

**BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON D.C. 20554**

In the Matter of)	
)	
Expanding the Economic and Innovation)	GN Docket No. 12-268
Opportunities of Spectrum Through)	
Incentive Auctions)	
)	

REPLY COMMENTS OF AT&T INC.

Alex Starr
Michael P. Goggin
Gary L. Phillips
Peggy Garber
AT&T SERVICES, INC.
1120 20th Street, NW
Washington, D.C. 20036
202-457-2055

Jonathan E. Nuechterlein
Samir C. Jain
WILMER CUTLER PICKERING
HALE & DORR LLP
1875 Pennsylvania Avenue, NW
Washington, D.C. 20006
202-663-6000

David L. Lawson
Christopher T. Shenk
SIDLEY AUSTIN LLP
1501 K Street, N.W.
Washington, D.C. 20005
202-736-8000

Attorneys for AT&T Inc.

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INTRODUCTION AND SUMMARY

As the opening comments underscore, the statutory task Congress has assigned the Commission is as unprecedented in its complexity as it is critical to the future of mobile broadband. Much of that complexity arises from a central and unprecedented feature of the Spectrum Act. By statutory design, this auction can succeed, and spectrum can be reallocated, only if the Commission elicits forward-auction revenues that exceed reverse-auction revenue requirements plus administrative and estimated repacking costs. The goal of meeting that statutory condition for the maximum possible amount of freed-up spectrum should guide every important decision the Commission makes in this proceeding. In other auctions, there might be some margin for error if the Commission makes speculative policy judgments that impair the value of auctioned spectrum or that keep it from promptly reaching the providers who can produce the greatest consumer benefits with it. Regulatory missteps might needlessly reduce the auction proceeds that are deposited into the Treasury, but consumers nonetheless benefit from the reallocation of spectrum to mobile broadband uses, and secondary-market transactions can normally be expected to produce the eventual assignment of spectrum assets to the providers most capable of putting them to the uses most valued by consumers.

This auction is different, and there is *no* room for regulatory error, because the consequences of such error would be much more severe: less (or no) spectrum would be reallocated for mobile broadband in the first place. To avoid that outcome and free up as much spectrum as possible, the Commission should (1) adopt a sound band plan that maximizes the prospective value of this spectrum to forward-auction bidders; (2) avoid anticompetitive, revenue-reducing restrictions on who may participate in the forward auction; (3) allow forward-

auction participants to express the full value of this spectrum in the form of high winning bids by creating efficient mechanisms for package bidding; and (4) retain full discretion to repack television stations efficiently in order to reduce the number of broadcasters who must be paid to cede spectrum rights.

1. Designing an optimal band plan

Overview. The opening comments reveal widespread support for key aspects of the NPRM's¹ proposed band plan but also a strong consensus that other aspects should be modified. First, there is a consensus against the NPRM's proposals to place (i) television stations in the duplex gap, (ii) all paired downlink blocks below channel 37, and (iii) uplink blocks as far down as current Channels 42-46. Each of those features would create substantial interference and other implementation problems and devalue the spectrum for carriers and consumers alike. Second, as a number of commenters explain, the NPRM proposes excessive market-to-market variation in the number of uplink blocks, a feature that would exacerbate the risk of co-channel interference across neighboring markets in which differing amounts of spectrum have been cleared. That said, the Commission should *not* err in the opposite direction by adopting NAB's proposal to limit cleared spectrum in *all* markets to the blocks that are cleared in markets with the *least* cleared spectrum. Instead, the Commission should adopt a middle-ground band plan that allows a limited amount of market-to-market variation but confines such variation to supplemental downlink spectrum, as AT&T's proposal would do.

TDD/FDD issues. The Commission should reject Sprint/Clearwire's proposal to designate some or all of the 600 MHz band for TDD operations. First, TDD is an outlier

¹ See Notice of Proposed Rulemaking, *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, 27 FCC Rcd 12357 (2012) ("NPRM").

technology in the United States; with the exception of a single carrier (Sprint/Clearwire itself), all U.S. LTE providers rely exclusively on FDD technology. As a result, there would likely be few bidders—and perhaps only one—for any TDD-designated spectrum in this auction, and the lack of competition for that spectrum would suppress bid levels. Second, TDD operations in the 600 MHz band would create serious risks of harmonic interference to FDD operations in other bands. Third, given the severe incompatibility of TDD and FDD, any mixed TDD/FDD environment would create substantial risks of adjacent and co-channel interference within the 600 MHz band. Such interference could be mitigated only by imposing substantial guard bands and/or exclusion zones that would reduce the amount or usability of licensed spectrum. Fourth, even for spectrum dedicated *entirely* to TDD operations, the coexistence of multiple TDD-based carriers in the same band would present substantial and costly coordination challenges among those TDD operators (or require substantial guard bands between them). Finally, a TDD-only band plan would require complex coordination between TDD operators and television broadcasters that operate on the same channels in adjacent markets in order to manage co-channel interference.

Guard band size and unlicensed spectrum. A key type of guard band—the duplex gap—is needed in any FDD environment to prevent interference between uplink and downlink operations. A strong consensus among carriers and equipment manufacturers is emerging that a duplex gap of 10-12 megahertz is sufficient to perform that role. As Professors Reed and Tripathi explain in their reply analysis,² there are also technical reasons to cap the size of the

² Jeffrey Reed and Nishith Tripathi, *The 600 MHz Spectrum Auction: An Analysis of the Band Plan Framework and Response to Certain Proposals*, at 22-25 (Mar. 12, 2013) (“Reed/Tripathi Reply”) (attached as Exh. A).

duplex gap at 15 megahertz, given technological constraints on efficient antenna design. The proper width of other guard bands depends on a variety of factors, including the transmission power of any adjacent television station, but will fall in the range of 6-12 megahertz.

Led by Google and Microsoft, a few commenters ask the Commission to devote far more spectrum to the duplex gap and other guard bands—not because that extra spectrum is genuinely needed to prevent interference to licensed uses, but simply to reserve more spectrum for unlicensed uses. Although AT&T supports creating additional unlicensed spectrum in other bands, the Google/Microsoft proposal for the 600 MHz band would be unlawful and unwise. First, the Spectrum Act means what it says: the Commission must limit any guard bands in the 600 MHz band to a size that is “no larger than is technically reasonable to prevent harmful interference between licensed services.”³ That mandate applies as much to the duplex gap as to any other type of guard band and prohibits the Commission from artificially enlarging guard bands to accommodate unlicensed uses.

Congress had good reason for including this limitation on the Commission’s authority: allocating wide swaths of spectrum for unlicensed uses in the 600 MHz band would impose major opportunity costs on the American public. The question is not whether allocating prodigious new spectrum for unlicensed uses would create value; the question is whether, taking opportunity costs into account, the Commission would create more value by locating such spectrum in this band or in some other band. This auction presents the Commission’s best opportunity in a generation to free up large amounts of much-needed new spectrum for *mobile*

³ Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, Tit. VI, § 6407(b), 126 Stat. 156, 231 (Feb. 22, 2012) (“Spectrum Act”) (codified at 47 U.S.C. § 1454(b)).

broadband uses in the bands below 3 GHz, which, as the National Broadband Plan has noted, have propagation characteristics well-suited to wide-area mobile uses. Google and Microsoft have not shown (and cannot show) that any benefits that might flow from diverting scarce mobile broadband spectrum to unlicensed uses would more than compensate for the consumer-welfare losses that would follow from the resulting reductions in mobile network capacity. In short, it would make a great deal more sense to focus on freeing up substantial new spectrum for unlicensed devices in bands that do *not* pose these opportunity costs for mobile networks, such as the 5 GHz band.

Even if the statutory language permitted the Google/Microsoft proposal (which it does not), and even if that proposal were plausible from an opportunity-cost perspective (which it is not), that proposal would still be untenable because exempting large swaths of unlicensed 600 MHz spectrum from competitive bidding would lower aggregate forward-auction revenues and thus reduce the odds that the auction will satisfy the statutory revenue requirement. Google and Microsoft cite abstract scenarios in which reductions in available spectrum blocks would not reduce aggregate revenues. But as Professor Katz et al. explain, such scenarios are exceedingly unlikely to arise in the real world, and needless reductions in the supply of spectrum subject to auction would indeed increase the risk of auction failure.⁴

First, reducing the supply of licensed spectrum blocks will reduce forward-auction revenues if the demand of potential bidders for those blocks is elastic, and it almost certainly is. Through numerous Monte Carlo simulations, Professor Katz et al. demonstrate that supply

⁴ Michael Katz, Philip Haile, Mark Israel, and Andres Lerner, *Spectrum Aggregation Policy, Spectrum-Holdings-Based Bidding, and Unlicensed Spectrum*, at ¶¶ 64-79 & Appx. A (Mar. 12, 2013) (“Katz et al. Reply Decl.”) (attached as Exh. B).

reductions typically lead to substantial revenue reductions under a broad variety of auction scenarios involving bidders with widely differential valuations. Second, even if demand were inelastic in general, revenues would still fall if the incremental unlicensed spectrum that is withheld from the auction is *a substitute for licensed spectrum* and will therefore diminish the value that a carrier could expect to derive from the purchase of new licensed spectrum.

Unlicensed spectrum is indeed a substitute for licensed spectrum, and on two levels: from the perspective of wireless carriers (because it is an alternative spectrum input and thus dilutes the value of licensed spectrum) and from the perspective of retail consumers (some of whom will choose unlicensed uses that rely on free spectrum inputs over wireless carriers that rely on licensed spectrum). In short, the Google/Microsoft proposal would substantially reduce auction revenues and thus increase the risk of auction failure.

AT&T does not necessarily oppose unlicensed uses in properly sized guard bands (including the duplex gap). As the Spectrum Act provides, however, the Commission must ensure that such uses will not cause harmful interference to licensed services. Conversely, such unlicensed uses should be required to accept any interference from licensed mobile broadband operations. Absent such protections for licensed operations, the value of licensed blocks would decrease, forward-auction revenues would fall, and paired blocks would become non-fungible.

Interoperability. The Commission *should* promote free-market solutions to efficient interoperability by designing a band plan that reduces the threat of disproportionate interference to particular blocks within the band (for example, by unlicensed devices or TDD operations). But the Commission should *not* usurp the traditional role of standards-setting organizations by requiring all devices that utilize 600 MHz spectrum to support all blocks in that band. Those organizations have always addressed interoperability issues in a collaborative, open, and

technologically flexible process that accounts for the diverse interests of providers, manufacturers, and consumers. In all events, it would be premature for the Commission even to consider imposing such mandates before it has even settled on a band plan.

2. Maximizing forward-auction participation

Some commenters—most of them wireless carriers hoping to minimize forward-auction competition—ask the Commission to adopt various mechanisms to keep AT&T and Verizon from purchasing the spectrum they need to compete as effectively as possible to meet their customers’ accelerating bandwidth demands. That outcome would thwart the public interest and radically increase the risk of auction failure.

First, disparities in spectrum holdings are not a “problem” that requires a regulatory solution; larger and more successful carriers need more spectrum than others because they face unusually intense capacity challenges. It would serve no valid purpose to deny them the opportunity to buy the additional spectrum inputs they need simply because, through marketplace success, they have won many customers and thus have already needed to purchase significant spectrum holdings.

Second, AT&T does not have “excessive” spectrum holdings by any measure; indeed, it has far less spectrum than Sprint/Clearwire. Various commenters try to obscure that fact by artificially gerrymandering spectrum holdings into “high-band” and “low-band” spectrum and attaching disproportionate importance to the latter. That gerrymander lacks any rational basis, as AT&T has explained elsewhere and briefly summarizes below.

Third, excluding AT&T and Verizon would risk auction failure by reducing forward-auction revenues, as Professor Katz et al. explain. Indeed, in the words of potential broadcaster participants in the reverse auction, if the Commission “restrict[s] Verizon and/or AT&T from

participating in the forward auction,” then “the auction will not produce the revenues necessary to meet the expectations of the potentially willing broadcast sellers”; “the auction will fail”; “there will be no new spectrum allocated for consumer use of wireless devices”; “there will be no surplus to fund an interoperable network for public safety first responders”; and “there will be no surplus for deficit reduction.”⁵ Moreover, as those broadcasters emphasize, even the fear of that outcome would subvert prospects for auction success by deterring them and other broadcasters from participating in the *reverse* auction.

Fourth, the Spectrum Act prohibits the Commission from relying on spectrum-aggregation policies to exclude any carrier from participating from any auction for 600 MHz spectrum, whether in particular localities or more broadly. Section 6404 provides that “the Commission may not prevent” an otherwise qualified bidder “from participating in a system of competitive bidding” on the basis of its spectrum holdings, subject only to the proviso that the Commission may exercise whatever authority it previously had “to adopt and enforce rules of general applicability, including rules concerning spectrum aggregation that promote competition.” Of course, the Commission need not “prevent” bidders “from participating in a system of competitive bidding” in order to “adopt and enforce” any valid spectrum-aggregation “rules of general applicability.” Instead, should it determine that spectrum acquisitions in the auction would result in an aggregation of spectrum that threatened to foreclose competition, it could simply allow winning bidders, post-auction, to divest existing spectrum in order to comply with the rules while rationalizing their spectrum holdings. That alternative bars the Commission

⁵ Comments of the Expanding Opportunities for Broadcasters Coalition at 13-14 (“EOBC Comments”).

from disqualifying carriers if they agree to make divestitures that will keep them from ever coming into violation of any otherwise valid spectrum-aggregation policy.

Finally, some commenters advocate a novel scheme of “bidding credits” that would confer arbitrary bidding advantages on carriers in inverse proportion to their existing spectrum holdings below 1 GHz. That scheme would suffer from the same defects as other restrictions on participation by AT&T and Verizon. Indeed, if the scheme achieved its intended objective—altering the identities of the winning bidders—the amounts those bidders would pay at auction would necessarily be lower than the amounts that would otherwise be paid by the winning bidders in the *absence* of bidding credits. Simply as a matter of mathematics, therefore, these bidding-credit proposals could not achieve their purpose without increasing the risk of auction failure.

3. Providing for efficient package-bidding mechanisms

Package bidding is necessary to avoid a bid-suppressing *exposure problem* that is well-recognized both in Commission precedent and in the auction literature: the risk to a bidder of “winning” a hodgepodge of scattered spectrum assets that lack much of the value they would have presented had they been part of a seamless geographic package. In the absence of a package-bidding solution, that exposure problem would reduce forward-auction revenues and increase the risk of auction failure. Tellingly, many opponents of package-bidding in this proceeding simply ignore the exposure problem.

Some commenters suggest that the exposure problem must not be real because the Commission did not rely on package bidding in the AWS auction and permitted package bidding for only a single block in the 700 MHz auction. That argument is flawed on two levels. First, the Commission assigned very large geographic areas to certain licenses sold in these auctions

and thus established a rough (but quite imperfect) proxy for package bidding. Second, the Commission may well have forgone substantial auction revenues in the AWS and 700 MHz auctions precisely because it did *not* make adequate provision for package bidding there. Indeed, there is compelling evidence for that conclusion in the form of the enormous sums that carriers have subsequently paid one another in the secondary market to rationalize their spectrum holdings and achieve geographic complementarities. Given the statutory auction-closing condition, the Commission has no similar luxury here to allow much of the value of geographic complementarities to be captured by bidders that sell their spectrum in that multi-year process of post-auction spectrum rationalization. Instead, the Commission should take the steps needed to capture that value up front, in the forward auction itself, and that means creating efficient mechanisms for package bidding.

Finally, whereas some commenters attack straw man package-bidding mechanisms with various design defects, the specific form of package bidding AT&T has proposed—the clock package auction set forth by Professors Che, Haile, and Kearns—would not add undue complexity to this auction or unfairly benefit large carriers over small ones. That mechanism will pick winners solely on the basis of which combination of bids expresses, and can be expected to produce, the greatest economic value for consumers. In addition, as Professors Che and Haile explain in their attached reply analysis,⁶ their proposed clock package auction will present no incremental risk of any “threshold problem” (*see* Section III below) beyond the risk already presented in the Auctionomics proposal (with or without any package-bidding component), and it also will present no significant risk of strategic bid manipulation.

⁶ Reply Analysis of Yeon-Koo Che and Phil Haile (Mar. 12, 2013) (“Che/Haile Reply Analysis”) (attached as Exh. C).

4. Providing for efficient repacking

As discussed in our opening comments (at 74-79), this proceeding will succeed only if the Commission retains flexibility to repack remaining broadcast stations as efficiently as possible. Efficient repacking is the key to reducing the statutory revenue requirements by limiting the number of stations that must be paid compensation for ceding spectrum rights.

The Commission should thus reject efforts by various broadcasters to hamstring its repacking discretion. First, Congress granted the Commission enormous flexibility to repack television stations in the public interest, and it rejected proposals to cabin that flexibility in the ways that broadcasters mistakenly attribute to the statutory language. The Commission need only “make all *reasonable* efforts to preserve, as of the date of the enactment of this Act, the coverage area and population served of each broadcast television licensee.” Spectrum Act § 6403(b)(2) (emphasis added). The qualifier “reasonable” means that broadcaster interests, while important, must sometimes yield to the public’s equally important interest in freeing up additional spectrum for mobile broadband.

Second, the Commission should reject the contention of the major broadcaster associations that “the Commission should not plan on relocating more than 400 to 500 stations because otherwise relocation costs will exceed the amount of the [\$1.75 billion] Fund Congress established to fully reimburse broadcasters.”⁷ In fact, the Commission might well need to repack more than 500 stations under a successful auction scenario, and it is free to do so. As an initial matter, the Spectrum Act nowhere suggests that the \$1.75 billion figure constrains the Commission’s discretion to repack as many stations as it deems appropriate to reallocate

⁷ Comments of ABC, CBS, FBC, and NBC Affiliates Associations at 47 (“Affiliates Associations Comments”).

spectrum for mobile broadband. In any event, even if the Commission repacks more than 500 stations, the costs the Commission must reimburse—those “reasonably incurred” by broadcasters in connection with repacking—will likely remain well below \$1.75 billion. The Commission has abundant discretion to ensure that outcome through a proper implementation of the undefined term “costs.”

ARGUMENT

I. THE COMMISSION SHOULD DESIGN A BAND PLAN THAT EXTRACTS THE GREATEST POSSIBLE VALUE FROM THE 600 MHZ BAND AND ELICITS THE GREATEST POSSIBLE FORWARD-AUCTION PARTICIPATION

A. The Record Reveals Key Points of Consensus Concerning the Design of the Band Plan, Including a Need for Certain Changes to the NPRM’s Proposal

The Commission faces a tremendously complex task in designing a 600 MHz band plan. Nonetheless, the record reveals significant points of consensus about the design of that band plan. Carriers and vendors alike agree with the Commission’s proposal to auction spectrum in five-megahertz blocks.⁸ Commenters also support the Commission’s key insight that spectrum blocks should be grouped into generic categories in which all individual blocks are treated as fungible.⁹ Further, they agree with the Commission that uplink blocks in an FDD band plan should be placed downward from channel 51, followed by a duplex gap and then paired

⁸ *E.g.*, AT&T Comments at 18-19 n.6; Cellular South Comments at 6; Leap Comments at 5; MetroPCS Comments at 17; T-Mobile Comments at 14; Verizon Comments at 15-16; Alcatel-Lucent Comments at 13; Nokia Siemens Comments at 9; Qualcomm Comments at 5; Research in Motion (“RIM”) Comments at 6; Letter From Joan Marsh (AT&T), Peter Pitsch (Intel), Rick Kaplan (National Association of Broadcasters), Dean Brenner (Qualcomm), Kathleen Ham (T-Mobile), & Charla Rath (Verizon Wireless) to Gary Epstein & Ruth Milkman (FCC), GN Docket No. 12-268, at 1 (filed Jan. 24, 2013) (“Jan. 24 Joint Letter”).

⁹ *E.g.*, AT&T Comments at 41; Alcatel-Lucent Comments at 4; Qualcomm Comments at 2, 5; T-Mobile Comments at 19; Verizon Comments at 44-45.

downlink blocks.¹⁰ All parties further agree that any operations in the duplex gap and other guard bands should not cause interference to adjacent licensed operations, although, as discussed below, there is some disagreement concerning the appropriate size of those guard bands.¹¹

A striking consensus has also emerged, however, that the Commission should make certain changes to the NPRM's band plan proposal. First, all parties addressing the issue—from broadcasters to carriers to equipment vendors—agree that television stations should *not* be placed in the duplex gap because doing so would create a risk of substantial intermodulation interference in a variety of downlink frequencies, not only in the 600 MHz band itself, but also in other bands such as the PCS band.¹² Second, all carriers and vendors support an approach that maximizes the amount of paired spectrum *above* channel 37.¹³ Placing all paired downlink blocks below channel 37, as the NPRM proposes, would create implementation problems by materially increasing the size of the antennas needed for devices and base stations in a 600 MHz

¹⁰ *E.g.*, AT&T Comments at 32-33; Alcatel-Lucent Comments at 3-4; Qualcomm Comments at 4-5; RIM Comments at 7-8; T-Mobile Comments at 10; Verizon Comments at 5; Jan. 24 Joint Letter at 1.

¹¹ *E.g.*, AT&T Comments at 22-23; Alcatel-Lucent Comments at 24; MetroPCS Comments at 25; Qualcomm Comments at 23 & n.38; Jan. 24 Joint Letter at 1. Other points of agreement include permitting existing operations in channel 37 to remain there and facilitating international harmonization and coordination. *See* AT&T Comments at 39-40, 48-49; National Association of Broadcasters (“NAB”) Comments at 5; Nokia Siemens Comments at 12, 20; Sprint Comments at 7; WMTS Coalition Comments at 17-18; Jan. 24 Joint Letter at 2.

¹² *E.g.*, AT&T Comments at 24-26; T-Mobile Comments at 8; Verizon Comments at 5-6; Alcatel-Lucent Comments at 14-16; Nokia Siemens Comments at 8; NAB Comments at 33-38; Jan. 24 Joint Letter at 1.

¹³ *E.g.*, AT&T Comments at 33-34; T-Mobile Comments at 3; Verizon Comments at 14-15; Alcatel-Lucent Comments at 13; Nokia Siemens Comments at 10-11; Qualcomm Comments at 5; RIM Comments at 7-8.

network.¹⁴ In addition, placing uplink blocks as far down as current Channels 42-46, as the NPRM proposes (for markets where fourteen or more stations are cleared), would create harmonics-related interference for handsets simultaneously using both the 600 MHz and other receive bands such as PCS and EBS/BRS.¹⁵

Finally, a number of commenters explain that the NPRM's proposed band plan goes too far in varying the number of uplink blocks from market to market depending on how much spectrum is cleared in each market.¹⁶ As AT&T and others have stressed, that maximum-uplink-variation approach would unduly increase the risk of co-channel interference across neighboring markets in which differing amounts of spectrum have been cleared. At the same time, AT&T disagrees with NAB's lowest-common-denominator proposal to limit cleared spectrum in *all* markets to the blocks that are cleared in markets with the *least* cleared spectrum.¹⁷ That approach would reduce the amount of spectrum available for mobile broadband and, by reducing forward-auction revenues, increase the risk of auction failure.¹⁸ An appropriate band plan likely will steer a middle course, as AT&T's band-plan proposal does, between the maximum uplink variation in the Commission's proposal and any lowest-common-denominator approach.¹⁹

¹⁴ See, e.g., AT&T Comments at 5-6; RIM Comments at 8; T-Mobile Comments at 8-9; Qualcomm Comments at 13-15; Verizon Comments at 14.

¹⁵ E.g., AT&T Comments at 19-20; Alcatel-Lucent Comments at 13; CTIA Comments at 26; Nokia Siemens Comments at 13; Qualcomm Comments at 7-10; Verizon Comments at 8.

¹⁶ AT&T Comments at 16-17, 35; CTIA Comments at 23-24; US Cellular Comments at 24; Verizon Comments at 38.

¹⁷ See NAB Comments at 45-47.

¹⁸ AT&T Comments at 15-17.

¹⁹ See *id.* at 32-33, 35-36.

B. The Commission Should Reject Calls To Create a TDD-Focused Band Plan

Although most commenters agree with the Commission's proposal to designate the entire 600 MHz spectrum for FDD operations, Sprint/Clearwire ask the Commission to devote much or all of the 600 MHz spectrum for TDD operations.²⁰ The Commission should reject that suggestion for several reasons.

As an initial matter, the vast majority of carriers—indeed, all carriers in the United States *except* Sprint/Clearwire—use FDD technologies to provide LTE service. Reed/Tripathi Reply at 4. As a result, there would be fewer bidders (and perhaps only one) for any spectrum blocks designated for TDD than for FDD spectrum, and that lower demand would predictably generate far less revenue from the sale of those blocks. As Professors Reed and Tripathi explain, a carrier using FDD would not even be able to aggregate a 600 MHz TDD band with an existing FDD band such as PCS or AWS. Reed/Tripathi Reply at 15. By contrast—and contrary to Sprint's claim (at 8-9 & n.18) that FDD supplemental downlink is of use only to larger carriers with low-band spectrum—LTE-Advanced will permit FDD carriers to aggregate a 600 MHz supplemental downlink band with higher-band spectrum such as PCS or AWS.

Quite apart from that concern, TDD operations in the 600 MHz band would also risk significant interference for FDD operations in the 600 MHz band and other bands as well, to the detriment of carriers and consumers alike. First, as AT&T and others explain, and as even Sprint acknowledges, uplink transmissions in the frequency range of 643-665 MHz would create harmonics that fall within the receive frequencies in the PCS band (1930-1990 MHz).²¹ Because

²⁰ Sprint Comments at 17-26; Clearwire Comments at 6-11.

²¹ AT&T Comments at 27; Qualcomm Comments at 6-7; Sprint Comments at 25. There is abundant industry precedent for such harmonic interference: in some circumstances, harmonics

TDD can transmit on any of its allocated frequencies at any time, designating spectrum blocks that include 643-665 MHz as TDD would produce such harmonic interference. Reed/Tripathi Reply at 13-14; *see also* Alcatel-Lucent Comments at 11. Indeed, that interference would occur not only within a single device that simultaneously uses both 600 MHz TDD and PCS, but also between two devices if a 600 MHz TDD device is in close proximity to a device using the PCS band. Reed/Tripathi Reply at 14; *see also* Alcatel-Lucent Comments at 11.

Second, designating any block for TDD operations would require guard bands to avoid significant adjacent-channel interference between adjacent FDD and TDD blocks. Reed/Tripathi Reply at 14, 17. In particular, as Alcatel-Lucent indicates, a ten-megahertz guard band would be needed between the frequencies assigned to FDD and TDD operations, including a guard band between the lower 700 MHz band (which uses FDD) and any TDD operations at the top of the 600 MHz band.²² In addition, a ten-megahertz guard band would be needed between 600 MHz TDD allocations below Channel 37 and adjacent broadcast operations. Alcatel-Lucent Comments at 11. Of course, making room for these multiple substantial guard bands would reduce the overall amount of usable, licensed spectrum, thereby increasing the risk that any

resulting from the use of 700 MHz frequencies have significantly degraded throughput and useful capacity for devices using both 700 MHz and AWS-1 (Band 4) spectrum. AT&T Comments at 27. Sprint nonetheless dismisses concerns about harmonic interference, blithely asserting that some unspecified “equipment design and operating practice” could solve the issue. Sprint Comments at 25. But blind faith in some as-yet developed design or practice is not a reasoned basis for ignoring interference concerns, particularly those with an existing track record of degrading wireless operations.

²² Alcatel-Lucent Comments at 11; Nokia Siemens Comments at 11 (“Interleaving of FDD and TDD blocks in a random manner is not recommended as it will require guard bands at each FDD/TDD frequency border.”).

TDD-focused band plan would produce inadequate auction revenues. Reed/Tripathi Reply at 14-15, 17.

Third, a mixed TDD/FDD environment such as the one Clearwire proposes—in which each carrier could choose whether to deploy TDD or FDD in its 600 MHz blocks—would create not only these risks of adjacent-channel interference, but also substantial additional risks of *co-channel* interference. Reed/Tripathi Reply at 16-17. In particular, when a TDD network and an FDD network use the same frequencies in neighboring geographic areas, the TDD network inevitably would *transmit* signals in the same frequencies on which the adjacent FDD network is trying to *receive* signals at the same time. *Id.* at 17. The signal emitted by the TDD base stations would be much more powerful than the simultaneous signals emitted on the same frequencies by FDD end user devices and thus would often interfere with the reception of those weaker signals by FDD base stations. *Id.*

AT&T has experienced just this problem in Kansas City. Although AT&T holds lower 700 MHz B and C block licenses in much of Kansas City, two other providers hold 700 MHz C block licenses in certain parts of the city and have deployed a WiMAX network using TDD technology. *Id.* Those TDD operations have inflicted severe interference on AT&T's FDD base stations in the 700 MHz C block. *Id.* That interference effectively forces AT&T to operate only with 700 MHz B block spectrum in large portions of Kansas City and thus substantially reduces the capacity and throughput in AT&T's network. *Id.* Permitting a mixed TDD-FDD environment, as Clearwire proposes, would cause similar interference throughout the country.

Even if there were no risk of interference to FDD—either because no FDD operations are permitted in the 600 MHz band at all or because a certain segment of spectrum is set off by guard bands and designated solely for TDD—TDD operations by multiple carriers in the same

band would present substantial and costly coordination challenges. Whenever two providers maintain TDD systems using adjacent spectrum, the base station of Carrier X will often *transmit* over frequencies adjacent to those that Carrier Y's nearby base station will be using to *receive* signals at the same time. Reed/Tripathi Reply at 4. In such cases, Carrier X's transmitting signal will interfere with the ability of Carrier Y's base station to receive uplink signals. And that interference will reduce Carrier Y's throughput or sever its connections, particularly when Carrier Y's customer is close to the cell edge and his signals are thus relatively weak when they reach Carrier Y's base station. *Id.* at 5. Similar adjacent-channel interference can occur between the user device of one carrier that is trying to receive a relatively weak signal from a base station (for example, because it is at the cell edge) in close proximity to another carrier's user device that is simultaneously sending a signal. *Id.* at 6. Moreover, two TDD operators operating on the same channel in geographically proximate markets could cause *co-channel* interference.

Because of this strong potential for interference, multiple operators using TDD in adjacent frequencies (or on the same channel in proximate markets) must engage in intensive coordination efforts. *Id.* at 7.²³ Even Sprint grudgingly acknowledges in a footnote that the need for such coordination is a “disadvantage of TDD.” Sprint Comments at 20 n.40. Among other things, the operators must synchronize their operations to the millisecond so that they are transmitting and receiving at exactly the same time. Reed/Tripathi Reply at 8-9. That also requires the operators to agree on the precise ratio of uplink to downlink traffic. *Id.* at 9. These coordination solutions will vary widely among the different sets of multiple carriers that differ by

²³ Alternatively, the band plan could place guard bands between the spectrum of each TDD operator, but—as with FDD/TDD guard bands—doing so would substantially reduce the amount of spectrum available for mobile broadband services. Reed/Tripathi Reply at 7.

market, and they would present large transaction costs. The need for such coordination would create uncertainty for any potential 600 MHz bidder about whether it will be able to reach an acceptable accommodation with each of its neighboring carriers and how much interference it will ultimately have to accept. *Id.* at 9-10. In addition, some operators may have to settle for suboptimal coordination arrangements. For example, if one carrier wants more downlink capacity (and correspondingly less uplink capacity) than a spectrally adjacent carrier, any coordination agreement would require one or both to accept a suboptimal downlink/uplink ratio. *Id.* at 10.

The need for this detailed coordination belies Sprint/Clearwire's claim that TDD systems are typically more flexible than FDD systems.²⁴ Even a single operator cannot dynamically change its uplink/downlink ratio at a particular base station or cell to match traffic patterns at that location. Rather, within any operator's network, all base stations must use the same ratios. Reed/Tripathi Reply at 11. Moreover, because of the need for coordination, a given carrier could not unilaterally make such a change where multiple operators are using TDD in the same area. *Id.* Instead, a carrier that wishes to change its ratio would have to reach negotiated agreements with all other operators in the areas where it wants to make the change (and potentially also with operators in adjacent areas that use the same frequencies). *Id.*²⁵

In addition to coordination among TDD operators in the 600 MHz band, a TDD-only band plan would likely also require complex coordination between TDD operators and television

²⁴ Sprint Comments at 23-25; Clearwire Comments at 6-8.

²⁵ In other respects as well, TDD systems suffer from disadvantages as compared to FDD systems. For example, TDD systems typically feature smaller cells or have lower throughput at the cell edge. Reed/Tripathi Reply at 12-13. Further, the deployment of small cell technologies, such as femtocells, is considerably more challenging for TDD than for FDD. *Id.* at 15.

broadcasters that operate in the same channels in geographically neighboring markets. Reed/Tripathi Reply at 12. Absent a lowest-common-denominator national band plan, the spectrum cleared would vary by market, and thus some television broadcasters would probably operate on the same channels as TDD operators in nearby markets. That would present a significant risk of co-channel interference. *Id.* Moreover, unlike FDD, in which any co-channel interference on a given channel would involve *either* uplink *or* downlink operations but not both, co-channel interference involving TDD would affect both the base station and the user equipment, and the network design would have to incorporate the larger of the two exclusion zones needed to address the interference issues. *Id.*

Of course, Sprint/Clearwire can be expected to contest the precise extent of the interference and other implementation problems that would result if the Commission permitted TDD operations in the 600 MHz band, whether on an exclusive basis or as part of a mixed TDD/FDD band plan. At a bare minimum, however, potential forward-auction bidders would confront considerable uncertainty about the value of 600 MHz spectrum if it is subjected to such a band plan, and the very existence of this uncertainty and associated risks would reduce the *perceived* value of 600 MHz spectrum and thereby depress forward-auction revenues.

C. The Duplex Gap and Other Guard Bands Should Be No Larger Than Technically Reasonable To Prevent Interference to Licensed Operations

As discussed below, a duplex gap of 10-12 megahertz is sufficient to prevent interference between uplink and downlink operations in an FDD environment, and for technical reasons the gap should not exceed 15 megahertz. The proper width of other guard bands depends on a variety of factors, including the transmission power of any television station on the other side of a guard band from mobile operations. A strong consensus is emerging on these points, including

not just from carriers but also from equipment manufacturers. Led by Google and Microsoft, however, a few commenters ask the Commission to remove much larger swaths of 600 MHz spectrum from the forward auction and reserve them for unlicensed uses. That approach would violate the Spectrum Act, would impair device functionality, would inflict opportunity costs on the public by diverting 600 MHz spectrum from its most valued uses, and would increase the risk that this auction will fail altogether.

1. The Duplex Gap Should Be 10-12 Megahertz Wide, and the Proper Width of Other Guard Bands Depends on the Power Levels of Potentially Interfering Operations on the Other Side

The function of a duplex gap is to avoid adjacent-channel interference between uplink and downlink transmissions. For example, in the absence of such a gap, the downlink transmissions from one base station could interfere with the ability of nearby base stations to receive uplink transmissions from user devices, particularly given that the transmit power of base stations is much higher than the transmit power of user equipment. Reed/Tripathi Reply at 18-19. Similarly, without an adequate duplex gap, the uplink transmissions from one user device could interfere with the ability of a nearby user device to receive downlink transmissions from a base station. *Id.* at 19-20.

As suggested by an emerging consensus in the opening comments, the size of the duplex gap needed to avoid such adjacent-channel interference is 10-12 megahertz. Engineering principles and industry experience have established that a duplex gap must be at least 1 to 1.5% percent of the center frequency in which the service is operating. Reed/Tripathi Reply at 20; Alcatel-Lucent Comments at 21-22. Thus, an FDD band centered at about 650 MHz requires a duplex gap of at least between 6.5 megahertz (1%) and 9.75 megahertz (1.5%). Reed/Tripathi Reply at 21. That theoretical figure must accommodate real-world factors that can increase the

size of the required gap. For example, differences in filter manufacturing processes can lead to about a 0.15 percent variation in filter performance—a one megahertz change at 650 megahertz. *Id.* The temperature at which a filter is operating can also affect its performance by as much as 2.2 megahertz at a 650 MHz center frequency. *Id.* at 21-22. Given these factors, there appears to be a consensus among equipment manufacturers that the duplex gap must be 10-12 megahertz to protect against interference in real-world deployments.²⁶

Google and Microsoft are wrong to suggest that a larger duplex gap is needed to protect mobile wireless operations from interference.²⁷ First, filter manufacturers themselves confirm that, contrary to Google's and Microsoft's claim, the filters required for a 10-12 megahertz duplex gap would not be appreciably more costly or complex than filters with a larger duplex gap. Reed/Tripathi Reply at 23. Second, Google and Microsoft are also wrong to assert (at 38) that the risk of intermodulation interference somehow justifies a larger duplex gap. Using a larger duplex gap to address intermodulation interference would be neither efficient nor effective, particularly given that intermodulation products have wide bandwidths. Reed/Tripathi Reply at 23. The better approach is to design the band plan to prevent intermodulation interference in the first place or, at a minimum, to weaken the power levels of intermodulation products. *Id.* That is precisely what AT&T's proposed band plan would do by, for example, excluding TV stations from the duplex gap. *Id.*

²⁶ Reed/Tripathi Reply at 22; Alcatel-Lucent Comments at 21-22; Nokia Siemens Comments at 9; Qualcomm Comments at ii; RIM Comments at 12-13.

²⁷ Google/Microsoft Comments at 37-39 & Decl. of David Borth at ¶¶ 4-16, attached to Google/Microsoft Comments.

As discussed below, because a duplex gap of 10-12 megahertz is sufficient to guard against interference, the Spectrum Act directs the Commission to establish a gap “no larger than” that figure. Quite apart from that legal directive, however, there are independent *technical* reasons to cap the size of the duplex gap at 15 megahertz. Given engineering limits of antenna design, a device operating in 600 megahertz spectrum likely can cover no more than about 65 megahertz in a band without either (1) significantly increasing antenna size, thereby sacrificing the form factors most popular with consumers today, or (2) degrading technological efficiency. Reed/Tripathi Reply at 23-25. Given this constraint, if a band plan has five paired blocks of five megahertz (i.e., a 2 x 25 configuration), that leaves no more than 15 megahertz for the duplex gap. *Id.* at 25; *see also* Qualcomm Comments at 13-15. A larger duplex gap would mean (1) that the band plan would need to have fewer paired blocks; (2) that devices would need an additional or substantially larger antenna, even though, as Qualcomm states (at 13), “there is no spare space in today’s smartphones”; or (3) that the antenna would need to operate less efficiently, leading to degraded handset performance. *Id.* at 23-25. Thus, practical and engineering considerations militate against a duplex gap any larger than 15 megahertz.

Finally, the size of any guard bands needed to protect mobile broadband operations from interference due to adjacent *television stations* depends on the power level of a television station and whether the mobile spectrum is being used for uplink or downlink. For downlink blocks, analyses by AT&T and Qualcomm suggest that a six-megahertz guard band should be sufficient to protect against interference from a television station operating at or below 50 kilowatts. Reed/Tripathi Reply at 26-27. In the case of full-powered television stations operating at power levels up to one megawatt, analysis of filter performance and other factors indicates that a guard

band of as much as 10-12 MHz will be necessary.²⁸ In the case of uplink, however, a six-megahertz guard band should be sufficient regardless of the power level of the television station. Reed/Tripathi Reply at 26. Indeed, AT&T is currently operating in 700 MHz Band 17, which is six megahertz away from television channel 51, and that distance has been sufficient to protect against interference from stations operating at a variety of power levels. *Id.*

2. *The Spectrum Act Requires the Commission To Determine the Size of the Duplex Gap or Other Guard Bands Based Only on Technical Considerations Concerning the Prevention of Interference*

The statute directs the Commission to limit any guard bands to a size that is “no larger than is technically reasonable to prevent harmful interference between licensed services.” Spectrum Act § 6407(b). For example, if a 10-megahertz guard band is sufficient to keep licensed services from interfering with one another, then that is the ceiling on the size of that guard band.

Some commenters argue that the word “reasonable” in this statutory language gives the Commission discretion to consider non-technical factors and general “policy goals” in order to enlarge guard bands *beyond* the size needed to prevent interference.²⁹ That is incorrect. Simply as a matter of syntax, the use of the word “reasonable” in this sentence does not authorize the Commission to consider policy objectives *other than* “prevent[ing] harmful interference” to licensed services as a basis for enlarging the duplex gap or other guard bands. *First*, the word “technically” modifies “reasonable,” and tells the Commission what kinds of factors—namely,

²⁸ Reed/Tripathi Reply at 27; Alcatel-Lucent Comments at 23; Nokia Siemens Comments at 15-19; RIM Comments at 11.

²⁹ *See, e.g.*, Comcast Comments at 44; Free Press Comments at 7; NCTA Comments at 13-14.

technical ones—it should consider in determining whether the size of a guard band is reasonable.³⁰ *Second*, a guard band may be “no larger than” what the Commission determines is technically needed to prevent harmful interference. If 12 megahertz is sufficient to stop licensed services from interfering with one another, that is the ceiling on the size of the guard band. Designating a larger guard band would read the words “no larger than” out of the statute. *Third*, section 6407(b) specifies the only purpose for which the Commission may create guard bands—namely, “to prevent harmful interference between licensed services.” Given that textual direction, the Commission would violate both the Spectrum Act and the Administrative Procedure Act if it gave weight to other policy goals in exercising its judgment, such as the purported value of giving unlicensed services a capacious home in the 600 MHz band.³¹

NCTA nonetheless contends (at 11-12) that these limitations do not apply to any duplex gap because, it suggests, a duplex gap is not a guard band subject to these statutory limitations. That is also incorrect: as Comcast recognizes (at 44), a duplex gap is simply a “type of guard band.” Under both ordinary usage and the usage employed in the Spectrum Act itself, a “guard band” is a segment of spectrum set aside—*i.e.*, not auctioned to licensed users—in order to prevent interference between licensed services. *See* Spectrum Act § 6407(b); *see also* NPRM ¶ 152 (guard bands are used “to minimize interference between dissimilar adjacent uses”).³² As

³⁰ Indeed, even Google and Microsoft, which otherwise advocate large guard bands, acknowledge that section 6407(b) only gives the Commission “discretion to use its expert *technical* judgment to set appropriate guard band sizes.” Google/Microsoft Comments at 36 (emphasis added).

³¹ *See, e.g., Massachusetts v. EPA*, 549 U.S. 497, 533-34 (2007) (agency may not take into account factors other than those made relevant by Congress).

³² *See also* Memorandum Opinion, *Cellular Telecommunications Industry Association et al.’s Request for Delay of the Auction of Licenses in the 747-762 and 777-792 MHz Bands*

discussed, a duplex gap is designed to perform that precise function: minimizing interference between licensed uplink and downlink operations using the same spectrum band.³³

In fact, treating the duplex gap like any other guard band is the only way to make sense of the statutory provisions addressing the use of guard bands. Section 6403(c)(1)(A) of the Spectrum Act directs that the Commission “shall” conduct a forward auction to “assign[] licenses for the use of the spectrum that the Commission reallocates.” Section 6407(b) creates an exception to that requirement for “guard bands.” The Commission has already recognized that, “[u]nder these provisions, [it] *must* license the spectrum [it] recover[s] through the broadcast television spectrum reorganization, with the exception of the guard bands.” NPRM ¶ 234 (emphasis added). Thus, if the duplex gap were not a “guard band,” the Commission would have to auction it for licensed use. In short, the statute flatly precludes any argument that (1) the duplex gap is not a guard band but (2) can somehow be exempted from the auction and dedicated to unlicensed uses. Indeed, that argument would create an irrational loophole through which the

Scheduled for September 6, 2000 (Auction No. 31), 15 FCC Rcd 17406, 17412 n.7 (2000) (stating that a “‘guard band’ is so-named” because it is “designed to protect [adjacent] spectrum from unwarranted interference”); *Newton’s Telecom Dictionary* 551 (26th ed. 2011) (defining guard band as “[a] narrow bandwidth between adjacent channels which serves to reduce interference between those adjacent channels.”).

³³ Section I.C.1, *supra*; see, e.g., Third Report and Order, *Amendment of Part 2 of the Commission’s Rules to Allocate Spectrum Below 3 GHz for Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, Including Third Generation Wireless Systems*, 18 FCC Rcd 2223, 2243 ¶ 39 n.108 (2003) (stating that a “duplex gap” is “an unused frequency block” used “to provide isolation between base and mobile transmit frequencies”). NCTA is mistaken in claiming (at 11) that the Commission has somehow already suggested that a duplex gap is *not* a guard band. The Commission has recognized that “guard bands” are used “to minimize interference between dissimilar adjacent operations,” NPRM ¶ 152, and that a duplex gap is the “required separation between the uplink and downlink bands,” *id.* ¶ 166. But, as explained, a duplex gap is “required” precisely because it “minimize[s] interference between dissimilar adjacent operations”—namely, uplink and downlink operations. In short, as the Commission recognizes, a duplex gap is simply a species of guard band.

Commission could exempt any amount of spectrum from the forward auction free from the “technically reasonable” or any other limitation, simply by labeling it a “duplex gap” or some other term besides “guard band.” That cannot be what Congress intended, given the clear policy choice in favor of licensed spectrum throughout the Spectrum Act.

3. *Enlarging the Duplex Gap or Other Guard Bands to Promote Unlicensed Uses Would Impose Large Opportunity Costs, Reduce Forward-Auction Revenues, and Increase the Risk of Auction Failure*

Even if Congress had not prohibited the Commission from needlessly enlarging the duplex gap or other guard bands, and even if antenna-related concerns did not independently cap the optimal size of the duplex gap at 15 megahertz or less, compelling policy considerations would still independently support the same outcome. Two of the Commission’s most fundamental objectives in this proceeding should be (1) to reallocate 600 MHz spectrum blocks to their most highly valued uses, taking into consideration the availability of *other* spectrum bands for alternative uses; and (2) to ensure great enough participation in the forward auction to satisfy the statutory revenue requirements for reallocating *any* 600 MHz spectrum at all. The Commission would undermine each of those objectives if it allocated unnecessarily large segments of 600 MHz spectrum to accommodate unlicensed uses. First, it would inflict immense opportunity costs on consumers and the American economy; and, second, it would substantially increase the risk of auction failure.

Minimizing opportunity costs. At the outset, it is important to stress that this is *not* a dispute about whether unlicensed uses are beneficial or whether more spectrum should be made available for them. AT&T agrees that unlicensed spectrum plays an important role in spectrum policy. The question, however, is not whether it would be beneficial to free up large amounts of additional spectrum suitable for unlicensed uses, but how to achieve that goal while minimizing

the opportunity costs of doing so. That analysis might well support reallocating vast swaths of 5 GHz band spectrum for unlicensed uses, as the Commission has proposed.³⁴ But it forecloses allocating unlicensed spectrum in the 600 MHz band beyond the appropriately sized guard bands described above.

In particular, any greater allocation of 600 MHz spectrum to unlicensed uses would present immense opportunity costs in the form of forgone uses of this band. This auction presents the single most important opportunity to make real progress on a central goal of this Administration: reallocating much-needed new spectrum for *mobile* broadband uses in the spectrum whose signal-propagation characteristics are best suited to such uses—the bands below 3.7 GHz.³⁵ As the National Broadband Plan recognized, the spectrum at issue here has “excellent propagation characteristics that make it well-suited to the provision of mobile broadband services, in both urban and rural areas,” and reallocating it for these mobile services “has the potential to create new economic growth and investment opportunities.”³⁶ And every additional block allocated to unlicensed uses is, by definition, a block removed from the spectrum allocated to licensed mobile uses.

Google and Microsoft propose to divert much of this scarce mobile broadband spectrum, which others would pay billions to clear, to unlicensed uses. But they give no reason to conclude

³⁴ See generally Notice of Proposed Rulemaking, *Revision of Part 15 of the Commission’s Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, ET Docket No. 13-49, at ¶ 22 (rel. Feb. 20, 2013) (proposing to “increase the spectrum available to unlicensed devices in the 5 GHz band by nearly 35 percent,” representing 195 MHz additional spectrum).

³⁵ FCC, *Connecting America: The National Broadband Plan*, at 84 (2010), <http://download.broadband.gov/plan/national-broadband-plan.pdf> (“*National Broadband Plan*”).

³⁶ *Id.* at 88.

that any benefits of those incremental unlicensed allocations would compensate for the huge opportunity costs of withholding this spectrum from capacity-constrained mobile providers. *See* Katz et al. Reply Decl. ¶ 52 *et seq.* Indeed, they have provided hardly any detail about what new types of unlicensed uses they envision for this spectrum. And there is abundant reason to conclude that diverting this spectrum from licensed to unlicensed uses would in fact result in far less efficient spectrum utilization. Because the transmissions of unlicensed devices are by definition not coordinated by any licensee, such devices must be subjected to stringent restrictions, such as power-level limitations, to avoid interference between similar devices in close proximity.³⁷ Given the need for such limitations, allocating large amounts of spectrum below 3 GHz for unlicensed uses might well make inefficient use of the key signal-propagation

³⁷ Although Google/Microsoft (at 16-18) claim that fixed wireless ISPs (“WISPs”) might benefit from unlicensed use of 600 MHz spectrum to reach customers in remote rural areas, that claim makes no sense on several levels. *First*, “[i]n a fixed wireless deployment, each customer has a high gain directional antenna/radio combination, typically mounted outside, that focuses the signal toward the base station.” WISPA, *America’s Broadband Heroes: Fixed Wireless Broadband Providers*, at 4 (2011), <http://www.wirelesscowboys.com/wp-content/uploads/2011/10/americas-broadband-heroes-fixed-wireless-2011.pdf>. This point-to-point technology has no special need for lower-band spectrum; indeed, it allows WISPs to transmit up to 50 miles or more using 5 GHz band spectrum. *See* Ubiquiti Networks, Rocket Dish Data Sheet, http://www.titanwirelessonline.com/v/vspfiles/assets/images/at-rd_datasheet.pdf. *Second*, to the extent that WISPs need additional lower-band spectrum for “non-line of sight operations” (Google/Microsoft Comments at 17), they can make heavy use of white-space technologies because there is often no significant television presence in the rural areas where WISPs operate. *Third*, even if WISPs had some need for cleared 600 MHz spectrum, they should participate in the forward auction alongside the mobile ISPs with whom they compete. *Fourth*, in any event, it would make no sense to reserve large blocks of unlicensed spectrum *nationwide*, including in densely packed urban areas, in order to accommodate WISP operations that are prevalent mainly in rural areas.

advantages that make this spectrum unusually valuable to licensed mobile providers. *See* Katz et al. Reply Decl. ¶¶ 59, 63.³⁸

Minimizing the risk of auction failure. Quite apart from these opportunity-cost concerns, reserving extra 600 MHz spectrum for unlicensed uses (beyond those permitted in appropriately narrow guard bands) would drive down forward-auction revenues and increase the risk of auction failure. Anticipating that concern, Google and Microsoft argue (at 29-31) that no matter how many slices of licensed spectrum the Commission removes from the auction, the value of the remaining slices would increase so dramatically in response that aggregate forward-auction revenues would never decline. That is incorrect. It is true that auction theorists can posit abstract auction models in which demand is highly inelastic and aggregate revenues might remain constant (or even increase) amid reductions in the amount of auctioned spectrum. But as Professor Katz et al. explain (at ¶¶ 64-79), the posited scenarios are improbable in the real world, and unnecessarily removing spectrum from the forward auction would likely reduce auction revenues by a substantial margin.

First, reducing the supply of licensed spectrum blocks in the forward auction will necessarily reduce aggregate revenues if the demand of potential bidders for those blocks is elastic, and it almost certainly is. *Id.* ¶¶ 65-70. Potential bidders have alternatives to 600 MHz spectrum acquisitions as a means of addressing escalating network demand. For example, they

³⁸ In addition, to the extent that Google/Microsoft (at 13-16) stress the value of Wi-Fi offload to mobile wireless providers, they are irrationally conflating two separate issues: (1) the value of certain technologies (such as the use of extremely small cells in congested settings) and (2) the licensed/unlicensed status of the spectrum used by those technologies. *See* Katz et al. Reply Decl. ¶¶ 60-63. Moreover, as discussed below, any use by licensed carriers of unlicensed spectrum suggests that the two can be input substitutes, and that fact will tend to lower the value of licensed spectrum and increase the risk of auction failure.

could constrain that demand by raising prices. Or, to increase network capacity without purchasing new spectrum, they could “recycle” their existing spectrum holdings by conducting additional cell splits or deploying distributed antenna systems. True, those alternative measures of augmenting capacity are very expensive. But from the perspective of would-be auction participants, those measures would become increasingly attractive and efficient in comparison to 600 MHz spectrum purchases if the per-megahertz price for new licensed spectrum were to rise in response to regulatory reductions in the supply of such spectrum. *Id.* ¶ 66. In any event, because there are no precise estimates of demand elasticity in this context, Professor Katz et al. have performed numerous Monte Carlo simulations of auction results under a broad variety of scenarios involving bidders with widely differential valuations. As those simulations show, reductions in the spectrum sold at auction would typically produce substantial losses in the revenues generated.³⁹

These considerations confirm that demand for auctioned spectrum in a band would be elastic even if the remaining, non-auctioned spectrum in that band were left completely fallow (or reserved only for continued broadcast uses). But even if demand were normally *inelastic* in that counterfactual setting, forward-auction prices would still fall if wide segments of spectrum are withheld from the auction and, as Google and Microsoft propose here, are *not* kept fallow but

³⁹ Katz et al. Reply Decl. ¶¶ 67-68 (and Appx. A). There is also no basis for Google and Microsoft’s reliance on theoretical suggestions that bidding teams go into auctions with fixed budgets. Google/Microsoft Comments at 29-30 (citing Jeremy Bulow, Jonathan Levin, and Paul Milgrom, *Winning Play in Spectrum Auctions* (Feb. 2009)). As Professor Katz et al. explain, “[a]lthough *bidding teams* may face budget constraints for a particular auction (while having considerable freedom in deciding which licenses to buy within their fixed budgets), this does not mean that *budgets* do not depend on the quantity of spectrum that is being offered at the auction.” Katz et al. Reply Decl. ¶ 70 (emphasis added). Indeed, budgets *must* depend significantly on the amount of that spectrum, for otherwise “the government could auction a nationwide license for 1 MHz of spectrum for tens of billions of dollars.” *Id.*

are instead released into the market for unlicensed uses as the result of that auction. *See* Katz et al. Reply Decl. ¶¶ 71-79. That is because, in two different respects, such unlicensed spectrum is a substitute for the licensed spectrum offered at auction, and it would therefore reduce the value of licensed spectrum to potential bidders. *See id.*

To begin with, from the perspective of mobile wireless carriers, unlicensed spectrum can be a substitute for licensed spectrum in the input market for spectrum resources. *Id.* ¶ 72. Indeed, Google and Microsoft themselves stress (at 13-16) that unlicensed spectrum can relieve carriers' demand for additional licensed spectrum by allowing them to offload traffic onto Wi-Fi networks in certain high-density contexts. The availability of that unlicensed alternative input, while inefficient in comparison to additional licensed spectrum, tends on the margin to drive down every carrier's demand for any given supply of licensed spectrum. Katz et al. Reply Decl. ¶ 72. The more unlicensed spectrum the Commission frees up that would be suitable for mobile services, the greater that demand-reducing effect will be. Lower demand, in turn, means lower revenues and a greater risk of falling short of the statutory revenue requirements.

Just as important, services offered solely or primarily by means of unlicensed spectrum would themselves be substitutes for licensed wireless services in the downstream retail marketplace. For that reason, too, if the Commission makes any new supply of *licensed* spectrum contingent upon the release of a large new supply of *unlicensed* spectrum suitable for competing uses, it would predictably reduce the value of that new licensed spectrum to potential bidders, who would have to account for that new unlicensed competition in assessing the net revenue streams the licensed spectrum could be expected to create. *See id.* ¶¶ 73-78.

Some context is necessary to understand this point. Google and Microsoft advocate a greater role for unlicensed spectrum in the 600 MHz band not because they are dispassionate

champions of the public interest, but because they both hope to capitalize on any business opportunities that might arise. Access to this spectrum would be free to Google and Microsoft and to any other service provider that deploys the wireless routers and backhaul links needed to connect users to communications networks. To a large extent, customers would be choosing—particularly at the margins—between (1) new services that would employ unlicensed spectrum as a free input and (2) mobile services from carriers who have paid for *licensed* 600 MHz spectrum in this proceeding. *See* Katz et al. Reply Decl. ¶¶ 73-75. For example, using this spectrum as a free input, an unlicensed provider might construct a new wireless network for users within defined geographic areas, and a consumer might opt to use that provider’s services for a particular device (such as a laptop or tablet) for which the consumer would otherwise buy connectivity from a mobile licensee.

Critically, however, no one will be able to use cleared 600 MHz spectrum for unlicensed uses in the first place unless someone pays broadcasters billions of dollars to vacate that spectrum. Under the Google/Microsoft proposal, the parties making those payments would be licensed mobile carriers, *not* Google, Microsoft, or any other primary user of such unlicensed spectrum. In other words, a large portion of the bids from licensed carriers would be used, in effect, to subsidize the diversion of scarce mobile broadband spectrum to allocation for competing unlicensed uses. Because licensed carriers will base their bids on the estimated net revenue effects of acquiring new 600 MHz spectrum, they will need to account for the revenue losses they will sustain as a consequence of subsidizing free inputs for the likes of Google and Microsoft. Of course, carriers would be less likely to bid aggressively for new 600 MHz spectrum if they know that a significant portion of those bids will be used to subsidize the clearing of unlicensed spectrum for these competing operations (beyond the minimum amounts

of unlicensed spectrum to protect licensed spectrum from interference).⁴⁰ Among other concerns, the new subsidized competitors would benefit from a much lower cost structure than conventional mobile licensees, precisely because they would not have to pay for their spectrum inputs.⁴¹

In sum, unnecessary reductions in the number of licensed spectrum blocks in the 600 MHz band would very likely lead to major reductions in aggregate auction revenues. Because this auction cannot close unless those revenues meet the statutory revenue requirement, any Commission decision that needlessly reduces the supply of licensed spectrum would increase the risk that no spectrum will be reallocated at all—not for licensed uses, and not for unlicensed uses either. That would be a regulatory failure of historic proportions.

4. *Any Unlicensed Uses in Guard Bands Must Not Interfere with Licensed Operations and Must Accept Interference from Mobile Broadband Operations*

Insofar as interference concerns in fact require guard bands (including a 10-12 megahertz duplex gap), AT&T does not oppose unlicensed uses in those guard bands.⁴² Any such uses, however, must meet at least two criteria. First, as the Spectrum Act provides (§ 6407(e)), “[t]he

⁴⁰ Katz et al. Reply Decl. ¶ 77. Indeed, carriers would be subsidizing competition to services they offer using their *existing* spectrum holdings and thereby reducing the value of those holdings as well.

⁴¹ To be clear, AT&T’s objection is *not* to facing competition from other providers that have obtained access to 600 MHz spectrum on fair and equal terms. If all the 600 MHz spectrum (other than guard bands) is auctioned as licensed spectrum, as AT&T advocates, and if AT&T purchases some of that spectrum, it will face post-auction competition from other providers who purchased all the rest of that licensed spectrum. AT&T welcomes that outcome insofar as those other providers, like AT&T, will have paid for the spectrum in a fair and efficient auction.

⁴² In its opening comments, AT&T suggested that it might be technically feasible to place supplemental downlink blocks in the duplex gap but noted the need for additional study of that issue. AT&T Comments at 33-34. Based on that further analysis, AT&T no longer advocates placing supplemental downlink blocks in the duplex gap.

Commission may not permit any use of a guard band that the Commission determines would cause harmful interference to licensed services.” Second, and conversely, such unlicensed uses must accept any interference from licensed mobile broadband operations.

Such protections are important for at least three reasons. First, if the Commission does not make clear that licensed spectrum will be protected from interference by unlicensed operations in the duplex gap and other guard bands, the risk of that interference would reduce the value of licensed spectrum and increase the risk of auction failure. Similarly, if licensed operations might be subject to restrictions in order to protect unlicensed uses, that too would reduce the value of licensed blocks.

Second, failure to establish such protections for licensed spectrum would undermine the Commission’s goal of creating a band plan with fungible spectrum blocks. If operations in the duplex gap, for example, were not precluded from causing interference to licensed mobile operations, the blocks closest to the duplex gap would be subject to the risk of the greatest interference and would accordingly be less valuable than blocks further away from the duplex gap. Likewise, any restrictions to protect unlicensed operations from interference would fall most heavily on the blocks closest to the duplex gap, further reducing their relative value. Third, as discussed in greater detail below, subjecting licensed blocks adjacent to the duplex gap (or other guard bands) to interference from unlicensed operations would present handset-interopability concerns by increasing the pressure on the international standards-setting process to assign those blocks to a different band class in order to protect the remaining spectrum blocks. Reed/Tripathi Reply at 25-26.

The Commission can straightforwardly establish by rule that unlicensed uses in the duplex gap and other guard bands are not entitled to any protection from interference from

licensed users. Designing rules to ensure that those unlicensed operations themselves do not cause interference to adjacent licensed operations is more complex. The appropriate limitations will depend on a number of characteristics of the potential unlicensed use, such as (1) whether it is uplink, downlink, or both; (2) where within the duplex gap or guard band the use will be located (*e.g.*, immediately adjacent to the licensed use or in the middle of the duplex gap, such that part of that gap functions as an internal guard band); (3) the power level of the unlicensed use; (4) the quality of the relevant filters; and (5) the nature of the likely real-world deployment of the unlicensed use (such as whether the unlicensed use will likely be physically proximate to licensed mobile equipment or, as in the case of wireless microphones, whether the unlicensed devices are likely to be confined to particular spaces). Reed/Tripathi Reply at 26. It is not possible at this stage to specify the precise restrictions to which unlicensed uses would have to be subject in order to satisfy the statutory requirement that they not interfere with licensed operations. Preliminary analysis suggests, however, that those restrictions are likely to be quite significant.

Finally, some commenters propose that the Commission permit unlicensed uses in spectrum blocks that have been awarded to a licensed operator, but in which the operator is not yet providing service.⁴³ Although AT&T does not necessarily oppose that outcome, this temporary-use regime would have to be subject to strict enforcement mechanisms, and any unlicensed user would have to commit unequivocally to clear the spectrum immediately once the licensed operator is ready to make use of it. As the history of wireless microphones

⁴³ Google/Microsoft Comments at 44-46; WhiteSpace Alliance Comments at 19-20.

demonstrates,⁴⁴ getting unlicensed operations to vacate once they have established themselves can be difficult, and the Commission should not allow unlicensed uses on spectrum that is otherwise licensed without clear, timely, and self-executing mechanisms under which those uses will be cleared so as to protect the rights of licensed users.

C. The Commission Should Design Its Band Plan to Promote Handset Interoperability but Should Reject Requests to Impose Interoperability Requirements on 600 MHz Handsets

As discussed in its opening comments, AT&T supports designing the *band plan* to enable market forces and private standards-setting initiatives to devise maximally efficient solutions to the use of this spectrum, including efficient interoperability among handsets. The Commission should not mandate that outcome by usurping the traditional role of standards-setting organizations; instead, it should take the steps noted above to reduce the threat of interference throughout the 600 MHz band. Two examples warrant repeating. First, the Commission should set effective limits on the power levels of devices operating in all guard bands, including the duplex gap, to avoid subjecting the immediately adjacent licensed blocks to disproportionate interference problems. Second, the Commission should avoid creating conditions in which TDD operations could ever be adjacent to FDD operations because these mutually incompatible technologies would create massive mutual interference, which again would affect some blocks more than others. Failing to take either step would almost certainly consign the 600 MHz band to a new generation of interference-created handset interoperability challenges.

⁴⁴ See FCC, *Consumer Guide: Operation of Wireless Microphones*, at 1-2 (2013) (describing need to ban wireless microphone operations that had been squatting in unused portions of the 700 MHz band), http://transition.fcc.gov/cgb/consumerfacts/wirelessmic_advisory.pdf.

The Lower 700 MHz band presents a textbook example of the interoperability problems that can arise if the Commission does *not* manage such interference concerns through a carefully designed band plan. The interoperability challenges there stem from a severe defect in the Lower 700 MHz band plan: Lower A Block transmissions are vulnerable to interference from Channel 51 broadcasters and high-power Lower E Block broadcasts, and such interference degrades performance on handsets whose filters allow A Block transmissions, even when those handsets are operating on other 700 MHz frequencies. Led by Motorola and a host of companies in an open industry-wide proceeding, the international standards-setting community responded by defining separate bands with different filter solutions designed to protect non-A Block users against such interference.⁴⁵ All parties understood before the 700 MHz auction that the A Block spectrum would face these unique interference issues, and A Block licensees obtained this spectrum at auction at a reduced price that reflected those concerns.⁴⁶ That has not stopped those licensees, however, from seeking “interoperability” requirements that would subject *all* Lower 700 MHz spectrum licensees, including those that paid more to obtain less-interference-prone spectrum blocks, to the same interference problems that these A Block licensees voluntarily undertook for themselves.⁴⁷

⁴⁵ See generally Notice of Proposed Rulemaking, *Promoting Interoperability in the 700 MHz Commercial Spectrum*, 27 FCC Rcd 3521, 3523-29 ¶¶ 6-14 (2012); Comments of AT&T, *Promoting Interoperability in the 700 MHz Commercial Spectrum et al.*, WT Docket No. 12-69 *et al.* (filed June 1, 2012) (“AT&T 700 MHz Interoperability Comments”).

⁴⁶ See, e.g., Letter from Joseph P. Marx (AT&T) to Marlene H. Dortch (FCC), WT Docket No. 06-150; PS Docket No. 06-229; GN Docket No. 09-51; RM-11592, at 1, 4 (filed June 3, 2010).

⁴⁷ See generally AT&T 700 MHz Interoperability Comments at 3, 27-35.

AT&T mentions this 700 MHz experience not to relitigate that controversy in this forum, but simply to note that the Commission could have precluded that controversy altogether had its band plan avoided the sources of interference that ended up compromising wireless operations. Had it done that, there would have been less of a need for the international standards-setting community to cope with such interference by prescribing different band classes for the Lower 700 MHz spectrum. The Commission should take pains to avoid any similar problems here by minimizing the extent to which avoidable interference, including from unlicensed uses, will impair mobile operations in particular 600 MHz blocks.

Although the Commission *should* design a sound band plan in order to promote standards-based solutions to efficient interoperability, it should *not* short-circuit those solutions by requiring all devices that utilize 600 MHz spectrum to support all blocks in that band. Such a requirement would be unprecedented. Since the dawn of the digital era in mobile communications, the FCC has never regulated equipment manufacturers' choice of pass-band filters or other handset components. Instead, the international standards-setting community has always addressed those issues in a collaborative process that accounts for the diverse interests of providers, manufacturers, and consumers. That process is open, efficient, and unparalleled in its technological sophistication, and the Commission should allow it to work here as well.

In contrast, mandated one-size-fits-all 600 MHz handset components would substantially devalue this spectrum, both for forward-auction bidders and for the consumers who may someday use it (if the auction is successful). Although the Commission can reduce block-by-block disparities in interference risk, it cannot eliminate such disparities altogether, nor can it predict with certainty exactly what technological challenges will arise once this spectrum is auctioned and assigned. As noted in our opening comments (at 50-51), the standards-setting

process is designed to provide the flexibility needed to address those concerns as they arise, and the Commission should not foreclose that role by prescribing equipment standards.

In all events, it would be premature for the Commission even to consider imposing such mandates before it has even settled on a band plan that balances the objective of clearing as much spectrum as possible against the objective of minimizing interference concerns in cleared spectrum. In the absence of a band plan, the Commission cannot know what band-specific technological challenges the industry will face, and it therefore cannot rationally conclude that it would serve the public interest to supplant the traditional standards-setting process with regulatory mandates.

II. THE COMMISSION SHOULD MAXIMIZE FORWARD-AUCTION REVENUES AND THE ODDS OF AUCTION SUCCESS BY REJECTING PROPOSALS TO LIMIT AUCTION ELIGIBILITY

In this and other proceedings, some commenters ask the Commission to resurrect the functional equivalent of a hard spectrum cap, which the Commission rightly abandoned twelve years ago,⁴⁸ and apply that cap against AT&T and Verizon by limiting their participation in this auction.⁴⁹ Other commenters seek to achieve essentially the same outcome through a self-interested scheme of auction-distorting “bidding credits.”⁵⁰ Although the details vary, these regulatory proposals all share a common theme: they are all aimed at keeping some providers—

⁴⁸ Report and Order, *2000 Biennial Regulatory Review Spectrum Aggregation Limits for Commercial Mobile Radio Services*, 16 FCC Rcd 22668, 22693-94 ¶ 50 (2001); see also Notice of Proposed Rulemaking, *Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band*, 22 FCC Rcd 17035, 17079 ¶ 101 (2007) (noting that the Commission eliminated the spectrum cap because it “found that the cap, by setting an *a priori* limit on spectrum aggregation without looking at the particular circumstances of specific proposed transactions, was unnecessarily inflexible and could be preventing beneficial arrangements that promote efficiency without undermining competition”).

⁴⁹ Cellular South Comments at 5-6; Sprint Comments at 8-9; T-Mobile Comments at 27-31.

⁵⁰ Leap Comments at 6; MetroPCS Comments at 26-27.

and AT&T and Verizon in particular—from competing as effectively as possible to serve their customers as well as possible.

That outcome might benefit individual wireless companies, but it would thwart the public interest and radically increase the risk of auction failure. First, disparities in spectrum holdings are not a symptom of market failure; to the contrary, they can be—and are here—signs of market success and thus cannot justify limitations on auction participation. *See* Section II.A, *infra*. Second, even if there were some sound policy basis to force reductions in such disparities, AT&T does not have disproportionate spectrum holdings in the first place; indeed, it has far less spectrum than Sprint/Clearwire. Sprint and others seek to exclude AT&T and Verizon from this auction on the theory that they have too much “low-band” spectrum, but that argument is untenable as well. *See* Section II.B, *infra*. Third, restricting AT&T and Verizon from fully participating in this auction would dramatically increase the risk of auction failure, as potential broadcaster reverse-auction participants have explained. *See* Section II.C, *infra*. Fourth, the “bidding credits” schemes proposed by some advocates would suffer from the same defects as other restrictions on participation by AT&T and Verizon. *See* Section II.D, *infra*. Finally, section 6404 of the Spectrum Act prohibits the Commission from relying on spectrum-aggregation rules to exclude AT&T and Verizon from this auction, in whole or in part, given the alternative of allowing them to participate and then divest other spectrum, if necessary, to preserve compliance with those rules. *See* Section II.E, *infra*.

A. As Commission Precedent Recognizes, Sound Economic Considerations Foreclose Proposals to Limit Auction Participation on the Basis of Existing Spectrum Holdings

As AT&T has previously explained, the spectrum requirements of any given carrier depend on the number of the carrier's customers and the intensity of their bandwidth demands.⁵¹ In general, carriers that best meet consumer needs are the ones that win the most customers, and carriers in the vanguard of the mobile broadband revolution, as AT&T has been, are the ones that win customers with the greatest bandwidth demands. Successful mobile-broadband-oriented providers are the providers that face the most pressing capacity challenges—and are thus the ones willing to invest most heavily in the spectrum resources needed to meet those challenges. In short, success drives carriers to increase their spectrum holdings, and it is thus no surprise that carriers with large spectrum holdings are also the ones with the greatest success-driven spectrum *needs*.

As Professor Katz et al. observe, however, holding large quantities of spectrum cannot itself make a carrier successful, let alone exclude other carriers from marketplace success. Katz et al. Reply Decl. ¶¶ 8-9. Nor, as they explain, do the market conditions exist in which any carrier today could possibly benefit from “hoarding” spectrum in order to disadvantage its rivals rather than to meet its own customers' needs. *Id.* ¶¶ 9-10. Indeed, that observation is not subject to serious dispute, even though several commenters persist in disputing it.⁵² As Chairman Genachowski has emphasized, it is “just not true” that “wireless companies[] are just sitting on

⁵¹ See Comments of AT&T, *Policies Regarding Mobile Spectrum Holdings*, WT Docket No. 12-269, at 6-7, 14 (filed Nov. 28, 2012) (“AT&T Spectrum Aggregation Comments”).

⁵² See, e.g., T-Mobile Comments at 30-31; Competitive Carriers Association Comments at 11.

top of, or ‘hoarding,’ unused spectrum The looming spectrum shortage is real—and it is the alleged hoarding that is illusory.”⁵³

Several commenters nonetheless urge the Commission to limit auction participation as a means of equalizing network assets and thereby keeping any given provider from becoming too big and successful.⁵⁴ But “[t]he Commission is not at liberty . . . to subordinate the public interest to the interest of ‘equalizing competition among competitors.’”⁵⁵ In particular, the “big is bad” rationale championed by some smaller providers would affirmatively harm consumers. Again, larger providers by definition serve more customers than smaller providers and thus may approach spectrum exhaust more rapidly than smaller carriers, even though the larger carriers might hold more spectrum in absolute terms. It would serve no sensible purpose for the Commission to deny larger providers access to the resources they need to serve the bandwidth demands of their customers.

Consistent with these conclusions, the Commission has long recognized that the best means of efficiently allocating new spectrum for the benefit of consumers is to auction it to the highest bidder and facilitate a secondary marketplace where providers may purchase or sell

⁵³ FCC Chairman Julius Genachowski, *The Clock Is Ticking*, Remarks on Broadband, at 7-8 (rel. Mar. 16, 2011), http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-305225A1.pdf.

⁵⁴ See Cellular South Comments at 5-6; T-Mobile Comments at 33; Competitive Carriers Association Comments at 7.

⁵⁵ *SBC Communications Inc. v. FCC*, 56 F.3d 1484, 1491 (D.C. Cir. 1995); see also *Competitive Telecomms. Ass’n v. FCC*, 87 F.3d 522, 531-32 (D.C. Cir. 1996) (striking down “interim” rule designed to protect smaller IXCs at expense of AT&T); *Western Union Tel. Co. v. FCC*, 665 F.2d 1112, 1122 (D.C. Cir. 1981); *Hawaiian Tel. Co. v. FCC*, 498 F.2d 771, 776 (D.C. Cir. 1974); see also *United States v. Western Elec. Co.*, 969 F.2d 1231, 1243 (D.C. Cir. 1992) (rejecting efforts to “aid the minnows against the trout”).

spectrum rights.⁵⁶ For example, in adopting rules for the Upper 700 MHz Band, the Commission rejected proposed eligibility limitations because, it found, “opening this spectrum to as wide a range of applicants as possible will encourage entrepreneurial efforts to develop new technologies and services, while helping to ensure the most efficient use of the spectrum.”⁵⁷ Two years later, when the Commission considered service rules for the Lower 700 MHz Band, it repeated that “open eligibility will enhance the opportunities for licensees to provide service in any market or combination of markets” and that “[a] policy of open eligibility for the Lower 700 MHz Band will best serve the public interest[.]”⁵⁸ And the Commission reaffirmed these conclusions in the *National Broadband Plan* (at 78) by stressing the importance of spectrum

⁵⁶ See, e.g., Report and Order and Further Notice of Proposed Rulemaking, *Service Rules for the 698-746, 747-762 and 777-792 MHz Bands*, 22 FCC Rcd 8064, 8150 ¶ 235 (2007) (“Congress and the Commission have determined that using competitive bidding mechanisms for assigning spectrum licenses offers significant public interest benefits. For example, the competitive bidding process ensures that spectrum licenses are assigned to those who place the highest value on the resource and will be suited to put the licenses to their most efficient use.”); see also Third Report and Order, *Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission’s Rules*, 16 FCC Rcd 2703, 2720 ¶ 42 (2001); Second Report and Order and Third Notice of Proposed Rulemaking, *Interconnection and Resale Obligations Pertaining to Commercial Mobile Radio Services*, 11 FCC Rcd 9462, 9477 ¶ 27 (1996); Policy Statement, *Principles for Reallocation of Spectrum to Encourage the Development of Telecommunications Technologies for the New Millennium*, 14 FCC Rcd 19868, 19870-72 ¶¶ 9-13 (1999); accord Gregory L. Rosston & Jeffrey S. Steinberg, *Using Market-Based Spectrum Policy to Promote the Public Interest*, 50 Fed. Comm. L.J. 87, 94-95 (1997).

⁵⁷ First Report and Order, *Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission’s Rules*, 15 FCC Rcd 476, 497 ¶ 49 (2000) (footnote omitted).

⁵⁸ Report and Order, *Reallocation and Service Rules for the 698-746 MHz Spectrum Band (Television Channels 52-59)*, 17 FCC Rcd 1022, 1074 ¶ 134 (2002) (footnote omitted); see also Report and Order, *Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands*, 18 FCC Rcd 25162, 25178 ¶ 42 (2003) (noting that carriers should be entitled “to tailor their acquisition of spectrum . . . to meet their individual business plans” and that “market forces rather than the Commission [will] ultimately determine how this spectrum is licensed”).

flexibility and the need to remove—not erect—regulation that “impedes the free flow of spectrum to its most highly valued uses.”

B. Distinctions Between “High Band” And “Low Band” Spectrum Cannot Justify Restrictions on Auction Participation

Even if it were otherwise reasonable to exclude some providers from this auction on the ground that they already have “too much” spectrum, AT&T would not qualify as such a provider in the first place. Indeed, AT&T has only about half as much spectrum as Sprint/Clearwire,⁵⁹ and it could therefore make no sense to exclude AT&T but *not* those more spectrum-rich corporate partners.

In response, Sprint and a variety of other carriers try to gerrymander comparative spectrum statistics to inflate the value of “low band” (below 1 GHz) spectrum, which they claim is far more valuable than “high band” (above 1 GHz) spectrum, which they have a great deal of.⁶⁰ And they conclude that AT&T and Verizon should be categorically excluded from obtaining more spectrum that would place them above some artificially designated quantum of “low-band” spectrum even where they have no particular advantage with respect to spectrum

⁵⁹ See Fifteenth Report, *Implementation of Section 6002(B) of the Omnibus Budget Reconciliation Act of 1993*, 26 FCC Rcd 9664, 9832 Chart 38 (2011) (“*Fifteenth Report*”) (showing that Sprint and Clearwire together account for approximately 52 billion MHz/pops, whereas Verizon and AT&T each have 25 billion MHz/pops or below). Even before Sprint and Clearwire announced plans to merge, the Commission properly viewed those two companies as a single entity for spectrum-aggregation purposes. It explained that Sprint “holds a 54 percent [economic] interest in Clearwire and has the ability to nominate seven of Clearwire’s thirteen directors,” and thus rightly decided to “attribute Clearwire to Sprint Nextel when discussing spectrum holdings and network coverage.” *Id.* at 9682 n.19. Notably, even a 10 percent holding triggers the Commission’s attribution rules. See, e.g., Memorandum Opinion and Order, *Sprint Nextel Corp. and Clearwire Corp.*, 23 FCC Rcd 17570, 17601 ¶ 77 (2008).

⁶⁰ See Sprint Comments at 2; T-Mobile Comments at 25-27; Cellular South Comments at 5.

holdings generally. That position is untenable for reasons that AT&T has previously explained and will briefly summarize here.⁶¹

Low-band spectrum has certain *coverage* advantages: because of its propagation characteristics, it is technically possible to use lower-band spectrum to provide service over a larger geographic area with a single cell site.⁶² That is why, as some commenters point out,⁶³ low-band spectrum, particularly in rural areas, tends to attract higher bids at auction: some carriers decide to pay more up front for low-band spectrum with wider coverage, while other carriers decide to build more cell sites in exchange for paying less up front for high-band spectrum. The higher “book value” of low-band spectrum simply reflects that economic trade-off (among many other variables), and it provides no basis for concluding that using low-band spectrum is any more or less expensive *on the whole* to meet any given level of consumer demand. Just as important, this “larger area” advantage is irrelevant in densely populated urban areas, where providers must deploy more and smaller cells simply to increase network capacity. Indeed, as the Commission has recognized, higher-band spectrum above 1 GHz can provide greater *capacity* in the geographic area it covers,⁶⁴ which can present advantages in urban and

⁶¹ See AT&T Spectrum Aggregation Comments at 62-73; Reply Comments of AT&T, *Policies Regarding Mobile Spectrum Holdings*, WT Docket No. 12-269, at 22-37 (filed Jan. 7, 2013).

⁶² *Fifteenth Report*, 26 FCC Rcd at 9833-34 ¶ 292.

⁶³ See T-Mobile Comments at 28-29 n.59; Competitive Carriers Association Comments at 2.

⁶⁴ *Fifteenth Report*, 26 FCC Rcd at 9836-37 ¶ 296 (“[H]igher-frequency spectrum may be just as effective, or more effective [than lower-band spectrum], for providing significant capacity, or increasing capacity, within smaller geographic areas.... In addition, capacity enhancement technologies such as multiple-input and multiple-output (MIMO) may perform better at higher frequencies. ... Thus, higher-frequency spectrum can be ideally suited for

suburban areas where demand is greatest. As the Commission has added, moreover, higher-band spectrum is also available in larger blocks, and there is more of it.⁶⁵

Indeed, the parties that complain the loudest to *the Commission* about the “excessive concentration” of low-band spectrum routinely tell *the market* that their high-band spectrum holdings place them, in the words of Sprint CEO Dan Hesse, “in the strongest place for the future.”⁶⁶ For example, in a presentation to investors, Clearwire Chairman John Stanton explained that his company’s 2.5 GHz spectrum is “much” superior to low-band spectrum in high-density markets:

Spectrum in the 2.5 gigahertz band is *ideally suited* for high-volume wireless data. *High-frequency spectrum is much more conducive than low- or mid-band spectrum to meeting the usage and speed requirements of heavy tonnage users in densely populated markets.* The 2.5 gigahertz band is also the sweet spot of global TDD LTE evolution. Earlier this year, Clearwire cofounded the GTI consortium with China Mobile, Vodafone, SoftBank and Bharti. Clearwire was the only American carrier included in the consortium. The members of this consortium serve more than 1.3 billion customers, representing 4x the population of the U.S. This means that this group will be driving the lowest possible cost and greatest variety of devices.⁶⁷

providing high capacity where it is needed, such as in high-traffic urban areas.”) (footnotes omitted).

⁶⁵ *Id.* (“[T]here currently is significantly more spectrum above 1 GHz that is potentially available for use . . . , and, in many parts of these higher bands, spectrum is licensed in larger contiguous blocks[, which]... can enable operators to deploy wider channels and simplify device design.”).

⁶⁶ Andrew Munchbach, *CTIA 2010’s day two keynote with Sprint CEO Dan Hesse*, BGR (May 24, 2010), <http://bgr.com/2010/03/24/live-from-ctia-2010s-day-one-keynote-with-sprints-dan-hesse/>.

⁶⁷ *Clearwire’s CEO Discusses Q2 2011 Results – Earnings Call Transcript*, Seeking Alpha (Aug. 4, 2011), <http://seekingalpha.com/article/284461-clearwire-s-ceo-discusses-q2-2011-results-earnings-call-transcript> (emphasis added).

In short, advocates of excluding AT&T and Verizon can point to no plausible rationale (beyond their own self-interest) for treating “low-band” spectrum differently for purposes of any spectrum-aggregation analysis or for excluding those companies from this auction, in whole or in part.

C. Restrictions on Auction Participation Would Dramatically Increase the Risk of Auction Failure

As AT&T has emphasized, the public policy consequences of imposing “aggregation”-oriented auction restrictions could easily undermine the Commission’s plans to free up 600 MHz spectrum for any mobile provider. In particular, restricting well-capitalized carriers such as AT&T and Verizon from full participation in this auction would undermine forward-auction competition, suppress bid levels, and thus dramatically increase the risk that forward-auction revenues will be insufficient to meet the statutory closing conditions for any given spectrum-clearing target. Although some carriers have claimed that they would somehow end up bidding more if AT&T and Verizon were banished from this auction,⁶⁸ that claim defies economic logic, as Professor Katz et al. explain (at ¶¶ 31-36). In fact, these carriers know that excluding AT&T and Verizon would stifle competition for 600 MHz spectrum assets and would thus reduce pressure on those other carriers to bid at appropriately high levels for those assets. That outcome would succeed only in depressing forward-auction revenue results and reducing the total amount

⁶⁸ T-Mobile Comments at 33. Shortly after the opening round of comments, a private consulting group issued a new paper purporting to show that bidding restrictions would not necessarily reduce auction issues. See Martyn Roetter & Alan Pearce, *The Impact of Bidding Eligibility Conditions on Spectrum Auction Revenues*, Information Age Economics (Feb. 2013), available at <http://www.ccianet.org/CCIA/files/ccLibraryFiles/Filename/000000000750/IAE%20Report%20-%20Final.pdf>. As Professor Katz et al. observe in their reply declaration (at ¶¶ 37-42), that paper suffers from numerous methodological flaws and is not credible.

of reallocated spectrum, and it would benefit no one other than the carriers seeking this regulatory favor.

This concern is hardly unique to the carriers that would be disadvantaged by this proposal; it is also a major concern of the very broadcasters who would otherwise be most interested in participating in the reverse auction and ceding spectrum rights. In the words of the Expanding Opportunities for Broadcasters Coalition (“EOBC”):

The Coalition strongly opposes any efforts to exclude or otherwise restrict any wireless providers from participating in the forward auction. Simple truths can be stated succinctly. The potentially willing broadcast sellers, upon whom the FCC must rely for the success of the incentive auction, strongly and sincerely believe that the following would be the nearly certain consequences of restricting Verizon and/or AT&T from participating in the forward auction (including any requirement that they divest other spectrum as a condition of closing on spectrum purchased in the incentive auction):

- *First*, the auction will not produce the revenues necessary to meet the expectations of the potentially willing broadcast sellers;
- *Second*, the auction will fail;
- *Third*, there will be no new spectrum allocated for consumer use of wireless devices;
- *Fourth*, there will be no surplus to fund an interoperable network for public safety first responders; and
- *Fifth*, there will be no surplus for deficit reduction.⁶⁹

This passage is critical not only because it is objectively accurate, but also because it reflects the subjective expectations of the very broadcasters who would be among the most willing to participate in this auction proceeding. Such broadcasters need reassurance that the auction stands a great enough chance of success that they should follow through on their plans to place their stations on the block. As these broadcasters’ lead economist explains, the auction

⁶⁹ EOBC Comments at 13-14 (emphasis in original). EOBC adds: “The Coalition offers these observations as an independent assessment. No wireless carrier is a member of our Coalition. No wireless carrier has contributed a single penny to our Coalition.” *Id.* at 14.

will succeed only if broadcasters have “confidence that they will face the full demand curve, and that demand will not be reduced by exclusion, or handicapping, of some potential buyers.”⁷⁰ If the Commission denied broadcasters that confidence by “handicapping . . . potential buyers” such as AT&T and Verizon, it would undermine the odds of success not only in the forward auction, but also in the reverse auction.

D. Proposals for “Bidding Credits” Based on Existing Spectrum Holdings Are As Untenable As Other Restrictions on Auction Participation

Various commenters ask the Commission to bestow “bidding credits” on auction participants on the basis of their relative spectrum holdings.⁷¹ Those proposals would suffer from all the defects of any of the other artificial means, discussed above, to exclude AT&T and Verizon from the forward auctions in various localities in whole or in part. *See* Katz et al. Reply Decl. ¶¶ 43-52. Among their other shortcomings, the proposed bidding-credit schemes would be purely and irrationally retrospective, in that they would consider only what spectrum a carrier has acquired in the past and would completely ignore the carrier’s expected future need for additional spectrum to accommodate its growing customer base and usage patterns. Moreover, these bidding-credit proposals, if successful, would drive down auction revenues simply as a matter of arithmetic. The whole point of bidding credits is to alter the identities of the winning bidders. But if the regime succeeds in that goal, then the amounts those bidders will pay at

⁷⁰ EOBC Comments, Exh. A (Decl. of Jeffrey Eisenach) at 12-13; Letter from Richard Bodorff (for EOBC) to Marlene Dortch (FCC), WT Docket No. 12-269, at 3 (filed Mar. 4, 2013) (“For an auction to allocate spectrum efficiently, sellers must enter the auction with confidence that they will face the full demand curve, and that demand will not be reduced by arbitrary exclusion of some potential buyers.”).

⁷¹ *See, e.g.*, Leap Comments at 6; MetroPCS Comments at 26-27; Competitive Carriers Comments at 11-12.

auction will necessarily be lower than the amounts that would otherwise be paid by the winning bidders in the *absence* of bidding credits. *See id.* ¶ 45. In other words, no bidding-credits regime can both serve its intended (and misguided) purpose of spectrum-equalization without reducing forward-auction revenues and therefore increasing the risk of auction failure.

Bidding credits would also distort the operation of secondary spectrum markets and give the beneficiaries multi-billion-dollar windfalls at the expense of forward-auction revenues and consumer welfare. Again, the Commission's current regime generally allocates spectrum assets to the highest bidder, which is then generally free to sell some or all of those assets to third parties in the secondary market. If the Commission maintains that regime, bidding credits would not keep spectrum out of the hands of the carriers that value it most highly, including large carriers with significant existing spectrum holdings. Instead, as Professor Katz et al. explain (at ¶¶ 49-51), bidding credits would simply add a wasteful new step in the process by initially assigning the spectrum to credit-assisted auction winners who would then monetize their credits by reselling the spectrum to less credit-eligible entities. In addition to reducing forward-auction revenues, *see id.* ¶ 47, that outcome would needlessly delay utilization of the affected spectrum, potentially by many years.

The Commission could avoid that outcome only by designing and administering a complex anti-alienation regime that would restrict credit-assisted winners from reselling their spectrum to willing buyers in the secondary market. But that approach would be even worse for consumers. By definition, restrictions on secondary-market transactions would keep auction winners from selling spectrum assets to other providers that can put those assets to uses more valued by consumers, such as alleviating severe network congestion in urban markets. In addition, any anti-alienation regime would also be susceptible to major implementation disputes.

The Commission has faced a similar set of controversies in administering its much more limited scheme of bidding credits for designated entities (*i.e.*, small businesses), and the result has been years of destabilizing litigation.⁷² Creating a *new* bidding-credits scheme on the basis of existing spectrum holdings would succeed only in creating a new dimension of intractable implementation controversies.

E. The Spectrum Act Prohibits the Commission from Excluding AT&T and Verizon from this Auction on the Basis of Spectrum-Aggregation Policies, Given the Alternative of Allowing Them to Participate and Then Make Any Necessary Divestitures to Preserve Compliance with Those Policies

The Commission would violate section 6404 of the Spectrum Act if, on the basis of existing spectrum holdings, it excluded any carrier from participating in any auction for 600 MHz spectrum, whether in a particular locality or more generally. Codified as section 307(j)(17) of the Communications Act, section 6404 provides that “the Commission may not prevent” an otherwise qualified bidder “from participating in a system of competitive bidding” on the basis of its spectrum holdings (or for any other reason). Congress added that the Commission may exercise whatever authority it previously had “to adopt and enforce rules of general applicability, including rules concerning spectrum aggregation that promote competition.” 47 U.S.C. § 309(j)(17).

These two provisions are easily harmonized. The Commission can “adopt and enforce” spectrum-aggregation “rules of general applicability” *without* “prevent[ing]” a carrier “from participating in a system of competitive bidding” simply by allowing the carrier, post-auction, to divest existing spectrum if necessary to keep itself in compliance with the rules while

⁷² See, *e.g.*, *Council Tree Commc’ns, Inc. v. FCC*, 619 F.3d 235 (3d Cir. 2010) (invalidating certain anti-alienation rules on APA grounds).

rationalizing its spectrum holdings across various markets. The availability of that option thus precludes the Commission from disqualifying carriers from bidding for spectrum in a given locality if they agree to make divestitures that will keep them from ever coming into violation of any spectrum-aggregation policy. Excluding those carriers from such bidding would be unlawful precisely because the Commission has other—indeed, better tailored—means of “enforc[ing] rules of general applicability, including rules concerning spectrum aggregation that promote competition.”

III. THE COMMISSION SHOULD DESIGN EFFICIENT AUCTION MECHANISMS—INCLUDING PACKAGE BIDDING—TO MAXIMIZE THE ODDS THAT FORWARD-AUCTION RESULTS WILL MEET THE STATUTORY REVENUE REQUIREMENTS

As discussed, this auction will succeed, and 600 MHz spectrum will be reallocated to mobile broadband, only if forward-auction bids meet the statutory revenue requirements. Whether the auction succeeds or fails will depend in large part on the decisions the Commission makes on the front end about auction participation and design. For example, as discussed in Sections I and II above, the Commission should maximize the prospective value of this spectrum to forward-auction bidders and avoid anticompetitive, revenue-reducing restrictions on who may participate in the forward auction. To increase the odds of success, the Commission should also design efficient auction mechanisms that (1) induce forward-auction participants to express the full value of this spectrum in the form of high winning bids and (2) structure the reverse-auction bidding and the repacking analysis to ensure attainable revenue requirements for meeting given spectrum-clearing targets.

AT&T addressed these auction-design issues in great detail in its opening comments and supporting declarations. As explained there, the Commission should (among other things):

- provide for “generic bidding” but carefully define the categories of generic licenses so that each category contains only truly interchangeable spectrum blocks of similar value;
- adopt a “clock package auction” format that, as proposed by Professors Che, Haile, and Kearns, will enable forward-auction participants to express the substantial value of geographic complementarities and will thereby avoid the bid-depressing consequences of the exposure problem;
- establish clear assignment rules that will provide winning bidders with geographically and spectrally contiguous spectrum to the maximum extent possible, thereby inducing forward-auction participants to express those complementarities in the form of higher bids for generic spectrum;
- hold a “single-pass reverse auction” that would ask broadcasters to indicate, *before* any forward-auction bidding is conducted, whether or not they would cede specified spectrum rights at progressively lower price levels; and
- establish mechanisms for eliciting additional bidding in *both* the forward *and* the reverse auction to maximize the odds of meeting the closing conditions for a given channel-clearing target if those conditions are not met when the descending reverse-auction clock has just eliminated excess supply and the ascending forward-auction clock has just eliminated excess demand.

Rather than repeat the rationales for all of these auction-design proposals here, we respectfully refer the Commission to our opening comments and to the opening and reply declarations of Professors Che, Haile, and Kearns. Nonetheless, the issue of package bidding is sufficiently important and controversial that we briefly respond to the claims of package-bidding opponents.

As discussed in our opening comments, package bidding is necessary to avoid a bid-suppressing *exposure problem* that is well-recognized both in Commission precedent and in the auction literature.⁷³ Understanding the exposure problem is key to understanding why package-

⁷³ E.g., Second Report and Order, *Service Rules for the 698-746, 747-762 and 777-792 MHz Bands et al.*, 22 FCC Rcd 15289, 15396-97 ¶¶ 287, 290 (2007) (“700 MHz Order”); Sang Won Kim *et al.*, *Measuring the Performance of Large-Scale Combinatorial Auctions: A Structural Estimation Approach*, at 1 (June 11, 2012), <http://www.hss.caltech.edu/~mshum/gradio/papers/Weintraub2012.pdf>. (“The main advantage of package bidding is that it allows bidders to express cost synergies in their bids. In contrast, if bidders were allowed only to

bidding options are essential, yet—tellingly—many opponents of package bidding *do not even mention* the exposure problem in their comments.⁷⁴ We thus briefly summarize the nature of the problem before returning to AT&T’s proposed solution.

As the Commission has explained, a “bidder whose business plan is premised on realizing economies of scale may need to win a large number of licenses in order to justify the bid that it would make if it could win all of them. The risk of winning less than all the licenses needed to support the amount of the aggregate bid is sometimes known as the ‘exposure problem.’”⁷⁵ A concrete example—a carrier’s investment in particular handset technologies—helps illustrate the point. Because portability is the essence of mobile technology, a carrier with regional or nationwide operations does not typically sell its customers different handsets depending on where they live; in general, it offers every customer the same menu of handset options. The carrier must therefore make footprint-wide decisions about which components to install in its handsets. Those decisions present important trade-offs. For example, to optimize device performance and form factors, a carrier must limit the number of—and carefully select—the antennas and radio-frequency filters that it installs in its handsets.⁷⁶

Carriers thus work hard to rationalize their spectrum holdings across different markets. If a carrier had licenses for Bands A and B in some cities, Bands C and D in other cities, and Bands E and F in yet other cities, its customers could not make use of all those bands when they travel

submit bids for each unit separately they would face the risk of winning some units but not others. This phenomenon, known as the *exposure problem*, makes the bidders less aggressive[.]” (emphasis in original).

⁷⁴ See Leap Comments at 9; MetroPCS Comments at 13-14.

⁷⁵ *700 MHz Order*, 22 FCC Rcd at 15396 ¶ 287.

⁷⁶ See Qualcomm Comments at iii, 3 & n.5; RIM Comments at 10-11.

unless the carrier installs an inefficiently large number of handset components designed to process signals on all of those bands. Instead, the carrier would much prefer to have licenses simply for the same two bands in all, or at least most, of its geographic markets.

For these reasons, a carrier might well decide that it makes no economic sense to invest in 600 MHz technology *at all* if it does not win 600 MHz spectrum rights in most of the geographic areas within its footprint. And it might thus wish to avoid paying substantial sums for 600 MHz licenses in some areas if it does not win them throughout most of its footprint. Without package bidding, however, such a carrier might well get stuck “winning” unwanted licenses because it would have to bid separately for licenses in every geographic area within its footprint. For example, the forward auctions in a few cities might conclude early and leave the carrier as a high bidder, while the bidding proceeds to such high levels in other cities that the carrier can no longer afford to remain in those auctions. Faced with that risk, the carrier would have a strong incentive to exit the auction process inefficiently early in order to avoid paying for spectrum that later turns out to be much less valuable than it would have been as part of a multi-area package.

Because of that exposure problem, the absence of a package-bidding mechanism would reduce forward-auction revenues and increase the risk of auction failure. Some commenters seek to minimize this concern by noting that the Commission did not rely on package bidding in the AWS auction and permitted package bidding for only a single block in the 700 MHz auction.⁷⁷

⁷⁷ See US Cellular Comments at 55; MetroPCS Comments at 13-14. The 700 MHz block subject to package bidding was the Upper C Block, whose constituent licenses Verizon ultimately won throughout the continental United States. The winning bids for the C Block were relatively low, but only because the Commission imposed various “openness” conditions that encumbered C Block licenses and deterred other carriers from bidding aggressively for

That argument is unsound on two levels. First, the Commission assigned very large geographic areas to certain licenses sold in these auctions and thus established a rough (but quite imperfect) proxy for package bidding, likely alleviating the exposure problem to some degree.⁷⁸ Here, in contrast, the Commission proposes to assign licenses only to relatively small geographic units (EAs), thereby maximizing the exposure problem that would arise in the absence of a package-bidding mechanism. That approach would be unwise as a policy matter, and it would disregard the Commission's statutory mandate to "consider assigning licenses that cover geographic areas of a variety of different sizes." Spectrum Act § 6403(c)(3).

Second, and just as important, the Commission may well have forgone substantial auction revenues in the AWS and 700 MHz auctions precisely because it did *not* make adequate provision for package bidding there. Indeed, there is compelling evidence for that conclusion. In the half-dozen years following those two auctions, carriers have paid one another enormous sums on the secondary market to rationalize the hodgepodge of spectrum holdings that they won in these two auctions. The likelihood of having to incur the costs, delays, and uncertainties of such post-auction transactions almost certainly induced carriers to bid less in the AWS and 700 MHz auctions than they would have bid if only they could have rationalized their spectrum holdings up front, in the form of winning package bids in those auctions themselves. Of course, the auctions closed anyway, despite the lower revenues deposited into the U.S. Treasury, but

them. *See* Comments of AT&T, *Framework for Broadband Internet Service*, GN Docket No. 10-127, at 111-12 & n.190 (filed July 15, 2010).

⁷⁸ *See 700 MHz Order*, 22 FCC Rcd at 15324 ¶¶ 81-82 (noting use of large regional licenses in AWS-1 auction and adopting similar areas for certain licenses in 700 MHz auction). Consistent with this observation, bids for REAG licenses in the AWS auction were on average 37 percent higher per MHz than those for EAs covering the same population. *See* Che/Haile Reply Analysis at 10.

only because the AWS and 700 MHz auctions were not subject to rigid revenue requirements. *This* auction for 600 MHz spectrum, however, *is* subject to a rigid revenue requirement, and the Commission should thus take all available steps, including the adoption of a package-bidding mechanism, to ensure that the requirement is met.

Some commenters further claim that package bidding would (1) add intractable complexity to the auction or (2) discriminate unfairly against smaller carriers.⁷⁹ The clock package auction proposed by Professors Che, Haile, and Kearns, however, is designed precisely to avoid both of those concerns. First, their proposal will efficiently manage computational complexity by specifying allowable package bids such that each pre-defined package is fully nested within the next-larger pre-defined package in a clear hierarchy (EAs, MEAs, and REAs).⁸⁰ This pre-defined hierarchy of permissible packages will avoid the severe computational challenges that, as the Commission has noted, *would* arise if bidders were simply allowed to define their own, partially overlapping packages.⁸¹

Second, the Che/Haile/Kearns proposal will not favor package bidders (such as national carriers) over auction participants that bid only on individual EAs. A package bidder could win licenses in all EAs within its geographic package only if the total price for that package exceeds

⁷⁹ See MetroPCS Comments at 13-14; US Cellular Comments at 51-55; Leap Comments at 9.

⁸⁰ See Yeon-Koo Che, Phil Haile, and Michael Kearns, *Design of the FCC Incentive Auctions*, at 35, 37-39 (Jan. 25, 2013) (“CHK Analysis”) (attached to AT&T’s opening comments as Exh. B).

⁸¹ See Che/Haile Reply Analysis at 3; Public Notice, *Mobility Fund Phase I Auction Scheduled for September 27, 2012; Comment Sought on Competitive Bidding Procedures for Auction 901 and Certain Program Requirements*, 27 FCC Rcd 530, 539 ¶ 32 (WTB & WCB 2012) (proposing to limit the number of package bids based on census blocks because selecting winning bidders “can be difficult . . . with large numbers of partially overlapping package bids”).

the sum of the bids that would otherwise prevail, including all EA-specific bids. That mechanism will pick winners solely on the basis of which combination of bids expresses—and can be presumed to produce—the greatest economic value for consumers. In particular, by enabling bidders to express the substantial complementarities they can achieve through geographic packages, the proposal will promote consumer welfare while maximizing the odds of satisfying the closing conditions for a given spectrum-clearing target. If anything, the Che/Haile/Kearns framework would be preferable to the Auctionomics proposal from the perspective of small bidders. *See* Che/Haile Reply Analysis at 9-10. Among other considerations, it would correct the “overflow problem” inherent in the Auctionomics design, which tends to disadvantage bidders for single-EA licenses in various circumstances. *Id.* at 9.

Third, theoretical concerns about the “threshold problem” also cannot justify opposition to the proposed clock package auction.⁸² The problem can arise “where bidders on individual licenses together have a higher valuation than the package bidder, but because of limited competition for the individual licenses, the sum of the bids on individual licenses is lower than the package bid. Each bidder would be willing to raise its own bid, but would prefer that other bidders do so to increase the sum of the bids on individual licenses.”⁸³ This concern is particularly substantial in traditional SMR (“simultaneous multiple-round”) auctions, but it could theoretically arise in a clock auction as well. *See* Che/Haile Reply Analysis at 4, 7.

⁸² *See* MetroPCS Comments at 14; US Cellular Comments at 53-54.

⁸³ *See* Gregory L. Rosston, *Implementing Package Bidding in the 700 MHz Band to Improve Consumer Welfare* at 11-12, attached to Letter From Kathleen Wallman (counsel to Pegasus Communications Corporation) and Ruth Milkman (counsel to Access Spectrum, LLC) to Marlene H. Dortch (FCC), WT Docket No. 06-150 (filed Feb. 5, 2007).

As Professors Che and Haile explain, however, the threshold problem does not arise from, and thus cannot be a basis for opposing, any well-designed mechanism for package bidding. *Id.* at 4-8. Instead, it arises from the market reality that—in any spectrum auction, with or without package bidding—some bidders will perceive complementarities in holding licenses in geographically adjacent regions, and they will place bids designed to capture those complementarities. *Id.* at 5. The Che/Haile/Kearns proposal for a clock package auction would not introduce any new threshold problem beyond what the Auctionomics proposal would present even without a package-bidding mechanism; indeed, if anything, the Auctionomics proposal would present the problem in more acute form. *Id.* at 5-8.

Finally, as Professors Che and Haile explain in their reply analysis, their proposed clock package auction presents no significant risk that bidders would engage in strategic bid manipulation by bidding up either component or package prices in order to induce inefficient undersell. *Id.* at 10-13. Concerns about any such risk appear to rest on a simple misunderstanding of how that auction would be structured. In any event, the prospect of supplementary bidding within the Che/Haile/Kearns framework greatly alleviates any undersell concern, whether arising from strategic manipulation or otherwise. *Id.* at 12-13; *see also* CHK Analysis at 54-57 (describing discretionary supplementary bid procedure).

IV. THE COMMISSION SHOULD REJECT PROPOSALS TO LIMIT ITS REPACKING DISCRETION

As discussed in our opening comments, this proceeding will succeed only if the Commission retains flexibility to repack remaining broadcast stations as efficiently as possible. Efficient repacking is the key to reducing the statutory revenue requirements by limiting the number of stations that must be paid compensation for ceding spectrum rights. The Commission should thus reject various broadcaster proposals to hamstring its own repacking discretion.

A. The Statute Requires Balancing Broadcaster Interests Against the Public Interest in Reallocating Additional Spectrum to Mobile Broadband

After prolonged legislative debate, Congress gave the Commission precisely the repacking flexibility that it needs to make this auction a success. In particular, the Spectrum Act gives the Commission broad discretion to “make such reassignments of television stations that the Commission considers appropriate” “[f]or purposes of making available spectrum to carry out the forward auction.” Spectrum Act § 6403(b)(1), (b)(1)(B)(i). To this generalized mandate, Congress attached a single relevant qualification: the Commission must “make all *reasonable* efforts to preserve, as of the date of the enactment of this Act, the coverage area and population served of each broadcast television licensee, as determined using the methodology described in OET Bulletin 69 of the Office of Engineering and Technology of the Commission.” *Id.* § 6403(b)(2) (emphasis added). As the NPRM recognizes, “all reasonable efforts” is a common statutory term; “its meaning depends on the circumstances involved, and comports with the common meaning of the word ‘reasonable,’” which includes “[f]it and appropriate to the end in view.”⁸⁴ Congress included this qualifier because it wished to grant the Commission very broad discretion to balance a range of objectives, including not only protections for broadcasters, but also the policy imperative to “[m]aximize[e] the amount of spectrum freed up” for mobile broadband.⁸⁵

This open-ended statutory language flatly precludes arguments by some broadcasters that Congress somehow required the Commission to sacrifice all other objectives in order to “hold

⁸⁴ NPRM ¶ 105 (citing, *inter alia*, Black’s Law Dictionary 1265 (6th ed. 1990)); *see, e.g., Capital Network Sys., Inc. v. FCC*, 28 F.3d 201, 204 (D.C. Cir. 1994).

⁸⁵ *See* NPRM, 27 FCC Rcd at 12547 (statement of Chairman Genachowski).

harmless” those broadcasters that do not participate in the auction and must be repacked.⁸⁶ The statutory language similarly forecloses NAB’s argument (at 19) that the Commission must identify “extraordinary” or “truly exceptional” circumstances before altering a station’s coverage area and population served. A mandate to make “reasonable efforts” to maintain coverage and population does not require or even permit the Commission to maintain coverage and population in all but “extraordinary circumstances” if such rigidity would risk decreasing the spectrum reallocated to mobile broadband uses.

Moreover, that conclusion follows no matter how the Commission resolves a secondary interpretive question: whether “preserv[ing] . . . the coverage area and population served” by a broadcaster means preserving coverage for *all the exact same people and places* as before or, instead, the same number of people and square mileage. *See, e.g.*, NAB Comments at 23-24. The statutory language is in fact ambiguous on that point, and the Commission should interpret it as needed to pursue its broader policy objectives. *See, e.g.*, Verizon Comments at 35-36. But even if this statutory language (“preserv[ing] . . . the coverage area and population served”) compelled the broadcasters’ preferred construction, that language would still be subject to the “reasonable efforts” standard. No matter how broadcasters’ interests in the repacking process are defined, the Commission need make only “all *reasonable* efforts” to protect them. Again, the unqualified term “reasonable” means that those interests must sometimes yield to competing interests.

⁸⁶ Affiliate Associations Comments at 32; *see also* NAB Comments at 18 (arguing that the statute “makes clear that . . . [broadcasters] who do not participate [in the auction] should not be harmed in any way”).

To be clear: AT&T agrees that the Commission should try hard to protect broadcasters' interests in the repacking process, and it should give substantial weight to a broadcaster's interests in avoiding significant new interference or significant changes in signal contours. But the Commission should not attribute *infinite* value to those broadcaster interests or even a disproportionately large value. It should instead balance them as appropriate against the public's equally important interest in freeing up additional spectrum for mobile broadband. In conducting that balance, the Commission should also bear a key fact in mind. Fewer than 10% of U.S. television households still rely exclusively on over-the-air broadcast signals to receive TV programming.⁸⁷ The remaining 90% subscribe to cable, satellite, or other MVPD services and receive local broadcast signals that way. In short, the vast majority of television viewers will be unaffected by the details of this repacking process. Commenting broadcasters sometimes overlook that fact when they discuss the viewer impact of new interference or contour adjustments. *See, e.g.*, NAB Comments at 21 & n.33. If a station has 100,000 potential viewers and repacking would subject the station to one percent additional interference, that change could be expected to affect, on average, only about 100 viewers (10% of 1% of 100,000), not 1000.⁸⁸

⁸⁷ Fourteenth Report, *Annual Assessment of the Status of Competition in the Market for the Delivery of Video Programming*, 27 FCC Rcd 8610, 8705-06 ¶ 211 (2012) (“After a steady decline over the last few years, the percentage of television households relying exclusively on over-the-air broadcast service” stands at approximately “9.6 percent (10.97 million households) at the end of 2011.”).

⁸⁸ Although ease of repacking should influence the selection of winners in the reverse auction, *see* AT&T Comments at 75-76, AT&T agrees with EOBC that “[a] station’s enterprise value has no correlation to the value of recovering spectrum rights” and should not be a “scoring factor” in the selection of reverse-auction winners. EOBC Comments at 4.

B. The \$1.75 Billion Cap on the Repacking Fund Does Not Limit the Commission to Repacking “400-500 Stations”

The major broadcaster associations contend that “the Commission should not plan on relocating more than 400 to 500 stations because otherwise relocation costs will exceed the amount of the [\$1.75 billion] Fund Congress established to fully reimburse broadcasters.” Affiliate Associations Comments at 47; *see also* NAB Comments at 49. In fact, the Commission might well need to repack more than 500 stations under a successful auction scenario. And any argument that the Commission is somehow limited to repacking “400 to 500 stations” is untenable as a matter of both law and accounting.

First, the argument misreads the Spectrum Act, which nowhere suggests that the \$1.75 billion figure constrains the Commission’s discretion to repack as many stations as it deems appropriate to reallocate spectrum for mobile broadband. Section 6402 provides that “\$1,750,000,000 of the proceeds from the incentive auction . . . shall be deposited in the TV Broadcaster Relocation Fund,” which is separately established in section 6403(d)(2). Section 6403 further provides that the auction can close only if forward-auction revenues exceed the sum of (1) winning reverse-auction bids, (2) certain administrative costs, and (3) “the estimated costs for which the Commission is required to make reimbursements under subsection (b)(4)(A).” *Id.* § 6403(c)(2)(B). Critically, the cross-referenced provision—section 6403(b)(4)(A)—directs the Commission merely to “reimburse costs reasonably incurred” by broadcasters and others “*from amounts made available under subsection (d)(2)*”—that is, from the Fund, which Congress capped at \$1.75 billion. (Emphasis added.) As a result, the third variable in the auction-closing equation set forth in section 6403(c)(2)—“the estimated costs for which the Commission is required to make reimbursements”—can be *at most* \$1.75 billion. Any repacking costs that

exceed \$1.75 billion therefore cannot keep the auction from meeting the statutory closing conditions. Significantly, broadcasters lobbied Congress for a much larger Fund for these purposes, and Congress considered that request, but it ultimately decided to cap the amount at \$1.75 billion.⁸⁹

More important, this dispute is likely to have only academic significance because, even if the Commission repacks more than 500 stations, the costs “reasonably incurred” in any foreseeable scenario will likely remain well below \$1.75 billion. For example, an economic analysis prepared on this issue in 2011 projected that full repacking costs for 629 stations would amount to only about \$565 million.⁹⁰

Of course, much of this discrepancy in repacking cost estimates stems from the broadcasters’ expansive view of the “costs” for which they claim entitlement to reimbursement. For example, the Affiliate Associations criticize the NPRM’s entirely reasonable proposal to borrow the standard from the 800 MHz rebanding proceeding and permit recovery of “costs that are reasonable, prudent, and the minimum necessary to provide facilities and services comparable to those presently in use.” NPRM ¶ 343. According to the Affiliate Associations (at 50), the statutory language (“costs reasonably incurred”) entitles them to recover *more* than the “minimum necessary” costs to maintain a comparable level of service.

⁸⁹ See Kim McAvoy, *Levin: TV Spectrum Auctions Likely Doomed*, TVNewsCheck (Jan. 5, 2012) (describing House bill that included broadcaster-backed provisions, including a \$3 billion relocation fund), <http://www.tvnewscheck.com/article/56476/levin-tv-spectrum-auctions-likely-doomed>.

⁹⁰ See CTIA & CEA, *Broadcast Spectrum Incentive Auctions*, at 6-7 (Feb. 15, 2011), attached to Letter from Christopher Guttman-McCabe (CTIA) and Julie Kearney (CEA) to Chairman Julius Genachowski and Commissioners (Feb. 15, 2011), http://cea.aristotle.com/Shared%20Documents/issuesSpectrum/CTIA_CEA_TV_Spectrum_Whitpaper-FINAL-021511.pdf.

That is implausible, and the Commission has clear authority to adopt its proposed standard. Congress did not define the “cost[s]” that may be recovered, and “without any better indication of meaning than the unadorned term, the word ‘cost’ . . . is a ‘chameleon’” and a “‘virtually meaningless’ term.” *Verizon Commc’ns, Inc. v. FCC*, 535 U.S. 467, 500 (2002). As the D.C. Circuit recently reaffirmed, Congress’s use of that term in a statute “is open to a wide range of reasonable interpretations” and grants the Commission great discretion to accommodate its policy preferences. *American Elec. Power Serv. Corp. v. FCC*, No. 11-1146, 2013 WL 673501, at *6 (D.C. Cir. Feb. 26, 2013) (citing *Transmission Access Policy Study Group v. FERC*, 225 F.3d 667, 704 (D.C. Cir. 2000)). Indeed, the cost standard upheld in *Verizon*—total long run incremental cost, or TELRIC—assesses costs on the basis of what a hypothetical, most efficient provider would pay to replicate the functionality of a network element, not what any provider *actually* paid for that functionality.⁹¹

AT&T also supports Sprint’s proposal (at 11) that, “as soon as practically possible . . . , all television broadcasters should be required to provide the Commission with an inventory of their equipment and facilities that would be impacted by repacking, along with a preliminary estimate of their repacking costs.”⁹² As Sprint explains, the Commission should “engage third party experts to evaluate these inventories and provide the Commission with independent estimates on the cost of broadcaster relocation . . . , extrapolating these figures to estimate total

⁹¹ See *AT&T Corp. v. Iowa Utilities Bd.*, 525 U.S. 366, 375 n.3 (1999) (TELRIC is “based upon the cost of operating a hypothetical network built with the most efficient technology available”).

⁹² As Sprint explains (at 12), this proposal is less burdensome than it might first appear, given that “as a result of the recent DTV transition, it is reasonable to assume that licensees have some level of system inventory already completed.”

relocation costs under a variety of scenarios and in different markets.” *Id.* AT&T also supports Sprint’s suggestion that the Commission “adopt clear rules and policies” concerning reimbursable costs in advance “so that television broadcasters can make the most educated decisions possible” about whether to participate in the reverse auction. *Id.* Without such guidance, “a broadcaster may inadvertently make a poor decision on participating in the reverse auction based on an erroneous assumption that certain costs associated with its repacking plans would be fully reimbursed.” *Id.*

Finally, the Commission should reject the Affiliate Associations’ proposal (at 48) for rules “to ensure that involuntarily repacked stations have *the maximum possible amount of time* to construct their new facilities and still qualify for reimbursement from the Fund.” (Emphasis added.) By permitting stations to remain in their existing channels as long as possible, this approach would greatly lengthen the interval between the date of the forward auction and the date on which forward-auction winners can make use of the relevant spectrum for the provision of mobile broadband services. Every additional month that goes by, however, is a month that those winners will have tied up billions of dollars of capital in prospective assets that are not yet producing any revenues for them. Given the time value of money, therefore, the broadcasters’ proposal for the “maximum possible” delay would depress forward-auction bids and exacerbate the risk of auction failure.

CONCLUSION

The Commission should take the steps outlined above and in AT&T's opening comments to derive the greatest value from the 600 MHz band and ensure that as much of it as possible is reallocated to mobile broadband uses.

Respectfully submitted,

Alex Starr
Michael P. Goggin
Gary L. Phillips
Peggy Garber
AT&T SERVICES, INC.
1120 20th Street, NW
Washington, D.C. 20036
202-457-2055

/s/ Jonathan E. Nuechterlein
Jonathan E. Nuechterlein
Samir C. Jain
WILMER CUTLER PICKERING
HALE & DORR LLP
1875 Pennsylvania Avenue, NW
Washington, D.C. 20006
202-663-6000

David L. Lawson
Christopher T. Shenk
SIDLEY AUSTIN LLP
1501 K Street, N.W.
Washington, D.C. 20005
202-736-8000

Attorneys for AT&T Inc.

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