A Fast-Track Approach to Enabling Expansion of Wireless Broadband

June 28, 2011

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Wireless Internet Service Providers Association

Introduction

- Motorola Solutions, Inc.(MSI) and the Wireless Internet Service Providers Association (WISPA) support the FCC and NTIA initiative to make available additional spectrum for wireless broadband

- There is an opportunity to leverage existing rules, licensing approach and equipment eco-system to quickly put the 3550 – 3650 MHz spectrum to productive use providing wireless broadband

- We will present the technical advantages of this approach as well as the business and public interest benefits

Background

- NTIA states that is impractical to move the 3 GHz incumbents and so geographic exclusion zones are employed to allow for spectrum sharing
- NTIA assumed a commercial mobile WIMAX broadband deployment scenario in its analysis of the 3 GHz band interference issues
- This assumption results in exclusion zones sufficiently large as to exclude broadband deployments in 9 of the top 10 MSAs
- Comments to the FCC from Commercial Mobile Carriers indicated no interest in 3 GHz band for commercial mobile use
- In comments to the FCC, the Satellite Industry Association opposed high power mobile broadband deployment but would accept fixed deployments with protections that mirror those used for the existing 3.65 GHz band

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Alternative Proposal

- MSI and WISPA propose an extension of the existing* 3.65 GHz rules and licensing arrangement to 3550 – 3650 MHz
- Key Provisions of 3.65 GHz Rules:
  - Non-exclusive Licensing / Fixed Station Registration / Incumbent exclusion zones
  - Licensees required to coordinate and cooperate to resolve interference issues
  - EIRP limited to 1 W / MHz occupied bandwidth
  - Standard Out of Band Emissions limits - No Tx Channel Mask or Receiver Performance requirements

* Restricted contention-based protocol of lower 25 MHz of 3.65 GHz band is preferred

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Business and Public Interest Benefits of Alternative Proposal

- Existing community of more than 20 suppliers currently ship equipment that is ready for use in the expanded spectrum
- Existing rules, certification process and licensing approach could be quickly extended to support the additional frequencies
- Existing community of WISPs and Industrial Users (with over 1600 active 3.65 GHz licensees) could make immediate use of the expanded spectrum
- 100 MHz of spectrum can quickly be put to use expanding access to broadband especially in rural areas:

"… 72.5 percent of the 26.2 million Americans that still lack access to … broadband services reside in rural areas …"

  - From the FCC Report: "Bringing Broadband to Rural America: Update to Report on a Rural Broadband Strategy, June 17, 2011"

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Technical Benefits of Alternative Proposal

- Reduced Interference Risk to Incumbents
  - Lowered Base Station Power, Lower device density and (practical) limitation to fixed services reduces risk of interfering with incumbents and allows for smaller exclusion zones
- Broadband Receiver Performance Requirements Not Needed
  - Use of broadband device directional antennas and the expectation of needing to accept some interference eliminates the need for restrictive receiver performance requirements on broadband devices

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NTIA 3 GHz Interference Analysis Issues

- Assumed a *mobile* WIMAX deployment model
  - High power and high density
- Over-estimated Interference potential of incumbent Radar Systems *to* Broadband Systems
- Assumed an overly-optimistic Propagation Model for Interference
- Assumed unnecessarily stringent Tx Channel Mask and Receiver Performance specifications

3 GHz Interference Analysis

- Interference Analysis focuses on three types of incumbent radar systems:
  - Airborne Radar (AB) operating up to 3500 MHz
  - Ground-Based Radar (GB) operating up to 3500 MHz
  - Ship-Borne Radar (SB) operating up to 3650 MHz
- NTIA considered Interference ***to*** the incumbents as well as ***from*** the incumbents to the broadband system
  - Potential interference *from* the incumbents significantly skews geographic usability.
- In practice, interference ***from*** incumbent radar ***to*** broadband system will be minimal; should not be a deciding factor:
  - Narrow beamwidth (<3deg), rotating radar antennas combined with low transmission duty cycles (< 0.1% for the highest power system) should limit the interference to the broadband system to occasional bit errors addressed by error correction protocols
  - NTIA analysis assumes continuous energy source along coastal areas; in reality, energy will be seen from a few point sources widely distributed.
    - Use of alternate channels by the broadband system alleviates most problems.
- Preventing interference ***to*** incumbents should be the primary consideration for determining exclusion zones, equipment limits and other deployment constraints

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Interference to Radar Systems

- The Base Station (BS) rather than the Subscriber Modules (SMs) are the devices that potentially contribute the most interference to the incumbent

- Under existing 3.65 GHz rule assumptions, the fixed wireless BS potential Interference contributions to Incumbents are less than that modeled by NTIA:
  - Max EIRP is +43 dBm per sector vs +62dBm for mobile BS
  - Lower expected density of fixed base station sites which have much larger cell radius (10kM vs. often <2kM)

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Airborne and Ground-Based Radar Systems

- Airborne Radar Systems:
  - We agree with the NTIA conclusion that exclusion zones are not necessary to protect incumbent radar systems
    - Radar System range already limited to ~10 nmi due to self-interference issues
    - Radar System operating at least 50 MHz off channel (< 3500 MHz) from broadband system
  - We believe exclusion zones are unnecessary to protect the broadband system from the incumbent radar system

- Ground-Based Radar Systems:
  - NTIA analysis required only small exclusion zones due to Radar System operating at least 50 MHz off channel (< 3500 MHz) from broadband system
  - Under Existing 3.65 GHz rule assumptions, these exclusion zones could be made smaller or remain the same with increased interference protection

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Interference to Ship-Borne Radar Systems

- NTIA calculated a worst case exclusion zone of 458 km to prevent interference **from** Ship-Borne Radar

- Exclusion Zones should be determined by interference **to** Ship-Borne Radar. Key parameters:
  - AP/BS Power levels +43 dBm (20 MHz channel)
  - Antenna Heights 60m radar / 100m (AGL) AP/BS
  - Acceptable Interference < -114 dBm (worst case NTIA analysis, 4-8)
  - Propagation model

- Using NTIA-provided Line-Of-Sight equation (see 4-13 of NTIA report), and utilizing 4/3 LOS, the exclusion zone for this same worst-case scenario 73 km

- Exclusion zones become more practical when interference to the broadband system is not a consideration and the BS has limited power

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Summary

- The best and most productive use of the 3550 – 3650 MHz spectrum for broadband would be to make it available under the existing 3.65 GHz band rules and licensing approach
- In the near term, this may be one of the most efficient and impactful actions that the FCC can take to foster expansion of access to rural broadband
- This approach promotes the public and business interests and has the technical advantage of reducing the risk of interference to incumbents
- Motorola Solutions and WISPA stand ready to assist the FCC and NTIA in moving forward with such an allocation of the spectrum

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BACKUP / Technical Detail

Interference to Airborne Radar Systems

- From the NTIA Report:
  - Airborne Radar systems are limited to effective ranges of ~10 Nautical Mile (Page 4-8).
  - Radar system sensitivity is limited by self-interference between radar systems rather than noise; I/N ratios of 30 – 40dB are acceptable.
  - Using 30dB as the I/N ratio, the interference threshold for Airborne Radar 2 is -62.5dBm (worst case device). Assuming FSPL and a AP transmit power of +42dBm, the required path loss is 104dB.
    - This equates to approximately 1kM (FSPL is 103.4dB at 1kM / 3650MHz)
- Use of down-tilt and / or controlled upward radiation reduces this range further
  - Unlike mobile markets / use, AP and SM can make use of engineered antennas to further protect incumbents.

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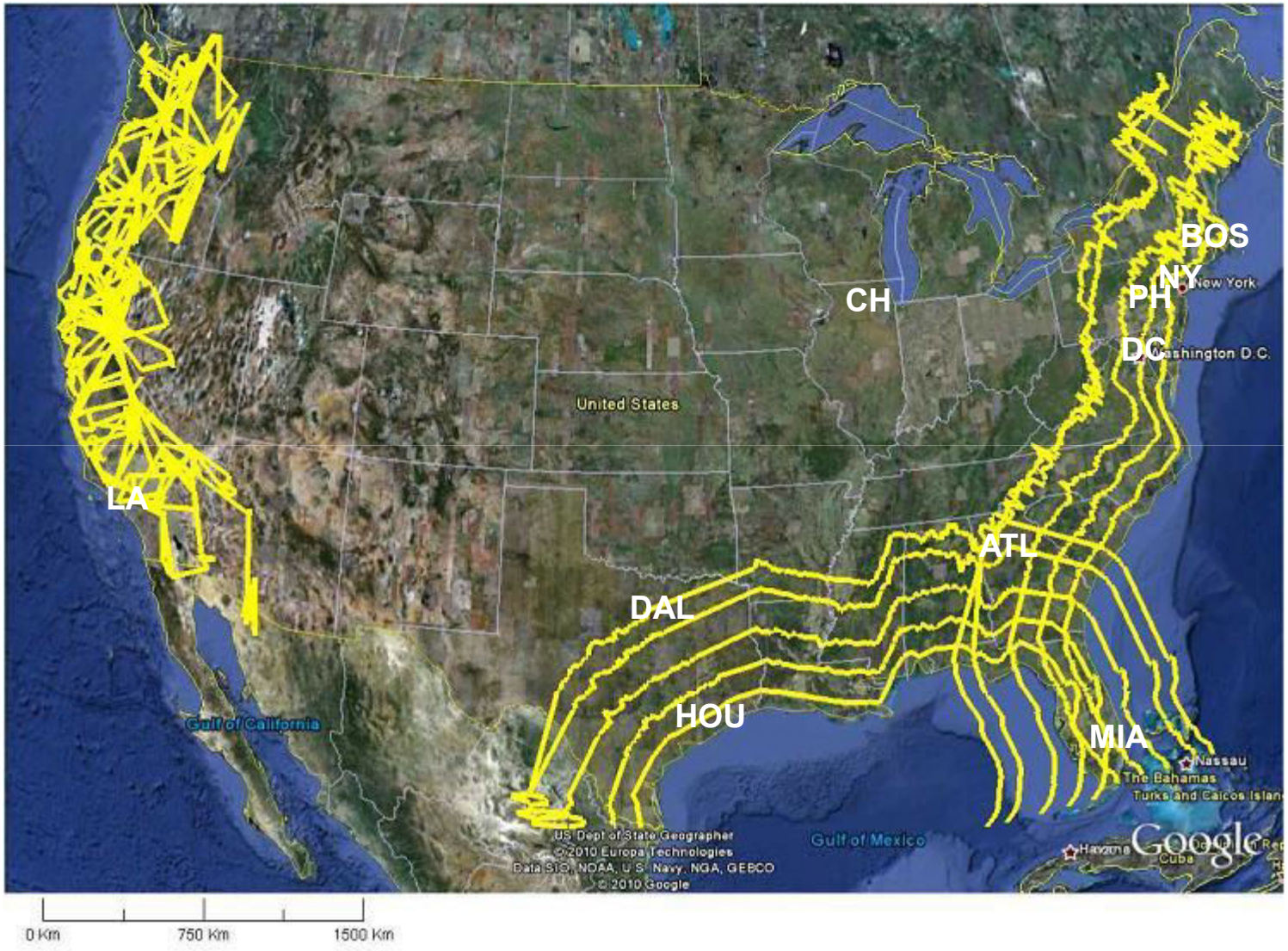
Original NTIA Ship-Borne Exclusion Zones

NY



Original NTIA Ground-Based Exclusion Zones