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

In the Matter of

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

COMMENTS OF CISCO SYSTEMS, INC.

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SUMMARY

Consistent with the national imperative to make multiple broadband alternatives available to all Americans by 2010, Cisco Systems, Inc. ("Cisco") profoundly believes U.S. policy makers must allocate more spectrum for high speed Internet access. To that end, prompt efforts to identify new radio frequencies for Third Generation ("3G") services are essential. But policy makers will not achieve this broadband imperative by switching spectrum from one high-speed use to another. Cisco's comments are directed toward its concern that the Commission not misguidedly derail imminent deployment of fixed wireless broadband in the 2500-2690 MHz band.

Recognizing the unmet demand for competitive broadband access, Cisco developed a robust MDS wireless platform capable of delivering the first broadband pipe to millions in smaller residential and rural markets, as well as offering a competitive alternative where DSL and cable have been the only options for broadband access. What is remarkable is the MDS platform's potential to greatly extend the reach of broadband access. Because the capital expense and installation time required to deploy the network are so much lower than traditional options, it presents a solid business case for serving small, rural and residential markets.

As the Commission knows from the receipt of a multitude of requests for two-way authorization, the 2500-2690 band is on the cusp of widespread deployment for high speed, broadband services in these underserved markets. This is, in large part, due to wise spectrum management decisions of recent years that have facilitated the development of such technology in this band. The Commission should not, now, reverse course and disrupt the expectations of manufacturers, investors and service providers.

Simply stated, the public would be disserved by any disruption of the ongoing deployment of this advanced wireless service simply to facilitate another. *Any* change in the 2500-2690 GHz band, whether a diminution or relocation of spectrum, would threaten the progress of broadband fixed wireless services and harm efforts to promote cross-platform broadband competition. What's more, residential and rural consumers – *precisely* those the Commission recently identified as most vulnerable to a lack of broadband access – would be disproportionately affected.

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COMMENTS OF CISCO SYSTEMS, INC.

Cisco Systems, Inc. ("Cisco"), the leading manufacturer of IP networking equipment, respectfully submits these comments in response to the Federal Communication Commission's ("FCC") recent Notice of Proposed Rulemaking in this Docket.[1] Cisco's public policy goal is to create an environment in which multiple and competing broadband networks are rapidly made available to all. Cisco has pursued this goal across all technology platforms–wireline, cable and wireless (whether mobile, fixed or unlicensed). Accordingly, Cisco fully supports the Commission's initiative to identify appropriate spectrum for new advanced wireless services, including Third Generation ("3G") mobile services. Our comments are addressed to one band under consideration for reallocation to 3G services – the 2500-2690 MHz band.[2]

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[1] *Notice of Proposed Rulemaking and Order*, FCC 00-455 (rel. January 5, 2001)("NPRM").

[2] The 2500-2690 band is allocated to the Fixed service and is predominately used by two non-Federal Government services, the Instructional Television Fixed Service ("ITFS") and Multichannel Mutipoint Distribution Service ("MDS").

I. INTRODUCTION

The 2500-2690 band is on the cusp of widespread deployment for high speed, broadband services in residential, rural and medium size markets. Simply stated, the public would be disserved by any disruption of the ongoing deployment of this advanced wireless service simply to facilitate another. *Any* change in the 2500-2690 GHz band, whether a diminution or relocation of spectrum, would threaten the progress of broadband fixed wireless services and harm efforts to promote cross-platform broadband competition. What's more, residential and rural consumers – *precisely* those the Commission recently identified as most vulnerable to a lack of broadband access[3] – would be disproportionately affected.

As a manufacturer of equipment used in the provision of broadband fixed wireless services ("BBFWS"), Cisco has analyzed the technical and economic consequences of two alternatives identified by the Commission's staff in the agency's Interim Report on the 2500-2690 MHz band.[4] One option is a reallocation of spectrum from MDS/ITFS services to 3G wireless services with no replacement spectrum. The other is a reallocation with supplemental relocation spectrum in a higher band, such as above 3 GHz.

This analysis resulted in the following conclusions:

- For rural and small markets, any change to the band would dramatically increase the cost of deployment and potentially threaten the business case for entering these markets.

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[3] *Deployment of Advanced Telecommunications Capability: Second report*, FCC 00-290, at ¶¶ 8, 88 (rel. Aug. 21, 2000) ("Second 706 Report")(noting that Americans living in "sparsely populated areas" are "particularly vulnerable to not having access to advanced services," and concluding that high-speed service availability rises with population density).

[4] *Spectrum Study of the 2500-2900 Band: The Potential for Accommodating Third Generation Mobile Systems,* Staff Report (rel. Nov. 15, 2000)("Interim Report").

- For urban and large markets, any change would dramatically increase the cost of deployment and threaten the business case for serving residential customers in those markets.

- For all markets, any change would result in a time-to-market delay until at least the 2002-2003 time-fame, with corresponding loss of market share, lagging time to profitability, and delay in service availability for all markets and all consumers.

Over the past 5 years, the Commission has intentionally and artfully restructured the MDS/ITFS service rules to promote the growth of a robust fixed wireless broadband industry.[5] Manufacturers and service providers have met the challenge, investing billions of dollars to acquire licenses, develop equipment, and prepare for deployment across the nation. The Commission must not now disrupt these plans and deprive the public of a valuable, competitive advanced service.

II. CISCO'S BROADBAND MDS PLATFORM BRINGS BROADBAND SERVICE TO NEW AREAS AND PROVIDES FACILITIES BASED COMPETITION TO DSL AND CABLE

Recognizing the unmet demand for competitive broadband access, Cisco developed a robust MDS wireless platform capable not only of delivering the first broadband pipe to millions in smaller residential and rural markets, but also offering a competitive alternative where DSL and cable have been the only options for broadband access. Essentially, Cisco's MDS platform provides either a first, or an alternative, "last mile access" solution, delivering two-way data, voice and video communications.

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[5] Originally, the MDS/ITFS band was used only for one-way analog video transmission. Starting in 1996, the Commission carefully revised the rules to allow greater technical and operational flexibility – eventually approving both digital and two-way transmissions. *See*, Request for Declaratory Ruling on the Use of Digital Modulation by Multipoint Distribution Service and Instructional Television Fixed Service Stations, *Declaratory Ruling and Order*, FCC 96-304 (rel. July 10, 1996) ("Digital Declaratory Ruling"); Amendment 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*, FCC 98-231 (rel. Sept. 1998) ("Two-Way Order"). In doing so, the Commission remarked on its intent to "provide significant benefits to consumers. A new, competitive group of players will now enter the market for high

This system offers tremendous advantages and innovation over many other broadband service platforms. It delivers robust service that is comparable in speed and capacity with DSL and cable broadband platforms. As a wireless solution, it allows service providers to quickly deploy where there is no existing infrastructure. Yet Cisco's fixed wireless solution is positioned to markedly extend the reach of broadband access: it presents a solid business case for serving small and rural markets because the capital expense and installation time required to deploy a network are so much lower.

In addition, the MDS platform expands subscriber coverage by surmounting the classic microwave limitation requiring clear line of sight. Cisco's Vector Orthogonal Frequency Division Multiplexing ("VOFDM") technology overcomes non-line-of-sight ("NLOS") environments, taking advantage of waves that bounce off of buildings, water, trees and other obstructions. The receiver combines these multi-path signals into one strong signal, rather than receiving them as interference. The capability to operate with high levels of multi-path permits obstructed links to be deployed, resulting in much improved 80-90 percent residential coverage. This also permits the mounting of towers on shorter buildings and rooftops. In short, carriers can use Cisco's technology to achieve access to unserved areas, increased coverage within all areas, high spectral efficiency, robust RF links and easier provisioning.

The Commission and many analysts have noted the tremendous pent-up demand for broadband access. The Forrester Brief, for example, reports that while only 3 percent of households had broadband access by mid-2000, 55 percent indicated that they would

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speed two-way communications service. . . . Also, consumers will be able to take advantage of new video-conferencing, distance learning and continuing education opportunities." *Two-Way Order,* at ¶9.

subscribe once it became available.[6] Estimates indicate a jump in subscribership from 2.8 million households today to 45.8 million – all in a mere five years.[7] The MDS platform has a critical role to play, as the Commission has recognized: "terrestrial wireless has the potential to reach residential consumers and business unserved by cable or DSL . . . ."[8] The Commission itself has predicted that the next three years will see fixed wireless high-speed services capture 12-15 percent of the broadband market, from 1 percent today.[9]

MDS broadband technology – with its unique potential to serve residential and rural areas – is poised to meet this demand.

III. ANY INFRINGEMENT OF MDS/ITFS SPECTRUM WILL DRAMATICALLY AFFECT THE ROLLOUT, CAPACITY, AND ULTIMATELY VIABILITY, OF THESE ADVANCED WIRELESS SERVICES

Cisco's innovative VOFDM technology has been used in trials by several major MDS licensees, including ongoing trials with Nucentrix Broadband Networks, Inc.[10] The nation's largest and most active MDS licensees – Worldcom, Sprint, and Nucentrix – applied for two-way authorizations during the Commission's recent filing window in August 2000, and merely await grant of those authorizations, anticipated in April 2001. Indeed, these licensees alone have sought two-way authorization to provide broadband service in 175 markets nationwide.[11] A conservative estimate indicates that these three

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[6] The Forrester Brief, *Consumer Broadband Hits Hypergrowth in 2001*, Oct. 6, 2000.

[7] *Id.*

[8] *Second 706 Report*, at ¶ 200.

[9] *Id.*, at ¶¶ 197, 200.

[10] Nucentrix holds licenses in 92 markets, spreading across Texas and throughout the mid-West. See Nucentrix Broadband Networks, Inc., Securities and Exchange Commission, Form 10-K, Dec. 31, 1999, at 9 and 11. *See also*, Nucentrix and Cisco Extend Broadband Wireless Trial in Amarillo, Press Release, Feb. 2, 2001, available at www.nucentrix.com.

[11] *See, e.g.*, www.wcom.com/about_the_company/press _releases/display.phtml?cr/20000814 (discussing Worldcom's plans for licensing and deployment in 60 markets nationwide);

service providers will offer competitive broadband access to 63 million households, more than 62 percent of the nation.[12]

Any 2500-2690 MHz band segmentation scheme would severely threaten the geographic reach and potential market penetration of these anticipated deployments. This is true even if MDS licensees were offered partial relocation in another band. To demonstrate these consequences, Cisco has calculated the effects on two types of markets: (1) a large, dense market and (2) a smaller, more rural market. To provide concrete examples of the impact of spectrum changes in such markets, we have chosen to analyze a representative of each: San Jose-Silicon Valley, as an example of the larger market, and Amarillo, as an example of the more rural market. Of course, business models vary from market to market, due to demographic and geographic variations. These examples are indicated as an amalgam of markets and service providers, providing a "typical case" for discussion.

A. THE CURRENT BUSINESS CASE SUPPORTS WIDESPREAD DEPLOYMENT IN RESIDENTIAL AND RURAL AREAS

The urban market and the small market present different feasibility challenges for the service provider. Cisco has met these challenges in its network design. These network solutions, however, are anchored in the promise of flexible access across the

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www3.sprint.com/Stemp/press/releases/200008/200008221040.html (same for Sprint); www.nucentrix.com/cgi-bin/t3.cgi/search/news.taf (same for Nucentrix). See also, Petition for Rulemaking of the Cellular Telecommunications and Internet Association Concerning Implementation of WRC-2000, Comments of Worldcom, Inc., RM-9920 (Aug. 28, 2000); Comments of Nucentrix Broadband Networks, Inc. (same proceeding); Sprint Comments on Petition for Rulemaking (same proceeding).

[12] See MCI Worldcom Wireless Solutions, Interpreting the Changing MMDS Landscape, Feb. 2000, at 15 (54 million households from Sprint and Worldcom); Nucentrix Broadband Networks, Inc., Securities and Exchange Commission, Form 10-K, Dec. 31, 1999, at 9 and 11) (9 million households). According to the U.S. Census Bureau, there are 101,041,000 households in the United States. ST-98-46, Estimates of Housing Units, Households, Households by Age of Householder, and Persons per Household (July 1, 1998) (most recent data available).

entire MDS/ITFS band. Any change to the band at this late date would require significant re-engineering, a marked increase in capital and operational costs, and a long delay in market entry.

The challenge Cisco's customers face in the dense urban market, such as San Jose-Silicon Valley, is the demand for high levels of network capacity. A business plan for this market could assume an eventual twenty percent penetration of the residential market: approximately 84,000 households. To provide this capacity, Cisco has developed a micro-cell network, with a frequency reuse pattern of three sectors per cell and clusters of three micro-cells each. Thus, each cluster requires 9 frequency sets for transmissions downstream and upstream. With a capacity of 10.5 MHz downstream and 7.5 MHz upstream, shared across thousands of customers, the network requires a total of 162 MHz (27-6 MHz channels). To serve the entire San Jose-Silicon Valley area, the network would incorporate a total of 26 micro-cells.

A small market, such as Amarillo, presents the challenge of minimizing network capital expenses because a more disperse customer base means that pro-rata costs of the network will be much higher. To address this need, Cisco has developed a single super-cell network. With a reuse pattern of four sectors per cell, the network requires sufficient spectrum to deploy multiple channels in each sector. With 21 MHz downstream and 12 MHz upstream per sector, again shared across thousands of customers, the entire system requires 132 MHz (22-6 MHz channels). With this design, the service provider can again assume 20 percent penetration, or 7,500 residential customers.

Cisco's customers planning deployment in dozens of markets by year-end established their business case based on these levels of capacity, efficiency and cost.

Likewise, Cisco designed its platform with the parameters – and the peculiarities – of the band design and service rules in mind. Thus, for example, the complex licensing, leasing and sharing arrangements among MDS and ITFS providers make access to the entire 190 MHz essential. This is true even though the examples cited above indicate active usage of 162 and 132 MHz for urban and rural markets, respectively. As the Commission staff quite appropriately noted in the Interim Report, the MDS and ITFS services "share the spectrum through complex licensing and leasing arrangements that have evolved over time and that are not uniform in all geographic areas."[13] Negotiation of the band is further complicated by the interference protections accorded among site-specific ITFS licenses, grandfathered MDS site licenses, and MDS geographic overlay licenses. As a result, the precise 162 or 132 MHz to be used for broadband access varies from market to market, as necessary to protect a multitude of incumbents. Simply stated: there is no single "piece" of the 190 MHz band that could be extracted for reallocation without severely upsetting the delicately interwoven co-existence among existing licensees. The same result pertains to the sliver of MDS spectrum at 2150-2160/62 MHz – spectrum that has been cobbled together for initial upstream communications, and now is essential to facilitate the transition from video to complete broadband services. As demonstrated below, even a small loss of spectrum in the MDS/ITFS band will upend the careful designs and projections that took these factors into account. Even a small loss of spectrum threatens the business case for serving rural and residential markets.

[13] Interim Report, at 18.

B. Any Band Segmentation Plan Would Increase Costs, Delay Market Entry and Significantly Affect the Business Case for Residential and Rural Markets

The FCC Interim Report considered three band segmentation options that would give 90 MHz of the 190 MHz MDS/ITFS spectrum to 3G services.[14] In short, any of these proposals would create significant time-to-market delays for both equipment manufacturers and service providers and would negatively affect the financial business case for providing broadband fixed wireless services. Ultimately those harmed would be consumers – many deprived of their first opportunity to obtain broadband access, and the remainder losing access to a new competitive service.

Band segmentation would entail a number of costs for broadband fixed wireless providers. First, setting aside capacity issues, the platform would require significant re-engineering. Cisco designed its MDS technology based on its understanding of the rules that no mobile services would operate in the 2500-2690 band. Accordingly, it proceeded with tradeoffs between cost and complexity that any manufacturer confronts in any design. If a reallocation were made to permit both fixed and mobile services, these original design assumptions and decisions, made to restrain product costs, would no longer hold. For example, the introduction of mobile services would require that guard bands be specified to ensure non-interference between fixed and mobile applications. A preliminary technological analysis indicates that Cisco's existing equipment theoretically could operate with 18 MHz guard bands separating the fixed broadband and 3G

[14] Interim Report, at 56.

services.[15] Under the Commission's three options, this could waste as much as 54 MHz – over one-quarter of the entire band!

To accommodate a narrower guard band, Cisco would need to re-engineer its channel filtering technology to achieve more robust adjacent channel rejection. In addition, Cisco would have to design entirely new duplexers to accommodate different transmit and receive capabilities. Finally, Cisco would need to jettison its reuse patterns and other deployment assumptions -- because its existing research is based on the fixed-only environment that has always defined the MDS/ITFS band – and return to the drawing board.

The same situation would exist if there were no segmentation and re-licensing, but rather a reallocation for Fixed and Mobile services on a co-primary basis (without relocation). Under such a scenario, existing licensees and lessees could theoretically institute mobile uses. This, essentially, is the sharing scenario addressed by FCC staff in the Interim Report, which indicated separation distances in some cases up to the radio horizon. At this point, it is difficult to begin to quantify the magnitude of the impact of a fixed/mobile environment.

Other costs of segmentation would result from time-to-market delays. The necessary reengineering efforts could take as much as a year or more to complete and test fully. For example, Cisco would need to revisit the entire design and manufacture cycle it has already completed: re-designing both hardware and software; revisiting component supply chains and partner agreements; duplicating lab and field trials; and reinitializing manufacturing plants. Furthermore, such work could not begin until the Commission's

[15] This figure is based solely on a preliminary theoretical analysis and would require verification through extensive filed testing. Such analyses could conclude that much more substantial guard bands are

final rules are in place. Therefore, the process described above would delay market entry until at least a 2002 to 2003 timeframe.

While customers lose the benefit of initial or alternative broadband access, the broadband fixed wireless industry would be shackled in its drive for market share at a time of tremendous growth. As discussed above, broadband penetration in the residential market is presently *de minimus* (approximately 3 percent of households), though demand is great. Should broadband fixed wireless access providers be denied access to this market due to a reallocation, they will be precluded from competing for 15 million new broadband households in the next two years.

These costs, delays and loss of potential market share are just the beginning – they inevitably flow from any change in available spectrum. The primary impact of band segmentation would be the loss of *nearly half of the available spectrum*. Such a drastic limitation in capacity, so late in the game, would radically change the business case in both residential and rural markets. Service providers faced with band segmentation would confront a Hobson's choice – to severely limit the capacity of their networks, or to multiply their up-front capital and recurring cost. Either way, consumers lose. Service will be less extensive and more expensive.

Assuming the network operator in San Jose-Silicon Valley had access to only 100 MHz of the band,[16] *the resulting loss in capacity would be nearly 71 percent*. Instead of reaching 84, 000 residences, the service provider could now reach only 24,000.[17] Of

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necessary.

[16] Even were the spectrum to be segmented 90 MHz/100 MHz as discussed in the Interim Report, it is not clear precisely how that spectrum would be re-distributed, and even less clear that MDS would receive 100 MHz. Issues of capacity for ITFS and the size of adequate guardbands would need to be addressed. Nonetheless, for the sake of simplicity, we have posited that MDS would have access to 100 MHz.

[17] Cisco's model also assumes 20 percent penetration of the small office/home office ("SOHO") and small and medium business ("SMB") markets. These markets also suffer a loss in capacity – of 52 percent –

course, the service provider could replace capacity by deploying additional base stations, producing more cells and greater frequency reuse. Yet to achieve the same capacity on 100 MHz of spectrum as the current network provides, the service provider would need to more than *triple* base station deployment, from 26 to 88. Not surprisingly, this magnitude of change greatly increases operational complexity and both capital and operating expenses. Where deployment of the entire 26 cell network in year one would cost approximately $7.4 million,[18] an 88 cell network would cost over $25 million. Ongoing operational expenses – for backhaul, maintenance, and roof or tower leasing -- also multiply from a mere $2.9 million to nearly $8 million per year. Considering the national implications of this band segmentation scenario, Cisco calculates that capital and operational expenses to deploy broadband fixed wireless in the top 100 Metropolitan Statistical Areas ("MSAs")[19] would increase by $5.19 billion over the first five years, from $12.15 billion to $17.34 billion.[20]

The small market service provider faces a starker choice: deploy with a fraction of the original capacity or, simply, don't deploy at all. Cisco designed the single, super-cell configuration to overcome a basic economic reality: lower density results in

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from 11,200 to 5,800. Cisco's model assumes that business customers generate traffic predominately during the daytime hours and residential customers generate traffic predominately during the evening hours. Therefore, it is possible for one customer segment to be more significantly capacity constrained while the other is not. Here, the brunt of the loss in capacity will be borne by residential and rural subscribers.

[18] This estimate of up-front capital expenditures includes equipment, site acquisition and installation.

[19] A Metropolitan Statistical Area ("MSA") is a geographic area defined by the Office of Management and Budget as "a Core Based Statistical Area associated with at least one urbanized area that has a population of at least 50,000. The metropolitan statistical area comprises the central country or counties containing the core, plus adjacent outlying counties having a high degree of social and economic integration with the central county as measured through commuting." There are 306 MSAs, including New England County Metropolitan Areas and the Gulf of Mexico Service Area.

[20] The increased capital and operational expenses were calculated for a five-year period for the San Jose/Silicon Valley market. These figures were then extrapolated to the top 100 MSAs. The calculations for this extrapolation included adjustments for varying total coverage areas and household densities.

proportionately higher up-front infrastructure cost. Accordingly, deploying more cells would only compound the problem. A small market or rural market like Amarillo, then, is more likely to be left behind. The loss of spectrum reduces the residential capacity by *nearly one-half* -- from approximately 7, 500 to 3,800 households.[21] Again, the business case that Cisco, its customers and their investors have developed is completely up-ended.

C. DUAL-BAND DEPLOYMENT OF FIXED WIRELESS BROADBAND SIMILARLY IMPOSES SIGNIFICANT COSTS

The Commission indicated that it will address the feasibility, and costs, of possible relocation of part or all of the MDS/ITFS band in its Final Report forthcoming next month.[22] Relocation would have three primary effects on fixed wireless broadband operators: increased coast of customer premises equipment ("CPE"); a greater than two year delay in time-to-market; and markedly reduced coverage areas. Like the examples discussed above, these changes would disproportionately affect the desirability of serving rural and residential consumers.

As an example, Cisco evaluated the consequences of a loss of 100 MHz in the MDS/ITFS band, replaced by equivalent spectrum at 3700 MHz.[23] A switch to dual-band operations for broadband fixed wireless would first require a re-design of the systems RF components. For example, if the 3700 MHz band were used for downstream transmissions, the base station would require complete re-design and reintegration of the transmit circuitry. The subscriber unit would require the same work on its receive circuitry. Vendors would be stalled in their efforts until the conclusion of this rulemaking and then would face a repetition of the process undertaken to date: hardware

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[21] Business capacity declines by 29 percent, from 1,050 subscribers to 750. *See supra*, note 17.
[22] NPRM, at ¶¶ 62, 65.

and software re-design; re-visiting supply chains and partner commitments; repeating lab and field trials; and re-initializing manufacturing plants. New spectrum essentially means starting from scratch.

Performing the necessary alterations to subscriber units designed to be used by residential customers would increase the costs of such units by 25 percent. Both the antenna and the oscillator would require modification.[24] Additional costs would result because (1) the higher frequency requires more expensive Printed Circuit Board material, and (2) manufacturers could no longer leverage low noise amplifier and RF mixer components from the PCS and ISM industries operating in the nearby 1.9 GHz and 2.4 GHz bands. There would be some cost offset in the duplexer due to increased receive and transmit separation though, in the wash, CPE costs would still rise significantly, with a potentially disastrous effect on the business case for providing service to residential customers.

To demonstrate this effect, Cisco calculated the net present value profits from a 5-year residential business plan for churn rates ranging from 1.5% per month to 3% per month.[25] If it assumed that an operator is using MDS-based CPE, the net present value of profits from a residential business plan will be positive for churn rates from 1.5% per month to 2.9% per month and only turn negative for churn rates of 3% per month and higher. However, if a more expensive dual-band CPE is used, the zone of profitability is reduced to churn rates between 1.5% per month and 1.8% per month. Given the most

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[23] As mentioned above, it is most likely that any replacement spectrum would be located above 3 GHz. For purposes of discussion, we use the 3.7 GHz band because it has been considered for fixed applications.

[24] Dual-band operation would require the oscillator to generate a 3.5 MHz full frequency rather than a 2.5 MHz half frequency.

[25] Churn refers to the number of customers an operator loses over a given period of time. Churn is usually expressed in terms of the average percentage number of customers lost per month. An operator that experiences churn of 1.5% loses 1.5% of its customers each month.

telecommunications service providers assume that they will experience churn in the range of 1.5% per month to 3% per month,[26] a dual-band CPE would place a residential business plan in jeopardy.

The necessary reengineering efforts required by a dual-band re-design could take as much as one to two years to complete and fully test. Furthermore, such work could not begin until the final FCC rules are in place. Assuming finality in the FCC's rules within 9-12 months, the process described above would delay market entry until a 2003 to 2004 time-frame. Considering the Forrester Brief projections for broadband subscribership, fixed wireless operators would lose the opportunity to compete for market share of 23 million new broadband subscribers.

Assuming manufacturers and service providers overcome this increased cost and delay, once the new product was out in the field, a dual-band allocation would reduce actual coverage by more than half. Because of propagation characteristics in the upper bands, a cell with a radius of approximately 20 miles in the MDS/ITFS band would shrink to less than a 14 mile radius at 3.7 GHz.[27] The coverage remaining is less than half of its original reach: approximately 600 square miles instead of approximately 1,300 miles.[28] This reduction in coverage would have a dramatic affect on the ability of service providers in smaller markets and rural communities to bring broadband services to unserved areas.

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[26] *See, e.g.*, Dennis Leibowitz et al, *The Global Wireless Communications Industry*, Donaldson, Lufkin & Jenrette, Winter 1999/2000, at 33-34; Peter Kennedy, Mary Meeker, Edings Thibault, and Stephen Flynn, *Covad Communications (COVD): Fat Pipes, Fat Returns*, Aug. 27, 1999, at 22.

[27] This analysis assumes that in both scenarios subscriber units are transmitting using the same power levels. In theory, a dual-band CPE could be designed to include the power amplification necessary to overcome the lesser propagation of the higher spectrum band. However, power amplification can add as much as several thousand dollars to the cost of a CPE, precluding it from use in a mass residential market.

[28] Area = $(\Pi)(\text{Radius}^2)$.

IV. CONCLUSION

Consistent with the national imperative to make multiple broadband alternatives available to all Americans by 2010, Cisco profoundly believes U.S. policy makers must allocate more spectrum for high speed Internet access. To that end, timely efforts to identify new radio frequencies for 3G services are essential. But policy makers will not achieve this broadband imperative by switching spectrum from one high-speed use to another.

As demonstrated above, fixed wireless broadband technology is poised to deliver highly-valued services to American consumers. Yet any change in spectrum allocation or service rules, at this late date, would delay deployment, markedly increase costs and undermine the business case for reaching those who need this service the most. This rulemaking alone has generated uncertainties in the fixed wireless broadband marketplace. Accordingly, Cisco believes that the public will best be served by a prompt decision preserving the integrity of the MDS/ITFS band.

Respectfully submitted,

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Dated: February 22, 2001

CERTIFICATE OF SERVICE

I, Karen R. Stephens, do hereby certify that on this 22nd day of February 2001, I caused true and correct copies of the foregoing Comments to be served, via hand delivery, upon the following parties:

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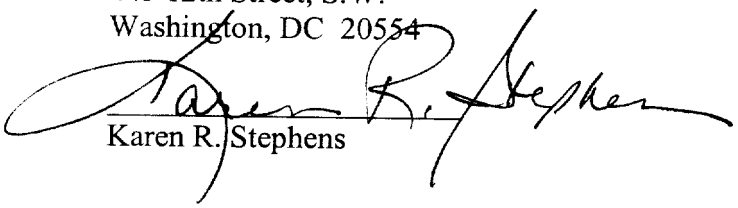

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