3G Wireless Overview

ITS 437
3G Definitions

• ITU recommendations for UMTS 2000
  – minimum mobile data rates: 144kbps
  – target mobile data rates: 384kbps
  – indoor/short-range rates: 2Mbps

• Delivery
  – cell-based terrestrial
  – MSS (mobile satellite systems)

• Global frequency plan
IG (AMPS) US Spectrum

- 832 channels (2 frequencies per channel)
  - Forward: 869-894 MHz
  - Reverse: 824-849 MHz
  - Forward/Reverse Spacing: 45 MHz
  - Adjacent Channel Spacing: 30 kHz
  - 21 Control Channels per group
- Cell Sizes: 2-20 km
2G Systems and Frequencies

- Advanced mobile phone service (AMPS)
  - 824 to 849 MHz and 869 to 894
- Digital-advanced mobile phone service (D-AMPS)
  - 824 to 849 MHz and 869 to 894
- Global system for mobile communications (GSM)
  - 450 MHz, 890 to 960 MHz, 1.8 GHz, 1.9 GHz
2G Systems

- Personal communications service (PCS)
  - 1.9 GHz
- iDen (Nextel) and other specialized mobile radio (SMR)
  - 816 MHz to 866 MHz
- Cellular digital packet data (CDPD)
  - 824 to 894 MHz, 1.8 GHz to 1.9 GHz
ITU 3G Recommendations

Andy Dornan, "The Essential Guide to Wireless Communications Applications"
ITU IMT-2000 Air Interface Recommendations

- Wide-Band CDMA
  - 5 MHz channels
- CDMA Multi Carrier
  - 1.25 and 3.75 MHz channels
- CDMA TDD
  - Used for unpaired spectrum
- TDMA (UWC-136 based on EDGE)
  - 30kHz, 200kHz, and 1.6MHz Carriers
2G/3G US Allocations (Proposed)

Advanced Wireless Services (AWS) Band Plan

- AWS I
- Broadband PCS
- MSS
- UPCS
- Proposed AWS II Block

1755-1850: Federal Government Exclusive Spectrum

2025-2110 MHz: BAS, Government Satellite

FCC web site
<table>
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<th>Frequency Range</th>
<th>Description</th>
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<tr>
<td>1700-1710</td>
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<td>METEOROLOGICAL-SATELLITE (space-to-Earth)</td>
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<td>MOBILE except aeronautical mobile</td>
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3G Transition Plans

Andy Dornan, "The Essential Guide to Wireless Communications Applications"
EDGE

- Based on GSM/GPRS channel structure
  - 200kHz channels
  - Add 8-PSK as a modulation option
  - per-slot data rates from 10kbps to 60kbps
  - per-channel data rates from 80kbps to 480kbps
cdma2000

• 1XMC
  – Small changes over IS95; doubles data rates

• 3XMC
  – 3.75 MHz channels (3 IS95 channels), similar (but incompatible) to W-CDMA

• HDR
  – Adds 8-PSK and 16-QAM modulation to increase data rates
W-CDMA

- 5MHz channels
- Variable chipping rates (4 to 128)
- Maximum data rate of 4Mbps under ideal conditions
- Deployed as 3G standard in Japan (DoCoMo and J-Phone)
- UMTS in Europe