

CSMAC WG-1 Update and Liaison's View

1695-1710 MHz
Meteorological-Satellite

WG-1 Participation

- Co-Chairs
 - Ivan Navarro, DOC/NOAA
 - Steve Sharkey, T-Mobile
- CSMAC Liaisons
 - Dennis Roberson
 - Mark McHenry
- FCC and NTIA Points of Contact
 - Ed Drocella
 - Robert Weller
 - Navid Golshahi
- Over 70 Participants Representing Federal Users, Industry and Other Interested Parties

Overview

- Purpose: “to explore ways to lower the repurposing costs and/or improve or facilitate industry access while protecting federal operations from adverse impact.”
- Approach: “begin using the Fast Track and 1755-1850 MHz reports as the basis for starting work point ... consider whether it can improve upon those assumptions with “real-world” knowledge of network operations.”
- Areas of focus include:
 - Revising Long-Term Evolution (“LTE”) technical parameters for interference models to more accurately reflect real world deployment scenarios
 - Review operating parameters of Federal systems
 - Modify simulation model to reflect updated parameters
 - Assess the feasibility of reducing the exclusion zones identified in the fast track report for maximizing availability of the spectrum in major markets.
 - Develop recommendations for service rules consistent with the agreed outcome of the WG-1 analyses
- Discussions have been cooperative and productive
 - Significantly furthering understanding of both system types, as a general matter, leading to consideration of various prospective methods of sharing

Method of Work

- Technical Committee created to review and revise LTE UE characteristics, based on “real-world” knowledge of network operations.”
 - Initially focused on User Equipment characteristics
 - Includes industry and Government representatives from all WGs as well as other experts
 - Significant time has been spent defining the appropriate uplink LTE parameters
 - Foundational work – a basis for interference analysis in all WGs
 - Work is on-going, anticipate completion by Oct. 12
- Interference analysis
 - Based on revised LTE inputs, NTIA has revised and continues to revise the analysis
- LTE is highly configurable and dynamic
 - Numerous system and operator controls, including wide range of dynamic power control, can be applied to protect federal operations and mitigate potential for interference
 - Deployment specific conditions create challenges in precisely modeling potential for interference in a general discussion

Recommendation 1

Allocation of the 1695-1710 MHz to shared use should limit commercial systems operations in the band to mobile uplink use only

- WG analysis is based on this understanding
- 1695-1710 MHz is immediately adjacent to the AWS-1 uplink band and use of the band will maximize use for commercial services
- Any deviation from this requirement would significantly change analysis for protection of federal operations

Recommendation 2

Study and Assess the Feasibility of Relocating Federal Government Receiver Locations or Other Methods to Maximize Commercial Use of the Top 100 Markets by Population

- Seven of the sites identified in the fast track report are located within top 100 markets
 - Suitland, MD; Miami, FL; St. Louis, MO; Cincinnati, OH; Sacramento, CA; Pearl Harbor, HI; Omaha, NE
- Working Group participants have identified potential challenges to use of site relocation, including the extensive non-spectrum related requirements for identification of suitable locations, access to infrastructure and redundant, robust backhaul that is not cost prohibitive, acceptable timeline for implementation, and does not impact the government mission
- Study and consider other methods, such as Receive Diversity, Interference Cancelling Mechanisms, Filtering, and Shielding, including an assessment of cost implications
- Complete feasibility, cost, and timeline analysis for Federal receiver relocation or other methods prior to FCC rulemaking and auction

Recommendation 3

WG-1 should remain active to recommend a framework for service rules and/or license conditions for wireless broadband use in the 1695-1710 MHz band

- To complete the remaining studies, analysis, and verification required to validate and recommend appropriate protection criteria, monitoring, enforcement mechanisms, and other elements of FCC rules and regulations based on agreed upon system characteristics and models
- Include analysis and verification of protections for federal user equipment operating in the adjacent band

Liaison's Remarks

Geographic Exclusion Zone Concept Will Not Maximize Spectrum Use

- **Alternative 1: Only use coordination zones**
 - Exclusion zones are too ill defined at this time, deliver sub-optimal spectrum utilization, and provides government an advantage in future negotiations
- **Alternative 2: Temporal sharing**
 - Satellite operation is easily predictable
 - Satellites only use a portion of the band at any one time
 - Satellite over flights are infrequent and short (15 min max)
 - LTE operators can control system configuration dynamically
- **Alternative 3: Regulate LTE uplink field strength limits at the satellite receivers**
 - Amplitude probability distribution function and event duration function
 - Most direct method to assume satellite protection
 - Minimizes prediction uncertainty
 - Accounts for LTE deployment choices
 - Small cells vs. large cells near satellite receivers
 - Deploy on mountain top or not
 - Limit handset power level
- **Alternative 4: Mix and Match Alternatives 1 through 3**

Geographic Exclusion Zone Issues

- Currently a large (2X to 10X) uncertainty on the 'correct' exclusion zone size
 - Simulation assumptions – Propagation, cell site lay-out, LTE power control, LTE TX duty cycle, 'outlier' signals, etc
 - LTE configuration – Deployment on mountains, cell size, temporal adaption, etc
 - Impact to satellite receiver – INR temporal distribution function, directional antenna impact, etc
- Additional tests are needed to reduce the uncertainty*
 - Inject LTE-like signals into satellite receiver to investigate image degradation and tracking loop issues (simulation and/or ideally actual receiver impact)
 - Validate LTE uplink power amplitude distribution function at multiple locations to validate simulation assumptions (LTE power control, LTE TX duty cycle, 'outlier' signals, etc)
 - Measure LTE uplink power amplitude distribution function with a directional antenna to validate distribute source effect

* Tests should not be expensive - A few person-months of work

Recommendations

- Industry and government should identify any perceived issues with temporal sharing and field strength approaches
 - Industry should conduct tests or provide evidence to address government concerns
- Government and industry need to conduct temporal and geographic exclusion zone technical tests in the near term (immediately?)
- If the geographic exclusion zone method must be used for reasons not understood by these presenters and the sizes must be determined in the near term, then
 - Size may initially be large to protect satellite system, but
 - Definitions / terminology must be sufficiently flexible to allow modifications to reduce the exclusion zone to much smaller sizes and to introduce alternative sharing method (temporal, structural) as evidence is obtained
 - Government must be provided sufficient resources and in a timely manner to support this activity