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January 22, 2010

Robert L. Pettit
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Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Re: Ex Parte Presentation (IB Docket No. 95-91; WT Docket No. 07-293)

Dear Ms. Dortch:

On January 21, 2010, representatives from Sirius XM Radio, Inc. ("Sirius XM") met with the staff of the Office of Engineering and Technology, the Wireless Telecommunications Bureau and the International Bureau to discuss issues associated with the above-captioned proceedings. The list of participants is attached.

Sirius XM again emphasized that if the Commission were to amend its rules to allow mobile broadband operations in the WCS band, those rules should identify and detail mobile WCS operating parameters and usage restrictions that would protect Sirius XM's subscribers. In so doing, Sirius XM discussed the attached presentation, which was distributed to the FCC's staff.

Sincerely,

/*S*/ *Robert L. Pettit*
Robert L. Pettit
Counsel to Sirius XM Radio, Inc.

Attachments: Meeting Participants
Sirius XM – OET Meeting: Follow up to January 4th 2010 Ex Parte

List of Participants
Sirius XM – FCC Staff Meeting
January 21, 2010

Sirius XM Radio Inc:

1. James Blitz
2. Terry Smith
3. Craig Wadin
4. Riza Akturan

Wiley Rein LLP (Counsel for Sirius XM Radio Inc.)

1. Robert Pettit
2. Michael A. Lewis (Engineering Consultant)

Office of Engineering and Technology:

1. Julius Knapp
2. Ron Repasi
3. Bob Weller
4. Ira Keltz
5. Salomon Satche
6. Hung Le
7. Patrick Forster
8. John Kennedy

Wireless Telecommunications Bureau:

1. Tom Derenge
2. BC "Jay" Jackson, Jr.

International Bureau:

1. Chip Fleming

Sirius XM - OET Meeting
Follow up to January 4th 2010 Ex Parte

January 21, 2010

Meeting Agenda

- Review main points raised in the Ex Parte
- Review Sirius XM proposal
- Review new field test data taken in South Florida
- Discuss next steps

Ex Parte Review

Ashburn Demonstrations

What was demonstrated

- **In best case reception and restricted use cases, mobile use of WCS bands can co-exist with satellite radio**
- **Guard bands are essential**
- **Duty cycle has a significant impact on interference**
- **Transmit power has a significant impact on interference**

What wasn't demonstrated

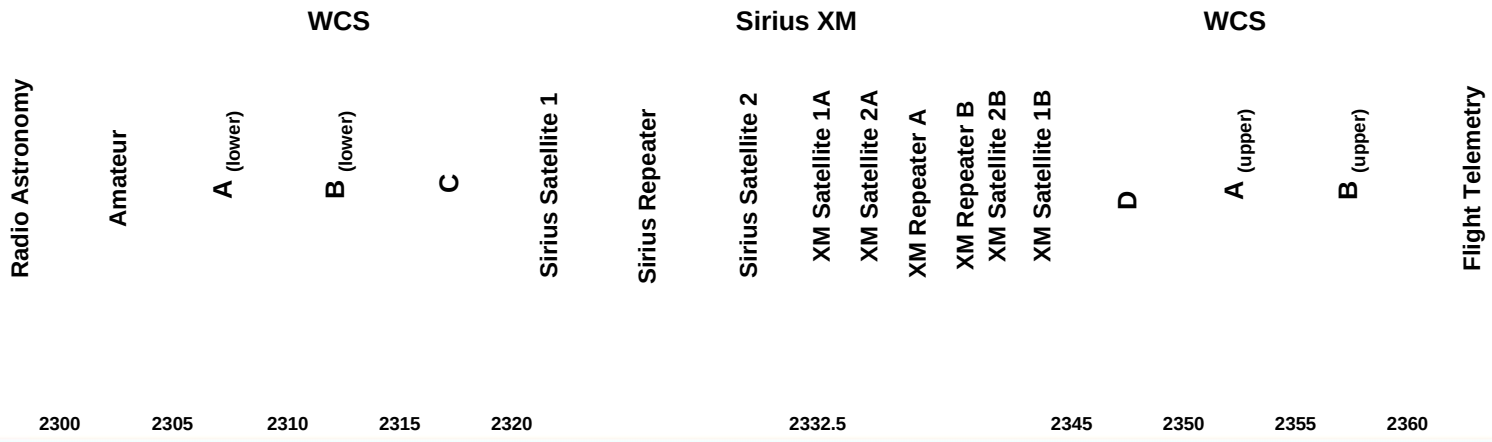
- **Impact outside of best case satellite reception**
- **Impact of multiple WiMAX mobile transmitters in a cell**
- **Impact of a cell area large enough to require max power transmission**
- **Impact of interference from WCS base station**

Real World vs. WCS Ashburn Demonstration

- **Ashburn demonstrations were conducted under "best case" conditions and do not validate WCS' proposed OOBE emission mask.**
- **Demonstrations were conducted with highest available satellite signals in the country, providing maximum link margin available to combat the interfering WCS signal.**
  - Satellite signal levels vary by as much as 8 dB between different geographic regions. *E.g.*, South Florida receives satellite signals 8 dB lower than Northern Virginia in open sky.
- **WCS base station provided an unconventionally small coverage area which minimized mobile transmit power.**
- **Only a single WCS user was demonstrated, rather than the multiple transmitters that would be typical in each cell.**
- **The tests were conducted on wide streets with few buildings, trees or other obstructions to reduce the link margin.**
- **These real world conditions would reduce link margins and require more than an additional 15 dB in OOBE protection to protect satellite radio receivers in our licensed area.**
- **The 15 dB additional protection validates Sirius XM's proposal of 70 + 10log(P) attenuation at the satellite radio band edge.**

The Need for Guard Bands

- **SDARS/WCS is a unique case of terrestrial service authorized immediately adjacent to an independently licensed satellite service with no allowance for a guard band.**
  - **The C and D blocks immediately adjacent to satellite radio receive bands pose the greatest risk of interference to satellite reception.**
- **WCS interests acknowledge the full 5 MHz cannot be occupied in C & D blocks and still meet their proposed 55 + 10 log(P) OOBE limits.**
- **The Commission should maintain stringent restrictions on mobile uses in the WCS C and D blocks. Current rules allow these bands to be used for fixed broadband service and backhaul, which are also critical components of the nation's broadband needs.**



Duty Cycle Restrictions

- The Ashburn tests showed that increasing the duty cycle of the WCS mobile device uplink aggravates the interference impact to satellite radio receivers.
- A comparison between the 6% duty cycle and 25% duty cycle shows that muting of satellite radio occurs at much lower power (by 14 dB) for the high duty cycle transmission vs. the lower duty cycle emission.
- Based on the Ashburn tests, the Commission should adopt rules limiting WCS mobile device operations to a duty cycle of 6% or less. A corresponding rule would require 300 microsecond pulses to occur no sooner than 5 milliseconds apart, a repetition rate based on the WiMAX frame rate. This approach is consistent with the current WCS rules, in Section 27.53(a)(9)(i).
- Need to consider restrictions applicable to non-WiMAX systems.

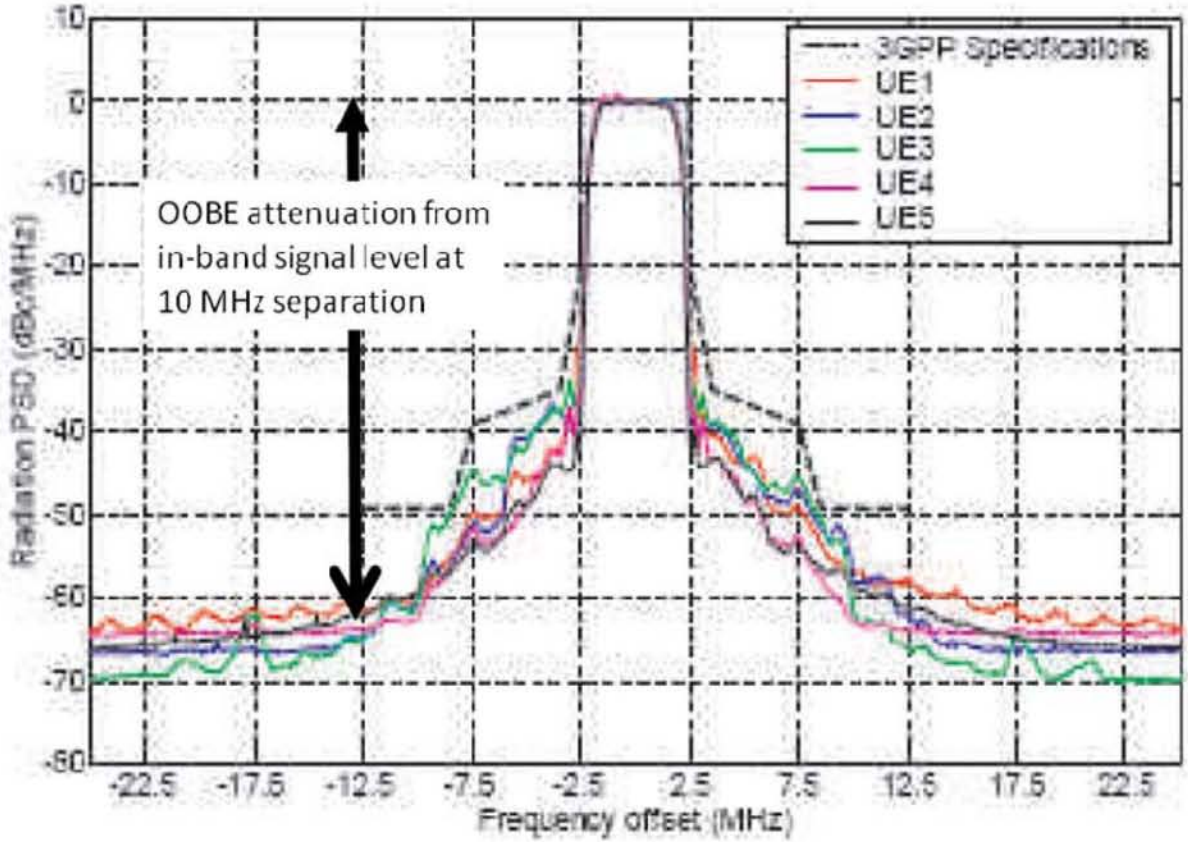
Transmit Power Control

- **Transmit Power Control (TPC) can assist in reducing interference potential from WCS into Sirius XM. However, the parameters need to be clearly defined to assure that protection is provided**

- **Any rule changes to allow WCS mobile devices in the A & B blocks should restrict transmit power to 250 mW with transmit power exceeding 150 mW no more than 10% of the time. To determine compliance with this requirement, the time frame should be defined as one second.**

- **This restriction is consistent with WCS filings that mobile terminals would transmit at no more than 125 mW 99% of the time.**

Current Technology Can Achieve OOBE Attenuation Proposed by Sirius XM



•OFCOM's 3GPP device emissions data helps establish the type of attenuation that can be expected from existing off-the-shelf technologies, ref: *Public Notice*, 23 FCC Rcd 14669 (2008).

• If this device operated in the lower WCS A or B blocks, its OOBE would be attenuated by 65 or 52 dB at Sirius XM band edge, satisfying 82+10 log P or 69+10 log P emission masks.

• WCS proposes 55+10 log P mask for the Bl block (5 MHz below 2320 MHz); however the Al block must meet 70+10 log P below 2300 MHz.

Current Technology Can Achieve OOBE Attenuation Proposed by Sirius XM (cont.)

- **Sirius XM investigated the availability of filters that could satisfy the OOBE attenuation requirements for devices that could be operated in the WCS band.**
  - **250 mw equals -6 dBW over the 5 MHz WCS band, or -13 dBW per one MHz.**
  - **To satisfy a 70+10logP mask, or -70 dBW per MHz within the first MHz of the satellite radio band, the WCS device emissions have to be attenuated by 57 dB.**
  - **Modern technologies, such as CDMA and OFDM provide more than 35 dB attenuation of emissions at band edge (*See* the OFCOM's measured 3GPP device emission profile).**
  - **Assuming another two dB attenuation for the WCS B-lower block emissions into the satellite radio band due to their 5 MHz separation, 20 dB attenuation would be required from a WCS B-lower block filter to satisfy the 70+10logP emission mask.**

- **Filter suppliers were tasked with supplying a filter that could provide:**
  - **25 dB attenuation (allow 5 dB margin for variations over the needed 20 dB)**
  - **Maximum of 6 dB in-band insertion loss due to filter implementation**
  - **Input power handling of 1.5 W (for 250 mw output power with ~8 dB insertion loss).**

- **Filter suppliers provided the following response:**
  - **Required insertion loss and power handling capabilities can be provided with existing BAW filter technology while providing 15 dB or slightly higher attenuation levels at 5 MHz separation with a Q factor of 1400.**
  - **They see with a high probability that attenuation could exceed 25 to 30 dB by increasing the Q factor above 2200, far exceeding the requirement to satisfy a 70+10logP mask.**

- **Thus, the WCS Coalition's arguments do not have an engineering basis.**

Sirius XM Rules Proposal

Part 27 mobile device rules

- **In the 2305–2320 MHz and 2345-2360 MHz bands, mobile devices must comply with all of the following requirements, taken together; changes to any of these parameters will directly affect the interference caused.**
  - Devices shall employ a WiMAX, CDMA, EVDO or LTE FDD Wireless System transmission scheme and utilize the 2305-2315 MHz (Al & Bl WCS Frequency blocks) for the mobile device intentional emissions.
  - No mobile device intentional emissions would be allowed in the WCS C and D blocks within 2315–2320 MHz and 2345-2350 MHz, or in the Au and Bu bands within 2350-2360 MHz.
  - Mobile devices shall attenuate all emissions into the 2320– 2345 MHz band by a factor of not less than 70 + 10 log (p) dB.
  - Maximum transmit output power of the mobile device shall be no more than 250 milliWatts (mW) in the bands 2305-2315 MHz, with 150 mW not being exceeded more than 10% of the time.
  - Mobile devices shall limit their transmit duty cycle to 6% or less.
  - The mobile device shall be battery operated, and operate with the minimum power necessary for successful communications.
  - Transmitting antennas shall employ linear polarization or another polarization that provides equivalent of better discrimination with respect to a DARS antenna.
- **These rules shall apply only to battery operated data modem devices with integrated antennas and installed in a host platform such as a notebook computer. Handheld or embedded devices designed for voice operation or that have antennas designed for mounted automotive applications shall be prohibited.**

Part 27 fixed station rules

- **Ground based field strength limits at 2 meters above ground level for all fixed transmitters > 2W EIRP**

  Verified by a predictive analysis. No later than 90 days prior to commencing commercial service of any base station, the deploying licensee must conduct a predictive analysis satisfying the above emission requirements, employing the following parameters:

  - An isotropic equivalent antenna at 2 meters AGL;
  - Recent clutter data with 30 meter or better accuracy;
  - Averaging the power over a 5 MHz bandwidth when the transmitter transmits full power in a continuous transmission mode.
  - Computer based planning tools shall be used. WCS Transmitters:
    - A, B Blocks 110 dBuV/m, shall not be exceeded more than 5% of the area within the 75 dBuV/m coverage contour of the site.
    - C,D Blocks 90 dBuV/m, shall not be exceeded more than 5% of the area within the 75 dBuV/m coverage contour of the site.
  - Low power fixed transmitters of 2 W EIRP or less excluded from field strength limit requirements. The existing OOBE limits for base stations in the WCS rules would continue to apply.

Part 25 fixed station rules

- **Ground based field strength limits at 2 meters above ground level for all transmitters > 2W EIRP**

  Verified by a predictive analysis showing:
  - 110 dBuV/m shall not be exceeded more than 5% of the area within the 75 dBuV/m coverage contour of the site.
  - Grandfathered sites will meet a PFD limit at 2 meter AGL antenna height of 78 µW/m2 or -39.9 dBm for 90% of Grandfathered Repeaters and 490 µW/m2 or -32dBm for 100% of existing repeaters.
  - SDARS Repeaters will be limited to no more than 25 kW
  - No later than 90 days prior to commencement of commercial service of any terrestrial repeater other than an Exempt repeater, the deploying repeater licensee must conduct a predictive analysis satisfying the above emission requirements, employing the following parameters:
    - An isotropic equivalent antenna at 2 meters AGL, recent clutter data with 10 meter or better accuracy;
    - Averaging the power over a 5 MHz bandwidth when the transmitter transmits full power in a continuous transmission mode; and
    - Low power fixed transmitters of 2 W or less are excluded from field strength limit requirements
- **OOBE shall be attenuated by 75+10Log(P) dB (measured in a 1MHz) with respect to the main carrier where P is the average transmitter power in watts.**
- **Transmitters will be authorized through a blanket licensing process which allows for parameter variances comparable to those allowed in other services where blanket licensing is used.**
- **Repeaters operating before the establishment of these rules shall be grandfathered.**
- **Substitute sites permitted for both SDARS and WCS grandfathered sites where economic or site specific issues outside of the operators control require removal of transmitters.** ***E.g.*** **demolition of building**

South Florida Test Data

Test Cases

Test cases simulate the mobile interference conditions that would occur from the WCS Coalition's proposal for the WCS band emission levels. All tests were for the handheld use case using a D-block WCS emitter.

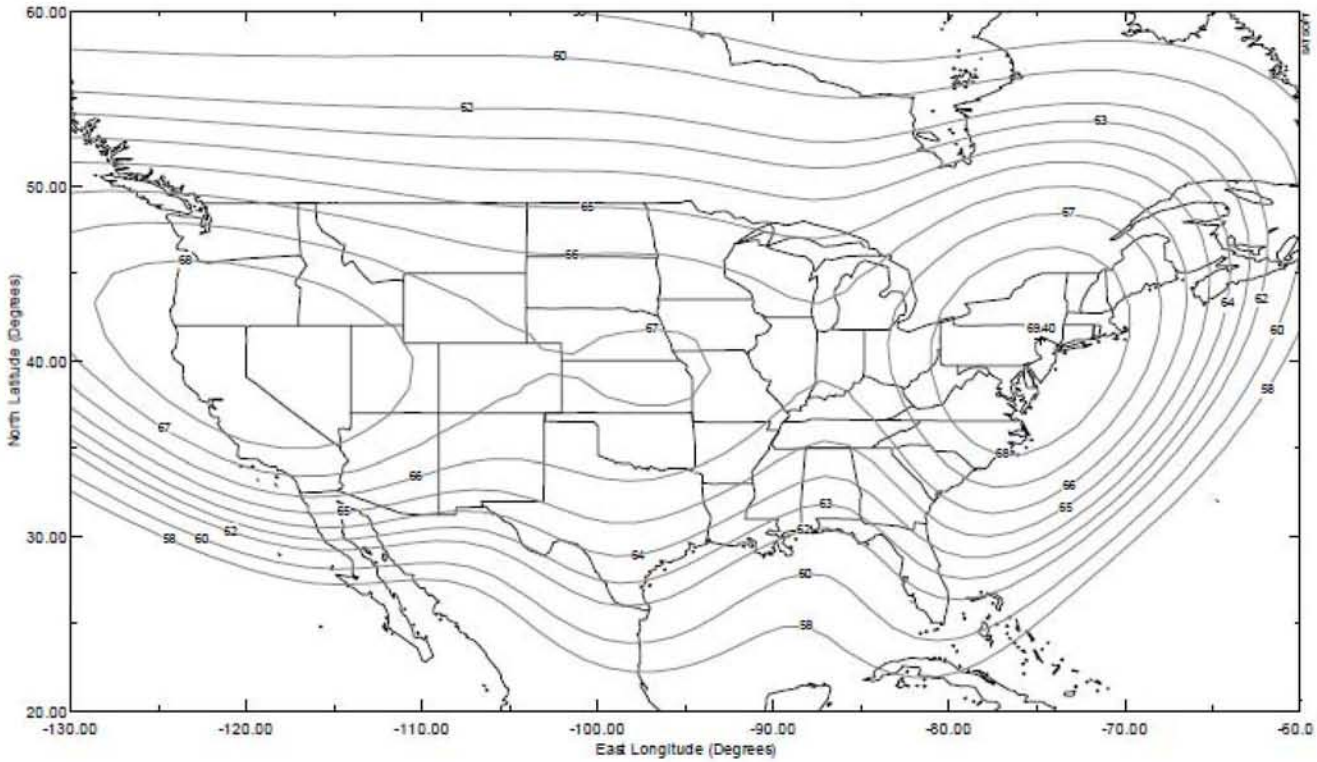
Test Cases

1. **5 MHz WiMAX signal occupying the full D-block, 25% duty cycle. Note that the filter employed in this test provides 1 MHz guard band.**
2. **5 MHz WiMAX signal, 6% duty cycle.**
3. **2.5 MHz WiMAX signal shifted up in frequency to attain a 2.5 MHz guard band within the D-block to the satellite radio band, 25% duty cycle**
4. **1.25 MHz WiMAX signal with 2.5 MHz guard band, 25% duty cycle**
5. **Baseline, No WCS interference**

Other Field Tests

Also conducted tests similar to those in Ashburn VA where the WCS emitter was stationary and the muting distance to the XM radio measured as the victim vehicle drove away from the jammer.

Test Location and Coverage



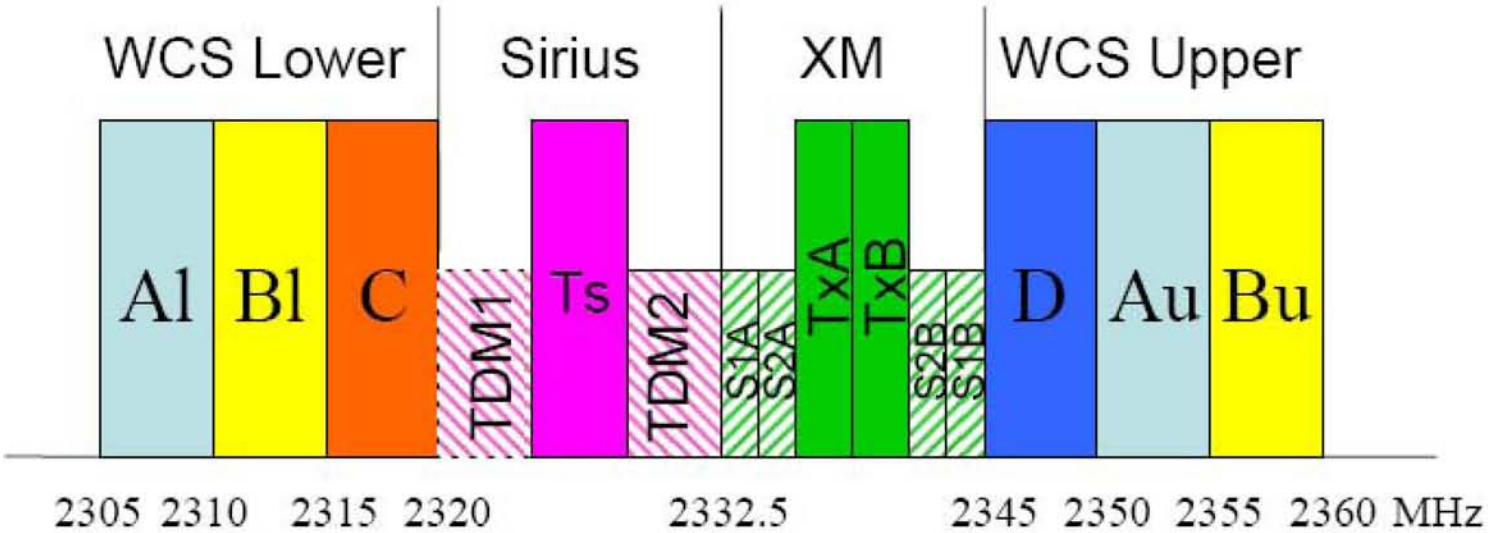
Princeton, NJ

Ashburn, VA

Deerfield Beach, FL

- **Ashburn, VA and Princeton, NJ are in the strongest satellite coverage region. Most other continental US locations receive less satellite signal, and therefore will be impacted at lower interference levels**

WCS/SDARS Band Plan and WiMAX Waveform Descriptions



WCS Interference Signal Bandwidth

5 MHz WiMAX Profile:
Entirely in D-Block with Channel Filter Rolloff in ~1 MHz Adjacent to SDARS Band

2.5 MHz Profile:
2.5 MHz Wide signal entirely in D-block, shifted by 2.5 MHz away from SDARS.

1.25 MHz Profile:
1.25 MHz Wide signal entirely in D-block, shifted by 2.5 MHz away from SDARS

Muting Distances Measured in Parking Lot

Parking Lot Muting Test - Jammer Static; Victim Driving Away

WiMAX Channel BW	Transmit Power	Duty Cycle	Deerfield Beach, FL Muting Distance		Ashburn, VA Muting Distance	
			Outside Car	Inside Car	Inside Car	Outside Car
5 MHz	**150mW**	**25%**	>90m	66m	17-28m	N/A
5 MHz	**150mW**	**6%**	>90m	66m	13-20m	N/A
2.5 MHz	**150mW**	**25%**	15m	7m	N/A	N/A
1.25 MHz	**75mW**	**25%**	4m	3m	N/A	N/A

- **Tests were run on January 12, 2010.**
- **Due to lower satellite received power, muting distances were 2-3 times greater as compared to Ashburn, VA using identical WCS signal profiles.**
- **In this instance, all tested WCS signals used the 55 + 10 log P OOBE mask.**
- **Tests with cars side by side simulating interference from the adjacent lane traffic showed muting for every case from interference case originating from the D-band.**
- **Results show for cases tested that interference distance decreased with increased guard band and decreased duty cycle.**

XM Service Availability on The Test Cases

Test Setup		Test Results		
WCS Signal Bandwidth (MHz)	WCS Signal Duty Cycle (%)	% Time Interference Caused Complete Mutes in the XM Audio Service	% Time Interference Caused Severe Link Losses in the Digital Bit Stream without mutes	% Total Service Degradation Period
Baseline (No Interference)	0	0	0.31	0.31
1.25	25	2.31	0.46	2.77
2.5	25	4.21	4.64	8.85
2.5	25	5.79	2.41	8.2
5	6	24.21	59.11	83.32
5	25	30.76	64.37	95.13

- **Table shows service availability in terms of percentage of time audio was muted in a typical suburban drive route.**
- **Results clearly indicate that:**
  - Worst interference occurs when WCS emitter populates the full D-block channel and has a long duty cycle.
  - Interference impact reduced with meaningful guard band and duty cycle restrictions.
  - Baseline test shows that the test route is error-free when no interference is present.