Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Amendment of Part 2 of the Commission's	)	ET Docket No. 00-258
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	)	
	)	
Petition for Rulemaking of the Cellular	)	
Telecommunications Industry Association	)	RM-9920
Concerning Implementation of WRC-2000:	)	
Review of Spectrum and Regulatory	)	
Requirements	)	
	)	
Amendment of the U.S. Table of Frequency	)	
Allocations to Designate the	)	RM-9911
2500-2690/2670-2690 MHz Frequency Bands	)	
for the Mobile-Satellite Service	)	

REPLY COMMENTS OF MOTOROLA, INC.

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March 9, 2001

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SUMMARY

Motorola hereby submits these reply comments in the FCC's proceeding to identify new spectrum below 3 GHz for allocation to third generation ("3G") consumer wireless services. As further detailed below, the record strongly supports an allocation for 3G that is harmonized with global allocations. Few, if any, commenters took issue with the fundamental premise that the FCC should provide additional spectrum for 3G. In fact, most wireless carriers and manufacturers are in essential agreement with Motorola's position that the allocation of additional spectrum for the provision of 3G wireless services is essential to enable the rapid development of advanced wireless services. Failure to provide the necessary critical mass of spectrum for 3G services will deprive the U.S. of dramatic economic gains.

There was wide support for the position that the 1710-1850 MHz and 2110-2150/2160-2165 MHz bands offer the best near term potential for supporting 3G services especially compared to the 2500-2690 MHz band. Commenters agreed that an allocation in the 1710-1850 MHz band would provide substantial harmonization with DCS-1800 allocations while spectrum in the 2110-2150/2160-2165 MHz band offers harmonization with 3rd generation UMTS allocations used in other regions of the world. As detailed in the comments of the *Association Group* jointly submitted by the Cellular Telecommunications & Internet Association (CTIA), the Personal Communications Industries Association (PCIA) and the Telecommunications Industry Association (TIA), a plan can be developed to accommodate 3G in the 1710-1850 MHz band while fully meeting the requirements for Federal Government incumbent users, including full cost compensation for relocation where necessary.

Motorola agrees with those commenters that noted that Frequency Division Duplex (FDD) technology will be the primary enabling 3G technology and the FCC's band plan should be aimed primarily at allowing FDD technologies. Motorola notes, however, that Time Division Duplex is a viable and useful technology, particularly for coverage of small areas with high data requirements. The FCC should consider provisions to accommodate low power TDD systems in guard bands or the duplex gaps of FDD systems.

Motorola is now in the process of performing simulations and other studies to determine to what extent guard bands will be needed to prevent interference between 3G and PCS systems considering the variety of technologies that are likely to be deployed. Preliminary indications are that the interference levels are dependent upon the technology deployed in the PCS band. Motorola also provides an appendix detailing the levels of interference to potential 3G services from MDS operations in the 2150-2162 MHz band. Motorola's analysis indicates that MDS base stations and response stations that comply with the minimum FCC emissions requirements will severely impact 3G operations in the 2110-2150 MHz and preclude 3G operation in the 2160-2165 MHz band. The FCC must consider solutions to this situation.

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Amendment of the U.S. Table of Frequency Allocations to Designate the 2500-2690/2670-2690 MHz Frequency Bands for the Mobile-Satellite Service	)	RM-9911

REPLY COMMENTS OF MOTOROLA, INC.

Motorola hereby submits these reply comments in the FCC's proceeding to identify new spectrum below 3 GHz for allocation to third generation ("3G") consumer wireless services.[1] As further detailed below, the record strongly supports an allocation for 3G that is harmonized with global allocations. Motorola urges the FCC to proceed on its expeditious course so that U.S. consumers can receive the benefits of advanced 3G services as rapidly as possible.

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[1] 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, *Notice of Proposed Rulemaking and Order*, ET Docket No. 00-258 (rel. Jan. 5, 2001) ("*NPRM*").

I. The Comments Provide Overwhelming Support for Additional Allocations for 3G Services.

Well over 100 parties filed comments in response to the *NPRM* but few, if any, took issue with the fundamental premise that the FCC should provide additional spectrum for 3G. Wireless carriers provide unanimous support for the allocation of additional spectrum to offer advanced services. For example, AT&T Wireless states that while it "is confident" that existing allocations are sufficient "to begin" the rollout of 3G, the data intensive nature of these services coupled with "growing consumer and business penetration" is expected to produce a significant increase in capacity demand.[2] AT&T Wireless concludes that "it is clear that improvements in technology and spectrum efficiency will not be sufficient to meet this rise in demand."[3]

Likewise, Verizon Wireless argues that "the likely deployment of 3G services in existing allocations does not obviate the need for additional spectrum."[4] Indicating that it will soon deploy a 3G technology that will provide customers with data rates of 144 kbps, Verizon notes that it "will only be able to serve about one-third the number of customers simultaneously at these higher rates."[5] Thus, "while 3G technologies will provide spectrum efficiency improvements, the net effect is that substantially more spectrum will be required to provide high-speed 3G services to the same number of customers."[6] Verizon also cautions the Commission against its proposed reliance on "*secondary markets*" mechanisms to make additional spectrum available for 3G.[7]

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2 *Comments of AT&T Wireless Services, Inc*. at 4,5 [emphasis in original].

3 *Id.* at 5.

4 *Comments of Verizon Wireless* at 5.

5 *Id.* at 6.

6 *Id.*

7 *Id.* at 32.

Other carriers echo this same refrain. Qwest Wireless states that "it is apparent that to accommodate 3G services, … the allocation of additional spectrum below 3 GHz, and the licensing of that spectrum expeditiously, will be necessary to meet … demand."[8] Cingular argues that existing allocations are being used as efficiently as possible and capacity constraints limit the extent to which new services can be offered.[9] Cingular points out that cellular licensees are particularly limited because they are precluded from performing a "complete switch-over to more spectrally-efficient technologies" due to the continuing requirement for cellular carriers to provide analog service.[10] Cingular argues that "at least 160 MHz of additional spectrum below 3 GHz is needed to support the development of 3G services in the United States."[11]

Manufacturers also provide broad support for additional allocations for 3G. Arguing that the "future competitiveness of U.S. industry is very much at stake," the TIA believes that "it is now time for the Commission to allocate additional spectrum for IMT-2000 services in the United States."[12] Noting that WRC-2000 recommended that "on the order of 160 MHz of additional spectrum will be needed in order to meet the projected requirements of IMT-2000," TIA argues that "additional spectrum must be made available that is suitable for advanced communications systems, such as 3G mobile systems."[13]

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8 *Comments of Qwest Wireless, LLC* at 2.

9 *Comments of Cingular Wireless, LLC* at 3.

10 *Id.*

11 *Id.* at 8.

12 *Comments of the Telecommunications Industry Association* at 3.

13 *Id.* at 2, 3.

Nortel agrees with the FCC's position that the "Internet, mobile data and continued expansion of voice communications will be major drivers pushing the need for additional spectrum."[14] Noting that the WRC-2000 recommendation "represents the consensus developed after significant research, analysis, and discussion among technical experts," Nortel urges the FCC to "make available an additional 160 MHz of spectrum below 3 GHz to meet 3G needs."[15]

All of these commenters are in essential agreement with Motorola's position that the "allocation of additional spectrum for the provision of 3G wireless services is essential to enable the rapid development" of advanced wireless services.[16] Failure to provide the necessary critical mass of spectrum for 3G services will deprive the U.S. of dramatic economic gains such as those forecasted by the Council of Economic Advisors who postulate that "an additional 150 MHz of spectrum [for advanced wireless services] could bring an additional $35.7 billion of service revenues per year."[17] Motorola joins the above-referenced commenters in urging the FCC to allocate sufficient quantities of spectrum for 3G in the most expeditious manner possible.

Motorola also agrees with Verizon that the Commission cannot rely on secondary markets mechanisms to provide for the accommodation of 3G services. In Motorola's view, the secondary markets approach may provide the possibility of meeting capacity demands in very limited circumstances where a licensee is willing to lease excess spectrum to another service provider and appropriate equipment is available. This process probably has a market place role -- perhaps a significant one -- but it is a wholly unsatisfactory approach in trying to introduce large-

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14 *Comments of Nortel Networks Inc*. at 3.

15 *Id*.

16 *Comments of Motorola* at 5.

17 *Id*. at 4. See also, The Council of Economic Advisors, *Economic Impact of Third Generation Wireless Technology*, Oct. 2000, at 6.

scale consumer services such as 3G. The hurdles to be overcome in introducing a nationwide consumer service under such an *ad hoc* approach are enormous, and include having to lease sufficient amounts of spectrum from an unknown number of different licensees, with each lease potentially having very different conditions, gaining funding for the upfront costs necessary to deploy the necessary infrastructure based on uncertain continued access to spectrum, and finally, convincing manufacturers that it is in their best interests to divert their resources to develop specialized equipment, particularly given the uncertainty of continued access to spectrum. In addition, the arbitrary nature of this approach is contradictory to the concept of harmonization and would thus deprive operators and consumers of the reduced costs achieved through manufacturing economies of scale.

Despite the great number of commenters in this proceeding, there is little, if any, fundamental opposition to the allocation of *some* spectrum for 3G services. While many commenters did oppose a reallocation of the 2500-2690 MHz band for IMT-2000 services, this position reflected more of a concern for the incumbent MDS and ITFS use of that frequency band than any deep-rooted opposition to 3G. As stated by the Wireless Communications Association, the principal advocacy group for the MDS operators: "the Commission's objectives here will best be served by a spectrum allocations that accommodates any demonstrable need of mobile service providers for additional spectrum to launch for 3G technologies *and* that preserves the entire 2.1 GHz and 2.5 GHz bands for the advanced, fixed wireless broadband services."[18] Based on this record, Motorola urges the FCC to continue on its "fast track" approach to securing new 3G spectrum allocations totaling at least 160 MHz.

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[18] *Comments of the Wireless Communications Association International, Inc.*, at i.

II. The Record Supports the Allocation of the 1710-1850 MHz Band as a Better Near Term Solution for IMT-2000 Global Spectrum Harmonization.

In its comments, Motorola stated its belief that the 1710-1850 MHz and 2110-2150/2160-2165 MHz bands offer the best near term potential for supporting 3G services.[19] An allocation in the 1710-1850 MHz band would provide substantial harmonization with DCS-1800 allocations while spectrum in the 2110-2150/2160-2165 MHz band offers harmonization with 3rd generation UMTS allocations used in other regions around the world.[20] Noting that "2500-2690 MHz is highly desirable mobile spectrum," Motorola concluded that the band "does not offer the same near term potential" for spectrum harmonization mainly because "it is unlikely that any country will deploy IMT-2000 services [in the band] before 2007 at the earliest."[21]

Motorola's views on harmonization and, in particular, the benefits of the 1710-1850 MHz band were shared by many of the commenters that addressed the issue. Qualcomm states that while the 1710-1755 MHz and 2110-2150/2160-2165 MHz bands "are good candidate bands for deploying 3G" technologies, it is "not clear that the pairing of these two bands together is the best use of the frequencies from a global harmonization perspective." Qualcomm continues by stating that "a better pairing arrangement of frequencies in the 1700 MHz range would be to follow the DCS-1800 allocation scheme used by a majority of countries around the world for second-generation services" and recommends that the U.S. "use a portion of the 1700/1800 MHz frequencies and pair them in a manner that maintains the DCS-1800 duplex spacing of 95 MHz."[22] Qualcomm also agrees with Motorola that the U.S. "could, at a minimum, achieve

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19 *Comments of Motorola* at 11.

20 *Id.* at 21.

21 *Id.* at 12.

22 *Id.* at 13, 14.

some harmonization by using the 2110-2150 and 2160-2165 MHz frequencies in a manner that is consistent with what numerous other countries are doing in the band" and that "using the 2110 MHz frequency range as a global common downlink band, there may be advantages in terms of equipment development to offer roaming capability and achieve some economies of scale."[23]

Nortel concurs with this basic arrangement noting that the "allocation of the 1710-1755 MHz and 1805-1850 MHz band would provide numerous advantages."[24] Lucent warns of "potential difficulties" that could arise if duplex spacing is overly wide, for example, if the 1.7 GHz band were paired with the 2.5 GHz band.[25] Lucent urges the FCC to consider its 3G allocations consistent with global 2G and 3G frequency arrangements and notes that U.S. consumers would "benefit from increased possibilities for global roaming and global manufacturing economies of scale" if the FCC were to allocate spectrum from the 1710-1850 MHz range in a manner compatible with the DCS 1800 frequency arrangement.[26]

Motorola believes that the record supports heightened focus on the 1710-1850 MHz band for supporting the near term needs for 3G. The band offers the best opportunity for harmonization with allocations used in the majority of the world. Further, as detailed by the joint comments submitted by CTIA, PCIA, and TIA – collectively referred to as the *Association Group Comments* -- a plan can be developed to accommodate 3G while fully meeting the requirements for Federal Government incumbent users, including full cost compensation for relocation where necessary.[27] Motorola supports the analysis contained in the *Association Group*

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23 *Id.* at 14, 15.

24 *Comments of Nortel Networks, Inc.* at 6.

25 *Comments of Lucent Technologies, Inc.* at 8 (unnumbered).

26 *Id.* at 9 (unnumbered).

27 See, *Joint Comments of the Cellular Telecommunications & Internet Association,*

Comments and urges the Commission to work expeditiously with NTIA and the Department of Defense on the technical and operational details that enable the allocation of the 1710-1850 MHz band for 3G.

Finally, Motorola reminds the Commission that the current auction system, where the true costs of relocating incumbents only becomes known to successful bidders *after the auction*, threatens the effective deployment of advanced wireless communications systems in a timely fashion.[28] Verizon concurs that relocation costs "must be determined with a high degree of certainty prior to any 3G auction."[29] Motorola urges the FCC to work closely with the NTIA to ensure that 3G auction bidders are fully aware of their potential obligations as soon as possible. To this end, Motorola also reiterates its position that the U.S. must develop a regulatory structure whereby the proceeds from the relevant auctions are used to fund the relocation of affected incumbent operations.[30] Forcing industry service providers to spend tens of billions of dollars before any investment in infrastructure is not in the best interest of advancing 3G deployment.

III. The FCC Should Move Cautiously in Allocating Spectrum for Time Division Duplex Technologies.

A number of commenters remind the FCC of its commitment to allocate spectrum in a technically neutral fashion and thus ensure that at least some spectrum is available for unpaired, time division duplex (TDD) technologies.[31] Other commenters argue that no allocations should be made for TDD as they can cause significant interference to frequency division duplex (FDD)

Telecommunications Industry Association, Personal Communications Industry Association ("*Association Group Comments*").

28 *Comments of Motorola* at 15.

29 *Comments of Verizon Wireless* at 13.

30 *Comments of Motorola* at 15.

31 *See, e.g., Comments of ArrayComm, Inc., Comments of LinkAir Communications, Inc.*

systems without fairly wide guard bands.[32] In Motorola's view, the comments submitted by the TIA provide a balanced analysis on the pros and cons of accommodating TDD technologies in 3G allocations. Essentially, TIA demonstrates that FDD systems can provide asymmetric capacity in high-mobility, large-scale deployments without many of the disadvantages of TDD technology.[33] TIA further notes, however, that TDD systems are useful generally in low power, lower mobility applications such as alternative access for telephony and the provision of higher data rates in a densely populated area.[34]

Motorola believes that FDD technology will be the primary enabling 3G technology and the FCC's band plan should be aimed primarily at allowing FDD technologies. Motorola strongly recommends that the FCC pair spectrum with clearly defined mobile and base transmit bands in a harmonious manner with global allocations. Motorola agrees, however, that TDD is a viable and useful technology, particularly for coverage of small areas with high data requirements. The FCC should consider provisions to accommodate TDD technologies. However, as recommended by the TIA, it is imperative that the FCC's rules segregate FDD and TDD systems and rules must be adopted that define bands for FDD and for TDD, with appropriate power and emission limits on both. Provisions should be made for low power TDD systems to operate in guard bands or the duplex gap of a band plan optimized for FDD deployment.

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32 *See, e.g., Comments of AT&T Wireless* at 7.

33 *Comments of TIA* at 7-11.

34 *Id.* at 15.

IV. Other Technical Matters.

In its opening comments, Motorola presented some preliminary thoughts on band plans that focused on pairing 1710-1755 MHz with 1800-1845 MHz and leaving the 1845-1850 MHz band to serve as a guard band between PCS facilities. As envisioned by Motorola, the 1800-1845 MHz band would be available for 3G base station transmitters (mobile receive) whereas the 1850-1910 MHz PCS band is most commonly used by mobile transmitters (base receive). The Radio Advisory Board of Canada submits similar band plan proposals including a proposed 5 MHz guard band between the U.S. PCS and the proposed 3G allocations.[35]

As the Commission moves forward in developing the best band plan for the spectrum under consideration, it is important that it fully understand the technical implications of various options, including interference to and from adjacent band services. Of particular concern is the amount of guard band necessary at the 1850 MHz interface between PCS and potential new 3G services operating in the 1710-1850 MHz band.

As indicated in Motorola's comments, we are continuing to study the appropriateness and the sufficiency of this guard band as well as other technical aspects of the various proposed band plans. We are now in the process of performing simulations and other studies to determine how successful a 5 MHz guard band would be in preventing interference between 3G and PCS considering the variety of technologies that are likely to be deployed. Preliminary indications are that the interference levels are dependent upon the technology deployed in the PCS band. For example, we calculate that, for a W-CDMA receiver, the separation required for a 3 dB increase in noise if W-CDMA is deployed is 25 meters, 126 meters if cdma2000 is deployed, and 20

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35 *Comments of the Radio Advisory Board of Canada* at 17.

meters if GSM (PCS1900) is deployed.[36] Motorola's simulations should provide a clearer picture of the effect of this interference on actual deployed systems. The full results of these studies will be shared with the Commission when complete.

Based on technical analysis contained in the attached appendix, Motorola agrees with Verizon that MDS operations in the 2150-2162 MHz band have the potential for interfering with adjacent band 3G services.[37] Motorola's preliminary analysis indicates that operation of MDS base stations and response stations that comply with the minimum FCC emissions requirements will severely impact 3G operations in the 2110-2150 MHz and completely preclude 3G operation in the 2160-2165 MHz band. Of particular concern are the MDS response stations due to their potentially ubiquitous deployment. Approaches to minimize interference from MDS systems warrant further investigation.[38]

V. Conclusion.

The 3rd generation of wireless technology offers tremendous economic and cultural benefits to people throughout the world. If the U.S. is to exert leadership in the development and exportation of 3G services and technologies, sufficient quantities of spectrum must now be made available so that U.S industry can at least equal existing efforts in other parts of the world. Motorola urges the Commission to allocate spectrum in a manner that achieves the maximum practicable degree of harmonization between domestic and international spectrum.

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[36] Worst-case analysis assumes that transmitters are operating at maximum peak power and that the received power is at the sensitivity threshold.

[37] *Comments of Verizon Wireless* at 14.

[38] The interference scenario is improved if actual MDS emissions are significantly reduced from the requirements of the FCC prescribed emissions mask. If not, either additional filtering on MDS transmitters or additional frequency separation between UMTS and MDS operations may be necessary.

Respectfully submitted,

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March 9, 2001

Appendix: Analysis of Interference in the 2110-2165 MHz Band To UMTS Mobiles From MDS Systems

Appendix: Analysis of Potential Interference in the 2110-2165 MHz Band To UMTS Mobiles From MDS Systems

1. Summary.

In comments submitted in ET Docket NO. 00-258, Verizon Wireless presented analysis of adjacent channel interference into UMTS from an MDS base station that indicated a potential interference issue. As further described below, Motorola concurs with the analysis presented by Verizon. Motorola's further analysis has also raised new concerns about interference from MDS response stations.

The concerns arise from a proposed use of the 2110-2165 MHz band as shown in Figure 1. In this proposed usage two interference situations from MDS operations occur, co-frequency interference from MDS channel 2 operations in the 2160-2162 MHz band and out-of-band (OOB) interference from MDS channel 1 operations to the 2110-2150 MHz band.

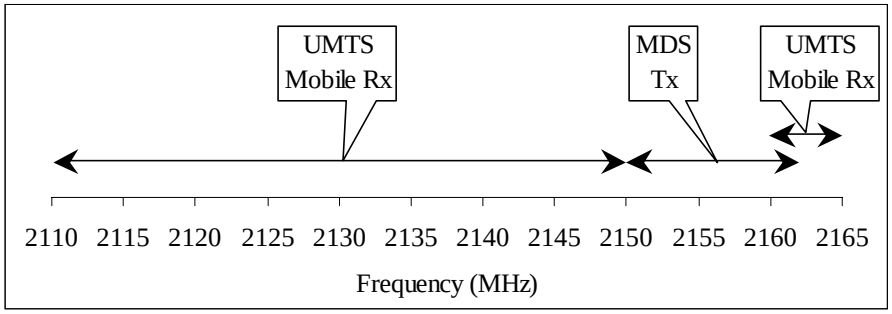

Figure 1: Possible frequency arrangement for 2110-2165 MHz band.

Computations indicate that:

- Operation of MDS channel 2 in the 2160-2162 MHz band will not permit UMTS operations in the 2160-2165 MHz band.
- Operation of MDS channel 1 will degrade UMTS operations in the 2110-2150 MHz band.
    - MDS base stations will significantly raise the UMTS noise floor for distances on the order of 320 to 1400 meters from their transmitting site.
    - MDS response stations will significantly raise the UMTS noise floor for distances on the order of 74 to 311 meters from their transmitting site.

Of particular concern are the MDS response stations. Because they will be ubiquitously deployed, operations of UMTS mobiles in urban areas will be significantly impacted. Approaches to minimize this interference include:

- Investigation of the actual out-of-band emission performance of MDS equipment relative to the FCC prescribed mask, if emissions are significantly lower than those required by the FCC, separation distances will be reduced.
- Additional filtering on MDS transmitters.
- Additional frequency separation between UMTS and MDS operations.

2. Interference Analysis

In order to illustrate the potential for interference, this analysis computes the distance that an UMTS mobile must be separated from an MDS transmitter in order to increase the receive noise level by 0.1 dB, 3 dB and 6 dB.

2.1 MDS Characteristics of systems in 2150-2162 MHz

MDS systems are allowed to operate both base station transmitters and response station transmitters in the 2150-2162 MHz band, channel 1 spans 2150-2156 MHz and channel 2 spans 2156-2162 MHz. Transmitter power characteristics are shown in Table 1, shown in Figure 2 are the out-of-band emissions requirements as found in 47 CFR 21.908. Note that for this study the response stations transmit bandwidth is assumed to be 200 kHz.

It is assumed in this study that the height of the base station is 100 m above the earth and the height of the response station is 5 m.

Table 1: Characteristics of MDS transmitters in 2150-2162 MHz

Parameter	Permitted value	Source
Base station transmit EIRP	33 dBW/6 MHz	47 CFR 21.904
Response station transmit EIRP	18.2 dBW/200 kHz (Assumes 200 kHz transmit bandwidth)	47 CFR 21.909

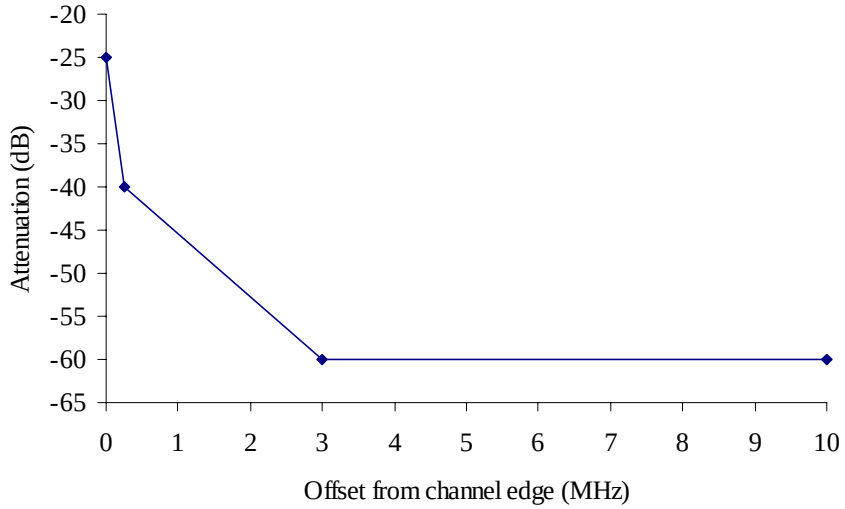

Figure 2: Out-of-band emissions for MDS transmitters.

2.2 UMTS Mobile Characteristics

The receiver noise level for UMTS mobile is 99 dBm, the receive antenna gain is assumed to be –6 dBi and the height of the mobile is assumed to be 2 m.

2.3 Propagation Loss Model

In order to compute the loss between the MDS transmitters and the UMTS mobile receivers a hybrid model is utilized. For small distances, the hybrid model follows a free space model and for larger distances a plane earth model is utilized. Free space propagation loss is computed as

$$L_{fs} = \left(\frac{\lambda}{4\pi R} \right)^2 \tag{1}$$

where:

$\lambda = c/f$ - Wavelength of calculation (m)

f - Frequency (Hz)

c - Speed of light (m/s)

R - Distance separation between transmitter and receiver (m).

Plane earth propagation loss is computed as:

$$L_{pe} = \left(\frac{\lambda}{4\pi R} \right)^2 \left(2\sin\left(\frac{2\pi}{\lambda} \frac{h_t h_r}{R} \right) \right)^2 \tag{2}$$

where:

h_t - Height of transmitter (m)

h_r - Height of receiver (m).

For this study the height of the mobile is assumed to be 2 m, the height of the MDS response station is assumed to be 5 m and the height of the MDS base station is assumed to be 100 m. Shown in Figure 3 and 4 are the hybrid propagation loss model utilized in this analysis, the propagation loss is the minimum of the free space loss and the plane earth loss (*i.e.*, the lower of the two curves indicated in the figures).

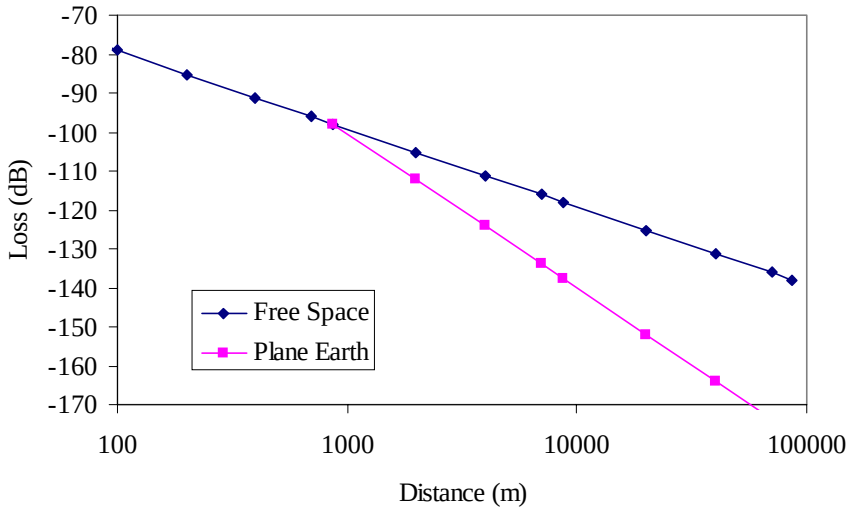

Figure 3: Hybrid propagation loss model for a transmitter of 5 m and a receiver of 2 m at frequency 2150 MHz.

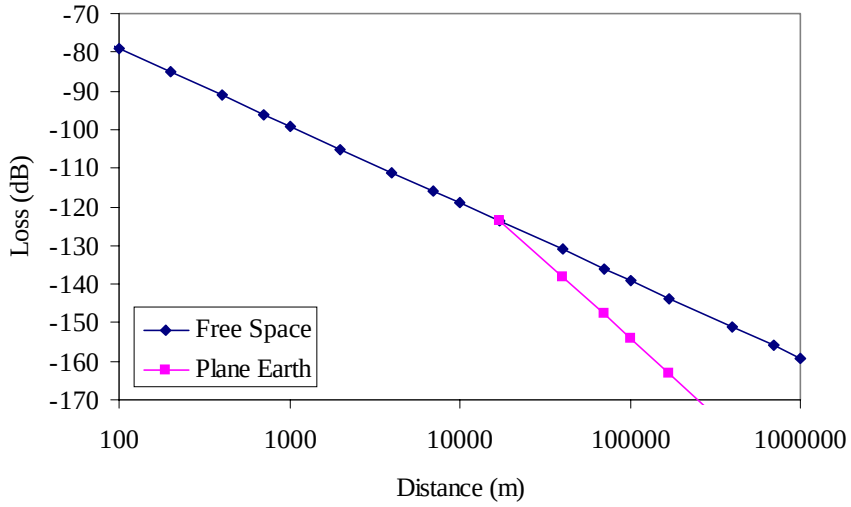

Figure 4: Hybrid propagation loss model for a transmitter of 100 m and a receiver of 2 m at a frequency of 2150 MHz.

2.4 MDS Channel 1 interference into 2110-2150 MHz

Interference from MDS channel 1 operations into the 2110-2150 MHz band considers two situations:

1) The first channel of UMTS operation (a 3.84 MHz receive channel centered at 2.5 MHz from the MDS channel edge).
2) All other channels.

The first channel of UMTS operation will experience the most interference due to the roll-off characteristics of the out-of-band emissions for MDS equipment (see Figure 1). All other UMTS channels will experience the same amount of interference due to the flat characteristics of the out-of-band emissions that fall beyond 3 MHz from the MDS channel edge.

The average attenuation of the MDS signal into the first channel of UMTS operation is computed by converting the mask found in Figure 1 to linear units, integrating over the 3.84 MHz channel bandwidth (from 0.58 MHz offset to 4.42 MHz offset) and then converting back to decibels. The result is that power is attenuated by 52.3 dB in the adjacent channel.

Results of interference calculations for MDS base stations are shown in Table 2, computations indicate that UMTS mobiles in the vicinity of the MDS base stations will experience significant increases in the noise level.

Table 2: Channel 1 separation distance from MDS base stations

MDS base station EIRP	33.0	dBW/6 MHz		
	61.1	dBm/3.84 MHz		
UMTS mobile Rx gain	-6.0	dBi		
Noise level	-99.0	dBm/3.84 MHz		
Out-of-band attenuation in 1st channel	-52.3	dBc		
Increase in noise level	0.1	3.0	6.0	dB
Interference level	-115.3	-99.0	-94.3	dBm
Attenuation required	-118.1	-101.8	-97.0	dB
Distance	8.9	1.4	0.79	km
Out-of-band attenuation (all other channels)	-60.0	dBc		
Increase in noise level	0.1	3.0	6.0	dB
Interference level	-115.3	-99.0	-94.3	dBm
Attenuation required	-110.4	-94.1	-89.3	dB
Distance	3.7	0.56	0.32	km

Results of interference calculations for MDS response stations are shown in Table 3. Computations indicate that significant increases in the noise level will be experienced by UMTS mobiles in the vicinity of the MDS response stations. Although the separation distances are smaller than that found for MDS base stations, the ubiquity of the response stations could result in a greater impact to UMTS operations.

Table 3: Channel 1 separation distance from MDS response stations

MDS response station EIRP	18.2	dBW/200 kHz		
	48.2	dBm/3.84 MHz		
UMTS mobile Rx gain	-6.0	dBi		
Noise level	-99.0	dBm/3.84 MHz		
Out-of-band attenuation in 1st channel	-52.3	dBc		
Increase in noise level	0.1	3.0	6.0	dB
Interference level	-115.3	-99.0	-94.3	dBm
Attenuation required	-105.3	-88.9	-84.2	dB
Distance	1353	310.9	197.7	m
Out-of-band attenuation (all other channels)	-60.0	dBc		
Increase in noise level	0.1	3.0	6.0	dB
Interference level	-115.3	-99.0	-94.3	dBm
Attenuation required	-97.6	-81.2	-76.5	dB
Distance	837.5	128.1	74.0	m

2.5 MDS Channel 2 interference into 2160-2162 MHz

MDS channel 2 operations overlap potential UMTS downlink spectrum in the 2160-2162 MHz band. Calculations shown in Table 4 and 5 considers only the power that will be within the 3.84 MHz channel centered at 2162.5 MHz. Specifically the power considered is that which will fall in the frequency range from 2160.58-2162 MHz, power due to out-of-band emissions will not significantly impact the results.

Table 4: Channel 2 separation distance from MDS base stations

MDS base station EIRP	33.0	dBW/6 MHz		
Power in 2160.58-2162 MHz	56.7	dBm		
UMTS mobile Rx gain	-6.0	dBi		
Noise level	-99.0	dBm/3.84 MHz		
Increase in noise level	0.1	3.0	6.0	dB
Interference level	-115.3	-99.0	-94.3	dBm
Attenuation required	-166.1	-149.8	-145.0	dB
Distance	44.8	17.5	13.3	km

Table 5: Channel 2 separation distance from MDS response stations

MDS response station EIRP	18.2	dBW/200 kHz		
Power in 2160.58-2162 MHz	48.2	dBm		
UMTS mobile Rx gain	-6.0	dBi		
Noise level	-99.0	dBm/3.84 MHz		
Increase in noise level	0.1	3.0	6.0	dB
Interference level	-115.3	-99.0	-94.3	dBm
Attenuation required	-157.6	-141.2	-136.5	dB
Distance	27.5	10.7	8.2	km