



What role can whitespace and dynamic use of spectrum play in maximising spectrum efficiency?

# Avoiding Interference

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# Background

- Responsible for key unlicensed decisions:



1985 ISM Band Decision  
(Wi-Fi, Bluetooth, etc).



1995 60 GHz Decision

- Spent 7 interim years as Associate Chief, FOB (EB predecessor) working on technical enforcement issues



# What is Interference?

- In a technical sense, information is not *destroyed* due to multiple transmitters on the same or nearby frequencies
- But information may not be receivable at a given receiver/antenna combination at a given location if the D/U ratio is less than a few dB
  - In analog systems much higher D/U ratios were sometimes needed, *e.g.* NTSC TV
- Legal definition of “harmful interference” is based on archaic pre-WWII ITU definition

# What is Interference?

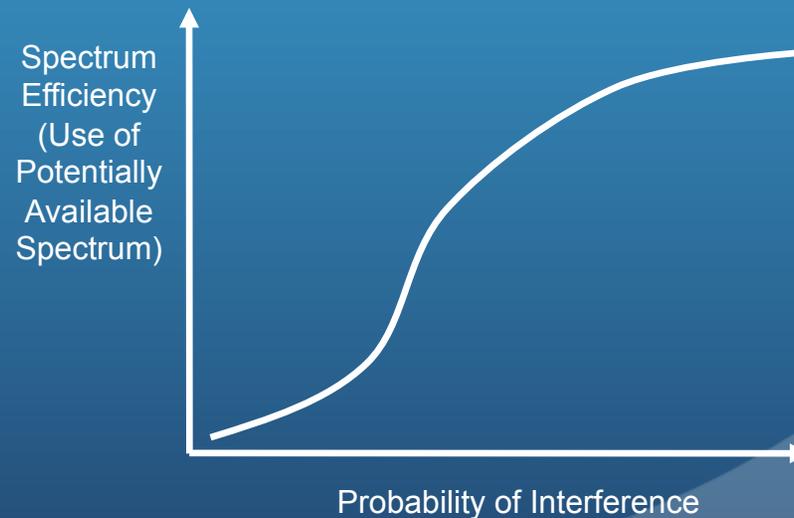
- Legal definition of “harmful interference” (HI) is based on archaic pre-WWII ITU definition
  - Both FCC and NTIA have recognized need to clarify what HI is, but neither have made any substantive progress
  - Spectrum incumbents may see HI ambiguities as a plus allowing them to battle potential new entrants who then exsanguinate in regulatory battles
  - But capital investment community may realize that without clearer “metes and bounds” incumbents for whom spectrum is a major asset may have due diligence problems

# Regulation – 1<sup>st</sup> Line of Defense

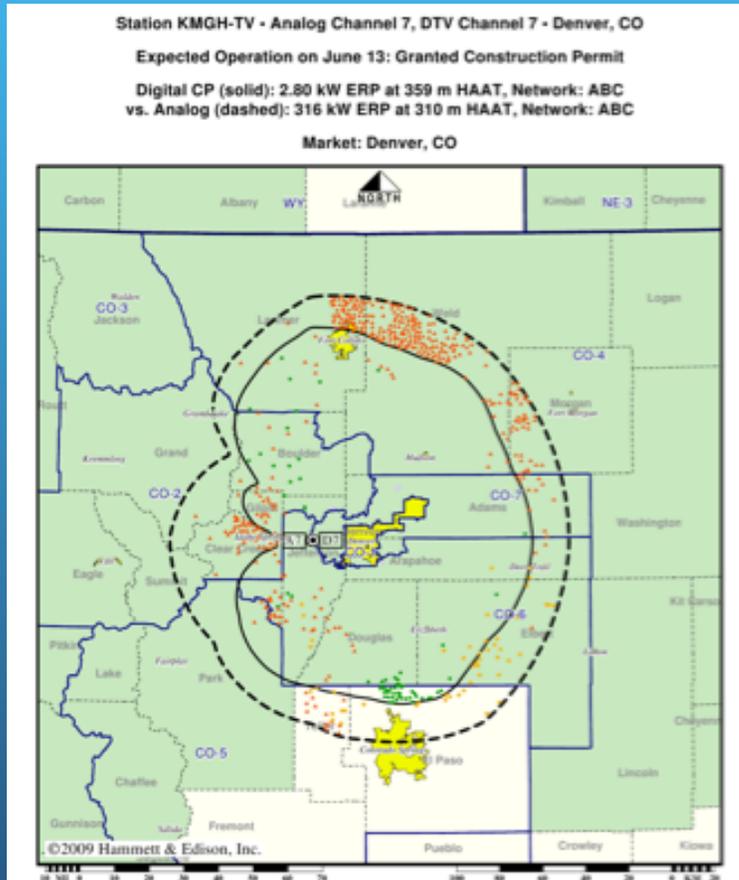
- Regulations should be conservative enough to make interference due to white space devices (WSD) comparable in risk to service loss due to other phenomena
- FCC WSD rules are certainly conservative enough to do this
  - Consistently erring on the side of protecting TV broadcast licensees

# Utilization vs. Interference Risk

- As in classic detection theory, there is a trade off between efficient spectrum use and minimizing interference
- FCC decision chose to use 1966 radio propagation model this is known to be too conservative in rough terrain



# Comparison of Ofcom and FCC WSD Models



FCC R-6602 model



Ofcom Arqiva model

# Enforcement – 2<sup>nd</sup> Line of Defense

- Regulator must assure that whatever rules are adopted are complied with
  - Necessary to avoid interference
  - Necessary to maintain trust of incumbents which is key to both continuance and growth of all types of DSA
- Database integrity must be maintained
- WSD compliance with rules must be maintained throughout equipment lifetime
  - Most WSD will be implemented in software defined radio technology



# 5 GHz U-NII Lessons

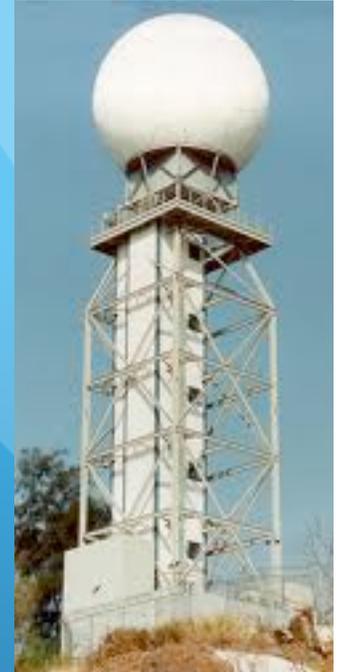
- Multiple cases of 5 GHz U-NII DFS transmitter interference to safety-of-life FAA terminal doppler weather radar (TDWR) systems
- In many of the cases NTIA testing showed DFS system was disabled!
- Why?



# 5 GHz U-NII Lessons

- While FAA and NTIA have been silent on the root cause of this, a FOIA request for Motorola response to FCC Letter of Inquiry has revealed:
  - Motorola sold Canopy models with different software for different countries
  - Motorola interpreted FCC rules as permitting “professional installers” and “systems operators” to change country codes and system parameters and issued them the passwords needed to do so
  - Almost 2 years after Motorola admitted this FCC issued a statement forbidding this action

(KDB 59428 - <http://apps.fcc.gov/kdb/GetAttachment.html?id=36663>)



## 5 GHz U-NII Lessons

- If a well respected mainstream manufacturer can make such a mistake, presumably unintentionally, imagine what an unsavory manufacturer could do!
- The original SDR rules adopted in Docket 00-47 were watered down at the request of industry in Docket 03-108 which exempted radios “not marketed as SDRs”.
  - Motorola Canopy was not marketed as an SDR, yet met every other characteristic of an SDR
  - Such radios have no security requirements to prevent software alternation by unauthorized parties
  - FCC believe general requirements of §15.15 is adequate to prevent repeats. Are they?



# Summary

- Avoidance of interference involves a necessary tradeoff with spectrum efficiency
- FCC rules based on model much more conservative than Ofcom model under consideration
- Interference avoidance requires attention to equipment regulation and compliance that has not been a strong point at FCC for some time due to budgetary resource limitations