OPERATOR SYSTEM REQUIREMENTS FOR MBWA

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Seamless, Ubiquitous Experience

- Field Service Apps
- High BW Connectivity
- Portable Office
- Portable Remote Access Services
- Mobile Office (Voice and Data Apps)
- Portable Services in Public Hot-Spots
- Campus W-PBX Services
- Mobile B-to-C M-Commerce Services
- Video Streaming - Conferencing Apps

TOTAL ACCESS
Broadband’s “Sweet Spot”

Source: FCC, 2002, with modifications by author
Completing the picture with XG……..
**Characteristics for Next Gen BB Wireless Technology**

- **DSL/ Cable performance**
- **Competitive Cost Structure**
- **Portability to Mobility service model**

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Next Gen BB Wireless Technology Characteristics (and biz case drivers)

- **True Broadband Speeds**: >1 Mbps/user bi-directional → compete w/ cable/DSL & differentiate from 3G
- **NLOS Operation**: upto 10usec delay spread → indoor self-install, retail distribution & low rate of returns
- **High Link Budget** (>160 dB) → Large Cell Sizes → Less Capex, Less site acquisition & backhaul costs
- **High # of Simultaneous Sessions** (>100 per carrier) → Greater # of Subs/sector/carrier with broadband performance
- **Large Channel Bandwidths** (>5 MHz) → High Capital Efficiency
- **Low Latency** (<50 msecs) → Allow for high user performance & satisfaction
- **Deep Indoor Penetration** → Indoor reliability and portability
- **QoS**: Allow increased ARPU using VoIP/Streaming apps
- **Cellular Architecture**: Scalability/Portability & Mobility
- **Integrated MIMO**: High capacity/spectral efficiency/reliability (>2 bps/Hz/sector)
- **Mobile IP**: Seamless IP session handover/data mobility
- **Low Power Integrated CPE/ PCMCIA**: Sub$100 CPE
- **Economical Cost Structure** (<$300/sub) → High ROI/NPV
Performance Characteristics

**User Performance:** Tiered Service Offering (speeds will increase over time)
- Average at Peak Busy Hour
  - 128 kbps up / 512 kbps down
  - 256 kbps up / 1 Mbps down

**Bursting Capabilities:**
- up to 1 Mbps DS and 256 kb US

**RF Link Budget:** 160 dB minimum
- Indoor Coverage - 90% indoor coverage at 1st floor, above grade and higher.
- Outdoor Coverage – 90% coverage, within the cell and at cell edge.

**Multipath Robustness/ Delay Spread:** Initial system must support delay spreads of 5 to 10 microseconds without impairment.

**Building Penetration Losses:** From Houston and Montreal trials
- Suburban - 18 dB
- Urban - 20 dB
- Dense Urban – 22 dB

**K-Factor:** Vendor must assume a Rayleigh fading channel, with a K-factor of 0.
**Spectral Efficiency**: Good-put
- Minimum DL=2bps/Hz/sector
- Minimum UL=1bps/Hz/sector

**Network Availability**: 99.9% end to end
- RF System Availability - 99.91%
- Equipment Reliability -> 99.99%

**Roundtrip Latency**: 100 ms end-to-end round trip system delay

**MAC Efficiency**: The overall MAC efficiency from Layer 1 through Layer 3 should be at least 75% or higher at capacity

**High # of Simultaneous Sessions**:

**Sector Load**: Must be able to support at least 1000 subscribers per carrier

**Packet Error Rate**
- Data - better than 1%, after FEC before ARQ
Multi-Cellular Wireless Access Network

99.9% Reliability with PER <=1%

High Capacity >1000 subs per sector/per carrier

Maximum path Loss from 158-165 dB

Co-Channel BTS

High Frequency Re-Use Network 1x1,1x3

Broadband User Experience 90% >(512 kbps DS >128 kbps US); E-E Latency <100ms

90% homes/bldgs in covered area

Indoor self-Install Portable. Mobile

Distance to mobile scatterers

1 - 4 miles
Houston Outdoor To Indoor Signal Loss (2.5 GHz) By Building Construction Type, All Floors

- **All Construction Types**: Mean = 7.2 dB, 90th Percentile = 8.1 dB, # of Data Points = 747
- **Brick**: Mean = 16.2 dB, 90th Percentile = 16.6 dB, # of Data Points = 503
- **Concrete**: Mean = 7.0 dB, 90th Percentile = 11.9 dB, # of Data Points = 12
- **Glass**: Mean = 3.4 dB, 90th Percentile = 4.0 dB, # of Data Points = 40
- **Metal**: Mean = 10.2 dB, 90th Percentile = 15.0 dB, # of Data Points = 7
- **Stone**: Mean = 10.6 dB, 90th Percentile = 22.3 dB, # of Data Points = 13
- **Stucco**: Mean = 12.7 dB, 90th Percentile = 20.7 dB, # of Data Points = 143
- **Wood**: Mean = 7.5 dB, 90th Percentile = 15.1 dB, # of Data Points = 29

Building Construction Type
Application Breakdown within User Classes

% of Traffic

0.0% 5.0% 10.0% 15.0% 20.0% 25.0% 30.0% 35.0% 40.0% 45.0% 50.0% 55.0% 60.0% 65.0% 70.0% 75.0% 80.0%

Daily Usage Consumption (User Classification)

HTTP  P2P  NNTP  POP3  AOL

less than 5MB  5MB to 10MB  10MB to 20MB  20MB to 50MB  50MB to 100MB  100MB to 200MB  200MB to 1000MB  over 1000MB
Q&A