

Before the  
**FEDERAL COMMUNICATIONS COMMISSION**  
Washington, DC 20554

In the Matter of	)	
	)	
Amendment of Part 27 of the	)	
Commission's Rules to Govern the	)	WT Docket No. 07-293
Operation of Wireless Communications	)	
Services in the 2.3 GHz Band	)	
	)	
Establishment of Rules and Policies for the	)	IB Docket No. 95-91
Digital Audio Radio Satellite Service in the	)	GEN Docket No. 90-357
2310-2360 MHz Frequency Band	)	RM No. 8610

**COMMENTS OF THE WCS COALITION**

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## EXECUTIVE SUMMARY

The 2.3 GHz band is poised to emerge as a viable source of wireless broadband services in America, just as it is elsewhere around the globe and just as the Commission envisions in the National Broadband Plan. If, however, the Commission unduly constrains WCS in response to overstated interference claims from SDARS and MAT interests, WCS will be doomed from the start by an unworkable regulatory regime.

Although the staff's proposed power limits and OOB restrictions are not the optimum from the perspective of one hoping to utilize WCS spectrum, the good news is that they are not so onerous as to preclude the deployment of viable mobile broadband services. However, because the U.S. will be departing from global standards, there will necessarily be some delay for vendors to make the necessary changes to their product line to accommodate U.S. requirements. Any more stringent limits, however, likely would result in more substantial delays in equipment availability because of the magnitude of the modifications required.

The single greatest impediment in the staff's proposed rules to achieving the objectives of the National Broadband Plan is the proposal to require coordination prior to the deployment of any WCS base station that is within 45 kilometers of a MAT receiver or that has radio line of sight to a MAT receiver. Adoption of this proposal threatens to delay, if not preclude, service to 25% of the U.S. population, and is unnecessary to adequately protect MAT from interference. Even in the worst case (operations in the upper B Block at 2355-2360 MHz), a coordination zone of 10 kilometers provides adequate protection for MAT interests, while significantly reducing the American population subject to coordination delay.

The Commission should modify proposed Section 25.144(e)(9) to make clear that it will only authorize SDARS terrestrial repeaters that do comply with the 12 kW average EIRP and OOB rules absent consent of potentially affected WCS licensees. It is conceivable that in a specific circumstance a SDARS licensee could demonstrate to all of the affected WCS licensees that, a specific terrestrial repeater could be deployed at a higher power level than otherwise permitted without an adverse impact on WCS (particularly if the SDARS licensee is willing to agree not to construct additional permissible repeaters in the same area). However, because of the threat of increased interference to WCS, the proposed 12 kW average EIRP and other restrictions on blanket licensing should be sacrosanct absent WCS consent.

To assure that licensees in both services have advance notice of new facilities that potentially could cause interference, the WCS Coalition supports proposed Sections 25.263 and 27.72, under which 10 business days advance notice will be required to potentially affected licensees before any SDARS terrestrial repeater or WCS base station becomes operational. Because new WCS base stations (and relocated base stations) are not deployed without substantial advance planning (network design, site acquisition, equipment acquisition), requiring 10 business days prior notice of new base stations should not hinder licensees in providing their service offerings to the public. However, the requirement that 5 business days advance notice be given before modifications are made to existing WCS base stations is problematic given the manner in which ubiquitous cellular networks are constantly being "tweaked" to assure

consumers the best quality of service. As an alternative, WCS Coalition proposes that notice of any modification to a WCS base station or a SDARS repeater (other than changes in location) be given within 24 hours of the modifications being made. This approach will assure that all licensees have current data regarding the configuration of each others' facilities, which will facilitate future cooperation and assure that as new facilities are designed the current configuration of existing ones will be considered. However, it allows modifications not related to locations to be made within the timeframes dictated by marketplace realities.

While the WCS Coalition has no objection to Sirius XM moving its terrestrial repeater usage closer to the center of the 2320-2345 MHz SDARS band (farther away from the boundaries with WCS), movement closer to the WCS band will only exacerbate the interference to which WCS subscribers will be subjected and should be prevented by rule.

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**COMMENTS OF THE WCS COALITION**

The WCS Coalition, by its attorneys, hereby responds to the April 2, 2010 *Public Notice* soliciting comment on draft rules developed by the Commission's staff to govern the potential for interference from satellite Digital Audio Radio Service ("SDARS") terrestrial repeaters and 2.3 GHz band Wireless Communications Service ("WCS") facilities.<sup>1</sup>

**I. INTRODUCTION**

Within the next two months, the Commission will be adopting new WCS and SDARS technical and service rules in these proceedings.<sup>2</sup> The 2.3 GHz band is poised to emerge as a viable source of wireless broadband services in America, just as it is elsewhere around the globe. If,

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<sup>1</sup> See FCC Public Notice, *Commission Staff Requests That Interested Parties Supplement The Record On Draft Interference Rules For Wireless Communications Service And Satellite Digital Audio Radio Service*, DA 10-592 (rel. Apr. 2, 2010) ("*Public Notice*"). The original deadline for responding to the *Public Notice* was subsequently extended until April 23, 2010 over the WCS Coalition's objection that further delay is unnecessary. See Commission Staff Request That Interested Parties Supplement the Record on Draft Interference Rules for Wireless Communications Service and Saellite Digital Audio Radio Service, *Order Extending Comment Period*, DA 10-622 (rel. Apr. 13, 2010). The WCS Coalition certainly hopes that, notwithstanding this delay in the deadline for responding to the *Public Notice*, the Commission will still be able to adopt technical and service rules in these proceeding no later than the end of June 2010 as presently scheduled. See FCC News Release, *FCC Announces Broadband Action Agenda* (rel. Apr. 8, 2010) ("*FCC News Release*").

<sup>2</sup> See *FCC News Release* at 3 (proposed 2010 key Broadband Action Agenda items, available at <http://www.broadband.gov/plan/chart-of-key-broadband-action-agenda-items.pdf>).

however, the Commission unduly constrains WCS in response to overstated interference claims from SDARS and Mobile Aeronautical Telemetry (“MAT”) interests, WCS will be doomed from the start by an unworkable regulatory regime. The Commission can achieve the desired result, while at the same time providing SDARS subscribers and MAT users with reasonable protection against harmful interference, by recognizing that SDARS and MAT are substantially less vulnerable to potential interference than they would have the Commission believe.

The stakes could not be higher. As the Commission recognized just last month when it submitted its National Broadband Plan to Congress, “[w]ireless broadband is poised to become a key platform for innovation in the United States over the next decade.”<sup>3</sup> However, to “meet growing demand for wireless broadband services, and to ensure that America keeps pace with the global wireless revolution,” the Commission has recognized that an additional 300 MHz in the 225-3700 MHz range must be made available within the next five years.<sup>4</sup> Accomplishing that task will not be easy, and achieving it will require the Commission to “remove legacy constraints that limit the usefulness” of bands like WCS.<sup>5</sup> Indeed, the National Broadband Plan recognizes that WCS can and should play a key role in meeting America’s pressing demand for broadband spectrum:

Since the FCC first auctioned the WCS spectrum in 1997, a number of new and robust wireless telecommunications technologies have been successfully introduced, including Time Division Duplex and Orthogonal Frequency Division Multiplexing technologies. Such dynamic technologies, coupled with the exploding demand for broadband services, suggest that the WCS spectrum may provide fertile ground for the provision of high-value mobile broadband services to the public. The same frequency band is currently being used in South Korea and other countries to deploy mobile WiMAX service today. Accordingly, the FCC should accelerate efforts to ensure that the WCS spectrum is used productively for the benefit of all Americans.<sup>6</sup>

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<sup>3</sup> FCC, *Connecting America: The National Broadband Plan*, at 75 (rel. Mar. 16, 2010) (“National Broadband Plan”).

<sup>4</sup> *Id.* at 84.

<sup>5</sup> *Id.* at 85.

<sup>6</sup> *Id.* at 86 (citation omitted).

Yet, even after more than a decade of debate over some of the pending issues, it remains to be seen whether WCS actually will become the home for the viable broadband services envisioned by the National Broadband Plan. The staff proposal set out in the *Public Notice* provides a solid foundation for facilitating co-existence among WCS, SDARS and MAT, but modifications are required to avoid rendering WCS a secondary service subject to the whim and caprice of its neighbors.<sup>7</sup>

Appendix A to these comments is a redlined version of the staff's proposed rules, modified to reflect specific changes suggested by the WCS Coalition. Each rule section containing a proposed edit is followed by a note that fully explains the rationale behind the proposed change. Many of the WCS Coalition's proposals are relatively straightforward, and need not be discussed further in the narrative of this pleading. Others, however, go to the heart of whether WCS will be doomed to failure because undue protection is afforded SDARS and MAT or insufficient protection is afforded WCS. With the remainder of these comments, the WCS Coalition will focus on these larger issues that the Commission must get right if the vision for WCS embraced by the National Broadband Plan is to be achieved.

## **II. DISCUSSION**

### **A. THE PROPOSED POWER AND OOBE RULES, WHILE NOT PERFECT, DO PROVIDE FOR VIABLE WIRELESS BROADBAND OFFERINGS.**

Throughout this proceeding, the WCS Coalition has emphasized that WCS-based mobile broadband services cannot be economically viable if the Commission either: (i) limits the maximum

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<sup>7</sup> That WCS should be treated as a secondary service has been a constant refrain from SDARS – one that the *Public Notice* properly rejects. Indeed, the Commission spoke with crystalline clarity on the relationship between SDARS and WCS in its *Memorandum Opinion and Order* in General Docket No. 96-228 that established WCS. There, the Commission left no ambiguity that the desire for a high quality SDARS must “be balanced with the need to provide reasonable operating parameters for adjacent services” and thus its objective in governing WCS must be “to limit the potential for interference to a reasonable level -- not to provide a pure, interference-free environment.” Amendment of the Commission's Rules to Establish Part 27, the Wireless Communications Service (“WCS”), *Memorandum Opinion and Order*, 12 FCC Rcd 3977, 3991 (1997).

permissible power levels of WCS equipment in a manner that forces the deployment of so many base stations that the service will not be economically viable; or (ii) imposes out-of-band emission (“OOBE”) restrictions for WCS that are so onerous as to effectively preclude wireless broadband service providers from tapping into the global marketplace for 2.3 GHz band equipment that offers the economies of scale necessary to maintain competitive pricing.<sup>8</sup> The good news is that the power limits and OOBE restrictions proposed in the *Public Notice* are not so onerous as to preclude the deployment of viable mobile broadband services.

Without doubt, equipment vendors that are currently providing wireless broadband equipment for use in the 2.3 GHz band outside the United States will have to modify their hardware for the U.S. market, even under the staff’s proposals. However, given the nature of the staff’s proposals limiting WCS power and OOBE, the WCS Coalition suspects that if the staff’s proposals are adopted (along with the changes suggested by the WCS Coalition in Appendix A), compliant equipment could start to become available for the U.S. market within approximately twelve-to-eighteen months, with shipments in volume possible several months thereafter.<sup>9</sup>

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<sup>8</sup> See Comments of the WCS Coalition, WT Docket No. 07-293, at 5-6, 30-34 (filed Feb. 14, 2008) (“WCS Coalition Comments”); Reply Comments of the WCS Coalition, WT Docket No. 07-293, at 7-9, 33-34 and Attachment D (filed Mar. 17, 2008) (“WCS Coalition Reply Comments”).

<sup>9</sup> Of course, equipment availability is not the only hurdle that WCS licensees will have to overcome to commence offering services. As discussed below, the potential for substantial coordination delays under the staff’s proposal for establishing coordination zones of at least 45 km surrounding MAT facilities could substantially delay deployments. In addition, the WCS Coalition, along with individual WCS licensees and lessees detailed earlier this week that the ongoing regulatory delay in processing renewal applications and one set of substantial service showings has cast a cloud over the band that is frustrating deployments. See Comments of the WCS Coalition, WT Docket No. 07-293, at 11-12 (filed Apr. 21, 2010) (“WCS Coalition Performance Requirements Comments”); Comments of Broadband South LLC, WT Docket No. 07-293, at 4-5 (filed Apr. 21, 2010); Comments of Horizon Wi-Com LLC, WT Docket No. 07-293, at 6 (filed Apr. 21, 2010). Moreover, as the Commission has recognized in a similar context:

4G network build-out will require the commercial availability of end-to-end integrated systems, including subscriber terminals, radio access network, core network, and transport network, in addition to flexible enhanced services and integrated back-office and customer support centers. To achieve a commercial availability benchmark, teams of service providers, vendors and integrators must complete several parallel processes, including completion of the standards, product development, field trials, interoperability testing and larger scale trials, followed by deployment. Such an implementation is challenging . . .

It should be stressed, however, that the staff proposal pushes the envelope about as far as possible. Even relatively small changes in the WCS OOB rules proposed by the staff could require very significant modifications to existing 2.3 GHz equipment designed for the global market, changes that could substantially delay the availability of equipment in the United States or, at worst, prevent vendors from offering user devices that meet essential prerequisites for success in the U.S. market – reasonably low costs, small form factors, and extended battery life. To the extent that any response to the *Public Notice* proposes restrictions on WCS power levels, OOB or other operating parameters in excess of those proposed in the *Public Notice*, the WCS Coalition intends to submit further analyses, as necessary, for the Commission’s consideration as these proceedings move towards resolution.

The WCS Coalition cannot emphasize enough that the staff’s proposed technical rules are not the optimum from the perspective of one hoping to utilize WCS spectrum. Even if adopted as proposed by the staff, the rules will subject WCS to real interference from SDARS terrestrial repeaters, and will force WCS licensees to suffer equipment delays and additional equipment costs to meet OOB limits that will be more restrictive than those applied in other nations where the 2.3 GHz band is allocated for wireless broadband services. The WCS community would prefer less restrictive OOB limits on WCS devices (particularly user devices), the use of average power measurements to govern WCS fixed stations in the C and D Blocks,<sup>10</sup> and the same 2 kW limit on

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Service Rules for the 698-746, 747-762 and 777-792 MHz Bands, *Second Report and Order*, 22 FCC Rcd 15289, 15350 n.385 (2007). While certainly many of these tasks can take place as equipment is being developed and manufactured, others are necessarily on hold until volume shipments of equipment can begin. The net result is that, as the WCS Coalition noted earlier this week, WCS licensees should be afforded at least the same four year period to meet initial performance requirements afforded 700 MHz licensees, if not even longer. WCS Coalition Performance Requirements Comments at 13-15.

<sup>10</sup> The staff’s proposal to restrict power measurement for the C and D Blocks to peak levels, rather than average levels, is difficult to square with the positions previously taken by the predecessors to Sirius XM. For example, in WT Docket No. 03-264, XM Radio Inc. (“XM”) expressed “support [for] the Commission’s proposal to amend its rules to specify the EIRP limit for base stations in Parts 24 and 27 of the rules in terms of average power.” Joint Reply Comments of WCS Wireless LLC and XM Satellite Radio Holdings Inc., WT Docket No. 03-264, at 7 (filed Jan. 17, 2006). It noted

maximum SDARS terrestrial repeater EIRP that will be imposed on WCS base stations in the A and B Blocks.<sup>11</sup> However, adoption of the staff proposal will keep these burdens to a tolerable level (albeit just barely), allowing the deployment of viable wireless broadband systems without any material “real world” adverse impact on SDARS subscribers or MAT systems.

*B. THE STAFF PROPOSAL TO ESTABLISH COORDINATION ZONES OF AT LEAST 45 KILOMETERS SURROUNDING EACH MAT FACILITY IS UNNECESSARY TO PROTECT MAT.*

The single greatest threat to the success of WCS as a viable mobile broadband service is the staff’s proposal to require prior coordination for every single WCS base station that will be within 45 kilometers of a MAT receiver or have radio line of sight to a MAT receiver.<sup>12</sup> This coordination distance is far greater than required to protect MAT operations and could substantially delay, if not effectively preclude, service to approximately 25% of the United States population.

As has been the case since WCS was created in 1997, Section 27.53(a)(3) of the Commission’s Rules requires WCS licensees to attenuate the OOB from their fixed and mobile devices into the 2360-2370 MHz band by at least  $43 + 10 \log (p)$ , and to attenuate their OOB above 2370 MHz by at least  $70 + 10 \log (p)$ .<sup>13</sup> To augment the protection afforded MAT, the staff

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that “average power provides a more accurate representation of the interference potential of non-constant envelope technologies, and base stations operating pursuant to an average rather than peak power specification will not cause increased interference.” *Id.* at 8 (emphasis added). And, it stressed that “[i]f average power is acceptable for operations of [PCS and AWS] low-powered cellular-like systems, there is no legitimate reason why it should not also be acceptable for operators of similar systems in the 2.3 GHz WCS band, to the extent these systems are deployed.” *Id.* Similarly, in response to a request by a former WCS licensee for a waiver that would permit it to operate at 2000 watts average EIRP, XM and Sirius Satellite Radio, Inc. jointly advised the Commission of their support for the request, so long as the Commission also utilized average measurements to regulate SDARS repeaters (which is exactly what the staff has proposed here). *See* Comments of Sirius Satellite Radio Inc. and XM Radio Inc., DA 05-1662, IB Docket No. 95-91 (filed July 5, 2005).

<sup>11</sup> The 12 kW average EIRP limit proposed by the staff is more power than necessary to accomplish the purposes of SDARS terrestrial repeaters and, while this proposed rule will no doubt reduce the costs Sirius XM will incur in deploying and operating its terrestrial network, it will result in interference to WCS broadband offerings in areas that otherwise could be served.

<sup>12</sup> *Public Notice* at 12 (proposed Section 27.73).

<sup>13</sup> *See* 47 C.F.R. § 27.53(a)(3) (attenuation required “For fixed, land, mobile, radiolocation land and radiolocation mobile stations: By a factor not less than  $70 + 10 \log (p)$  dB on all frequencies below 2300 MHz and on all frequencies

proposal would modify Section 27.73 to significantly tighten the OOB limits for WCS base stations and to mandate roll-off characteristics between 2360 MHz and 2370 MHz for customer equipment, providing MAT interests with materially greater protection than under the present rules. *So there is no confusion, the WCS Coalition reiterates what is noted above – it does not object to the Commission’s adoption of the staff’s proposed OOB limits at 2360 MHz and above.* What concerns the WCS Coalition is that, in addition to this tightening of the OOB limits faced by WCS, the staff is proposing that any WCS base station contemplated to be located within 45 kilometers of an MAT receiver or within radio line of sight of such a receiver (whichever is greater), be subject to coordination with the MAT operator.

A coordination process is not something that the Commission should lightly impose on WCS or any other service because of the potential adverse impact on deployment schedules. Quite frankly, the staff’s proposal to subject WCS to a coordination obligation, along with the tighter OOB limits that are proposed, is difficult to square with the Commission’s 2002 *Report and Order*

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above 2370 MHz; and not less than  $43 + 10 \log (p)$  dB on all frequencies between 2300 and 2320 MHz and on all frequencies between 2345 and 2370 MHz that are outside the licensed bands of operation”).

The history of the existing OOB restrictions set forth in Section 27.53(a)(3) is instructive. In the *Notice of Proposed Rulemaking* (“WCS NPRM”) that first proposed the creation of WCS, the Commission proposed that for fixed operations, all OOB from fixed WCS facilities be attenuated by  $43 + 10 \log (p)$  on all frequencies above 2360 MHz. For mobile operations, the *WCS NPRM* proposed that all WCS OOB be attenuated by  $43 + 10 \log (p)$  between 2360-2370 MHz and by  $70 + 10 \log (p)$  above 2370 MHz. Amendment of the Commission’s Rules to Establish Part 27 of the Wireless Communications Service (“WCS”), *Notice of Proposed Rule Making*, 11 FCC Rcd 21713, 21730 (1996). Aerospace and Flight Test Radio Coordinating Council (“AFTRCC”) participated extensively in response to the *WCS NPRM*, submitting both comments and reply comments addressing, among other things, the potential for WCS to interfere with telemetry operations. See Comments of Aerospace and Flight Test Radio Coordinating Council, GN Docket No. 96-228 (filed Dec. 4, 1996); Reply Comments of Aerospace and Flight Test Radio Coordinating Council, GN Docket No. 96-228 (filed Dec. 16, 2006). When the Commission ultimately adopted the current rules, AFTRCC did not petition for reconsideration of that decision or otherwise indicate that its telemetry constituents would be unable to address the OOB that WCS was permitted to create under the new rules. Thus, since 1997, those operating MAT systems above 2360 MHz have been on notice that they would be required to exist in an environment in which WCS licensees operating in the adjacent spectrum would be required to attenuate OOB by at least  $43 + 10 \log (p)$  between 2360-2370 MHz and by at least  $70 + 10 \log (p)$  above 2370 MHz. To the extent, if any, that AFTRCC’s constituents truly are vulnerable to possible interference from WCS, it is because they have failed over the past thirteen years to protect themselves from WCS operations permissible under the existing rules.

in WT Docket No. 02-8.<sup>14</sup> There, the Commission reallocated the 2385-2390 MHz band for a Part 27 fixed and mobile service that would operate adjacent to telemetry (just as WCS does).<sup>15</sup> Under the Part 27 rules for that service, licensees were required to attenuate their OOB by  $43 + 10 \log(p)$  into the telemetry band – affording less protection to MAT than would be available from WCS under the staff’s proposal.<sup>16</sup> But, licensees in this new service were *not* required to engage in prior coordination. Rejecting a proposal by AFTRCC to require adjacent channel coordination, the Commission found that:

[a]lthough we recognize the importance of aeronautical flight test telemetry, we believe that imposing AFTRCC’s coordination requirements . . . would be onerous and potentially harmful to the viability of operations in these bands overall. . . . Rather, we believe that the more appropriate approach is to afford aeronautical flight test telemetry operations protections from adjacent-band interference only to the extent that such radiation exceeds the limits on out-of-band emissions established for that service.<sup>17</sup>

The Commission ultimately reversed the new 2385-2390 MHz allocation as part of an arrangement to free other spectrum from government use for the Advanced Wireless Service. However, the rationale for refusing to impose a coordination requirement was sound and is equally applicable here.

As a general matter, coordination processes work best in services, like point-to-point microwave services, where both sides have to coordinate with each other. Under those circumstances the party being coordinated with has every incentive to be reasonable in its requirements and to resolve the matter promptly, for it knows that next time, it may be the party doing the coordinating. It works less well where (as here) only one side is required to coordinate, as

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<sup>14</sup> Amendments to Parts 1, 2, 27 and 90 of the Commission's Rules to License Services in the 216-220 MHz, 1390-1395 MHz, 1427-1429 MHz, 1429-1432 MHz, 1432-1435 MHz, 1670-1675 MHz, and 2385-2390 MHz Government Transfer Bands, *Report and Order*, 17 FCC Rcd 9980 (2002).

<sup>15</sup> *Id.*

<sup>16</sup> *See id.* at 10032.

<sup>17</sup> *Id.* at 10045

there is no incentive for the party being coordinated with to be reasonable or timely during the process.

The record developed in this proceeding gives credence to the fear that a WCS/MAT coordination process may prove to be interminable, with the net result being that service to the public will be substantially delayed or precluded. For example, AFTRCC has advised the Commission that “[n]o [coordination] approach is practical in the case of mobile, portable, and low power fixed subscriber units”<sup>18</sup> – the very sorts of devices the National Broadband Plan seeks to have deployed in the WCS band. One can only wonder as to what demands the MAT community will make of those proposing to build base stations designed to serve such devices. The WCS community’s concern is compounded by the fact that AFTRCC has consistently advocated OOB restrictions on WCS that, if adopted, would effectively preclude mobile broadband at 2.3 GHz.<sup>19</sup> Although the staff is proposing that the Commission reject AFTRCC’s proposed OOB limits, imposing a coordination process will allow MAT interests to hold WCS deployment hostage absent compliance with those rejected limits (which cannot be met without wasting spectrum as guardband).

This issue is far from trivial. The National Telecommunications and Information Administration (“NTIA”) and AFTRCC have provided the WCS Coalition with a listing of approximately 150 federal and non-federal MAT facilities that would require protection under the Commission’s proposal. Although NTIA has not been authorized to provide the WCS Coalition

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<sup>18</sup> Comments of Aerospace and Flight Test Radio Coordinating Council, WT Docket No. 07-293, Engineering Statement at 3 (filed Feb. 14, 2008) (“AFTRCC Comments”).

<sup>19</sup> For example, in its formal comments in response to the *NPRM* in WT Docket No. 07-293, AFTRCC recommended that the Commission require WCS mobile devices to attenuate their OOB by  $110 + 10 \log(p)$  on all WCS emissions above 2360 MHz. AFTRCC Comments at 5. Even now, it suggests that all WCS facilities attenuate their OOB on all WCS emissions above 2360 MHz by  $83 + 10 \log(p)$  average EIRP. Letter from William K. Keane, Counsel to Aerospace and Flight Test Radio Coordinating Council, to Marlene H. Dortch, Secretary, Federal Communications Commission, WT Docket No. 07-293, at slide 15 (filed Mar. 31, 2010).

with the specific coordinates of the non-federal facilities, a preliminary analysis suggests that over 76 million Americans (*i.e.*, almost 25 percent of the U.S. population) are likely to reside within the coordination zones established to protect federal and non-federal MAT. When, if ever, the WCS service will be available to these 76 million Americans hangs in the balance -- overly burdensome coordination requirements to protect MAT facilities will inevitably hamper, if not preclude, the offering of service by WCS licensees to a large portion of the population.

The 45 kilometer coordination zone proposed by the staff is apparently based on optical line of sight over featureless curved earth between a WCS base station antenna and a MAT receiver, assuming each to be at an elevation of 100 feet above ground level. This approach to establishing the boundaries of the coordination zone is simplistic, as it ignores both the attenuation of the undesired WCS signal that occurs over the path to the MAT receiver and the level of undesired WCS signal that would cause harmful interference to the MAT facility. To further examine the distance from a MAT facility at which WCS interference is possible, the WCS Coalition has retained Kolodzy Consulting, LLC. Dr. Paul J. Kolodzy has prepared an analysis, attached as Appendix B, that examines the vulnerability of MAT facilities to interference from both OOBE and overload, and concludes that even in the worst case (operations in the upper B Block at 2355-2360 MHz), a coordination zone of 10 kilometers would provide adequate protection for MAT interests.<sup>20</sup>

Thus, in Appendix A the WCS Coalition is proposing to amend draft Section 27.73 to provide for a reduced coordination zone, as well as to provide for the MAT community to make available all of the information that WCS licensees require to design their networks and properly protect MAT facilities from interference. Although adoption of this proposal will not entirely

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<sup>20</sup> Dr. Kolodzy's qualifications are available at <http://kolodzy.com>.

eliminate the potential for coordination delay, it will reduce the vulnerable population from approximately 76 million Americans to approximately 14.5 million.

C. *THE COMMISSION SHOULD NOT AUTHORIZE TERRESTRIAL REPEATERS THAT DO NOT COMPLY WITH THE BLANKET LICENSING RULES ABSENT CONSENT OF POTENTIALLY AFFECTED WCS LICENSEES.*

Proposed Section 25.144(e)(2) sets forth relatively simple rules that will govern the blanket licensing of SDARS terrestrial repeaters: repeaters must comply with international agreements; must comply with the general requirements of Parts 1 and 17 involving radiation exposure and tower markings; and, of greatest importance to the WCS Coalition, must comply with the power limits set forth in proposed Section 25.214(d)(1) and the OOB limits set forth in proposed Section 25.202(h)(1) and (2). Notwithstanding its misgivings regarding the staff's proposed maximum power limit for SDARS terrestrial repeaters, the WCS Coalition does not object to adoption of proposed Section 25.144(e)(2).

What the WCS community does object to is Section 25.144(e)(9), which provides that "SDARS terrestrial repeaters that are ineligible for blanket licensing must be authorized on a site-by-site basis."<sup>21</sup> Unfortunately, the *Public Notice* provides no guidance as to what sorts of SDARS terrestrial repeaters the Commission intends to license on a site-by-site basis. However, the proposed language is so open ended that it suggests the Commission will license on a site-by-site basis SDARS terrestrial repeaters that are not in compliance with the power limits imposed in proposed Section 25.214(d)(1) and/or the OOB limits set forth in proposed Section 25.202(h)(1) and (2).

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<sup>21</sup> *Public Notice* at 5.

The question of what power limits and OOB restrictions should govern SDARS terrestrial repeaters has been before the Commission since 1997.<sup>22</sup> Over this period, the issues associated with the potential for SDARS terrestrial repeaters to cause interference have been fully briefed and carefully examined by the staff, and it is time for a resolution that provides both sides with regulatory certainty. Again, while the WCS Coalition would prefer to see SDARS terrestrial repeater operations restricted to the same power level as WCS base stations to minimize interference to WCS broadband operations,<sup>23</sup> the staff's proposal that "SDARS terrestrial repeaters must be operated at a power level less than or equal to 12-kW average EIRP, with a maximum peak-to-average power ratio of 13 dB"<sup>24</sup> and its proposed OOB limits are not beyond the pale and the WCS community is prepared to adapt to SDARS repeaters operating up to that power level.

As such, the WCS Coalition is at a loss as to why the staff's proposal would suggest that SDARS terrestrial repeaters will be permitted to operate at even high power levels, or inject even greater OOB into the WCS bands, subjecting the WCS community to continuing uncertainty as to the level of interference protection from SDARS terrestrial repeaters that WCS broadband systems will enjoy. Simply put, the Commission should not permit SDARS repeaters to operate at variance

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<sup>22</sup> See Establishment of Rules and Polices for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band, *Report and Order Memorandum Opinion and Order and Further Notice of Proposed Rulemaking*, 12 FCC Rcd 5754 (1997).

<sup>23</sup> It is worth noting that SDARS had once proclaimed that coexistence of WCS and SDARS terrestrial repeaters is best promoted by rules that impose "equal and mutual obligations upon both services," something not accomplished by allowing SDARS repeaters to operate at 12 kW average EIRP while limiting WCS base stations to 2 kW average EIRP in the A and B Blocks and only 2 kW peak EIRP in the C and D Blocks. Petition of Sirius Satellite Radio Inc. for Rulemaking, and Comments, IB Docket No. 95-91, at 2 (filed Oct. 17, 2006). See also Letter from Bruce D. Jacobs, Counsel for XM Radio Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission, IB Docket No. 95-91, at 4 (filed Jan. 5, 2007).

<sup>24</sup> *Public Notice* at 7 (proposed Section 25.214(d)(1)). The staff presumably has recognized that adoption of SDARS' proposal to allow SDARS terrestrial repeaters to operate at unlimited EIRP, subject to signal strength limits measured at ground level would have been tantamount to a death sentence for broadband operations in the WCS band. See, e.g., WCS Coalition Reply Comments at 21-23.

from any of the repeater blanketing licensing rules, including the maximum power limit and the OOB restrictions, absent the consent of all potentially affected WCS licensees.

In the *Second Further Notice of Proposed Rulemaking* in IB Docket No. 95-91, the Commission specifically asked for comments on proposals to permit the deployment of SDARS repeaters at power levels greater than otherwise permitted, but only after consent by all affected WCS licensees.<sup>25</sup> As the WCS Coalition noted in response, “[a]lthough it will not generally be the case, it is conceivable that in a specific circumstance a SDARS licensee could demonstrate to all of the affected WCS licensees that in that particular case, a specific terrestrial repeater could be deployed at a higher power level than otherwise permitted without an adverse impact on WCS (particularly if the SDARS licensee is willing to agree not to construct additional permissible repeaters in the same area).”<sup>26</sup> The WCS Coalition continues to believe that while the option of higher-powered repeater operations should be preserved by the rules, the exercise of that option should not be permitted at the expense of current or future WCS operations.

Given the record that higher-powered SDARS repeaters pose a very real threat of interference to WCS and the need for WCS system operators to have a measure of certainty that they will not be subject to such interference, the WCS Coalition strongly objects to the adoption of rules that contemplate the licensing of any SDARS terrestrial repeaters in excess of 12 kW average EIRP absent the consent of potentially affected WCS licensees. Thus, Appendix A includes proposed edits to Section 25.144(e)(9) designed to restrict the licensing of repeaters that do not comport with the blanket licensing rules to those situations in which all potentially affected WCS

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<sup>25</sup> Amendment of Part 27 of the Commission’s Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band; Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band, *Notice of Proposed Rulemaking and Second Further Notice of Proposed Rulemaking*, 22 FCC Rcd 22123, 22134 (2007).

<sup>26</sup> WCS Coalition Comments at 28.

licensees consent.<sup>27</sup> The power limits imposed in proposed Section 25.214(d)(1) and/or the OOB limits set forth in proposed Section 25.202(h)(1) and (2) are critical to framing the interference environment in which WCS will operate, and the Commission should not allow site-based licensing to become the exception that swallows these rules.

*D. THE COMMISSION SHOULD REQUIRE NOTICE WITHIN 24 HOURS OF MODIFYING EXISTING SDARS TERRESTRIAL REPEATERS OR WCS BASE STATIONS (OTHER THAN RELOCATIONS).*

Pursuant to proposed Sections 25.263 and 27.72, 10 business days advance notice will be required to potentially affected licensees before any SDARS terrestrial repeater or WCS base station becomes operational.<sup>28</sup> The WCS Coalition applauds that approach, which assures that licensees in both services have advance notice of new facilities that potentially could cause interference.<sup>29</sup> Because new WCS base stations (and relocated base stations) are not deployed without substantial advance planning (network design, site acquisition, equipment acquisition), requiring 10 business days prior notice of new base stations should not hinder licensees in providing their service offerings to the public.

The same cannot be said, however, of the proposal advanced in the same proposed rule sections to require five business days advance notice before existing facilities are modified (other than being relocated). Focusing on mobile broadband offerings, it is important for the Commission to keep in mind that the process of deploying a network capable of providing ubiquitous mobile

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<sup>27</sup> The WCS Coalition is also proposing editorial changes to Sections 25.202(h), 25.263(b), which identify “potentially affected WCS licensees” for purposes of the rules. In each case, the proposed modifications are intended to eliminate the potential for confusion or ambiguity in cases where WCS service areas have been partitioned and to eliminate extraneous verbiage.

<sup>28</sup> See *Public Notice* at 8, 11.

<sup>29</sup> To assure that Sirius XM and all WCS licensees have a complete inventory of base stations and terrestrial repeaters that exist as of the effective date of the new rules, the WCS Coalition is proposing in Appendix A to modify Sections 25.263(c) and 27.72(c) to require an exchange of relevant information within 10 business days of the effective date of the new rules.

service is an iterative one.<sup>30</sup> Licensees are not only adding new base stations, but they are constantly “tweaking” their existing facilities as necessary to eliminate “dead zones” in coverage, avoid self-interference between the operator’s own cell sites and otherwise improve service to the public. Invariably, one iteration begets another – for instance, a slight modification of one antenna’s orientation to improve coverage may require a corresponding modification of a second antenna to avoid self-interference, which in turn might require a reorienting of a third antenna to fill-in coverage, and so on. Often, the need for these network modifications cannot be predicted beforehand, as propagation modeling tools are imperfect (particularly in urban areas with substantial man-made clutter).<sup>31</sup> Thus, they must be effectuated in real time – adjustments are made, signal levels measured, further adjustments made, etc., by field personnel until the system is in balance.

Under the rules proposed by the staff, what often must take place over the course of hours or a few days would be stretched out for months, as each individual modification would require delays. Take the example above – if the first antenna reorientation results in unexpected self-interference, the network operator will be precluded from fixing the problem until it provides an additional five business days notice. In the interim, it must either return the first base station to its prior condition (restoring the dead zone where it was not serving the public), or suffer the self-interference (and in the process degrade its service to the public). And, what public interest objective is advanced by this result? Sirius XM will have been on notice of the location of every WCS base station being modified and should have no difficulty identifying WCS as a potential source in the unlikely event any new interference arises.

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<sup>30</sup> See WCS Coalition Comments at 39-40.

<sup>31</sup> Of course, it is in these very same urban areas where SDARS terrestrial repeaters provide substantial coverage, and thus the risk of interference from WCS mobile operations is substantially mitigated.

As an alternative, WCS Coalition is proposing that notice of any modification to a WCS base station or a SDARS repeater (other than changes in location) be given within 24 hours of the modifications being made. This approach will assure that all licensees have current data regarding the configuration of each others' facilities, which will facilitate future cooperation and assure that as new facilities are designed the current configuration of existing ones will be considered. However, it allows modifications not related to locations to be made within the timeframes dictated by marketplace realities.

*E. THE COMMISSION SHOULD MANDATE THAT SDARS TERRESTRIAL REPEATERS OPERATE ONLY BETWEEN 2324.2 MHZ AND 2341.285 MHZ.*

The record before the Commission that has led to the proposed OOB and power limits for SDARS terrestrial repeaters has been developed based on the current location of SDARS terrestrial repeaters – the former Sirius system operates its terrestrial repeaters at 2324.2-2328.3 MHz and the former XM system operates its terrestrial repeaters at 2336.225-2341.285 MHz. While the WCS Coalition has no objection to Sirius XM moving its terrestrial repeater usage closer to the center of the 2320-2345 MHz SDARS band (farther away from the boundaries with WCS), movement closer to the WCS band will only exacerbate the interference to which WCS subscribers will be subjected and should be prevented by rule. Thus, Appendix A includes a proposed revision to Section 25.202 that would limit SDARS terrestrial repeaters to no lower in the SDARS band than 2324.2 MHz and no higher in the SDARS band than 2341.285 MHz.

### **III. CONCLUSION**

The National Broadband Plan summarizes the long-standing plight of the WCS industry well – “the failure to revisit historical allocations can leave spectrum handcuffed to particular use

cases and outmoded services.”<sup>32</sup> But revising obsolete rules – such as the OOB restrictions on WCS mobile devices – is not enough to ensure the band will be used for the deployment of mobile broadband services unless the Commission is also prepared to make difficult choices. The goal of freeing 300 MHz available for mobile broadband services over the next five years will not be easily achieved, and it will not be achieved at all unless the Commission is prepared to take a hard look at incumbents’ claims to interference protection. The price of not doing that will be high – “[u]ltimately, the cost of not securing enough spectrum may be higher prices, poorer service, lost productivity, loss of competitive advantage and untapped innovation.”<sup>33</sup> Thus, the WCS Coalition urges the Commission to adopt the modified rules set forth in Appendix A.<sup>34</sup>

Respectfully submitted,

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<sup>32</sup> National Broadband Plan at 78-79.

<sup>33</sup> *Id.* at 85.

<sup>34</sup> In Appendix A, the WCS Coalition urges that proposed Section 27.50(a)(1) be revised so as to permit the continued deployment of fixed point-to-point frequency division duplex (“FDD”) links in both the 2305-2320 MHz and 2345-2360 MHz segments of the WCS band. However, should the Commission not make the requested modification, at a minimum it should grandfather existing FDD point-to-point deployments constructed prior to the adoption of new technical rules to avoid customer dislocation and stranded investment, particularly since no one has complained of interference from such links.

## APPENDIX A

### Proposed Rules

Part 25 of Title 47 of the Code of Federal Regulations is proposed to be amended as follows:

#### **PART 25 – SATELLITE COMMUNICATIONS**

1. The authority citation for Part 25 continues to read as follows:

**Authority:** 47 U.S.C. 701-744. Interprets or applies Sections 4, 301, 302, 303, 307, 309, and 332 of the Communications Act, as amended, 47 U.S.C. Sections 154, 301, 302, 303, 307, 309, 332, unless otherwise noted.

2. Amend Section 25.121 by revising paragraph (a) to read as follows:

##### **§ 25.121 License term and renewals.**

(a) License Term. (1) Except for licenses for DBS space stations, SDARS space stations and terrestrial repeaters, and 17/24 GHz BSS space stations licensed as broadcast facilities, licenses for facilities governed by this part will be issued for a period of 15 years.

(2) Licenses for DBS space stations and 17/24 GHz BSS space stations licensed as broadcast facilities, and for SDARS space stations and terrestrial repeaters, will be issued for a period of 8 years. Licenses for DBS space stations not licensed as broadcast facilities will be issued for a period of 10 years.

\* \* \* \* \*

3. Amend Section 25.144 by revising paragraph (d) and adding paragraph (e), to read as follows:

##### **§ 25.144 Licensing provisions for the 2.3 GHz satellite digital audio radio service.**

\* \* \* \* \*

(d) The license term for each digital audio radio service satellite and any associated terrestrial repeaters are specified in § 25.121 of this chapter.

(e) SDARS Terrestrial Repeaters.

(1) Only entities holding or controlling SDARS space station licenses may construct and operate SDARS terrestrial repeaters and only if at least one SDARS space station is authorized and transmitting directly to subscribers.

(2) SDARS terrestrial repeaters will be eligible for blanket licensing only under the following circumstances:

(i) The SDARS terrestrial repeaters will comply with all applicable power limits set forth in § 25.214(d)(1) of this chapter and all applicable out-of-band emission limits set forth in § 25.202(h)(1) and (2) of this chapter.

(ii) The SDARS terrestrial repeaters will meet all applicable requirements in part 1, subpart I, and part 17 of this chapter. Operators of SDARS terrestrial repeaters must maintain

demonstrations of compliance with part 1, subpart I, of this chapter and make such demonstrations available to the Commission upon request within three business days.

(iii) The SDARS terrestrial repeaters will comply with all requirements of all applicable international agreements.

(3) After [**Insert release date of Order**], SDARS licensees shall, before deploying any new, or modifying any existing, terrestrial repeater, notify potentially affected WCS licensees pursuant to the procedure set forth in § 25.263 of this chapter.

(4) SDARS terrestrial repeaters are restricted to the simultaneous retransmission of the complete programming, and only that programming, transmitted by the SDARS licensee's satellite(s) directly to the SDARS licensee's subscribers' receivers, and may not be used to distribute any information not also transmitted to all subscribers' receivers.

(5) Operators of SDARS terrestrial repeaters are prohibited from using those repeaters to retransmit different transmissions from a satellite to different regions within that satellite's coverage area.

(6) Operators of SDARS terrestrial repeaters are required to comply with all applicable provisions of part 1, subpart I, and part 17 of this chapter.

(7)(i) Each SDARS terrestrial repeater transmitter utilized for operation under this paragraph must be of a type that has been authorized by the Commission under its certification procedure.

(ii) In addition to the procedures set forth in subpart J of part 2 of this chapter, power measurements for SDARS repeater transmitters may be made in accordance with a Commission-approved average power technique. Peak-to-average power ratio (PAPR) measurements for SDARS repeater transmitters should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that the PAPR will not exceed 13 dB for more than 0.1 percent of the time or another Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

(iii) Any manufacturer of radio transmitting equipment to be used in these services may request equipment authorization following the procedures set forth in subpart J of part 2 of this chapter. Equipment authorization for an individual transmitter may be requested by an applicant for a station authorization by following the procedures set forth in part 2 of this chapter.

(8) Applications for blanket authority to operate terrestrial repeaters must be filed using Form 312, except that Schedule B to Form 312 need not be filed. Such applications must also include the following information as an attachment:

(i) The space station(s) with which the terrestrial repeaters will communicate, the frequencies and emission designators of such communications, and the frequencies and emission designators used by the repeaters to re-transmit the received signals.

(ii) The maximum number of terrestrial repeaters that will be deployed under the authorization at 1) power levels equal to or less than 2-watt average EIRP, and 2) power levels greater than 2-watt average EIRP (up to 12-kW average EIRP).

(iii) A certification of compliance with the requirements of § 25.144(e)(1) through (7) of this chapter.

(9) SDARS terrestrial repeaters that are ineligible for blanket licensing must be authorized on a site-by-site basis. Applications for site-by-site authorization must be filed using Form 312, except that Schedule B need not be provided. Such applications must also include the following information, as an attachment:

(i) The technical information for each repeater required to be shared with potentially affected WCS licensees as part of the notification requirement set forth in § ~~25.263~~263(c)(2) of this chapter.

(ii) The space station(s) with which the terrestrial repeaters will communicate, the frequencies and emission designators of such communications, and the frequencies and emission designators used by the repeaters to re-transmit the received signals.

**(iii) Evidence that all potentially affected WCS licensees (as defined in §25.263(b)(1) of this chapter) have consented to the construction and operation of such repeater.**

**All potentially affected WCS licensees must be served with a copy of such application.**

*NOTE: Having just completed a 13-year proceeding to identify the limits on SDARS terrestrial repeaters necessary to protect WCS from interference, the Commission should not permit the routine licensing of SDARS terrestrial repeaters that fail to comport with the new licensing rules. The WCS Coalition has frequently noted in these proceedings that there will be circumstances where departure from the rules may serve both WCS and SDARS interests, and in the Further of Notice of Proposed Rulemaking in IB Docket No. 95-91 the Commission specifically sought public comment on whether to allow departures from the rules with the consent of WCS licensees. See WCS Coalition 2/14/08 Comments at 28-29. The proposed new language accommodates that possibility by allowing the SDARS licensee to reach agreement with potentially affected WCS licensees to permit repeaters that do not comply with the general blanket licensing rules. This approach is preferable to that contained in the staff draft, which provides no waiver or other standards by which requests for variance from the blanket licensing process are to be evaluated and did not assure that the interests of WCS licensees would be protected. The staff proposal, if adopted, threatens to become the exception that swallows the rule, and thus should be rejected in favor of the WCS Coalition's proposed alternative. The revision to subsection (i) merely corrects a typographical error in the cross-reference.*

4. Amend Section 25.202 by adding paragraph (a)(10), revising the introductory language of paragraph (f), and adding paragraph (h), to read as follows:

**§ 25.202 Frequencies, frequency tolerance, and emission limitations.**

(a) \* \* \*

(10) The following frequencies are available for use by the Satellite Digital Audio Radio Service (SDARS), and for any associated terrestrial repeaters:

2320-2345 MHz (space-to-Earth)

**Associated SDARS terrestrial repeaters are limited to operating between 2324.2 MHz and 2341.285 MHz unless otherwise authorized pursuant to the procedures set forth in §25.144(e)(9) of this chapter.**

*NOTE: The suggested limitation in the frequencies that can be utilized for SDARS terrestrial repeaters reflects the fact that the record developed regarding potential interference to WCS from SDARS terrestrial repeaters has been predicated on the current frequencies utilized by SDARS for the two repeater networks. There should be no doubt that operation of SDARS terrestrial repeaters at frequencies closer to the WCS band than currently authorized under the STAs will increase the risk of interference to WCS operations. Thus, as a general matter, Sirius XM should be restricted to operating terrestrial repeaters no closer than the frequencies it currently uses for operating its repeater networks. However, consistent with the position WCS has taken throughout these proceedings, the WCS Coalition recognizes that there may be circumstances where both WCS and SDARS could benefit from relocation of the frequencies used for SDARS, and the modification proposed by the WCS Coalition will allow the use of other frequencies in the SDARS band if agreed to by all potentially affected WCS licensees. See WCS Coalition 2/14/08 Comments at 34-35.*

\* \* \* \* \*

(f) Emission limitations. Except for SDARS terrestrial repeaters, the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the schedule set forth in paragraphs (f)(1) through (f)(4) of this section. The out-of-band emissions of SDARS terrestrial repeaters shall be attenuated in accordance with the schedule set forth in paragraph (h) of this section.

\* \* \* \* \*

(h) Out-of-band emission limitations for SDARS terrestrial repeaters.

(1) Any SDARS terrestrial repeater operating at a power level greater than 2-watt average EIRP is required to attenuate its out-of-band emissions by  $(90 + 10 \cdot \log(P) \text{ dB})$  ~~in a 1-megahertz bandwidth~~ outside the 2320-2345 MHz band, where P is average transmitter output power in watts.

(2) Any SDARS terrestrial repeater operating at a power level equal to or less than 2-watt average EIRP is required to attenuate its out-of-band emissions by  $(75 + 10 \cdot \log(P) \text{ dB})$  ~~in a 1-megahertz bandwidth~~ outside the 2320-2345 MHz band, where P is average transmitter power in watts.

(3) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve

measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

*NOTE: The proposed revisions to subsections (1), (2) and (3) are designed to clarify the mechanism to be employed in measuring compliance with the OOB restrictions applicable to SDARS terrestrial repeaters and to conform the SDARS measurement procedure and the proposed WCS process discussed in detail in the Note to Section 27.53(a)(4).*

(4) SDARS repeaters are permitted to attenuate out-of-band emissions less than the levels specified in paragraphs (1) and (2) above, unless a potentially affected WCS licensee provides written notice that it commenced service prior to [insert effective date of rule] or intends to commence ~~commercial~~ service within the ~~following~~ 365 days following such notice. Starting 180 days after receipt of such written notice, SDARS repeaters within the area notified by the potentially affected WCS licensee must attenuate out-of-band emissions to the levels specified in paragraphs (1) and (2) above.

*NOTE: The proposed edits are intended to address two considerations. First, WCS licensees have already deployed service in many areas, and one of the suggested changes merely reflects that their notices to SDARS commencing the 180 day transition period will not be coming prior to the commencement of service. Second, in some cases WCS facilities are being deployed for backhaul, rather than being used to provide commercial service directly to end users. This use is permitted under the WCS rules, and should be entitled to the same level of protection from SDARS repeater OOB interference as any other permissible WCS use.*

(5) For the purpose of this section, a WCS licensee is potentially affected if it meets any of the following criteria:

(i) The WCS licensee is authorized to operate ~~a base station in the 2305-2315 MHz or 2350-2360 MHz bands in the same Major Economic Area (MEA) as that~~ geographic service area in which a SDARS terrestrial repeater is located.

(ii) ~~The WCS licensee is authorized to operate a base station in the 2315-2320 MHz or 2345-2350 MHz bands in the same Regional Economic Area Grouping (REAG) as that in which a SDARS terrestrial repeater is located.~~

~~(iii) A SDARS terrestrial repeater is located within 5 kilometers of the boundary of an MEA or REAG~~ geographic service area in which the WCS licensee is authorized to operate ~~a WCS base station~~.

*NOTE: The proposed edits serve two objectives. First, WCS licenses are issued on a flexible use basis, and every WCS licensee is authorized to employ its spectrum for fixed point-to-point, fixed point-to-multipoint or mobile service. As such, each and every WCS licensee is authorized by definition to operate a base station within its authorized geographic service area. Thus, WCS is proposing to*

*eliminate the extraneous language limiting “potentially affected” status to those WCS licensees that are authorized to operate a base station, since all are so authorized. Second, because WCS licensees can geographically partition their authorized service areas (and indeed, some already have), the references to MEA and REAG in the staff draft may prove ambiguous or confusing. The proposed modification eliminates those references, replacing them with the more generic “geographic service area” terminology to cover whatever service area may be associated with a given WCS license.*

5. Amend Section 25.214 by revising the title and adding paragraph (d) to read as follows:

**§ 25.214 Technical requirements for space stations in the satellite digital audio radio service and associated terrestrial repeaters.**

\* \* \* \* \*

(d) Power limit for SDARS terrestrial repeaters.

(1) SDARS terrestrial repeaters must be operated at a power level less than or equal to 12-kW average EIRP, with a maximum peak-to-average power ratio of 13 dB.

(2) SDARS repeaters are permitted to operate at power levels above 12-kW average EIRP, unless a potentially affected WCS licensee provides written notice that it commenced service prior to [insert effective date of rule] or intends to commence ~~commercial~~ service within the ~~following~~ 365 days following such notice. Starting 180 days after receipt of such written notice, SDARS repeaters within the area notified by the potentially affected WCS licensee must be operated at a power level less than or equal to 12-kW average EIRP, with a maximum peak-to-average power ratio of 13 dB.

*NOTE: See Note accompanying similar modification of proposed Section 25.202(h)(4) for an explanation of the rationale for the proposed edits.*

(3) For the purpose of this section, a WCS licensee is potentially affected if it meets any of the following criteria:

(i) The WCS licensee is authorized to operate ~~a base station~~ in the ~~2305-2315 MHz or 2350-2360 MHz bands in the same Major Economic Area (MEA) as that~~ geographic service area in which a SDARS terrestrial repeater is located.

(ii) ~~The WCS licensee is authorized to operate a base station in the 2315-2320 MHz or 2345-2350 MHz bands in the same Regional Economic Area Grouping (REAG) as that in which a SDARS terrestrial repeater is located.~~

~~—(iii)—~~ A SDARS terrestrial repeater is located within 5 kilometers of the boundary of an ~~MEA or REAG~~ geographic service area in which the WCS licensee is authorized to operate ~~a WCS base station~~.

*NOTE: See Note accompanying proposed Section 25.202(h)(3) for an explanation of the rationale for the proposed edits.*

6. Add Section 25.263 to read as follows:

**§ 25.263 Information sharing requirements for SDARS terrestrial repeater operators.**

This section requires SDARS licensees in the 2320-2345 MHz band to share information regarding the location and operation of terrestrial repeaters with WCS licensees in the 2305-2320 MHz and 2345-2360 MHz bands. Section 27.72 of this chapter requires WCS licensees to share information regarding the location and operation of base stations in the 2305-2320 MHz and 2345-2360 MHz bands with SDARS licensees in the 2320-2345 MHz band.

(a) SDARS licensees must select terrestrial repeater sites and frequencies, to the extent practicable, to minimize the possibility of harmful interference to WCS base station operations in the 2305-2320 MHz and 2345-2360 MHz bands.

(b) Prior Notice Periods. SDARS licensees that intend to operate a new terrestrial repeater or to relocate an existing terrestrial repeater must, before commencing such operation, provide 10 business days prior notice to all potentially affected WCS licensees. SDARS licensees that ~~intend to~~ modify any of the technical parameters set forth in § 25.263(c)(2) of this chapter other than location for an existing repeater must, ~~before commencing such modified operation,~~ provide ~~5 business days prior~~ notice to all potentially affected WCS licensees within 24 hours of commencing such modified operations.

*NOTE: The proposed edits are designed to conform the requirement for SDARS advance notice with proposed modifications to the corresponding WCS rule (Section 27.72(b)).*

(1) For purposes of this section, a "potentially affected WCS licensee" is a WCS licensee that: (i) is authorized to operate ~~a base station in the 2305-2315 MHz or 2350-2360 MHz bands in the same Major Economic Area (MEA) as that~~ geographic service area in which the terrestrial repeater is to be located; or (ii) is authorized to serve a geographic service area the boundary of which is ~~operate a base station in the 2315-2320 MHz or 2345-2350 MHz bands in the same Regional Economic Area Grouping (REAG) as that in which the terrestrial repeater is to be located.~~ (iii) ~~In addition to the WCS licensees identified in paragraphs (b)(1)(i) and (ii) of this section, in cases in which the SDARS licensee plans to deploy or modify a terrestrial repeater within 5 kilometers of the boundary of an MEA or REAG in which the terrestrial repeater is to be located, a potentially affected WCS licensee is one that is authorized to operate a WCS base station in that neighboring MEA or REAG within 5 kilometers of the location of the terrestrial repeater.~~

*NOTE: See Note accompanying similar modification of proposed Section 25.202(h)(3) for explanation of rationale for proposed edits.*

(2) For the purposes of this section, a business day is defined by § 1.4(e)(2) of this chapter.

(c) Notification Requirements.

(1) Notification must be written (*e.g.*, certified letter, fax, or email) and include the licensee's name, and the name, address, and telephone number of its coordination representative, unless the SDARS licensee and all potentially affected WCS licensees reach a mutual agreement to provide notification by some other means. WCS licensees and SDARS licensees may establish such a mutually agreeable alternative notification mechanism without prior Commission approval, provided that they comply with all other requirements of this section.

(2) Regardless of the notification method, it must specify relevant technical details, including, at a minimum: (i) the coordinates of the proposed repeater to an accuracy of no less than  $\pm 1$  second latitude and longitude; (ii) the proposed operating power(s), frequency band(s), and emission(s); (iii) the antenna center height above ground and ground elevation above mean sea level, both to an accuracy of no less than  $\pm 1$  meter; (iv) the antenna gain pattern(s) in the azimuth and elevation planes that include the peak of the main beam; and (v) the antenna downtilt angle(s).

(3) An SDARS licensee operating terrestrial repeaters must maintain an accurate and up-to-date inventory of their terrestrial repeaters operating above 2 watts average EIRP, including the information set forth in § 25.263(c)(2) of this chapter, which shall be available upon request by the Commission.

**(4) No later than 10 business days after [insert effective date of rules], SDARS licensees shall notify each potentially affected WCS licensee of the technical details specified in § 25.263(c)(2) of this chapter for each then-existing terrestrial repeater that potentially affects the WCS licensee.**

*NOTE: The proposed additional language here and in the corresponding provision of Part 27 is designed to ensure that SDARS and WCS have a baseline of information regarding existing deployment as of the effective date of the new rules so as to facilitate coordination.*

(d) Calculation of Notice Period. Notice periods are calculated from the date of receipt by the licensee being notified. If notification is by mail, the date of receipt is evidenced by the return receipt on certified mail. If notification is by fax, the date of receipt is evidenced by the notifying party's fax transmission confirmation log. If notification is by email, the date of receipt is evidenced by a return e-mail receipt. If the SDARS licensee and all potentially affected WCS licensees reach a mutual agreement to provide notification by some other means, that agreement must specify the method for determining the beginning of the notice period.

(e) Duty to Cooperate. SDARS licensees must cooperate in good faith in the selection and use of new repeater sites to reduce interference and make the most effective use of the authorized facilities. Licensees of stations suffering or causing harmful interference must cooperate in good faith and resolve such problems by mutually satisfactory arrangements. If the licensees are unable to do so, the International Bureau, in consultation with the Office of Engineering and Technology and the Wireless Telecommunications Bureau, may impose restrictions including specifying the transmitter power, antenna height, or area or hours of operation of the stations.

Part 27 of Title 47 of the Code of Federal Regulations is proposed to be amended as follows:

## **PART 27 – MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES**

1. The authority citation for Part 27 continues to read as follows:

**Authority:** 47 U.S.C. 154, 301, 302, 303, 307, 309, 332, 336, and 337 unless otherwise noted.

2. Amend Section 27.50 by revising paragraph (a) to read as follows:

### **§ 27.50 Power limits and duty cycle.**

- (a) The following power limits and related requirements apply to stations transmitting in the 2305-2320 MHz band or the 2345-2360 MHz band.

(1) Base and fixed stations.

(i) For base and fixed stations transmitting in the 2305-2315 MHz band or the 2350-2360 MHz band:

(A) The average equivalent isotropically radiated power (EIRP) must not exceed 2,000 watts within any 5 megahertz of authorized bandwidth and must not exceed 400 watts within any 1 megahertz of authorized bandwidth.

(B) The peak-to-average power ratio (PAPR) of the transmitter output power must not exceed 13 dB. The PAPR measurements should be made using either an instrument with complementary cumulative distribution function (CCDF) capabilities to determine that PAPR will not exceed 13 dB for more than 0.1 percent of the time or other Commission approved procedure. The measurement must be performed using a signal corresponding to the highest PAPR expected during periods of continuous transmission.

(ii) For base and fixed stations transmitting in the 2315-2320 MHz band or the 2345-2350 MHz band, the peak EIRP must not exceed 2,000 watts.

(iii) ~~Base and fixed stations~~ Mobile systems using frequency division duplex (FDD) technology are restricted to utilizing the 2305-2320 MHz band for mobile-to-base station transmissions and transmitting in the 2345-2360 MHz bands for base station-to-mobile transmissions.

*NOTE: No party to these proceedings, nor anything in the record, supports a new rule that would preclude point-to-point FDD links from operating in the 2305-2320 MHz segment of the WCS band. Presumably, proposed Section 27.50(a)(1)(iii) was intended to require those WCS licensees that elect to deploy mobile FCC systems employ the lower WCS segment for mobile-to-base transmissions and to use the upper WCS segment for base-to mobile transmissions. The proposed language reflects that intent, without jeopardizing the continued ability of WCS licensees to use the 2305-2320 MHz band for point-to-point FDD links. Should the Commission not make this proposed rule change, at a minimum it should grandfather existing FDD point-to-point deployments constructed prior to the adoption of new technical rules to avoid customer dislocation and stranded investment, particularly since no one has complained of interference from such links.*

(2) Fixed customer premises equipment. For fixed customer premises equipment (CPE) transmitting in the 2305-2320 MHz band or the 2345-2360 MHz band, the peak EIRP must not exceed 20 watts.

(3) Mobile and portable stations.

(i) For mobile and portable stations transmitting in the 2305-2317.5 MHz band or the 2347.5-2360 MHz band, the average EIRP must not exceed 250 milliwatts. For mobile and portable stations using time division duplex (TDD) technology, the duty cycle must not exceed 38

percent in the 2305-2317.5 MHz and 2347.5-2360 MHz bands. For mobile and portable stations using frequency division duplex (FDD) technology, the duty cycle must not exceed 12.5 percent in the 2305-2317.5 MHz band. Mobile and portable stations using FDD technology are restricted to transmitting in the 2305-2317.5 MHz band. Power averaging shall not include intervals in which the transmitter is off.

(ii) Mobile and portable stations are not permitted to operate in the 2317.5-2320 MHz and 2345-2347.5 MHz bands.

(iii) Automatic transmit power control. Mobile and portable stations transmitting in the 2305-2317.5 MHz band or in the 2347.5-2360 MHz band must utilize automatic transmit power control when operating so the station operates with the minimum power necessary for successful communications.

(iv) Prohibition on external vehicle-mounted antennas. The use of external vehicle-mounted antennas for mobile and portable stations transmitting in the 2305-2317.5 MHz band or the 2347.5-2360 MHz band is prohibited.

\* \* \* \* \*

3. Amend Section 27.53 by revising paragraphs (a)(1), (a)(2), and (a)(3), removing and reserving paragraphs (a)(5) and (a)(9), and revising paragraph (a)(10) to read as follows:

**§ 27.53 Emission limits.**

(a) For operations in the 2305-2320 MHz band and the 2345-2360 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) (with averaging performed only during periods of transmission) within the licensed band(s) of operation, in watts, by the following amounts:

(1) For base and fixed stations. By a factor of not less than  $(43 + 10 \cdot \log(P) \text{ dB})$  on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band of operation, not less than  $(75 + 10 \cdot \log(P) \text{ dB})$  on all frequencies between 2320 and 2345 MHz, not less than  $(43 + 10 \cdot \log(P) \text{ dB})$  at 2305 and 2360 MHz, not less than  $(55 + 10 \cdot \log(P) \text{ dB})$  at 2362.5 MHz, not less than  $(70 + 10 \cdot \log(P) \text{ dB})$  at 2300 and 2365 MHz, not less than  $(72 + 10 \cdot \log(P) \text{ dB})$  at 2367.5 MHz, and not less than  $(75 + 10 \cdot \log(P) \text{ dB})$  at 2370 MHz.

(2) For fixed customer premises equipment.

(i) For fixed customer premises equipment (CPE) transmitting with more than 2 watts average EIRP, by a factor of not less than  $(43 + 10 \cdot \log(P) \text{ dB})$  on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band of operation, not less than  $(75 + 10 \cdot \log(P) \text{ dB})$  on all frequencies between 2320 and 2345 MHz, not less than  $(43 + 10 \cdot \log(P) \text{ dB})$  at 2305 and 2360 MHz, not less than  $(55 + 10 \cdot \log(P) \text{ dB})$  at 2362.5 MHz, not less than  $(70 + 10 \cdot \log(P) \text{ dB})$  at 2300 and 2365 MHz, not less than  $(72 + 10 \cdot \log(P) \text{ dB})$  at 2367.5 MHz, and not less than  $(75 + 10 \cdot \log(P) \text{ dB})$  at 2370 MHz.

(ii) For fixed CPE transmitting with 2 watts average EIRP or less, by a factor of not less than  $(43 + 10 \cdot \log(P) \text{ dB})$  on all frequencies between 2305 and 2320 MHz and on all frequencies between 2345 and 2360 MHz that are outside the licensed band of operation, not less than  $(55 + 10 \cdot \log(P) \text{ dB})$  on all frequencies between 2320 and 2324 MHz and on all frequencies between 2341 and 2345 MHz, not less than  $(61 + 10 \cdot \log(P) \text{ dB})$  on all frequencies between 2324

and 2328 MHz and on all frequencies between 2337 and 2341 MHz, not less than  $(67 + 10 \cdot \log(P))$  dB on all frequencies between 2328 and 2337 MHz, not less than  $(43 + 10 \cdot \log(P))$  dB at 2305 and 2360 MHz, not less than  $(45 + 10 \cdot \log(P))$  dB at 2362.5 MHz, not less than  $(55 + 10 \cdot \log(P))$  dB at 2365 MHz, not less than  $(65 + 10 \cdot \log(P))$  dB at 2367.5 MHz, and not less than  $(70 + 10 \cdot \log(P))$  dB at 2300 and 2370 MHz.

(3) For mobile and portable stations. For mobile and portable stations operating in the 2305-2317.5 MHz and 2347.5-2360 MHz bands, by a factor of not less than  $(43 + 10 \cdot \log(P))$  dB on all frequencies between 2305 and 2317.5 MHz and on all frequencies between 2347.5 and 2360 MHz that are outside the licensed band of operation, not less than  $(55 + 10 \cdot \log(P))$  dB on all frequencies between 2320 and 2324 MHz and on all frequencies between 2341 and 2345 MHz, not less than  $(61 + 10 \cdot \log(P))$  dB on all frequencies between 2324 and 2328 MHz and on all frequencies between 2337 and 2341 MHz, not less than  $(67 + 10 \cdot \log(P))$  dB on all frequencies between 2328 and 2337 MHz, not less than  $(43 + 10 \cdot \log(P))$  dB at 2305 and 2360 MHz, not less than  $(45 + 10 \cdot \log(P))$  dB at 2362.5 MHz, not less than  $(55 + 10 \cdot \log(P))$  dB at 2365 MHz, not less than  $(65 + 10 \cdot \log(P))$  dB at 2367.5 MHz, and not less than  $(70 + 10 \cdot \log(P))$  dB at 2300 and 2370 MHz.

**(4) Measurement procedure. Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (i.e. 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.**

*NOTE: The proposed amendment to subsection (4) is necessary to properly characterize wideband technologies that incorporate Orthogonal Frequency Division Multiple Access (“OFDMA”) technology, including WiMAX, TD-LTE and the SDARS terrestrial repeater carrier. At channel edge, with a resolution bandwidth of either 1% of the emissions bandwidth or 1 MHz as provided under the existing procedures, the measurement device will capture power associated with the main carrier into the out of band emissions measurement. This is due to the wideband nature and spectral roll off characteristic of the OFDMA signal. As such, the WCS Coalition recommends that a narrower bandwidth be permitted in the measurement, so long as the measured power is integrated over a 1 MHz bandwidth.. The proposed language is taken verbatim from Sections 25.254(d)(6) and 27.53(m)(6) of the Rules, which were adopted to solve the same problem in connection with wideband OFDMA operations in the Big LEO ATC and 2.5 GHz bands.*

(5) Reserved.

\* \* \* \* \*

(9) Reserved.

(10) The out-of-band emissions limits in paragraphs (a)(1) through (a)(3) of this section may be modified by the private contractual agreement of all affected licensees, who must maintain a copy of the agreement in their station files and disclose it to prospective assignees, transferees, or spectrum lessees and, upon request, to the Commission.

\* \* \* \* \*

4. Add Section 27.72 to read as follows:

**§ 27.72 Information sharing requirements.**

This section requires WCS licensees in the 2305-2320 MHz and 2345-2360 MHz bands to share information regarding the location and operation of base stations with Satellite Digital Audio Radio Service (SDARS) licensees in the 2320-2345 MHz band. Section 25.263 of this chapter requires SDARS licensees in the 2320-2345 MHz band to share information regarding the location and operation of terrestrial repeaters with WCS licensees in the 2305-2320 MHz and 2345-2360 MHz bands.

(a) WCS licensees must select base station sites and frequencies, to the extent practicable, to minimize the possibility of harmful interference to operations in the SDARS 2320-2345 MHz band.

(b) Prior Notice Periods. WCS licensees that intend to operate a new base station or to relocate an existing base station must, before commencing such operation, provide 10 business days prior notice to all SDARS licensees. WCS licensees that ~~intend to modify~~ any of the technical parameters set forth in § 27.72(c)(2) of this chapter other than location for an existing base station must, ~~before commencing such modified operation,~~ provide ~~5 business days prior~~ notice to all SDARS licensees within 24 hours of commencing such modified operations. For the purposes of this section, a business day is defined by § 1.4(e)(2) of this chapter.

*NOTE: New or relocated WCS base stations are not deployed without advance planning, and thus requiring 10 business days prior notice of new base stations will not adversely impact service to the public. However, as the WCS Coalition has previously explained, the process of deploying a network capable of providing ubiquitous mobile service is an iterative one. See WCS Coalition 2/14/08 Comments at 39-40. Licensees will be constantly “tweaking” as necessary to eliminate “dead zones” in coverage, avoid self-interference between the operator’s own cell sites and increase capacity. Modifications to cell sites are done over and over again as, for example, dead zones arise due to new construction or new areas of self-interference are discovered. Invariably, one iteration begets another – for instance, a slight modification of one antenna’s orientation to improve coverage may require a corresponding modification of a second antenna to avoid self-interference, which in turn might require a reorienting of a third antenna to fill-in coverage, and so on. Often, the need for these network modifications cannot be predicted before hand, as propagation modeling tools are imperfect (particularly in urban and suburban areas with substantial man-made clutter). Thus, they must be effectuated in real time – adjustments are made, signal levels measured, further adjustments made, etc., until the system is in balance. However, under the rules proposed by the staff, what often must take place over the course of hours or a few days would be stretched out for months, as each iteration of modification would require delays*

*and continued inferior service to the public before the system operator could actually implement all of the necessary system modifications. Because Sirius XM will already be aware of the location of every WCS base station and will receive notice of modifications within 24 hours of implementation, it will be able to address any interference resulting from the modification. The WCS Coalition is also proposing conforming edits to the corresponding SDARS rule (Section 25.263(b)).*

(c) Notification Requirements.

(1) Notification must be written (*e.g.*, certified letter, fax, or email) and include the licensee's name, and the name, address, and telephone number of its coordination representative, unless the SDARS licensee and all potentially affected WCS licensees reach a mutual agreement to provide notification by some other means. WCS licensees and SDARS licensees may establish such a mutually agreeable alternative notification mechanism without prior Commission approval, provided that they comply with all other requirements of this section.

(2) Regardless of the notification method, it must specify relevant technical details, including, at a minimum: (i) the coordinates of the proposed base station to an accuracy of no less than  $\pm 1$  second latitude and longitude; (ii) the proposed operating power(s), frequency band(s), and emission(s); (iii) the antenna center height above ground and ground elevation above mean sea level, both to an accuracy of no less than  $\pm 1$  meter; (iv) the antenna gain pattern(s) in the azimuth and elevation planes that include the peak of the main beam; and (v) the antenna downtilt angle(s).

(3) A WCS licensee operating base stations must maintain an accurate and up-to-date inventory of its base stations, including the information set forth in § 27.72(c)(2) of this chapter, which shall be available upon request by the Commission.

**(4) No later than 10 business days after [insert effective date of rules], each WCS licensee shall notify the SDARS licensees of the technical details specified in § 27.72(c)(2) of this chapter for each then-existing base station.**

*NOTE: The proposed additional language here and in the corresponding provision of Part 25 is designed to ensure that SDARS and WCS have a baseline of information regarding deployment existing as of the date the new rules become effective so as to facilitate future coordination.*

(d) Calculation of Notice Period. Notice periods are calculated from the date of receipt by the licensee being notified. If notification is by mail, the date of receipt is evidenced by the return receipt on certified mail. If notification is by fax, the date of receipt is evidenced by the notifying party's fax transmission confirmation log. If notification is by email, the date of receipt is evidenced by a return e-mail receipt. If the SDARS licensee and all potentially affected WCS licensees reach a mutual agreement to provide notification by some other means, that agreement must specify the method for determining the beginning of the notice period.

(e) Duty to Cooperate. WCS licensees must cooperate in good faith in the selection and use of new station sites and new frequencies to reduce interference and make the most effective use of the authorized facilities. Licensees of stations suffering or causing harmful interference must cooperate in good faith and resolve such problems by mutually satisfactory arrangements. If the licensees are unable to do so, the Wireless Telecommunications Bureau, in consultation with the Office of Engineering and Technology

and the International Bureau, may impose restrictions including specifying the transmitter power, antenna height, or area or hours of operation of the stations.

5. Add Section 27.73 to read as follows:

**§ 27.73 WCS and MAT coordination requirements.**

This section requires Wireless Communications Services (WCS) licensees in the 2345-2360 MHz band to coordinate the deployment of base stations with Mobile Aeronautical Telemetry (MAT) facilities in the 2360-2395 MHz band; and to take all practicable steps necessary to reduce the likelihood of harmful interference to MAT facilities.

(a) Wireless Communications Service (WCS) licensees operating base stations in the 2345-2360 MHz band shall, prior to operation of such base stations, achieve a mutually satisfactory coordination agreement with any MAT entity operating an MAT receiver facility within ~~10~~45-kilometers ~~or the radio line of site, whichever distance is larger,~~ of the intended WCS base station location. ~~The location of MAT receiver sites may be obtained from the Aerospace and Flight Test Radio Coordinating Council (AFTRCC) for non-federal MAT receivers. For federal MAT receivers, the WCS licensee shall supply sufficient information to the Commission to allow coordination to take place.~~ A listing of the geographic coordinates of current MAT receiver sites and the heights above ground level of receive antennas shall be provided to each WCS licensee no later than 10 business days after [insert effective date of new rule] by ~~can be obtained from~~ the Aerospace and Flight Test Radio Coordinating Council (AFTRCC) for non-federal sites and through the FCC's IRAC Liaison for federal MAT receiver sites, which shall be provide updated information promptly to WCS licensees as new sites are deployed or existing facilities modified.

*NOTE: The proposed modifications are intended to accomplish two purposes. First, as is discussed in more detail in the accompanying filing by the WCS Coalition and supporting report from Kolodzy Consulting, interference from a WCS base station is not a threat where the base station is located 10 or more kilometers from the MAT receiver. Thus, the proposed 45 km coordination zone would have imposed coordination costs and delays unnecessarily and can be substantially reduced in size. Second, the revised language assures that WCS licensees will have the information they need to design their networks to fully protect MAT facilities. The location and height of the MAT receivers is critical information, since it allows a determination of whether there is radio line of sight between the facilities (without which there cannot be interference). Shifting the burden to MAT users to keep WCS apprised of changes should not impose any material burden on MAT, particularly when one considers that the alternative is for WCS licensees to constantly request updates from MAT, placing a burden on MAT to respond.*

(b) Duty to Cooperate. WCS licensees and MAT receiver operators must cooperate in good faith in the coordination and deployment of WCS and MAT facilities. WCS licensees must also cooperate in good faith in the selection and use of new station sites and new frequencies when within radio line of site of MAT receiver facilities to reduce the likelihood of harmful interference and make the most effective use of the authorized facilities. Licensees of stations suffering or causing harmful interference must cooperate in good faith and resolve such problems by mutually satisfactory arrangements. If the licensees

are unable to do so, the Wireless Telecommunications Bureau, in consultation with the Office of Engineering and Technology and the National Telecommunications and Information Administration may impose restrictions including specifying the transmitter power, antenna height, or area or hours of operation of the stations.

## **APPENDIX B**

# **Analysis of Interference Potential from WCS to MAT Services in the 2360-2395 MHz Band**

**Paul J. Kolodzy, PhD**

## **I. Overview**

In a Public Notice released on April 2, 2010, the FCC sought public comment on draft interference rules for the Wireless Communications Service (WCS) and Satellite Digital Audio Radio Service (SDARS), including the appropriate interference protection standard for the protection of the mobile aeronautical telemetry (MAT) service that operates in spectrum above and adjacent to the WCS band. The draft rules propose both stringent out-of-band emissions limits on WCS operations into the MAT band and large coordination zones in areas near MAT receiver sites.

A study was conducted to assess the sources of current and potential interference to MAT receivers and the protection levels required by MAT operations in the 2360-2395 MHz band. The analysis demonstrates that the proposed coordination distance of 45 km or line-of-sight, whichever is greater, is excessive and unnecessary to protect MAT receivers. Based on a conservative set of assumptions regarding the MAT receivers and their operating characteristics, as well as the WCS OOB limits proposed by the FCC, a more reasonable set of coordination distances is proposed for base stations and mobile devices operating in the upper WCS blocks.

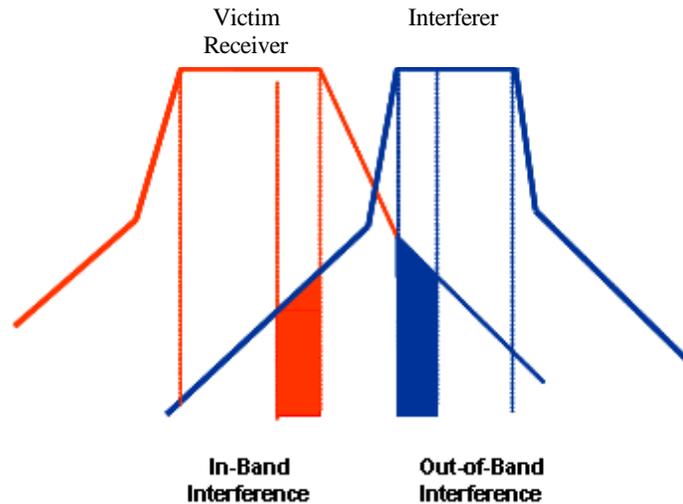
## **II. Background on Interference Sources**

The two primary sources of potential interference between services in adjacent bands are:

- a) Co-Channel Interference, which is caused by out-of-band emissions (OOBE, also known as in-band interference) from an undesired transmitter, is defined as emissions that are outside the bandwidth of an allocated channel in which a transmitter is operating that falls within the band pass of a neighboring receiver. Out-of-band emissions limits are frequently characterized such that the energy level may never exceed a specific power level, regardless of the transmit power. In other words, a 250 mW transmitter, such as a WCS mobile device, is often allowed to emit the same OOB level as a 2 kW transmitter, such as a WCS base station.
- b) Adjacent Channel Interference (or Overload) is interference caused by extraneous power from a signal transmitted in an adjacent channel or band. The effects of adjacent channel interference are exacerbated by inadequate receive filtering. Adjacent channel energy is always present when adjacent channels are operating, but only manifests itself when, due to poor receiver selectivity, the adjacent channel power degrades the linearity of the receiver's amplifier (amplification capability) or compresses the available digital to analog conversion bits, so that there is not enough of the receiver's resources available to accommodate the desired signal.

Figure 1 below depicts the relationship between OOB and overload in adjacent channel services.

**Figure 1: Effect of OOBE as in-band interference and overload as out-of-band interference**



### **III. Effect of OOBE on MAT**

In the draft WCS rules, the FCC has proposed the following OOBE limits on WCS base stations into the 2360-2395 MHz band:

by a factor of:

- Not less than  $(43 + 10 \cdot \log(P))$  dB at 2360 MHz
- Not less than  $(55 + 10 \cdot \log(P))$  dB at 2362.5 MHz
- Not less than  $(70 + 10 \cdot \log(P))$  dB at 2365 MHz
- Not less than  $(72 + 10 \cdot \log(P))$  dB at 2367.5 MHz, and
- Not less than  $(75 + 10 \cdot \log(P))$  dB at 2370 MHz.

For WCS mobile devices, the proposed OOBE limits into the 2360-2395 MHz band are:

by a factor of:

- Not less than  $(43 + 10 \cdot \log(P))$  dB at 2360 MHz
- Not less than  $(45 + 10 \cdot \log(P))$  dB at 2362.5 MHz
- Not less than  $(55 + 10 \cdot \log(P))$  dB at 2365 MHz
- Not less than  $(65 + 10 \cdot \log(P))$  dB at 2367.5 MHz, and
- Not less than  $(70 + 10 \cdot \log(P))$  dB at 2370 MHz.

In the case of both base stations and mobile devices, the proposed OOBE limit at the WCS band edge of 2360 MHz is  $43 + 10 \cdot \log(P)$ , which is the mask governing many terrestrial mobile bands and results in a constant OOBE level of -13 dBm regardless of transmit power.

MAT operators claim that this OOB level is insufficient to protect their operations and have requested both a significantly more stringent OOB limit of  $70+10*\log (P)$  at 2360 MHz as well as a coordination zone of 45 km around all MAT facilities.<sup>1</sup> It is assumed that the 45 km distance was selected based on the visual line-of-sight available from two antennas at 100 feet elevation operating over featureless curved earth, and does not account for either the attenuation of the undesired signal over the 45 km distance or the level of undesired signal that would cause harmful interference to the AMT facility.

In order to better account for these factors and determine an appropriate coordination distance between WCS and MAT, an interference study, known as the Range Ratio Analysis, was conducted. If the desired signal path and the undesired (interference) signal path are identical (or at least the desired signal has a smaller attenuation coefficient), then the Range Ratio Analysis can provide an estimate of the distance needed between the interfering source and the victim receiver.

The received power of the *desired* signal (MAT in this case) is a function of the power transmitted, the receiver antenna gain, and the attenuation of the desired signal path, which is a function of the propagation constant of the path (2 for line-of-sight paths with greater than one Fresnel zone of clearance and 2.4 to 3.4 for other paths). The equation for a line-of-sight path is:

$$P_R = P_T + G_R - 32.2 - 20\text{Log} (F_{\text{GHz}}) - 20\text{Log} (R_{\text{Meters}})$$

The received power of the *undesired* signal (WCS in this case) is also a function of the power transmitted (including antenna gain), receiver antenna gain, and attenuation of the undesired signal path. The ratio of the desired to undesired (D/U ratio) signals (in log space) for a line-of-sight path for both desired and undesired signals is:

$$P_{RD} - P_{RU} = P_{TD} - P_{TU} + 20\text{Log} (R_U) - 20\text{Log} (R_D)$$

With the ratio of the desired to undesired signal, the power transmitted and the range of the desired signal, the minimum range between the victim and the interferer can be computed.

For this analysis, the following conservative values regarding the MAT system were assumed: a D/U ratio of 20 dB for the MAT signal, 10 W (40 dBm) for the MAT transmitter ( $P_{TD}$ ), and a receive distance ( $R_D$ ) of 350 km.<sup>2</sup>

Assuming that the WCS base or mobile station is in the main beam of the MAT receive antenna, collinear with the transponder (the probability of which is 1.4 %), and using line-of-sight calculations, the minimum distance needed between a WCS transmitter and an MAT receiver to maintain the D/U ratio can be determined.

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<sup>1</sup> It is important to note that WCS transmitters have been authorized to operate with an OOB limit of  $43+10*\log (P)$  at 2360 MHz since 1997 and no incidences of interference to MAT receivers from WCS have been reported. Similarly, other services are authorized to operate at higher OOB limits than  $43+10*\log (P)$  into the 2360-2395 MHz band, including 2.4 GHz unlicensed devices, which are authorized to operate with OOB limits that are merely 20 dB below peak carrier power (see FCC Part 15.247(c)).

<sup>2</sup> See RECOMMENDATION ITU-R M.1459, Appendix 2.1, which indicates that the appropriate carrier to noise ratio for aeronautical telemetry systems is 9-15 dB, the transmitter power range is 2-25 W, and the transmission path length is up to 320 km.

For purposes of this analysis, it was assumed that the MAT service is operating with a propagation loss exponent of 2 (free space) and that the terrestrial WCS transmitters are operating with a path loss exponent of 2.4, which is common for mobile systems operating in rural environments.<sup>3</sup> Other path loss exponents, namely 3 and 3.4, which are common for mobile systems operating in suburban and urban environments where local clutter shields base stations and mobiles from direct view, were also analyzed.

Figure 2 below shows the ranges necessary to maintain at least a 20 dB D/U ratio between the MAT and WCS base station signals, assuming different WCS OOB levels in the 2360-2161 MHz band. It can be seen that, assuming a conservative 2.4 path loss exponent and a  $43+10*\log(P)$  mask at 2360 MHz, the 20 dB D/U ratio can be maintained with a 10 km separation distance between an upper B block WCS base station transmitter and the MAT receiver. A WCS upper A block base station would need a separation distance of 740 m or less to provide similar protection, assuming the A block base station has an OOB roll off to  $70+10*\log(P)$  at 2360 MHz, which would be consistent with equipment designed to meet the proposed WCS OOB limits between 2360-2370 MHz (see proposed OOB limits in Section III above). Similarly, a D block WCS base station would require a separation distance of only 459 m to maintain the needed protection ratio of 20 dB with an OOB roll off to  $75+10*\log(P)$  at 2360 MHz.

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<sup>3</sup> For propagation paths that do not meet the criteria for free space loss (any path operating under conditions of Fresnel zone incursions), path loss might be described by  $PL=A+B \log_{10}(R)$ , where R is greater than 2.0. To understand why free space propagation is inapplicable at extended ranges in a near-ground communication system environment, one should consider the two-ray propagation model, which takes into account the effects of occluded Fresnel zones on RF propagation. The two-ray model of propagation is discussed by WCY Lee in section 3 of "Mobile Communications Engineering" (McGraw-Hill, 1982, ISBN-0-07-037039-7). It takes into account the reflective environment in which ground-based mobile communication systems operate. Specular reflection, much like light off of a mirror, occurs and, to a very close approximation, arrives with strength equal to that of the direct path signal. However, the reflected signal arrives with a delay relative to the direct path signal and, as a consequence, adds destructively (out of phase), yielding a propagation path loss exponent greater than 2. In the two-ray model, propagation starts out with an  $R^2$  falloff rate and then transitions to a  $R^4$  falloff rate. The "point" at which this transition occurs is often called the Fresnel breakpoint. The use of the 2.4 propagation loss exponent in the present analysis is far more conservative than the two-ray model assumes for all conditions where a Fresnel zone reflection exists.

Figure 2:

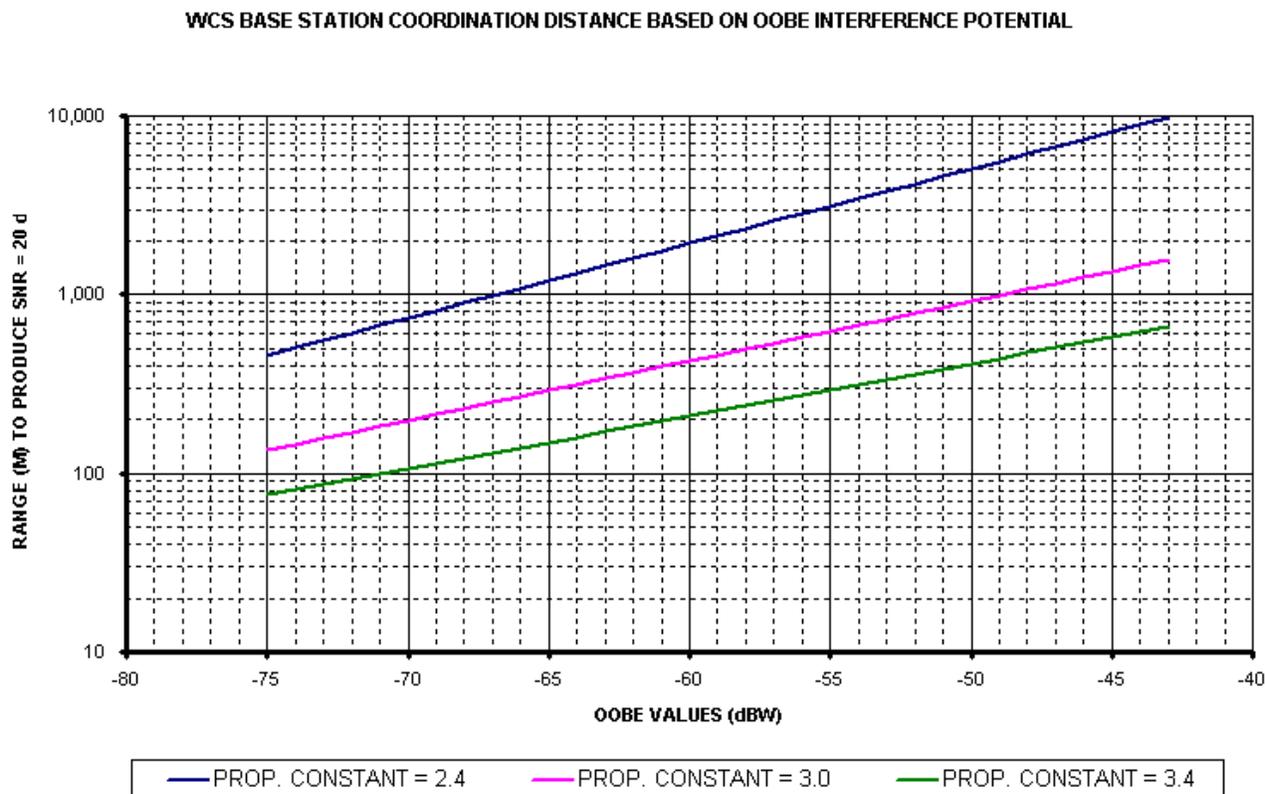
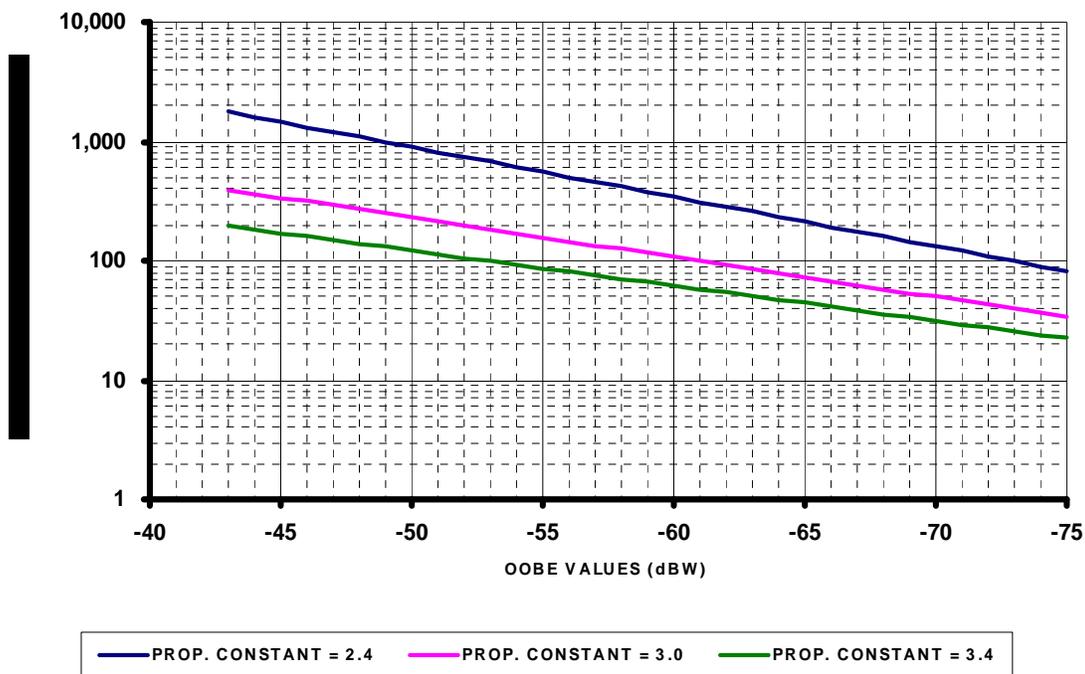


Figure 3 below shows the ranges necessary to maintain at least a 20 dB D/U ratio between the MAT and WCS mobile device signals, assuming different WCS OOBE levels in the 2360-2161 MHz band. It can be seen that, assuming a 2.4 path loss exponent and a  $43+10*\log(P)$  mask at 2360 MHz, the 20 dB D/U ratio can be maintained with a 1.8 km separation distance between an upper B block WCS mobile device and the MAT receiver. A WCS upper A block mobile device would need a separation distance of 556 m to provide similar protection, assuming the A block mobile device has an OOBE roll off to  $55+10*\log(P)$  at 2360 MHz, which would be consistent with equipment designed to meet the proposed WCS mobile OOBE limits between 2360-2370 MHz (see proposed OOBE limits in Section III above).

**Figure 3:**

**WCS MOBILE COORDINATION DISTANCE BASED ON OOB INTERFERENCE POTENTIAL**



Based on this analysis, it is clear that at the OOB levels proposed by the FCC, the separation distance needed between WCS base stations and MAT receivers to maintain a conservative D/U ratio is far less than the 45 km proposed by the MAT community. Rather, a 10 km coordination zone, which would protect MAT receivers under the worst possible case (namely a WCS base station operating in the upper B block), should be more than adequate to protect MAT receivers from OOB caused by either WCS base stations or mobile devices transmitting in any of the upper WCS channel blocks under the proposed limits.

#### **IV. Effect of Overload on MAT**

While not directly raised by the MAT community in its filings in this proceeding, it is accepted that MAT receivers may also be susceptible to overload from WCS transmitters. The potential for this type of interference is compounded if front-end or intermediate frequency stage filtering is not included in the MAT receiver design, which will result in the receivers having limited selectivity and being subject to capture by any signal within the bandpass of the receiver. The inclusion of such filtering would attenuate near band energy before it entered the receive chain, so it would no longer be a potential capture source.

Statements agreed to by the MAT community in a coordination agreement with XM Radio, Inc. in September of 2000 indicate that overload interference from SDARS terrestrial repeater operations to MAT receivers was a possibility and that, if it were to occur, then MAT operators would upgrade their

facilities by incorporating filters to reject the near band energy from the SDARS transmitters. The relevant section of that agreement reads:

Aeronautical telemetry facilities may need to add filtering to their equipment when the total in-band power flux density of the XM Radio repeater signals in the 2332.5-2345.0 MHz band exceeds approximately  $-60\text{dB(W/m}^2\text{)}$  at the aeronautical telemetry facilities, as computed using line-of-sight calculations. The operator of the aeronautical facilities agrees to bear the costs of the additional filtering. If practical levels of filtering will not resolve interference problems, the parties will cooperate in good faith to achieve a satisfactory resolution.<sup>4</sup>

Assuming that the power flux density (PFD) limit of  $-60\text{dB(W/m}^2\text{)}$  identified in the MAT-SDARS agreement is necessary to protect MAT receivers, an analysis was conducted to assess the potential for overload interference from WCS transmitters to MAT receivers. Calculations were run assuming WCS base stations operating at 2 kW average EIRP and WCS mobiles operating at 250 mW average EIRP, using the equation of PFD is equal to the radiated power in Watts divided by the surface area of the sphere surrounding the interfering transmitter (0 dBi isotropic antenna is assumed) or  $\text{PFD} = \text{EIRP}/(4 \times \text{PI} \times \text{R}^2)$  where R is the radial distance from the point of the transmitter to the surface of the sphere.

Solving the PFD equation for the radial distance (R) gives the following equation:

$$\text{R} = (\text{EIRP}/4 \times \text{PI} \times \text{PFD})^{0.50}$$

From these calculations, the distance necessary to protect an MAT receiver with no filtering from adjacent channel interference exceeding  $-60\text{dB(W/m}^2\text{)}$  by a 2 kW average EIRP WCS base station is 8.9 km, while the distance from a 250 mW average EIRP WCS mobile device would be 141 m (if a 2.4 exponent is used the base station distance would be 2.8 km and the mobile device distance would be 64m). Therefore, the separation distance needed for WCS transmitters to meet the PFD limits identified by the MAT community as necessary to protect MAT receivers with no filtering is far less than 45 km. Rather, a coordination zone of 3 km would be adequate to meet the protection level necessary for MAT receivers without filtering. Clearly this 8.9 km distance to protect MAT receivers from overload by WCS base stations falls well within the 10 km zone that would protect these receivers from WCS base station OOB, meaning that a 10 km coordination distance would be sufficient to protect MAT receivers from either type of interference.

## V. Conclusion

It can be concluded from the foregoing analysis that the proposed coordination distance of 45 km between MAT receivers and WCS base stations and mobiles does not account for real world conditions, including attenuation of the undesired signal and the level of undesired signal that would cause harmful interference to the AMT facility. The analysis conducted herein demonstrates that a coordination zone of 10 km around MAT receivers, which represents the greatest distance necessary to protect MAT from the most likely interference source – namely the OOB from a WCS base station operating in the upper B block - would be more than adequate to protect MAT operations from either OOB or overload

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<sup>4</sup> “Coordination Agreement Between XM Radio and AFTRCC,” dated Sept. 11, 2000, section 5, as filed in IB Docket No. 95-91, Sept. 19, 2000.

interference from WCS base stations and their associated mobile devices operating in accordance with the proposed OOB limits in any of the upper WCS channel blocks.