Broadband Mobile Systems

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Base Document:

Purpose:
To help 802.16 MBWA SG in the PAR discussions. To provide technical material in support of the mobility PAR.

Broadband mobile systems

Outline

- Definition of Service
- Essential Requirements
  - business case
  - technical
- A Good MBWA Solution
  - design for spatial channels and mobility
- Conclusion

MBWA Service

- Wide-area coverage
- Ubiquitous, always on
- Low cost
- High-speed Internet
- Delivered to mobile users at a range of speeds

MBWA Business Case Requirements

- Cellular-like coverage
  - macrocell economics permit consumer pricing
  - outdoor & reasonable indoor coverage for ubiquity
- Mobility implies deployment below 3 GHz
- Below 3 GHz implies small spectrum blocks
- Large number of users near peak data rates
- High data rate (peak user data rate > 1 Mbps)
  - data rates > 1 Mbps mobilize most IP applications
- Low cost modem hardware that easily integrates into subscriber unit

Technical Requirements

- Spectral efficiency greater than 3 b/s/Hz/cell in a fully loaded system
- Support for vehicular mobility
- Frequency Reuse < 1
- Matching of UL and DL range in mobile environment
- Low power user terminals

A Good MBWA Solution

- Critical design issues for spatial channels and mobility
  - Use of TDD
    - Fully leverage channel reciprocity for downlink beamforming
  - Matching the range of Broadcast control and traffic channels
  - Collision resolution using spatial processing
    - Sufficient and unique training data per spatial channel
  - MAC support of spatial channels design aspects

☞ Significant benefits even with Smart Antenna at BS only

Spatial Processing Benefits Summary

Selective Uplink Gain *Receive processing at base station	Increased Range, Coverage, Link budget •10*log10(M) gain •13dB – 17dB diversity gain •Lower terminal transmit power •Uplink Multipath Immunity
Uplink Interference Mitigation *Receive processing at base station	Improved Signal Quality •Robust to interference from multiple uplink interferers •30dB – 40dB interference immunity Higher spectral efficiency
Selective Downlink Gain •Transmit strategy based on uplink information and feedback from terminal	Increased Range, Coverage, Link budget •20*log10(M) gain •13dB – 17dB diversity gain •Reduced base station PA sizing •Reduced Downlink Multipath
Downlink Interference Mitigation Transmit strategy based on uplink information and feedback from terminal	Improved Signal Quality •Automatically reduces signal transmission to co channel interference •Increases system-wide downlink signal quality •30dB – 40dB interference immunity Higher Spectral Efficiency

Spatial Processing Advantages

- Beamforming
  - Higher capacity/Larger range
  - Cheaper power amplifiers
  - Interference rejection
  - Fading mitigation, equalizer simplification
  - Low frequency re-use, improved capacity
- Spatial Channels
  - Higher capacity/Larger range
  - “Soft” collision

Conclusion

- The MBWA business case and technical requirements call for a highly spectrally efficient air interface
- Design for spatial processing provides an excellent solution to MBWA challenge
- TDD option to best leverage spatial processing techniques
- Design for spatial processing has implications for both MAC/PHY

☞ We support a new WG in IEEE 802 for MBWA