AWS / BAS Frequency Coordination Technical Overview

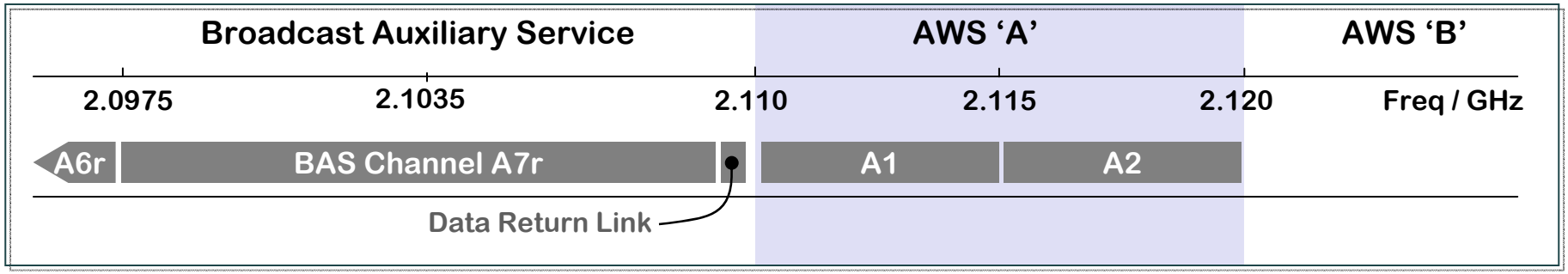
Experiences and lessons learned - FCC

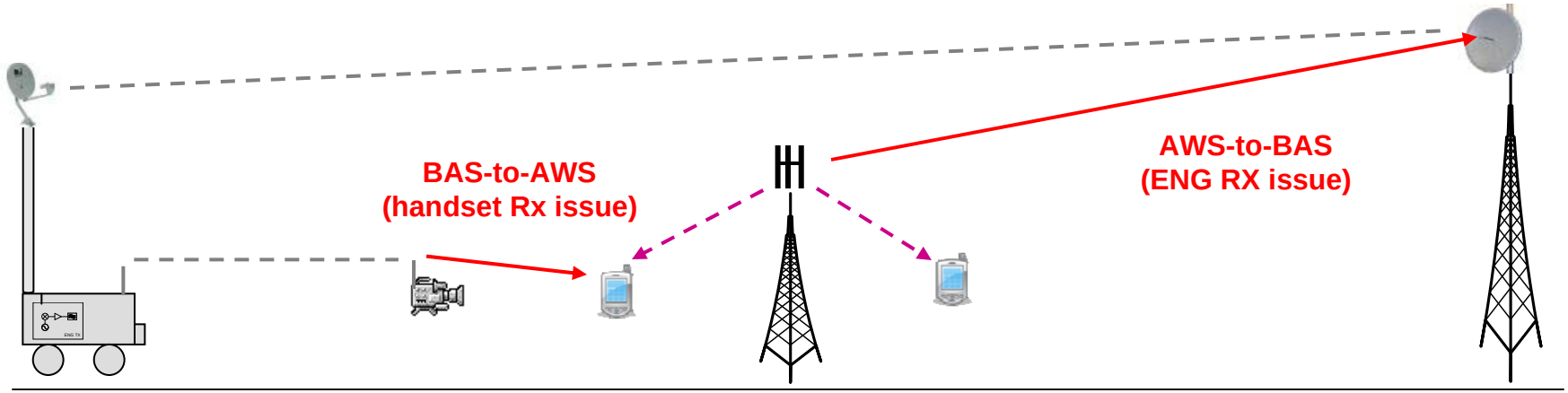
March 12, 2012

T · · Mobile ·
Spectrum Clearing

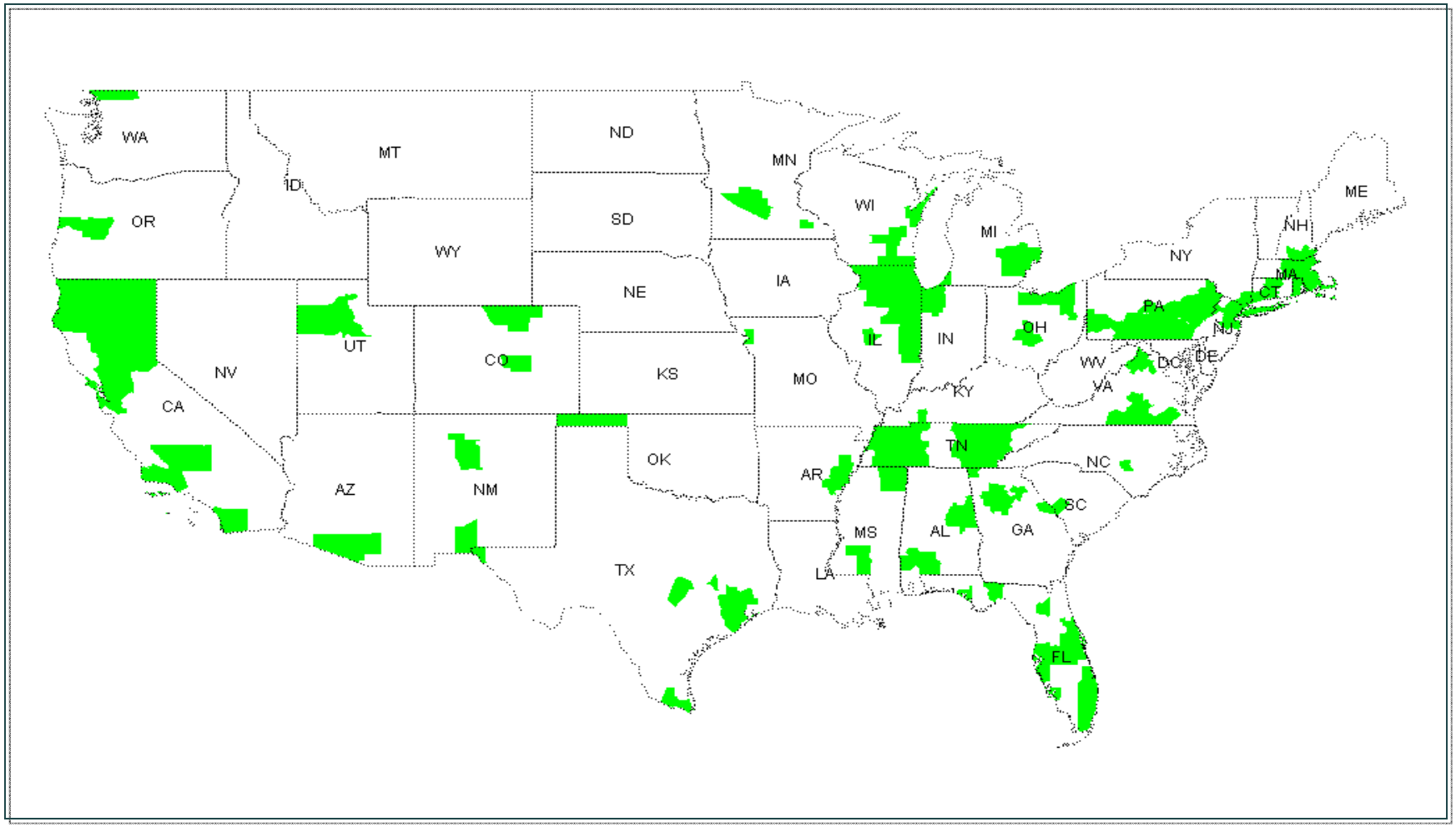
BAS and AWS frequency allocations

Advanced Wireless Services (AWS) A1 is directly adjacent to the BAS band, with a risk of mutual interference between ENG and AWS systems





T-Mobile A-block AWS spectrum holdings

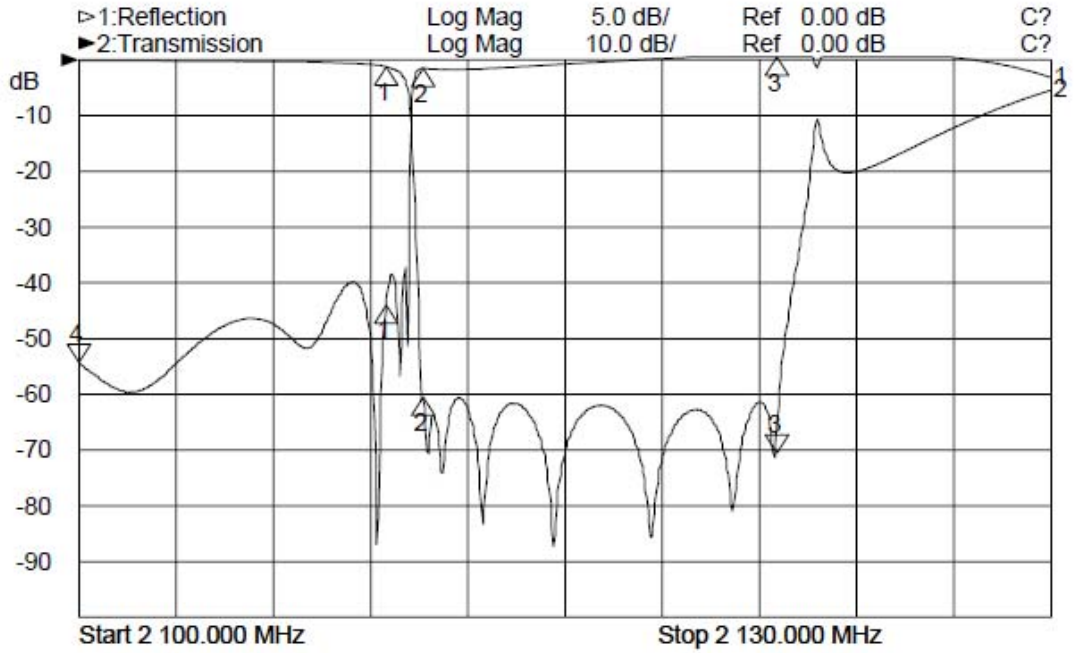


- T-Mobile holds AWS A-block spectrum in a number of markets across the country, as can be seen here (T-Mobile owned CMA license boundaries in green)

Historical Review of Technical Considerations

- Conducted joint AWS-to-BAS laboratory testing to characterize interference
  - T-Mobile cannot reasonably protect analog ENG operations, analog ENG Tx is also most harmful to T-Mobile
  - ~30 dB attenuation required to protect digital ENG from UMTS on AWS A1 (assuming a "worst case" situation and relative orientation)
  - UMTS emissions could not overload tower-top LNAs; minimal need to protect LNAs
  - Main interference mechanism - adjacent channel overload or BFO (rather than in band noise), therefore a receive selectivity issue to be addressed by additional RX filtering
- T-Mobile developed 'AWS' filter with CMT for ENG receivers
  - 1.4 dB insertion loss at 2109.5 MHz, <1 dB for channels A1 - A6
  - ~ 60 dB OOB rejection realized
  - Minimal group delay; no adverse effect on any digital ENG shots
  - Rack mounted 2RU form factor
  - Successfully lab tested in Seattle and field tested in NYC (WABC), Chicago (WLS), and Orlando
- Additional lab testing conducted to establish upper limit of filter performance
  - Protects offset-channel ENG shots (COFDM; 6 MHz; QPSK, 2/3, 1/32; ch7+) from AWS A1 RSL of up to -47 dBm at the RX
  - Channel center (COFDM; 8 MHz; 16QAM; 7/8, 1/32; ch7): up to -36 dBm
- T-Mobile also developed a bypass solution with Troll Systems
  - Switch can bypass CMT filter when needed (2.5 GHz or down converted co channel signal)
  - Rack mounted 1RU form factor
  - Automated switching feature option

CMT CMN719 Frequency Response



1:Mkr (MHz) dB	2:Mkr (MHz) dB
1: 2109.5000 -21.989	1: 2109.5000 -1.230
2: 2110.6000 -0.764	2: 2110.6000 -60.606
3: 2121.5000 0.529	3> 2121.5000 -70.598
4> 2100.0300 -27.185	

Near Cutoff Return Loss and Insertion Loss
Add Approximately 0.2 dB for Supports

Continued Coordination

- Identify potentially affected BAS licensees
  - Continue to work through SBE coordinator
  - Work with all willing stations
    - We have not heard from ~ 40 stations
  - Discuss specific concerns and system nuances
  - Determine number of filters and bypass switches required
- Provide required number of filters and switches to each licensee

Progress to date

~ 100 Total BAS licensees coordinated with since 2007

- > 95% of licensees have not had interference issues
- Markets are completely deployed across the country

Equipment distribution summary to BAS licensees

- Filters ~ 500
- Portable Filters ~ 140
- Bypass switches ~ 350