

## Summary of Recommended Practice for Coexistence of Broadband Wireless Access Systems

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Purpose:

This presentation is to give an overview of the current draft TG2 Practice document to TG1

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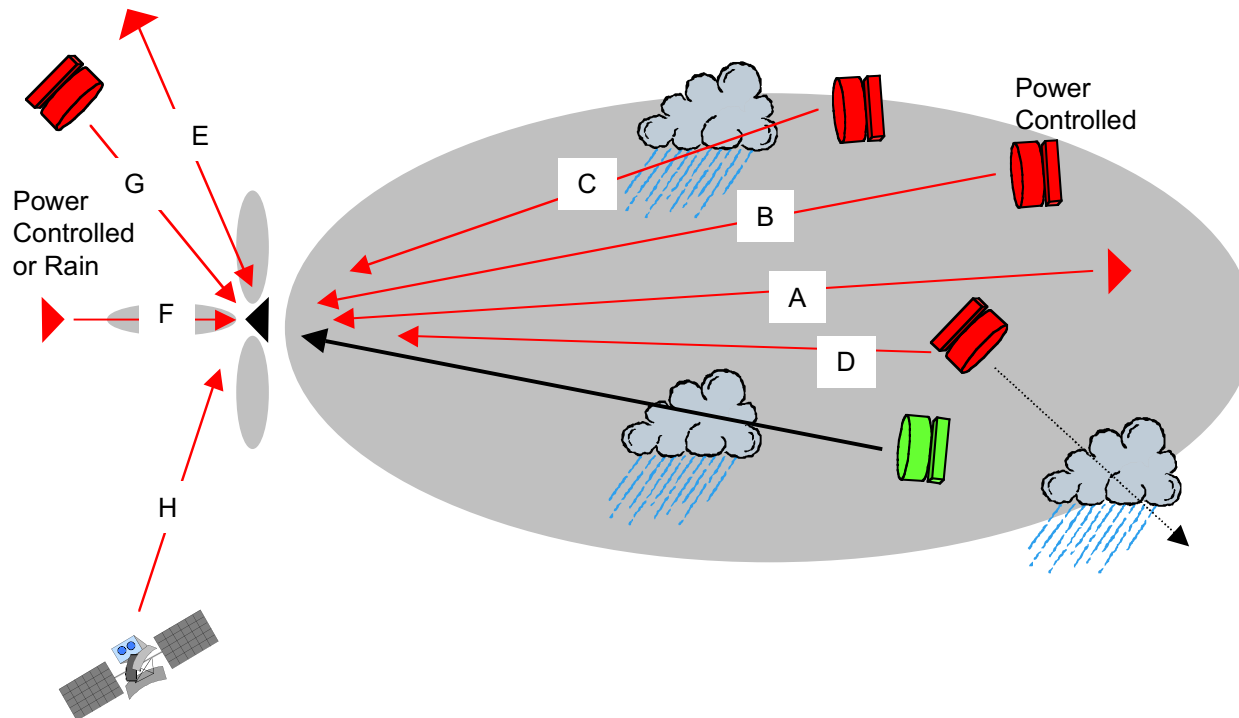
# Summary of Recommended Practice for Coexistence of Broadband Wireless Access Systems

IEEE 802.16.2 presentation  
14 September 2000

# Agenda

- Problem statement
- TG Activities
- Recommendations
- Conclusions

# Problem Statement



- Desired = sub – rain – hub
- A = hub – hub
- B = sub – hub
- C = sub – rain – hub

- D = sidelobe sub
- E, G = sidelobe hub
- F = backlobe – backlobe
- H = satellite/plane – hub  
(NOT in the Practice)

# Conclusion

Guaranteed interference protection is virtually unattainable

- The following recommendations alleviate problems but still have a small risk of significant interference
- Risk and protection are engineering trade-off
- To remove ALL risk would inhibit the industry and waste valuable & scarce spectrum

# Work Focus

- Scenarios:
  - Focus of work is 23.5 – 43.5 GHz
  - Co-channel, adjacent area
  - Same area, adjacent channel
    - Co-channel, Out-of-Band emissions
  - Hub-hub, hub-sub, sub-hub, sub-sub
  - TDD, FDD (up/down frequencies may be mis-aligned)
  - PP, PMP, Mesh
- Audience for Practice : operators, regulators & manufacturers
- Practice does NOT describe intra-system problems

# TG Activities

- Studied some of the issues using analytical techniques
- Studied many (not all) possible scenarios using Monte Carlo simulations
- Considered regulatory requirements
- Considered related work in other bodies

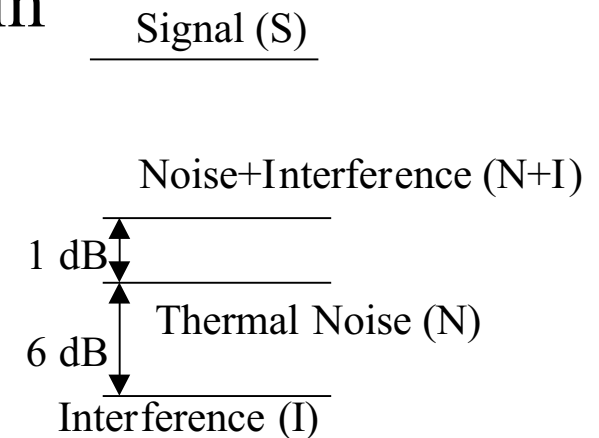
# TG Practice

- The Recommended Practice is the opinion of the Task Group
- Some recommendations may be controversial
- Enforcement of these opinions is beyond scope of IEEE



# Recommendation 1

- 6 dB below thermal noise interference acceptable/tolerable criterion
- Accept 1dB degradation in receiver sensitivity from one interferer (or 3dB degradation from 4 interferers)
- Service providers should include anticipated interference in system design margin



# Recommendation 2

- Each operator take initiative to collaborate initially and at any significant modification
- Use distance as a trigger value
- Use Power Flux Density as a trigger value

# Recommendation 3

- Operators should design systems for maximal intra-system frequency re-use
  - Improve intra-system performance
  - Improve interference mitigation by reducing likelihood of co-channel interference

# Recommendation 4

- Incumbent operators and new entrants have same coexistence rights & responsibilities
- No “squatter’s rights”
- Coexistence problem may NOT be solvable
- Unilateral changes by victim may be insufficient
- Operators must be prepared to share system parameters to facilitate coexistence

# Recommendation 5

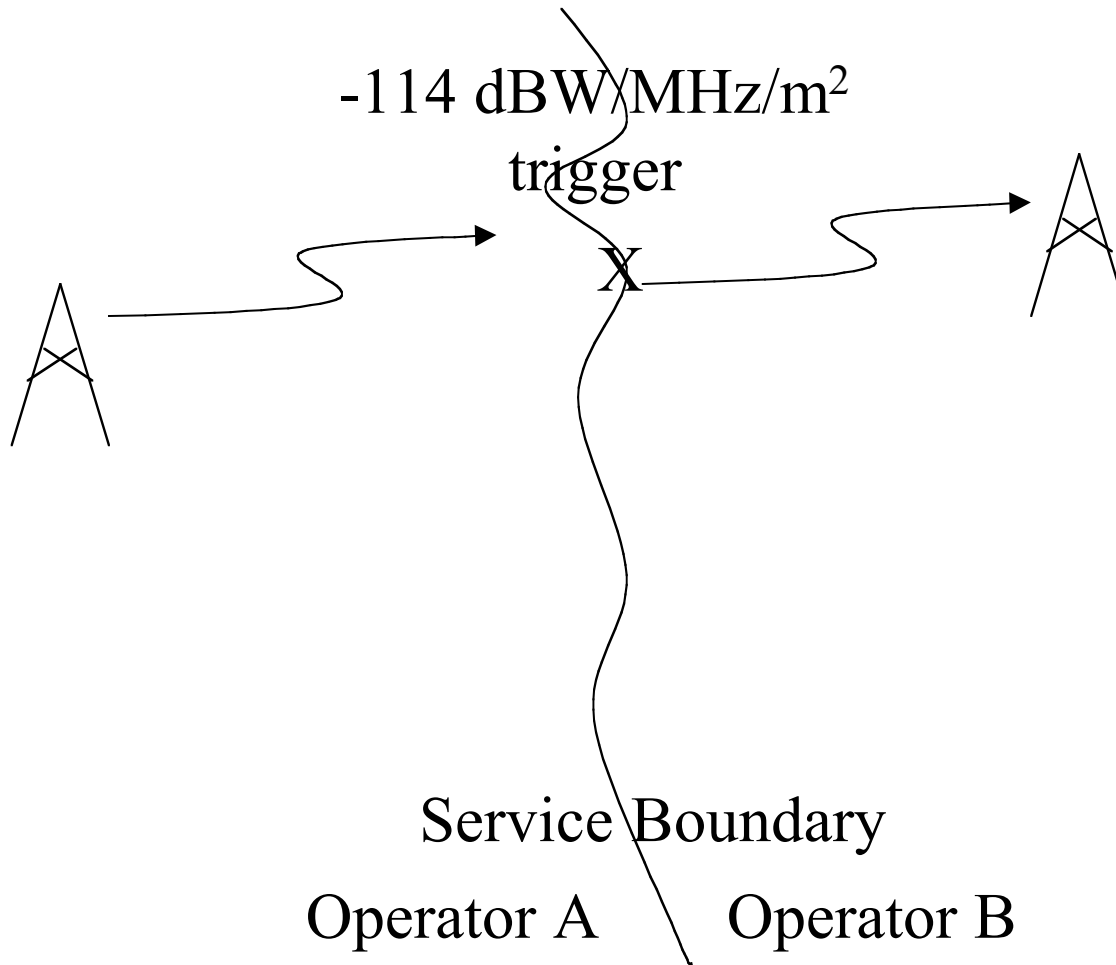
- Consideration of multiple interferers is important, however simulations indicate a single interfering source usually dominates
- Practice does not recommend aggregation of interference emissions from one system
  - Dominant interference mechanism is main-beam to main beam coupling
  - Simulations show that >two antennas coupling directly has low probability

# Recommendation 6

For adjacent-area, co-channel interference

- No coordination needed if transmitter  $>60\text{km}$  from own service boundary or neighbors service boundary (if known)
- “ $-114 + 20\log(\text{freq}/28)$ ” dBW/MHz/m<sup>2</sup> (for 23-43 GHz) at own service boundary as power flux density coordination *trigger* value
- Emissions above trigger at boundary needs coordination with other operator
- Coordination process likely to be country-specific e.g., Canada, UK & US/Canada Bi-lateral Arrangement
- Trigger may need to be tightened if pt-pt facilities are significantly used (e.g.  $-125$  dBW/MHz/m<sup>2</sup> @ 38GHz)

# Recommendation 6 (cont)



Note In some cases, service boundaries A/B may not touch

# Recommendation 7

For same-area, adjacent channel interference

- Usually need 1 guard channel between close transmitters
- Intelligent frequency usage or cross-polarizations may permit careful use of this “guard channel”



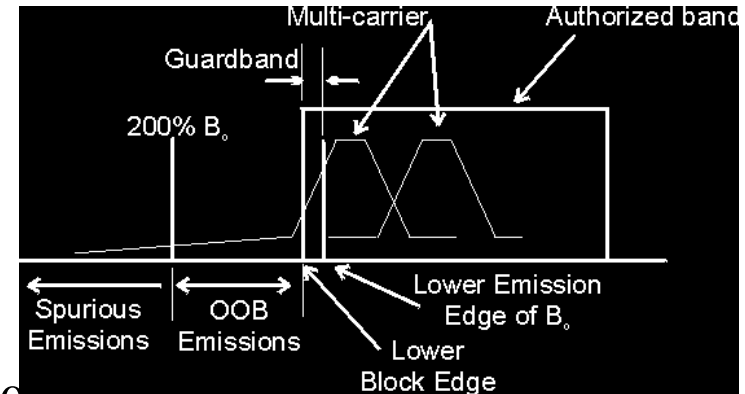
# Recommendation 8

- Antennas alone won't solve problems, but will mitigate trouble areas
- Use as good antennas as you can afford, but as a minimum use IEEE class 1 to promote co-existence

# Recommendation 9

## Unwanted emission spectral density:

Frequency offset from authorized band edge = 0 - 200% of occupied B W:



- For a single carrier transmitter:

- attenuated  $> A$  dB below total mean output power  $P_{\text{mean}}$

$$A \geq 11 + 40 f_{\text{offset}}/B_o + 10 \log_{10} (B_o), \text{ dB in 1MHz}$$

$$A_{\text{max}} = 50 + 10 \log_{10} (B_o) \text{ dB in 1MHz}$$

$$P_{\text{min}} = -70 \text{ dBW/MHz.}$$

- Occupied bandwidth = 99% power bandwidth

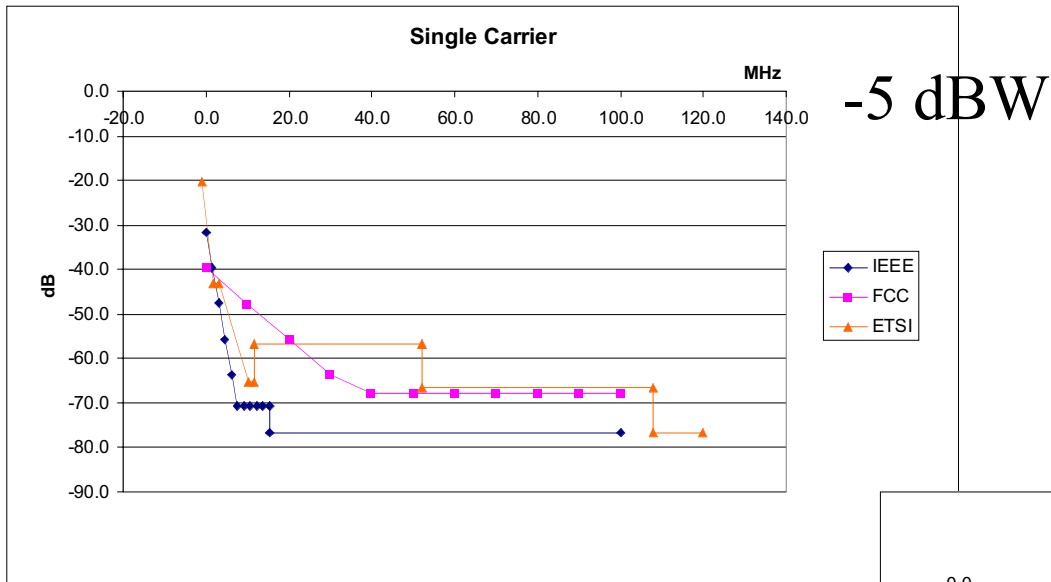
- For a multi-carrier or multi-transmitters into a common final stage amplifier:

- The mask is to be the same using the *occupied* bandwidth from lowest to highest frequency. The total mean power is to be the sum of the individual carrier/transmitter powers.

Frequency offset  $> 200\%$  of the occupied bandwidth:

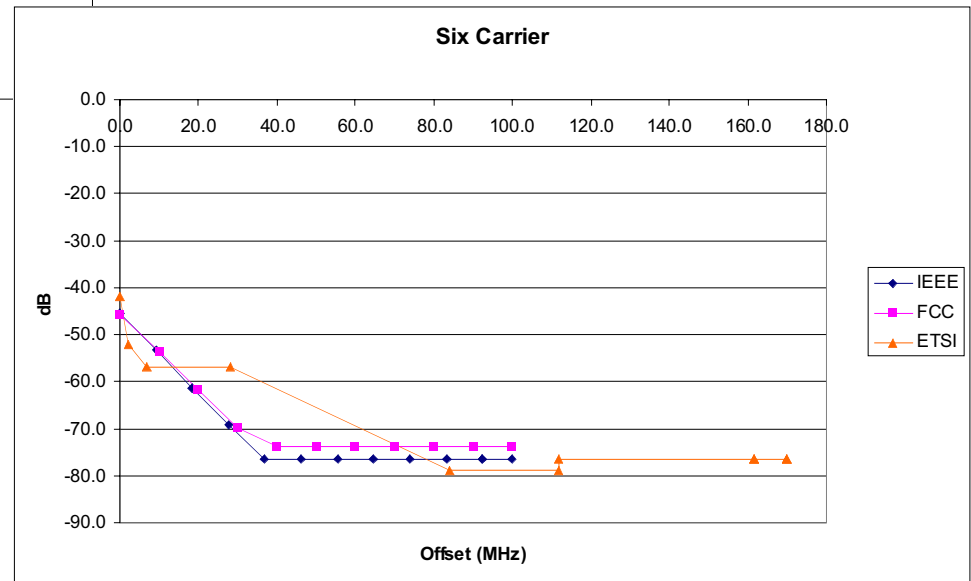
- $P_{\text{max}} = -70 \text{ dBW/MHz.}$

# Recommendation 9 (cont)



Examples of OOB psfd emissions masks for 1 (or 6) 7MHz carriers

-11 dBW



# Recommendation 10

- Use lowest needed transmitter power
  - Recommend using EIRP significantly less than regulators currently authorize to minimize interference potential
  - No current manufacturer is offering equipment near max permitted power
- Use ATPC subscriber power control to minimize emissions

# Recommendation 11

- Use appropriate parameters for Coordination calculations
  - Adjacent Area/Same Frequency
    - Estimation of compliance with trigger
    - If exceed psfd trigger, simulation of interference scenarios
  - Same Area / Adjacent Frequency

# Other Issues Addressed

- TG consensus to avoid inclusion or details of specific bandplans
- Mitigation techniques
  - Use of Bandplans
  - Frequency coordination
  - Transmitter siting
  - Separation of Distance
  - Power
  - Antenna – orientation, tilting, ....
  - ....

# Conclusions - 1

- Resolving coexistence is PREREQUISITE for sustainable BWA
- Coexistence relies on good-faith collaboration between operators

# Conclusion - 2

Guaranteed interference protection is virtually  
unattainable



# TG2 Request

- Please read latest draft (R9 will be issued 22nd September)
- Forward comments/ suggestions to TG2 by 11<sup>th</sup> Oct (Interim) or by Nov 6<sup>th</sup> (Tampa)
- Believe TG1 should include in their standard
  - Min antenna RPE
  - OOB emission spec
  - EIRP limits and considerations