services and provide further incentives for commercialization of the band.[41] In addition to providing both MDS and ITFS licensees with greater flexibility to swap channels, it further relaxed the requirements for instructional services. Those ITFS licensees deploying digital technology could now lease up to 95% of their spectrum capacity, while using only 5% for instructional purposes.

In sum, the spectrum allocated to ITFS has been largely commercialized, and is no longer used for its "primary intended purpose" of instructional programming. In 1963, about 5 percent of the total spectrum allocated for MDS/ITFS in the 2150-2162 MHz/2500-2690 MHz bands was assigned for commercial purposes, while the vast majority was assigned for instructional purposes. Today, the opposite appears to be true. Of the more than 200 MHz of spectrum in these two bands, the FCC requires that only 6 MHz be used for instructional purposes. This represents less than 3% of the total spectrum capacity. The remaining spectrum can be licensed directly to commercial MDS operators or leased by them.

In its Interim Report, the FCC did not determine how much spectrum assigned to ITFS licensees is actually used to provide instructional services and how much is leased to commercial entities. We urge the FCC to make such a determination and, to the extent it does not have the necessary data, to request it from ITFS licensees. Such an analysis will likely reveal that, on average, substantial portions of the ITFS spectrum are no longer being used for instructional purposes and can be made available for 3G. Considering its

[41] *See Gen Amendments of Parts 21 and 74 to Enable Multipoint Distribution* Service and Instructional *Television Fixed Service Licensees to Engage in Fixed Two-Way Transmissions*, Report and Order, 13 FCC Rcd 19112 (1998) ("Two-Way Order").

suitability for 3G services and the considerable need for 3G spectrum, we believe that the Commission should allocate a portion of this band for 3G use.

B. 3G and ITFS Can Be Accommodated Through Segmentation Of The 2500-2690 MHz Band.

Since substantial portions of the ITFS band are no longer used for instructional services, ITFS licensees can be accommodated in significantly less spectrum than is currently assigned to them. Consequently, Verizon Wireless believes that 3G services can be accommodated in the 2500-2690 MHz band through band segmentation. This would require that a portion of the band be cleared of incumbent services and made available for 3G.

The FCC's Interim Report assesses the feasibility of three band segmentation options, and concludes only that band segmentation "would raise technical and economic difficulties for incumbents."[42] It does not attempt to define or quantify these difficulties. We urge the Commission to do so in its Final Report. The Commission does, however, indicate that band segmentation options affecting only ITFS are more acceptable than those that affect commercial MDS operators.[43]

Study Assumptions. In assessing the feasibility of band segmentation, the Commission assumed that a minimum of 90 MHz of spectrum would need to be available for 3G in the 2500-2690 MHz band to support multiple licensees and thus promote competition. We do not agree with this assumption. While the reallocation of 90 MHz of ITFS spectrum, or an even greater amount, might prove to be the appropriate course of

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[42] FCC Interim Report at iii.

[43] FCC Interim Report at 58.

action, we do not agree that 90 MHz is the minimum amount necessary to make band segmentation possible. Operators can be expected to deploy 3G services in multiple frequency bands, pending the outcome of this proceeding. These services will be competitive, with operators licensed in the 1.7 GHz band, for instance, competing with operators licensed in the 2.5 GHz band.

We do agree with the Commission, however, that the spectrum made available to individual 3G licensees must be of sufficient size to enable development of 3G systems that are economically viable – *e.g.*, 30 MHz. The Commission should also license at least two operators in the band to facilitate the economies of scale necessary to warrant the development of 3G equipment. It would thus be prudent to make at least 60 MHz available for 3G use in the 2500-2690 MHz band.

Impact on ITFS Licensees. As discussed above, significant ITFS spectrum capacity is not being used for instructional purposes. The Commission has indicated that most ITFS licensees lease excess spectrum capacity to MDS operators.[44] The Commission's rules, having evolved considerably over the past 35 years to facilitate greater commercial use of the band, currently permit as much as 95% of ITFS spectrum to be used for non-instructional purposes.

While a thorough assessment of ITFS use will determine exactly how ITFS spectrum is being used, it is reasonable to assume that significantly less than half of the 120 MHz of spectrum currently allocated to ITFS is actually used for instructional purposes. Thus, 60 MHz of spectrum could be reallocated and made available for 3G services while leaving ITFS licensees with the spectrum resources necessary to provide

[44] NPRM at 59.

instructional services. To the extent ITFS licensees believe that this would not leave them with adequate spectrum, they should demonstrate with specific data why this is the case.

Relocation of ITFS to Other Spectrum. As the Commission notes, ITFS systems are not deployed uniformly.[45] While some ITFS licensees may use more than half of their assigned spectrum for instructional purposes, we expect that most of these do so using traditional one-way ITFS systems that employ analog technology.[46] As the Commission's Interim Report suggests, it "may be feasible to offset reductions in the spectrum available for incumbent systems by improving spectrum efficiency" through the use of digital technology.[47] In fact, many ITFS operations have already been converted to digital technology to provide increased capacity for commercial MDS operations.

To the extent that some ITFS licensees are able in this proceeding to show that they require more than 60 MHz of spectrum to provide instructional services, those services can be accommodated in frequency bands above 3 GHz that are well suited for fixed services but cannot support mobility. The modernization of ITFS systems from analog to digital technology will minimize the need for such alternate spectrum. In any event, the need to relocate incumbents is not a bar to reallocating spectrum. To the contrary, it is often the inevitable result of the reallocation process.[48]

Impact on MDS Licensees. A reallocation of ITFS spectrum to 3G mobile services would not directly harm MDS licensees. While MDS operators do lease

[45] FCC Interim Report at ii.

[46] FCC Interim Report at 30.

[47] FCC Interim Report at 37.

[48] *See* Section V *infra* for discussion of FCC spectrum allocation decisions resulting in the relocation of incumbent operators.

spectrum from ITFS licensees, their access to this spectrum is necessarily limited and, of course, they are not themselves ITFS licensees – they have access to ITFS spectrum only through private leasing arrangements.

It is also not clear that MDS operators require access to more than the approximately 80 MHz of spectrum for which they are already licensed. As described in the Interim Report, the amount of spectrum available to an operator directly affects the size of cells in its system.[49] This is no less true for cellular mobile systems, and is the reason why mobile base stations must be designed to cover areas that are typically no more than 80 square miles. In high density areas, they are considerably less than one square mile. Frequency reuse is a necessary technique used by mobile operators to make the most efficient use of their allotted spectrum. We do not agree with the Interim Report that MDS operators would bear an economic burden if they were required to reduce the size of their cells from 3,217 square miles to 1,662 square miles.[50] Clearly, MDS operators could make more efficient use of their spectrum. A reallocation of some portion of the 2500-2690 MHz band would further this goal.

To the extent that MDS operators may require still more spectrum, they can bid on it at auction. The Commission has indicated that any future spectrum it makes available for 3G services will be auctioned and available for any mobile or fixed service. Thus, reallocating some portion of ITFS spectrum will not deny MDS operators access to spectrum that they might need to deploy fixed broadband services.

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[49] FCC Interim Report at 61.

[50] FCC Interim Report at 61.

V. REALLOCATION OF SPECTRUM TO 3G SERVICES IS IN THE PUBLIC INTEREST AND CONSISTENT WITH PREVIOUS COMMISSION DECISIONS.

Reallocation of certain spectrum to 3G services is fully in line with the Commission's previous reallocation decisions. In those proceedings, instead of applying a precise, "bright line" test, the Commission has focused on general public interest factors such as the need for spectrum for a new service, the likely benefits of that service, the impact on incumbent spectrum users and other Commission licensees, and the degree of consistency with the international allocation framework. Looking to these factors, the Commission has in a wide variety of circumstances concluded, as it should here, that the spectrum should be reallocated to a different service.

For example, in 1982, the Commission deleted the primary allocation for fixed microwave service ("FS") in the 12.2-12.7 GHz band and reallocated this frequency band to the Direct Broadcast Satellite ("DBS") service. The Commission pointed to the benefits that could result from the development of DBS, including improved TV service to underserved rural areas and increased diversity in programming throughout the U.S. The Commission concluded that such potential benefits outweighed the costs to incumbent microwave operators. It stated that it would take steps to protect these incumbents, including initiating a new proceeding to identify spectrum to which these operators could relocate. The Commission also pointed out that the DBS allocation in this band would be consistent with the recent international allocation to BSS.[51] All these

[51] *Inquiry into the Development of Regulatory Policy in regard to Direct Broadcast Satellites for the Period following the 1983 Regional Administrative Radio Conference*, Report and Order, 90 F.C.C. 2d 676, ¶¶ 7-21, 56-73 (1982).

factors weigh equally in favor of reallocating spectrum in the 2500-2690 MHz band for auction to accommodate mobile services.

The Commission's analysis was similar in 1988 when it reallocated spectrum in the 220-222 MHz from the amateur service to land mobile service. In that decision, the Commission found that there was a substantial need for additional spectrum for land mobile communications, that the 220-222 MHz band was particularly conducive for land mobile use, and that such allocation would offer key encouragement to the development of narrowband technologies. Again, these same considerations apply to a reallocation of spectrum to 3G in this proceeding.[52]

Other reallocation decisions support the reallocation of spectrum for 3G services. First, as discussed *supra*, the Commission in 1983 reallocated a portion of the ITFS spectrum in the 2500-2690 MHz band to MDS. In that order, the Commission found that there was a substantial unmet demand for spectrum for multichannel MDS, and that this reallocation would have minimal impact on ITFS licensees. It pointed out that there was little or no use of the ITFS spectrum outside major metropolitan areas, and that future growth of ITFS was likely to be limited.[53]

In its 1992 *Emerging Technologies* proceeding, the Commission reallocated a substantial portion of spectrum in the vicinity of 2 GHz from fixed microwave services to next-generation, emerging digital technologies. The Commission again pointed to

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[52] *Amendment of Part 2 of the Commission's Rules Regarding the Allocation of the 216-225 MHz band*, Report and Order, 3 FCC Rcd 5287 ¶¶ 12-19, 25-40 (1988). *See also Amendment of the Commission's Rules with Regard to the Establishment and Regulation of New Digital Audio Radio Services*, Report and Order, 10 FCC Rcd 2310 (1995) (reallocating the 2310-2360 MHz band from aeronautical telemetry service to DARS).

[53] ITFS/MDS Report and Order at ¶¶ 51-64.

benefits offered by the new services, including Americans' enhanced personal access to communications services, increased business productivity, and maintenance of U.S. leadership in the global telecommunications marketplace. The Commission pointed out that the 1.85-2.2 GHz band was the appropriate spectrum for these services, and that this allocation was consistent with the international allocation for these services.[54]

The relevant public interest factors that led the Commission to reallocate spectrum in these cases exist here as well and weigh heavily in favor of a reallocation of MDS spectrum in the 2150-2160 MHz and a reallocation of ITFS spectrum in the 2500-2690 MHz band to 3G services. As indicated above, there is an urgent need in the United States for additional spectrum for 3G services. The ongoing convergence of mobile and Internet services has fueled extraordinary consumer interest in wireless data services, but only 189 MHz of spectrum is currently available for these services. This amount is insufficient to support the development of 3G and the long-term growth of the wireless industry. From a technical perspective, these bands are extremely well suited for 3G mobile services, and spectrum in these bands would be instrumental to meeting this surging spectrum demand.

With the United Kingdom, France, and other countries each having allocated more than 350 MHz to mobile services, it is clear that the Commission will have to allocate substantial additional spectrum to 3G services in order to maintain U.S. leadership in the global telecommunications marketplace. In addition, a reallocation of the spectrum bands identified would be consistent with the ITU's recommendation that

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[54] *Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies*, First Report and Order, 7 FCC Rcd 6886, ¶¶ 14-21 (1992).

the 1710-1850 MHz, 2110-2165 MHz, and 2500-2690 MHz bands be made available for 3G services, and would help harmonize U.S. 3G efforts with the worldwide implementation of these services.

Reallocation here would also be consistent with prior FCC spectrum reallocations because incumbents can be fully protected. First, it would not necessitate a loss of any instructional television services. As was the case in 1983, it is apparent that little of the ITFS-allocated spectrum is being utilized for these services. In addition, to the extent that some ITFS licensees today require considerably more spectrum, they can either reduce their spectrum needs through digitalization or relocate to frequency bands above 3 GHz that are conducive to fixed services.

MDS incumbents in the 2150-2160 MHz band can also be accommodated through relocation to other bands. With respect to the MDS operators currently leasing ITFS spectrum, these parties are non-licensees and therefore would not be directly harmed by the proposed reallocation of ITFS spectrum. Moreover, as explained above, it is not clear that these operators need more than their approximately 80 MHz of licensed spectrum; improved frequency reuse could substantially cut their spectrum needs. In addition, frequency-strapped MDS operators would have the opportunity to bid on the reallocated 3G spectrum at auction.

VI. SECONDARY MARKET MECHANISMS WILL NOT FACILITATE THE WIDESPREAD DEPLOYMENT OF ADVANCED WIRELESS SERVICES.

In its NPRM, the Commission suggests that increased flexibility and other features designed to encourage secondary markets for spectrum could facilitate the deployment of 3G and other advanced wireless services in those frequency bands

identified by the NPRM.[55] In general, Verizon Wireless endorses the Commission's efforts to explore ways in which secondary markets can be used to increase access to spectrum. However, as we stated elsewhere,[56] even if the Commission were to adopt the approaches it outlines in its Secondary Markets NPRM, it would not obviate the need to allocate additional spectrum for 3G and other advanced wireless services.

For example, to permit more efficient use of spectrum, in the Secondary Markets NPRM the Commission proposes that licensees be permitted to lease spectrum to other carriers, without seeking prior approval from the Commission.[57] Spectrum leasing may facilitate more intensive use of this scarce resource, and may alleviate "locational" shortages. Under a spectrum leasing scenario, those that demand capacity in a particular market can deal directly with those that can supply that capacity. Spectrum leasing can provide a carrier a means to "fill holes," either in its footprint, or by providing additional capacity where it already has licenses. However, spectrum leasing is not the ultimate "fix" for spectrum shortages or the most appropriate way for the Commission to make additional spectrum available.

Simply permitting spectrum leasing, or in the case of the ITFS/MDS bands, expanding ITFS licensees' authority to lease its spectrum, will not release the vast amounts of new spectrum required for 3G and other advanced wireless services. For

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[55] NPRM and Order at ¶ 33. *See also Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets*, Notice of Proposed Rulemaking, WT 00-230, FCC 00-402 (rel. Nov. 27, 2000) ("Secondary Markets NPRM"); and *Principles for Promoting the Efficient Use of Spectrum by Encouraging the Development of Secondary Markets*, Policy Statement, FCC 00-401 (rel. Dec. 1, 2000) ("Secondary Markets Policy Statement").

[56] Comments of Verizon Wireless to Secondary Markets NPRM (filed Feb. 9, 2001); *see also Wireless Telecommunications Bureau Seeks Comment on Request for Clarification of De Facto Control Policy and Proposed Lease Agreement*, Public Notice, DA 00-1953 (rel. Aug. 24, 2000), Comments of Verizon Wireless (filed Sept. 15, 2000).

[57] Secondary Markets NPRM at ¶¶ 24-62.

example, it would be very difficult for a mobile carrier to assemble a nationwide 3G footprint through negotiating agreements with the thousands of ITFS and MDS licensees. As the Commission states in the NPRM, "MDS and ITFS spectrum use is an amalgam of different channels and geographic boundaries that vary from location to location."[58] Because of this variation in geographic and spectrum location, and because ITFS spectrum is assigned on a site-specific basis, even after negotiating leases with ITFS licensees, a carrier would still not have access to all the required spectrum in a region, thus thwarting its ability to offer 3G services on a regional or nationwide basis. The transaction costs of such an endeavor are likely to be huge, and as such would hinder the introduction of 3G services.

Overlaying leased spectrum onto an already complex licensing scheme advantages businesses that have geographic coverage similar to the existing licensees and, as such, would disadvantage mobile carriers. It is also unlikely under such a scenario that manufacturers would develop equipment for use in the band without a clear understanding of how or whether the band will ultimately be used for 3G services.

Furthermore, a lease is no substitute for a license. Businesses desire as much control as possible over their assets. Regardless of the changes the Commission may make to its own regulations to implement leasing, by law a lease cannot grant control over spectrum. Spectrum is one of a wireless carrier's most valuable assets; leasing that spectrum from another licensee is simply more risky than controlling a license. Decisions as to how and to what extent to invest in network infrastructure, for example, are much more difficult if access to the underlying spectrum is vested in another entity.

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[58] NPRM at ¶ 61.

The lessee also must account for the risk that the lessor could violate FCC rules or declare bankruptcy, leaving the lessee with no spectrum and no business. While the risks associated with leasing can be mitigated through contract, they cannot be entirely removed. The importance of a company's long-term control over its business assets, something that is implicit in an FCC license, inevitably leads a carrier to prefer being a licensee.

The NPRM also suggests that the Commission could simply make the current allocations more flexible thus allowing incumbents to, in essence, "sell" their newly acquired rights to 3G service providers. For the same reasons that spectrum leasing will not produce an efficient reallocation of the large amount of additional spectrum needed for the development of 3G services, neither will providing incumbents the flexibility to sell their licensed spectrum produce an efficient result.

Secondary market mechanisms such as leasing or retroactively providing for more flexible spectrum allocations cannot remedy the current spectrum shortage. As the Commission itself has acknowledged, there is a serious need for additional spectrum that is flowing from the public's rapidly growing demand for access to wireless voice, data, and Internet-related services. Secondary market mechanisms are not a substitute for allocating and auctioning significant amounts of additional unencumbered spectrum.

CONCLUSION

The Commission's required actions should be clear. The Commission must allocate substantial amounts of additional spectrum to support the growing demand for mobile services, including emerging 3G services. These allocations should be harmonized with worldwide allocations, to the greatest extent possible. Consequently,

the Commission should allocate spectrum from within those bands that have been identified worldwide – *i.e.*, 1710-1850 MHz, 2110-2165 MHz, and 2500-2690 MHz. The reallocation proposals outlined in these comments accommodate existing users while clearing spectrum for auctioning. The public interest benefits of reallocations are clear, and we urge the Commission to take these actions forthwith.

Respectfully submitted,

VERIZON WIRELESS

By: John T. Scott III

John T. Scott, III
Vice President and Deputy
General Counsel – Regulatory Law
Verizon Wireless
1300 I Street, N.W., Suite 400W
Washington, DC 20005
(202) 589-3760

Donald C. Brittingham

Donald C. Brittingham
Director – Spectrum Policy
Verizon Wireless
1300 I Street, N.W., Suite 400W
Washington, DC 20005
(202) 589-3785

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Analysis of Adjacent Channel Interference Between 3G and MDS In the 2110-2165 MHz Band

An interference analysis has been conducted to determine the potential for interference due to spurious emissions from an MDS base station into a 3G (UMTS) handset operating in the adjacent band. The methodology used was to calculate the total spurious power into a 3G mobile receiver that falls within a single channel of a UMTS mobile. For this analysis, it is assumed that the propagation characteristic follows a free space model.

It is shown that operation of an MDS base station in accordance with the technical parameters specified in the FCC's rules, will cause unacceptable interference into a 3G handset. The level of interference would be unacceptable even with a guard band of more than 3 MHz between the MDS and 3G bands.

It is recommended that either the MDS band be relocated to an entirely new band or be pushed towards the edge of the (2110-2165) band while at the same time making modifications to the current FCC rule to impose a stricter requirements on the out of band emission of MDS base stations.

Study Assumptions

A potential 3G deployment scenario, adjacent to MDS, is analyzed. It is assumed that 3G would use the frequency block 2110 - 2150 MHz for the forward link (BTS to Mobile). An MDS operator is assumed operational at the lower end of the 2150 - 2162 band. Out-of-band emissions for the MDS transmitter, as described in Part 21 of the FCC's rules are used. Analysis considers the worst-case scenario: Interference from MDS base station into 3G (UMTS) mobile station.

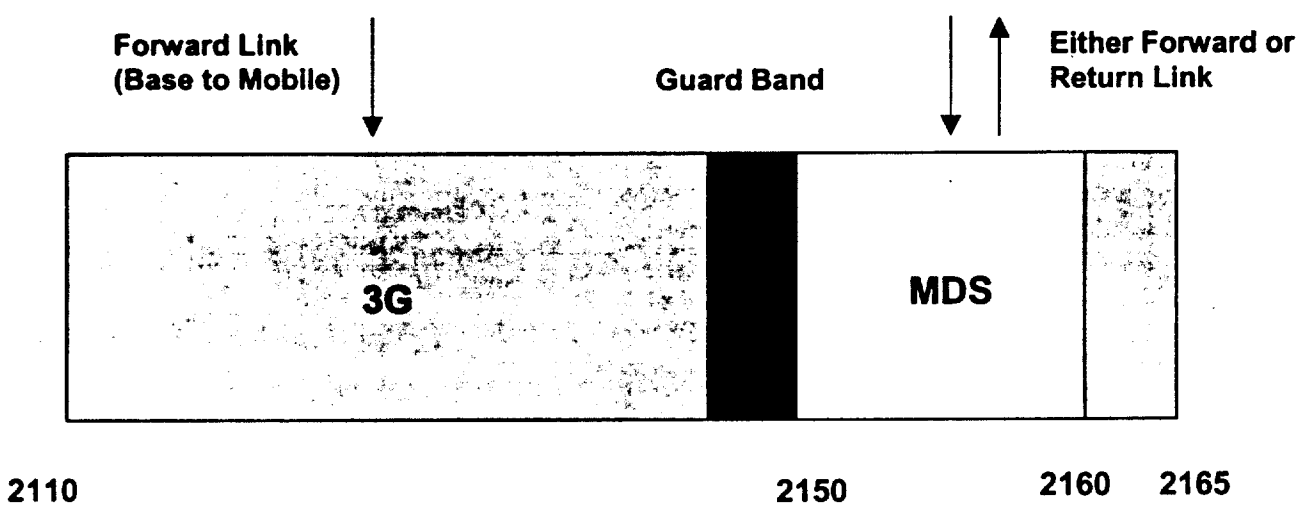

Fig. 1 Adjacent Channel Scenario (not to scale)

It is assumed that the MDS base station employs a 2000 watt transmitter with a 6 MHz bandwidth operating at a center frequency of 2153 MHz. This is the maximum allowed EIRP in a 6 MHz channel (FCC Rules, Part 21). It is also assumed that the 3G mobile is located 0.5 km from the MDS base station.

Pursuant to Part 21 of the FCC's rules, the maximum out-of-band emissions for an MDS transmitter utilizing digital modulation should be attenuated as follows:

- 25 dB at channel edges for 6 MHz channels
- Linear slope to 250 kHz beyond the nearest channel edge
- 40 dB at 250 kHz beyond the nearest channel edge
- Linear slope attenuation between 250 kHz and 3 MHz
- 60 dB at 3 MHz and all other frequencies

If we assume a 3 MHz guard band between the 3G and MDS bands, then the out-of-band emissions of the subject MDS transmitter into the 3G band will be 60 dB below the MDS maximum EIRP. As a result, the spurious emissions into the 3G band would be:

$$\text{OOB Emissions (@ 3 MHz)} = 45.22\ (\text{dBm/100kHz}) - 60\ \text{dB}$$
$$= -14.78\ (\text{dBm/100kHz})$$

The out-of-band emissions produced at the MDS transmitter would, of course, be reduced at the 3G mobile receiver located 0.5 km away. Assuming a free space loss model for simplicity, this additional attenuation can be calculated from the following equation:

$$L_{fs} = 10 \log_{10} (\lambda/4\pi d)^2$$

Where λ is the emission wavelength and d is the separation distance between the transmitter and receiver. With f = 2153 MHz and d = 0.5 km, the above formula gives free space loss as L_{fs} = 93.08 dB. The interference from the MDS base station would therefore be further attenuated by 93.08 dB when it gets to the 3G mobile receiver. The adjacent channel interference would be calculated as follows:

$$\text{ACI} = -14.78\ (\text{dBm/100kHz}) - 93.08\ \text{dB}$$
$$= -107.86\ (\text{dBm/100 kHz})$$
$$= -92.01\ (\text{dBm/3.84 MHz})$$

Assuming a thermal noise level of –108 (dBm/3.84 MHz) and a 3G mobile receiver with a noise figure of 9, there will be –99.2 (dBm/3.84 MHz) of thermal noise. Comparing this with the –92.01 (dBm/3.84 MHz) of interference, we see that the MDS transmitter would cause the noise level at the 3G mobile receiver to rise by 7.19 dB.

Findings

Interference from MDS into 3G was found to raise the noise floor of a mobile station by an excessive amount, translating into a significant loss in system capacity for 3G systems. As an example, the mobile noise floor rises 7 dB when the MDS and mobile are half a kilometer apart and a 3 MHz guard band exists between 3G and MDS. The results hold true for larger (than 3 MHz) guard bands, if the same MDS out-of-band emission limits are used, as described by Part 21 of the FCC's rules. In fact, since the maximum attenuation of out-of-band emissions required by the FCC is 60 dB (for any frequency out of the MDS band), then these same results would be obtained regardless of the size of guard band used to separate MDS and 3G operation.

Conclusion

Continued operation of MDS systems in the 2150-2160 MHz band in accordance with the FCC's technical rules would preclude the operation of 3G systems in the 2110-2150 MHz and 2160-2165 MHz portions of the band.

Recommendations

1. Allocate the entire 2110-2165 MHz band to 3G services and migrate MDS operations to alternate bands.
2. Modify the current out-of-band emission limits described in Part 21 of the FCC's rules to reduce adjacent channel interference caused by MDS systems, and thus, increase the efficient use of the 2110-2165 MHz band.

References

1. FCC Rules, Part 21 – Domestic Public Fixed Radio Services, Sec. 21. 908
2. Mobile station parameters source: W-CDMA for UMTS, John Wiley, 2000, Edited by H. Holma and A. Toskala.

Certificate of Service

I hereby certify that on this 22nd day of February copies of the foregoing "Comments of Verizon Wireless" in ET Docket 00-258 were sent by hand delivery to the following parties:

Peter Tenhula
Legal Advisor to Chairman Powell
Federal Communications Commission
445 12th Street, SW – Room 8-A204
Washington, DC 20554

Adam Krinsky
Legal Advisor to Commissioner Tristani
Federal Communications Commission
445 12th Street, SW – Room 8-C302
Washington, DC 20554

Mark Schneider
Legal Advisor to Commissioner Ness
Federal Communications Commission
445 12th Street, SW – Room 8-B115
Washington, DC 20554

Bryan Tramont
Legal Advisor to Commissioner
Furchtgott-Roth
Federal Communications Commission
445 12th Street, SW – Room 8-A302
Washington, DC 20554

Diane Cornell
Wireless Telecommunications Bureau
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Rodney Small
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Ira Keltz
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Geraldine Matise
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Sarah E. Weisman

Sarah E. Weisman