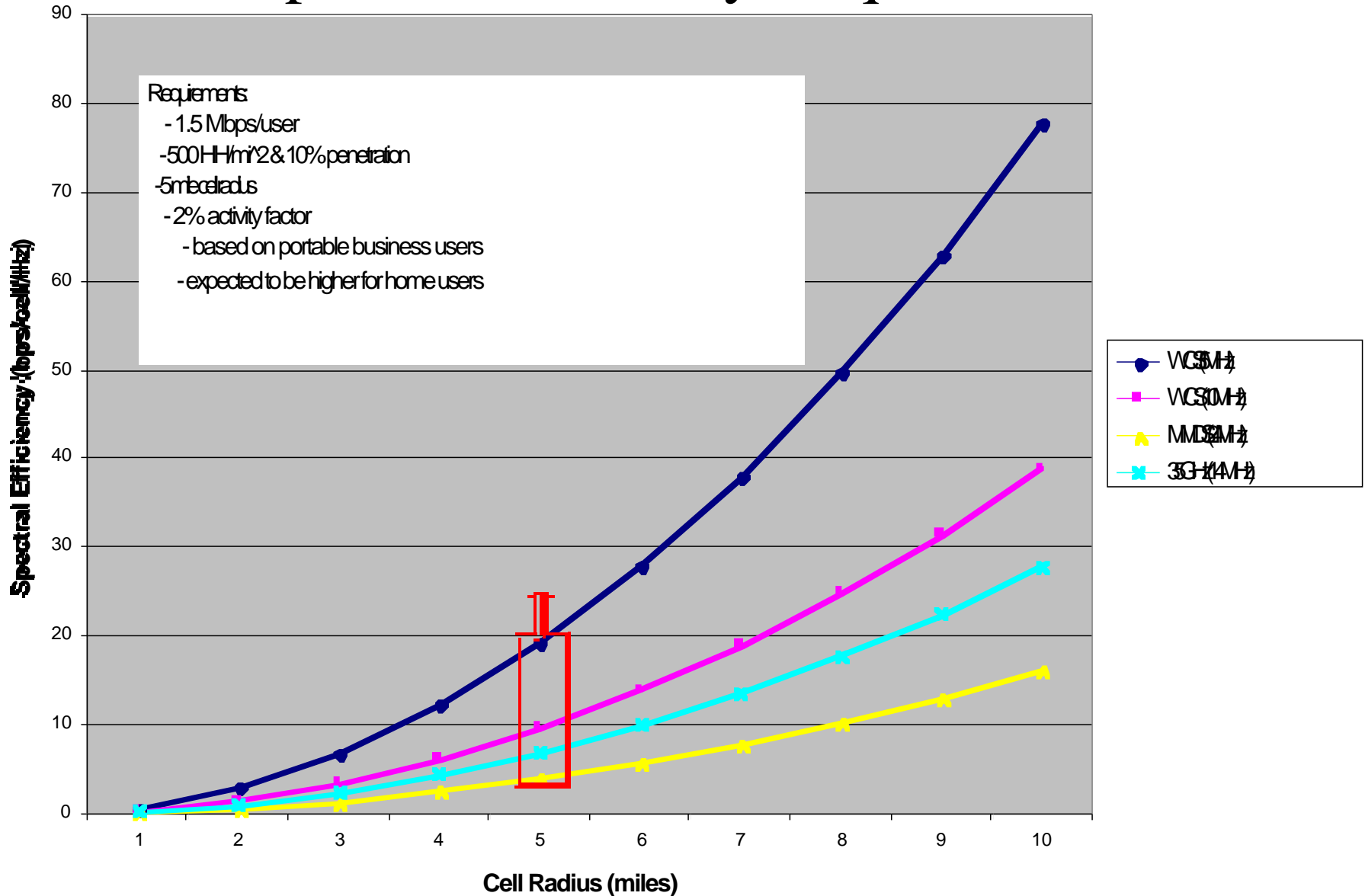
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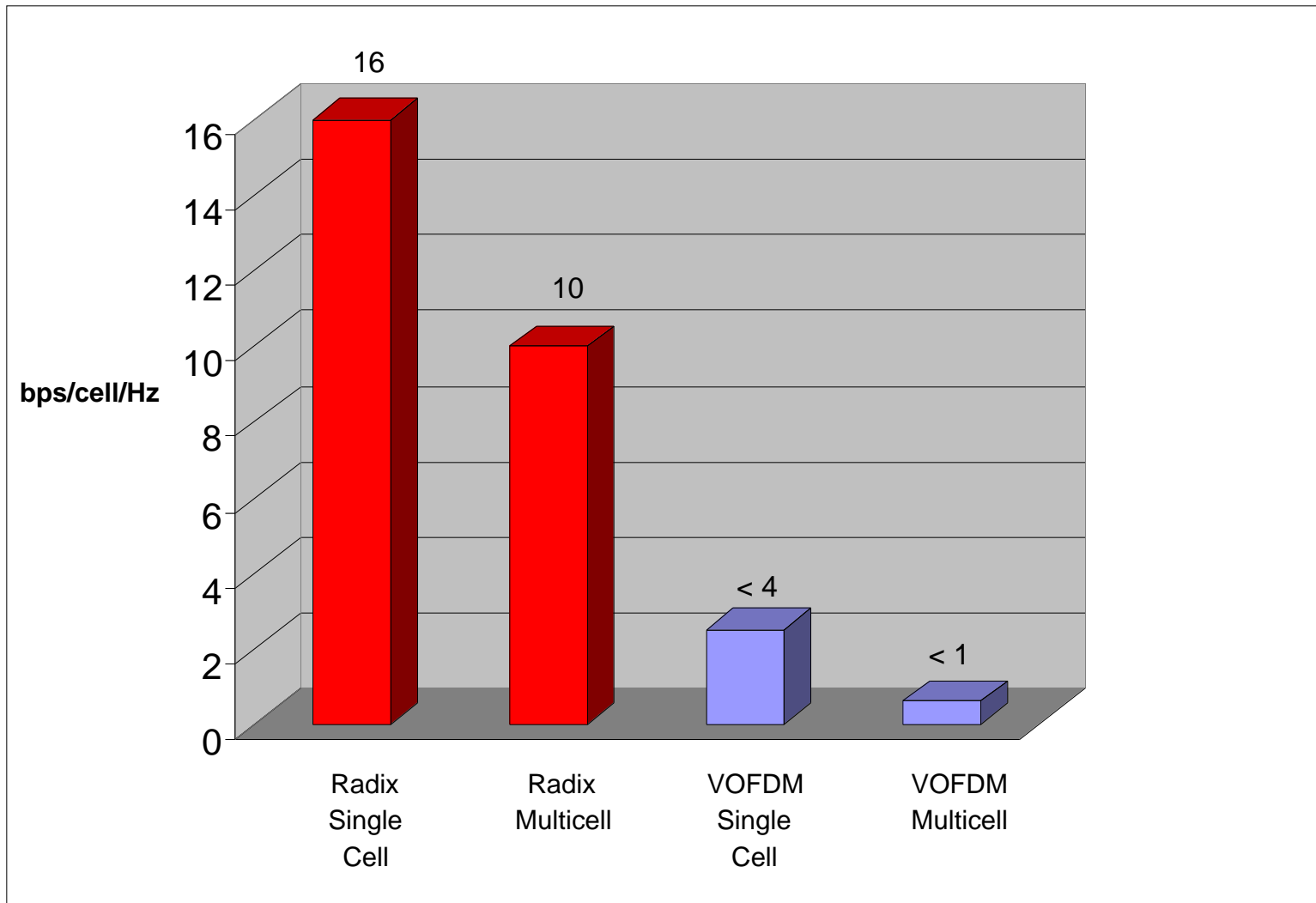
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# Frequency Band Requirement

# Spectral Efficiency Requirement



# Spectral Efficiency Comparison



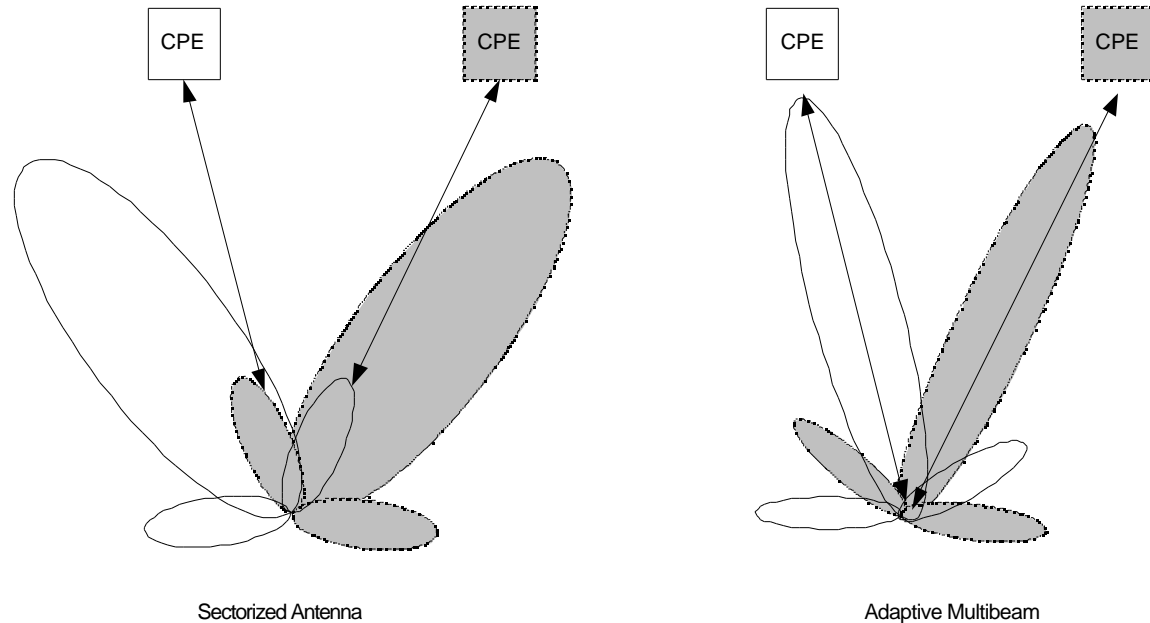
# Summary of the Proposed PHY

- OFDM for non-LOS propagation and multipath mitigation
  - large FFT size for better performance
    - better equalization in Rayleigh environment
    - generous delay spread compensation
    - better performance with adaptive antenna
  - adaptive modulation
    - QPSK, 8PSK, 16 & 32 QAM
  - concatenated codes
    - Reed-Solomon or turbo codes
    - convolutional codes as part of TCM
  - flexible channelization and frame structure
    - optimized for adaptive antenna processing
    - reduced synchronization overhead

# Summary of the Proposed PHY (cont.)

- Adaptive multibeam
  - simultaneously steers a beam toward a desired CPE and nulls toward interferers ==> orders of magnitude increase in SNR and SINR
  - full frequency reuse between cells ( $n = 1$ )
  - many times frequency reuse within a cell (SDMA)
- TDD as the duplexing method
  - provides path reciprocity
  - reduces cost of subscriber stations
- Hybrid contention + reservation multiple access
  - TDMA/FDMA in both directions
  - contention is best for bursty traffic
    - SDMA reduces contention and improves throughput
  - bandwidth reservation for priority flows

# Adaptive Multibeam vs Sectorized Antenna



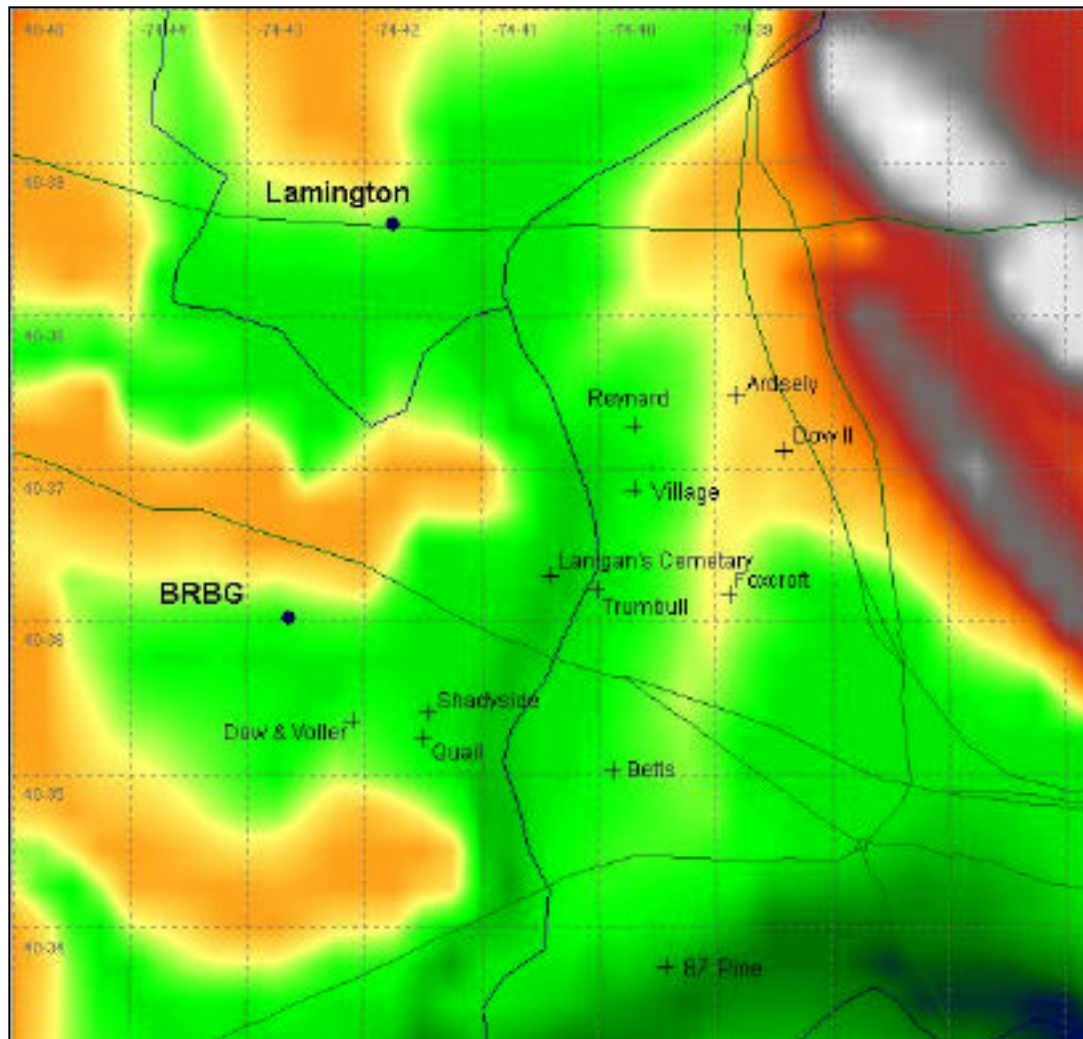
- beam patterns are not fixed
- dynamically creates a beam toward a CPE for a session
  - beam width not constrained by the need to cover a cell
- simultaneously steer nulls toward interferers









# Cost and Complexity

- Adaptive multibeam
  - builds on digital processing architecture of OFDM
  - using industry standard processor modules
  - innovative algorithms implemented in DSP software
  - proven technology successfully deployed in both military and commercial applications
- Increased cell radius and improved coverage
  - fewer base stations required
  - decoupled range and capacity allows flexible deployment
    - beam width not constrained by cell coverage
    - provides required range with smaller base stations
    - scale up capacity by adding processing modules
- Does not increase the cost of subscriber stations



# Coverage Comparison - Area

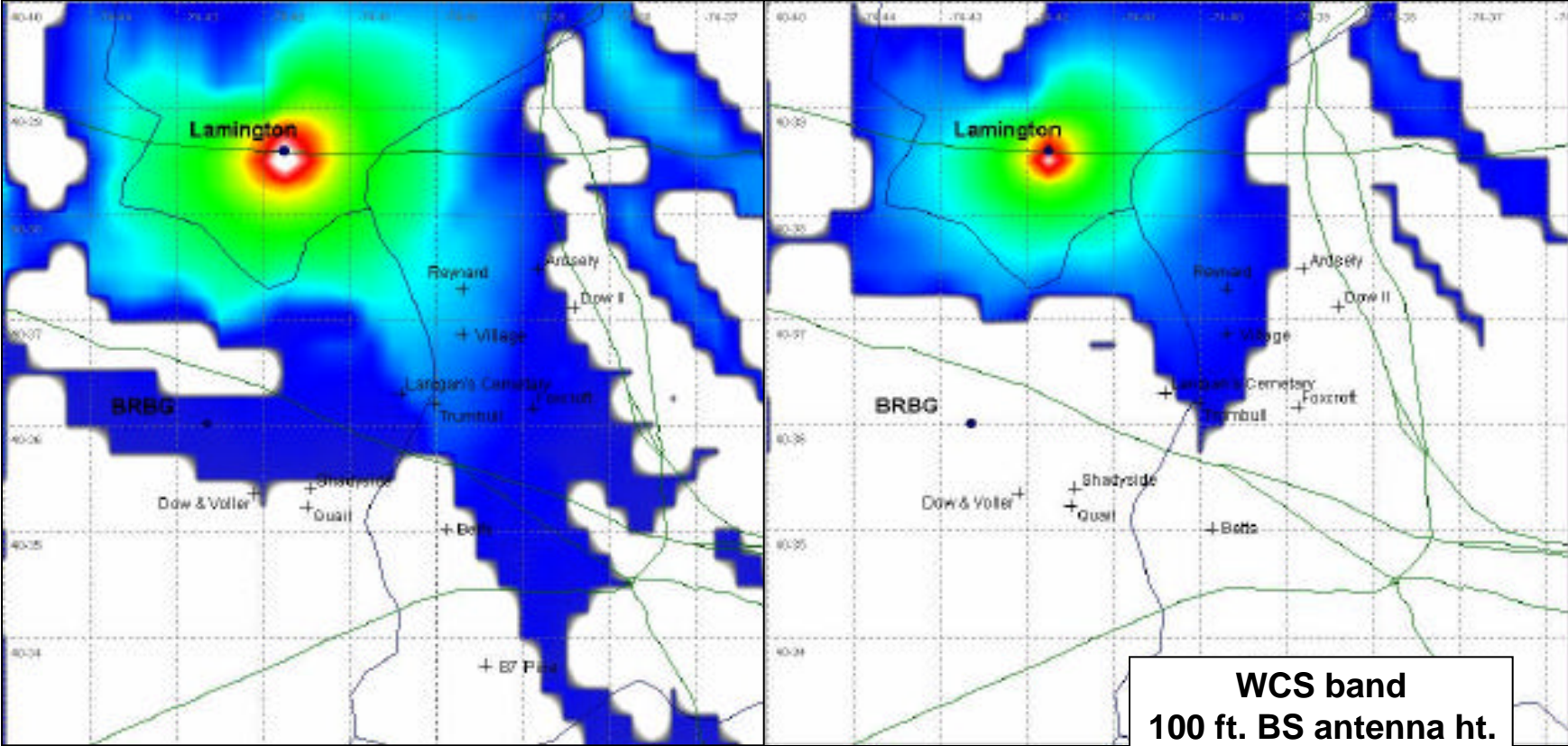


Clr	Level [ft]
	59.06
	70.92
	102.59
	152.18
	218.75
	301.72
	400.62
	515.09

# Coverage Comparison - Range

Radix

VOFDM



**WCS band**  
**100 ft. BS antenna ht.**  
**30 ft. SS antenna ht.**

# Implications for MAC Protocol

- adaptively formed beams are point-to-point
  - no broadcast mechanism
  - continuous TDM is not appropriate
  - FDMA/TDMA is more suitable
- contention based approach is very efficient
  - spatial division reduces contention
  - best for bursty traffic
- bandwidth reservation for priority flows

Thank You