Project	**IEEE 802.20 Mobile Broadband Wireless Access** <**http://grouper.ieee.org/groups/802/mbwa**>
Title	**Impact of FDD on MBWA System Performance**
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Re:	Mobility Enabling Technologies and Capabilities
Abstract	This submission discusses frequency-division duplexing (FDD) and its impact on mobile wireless systems
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Impact of FDD on MBWA system performance

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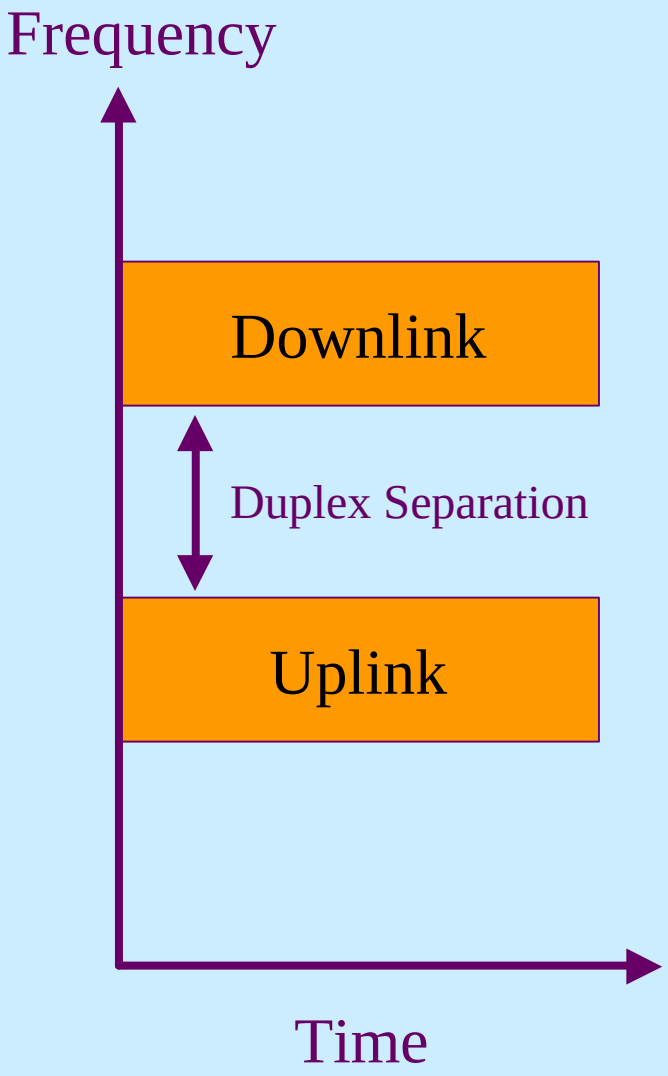
Outline

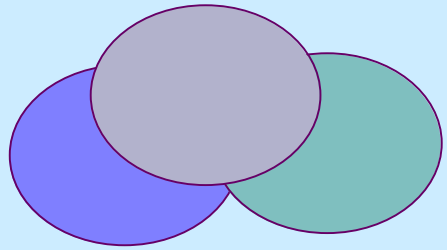
- FDD basic format
- FDD impact on system performance
  - Coverage & Mobility
  - Multiple Antennas
  - Asymmetric Link Utilization
  - Interference and Co-existence
- Summary

FDD Basic Format



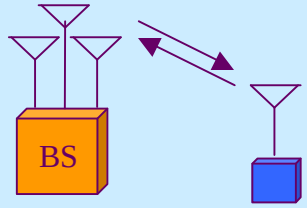
- Full-duplex communication
- Equal Uplink (UL) and Downlink (DL) bandwidths
- Duplex separation ~50-150 MHz
- Typical operation in licensed bands

Coverage & Mobility



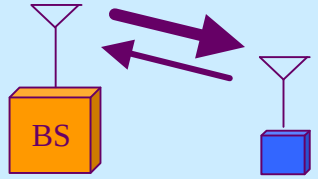
- *Ubiquity important for MBWA*
  - *Optimization for macro-cell coverage and mobility is important for ubiquity, which is cited as a key enabler for commercial success of any MBWA system*
- FDD suitable for macro- and micro-cellular operation and mobility
  - No guard time requirement between frames/time-slots for timing inaccuracies, synchronization and propagation delays. Does not limit cell size
  - No dependence between Downlink/Uplink slot times, modulation formats; No switching between UL/DL slots
  - Does not add to latencies in DL (DL grant/ DL transmit) and UL (UL request/ DL grant/UL transmit)

Multiple Antenna Processing



- *FDD lacks reciprocity in UL and DL channels, making multiple antenna processing more difficult*
  - *UL and DL channels occupy distinct bands, so there are different transmit and receive antenna processing coefficients*
- For connectionless, packet-switched operation, multiple antenna processing based on reciprocity is not efficient
  - DL and UL data traffic is asynchronous and bursty
  - Fast DL/UL channel state feedback essential
  - Conventional techniques optimized for voice systems can lead to sub-optimal performance and waste of precious airlink resources

Asymmetric Link Utilization



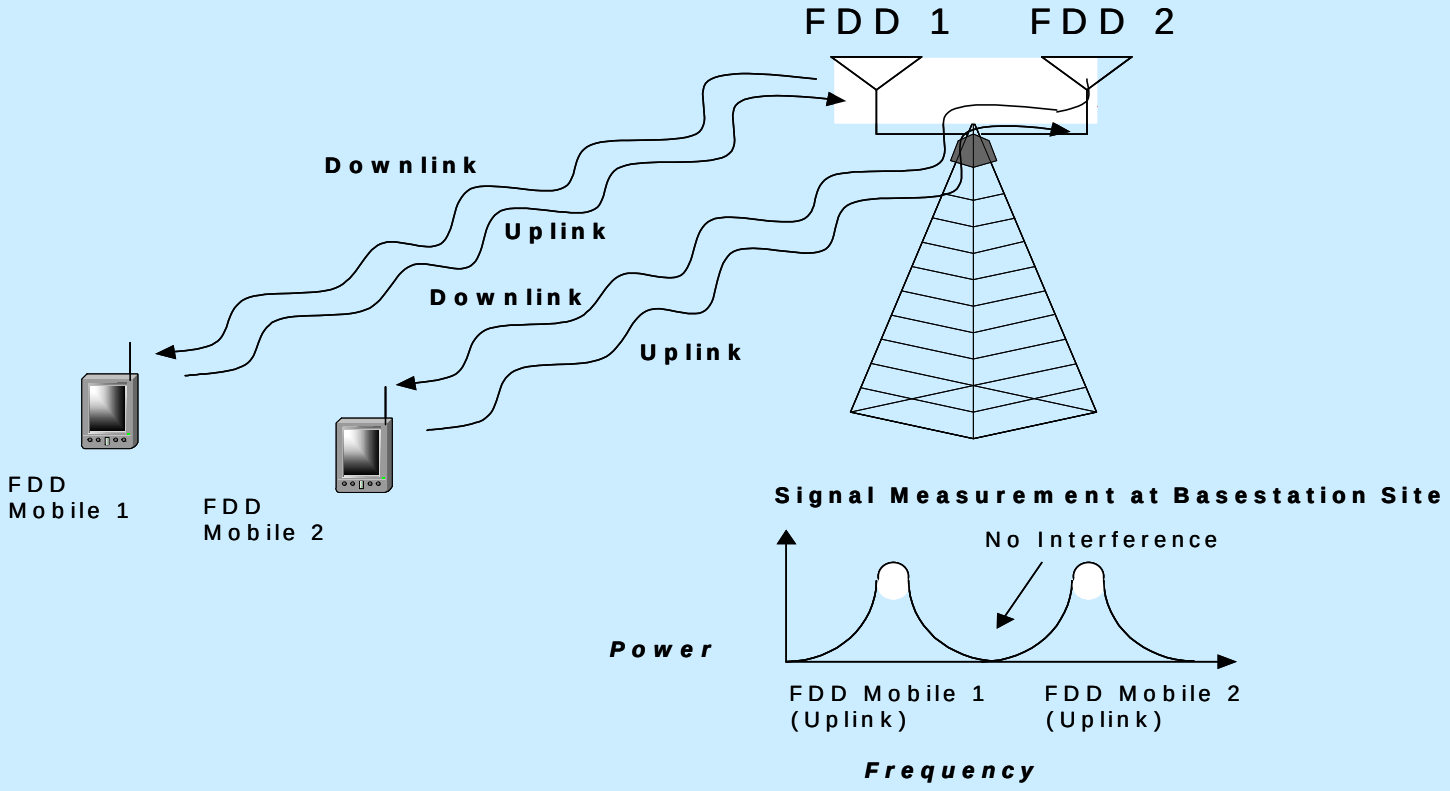
- *DL throughput rates are typically greater than UL, but FDD has equal resource allocations for DL & UL*
- In practice, this asymmetry is not an issue
  - Typical DL throughput rates are three times that of UL with equal resource allocation. Greater or lesser asymmetry ratios on a per-service basis easily accommodated
  - Does not require sync with other Base Stations
  - Mobile transmit power limitations and multiple access overhead on UL
  - For given throughput, UL transmission does not incur link budget penalty as UL bandwidth can be utilized all the time

Interference & Coexistence

- *Need to minimize interference between base stations and coexist with other cellular networks*
  - *Multi-vendor/Multi-operator/Multi-band deployment environment*
  - *Protection of existing users in adjacent bands from interference caused by new deployments. No retrofit to existing equipment.*
  - *Allow co-location of multi-operator radio equipment at common antenna sites*
  - *No significant infrastructure deployment/operational costs and unpredictability in ensuring co-existence*
  - *No Mobile-to-Mobile adjacent band RF interference issues (Mobile terminals have no ability to retrofit designs)*

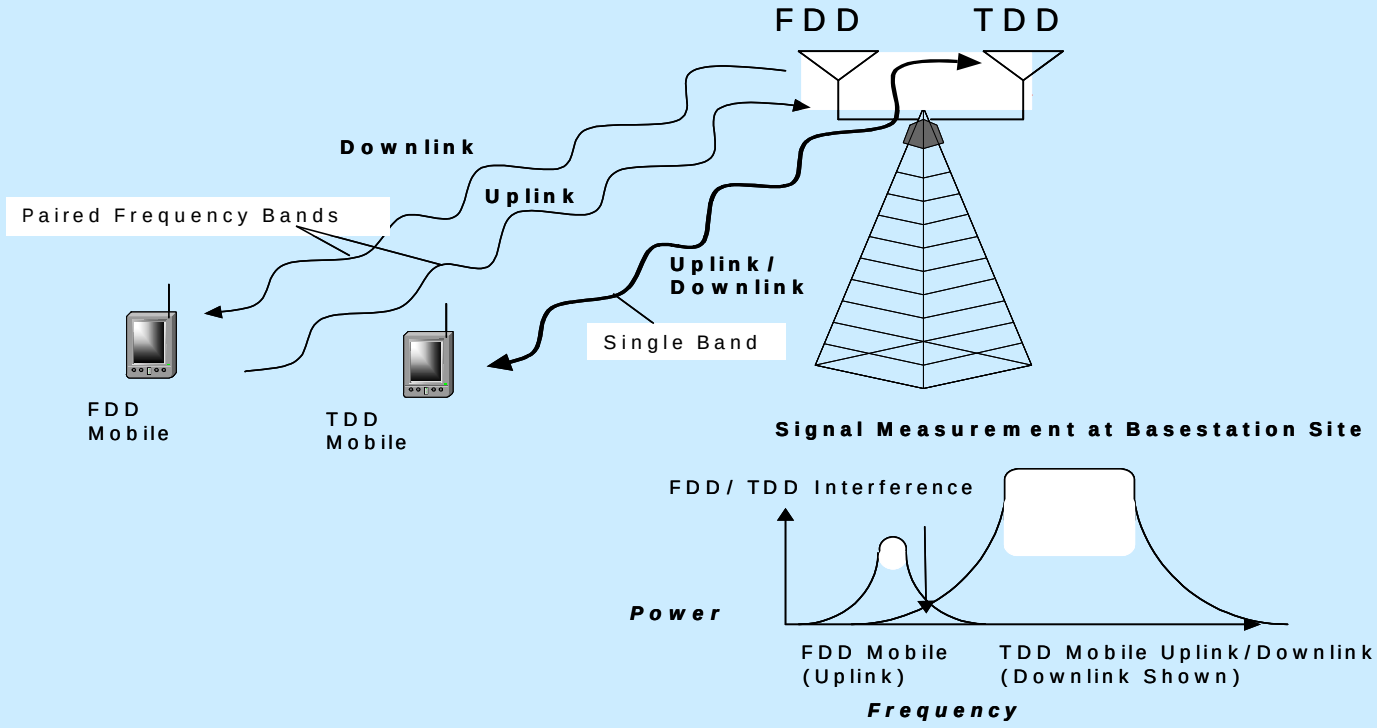
Interference & Coexistence: FDD-FDD

- FDD-FDD co-existence
  - FDD DL (UL) operator bands are grouped together
  - Relatively large frequency separation between DL and UL bands (no sharp filters required)
  - No inter-BS synchronization requirement



Interference & Coexistence: FDD-TDD

- FDD-TDD coexistence
  - Adjacent FDD-TDD deployments merit careful examination
  - TDD system near FDD DL
    - FDD BS transmitter interferes with TDD BS receiver
    - TDD Mobile transmitter interferes with FDD Mobile receiver
  - TDD system near FDD UL
    - TDD BS transmitter interferes with FDD BS receiver
    - FDD Mobile transmitter interferes with TDD Mobile receiver



Summary

- FDD is ideally suited for a packet-switched MBWA air interface
  - Optimal for wide-area coverage and vehicular mobility
  - Accommodates DL/UL asymmetry ratios as required
  - No inter-BS synchronization requirement
  - Licensed spectrum bands already exist globally for mobile operation. Large deployed base of FDD cellular systems
  - Does not pose co-existence issues