

**Before the  
FEDERAL COMMUNICATIONS COMMISSION**

In the Matter of	)	
	)	
Amendment of Parts 1, 21, 73, 74 and 101 of the Commission's Rules to Facilitate the Provision of Fixed and Mobile Broadband Access, Educational and Other Advanced Services in the 2150-2162 and 2500-2690 MHz Bands	)	WT Docket No. 03-66 RM-10586
	)	
Part 1 of the Commission's Rules - Further Competitive Bidding Procedures	)	
	)	
Amendment of Parts 21 and 74 to Enable Multipoint Distribution Service and the Instructional Television Fixed Service Amendment of Parts 21 and 74 to Engage in Fixed Two-Way Transmissions	)	WT Docket No. 03-67 MM Docket No. 97-217
	)	
Amendment of Parts 21 and 74 of the Commission's Rules With Regard to Licensing in the Multipoint Distribution Service and in the Instructional Television Fixed Service for the Gulf of Mexico	)	WT Docket No. 02-68 RM-9718
	)	

To: The Commission

**REPLY COMMENTS OF**

**THE NEW AMERICA FOUNDATION; MEDIA ACCESS PROJECT;  
ROCKWOOD AREA SCHOOL DISTRICT, SOMERSET COUNTY, PENNSYLVANIA;  
AMA TECHTEL COMMUNICATIONS; CONSUMERS UNION;  
CONSUMER FEDERATION OF AMERICA; CENTER FOR DIGITAL DEMOCRACY;  
PUBLIC KNOWLEDGE; BENTON FOUNDATION; EMENITY, INC.;  
ROADSTAR INTERNET, INC.; NYCWIRELESS.NET;  
BAY AREA WIRELESS USERS GROUP;  
BAY AREA RESEARCH WIRELESS NETWORK; NEWBURYOPEN.NET AND  
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October 23, 2003

Commentors in this proceeding fall into three broad categories: commercial providers of wireless services using unlicensed spectrum access; non-profit users of unlicensed spectrum access using unlicensed access to promote education, broadband deployment, free expression, and narrow the digital divide; and users of licensed and unlicensed wireless services.

**Eminity, Inc.:** Eminity builds custom-designed, fully outsourced local wireless networks for private and public organizations. Eminity is based in New York City and has field offices in San Francisco, Los Angeles, Boston, and Washington, DC. Eminity designed the Lower Manhattan Wireless Network, a public wireless network built for the Alliance for Downtown New York. <http://www.emenity.com>

**Roadstar Internet, Inc.:** Roadstar is a wireless Internet service provider serving Loudoun County, Virginia. Roadstar has over 100 business and residential subscribers to their wireless broadband Internet network, relying solely on license-exempt spectrum. <http://www.roadstarinternet.com>

**Rockwood Area School District, Somerset County, Pennsylvania** is a rural school district in southern Pennsylvania that has built an unlicensed wireless infrastructure for their elementary and high schools that also supports broadband connections for residences and businesses in the community.

**AMA\*TechTel Communications** is large regional provider of unlicensed wireless broadband Internet, serving more than 4,000 residential and business customers in West Texas. In addition to wireless Internet service, AMATechTel also provides Dial-up, ISDN, DSL, T1, and VPN services, as well as long distance and phone and messaging systems. <http://www.amatechtel.com/>

**NoCat** is a community supported 802.11b wireless network in Sonoma County, CA. They provide software, information and technical support to unlicensed wireless users and network and access point developers at their web site: <http://nocat.net/>

**NYCwireless:** NYCwireless serves as an advocacy group for wireless community networks providing free, public wireless Internet service to mobile users in public spaces throughout the New York City metro area. These public spaces include parks, coffee shops, and building lobbies. NYCwireless also works with public and nonprofit organizations to bring broadband wireless Internet to underserved communities. <http://www.nycwireless.net>

**Bay Area Wireless User Group:** BAWUG was founded to promote broadband wireless Internet within the greater San Francisco Bay Area. BAWUG was started by radio engineers and enthusiasts to provide technical and organizational support for wireless users and developers of access points. <http://www.bawug.org>

**The Bay Area Research Wireless Network:** BARWN.org has built free public wireless networks in the San Francisco Bay Area with the goal of researching and developing the most cost efficient technologies and network designs to provide under-served communities with wireless broadband Internet. <http://www.barwn.org>

**SeattleWireless.net:** SeattleWireless is a not-for-profit effort to develop a wireless broadband community network. SeattleWireless uses widely available, standards-based RF technology operating in license free frequency, to create a free, locally owned wireless Internet backbone. <http://www.seattlewireless.net>

**NewburyOpen.net** is an open WI-FI network that provides high-speed Internet services, in the form of free wireless and for-pay workstations, to Boston residents, workers, and travelers. NewburyOpen.net is a testbed for new business models, technologies, and applications—all revolving around the idea of the ubiquitous Internet. <http://www.newburyopen.net>

**New America Foundation:** NAF is a nonpartisan, non-profit public policy institute based in Washington, D.C., which, through its Spectrum Policy Program, studies and advocates reforms to improve our nation's management of publicly-owned assets, particularly the electromagnetic spectrum. <http://www.newamerica.net>

**Media Access Project:** MAP is a 30 year-old non-profit, public interest telecommunications law firm which represents civil rights, civil liberties, consumer, religious and other citizens groups before the FCC, other federal agencies and the Courts. <http://www.mediaaccess.org/>

**Consumers Union:** CU, publisher of Consumer Reports, is an independent, nonprofit testing and information organization serving only consumers. <http://www.consumersunion.org>

**Consumer Federation of America:** CFA is the nation's largest consumer advocacy group, composed of two hundred and eighty state and local affiliates representing consumer, senior, citizen, low-income, labor, farm, public power and cooperative organizations, with more than fifty million individual members. <http://www.consumerfed.org/>

**The Center for Digital Democracy:** CDD is a nonprofit public interest organization committed to preserving the openness and diversity of the Internet in the broadband era, and to realizing the full potential of digital communications through the development and encouragement of noncommercial, public interest content and services. <http://www.democraticmedia.org/>

**Public Knowledge:** PK is a public interest advocacy organization dedicated to fortifying and defending a vibrant information commons. PK works with wide spectrum of stakeholders to promote the core conviction that some fundamental democratic principles and cultural values – openness, access, and the capacity to create and compete – must be given new embodiment in the digital age. <http://www.publicknowledge.org>

**The Benton Foundation:** The Benton Foundation's mission is to articulate a public interest vision for the digital age and to demonstrate the value of communications for solving social problems. <http://www.benton.org>

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## SUMMARY

NAF, *et al.* begin by observing that the many descriptions of functioning ITFS services demonstrate the importance of maintaining the ITFS eligibility requirements and the value of non-commercial spectrum set-asides generally. This use of public spectrum to further valuable social goals and provide services where commercial actors could not or would not demonstrates the fundamental fallacy of regulating spectrum purely in the interest of maximizing revenue and economic efficiency. The Commission exists to secure “to all the people of the United States” the benefits of wireless communication. 47 USC §151. ITFS licensees that diligently fulfill their responsibilities to provide educational service provide some of the best examples of spectrum use “in the public interest.”

At the same time, however, the Commission cannot close its eyes to the misuses of the spectrum or allow the full potential of the spectrum to lie fallow. While ITFS licensees providing valuable service have legitimate concerns regarding their existing services, these concerns cannot justify holding back the next generation of technology that will enhance both educational and commercial uses of the spectrum. Indeed, as the comments of NAF, *et al.* demonstrated, many community organizations and educational organizations make use of existing unlicensed access technologies to provide noncommercial service that benefits their local communities. While the legitimate expectations of existing licensees providing actual ITFS service should be protected to the greatest extent possible, the Commission must also fulfill its obligation to “generally encourage the larger and more effective use of radio.” 47 USC §303(g).

### **NAF et al.’s Comments emphasize the following general points:**

- The proposed re-banding and grant of new flexibility rights to ITFS and MDS licenses should include a reallocation of approximately half the total band (90 MHz) for unlicensed public access on a primary basis; this can be done while protecting licensee’s reasonable expectations to the services and transmission capacity under their license, and any relocation to the upper portion of the band can be funded by makers of unlicensed equipment and/or from auction proceeds by asking Congress to extend the pending Spectrum Relocation Trust for relocating federal users.
- Alternatively, a band equivalent to the current ITFS allocation (120 MHz) should be preserved for education on a primary basis, but opened to maximize unlicensed citizen access

as an underlay, subject to non-interference with existing ITFS applications; this underlay should include both unlicensed access to the unassigned “white space” on a primary basis, but also opportunistic access of unlicensed communication using unused or underutilized capacity within licensed geographic service areas across the entire ITFS/MDS band.

- If the Commission decides to reallocate or reassign license rights on the band, any auction mechanism must comply with the statutory goals and restrictions of the Communications Act, which the proposed “two-sided” giveaway auction decidedly does not, as it diverts federal revenue from the Treasury to private parties; a genuine auction where potential licensees bid in terms of the annual user fee would best optimize the various policy goals of the Act.
- The ITFS allocation should be maintained as noncommercial public service spectrum; the Commission should retain the ITFS eligibility requirements and should require increased noncommercial public service requirements in return for the free use of spectrum and increased flexibility to provide valuable data networking services.
- If the Commission determines that unlicensed public access to the band – on an underlay or primary basis – is feasible and desirable, it should refrain from imposing a private intermediary between citizens and license exempt spectrum; a retreat from the open access Part 15 model that is characteristic of the WiFi band (2.4GHz), as suggested by the NPRM, would undermine First Amendment values, as well as the goals of innovation and competition favored by the Communications Act.

In surveying other comments filed in this proceeding, NAF, *et al.* observe the following trends. First, there exist many misunderstandings regarding the Commission’s authority to authorize a band as exclusively for unlicensed access. Leaving aside the discussion by some commentators<sup>1</sup> as to whether a band dedicated exclusively to unlicensed access is properly characterized as “primary” as a semantic argument of little value, several commentators do raise issues pertaining to the Commission’s general authority to expand unlicensed access, what level of record evidence should be required, and what level of protection is owed incumbent licensees.<sup>2</sup> None of these issues presents a bar to either NAF, *et al.*’s proposal to clear the band from 2500-

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<sup>1</sup>Joint Comments of Stanford University and Northeastern University in WT Docket No. 03-66, pp. 21-22.

<sup>2</sup> Comments of Sprint Corporation in WT Docket No. 03-66, p. 8.

2590 MHz for exclusive unlicensed use or, in the alternative, to expand the existing Part 15 underlay to either all or part of the 2500-2690 MHz band.

With regard to practical migration issues, NAF, *et al.* reiterate that the added value of the new flexible license rights – even with an underlay – provide suitable incentives for third party “proponents” to finance ITFS migration as proposed in the Coalition Plan. To address the concerns of licensees, however, NAF, *et al.* propose additional funding mechanisms below. For example, the Commission could recommend that Congress expand the proposed relocation trust fund in the pending Commercial Spectrum Enhancement Act, H.R. 1320, to include ITFS licensees. Or the Commission could follow its own precedent and designate an entity similar to UTAM, the Unlicensed-PCS frequency coordinator authorized by the FCC in 1996 to facilitate the relocation of microwave incumbents from the newly reallocated U-PCS bands at 1910-1930 MHz.<sup>3</sup> Today, in a Wi-Fi world with developed and booming markets for unlicensed networking equipment—and on a far larger band immediately adjacent to the unlicensed 2.4 MHz band—a frequency coordinator that pools small fees on qualified unlicensed equipment could provide needed funding for ITFS service relocation.

In response to the argument that the Commission already provides sufficient unlicensed access to spectrum to fill the needs of the public, NAF, *et al.* make the following replies.

First, the Commission has never required the kind of record that the incumbents demand here of proof of a need for further unlicensed. To the contrary, the Commission has traditionally expanded the availability of unlicensed spectrum, confident that opening spectrum to unlicensed use stimulates further innovation. Time and again, the virtuous circle of spectrum allocation followed by innovation and consumer demand has demonstrated the wisdom of the Commission’s trust in unlicensed access.

The proposal set forth in the NAF, *et al.* comments will provide the Commission and the public with an invaluable opportunity to develop new technologies and services on a *national* basis that are impossible when the devices must protect incumbent services, or if an unlicensed allocation is limited to geographically fragmented “white space.” The current tsunami of innovation and economic activity under the existing Part 15 rules provides more than ample evidence that the experiment is well worth conducting. In the unlikely event that the spectrum is underutilized, the Commission can reclaim the spectrum and auction it on an exclusive basis.

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<sup>3</sup> See “Amendment to Commission’s Rules Regarding a Plan for Sharing the Costs of Microwave Relocation,” First Report and Order and Notice of Proposed Rule Making, WT Docket No. 95-157 (April 30, 1996).

Second, growth in the use of unlicensed technologies continues unabated, not merely for WLAN mobility, for which Wi-Fi is best known, but increasingly as a competing facilities-based platform for “last-mile” residential and business broadband access.<sup>4</sup> The IEEE continues to develop new protocols for new uses, such as the 802.11g standard for wireless local area networks and 802.16 for metropolitan area networks.<sup>5</sup> As wireless LANs and WANs become integrated into the broader network infrastructure and carry greater amounts of information, such as voice and streaming media, these applications will continue to require more bandwidth. Even without further technical innovation, it seems extraordinarily shortsighted to say that those using unlicensed technology have all the spectrum they will ever need.

On the subject of ITFS eligibility and requirements, NAF, *et al.* agree with Stanford and Northeastern Universities (S&N) that the Commission should both retain the ITFS eligibility requirement and increase the educational service requirement.<sup>6</sup> Although S&N do not suggest an appropriate limit, NAF, *et al.* stand by the proposal in the initial comments that the Commission should model the service requirements on the Public Broadcasting digital broadcasting requirements or, at the least, increase the educational content requirement from 5% to 25%, as ITFS licensees are advocated.

Those arguing that ITFS licensees, post-transition, will continue to meet their current minimum obligations -- or that imposing greater service requirements will deprive ITFS licensees of revenue needed to fund existing programming -- miss the point of the ITFS reservation. Commission licenses are not subsidies to educational institutions so that they can fund good works. If that were the purpose, the Commission could make any non-commercial organization eligible for an ITFS license.

Rather, the Commission awards ITFS licensees to provide to the *public* a valuable, *educational* use of spectrum. The object is to utilize the public asset for the benefit of the public, not to provide a cash cow to a worthy institution. This is why the Commission limits and continues to limit ITFS licenses to educational organizations.

Nor does the current minimal requirement represent some fixed benefit the public should receive from the spectrum, almost like a tax or fee before the ITFS licensee can lease the rest. Rather, the public deserves the full benefit of the spectrum, set aside and provided for the purpose of “further[ing] the educational mission of accredited public and private schools, colleges and

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<sup>4</sup> See Appendix A

<sup>5</sup> See, e.g., “What’s next for 802?” available at <http://www.ieee.org/theinstitute>; See also Steven M. Cherry, “The Wireless Last Mile,” IEEE Spectrum (August 2003) at 19.

<sup>6</sup> Joint Comments of Stanford University and Northeastern University in WT Docket No. 03-66, pp. 4-6.

universities providing a formal educational and cultural development to enrolled students.” 47 CFR §74.931.

Many bright stars in the ITFS sky have filed comments demonstrating that this set aside does, indeed, serve the public interest. But it takes more than a few stellar examples to justify the whole set aside. The Commission can and should act against those “spectrum slackers” that barely meet their minimal requirements while treating public spectrum as a source of private gain. Only significant service requirements can restore the promise of ITFS as a whole and prevent the spectrum slackers from giving the true educational pioneers and innovators a bad name.

Finally, the Commission should reject the arguments of some commentors to extend the recently released *Secondary Markets Order* to MDS/ITFS spectrum. The *Secondary Markets Order* violates the plain language of Section 310(d) and, even if statutory authority existed for it, constitutes an unconscionable giveaway of public spectrum to incumbent licensees (many of whom received their licenses for free).

A spectrum license is not a license to mint money. It is an obligation to serve the public by providing the best and most efficient use of spectrum to the public. Rather than encouraging such use, the *Secondary Markets Order* will encourage speculation and spectrum hoarding. Worse, in the absence of any cross-ownership limitation, the *Secondary Markets Order* will encourage dominant LECs and cable MSOs to acquire spectrum for the sole purpose of denying competitors access to a new last mile solution.

With regard to cross-ownership, NAF, et al. agree with Earthlink and other commentors that support cross-ownership limits that prohibit incumbent cable operators and incumbent LECs from acquiring MDS licenses. MDS represents a potential competitor to the dominant DSL and cable broadband providers. The Commission stubbornly refuses to adopt a pro-competitive strategy on either of these platforms. If the Commission genuinely wishes to see competition in residential broadband, rather than divide the market into at best a duopoly, it should institute cross-ownership limits.

The suggestion of some commentors, such as Sprint, that the Commission’s merger review offers a significant safeguard is technically correct but practically worthless. On the one hand, the Commission has the authority to impose whatever conditions on a merger it finds necessary to protect the public interest. On the other hand, the Chairman has stated that any merger that complies with the Commission’s rules automatically serves the public interest. In re Application of UTV San Francisco, Inc., 16 FCC Rcd 14975, 14995-98 (2001) (statement of Chairman Powell). Indeed, since the Commission has repeatedly demonstrated a willingness to waive what few remaining ownership rules it has to facilitate mergers, *Id.* at 15000-02

(Dissenting statement of Commissioner Tristani), the logical course is to include cross-ownership restrictions in the rules and waive them where such waiver would serve the public interest, rather than decline to adopt such rules on the premise that the Commission will prohibit such mergers where harmful.

In supporting cross-ownership restrictions on LECs, NAF, et al. acknowledge the longstanding role of several LECs in attempting to operate MMDS systems and that some LECs, such as BellSouth, continue to operate MMDS systems. NAF, et al. do not propose that the Commission require divestiture of these systems (although the Commission certainly has adequate authority to require divestiture if it finds that such an action serves the public interest). In recognition of the investment by these LECs in MMDS, and because implementation of NAF, et al.'s band clearing proposal will leave significant bandwidth available for competing pathways via unlicensed access, NAF, et al. support grandfathering existing systems.

## **Argument**

### **I. THE COMMISSION HAS LEGAL AUTHORITY TO EXPAND THE EXISTING UNLICENSED UNDERLAY AND TO REQUIRE MIGRATION OF LICENSEES TO CREATE A BAND DEDICATED EXCLUSIVELY TO UNLICENSED ACCESS.**

With the framework of NAF *et al.*'s original Comments in mind, commentators turn to the objections raised by others to the expansion of unlicensed access proposed by the Commission in the *NPRM* and discuss how they impact the NAF, *et al.* proposal.

Several commentators question the Commission's authority to expand the existing Part 15 rules to new spectrum bands and question the legal sufficiency of the record. These commentators maintain that only a record that demonstrates with utter certainty (to the satisfaction of incumbents) that expansion of the underlay will cause no interference (as opposed to harmful interference) to incumbents can satisfy the Commission's legal requirements. Further, they appear to argue that some amount of band-specific testing is required before the Commission can expand unlicensed access to the band at issue here.

Bellsouth, Sprint, and other incumbents display the classic double standard on potential interference: potential interference is lamentable, but workable, when it enhances the economic value of incumbent licenses, but unacceptable when it means admitting a rival into the market.

The objections raised by the incumbents have no merit and should be rejected. The Commission has adequate statutory authority to implement NAF, *et al.*'s recommendation and to clear the lower 90 MHz exclusively for unlicensed uses. Indeed, such a proposal eliminates many of the concerns raised regarding potential interference. By creating a 90 MHz band for

unlicensed access, but declining to extend the Part 15 underlay to the remaining 100 MHz at issue, the Commission can both expand the direct availability of spectrum to the American public as a whole while providing incumbents the security and flexibility they wish to provide exclusive services to the American public.

Even if the Commission declines to clear the band requested by NAF, *et al.*, the Commission has both a sufficient record and sufficient authority to extend the existing Part 15 underlay to the entire spectrum.

**A. IT IS THE INCUMBENTS AND OTHERS WHO SEEK TO BLOCK EXTENSION OF UNLICENSED ACCESS TO THE MDS/ITFS BAND WHO HAVE THE BURDEN OF PROOF THAT SUCH EXTENSION WOULD VIOLATE THE PUBLIC INTEREST, NOT PROPONENTS OF UNLICENSED ACCESS AS THE INCUMBENTS ARGUE.**

As an initial matter, Section 7(a) of the Communications Act clearly establishes a presumption in favor of extending Part 15 in some manner to the existing band, either as an underlay or as a dedicated band devoted exclusively to unlicensed services. As the statute clearly states:

It shall be the policy of the United States to encourage the provision of new technologies and services to the public. Any person or party (other than the Commission) *who opposes a new technology or service shall have the burden* to demonstrate that such proposal is inconsistent with the public interest.

47 USC 157(a) (emphasis added).

The Commission has repeatedly found that expanding the Part 15 rules furthers the goals of encouraging “new technologies and services to the public.” *See, e.g., Amendment of the Commission’s Rules to Provide for Operation of Unlicensed NII Devices in the 5 GHz Range*, 12 FCC Rcd 1576, 1580-85 (1997) (finding that expanding unlicensed furthered interest of developing new technologies, new services, new competitors, deployment of advanced telecommunications capabilities to all Americans – with an emphasis on rural and educational uses, and helped fulfill the Commission’s obligations under Section 257 to promote entry by small businesses and to enhance diversity of information sources); *In re Section 257 Proceeding to Identify and Eliminate Market Entry Barriers for Small Businesses*, 12 FCC Rcd 16802, 16913-14 (1997). *See also* Ken Carter *et al.*, “Unlicensed and Unshackled: A Joint OET-OSP White Paper on Unlicensed Devices and Their Regulatory Issues,” FCC Office of Strategic Planning Working Paper #39, Washington, DC: FCC, May 2003.

The burden of proving that the NAF, *et al.* proposal “is inconsistent with the public interest” lies squarely with the incumbents and others who object to expansion of Part 15 to the 2500-2690 band.

In addition, NAF, *et al.* note that this burden is higher than simply demonstrating that exclusive licensing represents an acceptable choice. The language of Section 7(a) makes it clear that to deny a new service, those opposing the service must demonstrate that expansion of the Part 15 rules in some form (either in the form of an exclusive band or in the form of an underlay in the entire band) is *inconsistent* with the public interest.

It is true that, in some cases, in an abundance of caution, the Commission has required numerous tests and studies before creating a new service. *See, e.g., In re Amendment of Part 15 of the Commission’s Rules Regarding Ultra-Wide Band*, 17 FCCRcd 7435, 7461-68 (2002) (*UWB R&O*). The Commission has also paid particular heed to demands for a new service by the public. *In re Creation of a Low Power Radio Service*, 14 FCCRcd 2471 (1999).

But the Commission has never enunciated a legal standard mandating some minimum number of tests or minimum number of thwarted requests by would-be users. To the contrary, the Commission has often relied upon its expert judgment as to both demand and the potential for hostile interference. *See, e.g., Telocator Network of Am. v. FCC*, 691 F.2d 525, 538 (D.C. Cir. 1982).

For example, in the establishment of a low power FM service, the Commission relied on the interference data submitted by commentors and its own engineering staff; it did not require an experimental service or propose a limited trial. *In re Creation of a Low Power Radio Service*, 15 FCCRcd 2205 (2000).<sup>7</sup> In the ultra-wide band proceeding, although the Commission did require stringent testing, it did not require any proof of market demand. Instead, it relied upon submitted comments demonstrating the potential of the technology to serve the public and promote technical innovation. *UWB R&O* at 7441-42..

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<sup>7</sup> To the detriment of the public, the NAB did successfully lobby Congress to restrict the LPFM service and mandate an independent study. Radio Broadcasting Preservation Act of 2000, 114 Stat. 2762 Sec. 632 (2000). That independent study has confirmed that the Commission’s determinations based on commentor submitted data were correct, and that the Commission was wise to disregard the self-serving predictions of interference by incumbents and not require an experimental service first. Public Notice MM Docket No. 99-25, DA 03-2277 (released July 11, 2003).

**B. IF, AS INCUMBENTS ARGUE, AN UNLICENSED UNDERLAY WOULD CREATE UNACCEPTABLE INTERFERENCE, THEN THE SOLUTION IS MORE *DEDICATED* UNLICENSED SPECTRUM, NOT ZERO UNLICENSED SPECTRUM.**

Currently only 1% of the spectrum below 2 GHz is dedicated to unlicensed and 2.5% below 5GHz. If incumbents occupying the other 97.5% continue to argue, as they have done, that unlicensed underlays either 1) are completely unacceptable, or 2) need to be crippled, then the only remaining credible option for those who seriously support unlicensed devices is a dedicated band of unlicensed spectrum such as that proposed by NAF, *et al.* As Ericsson concluded, by following the logic of its own argument against unlicensed underlays, “unlicensed spectrum use” needs to be “segregated from licensed use.”<sup>8</sup>

The commentors themselves have overwhelmingly stated that an unlicensed underlay or any shared use would create unacceptable interference to licensed overlays.<sup>9</sup> Assuming that this analysis is accurate (an assumption the NAF, *et al.*, vigorously dispute), then the most reasonable option is to divide the 190 MHz band between dedicated licensed and dedicated unlicensed use.

Because the licensees themselves have requested that the Commission redefine the nature of their license rights, this proceeding represents a unique opportunity to allocate a meaningful band to unlicensed use on an exclusive basis. Since the vast majority of desirable spectrum is already dedicated to licensed use, the FCC should seize this opportunity to ensure that a proportion goes to unlicensed use commensurate with the demonstrated value of unlicensed access to reducing the cost of last-mile broadband access, enhancing telecommunications innovation, and providing toll-free usage on private property and public spaces. The FCC has compiled a more than adequate record, in this proceeding and elsewhere, to justify such an allocation.<sup>10</sup>

To be fair, ITFS/MDS licensees are correct that to the extent they use their spectrum in very low power situations, a low-power unlicensed underlay creates a more serious interference problem. But it is also true that to the extent spectrum devices use such low power, unlicensed spectrum makes increasing economic sense. This is evidenced by the broad consensus that it is

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<sup>8</sup> Comments of Ericsson, WT Docket No. 03-66, p. 5.

<sup>9</sup> For a sample of comments objecting to this NPRM’s suggestion of an unlicensed underlay, see the comments of Comspec Corporation, , p. 2; Consolidated Telcom, Polar Communications Mutual Aid Corporation, and Santel Communications Cooperative, Inc. (“rural MDS licenses”), p. 9; CTIA, pp. 5-6; Ericsson, pp. 3, 9; Hardin and Associates, Inc., pp. 6-7; IPWireless, Inc., pp. 20-21; Lucent Technologies; Motorola, p. 15; Sprint, pp. 7-8, 11; Telecommunications Industry Association, p. 2; WCA, NIA and CTN, p. 64.; Bellsouth Corporation and Bellsouth Wireless Cable, Inc., p. iii.; Cellular Telecommunications & Internet Association, p. 6.

<sup>10</sup> NAF, *et al.* provide further evidence of the value of unlicensed access as compared to historic uses of MDS/ITFS in Part II below and in Appendix A.

uneconomical and undesirable to charge consumers a fee to use the spectrum used by low power devices such as TV remote controls, garage door openers, and home Wi-Fi networks.

**C. THE COMMISSION’S EXPANSION OF UNLICENSED ACCESS IN THE LAST 15 YEARS ENTIRELY NEGATES THE ARGUMENTS THAT THE COMMISSION MUST CONDUCT FURTHER TESTS BEFORE EXPANDING UNLICENSED ACCESS TO THE 2500-2690 BAND.**

The Commission’s major revision of the Part 15 rules in 1989 and its adoption of the Unlicensed National Information Infrastructure (UNII) rules in 1997 demonstrate that the Commission has *never* required a record of the kind demanded by Commentors such as Sprint. Indeed, the existing record so far exceeds the record that supported those rule changes that requiring a record of the kind demanded by some commentors would represent an arbitrary and capricious change of policy.

In 1987, the Commission issued a proposal to simplify the Part 15 rules.<sup>11</sup> As part of this proposal, the Commission proposed to allow operation on numerous new bands and for any purpose, provided the devices complied with general strictures imposed in the rule. *Id.* at 6135-38.

The Commission faced virtually the same arguments raised by incumbents here, and rejected them. The Commission required no new testing or experimental service, relying instead on its technical expertise and real world experience in administering other unlicensed services.<sup>12</sup> In response to complaints in protected service bands that expansion was unnecessary because unlicensed devices had more than enough room under existing allocations and the risk of interference was too great, the Commission stated: “We believe that manufacturers, if given the opportunity to use the ISM frequencies, will develop many new and practical uses of Part 15 devices.”<sup>13</sup>

Throughout the proceeding, the Commission explained that the public interest demanded a balance between the risk of interference to licensed services and the tremendous potential to the public in expanded unlicensed access. As the Commission concluded:

The actions being taken in this Report and Order represent the Commission's best judgments as to the trade-offs between beneficial low power spectrum use and possible interference to the authorized radio services. We recognize that certain increased risks of interference to authorized devices may result from altering our

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<sup>11</sup> In re Revision of Part 15 of the Rules Regarding the Operation of Radio Frequency Devices Without Individual License, 2 FCC 6135 (1987) (1987 Part 15 NPRM).

<sup>12</sup> In re Revision of Part 15 of the Rules Regarding the Operation of Radio Frequency Devices Without Individual License, First Report & Order, 4 FCC 3493, 3494-95 (1989 Part 15 R&O).

<sup>13</sup> *Id.* at 3502.

regulations....On balance, we believe that the public interest benefits of the rule changes being adopted outweigh the potential for increased interference.

*Id.* at 3519.

Similarly, when the Commission proposed to create the Unlicensed National Information Infrastructure (UNII) Band, it acted proactively to encourage the development of new technologies. *In re Commission's Rules to Provide for Unlicensed NII/Super Net Operations in the 5 GHz Frequency Range*, 11 FCC Rcd 7205 (1996). The Commission observed the growing interest in wireless technologies by would-be users and found that advances in processor speed and digital technologies provided a firm basis for expecting that new uses of the spectrum would emerge to the benefit of the public. *Id.* at 7206, 7216. The Commission also noted that increasing the availability of unlicensed spectrum would further the Commission's mandate under Section 706 of the Communications Act to encourage deployment of advanced telecommunications capabilities to all Americans. *Id.* at 7206. The Commission reaffirmed this reasoning in its final *Order*, also finding that additional unlicensed spectrum "will further the Commission's mandate, in Section 257(b) of the Communications Act, to promote vigorous competition and technological advancement." *Amendment of the Commission's Rules to Provide for Operation of Unlicensed NII Devices in the 5 GHz Range*, 12 FCC Rcd 1576, 1585 (1997) (*UNII R&O*).

Again, the Commission explicitly rejected calls from incumbents to ensure absolutely no interference, and rejected the need to build a record through experimental licensing. *Id.* at 1580-85. The Commission also rejected arguments that sufficient unlicensed spectrum already existed to meet the needs of the public for unlicensed access. *Id.*

History has borne out the Commission's judgment in both cases. As discussed in greater detail below, the Commission's prediction that making a sufficient amount of spectrum available would prove a driver for innovation, deployment of broadband data services, and a boon to small business and noncommercial users has proven true.

Indeed, the one case where the Commission's expert judgment failed occurred when the Commission acted too cautiously. In 1989, the Commission declined to extend the Part 15 Rules to the television broadcast spectrum even though the Commission was "satisfied that our proposed limits are adequate to prevent harmful interference" because "more intensive use of these bands may occur with the introduction of various forms of High Definition Television (HDTV)." *1989 Part 15 R&O*, 4 FCC Rcd at 3501.

In other words, the Commission prohibited unlicensed access to potentially the most productive and useful spectrum, despite the fact that the proposed uses would cause no harmful

interference, based on the promises of incumbents to roll out superior services and the fear that unlicensed would interfere with these services. It is difficult to see, however, how the introduction of Part 15 devices to analog broadcast spectrum could have delayed the offering of HDTV any more than the current incumbents have done in the absence of Part 15 devices.

The Commission should take this lesson to heart. It should ignore the weary arguments of incumbents such as Sprint that have consistently failed to deliver promised new services despite favorable changes of the rules.<sup>14</sup> Instead, it should trust the small business, entrepreneurs, and noncommercial users pushing existing unlicensed access to its limits that freeing new spectrum for unlicensed access will continue the virtuous cycle of innovation and deployment begun by the Commission in 1989.

**D. BECAUSE THE INCUMBENTS HAVE SOUGHT CHANGES TO THE SERVICE RULES FOR THEIR OWN BENEFIT, THE COMMISSION OWES EVEN LESS THAN USUAL DEFERENCE TO THE SETTLED EXPECTATIONS OF THE INCUMBENTS.**

Incumbent licensees start their argument from a false premise when they assume they already have rights to provide services that are currently hypothetical. From this, they arrive at the revolutionary doctrine that all Part 15 unlicensed devices must be banned based on services that a licensed incumbent would like rights to provide within a band. No law or precedent supports this approach.

Furthermore, the incumbents have petitioned for changes that would confer billions of dollars in revenue upon themselves. As NAF, *et al.* observed in the initial comments, the Commission has an obligation to avoid simply conveying a windfall to the incumbents.

Even in the ordinary case, the Commission has broad authority to alter “the frequencies, authorized power, and time of operation” of any licensee provided that it makes a sufficient finding that “such changes will promote public convenience or interest or will serve public necessity.” 47 USC §303(f). As part of this finding, the Commission must take into account the legitimate expectations of licensees. *Mobile Communications Corporation of America v. FCC*, 77 F.3d 1399, 1407 (D.C. Cir. 1996) Nevertheless, the private interest of any licensee or class of licensee must yield to a determination that the public interest is better served by a different use of the spectrum. *Ass’n of Pub. Safety Communications Officials Int’l, Inc. v. FCC*, 76 F.3d 395 (D.C. Cir. 1997) In the past, the Commission has not hesitated to use this authority to mandate wholesale migration of licensees and develop mechanisms by which new users of the service fund the transition. *Teledesic LLC v. FCC*, 275 F.3d 75 (D.C. Cir. 2001).

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<sup>14</sup> Sprint Comments at 9.

Certainly here, where the incumbents themselves seek to change the nature of the service, and where the presumptions of Section 7(a) and Section 257(b) clearly apply, the Commission has no responsibility to protect hypothetical services from potential interference. On the other hand, it is entirely fitting for the Commission to recoup for the public a portion of the value given to licensees by requiring licensees that avail themselves of additional flexibility to accept the increased potential for interference by either recouping some of the spectrum and allowing unlicensed access in the cleared band, or by extending the unlicensed underlay.

**E. THE CREATION OF A DEDICATED BAND FOR UNLICENSED ACCESS OR EXTENSION OF THE EXISTING PART 15 UNDERLAY WILL NOT DELAY DEPLOYMENT OF NEW SERVICES BY LICENSEES.**

Several commentators argue that extending the Part 15 underlay will create uncertainty and delay deployment. To the contrary, it is precisely now, when the very nature of the service is in flux, that introduction of the underlay is best timed.

History demonstrates that incumbents will not build receivers more tolerant of noise than they must. This is understandable. Building “smarter” or more sensitive receivers and transmitters is potentially more expensive. As a result technology in a protected band tends to ossify, since incumbents have little incentive to adopt new technologies and incur the costs of replacement, even where new equipment is more efficient. Worse, incumbents have every incentive to avoid spectral efficiencies if the greater availability of spectrum would allow a competitor to enter the market. Finally, when economic realities or regulatory mandates force changes to next generation technologies, the incumbents spend endless time bickering over standards. The lack of new entrants into the spectrum gives incumbents the leisure to rely upon old technology and seek economic advantage in standards wars rather than quickly come to a resolution in order to be first to market.

If the Commission authorizes unlicensed underlay now, when the entire industry is preparing for change and investing in new equipment, the underlay will be incorporated into the new standards as a “cost of doing business.” Whatever relatively minor increases in the price of equipment anticipation of the underlay will cause, this is nothing compared to the cost of introducing the underlay at a later date.

Once equipment is deployed and the service is mature, the same incumbents that ask the Commission to delay in the interest of facilitating deployment will inform the Commission that the time to introduce an underlay has passed. As history makes clear, once a technology is adopted, it is very expensive to encourage incumbents to migrate. Indeed, many of the problems in the band today flow from the tyranny of protecting outmoded technology.

Accordingly, the Commission should ignore the chimera of future expansion of Part 15 after deployment, when any underlay will have to protect equipment designed for a service with no underlay. Instead, the Commission should require the service to incorporate an expectation of an underlay from the beginning.

Furthermore, the introduction of unlicensed from the beginning will guarantee a competitor to goad the licensees into continually upgrading their technology and deploying broadly. Again, history shows that competition is the best means of ensuring that incumbents will continue to upgrade and deploy. Exclusive licensees do not compete against each other, however, because they effectively control by assignment or by contract the entire swath of spectrum within a particular market area. Indeed, the previous service rules explicitly encouraged such aggregation as necessary under the existing technology of the time.

Thus, without a competitor in the form of unlicensed, each BTA or other geographic area is likely to have a single commercial provider in the 2500-2690 MHz range. This is a recipe for slow deployment and ossification of technology. To combat this, the Commission should authorize the underlay now, rather than waiting until some undefined future date when incumbents claim the technology will be “mature.”

As discussed further below, the specific history of this band shows that promises of incumbents to deploy advanced services in the near future must be viewed with some suspicion, regardless of whether the Commission recaptures spectrum for a dedicated band or extends the Part 15 Rules as an underlay. The Commission should avoid making the mistake it made in 1989, when it declined to extend Part 15 to television broadcast spectrum on the assurance of television licensees that high-definition television was immanent and would be hindered by extension of an unlicensed underlay. *1989 Part 15 R&O*, 4 FCC Rcd at 3501. Instead, it should continue the virtuous circle of making spectrum available as a stimulus to deployment and innovation.

**F. THE COMMISSION HAS THE AUTHORITY TO DEDICATE A BAND EXCLUSIVELY TO UNLICENSED USES.**

Contrary to the Comments of some incumbents,<sup>15</sup> the Commission has the authority to prohibit licensed uses in favor of unlicensed access. Furthermore, nothing requires the Commission to demand individual licenses. To the contrary, the Commission has in the past authorized new services by issuing broad categories of license.

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<sup>15</sup> Comments of Sprint Corporation and Joint Comments of Stanford University and Northeastern University in WT Docket No. 03-66.

As an initial matter, nothing requires the Commission to authorize any “primary” service within a band. As the Commission understands Section 301, any service guaranteed protection from interference requires licensing. Only those services that accept any interference from any source and protect licensed services from harmful interference are eligible for Part 15. *Intelligent Transportation Devices NPRM*, 17 FCCRcd 23136, 23167-68 (2002). Nothing compels the Commission, however, to create a primary or protected service in every available band of spectrum. Where, as here, the Commission exercises its predictive judgment to determine that the public is best served by allowing only unlicensed access in a particular band, it has the authority to act.

Second, the Commission can license equipment manufacturers to manufacture licensed equipment without requiring the licensing of individual users.<sup>16</sup> *In re Allocation of Spectrum for Radiodetermination Satellite Service*, 104 FCC.2<sup>nd</sup> 650, 666-67 (1986). The Commission can issue such licenses to multiple equipment manufacturers based on its authority in Section 302.*Id.* The Commission has in the past found that such rules satisfy the requirements of Section 301, even where the Commission guarantees protection from interference. *Id.*<sup>17</sup>

In short, nothing in the Communications Act or the Commission’s rules prohibits the Commission from allocating a band of spectrum exclusively for unlicensed access.

Economists have long recognized that FCC policy regarding interference should not be designed to minimize interference per se but to maximize social output from the spectrum. Incumbent license holders make this argument for themselves when they want to create more interference. But when non-incumbents want to create more tolerance for interference, incumbents switch standards and include no consideration for the benefits of interference. The Commission’s goal is to eliminate “harmful” interference, not all interference. Time and again, the Commission has found that the public interest is best served by requiring a licensee to accept a modest increase in interference risk in exchange for providing the public with a new service or opportunity to access the spectrum directly without individual licenses. The Commission should make the same calculation here.

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<sup>16</sup> Indeed, this is reflecting in the name of the 1987 Part 15 NPRM and 1989 R&O, “Revision of Part 15 of the Rules Regarding the Operation of Radio Frequency Devices Without an Individual License.”

<sup>17</sup> Such licenses could include a per unit fee paid into a fund to relocate ITFS licensees. *Teledesic*, 275 F.3d at 85-87 (approving fees on new entrants to fund migration). Discussion of such funding methods is discussed further at Part III.D.

## **II. THE COMMISSION SHOULD ALLOCATE A PORTION OF THE ITFS/MDS BAND FOR DEDICATED UNLICENSED USE.**

Contrary to the assertions of many commentors, the record provides a compelling case for expanding the public's direct access to spectrum by expanding unlicensed uses in the 2500-2690 band.

### **A. THE GENERAL BENEFITS OF UNLICENSED SPECTRUM ARE LARGE.**

Unlicensed spectrum promises to provide huge social welfare benefits not only for non-profits but also for individuals and for-profit organizations.<sup>18</sup> Wiring within buildings and from the curb to the building is, on a per foot per person basis, by far the most expensive part of a telecommunications network. Allowing efficient deployment of wireless for this portion of the network reduces the last-mile costs of the next generation broadband Internet by close to 50%.<sup>19</sup> By relying on low power transmissions, which facilitate massive spectrum reuse, unlicensed spectrum makes practical next generation network speeds of a gigabit per second and more. Finally, unlicensed spectrum is vital to realizing the information age dream of anywhere, anytime communications. Appendix A shows some indicators of unlicensed wireless device growth. Appendix B provides profiles of how unlicensed WISPs are making use of unlicensed spectrum.

### **B. THERE IS A DEMONSTRATED ECONOMIC NEED FOR UNLICENSED SPECTRUM IN THE 2.5GHZ BAND.**

Some commentors, while neutral on the subject of unlicensed underlays generally, claim there is no demonstrated economic need for more unlicensed spectrum in the 2.5 GHz band.<sup>20</sup>

NAF, *et al.* contend that there is more evidence of demand for unlicensed spectrum than the demonstrated demand for licensed service in the MDS/ITFS band. The adjacent 2.4 GHz band is home to the largest low frequency ("beachfront") allocation of dedicated unlicensed

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<sup>18</sup> James H. Johnston and J.H. Snider, "Breaking the Chains: Unlicensed Spectrum as a Last-Mile Broadband Solution," Spectrum Series Working Paper #7, New America Foundation (June 2003). Available at <http://www.newamerica.net/index.cfm?pg=article&pubID=1250>.

<sup>19</sup> *Ibid.* p. 17.

<sup>20</sup> For example, Bellsouth, an MDS licensee, argued that pursuing more unlicensed spectrum "would impair the deployment of advanced services without any countervailing benefit of effectively addressing a demonstrable spectrum shortage or efficiency problem.... Accordingly, the Commission should expressly prohibit unlicensed operations in the 2500-2690 MHz band." (Comments of Bellsouth Corporation and Bellsouth Wireless Cable, Inc., WT Docket No. 03-66, p. 28). Stanford and Northeastern, two ITFS licensees, argued that "there does not appear to be any demonstrated need for spectrum in the 2500-2690 MHz band for unlicensed usage, and such usage does not appear at this time to advance an instructional service.... The Commission should focus its efforts to ensure that sufficient spectrum is available for instructional uses." (Comments of Stanford University and Northeastern University, p. iii)

spectrum. Despite the fact that that band is less than half the size of the ITFS/MDS band, it has been the center of far more economic activity, investment, and innovation than the current ITFS/MDS band.

Nucentrix, the third largest MDS operator, recently declared bankruptcy. Sprint and Nextel, the largest two MDS operators, have token economic activity in their bands.<sup>21</sup> Yet only a few years ago the major MDS operators were touting to the FCC and Congress that their fixed wireless business was on the verge of explosive growth. Instead, it turned out that the unlicensed WISP business captured most of that growth. Appendix B describes the failed promises of one of the MDS highfliers, Nucentrix.

There are now far more unlicensed than licensed devices in the United States. In recent years, unlicensed devices and applications have also been at the center of telecommunications growth and innovation. During the recent telecommunications meltdown, it was unlicensed, not licensed devices, which were the bright spot of the telecommunications sector.

All this success came despite the fact that the FCC has continued to grant unlicensed devices only a tiny fraction of the spectrum and non-primary rights to the spectrum so allocated. In the words of a recent FCC report, “unlicensed devices have become pervasive, reaching nearly every household in the U.S.”<sup>22</sup> In contrast, less than 1% of households either directly or even indirectly use ITFS and MDS devices.<sup>23</sup>

Consider only instructional use of the unlicensed 2.4 GHz vs. licensed 2.5 GHz bands. According to the 2003 National Survey of Information Technology in U.S. Higher Education, 77.2% of campuses now have wireless LANs using unlicensed spectrum on campus--an increase from 67.9 in 2002 and 29.6 in 2001. The proportion of the campus covered by wireless LANs has also increased. The percentage of campuses with 25% or more campus coverage has increased from 10.9% in 2001 to 18.3% in 2002, and 27.4% in 2003.<sup>24</sup>

Many campuses--including Dartmouth College, University of Akron, University of Missouri, University of North Carolina at Chapel Hill, University of Wisconsin, and Western

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<sup>21</sup> Sue Marek, “Wireless Internet,” *Wireless Week*, January 1, 2003, p. 27.

<sup>22</sup> Ken Carter *et al.*, “Unlicensed and Unshackled: A Joint OET-OSP White Paper on Unlicensed Devices and Their Regulatory Issues,” FCC Office of Strategic Planning Working Paper #39, Washington, DC: FCC, May 2003, p. 22.

<sup>23</sup> Commentors provided extremely poor data on actual usage of content delivered via ITFS/MDS. Simply airing a program over a metropolitan area does not constitute usage any more than broadcasting any other programming. Commercial broadcasters use Nielson to determine actual viewership. The ITFS industry has offered no comparable benchmark. And many of the major MDS players have either gone bankrupt (e.g., Nucentrix and Worldcom) or provided no more fixed wireless service than necessary to justify keeping their licenses.

Michigan University--now have ubiquitous networks using unlicensed spectrum.<sup>25</sup> These networks provide vital campus services, including not only ITFS-style course content but also the full panoply of interactive broadband services. Data on the number of campuses using ITFS is unavailable. But at a conference of senior campus network technology officers recently held at Dartmouth, the audience was asked how many members had ITFS licenses. Only two of more than 100 officers raised their hands. At Dartmouth itself, more than 98% of incoming students have voluntarily purchased Wi-Fi devices to fully take advantage of campus resources. Many now use the Wi-Fi network for voice over IP service, which allows students to call anywhere in the world from anywhere on campus at no charge. And, of course, this is only on campus. There is massive home and business use of unlicensed spectrum as well.

Remarkably, for the last several years the annual National Survey of Information Technology in U.S. Education has made numerous mentions about unlicensed WLANs on campus but no mention of ITFS on campus. The 2003 annual survey concludes:

“Wireless is clearly exploding across college campuses, much as it is in the corporate and consumer sectors. Rising expectations about campus Wi-Fi services are fostered by the dramatic growth of inexpensive wireless in the consumer sector. Students and faculty come to campus wondering why there is no wireless service in dorms, classrooms, offices, and the campus quad, when they have Wi-Fi at home.” (p. 2)<sup>26</sup>

Of necessity, campuses have limited their applications to existing bandwidth and power restrictions. Within these constraints, they have already accomplished so much that it appears to some as if no more is needed. But there is a tsunami of applications in development that is on the verge of causing a campus crisis. Today’s broadband applications tend to be both relatively low bandwidth and bursty. A student downloads a large and complex web page or document but then will pause to read it before making further demands on the network. Newer applications, however, such as voice over IP and videoconferencing, place much greater and constant strains on network capacity. And within the next twelve months, all major consumer electronics companies will be selling devices using unlicensed spectrum to connect all consumer audio/visual/data equipment. When every dorm room on campus can have its TV, computer, stereo, telephone, and classroom assignments blaring through the same narrow band of unlicensed spectrum, a campus spectrum crisis is sure to ensue.

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<sup>24</sup> “2003 National Survey of Information Technology in U.S. Higher Education,” October 2003, The Campus Computing Project, [www.campuscomputing.net](http://www.campuscomputing.net).

<sup>25</sup> See Josh McHugh, “Unplugged U.,” *Wired Magazine*, October 2002.

<sup>26</sup> <http://www.campuscomputing.net/pdf/2003-CCP.pdf>.

**C. CLAIMS BY INCUMBENTS THAT THEY WILL PROVE MORE EFFICIENT THAN UNLICENSED SPECTRUM MUST BE REGARDED WITH SUSPICION IN LIGHT OF THE HISTORY OF THE BAND.**

ITFS/MDS incumbents now claim that in the future their licensed applications will be more economically productive. But many of their similar claims in the past have proved false. For example, many of these incumbents defended their current uses a few years ago when fending off attempts by mobile telephone companies to use the 2.5 GHz spectrum for the very purposes the incumbent licensees now claim they will use their spectrum so productively.<sup>27</sup> Specifically, incumbents claimed that they had invested billions of dollars in this band and that their fixed wireless applications were on the verge of immense success. In retrospect, those arguments turned out to be highly speculative. The licensed uses proved so unprofitable that many incumbents either went bankrupt (such as Nucentrix) or are providing the minimal level of service to hold on to their licenses (Sprint). Some have even switched over to using the adjacent unlicensed bands. Meanwhile, 3G mobile telephone operators are expected to lose tens of billions of dollars worth of business to hotspots and other premises using unlicensed spectrum. Why pay them a small fortune to connect your laptop to a relatively slow (often at speeds below 100 kbps) 3G network when a Wi-Fi network can offer mobile access for a much lower price and at speeds of 54 Mbps?<sup>28</sup> Indeed, incumbent wireless telcos' fear of unlicensed competition best explains their persistent and intense opposition to additional allocations of spectrum in the low frequency bands<sup>29</sup>.

Providing adequate low frequency spectrum for unlicensed use will reduce last-mile costs on the next generation broadband Internet by as much as 50% or hundreds of billions of dollars. The marginal benefit of spectrum is also greatest in the last few hundred feet of the network. The network backbone has close wireline substitutes. But the last few hundred feet do not because a critical advantage of wireless service is end-user portability, which cannot be delivered via a wire. Most portable uses are less than a few hundred feet from a wired node. Given that unlicensed allocations of spectrum are the most efficient way to provide service to the last few hundred feet

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<sup>27</sup> See: "3G Interim Report: Spectrum Study of the 2500-2690 MHz Band", p. 21-22, ET Docket No. 00-232, November 15, 2000

<sup>28</sup> See: "Best Effort versus Spectrum Markets: Wideband and Wi-Fi versus 3G MVNOs?", Lee McKnight, Raymond Linsenmayer, William Lehr, available at: [http://itc.mit.edu/itel/docs/2002/best\\_effort\\_v\\_spectrum.pdf](http://itc.mit.edu/itel/docs/2002/best_effort_v_spectrum.pdf)

<sup>29</sup> At higher frequencies unlicensed allocations are much less of a competitive threat because they are ill-suited for mobile applications. At high frequencies, unlicensed devices require huge batteries and cannot propagate around obstacles such as walls, desks, and other human beings. That makes them unsuitable for mobile service and thus are not a competitive threat to 3G licensees.

of existing wired networks, unlicensed spectrum is a highly efficient way to allocate spectrum for anytime, anywhere Internet access.

In rural areas, wireless also becomes very efficient for fixed, backhaul services.<sup>30</sup> According to a study by the National Exchange Carriers Association (NECA), it would cost \$9,000/household to provide wired broadband Internet service to the 1.2 million most rural American households, a total of more than \$10 billion.<sup>31</sup> In recent years, unlicensed WISP operators have demonstrated that they are a highly efficient way to provide this backhaul. Although both licensed WISPs in the 2.5 GHz band and unlicensed WISPs in the 2.4 GHz band have both provided this service, it is the unlicensed providers, using much less spectrum, that have proved most successful. Incumbent MDS operators have essentially abandoned this business, arguing, as the existence of this NPRM attests, that portability is the highest valued use of this band of spectrum.

Incumbents in the 2.5 GHz band should not scoff at these benefits of unlicensed, especially when unlicensed users have dedicated access to only approximately 2.5% of the spectrum below 5 GHz—widely considered to be the “beachfront” spectrum because of its favorable propagation characteristics and energy requirements.

Moreover, a certain measure of humility is needed when making prognostications about future economic demand. In recent years, relatively high powered mobile telephone applications have generated the highest economic returns to licensed users. And only a few years ago the conventional wisdom was that 3G operators, not unlicensed hotspots, would be the primary access nodes for high speed data networks. But campuses, schools, hotels, restaurants, libraries, public transportation nodes, homes, and other institutions are bypassing 3G networks for high speed portable data access. This is reflected in the skyrocketing number of hotspots and wireless nodes in the U.S. See Appendix A. It now looks quite possible that 3G networks may become a niche product for the high speed transportation market. As the number of unlicensed devices grows and far exceeds the number of licensed devices, the nature of spectrum use is likely to significantly shift in coming years.<sup>32</sup>

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<sup>30</sup> See Reply Comments of NAF, et al., In the Matter of Additional Spectrum for Unlicensed Devices Below 900 MHz And in the 3 GHz Band, ET Docket No. 02-380, p. 14 and Appendix A. See also Jim Johnston and J.H. Snider, *Breaking the Chains: Unlicensed Spectrum as a Last Mile Solution*, Washington, DC: New America Foundation, May 2003.

<sup>31</sup> "NECA Rural Broadband Cost Study: Summary of Results," Victor Glass, Ph.D., National Exchange Carrier Association, Inc. June 21, 2000.

**D. NAF, *ET AL.*'S BAND PLAN ALLOWS INCUMBENTS NOT ONLY TO CONTINUE THEIR PRESENT LEVEL OF SERVICE BUT ALSO TO SUBSTANTIALLY INCREASE IT.**

Numerous commentors reinforced NAF, *et al.*'s point in its comments that incumbent license holders can continue to provide their current level of service in far less spectrum.<sup>33</sup> To the extent this is true, the FCC must face the question how to divvy up this windfall. NAF, *et al.* suggest that a portion should go to create a dedicated unlicensed band. For example, the Coalition proposal envisages shrinking the current high-power ITFS allocation to approximately a fourth its current size, with the rest (3 new channels) dedicated to a new low power allocation. One reason that this works is that when the ITFS licensees switch from analog to digital service, they can squeeze in up to ten channels in the space previously taken up by one. For the additional three channels, NAF, *et al.* are recommending that one goes to ITFS for low power and that two go to unlicensed for low power. Similarly, the MDS licensees will be able to increase their capacity by a factor of hundreds as they move from high power, broadcast type service to low power, cellular type services. NAF, *et al.* are recommending that a portion of these gains be given back to the public.

**E. NAF, *ET AL.*'S ONE BAND LOW POWER ALLOCATION PROVIDES INCUMBENTS WITH ADEQUATE FLEXIBILITY WHEN COMBINED WITH THE OPTION OF USING OTHER SPECTRUM FOR THE DOWNSTREAM DATA FLOW.**

A number of commentors support a single low power band as the most equitable and efficient band plan.<sup>34</sup> NAF, *et al.* agree with this approach. In contrast, the Coalition proposal expresses a need for two separate low power bands in case TDD technology doesn't prove most efficient and FDD technology proves necessary. Of course, all other things being equal, TDD technology is more efficient than FDD because it doesn't tie up spectrum when information flows are asynchronous, which has historically been the case because people tend to download more information than they upload.

But if TDD technology does not pan out as hoped, NAF, *et al.* believe there are other options to create a return path on spectrum dedicated for such a purpose. These include 1) using

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<sup>32</sup> "Unlicensed and Unshackled: A Joint OET-OSP White Paper on Unlicensed Devices and Their Regulatory Issues," Ken Carter *et al.*, FCC Office of Strategic Planning Working Paper #39, Washington, DC: FCC, May 2003.

<sup>33</sup> See NAF, *et al.*'s extended discussion in its comments, WT Docket No. 03-66; see also comments in the same docket of Sprint, p. 19; and IPWireless, p. 21.

<sup>34</sup> See comments of ArrayComm, Inc., p. 3; Comments of Ericsson, Inc., p. 4; Comments of the Independent MMDS License Coalition, WT Docket No. 03-66, p. 6. The Coalition proposal also acknowledges some of these solutions, p. 17.

the high power band either by converting the high power band to lower power or using the high power allocation for downstream data flow (both these options already exist in the Coalition plan), and 2) using a band outside the MDS/ITFS band for this purpose. The assumption that all communications must be contained within historical band plans flies in the face of everything the Commission has been trying to achieve in recent years. With the widespread introduction of flexible use and secondary markets, finding return path spectrum should be easier than ever.

The Commission has had a long standing policy to promote efficiency of spectrum use and encouraging licensees to adopt more efficient technologies. *See generally Spectrum Task Force Report* at 21-22. Accordingly, rather than adopting a policy here for the express purpose of permitting licensees to use inefficient technologies that maximize the licensee's economic well-being, the Commission should adopt the policy urged by NAF, *et al.* as providing proper incentive to maximize spectral efficiency and deploy the best available technology.

**F. IF, AS COMMENTORS ARGUE, THE LOW POWER CHANNELS ARE EACH REDUCED TO 5 MHZ, THEN THE FREED UP SPECTRUM SHOULD BE ADDED TO THE UNLICENSED BAND.**

Several commentors arguing on behalf of ITFS and MDS interests argue that the low power allocations should be reduced in size to 5MHz to conform to industry norms. As CTIA argues: "This size channel will give providers the flexibility to offer new and innovative voice and data services in many areas that are currently underserved, including rural areas. In addition, it will also allow CMRS carriers and others providing services in the MDS and ITFS bands the ability to successfully aggregate and disaggregate spectrum, and allow carriers to make the most efficient use of limited spectrum resources as the demand for advanced data and voice service develops."<sup>35</sup>

If the Commission adopts 5 MHz bands, NAF, *et al.* recommend that the dedicated unlicensed band be increased from 90 MHz to 98 MHz. Otherwise, the proposed NAF, *et al.* band plan remains identical.<sup>36</sup> Specifically, if the eight initial low power bands shrink from 6MHz to 5 MHz each, then the 8 MHz shifted freed up should be shifted to the unlicensed band.

**G. THE BOUNDARIES OF MDS AND ITFS LICENSES SHOULD BE DETERMINED BY THE ORIGINAL LOCATION OF THE MAIN STATION.**

Some commentors argue that the boundaries of an incumbent licensee's area should be determined based on where it places its main transmitter, even if this is different from the location

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<sup>35</sup> Comments of CTIA, p. 3; see also Comments of Stanford and Northeastern, p. 10,

of their original transmitter.<sup>37</sup> NAF, *et al.* believe that this is a major license modification and that the white space that incumbents propose to acquire for themselves should either be retained for unlicensed use or auctioned. Moreover, as licensees shift from high-power to low-power use, the main transmitter of a licensee loses its current position of being the defining characteristic of a practical licensed area.

### **III. THE COALITION TRANSITION PLAN IS DEEPLY FLAWED AND NEEDS TO BE STREAMLINED.**

#### **A. THE TRANSITION PLAN MAY, IN FACT, BE THE FINAL PLAN.**

The Coalition offers a transition plan and a final plan. But since the transition plan does not have a deadline or compelling incentives to reach such a deadline, the transition plan may be the final plan. One ITFS commentor noted, “It is indefinite when, and uncertain whether, any particular market will ever be transitioned. In the meantime, unbuilt stations will continue to occupy spectrum....”<sup>38</sup> An MDS commentator, Grand Alliance, made the same point: “Grand Alliance operates an MMDS station from the Empire State Building in New York City.... It took Grand Alliance over ten years to begin operations of even these limited facilities in large part because of difficulties in negotiating with the incumbent ITFS licensee....If Grand Alliance’s own experience has taught it anything, it is that reliance on voluntary negotiations without any firm deadlines is a prescription for deadlock.”<sup>39</sup>

The Coalition’s “Default” transition plan is premised on market failure. It assumes that even if incumbents are given flexibility they will not engage in Coasian trades that will lead to optimal spectrum allocations. NAF, *et al.* do not dispute the existence of market failure. But we do dispute the Coalition’s contention that the Coalition plan is market-based rather than pro-incumbent-based. Indeed, the transition plan violates many of its own stated pro-market objectives. The endless transition proposed by the Coalition marks an extension, not the end, of the FCC’s command and control spectrum allocation system.

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<sup>36</sup> See Comments of NAF *et al.*, WT Docket No. 03-66, p. 17.

<sup>37</sup> Comments of the Independent MMDS License Coalition, WT Docket No. 03-66, p. 11.

<sup>38</sup> Joint Comments of Stanford University and Northeastern University, p. 15.

<sup>39</sup> Comments of Grand MMDS Alliance, WT Docket No. 03-66, pp. 2, 8.

**B. THE COALITION TRANSITION PLAN IS EXCEEDINGLY REGULATORY, WILL INVITE MASSIVE LITIGATION, AND IS A MEANS WHOLLY CONTRARY TO THE COMMISSION’S STATED ULTIMATE GOAL OF MOVING AWAY FROM A COMMAND-AND-CONTROL SPECTRUM ALLOCATION SYSTEM.**

Many commentators have noted that although the stated purpose of advocates of the Coalition proposal is to streamline, deregulate, and otherwise reduce government intrusion in the spectrum allocation process, the actual transition proposal it recommends is something quite different. Spectrum Market argues: “The Coalition’s market-by-market, non-synchronous, non-compulsory, Proponent-dependent transition plan is impractical, unwieldy, difficult and, in highly populated areas of the country, likely impossible of accomplishment.”<sup>40</sup> Representing ITFS licensees, Stanford and Northeastern state: “[T]he regulatory regime itself is becoming so complicated as to make the transition and new rules incomprehensible.”<sup>41</sup> And representing MDS licensees, the Independent MMDS License Coalition states: “[T]he procedures proposed by the Wireless Coalition are so cumbersome, so time-consuming and so needlessly complex as to invite years of squabbling before the FCC to resolve disputes.”<sup>42</sup>

Spectrum Market provides detailed data about the pseudo elegance and “hopeless complications” of the Coalition transition plan. For example, in some markets an incumbent’s new geographical service area will overlap with the geographical service area of five other incumbents. Bisecting the areas of overlap will result in a wildly contorted irregular shape. At the same time, there will be many site-based licenses outside of the new geographical service areas that will be grandfathered. The length of the Coalition’s plan—over 100 pages—is an indicator of its underlying complexity. Most of this complexity is due to the Coalition’s effort to strike compromises among the incumbent licensees’ interests. But the price of this cooperation is an industrial policy favoring incumbent license holders and extracting huge rents from the public.

Like the Telecom Act of 1996 and the DTV transition that were sold to the public as “deregulatory,” the consequence of the Coalition’s plan may be endless litigation and trips back to the FCC to fix its flaws. NAF, *et al.* advise the Commission that the means of the Coalition Plan cannot be separated from its ends. Communism promised the public “from each according to its means; to each according to its needs.” Likewise, the Coalition promises short-term pro-incumbent regulation in return for a long-term marketplace utopia characterized by competition and innovation. But it’s quite possible that the promised utopia will never arrive and the endless series of “transitions” will continue.

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<sup>40</sup> Comments of Spectrum Market, p. i.

<sup>41</sup> Joint Comments of Stanford University and Northeastern University, p. 4.

**C. THE COALITION’S PLAN IS UNLIKELY TO MARK THE END OF GOVERNMENT HANDOUTS TO INCUMBENT LICENSEES**

The history of the ITFS/MDS spectrum over the last few decades has been very simple. Incumbent license holders periodically come to the FCC and promise that if only they are given more spectrum rights all their financial woes will go away as they implement some wonderful new service. Then, as surely as night follows day, they come back and say that their business plan has changed due to unforeseen circumstances and they need a new government subsidy, which the government has been only too willing to give. The incumbents offer no proof that this plan, with no timeline for completion and relying upon the same sort of negotiations among the same fractious parties as previous efforts, will fare any better.

The Coalition has surely worked out many potential problems with its band plan, but it has also punted on many others that are likely to come back to haunt it and lead to a new round of pleading for government giveaways. Absence of a firm deadline for the end of its transition plan and numerous grandfathered site-based licenses are but two of these loose ends. Notably, Coalition proponents incur no significant costs if their promises don’t pan out and they must come back to government for yet more government handouts. The Commission should also consider whether incumbent licensees have considered or acknowledged all the problems associated with moving to a 4<sup>th</sup> generation mobile telephone business model. With this business model, they will have to start placing more and more cell towers closer to the home and neighborhood. And this is likely to lead to a whole new round of lobbying for access to public and private property on favorable terms.

**D. ALTHOUGH THE WINDFALL FROM SPECTRUM FLEXIBILITY SHOULD BE ADEQUATE COMPENSATION TO MOVE INCUMBENTS LICENSE HOLDERS AND COMPLETE THE BAND TRANSITION, ALTERNATE FUNDING MECHANISMS MAY NEED TO BE CONSIDERED.**

In its comments, NAF et al. suggested three options to fund the relocation of incumbent licensees: 1) through the increased leasing revenues gained from spectrum flexibility, 2) through a trust funded from auctioned spectrum, and 3) through a trust funded via equipment revenues.<sup>43</sup> NAF et al. believe that the first option would be ideal, the second option second best, and the third option the least desirable but also perhaps the most realistic.

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<sup>42</sup> Comments of the Independent MMDS License Coalition, WT Docket No. 03-66, p. 4.

<sup>43</sup> Comments of NAF, et al., pp. 19-20.

***a. Given the huge benefits granted to incumbent licensees as part of this band transition plan, they should bear the cost of their own transition***

A number of commentors argue that each incumbent license holder should bear the cost of the ITFS/MDS band transition.<sup>44</sup> The combination of greater value of spectrum flexibility combined with ability to realize value from leasing should in itself be sufficient to justify the cost of relocating any traditional ITFS operations. One option is to fund the relocation directly with lease revenues. Another is to use a long-term lease contract to secure a loan with a bank.

NAF, *et al.* believe that this band restructuring is unusual because it involves benefits as well as costs. Although there may be costs involved in moving existing services, the new flexible license rights are far more valuable than the cost of moving existing services. Incumbents are being asked to move in such a way that the spectrum rights they will acquire are far more valuable than what they currently possess. This explains why incumbent license holders are themselves asking to be moved because they recognize the huge benefits they will acquire by doing so. Accordingly, the Commission should focus on the net benefits of the overall plan rather than isolate the costs associated with one component.

Incumbents may respond that creating dedicated unlicensed spectrum will cause them economic harm. But as NAF, *et al.* argued in its comments,<sup>45</sup> the nature of this claimed economic harm needs to be carefully specified. Even if a 90 MHz dedicated unlicensed band is carved out of the ITFS/MDS band, the incumbent licensees come out at net winners. Using new technology, incumbents can provide their existing licensed services in far less spectrum than they currently use. So if rights are defined in terms of service capacity rather than the size of frequency bands, reducing allocated frequency bands per se does not diminish service and may in fact facilitate a great increase in service capacity, which is the nature of the NAF, *et al.* proposal. Even ITFS incumbents acknowledge that their present high power service can be provided in a quarter of their existing spectrum and probably much less. Their band plan, after all, reduces their amount of high power spectrum to a maximum of a fourth of its present levels. In contrast, the NAF, *et al.* band plan allows ITFS licensees to retain their high power post-transition band *plus* a low power band.

If the Commission deems additional inducements necessary to fund the transition, there are other well-known options.

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<sup>44</sup> Comments of the Independent MMDS Licensee Coalition, p. 13.

<sup>45</sup> See Comments of NAF *et al.*, WT Docket No. 03-66, p. 21.

***b. The relocation trust could also be funded via auctions or Equipment Sales.***

While it is true that Section 309(j)(8)(A) requires that revenue from auctions (with the exception of deductions made to reimburse direct administrative expenses of the auction) be deposited in the treasury, the Commission has in the past required new entrants to finance migration of licensees. See *Teledesic LLC v. FCC*, 275 F.3d 75, 85-87 (D.C. Cir. 2001).

Here, requiring such an arrangement would be more complex, because there is no individual licensee seeking to displace the incumbent. Arguably, the Commission could require a fixed cost paid in addition to any auction fee into a general fund to finance the migration. Ideally, the FCC should request that Congress remove any doubt as to the Commission's statutory authority by expanding the scope of the pending Spectrum Relocation Trust Fund that will finance the relocation of federal spectrum incumbents. H.R. 1320.

In addition, commercial licensees wishing to take advantage of the ITFS spectrum could finance the transfer in the same manner envisioned by the Coalition Plan. The Coalition Plan requires that a "proponent" should finance an ITFS licensee's transition to more efficient technology.

NAF, *et al.* support providing ITFS licensees with a new, equivalent "home" in the upper band. Even if the Commission adopts NAF, *et al.*'s proposed increase in ITFS service requirements, ITFS licensees will still have valuable excess spectrum to lease. Commercial proponents will still have incentive to help defray the cost of migration for ITFS licensees, and thus access otherwise unavailable ITFS spectrum.

In addition, funding the transition via unlicensed equipment sales may be uniquely viable in this band given the extraordinary growth of the unlicensed equipment market and the extraordinary value of this band for unlicensed use. Although the first attempt to use this funding mechanism was not a success, the circumstances in this band are quite different than they were in the unlicensed PCS band.<sup>46</sup> We're now in a post Wi-Fi world with unlicensed equipment sales in the tens of millions of units and growing rapidly. In the not too distant future, the average American family could have dozens of unlicensed devices.<sup>47</sup> Even a fee as low as \$1/unlicensed device could generate hundreds of millions of dollars. One approach might be to restrict the fee to equipment that uses the existing 2.4 GHz and new 2.5 GHz unlicensed bands. With NAF *et al.*'s proposed block of 173 MHz of prime spectrum (83 MHz in the 2.4 GHz band and 90 MHz

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<sup>46</sup> See "Amendment to the Commission's Rules Regarding a Plan for Sharing the Costs of Microwave Relocation," First Report and Order and Further Notice of Proposed Rule Making, WT Docket 95-157 (April 30, 1996).

<sup>47</sup> e.g., see Kenneth Carter, *et al.* "Unlicensed and Unshackled: A Joint OET-OSP White Paper on Unlicensed Devices and their Regulatory Issues," OSP Working Paper #39, FCC (May 2003).

in the 2.5 GHz band), many manufacturers would find it irresistible to provide devices to take advantage of this spectrum resource. In contrast, the fee in the 20 MHz unlicensed PCS band was \$20/device. This was expensive for a consumer device, and most manufacturers decided they were better off supplying unlicensed devices in other larger low frequency bands.

NAF *et al.* suggest that a combination of funding mechanism and “tough love” to reluctant incumbents may prove the best combination to achieve the greatest public good. Indeed, the Commission has in the past created deadlines for financed migrations, after which a licensee must pay its own way. *Teledesic*, 275 F.3d at 81 (after ten year “grandfathering” period, incumbents are not entitled to relocation costs).

Accordingly, NAF, *et al.* propose the following: the Commission should set up a trust fund to finance relocation. This will either be funded by auctions (if Congress grants the authority) or equipment manufacturers. Any additional cost of relocation will be funded either by commercial licensees seeking to avail themselves of ITFS spectrum, or by the ITFS licensees themselves as compensation to the public for the increased value of their licenses.

#### **IV. THE COMMISSION MUST PREVENT HOARDING AND SPECULATION BY INSTITUTING MEANINGFUL CROSS OWNERSHIP RESTRICTIONS AND REFUSING TO EXTEND THE SECONDARY MARKETS ORDER.**

##### **A. RAMPANT SPECULATION IN THIS BAND SHOULD NOT BE REWARDED.**

Many companies have been buying ITFS/MDS licenses for a large discount in the hopes that the FCC will bring them a financial windfall and save them the cost of buying spectrum at auction. The top four MDS licensees—Sprint, Nextel, SBC, and Clearwire—all appear to have bought MDS licenses in the expectation of such a windfall. Rewarding such speculation sends a terrible signal to companies that the way to get ahead is by lobbying the government rather than competing in markets.

##### **B. THE COMMISSION MUST IMPOSE MEANINGFUL CROSS-OWNERSHIP RESTRICTIONS.**

The Commission itself has found that the residential and small business markets are highly concentrated. Consistently, however, the Commission has relied upon the promise of emerging competition from MDS to find that deployment of advanced telecommunications services is satisfactory and that the Commission need take no action to protect non-facilities

based competitors. *See, e.g., Deployment of Advanced Telecommunications, Second Report*, 15 FCC Rcd 20913, 20934 (2000).

The Commission's persistent belief in "intermodal competition" at the expense of the genuine competition that spurred deployment of the narrowband Internet in the face of all evidence to the contrary, *see, e.g., Mark Cooper, The Importance of ISPs in the Growth of the Commercial Internet*, CFA (2002), has already had ruinous effects on the independent ISPs and on the communities they serve. As a result of the Commission's refusal to open the cable networks or to enforce existing obligations on LECs, broadband deployment continues to lag behind other OECD countries where unbundling has spurred widespread adoption. *See* "Broadband Internet Access in OECD Countries: A Comparative Analysis." Staff Report, Released October 7, 2003.

But, if the Commission insists on following this course, it must take the necessary steps to give competitors a fighting chance. In the absence cross-ownership limits, cable and LEC competitors will simply acquire rights in competing spectrum, blocking access to competitors. The example of the cable MSOs, anticompetitive use of its Primestar system to block DBS competition in 1997 should loom large in the Commission's mind. *See United States v. Primestar*, Civil No.: 1:98CV01193 (JLG) (filed May 12, 1998).

NAF, *et al.* recognize, however, that BellSouth has invested considerable effort in developing its MDS system as a genuine cable competitor. Accordingly, NAF, *et al.* support grandfathering existing cross-owned MDS systems.

**C. THE COMMISSION MUST NOT EXTEND THE *SECONDARY MARKETS ORDER* TO THE MDS/ITFS BAND.**

The Commission's recently released *Secondary Markets Order* constitutes nothing less than a flagrant attempt to ignore Sections 301, 304 and 310(d) of the Communications Act. It is unconscionable that, despite the continued unambiguous declarations of Congress that spectrum is a public asset and that ownership rests solely with the people of the United States, the Commission continues to try to a license to use the electromagnetic spectrum into a fee simple absolute.

NAF, *et al.* cannot hope to add to the well reasoned dissent issued by Commissioner Copps. NAF, *et al.* incorporate these arguments by reference here.

## **V. THE COMMISSION SHOULD STRENGTHEN BOTH EDUCATIONAL ELIGIBILITY AND PROGRAMMING REQUIREMENTS**

For more than 70 years, Congress and the Supreme Court have consistently repeated that the electromagnetic spectrum constitutes a public resource that must be administered for the good of all, not for private gain. As spectrum technologies have moved from simple broadcasting to advanced telecommunications service, Congress has continued to insist that this public resource serve the public good. In particular, Congress has emphasized the value of using public spectrum for non-commercial educational purposes. *See, e.g.*, 47 USC §396(a)(1) & (a)(2).

The ITFS reservation remains one of the great monuments to this national policy. As the Commission has seen, ITFS licensees throughout the country daily provide both educational programming and other telecommunications services.

Unfortunately, however, the service remains in danger of losing its educational roots. Too many licensees and would be licensees appear to believe that the spectrum is meant to provide additional monetary support for institutes of higher learning, rather than as a valuable tool to be used, as required by the Commission's rules, *primarily* for educational purposes.

As discussed in the initial comments, NAF, *et al.* urge the Commission to retain the ITFS set aside. At the same time, however, the Commission must take this opportunity to restore the service to its true educational purpose: as a wellspring of spectrum-based educational services rather than a revenue stream.

### **A. ITFS ELIGIBILITY SHOULD BE RESTRICTED**

NAF, *et al.* concur with the many ITFS licensee commentators who argue that ITFS eligibility should be restricted. However, NAF, *et al.* believe that the purpose of this restriction is to enhance the instructional programming provided over ITFS spectrum, not to increase the negotiating power of ITFS incumbents for higher lease rents or to increase the market power of ITFS incumbents in bidding for white space outside of their geographic service areas.<sup>48</sup> Some ITFS commentators explicitly noted the monetary advantages that come from possessing a bidding monopoly. For example, comments of the Education Community state: “the sale of licenses would undermine the ability of educational licensees to negotiate excess capacity leases... If ITFS licenses were auctioned, remaining licenses would be stripped of bargaining power to

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<sup>48</sup> Most ITFS commentators, such as Hispanic Information and Telecommunications Network, Inc., did not expand on the logic for wanting exclusive bidding rights to ITFS designated spectrum bands: “Any available ITFS white space in any market should be auctioned only to eligible ITFS entities.... The Commission should not require any minimum bid in any of these auctions and should not allow any third party commercial entities to directly fund the bids of any participant.” (p. 10).

negotiate favorable excess capacity arrangements with commercial entities, since companies would have little incentive to come to the bargaining table rather than holding out for sale.... In the end, educational institutions would find themselves shut out of the new and increasingly valuable digital spectrum.”<sup>49</sup>

## **B. ITFS ELIGIBILITY CANNOT EXIST WITHOUT ITFS OBLIGATIONS**

NAF, *et al.* believe that strengthening the ITFS eligibility and programming requirements must go hand in hand. Neither can exist without the other because the justification of the eligibility requirement is necessarily the programming requirement. Therefore, it is hypocritical to argue for ITFS eligibility requirements with no substantial educational obligations. A number of commentors mentioned the need to strengthen the ITFS programming requirements. NAF, *et al.* wholeheartedly agree. Stanford and Northeastern state: “The Commission raises a valid concern that the current rules only require an ITFS licensee to use 5% of its assigned spectrum for instructional purposes.... [A] licensee that holds 24 MHz of ITFS spectrum, and only uses the spectrum 5% of the time for instructional purposes, while leasing the remaining for commercial purposes, is potentially denying other instructional institutions the opportunity to use “ITFS” spectrum for instructional purposes. Accordingly, in adopting rules to transition ITFS licensees to a new band plan, the Commission should retain an instructional usage requirement for ITFS and raise the level of commitment to be consistent with the goals of the revised band plan.”<sup>50</sup>

Comments of the “Education Community” state: “[T]he proposal to eliminate the requirement that ITFS licensees provide educational services and to permit ITFS licenses to be acquired by commercial entities represent a wholesale assault on this critical educational resource.... If the ITFS educational requirement were eliminated, the loss of existing ITFS services would be devastating to communities across the country.”<sup>51</sup> Perhaps the School Board of Broward County expressed this idea most forcefully: “We... respectfully urge the Commission in its final rules in this proceeding to eliminate any hint of equivocation or mere lip-service regarding its commitment to broadband in the service of public education....”<sup>52</sup>

Other ITFS commentors forcefully state that eligibility and programming restrictions go hand in hand but then don’t elaborate on the policy implications of this . The Catholic Television Network (CTN) and National ITFS Association (NIA), for example, state:

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<sup>49</sup> Comments of the Education Community, p. 7.

<sup>50</sup> Comments of Stanford and Northeastern, p. 6.

<sup>51</sup> Comments of the Education Community, pp. 3, 5-6.

<sup>52</sup> Comments of the School Board of Broward County, WT Docket No. 03-66, p. 2.

As a general proposition, CTN and NIA can appreciate the Commission's desire to allow free market forces to drive spectrum to its highest and best use. However, market forces do not always achieve this goal. Thus, there are clear and compelling reasons not to treat ITFS like other services where eligibility *and use* [italics added] restrictions have been eliminated.<sup>53</sup>

The Illinois Institute of Technology urges the FCC "to ensure that the core educational focus of the ITFS channels be preserved" and belittles the FCC's concern that the 5% programming requirement might be indicative of low educational use by citing its own use of 80% of its spectrum for educational programming.<sup>54</sup> But it does not go on to argue for increasing the overall educational programming requirement of eligible ITFS institutions. NAF, *et al.* believe that if schools are already exceeding the 5% requirement, they should not object to formalizing a higher standard of public service. Indeed, when the National ITFS Association was clamoring for more spectrum flexibility several years ago, that was exactly what they proposed: a 25% instructional programming requirement.<sup>55</sup>

Just as commercial broadcasters have given great lip service to their public interest responsibilities when collecting public assets for their own gain,<sup>56</sup> so too do some "spectrum slackers" in the ITFS community appear bent on doing the same. Without quantifiable and substantial ITFS programming requirements, the programming will merely become a fig leaf for government subsidies.

In particular, the Commission has discovered that eliminating renewal hearings, eliminating local programming mandates, and failing to enforce public file requirements has severed the relationship between commercial broadcasters and the communities they are required by law and policy to serve. So great has been the public outcry that at last the Chairman, like a king of old, has decided to ride circuit and hear from local citizens how stations have or have not continued to serve their local communities.<sup>57</sup> The Commission must not allow the same thing to happen to ITFS.

NAF, *et al.* also urges the Commission to reject the "kill it to save it" arguments used to justify making the ITFS programming requirements all but meaningless. The kill-it-to-save-it argument is that ITFS licenses need non-educational revenues to fund ITFS educational

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<sup>53</sup> Joint Comments of Catholic Television Network and National ITFS Association, WT Docket No. 03-66, p. 3.

<sup>54</sup> Comments of Illinois Institute of Technology, WT Docket No. 03-66, p. i.

<sup>55</sup> Joint Statement of the Wireless Cable Association and the National ITFS Association. Two-Way Order, 15 FCC Rcd at ¶87-88.

<sup>56</sup> See J.H. Snider, "The Myth of Free TV" Spectrum Series Working Paper #5, New America Foundation (June 2002).

programming. This clever argument resolves the seeming paradox of killing instructional programming in the name of saving it. Sprint, for example, argues that if the Commission forced ITFS licensees to fulfill the original educational purpose of their licenses, “the Commission would reduce the amount of spectrum available for lease by ITFS licenses and thereby reduce the amount of consideration available for ITFS licensees who utilize leasing revenues to fund the production of programming and the provision of other educational and instructional services.”<sup>58</sup>

In an oft-cited passage, the Commission three years ago made a similar assertion:

We do not believe that there is any contradiction between an ITFS licensee performing its educational mission and that same licensee securing financial returns from the lease of its excess capacity. In fact, those financial returns can and do provide substantial resources to the ITFS licensees in the performance of its educational mission.... [W]e believe that current ITFS licensees are striving to fulfill that mission and that they should be permitted to obtain the maximum return from their licensed spectrum to further that mission.”<sup>59</sup>

However, the Commission has failed to provide any evidence whatsoever that the quality of ITFS programming has improved as a result of the additional subsidies and reduced programming requirements it has bestowed upon it. Perhaps, indeed, the FCC has merely been killing ITFS, not saving it. The current 5% programming standard doesn’t even require that students or any other human beings are actually making educational use of ITFS spectrum; the 5% requirement can be filled by simply transmitting a signal to nowhere.

To date, ITFS licensees who provide instructional programming to a large number of rural receiver sites over distances of 10 to 30 miles have the best economic case for licensed educational spectrum.<sup>60</sup> Over long links in sparsely populated areas, broadband service tends to be prohibitively expensive. And over relatively short distances and sparsely populated areas, satellite TV loses its economies of scale.

If the claims of other ITFS licensees to provide valuable instructional services cannot be verified, then their licenses should be returned to the public and their spectrum used for more unlicensed services.

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<sup>57</sup> See FCC News Release, “FCC Chairman Powell Launches ‘Localism in Media’ Initiative,” August 20, 2003.

<sup>58</sup> Comments of Sprint, WT Docket No. 03-66, pp. p. 19; see also Joint Comments of ITFS Parties, WT Docket No. 03-66, p. 4.

<sup>59</sup> cited in Joint Comments of Catholic Television Network and National ITFS Association, WT Docket No. 03-66, pp. 8-9.

<sup>60</sup> E.g., see comments of Education Service Center, Region 10, WT Docket No. 03-66.

**C. UNLICENSED ALLOCATIONS TO EDUCATIONAL INSTITUTIONS AND OTHER NON-PROFITS MAY PROVIDE GREATER BENEFITS THAN SELECT LICENSED ALLOCATIONS TO SUCH INSTITUTIONS**

Stanford and Northeastern contend that “assigning spectrum to unlicensed devices does not benefit” their “instructional missions.”<sup>61</sup> In fact, however, both universities make substantial use of unlicensed spectrum on their campuses. Stanford classrooms, for example, are outfitted with Wi-Fi links that allow students to link their laptops to class resources without plugging them in. At a recent conference at Stanford Law School, the dean lamented the shortage of unlicensed spectrum on the Stanford campus.<sup>62</sup> Demand is so high that even when cell sizes are limited to a single classroom unlicensed capacity may not be adequate.

Dartmouth has recently implemented a campus wide Wi-Fi network that not only gives students ubiquitous access to next generation broadband speeds, but also lets them make voice over IP Internet calls to anywhere in the world at no charge. Because of its immense cellular reuse, this low power network is substantially faster than most two-way ITFS networks.<sup>63</sup>

Not only does higher education have massive need for unlicensed spectrum, so, too, do hospitals, libraries, K12 schools, and other non-profits. For example, in Maryland this year, the state legislature allocated \$4.7 million to wire local school buildings in addition to the funds for this purpose provided by the E-Rate, a several billion dollar a year federal program to connect K12 schools and libraries to the Internet. If schools had adequate unlicensed spectrum for next generation networks, these costs could be significantly reduced. Local governments, too, have begun making significant use of unlicensed spectrum to set up municipal networks for business development, downtown revitalization, public transportation, public safety, and even residential use.<sup>64</sup> It is noteworthy that local and state governments have less than 1% of the spectrum allocated to private entities through the federal government.<sup>65</sup> Unlicensed spectrum has become vital to alleviating their spectrum drought.

Sometimes non-profits appear oblivious of the changed technological world. For example, the School Board of Miami-Dade County, Florida comments: “there is an increasing need for students and teachers to access web based instruction and the Internet from locations where there is not a hard wired high speed connection. The absence of wireless technology

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<sup>61</sup> P. 23.

<sup>62</sup> Comments at Cyberlaw conference, Stanford, California, March 2003.

<sup>63</sup> Katie Hafner, “A New Kind of Revolution in the Dorms of Dartmouth,” New York Times, September 23, 2003; see also the Dartmouth Center for Mobile Computing’s September 2003 newsletter, “Dartmouth Commits to Campuswide VoIP,” available at [cmc.cs.Dartmouth.edu](http://cmc.cs.Dartmouth.edu).

<sup>64</sup> E.g., see <http://www.muniwireless.com/reports>.

<sup>65</sup> See The Explanation of the Citizen’s Guide to the Airwaves, available at [www.spectrumpolicy.org](http://www.spectrumpolicy.org).

prevents students from fully benefiting from the new instructional technologies.”<sup>66</sup> The comment implies that the only alternatives for instructional access are wired vs. licensed wireless technologies. But clearly, unlicensed wireless is already far more important for instructional access than licensed. Moreover, only a handful of the more than 15,000 school systems in the United States have ITFS licenses. The rest must rely on unlicensed spectrum or pay large fees to spectrum license holders. NAF, *et al.* believe that there still is an important role for licensed ITFS spectrum, but ITFS claims must be more carefully qualified than those of the Miami-Dade County School Board.

**D. IF ITFS LICENSEES HAVE SUBSTANTIAL EDUCATIONAL USE REQUIREMENTS, AS A QUID PRO QUO FOR THEIR SPECTRUM, THEY MUST PROVIDE INFORMATION TO HOLD THEM ACCOUNTABLE.**

NAF, *et al.* believe that if ITFS licensees are given free use of an asset worth billions of dollars, there must be adequate accounting schemes in place to monitor its use. For this reason, NAF, *et al.* oppose the request by several ITFS commentators to eliminate ITFS reporting requirements.<sup>67</sup> In fact, the Commission should strengthen these by requiring that all ITFS licensees post their programming information and leases on a website and keep that information available to the public for at least five years.

This proposal is exactly analogous to the Commission’s current proposal to require digital broadcasters, after they complete the digital transition, to maintain their public file on a website or otherwise make it accessible to the public via the Internet. *In re Standardized & Enhanced Disclosure Requirements for Television Broadcast Licensee Public Interest Obligations*, 15 FCC Rcd 19816 (2000). This would serve the same purpose here, it would remind those who hold a public resource that they act as trustees for the benefit of the public, and it would allow the public whose asset this is to monitor the conduct of the public trustee.

**VI. THE GOVERNMENT SHOULD COMPLY WITH THE STATUTORY REQUIREMENTS OF THE COMMUNICATIONS ACT TO PREVENT SPECTRUM WINDFALLS TO INCUMBENT LICENSEES.**

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<sup>66</sup> Comments of the School Board of Miami-Dade County, WT Docket No. 03-66, p. 6.

<sup>67</sup> Joint Comments of Catholic Television Network and National ITFS Association, WT Docket No. 03-66, p. 16.

As one commentator estimated, the market value of the incumbent licensee's spectrum will increase by a factor of more than five if the Coalition proposal is accepted.<sup>68</sup> The commentator then goes on to propose rulemakings to increase the value of the incumbent licenses by a factor of two or more above that. NAF, *et al.* believe that, as the FCC considers the interests of various stakeholders, it should keep foremost in its mind the public trust it has taken on as custodian of the public's airwaves. That trust includes getting fair compensation for the use of publicly owned resources, not selling off the spectrum that is the public's means of communication within their own homes and businesses, and preserving a portion of the spectrum for non-profit use.

In its policy toward spectrum windfalls, the Commission also needs to address certain inconsistencies. Sometimes the FCC divides spectrum rights into their components and separately allocates those components. At other times it gives those same components to incumbent license holders. Consider the FCC's Northpoint proceeding. Northpoint developed a technology that allowed it to reuse spectrum assigned to satellites. Since spectrum can be divided by angle of arrival, it is possible for a signal delivered by satellite to share the same frequency and location with a signal delivered terrestrially at a different angle. Although incumbent satellite license holders made a bid for geographic service licenses, the FCC held that their licenses should be allocated on a site-based basis. The FCC's Northpoint decision thus runs completely contrary to the Coalition proposal.

**A. THERE IS WIDESPREAD OPPOSITION TO THE TWO-SIDED AUCTION, EVEN BY THOSE WHO WOULD SUPPOSEDLY BENEFIT FROM THE WINDFALL IT OFFERS INCUMBENT LICENSE HOLDERS.**

As NAF, *et al.*, argued in its comments, the two-sided auction raises serious equity concerns. Commentors did not dwell on this aspect of two-sided auctions. But many came out against it for one reason or another.<sup>69</sup> If those who are to benefit from the two-sided auction oppose it, we think the Commission should, too.

## CONCLUSION

Driven by emerging smart radio technologies, the reigning paradigm of spectrum regulations is being challenged as never before. Increasingly, spectrum can be allocated according

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<sup>68</sup> Comments of Spectrum Market. Spectrum Market estimates the current value of the spectrum is \$902 million and that this will increase to \$7.8 billion if the Coalition proposal is implemented. If Spectrum Market's proposal is implemented, they believe it will further increase to \$20.9 billion—still below the market value under conditions of complete flexibility (p. ii).

<sup>69</sup> E.g., Comments of Sprint, pp. 20-21; Wireless Communications Association, National ITFS Association, and Catholic Television Network, pp. 104-111.

to the principles of the acoustic spectrum. The government wouldn't dare regulate use of the acoustic spectrum the way the Coalition proposes to regulate the electromagnetic spectrum. Not allowing Americans to speak face-to-face to their neighbors without paying a fee to a licensed entity would generate howls of outrage among the American people. Not allowing someone to whisper in someone's ear even when someone else paid for the loudspeaker would elicit the same reaction. But that is exactly what the Coalition proposes. So its proposed restrictions on electromagnetic speech should be treated the same way such proposed restrictions on acoustic speech would be treated: as a clear violation of First Amendment principles and the statutory obligations of the FCC.<sup>70</sup>

Commentors have justified their opposition to unlicensed spectrum by arguing that unlicensed underlays or any other type of shared spectrum between licensed and unlicensed users will create unacceptable levels of interference. Given the FCC's often stated goal of preserving and enhancing access to unlicensed spectrum, the logical conclusion to be drawn from this argument is that the FCC needs to allocate more *dedicated* spectrum for unlicensed use.

Overall, the comments indicate that the unlicensed NIMBY phenomenon is as strong in this band as it has proven to be in other bands. Given the huge financial and popular success of unlicensed services, incumbent license holders have decided not to make a frontal assault on unlicensed spectrum allocations. Instead, they have chosen to argue that unlicensed spectrum shouldn't be allocated in any way that harms the spectrum rights licensing windfall they hope to secure for themselves. The problem is that if the FCC listens to all such special pleadings, the welfare of the American public will be seriously harmed. The danger of the FCC's band-by-band proceedings is that this big picture of spectrum reform will be lost as the incumbents seek to protect and expand their turf.

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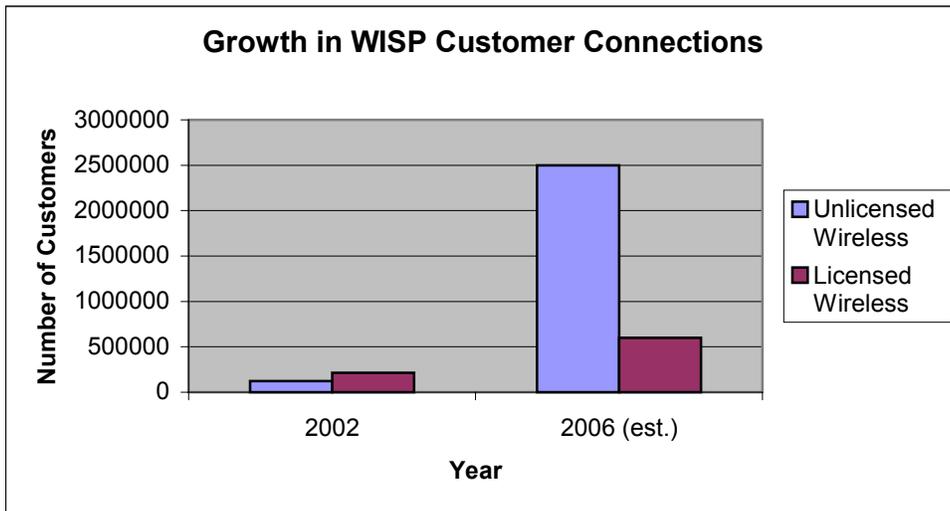
<sup>70</sup> See Benjamin Stuart, "The Logic of Scarcity: Idle Spectrum As a First Amendment Violation," 52 Duke L.J. 1 (2002).

**APPENDIX A**

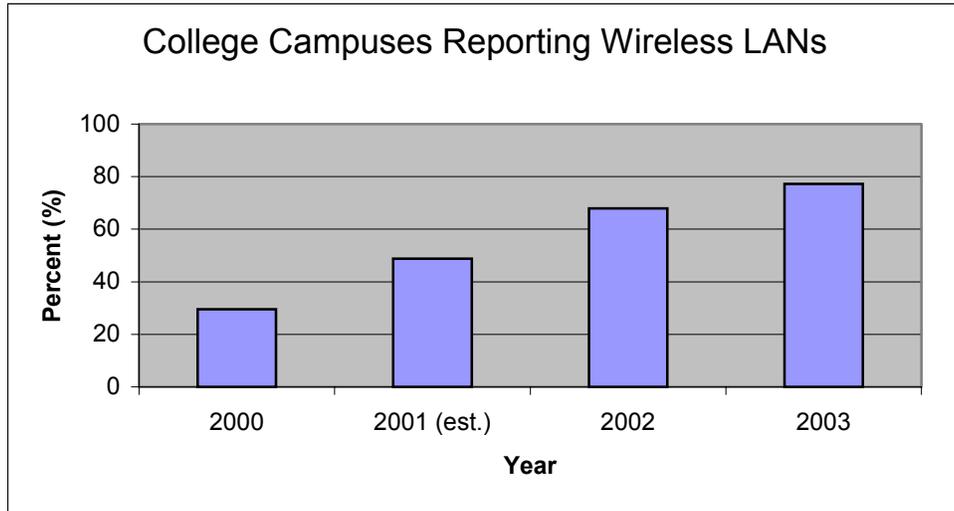
**ECONOMIC DEMAND FOR UNLICENSED DEVICES**

<b>U.S. Home Networks (in millions)</b>			
	<b>Wired</b>	<b>Unlicensed Wireless</b>	<b>Licensed Wireless</b>
<b>2002</b>	6.1	1.7	N/A
<b>2003</b>	6.5	4.5	N/A
<b>2004</b>	6.2	8.7	N/A
<b>2005</b>	5.7	13.7	N/A
<b>2006</b>	4.9	19.1	N/A
<b>2007</b>	4.1	24.0	N/A
<b>2008</b>	3.4	28.2	N/A

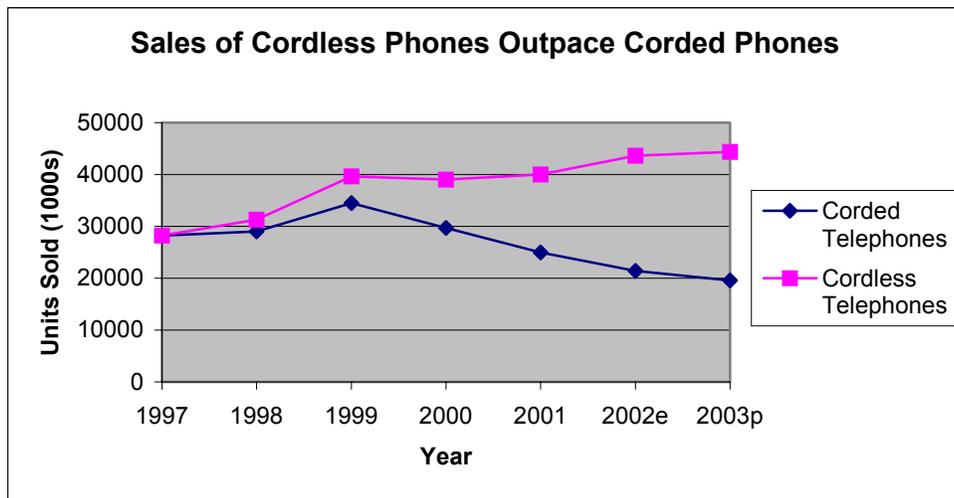
Source: Jupiter Research



Source: InStat/MDR



Source: The Campus Computing Project, October 2003



Source: Consumer Electronics Association

## **APPENDIX B**

### **ECONOMIC DEMAND FOR UNLICENSED WISPS**

#### **WISPs Come of Age: From Localized Hotspots to Organic Hot Pathways**

At the onset of the unlicensed movement, Wireless Internet Service Providers (WISPs) were typically small-scale efforts to bring broadband access to local areas using adapted WiFi equipment. Many of these efforts were scaled-up versions of the WiFi hotspots, now ubiquitous in urban coffee shops, hotel lobbies, and even some public parks. In recent years, however, unlicensed equipment has advanced well beyond WiFi to include more sophisticated technologies -- such as frequency-hopping, non-line-of-sight transmitters, mesh networks, and high-gain directional antennas that can make point-to-point connections over 20 miles. These days, providers construct networks into scalable cell sectors with varying levels of redundancy and security based on customer need, and they carefully engineer their deployments to accept more subscribers without compromising service as the network expands. In fact, the most successful WISPs have long-since outgrown the hotspot model and are now building contiguous wide-area networks that have raised the standard for unlicensed service.

One company that is redefining the notion of a WISP is AMA\*TechTel Communications of Amarillo, Texas. With more than 4,000 users on their license-exempt network, AMA\*TechTel is one of the country's largest regional carriers of wireless broadband. The company has built a 20,000 square mile, organic network comprised of 63 transmitting towers stretching across the North Texas plains.

According to Patrick Leary, the "Chief Evangelist" for Alvarion, one of the largest manufacturers of broadband wireless technology, the AMA deployment is a sophisticated, contiguous network that provides secure service to residential, corporate and educational campuses. Using Alvarion transmitters and multiple unlicensed bands (to include 900 MHz, 2.4 GHz, and 5 GHz) AMA has created private virtual environments for three college campuses, multiple school systems, law enforcement and public safety agencies, hospitals, and numerous banks within their expanding footprint.

The company is now building a wireless backbone for Texas Tech University that will connect Amarillo to Hobbs, New Mexico and provide broadband access to communities along its route. This wide area network will support K-12 and adult education and business development programs.

The expansiveness of the AMA network is due to the company's partnership with Attebury Grain, a large grain storage company that contracted AMA to connect their grain elevators to the commodities market. After the project, the two companies combined forces to widen the network using Attebury's numerous grain elevators to reach towns and businesses within line-of-sight of the elevator towers.

The wireless service is becoming increasingly popular with residents in North Texas towns who may or may not have DSL access. According to AMA\*TechTel Vice President of Business Development, Douglas Campbell, the company has been growing by 150 new subscribers a month with very little marketing.

The success of AMA\*TechTel may be daunting to entrepreneurs wanting to enter the WISP arena, however this ambitious network may not be the only successful model available. Numerous smaller-scale providers have relied on skillful engineering and integrated technology packages to build smaller networks for remote communities (see previous sidebars). These localized efforts usually focus on rural communities that have no other option for broadband, where WISPs can safely access unlicensed spectrum without fear of harmful interference. One company that has implemented this localized approach on a large scale is Prairie iNet, of Des Moines, Iowa.

With a total network reach of approximately 20,000 miles, Prairie iNet builds localized wireless oases in communities long ignored by telecommunications and cable companies. By focusing on towns such as Broadland, Illinois (population 350) and 120 other communities in Illinois and Iowa, Prairie iNet has the flexibility to concentrate their efforts on specific markets with a broadband demand.

Like AMA\*TechTel, Prairie iNet relies on the existing infrastructure of the high plains, with local silos, barns, and rooftops serving as towers for the company's point-to-point and point-to-multipoint transmitters. The company uses the 5 GHz frequencies for tower-to-tower and backhaul transmissions, while the last-mile connections to users are typically over a mile, and on the 2.4 GHz unlicensed band. The wireless networks eventually connect to the Internet via a DS3 fiber line. As of the summer of 2003, more than 4,000 users were receiving high-speed connections on Prairie iNet networks.

Both the wide-area "hot pathway" model and the localized network design present varying benefits. Regional utility companies with existing towers and customer base can learn quite a bit from AMA\*TechTel and leverage their infrastructure and clientele to create scalable, secure virtual private networks (VPN) for larger organizations and residential service for customers. Utility companies around the country are rapidly following suit: East Bay Municipal

Utility District in Oakland, California has recently installed the Motorola Canopy system; Owensboro Municipal Utilities in Kentucky and Wheatland Electric Cooperative, Inc. in Kansas have both installed Alvarion networks; and rural cellular providers like Midwest Wireless have also built a broadband business using unlicensed spectrum.

Localized networks, like the ones used by Prairie iNet offer a level of deployment flexibility not usually available with an existing fixed tower infrastructure. Localized networks can concentrate their infrastructure into the best available opportunity space and reach new markets quickly. This model has inspired small local providers to pop-up in many rural and suburban communities across the country. While hard data is unavailable about the number of localized providers in operation, In-Stat/MDR, a research and consulting firm, estimates in a 2002 report that there are up to 1,500 start-up WISPs in operation. Low start-up costs, numerous equipment options, and high consumer demand are part of this growth.

### **NYCwireless: Evolution of a Wireless User Group**

To followers of the wireless broadband revolution, New York has been a hotspot of activity among U.S. cities, and the NYCwireless user group has been leading the movement. The group began as an informal network of early WiFi adopters who placed access points on their apartment windows to share their broadband access with the public parks below their buildings. As the trend gained acceptance, the users organized to form NYCwireless, a non-profit, volunteer organization, to encourage others to share their broadband and foster an ethic of free public Internet access across the city.

“New Yorkers live in cramped quarters, and our goal has been to get people out of their apartments and into the public parks,” says NYCwireless volunteer Dustin Goodwin. The group considers ubiquitous broadband access to be a public amenity equivalent to streetlights or water fountains. However, it’s difficult, if not impossible, to provide public parks with wired broadband access because of construction impediments on historic or public land. Cheap, and easily installed WiFi technology allowed apartment dwellers with good line-of-sight to their parks to install the 802.11b transmitters and address the problem for themselves.

Volunteers from NYCwireless have built networks in Bryant Park, Bowling Green Park, and Tompkins Square Park, among others. This past year, founding members of the group formed a consulting firm, Emenity, to deploy six more public hot spots in lower Manhattan for the NYC Downtown Alliance. The new company was started to provide service to commercial clients, but their mission of building public access networks remains intact.

Ementy has recently built a public network in Union Square Park. This project is unique in that it relies on a wireless backhaul to connect to the Internet provided by the commercial wireless broadband provider TowerStream. Most public access points in the city ultimately access the Internet via a DSL Internet connection.

The efforts of NYCwireless have not gone unnoticed by broadband service providers. Some providers have slapped “acceptable use” clauses on their subscriber contracts in an effort to discourage wireless bandwidth sharing. One large cable operator has been accused of sending out a WiFi “sniffer” to scour the city in search of access points leading back to their customers’ connections to close down the transmitters.

However, as WiFi use has reached a critical mass, more broadband providers are trying to enter the public space arena. Speakeasy, Inc., a national DSL reseller, now offers “WiFi Netshare,” a service that allows users to resell their broadband connections to neighbors, with Speakeasy handling the billing. And Verizon DSL has built a number of hotspots in New York that are free to their DSL home subscribers.

NYCwireless volunteer Dustin Goodwin sees the commercial attention to public WiFi in the city as a direct response to NYCwireless’ success. While some see the entrance of commercial players into the public space as a threat to free access, others see the development as an important step to recognizing WiFi as a free public amenity that companies and organizations should provide as a value-added service to their constituents.

Now that wireless broadband has gained a foothold in New York City parks, Goodwin says that NYCwireless is expanding its mission to resemble a volunteer “Geek Corps” for communities without affordable broadband Internet. Currently, NYCwireless volunteers are helping a non-profit housing organization, Community Access, bring broadband to clients living in their community homes. The group has trained the housing residents to build and maintain a wireless network, which will provide more than 50 residents with private, high-speed connections.

This effort is part of a growing trend among wireless community groups across the country (see “Connected Communities” side-bar) to bring affordable broadband to underserved communities.

### **An Unlicensed Education:**

#### **A Model to Connect Rural School Communities**

While U.S. school districts have been issued the command to “leave no child behind,” many rural schools are without the resources to bring broadband Internet access into their classrooms. This is especially true for rural communities beyond the reach of DSL or cable lines. This last-mile problem presents hardships not only for schools, but also for local households and businesses unable to fully participate in the information economy. A public/private partnership has been formed in western Pennsylvania to use unlicensed spectrum and the social capital of local school districts to address the last mile on their own. Thus far, the efforts of the Broadband Rural Access Information Network (BRAIN) have yielded great results connecting rural areas, and their example could provide a template for other rural school communities across the country.

The BRAIN effort began with the vision of a small school district superintendent, Andy Demidont, and the help of a large regional WISP, Sting Communications. Demidont wanted to provide high-speed access to the Rockwood High School and the Kingwood Elementary School in mountainous Somerset County. The schools’ existing dial-up accounts were expensive, and rendered connection speeds barely surpassing 14 kbps.

Relying on the technical guidance from Sting Communications, and using grant money awarded from the Individuals with Disabilities Act and E-Rate discounts, the school district installed wireless access points on the roofs of both schools, turning each school into state-of-the-art wireless hotspots.

In total, Sting Communications installed three towers, creating a pie-shaped hot-zone using the 5.8 GHz and 2.4 GHz license-exempt bands. The Rockwood High School gymnasium hosts a 100-foot tower that transmits to a 150-foot tower located at Kingwood Elementary school. The two towers share a narrow beam, point-to-point connection with a third tower owned by the local Seven Springs Ski Resort.

Simply bringing the technology to the area wasn’t the end goal – using the network to connect the school with the community is the ultimate design of the project. Both the Rockwood and Kingwood schools have put many classroom and administrative operations on-line. Teachers use Palm Pilots and laptops to track student progress, design lessons, and record grades – which are available to parents online. Students can use the high-speed connection in each classroom, with each school “unwired” for access.

The project was designed to also give community residents a chance to purchase access from the school’s network, with the school district serving as a WISP for the area. Between the

three towers, Sting has installed access points in neighborhoods to provide coverage for much of the community. Sting has also provided an incentive for community members to join the network, by offering subscription rates between \$11 and \$20 per month, depending on the number of subscribers the school can attract. Currently, thirty-five families have been connected, with an additional 65 families expected to be online in the coming months.

From the project's onset, Sting hoped their approach could be replicated in other rural school communities. Building on what they have learned in Somerset County, Sting has built a much larger network in Cambria and Clearfield Counties to connect four more regional school districts. Sting Vice President Bob Roland says that this new network spans an 1100 square mile area, reaching residents of the Glendale, Philipsburgh, Osceola, and Moshannon Valley school districts. This network (see Figure 13 below) uses both 5 GHz frequency-hopping spread spectrum and 802.11 connections for the last mile.

BRAIN is seeking to expand the model into more communities. The group has applied for a \$7.4 million grant from the USDA's Rural Utilities Service to "light-up" a wide corridor between central Pennsylvania and Maryland. This larger effort could provide a valuable last-mile case study for rural school communities around the country.

### **Revolution in the Rural Last Mile:**

#### **Unlicensed Spectrum Closing the Technology Divide in Northern Virginia**

Despite their proximity to northern Virginia's Internet backbone, many towns in Loudoun County have no broadband access. The mountainous western regions of the county are far from the technology infrastructure of Northern Virginia where companies like AOL and VeriSign reside. However, because of license-exempt wireless activity, the technology divide across the county is starting to close.

The Northern Virginia area profited from the technology boom of the late 90s. But, when the technology bubble burst, as many as 30,000 jobs in the region were lost. Many laid-off professionals accustomed to broadband connections at their work started their own businesses or began working from their homes, creating a large demand for high-speed home services. One local company, Roadstar Internet, is meeting that demand by building a rapidly growing wireless network in rural Loudoun County.

Started in the autumn of 2002, the Roadstar Internet network connects more than 150 rural households and small businesses using 100% unlicensed spectrum. Most wireless

subscribers do not know exactly how their service operates; since what matters most to users is that their connections are fast and reliable, and not necessarily the technology behind the service. But, the Roadstar unlicensed network is similar in design to many other WISP efforts, and uses a combination of point-to-point connections for the long-distance transmissions, and point-to-multipoint transmissions to connect neighborhood access points to subscribers.

The first leg of the network travels 18 miles from a mountaintop transceiver using 5 GHz license-exempt bands. Roadstar uses OFDM (Orthogonal Frequency Division Multiplexing) technology that allows for point-to-point connections without perfect line-of-sight. OFDM transmissions make efficient, and secure, use of spread spectrum by dividing data into packets and encoding it over multiple frequencies.

Long distance point-to-point transmissions are the standard for rural WISPs seeking to extend their markets and reach larger population pockets. Under Part 15 rules for unlicensed usage, the FCC allows operators to make point-to-point connections without reducing Transmitter Power Output (TPO) for the 5.725 GHz and 5.825 GHz band. Because of this regulatory latitude for narrow beam transmissions, providers are able to reach long line-of-site distances with relatively low power.

The Roadstar network makes final, last-mile connections within neighborhoods by using modified WiFi wireless access points mounted on customer silos, barns and rooftops. Roadstar and other WISPs are able to transmit distances greater than the 300-foot standards for WiFi, 802.11b technology by creating sectorized cells with high-gain, directional antennas. These last-mile connections on the 2.4 GHz band are the result of good planning and engineering, and typically reach two to three miles.

### **A Community Access Model for the Last Mile**

While the success of commercial WISPs has generated much attention, grassroots community access networks or CANs are the originators of the unlicensed movement. Most CANs are groups of like-minded individuals sharing a similar philosophy—that citizens should and can have open, inexpensive, and ubiquitous access to the Internet. Using affordable and easily installed WiFi technology, community members in Seattle, New York, Austin, San Francisco, Portland, Oregon, and Athens, Georgia have built expanding networks of independently maintained wireless access points that are shared among many.

Most CANs provide access to people in public spaces, however some groups have made forays into residential space, by connecting neighborhoods with centrally placed access points. One such organization is the Bay Area Wireless Users Group (BAWUG), an informal group of

wireless early adopters who began mounting WiFi transmitters on the roofs of their homes to give neighbors free or shared-cost Internet connections via their DSL and cable lines. While the cable and phone companies didn't approve of the practice, consumers did and access points began popping up all over the city. Now there are over 25 BAWUG assisted access points in the area.

But BAWUG has not stopped there. Under the leadership of Tim Pozar, a telecommunications engineer and one of BAWUG's founders, the group has launched the Bay Area Research Wireless Network (BARWN). BARWN is an active wireless network with a mission to discover the best technical solutions to bring wireless broadband to remote and economically disadvantaged communities.

BARWN has set up two centrally located access points atop the San Bruno Mountain and Potrero Hill in south San Francisco, allowing anyone within an 8-mile radius to point a 2.4 GHz antenna at the BARWN towers to share the 11Mbps of bandwidth they provide. Pozar says that a third public access point is soon to be installed on Yerba Buena Island in the San Francisco Bay, which will link to the East Bay and light-up an underserved area called Treasure Island.

All of these access points are constructed with non-proprietary equipment and open protocols to keep costs down and to learn what technologies can be most easily adopted by lower income communities.

As evidence of the network's stability and flexibility, BARWN is working with the City of San Francisco to use this network for public safety communications—such as earthquake or disaster response. Pozar says one application for the unlicensed service would be to provide streaming video of a disaster site to command centers to evaluate response tactics.

### **Unlicensed Abroad: An Urban Case from the UK**

While policy makers in the U.S. debate over how to bridge the last mile, unlicensed technology is giving disadvantage communities the ability to confront and solve access issues for themselves. One shining example is the case of the EastServe network in East Manchester, England, where community members have installed a wireless broadband network connecting 350 households, 17 area schools, and nine community technology centers.

The EastServe network was created by residents from the towns of Beswick, Clayton and Openshaw through the British government's "Wired Up Communities" initiative, which pulls public and private entities to bring broadband Internet to disadvantaged areas. There are seven pilot communities across England in the Wired Up Communities initiative -- each of which is using a slightly different technology or implementation model to learn the best strategy to reach

the UK last mile. EastServe is the flagship project for unlicensed wireless broadband, and a showcase for unlicensed wireless in urban areas.

For East Manchester, wireless was the only viable solution. Ninety percent of the population have no high-speed cable access, and 25% have no fixed-line phone service since many households only use mobile phones. With 80% of the population living in houses, almost half of which are publicly funded, the expense of laying cable or a DSL loop to each residence is especially prohibitive. But a wireless solution, with its flexible and facile installation, allows community stakeholders to set-up, manage and trouble-shoot technical problems themselves.

A local company, Gaia Technologies, has trained resident volunteers to install and maintain the 10 community access points currently in place. Volunteers from the neighborhoods will add an additional 15 access points in the next phases of the project. Over 700 households within a 6-mile area have signed up for the service, and project leaders estimate that with the ease of rooftop installation they can bring 100 new users per week onto the network.

Gaia Technologies Managing Director, Anas Mawla says the network is a ring formation of six backbone towers, which are located among the 17 schools and nine on-line centers on the network. These six towers provide a total of 26Mbits of data transmitted in narrow beam, point-to-point connections at 45 Mbps on the 5.8 GHz band. The backbone relies on a partial mesh design for redundancy. Proxim makes the 5.8 GHz transceivers.

Within this ring of towers, twenty-five 802.11b access points transmit in wedge-shaped sectors to reach households with up to 11 Mbps of data to be shared among users. EastServe uses Cisco Systems' Aironet customer premise antennas for the last-mile link to houses. Flat dwellers share a wireless link that connects directly to the backbone, demonstrating the network's scalability.

Since activating the network, the local telephone carrier has launched limited ADSL access to parts of East Manchester, however this service offers a much slower, asymmetrical service at higher prices than the EastServe wireless network. EastServe users also have access to a community Intranet; customer service provided by community members; and the ability to purchase new or recycled computers through the program. They also have the added comfort that they will soon own and maintain their network – no-longer at the mercy of a third-party provider to bring them the service.

### **WiFi Calling: Campuses Turn to WiFi for Voice Applications**

Since the beginning of the wireless movement, college and corporate campuses have been fertile ground for extensive WiFi networks. The latest trend for campus organizations is to

bypass local telephone carriers and use their unlicensed wireless networks to support voice applications.

In one example, the University of Arkansas invested \$4 million in Cisco's call processing software, CallManager, to traffic local calls over the University's existing WiFi network. The University has reduced their monthly telephone service fees from \$530,000 to \$6,000 a month. At this savings rate, the University should recoup their call-processing investment in six months. Dartmouth College has a similar program, offering software to incoming freshman that turns wireless laptops and PDAs into "softphones."

Dartmouth implemented their voice over wireless local area network (VoWLAN) when they realized they were spending more money billing students for long-distance calls than they were taking in. The unlicensed VoWLAN provides a similar quality of service to traditional telephone service, but without the billing and administrative costs.

Hospitals have also been early adopters of VoWLAN technology. One company, Vocera has created an 802.11b communications device that doctors and nurses wear on their uniform collars to communicate with each other remotely. Users speak the name of the person they'd like to contact into the device, and they are instantly connected through the VoWLAN. The device has the potential to eliminate obtrusive use of intercoms and speakers that broadcast announcements or pages meant for only one person to an entire hospital floor.

### **Michigan Puts its Money in Unlicensed Spectrum:**

#### **The first loan of the Michigan Broadband Development Authority goes to local WISP**

As state and local government policy makers look for solutions to their own last-mile issues, wireless broadband is getting more attention as a viable alternative to cable or DSL. The great test of wireless broadband as an accepted solution to the last-mile problem is the use of state funds to help build wireless networks. An example is the State of Michigan's Broadband Development Authority, which gave its vote of confidence to unlicensed wireless by awarding its inaugural loan to a local WISP. ISP Wireless was awarded a \$350,000 loan in April 2003 to expand its service to seven cities in northern Michigan.

The Michigan Broadband Development Authority (MBDA) was created by the state legislature in 2002 to attract private sector investment in high-speed Internet deployment across the state. The MBDA offers low-cost loans to companies with proven business plans and a successful record of broadband deployments.

ISP Wireless, which has 200 wireless subscribers in addition to its established customer base of dial-up and DSL subscribers, is using the loan to purchase wireless transmitters and customer antennas to extend their network.

The WISP has selected the equipment manufacturer WaveRider's non-line-of-sight, 900 MHz point-to-multipoint transmitters and customer receivers for the last-mile connections. The company uses Trango Broadband's 5.8 GHz microwave transmitters for their point-to-point connections.

ISP Wireless President Chris Carey says the loan will establish seven new transmitter towers and bring 500 new subscribers online in the coming months. Carey says most of the point-to-point transmitters will be attached to grain elevators, which then connect to point-to-multipoint cell sectors in neighborhoods and communities.

Building the infrastructure to support the new network is much easier and less expensive than extending DSL loops or laying new cable lines. Depending on a customer's proximity and line-of-sight to the local access point, the WaveRider customer antennas can either be mounted on the customer's roof, or posted on the users' window sill or interior wall. The company is currently connecting between two and 10 new customers a day.

The unlicensed wireless service is less expensive and faster than DSL. ISP Wireless charges \$49.95 per month for a symmetrical wireless connection of 384 Kbps, while a comparable DSL connection with same speed is \$72.50 per month.

Carey says recent innovations in the unlicensed band technology have made a huge impact in his business. Before offering the wireless connection, dial-up and DSL installations were flat and it was becoming increasingly difficult to attract enterprise customers. However, since building the unlicensed network, the company's largest growth is in the small, medium and large enterprise market. ISP Wireless has connected municipal offices for the City of Alma; a private K through 12 school; an auto supply manufacturer and numerous small, and home-based businesses.

Attracting and building business growth is the goal of the Michigan Broadband Development Authority. According to a recent report by TechNet, a bipartisan organization of company CEO's, the state of Michigan is the national leader in promoting broadband deployment; and unlicensed spectrum is playing an increasing role in energizing business investment and bridging Michigan's last mile.

## APPENDIX C

### THEN AND NOW: THE STORY OF NUCENTRIX

On July 31st of 2001, while the nation's third largest MDS-ITFS licensee, Nucentrix Broadband Networks, Inc., lobbied Congress to not allow 3G services on the MDS-ITFS bands, an estimated 9 million households within the company's licensed coverage area were waiting for affordable broadband Internet access to come to their communities.<sup>71</sup> Speaking "on behalf of Sprint, WorldCom, and the thousands of MDS licensees across the country," Nucentrix CEO Carroll McHenry argued that "the MDS and ITFS bands are not appropriate for 3G, and that 3G proponents overwhelmingly prefer spectrum other than MDS/ITFS for their services." Carroll also claimed that "Nucentrix's fixed wireless service is likely to be the only broadband service available to many of the [rural] homes, offices, schools, hospitals, and community centers for the foreseeable future." He urged Congress: "Please don't allow the important broadband and educational services being provided over this spectrum to continue to be held hostage to efforts to find more spectrum for commercial 3G services."<sup>72</sup>

Now, more than two years later, ITFS-MDS incumbents like Nucentrix have changed their tune. In the current ITFS proceeding, Sprint and the other licensees have flipped their arguments, urging the Commission to make room for advanced mobile, 3G services, thus jeopardizing the promise of fixed wireless broadband for rural communities. And while the fixed wireless industry turns their allegiances to advanced mobile services, millions of households are still waiting for their affordable broadband access.

Fortunately for those millions of underserved households, Nucentrix's testimony that licensed wireless would be the "sole provider" for many rural communities was wrong. In the past two years, thousands of entrepreneurial WISPs and community groups have responded to rural demand and built numerous, sophisticated wireless networks on unlicensed frequencies,

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<sup>71</sup> See Statement of Carroll D. McHenry on behalf of Nucentrix Broadband Networks, Inc., "On Spectrum Allocation and Third Generation Wireless Services," Before the Subcommittee on Communications, Committee on Commerce, Science and Transportation, U.S. Senate, July 31, 2001.

<sup>72</sup> *Ibid.* p. 2. For further evidence of Nucentrix's opposition to 3G segmentation of the ITFS bands, see also Comments of Nucentrix Broadband Networks, Inc., ET Docket No. 00-232 Regarding the Interim Report on Spectrum Study of the 2500-2690 MHz Band and the Proposal to Segment the ITFS-MDS Bands to Allow 3G Services.

providing a tangible solution to the last-mile problem.<sup>73</sup> Now, just as unlicensed providers are reaching further into rural communities and providing hundreds of thousands of subscribers with broadband connections, the ITFS-MDS incumbents would like to temper the unlicensed broadband movement by closing off the most appropriate portion of the spectrum for unlicensed access—the 2.5 GHz bands located directly above the crowded Wi-Fi bands. Once again, the licensed providers are asking rural consumers to put their broadband dreams on hold, and continue to wait for their licensed services to, someday, arrive.

As history would have it, the 9.4 million households within Nucentrix’s coverage area may be waiting on a miracle if they expect to receive broadband from Nucentrix on its licensed ITFS-MDS spectrum. On September 5, 2003, the company filed for Chapter 11 bankruptcy, selling its ITFS/MDS licenses and infrastructure to SBC Communications, Inc. (SBC).<sup>74</sup> At the time of this filing, SBC has detailed no plans to use the licenses to offer fixed wireless broadband access. So the wait continues.

Nucentrix’s story of unfulfilled promises regarding the ITFS-MDS bands is not uncommon for the industry. Sprint, the incumbent possessing the most MDS licenses, rolled-out their Broadband Direct fixed wireless service in 2000 with a similar expectations. Despite possessing a coverage area significantly larger than Nucentrix’s, and with MDS licenses in high-value urban and suburban markets, Sprint couldn’t make their fixed wireless service profitable and they stopped accepting new customers in October of 2001. At that time, Sprint had an estimated subscriber base of 52,000 users across 14 markets.<sup>75</sup> But after two years of not accepting new customers, current subscriber numbers are undoubtedly lower. Sprint has blamed their lack of success on too many “truck rolls” caused by the first-generation wireless technology they implemented.<sup>76</sup> However, during the time when Nucentrix and Sprint floundered and failed, an estimated 1,500 to 1,800 WISP entrepreneurs built unlicensed networks using very similar equipment and with significantly less resources, capital and existing infrastructure.<sup>77</sup>

Why have these wealthy, licensed fixed wireless providers been so unsuccessful while hundreds of start-up WISPs have reached hundreds of thousands of rural residents on the

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<sup>73</sup> See James H. Johnston and J.H. Snider, “Breaking the Chains: Unlicensed Spectrum as a Last-Mile Broadband Solution,” New America Foundation, Spectrum Series Working Paper #7, July 2003.

<sup>74</sup> See “Nucentrix Broadband Networks Signs Agreement with SBC for Sale of Assets in Chapter 11 Proceeding,” company press release, September 5, 2003.

<sup>75</sup> See Victor Thompson and Sean Hao, “Sprint Halts Internet Service Signups in Brevard, Company says it will keep serving current broadband customers,” *Florida Today*, October 26, 2001.

<sup>76</sup> See Margot Suydam, “Fixed: Broken?; The future of fixed wireless broadband,” *CommVerge*, March 1, 2002.

<sup>77</sup> See In-Stat/MDR, “Unlicensed Spectrum Drives Wireless Broadband Infrastructure beyond WiFi,” December, 2002.

unlicensed bands? Why should we believe MDS-ITFS incumbents in their plans to use their licenses for third-generation mobile and fixed wireless broadband when the industry spent so much effort in 2000 and 2001 lobbying the Commission and Congress to not allow 90 MHz of 3G services (incidentally, the same bandwidth as NAF, et al.'s dedicated unlicensed band plan) on the MDS-ITFS bands? And how much longer should rural communities wait for licensed broadband to arrive while incumbents sit on their licenses and allow the bands to sit vacant?

While these questions remain unanswered, unlicensed devices and networks are proliferating throughout the country and serving as a beacon of innovation, growth, and economic investment in the telecommunications industry. Whether unlicensed services will have enough spectrum to reach their full potential remains to be seen.

## **APPENDIX D: THE HISTORY OF ITFS / MDS FLEXIBILITY**

**1963** The FCC establishes ITFS as an overlay on existing point-to-point microwave services in the 2500-2690 band. License terms are 3 years and will be granted only to accredited public and private schools, colleges, and universities for the formal education of students.

**1971** The FCC allocates twenty-eight 6 MHz channels (a total of 168 MHz) and twenty-eight 125 kHz response channels (a total of 3.5 MHz) for exclusive ITFS use.

**1974** The FCC establishes MDS on the 2150-2162 MHz band. MDS provides two 6 MHz TV channels and is described as "wireless cable" because, like cable TV, it provides TV programming. In the early 1970s, only three network TV stations dominated over-the-air TV programming and most cable TV systems provided fewer than ten channels of programming.

**1983** ITFS deemed a failure. Few even apply for ITFS licenses. The FCC reallocates eight of the ITFS channels and corresponding response channels for MDS. Incumbent ITFS licensees are grandfathered. Existing ITFS licensees are allowed to lease excess capacity to commercial entities, thus increasing the value of their licenses. This spurs demands for new ITFS licenses from applicants who hope to use the free licenses to generate leasing fees.

**1985** The FCC further increases the value of ITFS licenses by reducing educational obligations to a minimal level and relaxes restrictions governing the leasing of excess capacity to commercial providers. ITFS licensees only need use five percent of their capacity for educational purposes.

**1987** The FCC allows MDS to own the programming the [Michael Calabrese] y carry. The FCC eliminates the time-of-day restrictions on leasing ITFS spectrum. The FCC further relaxes requirements concerning ITFS licenses leasing spectrum for MDS operations.

**1991** FCC shifts 18 MHz from OFS to MDS.

**1993** FCC allows ITFS licensees to engage in channel loading. This allows ITFS licensees to move all of its program requirements onto one of its four channels so that it can lease the other three channels to a wireless cable operator.

**1995** FCC converts MDS to geographic area licensing system.

**1996** FCC allows ITFS licensees to use digital technology, thus allowing them to increase their information capacity up to tenfold.

**1998** FCC allows MDS and ITFS licensees to construct digital two-way systems, also allowing them to subdivide or aggregate channels into larger and smaller bandwidths. ITFS licensees are allowed to fulfill minimum educational usage obligations by transmitting content on other licensees' ITFS or MDS stations.

**2000** The World Radio Conference proposes that the 2500-2690 MHz band be allocated for IMT-2000, also known as 3G mobile telephone service.

**2001** FCC adds a mobile allocation to the 2500-2690 MHz band to enhance the value of spectrum incumbents' licensees.