

*Before the*  
**Federal Communications Commission**  
Washington, DC 20554

**In the Matter of** )  
 )  
**Additional Spectrum for** )  
**Unlicensed Devices** ) **ET Docket No. 02-380**  
**Below 900 MHz** )  
**And in the 3 GHz Band** )

**To: OET**

**REPLY COMMENTS OF**  
**THE NEW AMERICA FOUNDATION**  
**CONSUMERS UNION**  
**CONSUMER FEDERATION OF AMERICA**  
**MEDIA ACCESS PROJECT**  
**CENTER FOR DIGITAL DEMOCRACY**  
**PUBLIC KNOWLEDGE**  
**BENTON FOUNDATION**

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## Summary

New America Foundation, et al. (NAF, et al.) argued in their Comment that new information technologies are making it economical to allocate large amounts of previously unused spectrum for unlicensed devices without creating harmful interference to incumbent license holders. Incumbent license holders in their comments, however, argue that this technological revolution has not taken place; therefore, the status quo must be preserved in order to prevent harmful interference.

In this Reply Comment, NAF, et al. focus on the Reply Comment of National Association of Broadcasters, et al. (NAB, et al.), the trade associations representing the incumbent high power broadcast TV licensees. The central arguments of the other incumbent license holders tended to be very similar. NAB, et al. attempt a cost-benefit analysis concerning the FCC's proposal to allow an unlicensed allocation within the 402 MHz of the broadcast band. They conclude that the costs outweigh the benefits and that therefore the FCC should reject the proposed unlicensed allocation. NAF, et al. disagree with this cost-benefit analysis, including any assumption that there is necessarily a tradeoff between existing licensed broadcast service and new unlicensed services.

NAF, et al. also disagree with Cingular's Comment that the proposed unlicensed allocation violates statute. And it finds abhorrent the FCC's tacit sanction of the November 26, 1996 deal between the computer and broadcast industries preventing vigorous and public discussion of the issues under consideration in this Notice of Inquiry.

## **Introduction**

A review of the comments submitted in response to this Notice of Inquiry demonstrates that the NIMBY syndrome is alive and well when it comes to expanding public access to the airwaves. Incumbent spectrum license holders in the bands under discussion were all generally opposed to unlicensed access to the bands in which they hold spectrum rights, but were supportive of unlicensed use in other bands. The debate is not over whether unlicensed is desirable, but over whether it should be placed in what incumbents claim is their (grossly underutilized) back yard.

Incumbent license holders also appeared completely unaware that new wireless technology is opening up vast new information carrying capacity and that this may offer them a potential windfall if the FCC grants them “spectrum flexibility.” In contrast, advocates of unlicensed appeared keenly aware that new technology could allow incumbents to continue their present level of service while also allowing a flood of new services.

Why did incumbents miss this elephant in the room? On one level, the answer is simple: they dispute that such an elephant exists. Many argued that unlicensed devices would create unacceptable interference and thus it wasn’t possible to have your cake and eat it too. But on another level, the answer is more complex. Outside this NOI many of the same incumbents are intensively lobbying to capture this new information carrying capacity for themselves. Often this is done under the banner of spectrum flexibility.

The overall tone of the proceedings indicates that incumbents strongly favor command and control regulation when it can hold back potential competitors and public access. They reserve their fervor for flexibility to other proceedings (and the behind-the-scenes initiatives leading up to those proceedings) where the gains accrue to themselves.

Since the broadcasters are the dominant incumbent license holders in the spectrum bands covered by this Notice of Inquiry, these comments will focus on critiquing the joint arguments of their trade associations. Many other incumbent license holder arguments overlap with those of the broadcasters. The predictable, formulaic response that incumbents use in these types of proceedings—that a new proposed service will create unacceptable spectrum interference and economic uncertainty for an uncertain benefit—was endemic. With the exception of the broadcasters, however, few commenters made an attempt to back their assertions with “expert” studies.

## **Broadcasters’ Arguments**

Although NAB, et al. filed hefty and seemingly expert comments (71 pages, including expert reports by two economists and an engineer), it’s difficult to respond to their arguments when they themselves don’t appear to take them very seriously. The goal in writing their comment appears to have been to collect a catalog of plausible horror stories associated with the introduction of an unlicensed allocation in spectrum they have

historically claimed for themselves but for which they were not given licenses. The impression one gets is that NAB, et al. made relatively little effort to actually make a rigorous, defensible case for a reader inclined to look beyond surface details. This is reflected in the fact that NAB, et al. avoided addressing obvious and well-known objections to their arguments. Carelessness by their experts in modeling, using primitive baseline technologies, such as outdoor-only GPS location device technology, when more advanced alternatives are frequently reported in the trade press, comes across to a reader as cause for wonderment. How can such smart people overlook such obvious information?

The gist of NAB, et al.'s argument is that the potential costs of unlicensed outweigh their potential benefits. Much of it is an old-school command-and-control type of argument: our planned services are superior to competitors' planned services, so the government should favor us—only, the broadcasters are mum as to exactly why their planned services are superior.

NAB, et al.'s arguments can be divided into four categories. The first two relate to the economic and technical costs (or deficiencies) of unlicensed. The second two compare the benefits to society of a broadcast versus unlicensed allocation of spectrum. Missing from the analysis is the possibility that a broadcast allocation has any costs. NAF, et al. add that as an additional category.

In characterizing the debate over unlicensed allocations in the broadcast band as a tradeoff between unlicensed and broadcast service, NAF, et al. believe the NAB, et al. have fundamentally misconstrued the issue raised by this Inquiry. As NAF, et al. described in great detail in its Comments to this Inquiry, it is possible for both existing broadcast service—including broadcast DTV service—and unlicensed uses to co-exist in the same band. However, the focus of these Reply Comments is to respond to the particulars of the NAB, et al.'s comments. We hope the reader will keep in mind, however, that the tradeoffs the broadcasters pose are spurious: unlicensed and existing broadcaster uses of spectrum are not inconsistent and so no tradeoff need be involved. Accordingly, we hope the FCC will keep our original Comments—the big picture—clearly in mind.

## **1) Opening Unused Broadcast Spectrum to Unlicensed Sharing Will Not Create Harmful Economic Uncertainty and Slow Down the DTV Transition**

### **Broadcasters claim the FCC's goal should be to protect the fledgling DTV service.**

Digital TV in America is not fledgling. Tens of millions of Americans receive digital TV via satellite; tens of millions own digital DVD players; tens of millions receive digital cable TV service; tens of millions receive high speed digital broadband Internet service, tens of millions own high-resolution digital monitors (either flexible computer monitors or dedicated high-definition TV screens). Even popular video games machines, such as the Playstation 2 and XBox, provide digital TV service. Most of this DTV adoption has taken place in the last few years.

Thus, DTV in America is thriving and growing by leaps and bounds. At best it can be said that the distinctive and primitive broadcast DTV standard has not grown as fast as other DTV services, but this is a very different type of argument. DTV and broadcast DTV are not synonymous terms. America can have plenty of DTV without broadcast DTV.

Even HDTV programming, which broadcasters are not legally required to provide and to which they have shown little inclination, is primarily delivered via satellite and cable TV networks. And even the least expensive computer monitors now routinely have the resolution of an HDTV monitor. Indeed, the minimum resolution of a video card that Dell now includes in its computers has significantly higher resolution than HDTV.

**Broadcasters claim unlicensed devices would create economic uncertainty and thus slow down the (broadcast) DTV transition.**

The source of endless delays and missed just-around-the-corner promises should not be pinned on others. As CFA will soon demonstrate in their reply comments in Docket MB 03-15, the Second Periodic Review of the Commission's Rules and Policies Affecting the Conversion of Digital Television, the broadcasters have played a primary role in delaying the deployment of DTV. They should not now receive further spoils in this war of attrition. To summarize here, broadcasters began lobbying to warehouse unused broadcast spectrum for HDTV more than 20 years ago, with FCC proceedings as early as the mid-1980s. The original purpose of the HDTV lobbying campaign was to prevent competitors from accessing highly valuable spectrum.<sup>1</sup> And although the original threat was from mobile telephone licensed providers rather than from today's flexible unlicensed providers, the economic motivation for warehousing underutilized spectrum--holding out until broadcasters can acquire the spectrum's information carrying capacity and value for themselves--is no different.

NAF, et al. suggest that the largest source of consumer uncertainty today is the broadcasters' own changing ATSC DTV standard. Already those who purchased the first generation of DTV receivers that didn't include a DVI output will be left high and dry for receiving a large fraction of future so-called free, over-the-air programming. But this is nothing compared to the ATSC enhancements the broadcasters are planning that will be billed as "backward compatible" but will in fact largely disenfranchise early adopters. At least some of these "enhancements" will also allow broadcasters to utilize the "white space" that could otherwise be allocated to unlicensed. NAF, et al. does not intend to disparage these enhancements. At a minimum, they are necessary for ATSC to compete with the more advanced European DVB 2.0 standard in foreign countries (DVB stands for Digital Video Broadcast).<sup>2</sup> But the broadcasters have not clarified why the uncertainties they have already introduced or are planning to introduce into the digital transition are good while the uncertainty brought by a potential competitor is bad.

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<sup>1</sup>See also Joel Brinkley's "Defining Vision: How Broadcasters Lured the Government into Inciting a Revolution in Television,," Harvest Books, 1998.

<sup>2</sup> For information on the DVB 2.0 standard with enhancements, visit [www.dvb.org](http://www.dvb.org).

To be fair, broadcasters state that a major difficulty for manufacturers of license-exempt radio devices is that they would be “attempting to engineer around a still-developing [broadcast DTV] technology.” [p. 11] But unless broadcasters are planning to claim the spectrum allocated to unlicensed for themselves, this uncertainty should be eminently manageable. The burden of non-interference only applies when an unlicensed device harmfully interferes with the service legally allowed under an *existing* broadcast license.

**Broadcasters claim the television band will be in a fluid and fragile state during the DTV transition.**

As the NAF, et al. comments describe, broadcasters and other incumbent license holders have been constantly jockeying for enhanced spectrum rights since the DTV transition began. These enhanced spectrum rights includes higher power levels, better channel positions, and enhanced rights to use the spectrum, including the proposed cellular architecture for broadcast transmitters. NAF, et al. believe this jockeying needs to come to an end immediately. Left to its present course, the jockeying will not cease until there is no unused capacity left for an unlicensed allocation. In other words, since broadcasters control the fluidity and fragility and have no incentive to eliminate it until there is no unused information carrying capacity left for unlicensed use, this argument simply gives broadcasters a veto power over spectrum reallocation until there is no spectrum left to reallocate.

**2) Smart Radio Technologies, Sharing Protocols, and Empty Channel Space Belie Broadcasters’ Unsupported Claims that Unlicensed Devices will Cause Harmful Interference.**

The vast majority of the information carrying capacity in the broadcast bands is unused. Indeed, many entire channels are empty. At the same time, broadcast transmitters are at fixed, known locations, making it unusually easy to avoid interference with them. Moreover, technologies already exist—and are improving rapidly--to do so. Technologies such as frequency hopping spread spectrum, low power, and cognitive radio, now make it relatively easy to avoid harmful interference. Indeed, such new technologies were a major factor behind the FCC’s May 15, 2003 decision to allow unlicensed service in the 5GHz band.<sup>3</sup> As Intel states in its Comments, the broadcast band not only has large amounts of underutilized space. But also, unlicensed devices can utilize this space without creating harmful interference to incumbent license holders:

Use of the television broadcast bands is well understood; the fixed nature of TV transmitters makes it possible for unlicensed devices based on existing technology to coexist in the same band even using conservative assumptions; broadcast channels are frequently vacant; and the propagation characteristics of the TV broadcast spectrum make it highly suited to a variety of uses....

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<sup>3</sup> See Revision of Parts 2 and 15 of the Commission’s Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices, Notice of Proposed Rulemaking, Adopted May 15, 2003.

Sharing spectrum in this well-defined, stable environment is a manageable task for today's radio devices. The rapid advances in microprocessors have enabled nimble devices that can easily execute the algorithms necessary for mitigating interference.... [T]he technology required to implement sharing in the TV band by existing wireless broadband devices is much more modest than what is already incorporated in many wireless devices today. For example, current cell phones already perform dynamic power control and execute sophisticated algorithms for coordination and roaming to implement spread spectrum modulation.”

**Broadcasters estimate that the cost of an unlicensed device that could implement a “listen-before-talk” protocol in the broadcast band would be 2.25 times the price of a comparable unlicensed device without this ability.**

The emphasis that NAB, et al. place on this argument (p. 4) is exceedingly strange. First, it is by no means clear that it would be terrible if implementing an advanced “listen-before-talk” protocol cost several times as much as a device without that capacity. After all, the broadcast band has far more valuable propagation characteristics than other unlicensed bands, so consumers and others should be willing to pay a premium for use of that band if they can do things in it that they cannot presently do elsewhere. Perhaps the reason for this oversight is that broadcasters seem to argue that all frequencies are equally valuable for communication. They argue, for example, that the need for unlicensed spectrum can be met at higher frequencies where unused frequencies are more plentiful. Nowhere do they acknowledge the uniquely valuable frequencies they occupy.

Second, the assumptions used to generate that 2.25 multiplier figure are highly questionable. The engineer rightly states that there are two basic approaches to design an unlicensed device to avoid interference. One approach is to build in a spectrum analyzer (a DTV receiver) to scan the ambient RF environment and map the location and signal strength of TV stations within the local service area. The other approach is to build in location specific technology (a GPS receiver and TV station database), so that the unlicensed device can geolocate itself and lookup TV stations within the local service area.

NAB, et al.'s engineering expert dismisses the GPS-based solution to a listen-before-talk protocol (the engineer calls it “sniff and avoid”) as impractical because current GPS does not work indoors and most unlicensed devices would presumably be indoors. But the engineer completely ignores enhanced GPS and other geographical location determining devices that do operate indoors. Next generation mobile phones, for example, will incorporate enhanced GPS to meet their e911 obligations.<sup>4</sup> The GPS chip is expected to be no bigger than a dime and perhaps cost even less. A company called Rosum even uses DTV signals to assist in triangulating a location in a way similar to that used by satellite GPS systems, except that the high power and low frequency of DTV positioning information makes it well suited for indoor reception.<sup>5</sup> The engineer also disparages this

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<sup>4</sup> E.g., Herb Brody, “On Location,” Technology Review, September 2002.

<sup>5</sup> For further reading on a novel positioning concept that uses existing TV broadcast towers for geolocation, see Reply Comments of Max Vilimpoc, in ET Docket No. 02-380.

solution because he assumes that the database would have to be hardwired into the device by the manufacturer and thus would become obsolete. But if unlicensed devices were assumed, like Wi-Fi, to be interactive and at least occasionally connected to the Internet, then this objection immediately disappears. Intel claims that the marginal cost of Wi-Fi circuitry integrated into its latest generation of laptop processors is pennies.

Instead of a GPS-style solution to the “listen-before-talk” problem, the NAB, et al. engineer proposes having every unlicensed device in the broadcast band include a broadcast DTV tuner to listen for signals. And no sooner does he definitively claim that this is the only practical and therefore right technological solution to the “listen-before-talk” protocol, then he attacks it because of the “hidden terminal problem” (p. 14). This can occur if a TV receiver subject to interference is located between a licensed and unlicensed transmitter. In such a case, the unlicensed device may be too far away to hear the TV station. Unfortunately, broadcasters have no incentive to solve this problem by adding spatial intelligence to their transmissions. An unlicensed device assumes all responsibility for knowing its location.<sup>6</sup>

Regardless of the accuracy of the engineer’s \$100 cost estimate of a DTV tuner, the emphasis on this number is quite strange because the engineer is also the author of the Arthur D. Little study, which estimated that ATSC DTV tuners would soon be so inexpensive that an FCC mandate requiring every TV set sold in the United States to include such a tuner would not be overly burdensome on consumers. Specifically, he estimated that between 2001 and 2006 the cost of a DTV tuner would drop from \$100 to \$9 with a phased FCC DTV tuner mandate—the type of mandate the FCC adopted.<sup>7</sup> According to the logic of his argument, if unlicensed devices as well as TV sets included DTV receivers, then economies of scale would lower the cost even further.

**Broadcasters ignore the possibility that a household or business might want to opt-out of receiving a broadcast signal with no adverse impact on others.**

NAB, et al. assume that all interference that harms broadcast reception is bad. They assume that consumers would object if using an unlicensed device in their home would prevent them from simultaneously watching TV in their home. They ignore the possibility that a consumer, if only at a moment of his own choosing, might prefer to use the unlicensed device rather than to tune into a terrestrial, over-the-air ATSC DTV signal. As noted in NAF, et al.’s comments, the use of low power unlicensed devices need not interfere with broadcast signals outside the immediate vicinity of the low power device. Furthermore, the vast majority of Americans who do not rely on over-the-air signals at all for television (because they subscribe to cable or DBS) should be free to use the airwaves

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<sup>6</sup> *ibid.* Max Vilimpoc states in his Reply Comment: "Without taking any of the responsibility for mitigating interference upon their own shoulders, however, broadcasters should not be granted *carte blanche* to complain, if an unlicensed user occasionally strays into their channels. For broadcasters to say to unlicensed users, in effect, ‘We’re not going to help you find us, but you have to know we’re here,’ places too many responsibilities on the wrong side of the table. Part of the culpability should fall on the broadcasters as it already does on the users."

<sup>7</sup> Arthur D. Little, Inc., “Assessment of the Impact of DTV on the Cost of Consumer Television Receivers,” Final Report to MSTV and NAB, Cambridge, Massachusetts: Arthur D. Little, Inc., September 10, 2001.

on their own private property for personal communications. If there is any right to decide how unused frequencies are used on the most local level, it should belong to the individual American property holders—and not lie fallow at the discretion of a one-size-fits-all service provider.

**Broadcasters repeatedly observe that there can be “no guarantee” that unlicensed devices won’t create unacceptable interference.**

As it is said, there are no certainties in life except death and taxes. To assert that there are “no guarantees” is not to make a serious argument. If this standard were widely employed, there would be no innovation in this world and we’d all still be using Marconi’s original radio device. (Indeed, the FCC’s propensity to listen to such speculative arguments put forth by incumbent license holders may be why wireless technology has made so little progress compared to other computer-driven technologies.) The goal should be to minimize risk, not attempt to completely eliminate it. The potential upside of innovation and of having a low-cost, untethered broadband infrastructure is too great to adopt the status quo as the best of all possible outcomes. Contrast the broadcasters’ emphasis on uncertainty with the comments of the Software Defined Radio Forum:

[T]he technology required to implement the kinds of sharing mechanisms envisioned in the *Notice* are quite modest compared to the technology already incorporated in radio devices today.

**Broadcasters claim that interference will be significant up to the radio horizon on the order of 13 miles.**

The broadcaster’s engineer claims that an unlicensed device on the 2<sup>nd</sup> story of a typical house could create both co-channel and adjacent channel interference at “significant” levels on the order of 13 miles for a single interfering device. The definition of what constitutes “significant,” presumably a synonym for harmful, is not specified. Obviously, radio energy perpetuates to infinity from any given source. The only relevant question is not whether an energy source creates interference but whether this interference is at high enough levels to be harmful. For it to be harmful, it must have material consequences.

As the FCC’s low power FM docket illustrated, the definition of “harmful interference” is notoriously subjective and prone to disagreement among experts. We think the ultimate definition of harmful interference should be left to an impartial jury of consumers, not industry players with huge amounts of money at stake. The engineer also does not clearly specify the type of unlicensed device that would be creating this harmful interference 13 miles away. To imply that a single cordless phone or Wi-Fi device would do this seems ridiculous on its face.

**Broadcasters claim that unlicensed devices are unaccountable**

Broadcasters claim that unlicensed devices are unaccountable, but they don’t clarify: unaccountable to whom. Are they merely unaccountable to the broadcasters, or are they unaccountable to the public? And what exactly would it mean to be unaccountable to the

public? Obviously, just as unlicensed devices today are accountable to “rules of the road” promulgated by the FCC under Part 15, unlicensed access to new bands will be similarly regulated, although we hope to the minimum degree necessary to prevent harmful interference with licensed services.

The meaning of the word “accountable” is largely in the eye of the beholder. If a citizen on private property wants to use a low power unlicensed remote control to eliminate dozens of messy wires hidden behind consumer electronics equipment and strung within walls, why should she have to be accountable to the broadcasting industry? Or if a business or government agency wants to use a low power unlicensed LAN within its enterprise and doesn’t relish the idea of employees watching over-the-air broadcast TV during work, why shouldn’t it be able to?

**Broadcasters assert that their band is uniquely susceptible to interference because it provides an “open architecture;” that is, they do not control the design or manufacturer of receivers.**

Broadcasters control the development of the government mandated ATSC standard and they have recently gotten the FCC to mandate that every TV set built in the United States include a receiver for this continually evolving standard. It is true that some elements of TV sets are not controlled by broadcasters, but this is also true of many other spectrum allocations where incumbent licensees welcome the innovation and choice that comes from a competitive consumer electronics marketplace.

However, broadcasters do raise a valid concern about the need for receiver standards. As NAF, et al. noted in its Comments, there do need to be receiver standards. The poor design of broadcast receivers has led to the highly inefficient use of the spectrum allocated to the broadcasting industry. The reason that even *after* the DTV transition the average TV market will only receive 7 of the 49 available channels (that is, 1 in 7)<sup>8</sup> has a lot to do with the primitive broadcaster-endorsed, FCC-mandated, broadcast DTV architecture, which is characterized by using vast amounts of spectrum to provide relatively little service. The advent of ATSC DTV offers the government a chance to allocate the broadcast spectrum a little more efficiently. But as the European DVB 2.0 standard with enhancements illustrates, there is ample room for improvement.

### **3) Ad-Supported, Terrestrial, Over-The-Air Broadcast TV Below 1 GHz has Not Been the Elixir Broadcasters Claim**

It has been widely recognized for close to a decade that terrestrial, ad-supported, over-the-air-broadcasting below 1 GHz—whether analog or digital—is an economic dinosaur unless bolstered by a vast array of government subsidies and competitor restrictions.<sup>9</sup>

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<sup>8</sup> See Thomas Hazlett, “The U.S. Digital TV Transition: Time to Toss the Negroponte Switch,” Working Paper 01-15, Washington, DC: AEI-Brookings Joint Center for Regulatory Studies, November 2001.

<sup>9</sup> E.g., see George Gilder, *Life After Television*, New York: WW.Norton, 1994; and Nicholas Negroponte, *Being Digital*, New York: Knopf, 1995. Both authors have been sought after speakers at broadcaster events. Financial analysts have repeatedly advised broadcasters that their best money can be made by pursuing a congressional business model rather than a free market business model. Bernstein Research Senior Media Analyst Tom Wolzien promised the NAB’s board a financial bonanza of hundreds of billions

Broadcasters themselves have rarely missed an opportunity to lobby for spectrum flexibility so they can use their spectrum for a more highly valued service. Indeed, in the Telecom Act of 1996, broadcasters won the right to abandon ad-supported TV on nine-tenths of their spectrum. And this is just the tip of the iceberg of their plans to abandon the 1970s-model broadcast business they tout so highly.

**The broadcasters assert that the social value of ad-supported broadcasting is both large and incalculable.**

NAB, et al. claim that over-the-air broadcasting has an “incalculable value,” that “the value of broadcasting is not fully captured by a simple economic analysis,” that broadcasting has a “non-quantifiable importance,” and that “in economic terms, television broadcasting ranks among the highest-value spectrum utilizations.”

NAB, et al. back this up with 1970s data and citations of that data in later studies.<sup>10</sup> Hazlett’s more recent study of the opportunity cost of the broadcast allocation provides a very different analysis. Hazlett proposes what he calls a Negroponte Switch: have broadcast TV content distributed over cable TV and satellite TV and free up the broadcast spectrum for services that can really benefit from that low frequency, supremely valuable spectrum. If broadcasters can continue to provide the same service at other, higher, less valuable frequencies, then there is a net benefit, rather than a social cost, to completely freeing the 402 MHz allocated to broadcasting to more highly valued purposes. NAF, et al. disagree with Hazlett’s public policy recommendation of allocating the broadcasters’ spectrum for flexible *licensed* use. But we do agree with Hazlett that the broadcast spectrum is currently being inefficiently used and that spectrum should be used flexibly—with the difference that we propose flexible *unlicensed* use.

It is also revealing that broadcasters boast that they are on the verge of becoming like other telecommunications and content providers. Their economist states: “The advent of digital broadcast television... promises to accelerate the ongoing convergence among telecommunications, computing, the electronic mass media, the Internet and, significantly, the world of commerce. The new technology affords broadcasting an

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of dollars if they could win spectrum flexibility either through Congress or Congressional delegation of authority to the FCC. See Tom Wolzien, “Whose Bandwidth is it Anyway?” Speech at the National Association of Broadcasters Futures Summit, Monterey, California, March 25, 2001. For a partial list of government subsidies for the broadcasting industry, see J.H. Snider, “The Myth of Free TV,” Washington, DC: New America Foundation, June 2002.

<sup>10</sup> NAB, et al. cite Peck, McGowan, & Noll’s 1973 book that did gather empirical data. This was followed by a cite of Owen & Wildman’s 1992 book, which developed economic models as part of a theoretical social welfare analysis of broadcasting. However, Owen & Wildman did not gather original data; they provided theory and analysis. Moreover, Owen & Wildman noted that theoretical considerations cut both ways. For example, they theorized: “Pay television (particularly with unconstrained channels and a competitive structure) is more likely to allocate resources in television production efficiently than is advertiser-supported television. The reason is quite simple: revenues per viewer under pay television are more likely to reflect viewers’ program preferences than are revenues per viewer under advertiser support (which reflect advertisers’ values of viewers).” (p. 99). Wildman holds a broadcaster/NAB endowed academic chair at Michigan State University. Many others, such as Erik Barnouw in his *Sponsor* (1979), have noted that advertiser-supported programming leads to non-optimal program selection, including significant distortions in public affairs programming.

entrée into and technical means that are, in principle, compatible with the Information Age revolution that is rapidly remaking how we live and work” (p. 14). But if broadcasters are evolving to become just like other information providers, why should they be given special treatment? If all information providers are becoming alike, do all information providers offer services of inestimable value?

**As they did with digital radio, broadcasters seem to assert that they offer a superior service for the unused guard bands.**

Broadcasters recently won the right from the FCC to incorporate radio guard bands into their FCC radio licenses.<sup>11</sup> This was to facilitate the transition to digital radio.

A more recent broadcaster attempt at spectrum lebensraum occurred in FCC Docket No. 00-230 on secondary markets. Broadcasters argued that they should be able to lease out their block of spectrum to the highest bidder—even if that bidder didn’t intend to provide ad-supported broadcast TV programming, let alone community news or public affairs programming. Yesterday, May 15, 2003, the FCC announced that that proposed rule was too controversial and was taken out of the final rulemaking. But it will surely be introduced again at some opportune moment. Commissioner Copps explained his opposition to abandoning the services that the NAB, et al.’s economist touts so highly:

[A]llowing television and radio broadcasters to sell to non-broadcasters access to the spectrum that Congress and the FCC gave them for free would be a terrible mistake. It would have meant that broadcasters could sell control of part or all of their spectrum to others, potentially without Commission review. Broadcasters were given this spectrum for free because they are engaged in work that is critically important to our country—the provision of free over-the-air TV and radio. To allow them to sell this spectrum for other uses would have been deeply troubling. And by doing so we may have undermined the digital transition by giving broadcasters an incentive to hang on to as much spectrum as they can for as long as they can with the hope of leasing it for profit.<sup>12</sup>

In their comment in this proceeding, NAB, et al. allude to a similar spectrum lebensraum. For example, they state that “if wireless devices were permanently ensconced on these channels, they could preclude the use of these channels for existing television stations...” Elsewhere they state that “populating the band with unlicensed devices threatens to preclude future consideration of alternative, more efficient and more valuable uses of the broadcast spectrum at the conclusion of the DTV transition.” Although the context of these statements appears ambiguous, broadcasters at no time assert that they do not intend to continue their decades old efforts at spectrum lebensraum—acquiring new spectrum without monetary public compensation.

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<sup>11</sup> See *First Report and Order* in MM Docket No. 99-325, FCC 02-286, October 10, 2002.

<sup>12</sup> Statement of Commissioner Michael J. Copps regarding Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets; Report and Order and Further Notice of Proposed Rulemaking (WT Docket No. 00-230), May 15, 2003.

Broadcasters' implicit claim for spectrum lebensraum appears based on the assumption that the benefits of terrestrial, over-the-air, ad-supported ATSC DTV are greater than the benefits of unlicensed services that could be provided in the same band. This claim should not be accepted without far greater evidence than they have presented, especially when unlicensed technology has been so heavily praised by FCC commissioners, members of Congress, highly regarded business investors, and the media. In any case, no additional spectrum rights should be granted to broadcasters without public compensation.

**NAB, et al. claims that the broadcast allocation and DTV transition are a response to market failure in the provision of broadcast goods.**

NAB, et al.'s economists describe a world of pervasive market failure in broadcast information goods and call for continuing the current industrial policy of massive subsidies to the ad-supported, over-the-air TV industry. The gist of their argument is that the marginal cost of providing an additional viewer to over-the-air broadcasting is zero and that opportunities to exclude viewers and thus charge them directly for programming, are not practical. This does indeed describe the characteristics of a public good. As a description of the broadcast world of the 1970s, this analysis has a fair bit of weight. But as a description of the broadcast world in the 2000s, it is sorely lacking, full of outdated assumptions.

One outdated assumption is that broadcasters don't intend to charge users for their spectrum. Broadcasters' DTV license only specifies that broadcasters need to provide one standard definition TV channel with their 6MHz of spectrum; that is approximately 10% of their channel capacity with the current ATSC standard. The balance can be used for fee-based services. Even conventional user rights—such as recording a TV program for later viewing—will often be highly constrained or impossible unless the user pays a new, special fee to the broadcaster. Also, the analysis ignores that new technology has created many new substitute distribution media that can provide identical service at lower cost (see section below).

**Broadcasters claim there are no close and less expensive substitutes for the service they provide.**

The broadcasting industry provides two services: a distribution network and content. The broadcasters claim that their service, both separate and combined, constitutes a unique information service to the public. This is undoubtedly true in some sense. But there are clear lower cost substitutes for their over-the-air distribution network—the issue under contention here.

Broadcasters also claim that the distribution network they provide has aspects of a public good; notably zero marginal cost. While this is undoubtedly true, it doesn't distinguish them from other distribution networks and information products for which this is also true. For example, it costs no more to transmit to an additional satellite broadcast viewer than it does to an additional terrestrial broadcast viewer. In both cases, the viewer needs a DTV tuner. And in both cases, reception is optimized by having an external antenna, with most satellite antennas far more compact than most terrestrial antennas. Similarly,

since cable TV now passes close to 100% of U.S. home, the marginal cost of connecting additional viewers is minimal. Equally relevant, with the introduction of the Internet, the marginal cost of huge amounts of information have become infinitesimal. The broadcasters' logic would suggest that these content and distribution industries, too, should receive vast subsidies. But as Shapiro and Varian have argued, just because an information market is characterized by market failure, doesn't mean it should enjoy ever-increasing public subsidies—or even any public subsidies at all.<sup>13</sup> Moreover, the public goods aspect of broadcasting—zero marginal costs, network externalities, and chicken and egg problems—equally apply to unlicensed allocations. For example, the value of a Wi-Fi node in a Wi-Fi network is directly related to how many other nodes are in the network.

#### **4) The Benefits of Unlicensed Spectrum Allocations are Substantial and Real**

NAB, et al. claim that there are “very limited and speculative benefits to users of unlicensed devices.” (p. 13). They focus their critique on two types of unlicensed allocations: rural and urban.

##### **Broadcasters claim that in rural areas, where underutilized broadcast spectrum “may” be available, spectrum resources for unlicensed devices is already plentiful.**

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>14</sup> In contrast, unlicensed WISPs can provide this service for a tiny fraction of that cost.<sup>15</sup> NAF, et al. do not believe that billions of dollars are an insignificant amount of money to save, especially when combined with offering a service of great social value that would otherwise take many more years to reach rural America.

The numerous comments by unlicensed WISPs (Wireless Internet Service Providers) to this NOI, demonstrates that the broadcasters are making a highly controversial assertion. Unlicensed WISPs argue that access to low frequency spectrum would allow them to offer service to many areas not presently possible. As an example, consider the comment of WISP operator C. Crowley:

Broadband is becoming an integral component of America's industrial and educational infrastructure. WISPs are extending that infrastructure into underserved areas.

We are limited by various constraints, regulatory and economic, to the unlicensed 2.4GHz band. Unfortunately this is line-of-sight. You would

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<sup>13</sup> Carl Shapiro and Hal R. Varian, *Information Rules*, Boston: Harvard Business School Press, 1999.

<sup>14</sup> "NECA Rural Broadband Cost Study: Summary of Results," Victor Glass, Ph.D., National Exchange Carrier Association, Inc. June 21, 2000.

<sup>15</sup> See comments of the Information Technology Industry Council and Wi-Fi Alliance on the success and social contribution of unlicensed WISPs.

not believe how much contour and how many trees are on the Texas prairie until you start trying to do line-of-sight radio out there. Even the smallest hills rear themselves into mountains when you are out doing site surveys at customers' locations.

We get around some obstacles by creating local "hotspots" with shortrange 802.11 units. Much better than this would be access to NLOS (non-line-of-sight) frequencies.

If the FCC saw fit to free up the frequencies in question for unlicensed use, we'd be able to provide better service to our customers, be able to reach more people.... The phone system doesn't reach everybody, cable doesn't either, satellite has its problems, and there are a lot of trees out there. Please give us the tools to bring more people onto the broadband net."

FCC Chair Michael Powell himself echoed the controversial nature of the broadcasters' claims in a statement at the FCC's recent showcase of unlicensed WISP service providers:

Today's event vividly demonstrates how the economy and consumers benefit when spectrum policy removes barriers to innovation. In the sometimes abstract debate about spectrum policy, the showcase provides a glimpse of the concrete public benefits that flow inexorably from sound market-based spectrum policies. Our progress is no longer theoretical; it is embodied in the real world technologies and applications on display here.<sup>16</sup>

Appendix A describes some of the vendors and services on display at the FCC showcase.

**Broadcasters claim there is no underutilized spectrum in urban areas; therefore, unlicensed cannot offer any benefits.**

NAB, et al. define "unused" spectrum so narrowly that their comments seem largely irrelevant to the opportunity and challenge posed by the new unlicensed technologies. In particular, broadcasters conception of the information carrying capacity of the spectrum is based on an archaic technology model based on dumb radio technology. In the broadcasters' view, the spectrum space is as crowded as the land space in urban areas. But once smart radio technologies are introduced into the equation, the spectrum space begins to look like a primeval empty forest. For example, with low power, directional transmitters, directional receivers, and a modicum of software-defined intelligence, smart radios can increase the information carrying capacity of the current broadcaster block allocation—without interfering with broadcaster reception—by a factor of thousands. Broadcasters' contention that unused and underutilized spectrum exists in trivial amounts

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<sup>16</sup> FCC Chair Michael K. Powell's statement at the unlicensed wireless innovators showcase, May 12, 2003.

in the broadcast band in non-rural areas is countered by numerous commenters, including AT&T, The Consumer Electronics Association, The Information Technology Industry Council, Intel, Radio Shack, Shared Spectrum Company, and the Software Defined Radio Forum. As Intel comments:

Preliminary technical analysis conducted by Intel and testing performed by the Communications Research Centre Canada on Intel's behalf, demonstrates that technically viable broadband services can be operated on a non-interfering basis with both analog and digital broadcast services in a major metropolitan area in which many overlapping TV service contours exist.

**Broadcasters claim that the supply of underutilized spectrum is fundamentally different for urban and rural areas.**

NAB, et al. are correct that at high power levels, the supply of underutilized spectrum is different in urban and rural areas. But they are wrong to imply that the supply and demand conditions are fundamentally different for unlicensed spectrum at low power levels. City dwellers aren't the only Americans that want remote controls, cordless phones, Wi-Fi networks, and other low power communications devices that can pass through walls, furniture, and other common obstacles with ease at low power levels and without constantly replacing or recharging batteries. If the miracle of ultra-high-speed ubiquitous broadband service is ever going to happen in America, it will have to happen at low power levels. Only low power levels facilitate the massive reuse of spectrum, which in turn makes ultra high speed wireless broadband possible for every American. And it will have to happen in both urban and rural areas, although the power levels in rural areas will undoubtedly be higher. More generally, NAB, et al. have not thought through the different ways unlicensed can be allocated depending on the type of white space available—e.g., dedicated unlicensed on an unused guard band, a high power overlay on an assigned channel, or a low power underlay on all channels.

**Broadcasters claim the benefits of unlicensed have been oversold, and cite the failure of unlicensed PCS to make their point**

The unlicensed PCS band did not succeed because of regulatory failure, not any inherent feature of unlicensed. A small amount of spectrum (20 MHz) was allocated to digital unlicensed service, the frequency had poor propagation characteristics compared to the broadcast band (its frequency was about four times the magnitude of the average broadcast channel), incumbent users were never cleared from the band, manufacturers were required to pay a fee on every device they manufactured to pay for the removal of incumbents at a distant date in the future, use of spread spectrum technology was not granted unlike the 900 MHz, 2.4 GHz, and 5 GHz unlicensed bands, and the FCC made it clear before unlicensed devices took off in the last few years that it was going to rethink this band and probably eliminate unlicensed service within it. With all this investment uncertainty about an unlicensed band allocation with severe deficiencies, it should be no surprise that equipment manufacturers did not rush to invest in devices to operate in it.

## **5) Broadcasters ignore the social costs of their licenses**

Nowhere do broadcasters acknowledge in their cost-benefit analysis the costs of huge government subsidies and favorable regulatory treatment that come with their license to provide over-the-air broadcast television. These subsidies include free carriage on all competing broadcast platforms, including cable and satellite systems. This carriage is worth tens of billions of dollars and may take up close to a third of cable TV channel capacity—an infrastructure that cost more than a 100 billion dollars to build.

Broadcasters ignore the opportunity cost of allocating 402 MHz of prime spectrum to a service that can be provided much more efficiently over less valuable spectrum,<sup>17</sup> and they ignore the 4 GHz of spectrum of less valuable spectrum that is given to broadcasters to reduce their production costs.<sup>18</sup> It is also sad that because government has guaranteed broadcasters distribution on all telecommunications networks, a powerful voice that probably would have lobbied for competition and open networks has been turned into a voice for their opposites.

## **Other Considerations**

### **1) Cingular's claim that unlicensed spectrum violates section 301 is a misreading of the statute**

Cingular argues that the plain language of Section 301 prohibits the Commission from authorizing unlicensed uses. Cingular argues that the entire basis for Part 15 – that an intentional radiator designed for purely intrastate transmission does not fall within the mandatory licensing provisions of Section 301 – was eliminated by Congress when it amended Section 301 in 1982.<sup>19</sup>

Cingular's argument proves too much. If Cingular's interpretation is correct, then all existing unlicensed uses must cease. A multi-billion dollar industry in unlicensed devices would be criminalized, and every citizen using a remote control to change a channel or open a garage door would be subject to arrest.

An examination of the legislative history demonstrates that the 1982 modifications to Section 301 were never intended to alter the Commission's jurisdiction under Part 15. As explained in the Conference Report, Congress merely intended to relieve the FCC of the expense of producing engineering data demonstrating interstate effects when prosecuting violators of the rules governing citizens band radio. H.R. Conf. Rep. 97-765, 1982 U.S..S.C.A.N 2261 at 2275-76. The Senate and the Conference Committee intended the changes to clarify the Commission's criminal jurisdiction, not to eliminate the Commission's ability to authorize low-power unlicensed uses under Part 15.<sup>20</sup>

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<sup>17</sup> See Thomas Hazlett, "The U.S. Digital TV Transition: Time to Toss the Negro Ponte Switch."

<sup>18</sup> For a more detailed description of the huge costs of broadcaster subsidies, see J.H. Snider's "The Myth of Free TV," Washington, DC: New America Foundation, June 2002.

<sup>19</sup> Cingular Comments at 2-4.

<sup>20</sup> *Id.*

Congress was certainly aware of the Commission's Part 15 rules allowing unlicensed uses, which the Commission first authorized nearly 30 years previously. Had it intended to eliminate the FCC's authority to promulgate such rules, it would have given some sign. It is the general presumption both that Congress is aware of relevant rules and interpretations when it acts, and will not be presumed to have made significant changes to an agency's authority without some clear sign. *Whitman v. American Trucking Association*, 531 U.S. 457, 468 (2001) (Congress does not "hide elephants in mouseholes"); *MCI Telecommunications Corp. v. AT&T Corp.*, 512 U.S. 218, 232-33 (1994).

With regard to this docket, Cingular's argument admits no middle ground. Either Congress intended in 1982 to eliminate *all* unlicensed uses outside certain enumerated exceptions (*see, e.g.* 47 USC §303(k)) or, the Commission may continue to authorize unlicensed services consistent with the limitations of Part 15. Thus, Cingular's position cannot be read to require either a "freeze" on further unlicensed uses while permitting existing uses, or a prohibition against authorizing unlicensed uses consistent with Part 15 on other frequencies.

The Commission has modified the Part 15 rules since the 1982 amendment to Section 301, both to allow a greater range of uses and to authorize unlicensed operation on an ever greater number of frequencies. The Commission has consistently interpreted the 1982 amendment as merely expanding its criminal jurisdiction and general jurisdictional authority, rather than eliminating its authority to authorize unlicensed uses under Part 15. Cingular has given no reason to revisit that conclusion here.

## **2) The November 26, 1996 agreement between the broadcasters and the computer industry should be rendered null and void because it deprives the public of valuable voices concerning the DTV transition and the use of the country's most valuable airwaves.**

In November 26, 1996 representative of the broadcasting industry (the "broadcasting caucus") and computer industry (Computer Industry Coalition on Advanced Television Service; abbreviated CICATS) entered into an agreement. In return for incorporating certain computer friendly enhancements into the ATSC DTV standard, the computer industry agreed not to oppose the broadcasters' plans for the digital transition. Specifically, the agreement stipulated that "neither CICATS nor its members companies nor their representatives will directly or indirectly seek to oppose or delay—before the FCC, by judicial review, legislatively or otherwise—final adoption of the positions urged by broadcasters and consumer electronics manufacturers in MM Docket MM No. 87-268... or other proceedings related to the launch of digital television."<sup>21</sup> Computer industry members were Microsoft, Compaq, Apple, etc, none of which filed comments in this proceeding. NAF, et al. believe this provision of the deal over the ATSC TV standard was an abomination and should be immediately rendered null and void as a violation of the First Amendment and the public's right to hear the various sides of

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<sup>21</sup> Letter to FCC Commissioners, dated November 26, 1996.

complex technological issues. Perhaps no FCC sanctioned agreement has ever been more inconsistent with its mandate to encourage diverse and antagonistic views on important issues of public affairs.

## **Conclusion**

NAF, et al. believe that within the broadcast band there are large amounts of underutilized spectrum. Thus, the tradeoff the broadcasters pose between broadcast and unlicensed use of spectrum is spurious. But to the extent that broadcasters want to pursue this line of argument, we do not see how it comes out in their favor.

The cost of allocating some of the broadcast band spectrum to unlicensed is small compared to the potential benefits. We recognize that the future is full of uncertainty and difficult problems to tackle. But this is true of all great innovations. This Inquiry is a great opportunity for the FCC to reach to the future rather than to cling to the past. It would be unfortunate if the command and control model that the FCC's Spectrum Policy Task Force has criticized--and the incumbent license holders in the broadcast band have also elsewhere criticized--is used to reign in the vibrant unlicensed marketplace that is emerging and at the forefront of telecommunications innovation today.

## **Appendix A: Profiles of Existing Licensed-Exempt Wireless Services**

The following are examples of companies responding to last-mile demand for broadband services in rural areas. Two of the companies mentioned in these profiles (Alvarion and Roadstar Internet Services) recently exhibited at the FCC- and NTIA-sponsored event: “Wireless Innovations: New Technologies and Evolving Policies.” AMA.TechTel is a featured Alvarion customer, and Prairie iNet, participated at the Unlicensed Wireless Panel Roundtable hosted by the FCC the following day.

These examples here are just a sampling of the market activity and innovation occurring in rural, suburban and even urban areas as a result of license-exempt spectrum.

### **Loudoun County Virginia: Connecting the Unlicensed, Appalachian Last Mile**

Despite their proximity to northern Virginia’s Internet backbone, many small towns in Loudoun County have no broadband access. The mountainous rural areas of western Loudoun County are especially removed from technological growth of other areas of Northern Virginia where technology companies like AOL and VeriSign reside. However, as a result of advances in license-exempt wireless technology, entrepreneurial companies like Roadstar Internet Services and SkyNet Access are bringing the high-speed Internet to these rural and suburban communities.

The residents of Northern Virginia comprise a diverse mix of professionals who came to the area during the technology boom of the late 90’s. When the technology bubble burst, as many as 30,000 jobs were lost in the region. But the technology slump did not translate into a slump in demand for broadband Internet in the local market. SkyNet Access, a Wireless Internet Service Provider (WISP) is trying to meet that demand by providing access to residents and small and home office businesses in the Leesburg suburban area.

“Infrastructure, infrastructure, infrastructure” is the rallying cry for start-up businesses in the area, says Chris Chamberlain, President & CEO of SkyNet Access. He contends that unlicensed fixed wireless provides businesses with limited resources an opportunity to compete with larger firms with greater technological capability. SkyNet relies on a variety of unlicensed bands (2.4 GHz, 5.2 GHz, 5.7 GHz, and 5.8 GHz) and point-to-point and point-to-multi-point transmissions to reach over 100 subscribing customers in the Leesburg vicinity.

A local vineyard and a successful home-based e-commerce outfit are among SkyNet’s growing list of subscribers. In the coming months, they plan to extend their service into more rural areas of the county as well. In doing so, they will compete with and complement another local WISP, Roadstar Internet Services. Started in the autumn of 2002 by local entrepreneur Marty Dougherty, the Roadstar WiLAN network connects 50

households and small businesses in a rural footprint connected by antennas mounted on customer silos, barns and rooftops. The network reaches subscribers as far as 20 miles from the company's main transceiver, perched on a high mountaintop.

The first leg of the Roadstar network travels 18 miles from a mountaintop transceiver using license-exempt, 5.7 and 5.8 GHz spectral bands in a point-to-point, OFDM (orthogonal frequency division multiplexing) transmission. The OFDM technology makes efficient, and secure, use of spread spectrum by dividing data into packets and encoding it over multiple frequencies.

Then, using point-to-multipoint transmitters, Roadstar makes use of the 5.3 and 5.8 GHz unlicensed bands to reach strategically placed wireless Access Points in neighborhoods or commercial areas. The last mile connections to residential customers are typically two or three miles and use the Wi-Fi standard, 2.4 GHz unlicensed band.

Roadstar customers include home-schooling families, telecommuters and SOHOs who finally have access to high-speed applications like video conferencing and file sharing – at prices and data speeds that rival those paid by DSL and cable subscribers in technology-rich eastern Loudoun County.

**Somerset County, Pennsylvania:  
A Model for Bringing High-Speed Wireless to Rural Schools and Communities**

As the Superintendent of the Rockwood Area School District, Andy Demidont's goal was to "leave no child behind" regarding access to technology. But in this mountainous, rural section of southern Pennsylvania, there was no cable or fiber option for high-speed access and only the slowest dial-up connection. So Demidont enlisted the aid of Sting Communications, a Lebanon, Pennsylvania WISP. Using grant money awarded from the Individuals with Disabilities Act, they have built a high-speed wireless network to connect not only the two area schools, but also the area's residents and businesses.

Sting Communications has installed three towers in the area using the 5.8 GHz license-exempt bands. The Rockwood Junior and Senior High School gymnasium hosts a 100-foot tower that connects to a 150-foot tower located at Kingwood Elementary school 12 miles away. The two towers share a point-to-point connect with another tower owned by the local Seven Springs Ski Resort to create a coverage area blanketing much of the mountainous community. The last-mile connections in homes, businesses and classrooms are on 2.4 GHz license-exempt spectrum.

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 lap-tops to track student progress, design lessons and tests, and record student grades – which are accessible to parents in real-time. Students can use the high-speed connection in each classroom, with the entire school "unwired" for access.

As an incentive to bring local businesses and residents onto the system, Sting Communications has offered the low monthly fee of \$10 per month plus an additional \$10 equipment rental for the first 100 subscribers to the Rockwood network. When local businesses subscribe to the service, the schools' monthly access rates are discounted by 50% of the subscription rate paid by the business.

The initiative has generated a great deal of interest in the community, and the school has collected a list of approximately 100 households who would like to purchase access to the network. Currently, a dozen families have been connected, but deployment has been slower than expected because of weather delays this winter and spring.

Sting Communications CEO, David Pugh states that the company is planning to add these residents to the network using new, Alvarion 900 MHz "frequency hopping" radios that are soon to be released into the market. Frequency hopping technology allows WISPs to use multiple unlicensed bands to find the most appropriate frequencies to better reach subscribers in terrains obstructed by trees or buildings. For densely wooded areas, such as Rockwood, the 900 MHz frequencies have better propagation characteristics, which will cut through foliage for last mile connections to remote subscribers.

Alvarion, one of the largest providers of fixed wireless technology, makes the new 900 MHz radios. The new technology will be released in the coming months, and according to Alvarion it should provide more reliable service to more remote, forested areas, like Rockwood.

The originators of the Rockwood Area School last-mile project hoped their model for bringing broadband to a rural area could be copied and replicated in other communities. Building on what they have learned thus far, Sting Communications is working with school districts in two other rural counties in Pennsylvania. Clearfield and Cambria County school districts have created a non-profit organization, BRAIN (Broadband Rural Access Information Network), to bring unlicensed wireless access to their communities.

Building on what has thus far been learned in Rockwood, this larger effort will connect 15 rural schools and communities that previously had no other option for broadband.

### **North Texas Panhandle: Rural Wireless Broadband at DSL Prices**

With over 4,000 users on their license-exempt wireless network, AMA.TechTel Communications of Amarillo, Texas is one of the country's largest WISPs. Like many larger providers, they have roots in dial-up and DSL. But in recent years, they've benefited from the relative ease of fixed wireless deployment to grow their business and reach rural markets craving high-speed access.

AMA entered the WISP business when a large grain storage company, Attebury Grain Inc., approached them to connect their grain elevators to the commodities market. After

exploring different solutions, they decided a wireless network made the most economic and technological sense. Partnering with Attebury, they saw an opportunity to widen the network and provide wireless access to communities within the footprint of the elevators.

Like many larger WISPs, their customers are a mix of households and small and large enterprises. Using a mesh-network of Alvarion transmitters operating on the 5 GHz unlicensed bands, AMA has created secure, private environments for three college campuses and two banks. AMA has grown rapidly in the past two years – recently enlisting 150 new users a month with very little marketing.

The AMA network stretches over two and half hours from Amarillo. For their rural customers, unlicensed wireless helps to even the economic playing field as these customers pay roughly the same rates for similar service as urban DSL subscribers.

### **Broadland, Illinois: Wireless Broadband for Rural Broadland, Illinois**

There is little incentive for telecom and cable companies to bring high-speed Internet to towns as small as Broadland, Illinois, population 350. However, the local farmers of this town have a great need for high-speed access to monitor their markets and manage their businesses. To meet that demand, Prairie iNet, a Des Moines, Iowa WISP, has built a wireless network for rural residents in Broadland -- and 120 other communities in Illinois and Iowa.

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. With a coverage area of approximately 20,000 square miles, over 4,000 subscribers receive high-speed connections via 100% license-exempt spectrum.

The company uses the 5.3 and 5.8 GHz frequencies for tower-to-tower and backhaul transmissions, while the last-mile connections to users are typically well over a mile, and on the 2.4 GHz unlicensed band. The wireless network eventually connects to the Internet pipe via a DS3 fiber line at the Prairie iNet command center.

Dennis Riggs, a Broadland native and one of the founding partners of Prairie iNet, says that selling high speed Internet connections to people who live beyond the reach of wired providers is "one of the easiest things he's ever done." However, having future access to the unlicensed bands to improve that network could be a harder sell.