

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
International Comparison and Consumer)	GN Docket 09-47
Survey Requirements in the Broadband)	
Data Improvement Act)	
)	
A National Broadband Plan for)	GN Docket 09-51
Our Future)	
)	
Deployment of Advanced)	GN Docket 09-137
Telecommunications Capability to All)	
Americans in a Reasonable and Timely)	
Fashion and Possible Steps to Accelerate)	
Such Deployment Pursuant to Section 706)	
of the Telecommunications Act.)	

NBP Public Notice #26

COMMENT SUBMITTED BY THOMAS W. HAZLETT

December 18, 2009

UNLEASHING THE DTV BAND A Proposal for an Overlay Auction

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Dec. 18, 2009

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I. INTRODUCTION

The Federal Communications Commission's digital television (DTV) transition is not nearly complete. The total bandwidth set aside for terrestrial digital video broadcasting -- 49 channels allotted some 294 MHz -- is worth over \$100 billion in license value and at least ten times that amount in Consumer Surplus.² But it contributes virtually nothing to society in its current configuration, a verdict that will not change if the FCC continues on its present path. The existing policy, which freezes TV stations in their current positions and then attempts to sprinkle in unlicensed devices in the "white spaces" surrounding them, blocks the flow of spectrum inputs to the wireless services consumers most desire to use.

The opportunities squandered are highly valued by consumers: more competition among mobile voice and data carriers; innovative, spectrum-intensive applications for emerging platforms such as those supporting Blackberries, iPhones, and iPhones; broad expansion of machine-to-machine services as launched by OnStar, Kindle, health telemetrics vendors, and product monitoring devices. While the under-allocation of radio spectrum to mobile networks has been visible for some years,³ the crisis now looming is widely seen. The explosion in bandwidth usage by smart phone subscribers, a salubrious product of competitive rivalry between mobile carriers, is challenging network capacities even now -- when high-bandwidth applications, such as audio and video streaming, are just beginning to take-off.

The consensus is that a tsunami in mobile data usage is soon to swamp current network capacities.⁴ The deeper truth is that the tragedy is already imposed on the market. By delaying network expansion the mobile tsunami has been deterred, and a range of wireless gains suppressed. By allowing the market to access additional frequency space, consumer demands may be efficiently accommodated. Such economic activity would deliver extremely substantial social gains in terms of higher outputs and lower prices, as well as large advances in business productivity, global competitiveness, and technological innovation.

² Licenses allocated 52 MHz sold in the FCC's March 2008 700 MHz auction for over \$19 billion. If similar prices (per MHz) obtained, a sale of equivalent licenses allocated 294 MHz would generate revenues of ~\$107 billion. Such values reflect profit opportunities of wireless providers; the consumer surplus generated by additional bandwidth used by the carriers has been found to exceed ten times producers' surplus (Hazlett 2008a; Hazlett & Muñoz 2009). It should be noted that both the 700 MHz licenses and overlays to use the DTV band (294 MHz) embed encumbrances that reduce prices paid in auctions. These do not reduce the private value of the bandwidth, but its distribution between parties (one of which is the Government). In other words, this private valuation is not, per se, an estimate of what would be received by a sale of overlay licenses, but is an estimate of underlying bandwidth value assuming that the discounts for encumbrances in the overlays described herein are similar to those in the 2008 700 MHz license auction. In reality, the cost of such encumbrances could be more or less for overlay licenses sold now or in the future as compared to those for the 700 MHz licenses, while (similarly) bandwidth demand could be greater or lesser.

³ Hazlett (2001, 2003, 2008a). The rigidities in spectrum allocation, which account for this bottleneck, are responsible for blocking the flow of bandwidth to its highest valued employments. See Ronald Coase (1959).

⁴ Moffett (2009b); Meyer (2009b); Higgenbotham (2009).

To enable such benefits, policymakers need not sacrifice any announced goals. “Free” television can survive, and expanded opportunities for unlicensed devices can be accommodated.⁵ Yet, they must sharply redirect the regulatory trajectory. Decades of spectrum misallocation are being extended by regulatory mandates that protect the antiquated models of yesteryear. This administrative rigidity has long sabotaged consumer interests, and will continue to do so. Superior approaches are available. They enable markets to adjust to changing circumstances, capturing emerging opportunities now stifled by gridlock.

Terrestrial broadcasting has, since the TV Allocation Table of 1952, consumed an outsized block of prime frequencies. But the initial TV-era policy mistakes, which drove a fourth broadcasting network from the marketplace in 1955, long ago ceased to be the prime roadblock to efficiency. Even if initial allocations and primary license assignments had been optimal, they would have needed continual updating. That process of adjustment, however, has been stifled due to the nature of broadcast TV licenses. Such permits tightly constrain spectrum use, blocking transactions to make bandwidth available for new services. Moreover, most TV channels have been allotted to no license at all. Regulators, not market competitors, have controlled spectrum use. To avoid interference regulators have long left the vast majority of TV spectrum fallow, a tradition that continues even after the transition from analog to digital broadcasting.

Hence, what appears to solve one potential ‘tragedy of the commons’ (Hardin 1968) creates a reverse fiasco: ‘tragedy of the anti-commons’ (Heller 2008). The lack of economic activity is difficult to observe, but no less real than the economic dissipation famously flagged by Garrett Hardin. Americans could be accessing more advanced wireless networks, developing more useful technologies, and enjoying decidedly more productive opportunities in the economy were the TV Band – the Mother Lode of underutilized radio spectrum – allocated to its highest valued use.

This paper puts forward a simple proposal to accomplish that. It does not impose any given business model on the market, or dictate how airwaves should be utilized. Rather, it uses modern tools of spectrum management to create incentives for key players to cooperate, remedying conflicts and ending hold-outs. It is a specific plan in terms of its basic components, but it is sufficiently generic as to accommodate policy choices reflecting differing goals. It is a platform whose specifications can be customized.

The policy innovation is crafted using off-the-shelf regulatory models deployed in previous Commission proceedings. Moreover, it realizes a bountiful opportunity that has long been desirable: permitting the broadcast TV Band to host new services.⁶ If the

⁵ I am not recommending that historical policies be continued, but write this policy recommendation under the assumption that they will be. In fact, a floor to ceiling re-evaluation of the net benefits of broadcast television policies would be useful. Yet, to the degree that such a process would delay the crucial spectrum allocation reforms that are proposed herein, the ideal becomes the enemy of the good.

⁶ In 1996, then U.S. Senator John Ashcroft (R-MO), noted: “My commitment is to maintain free television, but I do not have a commitment to maintain free television if that misallocates a valuable resource of the country, namely, spectrum.” As a trade journal reported: “Sen. John Ashcroft (R-Mo.) is struggling to find

Commission is serious about propelling U.S. markets in the broadband era, it will move to initiate this general proposal.

II. THE TV BAND: SPECTRUM WAREHOUSE

For over a half-century, valuable new wireless services have been accommodated by airwaves originally set aside for over-the-air television. Figure 1 briefly summarizes.

FIG. 1. TV BAND SHRINKAGE THROUGH HISTORY			
<i>Year</i>	<i>TV Channels</i>	<i>MHz</i>	<i>Regulatory Event</i>
1953	81	486	TV Allocation Table of 1952 with UHF supplement
1982	67	402	50 MHz reallocated to cellular
2009	49	294	108 MHz reallocated with analog switch-off

Today, the social opportunity cost of using the TV Band for television broadcasting – 294 MHz of spectrum with excellent propagation characteristics for mobile voice and data networks, including 4G technologies – is conservatively estimated to exceed \$1 trillion (in present value). These projections are based on the issuance of liberal licenses such as those defined for CMRS operators – broad, flexible-use rights enabling the most intense, diverse, and highest-valued demands to be supplied.

It is apparent that these opportunities far exceed the value currently derived from the band. There are about 1,750 full-power TV stations, yet there are 10,290 local

a way to bring TV broadcasters into the digital age. Rather than giving TV stations new spectrum, Ashcroft has proposed migrating TV stations to cable and selling off their current spectrum to the highest bidder. The Federal Communications Commission estimates the spectrum's value at between \$20 billion and \$132 billion. Proceeds from the spectrum sale would go toward wiring every unserved home to cable. Former broadcasters would evidently become a new class of cable programmer afforded free access to cable systems. Many details of the plan remain murky, but Ashcroft's idea is designed to free up spectrum for mobile communications, which, in his view, are the highest and best use of a finite resource, while protecting broadcasting as a free service to all Americans." Ted Hearn, *Sen. Mulls Migrating Broadcasters to Cable*, NEWS (July 1, 1996), 20. In 2001, former FCC Chief of Staff (during the Clinton Administration) Blair Levin noted that, "TV stations were not in immediate danger of losing their spectrum. But political forces could shift if cable and DBS penetration climbs above 90 percent, if Japan and Europe race ahead of the U.S. in the advanced wireless data market and if lawmakers need to patch big holes in the budget with spectrum auction revenue." Ted Hearn, *Could TV Stations Lose Their Spectrum?* MULTICHANNEL NEWS (June 18, 2001). (It is noteworthy that Levin now serves as the FCC's "Broadband Czar.") FCC Chair Michael Powell, an appointee of George W. Bush, followed up with the following 2003 statement: "[I]t seems clear to me that at some point on the horizon, all Americans – perhaps in 10 years – will have pay-TV. As an entity, [over-the-air TV broadcasters] may and probably will be there but as a program supplying interest more than a distribution platform." *FCC's Powell Sees Big Change in Broadcast Environment*, 21 COMMUNICATIONS DAILY (Oct. 23, 2001), pp. 1–2.

channel slots (49 * 210 U.S. TV markets). Hence, off-air broadcasts “consume” just 17% of the total channels set aside for television. But that measure over-estimates *economic* utilization. Because the content of these TV broadcasts can be – and is – delivered via alternative cable and satellite platforms,⁷ the incremental social value currently supplied by the broadcasting band is extremely small.

This is widely recognized. There is general consensus that greater wireless opportunities can be accommodated. The basic policy choice is how to facilitate additional “band sharing.”

III. DTV BAND REALLOCATION

A. Current Policy

In Dec. 2002, the FCC announced its intention to reallocate unused TV channels, expressing a preference for unlicensed radio devices.⁸ In Nov. 2008, the FCC issued an Order to authorize such devices for use in DTV Band “white spaces.”⁹ Such radios (called “white space devices,” or WSDs) are regulated via the FCC’s equipment approval process. To be authorized for manufacture and sale, devices must locate frequencies not in local use by broadcasters and then access just these. Strict power limits are imposed, and approved radios will need to demonstrate that they will reliably avoid emissions that might degrade TV reception.¹⁰

This approach aims to promote band sharing by, first and foremost, protecting DTV broadcasts. This reinforces the key misallocation, which is that the *technically occupied* DTV channels are not *economically employed*. It then compounds the error by seeking to create new, non-exclusive use rights that will render rational reorganization of the band more difficult if not entirely infeasible. Once overlapping, non-exclusive use rights are distributed, the transactions required to efficiently relocate TV stations will flounder in a sea of rights fragmentation.

The cost and complexity of engineering devices to avoid TV station broadcasts has prevented device makers from gaining FCC approval for a single WSD radio design, despite years of rule making, submissions, and tests. Yet the bleaker scenario unfolding is that some devices will be developed and approved, and then render little benefit to users compared to a more efficient structuring of the 294 MHz DTV Band. Indeed, there is no demonstrated demand for WSDs that suggests they will yield value in excess of their spectrum opportunity cost (incurred in allocating “white spaces” for their use). But there is abundant evidence that the opportunity costs incurred will be extremely high. Were video broadcasts either relocated within the DTV Band, consuming much less

⁷ Increasingly, of course, broadcast TV content is also supplied to mass-market customers via broadband connections, fixed and mobile, and through emerging media platforms such as MediaFlo.

⁸ FCC (2002b).

⁹ FCC (2008).

¹⁰ OET (2008).

frequency space, or moved to alternative platforms, effectively releasing all 294 MHz for redeployment, far greater consumer welfare could be generated.

This progressive improvement will not, however, obtain via the path the FCC began in 2002. The under-utilization long extant will continue, as the rights needed to reorganize economic activity are unavailable to the market. Entrepreneurs cannot purchase spectrum inputs and create the far more productive wireless deployments that are possible.

B. The Productive Use of the White Spaces

Some 91% of U.S. households already contract out of the “free” TV delivery system via subscription to cable and satellite systems (MVPD) services.¹¹ These platforms deliver local off-air TV signals. Three competing service options are already in place for connecting the last 10 million TV households¹² that do not subscribe to such services: (a) the local cable TV operator, which passes over 99% of U.S. households¹³; (b) DirecTV, a direct broadcast satellite (DBS) system with a national footprint; (c) Echostar, a DBS system with a national footprint. A fourth video option, via telephone carrier build-outs, is now available to about one-third of U.S. households (Moffett 2009). A fifth platform, MediaFlo’s mobile TV service, is being built by Qualcomm, and aims to cover 200 million pops (about two-thirds of U.S. population) by year-end 2009.¹⁴ Another potential video platform, Multichannel Video Data & Distribution Service (MVDDS), has been licensed although systems have not yet been built. And burgeoning broadband networks supply, with increasing popularity, television programs.¹⁵

Broadcast content delivery over these alternative systems already substitutes for terrestrial video service in the great majority of U.S. households. Importantly, this coverage could be made universal at very low incremental cost. Non-MVPD households can be connected to existing networks at less than \$300 each, including customer premises equipment (set top boxes, dishes, internal wiring) and installation.¹⁶ To expand MVPD coverage to ~100% of households would then cost under \$3 billion in aggregate. Indeed, competitive bidding could well reduce costs much further.

Hence, an FCC policy to facilitate the reallocation of DTV spectrum could (as outlined below) conduct a reverse auction to assign the task of connecting ten million

¹¹ Consumer Electronics Association (Aug. 2009).

¹² There are currently 114 million U.S. households (CEA 2009). The 9% of antenna-only homes then constitute 10.26 million households.

¹³ FCC 2009, par. 30, Table 1.

¹⁴ Eric Savitz, *CES: Audivox Advises Cable Users To Buy An Antenna; Plus, Now You Can Play PS2 Games In The Back Seat*, BARRON’S TECH TRADER DAILY (Jan. 7, 2009).

¹⁵ Wendy Sheehan Donnell, *8 Ways to Watch TV and Movies Without Cable*, PC MAGAZINE (Nov. 19, 2009).

¹⁶ Goldman Sachs analysts estimate the subscriber acquisition cost (SAC) for a new satellite TV customer on the DISH (EchoStar) network at \$455. Of this, \$60 is for marketing and \$100 for commissions. Under the household connection program here, such costs would be avoided. The net wholesale cost for the provider is \$295, of which \$25 is for one “low-end” set-top converter box, and one satellite dish. Armstrong et al. (2009, p. 40).

non-MVPD households.¹⁷ Rival firms or consortia would bid to assume the obligation for distributing broadcast video programming to the defined subset of households. Marginal costs (including royalties) for broadcast content transmission would be nil; a new or existing platform simply replaces existing “free” transmissions. A service operator assuming this obligation captures financial benefits by establishing (via government subsidy) customer relationships with millions of new households. Bids in a procurement auction would reflect anticipated profits from up-selling additional content.

Hence, \$3 billion should be seen as an upper bound estimate of the cost of completing the transition of terrestrial broadcasting to alternative media. The value of the DTV Band, allocated to liberal licenses, is at least two, and maybe three, orders of magnitudes as much. Yet, by keeping TV stations in place and burdening unlicensed devices to detect and avoid broadcast signals that few are watching and that *none gain by watching over-the-air*, the DTV Band will remain economically dormant.

C. Moving the Impediments

In the digital TV band, as in the analog TV band now passed into history, licensees are tightly constrained. A station must broadcast across its entire 6 MHz channel using the ATSC standard set by the FCC. It cannot, e.g., go off the air and use the 6 MHz allocated its license for wireless broadband service. Nor may it reduce its transmissions and, say, use 3 MHz not utilized for TV broadcasts to provide mobile broadband. This lack of flexibility restricts productive use of the band.

The argument for using the “white spaces” for unlicensed devices appeals to the fact that, as currently constituted, there exists a “junk band.” Only 17% of local TV channels are assigned to stations. Most lie idle. The large swaths of under-utilized spectrum provide little value to society. The cost of allowing low-power radios to create some consumer value is then seen as essentially a free lunch.

But that is purely a product of the rigid rules in place. Once those impediments to progress are removed, spectrum resources flow to their highest valued uses. Stations can efficiently rearrange their use of inputs, and the “junk” littering the TV band can be cleaned up. Frequencies then satisfy the most intense consumer demands.

But this rationalization can only occur with the necessary spectrum use rights in place. Policies that focus on authorizing WDSs do not support such a process. Users with non-exclusive “white space” use rights cannot capture any substantial share of the gains that would be created by an efficient relocation of TV stations. In fact, the “unlicensed white spaces” process has *as its objective* the protection of existing DTV broadcasts. This ensures that the DTV Band maintains its junk status.

What is needed are *residual claimants* for the DTV Band, market competitors that are able to capture a portion of the economic value created when TV licensees cooperate to make TV Band spectrum available for new services. The FCC knows exactly how to

¹⁷ Costs would also be driven down by means-testing household eligibility.

create such entities, as it has done so before: via the issuance of liberal license overlays analogous to the A and B PCS licenses auctioned in 1995 (and encumbered by 4,500 microwave licensees); the AWS licenses auctioned in 2006 (encumbered by government users); and the 700 MHz licenses auctioned in 2008 (encumbered by analog TV stations).

As in these proceedings, the overlay license is auctioned. The license grants exclusive control over bandwidth, with very limited usage restrictions, leaving deployment decisions (technologies, network architecture, services, business models) to the market. Interference boundaries are taken from existing FCC rules. Incumbents, in this case including about 1,750 full power television stations, are vested. They are therefore allowed to continue broadcasting, and are protected from signal degradation by the overlay licensee (or others). They are allowed, however, to relocate their TV station, using another channel for broadcasting, or to vacate the terrestrial off-air distribution method in favor of other delivery platforms. The FCC *may or may not* maintain a mandate that the TV station licensee continue to make its content available, without charge, to all households within the local market.

D. A Base Case Overlay Band Plan

There are many formats to use in reallocating the DTV Band. Here is one plan that translates current U.S. policy into an alternative structure designed to overcome the common interest tragedy dissipating TV Band value:

- divide the 294 MHz DTV Band into seven national overlay licenses;
- allocate each overlay seven contiguous TV channels (42 MHz), reducing borders (as opposed to non-contiguous channel allotments);
- allot overlays exclusive, flexible-use rights as defined in the 700 MHz licenses previously sold at auction,¹⁸ subject to incumbents' encumbrances;
- grandfather DTV broadcast incumbents indefinitely¹⁹;
- DTV stations are required to distribute video content free-to-viewer, but the mandate is platform-neutral;
- overlay licenses are sold at auction;
- limit two per customer.

¹⁸ These rules should permit business models to be determined by the market, but if the FCC elects to impose regulatory rules similar to those embedded in the 700 MHz C block licenses auctioned in March 2008 (with "open access" requirements), such choices are easily accommodated in the overlay structure.

¹⁹ Protections for incumbents (interference contours) can be defined as in 700 MHz licenses. Those licenses, and subsequent FCC rules, permitted Qualcomm to buy emission rights from analog TV stations so as to launch MediaFlo, using Channel 55, prior to the analog TV switch-off.

TABLE 2. A BAND PLAN FOR DTV OVERLAY LICENSES							
<i>License</i>	A	B	C	D	E	F	G
<i>TV Channels</i>	2-8	9-15	16-22	23-29	30-36	38-44	45-51
<i>MHz</i>	42	42	42	42	42	42	42

This auction would assign rights to the most valuable bandwidth yet sold. It would result in efficiencies to offer either national licenses or combinatorial bidding for regional licenses, facilitating new network formation or (for existing carriers) network expansion.

The thrust of the policy innovation is to rationalize band usage. When an overlay licensee moves a TV station to another band or medium, it owns a more valuable spectrum space. That potential, in turn, drives the overlay licensee – and financial markets -- to fund the actions necessary to create such value increases. This investment process is missing under current policies.

Overlay licensees will bargain with broadcast TV stations to move. Under one option, TV stations could cluster on adjacent frequencies with transmitters that are co-located (operated from the same point) in each market. Alternatively, stations could move entirely to MVPD coverage. An important step to facilitate this spectrum-freeing migration would be the execution of long-term carriage contracts with cable and satellite TV operators. This is discussed below.

Each national overlay license will be encumbered by an average of about 250 vested, full-power TV stations. PCS overlays were able to relocate some 4,500 microwave incumbents (Cramton, Kwerel & Williams 1998). With the 700 MHz licenses purchased at auction by Qualcomm, dozens of incumbent TV stations broadcasting on Channels 54, 55, or 56 agreed to permit MediaFlo transmissions that potentially interfered with their viewers' reception (Hazlett 2008b).

These experiences are instructive. Four factors suggest that the same productive negotiations seen previously would result from DTV overlays. First, there is no veto afforded to a single TV station owner. Overlay licensees are not forced to gain unanimous consent before permitting new services; hold-outs can block only the use of the bandwidth allocated to their license (one 6 MHz block in one TV market). Second, it is costly for incumbents to hold-out. Because existing broadcast transmissions afford virtually little, no, or negative marginal product, and because airwave values are rich when moved to other employments, stations lose by deferring reasonable offers.

Third, overlay auctions encourage pre-auction contracting to reduce bargaining costs. To the degree that incumbent stations *are* able to block productive activities and resist reasonable buy-out offers, they become valuable partners for auction bidders. Auction participants that face lower costs in enlisting post-auction cooperation will reveal

a higher (private) value for licenses, out-bidding rivals. This reduces transaction costs, as parties gain by cooperating through the process.

Fourth, the Government can assist reorganization by arranging guidelines for voluntary, or by mandating imposed, arbitration procedures. The latter was done, successfully, with PCS licenses. It was also done, less successfully perhaps, with AWS licenses (O'Brien Ham 2009), presumably because the public, non-profit licensees are less subject to economic incentives. The DTV Band, where stations are owned by both private and public enterprises, could be subject to similar negotiated settlements. The FCC could fruitfully use established expertise in spectrum reallocation, including that held by agency staff, administrative law judges, and employees of the Departments of Commerce, Defense, and the Office of Management and Budget, as well as a review of arbitration procedures used by spectrum management authorities in other countries, to improve coordination mechanisms.

In dealing with such questions, it is essential that policy makers focus not on exhaustive contour definitions but on creating (imperfect) bundles of rights that can be productively utilized. That means, e.g., that broad licenses in scope are generally preferred to small licenses. This reduces the costs of defining borders by reducing the number of borders. It is why national or large regional licenses are recommended as opposed to local licenses in the Base Case Overlay Plan offered herein. And it is also why, were local or regional licenses substituted for national licenses, as in the AWS and 700 MHz auctions, that the auction include combinatorial bidding.²⁰ By allowing the auction to efficiently aggregate licenses, transactions costs can be reduced.

A tragedy of the anti-commons need not loom simply due to the presence of a large number of independently owned incumbents. The Nextel wireless network was created by the aggregation of over 41,000 Specialized Mobile Radio (SMR) licenses in secondary markets (Hazlett 2003b). It is not the number of contractual agreements that creates gridlock, but the complementary, overlapping nature of such fragmentary rights.

E. Policies to Maintain “Free to Home” TV Content

To facilitate the migration of TV stations out of terrestrial broadcasting, the FCC may wish to maintain the delivery of “free” (non-subscription) broadcast video content to U.S. households.²¹ This can effectively and inexpensively be done for virtually all U.S.

²⁰ Despite planning to use combination bidding since 2000, only very limited use of has been made of this auction feature, and it has not countered the fragmentation problem entailed by the use of small (much less than national) license areas. See Hazlett, Porter & Smith (2009). Combination bids are even more important in the aggregation of DTV spectrum because of the high social utility of using overlay rights to overcome coordination problems.

²¹ While this is seemingly the political equilibrium, it is not recommended. First, the vast majority of households, including those of lower-income Americans, already contract for video services. Second, while thought of as a “universal service” policy, TV broadcasting leaves much of the country (in both urban and rural areas) without full coverage – one of the drivers of the 91% MVPD penetration rate. Third, the government does not subsidize television sets and this policy does not deter 98% of households from purchasing such units. Fourth, even if there were an equity problem (low-income Americans are excluded

homes²² by imposing a rule that households that have not subscribed to MVPD services over the past 24 months – about 10 millions homes -- would be eligible for the installation of a new connection to deliver ‘broadcast-only’ service at no cost to the home for a period of n years.²³ To assign responsibility for this task, at least two alternative approaches are possible:

- a Government subsidy offered to non-MVPD households equal to x ($x < \$300$); or
- the FCC holds a reverse auction to equip non-MVPD households with MVPD ‘broadcast TV’ service.

Vouchers. Similar to the DTV set-top box coupon program, vouchers could be issued to households submitting online applications. The recommended rule: one voucher per household, each redeemable for, say, \$200. The vouchers would be redeemable by cable TV, satellite TV, telco TV, or broadband service providers, which would then guarantee delivery of ‘off-air video signals’ (which may cease to be ‘off air’ in the future) for a period of years specified by the FCC. To qualify for a voucher, a household would have to certify that the residents of the home have not subscribed (at any address) to MVPD service over the previous two-year period. A set number of vouchers would be allocated (say, 10 million), and the program would end (or be refunded) when the specified number of coupons was issued. This method allows multiple providers to supply services through the subsidy program.

Procurement Auction. A way to assign the task to a particular provider (which could still contract with other operators to help achieve full coverage) would result from an FCC-implemented reverse auction. Firms would be invited to bid for the liability specified by the Commission. The winner of the auction, bidding the lowest price (to be paid the winner), would be obligated to provide a set number of households (e.g., 10 million) ‘broadcast TV signals’ for a specified period of years. This liability should sell for less than \$3 billion.

A variety of firms and consortia would be likely to bid. Cable system operators and satellite TV firms could extend their systems at low cost, and would make efficient suppliers. Broadcasters would be likely partners. MVDDS licensees or MediaFlo might also be partners or stand alone bidders, using the payments to enter the fixed video market. All providers would bid with an eye to extending their networks to additional customers, selling other services. These efficiencies lower the cost of socially useful band clearing activity.

from valuable news and entertainment programming), direct cash subsidies are the least-cost remedy. Subsidizing TV access is a perverse way to improve the position of those in poverty. Fifth, other countries do not offer subsidies for TV viewing. Indeed, the U.K. taxes households about \$250 per year in the antenna license fee (such funds going to finance the BBC) without seeming to much discourage TV access.

²² It is important to recall that many U.S. homes cannot currently receive high-quality off-air DTV signals.

²³ Presumably, n would be set at five or ten years. The policy would then be revisited by regulators, deciding whether to renew the agreement and, if so, on what terms. Contract terms for the reverse auction winner would clarify the licensee’s rights as to renewals.

By either policy path, a program to continue government support for ‘off-air TV’ programming by technology-neutral means would result in (a) higher revenues from the overlay auction, as transitioning TV stations to non-broadcast platforms would be less expensive; (b) maintenance of the public interest in zero-priced access to broadcast TV content, even as DTV bandwidth migrates to more valuable employments.

F. License Limits

The restriction of bidders to just two licenses each is a policy designed to enhance efficiency in output markets by limiting concentration among suppliers. This effort is not without cost, as it may also restrict the flow of bandwidth to the most efficient service providers. Quite often, this includes the largest existing networks. These carriers exploit economies of scale and scope, delivering value to customers that, in turn, accounts for their size.

Trade-offs between efficient scale and market power are a key regulatory determination. Caps on licenses (or bandwidth) are crude, if easily imposed, devices intended to strike a balance. FCC policy, which originally imposed a 45 MHz “spectrum cap,” has relaxed explicit rules (abolishing the spectrum cap in 2003) and has allowed carriers to aggregate considerably more bandwidth. This outcome was driven by customer demand, on the one side, and supply-side efficiencies, on the other. Today analysts observe that the FCC, while having dropped an official spectrum cap, maintains informal policies that seek to allocate spectrum across at least four wireless carriers. The two-license cap would continue this approach, permitting access of up to 84 MHz for three bidders, and a least 42 MHz for a fourth.

A tighter cap – one license each -- would likely be considered by the FCC. This would impose deconcentration limits so as to mandate market entry. New rivals should be welcomed, but the policy of abundant spectrum availability – auctioning seven 42 MHz licenses -- does that. This will drive down the price of bandwidth (Hazlett 2008c). A one-license limit would constrain carriers able to productively deploy more than 42 MHz of bandwidth, reducing the social value of spectrum resources. This is a prime consideration in the current analysis of the mobile broadband tsunami, where large increments – considerably more than 42 MHz per carrier – are being demanded in coming years.²⁴ Hence, the recommendation in this paper.

G. Bandwidth Allocation for Unlicensed Devices

The use of overlays would not necessarily end DTV Band access for WSDs. The FCC can, in fact, use the overlays to create more effective unlicensed bands, frequency spaces that will not impose the high overhead devoted to “detect and avoid” the local presence of a broadcast TV station.

²⁴ See, e.g., Meyer (2009a). It is highly significant that the trade association for mobile carriers is now actively lobbying for additional bandwidth allocations. This has not always been the position of incumbent networks, and underscores the *social value* of additional liberal licensed allocations.

Suppose, for instance, that the FCC decided that one overlay should provide 20 MHz of cleared bandwidth for unlicensed use. The license would be sold with this encumbrance; the license holder would then relocate TV station broadcasts encroaching on the specified bandwidth to satisfy the obligation.²⁵ The license price would be discounted to reflect the expected cost of the band clearing operation, and could be negative (the government paying the overlay licensee). In any event, the result would be that unlicensed devices could access dedicated, nationwide bandwidth, shedding the overhead of detection and avoidance of interspersed TV broadcasting signals.

Rather than mandate a particular set of rules for spectrum use, as with unlicensed WSD authorizations, the more efficient path is to allow auction bidders to buy overlays that they would then use for “unlicensed spectrum” applications. Devices would access the spectrum, without wide area network support, and the licensee would capture payments from device license fees levied on vendors (Kwerel & Williams 2002). Competitive firms would then act as their own “FCC,” authorizing radios. Alternatively, device makers could, individually or as a consortium, cut out the broker and integrate into spectrum ownership. Finally, public agencies could directly acquire (through market purchase or government taking) bandwidth after the overlay auctions. This allows far greater transparency, revealing the opportunity costs of alternative wireless applications.

H. Must Carry Rights

Some broadcasters have a strong incentive to continue off-air transmissions to retain “must carry” rights mandating that cable and satellite systems include their programs. Some suggest that Congress simply redo the rights, granting them to broadcasters in perpetuity but not making them dependent on off-air transmissions. That approach would not be credible. Station owners understand that stand alone must carry rights would be insecure. Indeed, the constitutionality of “must carry” was premised, by the Supreme Court in *Turner*,²⁶ on maintaining the economic viability of free, over-the-air television. Ending broadcasting removes the rationale.

Negotiated agreements among private parties may achieve what regulation cannot (see, e.g., Doucet & Littlechild 2009). Here, private contracts can easily be written to guarantee long-term carriage of TV signals on cable and satellite systems. In fact, this contractual form is commonplace; hundreds of cable TV program networks are distributed to 100 million MVPD subscribers via long-term contracts.

The value-creating terms of the “broadcast” delivery guarantee are simple to outline. Overlay owners evince demand for carriage, as this helps to eliminate broadcast emissions, increasing spectrum value. MVPD providers have the capacity to supply such carriage and, indeed, already do. Shifting an existing (must carry) liability to a long-term commitment, in exchange for consideration, improves the position of the MVPD operator. The price paid would likely be modest, in that local TV station content is

²⁵ Of course, two adjacent bands with the same 20 MHz unlicensed obligation could be created to result in a 40 MHz unlicensed WSD Band.

²⁶ *Turner Broadcasting System, Inc. v. FCC*, 512 U.S. 622 (1997).

valuable to viewers and the MVPD system is competitively constrained. This retail rivalry pre-empts hold-up.

I. Protecting Other DTV Band Incumbents

Low-power TV (LPTV) stations and wireless microphones also access DTV airwaves. LPTV licensees could be vested in the same manner as full-power stations, and then relocated by overlay licensees. Given their small footprints, tenuous financial position, and the high desirability of shifting programming to local cable TV systems,²⁷ transactions (overlays paying cable operators to guarantee carriage in exchange for a cessation in broadcasting) would be likely. To ensure timely negotiations and prompt transitioning, overlay licenses could impose arbitration time lines as with PCS licenses.

Wireless microphones have been used as “white space devices,” free to roam through vast, unutilized stretches of the TV Band.²⁸ As such, wireless microphone makers and users have faced no opportunity costs in wasting spectrum (Marcus 2008). Wireless microphone technology has stagnated. But, if faced with incentives to economize, much lower cost spectrum inputs for wireless microphones are easily found. Former FCC Chief Engineer Michael Marcus sees AWS spectrum, where 90 MHz (in the 1.7 GHz and 2.1 GHz bands) was allocated to licenses sold by the FCC in 2006, as a cheap alternative. U.K. regulators have elected to pack wireless microphone transmissions into one 8 MHz TV channel (UHF channel 69 in the U.K.).²⁹

To create the proper incentives, U.S. regulators could vest wireless microphone users with specified frequency rights. An exclusive licensed band of no more than 8 MHz would suffice; other arrangements are possible. A recognized wireless microphone industry group should then be authorized to bargain with the overlay owner to adjust boundaries.

Proponents of unlicensed use of U.S. white spaces correctly note that wireless microphones squander resources, arguing that migrating these devices to less costly alternatives “would result in better long-term spectrum utilization” (NAF 2007, p. 21). But the stated cause of the problem is misconstrued: “*Free licensed spectrum with economic externalities usually results in lower direct costs to users than spectrum use based on marketplace forces...*” (Ibid.; emphasis original). The fact that licenses have

²⁷ LPTV stations already seek, and in some instances, obtain, cable carriage. A cable channel carriage deal delivering an LPTV station’s content for 2 hours per day – or per week – may produce higher ad revenues than 24/7 off-air LP broadcasting.

²⁸ Wireless microphones are licensed by the FCC but licensees are not assigned exclusive control over specific bandwidth. Moreover, “The FCC rarely enforces the licensing requirements on the microphones because there have been so few complaints. The microphones are programmed to avoid television channels.” Jon Dunbar, *Airwave Concerns Prompt Proposal to Ban Some Wireless Microphones*, WASHINGTON POST (Aug. 22, 2008); <http://www.washingtonpost.com/wp-dyn/content/article/2008/08/21/AR2008082103267.html>.

²⁹ Michael Marcus, *UK’s Ofcom Proposes Unlicensed TV White Space Devices* (Dec. 14, 2007); <http://spectrumtalk.blogspot.com/2007/12/uks-ofcom-proposes-unlicensed-tv-white.html>.

been granted without charge is not the problem, however. Nor is the presence of “economic externalities.”³⁰

Rather, the lack of exclusive rights over the spectrum pre-empts the process wherein those suffering harmful effects outbid the current users of the band. The wireless microphone makers and their customers own a non-exclusive right to pollute, and this pollution blocks a great deal of productive activity. Were they to actually own the spectrum inputs in question they would behave differently. This would not end “economic externalities,” but phase out those applications worth less than their cost. In short, the tragedy caused by wireless microphone is a product of the rules issued under administrative allocation of radio spectrum – precisely the regime that the unlicensed white space devices would radically expand.

J. Defining and Enforcing Emission Rights

The rights of overlay licensees should be subordinate to the incumbent users of the DTV band – the latter are “secondary” and the former are “primary” licensees in FCC parlance. But the crucial aspect of the overlay policy is to allow efficient reorganization of spectrum space. This can be assisted by clarity in the initial rights of the rival users, constrained by the costs of such clarity.

The FCC has often erred in previous regulatory proceedings by positing that its role was to eliminate “harmful interference,” or to “clearly and exhaustively” define new and existing wireless use rights.³¹ Both have been said to be necessary predicates for the market to work. Without certainty in the scope of such rights, private transactions will collapse.

This is a serious analytical misconception. Perfect clarity in the rights of spectrum users can never be achieved, nor can the elimination of “harmful interference” be complete. Moreover, the costs of achieving better, more extensive certainty in the rights of licensees are substantial. That is particularly true with respect to the deployment of possible technologies or business models that will not be known *ex ante*, to regulators or market actors. There is simply no way to pre-empt all future disputes over emission contours, and the process by which such questions are resolved is a natural part of the resource allocation process.

The FCC should aim to define rights that are reasonable starting points for market activity and which will permit a process to commence that out-performs top-down administrative allocation. The latter system, having been in place since 1927, has allocated TV spectrum in ways that impose decades-long rigidities. We have seen that new services and innovative technologies have been stymied. It is not perfection that the spectrum reallocation of overlays must improve upon, but the extant system.

³⁰ Coase (1998) explains just this misunderstanding of “economic externalities,” some of which has appeared in the discussion and application of his well-read 1960 article on social cost (which assiduously avoided use of the term “externality”).

³¹ See, e.g., FCC (2002a).

Under this system, FCC Chair Julius Genachowski estimates that spectrum takes “a long time – an average of over 9 years – to get... back.”³² It does not take a perfect alternative to improve upon this regulatory bottleneck.

K. Shifting Incentives from Protectionism to Gains from Trade

Under the FCC’s unlicensed “white spaces” approach, a rent seeking equilibrium seeks to *extend and protect* broadcast television. In the FCC’s 2008 Order, advocates for WSDs are cited as opposing the use of overlays because they would move over-the-air broadcast stations. In response to the argument that overlay “licensees would be able to negotiate with TV broadcasters to relax the interference requirements in individual situations, and thereby allow greater use of the white spaces,” proponents of unlicensed allocations respond:

[A]llowing broadcasters to negotiate to allow greater interference from white space devices would be contrary to broadcasters’ public interest obligations to provide free TV service to viewers because some TV viewers would lose the ability to receive over the air TV service (FCC 2008, par. 40).

Hence, the case for unlicensed WSDs embraces protection of the TV Allocation Table of 1952, thwarting efforts to “unjunk” the band. That the argument is analytically incorrect – the “broadcasters’ public interest obligations to provide free TV service” could be met at far lower social cost by shifting to alternative delivery platforms – is less interesting than the regulatory strategy revealed. The policy of rights fragmentation under the unlicensed model opposes market mechanisms that would pre-empt administrative allocation. This mandate is sufficiently powerful as to lead to a defense of an antiquated TV broadcasting structure that destroys social wealth and blocks the great majority of the rich bandwidth that white space device users now seek to access, if only in slivers. Under a better regulatory plan, however, those slivers would turn into wide swaths of rich, fertile spectrum space – for all kinds of wireless devices, services, and networks, potentially including those supplied via WSDs.

IV. SALVAGING A “JUNK BAND”

It is, of course, most important that we ensure that new unlicensed devices do not interfere with the incumbent licensed services in the TV Bands. (FCC 2008, par. 33)

The current DTV Band proceeding begins with the premise that TV broadcast stations are the most valuable use of 294 MHz of radio spectrum and that whatever

³² John Eggerton, *FCC Chairman Not Sure FCC Can Gauge Spectrum Demands*, BROADCASTING & CABLE (Nov. 18, 2009). The long lags required to “get spectrum back,” it should be noted, form a key reason why the FCC should not attempt that path, but rather permit market reallocation.

additional communications can be squeezed in via unlicensed devices are a bonus. But “white spaces” or “taboo channels” are not natural artifacts. They are a product of the administrative allocation system.

The idea that TV broadcasting occupies the DTV Band is an optical illusion. In economic terms, TV broadcasting wastes the DTV Band. The white spaces do not occupy 12 MHz or 48 MHz nationwide, but 294 MHz.

Advocates for unlicensed devices insist that, “The whole point... is to build a device that *doesn't* interfere with TV signals.”³³ To date, the FCC has agreed. The administrative allocation regime has frozen TV stations in place, and since 2002 has sought to sprinkle tiny, overlapping, non-exclusive use rights all around them. The tragedy of the anti-commons is leveraged. The transactions necessary for efficiency cannot be realized because the necessary band-clearing investments cannot be made.

Establishing overlays to the DTV Band will end this misallocation, freeing up enormously valuable spectrum inputs and encouraging the world-class wireless innovation the American public deserves. This short paper describes a Base Case that would, if implemented, enable the necessary social coordination to take place. Tailoring such a strategy to the specific policy choices of the current Commission would be an integral part of that implementation. As outlined here, the Plan can be criticized as imperfect and incomplete. But it stacks up very well against the past 60 years of FCC TV Band allocations. The U.S. economy would prosper were that top-down administrative system reformed in the manner suggested here.

³³ Cade Metz, *TV Giants Lock Horns with Microsoft and Google Over White Space Wireless Play*, THE REGISTER (Oct. 13, 2008) (reporting on the comments of Ed Thomas, former FCC Chief Engineer).

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