Course Overview

- Introduction and History
- Regulatory Issues
- Fundamentals of Cellular Systems
- 1st Generation: AMPS and CDPD
- 2nd Generation: GSM
- 3rd Generation: IMT-2000
- Mobile IP
- TCP over Wireless Link

Radio Frequency Bands

Classification Band	Initials	Frequency Range
Extremely low	ELF	Below 300 Hz
Infra low	ILF	300 Hz - 3 kHz
Very low	VLF	3 kHz - 30 kHz
Low	LF	30 kHz - 300 kHz
Medium	MF	300 kHz - 3 MHz
High	HF	3 Mhz - 30 MHz
Very high	VHF	30 Mhz - 300 MHz
Ultra high	UHF	300 Mhz - 3 Ghz
Super high	SHF	3 Ghz - 30 Ghz
Extremely high	EHF	30 Ghz - 300 Ghz
Tremendously high	THF	300 Ghz - 3000 Ghz

FCC Allocations

- FCC: Federal Communications Commission
  - allocates frequencies in less than 10 GHz range
  - US agency, but relevant to Canada (Industry Canada keeps spectrum allocation “compatible with that adopted by the United States”)
  - allocations determine which bands to use and whether to operate in a licensed or unlicensed band
  - unlicensed bands: can be used subject to operational procedures
  - licensed bands: high performance, expensive

Unlicensed Bands

- Industrial, Scientific, and Medical (ISM):
  - 915 MHz band (902 - 928 MHz, 26 MHz bandwidth)
    - only available in North America
    - highly crowded, expected to become even more crowded
    - many existing users are non-spread-spectrum applications
  - 2.4 GHz band (2.4 - 2.4835 GHz, 83.5 MHz bandwidth)
    - available worldwide
    - lightly loaded, but interference from microwave ovens
  - 5.8 GHz band (5.725 - 5.85 GHz, 125 MHz bandwidth)
    - only available in North America
    - lightly loaded, radar interference

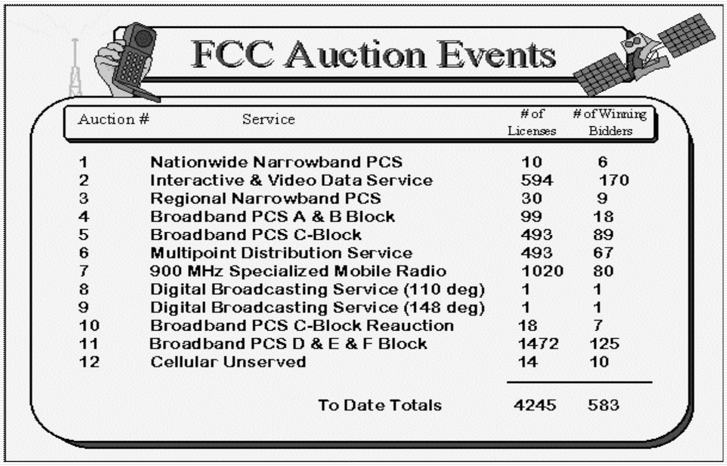
Unlicensed Band

- Personal Communications Services (PCS):
  - 1.9 GHz band (1910 - 1930 MHz, 20 MHz bandwidth
    - part of overall PCS band (1850-1990 MHz)
    - 1910-1920: unlicensed asynchronous or packet-switched applications
    - 1920-1930: unlicensed synchronous or circuit-switched applications
    - open band in Europe around 1.9 GHz for digital enhanced cellular telephone (DECT)
    - in US, this band currently occupied by other users with microwave point-to-point links, who will clear the band in a few years

Unlicensed Band

- requests for new unlicensed bands
  - 5.2 GHz band (250 MHz bandwidth)
    - requested by industry organization WINForum
    - band with 150 MHz bandwidth exists already in Europe
    - band to be called SUPERNET
  - 5.2 and 5.8 GHz bands (300 MHz bandwidth)
    - petition by Apple
    - frequency ranges: 5.15 - 5.3 GHz and 5.725 - 5.875 GHz
    - intended application: community networks
- above 10GHz, ETSI (European Telecommunications Standard Institute) designated 17.1 - 17.3 GHz band for wireless LAN operations

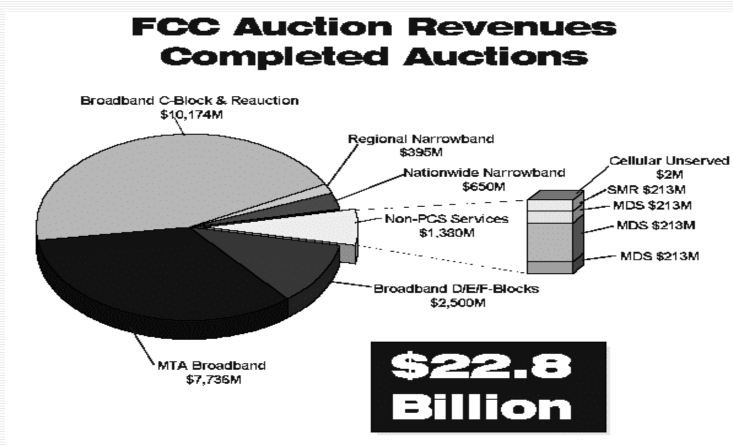
FCC Auctions: Overview



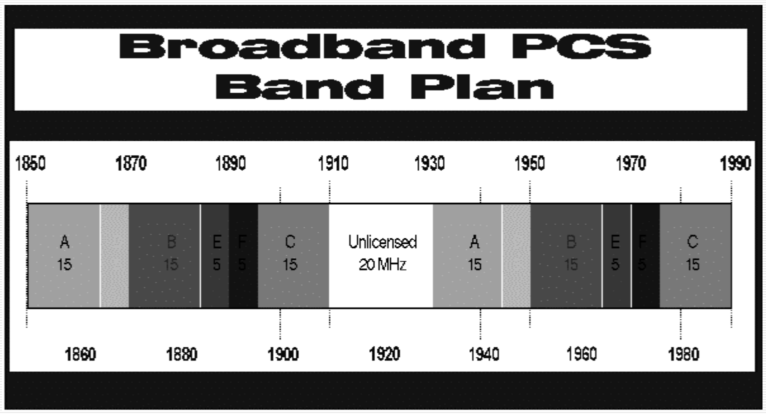
FCC Auction Events

Auction #	Service	# of Licenses	# of Winning Bidders
1	Nationwide Narrowband PCS	10	6
2	Interactive & Video Data Service	594	170
3	Regional Narrowband PCS	30	9
4	Broadband PCS A & B Block	99	18
5	Broadband PCS C-Block	493	89
6	Multipoint Distribution Service	493	67
7	900 MHz Specialized Mobile Radio	1020	80
8	Digital Broadcasting Service (110 deg)	1	1
9	Digital Broadcasting Service (148 deg)	1	1
10	Broadband PCS C-Block Reauction	18	7
11	Broadband PCS D & E & F Block	1472	125
12	Cellular Unserved	14	10
	To Date Totals	4245	583

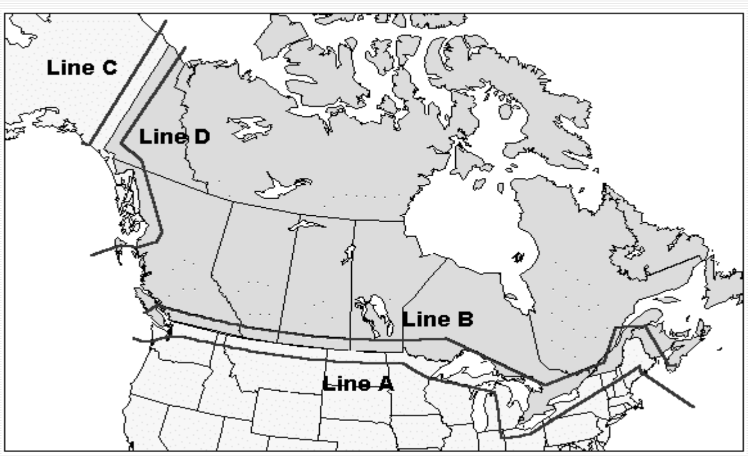
FCC Auctions: Revenues



FCC Auction for PCS



PCS Bands in Canada



PCS Bands in Canada

- June 15, 1995: Industry Canada issued call for license applications from parties interested in providing public PCS at the 2GHz frequency range
- three 30 MHz and three 10 MHz spectrum blocks, with 20 MHz for license-exempt devices
- December 18,1995: two 30 MHz licenses awarded to Clearnet PCS Inc. and Microcell Network Inc., two 10 MHz licenses awarded to Rogers Cantel Mobile Inc. and the regional shareholders of Mobility Personacom Canada Ltd.
- expected investments: over $3 billion

Industry Canada Vision

- PCS: a new family of advanced digital telecommunications services, built around the concept of a small, low-cost, personal, and fully portable wireless handset
- “on-ramp” to Information Highway
- PCS will usher in the era of the “personal” telephone number - user accessible anywhere in the world
- PCS is intended for everyone
- operational and commercially available in major cities by end of 1997, gradual extension across country