ATTACHMENT A

MDS INDUSTRY COMPROMISE

BELLSOUTH CORPORATION
NUCENTRIX BROADBAND NETWORKS, INC.
SPRINT CORPORATION
WORLDCOM, INC.
WIRELESS COMMUNICATIONS ASSOCIATION INTERNATIONAL, INC.

July 11, 2002

Hon. Michael K. Powell
Chairman
Federal Communications Commission
445 Twelfth Street, SW
Washington, DC 20554

Re: *Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems* -- ET Docket No. 00-258

Amendment of Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the1.6/2.4 GHz Band -- IB Docket No. 01-185

Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile Satellite Service -- ET Docket No. 95-18

Dear Chairman Powell:

The Commission currently is examining whether it can designate and auction the paired 1710-1770/2110-2170 MHz bands or significant subsets thereof for advanced wireless services, including third generation mobile services ("3G"), in accordance with the October 5, 2001 agreement among the Commission, the National Telecommunications and Information Administration, the Department of Defense and other Executive Branch agencies. Before the 1.7/2.1 GHz bands can be deployed on a paired basis, the Commission must address the thorny issue of relocating Multipoint Distribution Service ("MDS") channels 1 and 2/2A from the 2150-2162 MHz band.

The MDS industry has a strong preference for remaining at 2150-2162 MHz, but acknowledges that the Commission may nonetheless desire to relocate MDS channels 1 and 2/2A in order to accommodate an auction of paired spectrum in the 1.7 and 2.1 GHz bands for Frequency Division Duplex 3G services. Although the Commission first sought comment on the possibility of such a relocation in the *Notice of Proposed Rulemaking* ("*NPRM*") adopted in late 2000 in ET Docket No. 00-258, the proponents of relocating MDS have yet to present a viable plan for relocation. Meanwhile, the continuing uncertainty over the future of the 2150-2162 MHz band is impeding the development of advanced MDS technology for these channels. BellSouth Corporation, Nucentrix Broadband Networks, Inc., Sprint Corporation, and

WorldCom, Inc. (who collectively hold 2150-2162 MHz MDS licenses covering the vast majority of the population of the country), together with the Wireless Communications Association International, Inc. (the trade association of the MDS industry), have joined together to "jump start" the debate by advancing a proposal that, while not perfect, would be an acceptable compromise if implemented quickly.

The full details of our plan are contained in the accompanying paper, "A Compromise Solution For Relocating MDS From 2150-2162 MHz." Our proposal can be summarized as follows.

MDS channel 1 would be relocated to the paired 1910-1913/1990-1993 MHz bands, while MDS channel 2/2A would be moved to the paired 1913-1916/1993-1996 MHz bands. The 1910-1916/1990-1996 MHz MDS allocation would permit fixed and mobile services consistent with the Commission's recent decision allowing fixed and mobile use of the MDS channels in the 2.5 GHz band. The 1916-1920 MHz band could be reallocated for isochronous unlicensed Personal Communications Service ("UPCS") use under the existing rules applicable to the 1920-1930 MHz band.

To avoid introducing impermissible interference to adjacent broadband Personal Communications Service ("PCS") and Mobile Satellite Service ("MSS") operations, MDS licensees would be required to forfeit in the new band much of the system design flexibility they currently enjoy at 2150-2162 MHz, including the rights to operate at relatively high power levels. MDS operations in the 1910-1916/1990-1996 MHz bands would be subject to the more stringent power and field strength limits of the PCS rules, as well as the frequency stability requirement and spectral mask and other interference-limiting rules imposed on PCS operations. MDS licensees would not be required to bear any of the costs associated either with clearing the 1910-1916 MHz and 1990-1996 MHz bands of incumbents or with relocating existing MDS operations.

As is discussed in detail in the accompanying analysis, our compromise represents a classic "win-win" scenario. The proponents of reallocating more spectrum for 3G win the contiguous spectrum they covet for a 1.7/2.1 GHz band pair, the MDS industry wins regulatory certainty, and the public wins because the Commission will have created an environment in which new services can flourish, without any adverse impact on any incumbent stakeholder. The paper reviews in detail each of the proposals currently before the Commission for relocating MDS from 2150-2162 MHz, and conclusively establishes that none are viable. Ours is the only workable approach to clearing the 2150-2162 MHz band and allowing the auction of the 1.7/2.1 GHz bands on a paired basis for mobile 3G services.

By reallocating for MDS slivers of spectrum that would otherwise be underutilized, and by imposing significant technical restrictions on MDS's use of that spectrum, we have crafted an approach that avoids the relocation of any existing service (other than fixed microwave service, broadcast auxiliary service and cable television relay operations that were long-ago scheduled to be moved). Our plan does not adversely impact others because:

- the 1910-1916 MHz band is allocated for asynchronous PCS use, and there currently is no asynchronous UPCS use of the band;
- the six megahertz of spectrum at 1990-1996 MHz to be reallocated for MDS can be taken from the seven megahertz of spectrum in the 1990-2025 MHz MSS uplink band that has not yet been licensed for MSS and thus can be reallocated without adversely impacting any MSS licensee;
- the lower portion of the 1990-2025 MHz band is likely to be orphaned and unavailable for MSS anyway, as it is paired with the 2165-2170 MHz MSS downlink band that the Commission has proposed to reallocate for 3G; and
- by eliminating much of the system design flexibility MDS licensees currently enjoy at 2150-2162 MHz, including the ability to operate at relatively high power levels, our proposal avoids interference from relocated MDS stations to adjacent PCS and MSS services. As the *quid pro quo* for that sacrifice in flexibility, it offers the MDS industry an opportunity to escape the regulatory uncertainty that has dogged the 2150-2162 MHz band and to develop advanced services by building upon existing technologies that operate near 2 GHz and have 80 MHz of separation between transmit and receive frequencies.

We urge you and the Commission to give careful and prompt consideration to our proposal, and we look forward to working with the Commission in the weeks ahead to bring this compromise proposal to fruition.

Respectfully submitted,

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A COMPROMISE SOLUTION
FOR RELOCATING MDS FROM 2150-2162 MHz

ET Docket No. 00-258
IB Docket No. 01-185
ET Docket No. 95-18

BELLSOUTH CORPORATION
NUCENTRIX BROADBAND NETWORKS, INC.
SPRINT CORPORATION
WORLDCOM, INC.
THE WIRELESS COMMUNICATIONS ASSOCIATION
INTERNATIONAL, INC.

July 11, 2002

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A COMPROMISE SOLUTION
FOR RELOCATING MDS FROM 2150-2162 MHz

The Commission is examining whether it can designate and auction the paired 1710-1770/2110-2170 MHz bands or any significant subsets thereof (the "1.7/2.1 GHz bands") for advanced wireless services, including third generation mobile services ("3G"), in accordance with the October 5, 2001 agreement among the Commission, the National Telecommunications and Information Administration ("NTIA"), the Department of Defense and other Executive Branch agencies.[1] Before those bands can be deployed on a paired basis, the Commission must address the thorny issue of relocating Multipoint Distribution Service ("MDS") channels 1 and 2/2A from the 2150-2162 MHz band.[2] Although the Commission first sought comment on the possibility of such a relocation in the initial *Notice of Proposed Rulemaking* ("*NPRM*") adopted in December 2000 in ET Docket No. 00-258,[3] the proponents of relocating MDS have yet to present a viable plan for relocation. Meanwhile, the continuing uncertainty over the future of the 2150-2162 MHz band is impeding the development of advanced MDS technology for these channels. This document has been prepared on behalf of BellSouth Corporation ("BellSouth"), Nucentrix Broadband Networks, Inc. ("Nucentrix"), Sprint Corporation ("Sprint"), and WorldCom, Inc. ("WorldCom") (who collectively hold rights to 2150-2162 MHz MDS licenses covering the vast majority of the population of the country), together with the Wireless Communications Association International, Inc. ("WCA"), the trade association of the MDS industry, to advance a compromise that, while not perfect from the perspective of MDS licensees, could be an acceptable solution if implemented quickly.

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[1] "NTIA Statement Regarding New Plan to Identify Spectrum for Advanced Wireless Mobile Services (3G)," at http://www.ntia.doc.gov/ntiahome/threeg/3gplan_100501.htm (Oct. 15, 2001).

[2] With the increased attention to national security issues over the past ten months, the possibility exists that less than the entire 1710-1770 MHz band will be available for commercial advanced wireless services. Recent reports in the trade press suggest that the 1755-1770 MHz band may not be made available for 3G services immediately. Nonetheless, relocation of MDS from 2150-2162 MHz will be required in order to establish even a 1710-1755/2110-2155 MHz band pair for auction. The record in ET Docket No. 00-258 provides ample evidence that there must be a guardband of at least 5 MHz between the current MDS channels and spectrum used for downstream 3G communications. *See infra* at note 35. As a result, unless the Commission relocates MDS from the 2150-2162 MHz band, a 1710-1745/2110-2145 MHz pairing would be the most the Commission could reallocate for 3G. Relocating MDS makes it possible for the Commission to allocate at least the 1710-1755/2110-2155 MHz band for Frequency Division Duplex ("FDD") 3G services.

Moreover, even if the entire 1755-1770 MHz band cannot be freed for commercial service immediately, relocating MDS now will assure that the band is available in the event the entire band does become available. As discussed below, the proposal advanced herein is the only viable approach to relocating MDS and there is only a limited window of opportunity within which it can be implemented. In this regard, it should be noted that the Cellular Telecommunications & Internet Association ("CTIA") has recently reiterated its call "that the entire 60 MHz between 2110-2170 MHz be made available for advanced wireless services." *See* Letter from Diane Cornell to Marlene H. Dortch, ET Docket No. 00-258 (June 6, 2002). While CTIA misses the point that even today the MDS channels at 2150-2162 MHz can be used for advanced wireless services, the concept that relocation of MDS will free the spectrum for the auctioning of large contiguous pairs is not disputed.

[3] *See Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless* Systems, 16 FCC Rcd 596, 619 (2001)["*NPRM*"].

SUMMARY OF THE COMPROMISE

The record developed in ET Docket No. 00-258 establishes that as a practical matter there is no truly comparable spectrum to which licensees of MDS channels 1 and 2/2A (many of whom paid at the Commission's 1996 MDS auction for the right to use their newly-acquired spectrum in a flexible manner)[4] can be relocated. While MDS licensees have expressed a strong preference for remaining in the 2150-2162 MHz band,[5] BellSouth, Nucentrix, Sprint, WorldCom and other MDS licensees represented by WCA are willing to accept a specific compromise under which licensees are migrated to spectrum that, while inferior to the 2150-2162 MHz band in some respects, has countervailing positive attributes. The specific details of that proposal are as follows.

MDS channel 1 would be relocated to the paired 1910-1913/1990-1993 MHz bands, while MDS channel 2/2A would be moved to the paired 1913-1916/1993-1996 MHz bands.[6] The 1910-1916/1990-1996 MHz MDS allocation would permit fixed and mobile services consistent with the Commission's recent decision allowing fixed and mobile use of the MDS channels in the 2.5 GHz band.[7] The remainder of the 1916-1920 MHz band could be reallocated

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[4] *See Amendment of Parts 21 and 74 of the Commission's Rules with Regard to Filing Procedures in the Multipoint Distribution Service and in the Instructional Fixed Television Service and Implementation of Section 309(j) of the Communications Act – Competitive Bidding,* 10 FCC Rcd 9589, 9619 (1995) ("[U]nless otherwise directed or conditioned in the applicable instrument of authorization, Multipoint Distribution Service stations may render any kind of communications service consistent with the Commission's rules on a common carrier or non-common carrier basis."), *on recon*., 10 FCC Rcd 13821, 13824 (1995)("[T]he present regulations allow for use of MDS frequencies for 'any kind of communications service'. . .") (internal citations omitted).

[5] *See* Comments of Wireless Communications Association Int'l, ET Docket No. 00-258, at 7 (filed Oct. 22, 2001)["WCA Comments"]; Comments of Sprint Corp., ET Docket No. 00-258, at 2 (filed Oct. 22, 2001)["Sprint Comments"].

[6] As explained in WCA's comments in response to the *Further Notice of Proposed Rulemaking* in ET Docket No. 00-258, it would be appropriate for the Commission to relocate MDS channel 2A licensees (who today only have access to the 2156-2160 MHz band) to a full 6 MHz of spectrum, as the 25-year old rationale for awarding full 6 MHz channels only in fifty large markets (to protect point-to-point microwave services) will not apply upon relocation of MDS to the 1.9 GHz band. *See* WCA Comments, at 7. The Commission has in the past waived its rules and awarded full 6 MHz licenses outside the fifty markets specified in Section 21.902(c) of the Rules. Failure to eliminate this obsolete restriction will result, as a practical matter, in the stranding of 2 MHz of spectrum outside of the fifty major markets and others areas where full 6 MHz licenses are awarded for MDS channel 2. If the Commission only provides MDS channel 2A licensees the 1913-1915/1993-1995 MHz band pair, it is difficult to envision that any independent use will develop for the 1915-1916/1995-1996 MHz band pair when such use would be limited to areas distant from the fifty major markets and other areas where full 6 MHz MDS channel 2 licenses are issued. Moreover, paired 1 MHz channels are so narrow (particularly if industry-standard guardbands are required to protect adjacent channel users) that service offerings outside the 50 major markets and other areas could be compromised.

[7] *See Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems*, 16 FCC Rcd 17222 (2001). The Commission specifically proposed to extend a mobile allocation to MDS channel 1 and 2/2A licensees in Paragraph 41 of the *Further Notice of Proposed Rulemaking* in ET Docket No. 00-258. *See Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless*

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for isochronous unlicensed Personal Communications Service ("UPCS") use under the existing rules applicable to the 1920-1930 MHz band. To avoid impermissible interference to adjacent broadband Personal Communications Service ("PCS") and Mobile Satellite Service ("MSS") operations, MDS licensees would forfeit some of the system design flexibility they currently enjoy (including the ability to operate at high power) and instead be required to operate in compliance with the broadband PCS technical rules applicable to the immediately adjacent spectrum. In other words, MDS operations in the 1910-1916/1990-1996 MHz bands would be subject to the more stringent power and field strength limits of the PCS rules, as well as the frequency stability requirement and spectral mask and other interference-limiting rules imposed on PCS operations.[8] Because the Part 24 rules have proven effective in restricting co-channel and adjacent channel interference, the compromise contemplates that MDS licensees in the 1.9 GHz band would no longer be subject to the hybrid geographic area/site-by-site regime under Part 21 and would instead be permitted to construct and modify facilities within their license areas without prior Commission approval just like the Part 24 licensees in the adjacent bands.[9]

Under the compromise, MDS licensees would not be required to bear any of the costs associated either with clearing the 1910-1916 MHz and 1990-1996 MHz bands of incumbents or with relocating existing MDS operations from 2150-2162 MHz. As a general proposition, the costs of the band clearing and relocation ultimately must be borne by the beneficiaries of the relocation – the winners of the 1.7/2.1 GHz band auction. Throughout this proceeding, the MDS industry has stressed that relocation of MDS to any new spectrum will present novel relocation and compensation issues, as it will be the first time the Commission has forced the migration of a mass market, consumer-based subscription service to new spectrum and has relocated a service where the spectrum is frequently leased to non-licensee system operators who provide service to the public.[10] Appendix A discusses in detail how the rules set forth in Sections 101.69 *et seq.*

Systems, 16 FCC Rcd 16043, 16061 (2001)["*FNPRM*"]. Many submitted comments supporting that proposal. *See* WCA Comments, at 14-15; Comments of the Ad Hoc MDS Alliance, ET Docket No. 00-258, at 25-29 (filed Oct. 22, 2001); Comments of Nucentrix Broadband Networks, Inc., ET Docket No. 00-258, at 6-7 (filed Oct. 22, 2001)["Nucentrix Comments"]; Comments of WorldCom, Inc., ET Docket No. 00-258, at 11-12 (filed Oct. 22, 2001)["WorldCom Comments"].

[8] *See* 47 C.F.R. §§ 24.232-24.236, 24.238 (2001). However, where a single service provider owns or leases MDS 1 and 2, the emission limits of Section 24.238 should be measured from the edges of the combined bands. Such an approach has been permitted on a waiver basis for PCS licensees, and has been incorporated into the Part 21 MDS rules. *See Omnipoint Request for Broadband Declaratory Ruling or Waiver Concerning PCS Emission Limits*, 15 FCC Rcd 13422 (2000); 47 C.F.R. § 21.908 (2001).

[9] The MDS license areas would remain unchanged – incumbent MDS licensees would be permitted to operate within their circular protected service areas ("PSAs"), while BTA authorization holders would continue to operate within their BTAs (except for areas within the PSA of a cochannel incumbent). However, in cases where there are currently overlapping incumbent PSAs, the overlap should be eliminated by splitting the overlap area by drawing a straight line between the two points at which the circular PSAs intersect. BTA auction winners would continue to automatically be vested with the right to operate in incumbent service areas that are forfeited by incumbent licensees.

[10] *See, e.g.* WCA Comments, at 10-14; Comments of Wireless Communications Association Int'l, Inc., ET Docket No. 00-258, at 48-53 (filed Feb. 22, 2001)["WCA NPRM Comments"]; Sprint Comments, at 5-6; WorldCom Comments, at 10-11; Nucentrix Comments, at 5.

provide a useful starting point for regulating the relocation of MDS licensees, operators and subscribers from 2150-2162 MHz (a process that will require the simultaneous operation of systems in the 2150-2162 MHz band and in the relocation spectrum during a transitional period in which MDS subscribers are provided CPE capable of operating in the relocation band)[11] and for assuring that the MDS industry will not bear the costs of that relocation. In addition, Appendix A addresses how, with minor revisions, the Commission can rely on existing rules to regulate the clearing of incumbent point-to-point Fixed Microwave Service ("FMS") from 1910-1916 MHz and the Broadcast Auxiliary Service, Local Television Transmission Service and Cable Television Relay Service (collectively, "BAS") from the 1990-1996 MHz band.

As will be discussed in more detail below, this compromise represents a classic "win-win" scenario. The proponents of reallocating additional spectrum for 3G win the contiguous spectrum they covet at 2.1 GHz, the MDS industry wins regulatory certainty, and the public wins because the Commission will have created an environment in which new services can flourish in all of the bands at issue, without any adverse impact on any incumbent stakeholder. At bottom, it is the only viable approach to clearing the 2150-2162 MHz band and allowing the auction of the 1.7/2.1 GHz band pair for mobile 3G services. By pairing slivers of spectrum that would otherwise be underutilized, the compromise avoids the relocation of any existing service other than FMS and BAS operations that were long-ago scheduled to be moved. The compromise plan solves the MDS relocation issue without adversely impacting others because: (a) the 1910-1916 MHz band, which is allocated to asynchronous UPCS, has no current users of that technology; (b) the Commission has refrained from licensing seven megahertz of spectrum in the 1990-2025 MHz MSS uplink band, and can thus reallocate the six megahertz at 1990-1996 MHz for MDS without adversely impacting any MSS licensee; and (c) the lower portion of the 1990-2025 MHz band is about to be orphaned and unavailable for MSS anyway, as it is paired with the 2165-2170 MHz MSS downlink band that the Commission has proposed to reallocate for 3G.[12] By eliminating the valuable system design flexibility MDS licensees currently enjoy at 2150-2162 MHz, including the ability to operate at relatively high power, the compromise avoids interference from relocated MDS stations to adjacent services without requiring extensive guardbands. As the *quid pro quo* for that sacrifice, it offers the MDS industry an opportunity to escape the regulatory uncertainty that has dogged the 2150-2162 MHz band and to develop rapidly advanced services by building upon existing technologies that operate near 2 GHz and have 80 MHz of separation between transmit and receive frequencies.[13]

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[11] Because MDS customer premises equipment ("CPE) is designed to work on the specific frequencies currently allocated to the service, new CPE will be required by any subscriber that currently receives service over the 2150-2162 MHz band. To provide the requisite seamless transition for subscribers necessitates that dual systems operate for as long as necessary to outfit subscribers with equipment capable of operating on the relocation spectrum. Once all subscribers to a given system have transitioned to the relocation spectrum, MDS operations on the 2150-2162 MHz band can cease.

[12] *FNPRM,* 16 FCC Rcd at 16050-59.

[13] As is discussed *infra*, the rapid development of equipment capable of operating on the new MDS channels is key to the compromise proposal, as it will minimize the time during which MDS licensees are effectively precluded from utilizing MDS channels 1 and 2/2A. Moreover, by taking advantage of existing technologies, MDS equipment

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BACKGROUND OF 2150-2162 MHZ BAND

The compromise proposal derives from the sensitivity of the MDS community to the difficulties facing the Commission in identifying paired spectrum capable of being used for 3G frequency division duplex ("FDD") mobile services. While MDS interests responding to the *NPRM* and the *FNPRM* expressed a strong desire to remain in the 2150-2162 MHz band (and continue to prefer that result), they also acknowledge that the Commission might find that the public interest would be better served by relocating MDS from the 2150-2162 MHz band to comparable spectrum, thereby freeing the entire 2110-2170 MHz band for pairing with spectrum at 1.7 GHz.[14]

Accordingly, the MDS community has expressed a willingness to relocate from 2150-2162 MHz to alternative spectrum, if, *but only if*, the Commission: (1) identifies 12 MHz of truly comparable replacement spectrum that is capable of being cleared of incumbent users; (2) establishes a transition mechanism that provides certainty and avoids burdens on MDS licensees and system operators; (3) requires those seeking to clear the 2150-2162 MHz band to bear all costs associated with relocating any incumbents that already occupy the replacement spectrum identified for MDS channels 1 and 2/2A, and assures that MDS licensees, system operators and subscribers are fully compensated for all costs associated with any relocation from the 2150-2162 MHz band; (4) adopts rules and policies that sufficiently protect relocated MDS stations in the replacement spectrum from interference caused by their new spectral neighbors; (5) fully preserves the rights MDS licensees acquired at the Commission's 1996 nationwide auction of Basic Trading Area ("BTA") geographic authorizations; and (6) resolves all relocation issues promptly.[15]

Significantly, commenting parties who support relocation of MDS licensees from the 2150-2162 MHz band have not taken issue with any of these criteria, and in fact agree that relocated MDS licensees must receive comparable replacement spectrum and be fully compensated for the costs associated with any relocation.[16] To date, however, none of the proponents of designating the paired 1.7/2.1 GHz bands for 3G have advanced any meaningful proposals for addressing MDS relocation. While some have casually suggested spectrum to

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suppliers will be able to reduce the cost of equipment, minimizing the equipment costs that the 1.7/2.1 GHz 3G auction winners will be required to bear in connection with the relocation.

[14] *See, e.g.* WCA Comments, at 5-6.

[15] *See* WCA Comments, at 7-15; Sprint Comments, at 5-6; WorldCom Comments, at 6-11; Nucentrix Comments, at 4-7.

[16] *See, e.g.*, Comments of Motorola, Inc., ET Docket No. 00-258, at 13 (filed Oct. 22, 2001)["Motorola Comments"] ("Motorola supports the allocation of comparable spectrum for [MDS] licensees, as well as full compensation for relocation costs to the new spectrum."); Comments of Nortel Networks, ET Docket No. 00-258, at 5 (filed Oct. 19, 2001)("[T]he current MDS service users must be provided with appropriate replacement spectrum."); Reply Comments of Cingular Wireless LLC, ET Docket No. 00-258, at 4 (filed Nov. 8, 2001)["Cingular Reply Comments"] ("Comparable spectrum must be found for incumbent MDS licensees and they must be reimbursed for the cost of the relocation."); Reply Comments of Motorola, Inc., ET Docket No. 00-258, at 4 (filed Nov. 8, 2001)["Motorola Reply Comments"] ("[T]here is unquestioned industry support for compensation of incumbents whenever relocation is required.").

which MDS might be relocated, none has undertaken a rigorous examination of the criteria that would have to be met before MDS channels 1 and 2/2A could be migrated. To lift the cloud of regulatory uncertainty over the 2150-2162 MHz band, BellSouth, Nucentrix, Sprint, WorldCom and WCA have undertaken such an examination, and have concluded that as a practical matter the criteria cannot be met without the imposition of substantial burdens on other services.

As will be evident from the discussion below, the difficulties in identifying viable relocation spectrum for 2150-2162 MHz MDS are largely the result of the system design flexibility the Commission has afforded MDS licensees. Since MDS was first established in the early 1970s, MDS licensees have been free to "render any kind of communications service consistent with the Commission's rules"[17] and today MDS licensees in the 2150-2162 MHz band are utilizing their spectrum for a variety of broadband data and video applications. The technical rules set forth in Part 21 of the Commission's rules afford MDS licensees substantial flexibility in system design to accommodate the wide range of possible MDS services. Two components of that flexibility are of paramount importance for present purposes:

1) Part 21 of the Commission's rules permits the 2150-2162 MHz band to be used either for base-to-customer ("downstream") communications, for customer-to-base ("upstream") communications, or for both simultaneously. Most MDS broadband systems in operation today employ FDD technology and utilize the 2150-2162 MHz band for upstream communications, pairing that band with spectrum at 2.5 GHz used for downstream communications. However, the 2150-2162 MHz band can also be used for self-contained Time Division Duplex ("TDD") systems that utilize the spectrum for both upstream and downstream communications. And, of course, some still use the band for the downstream transmission of video programming.

2) Part 21 allows MDS stations to operate at relatively high EIRPs: 33 dBW + 10log(X/6) dBW (where X is the actual bandwidth) for omnidirectional transmission systems, regardless of antenna height; and at even higher power when directional antenna systems are used.[18]

Recreating the wide range of options MDS licensees enjoy in system design lies at the heart of the problem in identifying comparable relocation spectrum. The record before the Commission in ET Docket No. 00-258 establishes that there is no available relocation spectrum where MDS can retain its current flexibility, not cause interference in one or more of its possible configurations, and not suffer interference in one or more of its possible configurations (at least not unless the Commission imposes large guardbands). The compromise proposal rests on the willingness of MDS licensees to sacrifice a substantial degree of the design flexibility they currently enjoy in exchange for access to spectrum that can be cleared for relocation rapidly and for which advanced services equipment can be developed quickly.

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[17] 47 C.F.R. § 21.903(b) (2001). *See also Amendment of Parts 1, 2, 21, and 43 of the Commission's Rules and Regulations To Provide for Licensing and Regulation of Common Carrier Radio Stations in the Multipoint Distribution Service*, 45 F.C.C.2d 616, 633 (1974).

[18] *See* 47 C.F.R. § 21.904(a), (b) (2001).

The compromise is premised on MDS licensees securing spectrum that is near the broadband PCS band and, most importantly, that has the same 80 MHz separation between transmit and receive frequencies as broadband PCS. These two elements are essential if vendors are to rapidly develop equipment that can be utilized on the relocated MDS channels and that can be deployed at reasonable cost. If the same upstream/downstream separation as used by broadband PCS is retained, vendors will be able utilize existing or easily modified chip sets in MDS equipment – greatly reducing the equipment development cycle, minimizing equipment cost, and enhancing the ability of MDS to rapidly deploy. Indeed, it is only because the 1910-1916/1990-1996 MHz band holds promise for rapid deployment that the MDS industry is willing to accept the compromise now being proposed.

AS A PRACTICAL MATTER, NO PENDING PROPOSAL IS VIABLE

As noted above, BellSouth, Nucentrix, Sprint, WorldCom and WCA have conducted detailed analyses of the bands suggested in ET Docket No. 00-258 as possible relocation spectrum, and have concluded that as a practical matter none of these bands is viable for migrating MDS from the 2150-2162 MHz band. The results of that analysis are as follows:

The 2385-2400 MHz Band

The band most often suggested for relocation of the 2150-2162 MHz band MDS channels is the 2385-2400 MHz band.[19] That proposal, however, is fraught with insurmountable problems.

The first, but hardly the most significant, impediment to relocating MDS to 2385-2400 MHz is that the Commission has already scheduled the auction of the 2385-2390 MHz band to commence on September 18, 2002.[20] Even were the Commission to postpone that auction and reconsider its decision of earlier this year to auction 2385-2390 MHz on an unpaired basis, there are practical impediments to relocating MDS to 2385-2400 MHz. While the rights to utilize MDS at 2150-2162 MHz have been granted on a geographic basis for the entire nation, there are substantial areas of the country where the 2385-2390 MHz band will not be available for years. In its January 2, 2002 *Report and Order and Memorandum Opinion and Order* in ET Docket No. 00-221, the Commission allocated the 2385-2390 MHz band (along with 22 other megahertz of spectrum) for non-Government use.[21] Although the 2385-2390 MHz band has been reallocated exclusively for non-government use effective January 1, 2005, the Commission has grandfathered until January 1, 2007 Federal Government flight test programs at seventeen sites

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[19] *See* Comments of Verizon Wireless, ET Docket No. 00-258, at 10-11 (filed Oct. 19, 2001)["Verizon Comments"]; Motorola Comments, at 13-14; Comments of Ericsson, ET Docket No. 00-258, at 11 (filed Oct. 19, 2001)["Ericsson Comments"]; Reply Comments of Constellation Communications Holdings, ET Docket No. 00-258, at 16 (filed Nov. 8, 2001)["Constellation Reply Comments"].

[20] *See* "1392-1395 and 1432-1435 MHz, 1390-1392 MHz, 1670-1675 MHz and 2385-2390 MHz Bands Auction Scheduled for September 18, 2002," *Public Notice*, DA 02-1257 (rel. May 24, 2002).

[21] *See Reallocation of 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*, 17 FCC Rcd 368, -397-400 (2002)["*27 MHz Allocation Order*"].

and non-Government flight test programs at another nine sites.[22] These twenty-six grandfathered sites (twenty–four of which have protected zones of 160 kilometers and two of which have protected zones of 100 kilometers) implicate the relocation of MDS stations in many important markets, including Atlanta, GA; Amarillo, TX; Albuquerque, NM; Baltimore, MD; Colorado Springs, CO; Dallas, TX; Las Vegas, NV; Los Angeles, CA; Miami, FL; Mobile, AL; Orlando, FL; Phoenix, AZ; Salt Lake City, UT; San Diego, CA; Seattle, WA; St. Louis, MO; Tampa, FL; Tallahassee, FL and Washington, DC.[23] MDS licensees in the 2150-2162 MHz band cannot remain in regulatory limbo for another five years, awaiting the clearing of the 2385-2390 MHz band in these markets before they can even start a transition.

Moreover, although flight testing in the 2385-2390 MHz band is required to cease by January 1, 2007 in the grandfathered markets, it does not appear that even thereafter MDS stations could operate in the 2385-2400 MHz band with the same technical flexibility they currently enjoy. The Department of Defense, the National Aeronautics and Space Administration, the Department of Energy and the commercial aviation industry are using, and will continue to use, the 2360-2385 MHz band to support aeronautical flight test and other operations.[24] NTIA had insisted that reallocation of the 2385-2390 MHz band for non-government use "must be accompanied by mandatory commercial receiver and transmitter standards to reduce the potential for mutual adjacent band interference" to airborne telemetry systems.[25] In recently refusing to adopt NTIA's proposal, the Commission concluded that licensees in the 2385-2390 MHz band did not require the protection of a standard because "equipment manufacturers have sufficient incentive to design robust equipment capable of operating in this band absent specific Commission rules to that effect."[26] Yet, despite calls by WCA for the submission of additional information by proponents of moving MDS to 2385-2400 MHz,[27] the record is barren of any evidence that it is possible to develop MDS equipment (particularly MDS customer premises equipment) that both is robust enough to withstand interference from these ongoing government operations and is not cost-prohibitive.

The 2385-2390 MHz band also is disqualified from being considered as comparable to the 2150-2162 MHz band because the record in ET Docket No. 00-258 reflects that high-powered MDS facilities relocated to the 2385-2400 MHz band would likely have an adverse

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[22] *See id.* at 397-99.

[23] MDS systems using the 2150-2162 MHz band are already providing two-way broadband services in a number of these markets.

[24] *See 27 MHz Allocation Order*, 17 FCC Rcd at 397. *See also* Reply Comments of Wireless Communications Association Int'l, ET Docket No. 00-258, at 7-8 (filed Nov. 8, 2001)["WCA Reply Comments"]; *"Spectrum Reallocation Report – Response to Title III of The Balanced Budget Act of 1997*," NTIA Special Publication 98-36, at 3-37 (February 1998) ["*1998 NTIA Spectrum Report*"].

[25] *1998 NTIA Spectrum Report* at 3-46.

[26] *See 27 MHz Allocation Order*, 17 FCC Rcd at 398.

[27] *See* WCA Reply Comments, at 7-8.

impact on the operation of license-exempt operations in the 2.4 GHz band.[28] Rather clearly, the two services cannot co-exist without a substantial guardband between them, and there is insufficient spectrum available from which such a guardband can be secured.

Finally, migrating MDS to the 2385-2400 MHz band would require a relocation of the Amateur Radio Service that presently is allocated the 2390-2400 MHz band. ARRL, the National Association for Amateur Radio, has demonstrated that while amateurs can share the band with low-power asynchronous UPCS operations, amateurs would suffer unacceptable interference from higher-power operations (which would include MDS operations under the current Part 21 rules).[29] Moreover, the evidence suggests that amateur operations would interfere with some MDS operations if sharing of the band were attempted.[30] Not one proponent of reallocating this band for MDS has identified a band to which the Amateur Radio Service could be relocated in order to accommodate MDS, and WCA has been unable to identify such a band.[31] Given that the Commission proposed just last month in ET Docket No. 02-98 to afford the Amateur Radio Service primary status in the adjacent 2400-2402 MHz band, it appears unlikely that the Commission is disposed towards removing the Amateur Radio Service from 2390-2400 MHz.[32]

The 1910-1930 MHz Band

While it has been suggested that MDS licensees in the 2150-2162 MHz band could be relocated to the 1910-1930 MHz band,[33] the record in ET Docket No. 00-258 establishes conclusively that such an approach is unworkable. Most significantly, filings by Motorola, Verizon and others leave no doubt that high-power operation of MDS stations in the 1910-1930

[28] *See* Reply Comments of Ad Hoc MDS Alliance, ET Docket No. 00-258, at 15-16 (filed Nov. 8, 2001)["MDS Alliance Reply Comments"]. In addition, there is the possibility that out-of-band emissions from the ever-increasing number of devices operating in the license-exempt band could prove problematic for MDS operations were they relocated to the 2385-2400 MHz band. That issue has yet to be fully explored on the record.

[29] *See* Comments of ARRL, ET Docket No. 00-258, at 3-15 (filed Oct. 19, 2001)["ARRL Comments"].

[30] Both Cingular and ARRL have noted that amateur stations in the 2390-2400 MHz band are mobile and operate at relatively high transmitter power levels. *See* Comments of Cingular Wireless, ET Docket No. 00-258, at 14 (filed Oct. 22, 2001)["Cingular Comments"]; ARRL Comments, at 9; Cingular Reply Comments, at 6. This certainly suggests that MDS receivers would suffer interference from the Amateur Radio Service were MDS relocated to the 2385-2400 MHz band on a co-primary basis, rendering the band unacceptable for relocation.

[31] *See* Motorola Comments, at 14.

[32] *See Amendment of Parts 2 and 97 of the Commission's Rules to Create a Low Frequency Allocation for the Amateur Radio Service, Amendment of Parts 2 and 97 of the Commission's Rules Regarding an Allocation of a Band near 5 MHz for the Amateur Radio Service, Amendment of Parts 2 and 97 of the Commission's Rules Concerning the Use Of the 2400-2402 MHz Band by the Amateur and Amateur-Satellite Services*, FCC 02-136, ET Docket No. 02-98, at ¶¶ 49-51 (rel. May 15, 2002).

[33] *See* MDS Alliance Reply Comments, at 19-22; Constellation Reply Comments, at 16.

MHz band under the current Part 21 technical rules would result in substantial interference to PCS operations in the adjacent bands.[34] WCA agrees with those assessments.[35]

In addition, while there is no UPCS use of the 1910-1920 MHz portion of the 1910-1930 MHz band (which is reserved for asynchronous operations),[36] the 1920-1930 MHz portion (which is reserved for isochronous UPCS) is being used. Although it has been suggested that isochronous UPCS systems could migrate from the 1920-1930 MHz band to other spectrum (such as the 2390-2400 MHz band), the record reflects strong opposition to such relocation.[37] A substantial benefit of the compromise proposed herein is that it avoids any need to relocate isochronous UPCS[38] and, indeed, could provide isochronous UPCS four megahertz of additional spectrum.[39]

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[34] *See* Verizon Comments, at 9-10; Motorola Comments, at 15-18; Motorola Reply Comments, at 10-16. *See also* Cingular Comments, at 12-13. Indeed, the primary proponent of relocating 2150-2162 MHz licensees to the 1910-1930 MHz band has subsequently conceded that its plan is unworkable unless MDS licensees agree to operate at far lower power levels than are today permitted under Part 21. *See* MDS Alliance Reply Comments, at 9.

[35] The March 30, 2001 report by the Commission's staff – *Final Report*, "Spectrum Study of the 2500-2690 MHz Band: The Potential for Accommodating Third Generation Mobile Systems" ["*Final Report*"] – concludes that guard bands of up to 4 MHz will be needed to prevent interference between adjacent channel 3G systems (which have operating characteristics not dissimilar to those of PCS) and MDS stations. *Final Report* at 47-52. In response to the Commission's *Public Notice* soliciting comments from the public on the *Final Report*, "FCC Releases Staff Final Report 'Spectrum Study of 2500-2690 MHz Band: The Potential for Accommodating Third Generation Mobile Systems,'" *Public Notice*, DA 01-786 (rel. Mar. 30, 2001), WCA took issue with that conclusion, noting in pertinent part that somewhat larger guardbands might be required. *See* Comments of Wireless Communications Association Int'l on FCC Final Report, ET Docket No. 00-258, at 4-5 (filed April 16, 2001). *See also* Comments of Sprint, ET Docket No. 00-258, at 4-5 (filed April 16, 2001). While that discussion focused on interference between 3G and MDS stations at 2150-2162 MHz, the same logic would preclude MDS stations operating under current Part 21 rules from being placed in close spectral proximity to PCS stations in the 1.9 GHz band (which stations share the same interference-causing characteristics as the 3G stations analyzed in the *Final Report*).

WCA is far from alone in suggesting that guardbands of 5 MHz or more would be required between MDS stations operating under Part 21 rules and 3G/PCS stations. Similar concerns have been expressed by many others. *See, e.g.* Verizon Comments, at 9-10; Comments of Cisco Systems, Inc., ET Docket No. 00-258, at 9-10 (filed Feb. 22, 2001); WorldCom Comments, at 18. In response to the *FNPRM,* Cingular has suggested that 5 MHz guardbands are required between TDD (and, remember, MDS has the flexibility to operate utilizing TDD) and PCS/3G. *See* Cingular Comments, at 12-13. Motorola goes even further, arguing that a guardband of even 5-10 MHz may be inadequate to prevent interference between a station utilizing TDD and a PCS base station. *See* Motorola Comments, at 16-17. Indeed, even ArrayComm, which has pressed the Commission to reallocate the 1910-1930 MHz band for TDD, concedes that guardbands will be required. *See* Comments of ArrayComm, ET Docket No. 00-258, at 6-7 (filed Oct. 22, 2001)["ArrayComm Comments"].

[36] *See* ArrayComm Comments, at 5; Motorola Comments, at 20; Comments of NEC America, ET Docket No. 00-258, at 23 (filed Oct. 22, 2001)["NEC Comments"]; Reply Comments of ArrayComm, ET Docket No. 00-258, at 5 (filed Nov. 8, 2001).

[37] *See, e.g.* Comments of Avaya, ET Docket No. 00-258, at 3-10 (filed Oct. 19, 2001)["Avaya Comments"]; Motorola Comments, at 20-21; NEC Comments, at 11-14; Comments of Wireless Information Networks Forum, ET Docket No. 00-258, at 3-7 (filed Oct. 22, 2001)["WinForum Comments"].

[38] The record in ET Docket No. 00-258 shows that isochronous UPCS can operate immediately adjacent to upstream broadband PCS, as numerous proponents of isochronous UPCS have proposed that their allocation be expanded into

(footnote continued on next page)

The 1990-2025 MHz Band

Several mobile interests have suggested portions of the 1990-2025 MHz band as possible replacement spectrum for the MDS 2150-2162 MHz allocation.[40] It appears that MDS could be relocated to this band without losing any of the technical flexibility licensees currently enjoy. The problem, however, is that to do so the Commission would effectively preclude MSS from utilizing a minimum of 20 MHz (and more likely 22 MHz or more) of its 35 MHz to provide MDS continued use of 12 MHz of spectrum under the Part 21 rules.

The record in ET Docket No. 00-258 establishes that a guardband on the order of 5 MHz or more would be required between any MDS stations in the 1990-2025 MHz band and PCS C Block downstream operations in the band immediately below 1990 MHz to avoid inter-service interference.[41] Moreover, were the Commission to relocate MDS to 12 MHz in the 1990-2025 MHz band and allow operations under the Part 21 rules, and were the Commission to permit terrestrial operations in the remainder of the band, a guardband would be required between those terrestrial operations and the 12 MHz set aside for relocated MDS operations. As WCA noted in its comments in response to the *Notice of Proposed Rulemaking* in IB Docket No. 01-185:

> Although the record in ET Docket No. 00-258, the *Advanced Wireless Services* proceeding, has not yet identified precisely the size of the guardbands required between MDS and ITFS operations and third-generation mobile wireless operations (which WCA assumes will be similar to terrestrial MSS services), that record reflects a clear consensus that there must be guardbands and that the size of those guardbands is

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the spectrum immediately adjacent to upstream broadband PCS spectrum. *See, e.g.* NEC Comments, at 23-25; WinForum Comments, at 11-13. Because the compromise mandates that MDS operations in the 1910-1916 MHz band comport with the upstream broadband PCS rules, isochronous UPCS should be able to exist adjacent to relocated MDS stations.

[39] There had been some suggestion that the 1910-1930 MHz band should be used for high-power TDD applications. *See* ArrayComm Comments, at 5-7; Comments of Siemens Corporation, ET Docket No. 00-258, at 2 (filed Oct. 19. 2001). However, Motorola has demonstrated that substantial guardbands would be required to allow new TDD systems to co-exist with PCS, rendering the proposal unworkable. *See* Motorola Comments, at 15-17. Ericsson concurs that substantial guardbands are required between PCS and TDD operations. *See* Ericsson Comments, at 7-8. Moreover, TDD operations can be accommodated in a variety of other bands, including the upper and lower 700 MHz bands, in portions of the 27 MHz recently reallocated from Government to non-Government use, in the Wireless Communications Service spectrum at 2.3 GHz, and in the MDS and Instructional Television Fixed Service bands at 2500-2690 MHz. Several TDD systems from several different vendors have already been deployed in the 2500-2690 MHz band, in markets as large as Las Vegas, NV and as small as Pocahontas, IA.

[40] *See* Comments of Cellular Telecommunications and Internet Association, ET Docket No. 00-258, at 8-9 (filed Oct. 22, 2001); Cingular Comments, at 11; Motorola Comments, at 14; Letter from Elizabeth Ross, Counsel to Ericsson, to William F. Caton, Attachment at page 7 (filed Feb. 4, 2002).

[41] As discussed *supra* at note 35, there is a debate as to whether the *Final Report* on the use of the 2.5 GHz band for 3G services properly concluded that a guard band of only four megahertz is necessary to prevent inter-service interference between MDS and 3G/PCS. For present purposes, that debate need not be resolved, for whether 20 MHz, 22 MHz or more must be reallocated from MSS to provide 12 MHz for MDS and guardbands, placing 12 MHz MDS stations operating under the Part 21 rules in the MSS band is far from the ideal solution.

> dependent upon whether the spectrum adjacent to MDS/ITFS is used for base-to-handset communications, or for handset-to-base communications. The appropriate size for those guardbands will be dependent upon, among other things, the power levels and spectral masks required for MSS terrestrial operations (all other factors being equal, lower terrestrial MSS power levels and tighter terrestrial MSS masks translate into smaller guardbands). WCA intends to address the guardband issue in more depth if and when proponents of MSS terrestrial use provide sufficient information in response to the NPRM to allow a meaningful analysis.[42]

While the terrestrial MSS proponents have yet to respond to WCA's call for more technical information regarding their terrestrial system designs, it is fair to assume that a guardband of 5 MHz or more could be required to protect terrestrial MSS operations from high-power MDS transmissions were MDS assigned 12 MHz of the 1990-2025 MHz band and permitted to operate under the current Part 21 rules. Note, however, that under the compromise MDS would operate only downstream and only at lower power in the 1990-1996 MHz band and, by imposing similar restrictions on terrestrial operations in adjoining bands, the Commission can avoid any guardband.

Locating MDS at the upper edge of the 1990-2025 MHz (*i.e.* away from the broadband PCS band) would not alleviate the need for a substantial guardband. The Society of Broadcast Engineers ("SBE") has opposed relocating MDS to 2013-2025 MHz (the spectrum adjacent to BAS licensees) because of the potential for high-power MDS operations to cause brute force overload interference to BAS operations.[43] WCA agrees with SBE that there is a potential for such interference absent a guardband. Similarly, were MDS relocated adjacent to BAS, MDS operations could be subject to possible overload interference from nearby BAS facilities unless a guardband were established between the BAS channels starting at 2025 MHz and MDS.[44]

The 2185-2200 MHz Band

ArrayComm has proposed that MDS migrate from 2150-2162 MHz to the 2185-2200 MHz band, albeit without any discussion of the practicality of its proposal.[45] As with the proposed relocation of MDS to the 1990-2025 MHz MSS uplink band, MDS apparently can relocate to the MSS downlink spectrum at 2165-2200 MHz with no reduction in system design flexibility, so long as there are substantial guardbands. However, as discussed above, there is no

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[42] Comments of Wireless Communications Association Int'l, IB Docket No. 01-185, at 3-4 (filed Oct. 22, 2001)(footnotes omitted).

[43] *See* Comments of Society of Broadcast Engineers, ET Docket No. 00-258, at 4 (filed Oct. 19, 2001). The concerns expressed by SBE were shared by others in the broadcast industry. *See* Reply Comments of 2 GHz Broadcast Group, ET Docket No. 00-258 (filed Nov. 8, 2001); Joint Reply Comments of Association for Maximum Service Television, Inc. and National Association of Broadcasters, ET Docket No. 00-258 (filed Nov. 8, 2001).

[44] In addition, there is no evidence in the record that MDS facilities can be deployed in the 2010-2025 MHz band on a ubiquitous basis without interfering with government operations in the 2025-2110 MHz band.

[45] *See* ArrayComm Comments, at 9-10.

question that a guardband on the order of 5 MHz or larger would be required between the 12 MHz MDS allocation and any spectrum permitted to be used for terrestrial services by MSS licensees or others. In addition, since neither ArrayComm nor anyone else has provided evidence that MDS facilities can be deployed in the 2185-2200 MHz band on a ubiquitous basis without causing interference to or suffering interference from government operations above 2200 MHz, a guardband between MDS and 2200 MHz is a very real possibility.[46] Thus, relocating to the MSS downlink band would likely require divesting MSS of 22 MHz or more of its spectrum allocation.

THE BENEFITS OF THE COMPROMISE

The benefits of the compromise are substantial. Most importantly, it provides the Commission with one of the two substantial blocks of contiguous spectrum desired by advocates of 3G and other advanced wireless services while minimizing dislocation of existing services. As discussed above, the other proposals for migrating MDS raise the specter of relocation of or interference to nine separate constituencies: MDS, broadband PCS, isochronous UPCS, asynchronous UPCS, 2 GHz MSS, Government operations above 2200 MHz, Government and non-Government operations in the 2360-2385 MHz band, license-exempt users in the 2.4 GHz band, and the Amateur Radio Service. By splitting MDS into two non-contiguous bands and requiring relocated MDS stations to comply with the system design limitations of their spectrum neighbors, the compromise manages to eliminate virtually any adverse consequences to these threatened constituencies.

First, because the compromise avoids the 2165-2200 MHz and 2385-2400 MHz bands, Government operations above 2200 MHz, Government and non-Government operations in the 2360-2385 MHz band, the Amateur Radio Service, and license-exempt users in the 2.4 GHz band are not implicated in the least.

Second, although the proposed compromise does require a six megahertz reduction in the 1990-2025 MHz MSS earth-to-space spectrum allocation, that reduction will come from spectrum that is not currently licensed. When the International Bureau licensed 2 GHz MSS in July 2001, it restricted each of the eight system proponents to 3.5 MHz in each of the uplink and downlink band segments. Recognizing that the MSS spectrum could be reallocated for terrestrial services, the Bureau refrained from licensing 14 MHz (seven megahertz in each direction).[47] Under the compromise, only six megahertz of this unlicensed 2 GHz MSS uplink spectrum would be reallocated for MDS. Moreover, the MSS spectrum to be reallocated for MDS is largely paired with the 2165-2170 MHz block that the Commission has proposed to reallocate for advanced wireless services, including 3G.[48] Absent using the 1990-1996 MHz spectrum as

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[46] *See* WCA Reply Comments, at 11-12.

[47] *See, e.g., ICO Services Limited*, 16 FCC Rcd 13762, 13765 (2001); *see also Establishment of Policies and Service Rules for the Mobile Satellite Service in the 2 GHz Band,* 15 FCC Rcd 16127, 16138-49 (2000).

[48] As Motorola has noted "[t]here is widespread support in the record for reallocation, at a minimum, of the 14 MHz of MSS spectrum that remains unassigned following withdrawal of one MSS operator." Motorola Reply Comments, at 6.

contemplated by the compromise, the 1990-1995 MHz band would be orphaned and unavailable for MSS anyway by virtue of the reallocation of the paired 2165-2170 MHz block from MSS to 3G.

Third, the technical arguments advanced by broadband PCS licensees against relocating MDS to the 1910-1930 MHz band have been fully addressed. Since the compromise requires that MDS operate in the 1910-1916/1990-1996 MHz band under the same technical restrictions as the neighboring broadband PCS licensees, the PCS licensee adjacent to MDS is no more vulnerable to interference from MDS as it is to interference from any adjacent channel broadband PCS system.

Fourth, the record confirms the Commission's finding that "[t]here has been little development of unlicensed asynchronous devices in the 1910-1920 MHz" band.[49] Indeed, there is no evidence in the record that the 1910-1920 MHz band is currently being utilized at all in the United States. Any future demand for unlicensed asynchronous devices can be met by the 902-928 MHz, 2.4 GHz and 5.8 GHz license-exempt bands.[50]

Fifth, under our proposal, there would be no adverse impact on isochronous UPCS in the 1920-1930 MHz band. Indeed, although there is debate as to whether isochronous UPCS interests truly need additional spectrum,[51] the Commission can reallocate the 1916-1920 MHz band from asynchronous UPCS to isochronous UPCS in order to satisfy the requests by isochronous UPCS proponents for additional spectrum.[52] Since UPCS interests have proposed that they operate directly adjacent to the upstream broadband PCS C Block,[53] and since MDS licensees in the 1910-1916 MHz band would operate under the same technical rules as the adjacent C Block licensees, it appears that relocated MDS stations and isochronous UPCS can co-exist in adjacent spectrum.

Ultimately, when all is said and done, only MDS licensees will suffer any significant dislocation as a result of the compromise, and countervailing considerations render the compromise acceptable. It must be stressed that to eliminate the need for large guardbands surrounding any new MDS spectrum, the compromise requires MDS licensees to sacrifice the substantial flexibility they are afforded in system design, particularly the flexibility to operate at relatively high power levels on these channels. As the *quid pro quo* for that sacrifice, MDS will be afforded spectrum that is near the broadband PCS allocation and shares its 80 MHz transmit-receive separation, allowing a more rapid and cost-effective development of equipment. As noted above, the continuing regulatory uncertainty regarding the future spectrum home for MDS

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[49] *See FNPRM*, 16 FCC Rcd at 16048; *see also* NEC Comments, at 23-24; Motorola Comments, at 20.

[50] *See* Motorola Comments, at 20; WinForum Comments, at 12.

[51] *See, e.g.,* MDS Alliance Reply Comments, at 6-8; Reply Comments of ArrayComm, Inc., ET Docket No. 00-258, at 5-8 (filed Nov. 8, 2002); Reply Comments of DCT Los Angeles, LLC, ET Docket No. 00-258, at 6-10 (filed Nov. 8, 2002).

[52] *See, e.g.,* Comments of Avaya, ET Docket No. 00-258, at 5 (filed Oct. 22, 2001); NEC Comments, at 24-25; Comments of UTAM, Inc., ET Docket No. 00-258, at 12-15 (filed Oct. 22, 2001).

[53] *See id.*

channels 1 and 2/2A has cast a pall over efforts to develop advanced technology for use on those channels. While the MDS community is aggressively pursing the development of fixed, portable and mobile applications for the 2500-2690 MHz band, vendors have halted efforts to develop products capable of operating in the 2150-2162 MHz band in the aftermath of the Commission's December 2000 proposal to migrate MDS from that band.[54] Tens, if not hundreds, of millions of dollars have been spent at auction and in the secondary market to acquire rights to the 2150-2162 MHz band. At this stage, MDS licensees are prepared to make a sacrifice in system design flexibility, if it means that the regulatory cloud over the channels can be lifted and equipment for the new channels can be developed quickly.

CONCLUSION

In short, while MDS licensees would prefer to remain in the 2150-2162 MHz band that was auctioned in 1996, they recognize that the Commission seeks to identify paired spectrum for FDD 3G services. Adoption of the proposal put forth today will advance the Commission's objective of making available for auction a large amount of spectrum in two paired blocks appropriate for FDD 3G applications, while minimizing the disruption to existing spectrum users. And, adoption of the compromise will provide benefits to the MDS community that largely (although not fully) compensate it for the dislocation any relocation will cause. As such, it represents the best way for the Commission to relocate MDS from the 2150-2162 MHz band and free the 2.1 GHz band to be paired with the 1.7 GHz band for mobile 3G services.

[54] Because of the willingness of the MDS industry to accept relocation under the terms of the compromise presented here, despite the resulting delays in system deployment, the Commission should, at a minimum, issue a blanket extension of its current requirement that MDS BTA authorization holders build out their facilities by August 16, 2003 or their existing build-out date, whichever is later. *See Extension of the Five-Year Build-Out Period for BTA Authorization Holders in the Multipoint Distribution Service*, 16 FCC Rcd 12593 (2001).

APPENDIX A – RELOCATION AND BAND-CLEARING

RELOCATION OF MDS LICENSEES AND OPERATORS FROM 2150-2162 MHz

Throughout ET Docket No. 00-258, the Multipoint Distribution Service ("MDS") industry has stressed that relocation of MDS to any new spectrum will present novel relocation and compensation issues, as it will be the first time the Commission has forced the migration of a mass market, consumer-based subscription service to new spectrum and the first time the Commission has relocated a service where the spectrum is frequently leased to non-licensee system operators who provide service to the public.[1] None of the commenters has opposed the compensation requirements proposed by the MDS industry to address these unique circumstances, so it is unnecessary to repeat here in detail the industry's position that all relocation costs incurred by licensees, system operators and consumers must be reimbursed. Indeed, as noted in the accompanying compromise proposal, even those advocating the relocation of MDS from 2150-2162 MHz concede that full compensation is required.[2]

The mechanics of relocating MDS licensees and system operators from 2150-2162 MHz to the 1910-1916/1990-1996 MHz band need not be complicated. Indeed, the Fixed Microwave Service ("FMS") relocation rules set forth in Sections 101.69 *et seq.* of the Commission's Rules provide a useful starting point for establishing a transitional mechanism. The compromise envisions, as in the case with FMS relocation to make spectrum available for broadband Personal Communications Service ("PCS"), that a one-year voluntary negotiation period, followed by a one-year mandatory negotiation period, would commence when the 1.7/2.1 GHz 3G auction winner serves a written request for negotiation on the MDS licensee.[3] However, provisions for separate negotiations with any system operator utilizing the MDS channels will have to be included in the MDS relocation rules to reflect the fact that MDS channels, unlike the FMS links at issue when the Part 101 relocation rules were initially drafted, are frequently leased to system operators who have made substantial investments in reliance on those leases and must be reimbursed for costs incurred as a result of any relocation.[4] If the auction winner, licensee and any system operator/lessee are unsuccessful in negotiating a settlement within that one-year

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[1] *See, e.g.* Comments of Wireless Communications Association Int'l, ET Docket No. 00-258, at 10-14 (filed Oct. 22, 2001)["WCA Comments"]; Comments of Sprint Corp., ET Docket No. 00-258, at 5-6 (filed Oct. 22, 2001)["Sprint Comments"]; Comments of Wireless Communications Association Int'l, ET Docket No. 00-258, at 48-53 (filed Feb. 22, 2001)["WCA NPRM Comments"]; Comments of Nucentrix Broadband Networks, ET Docket No. 00-258, at 5 (filed Oct. 22, 2001)["Nucentrix Comments"]; Comments of WorldCom, ET Docket No. 00-258, at 10-11 (filed Oct. 22, 2001)["WorldCom Comments"].

[2] See "A Compromise Solution For Relocating MDS From 2150-2162 MHz," n. 16.

[3] *See Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies*, 8 FCC Rcd 6589, 6598 (1993); *see also* 47 C.F.R. § 101.69(b).

[4] Although consumers may, in some cases, have purchased MDS equipment, such consumers have subscriber relationships with system operators who can be expected to protect the consumers' interests in relocation negotiations. Thus, although operators will have to be reimbursed for the costs they incur in reimbursing consumers, direct negotiations between consumers and the 1.7/2.1 GHz auction winner can be avoided.

voluntary negotiation period, an involuntary relocation procedure similar to that afforded by Section 101.75 of the Commission's Rules (but modified to reflect both the additional cost considerations present with an MDS relocation and the role of the system operator) could then be invoked by the affected 1.7/2.1 GHz 3G auction winner.

The involuntary relocation procedures set forth in Section 101.75 also will require modification to reflect that any relocation of MDS to the 1910-1930 MHz and 1990-2025 MHz bands adds a new wrinkle to the Commission's prior experience with forced migrations, as MDS will be unable to relocate until the replacement spectrum is first cleared of current users.[5] Because of the need for a sequential, dual band-clearing here (which was not required when the FMS rules were adopted), any MDS relocation rule based on Section 101.75 will have to be modified such that the commencement of mandatory negotiations between an MDS licensee or system operator/lessee and the applicable 1.7/2.1 GHz auction winner is deferred until the date on which the 1910-1916/1990-1996 MHz bands are fully cleared of all incumbent FMS and BAS[6] operations within the MDS licensee's service area, plus any FMS incumbent operations within the MDS licensee's Proximity Threshold calculated under Section 24.247 of the Rules and any BAS operations that might interfere with MDS.

The Commission permits FMS licensees to self-relocate and later secure compensation for their expenses.[7] Similarly, to avoid undue delay in the clearing of the 1910-1916/1990-1996 MHz band and the relocation of MDS, the Commission must permit MDS licensees and system operator/lessees, at their sole discretion, to undertake the expenses of the band-clearing and relocation subject to later reimbursement.[8] Thus, to promote the earliest possible relocation of

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[5] *See Amendment of Part 2 of the Commission's Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems*, 16 FCC Rcd 16043, 16048, 16057-58 (2001)["*FNPRM*"].

[6] For purposes of this Appendix, "BAS" will refer to Broadcast Auxiliary Service, Local Television Transmission Service and Cable Television Relay Service operations in the 1990-2025 MHz band.

[7] *See Amendment to the Commission's Rules Regarding a Plan for Sharing the Costs of Microwave Relocation,* 12 FCC Rcd 2705, 2717-18 (1997). Because of the possibility for lengthy delays between MDS self-relocation and the 1.7/2.1 GHz auction, compensation should include a payment for the time value of expenditures incurred by MDS licensees and operators for the benefit of the eventual auction winners.

[8] This self-help approach not only will speed the clearing of the 1910-1916/1990-1996 MHz band, but it also accommodates the possibility that in some cases, MDS system operators will choose to migrate existing services from 2150-2162 MHz to spectrum other than the 1910-1916/1990-1996 MHz (such as WCS spectrum at 2.3 GHz or MDS/ITFS spectrum at 2.5 GHz) pending the clearing of the 1910-1916/1990-1996 MHz bands. There are several reasons why this option might be elected.

For example, as previously explained in ET Docket No. 00-258, one of the primary concerns MDS system operators have with any migration from 2150-2162 MHz is the negative impact on the subscriber, who will be required in many cases to remain at home for a service call during which its current consumer premises equipment will be exchanged for equipment capable of operating on the new spectrum. *See* WCA NPRM Comments, at 48-53; WorldCom Comments, at 11; Nucentrix Comments, at 5. The loss of customer good-will caused by this disruption is a "soft cost" that simply cannot be fully reimbursed, and must be minimized wherever possible. Operators may choose to minimize the disruption by starting to migrate customers immediately to currently-available alternate

(footnote continued on next page)

MDS from the 2150-2162 MHz band, MDS licensees should be provided with immediate authority to operate in the 1910-1916/1990-1996 MHz bands (subject to the clearing of those bands as discussed below), as well as in the 2150-2162 MHz band. As noted in the accompanying document, for there to be a seamless transition for subscribers requires that systems operate concurrently in the 2150-2162 MHz band and in the relocation spectrum until all subscribers can be provisioned with the equipment necessary to operate on the relocation spectrum. Providing MDS licensees the earliest possible access to the 1910-1916/1990-1996 MHz band will expedite the transition of subscribers that are currently receiving service via the 2150-2162 MHz band, as it will permit MDS licensees (if they so choose) to immediately construct facilities in the 1.9 GHz band and commence the process of providing subscribers with the equipment necessary to receive service in the new band.[9]

SPECIAL CONSIDERATIONS ARISING FROM THE NEED TO CLEAR THE 1910-1916/1990-1996 MHZ BANDS

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spectrum whenever a routine service call is made to the home, without awaiting the clearing of the 1910-1916/1990-1996 MHz band. While some operators are spectrum constrained and cannot avail themselves of this option, others may have spectrum that had been set aside initially for future use as the customer base expands. This expansion spectrum could be put to use more rapidly as part of a migration plan, and the 1910-1916/1990-1996 MHz band would then become that operator's expansion spectrum once it is cleared. For example, some system operators may choose to immediately migrate subscribers from MDS channels 1 and 2/2A to available Wireless Communications Service ("WCS") spectrum, and then utilize the relocated MDS channels for additional capacity when the WCS channels are saturated.

Another scenario, which derives from the fact that the 1910-1916/1990-1996 MHz band is not directly comparable to 2150-2162 MHz, may occur where the entire 2150-2162 MHz band is currently used for upstream communications. In such a situation, the system operator may find that due to the loss of six megahertz of upstream capacity, the new 1910-1916 MHz upstream band alone would not satisfy its immediate capacity requirements, and therefore decide to supplement the 1910-1916 MHz upstream band with channels in other bands on either a TDD or FDD basis. For example, a system that today uses all of the 2150-2162 MHz band for upstream communications may need to utilize MDS channels in the 2.5 GHz band to replace the upstream capacity lost as a result of the relocation of MDS channels 1 and 2/2A. In any such cases, the 1.7/2.1 GHz 3G auction winner should be required to bear the expenses incurred as a result of the move to the chosen relocation band, but not any of the costs incurred by the system operator in purchasing or leasing that new band (as such costs are essentially covered by the provision of spectrum at 1.9 GHz). In other words, returning to the prior example, the 1.7/2.1 GHz 3G auction winner should be responsible for the costs of clearing the 1910-1916/1990-1996 MHz band and the costs of migrating subscribers to the MDS channels at 2.5 GHz, but not the cost of buying or leasing those MDS channels. Similarly, in some cases spectrum constrained system operators may find that although the existing services offered over MDS channels 1 and 2/2A cannot be offered at 1910-1916/1990-1996 MHz because of the operating restrictions required to protect broadband PCS, they can provide those services in the 2.5 GHz band by introducing newer technologies. In such cases, the 1.7/2.1 GHz 3G auction winner should be required to bear the expenses incurred in introducing those technologies, but again, not any of the costs incurred by the system operator in purchasing or leasing the spectrum. In either of these cases, the system operator can migrate consumers immediately (regardless of whether the 1910-1916/1990-1996 MHz band can be quickly cleared), and then commence using the 1910-1916/1990-1996 MHz band later.

[9] *See* WCA Comments, at 8 n. 14; Reply Comments of Wireless Communications Association In't, ET Docket No. 00-258, at 33 n. 88 (filed March 9, 2001).

The task of developing rules to govern clearing the 1910-1916/1990-1996 MHz bands of incumbents will be simplified because, with some minor revisions, the Commission can rely on its existing relocation procedures for those bands: one of which currently provides for clearing incumbent FMS links out of the 1910-1930 MHz band for the benefit of unlicensed Personal Communications Services ("UPCS"); and the other of which currently provides for clearing the 1990-2008 MHz band of incumbent Broadcast Auxiliary Service, Cable Television Relay Service and Local Television Transmission Service (collectively, "BAS") licensees for the benefit of Mobile Satellite Service ("MSS"). While these procedures differ somewhat in their particulars, they are similar in that they (1) establish a negotiation period prior to involuntary relocation of incumbents, (2) require subsequent beneficiaries of relocation to share relocation costs according to formulae in the Commission's rules, and (3) eventually sunset an incumbent's right to reimbursement.[10] With these fundamental concepts in mind, the Commission's relocation procedures for the 1910-1916 MHz and 1990-2008 MHz bands should generally be retained, except as noted below.

Relocation of Fixed Microwave Service Licensees From 1910-1916 MHz

To provide for the clearing of the 1910-1916 MHz band of FMS licensees, an MDS licensee, system operator/lessee or 1.7/2.1 GHz 3G auction winner engaged in band clearing should have the same rights and obligations that UTAM, Inc. ("UTAM") – the joint venture of the UPCS industry charged with funding and managing the clearing of FMS from the 1910-1930 MHz band – currently has under Sections 101.69 *et seq.* of the Commission's Rules.[11] Specifically, like UTAM they should be able to force the involuntary relocation of an FMS licensee after a one-year mandatory negotiation period in the case of a commercial FMS licensee or a three-year voluntary and two-year mandatory negotiation period in the case of a public safety FMS licensee.[12] Notwithstanding these negotiation periods, and to avoid any delay in the clearing of the 1910-1916 MHz band, the August 5, 2005 relocation sunset date established under Section 101.79(a) must remain unchanged, and the appropriate MDS licensee, system operator/lessee or 1.7/2.1 GHz auction winner must be entitled to force the cessation of FMS operations thereafter on six months notice like any other "emerging technology" licensee entitled to the benefit of that rule.

The Commission has recognized that the relocation of an FMS link by one entity can benefit others (*i.e.*, a relocation by UTAM can benefit broadband PCS licensees, and *vice versa*).

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[10] *See Amendment to the Commission's Rules Regarding a Plan for Sharing the Costs of Microwave Relocation,* 11 FCC Rcd 8825, 8838 (1996)["*Microwave Relocation First Report and Order"*]; *Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile-Satellite Service*, 15 FCC Rcd 12315, 12333 (2000)["*BAS Relocation Order*"]. The sunset dates are April 5, 2005 for FMS and September 6, 2010 for BAS.

[11] *See* 47 C.F.R. § 101.69 *et seq.*; *see also Microwave Relocation First Report and Order* at 8858-59. Because the nature of MDS's actual use of the band will be more akin to that of a PCS licensee than UTAM, MDS must otherwise be classified as an emerging technology service for purposes of the relocation and cost-sharing rules.

[12] *See* 47 C.F.R. § 101.69(b).

For example, if an FMS link spans from 1900 MHz to 1920 MHz, its relocation by UTAM would also clear the C Block PCS frequencies for the benefit of one or more broadband PCS licensees. To avoid "free riders" on the band-clearing efforts of others, the Commission has adopted Sections 24.239 through 24.253 of its Rules, which mandate reimbursement of the party that pays to relocate an FMS link when others subsequently benefit.[13] Those rules should continue to apply as the 1910-1916 MHz band is cleared for MDS.[14] Specifically, an MDS licensee, system operator/lessee or 1.7/2.1 GHz 3G auction winner that incurs band-clearing expenses should be entitled to recover from UTAM and/or broadband PCS licensees as if it were a "PCS relocator" under the Part 24 cost-sharing rules. Consistent with the policy that a relocating MDS licensee or system operator/lessee should be reimbursed for any relocation expenses, any band-clearing costs incurred by the MDS licensee or system operator/lessee that are not recovered under Part 24 from others ultimately must be reimbursed by the 1.7/2.1 GHz 3G auction winners. However, to avoid excessive premiums from MDS licensees or system operators/lessees to FMS licensees to expedite FMS relocation, the 1.7/2.1 GHz 3G auction winners should only be liable for reimbursement of "actual relocation costs" as defined in Section 24.243(b).

The 1.7/2.1 GHz 3G auction winners should also be liable for payment of a portion of past and future costs incurred by UTAM or broadband PCS licensees in clearing the 1910-1916 MHz band. UTAM has estimated that it has spent over $30 million in clearing the 1910-1920 MHz band and has properly urged that it be entitled to recoup a portion of those costs to the extent they benefit others.[15] It is likely that broadband PCS licensees have also expended funds

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[13] *See, e.g., Microwave Relocation First Report and Order* at 8829-31 (discussing "free rider" problem where beneficiaries of relocation do not pay relocation costs). In the case of the 1910-1930 MHz band, the relevant cost-sharing formula is set forth in Section 24.243 of the Commission's rules. The formula is as follows: R=C/N x 120-T[m]/120, where R equals the amount of reimbursement, C equals the actual cost of relocating the link at issue, N equals the number of PCS entities that would have interfered with the link, 120 is the Commission-assigned value of amortizing the cost of relocating a particular microwave link over a ten-year period, and T[m] equals the number of months that have elapsed between the month the PCS relocator or voluntarily relocating microwave incumbent obtains reimbursement rights for the link and the month that the relevant PCS relocation clearinghouse notifies a later-entrant of its reimbursement obligation for the link.

[14] Although the Commission recently elected not to impose any cost-sharing rules with regard to clearing of the upper 700 MHz band, the situation there is readily distinguishable from that here. *See Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules; Carriage of the Transmissions of Digital Television Broadcast Stations; Review of the Commission's Rules and Policies Affecting the Conversion to Digital Television,* 16 FCC Rcd 2703, 2707 (2001); *see also Reallocation and Service Rules for the 698-746 MHz Spectrum Band (Television Channels 52-59)*, 17 FCC Rcd 7278, 7334-35 (2001). The Commission reasoned with respect to the upper 700 MHz band that since all of the new licensees were receiving their spectrum simultaneously as a result of an auction, they shared a strong incentive to enter into cost-sharing agreements. Here, however, the costs are not to be shared among a group of newcomers, but among existing broadband PCS licensees, UTAM and a newcomer. Moreover, cost-sharing rules are essential in the case of clearing the 1910-1916 MHz band because while the newcomer MDS licensee has incentives to expedite relocation, the winners of the auction for the 1.7/2.1 GHz bands who are paying for the 1910-1916 MHz band-clearing may not share that incentive.

[15] Comments of UTAM, Inc., ET Docket No. 00-258, at 3-4 (filed Oct. 22, 2001).

to clear all or part of the 1910-1916 MHz band. Accordingly, where expenses have been incurred in clearing the 1910-1916 MHz band of incumbent FMS links, those costs should be reimbursed by winning bidders in the 1.7/2.1 GHz 3G auction according to the cost sharing formula set forth in Section 24.243 of the Commission's rules, treating the winning bidder in the 1.7/2.1 GHz 3G auction as another broadband PCS licensee benefiting from the relocation.[16] By the same token, where the 1.7/2.1 GHz 3G auction winner relocates an FMS licensee to clear the 1910-1916 MHz band for a relocating MDS station and in the process benefits UTAM or a broadband PCS licensee, the auction winner should be entitled to recover a portion of its costs from those beneficiaries.

Relocation of Broadcast Auxiliary Service and Cable Television Relay Service Licensees From 1990-1996 MHz

Largely because the nature of BAS differs from FMS, the Commission has adopted a somewhat different system for clearing BAS from the 1990-2025 MHz band to accommodate MSS.[17] Recognizing that the Commission only recently concluded the development of that system after controversial proceedings, the Commission can and should retain that approach to clearing BAS Channel 1 (which spans 1990-2008 MHz) to the greatest extent possible consistent with the objective of rapidly clearing the 2150-2162 MHz band of MDS.

Specifically, the Commission should amend Sections 74.690 and 78.40 of the Rules to provide that relocating MDS licensees, system operator/lessees and 1.7/2.1 GHz 3G auction winners have essentially the same rights and responsibilities as MSS licensees with respect to the clearing of the 1990-1996 MHz band during Phase I of the BAS relocation (the phase designed to clear the 1990-2008 MHz band). Of course, because MDS facilities do not have the nationwide footprint of MSS, the rules will have to be modified slightly to reflect that MDS will be deployed in the 1990-1996 MHz band on a market-by-market basis. More specifically:

- <u>Markets Below The Top 100</u> – In each of the Nielsen Designated Market Areas ("DMAs") smaller than the 100 largest, BAS licensees currently are required during Phase I to cease operations on BAS Channel 1 and restrict usage to the remaining BAS spectrum (2008-2110 MHz) upon receipt of notice from an MSS licensee that it is ready to commence operations.[18]

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[16] Consistent with the policy that relocating MDS licensees and system operator/lessees should not be required to make any financial outlay, to the extent a broadband PCS licensee or UTAM has incurred or in the future incurs 1910-1916 MHz band-clearing expenses prior to the 1.7/2.1 GHz 3G auction, the clearinghouse should not dun the relocating MDS entity for a portion of the expense pursuant to Section 24.249. Instead, it should await the conclusion of the 1.7/2.1 GHz 3G auction and then notify the 1.7/2.1 GHz 3G auction winners of their reimbursement obligations.

[17] *See BAS Relocation Order* at 12326-28.

[18] Under the present BAS relocation policy, an MSS licensee cannot give that notice until it has cleared BAS Channel 1 usage of the top 30 DMAs. That policy reflects the fact that as a satellite service, MSS has a nationwide footprint. However, since MDS is a local service with a multitude of licensees across the nation, there is no logical reason to link MDS usage of the 1990-1996 MHz band in any given market to relocation in any other market. Thus, in DMAs outside the top 30, the Commission should permit the notice of intention to commence MDS operations to be served at any time, without regard to the status of relocation efforts in other DMAs. And, in each of the top 30

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That same approach should continue here – any BAS Channel 1 usage outside of the top 100 DMAs should cease upon notice from the applicable MDS licensee, system operator or 1.7/2.1 GHz auction winner that an MDS station with a service area overlapping the BAS license area or within the Proximity Threshold intends to commence operations.

- Markets 31 Through 100 – In DMAs 31 through 100, BAS licensees currently are required to cease operating on BAS Channel 1 and restrict usage to the remaining BAS spectrum upon receipt of notice from an MSS licensee that it is ready to commence operations. However, unlike the situation in the smaller markets, the MSS licensee is required to retune or replace the BAS equipment within three years so that it can operate on a rechannelized BAS band. That same approach should continue here – any BAS Channel 1 usage in DMAs 31-100 should cease upon notice from the applicable MDS licensee, system operator or 1.7/2.1 GHz auction winner that an MDS station with a service area overlapping the BAS license area or within the Proximity Threshold intends to commence operations. Within three years of that notice, the 1.7/2.1 GHz 3G auction winner must relocate the BAS licensee.

- Top 30 Markets – In the top 30 DMAs, MSS operations are not permitted to commence until the conclusion of a two year mandatory negotiation period (which ends on September 6, 2002), after which BAS stations can be relocated on an involuntary basis. Given the pending allegations that MSS licensees have not negotiated in good faith with BAS licensees (and no position is taken as to those allegations), it may not be appropriate to allow MDS licensees, system operators or 1.7/2.1 GHz auction winners to involuntarily relocate BAS immediately after September 6, 2002. On the other hand, as the Commission recognized when it adopted the MSS/BAS relocation regime, BAS licensees "have been aware of [the relocation issue], and closely following its progress, since 1995."[19] Indeed, for the past two years BAS licensees in the top 30 markets have known of the specific September 6, 2002 deadline for relocation out of BAS Channel 1 and have had the opportunity to develop transition plans. Moreover, the willingness of MDS licensees to compromise on relocating from the 2150-2162 MHz band is premised on their ability to quickly relocate to new spectrum. If the Commission were to mandate lengthy negotiations to free the 1990-1996 MHz band from BAS use, it will delay the relocation of MDS and deny MDS licensees the speedy transition and certainty they require. Thus, while it may be appropriate to provide an opportunity for negotiations between a BAS licensee and the MDS licensee, system operator or 1.7/2.1 GHz 3G auction winner before involuntary relocation, that mandatory negotiation period should not exceed six months. That is ample opportunity to negotiate the process for relocating BAS from 1990-1996 MHz into the remainder of the BAS band given the substantial opportunity BAS licensees have had to date to develop transition plans. If those negotiations

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DMAs, commencement of MDS operations should be permitted so long as the appropriate steps have been taken with respect to that DMA, regardless of the status of relocation efforts in other DMAs.

[19] *BAS Relocation Order*, 15 FCC Rcd at 12330.

do not yield agreement, then the BAS licensee should be subject to immediate involuntary relocation under the existing policy.[20]

Finally, the Commission's policy under which MSS licensees share the cost of clearing BAS Channel 1 among themselves on a *pro rata* basis based on the amount of spectrum utilized should be extended – relocating MDS licensees, system operators or 1.7/2.1 GHz 3G auction winners should share the benefits and obligations under that policy as if they were MSS licensees.[21] However, the cost-sharing system will have to be modified slightly to reflect the fact that unlike MSS licensees who have nationwide services areas, MDS licensees have more limited geographic service areas. Thus, where a BAS license area overlaps two or more MDS service areas, the cost-sharing rules should apportion the costs attributable to clearing the 1990-1996 MHz band *pro rata* based on the population of the MDS service areas. While the apportionment will be based on the population of the respective MDS service areas, ultimately those costs will be borne by the 1.7/2.1 GHz 3G auction winners responsible for the costs of clearing the 1990-1996 MHz band on behalf of the relocating MDS operations.

RESPONSIBILITY FOR BAND-CLEARING AND RELOCATION COSTS

As noted previously in ET Docket No. 00-258, the relocation process must be designed to ensure that any future financial problems encountered by those responsible for funding the relocations not leave relocating parties "holding the bag" for costs that are never reimbursed.[22] While it is presumed that any auction of the 1.7/2.1 GHz band will be designed to promote participation solely by those with the financial ability to satisfy the financial obligations of winning bidders, experience in prior auctions coupled with the recent financial difficulties faced by most in the telecommunications sector strongly suggest that the risk of default cannot be entirely eliminated. To minimize the risk that winning bidders will default on their obligations to reimburse relocation expenses incurred by MDS licensees and system operators, the Commission should embrace WCA's prior proposal to impose the obligation for paying the costs of clearing the replacement bands and of relocating MDS operations upon all winners in the 3G auction for the region in question jointly and severally, not just on the winner(s) of licenses that happen to include the 2150-2162 MHz channels.[23] In that manner, the Commission can enhance the odds

[20] *Id.* at 12331.

[21] MSS licensees who enter that spectrum after it has been cleared must reimburse the initial MSS licensee(s) for its relocation costs on a *pro rata* basis, according to the amount of spectrum the subsequently entering MSS licensees are authorized to use. *See id.* at 12337-38.

[22] *See* WCA Comments, at 15.

[23] *Id.* For example, were the Commission to auction the 1.7/2.1 GHz bands as 5 licenses of equal bandwidth, the relocation costs would be borne jointly and severally by the winners of the 5 licenses. In those cases where an MDS protected service area overlaps more than one of the geographic areas used in the auction, the Commission could apportion reimbursement obligations based on population. For example, assume the Commission were to auction based on MEAs and an MDS protected service area overlaps MEAs A and B. Further assume that 75% of the population with the MDS protected service area resides in MEA A, while the other 25% resides in MEA B. If the cost of clearing the 1910-1916/1990-1996 MHz bands and relocating to new spectrum were $100,000, the winners

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that the clearing of the 1910-1916/1990-1996 MHz band and the migration of MDS from 2150-2162 MHz will occur on schedule, regardless of whether any one auction winner defaults on its obligations. WCA notes that while some of the 3G proponents have called for the Commission to fund relocation out of auction proceeds, that cannot be done absent legislation and substantial post-legislation rulemaking proceedings by the Commission – delays that would preclude the speedy transition the MDS industry requires as part of its compromise proposal.[24]

of the 5 licenses in MEA A would be required jointly and severally to pay $75,000, while the winners of the 5 licenses in MEA B would be required jointly and severally to pay $25,000.

[24] *See* Reply Comments of Motorola, ET Docket No. 00-258, at 7 (filed Nov. 8, 2001); Comments of Ericsson, ET Docket No. 00-258, at 14-15 (filed Oct., 19, 2001); Comments of Verizon Wireless, ET Docket No. 00-258, at 6 (filed Oct. 19, 2001).

ATTACHMENT B

MARCONI REPORT ON 1910-1920 MHz BAND

Engineering Statement Analyzing Relocation of the MDS1 and MDS2 Frequencies to 1910-1916 MHz and 1990-1996 MHz

Introduction

Marconi Wireless has been retained on behalf of the Wireless Communications Association International, Inc ("WCA") to review certain issues in connection with the possible relocation of the MDS band frequencies (2150-2162 MHz) to the 1910-1916 MHz and 1990-1996 MHz band and a proposal by the Federal Communications Commission to reallocate the 1910-1920 MHz and 1990-1920 MHz bands for Advanced Wireless Services ("AWS"). The Commission has decided to reallocate 2150-2155 MHz to the Advanced Wireless Services ("AWS") for 3G mobile applications and therefore a suitable location for the MDS band frequencies must be found.

Background

Currently, the MDS band is located at 2150-2162 MHz and broken down into two 6 MHz channels as shown in Figure 1. MDS-1 is located from 2150-2156 MHz and MDS-2 from 2156-2162 MHz. These channels are licensed across the country either on a site-specific or BTA basis depending on the date of license. Services that operate on these channels currently enjoy excellent operational capabilities because of the favorable propagation characteristics at 2.1 GHz, the ability to broadcast at relatively high power levels and antenna heights, stringent interference protection from co- and adjacent channels licensees and freedom from interference caused by out-of-band emissions ("OOBE") generated by services in adjacent bands. In addition, current FCC rules allow operators tremendous flexibility to choose the type of service to be

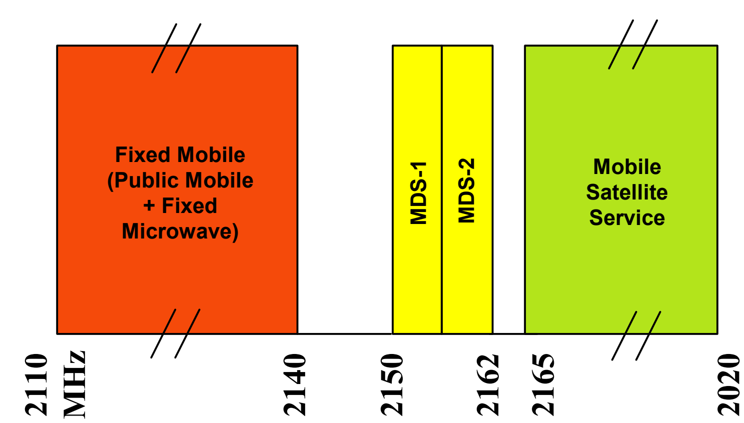

Figure 1

offered. Operators are free to offer analog television, digital television, one-way digital data or two-way digital data services. These data services can also be operated in a frequency division duplex ("FDD") mode or in a time division duplex ("TDD") mode.

However, in its November 2002 *Second Report and Order* in ET Docket No. 00-258, the Commission reallocated the 1710-1755 MHz and 2110-2155 MHz bands for AWS. Since the AWS allocation took 5 MHz that is currently occupied by MDS-1, the FCC announced that MDS-1 and 2 would be relocated from their current frequencies. But, the specifics as to where MDS would relocate and how the relocation would be funded were to be determined at a future time. In addition, on January 31, 2003 the FCC reduced the MSS (Mobile Satellite) band to 40 MHz, provided MSS with Ancillary Terrestrial Component authority (ATC) and enabled MSS terrestrial base stations to be deployed in the 2000-2020 MHz and 2180-2200 MHz bands. Subsequently, the Commission released a *Third Notice of Proposed Rulemaking* in ET Docket No. 00-258 in which several frequency bands have been offered up as potential candidates for the MDS relocation.

WCA has proposed that the MDS channels be relocated to available spectrum in the 1900 MHz band. The WCA is recommending the MDS band be split into two non-contiguous channels and relocated just above the PCS frequencies. This would result in MDS being relocated to 1910-1916 MHz and 1990-1996 MHz. Figure 2 shows the proposed spectrum locations relative to the existing PCS allocations and proposed MSS allocations.

Looking carefully at Figure 2, several potential issues become readily apparent regarding relocation to the 1910-1916 MHz and the 1990-1996 MHz frequencies. First, the MDS channels must coexist immediately adjacent to the

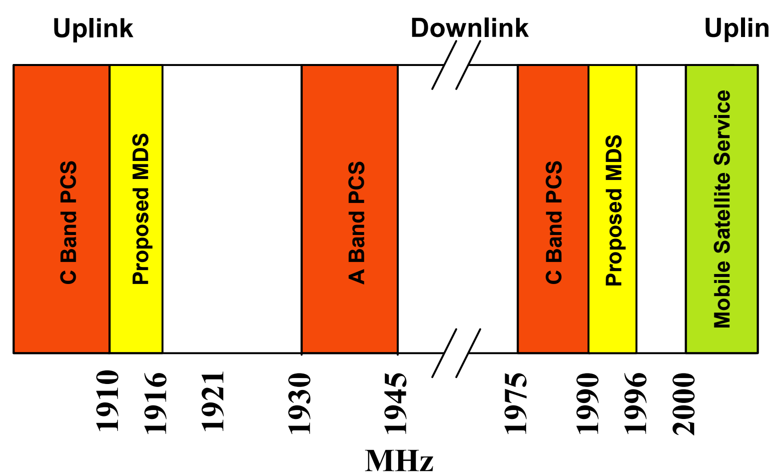

Figure 2

PCS C block frequencies. In order to coexist and not cause inter-service interference, the MDS-1 and 2 channels will have to adopt similar technical operational parameters to that of the PCS band. The probability of inter-service interference is minimized when similar operational guidelines are maintained and when uplink frequencies are grouped together in a contiguous block and separated from a similarly grouped set of downlink frequencies. The MDS service will therefore have to sacrifice certain operational flexibility in terms of power, height and uplink/downlink flexibility in order to comply with technical operational requirements as set out in current FCC and industry guidelines to coexist within the PCS block spectrum.

Coexistence within the PCS band will also require the operations at 1910-1916 MHz not cause interference to the PCS A block handsets receiving just 14 MHz away at 1930 MHz. TIA has adopted certain minimum standards for PCS handset design that are routinely followed by system operators in the United States, including restrictions on the OOBE from handsets into the 1930-1990 MHz band. These standards are discussed in more detail below. Current PCS handsets utilize duplexer filters to limit the amount of OOBE from a transmitting handset that could potentially cause interference to handsets receiving in the A block frequencies. These filters are designed to work in the 20 MHz between 1910 and 1930 MHz and provide sufficient attenuation for handset protection. The proposed location for MDS at 1910-1916 MHz will require this filter be widened to include the additional 6 MHz MDS channel while maintaining the same amount of attenuation at the 1930 MHz channel boundary.[1]

WCA has requested that we perform interference analyses to determine if the proposed MDS spectrum locations shown in Figure 2 can protect the adjacent services described previously. In addition, the *Third Notice of Proposed Rulemaking* inquires as to whether it is feasible to pair the 1910-1920 MHz and 1990-2000 MHz bands for an expanded PCS-like service, and WCA has requested that we perform similar analyses to consider the feasibility of that expanded pairing.

Interference Analysis Methodology

The methodology used in this report to judge whether a band location is acceptable for operation is to analyze the impact of OOBE levels on services that will be adjacent. Unacceptable OOBE levels will result in degraded receiver performance. This equates to reduced coverage areas, dropped calls or sessions, the inability to make calls or connections and overall system performance degradation. The impact of OOBE can be minimized or eliminated by physical separation between a victim receiver and an interfering transmitter.

[1] Because the MSS industry never suggested that upstream MSS/ATC operations will be adversely impacted if directly adjacent to downstream broadband PCS, this report does not consider any possible interference from the WCA proposal to MSS/ATC at 2000-2020 MHz.

The impact of OOBE levels will be evaluated by calculating the required physical separation distance between a victim receiver and an interfering transmitter in order to give a measurable impact to system performance. For purposes of this paper, a measurable impact to system performance will be defined as no more than 1 dB of degradation to a victim receiver's noise floor by the OOBE from an interfering transmitter. The 1 dB degradation criteria was chosen as this represents a significant reduction to the potential coverage area for a system. The following example shows the impact of 1 dB degradation in receiver noise floor and the corresponding reduction in coverage area.

If we assume a standard PCS like channel bandwidth of 1.25 MHz and a noise figure of 5 dB, the thermal noise floor for a typical base station receiver is calculated at –108.03 dBm as shown in Figure 3. If we now assume a typical 15 dBi base station antenna gain and a handset with 1 watt (30 dBm) EIRP, the amount of path loss it would take to reach the noise floor is 153 dB. This path loss budget can be translated into a maximum coverage distance through the use of a propagation model. Assuming circular or omni-directional coverage, this maximum coverage distance can then be translated into a maximum possible coverage area as shown in Figure 3. The impact of 1 dB degradation in receiver performance is realized by recalculating the maximum coverage area with the path loss budget reduced from 153 dB to 152 dB. As can be seen from the resulting comparison of coverage area reduction shown in Figure 3, 1 dB degradation in receiver noise floor will result in a 10% to 20% reduction in coverage area depending upon the selected propagation model. The impact on coverage may seem and would lead to the conclusion that the operator needs to just add additional cells. However the additional interference may make the system less spectrally efficient leading the operator to require more spectrum to accomplish coverage requirements. The 1 dB figure of merit is also supported by the United States' NSMA (National Spectrum Managers Association) Document WG 20.97.048, Rev 1.0 titled "Inter-PCS-Co-block Consideration Procedure".

Potential Interference to PCS A Block Handsets

Again looking at Figure 2 and assuming the MDS-1 and 2 channels are now constrained to the same technical standards as PCS services and described in Part 24 of the Commission's Rules and those described in TIA/EIA TSB-84A and 98-E, the potential interference from the OOBE of the MDS channels can be calculated to the PCS A block handsets. Interference analyses will be performed by applying standards given in TIA/EIA 98-E.

Noise Floor (1.25 MHz Bandwidth)	-113.03	dBm
Base Station Rx Noise Figure	5	dB
Total Noise Power	-108.03	dBm

Base station Rx Ant Gain	15	dBi
Handset Tx Power	30	dBm
Carrier Frequency	1900	MHz
Required C/N	0	dB
Path Loss Budget to Noise Floor	153	dB
Coverage Area, No Interference		
Free Space Path Loss Only	357,053.0	Mi
ITU Outdoor-to-Indoor Path Loss	1.7	Mi
ITU Vehicular Path Loss	22.6	Mi
Coverage Area, With Interference		
Free Space Path Loss Only	283,617.3	Mi
ITU Outdoor-to-Indoor Path Loss	1.5	Mi
ITU Vehicular Path Loss	20.0	Mi
Percent Reduction in Area		
Free Space Path Loss Only	20.6%	
ITU Outdoor-to-Indoor Path Loss	10.9%	
ITU Vehicular Path Loss	11.5%	

Figure 3

Included in the interference analyses is the response of a state-of-the-art handset duplexer provided by Agilent Technologies (HPMD-7904) and shown in the attached Figure 4. According to Agilent, the passband of the duplexer can be widened another 6 MHz (curve in Figure 4) to allow the 1910-1916 MHz signal to be transmitted without increasing the power consumption or size of the MDS handset and still meeting the OOBE requirement specified in TIA/EIA 98E within the PCS downlink band. This standard is specified at –76 dBm measured in 1 MHz. However, the duplexer cannot be widened to accommodate expansion of the channel into the 1916-1920 MHz band. Planned duplexer technology is capable of meeting the necessary attenuation specifications including the additional 1910-1916 MHz channel with only 500 kHz of margin. The Agilent duplexer will require a transition of 13.5 MHz to accomplish the TIA specifications. The Agilent duplexer uses “state of the art” F-BAR technology. Ceramic “state of the art” filter technology would also require 14 MHz to accomplish the TIA specification leaving no margin. This includes guardband in the filter passband to account for response drift due to normal temperature variations within the handset. If the passband of the duplexer is extended beyond the 1916 MHz point, normal operating conditions within a handset will cause attenuation to the OOBE at 1930 to decrease and will result in harmful interference to A block receivers in close proximity.

A detailed interference analysis of the potential for interference from an MDS handset operating in the 1910-1916 MHz band to a PCS A block handset operating at 1930 MHz is attached as Figures 5. As can be seen from the results, a handset operating in the 1910-1916 MHz channel can operate within ranges that current PCS customers enjoy. As this separation distance can easily be achieved in most rooms, operation in the 1910-1916 MHz band is judged to be more than adequate and is acceptable by PCS industry standards.

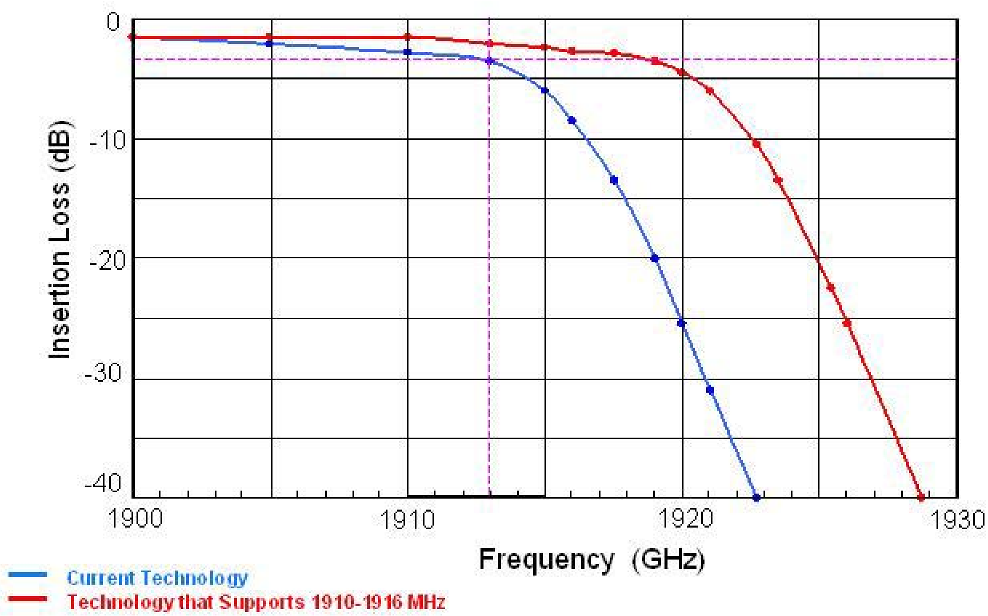

Figure 4

However, if WCA's proposed 1910-1916 MHz band is expanded to add the 1916-1920 MHz band as proposed in the *Third Notice of Proposed Rulemaking*, the required separation distance increases dramatically (assuming that the OOBE restriction is lifted such that a handset could operate using the state-of-the-art Agilent filter across the entire 1910-1920 MHz band). Attached as Figure 6 is another interference analysis with the upper edge of the proposed MDS channel moved 4 MHz from 1916 to 1920 MHz. The analysis shows a handset operating at 1920 MHz using the Agilent filter will create an interference potential for an A block handset within 27.78 meters. This is a completely unacceptable separation distance as handsets regularly come and stay within this distance of each other under normal operating conditions. For example, if a 1920 MHz handset were in use by someone on a sidewalk, a significant interference potential would exist for handsets operating in passing cars or in buildings around the user. Other cell phone users walking in the vicinity of the 1920 MHz handset could be prevented.

Another way to look at the issue is to examine how a handset manufacturer would meet the TIA standard for OOBE into the 1930-1990 MHz band using the state-of-the-art Agilent filter. In order to meet the standard, the manufacturer would be required to design the handset so as to not transmit in the 1916.5-1920 MHz band, effectively using that band (as well as the 1920-1930 MHz band) as a guardband.

Desensitization to A Block Handset from 1910-1916 MHz Handset	
1910-1916 MHz Handset Tx Parameters	
Gt antenna	0.0000
Tx Duplexer suppression at A band	-64.0000
EIRPmax within A band	-64.0000
Tx Freq (closest channel to A block) (MHz)	1916.0000
A Block Handset Rx Parameters	
Gt A Block antenna (dBi)	0.0000
Rx Bandwidth (MHz)	1.0000
Ktb Noise floor (dBm)	-114.0000
Rx LNA Noise Figure	9.0000
Rx Noise Floor (dBm)	-105.0000
A Rx Freq (closest channel to 1916MHz) (MHz)	1930.0000
Interference Results	
Frequency Separation (MHz)	14.0000
Interference Level to for 1dB degradation (6dB below noise floor)	-111.0000
Free Space Path Loss to achieve 1dB degradation	47.0000
Distance to achieve required Path Loss (ft)	9.13
Distance to achieve required Path Loss (mtrs)	2.78
Distance to achieve required Path Loss (mi)	0.0017

Figure 5

Conclusions

The interference analyses contained in this paper have shown that the WCA proposal for relocation of the MDS channels within the 1910-1916 MHz and 1990-1996 MHz frequency bands is a viable alternative. In order to protect existing PCS handsets receiving on the A block frequencies, the customer-to-base channel needs to be removed from the 1930 MHz boundary by a minimum of 13.5 MHz. Locating MDS at 1910-1916 MHz provides adequate interference protection to the A block receivers.

In addition, the analyses contained in this paper have shown that expanding the proposed new band to 1916-1920 MHz is not viable. Given the current state-of-the-art in duplex filters that are feasible for use in today's handsets, the 1916-1920 MHz band cannot be used without violating the TIA standard restriction on OOBE into the existing broadband PCS 1930-1990 MHz block.

Desensitization to A Block Handset from 1920 MHz Handset	
1920 MHz Tx Parameters	
Gt antenna	0.0000
Tx Mask suppression at A band	-44.0000
EIRPmax within A band	-44.0000
Tx Freq (closest channel to A block) (MHz)	1920.0000
A Block Rx Parameters	
Gt A Block antenna	0.0000
Rx Bandwidth (MHz)	1.0000
Ktb Noise floor (dBm)	-114.0000
Rx LNA Noise Figure	9.0000
Rx Noise Floor (dBm)	-105.0000
A Rx Freq (closest channel to 1920MHz) (MHz)	1930.0000
Interference Results	
Frequency Separation (MHz)	10.0000
Interference Level to for 1dB degradation (6dB below noise floor)	-111.0000
Path Loss to achieve 1dB degradation	67.0000
Distance to achieve required Path Loss (ft)	91.0137
Distance to achieve required Path Loss (mtrs)	27.7413
Distance to achieve required Path Loss (mi)	0.0172

Figure 6

ATTACHMENT C

LCC REPORT ON 2155-2180 MHz BAND

Advance Wireless Services,

Multipoint Distribution Services,

Mobile Satellite Services (with Ancillary Terrestrial Component)

Co-Existence Interference Analysis

Prepared for

Wireless Communications Association

April 14, 2003

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1 Executive Summary

The Wireless Communications Association International, Inc. (WCA) has requested that LCC examine interference and co-existence issues between Time Division Duplex (TDD) and Frequency Division Duplex (FDD) radio interface technologies operating in adjacent bands and in the same geographic area. LCC has previously analyzed TDD and FDD co-existence issues and within this interference analysis determines required guard band and guard zone when Advanced Wireless Services ("AWS") at 2110-2155 MHz, Multipoint Distribution Services ("MDS") located between 2155-2180 MHz and Mobile Satellite Services ("MSS") at 2180-2200 MHz (with an Ancillary Terrestrial Component ("ATC")) are operating in close spectral and geographic proximity.

LCC provides an interference analysis as well as a detailed examination of the International Telecommunications Union (ITU) ITU-R Working Party 8F document 8F/67-E. Working Party 8F has spent several years examining co-existence and interference issues between IMT 2000 FDD and TDD systems. Utilizing methodology performed by the ITU and other industry accepted standards, the minimum guard band-guard zones for AWS, MDS, and MSS/ATC services is determined based on the maximum allowed degradation in a victim system's performance in terms of increased noise/interference generated by the aggressor system.

This report summarizes LCC's main findings and conclusions and is organized as follows: Section 2 provides a brief overview of the current, proposed and under discussion spectrum usage plans. Section 3 examines the technical considerations regarding interference and deployment issues between the adjacent bands. Section 4 provides the interference analysis results. Recommendations and conclusions are given in section 5.

2 Overview of Current and Proposed Spectrum Plans

The 2150-2162 MHz is currently allocated to the Multipoint Distribution Services ("MDS") and is currently authorized for use in delivering a broad array of video, data and voice services. The Commission's rules permit MDS channels to be used in either conjunction with other spectrum for an FDD service or for a stand-alone TDD service. At present, the most prevalent use of the 2150-2162 MHZ band is for customer to base transmission in wireless broadband systems and/or the hi-power downstream transmission of video programming. In its November 2002 *Second Report and Order* in ET Docket No. 00-258, the Federal Communications Commission ("FCC") reallocated the 1710-1755 MHz and 2110-2115 MHz bands for AWS and on November 22, 2002 FCC released a *Notice of Proposed Rulemaking* in WT Docket No. 02-353 in which it proposed the 1710-1755 and 2110-2155 MHz bands be used for full "flexible use" AWS (Third Generation IMT2000 TDD/FDD systems), thus requiring MDS to be relocated to a different portion of the spectrum. Prior to the release of the *Second Report and Order*, the WCA proposed to the Commission that MDS be relocated to the 1910-1916 MHz and 1990-1996 MHz band pair and that MDS be required to operate consistent with the PCS standards and guidelines to avoid interference. Furthermore, in IB docket 01-185, the FCC authorized Mobile Satellite Services ("MSS") to provide Auxiliary Terrestrial Component ("ATC") in the 2180-2200 MHz band. As an alternative to the WCA proposal, FCC is seeking comments on relocation of MDS between 2155 and 2180 MHz. If MDS is assigned a single block of spectrum, by simply sliding to higher frequencies, MDS may also choose to deploy an IMT2000 TDD system. The relocation of MDS requires a very careful examination of potential mutual interference that adjacent band TDD and FDD systems operating in the same geographical area may create for each other.

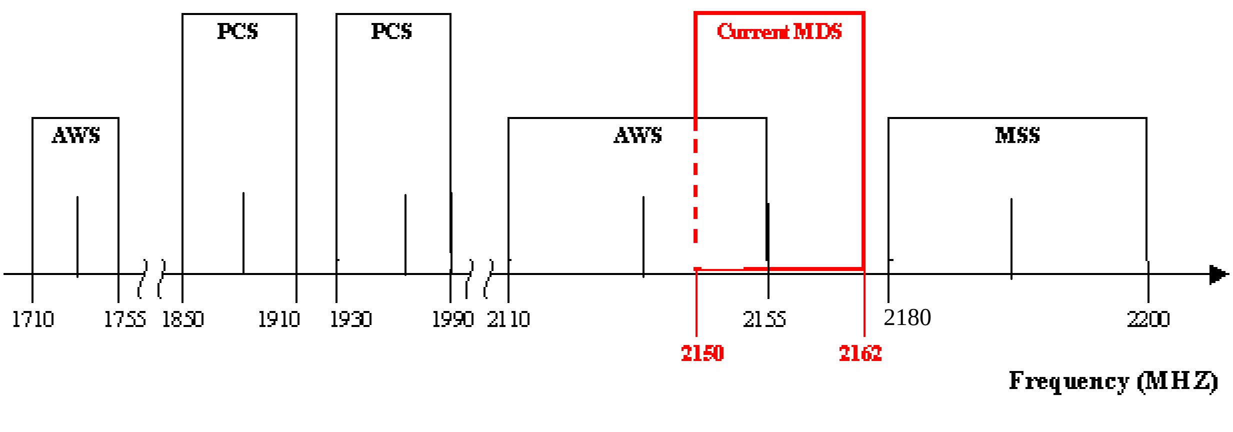

Figure 1 - Spectrum Allocation 1710-2200 MHz (not to scale)

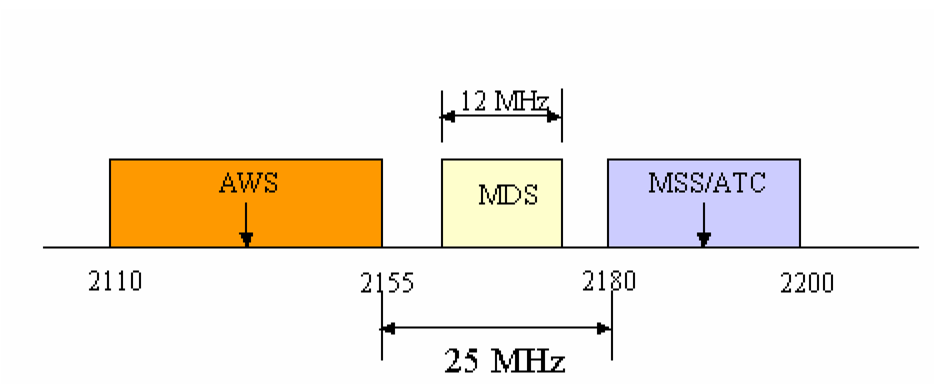

Figure 2 - Area of Interference Analysis 2110-2200 MHz

3 Technical Considerations

The purpose of this section is to provide technical analysis of the above spectrum deployment plans and address potential interference and system deployment related issues. The analysis will have two parts: Part I will examine interference between MDS and MSS/ATC. Part II will examine AWS and MDS interference scenarios. The interference analysis and results regarding AWS and MDS reported below are based on the published work of International Telecommunication Union, Radio Group (ITU-R) Working Party 8F/67-E document. ITU-R documents are the results of many years of research and development by top scientists and telecommunications engineers. They include contributions from all major operators as well as equipment manufactures. After many rounds of reviews and critiques, which typically is a very lengthy and thorough process, the final results serve as the industry de facto guidelines and standards. ITU-R Working Party 8F/67-E document, in particular, examines in great detail the coexistence issues between IMT2000 TDD and FDD radio interfaces operating in adjacent bands and in the same geographical area. The main portion of this document describes Base Station to Base Station (BS-BS), Base Station to Mobile Station (or Customer Premises Equipment (CPE) or handset) (BS-MS), and Mobile Station (or CPE or Handset) to Mobile Station (or CPE or Handset) (MS-MS) interference scenarios and the amount of guard band and geographical distance required to avoid excessive performance degradation.

3.1 Performance Degradation Metrics

Mutual interference between adjacent band systems will degrade (increase) the noise floors of both systems. The rise in the noise floor of the receiver can lead to Receiver Desensitization and/or Receiver Overload, which in turn can cause degradation in cell site's performance in terms of coverage and/or capacity.

The ITU-R Working Party 8F/67-E document defines the maximum tolerable external (i.e. other system's) interference, I_{ext}, as the amount of interference that would reduce the victim cell site's capacity significantly. With standard industry accepted range of parameters, for macro base station, I_{ext} is shown to be in the range of –114 to –106 dBm.

Receiver desensitization is typically defined as the degradation in receiver sensitivity due to an increase in the receiver noise floor. An acceptable degradation in noise floor has been defined in the United States' NSMA (National Spectrum Managers Association) Document WG 20.97.048, Rev 1.0 titled "Inter-PCS-Co-block Consideration Procedure". It defines the degradation of approximately 1 dB as an acceptable limit between interfering digital systems. Mathematically the 1 dB tolerance dictates that an interfering signal be at least 6 dB below the effective noise floor of the receiver. With typical receiver noise figure of 5 dB for IMT-2000 FDD and TDD systems, the maximum tolerable interference to avoid receiver desensitization can be easily calculated to be –109 dBm. This is in line with the aforementioned range of the maximum tolerable interference to avoid excessive capacity loss of –114 to –106 dBm.

Receiver overload occurs when the Low Noise Amplifier (LNA) in the front end of the receiver is pushed into saturation. This happens when input power levels exceed rated limits. Typically, a receiver is defined as overloaded when the total input power exceeds the receiver's 1 dB compression point minus safety margin. Based on 3GPP specifications, it can be shown that maximum tolerable external interference power, which would cause receiver blocking or overload is –40 dBm. It is obvious that the receiver desensitization is typically more severe of a problem and will occur before receiver overload. However, both are likely to occur without sufficient guard band, geographical separation, or both.

In terms of path loss, the minimum path loss distance required to prevent excessive noise rise, PL_{Min}^{Noise} can be computed as

$$PL_{Min}^{Noise} = TX\ Power + TX\ Ant.Gain + RX\ Ant.Gain - ACIR - Max\ Tolerable\ Noise$$

Above, *ACIR* is the Adjacent Channel Interference power Ratio and is defined as

$$ACIR = \frac{1}{\frac{1}{ACLR} + \frac{1}{ACS}} \quad (in\ linear\ terms)$$

Where *ACLR* is the Adjacent Channel Leakage power Ratio and depends on *TX* filter quality and *ACS* is the Adjacent Channel Selection and depends on the *RX* filter quality. In general both *ACLR* and *ACS*, and therefore *ACIR*, will depend on the frequency separation between the *TX* and the *RX*.

The noise floor of the receiver without considering the noise contribution from the aggressive transmitter can be computed as

Noise Floor (in dBm) = KTB (in dBm) + Noise Figure (in dB)

Where *K* is the Boltzmann's constant, *T* is the temperature in Kelvin and *B* is the bandwidth (typically 6 MHz). Then *Max. Tolerable Noise* power at the receiver can be computed as

$$Max.\ Tolerable\ Noise\ (in\ dBm) = 10 \log \left(10^{(Noise\ Floor + Max.\ Allowed\ Increase\ in\ Noise\ Floor)/10} - 10^{(Noise\ Floor)/10}\right)$$

Where *Max. Allowed Increase in Noise Floor* is a parameter that depends on how much degradation in performance can be tolerated. A typical value is *1 dB* and this value will be used through this study.

Similarly, the minimum distance needed to prevent receiver BFO can be computed as

$$PL_{Min}^{BFO} = TX\ Power + TX\ Ant.Gain + RX\ Ant.Gain - ACIR - Max\ \ Signal\ to\ Cause\ BFO$$

Where “Max. Signal to Cause BFO” may vary from vendor to vendor.

3.2 Deployment Scenarios

ITU-R Working Party 8F/67-E document examines various TDD and FDD deployment scenarios. The analysis results show significant interference in macro cell BS to macro cell BS combinations. Most of the emphasis from hereon will be on macro cell AWS, MDS and MSS/ATC deployment scenarios, which would also best describe proposed deployments in the United States. Also, analysis and results are provided for collocated sites and sites in close proximity.

3.2.1 BS-BS Collocation

Collocation of multiple operators on the same tower or building is a common practice that will become even more prevalent in future systems as the number of operators increases and more cell density is required for greater coverage and capacity. Because of deployment constraints, site acquisition difficulties, and other logistical and engineering issues, it is highly likely that TDD and FDD sites will have some number of co-sites (i.e., collocated). When collocated, mutual interference between the systems occurs. The amount of interference that one system introduces into the other system will depend on: 1) The interfering system’s transmit (TX) output power, TX filter characteristics, and TX antenna gain and pattern; 2) the victim receiver’s (RX) filtering characteristics and the RX antenna gain and pattern; 3) the amount of geographical separation and 4) the spectral separation between facilities. The term “antenna isolation” refers to the total path loss between the antenna ports of the RX and the TX units of collocated base stations, including the propagation loss and *effective* antenna gains of both stations. In the ITU-R Working Party 8F/67-E document, an industry standard value of 30 dB is assumed for the antenna isolation and is referred to as the Minimum Coupling Loss (MCL) between collocated base stations.

3.2.2 BS-BS Proximity

In case the base stations are not located on the same tower or rooftop, the physical distance separation can provide the extra isolation needed to protect both systems. The exact amount of path loss will depend on the physical distance between the TX and RX and the propagation path loss model.

3.3 General Assumptions

The primary assumptions made in the analysis are summarized in the following table.

Table 1 - General Parameter Values

Parameter	Value
FDD BS Height (AGL)[1]	50 m
TDD BS Height (AGL) [1]	50 m
FDD CPE Height (AGL) [1]	2 m
TDD CPE Height (AGL) [1]	2 m
Noise Figure of BS[1]	5 dB
Noise Figure of Handset[1]	9 dB
FDD TX Power[1]	43 dBm
BS Antenna Gain[1]	15 dBi
Handset Antenna Gain[1]	0 dBi
MDS Supercell (Hi-Power) BS EIRP[2]	2000 Watts
MDS Typical Cellular BS EIRP[3]	500 Watts
Supercell (Hi-Site) Height (AGL) [4]	300 m

[1] ITU WP – 8F document values

[2] MDS peak EIRP

[3] MDS typical values

[4] Some MDS sites are located on structures and mountain tops well above 300 meters

4 Results

Interference analysis results between AWS and MDS and MDS and MSS/ATC are summarized below.

4.1 Interference Analysis Results between AWS and MDS (Non-Collocated Sites)

The BS/MS transmit and receive filter characteristics, specified by Adjacent Channel Leakage power Ratio (ACLR) and Adjacent Channel Selectivity (ACS), respectively, are based on 3GPP standard recommendations. BS/MS ACLR and ACS values are given in the following tables:

Table 2 - FDD BS and TDD BS ACLR Values

Spacing From Block Edge (MHz)	FDD BS ACLR (dB)	TDD BS ACLR (dB)
0	45	70
5	50	70
10	67	70

Table 3 – FDD MS and TDD MS ACLR Values

Spacing From Block Edge (MHz)	FDD MS ACLR* (dB)	TDD MS ACLR* (dB)
5	43	43
10	53	53

Table 4 – FDD BS and TDD BS ACS Values

Spacing From Block Edge (MHz)	FDD BS ACS (dB)	TDD BS ACS (dB)
0	46	46
5	58	58
10	66	66

Table 5 – FDD MS and TDD MS ACS Values

Spacing From Block Edge (MHz)	FDD MS ACS* (dB)	TDD MS ACS* (dB)
5	43	43
10	53	53

* MS ACLR and ACS values for 10 MHz frequency spacing from block edge were extrapolated.

Table 6 – FDD BS to TDD BS ACIR; TDD BS to FDD BS ACIR

Spacing From Block Edge (MHz)	FDD BS to TDD BS ACIR (dB)	TDD BS to FDD BS ACIR (dB)
0	42	46
5	49	58
10	63	64

Table 7 – FDD BS to TDD MS ACIR; TDD BS to FDD MS ACIR

Spacing From Block Edge (MHz)	FDD BS to TDD MS ACIR (dB)	TDD BS to FDD MS ACIR (dB)
5	42.2	42.9
10	52.7	52.9

The ACLR and ACS values used for Supercell BS and CPE are given in the following table.

Table 8 – Supercell BSE and CPE ACLR and ACS Values

Spacing From Block Edge (MHz)	Supercell BS ACLR (dB)	Supercell BS ACS (dB)	Supercell CPE ACS (dB)
5	50	60	40
10	67	70	50

Following table summarizes the minimum separation distances required for the different interference cases.

Table 9 – Minimum Required Separation between AWS and MDS

Interference Case	Min. Required Separation
FDD (AWS) BS to TDD (MDS) BS[1]	80.1 Km @ 0 MHz Separation 44.9 Km @ 5 MHz Separation 6.3 Km @ 10 MHz Separation
MDS Hi-Power (2000 Watts) to AWS Handset[2]	126.9 Km @ 0 MHz 2.25 Km @ 5 MHz
MDS Hi-Power (500 Watts) to AWS Handset[3]	63.7 Km @ 0 MHz 1.1 Km @ 5 MHz
AWS BS to MDS Response Station Hub[4]	55 Km
AWS BS to MDS CPE[5]	4.9 Km

AWS BS to MDS Nomadic CPE[6]	31 Km
MDS CPE (2 Watts) to AWS Handset[7]	4.8 Km @ 0 MHz 85.5 m @ 5 MHz
MDS CPE (< 24 dBm) to AWS Handset[8]	1.4 Km @ 0 MHz 357 m @ 5 MHz

[1]Assumes AWS BS and MDS BS are not collocated and have LOS. With Dual Slope path loss model this distance is 76.3 Km @ 0 MHz

[2]Assumes MDS BS uses 60 dBc @ 3 MHz from channel edge FCC filter (normalized to 5 MHz); also assumes MDS BS and AWS handset have LOS. With Dual Slope path loss model this distance is 96.1 Km @ 0 MHz

[3]Assumes MDS BS uses 60 dBc @ 3 MHz from channel edge filter (normalized to 1 MHz); also assumes MDS BS and AWS handset have LOS.

[4]Assumes AWS BS uses 43 + 10 log P filter (normalized to 6 MHz); also MDS response station hub and AWS BS are not collocated and have LOS

[5]Assumes AWS BS uses 43 + 10 log P filter (normalized to 6 MHz); also MDS CPE and AWS BS and have LOS

[6]Assumes AWS BS uses 43 + 10 log P filter (normalized to 6 MHz); also MDS CPE and AWS BS and have LOS and MDS CPE has 12 dBi antenna gain

[7]Assumes MDS CPE of 2 watts with 60 dBc @ 3 MHz from channel edge filter (normalized to 5 MHz) and have LOS

[8]Assumes low power MDS CPE (24 dBm) with 43 + 10 log P filter (normalized to 5 MHz) and have LOS

From above results it is clear that even with 10 MHz of guard band, an MDS Base Station and AWS Base Station are required to be more than 6 km apart. When considering an AWS Base Station and MDS Response Station Hub, the required separation is 55 Km. And requiring MDS CPE's and AWS handsets to be more than 174 meters apart without harmful interference occurring would preclude existence of both systems in the same geographic area. This requirement would make deployment of actual systems impractical! Current cellular deployments, in major cities, have sites placed about 2-3 miles from each other. Assuming similar deployment for AWS, above results strongly indicate that AWS and MDS systems cannot be deployed in the same geographical area (market).

4.2 Interference Analysis Results between AWS and MDS (Collocated Sites)

For Collocated sites, since noise floor is –107 dBm, with a receiver noise figure of 5 dB, the Maximum Allowed Interference to avoid receiver Desense is

MAI_Desense = -107 + 5 - 6dB = -108 dBm

Assuming a Minimum Coupling Loss (MCL) of 30 dB (an Industry de facto number, also recommended by ITU), and using ACIR values, computed in Table 6 above, maximum interference at the receiver input of the victim system can be calculated as

Int@_Victim_Rec = Max TX power - ACIR - MCL

The extra protection needed is (Int@_Victim_Rec - MAI_Desense). These values are summarized in Table 10 below.

Table 10 - Extra Protection Needed for Collocated AWS and MDS Sites

Interfered System	Max. TX Power	ACLR of TX	ACS of RX	ACIR	Int@_Victim_Rec	Extra Protection Needed
MDS (TDD)	43 dBm	45 @ 0 MHz	46 @ 0 MHz	42.46	-29.46 dBm	78.54 dB
	43 dBm	50 @ 5 MHz	58 @ 5 MHz	49.36	-36.36	71.64 dB
	43 dBm	67 @ 10 MHz	66 @ 10 MHz	63.46	-50.46	57.54 dB
AWS (FDD)	40.2 dBm	70 @ 0 MHz	46 @ 0 MHz	45.98	-35.78	72.22 dB
	40.2 dBm	70 @ 5 MHz	58 @ 5 MHz	57.73	-47.53	60.47 dB
	40.2 dBm	70 @ 0 MHz	66 @ 10 MHz	64	-53.8	54.2 dB

From these results, it is clear that an extra protection as much as 78 dB is needed to protect the victim system. Even with as much as 10 MHz of guard band, extra protection of more than 57 dB is needed. Given these requirements, and recognizing that both MDS and AWS will be deployed in the same geographic areas, collocation of these facilities will not be possible.

4.3 Interference Analysis Results between MDS and MSS/ATC (Non-Collocated Sites)

The following table summarizes the results of interference analysis between MDS and MSS/ATC.

Table 11 – Minimum Required Separation between MDS and MSS/ATC

Interference Case	Min. Required Separation
MDS Hi-Power (2000 watts) BS to MSS/ATC Handset[9]	125.7 Km @ 0 MHz 2.25 Km @ 5 MHz
MDS Typical Cellular (500 watts) BS to MSS/ATC Handset[10]	63 Km @ 0 MHz 1.1 Km @ 5 MHz
MSS BS to MDS Response Station Hub[11]	1.15 Km @ Any Frequency Separation
MSS BS to MDS CPE[12]	102 m @ Any Frequency Separation
MSS BS to MDS Nomadic CPE	0.6 Km
MDS CPE (2 Watts) to MSS/ATC Handset[13]	3.9 Km @ 0 MHz 70.9 m @ 5 MHz
MDS CPE (< 24 dBm) to MSS/ATC Handset[14]	1.4 Km @ 0 MHz 355 m @ 5 MHz

[9] Assumes 60 dBc @ 3 MHz FCC filter, normalized to 1.23 MHz; hi-power case and have LOS. With Dual Slope path loss model this distance is 96.2 Km @ 0 MHz

[10] Assumes 60 dBc @ 3 MHz FCC filter, normalized to 1.23 MHz; typical case and have LOS.

[11] Assumes –100.6 dBW/4 KHz out of channel emission; MSS BS and MDS Response Stations are not collocated and have LOS

[12] Assume –100.6 dBW/4 KHz out of channel emission; MSS BS and MDS CPE have LOS

[13] Assumes 60 dBc @ 3 MHz FCC filter, normalized to 1.23 MHz, and have LOS

[14] Assumes 43 + 10 log P filter, normalized to 1.23 MHz, and have LOS

Above results clearly show that MSS/ATC handsets and MDS CPE cannot be operated in the same household or in close proximity (i.e. on a bus, in an airport terminal, at a park). Also, MSS/ATC handsets are restricted to stay more than 1.1 Km away from "typical" MDS base stations. Cellular bases stations with similar transmit powers are typically deployed with radius of 2-3 miles (or less). Similar deployment for MDS would completely prevent operation of MSS/ATC handsets. Also, above results show that MDS Response Station Hubs have to be more than 1.1 Km away from MSS base stations regardless of frequency separation.

4.4 Interference Analysis Results between MDS and MSS/ATC (Collocated Sites)

Since the choice of technology for MSS/ATC is not finalized yet, all the specification (e.g., ACLR and ACS, etc.) needed to perform exact collocated interference analysis between MDS and MSS/ATC collocated sites is not available. However, assuming that MSS/ATC will adopt cdma2000, and since cdma2000 and WCDMA technologies are expected to have similar TX power values, ACLR and ACS values, and similar noise figures values, etc. it is logical to expect the same type of results we obtained in section 4.2 above. Section 4.2 clearly indicated that even with 10 MHz of guard band, 57 dB extra protection was needed, which in practical deployment with current equipment is almost impossible to obtain.

5 Conclusions

The following are LCC's conclusions based on the published results of ITU-R Working Party 8F/67-E document, the current spectrum usage plan, and the results of interference analysis between AWS and MDS and MDS and MSS/ATC:

1. There is no fundamental difference in magnitude of interference when considering FDD downlink (DL) to TDD uplink (UL) or FDD uplink (UL) interference, or when considering FDD DL and TDD DL to FDD UL interference. The potential problems come from the basic fact that DL transmitters are geographically and spectrally close to sensitive UL receivers, regardless of the duplex method involved.

2. According to results shown in Table 10, for collocated systems even with 10 MHz of separation between AWS and an MDS TDD system an extra 57.54 dB of isolation is needed to prevent receiver desensitization. LCC believes this solution is not feasible because technically, it is unforeseeable to achieve 57.54 dB (i.e., a factor of over half a million) of equipment improvement in the near future.

3. Also, according to Tables 9 for macro AWS and MDS base stations in close proximity, even with 10 MHz of frequency separation (guard band), we still need at least 6.3 km of geographical separation. Based on LCC's twenty years experience in design and deployment of wireless systems, this kind of stringent requirement would make actual design and deployment of a cellular system impractical. The problem becomes even more severe as the number of operators and base stations in a given geographical area increases.

4. Also according to table 11, even with 10 MHz of frequency guard band, MSS/ATC handset has to be more than 1.1 Km away from typical cellular MDS BS! With typical deployment of MDS BSs, this requirement will practically preclude MSS/ATC handsets from operation in the same market. Also, minimum required separation between MDS CPE and MSS/ATC handset is 70.9 m, which would prevent operation of both devices in the same household, or airport area, etc. The problem becomes even more severe as the number of operators and number of CPEs and handsets in a given geographical area increases.

5. Most importantly, for both collocated and near proximity macro base stations, in excess of 10 MHz of guard bands on either side will be needed.

6. From above analysis, it is clear that collocation of AWS and MDS or MDS and MSS/ATC is practically impossible. Furthermore, the following table highlights some of the interference analysis results between AWS and MDS, and MDS and MSS/ATC. These results clearly indicate that placing MDS anywhere in the 2155-2180 MHz band, would cause severe interference problems for all the systems (AWS, MDS and MSS/ATC), and would make practical deployment of these systems impossible.

Table 12 - Summary of Results

Aggressor System	Victim System	Minimum Required Separation
AWS BS	MDS BS	6.3 – 80.1 (Km) [1] 55 (Km) [2]
MDS Supercell (2000 Watts) BS	AWS Handset	2.25 – 126 (Km)
MDS Cellular (500 Watts) BS	AWS Handset	1.1 – 126 (Km)
AWS BS	MDS CPE	4.9 – 31 (Km)
MDS (2 Watts) CPE	AWS Handset	0.085 – 4.8 (Km)
MDS (< 24 dBm) CPE	AWS Handset	0.357 – 1.4 (Km)
MDS Supercell (2000 Watts) BS	MSS/ATC Handset	2.25 – 125.7 (Km)
MDS Cellular (500 Watts) BS	MSS/ATC Handset	1.1 – 63 (Km)
MDS (2 Watts) CPE	MSS/ATC Handset	0.071 – 3.9 (Km)
MDS (< 24 dBm) CPE	MSS/ATC Handset	0.355 – 1.4 (Km)
MSS BS	MDS CPE	0.102 – 0.6 (Km)
MSS BS	MDS Response Station Hub	1.15 Km

[1]Based on ITU filter specifications;
[2]Based on United States' NSMA (National Spectrum Managers Association) Document WG 20.97.048, Rev 1.0 titled "Inter-PCS-Co-block Consideration Procedure" specifications for performance degradation

6 References

[1] ITU-R WP 8F Document: "Report on the coexistence between IMT-2000 TDD and FDD radio interface technologies operating in adjacent bands and in the same geographical area", March 4, 2002

7 Appendix 1 - Supporting Calculations

Desensitization to MDS CPE from AWS Base Stations

Bandwidth of MDS CPE in MHz	6
Noise figure of MDS CPE in dB	9
Transmitter Mask of AWS Base Station in dBm	-5.21
Antenna Gain of AWS Base Station	15
Antenna Gain of MDS RS Hub	0
Effective Noise Power in dBm*	9.79
Frequency of ACLR interferer in MHz	2160

KTB Rx Noise Floor dBm	-106.2184875
Rx Noise Floor dBm	-97.2184875
Attenuation required for 1 dB desensitization	113.0084875
Distance - 1 dB desense in meters	**4927.479089**
Distance - 1 dB desense in feet	**16166.07339**
Distance - 1 dB desense in miles	**3.061756325**

*** Assumes AWS Base Station (at 43 + 10 Log P watts / 1 MHz) normalized to 6 MHz and MDS CPE have LOS to each other**

Desensitization to MDS Response Station Hubs from AWS Base Stations

Bandwidth of MDS Receiver in MHz	6
Noise figure of MDS Receiver in dB	5
Transmitter Mask of AWS Base Station in dBm	-5.21
Antenna Gain of AWS Base Station	15
Antenna Gain of MDS RS Hub	17
Effective Noise Power in dBm*	26.79
Frequency of ACLR interferer in MHz	2160

KTB Rx Noise Floor dBm	-106.2184875
Rx Noise Floor dBm	-101.2184875
Attenuation required for 1 dB desensitization	134.0084875
Distance - 1 dB desense in meters	**55287.22471**
Distance - 1 dB desense in feet	**181386.3268**
Distance - 1 dB desense in miles	**34.35347099**

*** Assumes AWS Base Station (at 43 + 10 Log P watts / 1 MHz) normalized to 6 MHz and MDS RS Hub are not collocated and have LOS to each other**

Desensitization to MDS Nomadic CPE from AWS Base Stations

Bandwidth of MDS CPE in MHz	6
Noise figure of MDS CPE in dB	5
Transmitter Mask of AWS Base Station in dBm	-5.21
Antenna Gain of AWS Base Station	15
Antenna Gain of MDS RS Hub	12
Effective Noise Power in dBm*	21.79
Frequency of ACLR interferer in MHz	2160

KTB Rx Noise Floor dBm	-106.2184875
Rx Noise Floor dBm	-101.2184875
Attenuation required for 1 dB desensitization	129.0084875
Distance - 1 dB desense in meters	**31090.29121**
Distance - 1 dB desense in feet	**102001.0274**
Distance - 1 dB desense in miles	**19.3183764**

*** Assumes AWS Base Station (at 43 + 10 Log P watts / 1 MHz) normalized to 6 MHz and MDS CPE have LOS to each other**

Desensitization to MDS TDD Rx from AWS FDD Base Stations

	0 MHz Guard Band	5 MHz	10 MHz
Bandwidth of MDS Receiver in MHz	6	6	6
Noise figure of MDS Receiver in dB	5	5	5
Transmitter Mask of AWS Base Station in dBm	-2	-7	-24
Antenna Gain of AWS Base Station	15	15	15
Antenna Gain of MDS RS Hub	17	17	17
Effective Noise Power in dBm*	30	25	8
Frequency of ACLR interferer in MHz	2155	2160	2165
KTB Rx Noise Floor dBm	-106.2184875	-106.218	-106.2184875
Rx Noise Floor dBm	-101.2184875	-101.218	-101.2184875
Attenuation required for 1 dB desensitization	137.2184875	132.2185	115.2184875
Distance - 1 dB desense in meters	**80192.04092**	**44990.91**	**6340.45815**
Distance - 1 dB desense in feet	**263094.0478**	**147606.2**	**20801.7751**
Distance - 1 dB desense in miles	**49.82841815**	**27.95572**	**3.939730133**

*** Assumes 3GPP FDD AWS Base Station and MDS TDD Rx are not collocated and have LOS to each other**

Desensitization to AWS Handsets from MDS High Power Base Stations

Bandwidth of AWS Handset in MHz	5
Noise figure of AWS Handset in dB	9
Transmitter Mask of MDS Base Station in dBm*	37.2
Antenna Gain of MDS Base Station	0
Antenna Gain of AWS Handset	0
Effective Noise Power in dBm*	37.2
Frequency of ACLR interferer in MHz	2155

KTB Rx Noise Floor dBm	-107.0103
Rx Noise Floor dBm	-98.01029996
Attenuation required for 1 dB desensitization	141.2103
Distance - 1 dB desense in meters	**126976.0724**
Distance - 1 dB desense in feet	**416583.0985**
Distance - 1 dB desense in miles	**78.89831411**

*** Assumes AWS Handset and MDS Base Station (2000 watt E.I.R.P. and 25 dBc at 0 MHz from MDS channel edge) normalized to 5 MHz and have LOS to each other**

Desensitization to AWS Handsets from MDS High Power Base Stations

Bandwidth of AWS Handset in MHz	5
Noise figure of AWS Handset in dB	9
Transmitter Mask of MDS Base Station in dBm*	2.2
Antenna Gain of MDS Base Station	0
Antenna Gain of AWS Handset	0
Effective Noise Power in dBm*	2.2
Frequency of ACLR interferer in MHz	2160

KTB Rx Noise Floor dBm	-107.0103
Rx Noise Floor dBm	-98.01029996
Attenuation required for 1 dB desensitization	106.2103
Distance - 1 dB desense in meters	**2252.762525**
Distance - 1 dB desense in feet	**7390.863291**
Distance - 1 dB desense in miles	**1.399784714**

*** Assumes AWS Handset and MDS Base Station (2000 watt E.I.R.P. and 60 dBc at 3 MHz from MDS channel edge) normalized to 5 MHz and have LOS to each other**

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Desensitization to AWS Handsets from MDS Cellular Base Stations

Bandwidth of AWS Handset in MHz	5
Noise figure of AWS Handset in dB	9
Transmitter Mask of MDS Base Station in dBm*	31.21
Antenna Gain of MDS Base Station*	0
Antenna Gain of MSS/ATC Handset	0
Effective Noise Power in dBm*	31.21
Frequency of ACLR interferer in MHz	2155

KTB Rx Noise Floor dBm	-107.0103
Rx Noise Floor dBm	-98.01029996
Attenuation required for 1 dB desensitization	135.2203
Distance - 1 dB desense in meters	**63712.09554**
Distance - 1 dB desense in feet	**209026.643**
Distance - 1 dB desense in miles	**39.58837936**

*** Assumes AWS Handset and MDS Base Station (500 watt E.I.R.P. and 25 dBc at 0 MHz from MDS channel edge) normalized to 5 MHz and have LOS to each other**

Desensitization to AWS Handsets from MDS Cellular Base Stations

Bandwidth of AWS Handset in MHz	5
Noise figure of AWS Handset in dB	9
Transmitter Mask of MDS Base Station in dBm*	-3.79
Antenna Gain of MDS Base Station*	0
Antenna Gain of MSS/ATC Handset	0
Effective Noise Power in dBm*	-3.79
Frequency of ACLR interferer in MHz	2160

KTB Rx Noise Floor dBm	-107.0103
Rx Noise Floor dBm	-98.01029996
Attenuation required for 1 dB desensitization	100.2203
Distance - 1 dB desense in meters	**1130.35644**
Distance - 1 dB desense in feet	**3708.473408**
Distance - 1 dB desense in miles	**0.702362388**

*** Assumes AWS Handset and MDS Base Station (500 watt E.I.R.P. and 60 dBc at 3 MHz from MDS channel edge) normalized to 5 MHz and have LOS to each other**

Desensitization to AWS Handsets from MDS CPE

Bandwidth of AWS Handset in MHz	5
Noise figure of AWS Handset in dB	9
Transmitter Mask of MDS CPE in dBm	-26.21
Antenna Gain of MDS CPE	0
Antenna Gain of AWS Handset	0
Effective Noise Power in dBm*	-26.21
Frequency of ACLR interferer in MHz	2160

KTB Rx Noise Floor dBm	-107.0103
Rx Noise Floor dBm	-98.01029996
Attenuation required for 1 dB desensitization	77.80029996
Distance - 1 dB desense in meters	**85.54909368**
Distance - 1 dB desense in feet	**280.6694666**
Distance - 1 dB desense in miles	**0.053157096**

*** Assumes AWS Handset and MDS CPE (2 watt E.I.R.P. and 60 dBc at 3 MHz from MDS channel edge) normalized to 5 MHz and have LOS to each other**

Desensitization to AWS Handsets from MDS CPE

Bandwidth of AWS Handset in MHz	5
Noise figure of AWS Handset in dB	9
Transmitter Mask of MDS CPE in dBm	-13.79
Antenna Gain of MDS CPE	0
Antenna Gain of AWS Handset	0
Effective Noise Power in dBm*	-13.79
Frequency of ACLR interferer in MHz	2160

KTB Rx Noise Floor dBm	-107.0103
Rx Noise Floor dBm	-98.01029996
Attenuation required for 1 dB desensitization	90.22029996
Distance - 1 dB desense in meters	**357.4500918**
Distance - 1 dB desense in feet	**1172.722261**
Distance - 1 dB desense in miles	**0.222106489**

*** Assumes AWS Handset and MDS CPE 24 dBm and below (43 +10 log P watts) at MDS channel edge normalized to 5 MHz and have LOS to each other**

Desensitization to AWS Handsets from Low Power MDS CPE 0 MHz

Bandwidth of AWS Handset in MHz	5
Noise figure of AWS Handset in dB	9
Transmitter Mask of MDS CPE in dBm	-1.79
Antenna Gain of MDS CPE	0
Antenna Gain of AWS Handset	0
Effective Noise Power in dBm*	-1.79
Frequency of ACLR interferer in MHz	2155

KTB Rx Noise Floor dBm	-107.0103
Rx Noise Floor dBm	-98.01029996
Attenuation required for 1 dB desensitization	102.2203
Distance - 1 dB desense in meters	**1426.336151**
Distance - 1 dB desense in feet	**4679.523643**
Distance - 1 dB desense in miles	**0.886273417**

*** Assumes AWS Handset and MDS CPE 24 dBm and below 25 dBc at 0 MHz normalized to 5 MHz and have LOS to each other**

Desensitization to MDS CPE from MSS Base Stations

Bandwidth of MDS Receiver in MHz	6
Noise figure of MDS Receiver in dB	9
Transmitter Mask of MSS Base Station in dBm	-38.84
Antenna Gain of MSS Base Station	15
Antenna Gain of MDS RS Hub	0
Effective Noise Power in dBm*	-23.84
Frequency of ACLR interferer in MHz	2170

KTB Rx Noise Floor dBm	-106.2184875
Rx Noise Floor dBm	-97.2184875
Attenuation required for 1 dB desensitization	79.3784875
Distance - 1 dB desense in meters	**102.1218814**
Distance - 1 dB desense in feet	**335.0414685**
Distance - 1 dB desense in miles	**0.063454824**

*** Assumes MSS Base Station -100.6 dBW/4 kHz normalized to 6 MHz and MDS CPE are not collocated and have LOS to each other**

Desensitization to MDS Response Station Hubs from MSS Base Stations

Bandwidth of MDS Receiver in MHz	6
Noise figure of MDS Receiver in dB	5
Transmitter Mask of MSS Base Station in dBm	-38.84
Antenna Gain of MSS Base Station	15
Antenna Gain of MDS RS Hub	17
Effective Noise Power in dBm*	-6.84
Frequency of ACLR interferer in MHz	2170

KTB Rx Noise Floor dBm	-106.2184875
Rx Noise Floor dBm	-101.2184875
Attenuation required for 1 dB desensitization	100.3784875
Distance - 1 dB desense in meters	**1145.826355**
Distance - 1 dB desense in feet	**3759.227106**
Distance - 1 dB desense in miles	**0.711974831**

*** Assumes MSS Base Station -100.6 dBW/4 kHz normalized to 6 MHz and MDS RS Hub are not collocated and have LOS to each other**

Desensitization to MSS/ATC Handsets from MDS High Power Base Stations

Bandwidth of MSS/ATC Handset in MHz	1.23
Noise figure of MSS/ATC Handset in dB	9
Transmitter Mask of MDS Base Station in dBm*	31.12
Antenna Gain of MDS Base Station*	0
Antenna Gain of MSS/ATC Handset	0
Effective Noise Power in dBm*	31.12
Frequency of ACLR interferer in MHz	2180

KTB Rx Noise Floor dBm	-113.1009489
Rx Noise Floor dBm	-104.1009489
Attenuation required for 1 dB desensitization	141.2209489
Distance - 1 dB desense in meters	**125673.907**
Distance - 1 dB desense in feet	**412310.9542**
Distance - 1 dB desense in miles	**78.08919587**

*** Assumes MSS Handset and MDS Base Station (2000 watt E.I.R.P. and 25 dBc at 0 MHz from MDS channel edge) normalized to 1.23 MHz and have LOS to each other**

Desensitization to MSS/ATC Handsets from MDS High Power Base Stations

Bandwidth of MSS/ATC Handset in MHz	1.23
Noise figure of MSS/ATC Handset in dB	9
Transmitter Mask of MDS Base Station in dBm	-3.88
Antenna Gain of MDS Base Station	0
Antenna Gain of MSS/ATC Handset	0
Effective Noise Power in dBm*	-3.88
Frequency of ACLR interferer in MHz	2170

KTB Rx Noise Floor dBm	-113.1009489
Rx Noise Floor dBm	-104.1009489
Attenuation required for 1 dB desensitization	106.2209489
Distance - 1 dB desense in meters	**2245.131983**
Distance - 1 dB desense in feet	**7365.82901**
Distance - 1 dB desense in miles	**1.395043373**

*** Assumes MSS Handset and MDS Base Station (2000 watt E.I.R.P. and 60 dBc at 3 MHz from MDS channel edge) normalized to 1.23 MHz and have LOS to each other**

Desensitization to MSS/ATC Handsets from MDS Cellular Base Stations

Bandwidth of MSS/ATC Handset in MHz	1.23
Noise figure of MSS/ATC Handset in dB	9
Transmitter Mask of MDS Base Station in dBm*	25.12
Antenna Gain of MDS Base Station *	0
Antenna Gain of MSS/ATC Handset	0
Effective Noise Power in dBm*	25.12
Frequency of ACLR interferer in MHz	2180

KTB Rx Noise Floor dBm	-113.1009489
Rx Noise Floor dBm	-104.1009489
Attenuation required for 1 dB desensitization	135.2209489
Distance - 1 dB desense in meters	**62986.15781**
Distance - 1 dB desense in feet	**206644.9865**
Distance - 1 dB desense in miles	**39.13730805**

*** Assumes MSS Handset and MDS Base Station (500 watt E.I.R.P. and 25 dBc at 0 MHz from MDS channel edge) normalized to 1.23 MHz and have LOS to each other**

Desensitization to MSS/ATC Handsets from MDS High Power Base Stations

Bandwidth of MSS/ATC Handset in MHz	1.23
Noise figure of MSS/ATC Handset in dB	9
Transmitter Mask of MDS Base Station in dBm	-9.88
Antenna Gain of MDS Base Station	0
Antenna Gain of MSS/ATC Handset	0
Effective Noise Power in dBm*	-9.88
Frequency of ACLR interferer in MHz	2170

KTB Rx Noise Floor dBm	-113.1009489
Rx Noise Floor dBm	-104.1009489
Attenuation required for 1 dB desensitization	100.2209489
Distance - 1 dB desense in meters	**1125.231488**
Distance - 1 dB desense in feet	**3691.659465**
Distance - 1 dB desense in miles	**0.699177929**

*** Assumes MSS Handset and MDS Base Station (500 watt E.I.R.P. and 60 dBc at 3 MHz from MDS channel edge) normalized to 1.23 MHz and have LOS to each other**

Desensitization to MSS/ATC Handsets from MDS CPE

Bandwidth of MSS/ATC Handset in MHz	1.23
Noise figure of MSS/ATC Handset in dB	9
Transmitter Mask of MDS CPE in dBm	-33.88
Antenna Gain of MDS CPE	0
Antenna Gain of MSS/ATC Handset	0
Effective Noise Power in dBm*	-33.88
Frequency of ACLR interferer in MHz	2170

KTB Rx Noise Floor dBm	-113.1009489
Rx Noise Floor dBm	-104.1009489
Attenuation required for 1 dB desensitization	76.22094889
Distance - 1 dB desense in meters	**70.99730714**
Distance - 1 dB desense in feet	**232.9279653**
Distance - 1 dB desense in miles	**0.044115145**

*** Assumes MSS Handset and MDS CPE (2 watt E.I.R.P. and 60 dBc at 3 MHz from MDS channel edge) normalized to 1.23 MHz and have LOS to each other**

Desensitization to MSS/ATC Handsets from MDS CPE

Bandwidth of MSS/ATC Handset in MHz	1.23
Noise figure of MSS/ATC Handset in dB	9
Transmitter Mask of MDS CPE in dBm	-19.88
Antenna Gain of MDS CPE	0
Antenna Gain of MSS/ATC Handset	0
Effective Noise Power in dBm*	-19.88
Frequency of ACLR interferer in MHz	2170

KTB Rx Noise Floor dBm	-113.1009489
Rx Noise Floor dBm	-104.1009489
Attenuation required for 1 dB desensitization	90.22094889
Distance - 1 dB desense in meters	**355.8294396**
Distance - 1 dB desense in feet	**1167.405226**
Distance - 1 dB desense in miles	**0.221099475**

*** Assumes MSS Base Station -100.6 dBW/4 kHz normalized to 6 MHz and Nomadic MDS CPE and have LOS to each other**

Desensitization to MSS/ATC Handsets from MDS CPE 0 MHz

Bandwidth of MSS/ATC Handset in MHz	1.23
Noise figure of MSS/ATC Handset in dB	9
Transmitter Mask of MDS CPE in dBm	-7.88
Antenna Gain of MDS CPE	0
Antenna Gain of MSS/ATC Handset	0
Effective Noise Power in dBm*	-7.88
Frequency of ACLR interferer in MHz	2180

KTB Rx Noise Floor dBm	-113.1009489
Rx Noise Floor dBm	-104.1009489
Attenuation required for 1 dB desensitization	102.2209489
Distance - 1 dB desense in meters	**1410.084429**
Distance - 1 dB desense in feet	**4626.204995**
Distance - 1 dB desense in miles	**0.876175188**

*** Assumes MSS Handset and MDS CPE 24 dBm 25 dBc at 0 MHz normalized to a 1.23 MHz bandwidth and have LOS to each other**

Desensitization to Nomadic MDS CPE from MSS Base Stations

Bandwidth of MDS Receiver in MHz	6
Noise figure of MDS Receiver in dB	5
Transmitter Mask of MSS Base Station in dBm	-38.84
Antenna Gain of MSS Base Station	15
Antenna Gain of MDS RS Hub	12
Effective Noise Power in dBm*	-11.84
Frequency of ACLR interferer in MHz	2170

KTB Rx Noise Floor dBm	-106.2184875
Rx Noise Floor dBm	-101.2184875
Attenuation required for 1 dB desensitization	95.3784875
Distance - 1 dB desense in meters	**644.345511**
Distance - 1 dB desense in feet	**2113.968752**
Distance - 1 dB desense in miles	**0.40037287**

*** Assumes MSS Base Station -100.6 dBW/4 kHz normalized to 6 MHz and Nomadic MDS CPE and have LOS to each other**

ATTACHMENT D

MARCONI REPORT ON 2155-2180 MHz BAND

Engineering Statement Regarding Relocation of the MDS1 and MDS2 Frequencies to 2155-2180 MHz

Introduction

Marconi Wireless has been retained on behalf of the Wireless Communication Association International, Inc. ("WCA"), to analyze certain interference issues in connection with the possible relocation of the MDS band frequencies (2150-2162 MHz) to the 2155-2180 MHz band. The Commission has decided to reallocate 2150-2155 MHz to the Advanced Wireless Services ("AWS") for 3G mobile applications and therefore, a suitable location for the MDS band frequencies must be found.

Background

Currently, the MDS band is located at 2150-2162 MHz and broken down into two, 6 MHz channels as shown in Figure 1. MDS-1 is located from 2150-2156 MHz and MDS-2 from 2156-2162 MHz. These channels are licensed across the country either on a site-specific or BTA basis depending on the date of license. Services that operate on these channels currently enjoy excellent operational capabilities because of the favorable propagation characteristics at 2.1 GHz, the ability to broadcast at relatively high power levels and antenna heights, stringent interference protection from co- and adjacent channel licensees and freedom from interference caused by out-of-band emissions ("OOBE") generated by services in adjacent bands. In addition, current FCC rules allow operators tremendous flexibility to choose the type of service to be offered. Operators are free to offer analog television, digital television, one-way digital data or two-way digital data services. These data services can also be operated in a frequency division duplex ("FDD") mode or in a time division duplex

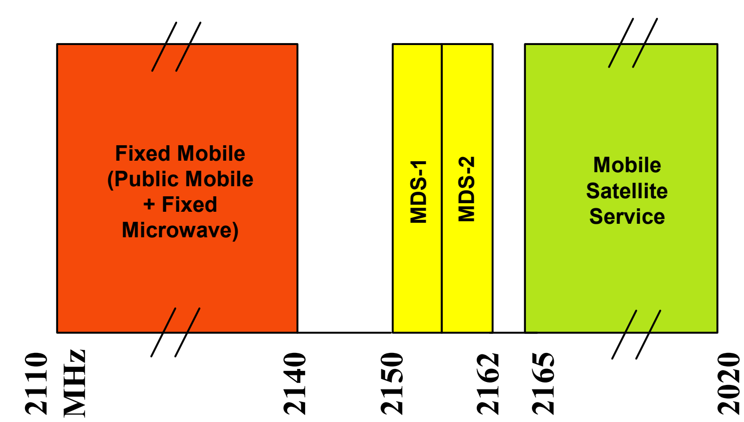

Figure 1

("TDD") mode.

However, in its November 2002 *Second Report and Order* in ET Docket No. 00-258, the Commission reallocated the 1710-1755 MHz and 2110-2155 MHz bands for AWS. Since the AWS allocation took 5 MHz that is currently occupied by MDS-1, the FCC announced that MDS-1 and 2 would be relocated from their current frequencies. But, the specifics as to where MDS would relocate and how the relocation would be funded were to be determined at a future time. In addition, on January 31, 2003 the FCC reduced the MSS (Mobile Satellite) band to 40 MHz, provided MSS with Ancillary Terrestrial Component authority (ATC) and enabled MSS terrestrial base stations to be deployed in the 2000-2020 MHz and 2180-2200 MHz bands. Subsequently, the Commission released a *Third Notice of Proposed Rulemaking* in ET Docket No. 00-258 in which several frequency bands have been offered up as potential candidates for the MDS relocation.

The proposal has been put forth to slide the MDS-1 and 2 channels up in frequency to a 12 MHz contiguous block somewhere in the 2155-2180 MHz band as shown in Figure 2.

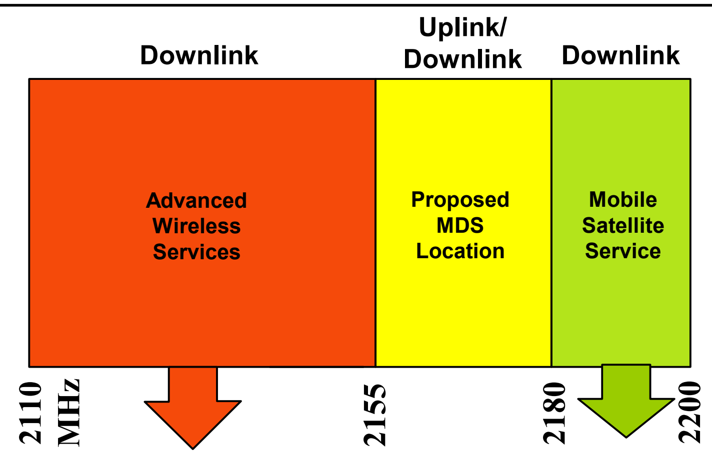

Figure 2

Looking carefully at Figure 2, several potential issues become readily apparent regarding relocation within the 2155-2180 MHz frequencies. First, the MDS channels must coexist with AWS[1] and MSS ATC services in adjacent bands. Because the MDS channels are both uplink and downlink capable, the potential exists for significant interference from AWS and MSS base station OOBE to MDS handset and base station receivers. Typically, inter-system

[1] It can be assumed from *Second Report and Order* in ET Docket No. 00-258 that AWS services will operate from 2110-2155 MHz in only a downlink mode. However it has been suggested that these services may be TDD and thus, may have an uplink component.

interference of this nature can be minimized by adopting similar technical standards for the adjacent systems. However, since the proposed spectrum is located between two services with different technical standards, there is not an opportunity to standardize and minimize potential interference. In addition, another technique for minimizing inter-system interference is to group uplink and downlink channels together. Again, since both AWS and MSS services are operating in a downlink mode and the MDS service needs to operate both uplink and downlink channels, similar services cannot be grouped together in frequency.

Coexistence will also require that AWS and MSS services be able to protect the MDS service in 2155-2180 MHz. Again because the MDS band will incorporate both uplink and downlink channels, there is potential for interference from AWS and MSS base stations to MDS base station and handset receivers.

WCA has requested we perform interference analyses to determine if the proposed MDS spectrum locations shown in Figure 2 can protect the adjacent services described previously and are afforded interference protection from these same services. These analyses will take into account that a 12 MHz block of contiguous MDS spectrum could be placed anywhere in the 2155-2180 MHz band in order to minimize interference and maximize the potential for coexistence.

Interference Analysis Methodology

The methodology used in this report to judge whether a band location is acceptable for operation is to analyze the impact of OOBE levels on services that will be adjacent. At these power levels, noise degradation from OOBE will occur at a receiver before signal overload. Unacceptable OOBE levels will result in degraded receiver performance. This equates to reduced coverage areas, dropped calls or sessions, the inability to make calls or connections and overall system performance degradation. The impact of OOBE can be minimized or eliminated by physical separation between a victim receiver and an interfering transmitter.

The impact of OOBE levels will be evaluated by calculating the required physical separation distance between a victim receiver and an interfering transmitter in order to give a measurable impact to system performance. For purposes of this paper, a measurable impact to system performance will be defined as no more than 1 dB of degradation to a victim receiver’s noise floor by the OOBE from an interfering transmitter. The 1 dB degradation criteria was chosen as this represents a significant reduction to the potential coverage area for a system. The following example shows the impact of 1 dB degradation in receiver noise floor and the corresponding reduction in coverage area.

If we assume a standard PCS like channel bandwidth of 1.25 MHz and a noise figure of 5 dB, the thermal noise floor for a typical base station receiver is calculated at –108.03 dBm as shown in Figure 3. If we now assume a typical 15 dBi base station antenna gain and a handset with 1 watt (30 dBm) EIRP, the amount of path loss it would take to reach the noise floor is 153 dB. This path loss budget can be translated into a maximum coverage distance through the use of a propagation model. Assuming circular or omni-directional coverage, this maximum coverage distance can then be translated into a maximum possible coverage area as shown in Figure 3. The impact of 1 dB degradation in receiver performance is realized by recalculating the maximum coverage area with the path loss budget reduced from 153 dB to 152 dB. As can be seen from the resulting comparison of coverage area reduction shown in Figure 3, 1 dB degradation in receiver noise floor will result in a 10% to 20% reduction in coverage area depending upon the selected propagation model. The impact on coverage may seem and would lead to the conclusion that the operator needs to just add additional cells. However the additional interference may make the system less spectrally efficient leading the operator to require more spectrum to accomplish coverage requirements. The 1 dB figure of merit is also supported by the LCC paper, "An acceptable degradation in noise floor has been defined in the United States' NSMA (National Spectrum Managers Association) Document WG 20.97.048, Rev 1.0 titled "Inter-PCS-Co-block Consideration Procedure".

Noise Floor (1.25 MHz Bandwidth)	-113.03	dBm
Base Station Rx Noise Figure	5	dB
Total Noise Power	-108.03	dBm
Base Station Rx Ant Gain	15	dBi
Handset Tx Power	30	dBm
Carrier Frequency	2160	MHz
Required C/N	0	dB
Path Loss Budget to Noise Floor	153	dB
Coverage Area, No Interference		
Free Space Path Loss Only	276,269.1	mi
ITU Outdoor-to-Indoor Path Loss	1.6	mi
ITU Vehicular Path Loss	21.1	mi
Coverage Area, With Interference		
Free Space Path Loss Only	219,448.4	mi
ITU Outdoor-to-Indoor Path Loss	1.4	mi
ITU Vehicular Path Loss	18.7	mi
Percent Reduction in Area		
Free Space Path Loss Only	20.6%	mi

ITU Outdoor-to-Indoor Path Loss	10.9% mi
ITU Vehicular Path Loss	11.5% mi

Interference From AWS Base Stations to MDS Base Station and Handset Receivers

The *Notice of Proposed Rulemaking* in ET Docket No. 02-353 suggests that emissions from AWS base stations operating in the 2110-2155 MHz band be attenuated to 43 + 10Log(P) as measured in a 1 MHz channel for frequencies in the 2155-2180 MHz band, where P is transmitter output power measured in watts. This results in an interference transmitter output power of –13 dBm across the entire 2155-2180 MHz band. Therefore, the level of interference caused by AWS base stations to MDS handsets or MDS base stations will be constant.

Attached as Figure 4 is an analysis of the potential for interference from an AWS base station to an MDS base station receiver located in the 2155-2180 MHz band. This analysis assumes the AWS transmitter is operating at the closest frequency to the MDS band and typical operating configurations for both the MDS and AWS systems. As the results show, an AWS base station must be separated from an MDS base station by at least 55 kilometers in order to prevent a 1 dB degradation in the noise floor.

Desensitization to MDS Base Stations from AWS Base Station Operations

FCC Specifications	
AWS Parameters	
Gt AWS Block antenna	15.0000
AWS Block TPOmax within MDS band (dBm)	-5.2185
AWS Tx Freq (closest channel to MDS block) (MHz)	2155.0000
MDS Rx Parameters	
Gt MDS Block antenna (dBi)	17.0000
Rx Bandwidth (mHz)	6.0000
ktb Noise floor (dBm)	-106.2185
Rx LNA Noise Figure	5.0000
Rx Noise Floor (dBm)	-101.2185
A Rx Freq (MHz)	2168.0000
Interference Results	
Frequency Separation (MHz)	13.0000
Interference Level to for 1dB degradation (6dB below noise floor)	-107.2185
Free Space Path Loss to achieve 1dB degradation	134.0000
distance to achieve required Path Loss (ft)	181629.61
distance to achieve required Path Loss (mtrs)	55361.38
distance to achieve required Path Loss (mi)	34.3995

Figure 4

It is not practical to expect AWS and MDS base stations to be separated by 55 kilometers, as both services will be targeting the same geographical areas around the country. Base station separation distances on the order of a 1-2 kilometers should be the goal for adequate system design. Therefore, it is apparent there is no location in the 2155-2180 MHz band that will adequately protect an MDS uplink receiver from potential interference caused by AWS base stations.

Similar analyses were performed to calculate the potential for interference from AWS base stations to MDS handsets or nomadic devices. The level of interference radiated from an AWS base station will be the same as described in the previous analysis, but the characteristics of the MDS receivers will change. A nomadic device is different from a handset in that the device is not intended to be mobile. A nomadic device is intended to have either an integrated or external antenna and will be portable in nature. The nomadic unit is not intended to be operational while being ported from one location to the next, but to become operational once its location is fixed. Therefore, the nomadic devices may have directional receive antennas with higher gains than a typical handset and different noise figures on the receiver front end.

Attached as Figures 5 and 6 are interference analyses from AWS base stations to MDS handsets and nomadic devices. The separation distances calculated in Figures 5 and 6 would require an AWS base station to be located at least 4.9 kilometers from an MDS handset and at least 31.1 kilometers from an MDS nomadic receiver. Again, these separation requirements are not practical as AWS and MDS systems will be serving the same geographic areas across the country. Therefore, there is no location in the proposed 2155-2180 MHz band where an MDS downlink service can exist without significant risk for interference from AWS base stations.

Desensitization to MDS Handset from AWS Base Station Operations

FCC Specifications	
AWS Parameters	
Gt AWS Block antenna	15.0000
AWS Block TPOmax within MDS band (dBm)	-5.2185
AWS Tx Freq (closest channel to MDS block) (MHz)	2155.0000
MDS Rx Parameters	
Gt MDS Block antenna (dBi)	0.0000
Rx Bandwidth (mHz)	6.0000
ktb Noise floor (dBm)	-106.2185
Rx LNA Noise Figure	9.0000
Rx Noise Floor (dBm)	-97.2185
A Rx Freq (MHz)	2168.0000
Interference Results	
Frequency Separation (MHz)	13.0000
Interference Level to for 1dB degradation (6dB below noise floor)	-103.2185
Free Space Path Loss to achieve 1dB degradation	113.0000
distance to achieve required Path Loss (ft)	16187.76
distance to achieve required Path Loss (mtrs)	4934.09
distance to achieve required Path Loss (mi)	3.0659

Figure 5

Desensitization to MDS Nomadic Stations from AWS Base Station Operations

FCC Specifications	
AWS Parameters	
Gt AWS Block antenna	15.0000
AWS Block TPOmax within MDS band (dBm)	-5.2185
AWS Tx Freq (closest channel to MDS block) (MHz)	2155.0000
MDS Rx Parameters	
Gt MDS Block antenna (dBi)	12.0000
Rx Bandwidth (mHz)	6.0000
ktb Noise floor (dBm)	-106.2185
Rx LNA Noise Figure	5.0000
Rx Noise Floor (dBm)	-101.2185
A Rx Freq (MHz)	2168.0000
Interference Results	
Frequency Separation (MHz)	13.0000
Interference Level to for 1dB degradation (6dB below noise floor)	-107.2185
Free Space Path Loss to achieve 1dB degradation	129.0000
distance to achieve required Path Loss (ft)	102137.84
distance to achieve required Path Loss (mtrs)	31131.99
distance to achieve required Path Loss (mi)	19.3443

Figure 6

Interference From MSS ATC Base Stations to MDS Base Station and Handset Receivers

The *Second Report and Order* in ET Docket No. 00-258 requires that the emissions mask for MSS/ATC base stations operating in the 2180-2200 MHz band be attenuated to –100.6 dBW measured in a 4 kHz channel for all frequencies below 2180 MHz. This corresponds to an interfering transmitter output power of –38.8 dBm at any frequency in the 2155-2180 MHz band when measured in a 1 MHz channel bandwidth. This results in the interference results for MDS base station receivers, handsets and nomadic devices contained in Figures 7, 8 and 9.

Desensitization to MDS Base Stations from MSS Base Station Operations

FCC Specifications -100.6 dBW/4kHz

MSS Parameters	
Gt MSS Block antenna	15.0000
MSS Block EIRPmax within MSS band (dBm)	-70.6000
Bandwidth (MHz)	0.0040
Power in Rx Bandwidth (dBm)	-38.8391
MSS Tx Freq (closest channel to MDS block) (MHz)	2180.0000
MDS Rx Parameters	
Gt MDS Block antenna (dBi)	17.0000
Rx Bandwidth (mHz)	6.0000
ktb Noise floor (dBm)	-106.2185
Rx LNA Noise Figure	5.0000
Rx Noise Floor (dBm)	-101.2185
Rx Freq (MHz)	2167.0000
Interference Results	
Frequency Separation (MHz)	13.0000
Interference Level to for 1dB degradation (6dB below noise floor)	-107.2185
Free Space Path Loss to achieve 1dB degradation	100.3794
distance to achieve required Path Loss (ft)	3742.38
distance to achieve required Path Loss (mtrs)	1140.69
distance to achieve required Path Loss (mi)	0.7088

Figure 7

The separation distances calculated in Figures 7, 8 and 9 would require an MSS base station be located at least 1.1 kilometers from an MDS base station, 101.7 meters from an MDS handset and 641.5 meters from an MDS nomadic receiver. These separation requirements are much more reasonable than the AWS requirements. Separation of base stations by 1.1 kilometers can be achieved within many markets. However, in the urban markets where large numbers of base stations may be required to address coverage and capacity concerns, this will not be the case. Urban markets would present difficult challenges for MSS and MDS systems to coexist, no matter what portion of the 2155-2180 MHz band the MDS service is located within.

Desensitization to MDS Mobile Stations from MSS Base Station Operations	
FCC Specifications -100.6 dBW/4kHz	
MSS Parameters	
Gt MSS Block antenna	15.0000
MSS Block EIRPmax within MSS band (dBm)	-70.6000
Bandwidth (MHz)	0.0040
Power in Rx Bandwidth (dBm)	-38.8391
MSS Tx Freq (closest channel to MDS block) (MHz)	2180.0000
MDS Rx Parameters	
Gt MDS Block antenna (dBi)	0.0000
Rx Bandwidth (MHz)	6.0000
ktb Noise floor (dBm)	-106.2185
Rx LNA Noise Figure	9.0000
Rx Noise Floor (dBm)	-97.2185
A Rx Freq (MHz)	2167.0000
Interference Results	
Frequency Separation (MHz)	13.0000
Interference Level to for 1dB degradation (6dB below noise floor)	-103.2185
Free Space Path Loss to achieve 1dB degradation	79.3794
Distance to achieve required Path Loss (ft)	333.54
Distance to achieve required Path Loss (mtrs)	101.66
Distance to achieve required Path Loss (mi)	0.0632

Figure 8

Desensitization to MDS Nomadic Stations from MSS Base Station Operations

FCC Specifications -100.6 dBW/4kHz

MSS Parameters	
Gt MSS Block antenna	15.0000
MSS Block EIRPmax within MSS band (dBm)	-70.6000
Bandwidth (MHz)	0.0040
Power in Rx Bandwidth (dBm)	-38.8391
MSS Tx Freq (closest channel to MDS block) (MHz)	2180.0000
MDS Rx Parameters	
Gt MDS Block antenna (dBi)	12.0000
Rx Bandwidth (mHz)	6.0000
ktb Noise floor (dBm)	-106.2185
Rx LNA Noise Figure	5.0000
Rx Noise Floor (dBm)	-101.2185
A Rx Freq (MHz)	2167.0000
Interference Results	
Frequency Separation (MHz)	13.0000
Interference Level to for 1dB degradation (6dB below noise floor)	-107.2185
Free Space Path Loss to achieve 1dB degradation	95.3794
distance to achieve required Path Loss (ft)	2104.49
distance to achieve required Path Loss (mtrs)	641.46
distance to achieve required Path Loss (mi)	0.3986

Figure 9

Interference From MDS Transmitters to AWS and MSS Handsets

The potential for interference will exist from the OOBE of MDS base station and nomadic consumer devices to AWS and MSS handsets. Current FCC rules for MDS base station and high power nomadic devices allow the same maximum EIRP and OOBE requirements for each. For low power nomadic devices, MDS rules currently allow different and more relaxed OOBE levels due to the decreased output power. For base stations and high power consumer devices (EIRP>24dBm), the current MDS mask as specified in Part 21.908 and depicted in Figure 10 requires the OOBE be attenuated by the following:

> "The maximum out-of-band power of an MDS response station using all or part of a 6 MHz channel, employing digital modulation and transmitting with an EIRP greater than -6 dBW per 6 MHz channel shall be attenuated (as measured in accordance with paragraph (e) of this section) at the 6 MHz channel edges at least 25 dB relative to the average 6 MHz channel power level, then attenuated along a linear slope to at least 40 dB at 250 kHz beyond the nearest channel edge, then attenuated along a linear slope from that level to at least 60 dB at 3 MHz above the upper and below the lower licensed channel edges, and attenuated at least 60 dB at all other frequencies."

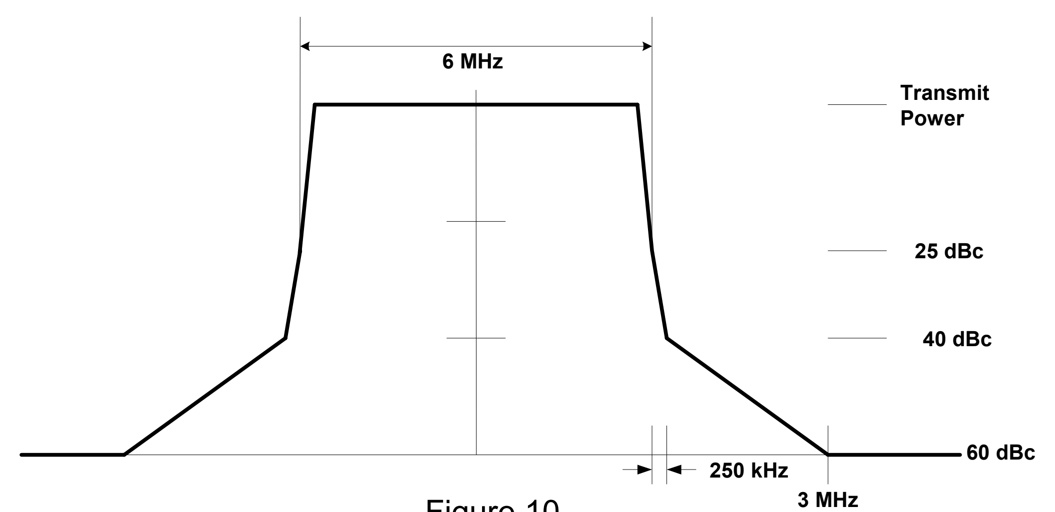

Figure 10

For low power consumer devices (EIRP<=24dBm), the current MDS mask requires the OOBE be attenuated by the following as referenced in Part 21.908 of the FCC rules and depicted in Figure 11:

"The maximum out-of-band power of an MDS response station using all or part of a 6 MHz channel, employing digital modulation and transmitting with an EIRP no greater than -6 dBW per 6 MHz channel shall be attenuated (as measured in accordance with paragraph (e) of this section) at the channel edges at least 25 dB relative to the average 6 MHz channel transmitter output power level (P), then attenuated along a linear slope to at least 40 dB or 33+10log(P) dB, whichever is the lesser attenuation, at 250 kHz beyond the nearest channel edge, then attenuated along a linear slope from that level to at least 60 dB or 43+10log(P) dB, whichever is the lesser attenuation, at 3 MHz above the upper and below the lower licensed channel edges, and attenuated at least 60 dB or 43+10log(P) dB, whichever is the lesser attenuation, at all other frequencies."

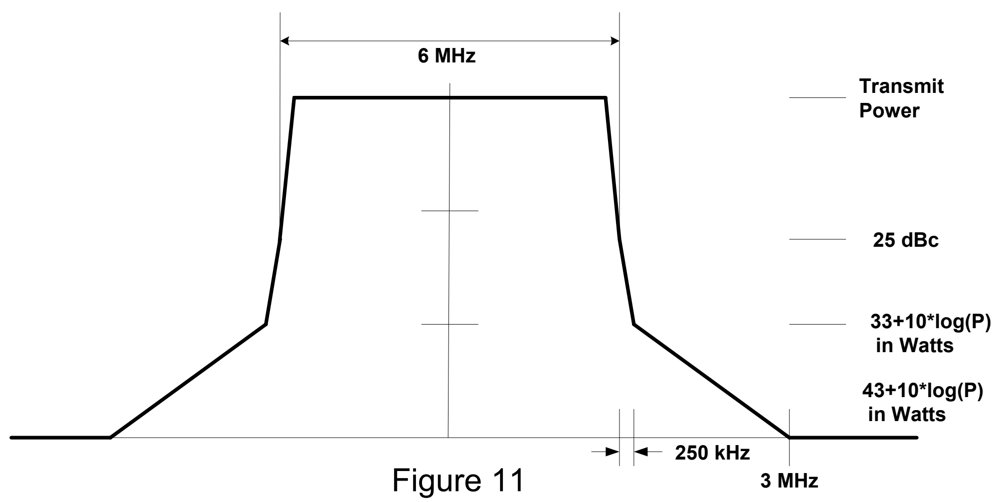

Figure 11

Interference analyses were conducted for AWS and MSS handsets using the OOBE levels shown above for both high power and lower power MDS devices. In addition, the analyses were performed with the interfering MDS channel varied in frequency from 2155 to 2180 MHz. The detailed results of the interference analyses are attached as Appendix A and the results are plotted on the chart in Figure 12.

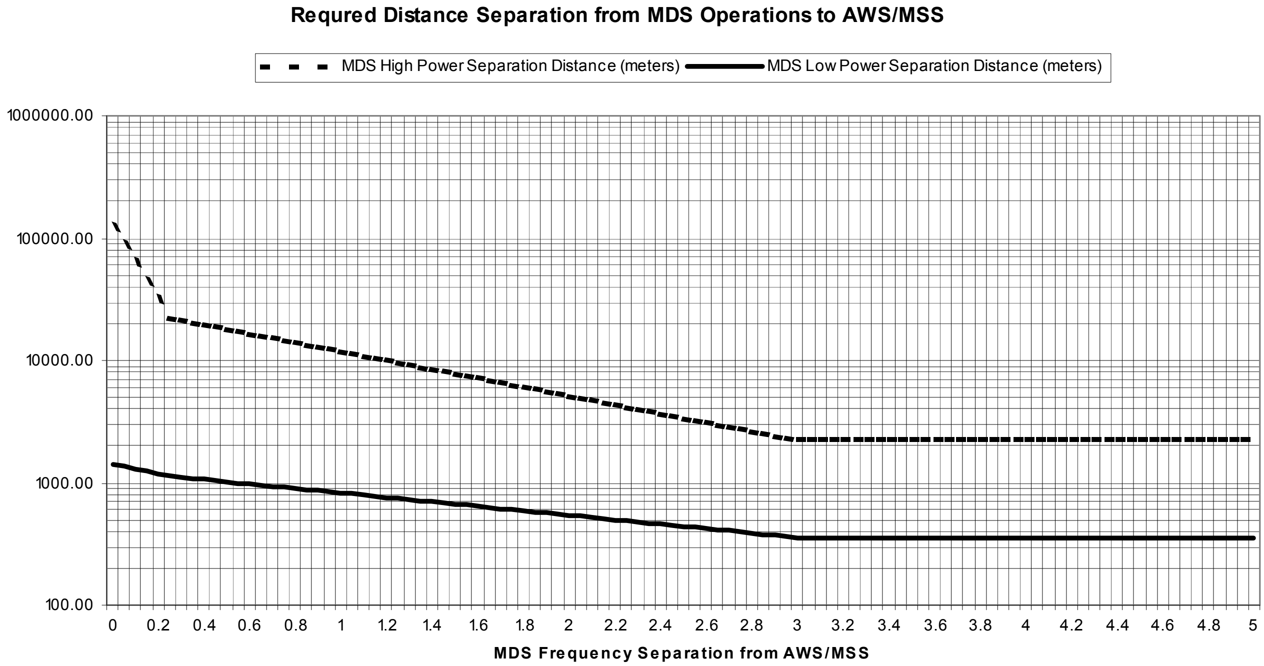

Figure 12

The results contained in Figure 12 show that when the MDS services are located 3 MHz or more from the edges of the 2155-2180 MHz band, the interference to adjacent AWS or MSS services are minimized because the OOBE from the MDS service experiences the most attenuation. The required separation distance between an MDS high power base station or consumer device and an AWS or MSS handset is 2.24 kilometers. For low power MDS transmitters, the required separation distance is 355 meters.

As the interfering MDS channel approaches the edge of the 2155-2180 MHz band, the level of attenuation to the OOBE decreases rapidly as is shown in Figure 12. The required separation distance for an MDS high power transmission increases from 2.24 kilometers to 126 kilometers, normally well beyond the radio horizon for most tower heights. The required separation distance for low power transmissions increases from 355 meters to 1.47 kilometers.

A separation distance of 2.24 to 126 kilometers is not practical and therefore, a significant potential exists for harmful interference from MDS high power devices to MSS and AWS handsets. Lower power separation distances of 355 meters to 1.47 kilometers are not practical either, as handsets or nomadic devices will commonly be within these distances of the handsets of MSS and AWS services.

Conclusions

A summary of the interference evaluations and required separation distances calculated in this paper are shown in Figure 13. As can be seen from the magnitude of the required separation distances, there is no minimum

Interference From:	Interference To:	Minimum Separation Distance
AWS Base Station	MDS Handset/CPE	4.9 - 31.1 Kms
AWS Base Station	MDS Base Station	55.3 Kms
MSS Base Station	MDS Handset/CPE	0.1 - 0.64 Kms
MSS Base Station	MDS Base Station	1.1 Kms
MDS Base Station / High Power CPE	AWS Handset	2.24 - 126 Kms
MDS Handset / Low Power CPE	AWS Handset	0.36 - 1.47 Kms
MDS Base Station / High Power CPE	MSS Handset	2.24 - 126 Kms
MDS Handset / Low Power CPE	MSS Handset	0.36 - 1.47 Kms

Figure 13

separation distance that is achievable in a real world situation. MDS, AWS and MSS systems will all be providing services in every market around the country. Handsets from these services need to be capable of operation in close proximity to one another. Separation distances need to be on the order of 1-3 meters, not 355 meters to kilometers. The same is true of base stations in these services, with minimum required separation distances down to 1-2 kilometers instead of 20 or more kilometers.

The studies in this paper prove that harmful interference will exist from and to an MDS service operating anywhere in the 2155 – 2180 MHz band because of the OOBE from adjacent AWS and MSS services in the same geographic area. By far, AWS services have the potential for a greater magnitude of interference than MSS since the MSS service has a much tighter OOBE specification than AWS. Likewise, MDS services represent a significant potential for interference to AWS and MSS services. Based on these facts, the 2155 – 2180 MHz band is not an acceptable alternative for existing MDS services.

Appendix A

Desensitization to AWS Handset from MDS High Power Operations	
Case 1 Band Edges Adjacent	
MDS Tx Parameters	
TPO (dBm/6 MHz)	53.0000
Losses (dB)	3.0000
Gt (dBi)	13.0000
EIRP (dBm/6 MHz)	63.0000
FCC Mask suppression (dBc)	25.0000
MDS EIRPmax within AWS band (dBm/1 MHz)	30.2185
MDSTx Cf Freq (MHz)	2158.0000
AWS Block Rx Parameters	
Gt MSS Block antenna (dBi)	0.0000
Rx Bandwidth (MHz)	1.0000
ktb Noise floor (dBm)	-114.0000
Rx LNA Noise Figure	9.0000
Rx Noise Floor (dBm)	-105.0000
Interference Results	
Interference Level to for 1dB degradation (6dB below noise floor)	-111.0000
Free Space Path Loss to achieve 1dB degradation	141.2185
Distance to achieve required Path Loss (ft)	414475.65
Distance to achieve required Path Loss (mtrs)	126333.71
Distance to achieve required Path Loss (mi)	78.4992

Desensitization to AWS Handset from MDS High Power Operations	
Case 2 Band Edges Maximum Apart	
MDS Tx Parameters	
TPO (dBm/6 MHz)	53.0000
Losses (dB)	3.0000
Gt (dBi)	13.0000
EIRP (dBm/6 MHz)	63.0000
FCC Mask suppression (dBc)	60.0000
MDS EIRPmax within AWS band (dBm/1 MHz)	-4.7815
MDSTx Cf Freq (MHz)	2177.0000
AWS Block Rx Parameters	
Gt MSS Block antenna (dBi)	0.0000
Rx Bandwidth (MHz)	1.0000
ktb Noise floor (dBm)	-114.0000
Rx LNA Noise Figure	9.0000
Rx Noise Floor (dBm)	-105.0000
Interference Results	
Interference Level to for 1dB degradation (6dB below noise floor)	-111.0000
Free Space Path Loss to achieve 1dB degradation	106.2185
Distance to achieve required Path Loss (ft)	7353.58
Distance to achieve required Path Loss (mtrs)	2241.40
Distance to achieve required Path Loss (mi)	1.3927

Desensitization to AWS Handset from MDS Low Power Devices	
Case 1 Band Edges Adjacent	
MDS Tx Parameters	
TPO (dBm/6 MHz)	24.0000
Losses (dB)	0.0000
Gt (dBi)	0.0000
EIRP (dBm/6 MHz)	24.0000
FCC Mask suppression (dBc)	25.0000
MDS EIRPmax within AWS band (dBm/1 MHz)	-8.7815
MDSTx Cf Freq (MHz)	2158.0000
AWS Block Rx Parameters	
Gt MSS Block antenna (dBi)	0.0000
Rx Bandwidth (MHz)	1.0000
ktb Noise floor (dBm)	-114.0000
Rx LNA Noise Figure	9.0000
Rx Noise Floor (dBm)	-105.0000
Interference Results	
Interference Level to for 1dB degradation (6dB below noise floor)	-111.0000
Free Space Path Loss to achieve 1dB degradation	102.2185
Distance to achieve required Path Loss (ft)	4650.49
Distance to achieve required Path Loss (mtrs)	1417.49
Distance to achieve required Path Loss (mi)	0.8808

Desensitization to AWS Handset from MDS Low Power Devices	
Case 2 Band Edges Maximum Apart	
MDS Tx Parameters	
TPO (dBm/6 MHz)	24.0000
Losses (dB)	0.0000
Gt (dBi)	0.0000
EIRP (dBm/6 MHz)	24.0000
FCC Mask suppression (dBc)	37.0000
MDS EIRPmax within AWS band (dBm/1 MHz)	-20.7815
MDSTx Cf Freq (MHz)	2177.0000
AWS Block Rx Parameters	
Gt MSS Block antenna (dBi)	0.0000
Rx Bandwidth (MHz)	1.0000
ktb Noise floor (dBm)	-114.0000
Rx LNA Noise Figure	9.0000
Rx Noise Floor (dBm)	-105.0000
Interference Results	
Interference Level to for 1dB degradation (6dB below noise floor)	-111.0000
Free Space Path Loss to achieve 1dB degradation	90.2185
Distance to achieve required Path Loss (ft)	1165.46
Distance to achieve required Path Loss (mtrs)	355.24
Distance to achieve required Path Loss (mi)	0.2207

Desensitization to MSS Handset from MDS High Power Operations	
Case 1 Band Edges Adjacent	
MDS Tx Parameters	
TPO (dBm/6 MHz)	53.0000
Losses (dB)	3.0000
Gt (dBi)	13.0000
EIRP (dBm/6 MHz)	63.0000
FCC Mask suppression (dBc)	25.0000
MDS EIRPmax within MSS band (dBm/1 MHz)	30.2185
MDSTx Cf Freq (MHz)	2177.0000
MSS Block Rx Parameters	
Gt MSS Block antenna (dBi)	0.0000
Rx Bandwidth (MHz)	1.0000
ktb Noise floor (dBm)	-114.0000
Rx LNA Noise Figure	9.0000
Rx Noise Floor (dBm)	-105.0000
Interference Results	
Interference Level to for 1dB degradation (6dB below noise floor)	-111.0000
Free Space Path Loss to achieve 1dB degradation	141.2185
Distance to achieve required Path Loss (ft)	414475.65
Distance to achieve required Path Loss (mtrs)	126333.71
Distance to achieve required Path Loss (mi)	78.4992

Desensitization to MSS Handset from MDS High Power Operations

Case 2 Band Edges Maximum Apart	
MDS Tx Parameters	
TPO (dBm/6 MHz)	53.0000
Losses (dB)	3.0000
Gt (dBi)	13.0000
EIRP (dBm/6 MHz)	63.0000
FCC Mask suppression (dBc)	60.0000
MDS EIRPmax within MSS band (dBm/1 MHz)	-4.7815
MDSTx Cf Freq (MHz)	2158.0000
MSS Block Rx Parameters	
Gt MSS Block antenna (dBi)	0.0000
Rx Bandwidth (MHz)	1.0000
ktb Noise floor (dBm)	-114.0000
Rx LNA Noise Figure	9.0000
Rx Noise Floor (dBm)	-105.0000
Interference Results	
Interference Level to for 1dB degradation (6dB below noise floor)	-111.0000
Free Space Path Loss to achieve 1dB degradation	106.2185
Distance to achieve required Path Loss (ft)	7353.58
Distance to achieve required Path Loss (mtrs)	2241.40
Distance to achieve required Path Loss (mi)	1.3927

Desensitization to MSS Handset from MDS Low Power Devices	
Case 1 Band Edges Adjacent	
MDS Tx Parameters	
TPO (dBm/6 MHz)	24.0000
Losses (dB)	0.0000
Gt (dBi)	0.0000
EIRP (dBm/6 MHz)	24.0000
FCC Mask suppression (dBc)	25.0000
MDS EIRPmax within MSS band (dBm/1 MHz)	-8.7815
MDSTx Cf Freq (MHz)	2177.0000
MSS Block Rx Parameters	
Gt MSS Block antenna (dBi)	0.0000
Rx Bandwidth (MHz)	1.0000
ktb Noise floor (dBm)	-114.0000
Rx LNA Noise Figure	9.0000
Rx Noise Floor (dBm)	-105.0000
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Desensitization to MSS Handset from MDS Low Power Devices	
Case 2 Band Edges Maximum Apart	
MDS Tx Parameters	
TPO (dBm/6 MHz)	24.0000
Losses (dB)	0.0000
Gt (dBi)	0.0000
EIRP (dBm/6 MHz)	24.0000
FCC Mask suppression (dBc)	37.0000
MDS EIRPmax within MSS band (dBm/1 MHz)	-20.7815
MDSTx Cf Freq (MHz)	2158.0000
MSS Block Rx Parameters	
Gt MSS Block antenna (dBi)	0.0000
Rx Bandwidth (MHz)	1.0000
ktb Noise floor (dBm)	-114.0000
Rx LNA Noise Figure	9.0000
Rx Noise Floor (dBm)	-105.0000
Interference Results	
Interference Level to for 1dB degradation (6dB below noise floor)	-111.0000
Free Space Path Loss to achieve 1dB degradation	90.2185
Distance to achieve required Path Loss (ft)	1165.46
Distance to achieve required Path Loss (mtrs)	355.24
Distance to achieve required Path Loss (mi)	0.2207