

Right-sizing Spectrum Auction Licenses:

The Case for Smaller Geographic License Areas in the TV Broadcast Incentive Auction

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I. Executive Summary

The wireless sector is a key contributor to economic activity and growth. Over the next several years, wireless service providers are expected to invest \$25 to \$53 billion upgrading and expanding their networks to deploy 4G mobile broadband across the nation. All told, wireless broadband investment and the services and innovation supported by such investment are expected to add between \$259 and \$355 billion to US GDP each year through 2017.

The Federal Communications Commission ("Commission" or "FCC") is currently designing several spectrum auctions including the largest ever auction of terrestrial wireless spectrum, currently planned for 2015 (the "Incentive Auction").¹ The purpose of the Incentive Auction is to free up to 120 MHz of prime spectrum in the 600 MHz band, currently licensed to over-the-air TV broadcasting, to be repurposed for licensing for mobile broadband and other higher value wireless services. To accomplish this goal, the FCC proposes to use a two-part auction process in which broadcast television license holders submit bids for relinquishing their licenses ("Reverse Auction"); and commercial broadband providers bid to acquire licenses to the spectrum freed up ("Forward Auction"). The FCC is currently evaluating various auction design elements to promote competition in the auction. To best ensure this important goal, the FCC is considering a number of auction design features, including spectrum aggregation limits, constraints on the types of bidding allowed, and the appropriate framework to use for the license territories to be used in the Forward Auction. This paper focuses solely on this last issue. We explain here how adopting appropriately small-sized geographic territories is necessary to promote competition and other important economic and social goals, while noting that right-sizing the license territories may not by itself be sufficient to ensure adequate competition and participation in the Forward Auction. For example, the Commission could adopt smaller license sizes and still end with an auction where the two largest wireless carriers aggregate all of the offered spectrum. Such an outcome would be inconsistent with the goal of promoting competition in wireless services.

The territory size used for spectrum licenses is as important for valuing spectrum as the parcel size is to real estate value. If all plots were 50 acres, parcels in Manhattan would be too expensive and too large for most; this might compel buyers interested in a small parcel in Manhattan or a parcel in New Jersey adjacent to Manhattan to bid for land they don't want. Alternatively, otherwise qualified buyers might be prevented from buying land altogether. Analogously, *wrong-sizing* spectrum license territories to be used in future spectrum auctions, and in particular the Incentive Auction, is likely to result in significant and unnecessary inefficiencies in the allocation of scarce radio frequency spectrum resources. For carriers who are compelled to bid for wrong-sized spectrum license packages, the added cost may be sufficient to discourage their participation; or if they do participate, they are less likely to offer successful bids; or if they are successful, they will

¹ *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Notice of Proposed Rulemaking, GN Docket No. 12-268, 27 FCC Rcd 12357, 12411 ¶ 148 (2012) (hereinafter *Incentive Auction NPRM*). The auction was originally planned for 2014, but has been delayed until at least mid 2015.

have fewer resources available to deploy services using the spectrum. In each case, the efficiency of the auction and the larger goals of the process suffer.

This paper explains why sufficiently small geographic areas, such as Cellular Market Areas ("CMAs"), are a more appropriate license territory framework to use to ensure that licenses are *right-sized* in the Forward Auction. Industry participants and the FCC have successfully used smaller geographic license sizes to auction spectrum in the past, and doing so in the Forward Auction offers important advantages. Using smaller territories is better than using the larger Economic Areas ("EAs") or even intermediate-size Partial Economic Areas ("PEAs") because smaller areas efficiently match the needs of bidders to the spectrum they seek. Their use ensures that the planned auction will reallocate spectrum resources efficiently while promoting competition, economic growth, and universal broadband service.

Smaller license areas are better than EAs because smaller areas will help to maximize the amount of spectrum that is repurposed for the Forward Auction. Specifically, smaller areas should increase the ability to allow for market variation in areas where limited amounts of spectrum are procured through the Reverse Auction, while reducing the amount of spectrum lost due to international border coordination with Canada and Mexico or other encumbrances. Smaller geographic license sizes should also maximize opportunities for efficient participation by both large and small wireless service providers, and promote efficient build out of spectrum acquired through the Forward Auction. Looking at past auctions, evidence suggests that auction proceeds would be optimized through the use of smaller areas as opposed to EAs. Moreover, using smaller territories is more consistent with the long-term direction of efficient spectrum management reform and future wireless markets, including access to spectrum through secondary market transactions. Finally, this paper rebuts some of the arguments made to date against the use of smaller geographic license areas.

Interested parties, particularly the Competitive Carriers Association ("CCA") and their members, have pressed the FCC to license the Forward Auction licenses using smaller territory sizes. These efforts, which included sponsoring an earlier draft of this paper, resulted in a compromise, intermediate solution. The FCC has moved from recommending that the Forward Auction be licensed using Economic Area territories to a compromise territory size based on Partial Economic Areas ("PEAs").² Nonetheless, the debate over the appropriate territory size for FCC licenses continues. As the future of spectrum management is trending toward more granular management of spectrum resources (in space and time), moving toward smaller area regulatory licenses is consistent with this trend; however, the debate continues. We emphasize that while the geographic area of the license is important, there are many other features that must also be considered holistically in order to design an appropriate spectrum auction or management framework, and as such, are likely to vary by band. The focus of the analysis here, while applicable more generally, is on the design of the upcoming Broadcast Incentive Auctions.

² See paragraph 69 in *Report and Order*, In the Matter of Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, Before the Federal Communications Commission, Docket No. 12-268, released June 2, 2014 ("FCC R&O Incentive Auctions"), available at https://apps.fcc.gov/edocs_public/attachmatch/FCC-14-50A1.pdf. This expands the number of license territories from 176 EAs to 416 PEAs, which is less than the 734 CMAs.

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II. Background

In 2010, the Federal Communications Commission released its National Broadband Plan, outlining its long-term plan for increasing spectrum for wireless broadband.³ A key element of the Plan calls for the reallocation of up to 120 MHz of television broadcast spectrum to wireless broadband. Although the FCC has used auctions as its primary method of allocating licenses since 1994, Congress recently granted the FCC authority to conduct the first-ever Incentive Auction.⁴ This auction will reclaim spectrum in the 600 MHz band by offering payments (incentives) to TV Broadcasters to motivate them to surrender their licenses and make the spectrum available for other wireless uses, including mobile broadband.

A. Goals of the Incentive Auction

Congress established a lofty goal for the Incentive Auction to unleash investment and innovation by repurposing the maximum amount of broadcast spectrum for flexible licensed and unlicensed use for the benefit of consumers, economic growth, and U.S. global competitiveness, while preserving a diverse broadcast television service.⁵ In the Spectrum Act, Congress also reaffirmed the FCC's authority to adopt rules of general applicability, including those concerning spectrum aggregation, that promote competition.⁶

1. Unleash Innovation and Investment

The wireless sector is a key contributor to economic activity and growth. Wireless service providers in the U.S. had revenues of \$185 billion and capital investments of \$30 billion in 2012.⁷ A recent study estimated that wireless broadband investment and the services and innovation they will support will add \$259 billion to \$355 billion to U.S. GDP each year through 2017.⁸ Over the

³ Fed. Communications Commission, CONNECTING AMERICA: THE NATIONAL BROADBAND PLAN, (Mar. 2010), available at <http://www.broadband.gov> (hereinafter *National Broadband Plan*).

⁴ Congress provided the FCC with the authority for this ambitious undertaking through the Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, §§ 6402-03, 125 Stat. 156 (2012) (hereinafter *Spectrum Act*).

⁵ More specifically, the FCC identifies key policy goals for the Forward Auction band plan including utility, certainty, interchangeability, quantity and interoperability. See *Incentive Auction NPRM*, *supra* note 1, at ¶¶ 10, 125.

⁶ See *Spectrum Act*, *supra* note 4, § 6404(B). Spectrum aggregation limits are a policy consideration that should be evaluated separate and apart from the multiple advantages of smaller geographic license sizes set forth in this paper; that is to say, the Commission could adopt smaller license sizes and still end with an auction where one or two wireless carriers aggregate all of the offered spectrum, contrary to the goal of promoting competition in wireless services.

⁷ CTIA – The Wireless Association, U.S. Wireless Quick Facts, <http://www.ctia.org/advocacy/research/index.cfm/AID/10323> (last visited Nov. 12, 2013).

⁸ Alan Pearce *et al.*, Information Age Economics, WIRELESS BROADBAND INFRASTRUCTURE: A CATALYST FOR GDP AND JOB GROWTH 2013-2017 1 (Sept. 2013), available at http://www.pcia.com/images/IAE_Infrastructure_and_Economy.pdf.

next several years, wireless service providers are expected to invest \$25 billion to \$53 billion upgrading and expanding their networks to deploy 4G mobile broadband across the nation.⁹ Mobile broadband services are critical to the realization of innovation and investment in a host of new and promising technologies and services such as machine-to-machine (M2M), smart health, smart farming, and mobile commerce.

Radio frequency spectrum is an essential resource for realizing this wireless bonanza. The FCC's Incentive Auction has the potential to help unleash innovation and investment in the wireless industry by significantly expanding access to prime spectrum resources. To ensure this is accomplished and that the benefits of the wireless future are realized across the nation, it is important that the planned auction promote competition and broad participation across the industry. This includes ensuring that smaller operators are able to participate.

Smaller operators are important for addressing the needs of underserved rural markets and contribute significantly to enhancing consumer choice and competition and to wireless investment.¹⁰ For example, the third through tenth largest wireless providers in the U.S. invested a combined \$5.5 billion in capital expenditures in 2012.¹¹

2. Free Maximum Quantity of Spectrum

In response to the innovative uses of mobile broadband, mobile traffic is growing rapidly. Cisco's Visual Networking Index forecasts that global mobile traffic will grow at a compound annual rate of 66 percent through 2017, and the number of mobile-connected devices will exceed the world's population by the end of 2013.¹² To meet this demand, the FCC plans to reallocate as much prime spectrum as possible from underutilized broadcast television bands to wireless broadband. Two challenges associated with meeting this demand will be accommodating variable spectrum supply and clearing sufficient spectrum channels in high-demand metropolitan markets in the Reverse Auction. Estimates of how much spectrum will be cleared have varied. Although the auction

⁹ Deloitte, THE IMPACT OF 4G TECHNOLOGY ON COMMERCIAL INTERACTIONS, ECONOMIC GROWTH, AND U.S. COMPETITIVENESS 7 (Aug. 2011), available at http://www.deloitte.com/assets/Dcom-UnitedStates/LocalAssets/Documents/TMT_us_tmt/us_tmt_impactof4g_edited060612.pdf.

¹⁰ See, e.g., Raul Katz *et al.*, Telecom Advisory Services, LLC, ECONOMIC IMPACT OF WIRELESS BROADBAND IN RURAL AMERICA (Feb. 2011), available at <http://competitivecarriers.org/wp-content/uploads/2011/02/Economic-Study-02.24.11.pdf>.

¹¹ The two largest operators, Verizon and AT&T, accounted for approximately \$20 billion of the \$30 billion in capital expenditures reported by the CTIA.

¹² Cisco Systems, Inc., CISCO VISUAL NETWORKING INDEX: GLOBAL MOBILE DATA TRAFFIC FORECAST UPDATE, 2012-2017 3 (Feb. 6, 2013), available at http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf. While it is clear that mobile traffic is growing rapidly, there is a history of overly-ambitious forecasts. For a further discussion see Mehta, Aalok and Musey, J. Armand, *Overestimating Wireless Demand: Policy and Investment Implications of Upward Bias in Mobile Data Forecasts* (August 15, 2014). Available at SSRN: <http://SSRN.com/abstract=2418364>

originally targeted clearing the full 120 MHz of spectrum, more recent forecasts have anticipated lower amounts.¹³

3. Promote Consumer Welfare, Economic Growth, and Competitiveness

Enhanced competition will help lower prices, expand customer choice, and encourage innovation. In turn, realization of these goals will help promote consumer welfare, economic growth, and U.S. global competitiveness today and in the future.

The FCC recognizes that:

Promoting competition is a fundamental goal of the Commission's policymaking. Competition has played and must continue to play an essential role in the mobile wireless industry – leading to lower prices and higher quality for American consumers, and producing innovation and investment in wireless networks, devices, and services.¹⁴

4. Allow for More Flexible Spectrum Usage Longer Term

Both the National Broadband Plan and the President's Council of Advisors on Science and Technology (PCAST) Report found that spectrum needs cannot be fully met by merely auctioning cleared spectrum.¹⁵ The PCAST report, in particular, recommended additional mechanisms to optimize spectrum utilization and encouraged the development of more efficient secondary markets for spectrum licenses. As the Commission noted in the Incentive Auction NPRM, facilitating well-tailored license sizes will:

facilitate the efficient use of spectrum by providing licensees with the flexibility to make offerings directly responsive to market demands for particular types of services, increase competition by allowing market entry by new entrants, and expedite provision of services to areas that might not otherwise receive service in the near term.¹⁶

¹³ See, e.g., CTIA – The Wireless Association and Consumer Electronics Association, BROADCAST SPECTRUM AND INCENTIVE AUCTIONS WHITE PAPER (Feb. 15, 2011), *available at* http://files.ctia.org/pdf/CTIA_CEA_TV_Spectrum_Whitepaper.pdf. More recently, it appears the FCC has scaled back its original expectations to 80MHz (see, "FCC Issues Rules for First-Ever Incentive Auction of TV Broadcast Spectrum," Skadden, Arps, Slate, Meagher & Flom, LLP, 13 June 2014, *available at* <http://www.skadden.com/insights/fcc-issues-rules-first-ever-incentive-auction-tv-broadcast-spectrum>).

¹⁴ *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Mobile Conditions with Respect to Commercial Mobile Services*, Sixteenth Report, WT Docket No. 11-186, 28 FCC Rcd 3700, 3958 ¶ 410 (2013) (hereinafter *FCC's 16th Wireless Competition Report*).

¹⁵ *National Broadband Plan* at 78-79; President's Council of Advisors on Sci. & Tech., Executive Office of the President, REPORT TO THE PRESIDENT: REALIZING THE FULL POTENTIAL OF GOVERNMENT-HELD SPECTRUM TO SPUR ECONOMIC GROWTH xi, xii (July 2012) (hereinafter *PCAST Report*).

¹⁶ *Incentive Auction NPRM*, *supra* note 1, at ¶ 385.

In the future, it is expected that more dynamic reassignment of spectrum rights on a time and geographic basis will be more common, and adopting smaller territory sizes will help facilitate such transactions.¹⁷

5. *Raise Auction Revenue*

The Incentive Auction, like other FCC spectrum auctions, is targeted to raise significant net revenues. Above and beyond the compensation to television broadcasters whose licenses are to be relinquished as a consequence of the Reverse Auction, the Spectrum Act requires that the Incentive Auction raise \$1.75 billion for reimbursing the remaining television broadcasters for the costs of "repacking" their channels into the remaining television spectrum.^{18,19} The Incentive Auction, in conjunction with other spectrum auctions such as the H Block (FCC Auction 96, completed Feb 2014) and AWS-3, are also expected to serve as a source, possibly the entire source, for funding the \$7 billion for FirstNet, a planned nationwide emergency communications system.²⁰ The auction must also recover costs associated with auction administration. In addition to the revenue required to close the auction, the auction is expected to raise funds for public safety research, deficit reduction, state and local implementation funds, and 911 grants.²¹ This represents a significant undertaking and one that is especially challenging in a recovering economy.

6. *Spectrum Act Requires the FCC to Consider Variety of Territory Sizes*

The Spectrum Act states "the Commission shall consider assigning licenses that cover geographic areas of a variety of different sizes."²² Right-sizing license territories by using smaller geographic license sizes, like Cellular Market Areas (CMAs), offers the best way to achieve this goal and match spectrum needs and licenses to geographic areas.

7. *FCC Obligated to Promote Participation by Small and Rural Entities*

The Communications Act obligates the FCC to implement auction regulations that promote a number of objectives, including providing opportunities for small rural entities to participate.

¹⁷ See generally *PCAST Report*, *supra* note 15; See also Ofcom, THE FUTURE ROLE OF SPECTRUM SHARING FOR MOBILE AND WIRELESS DATA SERVICES: LICENSED SHARING, WI-FI, AND DYNAMIC SPECTRUM ACCESS § 4 (Aug. 9, 2013), available at http://stakeholders.ofcom.org.uk/binaries/consultations/spectrum-sharing/summary/Spectrum_Sharing.pdf.

¹⁸ *Spectrum Act*, *supra* note 4, at § 6402 (to be codified at 47 U.S.C. § 309(j)(8)(G)(iii)).

¹⁹ The FCC is the subject of a lawsuit from the National Association of Broadcasters who argue that \$1.75 billion is insufficient. (See: Nagesh, Gautham, "TV Broadcasters Sue Over FCC Auction of Airwaves." Wall Street Journal (August 18, 2014). Available at: <http://online.wsj.com/articles/tv-broadcasters-sue-over-fcc-auction-of-airwaves-1408402394>).

²⁰ *Spectrum Act*, *Supra* note 3

²¹ *Id.* at § 6413.

²² *Id.* at § 6403(c)(3).

Specifically:

consistent with the public interest, convenience, and necessity, the purposes of this chapter, and the characteristics of the proposed service, [the Commission shall] prescribe area designations and bandwidth assignments that promote (i) an equitable distribution of licenses and services among geographic areas, (ii) economic opportunity for a wide variety of applicants, including small businesses, rural telephone companies, and businesses owned by members of minority groups and women, and (iii) investment in and rapid deployment of new technologies and services.²³

Moreover, Congress mandated through the Act that the Commission:

ensure that small businesses, rural telephone companies, and businesses owned by members of minority groups and women are given the opportunity to participate in the provision of spectrum-based services.²⁴

Geographic license size is a critical risk factor for promoting such participation. The relevant risk is that the FCC might adopt license territories that prove too large for smaller rural or regional operators to bid for or use efficiently. The FCC's current plan is to license the 600 MHz band using 416 Partial Economic Areas ("PEAs").²⁵ PEAs attempt to segment the EA's into urban and rural areas and can be combined to aggregate into EAs. Despite the FCC's decision, the policy debate over the appropriate size for FCC license territories continues.

B. History of FCC's Use of Different Auction Territory Sizes

The FCC has a long history of using a variety of territory sizes ranging from the 734 CMAs to a single national license. The original cellular band licenses were issued on the basis of CMAs.²⁶

The early auctions were based on a "trading area" system. The U.S. was divided into 493 Basic Trading Areas (BTAs), which nest up to 51 Major Trading Areas (MTAs) and 5 Regional PCS Areas (RPCs). The FCC conducted the first spectrum auctions, for PCS spectrum, in 1994 and 1995.²⁷ The first was done on a nationwide basis and was quickly followed by the auction of regional PCS licenses in which five licenses were awarded in each of five U.S. RPCs²⁸ and an

²³ 47 U.S.C. § 309(j)(4)(C).

²⁴ 47 U.S.C. § 309(j)(4)(D).

²⁵ See note 2 *supra*.

²⁶ The first cellular licenses were awarded in the 850MHz band. The 734 CMAs were created in 1990 from the 1980 Metropolitan Statistical Areas (MSA) defined by the Office of Management and Budget (CMAs 1 to 305), the Gulf of Mexico (CMA 306), and the Rural Service Areas (RSA) which were defined by the FCC and do not cross state boundaries (CMAs 307 to 734).

²⁷ FCC Auctions #1 through #5.

²⁸ FCC Auction #3, Narrowband PCS Auction.

auction of PCS Blocks A and B in each of the 51 MTAs.²⁹ An auction of the PCS C Block in each of the 493 BTAs followed in 1996.³⁰ The D, E, and F Blocks were auctioned in BTAs in late 1996 and early 1997.³¹

More recently, the FCC utilized a new licensing framework that divides the country into 176 Economic Areas (EAs). EAs nest up to 52 Major Economic Areas (MEAs) and 6 Regional Economic Groupings (REAGs). Several recent auctions including auction #73 (700 MHz), #78 (AWS-1) and #92 (Lower 700 MHz) have used a combination of both CMA and EA territories. The Wireless Communication Service ("WCS") Licenses were issued in a combination of the 52 MEAs and the 6 REAGs.

More recently, the FCC has shifted from using a multiplicity of license territory sizes toward use of a single framework based on EA-sized license territories. The FCC has proposed using EAs in the Incentive Auction,³² the H Block spectrum auction,³³ and the AWS-3 auction.³⁴ It is worth noting, however, that some commenters already have advocated for smaller license territories, or at a minimum, for the use of multiple-sized license territories.³⁵

C. Review of Industry Size and Concentration

As we discuss further below, there are structural features in the industry that raise concerns about the sustainability of competition in wireless services. As the FCC acknowledges, acquiring necessary spectrum resources poses an important entry barrier that needs to be addressed by spectrum policy.³⁶

²⁹ FCC Auction #4, Broadband PCS A and B Block Auction.

³⁰ FCC Auction #5, Broadband PCS C Block Auction.

³¹ FCC Auction #11, Broadband PCS D, E and F Block Auction.

³² *Incentive Auction NPRM*, *supra* note 1, at ¶ 148.

³³ *Service Rules for the Advanced Wireless Services H Block—Implementing Section 6401 of the Middle Class Tax Relief and Job Creation Act of 2012 Related to the 1915-1920 MHz and 1995-2000 Bands*, Report and Order, WT Docket No. 12-357, 28 FCC Rcd 9483, 9500-02 ¶¶ 37, 45 (2013) (hereinafter *H Block R&O*).

³⁴ *Amendment of the Commission's Rules with Regard to Commercial Mobile Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands*, Notice of Proposed Rulemaking and Order on Reconsideration, GN Docket Nos. 13-185, *et al.*, 28 FCC Rcd 11479, 11502-03 ¶ 52 (2013).

³⁵ See e.g., Reply Comment of T-Mobile USA, Inc., GN Docket Nos. 13-185, *et al.* at 25 (Oct. 28, 2013) (noting the various benefits to smaller geographic license sizes advocated by smaller carriers and concluding that "[a]ccordingly, T-Mobile supports a hybrid approach under which some license would be auctioned on a CMA basis and others on a larger EA basis.").

³⁶ According to the FCC:

If a potential entrant were to attempt to enter the mobile wireless services market, obtaining access to spectrum is crucial...Therefore, spectrum policies affect the ability of potential entrants to access spectrum and to build out or expand capacity.

1. *Market Share and Revenue Concentration*

By the FCC's own calculations, the industry is highly concentrated and becoming more so. The Herfindahl-Hirschman Index (HHI)³⁷ calculation for the wireless industry was estimated to be 2,873 in 2011, up from 2,151 in 2003.³⁸ Since 2011 the industry has become even more concentrated as a consequence of significant M&A activity.³⁹

Some of the forces driving consolidation include the desire to realize scale and scope economies. Moreover, the industry has become increasingly capital intensive as operators have upgraded network capacity and deployed new technology to expand service offerings, improve quality, and support increased traffic growth. Enabling ever-faster mobile broadband to support a growing diversity of interactive and rich multimedia services requires increased spectrum and capital resources (i.e., more cell sites). The industry is currently upgrading networks from 3G to 4G LTE technology. This newer technology offers important spectral efficiency benefits and the potential to support the dynamic assignment of wider-bandwidth channels to make use of more diverse and non-contiguous spectrum resources.⁴⁰ Smaller regional and rural operators, and new entrants with smaller market shares and less mature networks, are often at a significant cost disadvantage relative to the largest national operators. These cost disadvantages are exacerbated when smaller operators cannot access spectrum in the same bands to realize the same economies of scale as the largest operators.

Not surprisingly, industry concentration varies sharply by geographic market and, as Exhibit 1 and Exhibit 2 below show, is highest in rural areas with low population densities. While most of the top mobile service markets in urban areas already have four⁴¹ or more facilities-based mobile service providers, rural consumers have significantly fewer choices and market concentration is higher (see Exhibits 1 and 2 below).⁴²

See FCC's 16th Wireless Competition Report, supra note 13, at ¶ 75.

³⁷ HHI is a commonly used metric for assessing the degree of market concentration. It is computed by summing the squares of the market shares of each firm in the industry.

³⁸ *See FCC's 16th Wireless Competition Report, supra* note 13, at ¶ 59. The U.S. Department of Justice and Federal Trade Commission consider an industry with an HHI of between 1,500 to 2,500 to be moderately concentrated and above 2,500 to be highly concentrated. *See* U.S. Dep't of Justice & Fed. Trade Comm'n, HORIZONTAL MERGER GUIDELINES, § 5.3 (Aug. 19, 2010).

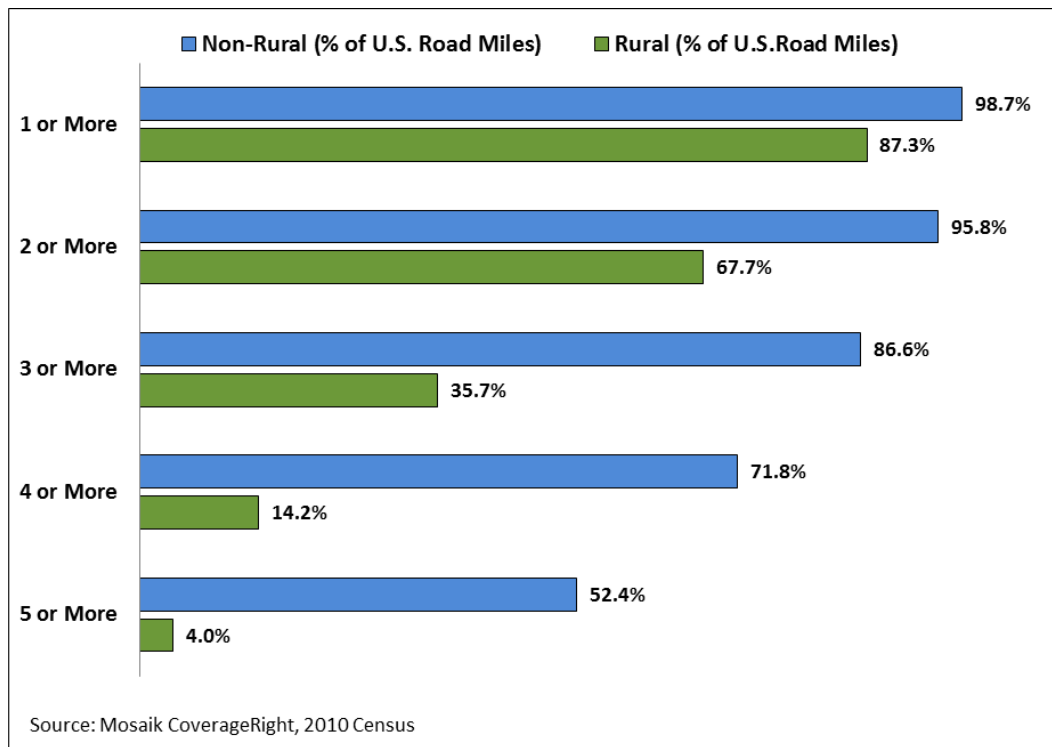
³⁹ Concentration has increased as a consequence of the Verizon/SpectrumCo, AT&T/NextWave, AT&T/Alltel, T-Mobile/MetroPCS, Sprint/Clearwire and Sprint/U.S Cellular transactions.

⁴⁰ A key design feature of LTE is to enable much more flexible assignment and use of spectrum resources. This useful both for dynamic assignment of spectrum resources to support heterogeneous application resource requirements and to allow operators to make use of heterogeneous spectrum resources (i.e., spectrum frequencies that may not be contiguous and may differ by geographic region).

⁴¹ Assuming AT&T Inc.'s acquisition of Leap Wireless International, Inc. closes. *See Applications of Cricket License Co., LLC, et al., Leap Wireless Int'l, Inc., and AT&T Inc. for Consent to Transfer Control of Authorizations, Description of Transaction, Public Interest Showing and Related Demonstrations*, WT Docket No. 13-193 (filed Aug. 1, 2013).

⁴² *See FCC's 16th Wireless Competition Report, supra* note 13, at ¶ 389.

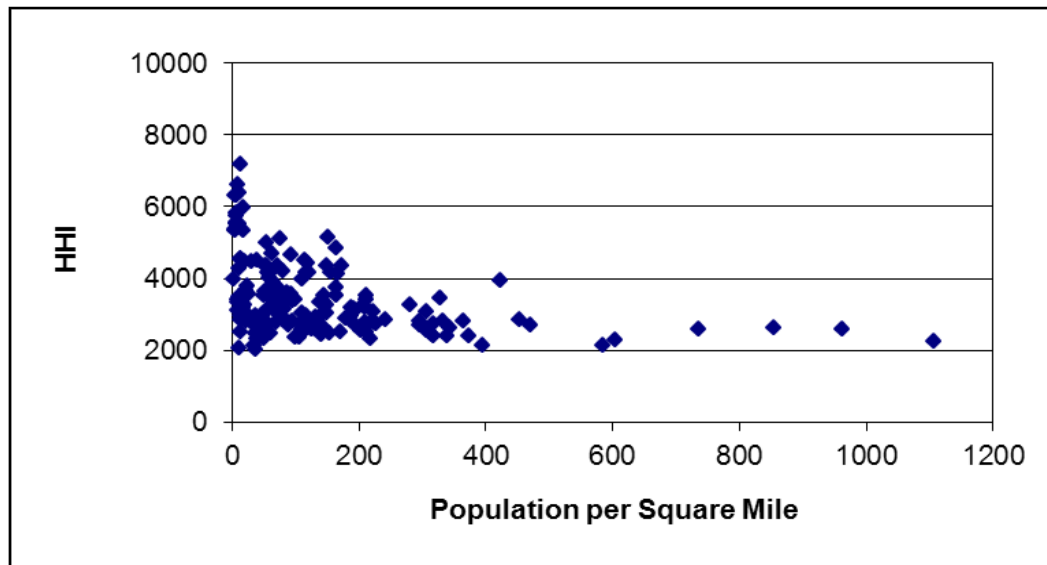
Exhibit 1: Percentage of Road Miles Covered by Mobile Broadband Providers in Rural vs. Non-Rural Areas, Oct. 2012⁴³



We note that just over 400,000 people in rural areas had no mobile wireless coverage, while approximately 58,000 in non-rural areas had no mobile wireless coverage as of October 2012. The percentage of the rural population covered by at least two providers remained flat at just over 96 percent from July 2010 to October 2012, and was lower than the 99.9 percent of the non-rural population covered by at least two providers. Further, 87 percent of the rural population was covered by at least three providers and 69 percent by at least four providers, compared to 99.5 percent and 98 percent, respectively, of the non-rural population.

⁴³ *FCC's 16th Wireless Competition Report*, *supra* note 14, at ¶ 393.

Exhibit 2: Plot of 2011 EA HHI Values on EA Population Densities⁴⁴



Source: NRUF, Census

2. *Spectrum concentration*

Access to spectrum resources poses a significant barrier to entry for wireless services. The control of spectrum resources is also highly concentrated, especially with respect to the prime spectrum below 1 GHz. Although AT&T and Verizon are the dominant service providers nationally, with total market share of approximately 65.2 percent,⁴⁵ they hold a disproportionately large 78 percent share of prime sub-1 GHz spectrum.⁴⁶

Spectrum below 1 GHz, which includes the Incentive Auction spectrum, has especially attractive propagation characteristics for serving rural areas and for achieving superior in-building penetration.

Sustaining competition from competitors in rural markets depends on expanding access to this low-band "beachfront," interoperable spectrum, making the planned Incentive Auction especially important for ensuring rural coverage for mobile broadband services.

⁴⁴ *FCC's 16th Wireless Competition Report*, *supra* note 14, at ¶ 60. The highest population density (1,107 pop/sq. mi) occurs in EA 34 (Tampa-St. Petersburg-Clearwater, FL), and the lowest population density (1 pop/sq. mi) occurs in EA 171 (Anchorage, AK). *Id.* at ¶ 60, n.189.

⁴⁵ *Id.* at ¶ 52.

⁴⁶ *Id.* at ¶ 2. Additionally, AT&T and Verizon control approximately 84 percent of the licensed 700 MHz spectrum and 90 percent of the 850 MHz licensed spectrum. *Id.*

III. Right-sizing Spectrum Licenses Requires Small Geographic Areas

One critical element in FCC spectrum auctions is license territory size. Ensuring that the geographic size of the license territories are right-sized means ensuring that they are sufficiently small to meet the needs of all mobile operators. While the FCC originally proposed to auction licenses based on the 176 EA territories (later changed to 416 PEAs), competitive carriers have urged the FCC to consider smaller geographic license sizes, such as the 734 CMA-based territories.⁴⁷ The choice of license size will have a significant impact, not only on the auction process, but also on service quality and the future structure and competitiveness of the industry. The benefits of using smaller license sizes are outlined in greater detail below.

A. More Unencumbered Spectrum Available for Auction

Repurposing the maximum amount of broadcast spectrum is a key goal of the Incentive Auction. Choosing smaller license territories instead of EAs will help realize this goal.

The Incentive Auction will confront two important challenges. First, there is the risk that broadcast licensees' incentives to participate in the Reverse Auction will vary by market, with the likely outcome that more spectrum will be cleared in some markets than in other markets. Second, following the Reverse Auction, the cleared spectrum will need to be repacked and mapped to new license territories for sale in the Forward Auction.

Adopting smaller licenses for the Forward Auction would allow more flexibility in the repacking of broadcast spectrum for licensees that decline to participate, and will contribute to overall auction efficiency. Greater efficiency will help encourage greater broadcaster participation in the Reverse Auction, helping to clear more spectrum in every geographic market. And, smaller sized licenses will allow the repurposed spectrum to be more easily mapped to higher-value, unencumbered licenses for sale in the Forward Auction.

1. *Facilitate Efficient Mapping of Broadcast Spectrum*

While the FCC hopes to reclaim up to 120 MHz of television broadcast frequencies nationally, it recognizes nationwide clearing may not be possible for all of the frequencies.⁴⁸ As the Incentive Auction NPRM indicates, some frequencies may be available in some but not all markets.⁴⁹ Moreover, those broadcast licensees that will continue to operate after the auction will need to be repacked into license territories that provide adequate interference protection, including protection from the new licensees of spectrum licenses acquired via the Forward Auction. As the FCC seeks

⁴⁷ In instances where we refer specifically to the advantages of using CMAs, the conclusions are similarly applicable to other geographic territories smaller in size than EAs that might be considered for the Incentive Auction.

⁴⁸ Posting of Ruth Milkman, FCC Wireless Telecommunications Bureau Chief, to Official FCC Blog, <http://www.fcc.gov/blog/band-plan-serves-public-interest> (June 21, 2013) (*A Band Plan that Serves the Public Interest*).

⁴⁹ *Incentive Auction NPRM*, *supra* note 1, at ¶ 174; Appendix C at 7.

to reallocate an increasingly crowded spectrum bands, similar problems are likely to occur in other spectrum reallocation processes as well.

Television markets are divided into 210 Designated Market Areas ("DMAs").⁵⁰ Repacking channels that need to be relocated following the Reverse Auction and mapping the freed spectrum from DMAs to new mobile license territories is a complex process. The amount of unencumbered spectrum the FCC will clear following repacking of the remaining broadcasters varies significantly based on the size of the license areas. Smaller sized licensing schemes such as CMA-based licensing would significantly increase the number of markets that would have 85 MHz of spectrum, or more, based on repacking alone.⁵¹ Moreover, larger EA-based territories do not eliminate the complex challenge of remapping television market areas (DMAs) to EAs. Instead, the use of EA-based territories would increase the population covered by areas encumbered by interference protection zones for remaining television broadcasters.

2. Reduce Encumbered Spectrum in Border Areas

Use of smaller territories also facilitates managing spectrum coordination with Canada and Mexico. Smaller CMA-based license territories would allow the FCC to limit the spectrum resources and markets (population, or "POPs") that might have to be encumbered in order to address national border coordination issues. The smaller the license territories, the more focused, flexible, and granular the options will be for addressing license boundary issues. And the more likely it will be that the share of encumbered spectrum in particular market areas will be minimized.

B. Increased Auction Participation Likely

Adopting smaller sized license territories will increase auction participation, potentially in all markets, but especially in the rural markets where the participation of smaller operators is most important.

Fundamentally, the smaller the license territories, the lower the expected total price per license (because fewer potential subscribers, or POPs, are included). Additionally, the smaller the license territories, the easier it is for a provider to right-size its desired service coverage area, particularly for rural carriers who do not provide service throughout a whole or multiple EAs. With EAs or larger license areas, the chance that a carrier will be required to purchase more spectrum than needed increases.

Requiring operators to buy more spectrum than desired imposes an unnecessary cost on participants. Smaller, more targeted territories will lower the barriers to entry in the auction and

⁵⁰ The FCC refers to these as TMAs (Television Market Areas). DMA is a term developed by the Neilson Company that refers to the same areas. DMA has become the standard reference term and TMAs are rarely used outside of FCC regulatory filings.

⁵¹ Comments of United States Cellular Corporation, *In the Matter of Expanding Economic and Innovation Opportunities of Spectrum through Spectrum Auction*, GN Docket No. 12-268 at Attachment A, pp. 2-3, 5-6 (filed Jan. 25, 2013).

thus allow more entities to participate. Economists generally believe greater participation in auctions enhances auction efficiency.⁵²

Furthermore, participants confronted with only wrong-sized license territories are likely to adjust their bids downward to compensate for the added expense associated with the surplus spectrum assets, thereby potentially depressing auction proceeds.

For carriers who are compelled to bid for wrong-sized spectrum license packages, the added cost may be sufficient to induce them to not participate;⁵³ or if they do participate, they are less likely to offer successful bids; or if they are successful, they will have fewer resources available to deploy services using the spectrum. In each case, the efficiency of the auction and the larger goals of the process suffer.

A number of wireless operators have already indicated to the FCC that they will not participate in the Incentive Auction if licenses are allocated using EAs (see Exhibit 3 below).

⁵² See, e.g., Jonathan B. Baker, SPECTRUM AUCTION RULES THAT FOSTER MOBILE WIRELESS COMPETITION 11 (Mar. 12, 2013), available at <http://apps.fcc.gov/ecfs/document/view?id=7022130365>; Martin Cave and William Webb, SPECTRUM LIMITS AND AUCTION REVENUE: THE EUROPEAN EXPERIENCE 18 (July 29, 2013), available at <http://apps.fcc.gov/ecfs/document/view?id=7520934210>; Leslie M. Marx, PhD, ECONOMIC ANALYSIS OF PROPOSALS THAT WOULD RESTRICT PARTICIPATION IN THE INCENTIVE AUCTION 23 (Sept. 18, 2013), available at <http://apps.fcc.gov/ecfs/document/view?id=7520944358> (citing Jeremy Bulow and Paul Klemperer, *Auctions Versus Negotiations*, 86 AM. ECON. REV. 180 (1996)) (hereinafter *Economic Analysis of Auction Participation*).

⁵³ According to Dr. Kovacs commenting on the 700 MHz auction,

[o]ne of the keys to the success of the small bidders was the availability of spectrum that covered areas that matched their needs. They did not have to pay for licenses that were too big for them to fund, either in terms of initial license cost or ultimate build-out cost.

Anna-Maria Kovacs, Industry Voices, *Key Lessons from the 700 MHz Auction and What Those Mean for the Next One*, FIERCEWIRELESS, June 24, 2013, <http://www.fiercewireless.com/story/kovacs-key-lessons-700-mhz-auction-and-what-those-mean-next-one/2013-06-24>.

Exhibit 3: Carriers Indicating to FCC they Won't Participate in an EA Auction⁵⁴

Carrier
Atlantic Seawinds Communications, LLC
Appalachian Wireless (East Kentucky Network LLC)
Bluegrass Cellular
Carolina West Wireless
Cellcom
Cellular One (MTPCS, LLC)
Chat Mobility
Northwest Missouri Cellular Limited Partnership
Plateau Telecommunications
Public Service Wireless Services, Inc.
Sandhill Communications
Vtel Wireless

Source: Competitive Carriers Association

In addition to the carriers listed above, other entities that have previously participated in auctions using EAs have exited the mobile operator market or have been acquired. A partial list of these firms is shown in Exhibit 4 below.

⁵⁴ Letter from Ron Smith, President, Bluegrass Cellular, Inc. to Marlene H. Dortch, Secretary, FCC, GN Docket No. 12-268 (filed July 10, 2013) ("Bluegrass Cellular will not participate in 600 MHz spectrum auction if FCC does not license the spectrum in small geographic areas, like CMAs."); Letter from Patrick D. Riordan, President and CEO, New-Cell, Inc. to Marlene Dortch, AU Docket No. 13-178, at 2 (filed Aug. 5, 2013) ("[If] Commission adopts EAs for its upcoming auctions, it will not be able to participate."); Letter from Counsel for Plateau Telecommunications, Inc. to M. Dortch, GN Docket No. 12-268 (filed July 30, 2013); Letter from Counsel for Northwest Missouri Cellular L.P. to M. Dortch, GN Docket No. 12-268 (filed July 30, 2013); Letter from Counsel for Chat Mobility to M. Dortch, GN Docket No. 12-268 (filed Aug. 8, 2013); Letter from Counsel for Sandhill Communications, LLC to M. Dortch, GN Docket No. 12-268 (filed Aug. 21, 2013); Letter from Counsel for VTel Wireless, Inc. to M. Dortch, GN Docket No. 12-268 (filed Sept. 6, 2013); Letter from Counsel for Public Service Wireless Services, Inc. to M. Dortch, GN Docket No. 12-268 (filed Sept. 18, 2013); Letter from Counsel for Atlantic Seawinds Communications, LLC to M. Dortch, GN Docket No. 12-268 (filed Sept. 18, 2013); Letter from Jonathan Foxman, President & CEO, MTPCS, LLC d/b/a Cellular One to Marlene H. Dortch, Secretary, FCC, GN Docket No. 12-268 (filed October 17, 2013).

Exhibit 4: Previous Bidders in EA Auctions that have Exited or been Acquired

Carrier
18 th Street Spectrum, LLC
Alltel Corporation
American Cellular Corporation
AWS Wireless Inc.
Broadband Wireless Unlimited, LLC
CenturyTel
Clearwire
Comporium Wireless, LLC
Cox Wireless
Cricket
MetroPCS
PCS Partners, L.P.
Qualcomm
Red Rock Spectrum Holdings
SpectrumCo
Toba Inlet PCS
VentureTel 700, Inc.
Wireless Communications Venture

Source: Competitive Carriers Association

Finally, it should be noted that the adverse harms of foreclosing smaller bidders or imposing excessive spectrum costs on small bidders who ultimately participate will not be limited to those bidders. The failure to assign spectrum to an entity that will put it to its best use will harm the populace in the affected territories and will induce artificial spectrum scarcity. The added costs and delay associated with re-assigning the spectrum via secondary markets or sub-leases will distort investment in complementary assets such as radio network infrastructure, and will increase the cost and delay of delivering broadband to underserved communities.

1. Promote Participation by Smaller and Rural Operators

The cost of adopting larger sized territories is likely to asymmetrically penalize smaller rural and regional operators with smaller service coverage areas. The FCC has recognized that smaller

license territories facilitate participation from new entrants as well as smaller and/or rural carriers in spectrum auctions.⁵⁵

For many smaller operators, an EA-sized license is significantly larger than needed.⁵⁶ EA-based licenses contain both rural and urban areas. For example, if a carrier wants spectrum to serve Carroll, NH, it must bid for spectrum in EA 3 that also includes Boston, MA, Providence RI, and Windham, VT. The expected cost of acquiring an EA may be beyond the financial wherewithal of smaller operators, which have fewer financial and other resources with which to finance a wrong-sized spectrum acquisition. Such operators may be foreclosed from participating.

Additionally, recent auction results suggest smaller carriers have a particularly strong interest in bidding for spectrum in rural areas. Data from the 700 MHz and AWS auctions is shown in Exhibit 5 and Exhibit 6 below.

Exhibit 5: Winning Bidders for B-Block CMAs in 700 MHz Auction⁵⁷

Bidder	Non-Rural		Rural	
	Licenses	MHz*POPs	Licenses	MHz*POPs
AT&T	150	1,881	77	229
Verizon	34	489	43	66
Qualcomm	1	2	2	3
Frontier (Dish)	0	0	0	0
T-Mobile (chose not to participate)	0	0	0	0
SpectrumCo (Sprint; chose not to participate)	0	0	0	0
Other	118	261	303	485
Total	303	2,634	425	783

Source: Calculations based on the FCC data and documentation.

⁵⁵ See *Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands*, Report & Order, WT Docket No. 02-353, 18 FCC Rcd 25162, 25176-77 ¶ 39 ("By being smaller, [CMAs] provide entry opportunities for smaller carriers, new entrants, and rural telephone companies. Their inclusion in our band plan will foster service to rural areas and tribal lands and thereby bring the benefits of advanced services to these areas.") (hereinafter *AWS-1 R&O*).

⁵⁶ For some operators, and particularly for rural operators, one EA may not cover their entire service area, but two EAs would provide a larger area than necessary.

⁵⁷ *Economic Analysis of Auction Participation*, *supra* note 52, at 9.

Exhibit 6: Winning Bidders for AWS Auction⁵⁸

Bidder	Non-Rural		Rural	
	Licenses	MHz*POPs	Licenses	MHz*POPs
T-Mobile	83	1,827	10	47
Cricket	38	715	35	136
AT&T	20	769	1	10
Verizon	2	11	5	10
SpectrumCo (Sprint)	0	0	0	0
Other	160	1,063	358	1,065
Total	303	4,384	409	1,268

Source: Calculations based on the FCC data and documentation.

The data in these exhibits shows that during these auctions that included CMAs, while smaller operators accounted for 41 percent of the total MHz-POP licenses acquired, they accounted for 82 percent of the rural MHz-POP licenses.⁵⁹ Had these auctions not included CMAs, many of these smaller operators would likely have been excluded, further exacerbating the concentration of spectrum resources under the control of the largest operators.

2. *Promote Efficient Participation of Large Operators*

Larger operators generally prefer larger spectrum license areas. Indeed, the largest national operators might be happiest with national territory licenses that would foreclose smaller, regional operators as well as new entrants and thereby reduce potential participation in spectrum auctions and competition in wireless services.⁶⁰ However, if licenses are available in smaller sizes, a national operator has the opportunity to aggregate bids on such licenses equivalent to a national license. Transaction costs are likely to be minimal compared to the high value of the acquired spectrum and hence, are unlikely to adversely impact the auction participation of large national operators. When confronting the increased competition for spectrum from smaller and rural operators, the larger operators may be induced to bid more aggressively.

Additionally, larger operators will logically focus deployment on the most densely populated portions of an EA, or other large license territory, and may ultimately determine that it is not economical to serve rural portions of an EA. In this scenario, the operator will purchase spectrum licenses that cover both rural and urban portions of an EA out of a desire to acquire spectrum in the more densely populated portions, and accept peripheral spectrum that did not motivate their bid. Allowing for smaller geographic license sizes that separate such rural areas from the economic

⁵⁸ *Economic Analysis of Auction Participation*, *supra* note 52, at 10.

⁵⁹ The smaller operators include everyone but the big four (AT&T, Verizon, Sprint, and T-Mobile). The smaller operators captured 3,730 out of the total 9,060 MHz-POPs (41%) and 1,689 out of the rural 2,051 MHz-POPs (82%) auctioned in the 700MHz and AWS auctions.

⁶⁰ See, e.g., Deborah D. McAdams, *Wireless Interest Spar at Senate Spectrum Hearing*, TVTECHNOLOGY, June 4, 2013, <http://www.tvtechnology.com/article/wireless-interests-spar-at-senate-spectrum-hearing/219691> (quoting Dr. George Ford as arguing that "if you want to maximize auction revenues, you should sell one license.").

centers will accordingly not negatively impact larger operators' motivation for bidding. Using smaller areas will, however, increase aggregate revenue by allowing a smaller carrier, who is motivated to serve rural portions of an EA, to target its bidding activity in areas where it experiences the highest use value.

Furthermore, as we noted above, the two largest national operators already have significant low-band spectrum resources nationwide. Any spectrum they acquire in the Incentive Auction will complement their current low-band spectrum resources. And with new and more flexible 4G LTE-based network technology, it is less important that large operators acquire the same amount of spectrum and the same frequencies in all geographic market areas.

Right-sizing spectrum bids should help all bidders avoid excess spectrum costs. Large operators would be able to better pinpoint spectrum additions in urban areas for their capacity and propagation/penetration requirements, or rural areas for their coverage requirements.⁶¹

3. Promote Efficient Build Out

As mentioned above, EAs will asymmetrically restrict smaller carriers' participation in the auction, with larger carriers who disproportionately serve major metropolitan markets likely dominating an EA-based auction. In instances where smaller carriers aren't entirely foreclosed from participating, using EAs will, at a minimum, force these carriers to bid on much larger territories that, in many cases, will contain areas that they have little interest or ability to serve.

In comparison, regional and rural operators or new entrants who make winning bids in auctions based on smaller license areas will have added incentives to accelerate their investment in complementary network infrastructure. Faster investment would accelerate their opportunity to realize scale/scope economies and profits from the use of their more focused spectrum acquisitions. Moreover, if such smaller operators are already incumbents in rural areas, their incremental costs will be lower for expanding coverage to adjacent under-served rural areas (relative to an operator without local infrastructure investments already in place).

4. Ease Financing and Other Resource Constraints

Better alignment in spectrum territories and operator business models means fewer resources devoted to excess spectrum resources, and more resources available to bid for the spectrum that is actually desired and to make the complementary investments required to realize the value from spectrum assets. Even if an operator plans to expand its coverage or use the secondary markets to reduce excess spectrum inventories, both of these options result in additional costs that increase financing risk and costs.

For an estimate of the magnitude of the additional costs imposed, consider that an EA-sized territory is 4-5 times larger than a CMA-sized territory and roughly twice the size of a PEA-size territory. Assuming a build-out cost of \$2,000 per square mile, it would cost roughly \$10 million to build-out a network for a CMA territory as compared to \$40 million for an EA territory or \$20

⁶¹ See *AWS-1 R&O*, *supra* note 54, at 25176-77 ¶ 39 ("These local service areas will be optimal for incumbent operators who may need spectrum capacity only in limited areas.").

million for a PEA territory.⁶² For an operator whose serving area is significantly smaller than an EA, this implies either leaving a large chunk of newly acquired spectrum fallow, incurring the costs of disposing of the excess spectrum, or greatly expanding its planned investments in network infrastructure and entering markets where they potentially do not have any existing business relationships or spectrum holdings in other frequency bands. For smaller operators, scaling their business plans to adjust accordingly are relatively more burdensome and more likely to confront financing and other resource constraints (e.g., skilled personnel).⁶³ The largest operators can access deeper wells of financial and personnel resources and typically earn significantly higher margins.⁶⁴ Hence, it is reasonable to expect that the costs of dealing with wrong-sized spectrum territories would adversely impact smaller operators disproportionately.

C. Mitigate Volatility and Likely Increase Auction Revenue

Ensuring a competitive and healthy wireless sector and ensuring spectrum goes to its highest value uses offers the best prospect for achieving the ultimate goals of the auction process, which are to promote economic growth, innovation, and consumer welfare. Maximizing auction revenue, while desirable, is subservient to these other goals. Nevertheless, because of the pressing need for additional commercial spectrum for wireless broadband and because the 600 MHz band spectrum is particularly valuable spectrum, most analysts expect the Incentive Auctions to raise gross proceeds on the order of \$36 billion.⁶⁵ Using a license size sufficiently smaller than an EA offers the best prospects for optimizing the quality of the auction revenue raised.

1. Increase Auction Revenues

The most likely outcome of selecting a smaller license territory size such as CMAs is that this will increase auction proceeds relative to adopting EA or larger sized license territories. Earlier, we explained why adopting smaller sized territories would help maximize the amount of

⁶² These estimates are likely quite conservative, but are based on an estimate for constructing a nationwide public safety network in the 700 MHz spectrum of \$7 billion. Since the U.S. is 3.8 million square miles, that implies a build-out cost of \$1,842 per square mile, or approximately \$2,000 per square mile. There are 734 CMAs so each is 5,177 square miles (approximately 5,000 square miles); 176 EAs so each is 21,591 square miles (approximately 20,000 square miles) and 416 PEAs so each is 9,134 square miles (approximately 9,000 square miles). Earlier we cited estimates of build out costs that ranged from \$1 to \$5 per \$1 spent on spectrum acquisition. This alternate estimate is comparable with the lower estimate. Compare Ford, *supra* note 23, at 16-17, with Bazelon & Mchenry, *supra* note 23, at § 4.3.

⁶³ For example, smaller firms are more likely to have more limited financing options and consequently confront higher capital costs. See, e.g., Joe Peek, Office of Advocacy, U.S. Small Bus. Admin., THE IMPACT OF CREDIT AVAILABILITY ON SMALL BUSINESS EXPORTERS 7-8 (Apr. 2013), available at [http://www.sba.gov/sites/default/files/files/rs404tot\(3\).pdf](http://www.sba.gov/sites/default/files/files/rs404tot(3).pdf).

⁶⁴ See FCC's 16th Wireless Competition Report, *supra* note 14, at ¶ 2.

⁶⁵ For example, assuming a spectrum value of \$1 per MHz-POP and a U.S. population of 300 million, an auction of 120MHz would raise gross proceeds of \$36 billion. See, e.g., CTIA – The Wireless Association and Consumer Electronics Association, BROADCAST SPECTRUM AND INCENTIVE AUCTIONS WHITE PAPER (Feb. 15, 2011), available at http://files.ctia.org/pdf/CTIA_CEA_TV_Spectrum_Whitepaper.pdf.

unencumbered spectrum available in the auctions. Smaller geographic sizes would also allow better opportunities for all bidders to right-size their bids. That would encourage participation and alleviate the need to reduce bids to compensate for the costs of acquiring wrong-sized spectrum licenses. Taken together, these effects would help ensure that the highest value bidders participate in each market and the winning bid goes to the operator best able to realize value from the spectrum resources acquired. Whether the winning bidder operates a national or regional network, and whether in urban, rural, or mixed markets, an auction based on smaller building blocks will allow all bidders the opportunity to bid for the spectrum they need and devote the maximum and efficient share of available resources to acquiring spectrum.

Furthermore, using smaller areas instead of EAs may reduce the volatility of auction proceeds, which could have additional beneficial implications for auction efficiency. The enhanced participation and greater flexibility in expanding the supply of unencumbered spectrum should garner more participation in both the Reverse and Forward Auctions. While it may not be feasible to predict the winning bids in particular markets, the added assurance that the auction will attract broad participation should help reduce auction revenue volatility. For example, broad participation which ensures that potential high bidders are not foreclosed will help reduce the risk of a low bidding scenario that may fail to meet reserve requirements and result in less spectrum being cleared. To the extent smaller areas help reduce the risk and costs of participation, that will further help reduce revenue volatility.

Finally, as suggested earlier, it is possible that an auction based on EA or larger territories that foreclose competition from smaller operators might confront incumbents with the prospect of being able to foreclose future wireless competition by acquiring a disproportionate share of the scarce spectrum. However, as Google pointed out in the lead up to its bid for the Upper 700 MHz C Block, auction experts and game theorists advised Google that the net effect of foreclosure can be a reduction in bids in opposition to incumbents.⁶⁶ This reduction leads to an "incumbent dilution discount" through which:

the resulting price [of licenses] will not reflect the fair market value that otherwise would have been reached. The dilution of competitive bidders means the final price will be lower than otherwise would be the case. Recent studies have confirmed that this is a pervasive aspect of the FCC auction environment.⁶⁷

In contrast, choosing the smaller sized territories, such as CMAs, would render such foreclosure strategies less likely and hence would contribute to the FCC's core mission of promoting competition and long-run efficiency in the markets for wireless services.

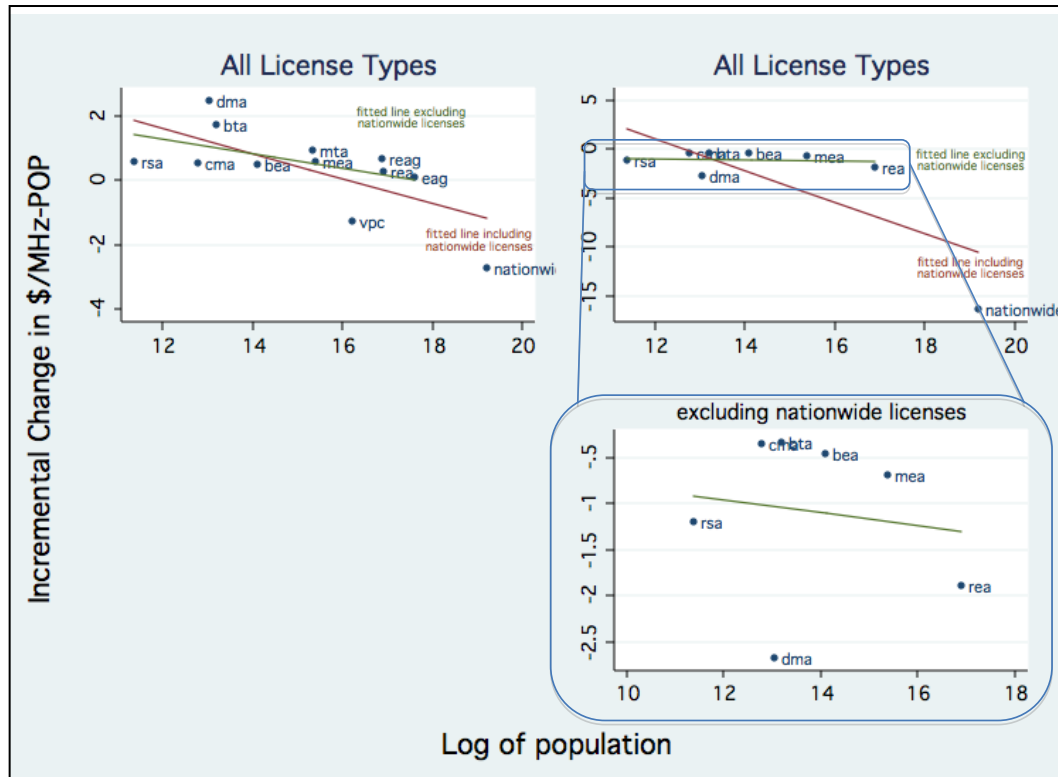
⁶⁶ Posting of Richard Whitt to Google Public Policy Blog, <http://googlepublicpolicy.blogspot.com/2007/07/restoring-competitive-balance-to.html> (July 23, 2007) (*Restoring Competitive Balance to the Upcoming Spectrum Auction*).

⁶⁷ *Id.* at 2 (citing Peter Cramton *et al.*, AUCTION REVENUES IN THE 700 MHz SPECTRUM AUCTION (June 27, 2007), available at <http://apps.fcc.gov/ecfs/document/view?id=6519537319>).

2. Past Auctions Demonstrate Value of Smaller Territories

Experience from prior FCC auctions supports the belief that auctions based on CMAs lead to greater aggregate revenue. Dr. Scott Wallsten recently analyzed 69,000 spectrum sales including those from every FCC spectrum auction since 1996, and his analysis on auction size is summarized in Exhibit 7 below:

Exhibit 7: Relationship of License Sales Price to Population Size Covered⁶⁸



Source: Wallsten, Scott, *Is There Really a Spectrum Crisis?*

Dr. Wallsten notes that "[w]hile the precise order of value by region differs by specification, regardless of specification the analysis reveals a clear negative correlation between the size of the region specified by the license and the revealed private value of the license."⁶⁹ This follows from his hypothesis that "[s]maller geographic definitions allow bidders to more selectively bid on areas they value."⁷⁰

⁶⁸ Scott Wallsten, Tech. Policy Institute, *IS THERE REALLY A SPECTRUM CRISIS? QUANTIFYING THE FACTORS AFFECTING SPECTRUM LICENSE VALUE* 22 (Jan. 13, 2013), available at https://techpolicyinstitute.org/files/wallsten_is_there_really_a_spectrum_crisis.pdf (hereinafter *Factors Affecting Spectrum License Value*).

⁶⁹ *Id.* at 21.

⁷⁰ *Id.* at 22.

The results of the 700 MHz auction provide support for this. In the 700 MHz auction (FCC Auction #73), the FCC used a variety of license sizes to allocate the spectrum: EAs for the A Block and E Block, CMAs for the B Block, REAGs for the C Block and a nationwide license for the D Block. In this case, the CMA sold for \$2.68 per MHz-POP, followed by the EA Blocks A (\$1.16 per MHz-POP) and E (\$0.74 per MHz-POP), the REAGs C Block (\$0.76 per MHz-POP). The national license in the D Block only fetched \$0.17 per MHz-POP which was less than the minimum price and so the D Block license was not awarded.

D. Better Alignment for Long-Term Spectrum Efficiency

Smaller territory sizes – including CMAs – are better aligned with the long-term direction of efficient spectrum management. The goal of spectrum management reform is not just to achieve a one-time repurposing of spectrum from a low value legacy use to today's best guess at the highest value use. Rather, the goal is to transition to a spectrum management regime that is robust and flexible enough to respond to future needs to repurpose spectrum when still higher value uses come along.

Today's mobile broadband revolution opens up important new markets for potential economic growth. These new market opportunities are associated with embedded computing-aided intelligence which may enable such things as smart infrastructure (buildings, roads), smart healthcare, smart supply chains, smart energy systems, and smart commerce (customization for one-to-one marketing). While it may not be possible to forecast which of these market opportunities will grow fastest, what can be reasonably said is that all of this activity will drive demand for wireless services of all kinds, and will help ensure continued growth in demand for spectrum resources. Meeting this demand and redirecting spectrum resources to keep pace with shifting industry structures, wireless innovation, and market needs will require more efficient, dynamic, and flexible spectrum management systems.

1. Promote Evolution of More Efficient Secondary Markets

An important feature of auctions is their ability to assign spectrum to its highest value uses. To help ensure that spectrum continues to be assigned to its highest value uses over time, spectrum licenses should be tradable on secondary markets. Enabling liquid and efficient secondary markets for spectrum licenses will help lower entry and exit barriers for new and smaller entrants, which is consistent with the universal service and competition goals of the FCC.

The FCC has pointed to the importance of the secondary markets for competition. It notes that "[t]he Commission's secondary market policies allow existing licensees to obtain additional spectrum capacity and expand their coverage areas to better meet the needs of their customers, while also providing new entrants with additional opportunities to access the spectrum so that they can compete."⁷¹ Smaller license territories, such as CMAs are more consistent with granular spectrum management, dynamic secondary markets, and other advanced spectrum sharing that are part of the long-term directions of communications technology, as well as the government's long-

⁷¹ FCC's 16th Wireless Competition Report, *supra* note 13, at ¶ 108.

term goals. Smaller license territories facilitate the granular division of spectrum that is needed for these goals much more so than large ones, and are thus more "future-proof" than EAs.

CMAs are also consistent with the FCC's current regulatory review processes. For example, the FCC reviews secondary market transactions on a CMA basis. An initial license allocation on this same basis would simplify later data collection efforts needed to review secondary market transactions. As secondary markets become more developed, this issue is likely to become increasingly important.

2. Smaller Territories Consistent with Future of Wireless

Accommodating growth in wireless services and the implicit demand for spectrum resources cannot be met solely by the allocation of new spectrum, even though such allocations are a key part of the solution.⁷² Technical innovations and denser cell architectures will both be needed to meet growing demand for wireless services of all types. More spectrally efficient wireless technologies permit transmission of more bits per Hz and enable more fine-grained dynamic assignment of spectrum resources. Denser cell architectures enable spatial reuse of frequencies. In addition to expanding access to available spectrum, these technical and architectural refinements also enable more dynamic, capable, and efficient service provisioning. The need to economize on device power also encourages moving to denser, smaller cell sizes. This is increasingly important as mobile broadband data rates increase. To the extent cell sites cover smaller areas, it is logical for territories to be smaller so that carriers can obtain licenses for smaller areas where they specifically need to increase capacity or extend service.

Additionally, modern wireless system architecture is well suited for smaller license territories. LTE is designed to provide more flexible, dynamic, and increasingly seamless assignment of spectrum resources to applications on a granular basis (with respect to frequency, space, and time). These enhanced capabilities are more naturally matched to smaller license territories.

3. Lower Frequency 600 MHz Spectrum Especially Well-Suited for Rural Broadband and In-Building Penetration

The 600 MHz spectrum, with its longer range than higher frequency spectrum, is particularly well-suited for deploying mobile service infrastructure in less dense areas, where using smaller cell sites to provide coverage would be significantly more expensive. According to the FCC, "[s]pectrum below 1 GHz is considered most suitable for establishing base network coverage, especially for wide area and in-building coverage."⁷³

While especially applicable for service in rural areas, the 600 MHz spectrum is also very valuable for providing service in urban areas. Its non-line-of-sight propagation characteristics makes it valuable for expanding in-building coverage and augmenting capacity in urban markets.

Using more granular license areas would allow the 600 MHz spectrum to go to its highest value uses in each of these markets. And, since the small regional and rural operators appear to be the

⁷² *PCAST Report*, *supra* note 15, at § 4.2.

⁷³ *FCC's 16th Wireless Competition Report*, *supra* note 14, at ¶ 2.

most likely to address rural markets, enabling economically-viable participation from those operators will accelerate and expand universal service goals while augmenting competition. At the same time, it will enable urban operators to provide better service in buildings and congested urban markets.

4. *No Pairing Issues with Other Frequencies*

In contrast to other bands, pairing issues do not arise as a reason for preferring larger EAs over an area size like CMAs in the 600 MHz auction. The FCC's NPRM for the AWS-3 auction noted that it is logical to use EAs as the spectrum was intended to be paired with AWS-1 or AWS-4 spectrum that was already licensed on the basis of EAs.⁷⁴ Similarly, in the recent H-Block Report and Order, the FCC considered EA-based licensing logical because adjacent bands were also allocated this way.⁷⁵ This is not the case with the Incentive Auction spectrum. With the Incentive Auction, the FCC will start with a clean slate in the 600 MHz band once the television broadcasters are cleared. The choice of license territories will not be encumbered by prior decisions. If anything, this argument cuts in favor of CMAs, as the adjacent 700 MHz band is licensed with a variety of license sizes including CMAs, and the 850 MHz band is licensed on a CMA basis.

⁷⁴ *Amendment of the Commission's Rules with Regard to Commercial Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands; Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band; Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz, and 2175-2180 MHz Bands; Applications for License and Authority to Operate in the 2155-2175 MHz Band; Petitions for Forbearance Under 47 U.S.C. § 160*, Notice of Proposed Rulemaking and Order on Reconsideration, GN Docket No. 13-185, 28 FCC Rcd 11479, 11502 ¶ 51 (2013). Nevertheless, the FCC used a variety of license sizes when auctioning AWS-1.

⁷⁵ *H Block R&O*, *supra* note 31, at ¶ 38.

IV. Addressing Concerns of Using Smaller License Territory Sizes

In the preceding sections, we explained how the choice of smaller license territories, such as CMAs, offers the best prospects for realizing the goals of the Incentive Auctions. In this section, we address concerns that might be raised suggesting that EAs or a larger territory size would be preferable, and explain why we believe these concerns are misplaced.

A. Smaller Territories will Not Prevent Acquisition of Nationwide Spectrum

Larger carriers have suggested that smaller auction territories could make it hard for them to develop national networks and leave holes in their networks.⁷⁶ First, it is worth noting that even if one accepts this argument, it may best be viewed as an argument in favor of auctioning a portion of the spectrum as national licenses, but does not offer a compelling justification for choosing larger EAs over smaller license territory sizes. In the following sub-sections, we explain why the choice of smaller license sizes instead of EAs would not inefficiently impact the efforts of larger operators to right-size their spectrum acquisitions.

1. Carriers Can Bid More

The bidding process most likely will be automated. Thus nothing prevents a carrier who wants spectrum for a larger coverage area, potentially even nationwide, from being the highest bidder in every CMA the carrier wants to cover.⁷⁷

As we explained above, choosing a smaller license territory size, such as CMAs will facilitate wider participation and is likely to yield higher auction proceeds. Some of this may be due to bid prices being higher for some licenses than would have been the case were EAs chosen, thereby discriminating against some bidders. To the extent that is the case, the winning bidder may have to pay more to acquire the spectrum in a CMA auction than they would have had to pay in an EA auction. It is understandable that the operator would prefer that were not the case. But it is not in the public interest to subsidize the spectrum acquisition costs of large operators.

2. No Need to Subsidize Carriers that Don't Want to Bid for All Markets

In suggesting that bidding by CMAs might result in spectrum holes in its national coverage, Verizon suggests that it may fail to be the winning bidder for all of the CMAs it wants in a CMA-based auction.⁷⁸ Implicitly, this may be because Verizon is unwilling to pay the value of the spectrum when it is put to its highest value use. While it is understandable that Verizon and others

⁷⁶ Comments of Verizon and Verizon Wireless, *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, GN Docket No. 12-268 at 61 (filed Jan. 25, 2013) (hereinafter *Verizon Incentive Auction Comments*).

⁷⁷ See AT&T's ability to acquire a near-nationwide footprint with CMAs in the Lower 700 B Block spectrum.

⁷⁸ See *Verizon Incentive Auction Comments*, *supra* note 76, at 49.

may want to price smaller carriers out of the auction through larger geographic license sizes, this objective is not in the public interest, for the reasons set forth above. It would result in directing spectrum away from its most efficient use. It would also subsidize the acquisition of spectrum by one of the national providers that, many might argue, already has an excess share of the prime sub-1 GHz spectrum.

A more subtle argument relates to the potential risk for hold-up, under the presumption that Verizon would be the most efficient licensee for the spectrum at issue. According to the hold-up argument, a speculator might recognize Verizon's desire to acquire a national footprint of spectrum, and would be willing to outbid Verizon for a CMA. Having acquired the CMA, the speculator could then hold-up Verizon for surplus rents. This argument is not convincing for several reasons.

First, the risk of such hold-up problems is a challenge for all auction designs, and it is dubious whether the risk is significantly impacted by the geographic license size used.

Second, the increased competitiveness of a smaller license territory size-based auction and other design characteristics being contemplated (e.g., bidding in the Forward Auction for amounts of spectrum instead of specific frequencies or appropriate build out requirements) offer better ways to address the risk of hold-up in any case.

Third, the presumption that the large carriers are especially vulnerable to hold-up in this context is not credible. Of all the operators, the largest carriers are in the strongest bargaining position and have the deepest resources (spectrum, network, and financial) with which to counter extortion attempts by such a would-be speculator.

Finally, the greater compatibility between smaller CMAs and more liquid secondary markets makes it more likely that future holes in national operator networks might be filled by acquiring spectrum after the auction.

3. Existing Spectrum Holdings Compensate for Spectrum Holes

Carriers do not need nationwide coverage in any given frequency or even spectrum band. They do, however, need a portfolio of spectrum in various bands to service a variety of circumstances. Newer multiband handsets and 4G LTE network technology make it feasible to operate national services while switching frequencies using heterogeneous spectrum holdings. Moreover, given their significant spectrum holdings below 1 GHz, the two largest carriers have the ability to shift customers to other bands. Finally, it is worth noting that not even the national operators have facilities offering ubiquitous coverage, and hence, rely on roaming agreements to provide service where they have coverage gaps.

4. Aggregation of Smaller License Sizes Would Not Incur Significant Transaction Costs

Larger operators with large coverage areas may argue that even if the frequencies do not change, there will be additional licensing-related transaction costs associated with having a larger number of licenses as opposed to having fewer EAs. For example, Verizon points to the FCC's discussion of the transaction costs that may be involved in aggregating large swaths of spectrum as a reason

for using larger territory sizes.⁷⁹ The computing and management tools and experience with managing complex portfolios of spectrum resources in more dynamic spectrum markets have advanced significantly during the subsequent decade. While CCA objects to package bidding, the forward portion of the Incentive Auction is widely expected to be a combinatorial auction that will facilitate complex packaged bidding strategies that should render the choice between smaller license size territories or larger ones is relatively unimportant from the perspective of transaction costs.⁸⁰

Furthermore, the future of spectrum management points toward smaller cells. With the increased emphasis on higher data rates and usage, cell sites will become increasingly dense over time.⁸¹ Additionally, secondary market trading, while dominated by the two largest carriers, is more advanced today.⁸² The combination of better spectrum management tools, the increased need to transact spectrum more dynamically (in time and space), and the trends toward smaller sized cell sites suggest that any such transaction costs should be significantly lower today and ought to decrease still further in the future. Indeed, the more granular licenses, such as CMAs, may actually contribute to lowering transaction costs.

B. Smaller Territories will Not Significantly Increase Auction Administrative Costs

Another concern is that an auction with more licenses will result in higher administrative costs for the auction, and subsequently, in managing the larger number of smaller license territories. We do

⁷⁹ *Verizon Incentive Auction Comments*, *supra* note 76, at 62, n.134 (citing Upper 700 MHz Service Rules, Order, 15 FCC Rcd at 501 ("When areas are inefficiently small, the costs of aggregation during or after the auction in terms of delay and transaction costs may harm both service providers and customers alike.")).

⁸⁰ Combinatorial auctions allow a bidder to bid on a combination of items as opposed to one discrete item. This would allow a bidder, for example, to bid on a combination of territories in the Incentive Auction with a single bid for the group.

⁸¹ See John Chapin & William Lehr, *Mobile Broadband Growth, Spectrum Scarcity, and Sustainable Competition*, 39th Research Conference on Communications, Information and Internet Policy (TRCP 2011), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1992423.

⁸² For a discussion of the growth in secondary market trading, see John W. Mayo & Scott Wallsten, Tech. Policy Institute, *Enabling Efficient Wireless Communications: The Role of Secondary Spectrum Markets*, 22 *Information Economics and Policy* 61 (2010). According to the FCC:

In 2003 and 2004, the FCC established new policies and procedures to facilitate broader access to valuable spectrum resources through the use of spectrum leasing arrangements, and streamlined procedures for approving license assignments and transfers of control. The FCC also provided for immediate processing of certain qualifying spectrum leasing and license assignment and transfer transactions.

The FCC has also taken steps to make it easier to find current licensees, including releasing the Spectrum Dashboard, which allows the public to search, map, and download licensing data with just a few clicks of a mouse.

Accessing Spectrum | FCC.gov, <http://www.fcc.gov/encyclopedia/accessing-spectrum>.

not believe any such increase in costs would be sufficient to outweigh the benefits of using smaller sized license territories.⁸³

Given its past use of both large and small license territories, the FCC clearly has the expertise to handle an auction with many licenses. Importantly, the Commission successfully managed auctions within 493 BTA regions in the mid 1990s. Since then, the experience and expertise of the FCC and the industry in auctions have advanced significantly. They have developed analytical tools and software to support increasingly complex auction frameworks, including combinatorial clock auctions.⁸⁴ Therefore, auctions based on smaller territories today, such as CMAs, will likely be much easier to manage than the BTA auctions in the mid 1990s. Moreover, the FCC is proposing to auction the 3.5 GHz band Priority Access licenses on the basis of Census tracts.⁸⁵ There are over 74,000 Census tracts in the US.. This is a further testament to the FCC's ability to manage auctions of many small territories on a nationwide basis and indicative of the general trend toward more granular management of spectrum resources.

These auctions took place when participants and their advisors had substantially less cumulative experience and the software tools for preparing bids and managing the auction were significantly less advanced. In today's environment of software-assisted auctions and spectrum management, the number of territories auctioned is unlikely to significantly impact costs. To alleviate any lingering concerns about burdens of complexity, the FCC could consider adding additional time between rounds in order to allow bidders to assess their positions. However, prior experience demonstrates that the number of territories does not impose an excessive burden and the significant benefits of right-sized territories outweigh any marginal costs.

Auctioning a larger number of licenses might add to license-related paperwork, but these costs should be trivial. However, even if one were to assume that transaction costs would increase as a result of choosing smaller areas, it would be inappropriate to view this as a cost solely attributable to the Incentive Auction. The future trend in wireless technology and spectrum management policy is toward finer-grained management of spectrum resources,⁸⁶ and thus any transaction costs associated with such a move will be incurred in any case. This finer-grained management will enable more dynamic allocation of resources in time, space, and frequency, greatly expanding the capacity of scarce spectrum. Increasingly fine articulation of spectrum contours and license areas will support more granular secondary market transactions, interference management, and future efforts to redeploy spectrum to higher value uses.

⁸³ There are 734 CMAs versus 176 EAs.

⁸⁴ Indeed, in the context of other auctions (such as awarding Universal Service Fund support) the FCC has conducted auctions on a basis as granular as road miles and census tracts.

⁸⁵ *3.5 GHz Licensing Framework*, FCC (Released November 1, 2013). Available at: <http://www.fcc.gov/document/35-ghz-licensing-framework-pn>.

⁸⁶ See generally *PCAST Report*, *supra* note 16.

C. Roaming and Interoperability Costs will Not Increase Significantly

One concern that arises with the use of smaller license territories is the potential that roaming costs might increase. The potential problem arises because it is more likely that a customer would cross the smaller territory boundaries than the boundary of an EA or larger license territory.

Within a territory, be it a CMA, an EA or some other area, a spectrum license would operate in a particular frequency. But across CMA boundaries, the same frequency may not be available or may be licensed to different operators. In the first case, that is because licensing on the basis of CMAs may enable the clearing of more unencumbered spectrum. In that context, the fact that more roaming may occur and that additional roaming costs might be incurred as a result should hardly be regarded as a problem. This is because the customer who roams to the new spectrum would be taking advantage of additional spectrum resources that would not have even been available if larger license territories were used.

This issue highlights another implicit concern that the auctions raise. Specifically, wireless costs will increase because of a loss of scale or scope economies in equipment (network and handset) because operators may need to support operations across multiple frequencies. While that is true, it is the explicit goal of spectrum auctions, including the Incentive Auction, to make new frequencies available for higher value wireless services. One cannot appropriately view the ability to deploy an asset for a higher value use as a cost.

It is certainly the case that there are global scale and scope economies to be realized when the market for equipment that operates in a particular frequency is larger. However, opportunities to take advantage of such scale and scope economies do not arise at the level of the individual operator nor at the level of CMA versus EA-sized markets; instead these issues arise in the context of global or national markets. With respect to network equipment and handsets, the markets are global. Likewise, network design, planning, and outside plant construction and infrastructure services are readily available from an ecosystem of service providers with national scale. For example, the most significant outside plant cost is associated with the siting, construction, and management of cell towers. Even the largest operators have significantly outsourced those costs by relying on national tower leasing companies.⁸⁷ Thus, it is not appropriate to confuse any additional costs realized by the wireless ecosystem as a consequence of operating in a larger range of frequencies as being attributable to the choice of smaller territories such as CMAs versus larger ones including EAs.

This leaves the second concern for how roaming costs might be increased by the choice of smaller areas. This second context arises where two different operators own the same frequency in adjacent territories. In this context, the question would arise as to how the customer should roam: should the customer be handed off to the operator with the license in the adjacent CMA or should the customer be moved to another frequency controlled by the customer's original operator (or by that operator's regular roaming partner)? In both cases, there may be incremental roaming charges. And in the latter case, the customer would require a multi-band handset that supports the various

⁸⁷ See FCC's 16th Wireless Competition Report, *supra* note 14, at ¶¶ 323-324.

frequencies that are to be used for roaming. While there might be additional roaming expenses, it is unclear that these should be viewed as a problem for three reasons.

1. Multiband Radios are Already the Norm in Mobile Devices

Multiband radios are already the norm in mobile devices, and the expectation is that support for multiband radios will increase and is needed to take advantage of the diverse spectrum resources that will become increasingly available.⁸⁸ Indeed, the Incentive Auctions will significantly expand the range of frequencies that will be used for wireless broadband and other services.⁸⁹ Moreover, the transition to LTE, wireless innovation, and the emerging ecosystem of mixed network roaming (e.g., WiFi offload) are expanding technical, business, and consumer options for enabling low-cost roaming and multi-frequency support for wireless data. Finally, 600 MHz interoperability is likely to significantly increase roaming opportunities.

2. Not all Radios Need to Roam

Not all radios need to roam because not all uses of the Incentive Auction spectrum will be to support high-speed or national mobile roaming services. For example, some of the spectrum may be used for backhaul, fixed wireless broadband, or other services that have yet to be determined.

3. Desirable that Handsets be Multimode

If one considers the typical national mobile broadband service, it is desirable that such handsets be multimode to encourage interoperability and enhance competition. For those operators who wish to offer less-capable handsets (possibly to support legacy, niche, or low-cost customers), there is always the option of acquiring a national license to a particular frequency band. As we explain further below, choosing a smaller license size does not preclude this from happening; this choice does, however, provide access to additional spectrum resources to allow the operator to shift uses (non-mobile or frequency agile) to free up scarce national frequencies.

In summary, therefore, it is less likely the case that the choice of smaller areas will increase roaming costs than that it will expand the tool-set for addressing a world where multi-frequency/multi-networking will be the norm.

D. Post-Auction Adjustments Easier with Smaller Territories

Advocates of EAs or larger license territories argue that after-market transactions can address any of the issues that may arise from failing to adopt smaller license territories, such as CMAs. Many

⁸⁸ See, e.g., Press Release, Qualcomm, Qualcomm RF360 Front End Solution Enables Single Global LTE Design for Next-Generation Mobile Devices (Feb. 21, 2013), [available at http://www.qualcomm.com/media/releases/2013/02/21/qualcomm-rf360-front-end-solution-enables-single-global-lte-design-next](http://www.qualcomm.com/media/releases/2013/02/21/qualcomm-rf360-front-end-solution-enables-single-global-lte-design-next) (touting Qualcomm's RF360 Front End Solution that offers a "comprehensive, system-level solution that addresses cellular radio frequency band fragmentation," capable of supporting more than 40 LTE band classes).

⁸⁹ FCC initiatives at 3.5GHz, 5.9GHz, and elsewhere are also expanding spectrum availability for wireless devices. Making use of all of these bands will require new radios, and in most cases, multiband radios.

of these arguments apply equally well to explain why choosing smaller territory sizes should not pose a problem for advocates of larger sized licenses.

The proponents of EAs argue that licensees whose original bids are wrong-sized can engage in post-auction spectrum leasing or secondary market trading to right-size their spectrum acquisitions. To the extent this is true, it would help ameliorate the damage from wrong-sizing the license territories to be auctioned. However, rather than taking those risks and incurring those costs in the first place, it would be better to right-size the licenses at the start.

Furthermore, the risks and costs are likely to be asymmetrically shared in the smaller versus larger cases. With smaller licenses, everyone has a symmetric opportunity to acquire the spectrum in each territory, since foreclosure risks are minimized. With larger licenses, there is the chance that post-auction secondary markets might not be sufficiently liquid to enable smaller entrants or rural operators to divest or acquire spectrum resources to make post-auction right-sizing adjustments to their spectrum holdings. Smaller providers (and even large providers seeking to fill spectrum holes) would be dependent on EA-licensees to partition those territories to make appropriately sized-territory (i.e., smaller) spectrum available to them. Smaller territory licenses may be sold or aggregated more easily in order to match spectrum buyers and sellers with heterogeneous supply and demand.

Second, while growing, the secondary market is still primarily dominated by the largest carriers. For example, larger carriers who benefited from the foreclosure of smaller operators due to the choice of EAs instead of CMAs would have little incentive to hand back such benefits by making any excess spectrum resources they have available to those same smaller operators. The more limited option of being able to lease spectrum from larger operators reduces the effectiveness of the potential competition such operators might offer. Finally, the surplus generated from secondary market trading would accrue to private interests instead of being captured in the auction proceeds.

V. Conclusion

The case for using smaller license territories for the Forward Auction is compelling. It will give the smaller carriers, particularly rural-based carriers, an opportunity to compete for the spectrum resources they need. In turn, this will support the development of a more competitive mobile broadband market, greater innovation, improved rural coverage and greater auction proceeds. It also dovetails with the long-term US spectrum policy trajectory towards more granular and dynamic spectrum markets that will help ensure efficient spectrum usage in the future, and specifically, the FCC's goals for the Incentive Auction as outlined in the Spectrum Act.

VI. About the Authors

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Dr. William Lehr is a telecommunications/Internet industry economist and policy analyst with over twenty years of experience in academic research and industry consulting.⁹⁰ He is currently a research scientist in the Computer Science and Artificial Intelligence Laboratory (CSAIL) at the Massachusetts Institute of Technology (MIT). Dr. Lehr's research focuses on the economic and policy implications of broadband Internet access, next generation Internet architecture, and the evolution of wireless technology.

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