AMPS: physical layer
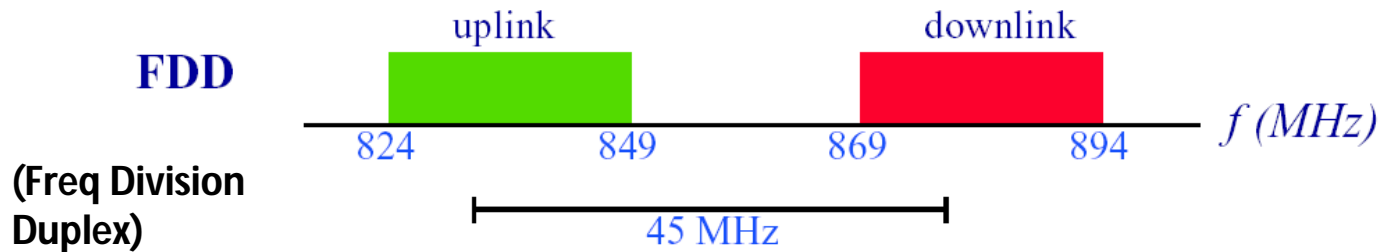
Radio bands

- 832 duplex (paired) channels
- A/B separation: 416 channels each
- channel spacing 30 kHz

FDD

uplink   downlink

824   849   869   894 $f\ (MHz)$

(Freq Division Duplex)

45 MHz

AMPS: physical layer

Modulation

- traffic (voice):
  analog FM
  peak deviation $\Delta f = \pm 12$ kHz
  companding / expanding
  pre-emphasis / de-emphasis

- control (data):
  binary FSK ("0" $\rightarrow$ -8 kHz, "1" $\rightarrow$ +8 kHz)
  10 kb/s data rate
  Manchester NRZ coding
  BCH(40,28) downlink, BCH(48,36) uplink
  blank-and-burst

- Supervisory Audio Tone (SAT)
  5970 / 6000 / 6030 tone
  co-channel separation

Digital Cellular: IS-54 TDMA System

- Second generation: **digital** (as opposed to analog as in AMPS)
- Same frequency as AMPS
- Each 30 kHz RF channel is used at a rate of 48.6 kbps
    - 6 TDM slots/RF band (2 slots per user)
    - 8 kbps voice coding
    - 16.2 kbps TDM digital channel (3 channels fit in 30kHz)

- 4 cell frequency reuse (instead of 7 as in AMPS)
- Capacity increase per cell per carrier
    - 3 x 416 / 4 = 312 (instead of 57 in AMPS)
    - Additional factor of two with speech activity detection.

US Digital Cellular

- **Standard: USDC = D-AMPS = IS-54 = IS-136 (EIA/TIA)**

- **TDMA/AMPS dual-mode terminals**

- **Split each AMPS FDMA channel into six TDMA channels**

- **Reuse of AMPS analog control channels: IS-54**

- **New digital control channels: IS-136**

USDC: architecture

- 7/21 site/sector reuse
- 18 dB C/I
- Mobile Identity Number (MIN)
- Electronic Serial Number (ESN)
- Network protocol IS-41

PSTN

MSC